

**ACCEL500  
DRIVE STAND APPLICATION SOFTWARE**

**Part Number 695115.V10**

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Cleveland, Ohio**

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AVTRON INDUSTRIAL AUTOMATION, INC.  
Cleveland, Ohio

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**DRIVE STAND APPLICATION SOFTWARE**  
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**TABLE OF CONTENTS**

| <u>SECTION</u> |  | <u>PAGE</u> |
|----------------|--|-------------|
| I              | INTRODUCTION AND GENERAL INFORMATION .....                       | 1-1         |
| II             | SELECTING THE CONTROL MODE .....                                 | 2-1         |
|                | 2-1    Remote Operation .....                                    | 2-1         |
|                | 2-2    Local Drive Keypad .....                                  | 2-1         |
|                | 2-3    PC Control (Computer Diagnostic Software ADDaptACC) ..... | 2-2         |
| III            | KEYPAD AND PARAMETER DESCRIPTIONS .....                          | 3-1         |
|                | 3-1    ACCEL500 Keypad Operation .....                           | 3-1         |
|                | 3-2    Menu Navigation .....                                     | 3-3         |
|                | 3-2.1    Navigation Tips .....                                   | 3-3         |
|                | 3-2.2    Main Menu .....   | 3-4         |
|                | 3-2.3    Monitor Menu (M1) .....                                 | 3-6         |
|                | 3-2.4    Parameter Menu (M2) .....                               | 3-7         |
|                | 3-2.5    Keypad Control Menu (M3) .....                          | 3-8         |
|                | 3-2.6    Active Faults Menu (M4) .....                           | 3-9         |
|                | 3-2.7    Fault History Menu (M5) .....                           | 3-11        |
|                | 3-2.8    System Menu (M6) .....                                  | 3-12        |
|                | 3-2.9    Expander Board Menu (M7) .....                          | 3-18        |
|                | 3-2.10    Editing a Numeric Value .....                          | 3-19        |
|                | 3-2.11    Editing a Configuration Value .....                    | 3-19        |
|                | 3-2.12    Editing a Selection Value .....                        | 3-20        |
|                | 3-2.13    Keypad Removal While Drive is Running .....            | 3-20        |
|                | 3-2.14    Stop Fault .....                                       | 3-20        |
|                | 3-2.15    Remote Keypad .....                                    | 3-20        |
| IV             | I/O PARAMETER DESCRIPTIONS .....                                 | 4-1         |
|                | 4-1    Analog Inputs .....                                       | 4-1         |
|                | 4-2    Analog Outputs .....                                      | 4-2         |
|                | 4-3    Digital Inputs .....                                      | 4-3         |
|                | 4-4    Digital Outputs .....                                     | 4-3         |
|                | 4-5    Encoder Counter Inputs .....                              | 4-4         |

## TABLE OF CONTENTS (continued)

| <u>SECTION</u>                                   | <u>PAGE</u> |
|--|-------------|
| V      LOGIC SEQUENCE .....                      | 5-1         |
| 5-1    Miscellaneous Logic .....                 | 5-1         |
| 5-2    Remote Operation .....                    | 5-1         |
| 5-2.1 Run OK .....                               | 5-1         |
| 5-2.2 Jog FR Input.....                          | 5-2         |
| 5-2.3 Start Input.....                           | 5-2         |
| 5-2.4 Run Enable.....                            | 5-2         |
| 5-2.5 Thread Enable .....                        | 5-3         |
| 5-2.6 Jog Enable.....                            | 5-3         |
| 5-2.7 RJT Enable.....                            | 5-3         |
| 5-2.8 Jog F En .....                             | 5-4         |
| 5-2.9 Jog R En.....                              | 5-4         |
| 5-2.10 Fast Stop.....                            | 5-4         |
| 5-2.11 Cntrl Mode.....                           | 5-4         |
| 5-2.12 Console Mode Bits.....                    | 5-5         |
| 5-2.13 In Rem Spd, In Rem Trq.....               | 5-5         |
| 5-2.14 Speed vs. Time Logic .....                | 5-6         |
| 5-2.15 Engine Start Simulator Logic.....         | 5-6         |
| 5-2.16 Speed Status .....                        | 5-7         |
| 5-2.17 Torque Status .....                       | 5-8         |
| 5-2.18 Ramp Delays.....                          | 5-9         |
| 5-3    Local Drive Keypad.....                   | 5-9         |
| 5-3.1 Local Run Mode .....                       | 5-9         |
| 5-3.2 Button Stop Fault .....                    | 5-9         |
| 5-4    ADDaptACC Software Control .....          | 5-9         |
| 5-4.1 PC Control .....                           | 5-9         |
| 5-4.2 SC Start .....                             | 5-10        |
| 5-4.3 SC Comm Fault.....                         | 5-10        |
| 5-5    Run Interface to Firmware .....           | 5-10        |
| 5-5.1 RunRequest .....                           | 5-10        |
| 5-5.2 Coast Stop .....                           | 5-10        |
| VI     REFERENCING AND OUTER CONTROL BLOCK.....  | 6-1         |
| 6-1    Speed Ramp Reference .....                | 6-1         |
| 6-1.1 Maintenance Speed Reference.....           | 6-1         |
| 6-1.2 Remote Speed Reference .....               | 6-1         |
| 6-1.3 Speed vs. Time Reference.....              | 6-1         |
| 6-1.4 Engine Starter Simulator Reference.....    | 6-2         |
| 6-1.5 Speed Control Word .....                   | 6-3         |
| 6-1.6 Speed Reference Selection.....             | 6-3         |
| 6-1.7 Reverse Command .....                      | 6-4         |
| 6-1.8 Reference Selection and Ramp Hold .....    | 6-4         |
| 6-1.9 Skip Frequency and Reference Polarity..... | 6-5         |

**TABLE OF CONTENTS (continued)**

| <u>SECTION</u>   | <u>PAGE</u> |
|--|-------------|
| 6-1.10 Low Pass and Delay.....                                   | 6-6         |
| 6-1.11 Ramping.....  | 6-6         |
| 6-1.12 Ramp Options .....  | 6-7         |
| 6-1.13 Ramp Outputs .....  | 6-8         |
| 6-2 PI Limiters .....  | 6-8         |
| 6-2.1 Open Loop Overvoltage Limiter.....                         | 6-9         |
| 6-2.2 Open Loop Undervoltage Limiter.....                        | 6-11        |
| 6-2.3 Open Loop Current Limiter .....                            | 6-12        |
| 6-2.4 Open Loop Torque Limiter.....                              | 6-13        |
| 6-2.5 Closed Loop Over Voltage Limiter .....                     | 6-14        |
| 6-3 Speed Step Reference .....                                   | 6-14        |
| 6-3.1 Speed Step References .....                                | 6-15        |
| 6-3.2 Open Loop Step Reference .....                             | 6-15        |
| 6-3.3 Closed Loop Step Reference.....                            | 6-16        |
| 6-4 Spare Blocks .....   | 6-17        |
| 6-4.1 Spare Reference Blocks .....                               | 6-17        |
| 6-4.2 Spare Logic Blocks .....                                   | 6-18        |
| VII MOTOR CONTROL MODE .....                                     | 7-1         |
| 7-1 Torque Reference.....  | 7-1         |
| 7-1.1 Torque Reference Blocks.....                               | 7-1         |
| 7-1.2 Closed Loop Torque Reference .....                         | 7-2         |
| 7-1.3 Torque Reference Polarity and Ramp.....                    | 7-2         |
| 7-1.4 Torque Reference Limit.....                                | 7-3         |
| 7-1.5 Torque Reference Firmware Part I .....                     | 7-3         |
| 7-1.6 Torque Reference Firmware Part II .....                    | 7-4         |
| 7-2 Open Loop Control .....                                      | 7-5         |
| 7-2.1 Torque Stabilizer.....                                     | 7-5         |
| 7-2.2 DC-Link Stabilizer.....                                    | 7-5         |
| 7-2.3 Flux Stabilizer.....                                       | 7-6         |
| 7-2.4 Open Loop Frequency Reference (MotorControlMode = 0) ..... | 7-6         |
| 7-2.5 Open Loop Speed Control (MotorControlMode = 1) .....       | 7-8         |
| 7-2.6 Open Loop Torque Control (MotorControlMode = 2) .....      | 7-9         |
| 7-3 Closed Loop Control.....                                     | 7-10        |
| 7-3.1 Closed Loop Speed Control (MotorControlMode = 3) .....     | 7-10        |
| 7-3.2 Closed Loop Torque Control (MotorControlMode = 4) .....    | 7-15        |
| 7-3.3 Flux Reference .....                                       | 7-17        |
| 7-3.4 Flux Modeling.....   | 7-18        |
| 7-3.5 Current Control Loop.....                                  | 7-19        |

**TABLE OF CONTENTS (continued)**

| <u>SECTION</u> |   | <u>PAGE</u> |
|----------------|---|-------------|
| VIII           | MISCELLANEOUS CONTROL BLOCKS.....                         | 8-1         |
| 8-1            | Overspeed and At Zero Speed .....                         | 8-1         |
| 8-2            | Limit Check .....   | 8-1         |
| 8-3            | Keypad Functions .....                                    | 8-1         |
| 8-4            | Slow Monitoring .....                                     | 8-2         |
| 8-5            | Logic .....   | 8-2         |
| 8-6            | Parameter Sets.....                                       | 8-2         |
| IX             | COMMUNICATIONS .....                                      | 9-1         |
| 9-1            | Read and Write Standard ID Numbers .....                  | 9-1         |
| 9-2            | Special Field Bus Variables .....                         | 9-3         |
| 9-3            | Faults.....   | 9-3         |
| 9-4            | System Bus.....   | 9-3         |
| X              | FAULT CODES.....  | 10-1        |
| 10-1           | Fault Actions .....                                       | 10-1        |
| 10-2           | Stop Action .....   | 10-1        |
| 10-3           | Fault Reset .....   | 10-1        |
| 10-4           | Recording.....  | 10-2        |
| 10-5           | Drive Faults.....   | 10-3        |
| 10-6           | Drive Fault Options.....                                  | 10-6        |
| XI             | QUICK STARTUP .....                                       | 11-1        |
| 11-1           | Startup Wizard .....                                      | 11-1        |
| 11-2           | Identification .....                                      | 11-1        |
| APPENDIX A     | Software Block Diagrams .....                             | A-1         |
| APPENDIX B     | Parameter List.....                                       | B-1         |
| APPENDIX C     | Alphabetical and Drawing Coordinate Cross-Reference ..... | C-1         |
| APPENDIX D     | Parameter ID Number Cross-Reference.....                  | D-1         |

**AVTRON ACCEL500  
DRIVE STAND APPLICATION SOFTWARE  
Part Number 695115.V10**

## **SECTION I**

### **INTRODUCTION AND GENERAL INFORMATION**

The ACCEL500 Drive Stand software is a specific application created for the aircraft test stands. It offers the stand to be operated in maintenance or remote mode either as a torque, speed or jet engine start modes. Following is a list of the major software features.

Communications options:

- Ethernet (Modbus TCP, Ethernet IP, EGD)
- Devicenet
- Profibus DP
- Modbus
- System Bus (Fiber)

Reference location options:

- Fixed value
- Analog input
- Communications
- Frequency

Speed reference features:

- Remote or local maintenance speed reference
- 24 point speed vs time table
- Jet engine simulator
- Reverse command
- Ramp with programmable rates and S-curves
- Ramp hold
- Master/Slave
- Speed step input

Speed loop:

- PI regulator
- Inertia compensation
- Current limit control
- Non-linear gains

Torque Reference:

- Slave torque control
- Remote or local torque reference
- 48 point torque vs speed table

Spare operation blocks:

- Variety of logic blocks including , Ands, Ors, Inverts, and latches
- Comparitors
- Switches
- Gains

Firmware Options enabled

- Start Wizard
- Identification (Motor and torque loop tuning)
- Motor control
  - Volt/Hertz
  - Open loop vector
  - Closed loop vector
- 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 / local modes ( Remote LED on drive keypad is lit )
- Drive keypad ( Local LED on drive keypad is lit )
- Computer diagnostic software ( Remote and Local LEDs flashing on keypad )

The drive out of the box is defaulted to the drive keypad 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).

#### 2-1 REMOTE / LOCAL 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.

NOTE: \*\*\* This is the standard mode for the test stand. \*\*\*

#### 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.

NOTE: \*\*\* Speed to 1000 rpm only available with 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.

NOTE: \*\*\* Speed to 1000 rpm only available with this mode. \*\*\*

## SECTION III

### KEYPAD AND PARAMETER DESCRIPTIONS

#### 3-1 ACCel500 KEYPAD OPERATION

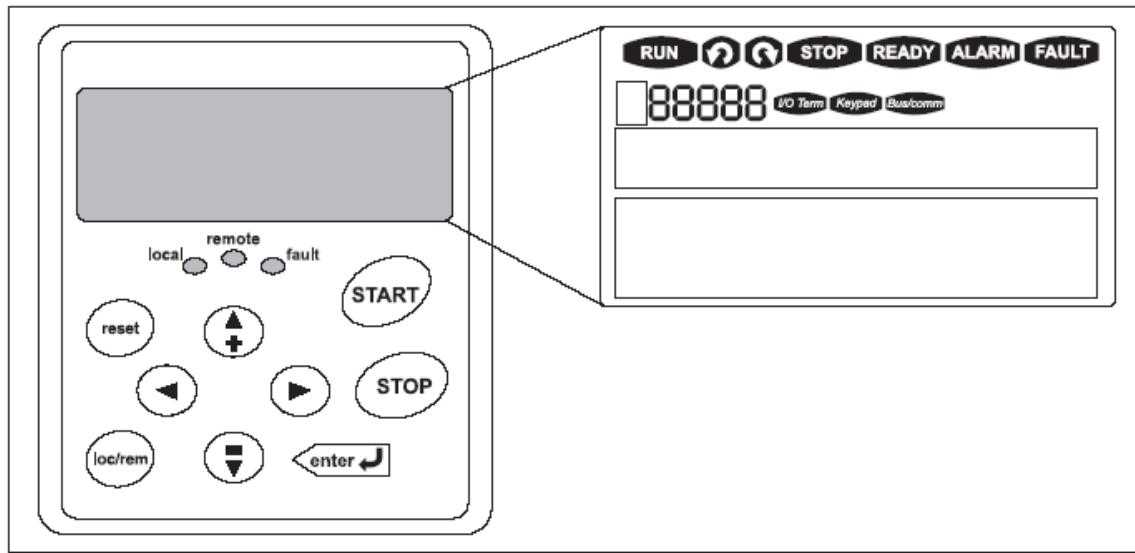


Figure 3-1. Keypad and Display

TABLE 3-1. NAVIGATION BUTTONS

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

TABLE 3-2. LCD STATUS INDICATORS

| Indicator | Description  |
|-----------|--|
|           | <b>Run</b><br>Indicates that the ACCEL500 is running and controlling the load. Blinks when a stop command has been given but the ACCEL500 is still ramping down. |
|           | <b>Counterclockwise Operation</b><br>The output phase rotation is BAC, corresponding to counterclockwise rotation of most motors.                                |
|           | <b>Clockwise Operation</b><br>The output phase rotation is ABC, corresponding to clockwise rotation of most motors.  |
|           | <b>Stop</b><br>Indicates that the ACCEL500 is stopped and not controlling the load.  |
|           | <b>Ready</b><br>Indicates that the ACCEL500 is ready to be started.  |
|           | <b>Alarm</b><br>Indicates that there is one or more active drive alarm(s).   |
|           | <b>Fault</b><br>Indicates that there is one or more active drive fault(s).   |
|           | <b>I/O Terminal*</b><br>Indicates that the I/O terminals have been chosen for control (remote).  |
|           | <b>Keypad*</b><br>Indicates that the keypad has been chosen for control (local).   |

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

TABLE 3-3. LED STATUS INDICATORS

| Indicator     | Description   |
|---------------|---|
| <b>local</b>  | <b>Local*</b><br>Indicates that the ACCEL500 is ready to be started and operated from the Local mode. |
| <b>remote</b> | <b>Remote*</b><br>Indicates that the ACCEL500 is operating and controlling the load remotely.         |
| <b>fault</b>  | <b>Fault</b><br>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.

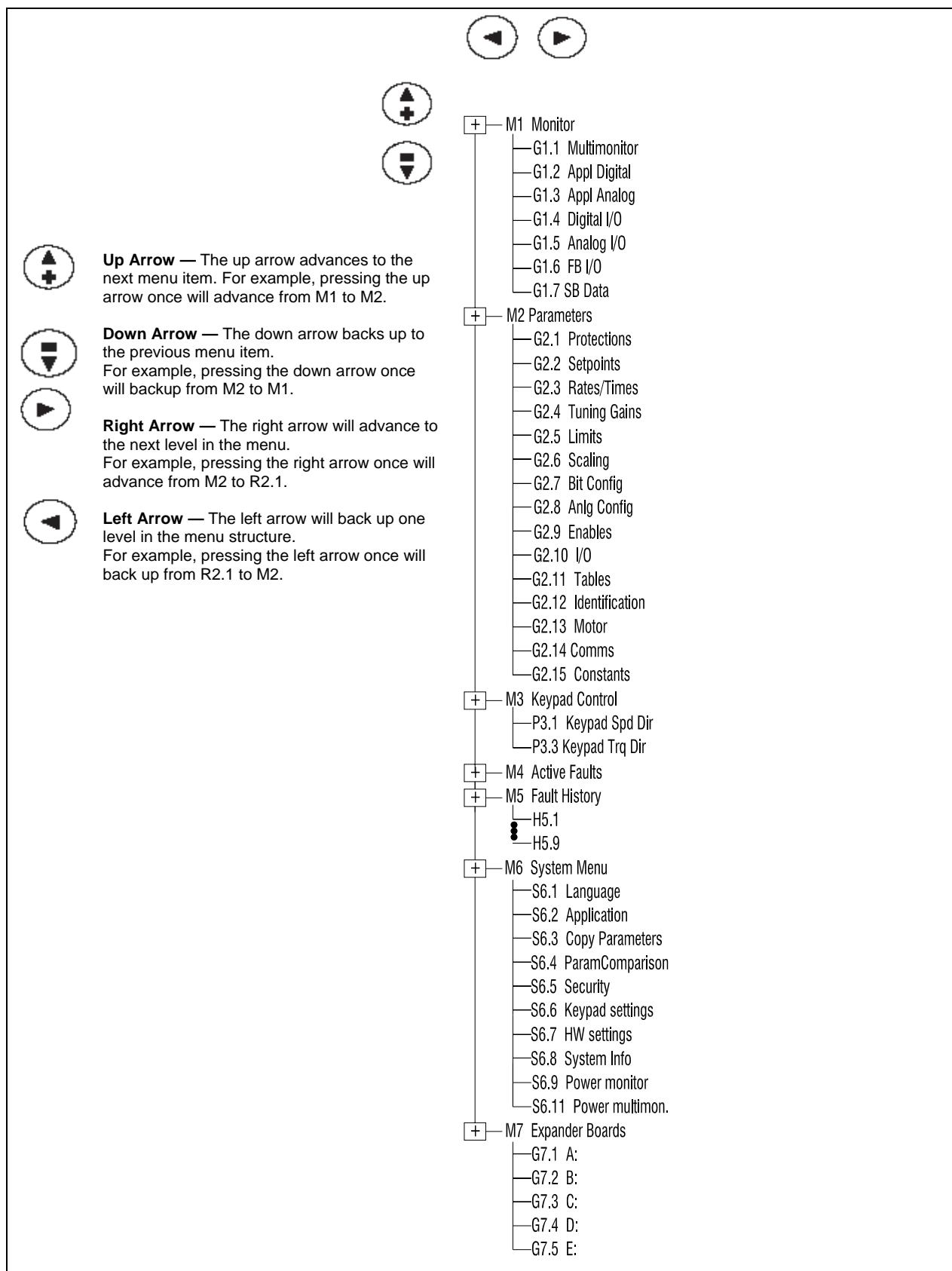


Figure 3-2. Main Menu Navigation

### 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).

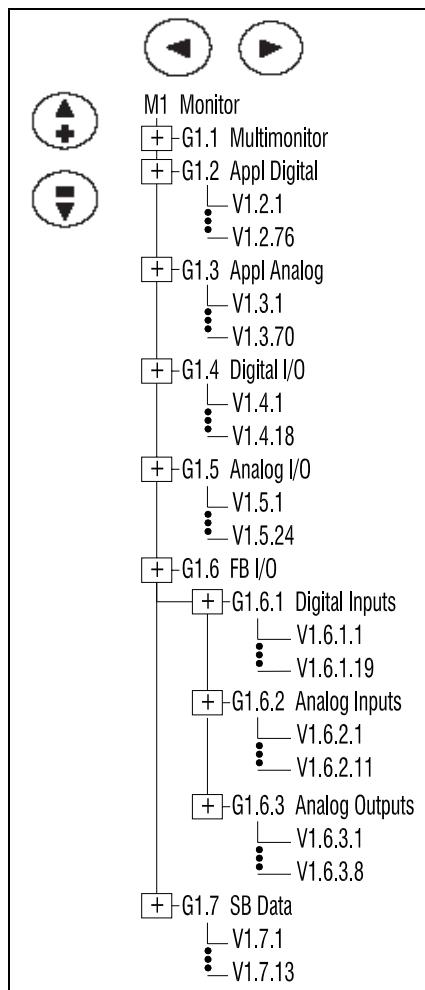


Figure 3-3. Monitor Menu Structure Example

#### 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.

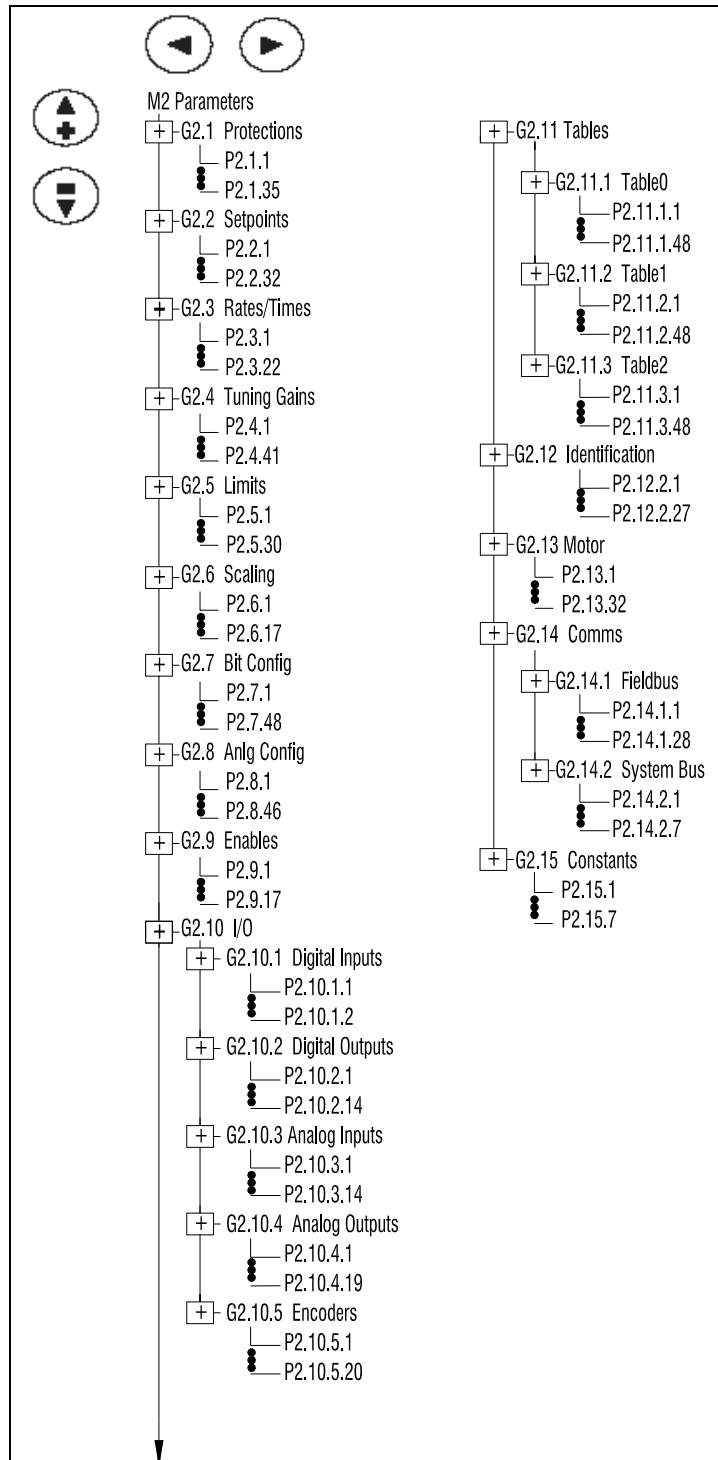


Figure 3-4. Parameter Menu

### **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.

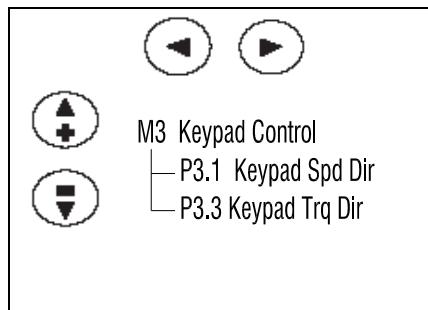


Figure 3-5. Keypad Control Menu

**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.

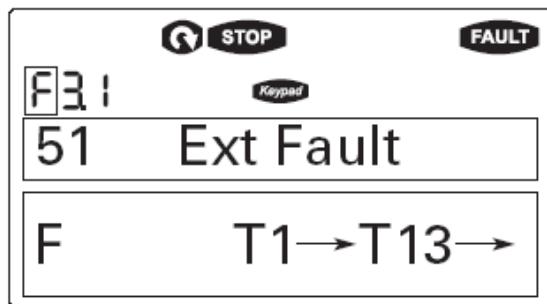


Figure 3-6. Active Fault Display Example

\*\*\*\*\*

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

Remove any External Start signals or permissives before resetting the fault to prevent an unintentional restart of the ACCel500, which could result in personal injury or equipment damage.

\*\*\*\*\*

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

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

TABLE 3-4. FAULT TYPES

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

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

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

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

The ACCeL500 drive's memory can store a maximum of 30 faults, in the order of appearance. If there are 30 uncleared faults in the memory, the next occurring fault will erase the oldest fault from the memory.

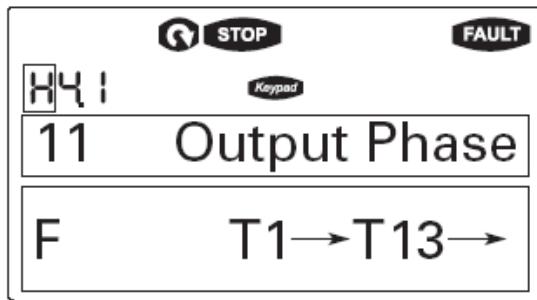


Figure 3-7. Sample Fault History Display

### 3-2.8 SYSTEM MENU (M6)

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

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

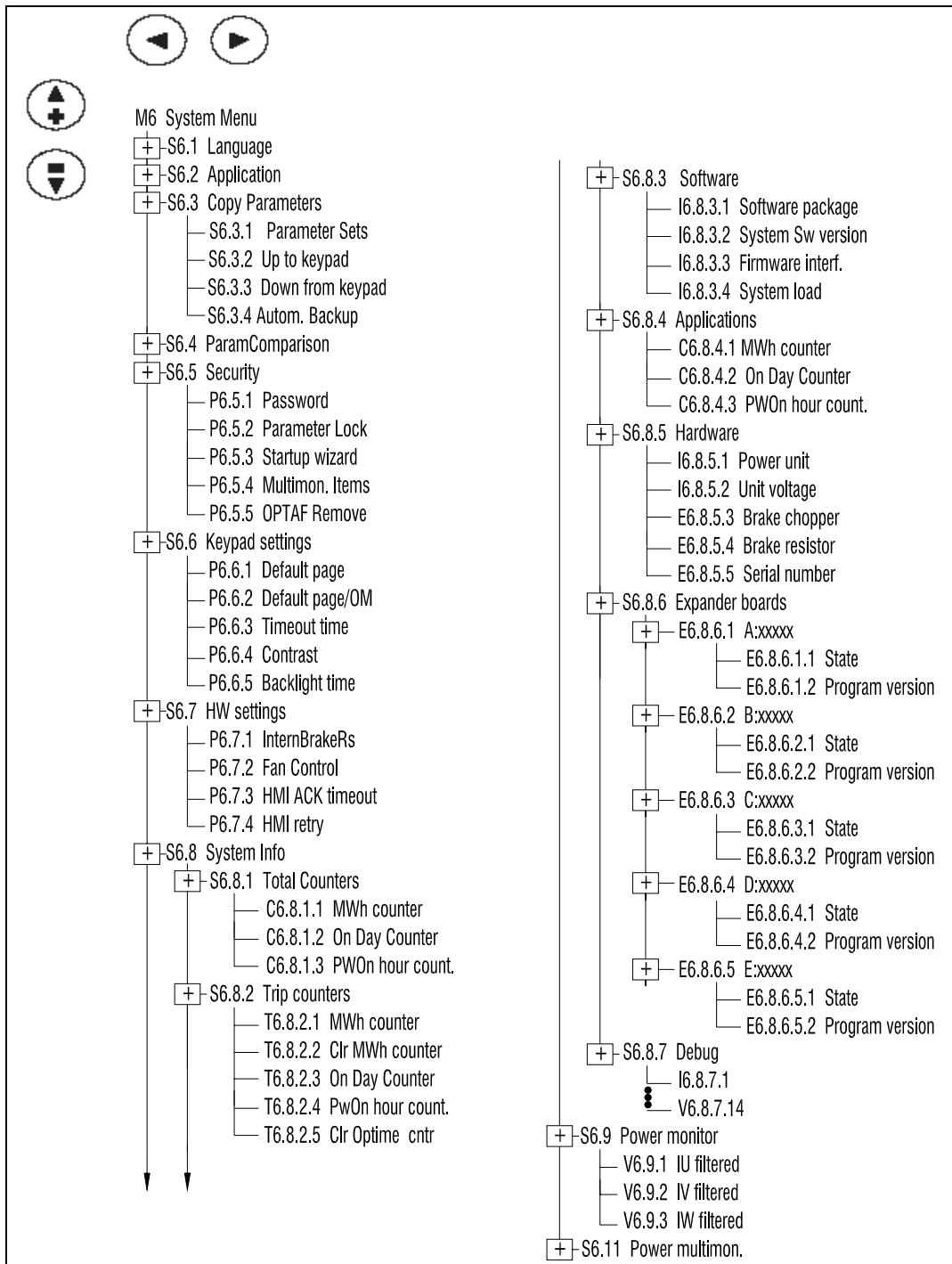


Figure 3-8. System Menu Structure

## System Menu Parameters

**S6.1** Range: English, Spanish, French, Portuguese      Default: English

**Language Selection** This parameter offers the ability to control the ACCe1500 through the keypad in the language of your choice. Available languages are: English, Spanish, French and Portuguese.

**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.

### 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  $\Delta$  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.

|   |  |                       |
|---|--|-----------------------|
| <b>P6.5.2</b>   | Range: ChangeEnable, ChangeDisabl  | Default: ChangeDisabl |
| <b>Parameter Lock</b>   |  |                       |
| 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. |                       |
| <b>P6.5.3</b>   |  |                       |
| <b>Start-up Wizard</b>  | Range: Yes, No   | Default: No           |
| 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. |  |                       |
| <b>P6.5.4</b>   |  |                       |
| <b>Multimon. Items</b>  | Range: ChangeEnable, ChangeDisabl  | Default: ChangeEnable |
| The keypad display can display three actual monitored values at the same time. This parameter determines if the operator is allowed to replace the values being monitored with other values.  |  |                       |

## Keypad Settings (S6.6)

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

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

|                      |   |                    |
|----------------------|---|--------------------|
| <b>P6.7.1</b>        | Range: Connected – Not Connected  | Default: Connected |
| <b>InternBrakeRs</b> | With this function you tell the ACCEL500 whether the internal brake resistor is connected or not. |                    |

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

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

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

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

|                |   |              |
|----------------|---|--------------|
| <b>P6.7.3</b>  | Range: 200 – 5,000  | Default: 200 |
| <b>HMI ACK</b> | Keypad Units: ms  |              |
| <b>timeout</b> | This function allows the user to change the timeout of the Keypad acknowledgement time. |              |

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

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

Example:

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

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

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

### System Information (S6.8)

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

#### S6.8.1

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

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

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

TABLE 3-6. TOTAL COUNTERS

| Number          | Name             | Description   |
|-----------------|------------------|---|
| <b>C6.8.1.1</b> | MWh counter      | Megawatt hours total operation time counter                     |
| <b>C6.8.1.2</b> | On Day counter   | Number of days the ACCEL500 drive has been supplied with power  |
| <b>C6.8.1.3</b> | 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  |
|-----------------|-----------------------|--|
| <b>T5.8.2.1</b> | MWh counter           | Megawatts hours since last reset                                     |
| <b>P5.8.2.2</b> | Clear MWh counter     | Resets megawatts hours counter                                       |
| <b>T5.8.2.3</b> | Power On day counter  | Number of days the ACCEL500 drive has been run since the last reset  |
| <b>T5.8.2.4</b> | Power On hour counter | Number of hours the ACCEL500 drive has been run since the last reset |
| <b>P5.8.2.5</b> | 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  |
|-----------------|-------------------|--------------|
| <b>I6.8.3.1</b> | Software package  | ACC00031V003 |
| <b>I6.8.3.2</b> | System Sw version | 11.53.6536   |
| <b>I6.8.3.3</b> | Firmware interf.  | 4.37         |
| <b>I6.8.3.4</b> | System load       | G9.1         |

**S6.8.4**

**Applications** The Application information page includes information on not only the application currently in use but also all other applications loaded into the ACCel500. The information available is shown in Table 3-9. Note that the “x” in the table refers to the sequential number of the application in the list.

TABLE 3-9. APPLICATIONS INFORMATION

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

**S6.8.5**

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

TABLE 3-10. HARDWARE INFORMATION

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

**S6.8.6**

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

TABLE 3-11. EXPANDER BOARD INFORMATION

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

**S6.8.7 Debug Menu**

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

**Power Monitor (S6.9)**

This menu shows the actual filtered current in amps.

TABLE 3-12. POWER MONITOR INFORMATION

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

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

The Expander Board Menu makes it possible for the user:

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

Each option board has its own set of parameters.

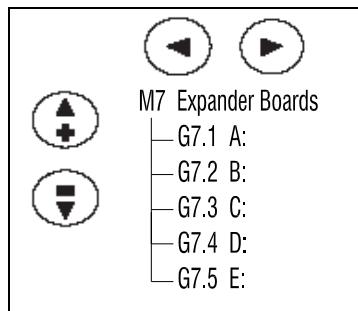


Figure 3-9. Expander Board Menu Structure

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

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

### **3-2.10 EDITING A NUMERIC VALUE**

Use the following procedure to edit numeric parameter values.

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

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

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

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

### **3-2.11 EDITING A CONFIGURATION VALUE**

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

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

Use the following procedure to edit configuration parameter values.

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

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

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

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

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

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

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

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

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

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

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

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

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

## SECTION IV

### I/O PARAMETER DESCRIPTIONS

#### 4-1 ANALOG INPUTS

| <b>Parameters</b>                   | <b>Type</b> | <b>Default</b> |
|-------------------------------------|-------------|----------------|
| <i>AIN3 Slot ID to AIN4 Slot ID</i> | ACFG        | 0              |
| <i>AIN1 Gain to AIN4 Gain</i>       | CAL         | 1.00           |
| <i>AIN1 Off to AIN4 Off</i>         | CAL         | 0.0            |
| <i>AIN1 Tc to AIN4 Tc</i>           | CAL         | 0.1 seconds    |
| <i>AII 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 four 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. The first two analog inputs are hard set Slot A input 0 and 1.

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:

| <u>Mode</u> |
|-------------|
| 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:

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

*AIN1 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 current 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>AOUT4 ID</i>           | ACFG | 3 = Motor Current<br>2 = Motor Speed<br>1200, 1200 = Zero analog |
| <i>AOUT1Zero</i> to <i>AOUT4Zero</i>         | CAL  | 0.0  |
| <i>AOUT1Cal</i> to <i>AOUT4Cal</i>           | CAL  | 1.00   |
| <i>AOUT_TC</i> to <i>AOUT4TC</i>             | CAL  | 0.10 seconds   |
| <i>AOUT2 Slot_ID</i> to <i>AOUT4 Slot_ID</i> | ACFG | 0  |
| <i>AOUT1 Val</i> to <i>AOUT4 Val</i>         | APB  |  |

### Description

Four analog outputs are available in this software. One analog output is available with the standard board in slot A. The other three 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. The first analog output is hard set to Slot A first 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 fist 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>DIN7 Slot ID to DIN8 Slot ID</i> | ACFG | 0       |
| <i>DIN 1 to DIN 8</i>               | DPB  |         |
| <i>Not DIN 1 to Not DIN 8</i>       | DPB  |         |

#### Description

Eight digital inputs are available in this software. Six digital 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 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 are hard set to Slot A digital inputs.

The digital inputs and their invert can be viewed as *DINx* and *Not\_DINx*.

### 4-4 DIGITAL OUTPUTS

| Parameters                            | Type | Default   |
|---------------------------------------|------|---|
| <i>DOUT1 ID to DOUT6 ID</i>           | BCFG | 111 6 = MC_Fault = Drive fault<br>1098 = MC_Run = Drive running<br>1118 = MC_AtSpeed = Not ramping<br>1002, 1002, 1002 = Zero Bit |
| <i>DOUT1 Inv to DOUT6 Inv</i>         | En   | 0   |
| <i>DOUT4 Slot ID to DOUT6 Slot ID</i> | ACFG | 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 first three digital outputs are hard set to the default boards ( One output in slot A and two in slot B ).

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

## 4-5 ENCODER COUNTER OUTPUTS

| Parameters                          | Type | Default         |
|-------------------------------------|------|-----------------|
| <i>Enc1 Slot ID, Enc2 Slot ID</i>   | ACFG | 0               |
| <i>Enc1 Mlt, Enc2 Mlt</i>           | CAL  | 1000            |
| <i>Enc1 Div, Enc2 Div</i>           | CAL  | 1000            |
| <i>C_Enc2_Add</i>                   | CAL  | 1 ms            |
| <i>Enc1 Tc, Enc2 Tc</i>             | CAL  | 0               |
| <i>Counter1 Dec, Counter2 Dec</i>   | CAL  | 1               |
| <i>Counter1 Mult, Counter2 Mult</i> | BCFG | 1               |
| <i>Counter1 Hld, Counter2 Hld</i>   | BCFG | <i>Zero Bit</i> |
| <i>Counter1 Res, Counter2 Res</i>   | En   | <i>Zero Bit</i> |
| <i>Counter1, Counter2</i>           | Cal  | 0 ( Disabled )  |
| <i>Encoder1FiltTime</i>             | APB  |                 |
| <i>Enc1_Out, Enc2_Out</i>           | APB  |                 |
| <i>Counter1, Counter2</i>           | APP  |                 |

### Frequency Description:

Two encoder inputs are available in this software, but require additional option boards 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.

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

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

*Enc1\_Out* = first encoder input scaled by (motor Hz x *Enc1 Mult / Enc1 Div*) with a low pass filter of time constant *Enc1 Tc*.

*Enc2\_Out* = second encoder input scaled by ((motor Hz + *Enc2 ADD*) x *Enc2 Mult / Enc2 Div*) with a low pass filter of time constant *Enc2 Tc*.

**Counter Description:**

Both encoder inputs have pulse counters associated with them. These are bi-directional counters with hold and reset bits. The values of the counters 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.

*Counter1* = Motor rotations x *Counter1 Mult* / *Counter1 Dec*

*Counter2* = Motor rotations x *Counter2 Mult* / *Counter2 Dec*

*Counter1 Hld*, *Counter2 Hld* will hold their respective counters at their current count when high.

*Counter1 Res*, *Counter2 Res* will reset their respective counters to zero when high.

**4-6 DRIVE HARDWARE INPUTS**

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



## SECTION V

# LOGIC SEQUENCE

### 5-1 MISCELLANEOUS LOGIC

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

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

*Zero Analog* = 0

*One Analog* = 1

*Int Ten* = 10

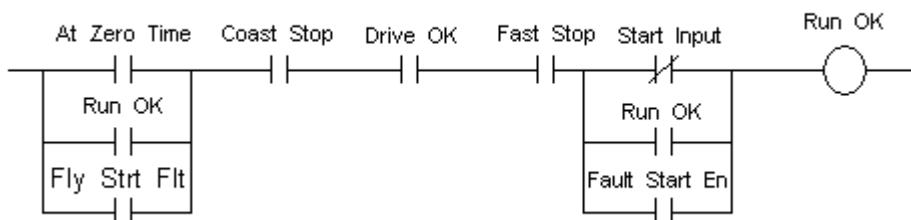
*Int Hundred* = 100

*Int Thousand* = 1000

### 5-2 REMOTE OPERATION

There are four basic run commands for the ACCe1500 drive. Run and thread are maintained. Jog forward and Jog reverse are momentary.

#### 5-2.1 Run OK



The *Run OK* bit is used to stop the drive in any control mode.

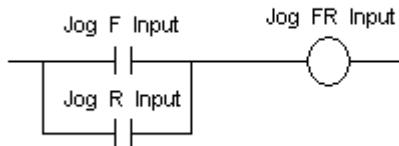
If the *Fly Start\_Flt* bit is enabled, then the drive can be restarted after a fault without first going to zero speed. This may be helpful for sections such as dryer helpers that get dragged along with the machine.

The *Fault Start En* bit allows the drive to start running as soon as the fault is cleared. If it is disabled, the Runs must first be removed before they can be energized again. This bit should be disabled when the runs come from a communication port rather than direct I/O. This will force the communications to come up and remove the runs before you can safely run.

The internal *MC Ready* is tied to the firmware *Drive OK* variable.

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

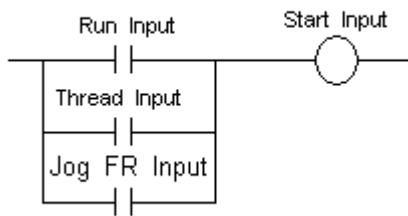
### 5-2.2 Jog FR Input



The *Jog FR Input* is active when either of the Jog inputs are a TRUE.

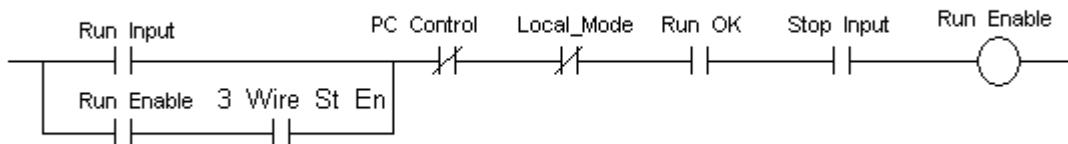
*Jog F Input* is defaulted to the second digital input. *Jog R Input* is defaulted to *Zero Bit*.

### 5-2.3 Start Input



*Start Input* is TRUE when any of the drive run inputs are active.

### 5-2.4 Run Enable

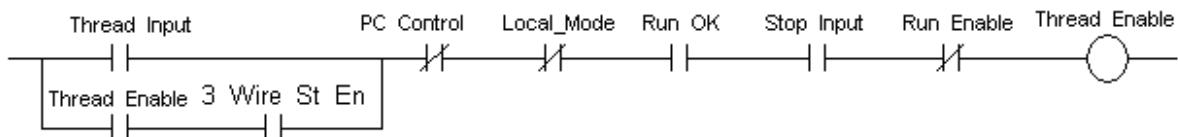


The *Run Input* will energize the *Run Enable* if all interlocks are met.

The *Stop Input* defaults to TRUE. This can be set to a normally closed stop input along with enabling the *3 Wire St En* to implement a three wire start/stop circuit.

*Run Input* is defaulted to the first digital input.

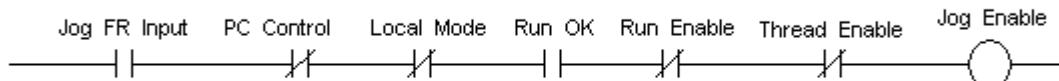
### 5-2.5 Thread Enable



*Thread Enable* is setup similar to the *RunEnable*. *Run\_Enable* takes priority. If in Thread and the *Run\_Input* goes high the control will transfer to the Run mode.

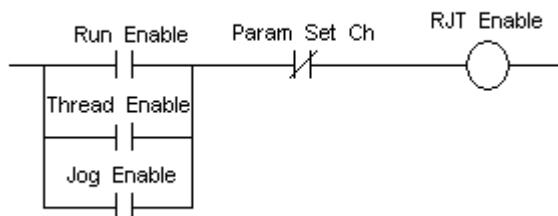
*Thread Input* is defaulted to Zero Bit which disables this function.

### 5-2.6 Jog Enable



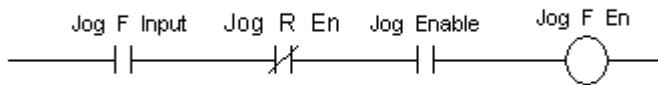
The *Jog Enable* is not maintained. Removing the input turns off the enable. Also, Thread and Run Enables have a higher priority.

### 5-2.7 RJT Enable



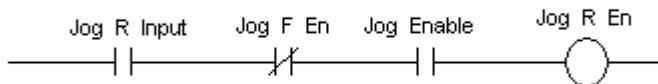
*RJT Enable* is high if any of the modes are enabled and the drive is done with a parameter change. This makes sure all proper values are in place before proceeding.

### 5-2.8 Jog F En



Enables Jog forward reference. First come, first serve between the two jog modes.

### 5-2.9 Jog R En



Enables Jog reverse reference. First come, first serve between the two jog modes.

### 5-2.10 Fast Stop

When *Fast stop* input goes low, the drive will stop at its fast ramp rate. This is defaulted to *One Bit*.

### 5-2.11 Cntr Mode

Control mode is an integer based on the following:

- 0 = Not enabled
- 1 = Run\_Enable
- 2 = Thread\_Enable
- 3 = Jog\_F\_En
- 4 = Jog\_R\_En

This is used for the reference select blocks.

|             |                          |
|-------------|--------------------------|
| Ltch_Rem    | = NOT ( <i>Rem Bit</i> ) |
| Ltch_LTrq   | = <i>Loc Trq Bit</i>     |
| Ltch_Con_Md | = <i>Con_Mode_Inp</i>    |
| Ltch_Maint  | = <i>Maint_Bit</i>       |

The state of four internal values above are latched when *MC Run* is high.

Ltch\_Rem – Latched into remote mode. External computer supplying setpoints.

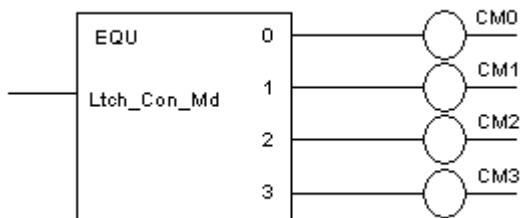
Ltch\_LTrq – The test stand control console has commanded torque mode.

