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067-0969-00

TAPE HEAD ALIGNMENT MODULE

INSTRUCTION MANUAL

Tektronix, Inc.
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This manual supports the following versions of this product: Serial No. B010100 and up.

MANUAL REVISION STATUS

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CONTENTS

		Page
Section 1	**INTRODUCTION**	
	General Information	1-1
	Equipment Required	1-1
	Quick Reference Chart	1-2
Section 2	**4050 SERIES ALIGNMENT PROCEDURE**	
	Preliminary Setup and Motor Speed Adjustment	2-1
	Head Skew Adjustment	2-2
	Head Height Adjustment	2-3
	Read Channel Balance Check	2-4
Section 3	**4923 TAPE ALIGNMENT PROCEDURE**	
	Preliminary Setup and Motor Speed Adjustment	3-1
	Head Skew Adjustment	3-2
	Head Height Adjustment	3-3
	Read Channel Balance Check	3-3
Section 4	**4924 TAPE ALIGNMENT PROCEDURE**	
	Preliminary Setup and Motor Speed Adjustment	4-1
	Head Skew Adjustment	4-2
	Head Height Adjustment	4-3
	Read Channel Balance Check	4-3
Section 5	**4081 TAPE ALIGNMENT PROCEDURE**	
	Preliminary Setup and Motor Speed Adjustment	5-1
	Head Skew Adjustment	5-2
	Head Height Adjustment	5-3
	Read Channel Balance Check	5-3
Section 6	**TAPE HEAD ALIGNMENT MODULE TEST PROCEDURE**	
	Introduction	6-1
	Equipment Required	6-1
	Test Procedure	6-1
Section 7	**DEFINITION OF HEAD AZIMUTH (SKEW)**	
Section 8	**REPLACEABLE PARTS**	
Section 9	**SCHEMATIC**	

ILLUSTRATIONS

Figure	Description	Page
1-1	067-0969-00 Tape Head Alignment Module	iv
1-2	Normal and Differentiated Tape Head Signals	1-1
2-1	4050 Series Tape Unit Test Points and Adjustments	foldout
2-2	4050 Series Tape Head Skew Adjustment Waveforms	2-2
2-3	4050 Series Tape Head Height Adjustment Waveform	2-3
2-4	4050 Series Read Channel Waveforms	2-4
3-1	Recorder Test and Adjustment Points	foldout
3-2	Tape Head Skew Adjustment Waveforms	foldout
3-3	Head Skew (Azimuth) Adjusting Screw	foldout
3-4	Tape Head Height Adjustment Waveform	foldout
3-5	Head Height Adjusting Screws	foldout
3-6	Read Channel Waveforms	foldout
6-1	Tape Head Alignment Module Test Setup	6-0
6-2	Tape Head Alignment Module Test Waveform	6-2
7-1	Head Skew Example	7-1

TABLES

Table	Description	Page
1-1	Quick Reference Chart	1-2
7-1	Original Alignment Conditions and Resultant Skew Conditions	7-2

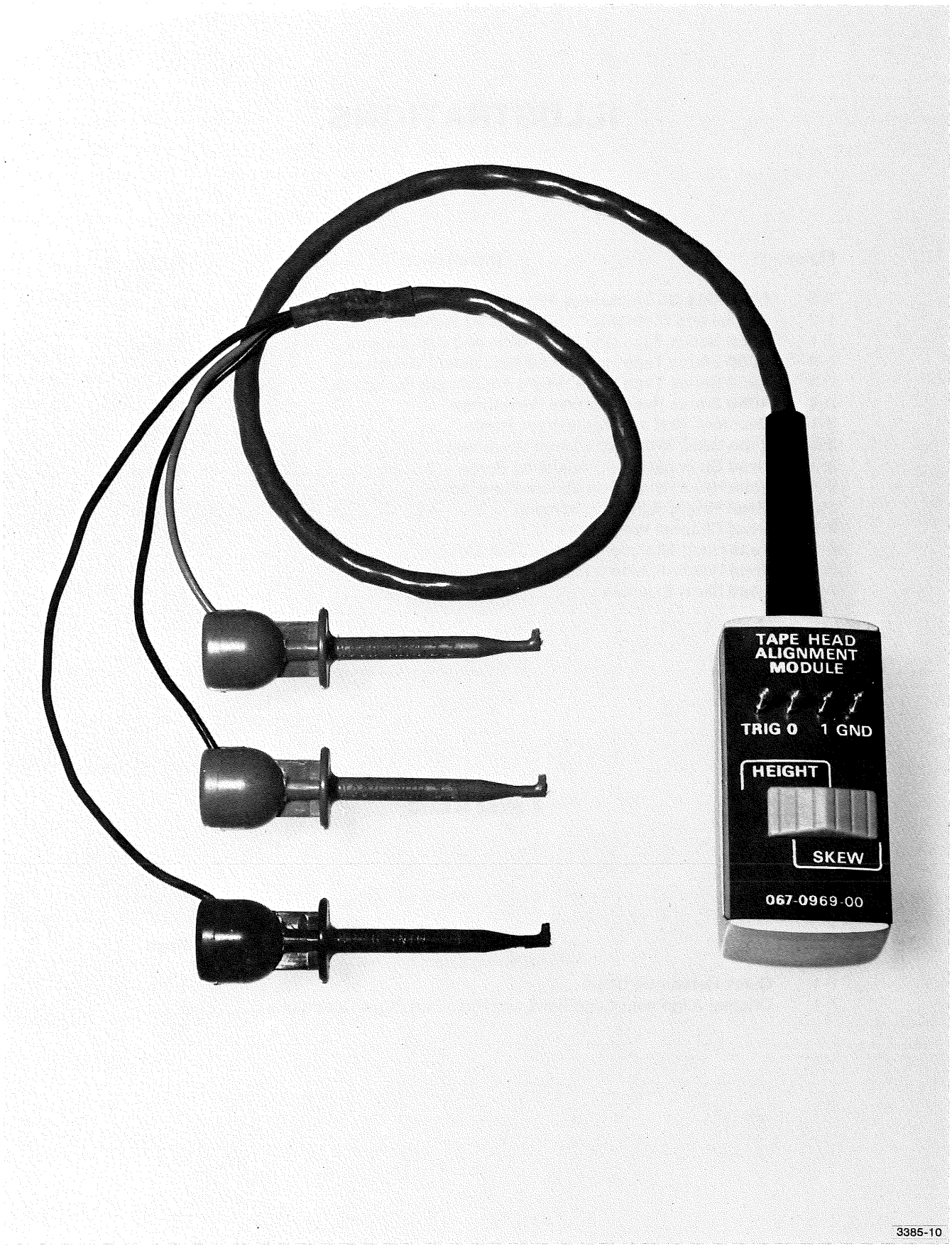


Figure 1-1. 067-0969-00 Tape Head Alignment Module.

Section 1

INTRODUCTION

GENERAL INFORMATION

The 067-0969-00 Tape Head Alignment Module (Figure 1-1) is a small test fixture used during tape head alignment of 4050 Series, 4923, 4924 and 4081 tape drive units. The module has three test leads that connect to the tape unit being calibrated, four test points for oscilloscope connection, and a two-position test mode switch.

The 067-0969-00 provides a more accurate method of aligning tape heads than what was previously available. Previous head alignment methods compared either the analog signals from the heads or the digital edges from the cross-over detectors. The 067-0969-00 differentiates the amplified signal from the tape heads. This provides a signal which is much easier to use for alignment because it has a zero crossing for every peak in the head signal (Figure 1-2).

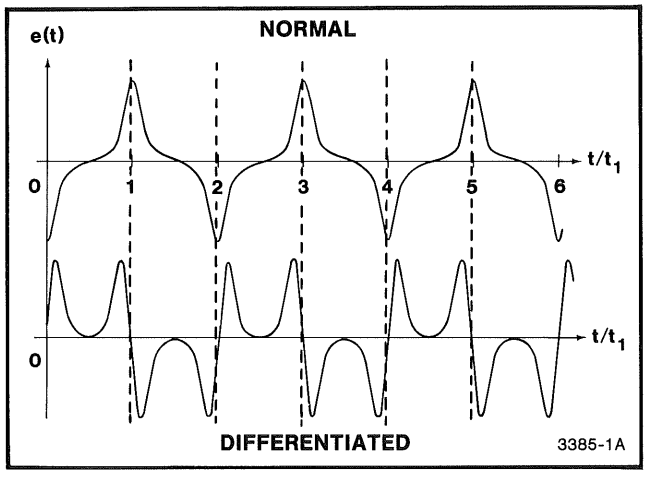


Figure 1-2. Normal and Differentiated Tape Head Signals.

The adjustment procedures in this manual describe how to use the Tape Head Alignment Module. (For best results, use these new procedures instead of previously available ones.) The Quick Reference Chart (Table 1-1) is a convenient reminder of test points for experienced technicians. For detailed alignment procedures, refer to the Table of Contents for the unit to be aligned.

EQUIPMENT REQUIRED

The following equipment is recommended for the alignment of the 4050 Series, the 4081 System, the 4923, and 4924 Digital Cartridge Tape Drives.

- Tape Head Alignment Module (TEKTRONIX 067-0969-00)
- Oscilloscope (TEKTRONIX 455 Oscilloscope or equivalent)
  Dual trace
  Bandwidth, dc to at least 30 MHz
  Deflection Factor, 5 mV per division minimum
- Frequency Counter (TEKTRONIX DC504 Counter or equivalent)
  Range, 10 kHz minimum
  Accuracy, 0.5%
- DC Voltmeter (TEKTRONIX DM502 Digital Multimeter or equivalent)
  Accuracy, 0.5%
  Input impedance, 1 MΩ minimum
- Screwdriver
  Non-inductive
  1/8 inch flat blade
- Screwdriver
  Phillips head
- Nutdriver
  5/16 drive
- Hex (Allen) Wrench Set
- Calibration Tape (TEKTRONIX 067-0781-02)
  The first half of this tape contains a 5 kHz burst signal that is used to adjust head height. The second half of the tape contains a continuous 5 kHz signal that is used for adjusting head skew and motor speed. (An -01 version of the calibration tape may be used if an -02 version is not available. However, the -02 version is a precision tape and the results will be more accurate.)

CAUTION

The 067-0781-02 Calibration Tape should not be dropped or disassembled. This could cause loss or dislocation of the small parts unique to this tape.

Table 1-1

QUICK REFERENCE CHART

ADJUSTMENT	ACTION	4050	4923	4924	4081
MOTOR SPEED ZERO	Tool Connect To Measure Adjust	Voltmeter TP591 0 ± 50 mV R573	n/a	n/a	n/a
"ONE'S" CHANNEL AMPLIFIER	Tool Connect To Measure Adjust	Voltmeter TP21 0 ± 50 mV R8	Voltmeter Top of R122 0 ± 50 mV R13	Voltmeter Top of R122 0 ±50 mV R13	Voltmeter Top of R122 0 ± 50 mV R13
"ZERO'S" CHANNEL AMPLIFIER	Tool Connect To Measure Adjust	Voltmeter TP22 0 ± 50 mV R9	Voltmeter Top of R114 0 ± 50 mV R213	Voltmeter Top of R114 0 ± 50 mV R213	Voltmeter Top of R114 0 ± 50 mV R213
	********** INSERT CALIBRATION TAPE TEXTRONIX 067-0781-02 **********				
MOTOR SPEED CALIBRATION	Signal Tool Connect To Measure Adjust	5 kHz,Steady Freq. Counter TP231 10 kHz ± .1 kHz R597	5 kHz,Steady Freq. Counter U241,Pin 7 10 kHz ± .1 kHz R186	5 kHz,Steady Freq. Counter U241,Pin 7 10 kHz ± .1kHz R186	5 kHz,Steady Freq. Counter U241,Pin 7 10 kHz ±.1 kHz R186
	********** Tool for SKEW and HEIGHT is the Tape Head Alignment Module ********** RL= Either Red Lead, BL= Black Lead, TR= Trigger				
SKEW SET	Signal THAM Setting RL RL BL TR Measure Adjust	5 kHz, Steady SKEW TP21 TP22 Ground Scope Zero Cross within 1 μs Skew Screw	5 kHz, Steady SKEW Top of R122 Top of R114 Ground Scope Zero Cross within 1 μs Skew Screw	5 kHz, Steady SKEW Top of R122 Top of R114 Ground Scope Zero Cross within 1 μs Skew Screw	5 kHz, Steady SKEW Top of R122 Top of R114 Ground Scope Zero Cross within 1 μs Skew Screw
	********** SWAP HEAD LEADS **********				
ANALOG CHANNEL DELAY	Retest Skew Set as above	J88, J89	J320, J321	J320, J321	J320, J321
	********** RESTORE HEAD LEADS **********				
HEAD HEIGHT	Signal THAM Setting RL RL BL TR Measure Adjust	5 kHz, Burst HEIGHT TP21 TP22 Ground Scope Inter-burst Signal, 200 mV Head Lock & Adj. Screws	5 kHz, Burst HEIGHT Top of R122 Top of R114 Ground Scope Inter-burst Signal, 200 mV Head Lock & Adj. Screws	5 kHz, Burst HEIGHT Top of R122 Top of R114 Ground Scope Inter-burst Signal, 200 mV Head Lock & Adj. Screws	5kHz, Burst HEIGHT Top of R122 Top of R114 Ground Scope Inter-burst Signal, 200 mV Head Lock & Adj. Screws
	********** REMOVE TAPE HEAD ALIGNMENT MODULE **********				
LOGIC CHANNEL DELAY	Signal Tool Connect To CH 1 Invert CH 2 Measure	5 kHz, Steady Scope TP231 TP232 Negative Going Edges within 1.5 μs	5 kHz, Steady Scope U241,Pin 7 U241,Pin 9 Negative Going Edges within 1.5 μs	5 kHz, Steady Scope U241,Pin 7 U241,Pin 9 Negative Going Edges within 1.5 μs	5 kHz, Steady Scope U241,Pin 7 U241,Pin 9 Negative Going Edges within 1.5 μs
	****** IF LAST TEST SHOWS GREATER THAN 1.5 μs, REPAIR OR REPLACE UNIT ******				

