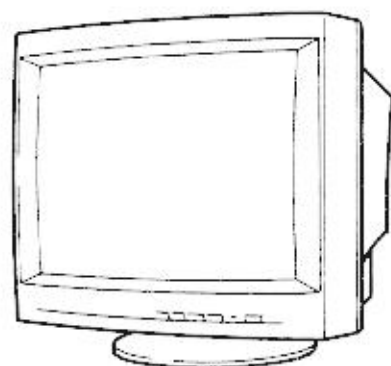


# Service Manual

Multi-Scan Color CRT Display  
MODEL P815 (TX-D2171V)

**Chassis No. GV3**

**Chassis Family No.21GV3**



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# SAFETY PRECAUTIONS

## 1 CAUTION:

No modification of any circuit should be attempted. Service work should only be performed after you are thoroughly familiar with all of the following safety checks and servicing guide lines.

## 2 SAFETY CHECK

Care should be taken while servicing this CRT display because of the high voltage used in the deflection circuits. These voltages are exposed in such areas as the associated flyback and yoke circuits.

## 3 FIRE & SHOCK HAZARD

- 3-1 Insert an isolation transformer between the CRT display and AC power line before servicing the chassis.
- 3-2 In servicing pay attention to original lead dress especially in the high voltage circuit. If a short circuit is found, replace all parts which have been overheated as a result of the short circuit.
- 3-3 All the protective devices must be reinstalled per original design.
- 3-4 Soldering must be inspected for possible cold solder joints, frayed leads, damaged insulation, solder splashes or sharp solder points. Be certain to remove all foreign material.

## 4 LEAKAGE CURRENT COLD CHECK

- 4-1 Unplug the AC cord and connect a jumper between the two prongs on the plug.
- 4-2 Turn the CRT display power switch "on".
- 4-3 Measure the resistance value with an ohmmeter between the jumpered AC plug and each exposed metallic part on the CRT display such as the meta frame, screwheads, control shafts, etc. When the exposed metallic part has a return path to the chassis, the reading should be 1.5 megohm minimum.

## 5 LEAKAGE CURRENT HOT CHECK

- 5-1 Plug the AC cord directly into the AC outlet. Do not use an isolation transformer during this check.
- 5-2 Connect a 1500 ohm, 10 watt resistor, paralleled by a 0.15 $\mu$ F capacitor between each exposed metallic part and a good earth ground (as shown in Fig.1).
- 5-3 Use an AC voltmeter with 1000 ohm/volt or more sensitivity and measure the AC voltage across the combination 1500 ohm resistor and 0.15 $\mu$ F capacitor.
- 5-4 Move the resistor connection to each exposed metallic part and measure the voltage.
- 5-5 Reverse the polarity of the AC plug in the AC outlet and repeat the above measurement.
- 5-6 Voltage measured must not exceed 7.5 volt RMS, from any exposed metallic part to ground. A leakage current tester may be used in the above hot check, in which case any current measured must not exceed 5.0 milliamp. In the case of a measurement exceeding the 5.0 milliamp value, a rework is required to eliminate the chance of a shock hazard.

*Note: High voltage is present when this CRT display is operating. Always discharge the anode of the picture tube to the display chassis to prevent shock hazard.*

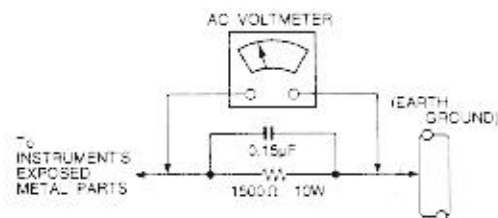


Fig.1

## 6 IMPLOSION PROTECTION

Picture tubes are equipped with an integral implosion protection system, but care should be taken to avoid damage and scratching during installation. Use only Panasonic replacement picture tubes.


## 7 X-RADIATION

**WARNING :** The only potential source of X-Radiation is the picture tube. However when the high voltage circuitry is operating properly there is no possibility of X-Radiation problem. The basic precaution which must be exercised is to keep the high voltage at the following factory-recommended level.

*Note: It is important to use an accurate periodically calibrated high voltage meter.*

- 7-1 If can not be adjust (automatic) 27.0 kV at immediate service is required to prevent the possibility of premature component failure.
- 7-2 To prevent X-Radiation possibility it is essential to use the specified picture tube

### IMPORTANT SAFETY NOTICE

There are special components used in this CRT displays which are important for safety. These parts are identified by the international symbol  on the schematic diagram and on the replacement parts list. It is essential that these critical parts should be replaced with manufacture's specified parts to prevent X-RADIATION, shock, fire or other hazards. Do not modify the original design or this will void the original parts and labor guarantee.

# GENERAL INFORMATION

## 1. OUTLINE

This monitor is 21 inch (20.0" viewable) multi-scan color CRT display with the following nice features.

Original SSP-LSI (Super Signal Processor) is newly introduced, which optimize the function.

## 2. FEATURES

### 2-1 SSP-LSI (Super Signal Processor) Mounted

Precise wave forms are generated for the correction of each geometric distortion.

### 2-2 Self Optimized-Picture Size and Position

Any non-preset timing will be roughly tuned by SSP-LSI for comfortable size and position.

### 2-3 Power Saving

Built-in Power Saving function based on VESA-DPMS standard.

Power energy shall be saved by controlling the circuit in accordance with power saving signal from computer.

### 2-4 OSD (On Screen Display) Function

OSD (5 Languages) function is new and excellent man-machine interface.

Anyone is able to set up the picture as he like through OSD menu.

### 2-5 Self Test Function

Self Testing picture comes out by pushing any key in the case of no-connection with computer or power saving operation.

This function shows if monitor is alive or not and can be used for self aging test.

### 2-6 Ergonomic Design

- Low emission design to meet MPR II & TCO'92
- ESF (Electrostatic field) free coating on CRT

### 2-7 Line Harmonics Compliant with EN61000-3-2

### 2-8 Multi-Scan with Digital Technology

8-bit micro computer controls the circuit operation to meet with wide range signal of  $f_h=30\sim 115\text{kHz}$  and  $f_v=50\sim 160\text{Hz}$ .

So VGA, SVGA, XGA(1024X768), SXGA(1280X1024) and UXGA(1600X1200) up to 90Hz refresh rate are applicable.

### 2-9 1 Factory Preset (+7 Reservation), 13 User Memories

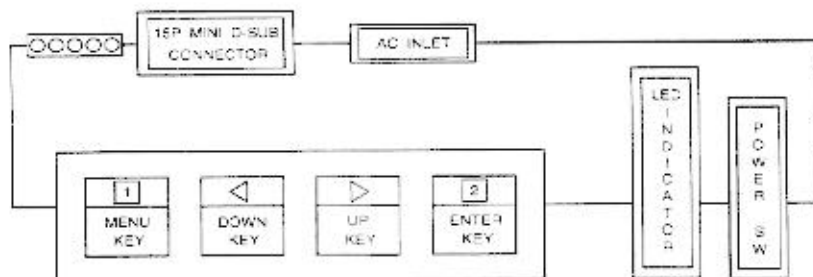
- 1 Standard modes are preset at the factory.
- 7 modes are reserved at the factory.
- 13 user memories are available to set the user's own timing and display information

### 2-10 Flat Face and Fine Dot Pitch

Flat face CRT with fine dot trio pitch 0.25mm (Horizontal: 0.218mm / Vertical: 0.130mm) gives a crispy and comfortable sight of the screen.

# SPECIFICATION

## 1. DIAGRAM



1.1 POWER SW, LED, [1]-key (MENU), [<]-key (DOWN), [>]-key (UP), and [2]-key (ENTER) are located on the front panel.

1.2 Signal connectors and AC inlet are located on the back side of the cabinet.

1.3 OSD menu includes the following function.

CONTRAST	BRIGHTNESS	DEGAUSS
RECALL	H. POSITION	H. SIZE
V. POSITION	V. SIZE	V. PINCUSHION
TRAPEZOID	PARALLELOGRAM	ROTATION
COLOR TEMPERATURE	DISPLAY FREQUENCY	

VIDEO INPUT LEVEL      VIDEO INPUT SELECT  
H. MOIRE      V. MOIRE      LANGUAGES

\*) CONTRAST can be directly controlled with [<]/[>]-key.

\*) With sync signal, OSD menu appears by pushing [1]-key and [2] key. Without sync signal, self test menu appears by pushing any key.

## 2. MECHANICAL SPECIFICATIONS

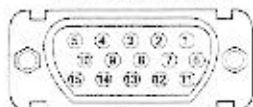
... refer to the attached drawing

- 2.1 Dimension Height : 487 mm (typ.)  
 Width : 505 mm (typ.)  
 Depth : 519 mm (typ.)
- 2.2 Net Weight : 28.5 kg (typ.)
- 2.3 Maximum Viewable Phosphor Display Area : 406X304 mm (min.)