Ltch\_Con\_Md – Command word sent from console as follows:

- 0 – Run speed vs time curve
- 1 – Run engine start simulator
- 2 – Run speed vs time then engine start simulator
- 3 - Run engine start simulator then speed vs time curve

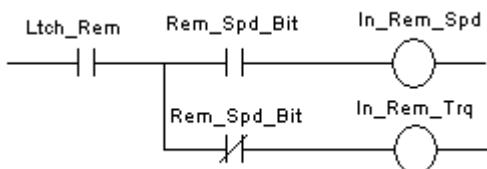
Ltch\_Maint – Command from console for Maintenance mode

#### 5.2.12 Console Mode Bits



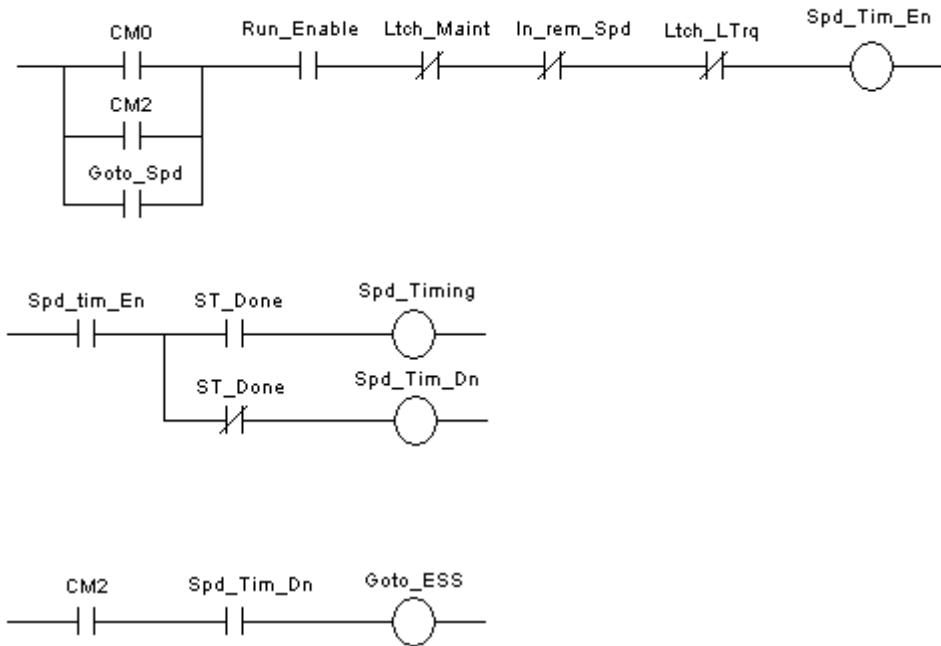
The four bits are set based on the value of Ltch\_Con\_Md used in the logic below.

#### 5.2.13 In\_Rem\_Spd, In\_Rem\_Trq



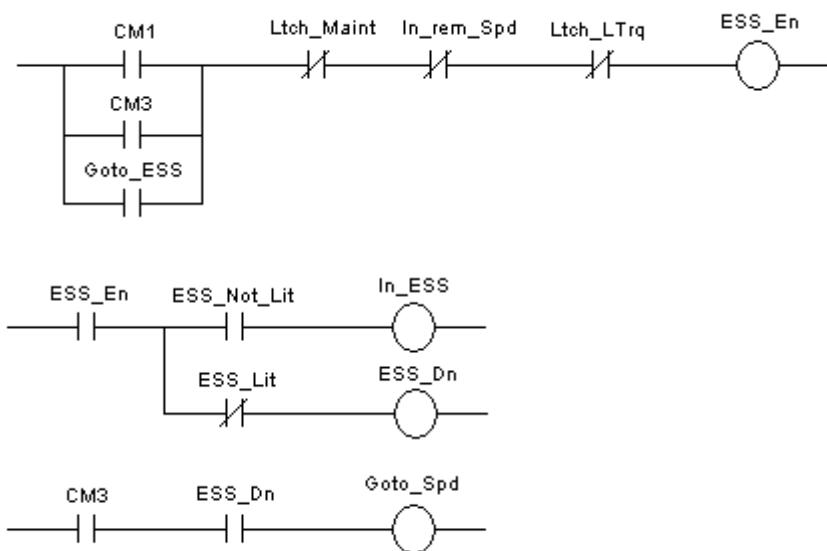
The drive can run in either a speed or torque mode in the remote mode. Drive does not have to stop to switch between these modes.

### 5-2.14 Speed vs. Time Logic



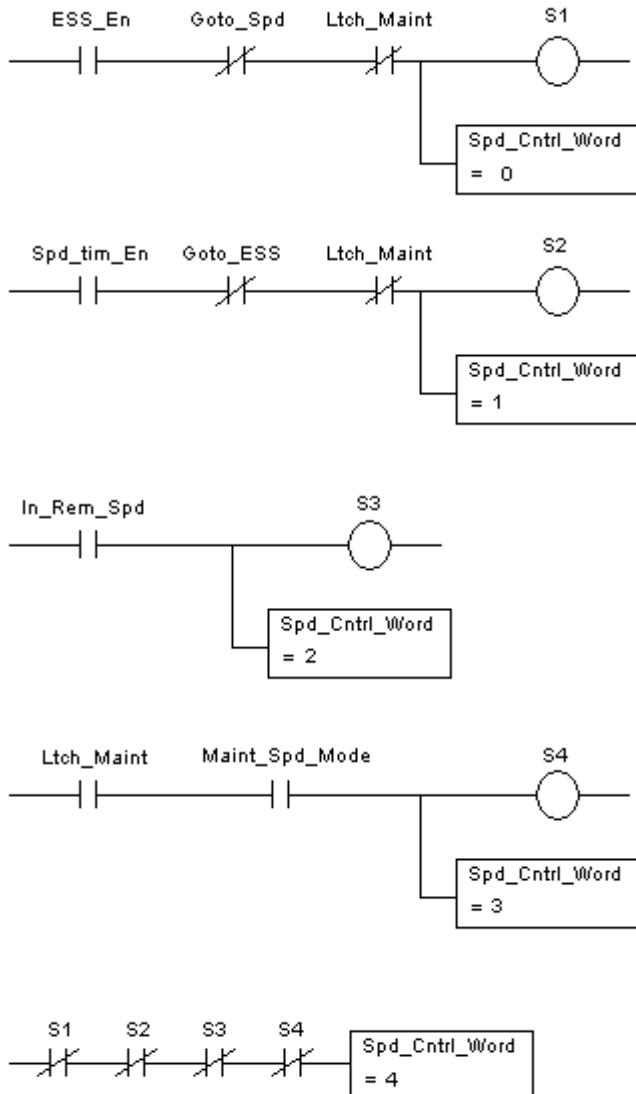
*Spd Tim En* is used to start the speed vs time table function. When the table is completed *ST Done* will go high. At that point if *CM2* is high the drive will transfer straight to the Engine start simulator mode. Otherwise the drive will stay at the tables last speed until the run is removed or the drive goes into maintenance mode.

### 5-2.15 Engine Start Simulator Logic



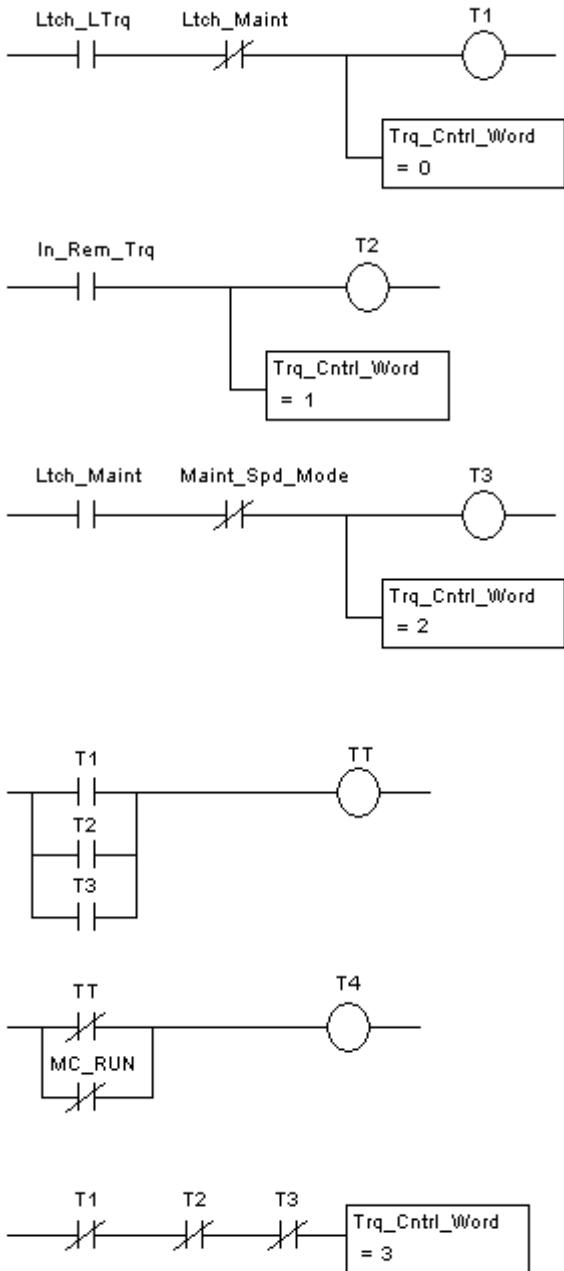
*ESS En* is used to start the engine starter simulator function. When the spdee has reached its lit setpoint *ESS Dn* will go high. At that point if *CM3* is high then the drive will transfer straight to the Speed vs time mode. Otherwise the drive will stay at the lit setpoint until run is removed or the drive goes into maintenance mode.

### 5.2.16 Speed Status



*Spd Cntrl Word* and the mode bits are used in the referencing to switch modes. They are also present for diagnostic purposes to determine the state of the drive.

## 5-2.17 Torque Status



The Torque status word and bits are used to switch torque references and also used for diagnostics to determine the mode the drive is in.

### 5-2.18 Ramp Delays

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

- *Start 0 Spd Time* 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. This operates in close loop mode only.
- *Stop 0 Spd Time* 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)

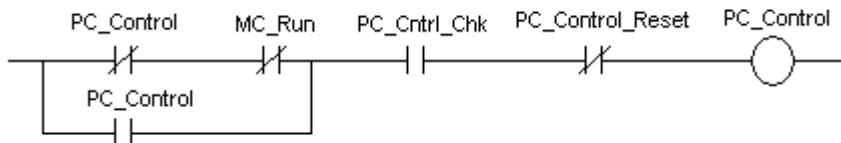
Pressing the Stop Button on the keypad will initiate a local stop. This does not stop the drive in remote or PC control. See button Stop fault in next section.

### 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.

## 5-5 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 RAMP REFERENCE**

#### 6-1.1 Maintenance Speed Reference

| <b>Parameters</b>     | <b>Type</b> | <b>Default</b>                         |
|-----------------------|-------------|--|
| <i>Maint Spd Inp</i>  | Acfg        | 1245 = <i>M Spd Stpt</i><br>= 1000 RPM |
| <i>Spd Cntrl Word</i> | APB         |  |

Description:

When the logic sets *Spd Cntrl Word* = 3 ( See section 5-2 ) the speed reference will be derived from the configuration input *Maint Spd Inp* which is defaulted to the calibration setpoint *M Spd Stpt*.

#### 6-1.2 Remote Speed Reference

| <b>Parameters</b>     | <b>Type</b> | <b>Default</b>                           |
|-----------------------|-------------|--|
| <i>Rem Spd Inp</i>    | Acfg        | 1237 = <i>Rem Spd Stpt</i> =<br>5000 RPM |
| <i>Spd Cntrl Word</i> | APB         |  |

Description:

When the logic sets *Spd Cntrl Word* = 2 ( See section 5-2 ) the speed reference will be derived from the configuration input *Rem Spd Inp* which is defaulted to the calibration setpoint *Rem Spd Stpt*.

#### 6-1.3 Speed vs Time Reference

| <b>Parameters</b>     | <b>Type</b> | <b>Default</b> |
|-----------------------|-------------|----------------|
| <i>Spd Tim En</i>     | DPB         |                |
| <i>T1 X47</i>         | TBL         |                |
| <i>ST Done</i>        | DPB         |                |
| <i>Spd Tbl Tim</i>    | APB         | Sec            |
| <i>Table 1</i>        | TBL         |                |
| <i>Spd Cntrl Word</i> | APB         |                |

Description:

When *Spd Tim En* goes high and *Spd Cntrl Word* = 1 the Speed vs time table becomes the speed reference. *Spd Tbl Tim* starts incrementing up in seconds. This becomes the time axis input to *Table 1*. The Y value corresponding to the time becomes the speed reference. There are 48 points that can be used to derive the speed function.

When the last point is executed in the table. *ST Done* goes high and the output is frozen at the last point.

## 6-1.4 Engine Starter Simulator Reference

| Parameters          | Type | Default                        |
|---------------------|------|--------------------------------|
| <i>Loss Tbl Inp</i> | Acfg | 1201 = One Analog              |
| <i>Abs Fil Spd</i>  | APB  |                                |
| <i>Loss Tbl Gn</i>  | CAL  | 0.01                           |
| <i>Table 0</i>      | TBL  |                                |
| <i>Loss Tbl Out</i> | APB  |                                |
| <i>Trq Ref Inp</i>  | Acfg | 1601 = AIN 1                   |
| <i>WK Scaling</i>   | CAL  | .01                            |
| <i>WK Inp</i>       | Acfg | 1234 = WK Stpt = 1.0           |
| <i>PR Accel</i>     | APB  |                                |
| <i>MC Run</i>       | DPB  |                                |
| <i>S1</i>           | DPB  |                                |
| <i>ESS Int Gn</i>   | CAL  | = 1.00                         |
| <i>Max ESS Lim</i>  | CAL  | 10000 rpm                      |
| <i>Min ESS Lim</i>  | CAL  | 0 rpm                          |
| <i>Abs Fil Spd</i>  | APB  | RPM                            |
| <i>ESS Lit Stpt</i> | CAL  | 5000 RPM                       |
| <i>ESS Lit</i>      | DPB  |                                |
| <i>ESS Not Lit</i>  | DPB  |                                |
| <i>Lit Spd Inp</i>  | Acfg | 1247 = Lit Speed = 4000<br>RPM |

Description:

In the Engine Starter simulator the test stand becomes a varying speed regulator that will resist against the starter. The basic concept is to accelerate like a jet engine. The starter torque minus the losses is the torque able to accelerate the engine. Dividing this torque by the programmable unit inertia yields the acceleration rate. This acceleration reference gets integrated to become the speed reference.

*Trq Ref Inp* is the starter torque input. This can be configured to an analog input from an external torque transducer or *Motor Torque* can be used.

To accurately depict engine torque losses a table is needed to modify the loss by speed. *Table 0* is a 48 point table that represents the losses. The X values are DUT RPM with no decimal point. The Y values is the torque loss and must be the same scale as *Trq Ref Inp*.

The difference from *Trq Ref Inp* and *Table 0* out is divided by *WK Inp* to become the acceleration torque. *WK Scaling* is a gain factor to properly scale the acceleration. The final value can be viewed by *PR Accel*.

*PR Accel* is integrated to become the speed reference. *ESS Int Gn* is a direct time constant that will affect the acceleration rate. *Max ESS Lim* and *Min ESS Lim* are output limits in RPM.

The integrated value becomes the speed reference until it reaches *ESS Lit Stpt*. At that time the drive stand will ramp to the value configured to *Lit Spd Inp*. *ESS Lit* indicates it has reached the value and *ESS Not lit* is the inverse bit.

The drive stand will stay at that speed until it is either stopped, goes to maintenance mode or is setup to automatically go to speed vs time table ( See logic section ).

#### 6-1.5 Speed Control Word

| Parameters            | Type | Default  |
|-----------------------|------|--|
| <i>Spd Cntrl Word</i> | APB  |  |
| <i>Mx Spd Lim</i>     | Acfg | $1243 = \text{Max ESS Lim} = 10,000 \text{ RPM}$ |
| <i>Spd Ref</i>        | APB  |  |

##### Description:

Depending on *Spd Cntrl Word* the speed reference comes from the maintenance, remote, speed vs time or ESS references( See previous sections). This speed reference is limited between zero and the *Mx Spd Lim* input configuration point. The reference can then be viewed by *Spd Ref* value.

#### 6-1.6 SPEED REFERENCE SELECTION

| Parameters         | Type | Default                      |
|--------------------|------|------------------------------|
| <i>Cntrl Mode</i>  | APB  |                              |
| <i>Master Ref</i>  | Acfg | <i>Spd Ref</i>               |
| <i>Thread Ref</i>  | Acfg | <i>Thread Speed</i> = 10.00  |
| <i>Jog F Ref</i>   | Acfg | <i>Jog Fwd Speed</i> = 5.00  |
| <i>Jog R Ref</i>   | Acfg | <i>Jog Rev Speed</i> = -5.00 |
| <i>RJT Ref</i>     | APB  |                              |
| <i>ABS RJT Ref</i> | APB  |                              |
| <i>Neg Spd Ref</i> | APB  |                              |

##### Description:

*Cntrl\_Mode* determines where the speed reference comes from. See Section IV, Logic Sequence, for details on the logic for *Cntrl Mode*. Normal operation for the test stand the speed reference will come from *Master Ref*.

After selecting the proper reference, it is checked to see if it is negative. If negative, *Neg Spd Ref* bit is set. The absolute value is then applied to the speed reference and can be viewed by *ABS RJT Ref*.

### 6-1.7 REVERSE COMMAND

| Parameters            | Type | Default         |
|-----------------------|------|-----------------|
| <i>Revers Inp</i>     | BCFG | <i>Zero Bit</i> |
| <i>Jog Enable</i>     | DPB  |                 |
| <i>Control Place</i>  | APB  |                 |
| <i>Keypad Spd Dir</i> | DPB  |                 |
| <i>SC_Reverse</i>     | DPB  |                 |
| <i>Reverse</i>        | DPB  |                 |

Description:

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

- Remote Control - Reverse comes from *Reverse Inp* (the reverse input configuration point). This is not used when jogging since there is a separate jog forward and jog reverse. Reverse can also be commanded by having a negative speed reference.
- 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*)

### 6-1.8 REFERENCE SELECTION AND RAMP HOLD

| Parameters            | Type | Default  |
|-----------------------|------|----------|
| <i>Control Place</i>  | APB  |          |
| <i>ABS RJT Ref</i>    | APB  |          |
| <i>Keypad_Spd_ref</i> | APB  |          |
| <i>SC Spd Ref</i>     | APB  |          |
| <i>LS to Freq</i>     | CAL  | .600     |
| <i>LS Scl Div</i>     | CAL  | 1000     |
| <i>Min Frequency</i>  | CAL  | 0        |
| <i>FreqMax</i>        | CAL  | 60.00 HZ |
| <i>Freq_Reference</i> | APB  |          |

Description:

The Speed reference is dependent on *Control Place* as follows:

- Remote control - Comes from the Run,Jog, Thread reference *ABS RJT Ref*.
- Panel control - Set from the keypad *Keypad\_Spd\_ref*.
- Computer control - Set from the computer control slider bar from ADDaptACC (*SC Spd Ref*).

The Speed reference is then scaled from RPM to motor hertz. The default scaling is 10,000 RPM speed = 60.00 Hz. *LS to Freq* and *LS to Freq* are used for this scaling.

The frequency reference is then limited between *Min Frequency* and *Freq Max* and can be viewed by *Freq Reference*.

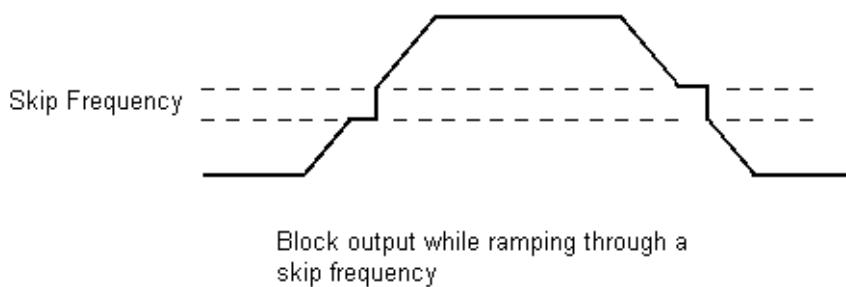
### 6-1.9 SKIP FREQUENCY AND REFERENCE POLARITY

| <b>Parameters</b>     | <b>Type</b> | <b>Default</b> |
|-----------------------|-------------|----------------|
| <i>Skp Frq Hi1</i>    | CAL         | 0              |
| <i>Skp Frq Low1</i>   | CAL         | 0              |
| <i>Skp Frq Hi2</i>    | CAL         | 0              |
| <i>Skp Frq Low2</i>   | CAL         | 0              |
| <i>Freq Reference</i> | APB         |                |
| <i>Reverse</i>        | DPB         |                |
| <i>Neg Spd Ref</i>    | DPB         |                |
| <i>FreqReference</i>  | APB         |                |

#### Description:

The speed reference after the ramp hold logic gets checked for skip frequencies. Two separate skip frequencies can be selected to keep from running the drive within the range. The skip frequencies are entered in motor Hertz.

See the example below:



*Freq Reference* is the speed reference after the skip frequency logic in motor Hertz.

The speed reference is then checked for polarity. The polarity can be derived from the digital input *Reverse* as described in section 6-3, or if the reference was negative from its reference point.

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

### 6-1.10 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:

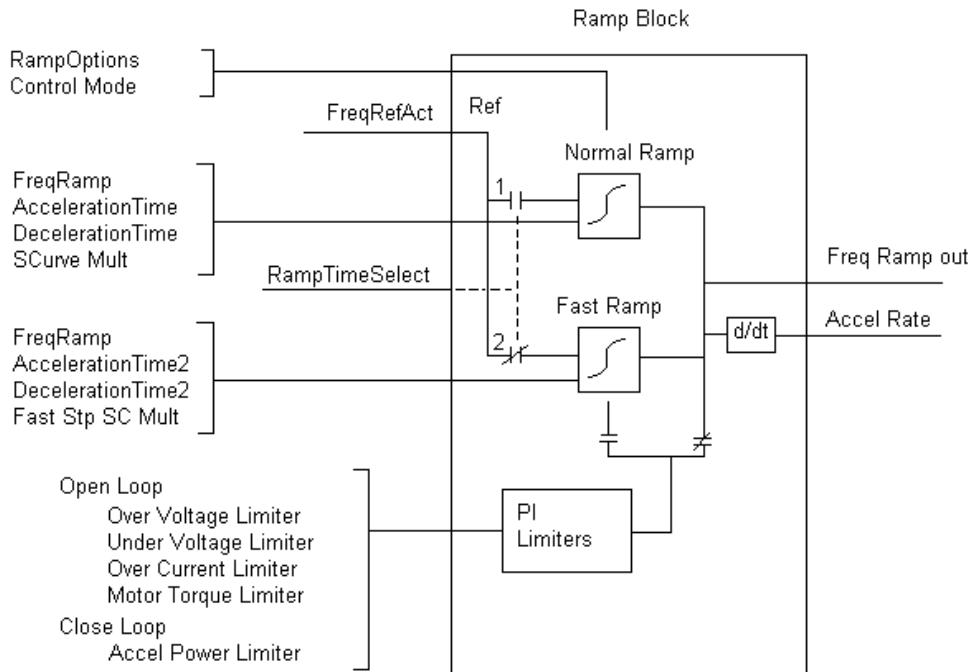
*FreqReference* is checked again to be within +/- *Freq Max* value and becomes *Freq Ref 3*.

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.

### 6-1.11 RAMPING



| Parameters        | Type | Default                   |
|-------------------|------|---------------------------|
| Accel Inp         | ACFG | Accel Time 1 = 10 seconds |
| Skip Freq Mlt     | CAL  | 0.5 ratio                 |
| Decel Time        | ACFG | Decel Time 1 = 10 seconds |
| Acc Skip Tim      | APB  |                           |
| Dec Skip Tim      | APB  |                           |
| In Skip Freq      | DPB  |                           |
| Acceleration Tim  | APB  |                           |
| Deceleration Time | APB  |                           |
| Fast Stop Tim     | CAL  | 0.1 seconds               |
| Fast Stop         | BCFG | One Bit                   |
| Smooth Ratio      | CAL  | 1                         |
| Smooth Ratio 2    | CAL  | 0                         |

#### Description:

The ramp rates are entered in seconds, from zero speed to *Freq Max*. A default of ten seconds with *Freq Max* of 60 Hz gives a ramp rate of 6 Hz/s. Forward and reverse acceleration input is *Accel Inp*. Forward and reverse deceleration input is *Decel Time*.

While in any of the three user-defined skip frequencies (*In Skip Freq* is high), the ramp rate can be modified to get through them quicker. The default multiplier is 0.5. This would reduce the 10 second ramp time to 5 seconds, which increases the ramp rate from 6 Hz/s to 12 Hz/s. The ramp times for the skip frequencies can be viewed at *Acc Skip Tim* and *Dec Skip Tim*.

*Acceleration Tim* and *Deceleration Time* are the ramp time value depending if the section is in a skip frequency or not.

When *Fast Stop* input is goes low the drive stops at *Fast Stop Tim* ramp time. This allows for a very fast current limit deceleration during emergencies.

*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.

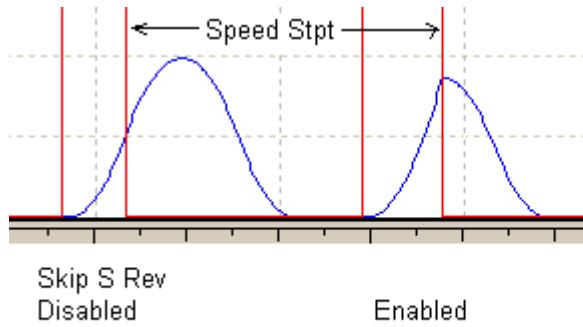
*Smooth Ratio 2* is used during the fast stop condition and should be left at zero unless the machine can not handle the stress.

#### 6-1.12 RAMP OPTIONS

| Parameters   | Type | Default  |
|--------------|------|----------|
| Skip S Rev   | E/D  | Disable  |
| Disable Ramp | BCFG | Zero Bit |
| Rmp Act Lim  | 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.

### 6-1.13 RAMP OUTPUTS

| Parameters           | Type | Default |
|----------------------|------|---------|
| <i>Freq Ramp Out</i> | APB  |         |
| <i>Freq Delta</i>    | APB  |         |

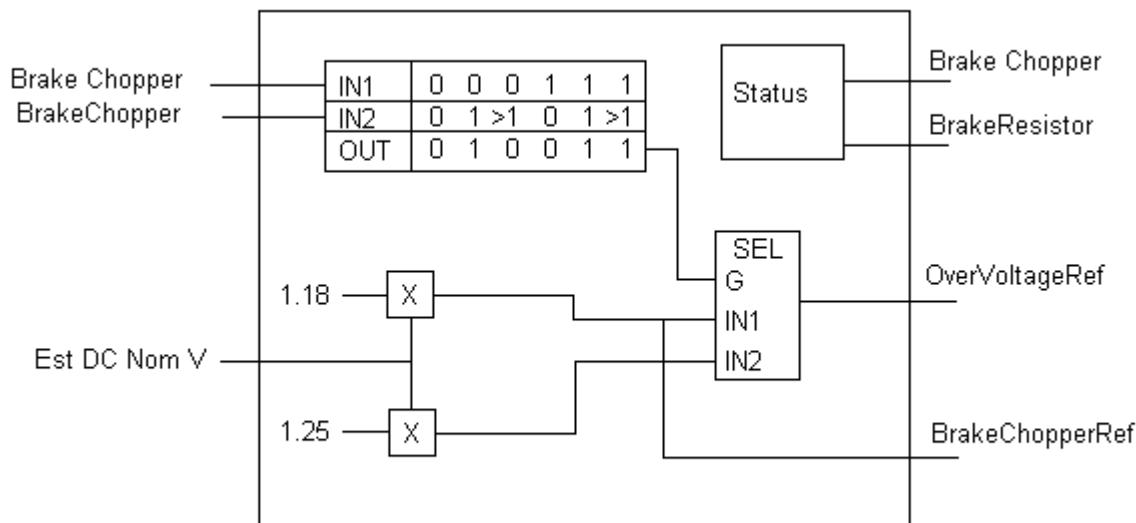
Description:

*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



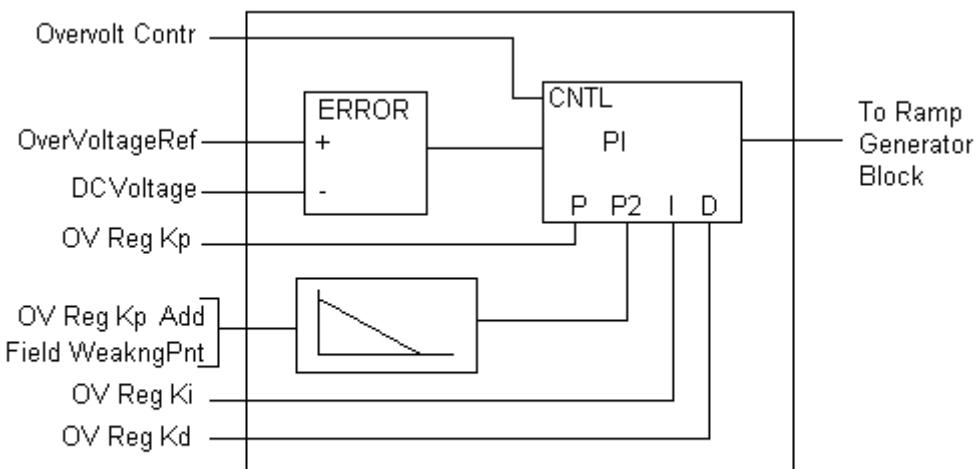
| <b>Parameters</b>    | <b>Type</b> | <b>Default</b> |
|----------------------|-------------|----------------|
| <i>Brake Chopper</i> | APB         |                |
| <i>BrakeChopper</i>  | CAL         | 0              |
| <i>Est DC Nom V</i>  | APB         |                |
| <i>BrakeResistor</i>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

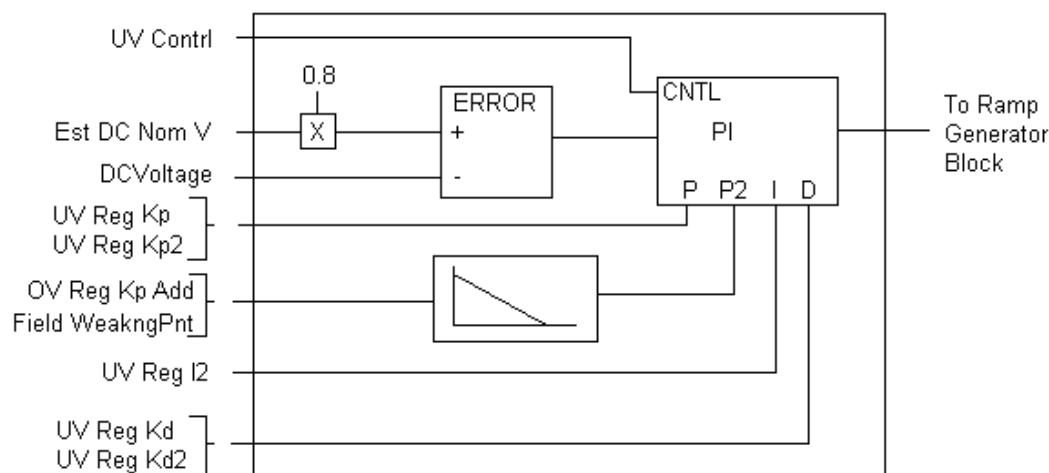
The over voltage reference is either 1.18 or 1.25 times the nominal bus voltage, depending on if there is a brake chopper circuit and resistor present.

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 UNDERTHRESHOLD LIMITER



| Parameters             | Type | Default       |
|------------------------|------|---------------|
| <i>UV Contrl</i>       | CAL  | disable       |
| <i>DCVoltage</i>       | APB  |               |
| <i>UV Reg Kp</i>       | CAL  | By frame size |
| <i>UV Reg Kd</i>       | CAL  | By frame size |
| <i>UV Reg 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  $0.8 \times Est\ DC\ Nom\ V$ .

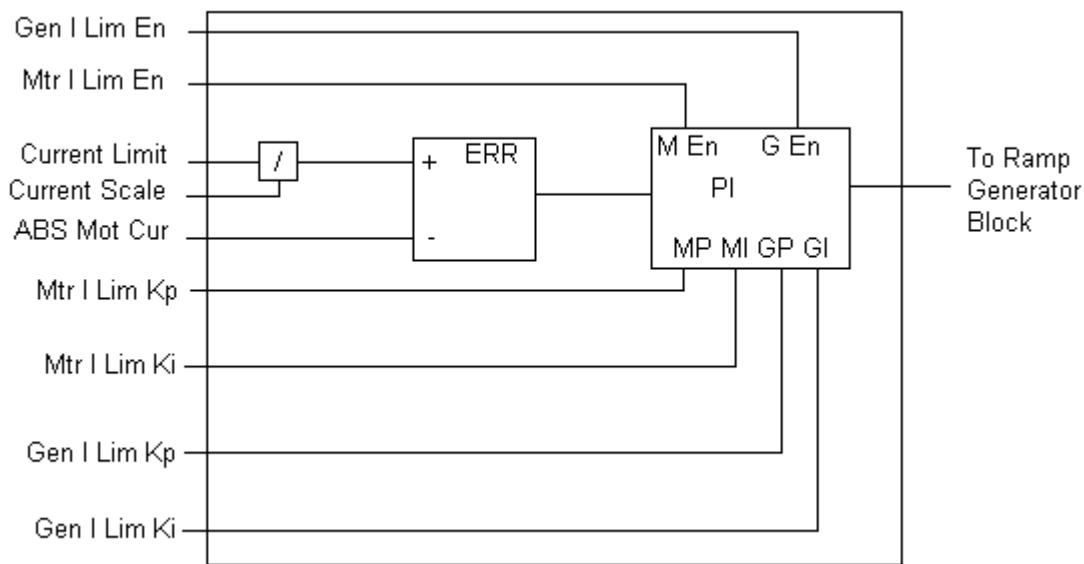
The four gains *UV Reg Kp*, *OV Reg Kp Add*, *UV Reg I2* and *UV Reg Kd* have different default values based on frame size. These should not need to be tuned except for extreme situations.

*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            |
|---------------|------|--------------------|
| Gen I Lim En  | EN   | 1 – Disable        |
| Mtr I Lim En  | EN   | 1 – Disable        |
| Current Scale | CAL  | 1,10 By frame size |
| Mtr I Lim Kp  | CAL  | By frame size      |
| Mtr I Lim Ki  | CAL  | By frame size      |
| Gen I Lim Kp  | CAL  | By frame size      |
| Gen I Lim Ki  | 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.

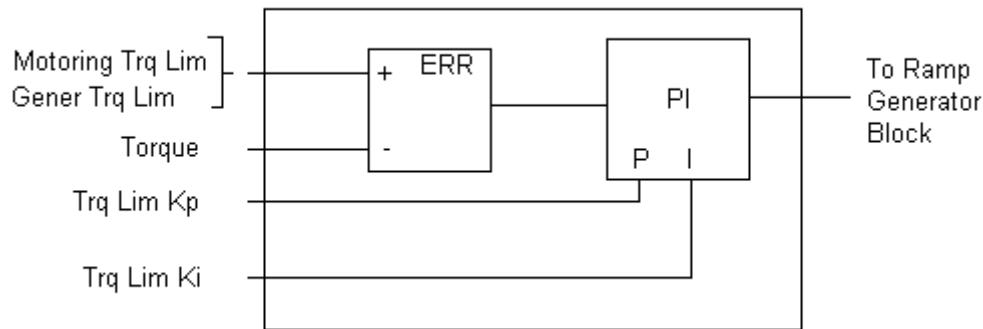
There are two regulators based on whether the drive is motoring or regenerating. *Gen I Lim En* enables the regeneration regulator, while *Mtr I Lim En* enables the motoring regulator. Both are defaulted to disable.

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.

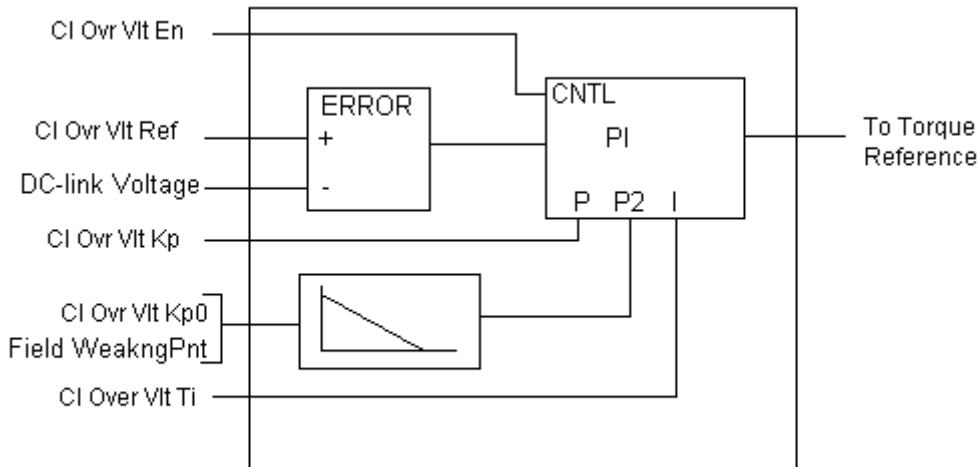
There are two regulators based on whether the drive is motoring or regenerating. Unlike the other regulators, there is no enable or disable for this limiter. The limits can be set above 300% to cause the drive to trip prior to the regulator turning on.

*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

*FreqRampOut* 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 REFERENCES

| Parameters              | Type | Default                  |
|-------------------------|------|--------------------------|
| <i>Sup Enable</i>       | BCFG | Zero Bit                 |
| <i>Slack Up</i>         | ACFG | <i>Spd Slk Up</i> = 10 % |
| <i>Step Reverse</i>     | BCFG | Zero_Bit                 |
| <i>Step Ref</i>         | APB  |                          |
| <i>LS to Freq</i>       | CAL  | 600                      |
| <i>LS Scl Div</i>       | CAL  | 10000                    |
| <i>Freq Max</i>         | CAL  | 60.0 Hz                  |
| <i>Freq Ramp Out</i>    | APB  |                          |
| <i>ProcessPITrimRef</i> | APB  |                          |

#### Description:

The *Slack Up* input is available to inject step changes into the speed reference. This can be used for tuning or current sharing. To enable set *Sup Enable* high.

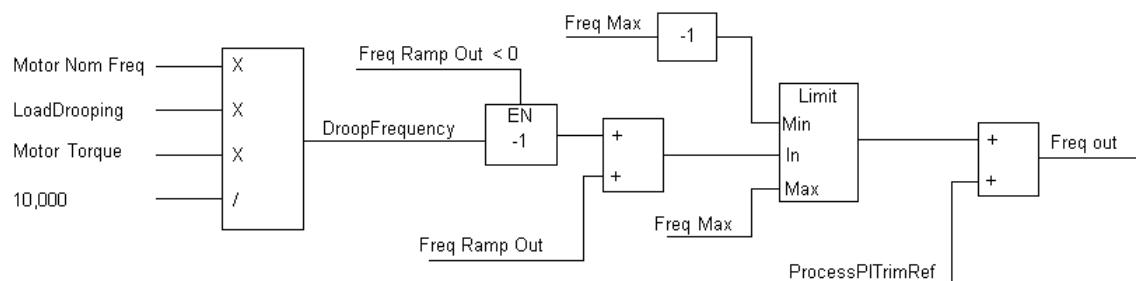
*Step Reverse* enables the inverse polarity of the *step reference*. The signal then becomes *Step Ref*.

*LS to Freq* and *LS Scl Div* are used to scale the speed step from process units to motor hertz.

**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 Ramp Out*.

### 6-3.2 OPEN LOOP STEP REFERENCE



| Parameters            | Type | Default |
|-----------------------|------|---------|
| <i>Motor Nom Freq</i> | CAL  | 60.0 Hz |
| <i>LoadDrooping</i>   | CAL  | 0       |
| <i>Motor Torque</i>   | APB  |         |
| <i>DroopFrequency</i> | APB  |         |
| <i>Freq Ramp Out</i>  | APB  |         |
| <i>Freq out</i>       | APB  |         |
| <i>Freq Max</i>       | CAL  | 60.0 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*

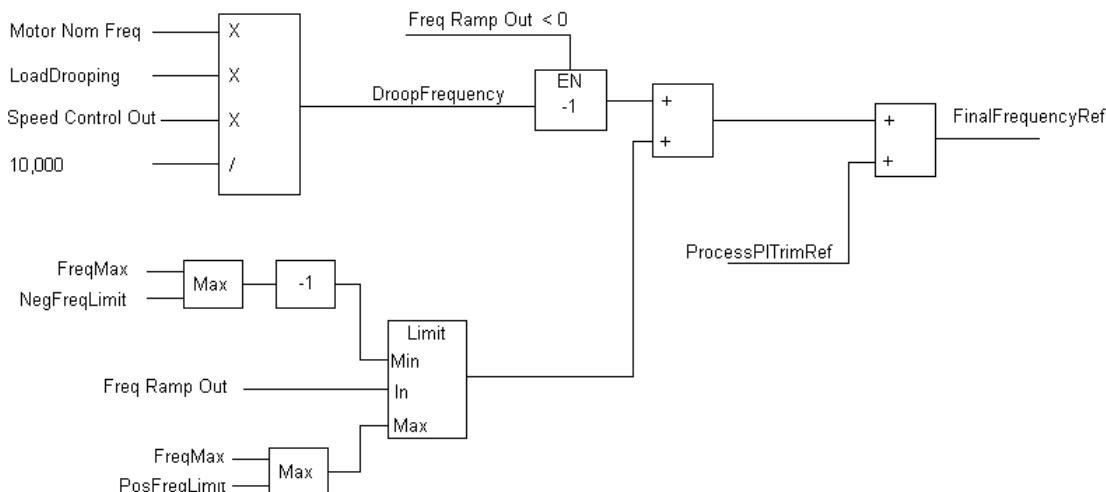
*Motor Torque = 25.0%*

*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



| <b>Parameters</b>       | <b>Type</b> | <b>Default</b> |
|-------------------------|-------------|----------------|
| <i>Motor Nom Freq</i>   | CAL         | 60.0 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         | 60.0 Hz        |
| <i>ProcessPITrimRef</i> | APB         |                |
| <i>Pos Freq Limit</i>   | CAL         | 60.0 Hz        |
| <i>Neg Freq Limit</i>   | CAL         | -60.0 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 SPARE BLOCKS

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

### 6-4.1 SPARE REFERENCE BLOCKS

| Parameters          | Type | Default                  |
|---------------------|------|--------------------------|
| <b>Muldiv Block</b> |      |                          |
| <i>Sp MD1 Val</i>   | ACFG | <i>Zero Analog</i>       |
| <i>Sp MD1 Mul</i>   | ACFG | <i>Sp MD1 Mlt</i> = 1.00 |
| <i>Sp MD1 Div</i>   | ACFG | <i>Sp MD1 Dv</i> = 1.00  |
| <i>Sp MD1 Out</i>   | APB  |                          |
| <b>Muldiv Block</b> |      |                          |
| <i>Sp MD2 Val</i>   | ACFG | <i>Zero Analog</i>       |
| <i>Sp MD2 Mul</i>   | ACFG | <i>Sp MD2 Mlt</i> = 1.00 |
| <i>Sp MD2 Div</i>   | ACFG | <i>Sp MD2 Dv</i> = 1.00  |
| <i>Sp MD2 Out</i>   | APB  |                          |
| <b>Add Block</b>    |      |                          |
| <i>Sp Add1 In1</i>  | ACFG | <i>Sp Add Val</i> = 0.00 |
| <i>Sp Add1 In2</i>  | ACFG | <i>Sp Add Val</i> = 0.00 |
| <i>Sp Add1 Out</i>  | APB  |                          |
| <b>Sub Block</b>    |      |                          |
| <i>Sp Sub1 In1</i>  | ACFG | <i>Sp Sub Val</i> = 0.00 |
| <i>Sp Sub1 In2</i>  | ACFG | <i>Sp Sub Val</i> = 0.00 |
| <i>Sp Sub1 Out</i>  | APB  |                          |

**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  |                        |

**Sel Block**

|                    |      |                        |
|--------------------|------|------------------------|
| <i>Sp Sel2 En1</i> | BCFG | <i>Zero_Bit</i>        |
| <i>Sp Sel2 In0</i> | ACFG | <i>Sp Sel2 ST0 = 0</i> |
| <i>Sp Sel2 In1</i> | ACFG | <i>Sp Sel2 ST1 = 0</i> |
| <i>Sp Sel2 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  |                    |

Description:

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

## 6-4.2 SPARE LOGIC BLOCKS

**Parameters      Type      Default****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   |
| <i>Sp Dly1 In</i>   | BCFG | <i>Zero Bit</i> |
| <i>Sp Dly1 Out</i>  | DPB  |                 |

| Parameters           | Type | Default         |
|----------------------|------|-----------------|
| <b>Latch Block</b>   |      |                 |
| <i>Sp Latch1 L</i>   | BCFG | <i>Zero Bit</i> |
| <i>Sp Latch1 H1</i>  | BCFG | <i>One Bit</i>  |
| <i>Sp Latch1 H2</i>  | BCFG | <i>One Bit</i>  |
| <i>Sp Latch1 Out</i> | DPB  |                 |
| <b>BInv Block</b>    |      |                 |
| <i>Sp Inv1 In</i>    | BCFG | <i>Zero Bit</i> |
| <i>Sp Inv1 Out</i>   | DPB  |                 |
| <b>BInv Block</b>    |      |                 |
| <i>Sp Inv2 In</i>    | BCFG | <i>Zero Bit</i> |
| <i>Sp Inv2 Out</i>   | DPB  |                 |
| <b>Or Block</b>      |      |                 |
| <i>Sp Or1 In1</i>    | BCFG | <i>Zero Bit</i> |
| <i>Sp Or1 In2</i>    | BCFG | <i>Zero Bit</i> |
| <i>Sp Or1 Nin3</i>   | BCFG | <i>One Bit</i>  |
| <i>Sp Or1 Out</i>    | DPB  |                 |
| <b>Or Block</b>      |      |                 |
| <i>Sp Or2 In1</i>    | BCFG | <i>Zero Bit</i> |
| <i>Sp Or2 In2</i>    | BCFG | <i>Zero Bit</i> |
| <i>Sp Or2 Nin3</i>   | BCFG | <i>One Bit</i>  |
| <i>Sp Or2 Out</i>    | DPB  |                 |
| <b>And Block</b>     |      |                 |
| <i>Sp And1 In1</i>   | BCFG | <i>One Bit</i>  |
| <i>Sp And1 In2</i>   | BCFG | <i>One Bit</i>  |
| <i>Sp And1 Nin3</i>  | BCFG | <i>Zero Bit</i> |
| <i>Sp And1 Out</i>   | DPB  |                 |
| <b>And Block</b>     |      |                 |
| <i>Sp And2 In1</i>   | BCFG | <i>One Bit</i>  |
| <i>Sp And2 In2</i>   | BCFG | <i>One Bit</i>  |
| <i>Sp And2 Nin3</i>  | BCFG | <i>Zero Bit</i> |
| <i>Sp And2 Out</i>   | DPB  |                 |

### Description:

Each of these are individual blocks 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>Abs Fil Spd</i>    | APB  |                                   |
| <i>Table 2</i>        | Tbl  |                                   |
| <i>Trq Spd Tbl</i>    | APB  |                                   |
| <i>Trq Cntrl Word</i> | APB  | Control Word by Logic             |
| <i>Rem_Trq Inp</i>    | ACFG | 1235 = <i>Rem Trq Stpt</i> = 10.0 |
| <i>Maint Trq Inp</i>  | ACFG | 1244 = <i>M Trq Stpt</i> = 10.0   |
| <i>Trq Lim Ref</i>    | APB  |                                   |
| <i>Trq Scl Mlt</i>    | CAL  | 1.00                              |
| <i>Trq Scl Div</i>    | CAL  | 1.00                              |
| <i>T4</i>             | DPB  |                                   |
| <i>Spd Trq Lim</i>    | CAL  | 100.0                             |
| <i>Trq No Ramp</i>    | BCFG | One Bit                           |
| <i>Trq Ref Rate</i>   | CAL  | 10.00                             |

Three torque references are available and select by *Trq Cntrl Word* (See section 4.2.17 for logic).