Section 2

4050 SERIES ALIGNMENT PROCEDURE

PRELIMINARY SETUP AND MOTOR SPEED ADJUSTMENT

The following electrical adjustments on the 4050 Series tape drive board set the Motor Speed Control and Data Level Offset. In addition, mechanical adjustments that provide for correct head height and skew (azimuth) alignment are measured on the 4050 Series tape drive board. The adjustments are made with the unit in its normal operating configuration, except for the removal of the cover.

1. Turn off the power to the instrument. Remove the top cover. Clean the tape head using a cotton swab moistened with isopropyl alcohol. Then remove the alcohol residue and polish the head with a clean, dry cotton swab.

2. Turn on the power to the instrument.

   Refer to Figure 2-1 for the location of test points and adjustments. (Figure 2-1 can be found in the pull-out tabbed section at the back of this manual.)

   Insert a scratch tape.

   NOTE

   The tape must be inserted to avoid a 100 mV offset at TP591 caused by the sensor bracket lamp.

   Connect the voltmeter low probe to circuit ground.

   Connect the voltmeter hi probe to TP591.

   Adjust the Servo Zero Pot (R573) for 0 ± 50 mV. The transport motor should not move.

3. Connect the voltmeter hi probe to TP21.

   Adjust U21 Offset (R8) for 0 ± 50 mV.

4. Connect the voltmeter hi probe to TP22.

   Adjust U121 Offset (R9) for 0 ± 50 mV.

5. Insert the calibration tape and press AUTO LOAD. Cycle the tape by allowing it to run for one complete pass (from beginning to end and back to the beginning). (For the 4052 and 4054 terminals, CALL "MTPACK".)

6. Run the tape for approximately one minute to get to the continuous 5 kHz signal on the second half of the tape.

   Connect the digital counter to TP231.

   Adjust the Motor Speed Pot (R597) for 10 kHz ± 0.1 kHz.

   CAUTION

   If the tape reaches the end and AUTO LOAD is pushed before EJECT, you may run the calibration tape off the end. This unique tape should not be disassembled for respooling unless a means of testing the accuracy of the tape is available.

   If the tape reaches the end, press EJECT, then reinsert the tape and press AUTO LOAD.

   After the tape rewinds and has been moving forward for one minute, finish adjusting R597.

HEAD SKEW ADJUSTMENT

1. Connect the red probes of the Tape Head Alignment Module to TP21 and TP22 (Figure 2-1). Connect the black probe to the ground pin on the circuit board.

   Set the HEIGHT/SKEW switch on the Tape Head Alignment Module to the SKEW position.

   Using a 1X probe, connect the A TRIGGER input of the oscilloscope to the TRIG pin on the module.

2. Set the oscilloscope as follows:

TIME/DIV	50 μs
SOURCE	EXT
SLOPE	+
COUPLING	AC HF REJ
TRIG MODE	NORM
VERT MODE	CHOP
VOLTS/DIV	50 mV AC (both channels)

3. Before connecting the oscilloscope probes, make sure both channels are zeroed at ground.

   Using the 10X probes, connect the vertical inputs of the oscilloscope to the 0 and 1 pins on the Tape Head Alignment Module.

4. Run the continuous 5 kHz signal on the second half of the tape and adjust the oscilloscope TRIGGER LEVEL to obtain the display shown in Figure 2-2A.

   Set the TIME/DIV to 20 μs and observe the display shown in Figure 2-2B.

   Set the TIME/DIV to 1 μs and readjust the TRIGGER LEVEL for the display shown in Figure 2-2C. This final setting will be used during the following adjustments.

5. Using an Allen wrench, adjust the tape head SKEW ADJUST screw (Figure 2-1) so that the two traces on the oscilloscope cross the 0 volt line within 1 μs of each other.

6. Remove the tape.

   Turn off the power to the instrument being calibrated.

   Interchange the tape head connectors on the circuit board (J88 and J89). Be sure Pin 1 of each plug is aligned with the index mark on the jack.

   Power up the instrument and recheck the skew.

   The two traces should still be within 1 μs of each other. If they are not, there is read channel time delay (electronically introduced skew); adjust the skew screw until the skew has been decreased to one half its previous value.

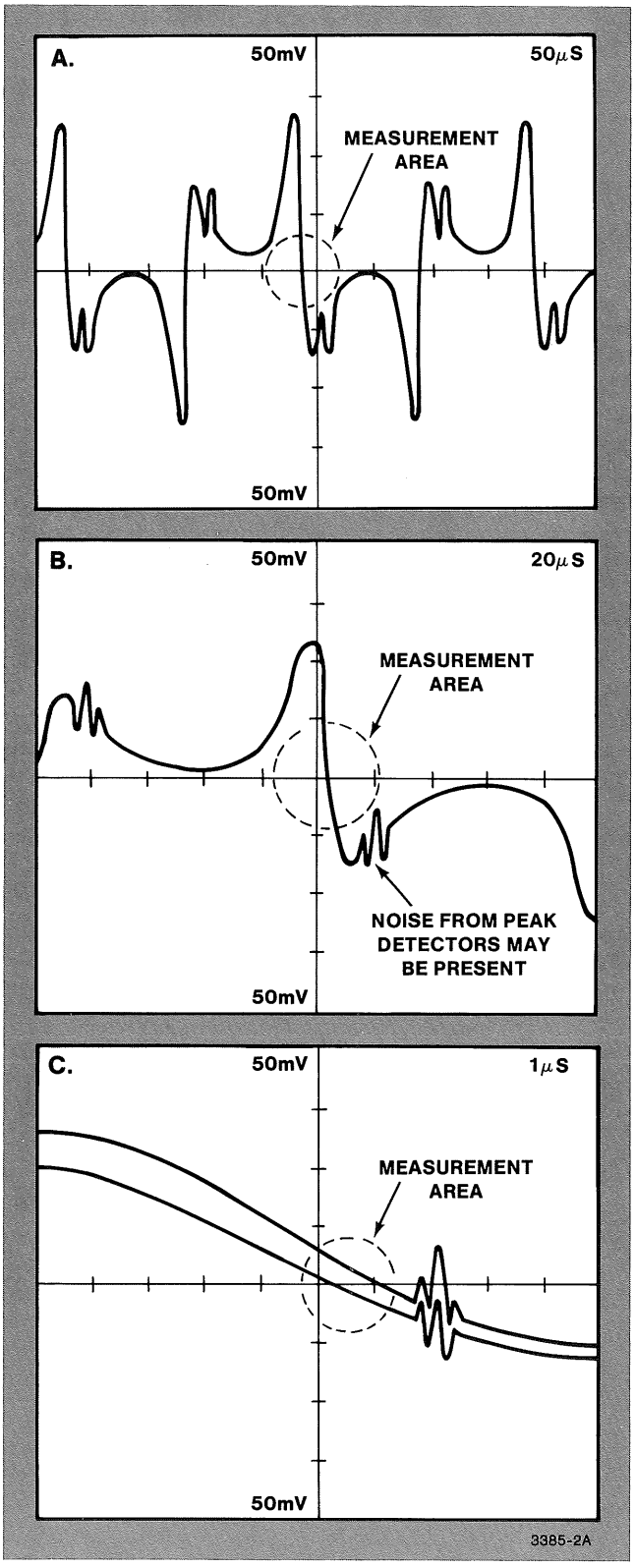


Figure 2-2. 4050 Series Tape Head Skew Adjustment Waveforms.

7. Power down the instrument and restore J88 and J89 to their original positions.

   Power up the instrument and recheck the skew; it should not have changed from last step.

   If the skew cannot be adjusted to within 1 μs with the head connectors in both positions, there is excessive channel time delay and the tape unit must be repaired or replaced.

HEAD HEIGHT ADJUSTMENT

1. Set the HEIGHT/SKEW switch on the Tape Head Alignment Module to HEIGHT.

   Set the oscilloscope as follows:

TIME/DIV	2 ms
VERT MODE	CH 1
VOLTS/DIV	2 V AC (both channels)

   All other controls and leads at their previous settings as specified in the Head Skew Adjustment procedure.

2. Head height is adjusted using the 5 kHz burst signal during the first minute of the Calibration Tape. Press AUTO LOAD and observe the oscilloscope pattern shown in Figure 2-3.

3. Set the oscilloscope as follows:

B TIME/DIV (DLY'D SWP)	0.1 ms
HORIZ DISPLAY	B DLY'D
VOLTS/DIV	0.1 V AC (both channels)
DELAY TIME POSITION	Set to observe the low level regions that follows the burst.

   All other controls at their previous settings as specified in the Head Skew Adjustment procedure.

4. Loosen the HEAD HEIGHT LOCKING screw (Figure 2-1) about three turns.

   Adjust the HEAD HEIGHT ADJUST screw for minimium amplitude during the erased interval. Turn the screw clockwise one quarter turn past minimum amplitude and then lock the adjustment with the locking screw. The signal amplitude should be about 200 mV p-p or less.

   When the tape reaches the end of the burst signal, press EJECT. Then reinsert the tape and press AUTO LOAD to finish the adjustment.

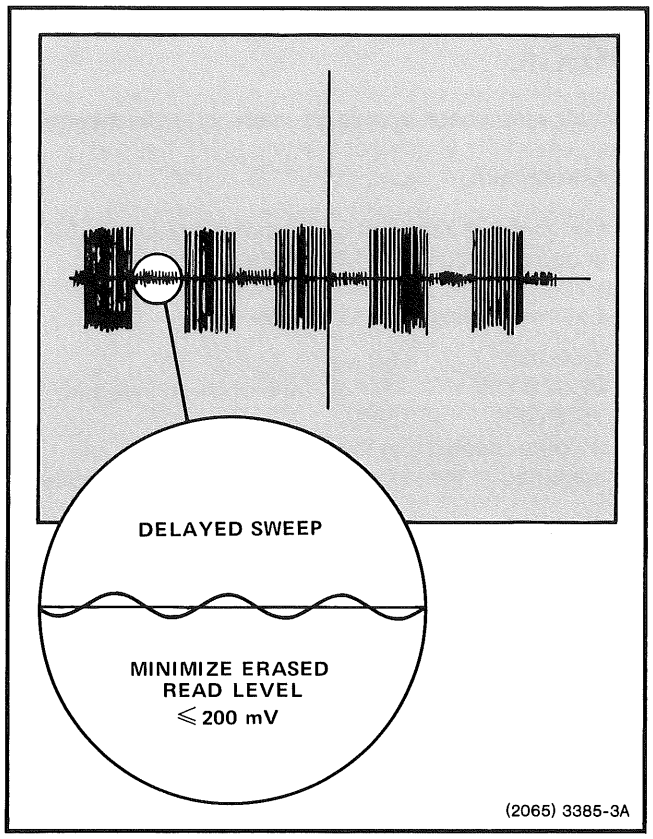


Figure 2-3. 4050 Series Tape Head Height Adjustment Waveforms.

