



WELLS-GARDNER

ELECTRONICS CORPORATION

0000MS

Service Manual

Safety Summary

1. POWER UP WARNING —

This product uses a switch mode power supply to provide the monitor chassis with isolation from the AC line. Although servicing the secondary circuitry can be safely done without the use of an AC isolation transformer, **it is recommended that an isolation transformer be used when servicing this product.** This will prevent shock hazard in the event of accidental or erroneous contact with primary power supply circuitry. Before servicing is performed, read all the precautions labelled on the CRT chassis.

2. **X-RAY RADIATION WARNING NOTICE**

WARNING: PARTS WHICH INFLUENCE X-RAY RADIATION IN HORIZONTAL DEFLECTION, HIGH VOLTAGE CIRCUITS, PICTURE TUBE, ETC. ARE INDICATED BY ★ ON THE SCHEMATIC DIAGRAM. FOR REPLACEMENT, USE ONLY THE TYPE SHOWN IN THE PARTS LIST.

3. HIGH VOLTAGE —

This monitor contains HIGH VOLTAGES derived from power supplies delivering LETHAL quantities of energy. Do not attempt to service until all precautions necessary for working on HIGH VOLTAGE equipment have been observed.

4. CRT HANDLING —

Care must be taken not to bump or scratch the picture tube as this may cause the picture tube to implode resulting in personal injury. Shatter proof goggles must be worn when handling the CRT. **HIGH VOLTAGE CHARGE REMAINS PRESENT ON THE CRT ANODE AFTER THE SET IS POWERED DOWN. THE CRT ANODE MUST BE DISCHARGED TO CHASSIS GROUND BEFORE HANDLING CRT.** Do not handle the CRT by the neck.

5. **PRODUCT SAFETY NOTICE**

WARNING: FOR CONTINUED SAFETY, REPLACE SAFETY CRITICAL COMPONENTS WITH MANUFACTURER RECOMMENDED PARTS. THESE PARTS ARE IDENTIFIED BY Δ ON THE SCHEMATIC DIAGRAM.

AVERTISSEMENT: POUR MAINTENIR LE DEGRE DE SECURITE DE L'APPAREIL NE REMPLACER LES COMPSANTS DONT LE FONCTIONNEMENT EST CRITIQUE POUR LA SECURITE QUE PAR LE FABRICANT.

For replacement purposes, use the same type or specified type of wire and cable, assuring the positioning of the wires is followed (especially for High Voltage and power supply circuits). Use of alternative wiring or positioning could result in damage to the moniotr, shock or fire.

Table of Contents

Theory of Operations

Switchmode Power Supply..... 5

Sync, Decoder Operation 5

Vertical Circuit 6

Horizontal Circuit 6

High Voltage Shutdown Circuit 7

Video Circuit 7

Monitor Connection Diagram..... 8

Overview of Monitor Controls 9

Replacement Parts List

Deflection Board 13

Theory of Operation

SWITCHMODE POWER SUPPLY

AC power is converted to DC by a bridge rectifier consisting of D101, D102, D103 and D104, and by filter capacitor C105. Start up voltage for U101 is supplied through R102 and R103. U101 oscillator frequency is determined by values of R116 and C116. Pin 6 of U101 provides a square wave output to drive switching MOSFET Q101. Switching action of Q101 generates a square wave using primary of T101 as load. A network consisting of C106, R104 and D107 acts as a snubber to prevent voltage spikes generated during switching from reaching levels that could damage Q101. Power is transferred to the secondary windings through the transformer action of T101. Voltages from the secondary windings are rectified and filtered providing output voltages to supply monitor.

Voltage regulation is achieved by sensing the output voltage of a tertiary winding on T101. The voltage on this winding is rectified and filtered (D112 and C100) and fed to pin 2 of U101 through a divider network. This sense voltage varies in proportion to the output voltage and is used to change the duty cycle of the square wave drive to Q101 in order to correct changes in output voltage. The waveform from the tertiary winding is also fed through D113 and C118 to generate the DC supply voltage for U101.