When *Trq Cntrl Word* = 0 the reference comes from *Table 2*. The table creates a torque reference based on the speed of the motor. The X parameter is speed in RPM while the associate Y parameter for each point is the torque reference.

When *Trq Cntrl Word* = 1 the reference comes from *Rem Trq Inp*.

When *Trq Cntrl Word* = 2 the reference comes from *Maint Trq Inp*.

The selected torque reference can be viewed at *Trq Lim Ref*.

*Trq Lim Ref* can be scaled in any customer units. *Trq Scl Mlt* and *Trq Scl Div* are used to convert the customer torque units to % motor torque with one decimal point.

*T4* selects the given reference when in torque mode. When low the torque reference becomes *Spd Trq Lim*.

If *Trq No Ramp* is selected low then the reference goes through a ramp limiter with a value of *Trq Ref Rate*. *Trq Ref Rate* units are percent motor torque per second.

### 7-1.2 CLOSED LOOP TORQUE REFERENCE

| Parameters           | Type | Default                   |
|----------------------|------|---------------------------|
| <i>Trq I Res1</i>    | BCFG | 1099 = <i>Cntrl Inhib</i> |
| <i>Trq I Res2</i>    | BCFG | 1001 ( <i>One Bit</i> )   |
| <i>Trq P Gain</i>    | CAL  | .01                       |
| <i>Trq I Gain</i>    | CAL  | 1.00                      |
| <i>Trq LP Max</i>    | CAL  | 100.0                     |
| <i>Trq LP Min</i>    | CAL  | -100.0                    |
| <i>Trq LP Gain</i>   | CAL  | 1                         |
| <i>Trq Lp Ref</i>    | ACFG | 1512 = <i>Trq Lim Ref</i> |
| <i>Trq Lp Fdbk</i>   | ACFG | 1601 = <i>AIN 1</i>       |
| <i>Trq PI Out</i>    | APB  |                           |
| <i>Regen_Trq_Lim</i> | APB  |                           |

An external torque transducer can be used to trim the torque reference. A PI regulator is present for this trim. The reference for the regulator is *Trq Lp Ref* which is defaulted to the open loop reference *Trq Lim Ref*. Configure the transducers analog input to *Trq Lp Fdbk*.

The Loop is enabled by having both *Trq I Res1* and *Trq I Res2* low.

The gains of the loop are set by *Trq P Gain*, *Trq I Gain* and *Trq LP Gain* which modifies both the proportional and integral gains.

The output of the close loop regulator can be limited by *Trq LP Max* and *Trq LP Min* values.

The output of the PI regulator can be viewed as *Trq PI Out* in % motor torque. This gets added to the open loop reference and becomes *Regen Trq Lim*.

### 7-1.3 TORQUE REFERENCE POLARITY AND RAMP

| Parameters            | Type | Default                     |
|-----------------------|------|-----------------------------|
| <i>Control Place</i>  | APB  |                             |
| <i>Trq Ref</i>        | ACFG | 1517 = <i>Regen Trq Lim</i> |
| <i>Keypad Trq Ref</i> | APB  |                             |
| <i>Trq Dir</i>        | BCFG | 1002 = <i>Zero Bit</i>      |
| <i>Keypad Trq Dir</i> | DPB  |                             |
| <i>Trq Ref En</i>     | BCFG | 1090 = <i>RunRequest</i>    |
| <i>Trq No Ramp</i>    | BCFG | 1001 = <i>One Bit</i>       |
| <i>Trq_Rmp_Rate</i>   | CAL  | 5                           |

The main torque reference *Trq Ref* is defaulted to the reference string described above. If *Control Place* = 1 the reference comes from the keypad (*Keypad Trq Ref*) for use as a debug setpoint. The polarity of the torque reference is set by *Trq Dir* in normal operation and *Keypad Trq Dir* in debug mode.

When *Trq No Ramp* is low then the final reference is rate limited by the value of *Trq Rmp Rate* in motor torque per second.

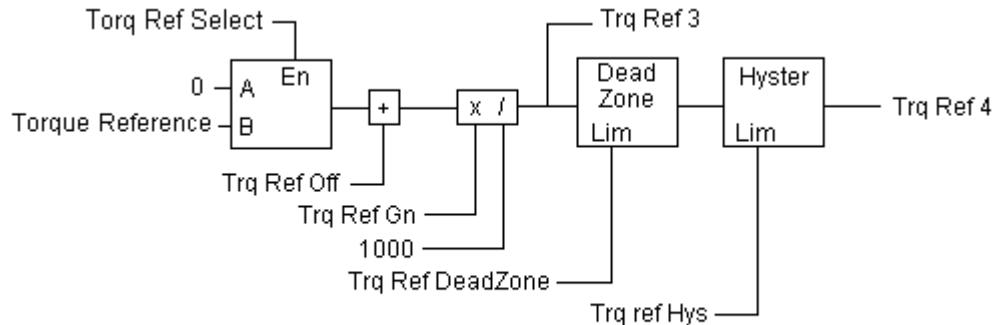
### 7-1.4 TORQUE REFERENCE LIMIT

| Parameters      | Type | Default  |
|-----------------|------|----------|
| Abs Fil Spd     | APB  |          |
| Trq Base_Spd    | CAL  | 1700 RPM |
| Trq Ref_Max     | CAL  | 100.0    |
| Trq End Spd     | CAL  | 5000 RPM |
| Trq Ref Min     | CAL  | 50.0     |
| Tbl Trq Lim     | APB  |          |
| TorqueReference | APB  |          |

The torque reference can be limited by speed. If the motor speed is below *Trq Base Spd* the reference is limited by *Trq Ref Max*. The limit will ramp down to *Trq Ref Min* when the speed reaches *Trq End Spd*. This limit can be viewed by *Tbl Trq Lim*.

The final torque reference goes into the firmware as *TorqueReference*.

### 7-1.5 TORQUE REFERENCE FIRMWARE, PART I



| Parameters       | Type | Default      |
|------------------|------|--------------|
| SC Trq Chain Sel | En   | 0 = Not used |
| Torq Ref Select  | En   | 0 = Not Used |
| Torque Reference | APB  |              |
| Trq Ref Gn       | CAL  | 1000         |
| Trq Ref Off      | CAL  | 0            |
| Trq Ref DeadZone | CAL  | 0            |
| Trq Ref Hyst     | CAL  | 0            |

*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.

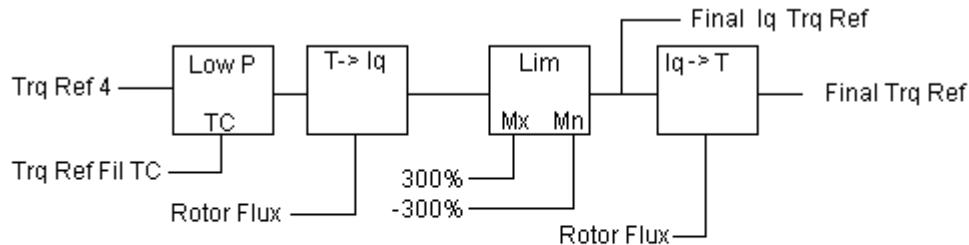
$$\text{Trq Ref 3} = (\text{Torque Reference} + \text{Trq Ref Off}) \times \text{Trq Ref Gn} / 1000$$

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.

#### 7-1.6 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 *MotorControlMode* = 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

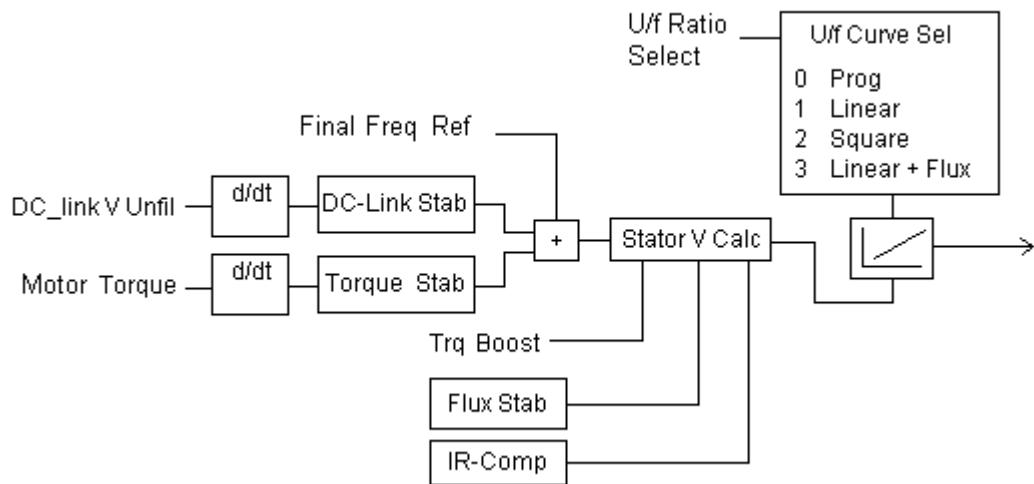
The Flux stabilizer purpose is to stabilize the magnetizing current. The error to the controller is from the difference between filtered and unfiltered magnetizing current. The filtered signal has a time constant of ldsFiltCoeff (in ms). The Flux stabilizer is a proportional-only controller with a gain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

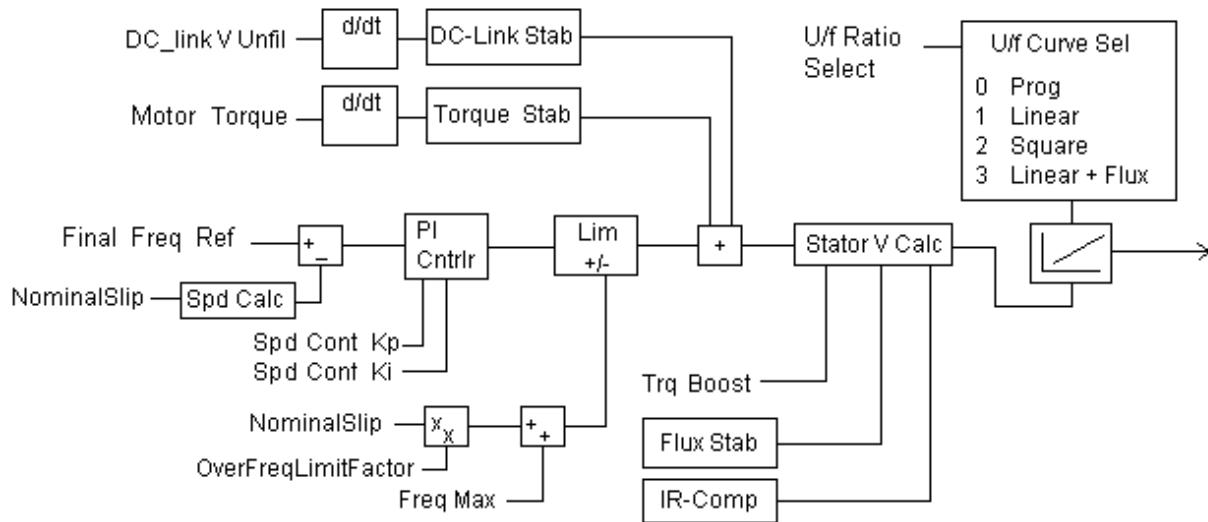
*UFZeroPointVoltage*

*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  | 60.00 Hz                     |

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

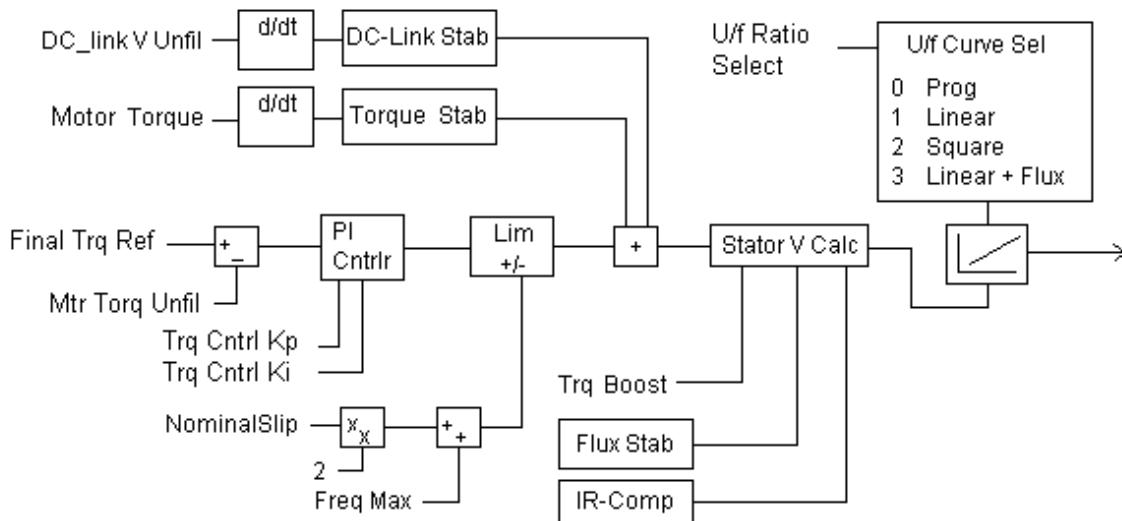
The motor speed feedback is calculated from the motor voltage and the estimated slip value (NominalSlip).

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.

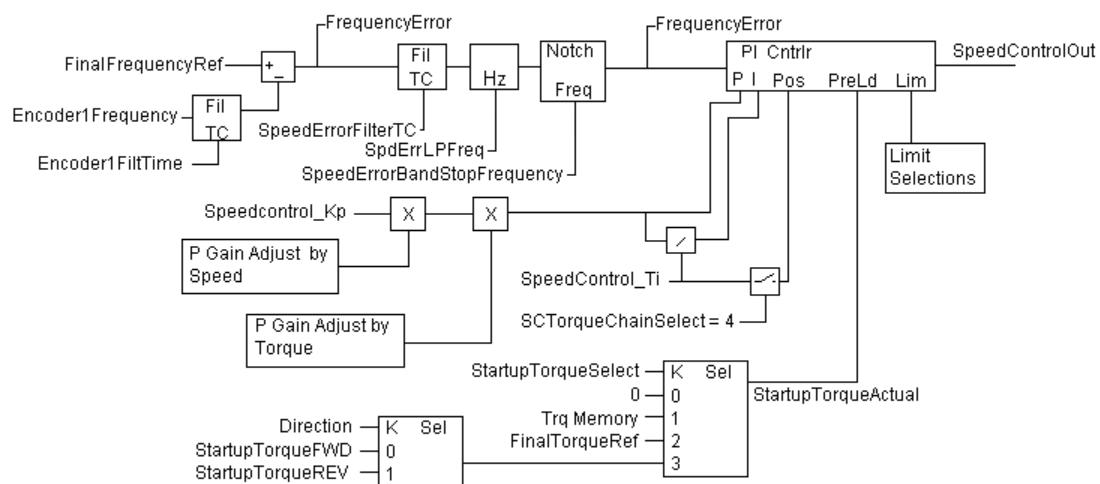
## 7-3 CLOSED LOOP CONTROL

Closed loop control is set by having *Motor Ctrl Mode* = 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.                |

| Parameters              | Type | Default                     |
|-------------------------|------|-----------------------------|
| <i>Startup Trq Sel</i>  | CAL  | 0 = No Preload              |
| <i>Startup Torq FWD</i> | CAL  | 0%                          |
| <i>Startup Torq 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%                        |
| <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.

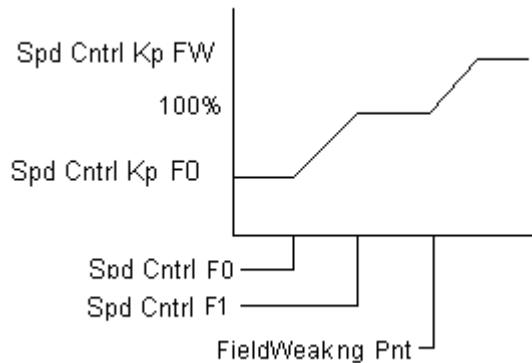
The error signal passes through two filters before going to the PI regulator. The first filter is a low pass filter with a time constant of *Spd Err Fil TC* and a cutoff frequency of *Spd Err LP Freq*. The second is a notch filter centered around *Spd Err Bnd Frq*. The error after filtering can be viewed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

### 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 Torq FWD* or *Startup Torq 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

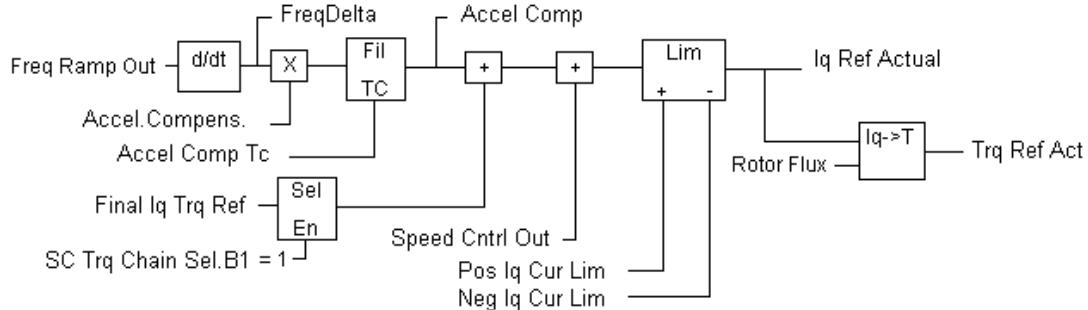
- *Gener Trq Lim* which is defaulted to 300%

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

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

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

The changes to *TC Pos Freq Lim* and *TC Neg Freq Lim* can be ramped to avoid fast speed changes. These limits are changed when *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.

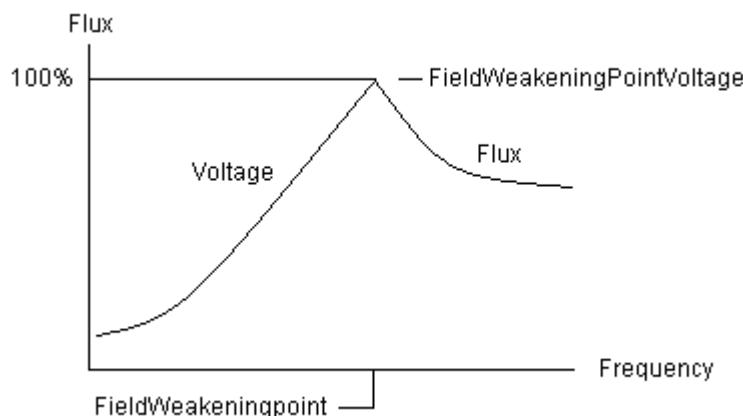
The speed reference ramp times are used when the limit ramping is enabled.

- 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 a linear line.

### 7-3.5 CURRENT CONTROL LOOP

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

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 OVERSPEED AND AT ZERO SPEED**

*Spd Fdbk* is defaulted to *Motor Speed* but can be reconfigured to an encoder input or analog input. This needs to be scaled into motor hertz with two decimal places.

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

The speed comparator setpoints are a percentage of the value *Ovr Spd Inp*, which is defaulted to parameter *Freq Max*. *Freq Max* is scaled in motor hertz with two decimal places.

The zero speed setpoint is defined by *Zero Detect* which is defaulted to 2.00%. *At Zero 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.

### **8-2 MOTOR BRAKING** ( See Appendix A-11)

#### 8-2.2 DC Braking

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

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

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

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

### 8-2.2 Flux Braking

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

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

## 8-3 SWITCHING FREQUENCY ( See Appendix A-11)

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

## 8-4 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.

**WARNING:** This function does not work in this application due to size limitation.

## 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.

There are four words where bits can be written to:

- 1) *FB Fix Cntl Wrd* (ID 1621) – Depending on which protocol is used several of these bits are predetermined.
- 2) *FB Gen Cntl Wrd* (ID 1630) – None of the bits are predefined and open to user choice.
- 3) *FB Word Out 8*  
(ID 1618) – Alternate word if more than one communication channel needs to write bits.
- 4) *SB In Cntl Word* (ID 1530) – Used for input bits from the system bus.

The above words can be unpacked to the following bits based on the selector.

| <b>ID</b> | <b>Parameter Name</b> | <b>Bit Location</b> | <b>Selector</b>     |
|-----------|-----------------------|---------------------|---------------------|
| 1040      | <i>FB Bit00</i>       | 0                   | <i>FB Bit Sel 1</i> |
| 1041      | <i>FB Bit01</i>       | 1                   | <i>FB Bit Sel 1</i> |
| 1042      | <i>FB Bit02</i>       | 2                   | <i>FB Bit Sel 1</i> |
| 1043      | <i>FB Bit03</i>       | 3                   | <i>FB Bit Sel 1</i> |
| 1044      | <i>FB Bit04</i>       | 4                   | <i>FB Bit Sel 2</i> |
| 1045      | <i>FB Bit05</i>       | 5                   | <i>FB Bit Sel 2</i> |
| 1046      | <i>FB Bit06</i>       | 6                   | <i>FB Bit Sel 2</i> |
| 1047      | <i>FB Bit07</i>       | 7                   | <i>FB Bit Sel 2</i> |
| 1048      | <i>FB Bit08</i>       | 8                   | <i>FB Bit Sel 3</i> |
| 1049      | <i>FB Bit09</i>       | 9                   | <i>FB Bit Sel 3</i> |
| 1050      | <i>FB Bit10</i>       | 10                  | <i>FB Bit Sel 3</i> |
| 1051      | <i>FB Bit11</i>       | 11                  | <i>FB Bit Sel 3</i> |
| 1052      | <i>FB Bit12</i>       | 12                  | <i>FB Bit Sel 4</i> |
| 1053      | <i>FB Bit13</i>       | 13                  | <i>FB Bit Sel 4</i> |
| 1054      | <i>FB Bit14</i>       | 14                  | <i>FB Bit Sel 4</i> |
| 1055      | <i>FB Bit15</i>       | 15                  | <i>FB Bit Sel 4</i> |

Each bit selector unpacks four bits from any of the four field bus words.

Example:

If *FB Bit Sel 1* is set to Gen Ctrl W then *FB Bit00 – FB Bit03* is unpacked from the first 4 bits of *FB Gen Cntl Wrld*.

Write integer to the drive:

| <b>ID</b> | <b>Parameter Name</b> |
|-----------|-----------------------|
| 1611      | <i>FB Word In 1</i>   |
| 1612      | <i>FB Word In 2</i>   |
| 1613      | <i>FB Word In 3</i>   |
| 1614      | <i>FB Word In 4</i>   |
| 1615      | <i>FB Word In 5</i>   |
| 1616      | <i>FB Word In 6</i>   |
| 1617      | <i>FB Word In 7</i>   |
| 1618      | <i>FB Word In 8</i>   |
| 1619      | <i>FB Word In 9</i>   |
| 1620      | <i>FB Word In 10</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.

16 configurable points are available to pack bits into two words for reading by the communications. The bits are directly written in order to *FB Gen Sts Word*. All the bits except for the lower 4 are written to *SB Out Cntl Word*.

Read bits from the drive:

| Configuration Parameter | Bit Set |
|-------------------------|---------|
| <i>FB Bit Cfg Out00</i> | 00      |
| <i>FB Bit Cfg Out01</i> | 01      |
| <i>FB Bit Cfg Out02</i> | 02      |
| <i>FB Bit Cfg Out03</i> | 03      |
| <i>FB Bit Cfg Out04</i> | 04      |
| <i>FB Bit Cfg Out05</i> | 05      |
| <i>FB Bit Cfg Out06</i> | 06      |
| <i>FB Bit Cfg Out07</i> | 07      |
| <i>FB Bit Cfg Out08</i> | 08      |
| <i>FB Bit Cfg Out09</i> | 09      |
| <i>FB Bit Cfg Out10</i> | 10      |
| <i>FB Bit Cfg Out11</i> | 11      |
| <i>FB Bit Cfg Out12</i> | 12      |
| <i>FB Bit Cfg Out13</i> | 13      |
| <i>FB Bit Cfg Out14</i> | 14      |
| <i>FB Bit Cfg Out15</i> | 15      |

Read integer from the drive:

| ID   | Parameter Name       | Configuration Parameter |
|------|----------------------|-------------------------|
| 1622 | <i>FB Word Out 1</i> | <i>FB Word Cfg Out1</i> |
| 1623 | <i>FB Word Out 2</i> | <i>FB Word Cfg Out2</i> |
| 1624 | <i>FB Word Out 3</i> | <i>FB Word Cfg Out3</i> |
| 1625 | <i>FB Word Out 4</i> | <i>FB Word Cfg Out4</i> |
| 1626 | <i>FB Word Out 5</i> | <i>FB Word Cfg Out5</i> |
| 1627 | <i>FB Word Out 6</i> | <i>FB Word Cfg Out6</i> |
| 1628 | <i>FB Word Out 7</i> | <i>FB Word Cfg Out7</i> |
| 1629 | <i>FB Word Out 8</i> | <i>FB Word Cfg Out8</i> |

## 9-2 SPECIAL FIELD BUS VARIABLES

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

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

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

## 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.

*WD Init Dly Tim* delays this fault on power up to give the communications a chance to establish.

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

## 9-4 SYSTEM BUS

The Drive Stand 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                   |
| 1 bit 1 | <i>MD Drive OK</i>     | From master <i>MC Ready</i>    |
| 1 bit 2 | <i>MD Run Enable</i>   | From master <i>Run Enable</i>  |
| 1 bit 3 | <i>MD Watchdog</i>     | From master <i>SB WD Pulse</i> |
| 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 toggles every 100 ms. This comes into the slave as *MD Watchdog* which is the default to *MD WD*. 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. *MC Fault* bit will go high when a fault has occurred and has not been reset. *MC Warning* goes high when a drive warning is active.

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 *FaultReset* 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 auto reset on certain faults. The drive will allow the fault to auto reset so many times per the following table within *Auto Rst SVTime*. After a fault the drive will wait

*Auto Rst Wait* time before reseting. *Auto Rst StartM* deteremines how the drive will start after an auto reset ( 0 = Ramp, 1 = Flying start, 2 = Start Function parameter ).

| Fault Code | Fault Text   | Trails                  |
|------------|--------------|-------------------------|
| 1          | Overcurrent  | <i>Auto Rst OC Trls</i> |
| 2          | Overtoltage  | <i>Auto Rst OV Trls</i> |
| 9          | Undervoltage | <i>Auto Rst UV Trls</i> |
| 16         | Mot.Overtemp | <i>Auto Rst Mtr OT</i>  |
| 17         | MotorUnderld | <i>Auto Rst Uload T</i> |
| 31         | IGBT Temp    | <i>Auto Rst OC Trls</i> |
| 41         | IGBT Temp    | <i>Auto Rst OC Trls</i> |
| 51         | Ext Fault    | <i>Auto Rst ExtF T</i>  |

## 10-4 RECORDING

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

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

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

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

## 10-5 DRIVE FAULTS

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

| Fault Code | Fault Text           | Possible Cause   | Solution   |
|------------|----------------------|--|--|
| 15         | Motor Stall          | Motor stall protection tripped.<br>- Motor is binding<br>- Not enough motor torque available.<br>- Stall protection set too tight. | - Check to make sure motor is not binding.<br>- Retune to get proper magnetizing current.<br>- Check stall protection for proper setup.<br>- Verify motor is getting current.<br>- Replace motor<br>- Replace inverter |
| 16         | Mot.Overtemp         | Motor over heating detected by temperature model.  | - Check for excessive motor loading<br>- Check motor cooling<br>- Check motor current to verify proper tuning.   |
| 17         | MotorUnderld         | Motor underload protection trip.   | - Check process for load.<br>- Check shafts and couplings<br>- Check Under load parameters for proper setting.   |
| 22/23      | Chksum Flt           | EEProm has checksum fault.   | - Verify parameters are set properly<br>- Replace microprocessor board.  |
| 24         | Changed data warning | Changes may have occurred during power interruption  | - Check parameters against saved file<br>- re-download parameters<br>- Replace microprocessor board.   |
| 25         | Micro Watchdog       | Microprocessor timed out.  | - Redownload the system and application software.<br>- Replace microprocessor board.   |
| 29         | Thermistor           | Thermistor out of range.   | - Replace thermistor   |
| 31         | IGBT Temp            | IGBT temperature exceeded its limit.   | - Check ambient temperature<br>- Check drive fan<br>- Check for excessive build up of material on heat sink<br>- Observe operation for high drive loading.   |
| 37         | Device Change        | Option board changed.  | - Enter correct parameters for new option board.<br>- Check I/O board seating<br>- Replace option board.   |
| 38         | Device Added         | Option board or different drive size changed.  | - Enter correct parameters for new hardware.<br>- Check I/O board seating.<br>- Check microprocessor board connection.<br>- Replace drive  |
| 39         | Device Removed       | Option board or drive removed from microprocessor.   | - Check I/O board seating<br>- Check microprocessor board connection.<br>Replace drive.  |
| 40         | Device Unknown       | Unknown option board added to the drive.   | - Check I/O board seating<br>- 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<br>- Check connections<br>- Verify correct option board and jumpers.<br>- Replace option board   |
| 51         | Ext Fault            | User configured PB_Ext_Fault_Inp is high.  | - Determine external fault reason<br>- Verify proper external fault setup  |
| 52         | Keypad Comm          | Connection between keypad and drive is broken.   | - Verify keypad cable connections or proper seating of keypad<br>- Replace keypad<br>- Replace microprocessor board.   |
| 53         | FBCommunicat         | Field bus fault fro D_FB_Fault bit.<br>Bit is set when board failure is noted  | - Check fieldbus board seating.<br>- 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"> <li>- Check board seating in slots C-E.</li> <li>- Replace option boards</li> <li>- Replace microprocessor board</li> </ul>   |
| 56         | PT100 Temp     | PT100 exceeds either the temperature warning or fault limit | <ul style="list-style-type: none"> <li>- Check device for over heating.</li> <li>- Check PT100 device</li> <li>- Check for proper temperature probe connections.</li> <li>- Check for proper limits</li> <li>- Replace PT100 option board</li> </ul> |
| 57         | Identification | Identification is completed                                 | <ul style="list-style-type: none"> <li>- Verify Identification parameter is set to a value other than 0.</li> </ul>  |
| 60         | Com Watchdog   | Communication watchdog bit is not toggling                  | <ul style="list-style-type: none"> <li>- Verify communications is working.</li> <li>- Verify watchdog bit is being toggled by host device.</li> </ul>  |
| 61         | User Fault 1   | PB_User_Flt_1 is configured to a value that is High.        | <ul style="list-style-type: none"> <li>- Check configuration for function.</li> </ul>  |
| 62         | User Fault 2   | PB_User_Flt_2 is configured to a value that is High.        | <ul style="list-style-type: none"> <li>- Check configuration for function.</li> </ul>  |
| 63         | User Fault 3   | PB_User_Flt_3 is configured to a value that is High.        | <ul style="list-style-type: none"> <li>- Check configuration for function.</li> </ul>  |
| 64         | User Fault 4   | PB_User_Flt_4 is configured to a value that is High.        | <ul style="list-style-type: none"> <li>- Check configuration for function.</li> </ul>  |
| 65         | Overspeed Flt  | Drive tripped out on overspeed.                             | <ul style="list-style-type: none"> <li>- Check for sudden loss of load.</li> <li>- verify proper speed feedback device and scaling.</li> <li>- Check overspeed setup</li> </ul>  |
| 66         | SB Comm Fault  | System bus watchdog trip or board failure.                  | <ul style="list-style-type: none"> <li>- Verify all drives on the system bus is up and running.</li> <li>- Verify system bus cabling.</li> <li>- Replace system bus cabling</li> <li>- Replace system bus board.</li> </ul>                          |
| 70         | Loc Stop Flt   | Keypad stop button pressed for two seconds.                 | <ul style="list-style-type: none"> <li>- Replace keypad.</li> </ul>  |

## 10-6 DRIVE FAULT OPTIONS

| Fault Code | Fault Text           | Fault Mode              | Stop Mode               |
|------------|----------------------|-------------------------|-------------------------|
| 1          | Overcurrent          | Fault                   | Coast Stop              |
| 2          | Overtension          | 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> |
| 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         | Loc Stop Flt         | Fault                   | Coast Stop              |

## 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.

### 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

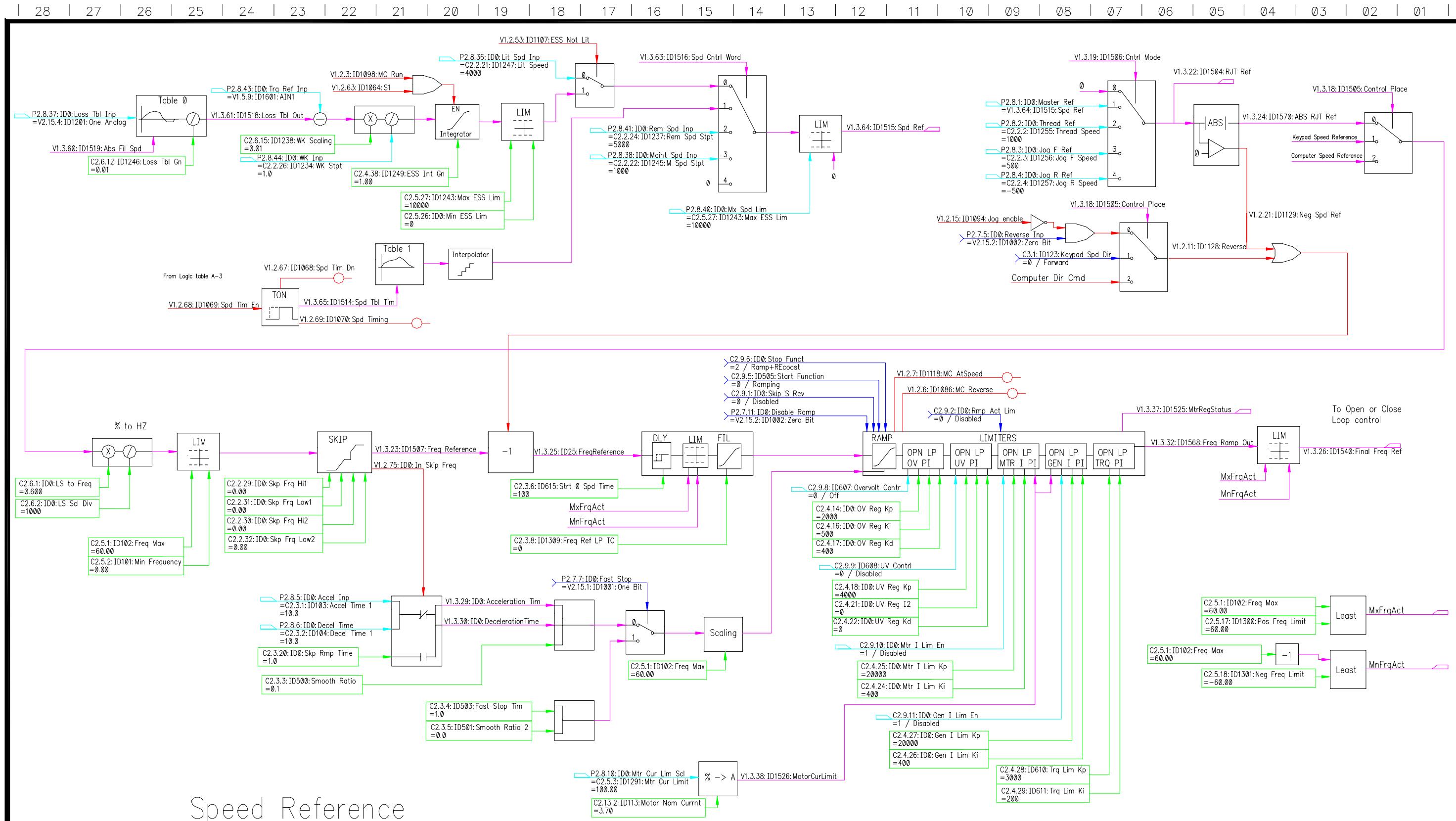
- IdentOptions:  
B0 = Enable U/f curve tuning  
B1 = Enable close loop tuning  
B2 = Enable encoder direction check  
B3 = Automatic magnetizing current check with motor change
- IdentRSVoltageDrop = Voltage drop found during self tune



## **APPENDIX A**

### **SOFTWARE BLOCK DIAGRAMS**





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NEXT ASSEMBLY

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7900 E. PLEASANT VALLEY RD.  
INDEPENDENCE, OH 44131 - 5529

SECTION NO.

# DEFUALTS

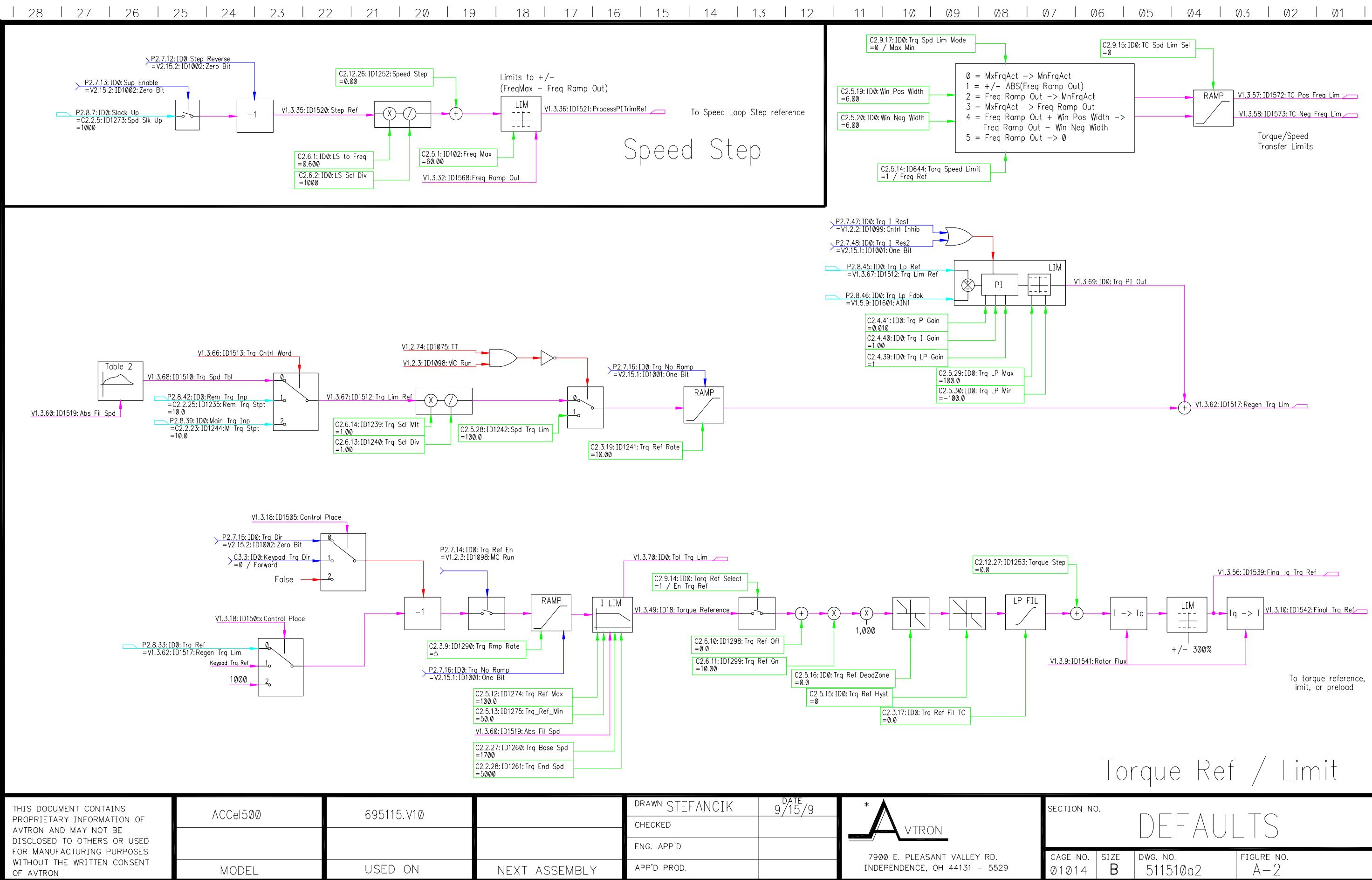
CAGE NO.  
01014

DW

G. NO.  
115100

FIGURE NO.  
A-1

A-1



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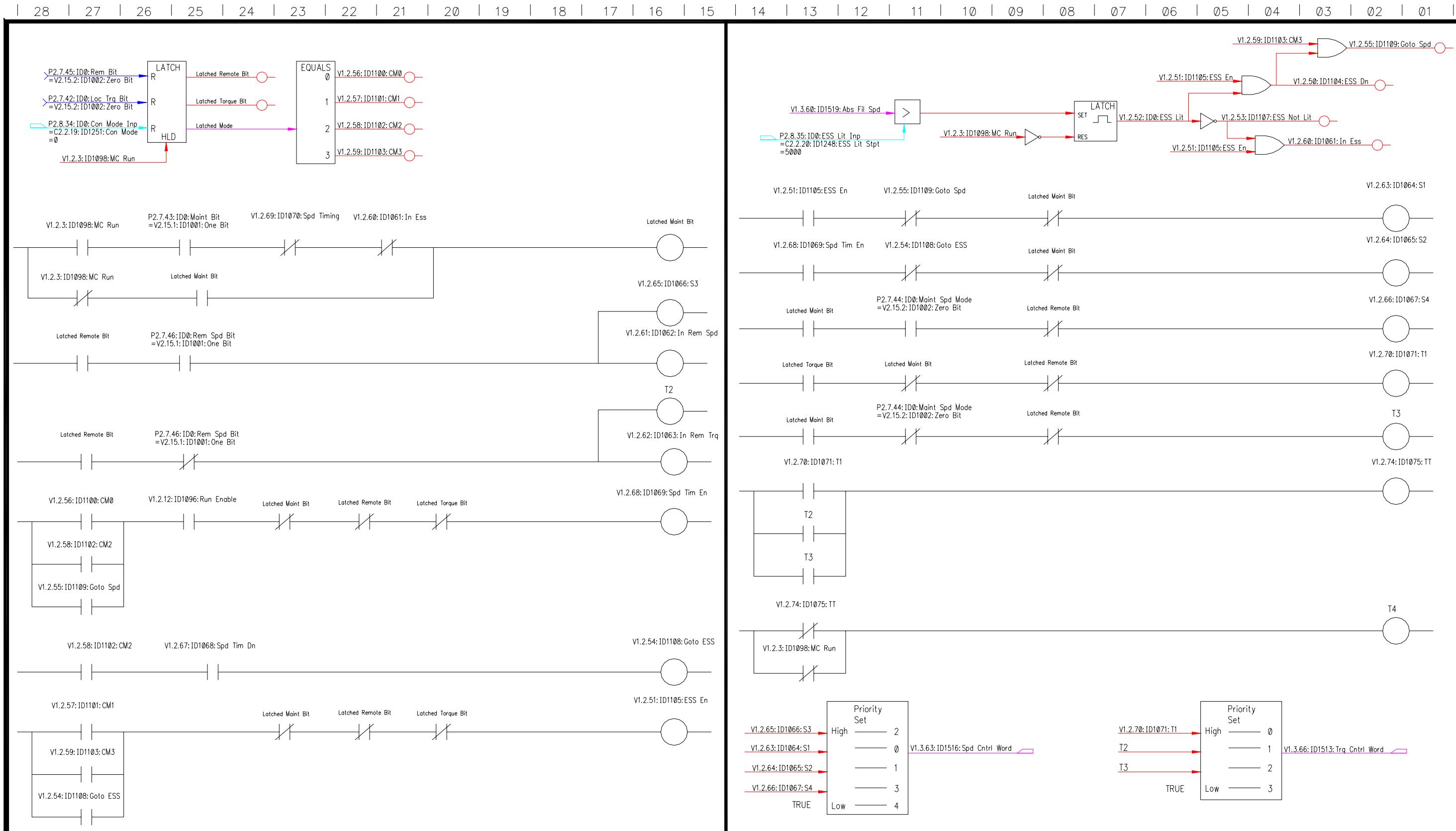
DEFUALTS

CAGE NO. 01014

SIZE B

DWG. NO. 511510a2

FIGURE NO. A-2



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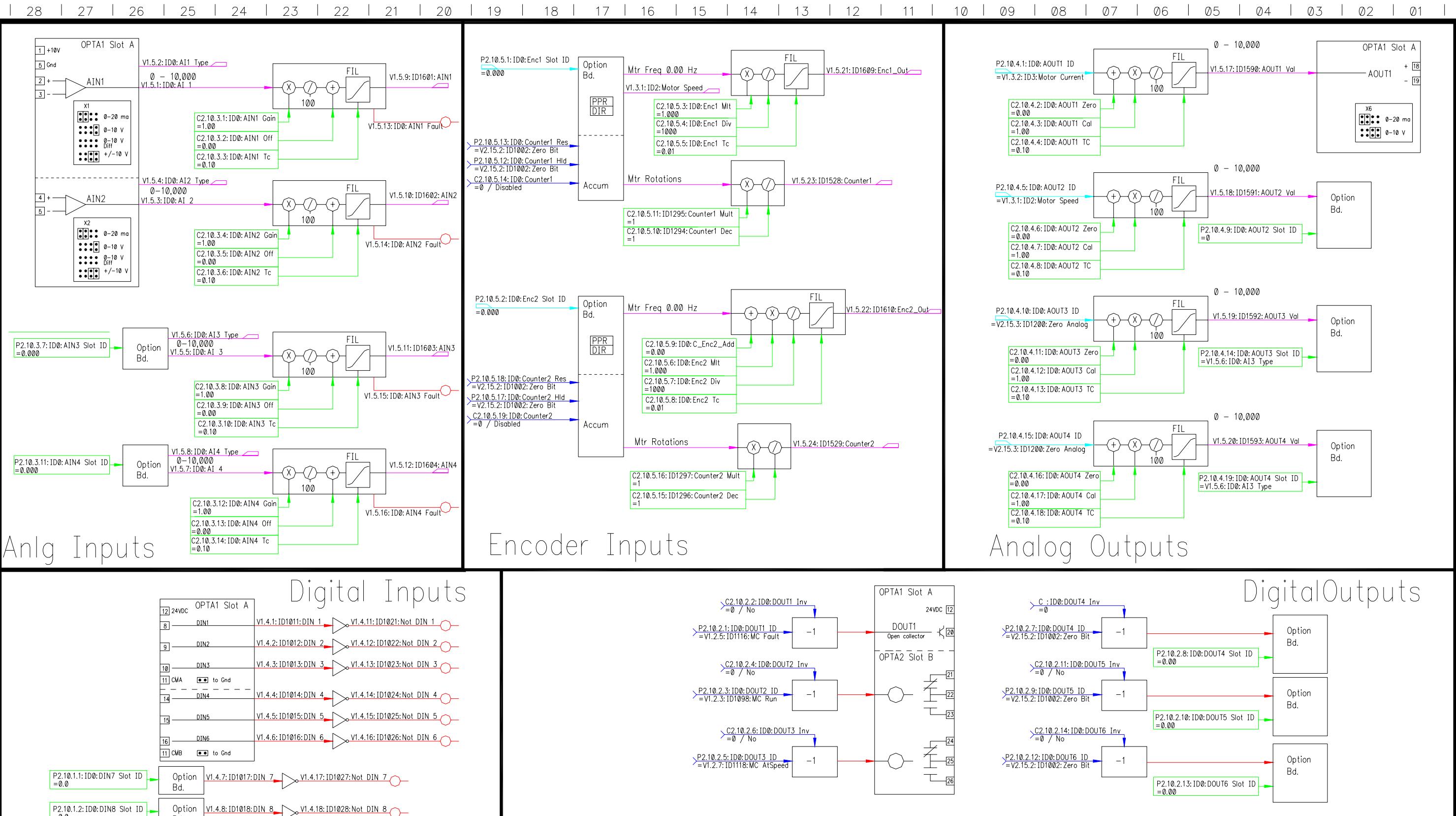
7900 E. PLEASANT VALLEY RD.  
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**SECTION NO.**

# DEFUALTS

|          |      |          |
|----------|------|----------|
| CAGE NO. | SIZE | DWG. NO. |
| 01014    | B    | 511510a3 |

FIGURE NO.  
A-3



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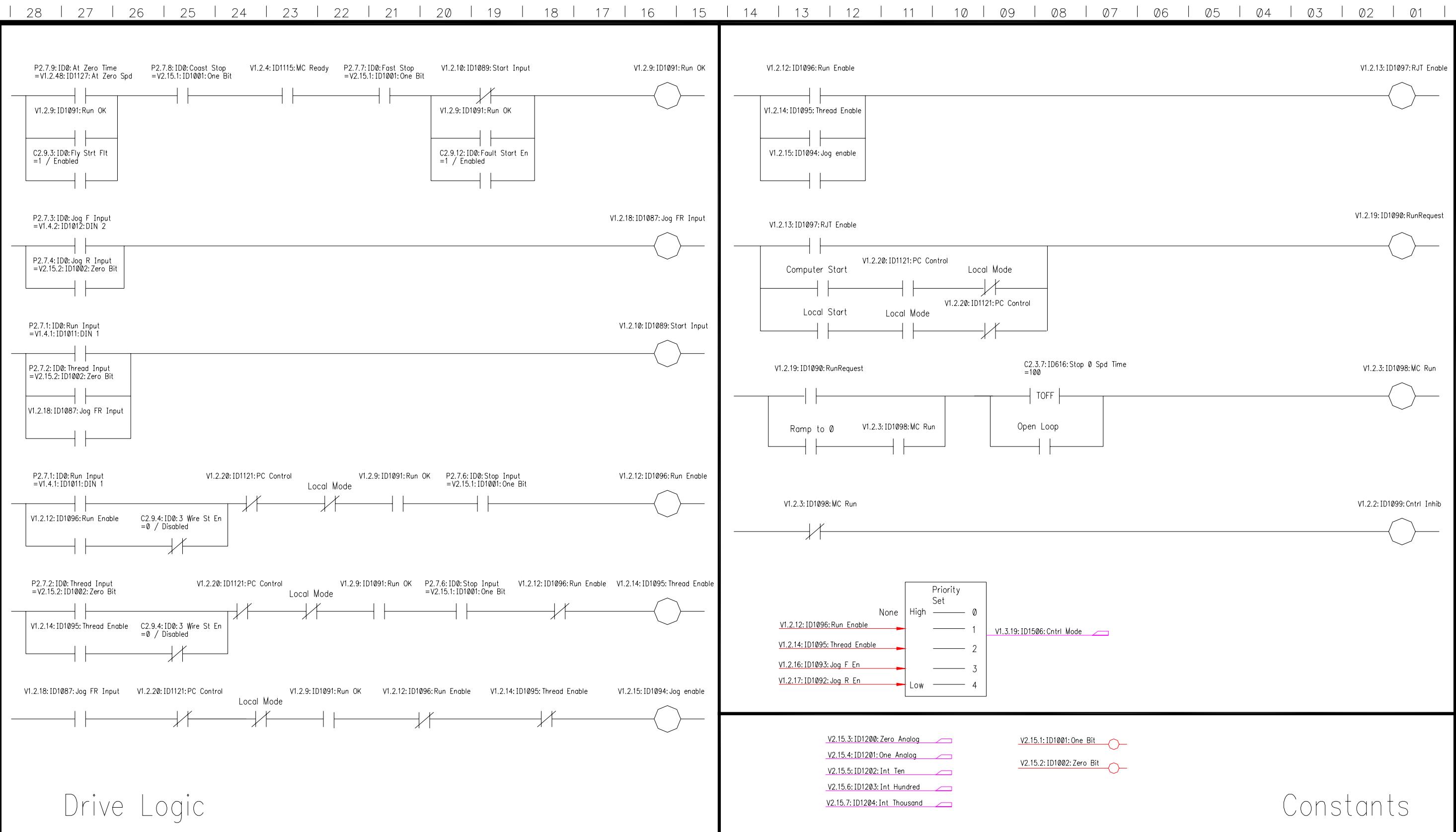
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APP'D PROD.

