SONY®

Training Manual

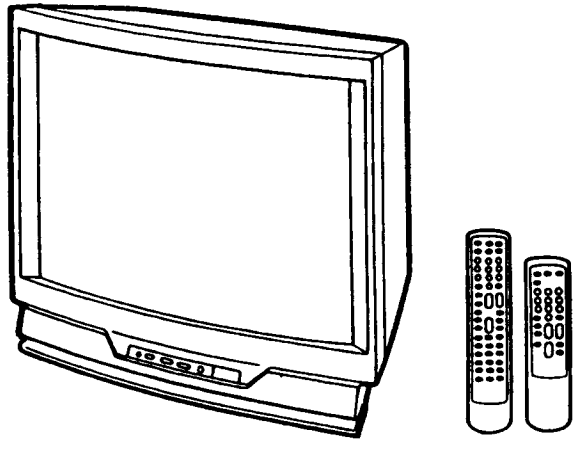
Color Television

AA-1/BA-1 Chassis

Circuit Description and Troubleshooting

KV-27TS36 / KV-20TS32

Course CTV-21



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Introduction

SONY has introduced a new modular line of TV chassis labeled the AA-1 and BA-1 chassis. The two chassis utilize PHILIP'S I^2C communications data bus for control of the internal chassis. They also share a common SONY main microprocessor and a common Y/C jungle IC to process video and generate deflection drive. Other features are a built-in closed-caption decoder IC and a newly designed dark tint trinitron picture tube.

The AA-1 chassis is used in all 27 and 32 inch screen size TV sets. The BA-1 is used in the 13 through 21 inch sets.

This manual begins by providing an overview of the AA-1 chassis. After that, detailed circuit analysis along with simplified drawings are provided on the AA-1. Since most of the circuits discussed are common to both chassis this manual provides only the major circuit differences for the BA-1 chassis. Additional troubleshooting hints, flowcharts and waveforms are provided to aid the technician in the repair of both chassis.

NOTE: Unless otherwise noted all voltages are measured with respect to chassis ground. During testing the TV was connected to an isolation transformer set to 117Vac and a color bar signal was input for a signal source. The instruments used are as follows:

FLUKE 8050A Multimeter.

VECTOR - VIZ ISO - V - ACII WP-30 Variac.

LEADER LCG-396 NTSC Pattern Generator.

AA-1 Chassis Block Diagram

A simplified block diagram of the AA-1 chassis is shown below. The major circuits are contained on the following boards:

UA Board Audio and video input/output terminals, audio and video switching, Y/C switching, comb filter and Y signal delay circuits.

A Board Main tuner (Audio MPX, VIF), sub tuner, and antenna switching.

M Board Main (system) microprocessor, audio processor (base and treble), variable audio amplifier, closed - caption decoder and Y/C jungle IC.

D Board Power supply, audio output amp, vertical drive and output, horizontal drive and output, pincushion modulation drive and output, x-ray protection module and flyback transformer.

Special features are added to upper line models by plug-in vertical boards to the set's D and UA boards. These are:

W Board Velocity modulation.

P Board Picture in Picture. This board connects onto the existing UA board.

E Board Dynamic convergence.

Operation

The ac line voltage is input to the power supply, on the D board, where it is noise filtered and rectified. The power supply generates the set's many regulated voltages. The main microprocessor, on the M board, communicates with the following ICs utilizing the I^2C data bus:

- Dynamic convergence IC.
- Y/C jungle IC on the M board.
- Picture in Picture (PIP) IC on the P board.
- Audio processor on the M board.

The main micon IC communicates with all other ICs from its output control ports and data, clock, and latch ports.

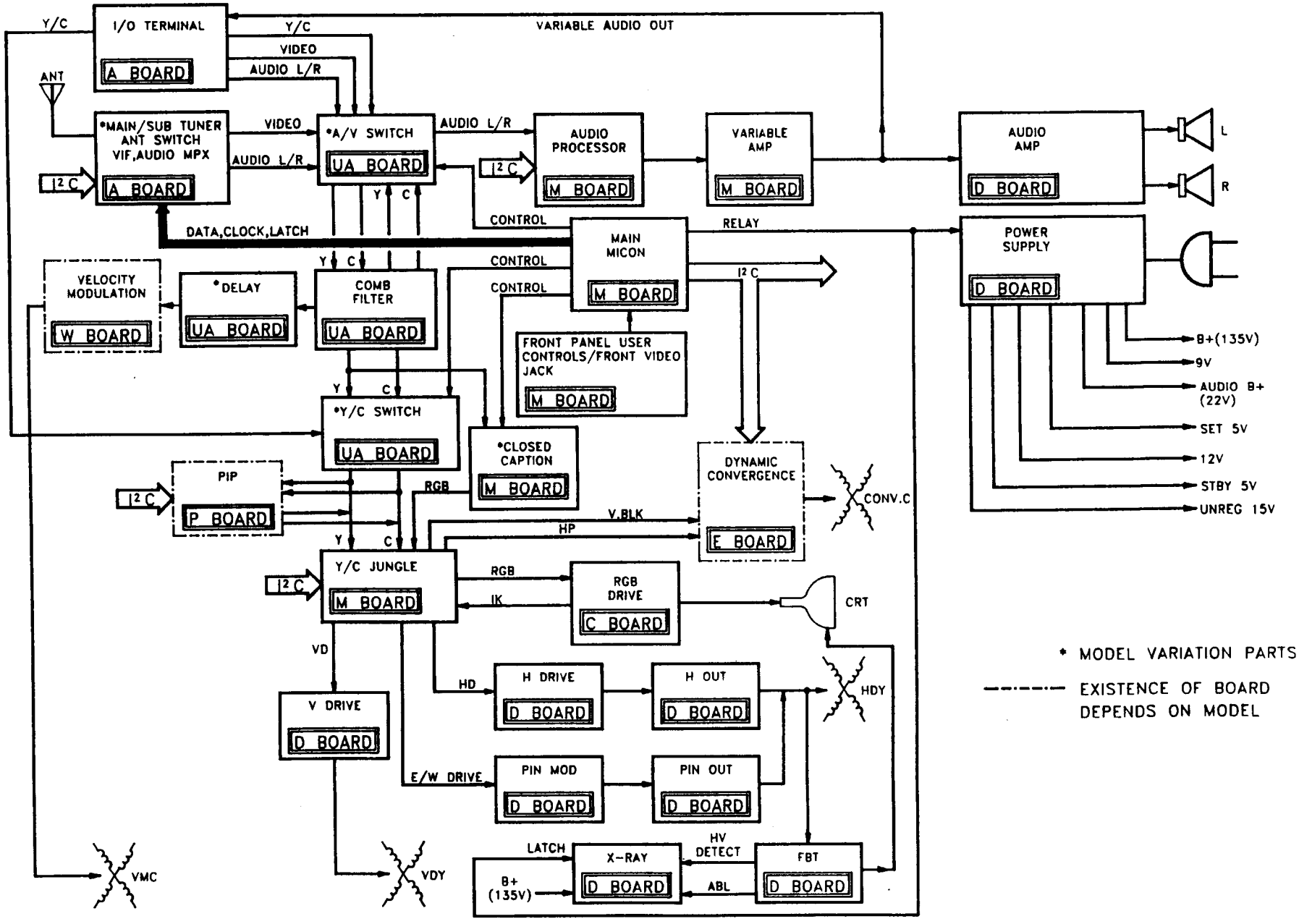
The main micon responds to key or SIRCS inputs from the user control H-board by communicating to the peripheral ICs via its output ports or I^2C data bus. In the case of video inputs, the main micon can select from various external I/O terminal inputs or the on board tuner. This is done by control signals sent to the A/V switch circuit on the UA board.

From the A/V switch, the selected video signal source is separated into Y (luminance) and C (chroma) components via either a glass or digital comb filter (depending on the tv model). Afterwards, the separated Y and C signals are input to the Y/C jungle IC. Additionally, depending on the tv model type, a separate Y/C switch circuit is utilized to switch the many external video inputs to the Y/C jungle IC.

The comb filter also outputs luminance signal information, via a Y delay, to the velocity modulation circuits on the W board. Likewise, the PIP circuit, on the P board, and the closed - caption circuit , on the M board, receive Y and C inputs from the comb filter (or from the Y/C switch in other sets), and outputs PIP Y and C signals to the Y/C jungle IC.

In addition to video signal outputs, the A/V switch selects L/R audio from the tuner and outputs these signals to the audio processor on the M board. From the audio processor circuit, the audio signals are sent to a variable audio amplifier. The variable audio amplifier outputs left/right audio signals to the audio output amp, to drive the speakers, and to the variable output jacks mounted on the I/O terminal board. The A/V switch also outputs left/right audio to the headphone's infrared amplifier mounted on the UA board.

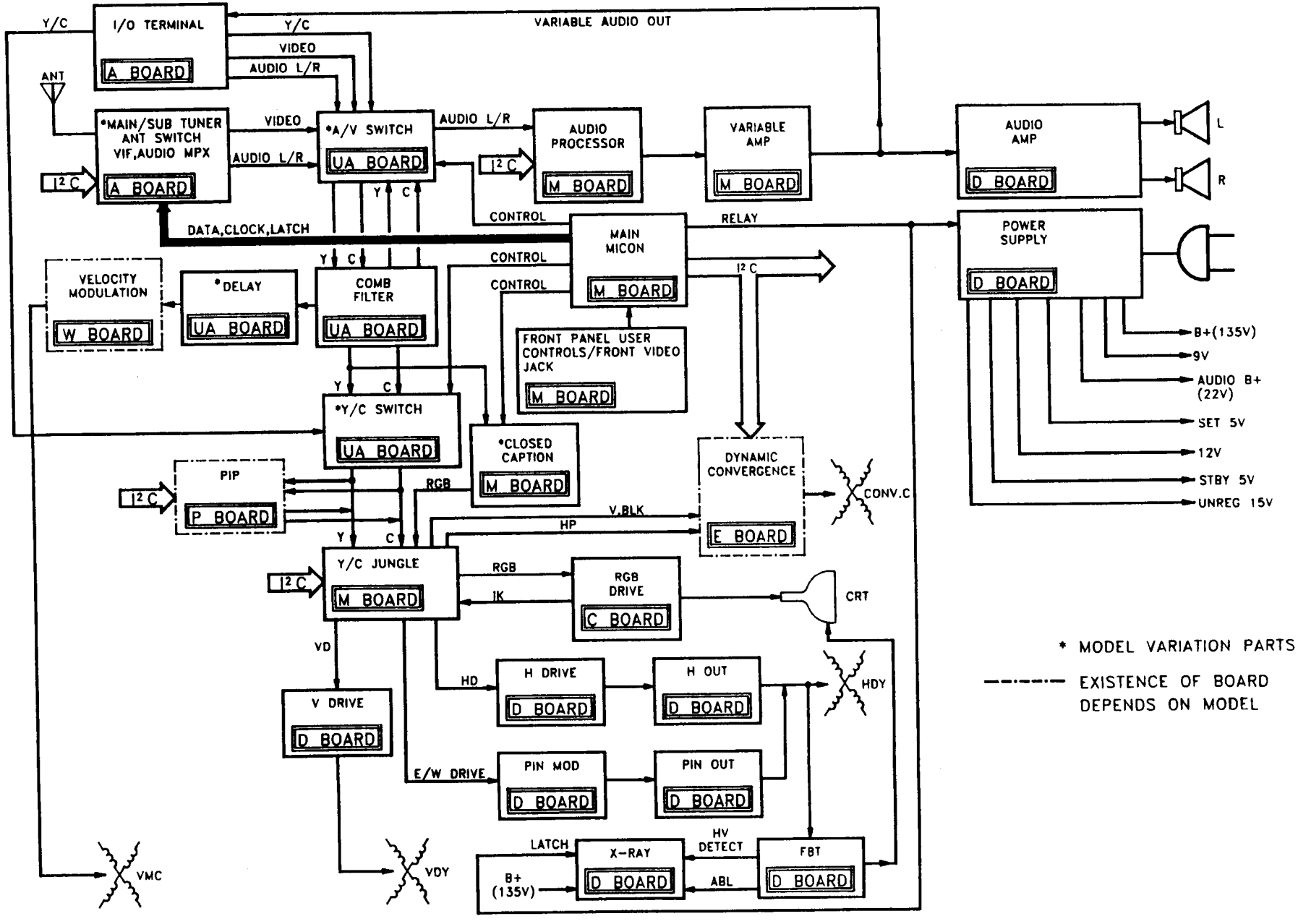
The Y/C jungle IC processes the Y and C input signals and outputs an RGB video signal to the CRT C board. It also outputs the east/west correction signal to the pincushion modulator, the vertical and horizontal drive signals to the deflection circuits, and the V. BLK and HP signals to the dynamic focus circuits on the E board.



AA-1 CHASSIS BLOCK DIAGRAM

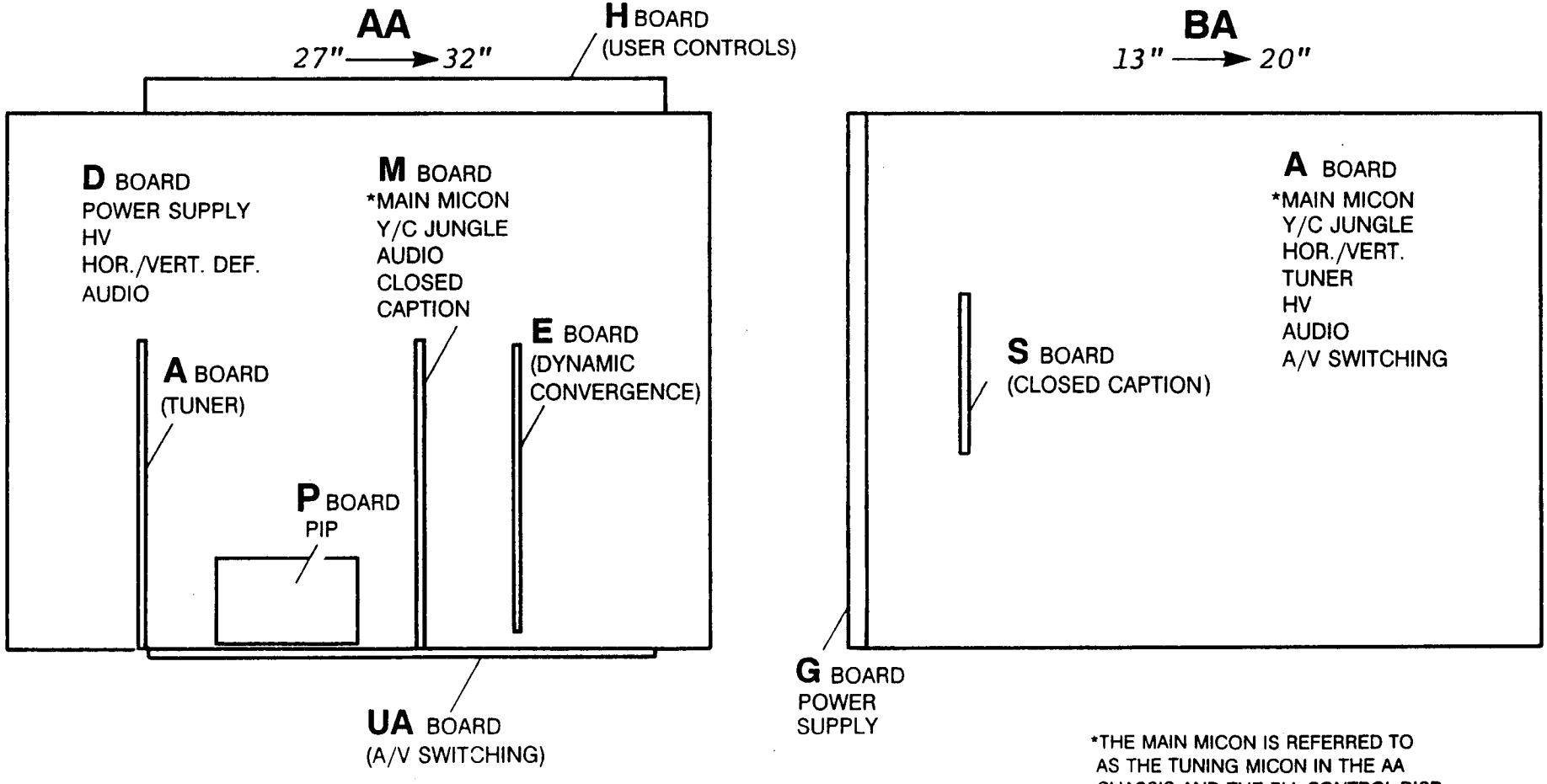
The horizontal deflection signal drives the flyback transformer which generates the high voltage to the CRT. In addition, the horizontal deflection signal is modulated with the east/west signal to correct for deflection system pincushion distortions.

The x-ray protection module monitors the high voltage system for abnormal high voltage conditions and to shut the set down.



AA-1 CHASSIS BLOCK DIAGRAM

NOTES



*THE MAIN MICON IS REFERRED TO AS THE TUNING MICON IN THE AA CHASSIS AND THE PLL CONTROL DISP. IN THE BA CHASSIS

AA-1 / BA-1 CHASSIS LAYOUT DIAGRAM

Power Supply Block

The AA-1 chassis power supply is comprised of the basic blocks shown below. These blocks can be divided into four separate sections. These are: Standby, Main Power, Regulation and Protection.

Standby 5V

The ac line input is filtered and is applied to the bridge rectifier, D602, and voltage doubler circuit, C607 and C608 to produce 315Vdc. This voltage is applied to two power converter transistors Q601 and Q602. The power converters alternately switch ON and OFF to allow current to flow through the CDT (constant drive transformer) T603 and the standby transformer T605. The standby transformer output is in turn rectified by D619 to produce unregulated 15Vdc. This voltage is then applied to the degaussing relay, RY601, and to IC602 to produce standby 5Vdc. The standby 5Vdc powers the main micon, IC101, while the set is OFF.

Main Power

To turn the set's main power ON, the main micon responds to inputs from the power ON switch, S1007, and the SIRCS detector IC101 (The power switch always has priority). The main micon will then output a relay drive signal via relay drive, Q604, to the power ON relay, RY602, which closes the relay contacts. When the relay contacts close, current flows through the power converters, the constant drive transformer and the power input transformer (PIT) T604. The resulting voltages produced by the PIT, (T604), are rectified to supply power to the set.

Regulation of the 135V Line

The 135Vdc is monitored by the control IC601 and control drive Q613. IC601 compares the 135 line voltage to a fixed internal voltage reference. As the 135 volts line varies (due to load changes) IC601 generates a control voltage that varies proportionally with load changes. This control voltage is applied to the constant drive transformer, T603, control winding. The control winding changes the ac efficiency of the constant drive transformer T603. Regulation is maintained by boosting or lowering the efficiency of the constant drive transformer with the varying load. Thereby, keeping the output levels of the power input transformer, T604, constant.

Protection

The 135 volt line is monitored by both an over current and over voltage (x-ray) circuit. In the figure, this circuit is represented by the x- ray and over current protector PM501.

Over Current

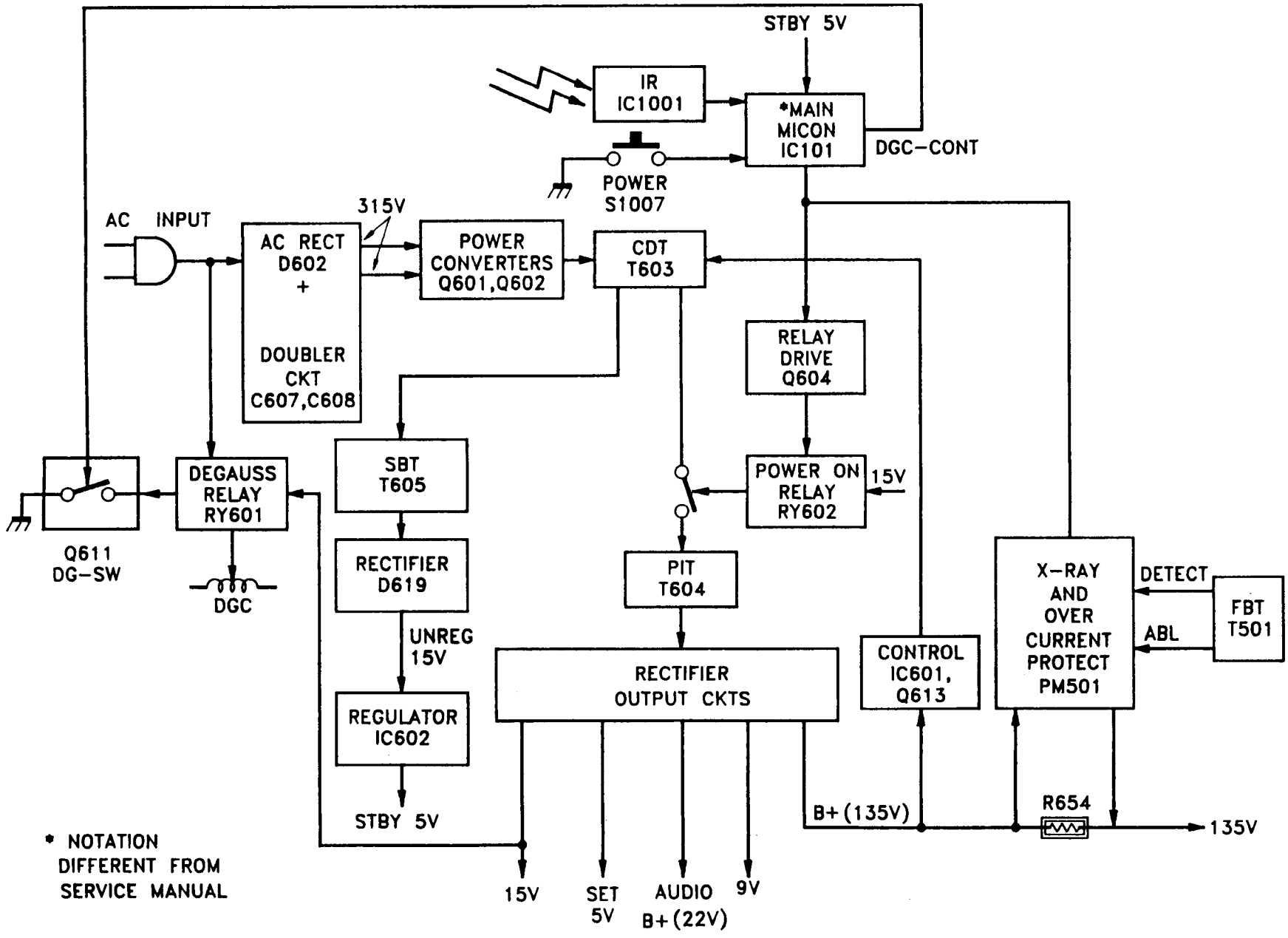
An over current condition is determined by the voltage drop across current limiting resistor R654. If a short or current overload occurs, on the 135 volts line, the voltage drop across the resistor will be enough to trigger the protection circuits within PM501. With the protection circuits triggered, the relay ON command will be shunted to ground de-energizing RY602. As a result, main power to T604 will be cut OFF and power to the set removed.