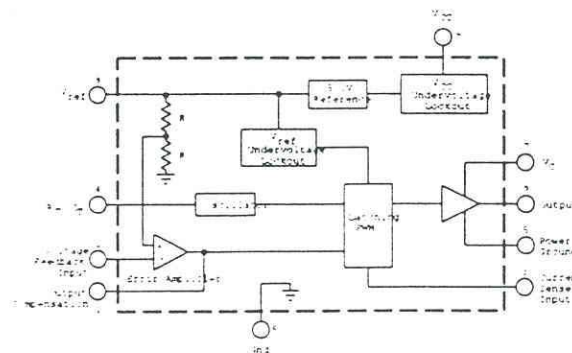
Current foldback is used to protect the supply from excessive load current. The current through Q101 is sensed at R108 and a proportional voltage is fed into pin 3 of Q101. If the voltage at pin 3 exceeds 0.6VDC, U101 shuts off the output at pin 6. U101 will periodically try to restart, however if the load fault is still present, the supply will continue to go into the shutdown mode. This condition will cause the supply to produce a slight ticking sound.

SYNC DECODER OPERATION

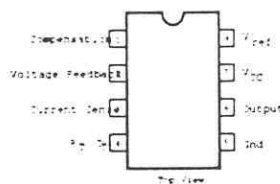
Vertical sync is fed into a pair of XOR gate (pins 9 and 12 of U302). This circuit configuration will provide a negative sync output at pin 8 for the vertical processor regardless of the polarity of the input signal. In addition, the output at pin 11 will be at a high or low logic level depending on the polarity of the vertical sync signal. This logic signal is fed to pin 3 of decoder IC U301.

Horizontal sync is fed into pin 5 of a second pair of XOR gates (pin 2 and 5 or U302) and is processed in a manner similar to the vertical sync signal. The negative horizontal sync output is provided at pin 6 and the DC logic signal for the decoder IC is provided at pin 3. In addition, the negative horizontal sync is fed to the frequency sensing circuit consisting of U303A and B.

U101
UC3842AN
CURRENT MODE CONTROLLER



PIN CONNECTIONS



Theory of Operation (continued)

The frequency sensing circuit detects whether a 31.5kHz (VGA) or 35.1kHz (SVGA) signal is present. Pin 5 is high for a 31.5 kHz signal (modes 1, 2 and 3) and low for a 35.1 kHz signal (mode 4). This logic signal is inverted by Q301 and fed to U301, Q302 and Q303.

For VGA modes 1,2 and 3, decoder IC U301 will pull down pin 4,5 or 6, selecting R319, R320 or R321 to set the vertical size for the detected mode. For the 35.1kHz SVGA mode, the outputs of U301 remain floating (high) and Q301 turns on, causing the vertical size to be set by VR318. In addition, Q302 turns on which turns on Q706 causing R746 to become part of the horizontal oscillator RC circuit (in parallel with R710 and VR701). This causes the horizontal oscillator frequency to increase to 35.1kHz.

VERTICAL CIRCUIT

Vertical sync from the decoder circuit is AC coupled through C304 to the vertical processor (U600). The vertical oscillator frequency is determined by the values of VR600, R609 and C603. The output from the oscillator is fed to a ramp generator. Linearity correction is accomplished by shaping the ramp through an external RC network connected between pins 1 and 12. The ramp is amplified and the output taken from pin 4 is buffered by Q601 and Q602 before it reaches the yoke.

The yoke is AC coupled through C612. The yoke current is sensed at R621 where a proportional voltage is fed back to the internal amplifier at pin 10.

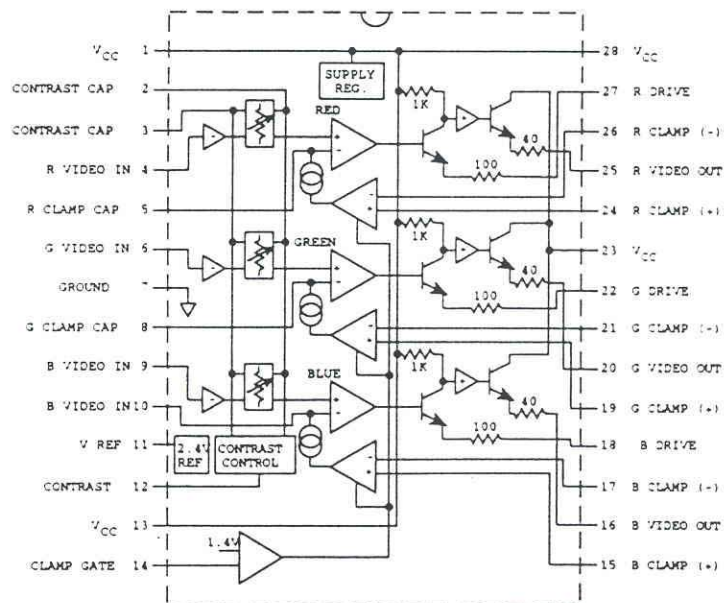
U600 uses a pump-up circuit to reduce retrace time. During retrace the voltage at pin 3 is increased to approximately 20 volts. Emitter follower Q600 then boosts the collector voltage of Q601 to approximately 44 volts using the charge stored C604. The output at pin 4 is also increased, and the resulting increased voltage across the yoke decreases the retrace time.

