

Cable Operator's Manual

**SERIES 8500
SET-TOP TERMINAL**

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33T056C

First Edition, August 1983, Revised March 1984

Additional copies available at \$25.00

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NOTE

See exceptions on page iii.

EXCEPTIONS TO SERIES 8500 SET-TOP TERMINAL WARRANTY

The following is a list of defects not covered by warranty, even if the units in question are still within the published warranty period.

1. Tampering or Misuse - Any units received in misused or tampered condition will void all warranty until such chargeable repairs can be made to bring it back to Scientific-Atlanta acceptable standards.
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7. Customer Attempted Repair, Not Adequately Completed - Scientific-Atlanta is responsible for its own material and workmanship only.

IMPORTANT SAFEGUARDS

1. All the safety and operating instructions should be read carefully before the set-top terminal is operated. These safety instructions and the operating instructions should be retained for future reference.
2. All operating and use instructions should be followed. Heed all warnings and cautions in the instructions and on the terminal.
3. Before cleaning, unplug the terminal from the wall outlet. Do not use liquid cleansers or aerosol cleaners. Use a damp cloth for cleaning.
4. Do not use the terminal near water or expose the terminal to rain.
5. Slots and openings on the terminal are provided for ventilation and to ensure reliable operation of the terminal. To prevent over heating these openings must not be blocked or covered. The openings should never be blocked by placing the terminal on a bed, sofa, rug, or other similar surface. The terminal should never be placed near or over a radiator or heat register. The terminal should not be placed in a built-in installation such as a bookcase or rack unless proper ventilation is provided.
6. This terminal should be operated only from a 120V, 60 Hz outlet. Do not overload wall outlets and extension cords as this can result in a risk of fire or electric shock.
7. This terminal is equipped with a polarized plug (a plug having one blade wider than the other). This plug will fit into the power outlet only one way. This is a safety feature. If you are unable to insert the plug fully into the outlet, try reversing the plug. If the plug should still fail to fit, contact your electrician to replace your obsolete outlet. Do not defeat the safety purpose of the polarized plug.
8. The power supply cords should be routed so that they are not likely to be walked on or pinched by items placed upon or against them, paying particular attention to cords at plugs, convenience receptacles, and the point where they exit from the terminal.

9. For added protection of the terminal against lightning during a storm, unplug it from the wall outlet and disconnect the cable system input wire. Also do this if the terminal will be left unattended or unused for a long period of time. This will prevent possible damage to the terminal from lightning and power-line surges. Your cable system should be grounded to provide some protection against voltage surges and built-up static charges. If you have questions about this, ask your cable operator.
10. Never push objects of any kind into the terminal through openings as they may touch dangerous voltage points or shortout parts that could result in a fire or electric shock. Never spill liquid of any kind on the terminal.
11. Do not attempt to service this terminal yourself as opening or removing covers may expose you to dangerous voltage or other hazards. Refer all servicing to qualified service personnel.
12. Damage requiring service- Unplug the terminal from the wall outlet and refer servicing to your cable operator under the following conditions:
 - a. When the power-supply cord or plug is damaged.
 - b. If liquid has been spilled, or objects have fallen into the terminal.
 - c. If the terminal has been exposed to rain or water.
 - d. If the terminal does not operate normally or exhibits a distinct change in performance, this may indicate a need for service. First however, unplug the unit from the wall outlet. Wait 30 seconds and plug the terminal back into the outlet. Check the unit's performance. If the unit still exhibits poor performance, call your cable operator.
 - e. If the terminal has been dropped or the enclosure has been damaged.
13. Upon completion of any service or repairs to the terminal, ask the service technician to perform safety checks to determine that the terminal is in proper operating conditions.

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SECTION 1 GENERAL DESCRIPTION

1.1 SCOPE AND PURPOSE OF MANUAL

This manual describes Scientific-Atlanta's Series 8500 Set-Top Terminal and Remote Control Transmitter shown in figure 1-1. This manual is intended for use by a cable company's installation and repair technician. The contents of this manual are divided into six sections. This section gives you an overview of the 8500, its purpose, features, specifications, and physical and functional description. Section 2 describes unpacking and installation procedures. Section 3 covers operation of the 8500, which is a duplication of the instructions given in the Subscriber's Guide. Section 4 gives the theory of operation. Section 5 covers troubleshooting and repair, and section 6 contains parts lists and drawings.



P14565

Figure 1-1. Series 8500 Set-Top Terminal
with Remote Control Transmitter

1.2 ASSOCIATED DOCUMENTATION

Because the addressable 8500 is driven by signals from your headend addressable transmitter (ATX), you may need to occasionally refer to its user's manual.

1.3 PURPOSE OF EQUIPMENT

The 8500 series is an interface between the cable television system's transmission line and the user's (subscriber) television receiver. It allows the subscriber to tune to any one of the cable television system's channels, which it then converts to a channel that can be received by a conventional television receiver. Its purpose is twofold: for the cable operator, the 8500 provides security by allowing only the tuning of service for which the user pays. For the user, the 8500 provides interference-free television reception, a wide choice of programming, and the provision of user security for channels where parental control is desired.

1.4 FEATURES AND SPECIFICATIONS

There are three unique set-top terminal models within the 8500 series. All offer full electronic, microprocessor-based control, and operate at frequencies up to 440 MHz and can deliver 128 channels in a dual cable system. The three models are as follows:

- The Series 8500 Programmable. This model includes a long list of standard product line features, including programmable frequency allocation and a built-in remote control receiver.
- The Series 8500 Programmable with Descrambling. This model uses dynamic switched sync suppression for signal security.
- The Series 8500 Addressable. This model is an advanced electronic set-top terminal providing headend control for service level authorizations and pay-per-view events. Table 1-1 summarizes the features offered for each model, and table 1-2 lists the overall 8500 specifications.

Table 1-1. Series 8500 Feature Summary

| Feature | Programmable | Programmable with Descrambling | Addressable |
|--|--------------|--------------------------------|-------------|
| Programmable Frequency Allocation | X | X | X |
| Unauthorized Channel Default to Barker | X | X | X |
| Parental Control Function | X | X | X |
| Automatic Dual Cable Switching | X | X | X |
| Increment/Decrement | X | X | X |
| Favorite Channel Memory | X | X | X |
| Remote Control Receiver | X | X | X |
| Switched AC to TV | X | X | X |
| Dynamic Switched Sync Suppression Scrambling | | X | X |
| Central Control of Authorizations | | | X |
| Central Execution of Pay-Per-View Functions | | | X |
| Global Authorization and Deauthorization | | | X |
| Pay-Per-View Preview | | | X |
| Advance Pay-Per-View Program Load | | | X |
| Nonvolatile Memory | | | X |
| System Security/Legal Terminal Test | | | X |
| System Security/Refresh Timer Signal | | | X |

Table 1-2. Series 8500 Specifications

| Parameter | Specification |
|--------------------|---------------------------------------|
| Environmental | |
| Temperature | 0 - 45° C |
| Relative Humidity | 5 - 95% |
| Electrical | |
| Bandwidth | 54 to 440 MHz |
| Number of Channels | 64 (single cable) 128 (dual cable) |

continued on next page

Table 1-2. Series 8500 Specifications

| Parameter | Specification |
|---|-------------------------------|
| Output Channels | 3 or 4 |
| Flatness (over channel bandwidth) | ±2 dB |
| Gain | 0 to 9 dB |
| Noise Figure | 13 dB, typical |
| Return Loss | 8 dB minimum on tuned channel |
| Output | 12 dB minimum |
| Isolation Input/Output | 60 dB |
| Spurious | |
| Input | -37 dBmV (up to 470 MHz) |
| Output | -57 dBmV |
| Frequency Accuracy | ±100 kHz |
| Frequency Stability | (0° - 50°) ±100 kHz |
| Input Voltage Range | 115 V ac ±10% |
| Power Consumption | 20 watts maximum |
| Power Supply Surge Protection | Yes |
| Distortion at +15 dBmV: 60 Channel Load Flat Input | |
| Second Order | -57 dB |
| Cross Modulation | -57 dB |
| Composite Triple Beat | -57 dB |
| Input Level | -7 to +20 dBmV |
| Mechanical | |
| Dimensions | 10.4" x 8" x 2.1" |
| Weight | 5.5 pounds |
| Keyboard Type | 16 position, X-Y matrix |
| Display Type | LED, 0.5" x 0.26" |

1.5 PHYSICAL DESCRIPTION

The small size of the 8500 makes it suitable for placement on top of most subscribers television receiver, or for small portable receivers, the 8500 can be placed alongside the television. Figure 1-2 is an outline drawing of the 8500 showing overall dimensions. Dimensions of the remote control transmitter are also given.

The 8500 is completely modular as shown by figure 1-3. This figure shows the addressable model, which contains a full complement of seven modules. Replacement procedure is given in section 5.

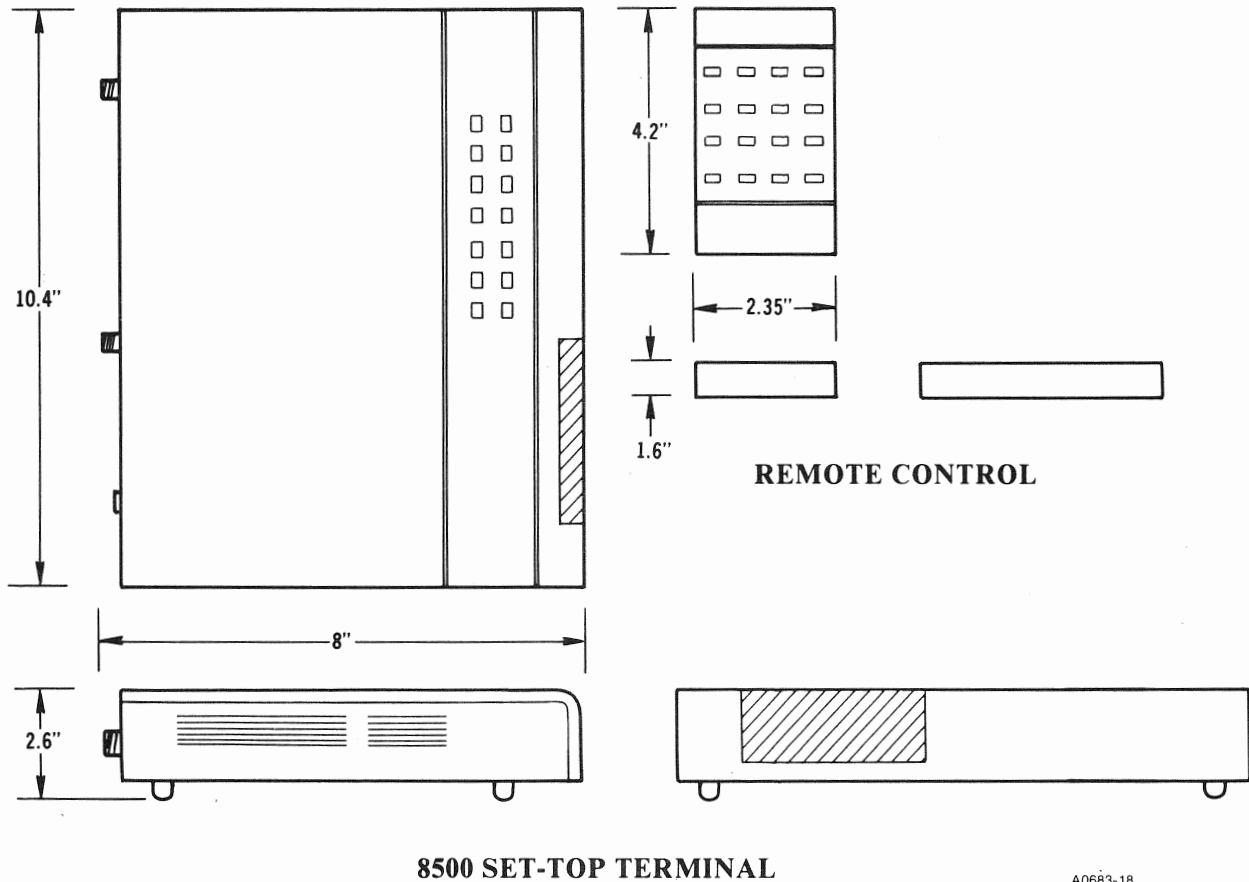


Figure 1-2. 8500 Outline Drawing

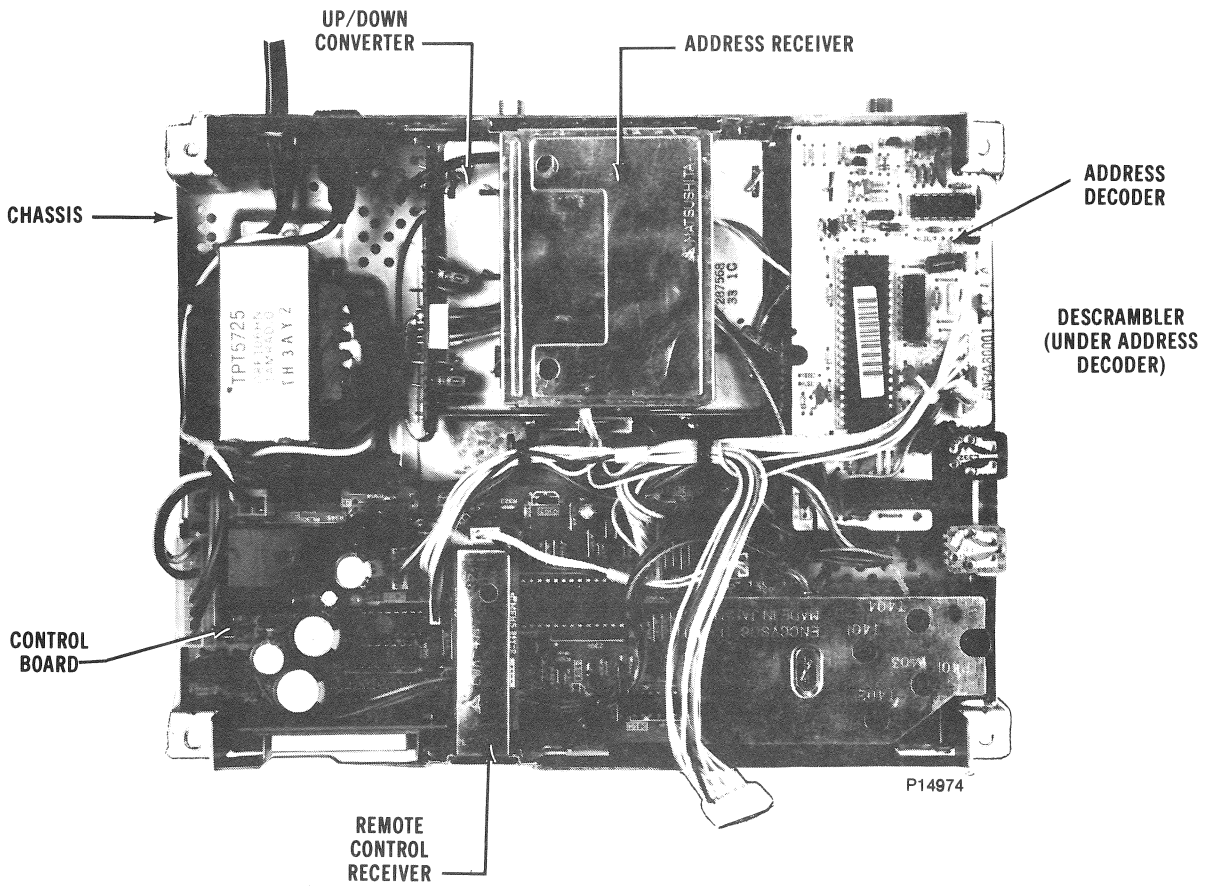
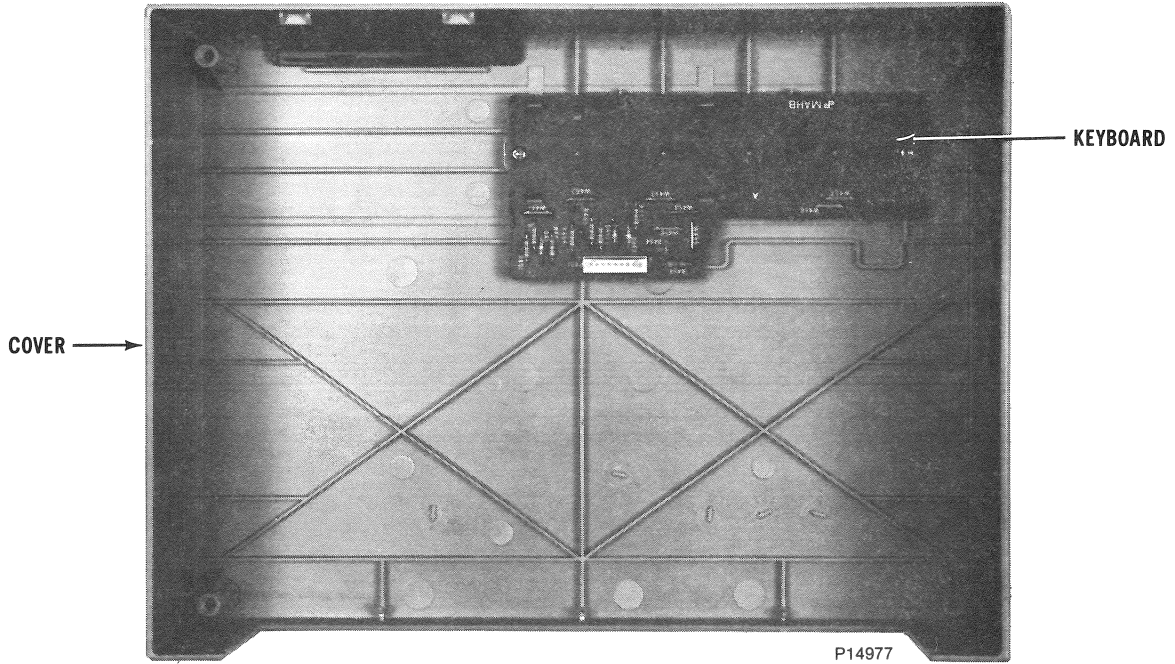
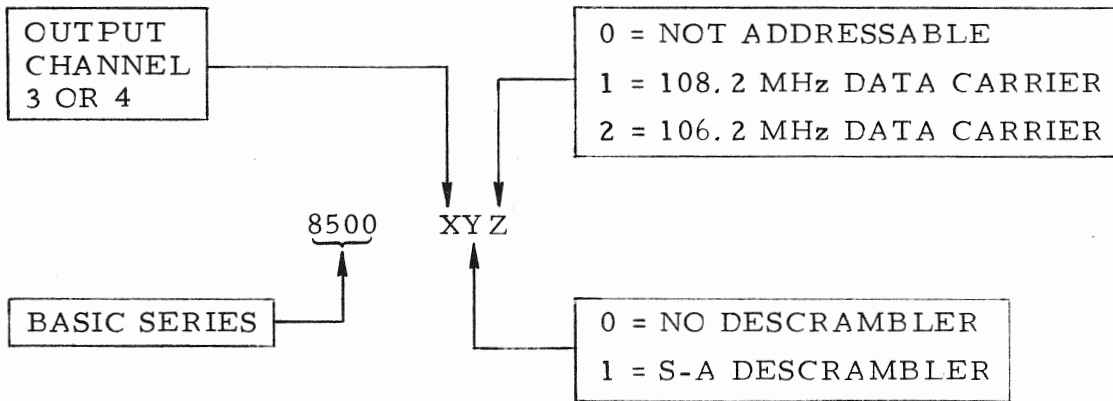


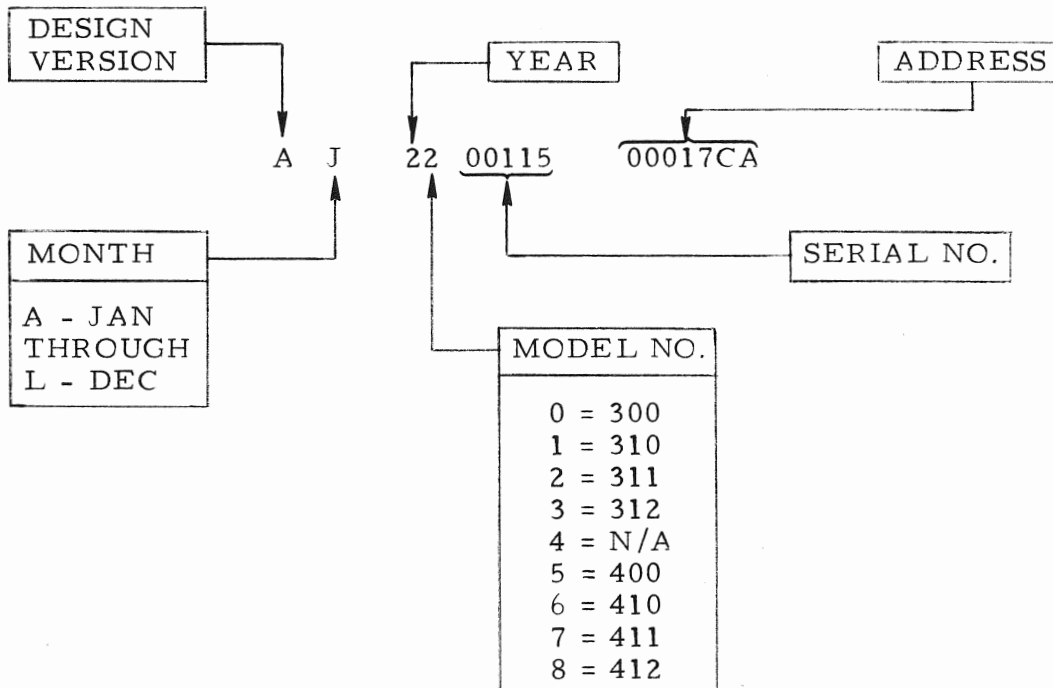
Figure 1-3. Series 8500 Internal View Showing Modules (Addressable Model)

1.6 MODEL NUMBER DIFFERENCES AND SERIAL NUMBER TRACKING

The model number and serial number is printed on a label affixed to the underside of the 8500's chassis. The model number is seven digits, the last three of which indicate specific model differences; the breakdown is as follows:



The complete serial number is 16-digits which are divided into six categories as shown below:



Printed on the label just below the 16-digit serial number is a bar-code representation of the serial number. This bar-code facilitates use of automatic scanners. The last 12-digits of the serial number are also printed in bar-code on a label affixed to the microprocessor chip on the address decoder module on addressable terminals; this is to assure a correct match.

