ORDER NO. MTC9703687C1
B1

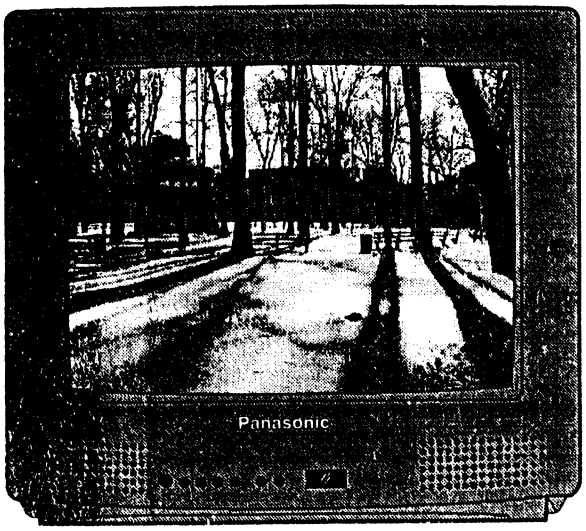
Service Manual

Color Television

Main Manual (NA6L)

Panasonic

Models	Chassis
CT–27G12V/CV/UV	AEDP280
CT–27G22V/CV/UV	APEDP280
CT–20R14V/CV	ADP277

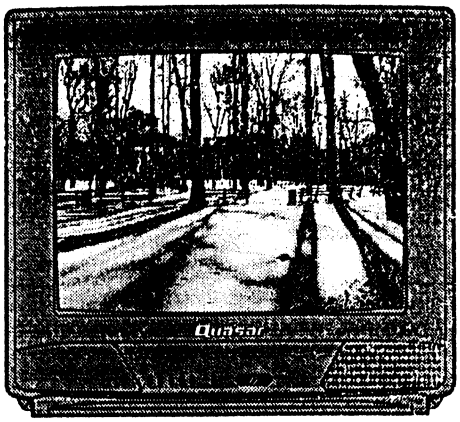


CT–27G12V/CV/UV
CT–27G22V/CV/UV

Quasar

Models	Chassis
TP2009DV	AMDC277

CT–20R14V/CV



TP2009DV

NOTE: Model **CT–27G12UV** is identical to the **CT–27G12UV** and model **CT–27G22UV** is identical to the **CT–27G22V** except for the magnetic field used in the factory to adjust **purity** and **convergence** for different markets.

This Service Manual is issued as a service guide for the models of the NA6L family listed above. Included in this manual are a set of schematics, operations overview, alignment procedures, disassembly procedures, and a complete parts list.

Note: Please refer to **NA6D/L Technical Guide (MTC9702684G1)** for functional descriptions and block diagrams.

"WARNING! This Service Manual is designed for experienced repair technicians only and is not designed for use by the general public. It does not contain warnings or cautions to advise non–technical individuals of potential dangers in attempting to service a product. **Products powered by electricity should be serviced or repaired only by experienced professional technicians.** Any attempt to service or repair the product or products dealt with in this Service Manual by anyone else could result in serious injury or death."

The service technician is required to read and follow the "**Safety Precautions**" and "**Important Safety Notice**" in this manual.

Panasonic Canada Inc.
5770 Ambler Drive
Mississauga, Ontario L4W 2T3
Canada

PSC
Ave. 65 de Infanteria, Km 9.5
San Gabriel Industrial Park
Carolina, Puerto Rico 00985

Panasonic Services Company
Division of Panasonic Consumer Electronics Company
A Unit of Matsushita Electric Corporation of America
50 Meadowland Parkway,
Secaucus, New Jersey 07094

Panasonic ®

Important Safety Notice

Special components are used in this television set which are important for safety. These parts are identified on the schematic diagram by the symbol ⚠ and printed in **BOLD TYPE** on the replacement parts list. It is essential that these critical parts are replaced with the manufacturer's specified replacement parts to prevent X–ray radiation, shock, fire or other hazards. Do not modify the original design without the manufacturer's permission.

Safety Precautions

General Guidelines

An **Isolation Transformer** should always be used during the servicing of a receiver whose chassis is not isolated from the AC power line. Use a transformer of adequate power rating as this protects the technician from accidents resulting in personal injury from electrical shocks. It will also protect the Receiver from being damaged by accidental shorting that may occur during servicing.

When servicing, observe the original lead dress, especially in the high voltage circuit. Replace all damaged parts (also parts that show signs of overheating.)

Always Replace Protective Devices, such as fishpaper, isolation resistors and capacitors, and shields after servicing the Receiver. Use only manufacturer's recommended rating for fuses, circuit breakers, etc.

High potentials are present when this Receiver is operating. Operation of the Receiver without the rear cover introduces danger from electrical shock. Servicing should not be performed by anyone who is not thoroughly familiar with the necessary precautions when servicing high–voltage equipment.

Extreme care should be practiced when **Handling the Picture Tube.** Rough handling may cause it to implode due to atmospheric pressure (14.7 lbs per sq. in.). Do not nick or scratch the glass or subject it to any undue pressure. When handling, use safety goggles and heavy gloves for protection. **Discharge the picture tube** by shorting the anode to chassis ground (not to the cabinet or to other mounting hardware). When discharging, connect cold ground (i.e. dag ground lead) to the anode with a well insulated wire or use a grounding probe.

Avoid prolonged exposure at close range to unshielded areas of the picture tube to prevent exposure to X–ray radiation.

The **Test Picture Tube** used for servicing the chassis at the bench should incorporate safety glass and magnetic shielding. The safety glass provides shielding for the tube viewing area against X–ray radiation as well as implosion. The magnetic shield limits X–ray radiation around the bell of the picture tube in addition to restricting magnetic effects. When using a picture tube test jig for service, ensure that the jig is capable of handling 35.5kV for 20" and 36.8kV for 27" without causing X–ray radiation.

Before returning a serviced receiver to the owner, the service technician must thoroughly test the unit to ensure that it is completely safe to operate. **Do not use a line isolation transformer when testing.**

Leakage Current Cold Check

Unplug the AC cord and connect a jumper between the two plug prongs.

Measure the resistance between the jumpered AC plug and exposed metallic parts such as screwheads, antenna terminals, control shafts, etc. If the exposed metallic part has a return path to the chassis, the reading should be between 240kΩ and 5.2MΩ. If the exposed metallic part does not have a return path to the chassis, the reading should be infinite.

Leakage Current Hot Check (See Figure 1)

Plug the AC cord directly into the AC outlet. Do not use an isolation transformer during the check.

Connect a 1.5kΩ 10 watt resistor in parallel with a 0.15μF capacitor between an exposed metallic part and ground. Use earth ground, for example a water pipe.

Using a DVM with a 1000 ohms/volt sensitivity or higher, measure the AC potential across the resistor.

Repeat the procedure and measure the voltage present with all other exposed metallic parts.

Verify that any potential does not exceed 0.75 volt RMS. A leakage current tester (such as a Simpson Model 229, Sencore Model PR57 or equivalent) may be used in the above procedure, in which case any current measure must not exceed 1/2 milliamp. If any measurement is out of the specified limits, there is a possibility of a shock hazard and the Receiver must be repaired and rechecked before it is returned to the customer.

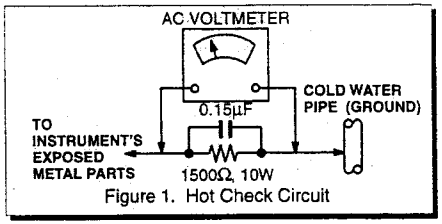


Figure 1. Hot Check Circuit

X–ray Radiation

WARNING: The potential source of X–ray radiation in TV sets is in the High Voltage section and the picture tube.

NOTE: It is important to use an accurate, calibrated high voltage meter.

Set the **brightness, picture, sharpness** and **color** controls to Minimum.

Measure the High Voltage. The high voltage meter should indicate 27.7kV ±1.25kV for 20" models and 29.25kV for 27" models. If the upper limit is out of tolerance, immediate service and correction is required to insure safe operation and to prevent the possibility of premature component failure.

Horizontal Oscillator Disable Circuit Test

This test must be performed as a final check before the Receiver is returned to the customer. See **Horizontal Oscillator Disable Circuit Procedure Check** in this manual.

Table of Contents

Important Safety Notice 2
Service Notes 4
Horizontal Oscillator Disable Circuit 5

SPECIFICATIONS

Features 6

OPERATION

Location of Controls (Receiver)
Receiver Front Control Panel 7
Remote Control (CT–20R14V/CV and TP2009DV)
Location of Controls 8
Universal Remote (CT–27G12V/CV/UV)
Location of Controls 9
Programming the Universal Remote 10
VCR and Cable Infrared Codes Index .. 11
Home Theater Remote (CT–27G22V/CV/UV)
Location of Controls 12
Programming the Home Theater Remote 13
Infrared Codes Index 14
Main Menu Icons Selection 14

SERVICE

Chassis Service Adjustment Procedures . 20
131.0V B+ Voltage Confirmation 20
Source Voltage Chart 20
B+ 5V Source Voltages 20
MPU 5V 20
Standby 5V 20
B+ 9V Source Voltage 20
B+ 12V (Stand–by) 20
High Voltage Check 20
Disassembly for Service 21
Disassembly for CRT Replacement 21
Purity and Convergence Procedures 22
Instructional Flow Chart for Serviceman Mode 24
Serviceman Mode (Electronic Controls) ... 26
Entering Serviceman Mode 26
For DAC Adjustments 26
For VCJ CUT–OFF Adjustments 27
For Options Adjustments 27
For MTS Adjustments 28
To Check Purity 28
Exiting the Serviceman Mode 28
Entry to Serviceman Mode (other method) 28
Service Adjustments (Electronic Controls) 29
Video Adjustment Level 29
Sub–Contrast 29
Tint/Color Adjustment 29
Color Temperature Adjustment 30
Complete Adjustment 30
Sub–Brightness 30
Horizontal Centering 31
Audio Adjustment 31
Clock Adjustment (Sb) 31
Vertical Size 31
Service Adjustments (Mechanical Controls) 31
VCO Field Adjustment L105 31
Focus (Part of T551) 31

CIRCUITS & BLOCK DIAGRAMS

IC001 MPU IN/OUT Pins and Functions ... 32
IC101 Block Diagram 33
Parts List 34

Service Notes

NOTE: *These components are affixed with glue. Be careful not to break or damage any foil under the component or at the pins of the ICs when removing. Usually applying heat to the component for a short time while twisting with tweezers will break the component loose.*

Leadless Chip Components (surface mount)

Chip components must be replaced with identical chips due to critical foil track spacing. There are no holes in the board to mount standard transistors or diodes. Some chip capacitor or resistor board solder pads may have holes through the board, however the hole diameter limits standard resistor replacement to 1/8 watt. Standard capacitors may also be limited for the same reason. It is recommended that identical chip components be used.

Chip resistors have a three digit numerical resistance code – 1st and 2nd significant digits and a multiplier. Example: 162 = 1600 or 1.6KΩ resistor, 0 = 0Ω (jumper).

Chip capacitors generally do not have the value indicated on the capacitor. The color of the component indicates the general range of the capacitance.

Chip transistors are identified by a two letter code. The first letter indicates the type and the second letter, the grade of transistor.

Chip diodes have a two letter identification code as per the code chart and are a dual diode pack with either common anode or common cathode. Check the parts list for correct diode number.

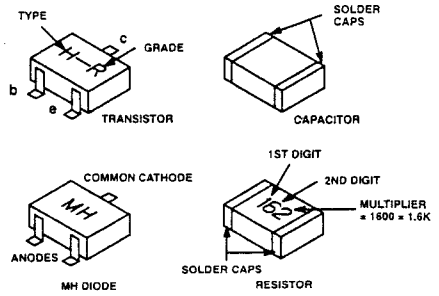
Component Removal

1. Use solder wick to remove solder from component end caps or terminals.
2. Without pulling up, carefully twist the component with tweezers to break the adhesive.
3. Do not reuse removed leadless or chip components since they are subject to stress fracture during removal.

Chip Component Installation

1. Put a small amount of solder on the board soldering pads.
2. Hold the chip component against the soldering pads with tweezers or with a miniature alligator clip and apply heat to the pad area with a 30 watt iron until solder flows. Do not apply heat for more than 3 seconds.

Chip Components

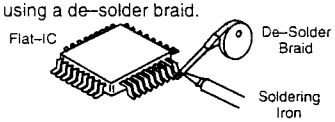


How to Replace Flat–IC

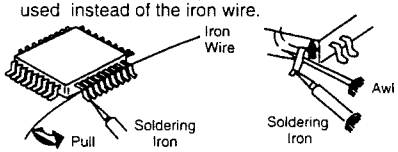
– Required Tools –

- Soldering iron
- De–solder braids
- Iron wire or small awl
- Magnifier

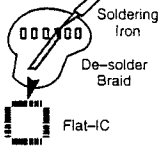
1. Remove the solder from all of the pins of a Flat–IC by using a de–solder braid.



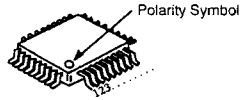
2. Put the iron wire under the pins of the Flat–IC and pull it in the direction indicated while heating the pins using a soldering iron. A small awl can be used instead of the iron wire.



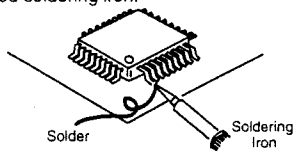
3. Remove the solder from all of the pads of the Flat–IC by using a de–solder braid.



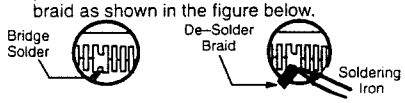
4. Position the new Flat–IC in place (apply the pins of the Flat–IC to the soldering pads where the pins need to be soldered). Properly determine the positions of the soldering pads and pins by correctly aligning the polarity symbol.



5. Solder all pins to the soldering pads using a fine tipped soldering iron.



6. Check with a magnifier for solder bridge between the pins or for dry joint between pins and soldering pads. To remove a solder bridge, use a de–solder braid as shown in the figure below.



Service Notes (Continued)

IMPORTANT: To protect against possible damage to the solid state devices due to arcing or static discharge, make certain that all ground wires and CRT DAG wire are securely connected.

CAUTION: The power supply circuit is above earth ground and the chassis cannot be polarized. Use an isolation transformer when servicing the Receiver to avoid damage to the test equipment or to the chassis. Connect the test equipment to the proper ground (⏚) or (⏚) when servicing, or incorrect voltages will be measured.

WARNING: This Receiver has been designed to meet or exceed applicable safety and X–ray radiation protection as specified by government agencies and independent testing laboratories.

To maintain original product safety design standards relative to X–ray radiation and shock and fire hazard, parts indicated with the symbol ⚠ on the schematic must be replaced with identical parts. Order parts from the manufacturer's parts center using the part numbers shown in this service manual, or provide the chassis number and the part reference number.

For optimum performance and reliability, all other parts should be replaced with components of identical specifications.

Horizontal Oscillator Disable Circuit

This chassis employs a special circuit to protect against excessive high voltage and beam current. If, for any reason, the high voltage and beam current exceed a predetermined level this protective circuit activates and detunes the horizontal oscillator that limits the high voltage.

The over–voltage protection circuit is not adjustable. However, if components indicated by the symbol ⚠ on the schematic in either the horizontal sweep system or the over–voltage protection circuit itself are changed, the operation of the circuit should be checked using the following procedure.

Equipment needed to check the disable circuit:

1. Voltmeter (0 – 200V scale)
2. High Voltage Meter (0 – 40kV)
3. Variac or Isolation Transformer

Procedure:

1. Tune in a station to verify that the horizontal is in sync.
2. Obtain a Monoscope pattern or a signal generator crosshatch pattern.
3. Connect the voltmeter (–) lead to TPD2 and the (+) lead to TPD1 (junction of D555 anode, R556 & R557). Set **Bright** level to (0) and **Picture** for a 1.8 volt reading on the voltmeter.
4. Turn the Receiver OFF. Connect a jumper across IC803 pin 3 and pin 4.
5. Reduce the AC supply voltage to approximately 45V. Connect the high voltage meter to the CRT anode (H.V. button). **NOTE:** Use the Dag Ground (C10 of the CRT Board) to connect the (–) lead of the meter.
6. Turn the Receiver ON. Slowly increase the AC supply voltage and verify that the high voltage does not exceed **35.5kV for 20" models** and **36.8kV for 27" models,** when horizontal just begins to pull out of sync. If the high voltage is not within the specified limit, the cause must be determined and corrected before the Receiver is returned to the customer.

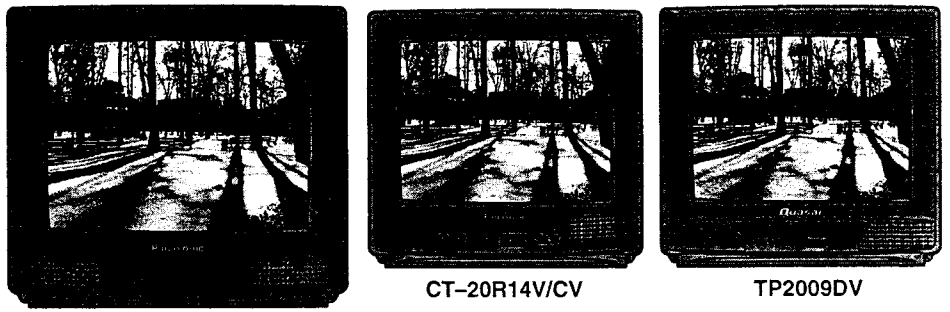
Feature Table

FEATURE \ MODEL	CT-27G22V/CV/UV	CT-27G12V/CV/UV	CT-20R14V/CV	TP2009DV
Chassis	NA6L	NA6L	NA6L	NA6L
# of channels / Phase	181 / PH22M	181 / PH22M	181 / PH22M	181 / PH22M
Menu language	ENG / SP / FR	ENG / SP / FR	ENG / SP / FR	ENG / SP / FR
Closed Caption	X	X	X	X
# of PIP tuners	1T	N/A	N/A	N/A
75 Ω input	X	X	X	X
Remote Model #	EUR511051	EUR511000A	EUR501371	EUR501345
Picture tube	M68LGL061X	M68LGL061X	A51KRE89XDT	A51LES069X
Black face regular tube	X	X	X	X
Notch filter	P	P	P	P
V/A norm (X=both)	V	V	V	V
MTS/SAP/DBX	X	X	N/A	N/A
Built-in audio power	1.5W X 2 (10%)	1.5W X 2 (10%)	–	–
# of speakers	2	2	1	1
AI sound (simple)	X	X	N/A	N/A
A/V in (rear/front)	1/0	1/0	1/1	N/A
Variable audio out	X	X	N/A	N/A
Dimensions mm (HxWxD) in	600 x 665 x 534 23.6 x 26.2 x 21.1	600 x 665 x 534 23.6 x 26.2 x 21.1	467 x 508 x 472 18.4 x 20.0 x 18.6	467 x 510 x 472 18.4 x 20.1 x 18.6
Weight (kb / lb)	34.3 / 75.5	34.3 / 75.5	19.8 / 43.5	19.6 / 43.2
Power soruce (V / Hz)	120 / 60	120 / 60	120 / 60	120 / 60
Power consumption, Max (A)	2.2	2.2	2.3	2.3
Anode voltage	29.25kV ± 1.25kV	29.25kV ± 1.25kV	27.7kV ± 1.25kV	27.7kV ± 1.25kV
Video input jack	$1V_{p-p}$ 75Ω, phono jack	$1V_{p-p}$ 75Ω, phono jack	$1V_{p-p}$ 75Ω, phono jack	$1V_{p-p}$ 75Ω, phono jack
Audio input jack	500mV RMS, 47kΩ	500mV RMS, 47kΩ	500mV RMS, 47kΩ	500mV RMS, 47kΩ
To audio out jack	0-2.0V RMS, 4.7kΩ	0-2.0V RMS, 4.7kΩ	0-2.0V RMS, 4.7kΩ	0-2.0V RMS, 4.7kΩ
"A"-Board TNP2AH003	NIL (V/UV) AF (CV)	BA (V/UV) BH (CV)	DF	DG
"C"-Board TNP2AA005	NIL	NIL	AD	AD
"Y"-Board TNP2AA009	NIL	N/A	N/A	N/A

Table 1. **Receiver Features**

Specifications are subject to change without notice or obligation.
Dimensions and weights are approximate.

Location of Controls, Receiver



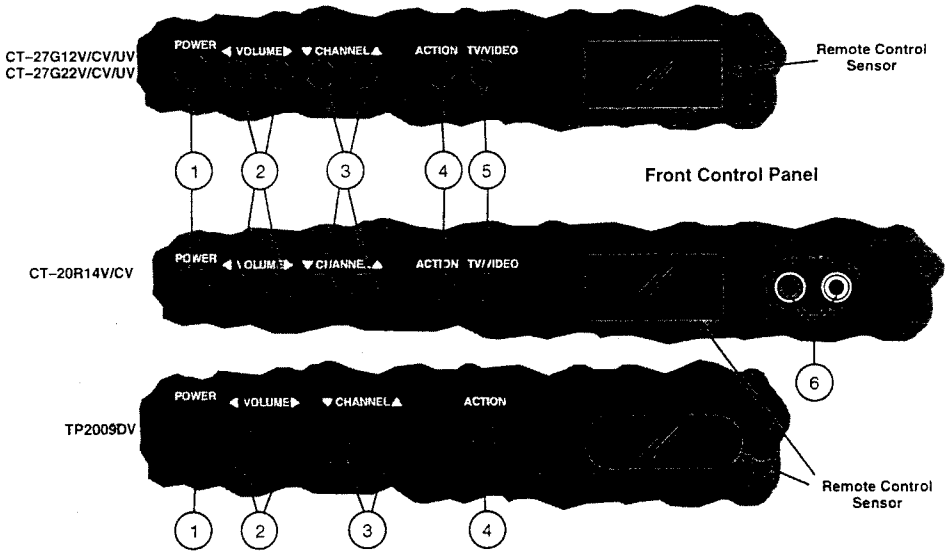


Figure 2. **Location of controls, receiver**

(1) **Power Button** – Press to turn ON or OFF.

(2) **Volume Buttons** – Press to adjust Sound Level. Press to adjust Video Menus and select operating features when menus are displayed.

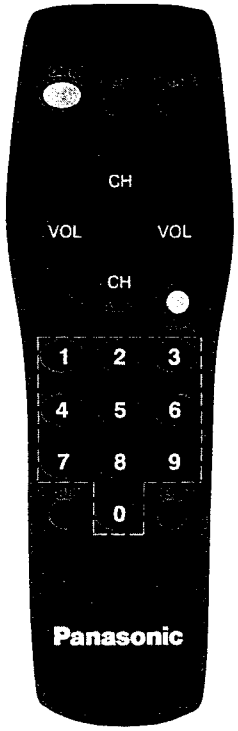
(3) **Channel Buttons** – Press to select programmed channels. Press to highlight desired features when menus are displayed.

(4) **Action Button** – Press to display Main Menu and access On Screen feature and Adjustment Menus.

(5) **TV/Video Button** – Press to select TV or Video Input.

(6) **Front A/V Input Jacks** – Used to connect a camcorder or other video devices to the front of the TV.

Location of Controls, Remote (CT–20R14V/CV & TP2009DV)



EUR501371

Power Button
Press to turn ON or OFF.

Mute Button
Press to mute sound. A second press resumes sound. Press also to access and delete Closed Caption.

TV/Video Button
Press to select TV or Video Input.

Sleep Button
Press to select automatic Turn OFF in 30, 60 or 90 minutes.

Channel Buttons
Press to select channels. Use with Volume buttons to navigate in menus.

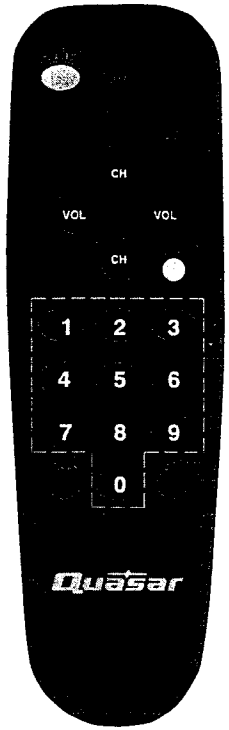
Volume Buttons
Press to adjust TV sound level. Use with Channel buttons to navigate in menus.

Action Button
Press to display Main Menu and access or exit On Screen feature and Adjustment Menus.

Keypad Buttons
Press desired channel number to randomly access any channel.

R–Tune (Rapid Tune) Button
Press to switch to the previous channel.

Recall Button
Press to display Time, status of Sleep Timer, Channel, Video Mode, Channel Caption (Station Identifier) and Audio Mode.



EUR501345

Figure 3. **Location of controls, remote**

Location of Controls, Remote (CT–27G12V/CV/UV)

Power Button
Press to turn ON or OFF.

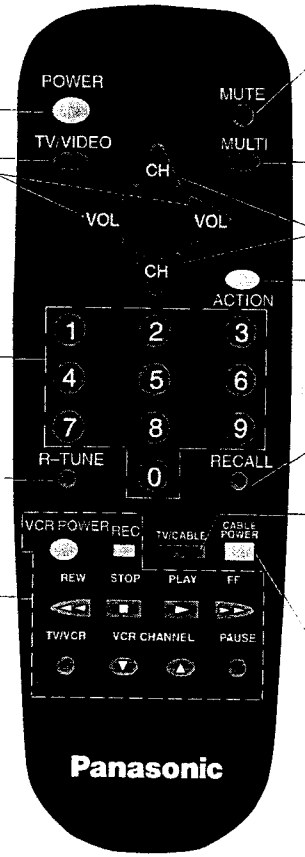
TV/Video Button
Press to select TV or Video Input.

Volume Buttons
Press to adjust TV sound level. Use with Channel buttons to navigate in menus.

Keypad Buttons
Press desired channel number to randomly access any channel.

R–Tune (Rapid Tune) Button
Press to switch to the previous channel.

VCR Function Buttons
Programmable to operate many brands of VCR's.



EUR511000A

Mute Button
Press to mute sound. A second press resumes sound. Press also to access and delete Closed Caption.

Multi Button
Programmable to operate up to six Remote Control Function buttons simultaneously.

Channel Buttons
Press to select channels. Use with Volume buttons to navigate in menus.

Action Button
Press to display Main Menu and access or exit On Screen feature and Adjustment Menus.

Recall Button
Press to display Time, status of Sleep Timer, Channel, Video Mode, Channel Caption (Station Identifier) and Audio Mode.

TV/Cable Switch – This switch is used to select the proper mode when programming Remote Control Infrared codes or operating the TV or external equipment (VCR or Cable Converter box).

Cable Power Button – Programmable to operate selected CATV converter boxes.

Figure 4. **Location of controls, remote (CT–27G12V/CV/UV)**

Programming The Universal Remote (CT–27G12V/CV/UV)

VCR

Preferred Procedure – Code Known

Programming Universal Remote Using Infra–Red Access Codes for VCRs

- Determine brand of VCR.
- Identify code(s) associated with the brand in the infra–red code index for VCRs (located in this manual).

Procedure

1. Place the Remote TV/CABLE into the TV position (Left).
2. Press and hold VCR POWER down on Universal Remote.
3. Enter two digit code using keypad "0 through 9" buttons. VCR POWER
   Release . The Universal Remote is now programmed.

NOTE: Some brands have multiple codes. Repeat procedure using each code listed until VCR responds correctly.

Alternate Procedure – Code Unknown

Programming Universal Remote Using the "Sequence Method" for VCRs

- Confirm VCR is plugged in and operating properly, then turn OFF.

Procedure

1. Place the Remote TV/CABLE into the TV position (Left).
2. Press and hold the VCR POWER down on Universal Remote.
3. Press CH repeatedly. Check for the VCR to turn ON after each press. When the VCR turns ON, release VCR Power button. The proper infra–red code has now been accessed.

NOTE:

1. It may take several attempts before the correct code is found.
2. The VOL can be used to return to a code that was accidently passed by.
3. Some Remote Controls may have unique operating functions for some buttons. For Example: The POWER button may only turn the VCR OFF as opposed to both ON and OFF. It will then be necessary to modify the procedure. Turn the VCR ON and repeatedly press the CH until the VCR turns OFF.

Cable Converter Box

Preferred Procedure – Code Known

Programming Universal Remote Using Infrared Access Codes for Cable Television Converter Boxes

- Determine brand of Cable Television Converter box.
- Identify code(s) associated with the brand in the infra–red code index for Cable Television Converter boxes (located in this manual).

Procedure

1. Place the Remote TV/CABLE into the CABLE position (Right).
2. Press and hold the CABLE POWER down on Universal Remote.
3. Enter two digit code using keypad "0 through 9" buttons. CABLE POWER
   Release The Universal Remote is now programmed. **Use the Remote CH and CH for selecting Cable Converter Box channels.**

NOTE: Some brands have multiple codes. Repeat procedure using each code listed until Cable Television Converter box responds correctly.

Alternate Procedure – Code Unknown

Programming Universal Remote Using the "Sequence Method" for Cable Television Converter Boxes

- Confirm Cable Television Converter box is plugged in and operating properly, then turn OFF.

Procedure

1. Place the Remote TV/CABLE into the CABLE position (Right).
2. Press and hold CABLE POWER down on Universal Remote.
3. Press CH repeatedly. Check for the Cable Television Converter box to turn ON after each press. When the Cable Television Converter box turns ON, release Cable Power button. The proper infrared code has now been accessed.

NOTE:

- It may take several attempts before the correct code is found.
- The VOL can be used to return to a code that was accidently passed by.
- Some Remote Controls may have unique operating functions for some buttons. For Example: The POWER button may only turn the Cable Television Converter box OFF as opposed to both ON and OFF. It will then be necessary to modify the procedure. Turn the Cable Television Converter box ON and repeatedly press the CH until the Cable Television Converter box turns OFF.

NOTE: When operating equipment (VCR or Cable Converter box) with the Universal Remote Control, the TV/CABLE Switch should be set to the same position where the Access Code was first programmed for the equipment. Otherwise, leave the switch in the TV position.

VCR and Cable Converter Box Infrared Codes Index (CT–27G12V/CV/UV)

The Universal infrared Remote Control is capable of operating many brands of VCRs and Cable Television Converter Boxes after entering the proper infrared code.

NOTE: The Universal Remote Control memory is limited. Some models of VCRs or Cable Television Converter Boxes may not operate. The Universal Remote Control is not designed to control all features that are available in all models.

