CONTENTS

SECTION 1. BRIEF SPECIFICATION

1.1 Power Input: 220-240VAC or 100-125/200-240VAC, 48-63Hz depending on model.

Power consumption	14"/15" models	17" models
Normal operation:	less than 100W	less than 120W
Screen saver operation:	less than 70W	less than 90W
VESA standby/suspend :	less than 30W	less than 30W
VESA Off mode:	less than 5W	less than 5W

NOTE: Power saving can only be achieved when suitable software and hardware is used in the attached computer.

1.2 Sync. Input:

TTL Levels: Presence of sync. signals determines the power saving status.

1.3 Signal Cable: 1.0 or 1.5 metres long with sub-miniature, 15 pin, compact D male connector.

1.4 Cathode Ray Tube:

14" (13V) Diagonal landscape mode or
15" (14V) diagonal FST landscape mode or
17" (16V) diagonal FST landscape mode, (Dual focus).
Dot pitch 0.28mm, anti-glare screen.
V Models only: VLMF (Very Low Magnetic Field emissions).
VA Models only: Anti-static and VLMF.
(All V and VA models have CRT's with a VLMF anti-static faceplate).

Models fitted with the Multi-media option have an integral 2 x 1W RMS (2 x 3W peak music power) stereo audio amplifier, two 3" round 16 ohms speakers, headphone socket (32 ohms), volume control and phono sockets.

1.5 Operating Ranges: Temperature: 10-35°C.
Humidity: 20-85% (non-condensing).

1.6 Weight: 14" (13V) 12kgs: 15" (14V) 14kgs: 17" (16V) 18kgs

1.7 Video Input: RGB analogue video signal 0.71V positive, 75 ohms impedance.

1.8 User Controls:

Power On/Off	Push button.
Brightness	Rotary.
Contrast	Rotary.
Keystone/Volume	Digital. (Volume - Multi-media models only).
H-Phase	Digital.
Width	Digital.
V-Centre	Digital.
Height	Digital.
Pincushion	Digital.
Tilt	Digital.
Manual Degauss switch	Push button. (17" models only).

1.9 Display Colours: Infinite (depends upon the graphics capability of the host computer).

1.10 Display Area: (Factory preset).

14" (13V) 260mm W x 190mm H approximately.
15" (14V) 270mm W x 203mm H approximately.
17" (16V) 305mm W x 230mm H approximately.

All models have full scan capability (edge to edge scan).

SECTION 2. PRECAUTIONS AND SAFETY

2.1 Observe all cautionary and safety related notes located on the chassis, cabinet and display tube.

2.2 Operation of the monitor with the back cover removed presents a potential shock hazard. Only personnel familiar with the precautions necessary for safe working on high voltage equipment should attempt to carry out servicing.

2.3 Always wear shatter proof goggles when removing, installing or generally handling the picture tube. People not so equipped should be kept at a safe distance when any such handling is being undertaken. Do not handle the picture tube by the neck or deflection coil. Do not carry the picture tube resting against the body.

2.4 The picture tube is designed and constructed to limit X-Radiation to a safe level during normal operation. To maintain the required level of protection and safe operation, replacement tubes must be correctly adjusted and any protective circuits ***must not be defeated***.

2.5 IMPORTANT - Safety Tests

After servicing, and before returning the monitor to the user, a thorough safety test must be carried out to ensure there is no potential shock hazard to any operator(s) using the monitor.

All the following tests must be performed. A monitor failing any of these tests should be rejected and have the problem rectified.

2.6 A.C. Leakage Test

Remove the power source. Connect the monitor to the circuit as in figure 1 below. Switch the monitor on/off switch to 'on'. A reading of less than 3.5mA should be obtained (ref. EN60950).

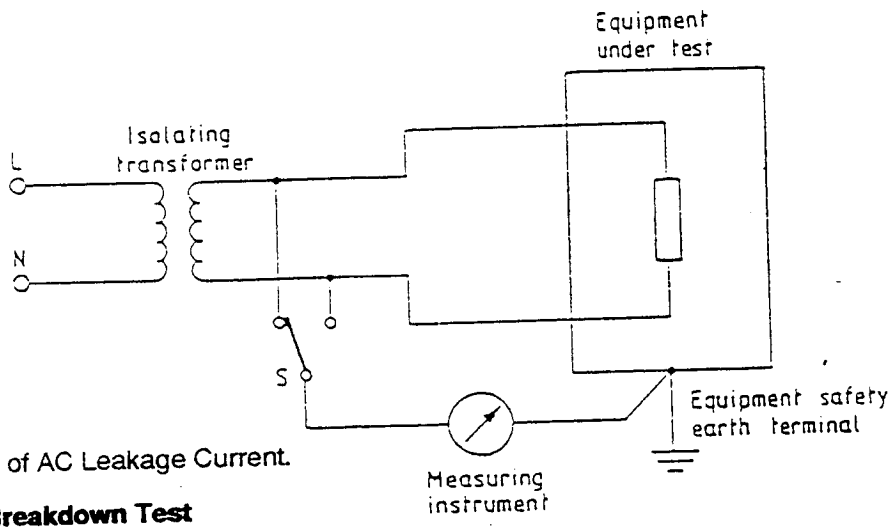


Fig.1. Measurement of AC Leakage Current.

2.7 Voltage Breakdown Test

Connect the live and neutral connections together. Switch the monitor on/off switch to 'on'. Apply 1500VAC RMS or 2250VDC, 50Hz for one minute between live and neutral shorted together and earth. Ensure no voltage breakdown occurs.

2.8 Earth Resistance/Continuity Test

Measure the resistance between the signal cable metal shell and the earth pin in the A.C. socket. At a current of 25 amperes the resistance should be less than 100mΩ.

NOTE: A portable appliance tester (PAT) is a suitable instrument to use for the above safety tests.

2.9 Critical Safety Components

A number of electrical components in this monitor contribute to operating safety, and the protection afforded by them cannot necessarily be maintained by using replacement components rated for higher voltage, wattage, etc. They are identified by the ⚠ symbol which indicates that only manufacturer's approved replacements are to be used.

2.10 Cabinet Back Removal

a) Place the monitor on its front, protecting the screen and cabinet with some suitable material, and remove the tilt/swivel base by pressing down its retaining clip at the rear of the swivel ball, and at the same time sliding the swivel base towards the back of the cabinet to release the bayonet catches.

b) Remove the retaining screw just below and to the right of the power inlet socket.

c) Remove the two retaining screws at the top left-hand and top right-hand corners of the cabinet back (if fitted).

d) Remove the screws from the bottom of the cabinet back.

e) The back can now be removed, threading the signal cable through its access opening.

SECTION 3. OPERATING INSTRUCTIONS

3.1 Introduction

This Service Manual covers 14", 15" and 17" models, including multi-media and DDC1/2B options.

The monitors support many display modes and resolutions, including:-
IBM VGA, VESA VGA, 8514/A, Super-VGA, XGA and UVGA up to 1280 x 1024 non-interlaced.

These display modes are achieved at a horizontal scan rate of between 30kHz. and 65kHz., and vertical scan rate of 50-110Hz, determined by the display adaptor in the PC.

The monitors automatically adapt to the horizontal and vertical frequencies given above. However, on non-standard display adaptor cards there may be differences in display sizes or centring when changing modes. The front controls allow fine adjustment of vertical and horizontal size and display position to compensate for non-standard display adaptors.

The Extended VGA monitor includes power management circuits to allow the monitor to save power when signalled to do so by the attached computer, for example, when the keyboard or mouse are not used for some time as defined by the user. The signalling method used conforms to the VESA Display Power Management System (DPMS) standard, and the power levels achieved meet the American Environmental Protection Agency (EPA) 'Energy Star', and the Swedish TCO 'NUTEK' requirements. When the system is used significant power savings can be achieved by shutting down parts of the monitor circuitry when a display is not required, resulting in energy cost savings over a period of time.

3.2 Connecting the video cable

Plug the monitor video cable (15 pin D-type connector) into your computer Video output connector, making secure with the locking screws on the connector. Be careful not to bend any pins by careless mating of the connector.
NOTE: If the monitor is switched on without the video cable connected, it will enter power management mode and the power LED will flash.

3.3 Connecting audio leads

Multi-media versions of the monitor are provided with an internal stereo audio amplifier and speakers. The audio connections are at the rear of the cabinet consisting two 'phono' sockets for the audio input, and a 3.5mm 'jack' socket for the connection of headphones if required. When the headphone socket is used the internal speakers are automatically disconnected.

3.4 Controls

3.4.1 Power On/Off

The On/Off switch is located on the right with the 'Power On' LED. The LED should illuminate shortly after switching on and the display should appear within 30 seconds.
Important Repeatedly switching On and Off should be avoided. This action may operate the safety protection circuits. If this occurs or the supply is accidentally interrupted causing the safety protection circuits to activate, switch off and allow 30 seconds for the circuits to reset before switching on again.

3.4.2 User Controls

The front facia panel below the screen houses the following user controls (behind door on 14"/15" models).

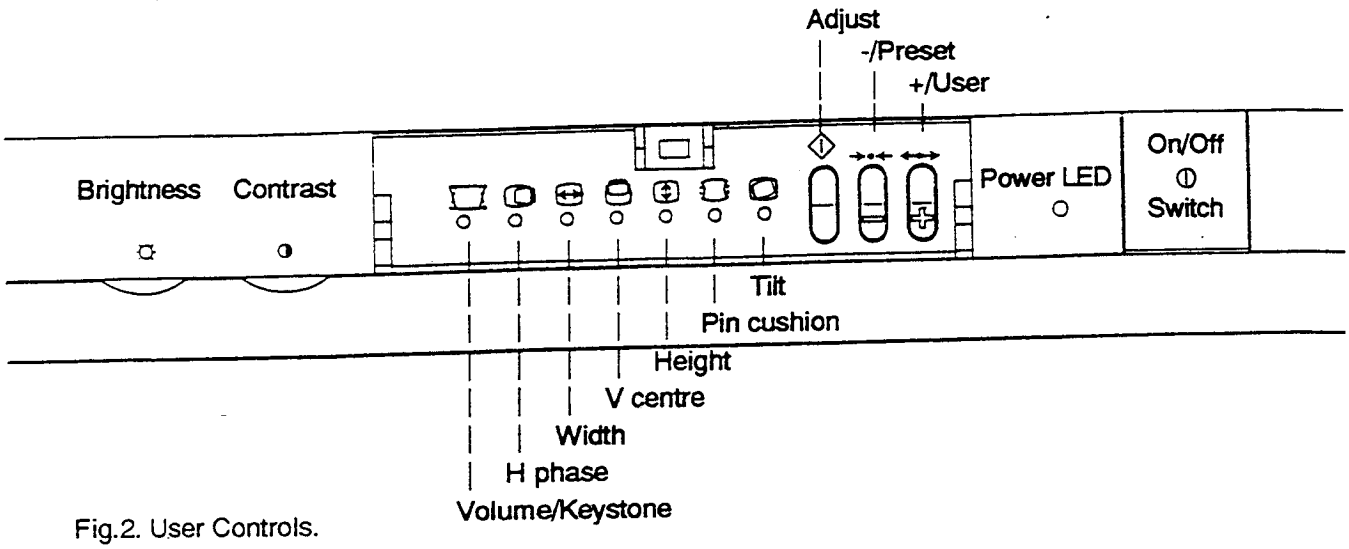


Fig.2. User Controls.

User Control Functions

☼ Brightness:

Varies the overall intensity of the display.

◑ Contrast:

Varies the differences between light and dark areas of the display.

Keystone/Volume:

Adjusts the relative display width between the top and bottom of the display (non multi-media models) or controls the sound volume (multi-media models). Sound volume may also be adjusted using the hardware or software controls provided with your computer.
NOTE: Keystone should be used in conjunction with Tilt and Pin Cushion adjustments.

H. Phase:

Centres the whole display on the screen horizontally.

Width:

Varies the horizontal size of the display.

Vertical Centre:

Centres the whole display on the screen vertically.

Height:

Varies the vertical size of the display.

Pin Cushion:

Adjust to compensate for barrel or pincushion shape distortion.
NOTE: Pin Cushion should be adjusted after Tilt and Keystone are corrected.

Tilt: (Not available on all models)

Rotates the whole display to compensate for small changes in the earth's magnetic field in your particular area.
NOTE: Tilt should be correct before adjusting Keystone and Pin Cushion.

 Manual degauss (17" models):

Corrects discolouration of picture caused by rotating the monitor while switched on.

3.4.3 Plinth

The plinth can be rotated or tilted to improve the viewing angle.

3.5 Mode Set Up

The monitor is supplied with the nominal display size and position for 20 modes already stored in memory. If further adjustment is required, this can be achieved by use of the push button controls.

The factory-stored settings provide the nominal display size and position for each preset mode, and are not user adjustable. The user may, however, store alternate settings for any factory stored mode. In this way a 'zoomed' display may be achieved by storing the necessary settings in the user memory whilst the standard settings remain in the factory preset area of memory. The user can then change from normal to zoom display, and *vice versa* with one key press.

3.5.1 Additional Display Modes

The monitor is supplied with factory default settings for a range of standard display modes pre-programmed into it's memory. When a previously unused mode is detected the monitor will select the nearest matching mode to it in memory, and the resultant display settings will be close to the optimum adjustment. If these settings require further adjustment, or if the user has a preference for a particular display size then the default settings may be changed and stored in memory. The revised settings will automatically be recalled the next time this mode is used. The horizontal and vertical frequencies are measured to a high degree of accuracy so the monitor can differentiate between the many modes currently in use and assign a unique memory to each mode required.

Start the following adjustment sequences with the monitor in normal operating mode. If any adjustment is not completed, the monitor will automatically return to normal operation after a suitable time-out period, storing any adjustment performed before the time-out period commenced.

To adjust the preset nominal settings for Keystone*/Volume* (depending on model), H.Phase, Width, V.Centre, Height, Pin Cushion and Tilt*:

1. Repeatedly press the 'ADJUST' key until the appropriate LED lights.
2. Press '-/PRESET' and/or '+/USER' until the required setting has been achieved.
3. Press 'ADJUST' key to move to next setting, or allow time-out to return you to normal operation.
4. Your new setting is now stored in 'USER' memory. The original 'FACTORY' setting is preserved and can be recalled when required. (See below).

* These adjustments are universal and common to all modes. Tilt is not available on 14" models and Volume will be present in place of Keystone on models with M in the model number.

To use 'FACTORY' settings for the current mode:

Press the '-/PRESET' key whilst in normal operating mode (all control area LED's off).

Picture settings will change accordingly (if applicable).

To return to 'USER' settings for the current mode (after using 'FACTORY' settings):

Press the '+/USER' key whilst in normal operating mode (all control area LED's off).

Picture settings will change accordingly (if applicable).

If no user settings have been previously stored, the monitor will use the current preset display settings.

To clear 'USER' settings for current mode:

Press and hold (for 5 seconds) the '-/PRESET key' in normal operating mode (all control area LED's off).

Picture settings will change accordingly (if applicable) and 'USER' memory for this mode will be cleared.

* These adjustments are universal and common to all modes.

3.5.2 Verification of Mode Selected

The preset mode, which the microcontroller has identified as the nearest match to the sync signals available, may be verified, when in normal operation or factory alignment menu, by pressing the +/USER key whilst the -/PRESET key is pressed. The microcontroller will then display, on the adjustment LEDs, a binary number (the LED furthest to the right corresponds to the least significant bit) which indicates the memory location of the control settings used. This gives the engineer a means of checking that the correct display mode is selected and/or confirming the mode in use.

It is also possible to check which user mode has been selected by the microcontroller, by pressing the -/PRESET key whilst the +/USER key is pressed. However, since the indication given is of the memory location used, and display modes are stored in the USER area of memory only in the order in which they are first identified, then the user mode number is of limited value.

3.5.3 Mode numbering

Modes are numbered according to the store that they occupy within non-volatile memory; USER modes are numbered 0 to 27 (decimal) and PRESET modes 28 to 50 (decimal).

The U-series, as delivered, will maintain the nominal display size, centring and geometry for the following display modes without need of adjustment by the user (Does not include test modes 24 and 25).

		Mode	Frequency		Sync. Polarity		Binary display on LED's LED Off = 0 LED On = 1	Decimal Value
			Hori'l (kHz)	Vert'l (Hz)	Horiz'l	Verti'l		
IBM VGA	640x480	0	31.47	59.94	-	-	001 1100	28
IBM VGA	640x400	1	31.47	70.00	-	+	001 1101	29
IBM VGA	640x350	2	31.47	70.00	+	-	001 1110	30
* SVGA	800x600	3	35.16	56.25	-	-	001 1111	31
IBM 8514/A	1024x768	4*	35.52	86.96	+	+	010 0000	32
VESA VGA	640x480	5	37.86	72.81	-	-	010 0001	33
VESA VGA	640x400	6	37.86	84.14	-	+	010 0010	34
IBM CGA emulation	720x400	7	39.40	87.80	-	+	010 0011	35
VESA SVGA	800x600	8	48.08	72.19	+	+	010 0100	36
VESA SVGA	800x600	9	37.88	60.32	+	+	010 0101	37
VESA SVGA	800x600	10	48.36	60.00	-	-	010 0110	38
VESA 75Hz	640x480	11	37.50	75.00	-	-	010 0111	39
VESA SVGA 75Hz	800x600	12	46.88	75.00	+	+	010 1000	40
ICL T34/1	960x510	13	44.51	71.30	-	-	010 1001	41
VESA	1024x768	14	56.48	70.07	-	-	010 1010	42
ICL T26/2	960x520	15	52.60	84.20	-	-	010 1011	43
IBM XGA	1360x1024	16*	58.11	105.80	-	+	010 1100	44
VESA SVGA 75Hz	1024x768	17	60.02	75.03	+	+	010 1101	45
IBM XGA 75	1024x768	18	61.10	75.80	+	+	010 1110	46
NEC	1280x1024	19	64.31	60.00	-	-	010 1111	47
TEST MODES		24	67.93	125.11			010 1111	47
		25	31.16	45.09	-	-	001 1110	30

Table 1. Preset and Test Modes, Polarities and Timings

* . Interlaced mode.

SECTION 4. CIRCUIT DESCRIPTIONS

4.1 Power Supply

The power supply is of the fly back switch mode type and will operate over the input range 110-125V or 220-240V RMS ±10% (depending on model). The circuit is based around IC801 (UC3842AN) which directly drives the switching FET Q801 at a fixed frequency synchronized to the line output stage. The output power is regulated by duty cycle control depending on input voltage and output load.

European models are designed for 220-240V operation. In these models, diodes D801 - D804 form a full wave bridge rectifier and CE807 provides smoothing.

North American models are designed for 110-125V or 220-240V operation. This is accomplished by either manual or automatic mains switch select. With the switch open (220-240V operation), diodes D801-D804 form a full wave bridge rectifier and capacitors CE807 and CE808 in series provide smoothing. With the switch closed (110-125V operation), diodes D801-D804 with capacitors CE807 and CE808 form a voltage doubler network. This ensures that the rectified DC voltage at the transformer (T801) primary is the same as for 220-240V operation.

Automatic mains switch select (option) IC805 is an automatic switch which allows the monitor to be operated at 110-125V or 220-240V without adjustment by the user. Pins 2 and 3 of IC805 are connected across SW1 and SW2. At switch-on pin 5 of IC805 senses the peak voltage of the mains supply. If the supply is 220-240V then pins 2 and 3 of IC805 remain open circuit. Rectified DC voltage is provided at T801 primary as described previously for switch open. If, at switch-on, the supply is 110-125V pins 2 and 3 of IC805 become short circuited. This again forms a voltage doubler network, as described for switch closed, and therefore provides the same rectified DC voltage at T801 primary as for 220-240V operation.

At switch-on pin 8 of IC801 is at 0V, TR806 switched off and Q804 switched on, enabling current flow from the rectified mains supply via R868, Q804 and D830 to pin 7 of IC801. The voltage rises across CE812 until the starting threshold of nominally 16 volts is achieved. IC801 now starts to operate feeding pulses to Q801 drain, via R825, from pin 6. The power supply can now supply operating current to IC801 from a winding on transformer T801 via R823 and D812. The nominal operating voltage at pin 7 of IC801 is 15 volts DC. The start-up supply is no longer required and is disabled using a reference voltage generated at pin 8 of IC801. This is used as a control voltage to switch TR806 on and Q804 off.

If the start-up switch (Q804) should become faulty (resistive) then current will pass through R868 from rectified mains. This would cause excessive power consumption in VESA off mode. To prevent this, after Q804 is switched off, TR807 switches on. If current passes through Q804, it will also pass through TR807 developing a voltage across R873 and R813. If the voltage exceeds 0.65 volts then TR808/TR809 latch circuit will be triggered. When triggered the power supply is disabled and latched off due to sustaining current through R868, Q804, D830 and R876.

Additionally, if an overload occurs in the chassis it is sensed by the power supply, pin 3 of IC801, which is momentarily disabled (primary over current sensing). This causes pin 8 of IC801 to fall to 0 volts, switching on Q804. Current flows through TR807 which is held on by the delay circuit C844 and voltage is sensed by the latch circuit input. Pin 1 of IC801 is pulled to 0 volts and the power supply disabled.

The circuit operates as follows:-

IC801 turns on Q801 causing a linear rise in current in the primary winding 1-4 of T801. After a period of time determined by voltage sensed across R828, in conjunction with feedback voltage via IC802, Q801 is turned off. Energy is now stored in T801 magnetized flux and is transferred to the secondary circuits due to fly back action induced in the primary. Diodes D818, D820, D824, D827 and D822 conduct until the transformer is de-magnetized. After a short delay, Q801 is turned on again as before.

The transformer secondary winding outputs are rectified and smoothed to produce DC voltages of 195V, 80V, 26.5V, 16V and 8 volt nominally. Linear secondary regulators are also used to provide 12V, 5V and 6.3 volts DC. In addition, on 17" monitors only, a voltage multiplier network from the 195 volts winding provides approximately 700 volts for dynamic focus.

The main regulation circuit is based around IC803 which conducts heavily when the voltage on the reference pin exceeds 2.5V. The regulation circuit directly senses the 80 volt supply rail on the secondary side. The control signal is fed back to the error amplifier in IC801 via the opto-isolator IC802. This forms the voltage feedback loop. A current feedback loop is also employed on the primary side to directly sense Q801 drain-source current. The linear ramp voltage sensed across R828 is fed into pin 3 of IC801 via a filter network R826 and C813 which removes transient spikes. The current feedback circuit actively limits the peak transformer flux during each cycle and is used to provide feed-forward compensation to improve supply line regulation.

A protective clamp is incorporated on the 195 volt winding formed by D819, C825, R833 and R879 to prevent damage to D818 under certain conditions. The dv/dt on Q801 drain is limited by C819 charging via D811 when Q801 turns off. Additionally, D809, C818, R831 and R832 clamp the peak drain voltage to <700 volts to prevent damage to Q801.

For horizontal scan frequencies in the range 31-45kHz, the operating frequency is synchronized to the horizontal output stage using a double-insulated single turn of wire around the horizontal fly back transformer core. This sync. pulse is fed onto pin 4 of IC801 via TR801, but is momentarily disabled, at switch-on, by TR802 TR802 holding TR801 collector high. For frequencies the range 45-65kHz, the operating frequency is synchronized to half the horizontal scan frequency.

4.2 U Series 80C51 Microcontroller Pin out

Pin	I/O	Monitor Function	Direction
1	i/o	tilt	o
2	i/o	pincushion (east/west)	o
3	i/o	horizontal phase	o
4	i/o	not connected	
5	i/o	trapezoid (or volume)	o
6	i/o	height	o
7	i/o	vertical centre	o
8	i/o	width	o
9	i	reset	i
10	i/o	\s2 (s-capacitor control)	o
11	i/o	\s0 (s-capacitor control)	o
12	i/o	\s1 (s-capacitor control)	o
13	i/o	normalized v.sync	i
14	i/o	h.sync	i
15	i/o	buffered h.sync	i
16	i/o	integrated h.sync	o
17	i/o	integrated v.sync	i
18	o	cpu oscillator	o
19	i	cpu oscillator	i
20	i	connect to 0V	i
21	i/o	serial data line	i/o
22	i/o	serial clock line	o
23	i/o	self test	o
24	i/o	standby	o
25	i/o	off	o
26	i/o	\user/+ key	i
27	i/o	\preset/- key	i
28	i/o	\adjust key	i
29	o	not connected	
30	i/o	not connected	
31	i	connect to logic '1'	i
32	i/o	not connected	
33	i/o	\volume led drive	o
34	i/o	\horizontal phase led drive	o
35	i/o	\width led drive	o
36	i/o	\vertical centre led drive	o
37	i/o	\height led drive	o
38	i/o	\pincushion (east/west) led drive	o
39	i/o	\tilt led drive	o
40	i	connect to +5V	i

Table 2. 80C51 Microcontroller Pin out Idents.

(This microcontroller is in a 40 pin DIP package)

\ - indicates active low input or output
i/o - can be input or output
i - input
o - output

4.3 Control Section

Mode detection and (digital) user controls, for a number of separate video modes, is provided by the 80C51 microcontroller (IC701).

This microcontroller is connected via a software driven I^2C (serial) bus, consisting of two lines viz, the serial clock line (SCL) and the serial data line (SDA), to an external non-volatile memory (IC702) which stores the control settings for all the modes.

The microcontroller detects the video mode in use and provides control signals to maintain correct picture size and position for each mode.

