RCA

Broadcast Equipment

BTR-15B
Remote Control System

ES-561157, ES-561158-26
and ES-561158-110

IB-8027591-1 P

WARRANTY ITEMS

Particular parts and/or equipment covered by warranty are specifically stated as such in the warranty or contract given to the customer at the time of sale. The warranty or contract also stipulates the conditions under which the warranty may be exercised.

To obtain a new replacement for such warranty items, contact your local RCA sales office and please supply Product Identification (including the Original Invoice Number, MI Number, Type Number, Model Number, and Serial Number) and Replacement Part Identification (including Stock Number and Description). Requests for warranty replacements may be unduly delayed if all this information is not supplied.

EQUIPMENT LOST OR DAMAGED IN TRANSIT

When delivering the equipment to you, the truck driver or carrier's agent will present a receipt for your signature. Do not sign it until you have (a) inspected the containers for visible signs of damage and (b) counted the containers and compared with the amount shown on the shipping papers. If a shortage or if evidence of damage is noted, insist that notation to that effect be made on the shipping papers before you sign them.

Further, after receiving the equipment, unpack it and inspect thoroughly for concealed damage. If concealed damage is discovered, immediately notify the carrier, confirming the notification in writing, and secure an inspection report. This item should be unpacked and inspected for damage WITHIN 15 DAYS after receipt. Report all shortages and damages to RCA, Communication Systems Division – Camden, New Jersey 08102.

RCA will file all claims for loss and damage on this equipment so long as the inspection report is obtained. Disposition of the damaged item will be furnished by RCA.

FIELD ENGINEERING SERVICE

RCA Field Engineering Service is available at current rates. Requests for field engineering service may be addressed to your RCA Broadcast Field Representative or the RCA Service Company, Incorporated – Broadcast Service Division – Camden, New Jersey 08102. Telephone 609-963-8000.

Broadcast Equipment

Instructions

BTR-15B Remote Control System

ES-561157, ES-561158-26 and ES-561158-110

Communications Systems Division/Front and Cooper Streets/Camden, New Jersey, U.S.A. 08102

BP744M

IB-8027591-1P

OPERATING HAZARDS

This equipment is designed to fully safeguard all personnel from operating hazards. Labels and warning notices on the equipment and warning and caution notices in the Instruction Book clearly point out these potential hazards and hazards that necessarily exist.

Before operating this equipment, read the following comments and take the necessary precautions to protect operating personnel. Safe operating practices are the responsibility of the station personnel.

HIGH VOLTAGE

High Voltages are present in this equipment which can cause serious injury or loss of life. High voltage circuits are enclosed to prevent accidental contact by personnel and have interlock switch circuits which open the primaries of power supply transformers and discharge high voltage capacitors whenever access to the equipment is required.

MICROWAVE RADIATION

Exposure of the human body to microwave radiation in excess of 10 mW/cm^2 (See Ref. A) may be unsafe and can result in blindness or other injury. Personnel must be fully protected from the microwave energy which may radiate from tubes or transmission line connections. All input and output R F connections, gaskets, and flanges must be leakproof and properly installed. Unless connected to an antenna, NEVER OPERATE MICROWAVE RADIATING EQUIPMENT WITHOUT A RADIATION ENERGY ABSORBING LOAD ATTACHED. Personnel must be prevented from looking into an open antenna while the equipment is operating.

X-RAYS

X-Ray radiation may be produced by energized VHF and UHF equipment. Personnel must be protected by appropriate shielding. Adequate shielding on all sides of the tubes and equipment is provided as well as on the auxiliary equipment. X-Ray Warning signs or labels are permanently attached to the equipment (where necessary) directing personnel not to operate the equipment without proper X-Ray shielding.

Reference A:

Federal Communications Report No. 7104
VHF-UHF Radiation Hazards and Safety Guidelines
July 19, 1971

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LIST OF ILLUSTRATIONS

TECHNICAL SUMMARY

ELECTRICAL SPECIFICATIONS

Control Functions . . . . . 30 (15 raise; 15 lower)
Metering Functions . . . . . 15 plus calibration
Control Output . . . . . one ampere, 120 Vac or Vdc, 50 W non-inductive load
Meter . . . . . 100 μA F.S.
Metering Stability . . . . . better than 1% with weekly checks
Metering Accuracy . . . . . 2% or better of full scale
Telemetry Input Requirements . . . . . approx. 1V for full scale deflection of studio meter; nominal 20 k resistive floating input; insulated for 350 Vdc
Calibration Controls . . . . . .multiturn potentiometers
Calibration Voltage Source . . . . . internal regulated power supply
Telemetry Frequencies
  Audible . . . . . .800-1200 Hz
  Subaudible . . . . . 20-30 Hz
Control Frequencies . . . . . .300-400 Hz
Interconnection Requirements
  BTR-15BW . . . . . voice grade telephone circuit; line level 0 dBm, adjustable; 30 dB allowable loss; line impedance 600 ohms; dc continuity not required
  BTR-15BR
    Control Circuit . . . . . internal subcarrier generator and demodulator provided. Studio unit output & transmitter unit input: 1.5 V p-p, 2000 ohms nominal, unbalanced. Nominal subcarrier frequencies, 26 kHz or 110 kHz
    Telemetry Circuit . . . . . metering signal generator (20-30 Hz) provided. Transmitter unit output: up to 6 V p-p behind 600 ohms unbalanced. Studio unit input: 1.5 V p-p, bridging, unbalanced.
    Optional Telemetry Subcarrier (SCA) Generator . . . . . .26 kHz to 185 kHz (67 kHz typical), internally mounted; 0.5 V rms, 2 ohms, unbalanced, nominal; 2 V rms max.
Operating Temperature Range . . . . . -20°C to 60°C
Power Requirements . . . . . .120/240 Vac, ±10%, 50-60 Hz. Studio unit and transmitter unit, each 20 W, nominal
Duty Cycle . . . . . continuous

MECHANICAL SPECIFICATIONS

	Size	Net Weight	Shipping Weight
Studio Unit	5-1/4"H x 19"W x 13-1/2"D (133 x 483 x 343 mm)	19 lbs. (8.6 kg)	30 lbs (13.6 kg)
Transmitter Unit	5-1/4"H x 19"W x 13-1/2"D (133 x 483 x 343 mm)	22 lbs (10 kg)	35 lbs. (16 kg)

Shipping Information (studio unit plus transmitter unit) . . . . . .65 lbs. (30 kg); approx. 5.2 cu. ft. (.15 cu m)

REMOTE CONTROL SYSTEMS

BTR-15BW – AUDIBLE CONTROL AND AUDIBLE METERING RETURN OVER VOICE GRADE TELEPHONE LINE (DC CONTINUITY NOT REQUIRED)

ES-561157

Quantity	Description	Reference
1	Transmitter Unit	MI-561187
1	Studio Unit	MI-561188
	One copy of IB-8027091-1 provided with each of the above MI's.	
1	Meter (Install in studio unit)	MI-561444-120

BTR-15BR – AUDIBLE CONTROL OVER INTERNAL SUBCARRIER GENERATOR AND DEMODULATOR, AND SUBAUDIBLE METERING RETURN OVER OPTIONAL INTERNAL SUBCARRIER GENERATOR AND DEMODULATOR

ES-561158-26
(26 kHz control subcarrier recommended for AM radio use)

Quantity	Description	Reference
1	Transmitter Unit	MI-561189-26
1	Studio Unit	MI-561190-26
	One copy of IB-8027091-1 provided with each of the above MI's.	
1	Meter (Install in studio unit)	MI-561444-120

ES-561158-110
(110 kHz control subcarrier recommended for FM use)

Quantity	Description	Reference
1	Transmitter Unit	MI-561189-110
1	Studio Unit	MI-561190-110
	One copy of IB-8027091-1 provided with each of the above MI's.	
1	Meter (Install in studio unit)	MI-561444-120

Custom systems can be supplied with any specified subcarrier frequency from 26 kHz to 185 kHz. Standard systems are available with optional frequencies of 26, 41, 67, 110, 135, or 185 kHz.

PRINTED CIRCUIT MODULES

BASIC SUBASSEMBLIES MI-560191-*

MI-560191-1	Control Generator
MI-560191-2	Control Tone Bandpass Filter
MI-560191-3	Audible Metering Demodulator
MI-560191-4	Subaudible Metering Demodulator
MI-560191-5	Control Demodulator
MI-560191-6	Audible Metering Generator
MI-560191-7	Subaudible Metering Generator
MI-560191-8	Subcarrier Generator, 26 kHz

MI-560191-9	Subcarrier Generator, 110 kHz
MI-560191-10	Subcarrier Demodulator, 26 kHz
MI-560191-11	Subcarrier Demodulator, 110 kHz
MI-560191-12	Jumper, Subcarrier Generator Board
MI-560191-13	Jumper, Subcarrier Demodulator Board
MI-560191-14	Transmitter Unit, Power Supply Regulator
MI-560191-15	Studio Unit, Power Supply Regulator

ACCESSORIES

Extra Meters (specify ranges)	MI-561444-*
Meter Panels	
One Meter	ES-561443-1
Two Meter	ES-561443-2
Three Meter	ES-561443-3
Telemetry Subcarrier Generator (67 kHz)	MI-561181-1
Program BTX-1B Subcarrier Generator including LP filter and Power Supply (specify frequency)	ES-560640
BTX-1B Program Subcarrier Generator Module (specify frequency)	MI-560714
Voltage Pickup, 115/230 Vac	MI-27516
Tower Light Monitor and Control Unit	MI-27519
Tower Light Monitor	MI-27544
Power to Linear Converter, Type PLC-1	MI-561179
Relay, DPDT, 120 Vac Coil	MI-561471-1
Panel Relay (For 8 MI-561471 Relays)	MI-561470
Sampling Kit, Plate Voltage	
Type PVK1, 1-3 kV	MI-561482-1
Type PVK2, 3-10 kV	MI-561485-2
Type PVK3, 10-20 kV	MI-561483
Relay, DPDT, 24 Vdc Coil (socket included)	MI-561448-1
Relay, DPDT, 120 Vac Coil (socket included)	MI-561448-2
Relay, Latching DPDT, 24 Vdc Coil (socket included)	MI-561448-3
Relay, Time-Delay, DPDT, 24 Vdc Coil (socket included)	MI-561448-4
Panel, Relay (For 8 MI-561448 Relays)	MI-561449
Metering Insertion Unit, Type MIU-1	MI-561458
Metering Recovery Unit, Type MRU-1	MI-561459
Monitor Adapter, Modulation, Type MMA-1	MI-561460
Chopper-Stabilized DC Amplifier, Type CSA-3	MI-561461
Tower-Light Monitor Kit, Type TLK-1	MI-561462
Line-Voltage Monitor Kit, Type LVK-1	MI-561463
Sampling Kit, Plate Circuit, Type MBB-1	MI-561464
Temperature Sensing Kit, Type TSK-1	MI-561465
Indicator, Status-Studio System, Type SCS-2	ES-561156
Alarm, Tolerance, Type TAU-2 (Frame only)	MI-561469
Alarm, Tolerance, Type TAU-2 (Module for above)	MI-561184
Combiner, Multi-System, Type MSC-1	MI-561479
Receiver, Telemetry, Type TMR-1	MI-561182
AM RF Voltage Kit RFK-1	MI-561193-1
FM RF Voltage Kit RFK-2 (3-1/8" Coax)	MI-561193-2
FM RF Voltage Kit RFK-3 (1-5/8" Coax)	MI-561193-3

DESCRIPTION

GENERAL

The RCA Model BTR-15B Remote Control System is designed to provide remote control and metering of standard AM and FM broadcast transmitters. The BTR-15B offers a total of 15 metering channels and 15 bi-directional control functions. Metering and control signals may be conveyed between studio and transmitter over a single voice-grade telephone circuit using the RCA Type BTR-15BW, or by radio link using the Type BTR-15BR.

The radio Type BTR-15BR generates a subcarrier which is multiplexed on the station STL link to send control signals to the transmitter. Transmitter metering signals are returned to the studio via a subcarrier multiplexed on the FM broadcast carrier signal, or in the case of AM, by subaudible modulation of the main broadcast carrier. A selection of control signal subcarrier frequencies is available as standard equipment, but any specified frequency of from 26 kHz to 185 kHz can be supplied on custom order. The standard 26 kHz system is recommended for AM radio and the 110 kHz system is recommended for FM.

In accordance with FCC regulations governing remote control systems, fail-safe provisions are incorporated in the BTR-15B that will operate to take the transmitter off the air in the event of failure of the remote control system or link.

EQUIPMENT

The BTR-15B comprises a studio unit and a transmitter unit. Each requires 5-1/4 inches of vertical 19-inch rack space. Pushbuttons on the studio unit permit selection of the desired control and metering channel. In each position, raise and lower (on or off) commands may be sent while return telemetry signals are simultaneously observed on the front panel meter. A simple strapping operation permits wiring of the signal

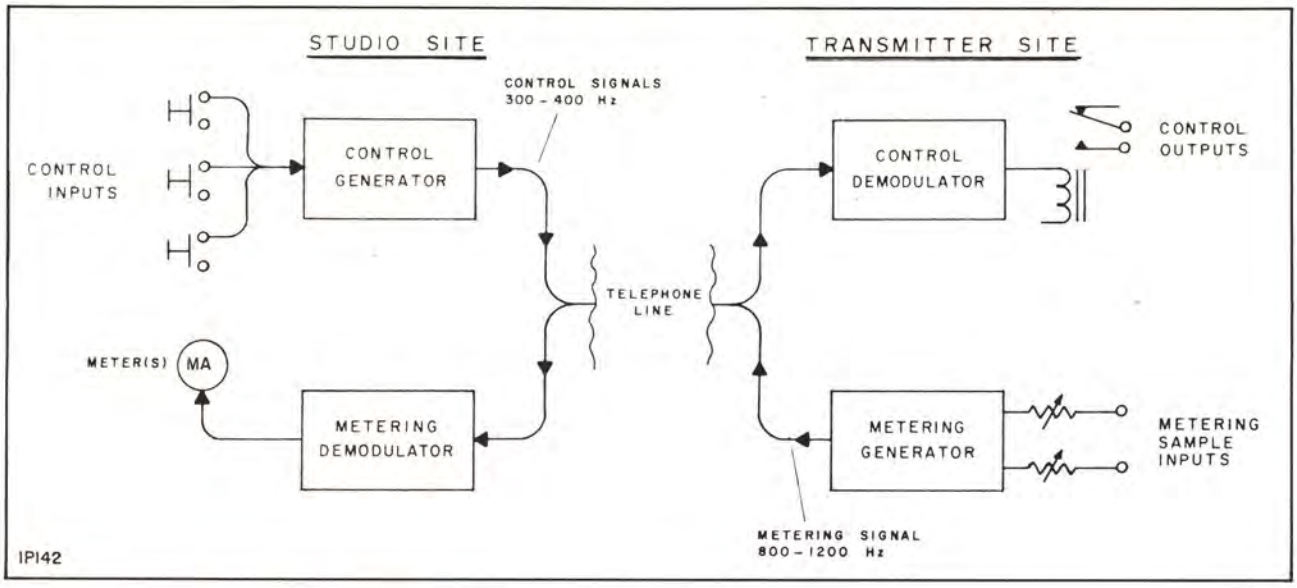


Figure 1. Basic BTR-15BW Wireline Remote Control System

to as many as four external meters. Certain of the plug-in circuit modules are used in both the wireline and radio systems.

Wireline AM and FM

The BTR-15BW for wireline operation, shown in the block diagram of figure 1, is the basic remote control system. Major modules of the studio unit are the control signal generator and metering signal demodulator. The transmitter unit contains a metering signal generator module and control demodulator module.