Over Voltage

Over voltage is determined by the voltage input to PM501 from the flyback transformer, T501, detect or ABL pins. If either high voltage (detect) or high current (ABL) is sensed, in the flyback system, the protection circuits within PM501 will trigger. The result is the same as mentioned earlier.

Degaussing

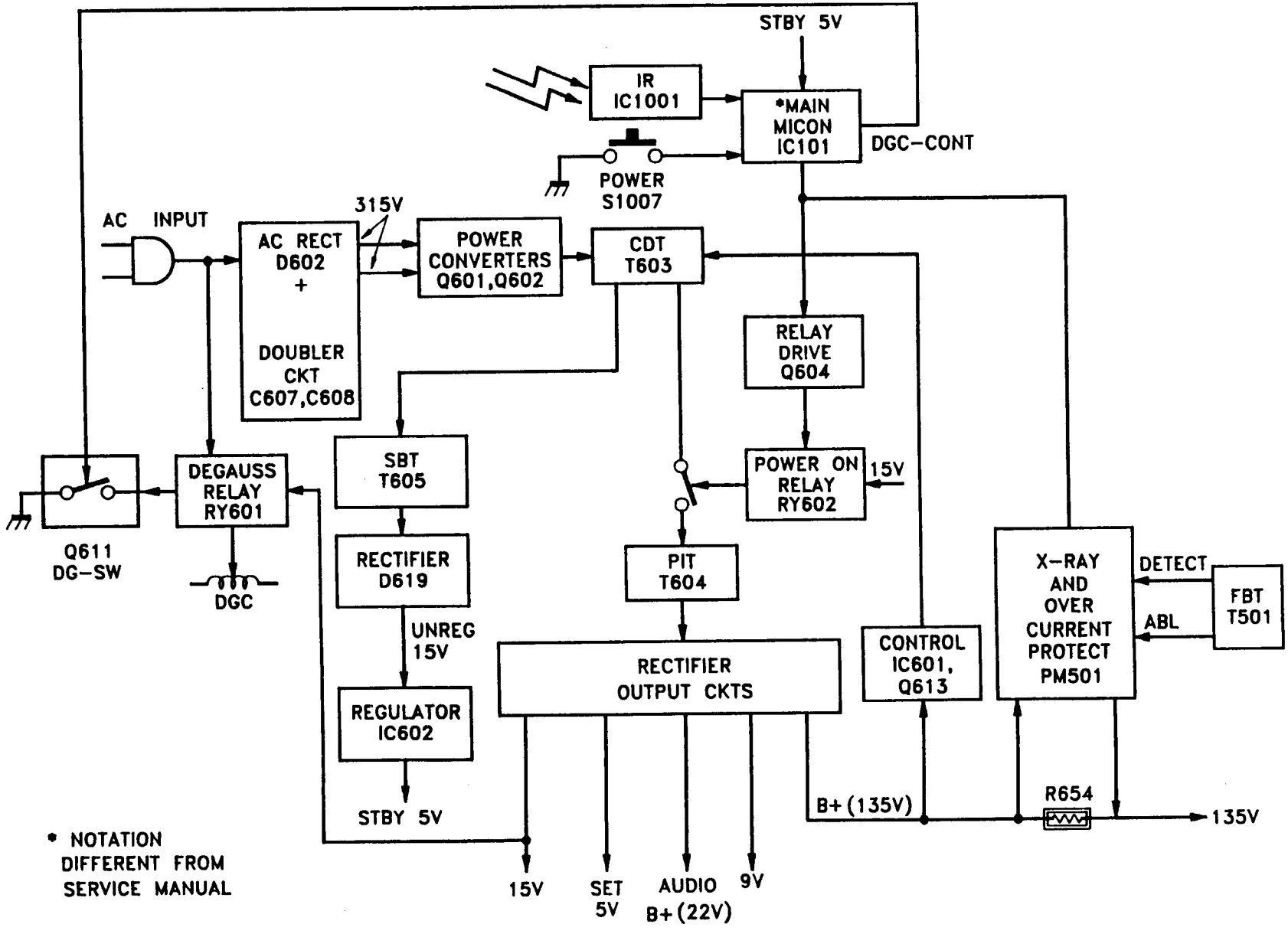
To degauss the CRT the main micon outputs a DGC-CONT signal to Q611 to turn Q611 ON. When Q611 turns ON current flows from ground through the degaussing relay, RY601, the 15Vdc supply, which closes the relay contacts. When the relay contacts close, ac current flows from the ac line through the degaussing coils to degauss the CRT. The DGC-CONT signal, output from the main micon, turns Q611 ON for a period of 4 seconds at power ON. Afterwards, the main micon turns Q611 OFF to stop current flow through the degaussing coils.



POWER SUPPLY BLOCK

BA-1 Chassis Degaussing

The BA-1 chassis does not use a degaussing transistor to control the degaussing of the CRT. In this chassis the degaussing relay, RY601, is driven from the PIT secondary rectified 16Vdc line. The other side of the degaussing relay is connected directly to ground. This allows the relay to be energized when the set is turned ON.



POWER SUPPLY BLOCK

AC Input / Degaussing

The power line is coupled through CN114, F601, line filters T601 and T602 to the bridge rectifier D602. The bridge rectifier and voltage doubling capacitors, C607 and C608, [illegible] the input ac line voltage to +315Vdc when measured across the anode and cathode of D602. When measured with respect to the ac power line neutral the cathode of D602 is +157Vdc and the anode is -157Vdc. The rectified +315Vdc sources the power converters Q601 and Q602. The power converters are discussed later.

The ac line is also connected to the degaussing coils through relay, RY601, degaussing switch transistor, Q611, and thermistor (positive temperature coefficient), THP601. When the set is turned ON, the main micon outputs a (HIGH) DGC-CONT signal to turn ON the degaussing switch transistor Q611. This activates relay, RY601, which allows ac current to flow through the thermistor and the degaussing coils. The DGC-CONT signal keeps Q611 ON for a period of 4 seconds. Thereafter, the main micon turns Q611 OFF to stop current flow through the thermistor and degaussing coils.

The thermistor in the degaussing circuit is used to gradually reduce current flow through the degaussing coils. Normally, this occurs within 1 second after current has been switched ON to the degaussing circuit. This action prevents the CRT from actually being magnetized rather than demagetized, which would occur if the current was suddenly cut-off to the degaussing circuit. The Q611 four second ON time period therefore ensures that a normal degaussing operation occurs.

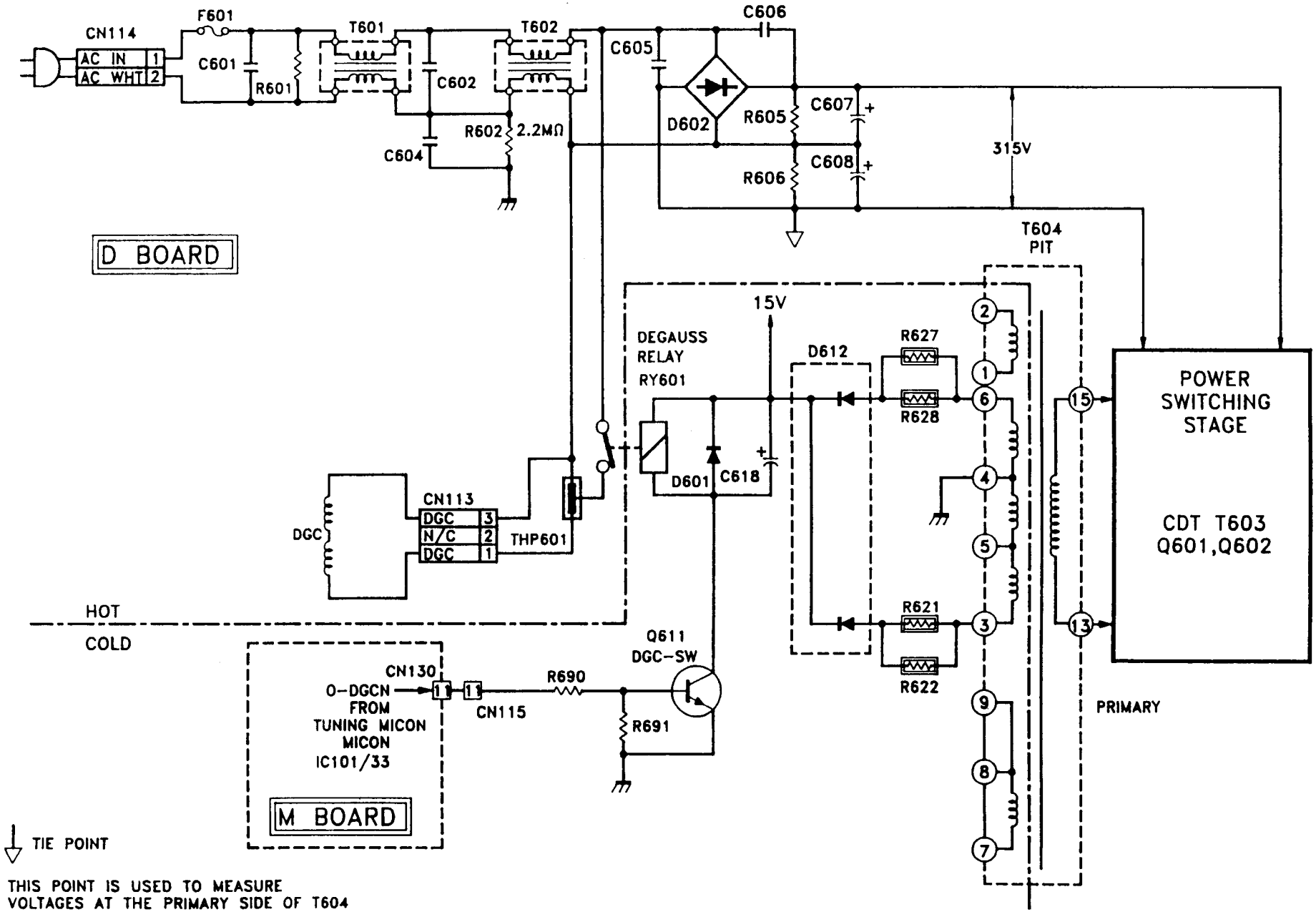
The degaussing switch Q611 circuit was designed into the AA-1 chassis for future considerations. With this circuit, it is quite possible for the user to degauss the CRT, at any given time, utilizing the remote control unit. This might easily be done by either pressing a function switch or selecting the degauss operation from the user menu screen.

Troubleshooting

WARNING! The set's chassis ground is isolated form the ac line. However, the power supply's input stage is at lethal ac potentials. You must use an isolation transformer prior to doing any type of troubleshooting to prevent bodily harm to yourself and damage to the set. Before replacing any parts, you must remove power and use the normal ESD measures to protect the electrostatically sensitive parts.

When troubleshooting for no power or dead set symptoms check the following:

Check the line fuse, F602, to ensure it passes the ac input line voltage to the bridge rectifier section, D602. If the fuse is opened, suspect the bridge rectifier,D602, filter capacitors C607 and C608 for shorts, and the power converters, Q601 and Q602 (in the following stage), for PN junction failure and for opened PIT, T604, windings.



AC INPUT / DEGAUSSING

Standby Power

The standby power supply is a switching type power supply. It consists of a constant drive transformer (CDT) T603, power converters Q601 and Q602, and a standby transformer (SBT) T605. The standby power supply produces both an unregulated 15Vdc supply, to the set's power ON relay, and to the reset/standby regulator IC602.

The standby power supply operates whenever the set is connected to the ac line.

Operation

As previously mentioned, the ac line is filtered, rectified, and voltage doubled to produce 315Vdc. The rectified 315Vdc is applied to the collector of Q601 and through R611 to the its base. Resistor R611 provides a slight forward bias to Q601. This immediately starts current flow from the anode of the bridge rectifier, D602, through the following components: C625, R644, SBT T605 pin 3 and pin 5, CDT T603 main windings pins 3 and 4, through Q601 emitter collector junction to the 315Vdc supply.

The initial circuit current flow starts the build-up of magnetic energy in the CDT. As result, a positive voltage is generated at T603 pin 6. This voltage is coupled through C609 and R609 to the base of Q601, turning Q601 ON. When Q601 turns ON it causes C625 to charge rapidly. When C625 is fully charged, it immediately cuts off the flow of current through the standby transformer, T605, the CDT, T603, and Q601. This action results in the immediate collapse of the build up of magnetic energy through the CDT and a negative voltage generated at T603 pin 6. As a result, Q601 turns OFF which completes the first half cycle of current flow through the CDT.

The collapse of magnetic energy through the CDT also generates a positive voltage at T603 pin 1. This voltage is coupled through C610, and R610 to the base of Q602, turning Q602 ON. When Q602 turns ON, C625 discharges through the following components: Q602 emitter collector junction, T603 pins 4 and 3, T605 pins 5 and 3, and R644. This completes the second half cycle of current flow through T603. Q601 will now turn ON again through the following components: C625, R644, SBT T605 pin 3 and pin 5, CDT T603 main windings pins 3 and 4, through Q601 emitter collector junction to the 315Vdc supply as described previously to maintain the oscillations.

The resonant frequency, in the standby mode, is approximately 55kHz determined by the capacitance of C609 and the inductance between the constant drive transformer T603 pins 6 and 5. The resonant frequency, in the power ON mode, is approximately 83kHz.

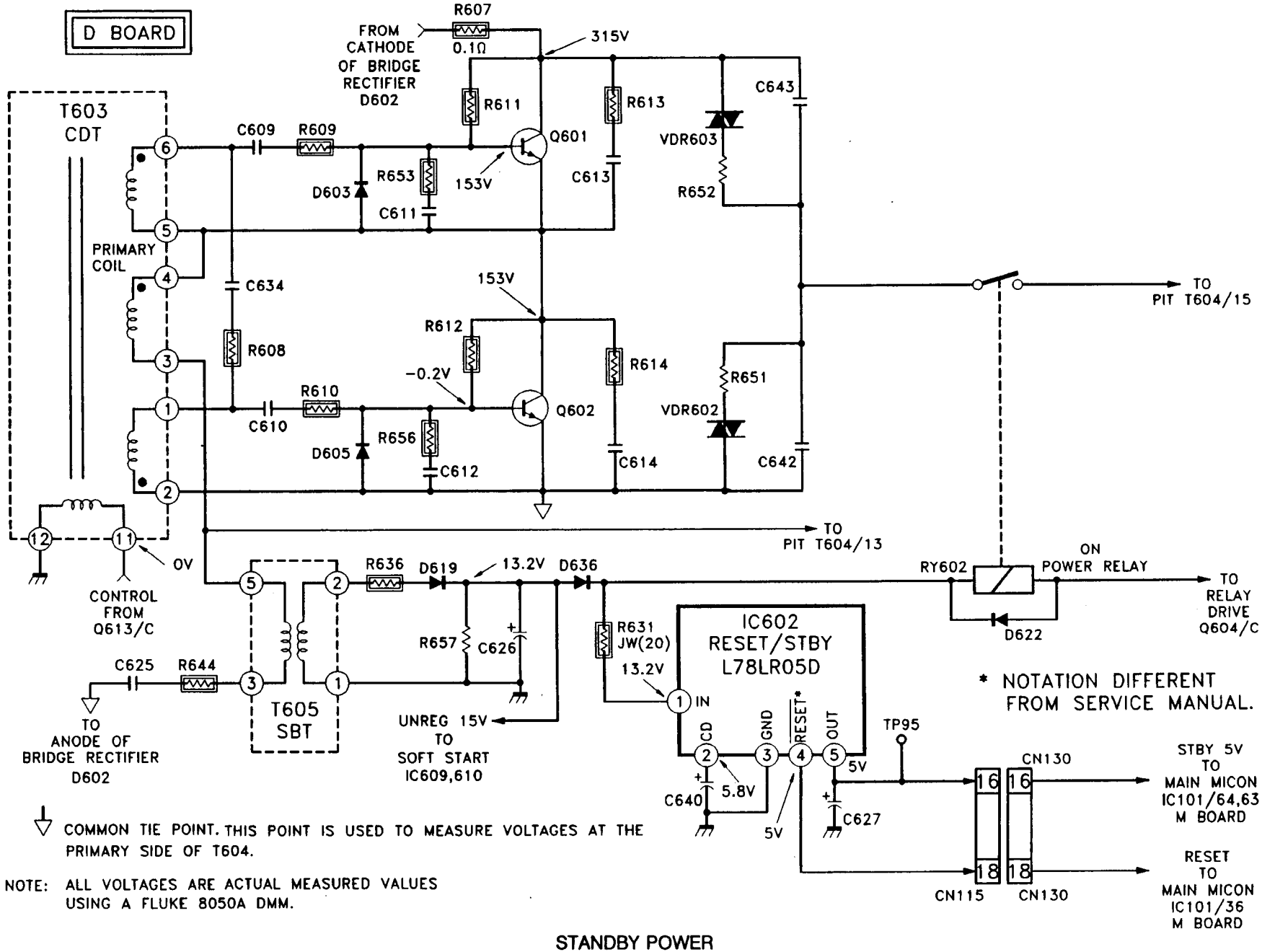
The inductance of the power input transformer, T604, (not shown) forms a parallel resonant circuit across the power converter circuit in the power ON mode. This forces the impedance of the main oscillation circuit to go down and the switching frequency to go up. This also results in a large current flow through C643, C642, the power converters Q601 and Q602. As a result, the voltage across both capacitors, C643 and C642, will increase. In order to prevent damage to the capacitors, they are clamped by two voltage dependent resistors VDR603 and VDR602. The VDR acts as a surge protector by bleeding the excess current across the capacitors when the VDR trigger point is exceeded.

As mentioned earlier Q601 and Q602 main current also flows through the primary windings of the standby transformer T605 pins 5 and 3. This current induces an ac voltage in the standby transformer secondary. The ac output from T605 pin 2 secondary is rectified by the half wave diode D619 and filtered by C626 to produce the set's unregulated 15Vdc supply (13.2Vdc measured). The resulting 13.2Vdc is coupled through D636 to the power ON relay, RY602, and to the reset/standby regulator IC602. The unregulated 15Vdc supply also sources soft start IC609 and IC610.

Relay, RY602, contacts close when the set is turned ON to apply switching power to the power input transformer, T604.

BA-1 Chassis Standby Power

The BA-1 chassis uses the same standby / reset regulator IC and has a similar switching power supply. Therefore, much of the power supply circuit operation and troubleshooting procedures will apply. The major difference between the two chassis is the physical location of the power supply. In the BA-1 chassis the power supply is located on a separated board labeled the G board.