CAUTION

If the address decoder module is ever replaced, the new module is supplied with a new chassis label that indicates the serial number and address of the replacement module. Be sure to affix the new label over the old chassis label so that the new, correct address is indicated.

With this unique serial number you will be able to keep track of each terminal. Furthermore, Scientific-Atlanta maintains its warranty and repair records with the same information. In this way we will accumulate a complete history file of repair work and problems encountered on each terminal.

1.7 FUNCTIONAL DESCRIPTION

1.7.1 General

The 8500 is available in what we refer to as three basic configurations.

- Basic A, Programmable
- Basic B, Programmable with Descrambling
- Basic C, Addressable.

Figure 1-4 is a simplified block diagram showing the configurations mentioned above. The solid lines on the diagram indicate modules and signal paths used by all three configurations. And the dashed lines indicate the additional modules and signal paths used by basic B and basic C configurations.

The basic A configuration is described first because its functions are identical to and used in the remaining two configurations as well.

1.7.2 Basic A Configuration

The rf signal supplied to the 8500 is applied to the INPUT of the up/down converter. The up/down converter contains the oscillator and mixers that produce the selected channel frequency at the rf OUTPUT connector. The oscillator is controlled from the control board, which contains a microprocessor and channel allocations PROM (programmable read-only memory). The PROM is programmed with the information that will allow the subscriber to select only the cable services which are paid for.

When a channel is selected via either the keyboard or the remote control transmitter (through the remote control receiver) the microprocessor within the control board analyzes the request to determine if the channel requested is one of those authorized for that subscriber. If everything matches, The control board tunes the oscillator, within the up/down converter, to the proper frequency to produce the channel requested at the rf OUTPUT connector.

If an unauthorized channel is requested, the control board senses this and causes the barker channel to be supplied to the rf OUTPUT connector.

1.7.3 Basic B configuration

In the basic B configuration a descrambler is added. In this case the output signal is sent through the descrambler before it reaches the rf OUTPUT connector. The descrambler has no affect on nonscrambled channel signals and passes them straight through. However, when a scrambled channel is selected, the control board determines if that channel is authorized, and, if so, it causes the descrambler to unscramble the signal and allow the signal to pass.

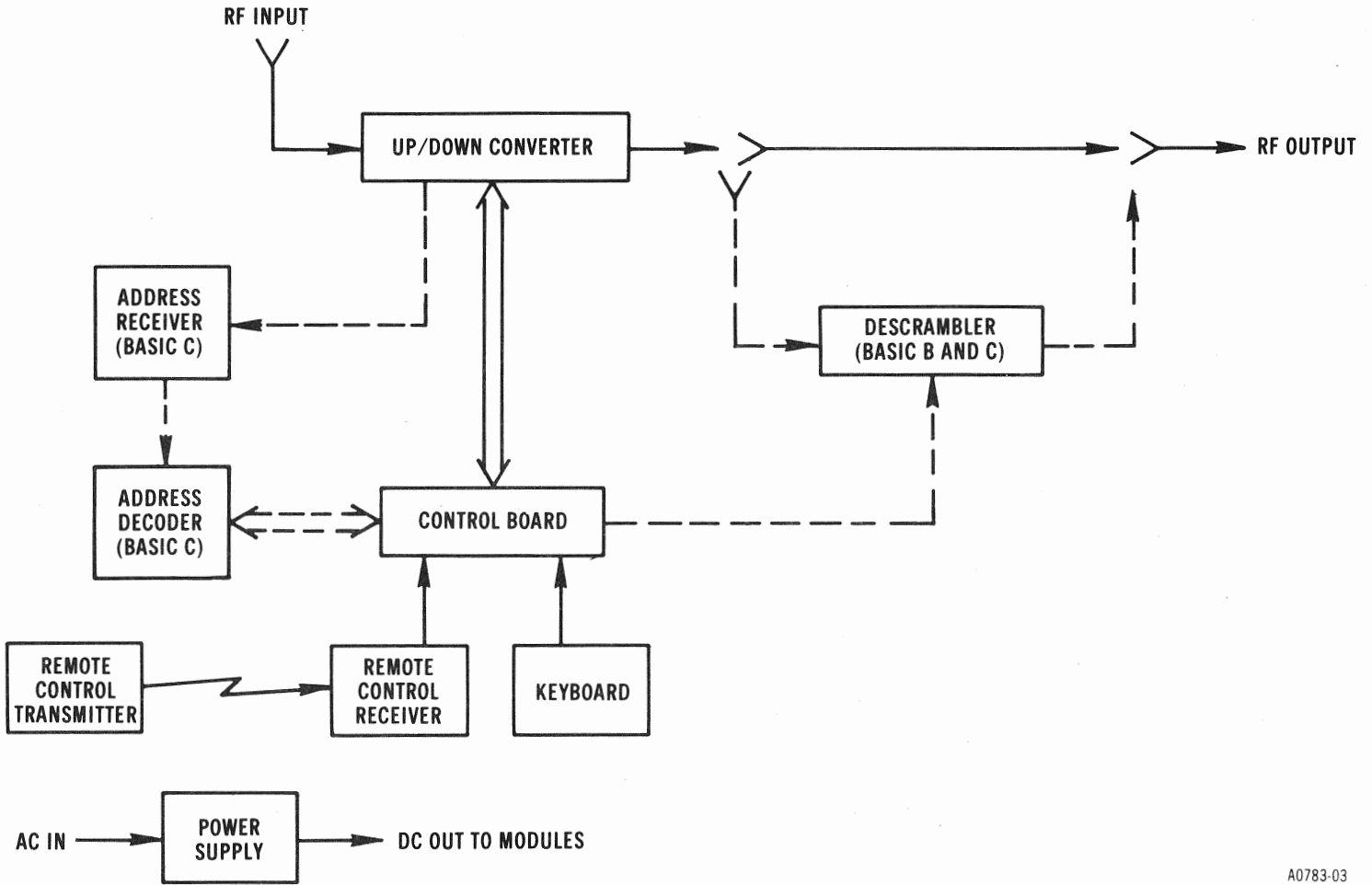
1.7.4 Basic C Configuration

In the basic C configuration the address receiver and address decoder are added to the basic A configuration, in addition to the descrambler. In this configuration the subscriber's service as well as the catv business management are automated. Each 8500 has a unique address code to which it responds. This address code is sent out over the cable network from the headend along with regular programming. Thus, all additions and deletions of program tiers, single channels, pay-per-view events and program promotions are accomplished from the headend through signal processing. This addressability also adds two important security features; a legal terminal test discourages theft of 8500 units. migration of 8500 units from one cable system to another, and helps control delinquent accounts. The headend stores the digital address of all 8500's authorized in a particular system and instructs all unauthorized 8500's to shut down.

The refresh timer signal prevents program theft by thwarting attempts to trap out deauthorization instructions from the headend, or attempts to cut off instructions from the headend by unplugging the 8500 in the home. A software-based timer in each addressable 8500 unit will expire and disable the unit unless it is periodically refreshed from the headend. The refresh counter period can be set at the headend for various time intervals. This ensures that each 8500 is operating at the service level for which it is billed. The actual refresh signal is sent every few minutes.

The address receiver and decoder modules sample the incoming rf signal through the up/down converter to detect presence of its address code. When its address code is sensed, the address decoder informs the control board that it has been polled. When the 8500 sees its address it resets power fail and refresh counters. The address decoder deciphers the information contained in the signal stream and informs the control board to perform the actions commanded by the headend. The remaining functions are as described for the basic A and basic B configurations.

Figure 1-4. Simplified Block Diagram
Showing the Three Configurations
of the 8500





SECTION 2 INSTALLATION

2.1 INTRODUCTION

This section includes unpacking instructions, installation prerequisites, and the installation procedure.

2.2 UNPACKING AND INSPECTION

2.2.1 General

All Scientific-Atlanta units are thoroughly inspected and carefully packed before shipment. However, responsibility for their safe delivery is assumed by the carrier at the time of shipment. Furthermore, damaged units should not be returned to Scientific-Atlanta; instead, file a claim with the carrier as noted in the following paragraphs.

2.2.2 Concealed Loss or Damage

Concealed loss or damage means loss or damage which does not become apparent until the unit has been unpacked. The contents may be damaged in transit due to rough handling, even though the carton may not show external damage. Lightly shake the unit while listening for movement of loose hardware or objects to check for concealed damage. When the damage is discovered upon unpacking, make a written request for inspection by the carrier's agent within 15 days of the delivery date, then file a claim with the carrier, since such damage is the carrier's responsibility. By following these instructions carefully, Scientific-Atlanta guarantees its full support of your claims to protect you against loss from concealed damage.

2.2.3 Visible Loss or Damage

Any external evidence of loss or damage must be noted on the freight bill or receipt, and signed by the carrier's agent. Failure to adequately describe such external evidence of loss or damage may result in the carrier refusing to honor a damage claim. The form required to file such a claim will be supplied by the carrier.

2.2.4 Equipment Inventory

Now that you have inspected the shipment for damage, you need to verify that all items ordered have been received. This is especially important if your order was for more than a single unit. Check off each item received against that listed on the packing slip included with the shipment, and verify that this list matches your purchase order. If any items are missing, notify Scientific-Atlanta or your local distributor right away.

2.2.5 Equipment Returns

Scientific-Atlanta makes a genuine effort to ensure that all items arrive safely and in working order. Occasionally, despite these efforts, equipment will be received which is not in working condition. When this occurs and it is necessary to return the equipment to us for either repair or replacement, or when operational equipment requires repair, the return can be expedited by following the procedure given below:

- a. Tag or identify the defective equipment and note the defect and circumstances, if any.
- b. Reference the sales order and purchase order and the date the equipment was received.
- c. Notify Scientific-Atlanta's Subscriber Products Factory Service of the defect and request shipping instructions; their toll-free telephone number is 800-241-1966 extension 5300 outside Georgia; in Georgia call 404-925-5300 and ask for "Subscriber Products Factory Service."

2.3 INSTALLATION REQUIREMENTS

2.3.1 Space and Physical Arrangement

Since the 8500 is small in size it does not require much space. It can be placed on or near the television receiver to which it services.

2.3.2 Cooling Requirements

Normally the 8500 does not require forced-air cooling as it is convection cooled. Just be sure that you do not place it where free-air will be restricted from moving through the units ventilation holes; that is, do not set it on top of carpet or place it within a cabinet. Also, never place the 8500 on or near a radiator or heat register.

2.3.3 Cabling

No special cables are required for use with the 8500 other than the standard 75-ohm coaxial cables you normally use in your cable system network. However, a 300-ohm to 75-ohm balun transformer may be required at the television's antenna terminals for use with receivers not equipped with 75-ohm connectors.

WARNING

REFER TO ARTICLE 820-22 OF THE NEC WHICH PROVIDES GUIDELINES FOR PROPER GROUNDING. IN PARTICULAR, IT SPECIFIES THAT THE CABLE GROUND SHALL BE CONNECTED TO THE GROUND SYSTEM OF THE BUILDING AS CLOSE TO THE POINT OF CABLE ENTRY AS PRACTICAL.

2.4 INSTALLATION GUIDELINES

Step 1. Run coaxial cable(s) from your cable system's feeder tap to the subscriber's home.

- Step 2. If applicable, install A/B cable switch at point where cables tie to structure.
- Step 3. Run coaxial cable from A/B switch to 8500 and connect to INPUT connector.
- Step 4. Install coaxial cable from 8500's OUTPUT connector to television's antenna terminals, using balun transformer if necessary.
- Step 5. Connect the television's power cord to the ac receptacle on rear of 8500.
- Step 6. Connect the 8500's power cord to an ac power receptacle. Make sure that the power receptacle is one that is not switch controlled.
- Step 7. This completes installation. The unit is now ready to be checked for proper operation; refer to paragraph 2.5.

2.5 INITIAL CHECK-OUT AT SUBSCRIBER'S HOME

You can quickly and easily check-out the 8500 for proper performance by following the instructions given in figure 2-1. This figure is a flow-chart diagram containing instruction blocks arranged in logical order. Each block represents a question requiring a yes or no answer which leads you to the next step in the sequence. A yes response to all questions indicates that the 8500 is working properly and that check-out is complete. While a no response indicates a fault which leads you to a corrective action block.

While the material presented in this flow chart is primarily aimed at the addressable, basic C configured 8500's, it is just as useful for checking out basic A and basic B configurations as well. However, you will have to ignore any of the addressable questions while checking out basic A and basic B configured 8500's.

2.6 SUBSCRIBER SAFEGUARDS

After checking out the 8500 and it is in proper working order, leave the customer with their copy of the Subscriber's Guide and Important Rules. Be sure to briefly explain operation of the 8500 to the customer and highlight the safeguards that they should heed.

SCIENTIFIC-ATLANTA 8500 SET-TOP TERMINAL FAULT FINDER

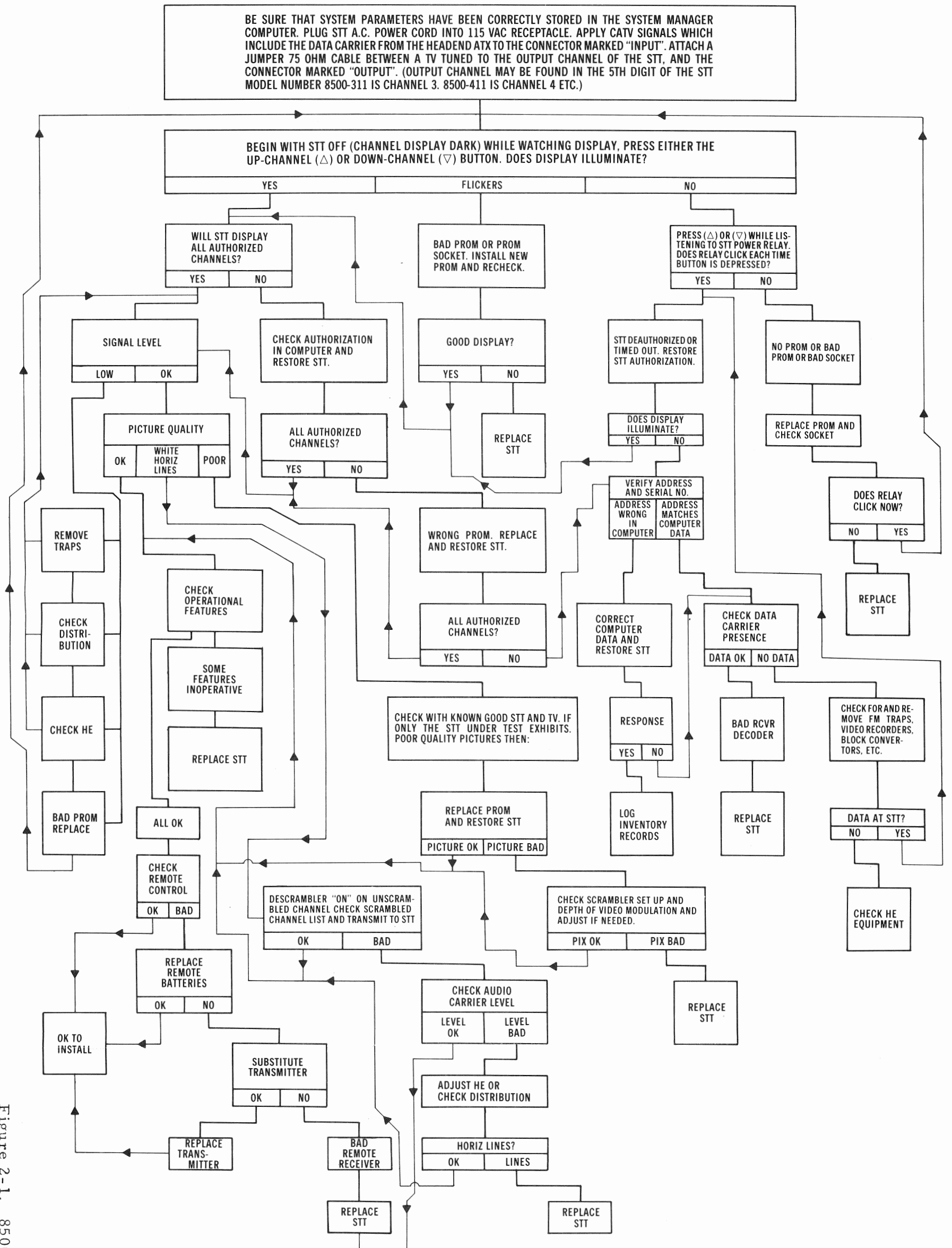


Figure 2-1. 8500 Check-Out Procedure and Fault Finder

SECTION 3 OPERATION

3.1 INTRODUCTION

This section repeats the operating instructions for the 8500 that are given in the Cable Television Subscriber's Guide along with the Important Rules for Safe Operation Figure 3-1 identifies the controls and indicators.

3.2 OPERATION INSTRUCTIONS

3.2.1 Set-Top Terminal

Your cable company has installed the Scientific-Atlanta Series 8500 set-top terminal in your home so you can enjoy a wide range of cable television programming. Please use the program guide supplied by the cable company for actual channel listings.

