

## SECTION 16

### HORIZONTAL DEFLECTION MODULE

#### TABLE OF CONTENTS

Section	Page
16.1 Technical Description .....	16-1
16.2 Servicing and Alignment .....	16-1
16.3 Component Layout and Schematics .....	16-2
16.4 Parts List .....	16-9
16.5 Specifications .....	16-13

#### LIST OF ILLUSTRATIONS

Figure	Page
16-1 Horizontal Deflection Module Alignment .....	16-2
16-2 Horizontal Deflection Module Component Layout .....	16-4
16-3 Horizontal Deflection Module Schematic (Sheet 1 of 2) .....	16-5
16-4 Horizontal Deflection Module Schematic (Sheet 2 of 2) .....	16-7

#### LIST OF TABLES

No tables are included in this section.

## 16.1 TECHNICAL DESCRIPTION

### 16.1.1 General Description

The Horizontal Deflection module splits the incoming composite sync video signal into horizontal and vertical components. The vertical sync pulse is fed to the Vertical Deflection & Horizontal Regulation module. The horizontal sync pulse is used by the auto-frequency lock, bandswitch and horizontal processor circuitry to form a horizontal drive pulse. This pulse, H DRIVE, is fed to the Power Deflection modules.

The Horizontal Deflection module also produces a regenerated sync pulse which is used by the MOVE key on the keypads to shift the projected image up, down, left and right.

## 16.2 SERVICING AND ALIGNMENT

### 16.2.1 Disassembly and Access

**WARNING**

**STATIC SENSITIVE COMPONENTS  
STATIC CONTROLLED WORK STATION REQUIRED**

#### Tools & Equipment Required:

- Phillips screw driver

a) Remove the back panel as described in Section 5.2.

b) Locate the Horizontal Deflection Module in the rear panel card rack. Using the printed circuit board extractor (from the tool pouch), pull the module from the card rack as described in Section 5.2.

### 16.2.2 Alignment

#### Module Location:

- rear panel card rack

#### Tools & Equipment Required:

- printed circuit board extractor
- extender board, Electrohome Part # 03-230330-01P
- digital voltmeter
- dual channel oscilloscope
- video source

### STEP 1 – Remove Horizontal Deflection

a) Hook the printed circuit board extractor into the hole in the outside corner of the Horizontal Deflection module. Pull the module out of its slot.

b) Insert the extender board into the Horizontal Deflection module slot. Connect the Horizontal Deflection module to the extender board.

### STEP 2 – Regulation Adjust

a) Connect the digital voltmeter between ground and test point P7. Adjust R93 to produce a reading of  $12.4 \pm 0.15$  VDC.

### STEP 3 – Move Circuitry Temperature Compensation

a) Remove jumper P8. Connect the digital voltmeter between test point TP11 (or the cathode pin of IC25) and ground. Adjust R139 to produce a reading of 8.25 VDC. Replace jumper P8.

### STEP 4 – Move Circuitry Alignment

a) Connect channel 1 of the oscilloscope to pin 10 of IC1. Connect channel 2 of the oscilloscope to test point TP10 or pin 6 of IC7. Adjust R130 until the falling edges of both waveforms are  $1.4 \mu\text{s}$  apart.

### STEP 5 – Autolock Alignment (High Band)

Note: If the high band lock-in range is functional, ignore this step and proceed to Step 6.

a) Connect the voltmeter between test point P6 and ground.

b) Apply a 24 KHz signal to the projector. Adjust R87 until the image is locked in. Observe the voltmeter reading. *24.5242 (MHz) -6.55 Volts*

c) Adjust R87 until the voltmeter reading drops by 0.2 to 0.3 VDC. *←*

d) Apply a 54 KHz signal to the projector. *Dec VR 54 KHz*

e) Adjust R67 to lock in the image. Observe the voltmeter reading.

f) Adjust R67 until the voltmeter reading drops by 0.2 to 0.3 VDC. *-0.53*

**NOTE: R87 and R67 are interactive controls. It may be necessary to switch between the above frequencies and adjust the controls accordingly until autolock is achieved.**

