








SECTION 3 - PROGRAMMING THE DELTA DRIVER

The Delta Driver is a fully digital driver that has a rich set of motion control building blocks that are configurable using the driver's software. A built in keypad and display are used to set internal parameters that configure the driver's software building blocks into user defined motion functions.

An easy to use menu scheme allows the user to:

- Set the basic mode of operation
- Activate optional features
- Define I/O functions
- Monitor key parameters and alarms
- Adjust driver parameters
- Manual or automatic tuning of the motor and driver
- Manual testing of driver operation

The drivers keypad and display are shown in **Figure 3.1**. The functions are as follows:

- **LED DISPLAY** is a 5-digit unit that displays coded messages, alarms and parameter values. Messages are displayed in coded bit patterns, hexadecimal, decimal and coded letters.
- **UP-ARROW**  is used to navigate around the minor menu loops, to increase the value of a parameter and in combination with other keys for special functions.
- **DOWN-ARROW**  is used to navigate around the minor menu loops, to decrease the value of a parameter and in combination with other keys for special functions.
- **SELECT**  is used to identify which digit of the display is selected for modification (flashing). This key is also used in combination with the **CONFIRM**  key to prepare a parameter for modification.
- **MODE**  is used to navigate the main menu loop and to return to the main menu loop from the minor loops.
- **CONFIRM**  is used to confirm a parameter value and to set into non-volatile memory and to reset alarms. This key is also used in combination with the **SELECT**  key to prepare a parameter for modification.
- **FLASHING DECIMAL POINT** indicates that an alarm is active.

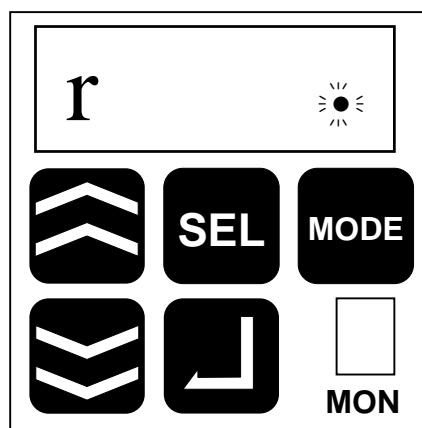










Figure 3.1 - Delta Driver Keypad and Display







3.1 NAVIGATING THE DRIVER'S MENU

The menu structure for programming the driver consists of a main menu loop with several minor menu loops and the Special Menu. The main menu loop and partial sections of the minor loops are shown in **Figure 3.2** below.

The major loop is shown vertically on the left side of the diagram. There are four major items on the main menu loop. Each of these items is the starting point for minor menu loops.

- **STATUS DISPLAY** minor menu loop contains drive and motor status displays such as motor speed, motor position, following error, etc.
- **DIAGNOSTIC DISPLAY** minor menu loop provides diagnostic information such as I/O status, alarms and alarm history.
- **ADJUST PARAMETER** minor menu loop contains parameters that are typically adjusted by the user. Parameters include speed scaling, servo tuning values and load inertia setting.
- **USER PARAMETER** minor menu loop contains basic configuration parameters that are usually set once per application such as control mode, motor type, electronic gear ratio and analog polarity.
- **HP PARAMETER** is a sub-menu loop from the **USER PARAMETER** minor menu. This sub-menu loop also contains configuration parameters that are less frequently used or modified.

The  key is used to move around the main menu loop. Once the main menu is positioned on the first parameter of a minor loop the  and  keys are used to move around the minor menu loop. When in the minor menu loop the  and  or the  and  keys move through the parameters in jumps of 10 rather than 1. The  mode key can be used to move from anywhere in the minor menu back to the main menu loop.

The HP parameter sub-menu is entered by putting the main menu loop on UP-01 and pressing and holding the  key then pressing both the  and  keys. Once in the HP sub-menu the  and  keys are used to move around the sub-menu. The  must be pressed twice quickly to move from the HP sub-menu back to the UP minor menu.

The Special Function Menu is used for Auto Tuning, manual jogging of the motor and forcing outputs. **Section 3.3** describes the Special Function Menu.

