CHAPTER 5
TROUBLESHOOTING THE LA120

5.1 GENERAL

Table 5-1 lists the most common LA120 failures, the associated symptoms, and remedies. Check for symptoms in the order given in Table 5-1. Refer to Figure 5-1 for location of logic/power board jacks and cables. Table 5-2 lists the dc voltages and test points on the logic/power board.

When troubleshooting, ensure that all plug-in chips on the logic/power board are seated properly. Improper initialization will probably result if any of these chips have worked loose in their sockets.

Keep in mind that whenever power is interrupted to the LA120, the terminal parameters are reinitialized to their stored values when power is applied.

In troubleshooting the LA120, use the applicable engineering logic drawings from the engineering drawing set. Also contained in the drawing set are unit assembly (UA) drawings that can be used for component location on the logic/power board and the keyboard assembly. The LA120 IPB (EK-LA120-IP) can also be helpful.

WARNING

Use extreme care when checking internal portions of the power supply due to exposed 120 Vac.

CAUTION
STATIC CAN DAMAGE COMPONENTS.

Logic modules contain static sensitive components. Before handling any subassembly with logic components (removing or installing from LA120 terminal, removing from shipping package, bench handling), touch the LA120 metal frame or some relatively large metal object, to remove static body charges.

Table 5-1 LA120 Troubleshooting Procedure

Symptom	Probable Cause	Remedy
1. No power when POWER switch is set to ON. Fan not operating and no lights.	Main power fuse (F1)	Check and replace fuse.
	Not plugged in, no power at wall socket	Check power cord, wall socket.
	Wiring between ac plug transformer and fan	Check and replace wiring.
2. Head slams into right bumper and no bell sounds.*	Power supply fuse F3	Check and replace fuse F3.
	Power supply	Replace power supply per Paragraph 6.21.
	CVT power supply module	Replace CVT power supply module per Paragraph 6.23.
	Logic/power board	Replace logic/power board per Paragraph 6.26.
3. Head slams into left bumper and no bell sounds.*	Power supply	Replace power supply per Paragraph 6.21.
	CVT power supply module	Replace CVT power supply module per Paragraph 6.23.
	Cable between J2 on power supply and J2 on logic/power board	Reconnect or replace cable.
	Logic/power board	Replace logic/power board per Paragraph 6.26.
4. Head slams into left or right bumper and bell sounds.*	DC motor/encoder cable to J5 on logic/power board	Reconnect or repair cable.
	DC motor/encoder or logic/power board	Perform dc servo test (Paragraph 5.2).
5. Head slams into left or right bumper after LA120 has warmed up.*	Encoder	Perform encoder duty cycle check/adjustment (Paragraph 5.3).

*Head slamming into bumper may cause CARRIAGE fuse (on logic/power board) to blow after a few seconds.

Table 5-1 LA120 Troubleshooting Procedure (Cont)

Symptom	Probable Cause	Remedy
6. No response when power switch is set to ON. Fan is operating but no lights.	5 A pico fuse F1 (located on CVT power supply module)	Remove power supply per Paragraph 6.21 and replace pico fuse F1.
	CVT power supply module	Replace CVT power supply module per Paragraph 6.23.
	Cable between J1 on keyboard and J1 on logic/power board	Reconnect or replace cable.
	Mate-N-Lok P5/J5 between power supply and ac input	Reconnect or replace wiring.
	Power supply	Replace power supply per Paragraph 6.21.
7. Display indicates 8888, print head does not move, and all lights light.	No paper	Replace paper.
	Top cover open	Close cover.
	Paper-out switch	Adjust or replace paper out switch per Paragraph 7.4
	J3 on keyboard	Reconnect J3. Check cable.
	Cable between J2 on keyboard and J1 on logic/power board	Reconnect or replace cable.
	Logic/power board	Replace logic/power board per Paragraph 6.26.
8. Display indicates one blinking digit (0 through 9). Print head does not move.	Logic/power board	Turn LA120 off, then back on. If display continues blinking replace logic/power board per Paragraph 6.26.
	Flashing 9 could indicate J2 on logic/power board or power supply is disconnected	Reconnect J2.

Table 5-1 LA120 Troubleshooting Procedure (Cont)

Symptom	Probable Cause	Remedy
9. Print head does not move, some lights light, display does not indicate any number. Bell sounds momentarily on power-up and PAPER OUT light blinks.	Carriage fuse F2 on logic/power board	Replace fuse.
	F2 on power supply	Replace fuse.
	DC motor/encoder or logic/power board	Perform dc servo test (Paragraph 5.2).
	Logic/power board	Perform clock test (Paragraph 5.4).
	Power supply	Replace power supply per Paragraph 6.21.
	Cable to J5 on logic/power board	Reconnect or repair cable.
10. Print head will not initialize properly. Light display is erratic.	Power supply or logic and power board.	Perform wake up test (Paragraph 5.5).
11. Print head moves left then right a few spaces; however, display indicates a number other than 1 (number does not flash).	Logic/power board	Replace logic/power board per Paragraph 6.26.
	Keyboard	Replace keyboard per Paragraph 6.20.
	Cable between J2 on keyboard and J1 on logic/power board.	Replace cable.
12. Display does not appear to work or lights appear to be faulty.	Display or lights	To check display and lights turn power OFF, open top cover, then turn power ON. Display should indicate 8888 and all lights should light. If display is bad, replace keyboard per Paragraph 6.20. Replace lights as required.

NOTE
The following steps exercise the logic/power board and the printing mechanism.

13. Press CTRL and SET-UP to enter SET-UP. SET-UP light does not blink.	Logic/power board or keyboard	While in LOCAL, press additional keyboard keys to isolate fault between keyboard and logic/power board. Replace logic/power board or keyboard per Paragraphs 6.26 or 6.20.

Table 5-1 LA120 Troubleshooting Procedure (Cont)

Symptom	Probable Cause	Remedy
14. While in SET-UP, press T to start self-test. Print head does not fire in self-test mode; however, carriage moves across carriage bar.	Print head	Replace print head per Paragraph 6.3.
	Print head cable disconnected	Reconnect print head cable.
	Logic/power board	Replace logic/power board per Paragraph 6.26.
15. No printout in self test; however, carriage moves across carriage bar and head solenoids sound as if they are firing.	Carriage adjustment lever	Adjust print head using carriage adjustment lever.
	Ribbon	Check and replace ribbon.
	Ribbon chassis assembly	Check to see if ribbon moves freely; if required, replace ribbon chassis assembly per Paragraph 6.18.
16. Missing dots or excessive dots in characters.	Print head, print head cable, or logic/power board	Perform print character test (Paragraph 5.6).
17. Missing or incorrect characters (always the same character).	USART or ROM chip	Perform USART Test (Paragraph 5.7).
	Keyboard	Perform keyboard test (Paragraph 5.8).
18. No line feed response from one of the following keys. Other two keys function normally. • LINE FEED • LOCAL LINE FEED • LOCAL FORM FEED	Keyboard	Perform keyboard test (Paragraph 5.8).
19. No line feed response from any of the following keys: • LINE FEED • LOCAL LINE FEED • LOCAL FORM FEED	Logic and power board or stepper motor	Perform line feed test (Paragraph 5.9).
20. Bell does not sound during self-test.	Logic and power board or speaker	Perform bell test (Paragraph 5.10).
21. Bell sounds during self-test but does not sound when CTRL G is pressed.	Keyboard	Perform keyboard test (Paragraph 5.8).