HORIZONTAL CIRCUIT

Horizontal sync from the decoder circuit is applied to pin 1 of U700. The first section of U700 is an adjustable delay, the delay being determined by the values of C701, R706 and VR700. Adjusting VR700 will move the position of the video on the screen horizontally. The output of the delay circuit is fed to the phase detector which compares the frequency of the sync signal to the frequency of the horizontal oscillator and produces a DC correction voltage to keep the oscillator frequency locked to the incoming sync frequency. The DC correction voltage is fed through R708 to the oscillator. The free running frequency of the oscillator is set by VR701.

U200

LM1203 RGB VIDEO AMPLIFIER SYSTEM



Theory of Operation (continued)

HIGH VOLTAGE SHUTDOWN CIRCUIT

The flyback pulse is sensed from the filament winding (pin 9) of the flyback transformer. The pulse is converted to a DC level proportional to the high voltage by D710 and C729. VR702 is adjusted so that when the high voltage exceeds an acceptable level, the internal X-Ray protect circuit of U700 (pin 13) will turn off the horizontal oscillator causing the high voltage to drop to zero. This circuit acts as a latch, therefore power to the monitor must be turned off for a few seconds in order to reset this circuit after it has been tripped.

VIDEO CIRCUIT

Red, green and blue video signals are applied to pins 10, 9 and 8 of P301 and are AC coupled to video processor IC U200. DC bias for the input amplifiers is provided from the output of pin 11 through R206, R207 and R250. The gain (contrast) of the RGB amplifiers is controlled simultaneously by the DC voltage applied at pin 12, which varies with the setting of the contrast control VR201.

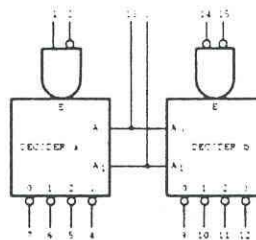
DC restoration occurs during retrace when the input signal is at black level. A negative pulse derived from horizontal sync amplifier Q205 is applied to the clamp gate input at pin 14. During this pulse, the black level of the signal is clamped to a DC level which is determined by the setting of brightness control VR200.

RGB output signals from U200 are fed through buffer amplifiers Q200, Q201 and Q202 to the neckboard cascode video amplifiers. The outputs of these amplifiers are fed to the CRT cathodes.

Blanking is provided by pulling down the video signals to below black level during the horizontal and vertical blanking periods. This is accomplished by turning on Q204 (vertical) or Q208 (horizontal), turning on diodes D209, D210 and D211, forcing the video outputs low. The horizontal blanking signal is derived from the filament pulse, and the vertical blanking signal is derived from the vertical retrace pulse.

Beam limiting is provided by sensing the voltage developed across R801. When beam current reaches approximately 800uA, Q800 begins to turn on and Q801 begins to turn off. As Q801 turns off, the voltage applied the CRT grid 1 begins to go negative, causing the beam current to limit.