To assist with servicing and testing the microcontroller facilitates a number of test and set-up modes. These are detailed in section 4.13

4.4 Mode Detection

The microcontroller performs mode detection of the video mode in use by continuously checking the frequency and polarity of the incoming synchronizing signals.

Mode changes are detected and the control signals stabilised within one second of the change being made.

4.5 Sync. signals

The incoming horizontal and vertical sync. pulses are fed to IC703 (74HC86) which has the function of providing positive-going sync pulses to the line & field oscillators, as well as the microcontroller, regardless of the sync. polarities provided by the graphics circuit of the computer.

A monostable comprising transistors TR724-725, etc., conditions the horizontal syncs. to give fixed pulses of approximately 1μs.

The vertical sync. integrator comprising R708, C711, etc., extracts vertical pulses from composite syncs., when supplied.

Vertical sync. pulses are integrated by R724 & CE706 to provide a signal of the sync. polarity to the microcontroller (pin 17) and to IC703 (pin 10); the latter uses the sync polarity to invert the vertical syncs., if necessary, and thereby produce positive-going syncs.

The microcontroller determines the polarity of the horizontal sync. pulses (arriving at pin 14) and signals this to IC703 (pin 5) which uses the polarity to invert the horizontal syncs., if necessary, and thereby produce positive-going syncs.

The microcontroller determines the frequencies of the horizontal and vertical syncs. arriving at pins 15 and 13 respectively.

The microcontroller will differentiate between two display modes having the same sync. polarities and vertical sync. frequency, provided that the horizontal sync. frequencies are at least 250Hz apart.

The microcontroller will differentiate between two display modes with the same sync. polarities and horizontal sync. frequency provided that the vertical sync. frequencies are at least 0.5Hz apart.

Once the microcontroller has measured the frequencies and polarities of the applied sync. signals it will then search through the external memory (IC702) to find the closest match against the stored modes.

The microcontroller will then output the appropriate control settings (keystone or volume, h.phase, width, v.centring, height and optional tilt).

4.6 VESA OFF Control Circuit

To reduce power consumption to less than 5 watts, the main power supply must be switched off. 'VESA OFF' is detected by the monitor as no horizontal syncs. and no vertical syncs. When the microprocessor detects no syncs. (in user mode) after a delay of 5 seconds pin 25 of IC701 goes high, switching TR715 on and removing current flow from pin 1 of IC806. When no current flows through the diode, the transistor switches off allowing pin 5 of IC806 to be pulled up to +5 volts. This supply is sourced through two 47k resistors from rectified mains (R884/R888).
IC807 is a voltage comparator. When the voltage at pin 3 exceeds that at pin 2, pin 1 goes to +5 volts turning on TR804 and switching off IC801. This disables the main power supply. The power LED flashes to indicate 'VESA OFF'.
When the sync pulses are restored the microprocessor cannot respond because it has no power. Horizontal and vertical syncs. are fed directly to pin 1 of IC806 through R721 and R780. Sync. pulses provide enough current to enable IC807 to detect and switch off TR804. The power supply can then start up.

4.7 Power Management System

The monitor includes a power management feature which shuts down parts of the monitor circuitry to reduce power consumption when a display is not required. To operate this power saving feature it is necessary to have suitable VESA DPMS software and hardware in your computer. When signalled by the computer the monitor shuts down in three stages. In the first stage the screen is blanked and only a small power saving is achieved. The second stage shuts down the monitor scan circuits achieving considerable power reduction. The final stage reduces the mains power to a minimum. In the first two power saving modes the power LED remains on and recovery to normal operation is immediate (less than 3 seconds). In maximum power saving mode the power LED flashes and recovery to normal operation is less than ten seconds.

The microcontroller will automatically enter power management mode as signalled by the combination of sync. signals available at any instant. Power management is disabled when the monitor is in 'factory test' mode.

In the following table, horizontal sync. frequencies of less than or equal to 20kHz signify 'NO' horizontal syncs., and vertical sync. frequencies of less than or equal to 30Hz signify 'NO' vertical syncs.

X - indicates sync. may be present or not.

Signal Cable pin	Hor. Sync. 13	Ver. Sync. 14	Power LED Indication	Power Consumption
Normal Operation	Yes	Yes	Continuous	Normal
VESA Standby	No	Yes	Continuous	Less than 30W
VESA Suspend	Yes	No	Continuous	Less than 30W
VESA Off	No	No	Flashing	Less than 5W
Factory Test Mode	X	X	Continuous	Normal

Table 3. Power Management Sequence.

4.8 Power Management Operation

When both sync. signals are removed from the monitor then the monitor will enter VESA Off mode. In this mode, the power supply will be shut-down and the monitor will enter low-power operation. If only one of the sync. signals is removed, on the other hand, then the monitor will enter VESA Standby/Suspend mode In this mode the scan circuits will be disabled to reduce power consumption.

The overall time delay between loss of signals and actually entering either of the power-management modes will be approximately 6 seconds, but the PC will determine under what conditions these modes will be used and after what overall period of inactivity.

Recovery from VESA Standby/Suspend mode to normal operation will take approximately 3 seconds after the syncs. are restored.

Recovery from VESA Off mode to normal operation will take the same time as mains switch-on to normal operation.

4.9 B+ Regulator

The horizontal scan coil has to be driven with a constant amplitude sawtooth current at all of the possible scan frequencies. This is done by controlling the B+ voltage applied to the scan coil. The B+ regulator is based on a step-down switched-mode regulator comprising switching FET Q501, flywheel diode D503 and filter L501/CE504. When the FET is switched on, its source becomes connected to the +195 volt rail and the current in L501 increases. After a period determined by IC501, the FET is switched off and the current in L501 decays, flowing via D503 with the voltage at the FET source now falling to about -1 volt. The switched waveform at the source is smoothed by the filtering action of L501 and CE504. The average voltage at the output of the filter depends on the proportion of the time that the Q501 is on. This is controlled by sampling the peak voltage appearing on pin 5 of the horizontal output transformer T402. A rectified and smoothed sample is compared with the internal reference in IC501 and this controls the on time of Q501. The current feedback signal required by IC501 is simulated by the circuit R515, C510, with TR506 being used to trigger discharge of C510 via D505 and C510 at the end of the on period. The RC circuit creates an artificial current ramp. The output on pin 6 of IC501 drives a pulse transformer T501 directly, the secondary winding of which is connected to Q501 gate. The regulator is synchronized to the horizontal time base via C507, R528 and R529.

A pulse derived from the horizontal drive circuit is fed via timing capacitor C507 to pin 4 of IC501 to trigger the oscillator. The B+ regulator is inhibited from a full voltage start-up. Initially pin 7 of IC402 will be high. It will be fed via R505 and D515 to pin 2 of IC501 which will keep the B+ regulator output voltage at zero. Diode D504 allows the output of the B+ regulator to rise to 26.5 volts, enabling the horizontal output to operate at low level. After a short delay determined by R472 and CE432, pin 7 of IC402 is forced low releasing the over-ride on pin 2 of IC501, enabling the regulator to operate as normal.

4.10 Vertical Deflection

The incoming sync. signal locks the vertical oscillator to provide a steady, synchronized display. The series combination C311/312 charge from a current out of pin 9 of IC301 , mirroring the current at pin 7 from TR302, with control provided by the microprocessor, to establish the correct height, producing a field rate ramp voltage on pin 9. The output current from pin 1 flows through the deflection coil CE309 and R307/R324. Feedback from R307/R324 into pin 12 is compared with this internally generated ramp to produce a linear scan.

Vertical centring (shift) is achieved by providing positive or negative offset current into the tube deflection coils via R345 and TR301, with control provided by the microcontroller.

4.11 Horizontal Deflection

The horizontal sync. pulse is used to synchronize a phase-lock loop (PLL), IC401, which controls the horizontal output. A variable-monostable (TR416/417/418) between the incoming sync. pulse and the PLL (IC401, pin 14) gives a variable delay to the timing pulse. A fixed monostable (TR419/420) is used to delay feedback from the horizontal time-base to the PLL (IC401, pin 3). Altering the delay has the effect of shifting the display horizontally.

The output of the PLL (IC401, pin 4) drives TR423 switching current into the base of the horizontal drive transistor TR422. IC402 is used to provide a start-up delay inhibiting the horizontal driver stage until the PLL is functioning correctly. The output from TR422 is coupled to the horizontal drive transformer whose secondary winding provides the high base current and controlled turn-off required by the horizontal output transistor TR402.

The horizontal output circuit is based on a diode modulator configuration. D403/C407 and D404/C409 form separate tuned fly back circuits with the horizontal deflection coil, and T403/C406 provides fine tuning and the voltage across C410 controls the scan width. In normal operation the voltage across C410 is a parabola with a positive d.c. offset voltage controlled by TR407.

PL406 allows a link selectable offset current to be added to the tube deflection coils to provide horizontal shift, RV414 provides adjustment.

The horizontal output section also includes a beam current limit circuit connected to the contrast control wiper of RV681 so that the screen light output is automatically limited to prevent excessive brightness. The voltage on the wiper is pulled low by TR415 if the beam current exceeds an average of 0.5mA.

4.12 Horizontal S-correction

The microcontroller controls s-correction by changing the amount of series capacitance in the horizontal deflection circuit. Following selection of a mode, the microcontroller switches in or out of circuit the appropriate combination of s-capacitors based on the measured horizontal sync. frequency of the current video mode.

The s-capacitors consist of C416 and C419 providing fixed correction, i.e. they are always switched in, and C413, C415 and C418 providing a switchable amount of s-correction.

Switching of the s-capacitors is controlled by the microcontroller using bi-polar transistors TR707-TR709 and field effect transistors Q401-Q403.

S-capacitor switching frequencies:

Horizontal sync. frequency (kHz)	S-capacitors output level* DD s2	DD s0	DD s1
<33.0	0	0	0
33.0 to <34.0	0	0	1
34.0 to <36.0	0	1	0
36.0 to <39.7	0	1	1
39.7 to <45.5	1	0	0
45.5 to <53.5	1	0	1
53.5 to <59.0	1	1	0
59.0 to <65.0	1	1	1

Table 4. S-Capacitor Switching.

* S-capacitor output at logic 0 is equivalent to s-capacitor 'switched in'.

4.13 Pincushion, Keystone and Horizontal Shift

These functions are performed by IC302 and IC303 which control the diode modulator. IC302 generates a parabola from the vertical current ramp fed into pin 2. This is internally compared with a horizontal rate sawtooth generated at pin 8. The output appears as a pulse-width modulated voltage at pin 5, which is filtered by R327 and C315. This is mixed with a DC control voltage from op-amp IC303 whose output drives the diode modulator controlling transistors TR406 and TR407.

4.13.1 Control of User Adjustments

The microcontroller controls Keystone (or volume), H. phase, Width, V. centring, Height, Pincushion and Tilt settings by means of seven digital to analogue converters (DAC's).

Each DAC consists of a discrete transistor/capacitor network which filters a repeated series of pulses generated by the microcontroller to give a D.C. control level.

4.14 Video Circuits

The monitor accepts RGB signals of 0.71 volt amplitude into 75 ohms. The incoming signals are capacitor coupled to the inputs of IC201. The function of IC201 is to provide gain control and clamping (D.C. restoration). The outputs at pins 16, 20 and 25 of IC201 directly drive the output amplifier IC202 which provides the CRT cathodes 40 volt (maximum) drive. The individual cut-off points for the tube are set by RV241/242/243.

4.15 Blanking

A pulse derived from the horizontal output stage is applied to C420 giving a sharply defined positive trigger at the start of fly back. This triggers monostable TR410/411 and gives a horizontal fly back blanking signal. This is combined with a vertical blanking signal derived from the vertical output (IC301, pin 13) to give a mixed blanking signal which is fed via PL402 and an amplifier consisting of TR201-TR204 on the video panel, to grid 1 on the CRT.

4.16 Audio Amplifier (Multi-media option)

On multi-media models an audio amplifier module is fitted to the main chassis P.W.B. by connector PL/SK606 and secured to the heat sink by two screws. The module uses a stereo amplifier circuit TDA2822M, (IC601) driving two 16 ohms speakers via PL601 and PL602, and a headphone socket SK603 for connection of headphones of 32 ohms impedance. The IC incorporates thermal shutdown and is protected by short circuit of the speakers.

Two MOSFET's in IC602 (4007VR) are used as digitally controlled attenuators (volume control) which control the signal input to the left and right amplifiers. A D.C. control voltage for these is provided by a simple digital to analogue converter based around TR730 on the main chassis P.W.B. This voltage is fed to the audio module to control the FET gates, with RV619 allowing a shift in range to compensate for variations in IC602 parameters, (see section 5.30 for adjustment procedure).
A third MOSFET in IC602 is used to pull the control voltage high at 'switch' on and 'switch off' to mute the noise bursts which would occur. At 'switch on' pin 10 of IC602 is held low until CE614 charges via D601 and R616. At 'switch off' CE624 discharges via D602, and CE615 maintains power to IC602 until the amplifier has shut down.
The input sockets SK604 and 605 are also part of the module.

Input signals should not exceed 150mV rms, otherwise distortion may occur. Input impedance is 22Kohm.
Insertion of the headphone jack disconnects the loudspeakers.
Resistors R608 and R609 limit the audio level to the headphones. High frequency stability of left and right channels is provided by CE611, R606 and CE613, R607. Protection against short circuit of the 16V supply is provided by R761 on th main chassis P.W.B.

4.17 Protection Circuits

4.17.1 Power Supply

The mains input fuse FS801 is of the time-delay type. Replacements must be of the same type and rating.

Immediately after the power supply has started Q804 is switched off This will prevent the power supply from re-starting in the event of a fault occurring. For example, the power supply will shut down (after a single start attempt) if any output is shorted. De-magnetization sensing is provided by D814 which feeds a voltage produced by the transformer secondary winding 8-9 onto pin 3 of IC807. Diodes D815, D816 and D817 limit the input to 1.8 volts maximum. This signal is a representation of the transformer flux during the secondary discharge cycle and only when it has fallen to zero can the IC begin another cycle. This circuit is constantly active but normally only limits the flux during the start-up sequence, or in the event of overload, or input under voltage.

Over-voltage protection has been included for fail-safe operation. The zener diode ZD806 conducts if the IC801 supply voltage derived from T801 exceeds 16.5 volts. This causes TR809 to turn on, and pull pin 1 of IC801 low. In addition, TR808 is turned on, latching pin 7 of IC801 low, disabling the power supply.

4.17.2 B+ Regulator

In the event of the B+ rail being short circuited D504 conducts heavily.This effectively shorts the 26.5 volt rail to ground and as a consequence the power supply shuts down. IC401 (B+ INHIBIT LOGIC) prevents full B+ voltage being applied to the line output stage at start-up. Also the balanced network R468/469 and R473/482 together with IC402 will immediately inhibit the B+ regulator when the power supply turns off.

4.17.3 Horizontal Drive

FS401 protects against the possible failure of TR422, CE401 or T401.

4.17.4 Horizontal Scan

The EHT is protected from exceeding a safe limit by monitoring the fly back pulse amplitude at pin 3 of T402. If it exceeds a factory preset limit, ZD420 conducts and causes a diode in the opto-isolator IC806 to conduct much more than normal, resulting in the power supply control IC801 reducing its output until its own supply is too low to function, thereby switching off the PSU, and the B+ Regulator is quickly inhibited via D513 and IC402. The circuit typically operates at an EHT of 28kV.

4.17.4.1 Beam Current Limit

The maximum beam current is automatically limited by TR414 and TR415 during normal operation. In the event of a fault causing excessive current flow in the EHT winding TR403 and TR404 are triggered by current from TR413 which shuts down the Power Supply and B+ regulator as above.

4.17.5 Pincushion Circuit

R411 gives protection to the pincushion circuits.

4.18 Factory Test

There are four facilities provided specifically to aid factory (or service) alignment. These are Non-volatile Memory Programming (NMP), Factory Alignment (FA), Enable Control Limits (ECL) and Disable Control Limits (DCL).

For factory test purposes these facilities will normally be used in the order NMP (prior to soak test), FA (after soak test) and ECL (final switch-on).

4.19 Initiating Test Facilities

Test facilities are initiated by satisfying various conditions during mains switch on.

4.20 Non-volatile Memory Programming

Non-volatile Memory Programming (NMP) is a means of programming the external memory (IC702) with default values when the memory is first installed or replaced. There are two methods of initiating the programming sequence; automatically when the memory is first fitted, or by manual override if necessary. During NMP the default video modes and their control settings are stored in the memory.

Also during NMP, a TEST flag will be set in the non-volatile memory to indicate that factory mode is in operation. This flag will remain set until specifically reset by an Enable Control Limits (ECL) or a Disable Control Limits (DCL) operation. When set, the TEST flag ensures that whenever the monitor is switched on operation is changed from normal in the following ways:

a). Power management operation is disabled.

b). Self test operation is enabled.

4.20.1 Manual Operation

If pin 36 of the microcontroller is connected to ground prior to switch-on (or reset of the microcontroller), then the microcontroller will copy the default settings from microcontroller memory (ROM) to the NVRAM; any USER created settings will be erased.

4.20.2 Automatic Operation

If, at switch-on, the microcontroller detects that the non-volatile memory is empty (no factory default settings stored) then the microcontroller will automatically copy the default settings from its internal memory (ROM) to the external memory; any USER created settings will be erased.

4.20.3 Indication

At switch-on into either manual or automatic NMP, the Horizontal Phase and Pincushion LEDs will be flashed in unison and will remain flashing until either the monitor is switched off, or the -/PRESET or +/USER key is pressed to start Factory Alignment.

4.21 Factory Alignment

If the ADJUST and +/USER keys are held down, or the TEST flag is set at switch-on, or the -/PRESET or +/USER key is pressed after an NMP operation, then the microcontroller will enter the Factory Alignment mode. This mode offers a range of functions accessible from a test 'menu'.

If, during Factory Alignment (excluding factory range check), a video mode is used which does not match exactly to one of the factory default modes programmed by the NMP operation, then the Height and Pincushion adjustment LEDs will be flashed alternately and the microcontroller will ignore the adjust key until a suitable mode is detected. This avoids alignment being performed on modes which are not relevant to the test specification.

NOTE:Factory range check (see section 5.3.4) will always be allowed irrespective of the applied graphics mode.

The criteria for an exact match of video mode with factory default mode are as follows:

1. Measured frequency = default frequency +/- tolerance, where tolerance is better than 0.5Hz for vertical frequencies and better than 250Hz for horizontal frequencies.

2. Measured sync. polarities = stored sync. polarities.

NOTE: For horizontal frequencies greater than or equal to 32kHz then both sync. polarities will be ignored.

In Factory alignment, Power Management will be disabled and Self-Test (see section 4.15.7) enabled.

4.21.1 Operation

On entering Factory alignment, the H Phase LED (or Width LED following an NMP operation) will be flashed to indicate that the menu is available. The engineer may then select different tests by using the +/- keys to move from one menu item to the next. In this mode, the adjustment LEDs will have alternate functions (see below) to those used in normal operation.

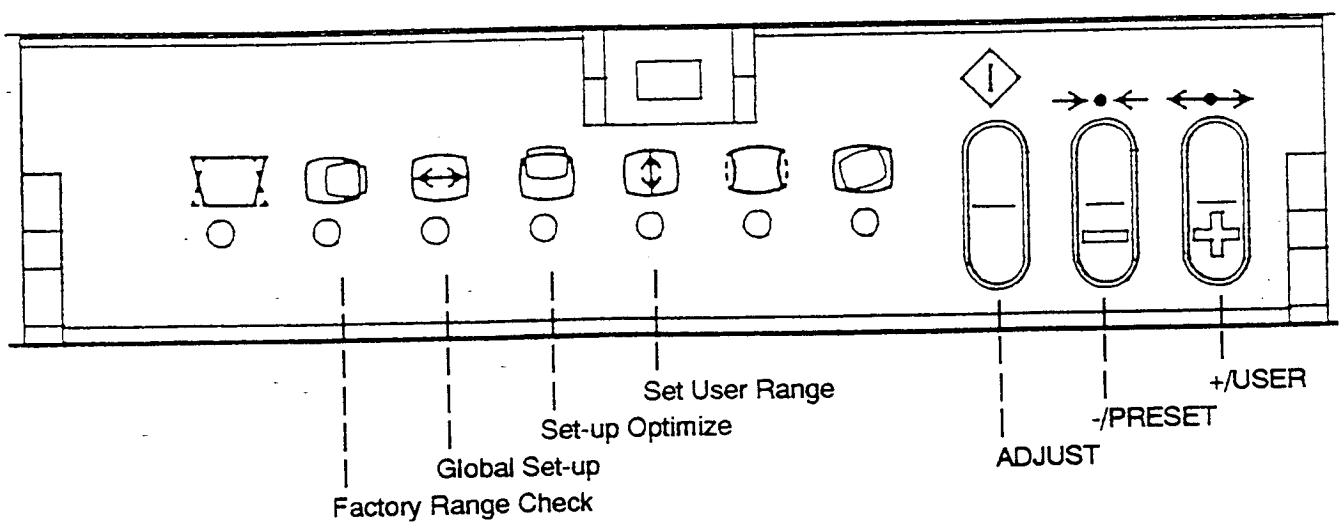


Fig.3. Factory Alignment Menu Functions.

With the appropriate LED flashing, pressing the ADJUST key will cause the microcontroller to enter the corresponding test mode. Each test then operates as detailed below.

4.21.2 Global Setup

Global Setup functions in a similar manner to normal operation but any adjustment to the horizontal phase, width, vertical centre, height or pincushion will automatically be copied to all mode stores.

Using Global Setup, any adjustments common to all modes e.g. to compensate for component tolerances on the particular monitor, may be made in one operation.

Global Setup is selected by pressing the ADJUST key when the Width L.E.D. is flashing.

4.21.2.1 Storage of Adjusted Parameters

Any revised settings are stored only when the ADJUST key is used to step to the next Global Setup function, there is no storage of control settings via a time-out. All default modes are adjusted and (re-)stored when the ADJUST key is used to step to the next parameter. It is possible that, due to an incorrect or faulty component, the setting required for the mode in use causes the control setting for some other modes to be outside of the normal range. To maintain the necessary differentials between modes an extra 'protection band' is maintained for control settings beyond the normal (127 step) resolution. If the settings for any mode are within this protection band when the ADJUST key is pressed and the memory updated, then the Keystone (Volume) L.E.D. will be flashed and the ADJUST key must be pressed a second time before the next Global Setup function can be used. This alerts the engineer to the fact that the control settings for one or more modes will have no user adjustment in one direction. This will normally only happen if a component fault exists on the chassis.

4.21.3 Setup Optimization

Setup Optimization allows the engineer to check and/or optimise the default settings for each of the default video modes.

Setup Optimization is selected by pressing the ADJUST key when the V.Centre L.E.D. is flashing, and operates in the same manner as for normal operation, except that the settings in the FACTORY memory are adjusted instead of those in the USER memory.

Using this facility, the default settings can be fine-tuned, if required.

4.21.4 Factory Range

This test is intended to be used as a quick check to ensure that the control circuitry is functioning correctly and that sufficient control range is available to the engineer during Global Setup and/or Setup Optimisation.

Factory Control Range check is selected by pressing the ADJUST key when the H.Phase L.E.D. is flashing. This will cause the Keystone (Volume) L.E.D. to light. Further presses will select the other parameters (LEDs) in turn for the parameter selected:

-/PRESET key will select the minimum value of the parameter or, if the maximum is currently selected, the nominal value.

+/USER key will select the maximum value of the parameter or, if the minimum is currently selected, the nominal value.

NOTE: Pressing the ADJUST key, as well as selecting the next parameter, will restore the parameter to its nominal value.

4.21.5 Set User Range

The Set Range function allows the engineer to set limits on certain User controls, if necessary, to avoid the USER selecting an extreme control setting which gives an obvious display degradation. When this option is selected the adjustment LEDs have alternate functions as shown below. The engineer may select the required option by pressing the ADJUST key until the appropriate L.E.D. is lit. The control limit may then be set by using the +/- keys and observing the effect on the display until the required setting is achieved. This setting will be stored when the ADJUST key is used to step to the next function.

NOTE 1 The function of the Keystone/Volume control is dependent on model, therefore it is possible to set a maximum Keystone range, should this be required.

NOTE 2 This facility affects the control range for all modes if it is used. It is the engineer's responsibility to ensure that sufficient control range is available in all required modes.