STANDBY POWER

Troubleshooting

The AA-1 chassis ground is isolated from the ac line however, the power supply is not fully isolated from the ac line. Therefore, the use of an isolation transformer is essential when servicing the set. When troubleshooting for no power symptoms do the following:

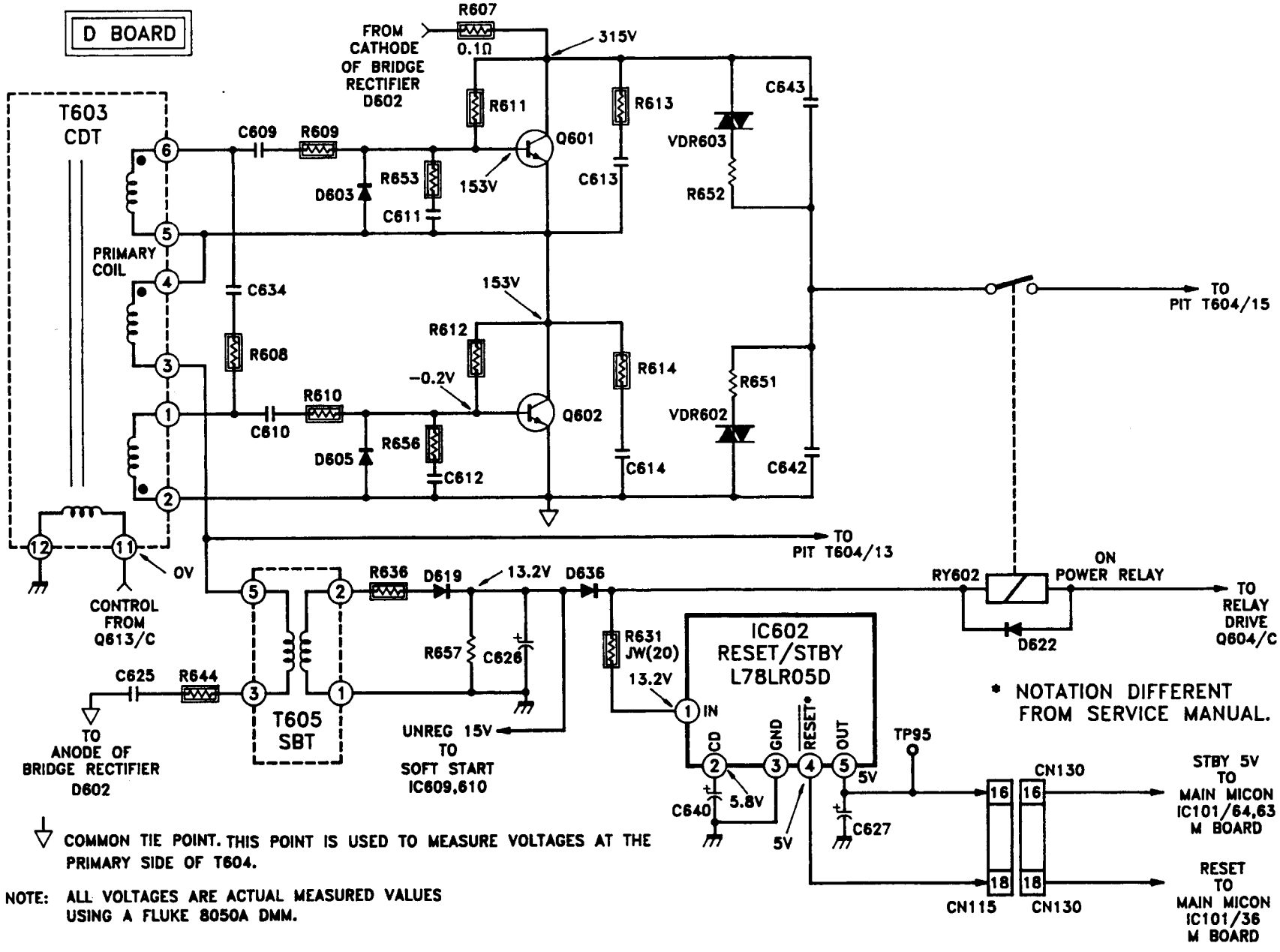
Check for 315Vdc at the collector of Q601 (measured from the emitter of Q602). If missing, suspect fuse resistor, R607, to have opened. If R607 is open, suspect Q601 and Q602 for PN junction failure. If Q601 and Q602 are defective, check diodes D603, D605, VDR603 and VDR602 for PN junction failure. Make the necessary repairs and proceed to do the following:

Set the oscilloscope to ac coupling and 50V/div. vertical deflection. Connect the oscilloscope probe to CDT T603 pin 3 and the ground probe to the emitter of Q602. Connect the set to an isolation transformer and variac. ***Do not turn the variac ON yet !*** Set the variac input voltage to 0Vac. Now turn the variac ON and slowly raise the input line voltage to 117Vac while observing the line fuse and the variac's current meter for any abnormal indications. If a current overload condition is detected, you still have a problem in either the ac input or power switching stage.

If okay, verify the normal switching frequency, input voltage, and current response are within those specified below:

AC Input	Switching Frequency	Volts Peak to Peak	Current
20Vac	71.5kHz	55.4Vp-p	< 0.1A
40Vac	71.5kHz	105Vp-p	< 0.1A
60Vac	71.5kHz	159Vp-p	< 0.1A
80Vac	65.5kHz	213Vp-p	< 0.1A
100Vac	59.5kHz	274Vp-p	< 0.1A
120Vac	56.5kHz	331Vp-p	< 0.1A
130Vac	57.1kHz	359Vp-p	< 0.1A

If okay, and the set will not power ON, check for unregulated 13.2Vdc at IC602 pin 1 and for regulated 5Vdc at IC602 pin 5. If either the 13.2 or 5 volts is missing, troubleshoot around the respective circuits.



STANDBY POWER

Power ON

The main power supply uses the same switching circuits described in the standby power supply section for main power. The main power supply consists of a constant drive transformer (CDT) T603, power converter transistors Q601 and Q602, and power input transformer (PIT) T604. The operation of the switching power supply was described in the previous section labeled standby power. This section will only describe the events that pertain to the operation of the main power supply.

Operation

To turn power ON, the main micon, IC101, responds to a LOW (0vdc) from the power ON switch, S1007, or SIRCS data from the sircs sensor IC1001 pin 1. IC101 pin 4 outputs a HIGH (5Vdc) through R009, CN131, CN116, R632, D628, R639 to produce 0.8Vdc at the base of relay drive Q604. Q604 turns ON causing current to flow from the standby transformer, T605 pin 2 (not shown), relay RY602 energizing the relay to close its contacts.

When the relay contacts close, current flows from the power switching stage comprised of CDT, T603, and power converter transistors, Q601 and Q602, to the power input transformer (PIT), T604, pins 13 and 15. The PIT primary current flow induces current flow in its secondary. The voltages generated from the secondary of the PIT powers the set's many circuits. These are discussed later on.

Protection

The function of the shutdown circuits is to safeguard the set in the event of a power supply or high voltage stage malfunction. In the event this occurred, a protection circuit triggers to cut OFF main power to the set. Normally, this is done by grounding the relay drive signal, at the anode of D628, through R645 and the protection module, PM501 (not shown).

During normal operation the voltage present at the anode of D628 is 2.8 Vdc. If a malfunction occurs, the voltage at the anode is immediately pulled LOW (0.7Vdc). The voltage at the base of Q604 now will be brought to 0Vdc due to the series voltage drop through D628, R639 and R638, which turns Q604 OFF. When Q604 turns OFF it de-energizes the relay causing its contacts to open. As a result, power to the PIT is cut OFF. The standby power supply however, will continue to function and the protection latch will remain triggered. The protection latch circuit may be reset by disconnecting the set from the ac power line or by pressing the power button again on the remote or the front panel of the set.

Troubleshooting

When troubleshooting a no power ON condition (dead set), first verify the operation of the standby unregulated 15Vdc and 5Vdc supply sections. Also look closely at the items that appear to work, such as relay click noise, the presence of CRT filament lighting, etc.. Much of this information will save you troubleshooting time. If the standby power supply section is operating but the sets secondary voltages are missing, then do the following checks:

- Apply ac power. Turn the set ON and verify that there is 0.8Vdc at the base of Q604. If okay, check for 0.3Vdc at the collector. If missing, check the relay for continuity. Suspect also the relay contacts.

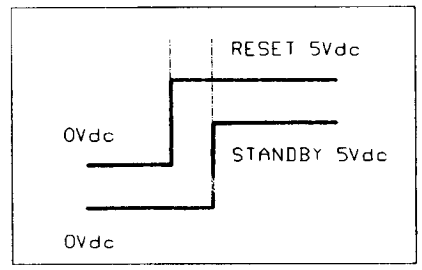
If 0.8Vdc is missing at the base of Q604 do the following:

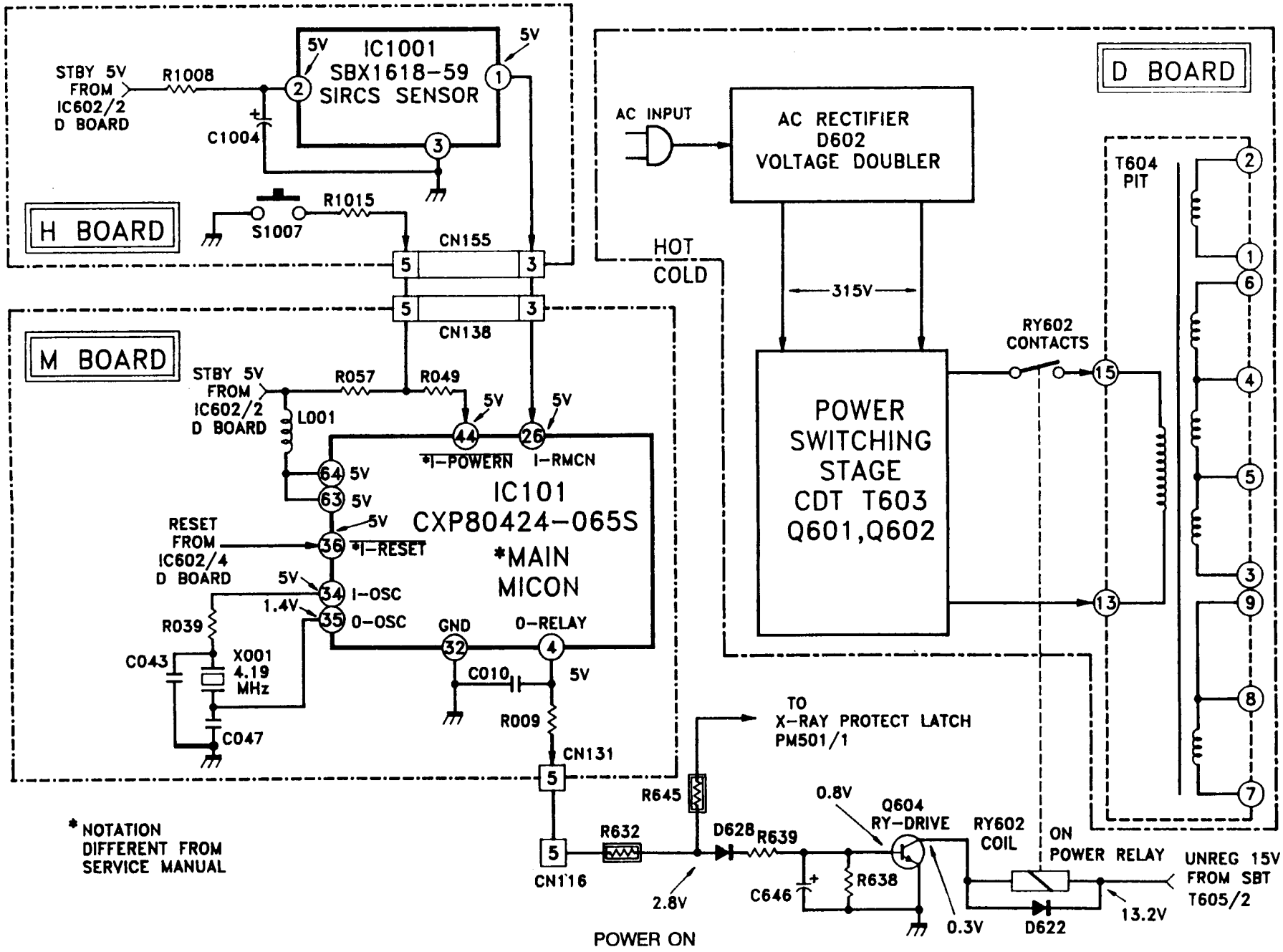
- Verify that there is 2.8Vdc at the anode of D628. If less than 2.8Vdc suspect the x-ray protect latch to have triggered. Go on to troubleshooting that section.

- Check for 5Vdc at connector CN116 pin 5. If missing, troubleshoot the main micon, IC101, on the M board. While there verify the following:

- Standby 5Vdc at IC101 pins 64 and 63.

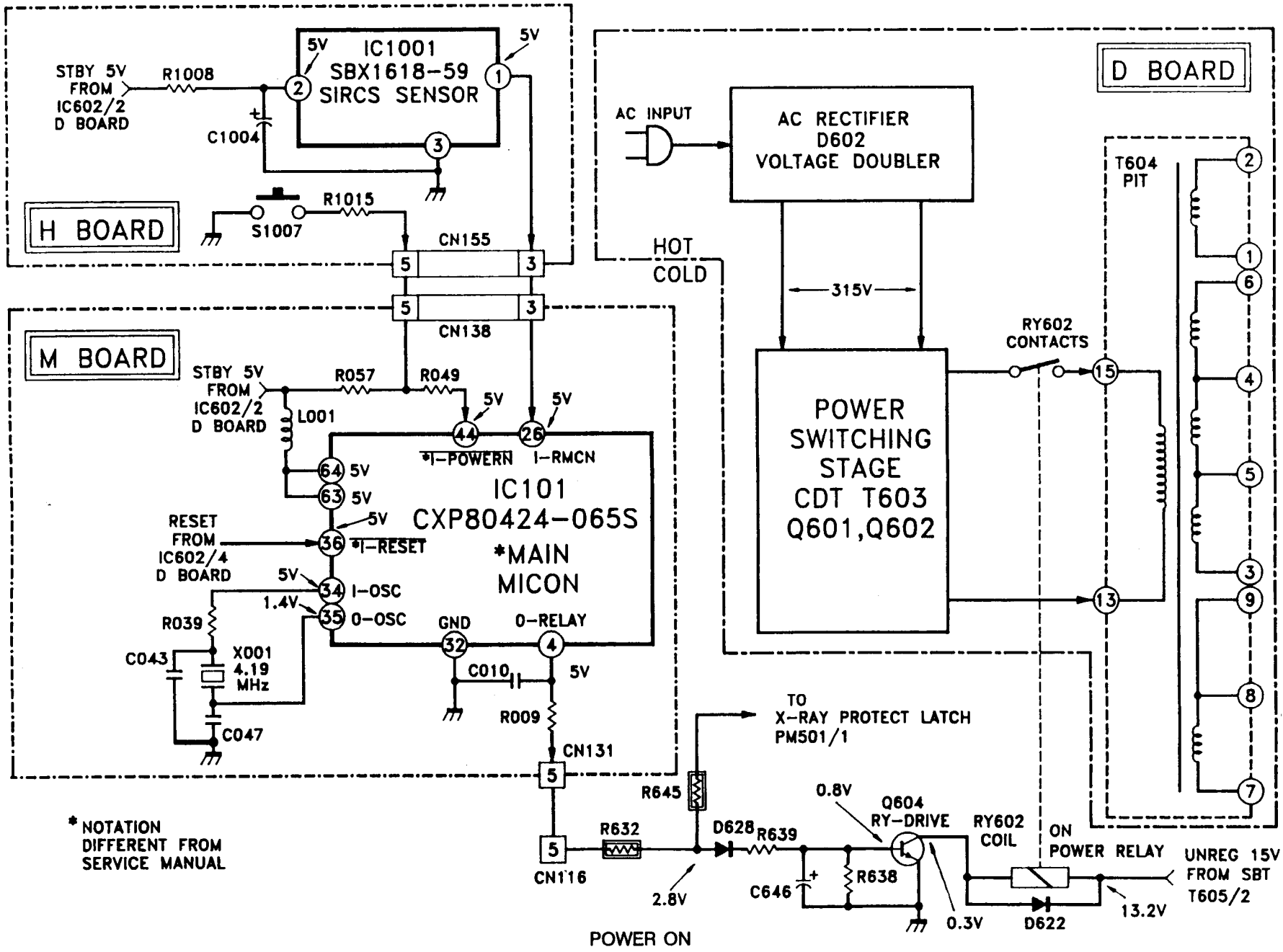
- Reset at IC101 pin 36. This is 0Vdc rising to 5Vdc (delayed with respect to the standby 5Vdc supply line) at ac plug in. Reset is shown in the figure below.




H BOARD
M BOARD
D BOARD
STBY 5V FROM IC602/2 D BOARD
R1008
C1004
IC1001
SBX1618-59
SIRCS SENSOR
5V
R1015
S1007
CN155
CN138
AC INPUT
AC RECTIFIER
D602
VOLTAGE DOUBLER
HOT
COLD
315V
POWER
SWITCHING
STAGE
CDT T603
Q601,Q602
RY602
CONTACTS
T604
PIT
R057
R049
L001
*I-POWERN
I-RMCN
IC101
CXP80424-065S
*MAIN
MICON
RESET FROM IC602/4 D BOARD
*I-RESET
I-OSC
O-OSC
1.4V
R039
C043
X001
4.19
MHz
C047
GND
O-RELAY
C010
R009
CN131
TO
X-RAY PROTECT LATCH
PM501/1
R645
0.8V
Q604
RY-DRIVE
RY602
COIL
ON
POWER RELAY
UNREG 15V
FROM SBT
T605/2
R632
D628
R639
CN116
2.8V
C646
R638
0.3V
D622
13.2V
POWER ON
* NOTATION
DIFFERENT FROM
SERVICE MANUAL

Note: If reset does not occur, the set will operate and the microprocessor will function normally. On the other hand, if reset is held LOW (0Vdc), the main micon, IC101, will not function however its crystal will run.

- 4.19MHz 4.2Vp-p clock signal at pins 35 and 34.
- LOW (0Vdc) at pin 44 when the power button is pressed or LOW going SIRCS data at pin 26 when the remote control power button is pressed.


H BOARD
M BOARD
D BOARD
STBY 5V FROM IC602/2 D BOARD
R1008
C1004
IC1001
SBX1618-59
SIRCS SENSOR
5V
S1007
R1015
CN155
CN138
AC INPUT
AC RECTIFIER
D602
VOLTAGE DOUBLER
HOT
COLD
315V
T604
PIT
RY602
CONTACTS
POWER
SWITCHING
STAGE
CDT T603
Q601,Q602
R057
R049
L001
*I-POWERN
I-RMCN
IC101
CXP80424-065S
*MAIN
MICON
RESET
FROM
IC602/4
D BOARD
*I-RESET
I-OSC
O-OSC
1.4V
R039
C043
X001
4.19
MHz
C047
GND
O-RELAY
C010
R009
CN131
TO
X-RAY PROTECT LATCH
PM501/1
R645
0.8V
Q604
RY-DRIVE
RY602
COIL
R632
D628
R639
CN116
2.8V
C646
R638
0.3V
D622
ON
POWER RELAY
13.2V
UNREG 15V
FROM SBT
T605/2
* NOTATION
DIFFERENT FROM
SERVICE MANUAL
POWER ON

Regulation / Soft Start

The power supply regulation circuit, IC601, compensates for the ac input line voltage fluctuations and power input transformer (PIT), T604, secondary load variations so that the secondary output voltages remain constant. Regulation is done by varying the power input to the PIT. Controlling the power input to this stage will determine the output voltage levels at the secondary of T604.

To regulate, IC601 pin 1 samples the B+ (135Vdc) line and uses this sample to output a control voltage from pin 3. This voltage is then used to vary current flow through the CDT,T603, control winding pins 11 and 12 via the control drive transistor, Q613. IC601 internally is comprised of a three terminal programmable shunt regulator. The standard circuit is shown in the diagram. The circuit operation is explained below.

Operation

The power regulating transformer is cross-wound. That is, it has a control winding wound at right angles to the main windings. In the diagram, the control windings are connected between T603 pins 11 and pin 12.

The characteristics of the CDT is such that current flow through the control winding changes the efficiency of the CDT. The efficiency of the CDT varies inversely with the current flow through the control winding. In other words, a current rise through the control winding decreases the efficiency of the CDT. Conversely, a current decrease, through the control winding, increases the efficiency of the CDT. As a result, input power to the PIT, T604, can be controlled with the CDT control current.

The B+ (135Vdc) supply line is coupled through R635 to IC601 pin 1. Therefore, any fluctuations in the B+ (135Vdc) supply line is sensed at IC601 pin 1. The fluctuations, in the 135Vdc line, are processed through the IC, which results in a control voltage to be generated from pin 3. The output, from IC601 pin 3, is coupled through R633 to the base of Q613. Q613 is biased by the 16Vdc supply derived from T604 pin 3 through R622, R621, D602, C618 and D627.

The operation of IC601 when the 135Vdc line decreases is as follows:

- Voltage at IC601 pin 1 decreases.
- The control voltage output from IC601 pin 3 increases.
- Q613 turns ON less which causes the CDT, T603 pin 11, control current to decrease.
- The CDT's efficiency increases (the switching frequency goes down).
- This increases the power input to the PIT, T604, which raises the secondary output voltages.

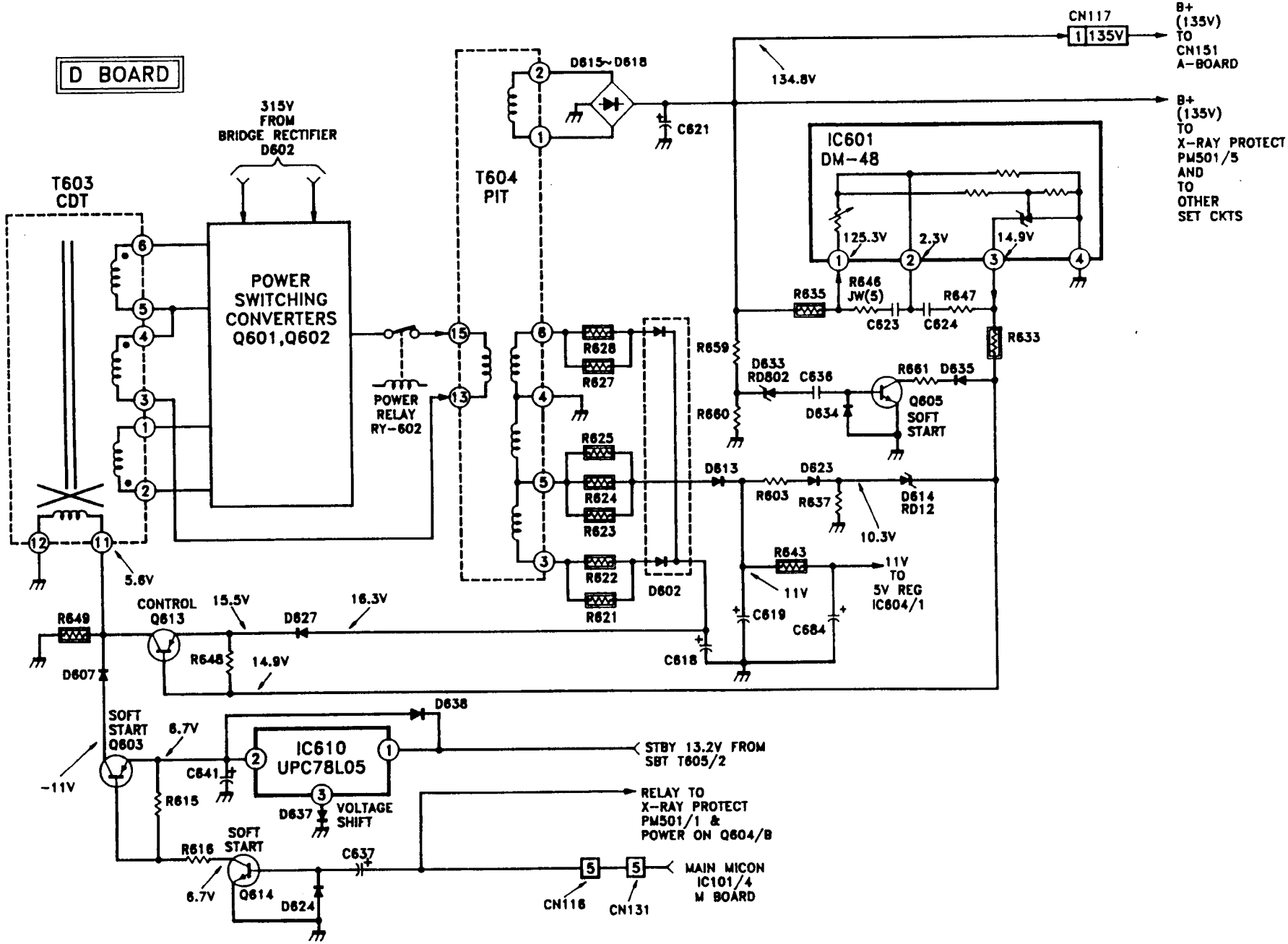
The opposite occurs if the 135Vdc secondary line should increase.