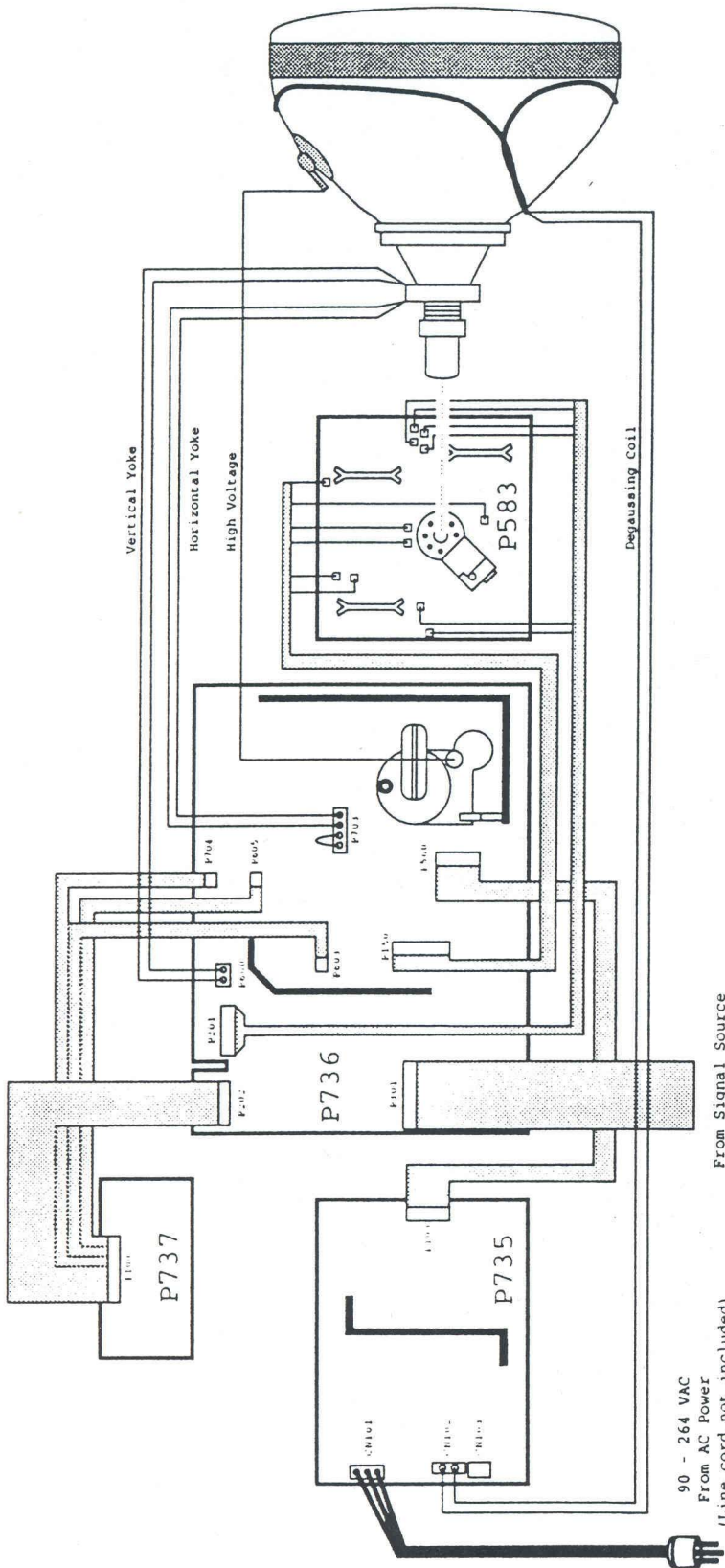
U301
74LS156
DUAL 1-OF-4 DECODER / DEMULTIPLEXER



Pin 16 = Pin 15
Pin 15 = Pin 16

ADDRESS		ENABLE 'a'		OUTPUT 'a'				ENABLE 'b'		OUTPUT 'b'			
A ₀	A ₁	E _a	\bar{E}_a	\bar{O}_0	\bar{O}_1	\bar{O}_2	\bar{O}_3	\bar{E}_b	\bar{E}_b	\bar{O}_0	\bar{O}_1	\bar{O}_2	\bar{O}_3
X	X	L	X	H	H	H	H	H	X	H	H	H	H
X	X	X	H	H	H	H	H	X	H	H	H	H	H
L	L	H	L	L	H	H	H	L	L	L	H	H	H
H	L	H	L	H	L	H	H	L	L	H	L	H	H
L	H	H	L	H	H	L	H	L	L	H	H	L	H
H	H	H	L	H	H	H	L	L	L	H	H	H	L

H = HIGH Voltage Level
L = LOW Voltage Level
X = Don't Care



90 - 264 VAC
From AC Power
(Line cord not included)