5. The skew and height adjustments interact; therefore, it may be necessary to repeat both the skew and height adjustments two or three times for best results. When both the skew and height are within tolerance and the HEAD HEIGHT LOCKING screw is tight, the tape head alignment is complete.

READ CHANNEL BALANCE CHECK

The following check should be made after the magnetic head is properly aligned according to the head alignment procedure.

1. Connect a probe from each channel of the oscilloscope to TP231 and TP232 (Figure 2-1).

2. Set the oscilloscope as follows:

TIME/DIV	50 μs
VOLTS/DIV	2 V AC (one channel inverted)
TRIGGER	NEG

   All other controls at their previous settings as specified in the Head Skew Adjustment procedure.

3. Run the calibration tape forward for one minute to get to the continuous 5 kHz signal. The waveforms on the oscilloscope should resemble those in Figure 2-4A.

4. Change the horizontal rate to 1 μs per division. Observe the waveforms (Figure 2-4B) and visually average out the jitter. The negative going edges should be within 1.5 μs of each other. If the channel delay is greater than 1.5 μs, the tape unit must be repaired or replaced.

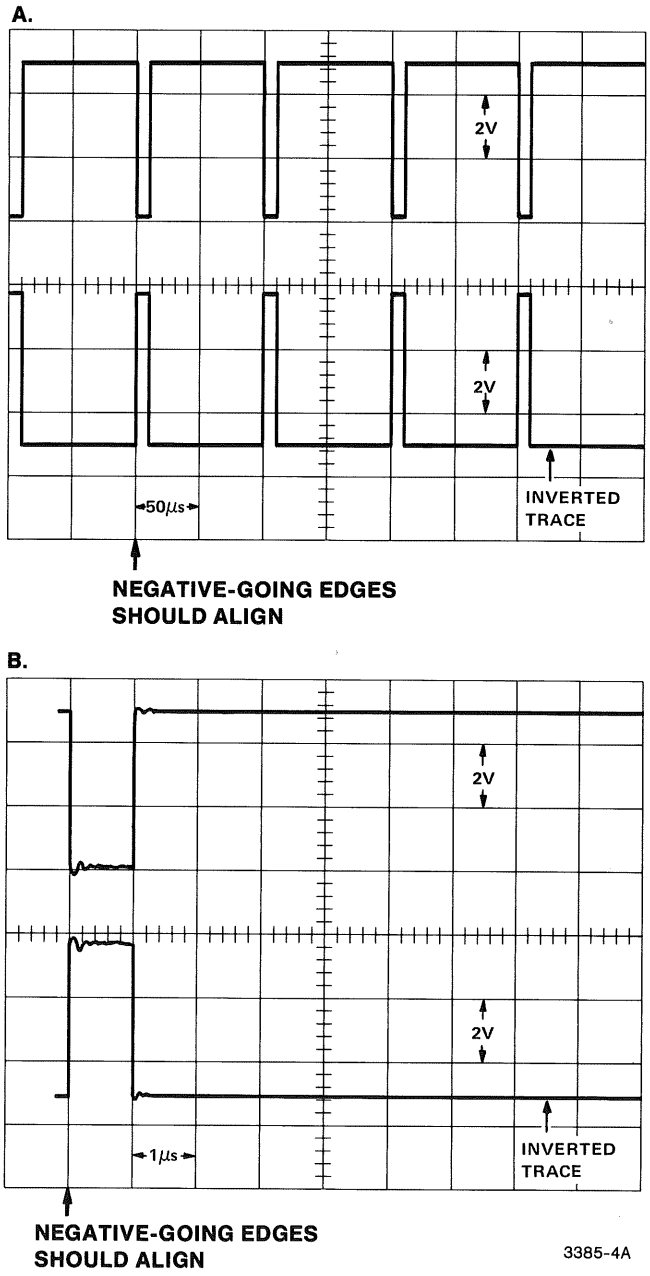


Figure 2-4. 4050 Series Read Channel Waveforms.

Section 3

4923 TAPE ALIGNMENT PROCEDURE

PRELIMINARY SETUP AND MOTOR SPEED ADJUSTMENT

The following electrical adjustments on the Read/Write board set the Motor Speed Control and Data Level Offset. In addition, mechanical adjustments that provide for correct head height and skew (azimuth) alignment are measured on the Read/Write board. The adjustments are made with the unit in its normal operating configuration, except for the removal of the covers.

NOTE

All figures referenced in these adjustment procedures (Figures 3-1, 3-2, 3-3, 3-4, 3-5, and 3-6) can be found in the tabbed pull-out section at the back of the manual.

1. Power the instrument down and remove the covers. Clean the tape head using a cotton swab moistened with isopropyl alcohol. Then remove alcohol residue and polish the head with a clean, dry cotton swab.

WARNING

Dangerous voltages are present when the power is on. Contact with these voltages may cause instant death. Do not touch any points other than those specified in this procedure.

2. Turn on the power to the instrument. Refer to Figure 3-1 for the location of test points and adjustments.

3. Place the voltmeter probe on the top of R122. With no tape installed, the output should be zero volts ± 50 mV. If not, adjust R13 for zero volts ± 50 mV.

4. Place the voltmeter probe on the top of R114. With no tape installed, the output should be zero volts ± 50 mV. If not, adjust R213 for zero volts ± 50 mV.

5. Install a calibration tape (TEKTRONIX P/N 067-0781-02). Set the ECHO switch (option 01 only) to local. Momentarily push the FORWARD button.

NOTE

If option 01 is not used, the 4923 must be interfaced to a 4010 Series terminal. The power to the terminal must be turned on before power is applied to the tape unit.

Allow the tape to run for one complete pass from beginning to end and back again.

6. Run the tape for approximately one minute to get the continuous 5 kHz signal on the second half of the tape.

Connect the digital counter to Pin 7 of U241 on the Read/Write board. (See Figure 3-1.)

Adjust the Motor Speed Pot (R186) for 10 kHz ± 0.1 kHz.

NOTE

Frequency measurements must be visually averaged over at least one second.

HEAD SKEW ADJUSTMENT

1. Connect the red probes of the Tape Head Alignment Module to the outputs of the two head amplifiers (top of R122 and top of R114). (See Figure 3-1 in the tabbed section at the back of this manual.) Connect the black probe to a ground pin on the circuit board.

   Set the HEIGHT/SKEW switch on the Tape Head Alignment Module to the SKEW position.

   Using a 1X probe, connect the A TRIGGER input of the oscilloscope to the TRIG pin on the module.

2. Set the oscilloscope as follows:

TIME/DIV	50 μs
SOURCE	EXT
SLOPE	+
COUPLING	AC HF REJ
TRIG MODE	NORM
VERT MODE	CHOP
VOLTS/DIV	50 mV AC (both channels)

3. Before connecting the oscilloscope probes, make sure both channels are zeroed at ground.

   Using the 10X probes, connect the vertical inputs of the oscilloscope to the 0 and 1 pins on the Tape Head Alignment Module.

4. Run the continuous 5 kHz signal on the second half of the tape and adjust the oscilloscope TRIGGER LEVEL to obtain the display shown in Figure 3-2A.

   Set the TIME/DIV to 20 μs and observe the display shown in Figure 3-2B.

   Set the TIME/DIV to 20 μs and readjust the TRIGGER LEVEL for the display shown in Figure 3-2C. This final setting will be used during the following adjustments.

5. Using an Allen wrench, adjust the tape head SKEW ADJUST screw (Figure 3-3) so that the two traces on the oscilloscope cross the zero volt line within 1 μs of each other.

6. Turn off the power to the tape unit.

   Interchange the tape head connectors on the circuit board (J321 and J320). Be sure Pin 1 of each plug is aligned with the index mark on the jack.

   Power up the tape unit and recheck the skew.

   The two traces should still be within 1 μs of each other. If they are not, there is a read channel time delay (electronically introduced skew); adjust the skew screw until the skew has been decreased to one half its previous value.

7. Power down the instrument and restore J320 and J321 to their original positions.

   Power up the instrument and recheck the skew; it should not have changed from the last step.

   If the skew cannot be adjusted to within 1 μs with the head connectors in both positions, there is excessive channel time delay and the Read/Write Board must be replaced or repaired.

HEAD HEIGHT ADJUSTMENT

1. Set the HEIGHT/SKEW switch on the Tape Head Alignment Module to HEIGHT.

   Set the oscilloscope as follows:

   TIME/DIV 2 ms
   VERT MODE CH 1
   VOLTS/DIV 2 V AC (both channels)
   All other controls at their previous settings as specified in the Head Skew Adjustment procedure.

2. Head height is adjusted using the 5 kHz burst signal during the first minute of the calibration tape. Press FORWARD and observe the oscilloscope pattern shown in Figure 3-4.

3. Set the oscilloscope as follows:

B TIME/DIV (DLY'D SWP)	0.1 ms
HORIZ DISPLAY	B DLY'D
VOLTS/DIV	0.1 V AC (both channels)
DELAY TIME POSITION	Set to observe the low level region that follows the burst.

   All other controls at their previous positions as specified in the Head Skew Adjustment procedure.

4. Loosen the HEAD HEIGHT LOCKING screw (Figure 3-5) about three turns.

   Adjust the HEAD HEIGHT ADJUST screw for minimum amplitude during the erased interval. Turn the screw clockwise one quarter turn past minimum amplitude and then lock the adjustment with the locking screw. The signal amplitude should be about 200 mV p-p or less.

   When the tape reaches the end of the burst signal, rewind the tape and then press FORWARD to restart the tape.

5. The skew and height adjustments interact; therefore, it may be necessary to repeat both the skew and height adjustments two or three times for best results. When both the skew and height are within tolerance and the HEAD HEIGHT LOCKING screw is tight, the tape head alignment is complete.

READ CHANNEL BALANCE CHECK

The following check should be made after the magnetic head is properly aligned according to the head alignment procedure.

1. Connect a probe from each channel of the oscilloscope to U241 Pins 7 and 9 (see Figure 3-1).

2. Set the oscilloscope as follows:

   TIME/DIV 50 μs
   VOLTS/DIV 2 V AC (both channels)
   TRIG NEG,INT
   Invert one channel.

3. Run the calibration tape forward for one minute to get to the continuous 5 kHz signal. The waveforms on the oscilloscope should resemble those in Figure 3-6A. (Figure 3-6 is found on the back of Figure 3-1.)

4. Change the horizontal rate to 1 μs per division. Observe the waveforms (Figure 3-6B) and visually average out the jitter. The negative going edges should be within 1.5 μs of each other. If the channel delay is greater than 1.5 μs, the tape Read/Write board must be repaired or replaced.

   When the tape head alignment and read channel balance check are complete, power down the tape unit and replace the covers.

Section 4

4924 TAPE ALIGNMENT PROCEDURE

PRELIMINARY SETUP AND MOTOR SPEED ADJUSTMENT

The following electrical adjustments on the Read/Write board set the Motor Speed Control and Data Level Offset. In addition, the mechanical adjustments that provide for correct head height and skew (azimuth) alignment are measured on the Read/Write board. The adjustments are made with the unit in its normal operating configuration, except for the removal of the covers.

> *NOTE*
>
> *All figures referenced in these adjustment procedures (Figures 3-1, 3-2, 3-3, 3-4, 3-5, and 3-6) can be found in the tabbed pull-out section at the back of the manual.*

1. Power the instrument down and remove the covers. Clean the tape heads using a cotton swab with isopropyl alcohol. Then remove the alcohol residue and polish the heads with a dry cotton swab.

   WARNING

   Dangerous voltages are present when the power is on. Contact with any of these points may cause instant death. Do not touch any points other that those specified in this procedure.

2. Turn on the power to the instrument and refer to Figure 3-1. Place the voltmeter probe on the top of R122. With no tape installed, the output should be zero volts ± 50 mV. If not, adjust R13 for zero volts ± 50mV.

3. Place the voltmeter probe on the top of R114, with no tape installed. The output should be zero volts ± 50 mV. If not, adjust R213 for zero volts ± 50 mV.

   Be sure the red ON LINE button is released (unit in off-line mode). Then momentarily press the FORWARD button.