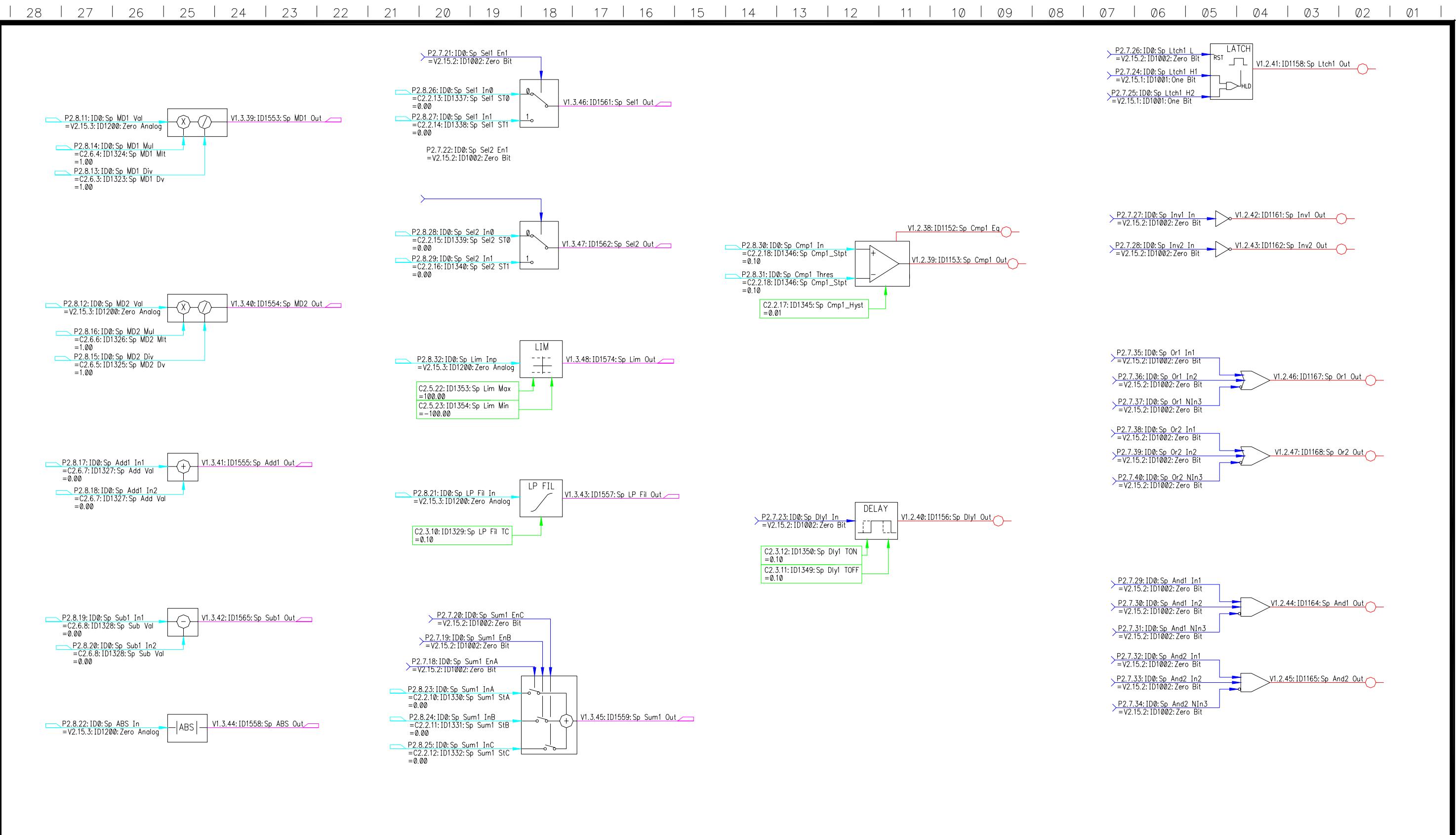


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SECTION NO.

DEFUALTS  
CAGE NO. 01014 SIZE B DWG. NO. 511510a4 FIGURE NO. A-4





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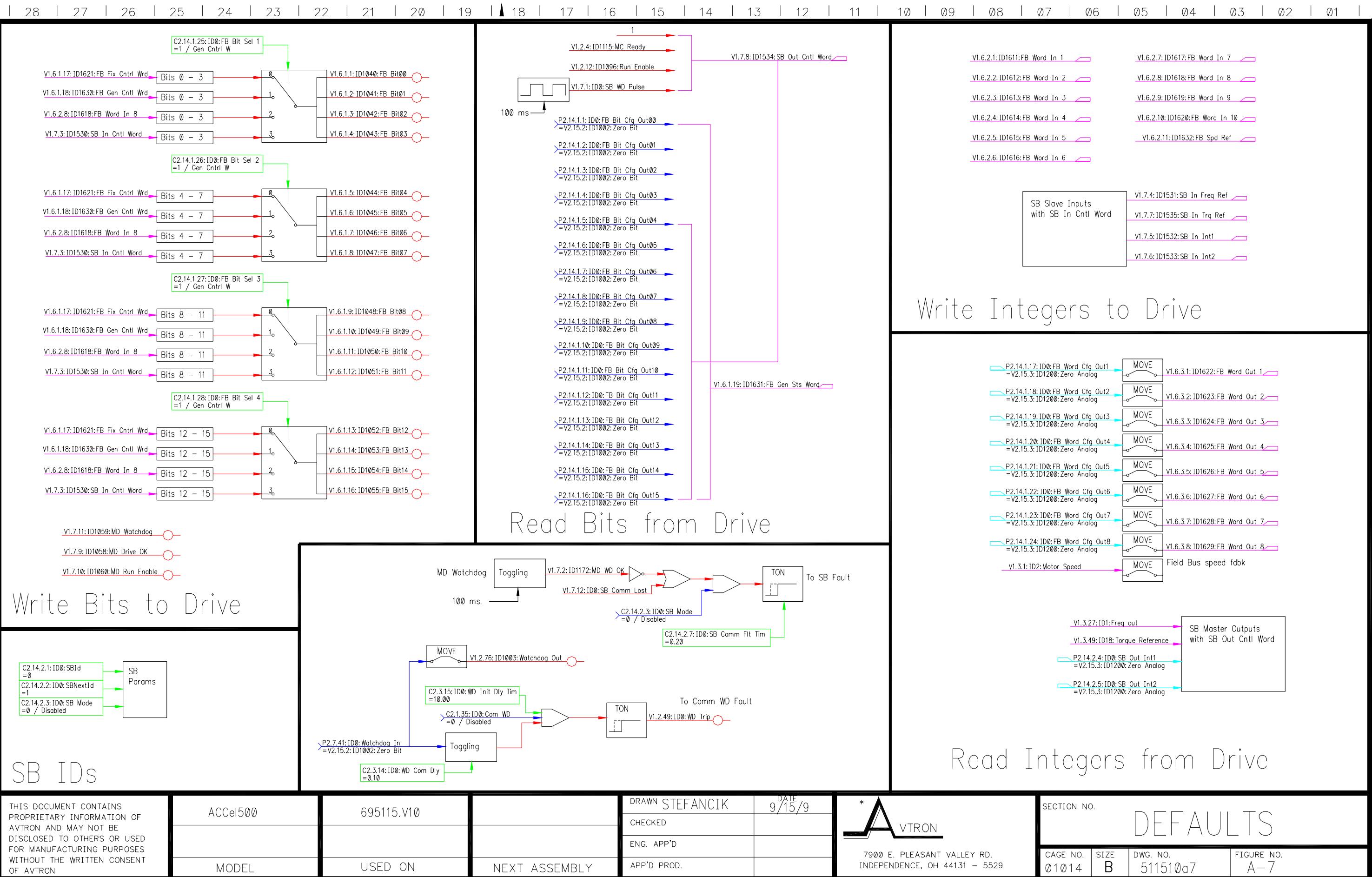
DEFUALTS

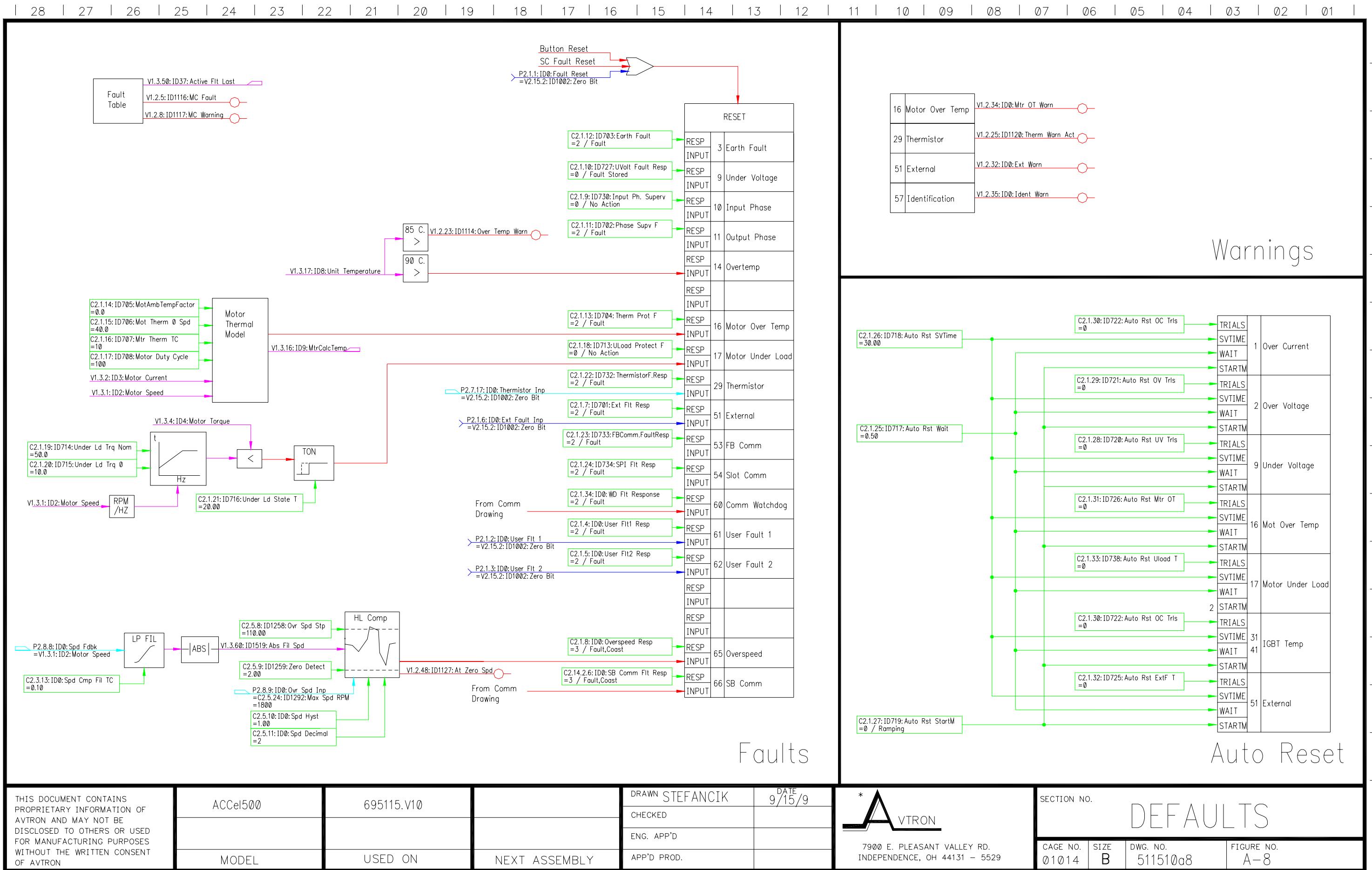
CAGE NO. 01014

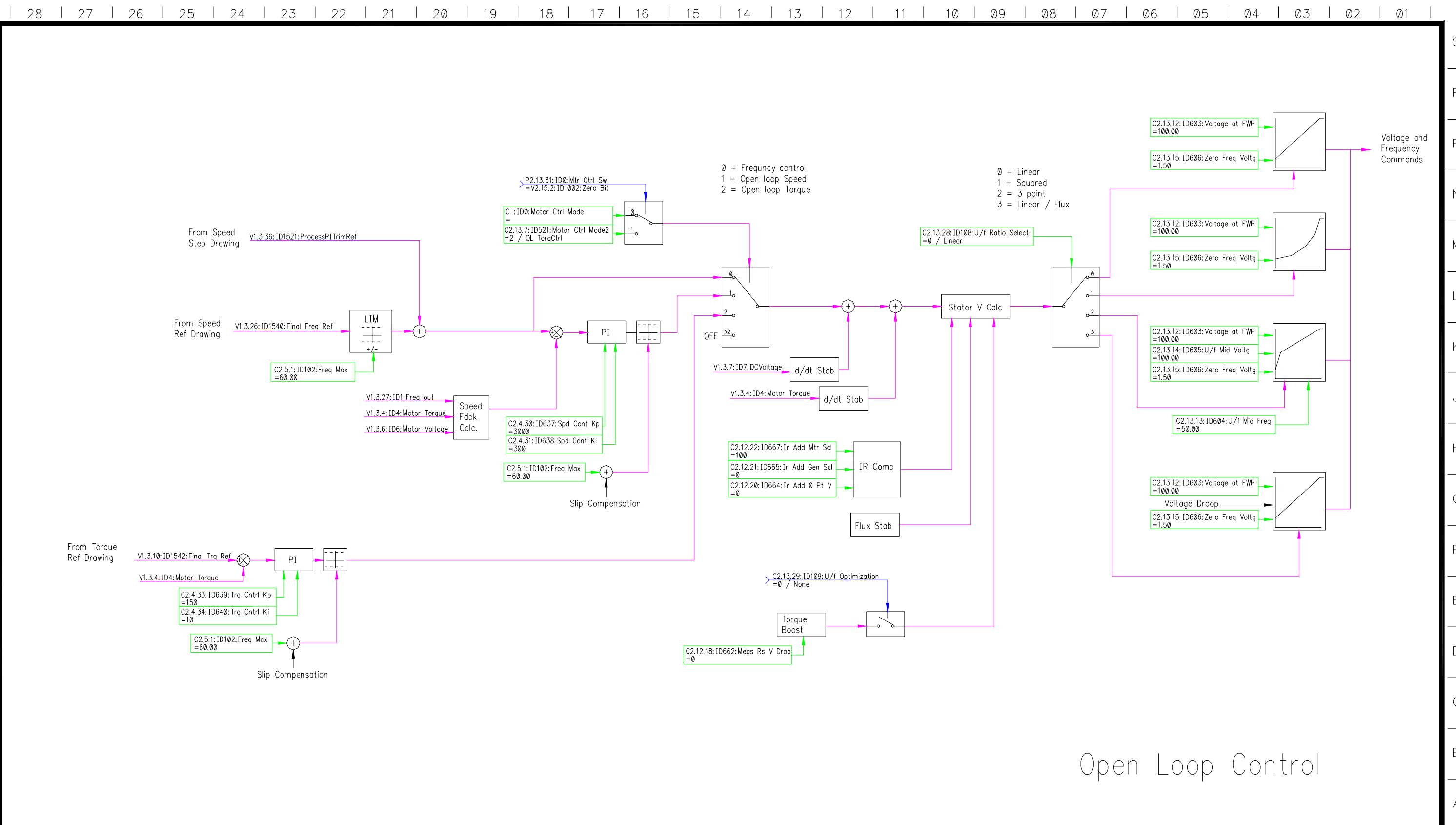
SIZE B

DWG. NO. 511510a6

FIGURE NO. A-6







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SECTION NO.

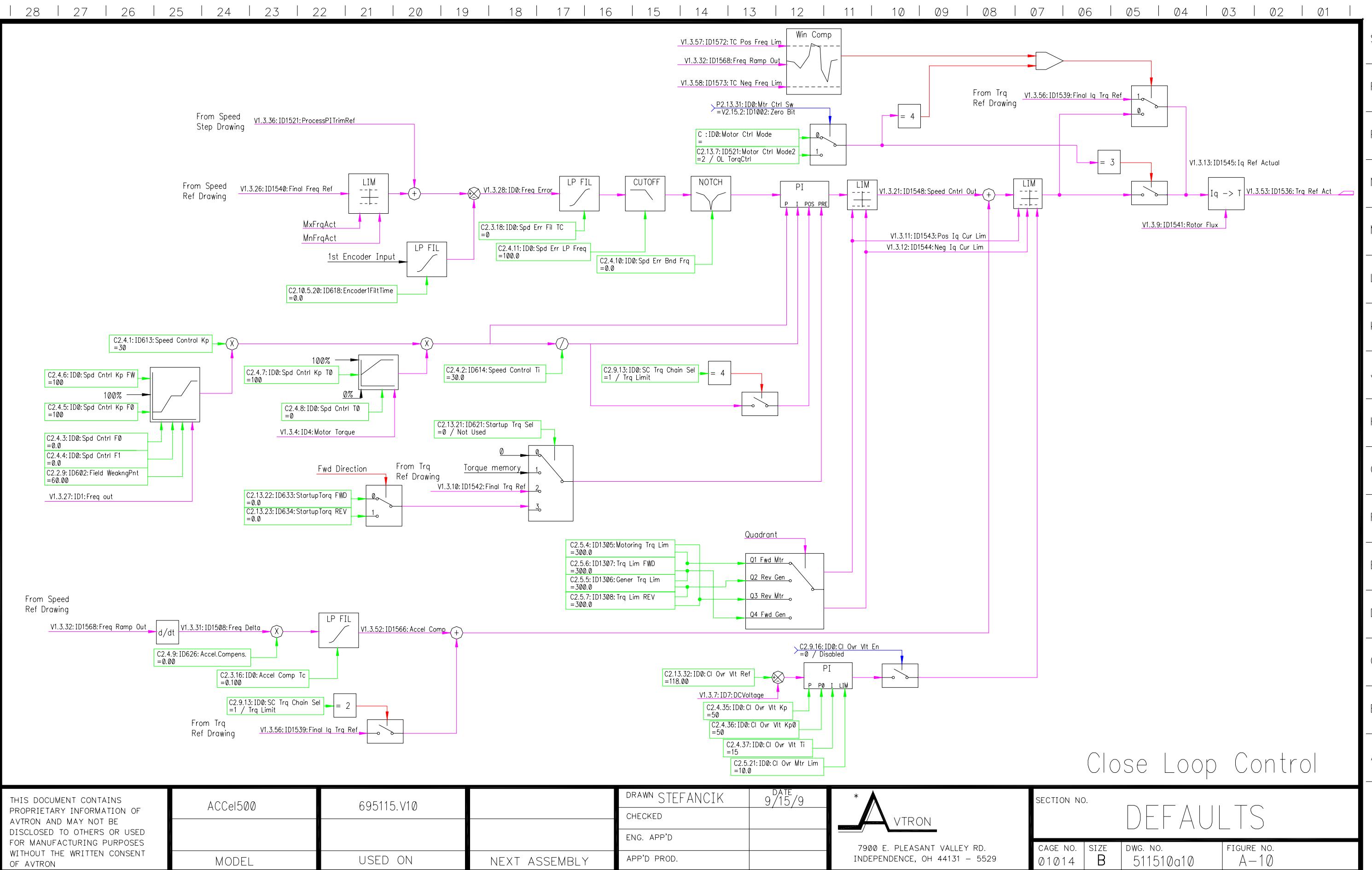
DEFAULTS

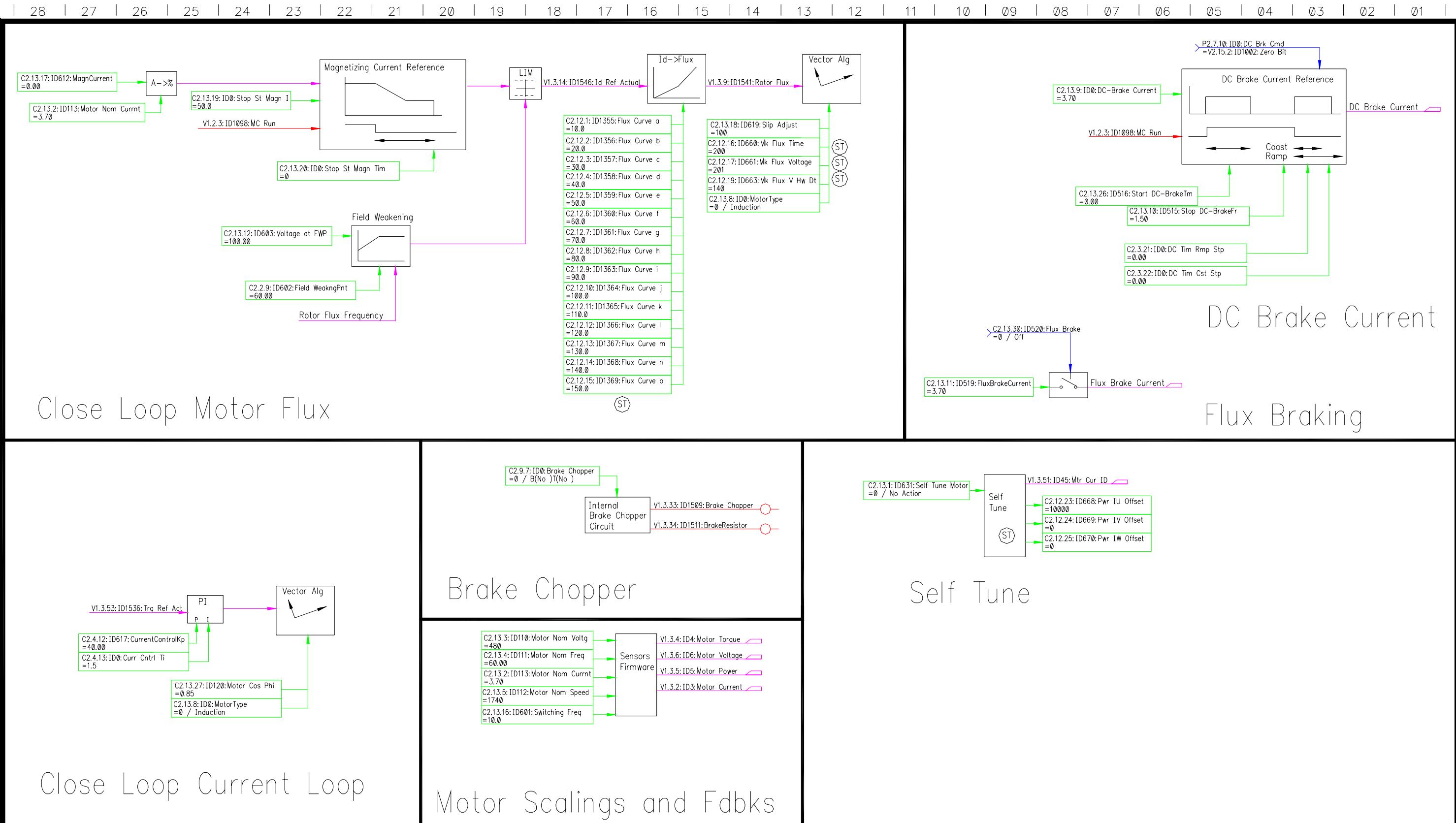
CAGE NO.  
01014

SIZE  
B

DWG. NO.  
511510a9

FIGURE NO.  
A-9





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SECTION NO.

DEFUALTS

CAGE NO. 01014

SIZE B

DWG. NO. 511510a11

FIGURE NO. A-11



## 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 | Start Input     | 1089 | 0   | 1   |         | Run jog or thread is requested.   |
| 1.2.11 | Reverse         | 1128 | 0   | 1   |         | Reverse commanded by remote, keypad or computer.  |
| 1.2.12 | Run Enable      | 1096 | 0   | 1   |         | Run is commanded and it is enabled.   |
| 1.2.13 | RJT Enable      | 1097 | 0   | 1   |         | Run jog or thread commanded and enabled.  |
| 1.2.14 | Thread Enable   | 1095 | 0   | 1   |         | Thread mode is commanded and enabled.   |
| 1.2.15 | Jog enable      | 1094 | 0   | 1   |         | Jog enabled   |
| 1.2.16 | Jog F En        | 1093 | 0   | 1   |         | Jog forward has been commanded and is enabled.  |
| 1.2.17 | Jog R En        | 1092 | 0   | 1   |         | Jog reverse commanded and enabled   |
| 1.2.18 | Jog FR Input    | 1087 | 0   | 1   |         | Either jog forward or jog reverse is commanded.   |
| 1.2.19 | RunRequest      | 1090 | 0   | 1   |         | Run request: 0=no, 1=yes  |
| 1.2.20 | PC Control      | 1121 | 0   | 1   |         | Control has been transferred to the PC.   |
| 1.2.21 | Neg Spd Ref     | 1129 | 0   | 1   |         | Speed reference is negative   |
| 1.2.22 | Local Stop Flt  | 1112 | 0   | 1   |         | Local stop button pressed for three seconds which will fault the drive on a stop fault.     |
| 1.2.23 | Over Temp Warn  | 1114 | 0   | 1   |         | Unit above 85 C. 90 C will trip unit  |
| 1.2.24 | Therm Fault Act | 1119 | 0   | 1   |         | Thermister fault from inverter.   |
| 1.2.25 | Therm Warn Act  | 1120 | 0   | 1   |         | Inverter thermister warning   |
| 1.2.26 | Panel Fault ACT | 0    | 0   | 1   |         | Panel fault detected  |
| 1.2.27 | UV Fault        | 0    | 0   | 1   |         | Under voltage fault detected.   |
| 1.2.28 | OC Fault        | 0    | 0   | 1   |         | Over current fault detected.  |
| 1.2.29 | OV Fault        | 0    | 0   | 1   |         | Over voltage fault detected.  |
| 1.2.30 | IGBT Temp Fault | 0    | 0   | 1   |         | IGBT temperature fault has been detected.   |
| 1.2.31 | Ext Fault       | 0    | 0   | 1   |         | External fault detected. See Ext Fault Response for action.                                 |
| 1.2.32 | Ext Warn        | 0    | 0   | 1   |         | External warning detected. See Ext Fault Response for action.                               |
| 1.2.33 | Mtr OT Fault    | 0    | 0   | 1   |         | Motor Over temperature fault  |
| 1.2.34 | Mtr OT Warn     | 0    | 0   | 1   |         | Motor Over temperature warning  |
| 1.2.35 | Ident Warn      | 0    | 0   | 1   |         | Warning has occurred during identification  |
| 1.2.36 | FB Fault Act    | 0    | 0   | 1   |         | Field Bus fault active  |
| 1.2.37 | SPI Fault Act   | 0    | 0   | 1   |         | SPI bus fault active.   |
| 1.2.38 | Sp Cmp1 Eq      | 1152 | 0   | 1   |         | First spare comparitor input and threshold difference is within the hysteresis value.       |
| 1.2.39 | Sp Cmp1 Out     | 1153 | 0   | 1   |         | First spare comparitor input is greater than the threshold plus/minus the hysteresis value. |
| 1.2.40 | Sp Dly1 Out     | 1156 | 0   | 1   |         | First spare delay block output bit.   |
| 1.2.41 | Sp Ltch1 Out    | 1158 | 0   | 1   |         | First spare latch block output.   |
| 1.2.42 | Sp Inv1 Out     | 1161 | 0   | 1   |         | First spare bit invert output.  |
| 1.2.43 | Sp Inv2 Out     | 1162 | 0   | 1   |         | Second spare bit invert output.   |

| MENU   | NAME             | ID   | MIN     | MAX             | DEFAULT | DESCRIPTION   |
|--------|------------------|------|---------|-----------------|---------|---|
| 1.2.44 | Sp And1 Out      | 1164 | 0       | 1               |         | First spare and output.   |
| 1.2.45 | Sp And2 Out      | 1165 | 0       | 1               |         | Second spare and output.  |
| 1.2.46 | Sp Or1 Out       | 1167 | 0       | 1               |         | First spare or output.  |
| 1.2.47 | Sp Or2 Out       | 1168 | 0       | 1               |         | Second spare or output.   |
| 1.2.48 | At Zero Spd      | 1127 | 0       | 1               |         | Speed feedback is near zero speed.  |
| 1.2.49 | WD Trip          | 0    | 0       | 1               |         | Communications watch dog timer is in fault condition.                                   |
| 1.2.50 | ESS Dn           | 1104 | 0       | 1               |         | ESS mode complete   |
| 1.2.51 | ESS En           | 1105 | 0       | 1               |         | ESS mode enabled  |
| 1.2.52 | ESS Lit          | 0    | 0       | 1               |         | ESS engine has started and running constant speed.                                      |
| 1.2.53 | ESS Not Lit      | 1107 | 0       | 1               |         | ESS mode still in acceleration mode.  |
| 1.2.54 | Goto ESS         | 1108 | 0       | 1               |         | Done with Spd vs time and ready to start ESS.   |
| 1.2.55 | Goto Spd         | 1109 | 0       | 1               |         | Done with ESS and ready to go to spd vs time  |
| 1.2.56 | CM0              | 1100 | 0       | 1               |         | Speed vs time mode selected.  |
| 1.2.57 | CM1              | 1101 | 0       | 1               |         | ESS mode selected.  |
| 1.2.58 | CM2              | 1102 | 0       | 1               |         | Speed vs time mode selected then ESS.   |
| 1.2.59 | CM3              | 1103 | 0       | 1               |         | ESS.selected then Speed vs time mode  |
| 1.2.60 | In Ess           | 1061 | 0       | 1               |         | In ESS mode   |
| 1.2.61 | In Rem Spd       | 1062 | 0       | 1               |         | In remote speed mode  |
| 1.2.62 | In Rem Trq       | 1063 | 0       | 1               |         | In remote torque mode   |
| 1.2.63 | S1               | 1064 | 0       | 1               |         | ESS mode speed reference enabled  |
| 1.2.64 | S2               | 1065 | 0       | 1               |         | Speed vs time speed reference enable  |
| 1.2.65 | S3               | 1066 | 0       | 1               |         | Remote speed reference enabled  |
| 1.2.66 | S4               | 1067 | 0       | 1               |         | Maint speed reference enabled.  |
| 1.2.67 | Spd Tim Dn       | 1068 | 0       | 1               |         | Speed vs time is enabled and timed out  |
| 1.2.68 | Spd Tim En       | 1069 | 0       | 1               |         | Speed vs time mode enabled.   |
| 1.2.69 | Spd Timing       | 1070 | 0       | 1               |         | Speed vs time table in process.   |
| 1.2.70 | T1               | 1071 | 0       | 1               |         | Local torque reference enabled.   |
| 1.2.71 |                  | 1072 | 0       | 1               |         | Remote torque reference enabled.  |
| 1.2.72 |                  | 1073 | 0       | 1               |         | Maintenance torque reference enabled.   |
| 1.2.73 |                  | 1074 | 0       | 1               |         | Full regen torque setpoint enabled.   |
| 1.2.74 | TT               | 1075 | 0       | 1               |         | Either in T1, T2 or T3 torque reference enabled.  |
| 1.2.75 | In Skip Freq     | 0    | 0       | 1               |         | In skip freq  |
| 1.2.76 | Watchdog Out     | 1003 | 0       | 1               |         | Output watch dog for PLC communication checks   |
| 1.3    | Appl Analog      |      |         |                 |         | Menu Name   |
| 1.3.1  | Motor Speed      | 2    | -10000  | 10000           |         | [R] Motor speed in rpm  |
| 1.3.2  | Motor Current    | 3    | 0.00    | MotorCurrentMax |         | Motor current. = MotorCurrent/current scale = Amps                                      |
| 1.3.3  | Mtr Cur Unfil    | 1113 | 0.00    | MotorCurrentMax |         | Filtered motor current. motorcurrent/currentscale = amps                                |
| 1.3.4  | Motor Torque     | 4    | -300.0  | 300.0           |         | [R] Motor torque as % value, +1000 equals +100.0 %//pos=clockwise, neg=counterclockwise |
| 1.3.5  | Motor Power      | 5    | -300.0  | 300.0           |         | Motor shaft power filtered. 1000 = 100%   |
| 1.3.6  | Motor Voltage    | 6    | 0.0     | 1000.0          |         | [R] Motor voltage in 0.1 Volts, e.g. 100 equals to 10.0V                                |
| 1.3.7  | DCVoltage        | 7    | 0       | 1000            |         | DC voltage in Volts with 32 ms time constant.   |
| 1.3.8  | DC_Link V Unfil  | 44   | 0       | 1000            |         | Unfiltered DC voltage in Volts.   |
| 1.3.9  | Rotor Flux       | 1541 | -300.0  | 300.0           |         | Estimated rotor flux, 1000 = nominal  |
| 1.3.10 | Final Trq Ref    | 1542 | -300.0  | 300.0           |         | Final, limited torque reference for speed/torque controller                             |
| 1.3.11 | Pos Iq Cur Lim   | 1543 | 0.0     | 300.0           |         | Final upper IqCurrentLimit 1000 = motor nominal current (unsigned)                      |
| 1.3.12 | Neg Iq Cur Lim   | 1544 | 0.0     | 300.0           |         | Final lower IqCurrentLimit 1000 = motor nominal current (unsigned)                      |
| 1.3.13 | Iq Ref Actual    | 1545 | -100.0  | 100.0           |         | Final IqReference, 1000 = motor nominal current   |
| 1.3.14 | Id Ref Actual    | 1546 | 0.0     | 300.0           |         | Final IdReference 1000 = motor nominal current  |
| 1.3.15 | Rotor TC         | 1547 | 0       | 32000           |         | Used RotorTimeConstant in ms  |
| 1.3.16 | MtrCalcTemp      | 9    | 0.0     | 1000.0          |         | Calculated motor temperature. 1000 = 100%   |
| 1.3.17 | Unit Temperature | 8    | -50     | 300             |         | Drive temperature in degrees C  |
| 1.3.18 | Control Place    | 1505 | 1       | 3               |         | Location of reference. 0 = remote, 1 = keypad, 2 = computer                             |
| 1.3.19 | Cntrl Mode       | 1506 | 0       | 4               |         | 0 = Off, 1 = Run, 2 = Thread, 3 = Jog F, 4 = Jog R                                      |
| 1.3.20 | Mtr Trq Unfil    | 1125 | -300.0  | 300.0           |         | Unfiltered motor torque. 1000 = 100%, pos = motor, Neg = regen                          |
| 1.3.21 | Speed Cntrl Out  | 1548 | -327.67 | 327.67          |         | TorqueReference from Speed controller output  |

| MENU   | NAME             | ID   | MIN     | MAX              | DEFAULT | DESCRIPTION  |
|--------|------------------|------|---------|------------------|---------|--|
| 1.3.22 | RJT Ref          | 1504 | -32767  | 32767            |         | RJT thread reference   |
| 1.3.23 | Freq Reference   | 1507 | 0.00    | 320.00           |         | Speed reference after checking for skip frequency  |
| 1.3.24 | ABS RJT Ref      | 1570 | 0       | 32767            |         | Absolute value of speed reference  |
| 1.3.25 | 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  |
| 1.3.26 | Final Freq Ref   | 1540 | -320.00 | 320.00           |         | Final shaft frequency reference for speed controller in FreqScale  |
| 1.3.27 | 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   |
| 1.3.28 | Freq Error       | 0    | -327.67 | 327.67           |         | Frequency Error  |
| 1.3.29 | Acceleration Tim | 0    | 0.1     | 3000.0           |         | Acceleration time in RampTimeScale,<br>Acceleration=FreqRamp[Hz]/AccelerationTime[s]   |
| 1.3.30 | DecelerationTime | 0    | 0.1     | 3000.0           |         | Deceleration time in RampTimeScale,<br>Deceleration=FreqRamp[Hz]/DecelerationTime[s]   |
| 1.3.31 | Freq Delta       | 1508 | -300.00 | 300.00           |         | Acceleration in FreqScale/s  |
| 1.3.32 | 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.   |
| 1.3.33 | Brake Chopper    | 1509 | 0       | 1                |         | 0 = no brake chopper, 1 = brake chopper is installed   |
| 1.3.34 | BrakeResistor    | 1511 | 0       | 1                |         | 1 = no brake resistor, 1 = brake resistor is installed   |
| 1.3.35 | Step Ref         | 1520 | -32767  | 32767            |         | Step speed reference before limit check  |
| 1.3.36 | ProcessPITrimRef | 1521 | -327.67 | 327.67           |         | Process PI Trim Frequency reference (in FreqScale)   |
| 1.3.37 | 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. |
| 1.3.38 | 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  |
| 1.3.39 | Sp MD1 Out       | 1553 | -327.67 | 327.67           |         | First spare MULDIV output  |
| 1.3.40 | Sp MD2 Out       | 1554 | -327.67 | 327.67           |         | Second spare MULDIV output   |
| 1.3.41 | Sp Add1 Out      | 1555 | -327.67 | 327.67           |         | Spare Add block output   |
| 1.3.42 | Sp Sub1 Out      | 1565 | -327.67 | 327.67           |         | Spare sub block output.  |
| 1.3.43 | Sp LP Fil Out    | 1557 | -327.67 | 327.67           |         | Output of spare low pass filter  |
| 1.3.44 | Sp ABS Out       | 1558 | 0.00    | 327.67           |         | Spare ABS block output   |
| 1.3.45 | Sp Sum1 Out      | 1559 | -327.67 | 327.67           |         | Sp sum block output  |
| 1.3.46 | Sp Sel1 Out      | 1561 | -327.67 | 327.67           |         | First spare select block output.   |
| 1.3.47 | Sp Sel2 Out      | 1562 | -327.67 | 327.67           |         | Second spare select block output.  |
| 1.3.48 | Sp Lim Out       | 1574 | -327.67 | 327.67           |         | Spare limit value output   |
| 1.3.49 | Torque Reference | 18   | -300.0  | 300.0            |         | Torque reference 3000 = 300%   |
| 1.3.50 | Active Flt Last  | 37   | 0       | 2000             |         | [R] Last active fault code.  |
| 1.3.51 | Mtr Cur ID       | 45   | 0.0     | MotorCurrent Max |         | Motor current from the Identification  |
| 1.3.52 | Accel Comp       | 1566 | -500.0  | 500.0            |         | AccelCompensation IqReference, 1000 = motor nominal current  |
| 1.3.53 | Trq Ref Act      | 1536 | -500.0  | 500.0            |         | Adjusted TorqueReference (-3000...3000) = -300...300%  |
| 1.3.54 | Trq Ref 3        | 1537 | -300.0  | 300.0            |         | Torque reference After scaling   |
| 1.3.55 | Trq Ref 4        | 1538 | -300.0  | 300.0            |         | Torque reference After scalingand hysteresis and dead zone   |
| 1.3.56 | Final Iq Trq Ref | 1539 | -300.0  | 300.0            |         | Final, limited Iq reference for speed/torque controller  |
| 1.3.57 | TC Pos Freq Lim  | 1572 | -3200.0 | 3200.0           |         | Upper frequency limit in Torque Control (signed)   |
| 1.3.58 | TC Neg Freq Lim  | 1573 | -3200.0 | 3200.0           |         | Lower frequency limit in Torque Control (signed)   |
| 1.3.59 | Current Scale    | 0    | 0       | 100              |         | Current Scale (1 or 10):: 1: I[A] = "CurrentVariable"// 10: I[A] = "CurrentVariable"/10//Depends on UnitSizeIndex  |
| 1.3.60 | Abs Fil Spd      | 1519 | 0       | 32767            |         | Absolute value of speed feedback in rpm.   |
| 1.3.61 | Loss Tbl Out     | 1518 | 0.0     | 3276.7           |         | Ouput of loss table for ESS mode.  |
| 1.3.62 | Regen Trq Lim    | 1517 | -3276.7 | 3276.7           |         | Regen torque limit   |
| 1.3.63 | Spd Cntrl Word   | 1516 | 0       | 5                |         | Speed reference. 0=ESS, 1=spd vs time, 2=Remote, 3=Maint, 4=none   |
| 1.3.64 | Spd Ref          | 1515 | 0       | 32767            |         | Spd reference in RPM from any of the modes.  |
| 1.3.65 | Spd Tbl Tim      | 1514 | 0       | 32767            |         | Speed table time elapsed in seconds.   |
| 1.3.66 | Trq Cntrl Word   | 1513 | 0       | 5                |         | Torque control word. 0=Torque tbl, 1=Remote, 2=Maint   |
| 1.3.67 | Trq Lim Ref      | 1512 | -3276.7 | 3276.7           |         | Torque limit reference from all modes in ft lbs.   |
| 1.3.68 | Trq Spd Tbl      | 1510 | -3276.7 | 3276.7           |         | Output of the speed vs torque table.   |
| 1.3.69 | Trq PI Out       | 0    | -3276.7 | 3276.7           |         | Torque PI output   |
| 1.3.70 | Tbl Trq Lim      | 0    | -3276.7 | 3276.7           |         |  |

| MENU    | NAME           | ID   | MIN     | MAX    | DEFAULT | DESCRIPTION   |
|---------|----------------|------|---------|--------|---------|---|
| 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   | DIN123 Status  | 15   | 0       | 7      |         | Digital Inputs 1, 2 and 3 Status (sum)  |
| 1.4.10  | DIN456 Status  | 16   | 0       | 7      |         | Digital Inputs 4, 5 and 6 Status (sum)  |
| 1.4.11  | Not DIN 1      | 1021 | 0       | 1      |         | Inverse of digital input 1  |
| 1.4.12  | Not DIN 2      | 1022 | 0       | 1      |         | Inverse of digital input 2  |
| 1.4.13  | Not DIN 3      | 1023 | 0       | 1      |         | Inverse of digital input 3  |
| 1.4.14  | Not DIN 4      | 1024 | 0       | 1      |         | Inverse of digital input 4  |
| 1.4.15  | Not DIN 5      | 1025 | 0       | 1      |         | Inverse of digital input 5  |
| 1.4.16  | Not DIN 6      | 1026 | 0       | 1      |         | Inverse of digital input 6  |
| 1.4.17  | Not DIN 7      | 1027 | 0       | 1      |         | Inverse of digital input 7  |
| 1.4.18  | 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   |
| 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  | AOUT3 Val      | 1592 | -327.67 | 327.67 |         | Value of third analog out. +/- 10,000 to full scale                                     |
| 1.5.20  | AOUT4 Val      | 1593 | -327.67 | 327.67 |         | Value of fourth analog out. +/- 10,000 to full scale                                    |
| 1.5.21  | Enc1_Out       | 1609 | -3276.7 | 3276.7 |         | First encoder input after scaling and low pass filter                                   |
| 1.5.22  | Enc2_Out       | 1610 | -3276.7 | 3276.7 |         | Second encoder input after scaling and low pass filter                                  |
| 1.5.23  | Counter1       | 1528 | -32767  | 32767  |         | First encoder counter output after scaling  |
| 1.5.24  | Counter2       | 1529 | -32767  | 32767  |         | Second 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 for field bus selected by FB Bit Sel 1  |
| 1.6.1.2 | FB Bit01       | 1041 | 0       | 1      |         | Bit for field bus selected by FB Bit Sel 1  |
| 1.6.1.3 | FB Bit02       | 1042 | 0       | 1      |         | Bit for field bus selected by FB Bit Sel 1  |
| 1.6.1.4 | FB Bit03       | 1043 | 0       | 1      |         | Bit for field bus selected by FB Bit Sel 1  |
| 1.6.1.5 | FB Bit04       | 1044 | 0       | 1      |         | Bit for field bus selected by FB Bit Sel 2  |
| 1.6.1.6 | FB Bit05       | 1045 | 0       | 1      |         | Bit for field bus selected by FB Bit Sel 2  |
| 1.6.1.7 | FB Bit06       | 1046 | 0       | 1      |         | Bit for field bus selected by FB Bit Sel 2  |
| 1.6.1.8 | FB Bit07       | 1047 | 0       | 1      |         | Bit for field bus selected by FB Bit Sel 2  |
| 1.6.1.9 | FB Bit08       | 1048 | 0       | 1      |         | Bit for field bus selected by FB Bit Sel 3  |