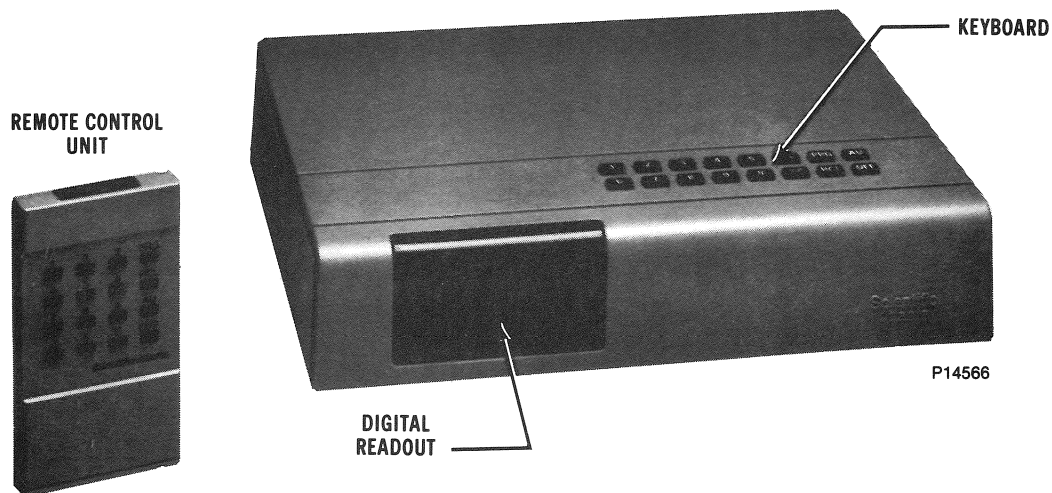


Figure 3-1. 8500 Controls and Indicators

With the Series 8500 set-top terminal, you can request channels one at a time and you can easily scan the many available channels before selecting one program of interest. The Series 8500 set-top terminal offers a twenty-channel memory so you can quickly survey programs on your favorite and most frequently watched channels. These simple instructions tell how to use all the features of your set-top terminal, including numerical channel selection, channel step through, favorite channel recall and parental control.

A hand-held remote control unit is also available from your cable operator. The added convenience of remote control enhances your enjoyment of the wide variety of channels offered on your cable system.

OFF On/Off

Insert the electrical power plug from the television set into the outlet on the back of the set-top terminal. Now you can turn the tv on by pressing any button on the set-top terminal or remote control unit. Turn the television and the set-top terminal off by pressing OFF .

0 Numerical Channel Selection

Select a channel simply by pressing the corresponding numbers on the set-top terminal or remote control unit keypad. For channels 1 through 9, press the 0 button first (channel 6 = 0 6). If you enter a single digit only, the set-top terminal will automatically add the leading 0 when four seconds elapse. The channel number will appear on the set-top terminal's bright red digital read out.

Δ ∇ Channel Step Through

When you press the Δ button, the set-top terminal will automatically tune to the next higher channel in your cable television subscription package. By pressing the ∇ button, the set-top terminal will tune to the next lower channel in your subscription package.

RCL PRG Favorite Channel Recall

Out of the dozen of channels available via cable tv, it is possible you will discover several favorites. Or perhaps you will want to keep track of several programs on different channels over the course of an evening.

You can program from one to twenty channels into memory for instant recall. Press the program button **PRG** to begin adding channels to the memory. The letters "PR" will appear on the digital read out. Enter one at a time the channel numbers you want put into memory. For channels 1 through 9, enter a **0** first to make a two digit number, or wait four seconds and the **0** will register automatically. Watch the digital read out to make sure each entry is accepted.

When you are finished adding channels to the memory, press the recall button **RCL** to set the memory. Then press **RCL** to step through the channels you have recorded. Each time you press **RCL**, the terminal will change to the next channel in memory.

When **PRG** is pressed again, the channel memory is eased and you can enter a new series of channel numbers. This function can be repeated as often as desired so different people watching tv at different times can all enjoy this convenience feature.

AU Parental Discretion

To view channels subject to parental control, first press the authorization button **AU**. Then enter the five-digit access code supplied by your cable company. After the code number is entered, all channels subject to parental control can be tuned until the set-top terminal is turned off.

If a controlled channel is requested without entering the access code first, a blank screen will appear. No picture or sound from the requested channel will enter the home.

3.2.2 Remote Control Unit

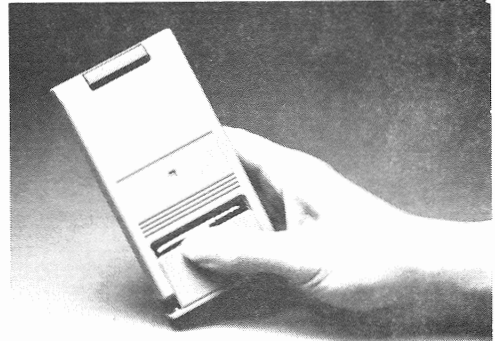
The lightweight remote control unit provides added convenience for cable television viewing. With more channels available than ever before, the ease of remote control enables you to quickly survey the many programs offered without leaving your seat. Your cable company can furnish the remote control unit without a service call.

All set-top terminal functions can be duplicated on the remote control unit keypad. Point the remote control unit in the direction of the set-top terminal when making channel selections, and when requesting parental control authorization of favorite channel recall.

The remote control unit is powered by two "AAA" batteries. Alkaline batteries offer the longest battery life. If the remote control unit does not respond to keypad entries, replace the batteries following these steps:

1. Press down on the spot marked on the back of the remote control. Push away from the unit to remove the battery cover.

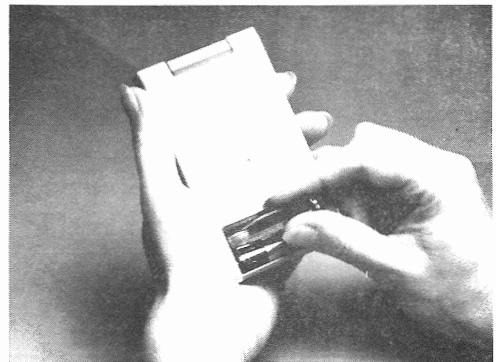
Figure 3-2. Removing the Remote Control Units Battery Cover



P15012

2. Replace the old batteries with new batteries. Make sure the positive (+) and negative (-) poles marked on the batteries match the poles marked in the remote control unit.

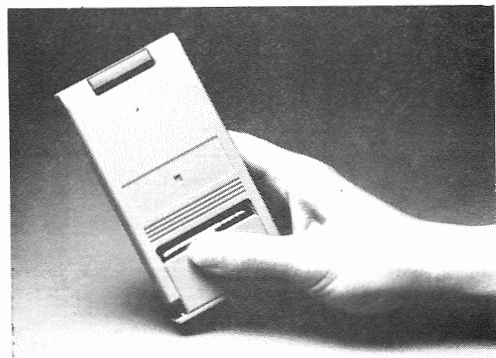
Figure 3-3. Installing Batteries in the Remote Control Unit



P15013

3. Snap the battery cover back into place.

Figure 3-4. Replacing the Remote Control Units Battery Cover



P15012

3.3 IMPORTANT RULES FOR SAFE OPERATION

Note

See Important Safeguards on page iv.

SECTION 4 THEORY OF OPERATION

4.1 INTRODUCTION

In section 1 we briefly explained the three basic configurations of the 8500. In this section we will go a little deeper and see how the module functions interact. We will begin with the power supply, then cover the modules forming the basic A configuration, and wind up by describing the descrambler and addressability modules which form the basic B and C configurations.

4.2 FUNCTIONAL BLOCK DESCRIPTION

4.2.1 General

The following description is based on the functional block diagram of the 8500 shown in figure 4-1. This diagram is a composite that shows all three configurations.

4.2.2 Power Supply

Alternating current is supplied through the ac power cord to a power transformer. The power transformer reduces the input voltage for application to the rectifiers, filters, and regulators which produce dc voltages of +5, +15, and +35 volts. These voltages are distributed to the modules within the 8500.

The input ac is also connected to a rear mounted relay-controlled ac outlet. This outlet is for use to power switch a television set through the 8500. The relay is operated by the control board when the 8500 is turned on. In this way the television set need not be manually turned on or off.

4.2.3 Up/Down Converter

The incoming rf signal supplied to the rear-mounted INPUT connector is applied to the up/down converter module. This signal is fed through a low-pass filter (LPF) to the first mixer. The low-pass filter contains a switched section to change the cutoff frequency so that it is just above 306 MHz when the 8500 is tuned to a low channel. When the 8500 is tuned to a channel above 306 MHz, a high-pass section is switched in the circuit to reduce the amplitude of low channels being applied to the mixer. Switching is accomplished by a switch driver in the control microcomputer on the control board.

The other input to the mixer is from the first oscillator. This oscillator operates at a frequency of from 668 MHz (when tuning channel 2) to a frequency of 1050 MHz (when tuning the highest channel). Frequency is determined by a phase-locked loop (PLL) circuit on the control board. A sample of the oscillator's energy is supplied to a prescaler ($\div 256$). The output from the prescaler is a square wave at the frequency of the first local oscillator divided by 256. This output is applied to the PLL. The PLL output is then fed back to the first oscillator through a loop amplifier to change channel frequency and maintain stability.

The first mixer up converts the selected signal to an IF frequency of 608-614 MHz. Its output is amplified, filtered, and applied to a second mixer. The other input to the second mixer comes from a second oscillator whose frequency is maintained by an automatic fine tuning (AFT) circuit located on the control board. A sample of the second mixer's output is fed to the AFT circuit which compares the frequency with a tuned circuit and supplies a correction signal to the second oscillator to maintain the correct frequency. The second mixer down converts the signal to either channel 3 (60-66 MHz) or channel 4 (66-72 MHz). The main output is then routed directly to the rf OUTPUT connector of a basic A configuration 8500. (For basic B and basic C configurations, the second mixer's output is routed through a descrambler module.)

4.2.4 Control Board

The control microcomputer scans the keyboard to detect when a key is pressed for a change in program selection. If the remote control transmitter is used instead of the keyboard, selection information comes from the remote control receiver. In this case, a 5 volt logic level is sent to the control microcomputer from the remote control receiver. This logic level causes an interrupt to the control microcomputer's routine, causing it to stop and service the remote control receiver's input.

For either of the above methods of program selection change, the control microcomputer changes the display appropriately. It also sends a signal to the channel allocation PROM (programmable read only memory) to determine the tuning information for the channel. In addition, for the basic A and basic B configurations, the channel allocation PROM contains channel authorization and descrambler authorization information.

Thus, the sequence of events is that when a key is pressed calling for a channel, the control microprocessor talks to the channel allocation PROM to verify that the channel is authorized and to determine if the descrambler should be turned on (other than basic A configurations). It also checks the channel allocation PROM to determine the new tuning information that should be sent to the PLL. (The control microcomputer senses the current PLL frequency through the $\div 2$ divider.) If the channel is authorized, then the display is lit with the proper channel number and the new tuning information is sent to the PLL. And for 8500's having descramblers, a signal is sent to the descrambler to turn it on when authorized.

The control microprocessor also operates the LPF switch to select the correct filtering for the channel selected, and on two cable systems, it activates the A/B switch. It also switches the outlet relay as previously described.

4.2.5 Remote Control Transmitter

The remote control transmitter acts as a remote keypad to control the 8500. It is battery operated and has four functional elements: a keyboard, a custom integrated circuit (IC) an oscillator, and an infrared light emitting diodes (LED) and driver circuit.

The keyboard is an X-Y matrix similar to the one on the 8500. It has all the same key functions.

The IC senses a keypress then sequentially scans the keyboard columns. It looks for its scanning signal on a single row line. It then converts that combination of column and row into a five-bit binary code. The IC then applies each binary bit and its complement to the LED driver in the form of an on/off 37.9 kHz carrier.

The LED driver turns the LED on and off in the binary code corresponding to the key function pressed.

Timing for the IC is generated by the oscillator which operates at 455 kHz.

4.2.6 Descrambler

The descrambler is used in both the basic B and basic C configuration to unscramble a scrambled signal. The descrambler uses the switched sync suppression technique with the timing pulse of the sound carrier being advanced in time with respect to the sync pulse on the video carrier. A demodulator in the descrambler recovers first a 4.5 MHz sound carrier signal which is then amplitude demodulated to recover timing pulses. The timing pulses are supplied to timing logic which sets up the correct delay from receipt of the timing pulse to the time that the horizontal blanking interval will be present on the video carrier. At this time, the timing logic sends a command to the switched gain amplifier to go to the high gain mode, which descrambles the signal.

4.2.7 Addressability

The basic C configuration offers addressability. The addressability circuitry receives channel authorization and descrambler authorization information from a data stream transmitted from the headend. When an addressable terminal (basic C) is used, the control microcomputer talks with the addressable microcomputer to determine channel authorization and descrambler authorization rather than obtaining such information from the PROM.

The addressability circuitry is contained in two modules; the address receiver and the address decoder. The address receiver accepts an input from the up/down converter input where a sample of the incoming broadband signal is sampled and supplied to the address receiver. Normally, the address receiver is looking for a data signal on 108.2 MHz. The address receiver is a straight forward single conversion crystal controlled FM receiver through the discriminator; at the output of the discriminator, the baseband signal is low pass filtered then supplied to a threshold detector which supplies 5 volt logic signal to the address decoder.

The address decoder receives the Manchester Encoded signal from the address receiver and converts this to 8-bit bytes which are then transmitted to the addressable microcomputer. The addressable microcomputer takes information from the address decoder and checks to determine if it should take any action on that information. If the addressable microcomputer should take any action on the information, it changes, if necessary, the information stored in nonvolatile memory (NVM). It also notifies the control microcomputer that a change has taken place. The control microcomputer then talks to the addressable microcomputer as if it had just tuned to a new channel to determine if a change in its current operating status should be made.

Data stored in the nonvolatile memory includes authorized channels, channels for which the descrambler should be turned on and pay-per-view information as well as certain housekeeping information and to the address of the box.

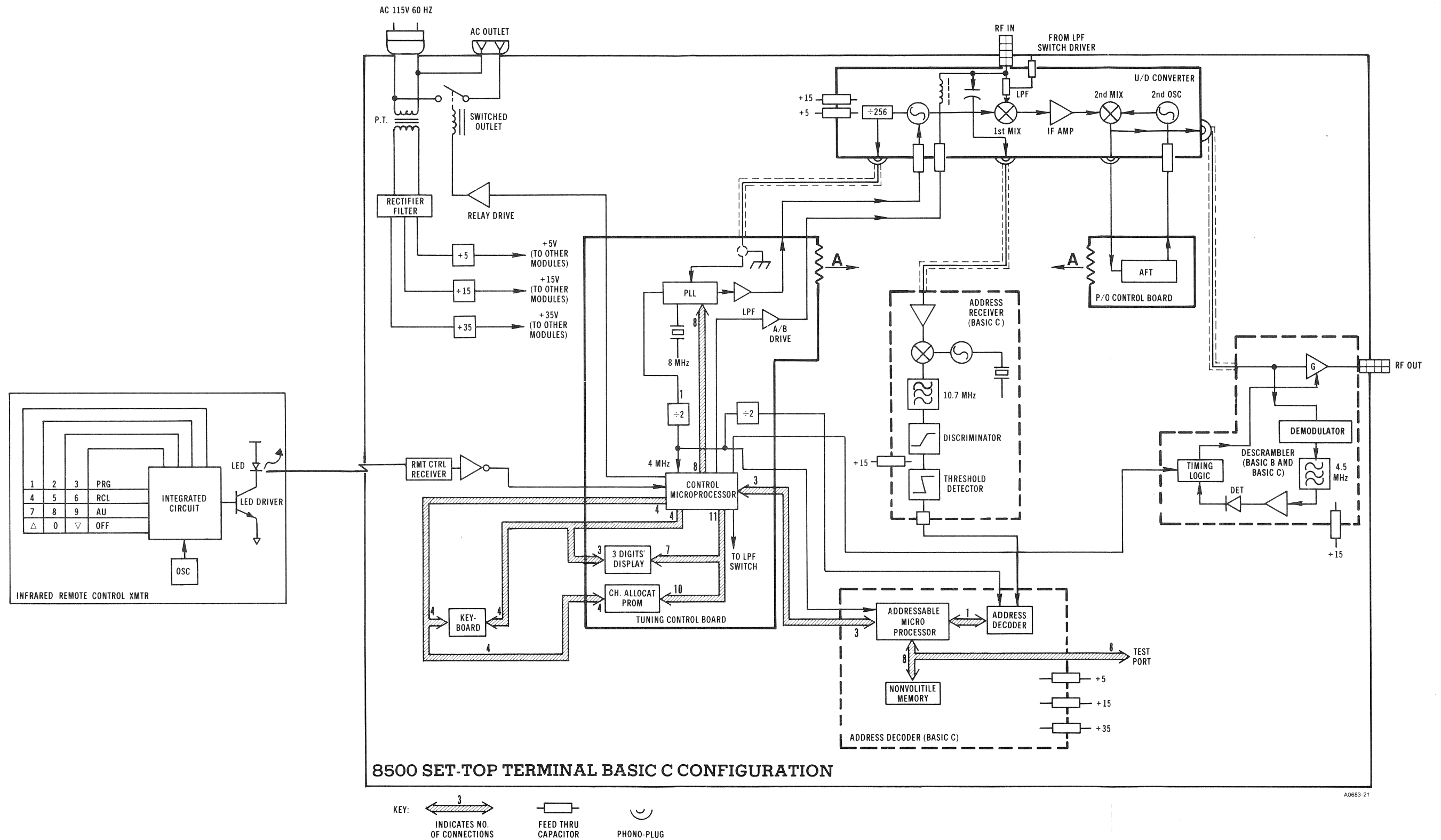


Figure 4-1. 8500 Functional Block Diagram Showing all Configurations

SECTION 5 TROUBLESHOOTING

5.1 INTRODUCTION

This section describes troubleshooting procedures that you can perform in the field. These procedures are presented in three segments, each of which address the particular 8500 configuration. Also covered are the tools and test equipment needed for troubleshooting and the procedures for removing and replacing modules. In addition, factory repair is discussed to inform you what to do when returning a unit to the factory for service.

5.2 FACTORY REPAIR

Generally, 8500s returned to Scientific-Atlanta for factory repair are done so for one of two reasons: the failed unit is still under warranty, or the unit is out of warranty and you do not have repair facilities adequate to service such units. In either case, when returning an 8500 for factory service, be sure to do the following:

- Step 1. Telephone Scientific-Atlanta's Subscriber Products Factory Service to inform them that you have a failed unit(s) that you wish to return for repair. Their toll-free telephone number is 800-241-1966 extension 5300 outside Georgia; within Georgia call 404-925-5300 and ask for "Subscriber Products Factory Service." Be prepared to furnish the following information:
 - a. Number of units to be returned
 - b. For each unit to be returned the following is needed:
 - (1) Model number
 - (2) Serial number
 - (3) Problem symptom
 - (4) Date of purchase
 - (5) From whom you purchased the unit, if not Scientific-Atlanta.

- c. Whether or not you are willing to pay for cosmetic damages not covered by the warranty.

- Step 2. Remove the customer (subscriber's) PROM from each unit as this PROM is not needed at the factory because a test PROM is used.
- Step 3. Package the unit(s) for safe shipment and ship as instructed during your telephone conversation.

5.3 FIELD REPAIR

Field repair is generally limited to replacing modules within the 8500 and should not be done while a unit is still within warranty. Field repair is not performed in the subscriber's home, but in your (cable operator's) shop and begins by troubleshooting. Once you find the problem area, you can then replace the malfunctioned module. The following paragraphs define the tools and test equipment needed and include step-by-step procedures for removing modules.

