ANILAM

3000M CNC
Motion Setup/Testing
Utility

Warranty

ANILAM warrants its products to be free from defects in material and workmanship for one (1) year from date of installation. At our option, we will repair or replace any defective product upon prepaid return to our factory.

This warranty applies to all products when used in a normal industrial environment. Any unauthorized tampering, misuse or neglect will make this warranty null and void.

Under no circumstances will ANILAM, any affiliate, or related company assume any liability for loss of use or for any direct or consequential damages.

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Introduction

This section describes how to use the ANILAM Motion Setup/Testing (MST) Utility. The MST provides commands that carry out motion-specific setup and testing in order to tune the Proportional, Integral, and Derivative (PID) filter parameters of a CNC.

A basic knowledge of machine operation and programming is required. Refer to the appropriate *3000M CNC Programming and Operations Manual* for details on how to program and operate the control.

Setup includes the following procedures:

- Servo Amplifier Balancing
- Servo Amplifier Signal Gain Setting (motor step response is displayed in open loop)

If using amplifiers not provided by ANILAM, follow the manufacturer's guidelines for balancing, signal gain setting, and overall adjustments.

The CNC provides the following troubleshooting tools:

- Detection of Index Pulse
- Detection of counts between index pulses (actual resolution)
- Tuning for the optimal PID values

The following General Status information is displayed:

- Display of active CNC status codes
- Display of machine position, feedrates, RPM, dwell, and override

Accessing the MST Utility

Access the Motion Setup/Testing Utility (MST) from the Software Options Screen. This screen activates automatically once the CNC has started successfully.

To activate the MST Utility:

1. Start the CNC.
2. Press (**F10**) to continue, as prompted. The Software Options screen is displayed.
3. Highlight **Motion Setup/Testing**, and press **ENTER**. The MST screen is displayed.

Activating the MST Screen

The axis positions displayed correspond to the current position. The Graphics Area displays step responses for the Signal Gain and Tuning functions. Refer to **Figure 1** and **Table 1**.

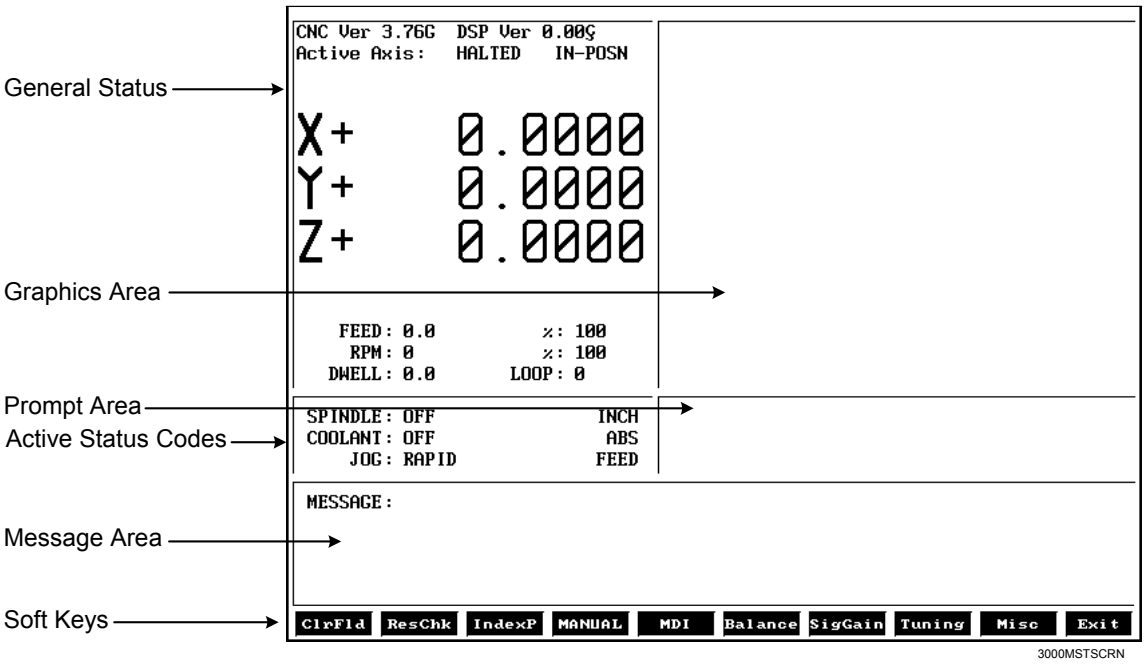


Figure 1, CNC Motion Setup/Testing Screen

Table 1, MST Screen Areas and Explanations

MST Screen Area	Description
General Status	Shows Active Modes, Machine Position for each axis, RPM, Dwell, Spindle Speed and Feedrate, Active Axis, and other information regarding the status of the CNC.
Graph Area	Displays step responses for the Signal Gain and Tuning functions.
Prompt Area	Displays messages regarding information that must be entered.
Active Status Codes	Displays currently active status codes.
Message Area	Displays error messages.
Soft Keys	Function keys (**F1**–**F10**) located below the LCD on the console to activate the functions, as labeled.

MST Soft Keys

NOTE: Select an active axis before you select an MST command (**F1**–**F9**).

NOTE: The CNC soft keys are displayed while the MST screen is active.

Access MST utility features using the labeled soft keys located beneath the LCD on the console. Press the corresponding soft key (**F1**–**F10**) to activate the function.

Refer to **Table 2** for soft key names and functions.

Table 2, MST Soft Key Functions

Soft Key	Name	Function
F1	**ClrFld**	Clears prompt field in SigGain and Tuning tests.
F2	**ResChk**	Calculates the resolution of the active axis. Troubleshooting tool.
F3	**IndexP**	Detects Index Pulse and displays an indicator beside the Active Axis line of the MST screen. Troubleshooting tool.
F4	**MANUAL**	Cancels active Manual Data Input (MDI) or test command.
F5	**MDI**	Activates MDI Mode.
F6	**Balance**	Sends out the signal needed to Balance the outputs of the system (0.0 VDC). Used to balance the Motion Control Board and the Servo Amplifiers.
F7	**SigGain**	Enables you to set the servo amplifier signal gain for the active axis.
F8	**Tuning**	Activates the Tuning Pop-Up menu, which allows the CNC to determine optimum filter values from the given parameters and save the results.
F9	**Misc**	Miscellaneous tests displays a pop-up menu with options for: CanBus Test and Rigid Tapping Test. For AC motors only, additional options display on the pop-up menu: Save Amp Settings, Amplifier Test Link, Reset Amplifier, BackUp Amp Settings, and Restore from BackUp. These tests can only be activated with the Servo Amplifier Test Board installed. See for DC systems “Servo Drive Test Board” or for AC systems “Servo Amplifier Test Board.”
F10	**Exit**	Returns the CNC to the software selection screen.

Clearing a Prompt Field or Message (F1)

Press **ClrFld** (**F1**) to clear an erroneous entry. This soft key is available during the Signal Gain and Tuning tests.

Selecting an Axis

NOTE: Select an active axis before you select an MST command (**F1**–**F9**). If no axis is selected, the CNC displays an **Error** message that prompts you to do so.

Use the following keypad keys to select and activate the corresponding axes:

X	Activates/Deactivates X-axis
Y	Activates/Deactivates Y-axis
Z	Activates/Deactivates Z-axis
U	Activates/Deactivates U-axis
0	Activates/Deactivates Spindle Axis

The active axis is displayed in the upper-left corner of the General Status area of the MST Screen.

Entering a Password

When you enter the MST Utility and press **Balance** (**F6**), **Signal Gain** (**F7**), or **Tuning** (**F8**), the CNC prompts for the password. Type the appropriate password and press **ENTER**. Refer to *3000M CNC Setup Utility Manual*, P/N 70000499, "Section 1, Password Restricted Parameters."

The soft key activates. If the password has been entered successfully, the CNC will not prompt for the password again, unless you exit and re-enter the MST Utility.

Checking Axis Resolution (F2)

Refer to **Figure 2**. Press **ResChk** (**F2**) to calculate the actual resolution for the active axis. In the Graphics Area of the screen, the actual resolution and the resolution in the Setup are displayed for comparison. In addition the screen displays:

- The number of times the system tested for resolution (Total Cycles:).
- The number of times that the encoder lines detected do not match the number of encoder lines in the setup (Errors:). An error indicates that something is wrong, either in the setup parameters or in the hardware.
- The actual number of encoder lines found by the test (Encoder Lines:)
- The resolution and counts per revolution found. (Encoder Resolution:)

NOTE: Resolution should be four times the number of encoder lines.

Once this test is activated, the user must move the axis for at least two encoder revolutions via MDI Mode, Jog Mode, or manual move. The CNC performs the calculation continuously until motion stops.

NOTE: This test is not available for axes with linear scales.

NOTE: Do not perform this test during Rapid Mode. Use it in Feed Mode only.

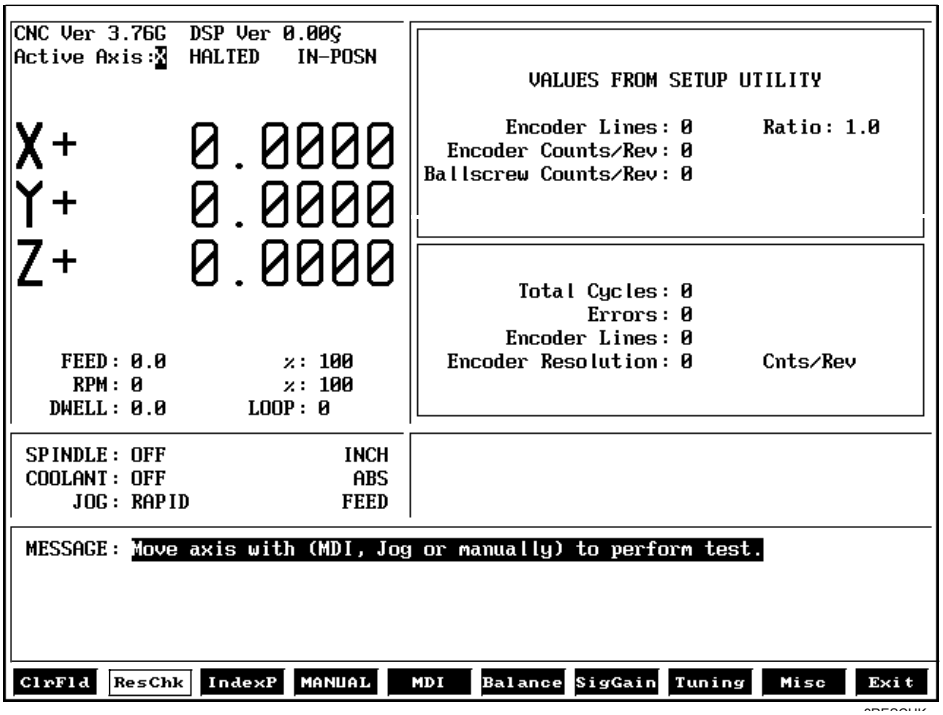


Figure 2, CNC Resolution Check (ResCheck) Screen

Starting Reference Mark

This procedure is only necessary during setup of the system and only when the encoder is type **EverTrack™.