Table 5-1 LA120 Troubleshooting Procedure (Cont)

Symptom	Probable Cause	Remedy
22. LA120 operates in self-test; however, printout is incorrect when operating with user's equipment.	User equipment, 20 mA/EIA interface, or logic/power board	Connect 20 mA or EIA loop back connector to interface cable. Place the LA120 on-line and type a few characters. If LA120 operates correctly, problem is with users equipment. If LA120 does not operate correctly, replace EIA interface cable, or logic/power board per Paragraph 6.26. (If 20 mA option is used, replace 20 mA cable or circuit board.)
	USART	Perform USART test (Paragraph 5.7).
	Modem	Replace modem.
	Incorrect SET-UP parameters.	Check SET-UP parameters.
23. Loss of position when printing multiple lines.	Logic/power board	Replace logic/power board per Paragraph 6.26.
	Power supply	Replace power supply per Paragraph 6.21.
	Encoder	Perform encoder duty cycle check/adjustment (Paragraph 5.3).
24. Print varies in density from dark to light or light to dark across page.	Print bar out of alignment	Perform print bar adjustment per Paragraph 7.9.
25. Print density varies randomly across page.	Ribbon	Replace ribbon.
	Power board	Replace logic/power board per Paragraph 6.26.
26. Printing is always light in the same spot.	Print bar pitted or bent printer mechanism	Replace print bar per Paragraph 6.6 or printer mechanism per Paragraph 6.22.
27. Printing density progresively drops off to no impression when printing single or multiple lines.	Ribbon drive assembly does not move ribbon	Replace ribbon drive assembly per Paragraph 6.11.
	Print head screws that secure head to carriage have worked loose.	Adjust print head per Paragraph 7.1

Table 5-1 LA120 Troubleshooting Procedure (Cont)

Symptom	Probable Cause	Remedy
28. Ribbon does not reverse.	Ribbon or ribbon chassis assembly	Check for eyelet on ribbon. Replace ribbon or ribbon chassis assembly.
	Pushrod disengaged	Reconnect pushrod.
29. Paper jams.	Paper path obstruction	Clear paper path.
	Carriage adjustment lever	Adjust carriage adjustment lever.
	Tractors	Replace tractors per Paragraph 6.15.
	Head gap	Check and adjust head gap per Paragraph 7.1

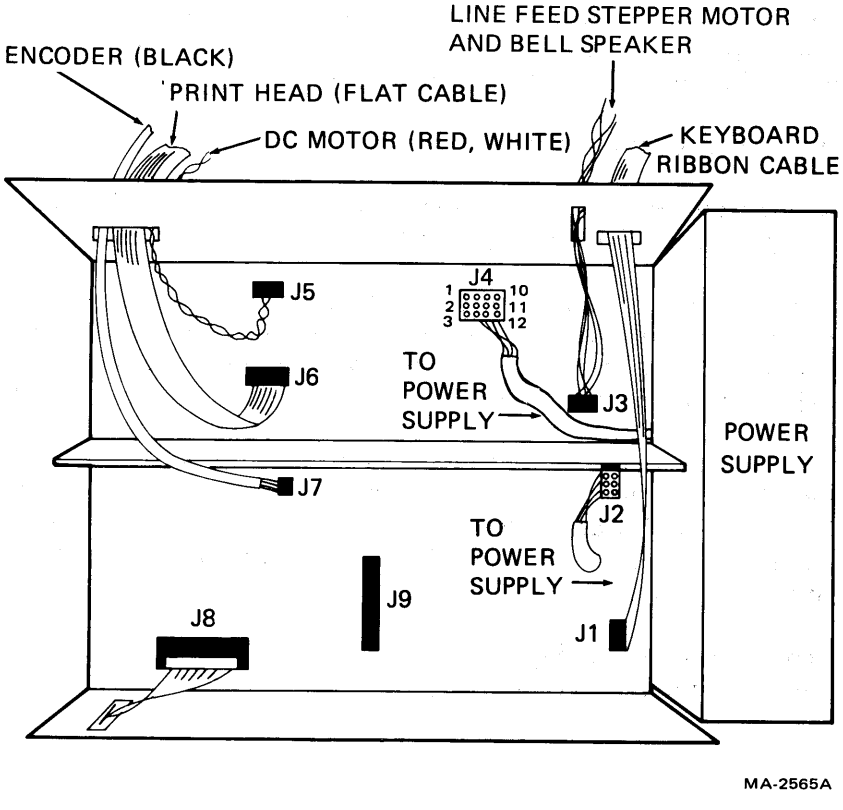


Figure 5-1 Logic/Power Board Connectors

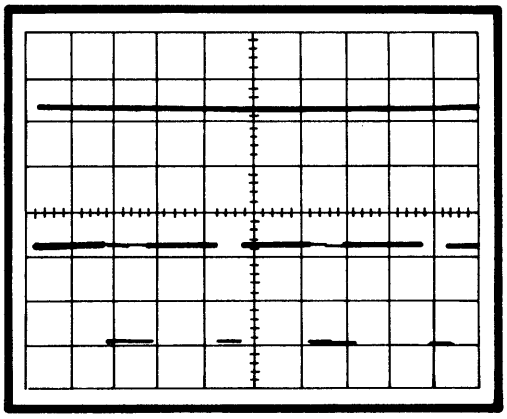
Table 5-2 DC Supply Voltages

Voltage (V)	Tolerance (V)	Logic/Power Board Test Points (Figure 5-1)
+5	±0.25	J2-6
+12	±0.6	J2-2
-12	±0.6	J2-3
+24	±2.0	J4-1,2,3
-24	±2.0	J4-7,8,9

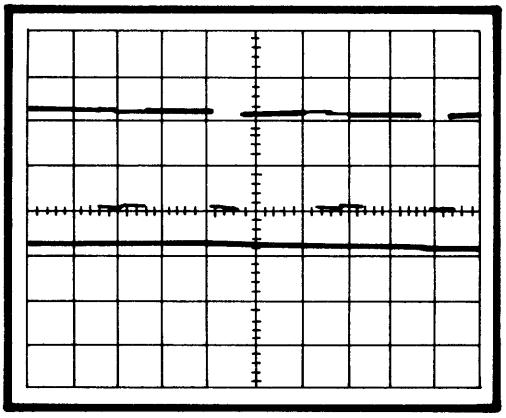
Note: All voltages measured with respect to ground.

5.2 DC SERVO TEST

1. Disconnect power from terminal.
2. Remove printer housing (Paragraph 6.2.1) and tape down cover interlock. Open rear door.
3. Push carriage assembly to the extreme left and slip timing belt off dc motor pulley.
4. Disconnect P5 from logic and power board. Connect +5 V to dc servo motor via pins 1 and 2 of P5 (filter capacitors C47, C48, C49, - provide a +5 V source). Connect +5 V to pin 1 (white wire) and ground to pin 2 (red wire). Apply power to terminal.
5. Check output of encoder per Paragraph 5.3.
6. Remove power from terminal. Connect channel 1 of scope to pin 8 of E25 (MINUS L) and channel 2 to pin 9 (PLUS L). Set up scope according to Figure 5-2.
7. Apply power to terminal. Check that dc motor is turning in a counterclockwise direction as viewed from the front of the terminal. (If the timing belt were on, the print head would be driven to the left.) Check for the waveform shown in Figure 5-2a. With a dc voltmeter, check servo amplifier output on pin 2 (red wire) of J5. The reading should be about +23 V.
8. Reverse +5 V connection to P5 by connecting ground to pin 1 (white wire) and +5 V to pin 2 (red wire). The dc motor will turn in a clockwise direction. Change scope trigger source from CHAN2 to CHAN1 and check for the waveshape of Figure 5-2b. Check servo amplifier dc output on pin 2 (red wire) of J5. The dc voltmeter should read about -23 V. Remove power and reconnect J/P5.
9. Remove scope leads. Slip timing belt onto dc motor pulley. Close up lower rear panel and install printer housing (Paragraph 6.2.2).



a. Motor Being Driven Counterclockwise



b. Motor Being Driven Clockwise

SCOPE SETUP

VOLTS/DIV:	5V CHANNELS 1 AND 2
VERTICAL MODE:	CHOP
SWEEP SPEED:	0.1 MS/DIV
TRIG MODE:	NORMAL
TRIG SOURCE:	CHAN 2, DC, INT, POS FOR FIGURE 5-2A. CHANGE TO CHAN 1 FOR FIGURE 5-2B.

