

## SECTION 6 - DRIVER TUNING

The Delta driver may be tuned using a built in Automatic Tuning Sequence or manually. The keypad and display are used in both cases to accomplish the tuning. The following parameters are used to tune the driver:

- AJ2 Load Inertia Ratio
- AJ3 High Frequency Response
- AJ4 Position Loop DC Gain

It is important to note that although the driver is the focus of the tuning activity the whole system of driver, motor and mechanical components are being tuned as a system. To be successful the system must be configured complete with all components that move during normal operation.

For the purposes of this section it is assumed that the user is proficient in navigating the Special Function Menu Loop, the Adjustment Parameter Menu Loop and adjusting parameters in those loops (See [Section 3](#)).

### 6.1 AUTO TUNING SEQUENCE

Parameters AJ2, AJ3, and AJ4 are set during the auto tuning sequence. Parameters AJ0 and AJ5, analog reference input offsets, are also set during auto tuning. The REF1 and REF2 analog inputs must be forced to 0.0 volts before executing the auto tuning sequence. During auto tuning the driver reads both REF1 and REF2 and sets the internal offsets AJ0 and AJ5 equal to and opposite to the value read during auto tuning. If the REF1 and REF2 inputs are not 0.0 volts during auto tuning, an unwanted offset will occur in the analog inputs.

The auto tuning sequence causes the motor to sharply rotate back and forth by an amount and at a speed set by the tuning parameters. The desired response is also set in the tuning parameters of the Special Function Menu Loop.

Auto tuning to an excessively high target response may result in unstable operation. Unstable operation will also result if the motor load is not rigidly attached or has backlash. If unstable operation results use the Adjustment Parameter menu to set AJ2, AJ3 and AJ4 back to the default settings. Try the Auto Tuning Sequence again with a lower value of target response.

If the Delta driver is used as a speed regulator (Speed Mode 1) in a system with a external position loop, the position loop must be disabled before driver auto tuning can be used. The gain and frequency response parameters of the external position loop will significantly influence the system response.

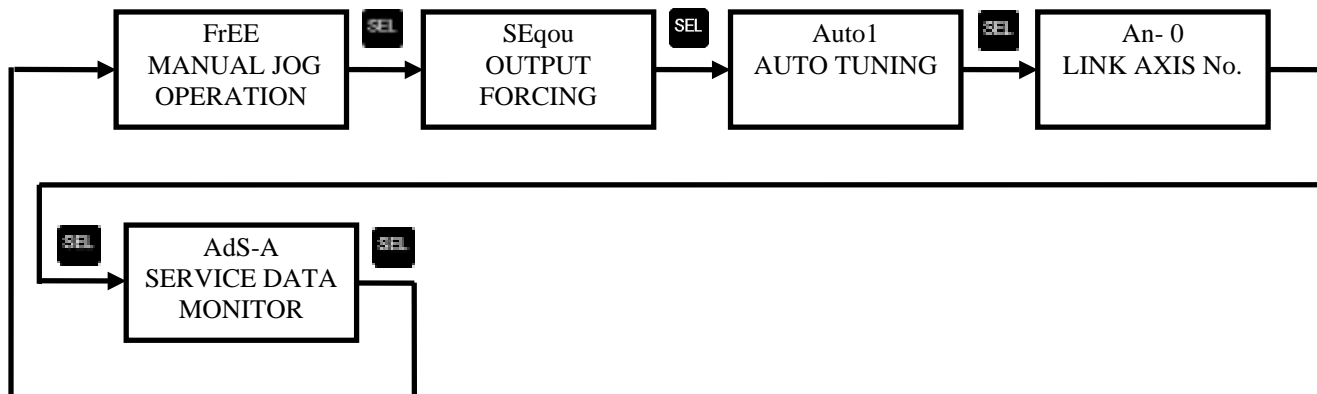
#### **\*\* CAUTION \*\***

**Must be used when executing the Auto Tuning Sequence. The motor moves through a sequence of reciprocal motions during the auto tuning. Be sure all personnel are clear of moving parts and that the mechanical systems will permit the full range of motion set in the auto tuning parameters Auto1, 2 & 3.**

### 6.1.1 SPECIAL FUNCTION MENU LOOP

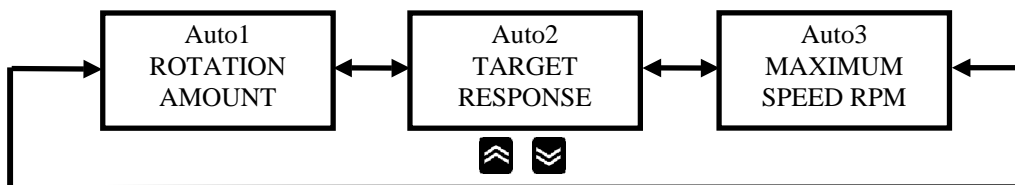
Enter the Special Function Menu Loop by concurrently pressing the keys for 5 seconds while the Main Menu status display shows motor speed [r 0]. The special menu will appear with the display showing [FrEE ]. To exit the Special Function Menu double click the key.