1. Select the axis you want to setup.
2. Press **F2** (Resolution Check) to display a pop-up menu with two options:
   - EverTrack Test
   - Save Current Mark

NOTE: Type must be specified as EverTrack on the Resolution – Setup screen in the Setup Utility.

3. Select **EverTrack Test**. The Setup Utility displays:
   - Encoder Resolution
   - Encoder Type
   - Starting Mark (N)

   The following information is displayed as the test is in progress:
   - mm between marks
   - Current Mark (N)
4. To determine the Starting Mark, move the axis to the right-most end of the EverTrack encoder (as you look at the encoder). Note that you must move the axis so that the Current Mark display changes/transitions at least twice (about two inches). If you are within 2 inches of the right-most end of the encoder, move in the opposite direction (left) a few inches, and then move back to the right-most end of the encoder. The Current Mark display also shows the proper sign.
5. Once you have found the right-most mark, press **F2** and select **Save Current Mark** to store the Current Mark in the configuration file as the Starting Mark entry.

   – or –

   Write down the Current Mark (sign included) and go the Setup Utility's Starting Mark choice and enter the information.

- - - - -

**EverTrack™ EverTrack™ is a trademark of Acu-Rite Companies Inc.

Detecting the Index Pulse (F3)

Refer to **Figure 1, CNC Motion Setup/Testing Screen**. When you press **IndexP** (**F3**), the CNC displays a flashing "**I**" each time it detects an Index Pulse. The flashing "I" replaces the axis name (X, Y, Z, U, or O) of the active axis. The index pulse indicator (flashing "**I**") for the spindle axis is displayed on the RPM field. In the figure, an index pulse has been detected on the X-axis. Refer to **Figure 3**.

To detect an index pulse:

1. Move the active axis to check for the presence of an index pulse.
2. On systems with rotary encoders with index pulses, the index pulse should be detected once per revolution.
3. On systems having linear scales, the index pulse should be detected where the linear scale specifies location of the index pulse.

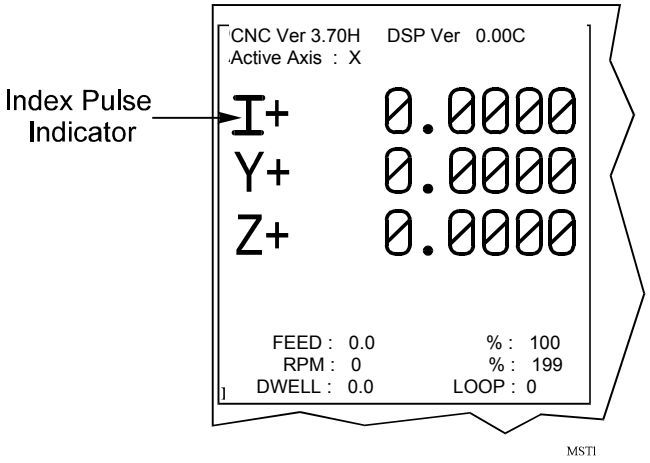


Figure 3, Index Pulse Indicator

Canceling the Active MDI or Test Command

Press **MANUAL** (**F4**) to cancel an active Manual Data Input (MDI) or test command.

Activating Manual Data Input Mode (MDI)

Press **MDI** (**F5**) to activate the MDI Mode. (Refer to the *3000M CNC Programming and Operations Manual* for information on MDI programming.)

Balancing Motion Control Axes

To balance the outputs properly, all connections between the CNC and the servo amplifiers must be complete.

Perform all of the adjustments on one axis at a time. Make the adjustments in the following order:

1. Select an axis
2. Balance the Motion Control Board outputs
3. Balance the Servo Amplifier outputs
4. Set Servo Amplifier gain
5. Repeat for all axes

Differential (AC Systems) and Single-Ended (DC Systems) DSP^2 Board

The digital signal processing (DSP)^2 board uses digital input and provides analog output. For the AC systems, the DSP^2 board, P/N 33001102, is differential (see **Figure 4**). The earliest AC systems were single-ended DSP^2 boards. For DC systems, the DSP^2 board, P/N 33001102, is single-ended (see **Figure 5**).

NOTE: In the illustrations, see the difference in the jumper pin direction for pins: J10–J17.

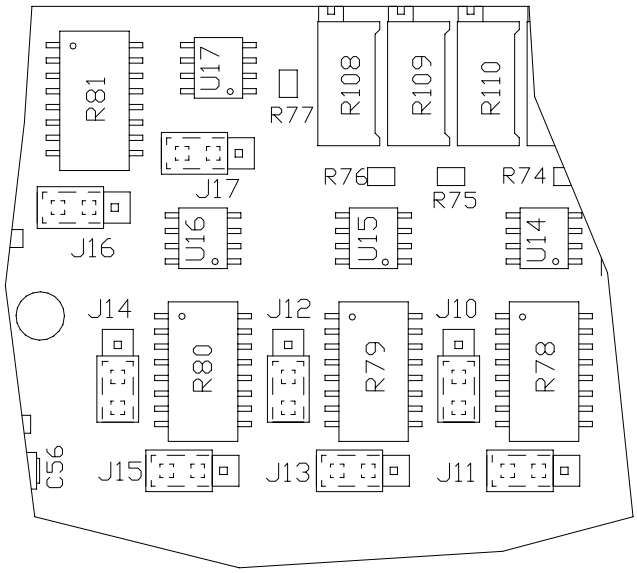


Figure 4, Differential DSP^2 Board, P/N 33001102, AC Systems

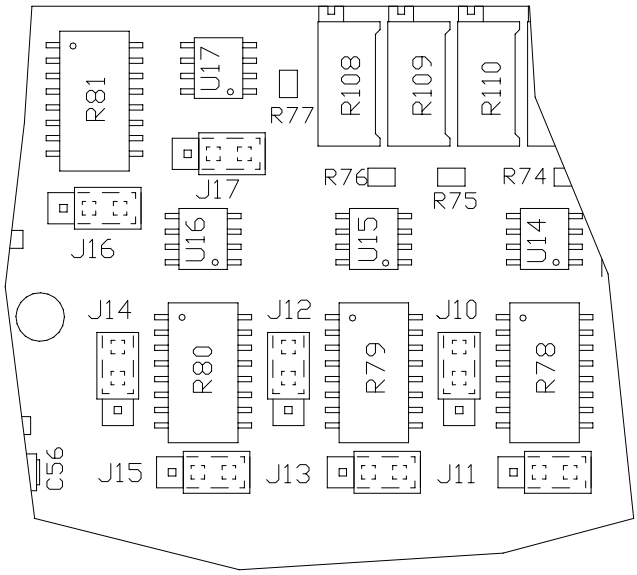


Figure 5, Single-Ended DSP^2 Board, P/N 33001102, DC Systems and earliest AC Systems

DC Systems

There are a number of differences for DC system and AC systems. The features specific to the DC systems are described in this section.

Servo Drive Test Board

Each CNC that uses ANILAM servo amplifiers (P/Ns 33000039 or 33000123) includes a Servo Drive Test Board, P/N 33000102. During machine operation, the board provides convenient access to critical signals for alignment and troubleshooting. Refer to **Figure 6**. description

NOTE: The test board only works with amplifiers supplied by ANILAM.

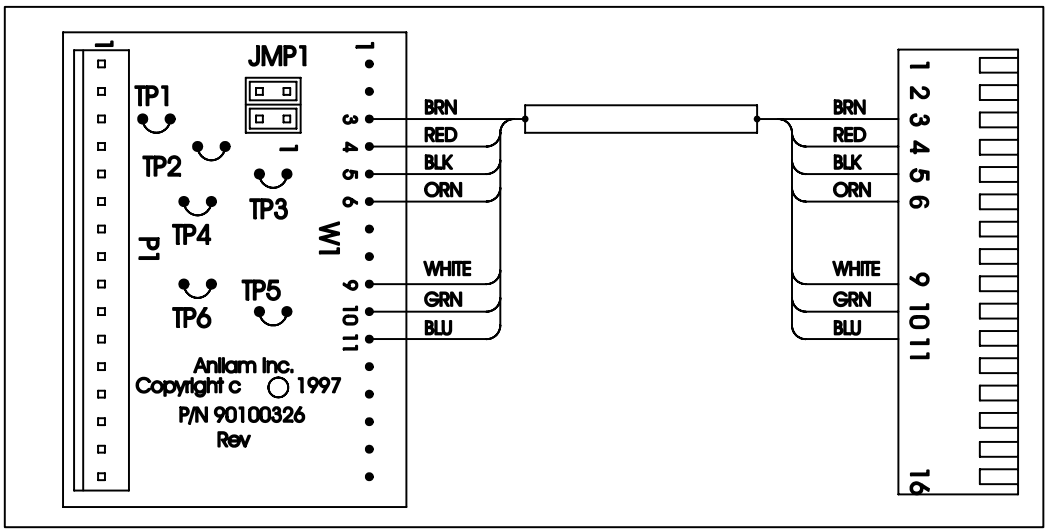


Figure 6, ANILAM Servo Drive Test Board, P/N 33000102, DC Systems

Test Board Installation

IMPORTANT: Press **E-STOP** to de-energize servos before installing the test board.

