

# FACTORY CALIBRATION PROCEDURE

## CONTENTS:

This is the guide for calibrating new instruments in Product Manufacturing. The procedure consists of 4 sections:

### Equipment Required

Factory Test Limits - Factory Test Limits are limits an instrument must meet before leaving Manufacturing. These limits are often more stringent than advertised performance requirements. This is to insure that the instrument will meet advertised requirements after shipment, allows for individual differences in test equipment used, and (or) allows for changes in environmental conditions.

Short Form Procedure - The Short Form Procedure has the same sequence of steps and the same limits on checks or adjustments as the Main Procedure.

Main Procedure - The Main Procedure gives more detailed instructions for the calibration of the instrument. This procedure may require that some checks and adjustments be made so that performance is better than that required by the Factory Test Limits. This insures the Factory Test Limits will be met when side panels are added, permits some normal variation in test equipment and plug-in scopes, etc.

Abbreviations in this procedure will be found listed in TEKTRONIX STANDARD A-100. Definitions of terms used in this procedure may be found in TEKTRONIX STANDARD A-101.

In this procedure, all front panel control labels and Tektronix instrument names are in capital letters (VOLT/DIV, etc). Internal adjustment labels are capitalized only (Gain Adj, etc).

## CHANGE INFORMATION:

This procedure has been prepared by Test-Final Staff Engineering. For information on changes made to this procedure, to make suggestions for changing this procedure, or to order additional copies: please contact T-FSE, 39-307.

*This procedure is  
company confidential*

240-250

April 1969  
For all serial  
numbers.



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T-FSE

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## EQUIPMENT REQUIRED

All TEKTRONIX test equipment must be calibrated to Factory Test Limits using methods specified in the applicable TEKTRONIX Factory Calibration Procedure. Other test equipment should be calibrated to its manufacturer's specifications. Exceptions to calibration procedures, which are necessary to improve the measurement capability of some test equipment, e.g. calibrated to  $\pm 0.5\%$  accuracy at some specific setting, are noted on this Equipment Required List.

Equivalent test equipment may be used. A Test-Final Staff Engineer must approve any substitutions.

### a. *TEKTRONIX Instruments*

- 1 TYPE 568 OSCILLOSCOPE
- 1 TYPE 3S5 PROGRAMMABLE SAMPLING UNIT
- 1 TYPE 3T5 PROGRAMMABLE SAMPLING SWEEP
- 1 TYPE 230 DIGITAL UNIT
- 1 TYPE 453 OSCILLOSCOPE
- 1 TYPE 284 PULSE GENERATOR
- 1 TYPE 240 PROGRAM CONTROL UNIT (see notes)
- 2 TYPE R250 AUXILIARY PROGRAM UNIT (see notes)

### b. *Test Fixtures and Accessories*

- 1 MULTIBIT GENERATOR (Special)
- 1 DATA DISC F 0.75 (020-0024-00)
- 1 DISC Address Writer (067-0580-99)
- 1 DISC Sector Generator (067-0579-99)
- 1 DC Voltage Bridge (067-0543-99)
- 1 20,000 $\Omega$ /VOLT Multimeter (067-0045-00)
- 1 Set Power Supply Load Units (Special)
- 1 Register Card Extender
- 1 192 Light Panel (Special)
- 1 TYPE 76TU Line Voltage Control Unit (067-0048-00)
- 1 J111 Input-Output Checker (Special)
- 1 TYPE 240 Only Adapter (013-0095-00)
- 2 Connector Circuit boards (388-0805-00)
- 1 Calibration Test Tape (Special) (See note 3)
- 1 TYPE 230 to TYPE 568 cable (012-0119-00)
- 5 36-pin cables (012-0131-00)
- 1 36-pin cable (012-0131-01)
- 1 TYPE 240 to TYPE R250 cable (012-0134-00)
- 1 TYPE 240 to two TYPE R250 cable (012-0135-00)
- 1 TYPE 240 to DISC MEMORY cable (012-0133-01)
- 1 TYPE 240 to Punched Tape Reader and Tape Punch (012-0146-00)

### c. *Other equipment*

- 1 Remex RR-302 Mode 2 Tape Reader
- 1 Tape Punch
- 1 Tape Punch Line Checker

Note 1 This unit is needed for Calibrating the TYPE R250, the DATA DISC, and the Perforator Drive Unit.

Note 2 This unit is needed for Calibrating the DATA DISC.

Note 3 The master program tape has been prepared by T-FSE; suggestions for modification of tape must be processed through T-FSE.

# FACTORY TEST LIMITS

Factory Test Limits are qualified by the conditions specified in the main body of the Factory Calibration Procedure. The numbers and letters to the left of the limits correspond to the procedure steps where the check or adjustment is made. Steps without Factory Test Limits (setups, presets, etc.) are not listed. Instruments may not meet Factory Test Limits if calibration or checkout methods and test equipment differ substantially from those in this procedure.

## 5. REGULATION AND RIPPLE -240

Ripple: +20V---40mV, max  
+10V---15mV, max  
+3.6V---8mV, max  
-10V--100mV, max

## 44. REGULATION AND RIPPLE -250

Ripple: +20V---40mV, max  
+10V---15mV, max  
+3.6V---8mV, max  
-10V--100mV, max

## 10. SHIFT REGISTER PULSE

- a. Pulse Period 1.66 $\mu$ s min
- b. True Pulse Width 330nsec or <
- c. Tr & Tf 70nsec or <

## 26. POWER SUPPLIES

- a. Adjust +20V,  $\pm$ 1%, max
- b. Adjust +10V,  $\pm$ 1%, max
- c. Adjust -10V,  $\pm$ 1%, max
- d. Adjust +3.7V,  $\pm$ 1%, max

## 29. DELAY

- a.  $\leq$ 25msec to  $\geq$ 250msec

## TYPE 250 SUPPLEMENT

## 43. POWER SUPPLIES -250

- b. Adjust +20V,  $\pm$ 1%, max
- c. Adjust +10V,  $\pm$ 1%, max
- d. Adjust -10V,  $\pm$ 1%, max
- e. Adjust +3.6V,  $\pm$ 1%, max

## PERFORATOR DRIVE UNIT SUPPLEMENT

## 63. PERFORATOR POWER SUPPLIES

- a. Check +3.6  $\pm$ 10%
- b. Check +48V +9V, -5V

## 64. CLOCK PULSE

- a. 4.5mS  $\pm$ .5mS

THE END

## SHORT FORM PROCEDURE

This instrument must meet Factory Test Limits before it leaves Manufacturing; therefore, it must be possible to inspect to these limits. Because of normal variations in test equipment and plug-in scopes, addition of side panels, etc, this procedure may require that some checks and adjustments be made so that performance is better than that required by Factory Test Limits.

### TYPE 240

#### 1. PRESETS

- a. Preset TYPE 240
- b. Preset Regulator Card

#### 2. POWER SUPPLY RESISTANCE

- a. Setup
- b. Check power supply resistance

#### 3. CONTROL BOARD RESISTANCE

Check control board resistance

#### 4. INITIAL POWER SUPPLY ADJUST

- a. Setup
- b. Adjust supplies

#### 5. REGULATION AND RIPPLE

Check ripple: +20V---40mV, max  
+10V---15mV, max  
+3.6V---8mV, max  
-10V--100mV, max

#### 7. J111 INPUTS

- a. Setup
- b. Check sector clock
- c. Check address counter
- d. Check origin
- e. Check ERROR and READY lights

#### 8. LOAD

- a. Setup
- b. Check 48 character load
- c. Check 96 character load
- d. Check 144 character load

#### 9. ADDRESS COINCIDENCE

- a. Setup
- b. Check 1, 2, 4, and 8
- c. Check 10, 20, 40, and 80
- d. Check 100

#### 10. SHIFT PULSE

- a. Setup
- b. Check Shift Pulse
- c. Check Shift

#### 11. EXAMINE MODIFY

Check examine and modify

#### 12. PARITY

- a. Setup
- b. Check Parity

#### 13. J111 OUTPUTS

- a. Check track selector
- b. Check DATA DISC supplies

14. READ TEST FROM DISC
  - a. Setup
  - b. Check NOT READY
  - c. Check READ TEST FROM DISC
15. READ TEST SEQUENCE FROM DISC
  - a. Check SEQUENCE SINGLE STEP
  - b. Check SEQUENCE AUTOMATIC
16. OUTPUT LINES
 

Check output lines
17. WRITE TEST IN REGISTER ON DISC
  - a. Setup
  - b. Check WRITE TEST IN REGISTER ON DISC
18. READ TEST SEQUENCE FROM DISC
  - a. Setup
  - b. Check READ TEST SEQUENCE FROM DISC
19. TRANSFER TAPE SEQUENCE TO DISC
  - a. Check WRITE INTERLOCK
  - b. Check TRANSFER TAPE SEQUENCE TO DISC
  - c. Check STOP
20. TRANSFER TEST ON DISC TO TAPE
  - a. Setup
  - b. Check TRANSFER TEST ON DISC TO TAPE
21. PARITY ERROR
  - a. Setup
  - b. Check parity errors
22. TYPE 240 AND MULTIBIT GEN REGISTERS
  - a. Setup
  - b. Check registers
23. RAW SHIFT REGISTERS
  - a. Check P1 shift registers
  - b. Check P2 - P12 shift registers
24. STANDARD PROGRAM CARDS
  - a. Setup
  - b. Check Standard Program Cards
25. PRESENT ADDRESS CHARACTERS
  - a. Setup
  - b. Check character 3
  - c. Check character 2
  - d. Check character 1
26. POWER SUPPLIES
  - a. Adjust +20V,  $\pm 1\%$ , max
  - b. Adjust +10V,  $\pm 1\%$ , max
  - c. Adjust -10V,  $\pm 1\%$ , max
  - d. Adjust +3.6V,  $\pm 1\%$ , max
27. SINGLE PASS-DOUBLE PASS
  - a. Setup
  - b. Check Single Pass-Double Pass
28. STOP
  - a. Setup
  - b. Check Stop Red
  - c. Check Stop Green
  - d. Check Stop Yellow
29. BRANCHING
  - a. Setup
  - b. Check Branch Red
  - c. Check Branch Yellow