## 3. CONNECTORS

- 3.1 Signal connector 15P Mini D-Sub connector x1  
 BNC CONNECTOR x5
- 3.2 AC inlet CEE 22 typed connector

<15P Mini D-Sub Pin assignment>



- |                    |               |                  |
|--------------------|---------------|------------------|
| 1 ... RED          | 6 ... GROUND  | 11 ... GROUND    |
| 2 ... GREEN        | 7 ... GROUND  | 12 ... SDA (DDC) |
| 3 ... BLUE         | 8 ... GROUND  | 13 ... H. SYNC.  |
| 4 ... GROUND       | 9 ... -(OPEN) | 14 ... V. SYNC.  |
| 5 ... GROUND (DDC) | 10 ... GROUND | 15 ... SCL (DDC) |

## 4. CRT SPECIFICATIONS

Part No	M51-KYY540X, Screen radius 2R (Diagonal=1440mm)
Type	21" (20.0" Viewable), 90°, ø29.1, in-line gun
Cathode	New impregnated Quick-Heating Cathode
Dot Trio Pitch	0.25mm
Dot Pitch	0.215mm horizontal / 0.130mm vertical
Bulb	Dark Tint (Total Transmission=39.5%)
Face Coating	New AGRAS Coat
Shadow Mask	Advanced Invar Mask
Implosion Protection	Tension-band with Mounting Lugs
Focusing Method	Electrostatic
Focusing Lens	Bipotential
Convergence Method	Magnetic
Deflection Method	Magnetic
Persistence	R, G, B Medium short persistence (Hi-EU RED)
Phosphor	Red x: 0.635 (typical) y: 0.333 (typical)
	Green x: 0.290 (typical) y: 0.555 (typical)
	Blue x: 0.152 (typical) y: 0.063 (typical)

## 5. ELECTRICAL SPECIFICATIONS

### 5.1 Standard conditions ... Except special items

Display image	Green, full "H" characters with a border line. (7 x 8 dots) Video signal : 100% duty Display area : 380 mm x 285 mm
Video signal level	0.7 V pp
Contrast, Brightness	Contrast : Max., Brightness : Center point
Ambient Temperature	20±5°C (68±9°F)
Input Voltage	AC 120 V, 60 Hz or AC 220 V, 50 Hz
Terrestrial magnetism	Vertical field : northern hemisphere field: 40µT (southern hemisphere field: -40µT) Horizontal field : no field
Viewing direction	Parallel to the CRT axis
Measurements	After an initial warming up time of more than 30 minutes.
Ambient light	200±50 lx
Display mode	1600 x 1200 (93.75 kHz, 75.00 Hz)

## 5.2 POWER

### 5.2.1 Power supply ... Commercial power source

Input voltage	AC 90 - 132 V, AC 188 - 264 V
Power frequency	50 Hz ± 3 Hz, 60 Hz ± 3 Hz
Input current	2.0 A Max. (at 100-120V AC), 1.5 A Max. (at 220-240V AC)
Inrush current (at 20°C)	25 A Max. (at 100-120V AC), 40 A Max. (at 220-240V AC)
Power consumption	160 W (Typ.)

### 5.2.2 Power Management for Power Saving

Power saving systems are designed based upon VESA DPMS standard (Version 1.0)

#### 1) Power consumption and recovery time.

*1 APM State	SIGNALS			MONITOR POWER CONSUMPTION	RECOVERY TIME TO ON STATE	INDICATOR
	H. Sync	V. Sync	VIDEO			
ON	*3 NOR- MAL	*3 NOR- MAL	*2 ACTIVE	*4 100%	—	Green
STAND- BY	No Sync or *5 < 6 kHz	> 40 Hz	BLANK	< 25 W	< 4S	Yellow
SUS- PEND	> 10 kHz	No Sync or *5 < 20 Hz	BLANK	< 25 W	< 4S	Yellow
OFF	No Sync or *5 < 6 kHz	No Sync or *5 < 20 Hz	BLANK	< 8 W	< 30S	Yellow

\*2 The transition time from ON state to each APM states is 5 seconds minimum.

\*1 : APM : Advanced Power Management.

\*2 : Measurement Condition of power consumption for ON state  
 DISPLAY IMAGE : WHITE full "H" characters (7 x 8 dots)

\*3 : NORMAL : See "7.4 ACCEPTABLE TIMING"

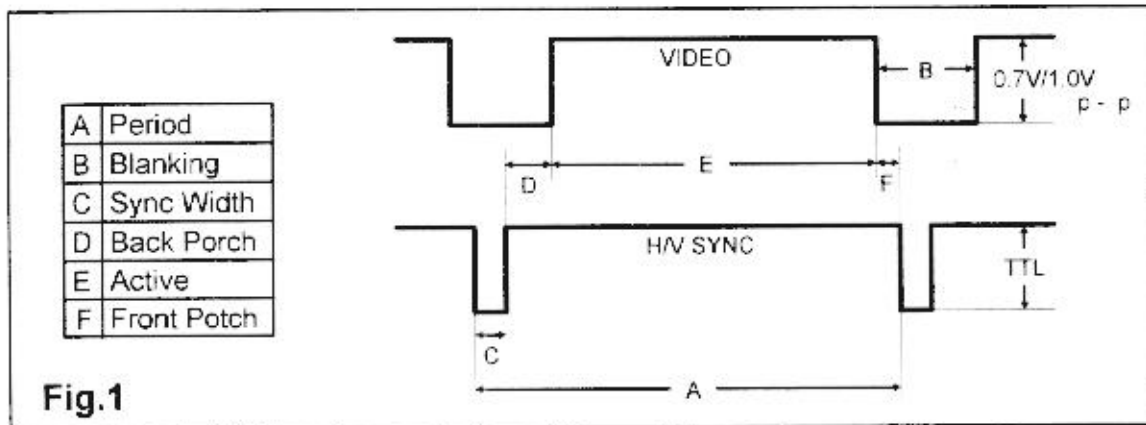
\*4 : Power Consumption is measured at AC 100-240V.

\*5 : Power saving operation is done at less than specified value in the list.

### 5.3 Standard timing

- Following 1 mode is preset in the memory as standard timing at the factory and 7 modes are reserved.
- Fig-1 shows a definition of timing and signal level.
- Electrical performance is specified based on 1600 x 1200 mode unless otherwise mentioned.

# TIMING CHART



	PRESET	RESERVATION	RESERVATION
	MODE - 1	MODE - 2	MODE - 3
	1600 × 1200 (75)	640 × 480 (60)	640 × 480 (75)
DOT CLOCK	202.5000 MHz	25.1750 MHz	31.5000 MHz
f H	93.7500 kHz	31.4688 kHz	37.5000 kHz
H A - PERIOD	10.657 μs ( 2.160 dots )	31.778 μs ( 800 dots )	26.657 μs ( 840 dots )
B - BLANKING TIME	2.755 μs ( 560 dots )	6.356 μs ( 160 dots )	6.349 μs ( 200 dots )
C - SYNC WIDTH	0.948 μs ( 192 dots )	3.813 μs ( 96 dots )	2.032 μs ( 64 dots )
D - BACK PORCH	1.501 μs ( 304 dots )	1.907 μs ( 48 dots )	3.810 μs ( 120 dots )
E - ACTIVE TIME	7.901 μs ( 1.600 dots )	25.422 μs ( 640 dots )	20.317 μs ( 640 dots )
F - FRONT PORCH	0.316 μs ( 64 dots )	0.636 μs ( 16 dots )	0.508 μs ( 16 dots )
f V	75.0000 Hz	59.9405 Hz	75.0000 Hz
V A - PERIOD	13.333 ms ( 1.250 lines )	16.683 ms ( 525 lines )	13.333 ms ( 500 lines )
B - BLANKING TIME	0.533 ms ( 50 lines )	1.433 ms ( 45 lines )	0.533 ms ( 20 lines )
C - SYNC WIDTH	0.032 ms ( 3 lines )	0.054 ms ( 2 lines )	0.080 ms ( 3 lines )
D - BACK PORCH	0.491 ms ( 46 lines )	1.049 ms ( 33 lines )	0.427 ms ( 16 lines )
E - ACTIVE TIME	12.800 ms ( 1.200 lines )	15.253 ms ( 480 lines )	12.800 ms ( 480 lines )
F - FRONT PORCH	0.011 ms ( 1 lines )	0.318 ms ( 10 lines )	0.027 ms ( 1 lines )
SYNC POLARITY(H/V)	Positive / Positive	Negative / Negative	Negative / Negative

	RESERVATION	RESERVATION	RESERVATION
	MODE - 4	MODE - 5	MODE - 6
	1024 × 768 (75)	MAC 1152 × 870 (75)	1280 × 1024 (75)
DOT CLOCK	78.7500 MHz	100.0000 MHz	135.0000 MHz
f H	60.0229 kHz	68.6813 kHz	79.9763 kHz
H A - PERIOD	16.660 μs ( 1.312 dots )	14.560 μs ( 1.456 dots )	12.504 μs ( 1.688 dots )
B - BLANKING TIME	3.657 μs ( 288 dots )	3.040 μs ( 304 dots )	3.022 μs ( 408 dots )
C - SYNC WIDTH	1.219 μs ( 96 dots )	1.280 μs ( 128 dots )	1.067 μs ( 144 dots )
D - BACK PORCH	2.235 μs ( 176 dots )	1.440 μs ( 144 dots )	1.837 μs ( 248 dots )
E - ACTIVE TIME	13.003 μs ( 1.024 dots )	11.520 μs ( 1.152 dots )	9.481 μs ( 1.280 dots )
F - FRONT PORCH	0.203 μs ( 16 dots )	0.320 μs ( 32 dots )	0.119 μs ( 16 dots )
f V	75.0286 Hz	75.0616 Hz	75.0247 Hz
V A - PERIOD	13.328 ms ( 800 lines )	13.322 ms ( 915 lines )	13.329 ms ( 1.056 lines )
B - BLANKING TIME	0.533 ms ( 32 lines )	0.655 ms ( 45 lines )	0.525 ms ( 42 lines )
C - SYNC WIDTH	0.050 ms ( 3 lines )	0.044 ms ( 3 lines )	0.038 ms ( 3 lines )
D - BACK PORCH	0.466 ms ( 28 lines )	0.568 ms ( 39 lines )	0.475 ms ( 38 lines )
E - ACTIVE TIME	12.795 ms ( 768 lines )	12.667 ms ( 870 lines )	12.804 ms ( 1.024 lines )
F - FRONT PORCH	0.017 ms ( 1 lines )	0.044 ms ( 3 lines )	0.013 ms ( 1 lines )
SYNC POLARITY(H/V)	Positive / Positive	Negative / Negative	Positive / Positive