1. Remove the cable attached to **J1** of the Servo Drive you wish to monitor and connect it to **P1** of the test board. installation
2. Attach **W1** of the test board to **J1** of the servo.
3. Re-energize the servos.

Test Points

Refer to **Table 3** for a description of test points and signals.

Table 3, Servo Drive Test Board: Test Points and Jumpers

Test Point	Pin	Signal
TP1	**3**	Command Signal
TP2	**4**	Common for all servo signals and potentiometers. All readings are referenced to TP2.
TP3	**5**	Tachometer
TP4	**6**	Motor Current output monitor. The scale factor is 1V = 5A.
TP5	**9**	Clamp input from the SCB. When pulled to chassis ground, the servo's output is forced to 0 VDC.
TP6	**10**	Fault output. When the servo card is faulted, the output is pulled low. If TP6 is pulled to chassis ground, the Servo is disabled and coasts to a stop.
JMP1	**11**	Command Signal Common. If removed, JMP1 will open the common line at Pin 11 of J1.
JMP2	**3**	Common Signal. If JMP2 is removed, the Command signal will open at Pin 3 of J1.

Jumpers

While troubleshooting, you can remove jumpers to isolate the Servo Drive from the DAC outputs of the Motion Control Board during troubleshooting. If Pin 2 of **JMP1** and **JMP2** are shorted together, the Servo Drive's input is fixed at 0 VDC; this can be useful in troubleshooting balance problems.

Balancing the DSP^2 Board (F6)

On systems that use an ANILAM Servo Amplifier Board, P/N 33000039 or 33000123 (see **Figure 8 (5 LEDS), DC Systems** or **Figure 9 (1 LED), DC Systems**), measurements for this procedure can be made at the J1 input connector with the Servo Drive Test Board, P/N 33000102.

NOTE: If ANILAM did not provide the servo amplifiers, follow the guidelines for balancing supplied by the manufacturer.

Refer to **Figure 7, ANILAM DSP^2 Board Balance Pots, P/N 33000413, DC Systems**. Measure command voltages across **TP1** and **TP2** of the test board.

NOTE: These signals can also be found on Pin #3 and Pin #11 of the J1 input connector on the ANILAM Servo Amplifier Board.

All DSP^2 Boards are adjusted at the factory and should be within limits. Only balance the DSP^2 Board if it is not at 0 VDC (±0.001V).

NOTE: On 3200MK and 3300MK systems, the DSP^2 Board is located inside the CNC console. On 3300M systems, the DSP^2 Board is located in the CNC chassis. Remove only the top cover of the console to access the Board. **Balance the DSP^2 Board with the servos off, initially**. Next, verify the DSP^2 Board balance with the servos on, and correct for voltage offset as required.

1. Press **Balance** (**F6**) to output a zero voltage signal to the axis.
2. Press **START**.
3. Refer to **Figure 7**. Make adjustments for axis outputs 0-3 on the DSP^2 Board at potentiometers R108-R111 respectively.
4. Adjust the potentiometer for the selected axis until the voltage across the pins is 0 VDC (± 0.001V).
5. Press **MANUAL** (**F4**) to cancel the test.

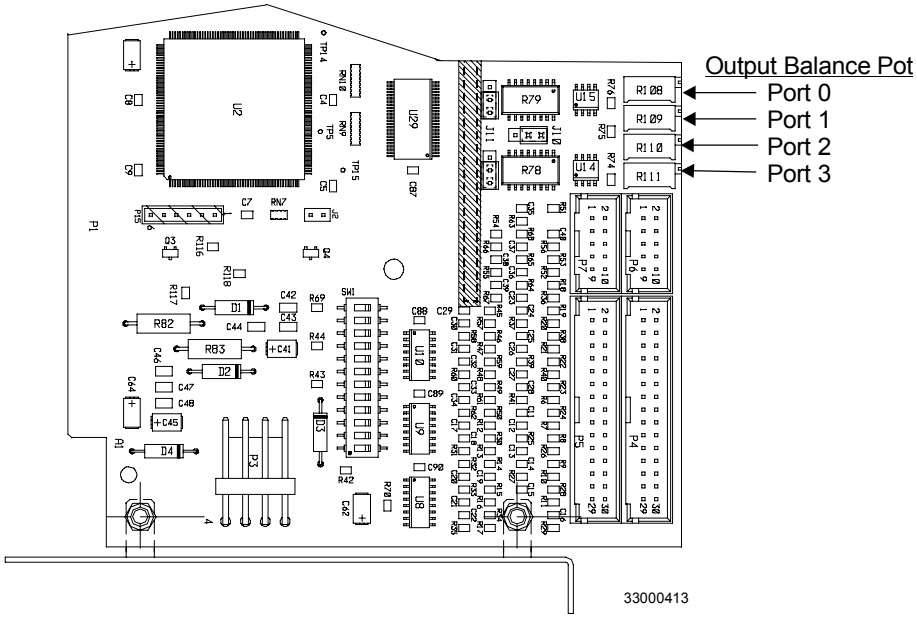


Figure 7, ANILAM DSP^2 Board Balance Pots, P/N 33000413, DC Systems

Balancing Servo Amplifier Outputs (F6)

When the command signal voltage from the DSP^2 Board is 0, the axis should be stationary and MST balance display should read “0000”. Alternatively, read the tachometer voltage from the motor. The tachometer should read 0 VDC (± 0.001 V). Monitor the tach voltage across **TP2** and **TP3** of the test board.

NOTE: These signals can also be found on Pins #5 and #11 of the J1 input connector on the ANILAM Servo Amplifier Board, P/N 33000123. Refer to **Figure 8, (5 LEDs), DC Systems** or **Figure 9, ANILAM Servo Amplifier (1 LED), P/N 33000123, DC Systems**.

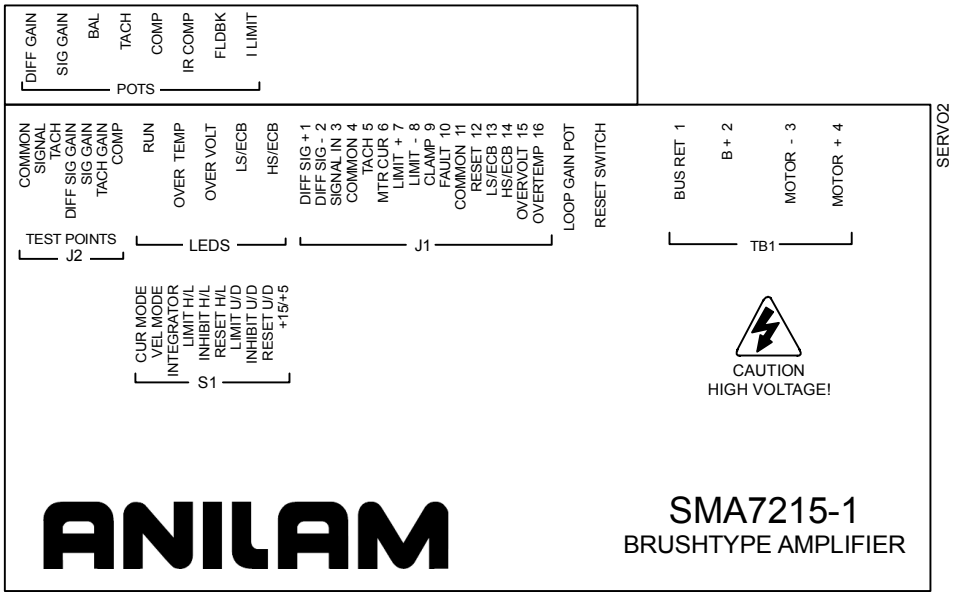


Figure 8, ANILAM Servo Amplifier (5 LEDs), P/N 33000123, DC Systems

NOTE: When the amplifier is shipped from the factory, the LOOP GAIN pot is fully counterclockwise (CCW). This is used to shut off uncalibrated amplifiers. When the loop gain is fully CCW, no current is delivered to the motor.

1. Apply main power and fan power.
2. Slowly turn the LOOP GAIN pot clockwise (CW). Motor should be stopped or turning slowly. If motor starts running away, remove power, reverse the tach leads, and retest. Turn the LOOP GAIN fully CW to enable.
3. Energize the servos and select an axis.
4. Refer to **Figure 10, Balance Screen, DC Systems**. Press **Balance** (**F6**) to output a zero voltage signal to the axis.
5. Press **START**.

6. On the ANILAM Servo Amplifier for the axis being adjusted, adjust the balance potentiometer until the MST display is 0000, indicating that the active axis is stationary.

   – or –

   Adjust until tach voltage is 0 VDC (±0.001 V), indicating that the active axis is stationary.

7. Press **MANUAL** (**F4**) to cancel the Balance command.

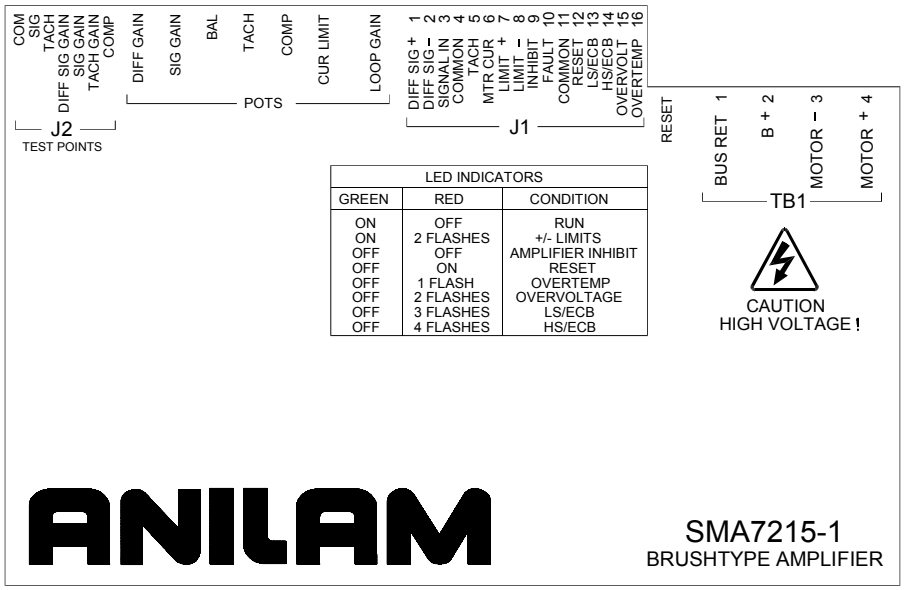


Figure 9, ANILAM Servo Amplifier (1 LED), P/N 33000123, DC Systems

Amplifier Faults

ANILAM amplifiers do not require any scheduled maintenance, although it is a good idea to occasionally check for dust build up or other contamination.