Infrared Code Index For VCRs

VCR Brand	Code(s)	VCR Brand	Code(s)
Audio Dynamics	14, 16	NEC	02, 14, 16, 30
Broksonic	10	Panasonic	00, 01
Canon	00, 01	Pentax	05
Capehart	01	Philco	00, 29
Citizen	09	Philips	00, 29
Craig	12	Pioneer	05
Curtis Mathes	00, 08, 15	Quasar	00, 01
DBX	14, 16	RCA	05, 07, 08, 28, 35
Emerson	10, 20, 34, 35, 36, 37	Realistic	00, 02, 06, 12, 15
Fisher	12, 18, 19	Samsung	07, 32
Funai	15	Sanyo	02, 12
GE	00, 07, 08, 32	Scott	04, 13, 33, 36
Goldstar	09	Sears	02, 05, 18, 19
Hitachi	05, 35, 36	Sharp	06, 24
Instant Replay	00	Sony	17, 26, 33, 34
JC Penney	00, 02, 05, 14, 16, 30	Sylvania	00, 29
JVC	02, 14, 16, 30	Symphonic	15
Kenwood	02, 14, 16, 30	Tashiko	09
Magnavox	00, 29	Tatung	30
Marantz	02, 14, 16, 29, 30	Teac	15, 30
Marta	09	Teknika	21
Memorex	00, 12	Toshiba	05, 13
MGA	04, 27	Vector Research	14, 16
Minolta	05	Video Concepts	14, 16
Mitsubishi	04, 27	Wards	06
Montgomery Ward	06	Yamaha	02, 14, 16, 30
Multitech	07, 15, 32	Zenith	11, 17

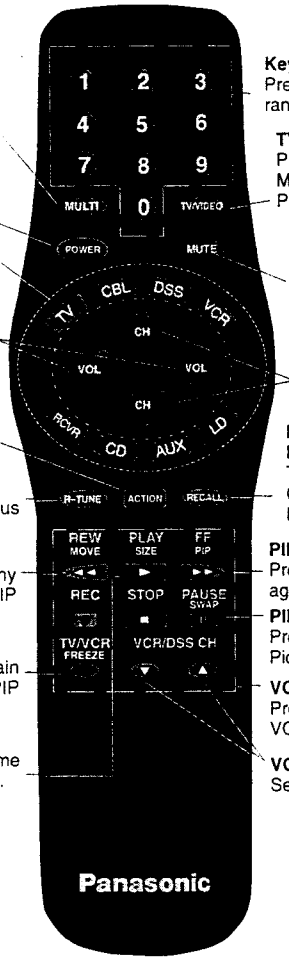
Infrared Code Index For Cable Television Converter Box

Brand of Cable–TV Box	Code(s)	Brand of Cable–TV Box	Code(s)
G.I.	04, 05, 15, 23, 24, 25, 30, 36	Pioneer	18, 20
		RCA	27
Hamlin	12, 13, 34	Regency	02
Jerrold	04, 05, 15, 23, 24, 25, 30, 36	Scientific Atlantic	03, 22
		Sylvania	11
Macom	27	Texscan	10, 11
Magnavox	19, 26, 28, 29, 32, 33, 40, 41	Tocom	17, 21
		Unika	31
Oak	14,16, 18	Viewstar	19, 26, 28, 29, 32, 33, 40, 41
Oak Sigma	16		
Panasonic	27, 39	Zenith	01, 42
Philips	19, 26, 28, 29, 32, 33, 40, 41		

Location of Controls Remote (For CT-27G22V/CV/UV)

Basic Remote Control Functions

The following is an overview of the Remote Control unit for television operation. Ensure the TV mode is selected by initially pressing TV.



Home Theater Remote Control
EUR511051

Multi Button
Programmable to operate up to six Remote Control Function buttons simultaneously.

Power Button
Press to turn ON or OFF.

Mode Selection Buttons
Select the operation mode for the remote control.

Volume Buttons
Press to adjust TV sound level. Use with Channel buttons to navigate in menus.

Action Button
Press to display Main Menu and access or exit On Screen feature and Adjustment Menus.

R-Tune (Rapid Tune) Button
Press to switch to the previous channel.

PIP Move Button
Press to position PIP frame to any corner of the Main Picture (when PIP frame is displayed).

PIP Freeze Button
Press to stop action in the Main Picture or PIP frame (when the PIP frame is displayed).

PIP Size Button
Press to select size of PIP frame (when the PIP frame is displayed).

Keypad "0 through 9" Buttons
Press desired channel number to randomly access any channel.

TV/Video Button
Press to select TV or Video Input, for the Main Picture or the PIP frame (when the PIP frame is displayed).

Mute Button
Press to mute sound. A second press resumes sound.

Channel Buttons
Press to select channels. Use with Volume buttons to navigate in menus.

Recall Button
Press to display Time, status of Sleep Timer, Channel, Video Mode, Channel Caption (Station Identifier) and Audio Mode.

PIP (Picture In Picture) Button
Press to display the PIP frame, press again to remove PIP frame.

PIP Swap Button
Press to interchange PIP frame with Main Picture (when the PIP frame is displayed).

VCR Function Buttons
Programmable to operate many brands of VCR's.

VCR/DSS Channel Buttons
Select VCR or DSS Up/Down channels.

Note:
For more information on the Remote Control, please refer to the Remote Control Quick Reference Functional Key Chart.

Helpful Hints:

If the selected component does not respond to the remote control, ensure that the proper mode is selected. **First**, press the **Mode Selection Button** that corresponds to that component. For example, after first pressing the TV Mode Button, the remote will remain in the TV mode for the following commands. If a different mode button is pressed while operating the television, the TV mode button must be pressed again to enable the TV mode condition.

Programming the Home Theater Remote (For CT-27G22V/CV/UV)

The remote control can be set to control other manufacturers components, by utilizing the **MODE SELECTION BUTTONS** for **CABLE**, **DSS**, **VCR**, **RCVR** (a **Receiver** or **Amplifier**), **CD**, **LD**, and **AUX** (for **Cassette Players, Second VCR** or a **DVD.**)

Code Known

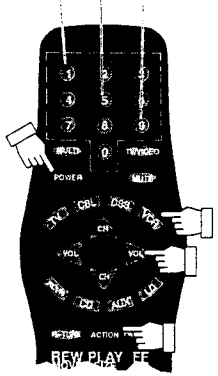
Use the following procedure for setting up the remote control using the numerical buttons when the component's remote code is known.

1. Determine the brand of the component.
2. Identify the code(s) associated with the brand from the infrared code index (see following pages). Record all possible codes.
3. Confirm that the component is plugged in and operating properly, then turn it OFF.
4. **Press and hold the ACTION button, then the POWER button so that both are pressed at the same time for at least 5 seconds.** Then let go of the buttons.
5. **Press the appropriate Mode button for the component.**
6. **Enter the 3-digit code, by using the Remote Control Keypad "0" through "9" buttons.**

   Now the remote is set for the entered code.
7. **Press the POWER button to test the remote. If the correct code is setup for the component (in step 6), the component will turn on.**

NOTE: Some brands have multiple codes. Repeat the procedure using another listed code until the component responds correctly.

6
Code From Index Sheet
1 5 9



EUR511051

Code Unknown

Use the following procedure for setting up the remote control when the component's remote access code is not known. This procedure uses the "sequence method".

1. Confirm that the component is plugged in and operating properly, then turn it OFF.
2. **Press and hold the ACTION button, then the POWER button so that both are pressed at the same time for at least 5 seconds.** Then let go of the buttons.
3. **Press the appropriate Mode button for the device.**
4. **Press the VOL button to step over to the next code.**
5. **Press the POWER button to test the remote. If the correct code is sent, the component will turn on.**
6. **Once the correct code is found, press the ACTION button to store the code.**
7. Repeat from step 3 above until the proper component code is found. It may take several attempts before the correct code is found.

NOTE: If an incorrect code is entered, or when the operation is not completed within 30 seconds, the settings will not change.

Infrared Remote Codes for Specific Components

Helpful Hint: **Write down the code numbers for your components in the space provided below. This will serve as a handy reference whenever you need to reprogram your remote control.**

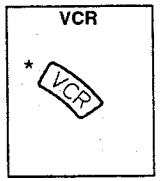
CABLE Cable TV Converter Box	**VCR** Video Cassette Recorder	**CD** Compact Disc Player
DSS Digital Satellite System	**RCVR** Receiver or Amplifier	**LD** Laser Disc Player
Other Component	Other Component	Other Component
Other Component	Other Component	Other Component

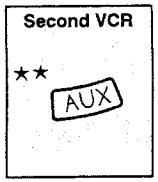
VCR Infrared Codes Index (For CT-27G22V/CV/UV)

The Universal Infrared Remote Control is capable of operating many brands of VCRs. Refer to the Programming the Remote Control section for procedures.

Note: The Universal Remote Control memory is limited; therefore, some models of VCRs may not operate. The Universal Remote Control is not designed to control all features that are available in all models.

Note: After entering the proper infrared code, press the Remote **VCR** (*) Selection Mode button. **A second VCR can be activated** using the same codes, from **AUX** (**) Selection Mode button. Then refer to the Remote Control Key Functions section, for Remote VCR and VCR 2 function key listing.





Code Index for VCRs

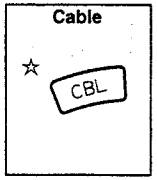
VCR Brand	Code(s)	VCR Brand	Code(s)
Admiral	200	Pentax	000, 011, 300
Aiwa	137, 160	Philco	081, 125, 130, 136, 137, 150
Akai	014, 015, 016, 142	Philips	125, 130, 150
Audio Dynamic	011, 240	Pioneer	125
Bell & Howell	005, 013	Proscan	000, 001, 002, 125, 130, 150, 300, 310
Broksonic	081, 136	Quasar	100, 101, 125, 130
Canon	125, 135	Radio Shack	005, 009, 130, 137, 170, 210, 241
Citizen	006	RCA	000, 001, 002, 125, 130, 150, 170, 300, 310
Craig	005, 006, 141	Realistic	005, 009, 130, 137, 210, 241
Curtis Mathes	130, 137, 300	Samsung	002, 004, 220
Daewoo	001, 130, 250	Sansui	081, 136, 240
DBX	010, 011, 240	Sanyo	005, 009
Dimensia	300	Scott	001, 002, 004, 009, 081, 136, 230, 241, 330, 340
Emerson	003, 051, 080, 081, 135, 136, 243, 250	Sears	000, 005, 006, 007, 008,
Fisher	005, 007, 008, 009	Shaintom	050
Funai	081, 136, 137	Sharp	200, 210
GE	130, 170, 300	Signature 2000	137, 200
Goldstar	006	Singer	050
Go Video	220	Sony	140, 141, 142
Hitachi	000, 125, 300,	SV2000	137
Instant Replay	125, 130,	Sylvania	125, 130, 137, 150
Jensen	240	Symphonic	137
JVC	010, 011, 190, 240	Tashiro	006
Kenwood	006, 010, 011, 240	Tatung	010, 011, 240
LXI	000, 005, 006, 007, 008, 009, 137	Teac	010, 011, 137, 240
Magnavox	025, 130, 150	Technics	100, 101, 125, 130
Marantz	010, 011, 240	Teknika	130, 137
Marta	006	Toshiba	001, 310
Memorex	009, 130	Vector Research	011
MGA	230, 241, 242, 243, 330, 340	Wards	006, 009, 200, 210, 290
Minolta	000, 300	Yamaha	005, 010, 011, 240
Mitsubishi	230, 241, 242, 243, 330, 340	Zenith	290
Multitech	004, 137, 330		
NEC	010, 011, 190, 240		
Olympic	125, 130		
Optimus	006, 200, 100, 140		
Orion	081, 136		
Panasonic	100, 101, 125, 130		
Penney	000, 005, 010, 011, 130, 240, 300		

Cable Converter Box and CD Players Infrared Codes Index (For CT-27G22V/CV/UV)

The Universal Infrared Remote Control is capable of operating many brands of Cable Converter Boxes and CD Players. Refer to the Programming the Remote Control section for procedures.

Note: The Universal Remote Control memory is limited; therefore, some models of Cable Converter Boxes and CD Players may not operate. The Universal Remote Control is not designed to control all features that are available in all models.

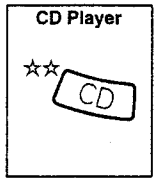
Note: After entering the proper infrared code, press the Remote **CBL** Selection Mode button (☆). Then refer to the Remote Control Key Functions section, for Remote CBL function key listing.



Codes for Cable Converter Box

Brand of Cable-TV Box	Code(s)	Brand of Cable-TV Box	Code(s)
ABC	530	Philips	006, 007, 540, 541, 542
Archer	531, 544	Pioneer	001, 260
Cableview	005, 544	Pulsar	005, 544
Citizen	005, 522	Puser	544
Curtis	130, 131	RCA	170, 220
Diamond	530, 531, 544	Realistic	544
Eagle	541	Regal	130, 350, 720, 730, 731, 900
Eastern	560	Regency	560
Gcbrand	005, 544	Rembrandt	005, 544, 702
Gemini	522	Samsung	005
General Instrument	122, 360, 520, 521, 522, 530, 531, 532, 533	Scientific Atlanta	122, 130, 131
Hamlin	130, 350, 720, 730, 731, 900	Slmark	001, 005
Hitachi	003, 530	Sprucer	005, 121
Jerrold	122, 360, 520, 521, 522, 530, 531, 532, 533	Stargate	005, 544
Macom	003, 004, 005	Teleview	001, 005
Memorex	542	Texscan	810
Movietime	005, 544	Tocom	700, 701
Oak	002, 702, 710	Toshiba	004
Panasonic	120, 121, 132	Unika	531, 544
Paragon	281	Universal	522, 544
		Videoway	006
		Viewstar	541, 542
		Zenith	000, 280, 281
		Zenith/Drake Satellite	000

Note: After entering the proper infrared code, press the Remote **CD** Selection Mode button (☆☆). Then refer to the Remote Control Key Functions section, for Remote CD Players function key listing.



Codes for CD Players

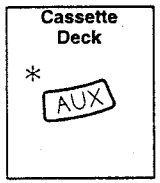
Brand of CD Players	Code(s)	Brand of CD Players	Code(s)
Admiral	110	Optimus	030, 057, 059, 061
Aiwa	162, 164	Panasonic	100, 101, 130
Carver	150, 151	Philips	150, 151
Denon	200	Pioneer	030
Emerson	172	Quasar	100, 101, 130
Fisher	005	RCA	160, 170, 171, 500
Garrard	057	Sansui	032, 050, 320
Harman/Kardon	059, 060	Sanyo	005
Hitachi	007	Scott	032, 050, 320
Jensen	163	Sharp	200, 201
JVC	190, 191, 270	Sherwood	059
Kardon	058	Sony	140
Kenwood	000, 001, 050, 270	Soundesigh	220
LXI	165	Teac	051, 055, 057
Magnavox	150, 161	Technics	100, 101, 130
Marantz	151	Victor	190, 191, 270
McIntosh	060	Yamaha	002, 003, 004
Nakamichi	032		
Onkyo	053, 054		

Cassette Deck, Receivers, and Amplifiers Infrared Codes Index (For CT-27G22V/CV/UV)

The Universal Infrared Remote Control is capable of operating many brands of Cassette Deck, Receivers, or Amplifiers. Refer to the Programming the Remote Control section for procedures.

Note: The Universal Remote Control memory is limited; therefore, some models of Cassette Deck, Receivers, and Amplifiers may not operate. The Universal Remote Control is not designed to control all features that are available in all models.

Note: After entering the proper infrared code, press the Remote **AUX** Selection Mode button (*). Then refer to the Remote Control Key Functions section, for Remote Cassette Deck function key listing.



Code Index for Cassette Deck

Brand of Cassette Deck	Code(s)	Brand of Cassette Deck	Code(s)
Aiwa	760, 761, 762	Philips	751
Denon	800	Pioneer	630
Fisher	603	RCA	763, 770, 771
Jensen	657	Sansui	631, 653
JVC	780, 781	Sharp	800
Kenwood	600, 650	Sony	740
Marantz	751	Teac	653, 654
Nakamichi	631	Technics	700, 701, 730
Onkyo	651, 652, 656	Yamaha	601, 602
Panasonic	700, 701, 730		

Note: After entering the proper infrared code, press the Remote **RCVR** Selection Mode button (**). Then refer to the Remote Control Key Functions section, for Remote Receivers/Amplifiers function key listing.

Code Index for Receivers and Amplifiers

Brand of Receiver / Amplifier	Code(s)	Brand of Receiver / Amplifier	Code(s)
Admiral	110	Panasonic	100, 101, 130
Aiwa	160, 161	Philips	150
Denon	200, 201, 202	Pioneer	030, 032
Fisher	004	Quasar	100, 101, 130
Garrard	055	RCA	003, 130, 162, 170, 171
Harman	150, 057	Sansui	003, 053, 320
Jensen	164	Sharp	200, 203
JVC	190, 191	Sony	140
Kenwood	000, 050	Soundesign	220
Magnavox	162	Teac	053, 054, 055
Marantz	151	Technics	100, 101, 130
McIntosh	058	Victor	190, 191
Nakamichi	031	Yamaha	001, 002
Onkyo	151, 156		
Optimus	003, 162, 170, 171		

Laser Disc, DSS (Digital Satellite System), and DVD (Digital Videodisc) Infrared Codes Index (For CT-27G22V/CV/UV)

The Universal Infrared Remote Control is capable of operating selected brands of Laser Disc, DSS Digital Satellite System, and DVD (Digital Videodisc). Refer to the Programming the Remote Control section for procedures.

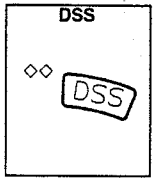
Note: The Universal Remote Control memory is limited; therefore, some models of Laser Disc, DSS Digital Satellite System, and DVD (Digital Videodisc) may not operate. The Universal Remote Control is not designed to control all features that are available in all models.

Note: After entering the proper infrared code, press the Remote **LD** Selection Mode button (◇). Then refer to the Remote Control Key Functions section, for Remote Laser Disc function key listing.

Codes for Laser Disc

Brand of Laser Disc	Code(s)	Brand of Laser Disc	Code(s)
Denon	370	Quasar	100, 101, 135, 380
Hitachi	000	RCA	370
Kenwood	002, 003	Samsung	160
Marantz	370	Sanyo	370
Mitsubishi	370	Sharp	200
NEC	370	Sony	140, 141, 142, 143
Panasonic	100, 101, 135, 380	Teac	370
Philips	150	Toshiba	370
Pioneer	370	Yamaha	001
Proscan	370		

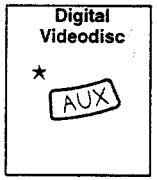
Note: After entering the proper infrared code, press the Remote **DSS** Selection Mode button (◇◇). Then refer to the Remote Control Key Functions section, for Remote DSS function key listing.



Codes for DSS (Digital Satellite System)

Brand of Satellite	Code(s)
GE	170
Panasonic	100
RCA	170
Sony	390

Note: After entering the proper infrared code, press the Remote **AUX** Selection Mode button (★). Then refer to the Remote Control Key Functions section, for Remote DVD function key listing.



Codes for DVD (Digital Videodisc)

Brand of DVD	Code(s)
Panasonic	102

Main Menu Icons Selection

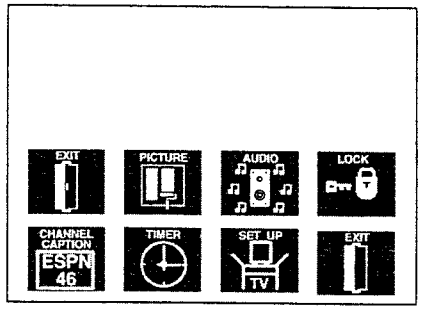


Figure 5. **Main Menu Icons**

Figure 6. **Displays and Exits Menus**

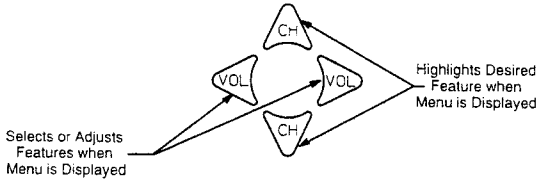


Figure 7. **Controls for Menu Icon Selection** (located on Remote Control)

1. Press the ACTION button to display the Main Menu.
2. Press the CH UP/DOWN and the VOL LEFT/RIGHT buttons to move from one icon to another. The selected Icon will be indicated in Red. Press the VOL buttons to move horizontally and the CH buttons to move vertically.
3. Press the ACTION button after selecting the desired Icon.
4. Select the EXIT Icon, then press the ACTION button to exit.

Bilingual Menu Selection

The Language Menu is factory set to ENGLISH. Follow these instructions to change the Language Menu to French and back to English.

1. Press the ACTION button to display the Main Menu.
2. Press the CH UP/DOWN and VOL LEFT/RIGHT buttons to highlight the SET–UP Icon.
3. Press the ACTION button to display the SET–UP Menu.

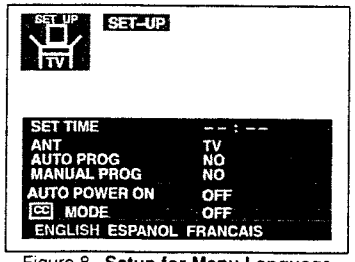


Figure 8. **Setup for Menu Language**

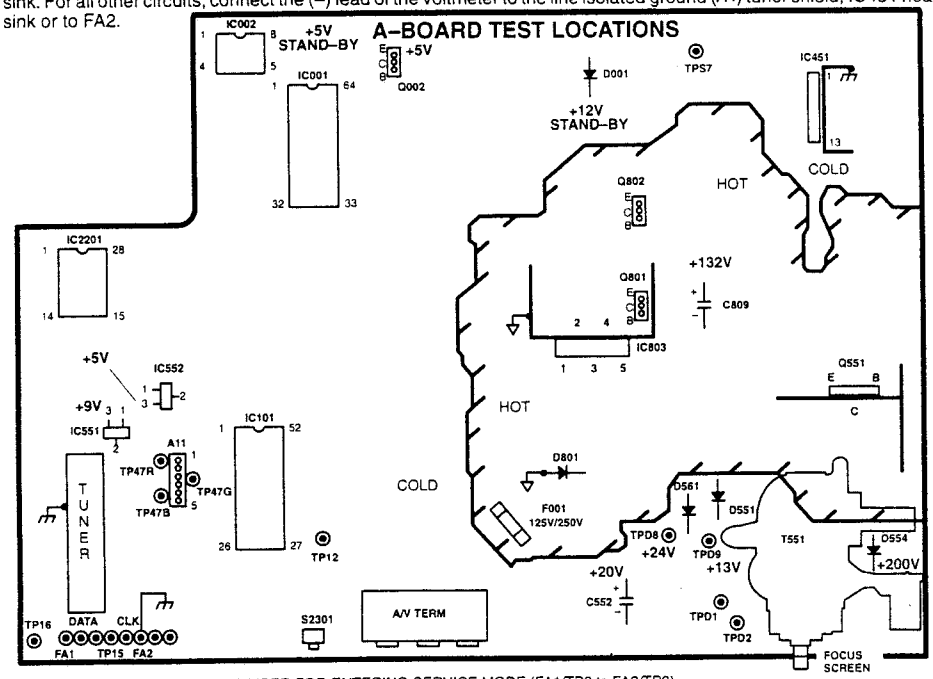
4. Press the CH UP or DOWN button to highlight ENGLISH FRANCAIS.
5. Press the VOL LEFT/RIGHT button to select ENGLISH or FRANCAIS.
6. Press the ACTION button twice to exit Menus.

Notes

Chassis Service Adjustment Procedures

All service adjustments are factory preset and should not require adjustments unless controls and/or associated components are replaced.

NOTE: Connect the (–) lead of the voltmeter to the appropriate ground for the circuit being checked. When necessary to use a line operated ground, the ground indication (⏚) is marked. For this ground use anode of D801 or IC803 heat sink. For all other circuits, connect the (–) lead of the voltmeter to the line isolated ground (⏚) tuner shield, IC451 heat sink or to FA2.



MOMENTARILY CONNECT A JUMPER FOR ENTERING SERVICE MODE (FA1/TP8 to FA2/TP3)

131.0V B+ Voltage Confirmation

1. Set the **Bright** and the **Picture** to Minimum by using the Picture Menu.
2. Connect a DVM between C809, + side and Hot ground (⏚).
3. Confirm that B+ voltage is 132.0V±2.5V. This voltage supplies B+ to the Horizontal Output & Flyback circuits.

Source Voltage Chart

120V AC line input. Set the **Bright** and the **Picture** to Minimum by using the Picture Menu . Use cold ground (⏚) for the (–) lead of the DVM.

IC551 pin 3	+9.0V ±0.5V
Cathode of D551 (TPD9)	+13.0V ±2V
C552 (+ side)	+20.0V ±2V
Cathode of D561 (TPD8)	+24.0V ±2V (20")
	+27.4V ±2V (27")
Cathode of D554	+200V ±1V (20")
	+220V ±15V (27")

Adjust Picture menu for normalized video adjustments.

B+ 5V Source Voltages

Volatile 5V:
C572, + side = IC552 pin 3, Tuner BP, IC101 (B+ V_{cc}).

MPU 5V:
Emitter Q002 = IC001(V_{DD}).

Standby 5V:
IC001 (Key in 1), I^2C EEPROM (IC002), TIMER LED, Remote Receiver.

B+ 9V Source Voltage

IC551 pin 3 = IC101 (B+ V_{cc}), Tuner (BM).

B+ 12V (Stand–by) Note: +16V when power is on

Cathode D001 = RL801 (on–off relay), Q002 (+5V Reg).

High Voltage Check

1. Select an active TV channel and confirm that horizontal is in sync.
2. Adjust Brightness and Picture using Picture Icon menu so video just disappears.
3. Confirm B+ 132V is within limit.
4. Using a high voltage meter confirm that the High Voltage is:
   - 20" models ..... 27.7kV ±1.25kV
   - 27" models ..... 29.25kV ±1.25kV

Disassembly for Service

Back Cover

Remove all the screws marked with an arrow (◀) from the back of the Receiver.

Note: screw configuration and number of screws may vary depending on the model of the Receiver serviced; various models are covered in this Manual.

1. 2 screws at the top edge of the Receiver (20").
   3 screws at the top edge of the Receiver (27").
2. 1 screw on the retainer plate for the AC power cord (27" only).
3. 1 screw by flyback assembly.
4. 1 screw by the A/V jacks.
5. 2 screws at the bottom edge of the Receiver.

A–Board – Main Chassis

1. Press tab on left rail.
2. Slide the chassis completely out of the guide rails.
   NOTE: Some tie–wraps that secure the wire dressings may need to be unfastened for chassis removal.
3. Stand the Receiver on its edge. The underside of the board is completely accessible for component replacement.

C–Board – CRT Output

Plugs into the socket on the CRT neck.

Y–Board – PIP Processing

Connected to the Main Chassis (A–Board). It is the board located close to the left edge of the A–Board. The Y–Board is connected to the A–Board with 2 connectors. Pull on the Y–Board, perpendicular to the A–Board, while releasing the snap tabs on connectors A31 & A32.

Keyboard Push Button Assembly

Fastened to the inside of the cabinet front by 3 screws.

Speakers

Secured to the cabinet by 2 screws each (20").
Secured to the cabinet by 4 screws each (27").

Disassembly for CRT Replacement

1. Discharge the CRT as instructed in the **Safety Precautions**.
2. Disconnect the yoke plug ,degaussing coil plug and the CRT 2nd anode button from the main board .
3. Remove the C–Board from the CRT base and unplug the black wire (CRT dag ground) C10–1 from the board.
4. Disconnect the A12 and SP plugs from the A–Board.
5. Slide the main chassis assembly completely out with the CRT Board attached.

CRT Replacement

1. Perform **Disassembly for CRT Replacement** procedure.
2. Insure that the CRT H.V. anode button is discharged before handling the CRT. See the **Safety Precautions** on handling the picture tube.
3. Remove the components from the CRT neck and place the cabinet face down on a soft pad.
4. Note the original order of the CRT mounting hardware as they are removed from the CRT mounting brackets at each corner of the CRT.
5. Remove the CRT with the degaussing coil and the dag ground braid attached.
6. Note the original locations and mounting of the degaussing coil and the dag ground assembly to insure proper reinstallation on the replacement CRT.

   To remove and re–mount the degaussing coil:
   The degaussing coil is held in place by clampers fastened to the CRT corner ears.
   These clampers must be installed onto the replacement CRT prior to mounting the degaussing coil.

   To remove and re–mount the dag ground braid:
   - Unhook the coil spring from the upper right CRT ear.
   - Release the braid loop from the upper left and the lower right CRT ear.
7. Mount the dag ground braid on the replacement CRT. Position the degaussing coil with new ties. Dress coil as was on the original CRT.
8. Replace the components on the CRT neck and re–install into cabinet. Verify that all ground wires and circuit board plugs get connected.

Purity and Convergence Procedure

Adjustment is necessary only if the CRT or the deflection yoke is replaced or if the setting was disturbed. The complete procedure consists of:

1. Initial static convergence.
2. Setting the purity.
3. Final static convergence.

When the CRT or the Yoke is Replaced

Place the yoke on the CRT neck (do not tighten the clamp).

For a 2–piece assembly (see Figure 9):

Position purity/convergence assembly as shown and tighten clamp snugly. Cut the hot–melt glue seal on assembly and place like tabs of purity device together at 12 o'clock to reduce its magnetic field effect. Manually degauss the CRT.

Turn the Receiver ON and slide the deflection yoke back and forth on the neck of the CRT. Stop at the position that produces a near white, uniform raster.

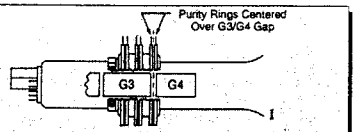


Figure 9. **Positioning of Purity/Convergence Assembly (2–piece assembly)**

For a 1–piece assembly (see Figure 10):

Place like tabs of purity devices together at 12 O'Clock to reduce any magnetic field effect. Manually degauss the set.

Connect a Black/White pattern generator and tune the receiver to the signal. Slide the deflection yoke & purity ring assembly back and forth on the CRT neck. Stop at a position that produces a near white signal.

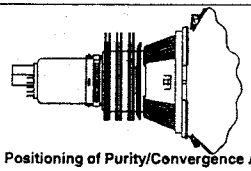


Figure 10. **Positioning of Purity/Convergence Assembly (1–piece assembly)**

Initial Center Static Convergence

Connect a dot/crosshatch generator to the Receiver and tune in signal. Observe misconvergence at center of the screen only.

Adjust the 4 pole magnet (center rings); separate tabs and rotate to converge blue with red.

Adjust the 6 pole magnet (rear rings): separate tabs and rotate to converge blue and red (magenta) with green.
Note: *Precise convergence at this point is not important.*

Purity Adjustment

When the Receiver is in the Serviceman Mode for making electronic adjustments, press the **Recall** button on the Remote Control to enter Purity Check. (See **Service Adjustments Electronic Controls**.)

Operate the Receiver for 60 minutes using the first Purity check field (white screen) to stabilize the CRT.

Fully degauss the Receiver by using an external degaussing coil.

Press the **Recall** button on the Remote Control again until the Purity Check (green screen) appears.

For a 2–piece assembly (see Figure 9):

Loosen the deflection yoke clamp screw and move the deflection yoke back as close to the purity magnet as possible.

Adjust the purity rings to set the vertical green raster precisely at the center of the screen (see Figure 11).

NOTES:
1. CRT warm up with white screen (three guns activated) is needed to stabilize the shadow mask expansion.
2. Initial center static convergence (roughly centers three gun beams) is required in order to perform purity adjustment.

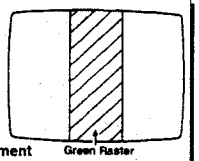


Figure 11. **Green Raster Adjustment**

Slowly move the deflection yoke forward until the best overall green screen is displayed.

For a 1–piece assembly (see Figure 10):

Slowly move the deflection yoke and purity rings assembly toward the CRT board and adjust the purity magnet rings to set vertical green raster at center of screen (see Figure 11).

Gradually move the deflection yoke & purity rings forward and adjust for the best overall green screen.

Continue from here for either assemblies:

Tighten the deflection yoke clamp screw.

Press the **Recall** button on the Remote Control again until the Purity Check (blue screen) and (red screen) appear and observe that good purity is obtained on each respective field.

Press the **Recall** button on the Remote Control again until Purity check (white screen) appears. Observe the screen for uniform white. If purity has not been achieved, repeat the above procedure.

Final Convergence Procedure (see Figure 12 through Figure 14):

Note: *Vertical size and focus adjustments must be completed prior to performing the convergence adjustment. Connect a dot pattern generator to the Receiver. The* ***Brightness*** *level should not be higher than necessary to obtain a clear pattern.*

Converge the red and blue dots at the center of the screen by rotating the 4 pole (R with B) Static Convergence Magnets.

Align the converged red/blue dots with the green dots at the center of the screen by rotating the 6 pole (R/B with G) Static Convergence Magnets. Melt wax with soldering iron to reseal the magnets.