Soft Start

The soft start circuit reduces the initial current surge, through the power switching converter transistors, as the filter capacitors in the PIT's secondary charge up at power ON. It also prevents false triggering by the protection circuits when power is turned ON.

Q603, Q614, IC610 and C637 comprise the soft start circuit. When power is turned ON, the main micon, IC101 pin 4, outputs 5 volts through C637 to the base of the soft start transistor Q614. Q614 turns ON for the period determined by the time constant of C637 and the Q614 base to emitter junction resistance. When Q614 turns ON it turns Q603 ON. This allows current to flow from chassis ground through the CDT, T603, pins 12 and 11, D607, Q603 collector to emitter junction to the standby power supply IC610.

The current flow through the CDT, T603, control winding decreases the efficiency of the CDT and the power input to the PIT for the period Q614 and Q603 are turned ON. As C637 gradually continues to charge, the voltage applied to Q614 and Q603 is reduced causing Q614 and Q603 to turn ON less. This causes less current to flow through the CDT control winding which increases the efficiency of the CDT. As a result, this increases the input power to the PIT which raises the secondary output voltages.



REGULATION / SOFT START

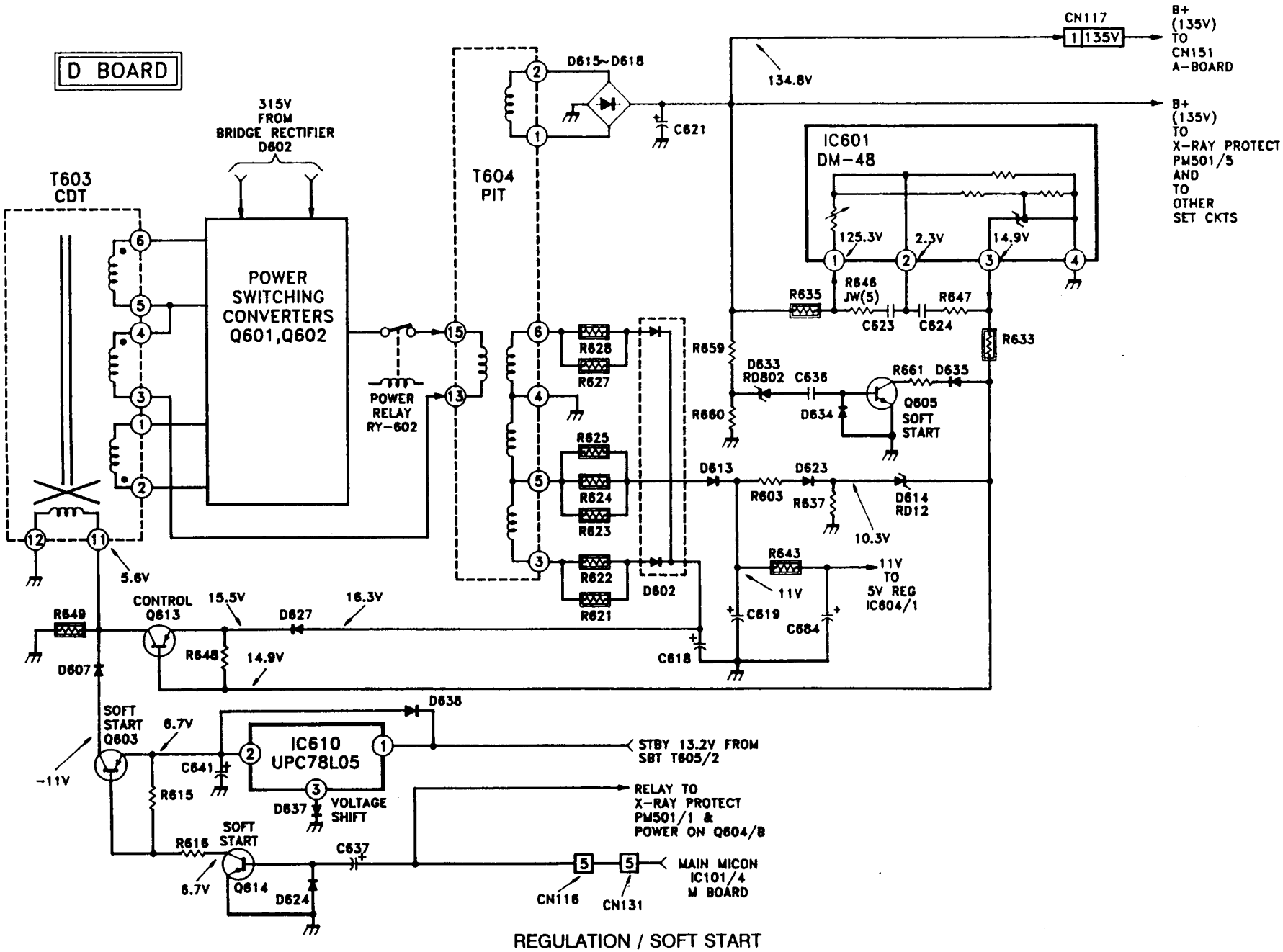
Troubleshooting

As previously mentioned, the power supplies regulator, IC601, and associated circuitry, function in a close loop manner to maintain precise and stable regulation. As a result, troubleshooting intermittent power supply shutdown problems or regulation problems can be difficult. The steps outlined below will allow you to perform basic power supply checks and roughly confirm safety related hold-down voltage checks by temporarily defeating the regulation control loop:

- Open the regulation control loop by unsoldering T603 pin 11 from the circuit.
- Tack solder the cathode end of a 1A rectifier diode to T603 pin 11 terminal. **NOTE:** The diode is needed to block ac feedback from the CDT T603 pin 11 to the external power supply you hook-up in the following step.
- Connect the other end of the diode to a variable dc power supply source. Then set the external power supply voltage to 5.2Vdc. Note: This voltage must be set to 5.2Vdc to allow the set to turn ON and prevent shutdown at power ON.
- Connect the ac supply line to a variac and isolation transformer combination and set the ac input line voltage to 79Vac.
- Turn the set ON. If the switching power supply is working the TV should power up.
- Now raise the external power supply voltage to 5.6Vdc.
- Then slowly raise the input line voltage to 117Vac while observing the voltage at CN117 pin 1 (measured from chassis ground). ***DO NOT ALLOW THIS VOLTAGE TO GO ABOVE 135Vdc!***
- Slowly raise the external input dc supply voltage while observing the voltage at CN117 pin 1. The voltage at CN117 pin 1 should now decrease.
- Slowly lower the external input dc supply voltage while observing the voltage at CN117 pin 1. The voltage at CN117 pin 1 should now increase.
- If you continue to lower the external supply voltage you will be able see the voltage, at CN117 pin 1, that will place the set into x-ray protect. This voltage should be approximately 137Vdc when the raster disappears. Remember, this is an approximate rough check and is not intended to replace any safety procedural checks outlined in the service manual.

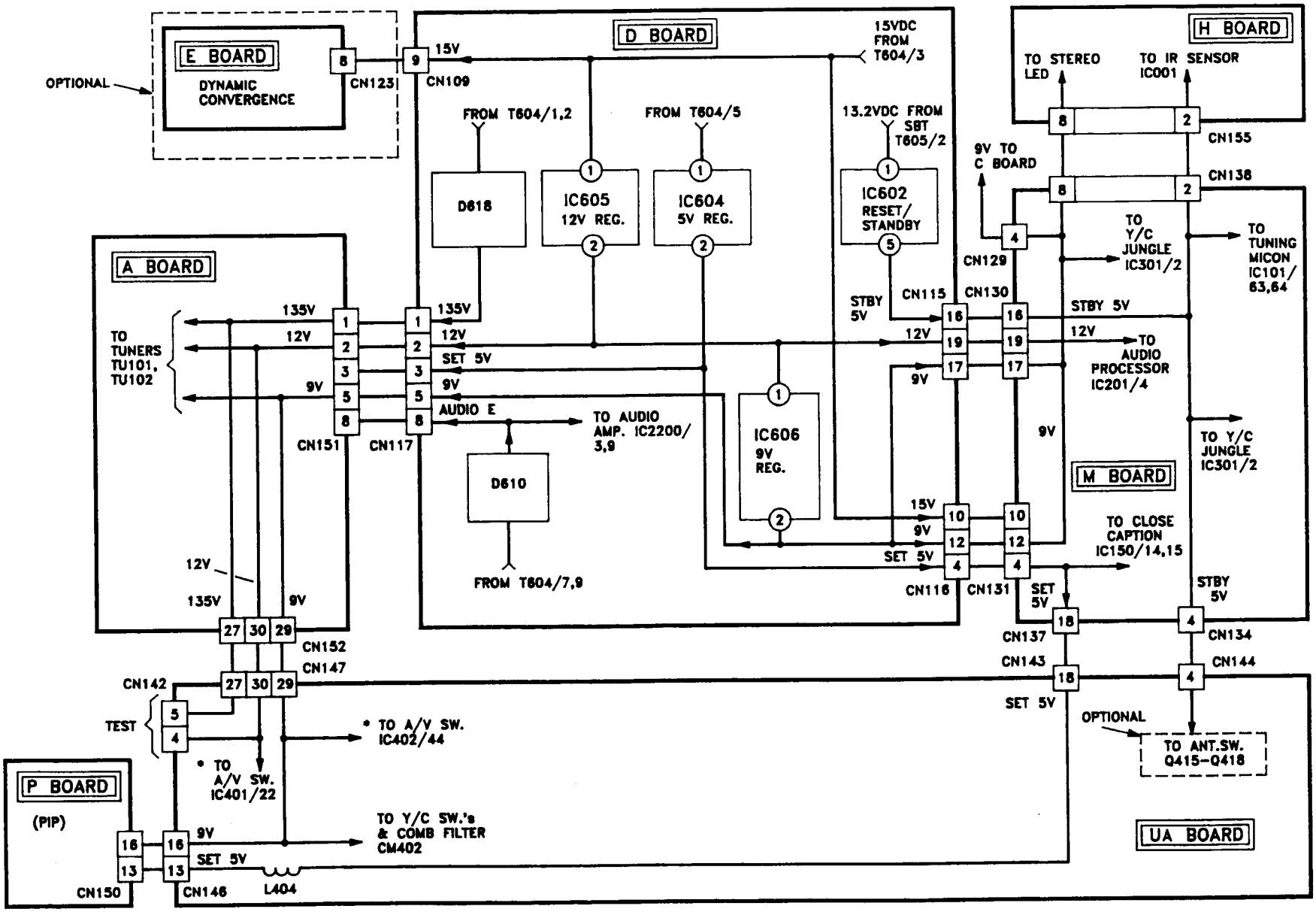
With the regulation control loop opened, you will be able to do basic voltage checks around the regulation stage while preventing the set from going into shutdown.

B+ (135Vdc) line output voltage when T603 pin 11 is fixed to 5.6 Vdc	
Input AC voltage	**B+ (135 volt line)**
80Vac	82Vdc
90Vac	92Vdc
100Vac	106Vdc
110Vac	120Vdc
120Vac	134Vdc



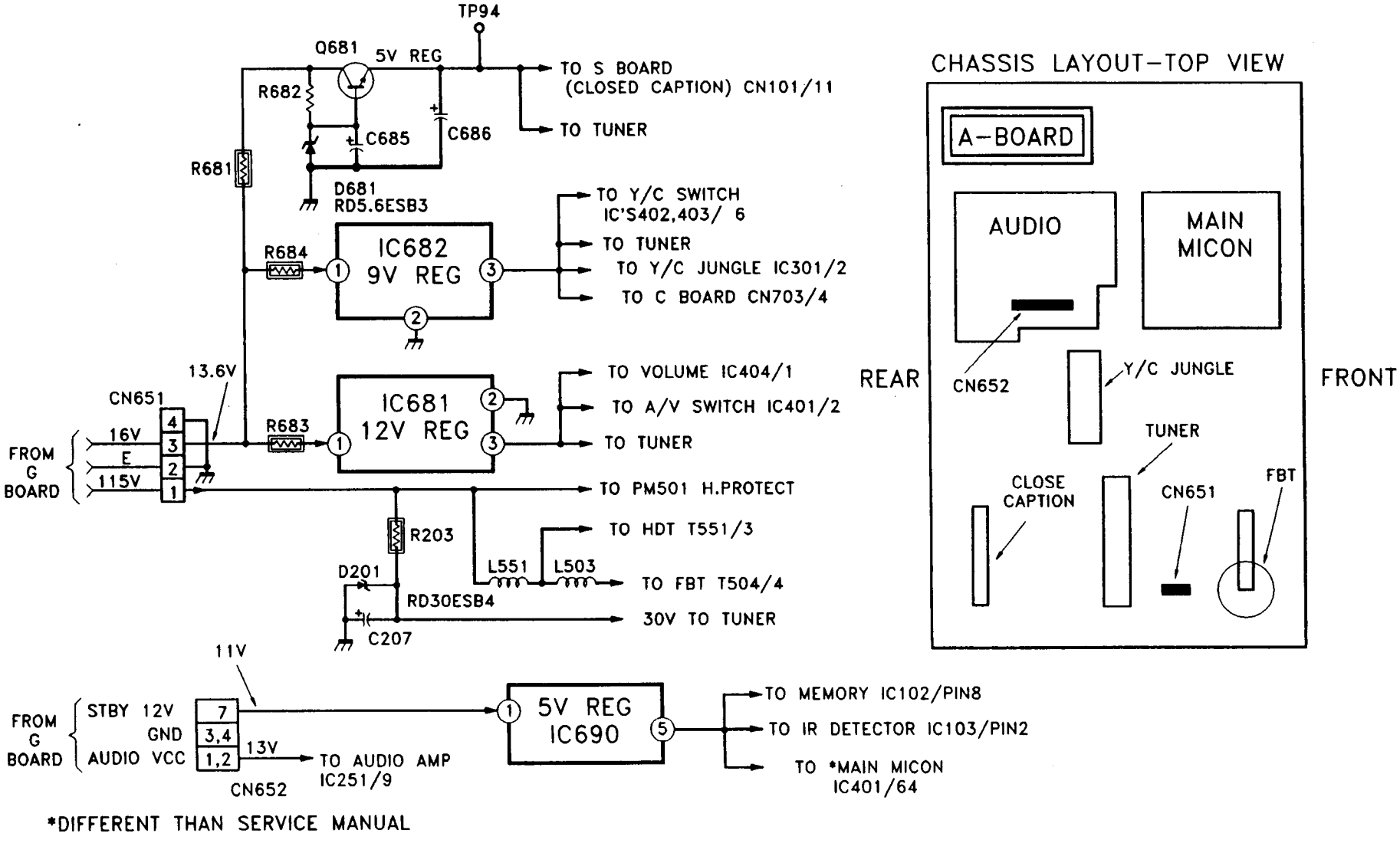
REGULATION / SOFT START

NOTES



AA-1 POWER DISTRIBUTION

NOTES



*DIFFERENT THAN SERVICE MANUAL

BA-1 POWER DISTRIBUTION

AA-1 Single Tuner Operation

The tuner in both the AA-1 and BA-1 chassis are self contained units. Although the part numbers may vary from unit to unit, the operation remains the same. Four outputs are used depending on the chassis and model number. These are video detect 1 and 2, and left and right audio. The tuner is controlled by the main micon IC101. IC101 provides the following.

- Channel selection.
- AFT (Auto Fine Tuning) control.
- Mute control.
- Switching between mono and stereo sound.

Tuner Operation Circuit Layout

The tuner circuit in the AA-1 chassis is located on three boards. The circuits are divided as follows.

1. A board contains the tuner(s).
2. UA board contains the A/V switch (see VIDEO SIGNAL FLOW for details).
3. M board contains the main micon which controls tuner operation.

Channel Set-up

When the customer turns the set ON for the first time, the memory IC102 will contain basic factory channel data. Therefore, the first thing the customer will probably do is to use the on screen menu set-up function to automatically scan and program all local TV stations. To do this, the following sequence occurs.

- Tuning data will be sent from IC101 pins 30 (data), 31 (CLK) and 22 (LATCH) to the tuner (TU101).
- The tuner will convert the data into an analog control voltage to demodulate the incoming signal. The demodulated RF is output as composite video from the tuner as VIDEO DET and VIDEO DET 2.
- The VIDEO DET output is applied to the H-SYNC detect Q001 (and associated components) which filters out the Y and C signals, and inverts the H. pulse.
- This pulse is applied to IC101 pin 28 (H - sync) where it is used to detect a valid station.
- IC101 will store the appropriate station data in the memory IC102 using the BDATN (pin 54) line and the BCLKN (pin 56) line.
- The VIDEO DET 2 output from the tuner provides composite video to the VIDEO BUFFER Q401/B for video signal processing.

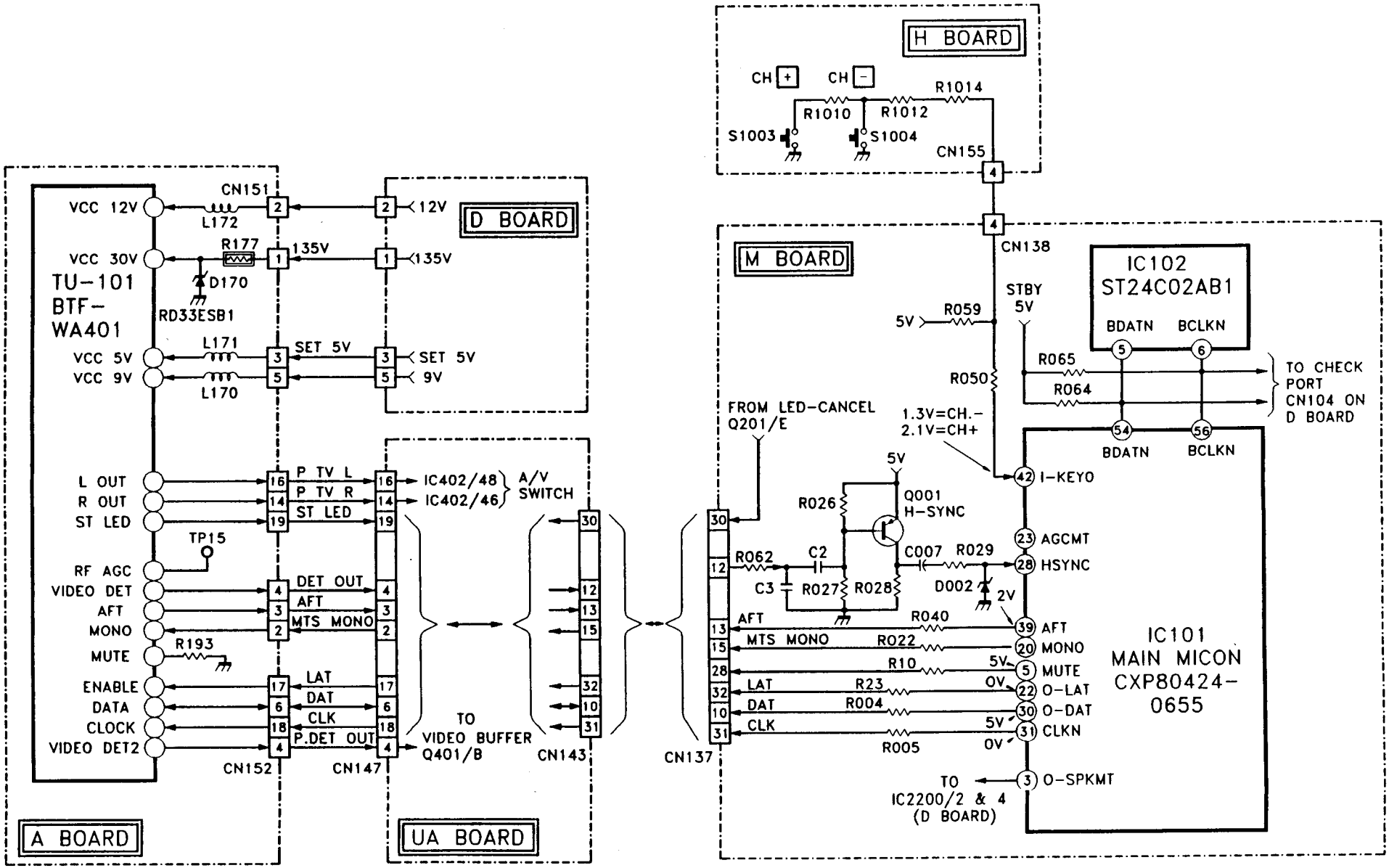
Channel Selection

Channels can be selected either by pressing a front panel channel select button (S1003 and S1004) or by pressing a select button on the remote commander. If a front panel button is used, the following voltages will be applied to IC101 pin 42 (KEY 0).