## RESERVATION

## RESERVATION

		MODE - 7	MODE - 8
		1280 × 1024 (85)	1600 × 1200 (85)
DOT CLOCK		157.5000 MHz	229.5000 MHz
f H		91.1458 KHz	106.2500 KHz
H	A - PERIOD	10.971 μs ( 1,728 dots )	9.412 μs ( 2,160 dots )
	B - BLANKING TIME	2.844 μs ( 448 dots )	2.440 μs ( 560 dots )
	C - SYNC WIDTH	1.016 μs ( 160 dots )	0.837 μs ( 192 dots )
	D - BACK PORCH	1.422 μs ( 224 dots )	1.325 μs ( 304 dots )
	E - ACTIVE TIME	8.127 μs ( 1,280 dots )	6.972 μs ( 1,500 dots )
	F - FRONT PORCH	0.406 μs ( 64 dots )	0.279 μs ( 64 dots )
f V		85.0241 Hz	85.0000 Hz
V	A - PERIOD	11.761 ms ( 1,072 lines )	11.765 ms ( 1,250 lines )
	B - BLANKING TIME	0.527 ms ( 48 lines )	0.471 ms ( 50 lines )
	C - SYNC WIDTH	0.033 ms ( 3 lines )	0.028 ms ( 3 lines )
	D - BACK PORCH	0.483 ms ( 44 lines )	0.433 ms ( 46 lines )
	E - ACTIVE TIME	11.235 ms ( 1,024 lines )	11.294 ms ( 1,200 lines )
	F - FRONT PORCH	0.011 ms ( 1 lines )	0.009 ms ( 1 lines )
SYNC POLARITY(H/V)		Positive / Positive	Positive / Positive

## ADJUSTMENT

## ADJUSTMENT

## ADJUSTMENT

		GV3 - 1	GV3 - 2	GV3 - 3
DOT CLOCK		22.6000 MHz	64.0442 MHz	134.9800 MHz
f H		29.5039 KHz	54.0002 KHz	82.5061 KHz
H	A - PERIOD	33.894 μs ( 766 dots )	18.518 μs ( 1,185 dots )	12.120 μs ( 1,636 dots )
	B - BLANKING TIME	6.018 μs ( 136 dots )	4.513 μs ( 289 dots )	3.230 μs ( 436 dots )
	C - SYNC WIDTH	4.115 μs ( 93 dots )	1.718 μs ( 110 dots )	1.096 μs ( 148 dots )
	D - BACK PORCH	1.593 μs ( 36 dots )	2.498 μs ( 150 dots )	1.852 μs ( 250 dots )
	E - ACTIVE TIME	27.876 μs ( 630 dots )	14.006 μs ( 897 dots )	8.890 μs ( 1,200 dots )
	F - FRONT PORCH	0.310 μs ( 7 dots )	0.297 μs ( 19 dots )	0.282 μs ( 38 dots )
f V		48.0520 Hz	77.0331 Hz	125.9635 Hz
V	A - PERIOD	20.811 ms ( 614 lines )	12.981 ms ( 701 lines )	7.939 ms ( 655 lines )
	B - BLANKING TIME	0.915 ms ( 27 lines )	0.741 ms ( 40 lines )	0.485 ms ( 40 lines )
	C - SYNC WIDTH	0.102 ms ( 3 lines )	0.111 ms ( 6 lines )	0.048 ms ( 4 lines )
	D - BACK PORCH	0.712 ms ( 21 lines )	0.519 ms ( 28 lines )	0.364 ms ( 30 lines )
	E - ACTIVE TIME	19.896 ms ( 587 lines )	12.241 ms ( 661 lines )	7.454 ms ( 615 lines )
	F - FRONT PORCH	0.102 ms ( 3 lines )	0.111 ms ( 6 lines )	0.073 ms ( 6 lines )
SYNC POLARITY(H/V)		Negative / Negative	Negative / Negative	Negative / Negative

## ADJUSTMENT

		GV3 - 5
DOT CLOCK		241.2000 MHz
f H		115.4619 KHz
H	A - PERIOD	8.661 μs ( 2,089 dots )
	B - BLANKING TIME	2.189 μs ( 528 dots )
	C - SYNC WIDTH	0.759 μs ( 183 dots )
	D - BACK PORCH	1.356 μs ( 327 dots )
	E - ACTIVE TIME	6.472 μs ( 1,561 dots )
	F - FRONT PORCH	0.075 μs ( 18 dots )
f V		164.9456 Hz
V	A - PERIOD	6.063 ms ( 700 lines )
	B - BLANKING TIME	0.442 ms ( 51 lines )
	C - SYNC WIDTH	0.026 ms ( 3 lines )
	D - BACK PORCH	0.398 ms ( 46 lines )
	E - ACTIVE TIME	5.621 ms ( 649 lines )
	F - FRONT PORCH	0.017 ms ( 2 lines )
SYNC POLARITY(H/V)		Negative / Negative

## 5.4 Acceptable timing

- If your timing is within following specification, this CRT display can automatically function with a certain size and position.

Horizontal: Sync frequency: 30.0 ~ 115.0 kHz  
Blanking Time:  $\geq 2.1 \mu\text{s}$   
Back Porch:  $\geq 1.2 \mu\text{s}$   
Front Porch:  $\leq$  Back Porch  
Sync Width:  $\geq 0.7 \mu\text{s}$

Vertical: Sync frequency: 50.0 ~ 160.0 Hz  
Blanking Time:  $\geq 0.44 \text{ ms}$   
Back Porch:  $\geq 0.4 \text{ ms}$   
Sync Width:  $\geq 0.02 \text{ ms}$

- Several items like size, position and distortion can be adjusted through OSD menu, and if you want to keep it, please push the key  $\square$  for memory, or keep the key untouched for about 20 seconds, it is automatically memorized.

NOTE: In case of RECALL, the key is untouched for about 30 seconds, RECALL function will be cancelled.

Please note, however, that there is the case you can not get the size and/or position you want, (for example, in case Display video Time is too short, you can't get bigger size of the image.)

- The CRT adopted in this CRT display is designed to minimize the moire phenomenon at suitable size for typical display modes. However, there might be a display format among many formats, in which the moire phenomenon appears on this display.

## 5.5 Signal level and input impedance

### 5.5.1 Video Signal level

- This CRT display is adjusted at the factory using 0.7V p-p Video Signal, Black level is 0V.
- This CRT display is compatible with 1.0V p-p Video Signal by using Video input level selection.

### 5.5.2 Sync Signal level

- H/V Separate: H/V Mixed: TTL level
- Sync on Green: 0.3 V p-p  $\pm 0.015 \text{ V}$

### 5.5.3 Input impedance

- Video input: 75  $\Omega$
- Sync input:  $\geq 1 \text{ k}\Omega$

## 5.6 Display performance

### 5.6.1 Display area

#### 1) PRESET TIMING

MODE 1, 1600 x 1200 @75Hz  
WIDTH : 380 mm  $\pm 5$  mm  
HEIGHT : 285 mm  $\pm 5$  mm

#### 2) RESERVATION TIMING

MODE 2, 640 x 480 @60Hz  
WIDTH : 380 mm  $\pm 7$  mm  
HEIGHT : 285 mm  $\pm 7$  mm

MODE 3, 640 x 480 @75Hz  
WIDTH : 380 mm  $\pm 7$  mm  
HEIGHT : 285 mm  $\pm 7$  mm

MODE 4, 1024 x 768 @75Hz  
WIDTH : 380 mm  $\pm 7$  mm  
HEIGHT : 285 mm  $\pm 7$  mm

MODE 5, 1152 x 870 @75Hz  
WIDTH : 380 mm  $\pm 7$  mm  
HEIGHT : 285 mm  $\pm 7$  mm

MODE 6, 1280 x 1024 @75Hz  
WIDTH : 355 mm  $\pm 7$  mm  
HEIGHT : 284 mm  $\pm 7$  mm

MODE 7, 1280 x 1024 @85Hz  
WIDTH : 355 mm  $\pm 7$  mm  
HEIGHT : 284 mm  $\pm 7$  mm

MODE 8, 1600 x 1200 @85Hz  
WIDTH : 380 mm  $\pm 7$  mm  
HEIGHT : 285 mm  $\pm 7$  mm