Slightly tilt vertically and horizontally (do not rotate) the deflection yoke to obtain a good overall convergence.

If convergence is not reached at the edges, insert permalloy (see following section) from the DY corners to achieve proper convergence. Recheck for purity and readjust if necessary.

After vertical adjustment of the yoke, insert wedge at 11 o'clock position, then make the horizontal tilt adjustment.

Secure the deflection yoke by inserting two side wedges at 3 and 7 o'clock positions.

Apply adhesive between tab (thin portion) of wedge and CRT and place tape over the tab to secure to the CRT.

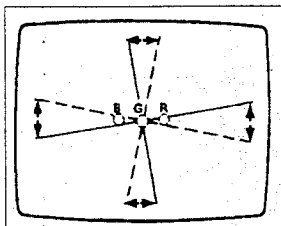
Permalloy Convergence Corrector Strip (Part No. OFMK014ZZ)

This strip is used in some sets to match the yoke and CRT for optimum convergence. If the yoke or CRT is replaced, the strip may not be required.

First converge the set without the strip and observe the corners.

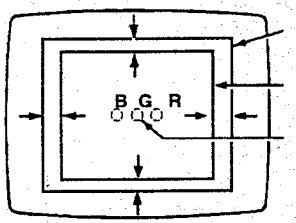
If correction is needed:

1. Place strip between CRT and yoke, in quadrant needing correction. Slowly move it around for desired results.
2. Press adhesive tightly to the CRT and secure with tape.



As the yoke is moved vertically, the rasters produced by the outside guns rotate in opposite directions.

Figure 12. **Vertical Yoke Movement**



Raster produced from one of the outside electron beams

Raster from the other outside electron beam

Static convergence magnets are set for center convergence

As the yoke is moved horizontally, one raster gets larger while the other gets smaller

Figure 13. **Horizontal Yoke Movement**

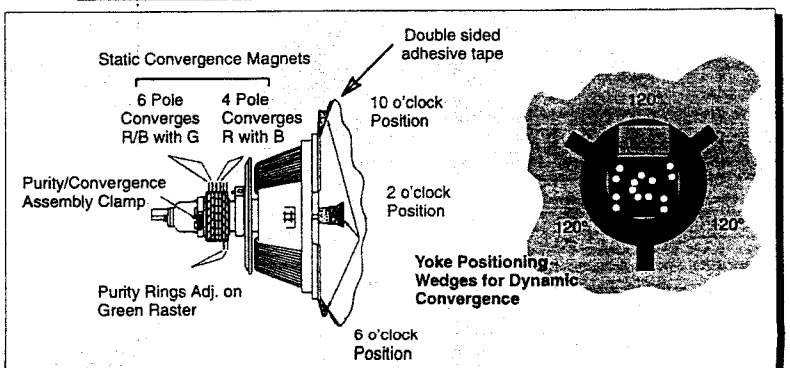


Figure 14. **Convergence Magnets and Wedges Location**

Instructional Flow Chart for Serviceman Mode

Caution: Always EXIT Serviceman Mode

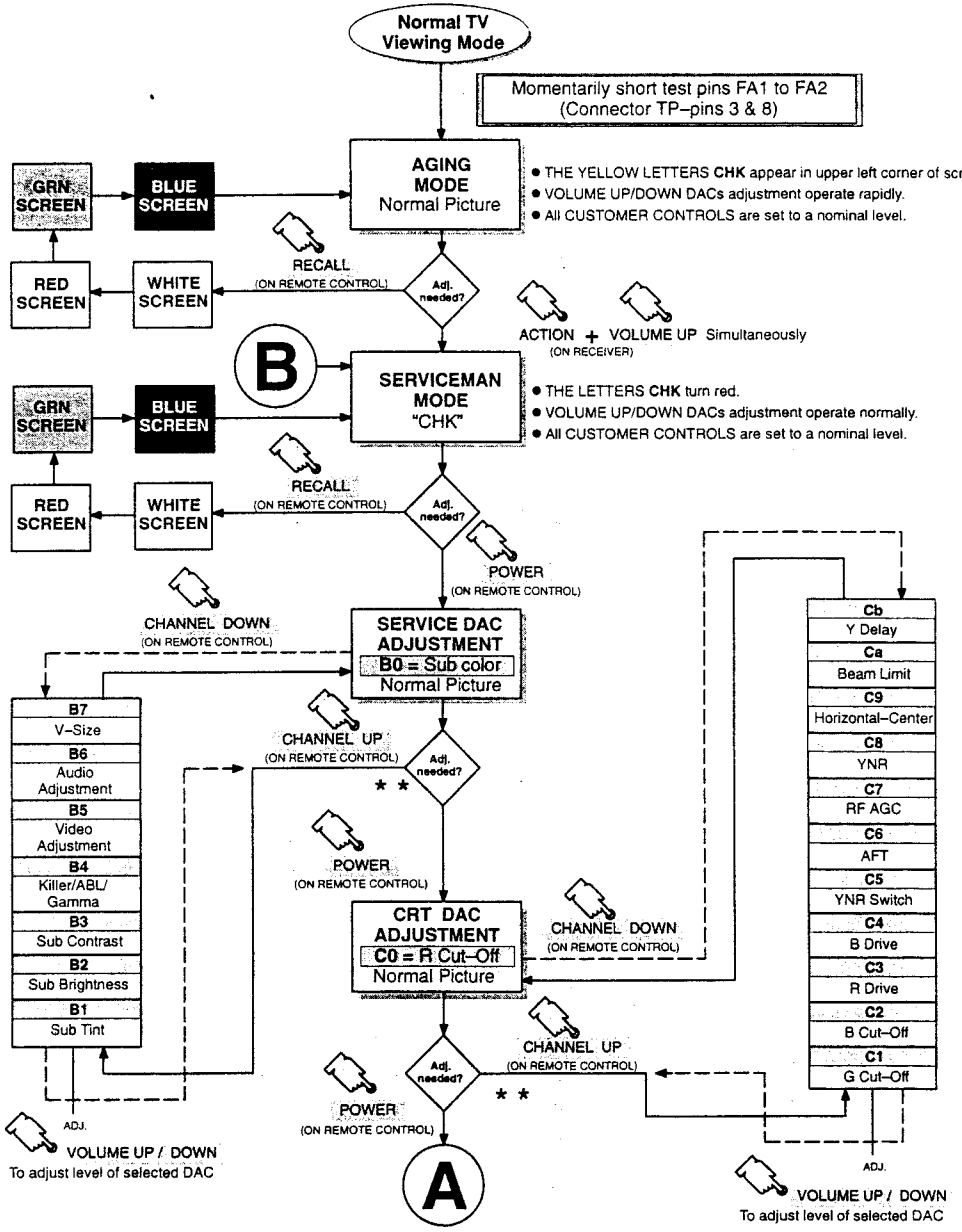


Figure 15. **Flow Chart for Serviceman Mode**

Instructional Flow Chart for Serviceman Mode – Continued

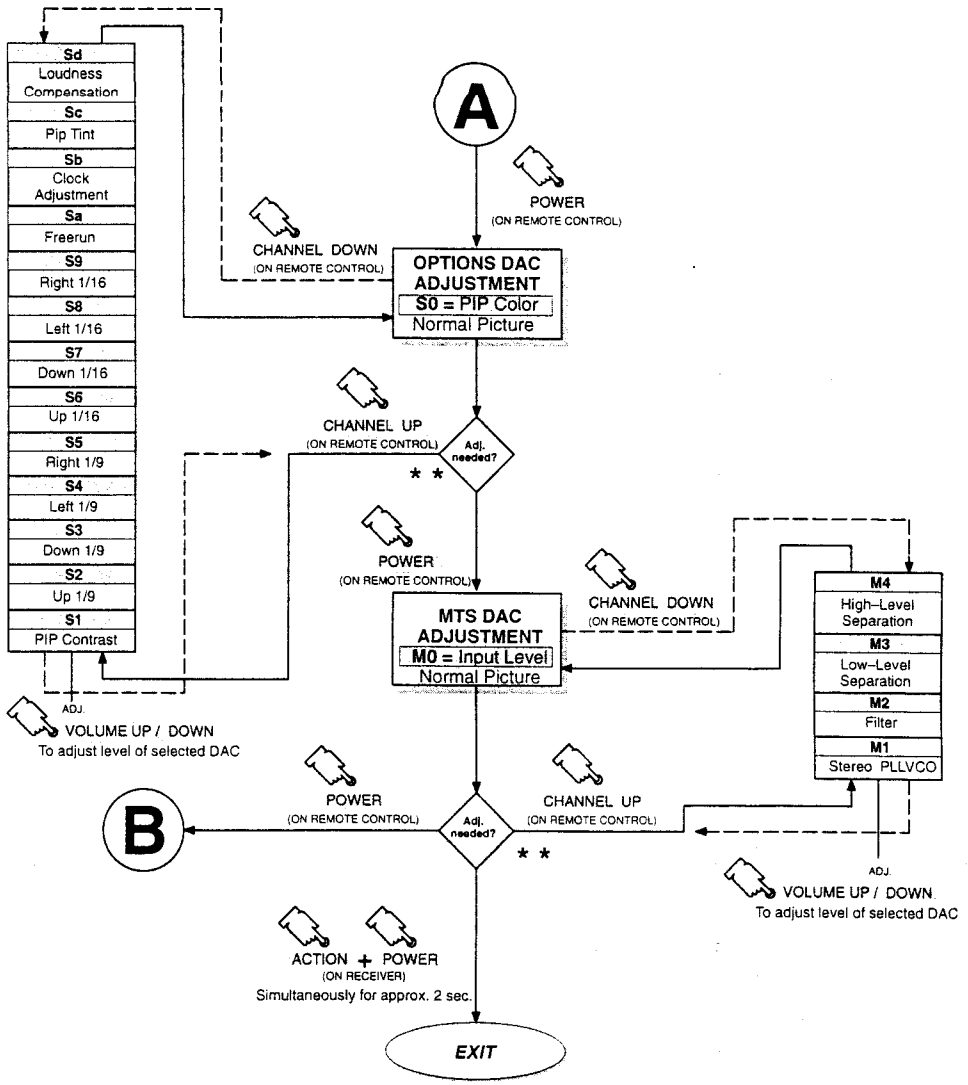


Figure 16. **Flow Chart for Serviceman Mode (Continued)**

Note: When *EXITING*, the Receiver shuts off; then turns on, TUNED TO CHANNEL 3 WITH A PRESET SOUND LEVEL.

Any Programmed Channels, Channels Caption data and some other user defined settings will be erased.

**** * Important Note***

Before making any DAC adjustments note the existing values!

Serviceman Mode (Electronic Controls)

This Receiver has electronic technology using the I²C Bus Concept. It performs as a control function and it replaces many mechanical controls. Instead of adjusting mechanical controls individually, many of the control functions are now performed by using the "On Screen Display Menu". (The **Serviceman Adjustment Mode**.)

Note: *It is suggested that the technician reads all the way through and understand the following procedure for Entering/Exiting the **Serviceman Adjustment Mode**; then proceed with the instructions working with the Receiver. When becoming familiar with the procedure, the Flow Chart for Serviceman Mode may be used as a quick guide.*

Quick Entry To Serviceman Mode:

At times when minor adjustments need to be done to the electronic controls, the method of Entering the Serviceman Mode without removal of the cabinet back is as follows using the Remote Control:

1. Select SET–UP icon and select CABLE mode.
2. Select TIMER Icon and set SLEEP timer for 30.
3. Press ACTION button twice to exit Menus.
   Tune to Channel 124.
   Adjust VOLUME to Minimum (0).
   On Receiver press the VOL ◄ button (decrease). Red "CHK" appears in upper corner.

To toggle between Aging and Serviceman modes:

While the "CHK" is displayed on the left top corner of the CRT, pressing the **Action** and the **Volume Down** buttons on the Receiver simultaneously will toggle between the modes.

4. **Press** the **Power** button on the Remote Control to select one of five Serviceman Adjustment Modes.
   1) B = Serviceman VCJ SUB ADJUSTMENTS
   2) C = Serviceman VCJ CUT–OFF ADJUSTMENTS
   3) S = Serviceman OPTIONS (PIP and CLOCK) ADJUSTMENTS
   4) M = Serviceman MTS ADJUSTMENTS
   5) "CHK" = Normal operation of CHANNEL ▲▼ and VOLUME ◄►

Note: *Only the applicable settings for the Receiver serviced will be available (see a in Figure 17).*

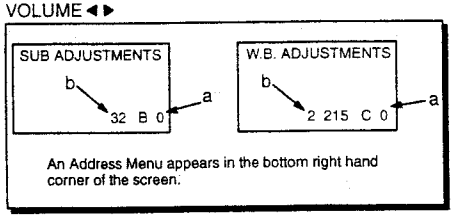


Figure 17. **Serviceman Mode Menu Adjustments**

For DAC Adjustments:

1. **Press**
   Channel Up/Down on the Remote Control to select one of the 8 available Service Adjustments (a in Figure 17).

   Important Note: *Write down the original value set (b in Figure 17) for each address before modifying anything. It is easy to erroneously adjust the wrong item.*

2. **Press**
   Volume Up/Down on the Remote Control to adjust the level of the selected Service Adjustment (b in Figure 17).

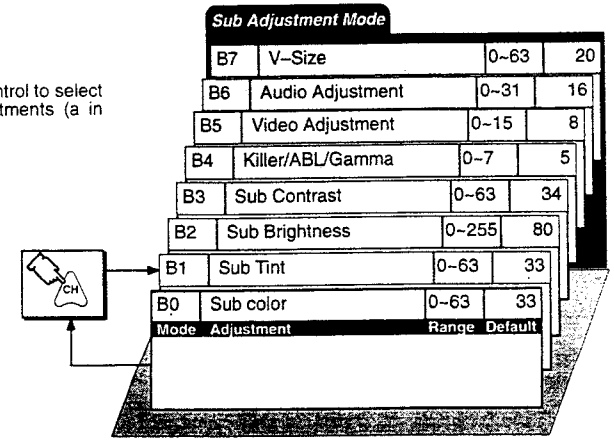


Figure 18. **Sub Adjustment Mode**

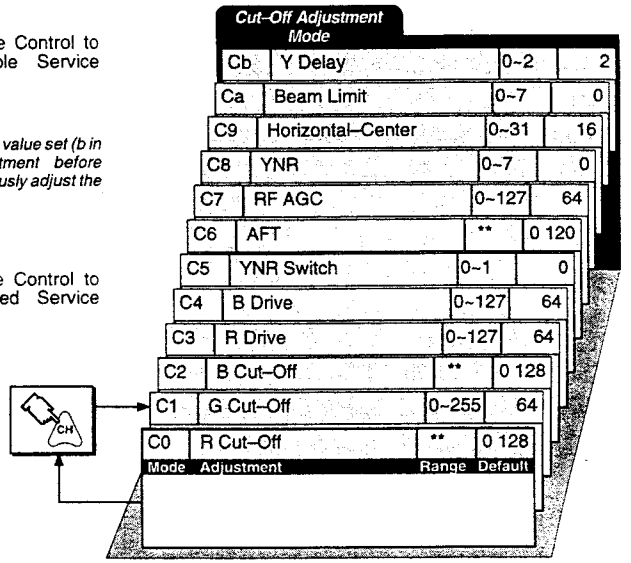
Press the **Power** button on the Remote Control to select the Serviceman White Balance Adjustment Mode.

For VCJ Cut–Off Adjustments:

1. **Press**
   Channel Up/Down on the Remote Control to select one of the 12 available Service Adjustments (a in Figure 17).

   Important Note: *Write down the original value set (b in Figure 17) for each address adjustment before modifying anything. It is easy to erroneously adjust the wrong item.*

2. **Press**
   Volume Up/Down on the Remote Control to adjust the level of the selected Service Adjustment (b in Figure 17).



** ***Note:*** *Range is in steps:*
0 0 ~ 0 255
1 0 ~ 1 255

Figure 19. **White Balance Adjustment Mode**

Press the **Power** button on the Remote Control to select the Serviceman MTS Adjustment Mode.

For Options (PIP and CLOCK) Adjustments:

1. **Press**
   Channel Up/Down on the Remote Control to select one of the 12 available Options Adjustments (a in Figure 17).

   Important Note: *Write down the original value set (b in Figure 17) for each address before modifying anything. It is easy to erroneously adjust the wrong item.*

2. **Press**
   Volume Up/Down on the Remote Control to adjust the level of the selected Service Adjustment (b in Figure 17).

** *Set Freerun on during this item selected.*

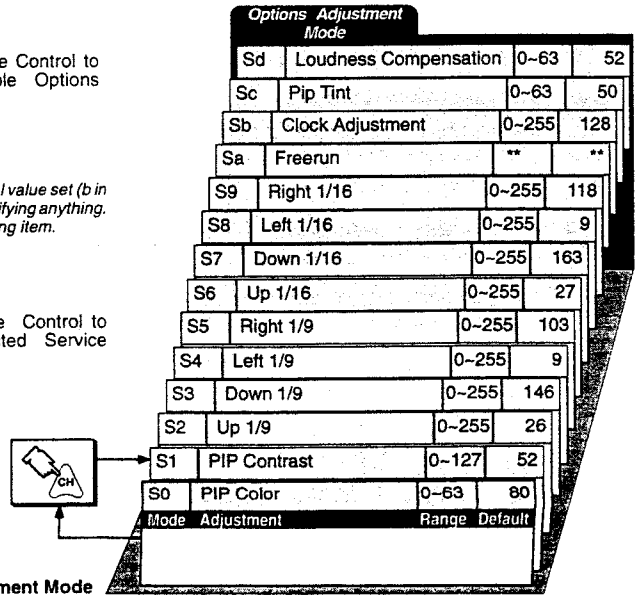


Figure 20. **Options Adjustment Mode**

SERVICE

Press the **Power** button on the Remote Control to select the Serviceman MTS Adjustment Mode.

For MTS Adjustments:

1. **Press**
   Channel Up/Down on the Remote Control to select one of the 5 available MTS Adjustments (a in Figure 17).

   Important Note: Write down the original value set (b in Figure 17) for each address before modifying anything. It is easy to erroneously adjust the wrong item.

2. **Press**
   Volume Up/Down on the Remote Control to adjust the level of the selected Service Adjustment (b in Figure 17).

3. Press the **POWER** button on the remote control to loop back to setting of the SUB ADJ Mode.

   OR

   Press **ACTION** and **POWER** buttons on the Receiver simultaneously for at least 2 seconds to return the Receiver to normal mode (exit Serviceman Mode).

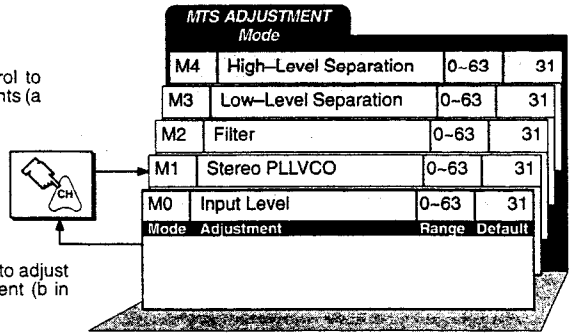


Figure 21. **MTS Adjustment Mode**

To Check Purity:

Press the **Recall** button on the Remote Control when in Serviceman Modes (red "CHK" is displayed) to enter the Purity Field Check Mode.

Note: The Receiver must be in the Serviceman Mode to display color.

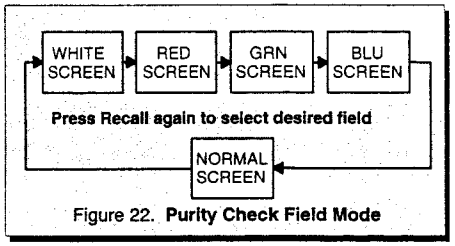


Figure 22. **Purity Check Field Mode**

IMPORTANT NOTE:
Always Exit the Serviceman Mode following Adjustments.

Exiting the Serviceman Mode:

Press the **Action** and the **Power** buttons on the Receiver simultaneously for at least 2 seconds.
"The Receiver exits Serviceman Mode".
The Receiver momentarily shuts off; then comes back on tuned to channel 3 with a preset level of sound.

Helpful Hints

Entering Serviceman Mode (Other Method – back open):

1. While the Receiver is ON and operating in Normal Mode, momentarily short test point FA1 to cold ground (⏚) FA2 (A–Board: TP pin 8 to pin 3).
   "The Receiver enters the Aging Mode".
   Yellow letters "CHK" appear in the upper left corner of the CRT.
   (The Volume Up/Down will adjust rapidly.)
2. Simultaneously **press** the **Action** and the **Volume Up** buttons on the Receiver Control Panel.
   "The Receiver enters the Serviceman's Mode".
   The letters in "CHK" turn red.
   (The Volume Up/Down will adjust normally.)
   (All customer controls are set to a nominal level.)

SERVICE

Service Adjustments (Electronic Controls)

Video Adjustment Level

Serviceman DAC Adjustment (B5)

Preparation:
1. Obtain an NTSC color bar pattern with 100 IRE white and 87.5% modulation.
2. Connect the oscilloscope to TP12. Use cold ground for scope connection. Set the scope at Horizontal Sweep rate (20µs) time base.

Procedure:
1. In the Serviceman Mode for making electronic adjustments, select DAC Video Adjustment Level (B5) and adjust for 1.0V ±0.05V from sync tip to white level. See Figure 23.

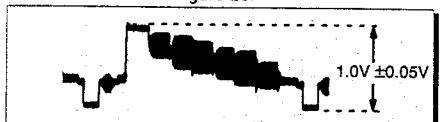


Figure 23. **TP12 waveform**

2. Set the DAC Sub–Contrast Adjustment (B3).

Sub–Contrast

Serviceman DAC Adjustment (B3)

This adjustment is factory set. **Do not adjust** unless repairs are made to associated circuits, the CRT Board, or when the CRT is replaced.

Preparation:
1. Apply a color bar signal pattern with 87.5% modulation, 70% saturated color bar with a 100 IRE white and 7.5 black.

NOTE: The pattern used in this procedure is an EIA color bar pattern with 87.5% modulation with 100 IRE white and 7.5 black. Correlate the information in this procedure to the pattern used if another signal is used.

2. Preset the following controls:
   - Brightness ..... Center
   - Color ..... Min
   - Picture ..... Max.
   - Sharpness ..... Center
3. Connect the oscilloscope to the CRT–Board connector C1–2. Set the scope time base to 20µs (horizontal).
4. Connect a jumper from TPD2 to ground (⏚)
5. Connect a jumper from IC101 pin 28 to ground (⏚).

Procedure:
1. In the Serviceman Mode for electronic adjustments, select DAC Sub–Brightness Adjustment (B2) and adjust for 1.0–1.5Vp–p between blanking and 7.5 IRE level so that the black level cannot be compressed. (see video waveforms detail, Figure 24).
2. In the Serviceman Mode for electronic adjustments, select DAC Sub–Contrast Adjustment (B3) and adjust for 2.8Vp–p ±0.1V from white level to black level on video waveform (see video waveforms detail, Figure 24).

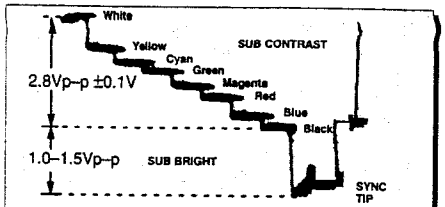


Figure 24. **TP35 waveform**

3. Remove the jumpers (Preparation steps 4 and 5).

Tint/Color Adjustment

Serviceman DAC Adjustment (B1) (B0)

Preparation:
1. Apply a rainbow color bar signal.
2. Preset the following controls:
   - Brightness ..... Min.
   - Color ..... Center
   - Picture ..... Max.
   - Sharpness ..... Min
   - Tint ..... Center
3. Connect the oscilloscope to TP47B (A–Board) or to connector C1 pin 3.
4. Connect a jumper from TPD2 to GND (⏚).
5. Connect a jumper from IC101 pin 28 to ground (⏚).

Procedure:
1. In the Serviceman Mode for making electronic adjustments, select DAC Sub–Tint Adjustment (B1). Adjust until the waveform measured is as the one shown in Figure 25.

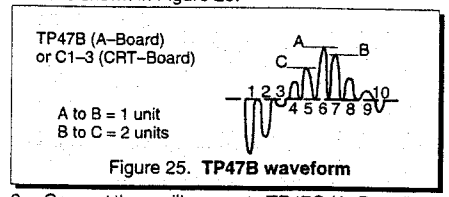


Figure 25. **TP47B waveform**

2. Connect the oscilloscope to TP47G (A–Board) or to connector C1 pin 2 (CRT–Board).
3. Select DAC Sub–Color Adjustment (B0) and adjust for peak to peak amplitude to be 0.8V p–p ±0.05V (20" models) or 0.9V p–p ±0.05V (27" models) (Figure 26).

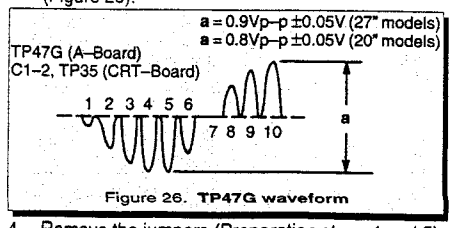


Figure 26. **TP47G waveform**

4. Remove the jumpers (Preparation steps 4 and 5).

SERVICE

Service Adjustments (Electronic Controls,cont.)

Color Temperature Adjustment (B/W Tracking)

Serviceman DAC Adjust. (C0) (C1) (C2) (C3) (C4)

Minor Touch–Up Method

OBSERVE low and high brightness areas of a B/W picture for proper tracking. Adjust only as required for "good grey scale and warm highlights".

1. LOW LIGHT areas – In Serviceman Mode for making electronic adjustments, select Cutoff (C0) RED, (C1) GRN, (C2) BLU and adjust the picture for grey.
2. HIGH LIGHT areas – In Serviceman Mode for making electronic adjustments, select Drive (C3) RED, (C4) BLU and adjust the picture for warm whites.

Complete Adjustment

Preparation:

1. Turn the Receiver "ON" and allow 10 minutes warm up at high brightness.
2. Apply a color bar signal with color "OFF".
3. Turn the SCREEN control (part of FBT T551) fully counterclockwise.

Procedure:

Preset the following Serviceman DAC's for the best results.

- C0 ..... 0 128
- C1 64
- C2 ..... 0 128
- C3 64
- C4 64

1. Connect the oscilloscope to C1–2 (CRT–Board).
2. In Serviceman Mode for making electronic adjustment, select the Sub–Bright DAC (B2).
3. Press the R–Tune key on the remote.
4. Observe the oscilloscope waveform at Horizontal rate and adjust the Serviceman Mode Sub–Bright DAC (B2) level until a scanning period of 3.0V above DC ground is measured, as indicated in Figure 27.

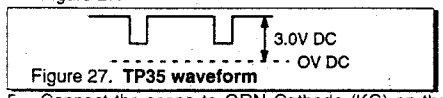


Figure 27. **TP35 waveform**

5. Connect the scope to GRN Cathode (KG) on the CRT–Board.
6. In the Serviceman Mode for making electronic adjustments, select the GREEN CUTOFF DAC (C1).
7. Press the R–Tune key on the remote.
8. View scope trace at Horizontal rate and adjust the Serviceman Mode DAC (C1) level until a scanning period of 195V (27" models) or 175V (20" models) above DC ground is measured, as indicated in Figure 28.

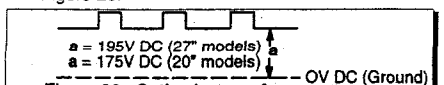


Figure 28. **Cathode waveform, Adjustment Waveform Detail (Steps 8, 12 & 16)**

9. Connect the scope to the RED Cathode (KR).
10. In Serviceman Mode for making electronic adjustments, select the RED CUTOFF DAC (C0).
11. Press the R–Tune key on the remote.
12. View the scope trace and adjust the Serviceman Mode DAC (C0) for the scanning period to be 195V (27" models) or 175V (20" models) above DC ground. (See Figure 28)
13. Connect the scope to the BLU Cathode (KB).
14. In Serviceman Mode for making electronic adjustments, select the BLU CUTOFF (C2).
15. Press the R–Tune key on the remote.
16. View the scope trace and adjust the Serviceman Mode DAC (C2) for the scanning period to be 195V (27" models) or 175V (20" models) above DC ground. (See Figure 28)
17. Turn the Screen Control (part of FBT) slowly clockwise until a color horizontal line appears.
18. With the other two colors Serviceman Mode DAC CUTOFF adjustments (C0) RED, (C1) GRN, (C2) BLU; increase the colors to create a white horizontal line.
19. Confirm that a good gray scale is established by viewing B/W color bar pattern.
20. In the Serviceman Mode for making electronic adjustments select the DAC DRIVE adjustments (C3) RED, (C4) BLU and adjust for warm white in a white color bar pattern.
25. EXIT the Serviceman Mode.
26. Adjust the Picture Menu Video Adjustments **Bright** and **Picture** from low scale to high scale and check Black and White tracking.
27. If correction is needed: Re–Enter the Serviceman Mode and perform the **Minor Touch – Up Method.**
28. Perform **Sub–Brightness** Adjustment procedure.

Sub–Brightness

Serviceman DAC Adjustment (B2)

Adjustment of this control is important for setting proper operation of customer brightness and picture controls. This adjustment must be made after Sub–Contrast or Color Temperature adjustments are made. **Do not adjust** SCREEN after the Sub–Brightness is set.

Preparation:

1. Apply a color bar signal with 100 IRE white and 7.5 IRE black. (Switch Color to "OFF" on the signal generator.) Operate the Receiver for a minimum of 10 minutes prior to performing this adjustment.
2. Preset the following controls:
   - Color ..... Center
   - Picture ..... Max.
   - Tint ..... Center

Procedure:

In the Serviceman Mode for making electronic adjustments, select the DAC adjustment (B2) and adjust until the black bar starts to look grey. Then decrease the level to the point where grey turns to black.

Service Adjustments (Electronic Controls,cont.)

Horizontal Centering

Serviceman DAC Adjustment (C9)

Preparation:

Connect a crosshatch generator.

Procedure:

1. In the Serviceman Mode for making electronic adjustments. Select the Horizontal Centering Adjustment DAC (C9) and adjust until the center of the crosshatch pattern is centered on CRT.
2. EXIT the Serviceman Adjustment Mode.

Audio Adjustment

Serviceman DAC Adjustment (B6)

This adjustment is factory set and needs to be performed only when IC002 or IC101 is replaced.

Preparation:

1. Apply the following signal at the antenna (70dB ±5dB, 75Ω open P/S 10dB): audio signal set to monaural, 300Hz. 100% modulation; video input of 100 IRE flat field, 30% modulation.
2. Connect the RMS Meter with filter jig as shown in Figure 29.

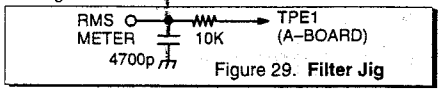


Figure 29. **Filter Jig**

Procedure:

1. In the Serviceman Mode for making electronic adjustments, select the Audio Adjustment DAC (B6) and adjust until the RMS meter reading are:
   150mV RMS ±7.5mV RMS (Stereo models)
   250mV RMS ±12.5mV RMS (Mono models)
2. EXIT the Serviceman Adjustment Mode.

Clock Adjustment (Sb)

Preparation:

Connect the frequency counter from TPS1 (IC001 Pin 13) to cold ground (⏚).

NOTE: Frequency Counter probe capacitance should be 8pF or less.

Procedure:

1. Turn the Receiver "OFF" with the AC power applied.
2. Measure TPS1 (IC001 pin 13) for the frequency of the waveform and record the reading.