- 30. SEARCH
  - a. Setup
  - b. Check SEARCH
- 31. DELAY
  - a. Setup
  - b. Adjust 100mSec
- 32. HI SPEED PROGRAM
  - a. Setup
  - b. Check Hi Speed
- 33. LOCATE NEXT DISC ADDRESS
  - a. Setup
  - b. Check Locate
- 34. PERFORMANCE CHECK PROGRAM
  - a. Setup
  - b. Check Programs 7001-7013
  - c. Check Programs 7014-7017
  - d. Check Programs 7020-7036
  - e. Check Programs 7039-7055
  - f. Check Programs 7058-7068
  - g. Check Programs 7069-7074
  - h. Check Programs 7075-7104

TYPE 250

- 40. PRESETS
  - a. Preset TYPE 250
  - b. Preset Regulator Card

- 41. POWER SUPPLY RESISTANCE
  - a. Setup
  - b. Check power supply resistance
- 42. LINE VOLTAGE SELECTOR
  - a. Check LO 115V
  - b. Check HI 115V
  - c. Check MED 230V
  - d. Check MED 115V
- 43. POWER SUPPLIES
  - a. Setup
  - b. Adjust +20V  $\pm 1\%$  max
  - c. Adjust +10V  $\pm 1\%$  max
  - d. Adjust -10V  $\pm 1\%$  max
  - e. Adjust +3.6V  $\pm 1\%$  max
  - f. Adjust Current Limit

- 44. REGULATION AND RIPPLE
  - Check Ripple: +20V 40mV
  - +10V 15mV
  - +3.6V 8mV
  - 10V 100mV

- 45. OUTPUT LINES
  - a. Setup
  - b. Check output lines

- 46. DELAY
  - a. Setup
  - b. Check Delay

DATA DISC SUPPLEMENT

- 50. PRESETS
  - a. Setup
  - b. Check Power Supplies

51. SECTOR GENERATOR

- a. Setup
- b. Erase Sectors
- c. Write 200 Sectors
- d. Write 135 Sectors
- e. Check Sectors

52. ADDRESS WRITER

- a. Setup
- b. Clear Register
- c. Write Address 200 Sector
- d. Fill-in Address 200 Sector
- e. Check 200 Sector Addressing
- f. Performance Program 200 Sector
- g. Write address 135 Sector
- h. Fill-In address 135 Sector
- i. Check 135 Sector Addressing
- j. Performance Program 135 Sector

64. CLOCK PULSE 60~ LINE

- a. Setup
- b. Adjust R60 CLOCK

65. CLOCK PULSE 50~ LINE

Repeat Step 64 if a 50~  
Line Source is used

66. PUNCH OPERATION

- a. Setup
- b. Check Buzz Sw
- c. Check Write Program
- d. Check Program Accuracy

THE END

PERFORATOR DRIVE UNIT SUPPLEMENT

60. PRE CHECK

- a. Check for Oil

61. PRESETS

- a. Preset Perforator Drive Unit
- b. Preset TYPE 240

62. POWER SUPPLY RESISTANCE

- a. Check Power Supply Resistance

63. POWER SUPPLY VOLTAGES

- a. Setup
- b. Check +3.6V  $\pm 10\%$
- c. Check +48V +9V, -5V



1. PRESETS*a. Preset TYPE 240*

NEW DATA	0
SOURCE	DIAL
CHARACTER ADDRESS	0001
SEQUENCE	SINGLE STEP
MODE	EXAMINE or MODIFY CHARACTERS IN REGISTER
POWER	off
WRITE INTERLOCK	WRITE
Line Voltage Selector	MED 115V

*b. Preset Regulator Card*

Current Limit	cw
All other	Mid Range

2. POWER SUPPLY RESISTANCE*a. Setup*

Install R13 Regulator Card in TYPE 240. Remove the following wires from the square pin connectors on the TYPE 240 control board: -10V, +10V, two 3.6V wires to the left of pin CC, and the 3.6V wire to the left of pin S.

Remove the four CHARACTER DATA lights.

*b. Check power supply resistance*

Set the VOM to X1k and connect the negative lead to GND. Check resistance:

<u>Supply</u>	<u>Approx resistance</u>
+3.6V wire	1k $\Omega$

Connect VOM to wire removed from square pin to the left of pin S.

+10V wire	160 $\Omega$
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Replace the CHARACTER DATA lamps one at a time and note resistance decreases from 160 $\Omega$  to 140 $\Omega$ , 120 $\Omega$ , 110 $\Omega$ , and 100 $\Omega$ .

2. The VOM common lead may not be the negative lead.

When measuring resistance of +3.6V supply, set VOM to X1 for a few seconds to charge capacitors.

## 2b. (CONT)

<u>Supply</u>	<u>Approx resistance</u>
-10V wire	2k
+20V	1.5k

Connect VOM 9-2-0 wire on lower right corner of read out board (rear view).

+180V	300k (10k scale)
-------	------------------

Connect VOM to right end of 20k resistor above track nixie on readout board.

3. CONTROL BOARD RESISTANCE

Set VOM to X100. Check resistance on square pins.

<u>Supply</u>	<u>Approx resistance</u>
+3.6V	200
+10V	600
-10V	2k $\Omega$

Remove VOM. Reconnect all square pin connectors.

4. INITIAL POWER SUPPLY ADJUST*a. Setup*

Install the three load cards in J3, J6, and J9. Connect alligator clip to 20V test point on Regulator Card. Connect TYPE 240 power card to TYPE 76TU. Set TYPE 76TU to 115VAC.

*b. Adjust supplies*

Turn TYPE 240 POWER to ON. Connect VOM between GND and the appropriate test point on the Regulator Card and adjust as follows:

<u>Test Point</u>	<u>Adjust</u>
+20V	R1120
+10V	R1145
-10V	R1210
+3.7V	R1175

## 4. (CONT)

*c. Adjust Current Limit*

Connect VOM between GND and +3.6V Test Point on Regulator Card. Press and hold button on load card. Adjust R1195 until the +3.6V supply begins to fall. Release button.

*d. Check +180V*

Connect VOM between CSD-18 (rt-TOP-rear of 240) & GND.

5. REGULATION AND RIPPLE

Use test scope to check ripple at test points on Regulator Card with TYPE 76TU set to 104VAC and 126VAC.

<u>Supply</u>	<u>Maximum ripple</u>
+20V	40mV
+10V	15mV
+3.6V	8mV
-10V	100mV

Set TYPE 76TU to 115VAC. Set TYPE 240 POWER off. Remove Load cards.

6. LINE VOLTAGE SELECTOR*a. Check LO 115V*

Connect common lead of VOM to rear of R1136 and + lead to +20V test point on Regulator Card.

Set line voltage selector to LO 115V. Set TYPE 240 POWER to ON and read  $\approx 37V$  on VOM.

Set POWER off.

*b. Check HI 115V*

Set line voltage selector to HI 115V. Set TYPE 240 POWER to ON and read  $\approx 29V$  on VOM.

Set POWER off.

6. R1136 is  $180\Omega$  .25 watt located on the top rear corner of Regulator Card.

6. (CONT)

c. Check MED 230V

Set line voltage selector to MED 230V. Set TYPE 240 POWER to ON and read  $\approx 15V$  on VOM.

Set POWER off.

d. Check MED 115V

Set line voltage selector to MED 115V. Set TYPE 240 POWER to ON and read  $\approx 32V$  on VOM.

Set POWER off.

Remove VOM.

7. J111 INPUTS

a. Setup

Install a set of checked cards in J1 through J12 of TYPE 240. Connect the 240 ONLY adapter to J112. Connect J111 checker to J111. Set POWER to ON.

b. Check sector clock

Connect Test Scope probe to Pin GH of TYPE 240 control board. See Fig. 1.

c. Check address counter

Change probe to pin EP. See Fig 2.

d. Check origin pulse

Change probe to Pin DG. See fig 3. Remove probe.

e. Check ERROR and READY lights

DATA ERROR and DISC ERROR should be on. Press ERROR LIGHT RESET. DATA ERROR and DISC ERROR should go off.

Press START several times and note READY light blinks off.