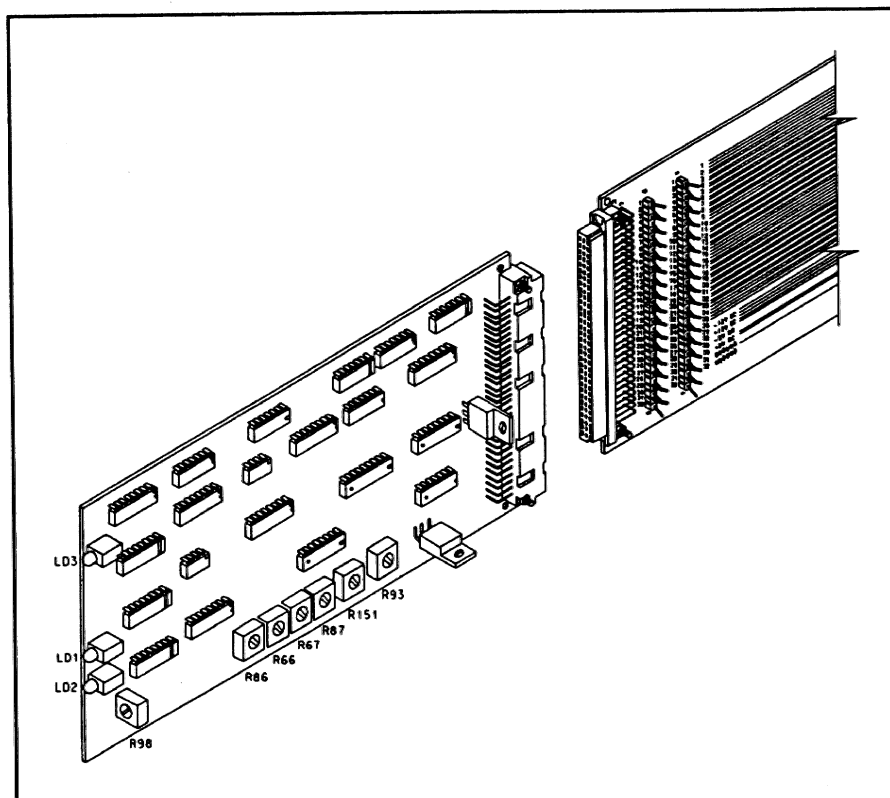


FIGURE 16-1. Horizontal Deflection Module Alignment

#### STEP 6 – Autolock Alignment (Low Band)

NOTE: If the low band lock-in range is functional, ignore this section and proceed to the reference voltage adjust section.

a) Connect the voltmeter between test point P6 and ground.

b) Apply a 15.72 KHz signal to the projector.

c) Adjust R86 to lock in the image. Observe the voltmeter reading.

d) Adjust R66 until the voltmeter reading drops by 0.2 to 0.3 VDC.

e) Apply a 35 KHz signal to the projector.

f) Adjust R66 to lock in the image. Observe the voltmeter reading.

g) Adjust R66 until the voltmeter reading drops by 0.2 to 0.3 VDC.

NOTE: R66 and R86 are interactive controls. Repeat the above steps several times until autolock is achieved at both frequencies.

#### STEP 7 – Reference Voltage Adjust

a) Remove the short between test points P3 and P4 on the Horizontal Deflection module. See Figure 6-29.

b) Apply a 27 KHz signal to the projector.

c) Adjust R98 until the green (LD1) and red (LD2) LEDs are lit and at equal brightness.

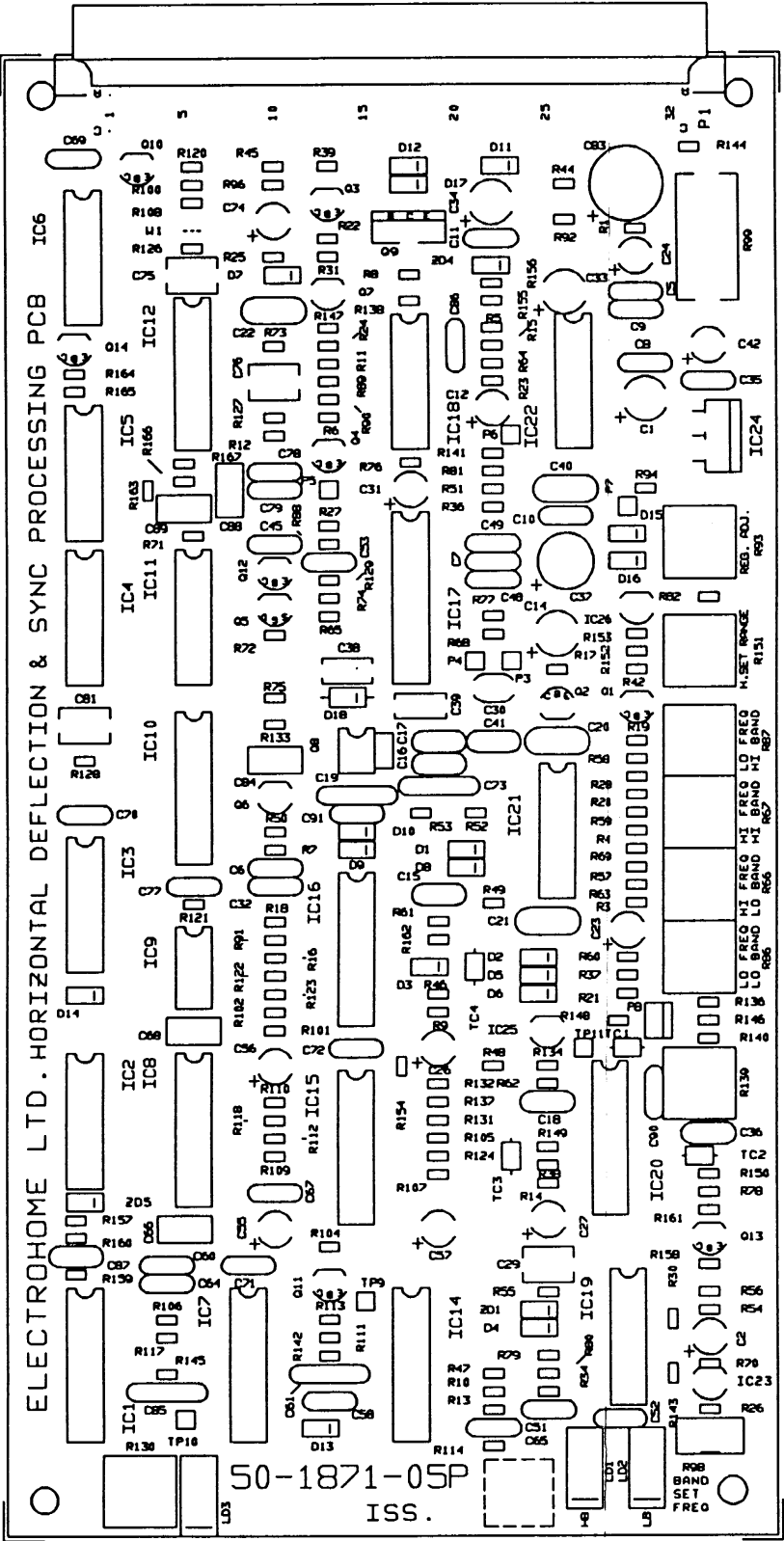
NOTE: If the projector is to be used with a 27 KHz computer source, it may be necessary to offset the R98 adjustment.

