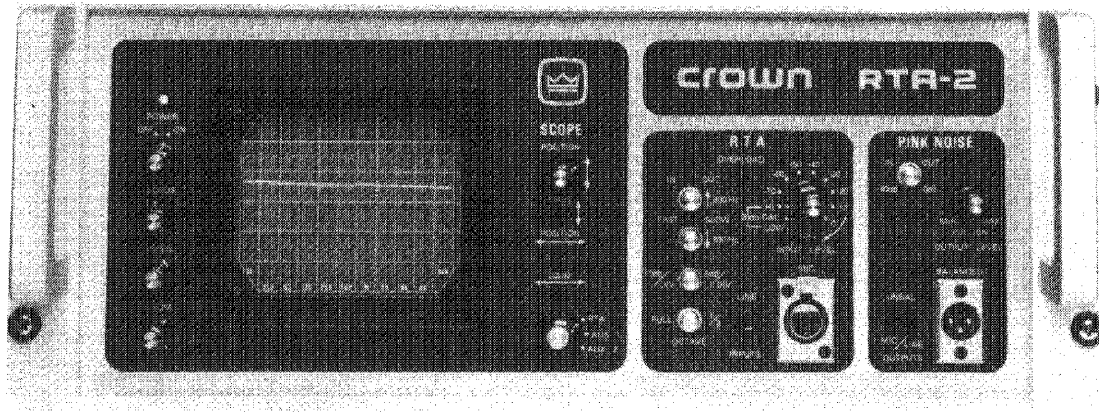




INSTRUCTION MANUAL

RTA-2 REAL TIME ANALYZER

CROWN INTERNATIONAL, INC. 1718 W. MISHAWAKA RD. ELKHART, INDIANA 46517

The information furnished in this manual does not include all of the details of design, production, or variations of the equipment. It does not cover all the possible contingencies which may arise during operation, installation, or maintenance. Should special problems arise, or further information be desired, please contact the Crown International Customer Services Department.

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WARNING

**TO PREVENT SHOCK OR FIRE HAZARD DO NOT EXPOSE TO
RAIN OR MOISTURE!**

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SECTION 1

GENERAL INFORMATION

1.1 Introduction

Based on mathematics established over 100 years ago by the French mathematician, Baron Jean-Baptiste Fourier, modern spectrum analysis provides a graphic representation of frequency versus amplitude in "real time".

With the information gained, one can see the frequency response of a sound system or any component in a system, and note where amplitude boosts or cuts are needed. The necessary adjustments can be made either electronically - as through an equalizer or acoustically - as with acoustic partitions.

This instruction manual is intended to aid its reader during the operation of the Crown Real Time Analyzer. Comments regarding the contents of this booklet will be accepted by the Crown Manual Department, 1718 W. Mishawaka Rd., Elkhart, Indiana 46517

1.2 Purpose of Equipment

The purpose of the CROWN RTA-2 (Fig. 1.1) is to provide the sound engineer with a quick and accurate means for checking the overall frequency response and other parameters of a sound system or any component of a system. That system could be a closed system - such as a tape deck amplifier, pre-amplifier, power amplifier, etc. or an open system, i.e. a living room, a high school auditorium or any other acoustically sore area.

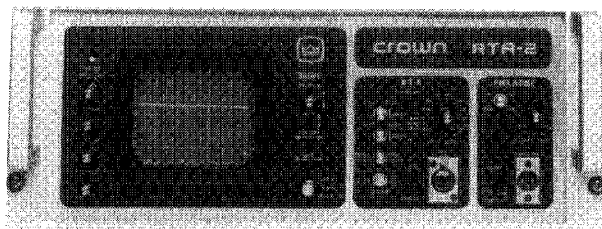


Fig. 1.1 RTA-2

1.3 Units and Accessories Supplied

- 1 RTA-2 instruction manual
- 1 proof of performance sheet
- 1 6-ft pin to phone cable
- 1 6-ft. male XLR to female XLR cable
- 4 thumb screws
- 4 washers

1.4 Required - Not Supplied

Equalizer
Calibrated microphone
(The above items are required for room equalization.)

1.5 Service Policy

Because of the complexity of its circuitry and high CRT (Cathode Ray Tube) voltages, the RTA-2 should be serviced only by a fully trained service technician. As a reminder, please observe the following labels on the rear panel of the unit which read:

WARNING:
HIGH VOLTAGE CIRCUITRY
INSIDE ELEVATED TO 1800 VOLTS

CAUTION: TO PREVENT ELECTRIC SHOCK DO NOT OPEN. NO USER SERVICABLE PARTS INSIDE. REFER SERVICING TO A QUALIFIED TECHNICIAN.

For service, return the unit to the factory in the original packing or in replacement packing obtainable from the Crown factory. For warranty service, the unit must be returned to the factory or an approved service station (Ameron customers consult your local representative). In either case, fill out and enclose the Service Information form located at the rear of this manual. This will help to ensure a speedy and effective response.

Crown will pay shipping costs (in the U.S.) for warranty service upon receiving copies of all shipping receipts.

All shipments should be sent UPS or truck freight (insured). The factory will then return your serviced unit by one of the above methods.

Upon receipt of the warranty registration card from your dealer, Crown will register your unit on our computer warranty file.

Retain your copy of the bill of sale from your Crown dealer. This is your proof of purchase.

When you need service for your unit from an authorized Crown Service Station, simply present your bill of sale. With it, the service station can promptly initiate any needed paperwork. It will save you time and effort.

The bill of sale is also your proof of ownership should you need it for insurance or legal reasons.

1.6 Glossary of Terms

A-B Test: Evaluating relative performance of two (or more) components or systems by changing quickly from one to the other. Most high fidelity dealers have A-B test facilities.

AGC: Automatic Gain Control. A type of circuit used to maintain the output volume of a receiver constant, regardless of variations in the signal strength applied to the receiver.

Attenuation: A decrease in signal magnitude from one point to another, or the process causing this decrease.

Balanced Input: A three wire input system where the voltages and currents in two of the wires are equal in magnitude but opposite in polarity with respect to ground which is the third wire. The impedance of a balanced input is usually low. (600 ohms or less)

Balun: A device used for the transformation from an unbalanced line or system to a balanced line or system, or vice versa. The term is derived from balance to unbalance transformer.

Bandpass Filter: A filter that allows transmission of alternating signals whose frequencies are between given upper and lower cutoff values, while substantially attenuating all frequencies outside this band.

Biamp: The use of independent amplifiers to feed the bass and treble portions of a loudspeaker or loudspeakers with a crossover network. The purpose is to help reduce intermodulation between bands when a system is overloaded. It also reduces the cost of implementing good, low loss precision crossover networks.

Butterworth Filter: A filter that exhibits the flattest possible response in the passband. The response rolls off smoothly into the stop band, where it approaches a constant slope of $6n$ dB/octave; where n is the number of poles in the network, i.e. a single pole is 6dB, two pole 12dB, 3 pole 18dB, etc.

Capture Ratio: The ability of a receiver to reject a weaker station whose frequency is the same as that of the desired station. This measurement will be in dB. The smaller the figure, the better the spec.

Ceramic Filter: A bandpass filter using a piezoelectric substrate material.

Channel: A channel is a complete sound path. A single channel, or monophonic system, has one channel. A stereophonic system has at least two full channels designated as left (A) and right (B). Monophonic material may be played through a stereo system; both channels will carry the same signal. Stereo material, if played on a monophonic system, mixes and emerges as a monophonic sound.

Channel Separation: Specified in dB, channel separation is the ratio of the measurable output of one channel to the unwanted output of the (undriven) opposite channel.

Clipping: The truncation of peaks of a signal due to exceeding the operating range of an electronic circuit. Normally, it refers to the result of voltage limitations in the circuit.

Corner Frequency: The frequency at which a filter goes from a condition of passing the signal unattenuated to "rolling off" or attenuating the signal according to its frequency. It is sometimes referred to as the "cutoff" frequency or the "break" frequency. It is also defined as 3dB below the unattenuated output level of the signal.

Cross Modulation: In FM signals, a type of intermodulation that occurs when the carrier of the desired signal is modulated by an undesirable signal. Each signal is of independent origin.

Crossover Frequency: The frequency at which a dividing network delivers equal power to the upper and lower frequency channels when both are terminated in specified loads.

Crossover Network: A selective network used to divide the audio frequency output of an amplifier into two or more bands of frequency. The band below the crossover frequency is fed the woofer loudspeaker while the high frequency band is fed to the tweeter. Also called dividing network and loudspeaker dividing network.

Crosstalk: Signal leakage from one signal source into another.

Damping: Controlling of vibrations, response, or resonances which if unchecked, would cause coloration of the sound.

Damping Factor: A numerical indication of an amplifier's ability to decrease unwanted loudspeaker movements. Damping factor can be found by dividing the load impedance by the amplifier's output impedance.



Decibel: A numerical expression of acoustic or electrical ratios, such as the relative intensity of a sound or the relative strength of a signal. One (dB) is about the smallest change in sound perceptible to the ear.

Decoder: A matrix of logic elements that selects one or more output channels according to the combination of input signals present. Can be used in FM to recover stereo signals of a stereo encoded multiplex transmission.

De-emphasis: In FM signals, restoring the pre-emphasized (for proper transmission characteristics) signal to result in a "flat" frequency response curve.

Distortion: Unwanted noise, or sounds which didn't exist in the studio when the original recording was made. Harmonic distortion produces tones harmonically related to a single, pure tone. Intermodulation distortion (IM) introduces new tones caused by mixing of two or more original tones. Phase distortion, or non-linear phase shift, disturbs timing sequence between a tone and its related overtones. Distortion which creates new spectra are expressed in percentages and phase distortion in degrees of phase shift or seconds of group delay vs. frequency errors.

Dynamic Range: The difference between the most intense and the least intense levels in a sound system.

EAROM: EAROM stands for Electrically Alterable Read Only Memory which is an integrated circuit chip used to store information without power applied (used in the FM1).

Equalization: Frequency response manipulation to meet the requirements of recording, and an inverse manipulation on playback to restore the original. Also known as compensation for acoustic problems of listening rooms.

Feedback: Sending a "part" of a system's output back to the input. Positive feedback may lead to unstable conditions such as PA system "howling" due to sound from the speakers being fed back thru the microphone and amplified again. Another form is low frequency interference created when vibrations from loudspeakers are picked up by the cartridge and amplified again. However, carefully controlled negative feedback in electronic circuits can be used to help reduce distortion and control stability.

Flutter: Rapid variation in the speed of a turntable or tape transport. Flutter causes a wavering of musical pitch.

Frequency Response: This term indicates any amplitude variations in a system output signal with respect to frequency. This measurement is made with a constant level input signal.

Gain: The ratio of an amplifier's output voltage to its input voltage.

Headroom: Stated in dB, headroom is the difference between the signal level and the limits of the sound system ie; the ratio of power available to power used.

Hertz: As in cycles-per-second, not rental agency.

High Pass/Low Pass Filter: High pass - a filter having a single transmission band extending from some critical, or cutoff, frequency other than zero, up to infinite frequency. Low pass - a filter network which passes all frequencies below a specified frequency with little or no loss but discriminates strongly against higher frequencies.

IF: An Intermediate Frequency is a frequency to which a signal wave is shifted locally as an intermediate step in FM transmission or reception.

Image Response: Response of a superheterodyne receiver to the image frequency, as compared to the response to the desired frequency.

Input Sensitivity: The input voltage required to drive an amplifier to its rated output.

IOC™: Stands for Input-Output Comparator. An extremely sensitive Crown circuit used to indicate, via a front panel LED, the fact that the operating limits of an amplifier are being exceeded resulting in output non-linearity.

LED: Light Emitting Diode. A PN junction that emits light when biased in the forward direction.

Limiter: A circuit in which the output amplitude is substantially linear with regard to the input up to a pre-determined value and substantially constant thereafter.

Load: A device that absorbs power and converts it into the desired form.

LSI: Large Scale Integration is an integrated circuit chip housing a large number of active devices.

Mixer: A device having two or more inputs, usually adjustable, and a common output, which operates to combine linearly in a desired proportion the separate input signals to produce an output signal.

Monitoring Amplifier: A power amplifier used primarily for evaluation and supervision of a program.

Multipath Delay: In FM the existence of more than one signal path between transmitter and receiver. The two signals arriving at different times causes distortion.

Music Power: This rating expresses the ability of an amplifier to handle short duration power peaks, as opposed to sustained power levels. An amplifier may only be capable of putting out 45 watts if that level is continuous, but it may be able to handle 60 watt peaks (such as might occur in a musical passage), if the peaks do not last too long.

Muting Circuit: In FM, a circuit which cuts off the receiver output when the r-f carrier reaching the first detector is at or below a pre-determined intensity.

Pre-emphasis: A process in a system designed to emphasize the magnitude of some frequency components with respect to the magnitude of others, to reduce adverse effects, such as noise, in subsequent parts of the system.

PLL: Phase Lock Loop; a circuit for synchronizing a variable local oscillator with the phase of a transmitted signal. Can be used in FM as a synthesizer circuit as well as a stereo decoder in the multiplex system.

Polar Curve: A pattern used to show the directional characteristics of antennas, microphones or speakers.

Quartz Crystal: A complete assembly, comprising a piezoelectric quartz-crystal element mounted, housed, and adjusted to the desired frequency. Such a device is commonly employed for purposes of frequency control, frequency measurement and electric wave filtering.

Rotor: A motor driven assembly which turns an antenna so that it can be aimed in the direction of best reception.

SAW Filter: Surface Acoustic Wave; commonly used as a bandpass filter. Device transmits surface acoustic waves on a piezoelectric substrate. Used in the FM1 for low FM distortion.

Selectivity: In FM a measure of the extent to which a receiver is capable of differentiating between the desired signal and disturbances at other frequencies.

Sensitivity: A receiver specification indicating the smallest input signal strength required to produce an output signal whose characteristics are standardized and used as a reference.

Signal: A visible, audible or other conveyor of information.

Signal-To-Noise-Ratio: Measured in dB, signal to noise ratio is a relative term meaning the ratio between the desired output signal and the interference or noise. A typical figure would be 60dB which stands for a ratio of 1000-1.

Superheterodyne: A method of receiving radio waves in which the process of heterodyne reception is used to convert the voltage of the received wave into a voltage of an intermediate, but usually superaudible frequency, that is then detected.

Synthesizer: A Phase Lock Loop (PLL) system which constructs an oscillator signal by phase locking it to a reference times (X) the ratio of two integers (reference is usually a quartz crystal oscillator).

Triamp: The use of three separate amplifiers to drive the high, middle and low frequency sections of a speaker system.

Varactor: A two terminal semiconductor device in which the electrical characteristic of primary interest is a voltage-dependent capacitance. Used in FM tuner inputs for voltage controlled timing.

Wow: Distortion caused in sound reproduction by slow variation in speed of the turntable or tape. (See flutter.)



SECTION 2

SPECIFICATIONS AND PERFORMANCE

2.1 Specifications

Frequency range: 16Hz to 20KHz

Filters: thirty-two "single pole pair" 1/3-octave bandpass filters centered on 1/3-octave intervals.

Display Modes: 1/3 or 1 octave, push button selected. (Octave filters are combinations of 1/3-octave filters.)

Sensitivity:

Indication	
Full Scale	-60dB
Unbalanced	
15.2mV to 150V max in*	15.2uV to .5V*
Balanced	
.76mV to 3V max in*	.76uV to 3V max in*
Unbalanced	
1mV/ $\sqrt{\text{Hz}}$ min **	1uV/ $\sqrt{\text{Hz}}$ **
Balanced	
50uV/ $\sqrt{\text{Hz}}$ **	50uV/ $\sqrt{\text{Hz}}$ **

*Sinusoidal test signal centered on any filter frequency in 1/3 or 1 octave display modes.

**Gaussian pink noise source whose intensity is referenced @1KHz.

The balanced (mic) preamp is adjustable from 10dB to 26dB using an internal gain set. Set to 20dB at factory. All filters and input amplifiers monitored for overload with catch-and-hold LED (red) with 75 msec hold time.

Overall Display Accuracy: (At any filter center frequency. Figures shown are for 5dB/division range. Add ± 1 dB to figures if in 10dB/division range.)

Full scale to -40dB: ± 1.0 dB

-40dB to -50dB: ± 1.5 dB

-50dB to -60dB: ± 3.0 dB

Detector Time Constants: Full wave average responding detectors with dual time constants of 15ms and 47ms (fast) or 15ms and 375ms (slow), push button selectable.

Scan: 32 channels in 16.6ms.

Inputs:

Unbalanced: 1 megohm ($\frac{1}{4}$ " phone jacks front and rear, front priority).

Balanced: 2K ohm (female XLR connector on front).

Controls: Power switch (with orange LED "on" indicator).

Fast/Slow integration rate select (16Hz-630Hz).

Fast/Slow integration rate select (800Hz-20KHz).

(5 or 10) dB per division select.

Full or 1/3 octave display select.

Input level (0-70dB, 10dB steps; 40dB range vernier).

Internal balanced-input gain control.

Calibration: Two identified positions on input level control differ by 20dB $\pm 2\%$.

Dimensions: 19 x 7 x 15" (48.3 x 17.8 x 38.1cm) behind rack mounting surface. EIA 19" rack mount.

Weight: 22 lb. (10Kg) net.

Color: Satin and charcoal grey with black knobs and bezel. Blue filtered graticule. Phosphor is P31 (blue/green at 2KV).

Environment: 0-50°C. Should be transported as baggage only in optional shipping case.

NOISE GENERATOR

Type: Pseudo-random multiple feedback, 20 stage, optimized for sonic performance.

Repetition rate: 2.1 second.

Pink Filter Accuracy: $\pm .5$ dB, 16Hz-20KHz, limited @ 10Hz and 40KHz by .1dB Chebyshev filters.

Controls: On/Off (push/pull)
Output level vernier attenuator

Max Output Level: 1.1V rms min, crest factor 4.4.

Output:

Attenuator switch setting:	0dB	40dB	Connector
Balanced output	600 ohm	50 ohm	Male XLR front
Unbalanced output	300 ohm	25 ohm	1/4" phone jack front and rear

DISPLAY CRT

OUTPUTS: 0-10V ramp at scan rate for external display driving (f axis) 2-8V log output (10dB/volt) (amplitude axis). Both outputs are 600 ohm unbalanced with rear-panel phono jack connectors.