   NOTE

   The tape should run forward at its normal speed of 30 inches per second. If it runs forward at the faster speed of 90 inches per second, wait for it to reach the end of the tape and rewind, and then press the FORWARD button again.

4. Run the tape for approximately one minute to get to the continuous 5 kHz signal on the second half of the tape.

   Connect the digital counter to Pin 7 of U241.

   Adjust the Motor Speed Pot (R186) for 10 kHz ± 0.1 kHz.

   NOTE

   Frequency measurements must be visually averaged over at least one second.

HEAD SKEW ADJUSTMENT

1. Connect the red probes of the Tape Head Alignment Module to the top of R122 and R114 (Figure 3-1). Connect the black probe to a ground pin on the circuit board.

   Set the HEIGHT/SKEW switch on the Tape Head Alignment Module to the SKEW position.

   Using a 1X probe, connect the A TRIGGER input of the oscilloscope to the TRIG pin on the Module.

2. Set the oscilloscope as follows:

TIME/DIV	50 μs
SOURCE	EXT
SLOPE	+
COUPLING	AC HF REJ
TRIG MODE	NORM
VERT MODE	CHOP
VOLTS/DIV	50 mV AC (both channels)

3. Before connecting the oscilloscope probes, make sure both channels are zeroed at ground.

   Using the 10X probes, connect the vertical inputs of the oscilloscope to the 0 and 1 pins on the Tape Head Alignment Module.

4. Run the continuous 5 kHz signal on the second half of the tape and adjust the oscilloscope TRIGGER LEVEL to obtain the display shown in Figure 3-2A.

   Set the TIME/DIV to 20 μs and observe the display shown in Figure 3-2B.

   Set the TIME/DIV to 1 μs and readjust the TRIGGER LEVEL for the display shown in Figure 3-2C. This final setting will be used during the following adjustments.

5. Using an Allen wrench, adjust the tape head SKEW ADJUST screw (Figure 3-3) so that the two traces on the oscilloscope cross the 0 volt line within 1 μs of each other.

6. Turn off the power to the Digital Cartridge Tape Drive.

   Interchange the tape head connectors on the circuit board (J320 and J321). Be sure Pin 1 of each plug is aligned with the index mark on the jack.

   Power up the instrument and recheck the skew.

   The two traces should still be within 1 μs of each other. If they are not, there is read channel time delay (electronically introduced skew); adjust the skew screw until the skew has been decreased to one half its previous value.

7. Power down the instrument and restore J320 and J321 to their original positions.

   Power up the instrument and recheck the skew. It should not have changed from the last step.

   If the skew cannot be adjusted to within 1 μs with the head connectors in both positions, there is excessive read channel time delay and the tape unit must be repaired or replaced.

HEAD HEIGHT ADJUSTMENT

1. Set the HEIGHT/SKEW switch on the Tape Head Alignment Module to HEIGHT.

   Set the oscilloscope as follows:

TIME/DIV	2 ms
VERT MODE	CH 1
VOLTS/DIV	2 V AC (both channels)

   All other controls at their previous settings as specified in the Head Skew Adjustment procedure.

2. Head height is adjusted using the 5 kHz burst signal during the first minute of the calibration tape. Be sure the red ON LINE button is released (unit in off-line mode). Then, momentarily press the FORWARD button and observe the oscilloscope pattern shown in Figure 3-4.

3. Set the oscilloscope as follows:

B TIME/DIV (DLY'D SWP)	0.1 ms
HORIZ DISPLAY	B DLY'D
VOLTS/DIV	0.1 V AC (both channels)
DELAY TIME POSITION	Set to observe the low level region that follows the burst.

   All other controls at their previous settings as specified in the Head Skew Adjustment procedure.

4. Loosen the HEAD HEIGHT LOCKING screw (Figure 3-5) about three turns.

   Adjust the HEAD HEIGHT ADJUST screw for minimum amplitude during the erased interval. Turn the screw clockwise one quarter turn past minimum amplitude and then lock the adjustment with the other screw. The signal amplitude should be about 200 mV p-p or less.

   When the tape reaches the end of the burst signal, rewind the tape to continue.

   Be sure the red ON LINE button is released (unit in off-line mode). Then momentarily press the FORWARD button.

   NOTE

   The tape should run forward at its normal speed of 30 inches per second. If the tape runs forward at the faster speed of 90 inches per second, wait for it to reach the end of the tape and rewind and then press the FORWARD button again.

5. The skew and height adjustments interact. Therefore, it may be necessary to repeat both the skew and height adjustments several times for optimum results. When both the skew and height are optimized and the HEAD LOCKING screw is tight, the tape head alignment is complete.

READ CHANNEL BALANCE CHECK

The following check should be made after the magnetic head is properly aligned according to the head alignment procedure.

1. Connect a probe from each channel of the oscilloscope to U241 Pins 7 and 9. (See Figure 3-1 in the pull-out section in back.)

2. Set the oscilloscope as follows:

TIME/DIV	50 μs
VOLTS/DIV	2 V AC (both channels)
TRIG	NEG,INT

   Invert one channel.

3. Run the calibration tape forward for one minute to get to the continuous 5 kHz signal. The waveforms on the oscilloscope should resemble those in Figure 3-6A. (Figure 3-6 is found on the back of Figure 3-1.)

4. Change the horizontal rate to 1 μs per division. Observe the waveforms (Figure 3-6B) and visually average out the jitter. The negative going edges should be within 1.5 μs of each other. If the channel delay is greater than 1.5 μs, the Read/Write board must be repaired or replaced.

When the tape head alignment and read channel balance check are complete, power down the tape drive and replace the cover.

Section 5

4081 TAPE ALIGNMENT PROCEDURE

PRELIMINARY SETUP AND MOTOR SPEED ADJUSTMENT

The following electrical adjustments of the Read/Write board set the Motor Speed Control and the Data Level Offset. In addition, mechanical adjustments that provide for correct head height and skew (azimuth) alignment are measured on the Read/Write board. The adjustments are made with the unit in its normal operating configuration with the covers removed and the unit pulled out on its slides.

> *NOTE*
>
> *All figures referenced in these adjustment procedures (Figures 3-1, 3-2, 3-3, 3-4, 3-5, and 3-6) can be found in the tabbed pull-out section at the back of the manual.*

1. Power down the instrument. Pull the tape unit out on its slides and remove it and place it on top of the 4081. Remove the bottom cover from the tape drive. Clean the heads using a cotton swab and isopropyl alcohol. Then remove the alcohol residue and polish the heads using a clean swab.

   WARNING

   When operating the unit with the bottom cover removed, contact only the designated points. Line voltage is exposed at several points when power is applied. Instant death may result from touching points at line voltage.

2. Turn on the power to the instrument and refer to Figure 3-1 for test points and adjustments. Place the voltmeter probe on the top lead of R122 to measure the output of head amplifier U5. With no tape installed, the output should be zero volts ± 0.5 mV. If not, adjust R13 (Figure 3-1) until you obtain zero volts ± 50mV.

3. Connect the voltmeter probe to the top of R114 and adjust R213 for zero volts ± 0.5 mV.

4. Insert a calibration tape (TEKTRONIX P/N 067-0781-02) into the transport under calibration.

   NOTE

   To run the tape, press the IPL button. The unit will read the entire tape and then stop. If the adjustment is not complete or you wish to rewind the tape and restart it, press the IPL button again. Allow the tape to run for one complete pass (from beginning to end and back again) before starting this procedure.

   Run the tape for approximately one minute to get to the continuous 5 kHz signal on the second half of the tape.

   Connect the digital counter to Pin 7 of U241 (on the Read/Write board shown in Figure 3-1).

   Adjust the Motor Speed Pot (R186) for 10 kHz ± 0.1 kHz.

   NOTE

   Frequency measurements must be averaged over a period of at least one second.

HEAD SKEW ADJUSTMENT

1. Connect the red probes of the Tape Head Alignment Module to the outputs of the two head amplifiers (top of R122 and R114). Connect the black probe to a ground pin on the circuit board.

   Set the HEIGHT/SKEW switch on the Tape Head Alignment Module to the SKEW position.

   Using a 1X probe, connect the A TRIGGER input of the oscilloscope to the TRIG pin on the module.

2. Set the oscilloscope as follows:

TIME/DIV	50 μs
SOURCE	EXT
SLOPE	+
COUPLING	AC HF REJ
TRIG MODE	NORM
VERT MODE	CHOP
VOLTS/DIV	50 mV AC (both channels)

3. Before connecting the oscilloscope probes, make sure both channels are zeroed at ground.

   Using the 10X probes, connect the vertical inputs of the oscilloscope to the 0 and 1 pins on the Tape Head Alignment Module.

4. Run the continuous 5 kHz signal on the second half of the tape by momentarily pressing the IPL button and waiting about one minute. Adjust the oscilloscope TRIGGER LEVEL to obtain the display shown in Figure 3-2A.

   Set the TIME/DIV to 20 μs and observe the display shown in Figure 3-2B.

   Set the TIME/DIV to 1 μs and readjust the TRIGGER LEVEL for the display shown in Figure 3-2C. This final setting will be used during the following adjustments.

5. Using an Allen wrench, adjust the tape head SKEW ADJUST screw (Figure 3-3) so that the two traces on the oscilloscope cross the zero volt line within 1 μs of each other.

6. Turn off power to the 4081 system and interchange the tape head connectors on the circuit board (J321 and J320). Make sure Pin 1 of each plug is aligned with the index mark on the jack.

   Power up the system and recheck the skew.

   The two traces should still be within 1 μs of each other. If they are not, there is read channel time delay (electronically introduced skew). Adjust the skew adjusting screw until the skew has been decreased to one half its previous value.

7. Power down the system and restore J320 and J321 to their original positions.

   Power up the system and recheck the skew. It should not have changed from the last step.

   If the skew cannot be adjusted to within 1 μs with the head connectors in both positions, there is excessive read channel time delay and the tape unit must be replaced.

HEAD HEIGHT ADJUSTMENT

1. Set the HEIGHT/SKEW switch on the Tape Head Alignment Module to HEIGHT.

   Set the oscilloscope as follows:

TIME/DIV	2 ms
VERT MODE	CH 1
VOLTS/DIV	2 V AC (both channels)

   All other controls at their previous settings.

2. Head height is adjusted using the 5 kHz burst signal during the first minute of the calibration tape. Press the IPL button and observe the oscilloscope pattern shown in Figure 3-4.

3. Set the oscilloscope as follows:

B TIME/DIV (DLY'D SWP)	.1 ms
HORIZ DISPLAY	B DLY'D
VOLTS/DIV	0.1 V AC (both channels)
DELAY TIME POSITION	Set to observe the low level region that follows the burst.

   All other controls at their previous positions as specified in the Head Skew Adjustment procedure.

4. Loosen the HEAD HEIGHT LOCKING screw (Figure 3-5) about three turns.

   Adjust the HEAD HEIGHT ADJUST screw for minimum amplitude during the erased interval. Turn the screw clockwise one quarter turn past minimum amplitude and then lock the adjustment with the other screw. The signal amplitude should be about 200 mV p-p or less.

   When the tape reaches the end of the burst signal, press the IPL button to restart the tape.

5. The skew and height adjustments interact. Therefore, may be necessary to repeat both the skew and height adjustments two or three times for best results. When both the skew and height are within tolerance and the HEAD HEIGHT LOCKING screw is tight, the tape head alignment is complete.

READ CHANNEL BALANCE CHECK

The following check should be made after the magnetic head is properly aligned according to the head alignment procedure.

1. Connect a probe from each channel of the oscilloscope to U241 Pins 7 and 9 (Figure 3-1).

2. Set the oscilloscope as follows:

TIME/DIV	50 μs
VOLTS/DIV	2 V AC (both channels)
TRIG	NEG,INT

   Invert one channel.

3. Run the calibration tape forward for one minute to get to the continuous 5 kHz signal. The waveforms on the oscilloscope should resemble those in Figure 3-6A. (Figure 3-6 is found on the back of Figure 3-1.)

4. Change the horizontal rate to 1 μs per division. Observe the waveforms (Figure 3-6B) and visually average out the jitter. The negative going edges should be within 1.5 μs of each other. If the channel delay is greater than 1.5 μs, the Read/Write board must be replaced or repaired.

When the tape head alignment and read channel balance check are complete, power down the 4081 and replace all the covers.