   Note: Pin 13 measurement must have at least four digits of resolution following the decimal point Example: 000.0000
3. Turn the Receiver "ON".
4. Place the Receiver into Serviceman Mode for making electronic adjustment, select the Clock Adjustment DAC (Sb).
5. Calculate and set Sb based on the following formula:

$$Sb = 128 + 0.901 \times 10^6 \times \frac{244.1406 - \text{pin 13 [Hz]}}{244.1406}$$

NOTE: Pin 13 measurement will not change regardless of the value stored in Sb.

Vertical Size (B7)

1. Adjust the VERTICAL SIZE DAC control, B7, until the top and the bottom edges of the raster are visible.
2. Adjust the VERTICAL SIZE control B7, until the top and the bottom of the raster touch the bezel edge. Then advance SIZE control to obtain an approximately 10% overscan. Linearity adjustment is done automatically when the size is being adjusted. (Best results can be obtained with a round test pattern.)

Service Adjustments (Mechanical Controls)

VCO Field Alignment L105

1. Connect a balance antenna and select a midband channel (Ch 10, 11 or 12)
2. Attenuate the signal strength for a weak noisy video.
3. While observing the picture tube, adjust L105 until best picture appears.
4. Change channels and observe that they are tuning properly.
5. If the channel monitored is not clear, repeat steps 1, 3 and 4 while applying a stronger signal.

Focus (Part of T551)

Preparation:

Connect a Signal generator and select a dot pattern.

Procedure:

Adjust the FOCUS control to obtain the sharpest and clearest dot pattern.

a. adjust for best center.
b. adjust for best area between the center and top right corner.

IC001 MPU IN/OUT Pins and Functions
MN1873265T7G

Remcon Signal	1	RMIN - P06	VSS	64	GND (system clock GND)
AFC <1st tuner>	2	ADIN0	OSC2	63	12MHz Xtal (or Ceramic OSC)
VERSION input 1	3	ADIN1	OSC1	62	12MHz Xtal (or Ceramic OSC)
LOCK DETECT input <main>	4	P50	VDD	61	+5V
KEY-SCAN input 1	5	ADIN3	P00	60	SCL
Action/HSS	6	ADIN4	P01	59	SDA
Beam FB	7	ADIN5	P02	58	Version MSB
S-VHS input	8	P54	P03	57	Version ABL
not used (open)	9	P55	P04/IRQ0	56	not used (open)
FA1	10	ADIN8/P56	VSYNC/IRQ1	55	V. SYNC (negative polatiry)
MTS	11	ADIN9/P57	P07/RST	54	RESET
GND	12	CM	P60	53	MAIN AV select 1
Test OSC open	13	SYNC	P61	52	MAIN AV select 2
BASS	14	PWM1	P62	51	Timer LED on (L) / off (H)
TREBLE	15	PWM2	P63	50	Sound Defeat on (H) / off (L)
BALANCE	16	PWM3	P64	49	PIP AV select 1
SURROUND on/off	17	PWM4	P65	48	PIP AV Select 2
V-Size	18	PWM5	P66	47	SPEAKER on (L) / off (H)
not used (open)	19	PWM6	PWM/VOI	46	not used (open)
not used (open)	20	PWM7	SPWM	45	VOLUME
not used (open)	21	PWM8	VOW1	44	OSD Red
(Analog DAC VDD) +5V	22	AVDD	VOW2	43	OSD Green
(for CC)	23	CREF	VOW3	42	OSD Blue
(for CC)	24	VPH	VOB	41	OSD Blank
(for CC)	25	VCP	P16	40	Hold down detect
(Video signal for CC)	26	CVBS	HSYNC	39	H. SYNC (negative polarity)
GND	27	AVSS	VSS	38	GND
not used (open)	28	P47	P20	37	AI Sound on/off
not used (open)	29	P46	P21	36	IF defeat
not used (open) (clone port)	30	P45	P40	35	RECHARGE
Relay on (H) / off (L)	31	P44	P41	34	Momentary power down
not used (open) (clone switch)	32	P43	P42	33	not used (open) (data in)

IC101 Block Diagram

INPUT PINS = ◁ ▷ OUTPUT PINS = ◀ ▶

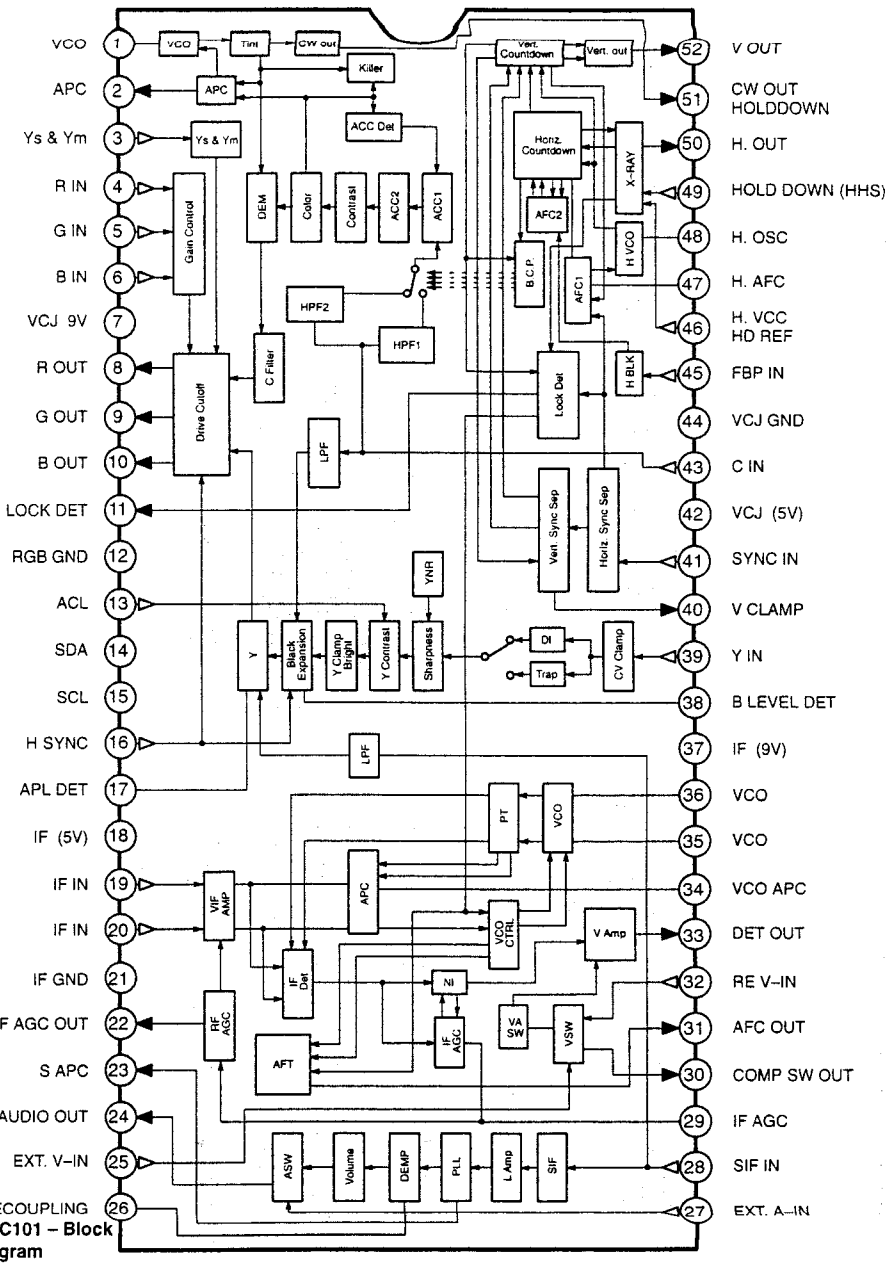


Figure 30. **IC101 – Block Diagram**

REPLACEMENT PARTS LIST

(Models: CT-20R14V, CT-20R14CV & TP2009DV)

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF. NO.	PART NO.	DESCRIPTION
		CAPRISTORS
CRA801	**EXNG471P365**	**RES-CAP 470PF/3.6 MEG**
CRA802	**EXNG471P365**	**RES-CAP 470PF/3.6 MEG**
		CAPACITORS
C001	ECA1AM101	CAP,E 100UF/10V
C003	ECA1HM4R7	CAP,E 4.7UF/50V
C004	ECUX1H330JCX	CAP,C 33PF-J-50V
C005	ECUX1H330JCX	CAP,C 33PF-J-50V
C008	TCUX1H103ZFN	CAP,C .01UF-Z-50V
C010	TCUX1H103ZFN	CAP,C .01UF-Z-50V
C011	ECA1CM221	CAP,E 220UF/16V
C013	ECA0JM101	CAP,E 100UF/6.3V
C016	ECUX1H101JCX	CAP,C 100PF-J-50V
C017	ECUX1H220JCX	CAP,C 22PF-J-50V
C018	ECUX1H220JCX	CAP,C 22PF-J-50V
C019	ECA0JM101	CAP,E 100UF/6.3V
C020	ECA0JM101	CAP,E 100UF/6.3V
C022	ECA1CM471	CAP,E 470UF/16V
C024	ECA1EM4R7	CAP,E 4.7UF/25V
C025	ECUX1H101JCX	CAP,C 100PF-J-50V
C026	ECA1HM010	CAP,E 1.0UF/50V
C031	ECUX1H821KBX	CAP,C 820PF-K-50V
C032	ECA1AM470	CAP,E 47UF/10V
C033	ECUX1H101JCX	CAP,C 100PF-J-50V
C036	ECUX1H220JCX	CAP,C 22PF-J-50V
C037	ECUX1H220JCX	CAP,C 22PF-J-50V
C038	ECUX1H220JCX	CAP,C 22PF-J-50V
C101	ECUX1H223ZFX	CAP,C .022UF-Z-50V
C102	ECA1EM100	CAP,E 10UF/25V
C103	ECUX1H300JCX	CAP,C 30PF-J-50V
C105	ECUX1H221JCX	CAP,C 220PF-J-50V
C106	ECA1HMR47	CAP,E .47UF/50V
C107	ECUX1H470JCX	CAP,C 47PF-J-50V
C108	ECA1HMR22	CAP,E .22UF/50V
C109	ECEA1HN4R7U	CAP,E 4.7UF/50V
C110	TCUX1H103ZFN	CAP,C .01UF-Z-50V
C111	ECA1EM100	CAP,E 10UF/25V
C113	ECA1EM100	CAP,E 10UF/25V
C117	ECUX1H070DCX	CAP,C 7PF-D-50V
C151	ECA1HMR22	CAP,E .22UF/50V
C201	TCUX1H103ZFN	CAP,C .01UF-Z-50V
C202	ECUX1H562JCX	CAP,C .0056UF-J-50V
C203	ECA1EM4R7	CAP,E 4.7UF/25V
C301	ECUX1H390JCX	CAP,C 39PF-J-50V
C302	ECEA1HN010U	CAP,E 1UF/50V
C304	ECEA1HNR47U	CAP,E .47UF-50V
C305	ECA1EM4R7	CAP,E 4.7UF/25V
C306	ECA1CM221	CAP,E 220UF/16V
C308	ECQB1H823KF	CAP,P .082UF-K-50V
C309	ECA1AM101	CAP,E 100UF/10V
C310	ECA1EM4R7	CAP,E 4.7UF/25V
C311	ECA1EM4R7	CAP,E 4.7UF/25V
C312	ECA1EM220	CAP,E 22UF/25V
C314	ECUX1H104ZFX	CAP,C .1UF-Z-50V
C351	TACCW391T50V	CAP,C 390PF/50V
C352	TACCW391T50V	CAP,C 390PF/50V
C353	TACCW471T50V	CAP,C 470PF/50V
C354	ECKD3D102KB	CAP,C .001UF-K-2KV
C357	ECEA1HN010U	CAP,E 1UF/50V
C401	ECQB1H153KF	CAP,P .015UF-K-50V
C402	ECUX1H471KBX	CAP,C 470PF-K-50V
C403	ECA1HM2R2	CAP,E 2.2UF/50V
C451	ECA1AM470	CAP,E 47UF/10V
C452	ECSF1EE105	CAP,T 1.0UF/25V
C453	ECEA1HFS2R2	CAP,E 2.2UF/50V
C454	ECA1EM102	CAP,E 1000UF/25V
C455	ECEA1EGE101	CAP,E 100UF/25V
C456	ECQB1H103JF	CAP,P .01UF-J-50V
C459	ECA1VM471	CAP,E 470UF/35V
C462	ECA1EM100	CAP,E 10UF/25V
C502	ECQB1H223JF	CAP,P .022UF-J-50V
C503	ECA1HM2R2	CAP,E 2.2UF/50V
C504	ECUX1H101JCX	CAP,C 100PF-J-50V
C505	ECUX1H221JUX	CAP,C 220PF-J-50V
C506	ECA1CM221	CAP,E 220UF/16V
C507	ECUX1H221JCX	CAP,C 220PF-J-50V
C508	ECUX1H121JCX	CAP,C 120PF-J-50V
C510	ECCD2H100D	CAP,C 10PF-D-500V
C511	ECKD2H821KB	CAP,C 820PF-K-500V
C512	ECKD2H101KB	CAP,C 100PF-K-500V
C531	**ECA1EM220**	**CAP,E 22UF/25V**
C532	ECA1AM102	CAP,E 1000UF/10V
C534	TCUX1H103ZFN	CAP,C .01UF-Z-50V
C551	**ECA1VM331**	**CAP,E 330UF/35V**
C552	**ECA1EM221**	**CAP,E 220UF/25V**
C553	ECKD2H561KB	CAP,C 560PF-K-500V
C554	ECKD2H561KB	CAP,C 560PF-K-500V
C555	**ECEA2EU220**	**CAP,E 22UF/250V**
C556	**ECA1CM471**	**CAP,E 470UF/16V**
C557	ECKD2H222KB	CAP,C .0022UF-K-500V
C559	ECA1HM220	CAP,E 22UF/50V
C560	**ECEA1HN2R2U**	**CAP,E 2.2UF/50V**
C561	ECKD2H561KB	CAP,C 560PF-K-500V
C563	**ECKD3D821JB**	**CAP,C 820PF-J-2KV**
		CT-20R14V CT-20R14CV
C564	**ECWH12H331JS**	**CAP,P 330PF-J-1.2KV**
		CT-20R14V CT-20R14CV
C564	**ECWH12H822JS**	**CAP,P .0082UF-J-1.2KV**
		TP2009DV
C565	**ECKD3D102JB**	**CAP,C .001UF-J-2KV**
		CT-20R14V CT-20R14CV
C565	**ECKD3D471JB**	**CAP,C 470PF-J-2KV**
		TP2009DV
C566	**ECKD3D181JB**	**CAP,C 180PF-J-2KV**
C569	**ECWF2394JBB**	**CAP,P .39UF-J-200V**
C571	ECA1EM220	CAP,E 22UF/25V
C572	ECA1EM100	CAP,E 10UF/25V
C573	ECA1CM101	CAP,E 100UF/16V
C574	ECA1EM100	CAP,E 10UF/25V
C601	ECUX1H181JCX	CAP,C 180PF-J-50V
C602	ECUX1H680JCX	CAP,C 68PF-J-50V
C604	ECUX1H150JUX	CAP,C 15PF-J-50V

REPLACEMENT PARTS LIST

(Models: CT-20R14V, CT-20R14CV & TP2009DV)

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF. NO.	PART NO.	DESCRIPTION
C605	ECUX1H332KBX	CAP,C .0033UF-K-50V
C606	ECA1HM010	CAP,E 1.0UF/50V
C801	**ECKD2H472PU**	**CAP,C .0047UF-P-500V**
C802	**ECKD2H472PU**	**CAP,C .0047UF-P-500V**
C805	**EC0S2DG151DG**	**CAP,E 151UF/200V**
C806	**EC0S2DG151DG**	**CAP,E 151UF/200V**
C807	ECA1HM3R3	CAP,E 3.3UF/50V
C808	ECA1CM101	CAP,E 100UF/16V
C809	**EC0S2DG151DG**	**CAP,E 151UF/200V**
C810	**ECQU2A153MN**	**CAP,P .015UF-M-250VAC**
C811	**ECQU2A153MN**	**CAP,P .015UF-M-250VAC**
C812	**ECQU2A224MN**	**CAP,P .22UF-M-250VAC**
C814	ECQB1H333JF	CAP,P .033UF-J-50V
C815	ECEA1HGE470	CAP,E 47UF/50V
C818	ECKD3A821KB	CAP,C 820PF-K-1KVDC
C820	ECEA1JGE100	CAP,E 10UF/63V
C823	**ECEA160V33Z**	**CAP,E 33UF/160V**
C824	ECKD3A331KB	CAP,C 330PF-K-1KVDC
C825	ECKD3A471KB	CAP,C 470PF-K-1KV
C2301	ECA1EM471	CAP,E 470UF/25V
C2302	ECA1EM220	CAP,E 22UF/25V
C2303	ECA1EM100	CAP,E 10UF/25V
C2304	ECQB1H683JF	CAP,P .068UF-J-50V
C2305	ECUX1H681KBX	CAP,C 680PF-K-50V
C2306	ECA1CM221	CAP,E 220UF/16V
C2307	ECEA1HN010U	CAP,E 1UF/50V
C2309	ECA1HM010	CAP,E 1.0UF/50V
C2310	ECUX1H332KBX	CAP,C .0033UF-K-50V
C2311	ECA1HM3R3	CAP,E 3.3UF/50V
C2358	ECUX1H332KBX	CAP,C .0033UF-K-50V
C3001	ECA1HM100	CAP,E 10UF/50V
		CT-20R14V CT-20R14CV
C3003	ECA1HM010	CAP,E 1.0UF/50V
		CT-20R14V CT-20R14CV
C3005	ECUX1H272KBX	CAP,C .0027UF-K-50V
C3006	ECUX1H272KBX	CAP,C .0027UF-K-50V
		DIODES
D001	ERA15-01	DIODE
D002	MA165	DIODE
D003	MA4047M	DIODE, ZENER
D006	MA4330H	DIODE
D008	MA165	DIODE
D009	MA165	DIODE
D011	MA165	DIODE
D016	MA165	DIODE
D017	MA165	DIODE
D451	ERA15-01	DIODE
D452	MA4047M	DIODE, ZENER
D501	MA4082L	DIODE
D531	**AS01**	**DIODE**
D532	**MA4062L**	**DIODE**
D551	**TVSRU2N**	**DIODE**
D553	**BYD33G-143**	**DIODE**
D554	**BYD33G-143**	**DIODE**
D555	MA165	DIODE
D556	MA4360H	DIODE, ZENER
D560	MA165	DIODE
D561	**BYD33G-143**	**DIODE**
D801	**EM02BM**	**DIODE**
D802	**EM02BM**	**DIODE**
D806	MA4047H	DIODE
D807	MA165	DIODE
D810	**TAP104XM05**	**PTC**
D820	EU02V1	DIODE
D821	EU02V1	DIODE
D822	EU02V1	DIODE
D823	RL30A	DIODE
D824	EU02V1	DIODE
D825	**TVSSR2KL**	**DIODE, PROTECTION**
D826	EU02V1	DIODE
D829	MA165	DIODE
D2312	MA4030M	DIODE, ZENER
D3001	MA165	DIODE
		CT-20R14V CT-20R14CV
D3002	MA4110M	DIODE, ZENER
		CT-20R14V CT-20R14CV
D3004	MA4110M	DIODE, ZENER
		CT-20R14V CT-20R14CV
D3006	MA4110M	DIODE, ZENER
		CT-20R14V CT-20R14CV
D3007	MA4110M	DIODE, ZENER
		CT-20R14V CT-20R14CV
D3008	MA4110M	DIODE, ZENER
		CT-20R14V CT-20R14CV
D3009	MA4110M	DIODE, ZENER
		CT-20R14V CT-20R14CV
		FUSES
F801	**0BA1C63NU100**	**FUSE, 6.3A/125V**
		INTEGRATED CIRCUITS
IC001	**MN1873265T7G**	**MPU**
IC002	24LC02BIP	INT CKT
IC101	AN5165K	INT CKT
IC451	**LA7837-TV**	**INT CKT**
IC551	**AN78M09**	**PLUS 9V AVR**
IC552	AN78M05	PLUS 5V AVR
IC553	AN78L12	INT CKT
IC801	**0N3131R**	**INT CKT**
IC803	**STR58041A**	**INT CKT**
IC2301	AN5265	INT CKT
		COILS
DEG	**0LK19042A**	**COIL, DEGAUSSING 20"**
DY	**KDY3NE708F**	**YOKE, DEFLECTION**
		TP2009DV
DY	**TLY2AA001**	**YOKE, DEFLECTION**
		CT-20R14V CT-20R14CV
L001	TSKA074	FERRITE BEAD
L002	TLTACT390K	COIL, PEAKING 39UH
L003	TLUABTA2R2K	COIL, PEAKING 2.2UH
L004	TLUABTA2R2K	COIL, PEAKING 2.2UH
L006	TSKA072	FERRITE BEAD
L008	TLUABTA470K	COIL, PEAKING 47UH
L009	TSKA074	FERRITE BEAD

REPLACEMENT PARTS LIST

(Models: CT-20R14V, CT-20R14CV & TP2009DV)

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF. NO.	PART NO.	DESCRIPTION
L103	TLUABTA120K	COIL, PEAKING 12UH
L104	TLUABTA1R0K	COIL, PEAKING 1.0UH
L105	EIV7EN053B	COIL, VCO
L106	TLTACT180J	COIL, PEAKING 18UH
L551	**TLH15652P**	**COIL, LINEARITY**
L602	TLTACT120J	COIL, PEAKING 12UH
L801	**ELF15N013A**	**LINE FILTER**
L802	ELEIE680KA	COIL, PEAKING 68UH
L804	TSKA076	FERRITE BEAD
L2301	TSKA064	FERRITE BEAD
		TRANSISTORS
Q001	MSD601-RT1	TRANSISTOR
Q002	JC501PQ	TRANSISTOR
Q003	MSB709-RT1	TRANSISTOR
Q004	MSB709-RT1	TRANSISTOR
Q302	MSD601-RT1	TRANSISTOR
Q304	MSD601-RT1	TRANSISTOR
Q351	2SC3063	TRANSISTOR
Q352	2SC3063	TRANSISTOR
Q353	2SC3063	TRANSISTOR
Q451	MSD601-RT1	TRANSISTOR
Q452	MSD601-RT1	TRANSISTOR
Q501	2SC1573AH	TRANSISTOR
Q551	**BU2506DF**	**TRANSISTOR**
Q801	2SC1685RS	TRANSISTOR
Q802	2SC1685RS	TRANSISTOR
Q804	2SA1767Q	TRANSISTOR
Q2301	MSD601-RT1	TRANSISTOR
Q2309	MSB709-RT1	TRANSISTOR
Q3001	MSD601-RT1	TRANSISTOR
		CT-20R14V CT-20R14CV
		RELAYS
RL801	**TSEH8007**	**RELAY**
		RESISTORS
R002	ERJ6GEYJ182	RES,M 1.8K-J-1/10
R003	ERJ6GEYJ562	RES,M 5.6K-J-1/10
R004	ERDS1TJ181	RES,C 180-J-1/2
R005	ERDS2TJ101	RES,C 100-J-1/4
R006	ERJ6GEYJ391	RES,M 390-J-1/10
R007	ERJ6GEYJ122	RES,M 1.2K-J-1/10
R008	ERJ6GEYJ103	RES,M 10K-J-1/10
R010	ERJ6GEYJ154	RES,M 150K-J-1/10
R011	ERJ6GEYJ684	RES,M 680K-J-1/10
R012	ERJ6GEYJ473	RES,M 47K-J-1/10
R016	ERJ6GEYJ472	RES,M 4.7K-J-1/10
R017	ERJ6GEYJ472	RES,M 4.7K-J-1/10
R020	ERJ6GEYJ474	RES,M 470K-J-1/10
R021	ERJ6GEYJ101	RES,M 100-J-1/10
R022	ERJ6GEYJ101	RES,M 100-J-1/10
R023	ERJ6GEYJ102	RES,M 1K-J-1/10
R025	ERJ6GEYJ103	RES,M 10K-J-1/10
R027	ERJ6GEYJ103	RES,M 10K-J-1/10
R028	ERJ6GEYJ103	RES,M 10K-J-1/10
		CT-20R14V CT-20R14CV
R028	ERJ6GEYJ752	RES,M 7.5K-J-1/10
		TP2009DV
R029	ERJ6GEYJ223	RES,M 22K-J-1/10
		CT-20R14V CT-20R14CV
R029	ERJ6GEYJ333	RES,M 33K-J-1/10
		TP2009DV
R030	ERJ6GEYJ102	RES,M 1K-J-1/10
R032	ER0S2CKF1002	RES,M 10K-F-1/4
R033	ERJ6GEYJ222	RES,M 2.2K-J-1/10
R034	ERJ6GEYJ222	RES,M 2.2K-J-1/10
R035	ERJ6GEYJ332	RES,M 3.3K-J-1/10
R036	ERJ6GEYJ562	RES,M 5.6K-J-1/10
R037	ERJ6GEYJ103	RES,M 10K-J-1/10
R038	ERJ6GEYJ223	RES,M 22K-J-1/10
R039	ERDS2TJ102	RES,C 1K-J-1/4
R045	ERJ6GEYJ102	RES,M 1K-J-1/10
R048	ERJ6GEYJ221	RES,M 220-J-1/10
R049	ERJ6GEYJ221	RES,M 220-J-1/10
R053	ERJ6GEYJ103	RES,M 10K-J-1/10
R055	ERJ6GEYJ103	RES,M 10K-J-1/10
R060	ERJ6GEYJ331	RES,M 330-J-1/10
R065	ERJ6GEYJ222	RES,M 2.2K-J-1/10
R066	ERJ6GEYJ222	RES,M 2.2K-J-1/10
R067	ERJ6GEYJ222	RES,M 2.2K-J-1/10
R068	ERJ6GEYJ222	RES,M 2.2K-J-1/10
R070	ERJ6GEYJ101	RES,M 100-J-1/10
R101	ERJ6GEYJ750	RES,M 75-J-1/10
R102	ERJ6GEYJ683	RES,M 68K-J-1/10
R103	ERJ6GEYJ183	RES,M 18K-J-1/10
R104	ERJ6GEYJ561	RES,M 560-J-1/10
R105	ERJ6GEYJ561	RES,M 560-J-1/10
R107	ERJ6GEYJ222	RES,M 2.2K-J-1/10
R108	ERJ6GEYJ471	RES,M 470-J-1/10
R152	ERDS2TJ183	RES,C 18K-J-1/4
R153	ERJ6GEYJ223	RES,M 22K-J-1/10
R154	ERJ6GEYJ393	RES,M 39K-J-1/10
R201	ERJ6GEYJ221	RES,M 220-J-1/10
R202	ERJ6GEYJ682	RES,M 6.8K-J-1/10
R303	ERJ6GEYJ682	RES,M 6.8K-J-1/10
R304	ERJ6GEYJ332	RES,M 3.3K-J-1/10
R305	ER0S2CKF3001	RES,M 3K-F-1/4
R306	ERJ6ENF1651	RES,M 1.65K-F-1/10
R307	ERJ6GEYJ564	RES,M 560K-J-1/10
R308	ERJ6GEYJ102	RES,M 1K-J-1/10
R309	ERJ6GEYJ333	RES,M 33K-J-1/10
R310	ERJ6GEYJ223	RES,M 22K-J-1/10
R311	ERJ6GEYJ185	RES,M 1.8MEG-J-1/10W
R317	ERJ6GEYJ684	RES,M 680K-J-1/10
R319	ERJ6GEYJ122	RES,M 1.2K-J-1/10
R320	ERJ6GEYJ102	RES,M 1K-J-1/10
R351	ERG2FJ123H	RES,M 12K-J-2W
R352	ERG2FJ123H	RES,M 12K-J-2W
R353	ERG2FJ123H	RES,M 12K-J-2W
R354	ERDS1TJ272	RES,C 2.7K-J-1/2
R355	ERDS1TJ272	RES,C 2.7K-J-1/2
R356	ERDS1TJ272	RES,C 2.7K-J-1/2
R357	ERDS2TJ301	RES,C 300-J-1/4
R358	ERDS2TJ301	RES,C 300-J-1/4

REPLACEMENT PARTS LIST

(Models: CT-20R14V, CT-20R14CV & TP2009DV)