Inputs (external): Two sets of X-Y inputs may be switch selected (Aux 1, Aux 2). Each input has rear-panel phono jack and attenuator control. Input impedance 25K ohm $\pm 30\%$. Beam intensity automatically reduced if no signal (2 sec. delay) to prevent phosphor burn.

Controls: Intensity, focus, graticule illumination, horizontal gain*, horizontal position*, vertical gain*, vertical position, input select, astigmatism (rear).

*Screwdriver adjust.



2.2 Performance Graphs

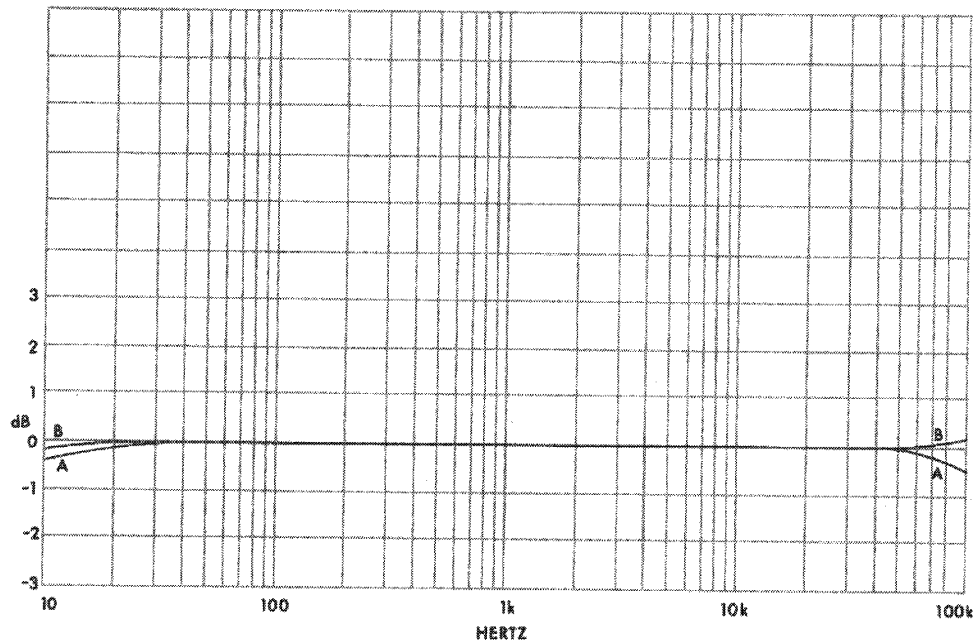


*Fig. 2.1 Frequency Response; Mic Amplifier;
A - 20dB Gain
B - Minimum Gain*

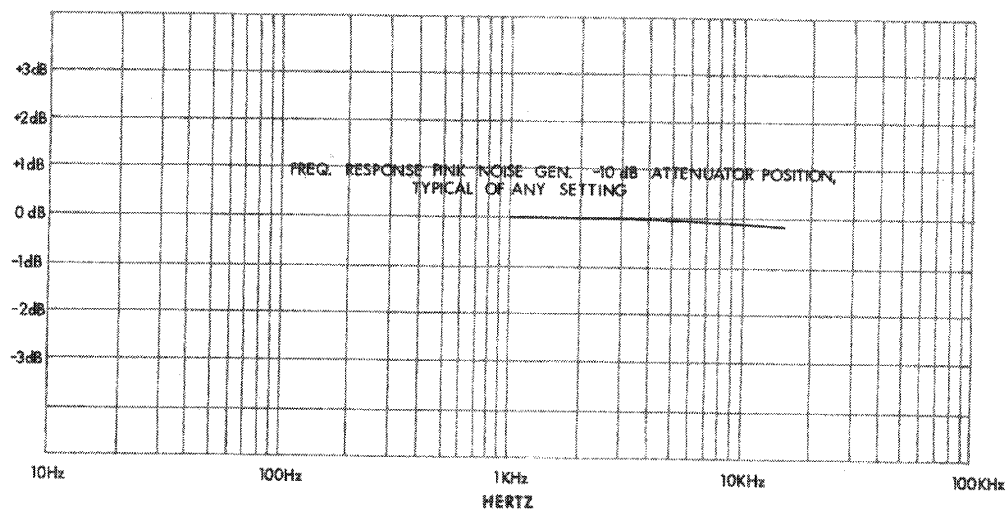


*Fig. 2.2 Frequency Response;
Pink Noise Generator*

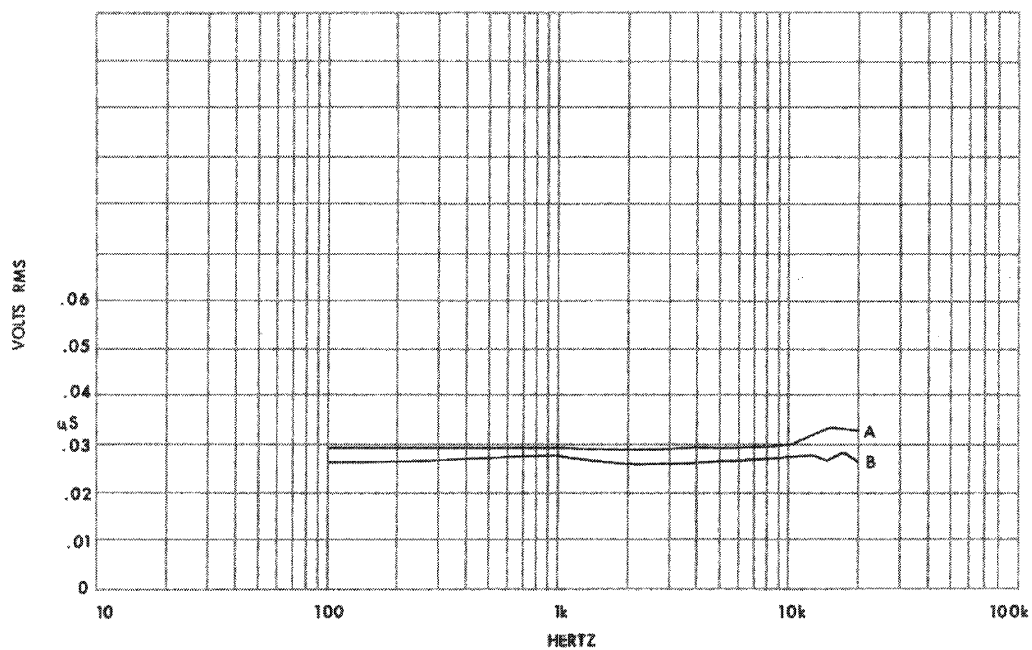
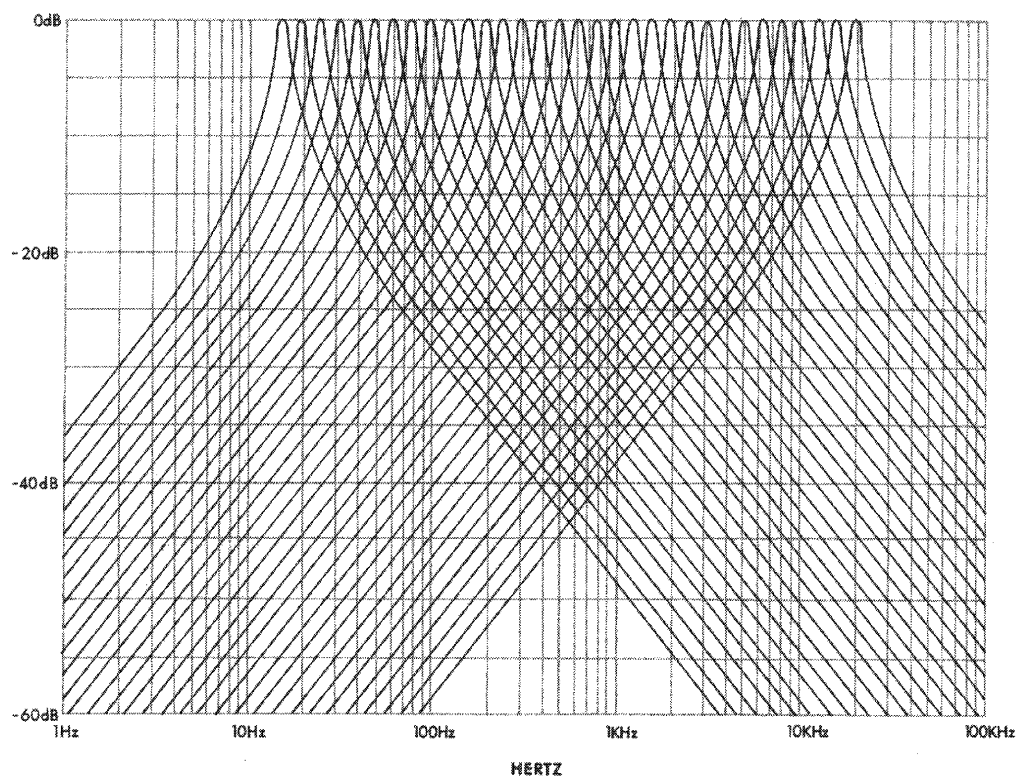


*Fig. 2.3 Beam Gate Threshold;
A - Aux 1 Horizontal Input
B - Aux 1 Vertical Input*



* Does not conform to any ANSI class

Fig. 2.4 1/3 Octave Filter Characteristics



SECTION 3

INSTALLATION AND OPERATION

3.1 Function

Since the RTA-2 is subject to a wide range of possible mounting methods and operational applications, all possibilities could not be covered in this manual. Therefore, enough basic information was put into this section to provide you with an overview of the unit's functions and installation specifications.

3.2 Unpacking and Inspecting

Since the RTA-2 was carefully inspected and tested before it left the factory, we recommend that you inspect the unit for any damages that may have occurred during transit. If any damages are found, notify the transportation company immediately. Only the consignee may initiate a claim with the carrier for damaged parcels. Crown, however, will cooperate fully in such an event. Also, be sure to save the carton as evidence for the shipper's inspection.

In addition, we request that you save all packing material; even if the unit arrives in good shape. Because the carton and internal pack were specifically designed for protection during transit, they will prove valuable in preventing damage should there be occasion to transport the unit.

PLEASE, DO NOT SHIP THE UNIT WITHOUT THE ORIGINAL PACKING MATERIALS!

3.3 Installation

The RTA-2 is packed and shipped in a specially constructed cardboard box. As accessories to the RTA-2, both an anvil case and a shipping case may be purchased through the Crown Parts Department. In addition, the unit may be mounted in a standard 19" electronic equipment rack or an enclosure of your own design. See Fig. 3.1 for mounting dimensions.

3.4 Operating Precautions

1. The RTA-2 was designed to operate most efficiently at voltages 10% above or below the voltage stated on

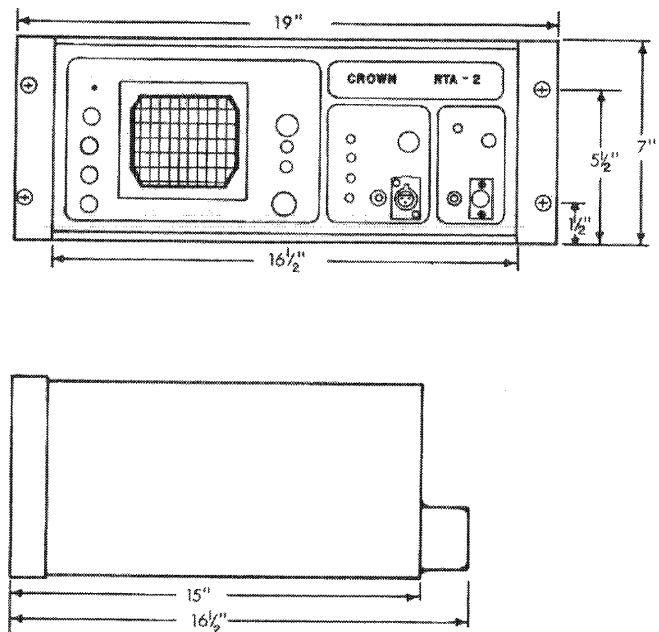


Fig. 3.1 Mounting Dimensions

the rear panel. Operating the unit on voltages outside of this range could harm the unit and invalidate the warranty.

2. Do not set beverages on top of the RTA-2! In the event of damage caused by liquid spilling into the circuitry, the warranty will also be cancelled.
3. All Crown products are made to be dependable and stable. However, since the RTA-2 houses a CRT, excessive abuse should be avoided.
4. Do not expose the RTA-2 to corrosive chemicals such as soft drinks, lye, salt water, etc.
5. Tampering in the circuit by unqualified personnel or the making of unauthorized circuit modifications invalidates the warranty.
6. Harsh cleaning agents should be avoided when cleaning the RTA-2. When cleaning becomes necessary, a soft cloth moistened with a mild detergent and water solution is recommended.

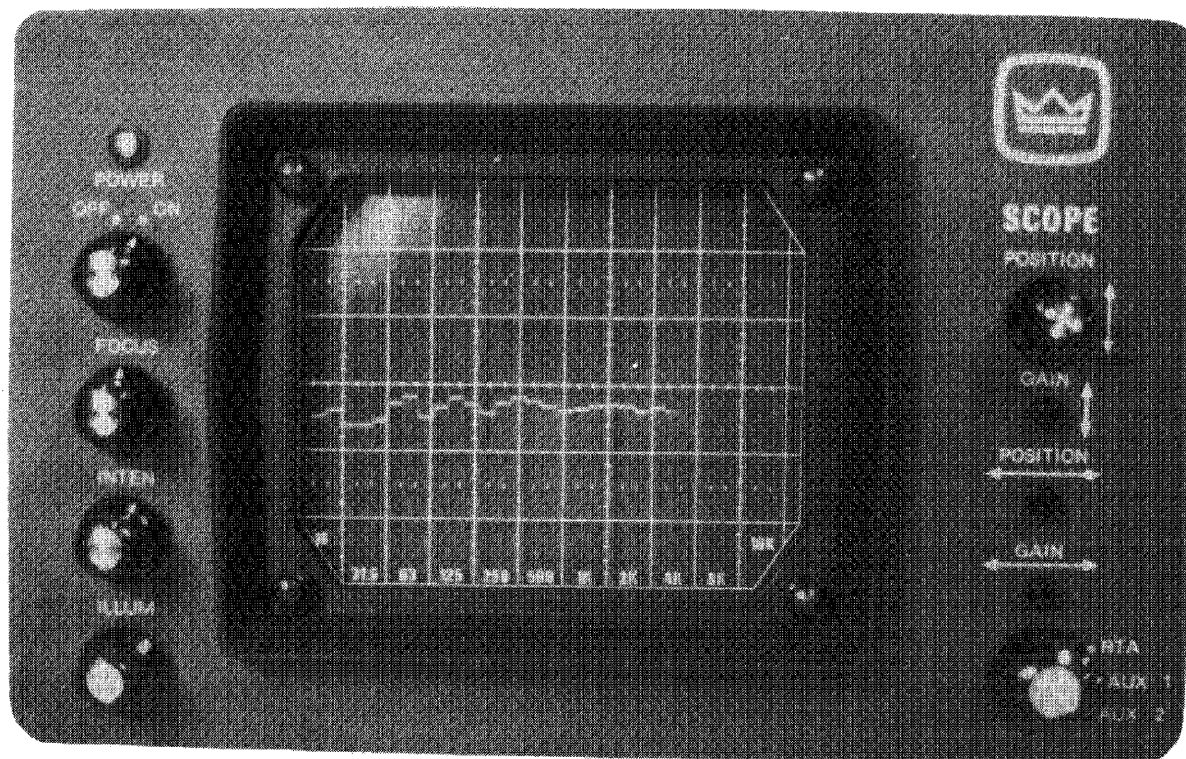


Fig. 3.2 Scope Section

3.5 Operation and Control Functions

The front panel of the RTA-2 is divided into three segments. Each segment is, in effect, autonomous and will be treated as such.

SCOPE (See Fig. 3.2)

The RTA-2 employs a 5" Cathode Ray Tube covered by a graduated overlay. This method of visual indication provides easy viewing as well as accurate measurement. The controls associated with the CRT affect the display in a manner as discussed below.

POWER - turning the power switch causes electrical potentials to be applied to the several control grids of the cathode ray tube as well as the rest of the RTA-2's circuitry.

FOCUS - the focus control works with the rear panel astigmatism control in determining the sharpness of the trace.

INTENSITY - the brightness of the trace is influenced by the intensity control.

ILLUMINATION - two lamps located beneath the CRT bezel provide illumination for the CRT graticule. The illumination control varies the intensity of the illumination.

VERTICAL POSITION - the trace is moved up or down by the vertical position control.

VERTICAL GAIN - the vertical gain control, located just below the vertical position control, adjusts the gain of the vertical deflection amplifier which in turn causes the trace to move upwards or downwards.

HORIZONTAL POSITION - position the trace horizontally by rotating the horizontal position control.

HORIZONTAL GAIN - the gain of the horizontal deflection amplifier is set via the horizontal gain control. The trace is expanded horizontally by rotating this control. (See horizontal calibration)

FUNCTION - the three modes of RTA-2 operation (RTA, AUX 1, AUX 2) represent the three separate input channels available on the RTA-2. While it is possible to simultaneously apply 3 distinct signals to the RTA-2, the unit is capable of displaying only one of those signals at any given moment. The function selector therefore selects which of the applied input signals will be routed to the CRT for display.

In addition to the front panel controls, there are five oscilloscopic controls on the rear panel of the RTA-2. The astigmatism control works with the front panel focus control in determining the crispness of the trace. It is located above and to the right of the high voltage warning label. Lastly, potentiometers are provided for independently adjusting the input sensitivities of the X and Y inputs.