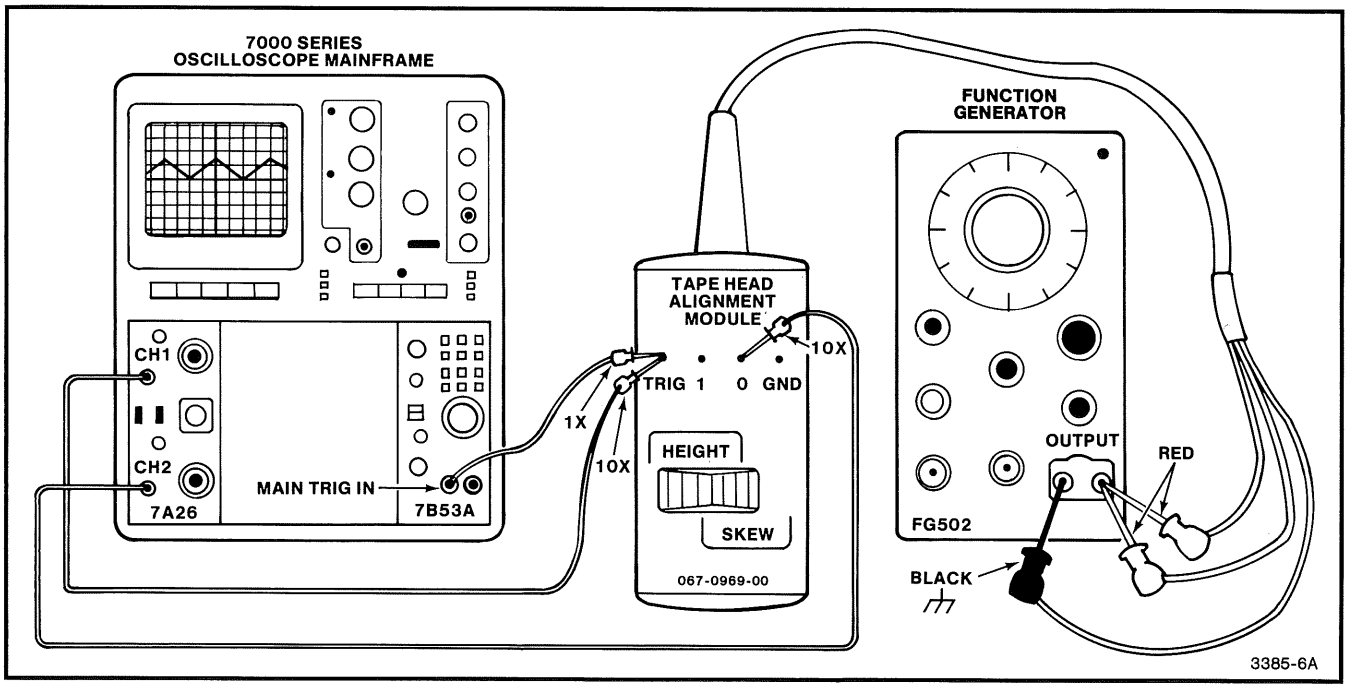


Figure 6-1. Tape Head Alignment Module Test Setup.

Section 6

TAPE HEAD ALIGNMENT MODULE TEST PROCEDURE

INTRODUCTION

Use this procedure to check the operation of the 067-0969-00 Tape Head Alignment Module. This procedure may be performed as an initial inspection of the module or as a check if the module appears to be defective.

EQUIPMENT REQUIRED

- Function Generator (TEKTRONIX FG502, which requires a TEKTRONIX TM 500 Series Power Module, or equivalent)
- Oscilloscope Mainframe (TEKTRONIX 7000 Series or equivalent)
- Dual Trace Amplifier (TEKTRONIX 7A26 or equivalent)
- Dual Time Base (TEKTRONIX 7B53A or equivalent)
- Two 10X Oscilloscope Probes (TEKTRONIX P6053B or equivalent)
- 1X Oscilloscope Probe (TEKTRONIX P6028 or equivalent)
- BNC Male to Dual Binding Post Adapter (TEKTRONIX 103-0035-00 or equivalent)

TEST PROCEDURE

1. Set the time base as follows:

TIME/DIV	50 μs
SOURCE	EXT
SLOPE	+
COUPLING	AC HR REJ
TRIG MODE	NORM
VERT MODE	CHOP
VOLTS/DIV	5 V AC (both channels)

2. Connect the 10X probes to the vertical amplifier inputs (Figure 6-1).

   Connect the 1X probe to the MAIN TRIG IN.

   Connect the BNC adapter to the output of the function generator. Connect the time base Trigger probe to the function generator using the adapter binding posts.

   Set the function generator for an output of 8 V p-p, 5 kHz, triangle wave.

3. Refer to Figure 6-1. Using the 10X probe, connect the vertical amplifier Channel 1 input to the TRIG pin of the Tape Head Alignment Module. Connect Channel 2 to the 0 pin of the module.

   Move the time base Trigger probe to the TRIG pin of the Tape Head Alignment Module.

   Connect both red probes of the Tape Head Alignment Module to the function generator output via the BNC adapter. Connect the black probe of the module to the ground post.

   Set the Tape Head Alignment Module HEIGHT/SKEW switch to HEIGHT.

NOTE

If the Tape Head Alignment Module passes all of the following test steps, it is operating correctly. If it fails any of the following test steps, it should be considered defective.

4. Both traces of the scope should be identical and should resemble the upper trace in Figure 6-2.

5. Move the Channel 2 probe to the 1 pin of the Tape Head Alignment Module. Both traces should be identical and should resemble the upper trace in Figure 6-2.

6. Move the Tape Head Alignment Module HEIGHT/SKEW switch to SKEW. Set the vertical gain of Channel 2 to 50 mV/DIV. The resulting traces should be similar to those shown in Figure 6-2. The Channel 1 (upper trace) signal should be 8 V p-p and the Channel 2 (lower trace) signal should be between 83 and 92 mV p-p.

7. Move the Channel 2 probe to the 0 pin of the Tape Head Alignment Module. The resulting traces should be the same as in Step 6.

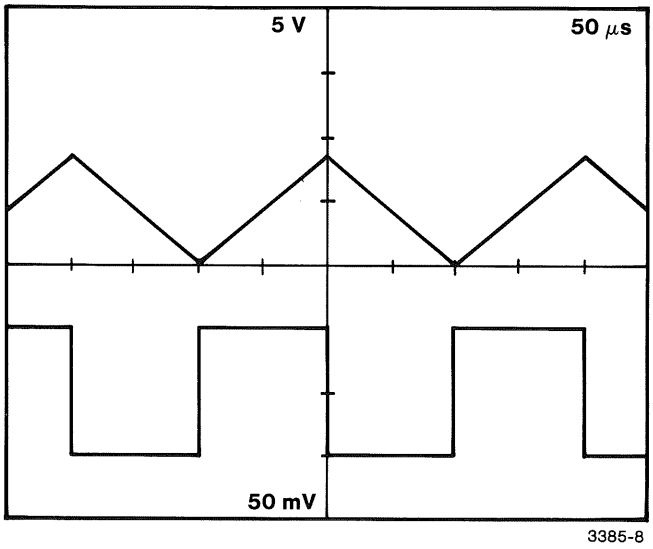


Figure 6-2. Tape Head Alignment Module Test Waveform.

Section 7

DEFINITION OF HEAD AZIMUTH (SKEW)

Head Azimuth (skew) can best be explained by looking at Figure 7-1. Data is recorded on the tape by a dual head in two distinct tracks. The data, ideally, is recorded on the tape on a line which is at right angles to the tape. Since information from both tracks is required to give a one or a zero during the read operation, reading the data from both tracks at exactly the same time is important. Should the head azimuth (skew) be misadjusted as in Figure 7-1, track two is read before track one, and the data read will probably be in error.

Additional time delay that appears to be skew error can be caused by electronically introduced propagation delays. Propagation delay is the amount of time it takes for a signal to have an effect on the output after it was applied to the input. Several stages of amplifiers and logic can cause a very large delay. As long as the delay for both channels is nearly the same (within tolerance), the read channels are said to be in balance and usable. If one channel is defective and has a vastly different delay, no amount of mechanical adjustment of the heads can compensate for the imbalance. Attempting to adjust the heads could result in the loss of read signal strength and additional read errors.

The Read Channel Balance Check, performed once the mechanical head alignment is done, shows whether or not the propagation delay is excessive or unbalanced. Small amounts of read channel unbalance can be compensated for by offsetting the mechanical alignment.

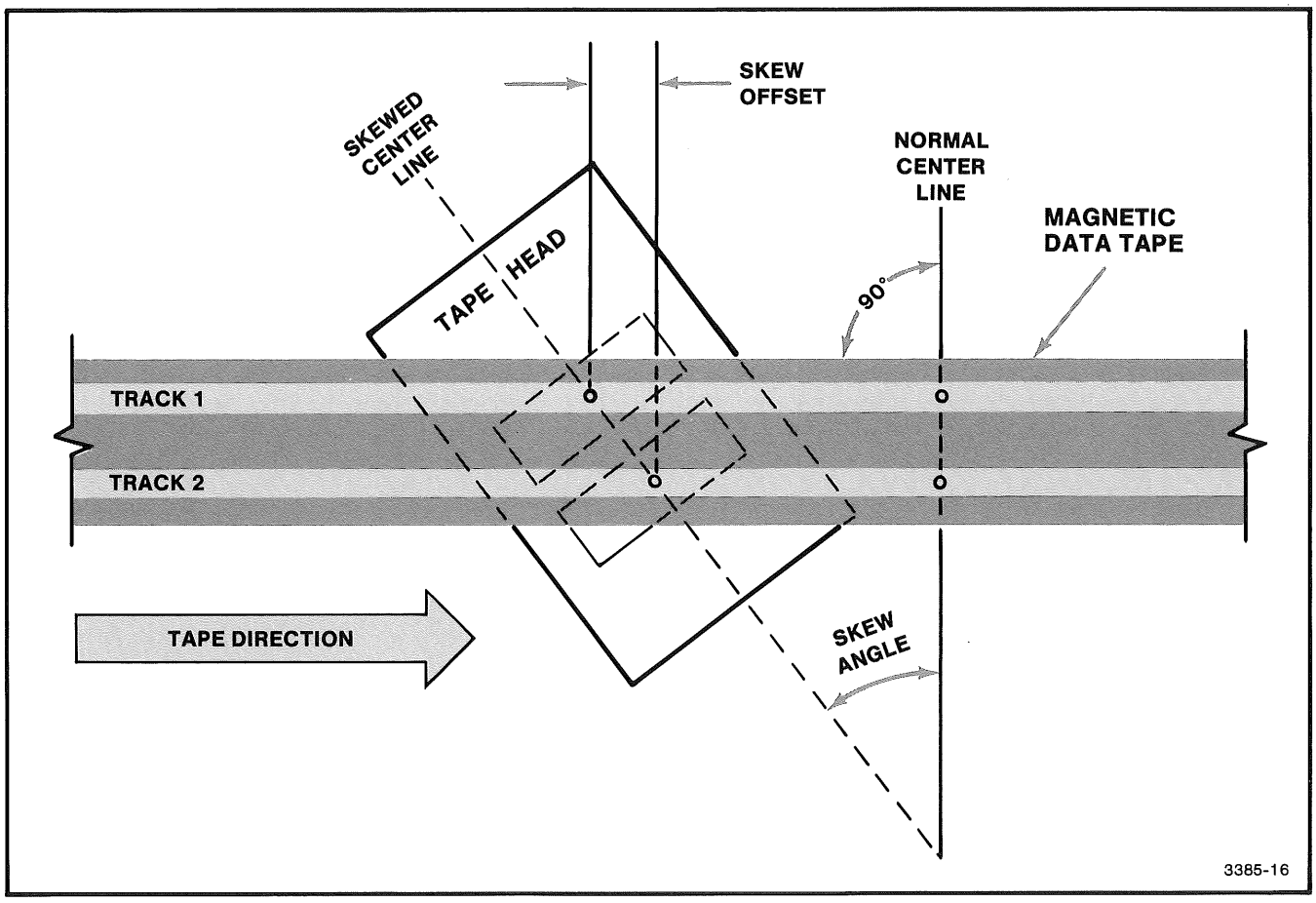


Figure 7-1. Head Skew Example.