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Figure 5-2 DC Servo Signals

5.3 ENCODER DUTY CYCLE CHECK/ADJUSTMENT

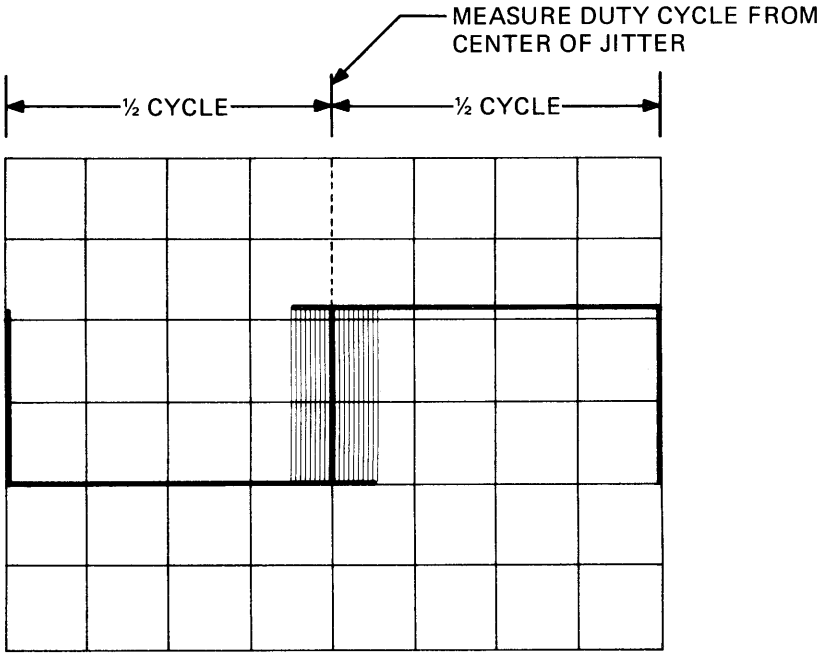
1. Disconnect power from terminal.
2. Remove printer housing (Paragraph 6.2.1) and tape down cover interlock. Open rear door.

3. Push carriage assembly to the extreme left and slip timing belt off dc motor pulley.

4. Check channel 1 output of the encoder by connecting channel 1 of the scope to pin 6 of E25 on the logic and power board. Apply power to terminal. The dc motor/encoder will rotate continuously. Adjust scope for settings given in Figure 5-3 and check for waveshape shown. The waveshape must show a 50 percent duty cycle (equal positive and negative alternations) as measured from the center of the waveform jitter.

5. If encoder output is good, proceed to Step 8. If the duty cycle is not 50 percent, proceed to Step 6.

6. Remove the two screws and the circular cover from rear of dc motor/encoder. If motor/encoder is the Hitachi model, the rear cover is square and is popped off instead of unscrewed.



SCOPE SETUP

VOLTS/DIV:	2V
VERTICAL MODE:	CHAN 1
SWEEP SPEED:	20 μS/DIV; ADJUST VARIABLE SWEEP SPEED FOR ONE CYCLE FILLING ENTIRE SWEEP
TRIG MODE:	NORMAL
TRIG SOURCE:	CHAN 1, DC, INT, POS

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Figure 5-3 Encoder Output Waveform

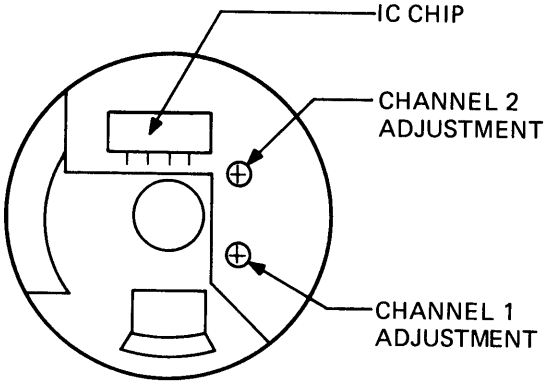
7. Adjust channel 1 adjustment (Figure 5-4) for a 50 percent duty cycle. Apply glyptol to the potentiometer after adjusting.

8. Connect channel 1 of scope to pin 7 of E25 to check channel 2 output of the encoder. Check for waveshape shown in Figure 5-3. The waveshape must show a 50 percent duty cycle as measured from the center of the waveform jitter.

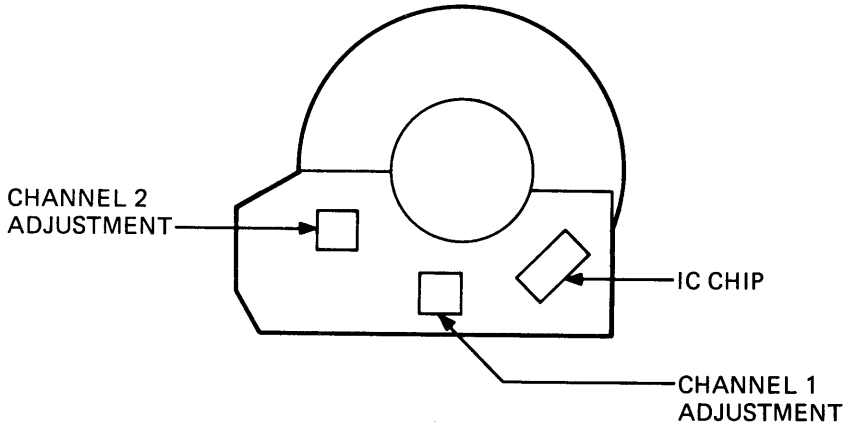
9. If duty cycle is not 50 percent, perform Steps 6 and 7 for channel 2 adjustment.

10. With belt tension spring in place (Figures 6-5 and 6-6), press left-hand pulley against printer mechanism and slip timing belt onto dc motor pulley.

11. Install printer housing (Paragraph 6.2.2).



a. Litton, Clifton Precision Model



b. Hitachi Model

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NOTE:
THE ENCODER CIRCUIT BOARD MAY BE ORIENTATED IN ANY POSITION AROUND A 360° CIRCUMFERENCE, NOT NECESSARILY AS SHOWN ABOVE. THE CHANNEL 2 ADJUSTMENT IS CLOSEST TO THE IC CHIP ON THE CLIFTON PRECISION MODEL AND FARTHEST FROM THE CHIP ON THE HITACHI MODEL.

Figure 5-4 Encoder Circuit Board

5.4 CLOCK TEST

The clock test checks the operation of the 18 MHz crystal and the 8224 clock chip E23.

1. Check $\phi 1$ and $\phi 2$ clock signals from E23 by connecting channel 1 of scope to pin 11 of E23 and channel 2 of scope to pin 10. Setup scope according to Figure 5-5 and check for waveshape shown.

