SGRP GALVO BOARD (P/N 60560094-01)
CONFIGURATION AND TUNING PROCEDURES

1.1. INTRODUCTION

This document provides information for the SGRP Galvo Boards used on LightWriter high-speed systems, and includes a description of the SGRP Galvo Board Test Pod.

1.2. BOARD CONFIGURATION

The following table shows the jumper configuration for the SGRP Board. Note that for LightWriter high-speed applications, the board operates in the " DG300 " mode.

JUMPER	NAME	SETTING
JP1	CLK SEL	(OPEN)
JP2	LOAD SEL	+5
JP3	XACK DLY	2
JP4	SW PA ENABLE	(OPEN)
JP5	NOTCH?	IN
JP6	-	(OPEN)
JP7	-	(OPEN)
JP8	IF SEL	DG300
JP9	CLK SEL	CLK2
JP10	-	I/O
JP12	-	(OPEN)
JP13	-	(OPEN)
JP14	-	(OPEN)
JP15	SS MSB INV	(OPEN)
JP16	LO DAMP	(OPEN)
JP17	345?	NO
JP18	345?	NO
JP19	OS MODE	MAN
JP20	-	OFF (not ACTIVE position)
JP21	-	OFF (not ACTIVE position)
JP22	-	OFF (not ACTIVE position)
JP23	-	OFF (not ACTIVE position)
JP24	-	VAR
JP25	-	(see note)

NOTE: The setting of the dual jumper (2 x 2) installed at JP25 is dependent on the optic system installed in the LightWriter; it determines whether the marking field will be inverted or not. This jumper provides a hardware method of establishing or changing the marking field, in preference to modifying the software optic keyword settings in the factory settings file.

There are two possible settings for the jumper at JP25 - either horizontally or vertically. The setting is normally determined when the system is configured, prior to shipment.

1.3. BOARD ADDRESS SELECT

The following table shows the settings for the Address Select DIP switch, SW1:

AXIS REF	X	Y
SW1 #1	open	closed (ON)
SW1 #2	closed (ON)	closed (ON)
SW1 #3	open	open
SW1 #4	open	open
SW1 #5	closed (ON)	closed (ON)
SW1 #6	closed (ON)	closed (ON)
SW1 #7	closed (ON)	closed (ON)
SW1 #8	closed (ON)	closed (ON)

Schematics and circuit diagrams of the SGRP Board are included in the Hardware and Maintenance manual provided with the system.

1.4. GALVO BOARD TEST POD INFORMATION

The Test Pod provides several aids to the field service technician which can be used for adjustment and test of the SGRP Galvo Boards. For these procedures, the Test Pod is connected by a 26-conductor ribbon cable to the Test/Diagnostic connector (J1) on the foreplane of the SGRP board. The Test Pod is directly powered from the galvo board under test.

The following controls, test points and indicators are provided on the pod:

- *External Test Point Access.* Galvo Board test points TP1 thru TP9 are brought out from the board to the right-hand side of the Test Pod. For convenience, a scope probe ground bar is also provided. Three test points which are used during the SGRP Tuning Procedure are also available as BNC jacks at the bottom of the Test Pod to allow the use of BNC-to-BNC cables for connection to an oscilloscope, as an alternative to using standard scope probes.

- *Calibrated Square Waves of 100%, 1%, and Variable 0 - 100%.* For use in board tuning and diagnostic procedures. Note that percentages are based on the maximum excursion of the galvo - as defined by the manufacturer - not on the size of the mark field of a particular application. A ±100% excursion is equivalent to ±10 volts at the GVO ANG test point, TP8.

- *Variable DC Offset.* Allows the positioning of the galvo to any angle throughout its range. This offset is summed with the step size, enabling a given step size to be positioned anywhere within the galvo's allowable excursion range. The maximum offset is large enough to drive the galvo beyond its over-rotation trip point (approximately ±12 volts at TP8), thereby allowing testing of this feature, if desired. (Additional information on this check is available in the SGRP document P/N 6190032.)

- *Board Reset Button.* Allows the user to reset the command DAC to zero (i.e. mid-scale), and to relatch the protection relay, if required. Note that the reset button is equivalent to a Multibus reset (INIT) - but this signal resets only the galvo board under test, not the complete Marker drawer.