Important Safety Notice: Components printed in BOLD TYPE have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF. NO.	PART NO.	DESCRIPTION
R359	ERDS2TJ301	RES,C 300-J-1/4
R360	ERDS2TJ102	RES,C 1K-J-1/4
R361	ERDS2TJ102	RES,C 1K-J-1/4
R362	ERDS2TJ102	RES,C 1K-J-1/4
R363	ERDS2TJ101	RES,C 100-J-1/4
R364	ERDS2TJ101	RES,C 100-J-1/4
R365	ERDS2TJ101	RES,C 100-J-1/4
R401	ERJ6GEYJ102	RES,M 1K-J-1/10
R451	ERDS1FJ1R2	RES,C 1.2-J-1/2
R454	ERJ6GEYJ473	RES,M 47K-J-1/10
R455	ERJ6GEYJ153	RES,M 15K-J-1/10
R456	ERJ6GEYJ562	RES,M 5.6K-J-1/10
R457	ERJ6GEYJ911	RES,M 910-J-1/10
R458	ERJ6GEYJ273	RES,M 27K-J-1/10
R459	ERJ6GEYJ683	RES,M 68K-J-1/10
R460	ERDS2TJ102	RES,C 1K-J-1/4
R462	ERJ6GEYJ473	RES,M 47K-J-1/10
R463	ERJ6GEYJ473	RES,M 47K-J-1/10
R465	ERJ6GEYJ103	RES,M 10K-J-1/10
R466	ERJ6GEYJ103	RES,M 10K-J-1/10
R467	ERJ6GEYJ104	RES,M 100K-J-1/10
R468	ERJ6GEYJ101	RES,M 100-J-1/10
R469	ERJ6GEYJ220	RES,M 22-J-1/10
R470	ERDS2TJ152	RES,C 1.5K-J-1/4
R471	ERJ6GEYJ223	RES,M 22K-J-1/10
R501	ERJ6GEYJ102	RES,M 1K-J-1/10
R502	ERDS2TJ562	RES,C 5.6K-J-1/4
R503	ERJ6GEYJ822	RES,M 8.2K-J-1/10
R504	ERJ6GEYJ821	RES,M 820-J-1/10
R505	ERJ6GEYJ472	RES,M 4.7K-J-1/10
R506	ERJ6GEYJ182	RES,M 1.8K-J-1/10
R507	ERJ6GEYJ392	RES,M 3.9K-J-1/10
R508	ERJ6GEYJ562	RES,M 5.6K-J-1/10
R509	ERDS2TJ331	RES,C 330-J-1/4
R510	**ERG3FJ182H**	**RES,M 1.8K-J-3W**
R512	ERG2FJ562H	RES,M 5.6K-J-2W
R531	**ERD25FJ470**	**RES,C 47-J-1/4**
R532	**ERJ6ENF4422**	**RES,M 44.2K-F-1/10**
R533	**ERJ6ENF1502**	**RES,M 15K-F-1/10W**
R536	ERJ6GEYJ223	RES,M 22K-J-1/10
R537	ERJ6GEYJ473	RES,M 47K-J-1/10
R551	**ERDS1FJ1R0**	**RES,C 1.0-J-1/2**
R552	**ERDS1FJ1R0**	**RES,C 1.0-J-1/2**
R553	**ERDS1FJ1R0**	**RES,C 1.0-J-1/2**
R554	ERG2FJ390H	RES,M 39-J-2W
R555	ERDS1FJ101	RES,C 100-J-1/2
R556	ERDS2TJ332	RES,C 3.3K-J-1/4
R557	ERDS2TJ103	RES,C 10K-J-1/4
R558	ERQ2CJP1R2	RES,F 1.2-J-2W
R559	ERG2FJ683H	RES,M 12K-J-2W
R560	ERDS1FJ182	RES,C 1.8K-J-1/2
R563	ERDS2TJ124	RES,C 120K-J-1/4
R564	ERDS2TJ104	RES,C 100K-J-1/4
R565	ERDS2TJ103	RES,C 10K-J-1/4
R567	ERG2FJ122H	RES,M 12K-J-2W
R602	ERJ6GEYJ331	RES,M 330-J-1/10
R603	ERJ6GEYJ331	RES,M 330-J-1/10
R604	ERJ6GEYJ331	RES,M 330-J-1/10
R614	ERJ6GEYJ332	RES,M 3.3K-J-1/10
R801	**ERF7ZK1R5**	**RES,W 1.5-K-7W**
R805	ERDS2TJ274	RES,C 270K-J-1/4
R806	ERDS2TJ274	RES,C 270K-J-1/4
R808	ERDS1FJ1R5	RES,C 1.5-J-1/2
R809	ERDS1FJ1R5	RES,C 1.5-J-1/2
R810	ERDS1FJ272	RES,C 2.7K-J-1/2
R812	ERDS1TJ183	RES,C 18K-J-1/2
R813	ERJ6GEYJ562	RES,M 5.6K-J-1/10
R815	**ERC12ZGM825**	**RES,S 8.2MEG-M-1/2**
R817	**ERX3FJ4R7**	**RES,M 4.7-J-3W**
R820	ERJ6GEYJ153	RES,M 15K-J-1/10
R821	ERJ6GEYJ392	RES,M 3.9K-J-1/10
R822	ERD50FJ474	RES,C 470K-J-1/2W
R823	ERDS2TJ222	RES,C 2.2K-J-1/4
R824	ERG3FJ680H	RES,M 68-J-3W
R825	ERDS2TJ102	RES,C 1K-J-1/4
R826	ERF2AKR33	RES,W .33-K-2W
R827	ERDS1FJ561	RES,C 560-J-1/2
R828	ERG3FJ470H	RES,M 47-J-3W
R829	ERQ14AJ270	RES,F 27-J-1/4
R2301	ERQ2CJP120	RES,F 12-J-2W
R2302	ERJ6GEYJ681	RES,M 680-J-1/10
R2303	ERD25FJ4R7	RES,C 4.7-J-1/4
R2304	ERJ6GEYJ223	RES,M 22K-J-1/10
R2305	ERJ6GEYJ102	RES,M 1K-J-1/10
R2306	ERJ6GEYJ101	RES,M 100-J-1/10
R2311	ERJ6GEYJ222	RES,M 2.2K-J-1/10
R2312	ERJ6GEYJ822	RES,M 8.2K-J-1/10
R2313	ERJ6GEYJ473	RES,M 47K-J-1/10
R2314	ERJ6GEYJ184	RES,M 180K-J-1/10
R2315	ERJ6GEYJ331	RES,M 330-J-1/10
R2316	ERJ6GEYJ472	RES,M 4.7K-J-1/10
R2317	ERJ6GEYJ561	RES,M 560-J-1/10
R2321	ERDS2TJ101	RES,C 100-J-1/4
R2322	ERJ6GEYJ472	RES,M 4.7K-J-1/10
R3001	ERJ6GEYJ473	RES,M 47K-J-1/10
		CT-20R14V CT-20R14CV
R3002	ERJ6GEYJ104	RES,M 100K-J-1/10
		CT-20R14V CT-20R14CV
R3005	ERDS2TJ750	RES,C 75-J-1/4
		CT-20R14V CT-20R14CV
R3006	ERDS2TJ391	RES,C 390-J-1/4
		CT-20R14V CT-20R14CV
R3009	ERDS2TJ682	RES,C 6.8K-J-1/4
		CT-20R14V CT-20R14CV
R3010	ERJ6GEYJ334	RES,M 330K-J-1/10
		CT-20R14V CT-20R14CV
R3013	ERDS2TJ682	RES,C 6.8K-J-1/4
		CT-20R14V CT-20R14CV
		SWITCHES
S001	EVQPF106K	SWITCH
		CT-20R14V CT-20R14CV

REPLACEMENT PARTS LIST

(Models: CT-20R14V, CT-20R14CV & TP2009DV)

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF. NO.	PART NO.	DESCRIPTION
S001	EVQQKH06K	SWITCH
		TP2009DV
S002	EVQPF106K	SWITCH
		CT-20R14V CT-20R14CV
S002	EVQQKH06K	SWITCH
		TP2009DV
S003	EVQPF106K	SWITCH
		CT-20R14V CT-20R14CV
S003	EVQQKH06K	SWITCH
		TP2009DV
S004	EVQPF106K	SWITCH
		CT-20R14V CT-20R14CV
S004	EVQQKH06K	SWITCH
		TP2009DV
S005	EVQPF106K	SWITCH
		CT-20R14V CT-20R14CV
S005	EVQQKH06K	SWITCH
		TP2009DV
S006	EVQQKH06K	SWITCH
		TP2009DV
S007	EVQQKH06K	SWITCH
		TP2009DV
S008	EVQPF106K	SWITCH
		CT-20R14V CT-20R14CV
S009	EVQPF106K	SWITCH
		CT-20R14V CT-20R14CV
		TRANSFORMERS
T001	**TLP16297**	**TRANSFORMER, POWER SUPPLY**
T501	**ETH19Y70AYM**	**TRANSFORMER, HORIZONTAL**
		DRIVER
T502	**ETE19Z30AY**	**TRANSFORMER, HORIZONTAL**
		COUPLING
T551	**KFT3AB054F**	**TRANSFORMER, FLYBACK**
T801	**ETS25AD129NC**	**TRANSFORMER**
		CRYSTALS/FILTERS
X001	TSS2AA002	CRYSTAL, 12MHZ
X101	M1969M	SAW FILTER
X102	EFCWS4504AB	FILTER 4.5MHZ
X201	EFCS4R5MS4	FILTER 4.5MHZ BANDPASS
X501	TAFCSB503F38	CRYSTAL, CLOCK
X601	TSS2AA001	CRYSTAL, 3.58MHZ
		OTHERS
M001	**A51KRE89XDT**	**CRT 20"**
		CT-20R14V CT-20R14CV
M002	**A51LES069X**	**CRT 20"**
		TP2009DV
TNR001	**ENV56D18G3**	**TUNER**
M003	EASG9D550B2	SPEAKER
M004	EUR501345	TRANSMITTER, REMOTE CONTROL
		TP2009DV
M005	EUR501371	TRANSMITTER, REMOTE CONTROL
		CT-20R14V CT-20R14CV
IC003	PIC-12042SRB	RECEIVER, REMOTE CONTROL
M006	TBM17454-2	NAMEPLATE: QUASAR
		TP2009DV
M007	TBM2A10141	BADGE, PANASONIC
		CT-20R14V CT-20R14CV
M008	TBX2AA00201G	BUTTON, 7 KEY
		TP2009DV
M009	TBX2AA00401G	BUTTON, 7-KEY
		CT-20R14V CT-20R14CV
M010	TJSC00300	CRT SOCKET
M011	TKU2A22210M	COVER, CABINET BACK 20"
		TP2009DV
M012	TKU2A22212M	COVER, CABINET BACK 20"
		CT-20R14V CT-20R14CV
M013	TLC2047-2	MAGNET,RINGS:PURITY &
		STATIC CONV.
M014	TMM2A30701	WEDGE, YOKE
M015	TQB2AA0126	MANUAL, OWNERS (BI-LING)
		TP2009DV
M016	TQB2AA0128	MANUAL, OWNERS (ENGLISH)
		CT-20R14V
M017	TQB2AA0129	MANUAL, OWNERS (BI-LING)
		CT-20R14CV
M018	**TSX2AA0011**	**LINE CORD**
M019	TXFKY0297SER	ASSY, CABINET FRONT 20"
		CT-20R14V CT-20R14CV
M020	TXFKY4296SER	ASSY, CABINET FRONT 20"
		TP2009DV
M021	TXF3A011DB2	ASSY. DAG GROUND
M022	UR50EC1136A	BATTERY COVER, REMOTE
		TP2009DV
M023	UR50EC1151A	BATTERY COVER, REMOTE
		CT-20R14V CT-20R14CV
M024	0FMK014ZZ	CONVERGENCE CORRECTOR STRIP
JK3001	TJB2A9061A	RCA TERMINAL, A/V
		CT-20R14V CT-20R14CV
JK3002	TJB2AA0032	TERMINAL, A/V
		CT-20R14V CT-20R14CV

REPLACEMENT PARTS LIST

(Models: CT-27G12V, CT-27G12CV, CT-27G12UV, CT-27G22V, CT-27G22CV & CT-27G22UV)

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF. NO.	PART NO.	DESCRIPTION
		CAPRISTORS
CRA801	**EXNG471P365**	**RES-CAP 470PF/3.6 MEG**
CRA802	**EXNG471P365**	**RES-CAP 470PF/3.6 MEG**
		CAPACITORS
C001	ECA1AM101	CAP,E 100UF/10V
C003	ECA1HM4R7	CAP,E 4.7UF/50V
C004	ECUX1H330JCX	CAP,C 33PF-J-50V
C005	ECUX1H330JCX	CAP,C 33PF-J-50V
C008	TCUX1H103ZFN	CAP,C .01UF-Z-50V
C010	TCUX1H103ZFN	CAP,C .01UF-Z-50V
C011	ECA1CM221	CAP,E 220UF/16V
C013	ECA0JM101	CAP,E 100UF/6.3V
C016	ECUX1H101JCX	CAP,C 100PF-J-50V
C017	ECUX1H220JCX	CAP,C 22PF-J-50V
C018	ECUX1H220JCX	CAP,C 22PF-J-50V
C019	ECA0JM101	CAP,E 100UF/6.3V
C020	ECA0JM101	CAP,E 100UF/6.3V
C022	ECA1CM471	CAP,E 470UF/16V
C024	ECA1EM4R7	CAP,E 4.7UF/25V
C025	ECUX1H101JCX	CAP,C 100PF-J-50V
C026	ECA1HM010	CAP,E 1.0UF/50V
C031	ECUX1H821KBX	CAP,C 820PF-K-50V
C032	ECA1AM470	CAP,E 47UF/10V
C033	ECUX1H101JCX	CAP,C 100PF-J-50V
		CT-27G12V CT-27G12CV
C035	ECUX1H220JCX	CAP,C 22PF-J-50V
C036	ECUX1H220JCX	CAP,C 22PF-J-50V
C037	ECUX1H220JCX	CAP,C 22PF-J-50V
C038	ECUX1H220JCX	CAP,C 22PF-J-50V
C101	ECUX1H223ZFX	CAP,C .022UF-Z-50V
C102	ECA1EM100	CAP,E 10UF/25V
C103	ECUX1H300JCX	CAP,C 30PF-J-50V
C105	ECUX1H221JCX	CAP,C 220PF-J-50V
C106	ECA1HMR47	CAP,E .47UF/50V
C107	ECUX1H470JCX	CAP,C 47PF-J-50V
C108	ECA1HMR22	CAP,E .22UF/50V
C109	ECEA1HN4R7U	CAP,E 4.7UF/50V
C110	TCUX1H103ZFN	CAP,C .01UF-Z-50V
C111	ECA1EM100	CAP,E 10UF/25V
C113	ECA1EM100	CAP,E 10UF/25V
C117	ECUX1H070DCX	CAP,C 7PF-D-50V
C151	ECA1HMR22	CAP,E .22UF/50V
C201	TCUX1H103ZFN	CAP,C .01UF-Z-50V
C202	ECUX1H101JCX	CAP,C 100PF-J-50V
C203	ECA1EM4R7	CAP,E 4.7UF/25V
C301	ECUX1H390JCX	CAP,C 39PF-J-50V
C302	ECEA1HN010U	CAP,E 1UF/50V
C304	ECEA1HNR47U	CAP,E .47UF-50V
C305	ECA1EM4R7	CAP,E 4.7UF/25V
C306	ECA1CM221	CAP,E 220UF/16V
C308	ECQB1H823KF	CAP,P .082UF-K-50V
C309	ECA1AM101	CAP,E 100UF/10V
C310	ECA1EM4R7	CAP,E 4.7UF/25V
C311	ECA1EM4R7	CAP,E 4.7UF/25V
C312	ECA1EM220	CAP,E 22UF/25V
C314	ECUX1H104ZFX	CAP,C .1UF-Z-50V
C315	ECUX1H680JCX	CAP,C 68PF-J-50V
		CT-27G22V CT-27G22CV
C351	TACCW391T50V	CAP,C 390PF/50V
C352	TACCW391T50V	CAP,C 390PF/50V
C353	TACCW471T50V	CAP,C 470PF/50V
C354	ECKD3D102KB	CAP,C .001UF-K-2KV
C357	ECEA1HN010S	CAP,E 1UF/50V
C401	ECQB1H153KF	CAP,P .015UF-K-50V
C402	ECUX1H471KBX	CAP,C 470PF-K-50V
C403	ECA1HM2R2	CAP,E 2.2UF/50V
C451	ECA1AM470	CAP,E 47UF/10V
C452	ECSF1EE105	CAP,T 1.0UF/25V
C453	ECEA1HFS010	CAP,E 1UF/50V
C454	ECA1EM102	CAP,E 1000UF/25V
C455	ECEA1VGE101	CAP,E 100UF/35V
C456	ECQB1H103JF	CAP,P .01UF-J-50V
C459	ECA1VM471	CAP,E 470UF/35V
C462	ECA1EM100	CAP,E 10UF/25V
C502	ECQB1H223JF	CAP,P .022UF-J-50V
C503	ECA1HM2R2	CAP,E 2.2UF/50V
C504	ECUX1H101JCX	CAP,C 100PF-J-50V
C505	ECUX1H221JUX	CAP,C 220PF-J-50V
C506	ECA1CM221	CAP,E 220UF/16V
C508	ECUX1H121JCX	CAP,C 120PF-J-50V
C510	ECCD2H100D	CAP,C 10PF-D-500V
C511	ECKD2H821KB	CAP,C 820PF-K-500V
C512	ECKD2H101KB	CAP,C 100PF-K-500V
C531	**ECA1EM220**	**CAP,E 22UF/25V**
C532	ECA1AM102	CAP,E 1000UF/10V
C534	TCUX1H103ZFN	CAP,C .01UF-Z-50V
C551	**ECA1VM331**	**CAP,E 330UF/35V**
C552	**ECA1EM471**	**CAP,E 470UF/25V**
C553	ECKD2H561KB	CAP,C 560PF-K-500V
C554	ECKD2H561KB	CAP,C 560PF-K-500V
C555	**ECEA2EU220**	**CAP,E 22UF/250V**
C556	**ECA1CM471**	**CAP,E 470UF/16V**
C557	ECKD2H102KB	CAP,C .001UF-K-500V
C558	ECA1CM221	CAP,E 220UF/16V
		CT-27G22V CT-27G22CV
C559	ECA1HM220	CAP,E 22UF/50V
C560	**ECEA1HN2R2U**	**CAP,E 2.2UF/50V**
C561	ECKD2H561KB	CAP,C 560PF-K-500V
C562	ECKD2H561KB	CAP,C 560PF-K-500V
		CT-27G22V CT-27G22CV
C563	**ECWH12H682JS**	**CAP,P .0068UF-J-1.2KV**
C564	**ECWH12H392JS**	**CAP,P .0039UF-J-1.2KV**
C565	**ECKD3D102JB**	**CAP,C .001UF-J-2KV**
C566	ECKD3D181JB	CAP,C 180PF-J-2KV
C568	**ECQM2274JZ**	**CAP,P .27UF-J-200V**
C569	**ECWF2474JBB**	**CAP,P .47UF-J-200V**
C571	ECA1EM220	CAP,E 22UF/25V
C572	ECA1EM100	CAP,E 10UF/25V
C573	ECA1CM101	CAP,E 100UF/16V
C601	ECUX1H181JCX	CAP,C 180PF-J-50V
C602	ECUX1H680JCX	CAP,C 68PF-J-50V
C604	ECUX1H150JUX	CAP,C 15PF-J-50V

REPLACEMENT PARTS LIST

(Models: CT-27G12V, CT-27G12CV, CT-27G12UV, CT-27G22V, CT-27G22CV & CT-27G22UV)

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF. NO.	PART NO.	DESCRIPTION
C605	ECUX1H332KBX	CAP,C .0033UF-K-50V
C606	ECA1HM010	CAP,E 1.0UF/50V
C801	**ECKD2H472PU**	**CAP,C .0047UF-P-500V**
C802	**ECKD2H472PU**	**CAP,C .0047UF-P-500V**
C805	**EC0S2DA221BB**	**CAP,E 220UF/200V**
C806	**EC0S2DA221BB**	**CAP,E 220UF/200V**
C807	ECA1HM3R3	CAP,E 3.3UF/50V
C808	ECA1CM101	CAP,E 100UF/16V
C809	**EC0S2DG151DG**	**CAP,E 151UF/200V**
C810	**ECQU2A153MN**	**CAP,P .015UF-M-250VAC**
C811	**ECQU2A153MN**	**CAP,P .015UF-M-250VAC**
C812	**ECQU2A224MN**	**CAP,P .22UF-M-250VAC**
C814	ECQB1H333JF	CAP,P .033UF-J-50V
C815	ECEA1EGE101	CAP,E 100UF/25V
C818	ECKD3A821KB	CAP,C 820PF-K-1KVDC
C820	ECEA1JGE100	CAP,E 10UF/63V
C823	**ECEA160V33Z**	**CAP,E 33UF/160V**
C824	ECKD3A331KB	CAP,C 330PF-K-1KVDC
C825	ECKD3A471KB	CAP,C 470PF-K-1KV
C1801	TCUX1H103ZFN	CAP,C .01UF-Z-50V
		CT-27G22V CT-27G22CV
C1802	ECQB1H154JF	CAP,P .15UF-J-50V
		CT-27G22V CT-27G22CV
C1803	ECEA1HKAR22	CAP,E .22UF/50V
		CT-27G22V CT-27G22CV
C1804	ECEA1HKAR22	CAP,E .22UF/50V
		CT-27G22V CT-27G22CV
C1805	ECUX1H333ZFX	CAP,C .033UF-Z-50V
		CT-27G22V CT-27G22CV
C1806	TCUX1H103ZFN	CAP,C .01UF-Z-50V
		CT-27G22V CT-27G22CV
C1807	ECEA1CKA470	CAP,E 47UF/16V
		CT-27G22V CT-27G22CV
C1808	TCUX1H103ZFN	CAP,C .01UF-Z-50V
		CT-27G22V CT-27G22CV
C1809	ECEA1CKA470	CAP,E 47UF/16V
		CT-27G22V CT-27G22CV
C1810	ECUX1H104ZFX	CAP,C .1UF-Z-50V
		CT-27G22V CT-27G22CV
C1811	TCUX1H103ZFN	CAP,C .01UF-Z-50V
		CT-27G22V CT-27G22CV
C1812	TCUX1H103ZFN	CAP,C .01UF-Z-50V
		CT-27G22V CT-27G22CV
C1813	TCUX1H103ZFN	CAP,C .01UF-Z-50V
		CT-27G22V CT-27G22CV
C1815	ECUX1H104ZFX	CAP,C .1UF-Z-50V
		CT-27G22V CT-27G22CV
C1816	TCUX1H103ZFN	CAP,C .01UF-Z-50V
		CT-27G22V CT-27G22CV
C1817	TCUX1H103ZFN	CAP,C .01UF-Z-50V
		CT-27G22V CT-27G22CV
C1818	ECEA1CKA100	CAP,E 10UF/16V
		CT-27G22V CT-27G22CV
C1819	TCUX1H103ZFN	CAP,C .01UF-Z-50V
		CT-27G22V CT-27G22CV
C1820	ECEA1CKA470	CAP,E 47UF/16V
		CT-27G22V CT-27G22CV
C1821	ECUX1H150JCX	CAP,C 15PF-J-50V
		CT-27G22V CT-27G22CV
C1822	ECUX1H120JCX	CAP,C 12PF-J-50V
		CT-27G22V CT-27G22CV
C1823	ECUX1H680JCX	CAP,C 68PF-J-50V
		CT-27G22V CT-27G22CV
C1826	TCUX1H103ZFN	CAP,C .01UF-Z-50V
		CT-27G22V CT-27G22CV
C1827	TCUX1H103ZFN	CAP,C .01UF-Z-50V
		CT-27G22V CT-27G22CV
C1828	TCUX1H103ZFN	CAP,C .01UF-Z-50V
		CT-27G22V CT-27G22CV
C1829	ECUX1H104ZFX	CAP,C .1UF-Z-50V
		CT-27G22V CT-27G22CV
C1830	ECUX1H560JCX	CAP,C 56PF-J-50V
		CT-27G22V CT-27G22CV
C1831	ECUX1H104ZFX	CAP,C .1UF-Z-50V
		CT-27G22V CT-27G22CV
C1832	ECUX1H104ZFX	CAP,C .1UF-Z-50V
		CT-27G22V CT-27G22CV
C1833	ECUX1H104ZFX	CAP,C .1UF-Z-50V
		CT-27G22V CT-27G22CV
C1835	ECEA1CKA100	CAP,E 10UF/16V
		CT-27G22V CT-27G22CV
C1836	ECUX1H470JCX	CAP,C 47PF-J-50V
		CT-27G22V CT-27G22CV
C1839	ECUX1H101JCX	CAP,C 100PF-J-50V
		CT-27G22V CT-27G22CV
C1840	ECUX1H101JCX	CAP,C 100PF-J-50V
		CT-27G22V CT-27G22CV
C1841	ECKF1H103ZF	CAP,C .01UF-Z-50V
		CT-27G22V CT-27G22CV
C2201	AP335K016CAE	CAP,T 3.3UF/16V
C2202	ECA1EM4R7	CAP,E 4.7UF/25V
C2203	ECA1HM010	CAP,E 1.0UF/50V
C2204	ECA1EM4R7	CAP,E 4.7UF/25V
C2205	ECA1EM4R7	CAP,E 4.7UF/25V
C2206	ECA1EM4R7	CAP,E 4.7UF/25V
C2207	ECA1EM4R7	CAP,E 4.7UF/25V
C2208	ECA1EM4R7	CAP,E 4.7UF/25V
C2209	ECA1AM101	CAP,E 100UF/10V
C2210	ECA1HMR33	CAP,E .33UF/50V
C2211	ECEA1HUR68	CAP,E .68UF/50V
C2212	ECA1HM2R2	CAP,E 2.2UF/50V
C2213	ECA1EM100	CAP,E 10UF/25V
C2214	ECQB1H104JF	CAP,P .1UF-J-50V
C2215	ECQB1H223JF	CAP,P .022UF-J-50V
C2216	ECUX1H332KBX	CAP,C .0033UF-K-50V
C2217	ECEA1HN010U	CAP,E 1UF/50V
C2218	ECEA1HN010U	CAP,E 1UF/50V
C2219	AP106K016CAE	CAP,T 10UF/16V
C2220	ECEA1CN100U	CAP,E 10UF-16V
C2221	TCUX1H103KBN	CAP,C .01UF-K-50V
C2222	ECUX1H472KBX	CAP,C .0047UF-K-50V

REPLACEMENT PARTS LIST

(Models: CT-27G12V, CT-27G12CV, CT-27G12UV, CT-27G22V, CT-27G22CV & CT-27G22UV)

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF. NO.	PART NO.	DESCRIPTION
C2302	ECEA1HGE3R3	CAP,E 3.3UF/50V
C2303	ECEA1EGE100	CAP,E 10UF/25V
C2304	ECQB1H104JF	CAP,P .1UF-J-50V
C2306	ECA1CM221	CAP,E 220UF/16V
C2307	ECEA1HN010U	CAP,E 1UF/50V
C2309	ECEA1HGE010	CAP,E 1UF/50V
C2310	ECUX1H332KBX	CAP,C .0033UF-K-50V
C2311	ECA1HM3R3	CAP,E 3.3UF/50V
C2351	ECA1EM102	CAP,E 1000UF/25V
C2352	ECEA1HGE3R3	CAP,E 3.3UF/50V
C2353	ECEA1EGE100	CAP,E 10UF/25V
C2354	ECQB1H104JF	CAP,P .1UF-J-50V
C2356	ECA1CM221	CAP,E 220UF/16V
C2357	ECEA1HN010U	CAP,E 1UF/50V
C2358	ECUX1H332KBX	CAP,C .0033UF-K-50V
C2451	ECA1EM100	CAP,E 10UF/25V
C2452	ECA1EM100	CAP,E 10UF/25V
C2453	ECA1EM4R7	CAP,E 4.7UF/25V
C2454	ECA1CM221	CAP,E 220UF/16V
C3001	ECA1HM010	CAP,E 1.0UF/50V
C3002	ECA1HM010	CAP,E 1.0UF/50V
C3003	ECA1HM010	CAP,E 1.0UF/50V
C3005	ECUX1H272KBX	CAP,C .0027UF-K-50V
C3006	ECUX1H272KBX	CAP,C .0027UF-K-50V
C4304	ECEA1CKA100	CAP,E 10UF/16V
		CT-27G22V CT-27G22CV
C4305	ECEA1CKN100	CAP,E 10UF/16V
		CT-27G22V CT-27G22CV
C4306	ECUX1H820JCX	CAP,C 82PF-J-50V
		CT-27G22V CT-27G22CV
C4313	ECUX1H391KBX	CAP,C 390PF-K-50V
		CT-27G22V CT-27G22CV
C4314	ECEA1HKA010	CAP,E 1.0UF/50V
		CT-27G22V CT-27G22CV
C4315	ECUX1H152KBX	CAP,C .0015UF-K-50V
		CT-27G22V CT-27G22CV
C4316	ECEA0JKA331	CAP,E 330UF/6.3V
		CT-27G22V CT-27G22CV
C4317	TCUX1H103ZFN	CAP,C .01UF-Z-50V
		CT-27G22V CT-27G22CV
C4318	ECEA0JKA101	CAP,E 100UF/6.3V
		CT-27G22V CT-27G22CV
C4319	ECUX1H391JCX	CAP,C 390PF-J-50V
		CT-27G22V CT-27G22CV
C4320	ECUX1H681KBX	CAP,C 680PF-K-50V
		CT-27G22V CT-27G22CV
		DIODES
D001	ERA15-01	DIODE
D002	MA165	DIODE
D003	MA4047M	DIODE, ZENER
D006	MA4330H	DIODE
D008	MA165	DIODE
D009	MA165	DIODE
D011	MA165	DIODE
D016	MA165	DIODE
D017	MA165	DIODE
D451	ERA15-01	DIODE
D452	MA4047M	DIODE, ZENER
D501	MA4082L	DIODE
D531	**AS01**	**DIODE**
D532	**MA4062L**	**DIODE**
D551	**TVSRU2N**	**DIODE**
D553	**AU02**	**DIODE**
D554	**BYD33G-143**	**DIODE**
D555	MA165	DIODE
D556	MA4360H	DIODE, ZENER
D557	**AU02**	**DIODE**
		CT-27G22V CT-27G22CV
D558	**RS3FS**	**DIODE**
D559	**BYD33G-113**	**DIODE**
D560	MA165	DIODE
D561	**BYD33G-143**	**DIODE**
D801	**RM10BLFA1**	**DIODE**
D802	**RM10BLFA1**	**DIODE**
D805	**TRPW5B0M050D**	**THERMISTOR**
D806	MA4047H	DIODE
D807	MA165	DIODE
D820	EU02V1	DIODE
D821	EU02V1	DIODE
D822	EU02V1	DIODE
D823	RL30A	DIODE
D824	EU02V1	DIODE
D825	**TVSSR2KL**	**DIODE, PROTECTION**
D826	EU02V1	DIODE
D829	MA165	DIODE
D2301	MA165	DIODE
D2302	MA165	DIODE
D2312	MA4068M	DIODE, ZENER
D3001	MA165	DIODE
D3002	MA4110M	DIODE, ZENER
D3003	MA4062M	DIODE, ZENER
		CT-27G22V CT-27G22CV
D3004	MA4110M	DIODE, ZENER
D3005	MA4110M	DIODE, ZENER
D4301	MA3036H	DIODE
		CT-27G22V CT-27G22CV
		FUSES
F801	**0BA1C63NU100**	**FUSE, 6.3A/125V**
		INTEGRATED CIRCUITS
IC001	MN1873265T8X	INT CKT
IC002	24LC02BIP	INT CKT
IC003	RPM-637CBRS1	IR RECEIVER, REMOTE CONTROL
IC101	**AN5165K**	**INT CKT**
IC451	**LA7838**	**INT CKT**
IC551	**AN78M09**	**PLUS 9V AVR**
IC552	AN78M05	PLUS 5V AVR
IC801	**0N3131R**	**INT CKT**
IC803	**STR58041A**	**INT CKT**
IC1801	M65617SP	PIP CONTROLLER
		CT-27G22V CT-27G22CV
IC2201	AN5819K	INT CKT
IC2303	LA4285	INT CKT

PARTS LIST

REPLACEMENT PARTS LIST

(Models: CT-27G12V, CT-27G12CV, CT-27G12UV, CT-27G22V, CT-27G22CV & CT-27G22UV)