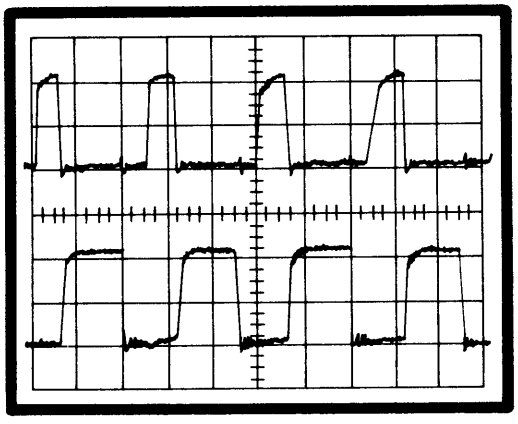
2. Check that 8080A microprocessor is being clocked through its addressing sequence by connecting channel 1 of the scope to any of the sixteen output address lines. The address lines out of the 8080A (E22) are designated A0 through A15. Set up scope according to Figure 5-6 and check for waveshape shown. The waveshape will be unsteady due to address sequencing of the 8080A.

3. Disconnect scope leads and close lower rear panel on terminal.

5.5 WAKE UP TEST

1. Remove power from terminal. Open lower rear panel.

2. Connect channel 1 of scope to DC OK L at the junction of C52/C53 and R4 (bottom of R4 is most accessible). Connect channel 2 of scope to DC OK H at E23-2. Set up scope according to Figure 5-7.



SCOPE SETUP

VOLTS/DIV:	CHANNELS 1 AND 2 = 5V
VERTICAL MODE:	ALTERNATE
SWEEP SPEED:	0.2 μS/DIV
TRIG MODE:	NORM
TRIG SOURCE:	CHI, DC, INT, POS

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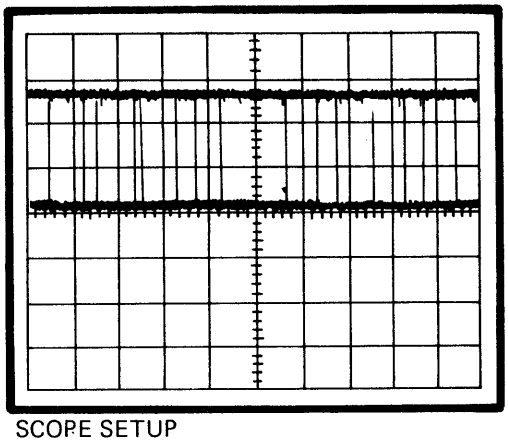
Figure 5-5 $\phi 1$ and $\phi 2$ Clock Signals



SCOPE SETUP

VOLTS/DIV:	2V
VERTICAL MODE:	DC
SWEEP SPEED:	10 μs/DIV
TRIG MODE:	NORM
TRIG SOURCE:	CHI, POS, INT*

* USE AC HIGH FREQUENCY REJECT.

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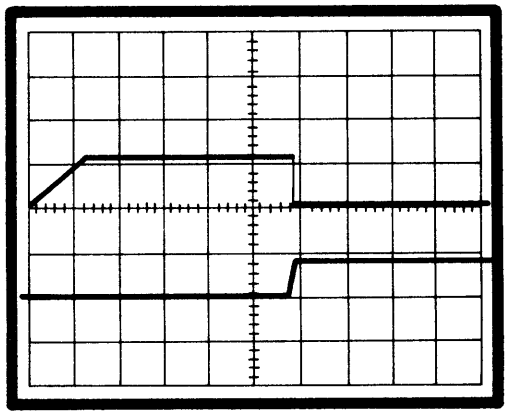
Figure 5-6 8080A Addressing Output



SCOPE SETUP

VOLTS/DIV:	5V
VERTICAL MODE:	SINGLE TRACE
SWEEP SPEED:	0.1 SEC/DIV
TRIG MODE:	NORMAL
TRIG SOURCE:	CHAN 1, DC, INT, POS

MA-4686

Figure 5-7 DC Wake Up Waveform

3. Apply power to terminal and check for waveshape of Figure 5-7. The DC OK L ramp should be approximately 0.6 seconds. Turn power off and on to repeat the waveshape.

NOTE

Leave power off for about 10 seconds to allow for capacitor discharge. Otherwise, the DC OK L ramp will not occur when power is applied.

4. Remove power from terminal. Check RESET H by changing channel 1 of the scope to E23-1. Leave channel 2 input and set up as in Step 3. Apply power and check for the waveshape of Figure 5-7.

5. Remove power from terminal. Disconnect scope leads and close lower rear panel.

5.6 PRINT CHARACTER TEST

The print character test checks print head operation and the circuits that process the character signal prior to application to the print head. The slash character (/) is used for most of the waveforms shown in this test. The slash is an ideal test character because it fires all seven wires in the print head and fires them only once. Other characters would produce different waveforms according to which wires are fired and how many times they are fired (see note in Step 4).

Sheet 5 of engineering drawing M7081 contains the print head schematic. In the upper right-hand corner of the sheet is a 7-dot printed image showing the signal versus dot position relationship for the seven print head wires. Use this image to determine which signal channel(s) are causing the faulty print character. Examine the character to determine which dots are missing or which dots are firing too often. Note on the logic print that each VDR head enable signal controls one-half of the print head, while each DR drive signal controls only one channel.

1. Remove power from terminal.

2. Using an ohmmeter, check continuity of print head solenoid in faulty channel. Check from pin 3 (metal screw) of drive switch transistor (Q16, Q19, Q32, Q33, Q34, Q35 or Q36, depending on which channel is faulty) to pin 3 of head enable switch transistor (Q30 or Q31).

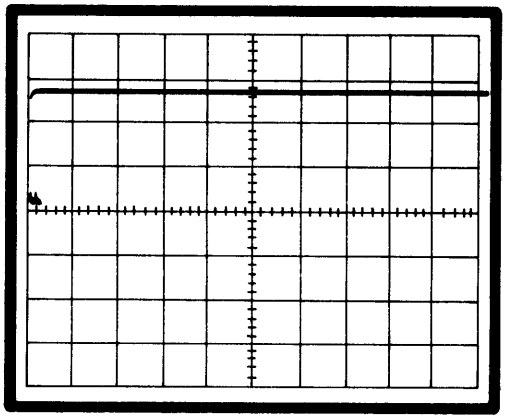
   (This checks connector J/P6 and cabling along with print head solenoid.) The resistance of a print head solenoid is about 2.5 ohms.

3. Connect channel 1 of scope to output of the faulty channel of E25. Set up scope according to Figure 5-8.

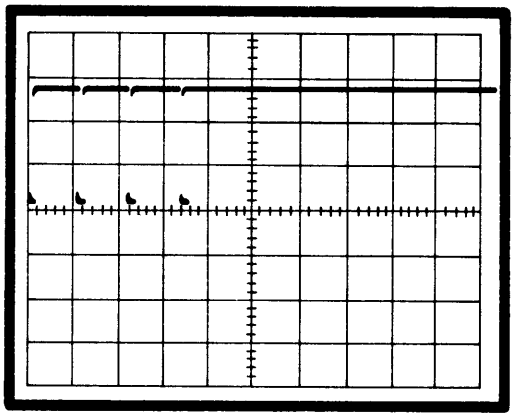
4. Apply power to terminal. Place terminal in local mode. Press and hold down the "/" key and check for the waveform of Figure 5-8a.

