

SECTION 8 - DRIVE TUNING

The DeltaMax has the ability to optimize the system drive response through the use of software. The macroprogramming instruction '**delta_comp**' is used to transmit adjustment parameters to the Delta drive. The syntax for this instruction is:

label **delta_comp** **controller#, AJ2, AJ3, AJ4, AJ7, AJ8, AJ9**

The parameters and their default values are defined in **Table 8.1**.

ADJUSTMENT PARAMETER	SYMBOL	DRIVE RANGE	DELTAMAX DEFAULT	DESCRIPTION
LOAD INERTIA RATIO	AJ2	0~100.0 TIMES	1.0 TIMES	Sets the baseline frequency response of the driver using the ratio of the load inertia/motor inertia for a rigidly coupled load. If the load is not rigidly coupled, the value entered may vary from the calculated value. If the value is set too high, the motor and driver may become unstable and oscillate.
HIGH FREQUENCY RESPONSE	AJ3	0.1~20.0	1.0	Sets the high frequency response of the driver. The higher the number the more responsive. If the value is set too high, the motor and driver may become unstable and oscillate. The value in AJ3 is unit less and works in concert with AJ2.
POSITION LOOP DC GAIN	AJ4	1~200 RAD/SEC	30 RAD/SEC	Sets the DC gain of the position control loop. A higher value in AJ4 results in stiffer, faster response. If the value is set too high, the motor and driver may become unstable & oscillate.
ZERO SPEED GAIN REDUCTION	AJ7	0~10000		Sets the amount of gain reduction at zero speed.
FEED FORWARD GAIN	AJ8	0~2.0 Times	1.0	Sets the feed forward gain in the position loop. A value of 50% results in 0.0 following error. Less than 50% will produce a lag between the actual motor position and the commanded position and greater than 50% produces a lead. The lead or lag will be proportional to speed at non 50% settings.
NOTCH FILTER FREQUENCY	AJ9	100~20000 rad/s	6000 RAD/SEC	Sets the notch frequency of a velocity loop anti-resonance filter. This filter can be used to cancel machine or servo resonance. Power must be turned OFF then ON for this parameter to take effect.

Table 8.1

NOTE
Any time a 'Reset' is issued from the MacroPro II Analyzer, the parameters will be set to their default values.

8.1 TUNING PROCEDURE

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 monitor output in Analyzer Parameter window for speed.

CAUTION

Make sure when executing motion that 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.

8.2 NOTCH FILTER ADJUSTMENT

The DeltaMax 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.

Once a program has set AJ9 via a delta_comp instruction, the operator must then cycle power to the controller for it to take effect.