d) Replace the short between test points P3 and P4.

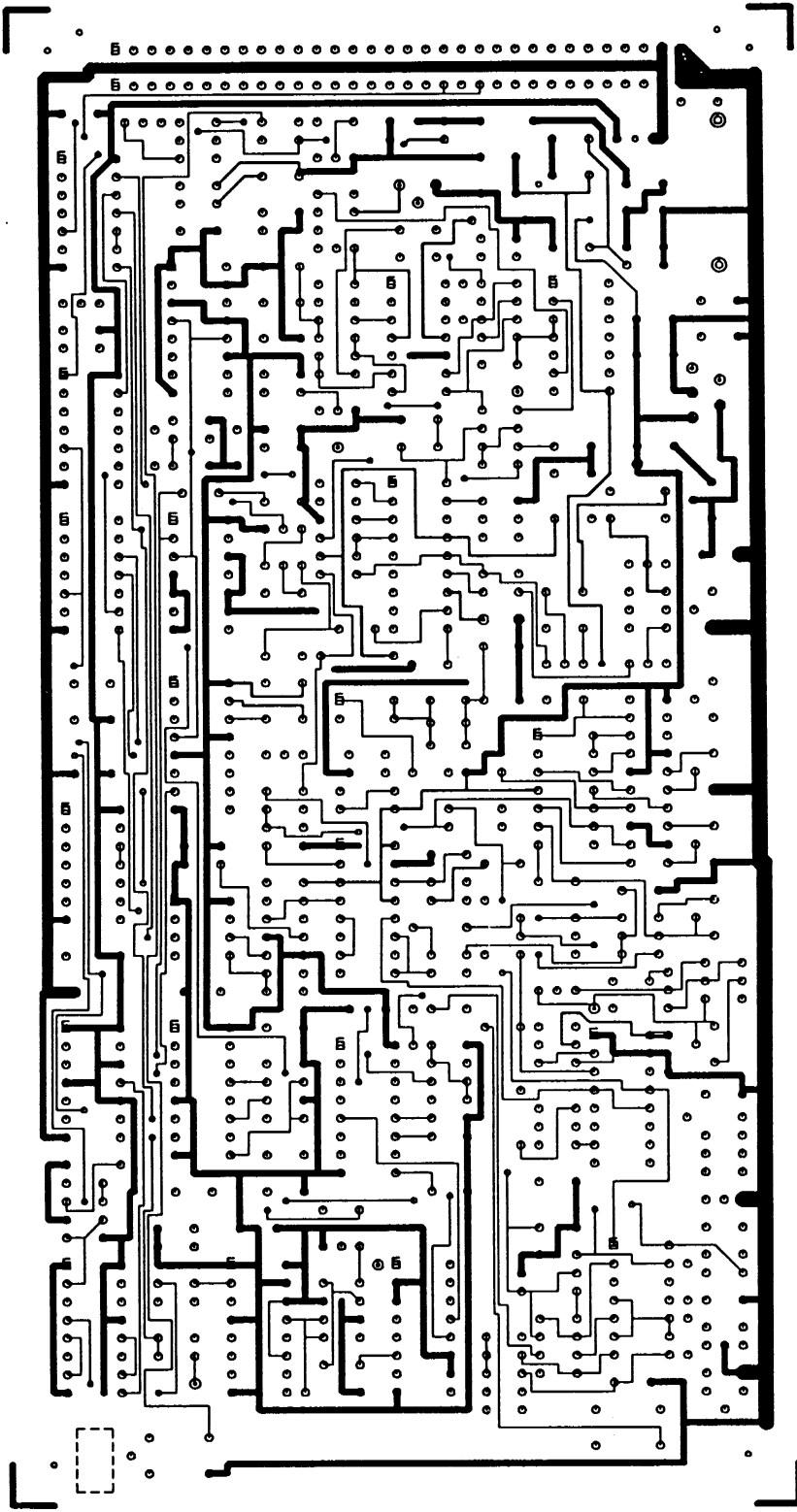
#### 16.3 COMPONENT LAYOUT AND SCHEMATICS

Refer to the following pages for component layouts and schematics of the Horizontal Deflection module.