From Signal Source

AC Input Connector: CN101

PCB connector

Amp type 640445-5
Mating Amp type 640251-5

Pin	Description
1	AC hot
2	N/A
3	AC Neutral
4	N/A
5	Ground

Input Signal Connector: P301

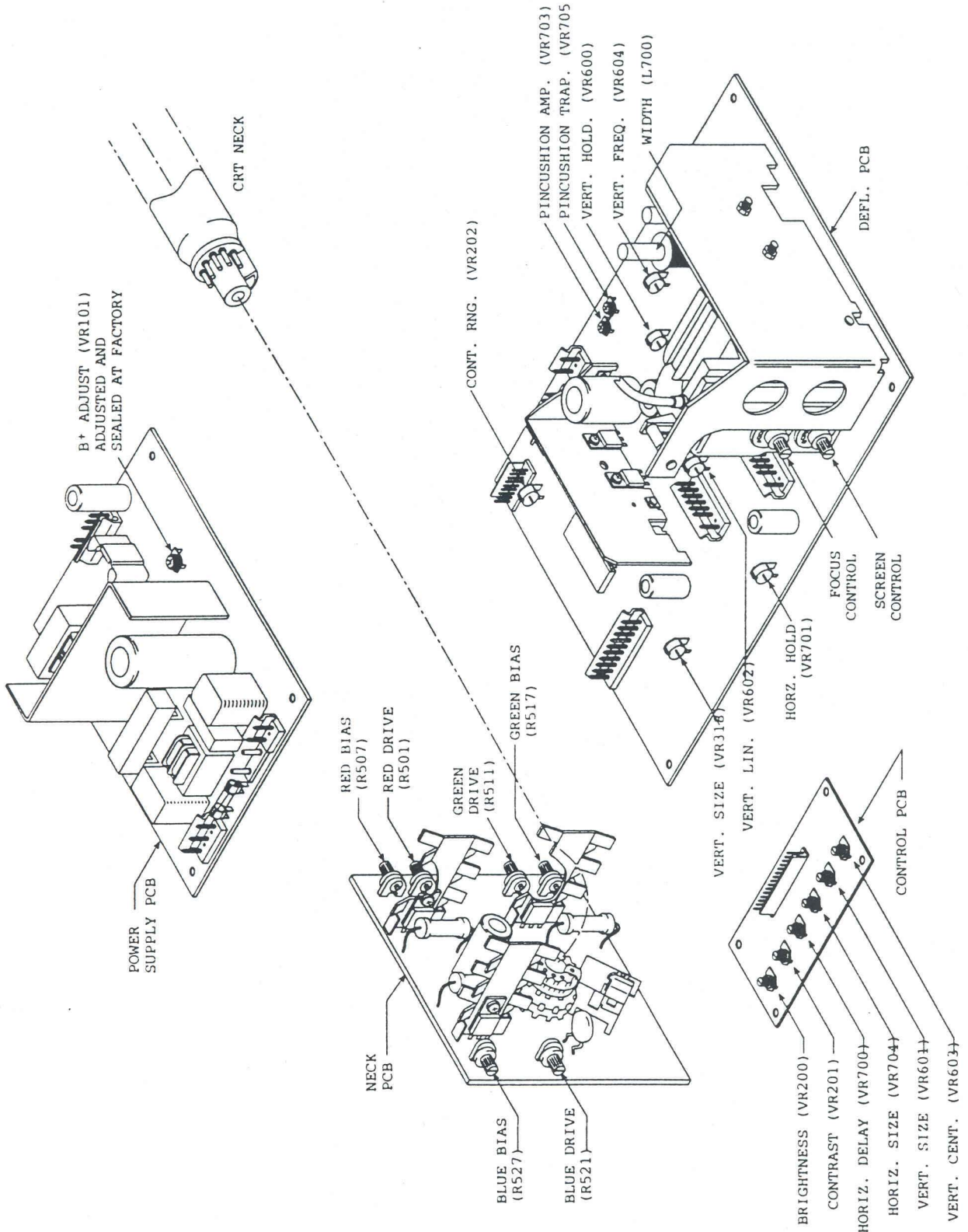
PCB connector

Amp type 1-640445-0
Mating Amp type 1-640251-0

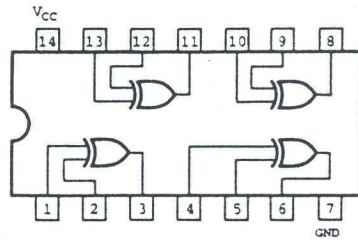
Pin	Description
1	Horizontal Sync
2	Vertical Sync
3	Sync Ground
4	Shield Ground
5	Blue return
6	Green return
7	Red return
8	Blue video
9	Green video
10	Red video

Optional Cable connector
Amp type 748364-1 (DB15)
Mating Amp type 748565-1

Pin	Description
1	Red video
2	Green video
3	Blue video
4	N/A
5	N/A
6	Red return
7	Green return
8	Blue return
9	N/A
10	Sync grounds
11	Sync grounds
12	N/A
13	Horizontal sync
14	Vertical sync
15	Shield ground



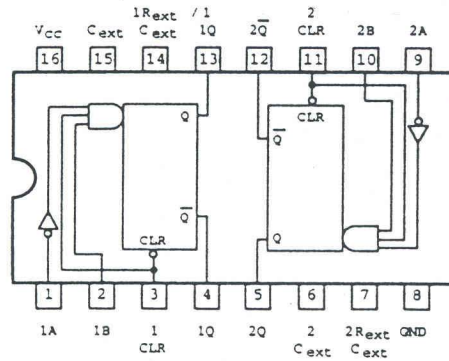
U302
74LS86
QUAD 2-INPUT
EXCLUSIVE OR GATE