As an aid during field repair, table 5-1 provides a list of the 8500 Set-Top Terminal channel plan, including video and audio frequencies

5.3.1 Special Tools and Test Equipment

The following tools and test equipment are required to service the 8500:

- Magnetic screwdriver for 1/2" hex bit; Scientific-Atlanta part number 288762.
- Torx tamper-resistant bit, 1/4" hex shank, 1" long, extra hard steel; Scientific-Atlanta part number 288763.
- Oscilloscope
- Digital Volt Meter
- Long-nose pliers
- Phillips screwdriver

Table 5-1. Set-Top Terminal Channel Plan

| Channel # | | | Standard | | HRC | | IRC | |
|--------------|-----|-----|----------|--------|-------|--------|--------|--------|
| Set-Top CATV | | | Video | Audio | Video | Audio | Video | Audio |
| CabA CabB | | | | | | | | |
| 1 | 65 | A-1 | 115.25 | 119.75 | 114 | 118.50 | 115.25 | 119.75 |
| 2 | 66 | 2 | 55.25 | 59.75 | 54 | 58.50 | 55.25 | 59.75 |
| 3 | 67 | 3 | 61.25 | 65.75 | 60 | 64.50 | 61.25 | 65.75 |
| 4 | 68 | 4 | 67.25 | 71.75 | 66 | 70.50 | 67.25 | 71.75 |
| 5 | 69 | 5 | 77.25 | 81.75 | 78 | 82.50 | 79.25 | 83.75 |
| 6 | 70 | 6 | 83.25 | 87.75 | 84 | 88.50 | 85.25 | 89.75 |
| 7 | 71 | 7 | 175.25 | 179.75 | 174 | 178.50 | 175.25 | 179.75 |
| 8 | 72 | 8 | 181.25 | 185.75 | 180 | 184.50 | 181.25 | 185.75 |
| 9 | 73 | 9 | 187.25 | 191.75 | 186 | 190.50 | 187.25 | 191.75 |
| 10 | 74 | 10 | 193.25 | 197.75 | 192 | 196.50 | 193.25 | 197.75 |
| 11 | 75 | 11 | 199.25 | 203.75 | 198 | 202.50 | 199.25 | 203.75 |
| 12 | 76 | 12 | 205.25 | 209.75 | 204 | 208.50 | 205.25 | 209.75 |
| 13 | 77 | 13 | 211.25 | 215.75 | 210 | 214.50 | 211.25 | 215.75 |
| 14 | 78 | A | 121.25 | 125.75 | 120 | 124.50 | 121.25 | 125.75 |
| 15 | 79 | B | 127.25 | 131.75 | 126 | 130.50 | 127.25 | 131.75 |
| 16 | 80 | C | 133.25 | 137.75 | 132 | 136.50 | 133.25 | 137.75 |
| 17 | 81 | D | 139.25 | 143.75 | 138 | 142.50 | 139.25 | 143.75 |
| 18 | 82 | E | 145.25 | 149.75 | 144 | 148.50 | 145.25 | 149.75 |
| 19 | 83 | F | 151.25 | 155.75 | 150 | 154.50 | 151.25 | 155.75 |
| 20 | 84 | G | 157.25 | 161.75 | 156 | 160.50 | 157.25 | 161.75 |
| 21 | 85 | H | 163.25 | 167.75 | 162 | 166.50 | 163.25 | 167.75 |
| 22 | 86 | I | 169.25 | 173.75 | 168 | 172.50 | 169.25 | 173.75 |
| 23 | 87 | J | 217.25 | 221.75 | 216 | 220.50 | 217.25 | 221.75 |
| 24 | 88 | K | 223.25 | 227.75 | 222 | 226.50 | 223.25 | 227.75 |
| 25 | 89 | L | 229.25 | 233.75 | 228 | 232.50 | 229.25 | 233.75 |
| 26 | 90 | M | 235.25 | 239.75 | 234 | 238.50 | 235.25 | 239.75 |
| 27 | 91 | N | 241.25 | 245.75 | 240 | 244.50 | 241.25 | 245.75 |
| 28 | 92 | O | 247.25 | 251.75 | 246 | 250.50 | 247.25 | 251.75 |
| 29 | 93 | P | 253.25 | 257.75 | 252 | 256.50 | 253.25 | 257.75 |
| 30 | 94 | Q | 259.25 | 263.75 | 258 | 262.50 | 259.25 | 263.75 |
| 31 | 95 | R | 265.25 | 269.75 | 264 | 268.50 | 265.25 | 269.75 |
| 32 | 96 | S | 271.25 | 275.75 | 270 | 274.50 | 271.25 | 275.75 |
| 33 | 97 | T | 277.25 | 281.75 | 276 | 280.50 | 277.25 | 281.75 |
| 34 | 98 | U | 283.25 | 287.75 | 282 | 286.50 | 283.25 | 287.75 |
| 35 | 99 | V | 289.25 | 293.75 | 288 | 292.50 | 289.25 | 293.75 |
| 36 | 100 | W | 295.25 | 299.75 | 294 | 298.50 | 295.25 | 299.75 |
| 37 | 101 | AA | 301.25 | 305.75 | 300 | 304.50 | 301.25 | 205.75 |

Table 5-1. 8500 Set-Top Terminal Plan - continued

| Channel # | | | Standard | | HRC | | IRC | |
|--------------|-----|-----|----------|--------|-------|--------|--------|--------|
| Set-Top CATV | | | Video | Audio | Video | Audio | Video | Audio |
| CabA CabB | | | | | | | | |
| 38 | 102 | BB | 307.25 | 311.75 | 306 | 310.50 | 307.25 | 311.75 |
| 39 | 103 | CC | 313.25 | 317.75 | 312 | 316.50 | 313.25 | 317.75 |
| 40 | 104 | DD | 319.25 | 323.75 | 318 | 322.50 | 319.25 | 323.75 |
| 41 | 105 | EE | 325.25 | 339.75 | 324 | 328.50 | 325.25 | 329.75 |
| 42 | 106 | FF | 331.25 | 335.75 | 330 | 334.50 | 331.25 | 335.75 |
| 43 | 107 | GG | 337.25 | 341.75 | 336 | 340.50 | 337.25 | 341.75 |
| 44 | 108 | HH | 343.25 | 347.75 | 342 | 346.50 | 343.25 | 347.75 |
| 45 | 109 | II | 349.25 | 353.75 | 348 | 352.50 | 349.25 | 353.75 |
| 46 | 110 | JJ | 355.25 | 359.75 | 354 | 358.50 | 355.25 | 359.75 |
| 47 | 111 | KK | 361.25 | 365.75 | 360 | 364.50 | 361.25 | 365.75 |
| 48 | 112 | LL | 367.25 | 371.75 | 366 | 370.50 | 367.25 | 371.75 |
| 49 | 113 | MM | 373.25 | 377.75 | 372 | 376.50 | 373.25 | 377.75 |
| 50 | 114 | NN | 379.25 | 383.75 | 378 | 382.50 | 379.25 | 383.75 |
| 51 | 115 | OO | 385.25 | 389.75 | 384 | 388.50 | 385.25 | 389.75 |
| 52 | 116 | PP | 391.25 | 395.75 | 390 | 394.50 | 391.25 | 395.75 |
| 53 | 117 | QQ | 397.25 | 401.75 | 396 | 400.50 | 397.25 | 401.75 |
| 54 | 118 | RR | 403.25 | 407.75 | 402 | 406.50 | 403.25 | 407.75 |
| 55 | 119 | SS | 409.25 | 413.75 | 408 | 412.50 | 409.25 | 413.75 |
| 56 | 120 | TT | 415.25 | 419.75 | 414 | 418.50 | 415.25 | 419.75 |
| 57 | 121 | UU | 421.25 | 425.75 | 420 | 424.50 | 421.25 | 425.75 |
| 58 | 122 | VV | 427.25 | 431.75 | 426 | 430.50 | 427.25 | 431.75 |
| 59 | 123 | WW | 433.25 | 437.75 | 432 | 436.50 | 433.25 | 437.75 |
| 60 | 124 | XX | 439.25 | 443.75 | 438 | 442.50 | 439.25 | 443.75 |
| 61 | 125 | A-2 | 109.25 | 113.75 | 108 | 112.50 | 109.25 | 113.75 |
| 62 | 126 | 4+ | --- | --- | 72 | 78.00 | 73.25 | 77.75 |
| 63 | 127 | | | | | | | |
| 64 | 128 | | | | | | | |

5.3.2 Module Removal and Replacement

5.3.2.1 Introduction. The following paragraphs describe step-by-step procedures for removing each module from the 8500 chassis. Generally it is assumed that replacement is accomplished by following the procedure in

reverse. Once you remove the cover as described in the next paragraph, each procedure is independent in that if you need to remove another module first, you will be directed to that procedure first.

CAUTION

When working on the 8500, be sure that the unit is placed on a grounded metal work bench. It is best to also clip a cable from the work bench to the unit's chassis. This precaution is necessary to avoid static electrical discharges that could cause damage to the integrated circuits.

CAUTION

Cable routing is very critical within the unit. When replacing modules be sure that you dress all wiring as it was originally; figure 5-3 can be used as a guide for cable dressing with all modules in place, while figure 5-6 shows the top modules removed.

CAUTION

When you are instructed to remove a connector plug, pay particular attention to its location in the referenced figure, for it is not readily obvious which end of a connector is removable.

5.3.2.2 Cover Removal. Turn the unit upside down and remove the Torx screw from each corner as shown in figure 5-1. Now turn the unit back over and lift off the cover by raising the back-end first. Use caution because the cable is connected to the keypad circuit board. Once the cover is off, you can unplug the connector.

Note

To allow module removal and access to cable routing you must first remove the plastic shield. Refer to figure 5-2 and remove the plastic shield by pressing in on the raised bumps while lifting it out.

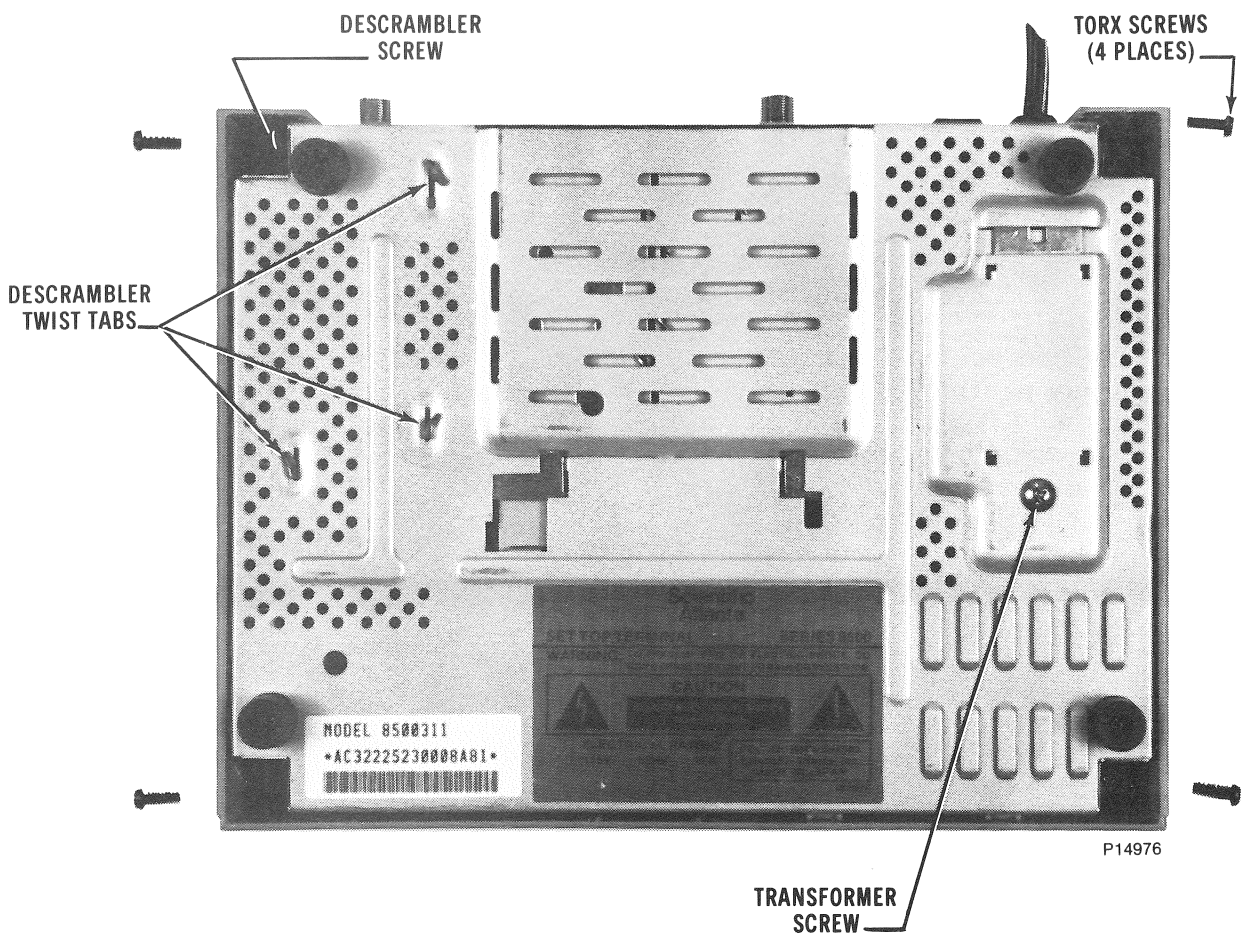


Figure 5-1. 8500 Bottem View

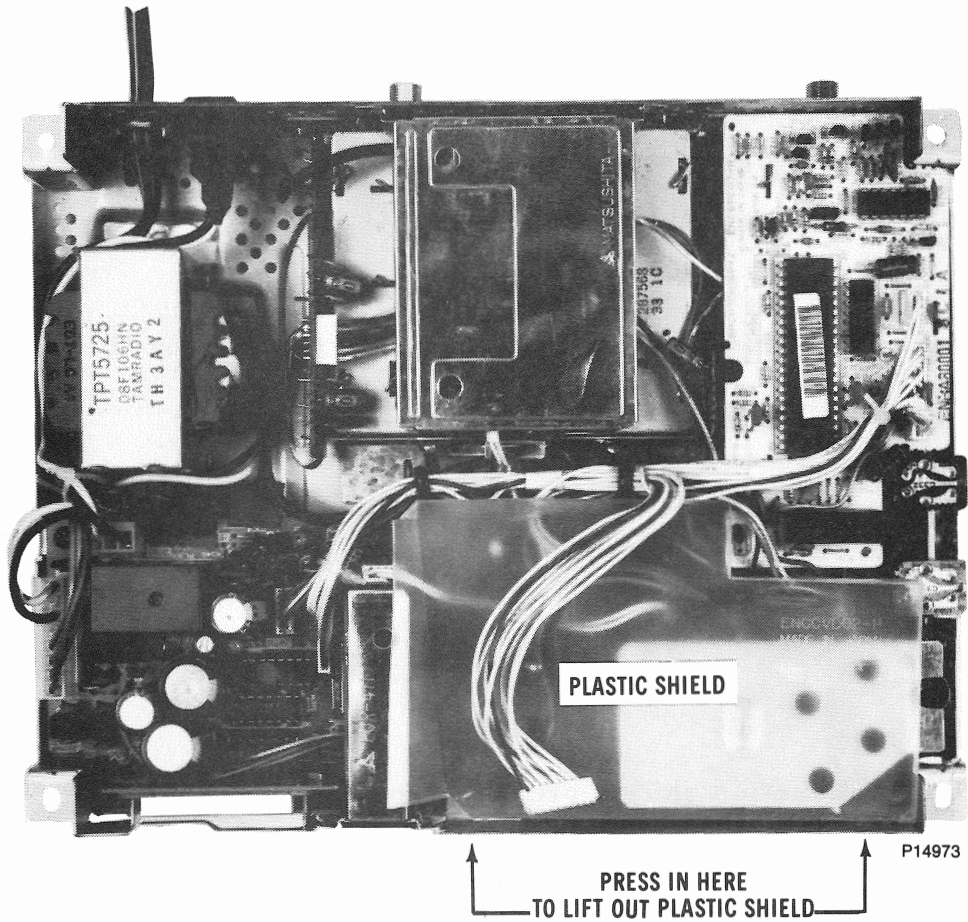


Figure 5-2. Plastic Shield Removal

5.3.2.3 Address Receiver Removal (figure 5-3).

- Step 1. Straighten the cable straps to allow removal of cable.
- Step 2. Cut cable tie.
- Step 3. Unplug connector from address decoder.
- Step 4. Unplug phono plug from up/down converter.
- Step 5. Straighten the three twist tabs.
- Step 6. Lift out address receiver module.

5.3.2.4 Address Decoder Removal (figure 5-4).

CAUTION

Be sure you are working on a grounded metal table or work bench; see CAUTION given under paragraph 5.3.2.1.

- Step 1. Unplug upper connector plug from board.
- Step 2. Unplug connector plug from middle area of control board.
- Step 3. Straighten cable straps to allow removal of cable.
- Step 4. Cut cable tie.
- Step 5. Straighten the three twist tabs.
- Step 6. Lift out address decoder module.

Note

On early production units a ground wire was connected from the module to the regulator. You must also unsolder this wire at the regulator to completely remove the module.