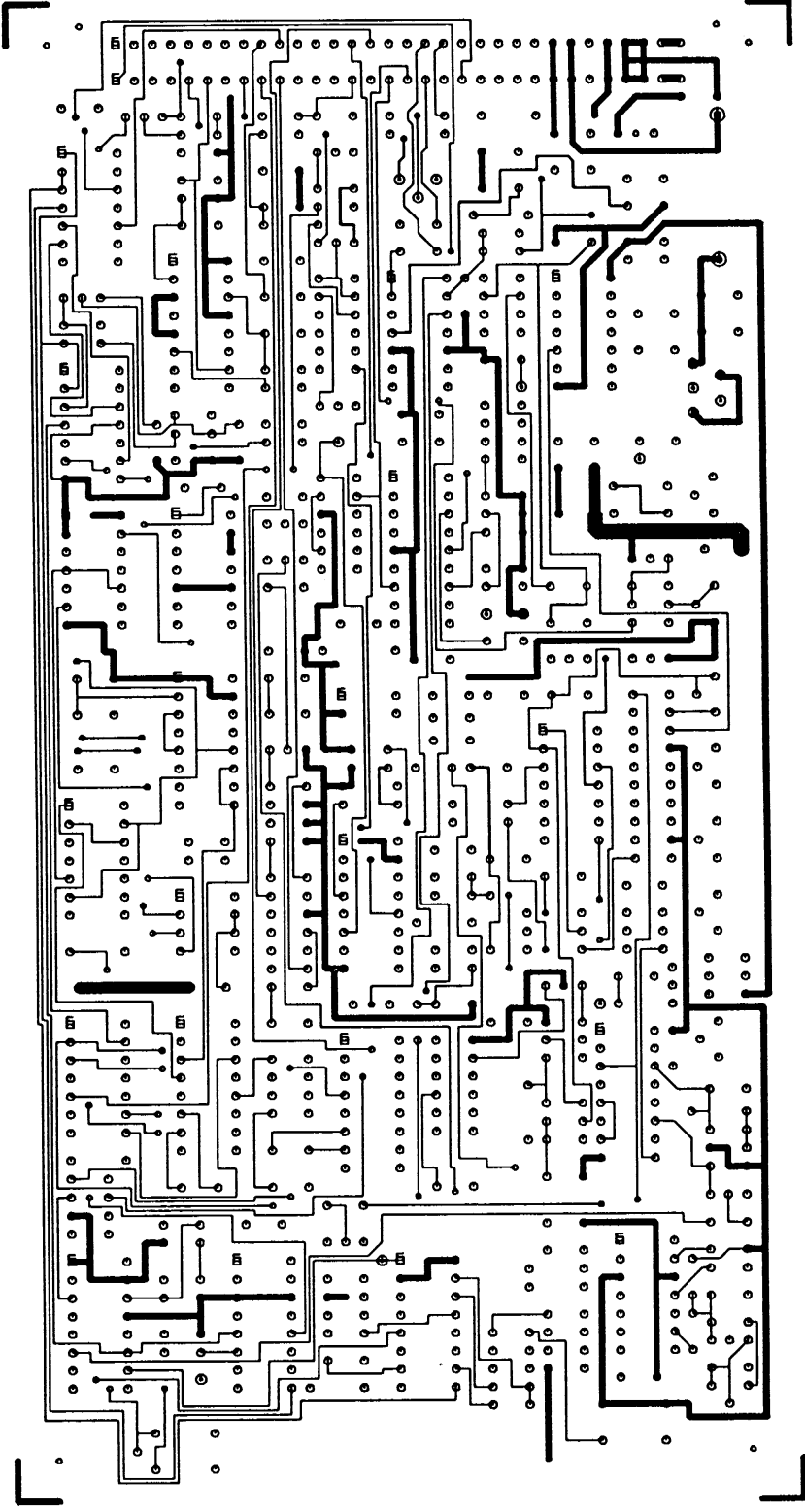
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Component Layout



Solder Side  
(Viewed from Component Side)