NOTE

Due to the slash (/) character firing each wire once, the waveshape of Figure 5-8a will be obtained for any of the seven solenoid (S) signals from E25. If signal S1 (top of printed image) is viewed (E25-21) and uppercase "T" is pressed, the top wire will fire four times producing the waveform of Figure 5-8b.



a. The Character "/"



b. The Character "T"

SCOPE SETUP

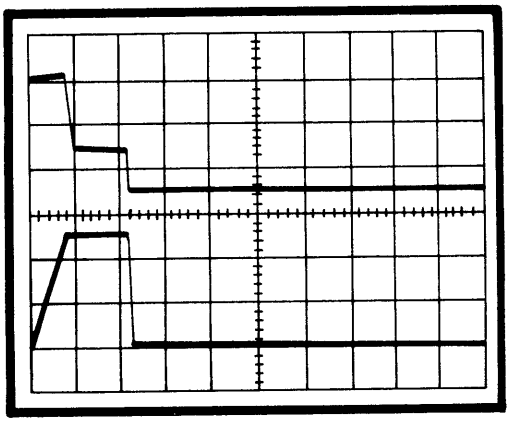
VOLTS/DIV:	2V
VERTICAL MODE:	CHAN 1
SWEEP SPEED:	5 MS/DIV
TRIG MODE:	NORMAL
TRIG SOURCE:	CH1, DC, INT, NEG

MA-4689

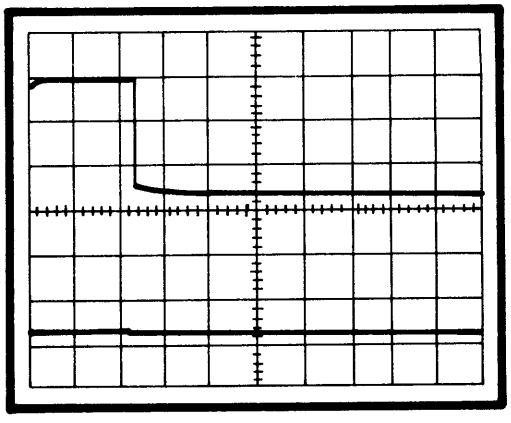
Figure 5-8 Solenoid Signal Output of DC305

5. Connect channel 1 of scope to drive signal output of the driver for the solenoid signal being checked (DR output of E40 or E45). Connect channel 2 of scope to current feedback pin (FB) of same driver. Use ac coupling for channel 2 input to scope. Set up scope according to Figure 5-9.

6. Press and hold the "/" key and check for the waveform of Figure 5-9a. If print head solenoid is open, there will be no current feedback to driver (channel 2 on scope) and driver output will be as shown in Figure 5-9b.



a. Normal Waveform



b. Open Print Wire

SCOPE SETUP	
VOLTS/DIV:	CH1 = 10V;CH2 = 2V*
VERTICAL MODE:	CHOP
SWEEP SPEED:	0.2 MS/DIV
TRIG MODE:	NORMAL
TRIG SOURCE:	CH1, DC,INT,POS

*USE AC COUPLING FOR CHANNEL 2 TO FLOAT SIGNAL

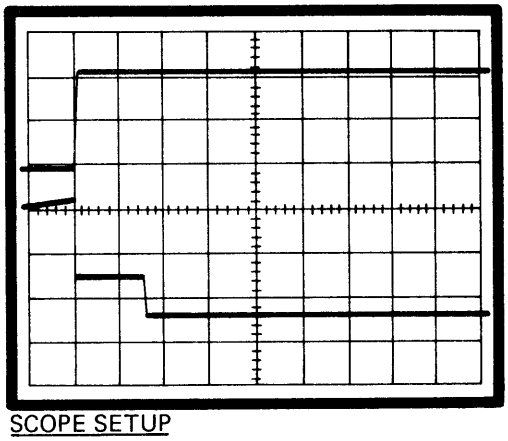
MA-4674

Figure 5-9 Drive Signal to Print Solenoid

7. Connect channel 1 of scope to head enable output of signal driver chip for solenoid signal being checked [pin 9 (VDR) of E40 or E45]. Connect channel 2 of scope to drive signal output pin (DR) of signal driver being checked. Set up scope according to Figure 5-10.

8. Press and hold the "/" key and check for the waveform of Figure 5-10.

9. Disconnect scope leads. Close lower rear panel.



SCOPE SETUP

VOLTS/DIV:	CH1 = 20V; CH2 = 10V
VERTICAL MODE:	CHOP
SWEEP SPEED:	0.2 MS/DIV
TRIG MODE:	CHOP
TRIG SOURCE:	CH1, DC, INT, POS

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Figure 5-10 Head Enable vs Drive Signal

5.7 USART TEST

The USART test checks the 8251A USART, the I/O path to the user's equipment (LA120 portion), and the transmit and receive clocks for various baud rates.

1. Remove power from terminal and swing down rear cover panel.

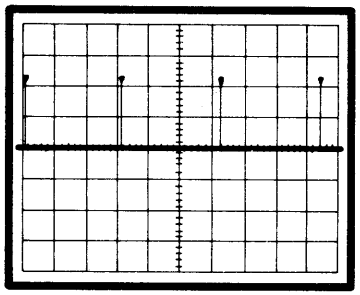
2. Check baud rates by connecting channel 1 of scope to E28-9 (TXC). Set up scope according to Figure 5-11.

3. Apply power to terminal. Place LA120 in SET-UP mode and set in a baud rate of 50. Check for 50 baud waveshape shown in Figure 5-11a.

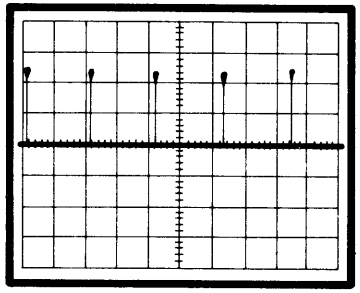
4. Set in the baud rates shown in Figure 5-11b through 5-11m and check for corresponding waveshapes. Change horizontal sweep speed when indicated in figure.

NOTE

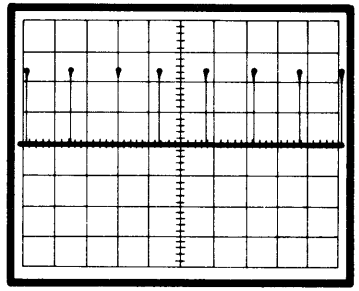
Note that TXC rate changes at 200 baud and at 7200 baud. Multiplier circuits within the USART are enabled at these frequencies to increase TXC to the correct rate.