3.1 NAVIGATING THE DRIVER'S MENU (cont'd)

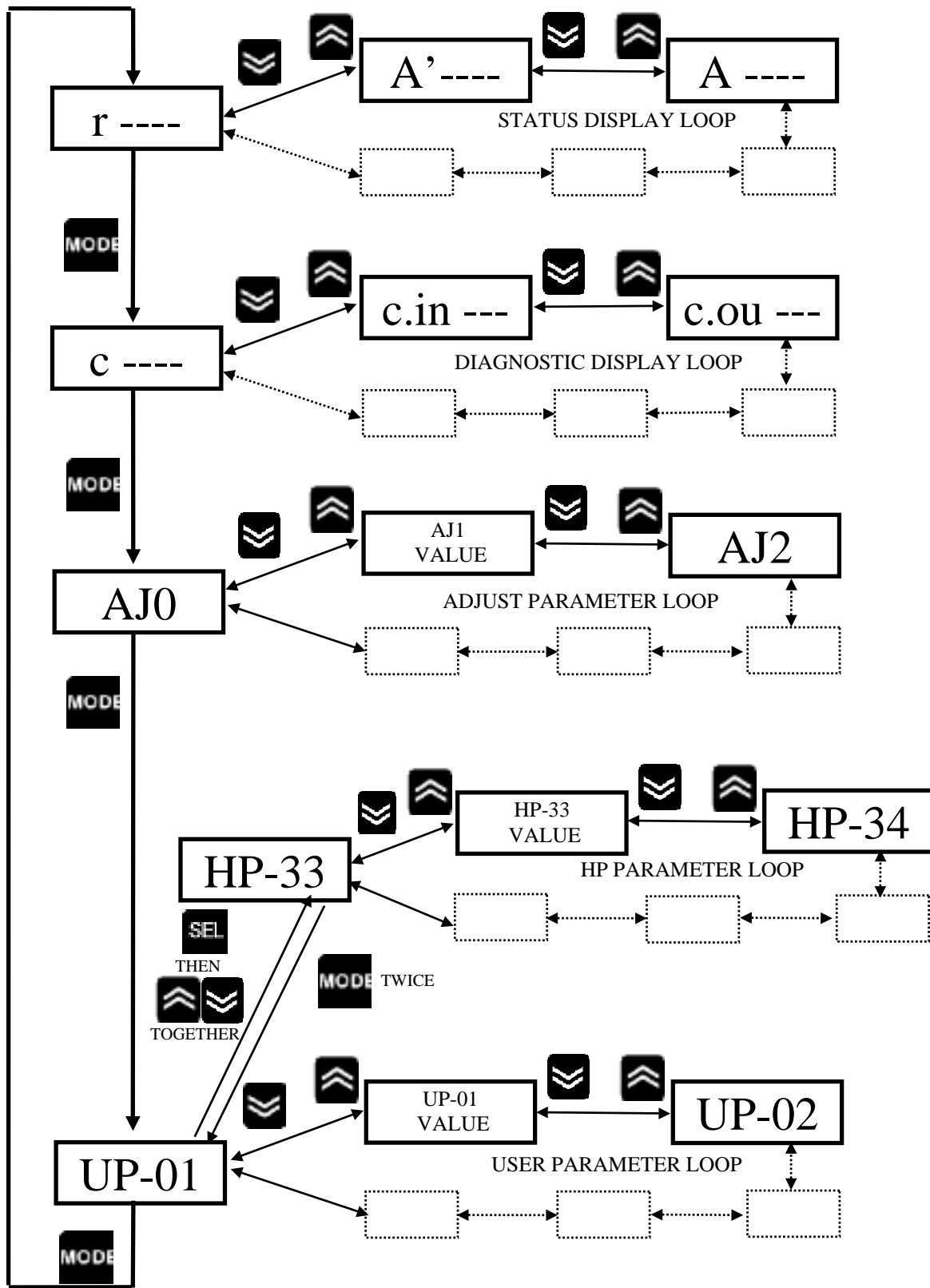


Figure 3.2 - Main Menu Loop and Minor Loops

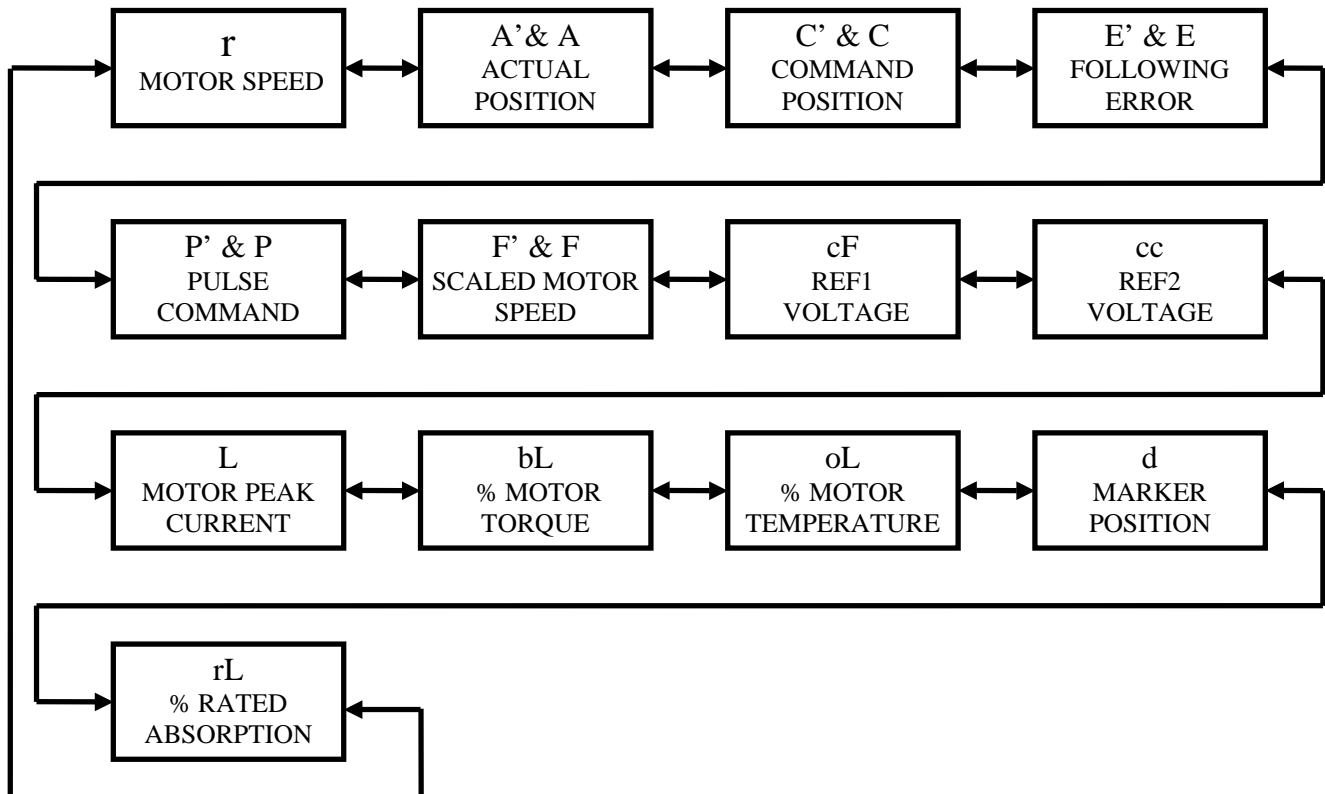
3.1.1 STATUS DISPLAY MENU LOOP

The Status Display Menu Loop provides a real time display of motor and driver status. The display format uses the left most digits for a coded message of the item to be displayed and the right most digits are the value. The coded item on the left will flash indicating negative (-) value. The sign convention is (+) is CCW and (-) is CW.

Some of the display values, such as A' & A, are too large for a single display so they are broken into two sections and are displayed on two successive menu displays. The prime (') symbol indicates the upper four (4) digits or most significant section and the non-prime symbol indicates lower four (4) digits. For example, if successive displays reads [A' 1466] and [A 6789], the ACTUAL POSITION is 14666789.

Parameters can only be read in the Status Display Menu. The driver is set to the (r) Motor Speed at power application. Any alarm will overwrite the display.

The Status Display Menu is organized as follows:



3.1.1 STATUS DISPLAY MENU LOOP (cont'd)

Status Display Descriptions:

DISPLAY ITEM	SYMBOL	RANGE & UNITS	CONTENTS
Motor rpm	r	±4000 RPM	Displays the speed of motor.
Actual Position	A' A	±9999999 Bits	Displays the actual position of the motor scaled by UP-05/UP-04 * 24000 bits/rev (driver is always 24000 bits/rev internally). With resolver feedback, the 0.0 position at power up is referenced to the nearest resolver 0.0. The Delta motors have a 2X resolver, and have two 0.0 points or markers per motor shaft rotation. When the count exceeds display range, 9999999 appears.