Table 7-1, Original Alignment Conditions and Resultant Skew Conditions, shows various combinations of mechanical versus electronic skew and what effect the adjustments have.

Table 7-1

ORIGINAL ALIGNMENT CONDITIONS AND RESULTANT SKEW CONDITIONS

Original Condition	Normal Head Connection	Interchange Head Connection	Normal Head Connection	Resultant Condition
Head azimuth error and channel time delay present	Reduce skew to zero via skew adjustment	Skew increases Reduce skew to 1/2 its value	Skew remains the same	Head azimuth error reduced to zero and channel time delay equal in value to skew
Zero head azimuth error but channel time delay present	Reduce skew to zero via skew adjustment screw	Skew increases Reduce skew to 1/2 its value	Skew remains the same	Head azimuth error reduced to zero and channel time delay equal in value to skew
Head azimuth error present but zero channel time delay	Reduce skew to zero via skew adjustment screw	Skew remains zero	Skew remains zero	Head azimuth error reduced to zero and zero channel time delay present
Zero head azimuth error and zero channel time delay	Skew is zero	Skew remains zero	Skew remains zero	Zero head azimuth error and zero channel time delay

Section 8
PARTS AND SCHEMATIC

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

SPECIAL NOTES AND SYMBOLS

X000	Part first added at this serial number
00X	Part removed after this serial number

FIGURE AND INDEX NUMBERS

Items in this section are referenced by figure and index numbers to the illustrations.

INDENTATION SYSTEM

This mechanical parts list is indented to indicate item relationships. Following is an example of the indentation system used in the description column.

1 2 3 4 5 *Name & Description*

Assembly and/or Component
Attaching parts for Assembly and/or Component
- - - * - - -
Detail Part of Assembly and/or Component
Attaching parts for Detail Part
- - - * - - -
Parts of Detail Part
Attaching parts for Parts of Detail Part
- - - * - - -

Attaching Parts always appear in the same indentation as the item it mounts, while the detail parts are indented to the right. Indented items are part of, and included with, the next higher indentation. The separation symbol - - - * - - - indicates the end of attaching parts.

Attaching parts must be purchased separately, unless otherwise specified.

ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

ABBREVIATIONS

"	INCH
#	NUMBER SIZE
ACTR	ACTUATOR
ADPTR	ADAPTER
ALIGN	ALIGNMENT
AL	ALUMINUM
ASSEM	ASSEMBLED
ASSY	ASSEMBLY
ATTEN	ATTENUATOR
AWG	AMERICAN WIRE GAGE
BD	BOARD
BRKT	BRACKET
BRS	BRASS
BRZ	BRONZE
BSHG	BUSHING
CAB	CABINET
CAP	CAPACITOR
CER	CERAMIC
CHAS	CHASSIS
CKT	CIRCUIT
COMP	COMPOSITION
CONN	CONNECTOR
COV	COVER
CPLG	COUPLING
CRT	CATHODE RAY TUBE
DEG	DEGREE
DWR	DRAWER
ELCTRN	ELECTRON
ELEC	ELECTRICAL
ELCTLT	ELECTROLYTIC
ELEM	ELEMENT
EPL	ELECTRICAL PARTS LIST
EQPT	EQUIPMENT
EXT	EXTERNAL
FIL	FILLISTER HEAD
FLEX	FLEXIBLE
FLH	FLAT HEAD
FLTR	FILTER
FR	FRAME or FRONT
FSTNR	FASTENER
FT	FOOT
FXD	FIXED
GSKT	GASKET
HDL	HANDLE
HEX	HEXAGON
HEX HD	HEXAGONAL HEAD
HEX SOC	HEXAGONAL SOCKET
HLCPS	HELICAL COMPRESSION
HLEXT	HELICAL EXTENSION
HV	HIGH VOLTAGE
IC	INTEGRATED CIRCUIT
ID	INSIDE DIAMETER
IDENT	IDENTIFICATION
IMPLR	IMPELLER
IN	INCH
INCAND	INCANDESCENT
INSUL	INSULATOR
INTL	INTERNAL
LPHLDR	LAMPHOLDER
MACH	MACHINE
MECH	MECHANICAL
MTG	MOUNTING
NIP	NIPPLE
NON WIRE	NOT WIRE WOUND
OBD	ORDER BY DESCRIPTION
OD	OUTSIDE DIAMETER
OVH	OVAL HEAD
PH BRZ	PHOSPHOR BRONZE
PL	PLAIN or PLATE
PLSTC	PLASTIC
PN	PART NUMBER
PNH	PAN HEAD
PWR	POWER
RCPT	RECEPTACLE
RES	RESISTOR
RGD	RIGID
RLF	RELIEF
RTNR	RETAINER
SCH	SOCKET HEAD
SCOPE	OSCILLOSCOPE
SCR	SCREW
SE	SINGLE END
SECT	SECTION
SEMICOND	SEMICONDUCTOR
SHLD	SHIELD
SHLDR	SHOULDERED
SKT	SOCKET
SL	SLIDE
SLFLKG	SELF-LOCKING
SLVG	SLEEVING
SPR	SPRING
SQ	SQUARE
SST	STAINLESS STEEL
STL	STEEL
SW	SWITCH
T	TUBE
TERM	TERMINAL
THD	THREAD
THK	THICK
TNSN	TENSION
TPG	TAPPING
TRH	TRUSS HEAD
V	VOLTAGE
VAR	VARIABLE
W/	WITH
WSHR	WASHER
XFMR	TRANSFORMER
XSTR	TRANSISTOR

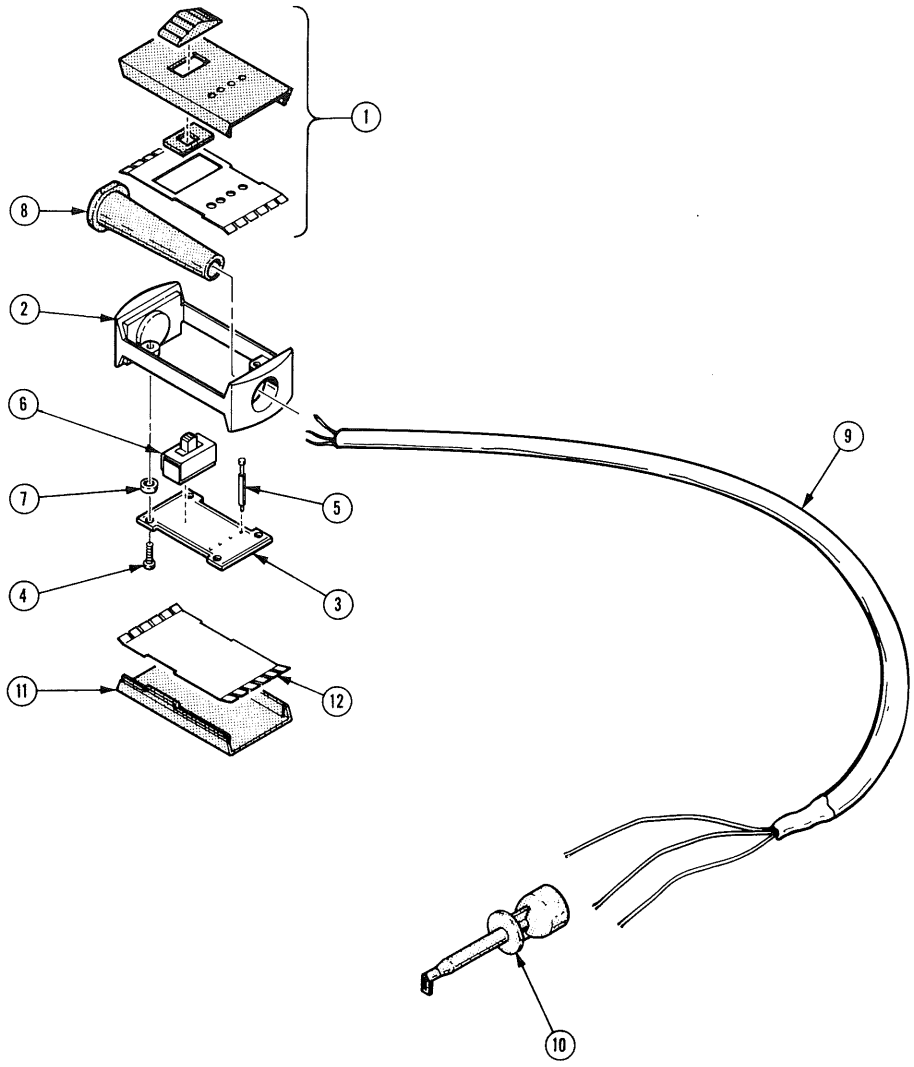
CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
14752	ELECTRO CUBE INC.	1710 S. DEL MAR AVE.	SAN GABRIEL, CA 91776
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
82389	SWITCHCRAFT, INC.	5555 N. ELSTON AVE.	CHICAGO, IL 60630
91637	DALE ELECTRONICS, INC.	P. O. BOX 609	COLUMBUS, NE 68601

Component No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A1	670-6562-00			CKT BOARD ASSY:TAPE ALIGNMENT AID	80009	670-6562-00
A1C1	285-0597-00			CAP.,FXD,PLSTC:0.001UF,1%,100V	14752	410B1B102F
A1C4	285-0597-00			CAP.,FXD,PLSTC:0.001UF,1%,100V	14752	410B1B102F
A1R2	321-0168-00			RES.,FXD,FILM:549 OHM,1%,0.125W	91637	MFF1816G549R0F
A1R3	321-0168-00			RES.,FXD,FILM:549 OHM,1%,0.125W	91637	MFF1816G549R0F
A1S1	260-1811-00			SWITCH,SLIDE:DPDT,0.5A,125VAC DC	82389	C56206L2

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
1-1	200-2498-00			1		COVER,CA TERMN:	80009	200-2498-00
-2	426-0423-15			1		FRAME,MODULE:TAPE HEAD ALIGNMENT	80009	426-0423-15
-3	----- -----			1		CKT BOARD ASSY:(SEE A1 EPL)		
						(ATTACHING PARTS)		
-4	211-0001-00			2		SCREW,MACHINE:2-56 X 0.25 INCH,PNH STL	83385	OBD
						- - - * - - -		
-5	131-2480-00			4		. TERMINAL,PIN:0.8 L X 0.072 DIA,BRASS	80009	131-2480-00
-6	----- -----			1		. SWITCH,SLIDE:(SEE S1 EPL)		
-7	361-0219-00			2		SPACER,SLEEVE:0.06 L X 0.093 ID,BRS NP	80009	361-0219-00
-8	200-1042-01			1		CABLE NIP,ELEC:0.225 ID X 2.0 L,BLACK	80009	200-1042-01
	175-2965-00			1		CA ASSY,SP,ELEC:2,22 AWG,25.0 L	80009	175-2965-00
-9	175-2971-00			1		. CA ASSY,SP,ELEC:2,22 AWG,15.0 L	80009	175-2971-00
-10	003-0625-00			1		. TIP,HOOK:E-Z HOOK 'Q' BALL,MINI,BLACK		
	003-0624-00			2		. TIP,HOOK:E-Z HOOK 'Q' BALL,MINI,RED		
-11	200-1851-00			2		COVER,ROM PACK:GRAY	80009	200-1851-00
-12	337-1183-00			1		SHIELD,ELEC:COMP BOX COVER	80009	337-1183-00

FIG. 1 EXPLODED VIEW



Section 9
SCHEMATIC

Symbols and Reference Designators

Electrical components shown on the diagrams are in the following units unless noted otherwise:

Capacitors = Values one or greater are in picofarads (pF). Values less than one are in microfarads (μF).

Resistors = Ohms (Ω).

Graphic symbols and class designation letters are based on ANSI Standard Y32.2-1975.

Logic symbology is based on ANSI Y32.14-1973 in terms of positive logic. Logic symbols depict the logic function performed and may differ from the manufacturer's data.

Abbreviations are based on ANSI Y1.1-1972.