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF. NO.	PART NO.	DESCRIPTION
IC2304	LA4285	INT CKT
IC2451	AN5285K	INT CKT
IC4301	TC74HC4066AL	INT CKT
		CT-27G22V CT-27G22CV
		COILS
DEG	**0LK19045A**	**COIL, DEGAUSSING 27"**
DY	**TLY2AA003**	**DEFLECTION YOKE**
L001	TSKA074	FERRITE BEAD
L002	TLTACT390K	COIL, PEAKING 39UH
L003	TLUABTA2R2K	COIL, PEAKING 2.2UH
L004	TLUABTA2R2K	COIL, PEAKING 2.2UH
L006	TSKA072	FERRITE BEAD
L008	TLUABTA470K	COIL, PEAKING 47UH
L009	TSKA074	FERRITE BEAD
L103	TLUABTA120K	COIL, PEAKING 12UH
L104	TLUABTA1R0K	COIL, PEAKING 1.0UH
L105	EIV7EN053B	COIL, VCO
L106	TLTACT180J	COIL, PEAKING 18UH
L351	TLUABTA101K	COIL, PEAKING 100UH
L551	**TLH6621P**	**COIL, LINEARITY**
L602	TLTACT120J	COIL, PEAKING 12UH
L801	**ELF17N017A**	**LINE FILTER**
		CT-27G12V CT-27G22V
L801	**ELF18D650K**	**CHOKE, AC LINE**
		CT-27G12CV CT-27G22CV
L802	ELEIE680KA	COIL, PEAKING 68UH
L804	TSKA076	FERRITE BEAD
L1801	TLTACT1R5K	COIL, PEAKING
		CT-27G22V CT-27G22CV
L1803	TLTACT2R2K	COIL, PEAKING 2.2UH
		CT-27G22V CT-27G22CV
L1804	TLTACT150J	COIL, PEAKING 15UH
		CT-27G22V CT-27G22CV
L1807	TLTACT1R0K	COIL, PEAKING 1UH
		CT-27G22V CT-27G22CV
L1808	EXCELDR25	COIL
		CT-27G22V CT-27G22CV
L2201	TLTACT102J	COIL, PEAKING 1000UH
L2202	ELESN471JA	COIL, PEAKING 470UH
L4301	TLTACT2R2K	COIL, PEAKING 2.2UH
		CT-27G22V CT-27G22CV
		TRANSISTORS
Q001	MSD601-RT1	TRANSISTOR
Q002	JC501PQ	TRANSISTOR
Q003	MSB709-RT1	TRANSISTOR
Q004	MSB709-RT1	TRANSISTOR
Q301	MSD601-RT1	TRANSISTOR
		CT-27G22V CT-27G22CV
Q302	MSD601-RT1	TRANSISTOR
Q303	MSB709-RT1	TRANSISTOR
		CT-27G22V CT-27G22CV
Q304	MSD601-RT1	TRANSISTOR
Q305	MSD601-RT1	TRANSISTOR
		CT-27G22V CT-27G22CV
Q306	MSB709-RT1	TRANSISTOR
		CT-27G22V CT-27G22CV
Q307	MSB709-RT1	TRANSISTOR
		CT-27G22V CT-27G22CV
Q351	2SC3063	TRANSISTOR
Q352	2SC3063	TRANSISTOR
Q353	2SC3063	TRANSISTOR
Q451	MSD601-RT1	TRANSISTOR
Q452	MSD601-RT1	TRANSISTOR
Q501	2SC4212H	TRANSISTOR
Q551	**BU2508DF**	**TRANSISTOR**
Q801	2SC1685RS	TRANSISTOR
Q802	2SC1384RS	TRANSISTOR
Q804	2SA1767Q	TRANSISTOR
Q1801	MSD601-RT1	TRANSISTOR
		CT-27G22V CT-27G22CV
Q1802	MSD601-RT1	TRANSISTOR
		CT-27G22V CT-27G22CV
Q1803	MSD601-RT1	TRANSISTOR
		CT-27G22V CT-27G22CV
Q1804	MSB709-RT1	TRANSISTOR
		CT-27G22V CT-27G22CV
Q1805	MSB709-RT1	TRANSISTOR
		CT-27G22V CT-27G22CV
Q2309	MSB709-RT1	TRANSISTOR
Q3001	MSD601-RT1	TRANSISTOR
Q4301	MSD601-RT1	TRANSISTOR
		CT-27G22V CT-27G22CV
Q4302	MSD601-RT1	TRANSISTOR
		CT-27G22V CT-27G22CV
Q4303	MSD601-RT1	TRANSISTOR
		CT-27G22V CT-27G22CV
Q4309	MSB709-RT1	TRANSISTOR
		CT-27G22V CT-27G22CV
Q4310	MSD601-RT1	TRANSISTOR
		CT-27G22V CT-27G22CV
Q4311	MSB709-RT1	TRANSISTOR
		CT-27G22V CT-27G22CV
Q4312	MSD601-RT1	TRANSISTOR
		CT-27G22V CT-27G22CV
Q4313	MSD601-RT1	TRANSISTOR
		CT-27G22V CT-27G22CV
Q4315	2SC1384Q	TRANSISTOR
		CT-27G22V CT-27G22CV
		RELAYS
RL801	**TSEH8007**	**RELAY**
		RESISTORS
R002	ERJ6GEYJ182	RES,M 1.8K-J-1/10
R003	ERJ6GEYJ562	RES,M 5.6K-J-1/10
R004	ERDS2TJ181	RES,C 180-J-1/4
R005	ERDS2TJ101	RES,C 100-J-1/4
R006	ERJ6GEYJ391	RES,M 390-J-1/10
R007	ERJ6GEYJ561	RES,M 560-J-1/10
R008	ERJ6GEYJ562	RES,M 5.6K-J-1/10
R010	ERJ6GEYJ154	RES,M 150K-J-1/10
R011	ERJ6GEYJ684	RES,M 680K-J-1/10
R012	ERJ6GEYJ473	RES,M 47K-J-1/10
R016	ERJ6GEYJ472	RES,M 4.7K-J-1/10

REPLACEMENT PARTS LIST

(Models: CT-27G12V, CT-27G12CV, CT-27G12UV, CT-27G22V, CT-27G22CV & CT-27G22UV)

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF. NO.	PART NO.	DESCRIPTION
R017	ERJ6GEYJ472	RES,M 4.7K-J-1/10
R020	ERJ6GEYJ474	RES,M 470K-J-1/10
R021	ERJ6GEYJ101	RES,M 100-J-1/10
R022	ERJ6GEYJ101	RES,M 100-J-1/10
R023	ERJ6GEYJ102	RES,M 1K-J-1/10
R025	ERJ6GEYJ103	RES,M 10K-J-1/10
R027	ERJ6GEYJ103	RES,M 10K-J-1/10
R028	ERJ6GEYJ103	RES,M 10K-J-1/10
		CT-27G22V CT-27G22CV
R029	ERJ6GEYJ103	RES,M 10K-J-1/10
		CT-27G12V CT-27G12CV
R030	ERJ6GEYJ102	RES,M 1K-J-1/10
R032	ER0S2CKF1002	RES,M 10K-F-1/4
R033	ERJ6GEYJ222	RES,M 2.2K-J-1/10
R034	ERJ6GEYJ222	RES,M 2.2K-J-1/10
R035	ERJ6GEYJ332	RES,M 3.3K-J-1/10
R036	ERJ6GEYJ562	RES,M 5.6K-J-1/10
R037	ERJ6GEYJ103	RES,M 10K-J-1/10
R038	ERJ6GEYJ223	RES,M 22K-J-1/10
R039	ERDS2TJ102	RES,C 1K-J-1/4
R041	ERJ6GEYJ471	RES,M 470-J-1/10
		CT-27G22V CT-27G22CV
R042	ERJ6GEYJ223	RES,M 22K-J-1/10
		CT-27G22V CT-27G22CV
R045	ERJ6GEYJ102	RES,M 1K-J-1/10
R048	ERJ6GEYJ221	RES,M 220-J-1/10
R049	ERJ6GEYJ221	RES,M 220-J-1/10
R052	ERJ6GEYJ103	RES,M 10K-J-1/10
		CT-27G22V CT-27G22CV
R053	ERJ6GEYJ103	RES,M 10K-J-1/10
		CT-27G12V CT-27G12CV
R055	ERJ6GEYJ103	RES,M 10K-J-1/10
R060	ERJ6GEYJ102	RES,M 1K-J-1/10
R065	ERJ6GEYJ222	RES,M 2.2K-J-1/10
R066	ERJ6GEYJ222	RES,M 2.2K-J-1/10
R067	ERJ6GEYJ222	RES,M 2.2K-J-1/10
R068	ERJ6GEYJ222	RES,M 2.2K-J-1/10
R070	ERJ6GEYJ101	RES,M 100-J-1/10
R101	ERJ6GEYJ750	RES,M 75-J-1/10
R102	ERJ6GEYJ683	RES,M 68K-J-1/10
R103	ERJ6GEYJ183	RES,M 18K-J-1/10
R104	ERJ6GEYJ681	RES,M 680-J-1/10
R105	ERJ6GEYJ681	RES,M 680-J-1/10
R107	ERJ6GEYJ222	RES,M 2.2K-J-1/10
R108	ERJ6GEYJ471	RES,M 470-J-1/10
R152	ERDS2TJ183	RES,C 18K-J-1/4
R153	ERJ6GEYJ223	RES,M 22K-J-1/10
R154	ERJ6GEYJ393	RES,M 39K-J-1/10
R201	ERJ6GEYJ471	RES,M 470-J-1/10
R202	ERJ6GEYJ682	RES,M 6.8K-J-1/10
R203	ERJ6GEYJ562	RES,M 5.6K-J-1/10
R301	ERJ6GEYJ471	RES,M 470-J-1/10
		CT-27G22V CT-27G22CV
R302	ERJ6GEYJ681	RES,M 680-J-1/10
		CT-27G22V CT-27G22CV
R303	ERJ6GEYJ682	RES,M 6.8K-J-1/10
R304	ERJ6GEYJ332	RES,M 3.3K-J-1/10
R305	ER0S2CKF3001	RES,M 3K-F-1/4
R306	ERJ6ENF1651	RES,M 1.65K-F-1/10
R307	ERJ6GEYJ564	RES,M 560K-J-1/10
R308	ERJ6GEYJ102	RES,M 1K-J-1/10
R309	ERJ6GEYJ393	RES,M 39K-J-1/10
R310	ERJ6GEYJ393	RES,M 39K-J-1/10
R311	ERJ6GEYJ185	RES,M 1.8MEG-J-1/10W
R313	ERJ6GEYJ471	RES,M 470-J-1/10
		CT-27G22V CT-27G22CV
R314	ERDS2TJ471	RES,C 470-J-1/4
		CT-27G22V CT-27G22CV
R315	ERJ6GEYJ101	RES,M 100-J-1/10
		CT-27G22V CT-27G22CV
R317	ERJ6GEYJ684	RES,M 680K-J-1/10
R319	ERJ6GEYJ122	RES,M 1.2K-J-1/10
R320	ERJ6GEYJ102	RES,M 1K-J-1/10
R324	ERJ6GEYJ222	RES,M 2.2K-J-1/10
		CT-27G22V CT-27G22CV
R325	ERJ6GEYJ102	RES,M 1K-J-1/10
		CT-27G22V CT-27G22CV
R326	ERJ6GEYJ332	RES,M 3.3K-J-1/10
		CT-27G22V CT-27G22CV
R327	ERJ6GEYJ332	RES,M 3.3K-J-1/10
		CT-27G22V CT-27G22CV
R328	ERJ6GEYJ102	RES,M 1K-J-1/10
		CT-27G22V CT-27G22CV
R335	ERJ6GEYJ471	RES,M 470-J-1/10
		CT-27G22V CT-27G22CV
R351	ERG2FJ123H	RES,M 12K-J-2W
R352	ERG2FJ123H	RES,M 12K-J-2W
R353	ERG2FJ123H	RES,M 12K-J-2W
R354	ERDS1TJ272	RES,C 2.7K-J-1/2
R355	ERDS1TJ272	RES,C 2.7K-J-1/2
R356	ERDS1TJ272	RES,C 2.7K-J-1/2
R357	ERDS2TJ271	RES,C 270-J-1/4
R358	ERDS2TJ271	RES,C 270-J-1/4
R359	ERDS2TJ271	RES,C 270-J-1/4
R360	ERDS2TJ751	RES,C 750-J-1/4
R361	ERDS2TJ751	RES,C 750-J-1/4
R362	ERDS2TJ751	RES,C 750-J-1/4
R363	ERDS2TJ101	RES,C 100-J-1/4
R364	ERDS2TJ101	RES,C 100-J-1/4
R365	ERDS2TJ101	RES,C 100-J-1/4
R401	ERJ6GEYJ102	RES,M 1K-J-1/10
R451	ERDS1FJ1R0	RES,C 1.0-J-1/2
R454	ERJ6GEYJ473	RES,M 47K-J-1/10
R455	ERJ6GEYJ183	RES,M 18K-J-1/10
R456	ERJ6GEYJ223	RES,M 22K-J-1/10
R457	ERJ6GEYJ152	RES,M 1.5K-J-1/10
R458	ERJ6GEYJ333	RES,M 33K-J-1/10
R459	ERJ6GEYJ683	RES,M 68K-J-1/10
R460	ERDS2TJ102	RES,C 1K-J-1/4
R462	ERJ6GEYJ473	RES,M 47K-J-1/10
R463	ERJ6GEYJ473	RES,M 47K-J-1/10
R465	ERJ6GEYJ103	RES,M 10K-J-1/10

REPLACEMENT PARTS LIST

(Models: CT-27G12V, CT-27G12CV, CT-27G12UV, CT-27G22V, CT-27G22CV & CT-27G22UV)

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF. NO.	PART NO.	DESCRIPTION
R466	ERJ6GEYJ103	RES,M 10K-J-1/10
R467	ERJ6GEYJ104	RES,M 100K-J-1/10
R468	ERJ6GEYJ101	RES,M 100-J-1/10
R469	ERJ6GEYJ220	RES,M 22-J-1/10
R471	ERJ6GEYJ223	RES,M 22K-J-1/10
R501	ERJ6GEYJ102	RES,M 1K-J-1/10
R502	ERDS2TJ562	RES,C 5.6K-J-1/4
R503	ERJ6GEYJ822	RES,M 8.2K-J-1/10
R504	ERJ6GEYJ561	RES,M 560-J-1/10
R505	ERJ6GEYJ682	RES,M 6.8K-J-1/10
R506	ERJ6GEYJ182	RES,M 1.8K-J-1/10
R507	ERJ6GEYJ392	RES,M 3.9K-J-1/10
R508	ERJ6GEYJ562	RES,M 5.6K-J-1/10
R509	ERDS2TJ331	RES,C 330-J-1/4
R510	**ERG3FJ362H**	**RES,M 3.6K-J-3W**
R511	**ERG3FJ362H**	**RES,M 3.6K-J-3W**
R512	ERG2FJ392H	RES,M 3.9K-J-2W
R515	ERJ6GEYJ562	RES,M 5.6K-J-1/10
		CT-27G22V CT-27G22CV
R531	**ERD25FJ470**	**RES,C 47-J-1/4**
R532	**ERJ6ENF5602**	**RES,M 56K-F-1/10**
R533	**ERJ6ENF2102**	**RES,M 21K-F-1/10**
R536	ERJ6GEYJ223	RES,M 22K-J-1/10
R537	ERJ6GEYJ473	RES,M 47K-J-1/10
R551	**ERDS1FJ1R0**	**RES,C 1.0-J-1/2**
R552	**ERDS1FJ1R0**	**RES,C 1.0-J-1/2**
R553	**ERDS1FJ1R0**	**RES,C 1.0-J-1/2**
R554	ERG2FJ390H	RES,M 39-J-2W
R556	ERDS2TJ272	RES,C 2.7K-J-1/4
R557	ERDS2TJ103	RES,C 10K-J-1/4
R558	ERQ1CKPR56	RES,F .56-K-1W
R559	ERG2FJ683H	RES,M 12K-J-2W
R560	ERG2FJ182H	RES,M 1.8K-J-2W
R561	ERG2FJ102H	RES,M 1K-J-2W
R563	ERDS2TJ393	RES,C 39K-J-1/4
R564	ERDS2TJ104	RES,C 100K-J-1/4
R565	ERDS2TJ103	RES,C 10K-J-1/4
R566	**ERDS1FJ1R0**	**RES,C 1.0-J-1/2**
		CT-27G22V CT-27G22CV
R602	ERJ6GEYJ331	RES,M 330-J-1/10
R603	ERJ6GEYJ331	RES,M 330-J-1/10
R604	ERJ6GEYJ331	RES,M 330-J-1/10
R611	ERJ6GEYJ333	RES,M 33K-J-1/10
R612	ERJ6GEYJ333	RES,M 33K-J-1/10
R613	ERJ6GEYJ333	RES,M 33K-J-1/10
R614	ERJ6GEYJ332	RES,M 3.3K-J-1/10
R801	**ERF7ZK1R5**	**RES,W 1.5-K-7W**
R805	ERDS2TJ274	RES,C 270K-J-1/4
R806	ERDS2TJ274	RES,C 270K-J-1/4
R808	ERDS1FJ1R0	RES,C 1.0-J-1/2
R809	ERDS1FJ1R0	RES,C 1.0-J-1/2
R810	ERDS1FJ272	RES,C 2.7K-J-1/2
R812	ERDS1TJ183	RES,C 18K-J-1/2
R813	ERJ6GEYJ562	RES,M 5.6K-J-1/10
R815	**ERC12ZGM825**	**RES,S 8.2MEG-M-1/2**
R820	ERJ6GEYJ153	RES,M 15K-J-1/10
R821	ERJ6GEYJ392	RES,M 3.9K-J-1/10
R822	ERD50FJ474	RES,C 470K-J-1/2W
R823	ERDS2TJ222	RES,C 2.2K-J-1/4
R824	ERG3FJ390H	RES,M 39-J-3W
R825	ERDS2TJ102	RES,C 1K-J-1/4
R826	ERF2AKR22	RES,W .22-K-2W
R827	ERDS1FJ561	RES,C 560-J-1/2
R828	ERG3FJ470H	RES,M 47-J-3W
R829	ERQ14AJ180	RES,F 180-J-1/4
R1801	ERJ6GEYJ301	RES,M 300-J-1/10
		CT-27G22V CT-27G22CV
R1802	ERJ6GEYJ104	RES,M 100K-J-1/10
		CT-27G22V CT-27G22CV
R1803	ERJ6GEYJ474	RES,M 470K-J-1/10
		CT-27G22V CT-27G22CV
R1804	ERJ6GEYJ202	RES,M 2K-J-1/10
		CT-27G22V CT-27G22CV
R1805	ERJ6GEYJ102	RES,M 1K-J-1/10
		CT-27G22V CT-27G22CV
R1807	ERJ6GEYJ103	RES,M 10K-J-1/10
		CT-27G22V CT-27G22CV
R1808	ERJ6GEYJ103	RES,M 10K-J-1/10
		CT-27G22V CT-27G22CV
R1809	ERJ6GEYJ473	RES,M 47K-J-1/10
		CT-27G22V CT-27G22CV
R1810	ERJ6GEYJ103	RES,M 10K-J-1/10
		CT-27G22V CT-27G22CV
R1811	ERJ6GEYJ682	RES,M 6.8K-J-1/10
		CT-27G22V CT-27G22CV
R1812	ERJ6GEYJ153	RES,M 15K-J-1/10
		CT-27G22V CT-27G22CV
R1813	ERJ6GEYJ153	RES,M 15K-J-1/10
		CT-27G22V CT-27G22CV
R1814	ERJ6GEYJ361	RES,M 360-J-1/10
		CT-27G22V CT-27G22CV
R1815	ERJ6GEYJ471	RES,M 470-J-1/10
		CT-27G22V CT-27G22CV
R1818	ERJ6GEYJ101	RES,M 100-J-1/10
		CT-27G22V CT-27G22CV
R1819	ERJ6GEYJ101	RES,M 100-J-1/10
		CT-27G22V CT-27G22CV
R1822	ERJ6GEYJ682	RES,M 6.8K-J-1/10
		CT-27G22V CT-27G22CV
R1823	ERJ6GEYJ473	RES,M 47K-J-1/10
		CT-27G22V CT-27G22CV
R1825	ERJ6GEYJ471	RES,M 470-J-1/10
		CT-27G22V CT-27G22CV
R1827	ERJ6GEYJ102	RES,M 1K-J-1/10
		CT-27G22V CT-27G22CV
R1828	ERJ6GEYJ471	RES,M 470-J-1/10
		CT-27G22V CT-27G22CV
R1830	ERJ6GEYJ102	RES,M 1K-J-1/10
		CT-27G22V CT-27G22CV
R1856	ERJ6GEYJ153	RES,M 15K-J-1/10
		CT-27G22V CT-27G22CV
R2201	ERJ6GEYJ472	RES,M 4.7K-J-1/10

PARTS LIST

REPLACEMENT PARTS LIST

(Models: CT-27G12V, CT-27G12CV, CT-27G12UV, CT-27G22V, CT-27G22CV & CT-27G22UV)

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF. NO.	PART NO.	DESCRIPTION
R2202	ERJ6GEYJ153	RES,M 15K-J-1/10
R2203	ERJ6GEYJ104	RES,M 100K-J-1/10
R2204	ERJ6GEYJ473	RES,M 47K-J-1/10
R2205	ERJ6GEYJ154	RES,M 150K-J-1/10
R2206	ERJ6GEYJ102	RES,M 1K-J-1/10
R2207	ERJ6GEYJ102	RES,M 1K-J-1/10
R2208	ERJ6ENF9102	RES,M 91K-F-1/10
R2212	ERJ6GEYJ682	RES,M 6.8K-J-1/10
R2301	ERQ2CJP120	RES,F 12-J-2W
R2303	ERD25FJ1R0	RES,C 1.0-J-1/4
R2306	ERJ6GEYJ682	RES,M 6.8K-J-1/10
R2310	ERDS2TJ221	RES,C 220-J-1/4
R2311	ERJ6GEYJ103	RES,M 10K-J-1/10
R2312	ERJ6GEYJ682	RES,M 6.8K-J-1/10
R2313	ERJ6GEYJ683	RES,M 68K-J-1/10
R2314	ERJ6GEYJ104	RES,M 100K-J-1/10
R2317	ERJ6GEYJ561	RES,M 560-J-1/10
R2318	ERJ6GEYJ103	RES,M 10K-J-1/10
R2319	ERDS2TJ392	RES,C 3.9K-J-1/4
R2321	ERDS2TJ101	RES,C 100-J-1/4
R2322	ERJ6GEYJ472	RES,M 4.7K-J-1/10
R2353	ERD25FJ1R0	RES,C 1.0-J-1/4
R2356	ERJ6GEYJ682	RES,M 6.8K-J-1/10
R2357	ERJ6GEYJ103	RES,M 10K-J-1/10
R2358	ERJ6GEYJ122	RES,M 1.2K-J-1/10
R2359	ERJ6GEYJ103	RES,M 10K-J-1/10
R2360	ERJ6GEYJ122	RES,M 1.2K-J-1/10
R2361	ERJ6GEYJ681	RES,M 680-J-1/10
R2362	ERJ6GEYJ681	RES,M 680-J-1/10
R2451	ERJ6GEYJ225	RES,M 2.2MEG-J-1/10
R2455	ERJ6GEYJ243	RES,M 24K-J-1/10
R2456	ERJ6GEYJ223	RES,M 22K-J-1/10
R3001	ERJ6GEYJ473	RES,M 47K-J-1/10
R3002	ERJ6GEYJ104	RES,M 100K-J-1/10
R3005	ERDS2TJ750	RES,C 75-J-1/4
R3006	ERDS2TJ390	RES,C 39-J-1/4
R3009	ERDS2TJ682	RES,C 6.8K-J-1/4
R3010	ERJ6GEYJ334	RES,M 330K-J-1/10
R3011	ERDS2TJ682	RES,C 6.8K-J-1/4
R3012	ERDS2TJ334	RES,C 330K-J-1/4
R4301	ERJ6GEYJ471	RES,M 470-J-1/10
		CT-27G22V CT-27G22CV
R4303	ERJ6GEYJ123	RES,M 12K-J-1/10
		CT-27G22V CT-27G22CV
R4305	ERJ6GEYJ102	RES,M 1K-J-1/10
		CT-27G22V CT-27G22CV
R4306	ERJ6GEYJ102	RES,M 1K-J-1/10
		CT-27G22V CT-27G22CV
R4307	ERJ6GEYJ472	RES,M 4.7K-J-1/10
		CT-27G22V CT-27G22CV
R4308	ERJ6GEYJ104	RES,M 100K-J-1/10
		CT-27G22V CT-27G22CV
R4309	ERJ6GEYJ103	RES,M 10K-J-1/10
		CT-27G22V CT-27G22CV
R4326	ERJ6GEYJ471	RES,M 470-J-1/10
		CT-27G22V CT-27G22CV
R4327	ERJ6GEYJ331	RES,M 330-J-1/10
		CT-27G22V CT-27G22CV
R4328	ERJ6GEYJ560	RES,M 56-J-1/10
		CT-27G22V CT-27G22CV
R4329	ERJ6GEYJ222	RES,M 2.2K-J-1/10
		CT-27G22V CT-27G22CV
R4330	ERJ6GEYJ561	RES,M 560-J-1/10
		CT-27G22V CT-27G22CV
R4331	ERJ6GEYJ471	RES,M 470-J-1/10
		CT-27G22V CT-27G22CV
R4332	ERJ6GEYJ393	RES,M 39K-J-1/10
		CT-27G22V CT-27G22CV
R4333	ERJ6GEYJ334	RES,M 330K-J-1/10
		CT-27G22V CT-27G22CV
R4334	ERJ6GEYJ152	RES,M 1.5K-J-1/10
		CT-27G22V CT-27G22CV
R4336	ERJ6GEYJ680	RES,M 68-J-1/10
		CT-27G22V CT-27G22CV
R4338	ERJ6GEYJ222	RES,M 2.2K-J-1/10
		CT-27G22V CT-27G22CV
R4339	ERJ6GEYJ102	RES,M 1K-J-1/10
		CT-27G22V CT-27G22CV
R4340	ERJ6GEYJ471	RES,M 470-J-1/10
		CT-27G22V CT-27G22CV
R4341	ERJ6GEYJ222	RES,M 2.2K-J-1/10
		CT-27G22V CT-27G22CV
R4342	ERJ6GEYJ223	RES,M 22K-J-1/10
		CT-27G22V CT-27G22CV
R4343	ERJ6GEYJ101	RES,M 100-J-1/10
		CT-27G22V CT-27G22CV
R4344	ERJ6GEYJ682	RES,M 6.8K-J-1/10
		CT-27G22V CT-27G22CV
R4345	ERJ6GEYJ103	RES,M 10K-J-1/10
		CT-27G22V CT-27G22CV
R4350	ERJ6GEYJ682	RES,M 6.8K-J-1/10
		CT-27G22V CT-27G22CV
R4351	ERJ6GEYJ183	RES,M 18K-J-1/10
		CT-27G22V CT-27G22CV
		SWITCHES
S001	EVQPF106K	SWITCH
S002	EVQPF106K	SWITCH
S003	EVQPF106K	SWITCH
S004	EVQPF106K	SWITCH
S005	EVQPF106K	SWITCH
S008	EVQPF106K	SWITCH
S009	EVQPF106K	SWITCH
S2301	ESB621283	SWITCH, CATV
		TRANSFORMERS
T001	**TLP16297**	**TRANSFORMER, POWER SUPPLY**
T501	**TLH15452**	**TRANSFORMER, HORIZONTAL DRIVER**
T502	**ETE19Z30AY**	**TRANSFORMER, HORIZONTAL COUPLING**
T551	**KFT4AB055F**	**TRANSFORMER**
T801	**ETS28AE219NC**	**TRANSFORMER**

PARTS LIST

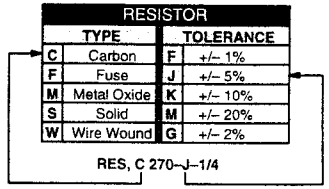
REPLACEMENT PARTS LIST

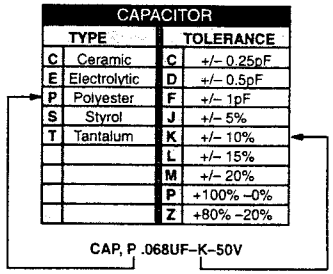
(Models: CT-27G12V, CT-27G12CV, CT-27G12UV, CT-27G22V, CT-27G22CV & CT-27G22UV)

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF. NO.	PART NO.	DESCRIPTION
		CRYSTALS/FILTERS
X001	TSS2AA002	CRYSTAL, 12MHZ
X101	M1969M	SAW FILTER
X102	EFCWS4504AB	FILTER 4.5MHZ
X201	EFCS4R5MS5W	FILTER 4.5MHZ BANDPASS
X501	TAFCSB503F38	CRYSTAL, CLOCK
X601	TSS2AA001	CRYSTAL, 3.58MHZ
X1801	TSSA050	CRYSTAL OSCILLATOR
		CT-27G22V CT-27G22CV
		OTHERS
TNR001	**ENV56D18G3**	**TUNER**
M001	EUR511000A	TRANSMITTER, REMOTE CONTROL
		CT-27G12V CT-27G12CV
M002	EUR511051	TRANSMITTER, REMOTE CONTROL
		CT-27G22V CT-27G22CV
M003	**M68LGL061X**	**CRT 27"**
M004	TAS2A0001	SPEAKER 16-OHM
M005	TBM2A10141	BADGE, PANASONIC
M006	TBX1886601	PUSHBUTTON, SPEAKER
M007	TBX2AA00801G	BUTTON, 7-KEY
M008	TJSC00300	CRT SOCKET
M009	TLC2047-2	MAGNET,RINGS:PURITY & STATIC CONV.
M010	TMM2A30701	WEDGE, YOKE
M011	TMW2A97121	STRAIN RELIEF: AC LINE CORD
M012	TQB2AA0143	MANUAL, OWNERS
		CT-27G22V
M013	TQB2AA0144	MANUAL, OWNERS (BI-LING)
		CT-27G22CV
M014	TQB2AA0145	MANUAL, OWNERS
		CT-27G12V
M015	TQB2AA0146	MANUAL, OWNERS (BI-LING)
		CT-27G12CV
M016	**TSX2AA0011**	**LINE CORD**
M017	TXFKU0197SER	ASSY, CABINET BACK 27"
M018	TXFKY0497SER	ASSY, CABINET FRONT 27"
M019	TXF3A01ADR	ASSY., DAG GND
M020	UR51EC810A	BATTERY COVER
		CT-27G12V CT-27G12CV
M021	UR51EC843A	BATTERY COVER
		CT-27G22V CT-27G22CV
M022	0FMK014ZZ	CONVERGENCE CORRECTOR STRIP
JK3001	TJB2A9063B	ASSY. JACK 1A/V

DESCRIPTION OF ABBREVIATIONS GUIDE





SERVICEMAN MODE (ELECTRONIC CONTROL)
SERVICE ADJUSTMENT VALUES

Model _____ Ser # _____ Date _____

Note: Record the original settings PRIOR to modifying the registers.