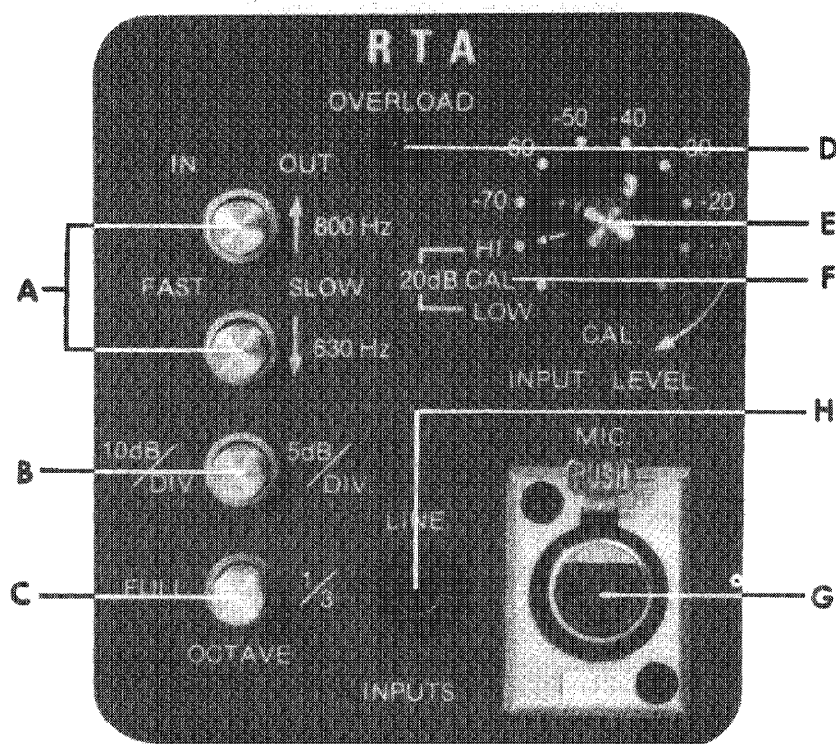


Fig. 3.3 RTA Section

RTA (See Fig. 3.3)

This segment of the unit provides jacks for the application of electrical signals to the analyzer circuitry. Furthermore, the controls and switches of the RTA segment affect the CRT display as follows:

fast/slow

The normal operating position (when displaying program signals) of these switches is IN. This setting allows viewing of the displayed signal with a minimum of averaging. Setting these switches to their OUT position selects detector time constants which provide averaging of the displayed signal such that equalization adjustments can be made with greater ease. The top switch of the two selects those frequencies from 800Hz to 20KHz, while the bottom switch selects frequencies from 16Hz to 630Hz. (Fig. 3.3A)

dB/division

When set to its IN position, the dB PER DIVISION switch selects a vertical CRT sensitivity of 10dB per division. A vertical sensitivity of 5dB per division is selected by releasing the switch to its OUT position. When calibrating the CRT graticule, it is most

convenient to select the 10dB per division position.(Fig. 3.3B)

full-1/3

You may choose to view the displayed signal in a full 1 octave format or a 1/3 octave format by engaging (IN) or releasing (OUT) the switch labeled FULL - 1/3. A full octave is selected by setting the switch to its IN position. When performing equalization adjustments, it is recommended to begin in the full format, using the 1/3 octave format for fine tuning. (Fig. 3.3C)

overload indicator

The red LED, indicating an overload condition, will glow whenever the amplitude of the input signal exceeds a level preset on a voltage regulator. Should the LED illuminate, a greater amount of attenuation should be selected via the INPUT LEVEL CONTROL.(Fig. 3.3D)

input level

Two portions of the INPUT LEVEL control offer selectable attenuation to all input signals. The outside control adds up to 70dB of attenuation in 10dB steps whereas the inside or vernier portion can further attenuate the signal by 40dB. (Fig.3.3E)

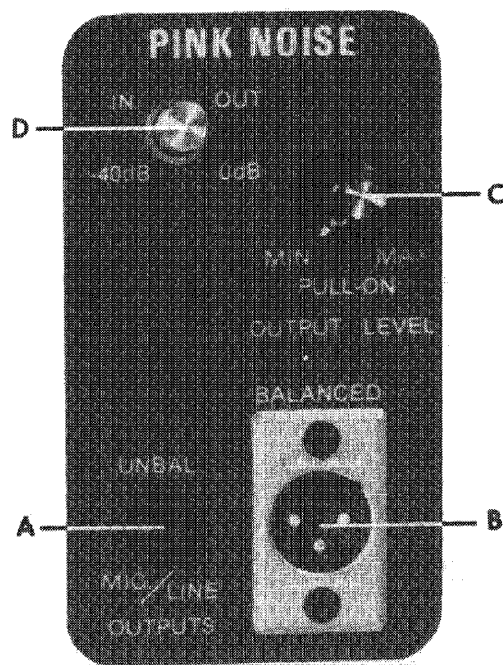


Fig. 3.4 Pink Noise Section

PINK NOISE

Access to the pink noise generator signal is made through either one of the front panel jacks (Fig. 3.4A,B) or the pin jack on the rear panel (Fig. 3.5). The pink noise generator is switched on by pulling the front panel output level control (Fig. 3.4C), while the intensity of the signal is controlled by rotating the same control. Also, for a 40dB reduction of signal strength (line level to mic level), the -40dB switch can be depressed. (Fig. 3.4D)

calibration

I. Purpose

A. Vertical Calibration - Vertical calibration causes the markings around the input level attenuator to be in agreement with the markings on the CRT graticule. Also, vertical calibration adjusts the gain of the vertical amplifier so that one vertical division is represented by 5dB or 10dB depending upon the position of the dB/DIV switch.

B. Horizontal calibration ensures that the numbers at the bottom of the CRT graticule will correctly identify frequency locations within the display.

II. Procedure

A. Vertical

1. Set the pink noise output level control to three o'clock.

2. Adjust the vernier input level attenuator to CAL (fully clockwise).

3. Turn the stepped input level attenuator to LOW.
4. With the vertical position control, position the trace at the bottom graticule line.
5. Move the stepped input level attenuator to HI.

a. The trace will ascend when you move the stepped input level attenuator to HI. The vertical gain should be set so that the trace will ascend by 20dB. Twenty dB will be represented by 2 or 4 vertical divisions depending on the position of the dB/DIV switch.

Note: In the event where the trace does not ascend by the stated amount, repeat steps 3, 4 and 5.

B. Horizontal

1. Set the stepped input level attenuator to either HI or LOW.
2. Set the OCTAVE switch to the one-third octave format (out).
3. Adjust the vertical position control so that the trace runs through one of the three sets of horizontal ditto marks.
4. With the horizontal position control, position the trace in a manner whereby the output of the 16 KHz filter falls between the first two ditto marks.
5. Using the horizontal gain control, set the right end of the trace to touch the first vertical line beyond 16KHz.

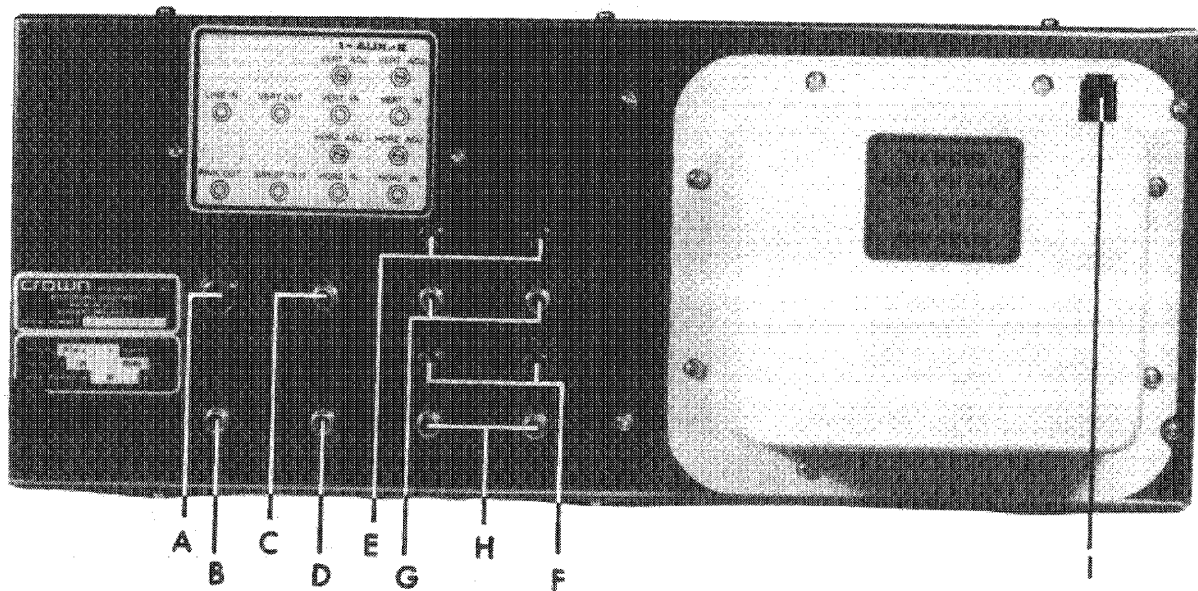


Fig. 3.5 Rear Panel

3.6 Rear Panel Controls and Connections

LINE IN

LINE LEVEL inputs accept voltages between approximately 75mv to 25v. This 1/4" phone (Fig. 3.5A) jack will be overridden by the insertion of a plug into either one of the two front panel input jacks.

PINK OUT

This pin jack connector (Fig. 3.5B) along with the two front panel jacks, supplies pink noise whose intensity is controlled by the pink noise output level control.

VERT OUT

The vertical output jack (Fig. 3.5C) offers a means of connecting other instruments to the RTA-2 that require a vertical input. Example of this would include connecting the RTA-2 up to a storage scope.

SWEEP OUT

The 60Hz ramp voltage from this jack (Fig. 3.5D) can be used to drive the horizontal (X) input of an oscilloscope.

VERT ADJ-HORIZ ADJ

When viewing an x vs. y display, it may be necessary to increase the sensitivity of the vertical or horizontal input. This is done by turning the vertical or horizontal adjustment screw (Fig. 3.5E,F) with a small flat head screwdriver.

VERT & HORZ IN

For an x vs. y display, the vertical and horizontal input jacks (Fig. 3.5G,H) are used. Two sets of these jacks are provided, and selected by a front panel control.

ASTIGMATISM

The astigmatism control, (Fig. 3.5I) located at the upper right hand corner of the rear panel, is used together with the focus control to adjust the trace for optimum clarity.

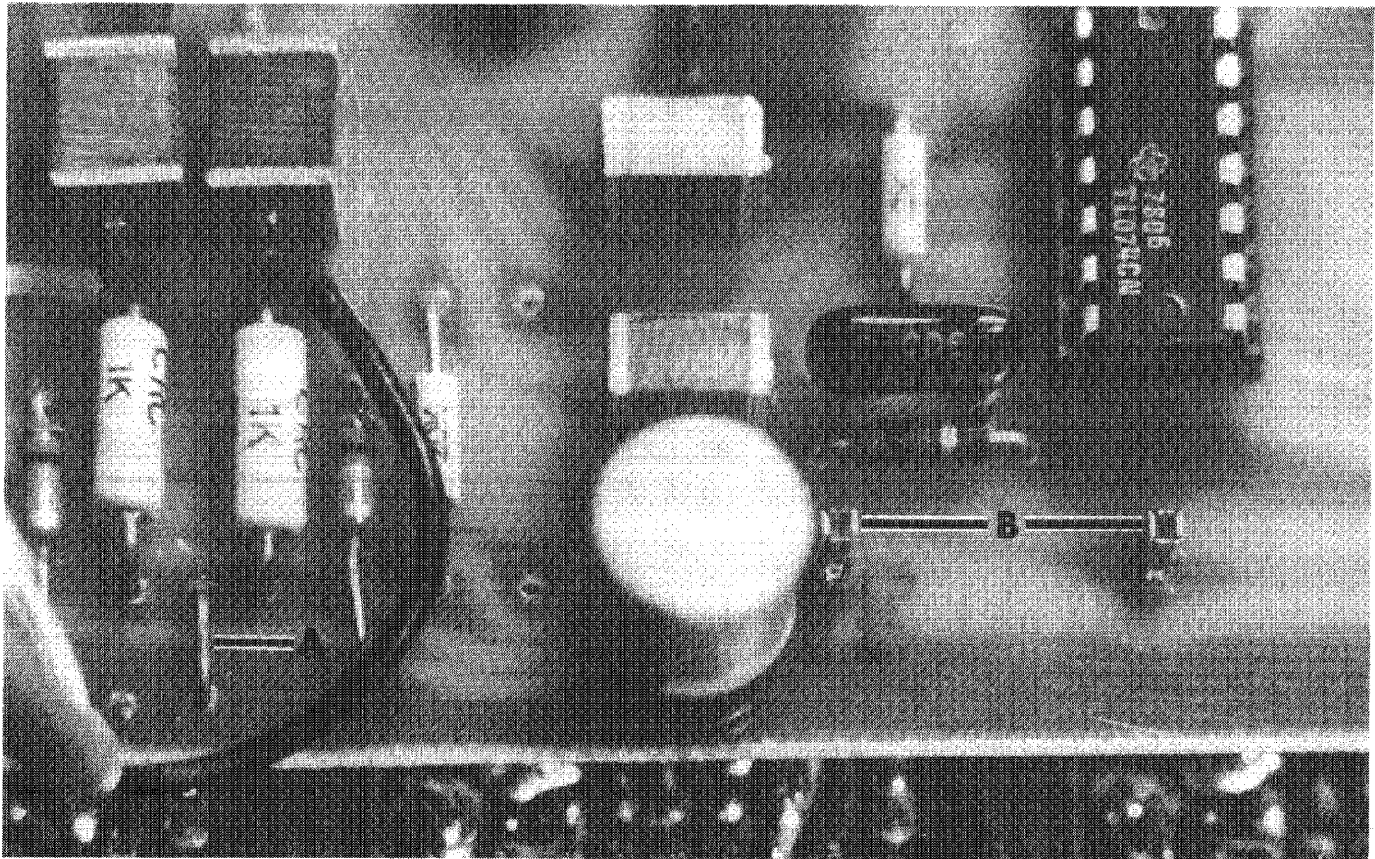


Fig. 3.6 Pink Noise/ Input Board

3.7 Phantom Power Supply

Some condenser microphones require a DC operating voltage. For this reason, a phantom power supply has been built into the RTA-2. This feature is standard on all units with serial number 20869 and above. For units below this number, a slight modification must be made. Referring to Fig. 3.6, locate the **PINK NOISE & INPUT** board on the underside of the RTA chassis and find jumper "A". Cut this jumper and insert a ¼ watt 680 ohm resistor into the two PC board receptacles indicated by "B" of Fig. 3.6. 18 volts will now be available at the balanced input jack on the front panel.

Note: The above modification was based on an AKG451 (CK22) mic. Should any complications arise as a result of this modification, please contact the Crown Technical Services Department.

3.8 Modifying AC Mains Voltage

Fig. 3.7 shows the jumper arrangement for modifying the RTA-2 to operate on 100, 120, 200, 220, and 240 VAC.

- * 100 volt operation - jumper A and D, B and E and move black wire to E.
- * 120 volt operation - jumper A and D, C and F and move black wire to F.
- * 200 volt operation - jumper B and D, and move black wire to E.
- * 220 volt operation - jumper B and D, and move black wire to F.
- * 240 volt operation - jumper C and D, and move black wire to F.
- * Use 1/16A MDL fuse for 200V, 220V, 240V line.
- * Use 1/8A MDL fuse for 100V, 120V line.

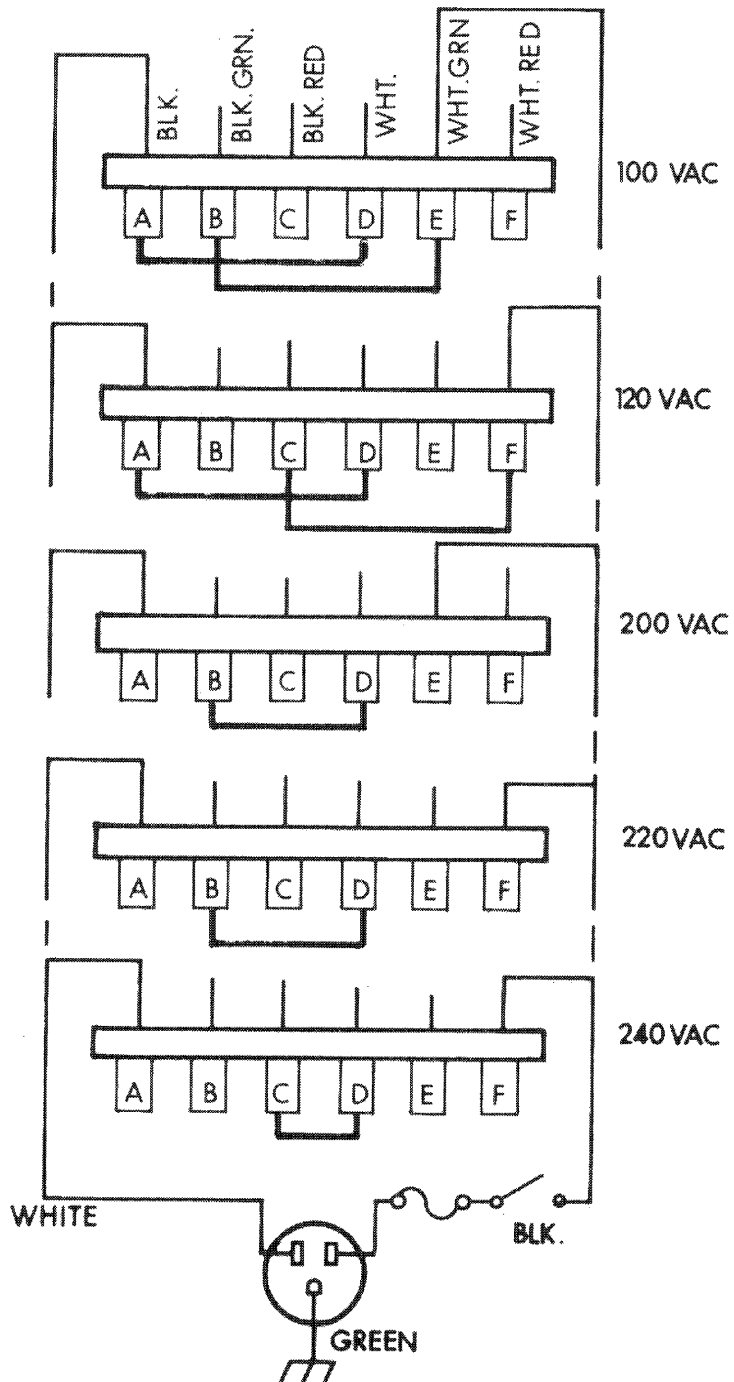


Fig. 3.7 AC Voltages



SECTION 4

TECHNICAL ASPECTS OF UNIT

4.1 General

The RTA-2 Real Time Audio Analyzer came to be as a spin-off of the RTA-1 which, in turn, was a demonstration tool used in conjunction with the CROWN EQ-2 equalizer. Information contained in this section of the manual is by no means meant to be a troubleshooting guide, but merely a brief technical explanation of the unit for those interested.