#### 3) FULL SCAN

WIDTH : 406 mm  
HEIGHT : 304 mm

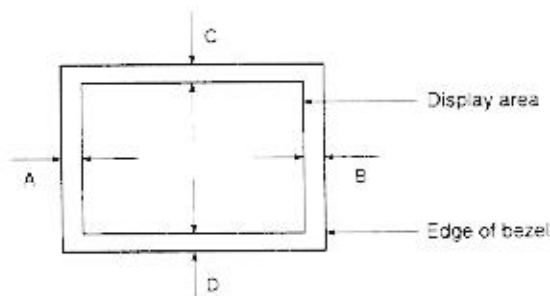
### 5.6.2 Centering

#### 1) PRESET TIMING (MODE1)

$|A - B| \leq 4.0 \text{ mm}$   
 $|C - D| \leq 4.0 \text{ mm}$

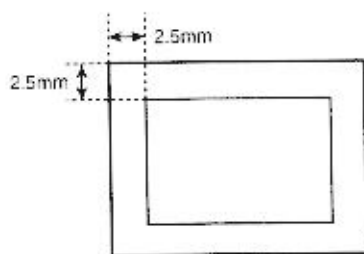
#### 2) RESERVATION TIMING (MODE2-8)

$|A - B| \leq 7.0 \text{ mm}$   
 $|C - D| \leq 7.0 \text{ mm}$



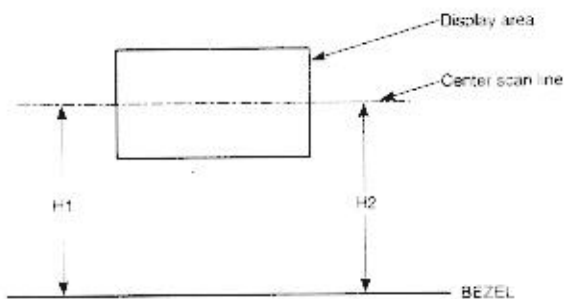
### 5.6.3 Distortion

Inside 2.5mm frame



### 5.6.4 Rotation

$$|H1 - H2| \leq 2.5 \text{ mm}$$



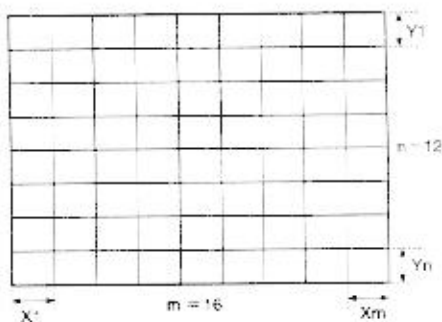
### 5.6.5 Linearity

Horizontal linearity

$$= \frac{X_{\max.} - X_{\min.}}{X_{\max.} + X_{\min.}} \times 100 \% \leq 7 \%$$

Vertical linearity

$$= \frac{Y_{\max.} - Y_{\min.}}{Y_{\max.} + Y_{\min.}} \times 100 \% \leq 6 \%$$



### <Conditions>

Display image ----- crosshatch pattern

Maximum and minimum values should not be adjacent to each other.

X max. is maximum value among X1-Xm

X min. is minimum value among X1-Xm

Y max. is maximum value among Y1-Yn

Y min. is minimum value among Y1-Yn

## 5.7 General performance

### 5.7.1 Maximum pixel clock

250.0 MHz

### 5.7.2 Maximum luminance

Value	100 cd/m <sup>2</sup> (min.) for 5% white field at the center of the display area. 90 cd/m <sup>2</sup> (min.) for 100% white field at the center of the display area. Specified by 9300 K + 8 MPCD
Conditions	Display image : White flat field Luminance : Max. (Contrast : Max.) (Brightness : Center point)

### 5.7.3 Minimum luminance

Value	≤ 17 cd/m <sup>2</sup> at the center of the display area. Specified by 9300 K + 8 MPCD
Conditions	Display image : White full flat field Luminance : Min. (Contrast : Min.) (Brightness : Center point)



#### 5.7.4 Brightness variation

Value	75 % (Min.) Variation = C/A X 100
Conditions	Display image : White full flat field Luminance : Max. (Contrast : Max.) (Brightness : Center point) A : Luminance at center position C : Luminance at position of lowest brightness

#### 5.7.5 Display area regulation

	Display area variation	Range of variation
Due to Luminance	within 1.0 %	17-100 cd/m <sup>2</sup> (white flat field)
Due to Power Supply	within 0.5 %	AC : 90-132 V or * 95-264 V
Due to Temperature	within 1.5%	20° C ± 20° C

#### 5.7.6 Color Point

< Conditions >

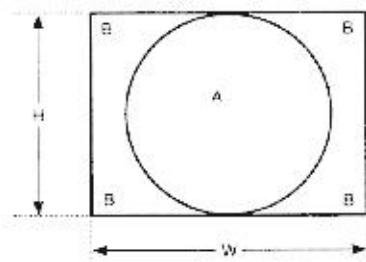
Display image : White flat field at the center of the display area.

Luminance : Brightness center point.

Contrast	max	min
Value	9300 K + 8 MPOD x = 0.283 ± 0.020 y = 0.298 ± 0.020	9300 K + 8 MPOD x = 0.283 ± 0.020 y = 0.298 ± 0.020

#### 5.7.7 Misconvergence

- Center area of display (A) : 0.30 mm (Max.)
- Corner area of display (B) : 0.40 mm (Max.)



<Conditions>

- Display image : Crosshatch pattern mixed with R, G and B colors.
- Convergence gauge : KLEIN CM7AG or equivalent.
- Display area : W x H : 380 x 285 mm

#### 5.7.8 White Uniformity

$$x_a - x_c \leq \pm 0.015$$

$x_a$ : x coordinate at CRT center

$x_c$ : x coordinate at the any other point

$$y_a - y_c \leq \pm 0.015$$

$y_a$ : y coordinate at the CRT center

$y_c$ : y coordinate at the any other point

<Conditions>

Display : White flat field

Luminance : 100 cd/m<sup>2</sup> at the center of display area

Display area 380 x 285 mm

#### 5.7.9 Purity

Conspicuous mislanding shall not be visible within display area at a distance of 60cm from CRT surface.

<Conditions>

Display image : Red / Green / Blue flat field and White field

Luminance : Contrast max, Brightness Center point.

Display area : 380 x 285 mm

#### 5.7.10 Jitter

Invisible at a distance of 60 cm from CRT surface.

## 6. ENVIRONMENTS

### 6.1 Ambient temperature, humidity and altitude

	Operating	Storage and shipment
Temperature	0 - 40° C (32 - 104° F)	-20 - +60° C (-4 - 140° F)
Humidity	5 - 90 % *	5 - 90 % *
Altitude	3,000 m (Max.) (10,000 ft)	12,000 m (Max.) (40,000 ft)

\* Non - condensat on

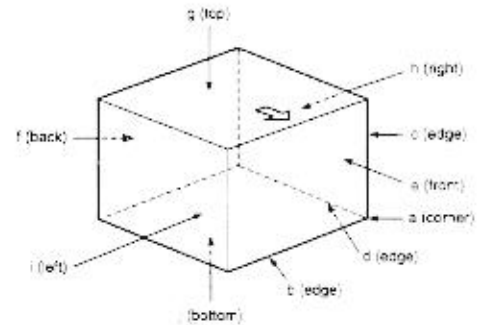
## 6.2 Vibration and shock

### 6.2.1 Vibration

	Order of tests	Direction of vibration		Acceleration		Frequency	Sweep	Test time
				Non-operation	Storage and shipment			
Unpacked	1	Vertical	Up to down	2.9 m/s <sup>2</sup> (0.3 G)		5 - 55 Hz	120 s	30 min.
	2	Horizontal	Front to back					15 min.
	3		Right to left					
Packed	1	Vertical	Up to down	12.3 m/s <sup>2</sup> (1.25 G)		5 - 50 Hz	810 s Log sweep	40 min.
	2	Horizontal	Front to back	7.4 m/s <sup>2</sup> (0.75 G)				20 min.
	3		Right to left					

### 6.2.2 Shock (Drop test)

Unpacked	20 G One time for each face (6 faces) (non-operation)			
Packed	Order of drop	Face to drop is to face the floor. (See the figure)	Height	Number of drop
	1	a, b, c, d, e, g, h, i	46 cm	1 time for each
	2	j	55 cm	



## 7. REGULATORY STANDARDS

### 7.1 Safety standards

Applicable standards

- UL 1950, Listing
- CSA 22.2 No. 950, Certification
- TüV (EN60950, IEC950) / GS (ZH1)
- NORDIC (SEMKO, NEMKO, DEMKO, FIMKO)

### 7.2 X-ray standards

Applicable standards

- DHHS, 21 CFR Subchapter J
- HC (HWC)
- PTB, Approval

### 7.3 EMC standards

Applicable standards

- VCC I class 2
- FCC part 15, subpart B, class B (up to 101 kHz)
- C (DOC) class B (up to 101 kHz)
- C SPR 22 class B (EN55022)
- CE Marking

<EMI test pattern>

White, full "H" characters (9x14 dots), black (12x24 dots)

## 8. OTHERS

Applicable programs

- MPR I Radiation
- TCO '92 Radiation
- Energy Star
- ISO9241-3 (Ergonomics)

## 9. POWER CORD

- Northern Hemisphere Version ... UL/CSA approved power cord (North America and Japan) (Wa Type)
- European Version ... VDE approved power cord (PC Type)
- Australia, New Zealand Version ... None