TRUTH TABLE

IN		OUT
A	B	Z
L	L	L
L	H	H
H	L	H
H	H	L

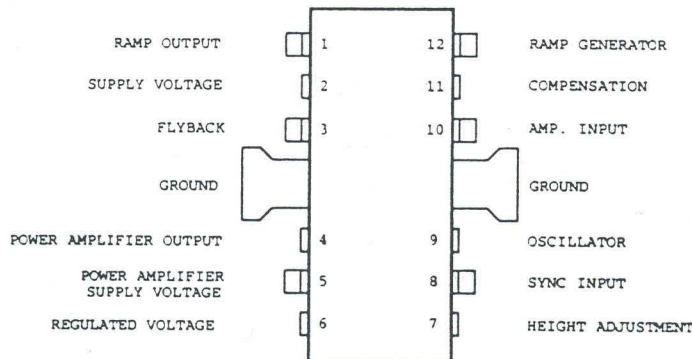
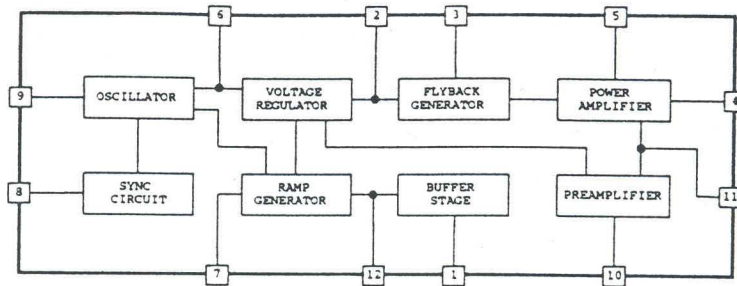
U303
74LS1234
RETRIGGERABLE MONOSTABLE
MULTIVIBRATORS



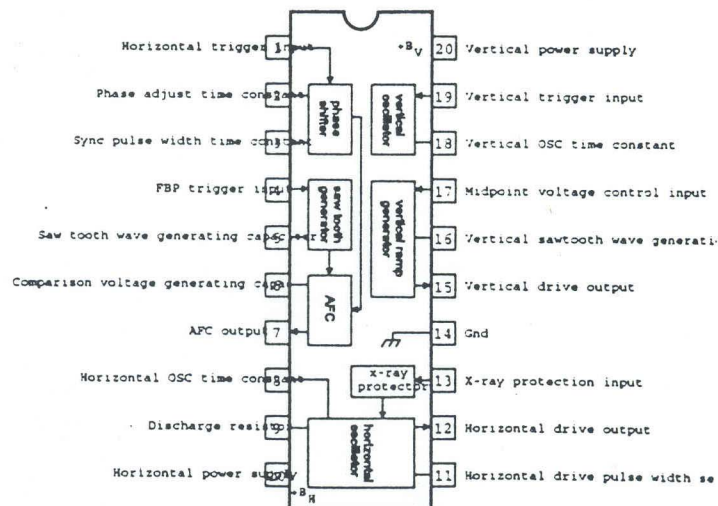
FUNCTIONAL TABLE

CLEAR	INPUTS		OUTPUTS	
	A	B	Q	\bar{Q}
L	X	X	L	H
X	H	X	L	H
X	X	L	L	H
H	L	\uparrow	\square	\sqcup
H	\downarrow	H	\square	\sqcup
\uparrow	L	H	\square	\sqcup