4.2 Principles of the RTA-2

There are essentially three major sections in the makeup of the RTA-2: the pink noise generator, the oscilloscope, and the audio analyzer. Each are individual circuits within the RTA-2. The noise generator begins with a digitally derived source whose output voltage is white noise. Active filters provide the rolloff and the filtering to change the white noise into pink noise and limit the bandwidth of the signal. An unbalanced, pseudo random pink noise signal is then delivered to the unbalanced jacks while the same signal plus an inverted version is applied to the XLR connector to provide a balanced output signal. Front panel switches control the On/Off function and signal attenuation.

Input terminations to the oscilloscopic circuitry appear on the rear panel of the RTA-2. In addition to horizontal and vertical output connectors, there are two sets of auxilliary input jacks. Adjacent to these jacks are individual sensitivity controls. Signals introduced at either set of auxilliary input jacks are buffered and amplified before being applied to the deflection plates. Front panel controls serve to vary the intensity and focus of the trace; position the trace on the screen and adjust the gain of the horizontal and vertical amplifiers.

As sound is being picked up by a microphone, it is, at the same instant, being transformed into an electrical signal. Connecting this signal to the RTA-2, via an unbalanced or balanced input jack, introduces it to either one or two gain blocks (depending on the strength of the input signal). After the signal has been amplified sufficiently, it is directed to a filter bus and distributed among a group

of 32 filters. Each of the 32 filters is a bandpass filter tuned to a center frequency selected at 1/3 octave intervals across the audio band (20Hz - 20KHz). Voltages appearing at the output of each filter are then fed to complex multiplexing circuitry which acts in conjunction with the sweep generator to direct the signals in their proper sequence to a logarithmic amplifier. Because the output of the multiplexing circuitry has some 60dB of dynamic range, the signals must be converted logarithmically so that they appear on the screen as linear (dB units).

4.3 Block Diagram Circuit Theory

A 491.5KHz signal, generated by the master clock, is used to drive the pink noise generator and the frequency dividing network. The output of the pink noise generator is a pseudo-random pink noise signal and is used in testing and analyzing sound systems. (See Fig. 4.1) Signals of line level are introduced - via a front or rear panel jack - to the input attenuator and gain stage. In this stage, the input signal is amplified and sent on to the filters where it is broken down to 32 distinct output voltages according to frequency. A multiplexer has been incorporated along with a sweep generator to provide control voltages that will arrange the analyzed information on the CRT in proper sequence. A logarithmic amplifier is used to convert the multiplexer output signal before it is sent on to the deflection amplifiers. This is done so that the displayed information will appear linear. Vertical and horizontal deflection amplifiers boost the signal to a level of sufficient value for use by the deflection plates. A low voltage power supply provides +200 volts in addition to a positive and negative 15 volts while a high voltage supply utilizes a voltage multiplier circuit to furnish -1800 volts to the CRT. Whenever the RTA-2 is in an auxilliary mode and no input signal is being applied, the beam gate circuitry reduces the intensity of the trace to prevent CRT phosphor burns.

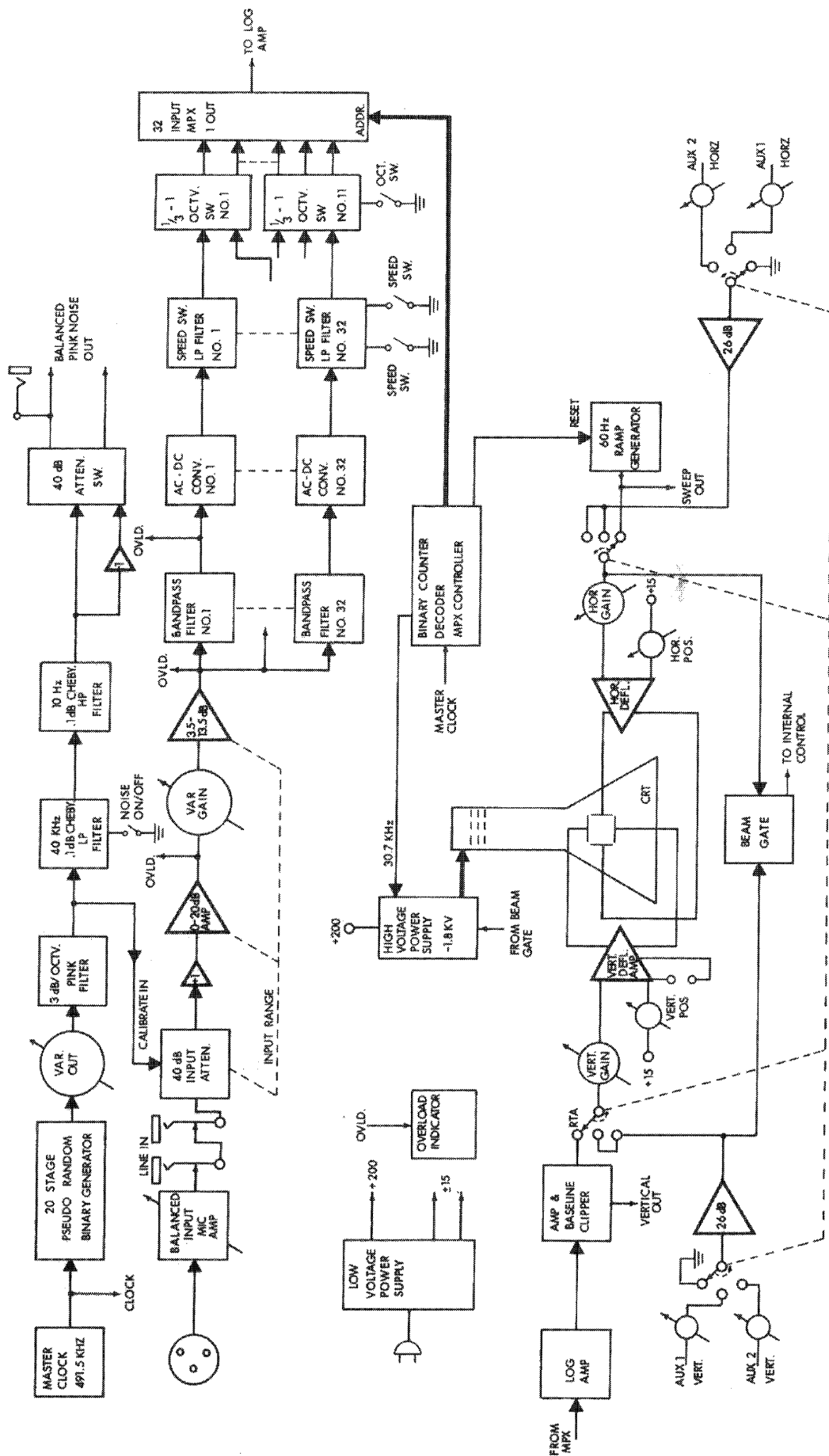


Fig. 4.1 Block Diagram



4.4 Detailed Circuit Theory

Balanced microphone signals entering the RTA-2 through J1 are fed to the gates of FETs C-100A and C-100B. The mic gain is adjusted with C-R135. Both sides of the balanced signal meet at buffer C-IC105D, whose non-inverting input is the arm of the common-mode-rejection trimmer pot C-R143. The now unbalanced output of C-IC105D appears at pin 14 and is applied to the next stage of amplification.

Line input jacks J2 and J3 are both pin jacks; J2 is a front panel jack, J3 a rear panel jack. Because J2 and J3 are connected in series, plugging into the front panel jack will disconnect source devices connected to the rear panel jack.

Signals injected via the line input jacks, J2 and J3, are fed through blocking capacitor C-C126 and buffer C-IC106A to the input attenuator C-SW100A. C-IC106D changes the impedance to a low value before sending the signal on to the front panel input attenuator C-R155. C-R156 together with C-IC105C and a resistor pack make up an attenuation network which provides the proper level of attenuation as per the markings on the RTA-2 front panel. Finally, the output of C-IC105C delivers the signal to the next stage which is the filter bank.

Each of the 32 filters is fed from the filter input buss (J1P7), through buffer F-IC100A. The actual filter is made up of components F-R100, F-C100, F-R101, F-R102, F-C101, F-R103, and F-IC100B. F-R102 tunes the frequency of the filter. F-C102 couples the AC signal through filter gain control F-R104 to the precision rectifier consisting of F-IC100C and diodes F-D101, and F-D102. At the output of the DC amplifier F-IC100D, a rectified and amplified version of the filter output appears and is stored on F-C106.

When a slower response time is desired, the front panel buttons labeled **fast** and **slow** may be released. Electrically this action turns FET 100 on which inserts capacitor F-C105 in parallel with F-C106 thus adding their values and slowing the integration time of the RC network. F-IC101A and F-IC101B are CMOS switches. When the control gates of these switches are grounded by depressing the front panel octave switch, sets of three filters combine and deliver an average voltage to the input of its associated multiplexer.

In order to get the information from the filters into the correct location on the CRT, multiplexing circuitry has been provided. The heart of the multiplexing circuitry is D-IC105 which is a dividing network. The same clock signal that is used by the pink noise generator is also used to drive D-IC105. Outputs of the counter are square wave pulse trains whose frequencies are divisions of the clock frequency (491.5KHz). As D-IC105 counts, it is essentially allowing the signals from the 32 filters to pass in sequence through F-IC132, F-IC133, F-IC134, and F-IC135 to the logarithmic amplifier.

The output signal from the multiplexer has over 60dB of possible dynamic range. Therefore, it is necessary to distribute the information across the CRT so that each filter's output will be discernable. The circuitry which improves the display dynamics of the filter output information is the logarithmic amplifier and consists of the semiconductors labeled D-Q108, D-IC102A, D-IC102B and D-IC102C. Also, surrounding components adjust linearity (D-R100), offset (D-R116) and gain (D-R108) respectively. Moving to D-IC102D, a precision limiter (base-line clamp), the signal is amplified and applied to the vertical deflection circuitry through SW100B.

Backing up a little, let's look at D-IC103C. Whenever it is desired to have the information being displayed on the RTA's screen also displayed on a second oscilloscopic instrument, the rear panel vertical output jack, (J7), is used. The vertical output signal is derived from the logarithmic amplifier, buffered by D-IC103C and applied to the vertical output jacks.

Signals injected through the horizontal and vertical input jacks are amplified and buffered by a section of D-IC103 (A or D) and applied through portions of SW100 to the vertical and horizontal deflection circuitry. D-R148 controls the vertical position of the trace, D-R149 controls the horizontal position and SW26 selects a vertical sensitivity of 5dB per division or 10dB per division. These adjustments all appear on the front panel.

D-IC104B and D-IC104C along with their associated componentry, make up a detector circuit whose function is to reduce the trace intensity during the absence of a vertical input signal. The reason for this circuitry is to eliminate the possibilities of burning holes in the CRT's phosphor coating.

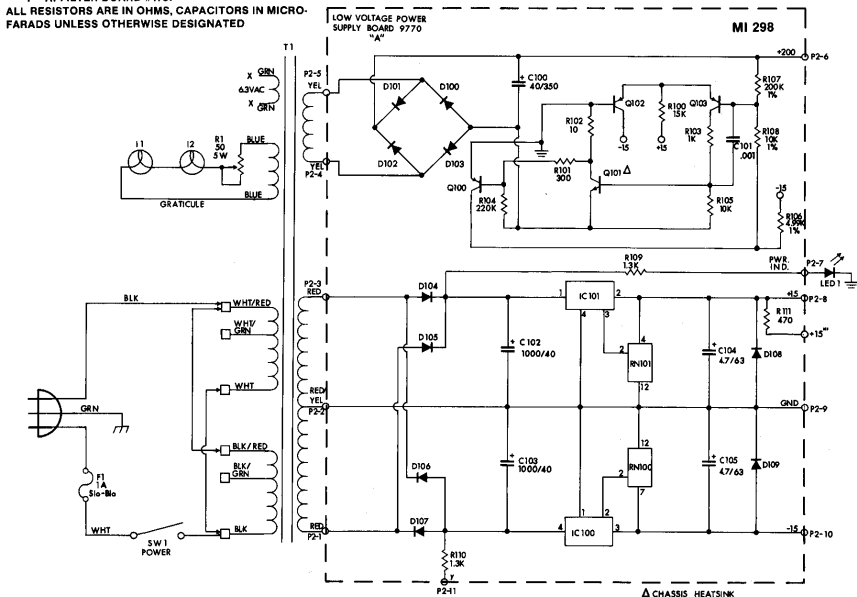
D-IC104A and D-IC104D form a voltage comparator circuit. This circuit is set up so that anytime a voltage enters the RTA-2 that is greater than the voltage set at the input of the comparator, D-Q107 will be biased into operation thereby illuminating the front panel overload indicator LED-2. The low voltage power supplies provide the proper operating voltages to the RTA-2 circuitry and light the power-on indicator. The low voltage power supply furnishes plus and minus 15 volts as well as plus 200 volts while the high voltage supply uses several capacitors and diodes in a voltage multiplier configuration to supply -1800 volts to the anodes of the CRT.

GENERAL

CIRCUITS SHOWN START WITH SN20569
 ALL COMPONENTS MOUNTED OFF BOARDS ARE NUMBERED 1-9 PER BOARD
 ALL COMPONENTS ARE NUMBERED 100-199 PER BOARD
 EACH BOARD HAS A CODE LETTER. THEY ARE LISTED BELOW:

- A - LOW VOLTAGE POWER SUPPLY BOARD #9770
- B - ULTRA HIGH VOLTAGE BOARD #9772
- C - INPUT BOARD #9780
- D - DEFLECTION BOARD #4788
- E - LOW FILTER BOARD #4788
- F - HI FILTER BOARD #4787

ALL RESISTORS ARE IN OHMS, CAPACITORS IN MICRO-FARADS UNLESS OTHERWISE DESIGNATED



POWER SUPPLY

- CIRCUIT SHOWN WIRED FOR 120 VAC
- SW1 SHOWN IN OFF POSITION
- RN DENOTES RESISTOR NETWORK
- Δ DENOTES CHASSIS HEATSINKED
- Y DENOTES CATHODE LEAD TO LED 2, OVLD INDICATOR