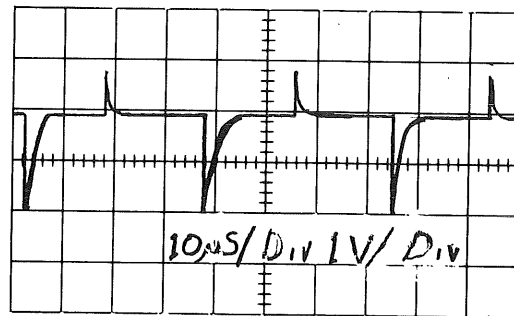


Fig 1

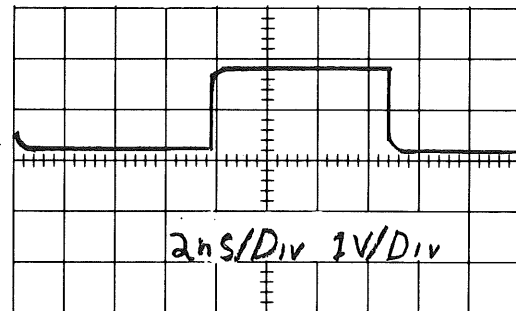


Fig 2

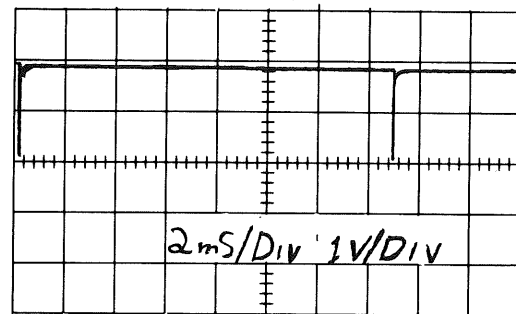


Fig 3

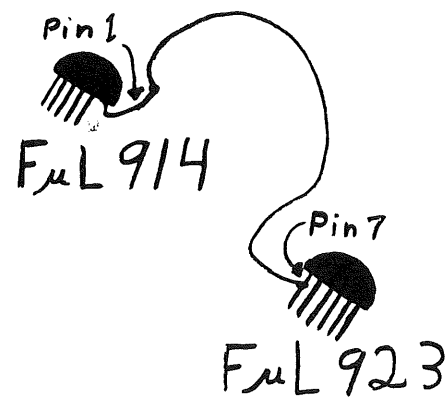


Fig 4

LOAD

a. Setup

Set TYPE 240 POWER off. Remove U773 and U901 and replace with a F<sub>u</sub>L914 and F<sub>u</sub>L923 connected for automatic start. Turn POWER on. See Fig 4.

b. Check 48 character load

Connect probe to pin DH. Check down time of display. See Fig. 5.

c. Check 96 character load

Connect jumpers and check down time of display. See Fig 6.

d. Check 144 character load

Connect jumpers and check down time of display. See Fig 7.

Reconnect Jumpers as in Fig 5. Remove Probe.

9. ADDRESS COINCIDENCE

a. Setup

Trigger TYPE 453 externally on pin GG (ORIGIN). Set TIME/DIV to .1mS. Connect CH 1 probe to pin 6 of U779.

b. Check 1, 2, 4, and 8

Observe address coincidence pulse. See Fig 8. Rotate CHARACTER ADDRESS units dial from 1 to 9 and note pulse shifts out  $\approx 70\mu\text{S}$  per digit. If pulse is not located as in Fig 8 when CHARACTER ADDRESS reads 001, mechanically reset the units dial. Leave dial set to 001.

c. Check 10, 20, 40 and 80

Set TYPE 453 TIME/DIV to 1mS. Rotate CHARACTER ADDRESS tens dial from 0 to 9 and note  $70\mu\text{S}$  pulse shifts out  $\approx .7\text{mS}$  per digit. If pulse is not at start of sweep when tens dial reads 0, mechanically reset dial. Leave dial at 0.

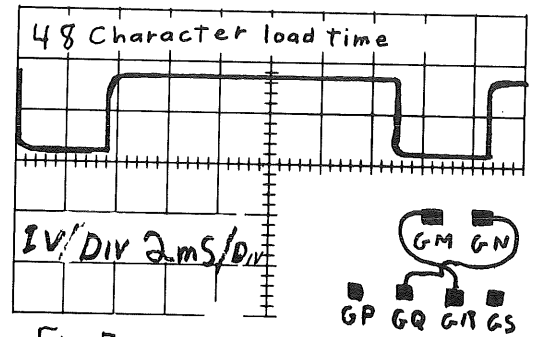


Fig 5

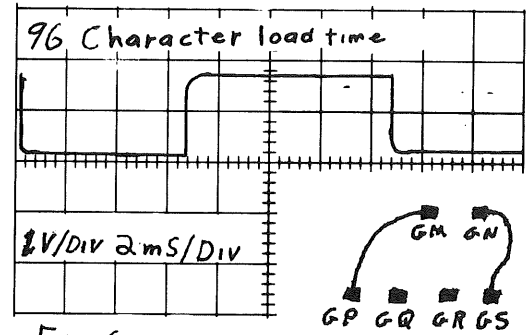


Fig 6

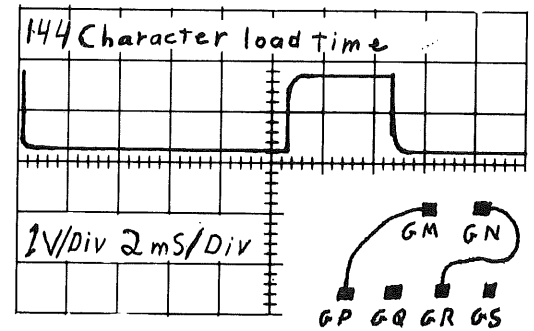


Fig 7

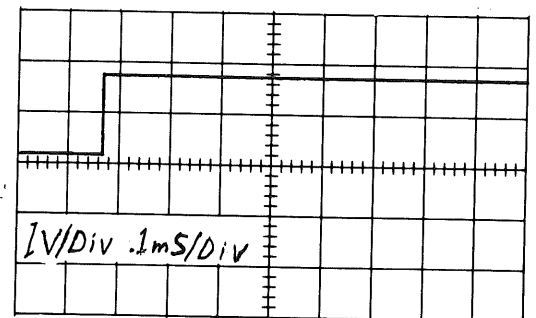


Fig 8

## 9. (CONT)

*d. Check 100*

Rotate CHARACTER ADDRESS 100 dial.  
Note pulse shifts out  $\approx 7\text{mS}$ . Leave  
dial at 0.

Remove Probes.

10. SHIFT PULSE*a. Setup*

Connect TEST SCOPE to TYPE 240 J112  
Pin 23 set TIME/DIV to  $.5\mu\text{Sec}$ .

*b. Check Shift Pulse*

True time 330nSec. Tr-Tf 70nSec  
or less.

*c. Check Shift*

Set TEST SCOPE TIME/DIV to 2mSec.  
Connect TEST SCOPE to TEST POINT  
on TYPE 240 Monitor Board, J1 end.  
Observe Shift Pulses.

10. A 240 only Adapter may be  
modified for this measurement.

11. EXAMINE MODIFY

Set TYPE 240 CHARACTER ADDRESS to  
003. Set NEW DATA to 1 and press  
MODIFY. Note first nixie reads 1  
and only CHARACTER DATA light 1 is  
on.

Set NEW DATA to 2 and press MODIFY.  
Note first nixie reads 2 and only  
CHARACTER DATA light 2 is on.

Set NEW DATA to 4 and press MODIFY.  
Note first nixie reads 4 and only  
CHARACTER DATA light 4 is on.

Set NEW DATA to 8 and press MODIFY.  
Note first nixie reads 8 and only  
CHARACTER DATA light 8 is on.

Set NEW DATA to 0 and press MODIFY.  
Note first nixie reads 0 and all  
CHARACTER DATA lights are off.

PARITY

a. Setup

Connect Test Probe to TYPE 240 Control Board Pin CK.

b. Check parity

Rotate NEW DATA and Press MODIFY for each of the steps of Fig 9.

NEW DATA	Pin CK	NEW DATA	Pin CK
0	F	8	T
1	T	9	F
2	T	10	F
3	F	11	T
4	T	12	F
5	F	13	T
6	F	14	T
7	T	15	F

Fig 9.

13. J111 OUTPUTS

a. Check selector

Rotate DISC TEST ADDRESS track selector dial from 0 to 7 and note only the corresponding lamp on the J111 Checker is on.

b. Check DATA DISC supplies

Rotate the knob on the J111 Checker from OFF through position 18 check meter reading as follows:

- |          |                            |
|----------|----------------------------|
| 1. +3.6V | 9. Address set pulse       |
| 2. +3.6V | Mid scale                  |
| 3. +10V  | 10. Read command--0V       |
| 4. +10V  | (open ckt)                 |
| 5. -10V  | 11. Write command--0V      |
| 6. -10V  | (open ckt)                 |
| 7. +20V  | 12-18. GND--Mid scale (0Ω) |
| 8. +20V  |                            |

Set J111 Checker to OFF.

14. READ TEST FROM DISC

a. Setup

Set TYPE 240 POWER off. Replace U773 and U901. Disconnect J111 Checker cable from J111. Connect J111 ONLY cable to TYPE 240 J111. Connect S1 and S2 of J111 only cable to DATA DISC.

## 14a. (CONT)

Connect the following cables between the corresponding Jack on the TYPE 240 and the Light Panel: J238, J204, J203, J202, J201, J214, J224, and J302.

*b. Check NOT READY*

Turn LIGHT PANEL power on. Depress POWER switch on DATA DISC. Set TYPE 240 POWER to ON. Note POWER switch on DATA DISC is illuminated white and TYPE 240 NOT READY light is on. After ~10 seconds the TYPE 240 NOT light is off and the DATA DISC POWER switch is illuminated green.

*c. Check READ TEST FROM DISC*

Set TYPE 240 MODE to READ TEST FROM DISC. Set DISC TEST ADDRESS to 6001 and press START. The nixies should read 6001 and the READY light is on.

Calibration Test Tape information step 35 of Cal Procedure.

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15. READ TEST SEQUENCE FROM DISC*a. Check SEQUENCE SINGLE STEP*

Set TYPE 240 MODE to READ TEST SEQUENCE FROM DISC. Set SEQUENCE to SINGLE STEP.

Press START and note READY light goes out and note nixies read 6001. Press START again and note nixies read 6002.