## 10. SIGNAL CABLE

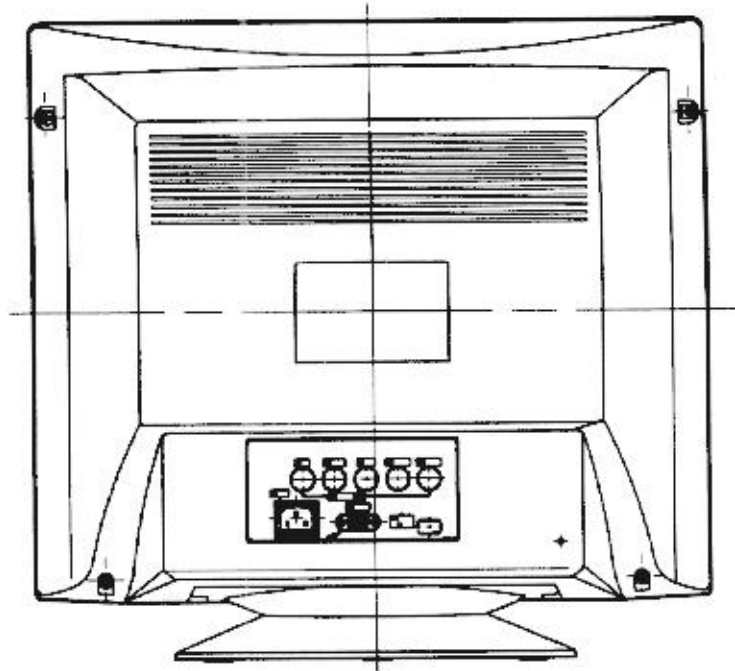
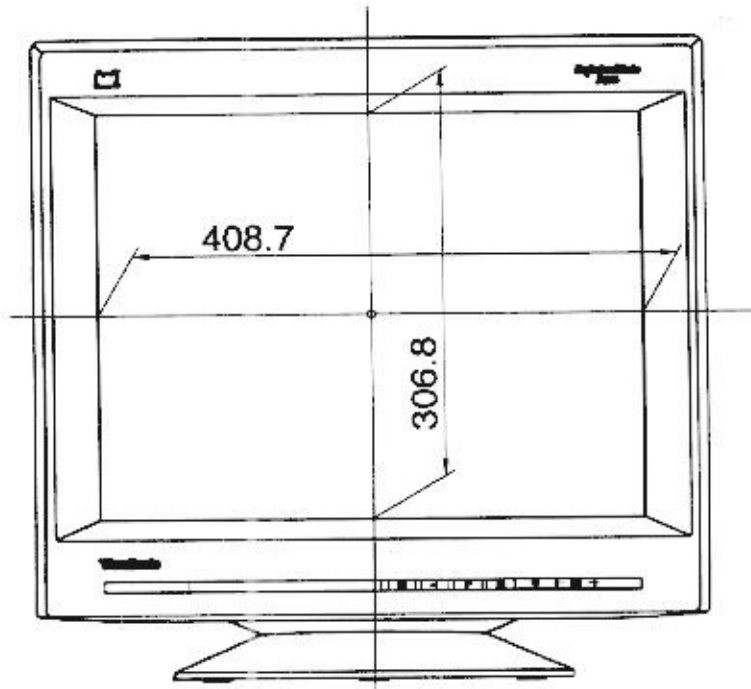
Signal cable with Mini D-Sub 15P connectors at both ends.

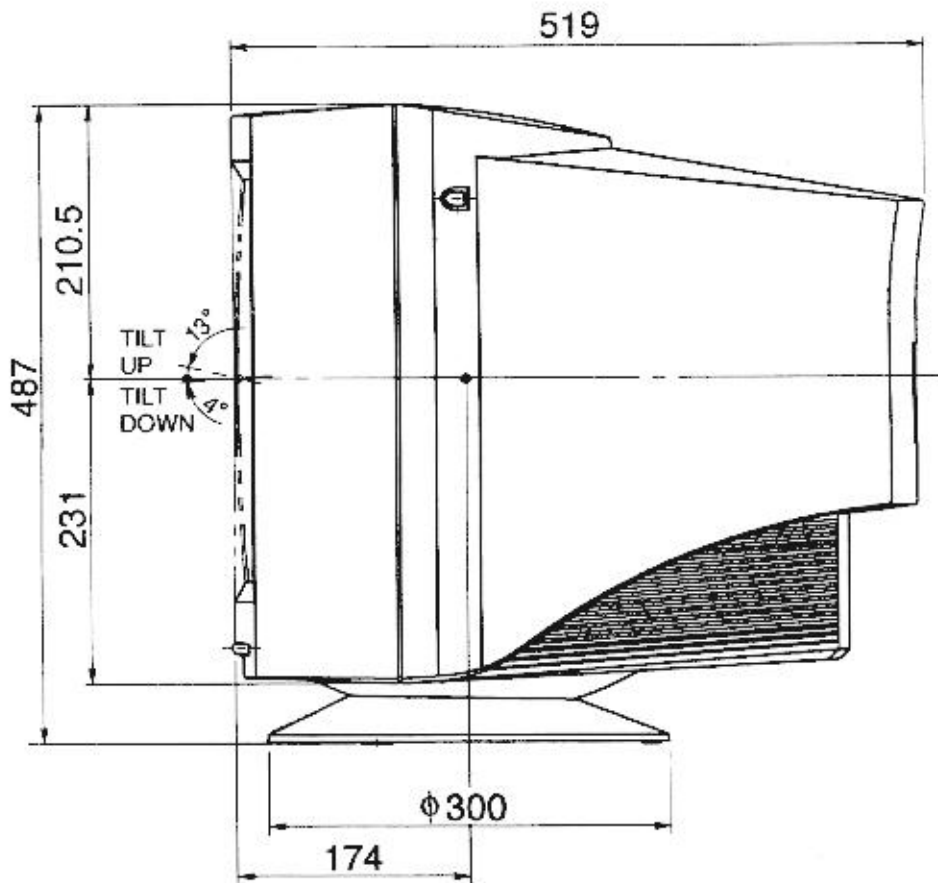
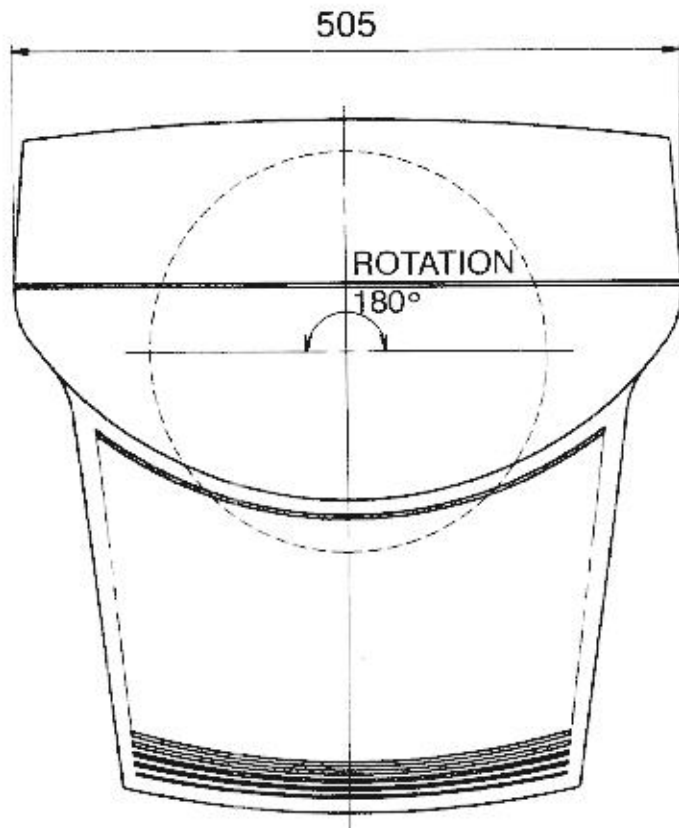
Length: 1.8 meter (5.91 feet)

## 11. RELIABILITY

>55,000hrs (demonstrated MTBF)

# DIMENSIONS



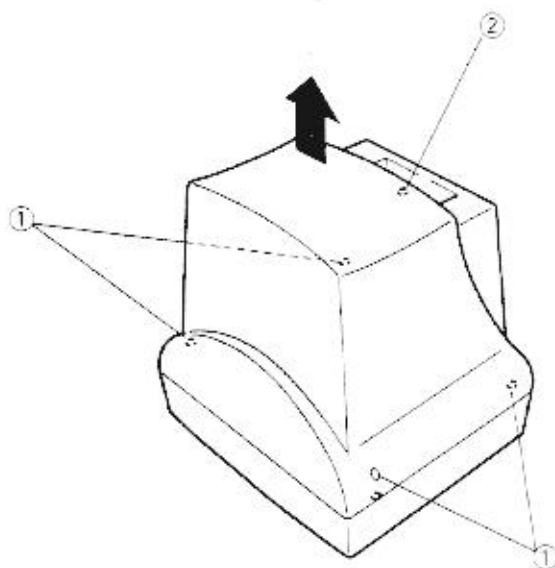
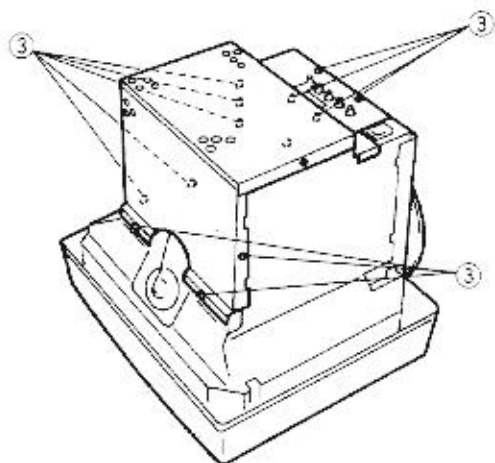