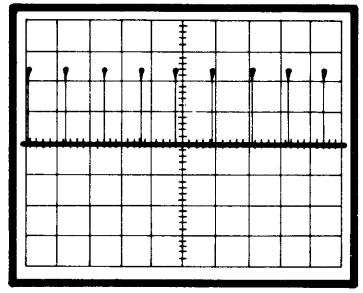
a. 50 Baud, Sweep Speed = 0.1 ms



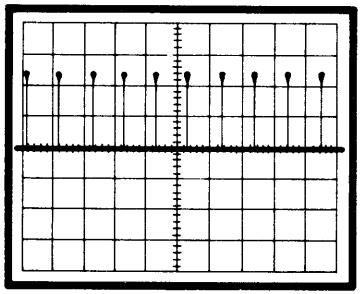
b. 75 Baud, Sweep Speed = 0.1 ms



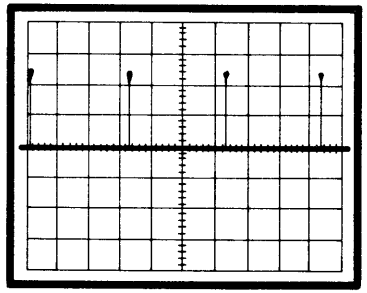
c. 110 Baud, Sweep Speed = 0.1 ms



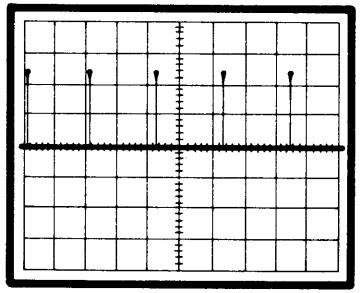
d. 134 Baud, Sweep Speed = 0.1 ms



e. 150 Baud, Sweep Speed = 0.1 ms



f. 200 Baud, Sweep Speed = 0.1 ms



g. 300 Baud, Sweep Speed = 0.1 ms

SCOPE SETUP

VOLTS/DIV:	2V
VERTICAL MODE:	CHAN 1
SWEEP SPEED:	AS NOTED FOR EACH WAVE FORM.
TRIG MODE:	NORM
TRIG SOURCE:	CHAN 1, DC, INT, POS

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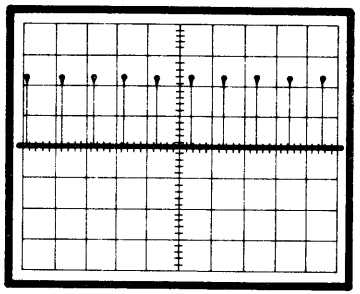
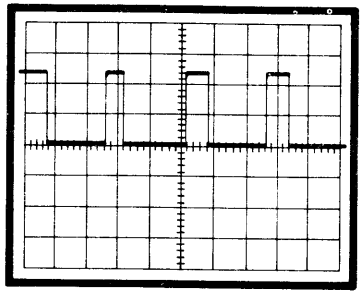
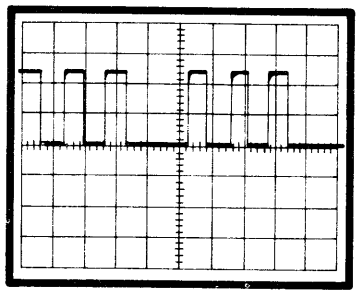
Figure 5-11 LA120 Baud Rate Clocks (Sheet 1 of 2)



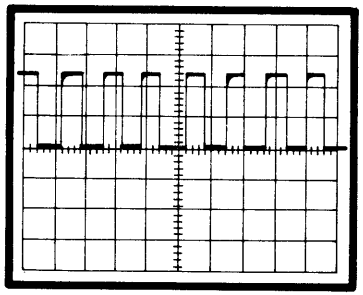
h. 600 Baud, Sweep Speed = 0.1 ms



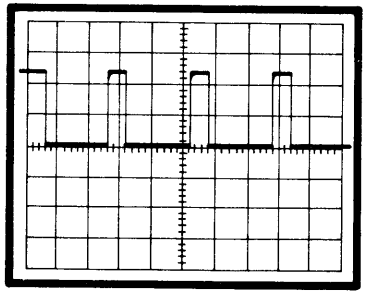
i. 1200 Baud, Sweep Speed = 5 μs



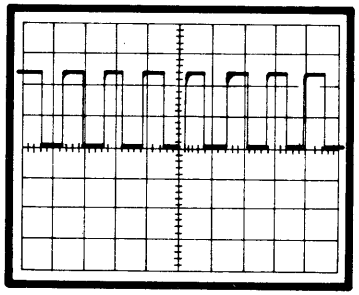
j. 1800 Baud, Sweep Speed = 5 μs



k. 2400 Baud, Sweep Speed = 5 μs



l. 7200 Baud, Sweep Speed = 5 μs



m. 9600 Baud, Sweep Speed = 5 μs

SCOPE SETUP

VOLTS/DIV:	2V
VERTICAL MODE:	CHAN 1
SWEEP SPEED:	AS NOTED FOR EACH WAVE FORM.
TRIG MODE:	NORM
TRIG SOURCE:	CHAN 1, DC, INT, POS

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Figure 5-11 LA120 Baud Rate Clocks (Sheet 2 of 2)

5. Check RXC by connecting channel 1 of scope to E28-25 and repeating Steps 3 and 4. The RXC waveshapes at E28-25 are identical to TXC waveshapes at E28-9.

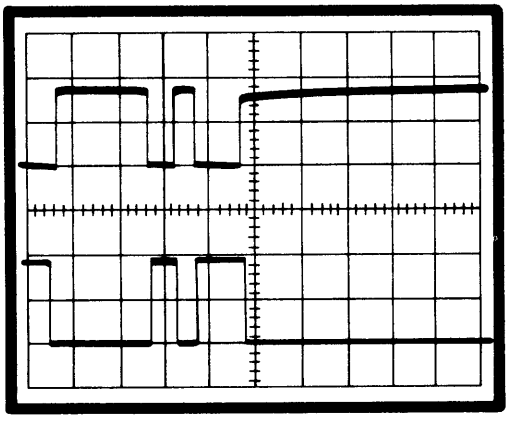
6. Clocks TXC and RXC are derived from ITC and IRC clocks out of the DC305 (E25-15, -14). The signal waveshapes at these points are identical to those in Figure 5-11.

7. Check USART I/O path as follows. Remove power from LA120. Wrap TXD EIA output around to RXD input by jumpering pins C and E of J8 on logic/power board. Connect channel 1 of scope to TXD output from USART (E28-19). Connect channel 2 of scope to J8 jumper. Set up scope according to Figure 5-12.

8. Apply power and place LA120 in modem setting 1.* Press and hold "/" key and check for the waveform of Figure 5-12.

9. Connect channel 1 of scope to RXD input to USART (E28-3). Leave channel 2 connected to J8 jumper and do not change scope settings. Waveform should be as shown in Figure 5-12.

10. Remove scope leads and close rear cover panel.



SCOPE SETUP

VOLTS/DIV:	CHANNEL 1 = 2V CHANNEL 2 = 10V
VERTICAL MODE:	CHOP
SWEEP SPEED:	0.2 MS/DIV
TRIG MODE:	NORM
TRIG SOURCE:	CHAN 1, DC, INT, NEG

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Figure 5-12 USART I/O Signals

* LA120 must be in modem setting 1 to remove enabling requirements imposed by EIA interface signals.

5.8 KEYBOARD TEST

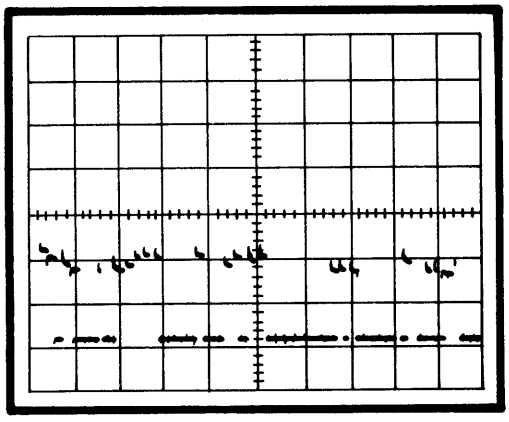
1. Remove power from terminal. Remove printer housing (Paragraph 6.2.1). Place LA120 in local mode. Proceed directly to Step 6 if faulty key/switch is one of the following:

SET-UP	SHIFT
RETURN	PAPER OUT (Switch)
CTRL	COVER INTERLOCK (Switch)
CAPS LOCK	

2. Using keyboard schematic, note which scanning chip (E5, E6, E101, E102) is connected to the nonfunctioning key. Turn over the keyboard bezel and connect channel 1 of scope to pin 1 of scanning chip.