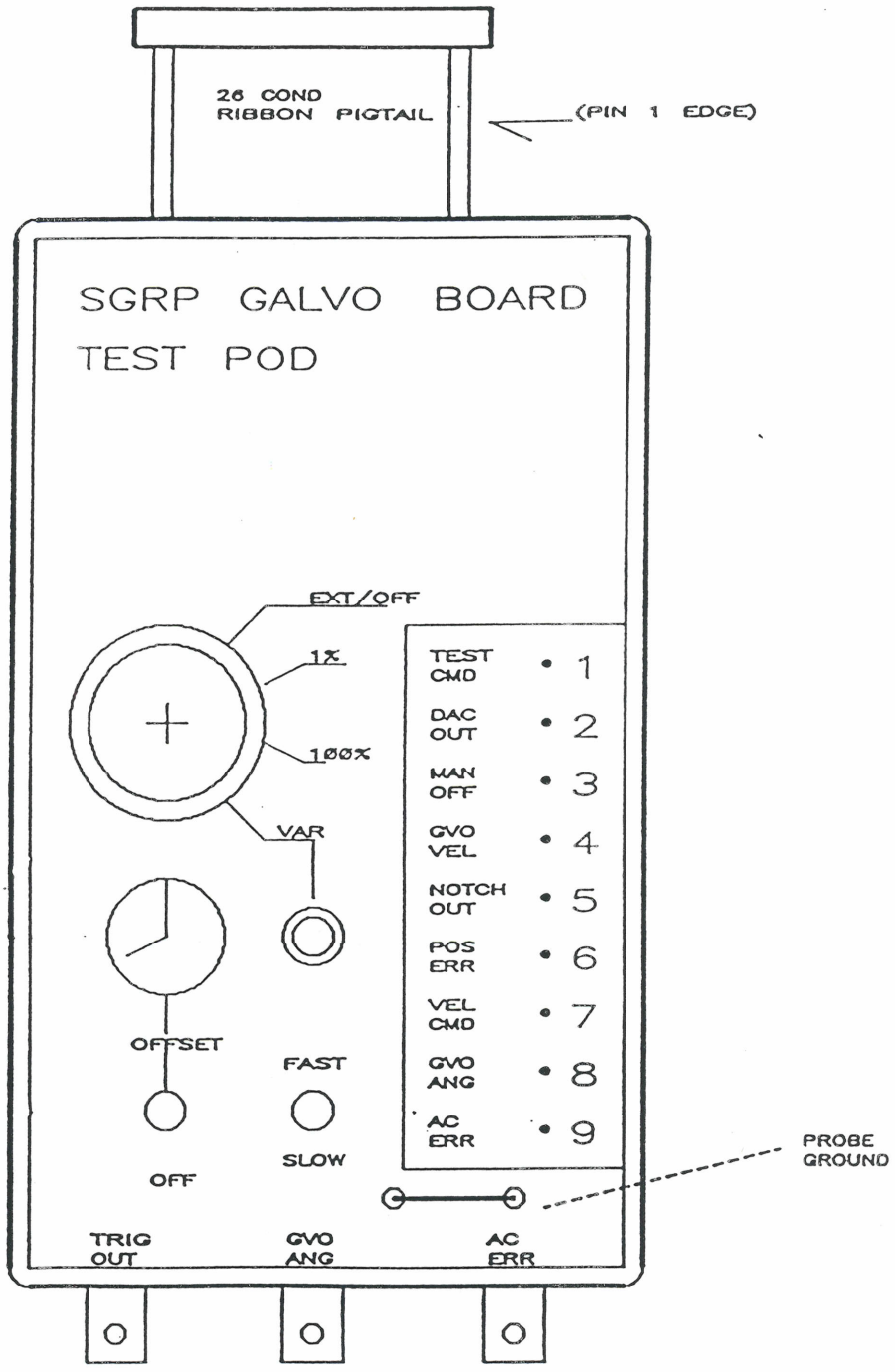

Figure 1. SGRP GALVO TEST POD LAYOUT

The Test Pod is a convenient and powerful tool for galvo subsystem troubleshooting and diagnostics which can be used for testing and exercising the SGRP board, the galvo, and the optical system. The usage of the Test Pod during troubleshooting will be dependent on the nature of the problem and the experience and skill level of the user. Typically in the field, an SGRP board which cannot be properly tuned will be replaced by a spare board from the site kit, and the defective board returned to the factory for repair; however, using the features of this Test Pod, a knowledgeable Field Service engineer will be able to isolate a defective component within the optical system, including running other tests which are not discussed in this document.