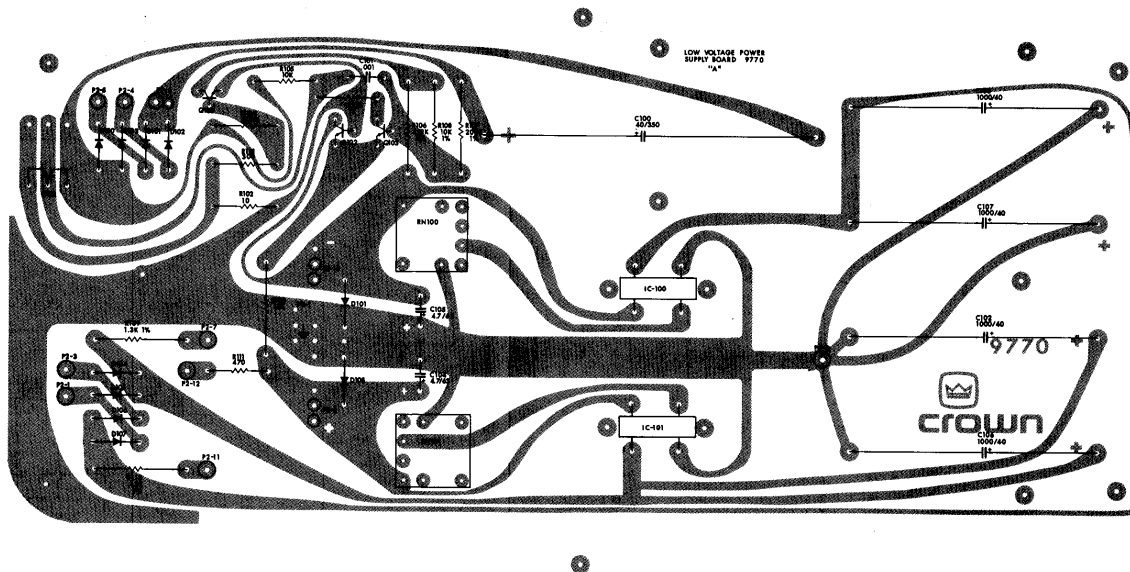
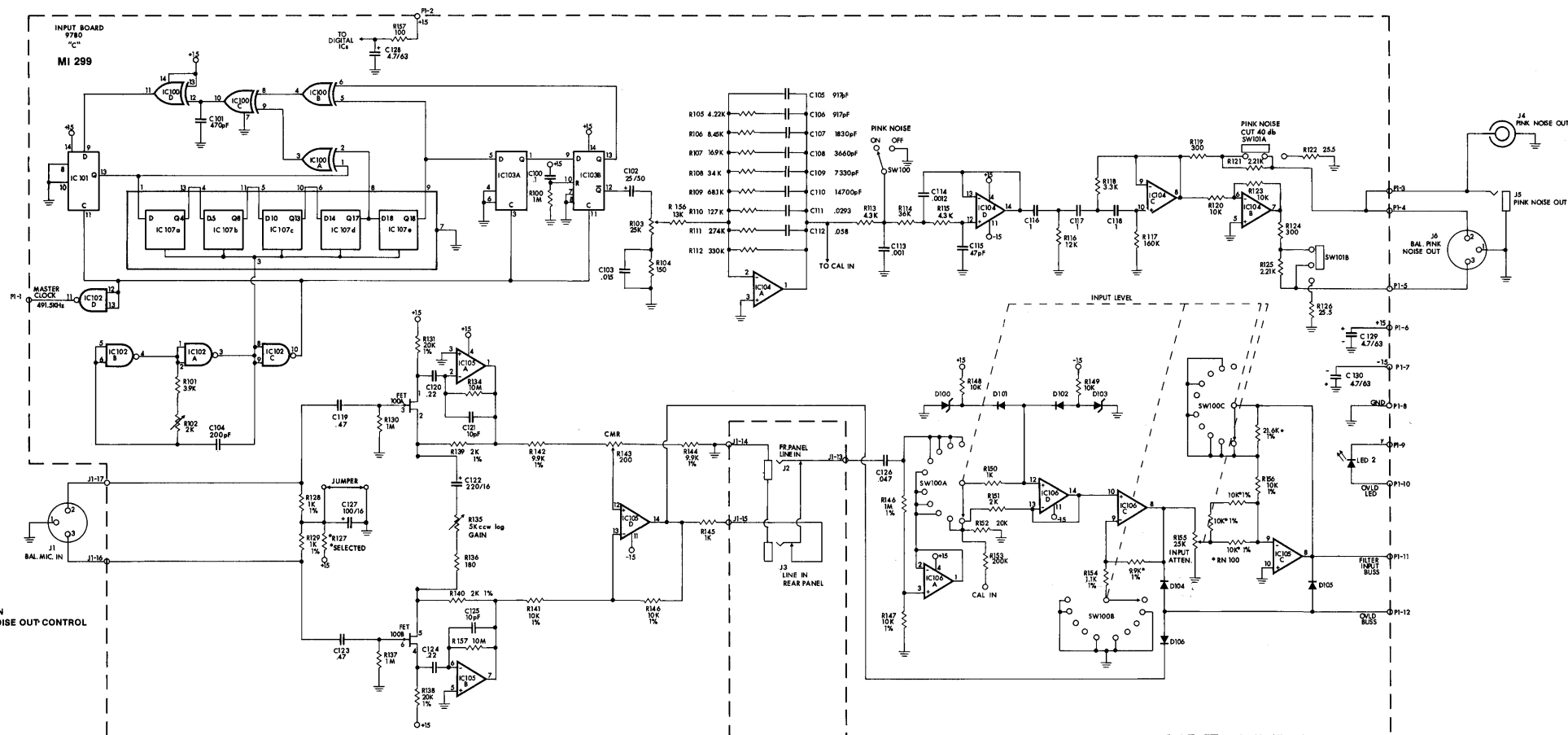
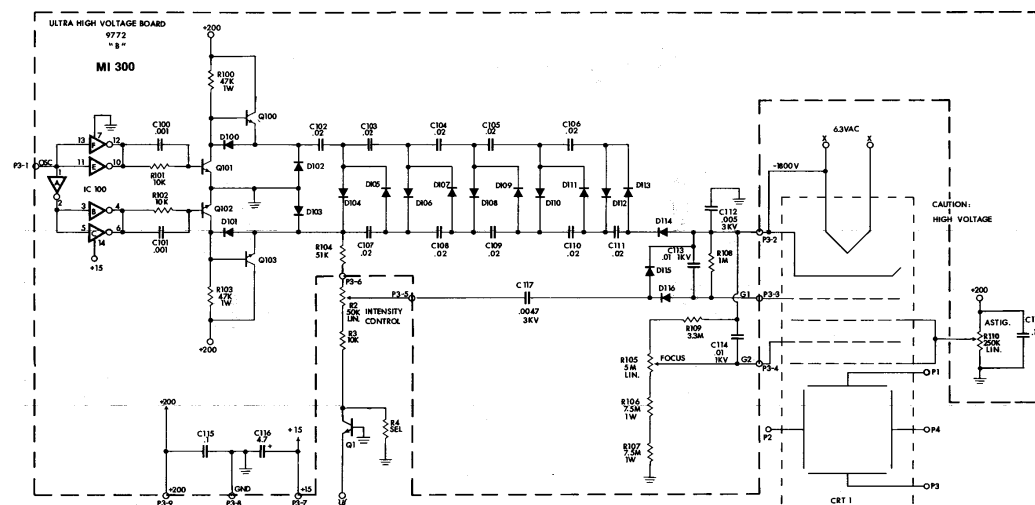
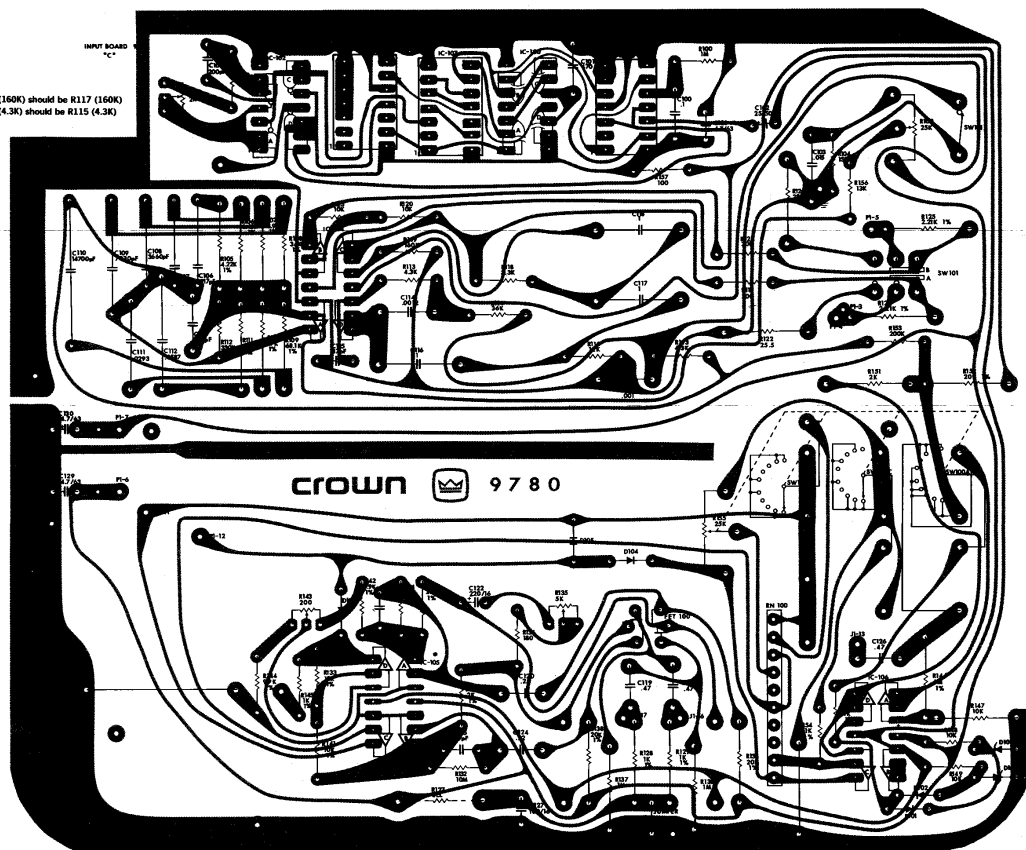


Fig. 4.2 RTA-2 Schematics Diagrams

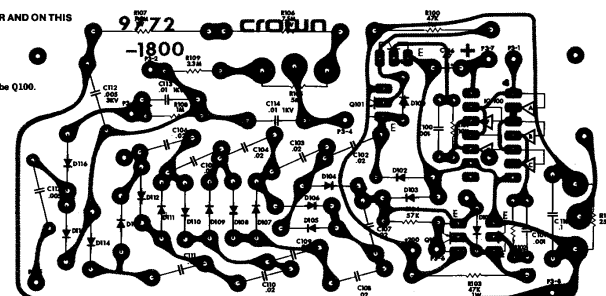


NOTE:
R119 (160K) should be R117 (160K)
R113 (4.3K) should be R115 (4.3K)



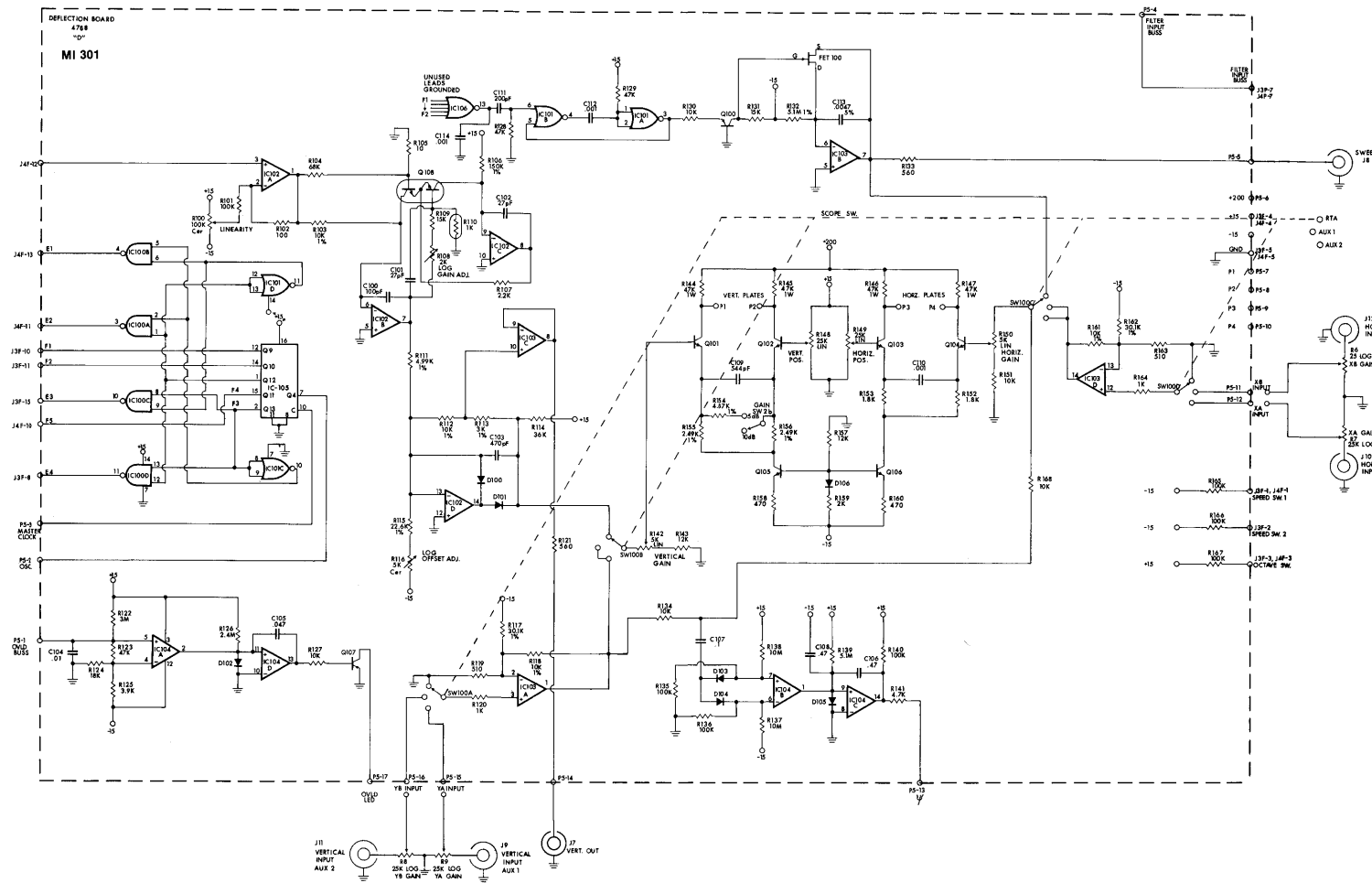
ULTRA HIGH VOLTAGE BOARD
- Y DENOTES CONNECTION POINT TO DEFLECTION
BOARD PS-13
- WARNING! HIGH VOLTAGE PRESENT NEAR AND ON THIS BOARD

NOTE: Q101 should be Q100.



DEFLECTION BOARD

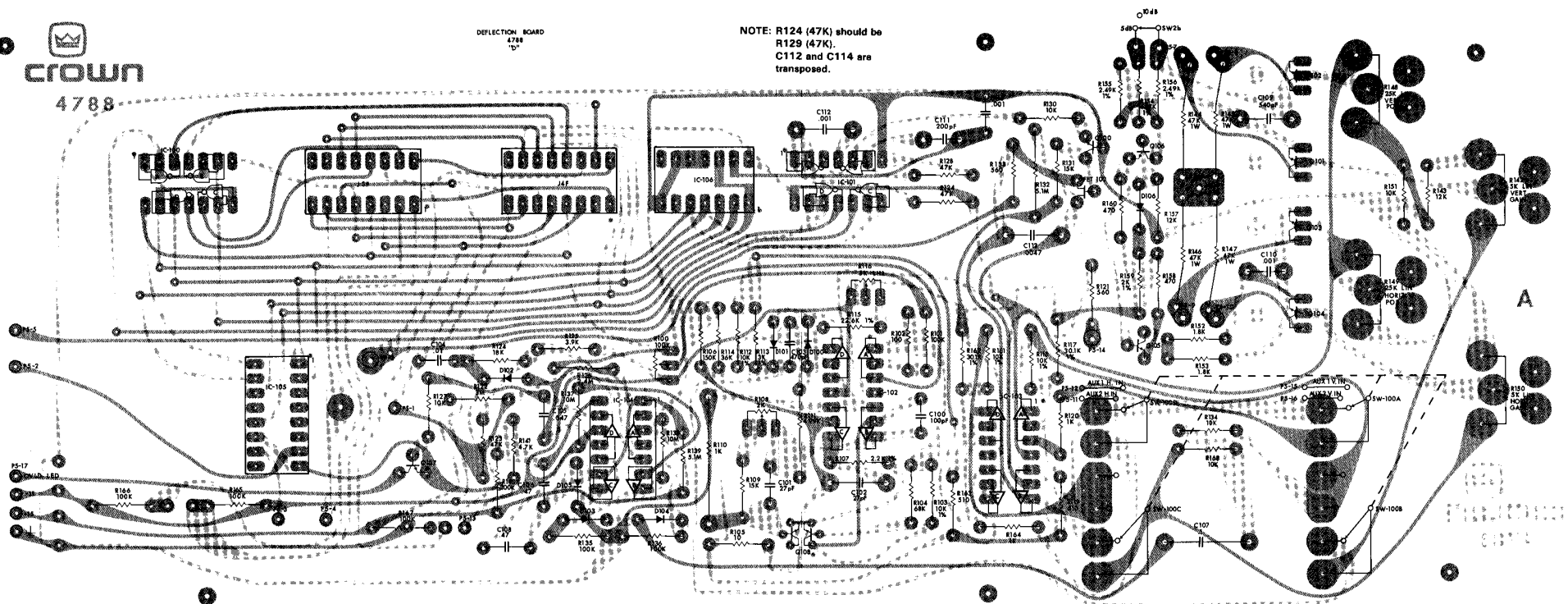
- J1-P CONNECTIONS GO TO THEIR RESPECTIVE CONNECTIONS ON J3-F, J2-P GO TO J4-F
- SCOPE SW100 SHOWN IN RTA POSITION




CROWN
 4788

DEFLECTION BOARD
 4788
 "D"

NOTE: R124 (47K) should be
 R129 (47K).
 C112 and C114 are
 transposed.





SECTION 5 PARTS LIST

5.1 General Information

This section contains parts lists for the RTA-2 real time analyzer. The information in this section will aid the service technician in rapidly and accurately identifying and replacing defective parts.

Reference designations correspond to those shown in the schematic diagrams in Sec. 4.

5.2 Standard and Special Parts

Many electrical and electronic parts and many attaching type parts used in the RTA-2 are standard items stocked by and available from electronic supply houses. However, some electronic parts that appear to be standard are actually special. This means that Crown has selected the item to meet specific requirements. A part ordered by the Crown part number will assure an acceptable replacement. Structural items such as covers and panels are available only from Crown.

5.3 Ordering Parts

When ordering parts for the RTA-2, be sure to give the model and serial number and include the part description and Crown part number from the parts list.