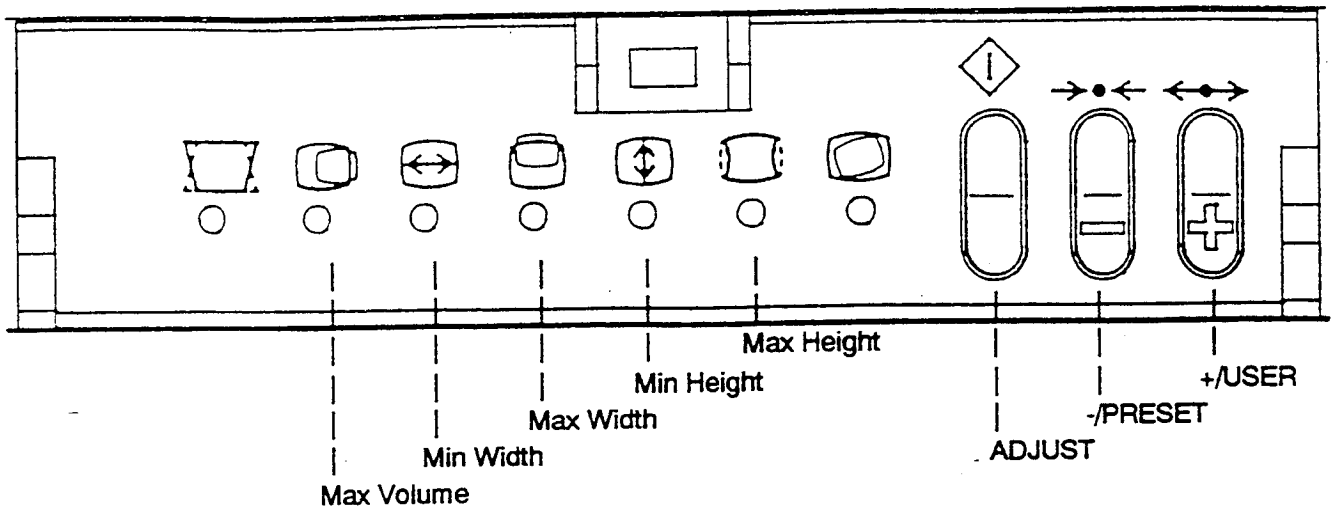


Fig.4. Set User Range Menu Functions.

4.21.6 Disable Control Limits

This test function allows cancellation of the control limits set by the Set User Range function and is intended to allow an engineer to change the limits to accommodate new display modes, if they should require further control range. In addition, this function resets the TEST flag in the NVRAM thereby enabling power management and disabling self-test.

4.21.7. Operation

Disable Control Limits is initiated by holding the +/USER key down during mains switch-on.

4.21.8 Enable Control Limits

This test function allows (re)instatement of the control limits set by the Set User Range function, and resets the TEST flag in the NVRAM thereby enabling power management and disabling self-test.

4.21.8.1 Operation

Enable Control Limits is initiated by holding the -/PRESET key down during mains switch-on.

4.21.9 Self-Test

In factory test/alignment mode power management is disabled and the Self-Test facility enabled. This has the effect of producing a white raster whenever both sync. signals are missing; the microcontroller (IC701) activates the Self-Test line, which produces the white raster, approximately 6 seconds after loss of syncs.

The Self-Test line goes inactive and hence the raster returns to normal only when both syncs. have been restored.

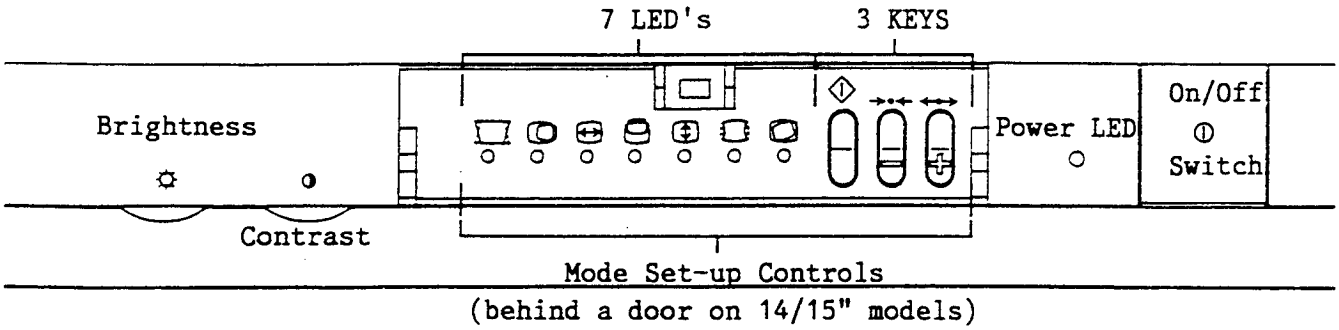


Fig.5. Front Panel Overall Layout

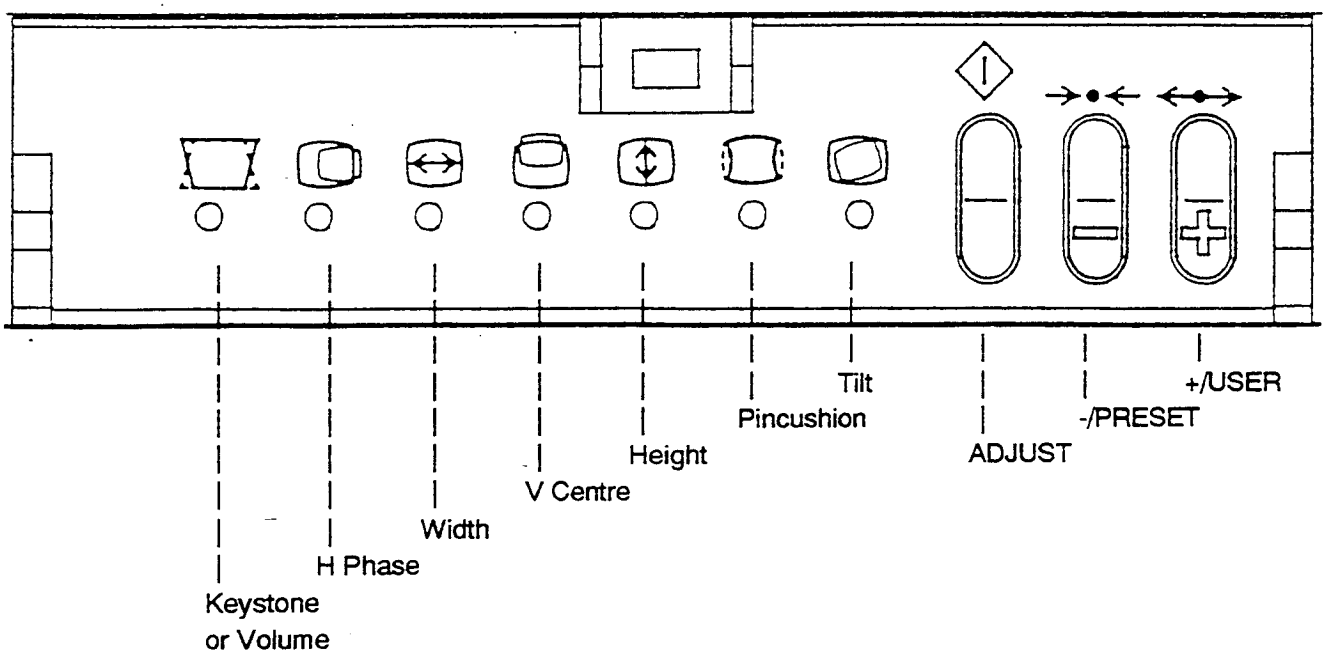


Fig.6. Control Area Detail

4.21.10 U-Series Link Option

If link LK701 is not fitted then the microcontroller will facilitate Tilt (raster rotation). If this link is fitted then the Tilt facility will be disabled.

4.22 Audio Amplifier Circuit (multi-media option).

This is a self-contained panel based upon the TDA2822M stereo amplifier (IC601), with digital volume control provided by field effect transistors in IC602.

IC602 contains six closely matched MOSFETS, two of which are used as variable attenuators to control the left and right inputs to the amplifier. A D.C. control voltage is supplied from the simple D to A converter based around TR730 on the main panel. This voltage is fed to the audio board to drive the FET gates, with RV619 allowing a shift in range to suit variations in FET resistances between different IC's. A third MOSFET in IC602 is used to pull the control voltage high at switch-on and switch-off, to mute bursts of noise which would otherwise occur. At switch-on pin 10 of IC601 is held low until CE614 charges via D601 and R616. At switch-off CE614 discharges via D602. De-coupling capacitor CE615 maintains power to IC602 until the amplifier has shut down.

R761 on the main panel protects against shorting the 16V supply to the audio panel.

4.23 **DDC Panel** (DDC1/2B)

IC281 is a DDC1/2B compatible eeprom which contains the display data channel (DDC) data for the monitor. This data can be accessed by a suitable computer (connected via its signal lead) and used for identification and configuration purposes.

The supply voltage (5V) for IC281 at pin 8 is derived from either, the monitor's own power supply when the voltage at SK281 (CRT's heater supply) is greater than the voltage at pin 6 of PL209 (from the computer), or the graphics card of the computer driving the monitor when pin 6 of PL209 is at a higher potential than SK281. This arrangement allows a DDC computer to read the DDC data even when the monitor is powered down.

The current drawn by IC281 is approximately 1mA.

NOTE: If the monitor is operating with either the field or line syncs. missing the heater voltage (SK281) will be approximately 3.7 volts.

C286 and CE285 de-couple the supply to IC281.

DDC data is serially clocked from pin 5 of IC281 and transferred to the computer via the Serial Data (SDA) line of the signal lead. The clock source for this is provided by either the field sync output of the computer to pin 7 of IC281, or the Serial Clock Line (SLC) of the computer to pin 6 of IC281. Whichever is used depends on the attached computer.

NOTE: If SCL is used by the computer, data on the SDA line is bi-directional, i.e. it may be sent as well as received by the computer. When SCL is used IC281 ignores anything on pin 7.

On the SDA line R282 and C282 provide filtering, D281 and D282 - transient protection and R285 is a pull-up resistor. SCL has a similar arrangement.

Ferrite beads FB218-220 and capacitors C243 and C344 filter the field and line syncs. to reduce the electromagnetic radiation (EMC).

SECTION 5 SERVICE TEST PROCEDURES

5.1 General

This section details the tests, voltage measurements and adjustments which can be made to ensure correct operation of the various circuits.

(Final set-up procedure is given in section 6).

5.2 Equipment required

5.2.1 Isolated variable voltage transformer (90V-265V @ 500VA).

5.2.2 Signal source to provide signals as defined in section 3.6.

5.2.3 Dual beam oscilloscope (100MHz).

5.2.4 Digital multi meter (1000V @ 10MΩ).

5.2.5 E.H.T. meter (30kV).

5.2.6 Low distortion audio source with 0-700mV r.m.s. @ 600Ω output.
Headphones with appropriate 3.5mm 'Jack' stereo connector.

5.3 Power Supply

5.3.1 Drain Waveform

5.3.2 Connect x100 scope probe to Q801 drain with earth to P.S U. zero volt reference.

WARNING: *CONNECTING SCOPE PROBE TO P.S.U. REFERENCE MUST NOT BE ATTEMPTED WITHOUT THE USE OF AN ISOLATION TRANSFORMER.*

5.3.3 Select mode 19.

5.3.4 Where supply switch is fitted ensure this is set to 230 volts.
Switch on power and check that drain waveform is as in appendix A1

5.3.5 Check that power L.E.D. is lit continuously.

5.3.6 If chassis is being powered up for the first time, 'horizontal phase' and 'E/W parabola' L.E.D's should be flashing simultaneously.

5.4 Output Voltages (initial relative to chassis 0 volts).

5.4.1 Measure 80V supply at CE822. (Adjust RV840): 80V ±0.5V.

5.4.2 Measure 195V supply at CE821: 195V ±5V

5.4.3 Measure 26.5V supply at CE823: 26.5V ±1.5V

5.4.4 Measure 16V supply at CE837: 16V ±2V

5.4.5 Measure 8V supply at CE841: 8V ±1V

5.4.6 Measure 12V supply at CE838: 12V ±0.5V

5.4.7 Measure 5V supply at CE714: 5V ±0.25V

5.4.8 Measure B+ supply at pin 2, T402. (Adjust RV512): 165V ±0.5V

5.5 P.S.U. Synchronization

5.5.1 Connect Y1 x10 scope probe to pin 1, of SK701 (horizontal sync. input).
Connect Y2 x100 scope probe to D818 anode.
Select mode 7.
Ensure the P.S.U. is synchronized and at the same frequency as the sync. pulses.

5.5.2 Select mode 12.
Ensure the P.S.U. is synchronized and at half line sync. frequency.
Remove power from chassis.

5.6 SAFETY TEST - Over Current Protection

5.6.1 With the power removed from the chassis connect a 10Ω, 15W resistor with a 5 amp protection fuse across CE821.
Connect x100 scope probe to CE821.
Connect power.
Check voltage across CE821 does not exceed 1 volt and the P.S.U. is disabled.

5.6.2 With power connected remove 10Ω load and ensure the voltage across CE821 remains at <1 volt.

5.6.3 Remove power.
Discharge CE820 using a 1kΩ, 5W resistor.
Reconnect power.
Check the voltage across CE821 is 195V ±5V.

5.7 SAFETY TEST - Over Voltage Protection

5.7.1 Connect x100 scope probe to CE821.
Connect power.
Measure voltage across CE821: 195V ±5V.

5.7.2 Connect a 470Ω resistor from IC803 control gate to 0 volts.
Ensure the P.S.U. is disabled and the voltage across CE821 falls to <1 volt.

5.7.3 Remove the 470Ω resistor and ensure the voltage across CE821 is <1 volt.

5.7.4 Remove power.
Discharge C820 using a 1kΩ, 5W resistor.
Reconnect power,
Check the voltage across CE821 is 195V ±5V.

5.8 SAFETY TEST - Start-up Circuit Leakage Test.

5.8.1 Connect x100 scope probe to CE821.
Connect power.
Check the voltage across CE821 is 195V ±5V.

5.8.2 Connect a 220kΩ, ¼W resistor* between Q804 drain and gate.
Check the P.S.U. is disabled and the voltage across CE821 falls to <1 volt.

5.8.3 Remove resistor from Q804 and ensure the voltage across CE821 remains at <1 volt.

5.8.4 Remove power.
Discharge C820 using a 1kΩ, 5W resistor.
Reconnect power.
Ensure voltage across CE821 is established.

***Warning** *The 220kΩ resistor used in the above test must be connected with the aid of a switch to avoid risk of electric shock.*

5.9 Power Line Regulation

5.9.1 Remove 230V mains supply.
Connect 185V A.C. supply.
Measure 80V supply: 80V ±1V.
Remove 185V A.C. supply.
Connect 265V A.C. supply.
Measure 80V supply: 80V ±1V.
Remove 265V A.C. supply.

5.10 115V Operation

NOTE: *This section applies to dual voltage versions only.*

5.10.1 Remove power from chassis.

5.10.2 Manual versions only. Switch voltage selector to 115V operation.

5.10.3 Connect 115V A.C. supply to mains input.
Check voltage across CE822 is 80V ±1V.

5.10.4 Reduce the 115V input supply to 90V.
Check voltage across CE822 is 80V ±1V.

5.10.5 Increase the 115V input supply to 137V.
Check voltage across CE822 is 80V ±1V.

5.10.6 Remove power.
Switch voltage selector to 230V.

5.11 CONTROL SYSTEM

5.11.1 Connect power to chassis.
Select signal Mode 19.
Connect D.V.M. to pin 40, IC701.
Measure 5V supply: 4.75V-5.25V.

5.11.2 Factory Test Mode.

5.11.2.1 If H.Phase L.E.D. only is flashing, the chassis is already in test mode. Go to 5.12.

5.11.2.2 If H.Phase and Pin-cushion L.E.D's are flashing allow chassis to remain switched on for a minimum of 5 seconds.
Press '-/PRESET' key until H.Phase L.E.D. only is flashing. Go to 5.12.

5.11.2.3 If no L.E.D's are flashing remove power from chassis.
Depress both 'Adjust' and '+/USER' function keys.
Connect power to chassis and, after one second, release both function keys. The H.Phase L.E.D. only should be flashing.

5.12 D.A.C. Range Test

Note: Nominal voltages may vary from those shown depending on adjustment setting.

5.12.1 Depress 'Adjust' function key once.
Check the Keystone/Volume L.E.D. is illuminated.

5.12.1.1 Connect D.V.M. to CE720(+).
Depress '-' key once. Measure voltage maximum: >3.8V (keystone).
>10V (volume).

5.12.1.2 Depress '+' key once. Measure voltage nominal: 2.0V-2.5V (keystone).
1V-1.5V (volume).

5.12.1.3 Depress '+' key once. Measure voltage minimum: <1.75V (keystone).
<0.25V (volume).

5.12.2 Depress 'Adjust' function key once

5.12.2.1 Check the H.Phase L.E.D. is illuminated.

5.12.2.2 Connect D.V.M to CE429(+).
Depress '-' key once. Measure voltage minimum: <1V.

5.12.2.3 Depress '+' key once. Measure voltage nominal: 3.5V-5.5V.

5.12.2.4 Depress '+' key once. Measure voltage maximum: >7V.

5.12.3 Depress 'Adjust' function key once.

5.12.3.1 Check the Width L.E.D. is illuminated.

5.12.3.2 Connect D.V.M. to pin1, IC303.
Depress '-' key once. Measure voltage minimum: >12V.

5.12.3.3 Depress '+' key once. Measure voltage nominal: 7V-10V.

5.12.3.4 Depress '+' key once. Measure voltage maximum: <0.5V.

5.12.4 Depress 'Adjust' function key once.

5.12.4.1 Check the Vertical Centre L.E.D. is illuminated.

5.12.4.2 Connect D.V.M. to TR301 emitter.
Depress '-' key once. Measure voltage minimum: 0.25V-0.75V.

5.12.4.3 Depress '+' key once. Measure voltage nominal: 3V-5V.

5.12.4.4 Depress '+' key once. Measure voltage maximum: 9.5V-10.5V.

5.12.5 Depress 'Adjust' function key once.

5.12.5.1 Check the Height L.E.D. is illuminated.

5.12.5.2 Connect D.V.M. to TR302 emitter.
Depress '-' key once. Measure voltage minimum: 1.25V-1.75V.

5.12.5.3 Depress '+' key once. Measure voltage nominal: 2V-3V.

5.12.5.4 Depress '+' key once. Measure voltage maximum: 4.75V-5.5V.

5.12.6 Depress 'Adjust' function key once.

5.12.6.1 Check the Pin-cushion L.E.D. is illuminated.

5.12.6.2 Connect D.V.M. to TR304 collector.
Depress '-' key once. Measure voltage minimum: <0.5V.

5.12.6.3 Depress '+' key once. Measure voltage nominal: 10V-13V.

5.12.6.4 Depress '+' key once. Measure voltage maximum: >20V.

5.12.7 Depress 'Adjust' function key once.

5.12.7.1 Check the Tilt L.E.D. is illuminated.
(where fitted, otherwise go to step 5.12.8).

5.12.7.2 Connect D.V.M. to pin 1, IC404.
Depress '-' key once. Measure voltage minimum: <4V.

5.12.7.3 Depress '+' key once. Measure voltage nominal: 6V-7V.

5.12.7.4 Depress '+' key once. Measure voltage maximum: >8.5V.

5.12.8 Depress 'Adjust' function key once.
Check the H.Phase L.E.D. is flashing.

5.13 'S' Correction Switching

Select modes as shown below and check that the appropriate drives are being activated:

NOTE: logic 1 = 12 volts unless otherwise stated.

	MODE	S0 TR707c	S1 TR708C	S2 TR709c
5.13.1	07	0	0	1*
5.13.2	14	0	1	0
5.13.3	10	1	0	0

* On chassis fitted with dynamic focus option, 12 volts mean with approximate 6V p-p horizontal parabola.

5.14 Power Management

5.14.1 Measure voltage at pin 24, IC701 (VESA Standby/Suspend control): <0.2V

5.14.2 Measure voltage at pin 25, IC701 (VESA Off control): <0.2V.

5.15 Sync. Detector

5.15.1 Select signal mode 0 (-/- sync. pulses).

5.15.1.1 Measure voltage at pin 5, IC703: >4V.
Ensure the voltage is at a steady state.

5.15.1.2 Observe that the polarity of horizontal sync. pulses at pin 6, IC703 are +ve.

5.15.1.3 Measure voltage at pin 10,IC703: >4V.
Ensure the voltage is at a steady state.

5.15.1.4 Observe that the polarity of vertical sync. pulses at pin 8, IC703 are +ve.

5.15.2 Select signal mode 8 (+/+ sync. pulses).

5.15.2.1 Measure voltage at pin 5, IC703: <0.2V.
Ensure the voltage is at a steady state.

5.15.2.2 Observe that the polarity of horizontal sync. pulses at pin 6, IC703 are +ve.

5.15.2.3 Measure voltage at pin 10, IC703: <0.2V.
Ensure the voltage is at a steady state.

5.15.2.4 Observe that the polarity of vertical sync. pulses at pin 8, IC703 are +ve.

5.16 Video Panel

5.16.1 Supply voltages

5.16.1.1 Select signal mode 0, white raster.

5.16.2 Measure voltages at the following locations with reference to pin 5, PL204 unless otherwise stated:

5.16.2.1	PL204 pin 1	80V	±0.5V
5.16.2.2	PL204 pin 3	0V	
5.16.2.3	PL204 pin 4	6.3V	±0.15V
5.16.2.4	PL204 pin 6	12V	±0.5V
5.16.2.5	PL202 pin 2	33V	±3V

5.17 Self Test

5.17.1 Measure voltage at TR205(e): 2.5V ±0.25V

5.17.2 Remove horizontal and vertical sync. pulses.
After approximately five seconds measure the voltage at TR205(e): 3.5V ±0.5V.
Reconnect sync. pulses.

5.18 Video Blanking (Waveforms as appendix A3).

5.18.1 Set user brightness control to minimum.
Set user contrast control to minimum.
Connect x100 scope probe to CE214(-).

5.18.1.1 Measure blanking voltage pulse amplitude: >75V p-p.

5.18.1.2 Measure rise and fall times of blanking pulse: <250ns @ 10%/90%.

5.18.2 Brightness range (minimum).
Measure D.C. voltage at CE214(-): -33V ±3V.

5.18.3 Brightness range (maximum).
Set user brightness control to maximum.
Measure D.C. voltage at CE214(-): -20V ±-3V.

5.19 Video Cut-offs.

5.19.1 Set user brightness control to detent.
Set user contrast control to minimum
Set R/G/B cut-off pots RV241,RV242 and RV243 fully clockwise.
Connect x100 scope probe to G201/2/3 in turn.
Measure the R/G/B output black level amplitudes are 53V ±3V.

5.19.2 Set R/G/B cut-off pots fully anti-clockwise.
Measure the R/G/B output black level amplitudes are 67V ±4V

5.20 Video Drives

5.20.1 Set user contrast control to maximum.
Adjust the following pots for 35V ±2V at R/G/B outputs (G201/G202/G203).
Red drive: RV238.
Green drive: RV239.
Blue drive: RV240.

NOTE: *Ensure the black levels do not deviate from the tolerances in 5.19.2.*

5.20.1.1 Set user contrast control to minimum.

5.20.1.2 Using a x100 scope probe measure the R/G/B output black to white amplitudes are 14V ±3V.

5.21 Horizontal Deflection/B+ Regulator

SAFETY TEST - E.H.T. OVER CURRENT PROTECTION (BEAM CURRENT).

5.21.1 Ensure the voltage across CE821 is 195V ±5V.

5.21.2 Connect a 2k7Ω resistor between pin 8, T402 and 0 volts.
Ensure the P.S.U. is disabled and the voltage across CE821 falls to <1V.

5.21.3 Remove the resistor and ensure the voltage across CE821 remains at <1V.

5.21.4 Remove power.
Discharge capacitor C820 using a 1kΩ, 5W resistor.
Reconnect power.
Check the voltage across CE821 is 195V ±5V.

5.22 Beam Current Limit

5.22.1 Connect a 12kΩ resistor between TR413 base and 0 volts.
Measure the voltage at TR413 base: 8V ±1V.

5.22.2 Measure the voltage at TR401 emitter: <1V.

5.23 Phase Locked Loop/S capacitor switching (no sync. pulse mode)

5.23.1 Select mode 19, black screen.
Connect power to chassis.

5.23.1.1 Measure voltage at Q401 gate: <0.5V.

5.23.1.2 Measure voltage at Q402 gate: <0.5V.

5.23.1.3 Measure voltage at Q403 gate: <0.5V.

5.23.2 Remove horizontal sync. source from chassis.
Measure frequency of horizontal drive pulses: 22-26kHz.

5.23.2.1 Measure voltage at Q401 gate: <0.5V.

5.23.2.2 Measure voltage at Q402 gate: 12V ±2V.

5.23.2.3 Measure voltage at Q403 gate: 12V ±2V.

5.23.2.4 Reconnect horizontal sync.

5.24 B+ Regulator/Horizontal Output

5.24.1. Connect a x10 scope probe toTR402 base.
Measure amplitude of horizontal drive pulses: 2V-2.5V.

5.24.2 Measure frequency of horizontal drive pulses: 64.31kHz.

5.24.3 Measure duration of horizontal drive pulses: (>0V) 9-11μs.

5.24.4 Measure B+ at pin 2, T402 and adjust RV512: 165V ±0.5V.

5.24.5 Measure amplitude of horizontal fly back pulses: 1280V ±25V.

5.24.6 Using an E.H.T. meter measure the voltage at E.H.T. connector: 25kV ±1kV.

5.24.7 Select mode 19, cross-hatch music pattern.
With user brightness control RV497 set to mid-position, adjust A1 focus for optimum display.

5.25 SAFETY TEST - E.H.T. Over Voltage Protection

5.25.1 Connect a 1n0 capacitor across C510.

NOTE: Connections to this capacitor must be as short as possible and located directly onto solder side of P.W.B.

Select mode 19, pattern black screen (no raster).
Connect a 22kΩ resistor in series with a 470kΩ pot from R513/R524 to 0V.
Connect power to chassis.
With the aid of a high voltage detector and D.V.M. adjust 470kΩ pot for a fly back amplitude of 1450V.