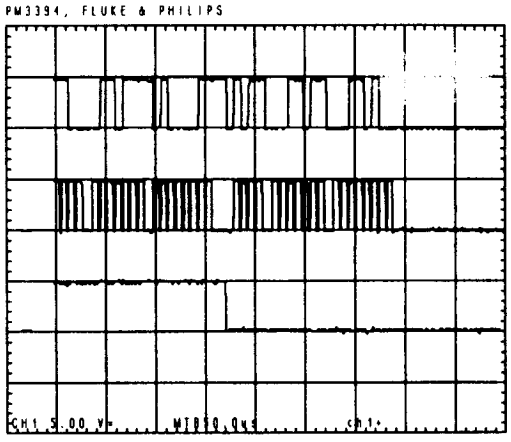
Channel UP (+) S1003 = 2.1Vdc

Channel DOWN (-) S1004 = 1.3Vdc

IC101 will then send the channel data for the appropriate channel (which had been stored in memory) to the tuner on the data, clock and latch lines. The data will take the form of a repetitive data packet at 60Hz. The waveforms shown in the schematic below show this data during normal operation. These three signals are always present.

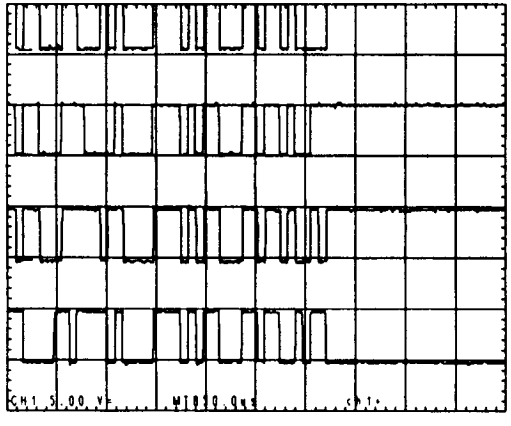


AA-1 SINGLE TUNER OPERATION



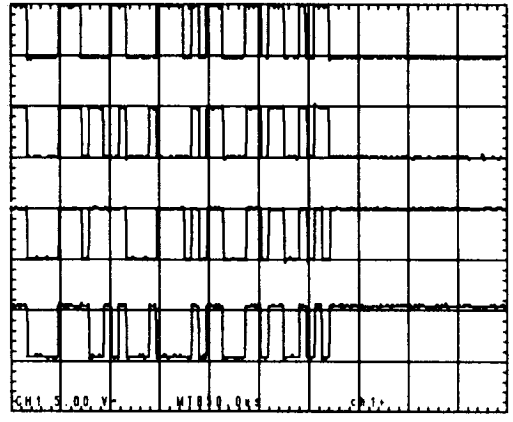
TOP IC101 pin 30 (DATA)
MIDDLE IC101 pin 31 (CLK)
BOTTOM IC101 pin 22 (LATCH)
5V/DIV. TB 50μSEC/DIV.

FIG. 1



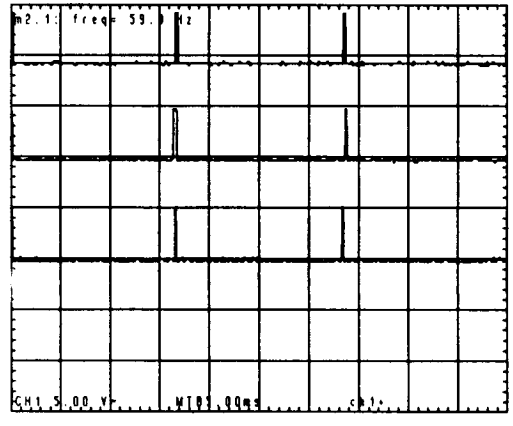
TOP IC101 pin 30 (DATA)
MIDDLE IC101 pin 31 (CLK)
BOTTOM IC101 pin 22 (LATCH)
5V/DIV. TB 50μSEC/DIV.

FIG. 3



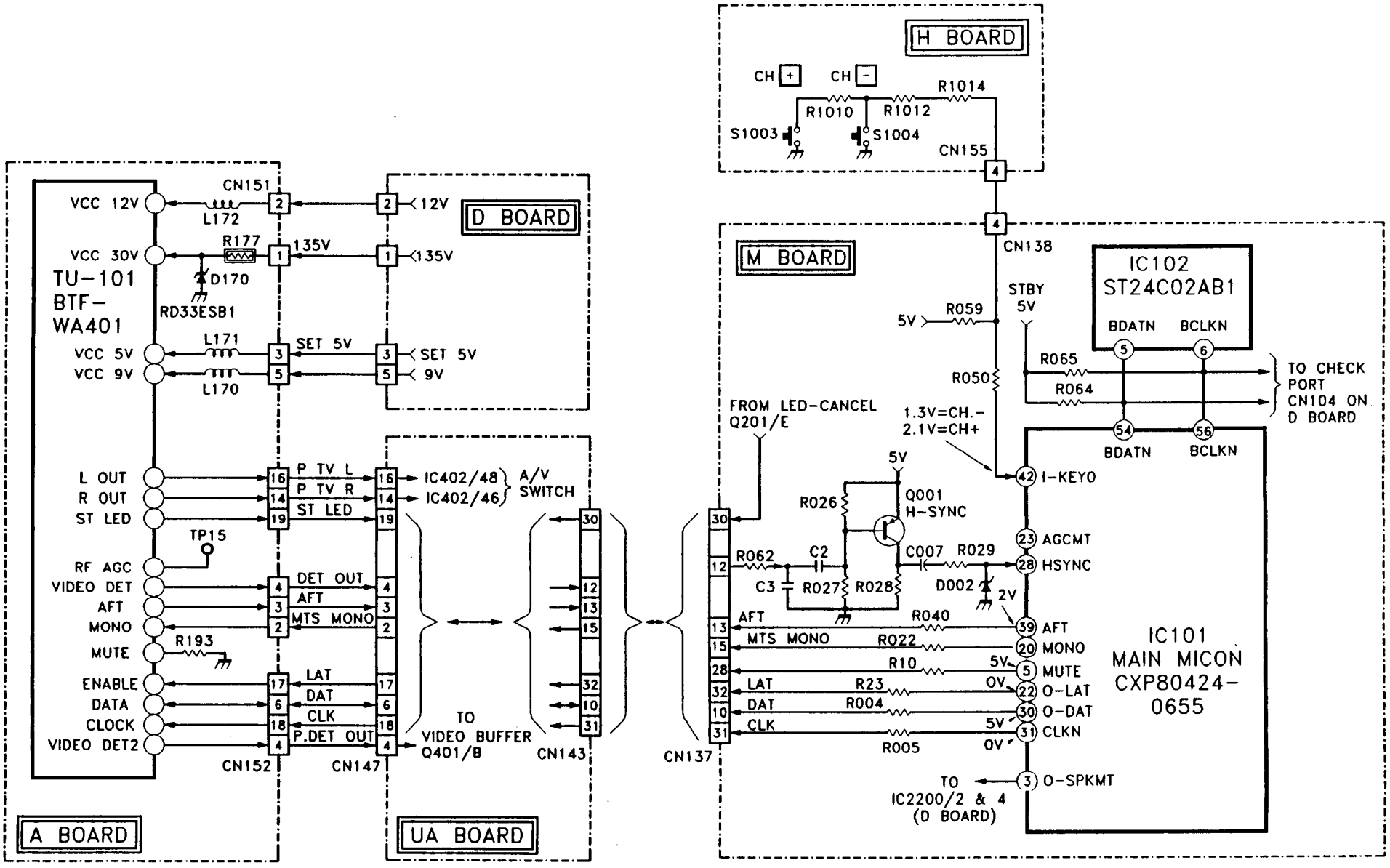
IC101 pin 30 (DATA) for TV tuner channels 2, 4, 6 and 7 (from top to bottom).
5V/DIV. TB 50μSEC/DIV.

FIG. 2



IC101 pin 30 (DATA) for TV tuner channels 2, 4, 6 and 7 (from top to bottom).
5V/DIV. TB 50μSEC/DIV.

FIG. 4



AA-1 SINGLE TUNER OPERATION

Troubleshooting

Referring to the figures on page 32 figure 1 shows the data in relation to the clock and latch lines. When the latch line is HIGH, the channel data is being sent to the tuner. If you look at figures 2 and 3, you will notice that the data is different for each channel. With this in mind, you can easily isolate a defective tuner from a defective controller. To do this simply advance channels while observing the data clock and latch lines. To observe these lines easily, set your scope as follows:

Vertical Attenuator: 5V/div.
Time base: 50usec/div.
Triggering: Negative edge/TV field

If the data continually changes but the channels do not, the tuner is probably at fault. If the data remains the same or the clock line and latch lines are intermittent, the controller is probably at fault.

Figure 4 shows the same three signals at a time base of 5msec/div. so that you can verify that the repetitive data packet is at 60Hz.

AFT Control

The AFT signal is a varying dc feedback voltage which tells the tuner control IC101 what the RF level is. IC101 will change the tuning voltage until the maximum RF level is achieved. This will take place with or without an H pulse present although a station will be tuned alot quicker with the H pulse present. The nominal AFT voltage is 2.1Vdc.

Mute Control

The main micon will mute the audio signal under two conditions.

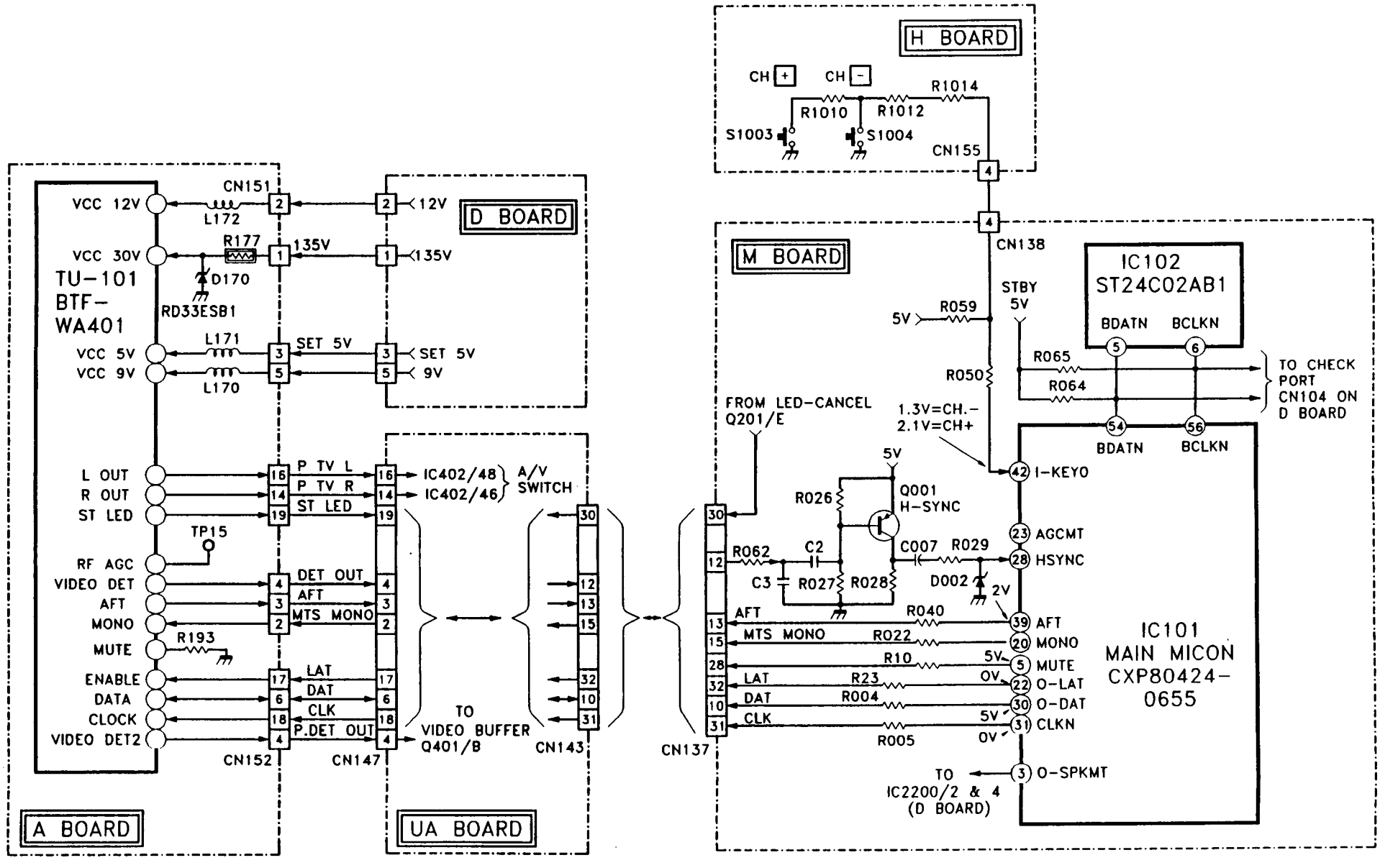
- Between stations
- When the MUTE button on the remote commander is pressed.

To mute the audio between stations, data from the main micon IC101 pin 30 (O-DAT) is used.

When the MUTE button on the remote commander is pressed, IC101 pin 3 (SPKMT) will go HIGH. This is applied to the mute circuitry for the audio amp only on the D board (not shown - refer to the AUDIO PROCESS section).

Switching Between Mono and Stereo

The customer can manually switch between mono and stereo operation using the on screen menus. When mono is selected, IC101 pin 20 will go HIGH. In all other modes, this pin will be LOW.



AA-1 SINGLE TUNER OPERATION

AA-1 Video Signal Flow / Switching

The AA-1 chassis has the option of containing two tuners and a PIP (picture in picture) circuitry. Those sets which contain two tuners (KV-32TS46) can have two TV programs appear on the screen at the same time. All other sets will only allow one TV program to be viewed at one time. If the PIP function is selected on these sets, the main tuner output will be seen as the main picture as well as the child picture. The circuit description that follows applies to the following models; KV27TS36, KV32TS36 and KV32TS46. For all other models, refer to the A/V switching section.

Circuit Description of Main Tuner Signal Flow

The main tuner video signal (P DET OUT) is buffered by Q402 and applied to the Video switch IC402 pin 47. This signal is amplified to and is output at pin 40. This composite video signal is applied to a comb filter which separates the signal into Y and C components. The BA-1 chassis however does not contain a comb filter instead, discrete filtering is used at the input of the Y/C jungle. The output of the comb filter is applied back to the video switch at pins 37 (Y IN 1) and 35 (C IN 1). The Y and C outputs of the video switch (pins 43 and 45) can be switched between TV video (or VID 1, 2 or 3) and S-video which is applied to pins 31 (Y) and 5 (C). Switching is accomplished via data from the main micon, on the I^2C bus. This will be explained later.

The Y and C outputs are buffered by Q405 (Y) and Q406 (C) and applied to the PIP processor on the P board. The video signal is processed on this board even if the PIP function is not selected. Therefore, if there is a problem with the quality of the picture or lack of picture, The problem may be on the PIP board. These problems can be mistaken for defects in other areas such as the IK lines, muting circuits, Y/C jungle or RGB drives. Before you troubleshoot these areas, make sure that the video signal is present at the input of the Y/C jungle IC301 pins 3 and 5 (M board). If it is not, you can bypass the PIP board as follows:

1. Locate the P board connector CN150.

2. Jumper pin 1 (C OUT) to pin 5 (C IN) and pin 3 (Y OUT) to pin 7 (Y IN).

This will bypass the P board so that the Y and C signals are applied directly to the Y/C jungle. PIP processing will be explained in the PIP section of the manual.

After being processed by the PIP processor, the Y and C signals are applied to the Y/C jungle IC301 pins 3 (Y) and 5 (C). In addition, the Y signal is also applied to the closed caption IC150 pin 11 (V IN). The Y/C jungle mixes the video signal, the closed caption signal, and the on screen display information from the main micon and outputs the composite signal as RGB at pins 20 (R), 22 (G) and 24 (B). The RGB outputs are then applied to the C board to be amplified by the video amps.

S-Video Switching

When the S-VIDEO cable is connected, the switch output in the connector will be grounded. This signal is connected to both the A/V switch IC402 pin 6 (SIN1) and the main micon IC101 pin 9 (SSWN). As a result, the following will occur:

1. A/V switch will automatically switch to the S-VIDEO input at pins 3 and 5.

2. The main micon will change the on screen menu to show that the S-Video input had been connected.

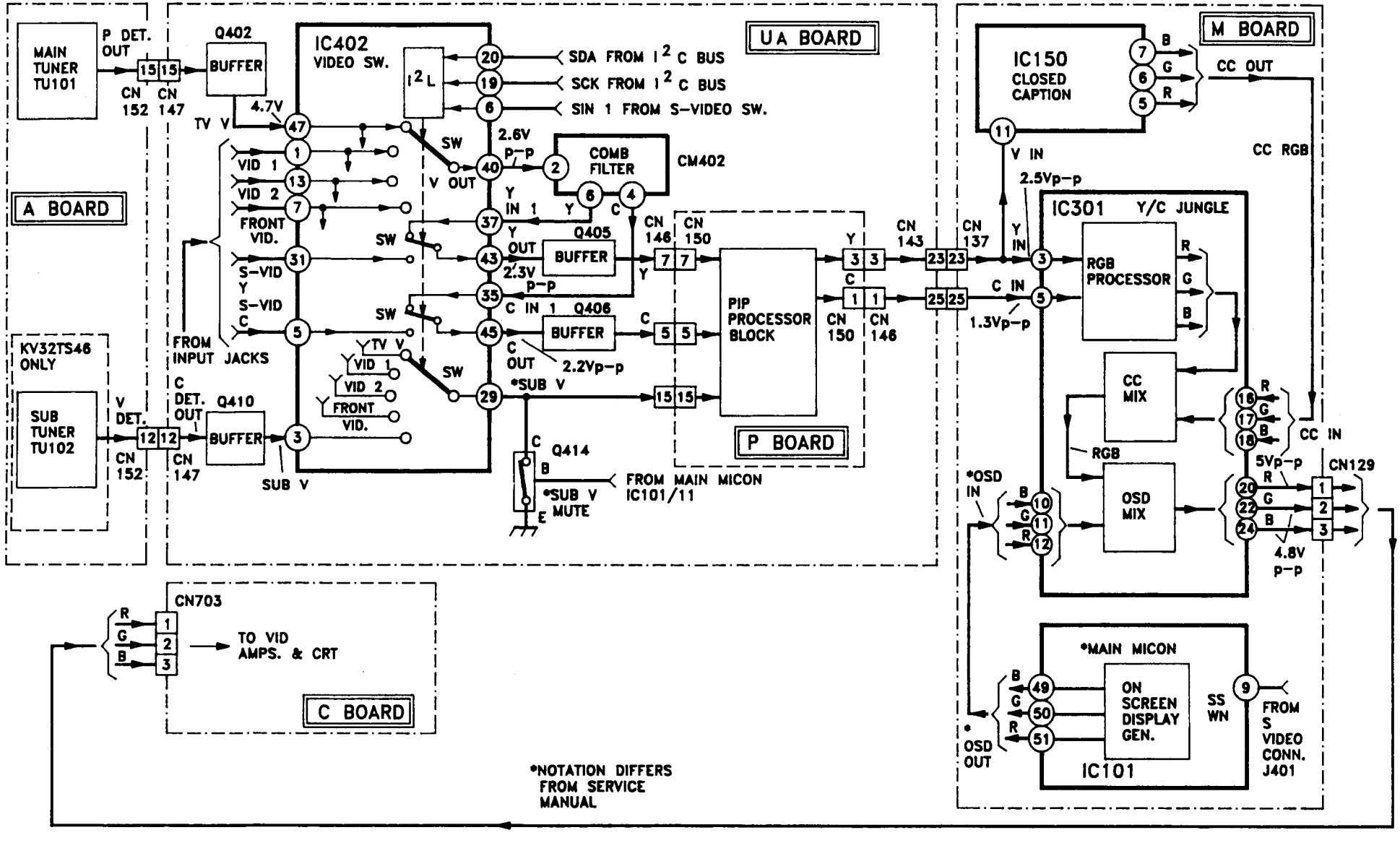
As long as the S-VIDEO connector is in place, the VIDEO 1 input cannot be used since the S-VIDEO signal has priority. Also, the on screen display will not show that the S-VIDEO input is being displayed. It will continue to display VIDEO 1.

Sub Tuner Signal Switching

The sub tuner is only available on the KV32TS46. When PIP is selected, the sub tuner signal will be output from the A/V switch at pin 29 and applied directly to the PIP processor. There is no comb filter used for the child picture in this set. Instead, a discrete filter located on the P board is used to separate the Y and C components. On units with a single tuner, Q414 is used to mute the sub V line to prevent noise.