| MENU     | NAME             | ID   | MIN     | MAX    | DEFAULT | DESCRIPTION   |
|----------|------------------|------|---------|--------|---------|---|
| 1.6.1.10 | FB Bit09         | 1049 | 0       | 1      |         | Bit for field bus selected by FB Bit Sel 3  |
| 1.6.1.11 | FB Bit10         | 1050 | 0       | 1      |         | Bit for field bus selected by FB Bit Sel 3  |
| 1.6.1.12 | FB Bit11         | 1051 | 0       | 1      |         | Bit for field bus selected by FB Bit Sel 3  |
| 1.6.1.13 | FB Bit12         | 1052 | 0       | 1      |         | Bit for field bus selected by FB Bit Sel 4  |
| 1.6.1.14 | FB Bit13         | 1053 | 0       | 1      |         | Bit for field bus selected by FB Bit Sel 4  |
| 1.6.1.15 | FB Bit14         | 1054 | 0       | 1      |         | Bit for field bus selected by FB Bit Sel 4  |
| 1.6.1.16 | FB Bit15         | 1055 | 0       | 1      |         | Bit for field bus selected by FB Bit Sel 4  |
| 1.6.1.17 | 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  |
| 1.6.1.18 | FB Gen Cntl Wrd  | 1630 | -32767  | 32767  |         | Application Specific control word   |
| 1.6.1.19 | FB Gen Sts Word  | 1631 | -32767  | 32767  |         | Status word (bits B0...B15) Binary Coded, Application Specific//B0 - B7 Digital Outputs//B8 Fieldbuscard & Application specific fieldbus process data in use  |
| 1.6.2    | Analog Inputs    |      |         |        |         | Menu Name   |
| 1.6.2.1  | FB Word In 1     | 1611 | -327.67 | 327.67 |         | First int in from field bus   |
| 1.6.2.2  | FB Word In 2     | 1612 | -327.67 | 327.67 |         | Second int input from field bus   |
| 1.6.2.3  | FB Word In 3     | 1613 | -327.67 | 327.67 |         | Third int input from field bus  |
| 1.6.2.4  | FB Word In 4     | 1614 | -327.67 | 327.67 |         | Fourth int input from field bus   |
| 1.6.2.5  | FB Word In 5     | 1615 | -327.67 | 327.67 |         | Fifth int input from field bus  |
| 1.6.2.6  | FB Word In 6     | 1616 | -327.67 | 327.67 |         | Sixth int input from field bus  |
| 1.6.2.7  | FB Word In 7     | 1617 | -327.67 | 327.67 |         | Seventh int input from field bus  |
| 1.6.2.8  | FB Word In 8     | 1618 | -327.67 | 327.67 |         | Eighth int input from field bus   |
| 1.6.2.9  | FB Word In 9     | 1619 | -327.67 | 327.67 |         | Ninth int input from field bus  |
| 1.6.2.10 | FB Word In 10    | 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 Word Out 1    | 1622 | -32767  | 32767  |         | Application Specific process data   |
| 1.6.3.2  | FB Word Out 2    | 1623 | -32767  | 32767  |         | Application Specific process dataApplication Specific process data  |
| 1.6.3.3  | FB Word Out 3    | 1624 | -32767  | 32767  |         | Application Specific process dataApplication Specific process dataApplication Specific process data   |
| 1.6.3.4  | FB Word Out 4    | 1625 | -32767  | 32767  |         | Application Specific process dataApplication Specific process dataApplication Specific process dataApplication Specific process data  |
| 1.6.3.5  | FB Word Out 5    | 1626 | -32767  | 32767  |         | Application Specific process dataApplication Specific process dataApplication Specific process dataApplication Specific process dataApplication Specific process data   |
| 1.6.3.6  | FB Word Out 6    | 1627 | -32767  | 32767  |         | Application Specific process dataApplication Specific process data                                  |
| 1.6.3.7  | FB Word Out 7    | 1628 | -32767  | 32767  |         | Application Specific process dataApplication Specific process data                                  |
| 1.6.3.8  | FB Word 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 Wathcdog is OK.   |
| 1.7.3    | SB In Cntl Word  | 1530 | 0       | 32767  |         | System bus control word form 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 Drive OK      | 1058 | 0       | 1      |         | System bus master section Drive OK Bit.   |
| 1.7.10   | MD Run Enable    | 1060 | 0       | 1      |         | System bus master section Run Enable is high.   |

| MENU   | NAME             | ID   | MIN    | MAX    | DEFAULT          | DESCRIPTION   |
|--------|------------------|------|--------|--------|------------------|---|
| 1.7.11 | MD Watchdog      | 1059 | 0      | 1      |                  | From master section watchdog bit.   |
| 1.7.12 | SB Comm Lost     | 0    | 0      | 1      |                  | System bus is not communicating   |
| 1.7.13 | SB Comm Flt      | 1173 | 0      | 1      |                  | Ssystem 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  | User Flt 1       | 0    | 0      | 2000   | 1002             | First user fault configuration point. Default to Zero Bit.  |
| 2.1.3  | User Flt 2       | 0    | 0      | 2000   | 1002             | Second user fault configuration point. Default to Zero Bit.   |
| 2.1.4  | User Flt1 Resp   | 0    | 0      | 3      | 2 / Fault        | Response to the 1st user fault.   |
| 2.1.5  | User Flt2 Resp   | 0    | 0      | 3      | 2 / Fault        | Response to the 2nd user fault.   |
| 2.1.6  | Ext Fault Inp    | 0    | 0      | 2000   | 1002             | External fault input. High for fault. Default to zero bit.  |
| 2.1.7  | Ext Flt Resp     | 701  | 0      | 3      | 2 / Fault        | Set Drive response to an external fault. Ignore, Warn, Fault, Fault coast   |
| 2.1.8  | Overspeed Resp   | 0    | 0      | 3      | 3 / Fault,Coast  | Response to drive overspeed. Default to coast stop and fault the drive.   |
| 2.1.9  | Input Ph. Superv | 730  | 0      | 3      | 0 / No Action    | Set response to an input phase fault. Ignore, Warn, Fault, Fault coast  |
| 2.1.10 | UVolt Fault Resp | 727  | 0      | 1      | 0 / Fault Stored | Set Drive response to an under voltage fault. Ignore, Warn, Fault, Fault coast  |
| 2.1.11 | Phase Supv F     | 702  | 0      | 3      | 2 / Fault        | Set Drive response to an output phase fault. Ignore, Warn, Fault, Fault coast   |
| 2.1.12 | Earth Fault      | 703  | 0      | 3      | 2 / Fault        | Set Drive response to a ground fault. Ignore, Warn, Fault, Fault coast  |
| 2.1.13 | Therm Prot F     | 704  | 0      | 3      | 2 / Fault        | Set Drive response to a motor thermal fault. Ignore, Warn, Fault, Fault coast   |
| 2.1.14 | MotAmbTempFactor | 705  | -100.0 | 100.0  | 0.0              | [W] Ambient temperature factor,(-1000... 1000) 0= nominal, 1000= max, kf=(Tamb-Tn)/(Tmax-Tn)*1000.                          |
| 2.1.15 | Mot Therm 0 Spd  | 706  | 0.0    | 150.0  | 40.0             | [W] Motor cooling ability at zero speed unit 0,1%. Init := 400  |
| 2.1.16 | Mtr Therm TC     | 707  | 1      | 200    | 10               | [W] Motor Thermal Time Constant in minutes, (1... 200). Init := 45  |
| 2.1.17 | Motor Duty Cycle | 708  | 0      | 100    | 100              | [W] Motor Duty Cycle in %. Init := 100  |
| 2.1.18 | ULoad Protect F  | 713  | 0      | 3      | 0 / No Action    | Set Drive response to a loss of load fault. Ignore, Warn, Fault, Fault coast  |
| 2.1.19 | Under Ld Trq Nom | 714  | 10.0   | 150.0  | 50.0             | [W] Underload load curve at nominal freq.unit = 0.1%. Init := 500   |
| 2.1.20 | Under Ld Trq 0   | 715  | 5.0    | 150.0  | 10.0             | [W] Underload load curve at zero freq.unit = 0.1%. Init := 100  |
| 2.1.21 | Under Ld State T | 716  | 2.00   | 600.00 | 20.00            | [W] Time limit for underload supervision in 0.01 sec (0 .... 65536). Init := 2000   |
| 2.1.22 | ThermistorF.Resp | 732  | 0      | 3      | 2 / Fault        | Set Drive response to a thermistor fault. Ignore, Warn, Fault, Fault coast  |
| 2.1.23 | FBComm.FaultResp | 733  | 0      | 3      | 2 / Fault        | Set Drive response to a field bus fault. Ignore, Warn, Fault, Fault coast   |
| 2.1.24 | SPI Flt Resp     | 734  | 0      | 3      | 2 / Fault        | Set Drive response to a slot communication fault. Ignore, Warn, Fault, Fault coast  |
| 2.1.25 | Auto Rst Wait    | 717  | 0.10   | 10.00  | 0.50             | Wait time between logging separate instance of the same fault. Enter in seconds.  |
| 2.1.26 | Auto Rst SVTime  | 718  | 0.00   | 60.00  | 30.00            | Used with trials. The drive will allow the number of trial resets on this fault within this given time. Entered in seconds. |
| 2.1.27 | Auto Rst StartM  | 719  | 0      | 2      | 0 / Ramping      | 0 = ramp,1 = flying start,2 = system defined  |
| 2.1.28 | Auto Rst UV Trls | 720  | 0      | 10     | 0                | Determines the numbe of auto restarts allowed in the trial time for the undervoltage fault.                                 |
| 2.1.29 | Auto Rst OV Trls | 721  | 0      | 10     | 0                | Determines the numbe of auto restarts allowed in the trial time for the over voltage fault.                                 |
| 2.1.30 | Auto Rst OC Trls | 722  | 0      | 3      | 0                | Determines the numbe of auto restarts allowed in the trial time for the over current fault.                                 |
| 2.1.31 | Auto Rst Mtr OT  | 726  | 0      | 10     | 0                | Determines the numbe of auto restarts allowed in the trial time for the motor temperature fault.                            |
| 2.1.32 | Auto Rst ExtF T  | 725  | 0      | 10     | 0                | Determines the numbe of auto restarts allowed in the trial time for the external fault.                                     |
| 2.1.33 | Auto Rst Uload T | 738  | 0      | 10     | 0                | Determines the numbe of auto restarts allowed in the trial time for the under load fault.                                   |
| 2.1.34 | WD Flt Response  | 0    | 0      | 3      | 2 / Fault        | Response to a communication watch dog time out. Default to fault the drive.   |
| 2.1.35 | Com WD           | 0    | 0      | 1      | 0 / Disabled     | Enables the communications watchdog timer. Default to not run it.   |
| 2.2    | Setpoints        |      |        |        |                  | Menu Name   |
| 2.2.1  | Run Speed        | 1254 | -32767 | 32767  | 2000             | Default run speed if a fix value is desired. Default to 0 - 100% speed  |
| 2.2.2  | Thread Speed     | 1255 | -32767 | 32767  | 1000             | Default thread speed. Used if a fixed value is desired.   |
| 2.2.3  | Jog F Speed      | 1256 | -32767 | 32767  | 500              | Fixed jog forward speed setpoint.   |

| MENU   | NAME            | ID   | MIN     | MAX    | DEFAULT         | DESCRIPTION  |
|--------|-----------------|------|---------|--------|-----------------|--|
| 2.2.4  | Jog R Speed     | 1257 | -32000  | 32000  | -500            | Jog reverse speed setpoint.  |
| 2.2.5  | Spd Slk Up      | 1273 | -32767  | 32767  | 1000            | Speed step slack up value  |
| 2.2.6  | Panel Ref Src   | 121  | 0       | 9      | 8 / Keypad Ref. | 0=AI1, 1=AI2, 2=Panel, 3=Remote to the fieldbus output   |
| 2.2.7  | Remote Ref Src  | 122  | 0       | 9      | 9 / Fieldbus    | 0=AI1, 1=AI2, 2=Panel, 3=Remote reference to the fieldbus output.  |
| 2.2.8  | Trq Ref STA     | 1302 | -300.0  | 300.0  | 0.0             | Fixed value for the first torque reference input if desired. Enter in percent torque.  |
| 2.2.9  | Field WeakngPnt | 602  | 0.80    | 320.00 | 60.00           | [W] Field weakening point, f[Hz] = FieldWeakeningPoint/FreqScale//f FreqScale=100 then 5000 equals 50.00 Hz  |
| 2.2.10 | Sp Sum1 StA     | 1330 | -327.67 | 327.67 | 0.00            | Sp sum blocks first inputs default calibration value..   |
| 2.2.11 | Sp Sum1 StB     | 1331 | -327.67 | 327.67 | 0.00            | Sp sum blocks second inputs default calibration value..  |
| 2.2.12 | Sp Sum1 StC     | 1332 | -327.67 | 327.67 | 0.00            | Sp sum blocks third inputs default calibration value..   |
| 2.2.13 | Sp Sel1 ST0     | 1337 | -327.67 | 327.67 | 0.00            | First spare select block input 0 default calibration value.  |
| 2.2.14 | Sp Sel1 ST1     | 1338 | -327.67 | 327.67 | 0.00            | First spare select block input 1 default calibration value.  |
| 2.2.15 | Sp Sel2 ST0     | 1339 | -327.67 | 327.67 | 0.00            | Second spare select block input 0 default calibration value.   |
| 2.2.16 | Sp Sel2 ST1     | 1340 | -327.67 | 327.67 | 0.00            | Second spare select block input 1 default calibration value.   |
| 2.2.17 | Sp Cmp1_Hyst    | 1345 | 0.00    | 327.67 | 0.01            | First spare comparitor block Hysteresis value. PLus or minus around the threshold.   |
| 2.2.18 | Sp Cmp1_Spt     | 1346 | -327.67 | 327.67 | 0.10            | First spare comparitor block default setpoint value. Can be used for the input or threshold.   |
| 2.2.19 | Con Mode        | 1251 | 0       | 5      | 0               | Console mode stpt 0=spd vs time, 1=ESS, 2= spd vs time then ESS, 3=ESS then Spd vs time, 4=None  |
| 2.2.20 | ESS Lit Stpt    | 1248 | 0       | 32767  | 5000            | Engine start speed to trasnfer from starting to constant speed mode.   |
| 2.2.21 | Lit Speed       | 1247 | 0       | 32767  | 4000            | Constant speed to go to after engine start.  |
| 2.2.22 | M Spd Stpt      | 1245 | 0       | 32767  | 1000            | Maint speed setpoint in rpm.   |
| 2.2.23 | M Trq Stpt      | 1244 | -3276.7 | 3276.7 | 10.0            | Maint torque setpoint in ft lbs.   |
| 2.2.24 | Rem Spd Stpt    | 1237 | 0       | 32767  | 5000            | Optional remote speed stpt   |
| 2.2.25 | Rem Trq Stpt    | 1235 | -3276.7 | 3276.7 | 10.0            | Optional remote torque setpoint in ft lbs.   |
| 2.2.26 | WK Stpt         | 1234 | 0.0     | 3276.7 | 1.0             | Inertia of unit for engine start. Entered in ft lbs seconds squared  |
| 2.2.27 | Trq Base Spd    | 1260 | 0       | 32767  | 1700            | Start RPM to start torque limit  |
| 2.2.28 | Trq End Spd     | 1261 | 0       | 32767  | 5000            | End speed to go to low torque limit  |
| 2.2.29 | Skp Frq Hi1     | 0    | 0.00    | 320.00 | 0.00            | First skip frequency high setpoint.  |
| 2.2.30 | Skp Frq Hi2     | 0    | 0.00    | 320.00 | 0.00            | Second skip frequency high setpoint.   |
| 2.2.31 | Skp Frq Low1    | 0    | 0.00    | 320.00 | 0.00            | First skip frequency low setpoint.   |
| 2.2.32 | Skp Frq Low2    | 0    | 0.00    | 320.00 | 0.00            | Second skip frequency low setpoint.  |
| 2.3    | Rates / Times   |      |         |        |                 | Menu Name  |
| 2.3.1  | Accel Time 1    | 103  | 0.1     | 3000.0 | 10.0            | Default acceleration time constant for the speed ramp.   |
| 2.3.2  | Decel Time 1    | 104  | 0.1     | 3000.0 | 10.0            | Default deceleration time constant for the speed ramp.   |
| 2.3.3  | Smooth Ratio    | 500  | 0.0     | 10.0   | 0.1             | [W] Smooth ratio for S-curves//0 = linear ramps//100 = full acc/dec inc/dec times.   |
| 2.3.4  | Fast Stop Tim   | 503  | 0.1     | 3000.0 | 1.0             | Fast stop ramp time  |
| 2.3.5  | Smooth Ratio 2  | 501  | 0.0     | 10.0   | 0.0             | [W] Smooth ratio 2 for S-curves//0 = linear ramps//100 = full acc/dec inc/dec times.   |
| 2.3.6  | Strl 0 Spd Time | 615  | 0       | 32000  | 100             | After giving the start command the drive will remain in zero speed for the time defined by this parameter. The ramp will be released to follow the set frequency/speed reference after this time is elapsed from the instant where command is given. |
| 2.3.7  | Stop 0 Spd Time | 616  | 0       | 32000  | 100             | The drive will remain at zero speed with controllers active for the time defined by this parameter after reaching the zero speed on giving a stop command.   |
| 2.3.8  | Freq Ref LP TC  | 1309 | 0       | 1000   | 0               | Frequency reference filter time constant in ms//0 = not in use   |
| 2.3.9  | Trq Rmp Rate    | 1290 | 0       | 3200   | 5               | Torque reference ramp limit in percent per second.   |
| 2.3.10 | Sp LP Fil TC    | 1329 | 0.00    | 10.00  | 0.10            | Spare low pass filter time constant. Default to 100 ms.  |
| 2.3.11 | Sp Dly1 TOFF    | 1349 | 0.00    | 327.67 | 0.10            | First spare timer delay off setting in seconds. Default to 100 ms.   |
| 2.3.12 | Sp Dly1 TON     | 1350 | 0.00    | 327.67 | 0.10            | First spare timer delay on setting in seconds. Default to 100 ms.  |
| 2.3.13 | Spd Cmp Fil TC  | 0    | 0.00    | 10.00  | 0.10            | Spd Comparitor low pas filter. Default to 100 ms.  |
| 2.3.14 | WD Com Dly      | 0    | 0.00    | 100.00 | 0.10            | Communications watch dog timer delay. Default to 100 ms.   |
| 2.3.15 | WD Init Dly Tim | 0    | 0.00    | 327.67 | 10.00           | Power up delay for the communications wathdog timer. Default to 10 seconds.  |
| 2.3.16 | Accel Comp Tc   | 0    | 0.002   | 1.000  | 0.100           | Filtering Time Constant for acceleration compensation in s   |

| MENU   | NAME             | ID   | MIN     | MAX    | DEFAULT | DESCRIPTION   |
|--------|------------------|------|---------|--------|---------|---|
| 2.3.17 | Trq Ref Fil TC   | 0    | 0.0     | 1000.0 | 0.0     | Filter time for torque reference (0...10000) = 0...1000.0 ms  |
| 2.3.18 | Spd Err Fil TC   | 0    | 0       | 1000   | 0       | Filter time for speed error (0 ...1000 ) = 0...1000 ms  |
| 2.3.19 | Trq Ref Rate     | 1241 | 0.00    | 327.67 | 10.00   | Regen torque reference ramp limit.  |
| 2.3.20 | Skp Rmp Time     | 0    | 0.0     | 1000.0 | 1.0     | Ramp time during skip frequencies. Default to 1 second to max freq.   |
| 2.3.21 | DC Tim Rmp Stp   | 0    | 0.00    | 100.00 | 0.00    | Dc brake time [ms] in coast stop  |
| 2.3.22 | DC Tim Cst Stp   | 0    | 0.00    | 100.00 | 0.00    | Dc brake time [ms] in ramp stop   |
| 2.4    | Tuning Gains     |      |         |        |         | Menu Name   |
| 2.4.1  | Speed Control Kp | 613  | 1       | 1000   | 30      | Gain for the speed controller. (% / Hz)   |
| 2.4.2  | Speed Control Ti | 614  | 0.0     | 500.0  | 30.0    | Integral time constant for the speed controller   |
| 2.4.3  | Spd Cntrl F0     | 0    | 0.0     | 3200.0 | 0.0     | Corner frequency for SpeedControl_Kp_f0   |
| 2.4.4  | Spd Cntrl F1     | 0    | 0.0     | 3200.0 | 0.0     | Corner frequency for SpeedControl_Kp  |
| 2.4.5  | Spd Cntrl Kp F0  | 0    | 0       | 300    | 100     | Relative gain (%) below SpeedControl_f0   |
| 2.4.6  | Spd Cntrl Kp FW  | 0    | 0       | 300    | 100     | Relative final gain for Speed controller p-gain at field weakening in%//< 100 reduces gain, >100 increases gain above FWP   |
| 2.4.7  | Spd Cntrl Kp T0  | 0    | 0       | 300    | 100     | Relative gain (%) if torque is below SpeedControl_T0  |
| 2.4.8  | Spd Cntrl T0     | 0    | 0       | 300    | 0       | Torque Limit for reduced SpeedControl_Kp (1000 = nominal)   |
| 2.4.9  | Accel.Compens.   | 626  | 0.00    | 300.00 | 0.00    | Inertia compensation to improve speed response during acceleration and deceleration. Time is defined as acceleration time to nominal speed with nominal torque. This parameter is active also in advanced openloop. |
| 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 | CurrentControlKp | 617  | 0.00    | 100.00 | 40.00   | Gain for the current controller. This controller is active only in closed loop and advanced open loop. It generates the voltage vector reference to the modulator.  |
| 2.4.13 | Curr Cntrl Ti    | 0    | 0.0     | 100.0  | 1.5     | Current controller integrator time constant (0 ... 1000) = 0...100.0 ms   |
| 2.4.14 | OV Reg Kp        | 0    | 0       | 32767  | 2000    | P-gain of over voltage controller ( 0 ...32767)   |
| 2.4.15 | OV Reg Kp Add    | 0    | 0       | 32767  | 2000    | Addition to P-gain of over voltage controller ( 0 ...32767)   |
| 2.4.16 | OV Reg Ki        | 0    | 0       | 32767  | 500     | I-gain of over voltage controller ( 0 ...32767)   |
| 2.4.17 | OV Reg Kd        | 0    | 0       | 32767  | 400     | D-gain of over voltage controller OL, 256 equals 1.0 ( 0 .. 32767 )   |
| 2.4.18 | UV Reg Kp        | 0    | 0       | 32767  | 4000    | P-gain of under voltage controller ( 0 ...32767)  |
| 2.4.19 | UV Reg Kp2       | 0    | 0       | 32767  | 0       | P-gain of under voltage controller nonlinear part   |
| 2.4.21 | UV Reg I2        | 0    | 0       | 32767  | 0       | I-gain of under voltage controller nonlinear part   |
| 2.4.22 | UV Reg Kd        | 0    | 0       | 32767  | 0       | D-gain of under voltage controller  |
| 2.4.23 | UV Reg Kd2       | 0    | 0       | 32767  | 0       | D-gain of under voltage controller nonlinear part   |
| 2.4.24 | Mtr I Lim Ki     | 0    | 0       | 32767  | 400     | I-gain of motor side over current controller (0 ... 32767 )   |
| 2.4.25 | Mtr I Lim Kp     | 0    | 0       | 32767  | 20000   | P-gain of motor side over current controller (0 ... 32767 )   |
| 2.4.26 | Gen I Lim Ki     | 0    | 0       | 32767  | 400     | I-gain of generator side over current controller (0 ... 32767 )   |
| 2.4.27 | Gen I Lim Kp     | 0    | 0       | 32767  | 20000   | P-gain of generator side over current controller (0 ... 32767 )   |
| 2.4.28 | Trq Lim Kp       | 610  | 0       | 32000  | 3000    | P-gain of torque limit controller   |
| 2.4.29 | Trq Lim Ki       | 611  | 0       | 32000  | 200     | I-gain of torque limit controller   |
| 2.4.30 | Spd Cont Kp      | 637  | 0       | 32767  | 3000    | [W] P-gain of open loop speed controller (0...32767 ). Init := 3000   |
| 2.4.31 | Spd Cont Ki      | 638  | 0       | 32767  | 300     | [W] I-gain of open loop speed controller (0 ... 32767). Init := 300   |
| 2.4.32 | Temp CL Param    | 0    | 0       | 0      | 0       | Reserved for future use.  |
| 2.4.33 | Trq Cntrl Kp     | 639  | 0       | 32000  | 150     | P-gain of torque controller   |
| 2.4.34 | Trq Cntrl Ki     | 640  | 0       | 32000  | 10      | I-gain of torque controller   |
| 2.4.35 | Cl Ovr Vlt Kp    | 0    | 0       | 5000   | 50      | CL OverVoltage Controller base gain   |
| 2.4.36 | Cl Ovr Vlt Kp0   | 0    | 0       | 5000   | 50      | CL OverVoltage Controller gain increase at zero frequency   |
| 2.4.37 | Cl Ovr Vlt Ti    | 0    | 0       | 500    | 15      | CL OverVoltage Controller integral time in ms   |
| 2.4.38 | ESS Int Gn       | 1249 | 0.00    | 100.00 | 1.00    | Engine start integral time constant in seconds. Scales input to output.   |
| 2.4.39 | Trq LP Gain      | 0    | -32767  | 32767  | 1       | Overall gain for the outer trq regulator  |
| 2.4.40 | Trq I Gain       | 0    | 0.00    | 327.67 | 1.00    | Tension loop i gain   |
| 2.4.41 | Trq P Gain       | 0    | 0.000   | 32.767 | 0.010   | Trq loop p gain   |
| 2.5    | Limits           |      |         |        |         | Menu Name   |
| 2.5.1  | Freq Max         | 102  | FreqMin | 320.00 | 60.00   | [W] Max output frequency, f[Hz] = FreqMax/FreqScale//Range[FreqMin...32767]//If FreqScale=100 then 5000 equals 50.00 Hz. Init := 5000   |

| MENU   | NAME             | ID   | MIN     | MAX           | DEFAULT      | DESCRIPTION  |
|--------|------------------|------|---------|---------------|--------------|--|
| 2.5.2  | Min Frequency    | 101  | 0.00    | Max_Frequency | 0.00         | Minimum frequency the speed reference is allowed to go down to in hertz.   |
| 2.5.3  | Mtr Cur Limit    | 1291 | 0.00    | 300.00        | 100.00       | Motor current limit value  |
| 2.5.4  | Motoring Trq Lim | 1305 | 0.0     | 300.0         | 300.0        | Torque limit for motor side torque limiter, 1000 equals 100% nominal torque  |
| 2.5.5  | Gener Trq Lim    | 1306 | 0.0     | 300.0         | 300.0        | Torque limit for generator side torque limiter, 1000 equals 100% nominal torque  |
| 2.5.6  | Trq Lim FWD      | 1307 | 0.0     | 300.0         | 300.0        | Additional Torque limit for Forward Reference Direction, 1000 equals 100% nominal torque   |
| 2.5.7  | Trq Lim REV      | 1308 | 0.0     | 300.0         | 300.0        | Additional Torque limit for Reverse Reference Direction, 1000 equals 100% nominal torque   |
| 2.5.8  | Ovr Spd Stp      | 1258 | 0.00    | 327.67        | 110.00       | Overspeed setpoint in percentage of max speed. Default to 110%   |
| 2.5.9  | Zero Detect      | 1259 | 0.00    | 200.00        | 2.00         | Speed feedback comparitor At zero speed setpoint. Default to 2% of max speed.  |
| 2.5.10 | Spd Hyst         | 0    | 0.00    | 200.00        | 1.00         | Speed feedback comparitor hysteresis value. Default to 1%  |
| 2.5.11 | Spd Decimal      | 0    | 0       | 4             | 2            | Speed feedback comparitor decimal point resolution. Default to 2.  |
| 2.5.12 | Trq Ref Max      | 1274 | 0.0     | 300.0         | 100.0        | Maximum limit for the torque reference. Entered in percent torque.   |
| 2.5.13 | Trq_Ref_Min      | 1275 | 0.0     | 300.0         | 50.0         | Minimum limit for the torque reference. Entered in percent torque.   |
| 2.5.14 | Torq Speed Limit | 644  | 0       | 2             | 1 / Freq Ref | Torque control max frequency 0 = Max Frequency Par 2.1.1, 1 = Selected frequency reference, 2 = Preset speed 7   |
| 2.5.15 | Trq Ref Hyst     | 0    | -3000   | 3000          | 0            | Hysteresis for TorqueReference before filtering (-3000...3000) = -300...300%   |
| 2.5.16 | Trq Ref DeadZone | 0    | -300.0  | 300.0         | 0.0          | Dead zone for TorqueReference before hysteresis (-3000...3000) = -300...300%   |
| 2.5.17 | 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   |
| 2.5.18 | 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 direction/Additional signed Lower Frequency limit in FreqScale, //Range [-32767..32767],//0 prevents running to reverse direction |
| 2.5.19 | Win Pos Width    | 0    | 0.00    | 320.00        | 6.00         | Frequency Window width for positive direction in FreqScale, activated with TCSpeedLimiterMode=4  |
| 2.5.20 | Win Neg Width    | 0    | 0.00    | 320.00        | 6.00         | Frequency Window width for negative direction in FreqScale, activated with TCSpeedLimiterMode=4.   |
| 2.5.21 | Cl Ovr Mtr Lim   | 0    | 0.0     | 500.0         | 10.0         | CL Motoring current limit (1000 = 100.0%) for OverVoltage Controller   |
| 2.5.22 | Sp Lim Max       | 1353 | -327.67 | 327.67        | 100.00       | Spare limit block maximum value.   |
| 2.5.23 | Sp Lim Min       | 1354 | -327.67 | 327.67        | -100.00      | Spare limit block minimum value.   |
| 2.5.24 | Max Spd RPM      | 1292 | 0       | 32565         | 1800         | Max speed used for overspeed and zero speed detection in RPM.  |
| 2.5.25 | DUT Max Spd      | 1250 | 0       | 32767         | 10000        | Device under test max speed limit in rpm   |
| 2.5.26 | Min ESS Lim      | 0    | 0       | 32767         | 0            | Minimum for ESS integrator output. Usually left at 0.  |
| 2.5.27 | Max ESS Lim      | 1243 | 0       | 32767         | 10000        | Maximum limit for ESS integrator output.   |
| 2.5.28 | Spd Trq Lim      | 1242 | -3276.7 | 3276.7        | 100.0        | Regen torque limit.  |
| 2.5.29 | Trq LP Max       | 0    | -3276.7 | 3276.7        | 100.0        | Upper torque loop limit  |
| 2.5.30 | Trq LP Min       | 0    | -3276.7 | 3276.7        | -100.0       | Lower torque loop limit  |
| 2.6    | Scaling          |      |         |               |              | Menu Name  |
| 2.6.1  | LS to Freq       | 0    | -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       | 0    | -32767  | 32767         | 1000         | Scaling factor to convert speed reference units (usually %) to motor units (Usually motor Hz)  |
| 2.6.3  | Sp MD1 Dv        | 1323 | -327.67 | 327.67        | 1.00         | Default value for the first spare MULDIV block divide input.   |
| 2.6.4  | Sp MD1 Mlt       | 1324 | -327.67 | 327.67        | 1.00         | Default value for the first spare MULDIV block multiply input.   |
| 2.6.5  | Sp MD2 Dv        | 1325 | -327.67 | 327.67        | 1.00         | Default value for the second spare MULDIV block divide input.  |
| 2.6.6  | Sp MD2 Mlt       | 1326 | -327.67 | 327.67        | 1.00         | Default value for the second spare MULDIV block multiply input.  |
| 2.6.7  | Sp Add Val       | 1327 | -327.67 | 327.67        | 0.00         | Spare add block optional cal number.   |
| 2.6.8  | Sp Sub Val       | 1328 | -327.67 | 327.67        | 0.00         | Spare sub block optional scaling value.  |
| 2.6.9  | FreqRamp         | 0    | 0.00    | 327.67        | 60.00        | Frequency range for ramp calculation, f[Hz] = FreqRamp/FreqScale//If FreqScale=100 then 5000 equals 50.00 Hz   |
| 2.6.10 | Trq Ref Off      | 1298 | -3200.0 | 3200.0        | 0.0          | Offset for TorqueReference (-32000..32000)   |
| 2.6.11 | Trq Ref Gn       | 1299 | -320.00 | 320.00        | 10.00        | Gain for TorqueReference, Divided by 1000 for end gain.//(-32000..32000), nom = 1000   |
| 2.6.12 | Loss Tbl Gn      | 1246 | 0.00    | 100.00        | 0.01         | Loss table gain. Usually left at default.  |

| MENU   | NAME           | ID   | MIN     | MAX    | DEFAULT | DESCRIPTION   |
|--------|----------------|------|---------|--------|---------|---|
| 2.6.13 | Trq Scl Div    | 1240 | 0.01    | 327.67 | 1.00    | Scaling from ft lbs to percent motor torque.  |
| 2.6.14 | Trq Scl Mlt    | 1239 | -327.67 | 327.67 | 1.00    | Torque reference scaling from ft lbs to %   |
| 2.6.15 | WK Scaling     | 1238 | -327.67 | 327.67 | 0.01    | Optional scaling for inertia input.   |
| 2.6.16 | GR Whole       | 1262 | 0       | 32000  | 1       | Gear ratio whole number used by the computer console.                                       |
| 2.6.17 | GR Decimal     | 1263 | 0.0000  | 0.9999 | 0.0000  | GR decimal portion used by the computer console.  |
| 2.7    | Bit Config     |      |         |        |         | Menu Name   |
| 2.7.1  | Run Input      | 0    | 0       | 2000   | 1011    | enables the drive in run mode. Default to the first digital input                           |
| 2.7.2  | Thread Input   | 0    | 0       | 2000   | 1002    | Enables the drive at the thread speed. Default to zero bit.                                 |
| 2.7.3  | Jog F Input    | 0    | 0       | 2000   | 1012    | Enables jog forward in the drive. Default to second digital input                           |
| 2.7.4  | Jog R Input    | 0    | 0       | 2000   | 1002    | Enables the jog reverse function in the drive. Default to zero bit.                         |
| 2.7.5  | Reverse Inp    | 0    | 0       | 2000   | 1002    | Negates the speed reference. Default to zero bit.   |
| 2.7.6  | Stop Input     | 0    | 0       | 2000   | 1001    | Stop input used for 3 wire control. Stops drive when it goes low. Default to one bit.       |
| 2.7.7  | Fast Stop      | 0    | 0       | 2000   | 1001    | Initiates a stop and switches in faster ramp rates when input goes low. Default to one bit. |
| 2.7.8  | Coast Stop     | 0    | 0       | 2000   | 1001    | Set to input for emergency coast stop. Default to one bit.                                  |
| 2.7.9  | At Zero Time   | 0    | 0       | 2000   | 1127    | Rests the Drive OK after a fault. Default to At Zero Spd                                    |
| 2.7.10 | DC Brk Cmd     | 0    | 0       | 2000   | 1002    | Enables DC injection braking after stop. Default to Zero Bit                                |
| 2.7.11 | Disable Ramp   | 0    | 0       | 2000   | 1002    | Disable speed reference ramp function   |
| 2.7.12 | Step Reverse   | 0    | 0       | 2000   | 1002    | Inverts the speed step references when set.   |
| 2.7.13 | Sup Enable     | 0    | 0       | 2000   | 1002    | Enables the speed slack up setpoint.  |
| 2.7.14 | Trq Ref En     | 0    | 0       | 2000   | 1098    | Enables torque reference. Default to RunRequest   |
| 2.7.15 | Trq Dir        | 0    | 0       | 2000   | 1002    | Reverse the polarity of the torque reference. Default to Zero bit                           |
| 2.7.16 | Trq No Ramp    | 0    | 0       | 2000   | 1001    | Disables the torque reference ramp. Defaults to disable the ramp.                           |
| 2.7.17 | Thermistor Inp | 0    | 0       | 2000   | 1002    | Input for thermistor fault. Default to zero Bit.  |
| 2.7.18 | Sp Sum1 EnA    | 0    | 0       | 2000   | 1002    | Enables the first spare sum input. Default to Zero bit.                                     |
| 2.7.19 | Sp Sum1 EnB    | 0    | 0       | 2000   | 1002    | Enables the second spare sum input. Default to Zero bit.                                    |
| 2.7.20 | Sp Sum1 EnC    | 0    | 0       | 2000   | 1002    | Enables the third spare sum input. Default to Zero bit.                                     |
| 2.7.21 | Sp Sel1 En1    | 0    | 0       | 2000   | 1002    | First spare select block enables input 1 configuration point.                               |
| 2.7.22 | Sp Sel2 En1    | 0    | 0       | 2000   | 1002    | Second Spare select block enables input 1 configuration point.                              |
| 2.7.23 | Sp Dly1 In     | 0    | 0       | 2000   | 1002    | First delay block input. Default to Zero Bit  |
| 2.7.24 | Sp Ltc1 H1     | 0    | 0       | 2000   | 1001    | First spare latch block first hold bit. Default to One bit.                                 |
| 2.7.25 | Sp Ltc1 H2     | 0    | 0       | 2000   | 1001    | First spare latch block second hold bit. Default to One bit.                                |
| 2.7.26 | Sp Ltc1 L      | 0    | 0       | 2000   | 1002    | First spare latch block latch input bit. Default to Zero bit.                               |
| 2.7.27 | Sp Inv1 In     | 0    | 0       | 2000   | 1002    | First spare Bit invert blocks input bit.  |
| 2.7.28 | Sp Inv2 In     | 0    | 0       | 2000   | 1002    | Second spare Bit invert blocks input bit.   |
| 2.7.29 | Sp And1 In1    | 0    | 0       | 2000   | 1002    | First spare And block input 1. Default to Zero Bit.   |
| 2.7.30 | Sp And1 In2    | 0    | 0       | 2000   | 1002    | First spare And block input 2. Default to Zero Bit.   |
| 2.7.31 | Sp And1 NIn3   | 0    | 0       | 2000   | 1002    | First spare And block inverted input 3. Default to Zero Bit.                                |
| 2.7.32 | Sp And2 In1    | 0    | 0       | 2000   | 1002    | Second spareAnd block input 1. Default to Zero Bit.   |
| 2.7.33 | Sp And2 In2    | 0    | 0       | 2000   | 1002    | Second spare and block input 2. Default to Zero Bit.  |
| 2.7.34 | Sp And2 NIn3   | 0    | 0       | 2000   | 1002    | Second spare And block inverted input 3. Default to Zero Bit.                               |
| 2.7.35 | Sp Or1 In1     | 0    | 0       | 2000   | 1002    | First spare Or block input 1. Default to Zero Bit.  |
| 2.7.36 | Sp Or1 In2     | 0    | 0       | 2000   | 1002    | First spare Or block input 2. Default to Zero Bit.  |
| 2.7.37 | Sp Or1 NIn3    | 0    | 0       | 2000   | 1002    | First spare Or block inverted input 3. Default to Zero Bit.                                 |
| 2.7.38 | Sp Or2 In1     | 0    | 0       | 2000   | 1002    | Second spareOr block input 1. Default to Zero Bit.  |
| 2.7.39 | Sp Or2 In2     | 0    | 0       | 2000   | 1002    | Second spareOr block input 2. Default to Zero Bit.  |
| 2.7.40 | Sp Or2 NIn3    | 0    | 0       | 2000   | 1002    | Second spare Or block inverted input 3. Default to Zero Bit.                                |
| 2.7.41 | Watchdog In    | 0    | 0       | 2000   | 1002    | Communications watchdog timer input from PLC. Default to Zero Bit.                          |
| 2.7.42 | Loc Trq Bit    | 0    | 0       | 2000   | 1002    | Enabled local torque mode   |
| 2.7.43 | Maint Bit      | 0    | 0       | 2000   | 1001    | Enables Maintenance mode  |
| 2.7.44 | Maint Spd Mode | 0    | 0       | 2000   | 1002    | Speed mode is used instead of torque when enabled and in maint mode.                        |
| 2.7.45 | Rem Bit        | 0    | 0       | 2000   | 1002    | Remote control selector bit input.  |
| 2.7.46 | Rem Spd Bit    | 0    | 0       | 2000   | 1001    | Remote speed / torque selector bit. Default to speed control.                               |
| 2.7.47 | Trq I Res1     | 0    | 0       | 2000   | 1099    | Reset the torque outer PI loop.   |
| 2.7.48 | Trq I Res2     | 0    | 0       | 2000   | 1001    | Reset the torque outer PI loop.   |
| 2.8    | Anlg Config    |      |         |        |         | Menu Name   |

| MENU   | NAME            | ID  | MIN | MAX  | DEFAULT      | DESCRIPTION  |
|--------|-----------------|-----|-----|------|--------------|--|
| 2.8.1  | Master Ref      | 0   | 0   | 2000 | 1515         | Speed ref - Default to Run Speed   |
| 2.8.2  | Thread Ref      | 0   | 0   | 2000 | 1255         | Thread speed ref. Default to Thread Speed  |
| 2.8.3  | Jog F Ref       | 0   | 0   | 2000 | 1256         | Jog forward ref. Defaulted to Jog F Speed  |
| 2.8.4  | Jog R Ref       | 0   | 0   | 2000 | 1257         | Jog Reverse ref. Default to Jog R Speed  |
| 2.8.5  | Accel Inp       | 0   | 0   | 2000 | 103          | Acceleration rate input. Default to Accel_Time_1 parameter.  |
| 2.8.6  | Decel Time      | 0   | 0   | 2000 | 104          | Deceleration rate input. Default to Decel_Time_1 parameter.  |
| 2.8.7  | Slack Up        | 0   | 0   | 2000 | 1273         | Speed slack up input. Default to Spd Slk Up  |
| 2.8.8  | Spd Fdbk        | 0   | 0   | 2000 | 2            | Speed feedback input for over and zero speed comparitor.   |
| 2.8.9  | Ovr Spd Inp     | 0   | 0   | 2000 | 1292         | Overspeed comparitor maximum setpoint. Default to MaxFreq.   |
| 2.8.10 | Mtr Cur Lim Scl | 0   | 0   | 2000 | 1291         | Scaling value for current limit. Default to MotorCurrentLim.   |
| 2.8.11 | Sp MD1 Val      | 0   | 0   | 2000 | 1200         | Input for the first spare MULDIV block. Default to Zero analog.  |
| 2.8.12 | Sp MD2 Val      | 0   | 0   | 2000 | 1200         | Input for the second spare MULDIV block. Default to Zero analog.   |
| 2.8.13 | Sp MD1 Div      | 0   | 0   | 2000 | 1323         | First spare MULDIV block divide input. Default to Sp MD1 Dv cal number.                                  |
| 2.8.14 | Sp MD1 Mul      | 0   | 0   | 2000 | 1324         | First spare MULDIV block multiply input. Default to Sp MD1 Mlt cal number.                               |
| 2.8.15 | Sp MD2 Div      | 0   | 0   | 2000 | 1325         | Second spare MULDIV block divide input. Default to Sp MD2 Dv cal number.                                 |
| 2.8.16 | Sp MD2 Mul      | 0   | 0   | 2000 | 1326         | Second spare MULDIV block multiply input. Default to Sp MD2 Mlt cal number.                              |
| 2.8.17 | Sp Add1 In1     | 0   | 0   | 2000 | 1327         | First input of spare Add block.  |
| 2.8.18 | Sp Add1 In2     | 0   | 0   | 2000 | 1327         | Second input of spare Add block.   |
| 2.8.19 | Sp Sub1 In1     | 0   | 0   | 2000 | 1328         | First input of spare Sub block.  |
| 2.8.20 | Sp Sub1 In2     | 0   | 0   | 2000 | 1328         | Second input of spare Sub block.   |
| 2.8.21 | Sp LP Fil In    | 0   | 0   | 2000 | 1200         | Input to the spare low pass filter. Default to zero analog.  |
| 2.8.22 | Sp ABS In       | 0   | 0   | 2000 | 1200         | Spare absolute value block input. Default to Zero Analog   |
| 2.8.23 | Sp Sum1 InA     | 0   | 0   | 2000 | 1330         | Spare sum block first input. Default to Sp Sum1 STA.   |
| 2.8.24 | Sp Sum1 InB     | 0   | 0   | 2000 | 1331         | Spare sum block second input. Default to Sp Sum1 StB.  |
| 2.8.25 | Sp Sum1 InC     | 0   | 0   | 2000 | 1332         | Spare sum block third input. Default to Sp Sum1 StC.   |
| 2.8.26 | Sp Sel1 In0     | 0   | 0   | 2000 | 1337         | First spare select block input 0. Default to Sp Sel1 ST0   |
| 2.8.27 | Sp Sel1 In1     | 0   | 0   | 2000 | 1338         | First spare select block input 1. Default to Sp Sel1 ST1   |
| 2.8.28 | Sp Sel2 In0     | 0   | 0   | 2000 | 1339         | Second spare select block input 0. Default to Sp Sel2 ST0  |
| 2.8.29 | Sp Sel2 In1     | 0   | 0   | 2000 | 1340         | Second spare select block input 1. Default to Sp Sel2 ST1  |
| 2.8.30 | Sp Cmp1 In      | 0   | 0   | 2000 | 1346         | First spare comparitor block input parameter to be compared with the threshold. Default to Sp Cmp1 Stpt. |
| 2.8.31 | Sp Cmp1 Thres   | 0   | 0   | 2000 | 1346         | First spare comparitor block threshold parameter to be compared with the input. Default to Sp Cmp1 Stpt. |
| 2.8.32 | Sp Lim Inp      | 0   | 0   | 2000 | 1200         | Spare limit input. default to Zero Analog  |
| 2.8.33 | Trq Ref         | 0   | 0   | 2000 | 1517         | Torque reference. Default to C_Trq_Ref_STA   |
| 2.8.34 | Con Mode Inp    | 0   | 0   | 2000 | 1251         | Console command for which mode to run.   |
| 2.8.35 | ESS Lit Inp     | 0   | 0   | 2000 | 1248         | ESS speed setpoint to switch from engine start to constant speed.  |
| 2.8.36 | Lit Spd Inp     | 0   | 0   | 2000 | 1247         | Speed to run at after engine lit complete.   |
| 2.8.37 | Loss Tbl Inp    | 0   | 0   | 2000 | 1201         | Optional Loss table input gain input. Default to 1.  |
| 2.8.38 | Maint Spd Inp   | 0   | 0   | 2000 | 1245         | Maint speed reference input in rpm   |
| 2.8.39 | Main Trq Inp    | 0   | 0   | 2000 | 1244         | Main torque reference input in ft lbs.   |
| 2.8.40 | Mx Spd Lim      | 0   | 0   | 2000 | 1243         | Unit under test max speed reference limit in rpm.  |
| 2.8.41 | Rem Spd Inp     | 0   | 0   | 2000 | 1237         | Remote speed reference input in rpm.   |
| 2.8.42 | Rem Trq Inp     | 0   | 0   | 2000 | 1235         | Remote torque reference input in ft lbs.   |
| 2.8.43 | Trq Ref Inp     | 0   | 0   | 2000 | 1601         | Torque input for engine start mode.  |
| 2.8.44 | WK Inp          | 0   | 0   | 2000 | 1234         | Inertia compensation input.  |
| 2.8.45 | Trq Lp Ref      | 0   | 0   | 2000 | 1512         | Outer torque loop reference input. Default to A Trq Lim Ref  |
| 2.8.46 | Trq Lp Fdbk     | 0   | 0   | 2000 | 1601         | Outer torque loop feedback selection input. Default to first analog input.                               |
| 2.9    | Enables         |     |     |      |              | Menu Name  |
| 2.9.1  | Skip S Rev      | 0   | 0   | 1    | 0 / Disabled | Skip S2,S4 scurve when opposite direction asked for during a ramp  |
| 2.9.2  | Rmp Act Lim     | 0   | 0   | 1    | 0 / Disabled | Enables ramping during the over ride limits  |
| 2.9.3  | Fly Strt Flt    | 0   | 0   | 1    | 1 / Enabled  | Enables the ability to start into a spinning motor after a fault   |
| 2.9.4  | 3 Wire St En    | 0   | 0   | 1    | 0 / Disabled | Enables three wire start stop logic  |
| 2.9.5  | Start Function  | 505 | 0   | 1    | 0 / Ramping  | Start function. 0 = Ramp, 1 = Flying start   |