The features of the Test Pod and the controls mounted on the front panel are as follows:

MODE SELECT SWITCH - This rotary switch has four positions:

1. **EXT/OFF** - Disables internally generated square wave and allows an external input to be injected at the TEST CMD (TP1) terminal on the front of the Pod. The galvo angle at TP8 should follow this input, but will opposite in polarity to the signal at TP1.

2. **1%** - Drives the galvo with a square wave equal to 1% of its maximum excursion (±100 mv at GVO ANG, TP8)

3. **100%** - Drives the galvo with a square wave equal to 100% of its maximum excursion (±10 volts at GVO ANG, TP8)

4. **VAR** - Drives the galvo with a square wave which may be varied by the user, using the VAR control, between 0% and 100% of its maximum excursion. Fully counterclockwise will produce a 0% excursion, and fully clockwise will produce a 100% excursion.

OFFSET ENABLE SWITCH - This toggle switch enables the OFFSET control knob. In the OFF position, no offset is applied and galvo movement is symmetrical about the center. Note that OFFSET does not affect the 100% step size.

OFFSET KNOB - This 10-turn control allows the selected square wave to be moved anywhere throughout the mark field when enabled by the OFFSET ENABLE SWITCH. Center scale (i.e. the center of the galvo's rotation range) is at 5 o'clock (mid-point) on the dial face. The Offset Knob has enough range to drive the galvo beyond the over-rotation trip limits (for test purposes, if required). For this test the MODE should be set to VAR, and the VAR control turned fully counter-clockwise (0% excursion).

FAST/SLOW SWITCH - This toggle switch selects the frequency of the calibrated square wave generated by the Test Pod. Normally, the SLOW position is used during board tuning, although FAST can be used to produce a sharper scope trace during small galvo movements, or when faster galvos become available.

TEST POINTS - The test points, names and numbers indicated on the SGRP board are brought out to the front of the Test Pod to aid in troubleshooting and testing. These points are isolated and short-circuit protected; a ground bar is provided for scope probes.

BNC JACKS - Three BNC outputs are provided for use during board testing:

TRIG OUT Provides a TTL square wave for scope triggering during tuning. This signal is synced to the calibrated test signal - simplifying scope usage and measurement of settling times.

GVO ANG — Same as TP8. Allows the user to monitor the galvo angle, effect of offset, etc., and is helpful during coarse tuning adjustment. ±10 volts = 100% full scale; 0 volts = center. Note: 100% refers to the mechanical full scale. 100% of the mark field will always be less than 100% of the mechanical full scale.

AC ERR — Same as TP9. Used for fine tuning the galvo response and adjusting the settling times.

RESET BUTTON - Located on the upper left side of the Test Pod, this button initializes the DAC command to 0 volts (mid-scale) and relatches the over-rotation protection relay. This is a local reset on the SGRP Board - and does not affect the Multibus.

1.5. GALVO TUNING PROCEDURE USING THE TEST POD

The following procedure allows trained personnel to perform a fine tuning adjustment of the SGRP Galvo Board. Generally, this should only be necessary after replacing a defective galvo board, galvo assemblies, or galvo mirrors. Replacement galvo boards received from stock will have been tested and adjusted to preliminary settings.

NOTE

If the tuning adjustment pots on the galvo board are suspected of being grossly mis-adjusted such that the OVER-ROTATION relay trips, either when powering up the card cage or during the initial steps of the tuning procedure (below), the pots should be readjusted to their initial settings so that they are at a known starting point before proceeding with the tuning procedure. To do this, first turn pots VR1 thru VR6 fully counterclockwise, then adjust the pots to the suggested initial settings shown in the following list:

DESIGNATION	NAME	SETTING
VR5	OFFSET	Center (Measure 0 volts at TP3)
VR4	CMD RNG	Not Applicable
VR3	SPG CMP	25 turns Clockwise
VR2	DMPING	Fully Counterclockwise
VR1	VEL BAL	10 turns Clockwise
VR6	PO GAIN	15 turns Clockwise

When the pot is in the full counterclockwise position, an audible click can be heard, once per revolution. The number of turns in the clockwise direction is counted from this point.