Video Signal Switching in PIP Mode

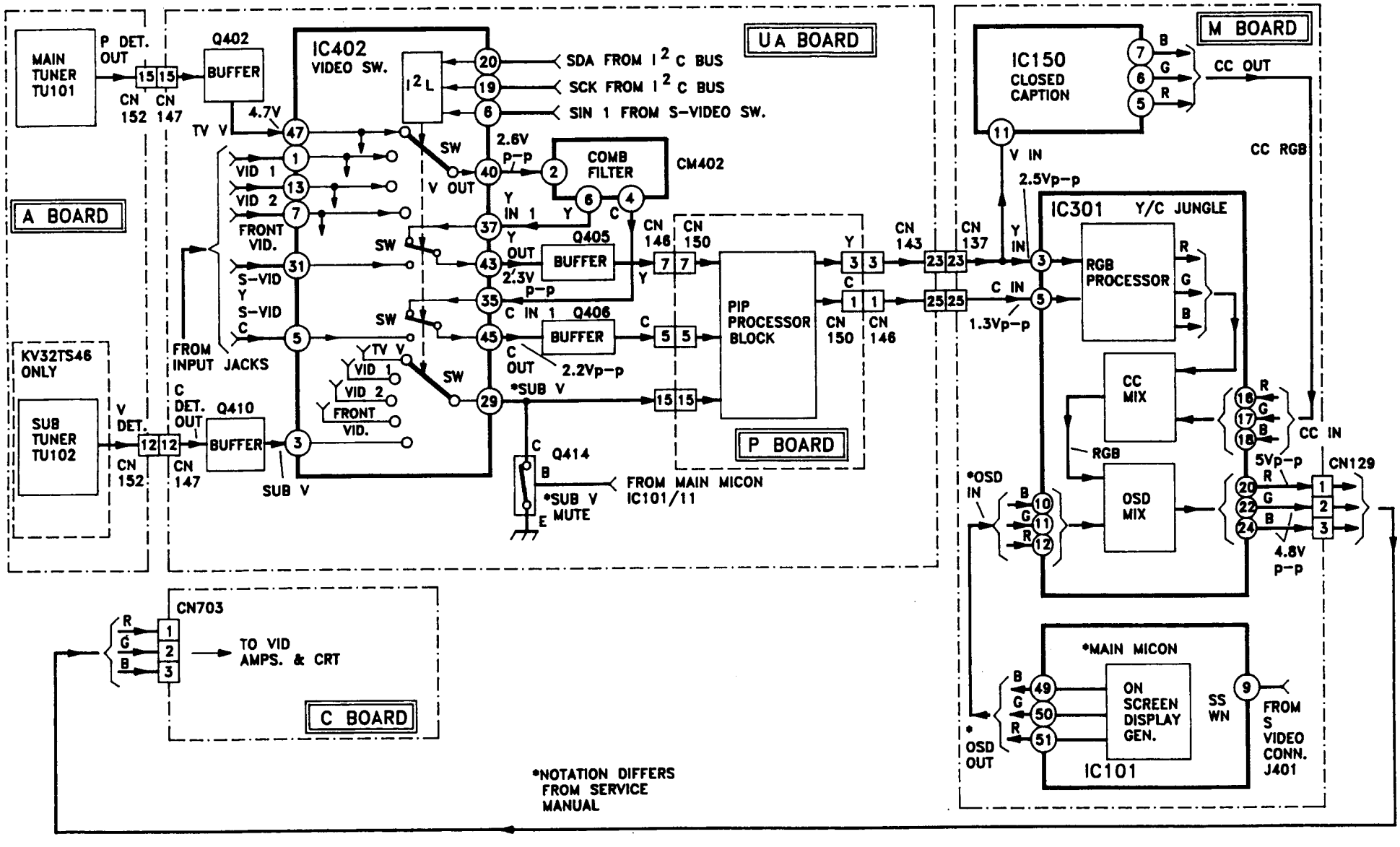
The A/V switch is set up so that all video inputs are available at both the VOUT (pin 40) and the SUB V (pin 29). When the user selects a source for the main picture and the child picture, the video switch will receive the data



AA-1 VIDEO SIGNAL FLOW / SWITCHING

at pin 20 (SDA) and respond by switching each output to the appropriate source.

NOTE: If there is no main picture, the child picture will not be in color. Also, If you select TV while in PIP mode, the main picture and the child picture will be the same in single tuner sets.



AA-1 VIDEO SIGNAL FLOW / SWITCHING

BA-1 Single Tuner Operation

The tuner in BA-1 chassis is a self contained RF, VIF and audio unit. Although the part number may vary from unit to unit, the operation remains the same. The tuner, BTF-WA401, has three outputs: video, left and right audio. The BTF-LA401 tuner is basically used as the sub tuner to provide the PIP picture in the dual tuner AA-1 chassis sets and to provide the mono only audio in the 13 inch BA-1 chassis sets. Both tuners are controlled by the Main Micon IC101. IC101 provides the following:

- Channel selection
- AFT (Auto Fine Tuning) control
- Mute control
- Switching between mono and stereo sound (BTF-WA401 tuner)

Channel Set-up

When the customer turns the set on for the first time, the memory IC102 will not contain any channel data. Therefore, the first thing the customer will probably do is use the on screen menu to automatically scan the incoming RF and program all local stations. To do this, the following sequence occurs.

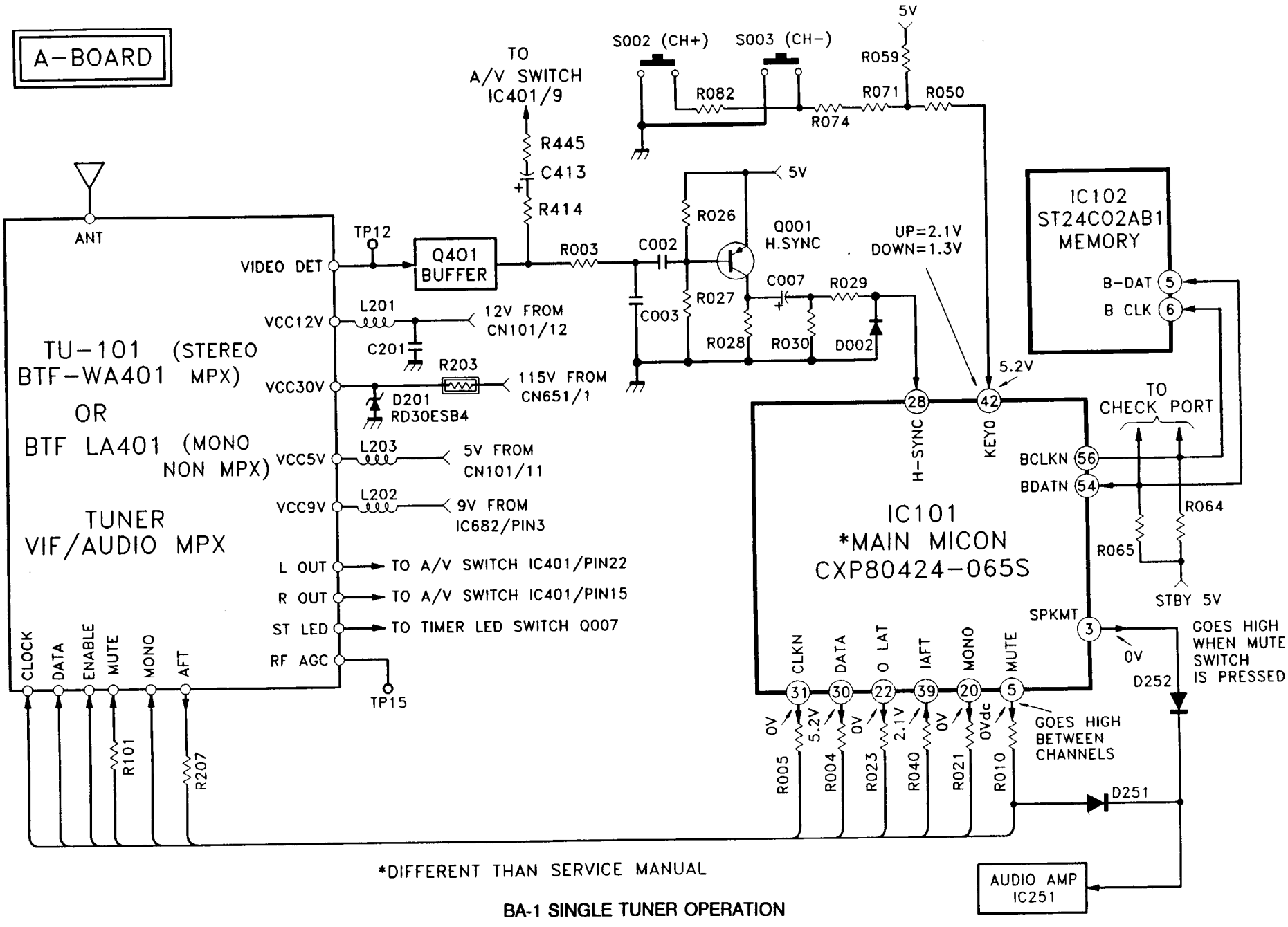
- Tuning data will be sent from IC101 pins 30 (data), 31 (CLK) and 22 (LATCH) to the tuner (TU101).
- The tuner will convert the data into an analog control voltage to tune the incoming signal. The demodulated RF is output as composite video from the tuner as VIDEO DET.
- The composite video signal is buffered by Q401 (not shown) and applied to a H. sync detector Q101 (and associated components) which filters out the Y and C signals, and inverts the H. pulse.
- This pulse is applied to IC101 pin 28 (H sync) where it is used to detect a valid station.
- IC101 will store the appropriate station data in the memory IC102 using the BDATN (pin 54) line and the BCLKN (pin 56) line channel selection.

Channels can be selected either by pressing a front panel channel select button (S003 and S002) or by pressing a select button on the remote commander. If a front panel button is used, the following voltages will be applied to IC101 pin 42 (KEY 0).

Channel UP (+) S002 = 2.1Vdc

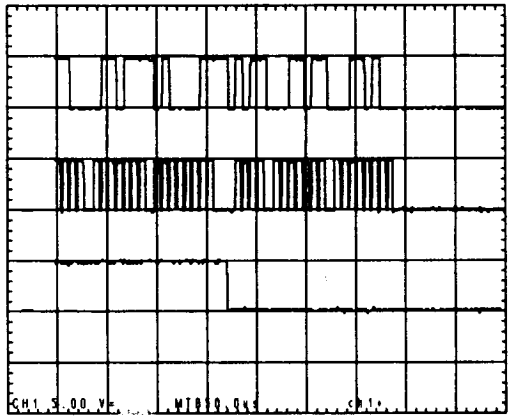
Channel DOWN (-) S003 = 1.3Vdc

IC101 will then send the channel data for the appropriate channel (which had been stored in memory) to the tuner on the data, clock and latch lines. The data will take the form of a repetitive data packet at 60Hz. The waveforms shown in the schematic below show this data during normal operation. These three signals are always present.



*DIFFERENT THAN SERVICE MANUAL

BA-1 SINGLE TUNER OPERATION

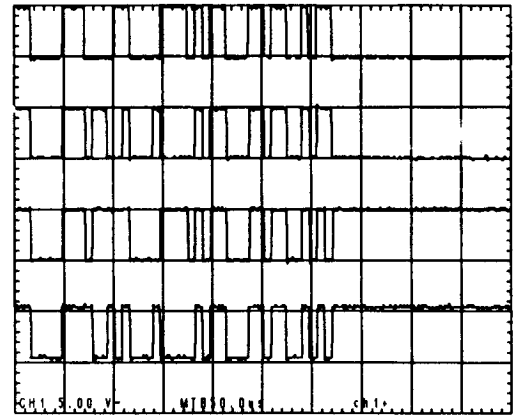


TOP IC101 pin 30 (DATA)
MIDDLE IC101 pin 31 (CLK)
BOTTOM IC101 pin 22 (LATCH)
5V/DIV. TB 50μSEC/DIV.

FIG. 1

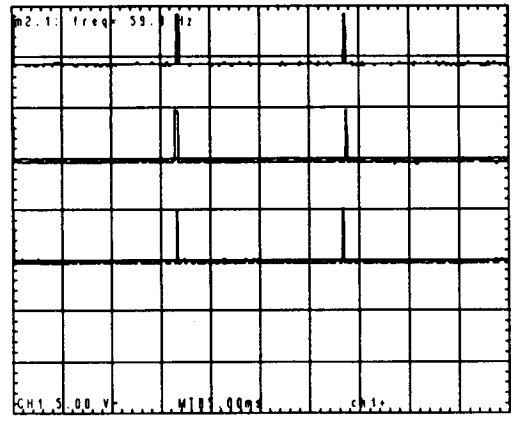
IC101 pin 30 (DATA) for TV tuner channels 2, 4, 6 and 7 (from top to bottom).
5V/DIV. TB 50μSEC/DIV.

FIG. 2



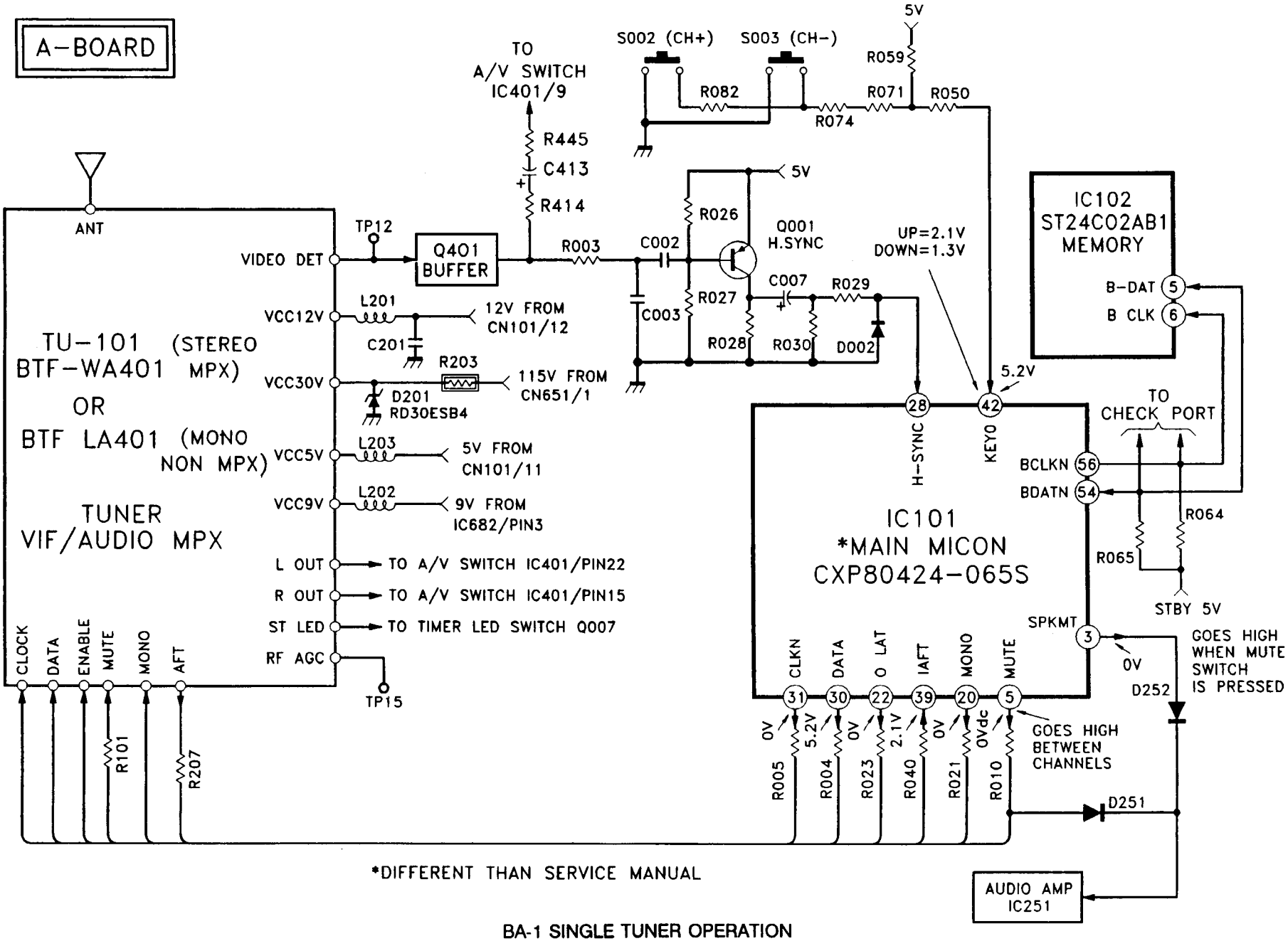
IC101 pin 30 (DATA) for TV tuner channels 2, 4, 6 and 7 (from top to bottom).
5V/DIV. TB 50μSEC/DIV.

FIG. 3



TOP IC101 pin 30 (DATA)
MIDDLE IC101 pin 31 (CLK)
BOTTOM IC101 pin 22 (LATCH)
5V/DIV. TB 50μSEC/DIV.

FIG. 4



*DIFFERENT THAN SERVICE MANUAL

BA-1 SINGLE TUNER OPERATION

Troubleshooting

Referring to the figures on page 42 figure 1 shows the data in relation to the clock and latch lines. When the latch line is HIGH, the channel data is being sent to the tuner. If you look at figures 2 and 3, you will notice that the data is different for each channel. With this in mind, you can easily isolate a defective tuner from a defective controller. To do this simply advance channels while observing the data clock and latch lines. To observe these lines easily, set your scope as follows:

Vertical Attenuator: 5V/div.

Time base: 50usec/div.

Triggering: Negative edge/TV field.

If the data continually changes but the channels do not, the tuner is probably at fault. If the data remains the same or the clock line and latch lines are intermittent, the controller is probably at fault.

Figure 4 shows the same three signals at a time base of 5msec/div so that you can verify that the repetitive data packet is at 60Hz.

AFT Control

The AFT signal is a varying dc feedback voltage which tells the tuner control, IC101, what the IF center frequency is. IC101 will change the tuning voltage until the maximum IF level is achieved. This will take place with or without an H pulse present although a station will be tuned alot quicker with the H pulse present. The nominal AFT voltage is 2.1Vdc.

Mute Control

The tuner control will mute the audio signal under two conditions.

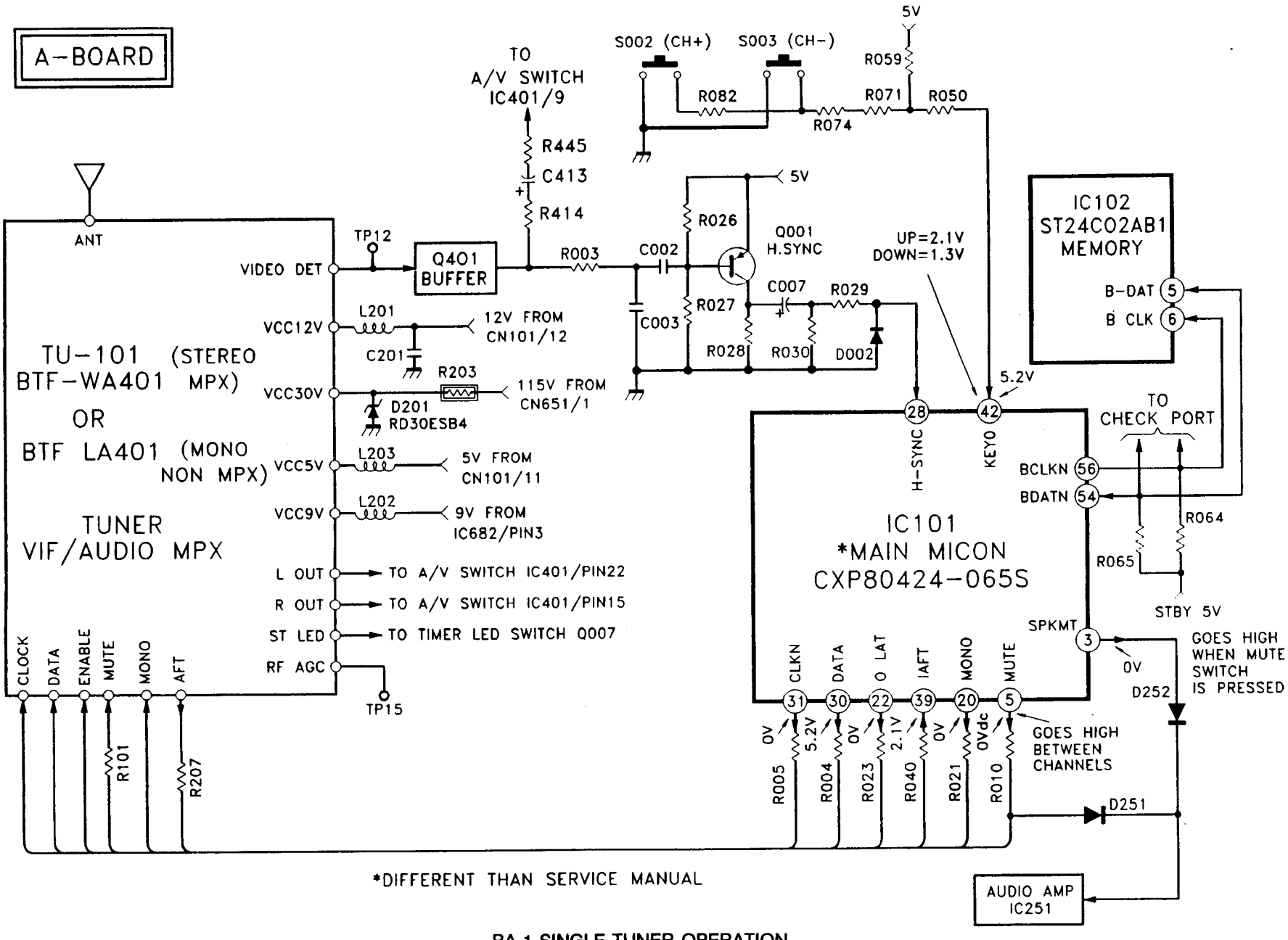
- Between stations
- When the MUTE button on the remote commander is pressed.

To mute the audio between stations, IC101 pin 5 (MUTE) will go HIGH. This signal is applied to the tuner and to the audio amp IC251 (through D251).

When the MUTE button on the remote commander is pressed, IC101 pin 3 (SPKMT) will go HIGH. This is applied to the audio amp only (through D252).

Switching Between Mono and Stereo

The customer can manually switch between mono and stereo operation using the on screen menus. When mono is selected, IC101 pin 20 will go HIGH. In all other modes, this pin will be LOW.