The studio unit sends control tones in the region of 300 to 400 Hz to the transmitter site. At the transmitter, the audible metering generator in the transmitter unit returns metering tones of 800 to 1200 Hz over the telephone line back to the studio unit.

Wireless FM

If the link is by radio rather than by telephone line, the BTR-15BR system for wireless operation is used. The basic BTR-15BR system is applicable to the FM station equipped with SCA facilities at the trans-

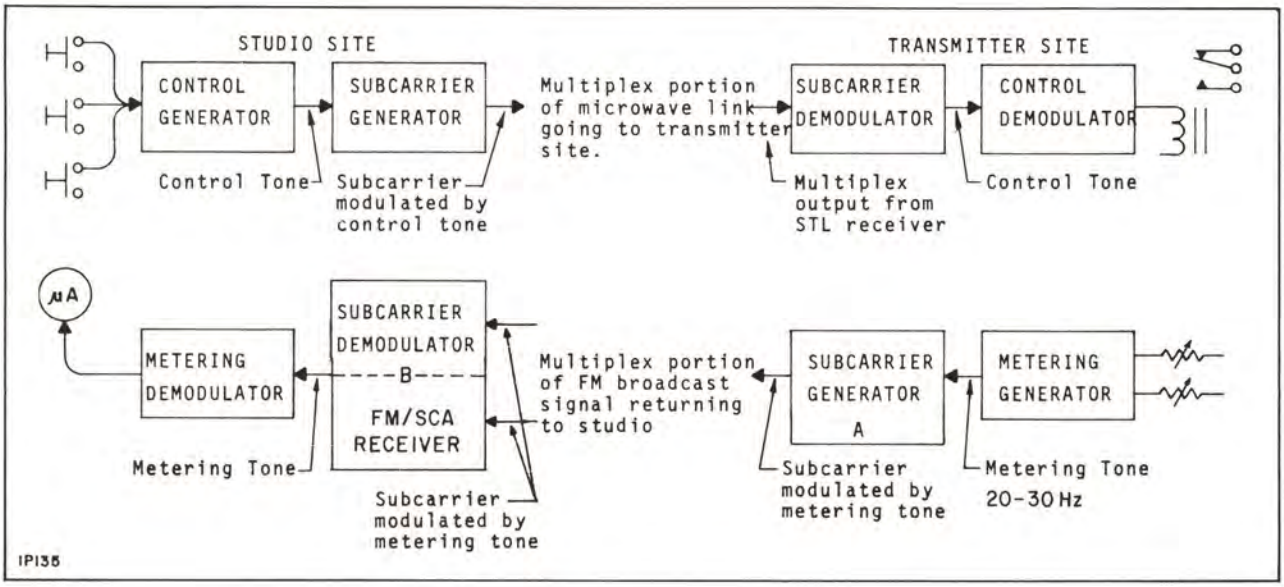


Figure 2. Basic BTR-15BR Wireless FM Remote Control System

mitter and an FM/SCA receiver at the studio. This system is shown in the block diagram of figure 2. The studio unit contains a subcarrier generator which is modulated by the control signals in the range of 300 to 400 Hz from the control generator. The output of the subcarrier generator is applied to the subcarrier input of an STL microwave link. The multiplexed subcarrier signal is then detected at the transmitter site by a subcarrier demodulator in the transmitter unit to provide the same control tone which originated at the studio.

Wireless AM

The BTR-15BR system for wireless remote control and metering of an AM broadcast transmitter is shown in the block diagram of figure 3. The studio unit sends control signals to the transmitter site on a subcarrier of the STL link, as in the FM transmitter system, but the metering tone is returned to the studio on the AM broadcast carrier. The metering signal is in the subaudible 20 to 30 Hz range and is applied directly to the AM carrier through use of the RCA MIU-1 Metering Insertion Unit, MI-561458. Modulation of the AM carrier is set to about 5%, 6% being the maximum allowed by FCC rules.

The return path for the metering signals in this system is also by subcarrier. The subaudible metering generator (20 to 30 Hz) in the transmitter unit frequency modulates subcarrier generator which is a part of the FM transmitter. The metering signal is multiplexed on the FM carrier as an SCA signal which is received and demodulated by an SCA receiver at the studio.

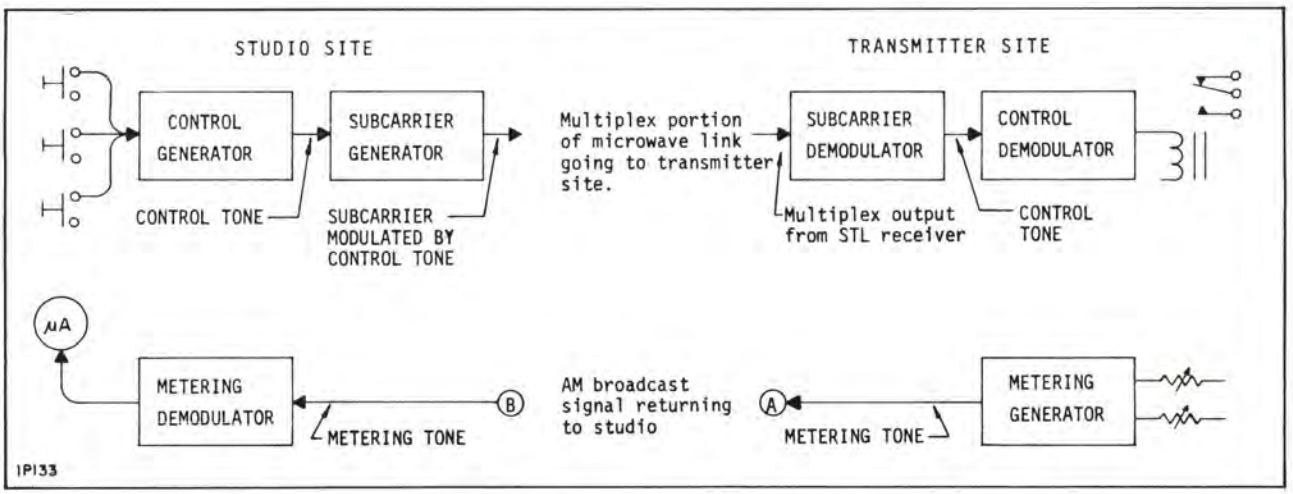


Figure 3. Basic BTR-15BR Wireless AM Remote Control System

When the metering signal is returned to the studio in this manner, it is customary to use the frequency range of 20 to 30 Hz for the metering signal. In this way, program material may also be broadcast on the SCA. The subaudible metering signal is usually adjusted to modulate the SCA subcarrier at about 14 dB below program level. Low pass filtering in the BTR-15BR keeps normal program material above 40 Hz out of the metering circuit.

If the FM station equipment does not include an SCA generator, an accessory 67 kHz (or other optional frequency) special telemetering (frequency response limited) subcarrier generator module can be plugged into the BTR-15B transmitter and studio units to provide the metering function of the transmitter at the studio.

CIRCUITS, STUDIO UNIT

The BTR-15B Remote Control System may be functionally divided into control circuits and metering circuits. Control signal flow is from the studio unit to the transmitter unit, and metering signal flow is from the transmitter unit to the studio unit.

The modules of the BTR-15B that perform the control and metering functions are described in the following paragraphs with reference to individual block diagrams and schematics.

Control Generator

The control generator module in the studio unit develops a control tone which is frequency shifted by control commands. The unit is shown in the block diagram of figure 4 and the schematic of figure 40.

The control generator idling frequency of the FM oscillator is 300 Hz. Any of four different commands shifts the frequency upward to about 400 Hz. Com-

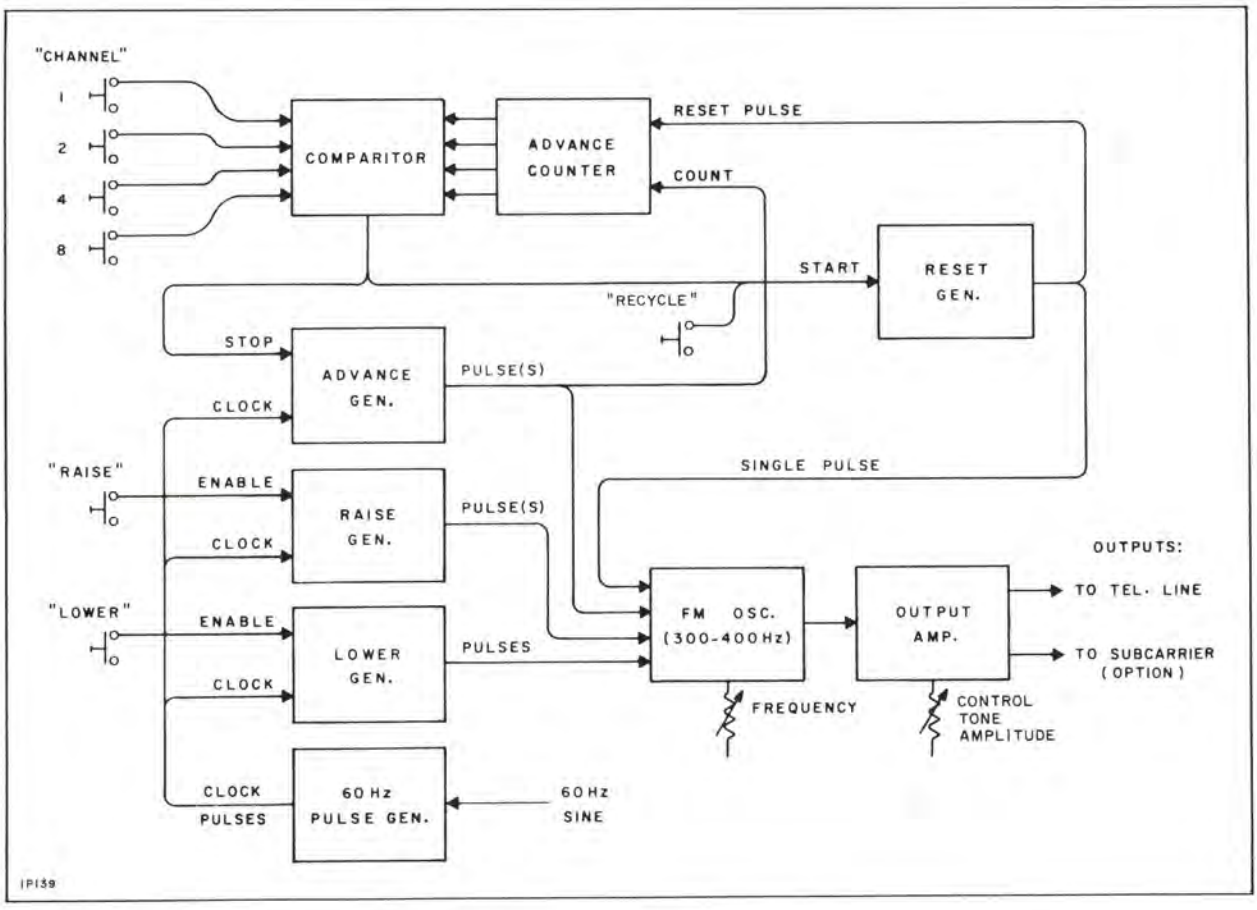


Figure 4. Control Generator, Block Diagram.

mands are in the form of pulses of different widths. One of these pulses is a channel advance or counting pulse (approximately 0.033 second duration) that determines which metering channel is selected, and enables selection of a specific raise/lower output terminal pair. Two other commands pulses operate the raise (0.066 sec.) and lower relays (0.133 sec.) in the transmitter unit. The longest pulse, (about 0.3 seconds) is a reset pulse. This is a single reset pulse triggered by pushing the front panel RECYCLE button.

The reset pulse returns the channel selecting electronics at the studio and transmitter sites to the start or calibrate positions, and resets the channel-counter at the studio.

To select a specific channel, the channel button is pushed where upon the advance provides a series of pulses which drive the advance counter unit until it develops a binary number which agrees with the number selected by the front panel pushbutton deck. When this occurs the advance generator stops, and the transmitter and studio units will be locked on the same channel.

The raise or lower commands may be applied only when the system is not resetting or advancing to a new channel.

The remaining digital circuitry on the control generator board separates the commands by appropriate time delays to electronically lock out simultaneous transmission of commands.

There are two adjustments on the module: the FREQUENCY control, R27, sets the idling frequency of the FM oscillator; and the CONTROL TONE AMPLITUDE control, R41, adjusts the level of the control tone to the telephone line. A second output is available for application to a subcarrier generator if a radio link is used.

Subcarrier Generator

The subcarrier generator is used in both the control and transmitter units of the BTR-15BR when metering signals are to be returned by broadcast carrier. However, if the system provides for programming, the operation may use the subcarrier in service with the FM Transmitter. Circuits are shown in the block diagram of figures 5, and in the schematic diagram of figure 41.

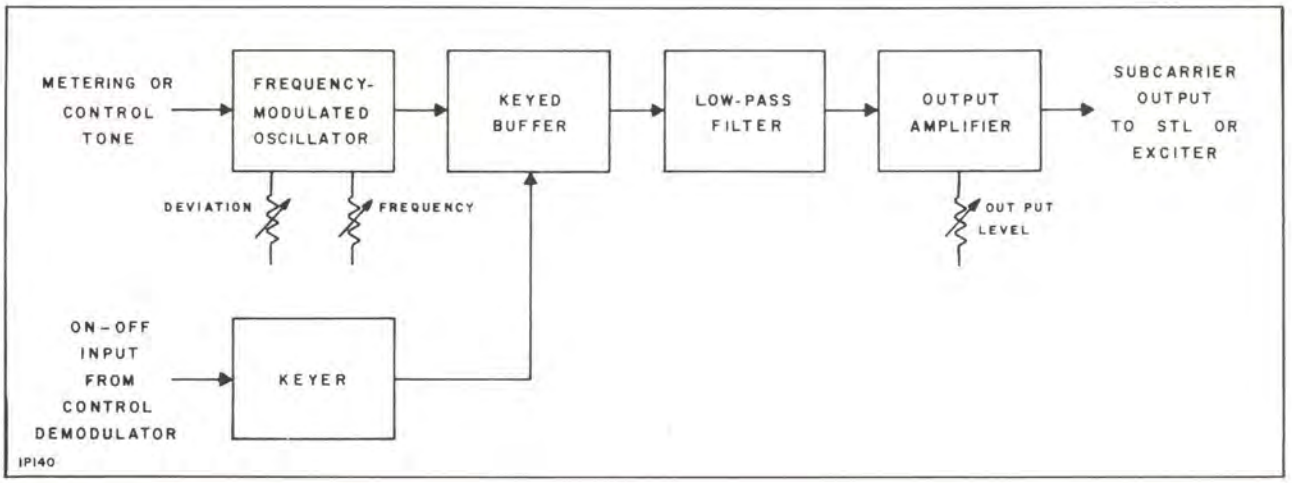


Figure 5. Subcarrier Generator, Block Diagram

Modulation, which can be 300 to 400 Hz control tones, or 20 to 30 Hz metering tones, is applied via a deviation adjustment to the modulated oscillator, which is a free running multivibrator with temperature compensation and voltage regulation. Typical frequency deviation is about 5 to 6% of carrier frequency for control purposes, and about 1% (or more) for metering. Output of the modulated oscillator is applied to a buffer amplifier, which can be keyed on or off by a 3.3 volt signal applied to a metering input terminal. This signal, if used, is normally supplied by the control demodulator module. By removing the keyer transistor, the subcarrier will always remain on. The output of the buffer is applied to a low pass filter for removal of the unwanted harmonics of the subcarrier, and amplified for application to an STL at the studio, or to an FM exciter for return of metering signals by broadcast carrier.