*b. Check SEQUENCE AUTOMATIC*

Set SEQUENCE to AUTOMATIC. Press START and note nixies return to 6001 and start sequencing to 6028.



16. OUTPUT LINES

Increase LIGHT PANEL DISPLAY TIME until light sequence can be easily observed. The Light Panel pattern should sequence through row by row and column by column. See note.

16. When reference is made to LIGHT PANEL patterns, ignore the 12 lights in the first 3 characters and all yellow lights.

Row by row: all 1 bit, 2 bit, 4 bit, or 8 bit lights are on.

Column by column: all character 10 & 34, 11 & 35, 12 & 36, etc, lights are on.

17. WRITE TEST IN REGISTER ON DISC*a. Setup*

Set TYPE 240 MODE to READ TEST FROM DISC. Set DISC TEST ADDRESS dials to 6029. Press START and note nixies read 6029. Observe LIGHT PANEL pattern. See Fig 10.

Set MODE to EXAMINE OR MODIFY CHARACTERS IN REGISTER. Set CHARACTER ADDRESS dials to 002. Set NEW DATA to 3 and press MODIFY. Set CHARACTER ADDRESS dials to 003. Set NEW DATA to 2 and press MODIFY.

*b. Check WRITE TEST IN REGISTER ON DISC*

Set TYPE 240 MODE to WRITE TEST IN REGISTER ON DISC and press START. Set MODE to READ TEST FROM DISC. Set DISC TEST ADDRESS dials to 6032 and press START. Fig 10 light pattern should appear on LIGHT PANEL.

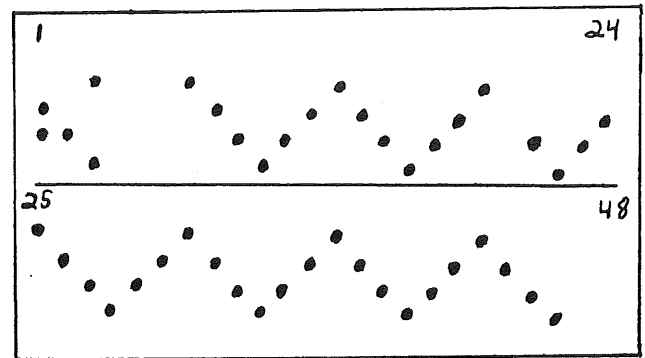


Fig 10 Prog 6029

18. READ TEST SEQUENCE FROM TAPE*a. Setup*

Connect power cords to the REMEX tape reader and tape punch. Set REMEX reader POWER to ON. Set RUN-LOAD switch to LOAD. Load the REMEX reader with the loop of tape with programs 6030-6033.

## 18a. (CONT)

Connect the bifurcated cable from TYPE 240 J114 to REMEX reader and tape punch.

Set REMEX reader LOAD-RUN switch to RUN.

*b. Check READ TEST SEQUENCE FROM TAPE*

Set TYPE 240 MODE to READ TEST SEQUENCE FROM TAPE. Press START. The TYPE 240 should continuously sequence from 6030 to 6033.

*c. Check Stop On Red*

Set LIGHT PANEL Red Limit on. The TYPE 240 should stop on Prog 6033.

*d. Check Stop On Yellow*

Set LIGHT PANEL Red Limit off and Yellow Limit on. Press START. The TYPE 240 should sequence to Prog 6033 and stop.

*e. Check Stop On Green*

Set LIGHT PANEL Yellow Limit off and Green Limit on. Press START. The TYPE 240 should sequence to Prog 6033 and stop. Set Green Limit off.

---

19. TRANSFER TAPE SEQUENCE TO DISC

*a. Check WRITE INTERLOCK*

Set TYPE 240 WRITE INTERLOCK to LOCK. Set MODE to TRANSFER TAPE SEQUENCE TO DISC. The readout panel should indicate the instrument is NOT READY. Press START and note tape does not move.

Set WRITE INTERLOCK to WRITE. Note NOT lamp goes out.

## 19. (CONT)

*b. Check TRANSFER TAPE SEQUENCE  
TO DISC AUTOMATIC*

Press START. Tape should run continuously.

*c. Check STOP*

Press STOP and hold, tape should stop.

*d. Check SINGLE STEP*

Set SEQUENCE to SINGLE STEP Press START. Tape should advance only one program.

Set MODE to READ TEST FROM DISC. Set DISC TEST ADDRESS dials to 6032 and press START. Nixies should read 6032 and the LIGHT PANEL should be as in Fig 11.

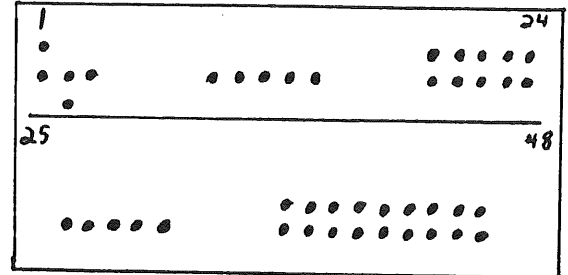


Fig 11 Prog 6032

20. TRANSFER TEST ON DISC TO TAPE*a. Setup*

Set Tape Punch power to ON, Set TYPE 240 DISC TEST ADDRESS dials to 0030. Press TYPE 240 START. Press and hold CONTINUOUS PERFORATE on Tape Punch until ~4 inches of tape has been punched.

*b. Check TRANSFER TEST ON DISC  
TO TAPE*

Set DISC TEST ADDRESS dials to 6030 and press START. Tape should punch one 48 character program.

Set DISC TEST ADDRESS dials to 6031 and press START. Tape should punch one 48 character program.

Repeat for 6032 and 6033.

Set DISC TEST ADDRESS dials to 0000 and press START. Tape should advance 48 characters.

## 20a. (CONT)

Remove tape from Tape Punch and tape loop from REMEX reader. Compare the new tape with the tape loop visually, character by character, for errors.

Set tape punch power OFF.

Set REMEX reader to LOAD.

---

21. PARITY ERROR TEST*a. Setup*

Load REMEX reader with parity check tape. Program number 6. Set LOAD RUN switch to RUN. Set TYPE 240 MODE to READ TEST SEQUENCE FROM TAPE.

*b. Check parity*

Press TYPE 240 START. Note REMEX reader advances only one character and the TYPE 240 reads DATA ERROR. Press ERROR LIGHT RESET. Repeat 15 times to complete the parity check for all 16 possibilities. Check that all LIGHT PANEL lights are out disregarding the first 6 characters.

Turn REMEX reader power off.

Disconnect J114 from TYPE 240.

---

22. TYPE 240 AND MULTIBIT GEN REGISTERS*a. Setup*

Connect the special cable from J231, J237, and J112 of the MULTIBIT GEN to J112, J114, and J205 of the TYPE 240.

Set all limit switches on LIGHT PANEL to OFF. Set TYPE 240 MODE to READ TEST SEQUENCE FROM TAPE. Set MULTIBIT GEN power on.

## 22. (CONT)

*b. Check registers*

Press TYPE 240 START. Nixies should begin reading randomly.

Press light reset button on MULTIBIT GEN P1.

Allow enough time for at least one full off-on cycle of the cycle light on MULTIBIT GEN P12.

After one cycle, if none of the 1, 2, 4, or 8 bit lights on MULTIBIT GEN P1 are on, all the registers are good.

If a light is on, the 8 bit light, for example, U8 in one of the registers is defective. Any of the 12 registers in the TYPE 240 or the MULTIBIT GEN can contain the defective U8. The defective U8 must be found by the trial and error method and replaced.

23. RAW SHIFT REGISTERS*a. Check P1 shift registers*

Remove P1 from TYPE 240 and replace with a raw P1.

Press light reset on MULTIBIT GEN P1. Allow cycle light on MULTIBIT GEN P12 to complete at least one off-on cycle. After one cycle, if none of the 1, 2, 4, and 8 bit lights on MULTIBIT GEN P1 are on, all the P1 registers are good. If a light is on, replace that particular register in the new card.

*b. Check P2 - P12 shift registers*

Repeat step 22a for each card, P2 - P12.

## 24. STANDARD PROGRAM CARDS

### *a. Setup*

Set TYPE 240 MODE to READ TEST SEQUENCE FROM DISC. Set DISC TEST ADDRESS to 6001 and SEQUENCE to SINGLE STEP.

### *b. Check Standard Program Cards*

Press START. Single step the TYPE 240 and LIGHT PANEL through the row by row - column by column check with the START switch. Check each step for the proper light display see step 16 note.

### *c. Check Shift Register Set*

Turn TYPE 240 POWER off. Turn TYPE 240 POWER on. Set TYPE 240 MODE SW to EXAM-MODIFY

Press the START button and observe that 11 lights on LIGHT PANEL are off.

## 25. PRESENT ADDRESS CHARACTERS

### *a. Setup*

Set TYPE 240 DISC TEST ADDRESS to 0001. Set SEQUENCE to AUTOMATIC. Adjust LIGHT PANEL Display Time for  $\approx$ 1sec rate.

### *b. Check character 3*

Press START and observe LIGHT PANEL. Check character 3 counts BCD 0 to 9.

### *c. Check character 2*

Decrease LIGHT PANEL Display Time. Check character 2 counts BCD 0 to 9.

### *d. Check character 1*

Check 1, 2, and 4 bit of character 1 counts BCD 0 thru 7.

Check the 8 bit of character 1 lights when the TYPE 240 NIXIES indicate an address of 100 to 199.