# DISASSEMBLY INSTRUCTIONS

## 1. Rear cover removal

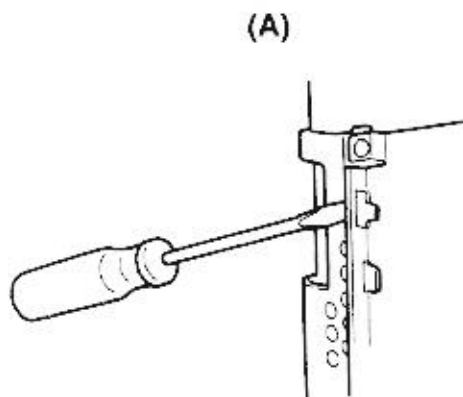
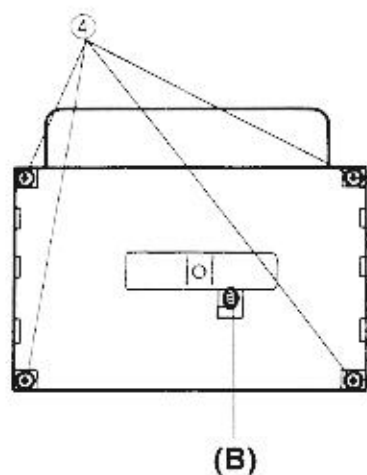
Note: Spread a mat underneath to avoid damaging the CRT surface.

- 1) Remove four large screws ① and small screw ② from the rear cover.
- 2) Remove the cover.
- 3) Remove 13 screws ③ from the shield case.
- 4) Remove the shield case.

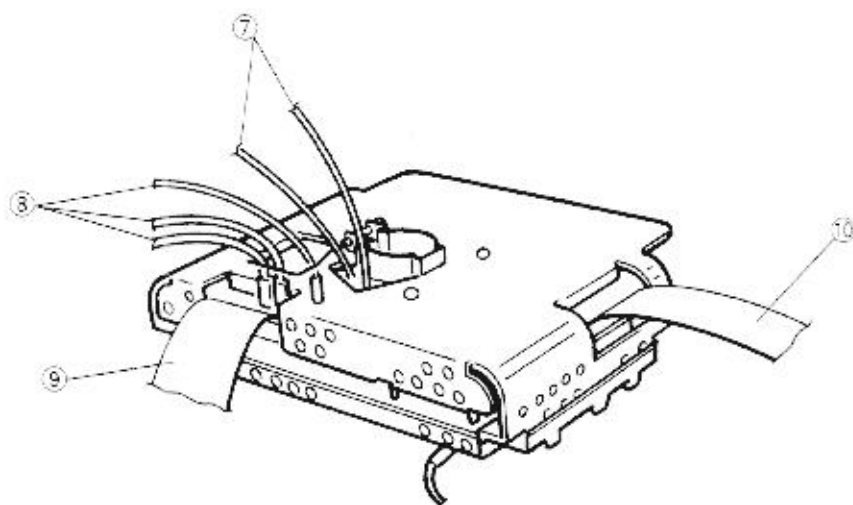
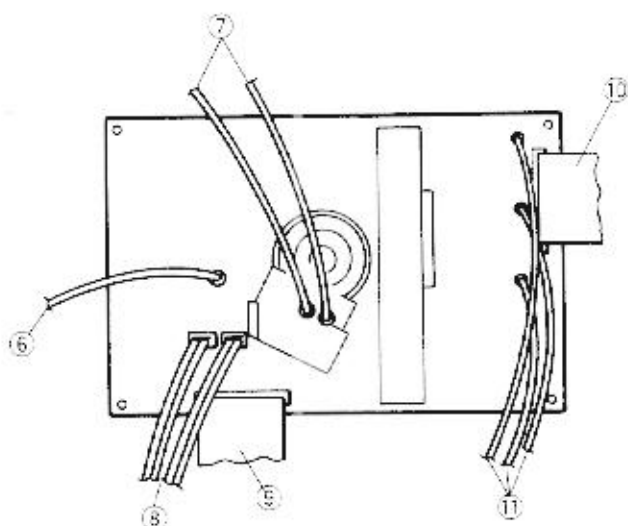
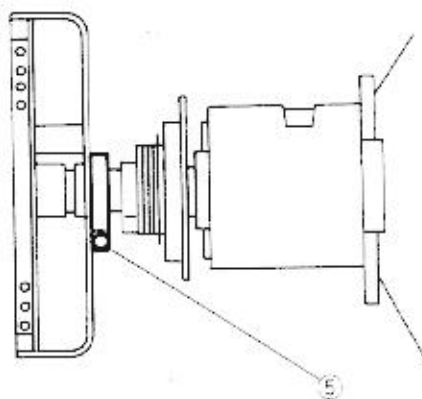


## 2. Video PCB removal

- 1) Remove four screws ④ securing the shield cover.
- 2) Desolder (B) and Remove the shield cover (A).

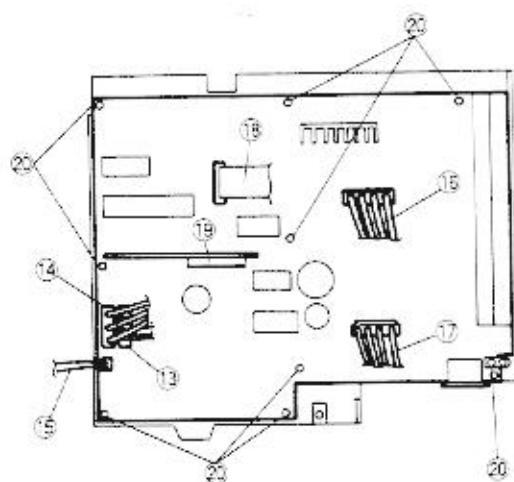


- 3) Loosen the screw ⑤ securing the CRT neck and the shield case.
- 4) Remove the PCB block from the CRT.
- 5) Remove the N651B connector ⑥.
- 6) Remove two focus leads ⑦.
- 7) Remove ground connector ⑧ (N106, N107A) connected to the PCB.
- 8) Remove N1010A connector ⑨.
- 9) Remove N1013A connector ⑩.
- 10) Remove RGB connector ⑪.
- 11) Remove the PCB from the shield case.



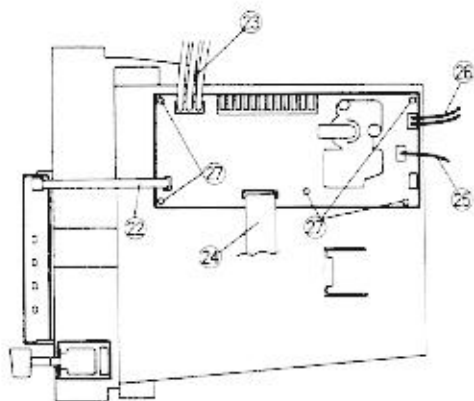
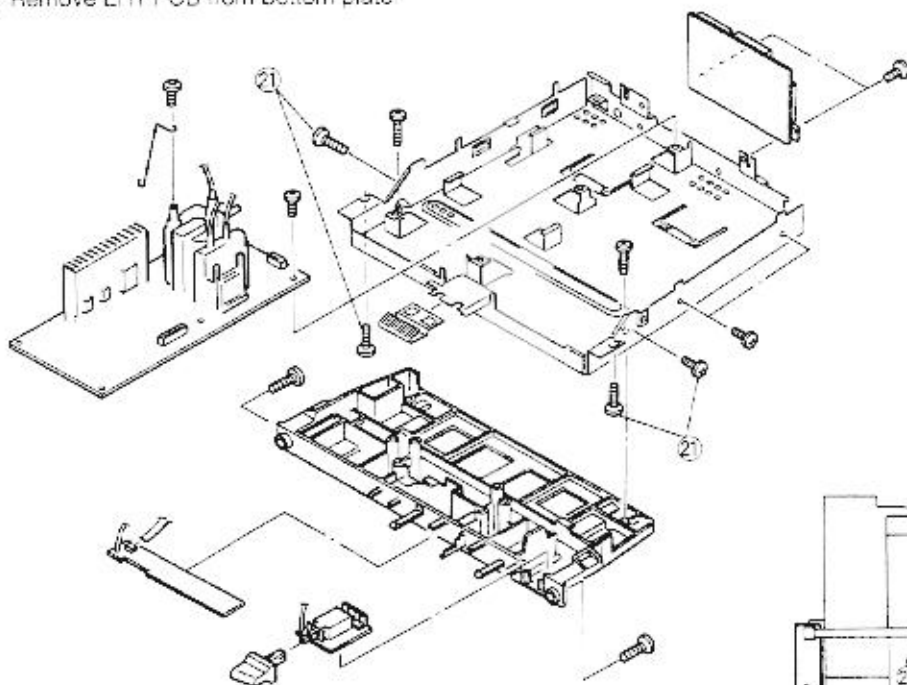
### 3. Main PCB Removal

- 1) Remove the connector ⑫ located bottom right.
- 2) Lift and pull out for main PCB block.
- 3) Remove the connector ⑬ N901 and ⑭ N902 of the degauss coil.
- 4) Remove the connector ⑮ N991 of the tilt coil.
- 5) Remove the connector ⑯ N510 of th DY.
- 6) Remove the connector ⑰ N802A of the power switch.
- 7) Remove the connector ⑱ N601A of the EHT PCB.
- 8) Remove the connector ⑲ N1013A of the video PCB.
- 9) Remove the fitting metal and the PCB from bottom plate.
- 10) Remove nine screws ⑳.