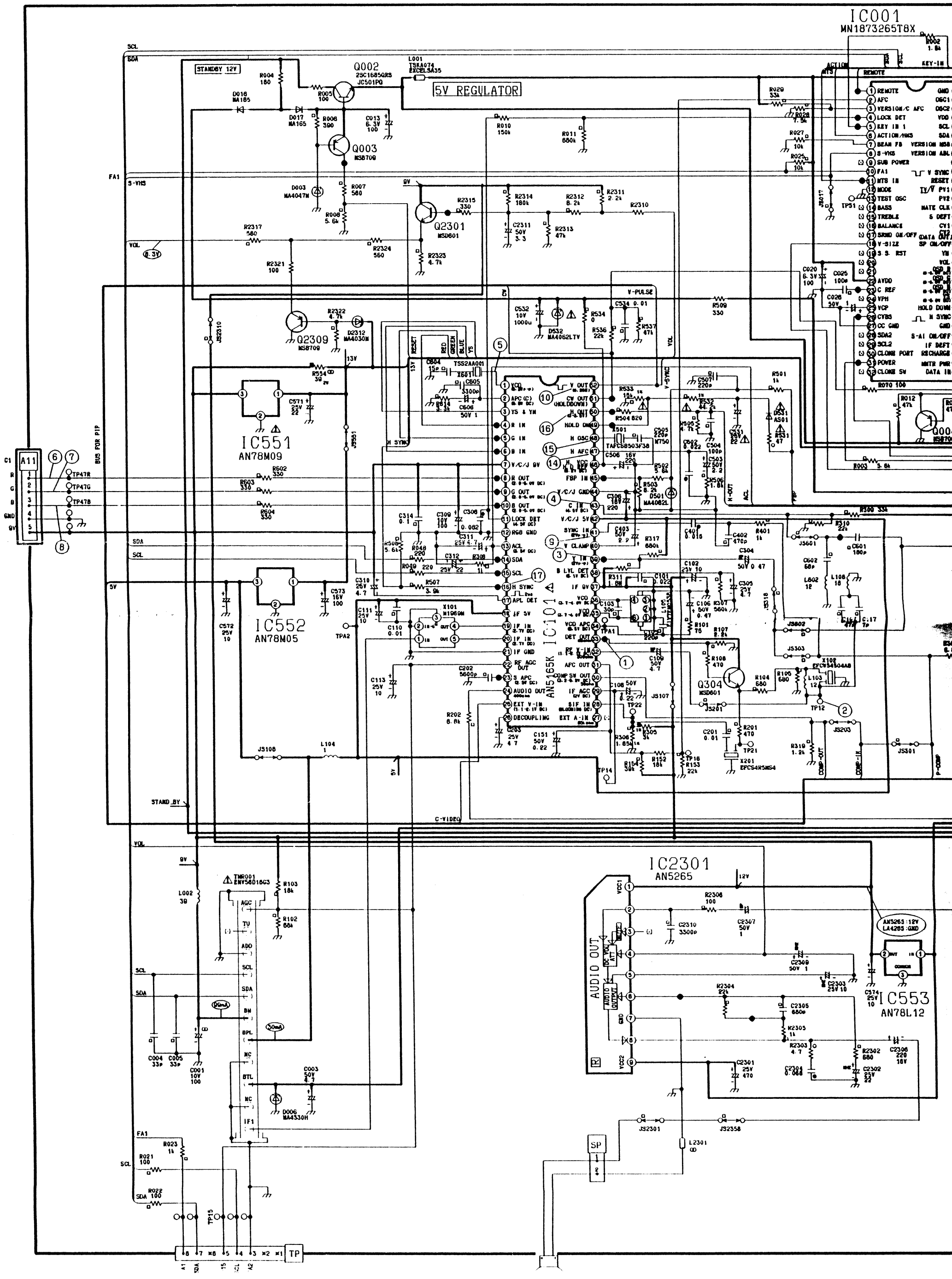
Mode	Service Adjustment	Adjustment Range	Def Val.	Original Value	New Value
Sub Adjustments					
B0	Sub Color	0 ~ 63	33		
B1	Sub Tint	0 ~ 63	33		
B2	Sub Brightness	0 ~ 255	80		
B3	Sub Contrast	0 ~ 63	34		
B4	Killer/ABL/Gamma	0 ~ 7	5		
B5	Video Adjustment	0 ~ 15	8		
B6	Audio Adjustment	0 ~ 31	16		
B7	V-Size	0 ~ 63	20		
White Balance Adjustments					
C0	RED Cutoff	*	0 128		
C1	GRN Cutoff	0 ~ 255	64		
C2	BLU Cutoff	*	0 128		
C3	R Drive	0 ~ 127	64		
C4	Blue Drive	0 ~ 127	64		
C5	YNR Switch	0 ~ 1	0		
C6	AFT	*	0 120		
C7	RF AGC	0 ~ 127	64		
C8	YNR	0 ~ 7	0		
C9	Horizontal-Center	0 ~ 31	16		
Ca	Beam Limit	0 ~ 7	0		
Cb	Y Delay	0 ~ 2	2		

* Adjustment indicated in steps:
0 0 ~ 0 255
1 0 ~ 1 255

Mode	Service Adjustment	Adjustment Range	Def. Val.	Original Value	New Value
Options Adjustments					
S0	PIP Color	0 ~ 63	25		
S1	PIP Contrast	0 ~ 127	52		
S2	Up 1/9	0 ~ 255	26		
S3	Down 1/9	0 ~ 255	146		
S4	Left 1/9	0 ~ 255	9		
S5	Right 1/9	0 ~ 255	103		
S6	Up 1/16	0 ~ 255	27		
S7	Down 1/16	0 ~ 255	163		
S8	Left 1/16	0 ~ 255	9		
S9	Right 1/16	0 ~ 255	118		
Sa	Freerun	**	**		
Sb	Clock Adjustment	0 ~ 255	128		
Sc	Pip Tint	0 ~ 63	50		
Sd	Loudness Compensation	0 ~ 63	52		
MTS Adjustments					
M0	Input Level	0 ~ 63	31		
M1	Stereo PLLVCO	0 ~ 63	31		
M2	Filter	0 ~ 63	31		
M3	Low-level Separation	0 ~ 63	31		
M4	High-level Separation	0 ~ 63	31		

** Set Freerun on when this item is selected.

Printed in USA
97034000ME0310U


IC001
MN1873265T8X
5V REGULATOR
STANDBY 12V
Q002
2SC1685QRS
JC501PQ
L001
TSKA074
EXCELSA35
Q003
MSB709
Q2301
MSD601
Q2309
MSB709
Q304
MSD601
IC551
AN78M09
IC552
AN78M05
IC101
AN5165K
IC2301
AN5265
IC553
AN78L12
X601
TSS2AA001
X501
TAFCS8503F38
X101
M1060M
X102
EFCS4R5MS4
X201
EFCS4R5MS4
TNR001
ENV56D18G3
D016
MA165
D017
MA165
D003
MA4047M
D2312
MA4030M
D532
MA4062LTV
D501
MA4082L
D531
AS01
D006
MA4330H
SCL
SDA
FA1
S-VHS
VOL
8.3V
9V
5V
13V
H SYNC
V-SYNC
V-PULSE
RESET
STAND BY
C-VIDEO
BUS FOR PIP
REMOTE
ACTION
MTS
KEY-IN
AUDIO OUT
SP
TP
2
3
4

IC001
MN1873265T8X

IC002
24LC02BIP
I²C
EEPROM

IC003
PIC-12042SRB

IC553
AN78L12

IC803
STR58041A

POWER
SWITCH

COLD

HOT

ACCORD
T5I2AA0011

Board Index
"A"-Board – Main Chassis
"C"-Board – CRT Board

TNP2AH003DG (A)

ACTION
KEY-IN
5V
R032 10k
R030 1k
CH UP
CH DWN
VOL UP
VOL DWN
POWER
TP57
R038 22k
R037 10k
R036 8k
R035 2k
R034 2k
R033 2.2k
EVQQKN06K S006 S005 S004 S003 S002 S001
R820 15k
R821 3.9k

IC451
LA7837-TV
V. OUT
VCC1 VERT IN ONE SHOT MULTI RAMP GEN 50/60 Hz RAMP GEN DRIVE VCC2 PUMP UP GND VERT OUT
R469 22
C451 10V 47
R458 68k
C452 25V 1
C456 0.01
R467 100k
R468 100
R454 47k
R455 15k
C455 25V 100
D451 ERA15-01
C459 35V 470
R463 47k
R457 910
R456 5.6k
C453 50V 2.2
R466 27k
R460 1k
J5451
Q452 MS0601
Q451 MS0601
D452 MA4047M
R471 22k
R451 1.8
C454 25V 1000
R470 1.5k
R462 47k
NECK PROTECTOR
ACL
H-OUT
C308 120p
13V
26V
FBP
ACL

HOT
COLD
HOT
COLD
HOT
COLD
HOT
COLD

T502 ETE19230AY
C510 500V 10p
Q501 2SC1573AH
R512 5.6k 2W
DOUBLE 1W/2W
C511 820p 500V
H. DRIVE
T501 ETH19Y70AYM
C512 100p 500V
R510 1.8k
C566 2kV 180p
H. OUT
Q551 BU2508DF
J5553
J5552
C565 470p 2kV
C564 8200p 1.2kV
L551 TLM15652P
J5667
C568 0.30 200V
R567 1.2k
T551 KFT3AB054F
R617 4.7
C823 100V 33
D554 BYD33G-143
R555 100 1W
C557 2200p 500V
C555 250V 82
D553 BYD33G-143
R553 1
C563 100V 1500p
C562 25V 220
D561 BYD33G-143
R552 1.0
C561 500V 560p
TPD8
R551 1.0
D551 RU2M
C554 500V 560p
TPD9
C556 16V 470
D558 MA4360H
C560 50V 2.2
TPD1
R557 10k
R556 3.3k
D555 MA185
D560 MA185
R565 10k
R564 100k
R563 120k
HEATER (G)
464mA
13V
26V
19V
200V
DY KDY3NE708F
Y. H1
Y. L2
H. L4
H. H6
V
H
A12

815V
C805 200V 150
C806 200V 150
R805 270k
R806 270k
D824 EU02
R829 27
C815 50V 47
Q802 2SC1685RS JC501RS
D822 EU02
D826 EU02
D829 MA185
R827 680
R824 68
C814 0.033
R823 8.2k
R828 47
D820 EU02
D821 EU02
R826 0.33
R825 1k
Q801 2SC1685RS JC501RS
TC801 DN3131R TLP621GR
C807 50V 3.3
Q804 2SA1767Q
C808 16V 100
R808 1.5
R809 1.5
D823 RL30A
C810 1kV 820p
C809 200V 150
D825 TVSSR2KLV
J5826
130V
T801 ETS25AB126HC

TP-2009 DV
A-BOARD SCHEM

IC001
MN1873265T8X

5V REGULATOR

STANDBY 12V

Q002 2SC1685QRS JC501PQ

L001 TSKA074 EXCELSA35

Q003 MSB709

Q2301 MSD601

Q2309 MSB709

Q004 MSB709

Q304 MSD601

IC551 AN78M09

IC552 AN78M05

IC101 AN5165K

IC2301 AN5265

IC553 AN78L12

X101 M1960M

X102 EFCW4504AB

X201 EFCS4R5MS4

TNR001 ENV56D18G3

TSS2AA001

TAFC58503F38

D532 MA4062LTV

D2312 MA4030M

D003 MA4047M

D016 MA165

D017 MA165

D501 MA4082L

D531 AS01

D006 MA4330H

D3006 MA4110M

D3007 MA4110M

D3008 MA4110M

D3009 MA4110M

REMOTE

KEY-IN

ACTION/MTS

V-PULSE

H SYNC

V-SYNC

AUDIO OUT

SP

FRONT
TJB2AA0032

TJB2A9061

BUS FOR PIP

TP

STAND_BY

C-VIDEO

L-KY1

COMP-OUT

COMP-IN

P-COMP

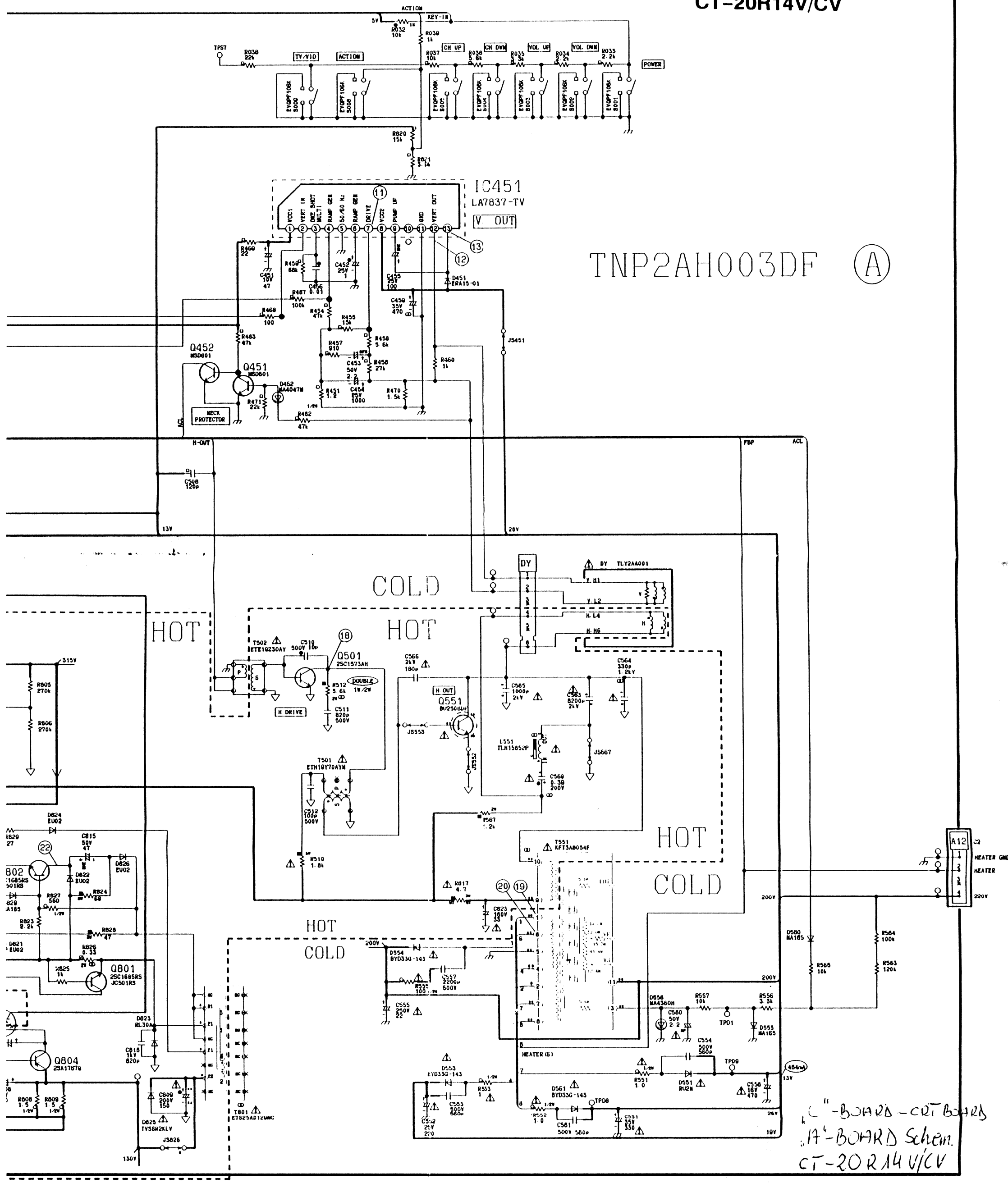
AN5265 : 12V
LA4285 : GND

001
73265T8X

R002 1.8k
KEY-IN
J5005
J5011
SDA SCL
IC003 PIC-12042SRB
ACTION
REMOTE
C011 220 16V
C010 0.01
X001 TS52AA002
C017 22p
C018 22p
L004 2.2
L005 2.2
C033 100p
J5007
R053 10k
R055 10k
R030 10k
R060 330
TP52
C024 25V 4.7
C018 100p
C038 22p
C037 22p
R068 2.2k
R067 2.2k
R066 2.2k
R065 2.2k
R013 0
C031 820p
J5015
D006 MA165
R070 100
R012 47k
R020 470k
C019 6.3V 100
Q004 MSB709
C036 22p
R045 1k
5V
L006 47
C032 10V 47
C008 0.01
L006 TSKA072 EXCELSA24T
IC002 24LC02BIP I²C EEPROM
SCL
SDA
R016 4.7k
R017 4.7k
JS006
9V
R465 10k
R466 10k
C462 25V 10
CC
13V
7.6V
D009 MA165
H-VCC
C-IN
9V
STAND BY
16V
D011 MA165
7.5V
R2301 12
AUDIO B+
19V
200V
L009 TSKA074 EXCELSA36V
R550 68k
JS012
R303 6.8k
C301 39p
Q302 MSD601
R320 1k
C302 50V 1
R304 3.3k
BUS FOR PIP
JS301
P-COMP
R3001 47k
R3002 100k
Q3001 MSD601
D3001 MA165
TP802
D810 TAP104XM05
QEG
R801 1.5
C801 500V 4700p
D801 EM02BM
D802 EM02BM
C802 4700p 500V
J5803
C805 200V 150
C806 200V 150
R805 270k
R806 270k
315V
POWER
J5009
Q001 MSD601
D002 MA165
RLB01 TSEH8007 TSEH0005
D001 ERA15-01
POWER SWITCH
C022 16V 470
T001 TLP16297
L-AV1
V-OUT
JS2302
JS2305
4.5V
JS2311
R1
AN5265 :12V
LA4285 :GND
IC553
AN78L12
C2306 220 16V
D3004 MA4110M
C3001 50V 10
C3005 2700p
R3010 330k
R3013 220
R3009 220
D3008 MA4110M
D3009 MA4110M
R3006 390
R3005 75
C3003 50V 1.0
D3002 MA4110M
STAND BY
H-VCC
POWER
9V
TJB2A9061A
L801 ELF15N013A
C812 AC250V 0.22
R815 6.2M
F801 0BA1C63NU100
CRA801 EXNG471P365
CRA802 EXNG471P365
COLD
C811 0.015 AC250V
C810 0.015 AC250V
ACCORD TSX2AA0011
R822 470k
C825 470p
L804 EXCELSA39 TSKA078
D824 EU02
R829 27
C815 50V 47
22
21
C820 63V 10
Q802 2SC1685RS JC501RS
D822 EU02
D828 MA165
R827 560
R824 68
C824 330p
C814 0.033
R823 8.2k
R828 47
D820 EU02
D821 EU02
R826 0.33
IC803 STR58041A
IC801 ONC3131R TLP621GRJ
D807 MA165
D806 MA4047H
R813 5.6k
R812 18k
C807 50V 3.3
Q804 2SA1767G
C808 16V 100
R808 1.5
R809 1.5
R810 2.7k
L802 68
JS804
HOT
COLD

A-Board Schematic
CT-20R14V/CV

TNP2AH003DF (A)



IC001
MN1873265T8X
5V REGULATOR
STANDBY 12V
Q002
2SC1685QRS
JC501PQ
L001
TSRA074
EXCELSA35
Q003
MSB709
Q2309
MSB709
IC551
AN78N09
IC552
AN78M05
IC101
AN5165K
IC2304
LA4285
IC2303
LA4285
Q004
MSB709
Q304
MSD601
AUDIO OUT
REMOTE
KEY-IN
BUS FOR PIP
STAND_BY
SCL
SDA
5V
9V
12V
VOL
FA1
AUDIO
S-VHS
TV-OUT
C-IN
Y-IN
CV1
P-COMP
V-PULSE
H-PULSE
L-AV1
C-VIDEO
R-AV1
TV-L
TV-R
SP
TP
2
3
4

IC001
MN1873265T8X

IC002
24LC02BIP
I²C
EEPROM

IC2201
AN5819K
MTS

IC2451
AN5285K
SOUND AGC

IC803
STR58041A

Q004
MSB709

Q3001
MSD601

Q302
MSD601

Q001
MSD601

Q802
2SC1384R5

Q804
2SA1767Q

POWER
SWITCH

COLD
HOT

JK3001 TJB2A9063B

A-Board Schematic
CT-27G12V/CV/UV

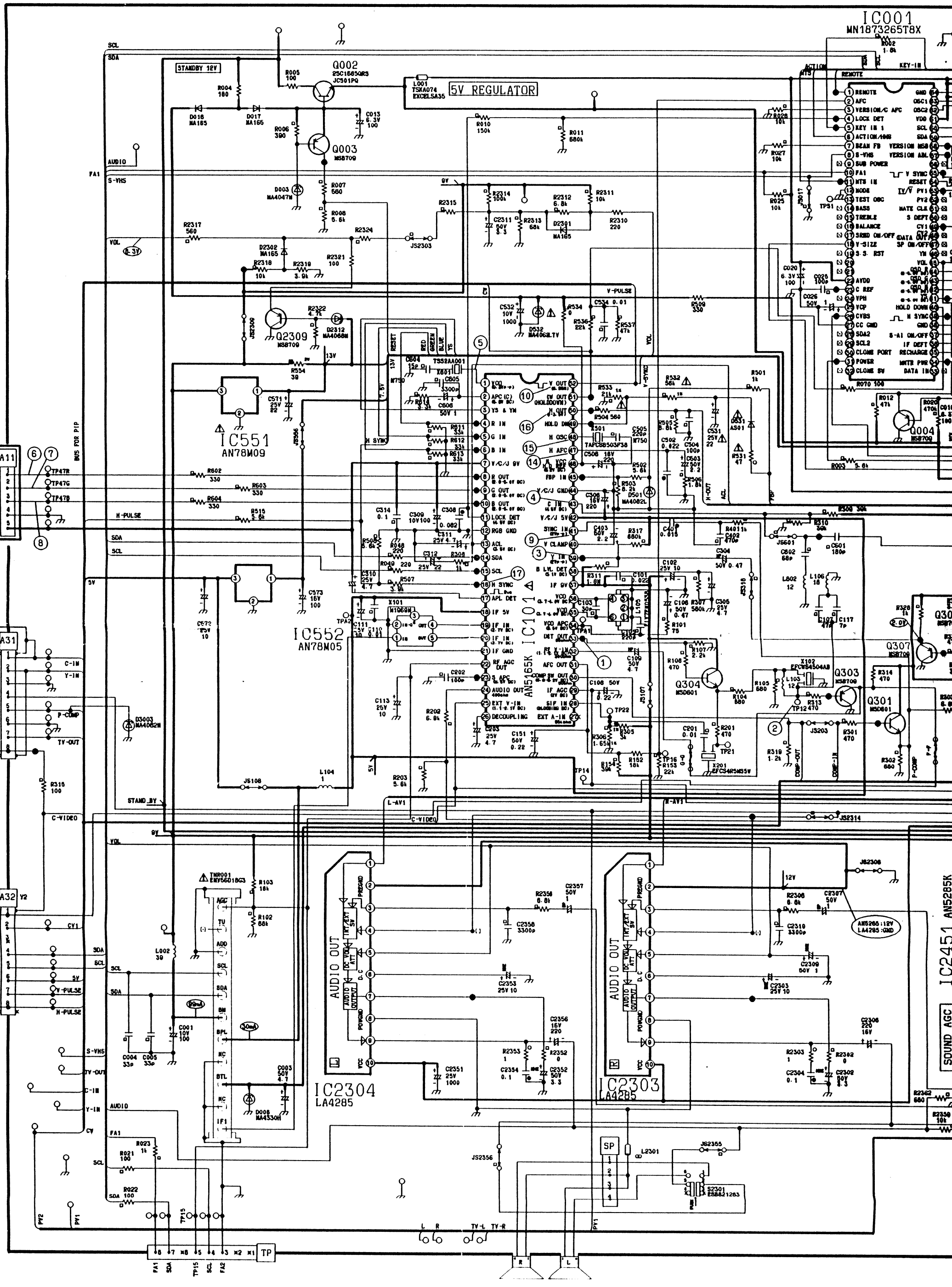
IMPORTANT SAFETY NOTICE

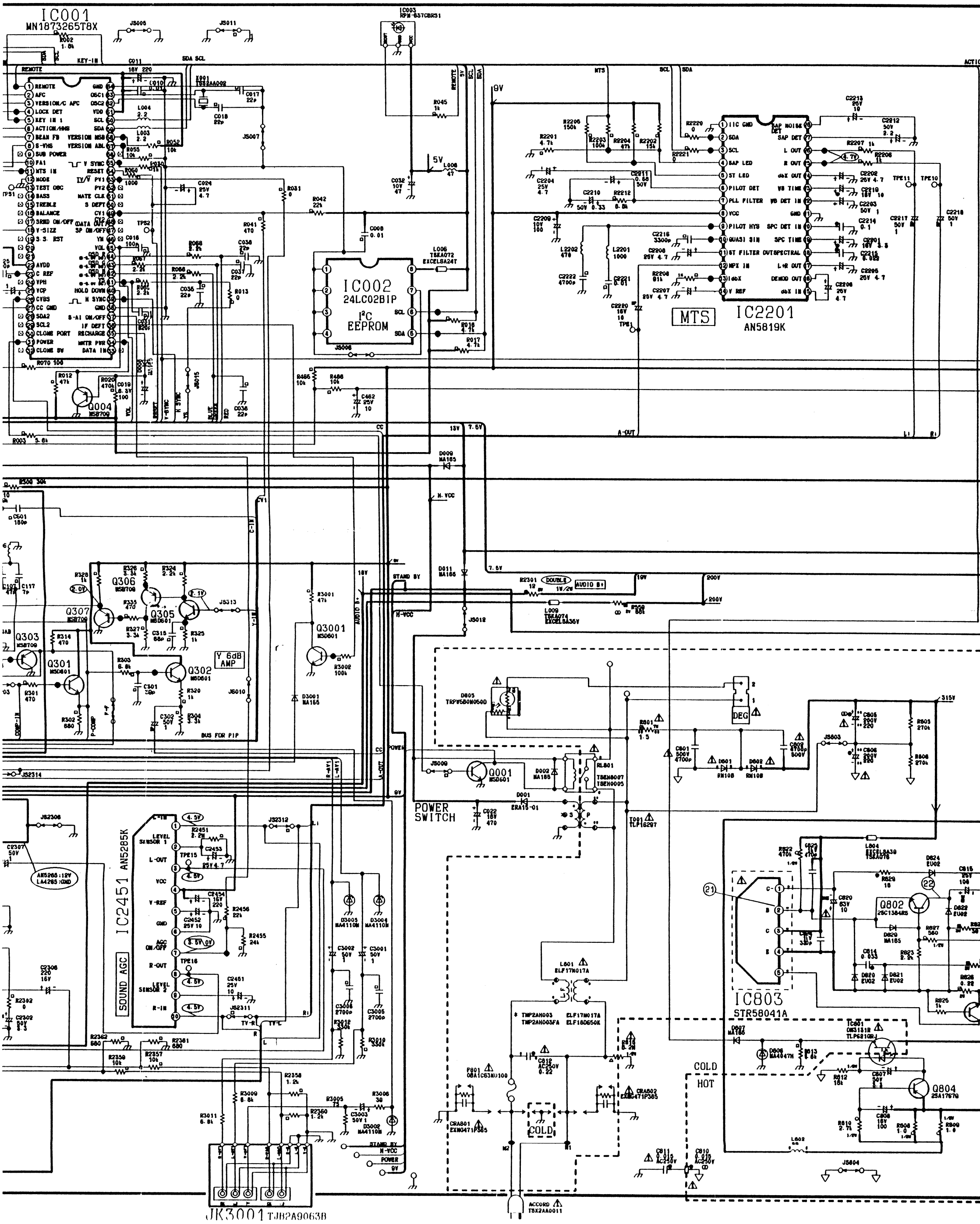
THIS SCHEMATIC DIAGRAM INCORPORATES SPECIAL FEATURES THAT ARE IMPORTANT FOR PROTECTION FROM X-RADIATION, FIRE AND ELECTRICAL SHOCK HAZARDS. WHEN SERVICING IT IS ESSENTIAL THAT ONLY MANUFACTURERS SPECIFIED PARTS BE USED FOR THE CRITICAL COMPONENTS DESIGNATED WITH A ⚠ IN THE SCHEMATIC.

TNP2AH003BA/BH (A)

* The only difference between TNP2AH003BA and TNP2AH003BH is L801.

ACTION
KEY-IN
TV/VID
CH UP
CH DWN
VOL UP
VOL DWN
POWER
IC451 LA7838 ⚠
V. OUT
Q452 RSD601
Q451 RSD601
D452 MA4047M
NECK PROTECTOR
H-OUT
FBP
13V
26V
COLD
HOT
DY
DY TLY15525F
T502 ETE19230AY
Q501 2SC4212MLB
H. DRIVE
DOUBLE
Q551 BU2508DF
T501 TLH15452
T551 KFT4AB055F
T601 ET526AE219NC
Q802 2SC1384R5
Q801 2SC1685R5 JC501R5
Q804 2SA1767Q
D825 TVSSR2KLV
A12
HEATER
220V
200V
315V
130V
464mA


IC001
MN187326STBX
STANDBY 12V
5V REGULATOR
Q002
2SC1685QRS
JC501PQ
Q003
MSB709
IC551
AN78M09
IC552
AN78M05
IC101
AN5165K
IC2304
LA4285
IC2303
LA4285
IC2451
AN5285K
SOUND AGC
Q2309
MSB709
Q004
MSB709
Q307
MSB709
Q303
MSB709
Q304
MSD601
Q301
MSD601
SCL
SDA
AUDIO
FA1
S-VHS
VOL
5V
9V
13V
H-PULSE
V-PULSE
C-VIDEO
STAND_BY
BUS FOR PIP
FOR PIP
REMOTE
KEY-IN
ACTION/MS
SP
AUDIO OUT
SP ON/OFF
DATA OUT
DATA IN
SAT ON/OFF
COMP-OUT
COMP-IN
P-COMP
TV-OUT
C-IN
Y-IN
L-AV1
R-AV1
TV-L
TV-R
L
R

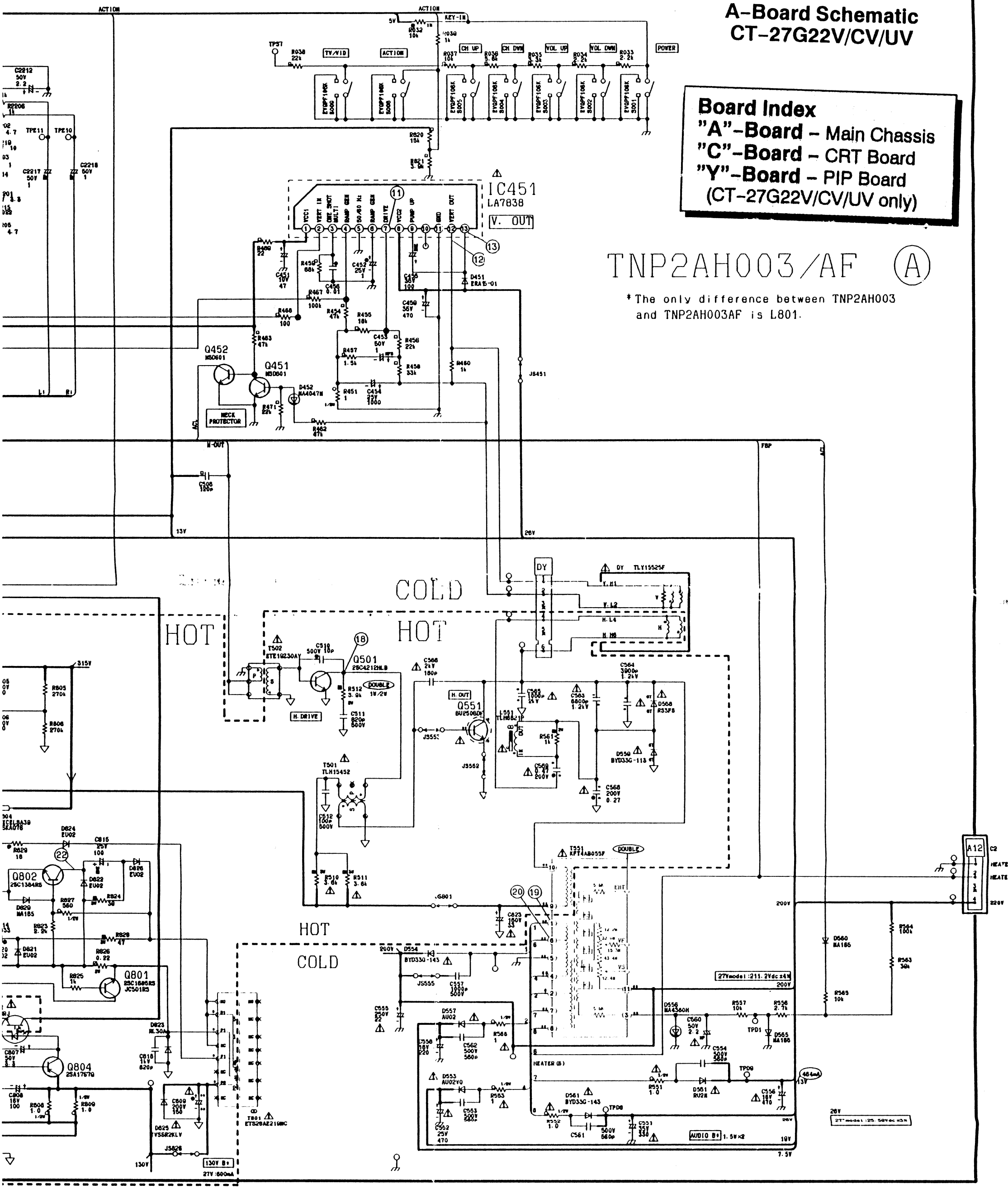

IC001
MN187326STBX
IC002
24LC02B1P
I²C
EEPROM
IC2201
AN5819K
MTS
IC2451
AN5285K
SOUND AGC
IC803
STR58041A
JK3001 TJB2A9063B
POWER
SWITCH
COLD
HOT
Y 6dB
AMP
BUS FOR PIP
STAND BY
N-VCC
POWER
9V
5V
13V
7.5V
AUDIO B+
A-OUT
SDA
SCL
REMOTE
KEY-IN
ACCORD TSX2AA0011