Component Side

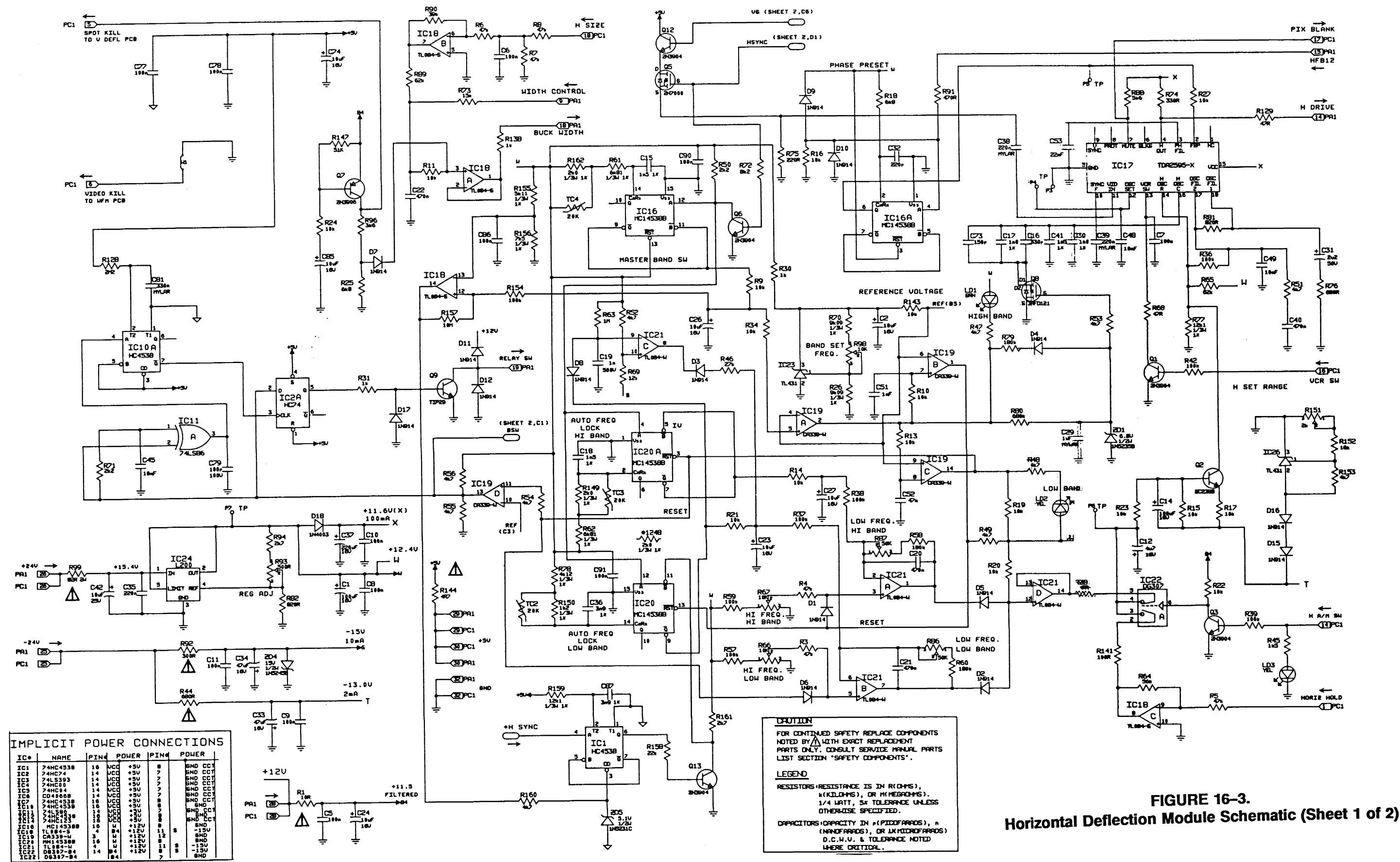
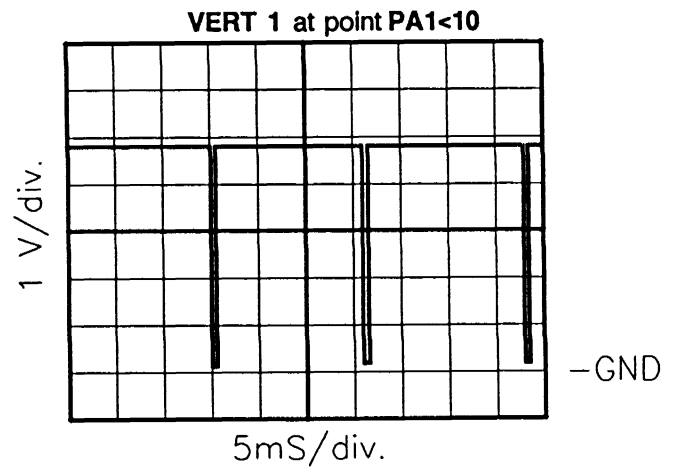
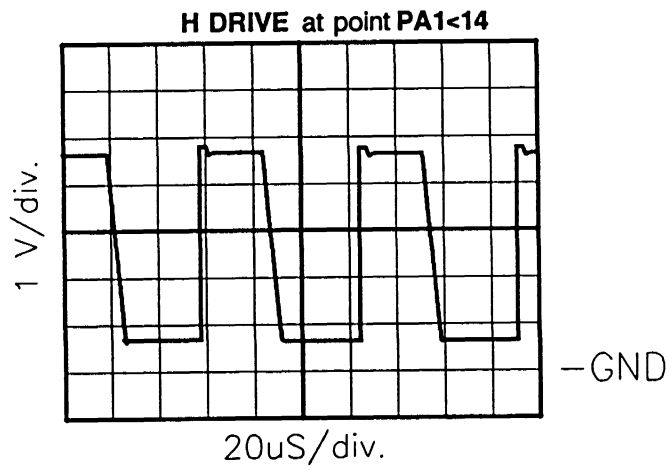


FIGURE 16-3.  
Horizontal Deflection Module Schematic (Sheet 1 of 2)