26. POWER SUPPLIES

a. *Adjust +20V +20V,  $\pm 1\%$ , max*

Set DC VOLTAGE BRIDGE to +20V and connect GND and +20V test point on Regulator Card. Adjust R1120 for null.

b. *Adjust +10V +10V,  $\pm 1\%$ , max*

Set DC VOLTAGE BRIDGE to +10V and connect to +10V test point. Adjust R1145 for null.

c. *Adjust -10V -10V  $\pm 1\%$ , max*

Set DC VOLTAGE BRIDGE to -10V and connect to -10V test point. Adjust R1120 for null.

d. *Adjust +3.6V +3.7V,  $\pm 1\%$ , max*

Set DC VOLTAGE BRIDGE to +3.7V and connect to +3.6V test point. Adjust R1175 for null.

d. The +3.6V supply is adjusted to +3.7V to allow for voltage drop between TYPE 240 and DISC.

Remove DC VOLTAGE BRIDGE.

27. SINGLE PASS - DOUBLE PASS

a. *Setup*

Set TYPE 240 DISC TEST ADDRESS to 6034. Press STOP. Press START. Set LIGHT PANEL Red Limit on.

b. *Single pass - Double pass*

The TYPE 240 should sequence in a loop between 6034 and 6037. Adjust LIGHT PANEL Display Time and note the display time light blinks two times for each address 6034 and 6035. Note Light blinks one time for each address 6036 and 6037.

28. STOP*a. Setup*

Set TYPE 240 DISC TEST ADDRESS to 6038. Press STOP. Press START, The TYPE 240 should be sequencing in a loop between 6038 and 6043.

*b. Check Stop Red*

Set LIGHT PANEL Red Limit on. Nixies should stop at 6041. Set Red Limit off. Press TYPE 240 START.

*c. Check Stop Green*

Set LIGHT PANEL Green Limit on. Nixies should stop at 6040. Set Green Limit off. Press TYPE 240 START.

*d. Check Stop Yellow*

Set LIGHT PANEL Yellow Limit on. Nixies should stop at 6039. Set Yellow Limit off. Press TYPE 240 START.

29. BRANCHING*a. Setup*

Set TYPE 240 DISC TEST ADDRESS to 6044. Press STOP. Press START. LIGHT PANEL display should be row by row, 1 bits, 2 bits, 4 bits, and 8 bits. Nixies read 6044, 6045, 6046, and 6048.

*b. Check Branch Red*

Set LIGHT PANEL Red Limit on. LIGHT PANEL display should now be row by row, 8 bits, 4 bits, 2 bits, and 1 bits. Nixies should read 6049, 6050, 6052, and 6053. Set Red Limit off.

*c. Check Branch Yellow*

Set LIGHT PANEL Yellow Limit on. LIGHT PANEL display and nixies should be as in step 29a:

Set Yellow Limit off.



30. SEARCH*a. Setup*

Set TYPE 240 DISC TEST ADDRESS to 6054.

*b. Check SEARCH*

Press TYPE 240 STOP. Press START the readout should be 6054 and SEARCH LIGHT on.

31. DELAY*a. Setup*

Connect the TYPE 240 to the TYPE 230 J201, J202, J203 and J204.

Connect J214 from the TYPE 240 to the TYPE 568 J214.

Connect the J224 cable from the TYPE 240 to the TYPE 568 J224.

Set the TYPE 230 MEASUREMENT MODE to EXT PROG, TRIGGERED MEASUREMENT to ON, and POWER to ON.

Set the TYPE 3S5 mode switch to EXT PROG.

Set the TYPE 3T5 PROGRAM SELECTOR to EXT, TRIGGER MODE to EXT AUTO, and POLARITY to +. Connect cable from TYPE 284 TRIGGER to TYPE 3T5 TRIGGER INPUT.

Set TYPE 284 PERIOD to 10 $\mu$ sec and power switch to ON.

Set test scope to 1V/div, 10mS/div, and TRIGGERING SLOPE and LEVEL to -. A SWEEP MODE to NORMAL TRIG.

Connect Test scope probe to TYPE 240 Delay test point on Regulator Card.

Set TYPE 240 MODE to READ TEST SEQUENCE FROM DISC. SET DISC TEST ADDRESS to 6055.

31. Insure that the 2 connector circuit boards have been placed in TYPE 3S5 and TYPE 3T5.

31. (CONT)

*b. Check delay <25mS to >250mS*

Rotate R1289 on TYPE 240 Regulator card ccw and note True time (down time) of test scope display will decrease to less than 25mSec.

Set test scope to 50mS/DIV. Rotate R1289 cw and note true time of test scope display can be increased to greater than 250mSec.

Set test scope to 20mS. Adjust R1289 to set true time to 100mS.

32. HI SPEED PROGRAM

*a. Setup*

Set TYPE 240 MODE to READ TEST SEQUENCE FROM DISC. Set DISC TEST ADDRESS to 6056.

*b. Check Hi Speed Program*

Press START. Increase TYPE 230 DISPLAY TIME and note TYPE 240 is sequencing between 6056 and 6060. The TYPE 568 display should be a HORIZ MM measurement with sweep length as noted in table:

<u>Program</u>	<u>≈ Sweep Length</u>
6056	2.6div
6057	3.2
6058	4.0
6059	4.8
6060	5.4

33. LOCATE NEXT DISC ADDRESS

*a. Setup*

Set TYPE 240 MODE to READ TEST FROM DISC.

Set TYPE 230 DISPLAY TIME ccw.

33. The TYPE 230 Delay must be set to its nominal value of 2msec.

## 33. (CONT)

*b. Check LOCATE NEXT DISC ADDRESS*

Press START. Nixies should read 6056. Set MODE to LOCATE NEXT DISC ADDRESS and press START. Nixies should read approx 0100.

Set MODE to READ TEST FROM DISC and DISC TEST ADDRESS to 6057. Press START. Nixies should read 6057. Set MODE to LOCATE NEXT DISC ADDRESS and press START. Nixies should read approx 0110.

Repeat for the following programs.

<u>READ TEST FROM DISC</u>	<u>LOCATE NEXT DISC ADDRESS</u>
6058	0120
6059	0130
6060	0140

34. PERFORMANCE TEST PROGRAM*a. Setup*

Connect TYPE 284 PULSE GENERATOR Square Wave output to the TYPE 3S5 A Channel input through a X2 attenuator. Connect TYPE 284 PULSE GENERATOR Trig Out to the TYPE 3T5 External Trig Input.

Set TYPE 3T5 TRIGGER MODE to EXT. AUTO and PROGRAM SELECTOR to EXT.

Set TYPE 3S5 to EXTERNAL PROGRAM.

Set TYPE 230 to EXTERNAL PROGRAM and TRIGGERED MEASUREMENT to ON.

Set TYPE 284 PULSE GENERATOR AMPLITUDE to 1.0V and PERIOD to 10 $\mu$ Sec.

Set DISC TEST ADDRESS DIALS to 7001.  
Set SEQUENCE to AUTOMATIC.

34. Information concerning the performance Test Program may be found under Performance Check number 1 through 6 of section 9 in TYPE 240 MANUAL.

## 34. (CONT)

*b. Check Programs 7001-7013*

Set TYPE 240 MODE to READ TEST SEQUENCE FROM DISC. Press START.

Observe that the TYPE 240 sequences through program 7001-7013 with all Green Limit Lights. Press STOP.

*c. Check Programs 7014-7017*

Remove Signal from TYPE 3S5 A CH and reconnect it to TYPE 3S5 B CH. Set TYPE 240 DISC TEST ADDRESS Dials to 7014. Press START. Observe that the TYPE 240 sequences through programs 7014-7017 with all Green Limit Lights. Press STOP.

*d. Check Programs 7020-7036*

Remove Signal from TYPE 3S5 B CH and reconnect it to TYPE 3S5 A CH. Set TYPE 284 AMPLITUDE to 100mV.

Set TYPE 240 DISC TEST ADDRESS Dials to 7020. Press START. Observe that the TYPE 240 sequences through programs 7020-7036 with all Green Limit Lights. Press STOP.

*e. Check Programs 7039-7055*

Remove Signal from TYPE 3S5 A CH. and reconnect it to TYPE 3S5 B CH. Set TYPE 240 DISC TEST ADDRESS Dials to 7039. Press START. Observe that the TYPE 240 sequences through program 7039 to 7055 with all Green Limit Lights. Press STOP.

*f. Check Programs 7058-7068*

Remove the X2 attenuator from the TYPE 3S5 A CH. Connect the TYPE 284 PULSE GENERATOR to the TYPE 3S5 A CH through a GR tee.

Remove the TYPE 3T5 EXT TRIG input. Connect the GR tee, through a X5 Attenuator to the TYPE 3T5 EXT TRIG input. Set the TYPE 284 to 1.0V. Set TYPE 240 DISC TEST ADDRESS Dials to 7058. Press START. Observe that the TYPE 240 sequences through program 7058 - 7068 with all Green Limit Lights. Press STOP.

## 34. (CONT)

*g. Check Programs 7069-7074*

Set TYPE 284 PULSE GENERATOR PERIOD to 1 $\mu$ Sec. Set TYPE 240 DISC TEST ADDRESS Dials to 7069. Press START. Observe that TYPE 240 sequences through programs 7069 - 7074 with all Green Limit Lights. Press STOP.

*h. Check Programs 7075-7104 Sweep rates*

Remove TYPE 3S5 A CH input signal. Remove TYPE 3T5 EXT TRIG input. Set TYPE 3T5 TRIGGER MODE to INT and free-run the sweep.

Set the TYPE 240 DISC TEST ADDRESS Dials to 7075. Press START. Observe the TYPE 3T5 Readout for all sweep rate combinations beginning with 500mSec, reading all "5" combinations to 500pSec followed by 200mSec read all "2" combinations to 200pSec followed by 100mSec, reading all "1" combinations to 100pSec.