If an amplifier should cease to operate or one or more of the fault LEDs are lit, review the following sections for information on the fault and possible causes.

NOTE: A fault can on be caused by abnormal conditions. Locate and correct the cause of the fault before repeated recycling of power to the amplifier to prevent possible damage.

For LED fault conditions on 5 LED servo amplifiers (**Figure 8, ANILAM Servo Amplifier (5 LEDs), P/N 33000123, DC Systems**), see **Table 4, Table of Fault LED Conditions (5 LEDs)**.

Table 4, Table of Fault LED Conditions (5 LEDs)

Input or Fault Condition	RUN LED	HS/ECB LED	LS/ECB LED	OVER VOLT LED	OVER TEMP LED	FAULT OUTPUT
NORMAL OPERATION	**ON**	OFF	OFF	OFF	OFF	GROUND
LIMIT + (ON)	**ON**	OFF	OFF	OFF	OFF	GROUND
LIMIT – (ON)	**ON**	OFF	OFF	OFF	OFF	GROUND
CLAMP (ON)	OFF	OFF	OFF	OFF	OFF	GROUND
RESET (ON)	OFF	OFF	OFF	OFF	OFF	**PULL-UP**
EXT. FAULT	OFF	OFF	OFF	OFF	OFF	**PULL-UP**
UNDER VOLTAGE (+15V)	OFF	OFF	OFF	OFF	OFF	**PULL-UP**
HS/ECB (LATCHED)	OFF	**ON**	OFF	OFF	OFF	**PULL-UP**
LS/ECB (LATCHED)	OFF	OFF	**ON**	OFF	OFF	**PULL-UP**
OVER VOLTAGE B+ (LATCHED)	OFF	OFF	OFF	**ON**	OFF	**PULL-UP**
OVER TEMP (LATCHED)	OFF	OFF	OFF	OFF	**ON**	**PULL-UP**

For LED fault conditions 1 LED servo amplifiers, see **Figure 9, ANILAM Servo Amplifier (1 LED), P/N 33000123, DC Systems** or **Table 5**.

Table 5, Table of Fault LED Conditions (1 LED)

Green	Red	Condition
ON	OFF	RUN
ON	2 FLASHES	+/– LIMITS
OFF	OFF	AMPLIFIER INHIBIT
OFF	ON	RESET
OFF	1 FLASH	OVER TEMPERATURE
OFF	2 FLASHES	OVER VOLTAGE
OFF	3 FLASHES	LS/ECB
OFF	4 FLASHES	HS/ECB

Under Voltage Fault

When the +15VDC power supply is below +12VDC, a level that would cause unreliable operation: description

For 5 LED amplifiers: The Run LED turns off, a Fault Output is generated, and the amplifier is inhibited.

For 1 LED amplifiers: The Green LED turns off, the Red LED is off, a Fault Output is generated, and the amplifier is inhibited.

The following is a list of possible causes:

- Main buss line voltage is too low
- Bad power supply

High Speed Electronic Circuit Breaker (HS/ECB) Fault

When the peak output of the amplifier exceeds 80A for 10 microseconds:

For 5 LED amplifiers: The Run LED turns off, the HS/ECB LED turns on, a Fault Output is generated, and the amplifier is inhibited.
NOTE: This is a latched condition.

For 1 LED amplifiers: The Green LED turns off, the Red LED displays 4 flashes, a Fault Output is generated, and the amplifier is inhibited.
NOTE: This is a latched condition.

The following is a list of possible causes:

- Shorted motor leads.
- Motor inductance too low.
- Short from the motor lead to ground.

Low Speed Electronic Circuit Breaker (LS/ECB) Fault

When the RMS output of the amplifier exceeds 13A for 5 seconds:

For 5 LED amplifiers: The Run LED turns off, the LS/ECB LED turns on, a Fault Output is generated, and the amplifier is inhibited.
NOTE: This is a latched condition.

For 1 LED amplifiers: The Green LED turns off, the Red LED displays 3 flashes, a Fault Output is generated, and the amplifier is inhibited.
NOTE: This is a latched condition.

The following is a list of possible causes:

- Binding or stalling of motor shaft due to excessive mechanical overload.
- Overload of amplifier output to motor.
- Large reflected load inertia.

Over Temp Fault

When the amplifier heatsink temperature has reached a level that, if exceeded, would damage the output transistors:

For 5 LED amplifiers: The Run LED turns off, the OVER TEMP LED turns on, a Fault Output is generated, and the amplifier is inhibited.
NOTE: This is a latched condition.

For 1 LED amplifiers: The Green LED turns off, the Red LED displays 1 flash, a Fault Output is generated, and the amplifier is inhibited.
NOTE: This is a latched condition.

The following is a list of possible causes:

- Loss of cooling, or fans are defective, or airflow is blocked.
- Excessive rise in cooling temperature due to cabinet vents being blocked or excessive hot air being ingested.
- Extended operational duty cycle due to mechanical overload of motor or defective motor.

Over Voltage Fault

When the DC Buss voltage reaches 250VDC:

For 5 LED amplifiers: The Run LED turns off, the OVER VOLTAGE LED turns on, a Fault Output is generated, and the amplifier is inhibited.
NOTE: This is a latched condition.

For 1 LED amplifiers: The Green LED turns off, the Red LED displays 2 flashes, a Fault Output is generated, and the amplifier is inhibited.
NOTE: This is a latched condition.

The following is a list of possible causes:

- Main Buss line voltage is too high.
- Decelerating a large inertial load. When decelerating, a DC motor acts as a generator. If the inertial load is large, the generated voltage can pump up the DC-Buss. If this fault occurs, you may need a Regen Clamp. Consult ANILAM.

Resetting a Fault

The fault latch may be reset by pushing the Reset button, activating the Reset input J1–12 or by removing power and allowing the filter capacitor(s) to discharge. Note that the fault latch will not reset unless the fault has been cleared.

Amplifier Failure

If the amplifier should fail, that is, if it should cease to operate with no apparent fault, contact ANILAM.

Setting the Signal Gain (F7)

Adjust the gains of the ANILAM Servo Amplifier. Refer to **Figure 10**.

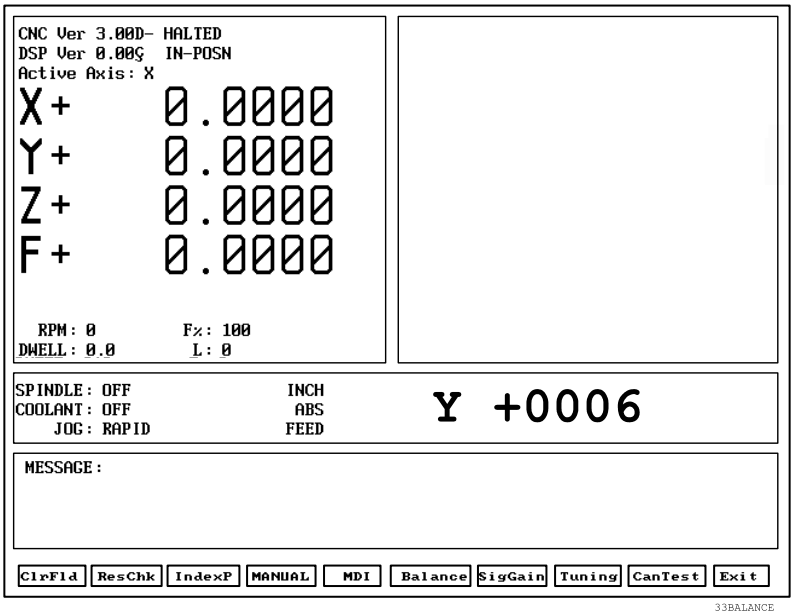


Figure 10, Balance Screen, DC Systems

NOTE: If ANILAM did not provide the servo amplifiers, follow the guidelines for balancing supplied by the manufacturer.

NOTE: 0.9V output is used during this procedure.

The gain is adjusted at 10% of the machine's maximum Rapid speed, using the fastest axis.

1. Energize the servos and select an axis.
2. Press **SigGain** (**F7**).
3. Refer to **Figure 11, Signal Gain (SigGain) Screen, DC Systems**. Look at the Prompt Area of the MST screen. Enter a timed delay at the **T(sec)** entry field (two seconds is usually adequate). The graph in the graphics area plots machine motion as follows:
   - The X-axis represents elapsed time in milliseconds.
   - The Y-axis represents the speed of the machine, from 0 to constant velocity.
   - Rise time is the time required (in milliseconds) for machine movement to go from 10% to 90% of constant velocity.

- T is the amount of time in seconds that the axis will travel in one direction before it reverses for the same amount of travel in the opposite direction. The actual distance depends on the feedrate that corresponds to 0.9V.

NOTE: Press **ClrFld** (**F1**) to erase the entry and enter another number.

4. Press **START**. The CNC generates an open loop step response, including rise time, in the Graph Area of the screen.
5. Adjust the signal gain pot until the displayed feedrate is at 10% of the machine's maximum Rapid speed, using the fastest axis. (The maximum rapid speed is set by the machine builder in the Setup Utility.)
6. Press **MANUAL** (**F4**) to cancel the test.