SCHEMATIC REFERENCE



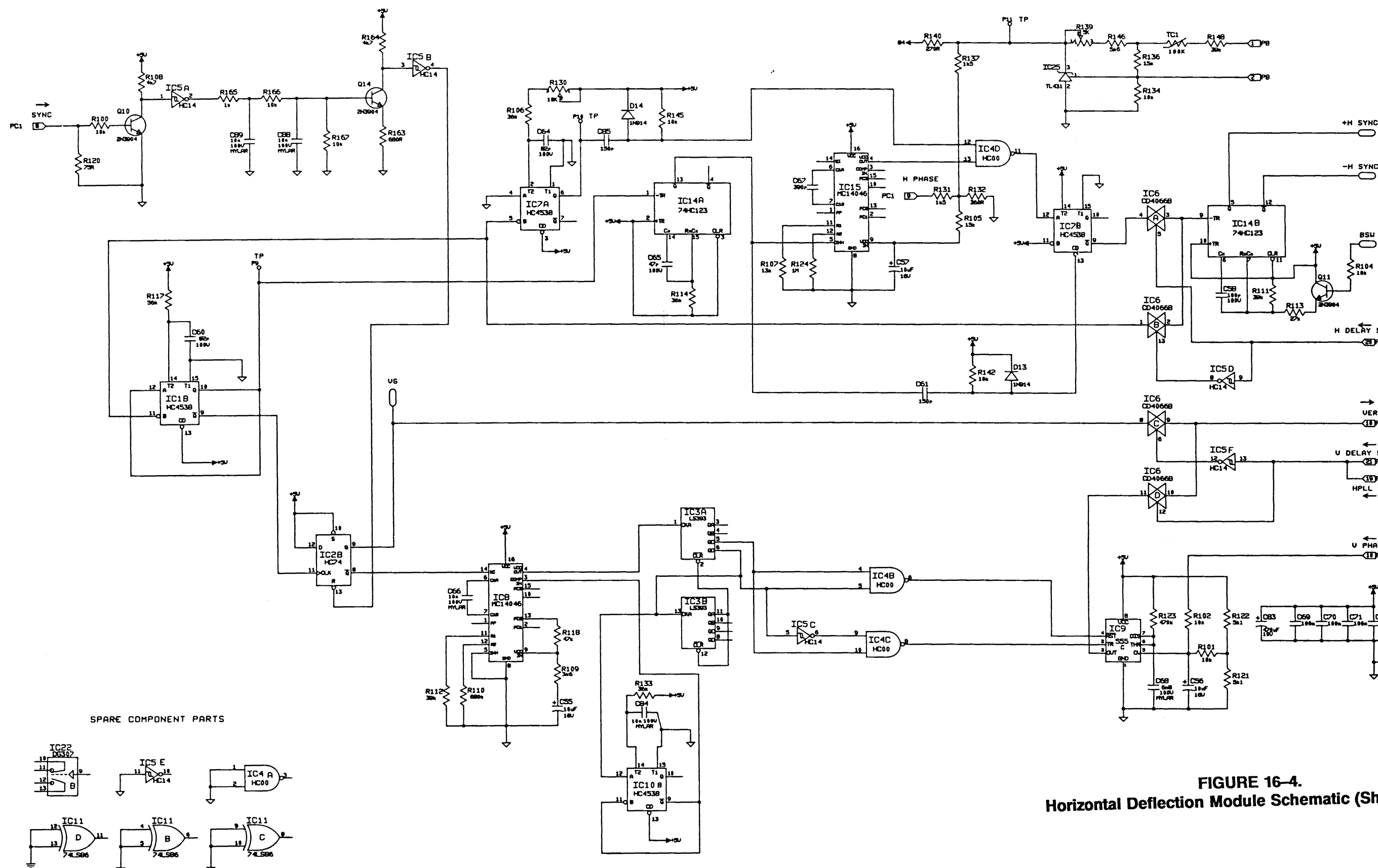


FIGURE 16-4.  
Horizontal Deflection Module Schematic (Sheet 2 of 2)





## 16.4 PARTS LIST

Item Ref.	Part No.	Description
<b>Integrated Circuits</b>		
IC1,IC7,IC10	14-A04041-01P	MM74HC4538, CMOS multivibrator
IC2	14-A04007-01P	74HC74, H-CMOS, dual D flip flop
IC3	14-004688-01P	74LS393, dual 8 bit digital TTL
IC4	14-A04001-01P	74HC00, quad 2-input NAND gate
IC5	14-A04073-01P	74HC14, hex Schmitt trigger inverter
IC6	14-A03008-01P	CD4066BM, 1/F CMOS quad biFET latch
IC8	14-A02006-02P	MC14046, CMOS phase lock loop
IC9	14-A04069-01P	TLC555C, CMOS digital timer
IC11	14-004620-01P	74LS86, quad EXOR gate
IC14	14-A04062-01P	74HC123, dual monostable multivibrator
IC15	14-A02006-03P	MC14046, phase lock loop
IC16,IC20	14-A04041-01P	MC14538B, precision dual monostable
IC17	14-002824-01P	TDA2594
IC18,IC21	14-002104-01P	TL084CN, quad biFET linear op amp
IC19	14-002154-01P	CA339, quad linear voltage comparator
IC22	14-A03009-01P	DG307CJ, 1/F analog CMOS gate switch
IC23,IC25,IC26	14-002833-01P	TL431C, precision shunt regulator
IC24	14-002088-01P	L200, linear adjust voltage regulator
<b>Transistors and Diodes</b>		
Q1,Q3,Q6, Q10-Q14	14-000881-06P	2N3904, NPN, 40V, 0.2A, 0.35W
Q2	14-000723-01P	BC238B, NPN transistor
Q5	14-A00705-01P	2N7000, TMOS, 60V, 0.2A, 4W
Q7	14-000873-82P	2N3906, PNP, small signal
Q8	14-A00700-01P	1RFD1Z0, hex FET, 100V
Q9	14-000966-23P	TIP29B, NPN transistor, 80V, 1A 2W
D1-D7	14-000513-01P	1N914, 0.075A, 75V
D18	14-000525-53P	1N4003, rectifier, 1A, 200V, T
LD1	14-001005-02P	LED, 3V, 0.09A, green
LD2,LD3	14-001005-03P	LED, 3V, 0.06A, yellow
ZD1	14-000531-32P	1N5235B, zener diode, 6.8V, 5%, 1/2W
ZD4	14-000530-38P	1N5245B, zener diode, 15V, 1/2W
ZD5	14-000515-98P	1N5231, zener diode, 5.1V, 1/2W, 2%, T
<b>Capacitors</b>		
C1,C14	84-410104-03P	100 $\mu$ F, 25V
C2,C23,C24,C26, C27,C42,C55-C57, C74,C85	84-410004-01P	10 $\mu$ F, 25V
C5-C11,C69-C72, C77,C78,C86,C90, C91	89-000032-03P	100 nF, 50V