35. CALIBRATION TEST TAPE*a. Tape Information*

Program No. 1 is the 96 Character Performance Test Program 7001 to 7104  
 Program No. 2 is the 144 Character Performance Test Program 7001 to 7104  
 Program No. 3 is the DATA DISC fill-in Program for 200 Sector Addressing  
 Program No. 4 is the DATA DISC fill-in Program for 135 Sector Addressing  
 Program No. 5 is the Test Tape used for Calibration all Track 6 information  
 Program No. 6 is the Parity Error Program covers all 16 possible error combinations  
 Program No. 7 is the QC Test Program with a Track 5 location  
 Program No. 8 is the TYPE 250 Test Program for checking all output lines  
 Program No. 9 is the PERFORATOR Test Program 6070

## TYPE 250 SUPPLEMENT

40. PRESETS

a. *Preset TYPE 250*

POWER---off

b. *Preset Regulator Card*

Current Limit---cw all other  
---mid Range

41. POWER SUPPLY RESISTANCE

a. *Setup*

Install a P13 Regulator Card in  
TYPE 250 J13.

Connect VOM negative lead to GND  
and positive lead to the appro-  
priate test point on the Regulator  
Card.

b. *Check power supply resistance*

Check resistance as follows:

<u>Supply</u>	<u>VOM scale</u>	<u>≈Resistance</u>
+20V	x1K	2K
-10V	x1K	2K
+10V	x10	75Ω
+3.6V	x10	200Ω

42. LINE VOLTAGE SELECTOR

a. *Check LO 115V*

Connect common lead of VOM to rear  
of R1136 and + lead to +20V test  
point on Regulator Card.

Connect TYPE 250 Power Cord to TYPE  
76TU. Set TYPE 76TU to 115VAC.

Set line voltage selector to LO 115V.  
Set TYPE 250 POWER to ON and read  
≈37V on VOM.

Set POWER off.

42. R1136 is 180Ω .25 watt located  
on the top rear corner of Reg-  
ulator Card.

## 42. (CONT)

*b. Check HI 115V*

Set line voltage selector to HI 115V. Set TYPE 250 POWER to ON and read  $\approx 29V$  on VOM.

Set POWER off.

*c. Check MED 230V*

Set line voltage selector to MED 230V. Set TYPE 250 POWER to ON and read  $\approx 15V$  on VOM.

Set POWER off.

*d. Check MED 115V*

Set line voltage selector to MED 115V. Set TYPE 250 POWER to ON and read  $\approx 32V$  on VOM.

Set POWER off.

Remove VOM.

---

43. POWER SUPPLIES*a. Setup*

Install the P6 and P9 load cards. Connect alligator clip to 20V test point on Regulator card. Set switch on P9 load card to 250.

*b. Adjust +20V,  $\pm 1\%$ , max*

Set DC VOLTAGE BRIDGE to +20V and connect GND and +20V test point on Regulator Card. Adjust R1120 for null.

*c. Adjust +10V  $\pm 1\%$ , max*

Set DC VOLTAGE BRIDGE to +10V and connect to +10V test point. Adjust R1145 for null.

## 43. (CONT)

*d. Adjust -10V  $\pm 1\%$ , max*

Set DC VOLTAGE BRIDGE to -10V and connect to -10V test point. Adjust R1120 for null.

*e. Adjust +3.6V  $\pm 1\%$ , max*

Set DC VOLTAGE BRIDGE to +3.6V and connect to +3.6V test point. Adjust R1175 for null.

Remove DC VOLTAGE BRIDGE.

*f. Adjust Current Limit*

Install a P3 load card. Connect VOM between GND and +3.6V Test Point on Regulator Card. Press and hold button on P9 load card. Adjust R1195 until the +3.6V supply begins to fall. Release button.

Remove VOM.

## 44. REGULATION AND RIPPLE

Use test scope to check ripple at test points on Regulator Card with TYPE 76TU set to 104VAC and 126VAC.

<u>Supply</u>	<u>Maximum ripple</u>
+20V	40mV
+10V	15mV
+3.6V	8mV
-10V	100mV

Set TYPE 76TU to 115VAC. Set TYPE 250 POWER off. Remove Load cards.

## 45. OUTPUT LINES

*a. Setup*

TYPE 240: Connect control board for 96 characters as in step 8c. Connect J204 to Light Panel J204. Set MODE to READ TEST SEQUENCE FROM TAPE and SOURCE to SINGLE STEP.

Connect a J112 cable from TYPE 240 J112 to TYPE 250 J112.



## 45a. (CONT)

TYPE 250: Install 12 P6/P7 Cards.  
Connect the following cables:

<u>Light Panel</u>	<u>TYPE 250</u>
J238	J237
J203	J236
J202	J235
J201	J234
J233	J233
J232	J232
J231	J231

Connect REMEX reader to TYPE 240  
with J114 cable.

Load REMEX reader with CAL TEST  
TAPE Program Number 8.

*b. Check output lines*

Sequence Light Panel through  
column by column, row by row check with  
TYPE 240 START button. See step 16.

Remove the 12 P6/P7 Cards.

---

46. DELAY

*a. Setup*

Interchange the TYPE 240 and TYPE  
250 P13 Cards.

*b. Check Delay*

Repeat Step 31.

Interchange the P13 Cards to their  
proper units.

THE END

## DATA DISC SUPPLEMENT

50. PRESETS*a. Setup*

Set TYPE 240 POWER OFF. Connect DATA DISC Power Cord to power receptical.

Connect J111 Cable from the TYPE 240 to the DATA DISC S1 and S2 inputs.

Press DATA DISC Power Button note that the DATA DISC comes up to speed.

*b. Check Power Supplies*

Set TYPE 240 Power ON note that the DATA DISC POWER Button lights White and the TYPE 240 indicates NOT READY.

Approximately 20sec later the DATA DISC Power Button should light Green and the TYPE 240 indicates READY.

Connect a VOM from GND to DATA DISC S22 Pin -5 check for  $\pm 20V$ .

Connect VOM to DATA DISC S22 Pin -4 check for +10V.

Connect VOM to DATA DISC S22 Pin -1 check for -10V.

Connect VOM to DATA DISC S22 Pin -21 check for +3.6V

50. The MINUS (-) Pins are the Lower set of Pins on all card cage connectors and Pins are numbered right to left as viewed from the back of DATA DISC.

51. SECTOR GENERATOR*a. Setup*

Set TYPE 240 Power off.

Disconnect the J111 S2 end from the DATA DISC and connect it to the J111 input of the DISC SECTOR GENERATOR.

Connect the DISC SECTOR GENERATOR to the DATA DISC S2 Input.

## 51a. (CONT)

Connect the DISC SECTOR GENERATOR Pigtail Jack to DATA DISC S19 Pins -16, -17, and -18 with the Shield wire in Pin -18.

Connect the GND wire to S22 Pin -15.

Set the DISC SECTOR GENERATOR SECTOR sw to 135.

Set TYPE 240 POWER ON.

Connect Test Scope to DATA DISC S22 Pin -13 and check for 6mHz square wave Pulses. Remove Test Scope.

*b. Erase Sectors*

Press the ERASE Button.

Set SECTOR sw to 200. Press the ERASE Button.

*c. Write 200 Sectors*

Press the DISC SECTOR GENERATOR WRITE Button.

*d. Write 135 Sectors*

Set SECTORS to 135 and Press DISC SECTOR GENERATOR WRITE Button.

*e. Check Sectors*

Disconnect the GND from S22 and the Pigtail Jack from S19.

Connect TEST SCOPE to Pin GH of TYPE 240.

Check for Pulse as in Fig 12.

Remove TEST SCOPE. Set TYPE 240 POWER OFF. Remove DISC SECTOR GENERATOR from DATA DISC. Reconnect S2 to DATA DISC.

c. For a 200 Sector DISC ONLY.

d. For a 135 Sector DISC ONLY.

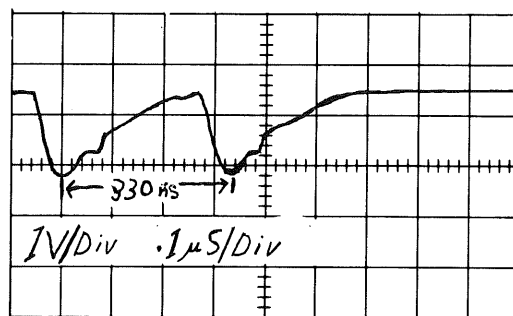


Fig 12

52. ADDRESS WRITER*a. Setup*

Remove P1 and P2 from the TYPE 240 and install the ADDRESS WRITER.

Connect the 9-7 wire to Pin GK and the 9-8 wire to Pin DG of TYPE 240 Control Bd.

Set ADDRESS WRITER TRACK Selector Toggle switches DOWN.

For a 200 Sector DISC, connect TYPE 240 to 1 TYPE 250 with a J112 cable and set TYPE 240 control board for 96 characters (see STEP 8c).

For a 135 Sector DISC connect TYPE 240 to 2 TYPE 250's with a 3 ended J112 cable and set TYPE 240 Control Board for 144 characters (see STEP 8d).

Set TYPE 240 MODE sw to EXAMINE MODIFY SEQUENCE switch to AUTOMATIC.

Set TYPE 240 POWER ON.

Set TYPE 250(s) POWER ON.

*b. Clear Register*

Press ADDRESS WRITER START Button.

Check that TYPE 240 NIXIE Lights sequence to 199.

*c. Write Addresses 200 Sector DISC*

Set TYPE 240 MODE switch to WRITE TEST IN REGISTER ON DISC.