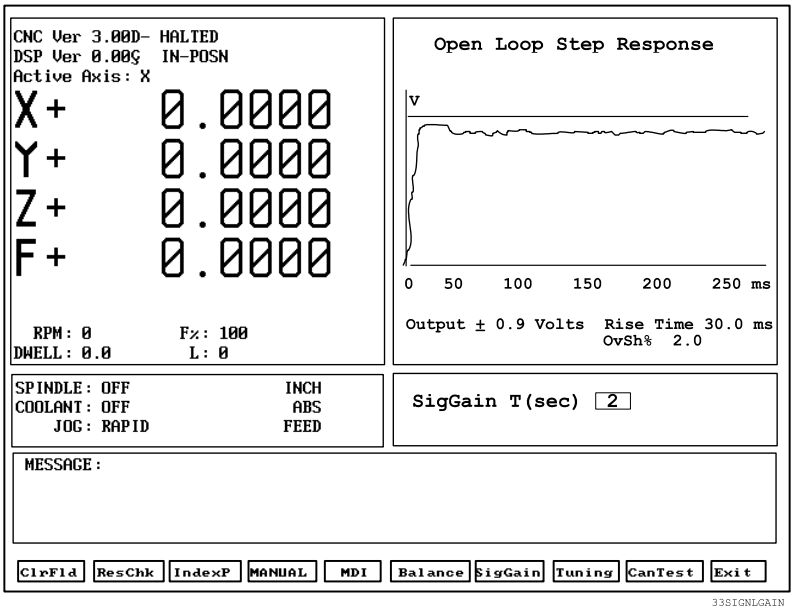


Figure 11, Signal Gain (SigGain) Screen, DC Systems

If the system is equipped with an ANILAM Servo Amplifier Board, all of the voltage measurements can be made with the Servo Drive Test Board.

Measure command voltage across **TP1** and **TP2** of the test board. These signals can also be found on Pins #3 and #11 of **J1**.

Measure the tachometer output across **TP2** and **TP3** of the test board. These signals can also be found on Pins #5 and #11 of the **J1** input connector on the ANILAM Servo Amplifier Board.

AC Systems

There are a number of differences for AC system and DC systems. The features specific to the AC systems are described in this section.

Instructions are provided for amplifier balancing and signal gain setting when using the ANILAM AC Brushless Digital Servo Amplifiers and motors. The servo amplifiers provided by ANILAM are completely digital; parameter settings are done by communicating to the amplifier using the Servo Amplifier Communications Cable, P/N 33001389, between the amplifier's **J1** connector and the CNC's RS-232 port. The digital amplifier eliminates the need for adjusting trim pots and provides overall better performance. Make sure cable is connected when doing any amplifier adjustments; disconnect cable when done. If using amplifiers not provided by ANILAM, follow the manufacturer's guidelines for balancing, signal gain setting, and overall adjustments.

Servo Amplifier Test Board

Each CNC that uses ANILAM AC motors and amplifiers, P/N 33001279, includes a Servo Amplifier Test Board, P/N 33001399. During machine operation, the board provides convenient access to critical signals for alignment and troubleshooting. Refer to **Figure 12**.

NOTE: The test board only works with amplifiers supplied by ANILAM.

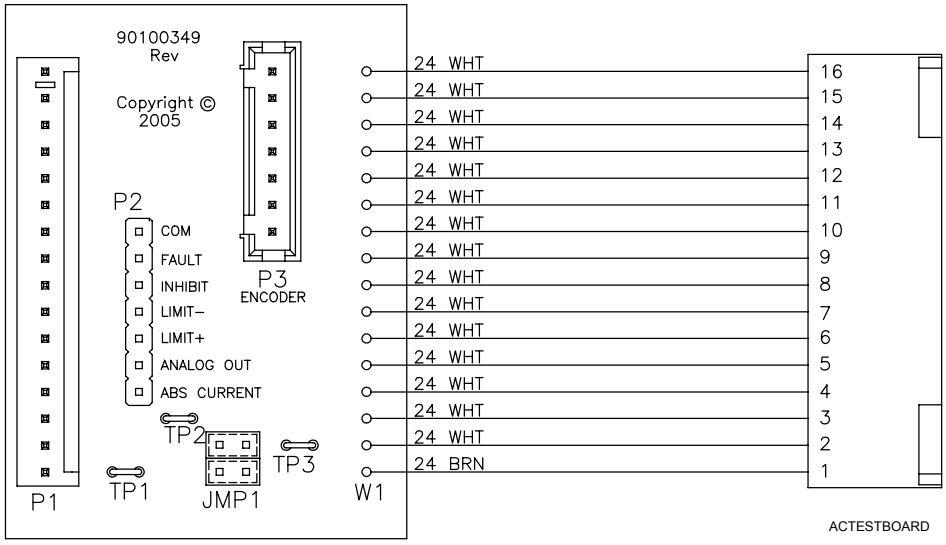


Figure 12, ANILAM Servo Amplifier Test Board, P/N 33001399, AC Systems

Test Board Installation

IMPORTANT: Press **E-STOP** to de-energize servos before installing the test board.

1. Remove the cable attached to **J2** of the Servo Amplifier you wish to monitor and connect it to **P1** of the test board.
2. Attach **W1** of the test board to **J2** of the servo.
3. Re-energize the servos.

Test Points

Refer to **Table 6** for a description of test points and signals. For AC brushless systems with differential DSP^2 boards, use **TP1** and **TP3**. For the earliest AC systems with single-ended DSP^2 boards, use **TP1** and **TP2**.

Table 6, Servo Amplifier Test Board: Test Points and Jumpers

Test Point	Pin	Signal
TP1	**1**	Command Signal +
TP2	**3**	Common for all servo signals and potentiometers. All readings are referenced to **TP2**.
TP3	**2**	Command Signal –
P2-1	**4**	Motor Current output monitor. The scale factor is 1V = 7.5A.
P2-2	**5**	Analog Out
P2-3	**6**	+Limit In
P2-4	**7**	–Limit In
P2-5	**8**	Clamp input from the SCB. When pulled to chassis ground, the servo's output is forced to 0 VDC.
P2-6	**9**	Fault output. When the servo card is faulted, the output is pulled low.
P2-7	**3**	Common
JMP1	**1**	Signal. If **JMP1** is removed, the Command signal will open at Pin 1 of **J1**.
JMP2	**3**	Common. If removed, **JMP2** will open the common line at Pin 3 of **J1**.

Jumpers

While troubleshooting, you can remove jumpers to isolate the Servo Amplifier from the DAC outputs of the Motion Control Board during troubleshooting. If Pin 2 of **JMP1** and **JMP2** are shorted together, the Servo Amplifier's input is fixed at 0 VDC; this can be useful in troubleshooting balance problems.

Balancing the DSP^2 Board (F6)

On systems that use an ANILAM Servo Amplifier Board (see **Figure 14, Digital Brushless AC Servo Amplifier, P/N 33001279, AC Systems**), measurements for this procedure can be made at the **J2** input connector with the Servo Amplifier Test Board, (see **Figure 12, ANILAM Servo Amplifier Test Board, P/N 33001399, AC Systems**).

NOTE: If ANILAM did not provide the servo amplifiers, follow the guidelines for balancing supplied by the manufacturer.

Refer to **Figure 13, ANILAM DSP^2 Board Balance Pots, P/N 33001102, AC Systems**. Measure command voltages across **TP1** and **TP3** of the test board for AC brushless systems with differential DSP^2 boards. For the earliest AC systems with single-ended DSP^2 boards, measure command voltages across **TP1** and **TP2** of the test board.

NOTE: These signals can also be found on Pin #1 and Pin #3 of the **J2** input connector on the ANILAM Servo Amplifier Board.

All DSP^2 Boards are adjusted at the factory and should be within limits. Only balance the DSP^2 Board if it is not at 0 VDC (±0.001 V).

NOTE: On 3000M Kit style systems, the DSP^2 Board is located inside the CNC console. On 3000M OEM systems, the DSP^2 Board is located in the CNC chassis. Remove only the top cover of the console or open the CNC chassis to access the Board. **Balance the DSP^2 Board with the servos off, initially**. Next, verify the DSP^2 Board balance with the servos on, and correct for voltage offset as required.

Install the Servo Amplifier Communications Cable, P/N 33001389, between the amplifier's **J1** connector and the CNC's RS-232 port.

1. Press **Balance** (**F6**) to output a zero voltage signal to the axis.
2. Press **START**.
3. Refer to **Figure13, ANILAM DSP^2 Board Balance Pots, P/N 33001102, AC Systems**. Make adjustments for axis outputs 0–3 on the DSP^2 Board at potentiometers R108-R111 respectively.
4. Adjust the potentiometer for the selected axis until the voltage across the pins is 0 VDC (± 0.001 V).
5. Press **MANUAL** (**F4**) to cancel the test.

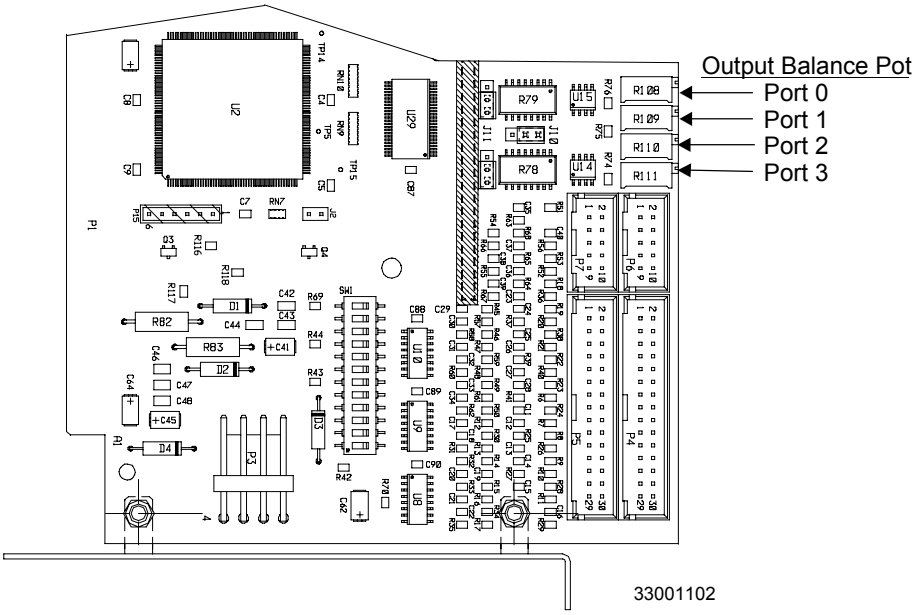


Figure 13, ANILAM DSP^2 Board Balance Pots, P/N 33001102, AC Systems

ANILAM Amplifier Parameter Files

If using the ANILAM AC Brushless Servo Amplifier (refer to **Figure 8, Digital Brushless AC Servo Amplifier, P/N 33001279, AC Systems**) make sure that the amplifier's communications cable, P/N 33001389, is connected between the amplifier **J1** and the CNC. All servo amplifier settings are done digitally through the communications cable and the CNC. Parameter settings can be sent from the CNC to the amplifier and vice versa. The parameter settings are saved on the CNC in C:\P3M under the filename **DIGAMP-*.BK** (where * corresponds to the specific axes).