5.25.2 Adjust RV404 slowly anti-clockwise until the over voltage protection circuit is activated, shutting down the power supply. The power L.E.D. should be flashing.
DO NOT ADJUST RV404 ANY FURTHER. Adjust 470kΩ pot fo minimum voltage.

5.25.3 Remove power from chassis.
Discharge capacitor C820 using a 1k0, 5W resistor.
Reconnect power to chassis and ensure the voltage across CE821 is 195V ±5V.

5.25.4 Adjust 470kΩ pot to obtain 1400V fly back pulse amplitude, ensuring the over voltage protection circuit is not activated.

5.25.5 Remove the 27kΩ resistor, 470kΩ pot and 1nF capacitor.

5.25.6 Adjust RV512 for B+ at 165V ±0.5V (if necessary).

5.25.7 Remove sync. pulses and ensure the over voltage protection circuit is not activated.

5.25.8 Reconnect sync. pulses and ensure the display is reinstated.

5.25.8.1 Apply sealant to inhibit further adjustment.

5.26 Horizontal Shift

5.26.1 Increase brightness to display raster.
If necessary reduce width to reveal raster limits.
Connect PL406 jumper between pins 1 and 2.
Adjust H. Shift RV414.
Ensure that a range from 0mm to 2mm offset can be achieved.

5.26.2 Connect PL406 between pins 3 and 4.
Adjust H. Shift RV414.
Ensure that a range from 0mm to 2mm offset can be achieved in the opposite direction to that in 5.26.1.

5.26.3 Select PL406 jumper position and adjust RV414 for nominal horizontal position of raster.
NOTE: No adjustment is possible if jumper is positioned across pins 2 and 3.

5.27 Horizontal Blanking adjustment

5.27.1 Connect a x10 scope probe to PL402 (TR411 collector).
Select mode 0, pattern black screen (no raster).

5.27.2 Measure amplitude of blanking/clamping pulses: 3V ±0.5V. (As appendix A2).

5.27.3 Adjust user brightness control to maximum to display a full raster.
Adjust width to display raster edges.
Adjust RV444 fully clockwise. Slowly turn anti-clockwise until bright vertical line on left side of raster is just blanked off.

5.27.4 Measure duration of blanking pulses: 3.3μs-3.4μs.

5.27.5 Select mode 19, cross hatch pattern.
Check the display data is completely accommodated within the raster.

5.28 Horizontal Phase preset adjustment

5.28.1 Select mode 19, cross hatch pattern.
Connect a x10 scope probe (channel A) to TR420 collector.
Connect a x10 scope probe (channel B) to pin 3, T402.
Note the point at which the fly back pulse (channel B) passes through 0 volts in the +ve direction. With reference to this, adjust RV401 so that the rising edge of the reference pulse (channel A) occurs 2.5μs ±0.25μs later.

5.29 Vertical Deflection

5.29.1 Vertical Frequency.

5.29.1.1 Connect power to chassis.
Select Mode 25 (45Hz. Set-up).
Adjust RV303 fully anti-clockwise.
Turn slowly clockwise until display becomes stable.
DO NOT ADJUST ANY FURTHER.

5.29.1.2 Select Mode 24 (125Hz. check).
Check that field frequency is locked and stable.
If not, repeat step 5.29.1.1.

5.29.2 Vertical Linearity.

5.29.2.1 Select signal Mode 19, 4x4 grid.
Adjust vertical linearity RV316 to minimize the difference in vertical distance between horizontal lines.

5.30 Audio (Multi-media models - optional).

5.30.1 Initial Conditions.

5.30.1.1 Connect audio source to amplifier via 2 x phono plugs.

5.30.1.2 Connect audio outputs to speakers (or simulated load).

5.30.2 Preset Volume Control (FET threshold control adjustment) RV619.

5.30.2.1 Connect power to chassis.

5.30.2.2 Adjust audio source to 150mV r.m.s. @ 1kHz sine wave.

5.30.2.3 Connect a x10 scope probe to pin 2, SK601 (ground to pin 1).

5.30.2.4 Select audio d.a.c. output for maximum volume (as defined in section5.12.1).

5.30.2.5 Adjust RV619 to achieve sine wave with symmetrical clipping.

5.30.2.6 Adjust RV619 to the point at which clipping is eliminated.

5.30.3 Audio Power/Distortion.

5.30.3.1 Connect a x10 scope probe to pin 2, SK602 (ground to pin 1).
Observe the wave form displays a sine wave. If clipping occurs, adjust RV619 to the point at which clipping is eliminated.

5.30.3.2 Measure amplitude of sine wave: 10V p-p typically.

5.30.3.3 Ensure the total noise and distortion does not exceed 10%.

5.30.3.4 Connect a x10 scope probe to pin 1, SK601.
Measure amplitude of sine wave: 10V p-p typically.

5.30.3.5 Ensure the total noise and distortion does not exceed 10%.

5.30.3.6 Reduce user volume to minimum (as defined in section 5.12.1).
Measure amplitude of sine wave: <300mV p-p.

5.30.4 Headphones Output.

5.30.4.1 Increase user volume to maximum (as defined in section 5.12.1).
Connect headphones (32Ω nominal impedance) via SK603.
Ensure both speakers are muted.

5.30.4.2 Connect scope probe to R608.
Measure amplitude of left channel sine wave: 1.5V p-p ±0.2V.

5.30.4.3 Connect scope probe to R609.
Measure amplitude of right channel sine wave: 1.5V p-p ±0.2V.

5.31 Dynamic Focus (optional)

5.31.1 Connect power to chassis.
Select signal mode 19, cross hatch pattern.
Adjust picture size for a normal display i.e. full screen.
Connect x100 scope probe to SK103.
Measure mean D.C. level of parabola: 350V ±50V.

5.31.2 Measure amplitude of horizontal parabola: 310V p-p ±40V.

5.31.3 Measure amplitude of vertical parabola: 115V p-p ±30V

5.32 Final Chassis Test Assessment

5.32.1 Select mode 19, black screen.
Voltage supplies (nominal loading).
Depress '+/USER button' to achieve flashing 'Width' L.E.D. (Global Set-up mode).

5.32.1.1 Measure 80V supply at CE822: 80V ±0.5V.
(Adjust RV840 if necessary).

5.32.1.2 Measure 195V supply at CE821: 195V ±3V.

5.32.1.3 Measure 26.5V supply at CE823: 26.5V ±1V.

5.32.1.4 Measure 16V supply at CE836: 16V ±1V.

5.32.1.5 Measure 8V supply at CE841: 8V ±0.5V.

5.32.1.6 Measure 12V supply at CE838: 12V ±0.5V.

5.32.1.7 Measure 5V supply at CE714: 5V ±0.25V.

5.32.1.8 Measure tube heater voltage at R892 (top) (TR812[e]) Adjust RV895 for 6.3V ±0.05V.

5.32.2 Composite Sync. Pulses.

5.32.2.1 Remove normal sync. pulses
Connect composite sync. pulses.
(These can be derived by feeding horizontal and vertical sync. pulses to an Exclusive OR gate, feeding the output to pin 1, SK701 leaving pin 3, SK701 with no signal).
Ensure the display is locked without instability.

5.32.3 Height Pre-set Adjustment/Range.

5.32.3.1 Ensure 'Global Set-up' mode is selected (as is section 5.32.1).
Select mode 2, (Fv 70Hz) cross hatch pattern.
Connect scope probe to R307.
Adjust RV353 and ensure that 1.53V p-p without clipping is achievable.

5.32.3.2 Depress 'Select' button until 'Height' parameter is selected.
Measure voltage at TR302 emitter.
Adjust 'User' height to achieve a voltage of 2.7V ±0.05V.

5.32.3.3 Adjust RV353 to achieve full height raster.
Adjustment of 'User' 'V. Centre' may be necessary.
Connect scope probe to R307.
Ensure that the waveform is 1V-1.4V p-p.

5.33 Keystone Adjustment

5.33.1 (Chassis with User Keystone adjustment).
Connect D.V.M. to CE720(+).
Measure voltage: 2.25V ±0.25V.
(Adjust User Keystone if necessary in optimize mode).

5.33.2 Adjust keystone RV324 from one limit to the other.
Ensure that an offset of ±20mm from nominal width is achievable.

5.33.3 Display Optimization.

Select global set-up, mode 10, cross hatch pattern.

5.33.3.1 If necessary, adjust the following parameters to achieve an optimum display as follows: (as in appendix B).
RV353 to achieve normal height.
RV324 to achieve parallel sides.
User H. Phase to centre display horizontally.
User Width to achieve a full display horizontally.
User V. Centre to centralize the display vertically.
User Pincushion to achieve straight vertical lines.
Repeat as necessary.

5.33.3.2 To adjust Tilt (with monitor display facing east):
Select Optimize mode (V. Centre L.E.D. flashing).
Select Tilt parameter and adjust to achieve horizontal lines parallel to the display tube.

5.33.4 Final Display Analysis.

Remove mains supply from chassis.
Depress '-/PRESET' button (User mode).
Connect power to chassis and release button after approximately 2 seconds.
Ensure that no L.E.D's are flashing.

5.33.4.1 Select mode 19, cross hatch pattern.
Check the display is free of unwanted interference.
Check the geometry is within limits.
Adjust width and ensure that over-scan of 20mm is achievable.
Ensure the operation is smooth.

5.33.4.2 Select mode 0, cross hatch pattern.
Check the display is free of unwanted interference.
Check the geometry is within limits.
Adjust width and ensure that over-scan of 20mm is achievable.
Ensure the operation is smooth.

5.34 Power Management

5.34.1 VESA 'Standby/Suspend'.
Remove horizontal sync. pulses.
Display should exhibit unlocked picture.
After approximately 5 seconds the display should extinguish.
Power indicator should remain illuminated.
Measure power consumption after approximately 5 seconds: <30W.

5.34.1.1 Measure tube heater voltage at R892 (top): 4V ±0.5V (TR812[e]).

5.34.1.2 Reconnect horizontal sync. pulses.
Display should return locked and stable within 2 seconds.

5.34.2 VESA 'Standby/Suspend'.
Remove vertical sync. pulses.
Display should exhibit unlocked picture.
After approximately 5 seconds the display should extinguish.
Power indicator should remain illuminated.
Measure power consumption after approximately 5 seconds: <25W.
Reconnect vertical sync.pulses.
Display should return locked and stable within 2 seconds.

5.34.3 VESA 'Off'.
Remove horizontal and vertical sync. pulses.
Display should exhibit unlocked picture.
After 5 seconds the display should extinguish.
Power indicator should be flashing.
Measure power consumption after approximately 5 seconds: <5W.
Reconnect sync.pulses.
Display should return locked and stable within 10 seconds.

SECTION 6 FINAL SET-UP PROCEDURES

NOTES: *Prior to final Set-up a minimum 30 minute warm up time* ***MUST*** *be allowed.*

All light intensity measurements should be made at the centre of the screen unless otherwise stated.

(Any problems with Set-up refer to section 5).

6.1 Final Set-up Procedure - Equipment required.

6.1.1 Signal source capable of producing Timing Modes (as in section 3.6).

6.1.2 E.H.T. meter to 30kV.

6.1.3 D.V.M. 1kV.

6.1.4 Minolta 2150 Colour Analyser or equivalent.

6.1.5 Isolated 230V mains power source.

6.2 Initial Conditions.

6.2.1 Connect signal source to monitor.

6.2.2 Connect power source to monitor.

6.2.3 Switch on monitor.

6.2.4 If H. Phase L.E.D. is flashing (factory set-up mode) proceed to 6.3.1, otherwise carry out the following procedure:

Switch off monitor.
Depress 'Adjust' and +/USER buttons simultaneously.
Switch on the monitor.
After approximately 2 seconds release Adjust and +/USER buttons.
H. Phase L.E.D. should now be flashing.

6.3 Focus Setting

6.3.1 Select mode 19, focus pattern, green screen.

6.3.2 Adjust user contrast/brightness controls to mid-position.

6.3.3 Adjust focus to achieve most clearly defined vertical lines.

6.4 Horizontal Raster Centring

6.4.1 Select mode 19, black screen.

6.4.2 Adjust user contrast control to minimum, user brightness control to maximum.

6.4.3 Adjust RV414 to centre raster. If necessary relocate PL406 to other end of socket.

6.5 Global Set-up Mode

6.5.1 Adjust user contrast control to maximum, user brightness control to mid-position.

6.5.2 Select mode 19, 4x4 grid.

NOTE: *Global set-up is not functional on Volume/Keystone or Tilt parameters as these are unconditionally global.*

6.5.3 With only H. Phase L.E.D. flashing depress +/USER button once.
'Width' L.E.D. should now be flashing (Global setting).

6.6 Horizontal Phase

6.6.1 Depress 'Adjust' button once.
H. Phase L.E.D. should be continuously lit.

6.6.2 Use the '+/-' buttons to centralize the display .

6.7 Width

6.7.1 Depress 'Adjust' key once.
Width L.E.D. should be continuously lit.

6.7.2 Use the '+/-' keys to extend the display to edge of screen.

6.8 Vertical Centre

6.8.1 Depress 'Adjust' key once.
V. Centre L.E.D. should be continuously lit.

6.8.2 Use the '+/-' keys to centralize the display.

6.9 Height

6.9.1 Depress 'Adjust' key once.
Height L.E.D. should be continuously lit.

6.9.2 Use the '+/-' keys to extend the display to edge of screen.

6.10 Pincushion

6.10.1 Depress 'Adjust' key once.
Pincushion L.E.D. should be continuously lit.

6.10.2 Use the '+/-' keys to establish straight vertical lines.

6.10.3 Depress 'Adjust' key once.
Width L.E.D. should be flashing.

6.11 Keystone Adjustment

If Keystone adjustment is required, adjust RV324 to achieve parallel vertical lines.

6.12 Tilt Adjustment (Where fitted)

Select Optimize Mode by depressing +/USER key once while the Width L.E.D. is flashing.

With V. Centre L.E.D. flashing, depress Function key until Tilt parameter is selected.
Use '+/-' keys to achieve a display with horizontal lines parallel to the display tube.

Repeat 6.5 - 6.12 as necessary to give optimum display.

6.13 Horizontal Linearity

There is no adjustment for horizontal linearity.

6.14 Vertical Linearity

With reference to App A/B2 ensure that linearity is within limits shown. Adjust RV316 if necessary.

6.14.1 Select modes 0 and 10 and check that the display complies with App A/C2. If necessary select Optimise Mode (V centre LED flashing) and adjust parameters as required.

6.15 White Balance

6.15.1 Select mode 19, black screen.

6.15.2 Adjust user brightness control to maximum and user contrast control to minimum.

6.15.3 Adjust R/G/B cut-off controls, RV241, RV242 and RV243 fully anti-clockwise.

6.15.4 Using Minolta light meter adjust the A1 control (screw) for (Y) = 3.0 ±0.5Cd/m².

6.15.5 Observe the reading of (x) and (y) and adjust the two least predominant colours to obtain grey raster (x = 0.281 ±0.015) and (y = 0.311 ±0.015).

6.15.6 Check that (Y) remains at 3.0 ±0.5Cd/m², adjust A1 if required.

6.15.7 Adjust user Contrast control to maximum, user Brightness control to mid-position.

6.15.8 Select mode 19, green block.
Using Minolta light meter adjust RV239 (green) for a reading of 100 ±5Cd/m².

6.15.9 Select mode 19, white block.
Adjust RV238 and RV240 as follows:
RV240 (blue) for a (y) reading of 0.311 ±0.005Cd/m².
RV238 (red) for an (x) reading of 0.281 ±0.005Cd/m².
Repeat as necessary.

6.15.10 Check that (Y) reading is 120 ±10Cd/m².

6.15.11 Reduce user Contrast for a reading of 20 ±3Cd/m².
Check that (x) = 0.281 ±0.005Cd/m² and (y) = 0.311 ±0.005Cd/m².
If adjustment is required, re-adjust only those controls adjusted in 6.15.5, repeating steps 6.15.7 to 6.15.11 until no further adjustment is required

6.15.12 Select mode 19, full white screen.
Adjust contrast and brightness controls to maximum.
Check that (Y) reading is 120 +15/-10 Cd/m².

6.16 Static Convergence

6.16.1 Select mode 19, 4x4 grid.

6.16.2 Set user Brightness to detent, user Contrast to maximum.
With reference to App A/C3 check the convergence error at:
Centre: <0.15mm.
Zone A: <0.30mm.
Zone B: <0.40mm.

Slight adjustment of the static convergence rings at the tube neck may be necessary to achieve this specification.

6.17 Purity (no adjustment for this parameter).

6.17.1 Adjust user Contrast to maximum, user Brightness to mid-position.

6.17.2 Select mode 19, full red raster.

6.17.3 Check that no discolouration of the raster is visible.

6.17.4 Select mode 19, full green raster.

6.17.5 Check that no discolouration of the raster is visible.

6.17.6 Select mode 19, full blue raster.

6.17.7 Check that no discolouration of the raster is visible.

6.18 Final Picture Quality check (User Mode)

Switch off monitor.
Depress +/USER key and switch on monitor.
No L.E.D's should be flashing.
Chassis now in User Mode.

6.18.1 Select mode 19, text pattern.

6.18.2 Adjust user Contrast and user Brightness to mid-position.

6.18.3 Check the text is clearly legible.
Check that no smearing or streaking occurs, especially between text characters.

6.18.4 Repeat 6.18.3 in Modes 0 and 10.

6.19 Dual Voltage (where fitted).

6.19.1 Switch off monitor.

6.19.2 Remove 230V supply and connect 115V supply to monitor.

6.19.3 If monitor is fitted with manual voltage selector switch, select 115V operation.

6.19.4 Switch on monitor and check the display is the same as was seen in 6.18.3.

6.19.5 Switch off monitor.

6.19.6 Select 230V operation with voltage selector switch (if fitted).

6.19.7 Remove 115V supply and connect 230V supply to monitor.

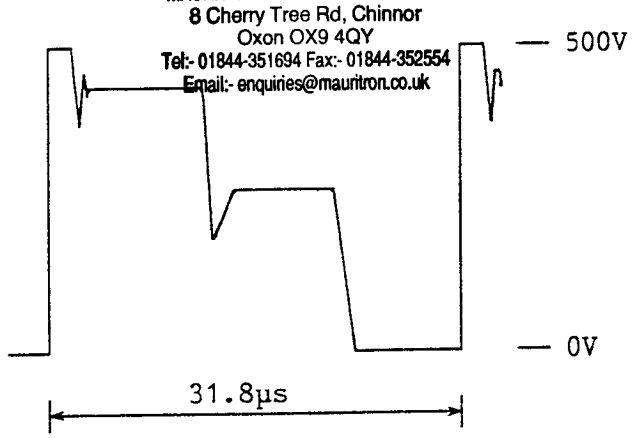
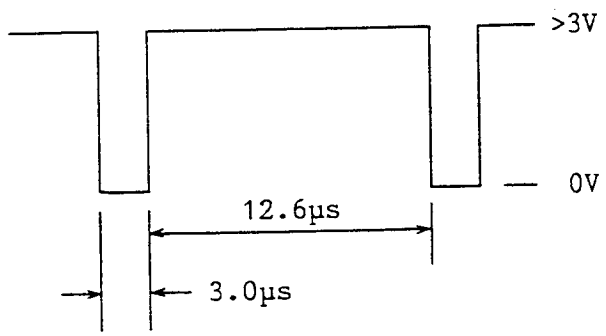
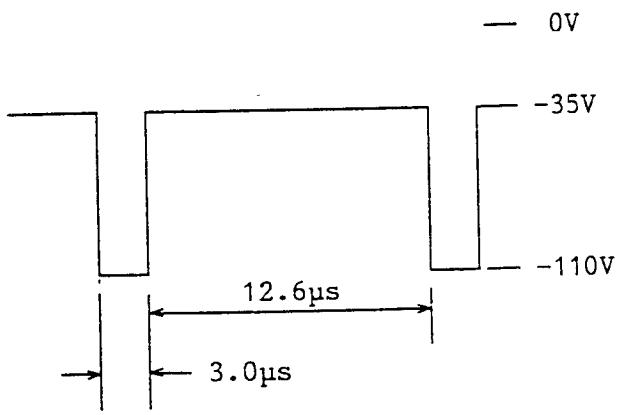
6.19.8 Switch on monitor and check the display is the same as was seen in 6.18.3

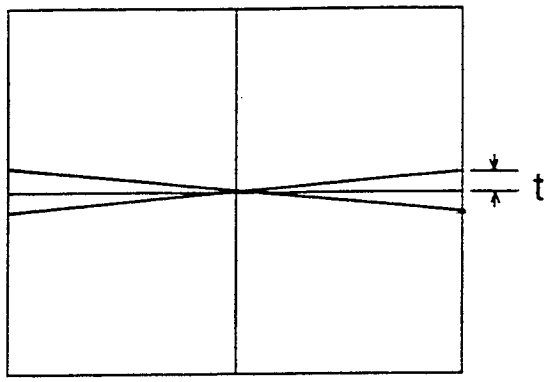
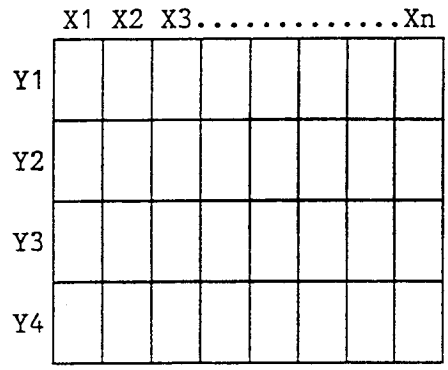
6.20 Safety Testing

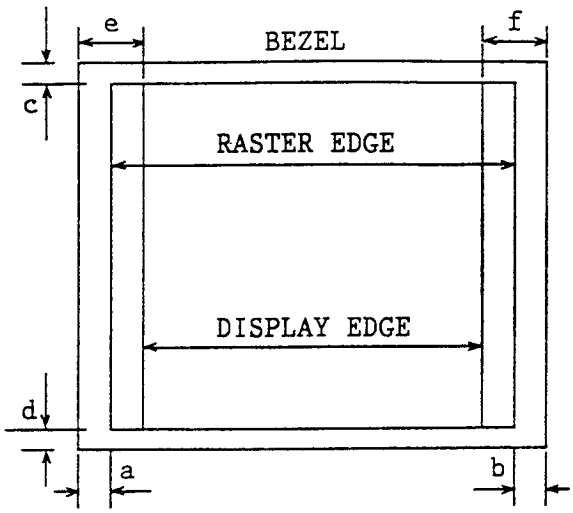
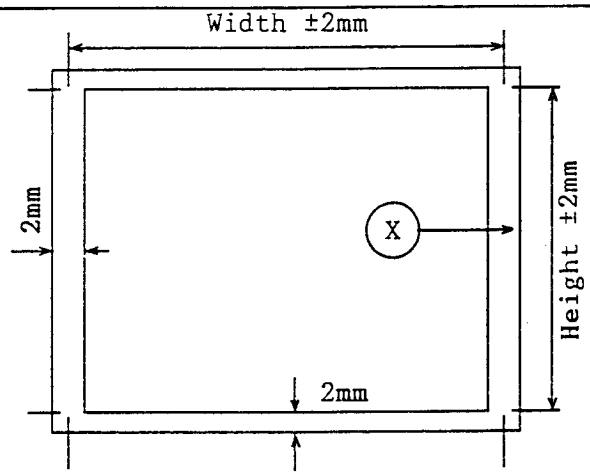
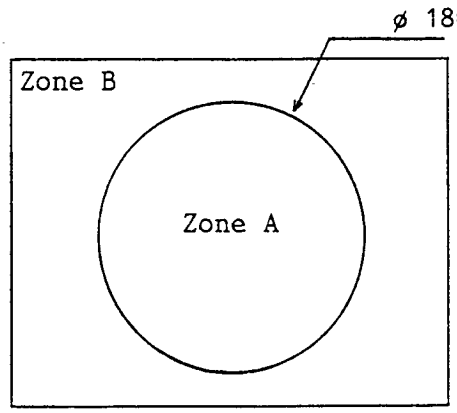
IMPORTANT

6.20.1 After repair, perform Safety Tests as defined in section 2.5.
Any monitor not passing any of the Safety Tests defined in section 2.5 must be rejected.