*DIFFERENT THAN SERVICE MANUAL

BA-1 SINGLE TUNER OPERATION

BA-1 A/V Switching

The BA-1 chassis has four inputs as shown below. These are: Antenna, Video 1, Video 2 and S-Video. These signals are switched by the A/V switch, IC401, the Y switch, IC402, and the C switch, IC403. The tuner (antenna) and video 2 can be selected at any time. Video 1 can only be selected if the S video input (J401) is disconnected. Otherwise, the S video input has priority. These three switches are controlled by the main micon, IC101, through three control lines from IC101 pin 6 (V0), pin 7 (V1) and pin 8 (V2). The switching circuit operates as follows.

Selecting an Input

Inputs are selected by either pressing the front panel TV/VIDEO switch S006, or by using the remote commander (not shown). Each time the TV/VIDEO switch is pressed, IC101 pin 42 will go to 2.5Vdc. This also causes the on screen graphics for the input selected to be displayed on the CRT temporarily.

Switching Between Inputs

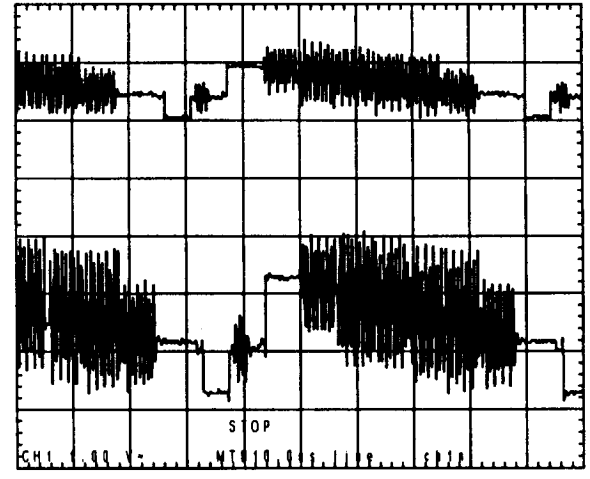
The A/V switch IC401 is used to select between the tuner, VIDEO 1, J402 (rear panel) and, J403, (front panel). To do this, two control lines at pins 4 and 6 are used. A 2-bit code is generated by IC101 pin 6 (V1) and 7 (V0) to accomplish the switching. The following chart shows the code.

	TV	VIDEO 1	VIDEO 2
IC101 pin 6	5.2Vdc	0	5.2Vdc
IC101 pin 7	5.2Vdc	5.2Vdc	0

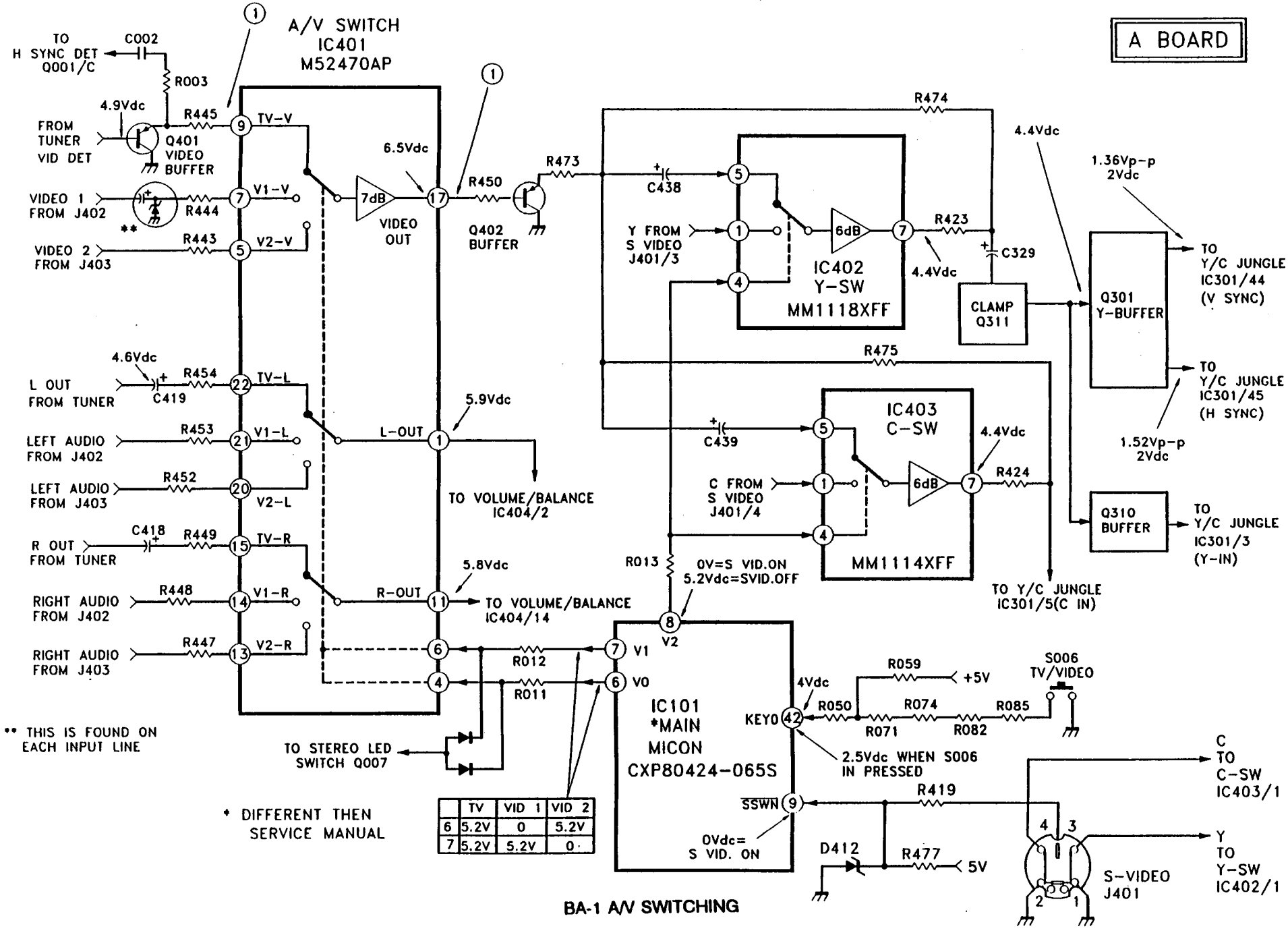
The A/V switch has three switches in it to switch the video signal, and left and right audio signals separately. The video switch has a 7dB amplifier to increase the voltage gain of the video signal from 1.4Vp-p at its input (pins 5, 7, and 9) to 3Vp-p at the output (pin 17). This is shown in the figure on the right.

The Y switch, IC402, and the C switch, IC403, are identical switches used to select between tuner video at pin 5 and either video 2 or S video at pin 1. These switches are controlled by a switching signal from IC101 pin 8 (V2). This signal will go LOW when the S video cable is plugged in and VIDEO 1 is selected. At this time, IC101 pin 9 (SSWN) will go LOW as a result of the switch in the S video connector closing. A 6dB amplifier inside both of these switches changes the 1.3Vp-p signal input to IC402 and IC403 pins 5 to a 2.7Vp-p signal at pins 7. These waveforms will look similar to the ones in the figure below.

The Y signal is clamped and buffered by Q311 and Q301 and applied to the Y/C jungle IC301 pins 45 (H sync), 44 (V sync), and pin 3 (Y-IN). The C signal is applied to the Y/C jungle IC301 pin 5 (C IN).



IC402 and IC403 pin 5 (Top)
IC402 and IC403 pin 7 (Bottom)



BA-1 A/V SWITCHING

AA-1 Audio Process

The Audio circuitry in the AA-1 chassis is located on four boards. The circuits are divided as follows:

1. A board contains the tuner and the speaker connections.
2. UA board contains the A/V switching and I/O jacks to select input sources
3. M board contains the audio processor and variable audio amp for volume, bass, treble and balance adjustment.
4. D board contains the muting circuit and the audio power amp.

A/V Switching

All audio sources enter the UA board and are applied to the A/V switch IC402 through a series resistor and capacitor. The number of inputs depends upon the particular model. The switching of signals is performed by the switch from a command by the main micon. The command is applied to the switch on the I^2C bus. The audio signals will the exit the switch from two outputs at pins 26 (left) and 28 (right). The A/V switch uses only two outputs for audio although the switch has provisions for 6 outputs. The outputs of the A/V switch are coupled through C413 and C416 to the audio processor IC201 on the M board.

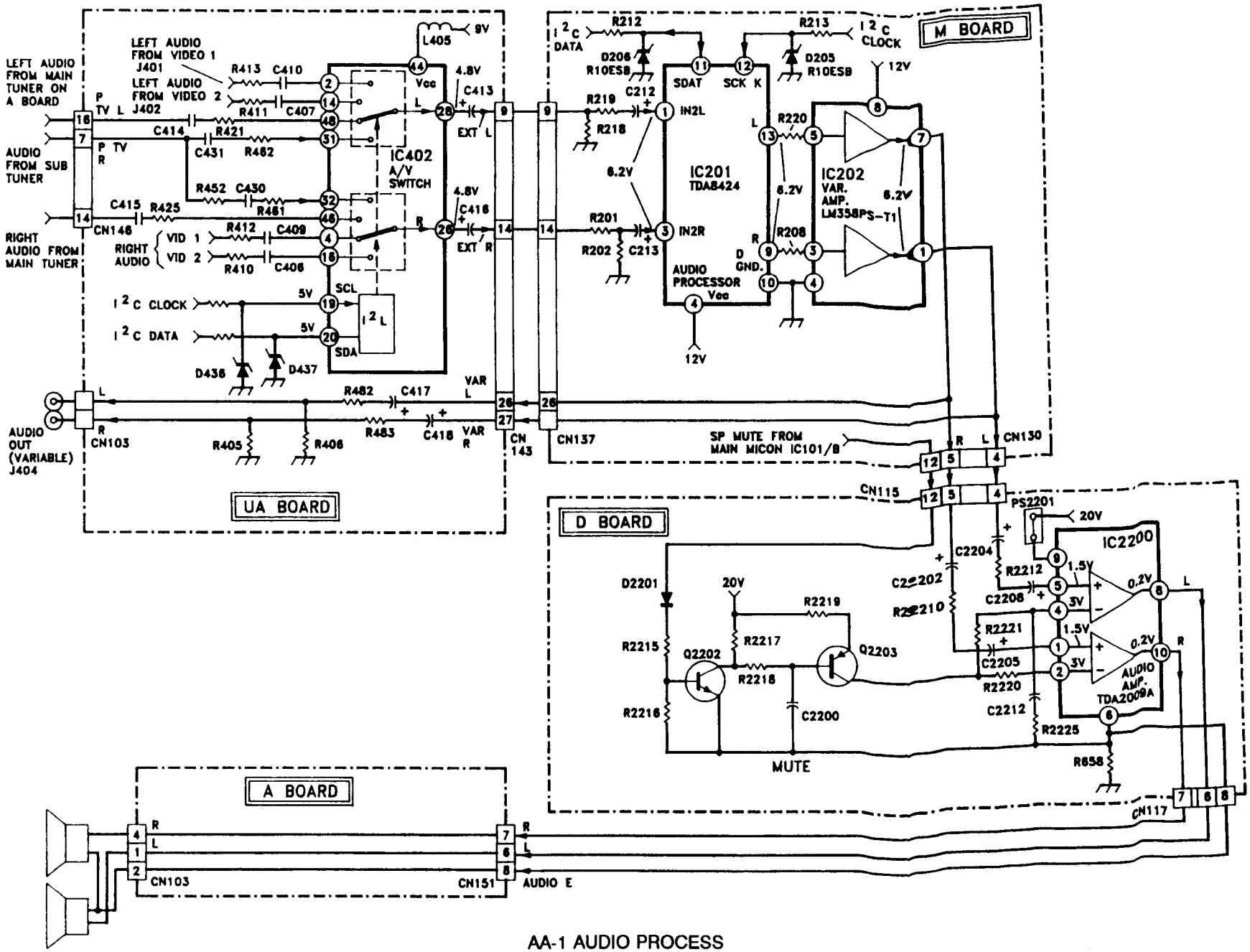
Audio Processor

The audio processor in this chassis uses data from the I^2C bus to adjust the audio parameters such as volume, bass, treble and balance. Once processed, the audio signals are output from IC201 pins 13 (left) and 9 (right) and applied to a fixed gain amplifier IC202 through R220 (left) and R208 (right). IC202 provides a gain of 2 so that a 50mv input signal will be output at 100mv. The amplified audio signals are then applied to the audio amp IC2200 on the D board.

Audio Amplifier

The audio amplifier provides power gain [illegible] and right audio signals. Each signal is coupled through a series resistor and capacitor to the non-inverting inputs of the amplifier IC2200 pins 5 (left) and 1 (right). A muting circuit composed of Q2202 and Q2203 is [illegible] to the inverting inputs of the amplifier IC220 pins 4 (left) and 2 (right) through series resistors R2221 (Left) and R2220 (right). When the mute button on the remote commander is pressed, main micon IC101 pin 3 (SP MUTE) will go HIGH. As a result, a mute switch Q2202 will be turned on through D2201. Q2202 will turn ON mute switch Q2203 which brings the inverting inputs of amplifier IC2200 up to 3.6Vdc. Acting as a comparator, the amplifier will not pass the audio signal since the bias on the inverting inputs is much higher than that of the non inverting inputs.

The outputs of the audio amplifier IC2200 pins 8 (left) and 10 (right) are applied to one side of each speaker connected to the A board. The ground return for both speakers float above chassis ground through R658. Notice that all the audio amplifier IC2200 circuitry also floats above chassis ground through R658.



AA-1 AUDIO PROCESS

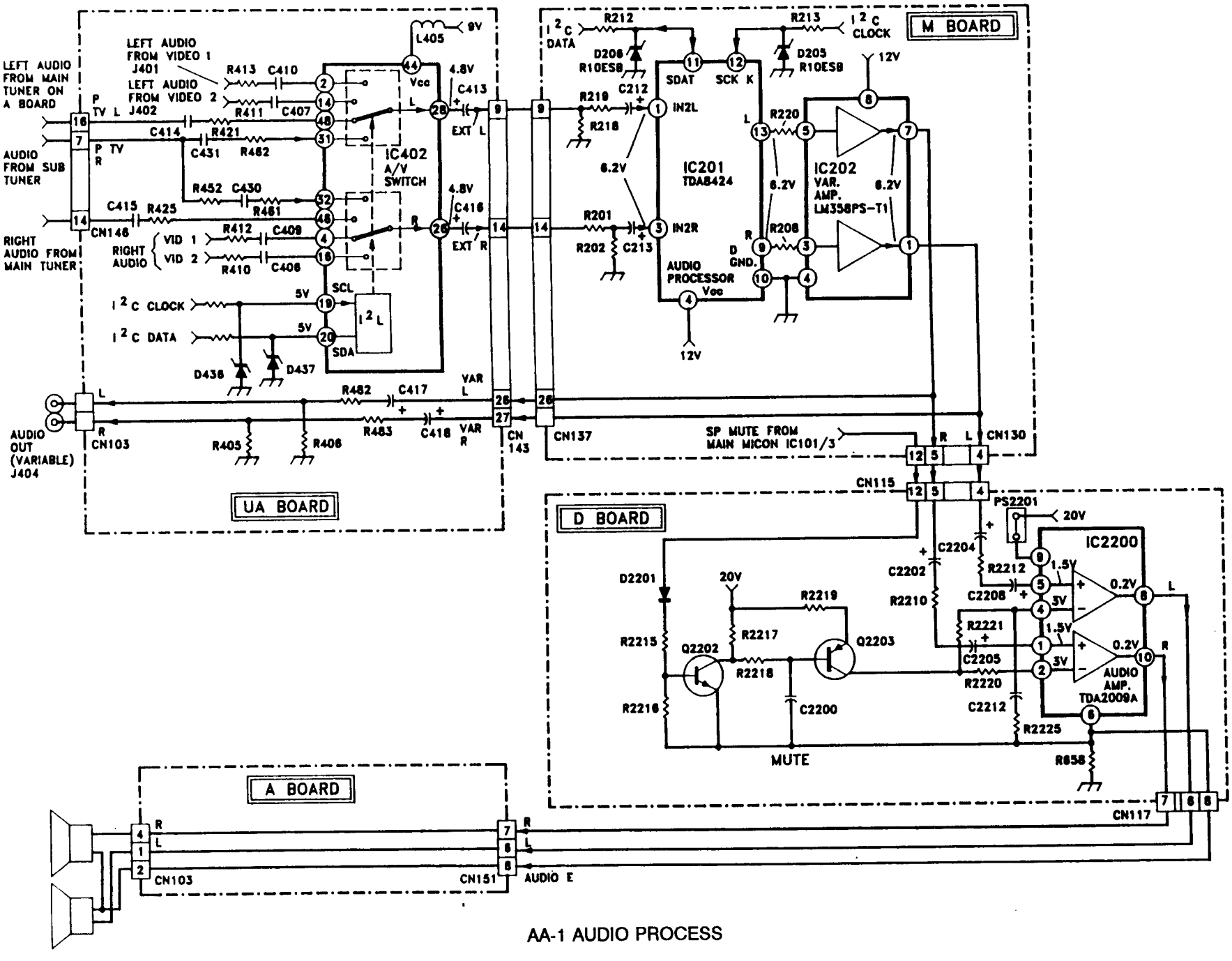
Troubleshooting

The first step in troubleshooting the audio process circuitry is to check the must-haves. In this case, the must-haves are:

1. Power for each IC on each board as follows.
   - 9V on the A board.
   - 12V on the M board.
   - 20V on the D board and fuse PS2201.
2. Check for proper data and clock signals on the I^2C bus at IC201 pins 11 (data) and 12 (clock).

If the above items check out ok, make sure that the muting circuit is not operating. To do this verify that IC2200 pins 2 and 4 are at a 3V level or below. If not, troubleshoot the mute circuit. Then check to see that the A/V switch is passing the audio signal by signal tracing through it. If there is a question regarding the A/V switch, jumper the input and output pins to bypass it.

To signal trace the audio process circuit, input a 1kHz 500mV sinewave at any video input and trace it through.



AA-1 AUDIO PROCESS

Super Woofer

A super woofer is a single channel low frequency reinforcement device. It is used to add extra bass to small speaker systems which cannot produce enough bass due to their small size. Since very low frequencies are non directional, the left and right audio signals are mixed together to produce one channel. The SA-W200 active super woofer is an accessory provided with the KV32TS46. It is a self contained unit equipped with its own power supply and automatic internal power switch.

Circuit Description

The super woofer circuitry is divided into four sections; mixing, filtering, amplification and switching. For testing purposes, a 0.775Vp-p 100Hz sine wave was applied to the unit. The peak to peak voltages which appear in the diagram below are a result of that input signal.

Mixing

Left and right audio signals from the variable output of the tv set are coupled to buffer IC001 pins 6 (left) and 4 through C003 (left) and C004. The 40mVp-p output of the buffer is applied to the inverting input of mixer IC002 pin 7. The mixer adds the left and right channels together as well as providing some gain to the signal. The 60mVp-p signal is then applied to the 1st filter stage.

Filtering

The output of the mixer is applied to the low pass filter IC003 pin 4. Two stages of filtering provide an 18dB/octave roll-off low pass filter. At the tested frequency, the 20mVp-p input signal at IC003 pin 4 was reduced to 10mVp-p at pin 8. The output of the second stage at pin 8 is coupled by C009 to variable resistor VR001. VR001 is a volume control which is mounted in the front case.

The following list is provided to aid in troubleshooting.

FREQ.	VOLTAGE AT SPEAKER
50HZ	1.5Vp-p
100HZ	300mVp-p
200HZ	50mVp-p

Amplification

The woofer signal from VR001 is coupled by C010 and applied to the amplifier IC005. IC005 then provides a push-pull type signal to the woofer SP901. The two outputs from pins 11 and 16 are 180 degrees out of phase.

Switching

To switch the amplifier IC on and off, a sample of the mixed audio signal is taken from mixer IC002 pin 8 and applied to the non-inverting input of the signal detector IC002 pin 4. The signal detect IC will amplify the 30mVp-p signal to 4Vp-p and apply it to the discharge switch which has an open loop gain. A clipping circuit (D005) cuts off the negative cycle of the sampled signal to prevent the discharge switch from being turned off.

When a signal of 25mVp-p or more is present at the input terminals of the super woofer, the inverting input of the discharge switch IC004 will be greater than 0.8Vdc (at the non-inverting terminal). The switch will act as a discharge path for C014 which had been charged up by Q004 (quick charge) when the unit had been plugged in. As long as there is a signal present the output at pin 1 will be 0V. When no signal is present, C014 will charge up to 7.8V through R28. The charging time is approximately 14 seconds due to the long time constant created by the 1MΩ resistor R28. The purpose of the delay is so that the woofer does not shut off during periods of time when there is no audio present in the television signal.

The output signal from the discharge switch is applied to the AUTO POWER-OFF IC004/pin 6. The auto peer-off circuit will invert the input signal and apply it to the mute switch Q003. The mute switch passes the power-off signal to the amplifier IC005/pin 1. When an audio signal is present, this pin will be HIGH, activating the amplifier.