There are three controls on the subcarrier generator board: The DEVIATION frequency control, R1, permits adjustment of modulation (frequency deviation); the FREQUENCY control, R4, permits adjustment of oscillator center frequency; and the OUTPUT LEVEL control, R31, sets the output level of the subcarrier generator. If the subcarrier generator board is not required, a subcarrier generator jumper board must be installed in its place.

Subcarrier Demodulator

The subcarrier demodulator is used in the studio and transmitter units of systems where control signals are sent by an STL link and metering signals are returned by a broadcast carrier. Its purpose is to demodulate an RF subcarrier to extract control or metering signals. Circuits are shown in the block diagram of figure 6 and the schematic of figure 42.

The input to this module is derived either from the multiplex output of an STL receiver, or the composite output of an FM monitor or receiver. The subcarrier signal and its important sidebands are passed by the input bandpass filter, while program material and other unwanted components are rejected. Output of the bandpass filter is applied to a limiter where amplitude variations are removed and the subcarrier signal is turned into a square wave. This signal is then applied to a pulse counting demodulator circuit. The output of the demodulator is applied to a 4000 Hz low pass filter where

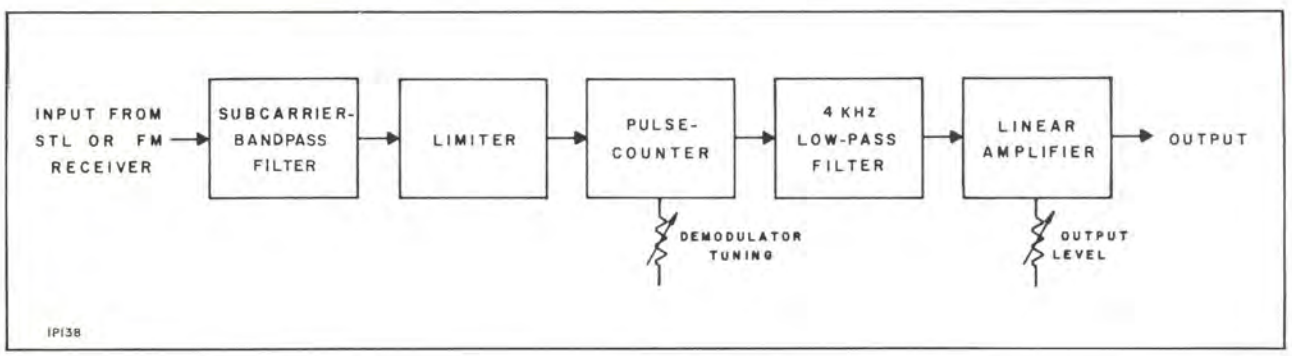


Figure 6. Subcarrier Demodulator, Block Diagram

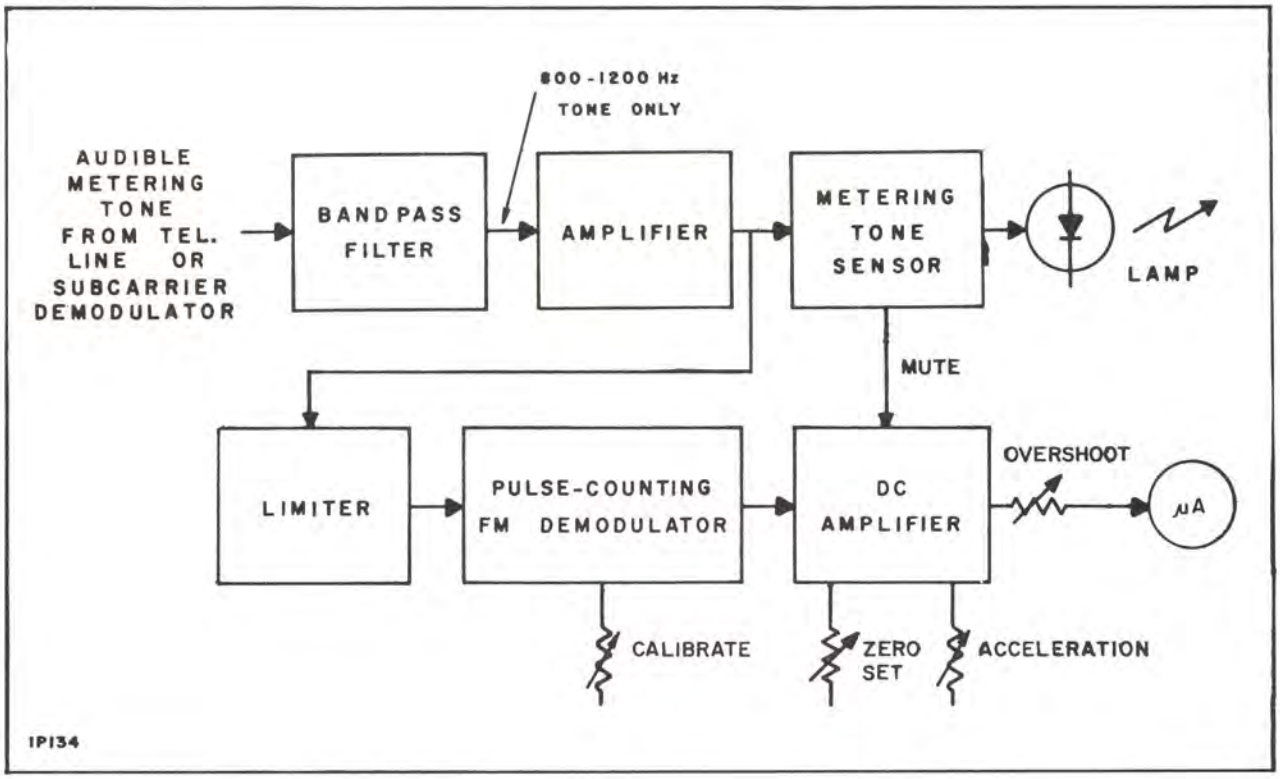


Figure 7. Audible Metering Demodulator, Block Diagram.

the subcarrier and possible high frequency beat notes are rejected. Metering signals in the 20 to 30 Hz range, and control signals in the 300 to 400 Hz range are passed by this filter. Output of the filter is amplified by the linear amplifier, IC1.

Adjustments on this module are the DEMODULATOR TUNING control, R9, and the OUTPUT LEVEL control, R17. Adjustment of the subcarrier bandpass filter, which is tunable, is covered in the TUNING section. If the subcarrier demodulator board is not required, a subcarrier demodulator jumper board must be installed in its place.

Audible Metering Demodulator

The audible metering demodulator is located in the studio unit, and processes the metering tone into a direct current suitable for application to the studio unit meter. Circuits are shown in the block diagram of figure 7 and the schematic of figure 43.

An on-board strapping option allows selection of metering recovery from either the telephone line or a subcarrier demodulator. The selected signal is applied to a bandpass filter which extracts the 800 to 1200 Hz tone and applies it to limiter and level sensing circuits. The latter allows the front panel metering-read lamp to be energized. The limiter drives a pulse-counting demodulator employing a Schmitt trigger and monostable multivibrator. The output of this demodulator is applied to a dc amplifier which is arranged so as to provide considerable control over the meter ballistics. In addition, the input level sensor is connected to a muting system so that the meter comes to rest near zero when the metering tone is of insufficient amplitude.

Adjustment of the ACCLERATION control, R42, and the OVERSHOOT control, R45, are given in the TUNING section. Two more controls, electrically connected but located on the front panel (figure 39, studio unit) are the ZERO SET control, R3, for adjusting meter zero position (tone at 800 Hz), and the CALIBRATE control, R4, for adjusting meter deflection in the calibrate mode (tone at 1000 Hz).

Subaudible Metering Demodulator

The subaudible metering demodulator is located in the BTR-15BR studio unit. This module converts the subaudible metering signal into a direct current suitable for application to the studio meter. Circuits are shown in the block diagram of figure 8 and in the schematic of figure 44.

The signal applied to this board possibly could have program material on it as well as the subaudible

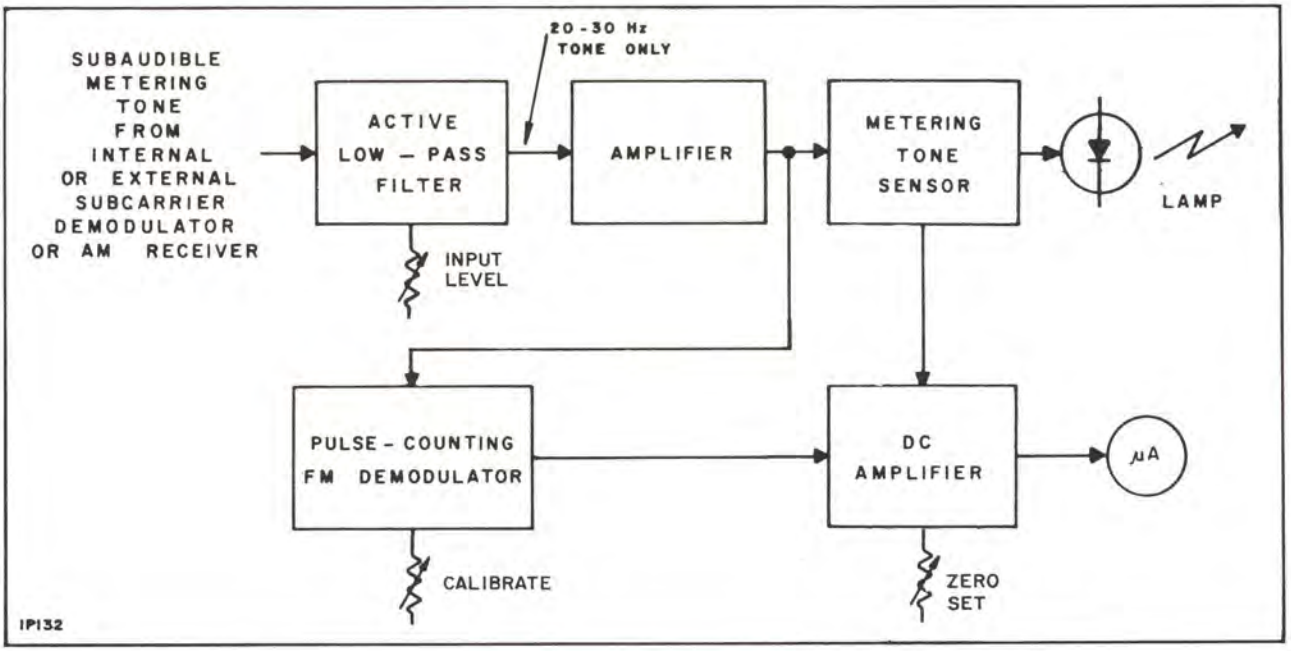


Figure 8. Subaudible Metering Demodulator, Block Diagram.

metering signal. The active low pass filter rejects the program material and passes only the subaudible signal.

This filter significantly outperforms a conventional L-C filter at the frequencies involved (20 to 30 Hz). Following the filter, the signal is amplified for application to a Schmitt trigger which shapes the sinusoidal signal into a square wave as required to trigger a monostable multivibrator. The monostable and associated circuitry form the last stage of the pulse-counting demodulator. The output of this demodulator is applied to a dc amplifier which has a frequency cutoff of about 5 Hz. In this way, the 20 to 30 Hz signal is kept from causing "dither" or quivering of the meter pointer, while still maintaining a reasonable rate of response for the meter movement. The output of the Schmitt trigger is connected to a muting system to cause the meter to come to rest near zero when the metering tone is of insufficient amplitude.

The only adjustment on this board is an INPUT LEVEL control, R1 (figure 39, studio unit). The ZERO SET (R3) and CALIBRATE (R4) controls are on the front panel.

Power Supply

Power input of 120/240 volts 50/60 Hz is applied to the studio unit through an ac line filter and a 1/4 ampere slo-blo fuse. The power supply is normally shipped connected for 120 volt ac input. To verify or to change the power input connections, refer to the schematic diagram, figure 39. Power supply resistors and diodes are mounted on a printed circuit board. Output is 15 Vdc regulated and 5 Vdc regulated. A 17 volt rms sine wave is also supplied to the control generator for sync purposes.

CIRCUITS, TRANSMITTER UNIT

Circuits of the transmitter unit are shown in the schematic of figure 45. This unit of the BTR-15BR employs subcarrier generator and subcarrier demodulator modules which are described under CIRCUITS, STUDIO UNIT.

Control Bandpass Filter

Output from the subcarrier demodulator in the BTR-15B, or the telephone line in the case of the BTR-15BW, is fed to the control bandpass filter. A jumper or resistor is installed on this board, depending upon whether the BTR-15B is a radio or wireline version. Refer to the schematic diagram of figure 46.

Control Demodulator

This module in the transmitter unit receives and processes the 300 Hz frequency modulated control tone originating in the studio unit. Circuits are shown in the block diagram of figure 9 and in the schematic of figure 47.

Control tones are extracted by a bandpass filter followed by an amplifier and limiter which provide a constant-amplitude signal for the FM demodulator. The demodulated pulses are then separated by four pulse-

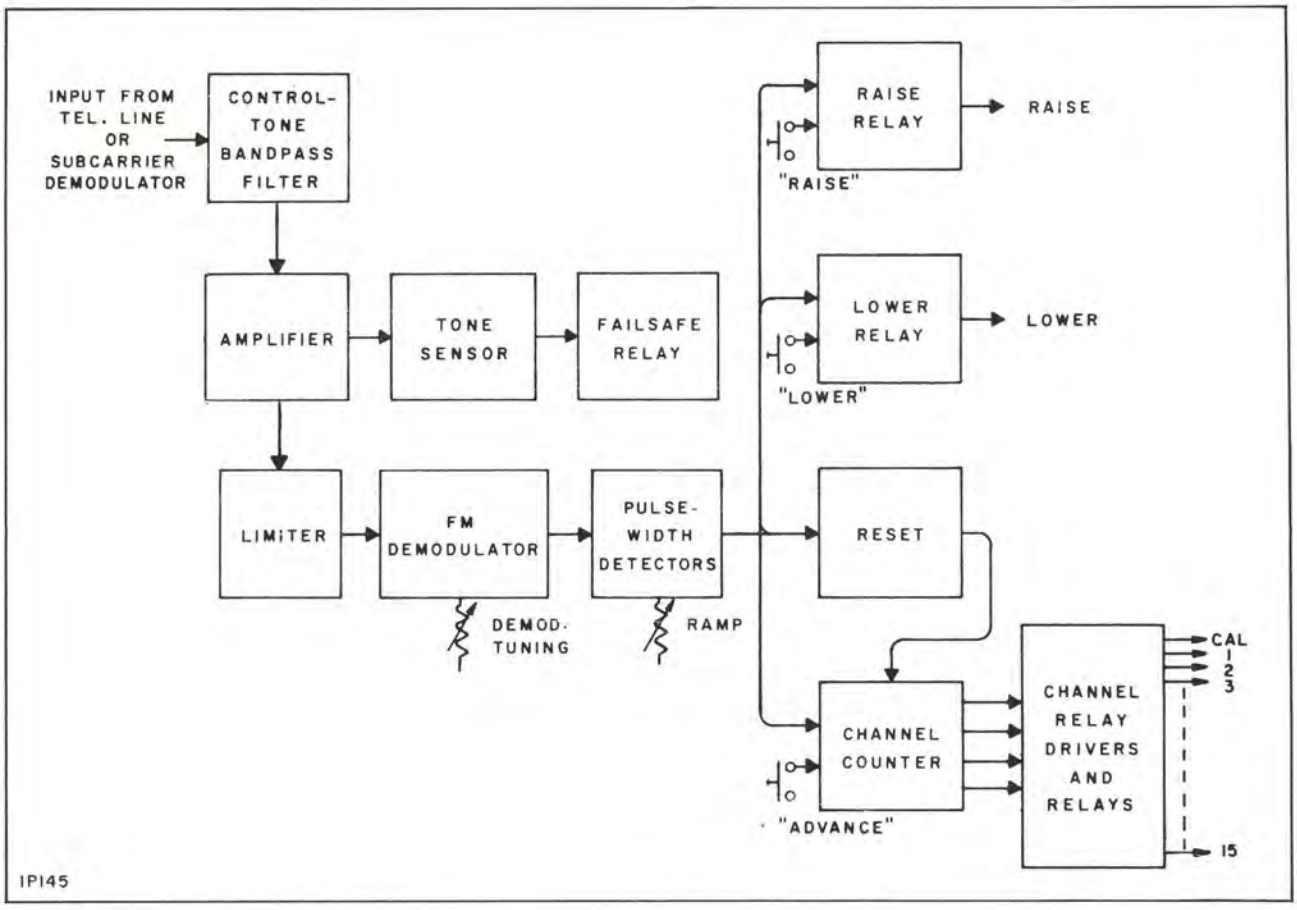


Figure 9. Control Demodulator, Block Diagram

width detectors into reset pulses, channel advance pulses, and raise or lower relay pulses. The control tone level sensor deenergizes fail safe relay K19, if the control tone should fail. Other circuitry permits local control of the unit by means of the front panel buttons, and to interlock circuits for proper sequencing.