### 4. EHT PCB Removal

- 1) Remove 4 screws ㉑
- 2) Remove the anode cap
- 3) Remove the connector ㉒ N102B of the front switch.
- 4) Remove the connector ㉓ N12 of the radiator and pick up PCB.
- 5) Remove the connector ㉔ N601B of the main PCB.
- 6) Remove the connector ㉕ N851A of the video PCB.
- 7) Remove the connector ㉖ N1017B of the GND.
- 8) Remove 5 screws ㉗
- 9) Remove EHT PCB from bottom plate



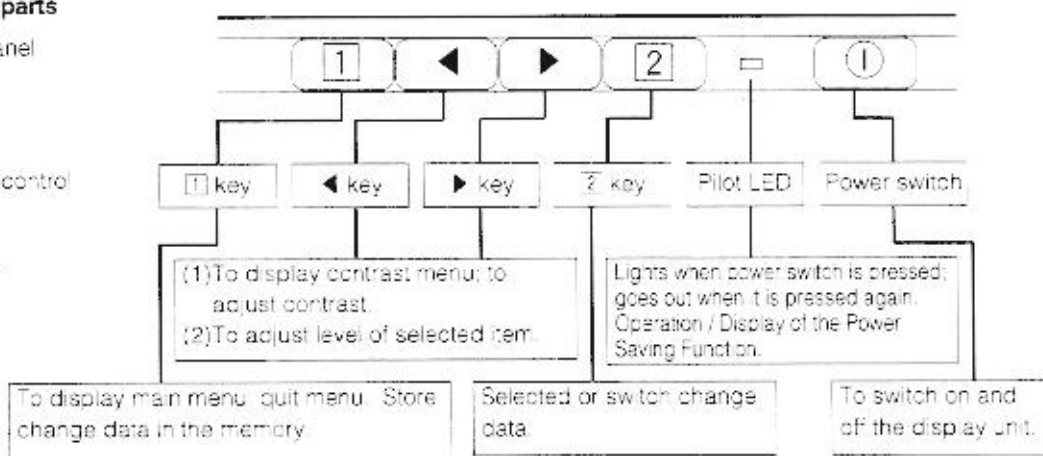
# CONTROL LOCATION

## Basic operation of parts

Control panel

Names of control

Functions



\* For a detailed description of the functions of the [1] key, ◀ key, ▶ key, and [2] key, refer to the next section onward.

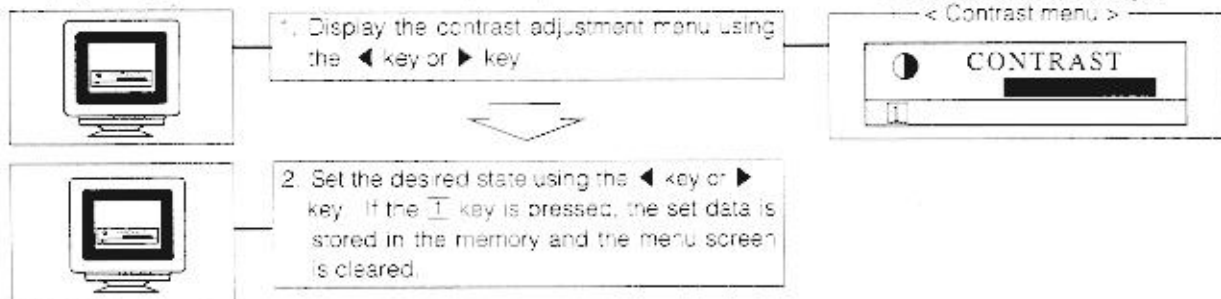
## Examples of on-screen operation

### A. Contrast adjustment

Display changes

Steps of operation

On-screen display changes

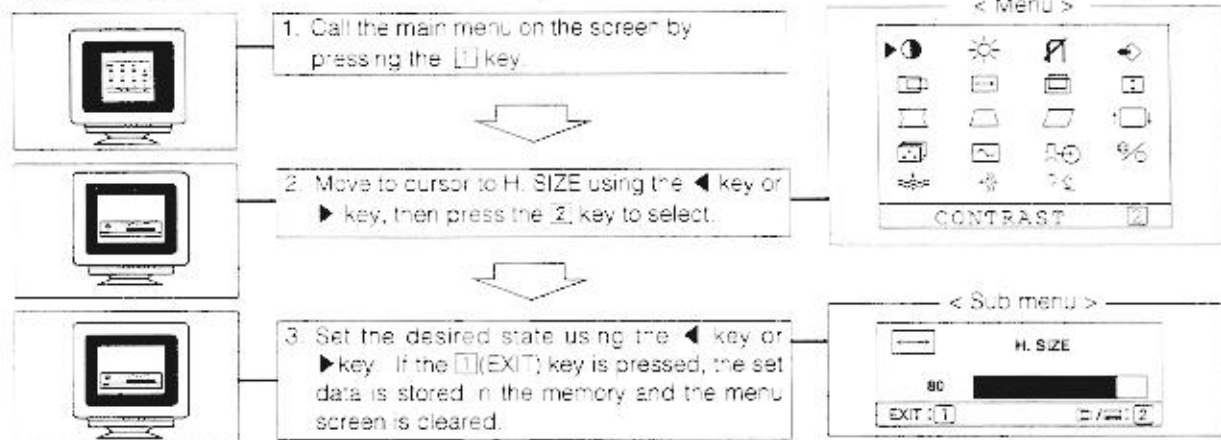


### B. H. size adjustment

Display changes

Steps of operation

On-screen display changes



Main menu





## CAUTION FOR ADJUSTMENT AND REPAIR

1. Degaussing is inevitably required at purity adjustment or convergence adjustment.
2. If you check or adjust electrical specification or function, more than 20 minutes burn-in is required.
3. Reforming of the lead wire is required after your repair work.
4. Prior to starting work, be sure to check that the input signal is at the specified timing and that the polarity is as specified in all modes.
5. Brightness control: After mounting the rear cover, brightness tends to decrease about 5 cd/m<sup>2</sup> on a flat white field and about 1 cm/m<sup>2</sup> on a white raster field. This should be taken into consideration.
6. Brightness stabilizing time: It takes about 20 to 50 seconds for the brightness to stabilize after turning the power off for 5 seconds (AC). Therefore, care should be taken to this.
7. Aging should be made in white raster of 30 – 50 cd/m<sup>2</sup> and raster size, 402 x 301 mm before adjusting the ITC.
8. Set the CONTRAST to MAX and BRIGHTNESS to CENTER using the C.S.D.

## CAUTION FOR SERVICING

When servicing or replacing the CRT, high voltage sometimes remains on the anode. So, completely discharge high voltage before servicing or replacing the CRT so as to prevent a shock to the service person.

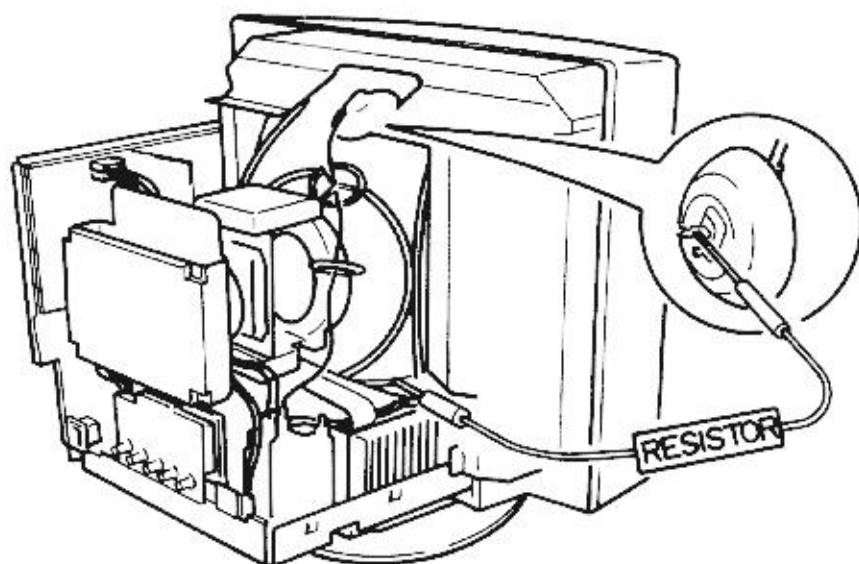
### CRT Anode Discharge

1. When you check the CRT anode or replace the CRT, discharge the CRT anode to the external conductive coating (aquadag) of CRT, especially when checked right after power turn-off.
2. Ground one end of a jumper wire which has a resistor (30 kV < resisting pressure: 100 MΩ) and connect the other point to the CRT anode.