It is recommended that after making any amplifier parameter settings that these settings be saved on the CNC for easy restore, if needed. To save the parameter settings on the CNC:

1. Select the Axes
2. Press **Misc** (**F9**)
3. Select **Backup Amp Settings**

For later restore of the saved parameter settings from the backup:

1. Select the Axes
2. Press **Misc** (**F9**)
3. Select **Restore from Backup**

Balancing Servo Amplifier Outputs (F6)

Refer to “Servo Amplifier Test Board.”

Use the following procedures for:

- Setup parameter verification
- Setting the Balance (F6)
- Setting the Signal Gain (F7)

Setup Parameter Verification

Refer to **Figure 14, Digital Brushless AC Servo Amplifier, P/N 33001279, AC Systems**.

1. At the Software Options menu, select **Setup Utility**.
2. Select **Builder Setup**.
3. Select **General Axis**.
4. Select **Digital Amplifier Settings**.

> **NOTE:** Step 5 values are valid only when you are using ANILAM AC Brushless Digital Servo Amplifiers. If using amplifiers not provided by ANILAM, follow the manufacturer's guidelines for balancing, signal gain setting, and overall adjustments.

5. Verify the following Digital Amplifier Settings menu values as follows and change as required:
   - Balance adjustment (mV): 0.5
   - Signal Gain adjustment (%): 0.01
   - Compensation adjustment (%): 0.02
6. Select **Active digital amplifiers**, to display the Active Digital Amplifiers menu. Press **ENTER** to toggle to Enable when using ANILAM AC amplifiers. Toggle to Disable when using any other amplifier.

> **IMPORTANT:** For ANILAM AC Brushless Digital Servo Amplifiers, set **Active digital amplifiers** to ENABLE. If using amplifiers not provided by ANILAM, set to DISABLED.

7. Press **Exit** (**F10**) to exit the Digital Amplifier Setting menu and display the General Axis Setup Menu.
8. Select **Invert DAC Output**, and press **ENTER** to toggle to **Yes**, if necessary.
9. Press **Exit** (**F10**) until you return to the Software Options startup screen.

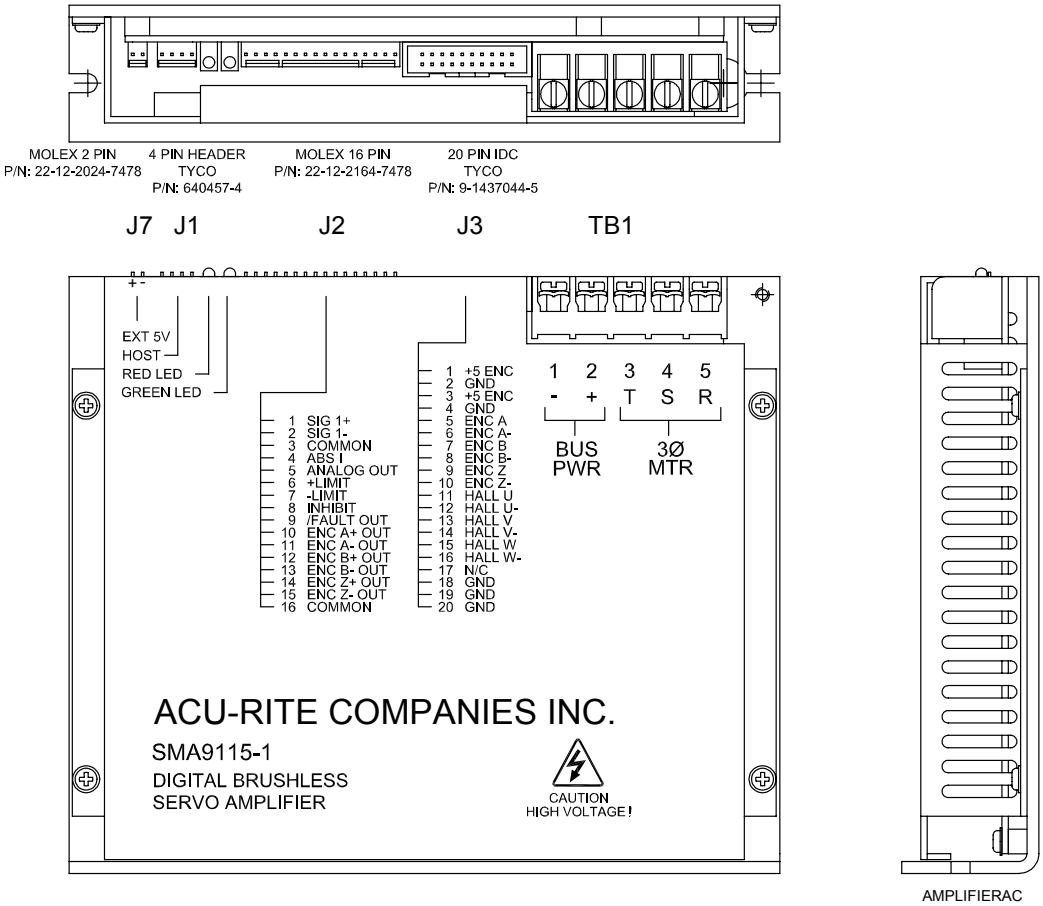
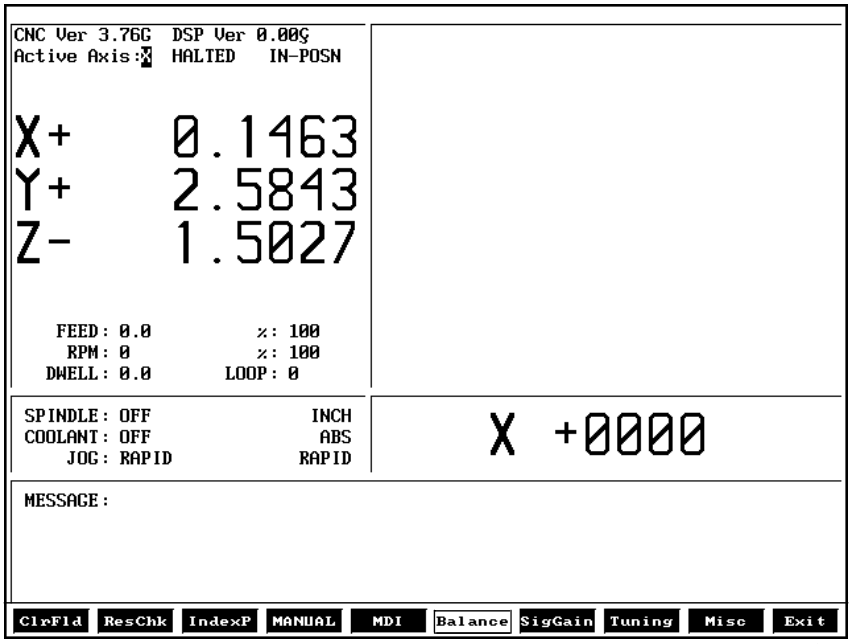


Figure 14, Digital Brushless AC Servo Amplifier, P/N 33001279, AC Systems

Setting the Balance (F6)

Install the Servo Amplifier Communications Cable, P/N 33001389, between the amplifier's **J1** connector and the CNC's RS-232 port.

1. At the Software Options menu, select **Motion Setup/Testing**.
2. Press and release the **E-STOP** button.
3. Press the **SERVO RESET** to energize the system.
4. Select an axis to be tested by pressing the corresponding key on the keypad (**X**, **Y**, **Z**, or **U**).
5. Press **Balance** (**F6**) to perform the balance test on the selected amplifier (axis) and display the balance test screen. Refer to **Figure 15**.



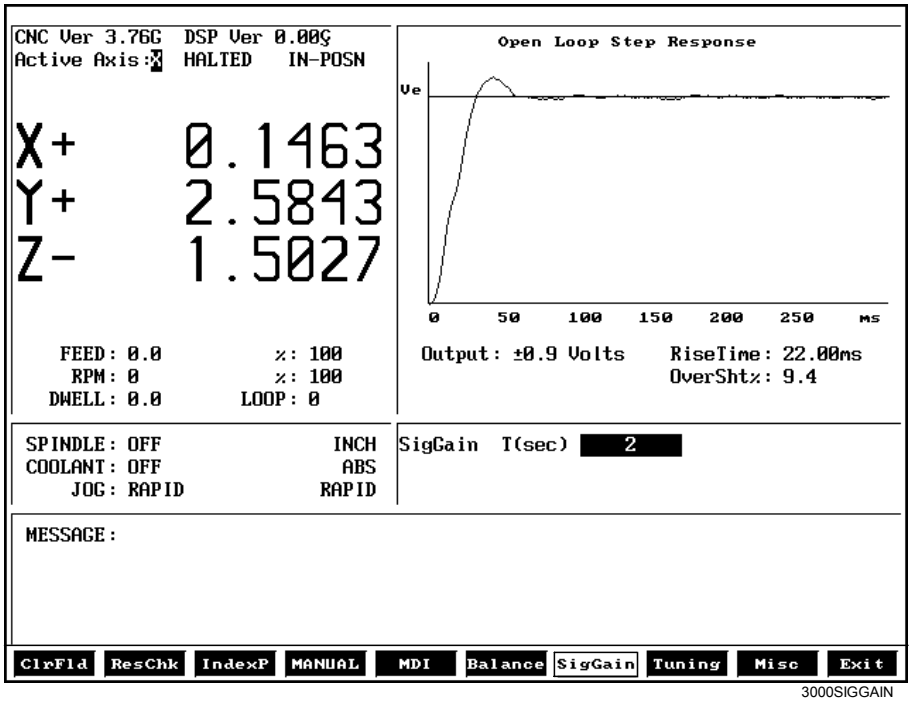
3000BALANCE

Figure 15, Balance Test Screen, AC Systems

6. Use the keypad up and down **ARROW** keys to change the axis offset until the selected axis reads: +0000. Use the left and right **ARROW** keys to change the Offset value.
7. To cancel the balance test, press **MANUAL** (**F4**).