The DEMOD TUNING control R27, sets the operating point of the pulse counter, and the RAMP control R41, allows the various pulses to be correctly separated according to width. For proper adjustment procedures, refer to the TUNING section.

Audible Metering Generator

This module is used in the BTR-15BW transmitter unit to convert the dc metering sample into an audible tone of 800 to 1200 Hz for transmission back to the studio on a telephone line. Circuits are shown in the block diagram of figure 10 and in the schematic diagram of figure 48.

The metering sample is applied to an adjustable gain dc amplifier which shapes the output to audible frequencies and applies them to a voltage-controlled

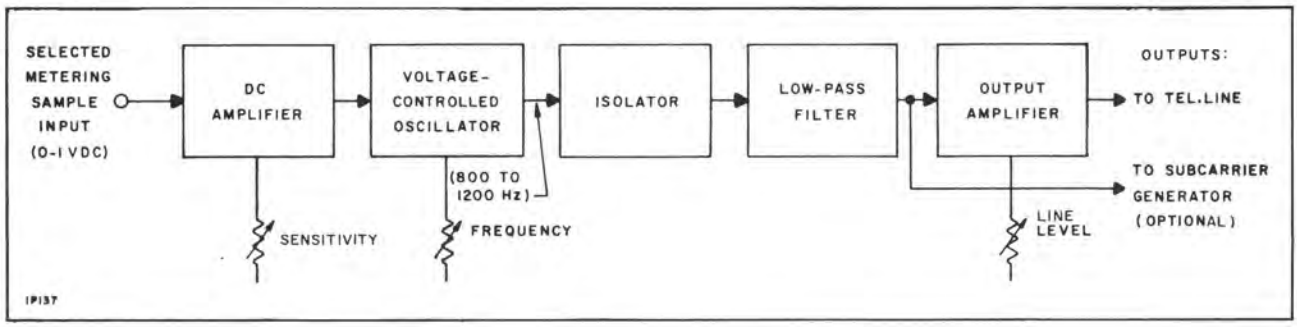


Figure 10. Audible Metering Generator, Block Diagram

oscillator. This oscillator, with no metering input, idles at a frequency of 800 Hz. This frequency is shifted upward in direct proportion to the amplitude of the applied metering signal. Its upper limit of 1200 Hz, representing full scale deflection of the studio meter, is reached upon application of a one-volt dc sample.

The entire module, including power supply and regulators, floats with no connection to ground. To translate the output of the voltage-controlled oscillator to ground, an optical isolator is used. The output of this device is a square wave which is applied to a low pass filter for conversion to a sine wave. This is applied to an output amplifier to drive the telephone line. An output is also available for application to a subcarrier generator, should a radio return link, such as with the BTR-15BR, be used.

Adjustments on this module include: an idling FREQUENCY control, R11, for tuning the voltage-controlled oscillator; SENSITIVITY control, R4, for adjusting the gain of the dc amplifier for full scale sensitivity; and a LINE LEVEL control, R33, for adjusting the level of the metering signal applied to the telephone line.

Subaudible Metering Generator

This module is located in the transmitter unit of the BTR-15BR system. It converts the dc metering sample into a 20 to 30 Hz signal which may be sent back to the studio unit on a subcarrier or other return link capable of passing 20 Hz. Circuits are shown in the block diagram of figure 11 and in the schematic diagram of figure 49.

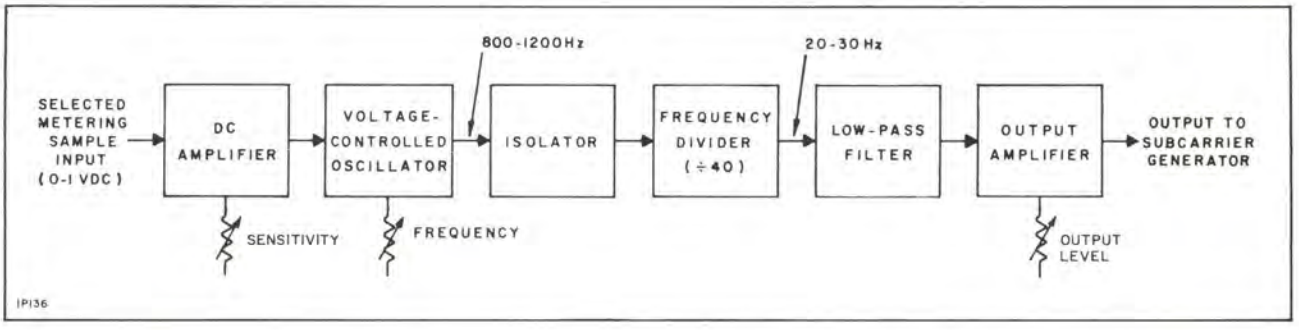


Figure 11. Subaudible Metering Generator, Block Diagram.

The metering sample is applied to a dc amplifier which has a roll-off to reduce its response above 30 Hz. Its output is applied to a voltage-controlled oscillator. This oscillator, with no metering input, idles at a frequency of 800 Hz. Frequency is shifted upwards in direct proportion to the amplitude of the applied metering signal. Its upper limit of 1200 Hz, representing full-scale deflection of the studio meter, is reached upon application of a one-volt dc sample.

The entire module, including power supply and regulators, floats electrically with no connection to ground. To translate the output of the voltage-controlled oscillator down to ground, an optical isolator is used. The output of this device is applied to an integrated circuit divider chain for frequency scaling down to the 20 to 30 Hz region. The output of this divider chain is a square wave which is applied to a low pass filter for conversion to a sine wave. This sine wave is applied to an adjustable-gain amplifier which drives either the internal metering return SCA subcarrier generator or an external subcarrier system.

Adjustments on this board include: an idling FREQUENCY control, R11, for tuning of the voltage-controlled oscillator; SENSITIVITY control, R4, for adjusting the gain of the dc amplifier for full scale sensitivity; and an OUTPUT LEVEL control, R32, for adjusting the level of the metering signal applied to the subcarrier generator.

Power Supply

Power input of 120/240 volts 50/60 Hz is applied to the transmitter unit through an ac line filter and a 1/2 ampere slo-blo fuse. The power supply is normally shipped connected for 120 Vac input. To verify or to change the power input connections, refer to the schematic diagram of figure 45.

The power supply printed circuit board holds most of the power supply resistors and diodes. Output of the power supply is 15 Vdc and 5 Vdc regulated, 22 Vdc, -15 Vdc and a -15 Vdc auxiliary unregulated. Also included is a floating unregulated power supply providing 15 Vdc, -15 Vdc with floating common.

PRE-INSTALLATION CHECK

It is recommended that the front panels be pulled forward for a brief superficial inspection. Be sure the various printed circuit boards are secure, the integrated circuits and transistors are seated in their sockets, and that the fuse-holder caps are installed. The rear door of the transmitter unit should be swung down and the relays and fuses confirmed as being in place.

Check the subcarrier generator frequency determining parts for installation and correct value, as presented in table 1. See figure 41. Check the subcarrier demodulator frequency determining parts for installation and correct value, as presented in table 2. Refer to figure 42.

One Studio Unit, one Transmitter Unit, and two instruction manuals are shipped with each system as standard items.

TABLE 1. SUBCARRIER GENERATOR, FREQUENCY DETERMINING PARTS

Frequency	26 kHz	39 or 41 kHz	67 kHz	110 kHz	135 kHz	185 kHz
CA	1500	1000	560	390	270	220
CB	1500	1000	560	390	270	220
CC	1500	750	470	470	330	120
CD	270	150	120	68	91	36
CE	3300	1500	1000	680	620	270
CF	680	1200	470	270	220	75
CG	2000	1500	820	220	240	150
LA	22	10	4.7	3.9	2.2	2.2
LB.	15	4.7	3.9	2.2	2.2	2.2

Values shown in picofarads and millihenries, ±5% or better.

TABLE 2. SUBCARRIER DEMODULATOR, FREQUENCY DETERMINING PARTS

	26 kHz	39 kHz	41 kHz	67 kHz	110 kHz	185 kHz
CA	1500	1110	1110	910	910	180
CB	2000	680	620	1000	1500	910
CC	250	75	68	82	75	75
CD	680	390	360	430	510	100
CE	160	51	43	75	47	51
CF	680	390	360	430	510	100
CG	250	75	68	82	75	75
CH	2000	680	620	1000	1500	910
CI	1500	1110	1110	910	910	180
LA	33	33	33	10	3.3	3.3
LB	33	33	33	10	3.3	3.3
LC	33	33	33	10	3.3	3.3
LD	33	33	33	10	3.3	3.3

Values shown in picofarads and millihenries, ±5% or better.

INSTALLATION

GENERAL

Appropriate locations should be selected in rack cabinets for the studio and transmitter units of the BTR-15B. Both units should be mounted at heights that are convenient for use and for observation of meter readings. Since the studio unit will receive frequent operator attention during the routine controlling and logging operation, its location at the studio should receive careful attention. Since the transmitter unit may require occasional adjustment of front panel controls, its location is also important. It is suggested that the transmitter unit be located so as to provide easy access for weekly calibration. In each case, rack cabinets should be well bonded to a good ground system.

NOTE: It is highly recommended that no connections be made to the BTR-15B by installing personnel until the basic concepts of system operation are understood. The reader is referred to these concepts as they are presented in the preceding chapter, under DESCRIPTION, and with particular reference to the system block diagrams of figures 1, 2 and 3.

BTR-15B SYSTEM INTERCONNECTIONS

Installation of studio and transmitter units may proceed as soon as installation personnel are thoroughly familiar with the principles involved in the particular BTR-15B system to be used.

The first stage of installation will involve the studio and transmitter units only; no connections will be made to the transmitting equipment. After the units are installed and operation is confirmed, the remainder of the installation may be accomplished.

The control path to the transmitter site, and the metering path to the studio should be completed.

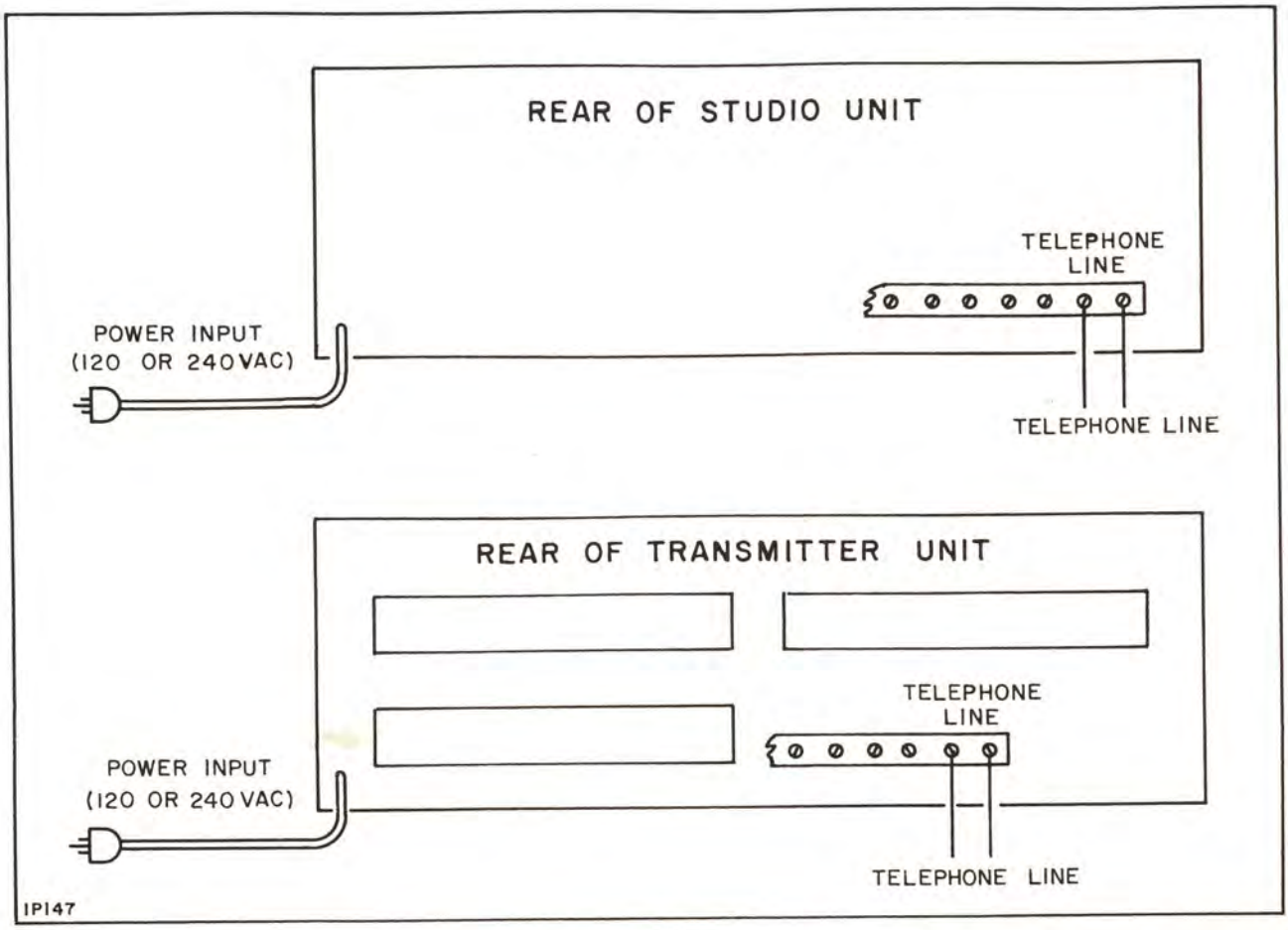


Figure 12. Telephone Line Interconnections

BTR-15BW Studio-Transmitter Units

In the case of the BTR-15BW, the interconnecting link is simply a telephone line to carry control tones of 300 Hz to 400 Hz produced at the studio unit and metering tones of 800 to 1200 Hz produced at the transmitter unit. Figure 12 illustrates the telephone line connections to the rear of these units. Make these connections. Then with reference to figures 39 and 45, verify the power transformer primary connections in each unit for the power source to be used.