*Note: Grounding must be done first.*

This model has a section that does not share a common ground with the power supply section. The different sections are referred to as the HOT section and the COLD section in the precautions below.

1. Do not touch the HOT section and the COLD section at the same time. You may be hit by an electric shock.
2. Do not short the HOT section to the COLD section. This could blow the fuse or damage parts.
3. Never measure the HOT section and the COLD section at the same time when using tools such as oscilloscopes or multimeters.
4. Always unplug the unit before beginning any operation such as removing the chassis.



# ADJUSTMENT AND CHECK PROCEDURE

## INTRODUCTION

- This monitor is controlled by a microcomputer. With the exception of purity/convergence/focus all is digitally adjusted. Therefore a computer, the dedicated control software, the dedicated interface, a 9-12 V power supply, and a signal generator are required servicing.

## TOOLS REQUIRED

- Computer**  
The control software is IBM PC compatible only. Therefore, it is not compatible with any other operating systems. For further information please contact our sales office.
- Control Software**  
The GV3 chassis can only use adjustment program disk for this model. No other program can access the EEPROM on the monitor. For further information please contact our sales office.

- Interface**

The interface is dedicated to work only with the control software and the HV and GV chassis. There are no substitutes for this interface. For further information please contact our sales office.

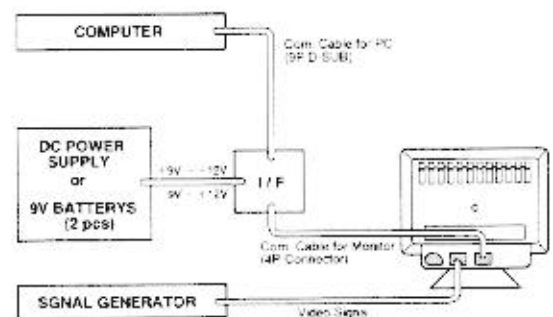
- Power Supply**

A DC 9-12 V (+9-12 V/-9-12 V) power supply is required for operating the interface.

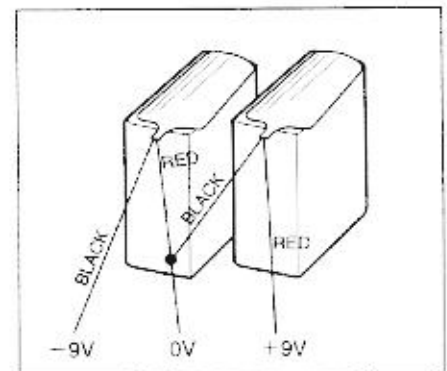
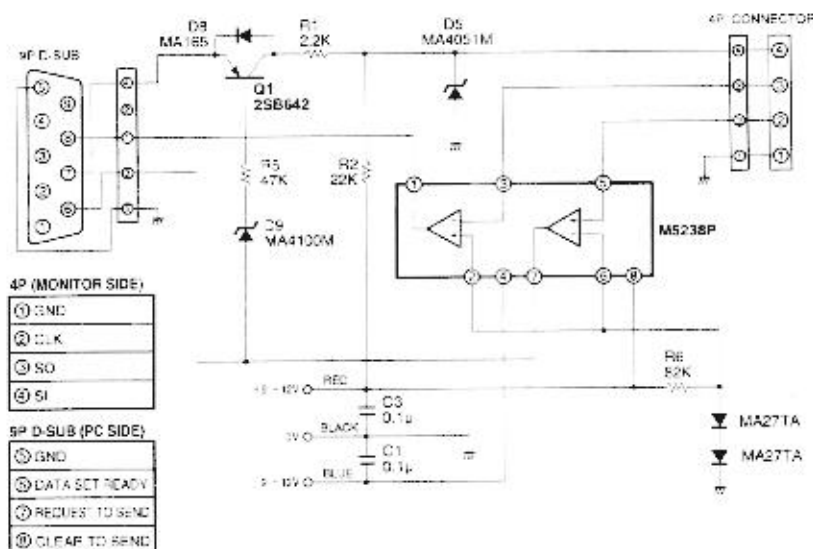
- Signal Generator**

It is necessary for you to use a signal generator which operates on fH 115 kHz, fv 160 Hz, and f0 250 MHz bands.

## INTERFACE CONNECTION



## INTERFACE SCHEMATIC DIAGRAM



BATTERY CONNECTION

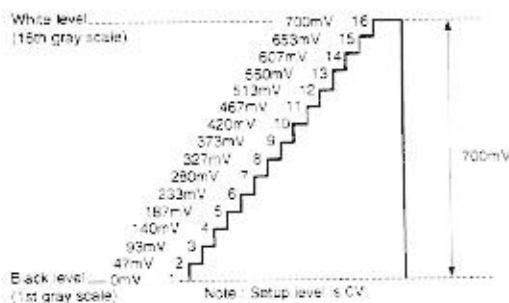
## OTHER TOOLS

- Oscilloscope (dual trace)
- Scope probe – Attenuation: 100:1  
Attenuation: 10:1
- Digital Voltmeter – Range: 0 to 1000 V DC  
Accuracy: 0.1 %
- TV color Analyzer II – that reads luminance and chromaticity X and Y coordinates.
- Digital High Voltmeter
- AC power supply – Output voltage : 0 to 300 V
- Degaussing coil
- Convergence meter
- Scale
- Double-faced scale
- Microscope – Scale factor: 50
- White racquer (Paint)

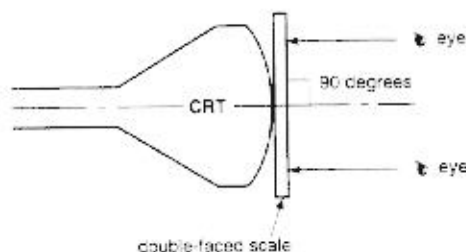
## STANDARD CONDITION OF ADJUSTMENT PROCEDURE

- Signal timing : Standard timing 1600 x 1200  
(See page 5)
- Display pattern : White, full "H" character
- Signal level : V/H: TTL level video: 700 mV
- Input source : AC 120 V, 60 Hz
- Ambient temperature : Room temperature
- Warm-up time : More than 30 minutes
- Brightness control : Center
- Contrast control : Max.
- Magnetic field : Vertical: 40  $\mu$ T  
Horizontal: 0  $\mu$ T
- Signal cable : Attached

Video input signal from PC.



- Use a Helmholtz device to adjust an unit with no horizontal magnetic field and a vertical field of 40  $\mu$ T. Inspect the unit under the same conditions.
- The ambient illuminance must be 200 lux.
- Use an external degaussing coil any time the DEGAUSS switch does not remove color shading.
- To check the image width, height, linearity and distortion, proceed as below



Measure level with respect to tube axis.

## ADJUSTMENT SOFTWARE

### 1. Software operating procedure

- A) Remove the rear cover of the monitor.
- B) Power on the computer and monitor.
- C) Connect the Communication cable for monitor adjustment.
- D) Insert the adjustment disk into the drive.
- E) At the A:> on the DOS prompt type "VSR", then press [ENTER].
- F) Refer to the adjustment procedures.

### 2. Adjustment Program

#### Main Menu of Adjustment Program

<<TX-D2171 ADJUST PROGRAM MAIN MENU>> (e: ext) <Ver 6.0>	
1) Initial CHECK	6) Information
2) OSC DATA SET	7) Preset Editor
3) VSR	8) ADJ. VIDEO 1.0Vpp
4) VIDEO	9) COLOR ADJUST
5) EEPROM	10) DAF ADJUST

#### Description of Function of Each Menu

##### 1) Initial check

- The communication port is changed over from DDC use to servicing use.  
Normally, this port is set for DDC use. When this item is selected, switched to the service use by the switching command. When this transmission is successful, the computer screen is cleared and a message "RETURN KEY >" is displayed.
- When the RETURN key is pressed at this stage, chassis discrimination is carried out. If there is OK, the is recovered and various controls from computer become possible. If the connected monitor is other chassis, a message of "This is not GV3 chassis" is displayed and execution is stopped.
- If this menu is selected and a communication error occurs, examine communication cable connection, the power supply for the communication cable and monitors.
- This port is set for DDC use after the monitor's power switch has been turned on. Therefore, transmit command is needed prior to adjustments.

##### 2) OSC data set

This is a menu intended to set up automatic VCC adjusting data in the PLL for horizontal and vertical incorporated in the SSP (Super Signal Processor). When this item is selected, a command for data is transmitted to the monitor. It takes about 5 seconds to set up data. During this period, monitor screen is blank. Upon completion of setting, a message of "HIT RETURN KEY >" is displayed in the computer screen.

##### 3) VSR (Variable Scan Rate)

To achieve stabilized operation and high performance throughout the working frequency range, the frequencies are split into 4 positions. In each position, adjustments for major items are performed and the result is stored in EEPROM as interpolation data. In this model, the following frequencies are specified for VSR adjustment. For frequencies other than those specified below, adjustment is disabled.

Signal name	Adjust mode	Horizontal frequency	Vertical frequency
GV3-1	INTP0	29.5kHz	48.0Hz
GV3-2	INTP1	54.0kHz	77.0Hz
GV3-3	INTP2	82.5kHz	126.0Hz
GV3-5	INTP3	115.5kHz	165.0Hz

##### 4) Video

This is a menu for CRT set off and brightness adjustments. Focus adjustment is also effected in this menu.