| MENU      | NAME             | ID  | MIN     | MAX          | DEFAULT          | DESCRIPTION   |
|-----------|------------------|-----|---------|--------------|------------------|---|
| 2.9.6     | Stop Funct       | 0   | 0       | 3            | 2 / Ramp+RECoast | Stop function, 0=coasting, 1=framp  |
| 2.9.7     | Brake Chopper    | 0   | 0       | 8            | 0 / B(No)T(No)   | 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)     |
| 2.9.8     | Overvolt Contr   | 607 | 0       | 2            | 0 / Off          | [W] Over voltage controller oper. Mode 0=disabled, 1=no ramping, 2 = ramping//. Init := 1   |
| 2.9.9     | UV Contrl        | 608 | 0       | 1            | 0 / Disabled     | [W] Enables under voltage controller, 0= disabled, 1= enabled. Init := 1  |
| 2.9.10    | Mtr I Lim En     | 0   | 0       | 1            | 1 / Disabled     | Enables motor side over current control, 0= disabled, 1= enabled  |
| 2.9.11    | Gen I Lim En     | 0   | 0       | 1            | 1 / Disabled     | Enables generator side over current control, 0= disabled, 1= enabled  |
| 2.9.12    | Fault Start En   | 0   | 0       | 1            | 1 / Enabled      | Enable restart of the drive after a fault without toggling run inputs   |
| 2.9.13    | SC Trq Chain Sel | 0   | 0       | 4            | 1 / Trq Limit    | Control word for torque in speed control mode, bits B0 ... B7 //B0=TorqueLim, 0-not in use, 1= TorqueReferenceActual  is used as an additional torque limit//B1=TorqueAdd, 0-not in use, 1=TorqueReferenceActual is added to speed control output//B2=Posi        |
| 2.9.14    | Torq Ref Select  | 0   | 0       | 1            | 1 / En Trq Ref   | Selector for torque reference//0 = not in use//1 = TorqueReference//2 = ExtTorqueReference  |
| 2.9.15    | TC Spd Lim Sel   | 0   | 0       | 255          | 0                | options for speed limit in torque control mode, bits B0 ... B7 //B0=Update Ramp Generator when MotorControlMode changes from TC (4) to SC (3)//B1=SmartRampDown, When speed limit goes down it rapidly goes to actual value//and then goes to a lower valu        |
| 2.9.16    | Cl Ovr Vlt En    | 0   | 0       | 1            | 0 / Disabled     | Enable CL OverVoltage Controller  |
| 2.9.17    | Trq Spd Lim Mode | 0   | 0       | 5            | 0 / Max Min      | Speed Limiter operation mode for torque control//0: NegFreqMax ... PosFreqMax//1: - FreqRampOut  ... + FreqRampOut //2: NegFreqMax ... FreqRampOut (MIN)//3: FreqRampOut ... PosFreqMax (MAX)//4: FreqRampOut +WindowPos/NegWidth//5: 0..FreqRampOut (pos or neg) |
| 2.10      | I/O              |     |         |              |                  | Menu Name   |
| 2.10.1    | Digital Inputs   |     |         |              |                  | Menu Name   |
| 2.10.1.1  | DIN7 Slot ID     | 0   | 0.0     | CrossCon_Max | 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_Max | 0.0              | Configure to the the desired I/O slot and position for the eighth 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 / No           | 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 / No           | 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 / No           | 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_Max | 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_Max | 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 / No           | 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_Max | 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 / No           | 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.   |

| MENU      | NAME           | ID   | MIN     | MAX              | DEFAULT         | DESCRIPTION  |
|-----------|----------------|------|---------|------------------|-----------------|--|
| 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<br>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<br>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.  |
| 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<br>x | 0               | Selects which slot and address the second analog out goes to. Default to 0. Need additional option boards.                   |
| 2.10.4.10 | AOUT3 ID       | 0    | 0       | 2000             | 1200            | Select value for third analog output. Default to MotorSpeed  |
| 2.10.4.11 | AOUT3 Zero     | 0    | -327.67 | 327.67           | 0.00            | Offset for the third analog output.  |
| 2.10.4.12 | AOUT3 Cal      | 0    | -327.67 | 327.67           | 1.00            | Multiply for third analog output. 100 equals 1.00  |
| 2.10.4.13 | AOUT3 TC       | 0    | 0.00    | 5.00             | 0.10            | filter time constant for the third analog out. 100 equals one second.  |
| 2.10.4.14 | AOUT3 Slot ID  | 0    | 0       | CrossCon_Ma<br>x | 0               | Selects which slot and address the third analog out goes to. Default to 0. Need additional option boards.                    |
| 2.10.4.15 | AOUT4 ID       | 0    | 0       | 2000             | 1200            | Select value for fourth analog output. Default to MotorSpeed   |
| 2.10.4.16 | AOUT4 Zero     | 0    | -327.67 | 327.67           | 0.00            | Offset for the fourth analog output.   |
| 2.10.4.17 | AOUT4 Cal      | 0    | -327.67 | 327.67           | 1.00            | Multiply for fourth analog output. 100 equals 1.00   |
| 2.10.4.18 | AOUT4 TC       | 0    | 0.00    | 5.00             | 0.10            | filter time constant for the fourth analog out. 100 equals one second.   |
| 2.10.4.19 | AOUT4 Slot ID  | 0    | 0       | CrossCon_Ma<br>x | 0               | Selects which slot and address the fourth 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<br>x | 0.000           | First encoder slot ID. Default to not present.   |
| 2.10.5.2  | Enc2 Slot ID   | 0    | 0.000   | CrossCon_Ma<br>x | 0.000           | Second encoder slot ID. Default to not present.  |
| 2.10.5.3  | Enc1 Mlt       | 0    | 0.000   | 32.767           | 1.000           | First encoder scaling multiply value. Used with Enc1_Div   |
| 2.10.5.4  | Enc1 Div       | 0    | 0       | 32767            | 1000            | First encoder scaling divide value. Used with Enc1_Mlt   |
| 2.10.5.5  | Enc1 Tc        | 0    | 0.00    | 10.00            | 0.01            | First encoder low pass filter time constant. Default to 10 ms.   |
| 2.10.5.6  | Enc2 Mlt       | 0    | 0.000   | 32.767           | 1.000           | Second encoder scaling multiply value. Used with Enc2_Div  |
| 2.10.5.7  | Enc2 Div       | 0    | 0       | 32767            | 1000            | Second encoder scaling divide value. Used with Enc2_Mlt  |
| 2.10.5.8  | Enc2 Tc        | 0    | 0.00    | 10.00            | 0.01            | Second encoder low pass filter time constant. Default to 10 ms.  |
| 2.10.5.9  | C_Enc2_Add     | 0    | -327.67 | 327.67           | 0.00            | Offset for the second encoder input.   |
| 2.10.5.10 | Counter1 Dec   | 1294 | 1       | 10000            | 1               | Divide number for the first counter scaling. Should be power of tens.  |
| 2.10.5.11 | Counter1 Mult  | 1295 | 0       | 30000            | 1               | Gain factor for first counter. Used with Counter1 Dec .  |
| 2.10.5.12 | Counter1 Hld   | 0    | 0       | 2000             | 1002            | Holds the first counter when high  |
| 2.10.5.13 | Counter1 Res   | 0    | 0       | 2000             | 1002            | Resets the first counter when high   |
| 2.10.5.14 | Counter1       | 0    | 0       | 1                | 0 /<br>Disabled | Enables the first footage counter  |
| 2.10.5.15 | Counter2 Dec   | 1296 | 1       | 10000            | 1               | Divide number for the second counter scaling. Should be power of tens.   |
| 2.10.5.16 | Counter2 Mult  | 1297 | 0       | 30000            | 1               | Gain factor for second counter. Used with Counter2 Dec .   |
| 2.10.5.17 | Counter2 Hld   | 0    | 0       | 2000             | 1002            | Holds the second counter when high   |
| 2.10.5.18 | Counter2 Res   | 0    | 0       | 2000             | 1002            | Resets the second counter when high  |
| 2.10.5.19 | Counter2       | 0    | 0       | 1                | 0 /<br>Disabled | Enables the second footage counter   |

| MENU      | NAME               | ID   | MIN     | MAX    | DEFAULT | DESCRIPTION   |
|-----------|--------------------|------|---------|--------|---------|---|
| 2.10.5.20 | Encoder1FilterTime | 618  | 0.0     | 100.0  | 0.0     | Filter time constant for speed measurement.               |
| 2.11      | Tables             |      |         |        |         | Menu Name   |
| 2.11.1    | Table0             |      |         |        |         | Menu Name   |
| 2.11.1.1  | X0                 | 1700 | 0       | 32767  | 0       | Table 0 - X0 - Value. See table block descr for details.  |
| 2.11.1.2  | X1                 | 1701 | 0       | 32767  | 500     | Table 0 - X1 - Value. See table block descr for details.  |
| 2.11.1.3  | X2                 | 1702 | 0       | 32767  | 1000    | Table 0 - X2 - Value. See table block descr for details.  |
| 2.11.1.4  | X3                 | 1703 | 0       | 32767  | 1500    | Table 0 - X3 - Value. See table block descr for details.  |
| 2.11.1.5  | X4                 | 1704 | 0       | 32767  | 2000    | Table 0 - X4 - Value. See table block descr for details.  |
| 2.11.1.6  | X5                 | 1705 | 0       | 32767  | 2500    | Table 0 - X5 - Value. See table block descr for details.  |
| 2.11.1.7  | X6                 | 1706 | 0       | 32767  | 3000    | Table 0 - X6 - Value. See table block descr for details.  |
| 2.11.1.8  | X7                 | 1707 | 0       | 32767  | 3500    | Table 0 - X7 - Value. See table block descr for details.  |
| 2.11.1.9  | X8                 | 1708 | 0       | 32767  | 4000    | Table 0 - X8 - Value. See table block descr for details.  |
| 2.11.1.10 | X9                 | 1709 | 0       | 32767  | 4500    | Table 0 - X9 - Value. See table block descr for details.  |
| 2.11.1.11 | X10                | 1710 | 0       | 32767  | 5000    | Table 0 - X10 - Value. See table block descr for details. |
| 2.11.1.12 | X11                | 1711 | 0       | 32767  | 5500    | Table 0 - X11 - Value. See table block descr for details. |
| 2.11.1.13 | X12                | 1712 | 0       | 32767  | 6000    | Table 0 - X12 - Value. See table block descr for details. |
| 2.11.1.14 | X13                | 1713 | 0       | 32767  | 6500    | Table 0 - X13 - Value. See table block descr for details. |
| 2.11.1.15 | X14                | 1714 | 0       | 32767  | 7000    | Table 0 - X14 - Value. See table block descr for details. |
| 2.11.1.16 | X15                | 1715 | 0       | 32767  | 7500    | Table 0 - X15 - Value. See table block descr for details. |
| 2.11.1.17 | X16                | 1716 | 0       | 32767  | 8000    | Table 0 - X16 - Value. See table block descr for details. |
| 2.11.1.18 | X17                | 1717 | 0       | 32767  | 8500    | Table 0 - X17 - Value. See table block descr for details. |
| 2.11.1.19 | X18                | 1718 | 0       | 32767  | 9000    | Table 0 - X18 - Value. See table block descr for details. |
| 2.11.1.20 | X19                | 1719 | 0       | 32767  | 9500    | Table 0 - X19 - Value. See table block descr for details. |
| 2.11.1.21 | X20                | 1720 | 0       | 32767  | 10000   | Table 0 - X20 - Value. See table block descr for details. |
| 2.11.1.22 | X21                | 1721 | 0       | 32767  | 10500   | Table 0 - X21 - Value. See table block descr for details. |
| 2.11.1.23 | X22                | 1722 | 0       | 32767  | 11000   | Table 0 - X22 - Value. See table block descr for details. |
| 2.11.1.24 | X23                | 1723 | 0       | 32767  | 11500   | Table 0 - X23 - Value. See table block descr for details. |
| 2.11.1.25 | Y0                 | 1748 | -3276.7 | 3276.7 | 10.0    | Table 0 - Y0 - Value. See table block descr for details.  |
| 2.11.1.26 | Y1                 | 1749 | -3276.7 | 3276.7 | 10.0    | Table 0 - Y1 - Value. See table block descr for details.  |
| 2.11.1.27 | Y2                 | 1750 | -3276.7 | 3276.7 | 10.0    | Table 0 - Y2 - Value. See table block descr for details.  |
| 2.11.1.28 | Y3                 | 1751 | -3276.7 | 3276.7 | 10.0    | Table 0 - Y3 - Value. See table block descr for details.  |
| 2.11.1.29 | Y4                 | 1752 | -3276.7 | 3276.7 | 10.0    | Table 0 - Y4 - Value. See table block descr for details.  |
| 2.11.1.30 | Y5                 | 1753 | -3276.7 | 3276.7 | 10.0    | Table 0 - Y5 - Value. See table block descr for details.  |
| 2.11.1.31 | Y6                 | 1754 | -3276.7 | 3276.7 | 10.0    | Table 0 - Y6 - Value. See table block descr for details.  |
| 2.11.1.32 | Y7                 | 1755 | -3276.7 | 3276.7 | 10.0    | Table 0 - Y7 - Value. See table block descr for details.  |
| 2.11.1.33 | Y8                 | 1756 | -3276.7 | 3276.7 | 10.0    | Table 0 - Y8 - Value. See table block descr for details.  |
| 2.11.1.34 | Y9                 | 1757 | -3276.7 | 3276.7 | 10.0    | Table 0 - Y9 - Value. See table block descr for details.  |
| 2.11.1.35 | Y10                | 1758 | -3276.7 | 3276.7 | 10.0    | Table 0 - Y10 - Value. See table block descr for details. |
| 2.11.1.36 | Y11                | 1759 | -3276.7 | 3276.7 | 10.0    | Table 0 - Y11 - Value. See table block descr for details. |
| 2.11.1.37 | Y12                | 1760 | -3276.7 | 3276.7 | 10.0    | Table 0 - Y12 - Value. See table block descr for details. |
| 2.11.1.38 | Y13                | 1761 | -3276.7 | 3276.7 | 10.0    | Table 0 - Y13 - Value. See table block descr for details. |
| 2.11.1.39 | Y14                | 1762 | -3276.7 | 3276.7 | 10.0    | Table 0 - Y14 - Value. See table block descr for details. |
| 2.11.1.40 | Y15                | 1763 | -3276.7 | 3276.7 | 10.0    | Table 0 - Y15 - Value. See table block descr for details. |
| 2.11.1.41 | Y16                | 1764 | -3276.7 | 3276.7 | 10.0    | Table 0 - Y16 - Value. See table block descr for details. |
| 2.11.1.42 | Y17                | 1765 | -3276.7 | 3276.7 | 10.0    | Table 0 - Y17 - Value. See table block descr for details. |
| 2.11.1.43 | Y18                | 1766 | -3276.7 | 3276.7 | 10.0    | Table 0 - Y18 - Value. See table block descr for details. |
| 2.11.1.44 | Y19                | 1767 | -3276.7 | 3276.7 | 10.0    | Table 0 - Y19 - Value. See table block descr for details. |
| 2.11.1.45 | Y20                | 1768 | -3276.7 | 3276.7 | 10.0    | Table 0 - Y20 - Value. See table block descr for details. |
| 2.11.1.46 | Y21                | 1769 | -3276.7 | 3276.7 | 10.0    | Table 0 - Y21 - Value. See table block descr for details. |
| 2.11.1.47 | Y22                | 1770 | -3276.7 | 3276.7 | 10.0    | Table 0 - Y22 - Value. See table block descr for details. |
| 2.11.1.48 | Y23                | 1771 | -3276.7 | 3276.7 | 10.0    | Table 0 - Y23 - Value. See table block descr for details. |
| 2.11.2    | Table1             |      |         |        |         | Menu Name   |
| 2.11.2.1  | X0                 | 1796 | 0       | 32767  | 0       | Table 1 - X0 - Value. See table block descr for details.  |
| 2.11.2.2  | X1                 | 1797 | 0       | 32767  | 1       | Table 1 - X1 - Value. See table block descr for details.  |
| 2.11.2.3  | X2                 | 1798 | 0       | 32767  | 2       | Table 1 - X2 - Value. See table block descr for details.  |
| 2.11.2.4  | X3                 | 1799 | 0       | 32767  | 3       | Table 1 - X3 - Value. See table block descr for details.  |
| 2.11.2.5  | X4                 | 1800 | 0       | 32767  | 4       | Table 1 - X4 - Value. See table block descr for details.  |

| MENU      | NAME   | ID   | MIN | MAX   | DEFAULT | DESCRIPTION   |
|-----------|--------|------|-----|-------|---------|---|
| 2.11.2.6  | X5     | 1801 | 0   | 32767 | 5       | Table 1 - X5 - Value. See table block descr for details.  |
| 2.11.2.7  | X6     | 1802 | 0   | 32767 | 6       | Table 1 - X6 - Value. See table block descr for details.  |
| 2.11.2.8  | X7     | 1803 | 0   | 32767 | 7       | Table 1 - X7 - Value. See table block descr for details.  |
| 2.11.2.9  | X8     | 1804 | 0   | 32767 | 8       | Table 1 - X8 - Value. See table block descr for details.  |
| 2.11.2.10 | X9     | 1805 | 0   | 32767 | 9       | Table 1 - X9 - Value. See table block descr for details.  |
| 2.11.2.11 | X10    | 1806 | 0   | 32767 | 10      | Table 1 - X10 - Value. See table block descr for details. |
| 2.11.2.12 | X11    | 1807 | 0   | 32767 | 11      | Table 1 - X11 - Value. See table block descr for details. |
| 2.11.2.13 | X12    | 1808 | 0   | 32767 | 12      | Table 1 - X12 - Value. See table block descr for details. |
| 2.11.2.14 | X13    | 1809 | 0   | 32767 | 13      | Table 1 - X13 - Value. See table block descr for details. |
| 2.11.2.15 | X14    | 1810 | 0   | 32767 | 14      | Table 1 - X14 - Value. See table block descr for details. |
| 2.11.2.16 | X15    | 1811 | 0   | 32767 | 15      | Table 1 - X15 - Value. See table block descr for details. |
| 2.11.2.17 | X16    | 1812 | 0   | 32767 | 16      | Table 1 - X16 - Value. See table block descr for details. |
| 2.11.2.18 | X17    | 1813 | 0   | 32767 | 17      | Table 1 - X17 - Value. See table block descr for details. |
| 2.11.2.19 | X18    | 1814 | 0   | 32767 | 18      | Table 1 - X18 - Value. See table block descr for details. |
| 2.11.2.20 | X19    | 1815 | 0   | 32767 | 19      | Table 1 - X19 - Value. See table block descr for details. |
| 2.11.2.21 | X20    | 1816 | 0   | 32767 | 20      | Table 1 - X20 - Value. See table block descr for details. |
| 2.11.2.22 | X21    | 1817 | 0   | 32767 | 21      | Table 1 - X21 - Value. See table block descr for details. |
| 2.11.2.23 | X22    | 1818 | 0   | 32767 | 22      | Table 1 - X22 - Value. See table block descr for details. |
| 2.11.2.24 | X23    | 1819 | 0   | 32767 | 23      | Table 1 - X23 - Value. See table block descr for details. |
| 2.11.2.25 | Y0     | 1844 | 0   | 32767 | 1000    | Table 1 - Y0 - Value. See table block descr for details.  |
| 2.11.2.26 | Y1     | 1845 | 0   | 32767 | 1000    | Table 1 - Y1 - Value. See table block descr for details.  |
| 2.11.2.27 | Y2     | 1846 | 0   | 32767 | 1000    | Table 1 - Y2 - Value. See table block descr for details.  |
| 2.11.2.28 | Y3     | 1847 | 0   | 32767 | 1000    | Table 1 - Y3 - Value. See table block descr for details.  |
| 2.11.2.29 | Y4     | 1848 | 0   | 32767 | 1000    | Table 1 - Y4 - Value. See table block descr for details.  |
| 2.11.2.30 | Y5     | 1849 | 0   | 32767 | 1000    | Table 1 - Y5 - Value. See table block descr for details.  |
| 2.11.2.31 | Y6     | 1850 | 0   | 32767 | 1000    | Table 1 - Y6 - Value. See table block descr for details.  |
| 2.11.2.32 | Y7     | 1851 | 0   | 32767 | 1000    | Table 1 - Y7 - Value. See table block descr for details.  |
| 2.11.2.33 | Y8     | 1852 | 0   | 32767 | 1000    | Table 1 - Y8 - Value. See table block descr for details.  |
| 2.11.2.34 | Y9     | 1853 | 0   | 32767 | 1000    | Table 1 - Y9 - Value. See table block descr for details.  |
| 2.11.2.35 | Y10    | 1854 | 0   | 32767 | 1000    | Table 1 - Y10 - Value. See table block descr for details. |
| 2.11.2.36 | Y11    | 1855 | 0   | 32767 | 1000    | Table 1 - Y11 - Value. See table block descr for details. |
| 2.11.2.37 | Y12    | 1856 | 0   | 32767 | 1000    | Table 1 - Y12 - Value. See table block descr for details. |
| 2.11.2.38 | Y13    | 1857 | 0   | 32767 | 1000    | Table 1 - Y13 - Value. See table block descr for details. |
| 2.11.2.39 | Y14    | 1858 | 0   | 32767 | 1000    | Table 1 - Y14 - Value. See table block descr for details. |
| 2.11.2.40 | Y15    | 1859 | 0   | 32767 | 1000    | Table 1 - Y15 - Value. See table block descr for details. |
| 2.11.2.41 | Y16    | 1860 | 0   | 32767 | 1000    | Table 1 - Y16 - Value. See table block descr for details. |
| 2.11.2.42 | Y17    | 1861 | 0   | 32767 | 1000    | Table 1 - Y17 - Value. See table block descr for details. |
| 2.11.2.43 | Y18    | 1862 | 0   | 32767 | 1000    | Table 1 - Y18 - Value. See table block descr for details. |
| 2.11.2.44 | Y19    | 1863 | 0   | 32767 | 1000    | Table 1 - Y19 - Value. See table block descr for details. |
| 2.11.2.45 | Y20    | 1864 | 0   | 32767 | 1000    | Table 1 - Y20 - Value. See table block descr for details. |
| 2.11.2.46 | Y21    | 1865 | 0   | 32767 | 1000    | Table 1 - Y21 - Value. See table block descr for details. |
| 2.11.2.47 | Y22    | 1866 | 0   | 32767 | 1000    | Table 1 - Y22 - Value. See table block descr for details. |
| 2.11.2.48 | Y23    | 1867 | 0   | 32767 | 1000    | Table 1 - Y23 - Value. See table block descr for details. |
| 2.11.3    | Table2 |      |     |       |         | Menu Name   |
| 2.11.3.1  | X0     | 1892 | 0   | 32767 | 0       | Table 2 - X0 - Value. See table block descr for details.  |
| 2.11.3.2  | X1     | 1893 | 0   | 32767 | 500     | Table 2 - X1 - Value. See table block descr for details.  |
| 2.11.3.3  | X2     | 1894 | 0   | 32767 | 1000    | Table 2 - X2 - Value. See table block descr for details.  |
| 2.11.3.4  | X3     | 1895 | 0   | 32767 | 1500    | Table 2 - X3 - Value. See table block descr for details.  |
| 2.11.3.5  | X4     | 1896 | 0   | 32767 | 2000    | Table 2 - X4 - Value. See table block descr for details.  |
| 2.11.3.6  | X5     | 1897 | 0   | 32767 | 2500    | Table 2 - X5 - Value. See table block descr for details.  |
| 2.11.3.7  | X6     | 1898 | 0   | 32767 | 3000    | Table 2 - X6 - Value. See table block descr for details.  |
| 2.11.3.8  | X7     | 1899 | 0   | 32767 | 3500    | Table 2 - X7 - Value. See table block descr for details.  |
| 2.11.3.9  | X8     | 1900 | 0   | 32767 | 4000    | Table 2 - X8 - Value. See table block descr for details.  |
| 2.11.3.10 | X9     | 1901 | 0   | 32767 | 4500    | Table 2 - X9 - Value. See table block descr for details.  |
| 2.11.3.11 | X10    | 1902 | 0   | 32767 | 5000    | Table 2 - X10 - Value. See table block descr for details. |
| 2.11.3.12 | X11    | 1903 | 0   | 32767 | 5500    | Table 2 - X11 - Value. See table block descr for details. |
| 2.11.3.13 | X12    | 1904 | 0   | 32767 | 6000    | Table 2 - X12 - Value. See table block descr for details. |

| MENU      | NAME            | ID   | MIN     | MAX    | DEFAULT | DESCRIPTION   |
|-----------|-----------------|------|---------|--------|---------|---|
| 2.11.3.14 | X13             | 1905 | 0       | 32767  | 6500    | Table 2 - X13 - Value. See table block descr for details.   |
| 2.11.3.15 | X14             | 1906 | 0       | 32767  | 7000    | Table 2 - X14 - Value. See table block descr for details.   |
| 2.11.3.16 | X15             | 1907 | 0       | 32767  | 7500    | Table 2 - X15 - Value. See table block descr for details.   |
| 2.11.3.17 | X16             | 1908 | 0       | 32767  | 8000    | Table 2 - X16 - Value. See table block descr for details.   |
| 2.11.3.18 | X17             | 1909 | 0       | 32767  | 8500    | Table 2 - X17 - Value. See table block descr for details.   |
| 2.11.3.19 | X18             | 1910 | 0       | 32767  | 9000    | Table 2 - X18 - Value. See table block descr for details.   |
| 2.11.3.20 | X19             | 1911 | 0       | 32767  | 9500    | Table 2 - X19 - Value. See table block descr for details.   |
| 2.11.3.21 | X20             | 1912 | 0       | 32767  | 10000   | Table 2 - X20 - Value. See table block descr for details.   |
| 2.11.3.22 | X21             | 1913 | 0       | 32767  | 10500   | Table 2 - X21 - Value. See table block descr for details.   |
| 2.11.3.23 | X22             | 1914 | 0       | 32767  | 11000   | Table 2 - X22 - Value. See table block descr for details.   |
| 2.11.3.24 | X23             | 1915 | 0       | 32767  | 11500   | Table 2 - X23 - Value. See table block descr for details.   |
| 2.11.3.25 | Y0              | 1940 | -3276.7 | 3276.7 | 10.0    | Table 2 - Y0 - Value. See table block descr for details.  |
| 2.11.3.26 | Y1              | 1941 | -3276.7 | 3276.7 | 10.0    | Table 2 - Y1 - Value. See table block descr for details.  |
| 2.11.3.27 | Y2              | 1942 | -3276.7 | 3276.7 | 10.0    | Table 2 - Y2 - Value. See table block descr for details.  |
| 2.11.3.28 | Y3              | 1943 | -3276.7 | 3276.7 | 10.0    | Table 2 - Y3 - Value. See table block descr for details.  |
| 2.11.3.29 | Y4              | 1944 | -3276.7 | 3276.7 | 10.0    | Table 2 - Y4 - Value. See table block descr for details.  |
| 2.11.3.30 | Y5              | 1945 | -3276.7 | 3276.7 | 10.0    | Table 2 - Y5 - Value. See table block descr for details.  |
| 2.11.3.31 | Y6              | 1946 | -3276.7 | 3276.7 | 10.0    | Table 2 - Y6 - Value. See table block descr for details.  |
| 2.11.3.32 | Y7              | 1947 | -3276.7 | 3276.7 | 10.0    | Table 2 - Y7 - Value. See table block descr for details.  |
| 2.11.3.33 | Y8              | 1948 | -3276.7 | 3276.7 | 10.0    | Table 2 - Y8 - Value. See table block descr for details.  |
| 2.11.3.34 | Y9              | 1949 | -3276.7 | 3276.7 | 10.0    | Table 2 - Y9 - Value. See table block descr for details.  |
| 2.11.3.35 | Y10             | 1950 | -3276.7 | 3276.7 | 10.0    | Table 2 - Y10 - Value. See table block descr for details.   |
| 2.11.3.36 | Y11             | 1951 | -3276.7 | 3276.7 | 10.0    | Table 2 - Y11 - Value. See table block descr for details.   |
| 2.11.3.37 | Y12             | 1952 | -3276.7 | 3276.7 | 10.0    | Table 2 - Y12 - Value. See table block descr for details.   |
| 2.11.3.38 | Y13             | 1953 | -3276.7 | 3276.7 | 10.0    | Table 2 - Y13 - Value. See table block descr for details.   |
| 2.11.3.39 | Y14             | 1954 | -3276.7 | 3276.7 | 10.0    | Table 2 - Y14 - Value. See table block descr for details.   |
| 2.11.3.40 | Y15             | 1955 | -3276.7 | 3276.7 | 10.0    | Table 2 - Y15 - Value. See table block descr for details.   |
| 2.11.3.41 | Y16             | 1956 | -3276.7 | 3276.7 | 10.0    | Table 2 - Y16 - Value. See table block descr for details.   |
| 2.11.3.42 | Y17             | 1957 | -3276.7 | 3276.7 | 10.0    | Table 2 - Y17 - Value. See table block descr for details.   |
| 2.11.3.43 | Y18             | 1958 | -3276.7 | 3276.7 | 10.0    | Table 2 - Y18 - Value. See table block descr for details.   |
| 2.11.3.44 | Y19             | 1959 | -3276.7 | 3276.7 | 10.0    | Table 2 - Y19 - Value. See table block descr for details.   |
| 2.11.3.45 | Y20             | 1960 | -3276.7 | 3276.7 | 10.0    | Table 2 - Y20 - Value. See table block descr for details.   |
| 2.11.3.46 | Y21             | 1961 | -3276.7 | 3276.7 | 10.0    | Table 2 - Y21 - Value. See table block descr for details.   |
| 2.11.3.47 | Y22             | 1962 | -3276.7 | 3276.7 | 10.0    | Table 2 - Y22 - Value. See table block descr for details.   |
| 2.11.3.48 | Y23             | 1963 | -3276.7 | 3276.7 | 10.0    | Table 2 - Y23 - Value. See table block descr for details.   |
| 2.12      | Identification  |      |         |        |         | Menu Name   |
| 2.12.1    | Flux Curve a    | 1355 | 0.0     | 250.0  | 10.0    | Flux linearisation point. Init := 100   |
| 2.12.2    | Flux Curve b    | 1356 | 0.0     | 250.0  | 20.0    | Flux linearisation point. Init := 200   |
| 2.12.3    | Flux Curve c    | 1357 | 0.0     | 250.0  | 30.0    | Flux linearisation point. Init := 300   |
| 2.12.4    | Flux Curve d    | 1358 | 0.0     | 250.0  | 40.0    | Flux linearisation point. Init := 400   |
| 2.12.5    | Flux Curve e    | 1359 | 0.0     | 250.0  | 50.0    | Flux linearisation point. Init := 500   |
| 2.12.6    | Flux Curve f    | 1360 | 0.0     | 250.0  | 60.0    | Flux linearisation point. Init := 600   |
| 2.12.7    | Flux Curve g    | 1361 | 0.0     | 250.0  | 70.0    | Flux linearisation point. Init := 700   |
| 2.12.8    | Flux Curve h    | 1362 | 0.0     | 250.0  | 80.0    | Flux linearisation point. Init := 800   |
| 2.12.9    | Flux Curve i    | 1363 | 0.0     | 250.0  | 90.0    | Flux linearisation point. Init := 900   |
| 2.12.10   | Flux Curve j    | 1364 | 0.0     | 250.0  | 100.0   | Flux linearisation point. Init := 1000  |
| 2.12.11   | Flux Curve k    | 1365 | 0.0     | 250.0  | 110.0   | Flux linearisation point. Init := 1100  |
| 2.12.12   | Flux Curve l    | 1366 | 0.0     | 250.0  | 120.0   | Flux linearisation point. Init := 1200  |
| 2.12.13   | Flux Curve m    | 1367 | 0.0     | 250.0  | 130.0   | Flux linearisation point. Init := 1300  |
| 2.12.14   | Flux Curve n    | 1368 | 0.0     | 250.0  | 140.0   | Flux linearisation point. Init := 1400  |
| 2.12.15   | Flux Curve o    | 1369 | 0.0     | 250.0  | 150.0   | Flux linearisation point. Init := 1500  |
| 2.12.16   | Mk Flux Time    | 660  | 0       | 60000  | 200     | [W] Time for magnetize the motor 1 equals 1 ms. Init := 200   |
| 2.12.17   | Mk Flux Voltage | 661  | 0       | 30000  | 201     | [W] Magnetizing voltage. 10000 equals nominal voltage of the motor. Init := 201                                     |
| 2.12.18   | Meas Rs V Drop  | 662  | 0       | 30000  | 0       | [W] Measured Voltage drop at stator resistanse between two phases with nom current of motor. Unit: 256=10%.         |
| 2.12.19   | Mk Flux V Hw Dt | 663  | 0       | 30000  | 140     | [W] Magnetizing voltage with harware dead time compensation. 10000 equals nominal voltage of the motor. Init := 140 |

| MENU    | NAME             | ID   | MIN             | MAX                 | DEFAULT          | DESCRIPTION   |
|---------|------------------|------|-----------------|---------------------|------------------|---|
| 2.12.20 | Ir Add 0 Pt V    | 664  | 0               | 30000               | 0                | [W] IrAddVoltage for Zero frequency.  |
| 2.12.21 | Ir Add Gen Scl   | 665  | 0               | 30000               | 0                | [W] Scaling factor for generator side IR-compensation (0 ... 200%).   |
| 2.12.22 | Ir Add Mtr Scl   | 667  | 0               | 30000               | 100              | [W] Scaling factor for motor side IR-compensation (0 ... 200%). Init := 100   |
| 2.12.23 | Pwr IU Offset    | 668  | -32000          | 32000               | 10000            | [W] offset value of U-phase current measurement. 1000=unit nom.   |
| 2.12.24 | Pwr IV Offset    | 669  | -32000          | 32000               | 0                | [W] offset value of V-phase current measurement. 1000=unit nom.   |
| 2.12.25 | Pwr IW Offset    | 670  | -32000          | 32000               | 0                | [W] offset value of W-phase current measurement. 1000=unit nom.   |
| 2.12.26 | Speed Step       | 1252 | -50.00          | 50.00               | 0.00             | Speed step used for Identification  |
| 2.12.27 | Torque Step      | 1253 | -300.0          | 300.0               | 0.0              | Torque step used for Identification   |
| 2.13    | Motor            |      |                 |                     |                  | Menu Name   |
| 2.13.1  | Self Tune Motor  | 631  | 0               | Ident_Limit         | 0 / No Action    | Identification status. 0 = No Action, 1= No Run, 2 = Run  |
| 2.13.2  | Motor Nom Currnt | 113  | MotorCurrentMin | MotorCurrentMax     | 3.70             | [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  | 0.80            | 320.00              | 60.00            | [W] Motor nominal frequency in Hz   |
| 2.13.5  | Motor Nom Speed  | 112  | 24              | 32000               | 1740             | [W] Motor nominal speed in rpm  |
| 2.13.6  | Motor Ctrl Mode  | 600  | 0               | ControlModeMax      | 0 / Freq Control | 0 = Open Loop Frequency control//1 = Open Loop Speed control//2 = Open Loop Torque control//3 = Closed Loop Speed control (NXP only)//4 = Closed Loop Torque control (NXP only)//5 = Advanced Open Loop Frequency control (NXP only)//6 = Advanced Open Loop Speed control (NXP only)// |
| 2.13.7  | Motor Ctrl Mode2 | 521  | 0               | ControlModeMax      | 2 / OL TorqCtrl  | 0 = Open Loop Frequency control//1 = Open Loop Speed control//2 = Open Loop Torque control//3 = Closed Loop Speed control (NXP only)//4 = Closed Loop Torque control (NXP only)//5 = Advanced Open Loop Frequency control (NXP only)//6 = Advanced Open Loop Speed control (NXP only)   |
| 2.13.8  | MotorType        | 0    | 0               | 1                   | 0 / Induction    | 0 = Induction motor, 1 = perm magnet//1 = Permanent magnet synchronous motor  |
| 2.13.9  | DC-Brake Current | 0    | MotorCurrentMin | MotorCurrentMax     | 3.70             | [W] Dc brake current, I[A] = MotorCurrent/CurrentScale//(1...65535) //if CurrentScale=10 then 100 equals 10.0 A. Init := 100  |
| 2.13.10 | Stop DC-BrakeFr  | 515  | 0.10            | 10.00               | 1.50             | [W] Dc-brake is allowed under this frequency limit, If FreqScale=100 then 5000 equals 50.00 Hz.   |
| 2.13.11 | FluxBrakeCurrent | 519  | MotorCurrentMin | UnitVTCURRENT       | 3.70             | [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              | 100.00           | [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 | 50.00            | [W] Programmable U/F curve middle point, f[Hz] = UFMidPoint/FreqScale//Range[0...FieldWeakeningPoint]//If FreqScale=100 then 5000 equals 50.00 Hz   |
| 2.13.14 | U/f Mid Voltg    | 605  | 0.00            | 100.00              | 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               | 1.50             | [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    | 10.0             | [W] Switching frequency in 0.1 kHz, Range[1...400]  |
| 2.13.17 | MagnCurrent      | 612  | 0.00            | 100.00              | 0.00             | 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                 | 100              | The motor name plate speed is used to calculate nominal slip. This value should be used to adjust motor voltage when loaded. Reducing the slip adjust value increases the motor voltage when loaded.  |
| 2.13.19 | 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  |
| 2.13.21 | Startup Trq Sel  | 621  | 0               | 3                   | 0 / Not Used     | 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               | 0.0              | Startup Torque for forward direction if selected with StartUp Torq Sel.   |
| 2.13.23 | StartupTorq REV  | 634  | -300.0          | 300.0               | 0.0              | Startup Torque for reverse direction if selected with StartUp Torq Sel.   |
| 2.13.24 | OL TC Min Freq   | 636  | 0.00            | FreqMax             | 3.00             | Minimum operation frequency of open loop torque control,f[Hz].//Init := 300   |

| MENU      | NAME             | ID   | MIN    | MAX    | DEFAULT         | DESCRIPTION   |
|-----------|------------------|------|--------|--------|-----------------|---|
| 2.13.25   | Local Reference  | 0    | -32767 | 32767  | 0               | Not used.   |
| 2.13.26   | Start DC-BrakeTm | 516  | 0.00   | 600.00 | 0.00            | [W] Dc brake time [ms] in ramp start. Init := 0                                     |
| 2.13.27   | Motor Cos Phi    | 120  | 0.30   | 1.00   | 0.85            | := 85   |
| 2.13.28   | U/f Ratio Select | 108  | 0      | 3      | 0 / Linear      | [W] U/F ratio selection, 0=linear, 1=squared, 2=programmable                        |
| 2.13.29   | U/f Optimization | 109  | 0      | 1      | 0 / None        | [W] U/F optimization selection, 0=none, 1=automatic torque boost                    |
| 2.13.30   | Flux Brake       | 520  | 0      | 1      | 0 / Off         | [W] 1=flux braketing is enabled.  |
| 2.13.31   | Mtr Ctrl Sw      | 0    | 0      | 2000   | 1002            | Selects between different motor control schemes. Default to Zero Bit.               |
| 2.13.32   | Cl Ovr Vlt Ref   | 0    | 100.00 | 200.00 | 118.00          | CL OverVoltage Controller reference (10000 = 100.00%)                               |
| 2.14      | Comms            |      |        |        |                 | Menu Name   |
| 2.14.1    | Fieldbus         |      |        |        |                 | Menu Name   |
| 2.14.1.1  | FB Bit Cfg Out00 | 0    | 0      | 2000   | 1002            | Output field bus bit configuration point.   |
| 2.14.1.2  | FB Bit Cfg Out01 | 0    | 0      | 2000   | 1002            | Output field bus bit configuration point.   |
| 2.14.1.3  | FB Bit Cfg Out02 | 0    | 0      | 2000   | 1002            | Output field bus bit configuration point.   |
| 2.14.1.4  | FB Bit Cfg Out03 | 0    | 0      | 2000   | 1002            | Output field bus bit configuration point.   |
| 2.14.1.5  | FB Bit Cfg Out04 | 0    | 0      | 2000   | 1002            | Output field bus bit configuration point.   |
| 2.14.1.6  | FB Bit Cfg Out05 | 0    | 0      | 2000   | 1002            | Output field bus bit configuration point.   |
| 2.14.1.7  | FB Bit Cfg Out06 | 0    | 0      | 2000   | 1002            | Output field bus bit configuration point.   |
| 2.14.1.8  | FB Bit Cfg Out07 | 0    | 0      | 2000   | 1002            | Output field bus bit configuration point.   |
| 2.14.1.9  | FB Bit Cfg Out08 | 0    | 0      | 2000   | 1002            | Output field bus bit configuration point.   |
| 2.14.1.10 | FB Bit Cfg Out09 | 0    | 0      | 2000   | 1002            | Output field bus bit configuration point.   |
| 2.14.1.11 | FB Bit Cfg Out10 | 0    | 0      | 2000   | 1002            | Output field bus bit configuration point.   |
| 2.14.1.12 | FB Bit Cfg Out11 | 0    | 0      | 2000   | 1002            | Output field bus bit configuration point.   |
| 2.14.1.13 | FB Bit Cfg Out12 | 0    | 0      | 2000   | 1002            | Output field bus bit configuration point.   |
| 2.14.1.14 | FB Bit Cfg Out13 | 0    | 0      | 2000   | 1002            | Output field bus bit configuration point.   |
| 2.14.1.15 | FB Bit Cfg Out14 | 0    | 0      | 2000   | 1002            | Output field bus bit configuration point.   |
| 2.14.1.16 | FB Bit Cfg Out15 | 0    | 0      | 2000   | 1002            | Output field bus bit configuration point.   |
| 2.14.1.17 | FB Word Cfg Out1 | 0    | 0      | 2000   | 1200            | Configuration to send to FBProcessDataOUT1  |
| 2.14.1.18 | FB Word Cfg Out2 | 0    | 0      | 2000   | 1200            | Configuration to send to FBProcessDataOUT2  |
| 2.14.1.19 | FB Word Cfg Out3 | 0    | 0      | 2000   | 1200            | Configuration to send to FBProcessDataOUT3  |
| 2.14.1.20 | FB Word Cfg Out4 | 0    | 0      | 2000   | 1200            | Configuration to send to FBProcessDataOUT4  |
| 2.14.1.21 | FB Word Cfg Out5 | 0    | 0      | 2000   | 1200            | Configuration to send to FBProcessDataOUT5  |
| 2.14.1.22 | FB Word Cfg Out6 | 0    | 0      | 2000   | 1200            | Configuration to send to FBProcessDataOUT6  |
| 2.14.1.23 | FB Word Cfg Out7 | 0    | 0      | 2000   | 1200            | Configuration to send to FBProcessDataOUT7  |
| 2.14.1.24 | FB Word Cfg Out8 | 0    | 0      | 2000   | 1200            | Configuration to send to FBProcessDataOUT8  |
| 2.14.1.25 | FB Bit Sel 1     | 0    | 0      | 3      | 1 / Gen Cntrl W | Selects input location for first 4 field bus bits.                                  |
| 2.14.1.26 | FB Bit Sel 2     | 0    | 0      | 3      | 1 / Gen Cntrl W | Selects input location for second 4 field bus bits.                                 |
| 2.14.1.27 | FB Bit Sel 3     | 0    | 0      | 3      | 1 / Gen Cntrl W | Selects input location for third 4 field bus bits.                                  |
| 2.14.1.28 | FB Bit Sel 4     | 0    | 0      | 3      | 1 / Gen Cntrl W | Selects input location for fourth 4 field bus bits.                                 |
| 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 / Disabled    | 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 Comm Flt Resp | 0    | 0      | 3      | 3 / Fault,Coast | Response to system bus error.   |
| 2.14.2.7  | 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  |
| 2.15.5    | Int Ten          | 1202 | 10     | 10     |                 | Always 10. Used for scaling   |

| MENU   | NAME            | ID   | MIN  | MAX  | DEFAULT     | DESCRIPTION                           |
|--------|-----------------|------|------|------|-------------|---------------------------------------|
| 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    | 0 / Forward | Keypad control direction.             |
| 3.3    | Keypad Trq Dir  | 0    | 0    | 1    | 0 / Forward | Keypad control torque direction.      |
| 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 AND DRAWING COORDINATE CROSS-REFERENCE