Note: All component designation numbers are preceded by board code letter -

Schematic Designation	Description	Qty.	Crown Part No.	Other Information
	RTA-2 High Low Voltage Module		41989	
	Resistors			
A-R100	15K ohm 1/2W 5% CF	1	1064	
A-R101	300 ohm 1/4W 5% CF	1	3801	
A-R102	10 ohm 1/4W 5% CF	1	3753	
A-R103	1K ohm 1/4W 5% CF	1	2627	
A-R104	220K ohm 1/4W 5% CF	1	4219	
A-R105	10K ohm 1/4W 5% CF	1	2631	
A-R106	4.99K ohm 1/4W 1% MF	1	3686	
A-R107	200K ohm 1/2W 5% MF	1	3197	
A-R108	10K ohm 1/2W 1% MF	1	2343	
A-R109, R110	1.3K ohm 1/2W 1% MF	2	3114	
A-R111	470 ohm 1/4W 5% CF	1	2626	
A-RN100, RN101	Resistor trim network	2	4445	
	Capacitors			
A-C100	40mF 450V	1	4848	
A-C101	.001mF Cer Disc	1	2288	
A-C102, C103				
C106, C107	1000mF 40V	4	4303	
A-C104, C105	4.7mF 63V	2	4253	
	Diodes			
A-D100, D101, D102, D103, D104, D105, D106, D107	1N4004	8	2851	
	Integrated Circuits			
A-IC100	79MGT2C	1	~~C 5486-3~~ ~~4297-5~~	-Reg
A-IC101	78MGT2C	1	~~4296-7~~	+Reg
	Transistors			
A-Q100, Q102	PN4250A PNP	2	3786	
A-Q101	NDS128 NPN	1	~~C 4061-5~~	
A-Q103	MPSA93 PNP	1	3578	
	Miscellaneous			
A	Power supply heat sink	1	9756	
	Power Supply Board	1	9770	*Not available for purchase
	Int star lockwasher #4	4	1824	
	4-40X .25 RHS screw	4	1827	
	4-40 hex nut	4	1938	
	7 cable tie	3	1812	
	312 X 125 X 031 nylon washer	4	4567	



Schematic Designation	Description	Qty.	Crown Part No.	Other Information
	Ultra High Voltage Module		41988	
	Resistors			
B-R100, R103	47K ohm 1W 5% Comp	2	4866	
B-R101, R102	10K ohm ¼W 5% CF	2	2631	
B-R104	51K ohm ¼W 5%	1	2881	
B-R105	5M ohm POT	1	4779	Focus control
B-R106, R107	7.5M ohm 1W 5% Comp	~~2~~	~~4874~~	7323-6
B-R108	1M ohm ¼W 5%	1	3198	
B-R109	3.3M ohm ¼W 5% CF	1	4237	
B-R110	250K POT	1	4778	Astig control
	Capacitors			
B-C100, C101	.001mF Cer Disc	2	2288	
B-C102, C103, C104, C105, C106, C107, C108, C109, C110, C111	.02mF 500V Cer Disc	10	4847	
B-C112, C117	.0047mF 3kV Cer Disc	2	4845	
B-C113, C114	.01mF 1kV Cer Disc	2	4846	
B-C115, C118	.1mF 200V Filmatic	1	2938	
B-C116	4.7mF 63V Vertical	1	4253	
	Diodes			
B-D100, D101	1N4148	2	3181	
B-D102, D103, D104, D105, D106, D107, D108, D109, D110, D111, D112, D113, D114, D115 D116	1N4005	15	4842	
	Integrated Circuits			
B-IC-1	4060 Hex inverter	1	4665	
	Transistors			
B-Q100, Q101, Q102, Q103	NDS128 NPN	4	4061	
	Miscellaneous			
B	RTA ultra hi voltage brd.	1	9772	*Not available for purchase
	14 Pin DIL IC socket	1	3450	

Schematic Designation	Description	Qty.	Crown Part No.	Other Information
RTA-2 Input Module			41987	
Resistors				
C-R100, R130, R-137	1M ohm ¼W 5% CF	3	3198	
C-R101	3.9K ohm ¼W 5% CF	1	2630	
C-R102	2K ohm heli-pot trim	1	3672	Noise
C-R103	25K ohm audio	1	4770	Pink noise level
C-R104	150 ohm ¼W 5% CF	1	3799	
C-R105	4.22K ohm ½W 1% MF	1	4854	
C-R106	8.45K ohm ½W 1% MF	1	4857	
C-R107	16.9K ohm ½W 1% MF	1	4860	
C-R108	34K ohm ½W 1% MF	1	4864	
C-R109	68.1K ohm ½W 1% MF	1	4916	
C-R110	137K ohm ½W 1% MF	1	4869	
C-R111	274K ohm ½W 1% MF	1	4871	
C-R112	330K ohm ¼W 5% CF	1	4222	
C-R113, R115	4.2K ohm ¼W 5% CF	2	4855	
C-R114	36K ohm ¼W 5% CF	1	4865	
C-R116	12K ohm ¼W 5% CF	1	2878	
C-R117	160K ohm ¼W 5% CF	1	4217	
C-R118	3.3K ohm ¼W 5% CF	1	2629	
C-R119, R124	300 ohm ¼W 5% CF	2	3801	
C-R120, R123, R148, R149	10K ohm ¼W 5% CF	4	2631	
C-R121, R125	2.21K ohm ½W 1% MF	2	4906	
C-R122, R126	25.5 ohm ½W 1% MF	2	4905	
C-R127	Selected	1		
C-R128, R129	1K ohm ½W 1% MF	2	3194	
C-R131	20K ohm ½W 1% MF	1	3752	
C-R132, R-134	10M ohm ¼W 10% Comp	2	3221	
C-R135	5K ohm Helipot trim	1	3670	CCW log
C-R136	180 ohm ¼W 5% CF	1	2873	
C-R139, R140	2K ohm ¼W 1% MF	2	4505	
C-R141, R147, R133	10K ohm ¼W 1% MF	3	4859	
C-R142, R144	9.9K ohm ¼W 1% MF	2	4858	
C-R143	200 ohm Helipot trim	1	3683	
C-R145, R150	1K ohm ½W 1% MF	2	4850	
C-R146,	1M ohm ½W 1% MF	1	4872	
C-R152, R138	20K ¼W 1% MF	2	4861	
C-R153	200K ohm ¼W 5% CF	1	3622	
C-R154	1.1K ohm ¼W 1% MF	1	4851	
C-R155	25K ohm Audio	1	4779	
C-R156	13K ohm ¼W 5% CF	1	4300	
C-RN100	Resistor network	1	4280	
C-R157	100 ohm ¼W 5% CF	1	2872	
C-R151	2K ¼W 5% CF	1	3804	



Schematic Designation	Description	Qty.	Crown Part No.	Other Information
Capacitors				
C-C100	.1mF 12V Cer Disc	1	2600	
C-C101	470pF Mica	1	2511	
C-C102	33mF 50V	1	3679	
C-C103	.015mF 200V Filmatic	1	3288	
C-C104	200pF Mica	1	3411	
C-C105, C106	917pF 63V 2.5 Styr	2	4287	
C-C107	1830pF 63V 2.5 Styr	1	4286	
C-C108	3660pF 63V 2.5 Styr	1	4285	
C-C109	7330pF 63V 2.5 Styr	1	4284	
C-C110	14,700pF 63V 2.5 Styr	1	4283	
C-C111	.0293mF 200V 2.5	1	4293	
C-C112	.058mF 100V 2.5	1	4292	
C-C113	.001mF 200V Filmatic	1	3480	
C-C114	.0012mF	1	2406	
C-C115	47pF Mica	1	3409	
C-C116, C117, C118	1.0mF 100V 5 polycrb	3	4472	
C-C119, C123	.47mF 100V 5 Polycrb	2	4119	
C-C120, C124	.22mF 100V 5 Polycrb	2	4510	
C-C121, C125	10pF Mica	2	2821	
C-C122	220mF 16V Vertical	1	3796	
C-C126	.047mF 250V 5 Polycrb	1	4404	
C-C127	400mF 16V Vertical	1	3729	
C-C128, C129, C130	4.7mF 63V Vertical	3	4253	
Diodes				
C-D100, D103	1N961B 10V Zener	2	3549	
C-D101, D102, D104, D105, D106	1N4148	5	3181	
Integrated Circuits				
C-IC100	MC14070	1	4833	
C-IC101, C103	MC14013 Flip Flop	2	4831	
C-IC102	4011 Quad Two Input Nand	1	4529	
C-IC104, IC105, IC106	TL074	3	4696	
C-IC107	MC14006 Div-By-N-Ctr	1	4832	
Transistors				
C-FET100	E4111 Dual N-Ch JFET	1	4015	

Schematic Designation	Description	Qty.	Crown Part No.	Other Information
	Miscellaneous			
C	RTA Input Board	1	9780	*Not available for purchase
SW100	DPDT DB SW W/O Brekt	1	4923	
	Xistor Lead PC Recpt	2	3519	
	14 Pin D/C IC Socket	8	3450	
	Deflection Module		41986	
	Resistors			
D-R100	100K ohm Cermet Trim	1	4843	
D-R101, R135, R136, R140, R165, R166, R167	100K ohm ¼W 5% CF	7	2883	
D-R102	100 ohm ¼W 5% CF	1	2872	
D-R103, R112, R118, R161	10K ohm ¼W 1% MF	4	4859	
D-R104	68K ohm ¼W 5% CF	1	3620	
D-R105	10 ohm ¼W 5% CF	1	3753	
D-R106	150K ohm ¼W 1% MF	1	4870	
D-R107	2.2K ohm ¼W 2% MF	1	3152	
D-R108	2K ohm Helipot Trim	1	3672	
D-R109, R131	15K ohm ¼W 5% CF	2	2632	
D-R110	1K ohm 3W Q-81	1	4876	
D-R111	4.99K ohm ¼W 1% MF	1	3686	
D-R113	3K ohm ¼W 1% MF	1	4853	
D-R114	36K ohm ¼W 5% CF	1	4865	
D-R115	22.6K ohm ¼W 1% MF	1	4146	
D-R116	5K ohm Helipot Trim	1	3670	
D-R117, R162	30.1K ohm ¼W 1% MF	2	4862	
D-R119, R163	510 ohm ¼W 5% CF	2	4849	
D-R120, R164	1K ohm ¼W 5% CF	2	2627	
D-R121, R133	560 ohm ¼W 5% CF	2	2874	
D-R122	3M ohm ¼W 5% CF	1	4489	
D-R123, R128, D-129	47K ohm ¼W 5% CF	3	2880	
D-R124	18K ohm ¼W 5% CF	1	2633	
D-R125	3.9K ohm ¼W 5% CF	1	2630	
D-R126	2.4M ohm ¼W 5% CF	1	4600	
D-R127, R130, R134, R168, R151	10K ohm ¼W 5% CF	5	2631	
D-R132	5.1M ohm ½W 1% MF	1	5035	
D-R137, R138	10M ohm ¼W 10% Comp	2	3221	
D-R139	5.1M ohm ¼W 5% CF	1	4126	
D-R141	4.7K ohm ¼W 5% CF	1	3939	
D-R142, R150	5K ohm Vrt+Hrz RTA	2	4773	
D-R143, R157	12K ohm ¼W 5% CF	2	2878	
D-R144, R145, R146, R147	47K ohm 1W 5% Comp	4	4866	



Schematic Designation	Description	Qty.	Crown Part No.	Other Information
D-R148	25K ohm Vert Pos RTA	1	4774	
D-R149	25K ohm Horz Pos RTA	1	4775	
D-R152, R153	1.8K ohm 1/4W 5% CF	2	3807	
D-R154	4.87K ohm 1% MF	1	4856	
D-R155, R156	2.49K ohm 1/4W 1%	2	4852	
D-R158, R160	470 ohm 1/4W 5% CF	2	2626	
D-R159	2K ohm 1/4W 1% MF	1	4505	
Capacitors				
D-C100	100pf Mica	1	3410	
D-C101, C102	27pf Mica	2	2342	
D-C103	470pf Mica	1	2511	
D-C104	.01mF Cer Disc	1	1751	
D-C105	.047mF 250V 5 Polycarb	1	4404	
D-C106, C108	.47MFD 100V 5 Polycrb	2	4119	
D-C107	.1MFD 200 V Filmatic	1	2938	
D-C109	.544pF 63V 25 Styr	1	4463	
D-C110, C112	.001MFD Cer Disc	2	2288	
D-C111	200pF Mica	1	3411	
D-C113	.0047mF 200V 5 Poly	1	3996	
D-C114	.001mF 200V Filmatic	1	3480	
Diodes				
D-D100, D101, D102, D103 D104, D105, D106	1N4148	7	3181	
Integrated Circuits				
D-IC100	4011 Quad 2 Input Nand	1	4529	
D-IC101	4001 Quad 2 Input Nor	1	4528	
D-IC102, IC103	TL074	2	4696	
D-IC104	LM339N Volt Comparatr	1	4345	
D-IC105	4020 Shift Register	1	4829	
D-IC106	4078 8 Input Nor Gate	1	4830	
Transistors				
D-Q100, Q107	PN4250A PNP	2	3786	
D-Q101, Q102, Q103, Q104	ND 128 NPN	4	4061	
D-Q105, Q106	Sel 2N3859A NPN	2	2961	
D-FET 100	2N5459 N-Ch JFET	1	3053	
D-Q108	Sel 1T129 NPN	1	4838	

Schematic
Designation

Description

Qty. Crown
Part No.

Other Information

Miscellaneous

D	RTA-2 Deflection Board	1	4788	*Not available for purchase
	14 Pin Dil IC Socket	6	3450	
	16 Pin Dil IC Socket	3	4508	
	PC Mount Post Mod 1	2	4729	
	1P 3 Pos Scope 1NP SW	1	4772	

General Miscellaneous

Back Panel Assembly

J2	NI12A 2 Could. HI-D Jack	1	3631	Line in
J4	350 1FP Panel Pin Jack	1	1533	Pinkout
J7	350 1FP Panel Pin Jack	1	1533	Vert out
J8	350 1FP Panel Pin Jack	1	1533	Sweep out
J9	350 1FP Panel Pin Jack	1	1533	Aux 1 Vert In
J10	350 1FP Panel Pin Jack	1	1533	Aux 1 Horz In
J11	350 1FP Panel Pin Jack	1	1533	Aux 2 Vert In
J12	350 1FP Panel Pin Jack	1	1533	Aux 2 Horz In
R9	33K ohm Pot VA2632	1	3307	Aux 1 Vert Adj
R7	33K ohm Pot VA2632	1	3307	Aux 1 Horz Adj
R8	33K ohm Pot VA2632	1	3307	Aux 2 Vert Adj
R6	33K ohm VA2632	1	3307	Aux 2 Horz Adj
	CRT 14 Pin Socket	1	4839	
	3823-1 Fuse Block	1	3776	
F1	3A6 1A Slow Blow	1	4875	
T1	11939 RTA XFMR	1	4762	
CRT 1	5 DEP-31F CRT	1	4757	

Front Panel Assembly

J1	XLR3-32 Panel M Cannon	1	1525	Pink noise, Balanced out
J6	XLR3-31 Panel F Cannon	1	4902	Mic Input
J3, J5	NI12A 2 Cond. HI-D Jack	2	3631	Mic line input
R5	250K ohm Astig	1	4778	Pink noise output
R2	25K ohm Audio HKX450	1	4771	Astigmatism control
R1	50 ohm AW45	1	4776	Intensity control
SW1	1 Pos Rotary Prw Sw	1	3492	Illum control
Led 1	Amber LED MV5153	1	4342	Power on/off
LED 2	Red LED MV5053	1	4341	Power on light
SW2 a,b,c,d	4 St-Pushbutton Sw	1	4765	Overload indicator
				a) Octave
				b) 10dB/SDB
				c) Hi Fast/Slow
				d) Lo Fast/Slow
Q1	MPSA43	1	3810	



Schematic Designation	Description	Qty.	Crown Part No.	Other Information
Low Filter #1				
Resistors				
E-RN162	Resistor Network	1	4713	Frequency Adjust Filter Gain Adjust
E-RN163	Resistor Network	1	4712	
E-R389	1K ohm Helipot Trim	1	3669	
E-R390	5K ohm Helipot Trim	1	3670	
E-R391, R392	1M ohm ¼W 5% CF	2	3198	
E-R393, R394	1.5M ohm ¼W 5% CF	2	4234	
E-R395	10K ohm ½W 5% CF	1	2631	
E-R396	7.5M ohm ¼W 5% CF	1	4915	
E-R397	1M ohm Horz Trimpot	1	4844	
Capacitors				
E-C328, C329	.94mF 200V	2	4288	
E-C330, C334	4.7mF 35V	2	4019	
E-C331, C332	.01mF	2	1751	
E-C333	33mF 50V Vertical	1	3679	
Diodes				
E-D193, D194, D195	1N4148	3	3181	
Integrated Circuits				
E-IC131	TL074	1	4696	
E-IC141	MC14016 Quad Switch	3/brd	4834-5	
E-IC135	MC14051 8 Ch Multiplexer	2/brd	4835	
Transistors				
E-FET131	2N5459 N-Ch FET	1	3053	
Low Filter #2				
Resistors				
E-RN160	Resistor Network	1	4714	Frequency Adjust Filter Gain Adjust
E-RN161	Resistor Network	1	4712	
E-R380	1K ohm Helipot Trim	1	3669	
E-R381	5K ohm Helipot Trim	1	3670	
E-R382, R383	1M ohm ¼W 5% CF	2	3198	
E-R384, R385	1.5M ohm ¼W 5% CF	2	4234	
E-R386	10K ohm ½W 5% CF	1	2631	
E-R387	7.5M ohm ¼W 5% CF	1	4915	
E-R388	1M ohm Horz Trimpot	1	4844	

Schematic Designation	Description	Qty.	Crown Part No.	Other Information
Capacitors				
E-C321, C322	.94mF 200V	2	4288	
E-C323, C327	4.7mF 35V	2	4019	
E-C324, C325	.01mF	2	1751	
E-C326	33mF 50V Vertical	1	3679	
Diodes				
E-D190, D191 D192	1N4148	3	3181	
Integrated Circuits				
E-IC130	TL074	1	4696	
E-IC141	MC14016 Quad Switch	3/brd	4834	
E-IC135	MC14051 8 Ch Multiplexer	2/brd	4835	
Transistors				
E-FET130	2N5459 N-Ch FET	1	3053	
Low Filter #3				
Resistors				
E-RN158	Resistor Network	1	4715	
E-RN159	Resistor Network	1	4712	
E-R371	1K ohm Helipot Trim	1	3669	Frequency Adjust Filter Gain Adjust
E-R372	5K ohm Helipot Trim	1	3670	
E-R373, R374	1M ohm ¼W 5% CF	2	3198	
E-R375, R376	1.5M ohm ¼W 5% CF	2	4234	
E-R377	10K ohm ½W 5% CF	1	2631	
E-R378	7.5M ohm ¼W 5% CF	1	4915	
E-R379	1M ohm Horz Trimpot	1	4844	
Capacitors				
E-C314, C315	.47mF 200V	2	4289	
E-C316, C320	4.7mF 35V	2	4019	
E-C317, C318	.01mF	2	1751	
E-C319	33mF 50V Vertical	1	3679	
Diodes				
E-D187, D188, D189	1N4148	3	3181	
Integrated Circuits				
E-IC129	TL074	1	4696	
E-IC141	MC14016 Quad Switch	3/brd	4834	
E-IC135	MC14051 8 Ch Multiplexer	2/brd	4835	
Transistors				
E-FET129	2N5459 N-Ch FET	1	3053	



Schematic Designation	Description	Qty.	Crown Part No.	Other Information
Low Filter #4				
Resistors				
E-RN156	Resistor Network	1	4713	Frequency Adjust Filter Gain Adjust
E-RN157	Resistor Network	1	4712	
E-R361	1K ohm Helipot Trim	1	3669	
E-R362	5K ohm Helipot Trim	1	3670	
E-R363, R364	1M ohm ¼W 5% CF	2	3198	
E-R365, R366	1.5M ohm ¼W 5% CF	2	4234	
E-R367	10K ohm ½W 5% CF	1	2631	
E-R368	7.5M ohm ¼W 5% CF	1	4915	
E-R369	1M ohm Horz Trimpot	1	4844	
E-R370	5.6K ohm ¼W 5% CF	1	3220	
Capacitors				
E-C306, C307	.47mF 200V	2	4289	
E-C308, C312, E-C313	4.7mF 35V	2	4019	
E-C309, C310	.01mF	2	1751	
E-C311	33mF 50V Vertical	1	3679	
Diodes				
E-D184, D185, D186	1N4148	3	3181	
Integrated Circuits				
E-IC128	TL074	1	4696	
E-IC141	MC14016 Quad Switch	3/brd	4834-5	
E-IC135	MC14051 8 Ch Multiplexer	2/brd	4835	
Transistors				
E-FET128	2N5459 N-Ch FET	1	3053	
Low Filter #5				
Resistors				
E-RN154	Resistor Network	1	4714	Frequency Adjust Filter Gain Adjust
E-RN155	Resistor Network	1	4712	
E-R352	1K ohm Helipot Trim	1	3669	
E-R353	5K ohm Helipot Trim	1	3670	
E-R354, R355	1M ohm ¼W 5% CF	2	3198	
E-R356, R357	1.5M ohm ¼W 5% CF	2	4234	
E-R358	10K ohm ½W 5% CF	1	2631	
E-R359	7.5M ohm ¼W 5% CF	1	4915	
E-R360	1M ohm Horz Trimpot	1	4844	