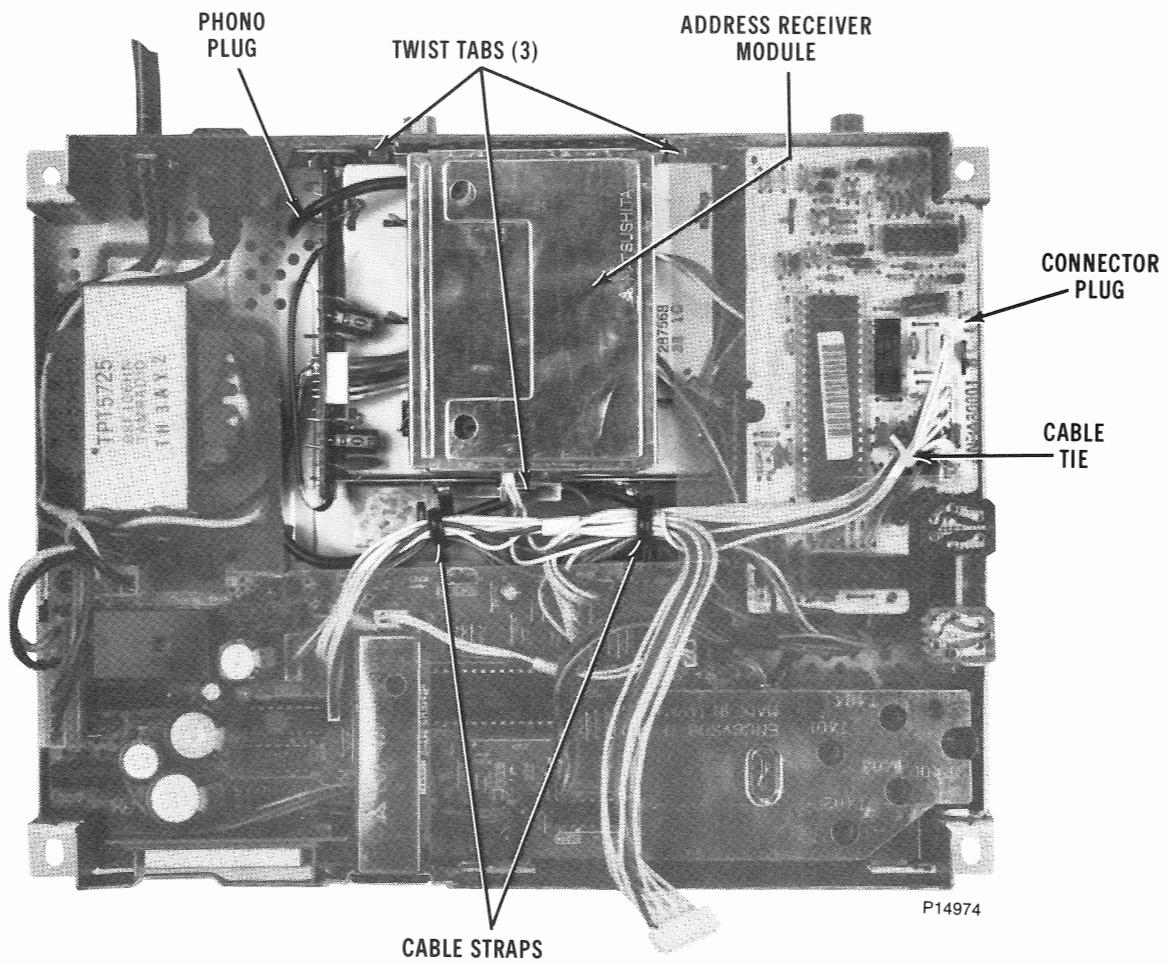


Figure 5-3. Address Receiver Removal

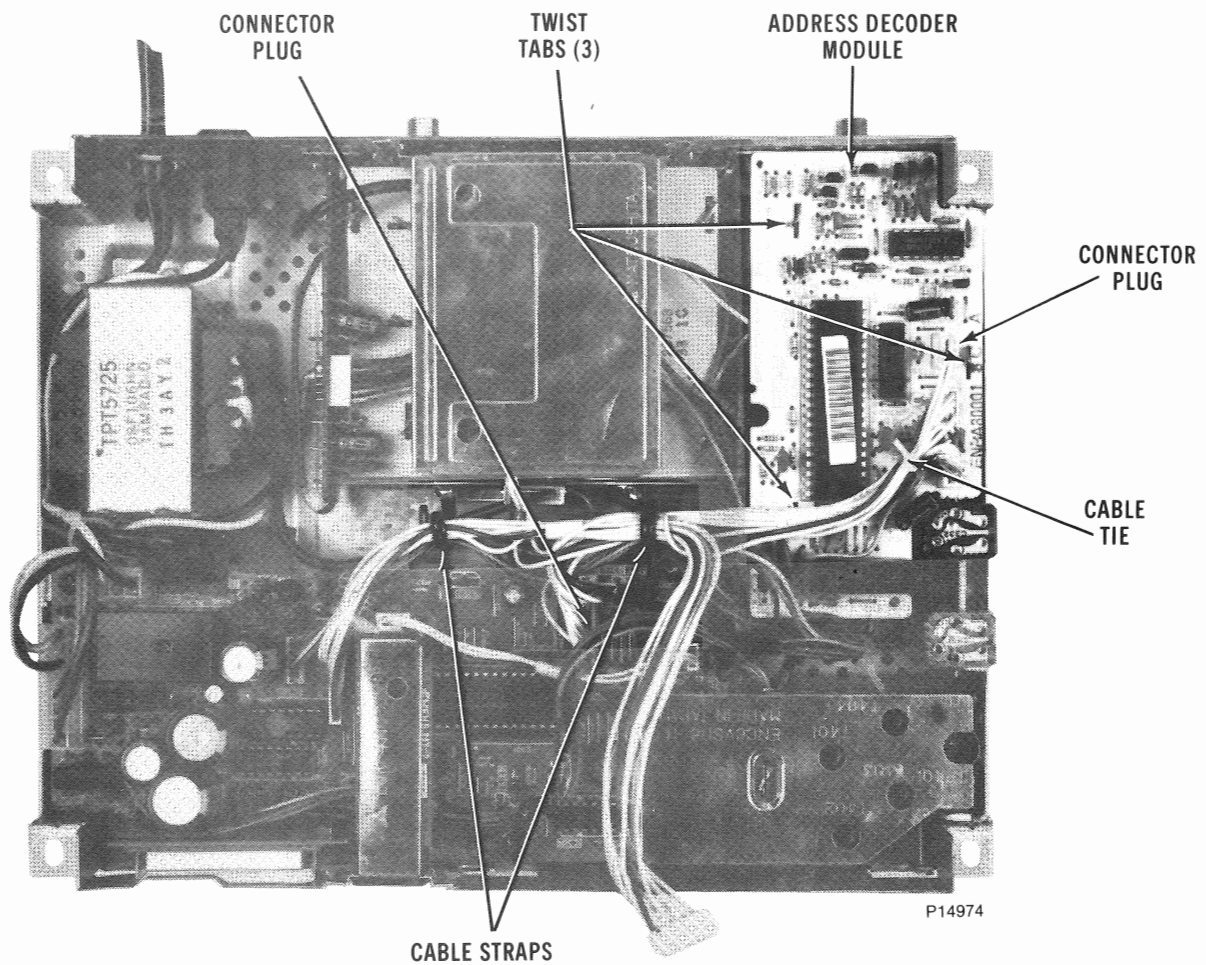


Figure 5-4. Address Decoder Removal

5.3.2.5 Remote Control Receiver Removal (figure 5-5).

- Step 1. Remove connector plug from the rear of the remote control receiver.
- Step 2. Straighten the two twist tabs.
- Step 3. Remove the module by first pulling unit straight up, just enough for bottom front edge to clear tabs in chassis, then tilt rear end up and pull module off of twist tabs.

5.2.3.6 Up/Down Converter Removal (figure 5-6).

Note

You must first remove the address receiver to gain access to the up/down converter; refer to paragraph 5.3.2.3.

- Step 1. Unplug phono plug connectors; one from left side of module and two from right side of module.
- Step 2. Unsolder ground wire at right side of module coming from control board.
- Step 3. Unplug the connector going to the control board.
- Step 4. Straighten the two cable straps to allow cable removal; these straps are attached to the module.
- Step 5. Straighten the three twist tabs and remove the module.

Note

The twist tab at the right front of the module has a small metal plate that must be removed first.

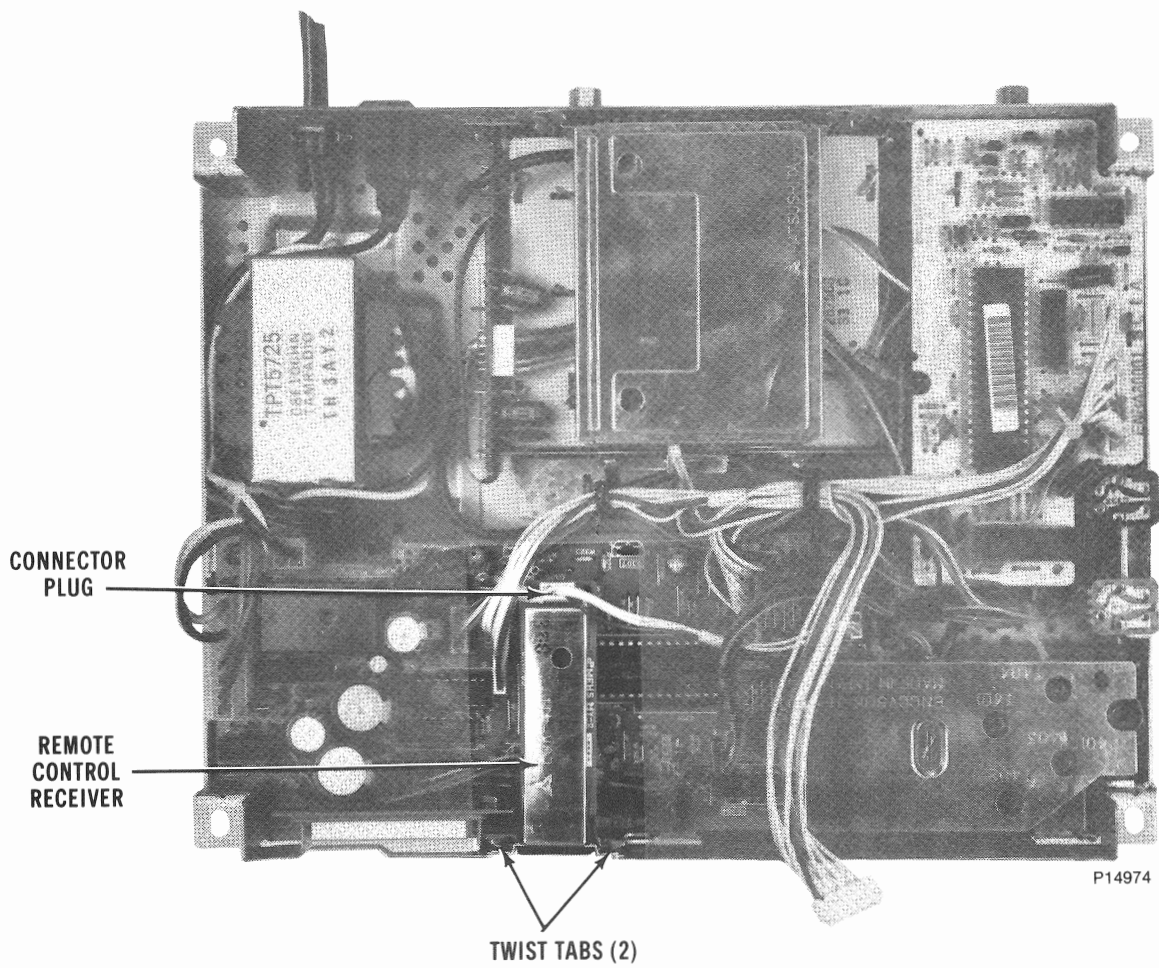


Figure 5-5. Remote Control Receiver Removal

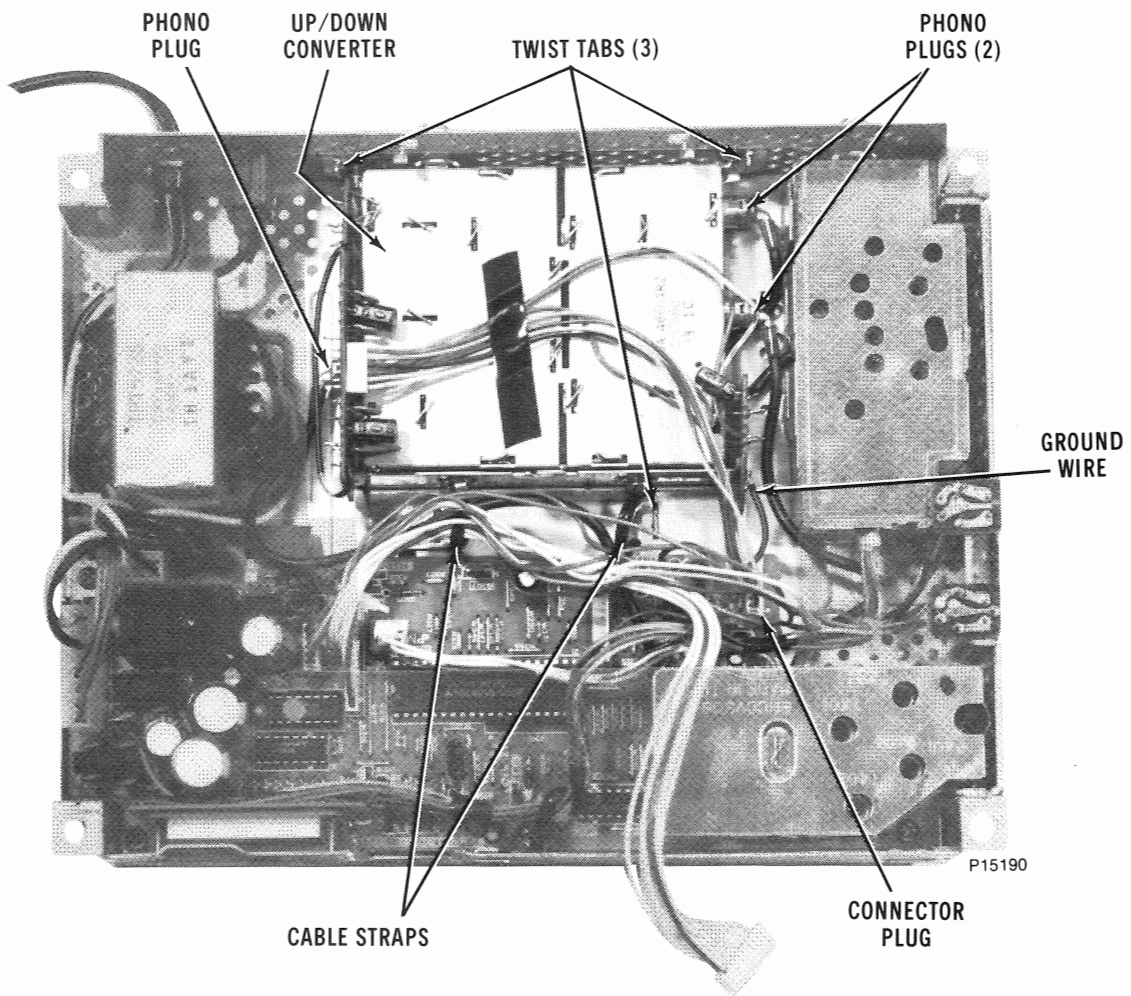


Figure 5-6. Up/Down Converter Removal

5.3.2.7 Descrambler Removal (figures 5-1 and 5-7).

Note

You must first remove the address decoder to gain access to the descrambler; refer to paragraph 5.3.2.4.

- Step 1. Cut cable ties, two places.
- Step 2. Remove regulator screw and descrambler screw.
- Step 3. Unplug phono plug from up/down converter.
- Step 4. Unplug connector plug form control board.
- Step 5. Straighten the two cable straps to allow cable removal.
- Step 6. Turn unit over and straighten the three twist tabs, see figure 5-1.
- Step 7. Remove module.

5.3.2.8 Control Board Removal (figure 5-8).

Note

You must first remove the remote control receiver to allow removal of the control board; refer to paragraph 5.3.2.5.

- Step 1. Cut cable ties, three places.
- Step 2. Remove regulator screws.

Note

On new control boards the regulator boards are attached to the control board and must be separated by breaking off where perforated.

- Step 3. Unsolder ground wire from up/down converter.
- Step 4. Unplug connector plugs; four places.

NOTE: SEE BOTTOM VIEW, FIGURE 5-1
FOR DESCRAMBLER TWIST TAB
LOCATIONS.

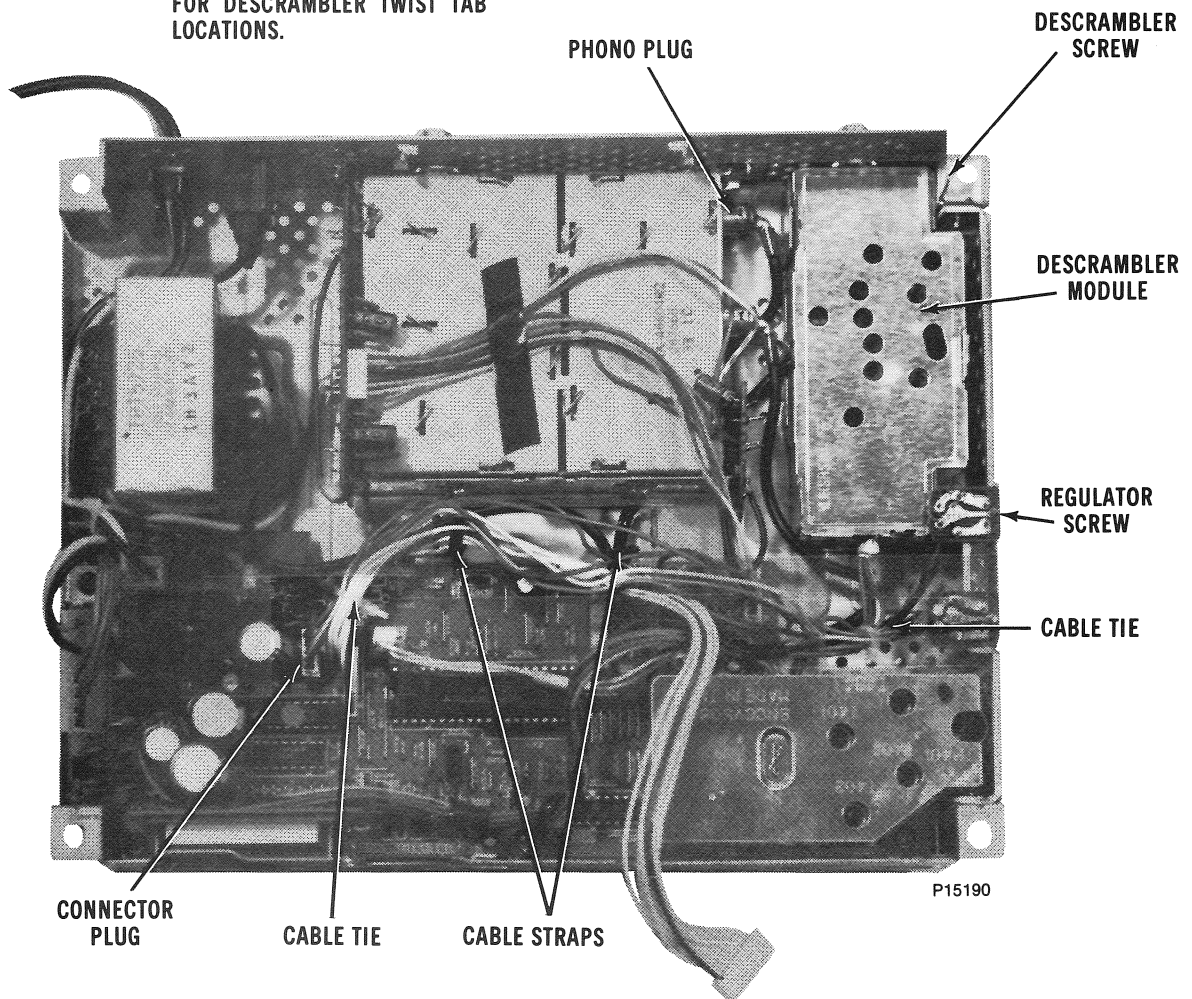
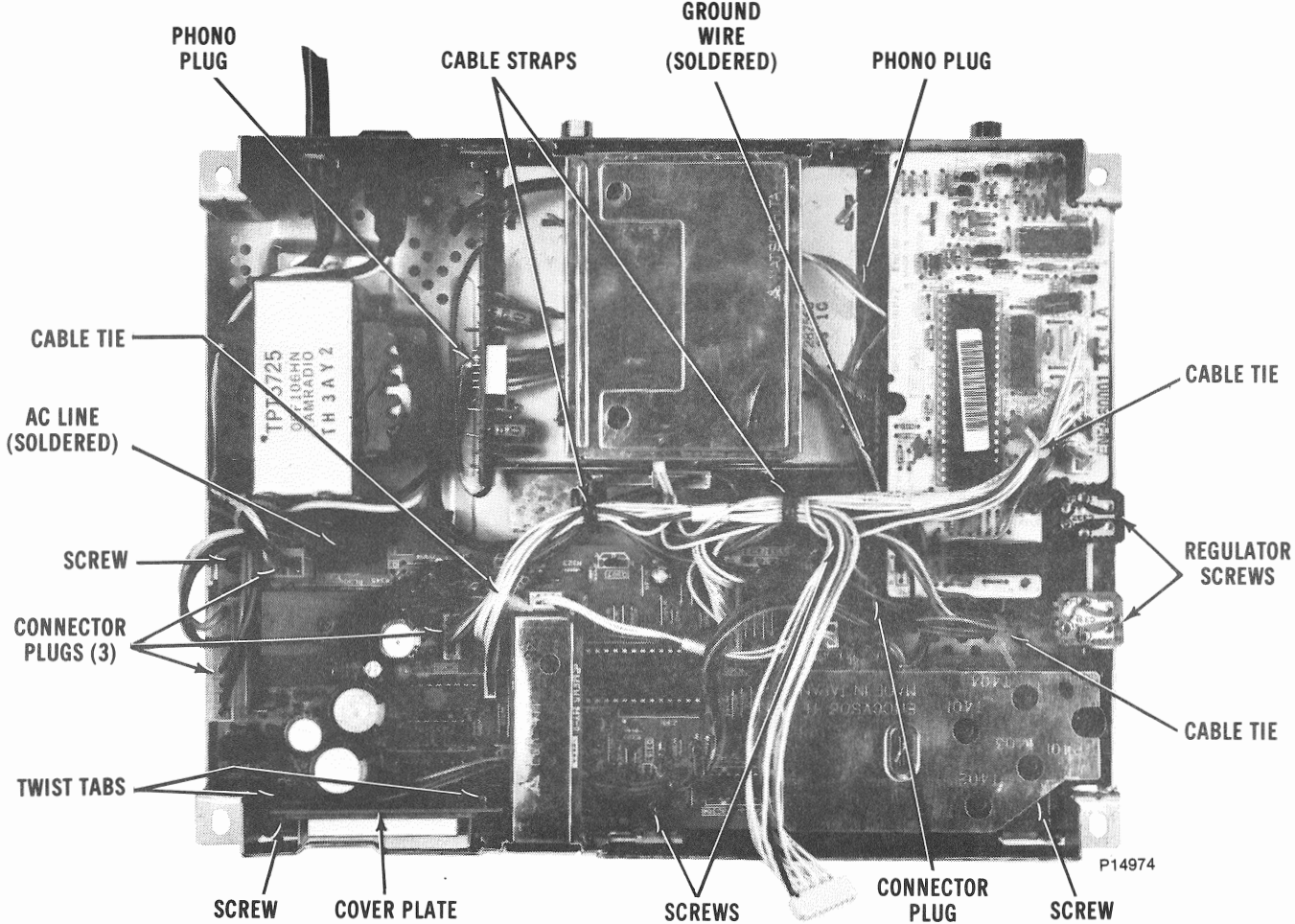


Figure 5-7. Descrambler Removal

Figure 5-8. Control Board Removal



- Step 5. Unplug phono plugs, two places.
- Step 6. Straighten cable straps to allow cable removal.
- Step 7. Unsolder the two ac line wires.
- Step 8. Remove the five screws holding the board to the chassis.
- Step 9. Straighten the two twist tabs behind the LED and remove the plastic cover plate.
- Step 10. Remove the control board, by first raising the rear portion up slightly while pulling toward the rear of the chassis, it may be necessary to slightly pull the chassis area just in front of the LED so that the twist tabs clear the LED.