The next step is to check that control signals originating at the studio are received correctly at the transmitter. For this test, make no connections to the control terminals or metering terminals of the transmitter unit (figure 23). The test for return of metering signals is described later.

With power applied to both units, press the RAISE button on the studio unit. This should make the raise relay, K17, pull in. Pressing the LOWER button should make the lower relay, K18, pull in. Pressing a numbered button on the studio unit should energize the correspondingly numbered relay at the transmitter unit.

Should there be a problem at this point, check interconnections between studio and transmitter units to be sure each line is carrying the correct signal. To assist in initial setup, recommended standards are given in table 3. The first three measurements involving the telephone line are made at the telephone line terminals. Refrain from making internal adjustments unless a reading is definitely unsatisfactory.

BTR-15BR Studio Unit

Figure 13 illustrates subcarrier and radio equipment connections to the studio and transmitter units of the BTR-15BR wireless systems shown in figures 2 and 3. At the rear of the studio unit, the CONTROL OUTPUT jack normally delivers a subcarrier signal which is frequency-modulated by the control tone (300 to 400 Hz). This signal is to be routed to the STL transmitter multiplex or subcarrier input. If an external subcarrier generator is to be used, the internal generator is removed and replaced with a jumper/terminating board (figure 18). The connector will then deliver the control tone itself.

Metering input to the studio unit is normally applied from the output of a telemetry receiver, or any receiver capable of extracting the metering tone from the AM or FM broadcast carrier. For FM, an SCA receiver modified for telemetry purposes is customarily used. For AM, any receiver with a 1.5 volt peak-to-peak subaudible output may be used. (The studio unit of the BTR-15B can be easily modified to increase its sensitivity by as much as 20 dB above this figure).

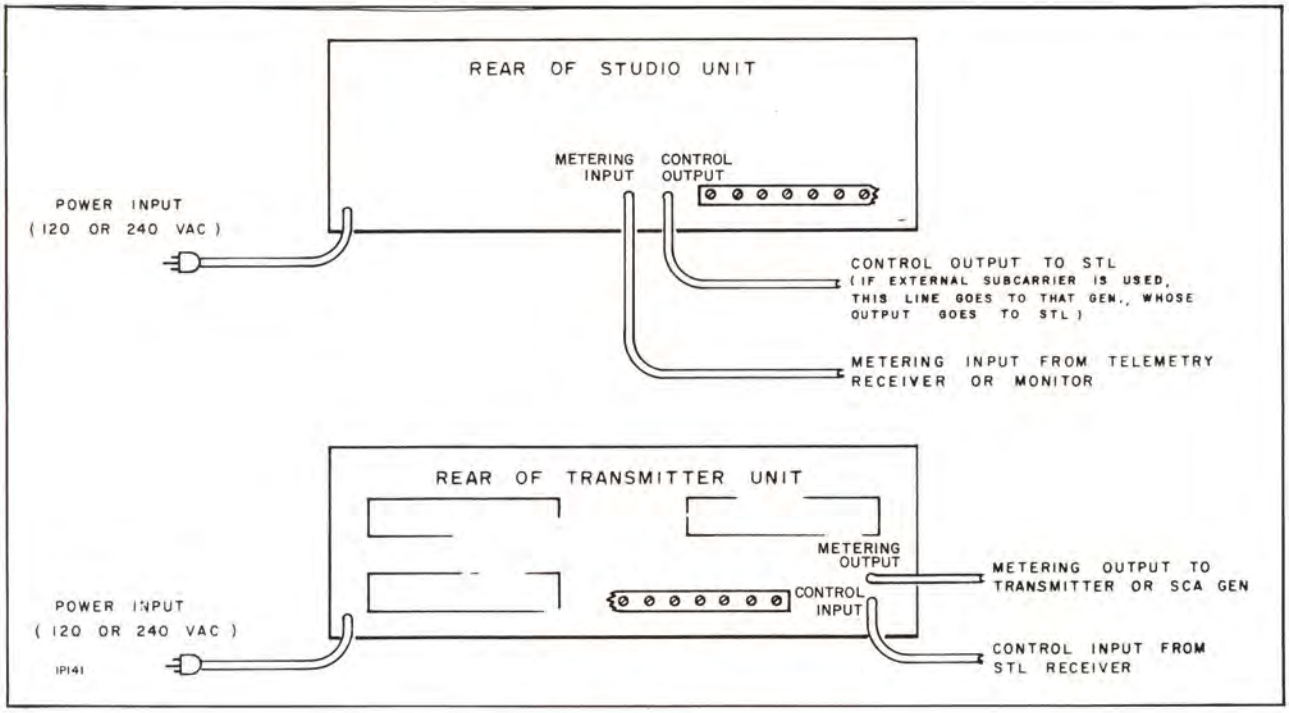


Figure 13. Wireline Interconnections

TABLE 3. RECOMMENDED CONTROL AND METERING STANDARDS

Control or Signal	Level
Control tone leaving studio	0 dBm
Metering tone leaving transmitter	0 dBm
Maximum telephone line loss, 300 Hz to 1200 Hz (with 0 dBm send level at each end of line)	30 dB
Subcarrier generator output at studio site (used for control; connects to STL transmitter)	1.5 volts peak-to-peak
Subcarrier demodulator input at transmitter site (used for control; driven by STL receiver)	1.5 volts peak-to-peak of subcarrier
Subcarrier generator output at transmitter site (used for metering return to studio; connects to FM transmitter)	Adjustable up to 6 volts peak-to-peak
Subcarrier demodulator input at studio site (used for metering; driven by FM receiver)	1.5 volts peak-to-peak of subcarrier
Control signal direct output at studio (connects to external subcarrier generator)	1.5 volts peak-to-peak
Control signal direct input at transmitter site (driven from STL via external subcarrier demodulator)	1.5 volts peak-to-peak
Metering signal direct output at transmitter site (connects to AM transmitter or to external subcarrier generator)	Subaudible: up to 6 volts peak-to-peak, adjustable. Audible: approximately 1.5 volts peak-to-peak, fixed
Metering signal direct input at studio site (driven from AM or SCA receiver)	1.5 volts peak-to-peak of metering signal
Modulation of AM transmitter by metering signal	5% (6% maximum)
Deviation of SCA subcarrier at FM transmitter site by metering signal	800 Hz

Make connections that link the studio and transmitter units as indicated in figure 13, but do not connect control terminals or metering terminals of the transmitter unit (figure 23) to the broadcast transmitter equipment at this time. With reference to figures 39 and 45, verify the power transformer primary connections in each unit is for the power source that is to be used.

Next check that control signals are received correctly by the transmitter unit. The test for return of metering signals will be made later.

With power applied to both units, press the RAISE button on the studio unit. This should make the raise relay, K17, on the transmitter unit pull in. Pressing the LOWER button should make the lower relay, K18, pull in. Pressing a numbered button on the studio unit should energize the correspondingly numbered relay at the transmitter unit.

Should there be a problem at this point, check interconnections between studio and transmitter units to be sure each line is carrying the correct signal. To assist in initial setup, recommended standards are given in table 3. The measurements applicable to wireless systems are made at the type BNC connectors. Refrain from making internal adjustments unless a reading is definitely unsatisfactory.

If the metering signal to be fed to the studio unit is a sample of the undemodulated subcarrier as radiated from the FM transmitter, then an optional internal subcarrier demodulator is substituted (figure 18) for the jumper/terminating board in the studio unit.

BTR-15BR Transmitter Unit

The CONTROL INPUT connector of the transmitter unit is generally connected to the multiplex or subcarrier output of the STL receiver, and the internal subcarrier demodulator extracts from the subcarrier a replica of the control tones originating at the studio. If the signal to be fed into the CONTROL INPUT connector is in the form of an audible tone, as supplied by an external subcarrier demodulator, then the internal subcarrier generator must be replaced by a jumper/terminating board (figure 22).

The METERING OUTPUT jack of the BTR-15BR transmitter unit normally delivers 20 to 30 Hz metering tones. These may be applied to the subcarrier generator in the FM transmitter, or for AM, to the RCA accessory MIU-1 Metering Insertion Unit, MI-561458. If the FM transmitter is not equipped with a subcarrier generator, an accessory subcarrier generator board for telemetry is available to plug into the BTR-15BR transmitter unit in place of the existing jumper/terminating board (figure

22). The METERING OUTPUT jack will then deliver a tone-modulated subcarrier signal which may be applied directly to the transmitter multiplex input. If program service is to be accommodated along with the telemetry signal, the RCA BTX-1A Subcarrier Generator is recommended and no modification of the BTR-15BR will be necessary.

Telemetry SCA Generator (Optional)

As previously mentioned, an accessory plug-in subcarrier (SCA) generator board, MI-561181-1, (67 kHz) is available for telemetry use with the BTR-15B transmitter unit when the FM transmitter is not equipped with a subcarrier generator. This will of course require use of the optional plug-in subcarrier demodulator board at the studio unit. This accessory generator is for telemetry use only and will not carry program material.

The normal operating frequency of the accessory generator is 67 kHz, but other frequencies from 26 kHz to 185 kHz are available on special order. Subcarrier signal from the METERING OUTPUT jack may be fed conveniently into one of the telemetry input jacks J104 or J105 on the main frame of the RCA BTE-15 FM Exciter. When using either of these inputs, it will be necessary to jumper pin 4 to pin 1 on whichever jack is used. In this way, subcarrier input will be fed directly to input terminals 12 or 13 of the FM exciter. (See figure 50, IB-8027524 or 8027524-1).

BTX-1B Subcarrier Generator (Optional)

If program service is to accompany the telemetry signal, the RCA BTX-1B Subcarrier Generator is recommended for use with the BTE-15 FM exciter in the FM transmitter. In this case, the optional subcarrier generator will not be needed at the BTR-15B transmitter unit, and the telemetry tones from the METERING OUTPUT jack may be fed directly to the SCA input jacks J104 or J105 on the main frame. The optional demodulator board, however, will still be required at the studio unit.

METERING CONNECTIONS

NOTE: Before any metering connections are made to the BTR-15B, it is recommended that the installer read the following instructions so that the metering requirements of the system will be understood.

Voltage Samples

Obviously, metering signals applied to the BTR-15B metering terminals are not the same voltages and currents that are indicated on the transmitter panel meters. They are "metering samples," derived independently and in such a manner that they represent the meter readings without interfering with the meters.

Whatever the source of the metering voltage sample, it should measure in the vicinity of 2 volts dc when a 22 k resistor is connected across it, and it should not measure more than 10 volts when the resistor is disconnected. It must be no more than 350 volts peak, or dc referenced to ground, or damage may result to the BTR-15B. It should not be more than 50 volts above or below ground unless wiring is protected and all terminals and points where it is exposed, covered. The use of shielded wire, conduit, and other techniques to keep rf out of the metering samples is encouraged.

RCA offers a variety of kits designed for several sampling functions, the principles of which are described in the following paragraphs.

Plate Voltage and Plate Current Sampling

The RCA sampling unit for one of these functions is available as PVK-1 or PVK-2 Plate Voltage Sample Resistor Kit, MI-561482-* or MI-561483, respectively.

This method of plate voltage sampling is illustrated in figure 14A, where resistors R1, R2 and R3 have been added to develop an output voltage representative of plate voltage. R1 and R2 are typically stable metal-oxide resistors of several megohms, with power ratings of 10 to 20 watts. R3 is in the vicinity of 10 k to 100 k ohms and serves to keep the output sample terminals at a reasonable voltage should the load (transmitter unit) be removed. The target output voltage is 2 Vdc with 1 volt minimum and 10 volts maximum. Less than 1 volt may not produce full-scale deflection of the studio meter, and more than 4 volts may make setting of the calibration controls difficult.

Figure 14B shows the addition of a shunt resistor, R4, to the cathode circuit. This resistor of about 1.5 ohms develops a plate current sample at a point of safe potential in the circuit. The value of this resistor is calculated to develop 2 volts with normal plate current flowing. Two resistors in parallel are recommended for safety, in which case two resistors of three (3) ohms each would provide the proper voltage.

WARNING

Connections to this resistor must be secure. A poor connection or open resistor will result in excessive voltage appearing at the output sample terminals. It is for this reason that paralleled resistors are preferred.

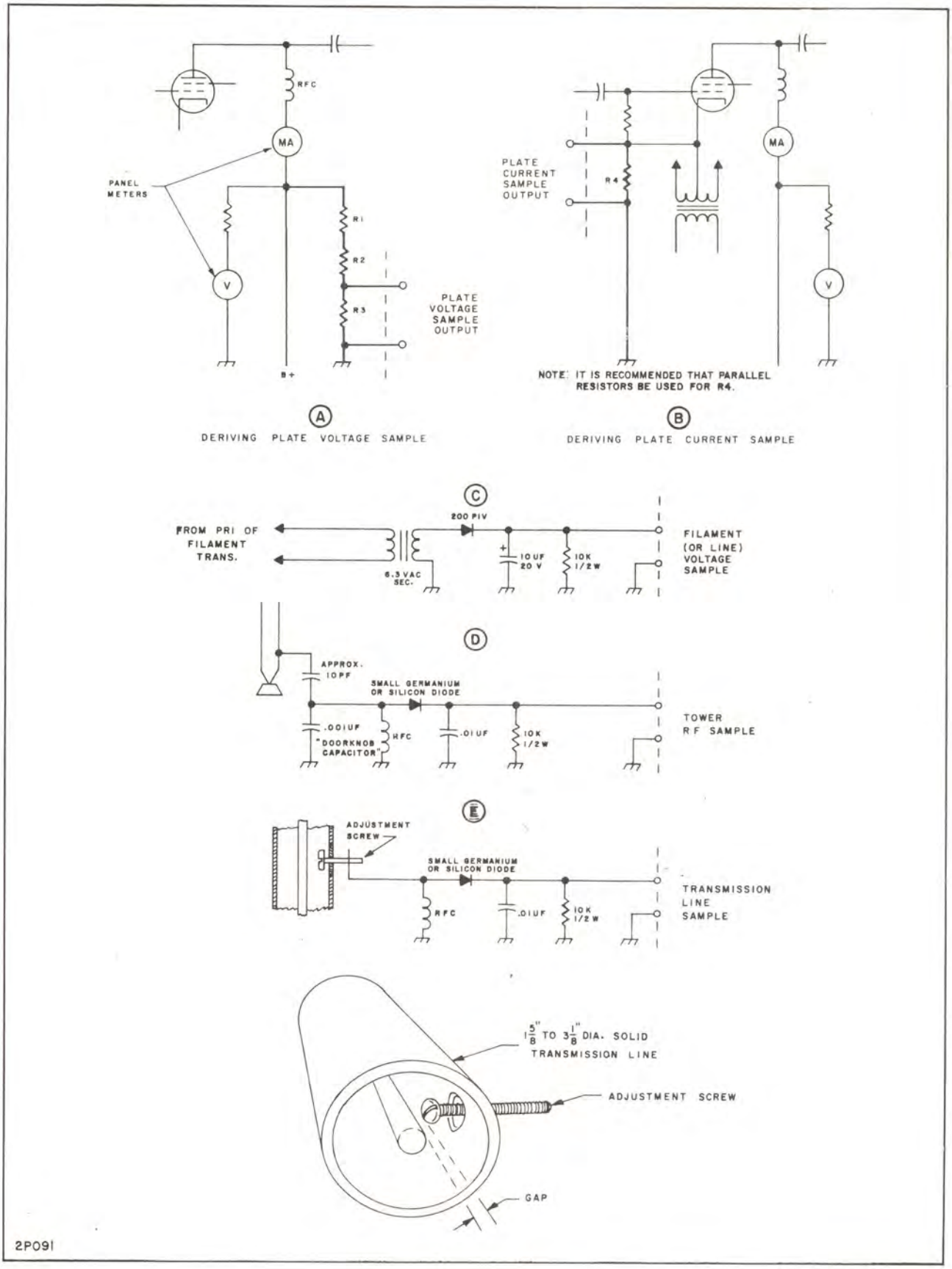


Figure 14. Deriving Metering Samples.