APPENDIX A

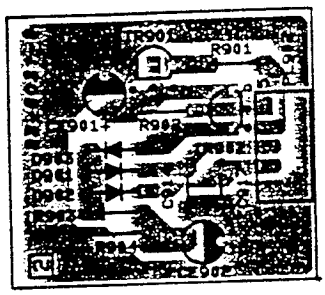
PARAMETER	APPENDIX A: U-SERIES WAVEFORMS	NOTES
A1 Q801 drain wave form SMPS waveform Q801d	 	Measurement must be made using an isolated supply with S.M.P.S. primary ground as reference. See Section 5.3
A2 Clamp gate Waveform PL402		See Section 5.27
A3 Blanking Waveform		See Section 5.18

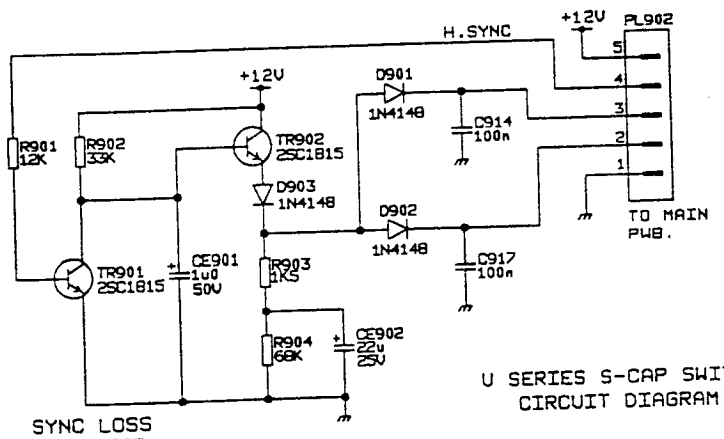
PARAMETER	APPENDIX A: U-SERIES LINEARITY/TILT	TEST CONDITIONS
B1 TILT	 t ≤1.0mm	TILT CONTRAST = Maximum BRIGHTNESS = Detent Pattern = 4x4 Grid
B2 LINEARITY	 $\text{Average } X = \frac{\Sigma\ X1 \ldots Xn}{n} = \bar{X}$ $\text{Average } Y = \frac{\Sigma\ Y1 \ldots Y4}{4} = \bar{Y}$ $\frac{(\bar{X} - Xi)}{\bar{X}} \leq 0.05 \quad \text{for } i = 1 \text{ to } n$ $\frac{(\bar{Y} - Yi)}{\bar{Y}} \leq 0.05 \quad \text{for } i = 1 \text{ to } 4$ NOTE! NO STEP CHANGES ALLOWED.	CONTRAST = Maximum BRIGHTNESS = Detent MODE 19 Pattern = 4x4 Grid

PARAMETER	APPENDIX A: U-SERIES SPEC. LIMITS	TEST CONDITIONS
C1 Raster + Display Centring	 [a-b]≤4.0mm, [c-d]≤4.0mm, [e-f]≤4.0mm	CONTRAST = Central BRIGHTNESS = Maximum Pattern = White Raster
C2 Geometric Distortion	 Allowing for height and width setting tolerances, total display distortion must be within area x	Geometric Distortion CONTRAST = Maximum BRIGHTNESS = Detent MODE = 19 Pattern = Cross Hatch Width = 305mm [17"] = 270mm [15"] = 260mm [14"] Height = 230mm [17"] = 203mm [15"] = 190mm [14"]
C3 Convergence	 Centre <0.15mm Zone A <0.30mm Zone B <0.40mm	STATIC CONVERGENCE CONTRAST = Maximum BRIGHTNESS = Detent Pattern = Cross Hatch

SECTION 7 P.W.B. COMPONENT LOCATIONS and CIRCUIT DIAGRAMS

7.1 S. Cap Switch P.W.B. (component side) and Circuit Diagram

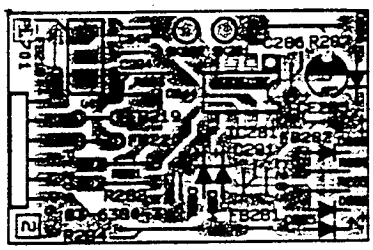


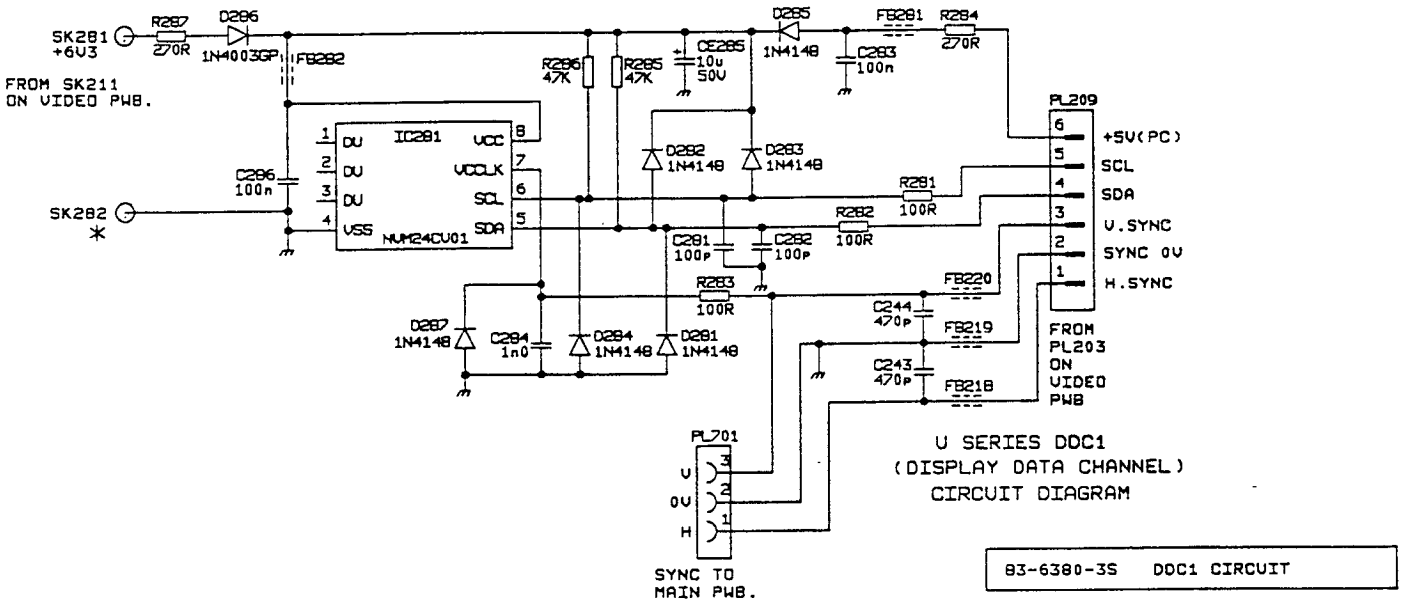


U SERIES S-CAP SWITCH
CIRCUIT DIAGRAM

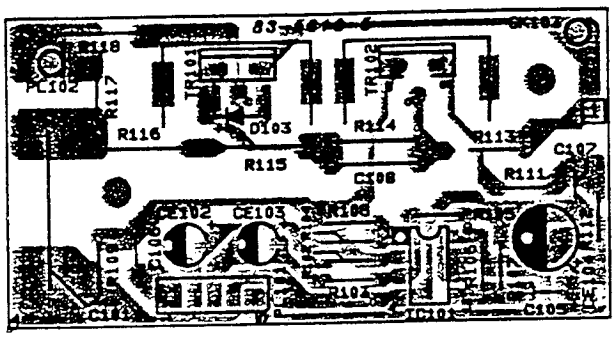
83-6021-9S U SERIES S-CAP SWITCH

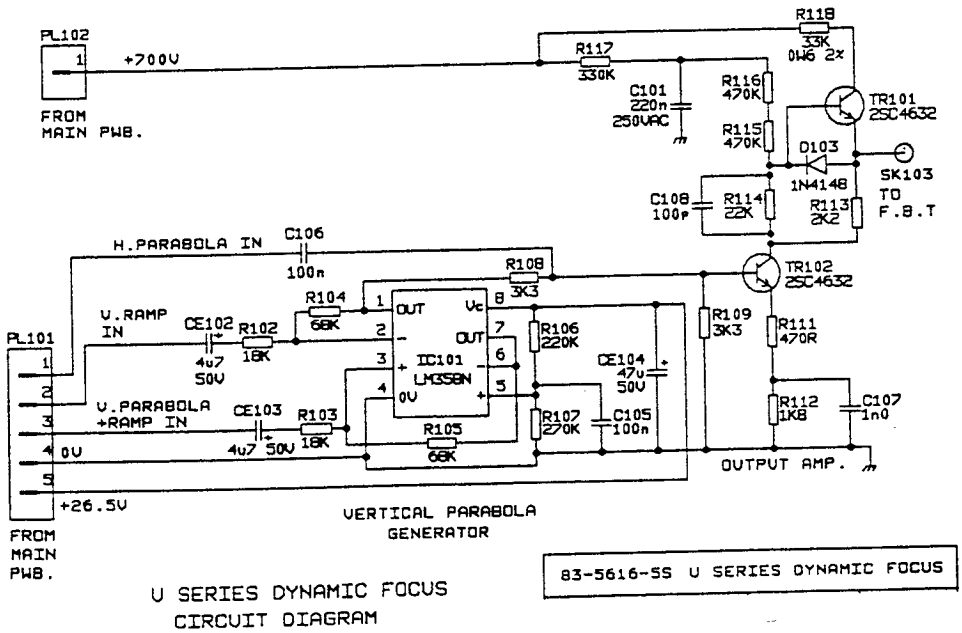
7.2 D.D.C.1 Communications Interface P.W.B (component side) and Circuit Diagram





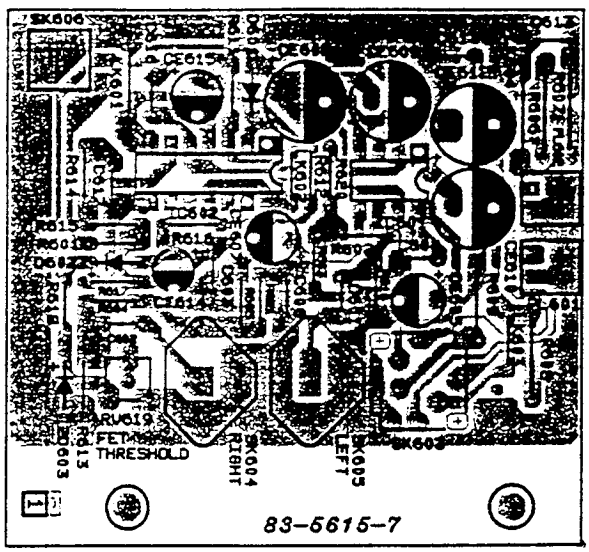
7.3 Dynamic Focus P.W.B. (component side) and Circuit Diagram





U SERIES DYNAMIC FOCUS
CIRCUIT DIAGRAM

7.4 Audio Panel P.W.B. (component side) and Circuit Diagram



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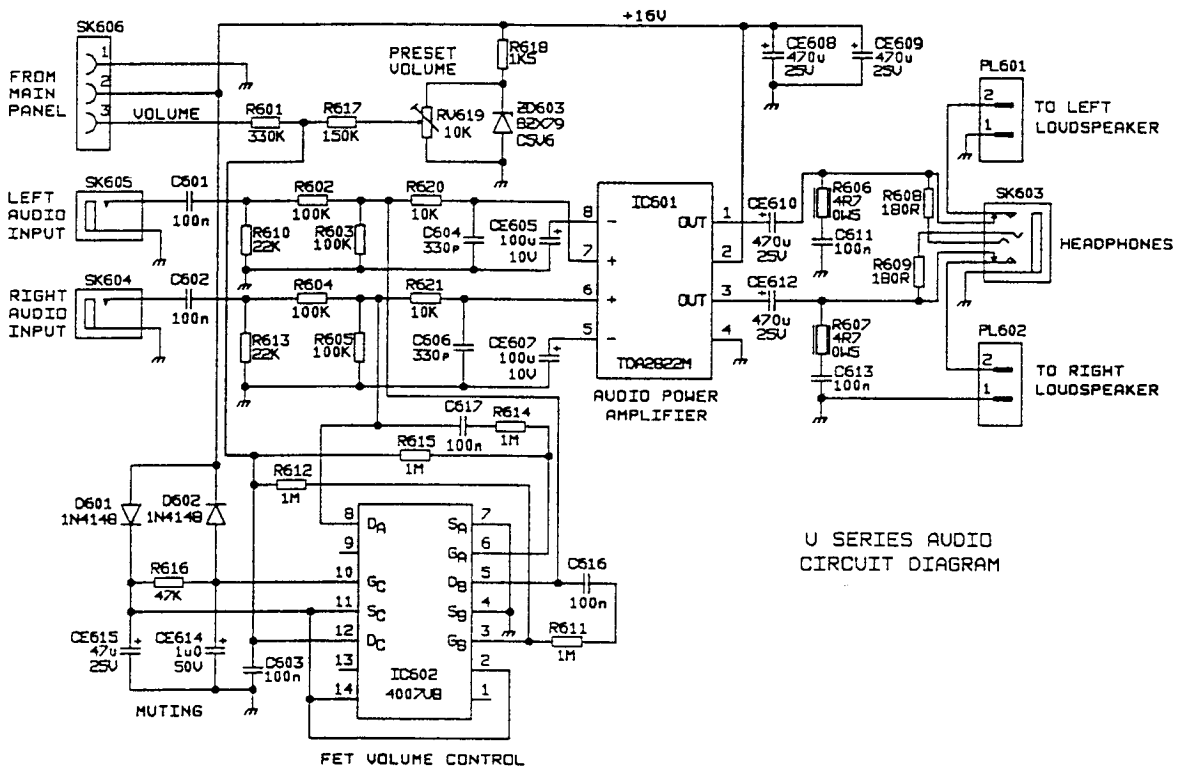
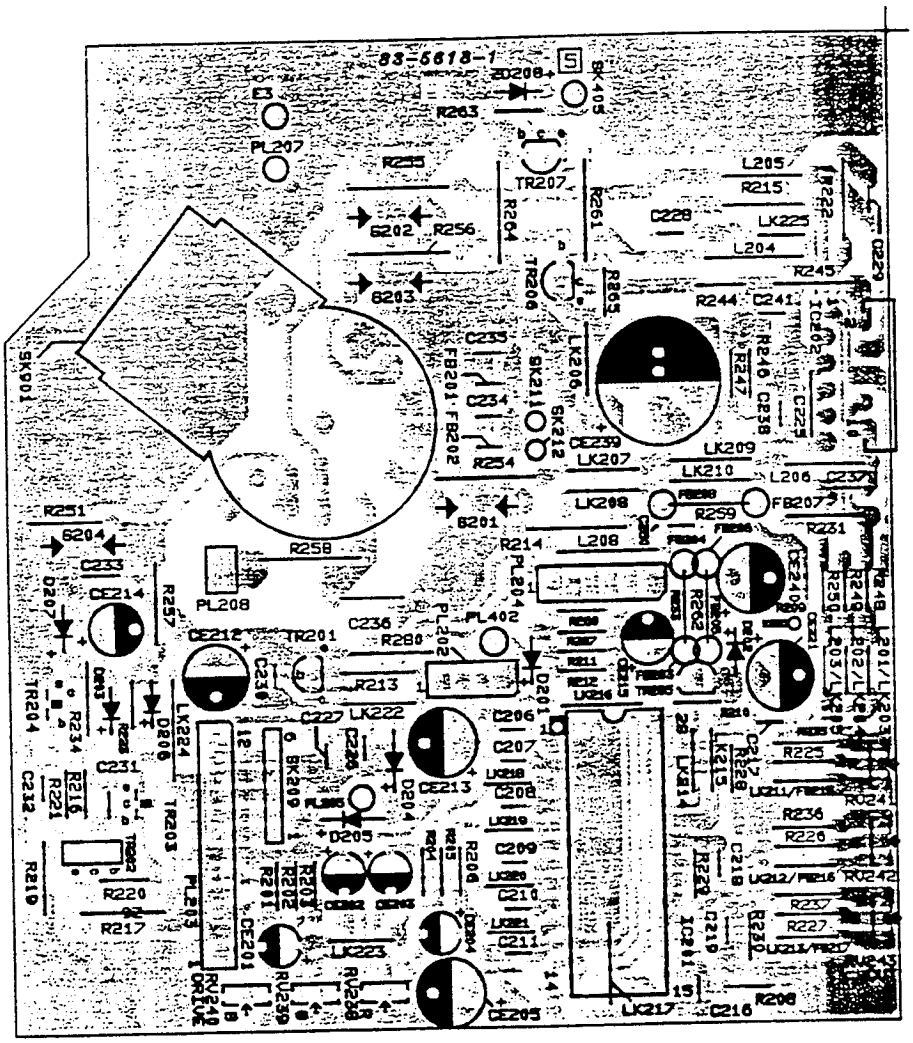
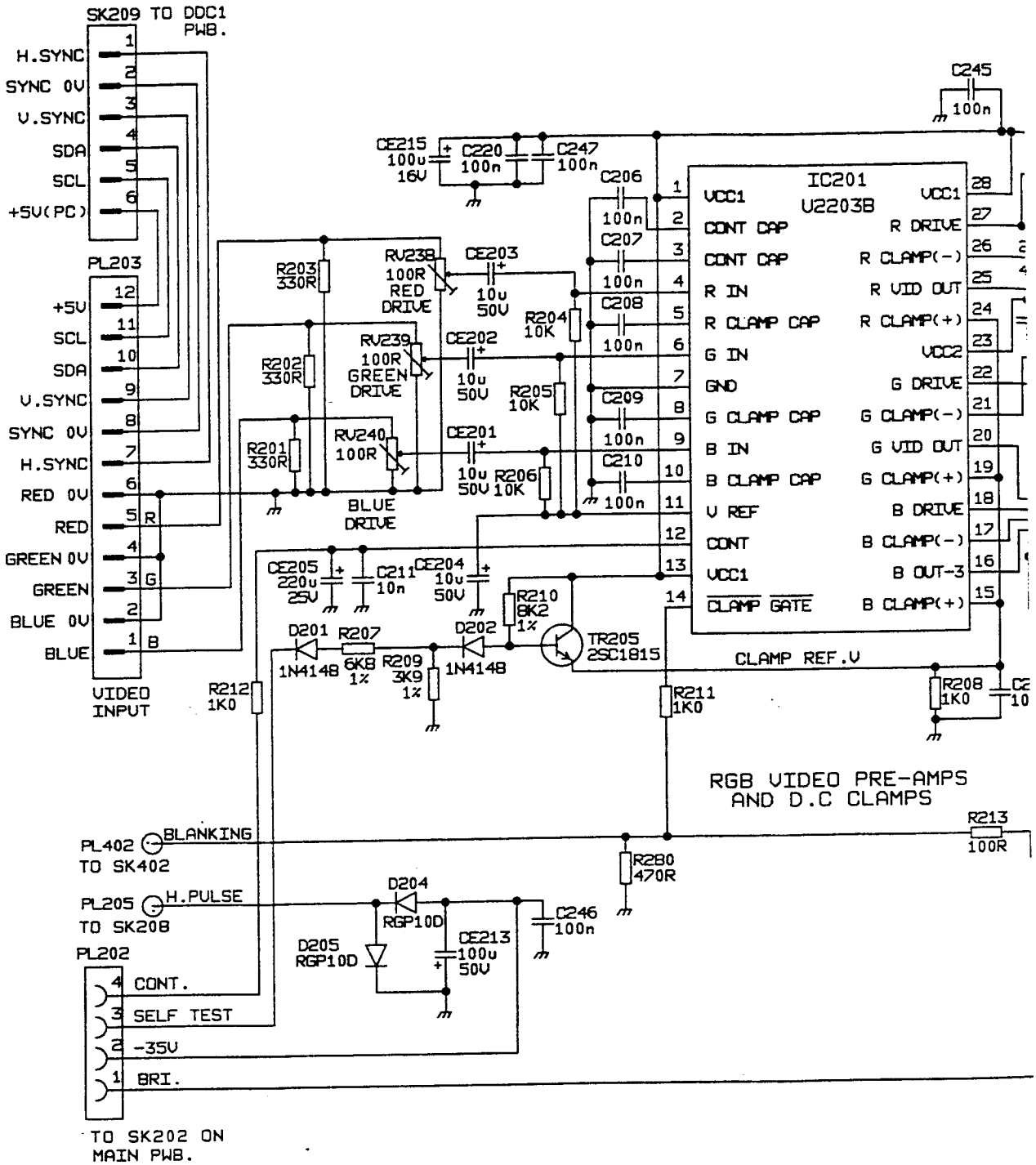


83-5615-7S AUDIO CIRCUIT DIAGRAM

7.5 Video P.W.B (component side)



7.5.1 Video Base Circuit Diagram



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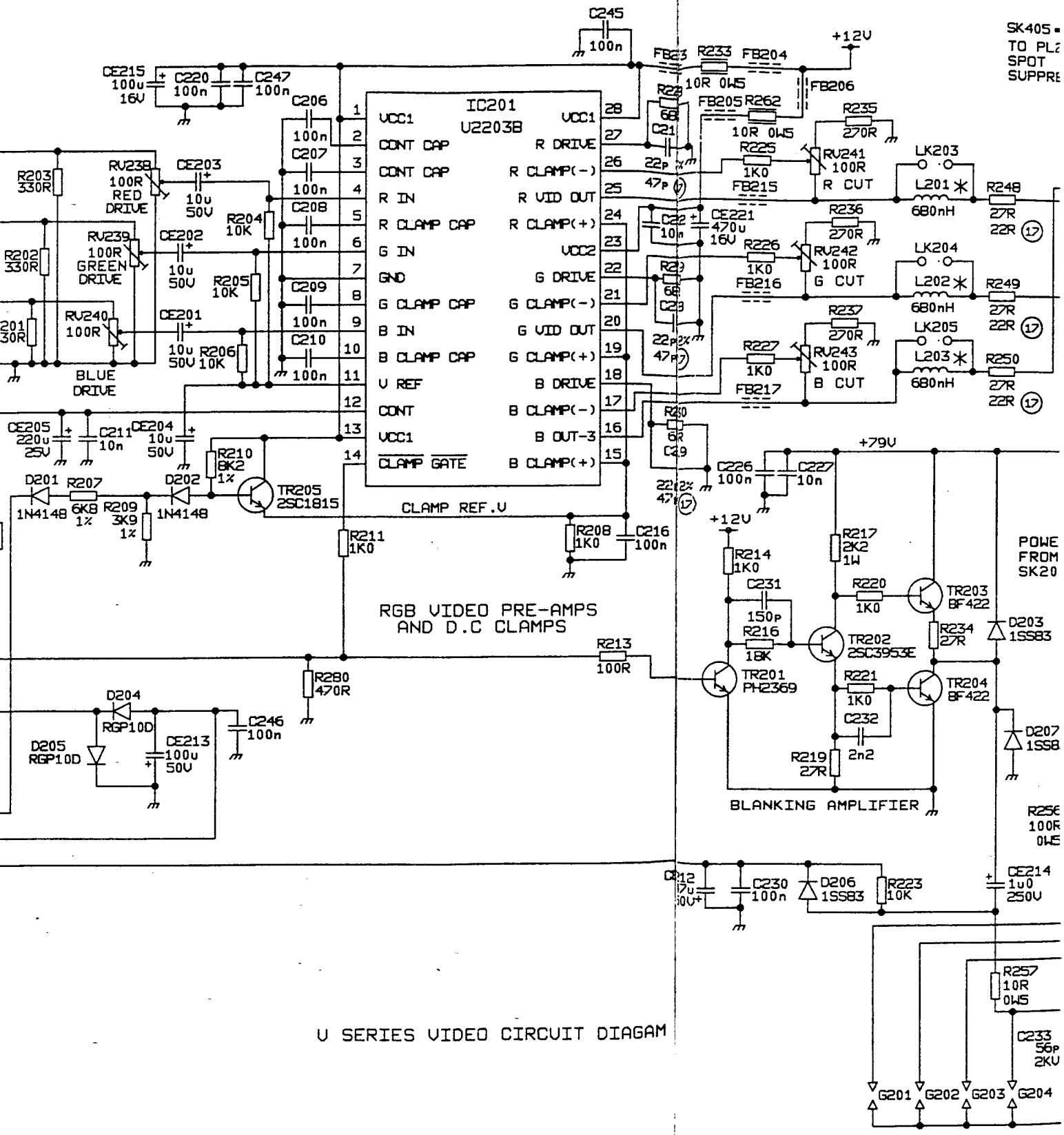
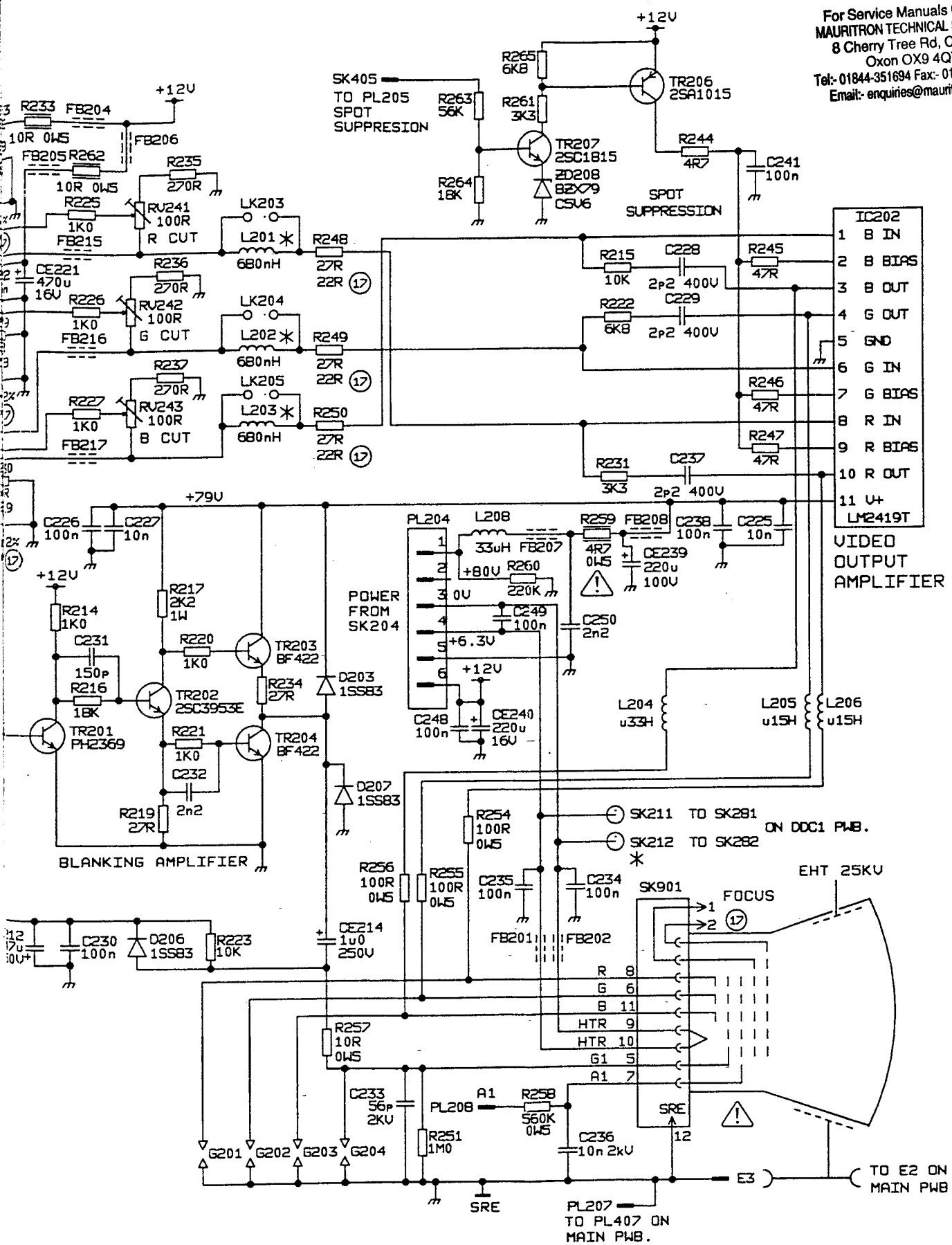
U SERIES VIDEO CIRCUIT DIAGR