Setting the Signal Gain (F7)

1. Press **SigGain** (**F7**) to perform the signal gain test for the selected amplifier.
2. Select **2** for the time (i.e., 2 seconds). Refer to **Figure 16**. The following screen will be displayed:



3000SIGGAIN

Figure 16, Signal Gain Test Screen, AC Systems

IMPORTANT: Steps 9–13 apply only to ANILAM brushless AC amplifiers. For other amplifiers, refer to the manufactures guidelines to set the signal gain in the amplifier.

3. Use the keypad up and down **ARROW** keys to change the signal gain until **FEED:** reads: 20.0 or 10% of Rapid.
4. To cancel the signal gain test, press **MANUAL** (**F4**); otherwise, press **Misc** (**F9**) to display the Miscellaneous Menu.
5. Select **Save Amp Settings** to save the amplifier settings to the amplifier.
6. Press **Misc** (**F9**) to display the Miscellaneous Menu
7. Select **BackUp Amp Settings** to backup the amplifier settings to a file on the CNC. The backup filename is DIGAMP-*.BK where '*' is the selected axis name (i.e., X, Y, Z, U). This file is stored on the hard disk drive.
8. Repeat steps in "Setup Parameter Verification," "Setting the Balance (F6)," and "Setting the Signal Gain (F7)" for each amplifier axis.

Amplifier Faults

ANILAM amplifiers do not require any scheduled maintenance, although it is a good idea to occasionally check for dust build up or other contamination.

If an amplifier should cease to operate or one or more of the fault Light Emitting Diodes (LEDs) are lit, refer to **Table 7**.

NOTE: A fault can on be caused by abnormal conditions. Locate and correct the cause of the fault before repeated recycling of power to the amplifier to prevent possible damage.

Table 7, Amplifier – LED Indicators

Red	Green	Condition
Off	Off	No power
Off	On	Enabled
On	Off	Fault
On	On	Inhibit

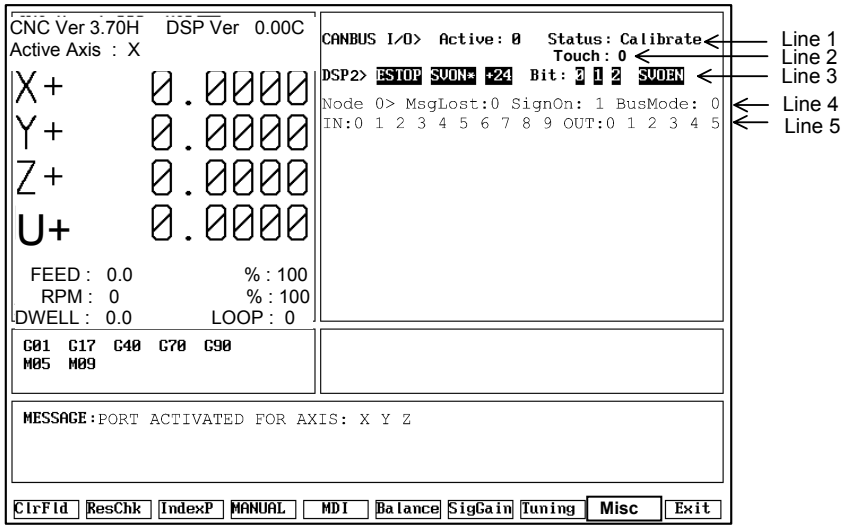
Miscellaneous Tests (F9)

Press **Misc** (**F9**) to display a pop-up menu with eight (8) selections. The tests marked ****** on the right apply only for systems equipped with an ANILAM AC Amplifier (P/N 33001279). These tests can only be activated with the Servo Amplifier Test Board installed. See “Servo Amplifier Test Board.” The pop-up does not display the ****** notation.

- CanBus Test
- Rigid Tapping Test
- Save Amp Settings******
- Amplifier Test Link******
- Reset Amplifier******
- BackUp Amp Settings******
- Restore from BackUp******

CanBus Test

Refer to **Figure 17**. Press **Misc** (**F9**) to display the Miscellaneous Test pop-up window. Select **CanBus Test** to display the graphics area and to troubleshoot the status of all inputs and outputs for the nodes.



CanTest

Figure 17, CanBus Test Screen, AC Systems

Table 8 lists the CanBus test results displays.

Table 8, CanBus Test Results Displays

Display	CanBus Status
Normal	Normal operation
Calibrate	Node found and CNC is calibrating
Warning	CNC lost a node and is actively searching for active nodes.
Bus off	Fatal error. The bus has turned itself off due to errors.

1. Line 1 of the graph area indicates the number of active CanBus I/O nodes and their status.
2. Line 2 of the graph area indicates the state of the touch probe input when a probe is connected to the Motion Control Board (MCB):

   0 Not deflected (touching)

   1 Deflected (touching)
3. Line 3 of the graph area indicates the basic machine I/O status.
4. Line 4 of the graph area indicates:
   - The address of the active node. Possible values are 0 to 5.
   - The number of message packets lost between the node and the controller. This should be 0.
   - The number of times the node has signed on since the control started. This should be 1 unless power was interrupted.
   - The node bus type. This is normally 0.

5. Line 5 indicates:
   - The status of the ten inputs of each node.
   - The status of the six outputs of each node.
   - Subsequent lines indicate the I/O status of any additional nodes.
6. Subsequent lines indicate the I/O status of any additional nodes.

Rigid Tapping Test

This test displays the lag between the spindle and the Z-axis velocity as a measurement of synchronization between the mentioned axes. The display units are microns per position loop sample. After the test is selected, a Rigid Tapping Cycle must be programmed using Manual Data Input (MDI).

The lag display has 3 main sections:

a) Going in

b) Reversing direction (retract)

c) Going out the thread

If the controller is optimally tuned, the sections [a] and [c] should present near zero lag. Any peak on these sections means that either the spindle or Z-axis motors are not reaching their final speeds. The most critical section is [b] since some lag will appear when reversing direction. This lag will increase proportionally to the spindle rpm and it may be diminished by fine-tuning the rigid tapping gains of the Proportional Integral Derivative (PID) controller in the Z-axis (proportional gain [Kp] and feedforward gain [Kf]). As a point of reference, the threading (sections [a] and [c]), the retract lag (section [b]), and the Z-axis lag are displayed on the screen after each rigid tapping cycle. Also, gains Kp and Kf for the Z-axis can also be changed in the test before the cycle is commanded.

The best approach to fine-tune these gains is to auto-tune the PID filter for the Z-axis with only derivative gain (Kd). After the test is done, save these values in the rigid tapping gain table. With the help of the rigid tapping test, start increasing Kf and/or Kp in the test until the Z-axis lag is zero or very close to zero. Save the results with the “save” soft key after this is done.

The following graphics display two possible results:

- Refer to **Figure 18**. Axes optimally tuned reported a retract lag of 51 microns.

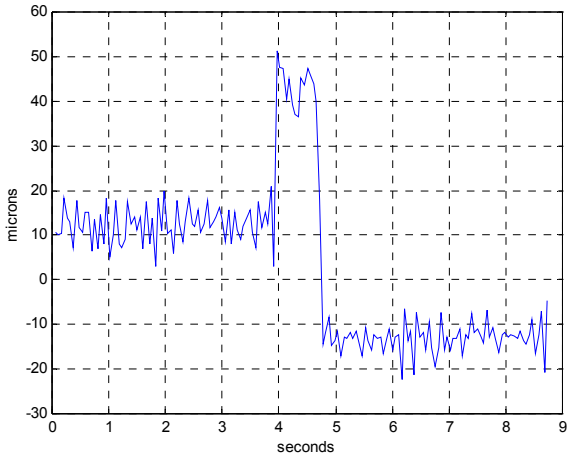


Figure 18, Axes Optimally Tuned Screen

- Refer to **Figure 19**. Z-axis without being optimally tuned (default gains). Reported retract lag was 79 microns and threading lag of 12 microns.

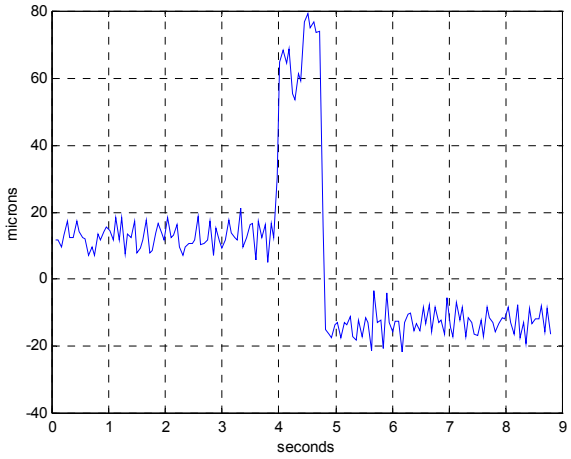


Figure 19, Z-axis Not Optimally Tuned Screen

Save Amp Settings

This feature is only for systems equipped with an ANILAM AC Amplifier (P/N 33001279) and with the Servo Amplifier Communications Cable, P/N 33001389, connected. Refer to “Setting the Balance (F6)” and “Setting the Signal Gain (F7).”

Saves all modified amplifier parameters to non-volatile memory. This must be done after performing a signal gain test and/or a balance test.

Balance Test – When Balance test [**Balance** (**F6**)] is selected and if the Communication link between the CNC and ANILAM AC Drive is enabled/open, the Parameter IAO (Analog 1 Input Offset) will be displayed and you will be able to modify it by using the up/down **arrow** keys. Use right/left **arrow** to change the increment amount (which is set on Setup Utility). Save the final value by selecting **Save Amp Settings** [**MISC** (**F9**)].

Signal Gain Test – When Signal Gain test [**SigGain** (**F7**)] is selected and if the Communication link between the CNC and ANILAM AC Drive is enabled/open, the Parameter IAS (100% PWM RPM Value) will be displayed and you will be able to modify it using the up/down **arrow** keys. Also, the Compensation (equivalent to Comp Pot) parameter GVC (Velocity Loop Master Gain) will also be displayed; you will be able to modify it by using right/left **arrow** keys. Every time you press the **arrow** keys, the value will be incremented by the amount entered in the Setup Utility. Save the final value(s) by selecting **Save Amp Settings** [**MISC** (**F9**)].