Press ADDRESS WRITER START Button.

Note that the TYPE 240 sequences through 199 and cycle is ended with a READY Light.

c. Do steps c, d, e and f for 200 Sector DISC. Do steps g, h, i and j for 135 Sector DISC.

52c. (CONT)

Set ADDRESS TRACK Selector Toggle switch 1 to UP.

Press ADDRESS WRITER START Button note that the TYPE 240 sequences for Track 1.

Repeat for all 8 Tracks.

Remove the ADDRESS WRITER and replace P1 and P2.

*d. Fill-in Addressing 200 Sector DISC*

Connect the REMEX reader to the TYPE 240 with the bifurcated cable J114.

Load REMEX reader with CAL TEST TAPE Program number 3.

Set reader to RUN.

Set TYPE 240 MODE switch to TRANSFER TAPE SEQUENCE TO DISC.

Press TYPE 240 START Button. (Cross-over Addresses from Track to track will be written).

Remove REMEX reader.

*e. Check 200 Sector Addressing*

Set TYPE 240 MODE switch to READ TEST SEQUENCE FROM DISC. Set DISC TEST ADDRESS DIALS to 0000.

Set TYPE 230 DISPLAY TIME for an approximately 1sec blink of READY Light.

Press TYPE 240 START Button.

Check that the TYPE 240 NIXIES indicate all programs from 0000 to 7199.

52e. (CONT)

Readjust TYPE 230 DISPLAY TIME to Operator preference after the first 10 programs of each TRACK.

*f. Performance Test Program 200  
Sector DISC*

Load REMEX reader with CAL TEST TAPE Program No. 1. Set reader to Run.

Set TYPE 240 MODE sw to TRANSFER TAPE SEQUENCE TO DISC Press START.

Repeat Step 34.

*g. Write Addresses 135 Sector DISC*

Set TYPE 240 MODE sw to WRITE TEST IN REGISTER ON DISC.

Press ADDRESS WRITER START Button.

Note that the TYPE 240 Sequences through 136, the SEARCH Light then comes on. The cycle is complete when the NIXIES read 0000.

Set ADDRESS TRACK Selector Toggle switch 1 to up.

Set TYPE 240 Sequence switch to SINGLE STEP and back to AUTOMATIC. This will clear the SEARCH Light and Reset the READY Light.

Press ADDRESS WRITER START Button  
Note that the TYPE 240 sequences for TRACK 1.

Repeat for all 8 TRACKS.

Remove the ADDRESS WRITER and replace P1 and P2.

## 52. (CONT)

*h. Fill-in Addressing 135 Sector  
DISC*

Connect the REMEX reader to the  
TYPE 240 with the bifurcated cable  
J114.

Load REMEX reader with CAL TEST  
TAPE Program number 4.

Set reader to RUN.

Set TYPE 240 MODE switch to TRANS-  
FER TAPE SEQUENCE TO DISC.

Press TYPE 240 START Button. (Cross-  
over Addresses from Track to Track  
will be written).

There is no address zero in  
any Track on a 135 Sector DISC.

Remove REMEX reader.

*i. Check 135 Sector Addressing*

Set TYPE 240 MODE switch to READ  
TEST SEQUENCE FROM DISC. Set  
DISC TEST ADDRESS DIALS to 0001.

Set TYPE 230 DISPLAY TIME for an  
approx 1sec blink of READY light.

Press TYPE 240 START Button.

Check that the TYPE 240 NIXIES  
indicate all programs from 0001  
to 7135.

Readjust TYPE 230 DISPLAY TIME to  
Operator preference after the first  
10 programs of each TRACK.

*j. Performance Test Program  
135 Sector DISC*

Load REMEX reader with CAL TEST  
TAPE Program No. 2. Set reader  
to Run.

Set TYPE 240 MODE switch to TRANSFER  
TAPE SEQUENCE TO DISC. Press START.

Repeat Step 34.

THE END

## PERFORATOR DRIVE UNIT SUPPLEMENT

60. PRECHECK

Check the TALLY punch oil reservoir filled to the MAX line.

61. PRESETS

*a. Preset Perforator Drive Unit*

POWER OFF  
CLOCK Width R60 MID-RANGE

*b. Preset TYPE 240*

POWER ON  
MODE Sw READ TEST FROM DISC  
DISC TEST ADDRESS Dials 6070

This test may be found on the CAL TEST Tape Program No. 9. Refer to Step 19 for transfer of program to DISC.

62. POWER SUPPLY RESISTANCE

*a. Check Power Supply Resistance*

Set VOM to x1K Scale. Connect the Negative Lead to Perforator P2 card. COIL GND TP and the Positive Lead to the P2 Card +3.6V TP note approx Resistance of 2k $\Omega$ .

Reverse the VOM leads note approx Resistance of 1.4k $\Omega$ .

Connect the VOM Negative lead to the +48V Point (Right end of R175 1k $\Omega$  below Q74) note approx resistance of 600 $\Omega$ .

Reverse the VOM leads note approx resistance of 600 $\Omega$ . Remove VOM.

63. POWER SUPPLY VOLTAGES

*a. Setup*

Connect Power Cord to TYPE 76TU unit set to 117VAC. Set Perforator Power ON.



## 63a. (CONT)

Connect TEST SCOPE to +3.6V TP  
and GND to P2 Coil GND TP.

*b. Check +3.6V  $\pm 10\%$*

Check for +3.6V  $\pm 10\%$  with Line  
Voltage varied from 104V to 126V.

*c. Check +48V*

Connect TEST SCOPE to +48V TP.  
Check +48V; +9V, -5V with line  
voltage varied from 104V to 126V.

Set TYPE 76TU to 117VAC.

---

 64. CLOCK PULSE 60 $\sim$  LINE

*a. Setup*

Connect TEST SCOPE CH 1 Probe to  
Perforator CLOCK TP.

Set TEST SCOPE TIME/DIV to .5mS/DIV.

*b. Adjust R60 CLOCK*

Set CLOCK with R60 for a reading of  
4.5mS  $\pm 0.5$ mS.

Rotate the TYPE 76TU from 104V to  
126V and check that CLOCK remains  
within 4.5mS  $\pm 0.5$ mS. Return TYPE  
76TU to 117VAC.

Check that CLOCK amplitude is approx  
1.5VAC.

---

 65. CLOCK PULSE 50  $\sim$  LINE

Repeat Step 64 with power cord  
connected to a 50  $\sim$  source.

This step should be done when unit  
is to be used with a 50  $\sim$  line source.

66. PUNCH OPERATION*a. Setup*

Set Perforator POWER OFF Feed plank tape into Punch head. Connect cable from TYPE 240 J114 to the Tape Punch Line Checker.

Connect Tape Punch Line Checker to Perforator Drive Unit J114 input.

Set Tape Punch Line Checker Sw's to normal.

Set Perforator POWER ON.

*b. Check Buzz Switch*

Press Perforator Buzz Switch note that the Perforator punches a series of clock pulses in the tape. Release switch.

The Buzz Switch is located on Front Panel next to the Power Switch. Neither switch is identified.

*c. Check Write Program*

Set TYPE 240 MODE switch to TRANSFER TEST ON DISC TO TAPE.

Press TYPE 240 START note that the Perforator punches one 48 character program.

Set Tape Punch Line Checker Switches to LINE SHIFT. Press TYPE 240 START note that the Perforator punches one 48 character program.

Press Buzz Switch to obtain  $\approx 4$ in. of leader.

*d. Check Program Accuracy*

Cut the 2 programs from perforator.

Compare the new tape to the Cal Test Tape Program No. 9 visually character by character for errors.

Turn off Perforator POWER. Remove cables and cords.

THE END

## TYPE 240 TROUBLE SHOOTING PROCEDURE

The following section of the TYPE 240 Calibration Procedure is intended to help the calibrator trouble shoot the instrument. The step numbers in this section corresponds directly to the CAL procedure giving the calibrator immediate cross reference when ever a problem occurs. Only steps which are extremely difficult will be covered in this section and assumes that all preceeding steps are correct.

8. LOAD*a. Load remains false (High)*

Check for Cycle at Pin 7 of U866.  
Check for Begin at Pin 7 of U924.  
Check for Load Clock at Pin DP.  
Check for Pin 7 of U865 to be in the true state (Down). (In EXAM-MODIFY Pin 7 should always be down).

*b. Load goes True and Remains*

Check Pin 7 of U866 for true state.  
Check for output pulses at Pin GM & GN. Check for sector pulses at Pin CM. Check Pin CL for true state. Check Pin GE for false state. Check for pulses at Pin 2 of U891. (Failure of any part of the character counter disables the circuit).

9. ADDRESS COINCIDENCE*a. Always False*

Check Pin 5 of 779 for a pulse  
Rotate CHARACTER ADDRESS Dials to obtain pulse.

*b. Pulse present but not movable*

Check Pin AR for Address Set pulse.

## 9. (CONT)

- c. Pulse present at 200th sector--  
not movable*

Check Pin EA for a 5 $\mu$ S pulse. Check SOURCE switch is in DIAL. Check Pin EJ-EQ for true condition with CHARACTER ADDRESS Dials set to their respective numbers.

- d. More than one Coincidence pulse*

A bad Transistor or IC in Register Circuitry.

---

11. EXAMINE-MODIFY

- a. Characters light but no NIXIE'S*

Check 1's, 2's, 4's and 8's. Check Pin DN for Displayed Add Enable. Check NIXIE circuitry.

- b. Character DATA Lights indicate  
only character 1 information*

Check for Shift at TP on Mother Board.