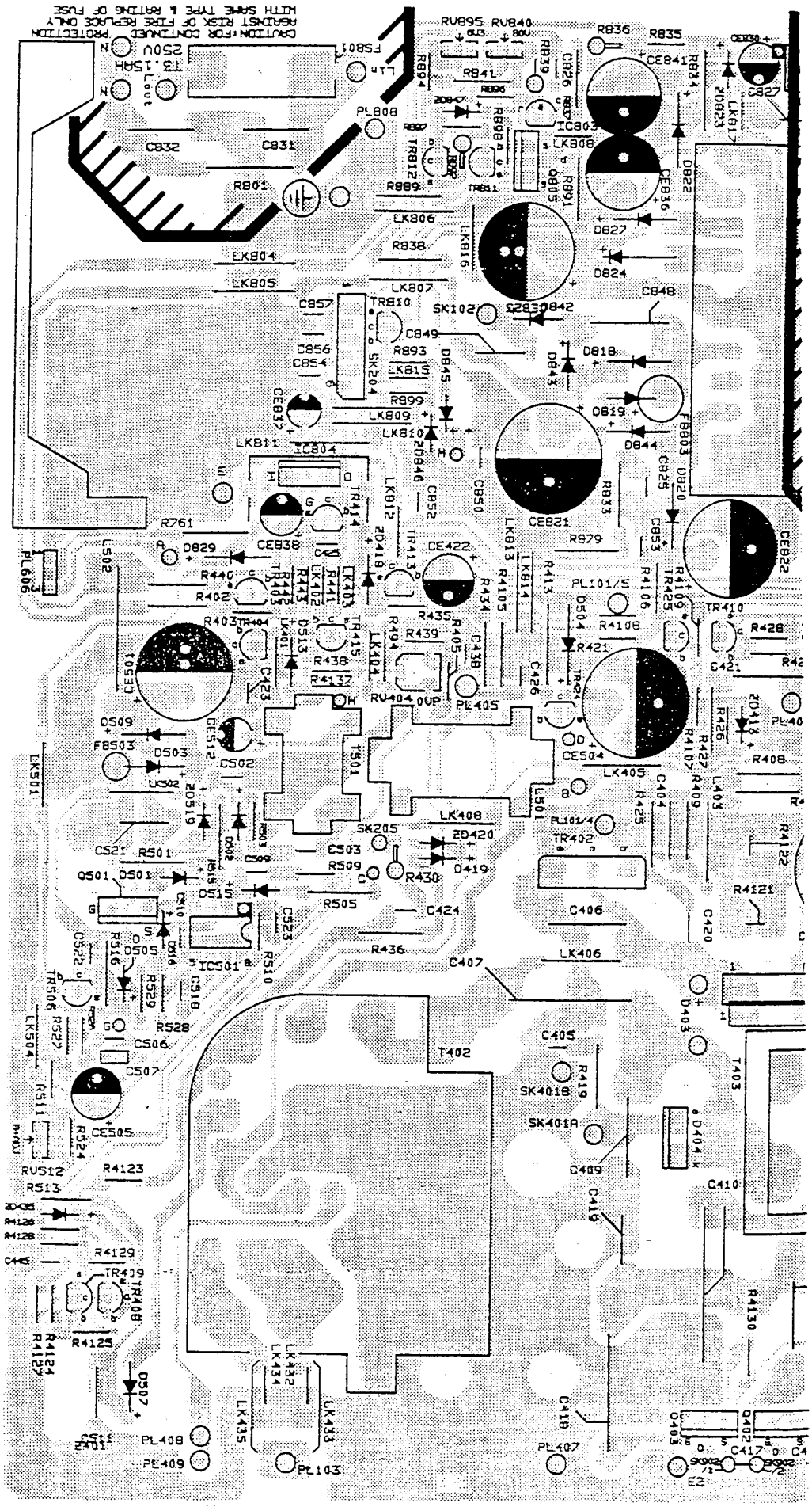
ram


IC201
U2203B
VCC1
CONT CAP
CONT CAP
R IN
R CLAMP CAP
G IN
GND
G CLAMP CAP
B IN
B CLAMP CAP
V REF
CONT
VCC1
CLAMP GATE
R DRIVE
R CLAMP(-)
R VID OUT
R CLAMP(+)
VCC2
G DRIVE
G CLAMP(-)
G VID OUT
G CLAMP(+)
B DRIVE
B CLAMP(-)
B OUT-3
B CLAMP(+)
+12V
+79V
CLAMP REF.V
RGB VIDEO PRE-AMPS
AND D.C CLAMPS
BLANKING AMPLIFIER
BLUE DRIVE
TR205 2SC1815
TR203 BF422
TR202 2SC3953E
TR201 PH2369
TR204 BF422
RV238 100R RED DRIVE
RV239 100R GREEN DRIVE
RV240 100R
RV241 100R R CUT
RV242 100R G CUT
RV243 100R B CUT
L201 680nH
L202 680nH
L203 680nH
LK203
LK204
LK205
G201
G202
G203
G204
U SERIES VIDEO CIRCUIT DIAGAM



83-5618-1S VIDEO PWB.- V SERIES

7.6 Main Chassis P.W.B. (component side)



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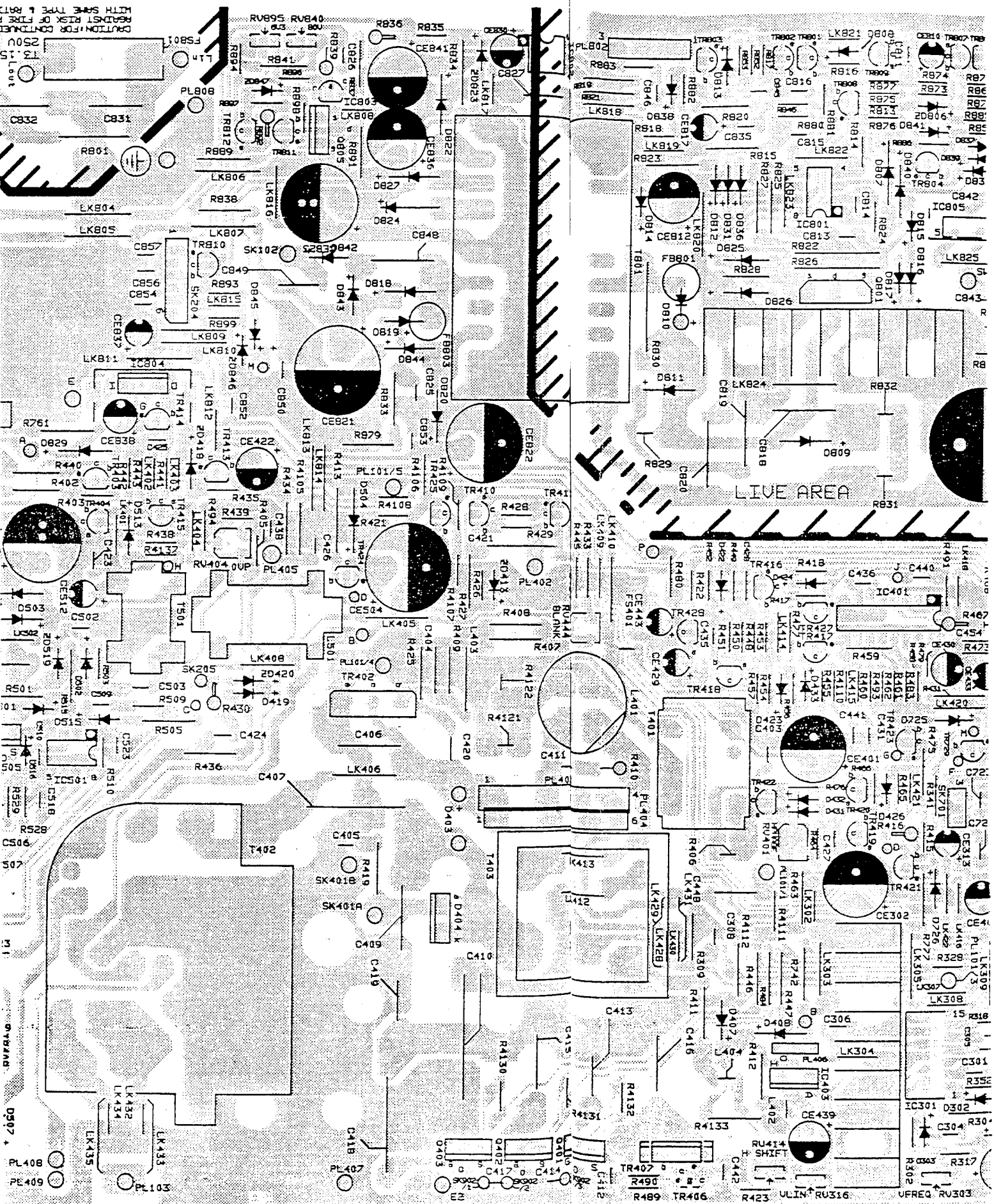
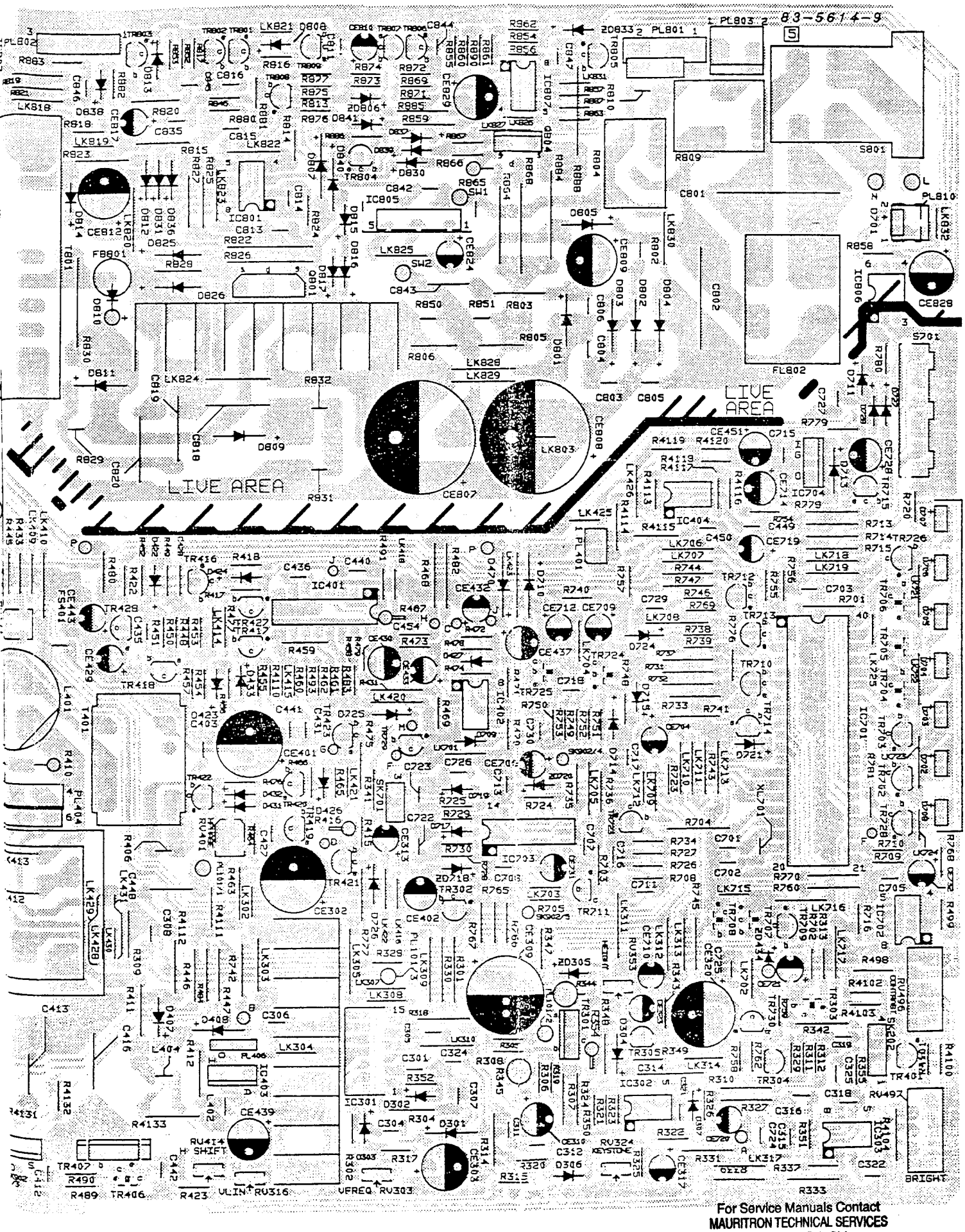
nent side)





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7.6.1 Main Chassis Circuit Diagram

The Main Chassis circuit diagram 83-5614-9S can be found in the pocket at the rear of this manual.

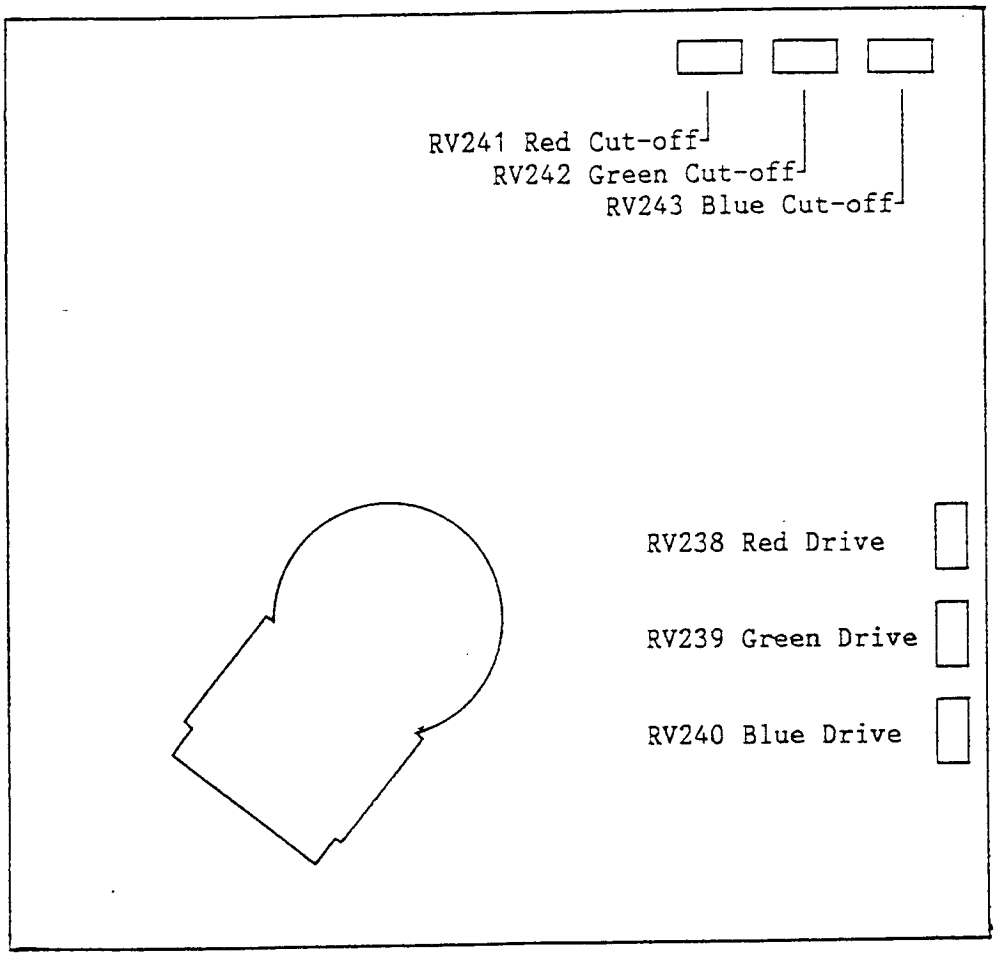
PLEASE NOTE

Between the initial printing of the Main Chassis circuit diagram 83-5614-9S, and the subsequent publication of the U Series Service Manual 79-1691-4-001, the following changes have been made and may not appear on your circuit diagram. Please check and amend accordingly.

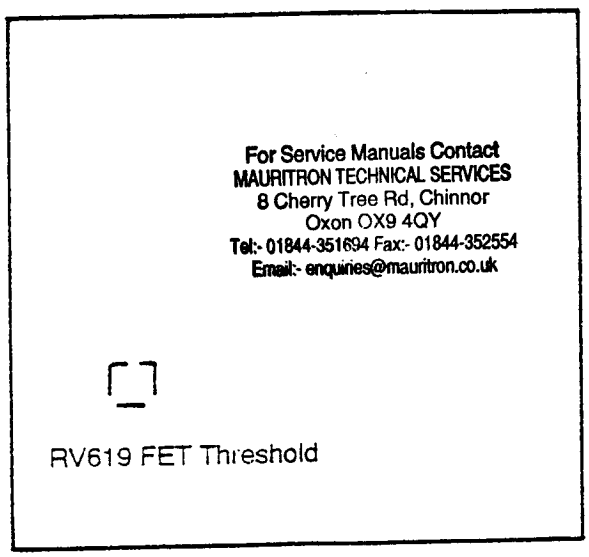
Delete diode D726 (1N4148)	19-3992-0
Change capacitor C314 to 180pF (180p,5%,630V,P)	14-2786-5
Change resistor R312 to 47k ohms (47k,5%,0.125W,SF)	11-5233-5
Change capacitor ident C508 to C523 (4n7,10%,100V,CP)	14-6894-4
Add 120k ohms resistor R356 (120k,5%,0.125W,SF)	11-5431-1
Add 1nF capacitor C326 (1n,10%,100V,CP)	14-6934-7
Change resistor R320 to 220k ohms (220k,5%,0.125W,SF)	11-5347-5
Change capacitor C321 to 10nF (10n,10%,400V,MP)	14-6994-0

SECTION 8 ADJUSTMENT LOCATIONS (Physical)

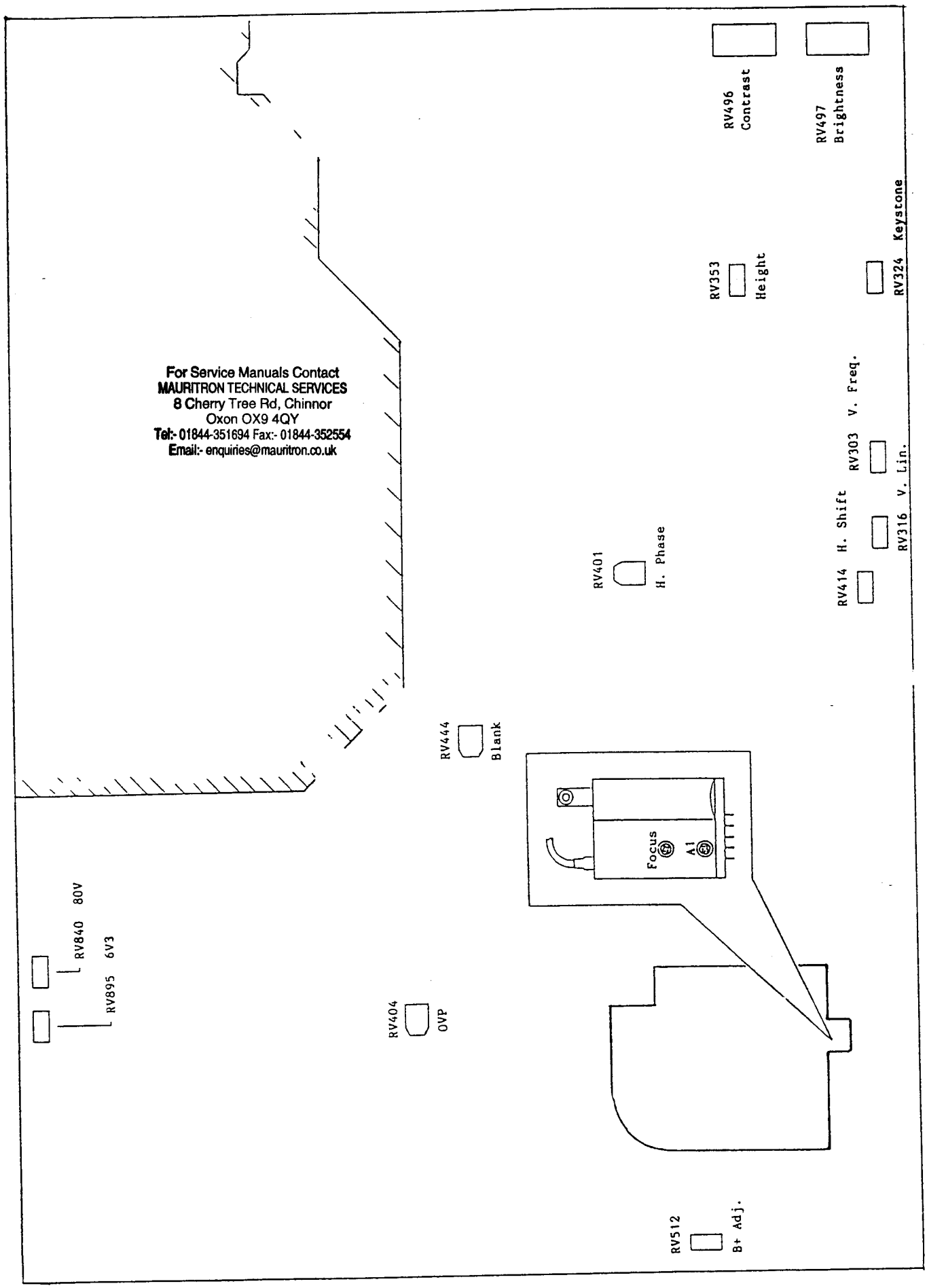
8.1 Video P.W.B. Adjustments



8.2 Audio P.W.B Adjustments



8.3 Main Chassis P.W.B Adjustments



SECTION 9. PARTS LIST

This section lists most of the parts common to all the chassis identified on the front cover of this manual and which should be changed with replacement parts supplied by the manufacturer,s parts and service division. All parts not listed can be purchased at most reputable electronic components suppliers. See main circuit diagram for individual values and tolerances.

Components marked ⚠ are safety critical approved types and ***must*** be replaced with components supplied by the manufacturer. All other parts should be replaced with components of the same type and rating as those originally fitted.

9.1 Capacitors

Key to capacitor type codes.

MP - Metalized Polyester, PP - Polypropylene, P - Polyester, MPP - Metalized Polypropylene, CP - Ceramic Plate, PS - Polystyrene, CD - Ceramic Disc, MPS - Metalized Polystyrene, E - Electrolytic.