5.3.2.9 Power Transformer Removal (figure 5-9).

- Step 1. Cut cable tie.
- Step 2. Unplug connector plug.
- Step 3. Using pliers or nut driver, hold nut (under cardboard) while removing transformer screw from bottom of chassis, see figure 5-1.
- Step 4. Remove transformer by sliding toward front of chassis until rear tab clears slot and lift out.

5.3.2.10 Keypad Circuit Board Removal (figure 5-10).

- Step 1. Remove cover from unit as described in paragraph 5.3.2.2.
- Step 2. Lay the cover upsidedown on a flat surface. This will keep the keys from falling out, but be sure that you do not lift the cover up off of the surface.
- Step 3. Remove the two screws holding the keypad circuit board to the cover.
- Step 4. Carefully lift off the circuit board and install the new one. Figure 5-10 shows the parts arrangement of the keypad assembly.

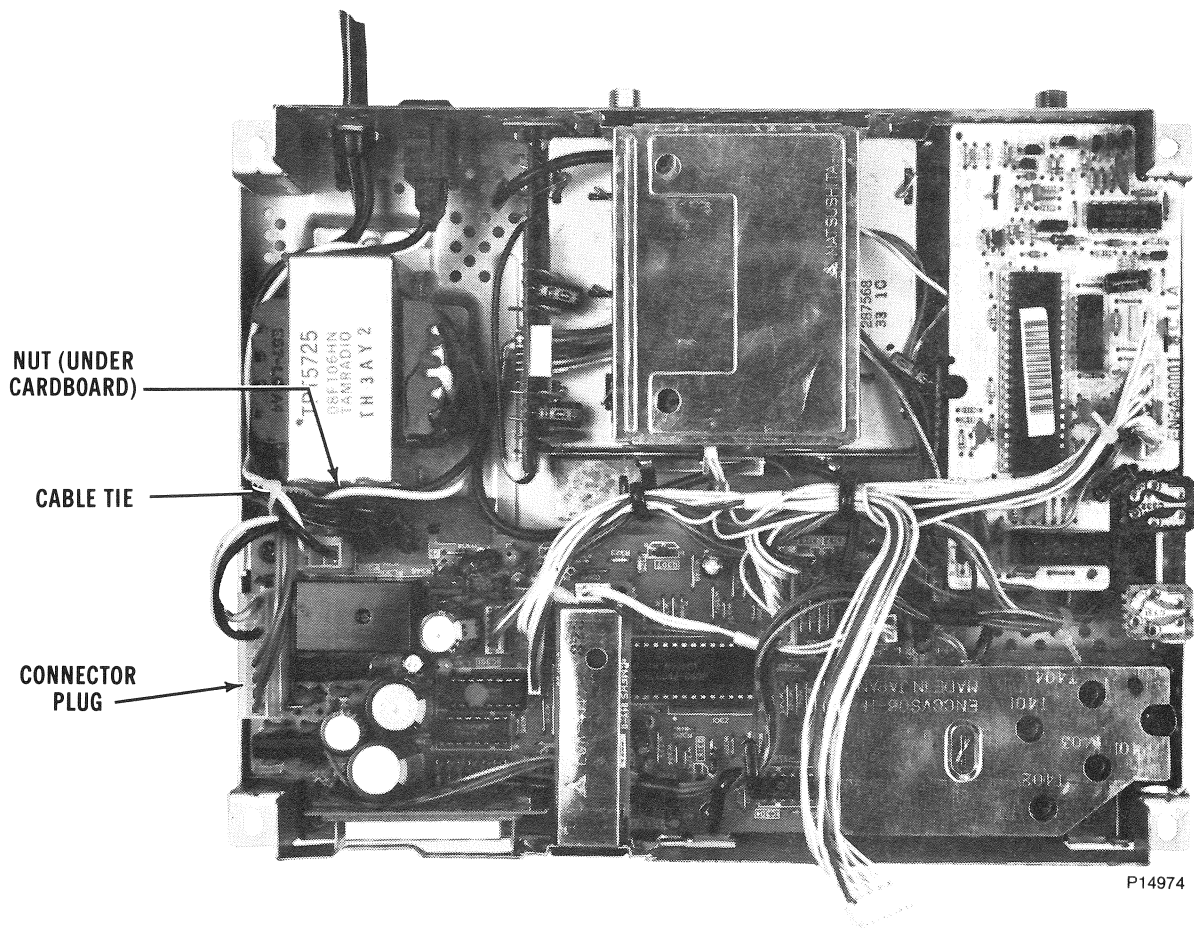


Figure 5-9. Power Tranformer Removal

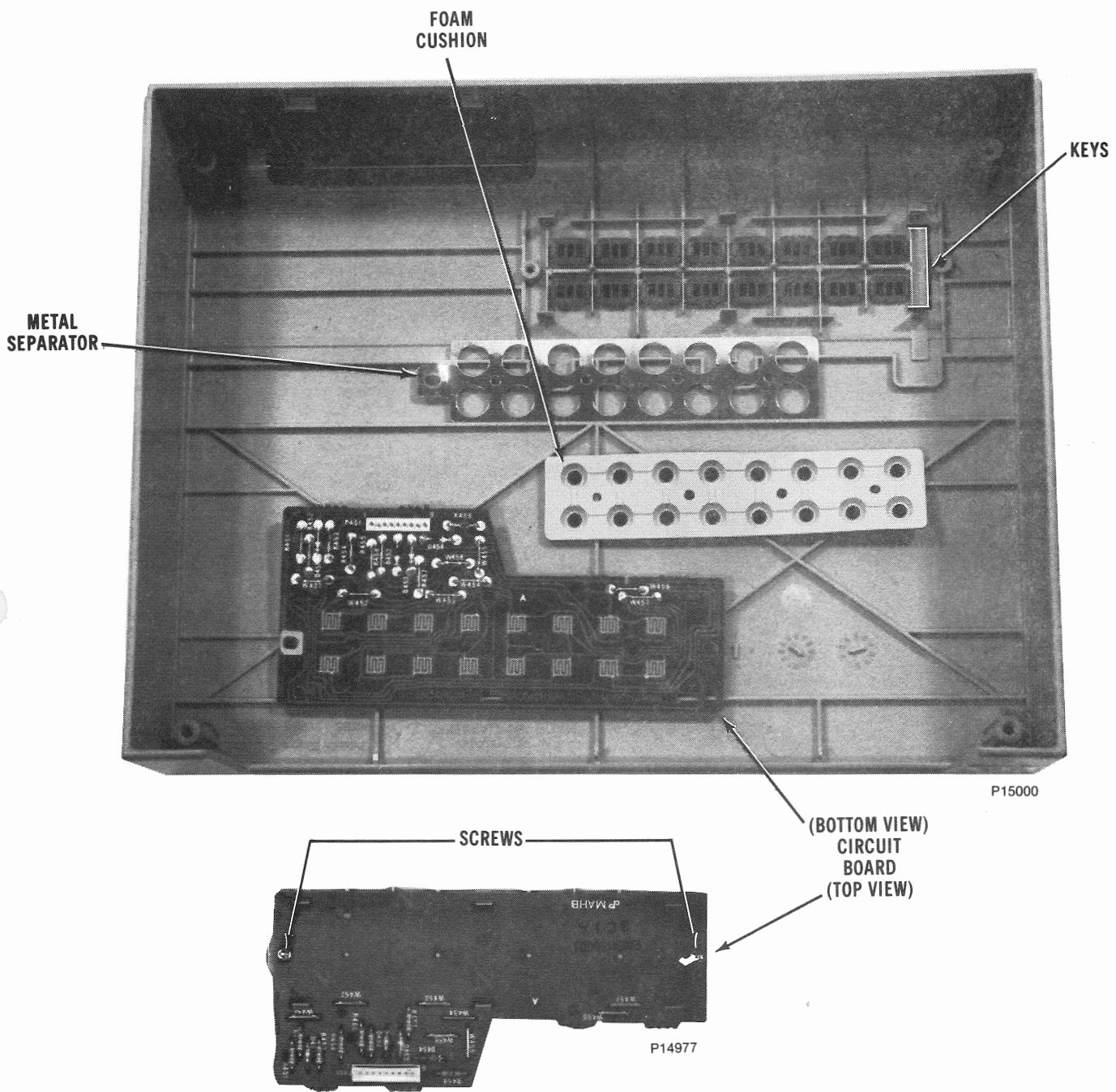


Figure 5-10. Keypad Circuit Board Removal

5.3.2.11 Regulator Removal.

- Step 1. Remove screw holding regulator to chassis.
- Step 2. Unsolder regulator from board.
- Step 3. Solder a new regulator on the board.
- Step 4. Coat new regulator with heat-sink compound and screw to chassis.

5.4 TROUBLESHOOTING THE BASIC A CONFIGURATION

5.4.1 General Symptom 1: (Terminal will not come on.)

Step 1. Narrow the failure possibilities by eliminating the remote or keyboard control circuitry by following the condition comments given in table 5-2.

Step 2. Adjust the remote receiver sensitivity as follows:

- a. Place oscilloscope probe on pin 6 of the control micro-processor (IC 303 40 pin IC chip of tuning control board) oscilloscope setting is .5V per division using X10 probe.
- b. With remote receiver P-307 connected, pin 6 indication should be stable, approximately 5V HIGH and go LOW with serial data only when remote transmitter is used.
- c. If serial data or "garbage" signal is present at pin 6, even when remote transmitter is not in use, sensitivity of remote receiver must be adjusted. Using small screwdriver or slotted blade tuning wand, adjust potentiometer located in small access hole on left side (LED side) of remote receiver module. Adjust until unwanted signal disappears.
- d. Retest for proper sensitivity using remote transmitter. Adjust sensitivity as required.
- e. If conditions 1 or 2 of table 5-2 still exist after completing these action items, replace control board module.

Table 5-2. Conditions and Corrective Action
for Step 1 of Paragraph 5.4.1

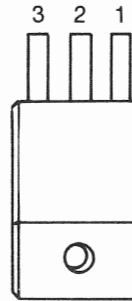
| Condition | Action | Repair Problem Found |
|--|---|---|
| <p>1. Will turn on with remote only.</p> | <p>Unplug keyboard connector and inspect pins.</p> <p>Plug in known good top to terminal in question and test.</p> | <p>Straighten pins and reinsert connector.</p> <p>Replace keyboard control.</p> |
| <p>2. Will turn on with keyboard only.</p> | <p>Unplug remote receiver from control board and inspect pins.</p> <p>Plug in known good receiver and test.</p> <p>Use another remote transmitter</p> | <p>Straighten pins and reinsert connector.</p> <p>Replace remote receiver.</p> <p>Check remote transmitter.</p> |
| <p>3. Will not work at all from keyboard control. Works only randomly from remote control. Remote receiver gain is too high.</p> | <p>Unplug (P-307) remote receiver from tuning control board. Retest operation from keyboard.</p> | <p>If okay, replace remote receiver or adjust remote receiver sensitively: (See procedure in step 2.)</p> |
| <p>4. Unit won't turn on from remote or keypad.*</p> | <p>Disconnect ac power remove PROM from socket and replace with known working PROM.</p> <p>Inspect PROM socket for damaged or loose pins.</p> | <p>Replace PROM.</p> <p>Replace socket or control board.</p> |
| <p>5. If unit still will not come on, go to step 3.</p> | | |

- f. If the malfunction does not meet either condition 1, 2, or 3 of table 5-1, proceed to Step 3.

***CAUTION**

Be sure to turn off power before removing or installing PROMs.

- Step 3. Refer to the chart below and measure the 5 volt and 15 volt regulators for proper output.



Typical pin configuration, voltage regulator.

Input = Pin 1
Ground = Pin 2
Output = Pin 3

| Drawing Designator | Component Designator | Input (Pin 1) | Output (Pin 3) |
|--------------------|----------------------|----------------|-----------------|
| Regulator A (5V) | IC 307 | 8.5 to 10 V dc | 5V dc \pm .5 |
| Regulator B (15V) | IC 306 | 21 to 24 V dc | 15V dc \pm .5 |

- a. If all voltages are present and within specification, go to step 4.
- b. If any voltage is not correct, go to step 5.

Step 4. Check the regulators for ac ripple. Use an oscilloscope and measure pin 3 of for ac ripple. Set the oscilloscope's vertical input controls for 2V/division and use a 1:1 probe. Refer to table 5-3 for conditions and corrective action.

Step 5. Check unit for shorts or open circuits as indicated in table 5-4.

Table 5-3. Conditions and Corrective Action for Step 4 of Paragraph 5.4.1

| Condition | Action | Repair Problem Found |
|---|--|---|
| 1. If ripple present. | Carefully remove control board from chassis. Look for broken or lifted pc pads in area of power supply capacitors. | Repair broken circuitry on pc board as necessary. |
| 2. If ripple present and no broken pc pads found. | None. | Malfunction is internal to control board module, replace. |
| 3. If no ripple present and regulator voltages are correct. | None. | Malfunction is internal to control board module, replace. |

Table 5-4. Conditions and Corrective Action for Step 5 of Paragraph 5.4.1

| Condition | Action | Repair Problem Found |
|--|--|--|
| 1. If no voltage present on both 5V and 15V regulator pin 1. | With vom on ac range, measure across T1 and T2 of P302 of Control Board. Should indicate 115V ac. Measure across pins 1 and 2 of P301. Should indicate 115V ac. | Replace ac power cord. Damaged pc board foil. Replace Control Board. (Caution: For safety sake, do not attempt repair of damaged ac power line foil.) |

Table 5-4. Conditions and Corrective Action for Step 5 of Paragraph 5.4.1 continued

| Condition | Action | Repair Problem Found |
|---|--|---|
| | <p>Measure across pins 3 and 4, then 5 and 6 of P301. Should indicate 20V ac and 9V ac respectively.</p> | <p>Replace transformer Warning: This transformer contains an internal fuse. Use vom and another control board to make resistance comparisons across P301 pins 3 and 4 and pins 5 and 6. Make sure there are no internal short circuits before applying power to new transformer. If internal short is found, replace control board.</p> |
| <p>2. Output voltage (pin 3) from either regulator is low or not present.</p> | <p>Desolder red wire from pin 3 of regulator in question. With ohmmeter, measure red wire to ground. Resistance of 5V regulator wire should indicate greater than 350 ohms. 15V regulator should indicate greater than 600 ohms.</p> | <p>If resistance readings are correct, replace regulator in question on control board.</p> |
| <p>3. Resistance indications of red wire to ground are lower than those specified in condition 2.</p> | <p>Resolder red wire to pin 3 and unplug P308 from control board. Use volt-meter to check proper voltages at pin 3 of both regulators.</p> | <p>None.</p> |
| <p>4. Voltage indications returned to normal after completing condition 3.</p> | <p>None.</p> | <p>Check wiring to up/down converter module. If okay, replace up/down converter module.</p> |

Table 5-4. Conditions and Corrective Action for
Step 5 of Paragraph 5.4.1 - continued

| Condition | Action | Repair Problem Found |
|---|--------|---|
| 5. Voltage indications at pin 3 of either regulator are still low or not present. | None. | Check regulator wiring. If okay, replace control board and reinsert P308. |

5.4.2 General Symptom 2: (No rf output, low gain, or distorted picture.)

Note

Make sure rf input signal is clean with approximate 0 dB mV level when performing the following steps.

Step 1. If the television picture is snowy or not present, inspect the PROM socket for damaged or loose pins. Also try replacing the PROM with a known working PROM.

CAUTION

Be sure to turn off power before removing or installing a PROM.

Step 2. If the television picture is distorted and displays horizontal hum bars across the screen, the problem is probably ripple in the ac power link. Refer to step 4 under paragraph 5.4.1.

Step 3. If the problem can not be corrected by steps 1 or 2, the problem must be isolated further. There are basically two modules that can control picture quality, the up/down converter and/or the

phase-lock loop (PLL) portion of the tuning control board. Both of these modules will display identical symptoms and must be isolated by the process of elimination.

The easiest method to eliminate the defective module is to temporarily replace the up/down converter with a known operational unit. This is accomplished by placing a known working unit over the top of the up/down converter in question "piggyback" style (sandwich a piece of cardboard or heavy paper between the two modules so as to not short or damage components). Remove three RCA type phono connectors (refer to figure 6-2) identified as PR Out, RF Out, and AFC Out, and insert them in their corresponding receptacles on the new up/down converter. Remove the existing connector (P308) from the tuning control board and insert the identical cable from the piggybacked up/down converter. Remove the signal input cable and reinsert into the jack marked RF IN of the new up/down converter. Make certain there is nothing shorted or touching that can cause damage and apply power. Refer to table 5-5 for conditions and corrective action.

Table 5-5. Conditions and Corrective Action for Step 3 of Paragraph 5.4.2

| Condition | Action | Repair Problem Found |
|--|--|--------------------------------|
| 1. Unit works correctly, displays good picture quality. | Allow unit to burn-in for two hours min. Then check all channels for good picture quality. | Replace bad up/down converter. |
| 2. Unit still displays identical picture quality problems. | Remove the test up/down converter and reinsert cabling in existing module. | Replace tuning control board. |

Note

If after replacing tuning control board symptoms improve but do not disappear, the problem could be a combination of both modules. Repeat step 3.

5.4.3 General Symptom 3: (No ac present at connector receptacle.)

Step 1. Refer to table 5-6 and perform some initial checks for the conditions listed.