Schematic Designation	Description	Qty.	Crown Part No.	Other Information
Capacitors				
E-C299, C300	.47mF 200V	2	4289	
E-C301, C305	4.7mF 35V	2	4019	
E-C302, C303	.01mF	2	1751	
E-C304	33mF 50V Vertical	1	3679	
Diodes				
E-D181, D182, D183	1N4148	3	3181	
Integrated Circuits				
E-IC127	TL074	1	4696	
E-IC141	MC14016 Quad Switch	3/brd	4834	
E-IC135	MC14051 8 Ch Multiplexer	2/brd	4835	
Transistors				
E-FET127	2N5459 N-Ch FET	1	3053	
Low Filter #6				
Resistors				
E-RN152	Resistor Network	1	4715	
E-RN153	Resistor Network	1	4712	
E-R343	1K ohm Helipot Trim	1	3669	Frequency Adjust Filter Gain Adjust
E-R344	5K ohm Helipot Trim	1	3670	
E-R345, R346	1M ohm ¼W 5% CF	2	3198	
E-R347, R348	1.5M ohm ¼W 5% CF	2	4234	
E-R349	10K ohm ½W 5% CF	1	2631	
E-R350	7.5M ohm ¼W 5% CF	1	4915	
E-R351	1M ohm Horz Trimpot	1	4844	
Capacitors				
E-C292, C293	.234mF 200V	2	4290	
E-C294, C298	4.7mF 35V	2	4019	
E-C295, C296	.01mF	2	1751	
E-C297	33mF 50V Vertical	1	3679	
Diodes				
E-D178, D179, D180	1N4148	3	3181	
Integrated Circuits				
E-IC126	TL074	1	4696	
E-IC140	MC14016 Quad Switch	3/brd	4834	
E-IC135	MC14051 8 Ch Multiplexer	2/brd	4835	
Transistors				
E-FET126	2N5459 N-Ch FET	1	3053	



Schematic Designation	Description	Qty.	Crown Part No.	Other Information
Low Filter #7				
Resistors				
E-RN150	Resistor Network	1	4713	Frequency Adjust Filter Gain Adjust
E-RN151	Resistor Network	1	4712	
E-R333	1K ohm Helipot Trim	1	3669	
E-R334	5K ohm Helipot Trim	1	3670	
E-R335, R336	1M ohm ¼W 5% CF	2	3198	
E-R337, R338	1.5M ohm ¼W 5% CF	2	4234	
E-R339	10K ohm ½W 5% CF	1	2631	
E-R340	7.5M ohm ¼W 5% CF	1	4915	
E-R341	1M ohm Horz Trimpot	1	4844	
E-R342	5.6K ohm ¼W 5% CF	1	3220	
Capacitors				
E-C284, C285	.234mF 200V	2	4290	
E-C286, C290				
C291	4.7mF 35V	3	4019	
E-C287, C288	.01mF	2	1751	
E-C289	33mF 50V Vertical	1	3679	
Diodes				
E-D175 D176, D177	1N4148	3	3181	
Integrated Circuits				
E-IC125	TL074	1	4696	
E-IC140	MC14016 Quad Switch	3/brd	4834	
E-IC135	MC14051 8 Ch Multiplexer	2/brd	4835	
Transistors				
E-FET125	2N5459 N-Ch FET	1	3053	
Low Filter Board #8				
Resistors				
E-RN148	Resistor Network	1	4714	Frequency Adjust Filter Gain Adjust
E-RN149	Resistor Network	1	4712	
E-R324	1K ohm Helipot Trim	1	3669	
E-R325	5K ohm Helipot Trim	1	3670	
E-R326, R327	1M ohm ¼W 5% CF	2	3198	
E-R328, R329	1.5M ohm ¼W 5% CF	2	4234	
E-R330	10K ohm ½W 5% CF	1	2631	
E-R331	7.5M ohm ¼W 5% CF	1	4915	
E-R332	1M ohm Horz Trimpot	1	4844	

Schematic Designation	Description	Qty.	Crown Part No.	Other Information
Capacitors				
E-C277, C278	.234mF 200V	2	4290	
E-C279, C283	4.7mF 35V	2	4019	
E-C280, C281	.01mF	2	1751	
E-C282	33mF 50V Vertical	1	3679	
Diodes				
E-D172, D173, D174	1N4148	3	3181	
Integrated Circuits				
E-IC124	TL074	1	4696	
E-IC140	MC14016 Quad Switch	3/brd	4834	
E-IC135	MC14051 8 Ch Multiplexer	2/brd	4835	
Transistors				
E-FET124	2N5459 N-Ch FET	1	3053	
Low Filter #9				
Resistors				
E-RN146	Resistor Network	1	4715	
E-RN147	Resistor Network	1	4712	
E-R315	1K ohm Helipot Trim	1	3669	Frequency Adjust Filter Gain Adjust
E-R316	5K ohm Helipot Trim	1	3670	
E-R317, R318	1M ohm ¼W 5% CF	2	3198	
E-R319, R320	1.5M ohm ¼W 5% CF	2	4234	
E-R321	10K ohm ½W 5% CF	1	2631	
E-R322	7.5M ohm ¼W 5% CF	1	4915	
E-R323	1M ohm Horz Trimpot	1	4844	
Capacitors				
E-C270, C271	.117mF 200V	2	4291	
E-C272, C276	4.7mF 35V	2	4019	
E-C273, C274	.01mF	2	1751	
E-C275	33mF 50V Vertical	1	3679	
Diodes				
E-D169, D170, D171	1N4148	3	3181	
Integrated Circuits				
E-IC123	TL074	1	4696	
E-IC140	MC14016 Quad Switch	3/brd	4834	
E-IC134	MC14051 8 Ch Multiplexer	2/brd	4835	
Transistors				
E-FET123	2N5459 N-Ch FET	1	3053	



Schematic Designation	Description	Qty.	Crown Part No.	Other Information
Low Filter #10				
Resistors				
E-RN144	Resistor Network	1	4713	Frequency Adjust Filter Gain Adjust
E-RN145	Resistor Network	1	4712	
E-R305	1K ohm Helipot Trim	1	3669	
E-R306	5K ohm Helipot Trim	1	3670	
E-R307, R308	1M ohm ¼W 5% CF	2	3198	
E-R309, R310	1.5M ohm ¼W 5% CF	2	4234	
E-R311	10K ohm ½W 5% CF	1	2631	
E-R312	7.5M ohm ¼W 5% CF	1	4915	
E-R313	1M ohm Horz Trimpot	1	4844	
E-R314	5.6K ohm ¼W 5% CF	1	3220	
Capacitors				
E-C262	.117mF 200V	2	4291	
E-C264, C268, C269	4.7mF 35V	3	4019	
E-C265, C266	.01mF	2	1751	
E-C267	33mF 50V Vertical	1	3679	
Diodes				
E-D166, D167 D168	1N4148	3	3181	
Integrated Circuits				
E-IC122	TL074	1	4696	
E-IC140	MC14016 Quad Switch	3/brd	4834	
E-IC134	MC14051 8 Ch Multiplexer	2/brd	4835	
Transistors				
E-FET122	2N5459 N-Ch FET	1	3053	
Low Filter #11				
Resistors				
E-RN142	Resistor Network	1	4714	Frequency Adjust Filter Gain Adjust
E-RN143	Resistor Network	1	4712	
E-R296	1K ohm Helipot Trim	1	3669	
E-R297	5K ohm Helipot Trim	1	3670	
E-R298, R299	1M ohm ¼W 5% CF	2	3198	
E-R300, R301	1.5M ohm ¼W 5% CF	2	4234	
E-R302	10K ohm ½W 5% CF	1	2631	
E-R303	7.5M ohm ¼W 5% CF	1	4915	
E-R304	1M ohm Horz Trimpot	1	4844	

Schematic Designation	Description	Qty.	Crown Part No.	Other Information
Capacitors				
E-C255, C256	.117mF 200V	2	4291	
E-C257, C261	4.7mF 35V	2	4019	
E-C258, C259	.01mF	2	1751	
E-C260	33mF 50V Vertical	1	3679	
Diodes				
E-D163, D164, D165	1N4148	3	3181	
Integrated Circuits				
E-IC121	TL074	1	4696	
E-IC140	MC14016 Quad Switch	3/brd	4834	
E-IC134	MC14051 8 Ch Multiplexer	2/brd	4835	
Transistors				
E-FET121	2N5459 N-Ch FET	1	3053	
Low Filter #12				
Resistors				
E-RN140	Resistor Network	1	4715	
E-RN141	Resistor Network	1	4712	
E-R287	1K ohm Helipot Trim	1	3669	Frequency Adjust Filter Gain Adjust
E-R288	5K ohm Helipot Trim	1	3670	
E-R289, R290	1M ohm ¼W 5% CF	2	3198	
E-R291, R292	1.5M ohm ¼W 5% CF	2	4234	
E-R293	10K ohm ½W 5% CF	1	2631	
E-R294	7.5M ohm ¼W 5% CF	1	4915	
E-R295	1M ohm Horz Trimpot	1	4844	
Capacitors				
E-C248, C249	.058mF 100V	2	4292	
E-C250, C254	4.7mF 35V	2	4019	
E-C251, C252	.01mF	2	1751	
E-C253	33mF 50V Vertical	1	3679	
Diodes				
E-D160, D161, D162	1N4148	3	3181	
Integrated Circuits				
E-IC120	TL074	1	4696	
E-IC139	MC14016 Quad Switch	3/brd	4834	
E-IC134	MC14051 8 Ch Multiplexer	2/brd	4835	
Transistors				
E-FET120	2N5459 N-Ch FET	1	3053	



Schematic Designation	Description	Qty.	Crown Part No.	Other Information
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Low Filter #13

Resistors

E-RN138	Resistor Network	1	4713	
E-RN139	Resistor Network	1	4712	
E-R277	1K ohm Helipot Trim	1	3669	Frequency Adjust
E-R278	5K ohm Helipot Trim	1	3670	Filter Gain Adjust
E-R279, R280	1M ohm ¼W 5% CF	2	3198	
E-R281, R282	1.5M ohm ¼W 5% CF	2	4234	
E-R283	10K ohm ½W 5% CF	1	2631	
E-R284	7.5M ohm ¼W 5% CF	1	4915	
E-R285	1M ohm Horz Trimpot	1	4844	
E-R286	5.6K ohm ¼W 5% CF	1	3220	

Capacitors

E-C240, C241	.058mF 100V	2	4292	
E-C242, C246, C247	4.7mF 35V	3	4019	
E-C243, C244	.01mF	2	1751	
E-C245	33mF 50V Vertical	1	3679	

Diodes

E-D157, D158, D159	1N4148	3	3181	
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Integrated Circuits

E-IC119	TL074	1	4696	
E-IC139	MC14016 Quad Switch	3/brd	4834	
E-IC134	MC14051 8 Ch Multiplexer	2/brd	4835	

Transistors

E-FET119	2N5459 N-Ch FET	1	3053	
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Low Filter #14

Resistors

E-RN136	Resistor Network	1	4714	
E-RN137	Resistor Network	1	4712	
E-R268	1K ohm Helipot Trim	1	3669	Frequency Adjust
E-R269	5K ohm Helipot Trim	1	3670	Filter Gain Adjust
E-R270, R271	1M ohm ¼W 5% CF	2	3198	
E-R272, R273	1.5M ohm ¼W 5% CF	2	4234	
E-R274	10K ohm ½W 5% CF	1	2631	
E-R275	7.5M ohm ¼W 5% CF	1	4915	
E-R276	1M ohm Horz Trimpot	1	4844	

Schematic Designation	Description	Qty.	Crown Part No.	Other Information
Capacitors				
E-C233, C234	.058mF 100V	2	4292	
E-C235, C239	4.7mF 35V	2	4019	
E-C236, C237	.01mF	2	1751	
E-C238	33mF 50V Vertical	1	3679	
Diodes				
E-D154, D155, D156	1N4148	3	3181	
Integrated Circuits				
E-IC118	TL074	1	4696	
E-IC139	MC14016 Quad Switch	3/brd	4834	
E-IC134	MC14051 8 Ch Multiplexer	2/brd	4835	
Transistors				
E-FET118	2N5459 N-Ch FET	1	3053	
Low Filter #15				
Resistors				
E-RN134	Resistor Network	1	4715	
E-RN135	Resistor Network	1	4712	
E-R259	1K ohm Helipot Trim	1	3669	Frequency Adjust Filter Gain Adjust
E-R260	5K ohm Helipot Trim	1	3670	
E-R261, R262	1M ohm ¼W 5% CF	2	3198	
E-R263, R264	1.5M ohm ¼W 5% CF	2	4234	
E-R265	10K ohm ½W 5% CF	1	2631	
E-R266	7.5M ohm ¼W 5% CF	1	4915	
E-R267	1M ohm Horz Trimpot	1	4844	
Capacitors				
E-C226, C227	.0293mF 200V	2	4293	
E-C228, C232	4.7mF 35V	2	4019	
E-C229, C230	.01mF	2	1751	
E-C231	33mF 50V Vertical	1	3679	
Diodes				
E-D151, D152, D153	1N4148	3	3181	
Integrated Circuits				
E-IC117	TL074	1	4696	
E-IC139	MC14016 Quad Switch	3/brd	4834	
E-IC134	MC14051 8 Ch Multiplexer	2/brd	4835	
Transistors				
E-FET117	2N5459 N-Ch FET	1	3053	



Schematic Designation	Description	Qty.	Crown Part No.	Other Information
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Low Filter Board #16

Resistors

E-RN132	Resistor Network	1	4713	
E-RN133	Resistor Network	1	4712	
E-R249	1K ohm Helipot Trim	1	3669	Frequency Adjust
E-R250	5K ohm Helipot Trim	1	3670	Filter Gain Adjust
E-R251, R252	1M ohm ¼W 5% CF	2	3198	
E-R253, R254	1.5M ohm ¼W 5% CF	2	4234	
E-R255	10K ohm ½W 5% CF	1	2631	
E-R256	7.5M ohm ¼W 5% CF	1	4915	
E-R257	1M ohm Horz Trimpot	1	4844	
E-R258	5.6K ohm ¼W 5% CF	1	3220	

Capacitors

E-C218, C219	.0293mF 200V	2	4293	
E-C220, C224, C225	4.7mF 35V	3	4019	
E-C221, C222	.01mF	2	1751	
E-C223	33mF 50V Vertical	1	3679	

Diodes

E-D148, D149, D150	1N4148	3	3181	
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Integrated Circuits

E-IC116	TL074	1	4696	
E-IC139	MC14016 Quad Switch	3/brd	4834	
E-IC134	MC14051 8 Ch Multiplexer	2/brd	4835	

Transistors

E-FET116	2N5459 N-Ch FET	1	3053	
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Miscellaneous

	RTA-2 Low Freq Filter Mod	1	42007	
	14 Pin DIL IC Socket	19	3450	
	16 Pin DIL IC Socket	2	4508	
E	Low Filter Board	1	4786	*Not available for purchase

Schematic Designation	Description	Qty.	Crown Part No.	Other Information
High Filter #17				
Resistors				
F-RN130	Resistor Network	1	4714	Frequency Adjust Filter Gain Adjust
F-RN131	Resistor Network	1	4712	
F-R240	1K ohm Helipot Trim	1	3669	
F-R241	5K ohm Helipot Trim	1	3670	
F-R242, R243	1M ohm ¼W 5% CF	2	3198	
F-R244, R245	1.5M ohm ¼W 5% CF	2	4234	
F-R246	10K ohm ½W 5% CF	1	2631	
F-R247	7.5M ohm ¼W 5% CF	1	4915	
F-R248	1M ohm Horz Trimpot	1	4844	
Capacitors				
F-C211, C212	.0293mF 200V	2	4293	
F-C213, C217	4.7mF 35V	2	4019	
F-C214, C215	.01mF	2	1751	
F-C216	33mF 50V Vertical	1	3679	
Diodes				
F-D145, D146, D147	1N4148	3	3181	
Integrated Circuits				
F-IC115	TL074	1	4696	
F-IC139	MC14016 Quad Switch	3/brd	4834	
F-IC133	MC14051 8 Ch Multiplexer	2/brd	4835	
Transistors				
F-FET115	2N5459 N-Ch FET	1	3053	
High Filter #18				
Resistors				
F-RN128	Resistor Network	1	4715	Frequency Adjust Filter Gain Adjust
F-RN129	Resistor Network	1	4712	
F-R231	1K ohm Helipot Trim	1	3669	
F-R232	5K ohm Helipot Trim	1	3670	
F-R233, R234	1M ohm ¼W 5% CF	2	3198	
F-R235, R236	1.5M ohm ¼W 5% CF	2	4234	
F-R237	10K ohm ½W 5% CF	1	2631	
F-R238	7.5M ohm ¼W 5% CF	1	4915	
F-R239	1M ohm Horz Trimpot	1	4844	
Capacitors				
F-C204, C205	14700pF 63V	2	4283	
F-C206, C210	4.7mF 35V	2	4019	
F-C207, C208	.01mF	2	1751	
F-C209	33mF 50V Vertical	1	3679	