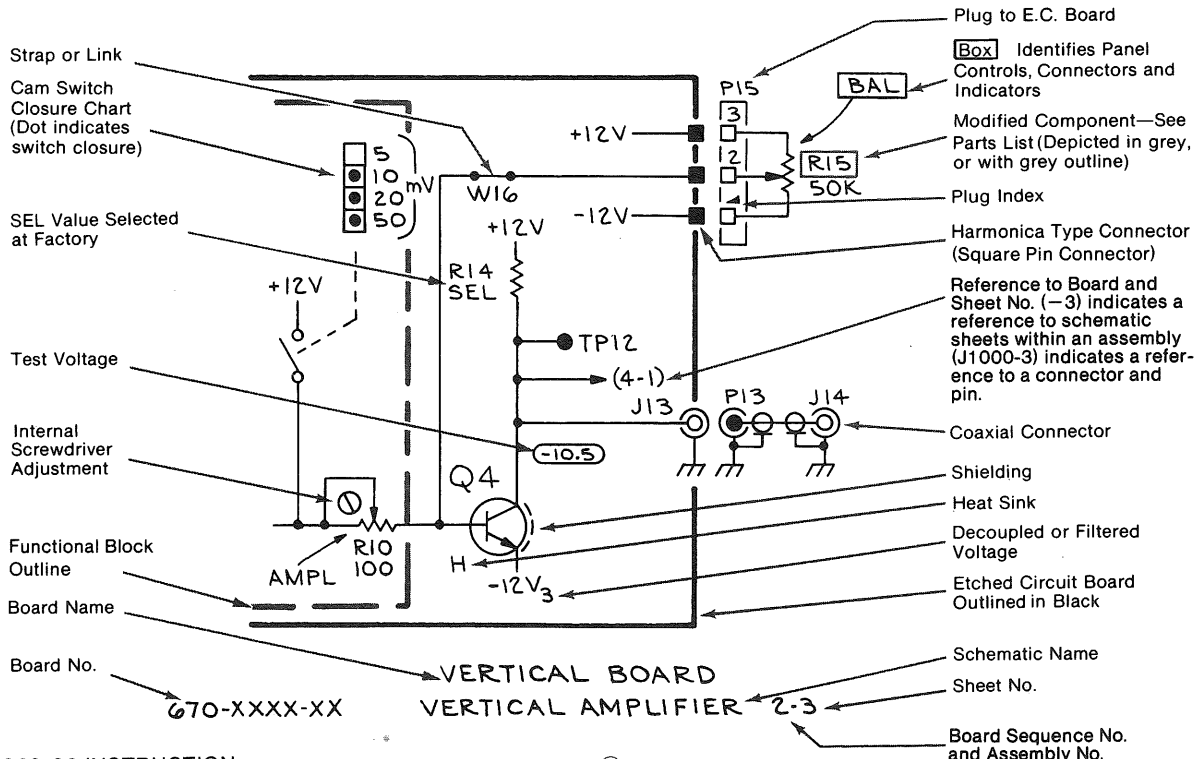
Other ANSI standards that are used in the preparation of diagrams by Tektronix, Inc. are:

Y14.15, 1966	Drafting Practices.
Y14.2, 1973	Line Conventions and Lettering.
Y10.5, 1968	Letter Symbols for Quantities Used in Electrical Science and Electrical Engineering.

The following prefix letters are used as reference designators to identify components or assemblies on the diagrams.

A	Assembly, separable or repairable (circuit board, etc)	H	Heat dissipating device (heat sink, heat radiator, etc)	S	Switch or contactor
AT	Attenuator, fixed or variable	HR	Heater	T	Transformer
B	Motor	HY	Hybrid circuit	TC	Thermocouple
BT	Battery	J	Connector, stationary portion	TP	Test point
C	Capacitor, fixed or variable	K	Relay	U	Assembly, inseparable or non-repairable (integrated circuit, etc.)
CB	Circuit breaker	L	Inductor, fixed or variable	V	Electron tube
CR	Diode, signal or rectifier	M	Meter	VR	Voltage regulator (zener diode, etc.)
DL	Delay line	P	Connector, movable portion	W	Wirestrap or cable
DS	Indicating device (lamp)	Q	Transistor or silicon-controlled rectifier	Y	Crystal
E	Spark Gap, Ferrite bead	R	Resistor, fixed or variable	Z	Phase shifter
F	Fuse	RT	Thermistor		
FL	Filter				

The following special symbols may appear on the diagrams:



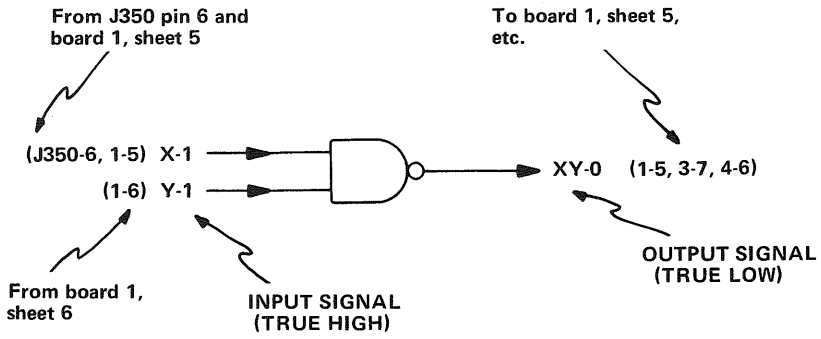
1. TRUE HIGH and TRUE LOW Signals

Signal names on the schematics are followed by −1 or −0. A TRUE HIGH signal is indicated by −1, and a TRUE LOW signal is indicated by −0.

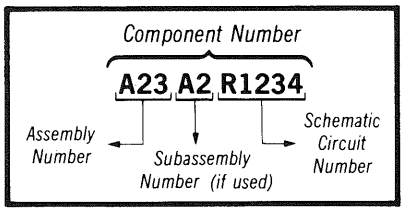
SIGNAL−1 = TRUE HIGH
SIGNLA−0 = TRUE LOW

2. Cross-References

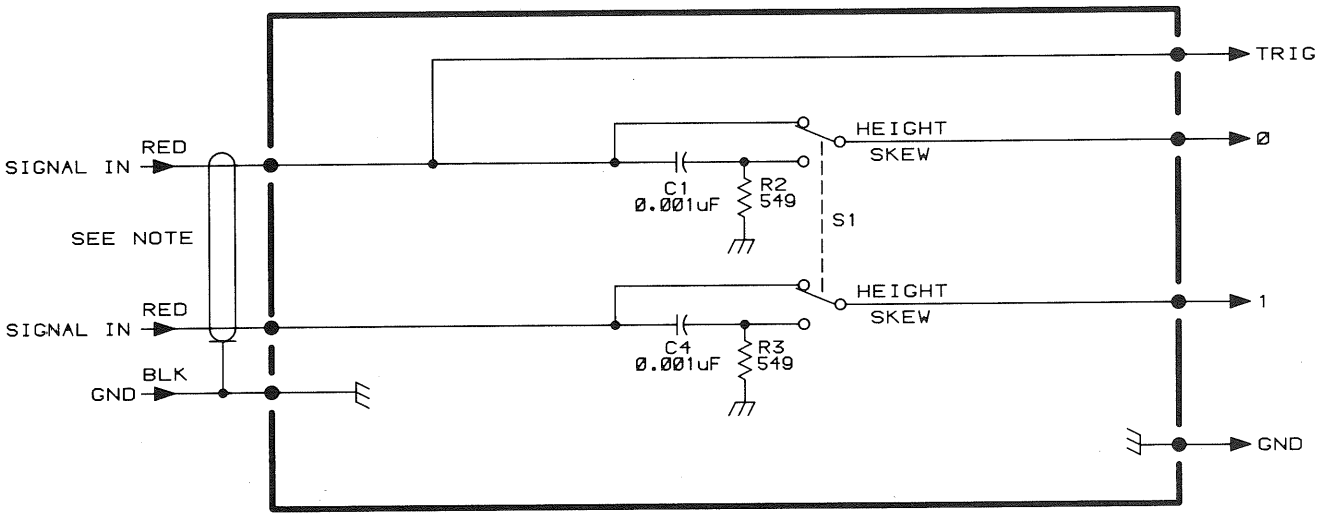
Schematic cross-references (from/to information) are included on the schematics. The "from" reference only indicates the signal "source," and the "to" reference lists all loads where the signal is used. All from/to information will be enclosed in parentheses.



3. Component Number Example



Chassis-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.



NOTE. SIGNAL IN IS FROM THE HEAD AMPLIFIERS OF THE 405X SERIES, THE 4923 AND 4924 DIGITAL TAPE DRIVERS AND THE 4081 DIGITAL TAPE DRIVER.

Ø67-Ø969-ØØ @ 3385-18 670-6562-00 T.H.A.M.

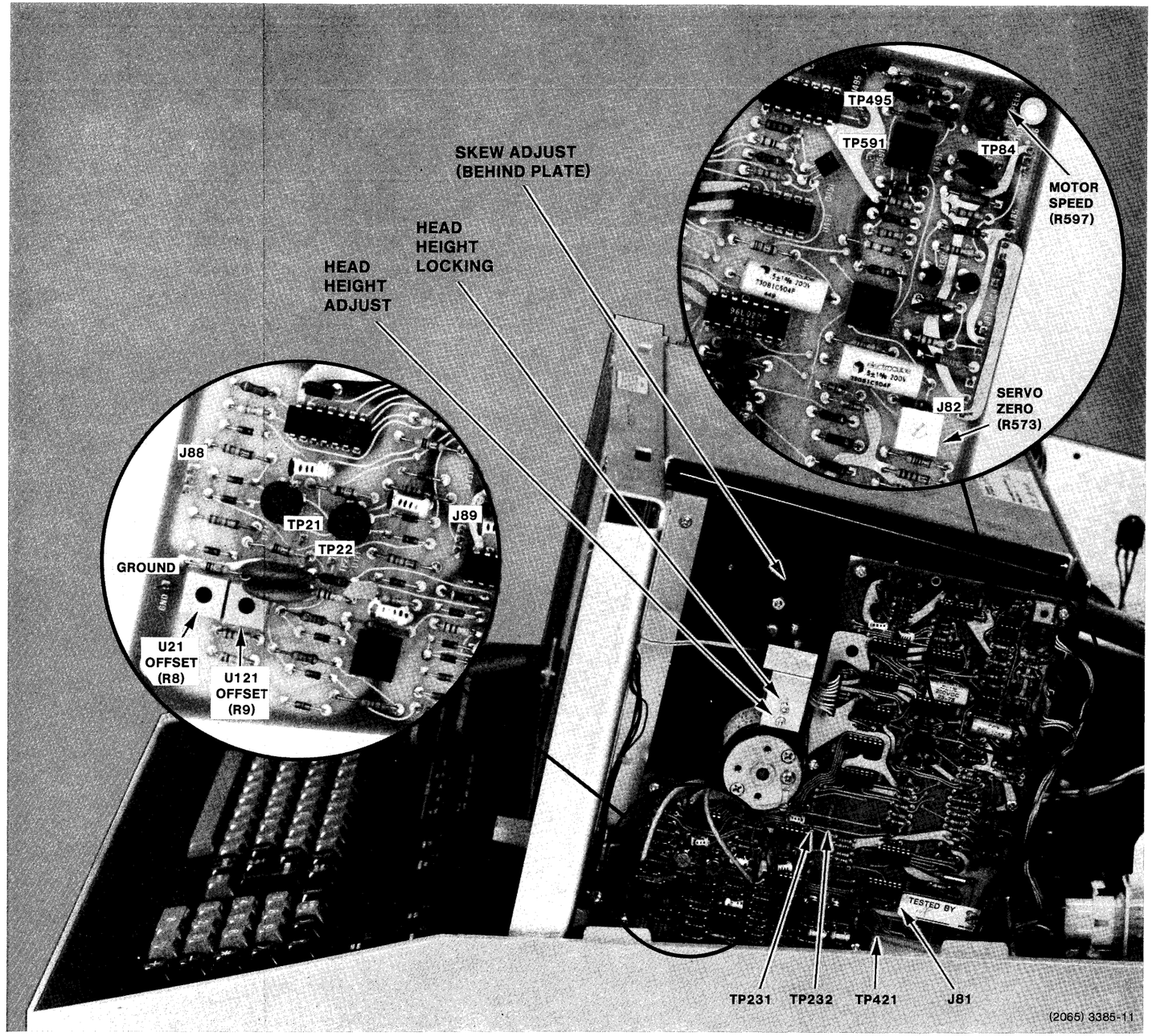


Figure 2-1. 4050 Series Tape Unit Test Points and Adjustments.