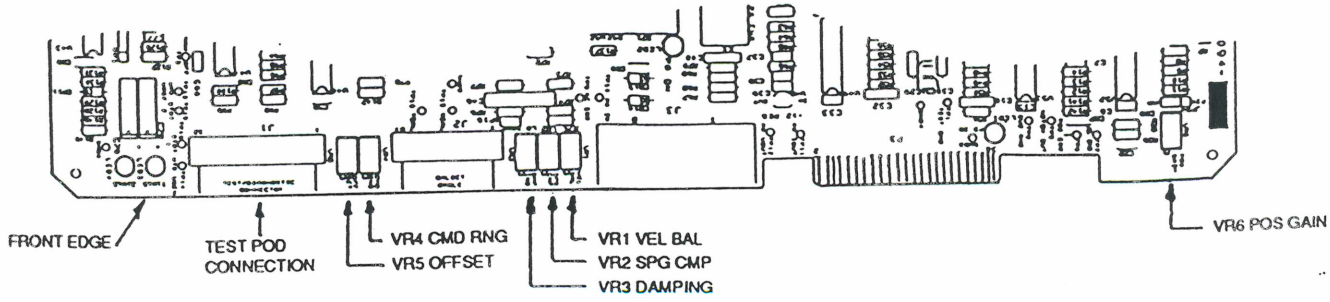

Figure 2 - Location of SGRP Foreplane Potentiometers

The object of the following tuning procedure is to adjust the galvo system response so that defined settling times can be defined for both large (100%) and small (1%) step sizes. Note that although rise time is not used as a tuning parameter, it will be indirectly optimized using this procedure.

Equipment Required

SGRP Test Pod with 2 BNC-to-BNC cables
Oscilloscope

PROCEDURE

1. With the card cage powered off, connect the Test Pod to the Test/Diagnostic connector on the appropriate SGRP board (J1, 26-pin header on the left side of the board).

2. Set the Test Pod switches and controls to the following positions:

   OFFSET enable switch to OFF
   MODE switch to VAR
   FAST/SLOW switch to SLOW
   VAR control knob fully counter-clockwise

3. Connect the TRIG OUT jack to the scope Ext Trigger and the GVO ANG jack to the scope signal input.

4. Set the scope as follows:

   5 volts/div
   5 msec/div
   DC coupled input.
   External Trigger

5. Power up the card cage.

6. On the Test Pod, press the RESET button to ensure that the DAC is at center. Adjust the scope trigger and horizontal controls until the trace starts at the left edge of the screen, and the scope ground is vertically centered. The GVO ANG signal should be at approximately 0 volts (with the MAN OFF pot centered).

7. Slowly rotate the VAR control fully clockwise (to 100%) and verify that a response similar to that shown in Figure 3 is achieved. This confirms that *coarse tuning* has been satisfactorily set. If excessive overshoot or oscillation is observed, refer to Figure 2 for pot locations and adjust the DMP ING (VR3) pot and VEL BAL (VR1) pot until a reasonable square wave can be achieved without any overshoot, with the VAR control set fully clockwise. ***This waveform must be achieved before proceeding to fine tuning adjustment in step 8.***

TYPICAL COARSE TUNING RESPONSE

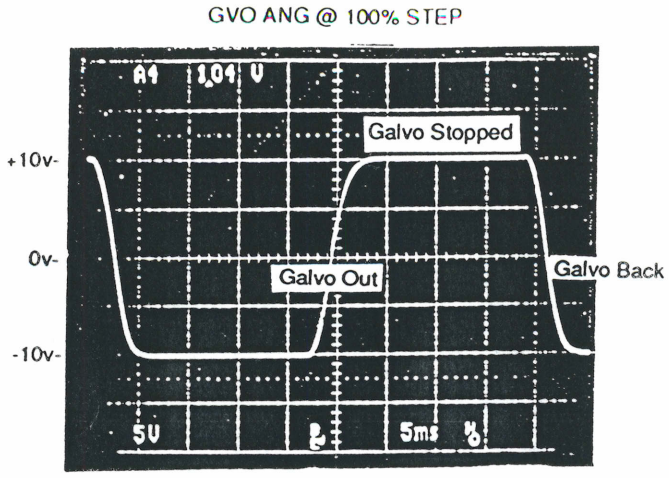

Figure 3

8 Fine tuning is performed by optimizing the AC ERR signal on the scope while alternating the MODE switch between the 1% and 100% positions; this consists of making adjustments until the following conditions are met:

AC ERR settles to ± 100 mvolts (of final value) within 9-to-11 msecs at the 100% setting.
AC ERR settles to ± 100 mvolts (of final value) within 2-to-2.5 msecs at the 1% setting.