AC Sampling

Since metering inputs to the BTR-15B must be dc, ac voltages such as filament and line voltages must be rectified to be sampled. Filament voltages must also be near ground potential with either a center tap or one side grounded. RCA offers the LVK-1 Filament Voltage Rectifier Kit, MI-561463, 120 to 240 VAC, as an optional accessory for this purpose. A simple method of sampling ac filament or line voltages is shown in figure 14C.

RF Sampling

Since the AM tower is a linear device, antenna base current may be measured by connecting a capacitive voltage divider from antenna to ground and measuring the voltage as shown in figure 14D. An RCA Antenna Voltage Kit, RFK-1, MI-561193-1 is available as an accessory for this purpose. The 10 pf capacitor may be a short piece of coaxial cable or transmitting mica capacitor. The divider provides about 50 volts peak which is rectified by a 200 volt high-speed type diode and smoothed by an .01 μf capacitor. For high base voltage installations, reduce the value of the 10 pf capacitor to lower the voltage at the junction of the capacitors. The same system may be used to measure transmission line or common point current.

FM systems may use the method illustrated in figure 14E, although it must be constructed carefully to avoid damage to transmitting equipment, therefore purchase from a manufacturer is recommended. An optional FM Antenna Voltage Kit is available from RCA as RFK-2, MI-561193-2 or RFK-3, MI-561193-3.

Monitor Sampling

Outputs from reflectometers and frequency monitors are generally as low as 25 μA, and in the case of the frequency monitor, an offset adjustment may be required (no input results in half-scale deflection). Both these disadvantages are solved by use of a dc amplifier, such as the RCA Type CSA-3, MI-561461, connected between the reflectometer or frequency monitor and the BTR-15B.

CONTROL CONNECTIONS

NOTE: Before any control connections are made to the transmitter unit of the BTR-15B, it is recommended that the installer read the following paragraphs so that control requirements of the system will be thoroughly understood.

Figure 15 is a simplified schematic showing the "Raise" control section of the BTR-15B transmitter unit. A series of relays, identified as "1" through "15" and actuated by the CHANNEL SELECTOR pushbuttons on the studio unit, allows 15 terminal pairs to be selected, one at a time. After a pair has been selected, the circuit between terminals of the pair is completed by energizing the Raise relay. With selection of any one channel, all other channels are locked out. This circuitry is duplicated for the Lower terminal pairs, and there is no connection between Raise and Lower circuits. A third set of contacts on each channel relay selects the metering sample for that channel.

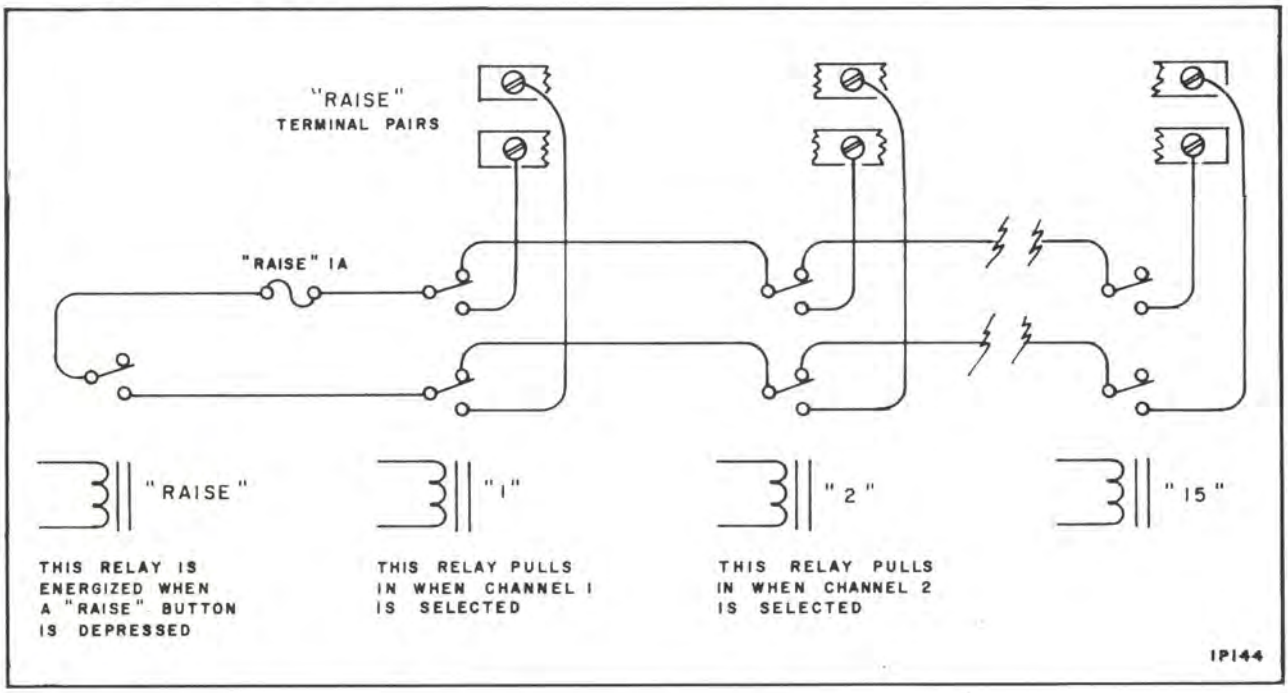


Figure 15. Control Connections, Simplified Schematic

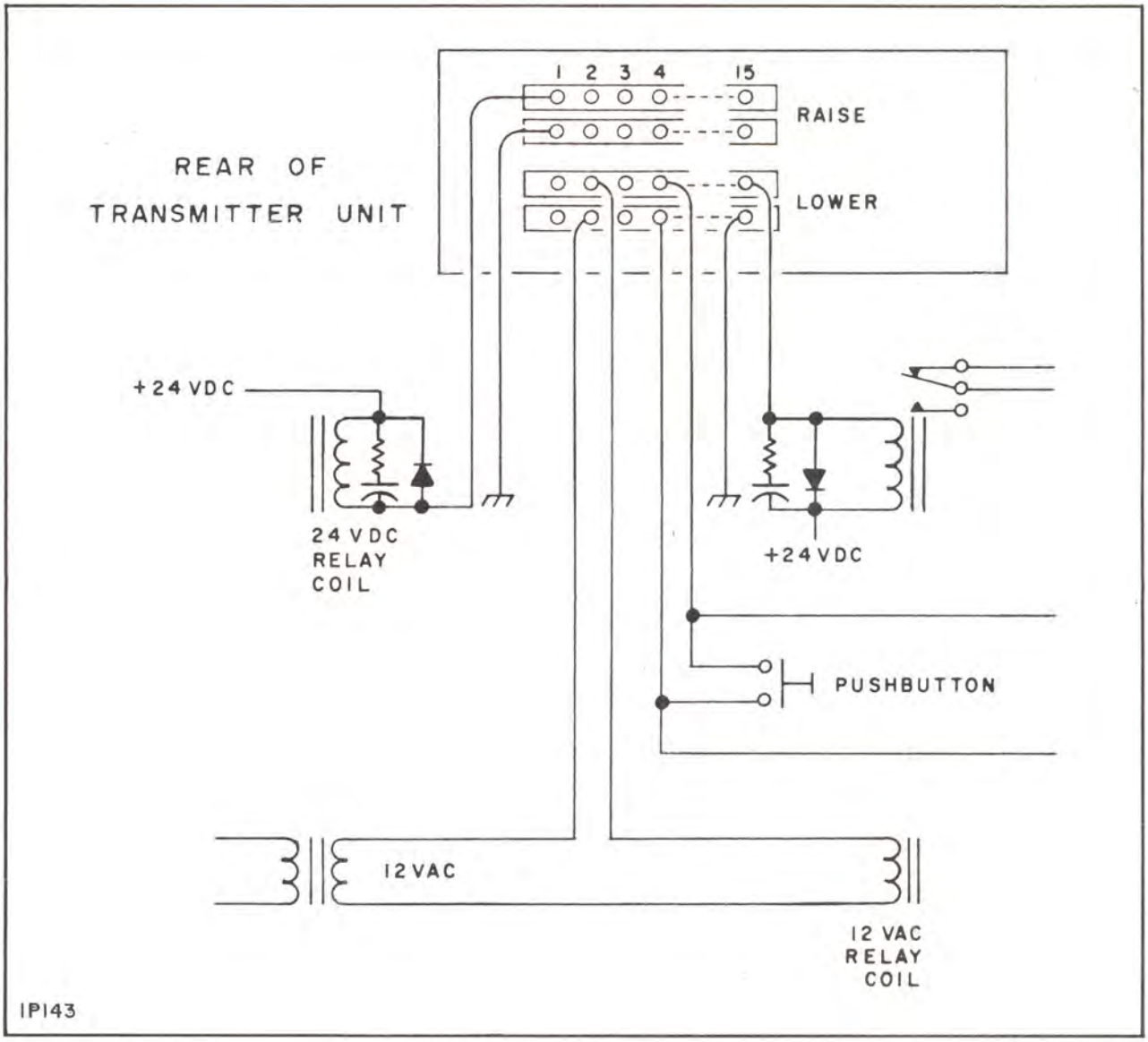


Figure 16. Control Circuitry, Simplified Schematic

Figure 16 illustrates simple control circuits and how they may be connected to the Raise and Lower pairs of the BTR-15B transmitter unit. When Channel 1 is selected, the 24 volt dc relay will be energized by pressing the RAISE button. Selecting Channel 2 and pressing and LOWER button will energize the 12 Vac relay coil. Going to Channel 4 and pressing the LOWER button will close the pushbutton circuit.

Control Contact Loads

Current through the control contacts of the BTR-15B should never exceed 1 ampere, even of a transient nature; a lesser value is preferred. External ac loads must be bypassed by a series RC network. Values of 0.1 μf and 100 ohms are suggested for small loads. Voltages should not exceed 250 volts dc or peak ac. Use of interface relays, as described in the following paragraph is to be encouraged.

Use of Interface Relays

Channels are isolated from each other, that is, there are no connections between channels inside the unit. This allows great flexibility, since various voltages, ac and dc, can be used with the control system. Nevertheless, it is considered wise to use a repeating or interface relay between the BTR-15B and outside loads. These relays have important advantages. They prevent serious control transients from entering the circuitry of the BTR-15B. They provide a form of power gain, handling loads up to several amperes without ill effect to the BTR-15B. They also provide a means for opening, instead of closing circuits, where necessary, by use of

relays with normally closed contacts (figure 16, Channel 15). It is suggested that these relays be operated from a simple dc supply, and with their coils shunted by a diode to suppress transients. Connect the diode as shown in figure 16 so that it will not conduct coil energizing current.

RCA provides a series of plug-in relays that can be mounted on a rack panel so installer can interface high current/voltage transmitter circuits with the BTR-15B Transmitter unit. Contact your RCA representative for information on various types of relays available.

Fail Safe Circuits

FCC regulations require that the remote control system be fail-safe, meaning that a control system or link failure will take the transmitter off the air. This is accomplished in the BTR-15B by means of the fail safe circuitry in the transmitter unit. The fail-safe output is in the form of a single-pole, double-throw relay contact. When the control system is operational the fail-safe relay is energized and a pair of terminals on the rear of the transmitter unit is closed. When a failure occurs in the control system, or in the link carrying control system signals, the normally-closed fail-safe contacts are opened. Terminals of these contacts must be connected to transmitter control in a manner that will take the transmitter off the air should the contacts open. A commonly used method is to connect these contacts in series with the transmitter door interlock system.

Auxiliary Power Circuits

The terminals labeled AUX POWER on the rear of the BTR-15B transmitter unit are intended to supply power to RCA accessory kits. Available at the terminals is 15 Vdc at up to 100 mA. Use of this power for miscellaneous non-remote control purposes is not recommended.

OPERATION

Connections to the units should be made permanent, with power applied continuously, so that controls are operational at all times. If a wireless system is used, of course the radio subcarrier links must be operating properly before control or metering can be accomplished.

The LOCAL/REMOTE switch on the transmitter unit must be in the REMOTE position for the studio unit to assume control. Operation is simple. Going, for example, to Channel 1, pressing the RAISE button will actuate the device connected to the Raise/1 terminals at the transmitter, such as a relay to turn on the filaments. Other channels may be selected and operated as well as monitored.

Operation of the system from the transmitter site is accomplished after depressing the LOCAL switch on the transmitter unit. This disconnects the studio unit from the system. RAISE and LOWER switches control the respective relays just as if they were controlled from the studio. The selected channel can be determined by observing the front panel readout lamps.

Before using the BTR-15B, return transmitter control to the studio by pressing the REMOTE COMMAND switch, and make the following routine tests and adjustments to assure proper calibration of the system.

ROUTINE ADJUSTMENTS

The controls to be checked initially as well as routinely are the meter ZERO SET and CALIBRATE controls on the studio unit, and the channel CALIBRATE controls on the transmitter unit.

Adjustments are made with the help of a voice link between studio and transmitter locations. With the LOCAL/REMOTE switch on the transmitter unit in REMOTE, select the CAL channel by pressing the CAL button on the studio unit. Now press the RAISE button. The meter should show a deflection to mid scale. If it does not, adjust the CALIBRATE control until it does. Release the RAISE button. The meter pointer should drop to zero. If it does not, adjust the ZERO SET control. Recheck mid-scale deflection by pressing the RAISE button. Readjust CALIBRATE control if necessary.

At the transmitter site, adjust the channel CALIBRATE controls to make the studio meter readings coincide with the transmitter meter readings. Check these controls as often as required or deemed necessary, probably weekly.

INTERNAL ADJUSTMENTS

The various modules in the BTR-15B have adjustable controls that provide a means to compensate for manufacturing tolerances and offer operational flexibility. The settings of these controls should not be altered unless it has been determined that a problem exists which will be corrected by readjustment of the control. For the location of these controls, refer to the component diagram for the particular module. When making measurements involving a test point, the common lead of the test equipment is connected to the chassis, except for TP1 through TP4 on the Audible Metering Generator and Subaudible Metering Generator, where the common side of the equipment is connected to the floating common point.

Control Generator

The quiescent frequency of the Control Generator should be within the limits of 280 to 320 Hz and is frequency-shift-keyed upward to about 400 Hz. Refer to the schematic diagram, figure 40. Observe TP7, the violet test point on the Control Generator board, and adjust the CONTROL TONE FREQUENCY control, R27, to an indicated 300 Hz. Use a frequency counter, compare the tone with an accurately calibrated audio oscillator, or use an oscilloscope to set the tone to the fifth or sixth harmonic of the power line, depending on the input frequency.

The amplitude of the control tone output is set by the CONTROL TONE AMPLITUDE control, R41, and is normally adjusted to a level of 0 dBm into the telephone line. Use a VTVM calibrated directly in dBm for this adjustment, or an ac VOM as an alternate. Should excessive RF or noise appear on the line, use TP8, the gray test point on the control generator board.

If this is done, set for an indication of +6 dBm. The drop in an internal resistor will reduce this to 0 dBm on the telephone line. There is no adjustment provided for the control-tone-output level as applied to the subcarrier generator; this is fixed by internal resistor values to a suitable value.