# 16-10 MODULE SERVICING Horizontal Deflection Module

## 16.4 PARTS LIST (cont.)

Item Ref.	Part No.	Description
<b>Capacitors</b>		
C12	84-447506-01P	4.7 $\mu$ F, 50V
C15,C18,C41	89-000033-04P	1.5 nF, 1%, NPO
C16	89-000033-06P	330 pF, 5%, NPO
C17,C30	89-000033-02P	1.0 nF, 50V, 1%
C19	86-310213-02P	1 nF, 500V, 10%, Z5P
C20-C22,C40	89-000032-02P	0.47 $\mu$ F, 50V, $\pm$ 20%
C29	88-171053-12P	1 $\mu$ F, 50V
C31	84-422506-01P	2.2 $\mu$ F, 50V, 20% electrolytic
C32	89-000033-07P	220 pF, 100V, 5%, NPO
C33,C34	84-447003-02P	47 $\mu$ F, 16V
C35	89-000032-01P	0.22 $\mu$ F, 50V
C36,C87	89-000033-05P	3.9 nF, 1%, NPO
C37	84-422103-03P	220 $\mu$ F, 16V
C38,C39	88-172240-02P	220 nF, 50V, 10%
C45,C48,C49	89-000032-04P	10 nF, 50V, 20%
C51	89-000032-05P	1 nF, 50V, 20%
C52	89-000032-09P	47 nF, 50V, 20%, Z5U
C53	89-000032-10P	22 nF, 50V, 20%
C58,C79	86-610134-04P	100 pF, NPO
C60,C64	86-682034-04P	82 pF, 2%
C61,C85	86-315113-51P	150 pF, 40V, Z5P
C65	86-647033-04P	47 pF, 100V, NPO
C66,C84,C88,C89	88-171031-02P	10 nF, 100V, 10%
C67	89-000033-08P	390 pF, NPO
C68	88-176821-03P	6800 pF, 100V, $\pm$ 5%
C73	89-000033-03P	150 pF, 50V, 5%
C81	88-173340-02P	330 nF, 63V, 10%
C83	44-447102-05P	470 $\mu$ F, 10V
<b>Resistors</b>		
R1	80-110095-11P	10R, 1/2W, 5%, metal film
R3-R8,R118	80-147025-11P	47K, 1/2W, 5%, metal film
R9-R11,R13-R17, R19-R24,R27,R34, R51,R100-R102, R104,R134,R142, R143,R145,R166,R167	80-110025-11P	10K, 1/2W, 5%, metal film
R18,R25	80-168015-11P	6.8K, 1/2W, 5%, metal film
R26,R70,R72	80-182015-11P	8.2K, 1/2W, 5%, metal film
R28,R68,R129	80-147095-11P	47R, 1/2W, 5%, metal film
R30,R31,R138 R165	80-110015-11P	1K, 1/2W, 5%, metal film
R36-R39,R42,R57, R59,R154	80-110035-11P	100K, 1/2W, 5%, metal film
R44,R76,R163	80-168005-11P	680R, 1/2W, 5%, metal film

# 16.4 PARTS LIST (cont.)

Item Ref.	Part No.	Description
<b>Resistors</b>		
R45,R131,R137	80-115015-11P	1.5K, 1/2W, 5%, metal film
R46,R113	80-127025-11P	27K, 1/2W, 5%, metal film
R47-R49,R52-R56, R108,R153,R160, R164	80-147015-11P	4.7K, 1/2W, 5%, metal film
R50,R71	80-122015-11P	2.2K, 1/2W, 5%, metal film
R58,R60,R79	80-118035-11P	180K, 1/2W, 5%, metal film
R61,R62	82-368111-29P	6.81K, 1/3W, 1%, metal film
R63,R124	80-110045-11P	1M, 1/2W, 5%, metal film
R64,R111,R117	80-156025-11P	56K, 1/2W, 5%, metal film
R65,R89	80-162025-11P	62K, 1/2W, 5%, metal film
R66,R67,R130	41-000344-10P	10K, carbon trim pot.
R69	80-112025-11P	12K, 1/2W, 5%, metal film
R73,R105,R136	80-115025-11P	15K, 1/2W, 5%, metal film
R74	80-133005-11P	330R, 1/2W, 5%, metal film
R75	80-122005-11P	220R, 1/2W, 5%, metal film
R77,R159	82-312121-29P	12.1K, 1/3W, 1%, metal film
R78	82-341211-29P	4.12K, 1/3W, 1%, metal film
R80,R110	80-168035-11P	680K, 1/2W, 5%, metal film
R81,R82	80-182005-11P	820R, 1/2W, 5%, metal film
R86, R87	41-000344-13P	50K, carbon trim pot.
R88,R146	80-156015-11P	5.6K, 1/2W, 5%, metal film
R90,R112,R148	80-139025-11P	39K, 1/2W, 5%, metal film
R91	80-147005-11P	470R, 1/2W, 5%, metal film
R92	80-130005-11P	300R, 1/2W, 5%, metal film
R93	41-000344-06P	500R, carbon trim pot.
R94,R161	80-127015-11P	2.7K, 1/2W, 5%, metal film
R96,R109	80-136015-11P	3.6K, 1/2W, 5%, metal film
R98	41-000344-40P	10K, carbon trim pot.
R99	42-000134-04P	82R, 2W, 5%, CS
R106,R114,R133	80-136025-11P	36K, 1/2W, 5%, metal film
R107	80-113025-11P	13K, 1/2W, 5%, metal film
R120	80-175095-11P	75R, 1/2W, 5%, metal film
R121,R122	80-151015-11P	5.1K, 1/2W, 5%, metal film
R123	80-147035-11P	470K
R128	40-122255-31P	2.2M, 1/4W, 5%, metal film
R132	80-136005-11P	360R, 1/2W, 5%, metal film
R139	41-000344-09P	5K, carbon trim pot.
R140	80-127005-11P	270R, 1/2W, 5%, metal film
R141	80-110005-11P	100R, 1/2W, 5%, metal film
R144	80-147085-11P	4.7R, 1/2W, 5%, metal film
R147	80-151025-11P	51K, 1/2W, 5%, metal film
R149,R162	82-320011-29P	2.0K, 1/3W, 1%, metal film
R150	82-312111-29P	1.21K, 1/3W, 1%, metal film
R151	41-000344-08P	2K, carbon trim pot.