Table 5-6. Conditions and Corrective Action for Step 1 of Paragraph 5.4.3

| Condition | Action | Repair Problem Found |
|---|--|---|
| 1. Relay fails to give audible "click" when 8500 terminal turned on. | Inspect PROM socket for damaged or loose pins. Remove PROM from socket and replace with known working PROM. | Replace PROM or socket as required. |
| 2. Anything other than condition 1 above and does give audible "click." | Refer to step 4 under paragraph 5.4.1. | Repair broken pc circuitry or replace tuning control board as required. |

Step 2. Check tuning control board as indicated in table 5-7.

Table 5-7. Conditions and Corrective Action for Step 2 of Paragraph 5.4.3

| Condition | Action | Repair Problem Found |
|---|---|---|
| 1. Relay "clicks" but no ac out to socket. | Check socket for loose or broken connections. | Replace socket, if socket OK, replace tuning control board. |
| 2. Relay fails to "click" but step 1 was no help. | None. | Replace tuning control board. |

WARNING

AFTER EXAMINING THE DEFECTIVE TUNING CONTROL BOARD, YOU MIGHT FIND THAT A PC RUN HAS BEEN BURNED OFF THE BOARD IN THE AREAS OF THE AC AND RELAY CIRCUITS. THIS WAS CAUSED BY EXCESSIVE CURRENT DRAW FROM THE APPLIANCE PLUGGED INTO THAT SOCKET. TOTAL CURRENT DRAW FROM THAT PART SHOULD NOT EXCEED 5 AMPS MAXIMUM.

DO NOT ATTEMPT TO REPAIR ANY BURNED OR MISSING PC COPPER RUNS ASSOCIATED WITH AC CIRCUITRY. REPLACE THE TUNING CONTROL BOARD ONLY FOR THIS TYPE REPAIR.

5.4.4 General Symptom 4: (Certain buttons on keyboard or remote control do not work or are slow in reacting.)

Step 1. If the unit works for either keyboard or remote control but not both, refer to the actions column of table 5-2.

Step 2. If step 1 didn't correct the problem, you will need to dig a little deeper; refer to table 5-8.

Table 5-8. Conditions and Corrective Action for Step 2 of Paragraph 5.4.4

| Condition | Action | Repair Problem Found |
|---|--|--|
| 1. Certain commands on both keyboard and remote controls do not work or are slow in reacting. | Inspect PROM socket for damaged or loose pins. Remove PROM from socket and replace with known working PROM. | Replace PROM, socket, or tuning control board as required. |
| 2. Step 1 and condition 1 of step 2 completed and still no help. | None. | Replace tuning control board. |

5.4.5 General Symptom 5: (Unit's LED displays three digits when only two digits are requested by PROM tiering.)

Step 1. Look for PROM; if missing, install new PROM.

Step 2. Remove PROM from socket and replace with known working PROM. If this does not help, replace tuning control board.

Step 3. Inspect PROM socket for damage or loose pins. Replace socket or tuning control board as necessary.

Step 4. If the above steps do not resolve problem, refer to step 3 under paragraph 5.4.1 and check voltage regulators.

5.5 TROUBLESHOOTING THE BASIC B CONFIGURATION

This paragraph covers descrambler related symptoms only. If symptoms covered here do not adequately describe the symptoms of the 8500 to be repaired, go back to paragraph 5.4 which describes troubleshooting the basic A configuration.

5.5.1 General Symptom 1: (Terminal will not come on.)

Step 1. Eliminate the non-descrambler related problems by going back to paragraph 5.4 and doing steps 1, 3, 4, and 5 using table 5-4 up to condition 4.

Step 2. For a descrambler related problem, perform the action for the conditions listed in table 5-9.

Table 5-9. Conditions and Corrective Action for Step 2 of Paragraph 5.5.1

| Condition | Action | Repair Problem Found |
|---|--|---|
| 1. After completing the action for condition 3 from table 5-4, correct voltages are still missing at pin 3 of either regulator. | Unplug P304 from tuning control board and retest voltage reading at pin 3 of either regulator. | If voltage readings returned to normal, check wiring to descrambler. If OK, replace descrambler module. |
| 2. Voltage readings at pin 3 of either regulator are still low or not present. | Replace P304 and go to table 5-3 condition 5. | |

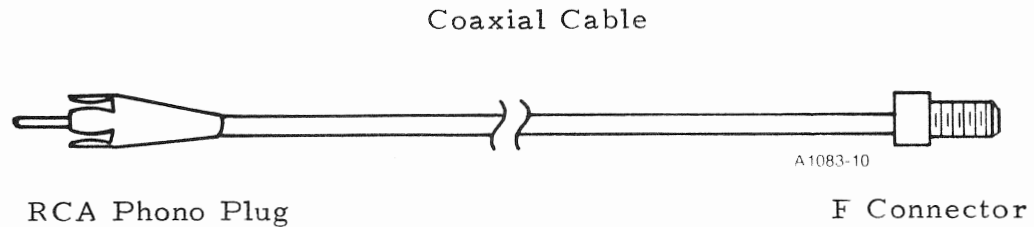
5.5.2 General Symptom 2: (Terminal has no rf output, low gain, or distorted picture.)

Step 1. Eliminate the PROM and power supply problems by going back to paragraph 5.4.2 and repeating steps 1 and 2.

Step 2. For descrambler related picture quality problems, perform the following:

- a. Construct a short adapter cable as shown below:

Materials required: 1 ea. (RCA type) phono plug (male)
1 ea. 6" length of coaxial cable (75 ohm)
1 ea. F connector (female)



Connect the coaxial cable in normal fashion, with the center conductor of the cable going to the center pin of both connectors and the shield going to the outer circuit of the connectors.

- b. Remove the descrambler module from the 8500.

CAUTION

If the 8500 is an addressable unit, one equipped with an address decoder module, this module must be removed before the descrambler can be removed. Use extreme caution when handling this module. The address decoder module must be reconnected before further testing can be done. Make sure this module is not touching or shorted to any components while power is on during the test.

- c. Connect the phono plug end of the adapter cable to RF OUT port connector of the up/down converter. Connect the F connector end of the adapter cable to the output cable from the 8500.
- d. Reapply power and check the conditions listed in table 5-10.

Table 5-10. Conditions and Corrective Action for Step 2d of Paragraph 5.5.2

| Condition | Action | Repair Problem Found |
|--|---|--|
| 1. Picture is greatly improved with good quality and gain. | None. | Replace descrambler module. |
| 2. Picture quality is still poor. | Problem is not descrambler related. Refer to step 3 of paragraph 5.4.2. | Replace up/down converter or tuning control board as required. |

5.5.3 General Symptom 3: (Terminal will not descramble on certain or all channels.)

Step 1. Check headend scrambler signals for timing and proper operation; if OK, go to step 2.

Step 2. Refer to table 5-11 and perform the action indicated for the conditions listed.

Table 5-11. Conditions and Corrective Action for Step 2 of Paragraph 5.5.3

| Condition | Action | Repair Problem Found |
|--|--|-------------------------------|
| 1. Terminal will not descramble on certain or all channels. | Replace PROM with known good unit. | Replace PROM. |
| 2. Same | Temporarily replace existing descrambler with known good working unit. | Replace descrambler. |
| 3. Items 1 and 2 completed and terminal still displays same condition. | Check all wiring and connections to descrambler. | Replace tuning control board. |

5.6 TROUBLESHOOTING THE BASIC C CONFIGURATION

This paragraph covers addressable circuitry related symptoms only. If symptoms covered here do not adequately describe the symptoms of the 8500 to be repaired, go back to paragraph 5.4 (basic A configuration troubleshooting) or paragraph 5.5 (basic B configuration troubleshooting) as applicable.

If you suspect that the 8500 has failed due to a problem with the addressable circuitry, it is best to try to simulate the failure before attempting any repair. There are many variables in the field, such as traps, directional splitters, or even customer tampering that will block the addressable signals from getting to the terminal. As part of the security of the 8500, the terminal has been designed to "time out" and not operate within 64 hours of operation if it does not receive the proper addressable signals.

- Addressable Rule #1 - Always try to reauthorize the 8500 terminal with the Addressable Transmitter (ATX) before attempting any repair.

CAUTION

Use extreme care when handling or working with the address decoder module. This module contains a non-volatile memory (NVM) device that can be altered or destroyed if subjected to static discharge or power shorts.

- Addressable Rule #2 - Always handle the decoder module with care, making sure that you have a grounded work station and use an anti-static wrist strap whenever possible.

5.6.1 General Symptom 1: (Terminal will not come on.)

Step 1. Eliminate the non-addressable circuitry related problems by going back to paragraph 5.4 and repeating steps 1, 3, 4, and 5 using table 5-4 up to condition 4.

Step 2. For addressable circuitry related problems, perform the action for the conditions listed in table 5-12.

Table 5-12. Conditions and Corrective Action for
Step 2 of Paragraph 5.6.1

| Condition | Action | Repair Problem Found |
|--|--|---|
| 1. After completing the action for condition 3 from table 5-4, correct voltage is still missing at pin 3 of 15V regulator. | Unplug P701 from address decoder module and retest voltage readings at pin 3 of 15V regulator. | If voltage readings returned to normal, check wiring to address data receiver. If OK, replace data receiver module. |

Table 5-12. Conditions and Corrective Action for Step 2 of Paragraph 5.6.1 - continued

| Condition | Action | Repair Problem Found |
|--|---|---|
| 2. Voltage readings at pin 3 of either regulator are still low or not present. | Unplug P306 from tuning control board and retest voltages at pin 3 of either regulator. | If voltage readings returned to normal, check wiring to address data decoder. If OK, replace data decoder module. |
| 3. Voltage readings at pin 3 of either regulator are still low or not present. | Replace P701 and P306 and go to table 5-4 condition 5. | None. |

5.6.2 General Symptom 2: (Terminal will not authorize, update, or receive addressable commands.)

Step 1. Check headend to be sure that addressable signal is present and has proper amplitude; if OK, go to step 2.

Note

These tests must be made from a headend cable drop that incorporates an active addressable signal.

Step 2. Eliminate the data receiver by performing the action indicated for the conditions listed in table 5-13.

Table 5-13. Conditions and Corrective Action
Step 2 of Paragraph 5.6.2

| Condition | Action | Repair Problem Found |
|---|---|--|
| 1. Unit will not authorize or update. | Place scope probe on pin 2 of connector P701 of the address decoder module. (X10 probe at .5V per div) Result should display very fast pulse train at an amplitude of 4-5 Vdc peak to peak. | |
| 2. No pulse train present. | Temporarily replace the address receiver with a known good unit. Retest as described in Action 1 above | If pulse train now present, replace data receiver module. |
| 3. Pulse train still not present. Pin 2 of P701 is low. | Remove temporary address receiver and reconnect existing module. Temporarily replace the address decoder module with a known working unit. | If pulse train now present, check data decoder wiring. If OK, replace data decoder module. |
| 4. Pulse train still not present. | Remove temporary address decoder and reconnect existing module. Temporarily replace the up/down converter with a known working unit. | If pulse train now present, replace up/down converter module. |
| 5. Pulse train is present, but unit still will not authorize or update. | Temporarily replace data decoder module. Reauthorize terminal using new address code. Test to see if unit will now update. | Replace address decoder module. |

Table 5-13. Conditions and Corrective Action
 Step 2 of Paragraph 5.6.2 - continued

| Condition | Action | Repair Problem Found |
|--|---|-------------------------------|
| <div style="text-align: center; border: 1px dashed black; padding: 5px; width: fit-content; margin: 0 auto;"> CAUTION </div> <p>Remember, if you have to replace a data decoder module, you have changed the unique address identity code of that 8500 terminal. A stick on label with the new address is provided with the replacement module. Make sure that this new address is used in testing the unit and that only the new address is used when the unit goes back in service.</p> | | |
| 6. Same | Replace PROM with known, good unit. | Replace PROM. |
| 7. Same | It is possible that information is being distorted by a defective control microprocessor. | Replace tuning control board. |



SECTION 6
PARTS LIST AND DRAWINGS

6.1 INTRODUCTION

This section contains the parts list, block diagrams, and wiring diagrams for the 8500.

6.2 PARTS LIST

Table 6-1 lists the replaceable parts and modules for the 8500. When ordering parts from Scientific-Atlanta, always include the S-A part number, part description, unit serial number, unit name, and subassembly name.

6.3 DRAWINGS

Block and wiring diagrams for the 8500 are given in figures 6-1 through 6-6. The drawings are grouped by configuration; that is, basic A, B, and C.

Table 6-1. 8500 Parts List

| Part Number | Description | Model Number |
|-------------|---|--------------|
| S288147 | Ch. 3 Basic Unit | 8500300 |
| S288148 | Ch. 3 Descrambled Units | 8500310 |
| S288149 | Ch. Descrambled - Add. Unit Std. Frequency | 8500311 |
| S288150 | Ch. 3 Descrambled - Add. Unit Custom Frequency | 8500312 |
| S288151 | Ch. 4 Basic Unit | 8500400 |
| S288152 | Ch. 4 Descrambled Unit | 8500410 |
| continued | | |

Table 6-1. 8500 Parts List - continued

| Part Number | Description | Model Number |
|-------------|---|--------------|
| S288153 | Ch. 4 Descrambled - Add. Unit Std. Frequency | 8500411 |
| S288154 | Ch. 4 Descrambled - Add. Unit Custom Frequency | 8500412 |
| S288188 | Remote Control Unit | 8550075 |
| D288189 | Descrambler Ch. 3 | ENBD80301 |
| D288190 | Descrambler Ch. 4 | ENBD80401 |
| D288191 | Up/Down Converter Ch. 3 | ENBT80301 |
| D288192 | Up/Down Converter Ch. 4 | ENBT80401 |
| D288193 | Tuning Control Board Ch. 3 Programmable | ENBC8A301 |
| D288194 | Tuning Control Board Ch. 3 Addressable | ENBC8B301 |
| D288825 | Tuning Control Board Ch. 4 Programmable | ENBC8A401 |
| D288826 | Tuning Control Board Ch. 4 Addressable | ENBC8B401 |
| D288195 | Remote Control Receiver | EUR-411 |
| D288196 | Addressable Receiver 108.2 MHz | ENBR80801 |
| D288197 | Addressable Decoder | ENBA80001 |
| D288198 | Power Transformer | TPT5725 |
| D288199 | Keypad Assembly | - - - |
| D288700 | AC Outlet | ENB-RSPA001 |
| D288701 | Rubber Foot | ENB-SSMOT |
| D288702 | Case With Smoke board | ENB-BDPA001 |
| D288703 | A. C. Cord | ENB-WPPA001 |
| D288704 | Light Emitting Diode -3 digit display | ENB-LN536RA |
| D288705 | F - Connector | - - - |
| D288706 | Key Pad Buttons | ENB-8TS01 |
| D288707 | Smoke Board | - - - |
| D288708 | Screw for Rubber Foot | XTN3+6FFX |
| | continued | |

Table 6-1. 8500 Parts List - continued

| Part Number | Description | Model Number |
|-------------|-------------------------|--------------|
| D289005 | Power Relay | AR39080 |
| D289006 | +15 Volt Regulator | AN7815 |
| D289007 | +5 Volt Regulator | AN7805 |
| D289008 | Torx Screw | ENB-SRM01 |
| D289017 | Up/Down Converter Screw | XYN3+C5FXS |
| D289018 | Washer | - - - |
| D289020 | L. C. Screw | XTN3+6CFX |
| D289021 | Transformer Screw | XSTH+8FX |
| D289022 | Transformer Washer | XWE4FX |
| D289023 | Transformer Nut | XNG4HFX |

NOTE

To ensure proper security, sale of these parts is limited to either an 8500 customer or an authorized Scientific-Atlanta repair center.