Connect the AC ERR jack to the scope signal input, and adjust the VEL BAL (VR1), DMPING (VR3), and POS GAIN (VR6) pots until the waveforms appear similar to those shown in Figures 4 and 5. (This adjustment is made at the 5 volts/div scope setting.)

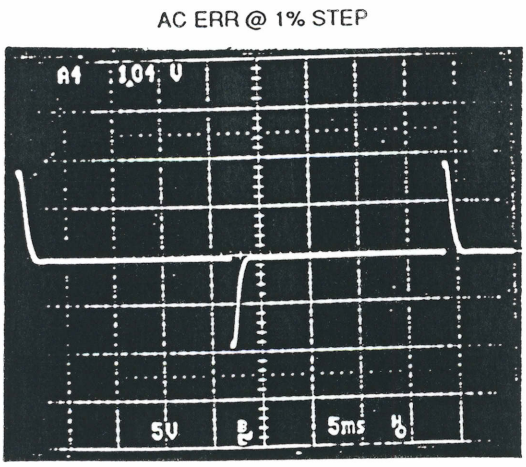

Figure 4

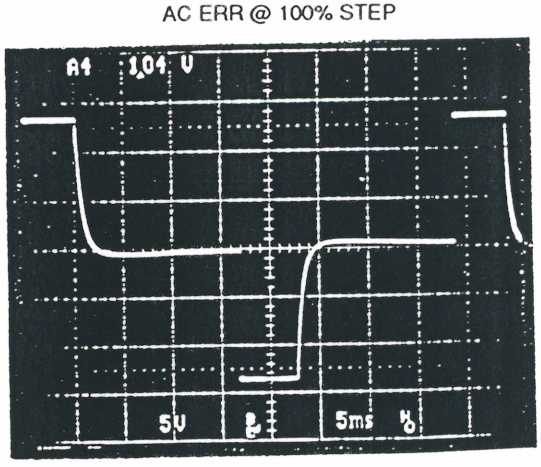

Figure 5

9. Change the scope to the 500 mvolts/div setting and readjust VR1, VR3 and VR6 until the "time to settle" and ±100 mv "window" have been achieved, as shown in Figures 6 and 7.

Note: VR6 should only be adjusted if these measurements cannot be achieved by adjusting VR1 and VR3.

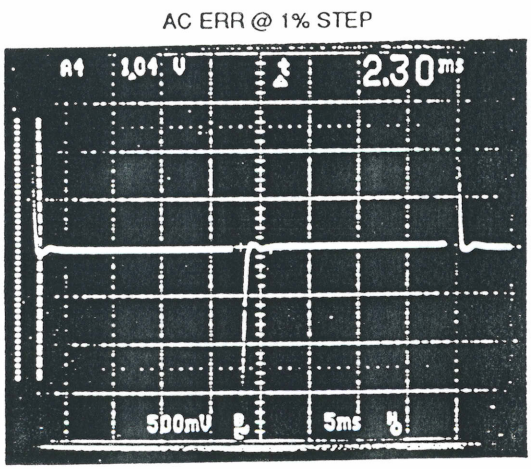

Figure 6

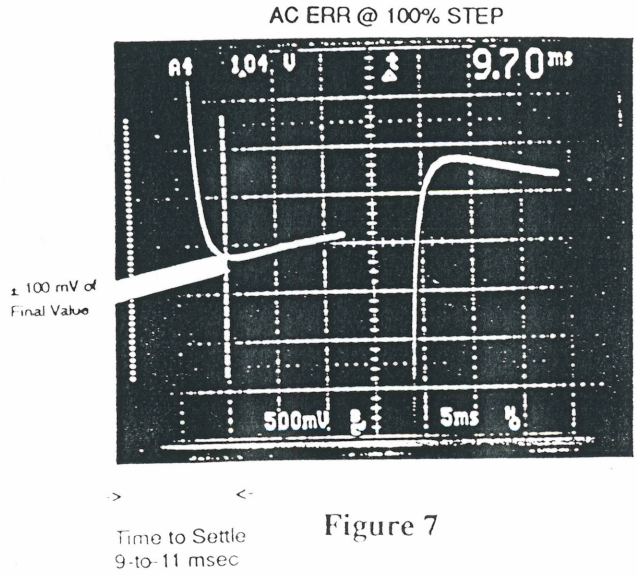

Figure 7

If the "time to settle" measurement is too long and cannot be reduced to meet the required response, adjust VR6 clockwise until AC ERR settles within 9-to-11 msecs.