Command Position	C' C	±9999999 Bits	Displays the command position of the driver (scaled by UP-05/UP-04 similar to A' A above). When the count exceeds display range, 9999999 appears.
Following Error	E' E	±9999999 Bits	Displays the difference between command position and actual position (scaled by UP-05/UP-04 similar to A' A above). Used in position control modes only.
Pulse Command	P' P	+32767~32768 Pulses	Displays the pulse command input register in position control mode. This counter is a signed 16 bit counter with a range of +32767 to -32768. Counter rolls over when it reaches the maximum count (ring counter).
Scaled Motor Speed	F' F	±9999999 RPM	Displays the speed of the motor scaled by HP-41/HP-42. This used typically used to display "machine speed" if the speed exceeds display range, 9999999 appears.
REF1 Voltage	cF	±10.0 V	Displays the input voltage REF1 (speed command or speed limit depending on mode of operation).
REF2 Voltage	cc	±10.0 V	Displays the input voltage REF2 (torque command, torque limit or speed command depending on mode of operation).
Motor Peak Current	L	±160.0 A (peak)	Displays the output current to motor. "A (peak)" shows the peak value of AC current.
% Motor Torque	bL	0~255%	Displays the load ratio (output torque/rated torque) * 100%. The time constant for calculating this ratio is set by HP-33.
% Motor Temperature	oL	0~110%	Displays calculated motor temperature as a % of the maximum rating. The electronic motor thermal limit alarm activates at 110% (AL-17). oL initializes to 90% at power on.