Cct Ref	Value	Tol%.	Volts	Type	Part number
C211,440,441	10n	-20+80	63	CP	14-6892-8
C216,220,222,234, C235,241,245,246,	100n	20	50	RPE132	14-7093-0
C225,227	10n	10	100	CP	14-7306-9
C226,238,853	100n	5	100	CP	14-7221-6
C228,229,237	2p2	±0.5p	400	CD	14-4298-8
C231	150p	5	50	CP N150	14-6912-6
C232,250	2n2	10	100	CP	14-6893-6
C233,420	56p	5	2kV	CP	14-7215-1
⚠C236	10n	-20+50	2kV	CD	14-6954-1
C243,244	470p	10	100	CP	14-6940-1
C247-249	100n	-20+80	50	Z5U	72-0000-5
C301,306,711, C716	4n7	10	100	CP	14-6894-4
C304	330n	5	63	MP	14-7124-4
C308,403,722,723, C726,727	10n	20	400	MP	14-6838-3
C311,312,509	100n	5	63	MP	14-6980-0
C314	270p	1	630	PS	14-7046-9
C315	820p	10	100	CP	14-7064-7
C318,717,846	470p	10	100	CP	14-6940-1
C321	10n	10	400	MP	14-6994-0
C522,713,816	1n	10	100	CP	14-6934-7
C325	470n	5	63	MP	14-6964-9
C405	33n	20	250	MP	14-6840-5
C406	150p	5	2kV	PP	14-7272-0
C411	1n	20	400	CD	14-4320-8
C421,427	470p	1	630	PS	14-6999-1
C425	10n	-20+50	100	CP	14-6903-7
C435	120p	5	50	CP NPO	14-7308-5
C436	1n	5	100	CP NPO	14-7307-7
C442	3n3	5	100	CP NPO	14-7305-0
C506,701,702	27p	2	50	CP N150	14-6886-3
C507	100p	2	100	CP NPO	14-6948-7
C510	3n3	5	63	MP	14-7286-0
C511	100n	20	100	MP	14-6864-2
C521	100n	20	250	MP	14-4386-0
C705,707,729,730, C854	10n	20	50	RPE132	14-7105-8
C718	47p	5	63	CP N150	14-6882-0
⚠C801	1μ	20	250VAC MAINS		14-6919-3
⚠C802	470n	10	250	MP X2	14-7290-9
⚠C806	1n	20	250VAC	CP	14-6937-1
C813	470p	2	100	CP N1500	14-7045-0
C814,815	3n3	1	160	PS	14-4849-8
C818	33n	10	1kV	PP	14-6991-6
C819	680p	5	1k6	PP	14-7077-9
C820	100n	20	400	MP	14-5003-4
C825	10n	10	400	MP	14-6994-0

Cct Ref	Value	Tol%.	Volts	Type	Part number
C826	22n	10	250	MP	14-6877-4
⚠C827	3n3	20	400VAC	CLASS Y	14-6977-0
⚠C831,832	1n	20	400VAC		14-6949-5
⚠C835	1n0	1	250	PS	14-7003-5
C845	220p	2	50	CP N470	14-7092-2
C850	100n	10	100	MP	14-7213-5
C852	10n	10	100	CP	14-7306-9
C855,857	220n	20	50	RPE122	14-7072-8
CE215,838	100µ	20	16	E 6.8 DIA	14-7162-7
CE239	220µ	20	100	E 105°C	14-7186-4
CE501	47µ	20	250VDC	LOW ESR	14-6992-4
CE504,821	100µ	20	250	E 105°C	14-7257-7
CE807	100µ	20	400	E 105°C	14-7079-5
CE822	470µ	20	100	E 105°C	14-7297-6
CE823	1000µ	20	35	E 105°C	14-7265-8
CE836,841	1000µ	20	25	E 105°C	14-7210-0

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9.1.1 Chassis differences - Capacitors - Circuit reference and part numbers

The following table lists all capacitors not common to all the chassis identified below. Component values are listed below against each circuit reference. Where a circuit reference has capacitors with different values, the part number is added for ease of identification.

	CHASSIS NUMBERS					
CAP ID	U14N1	U14N1M	U15N1	U15N1M	U17N1	U17N1M
C101					14-5163-4	14-5163-4
C105/106					14-6836-7	14-6836-7
C107					14-6934-7	14-6934-7
C108					14-6814-6	14-6814-6
C407	14-7317-4	14-7317-4	14-7317-4	14-7317-4	14-7277-1	14-7277-1
C409	14-7289-5	14-7289-5	14-7289-5	14-7289-5	14-7288-7	14-7288-7
C410	14-7292-5	14-7292-5	14-7292-5	14-7292-5	14-7298-4	14-7298-4
C413	14-7279-8	14-7279-8	14-7284-4	14-7284-4	14-7279-8	14-7279-8
C415/416	14-7329-8	14-7329-8	14-7269-0	14-7269-0	14-7326-3	14-7326-3
C418	14-7225-9	14-7225-9	14-6960-6	14-6960-6	14-7225-9	14-7225-9
C419			14-7268-2	14-7268-2		
C448					14-4384-4	14-4384-4
C601-603		14-6836-7		14-6836-7		14-6836-7
C604		14-7030-2		14-7030-2		14-7030-2
C606		14-7030-2		14-7030-2		14-7030-2
C611		14-6836-7		14-6836-7		14-6836-7
C613		14-6836-7		14-6836-7		14-6836-7
C616/617		14-6836-7		14-6836-7		14-6836-7
C724		14-6869-3		14-6869-3		14-6869-3
C848					14-6984-3	14-6984-3
C849					14-7182-1	14-7182-1
CE102/3					14-6846-4	14-6846-4
CE104					14-6962-2	14-6962-2
CE317	14-6844-8		14-6844-8		14-6844-8	
CE605		14-6854-5		14-6854-5		14-6854-5
CE607		14-6854-5		14-6854-5		14-6854-5
CE608-10		14-7310-7		14-7310-7		14-7310-7
CE612		14-7310-7		14-7310-7		14-7310-7
CE614		14-6844-8		14-6844-8		14-6844-8
CE615		14-6853-7		14-6853-7		14-6853-7
CE719			14-7162-7	14-7162-7	14-7162-7	14-7162-7
CE732	14-6846-4		14-6846-4		14-6846-4	
C217-219	14-7090-6	14-7090-6	14-7090-6	14-7090-6	14-6902-9	14-6902-9

Table 5

9.1.2 Chassis Differences - Capacitors - Values and tolerances

Cct Ref.	Val	Tol%	Volts	Type	Part number
C101	220n	20	250 AC mains		See Table 5
C105,106	100n	20	63	MP	"
C107	1n	10	100	CP	"
C108	100p	5	50	TC	"
C407	5n6	2	2kV	PP	14-7277-1
C407	4n3	2	2kV	PP	14-7317-4
C409	7n5	2	1.6kV	PP	14-7288-7
C409	6n2	2	1.6kV	PP	14-7289-5
C410	6µ8	10	100	MP	14-7292-5
C410	10µ	10	100	MP	14-7298-4
C413	120n	5	400	PP	14-7279-8
C413	100n	5	400	PP	14-7284-4
C415,416	270n	5	400	PP	14-7269-0
C415,416	390n	5	400	PP	14-7329-8
C415,416	330n	5	400	PP	14-7326-3
C418	820n	5	250	PP	14-6960-6
C418	1µ0	5	250	PP	14-7225-9
C419	27n	5	630	PP	See Table 5
C448	47n	20	250	MP	"
C611,613,616,617, C601-603	100n	20	63	MP	"
C604,606	330p	2	50	CP N750	"
C724	470n	10	63	MP	"
C848	33n	10	630	PP	"
C849	5n6	5	800	PP	"
CE102,103,732	4µ7	20	50	E	"
CE104	47µ	20	50	E	"
CE317,614	1µ	20	50	E	"
CE605,607	100µ	20	10	E	"
CE608-10,612	470µ	20	25	E	
"					
CE615	47µ	20	25	E	"
CE719	100	20	16	E	"
C217-219	22p	2	50	CP NPO	14-7090-6
C217-219	47p	5	50	CP	14-6902-9

9.2 Resistors

The majority of resistors are carbon film types of less than 0.6W obtainable from most electronic components stockists and are therefore not listed. Refer to the circuit diagram for values. All other parts should be replaced with components supplied by the manufacturer. Replacements should always be of a power rating equal to the originals. This is particularly important for those resistors 'stood off' the printed circuit board.

Key to resistor type codes:

MF - Metal Film, MO - Metal Oxide, CF - Carbon Film, SF - Standard Film, WW - Wire Wound, Fl Ret - Flame Retardant, Fl Prf - Flame Proof, Fus - Fusible.

Cct Ref	Value	Tol%.	Watts	Type	Part number
R207	6k8	1	0.125	M/F	11-5791-4
R209	3k9	1	0.125	M/F	11-5790-6
R210	8k2	1	0.125	M/F	11-5792-2
R217	2k2	5	1	M/O	11-5811-2
⚠R233,262,412,4133					
⚠R480	10	5	0.5	M/F Fl Ret	11-5292-0
⚠R259	4R7	5	0.5	M/F Fl Ret	11-5291-2
R305	1k0	1	0.125	M/F	11-5750-7
R308	2k7	1	0.125	M/F	11-5538-5
R333	18k	2	0.25	C/F	11-5701-9
R339	68k	2	0.25	C/F	11-5702-7
R344	68R	5	2	M/O	11-5751-5
R345	180R	5	2	M/O	11-5696-9
R406	220R	5	3	W/W	11-5542-3
⚠R410,516	100R	5	0.5	M/F Fl Prf	11-5628-4
⚠R411	1R	5	0.5	M/F Fl Ret	11-5461-3
⚠R419	1R8	5	0.5	M/F Fl Ret	11-5373-0
R742	180k	2	0.25	C/F	11-5703-5
R743	18k	2	0.25	C/F	11-5701-9
⚠R828	0R27	5	0.5	M/F Fl Ret	11-5459-1
R829	2k5	5	7	W/W	11-5580-6
⚠R830	1k	5	2	M/O	11-5612-8
R831,832	18k	5	5	W/W	11-5576-8
R838	68k	2	0.4	M/F	11-3344-6
R839	1k8	2	0.4	M/F	11-3722-0
R846	27k	1	0.125	M/F	11-5710-8
⚠R868	47k	5	3	M/F Fl Ret	11-5691-8
R884,888	47k	5	2	M/F	11-5418-4
R4121,4122	3R9	5	5	W/W	11-5748-5
RV238,239,240-243, RV414,895	100R	30	6mm Pot Lin		12-4603-8
RV303	22k	30	6mm Pot Lin		12-4617-8
RV316	100k	30	6mm Pot Lin		12-4621-6
RV324	5k	30	6mm Pot Lin		12-4613-5
RV353	220k	30	6mm Pot Lin		12-4622-4
RV401	10k	30	6mm Pot Lin		12-4639-9
RV404,444	47k	30	6mm Pot Lin		12-4641-0
RV496	10k	20	R121V0AF15B103		12-3215-0
RV497	20k	20	R121V1AF15B203		12-4649-6
RV512	10k	30	6mm Pot Lin		12-4615-1
RV840	4k7	30	6mm Pot Lin		12-4612-7
R802	10R	NTC Thermistor			11-5529-6
⚠R804	18R	Dual PTC Thermistor			11-5531-8

9.2.1 Chassis differences - Resistors - Circuit reference and part numbers

The following table lists all resistors not common to all the chassis identified below. Component values are listed below against each circuit reference. Where a circuit reference has resistors with different values, the part number is added for ease of identification.

	CHASSIS NUMBERS					
RES ID	U14N1	U14N1M	U15N1	U15N1M	U17N1	U17N1M
R102/103					11-5246-7	11-5246-7
R104/105					11-5235-1	11-5235-1
R106					11-5247-5	11-5247-5
R107					11-5438-9	11-5438-9
R108/109					11-5229-7	11-5229-7
R111					11-5226-2	11-5226-2
R112					11-5254-8	11-5254-8
R113					11-2732-2	11-2732-2
R114					11-2768-3	11-2768-3
R115/116					11-2736-5	11-2736-5
R117					11-5489-3	11-5489-3
R118					11-5207-6	11-5207-6
R314	11-5451-6	11-5451-6	11-5487-7	11-5487-7	11-5487-7	11-5487-7
R315	11-5234-3	11-5234-3	11-5276-9	11-5276-9	11-5276-9	11-5276-9
R325	11-5781-7	11-5245-9	11-5781-7	11-5245-9	11-5781-7	11-5245-9
R331	11-5380-3		11-5380-3		11-5380-3	
R4111					11-5227-0	11-5227-0
R4112					11-2792-6	11-2792-6
R4113			11-5233-5	11-5233-5	11-5233-5	11-5233-5
R4114/5			11-3430-2	11-3430-2	11-3430-2	11-3430-2
R4116/7			11-5231-9	11-5231-9	11-5231-9	11-5231-9
R4118			11-5344-7	11-5344-7	11-5344-7	11-5344-7
R4119			11-5231-9	11-5231-9	11-5231-9	11-5231-9
R4120			11-5228-9	11-5228-9	11-5228-9	11-5228-9
R601		11-5489-3		11-5489-3		11-5489-3
R602-605		11-5221-1		11-5221-1		11-5221-1
R606/607		11-5291-2		11-5291-2		11-5291-2
R608/609		11-2737-3		11-2737-3		11-2737-3
R610-613		11-5230-0		11-5230-0		11-5230-0
R611/612		11-5216-5		11-5216-5		11-5216-5
R614/615		11-5216-5		11-5216-5		11-5216-5
R616		11-5233-5		11-5233-5		11-5233-5
R617		11-5380-3		11-5380-3		11-5380-3

Table 6

9.2.2 Chassis differences - Resistors continued

	CHASSIS NUMBERS					
RES ID	U14N1	U14N1M	U15N1	U15N1M	U17N1	U17N1M
R618		11-5248-3		11-5248-3		11-5248-3
R620/621		11-5232-7		11-5232-7		11-5232-7
R754			11-5231-9	11-5231-9	11-5231-9	11-5231-9
R755			11-5249-1	11-5249-1	11-5249-1	11-5249-1
R758	11-5221-1	11-5230-0	11-5221-1	11-5230-0	11-5221-1	11-5230-0
R759		11-5232-7		11-5232-7		11-5232-7
R761		11-4266-6		11-4266-6		11-4266-6
R762		11-5213-0		11-5213-0		11-5213-0
R809					11-5693-4	11-5693-4
R810					11-5542-3	11-5542-3
RV619		12-4639-9		12-4639-9		12-4639-9

Table 7

9.2.3 Chassis Differences - Resistors - Values and tolerances

Cct Ref	Value	Tol%.	Watts	Type	Part Numbers
R102,103	18k	5	0.125	C/F	See Tables 6/7
R104,105	68k	5	0.125	S/F	"
R106	220k	5	0.125	S/F	"
R107	270k	5	0.125	C/F	"
R108,109	3k3	5	0.125	S/F	"
R111	470R	5	0.125	S/F	"
R112	1k8	5	0.125	C/F	"
R113	2k2	5	0.25	C/F	"
R114	22k	5	0.25	C/F	"
R115,116	470k	5	0.25	C/F	"
R117,601	330k	5	0.125	C/F	"
R118	33k	2	0.6	M/F	
R314	820k	5	0.125	S/F	11-5451-6
R314	560k	5	0.125	S/F	11-5487-7
R315	82k	5	0.125	S/F	11-5234-3
R315	56k	5	0.125	S/F	11-5276-9
R325	33k	5	0.125	S/F	11-5245-9
R325	36k	5	0.125	M/F	11-5781-7
R331,617	150k	5	0.125	S/F	See Tables 6/7
R4111	820R	5	0.125	S/F	"
R4112	3k9	5	0.125	C/F	"
R4113,616	47k	5	0.125	S/F	"
R4114,4115	10R	5	0.25	C/F	
R4116,4117,4119, R754	4k7	5	0.125	C/F	"
R4118	2k7	5	0.125	S/F	"
R4120	1k2	5	0.125	S/F	"
R602-605	100k	5	0.125	S/F	"
⚠R606,607	4R7	5	0.5	M/F Fl Ret	"
R608,609	180R	5	0.25	C/F	"
R610,613	22k	5	0.125	S/F	"
R611,612,614,615	1M	5	0.125	C/F	"
R618	1k5	5	0.125	C/F	"
R620,621,759	10k	5	0.125	S/F	"
R755	15k	5	0.125	S/F	"
R758	100k	5	0.125	S/F	11-5221-1
R758	22k	5	0.125	S/F	11-5230-0
⚠R761	10R	5	0.5	M/F Fusible	See Tables 6/7
R762	1k	5	0.125	C/F	"
⚠R809	18R	Single PTC Thermistor			"
R810	220R	5	3	W/W	"
RV619	10K	30	6mm Pot Lin		

9.3 Diodes

Cct Ref	Description	Part number
D201,202,302-304,306,307, D419,422-424,426,427,431-433, D501,502,505,513,515,709-711, D714,715,721,724-728,807,808, D814-817,830,837-841,845,901-903,	1N4148	19-3992-0
D203,206,207	1SS83 1A 250V 100ns	19-8595-7
D204,205,407,408,507,812,813,827	RGP10D 1A 200V 150ns	19-8603-1
D301,470,504,509,825,826,829	1N4003	19-8346-6
D404	Ultra fast 8A 800V	19-8803-4
D503	UF5404 3A 400V	19-8606-6
D702-706,708	LED Green L-21GD	19-8737-2
D717,719	BAT85 Schottky	19-8163-3
D801-804	BY133GP	19-8144-7
D809-811,818	RGP15M	19-8340-7
D819,820,844	RGP10M	19-5135-1
D821	RGP10D 1A 200V 150ns	19-8603-1
D822,824	3GU41 400V 3A S-FRD	19-8637-6
ZD305	C9V1 5% 345mW	19-4033-3
ZD413	Zener 2V7 500mW	19-8598-1
ZD418	C6V8 5% 345mW V/Reg	19-4528-9
ZD420	C33V 5% 345mW V/Reg	19-8531-0
ZD435	C4V7 5% 350mW V/Reg	19-8032-7
ZD519,823	C12V 5% 350mW V/Reg	19-5070-3
ZD718,720	C5V1 5% 345mW	19-6295-7
ZD806	Zener C16V 5% 345mW	19-4517-3
ZD833	Zener C5V6 5% 850mW	19-8774-7
ZD846	C5V6 5% 345mW V/Reg	19-4952-7

9.3.1 Chassis differences - Diodes - Circuit reference and part numbers

The following chart lists all diodes not common to all the chassis identified below. Component values are listed below against each circuit reference. Where a circuit reference has diodes with different values, the part number is added for ease of identification.

	CHASSIS NUMBERS					
DIODE ID	U14N1	U14N1M	U15N1	U15N1M	U17N1	U17N1M
D103					19-3992-0	19-3992-0
D601/602		19-3992-0		19-3992-0		19-3992-0
D701	19-8678-3	19-8678-3	19-8678-3	19-8678-3		
D707			19-8737-2	19-8737-2	19-8737-2	19-8737-2
D842/843					19-5135-1	19-5135-1
ZD434					19-8076-9	19-8076-9
ZD603		19-4952-7		19-4952-7		19-4952-7
D403	19-8650-3	19-8650-3	19-8650-3	19-8650-3	19-8833-6	19-8833-6

Table 8

9.3.2 Chassis Differences - Diodes - Description

Cct Ref	Description	Part number
D103,601,602	1N4148	See Table 8
D404	5A 1600V 5THZ52	19-8650-7
D403	8A 1500V DD82RC	19-8833-6
D701	LED Green	19-8678-3
D707	LED Green L-21GD	See Table 8
D842,843	RGP10M	"
ZD434	C18V 5% 345mW V/Reg	"
ZD603	C5V6 5% 345mW V/Reg	"

9.4 Ferrite Beads

Cct Ref	Description	Part number
FB201,202,218-220	FBR07VA121NB	15-7887-1
FB203-208	CP22 53R @ 100MHz	15-7886-3
FB215-217	FBA04VA450AB	15-7890-1
FB221,222	CP22RB120070060M	15-7883-9
FB503	4S2 5x1.5x4mm	15-7590-2
FB801,803	4S2 8x1.5x10mm	15-7578-3
FB804	BRH 17.5x28.5x9.5mm	15-7844-8

9.5 Chokes, Filters, and Crystals

Cct Ref	Description	Part number
⚠FL802	Filter choke mains	15-7688-7
L204	Choke 330nH 10%	15-7705-0
L205,206	Choke 150nH	15-7692-5
L208	Choke 33µH 10%	15-7818-9
⚠L401	Coil horizontal linearity	87-0292-6-002
L402	Choke 700µH CHK311	15-7679-8
L403	Choke 0.56µH 20%	15-7876-6
L404	Choke 100µH 10% 1.2A	15-7869-3
L501	Choke 3mH 10% 1A	87-0229-2-001
L502	Choke 10µH (high current)	85-1753-3
XL/U1	Xtal 12.00MHz (20pF) PR	16-1940-3

9.5.1 Chassis differences - Chokes, Filters & Crystals - Circuit reference and part numbers

The following chart lists all diodes not common to all the chassis identified below. Component values are listed below against each circuit reference. Where a circuit reference has diodes with different values, the part number is added for ease of identification.

	CHASSIS NUMBERS					
DIODE ID	U14N1	U14N1M	U15N1	U15N1M	U17N1	U17N1M
L401	87-0292-6-002		87-0292-6-002		87-0307-8-001	

Table 9

9.5.2 Chassis differences - Chokes, Filters & Crystals - Description

L401	Coil horizontal linearity	87-0292-6-002
L401	Coil horizontal linearity	87-0307-8-001

9.6 Transformers

Cct Ref	Description	Part number
⚠T401	Line Drive	87-0293-4-001
⚠T501	Gate Drive	87-0233-0-001
⚠T801	SMPSU	87-0274-8-001

9.6.1 Chassis differences - Transformers - Circuit reference and part numbers

The following chart lists all transformers not common to all the chassis identified below. Component values are listed below against each circuit reference. Where a circuit reference has transformers with different values, the part number is added for ease of identification.

	CHASSIS NUMBERS					
T'form'r ID	U14N1	U14N1M	U15N1	U15N1M	U17N1	U17N1M
T402	87-0284-5-001		87-0284-5-001		87-0278-0-002	
T403	87-0271-3-001		87-0271-3-001		87-0285-3-001	
T402 Assy	01-1151-1	01-1151-1	01-1151-1	01-1151-1		

Table 10

9.6.2 Chassis Differences - Transformers - Description

T402	Fly back	87-0284-5-001
T402	Fly back	87-0278-0-002
⚠T403	Diode Modulator	87-0271-3-001
⚠T403	Diode Modulator	87-0285-3-001

9.7 Integrated Circuits

Cct Ref	Description	Part number
IC201	U2203B	19-8789-5
IC202	LM2419T	19-8776-3
IC301	TDA1675A	19-8480-2
IC303,402	LM358N	19-8356-3
IC401	4046B	19-8597-3
IC403	LM317T	19-8264-8
IC501,801	UC3842AN	19-8696-1
IC701	PCB80C51BH-2P	19-8719-4
IC702	CMOS EEPROM 512 BYTE	19-8525-6
IC703	74HC86	19-8712-7
IC704	L4941	19-8276-1
⚠IC802	Opto-Isolator	19-8644-9
IC803	Regulator TL431CLPR	19-8584-1
IC804	Regulator +12v 0.5A TO220	19-8398-9
⚠IC806	Opto-Isolator TLP731GB(D4)-LF2	19-8790-9
IC807	LM393N	19-8162-5

9.7.1 Chassis differences - Integrated Circuits - Circuit reference and part numbers

The following chart lists all integrated circuits not common to all the chassis identified below. Component values are listed below against each circuit reference. Where a circuit reference can have different I/C's, the part numbers are added for ease of identification.

	CHASSIS NUMBERS					
IC IDENT	U14N1	U14N1M	U15N1	U15N1M	U17N1	U17N1M
IC101					19-8356-3	19-8356-3
IC302	19-8660-0	19-8660-0	19-8698-8	19-8698-8	19-8698-8	19-8698-8
IC404			19-8401-2	19-8401-2	19-8401-2	19-8401-2
IC601		19-8401-2		19-8401-2		19-8401-2
IC602		19-8771-2		19-8771-2		19-8771-2

Table 11

9.7.2 Chassis Differences - Integrated Circuits - Descriptions

Cct Ref	Description	Part number
IC101	LM358N	See Table 11
IC302	TDA4950	19-8660-0
IC302	TDA8145	19-8698-8
IC404,601	TDA2822M	See Table 11
IC602	4007UB	

9.8 Transistors

Cct Ref	Description	Part number
Q401-403	FET 2SK526	19-8705-4
Q501	FET STP10NA40FI	19-8809-3
Q801	FET 2SK1649 900V 6A	19-8647-3
Q804	Trans 2SK858	19-8424-1
Q805	MOSFET BUK452-60B	19-8710-0
TR201,711,724,725	PH2369	19-8324-5
TR202	2SC3953E	19-8624-4
TR203,204	BF422	19-8744-5
TR205,302,303,404,408, TR415,418,421,506,707-710, TR712-715,723,729,730.804-806, TR810-812,901,902	General purpose NPN	19-8590-6
TR301,407	DD711	19-8826-3
TR304,305,401,403,409-411, TR413,414,416,417,419,420, TR423,425,427,428,801-803,808,206	General purpose PNP	19-8591-4
TR406	MPSA43	19-8532-9
TR422	2SD667C 1A NPN	19-8601-5
TR424	BF423	19-8767-4A
TR702-706,728	RN2202	19-8711-9
TR807,809	2SC1815-BL NPN	19-8646-5

9.8.1 Chassis differences - Transistors - Circuit reference and part numbers

The following chart lists all transistors not common to all the chassis identified below. Component values are listed below against each circuit reference. Where a circuit reference can have different transistors the part numbers are added for ease of identification.