**16-12 MODULE SERVICING**  
**Horizontal Deflection Module**

**16.4 PARTS LIST (cont.)**

<b>Item Ref.</b>	<b>Part No.</b>	<b>Description</b>
<b>Resistors</b>		
R152	80-116025-11P	16K, 1/2W, 5%, metal film
R155	82-351111-29P	5.11K, 1/3W, 1%, metal film
R156	82-375011-29P	7.5K, 1%
R157	40-121065-31P	10M, 1/4W, 5%, metal film
R158	80-122025-11P	22K, 1/2W, 5%, metal film
TC1	42-000079-08P	100K, precision thermistor
TC2-TC4	42-000079-10P	20K, thermistor, 2%

## 16.5 SPECIFICATIONS

### Connector P1, Row A:

Pin 9 ..... analog input **WIDTH**  
**NOTE: horizontal size control voltage from Power Deflection module**

Pin 10 ..... analog output **VERT1**  
**NOTE: +ve going vertical sync pulse**  
signal level ..... 0 to 5V  $\pm$  10%

Pin 14 ..... analog output **H DRIVE**  
**NOTE: horizontal drive pulse from IC17**  
signal level (500 $\Omega$  load) ..... 5V peak  $\pm$  10%

Pin 15 ..... analog input **HFB**  
**NOTE: see Power Deflection module**  
signal level ..... 0 to 12V

Pin 18 ..... analog output **BUCK WIDTH**  
**NOTE: control voltage for horizontal regulator**  
normal condition ..... 3.5 to 3.9V  
during bandswitch ..... 5.4V max

Pin 19 ..... analog output **RELAY SW**

Pin 25 ..... -24V power supply **-24 VDC**  
current level ..... 40 mA max

Pin 26 ..... +24V power supply **+24 VDC**  
current level ..... 100 mA max

Pin 27 ..... -12V power supply **-12 VDC**  
current level ..... 5 mA max

Pin 28 ..... +12V power supply **+12 VDC**  
current level ..... 10 mA

Pin 29 ..... +5V power supply **+5 VDC**  
total current ..... 35 mA max

Pin 30 ..... connected to Pin 29 +5 VDC

### Connector P1, Row C:

Pin 1 ..... analog input **H HOLD**  
horizontal oscillator lock-in range  
manual mode @ SW = 5V  
low band ..... 15.7 to 35 KHz  
high band ..... 24 to 54 KHz  
auto mode @ SW = 0V  
lock-in range ..... 15.7 to 54 Hz  
pull-in range ..... 500 Hz min

Pin 5 ..... analog output **SPOT KILL**

Pin 6 ..... analog output **VIDEO KILL**

Pin 8 ..... analog input **SYNC**  
composite -ve sync ..... 1V peak min

Pin 9 ..... analog input **H PHASE**  
horizontal phase delay control ..... 0 to 10VDC

Pin 10 ..... analog input **V PHASE**  
vertical phase delay control ..... 0 to 10VDC

Pin 14 ..... analog input **H A/M SW**  
**NOTE: horizontal auto/manual switch**  
signal level ..... 0 to 5V

Pin 16 ..... analog input **VCR SW**  
**NOTE: fast/slow time base switching signal**  
signal level ..... 0 to 5VDC

Pin 18 ..... analog input **H SIZE**  
**NOTE: size control from Remote Control module**  
signal level ..... 0 to 10VDC

Pin 20 ..... analog input **H DELAY SW**  
**NOTE: turns horizontal phase delay circuit ON or OFF**  
signal level ..... 0 to 5VDC

Pin 21 ..... analog input **V DELAY SW**  
**NOTE: turns vertical phase delay circuit ON or OFF**  
signal level ..... 0 to 5VDC

**NOTES**