3.1.1 STATUS DISPLAY MENU LOOP (cont'd)

Status Display Descriptions (cont'd):

DISPLAY ITEM	SYMBOL	RANGE & UNITS	CONTENTS
Marker Position	d	0~359.9 deg	Displays the motor shaft angle from the motor marker ZPD position. The driver has N marker ZPD positions depending on the resolver/encoder installed in the motor. (i.e. a motor with a 2X resolver has 2 ZPD positions per motor revolution, see motor drawings in Appendix A.6, A.7 & A.8). If the motor has 3X resolver and 3 ZPD positions, this display will go from 0.0 to 359.9 degrees 3 times per motor rotation.
% Rated Absorption	rL	0~100%	For DSD-1.5, DSD-4.25, DSD-8.5 and DSD-17.5 the display is (motor absorption torque/motor rated torque) * 100%. For DSD-35 and up the display is % rating of the regeneration resistor capacity (UL-31).

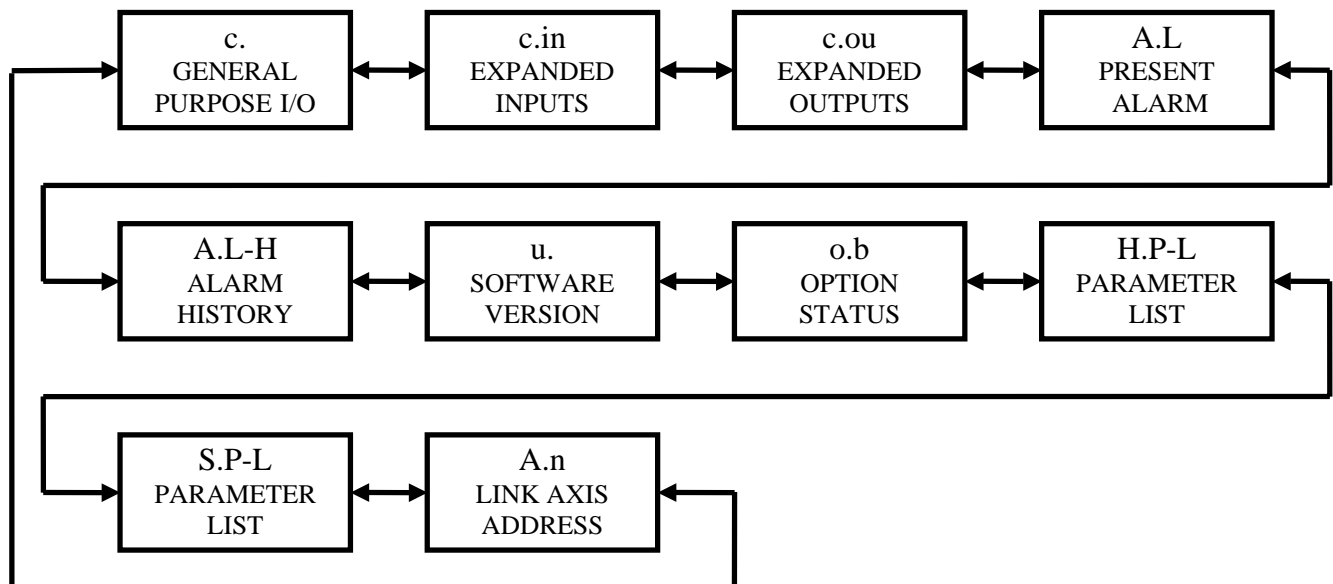
3.1.2 DIAGNOSTIC DISPLAY MENU LOOP

The Diagnostic Display Menu Loop provides a real time display of I/O points, alarms, alarm history and driver configurations. The display format uses the left most digits for a coded message of the item to be displayed and the right most digits are the value.

Some of the display values, such as A.L-H ALARM HISTORY require additional keystrokes to view the complete status. The additional keystrokes are described in the individual display descriptions.

Parameters can only be read in the Diagnostic Display Menu, with the exception that the ALARM HISTORY can be cleared.

The Diagnostic Display Menu Loop is organized as follows:











3.1.2 DIAGNOSTIC DISPLAY MENU LOOP (cont'd)

Diagnostic Display Descriptions:



DISPLAY ITEM	SYMBOL	CONTENTS
General purpose I/O	c.	<p>Displays the current I/O status using the vertical segment bars in the display. The top half of the segment bar are inputs and the bottom half are outputs. The right most vertical bar is IN0 (top half) and OUT0 (bottom half). The vertical bar just to the right of the c. is IN7 (top half) and OUT7 (bottom half). When the bar is illuminated the I/O point is ON. The I/O point can be inverted using HP-44 & HP-45. See the individual signal level I/O diagrams in Section 4.</p> <div style="text-align: center;"> <p>The diagram shows two rows of vertical bars. The top row is labeled 'IN7' on the left and 'IN0' on the right. The bottom row is labeled 'OUT7' on the left and 'OUT0' on the right. Each row contains eight bars, representing points IN0-7 and OUT0-7 respectively.</p> </div>
General Purpose Input	c.in	Not used for the modes described in the manual.
General Purpose Output	c.out	Not used for the modes described in the manual.
Alarm	A.L	<p>Displays the current alarm if present. A.L with no numbers indicates that there is no current alarm. A.L # indicates a current alarm code #. Most alarms can be reset with the key. See Section 10 for alarm code descriptions and reset method.</p>
Alarm History	A.L-H 0-E	<p>Displays the alarm history log for the previous 15 alarms. When key and key are concurrently pressed, the AL-H display changes to N.- #, where N is the position of the alarm in the history log (0 most current, E oldest) and # is the alarm code. The history log can be scrolled forward and backward using the and keys. The key returns to the A.L-H display.</p> <p>Clearing the complete alarm history is possible with software revision 10 and above. To clear the alarm history, use the keys to navigate the menu until the A.L-H is in the display.</p> <ul style="list-style-type: none"> • Concurrently press the and keys and the display changes to N.- #. • Concurrently press the and keys while holding down the key and the display changes to AHcLr. • Concurrently press the and and the display starts flashing indicating alarm clearing, then press to complete the clearing procedure. <p>Double clicking goes back to 0. - and another press of returns to A.L-H.</p>
Software Version	u.	Displays the revision of the operating system software.

3.1.2 DIAGNOSTIC DISPLAY MENU LOOP (cont'd)

Diagnostic Display Descriptions (cont'd):

DISPLAY ITEM	SYMBOL	CONTENTS
Option Status	o.b	Displays the status of any option modules installed. 00: No options 02: 14 bit A/D converter
HP Parameter Change History	H.P-L	Displays a history of the HP parameters that have been changed. When  key and  key are concurrently pressed the display changes to a list of HP-# parameters that have been changed. The history log is 65 deep. The history log can be scrolled forward and backward using the  and  keys.
SP Parameter Change List	S.P-L	Displays a history of the SP that have been changed. When  key and  key are concurrently pressed the display changes to a list of SP-# parameters that have been changed. The history log is 65 deep. The history log can be scrolled forward and backward using the  and  keys.
Link Axis No.	A.n	N/A to the Delta driver without option module.

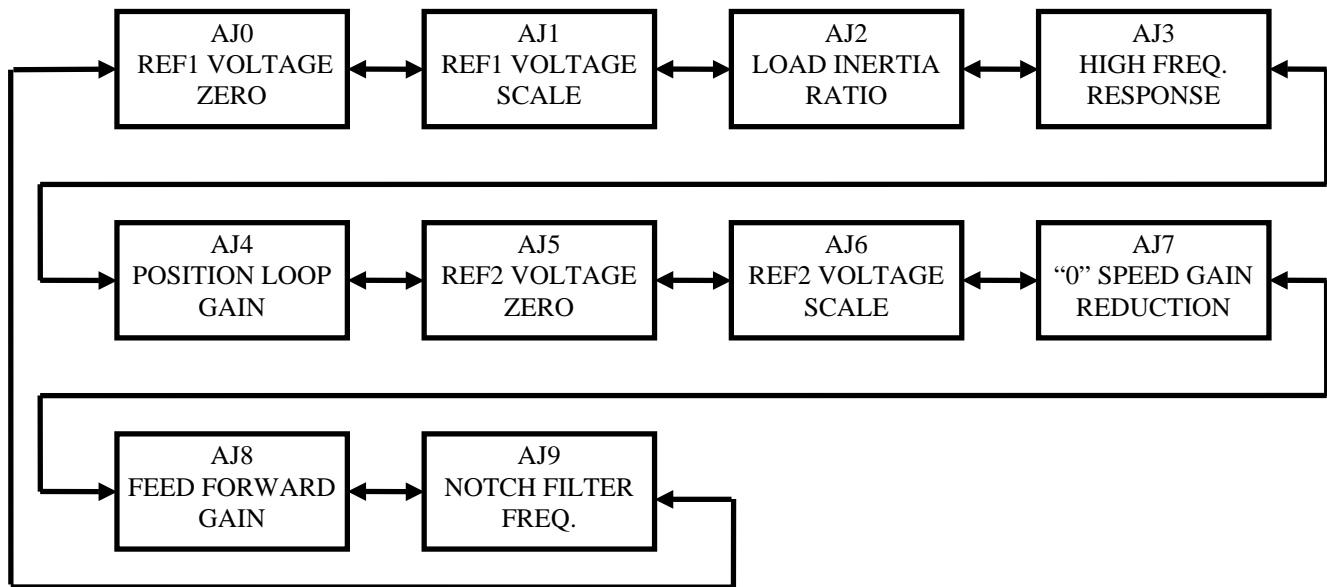
3.1.3 ADJUSTMENT PARAMETER MENU LOOP

The Adjustment Parameter Menu Loop provides access to setup and tuning parameters that are commonly used. Each parameter is displayed in two successive displays. The coded parameter name appears on the first display and the parameter value appears on the second display. The  key will always move from the parameter-coded name to the parameter value. The  key will always move from the parameter value to the coded parameter name. If the parameter value is negative, a (-) sign appears in the left most digit of the display.