3. Apply power. Set up scope according to Figure 5-13. The waveshape seen on scope (Figure 5-13) is due to keyboard scan and does not represent a signal condition. The waveshape will be a steady pattern but may not exactly match that shown in Figure 5-13.*

4. Press the nonfunctioning key. The waveshape should change to an unsteady† pattern similar to that shown in Figure 5-14.



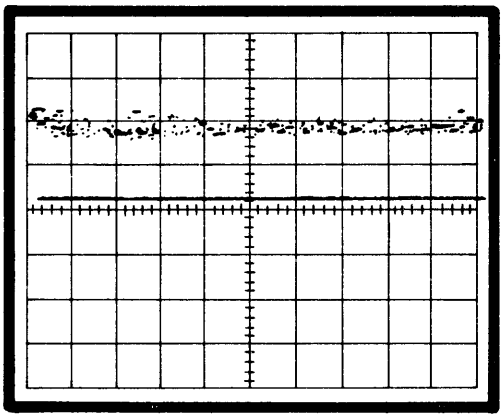
SCOPE SETUP

VOLTS/DIV:	2V
VERTICAL MODE:	NORMAL
SWEEP SPEED:	10 μs/DIV
TRIG MODE:	NORMAL
TRIG SOURCE:	CHAN 1,DC,INT,POS

MA-4675

Figure 5-13 Keyboard Scan Waveform

* The scope is triggered on a dc level. Pattern depends on which scan pulse triggers scope.
† The changing nature of the pattern is due to microprocessor program action.



SCOPE SETUP

VOLTS/DIV:	2V
VERTICAL MODE:	NORMAL
SWEEP SPEED:	10 μs/DIV
TRIG MODE:	NORMAL
TRIG SOURCE:	CHAN 1, DC, INT, POS

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Figure 5-14 Keyboard Scan Waveform with Key Pressed

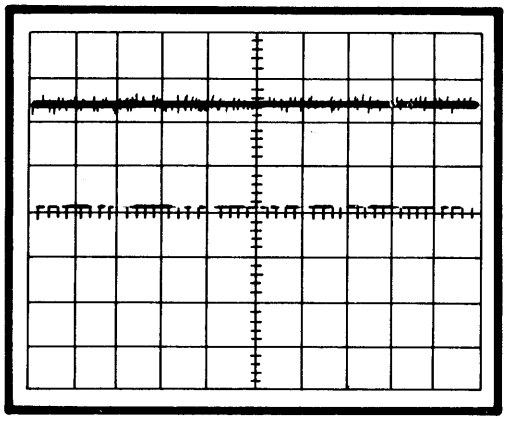
5. Connect channel 1 of scope to pin on scanning chip that connects to nonfunctioning key. Set up scope according to Figure 5-15. Press nonfunctioning key and check for waveform shown. Trace circuit through key and J1, to KBD IN chip (E2) on logic and power board. The waveshape of Figure 5-15 should also appear on the corresponding pin of E2. If proper waveform is not obtained, check key and associated circuitry.

6. Check pin on scanning chip E8 that connects to nonfunctioning key/switch. The pin should go to 0 V (ground) when key/switch is closed.

7. Connect channel 1 of scope to pin 5 (KD7 L) of scanning chip E8. Set up scope according to Figure 5-16. The waveshape seen on the scope (Figure 5-16) is due to keyboard scan and does not represent a signal condition. The waveshape will be a steady pattern but may not exactly match that shown in Figure 5-16.*

8. Press nonfunctioning key. The waveshape should change to an unsteady pattern similar to that of Figure 5-16. Trace KD7 L through J2 and J1 to KBD IN chip (E2) on logic and power board. The waveshape of Figure 5-16 should also appear on pin 2 of E2.

*The scope is triggered on a dc level. Pattern depends on which scan pulse triggers scope.



SCOPE SETUP

VOLTS/DIV:	2V
VERTICAL MODE:	CHAN 1
SWEEP SPEED:	10 μs/DIV
TRIG MODE:	AUTO
TRIG SOURCE:	CHAN 1, DC, INT, POS

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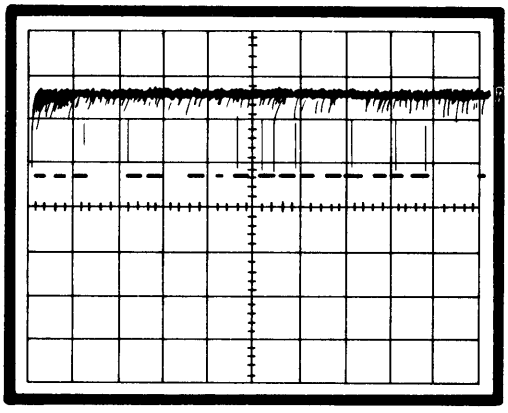
Figure 5-15 Key Circuit Waveform



SCOPE SETUP

VOLTS/DIV:	2V
VERTICAL MODE:	NORMAL
SWEEP SPEED:	5μ SEC/DIV
TRIG MODE:	NORMAL
TRIG SOURCE:	CHAN 1, DC, INT, POS

MA-4691

Figure 5-16 Keyboard Scan for Chip E8

5.9 LINE FEED TEST

The line feed test checks the printer LSI and the line feed amplifier (both on the logic/power board) and the stepper motor.

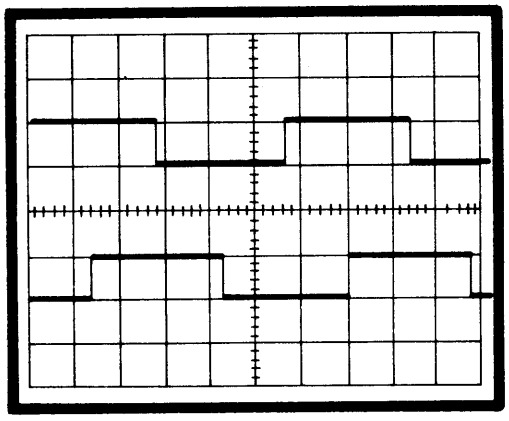
1. Remove power from terminal. Remove paper from terminal.

2. Jam paper into paper-out switch to override interlock.

3. Apply power to terminal.

4. Place terminal in local mode with LINE LOCAL key.

5. Connect channel 1 of scope to pin 13 of E25 on logic and power board. Connect channel 2 of scope to pin 12. Set up scope according to Figure 5-17. Press LINE FEED and observe the two channel inputs to the line feed amplifiers. Check that the waveforms are as shown in Figure 5-17.