These two tests should cover the equivalent of Signal, Balance & Comp Pots on the analog drives.

Amplifier Test Link

This feature is only for systems equipped with an ANILAM AC Amplifier (P/N 33001279) and with the Servo Amplifier Communications Cable, P/N 33001389, connected.

This enables/disables the communications monitor. The communications monitor has two modes of operation: Monitor and Command. Using an external keyboard, use hot key (**CTRL** + **F7**) to switch between the two modes.

Monitor: (Default) During this mode, you can monitor all communication between the Amplifier and the Control.

Command: During this mode, it not only monitors all communications; but also, allows you to send direct commands to the Amplifier.

Reset Amplifier

This feature is only for systems equipped with an ANILAM AC Amplifier (P/N 33001279) and with the Servo Amplifier Communications Cable, P/N 33001389, connected.

This resets the AC amplifier.

BackUp Amp Settings

This feature is only for systems equipped with an ANILAM AC Amplifier (P/N 33001279) and with the Servo Amplifier Communications Cable, P/N 33001389, connected. Refer to “Restore from Backup.”

To backup amplifier parameters:

1. Select an axis (i.e., X, Y, Z, U).
2. Press **Misc** (**F9**) to display the pop-up menu.
3. Highlight **BackUp Amp Settings** and press **ENTER**. A message is displayed indicating the amplifier backup file is created.

This reads all parameters from the amplifier and creates a backup file named DIGAMP-*.BK, where ‘*’ is the selected axis name (i.e., X, Y, Z, U). This file is stored on the hard disk drive.

NOTE: The backup file is compatible with the file generated by MotionMaestro. When functions pertaining to ANILAM AC Drive are selected, the user needs to have a RS-232 communication cable connected between the amplifier and the CNC.

Restore from BackUp

This feature is only for systems equipped with an ANILAM AC Amplifier (P/N 33001279) and with the Servo Amplifier Communications Cable, P/N 33001389, connected.

To restore amplifier parameters from backup:

1. Select an axis (i.e., X, Y, Z, U).
2. Press **Misc** (**F9**) to display the pop-up menu.
3. Highlight **Restore from BackUp** and press **ENTER**. A message is displayed indicating the amplifier backup file is restored created.
4. Press **Misc** (**F9**) to display the pop-up menu, highlight **Reset Amplifier** and press **ENTER**.

This sends the parameters in the backup file to the amplifier.

AC and DC Systems

The following headings describe both the AC and DC systems:

- Tuning (F8)
- Saving Final Values
- Exiting the MST Screen (F10)

Tuning (F8)

NOTE: ANILAM recommends that you set signal gain and balance the servo amplifier, as discussed in previous text, before tuning.

CAUTION: Most machines will operate correctly with the default filter parameters. Only qualified technicians who have knowledge of motion control tuning parameters should use this tool.

The Tuning function can determine optimum values within constraints you specify. The default values are usually correct for most machines. To fine-tune, enter values manually or use this test. Refer to **Figure 21, Tuning Parameters Test Results Screen**.

The Tuning Test has a setup screen that enables you to configure the extent of the test. Check the setup parameters, run the test, and then save the results. Refer to **Figure 20** and **Table 9**.

Tuning Setup

1. Tune Ki ..... No
2. Tune Kd ..... No
3. Tune All Axis ..... No
4. Match Axis Lag ... No

Figure 20, Tuning Setup Menu

Table 9, Tuning Test Parameters

Parameter	Function
Tune Ki	Switches integral tuning ON or OFF. [Default: **No**]
Tune Kd	Switches derivative tuning ON or OFF. [Default: **No**]
Tune All Axis	If set, tunes all axes sequentially. [Default: **No**]
Match Axis Lag	If set, calculates the inch/min/mil (Imm) of each axis, chooses the smallest one and matches the inch/min/mil of the other axes to the smallest by decreasing Kp. **Tune All Axis** must be set to use this option. [Default: **No**]

If you have selected Kd (derivative gain), the CNC begins by measuring derivative sampling time (Ds). It measures the time between 10% and 90% of the final velocity (rise time) and divides it by five. A portion of this time is determined to be the Ds.

WARNING: If you select the Kd test, you must have at least 2.5" (63 mm) of travel in the positive (+) direction.

Next, the CNC calculates Kp (proportional gain). If the current overshoot is smaller than the set one, Kp is increased by 1. If it is larger, Kp is decreased by 0.1.

If you have selected Ki (integral gain), the CNC then calculates Ki and Il (integral limit). If the lag between the commanded position and the actual position is not zero, Il is increased by 5 and this portion of the test is repeated.

The CNC calculates Kd, if selected. The CNC will attempt to decrease the overshoot until the set value (Kd overshoot) is matched. When this condition is not matched, Kd is increased by 2.

If you have chosen to test only one axis, the test is completed at this point. If you have chosen to test multiple axes, and have not selected "Lag Matching" the test will repeat the procedure on each axis in turn, until complete.

If you have chosen all axes and Lag Matching, the CNC calculates the inch/min/mil (Imm) of each axis being tested and matches the inch/min/mil to the lowest value of all axes tuned.

To test:

1. Energize the servos and select an axis.
2. Press **Tuning** (**F8**). A pop-up is displayed with the following choices: **Tuning Test**, **Save Results**, and **Tuning Setup**.
3. Refer to **Table 9, Tuning Test Parameters**. Check the Tuning Setup menu to determine which parameter(s) you wish to change. Select **Tuning Test**, and press **ENTER**. Choose the parameter(s) you wish to include in the test.
4. Refer to **Table 10, Tuning Functions Values**. Enter values for the following tuning parameters:

NOTE: Kp overshoot must be greater than Kd overshoot.

Table 10, Tuning Functions Values

Parameter	Function
Kp Overshoot %	Determines amount of overshoot the CNC will seek before ending the Kp cycle. 1% to 5% is a normal overshoot range for this test. If detected overshoot exceeds the entered OvSht%, the cycle ends. [Default: **5**]
Kd Overshoot %	Sets limit for Kd overshoot. [Default: **2**]
Kp min	Sets Kp to starting value during proportional tuning. [Default: **1**]

5. Press **START**. The CNC begins the test.
6. Refer to **Figure 21, Tuning Parameters Test Results Screen**. After the test, the CNC plots the final step responses for all axes tested, and displays them in the graphics area of the screen.
7. To save results of the test, press **Tuning** (**F8**) and select **Save Results**.
8. Press **MANUAL** (**F4**) to exit or cancel the test.

Saving Final Values

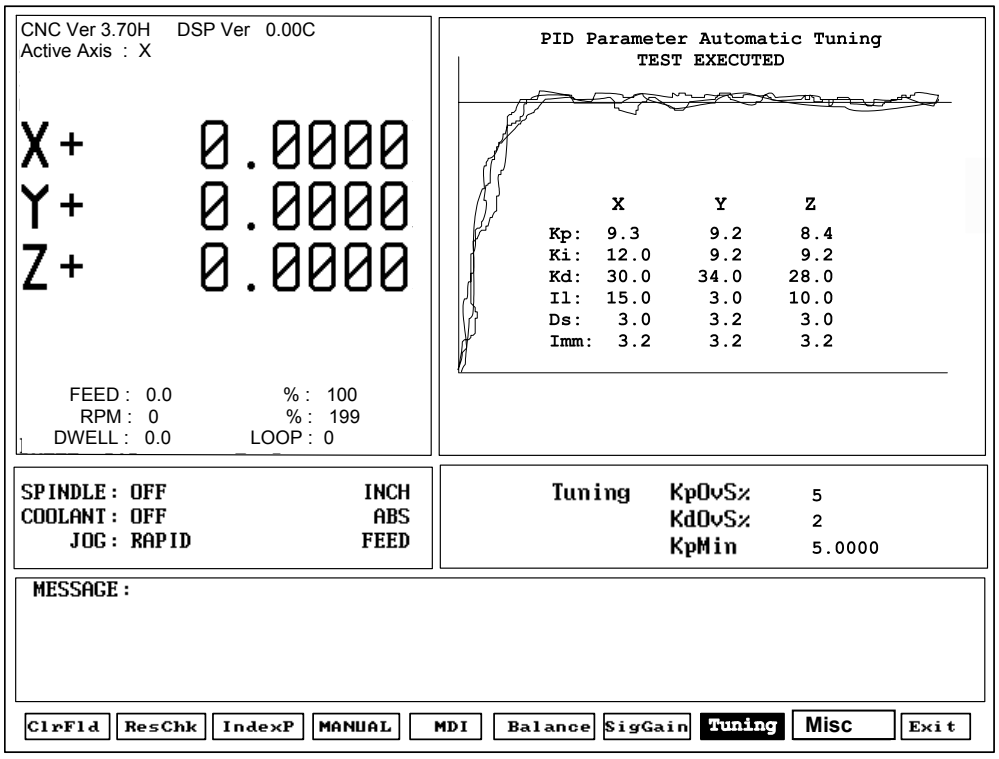


Figure 21, Tuning Parameters Test Results Screen

To save the Tuning Test values:

1. Refer to **Figure 21**. After the Tuning Test, the results are displayed in the Graphics Area of the screen. Press **TUNING** (**F8**) and highlight **Save Results**.
2. A pop-up is displayed with the following options: **[No Motion]**, **[Feed]**, **[Rapid]**, **[ALL Tables]**. Highlight the table to which you wish to save the final values, and press **ENTER**. This overrides the values in the Setup Utility. Normally, choose **All Tables**.
3. The CNC stores the new values in the configuration file.
4. Or, press **F9** to cancel.

NOTE: ANILAM recommends that you back up your configuration file before you save tuning results. This will enable the filter parameters to be recovered if necessary. Refer to *3000M CNC Setup Utility Manual*, P/N 70000499, for details on backing-up and restoring setup parameters.

Exiting the MST Screen (F10)

Press **Exit** (**F10**) to exit the MST Screen and return to the Software Options screen in the Setup Utility.

C

D

Z

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