Parameters can be read or written in the Adjust Parameter Menu Loop. The procedure to write into a parameter is found in [Section 3.2](#).

The Adjustment Parameter Menu Loop is organized as follows:



The Adjustment Parameters have different meaning and content depending on the mode of operation of the driver. The detailed descriptions of the Adjustment Parameters are listed in [Section 4](#) of this manual as part of the description of each of the individual modes.

3.1.4 USER PARAMETER MENU LOOP

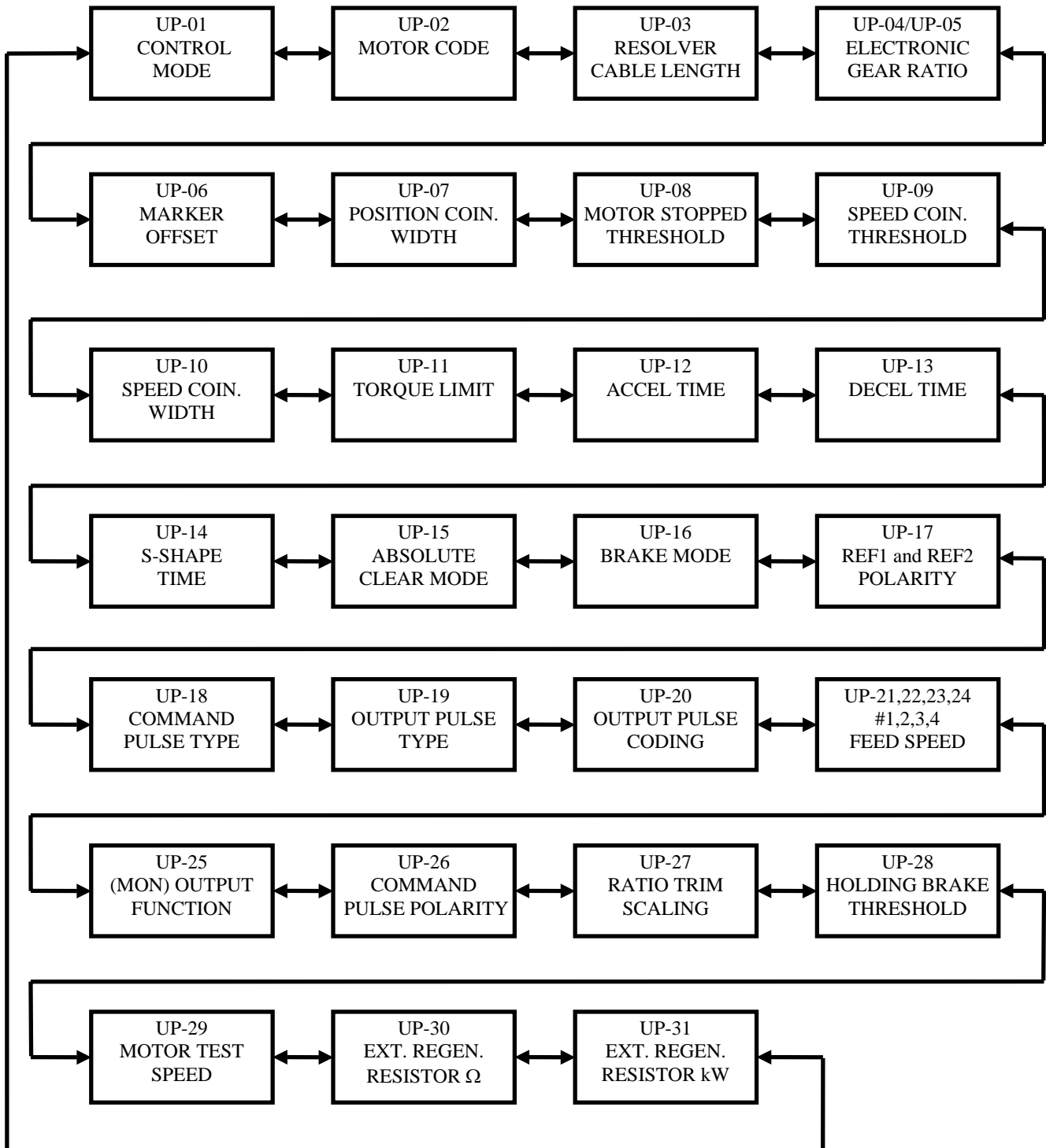
The User Parameter Menu Loop provides access to basic setup parameters that are commonly used. Each parameter is displayed in two successive displays. The coded parameter name appears on the first display and the parameter value appears on the second display. The  key will always move from the parameter-coded name to the parameter value. The  key will always move from the parameter value to the coded parameter name.