| NAME             | ID   | MENU      | COORDINATES                            |
|------------------|------|-----------|--|
|                  | 1072 | 1.2.71    |  |
|                  | 1073 | 1.2.72    |  |
|                  | 1074 | 1.2.73    |  |
| 3 Wire St En     | 0    | 2.9.4     | A5-G25, A5-E25                         |
| Abs Fil Spd      | 1519 | 1.3.60    | A1-P27, A2-B18, A2-J28, A3-R13, A8-D24 |
| ABS RJT Ref      | 1570 | 1.3.24    | A1-R4                                  |
| Accel Comp       | 1566 | 1.3.52    | A10-D21                                |
| Accel Comp Tc    | 0    | 2.3.16    | A10-D24                                |
| Accel Inp        | 0    | 2.8.5     | A1-F23                                 |
| Accel Time 1     | 103  | 2.3.1     | A1-F23                                 |
| Accel.Compens.   | 626  | 2.4.9     | A10-D25                                |
| Acceleration Tim | 0    | 1.3.29    | A1-F20                                 |
| Active Flt Last  | 37   | 1.3.50    | A8-S25                                 |
| AI 1             | 0    | 1.5.1     | A4-S25                                 |
| AI 2             | 0    | 1.5.3     | A4-N25                                 |
| AI 3             | 0    | 1.5.5     | A4-L25                                 |
| AI 4             | 0    | 1.5.7     | A4-H25                                 |
| AI1 Type         | 0    | 1.5.2     | A4-S25                                 |
| AI2 Type         | 0    | 1.5.4     | A4-P25                                 |
| AI3 Type         | 0    | 1.5.6     | A4-L25, A4-L5, A4-H5                   |
| AI4 Type         | 0    | 1.5.8     | A4-J25                                 |
| AIN1             | 1601 | 1.5.9     | A1-S24, A2-L11, A4-S21                 |
| AIN1 Fault       | 0    | 1.5.13    | A4-R21                                 |
| AIN1 Gain        | 0    | 2.10.3.1  | A4-R24                                 |
| AIN1 Off         | 0    | 2.10.3.2  | A4-R24                                 |
| AIN1 Tc          | 0    | 2.10.3.3  | A4-P24                                 |
| AIN2             | 1602 | 1.5.10    | A4-P21                                 |
| AIN2 Fault       | 0    | 1.5.14    | A4-N21                                 |
| AIN2 Gain        | 0    | 2.10.3.4  | A4-N24                                 |
| AIN2 Off         | 0    | 2.10.3.5  | A4-N24                                 |
| AIN2 Tc          | 0    | 2.10.3.6  | A4-M24                                 |
| AIN3             | 1603 | 1.5.11    | A4-L21                                 |
| AIN3 Fault       | 0    | 1.5.15    | A4-K21                                 |
| AIN3 Gain        | 0    | 2.10.3.8  | A4-K24                                 |
| AIN3 Off         | 0    | 2.10.3.9  | A4-K24                                 |
| AIN3 Slot ID     | 0    | 2.10.3.7  | A4-L28                                 |
| AIN3 Tc          | 0    | 2.10.3.10 | A4-J24                                 |
| AIN4             | 1604 | 1.5.12    | A4-H21                                 |
| AIN4 Fault       | 0    | 1.5.16    | A4-G21                                 |
| AIN4 Gain        | 0    | 2.10.3.12 | A4-H24                                 |
| AIN4 Off         | 0    | 2.10.3.13 | A4-G24                                 |
| AIN4 Slot ID     | 0    | 2.10.3.11 | A4-J28                                 |
| AIN4 Tc          | 0    | 2.10.3.14 | A4-G24                                 |
| AOUT1 Cal        | 0    | 2.10.4.3  | A4-R8                                  |
| AOUT1 ID         | 0    | 2.10.4.1  | A4-S9                                  |
| AOUT1 TC         | 0    | 2.10.4.4  | A4-R8                                  |
| AOUT1 Val        | 1590 | 1.5.17    | A4-S5                                  |
| AOUT1 Zero       | 0    | 2.10.4.2  | A4-S8                                  |
| AOUT2 Cal        | 0    | 2.10.4.7  | A4-N8                                  |
| AOUT2 ID         | 0    | 2.10.4.5  | A4-P9                                  |
| AOUT2 Slot ID    | 0    | 2.10.4.9  | A4-N5                                  |
| AOUT2 TC         | 0    | 2.10.4.8  | A4-M8                                  |

| NAME             | ID   | MENU      | COORDINATES                  |
|------------------|------|-----------|------------------------------|
| AOUT2 Val        | 1591 | 1.5.18    | A4-P5                        |
| AOUT2 Zero       | 0    | 2.10.4.6  | A4-N8                        |
| AOUT3 Cal        | 0    | 2.10.4.12 | A4-K8                        |
| AOUT3 ID         | 0    | 2.10.4.10 | A4-L9                        |
| AOUT3 Slot ID    | 0    | 2.10.4.14 | A4-L5                        |
| AOUT3 TC         | 0    | 2.10.4.13 | A4-K8                        |
| AOUT3 Val        | 1592 | 1.5.19    | A4-L4                        |
| AOUT3 Zero       | 0    | 2.10.4.11 | A4-L8                        |
| AOUT4 Cal        | 0    | 2.10.4.17 | A4-H8                        |
| AOUT4 ID         | 0    | 2.10.4.15 | A4-J9                        |
| AOUT4 Slot ID    | 0    | 2.10.4.19 | A4-H5                        |
| AOUT4 TC         | 0    | 2.10.4.18 | A4-H8                        |
| AOUT4 Val        | 1593 | 1.5.20    | A4-J4                        |
| AOUT4 Zero       | 0    | 2.10.4.16 | A4-H8                        |
| At Zero Spd      | 1127 | 1.2.48    | A5-S28, A8-C20               |
| At Zero Time     | 0    | 2.7.9     | A5-S28                       |
| Auto Rst ExtF T  | 725  | 2.1.32    | A8-C6                        |
| Auto Rst Mtr OT  | 726  | 2.1.31    | A8-G6                        |
| Auto Rst OC Trls | 722  | 2.1.30    | A8-L6, A8-E6                 |
| Auto Rst OV Trls | 721  | 2.1.29    | A8-K6                        |
| Auto Rst StartM  | 719  | 2.1.27    | A8-C10                       |
| Auto Rst SVTime  | 718  | 2.1.26    | A8-L10                       |
| Auto Rst Uload T | 738  | 2.1.33    | A8-F6                        |
| Auto Rst UV Trls | 720  | 2.1.28    | A8-H6                        |
| Auto Rst Wait    | 717  | 2.1.25    | A8-J10                       |
| Brake Chopper    | 1509 | 1.3.33    | A11-H15                      |
| Brake Chopper    | 0    | 2.9.7     | A11-H18                      |
| BrakeResistor    | 1511 | 1.3.34    | A11-G15                      |
| C_Enc2_Add       | 0    | 2.10.5.9  | A4-L16                       |
| Cl Ovr Mtr Lim   | 0    | 2.5.21    | A10-B13                      |
| Cl Ovr Vlt En    | 0    | 2.9.16    | A10-D11                      |
| Cl Ovr Vlt Kp    | 0    | 2.4.35    | A10-C13                      |
| Cl Ovr Vlt Kp0   | 0    | 2.4.36    | A10-B13                      |
| Cl Ovr Vlt Ref   | 0    | 2.13.32   | A10-D14                      |
| Cl Ovr Vlt Ti    | 0    | 2.4.37    | A10-B13                      |
| CM0              | 1100 | 1.2.56    | A3-S22, A3-H27               |
| CM1              | 1101 | 1.2.57    | A3-R22, A3-D27               |
| CM2              | 1102 | 1.2.58    | A3-R22, A3-G27, A3-E27       |
| CM3              | 1103 | 1.2.59    | A3-P22, A3-C27, A3-T4        |
| Cntrl Inhib      | 1099 | 1.2.2     | A2-N11, A5-H2                |
| Cntrl Mode       | 1506 | 1.3.19    | A1-S7, A5-E9                 |
| Coast Stop       | 0    | 2.7.8     | A5-S25                       |
| Com WD           | 0    | 2.1.35    | A7-C19                       |
| Con Mode         | 1251 | 2.2.19    | A3-R27                       |
| Con Mode Inp     | 0    | 2.8.34    | A3-R27                       |
| Control Place    | 1505 | 1.3.18    | A1-N7, A1-S3, A2-E24, A2-G23 |
| Counter1         | 1528 | 1.5.23    | A4-P13                       |
| Counter1         | 0    | 2.10.5.14 | A4-P19                       |
| Counter1 Dec     | 1294 | 2.10.5.10 | A4-N16                       |
| Counter1 Hld     | 0    | 2.10.5.12 | A4-P19                       |
| Counter1 Mult    | 1295 | 2.10.5.11 | A4-N16                       |
| Counter1 Res     | 0    | 2.10.5.13 | A4-R19                       |
| Counter2         | 1529 | 1.5.24    | A4-J13                       |
| Counter2         | 0    | 2.10.5.19 | A4-J19                       |
| Counter2 Dec     | 1296 | 2.10.5.15 | A4-H16                       |
| Counter2 Hld     | 0    | 2.10.5.17 | A4-K19                       |
| Counter2 Mult    | 1297 | 2.10.5.16 | A4-H16                       |
| Counter2 Res     | 0    | 2.10.5.18 | A4-K19                       |
| Curr Cntrl Ti    | 0    | 2.4.13    | A11-E27                      |
| Current Scale    | 0    | 1.3.59    |                              |
| CurrentControlKp | 617  | 2.4.12    | A11-E27                      |
| DC Brk Cmd       | 0    | 2.7.10    | A11-T5                       |
| DC Tim Cst Stp   | 0    | 2.3.22    | A11-M6                       |
| DC Tim Rmp Stp   | 0    | 2.3.21    | A11-N6                       |

| NAME             | ID   | MENU      | COORDINATES                  |
|------------------|------|-----------|------------------------------|
| DC_link V Unfil  | 44   | 1.3.8     |                              |
| DC-Brake Current | 0    | 2.13.9    | A11-S8                       |
| DCVoltage        | 7    | 1.3.7     | A9-K14, A10-C14              |
| Decel Time       | 0    | 2.8.6     | A1-E23                       |
| Decel Time 1     | 104  | 2.3.2     | A1-E23                       |
| DecelerationTime | 0    | 1.3.30    | A1-E20                       |
| DIN 1            | 1011 | 1.4.1     | A4-E23, A5-L28, A5-H28       |
| DIN 2            | 1012 | 1.4.2     | A4-E23, A5-N28               |
| DIN 3            | 1013 | 1.4.3     | A4-D23                       |
| DIN 4            | 1014 | 1.4.4     | A4-D23                       |
| DIN 5            | 1015 | 1.4.5     | A4-C23                       |
| DIN 6            | 1016 | 1.4.6     | A4-C23                       |
| DIN 7            | 1017 | 1.4.7     | A4-B24                       |
| DIN 8            | 1018 | 1.4.8     | A4-B24                       |
| DIN123 Status    | 15   | 1.4.9     |                              |
| DIN456 Status    | 16   | 1.4.10    |                              |
| DIN7 Slot ID     | 0    | 2.10.1.1  | A4-B27                       |
| DIN8 Slot ID     | 0    | 2.10.1.2  | A4-B27                       |
| Disable Ramp     | 0    | 2.7.11    | A1-K14                       |
| DOUT1 ID         | 0    | 2.10.2.1  | A4-E15                       |
| DOUT1 Inv        | 0    | 2.10.2.2  | A4-F14                       |
| DOUT2 ID         | 0    | 2.10.2.3  | A4-D15                       |
| DOUT2 Inv        | 0    | 2.10.2.4  | A4-E14                       |
| DOUT3 ID         | 0    | 2.10.2.5  | A4-C15                       |
| DOUT3 Inv        | 0    | 2.10.2.6  | A4-C14                       |
| DOUT4 ID         | 0    | 2.10.2.7  | A4-E9                        |
| DOUT4 Slot ID    | 0    | 2.10.2.8  | A4-E6                        |
| DOUT5 ID         | 0    | 2.10.2.9  | A4-D9                        |
| DOUT5 Inv        | 0    | 2.10.2.11 | A4-E8                        |
| DOUT5 Slot ID    | 0    | 2.10.2.10 | A4-D6                        |
| DOUT6 ID         | 0    | 2.10.2.12 | A4-C9                        |
| DOUT6 Inv        | 0    | 2.10.2.14 | A4-C8                        |
| DOUT6 Slot ID    | 0    | 2.10.2.13 | A4-B6                        |
| Drive OK         | 1088 | 1.2.1     |                              |
| DUT Max Spd      | 1250 | 2.5.25    |                              |
| Earth Fault      | 703  | 2.1.12    | A8-R16                       |
| Enc1 Div         | 0    | 2.10.5.4  | A4-R15                       |
| Enc1 Mlt         | 0    | 2.10.5.3  | A4-R15                       |
| Enc1 Slot ID     | 0    | 2.10.5.1  | A4-S19                       |
| Enc1 Tc          | 0    | 2.10.5.5  | A4-R15                       |
| Enc1_Out         | 1609 | 1.5.21    | A4-S12                       |
| Enc2 Div         | 0    | 2.10.5.7  | A4-K16                       |
| Enc2 Mlt         | 0    | 2.10.5.6  | A4-K16                       |
| Enc2 Slot ID     | 0    | 2.10.5.2  | A4-M19                       |
| Enc2 Tc          | 0    | 2.10.5.8  | A4-K16                       |
| Enc2_Out         | 1610 | 1.5.22    | A4-L12                       |
| Encoder1FiltTime | 618  | 2.10.5.20 | A10-M22                      |
| ESS Dn           | 1104 | 1.2.50    | A3-S3                        |
| ESS En           | 1105 | 1.2.51    | A3-D16, A3-S6, A3-R5, A3-P13 |
| ESS Int Gn       | 1249 | 2.4.38    | A1-P21                       |
| ESS Lit          | 0    | 1.2.52    | A3-R6                        |
| ESS Lit Inp      | 0    | 2.8.35    | A3-R13                       |
| ESS Lit Stpt     | 1248 | 2.2.20    | A3-R13                       |
| ESS Not Lit      | 1107 | 1.2.53    | A1-T19, A3-R4                |
| Ext Fault        | 0    | 1.2.31    |                              |
| Ext Fault Inp    | 0    | 2.1.6     | A8-J19                       |
| Ext Flt Resp     | 701  | 2.1.7     | A8-J16                       |
| Ext Warn         | 0    | 1.2.32    | A8-P8                        |
| Fast Stop        | 0    | 2.7.7     | A1-F17, A5-S21               |
| Fast Stop Tim    | 503  | 2.3.4     | A1-D20                       |
| Fault Reset      | 0    | 2.1.1     | A8-S17                       |
| Fault Start En   | 0    | 2.9.12    | A5-R20                       |
| FB Bit Cfg Out00 | 0    | 2.14.1.1  | A7-R17                       |
| FB Bit Cfg Out01 | 0    | 2.14.1.2  | A7-R17                       |

| NAME             | ID   | MENU      | COORDINATES                           |
|------------------|------|-----------|---------------------------------------|
| FB Bit Cfg Out02 | 0    | 2.14.1.3  | A7-P17                                |
| FB Bit Cfg Out03 | 0    | 2.14.1.4  | A7-P17                                |
| FB Bit Cfg Out04 | 0    | 2.14.1.5  | A7-N17                                |
| FB Bit Cfg Out05 | 0    | 2.14.1.6  | A7-N17                                |
| FB Bit Cfg Out06 | 0    | 2.14.1.7  | A7-M17                                |
| FB Bit Cfg Out07 | 0    | 2.14.1.8  | A7-L17                                |
| FB Bit Cfg Out08 | 0    | 2.14.1.9  | A7-L17                                |
| FB Bit Cfg Out09 | 0    | 2.14.1.10 | A7-K17                                |
| FB Bit Cfg Out10 | 0    | 2.14.1.11 | A7-K17                                |
| FB Bit Cfg Out11 | 0    | 2.14.1.12 | A7-J17                                |
| FB Bit Cfg Out12 | 0    | 2.14.1.13 | A7-J17                                |
| FB Bit Cfg Out13 | 0    | 2.14.1.14 | A7-H17                                |
| FB Bit Cfg Out14 | 0    | 2.14.1.15 | A7-H17                                |
| FB Bit Cfg Out15 | 0    | 2.14.1.16 | A7-G17                                |
| FB Bit Sel 1     | 0    | 2.14.1.25 | A7-T25                                |
| FB Bit Sel 2     | 0    | 2.14.1.26 | A7-P25                                |
| FB Bit Sel 3     | 0    | 2.14.1.27 | A7-M25                                |
| FB Bit Sel 4     | 0    | 2.14.1.28 | A7-J25                                |
| FB Bit00         | 1040 | 1.6.1.1   | A7-S21                                |
| FB Bit01         | 1041 | 1.6.1.2   | A7-R21                                |
| FB Bit02         | 1042 | 1.6.1.3   | A7-R21                                |
| FB Bit03         | 1043 | 1.6.1.4   | A7-R21                                |
| FB Bit04         | 1044 | 1.6.1.5   | A7-N21                                |
| FB Bit05         | 1045 | 1.6.1.6   | A7-N21                                |
| FB Bit06         | 1046 | 1.6.1.7   | A7-N21                                |
| FB Bit07         | 1047 | 1.6.1.8   | A7-M21                                |
| FB Bit08         | 1048 | 1.6.1.9   | A7-L21                                |
| FB Bit09         | 1049 | 1.6.1.10  | A7-L21                                |
| FB Bit10         | 1050 | 1.6.1.11  | A7-K21                                |
| FB Bit11         | 1051 | 1.6.1.12  | A7-K21                                |
| FB Bit12         | 1052 | 1.6.1.13  | A7-J21                                |
| FB Bit13         | 1053 | 1.6.1.14  | A7-H21                                |
| FB Bit14         | 1054 | 1.6.1.15  | A7-H21                                |
| FB Bit15         | 1055 | 1.6.1.16  | A7-G21                                |
| FB Fault Act     | 0    | 1.2.36    |                                       |
| FB Fix Cntrl WrD | 1621 | 1.6.1.17  | A7-S27, A7-N27, A7-L27, A7-J27        |
| FB Gen Cntl WrD  | 1630 | 1.6.1.18  | A7-S27, A7-N27, A7-L27, A7-H27        |
| FB Gen Sts Word  | 1631 | 1.6.1.19  | A7-J13                                |
| FB Spd Ref       | 1632 | 1.6.2.11  | A7-R4                                 |
| FB Word Cfg Out1 | 0    | 2.14.1.17 | A7-K7                                 |
| FB Word Cfg Out2 | 0    | 2.14.1.18 | A7-J7                                 |
| FB Word Cfg Out3 | 0    | 2.14.1.19 | A7-J7                                 |
| FB Word Cfg Out4 | 0    | 2.14.1.20 | A7-H7                                 |
| FB Word Cfg Out5 | 0    | 2.14.1.21 | A7-H7                                 |
| FB Word Cfg Out6 | 0    | 2.14.1.22 | A7-G7                                 |
| FB Word Cfg Out7 | 0    | 2.14.1.23 | A7-G7                                 |
| FB Word Cfg Out8 | 0    | 2.14.1.24 | A7-F7                                 |
| FB Word In 1     | 1611 | 1.6.2.1   | A7-S8                                 |
| FB Word In 10    | 1620 | 1.6.2.10  | A7-R5                                 |
| FB Word In 2     | 1612 | 1.6.2.2   | A7-S8                                 |
| FB Word In 3     | 1613 | 1.6.2.3   | A7-R8                                 |
| FB Word In 4     | 1614 | 1.6.2.4   | A7-R8                                 |
| FB Word In 5     | 1615 | 1.6.2.5   | A7-R8                                 |
| FB Word In 6     | 1616 | 1.6.2.6   | A7-P8                                 |
| FB Word In 7     | 1617 | 1.6.2.7   | A7-S5                                 |
| FB Word In 8     | 1618 | 1.6.2.8   | A7-S5, A7-R27, A7-N27, A7-K27, A7-H27 |
| FB Word In 9     | 1619 | 1.6.2.9   | A7-R5                                 |
| FB Word Out 1    | 1622 | 1.6.3.1   | A7-K4                                 |
| FB Word Out 2    | 1623 | 1.6.3.2   | A7-J4                                 |
| FB Word Out 3    | 1624 | 1.6.3.3   | A7-J4                                 |
| FB Word Out 4    | 1625 | 1.6.3.4   | A7-H4                                 |
| FB Word Out 5    | 1626 | 1.6.3.5   | A7-H4                                 |
| FB Word Out 6    | 1627 | 1.6.3.6   | A7-G4                                 |
| FB Word Out 7    | 1628 | 1.6.3.7   | A7-G4                                 |

| NAME             | ID   | MENU    | COORDINATES  |
|------------------|------|---------|--|
| FB Word Out 8    | 1629 | 1.6.3.8 | A7-F4  |
| FBComm.FaultResp | 733  | 2.1.23  | A8-H16   |
| Field WeakingPnt | 602  | 2.2.9   | A10-H27, A11-M23   |
| Final Freq Ref   | 1540 | 1.3.26  | A1-J3, A9-L24, A10-N23                                       |
| Final Iq Trq Ref | 1539 | 1.3.56  | A2-F3, A10-B23, A10-R7                                       |
| Final Trq Ref    | 1542 | 1.3.10  | A2-E2, A9-G25, A10-G19                                       |
| Flux Brake       | 520  | 2.13.30 | A11-L9   |
| Flux Curve a     | 1355 | 2.12.1  | A11-R17  |
| Flux Curve b     | 1356 | 2.12.2  | A11-R17  |
| Flux Curve c     | 1357 | 2.12.3  | A11-P17  |
| Flux Curve d     | 1358 | 2.12.4  | A11-P17  |
| Flux Curve e     | 1359 | 2.12.5  | A11-P17  |
| Flux Curve f     | 1360 | 2.12.6  | A11-N17  |
| Flux Curve g     | 1361 | 2.12.7  | A11-N17  |
| Flux Curve h     | 1362 | 2.12.8  | A11-N17  |
| Flux Curve i     | 1363 | 2.12.9  | A11-M17  |
| Flux Curve j     | 1364 | 2.12.10 | A11-M17  |
| Flux Curve k     | 1365 | 2.12.11 | A11-M17  |
| Flux Curve l     | 1366 | 2.12.12 | A11-L17  |
| Flux Curve m     | 1367 | 2.12.13 | A11-L17  |
| Flux Curve n     | 1368 | 2.12.14 | A11-K17  |
| Flux Curve o     | 1369 | 2.12.15 | A11-K17  |
| FluxBrakeCurrent | 519  | 2.13.11 | A11-K10  |
| Fly Strt Flt     | 0    | 2.9.3   | A5-R28   |
| Freq Delta       | 1508 | 1.3.31  | A10-D24  |
| Freq Error       | 0    | 1.3.28  | A10-N18  |
| Freq Max         | 102  | 2.5.1   | A1-G27, A1-F5, A1-E6, A1-E16, A2-P20, A9-K23, A9-H18, A9-E24 |
| Freq out         | 1    | 1.3.27  | A7-E6, A9-K21, A10-G27                                       |
| Freq Ramp Out    | 1568 | 1.3.32  | A1-J6, A2-P19, A10-D27, A10-S14                              |
| Freq Ref LP TC   | 1309 | 2.3.8   | A1-G18   |
| Freq Reference   | 1507 | 1.3.23  | A1-J21   |
| FreqRamp         | 0    | 2.6.9   |  |
| FreqReference    | 25   | 1.3.25  | A1-J18   |
| Gen I Lim En     | 0    | 2.9.11  | A1-D11   |
| Gen I Lim Ki     | 0    | 2.4.26  | A1-C11   |
| Gen I Lim Kp     | 0    | 2.4.27  | A1-C11   |
| Gener Trq Lim    | 1306 | 2.5.5   | A10-E16  |
| Goto ESS         | 1108 | 1.2.54  | A3-E16, A3-B28, A3-N11                                       |
| Goto Spd         | 1109 | 1.2.55  | A3-F28, A3-P11, A3-T2  |
| GR Decimal       | 1263 | 2.6.17  |  |
| GR Whole         | 1262 | 2.6.16  |  |
| Id Ref Actual    | 1546 | 1.3.14  | A11-S18  |
| Ident Warn       | 0    | 1.2.35  | A8-N8  |
| IGBT Temp Fault  | 0    | 1.2.30  |  |
| In Ess           | 1061 | 1.2.60  | A3-N21, A3-R3  |
| In Rem Spd       | 1062 | 1.2.61  | A3-L16   |
| In Rem Trq       | 1063 | 1.2.62  | A3-J16   |
| In Skip Freq     | 0    | 1.2.75  | A1-H21   |
| Input Ph. Superv | 730  | 2.1.9   | A8-N16   |
| Int Hundred      | 1203 | 2.15.6  | A5-B12   |
| Int Ten          | 1202 | 2.15.5  | A5-B12   |
| Int Thousand     | 1204 | 2.15.7  | A5-B12   |
| Iq Ref Actual    | 1545 | 1.3.13  | A10-P3   |
| Ir Add 0 Pt V    | 664  | 2.12.20 | A9-H14   |
| Ir Add Gen Scl   | 665  | 2.12.21 | A9-H14   |
| Ir Add Mtr Scl   | 667  | 2.12.22 | A9-J14   |
| Jog enable       | 1094 | 1.2.15  | A1-N10, A5-D16, A5-P13                                       |
| Jog F En         | 1093 | 1.2.16  | A5-D13   |
| Jog F Input      | 0    | 2.7.3   | A5-N28   |
| Jog F Ref        | 0    | 2.8.3   | A1-R9  |
| Jog F Speed      | 1256 | 2.2.3   | A1-R9  |
| Jog FR Input     | 1087 | 1.2.18  | A5-N16, A5-J28, A5-D28                                       |
| Jog R En         | 1092 | 1.2.17  | A5-D13   |

| NAME               | ID   | MENU    | COORDINATES  |
|--------------------|------|---------|--|
| Jog R Input        | 0    | 2.7.4   | A5-N28   |
| Jog R Ref          | 0    | 2.8.4   | A1-P9  |
| Jog R Speed        | 1257 | 2.2.4   | A1-P9  |
| Keypad Spd Dir     | 123  | 3.1     | A1-N8  |
| Keypad Trq Dir     | 0    | 3.3     | A2-F23   |
| Lit Spd Inp        | 0    | 2.8.36  | A1-S19   |
| Lit Speed          | 1247 | 2.2.21  | A1-S19   |
| Loc Trq Bit        | 0    | 2.7.42  | A3-S27   |
| Local Reference    | 0    | 2.13.25 |  |
| Local Stop Flt     | 1112 | 1.2.22  |  |
| Loss Tbl Gn        | 1246 | 2.6.12  | A1-P27   |
| Loss Tbl Inp       | 0    | 2.8.37  | A1-R28   |
| Loss Tbl Out       | 1518 | 1.3.61  | A1-R24   |
| LS Scl Div         | 0    | 2.6.2   | A1-H28, A2-P22   |
| LS to Freq         | 0    | 2.6.1   | A1-H28, A2-P22   |
| M Spd Stpt         | 1245 | 2.2.22  | A1-P16   |
| M Trq Stpt         | 1244 | 2.2.23  | A2-J25   |
| MagnCurrent        | 612  | 2.13.17 | A11-S28  |
| Main Trq Inp       | 0    | 2.8.39  | A2-J25   |
| Maint Bit          | 0    | 2.7.43  | A3-N25   |
| Maint Spd Inp      | 0    | 2.8.38  | A1-R16   |
| Maint Spd Mode     | 0    | 2.7.44  | A3-M11, A3-K11   |
| Master Ref         | 0    | 2.8.1   | A1-S9  |
| Max ESS Lim        | 1243 | 2.5.27  | A1-P20, A1-N15   |
| Max Spd RPM        | 1292 | 2.5.24  | A8-C23   |
| MC AtSpeed         | 1118 | 1.2.7   | A1-K11, A4-C15   |
| MC Fault           | 1116 | 1.2.5   | A4-E15, A8-R25   |
| MC Ready           | 1115 | 1.2.4   | A5-S23, A7-S16   |
| MC Reverse         | 1086 | 1.2.6   | A1-K11   |
| MC Run             | 1098 | 1.2.3   | A1-S22, A2-F19, A2-K20, A3-P27, A3-N27, A3-M28, A3-R10, A3-E13, A4-D15, A5-H13, A5-K2, A5-J11, A11-R24, A11-R7 |
| MC Warning         | 1117 | 1.2.8   | A8-R25   |
| MD Drive OK        | 1058 | 1.7.9   | A7-F27   |
| MD Run Enable      | 1060 | 1.7.10  | A7-F27   |
| MD Watchdog        | 1059 | 1.7.11  | A7-F27   |
| MD WD OK           | 1172 | 1.7.2   | A7-F17   |
| Meas Rs V Drop     | 662  | 2.12.18 | A9-E15   |
| Min ESS Lim        | 0    | 2.5.26  | A1-N20   |
| Min Frequency      | 101  | 2.5.2   | A1-G27   |
| Mk Flux Time       | 660  | 2.12.16 | A11-R14  |
| Mk Flux V Hw Dt    | 663  | 2.12.19 | A11-P14  |
| Mk Flux Voltage    | 661  | 2.12.17 | A11-P14  |
| Mot Therm 0 Spd    | 706  | 2.1.15  | A8-L26   |
| MotAmbTempFactor   | 705  | 2.1.14  | A8-L26   |
| Motor Cos Phi      | 120  | 2.13.27 | A11-D25  |
| Motor Ctrl Mode    | 600  | 2.13.6  |  |
| Motor Ctrl Mode2   | 521  | 2.13.7  | A9-N18, A10-P14  |
| Motor Current      | 3    | 1.3.2   | A4-S9, A8-K26, A11-D15   |
| Motor Duty Cycle   | 708  | 2.1.17  | A8-K26   |
| Motor Nom Currnt   | 113  | 2.13.2  | A1-B17, A11-R28, A11-D19   |
| Motor Nom Freq     | 111  | 2.13.4  | A11-E19  |
| Motor Nom Speed    | 112  | 2.13.5  | A11-D19  |
| Motor Nom Voltg    | 110  | 2.13.3  | A11-E19  |
| Motor Power        | 5    | 1.3.5   | A11-D15  |
| Motor Speed        | 2    | 1.3.1   | A4-S16, A4-P9, A7-F7, A8-J26, A8-G28, A8-D28   |
| Motor Torque       | 4    | 1.3.4   | A8-J25, A9-J21, A9-K14, A9-F25, A10-H22, A11-E15   |
| Motor Voltage      | 6    | 1.3.6   | A9-J21, A11-E15  |
| MotorCurLimit      | 1526 | 1.3.38  | A1-B14   |
| Motorizing Trq Lim | 1305 | 2.5.4   | A10-F16  |
| MotorType          | 0    | 2.13.8  | A11-D25, A11-P14   |
| Mtr Ctrl Sw        | 0    | 2.13.31 | A9-P18, A10-R13  |
| Mtr Cur ID         | 45   | 1.3.51  | A11-H8   |
| Mtr Cur Lim Scl    | 0    | 2.8.10  | A1-B17   |

| NAME             | ID   | MENU    | COORDINATES   |
|------------------|------|---------|---|
| Mtr Cur Limit    | 1291 | 2.5.3   | A1-B17  |
| Mtr Cur Unfil    | 1113 | 1.3.3   |   |
| Mtr I Lim En     | 0    | 2.9.10  | A1-E11  |
| Mtr I Lim Ki     | 0    | 2.4.24  | A1-D11  |
| Mtr I Lim Kp     | 0    | 2.4.25  | A1-E11  |
| Mtr OT Fault     | 0    | 1.2.33  |   |
| Mtr OT Warn      | 0    | 1.2.34  | A8-R8   |
| Mtr Therm TC     | 707  | 2.1.16  | A8-K26  |
| Mtr Torq Unfil   | 1125 | 1.3.20  |   |
| MtrCalcTemp      | 9    | 1.3.16  | A8-K23  |
| MtrRegStatus     | 1525 | 1.3.37  | A1-J6   |
| Mx Spd Lim       | 0    | 2.8.40  | A1-N15  |
| Neg Freq Limit   | 1301 | 2.5.18  | A1-D5   |
| Neg Iq Cur Lim   | 1544 | 1.3.12  | A10-M10   |
| Neg Spd Ref      | 1129 | 1.2.21  | A1-N4   |
| Not DIN 1        | 1021 | 1.4.11  | A4-E21  |
| Not DIN 2        | 1022 | 1.4.12  | A4-E21  |
| Not DIN 3        | 1023 | 1.4.13  | A4-D21  |
| Not DIN 4        | 1024 | 1.4.14  | A4-D21  |
| Not DIN 5        | 1025 | 1.4.15  | A4-C21  |
| Not DIN 6        | 1026 | 1.4.16  | A4-C21  |
| Not DIN 7        | 1027 | 1.4.17  | A4-B22  |
| Not DIN 8        | 1028 | 1.4.18  | A4-B22  |
| OC Fault         | 0    | 1.2.28  |   |
| OL TC Min Freq   | 636  | 2.13.24 |   |
| One Analog       | 1201 | 2.15.4  | A1-R28, A5-C12  |
| One Bit          | 1001 | 2.15.1  | A1-F17, A2-D19, A2-M11, A2-K16, A3-N25, A3-L25, A3-J25, A5-S25, A5-S21, A5-H19, A5-F20, A5-C8, A6-S6, A6-S6 |
| OV Fault         | 0    | 1.2.29  |   |
| OV Reg Kd        | 0    | 2.4.17  | A1-G12  |
| OV Reg Ki        | 0    | 2.4.16  | A1-G12  |
| OV Reg Kp        | 0    | 2.4.14  | A1-H12  |
| OV Reg Kp Add    | 0    | 2.4.15  |   |
| Over Temp Warn   | 1114 | 1.2.23  | A8-N19  |
| Overspeed Resp   | 0    | 2.1.8   | A8-D16  |
| Oervolt Contr    | 607  | 2.9.8   | A1-H12  |
| Ovr Spd Inp      | 0    | 2.8.9   | A8-C23  |
| Ovr Spd Stp      | 1258 | 2.5.8   | A8-E23  |
| Panel Fault ACT  | 0    | 1.2.26  |   |
| Panel Ref Src    | 121  | 2.2.6   |   |
| PC Control       | 1121 | 1.2.20  | A5-H24, A5-F24, A5-D26, A5-M11, A5-M10  |
| Phase Supv F     | 702  | 2.1.11  | A8-N16  |
| Pos Freq Limit   | 1300 | 2.5.17  | A1-E5   |
| Pos Iq Cur Lim   | 1543 | 1.3.11  | A10-N10   |
| ProcessPITrimRef | 1521 | 1.3.36  | A2-R17, A9-N23, A10-R23   |
| Pwr IU Offset    | 668  | 2.12.23 | A11-H8  |
| Pwr IV Offset    | 669  | 2.12.24 | A11-G8  |
| Pwr IW Offset    | 670  | 2.12.25 | A11-G8  |
| Regen Trq Lim    | 1517 | 1.3.62  | A2-D25, A2-J3   |
| Rem Bit          | 0    | 2.7.45  | A3-S27  |
| Rem Spd Bit      | 0    | 2.7.46  | A3-L25, A3-J25  |
| Rem Spd Inp      | 0    | 2.8.41  | A1-R16  |
| Rem Spd Stpt     | 1237 | 2.2.24  | A1-R16  |
| Rem Trq Inp      | 0    | 2.8.42  | A2-J25  |
| Rem Trq Stpt     | 1235 | 2.2.25  | A2-J25  |
| Remote Ref Src   | 122  | 2.2.7   |   |
| Reverse          | 1128 | 1.2.11  | A1-N5   |
| Reverse Inp      | 0    | 2.7.5   | A1-N9   |
| RJT Enable       | 1097 | 1.2.13  | A5-S2, A5-N13   |
| RJT Ref          | 1504 | 1.3.22  | A1-S5   |
| Rmp Act Lim      | 0    | 2.9.2   | A1-K10  |
| Rotor Flux       | 1541 | 1.3.9   | A2-D6, A10-N4, A11-S14  |
| Rotor TC         | 1547 | 1.3.15  |   |

| NAME             | ID   | MENU     | COORDINATES  |
|------------------|------|----------|--|
| Run Enable       | 1096 | 1.2.12   | A3-H25, A5-G28, A5-H16, A5-F18, A5-D21, A5-S13, A5-E13, A7-S16 |
| Run Input        | 0    | 2.7.1    | A5-L28, A5-H28   |
| Run OK           | 1091 | 1.2.9    | A5-R28, A5-R20, A5-S16, A5-H21, A5-F22, A5-D23                 |
| Run Speed        | 1254 | 2.2.1    |  |
| RunRequest       | 1090 | 1.2.19   | A5-N2, A5-K13  |
| S1               | 1064 | 1.2.63   | A1-S22, A3-P2, A3-C14  |
| S2               | 1065 | 1.2.64   | A3-N2, A3-B14  |
| S3               | 1066 | 1.2.65   | A3-M16, A3-C14   |
| S4               | 1067 | 1.2.66   | A3-M2, A3-B14  |
| SB Comm Flt      | 1173 | 1.7.13   |  |
| SB Comm Flt Resp | 0    | 2.14.2.6 | A8-D16   |
| SB Comm Flt Tim  | 0    | 2.14.2.7 | A7-D14   |
| SB Comm Lost     | 0    | 1.7.12   | A7-E16   |
| SB In Cntl Word  | 1530 | 1.7.3    | A7-R27, A7-M27, A7-K27, A7-G27                                 |
| SB In Freq Ref   | 1531 | 1.7.4    | A7-N5  |
| SB In Int1       | 1532 | 1.7.5    | A7-N5  |
| SB In Int2       | 1533 | 1.7.6    | A7-M5  |
| SB In Trq Ref    | 1535 | 1.7.7    | A7-N5  |
| SB Mode          | 0    | 2.14.2.3 | A7-E15, A7-C28   |
| SB Out Cntl Word | 1534 | 1.7.8    | A7-S13   |
| SB Out Int1      | 0    | 2.14.2.4 | A7-D6  |
| SB Out Int2      | 0    | 2.14.2.5 | A7-C6  |
| SB WD Pulse      | 0    | 1.7.1    | A7-S16   |
| SBId             | 0    | 2.14.2.1 | A7-D28   |
| SBNextId         | 0    | 2.14.2.2 | A7-C28   |
| SC Trq Chain Sel | 0    | 2.9.13   | A10-K16, A10-C23   |
| Self Tune Motor  | 631  | 2.13.1   | A11-H11  |
| Skip S Rev       | 0    | 2.9.1    | A1-K14   |
| Skp Frq Hi1      | 0    | 2.2.29   | A1-H24   |
| Skp Frq Hi2      | 0    | 2.2.30   | A1-G24   |
| Skp Frq Low1     | 0    | 2.2.31   | A1-H24   |
| Skp Frq Low2     | 0    | 2.2.32   | A1-G24   |
| Skp Rmp Time     | 0    | 2.3.20   | A1-E23   |
| Slack Up         | 0    | 2.8.7    | A2-R27   |
| Slip Adjust      | 619  | 2.13.18  | A11-R14  |
| Smooth Ratio     | 500  | 2.3.3    | A1-D23   |
| Smooth Ratio 2   | 501  | 2.3.5    | A1-C20   |
| Sp ABS In        | 0    | 2.8.22   | A6-C27   |
| Sp ABS Out       | 1558 | 1.3.44   | A6-C24   |
| Sp Add Val       | 1327 | 2.6.7    | A6-H27, A6-H27   |
| Sp Add1 In1      | 0    | 2.8.17   | A6-J27   |
| Sp Add1 In2      | 0    | 2.8.18   | A6-H27   |
| Sp Add1 Out      | 1555 | 1.3.41   | A6-H24   |
| Sp And1 In1      | 0    | 2.7.29   | A6-F6  |
| Sp And1 In2      | 0    | 2.7.30   | A6-F6  |
| Sp And1 NIn3     | 0    | 2.7.31   | A6-E6  |
| Sp And1 Out      | 1164 | 1.2.44   | A6-F3  |
| Sp And2 In1      | 0    | 2.7.32   | A6-E6  |
| Sp And2 In2      | 0    | 2.7.33   | A6-D6  |
| Sp And2 NIn3     | 0    | 2.7.34   | A6-D6  |
| Sp And2 Out      | 1165 | 1.2.45   | A6-D3  |
| Sp Cmp1 Eq       | 1152 | 1.2.38   | A6-N10   |
| Sp Cmp1 In       | 0    | 2.8.30   | A6-N14   |
| Sp Cmp1 Out      | 1153 | 1.2.39   | A6-M10   |
| Sp Cmp1 Thres    | 0    | 2.8.31   | A6-M14   |
| Sp Cmp1_Hyst     | 1345 | 2.2.17   | A6-M13   |
| Sp Cmp1_Stpt     | 1346 | 2.2.18   | A6-N14, A6-M14   |
| Sp Dly1 In       | 0    | 2.7.23   | A6-G13   |
| Sp Dly1 Out      | 1156 | 1.2.40   | A6-G11   |
| Sp Dly1 TOFF     | 1349 | 2.3.11   | A6-F13   |
| Sp Dly1 TON      | 1350 | 2.3.12   | A6-G13   |
| Sp Inv1 In       | 0    | 2.7.27   | A6-N6  |
| Sp Inv1 Out      | 1161 | 1.2.42   | A6-N4  |

| NAME            | ID   | MENU   | COORDINATES    |
|-----------------|------|--------|----------------|
| Sp Inv2 In      | 0    | 2.7.28 | A6-N6          |
| Sp Inv2 Out     | 1162 | 1.2.43 | A6-N4          |
| Sp Lim Inp      | 0    | 2.8.32 | A6-L20         |
| Sp Lim Max      | 1353 | 2.5.22 | A6-K20         |
| Sp Lim Min      | 1354 | 2.5.23 | A6-K20         |
| Sp Lim Out      | 1574 | 1.3.48 | A6-K17         |
| Sp LP Fil In    | 0    | 2.8.21 | A6-H20         |
| Sp LP Fil Out   | 1557 | 1.3.43 | A6-H17         |
| Sp LP Fil TC    | 1329 | 2.3.10 | A6-G20         |
| Sp Ltch1 H1     | 0    | 2.7.24 | A6-S6          |
| Sp Ltch1 H2     | 0    | 2.7.25 | A6-S6          |
| Sp Ltch1 L      | 0    | 2.7.26 | A6-T6          |
| Sp Ltch1 Out    | 1158 | 1.2.41 | A6-S4          |
| Sp MD1 Div      | 0    | 2.8.13 | A6-P27         |
| Sp MD1 Dv       | 1323 | 2.6.3  | A6-P27         |
| Sp MD1 Mlt      | 1324 | 2.6.4  | A6-R27         |
| Sp MD1 Mul      | 0    | 2.8.14 | A6-R27         |
| Sp MD1 Out      | 1553 | 1.3.39 | A6-R24         |
| Sp MD1 Val      | 0    | 2.8.11 | A6-R27         |
| Sp MD2 Div      | 0    | 2.8.15 | A6-L27         |
| Sp MD2 Dv       | 1325 | 2.6.5  | A6-L27         |
| Sp MD2 Mlt      | 1326 | 2.6.6  | A6-L27         |
| Sp MD2 Mul      | 0    | 2.8.16 | A6-L27         |
| Sp MD2 Out      | 1554 | 1.3.40 | A6-L24         |
| Sp MD2 Val      | 0    | 2.8.12 | A6-M27         |
| Sp Or1 In1      | 0    | 2.7.35 | A6-L6          |
| Sp Or1 In2      | 0    | 2.7.36 | A6-K6          |
| Sp Or1 NIn3     | 0    | 2.7.37 | A6-K6          |
| Sp Or1 Out      | 1167 | 1.2.46 | A6-K3          |
| Sp Or2 In1      | 0    | 2.7.38 | A6-J6          |
| Sp Or2 In2      | 0    | 2.7.39 | A6-J6          |
| Sp Or2 NIn3     | 0    | 2.7.40 | A6-H6          |
| Sp Or2 Out      | 1168 | 1.2.47 | A6-J3          |
| Sp Sel1 En1     | 0    | 2.7.21 | A6-T20         |
| Sp Sel1 In0     | 0    | 2.8.26 | A6-S20         |
| Sp Sel1 In1     | 0    | 2.8.27 | A6-R20         |
| Sp Sel1 Out     | 1561 | 1.3.46 | A6-R17         |
| Sp Sel1 ST0     | 1337 | 2.2.13 | A6-S20         |
| Sp Sel1 ST1     | 1338 | 2.2.14 | A6-R20         |
| Sp Sel2 En1     | 0    | 2.7.22 | A6-R20         |
| Sp Sel2 In0     | 0    | 2.8.28 | A6-N20         |
| Sp Sel2 In1     | 0    | 2.8.29 | A6-N20         |
| Sp Sel2 Out     | 1562 | 1.3.47 | A6-N17         |
| Sp Sel2 ST0     | 1339 | 2.2.15 | A6-N20         |
| Sp Sel2 ST1     | 1340 | 2.2.16 | A6-M20         |
| Sp Sub Val      | 1328 | 2.6.8  | A6-E27, A6-E27 |
| Sp Sub1 In1     | 0    | 2.8.19 | A6-F27         |
| Sp Sub1 In2     | 0    | 2.8.20 | A6-E27         |
| Sp Sub1 Out     | 1565 | 1.3.42 | A6-E24         |
| Sp Sum1 EnA     | 0    | 2.7.18 | A6-E20         |
| Sp Sum1 EnB     | 0    | 2.7.19 | A6-E20         |
| Sp Sum1 EnC     | 0    | 2.7.20 | A6-F20         |
| Sp Sum1 InA     | 0    | 2.8.23 | A6-D20         |
| Sp Sum1 InB     | 0    | 2.8.24 | A6-D20         |
| Sp Sum1 InC     | 0    | 2.8.25 | A6-C20         |
| Sp Sum1 Out     | 1559 | 1.3.45 | A6-C17         |
| Sp Sum1 StA     | 1330 | 2.2.10 | A6-D20         |
| Sp Sum1 StB     | 1331 | 2.2.11 | A6-C20         |
| Sp Sum1 StC     | 1332 | 2.2.12 | A6-C20         |
| Spd Cmp Fil TC  | 0    | 2.3.13 | A8-C28         |
| Spd Cntrl F0    | 0    | 2.4.3  | A10-H27        |
| Spd Cntrl F1    | 0    | 2.4.4  | A10-H27        |
| Spd Cntrl Kp F0 | 0    | 2.4.5  | A10-J27        |
| Spd Cntrl Kp FW | 0    | 2.4.6  | A10-K27        |