U600
TDA1175
VERTICAL DEFLECTION IC



U700
LA7850
H/V SYNC PROCESSOR



Note: Vertical section of LA7850 is not used in U3000

Replacement Part List

Deflection Board

025A1424-01

P736

PCBA	Ref Desig	Part Number	Description	Qty	Seq
P736	C150	045X0560-030	CAP LYT 470UF 35V	1	300
P736	C152	045X0569-011	CAP LYT 47UF 250V	1	340
P736	C231	080X0099-221	CAP .01UF 10% Y5P 500V CER	1	480
P736	C307	080X0099-220	CAP 270PF 10% Z5F CER	1	470
P736	C612	045X0600-001	CAP LYT 2200UF 50V	1	350
P736	C614	045X0560-048	CAP LYT 4700UF 20% 35V	1	310
P736	C616	047X0788-019	CAP .001UF 10% X7R 200V MON	1	420
P736	C708	046X0536-064	CAP 1000PF 10% 630V P-PROP	2	390
P736	C708	046X0536-064	WG, CAP 1000PF 10% 630V P-PROP	2	390
P736	C716	045X0560-027	CAP LYT 220UF 63V	1	290
P736	C718	046X0536-065	CAP 680PF 2% 1600V P-PROP	1	400
P736	C718	046X0536-065	WELLS	1	400
P736	C719	046X0536-051	CAP 5200PF 2% 1600V P-PROP	1	370
P736	C720	046X0536-012	CAP .015UF 5% 400V P-PROP	1	360
P736	C721	046X0536-064	CAP 1000PF 10% 630V P-PROP	2	390
P736	C721	046X0536-064	WG, CAP 1000PF 10% 630V P-PROP	2	390
P736	C722	046X0536-063	CAP 5600PF 10% 630V P-PROP	1	380
P736	C723	046X0537-006	CAP .68UF 5% 250V P-CARB	1	410
P736	C728	045X0562-003	CAP LYT 68UF 125V	1	320
P736	C728	045X0562-003	CAPACITOR,Radial,68UF,125V,Polar,LYT	1	320
P736	C800	045X0569-008	CAP LYT 22UF 160V	1	330
P736	D705	066X0126-002	DIODE BOOST 900V 4A MOTOROLA TYPE MUR490	1	460
P736	D705	066X0126-002	WG,DIODE BOOST 900V 4A	1	460
P736	L150	009A2873-001	COIL 12UH	2	140
P736	L151	009A2873-001	COIL 12UH	2	140
P736	L700	009A2812-004	COIL WIDTH 20-100UH	1	110
P736	L701	009A2813-010	COIL LINEARITY	1	120
P736	L702	009A2838-003	COIL PINCUSHION CORRECTION	1	130
P736	L702	009A2838-003	COIL WIDTH 75-350UH	1	130
P736	P202	006A0419-009	HEADER 9-PIN AMP #640456-9	1	100
P736	P300	003A0680-001	SHUNT AMP 531220-1 10/STRIP	0.3	20
P736	P300	006A0417-003	HEADER 3-PIN AMP #103327-3	3	80
P736	P301	006A0403-010	HEADER 10-PIN AMP #1-640445-0	1	70
P736	P603	006A0419-003	HEADER 3-PIN AMP #640456-3	3	90
P736	P605	006A0419-003	HEADER 3-PIN AMP #640456-3	3	90
P736	P701	003A0680-001	SHUNT AMP 531220-1 10/STRIP	0.3	20
P736	P701	006A0417-003	HEADER 3-PIN AMP #103327-3	3	80
P736	P702	003A0680-001	SHUNT AMP 531220-1 10/STRIP	0.3	20
P736	P702	006A0417-003	HEADER 3-PIN AMP #103327-3	3	80
P736	P704	006A0419-003	HEADER 3-PIN AMP #640456-3	3	90
P736	Q600	086X0176-001	TRSTR 2SC2275 NEC	2	500
P736	Q600	086X0176-001	WG, TRANS WELLS	2	500
P736	Q601	038A7426-000	SADD VERT TRSTR & HEAT SINK	1	200
P736	Q602	038A7426-000	SADD VERT TRSTR & HEAT SINK	1	200
P736	Q603	086X0176-001	TRSTR 2SC2275 NEC	2	500
P736	Q603	086X0176-001	WG, TRANS WELLS	2	500
P736	Q700	086X0177-001	TRSTR 2SA968Y	1	510