Parameters can be read or written in the User Parameter Menu Loop. The procedure to write into a parameter is found in [Section 3.2](#).

3.1.4 USER PARAMETER MENU LOOP (cont'd)

The User Parameter Menu Loop is organized as follows:



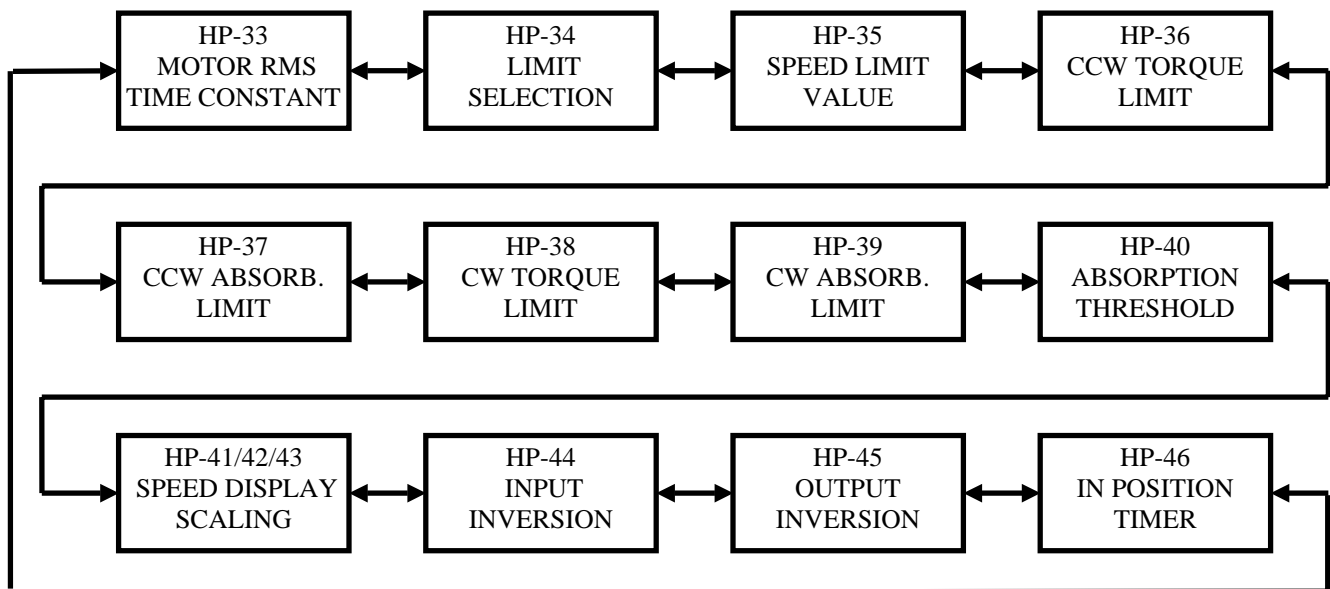
3.1.5 HP PARAMETER MENU LOOP

The HP Parameter Menu Loop provides access to basic setup parameters that are less commonly used. Each parameter is displayed in two successive displays. The coded parameter name appears on the first display and the parameter value appears on the second display. The  key will always move from the parameter-coded name to the parameter value. The  key will always move from the parameter value to the coded parameter name.




Parameters can be read or written in the HP Parameter Menu Loop. The procedure to write into a parameter is found in [Section 3.2](#).















The HP Parameter Menu Loop is organized as follows:






3.2 WRITING NEW VALUES IN READ/WRITE PARAMETERS

Many parameters require adjustment or modification to properly configure the Delta driver. These parameters include AJ, UP and HP. The procedure for changing these parameters is the same and is described in this section. Although the parameter is changed in the display, pressing the  key is required to log the new parameter value in the driver's non-volatile memory.

To change a parameter:

- Navigate the main menu using the    keys to get the parameter name to be changed in the display. See [Figure 3.2](#).
- Press the  key to get the parameter value in the display.
- Concurrently press the  and  keys to prepare the parameter for change. The least significant digit in the display will now be flashing, indicating that the least significant digit can be increased or decreased with the   keys.
- Use the  key to move the flashing digit to the left to prepare another digit in the display for change. When the flashing digit reaches the left most position one more  key press will return the flashing digit to the right most position.
- Repeating the above steps, change the display to the new desired value.
- Press the  to log the new parameter setting in the Delta driver's non-volatile memory.
- The    keys can again be used to navigate the main menu.

Changes in the AJ parameters take effect when the parameter is changed using the   keys. The UP and HP parameters require pressing the  key to have the parameter change take effect.