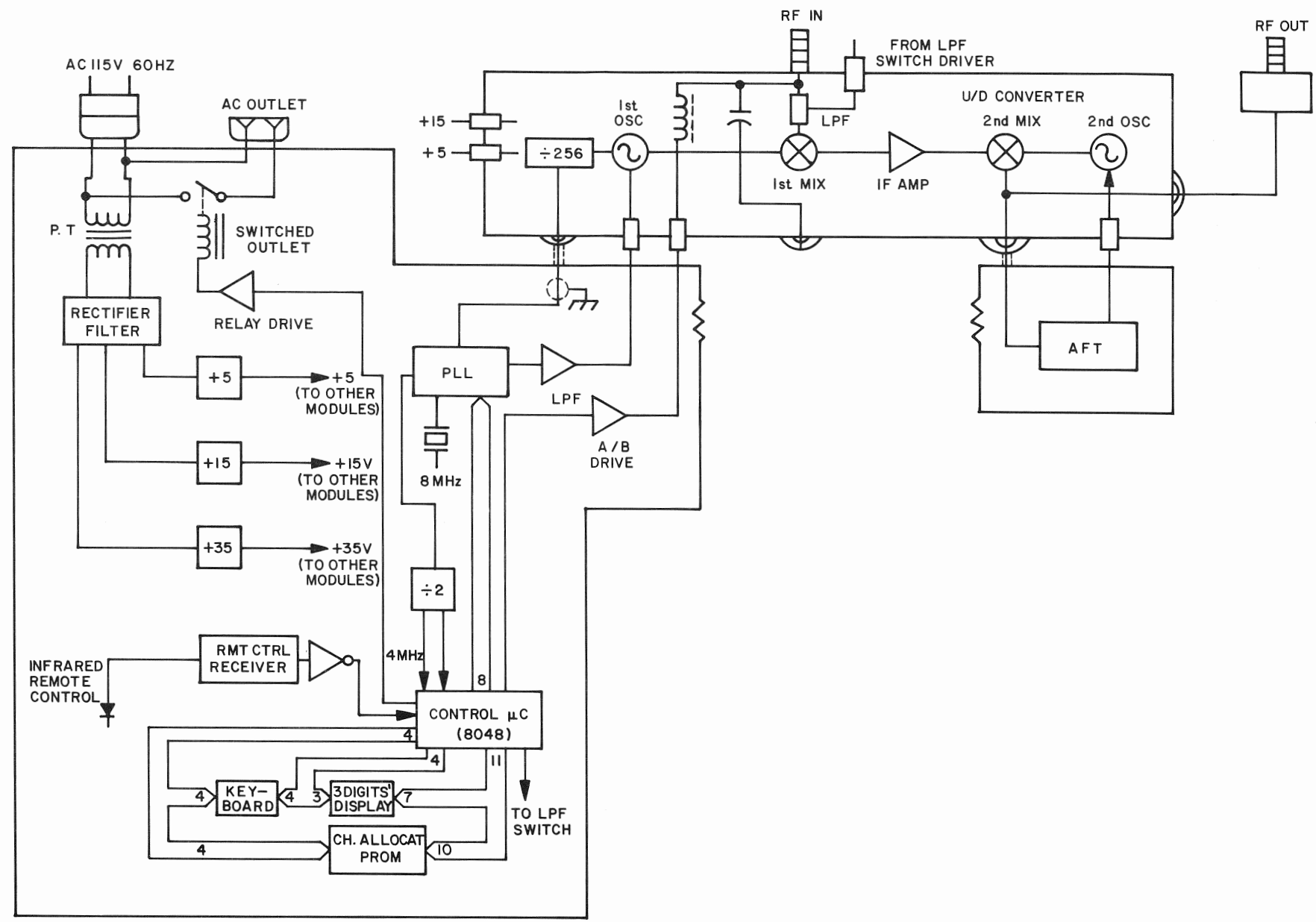


Figure 6-1. Block Diagram, Basic A Configuration

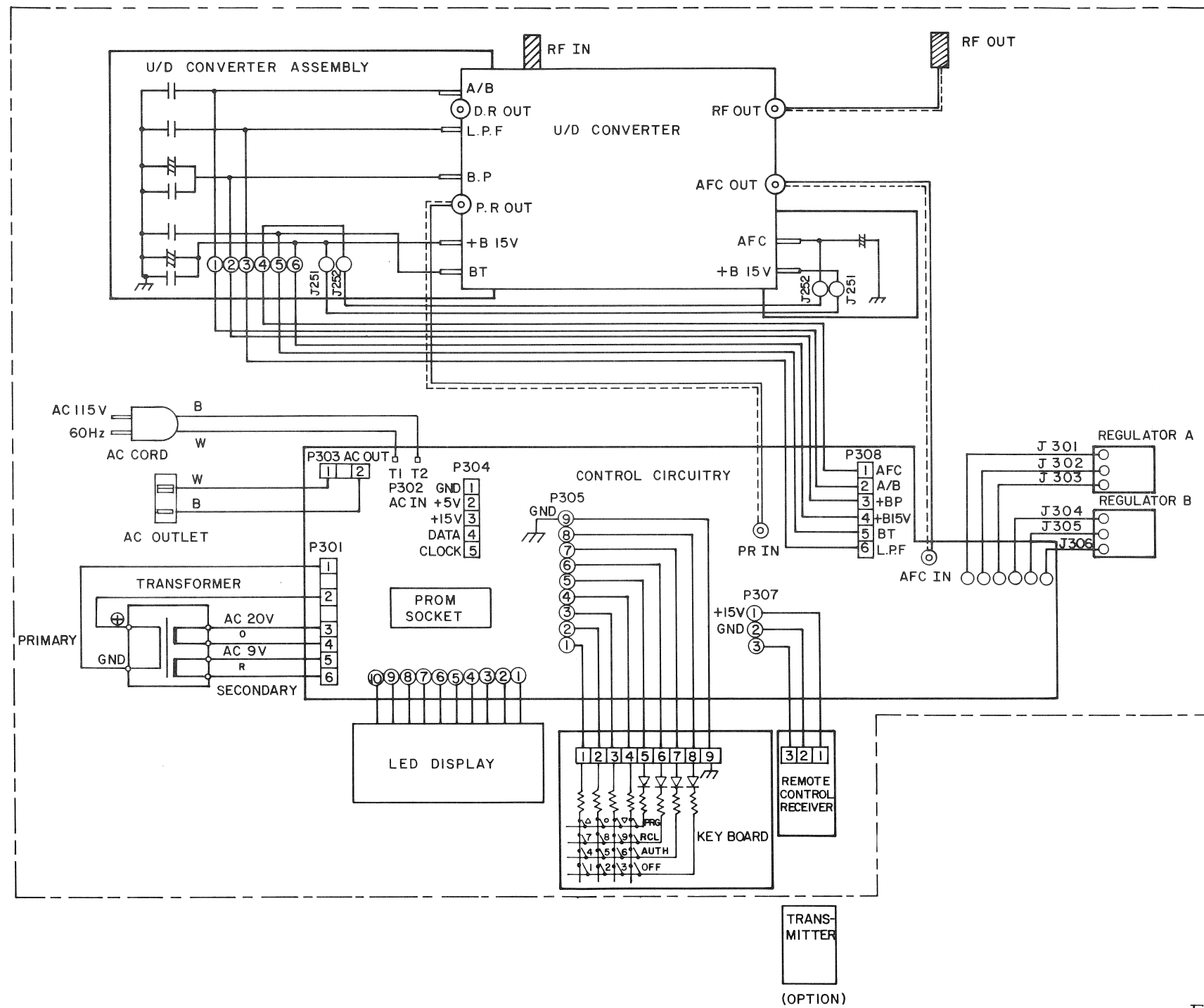


Figure 6-2. Wiring Diagram, Basic A Configuration

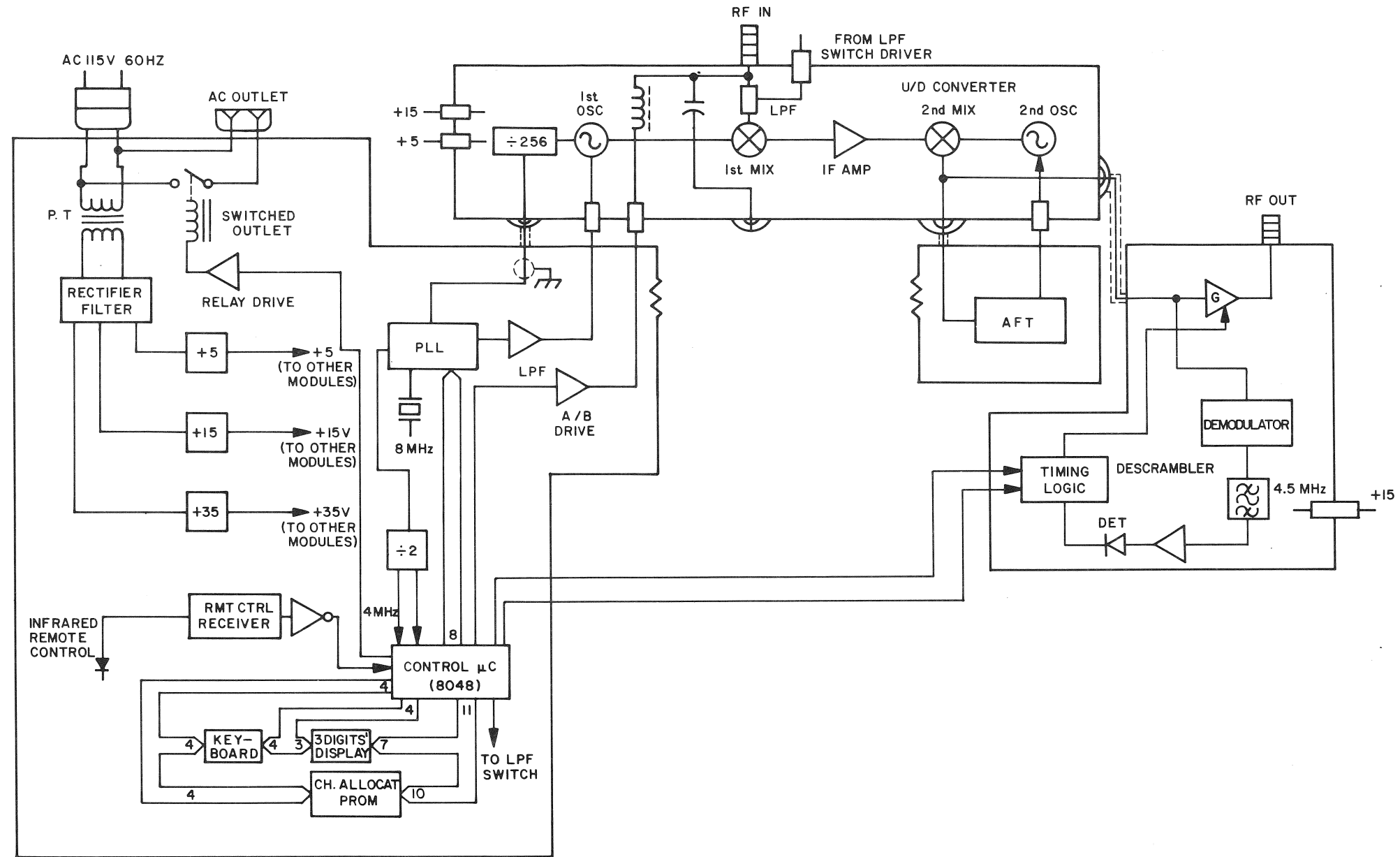


Figure 6-3. Block Diagram, Basic B Configuration

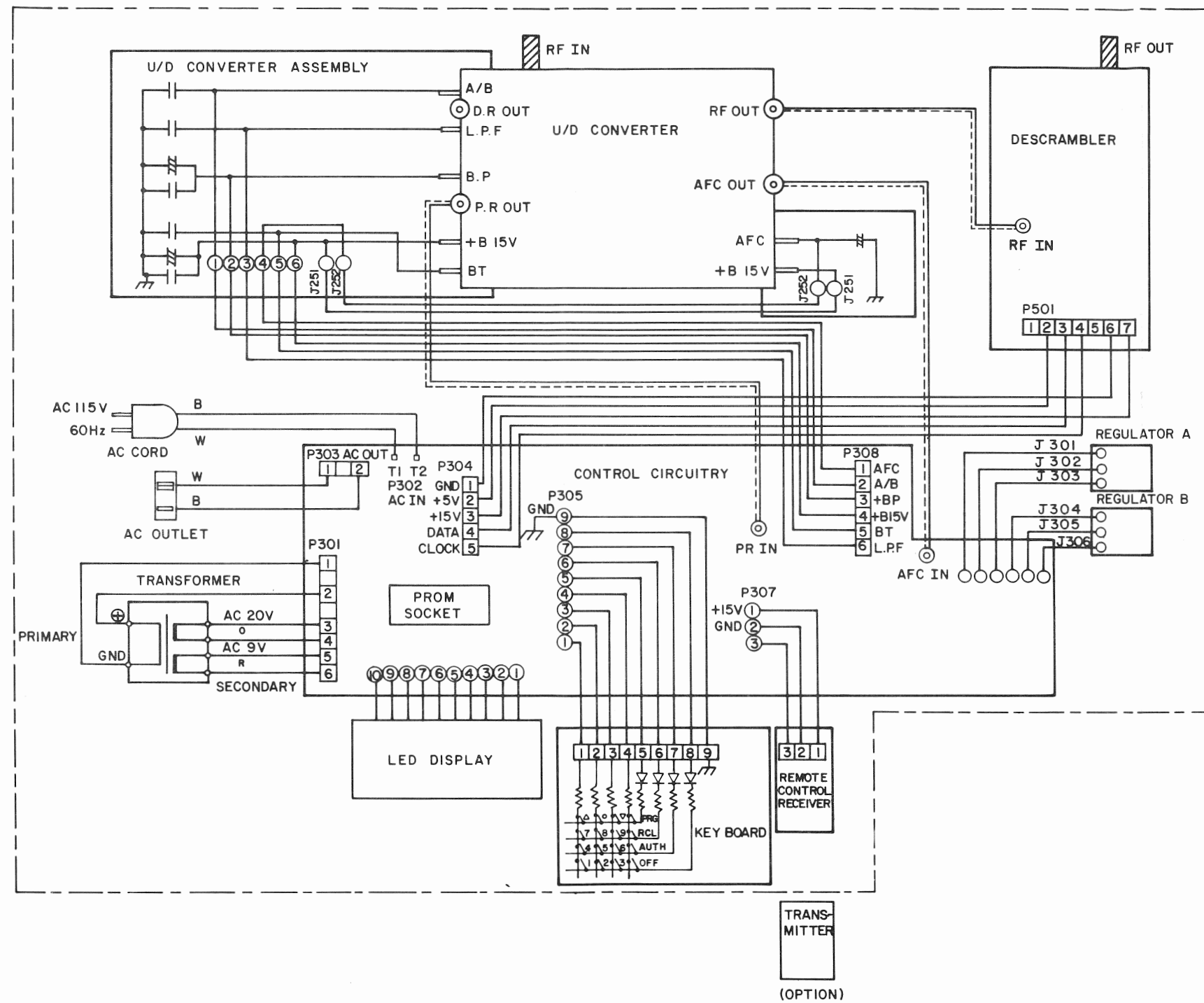


Figure 6-4. Wiring Diagram, Basic B Configuration

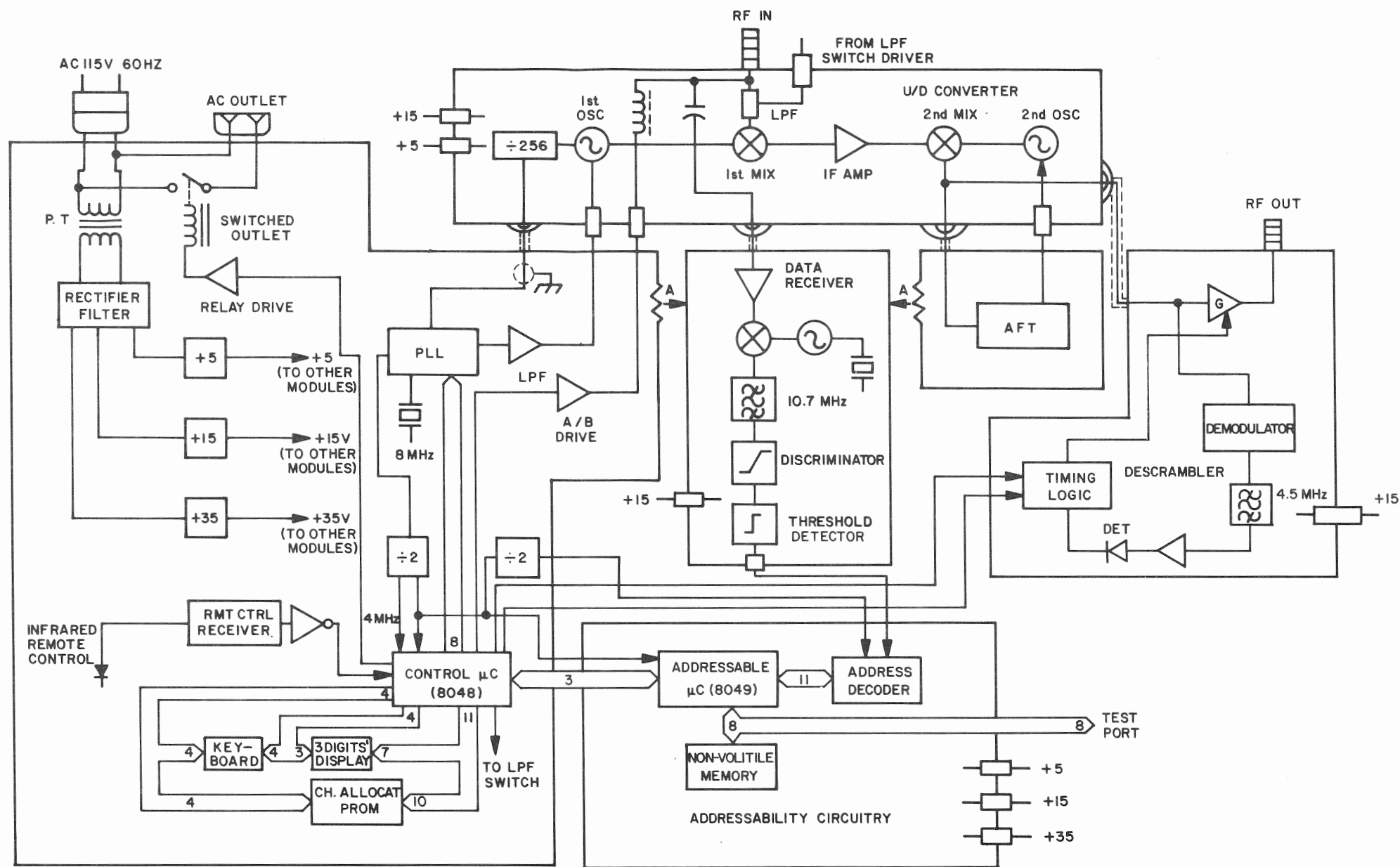


Figure 6-5. Block Diagram, Basic C Configuration

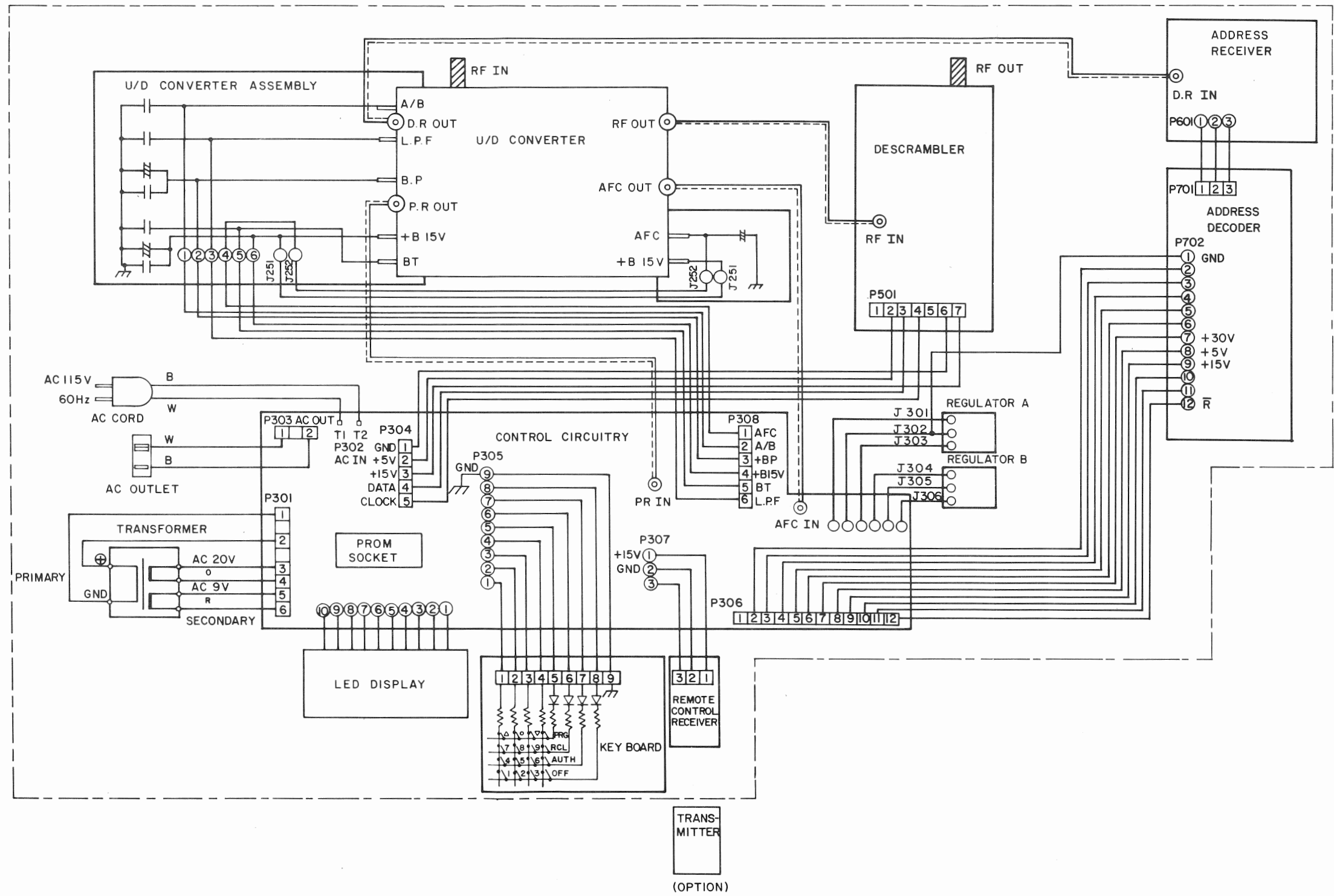


Figure 6-6. Wiring Diagram, Basic C Configurations

**Cable Operator's Manual
Series 8500 Set-Top Terminal**

Reader's Comments

This manual was compiled to answer commonly asked questions and to supply you with service information we felt you should know. However, it is conceivable that some of this information supplied could jeopardize the security of the 8500. For your protection, as well as ours, please make sure this manual is delegated to a responsible person within your organization.

From time to time, we will be sending updates and other technical information to be included in this manual. In keeping with Scientific-Atlanta's policy on product improvement, most of these updates will reference a Design Version change. (For information on how to find the Design Version of the 8500 Set-Top Terminals you have, see page 1-7 of this manual.) To ensure that you are sent manual updates, be sure that you fill out this reply card and mail it right away.

If you should have a special person or department you would like this information sent to, please let us know. We will be glad to modify our mailing list to comply.

Your comments and suggestions will help us in our continuous effort to improve the quality and usefulness of our publications.

What is your general reaction to this manual?

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