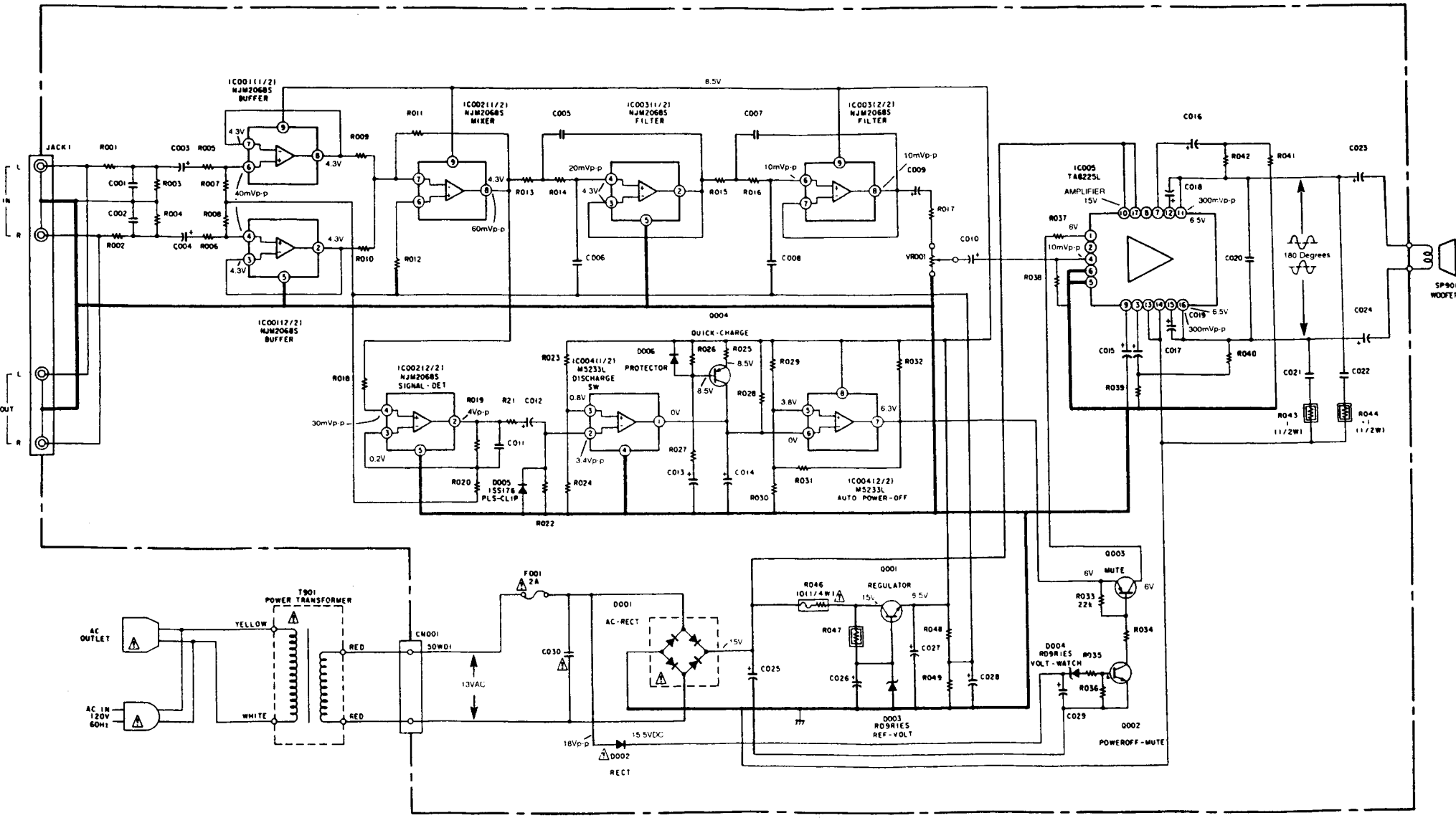
Mute Switch

The mute switch disables the amplifier when the AC voltage drops below 70Vac. In this case, the 9V zener diode D004 will become reverse biased and remove the base bias from Q002. Q002 will then turn OFF thereby turning mute switch Q003 OFF.

Troubleshooting Tips

The first step in troubleshooting any circuit are the must-haves. In this case they are:

1. Check for 15Vdc at the junction of R046 and C025.
2. Check for reg. 8.5Vdc at Q001/E (8.5Vdc regulator). Check for open R046.
3. Make sure that the collector of Q003 is HIGH when an audio signal is present.
4. Apply a 100Hz sinewave (0.775Vp-p) and signal trace.



SUPER WOOFER

BA-1 Audio Process

The left and right audio signals are output from the A/V switch, IC401, and are applied to the volume control IC404 pins 2 (left) and 14 (right). The volume control IC is controlled by the main micon, IC101, pin 59 (O-VOL). Both signals are amplified by the audio amp, IC251, and are applied to the speakers. To control the volume level, of the audio signal, a control signal of varying pulse width and amplitude is produced by IC101 as follows:

When the VOL+ button is pressed, IC101 pin 42 will go to 0.6Vdc (it is normally 5.2Vdc). IC101 will produce a 1.024kHz positive pulse at 3.3Vp-p from IC101 pin 59. As the volume increases, the pulse width and amplitude will increase until the signal is a negative going pulse at 8.8Vp-p. This signal charges up C063 and C461 through R093, R062 and R063. The result is a gradually rising dc voltage at IC404 pin 8 (volume 1).

Balance between the speakers, is maintained by a 1.024kHz square wave at IC101 pin 58. This signal charges up C064 through R080 to produce a 2.4Vdc level at IC404 pin 10 (volume 2).

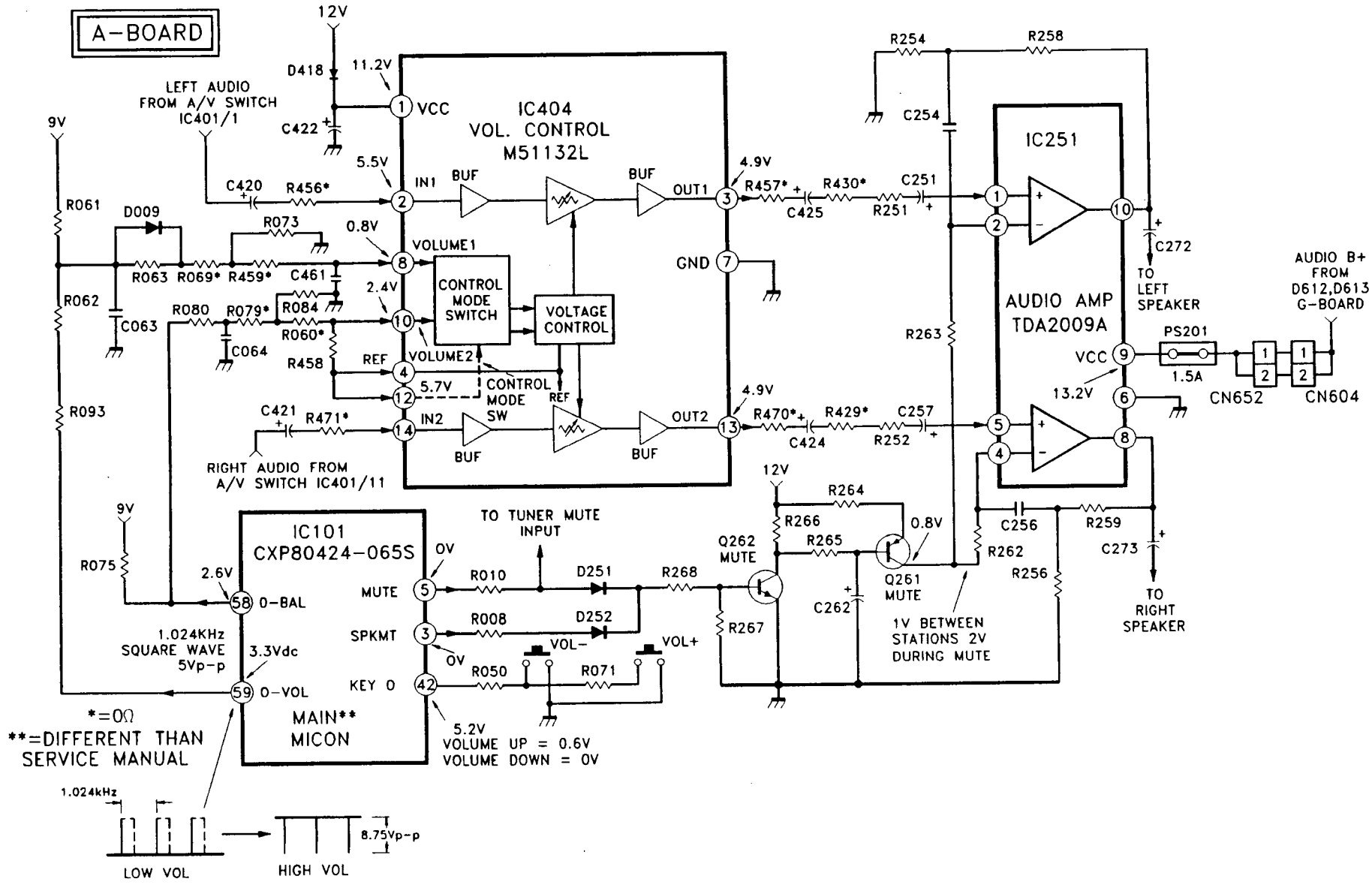
Muting

The audio signal is muted when scanning between stations and when the MUTE button on the remote commander is pressed. To mute the stations, IC101 pin 3 (SPKMT) will go HIGH. When the MUTE button on the remote commander is pressed, IC101 pin 5 (MUTE) will go HIGH. In either case, the following will occur:

- The base of Q262 (MUTE) will go HIGH, turning Q602 ON.
- Q262 will discharge C262 as long as Q262 is ON. This will turn Q261 ON which produces a positive voltage at its collector.

The voltage at the collector depends on which mute line is triggered. When muting between stations, Q262 is ON briefly. C262 will then discharge momentarily and Q261 will produce 1Vdc at its collector. When the MUTE button on the remote is pressed, C262 will discharge completely and Q261 will turn ON completely producing 2Vdc at its collector.

The voltage at the collector of Q261 will cause C254 to charge up through R254 and R263. This creates a "soft" mute since the muting voltage is gradually applied to the audio amp IC251 pins 2 and 4.



BA-1 AUDIO PROCESS

I^2C Data Format

In the last decade digital communication has taken a greater role in the control of the television chassis. To interface the digital system to the TV sub circuits, data, clock and chip select lines are connected in parallel from the main microprocessor to the many TV peripheral circuits. To direct data to a specific device, a specific chip select line is enabled which allows communication only with the selected device.

In the I^2C format however, each peripheral IC is connected to the main microprocessor via a two wire, data and clock, bus. Further each IC is assigned a unique address code. Data is then sent to a specific device by addressing the device with its uniquely assigned code, as appose to using a chip select. This permits only the addressed peripheral IC to accept data.

The data stream in the I^2C format contains the following items shown in the figure below:

- Start Bit.
- Address Word.
- Acknowledge Bit.
- At least one Data Word followed by an Acknowledge Bit.
- Stop Bit.

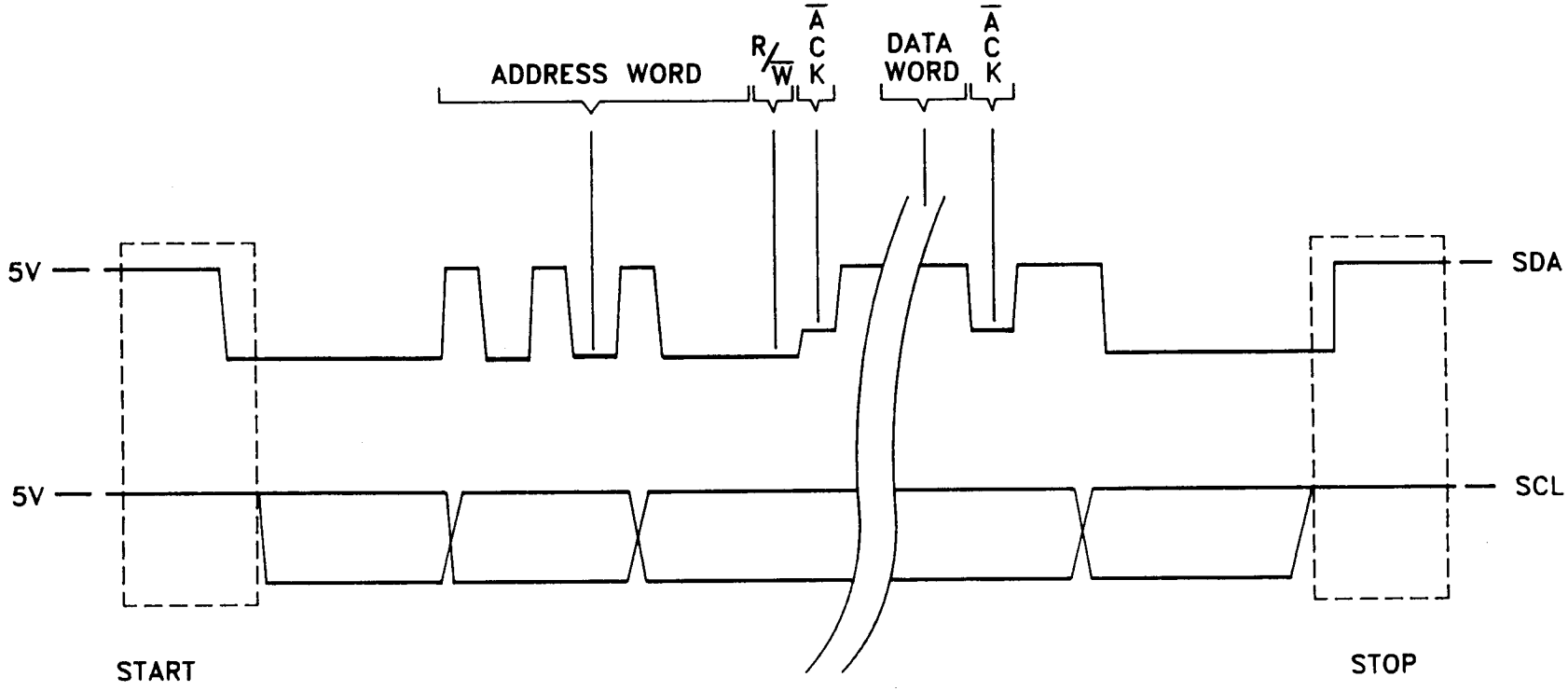
Note: The clock signal is always generated by the main micon.

Using this format eliminates the many separate chip select lines normally needed to address the peripheral devices — simplifying the hardware.

The format of the data on the I^2C bus is tightly controlled by the main micon. All devices connected to the bus other than the main micon are considered slaves and can only accept data when addressed. The slaves will recognize their address code when it is sent by the main micon. The slave must then acknowledge if communication with the main micon is to continue. As an example, when the main micon wants to send data to any device, it generates the bus clock and data stream signals to permit that transfer. Then the device being addressed must respond by acknowledging the main micon's request. The micon will then respond by sending the instructions it wants the slave to perform.

Within the format of the I^2C bus, unique situations occur at the start and stop of any data transfer. For instance, prior to the beginning of any data transfer the main micon will generate a start bit. As show in the figure below this is normally a HIGH to LOW transition of the data line while the bus clock is HIGH. Thus, all devices connected to the bus will recognize this as the beginning of the communication period. The bus is considered busy immediately after the generation of the start bit. Following the start bit the main micon will generate the address word. The address word is comprised of seven bits of data or highs and lows. The seven bit address word calls the device that the main micon wants to communicate with.

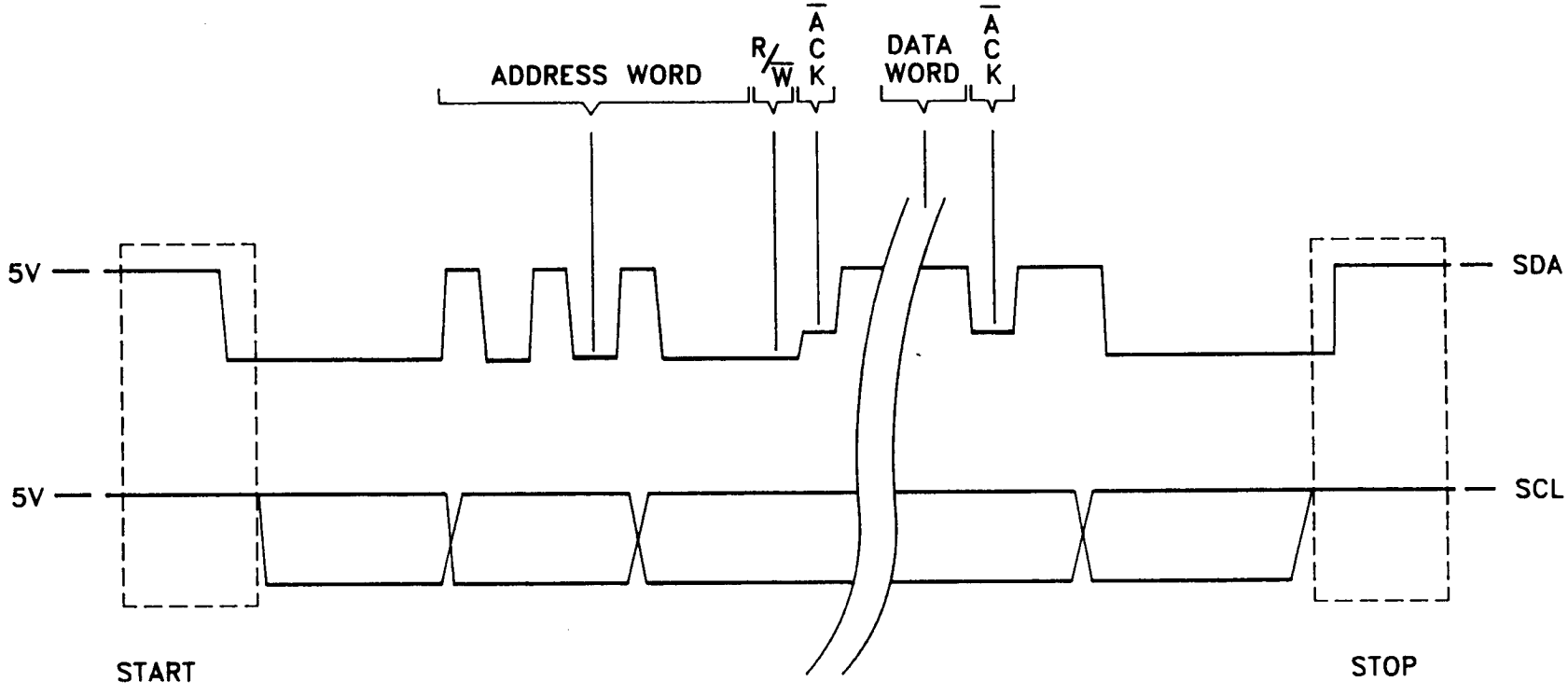
The address word is then followed by a read/write bit. If the main micon wants to write data, into the device being addressed, the read/write bit will be LOW. In the event that the main micon wants to read data from the device being addressed, the read/write bit will be HIGH. Following the address word the device being addressed will generate an acknowledge pulse. Data transfer followed by acknowledgement is mandatory in the I^2C format. During the acknowledgement period the main micon's data I/O port will assume a high impedance state. The data line will go HIGH because of external pull-up circuitry. The device being addressed must pull down the data line from its HIGH state to a LOW which signifies acknowledgement or receipt of the address information from the main micon. The main micon must detect the acknowledge pulse before it can send any additional data to the device. In the event the device does not acknowledge, the main micon will abort all further communications with the device.



I²C DATA FORMAT

Following the acknowledge pulse, data will be transferred in eight bit segments (eight bit data word). Afterwards, the device being addressed must once again generate an acknowledge pulse immediately following the receipt of each data word. Of course the data word may be an input or an output (read/write), to or from the main micon, depending on the read/write bit.

Any number of data words may follow a single address word. When data communication with the addressed device is finished, the main micon will output a stop condition or stop bit. The stop of data transfer is similar to the start condition. In this situation however, the data line will go from LOW to HIGH while the bus clock line is HIGH. The bus is considered to be free again (not busy) following the generation of the stop bit



I²C DATA FORMAT

I^2C Data Communication

As already mentioned, the AA-1 and BA-1 chassis utilize the I^2C format for data communication. This format uses a two wire (data and clock) bi-directional data bus structure. These two chassis share a common SONY microprocessor, IC101, for I^2C data transfer. Note: The AA-1 chassis service manual refers to this microprocessor as a Tuning Micon. The BA-1 chassis service manual refers to it as a PLL Control/Display IC. For the sake of simplicity, the two microprocessors will be referred to as a Main Micon in this course book.

Data Exchange

Standby 5Vdc is applied from IC602 pin 5 to the main micon IC101 at pins 64 and 63 and to the memory IC102 at pin 8. Reset is applied from IC602 pin 4 to the main micon IC101 at pin 36. The I^2C data and clock ports, for the main micon IC101, are at pins 53 and 55 respectively. The data and clock signals are coupled from pins 53 and 55, to the peripheral ICs, for most of the set's functions. These include the following ICs:

- The Y/C jungle, IC301, on the M board.
- The audio processor, IC201, on the M board.
- The dynamic convergence, IC1501, on the E board.
- The PIP control, IC3201, on the P board.
- The A/V switch, IC402, on the UA board.
- The antenna switch, IC171, on the A board.

Once reset occurs, IC101 has main crystal activity present at pins 35 and 34. When the set is turned ON, IC101 outputs I^2C data and clock to the data bus. Unlike previous I^2C bus chassis, the non volatile memory, IC102 (EEPROM), is connected to the main micon, IC101, at separate ports which permits direct and isolated bi-directional data communication to take place for all read/write operations. This also eliminates the use of a data switch (used in previous chassis) to isolate the EEPROM and peripheral ICs before power ON. The EEPROM, IC102, functions are to store the set's alignment data, last channel watched, volume, color, and brightness settings for all input sources.

The external I/O port connector, CN104, is used to interface the I^2C bus to a design computer during the manufacturing process. The computer grabs control of the bus by setting the CN104 pin 8 (BINT) interrupt signal LOW (0Vdc) which allows the computer to send the set's alignment data to the non volatile memory IC.