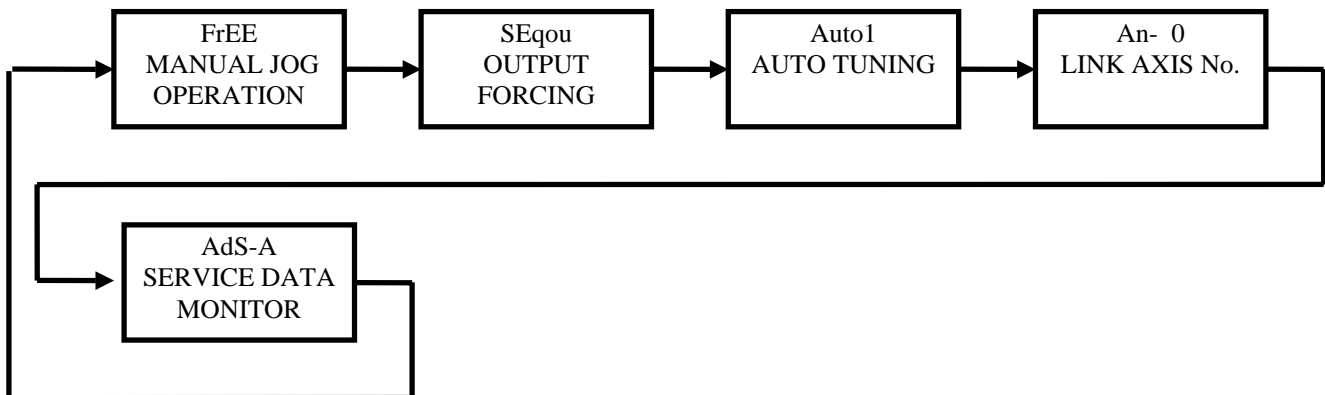
The following parameters require a power OFF, power ON cycle to have the parameter take effect: AJ-9, UP-01, UP-02, UP-03, UP-04, UP-05 & UP-16.

3.3 NAVIGATING THE SPECIAL FUNCTION MENU LOOP

The Special Function Menu Loop provides special diagnostic and setup functions. Enter the Special Function Menu by concurrently pressing the keys for 5 seconds while the Main Menu status display shows motor speed [r 0]. The special menu will appear with the display showing [FrEE]. To exit the Special Function Menu double click the key.

Once in the Special Menu the key is used to move around the menu loop.

The Special Menu Loop is organized as follows:



3.3.1 MANUAL JOG OPERATION

The driver can be jogged manually using the front panel keyboard switches. The jog speed is set by UP-29 and the accel/decel rate is set by UP-12, UP-13 or UP-14. The normal brake sequencing of BRAKE OUTPUT and BRAKE CONFIRM must be observed during jog operation.








Caution should be used when manually jogging the motor. Be sure all personnel are clear of moving parts and that the motor's movement is not restricted by ancillary moving mechanisms.

- Use the key to locate the FrEE menu display in the Special Menu.
- Activate the servo by pressing key. The display shows the current jog speed [L 0]
- Jog the motor CCW using the key or CW by using the key. The motor continues to run as long as the key is held down.
- Pressing the keys together latches the motor in jog CCW until the or key is momentarily pressed to unlatch the jog operation and stop the motor. The keys provide similar latched jog operation in the CW direction.
- Deactivate the servo by pressing key. The display returns to [FrEE].

3.3.2 OUTPUT FORCING FUNCTION

The Delta driver has 8 outputs that are controlled by the driver. The functions of these outputs in normal operation are described in [Section 4](#). The normal ON/OFF state of these outputs can be forced using the Output Forcing Function in the Special Menu.

Caution should be used when forcing output states. The outputs may activate ancillary equipment or cause other motion or events to occur. Forcing the output may create a danger to personnel or equipment.

- Use the  key to locate the SEqou menu display in the Special Menu.
- Outputs maintain their current state coming into the Output Forcing Function.
- Activate the Output Forcing Function by concurrently pressing   keys. The display shows [50x.-y] where x is the bit number of the output to be forced ON or OFF and y is the current state of the output where 1 = ON and 0 = OFF. The bit number x corresponds to the output number 0->7. The bit number can be changed using the   keys.
- The selected bit number output is forced to toggle state with successive presses of the  key.
- Pressing the  key returns to the Special Function Menu and the display reads [SEqou]. The active outputs return to their normal state rather than the forced state. Outputs that have no active function in the current driver mode of operation are left in the state set by the Output Forcing Function.

3.3.3 AUTO TUNING

The Delta provides an automatic servo parameter tuning function. Auto Tuning is accessed via the Special Function Menu. [Section 6](#) of this manual is dedicated to auto and manual tuning of the driver parameters. See [Section 6](#) for Auto Tuning procedure.

3.3.4 LINK AXIS NUMBER

The Link Axis Number is only used when the Delta Driver is fitted with the Link Axis option. See the appropriate technical manual for this option.

3.3.5 SERVICE DATA MONITOR

The Delta Driver contains detailed service information. The Service Data Monitor contains detailed coded information meant for a qualified IIS Technician. There is no user serviceable information in this menu item. Contact IIS for any service related issues.