Control Demodulator

The DEMODULATOR TUNING control, R27, sets the operating point of the pulse counter. Refer to the Control Demodulator Schematic Diagram, figure 47. It may be set by observing TP "E", the green test point on the Control Demodulator board. While observing this test point, press the RAISE button on the studio unit to send a continuous pulse train. Then set the demodulator tuning control for zero volts dc as read on an ordinary dc voltmeter connected between ground and test point "E" (green) on the Control Demodulator. When the button at the studio is released, test point "E" will show a negative voltage reading. When the RAISE, LOWER, or RECYCLE buttons are held down, the reading will go to zero and will show "dither" or low-frequency variation due to the presence of the low-frequency train.

The RAMP control, R41, allows the various pulses to be correctly separated according to their width. If misadjusted one control command could be misinterpreted by the comparators, IC12 through IC15 as being another. For example, pressing the studio RAISE button might result in the Lower relay being energized, or perhaps the other way around. Prior to resetting the RAMP adjustment, be sure that the Control Generator and the DEMODULATOR TUNING controls are both correctly set. To adjust the RAMP control, press the studio RAISE button. When the RAMP control is turned, a point will be reached where the Lower relay will be energized instead of the Raise relay. Turning the control the other way, the Raise relay will become de-energized. The correct setting for this control is midway between these two settings. After resetting this control, confirm that all other functions are satisfactory. Minor readjustment may be necessary.

Audible Metering Generator

The FREQUENCY control, R11, sets the "no input" frequency of the metering oscillator. Refer to the schematic diagram, figure 48. To set this control, go to an unused telemetry input or the CAL position. Connect a frequency counter or other measurement device (see the suggestions listed under "Control Generator") to TP6, the gray test point on the Audible Metering Generator board. Set the FREQUENCY control for an indication of 800 Hz. The acceptable limits are 780 Hz to 830 Hz.

The SENSITIVITY control, R4, sets the sensitivity of the voltage-controlled metering oscillator. When the calibration voltage is applied to the unit, this control is adjusted for a metering oscillator frequency of 1000 Hz. To set the SENSITIVITY control, go to the CAL position and press the RAISE button. This applies the calibration voltage from the Audible Metering Generator board terminal 3, through contacts on raise relay K17 and calibrate relay K16, to terminal 1 of the Audible Metering Generator board. Refer to the Transmitter Unit Schematic Diagram, figure 45. This applies the calibration voltage to the dc amplifier. Set the SENSITIVITY control for an indication of 1000 Hz at TP6, the gray test point, using the same procedure recommended in the preceding paragraph. Acceptable limits are 980 Hz to 1020 Hz.

The LINE LEVEL control, R33, sets the amplitude of the metering tone applied to the telephone line. This will normally be set to a level of 0 dBm into the line. Use a VTVM calibrated in dBm for this adjustment, or an ac VOM as an alternate. Should the line have RF or noise on it, use TP7, the white test point, on the Audible Metering Generator board. If this is done, set for an indication of +6 dBm. The drop in an internal resistor will reduce this to 0 dBm on the telephone line. There is no adjustment provided for the metering tone level applied to the Subcarrier Generator; this is fixed by internal resistor values to a suitable value.

Subaudible Metering Generator

The FREQUENCY control, R11, sets the "no input" frequency of the metering oscillator. Refer to the schematic diagram, figure 49. To set this control, go to an unused telemetry input or the CAL position. Connect a frequency counter or other measurement device (see Control Generator equipment suggestions, above) to TP6, the gray test point on the Subaudible Metering Generator board. Set the FREQUENCY control for an indication of 20 Hz ± 1/2-Hz.

The SENSITIVITY control, R4, sets the sensitivity of the voltage-controlled metering oscillator. When the calibration voltage is applied to the unit, this control is adjusted for a metering oscillator frequency of 25 Hz. To set the SENSITIVITY control, go to the CAL position and press the RAISE button. This applies the calibration voltage from the Subaudible Metering Generator board terminal 3, through contacts on raise relay K17 and calibrate relay K16, to terminal 1 of the Subaudible Metering Generator board. Refer to the Transmitter Unit, Schematic Diagram, figure 45. This applies the calibration voltage to the dc amplifier. Set the SENSITIVITY control for an indication of 25 Hz ± 1/2-Hz at TP6, the gray test point, using the same procedure recommended in the preceding paragraph.

THE OUTPUT LEVEL control, R32, sets the amplitude of the metering tone applied to the Subcarrier Generator. This will normally be set to a level of 0 dBm output. Use a VTVM calibrated in dBm for this adjustment, or an ac VOM as an alternate. Should the line have RF or noise on it, use TP7, the white test point, on the Subaudible Metering Generator board. If this is done, set for an indication of +6 dBm.

Audible Metering Demodulator

The OVERSHOOT control, R45, sets the effective damping of the meter movement. Refer to the Audible Metering Demodulator Schematic Diagram, figure 43. First, set both controls on this board fully counterclockwise. Then adjust the OVERSHOOT control so that the meter nearly overshoots when a step voltage is applied to the metering system. A convenient step for adjustment is the calibrate signal. Merely select the calibrate channel, and alternately press and release the RAISE button for a step input to the metering system from the internal calibration voltage at the transmitter site.

The ACCELERATION control, R42, sets the amplitude of the "speedup" applied to the meter movement. After the OVERSHOOT adjustment is made, the ACCELERATION is adjusted. As it is advanced from the counterclockwise position, it will be noticed that the meter movement is more and more responsive. Finally, the meter overshoots, and the control may be backed off somewhat. The meter-movement rise time is quickened if a small overshoot is permitted.

Subaudible Metering Demodulator

The INPUT LEVEL control, R1, is the only control on this board. Refer to the schematic diagram, figure 44. With a signal containing subaudible metering information applied to this module, adjust the INPUT LEVEL control for a reading of −6 Vdc at TP "E", the violet test point, using an ordinary voltmeter. Should the input signal be of very low amplitude, the sensitivity of the amplifier, IC4, can be increased by installing a resistor in parallel with R15. A value of 2200 ohms installed in the holes provided will give an increase in gain of about five times (14 dB). A 470 ohm resistor will provide a gain increase of about twenty times (26 dB).

Subcarrier Generator

The FREQUENCY control, R4, adjusts the center frequency of the Subcarrier Generator. The Subcarrier Generator Schematic Diagram is presented in figure 41. Observe TP2, the yellow test point, with a counter or oscilloscope and adjust the FREQUENCY control for the correct frequency. For a list of frequency-determining (FD) parts, refer to table 1. It may be advisable if a counter is used, and will be necessary if an oscilloscope is used, to first remove any modulation on the subcarrier prior to setting the frequency. This can be done by turning the DEVIATION control, R1, fully counterclockwise.

The DEVIATION control, R1, is set by using an SCA modulation monitor, an oscilloscope, or by observing the subcarrier demodulator. Adjust the deviation control for a subcarrier deviation of about 5% of its center frequency for control purposes or 800 Hz for metering service. If the subcarrier demodulator is used to measure the subcarrier deviation, refer to the section on that module for instruction.

The OUTPUT LEVEL control, R31, is set for about 20% injection of subcarrier into an aural STL, or 1.5 volts peak-to-peak at the output of the Subcarrier Generator (green test point 3). If the Subcarrier Generator is used to modulate an FM exciter, the OUTPUT LEVEL control is adjusted for 9% modulation of the FM carrier. Notice that the word deviation as used in this section means modulation of the subcarrier by the control or metering signal, and the word injection means modulation of the main carrier by the subcarrier.

Subcarrier Demodulator

With 1.5 volts peak-to-peak of subcarrier signal applied to the Subcarrier Demodulator, figure 42, adjust the four inductors, LA through LD, for maximum subcarrier amplitude coincident with minimum ripple or modulation as observed with an oscilloscope connected to TP1, the orange test point. This filter realignment should not be necessary unless a component has been replaced.

The DEMODULATOR TUNING control, R9, is used to set the operating point of the pulse-counting discriminator. Connect voltmeter to TP2, the yellow test point, and adjust the DEMODULATOR TUNING control for a reading of 5 volts dc. This reading should be within the range of 4 volts to 6 volts dc and must not exceed 7 volts dc. Be sure the subcarrier Generator is on frequency and of the correct amplitude before this adjustment is made.

The OUTPUT LEVEL control, R17, is used to set the output level from the Subcarrier Demodulator. This control is set for 1.5 volts peak-to-peak output from the demodulator as observed at TP3, the green test point. Should a particular unit yield higher than this figure, the DEMODULATOR TUNING control may be adjusted counterclockwise for a vernier adjustment. The subcarrier is being deviated correctly for control purposes (studio-to-transmitter link) when 0.2 volts rms is measured at TP2, the yellow test point, of the Subcarrier demodulator when the DEMODULATOR TUNING control is set for 5 volts dc at TP2.

MAINTENANCE

GENERAL

The transmitter should be visited periodically as specified by FCC regulations and the remote meter readings checked against the transmitter site meter readings using the routine adjustment procedure given under OPERATION.

In case of a failure of the BTR-15B Remote Control System, the following comments may prove helpful:

1. If possible, remove nearby sources of RF when the electronic circuitry is exposed. Strong RF fields tend to re-bias amplifiers and saturate IC's, making operation unpredictable.

2. Try to isolate the problem to a specific area. To assist in this, voltages and waveforms are shown on the schematics at key points. By comparing the suspected unit with the measurements given on the schematics, the difficulty can usually be localized quickly.

3. If an integrated circuit is suspected, carefully remove the original and plug in the new one, observing polarity. These devices may be inadvertently installed backwards and improper installation may damage the new IC. The "key" on these IC's is a small dot at pin 1, or an indentation at one end, or (for round IC's only) a tab extending out from the highest numbered pin. Correct orientation of the IC's is shown on the component diagrams.

4. Repairs may be effected by replacing the defective component, replacing the defective subassembly, or RCA Field Engineering Service may be utilized.

5. When replacing fuses, replace only with a fuse of the type and current rating called for in the REPLACEMENT PARTS list.

6. Upon completion of repairs, be certain correct polarity is observed for telephone lines and that any other connections that were removed are correctly and securely reconnected.

CARE AND SERVICE OF RELAYS AND SWITCHES

Trouble free relay and switch operation depends upon keeping contacts clean and free of dust, lint, grease, paint, oil or similar materials. Contamination from sources such as these is the most common cause of contacts arcing, pitting and burning.

Relays and switches should be inspected periodically, and at such times contacts should be cleaned and adjusted as necessary. Relay contacts should be cleaned with Chlorothene applied with a soft brush after which they should be burnished with a tool such as the RCA Stock No. 22963 Contact Cleaning Tool. Finally, contacts should be wiped with a clean piece of bond paper.

The following is a list of conditions to watch for when making routine relay maintenance checks.

- Improperly adjusted residual screws on relays.
- Arcing contacts caused by a defective spark suppressor.
- Spring and contact assemblies which show evidence of tampering.
- Contacts out of alignment more than 1/3 of their diameter at the base of the contact points.
- Loose screws and nuts.
- Insecurely mounted coils, contacts, and other parts.
- Mutilated or defective screws, nuts, or other parts.
- Sharp bends or kinks in springs. The free length of relay spring can have only a normal bow.
- Bushings not in the approximate center of the springs they strike.