Schematic Designation	Description	Qty.	Crown Part No.	Other Information
Diodes				
F-D142, D143 D144	1N4148	3	3181	
Integrated Circuits				
F-IC114	TL074	1	4696	
F-IC138	MC14016 Quad Switch	3/brd	4834	
F-IC133	MC14051 8 Ch Multiplexer	2/brd	4835	
Transistors				
F-FET114	2N5459 N-Ch FET	1	3053	
High Filter #19				
Resistors				
F-RN126	Resistor Network	1	4713	
F-RN127	Resistor Network	1	4712	
F-R221	1K ohm Helipot Trim	1	3669	Frequency Adjust Filter Gain Adjust
F-R222	5K ohm Helipot Trim	1	3670	
F-R223, R224	1M ohm ¼W 5% CF	2	3198	
F-R225, R226	1.5M ohm ¼W 5% CF	2	4234	
F-R227	10K ohm ½W 5% CF	1	2631	
F-R228	7.5M ohm ¼W 5% CF	1	4915	
F-R229	1M ohm Horz Trimpot	1	4844	
F-R230	5.6K ohm ¼W 5% CF	1	3220	
Capacitors				
F-C196, C197	14700pF 63V	2	4283	
F-C198, C202, C203	4.7mF 35V	3	4019	
F-C199, C200	.01mF	2	1751	
F-C201	33mF 50V Vertical	1	3679	
Diodes				
F-D139, D140, D141	1N4148	3	3181	
Integrated Circuits				
F-IC113	TL074	1	4696	
F-IC138	MC14016 Quad Switch	3/brd	4834	
F-IC133	MC14051 8 Ch Multiplexer	2/brd	4835	
Transistors				
F-FET113	2N5459 N-Ch FET	1	3053	

Schematic Designation	Description	Qty.	Crown Part No.	Other Information
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High Filter #20

Resistors

F-RN124	Resistor Network	1	4714	Frequency Adjust Filter Gain Adjust
F-RN125	Resistor Network	1	4712	
F-R212	1K ohm Helipot Trim	1	3669	
F-R213	5K ohm Helipot Trim	1	3670	
F-R214, R215	1M ohm ¼W 5% CF	2	3198	
F-R216, R217	1.5M ohm ¼W 5% CF	2	4234	
F-R218	10K ohm ½W 5% CF	1	2631	
F-R219	7.5M ohm ¼W 5% CF	1	4915	
F-R220	1M ohm Horz Trimpot	1	4844	

Capacitors

F-C189, C190	14700pF 63V	2	4283	
F-C191, C195	4.7mF 35V	2	4019	
F-C192, C193	.01mF	2	1751	
F-C194	33mF 50V Vertical	1	3679	

Diodes

F-D136, D137, D138	1N4148	3	3181	
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Integrated Circuits

F-IC112	TL074	1	4696	
F-IC138	MC14016 Quad Switch	3/brd	4834	
F-IC133	MC14051 8 Ch Multiplexer	2/brd	4835	

Transistors

F-FET112	2N5459 N-Ch FET	1	3053	
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High Filter #21

Resistors

F-RN122	Resistor Network	1	4715	Frequency Adjust Filter Gain Adjust
F-RN123	Resistor Network	1	4712	
F-R203	1K ohm Helipot Trim	1	3669	
F-R204	5K ohm Helipot Trim	1	3670	
F-R205, R206	1M ohm ¼W 5% CF	2	3198	
F-R207, R208	1.5M ohm ¼W 5% CF	2	4234	
F-R209	10K ohm ½W 5% CF	1	2631	
F-R210	7.5M ohm ¼W 5% CF	1	4915	
F-R211	1M ohm Horz Trimpot	1	4844	

Capacitors

F-C182, C183	7330pF 63V	2	4284	
F-C184, C188	4.7mF 35V	2	4019	
F-C185, C186	.01mF	2	1751	
F-C187	33mF 50V Vertical	1	3679	



Schematic Designation	Description	Qty.	Crown Part No.	Other Information
Diodes				
F-D133, D134, D135	1N4148	3	3181	
Integrated Circuits				
F-IC111	TL074	1	4696	
F-IC137	MC14016 Quad Switch	3/brd	4834	
F-IC133	MC14051 8 Ch Multiplexer	2/brd	4835	
Transistors				
F-FET111	2N5459 N-Ch FET	1	3053	
High Filter #22				
Resistors				
F-RN120	Resistor Network	1	4713	
F-RN121	Resistor Network	1	4712	
F-R193	1K ohm Helipot Trim	1	3669	Frequency Adjust
F-R194	5K ohm Helipot Trim	1	3670	Filter Gain Adjust
F-R195, R196	1M ohm ¼W 5% CF	2	3198	
F-R197, R198	1.5M ohm ¼W 5% CF	2	4234	
F-R199	10K ohm ½W 5% CF	1	2631	
F-R200	7.5M ohm ¼W 5% CF	1	4915	
F-R201	1M ohm Horz Trimpot	1	4844	
F-R202	5.6K ohm ¼W 5% CF	1	3220	
Capacitors				
F-C174, C175	7330pF 63V	2	4284	
F-C176, C180, C181	4.7mF 35V	3	4019	
F-C177, C178	.01mF	2	1751	
F-C179	33mF 50V Vertical	1	3679	
Diodes				
F-D130, D131, D132	1N4148	3	3181	
Integrated Circuits				
F-IC110	TL074	1	4696	
F-IC137	MC14016 Quad Switch	3/brd	4834	
F-IC133	MC14051 8 Ch Multiplexer	2/brd	4835	
Transistors				
F-FET110	2N5459 N-Ch FET	1	3053	

Schematic Designation	Description	Qty.	Crown Part No.	Other Information
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High Filter #23

Resistors

F-RN118	Resistor Network	1	4714	
F-RN119	Resistor Network	1	4712	
F-R184	1K ohm Helipot Trim	1	3669	Frequency Adjust
F-R185	5K ohm Helipot Trim	1	3670	Filter Gain Adjust
F-R186, R187	1M ohm ¼W 5% CF	2	3198	
F-R188, R189	1.5M ohm ¼W 5% CF	2	4234	
F-R190	10K ohm ½W 5% CF	1	2631	
F-R191	7.5M ohm ¼W 5% CF	1	4915	
F-R192	1M ohm Horz Trimpot	1	4844	

Capacitors

F-C167, C168	7330pF 63V	2	4284	
F-C169, C173	4.7mF 35V	2	4019	
F-C170, C171	.01mF	2	1751	
F-C172	33mF 50V Vertical	1	3679	

Diodes

F-D127, D128, D129	1N4148	3	3181	
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Integrated Circuits

F-IC109	TL074	1	4696	
F-IC137	MC14016 Quad Switch	3/brd	4834	
F-IC133	MC14051 8 Ch Multiplexer	2/brd	4835	

Transistors

F-FET109	2N5459 N-Ch FET	1	3053	
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High Filter Board #24

Resistors

F-RN116	Resistor Network	1	4715	
F-RN117	Resistor Network	1	4712	
F-R175	1K ohm Helipot Trim	1	3669	Frequency Adjust
F-R176	5K ohm Helipot Trim	1	3670	Filter Gain Adjust
F-R177, R178	1M ohm ¼W 5% CF	2	3198	
F-R179, R180	1.5M ohm ¼W 5% CF	2	4234	
F-R181	10K ohm ½W 5% CF	1	2631	
F-R182	7.5M ohm ¼W 5% CF	1	4915	
F-R183	1M ohm Horz Trimpot	1	4844	

Capacitors

F-C160, C161	3660pF 63V	2	4285	
F-C162, C166	4.7mF 35V	2	4019	
F-C163, C164	.01mF	2	1751	
F-C165	33mF 50V Vertical	1	3679	



Schematic Designation	Description	Qty.	Crown Part No.	Other Information
Diodes				
F-D124, D125, D126	1N4148	3	3181	
Integrated Circuits				
F-IC108	TL074	1	4696	
F-IC137	MC14016 Quad Switch	3/brd	4834	
F-IC133	MC14051 8 Ch Multiplexer	2/brd	4835	
Transistors				
F-FET108	2N5459 N-Ch FET 1	3053		
High Filter #25				
Resistors				
F-RN114	Resistor Network	1	4713	
F-RN115	Resistor Network	1	4712	
F-R165	1K ohm Helipot Trim	1	3669	Frequency Adjust Filter Gain Adjust
F-R166	5K ohm Helipot Trim	1	3670	
F-R167, R168	1M ohm ¼W 5% CF	2	3198	
F-R169, R170	1.5M ohm ¼W 5% CF	2	4234	
F-R171	10K ohm ½W 5% CF	1	2631	
F-R172	7.5M ohm ¼W 5% CF	1	4915	
F-R173	1M ohm Horz Trimpot	1	4844	
F-R174	5.6K ohm ¼W 5% CF	1	3220	
Capacitors				
F-C152, C153	3660pF 63V	2	4285	
F-C154, C158, C159	4.7mF 35V	3	4019	
F-C155, C156	.01mF	2	1751	
F-C157	33mF 50V Vertical	1	3679	
Diodes				
F-D121, D122, D123	1N4148	3	3181	
Integrated Circuits				
F-IC107	TL074	1	4696	
F-IC137	MC14016 Quad Switch	3/brd	4834	
F-IC132	MC14051 8 Ch Multiplexer	2/brd	4835	
Transistors				
F-FET107	2N5459 N-Ch FET	1	3053	

Schematic Designation	Description	Qty.	Crown Part No.	Other Information
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High Filter #26

Resistors

F-RN112	Resistor Network	1	4714	Frequency Adjust Filter Gain Adjust
F-RN113	Resistor Network	1	4712	
F-R156	1K ohm Helipot Trim	1	3669	
F-R157	5K ohm Helipot Trim	1	3670	
F-R158, R159	1M ohm ¼W 5% CF	2	3198	
F-R160, R161	1.5M ohm ¼W 5% CF	2	4234	
F-R162	10K ohm ½W 5% CF	1	2631	
F-R163	7.5M ohm ¼W 5% CF	1	4915	
F-R164	1M ohm Horz Trimpot	1	4844	

Capacitors

F-C145, C146	3660pF 63V	2	4285	
F-C147, C151	4.7mF 35V	3	4019	
F-C148, C149	.01mF	2	1751	
F-C150	33mF 50V Vertical	1	3679	

Diodes

F-D118, D119 D120	1N4148	3	3181	
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Integrated Circuits

F-IC106	TL074	1	4696	
F-IC137	MC14016 Quad Switch	3/brd	4834	
F-IC132	MC14051 8 Ch Multiplexer	2/brd	4835	

Transistors

F-FET106	2N5459 N-Ch FET	1	3053	
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High Filter #27

Resistors

F-RN110	Resistor Network	1	4715	Frequency Adjust Filter Gain Adjust
F-RN111	Resistor Network	1	4712	
F-R147	1K ohm Helipot Trim	1	3669	
F-R148	5K ohm Helipot Trim	1	3670	
F-R149, R150	1M ohm ¼W 5% CF	2	3198	
F-R151, R152	1.5M ohm ¼W 5% CF	2	4234	
F-R153	10K ohm ½W 5% CF	1	2631	
F-R154	7.5M ohm ¼W 5% CF	1	4915	
F-R155	1M ohm Horz Trimpot	1	4844	

Capacitors

F-C137, C138	1830pF 63V	2	4286	
F-C139, C143	4.7mF 35V	2	4019	
F-C140, C141	.01mF	2	1751	
F-C142	33mF 50V Vertical	1	3679	



Schematic Designation	Description	Qty.	Crown Part No.	Other Information
Diodes				
F-D115, D116, D117	1N4148	3	3181	
Integrated Circuits				
F-IC105	TL074	1	4696	
F-IC136	MC14016 Quad Switch	3/brd	4834	
F-IC132	MC14051 8 Ch Multiplexer	2/brd	4835	
Transistors				
F-FET105	2N5459 N-Ch FET	1	3053	
High Filter #28				
Resistors				
F-RN108	Resistor Network	1	4713	
F-RN109	Resistor Network	1	4712	
F-R137	1K ohm Helipot Trim	1	3669	Frequency Adjust Filter Gain Adjust
F-R138	5K ohm Helipot Trim	1	3670	
F-R139, R140	1M ohm ¼W 5% CF	2	3198	
F-R141, R142	1.5M ohm ¼W 5% CF	2	4234	
F-R143	10K ohm ½W 5% CF	1	2631	
F-R144	7.5M ohm ¼W 5% CF	1	4915	
F-R145	1M ohm Horz Trimpot	1	4844	
F-R146	5.6K ohm ¼W 5% CF	1	3220	
Capacitors				
F-C129, C130	1830pF 63V	2	4286	
F-C131, C135, C136	4.7mF 35V	3	4019	
F-C132	.01mF	2	1751	
F-C133	33mF 50V Vertical	1	3679	
Diodes				
F-D112, D113, D114	1N4148	3	3181	
Integrated Circuits				
F-IC104	TL074	1	4696	
F-IC136	MC14016 Quad Switch	3/brd	4834	
F-IC132	MC14051 8 Ch Multiplexer	2/brd	4835	
Transistors				
F-FET104	2N5459 N-Ch FET	1	3053	

Schematic Designation	Description	Qty.	Crown Part No.	Other Information
High Filter #29				
Resistors				
F-RN106	Resistor Network	1	4714	Frequency Adjust Filter Gain Adjust
F-RN107	Resistor Network	1	4712	
F-R128	1K ohm Helipot Trim	1	3669	
F-R129	5K ohm Helipot Trim	1	3670	
F-R130, R131	1M ohm ¼W 5% CF	2	3198	
F-R132, R133	1.5M ohm ¼W 5% CF	2	4234	
F-R134	10K ohm ½W 5% CF	1	2631	
F-R135	7.5M ohm ¼W 5% CF	1	4915	
F-R136	1M ohm Horz Trimpot	1	4844	
Capacitors				
F-C122, C123	1830pF 63V	2	4286	
F-C124, C128	4.7mF 35V	2	4019	
F-C125, C126	.01mF	2	1751	
F-C127	33mF 50V Vertical	1	3679	
Diodes				
F-C109, D110, D111	1N4148	3	3181	
Integrated Circuits				
F-IC103	TL074	1	4696	
F-IC136	MC14016 Quad Switch	3/brd	4834	
F-IC132	MC14051 8 Ch Multiplexer	2/brd	4835	
Transistors				
F-FET103	2N5459 N-Ch FET	1	3053	
High Filter #30				
Resistors				
F-RN104	Resistor Network	1	4715	Frequency Adjust Filter Gain Adjust
F-RN105	Resistor Network	1	4712	
F-R119	1K ohm Helipot Trim	1	3669	
F-R120	5K ohm Helipot Trim	1	3670	
F-R121, R122	1M ohm ¼W 5% CF	2	3198	
F-R123, R124	1.5M ohm ¼W 5% CF	2	4234	
F-R125	10K ohm ½W 5% CF	1	2631	
F-R126	7.5M ohm ¼W 5% CF	1	4915	
F-R127	1M ohm Horz Trimpot	1	4844	
Capacitors				
F-C115, C116	917pF 63V	2	4287	
F-C117, C121	4.7mF 35V	2	4019	
F-C118, C119	.01mF	2	1751	
F-C120	33mF 50V Vertical	1	3679	



Schematic Designation	Description	Qty.	Crown Part No.	Other Information
Diodes				
F-D106, D107, D108	1N4148	3	3181	
Integrated Circuits				
F-IC102	TL074	1	4696	
F-IC136	MC14016 Quad Switch	3/brd	4834	
F-IC132	MC14051 8 Ch Multiplexer	2/brd	4835	
Transistors				
F-FET102	2N5459 N-Ch FET	1	3053	
High Filter #31				
Resistors				
F-RN102	Resistor Network	1	4713	
F-RN103	Resistor Network	1	4712	
F-R109	1K ohm Helipot Trim	1	3669	Frequency Adjust Filter Gain Adjust
F-R110	5K ohm Helipot Trim	1	3670	
F-R111, R112	1M ohm ¼W 5% CF	2	3198	
F-R113, R114	1.5M ohm ¼W 5% CF	2	4234	
F-R115	10K ohm ½W 5% CF	1	2631	
F-R116	7.5M ohm ¼W 5% CF	1	4915	
F-R117	1M ohm Horz Trimpot	1	4844	
F-R118	5.6K ohm ¼W 5% CF	1	3220	
Capacitors				
F-C107, C108	917pF 63V	2	4287	
F-C109, C113, C114	4.7mF 35V	3	4019	
F-C110, C111	.01mF	2	1751	
F-C112	33mF 50V Vertical	1	3679	
Diodes				
F-D103, D104, D105	1N4148	3	3181	
Integrated Circuits				
F-IC101	TL074	1	4696	
F-IC136	MC14016 Quad Switch	3/brd	4834	
F-IC132	MC14051 8 Ch Multiplexer	2/brd	4835	
Transistors				
F-FET101	2N5459 N-Ch FET	1	3053	

Schematic Designation	Description	Qty.	Crown Part No.	Other Information
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High Filter Board #32

Resistors

F-RN100	Resistor Network	1	4714	Frequency Adjust Filter Gain Adjust
F-RN101	Resistor Network	1	4712	
F-R100	1K ohm Helipot Trim	1	3669	
F-R101	5K ohm Helipot Trim	1	3670	
F-R102, R103	1M ohm ¼W 5% CF	2	3198	
F-R104, R105	1.5M ohm ¼W 5% CF	2	4234	
F-R106	10K ohm ½W 5% CF	1	2631	
F-R107	7.5M ohm ¼W 5% CF	1	4915	
F-R108	1M ohm Horz Trimpot	1	4844	

Capacitors

F-C100, C101	917pF 63V	2	4287	
F-C102, C106	4.7mF 35V	2	4019	
F-C103, C104	.01mF	2	1751	
F-C105	33mF 50V Vertical	1	3679	

Diodes

F-D100, D101, D102	1N4148	3	3181	
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Integrated Circuits

F-IC100	TL074	1	4696	
F-IC136	MC14016 Quad Switch	3/brd	4834	
F-IC132	MC14051 8 Ch Multiplexer	2/brd	4835	

Transistors

F-FET100	2N5459 N-Ch FET	1	3053	
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Miscellaneous

	RTA-2 High Freq Filter Mod	1	42006	
	14 Pin DIL IC Socket	19	3450	
	16 Pin DIL IC Socket	2	4508	
F	High Filter Board	1	4787	*Not available for purchase