Replacement Parst List

Deflection Board

025A1424-01

P736

PCBA	Ref Desig	Part Number	Description	Qty	Seq
P736	Q701	038A7427-000	SADD TRSTR/DIODE HEAT SINK	1	210
P736	R248	420X5151-323	RES 150 OHM 5% 2W MO	1	700
P736	R715	420X4221-314	RES 220 OHM 5% 1W	1	680
P736	R721	420X4220-313	RES 22 OHM 5% 1W MO/MF	1	670
P736	R722	340X4039-633	RES 3.9 OHM 5% 1W MO/MF	1	640
P736	R725	340X4471-631	RES 470 OHM 5% 1W MO/MF	1	650
P736	R727	420X5012-314	RES 1.2 OHM 5% 2W MF/MO SUB 43X0486-002	1	690
P736	R740	340X8150-341	RES 15 OHM 5W WW	1	660
P736	T0600	020X2094-001	NUT #4-40 HEX NYLON	1	170
P736	T700	052X0140-001	TFMR HORIZ DRIVE	1	440
P736	TP 3	030X0798-001	PIN 1MM OHSHIMA	2	190
P736	TP 4	030X0798-001	PIN 1MM OHSHIMA	2	190
P736	U200	086X0270-001	IC LM1203N RGB VID AMP NSC	1	530
P736	U200	086X0270-001	WG, TRANS WELLS	1	530
P736	U201	086X0243-001	IC MC7812ACT V REG MOT	1	520
P736	U201	086X0243-001	WG, TRANS WELLS	1	520
P736	U301	086X0295-001	IC DEMULTIPLEXER 74LS156	1	550
P736	U301	086X0295-001	WG, TRANS, WELLS	1	550
P736	U302	086X0313-001	IC 74LS86 EXCL-OR	1	560
P736	U302	086X0313-001	WG, TRANS WELLS	1	560
P736	U303	086X0338-001	IC 74LS123 DUAL MONO MOTOROLA	1	570
P736	U303	086X0338-001	WG, WELLS	1	570
P736	U600	025X3120-002	HEAT SINK STAVER V8-8005	1	180
P736	U600	086X0353-001	IC TDA1175P VERT SGS	1	580
P736	U700	086X0274-001	IC LA7850 H/V SYNC PROC SANYO	1	540
P736	U700	086X0274-001	WG, TRANS WELLS	1	540
P736	VR202	040X0649-003	TRIM POT 2K OHM 0.5W	3	230
P736	VR202	040X0649-003	TRIM POT.2K	3	230
P736	VR318	040X0649-006	TRIM POT 200K OHM 0.5W	1	240
P736	VR600	040X0649-009	TRIM POT 100K OHM 0.5W	2	250
P736	VR600	040X0649-009	TRIM POT.100K	2	250
P736	VR602	040X0649-009	TRIM POT 100K OHM 0.5W	2	250
P736	VR602	040X0649-009	TRIM POT.100K	2	250
P736	VR604	040X0649-003	TRIM POT 2K OHM 0.5W	3	230
P736	VR604	040X0649-003	TRIM POT.2K	3	230
P736	VR701	040X0649-003	TRIM POT 2K OHM 0.5W	3	230
P736	VR701	040X0649-003	TRIM POT.2K	3	230
P736	VR702	040X0711-004	TRIM POT 500 OHM 0.15W	1	270
P736	VR703	040X0711-012	TRIM POT 50K OHM 0.15W	1	280
P736	VR703	040X0711-012	TRIM POT. 50K	1	280
P736	VR705	040X0711-001	TRIM POT 100 OHM 0.15W	1	260
P736	VR705	040X0711-001	TRIM POT. 100 OHM	1	260
P736		002X0602-009	SPACER 5/8 LG 1/4 OD .1711ID #8	1	10
P736		006A0403-003	HEADER 3-PIN AMP #640445-3	1	30
P736		006A0403-006	HEADER 6-PIN AMP #640445-6	1	40
P736		006A0403-007	HEADER 7-PIN AMP #640445-7	2	50
P736		006A0403-008	HEADER 8-PIN AMP #640445-8	1	60

Replacement Part List

Deflection Board

025A1424-01

P736

Ref					
PCBA	Desig	Part Number	Description	Qty	Seq
P736		013X1337-001	CABLE ASSY REMOTE CONTROL U3000	1	150
P736		020X2093-001	SCR #4-40 X 1 1/2 HH SLOT NYLON	1	160
P736		038A7430-000	SADD TRSTR & HEAT SINK ASSY	1	220
P736		047X0788-501	CAP .010UF 10% X7R 100V MON	1	430
P736		053X0643-001	FLYBACK TFMR 31.5KHZ	1	450
P736		053X0643-001	WG, TFMR FLYBACK P736	1	450
P736		089X0052-001	SOLDER BAR ULTRAPURE 60/40	0.04	590
P736		325X2201-444	WIRE #22 YEL 7/30 STR 300V	5.5	610
P736		325X2201-555	WIRE #22 GRN 7/30 STR 300V	6	620
P736		325X2201-777	WIRE #22 VIO 7/30 STR 300V	8	630
P736		769X1424-004	LABEL P736 "REV I"	1	710
P736		P736R	PCB DD DEFLECTION RADIAL INSERT	1	720
P736		P737	PCB DD REMOTE BRD ASSY U3 (OBSOLETE - NOT AVAILABLE)	1	730