Once in the Special Function Menu Loop, use the key is used to move to various menu items.



### 6.1.2 AUTO TUNING SETUP PARAMETERS

Verify the correct setting of the auto tuning setup parameters by using the and keys to navigate the auto menu. The menu loop will display the parameter name followed by the parameter value with successive presses of the key. Use the and keys to select value to be modified. Then use and keys to adjust value, then confirm value with key.



TUNING PARAMETER	SYMBOL	SETTING RANGE	FACTORY SETTING	DESCRIPTION
ROTATION AMOUNT	<b>Auto1</b>	0~300 REV	2 REVS	Sets the amount of reciprocal rotation during the auto tuning sequence
TARGET RESPONSE	<b>Auto2</b>	1~1000 Hz	40 Hz	Sets the desired frequency response. The auto tuning software uses this value to set the desired response of the system. If the value is too high, unstable operation may result.
MAXIMUM SPEED	<b>Auto3</b>	1~4000 RPM	1000 RPM	Sets the speed of the reciprocal rotation during the auto tune sequence.

### 6.1.3 INITIATE AUTO TUNING

To initiate Auto Tuning use the **SEL** keys to get [Auto 1] in the display. With [Auto1] in the display press and hold the **↩** key followed by the **⏮** key. The [Auto1] in the display will flash indicating initiation of the Auto Tuning Sequence and the motor will begin the reciprocal rotation. The driver will continuously adjust the tuning parameters while the motor is moving. When the Auto Tuning Sequence is complete the display will stop flashing. The BRAKE CONFIRM input must be functional to initiate the Auto Tuning Sequence.

Exit the Special Function Menu with a double click of the **MODE** key.

## 6.2 MANUAL TUNING PROCEDURE

The Delta driver may be tuned manually using the Adjustment Parameter Menu Loop described in **Section 3.1.3**.

AJ2 Load inertia ratio, AJ3 High frequency response and AJ4 Position loop DC gains are the parameters that adjust the response of the driver. A qualified technician using a chart recorder or oscilloscope to view the performance of the system should do adjustment of these parameters.

1. Start the manual adjustment by setting AJ2 to the ratio of the load inertia to the motor rotor inertia. Set AJ3 and AJ4 to the default settings.
2. Connect an oscilloscope or chart recorder to the MON output on the driver front panel. Set UP-25 to 1x0 so the MON output is set to motor speed.

**\*\* CAUTION \*\***

**Must be used when executing the motor motion. Be sure all personnel are clear of moving parts and that the mechanical systems will permit the full range of motion.**

3. Cause the system to move through the most aggressive, highest speed and highest acceleration, motion encountered in normal operation. The stimulus for this motion depends on the system configuration.
4. Adjust AJ2, AJ3 and AJ4 for the desired response using the Adjustment Parameter Loop.

Parameter AJ2 primarily provides the damping function in the system response. The larger the system inertia the larger the value of AJ2 required. If the load inertia is not rigidly attached to the motor shaft, the value of AJ2 may be smaller than the calculated value.

Parameter AJ3 sets the frequency of any small oscillations and overshoots that may be present. Too high a value can result in high frequency oscillations. AJ3 also sets the system frequency response to external stimulus.

Parameter AJ4 sets the basic gain of the control loop and should be set as high as practical without causing oscillations. This parameter primarily affects the stiffness of the system response or the conformance of the motor motion to the commanded motion.

### 6.3 NOTCH FILTER ADJUSTMENT

The Delta driver drive contains a Notch Filter, adjusted by parameter AJ9 that can be used to eliminate system natural resonance frequency oscillations. Natural frequency resonance oscillations can occur with a belt drive, a flexible coupling or any mechanical component that causes flexing or compliance in the motor drive train.

In general, the normal tuning of the driver will not eliminate the natural resonance without lowering the system response to an unacceptable level. If the natural frequency of the system can be determined, the Notch Filter, AJ9, can be set to that frequency to notch out that particular frequency thereby allowing higher gain settings and better response.