| NAME             | ID   | MENU    | COORDINATES                            |
|------------------|------|---------|--|
| Spd Cntrl Kp T0  | 0    | 2.4.7   | A10-K23                                |
| Spd Cntrl T0     | 0    | 2.4.8   | A10-J22                                |
| Spd Cntrl Word   | 1516 | 1.3.63  | A1-S16, A3-C11                         |
| Spd Cont Ki      | 638  | 2.4.31  | A9-J18                                 |
| Spd Cont Kp      | 637  | 2.4.30  | A9-J18                                 |
| Spd Decimal      | 0    | 2.5.11  | A8-B23                                 |
| Spd Err Bnd Frq  | 0    | 2.4.10  | A10-M16                                |
| Spd Err Fil TC   | 0    | 2.3.18  | A10-N18                                |
| Spd Err LP Freq  | 0    | 2.4.11  | A10-M18                                |
| Spd Fdbk         | 0    | 2.8.8   | A8-D28                                 |
| Spd Hyst         | 0    | 2.5.10  | A8-C23                                 |
| Spd Ref          | 1515 | 1.3.64  | A1-R9, A1-R12                          |
| Spd Slk Up       | 1273 | 2.2.5   | A2-R27                                 |
| Spd Tbl Tim      | 1514 | 1.3.65  | A1-L22                                 |
| Spd Tim Dn       | 1068 | 1.2.67  | A1-M23, A3-E25                         |
| Spd Tim En       | 1069 | 1.2.68  | A1-L25, A3-H16, A3-N13                 |
| Spd Timing       | 1070 | 1.2.69  | A1-L22, A3-N23                         |
| Spd Trq Lim      | 1242 | 2.5.28  | A2-J19                                 |
| Speed Cntrl Out  | 1548 | 1.3.21  | A10-N10                                |
| Speed Control Kp | 613  | 2.4.1   | A10-K26                                |
| Speed Control Ti | 614  | 2.4.2   | A10-K19                                |
| Speed Step       | 1252 | 2.12.26 | A2-S21                                 |
| SPI Fault Act    | 0    | 1.2.37  |  |
| SPI Flt Resp     | 734  | 2.1.24  | A8-H16                                 |
| Start DC-BrakeTm | 516  | 2.13.26 | A11-P7                                 |
| Start Function   | 505  | 2.9.5   | A1-K14                                 |
| Start Input      | 1089 | 1.2.10  | A5-S20, A5-L16                         |
| Startup Trq Sel  | 621  | 2.13.21 | A10-J19                                |
| StartupTorq FWD  | 633  | 2.13.22 | A10-G23                                |
| StartupTorq REV  | 634  | 2.13.23 | A10-G23                                |
| Step Ref         | 1520 | 1.3.35  | A2-R22                                 |
| Step Reverse     | 0    | 2.7.12  | A2-S25                                 |
| Stop 0 Spd Time  | 616  | 2.3.7   | A5-K8                                  |
| Stop DC-BrakeFr  | 515  | 2.13.10 | A11-N6                                 |
| Stop Funct       | 0    | 2.9.6   | A1-L14                                 |
| Stop Input       | 0    | 2.7.6   | A5-H19, A5-F20                         |
| Stop St Magn I   | 0    | 2.13.19 | A11-S24                                |
| Stop St Magn Tim | 0    | 2.13.20 | A11-P23                                |
| Strt 0 Spd Time  | 615  | 2.3.6   | A1-H18                                 |
| Sup Enable       | 0    | 2.7.13  | A2-S26                                 |
| Switching Freq   | 601  | 2.13.16 | A11-D19                                |
| T1               | 1071 | 1.2.70  | A3-L2, A3-H13, A3-C6                   |
| Tbl Trq Lim      | 0    | 1.3.70  | A2-F15                                 |
| TC Neg Freq Lim  | 1573 | 1.3.58  | A2-R3, A10-S14                         |
| TC Pos Freq Lim  | 1572 | 1.3.57  | A2-R3, A10-T14                         |
| TC Spd Lim Sel   | 0    | 2.9.15  | A2-T5                                  |
| Temp CL Param    | 0    | 2.4.32  |  |
| Therm Fault Act  | 1119 | 1.2.24  |  |
| Therm Prot F     | 704  | 2.1.13  | A8-L16                                 |
| Therm Warn Act   | 1120 | 1.2.25  | A8-R8                                  |
| Thermistor Inp   | 0    | 2.7.17  | A8-J19                                 |
| ThermistorF.Resp | 732  | 2.1.22  | A8-K16                                 |
| Thread Enable    | 1095 | 1.2.14  | A5-E28, A5-F16, A5-D19, A5-R13, A5-E13 |
| Thread Input     | 0    | 2.7.2   | A5-K28, A5-F28                         |
| Thread Ref       | 0    | 2.8.2   | A1-R9                                  |
| Thread Speed     | 1255 | 2.2.2   | A1-R9                                  |
| Torq Ref Select  | 0    | 2.9.14  | A2-F15                                 |
| Torq Speed Limit | 644  | 2.5.14  | A2-P10                                 |
| Torque Reference | 18   | 1.3.49  | A2-E15, A7-D6                          |
| Torque Step      | 1253 | 2.12.27 | A2-F8                                  |
| Trq Base Spd     | 1260 | 2.2.27  | A2-B18                                 |
| Trq Cntrl Ki     | 640  | 2.4.34  | A9-F25                                 |
| Trq Cntrl Kp     | 639  | 2.4.33  | A9-F25                                 |
| Trq Cntrl Word   | 1513 | 1.3.66  | A2-K24, A3-C3                          |

| NAME             | ID   | MENU    | COORDINATES                         |
|------------------|------|---------|-------------------------------------|
| Trq Dir          | 0    | 2.7.15  | A2-G24                              |
| Trq End Spd      | 1261 | 2.2.28  | A2-B18                              |
| Trq I Gain       | 0    | 2.4.40  | A2-L10                              |
| Trq I Res1       | 0    | 2.7.47  | A2-N11                              |
| Trq I Res2       | 0    | 2.7.48  | A2-N11                              |
| Trq Lim FWD      | 1307 | 2.5.6   | A10-F16                             |
| Trq Lim Ki       | 611  | 2.4.29  | A1-B9                               |
| Trq Lim Kp       | 610  | 2.4.28  | A1-C9                               |
| Trq Lim Ref      | 1512 | 1.3.67  | A2-M11, A2-J21                      |
| Trq Lim REV      | 1308 | 2.5.7   | A10-E16                             |
| Trq Lp Fdbk      | 0    | 2.8.46  | A2-L11                              |
| Trq LP Gain      | 0    | 2.4.39  | A2-K10                              |
| Trq LP Max       | 0    | 2.5.29  | A2-K9                               |
| Trq LP Min       | 0    | 2.5.30  | A2-K9                               |
| Trq Lp Ref       | 0    | 2.8.45  | A2-M11                              |
| Trq No Ramp      | 0    | 2.7.16  | A2-D19, A2-K16                      |
| Trq P Gain       | 0    | 2.4.41  | A2-L10                              |
| Trq PI Out       | 0    | 1.3.69  | A2-M6                               |
| Trq Ref          | 0    | 2.8.33  | A2-D25                              |
| Trq Ref 3        | 1537 | 1.3.54  |                                     |
| Trq Ref 4        | 1538 | 1.3.55  |                                     |
| Trq Ref Act      | 1536 | 1.3.53  | A10-N2, A11-F26                     |
| Trq Ref DeadZone | 0    | 2.5.16  | A2-D12                              |
| Trq Ref En       | 0    | 2.7.14  | A2-F19                              |
| Trq Ref Fil TC   | 0    | 2.3.17  | A2-C10                              |
| Trq Ref Gn       | 1299 | 2.6.11  | A2-D14                              |
| Trq Ref Hyst     | 0    | 2.5.15  | A2-C11                              |
| Trq Ref Inp      | 0    | 2.8.43  | A1-S24                              |
| Trq Ref Max      | 1274 | 2.5.12  | A2-C18                              |
| Trq Ref Off      | 1298 | 2.6.10  | A2-D14                              |
| Trq Ref Rate     | 1241 | 2.3.19  | A2-H16                              |
| Trq Ref StA      | 1302 | 2.2.8   |                                     |
| Trq Rmp Rate     | 1290 | 2.3.9   | A2-D19                              |
| Trq Scl Div      | 1240 | 2.6.13  | A2-H21                              |
| Trq Scl Mlt      | 1239 | 2.6.14  | A2-J21                              |
| Trq Spd Lim Mode | 0    | 2.9.17  | A2-T10                              |
| Trq Spd Tbl      | 1510 | 1.3.68  | A2-K25                              |
| Trq_Ref_Min      | 1275 | 2.5.13  | A2-C18                              |
| TT               | 1075 | 1.2.74  | A2-K20, A3-H2, A3-F13               |
| U/f Mid Freq     | 604  | 2.13.13 | A9-J5                               |
| U/f Mid Voltg    | 605  | 2.13.14 | A9-L5                               |
| U/f Optimization | 109  | 2.13.29 | A9-F13                              |
| U/f Ratio Select | 108  | 2.13.28 | A9-N10                              |
| ULoad Protect F  | 713  | 2.1.18  | A8-K16                              |
| Under Ld State T | 716  | 2.1.21  | A8-G24                              |
| Under Ld Trq 0   | 715  | 2.1.20  | A8-H28                              |
| Under Ld Trq Nom | 714  | 2.1.19  | A8-H28                              |
| Unit Temperature | 8    | 1.3.17  | A8-M22                              |
| User Flt 1       | 0    | 2.1.2   | A8-F18                              |
| User Flt 2       | 0    | 2.1.3   | A8-F18                              |
| User Flt1 Resp   | 0    | 2.1.4   | A8-G16                              |
| User Flt2 Resp   | 0    | 2.1.5   | A8-F16                              |
| UV Contrl        | 608  | 2.9.9   | A1-G12                              |
| UV Fault         | 0    | 1.2.27  |                                     |
| UV Reg I2        | 0    | 2.4.21  | A1-F12                              |
| UV Reg Kd        | 0    | 2.4.22  | A1-E12                              |
| UV Reg Kd2       | 0    | 2.4.23  |                                     |
| UV Reg Kp        | 0    | 2.4.18  | A1-F12                              |
| UV Reg Kp2       | 0    | 2.4.19  |                                     |
| UVolt Fault Resp | 727  | 2.1.10  | A8-P16                              |
| Voltage at FWP   | 603  | 2.13.12 | A9-R5, A9-N5, A9-L5, A9-H5, A11-N24 |
| Watchdog In      | 0    | 2.7.41  | A7-B21                              |
| Watchdog Out     | 1003 | 1.2.76  | A7-D18                              |
| WD Com Dly       | 0    | 2.3.14  | A7-B21                              |

| NAME            | ID   | MENU      | COORDINATES |
|-----------------|------|-----------|-------------|
| WD Flt Response | 0    | 2.1.34    | A8-G16      |
| WD Init Dly Tim | 0    | 2.3.15    | A7-C19      |
| WD Trip         | 0    | 1.2.49    | A7-C15      |
| Win Neg Width   | 0    | 2.5.20    | A2-R11      |
| Win Pos Width   | 0    | 2.5.19    | A2-S11      |
| WK Inp          | 0    | 2.8.44    | A1-P23      |
| WK Scaling      | 1238 | 2.6.15    | A1-R24      |
| WK Stpt         | 1234 | 2.2.26    | A1-P23      |
| X0              | 1796 | 2.11.2.1  |             |
| X0              | 1892 | 2.11.3.1  |             |
| X0              | 1700 | 2.11.1.1  |             |
| X1              | 1797 | 2.11.2.2  |             |
| X1              | 1893 | 2.11.3.2  |             |
| X1              | 1701 | 2.11.1.2  |             |
| X10             | 1710 | 2.11.1.11 |             |
| X10             | 1902 | 2.11.3.11 |             |
| X10             | 1806 | 2.11.2.11 |             |
| X11             | 1903 | 2.11.3.12 |             |
| X11             | 1807 | 2.11.2.12 |             |
| X11             | 1711 | 2.11.1.12 |             |
| X12             | 1808 | 2.11.2.13 |             |
| X12             | 1712 | 2.11.1.13 |             |
| X12             | 1904 | 2.11.3.13 |             |
| X13             | 1905 | 2.11.3.14 |             |
| X13             | 1809 | 2.11.2.14 |             |
| X13             | 1713 | 2.11.1.14 |             |
| X14             | 1810 | 2.11.2.15 |             |
| X14             | 1714 | 2.11.1.15 |             |
| X14             | 1906 | 2.11.3.15 |             |
| X15             | 1811 | 2.11.2.16 |             |
| X15             | 1715 | 2.11.1.16 |             |
| X15             | 1907 | 2.11.3.16 |             |
| X16             | 1908 | 2.11.3.17 |             |
| X16             | 1812 | 2.11.2.17 |             |
| X16             | 1716 | 2.11.1.17 |             |
| X17             | 1909 | 2.11.3.18 |             |
| X17             | 1717 | 2.11.1.18 |             |
| X17             | 1813 | 2.11.2.18 |             |
| X18             | 1910 | 2.11.3.19 |             |
| X18             | 1814 | 2.11.2.19 |             |
| X18             | 1718 | 2.11.1.19 |             |
| X19             | 1911 | 2.11.3.20 |             |
| X19             | 1719 | 2.11.1.20 |             |
| X19             | 1815 | 2.11.2.20 |             |
| X2              | 1894 | 2.11.3.3  |             |
| X2              | 1798 | 2.11.2.3  |             |
| X2              | 1702 | 2.11.1.3  |             |
| X20             | 1912 | 2.11.3.21 |             |
| X20             | 1816 | 2.11.2.21 |             |
| X20             | 1720 | 2.11.1.21 |             |
| X21             | 1817 | 2.11.2.22 |             |
| X21             | 1721 | 2.11.1.22 |             |
| X21             | 1913 | 2.11.3.22 |             |
| X22             | 1914 | 2.11.3.23 |             |
| X22             | 1818 | 2.11.2.23 |             |
| X22             | 1722 | 2.11.1.23 |             |
| X23             | 1819 | 2.11.2.24 |             |
| X23             | 1915 | 2.11.3.24 |             |
| X23             | 1723 | 2.11.1.24 |             |
| X3              | 1799 | 2.11.2.4  |             |
| X3              | 1895 | 2.11.3.4  |             |
| X3              | 1703 | 2.11.1.4  |             |
| X4              | 1704 | 2.11.1.5  |             |
| X4              | 1896 | 2.11.3.5  |             |

| NAME | ID   | MENU      | COORDINATES |
|------|------|-----------|-------------|
| X4   | 1800 | 2.11.2.5  |             |
| X5   | 1801 | 2.11.2.6  |             |
| X5   | 1897 | 2.11.3.6  |             |
| X5   | 1705 | 2.11.1.6  |             |
| X6   | 1706 | 2.11.1.7  |             |
| X6   | 1802 | 2.11.2.7  |             |
| X6   | 1898 | 2.11.3.7  |             |
| X7   | 1803 | 2.11.2.8  |             |
| X7   | 1707 | 2.11.1.8  |             |
| X7   | 1899 | 2.11.3.8  |             |
| X8   | 1900 | 2.11.3.9  |             |
| X8   | 1708 | 2.11.1.9  |             |
| X8   | 1804 | 2.11.2.9  |             |
| X9   | 1901 | 2.11.3.10 |             |
| X9   | 1805 | 2.11.2.10 |             |
| X9   | 1709 | 2.11.1.10 |             |
| Y0   | 1844 | 2.11.2.25 |             |
| Y0   | 1748 | 2.11.1.25 |             |
| Y0   | 1940 | 2.11.3.25 |             |
| Y1   | 1941 | 2.11.3.26 |             |
| Y1   | 1845 | 2.11.2.26 |             |
| Y1   | 1749 | 2.11.1.26 |             |
| Y10  | 1950 | 2.11.3.35 |             |
| Y10  | 1854 | 2.11.2.35 |             |
| Y10  | 1758 | 2.11.1.35 |             |
| Y11  | 1759 | 2.11.1.36 |             |
| Y11  | 1951 | 2.11.3.36 |             |
| Y11  | 1855 | 2.11.2.36 |             |
| Y12  | 1952 | 2.11.3.37 |             |
| Y12  | 1760 | 2.11.1.37 |             |
| Y12  | 1856 | 2.11.2.37 |             |
| Y13  | 1857 | 2.11.2.38 |             |
| Y13  | 1761 | 2.11.1.38 |             |
| Y13  | 1953 | 2.11.3.38 |             |
| Y14  | 1858 | 2.11.2.39 |             |
| Y14  | 1954 | 2.11.3.39 |             |
| Y14  | 1762 | 2.11.1.39 |             |
| Y15  | 1763 | 2.11.1.40 |             |
| Y15  | 1955 | 2.11.3.40 |             |
| Y15  | 1859 | 2.11.2.40 |             |
| Y16  | 1860 | 2.11.2.41 |             |
| Y16  | 1956 | 2.11.3.41 |             |
| Y16  | 1764 | 2.11.1.41 |             |
| Y17  | 1765 | 2.11.1.42 |             |
| Y17  | 1861 | 2.11.2.42 |             |
| Y17  | 1957 | 2.11.3.42 |             |
| Y18  | 1862 | 2.11.2.43 |             |
| Y18  | 1958 | 2.11.3.43 |             |
| Y18  | 1766 | 2.11.1.43 |             |
| Y19  | 1863 | 2.11.2.44 |             |
| Y19  | 1959 | 2.11.3.44 |             |
| Y19  | 1767 | 2.11.1.44 |             |
| Y2   | 1846 | 2.11.2.27 |             |
| Y2   | 1942 | 2.11.3.27 |             |
| Y2   | 1750 | 2.11.1.27 |             |
| Y20  | 1864 | 2.11.2.45 |             |
| Y20  | 1960 | 2.11.3.45 |             |
| Y20  | 1768 | 2.11.1.45 |             |
| Y21  | 1769 | 2.11.1.46 |             |
| Y21  | 1865 | 2.11.2.46 |             |
| Y21  | 1961 | 2.11.3.46 |             |
| Y22  | 1770 | 2.11.1.47 |             |
| Y22  | 1962 | 2.11.3.47 |             |
| Y22  | 1866 | 2.11.2.47 |             |

| NAME            | ID   | MENU      | COORDINATES   |
|-----------------|------|-----------|---|
| Y23             | 1963 | 2.11.3.48 |   |
| Y23             | 1867 | 2.11.2.48 |   |
| Y23             | 1771 | 2.11.1.48 |   |
| Y3              | 1751 | 2.11.1.28 |   |
| Y3              | 1847 | 2.11.2.28 |   |
| Y3              | 1943 | 2.11.3.28 |   |
| Y4              | 1848 | 2.11.2.29 |   |
| Y4              | 1752 | 2.11.1.29 |   |
| Y4              | 1944 | 2.11.3.29 |   |
| Y5              | 1945 | 2.11.3.30 |   |
| Y5              | 1753 | 2.11.1.30 |   |
| Y5              | 1849 | 2.11.2.30 |   |
| Y6              | 1946 | 2.11.3.31 |   |
| Y6              | 1850 | 2.11.2.31 |   |
| Y6              | 1754 | 2.11.1.31 |   |
| Y7              | 1851 | 2.11.2.32 |   |
| Y7              | 1755 | 2.11.1.32 |   |
| Y7              | 1947 | 2.11.3.32 |   |
| Y8              | 1756 | 2.11.1.33 |   |
| Y8              | 1852 | 2.11.2.33 |   |
| Y8              | 1948 | 2.11.3.33 |   |
| Y9              | 1949 | 2.11.3.34 |   |
| Y9              | 1853 | 2.11.2.34 |   |
| Y9              | 1757 | 2.11.1.34 |   |
| Zero Analog     | 1200 | 2.15.3    | A4-L9, A4-J9, A5-C12, A6-R27, A6-M27, A6-K20, A6-H20, A6-C27, A7-D6, A7-C6, A7-K7, A7-J7, A7-J7, A7-H7, A7-H7, A7-G7, A7-G7, A7-F7  |
| Zero Bit        | 1002 | 2.15.2    | A1-N9, A1-J14, A2-S26, A2-S25, A2-F24, A3-S27, A3-S27, A3-M11, A3-K11, A4-R19, A4-P19, A4-K19, A4-K19, A4-E9, A4-D9, A4-C9, A5-M28, A5-K28, A5-F28, A5-C8, A6-S20, A6-R20, A6-E20, A6-E20, A6-E20, A6-G13, A6-S6, A6-N6, A6-N6, A6-L6, A6-K6, A6-K6, A6-J6, A6-J6, A6-H6, A6-F6, A6-F6, A6-E6, A6-E6, A6-D6, A6-D6, A7-B21, A7-P17, A7-R17, A7-P17, A7-N17, A7-N17, A7-M17, A7-M17, A7-L17, A7-L17, A7-K17, A7-K17, A7-J17, A7-J17, A7-H17, A7-H17, A7-G17, A8-J19, A8-F18, A8-F18, A8-S17, A8-J19, A9-P18, A10-R13, A11-T5 |
| Zero Detect     | 1259 | 2.5.9     | A8-D23  |
| Zero Freq Voltg | 606  | 2.13.15   | A9-P5, A9-N5, A9-K5, A9-G5  |

## APPENDIX D

### PARAMETER ID NUMBER CROSS-REFERENCE

| ID  | NAME             | MENU    |
|-----|------------------|---------|
| 1   | Freq out         | 1.3.27  |
| 2   | Motor Speed      | 1.3.1   |
| 3   | Motor Current    | 1.3.2   |
| 4   | Motor Torque     | 1.3.4   |
| 5   | Motor Power      | 1.3.5   |
| 6   | Motor Voltage    | 1.3.6   |
| 7   | DCVoltage        | 1.3.7   |
| 8   | Unit Temperature | 1.3.17  |
| 9   | MtrCalcTemp      | 1.3.16  |
| 15  | DIN123 Status    | 1.4.9   |
| 16  | DIN456 Status    | 1.4.10  |
| 18  | Torque Reference | 1.3.49  |
| 25  | FreqReference    | 1.3.25  |
| 37  | Active Flt Last  | 1.3.50  |
| 44  | DC_link V Unfil  | 1.3.8   |
| 45  | Mtr Cur ID       | 1.3.51  |
| 101 | Min Frequency    | 2.5.2   |
| 102 | Freq Max         | 2.5.1   |
| 103 | Accel Time 1     | 2.3.1   |
| 104 | Decel Time 1     | 2.3.2   |
| 108 | U/f Ratio Select | 2.13.28 |
| 109 | U/f Optimization | 2.13.29 |
| 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    | 2.13.27 |
| 121 | Panel Ref Src    | 2.2.6   |
| 122 | Remote Ref Src   | 2.2.7   |
| 123 | Keypad Spd Dir   | 3.1     |
| 500 | Smooth Ratio     | 2.3.3   |
| 501 | Smooth Ratio 2   | 2.3.5   |
| 503 | Fast Stop Tim    | 2.3.4   |
| 505 | Start Function   | 2.9.5   |
| 515 | Stop DC-BrakeFr  | 2.13.10 |
| 516 | Start DC-BrakeTm | 2.13.26 |
| 519 | FluxBrakeCurrent | 2.13.11 |
| 520 | Flux Brake       | 2.13.30 |
| 521 | Motor Ctrl Mode2 | 2.13.7  |
| 600 | Motor Ctrl Mode  | 2.13.6  |
| 601 | Switching Freq   | 2.13.16 |
| 602 | Field WeakingPnt | 2.2.9   |
| 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 | Overtolt Contr   | 2.9.8     |
| 608 | UV Contrl        | 2.9.9     |
| 610 | Trq Lim Kp       | 2.4.28    |
| 611 | Trq Lim Ki       | 2.4.29    |
| 612 | MagnCurrent      | 2.13.17   |
| 613 | Speed Control Kp | 2.4.1     |
| 614 | Speed Control Ti | 2.4.2     |
| 615 | Strt 0 Spd Time  | 2.3.6     |
| 616 | Stop 0 Spd Time  | 2.3.7     |
| 617 | CurrentControlKp | 2.4.12    |
| 618 | Encoder1FiltTime | 2.10.5.20 |
| 619 | Slip Adjust      | 2.13.18   |
| 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      | 2.4.30    |
| 638 | Spd Cont Ki      | 2.4.31    |
| 639 | Trq Cntrl Kp     | 2.4.33    |
| 640 | Trq Cntrl Ki     | 2.4.34    |
| 644 | Torq Speed Limit | 2.5.14    |
| 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   |
| 701 | Ext Flt Resp     | 2.1.7     |
| 702 | Phase Supv F     | 2.1.11    |
| 703 | Earth Fault      | 2.1.12    |
| 704 | Therm Prot F     | 2.1.13    |
| 705 | MotAmbTempFactor | 2.1.14    |
| 706 | Mot Therm 0 Spd  | 2.1.15    |
| 707 | Mtr Therm TC     | 2.1.16    |
| 708 | Motor Duty Cycle | 2.1.17    |
| 713 | ULoad Protect F  | 2.1.18    |
| 714 | Under Ld Trq Nom | 2.1.19    |
| 715 | Under Ld Trq 0   | 2.1.20    |
| 716 | Under Ld State T | 2.1.21    |
| 717 | Auto Rst Wait    | 2.1.25    |

| ID   | NAME              | MENU     |
|------|-------------------|----------|
| 718  | Auto Rst SVTime   | 2.1.26   |
| 719  | Auto Rst StartM   | 2.1.27   |
| 720  | Auto Rst UV Trls  | 2.1.28   |
| 721  | Auto Rst OV Trls  | 2.1.29   |
| 722  | Auto Rst OC Trls  | 2.1.30   |
| 725  | Auto Rst ExtF T   | 2.1.32   |
| 726  | Auto Rst Mtr OT   | 2.1.31   |
| 727  | UVolt Fault Resp  | 2.1.10   |
| 730  | Input Ph. Superv  | 2.1.9    |
| 732  | ThermistorF.Resp  | 2.1.22   |
| 733  | FBCComm.FaultResp | 2.1.23   |
| 734  | SPI Flt Resp      | 2.1.24   |
| 738  | Auto Rst Uload T  | 2.1.33   |
| 1001 | One Bit           | 2.15.1   |
| 1002 | Zero Bit          | 2.15.2   |
| 1003 | Watchdog Out      | 1.2.76   |
| 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         | 1.4.11   |
| 1022 | Not DIN 2         | 1.4.12   |
| 1023 | Not DIN 3         | 1.4.13   |
| 1024 | Not DIN 4         | 1.4.14   |
| 1025 | Not DIN 5         | 1.4.15   |
| 1026 | Not DIN 6         | 1.4.16   |
| 1027 | Not DIN 7         | 1.4.17   |
| 1028 | Not DIN 8         | 1.4.18   |
| 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  |
| 1048 | FB Bit08          | 1.6.1.9  |
| 1049 | FB Bit09          | 1.6.1.10 |
| 1050 | FB Bit10          | 1.6.1.11 |
| 1051 | FB Bit11          | 1.6.1.12 |
| 1052 | FB Bit12          | 1.6.1.13 |
| 1053 | FB Bit13          | 1.6.1.14 |
| 1054 | FB Bit14          | 1.6.1.15 |
| 1055 | FB Bit15          | 1.6.1.16 |
| 1058 | MD Drive OK       | 1.7.9    |
| 1059 | MD Watchdog       | 1.7.11   |
| 1060 | MD Run Enable     | 1.7.10   |
| 1061 | In Ess            | 1.2.60   |
| 1062 | In Rem Spd        | 1.2.61   |
| 1063 | In Rem Trq        | 1.2.62   |
| 1064 | S1                | 1.2.63   |
| 1065 | S2                | 1.2.64   |
| 1066 | S3                | 1.2.65   |
| 1067 | S4                | 1.2.66   |
| 1068 | Spd Tim Dn        | 1.2.67   |

| ID   | NAME            | MENU   |
|------|-----------------|--------|
| 1069 | Spd Tim En      | 1.2.68 |
| 1070 | Spd Timing      | 1.2.69 |
| 1071 | T1              | 1.2.70 |
| 1072 |                 | 1.2.71 |
| 1073 |                 | 1.2.72 |
| 1074 |                 | 1.2.73 |
| 1075 | TT              | 1.2.74 |
| 1086 | MC Reverse      | 1.2.6  |
| 1087 | Jog FR Input    | 1.2.18 |
| 1088 | Drive OK        | 1.2.1  |
| 1089 | Start Input     | 1.2.10 |
| 1090 | RunRequest      | 1.2.19 |
| 1091 | Run OK          | 1.2.9  |
| 1092 | Jog R En        | 1.2.17 |
| 1093 | Jog F En        | 1.2.16 |
| 1094 | Jog enable      | 1.2.15 |
| 1095 | Thread Enable   | 1.2.14 |
| 1096 | Run Enable      | 1.2.12 |
| 1097 | RJT Enable      | 1.2.13 |
| 1098 | MC Run          | 1.2.3  |
| 1099 | Cntrl Inhib     | 1.2.2  |
| 1100 | CM0             | 1.2.56 |
| 1101 | CM1             | 1.2.57 |
| 1102 | CM2             | 1.2.58 |
| 1103 | CM3             | 1.2.59 |
| 1104 | ESS Dn          | 1.2.50 |
| 1105 | ESS En          | 1.2.51 |
| 1107 | ESS Not Lit     | 1.2.53 |
| 1108 | Goto ESS        | 1.2.54 |
| 1109 | Goto Spd        | 1.2.55 |
| 1112 | Local Stop Flt  | 1.2.22 |
| 1113 | Mtr Cur Unfil   | 1.3.3  |
| 1114 | Over Temp Warn  | 1.2.23 |
| 1115 | MC Ready        | 1.2.4  |
| 1116 | MC Fault        | 1.2.5  |
| 1117 | MC Warning      | 1.2.8  |
| 1118 | MC AtSpeed      | 1.2.7  |
| 1119 | Therm Fault Act | 1.2.24 |
| 1120 | Therm Warn Act  | 1.2.25 |
| 1121 | PC Control      | 1.2.20 |
| 1125 | Mtr Torq Unfil  | 1.3.20 |
| 1127 | At Zero Spd     | 1.2.48 |
| 1128 | Reverse         | 1.2.11 |
| 1129 | Neg Spd Ref     | 1.2.21 |
| 1152 | Sp Cmp1 Eq      | 1.2.38 |
| 1153 | Sp Cmp1 Out     | 1.2.39 |
| 1156 | Sp Dly1 Out     | 1.2.40 |
| 1158 | Sp Litch1 Out   | 1.2.41 |
| 1161 | Sp Inv1 Out     | 1.2.42 |
| 1162 | Sp Inv2 Out     | 1.2.43 |
| 1164 | Sp And1 Out     | 1.2.44 |
| 1165 | Sp And2 Out     | 1.2.45 |
| 1167 | Sp Or1 Out      | 1.2.46 |
| 1168 | Sp Or2 Out      | 1.2.47 |
| 1172 | MD WD OK        | 1.7.2  |
| 1173 | SB Comm Flt     | 1.7.13 |
| 1200 | Zero Analog     | 2.15.3 |
| 1201 | One Analog      | 2.15.4 |
| 1202 | Int Ten         | 2.15.5 |

| ID   | NAME             | MENU      |
|------|------------------|-----------|
| 1203 | Int Hundred      | 2.15.6    |
| 1204 | Int Thousand     | 2.15.7    |
| 1234 | WK Stpt          | 2.2.26    |
| 1235 | Rem Trq Stpt     | 2.2.25    |
| 1237 | Rem Spd Stpt     | 2.2.24    |
| 1238 | WK Scaling       | 2.6.15    |
| 1239 | Trq Scl Mlt      | 2.6.14    |
| 1240 | Trq Scl Div      | 2.6.13    |
| 1241 | Trq Ref Rate     | 2.3.19    |
| 1242 | Spd Trq Lim      | 2.5.28    |
| 1243 | Max ESS Lim      | 2.5.27    |
| 1244 | M Trq Stpt       | 2.2.23    |
| 1245 | M Spd Stpt       | 2.2.22    |
| 1246 | Loss Tbl Gn      | 2.6.12    |
| 1247 | Lit Speed        | 2.2.21    |
| 1248 | ESS Lit Stpt     | 2.2.20    |
| 1249 | ESS Int Gn       | 2.4.38    |
| 1250 | DUT Max Spd      | 2.5.25    |
| 1251 | Con Mode         | 2.2.19    |
| 1252 | Speed Step       | 2.12.26   |
| 1253 | Torque Step      | 2.12.27   |
| 1254 | Run Speed        | 2.2.1     |
| 1255 | Thread Speed     | 2.2.2     |
| 1256 | Jog F Speed      | 2.2.3     |
| 1257 | Jog R Speed      | 2.2.4     |
| 1258 | Ovr Spd Stp      | 2.5.8     |
| 1259 | Zero Detect      | 2.5.9     |
| 1260 | Trq Base Spd     | 2.2.27    |
| 1261 | Trq End Spd      | 2.2.28    |
| 1262 | GR Whole         | 2.6.16    |
| 1263 | GR Decimal       | 2.6.17    |
| 1273 | Spd Slk Up       | 2.2.5     |
| 1274 | Trq Ref Max      | 2.5.12    |
| 1275 | Trq_Ref_Min      | 2.5.13    |
| 1290 | Trq Rmp Rate     | 2.3.9     |
| 1291 | Mtr Cur Limit    | 2.5.3     |
| 1292 | Max Spd RPM      | 2.5.24    |
| 1294 | Counter1 Dec     | 2.10.5.10 |
| 1295 | Counter1 Mult    | 2.10.5.11 |
| 1296 | Counter2 Dec     | 2.10.5.15 |
| 1297 | Counter2 Mult    | 2.10.5.16 |
| 1298 | Trq Ref Off      | 2.6.10    |
| 1299 | Trq Ref Gn       | 2.6.11    |
| 1300 | Pos Freq Limit   | 2.5.17    |
| 1301 | Neg Freq Limit   | 2.5.18    |
| 1302 | Trq Ref StA      | 2.2.8     |
| 1305 | Motoring Trq Lim | 2.5.4     |
| 1306 | Gener Trq Lim    | 2.5.5     |
| 1307 | Trq Lim FWD      | 2.5.6     |
| 1308 | Trq Lim REV      | 2.5.7     |
| 1309 | Freq Ref LP TC   | 2.3.8     |
| 1323 | Sp MD1 Dv        | 2.6.3     |
| 1324 | Sp MD1 Mlt       | 2.6.4     |
| 1325 | Sp MD2 Dv        | 2.6.5     |
| 1326 | Sp MD2 Mlt       | 2.6.6     |
| 1327 | Sp Add Val       | 2.6.7     |
| 1328 | Sp Sub Val       | 2.6.8     |
| 1329 | Sp LP Fil TC     | 2.3.10    |
| 1330 | Sp Sum1 StA      | 2.2.10    |

| ID   | NAME             | MENU    |
|------|------------------|---------|
| 1331 | Sp Sum1 StB      | 2.2.11  |
| 1332 | Sp Sum1 StC      | 2.2.12  |
| 1337 | Sp Sel1 ST0      | 2.2.13  |
| 1338 | Sp Sel1 ST1      | 2.2.14  |
| 1339 | Sp Sel2 ST0      | 2.2.15  |
| 1340 | Sp Sel2 ST1      | 2.2.16  |
| 1345 | Sp Cmp1_Hyst     | 2.2.17  |
| 1346 | Sp Cmp1_Stpt     | 2.2.18  |
| 1349 | Sp Dly1 TOFF     | 2.3.11  |
| 1350 | Sp Dly1 TON      | 2.3.12  |
| 1353 | Sp Lim Max       | 2.5.22  |
| 1354 | Sp Lim Min       | 2.5.23  |
| 1355 | Flux Curve a     | 2.12.1  |
| 1356 | Flux Curve b     | 2.12.2  |
| 1357 | Flux Curve c     | 2.12.3  |
| 1358 | Flux Curve d     | 2.12.4  |
| 1359 | Flux Curve e     | 2.12.5  |
| 1360 | Flux Curve f     | 2.12.6  |
| 1361 | Flux Curve g     | 2.12.7  |
| 1362 | Flux Curve h     | 2.12.8  |
| 1363 | Flux Curve i     | 2.12.9  |
| 1364 | Flux Curve j     | 2.12.10 |
| 1365 | Flux Curve k     | 2.12.11 |
| 1366 | Flux Curve l     | 2.12.12 |
| 1367 | Flux Curve m     | 2.12.13 |
| 1368 | Flux Curve n     | 2.12.14 |
| 1369 | Flux Curve o     | 2.12.15 |
| 1504 | RJT Ref          | 1.3.22  |
| 1505 | Control Place    | 1.3.18  |
| 1506 | Cntrl Mode       | 1.3.19  |
| 1507 | Freq Reference   | 1.3.23  |
| 1508 | Freq Delta       | 1.3.31  |
| 1509 | Brake Chopper    | 1.3.33  |
| 1510 | Trq Spd Tbl      | 1.3.68  |
| 1511 | BrakeResistor    | 1.3.34  |
| 1512 | Trq Lim Ref      | 1.3.67  |
| 1513 | Trq Cntrl Word   | 1.3.66  |
| 1514 | Spd Tbl Tim      | 1.3.65  |
| 1515 | Spd Ref          | 1.3.64  |
| 1516 | Spd Cntrl Word   | 1.3.63  |
| 1517 | Regen Trq Lim    | 1.3.62  |
| 1518 | Loss Tbl Out     | 1.3.61  |
| 1519 | Abs Fil Spd      | 1.3.60  |
| 1520 | Step Ref         | 1.3.35  |
| 1521 | ProcessPITrimRef | 1.3.36  |
| 1525 | MtrRegStatus     | 1.3.37  |
| 1526 | MotorCurLimit    | 1.3.38  |
| 1528 | Counter1         | 1.5.23  |
| 1529 | Counter2         | 1.5.24  |
| 1530 | SB In Cntl Word  | 1.7.3   |
| 1531 | SB In Freq Ref   | 1.7.4   |
| 1532 | SB In Int1       | 1.7.5   |
| 1533 | SB In Int2       | 1.7.6   |
| 1534 | SB Out Cntl Word | 1.7.8   |
| 1535 | SB In Trq Ref    | 1.7.7   |
| 1536 | Trq Ref Act      | 1.3.53  |
| 1537 | Trq Ref 3        | 1.3.54  |
| 1538 | Trq Ref 4        | 1.3.55  |
| 1539 | Final Iq Trq Ref | 1.3.56  |

| ID   | NAME             | MENU     |
|------|------------------|----------|
| 1540 | Final Freq Ref   | 1.3.26   |
| 1541 | Rotor Flux       | 1.3.9    |
| 1542 | Final Trq Ref    | 1.3.10   |
| 1543 | Pos Iq Cur Lim   | 1.3.11   |
| 1544 | Neg Iq Cur Lim   | 1.3.12   |
| 1545 | Iq Ref Actual    | 1.3.13   |
| 1546 | Id Ref Actual    | 1.3.14   |
| 1547 | Rotor TC         | 1.3.15   |
| 1548 | Speed Cntrl Out  | 1.3.21   |
| 1553 | Sp MD1 Out       | 1.3.39   |
| 1554 | Sp MD2 Out       | 1.3.40   |
| 1555 | Sp Add1 Out      | 1.3.41   |
| 1557 | Sp LP Fil Out    | 1.3.43   |
| 1558 | Sp ABS Out       | 1.3.44   |
| 1559 | Sp Sum1 Out      | 1.3.45   |
| 1561 | Sp Sel1 Out      | 1.3.46   |
| 1562 | Sp Sel2 Out      | 1.3.47   |
| 1565 | Sp Sub1 Out      | 1.3.42   |
| 1566 | Accel Comp       | 1.3.52   |
| 1568 | Freq Ramp Out    | 1.3.32   |
| 1570 | ABS RJT Ref      | 1.3.24   |
| 1572 | TC Pos Freq Lim  | 1.3.57   |
| 1573 | TC Neg Freq Lim  | 1.3.58   |
| 1574 | Sp Lim Out       | 1.3.48   |
| 1590 | AOUT1 Val        | 1.5.17   |
| 1591 | AOUT2 Val        | 1.5.18   |
| 1592 | AOUT3 Val        | 1.5.19   |
| 1593 | AOUT4 Val        | 1.5.20   |
| 1601 | AIN1             | 1.5.9    |
| 1602 | AIN2             | 1.5.10   |
| 1603 | AIN3             | 1.5.11   |
| 1604 | AIN4             | 1.5.12   |
| 1609 | Enc1_Out         | 1.5.21   |
| 1610 | Enc2_Out         | 1.5.22   |
| 1611 | FB Word In 1     | 1.6.2.1  |
| 1612 | FB Word In 2     | 1.6.2.2  |
| 1613 | FB Word In 3     | 1.6.2.3  |
| 1614 | FB Word In 4     | 1.6.2.4  |
| 1615 | FB Word In 5     | 1.6.2.5  |
| 1616 | FB Word In 6     | 1.6.2.6  |
| 1617 | FB Word In 7     | 1.6.2.7  |
| 1618 | FB Word In 8     | 1.6.2.8  |
| 1619 | FB Word In 9     | 1.6.2.9  |
| 1620 | FB Word In 10    | 1.6.2.10 |
| 1621 | FB Fix Cntrl Wrd | 1.6.1.17 |
| 1622 | FB Word Out 1    | 1.6.3.1  |
| 1623 | FB Word Out 2    | 1.6.3.2  |
| 1624 | FB Word Out 3    | 1.6.3.3  |
| 1625 | FB Word Out 4    | 1.6.3.4  |
| 1626 | FB Word Out 5    | 1.6.3.5  |
| 1627 | FB Word Out 6    | 1.6.3.6  |
| 1628 | FB Word Out 7    | 1.6.3.7  |
| 1629 | FB Word Out 8    | 1.6.3.8  |
| 1630 | FB Gen Cntl Wrd  | 1.6.1.18 |
| 1631 | FB Gen Sts Word  | 1.6.1.19 |
| 1632 | FB Spd Ref       | 1.6.2.11 |
| 1700 | X0               | 2.11.1.1 |
| 1701 | X1               | 2.11.1.2 |
| 1702 | X2               | 2.11.1.3 |

| ID   | NAME | MENU      |
|------|------|-----------|
| 1703 | X3   | 2.11.1.4  |
| 1704 | X4   | 2.11.1.5  |
| 1705 | X5   | 2.11.1.6  |
| 1706 | X6   | 2.11.1.7  |
| 1707 | X7   | 2.11.1.8  |
| 1708 | X8   | 2.11.1.9  |
| 1709 | X9   | 2.11.1.10 |
| 1710 | X10  | 2.11.1.11 |
| 1711 | X11  | 2.11.1.12 |
| 1712 | X12  | 2.11.1.13 |
| 1713 | X13  | 2.11.1.14 |
| 1714 | X14  | 2.11.1.15 |
| 1715 | X15  | 2.11.1.16 |
| 1716 | X16  | 2.11.1.17 |
| 1717 | X17  | 2.11.1.18 |
| 1718 | X18  | 2.11.1.19 |
| 1719 | X19  | 2.11.1.20 |
| 1720 | X20  | 2.11.1.21 |
| 1721 | X21  | 2.11.1.22 |
| 1722 | X22  | 2.11.1.23 |
| 1723 | X23  | 2.11.1.24 |
| 1748 | Y0   | 2.11.1.25 |
| 1749 | Y1   | 2.11.1.26 |
| 1750 | Y2   | 2.11.1.27 |
| 1751 | Y3   | 2.11.1.28 |
| 1752 | Y4   | 2.11.1.29 |
| 1753 | Y5   | 2.11.1.30 |
| 1754 | Y6   | 2.11.1.31 |
| 1755 | Y7   | 2.11.1.32 |
| 1756 | Y8   | 2.11.1.33 |
| 1757 | Y9   | 2.11.1.34 |
| 1758 | Y10  | 2.11.1.35 |
| 1759 | Y11  | 2.11.1.36 |
| 1760 | Y12  | 2.11.1.37 |
| 1761 | Y13  | 2.11.1.38 |
| 1762 | Y14  | 2.11.1.39 |
| 1763 | Y15  | 2.11.1.40 |
| 1764 | Y16  | 2.11.1.41 |
| 1765 | Y17  | 2.11.1.42 |
| 1766 | Y18  | 2.11.1.43 |
| 1767 | Y19  | 2.11.1.44 |
| 1768 | Y20  | 2.11.1.45 |
| 1769 | Y21  | 2.11.1.46 |
| 1770 | Y22  | 2.11.1.47 |
| 1771 | Y23  | 2.11.1.48 |
| 1796 | X0   | 2.11.2.1  |
| 1797 | X1   | 2.11.2.2  |
| 1798 | X2   | 2.11.2.3  |
| 1799 | X3   | 2.11.2.4  |
| 1800 | X4   | 2.11.2.5  |
| 1801 | X5   | 2.11.2.6  |
| 1802 | X6   | 2.11.2.7  |
| 1803 | X7   | 2.11.2.8  |
| 1804 | X8   | 2.11.2.9  |
| 1805 | X9   | 2.11.2.10 |
| 1806 | X10  | 2.11.2.11 |
| 1807 | X11  | 2.11.2.12 |
| 1808 | X12  | 2.11.2.13 |
| 1809 | X13  | 2.11.2.14 |

| ID   | NAME | MENU      |
|------|------|-----------|
| 1810 | X14  | 2.11.2.15 |
| 1811 | X15  | 2.11.2.16 |
| 1812 | X16  | 2.11.2.17 |
| 1813 | X17  | 2.11.2.18 |
| 1814 | X18  | 2.11.2.19 |
| 1815 | X19  | 2.11.2.20 |
| 1816 | X20  | 2.11.2.21 |
| 1817 | X21  | 2.11.2.22 |
| 1818 | X22  | 2.11.2.23 |
| 1819 | X23  | 2.11.2.24 |
| 1844 | Y0   | 2.11.2.25 |
| 1845 | Y1   | 2.11.2.26 |
| 1846 | Y2   | 2.11.2.27 |
| 1847 | Y3   | 2.11.2.28 |
| 1848 | Y4   | 2.11.2.29 |
| 1849 | Y5   | 2.11.2.30 |
| 1850 | Y6   | 2.11.2.31 |
| 1851 | Y7   | 2.11.2.32 |
| 1852 | Y8   | 2.11.2.33 |
| 1853 | Y9   | 2.11.2.34 |
| 1854 | Y10  | 2.11.2.35 |
| 1855 | Y11  | 2.11.2.36 |
| 1856 | Y12  | 2.11.2.37 |
| 1857 | Y13  | 2.11.2.38 |
| 1858 | Y14  | 2.11.2.39 |
| 1859 | Y15  | 2.11.2.40 |
| 1860 | Y16  | 2.11.2.41 |
| 1861 | Y17  | 2.11.2.42 |
| 1862 | Y18  | 2.11.2.43 |
| 1863 | Y19  | 2.11.2.44 |
| 1864 | Y20  | 2.11.2.45 |
| 1865 | Y21  | 2.11.2.46 |
| 1866 | Y22  | 2.11.2.47 |
| 1867 | Y23  | 2.11.2.48 |
| 1892 | X0   | 2.11.3.1  |
| 1893 | X1   | 2.11.3.2  |
| 1894 | X2   | 2.11.3.3  |
| 1895 | X3   | 2.11.3.4  |
| 1896 | X4   | 2.11.3.5  |
| 1897 | X5   | 2.11.3.6  |
| 1898 | X6   | 2.11.3.7  |
| 1899 | X7   | 2.11.3.8  |
| 1900 | X8   | 2.11.3.9  |
| 1901 | X9   | 2.11.3.10 |
| 1902 | X10  | 2.11.3.11 |
| 1903 | X11  | 2.11.3.12 |
| 1904 | X12  | 2.11.3.13 |
| 1905 | X13  | 2.11.3.14 |
| 1906 | X14  | 2.11.3.15 |
| 1907 | X15  | 2.11.3.16 |
| 1908 | X16  | 2.11.3.17 |
| 1909 | X17  | 2.11.3.18 |
| 1910 | X18  | 2.11.3.19 |
| 1911 | X19  | 2.11.3.20 |
| 1912 | X20  | 2.11.3.21 |
| 1913 | X21  | 2.11.3.22 |
| 1914 | X22  | 2.11.3.23 |
| 1915 | X23  | 2.11.3.24 |
| 1940 | Y0   | 2.11.3.25 |

| ID   | NAME | MENU      |
|------|------|-----------|
| 1941 | Y1   | 2.11.3.26 |
| 1942 | Y2   | 2.11.3.27 |
| 1943 | Y3   | 2.11.3.28 |
| 1944 | Y4   | 2.11.3.29 |
| 1945 | Y5   | 2.11.3.30 |
| 1946 | Y6   | 2.11.3.31 |
| 1947 | Y7   | 2.11.3.32 |
| 1948 | Y8   | 2.11.3.33 |
| 1949 | Y9   | 2.11.3.34 |
| 1950 | Y10  | 2.11.3.35 |
| 1951 | Y11  | 2.11.3.36 |
| 1952 | Y12  | 2.11.3.37 |
| 1953 | Y13  | 2.11.3.38 |
| 1954 | Y14  | 2.11.3.39 |
| 1955 | Y15  | 2.11.3.40 |
| 1956 | Y16  | 2.11.3.41 |
| 1957 | Y17  | 2.11.3.42 |
| 1958 | Y18  | 2.11.3.43 |
| 1959 | Y19  | 2.11.3.44 |
| 1960 | Y20  | 2.11.3.45 |
| 1961 | Y21  | 2.11.3.46 |
| 1962 | Y22  | 2.11.3.47 |
| 1963 | Y23  | 2.11.3.48 |
|      |      |           |