A-Board Schematic
CT-27G22V/CV/UV

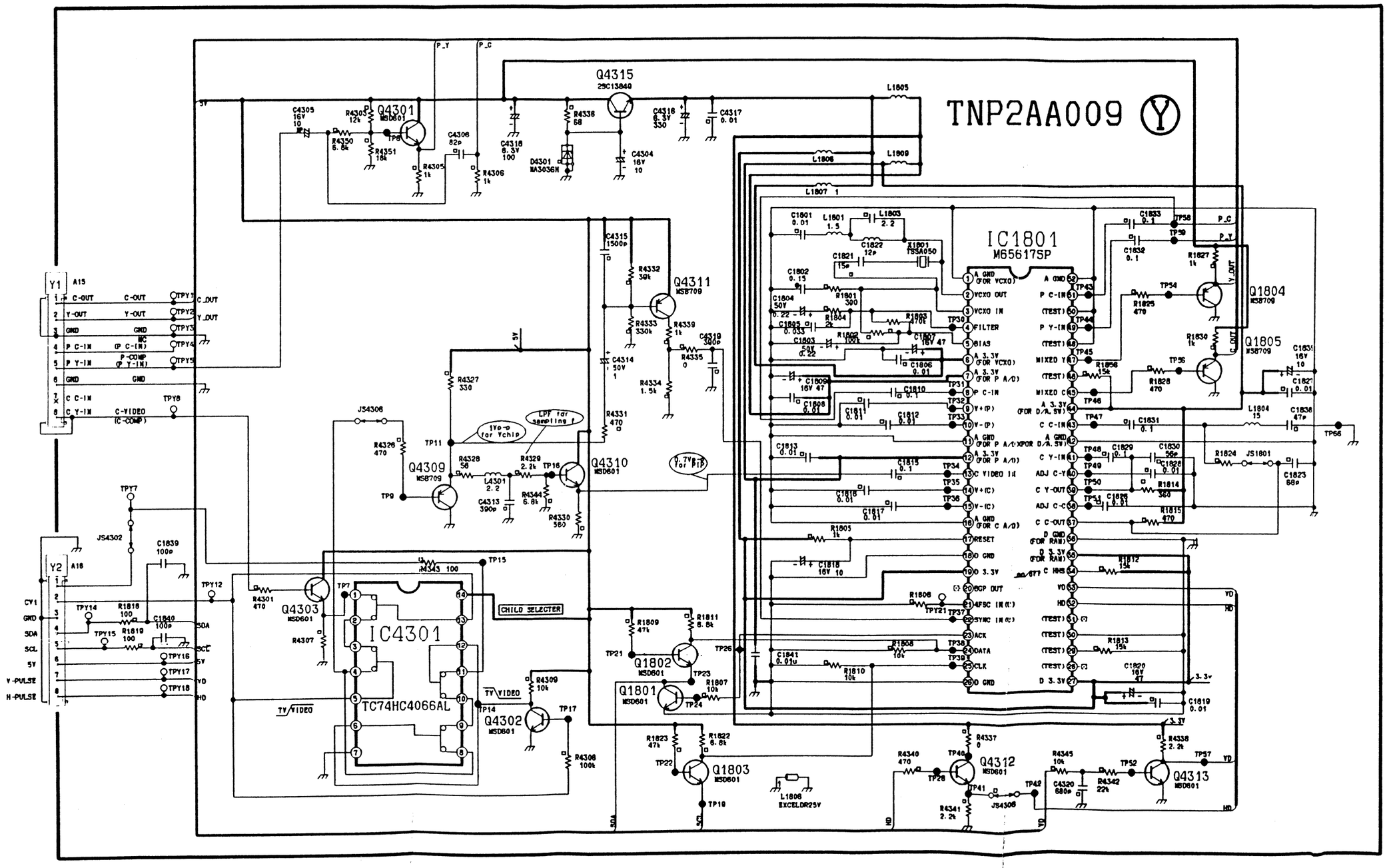
Board Index
"A"-Board – Main Chassis
"C"-Board – CRT Board
"Y"-Board – PIP Board
(CT-27G22V/CV/UV only)

TNP2AH003/AF (A)

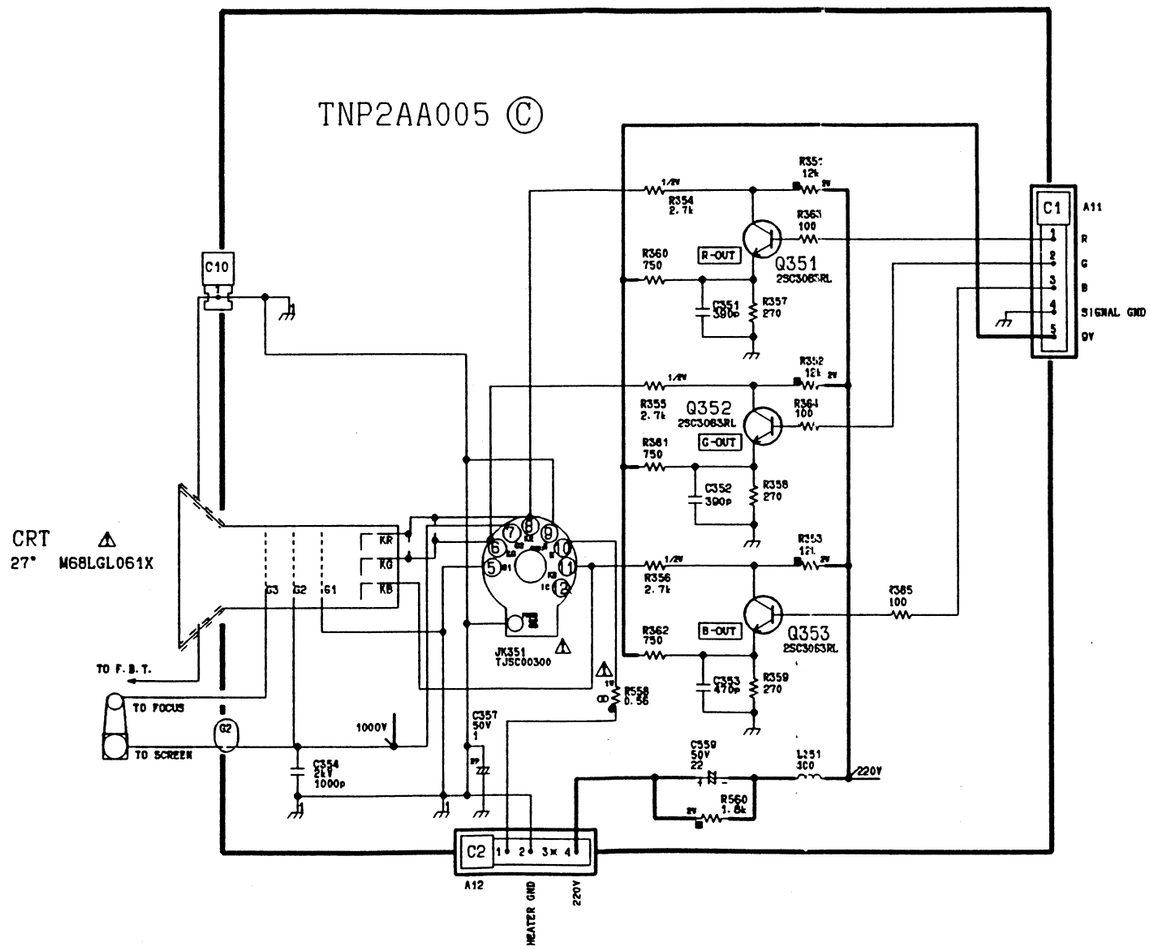
* The only difference between TNP2AH003 and TNP2AH003AF is L801.



Y-Board Schematic
CT-27G22V/CV/UV

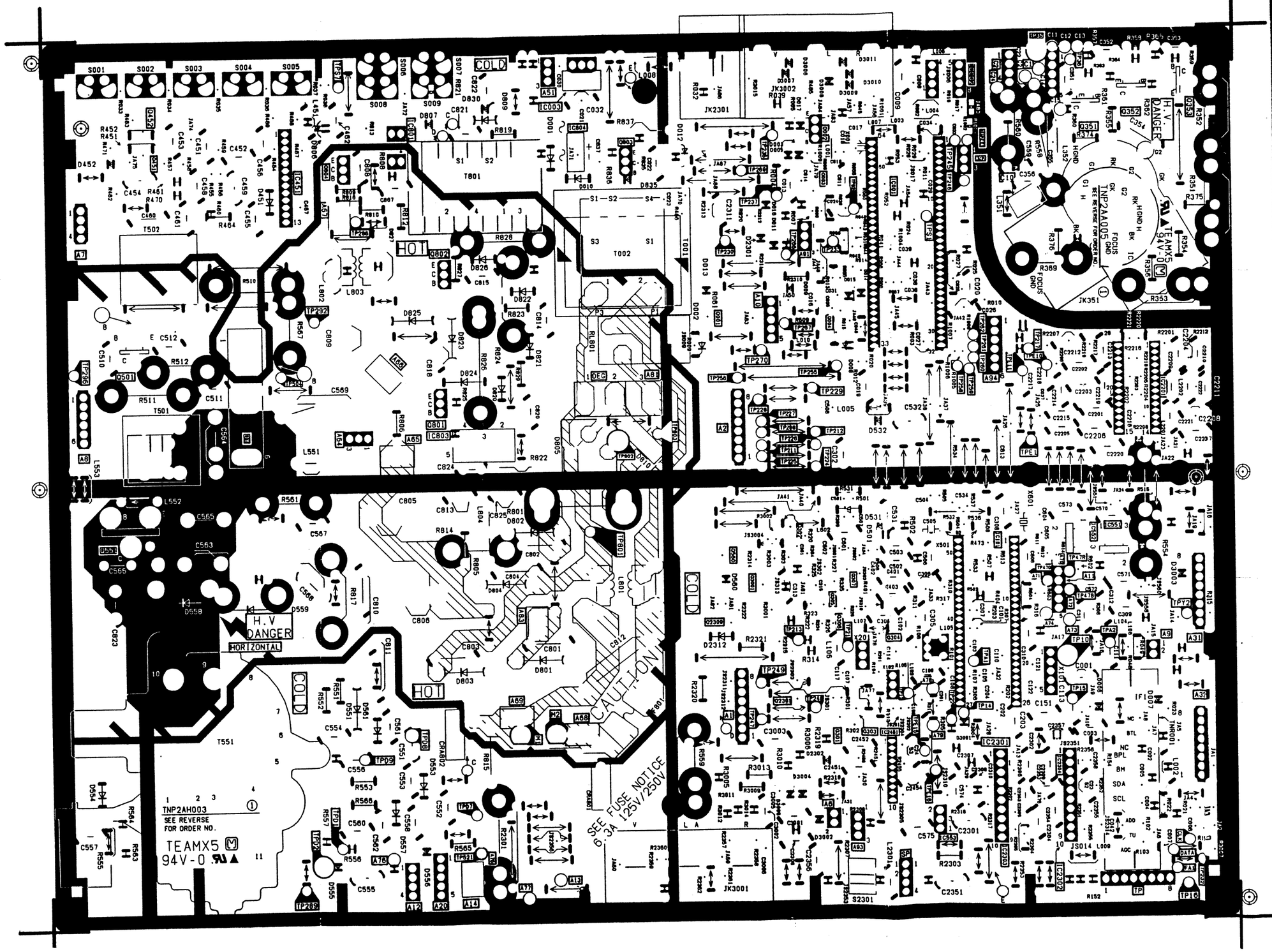


C-Board Schematic
27" MODELS



A-Board Layout

C-Board Layout



Tuner Voltage Chart

Enable, Data, and Clock have no DC readings. They are digital signals from the MPU.

NOTE: Voltage at the 30V test pin varies with channel selection. Refer to chart for sample tuning voltages of TV/CATV(CABLE) channels as shown.

Voltage Reading Are Nominal And May Vary ± 15%

- VHF -	
Ch. 02	4.0V
Ch. 06	8.2V
Ch. 07	7.0V
Ch. 13	9.3V

- UHF -	
Ch. 14	7.7V
Ch. 69	24V

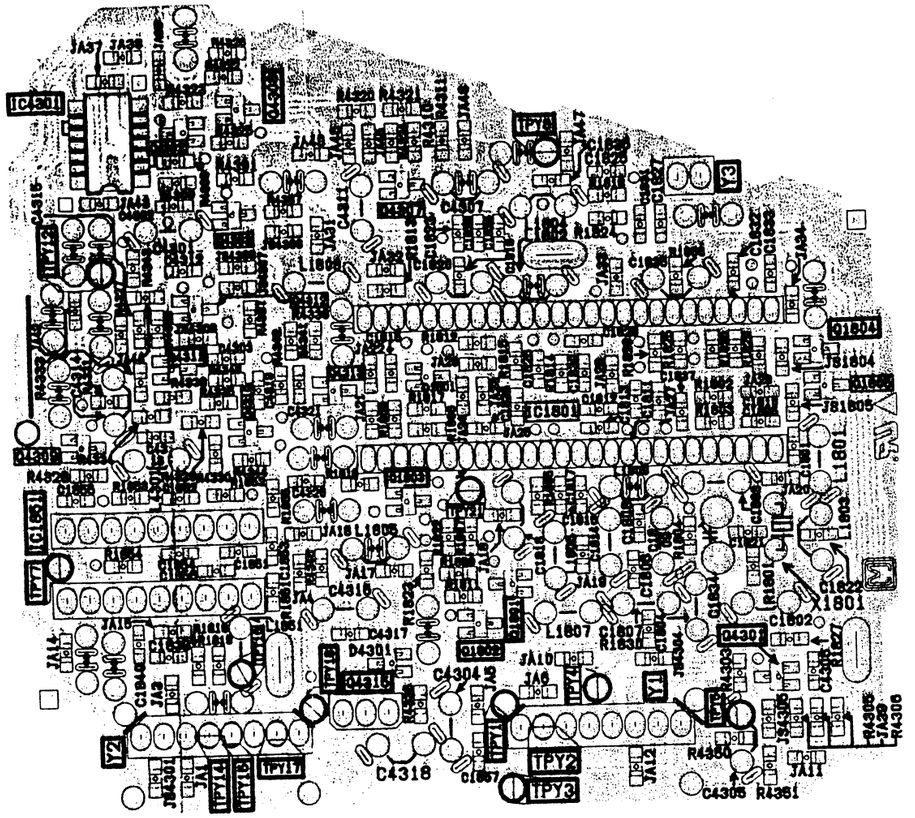
- CABLE -					
1st Band		2nd Band		3rd Band	
Ch. 1	6.7V	Ch. 16	4.5V	Ch. 47	3.7V
Ch. 15	24.7V	Ch. 46	2.70V	Ch. 94	14.9V
Ch. 95	9.8V			Ch. 100	15.1V
Ch. 99	17.5V			Ch. 125	24.0V

MICROPROCESSOR PROGRAMMING FOR BAND TUNING/SWITCHING

54MHz ◄——► 130MHz ◄——► 360MHz ◄——► 806MHz

	FIRST TUNING BAND	SECOND TUNING BAND	THIRD TUNING BAND
VHF	02-06	07-13	
UHF			14-69
CABLE	01-06,14,15, 95-99	07-13, 16-46	47-94, 100-125

NOTE: CABLE channel numbers as recommended by the joint EIA/NCTA Engineering Committee and published as EIA INTERIM STANDARD NO. 5 — CABLE TELEVISION CHANNEL IDENTIFICATION PLAN — MAY 1983.



Y-Board Layout

Note: Stereo Models

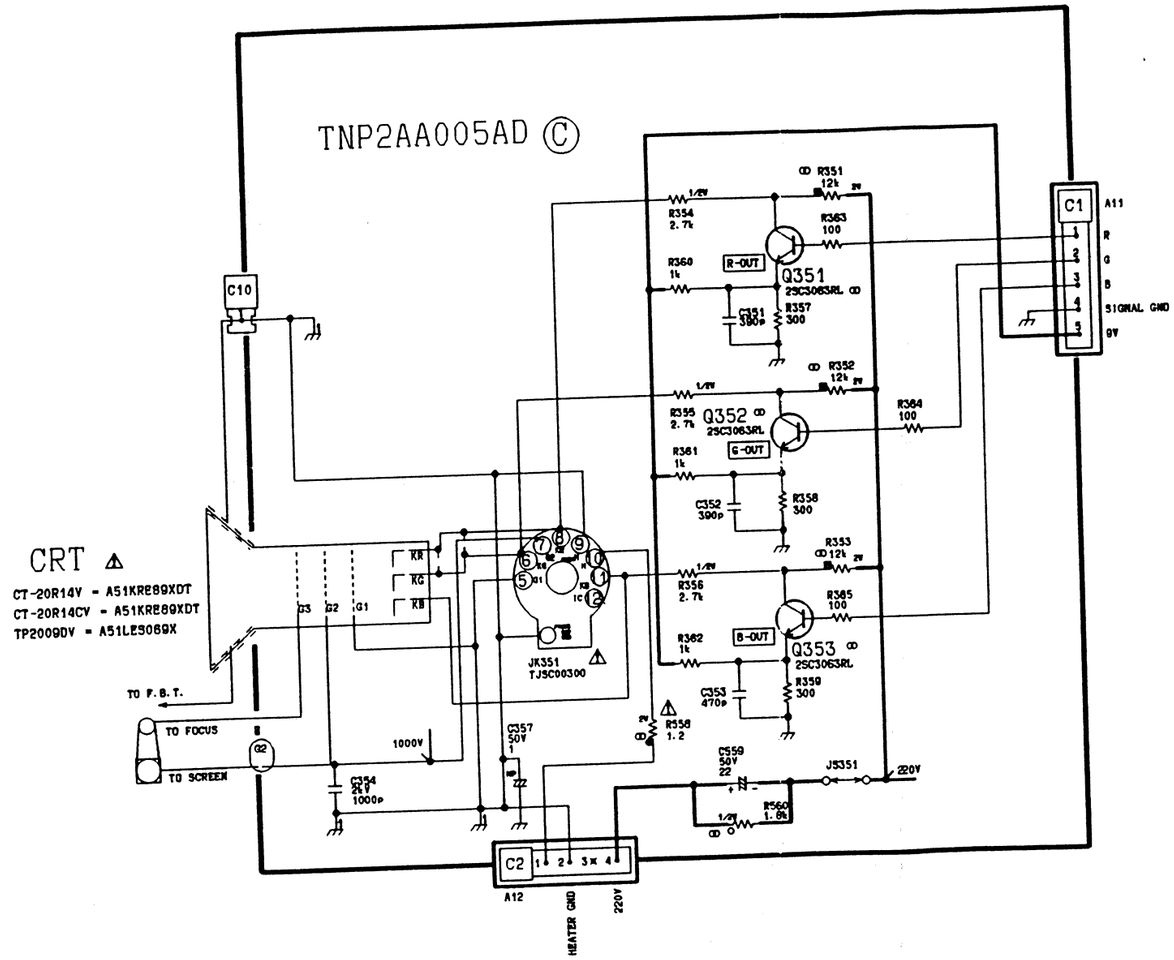
The Functions listed below are activated by a DC voltage change to DAC Inputs (Pin 5 and 6) of MPU IC001. Press and hold a function button on the Receiver to measure voltages.

FUNCTION	PIN 5	PIN 6
POWER	0V~0.443V	N/A
VOL ◄	0.797V~1.07V	N/A
VOL ►	1.424V~1.696V	N/A
CH ▼	2.05V~2.323V	N/A
CH ▲	2.677V~2.95V	N/A
TV/VIDEO	3.304V~3.576V	N/A
ACTION	N/A	0V~0.443V
SHUT DOWN	N/A	3.930V~5.000V

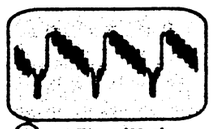
The AUDIO MODES being broadcast are displayed on screen in red by the voltage change to DAC Input (Pin 11) of MPU IC001.

AUDIO MODE BROADCAST	PIN 11 MN1872265T7G
MONO	4.0V~5.0V
SAP	2.2V~3.8V
STEREO	0.9V~1.9V
STEREO & SAP	0V~0.6V

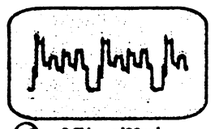
C-Board Schematic
20" MODELS



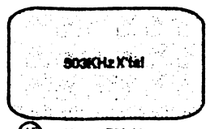
Waveforms – A-Board



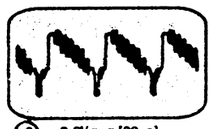
1 1.7V p-p [20µs]
IC101 PIN 33 (DET OUT)



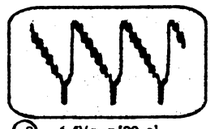
8 3.7V p-p [20µs]
A11 PIN 3 (B)
TP47B



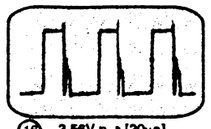
15 IC101 PIN 48
H OSC
OSC Waveform



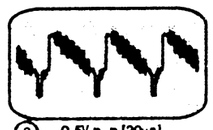
2 0.9V p-p [20µs]
TP12



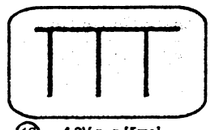
9 1.4V p-p [20µs]
IC101 PIN 41 (SYNC)



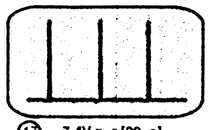
16 3.56V p-p [20µs]
IC101 PIN 50 (H OUT)



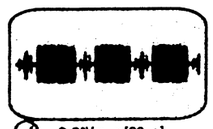
3 0.5V p-p [20µs]
IC101 PIN 39 (Y IN)



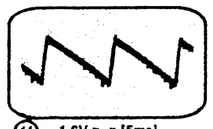
10 4.3V p-p [5ms]
IC101 PIN 52 (VERT OUT)



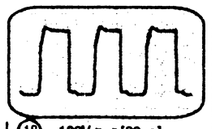
17 7.4V p-p [20µs]
IC101 PIN 18 (H SYNC)



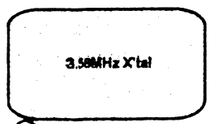
4 0.38V p-p [20µs]
IC101 PIN 43 (C IN)



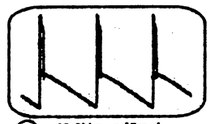
11 1.6V p-p [5ms]
IC451 PIN 7 (DRIVE)



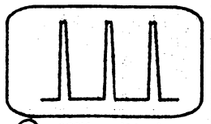
18 180V p-p [20µs]
Q501 collector (H DRIVE)



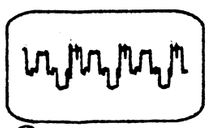
5 IC101 PIN 1
3.58VCO
OSC Waveform



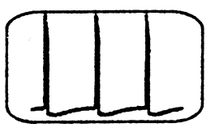
12 48.8V p-p [5ms]
IC451 PIN 12 (VERT OUT)



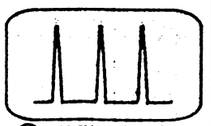
19 256V p-p [20µs]
T551 PIN 1



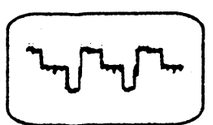
6 3.28V p-p [20µs]
A11 PIN 1 (R)
TP47R



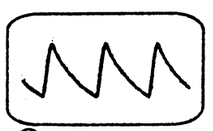
13 26.6V p-p [5ms]
IC451 PIN 13



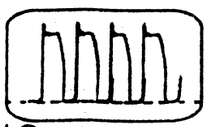
20 22.6V p-p [20µs]
T551 PIN 6



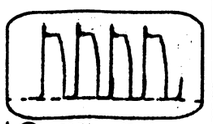
7 2.6V p-p [20µs]
A11 PIN 2 (G)
TP47G



14 1.7V p-p [20µs]
IC101 PIN 46 (H AFC)



21 282V p-p [5µs]
IC803 PIN 2



22 284V p-p [5µs]
Collector of Q802

Voltage Measurements "A" & "C"-Boards

IC001

01	5.13	33	0.00
02	2.82	34	5.12
03	5.14	35	5.14
04	4.3	36	0.00
05	5.3	37	5.13
06	1.64	38	0.00
07	0.01	39	0.17
08	0.01	40	4.14
09	N.C	41	0.02
10	5.14	42	0.00
11	0.11	43	0.00
12	0.00	44	0.00
13	2.58	45	0.11
14	N.C	46	N.C
15	N.C	47	N.C
16	N.C	48	0.00
17	N.C	49	N.C
18	4.38	50	N.C
19	N.C	51	2.4
20	N.C	52	N.C
21	N.C	53	0.00
22	5.14	54	**
23	-0.07	55	4.17
24	N.C	56	N.C
25	1.32	57	0.00
26	1.76	58	0.00
27	0.00	59	3.9
28	N.C	60	4.4
29	N.C	61	5.15
30	0.00	62	2.5
31	5.09	63	2.57
32	0.00	64	0.00

IC101

01	3.12	27	4.38
02	5.68	28	5.19
03	0.00	29	2.53
04	0.00	30	2.91
05	0.00	31	3.82
06	0.00	32	2.01
07	8.97	33	2.60
08	2.90	34	2.56
09	2.66	35	3.45
10	2.70	36	3.45
11	4.3	37	8.97
12	0.00	38	4.0
13	3.52	39	4.14
14	3.91	40	2.91
15	4.35	41	4.16
16	0.31	42	4.99
17	3.81	43	6.12
18	5.0	44	0.00
19	2.77	45	0.44
20	2.77	46	6.08
21	0.00	47	4.04
22	5.19	48	2.27
23	5.57	49	5.22
24	4.48	50	0.90
25	1.72	51	6.32
26	6.08	52	4.18

IC551

01	13.18
02	0.00
03	8.98

IC552

01	13.18
02	0.00
03	5.01

**** WARNING**
CRT shuts off when probing pin. Shut Receiver off and turn back on to continue testing

IC002

01	0.00
02	0.00
03	0.00
04	0.00
05	3.95
06	4.40
07	0.00
08	5.15

IC451

01	8.93
02	4.18
03	4.48
04	4.52
05	0.00
06	4.37
07	4.27
08	23.3
09	2.37
10	N.C
11	0.00
12	13.27
13	23.8

IC2201

01	0.00	15	3.85
02	3.95	16	4.57
03	4.37	17	4.59
04	0.12	18	4.57
05	0.10	19	0.66
06	6.47	20	4.51
07	2.70	21	0.00
08	8.98	22	4.64
09	4.73	23	0.85
10	4.53	24	4.57
11	4.55	25	4.35
12	4.40	26	4.65
13	1.37	27	5.28
14	4.53	28	4.78

IC2303

01	5.40
02	0.00
03	0.00
04	0.02
05	0.79
06	8.79
07	8.86
08	0.00
09	8.95
10	18.93

IC2304

01	5.34
02	0.00
03	6.28
04	0.00
05	0.78
06	8.79
07	8.85
08	0.00
09	8.93
10	18.93

IC2451

01	4.47
02	1.53
03	4.50
04	8.97
05	4.48
06	0.00
07	3.59
08	4.51
09	2.75
10	4.47

IC803

01	0.00
02	0.17
03	3.07
04	0.00
05	132.0

	Q001	Q002	Q003	Q004	Q302	Q304	Q351

Voltage Measurements "Y"-Board (CT-27G22V/UV/CV only)

IC1801			
01	0.00	27	3.38
02	1.40	28	3.31
03	1.60	29	0.00
04	1.60	30	0.00
05	1.60	31	0.00
06	3.33	32	0.61
07	3.33	33	1.10
08	1.00	34	3.33
09	1.50	35	3.31
10	0.50	36	0.00
11	0.00	37	2.20
12	3.30	38	1.42
13	0.90	39	2.94
14	1.51	40	1.24
15	0.50	41	1.11
16	0.00	42	0.00
17	3.31	43	1.12
18	0.00	44	3.30
19	3.30	45	1.04
20	0.00	46	3.33
21	0.00	47	1.10
22	0.30	48	0.00
23	0.00	49	1.10
24	3.00	50	0.00
25	3.00	51	1.00
26	0.00	52	0.00

IC4301	
01	1.14
02	0.28
03	0.28
04	1.90
05	0.00
06	4.96
07	0.00
08	1.80
09	1.90
10	1.90
11	1.90
12	4.90
13	0.00
14	4.91

CHIP TRANSISTOR LEAD DESIGNATION

	Q1801	Q1802	Q1803	Q1804	Q1805	Q4301	Q4302
B	0.02	3.50	3.50	1.00	1.01	2.92	0.00
C	3.51	3.00	3.00	0.00	0.00	4.94	4.90
E	0.00	3.51	3.61	1.70	1.69	2.30	0.01

	Q4303	Q4309	Q4310	Q4311	Q4312	Q4313	Q4315
B	0.00	4.41	3.59	4.40	0.12	0.65	4.01
C	4.95	0.02	4.97	0.03	3.30	0.12	4.97
E	0.00	4.80	2.90	4.97	0.58	0.0	3.33

	Q001	Q002	Q003	Q004	Q302	Q304	Q351
B	0.71	5.76	4.93	5.14	2.9	2.2	2.88
C	0.06	10.38	5.77	0.00	8.97	0.9	159.9
E	0.00	5.14	5.79	5.12	2.31	1.6	2.5

	Q362	Q353	Q501 ⏚	Q551 ⏚	Q601 ⏚	Q604 ⏚	Q3001
B	2.84	2.7	0.00	0.00	0.00	130.3	0.00
C	169.2	165.0	99.7	127.7	132.0	0.6	6.93
E	2.49	2.3	0.00	0.00	0.00	130.7	0.00

Waveform Measurements

1. (3) Indicates waveform measurement. (Measurement can be taken at the best accessible location in common to the indicated point.)
2. Taken with a NTSC signal generator connected to the antenna terminal. (NTSC color bar pattern of 8 bars of EIA colors, 100 IRE white and 7.5 IRE black.)
3. Customer Controls (Picture/Audio Menu) are set to Normalize. Volume is set to "MIN".
4. All video and color waveforms are taken with a wideband scope and a probe with low capacitance (10 to 1). Shape and peak amplitudes may vary depending on the type of Oscilloscope used and its settings.
5. Ground symbol ⏚ shown on waveform number indicates (Hot) ground lead connection of the Oscilloscope. **CAUTION!** Incorrect ground connection of the test equipment will result in erroneous readings.

The waveforms are taken in the order of circuit flow through the various sections as follows:

VIDEO - Waveforms 1-3
COLOR - Waveforms 4-8
VERTICAL - Waveforms 9-13
HORIZONTAL - Waveforms 14-17
CRT DRIVE - Waveforms 18-20
POWER SUPPLY - Waveforms 21-22

Schematic Notes

1. Resistors are carbon 1/4W unless noted otherwise.
2. Capacitors are ceramic 50V unless noted otherwise.
3. Coil value noted is inductance in µH.
4. Test point indicated by ●; Test point but no pin ○.
5. Components indicated with ⚠ are critical parts and replacement should be made with manufacture specified replacement parts only.
6. ▬ **(BOLD LINE)** indicates the route of B+ supply.
7. The schematic diagrams are current at the time of printing and are subject to change without notice.
8. Ground symbol ⏚ indicates **HOT GROUND CONNECTION;** ⏥ indicates COLD GROUND.
   NOTE: All other component symbols are used for engineering design purposes.

Voltage Measurements

1. Voltage measurement:
   - AC input to the Receiver is 120V. NTSC generator is connected to the antenna of the Receiver. (Color bar pattern of 100IRE white and 7.5 IRE black.)
   - All Picture and Audio adjustments are set to Normalize.
   - TV ANT/CABLE - (Set-Up Menu) in TV/ANT Mode
   - Volume - Min
   - TV/Video SW - TV position
   - Audio Mode - Stereo
   - Voltage readings are nominal and may vary ±10% on active devices. Some voltage reading will vary with signal strength and picture content.
   - Supply voltages are all nominal.
2. Ground symbol ⏚ indicates ground lead connection of meter. **Caution!!** Incorrect ground connection will result in erroneous readings.