FIGURE 2-1

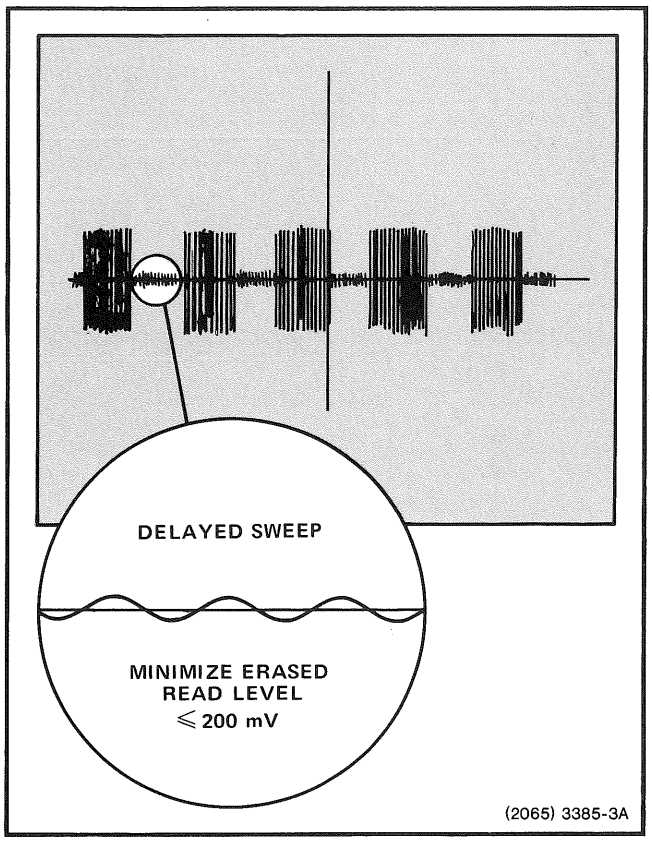


Figure 3-4. Tape Head Height Adjustment Waveform.

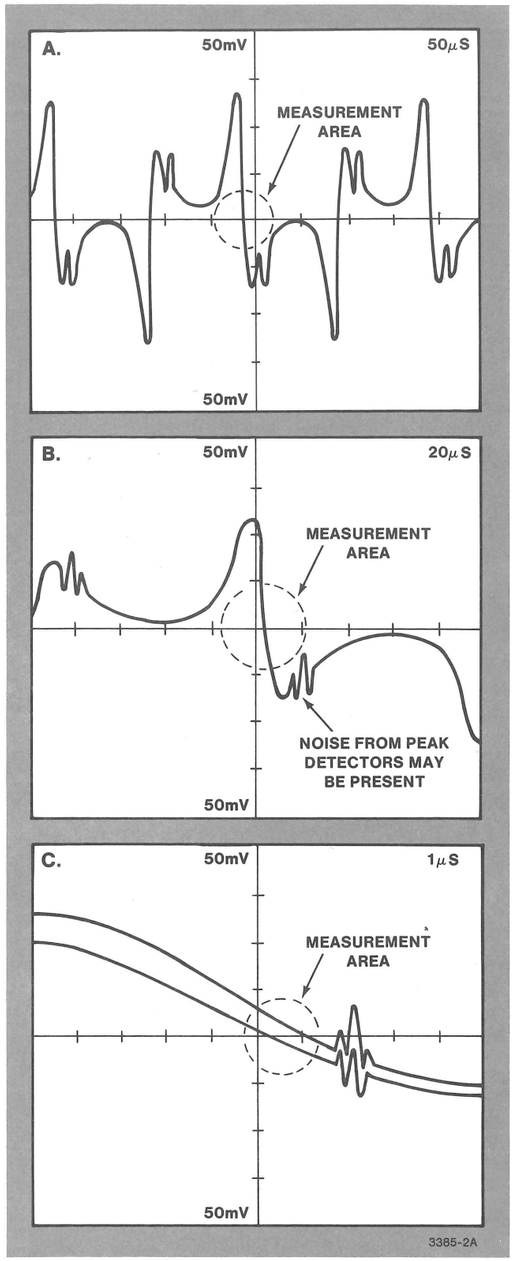


Figure 3-2. Tape Head Skew Adjustment Waveforms.

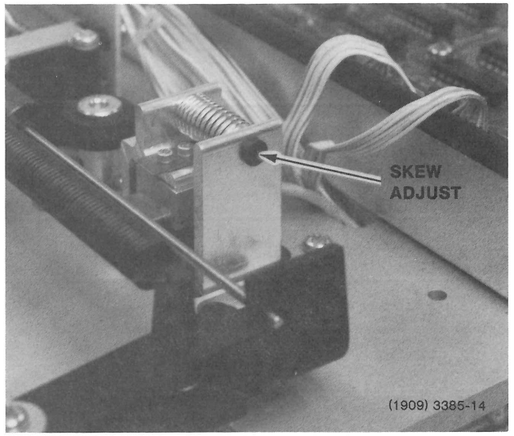


Figure 3-3. Head Skew (Azimuth) Adjusting Screw.

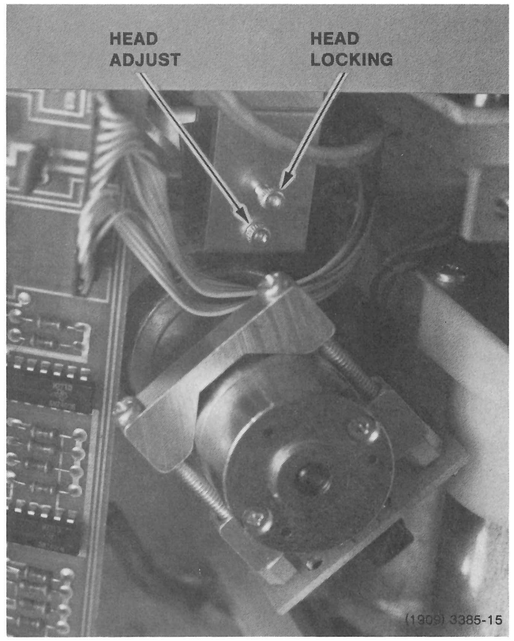


Figure 3-5. Head Height Adjustment Screws.

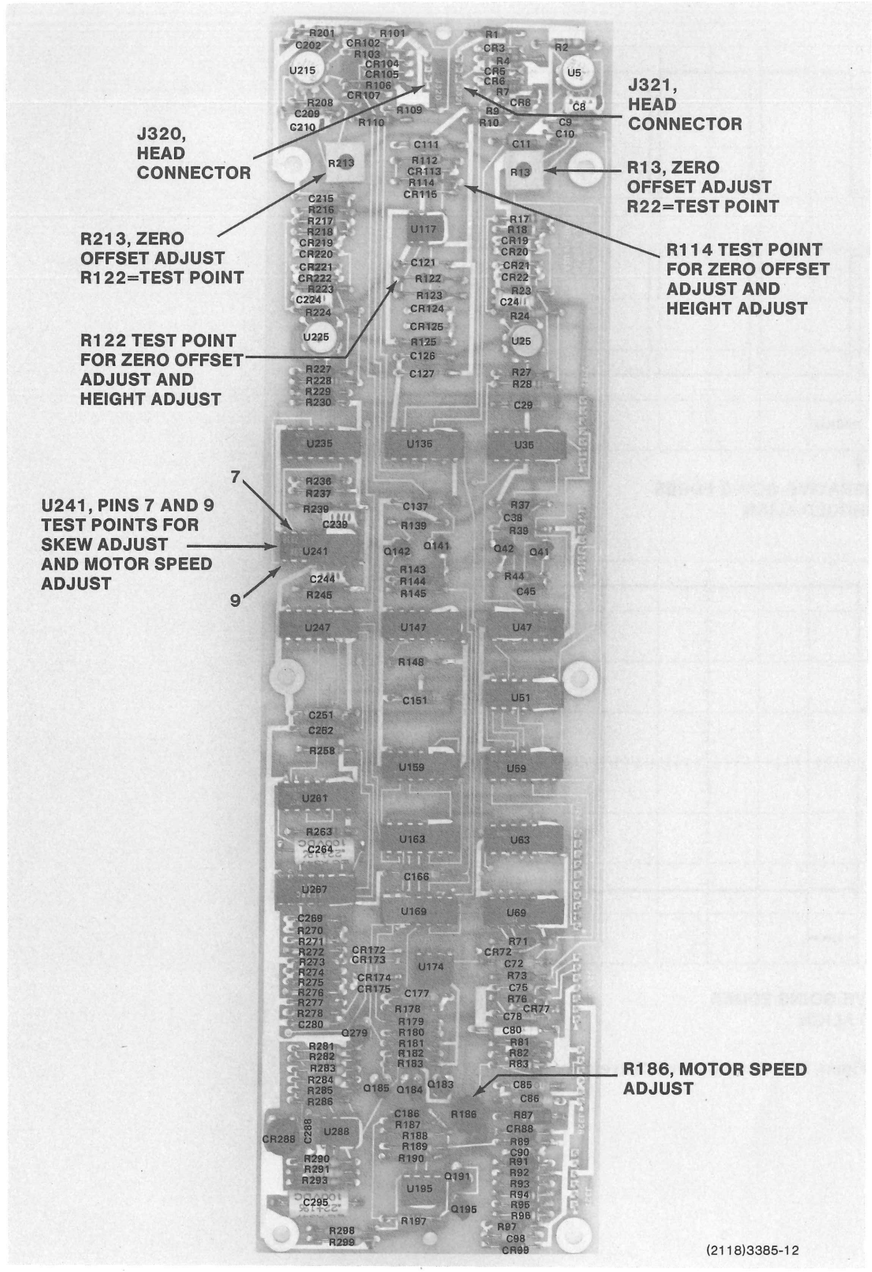
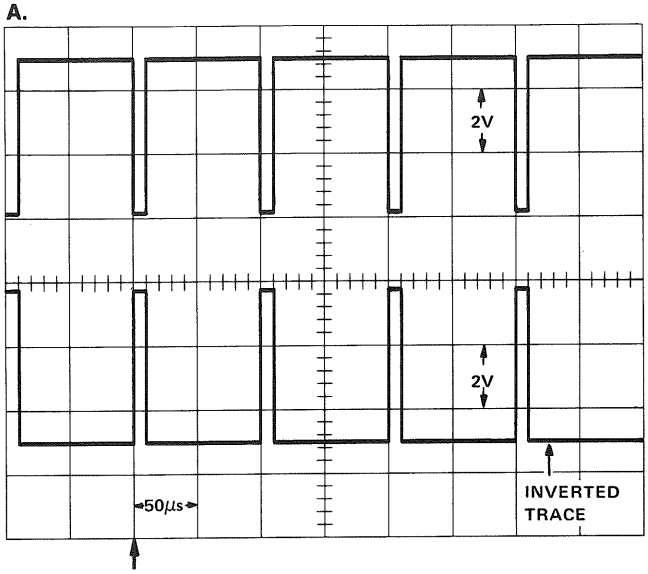


Figure 3-1. Recorder Test and Adjustment Points.

FIGURES 3-1, 3-2, 3-3, 3-4, 3-5
FIGURE 3-6 (ON BACK)

A.



B.

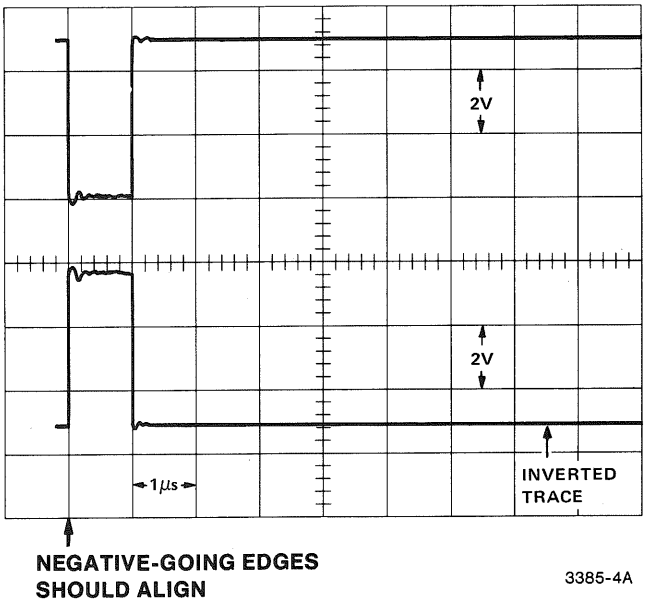


Figure 3-6. Read Channel Waveforms.