If "time to settle" is within 9-to-11 msecs but overshoot and ringing can be seen, adjust VR6 counterclockwise until the ringing has been eliminated (with no overshoot) and the correct response has been achieved.

1.6. SGRP GALVO BOARD MANUAL TUNING PROCEDURE

The following procedure is the recommended method of performing fine tuning adjustment of SGRP Galvo Boards (P/N 60560094-01) when the (optional) SGRP Test Pod is not available.

Generally, this should only be necessary after replacing a defective galvo board, galvo assemblies, or galvo mirrors. Replacement galvo boards received from stock will have been tested and adjusted to preliminary settings.

The object of this tuning procedure is to adjust the galvo system response so that defined settling times can be defined for both large and small step sizes. Note that although rise time is not used as a tuning parameter, it will be indirectly optimized using this procedure.

Equipment Required

Oscilloscope

System Operating Software

Operator Interface Version 300.15 or higher

PROCEDURE

1. Power on the LightWriter and initialize the Operator Interface.

2. If the security access feature is implemented, log on to the Sign-On Screen and select the <F8> CALIBRATION option from the Engineer's Main Menu.

100% Step Adjustment

3. In the Galvo Calibration Screen, use the up and down arrow keys to position the cursor and set the parameters to the following values:

   BOX SIZE : 65000
   REP RATE : 1000
   UPDATE DELAY : 10000

4. Set the scope controls as follows:

   Channel 1: 2 volts/div
   Channel 2: 500 mvolts/div
   DC coupled
   Trigger on Channel 2

5. Connect Channel 1 of the scope to TP8 (GVO ANG) on the SGRP Board, and Channel 2 to TP9 (AC ERR). (Note that TP9 is mis-labeled INV ANG on some earlier boards).

6. Press <F2> to start the galvos. To observe the mark, press <F3> to open the shutter.

7. Adjust the triggering on the scope until the trace appears as shown in Figure 1.

8. On the galvo board, adjust pots VR1 (VEL BAL), VR3 (DMP ING), and VR6 (POS GAIN) until the AC ERR trace (Channel 2) is between ±100 mvolts of its final value, within 6.5-to-7.5 msec from the start of the trace as shown in Figures 2 and 3. Check both directions of the step using the + and - trigger slope.