	CHASSIS NUMBERS					
T'sistor ID	U14N1	U14N1M	U15N1	U15N1M	U17N1	U17N1M
TR101					19-8753-4	19-8753-4
TR102					19-8753-4	19-8753-4
TR402	19-8760-7	19-8760-7	19-8760-7	19-8760-7	19-8770-4	19-8770-4
TR726			19-8711-9	19-8711-9	19-8711-9	19-8711-9

Table 12

9.8.2 Chassis Differences - Transistors - Descriptions

Cct Ref	Description	Part number
TR101,102	2SC4632FI	See Table 12
TR402	2SC3886A	19-8760-7
TR402	2SC4288A	19-8770-4
TR726	RN2202	See Table 12

9.9 Plugs and Sockets

Cct Ref	Description	Part number
PL203	Conn 9 way header straight	22-8377-8
PL207,407,808	PWB pin 2.36mm	22-8421-9
PL208	Conn 1 way B1P-LV-TN	22-8280-1
PL406	Conn 4 way plug 22-03-2041	22-8210-0
PL802	Conn 3 way plug RTB-1.5-3	22-8279-8
PL902	Conn 5 way header 90 degree	22-8373-5
SK202	W/harness brightness/contrast	83-5760-9-002
SK204	W/harness power video	83-5759-5-001
SK205	Lead E1	83-5970-9-001
SK402	Lead BKG/CMP	83-6005-7-001
SK406	Shunt type 9610-102-10	22-8203-8
⚠ SK801	Mains lead internal	83-5848-6-001
SK804	Wire G1 bias	83-5320-4-002
SK902	W/harness S-cap switch	83-6006-5-002

9.9.1 Chassis differences - Plugs and Sockets - Circuit reference and part numbers

The following chart lists all plugs and sockets not common to all the chassis identified below. Component values are listed below against each circuit reference. Where a circuit reference can have different plugs or sockets the part numbers are added for ease of identification.

	CHASSIS NUMBERS					
PLG/SKT ID	U14N1	U14N1M	U15N1	U15N1M	U17N1	U17N1M
PL101					22-8364-6	22-8364-6
PL102					22-8421-9	22-8421-9
PL401			22-8386-7	22-8386-7	22-8386-7	22-8386-7
PL403			22-8433-2	22-8433-2	22-8433-2	22-8433-2
PL404	22-8255-0	22-8255-0				
PL601		22-8382-4		22-8382-4		22-8382-4
PL602		22-8382-4		22-8382-4		22-8382-4
PL606		22-8442-1		22-8442-1		22-8442-1
PL803					22-8402-2	22-8402-2
PL810					22-8386-7	22-8386-7
SK103					83-5968-7-001	
SK603		22-8441-3		22-8441-3		22-8441-3
SK604		22-8337-9		22-8337-9		22-8337-9
SK605		22-8337-9		22-8337-9		22-8337-9
SK606		22-8440-5		22-8440-5		22-8440-5
SK901	25-2079-6	25-2079-6	25-2079-6	25-2079-6	25-2085-0	25-2085-0
PL801	42-0211-2	42-0211-2	42-0211-2	42-0211-2	22-8423-5	22-8423-5

Table 13

9.9.2 Chassis Differences - Plugs and Sockets - Descriptions

Cct Ref	Description	Part number
PL101	Conn 5 way header 5267-05	See Table 13
PL102	PWB pin 2.36mm	"
PL401	Conn 2 way header straight	"
PL403	Conn 4 way B4P-LV-TN	"
PL404	Base and pin 6P HBR-206C	"
PL601	Conn 2 way header 90 degree	"
PL602	Conn 2 way header 90 degree	"
PL606	Conn 3 way plug 2556P03TA00	"
PL803	Conn 2 way header 5289	"
PL810	Conn 2 way header straight	"
SK103	W/harness dynamic focus output	"
SK603	Conn 3.5mm stereo audio	"
SK604	Conn phono skt LVP1120-0101	"
SK605	Conn phono skt LVP1120-0101	"
SK606	Conn 3 way skt	
⚠SK901	CRT base skt Narrow neck	25-2079-6
⚠SK901	CRT base skt Dual focus	25-2085-0
PL801	Conn 2 way plus base	22-8423-5
PL801	Conn 2 way plug SE20/4451	42-0211-2

** The part numbers for these components can be found on the difference grid at their circuit reference and chassis co-ordinates.

9.10 Miscellaneous

Cct Ref	Description	Part number
S701	Switch 3 way JTP 32-03B	20-4096-4
⚠S801	Switch 2 pole push-push power	20-4091-3
⚠FS401	Fuse T500mA TR5-T 19372/K	21-3713-5
⚠FS801	Fuse Timelag 3.15A ceramic	21-3743-7
⚠FS801A	Fuse holder DE611/01	21-3712-7
⚠G201-204	Spark gap DSP-201M-A11F	21-3727-5
A-A	Wiring harness grey 360mm ±5mm	83-6207-6-001
B-B	Wiring harness red 220mm ±5mm	83-6208-4-001
C-C	Wiring harness grey 220mm ±5mm	83-6209-2-001
D-D	Wiring harness red 220mm ±5mm	83-6208-4-001
F-F	Wiring harness grey 145mm ±5mm	83-6210-6-001
G-G	Wiring harness grey 280mm ±5mm	83-6211-4-001
H-H	Wiring harness grey 220mm ±5mm	83-6209-2-001
J-J	Wiring harness grey 50mm ±2.5mm	83-6212-2-002
-	Lead - Signal 1.5M long	83-5967-9-003
-	Lead - Field cancellation 450mm	83-5971-7-002
-	Lead - Video earth	83-6170-3-004
-	Screen PLL U Series	83-6216-5-001
-	Earth braid	83-6171-1-001
-	Earth braid	83-6309-9-003

For ease of identification the cabinet parts are listed by model number.

	PART ID	DESCRIPTION	14" MODELS		
			TM6412V-N128Z chassis U14N1	TM6414V-N128 chassis U14N1	TM6414VM-N128 chassis U14N1M
⚠	CRT 14" V	M34AFA60X48 CPT	18-1067-7	18-1067-7	18-1067-7
	CRT 14" VA				
⚠	Cabinet front		83-5951-2-001C	83-5963-6-002C	83-5963-6-002C
⚠	Cabinet back		83-5822-2-001C	83-5656-4-002C	83-5656-4-102C
	Plinth	Complete Assembly	01-0239-3	03-0860-9	03-0860-9
⚠	Degaussing coil		15-7864-2-001	15-7864-2-001	15-7864-2-001
	Tilt coil				
	Tilt coil mould'g				
	Earth braid		83-6350-1-001	83-6350-1-001	83-6350-1-001
	Control knob		83-5950-4-001C	83-4008-0-001C	83-4008-0-001C
	On/off knob		83-5946-6-001C	83-5699-8-001C	83-5699-8-001C
	Degaussing knob				
	Door		83-5945-8-001	83-5697-1-001C	83-5697-1-001C
⚠	Power lead		22-8366-2	22-8366-2	22-8366-2
	Back fixing screw		41-1482-5	41-1482-5	41-1482-5
	Carton		83-5599-1-002	83-5838-9-002	83-5838-9-002
	EPS top/front		83-5493-6-001	83-5892-3-004	83-5892-3-004
	EPS bottom/rear		83-5494-4-001	83-5893-1-003	83-5893-1-003
	Op Instructions	Five language	79-1596-9-003	79-1596-9-003	79-1596-9-003
⚠	Lead	Field cancel'n 730mm	83-6152-5-002	83-6152-5-002	83-6152-5-002

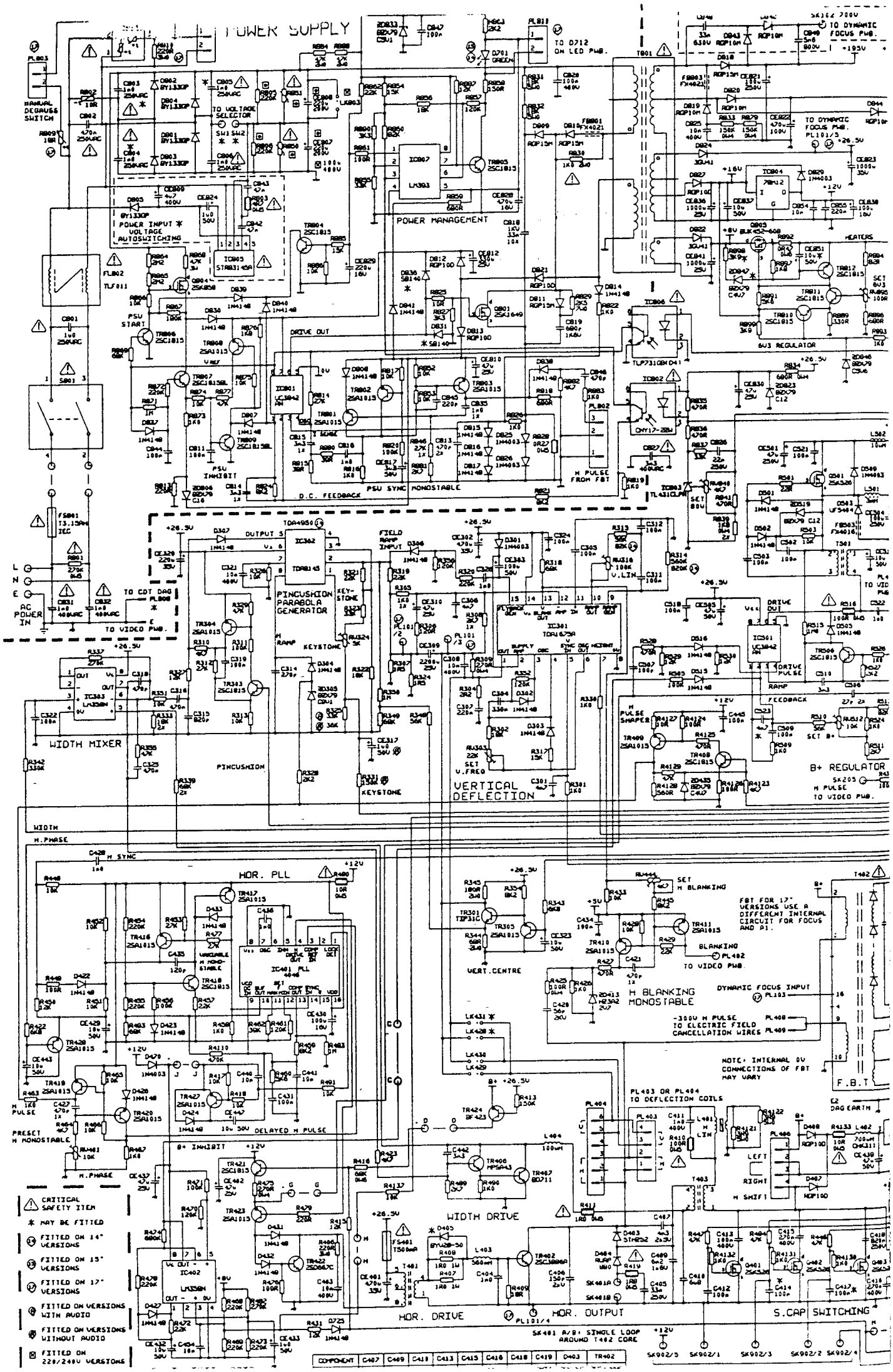
Table 14

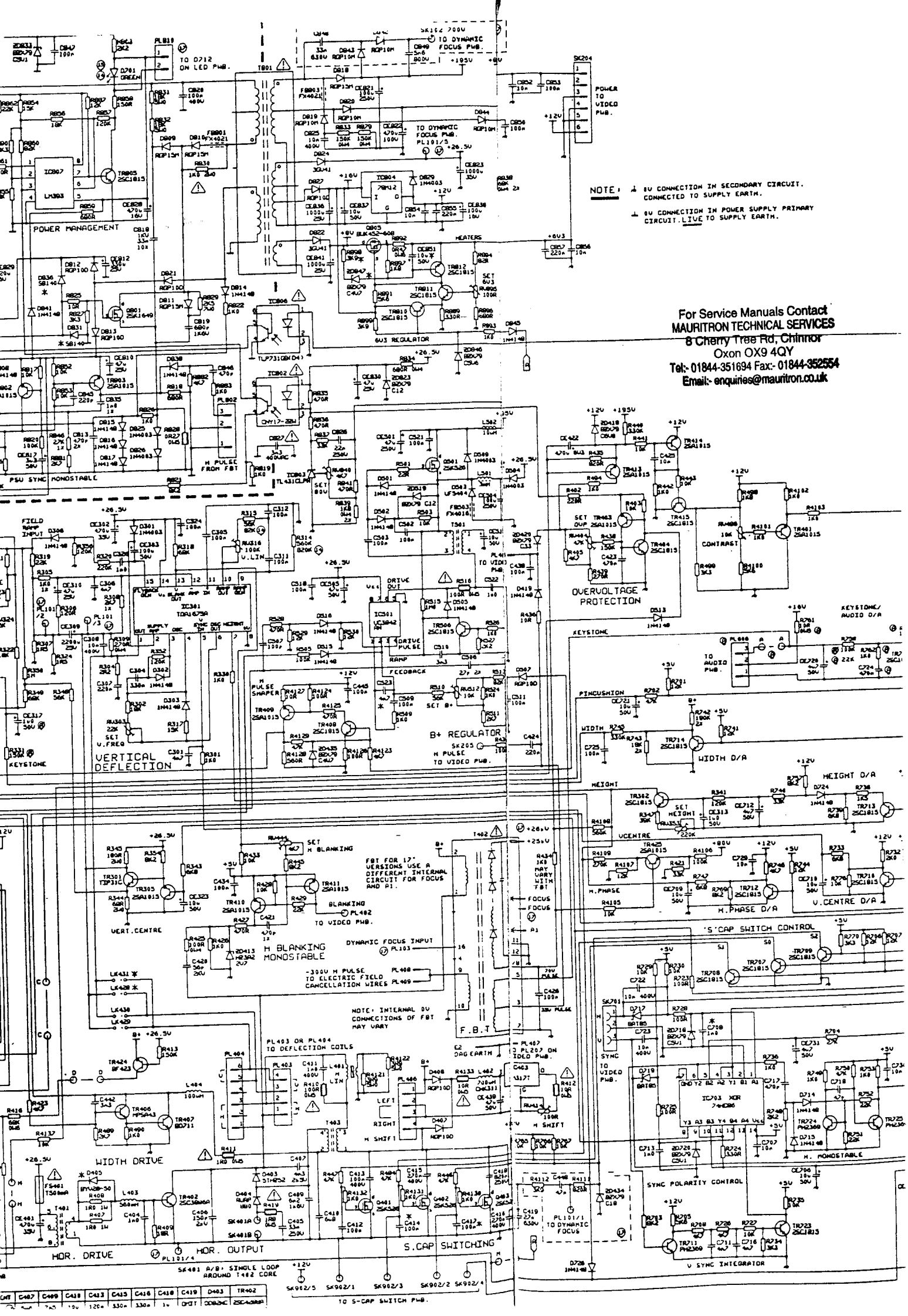
	PART ID	DESCRIPTION	15" MODELS		
			TM6513VA-N128Z chassis U15N1	TM6514VA-N128 chassis U15N1	TM6514VAM-N128 chassis U15N1M
⚠	CRT 15" V				
⚠	CRT 15" VA	M36EDR320X131/2F01 Phil	18-1072-3	18-1072-3	18-1072-3
⚠	Alternative CRT	M36KLH680X18 Hitachi	18-1056-1	18-1056-1	18-1056-1
⚠	Alternative CRT	M36EDR320X131/2F00 Phil	18-1071-5	18-1071-5	18-1071-5
⚠	Cabinet front		83-5960-1-001C	83-5655-6-002C	83-5655-6-002C
⚠	Cabinet back		83-5980-6-001C	83-5656-4-002C	83-5656-4-102C
	Plinth	Complete Assembly	01-0605-4	03-0860-9	03-0860-9
⚠	Degaussing coil		15-7864-2-001	15-7864-2-001	15-7864-2-001
	Tilt coil		87-0294-2-001	87-0294-2-001	87-0294-2-001
	Tilt coil mould'g		83-5912-1-003	83-5912-1-003	83-5912-1-003
	Earth braid		83-6308-0-003	83-6308-0-003	83-6308-0-003
	Control knob		83-6054-5-001C	83-4008-0-001C	83-4008-0-001C
	On/off knob		83-5966-0-001C	83-5699-8-001C	83-5699-8-001C
	Degaussing knob				
	Door		83-5697-1-001C	83-5697-1-001C	83-5697-1-001C
⚠	Power lead		22-8366-2		
	Back fixing screw		41-1482-5	41-1482-5	41-1482-5
	Carton		83-5838-9-002	83-5838-9-002	83-5838-9-002
	EPS top/front		83-6243-2-001	83-5892-3-004	83-5892-3-004
	EPS bottom/rear		83-6244-0-001	83-5893-1-003	83-5893-1-003
	Op Instructions	Five language	79-1596-9-003	79-1596-9-003	79-1596-9-003
⚠	Lead	Field cancel'n 730mm	83-6152-5-002	83-6152-5-002	83-6152-5-002

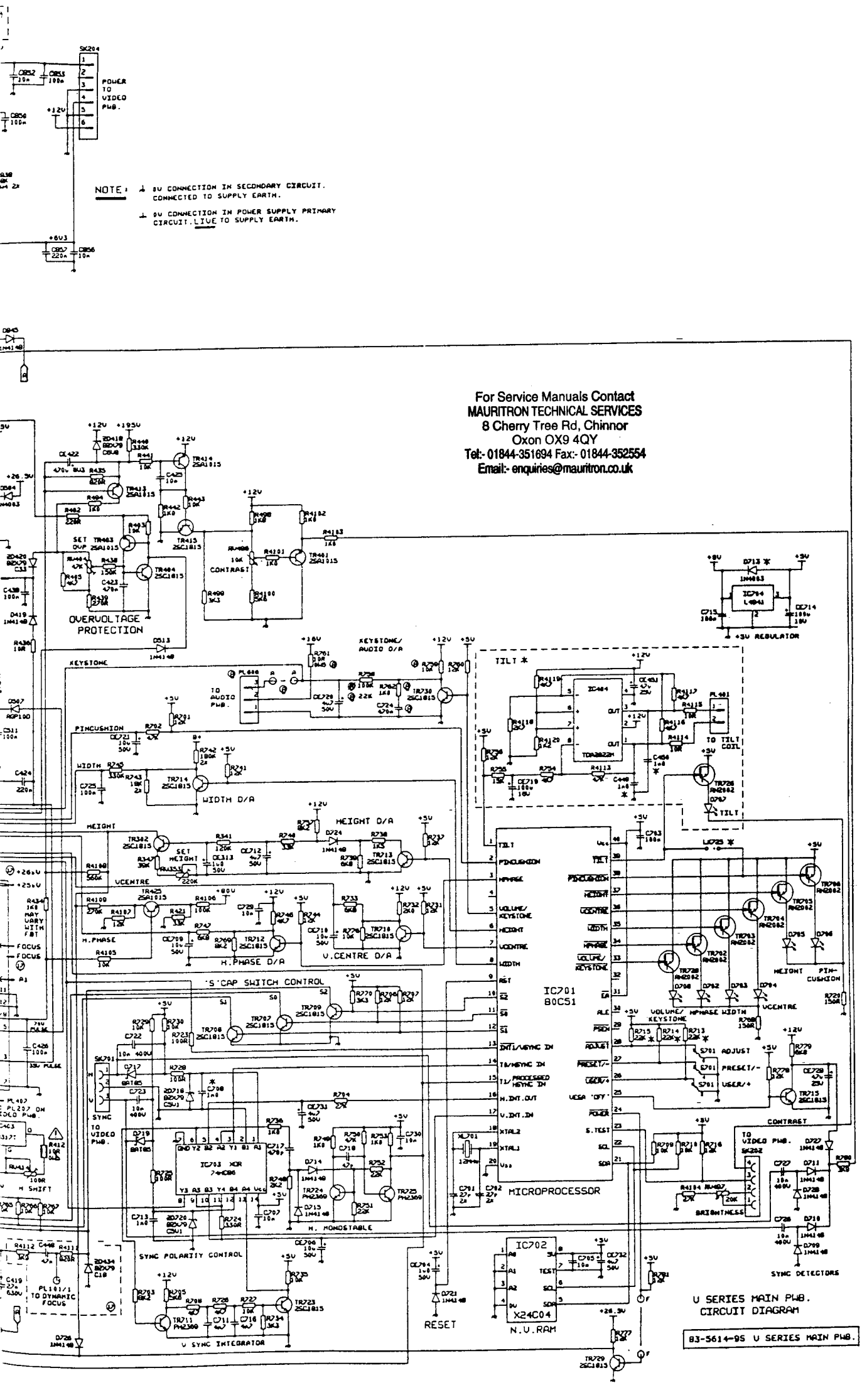
Table 15

	PART ID	DESCRIPTION	17" MODELS		
			TM6714VA-N128 chassis U17N1	TM6714VAM-N128 chassis U17N1M	
⚠	CRT 17" V				
⚠	CRT 17" VA	M41KVZ680X71(U) Hitachi	18-1077-4	18-1077-4	
⚠	Cabinet front		83-5881-8-001C	83-5881-8-002C	
⚠	Cabinet back		83-5882-6-001C	83-5882-6-101C	
	Plinth	Complete Assembly	03-1015-8	03-1015-8	
⚠	Degaussing coil		87-0235-7-002C	87-0235-7-002C	
	Tilt coil		87-0294-2-001	87-0294-2-001	
	Tilt coil mould'g		83-5912-1-003	83-5912-1-003	
	Earth braid		83-6044-8-003	83-6044-8-003	
	Control knob		83-4008-0-001C	83-4008-0-001C	
	On/off knob		83-5885-0-001C	83-5885-0-001C	
	Degaussing knob		83-5886-9-001C	83-5886-9-001C	
	Door				
⚠	Power lead				
	Back fixing screw		41-1482-5	41-1482-5	
	Carton		83-6041-3-001	83-6041-3-001	
	EPS top/front		83-6011-1-001	83-6011-1-001	
	EPS bottom/rear		83-6013-8-001	83-6013-8-001	
	Op Instructions	Five language	79-1596-9-003	79-1596-9-003	
	W/harness	Mains indicator	83-6079-0-001	83-6079-0-001	
	W/harness	Manual Degaussing	83-6084-7-001	83-6084-7-001	
⚠	Lead	Field cancel'n 850mm	83-6304-8-001	83-6304-8-001	
⚠	Switch	Push button momentary	20-4101-4	20-4101-4	

Table 16


POWER SUPPLY
MANUAL DEGAUSS SWITCH
TO VOLTAGE SELECTOR
POWER INPUT * VOLTAGE AUTOSWITCHING
PSU START
PSU INHIBIT
DRIVE OUT
POWER MANAGEMENT
TO DYNAMIC FOCUS PWB.
TO D712 ON LED PWB.
HEATERS
6V3 REGULATOR
M PULSE FROM FBT
PSU SYNC MONOSTABLE
D.C. FEEDBACK
AC POWER IN
TO CRT DAG
TO VIDEO PWB.
PINCUSHION PARABOLA GENERATOR
KEYSTONE
WIDTH MIXER
PINCUSHION
VERTICAL DEFLECTION
B+ REGULATOR
WIDTH
H.PHASE
H SYNC
HOR. PLL
PRESET H MONOSTABLE
DELAYED H PULSE
WIDTH DRIVE
H BLANKING MONOSTABLE
VERT.CENTRE
BLANKING
DYNAMIC FOCUS INPUT
-300V H PULSE TO ELECTRIC FIELD CANCELLATION WIRES
FBT FOR 17" VERSIONS USE A DIFFERENT INTERNAL CIRCUIT FOR FOCUS AND A1.
NOTE: INTERNAL 0V CONNECTIONS OF FBT MAY VARY
PL403 OR PL404 TO DEFLECTION COILS
H SHIFT
LEFT
RIGHT
HOR. DRIVE
HOR. OUTPUT
S.CAP SWITCHING
SK401 A/B: SINGLE LOOP AROUND T402 CORE
CRITICAL SAFETY ITEM
* MAY BE FITTED
FITTED ON 14" VERSIONS
FITTED ON 15" VERSIONS
FITTED ON 17" VERSIONS
FITTED ON VERSIONS WITH AUDIO
FITTED ON VERSIONS WITHOUT AUDIO
FITTED ON 220/240V VERSIONS
COMPONENT C407 C409 C418 C413 C415 C416 C418 C419 D403 TR402




SK204
POWER TO VIDEO PWB.
+12V
+6V3
NOTE :
⊥ 0V CONNECTION IN SECONDARY CIRCUIT. CONNECTED TO SUPPLY EARTH.
⊥ 0V CONNECTION IN POWER SUPPLY PRIMARY CIRCUIT. LIVE TO SUPPLY EARTH.
For Service Manuals Contact
MAURITRON TECHNICAL SERVICES
8 Cherry Tree Rd, Chinnor
Oxon OX9 4QY
Tel:- 01844-351694 Fax:- 01844-352554
Email:- enquiries@mauritron.co.uk
OVERVOLTAGE PROTECTION
CONTRAST
+5V REGULATOR
KEYSTONE
KEYSTONE/ AUDIO D/A
TO AUDIO PWB.
PINCUSHION
WIDTH
WIDTH D/A
HEIGHT
HEIGHT D/A
TILT
TO TILT COIL
VCENTRE
H.PHASE
H.PHASE D/A
V.CENTRE D/A
'S' CAP SWITCH CONTROL
IC701
80C51
MICROPROCESSOR
VOLUME/ KEYSTONE
H/PHASE
WIDTH
ADJUST
PRESET/-
USER/+
BRIGHTNESS
SYNC TO VIDEO PWB.
SYNC POLARITY CONTROL
H. MONOSTABLE
V SYNC INTEGRATOR
SYNC DETECTORS
RESET
IC702
X24C04
N.V.RAM
PL101/1 TO DYNAMIC FOCUS
U SERIES MAIN PWB.
CIRCUIT DIAGRAM
83-5614-9S U SERIES MAIN PWB.