- c. Nixies operate but none of the  
CHARACTER DATA Lights*

Check Pin CC for Examine Set pulse. Check for +10V on Data Light bulbs. Check individual character light components.

---

13. J111 CHECK

- a. Partial or no operation*

Check TRACK selector circuitry for errors. Continuity test any lines back from J111 which failed to operate properly.

14. READ TEST FROM DISC

a. *Partial or no operation*

Replace the AUTO START as in Step 8 of Cal procedure. Check Read Command at Pin CL. Check Load circuitry and U802 inputs if Pin CL is always false. Set TYPE 240 DISC TEST ADDRESS Dials to read 1001. Check for a burst of 3mHz pulses at Pin E. Compare Pin AB to Pin E for a  $\div 5$  pulse. Remove Probe from Pin AB and connect it to Pin D. Check for wave forms Fig. 1. Remove Probe from Pin E and connect it to Pin BS.

Check for waveform at Pin BS which is the compliment of Pin D and delayed by one 3mHz clock pulse. Remove Probe from Pin D and connect it to Pin BT. Check for waveform at Pin BT which is the same as Pin BS but delayed by one 3mHz clock. Remove probe from Pin BS and connect it to Pin BN.

Check for waveform at Pin BM which is the same as Pin BT but delayed by one 3mHz clock. Remove Probe from Pin BT and connect it to Pin B0.

Check for waveform at Pin B0 which is the same as Pin BM but delayed by one 3mHz clock. Connect TEST SCOPE Channel 1 Probe to Pin D. Connect Channel 2 Probe to Pin AA. Observe that both pulse strings coincide in time.

If any problems occur from this point, accurately adjust the power supplies. Remove Auto Start after the problem has been solved.

Test scope setup. Set A Trigger slope to minus. SOURCE to EXT Trigger. Connect X1 probe from EXT Trigger input to the TYPE 240 Address coincidence pulse connect TEST SCOPE Channel 1 to TYPE 240 Pin E. Set TEST SCOPE TIME/DIV to 50 S/DIV. Set HORIZ DISPLAY to A INTENS DURING B. Set DELAY TIME MULT to intensify the start of the signal burst. Set HORIZONTAL DISPLAY to B DELAY Sweep. Connect Channel 2 probe to TYPE 240 Pin AB. Set Vertical MODE Switch to ALTERNATE.

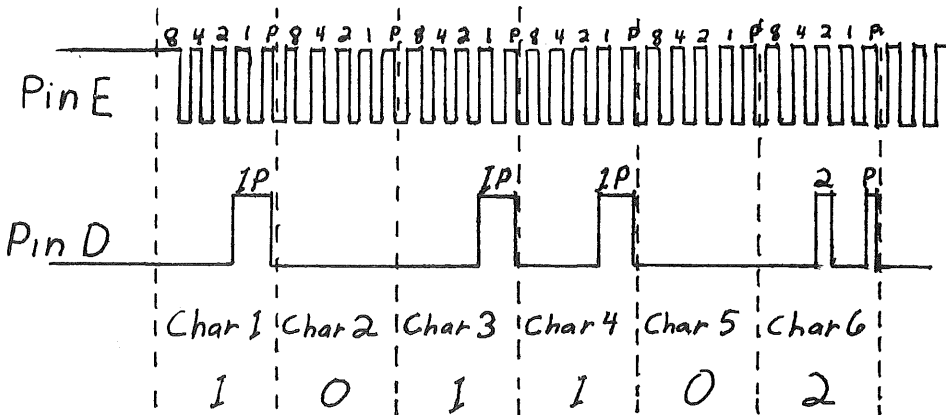


Fig 1

## 15. READ TEST SEQUENCE FROM DISC

### *a. Sequence Single Step*

Externally trigger the Test Scope on address coincidence.

Connect CH 1 probe to Pin EC. Press START Button and note there is no change. Press START Button a second time. The Test Scope should indicate a True condition of approx  $5\mu\text{S}$ . Connect Test scope CH 1 probe to Pin DQ and repeat step 15a.

### *b. Sequence Automatic*

Check for true pulse of approx  $5\mu\text{S}$  with rep rate governed by TYPE 230 DISPLAY TIME. Connect probe CH 1 to Pin BJ and check for  $5\mu\text{S}$  pulse. If pulse is not present at Pin 13J, trace print command circuit from TYPE 230.

## 16. OUTPUT LINES

### *a. No Light patterns after Char 6*

Check Pin AP for a false condition. If Pin AP is true, check U712 for proper input and outputs.

Check that the TYPE 240 NOT light is OFF.

### *b. Light patterns alternate by Character; 2 on and 2 off*

Check Pin 27 and 23 of P13.

### *c. Light patterns correct except for groups of 4 characters*

Check for proper enable pulses to Card not operating.

17. WRITE TEST IN REGISTER ON DISC*a. No operation*

Check for write command out Pin GE  
 This pulse will be a true condition  
 whose width is the same as Load.  
 Check for Write on Pin 2 of U802.  
 Check for Shift at Pin GC.

*b. Writes improper information*

Connect the Auto Start circuit Mode  
 switch to READ TEST FROM DISC. Set-  
 up Test scope as in step 14 notes.  
 Connect Channel 1 probe to Pin D and  
 Channel 2 probe to Pin AA. Check that  
 the two pulses coincide. Trouble  
 shoot the parallel to serial con-  
 verter and check for proper insertion  
 of the parity pulse.

18. READ TEST SEQUENCE FROM TAPE*a. Does not start the REMEX reader*

Check Pin BH for Read Command true.

*b. Reader advances but not full program*

Check for DATA ERROR light. Check  
 Repeat at Pin CS is true when this  
 condition occurs, set the TYPE 240  
 back to READY.

Set the tape manually under the  
 photo cells to the character where  
 the problem occurs. Visually read  
 the holes to determine what bits  
 should be energized.

*c. Connect Test Scope to Pins BN,  
BL, BW, BU, BP*

Check for False conditions on bits  
 represented by Step b.

If step C is incorrect, use the same  
 process at Pin P, S, U, B, C and check  
 for true condition on bits represented  
 by the first part of this step.

Remember that the number of false  
 conditions for any character must  
 always be even.

## 18. (CONT)

- d. *Reader runs continuously  
but does not call up a program*

Check Pin BR for Tape read clocks.

- e. *The TYPE 240 calls up programs  
but will not stop on Red, Green  
or Yellow*

Check Pin DR for End pulse. If  
an End pulse is present check  
operation of U745 and 744.

- f. *The TYPE 240 stops on one or  
two of the three possibilities*

Check the P12 card for source of  
the problem.

19. TRANSFER TAPE SEQUENCE TO DISC

- a. *Check Ready condition of Pin  
AO true AQ false and EB true*
- b. *Check Ready condition of Pin  
BG to be true when SOURCE is  
in SINGLE STEP and false when  
SOURCE is in AUTOMATIC*
- c. *Check that Pin DF is GND*
- d. *Check with SOURCE to AUTO*

Connect CH 1 probe to Pin AQ.  
Press START. Pin AQ should alternate  
from a false level, to a true level,  
to a false for each tape Program.

Connect CH 1 probe to Pin EB. Press  
START. Pin EB should alternate from  
a true level, to a false level, to a  
true for each tape program.

If alternate does not occur check for  
false at Pin 1 of U805; also check for  
proper operation of U803.



20. TRANSFER TEST ON DISC TO TAPE

a. *Tape punch does not start*

Check Pin AN for a false level.  
 Check Pin BA for a true level.  
 Set DISC TEST ADDRESS Dials to 6030. Press START. If the NIXIE'S now read 6030, the DISC has properly called the program and the problem is in the second portion dealing with the tape punch. Set Test Scope to Pin DH T/DIV to .1mS; NORM TRIG, SLOPE to - with TYPE 240 MODE switch in TRANSFER TEST ON DISC TO TAPE position. Press START. Observe Fig. 2 waveform. If Fig. 2 is correct check Pin O for a true condition.

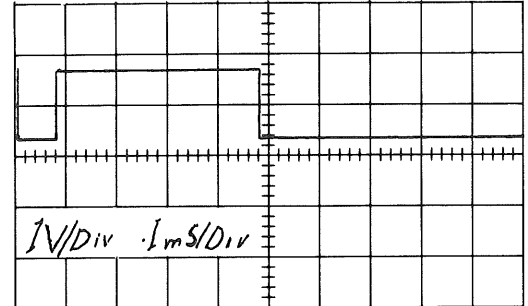


Fig 2

b. *Tape punch starts and runs continuously*

Check for Write Clocks at Pin F.  
 Check Pin GD for Write Shift pulses.

27. SINGLE PASS - DOUBLE PASS

- a. *Check Q314 P12 for true on collector when Single Pass is programmed*
- b. *Check SINGLE PASS logic circuitry*

28. STOP

- a. *Check for true condition on Collector of Q328 Stop on Red*
- b. *Check for true condition on Collector of Q322 Stop on Yellow*
- c. *Check for true condition on Collector of Q324 Stop on Green*
- d. *Check the Stop gating circuitry*

29. BRANCHING

- a. *Check for true condition on Collector of Q312 and 318*
- b. *Check Branching logic circuitry*
- c. *Check for Branch pulse on Q21 upper of P2 card*

31. DELAY

- a. *Set TYPE 230 TRIG MEASUREMENT to OFF*
- b. *Check for MINUS TRIG pulse at Pin 15 of P13*
- c. *Check for MINUS TRIG pulse at Pin DE*
- d. *Check DELAY TP on P13*
- e. *Check the delay circuit*

32. HI SPEED PROGRAM

- a. *Check Pin 24 P12 for a true condition*

THE END