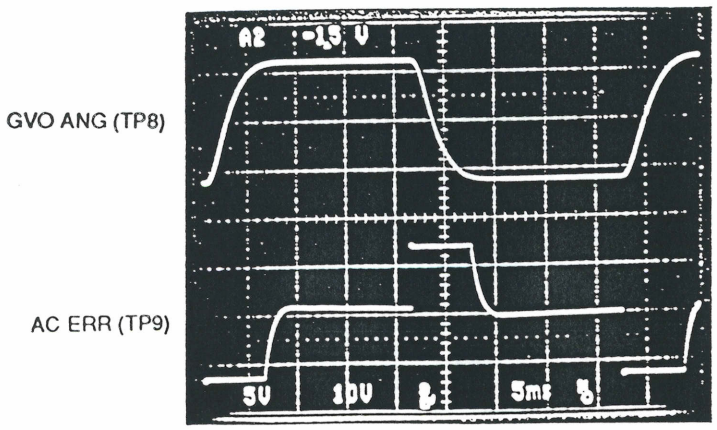

Figure 1

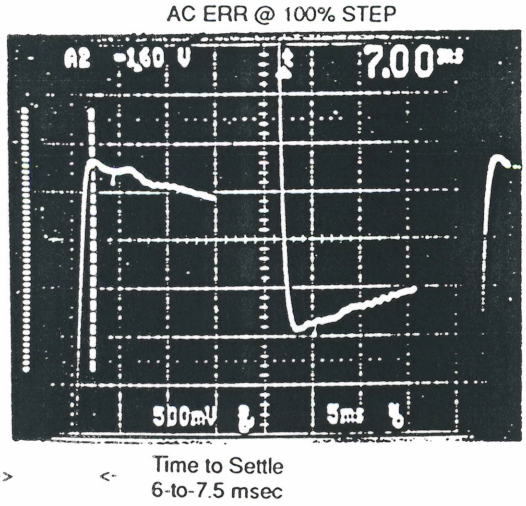

Figure 2

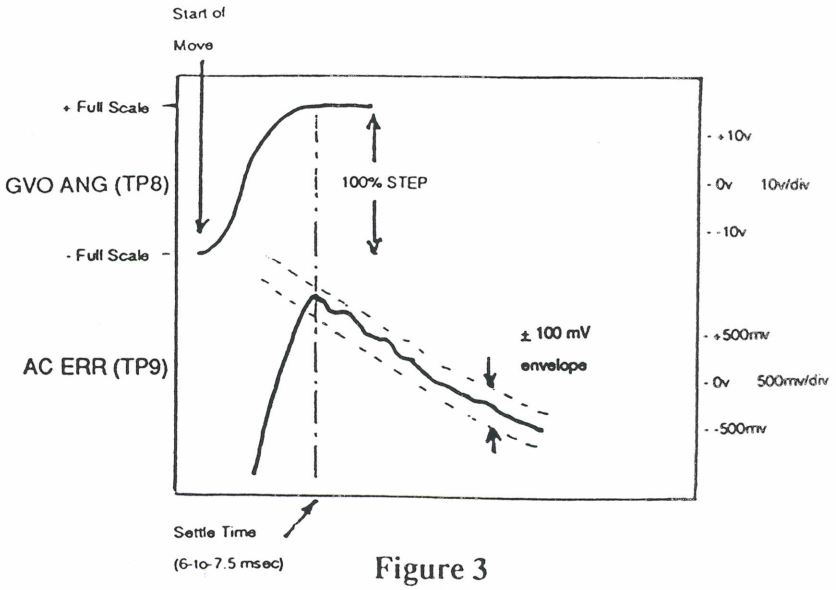

Figure 3

If the board cannot be adjusted to this specification, the tuning pots may be grossly misadjusted; in this case, refer to page 5 and reset the pots to their initial settings, then repeat step 8.

1% Step Adjustment

9. Press <F2> to stop the galvos (and close the shutter, if open). Change the galvo parameters to the following values:

BOX SIZE	:	650
REP RATE	:	1000
UPDATE DELAY	:	10000

10. Set the scope controls as follows:

Channel 1: 500 mvolts/div
Channel 2: 500 mvolts/div
DC coupled
Trigger on Channel 1

11. Press <F2> to start the galvos. To observe the mark, press <F3> to open the shutter.

12. Using very small changes (to minimize the counter-affect of the 100% step), adjust VR1, VR3 and VR6 until the AC ERR trace is at ±100 mvolts of its final value, within 2-to-2.5 msec from the start of the trace as shown in Figure 4. Check both directions of the step using the + and - trigger slope.

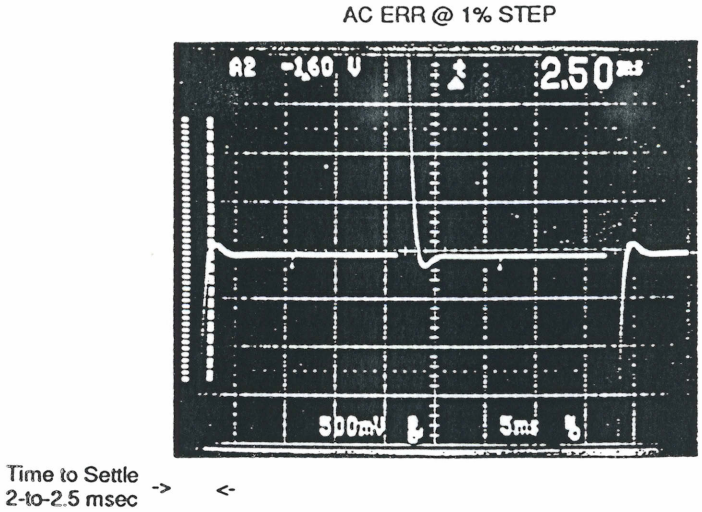

Figure 4

13. Press <F2> to stop the galvos (and close the shutter, if open).

14. Repeat steps 3 thru 8 and verify that the settle time for the 100% step adjustment is still within 6.5-to-7 msec.

15. If necessary, "walk" the values in by repeating steps 3 thru 8, and 9 thru 12, until the 6.5-to-7.5 msec settle time and 2-to-2.5 msec settle time can be met for the 100% and 1% step sizes, respectively.