SCOPE SETUP

VOLTS/DIV:	5V, CHANNELS 1 AND 2
VERTICAL MODE:	CHOP
SWEEP SPEED:	2 MS/DIV
TRIG MODE:	NORMAL
TRIG SOURCE:	CHAN 1, DC, INT, POS

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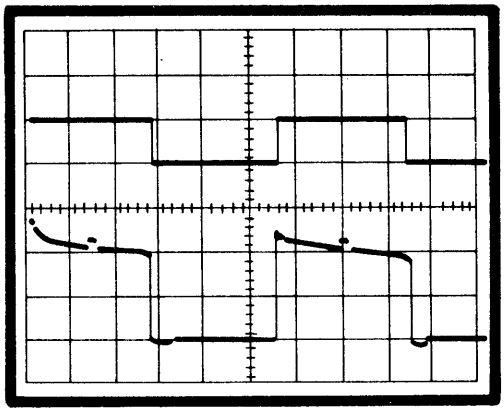
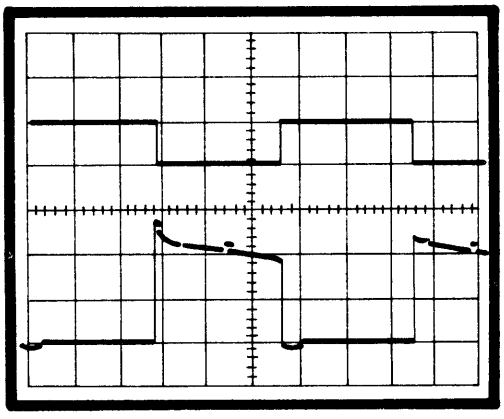
Figure 5-17 Line Feed Signal Output of DC305

6. Each phase of the quadrature phase, push-pull, line feed amplifier is checked by connecting channel 1 of scope to amplifier channel input and channel 2 to amplifier output. Set up scope according to Figure 5-18. Connect scope inputs according to Table 5-3. Press LOCAL FORM FEED and check for waveform specified in table.

7. Check run signal of line feed amplifier by connecting channel 1 of scope to E14-9 (amplifier input) and channel 2 to pin 3 (collector) of Q11 (amplifier output). Set up scope according to Figure 5-19. Press LINE FEED and check for waveshape shown.



a. Phase 1 and 2



b. Phase 3 and 4

SCOPE SETUP

VOLTS/DIV:	5V/DIV, CHANNEL 1 20V/DIV, CHANNEL 2
VERTICAL MODE:	CHOP
SWEEP SPEED:	2 MS/DIV
TRIG MODE:	NORMAL
TRIG SOURCE:	CHAN 1, DC, INT, POS

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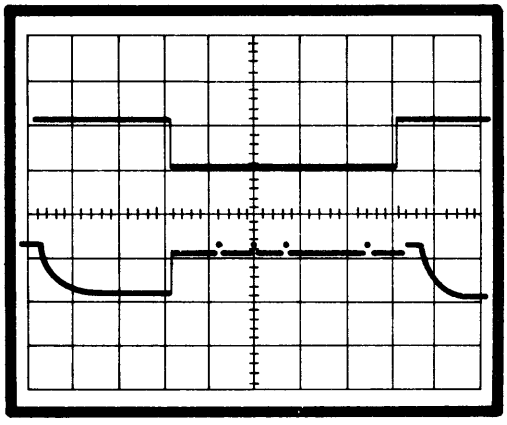
Figure 5-18 Line Feed Amplifier Input vs Output

Table 5-3 Line Feed Amplifier Test

Amplifier Phase Under Test	Scope Channel 1	Scope Channel 2	Waveform Figure No.
Phase 1	E3-1	Q15-3*	5-18a
Phase 2	E3-5	Q13-3*	5-18a
Phase 3	E14-13	Q14-3*	5-18b
Phase 4	E14-11	Q12-3*	5-18b

*Pin 3 is the collector.



SCOPE SETUP

VOLTS/DIV:	5V/DIV, CHANNEL 1 20V/DIV, CHANNEL 2
VERTICAL MODE:	CHOP
SWEEP SPEED:	5 MS/DIV
TRIG MODE:	NORMAL
TRIG SOURCE:	CHAN 1, DC, INT, POS

MA-4680

Figure 5-19 Line Feed Run Signal

8. Remove power from terminal. Disconnect P7 to check stepper motor windings. Using an ohmmeter, check between the following pins on P3:

   1 and 2
   2 and 3
   6 and 7
   7 and 8.

   All four readings should be 7.5 ± 0.5 ohm.

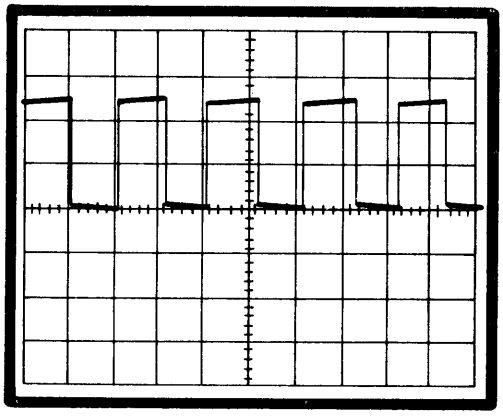
9. Remove scope leads and close lower rear cover.

5.10 BELL TEST

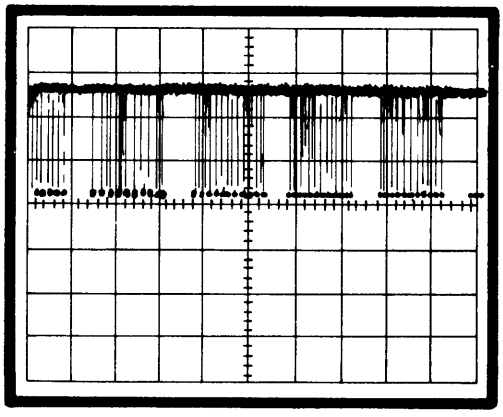
1. Apply power to terminal and initialize to the SET-UP parameters.

2. Place terminal in local mode with LINE LOCAL key. Open rear door.

3. Check input to bell amplifier by connecting channel 1 of scope to pin 10 of E25 on logic and power board. Set up scope according to Figure 5-20. Press CTRL G and check for the waveshape of Figure 5-20a. A high volume bell should sound. Check low volume bell signal by pressing SET-UP G and then CTRL G. The low volume bell will sound and the waveshape of Figure 5-20b should appear on scope. Press SET-UP G to return to high volume bell signal.



a. High Volume



b. Low Volume

SCOPE SETUP

VOLTS/DIV:	2V
VERTICAL MODE:	NORMAL
SWEEP SPEED:	0.2 MS/DIV
TRIG MODE:	NORMAL
TRIG SOURCE:	CHAN 1, DC, INT, POS

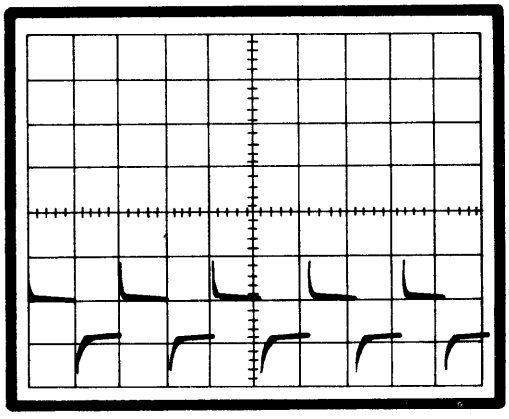
MA-4683

Figure 5-20 Bell Amplifier Input

4. Check output of bell amplifier by connecting channel 1 of scope to junction of diode D2 and R22 on logic and power board. With scope set-up as in Step 3, press CTRL G and check for the waveshape shown in Figure 5-21. If a waveform is present but is not the proper shape, speaker coil may be open. Perform Step 5 before replacing logic and power board.

5. Remove power from terminal. Disconnect P3. Check speaker coil by connecting an ohmmeter between pins 4 and 5 of P3. The reading should be 8 ± 2 ohms.

6. Reconnect P3 to J3 on logic board. Disconnect scope leads and close lower rear panel on LA120.



SCOPE SETUP

VOLTS/DIV:	2V
VERTICAL MODE:	NORMAL
SWEEP SPEED:	0.2 MS/DIV
TRIG MODE:	NORMAL
TRIG SOURCE:	CHAN 1, DC, INT, POS

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Figure 5-21 Bell Amplifier Output