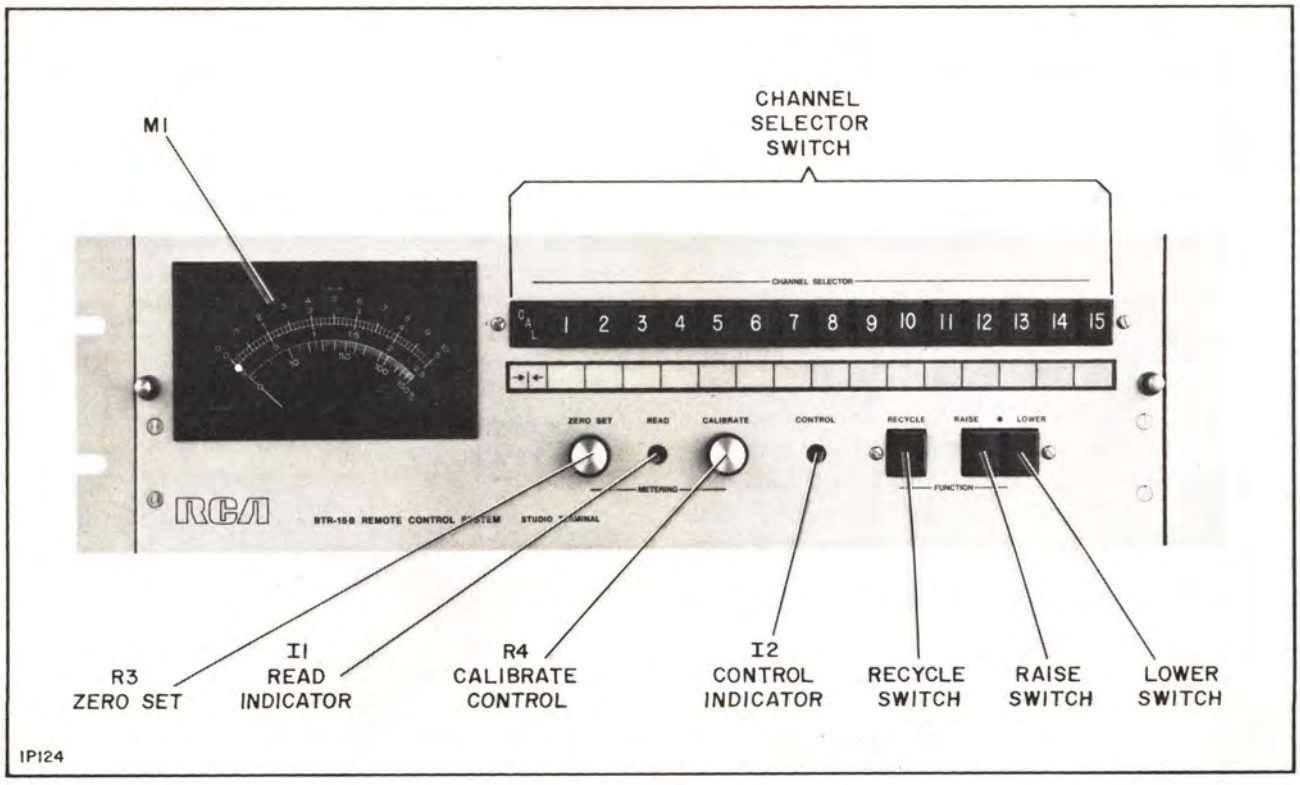


Figure 17. BTR-15B Studio Unit, Front View

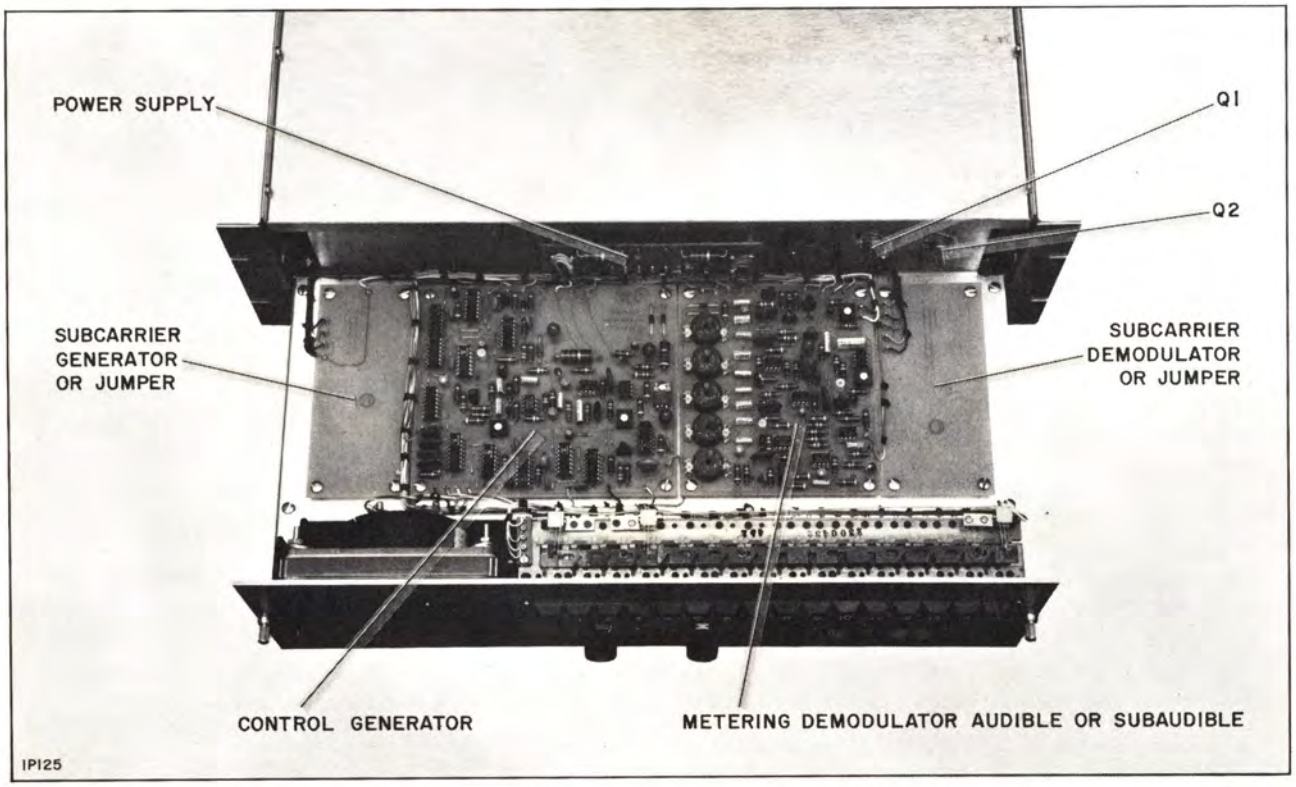


Figure 18. Studio Unit, Front View, Drawer Open

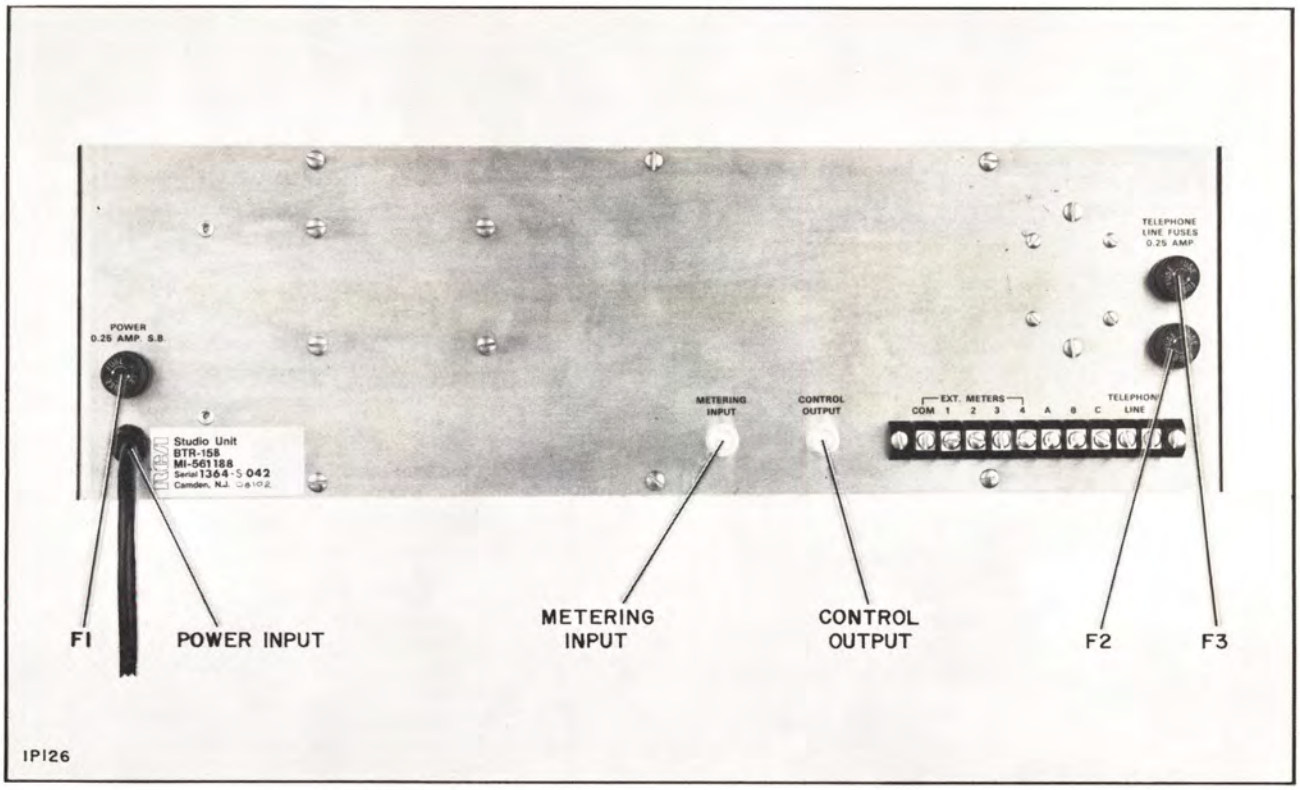


Figure 19. Studio Unit, Rear View

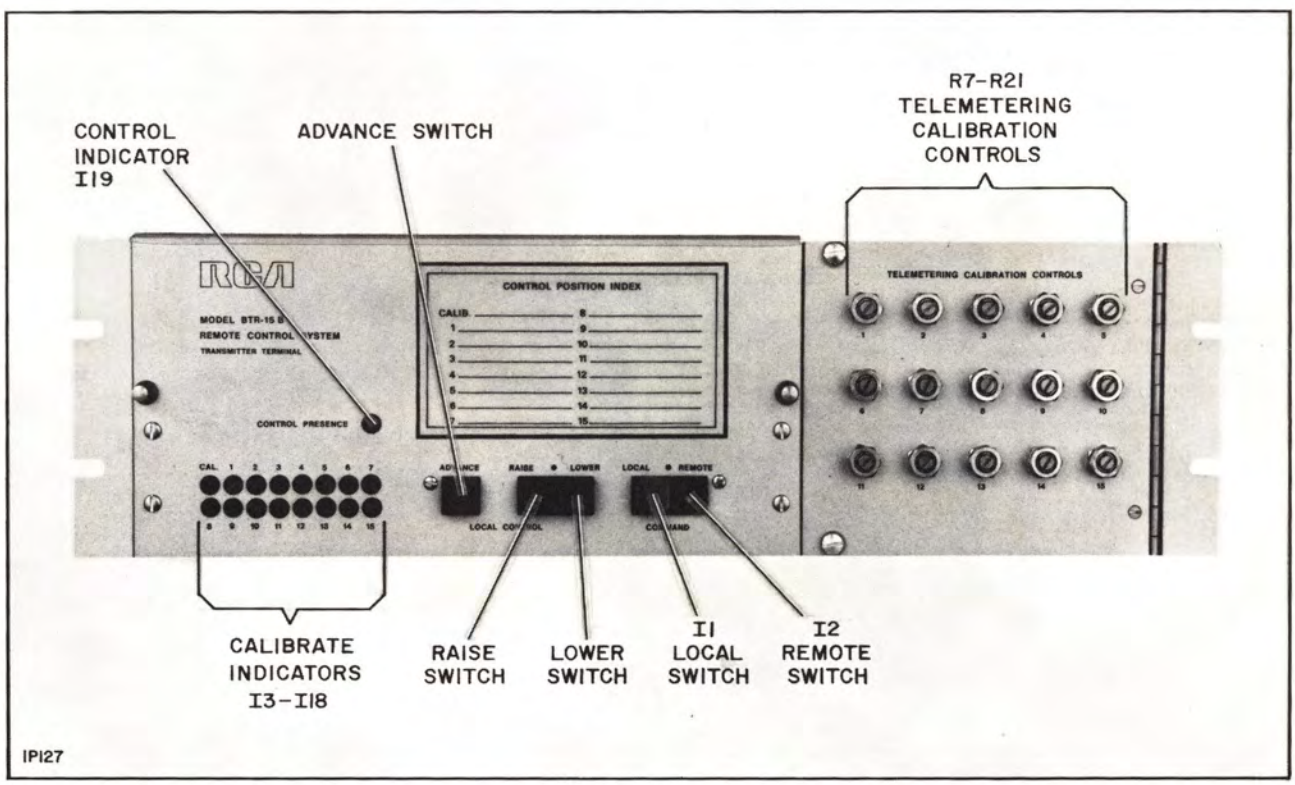


Figure 20. BTR-15B Transmitter Unit, Front View

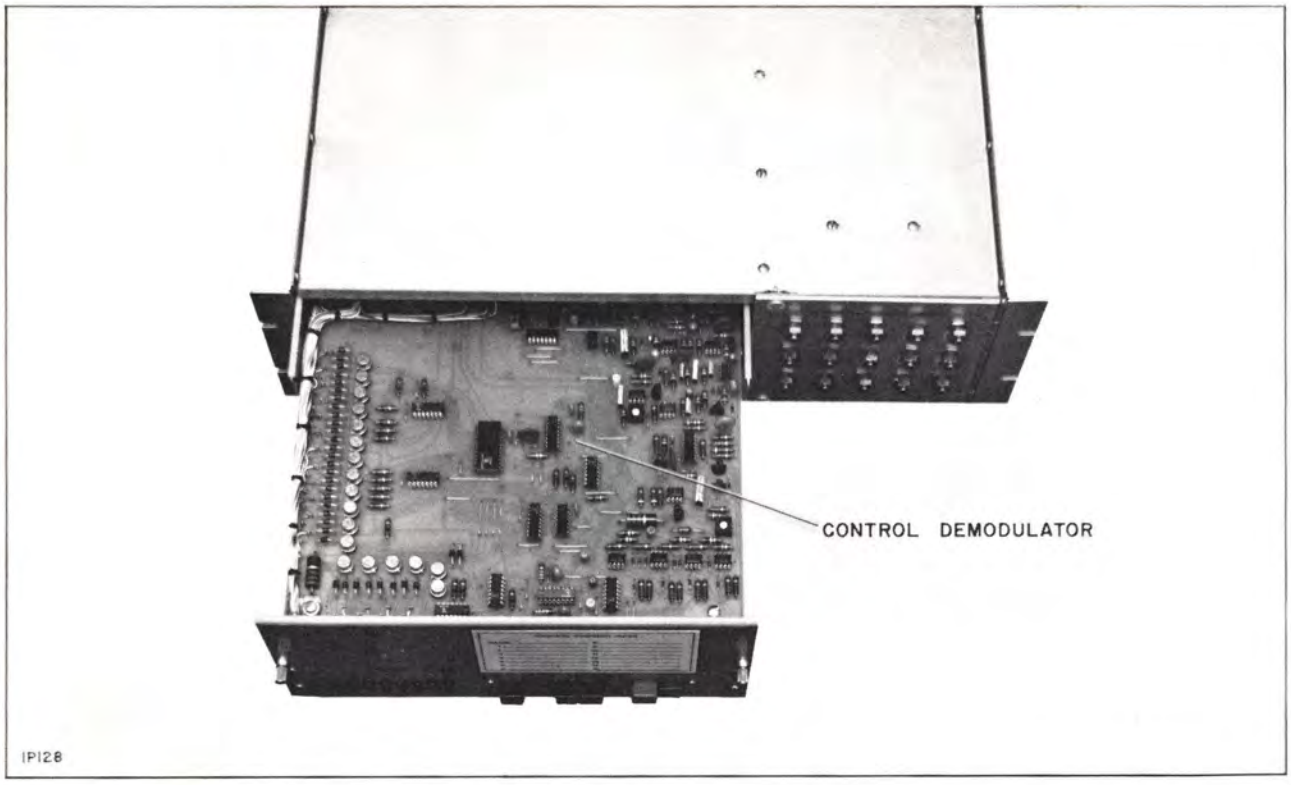


Figure 21. Transmitter Unit, Front View, Drawer Open

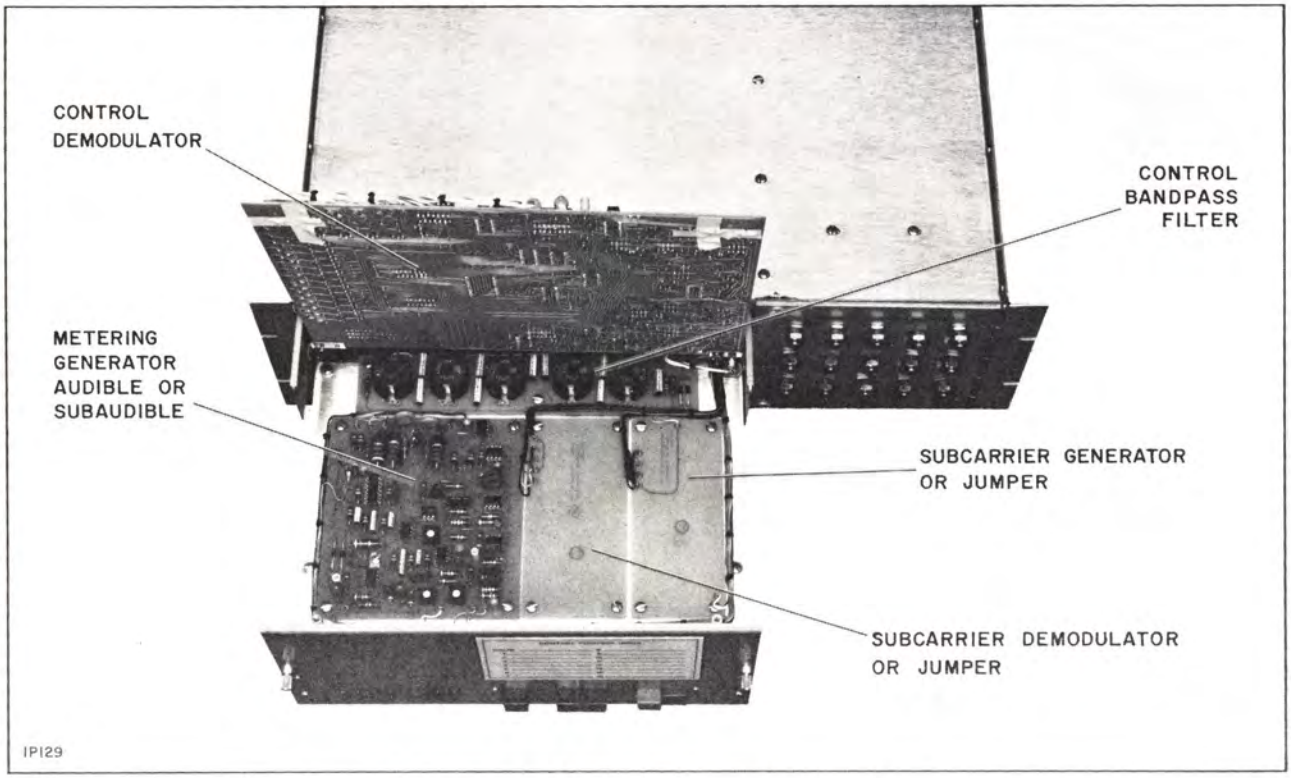


Figure 22. Transmitter Unit, Front View, Drawer Open

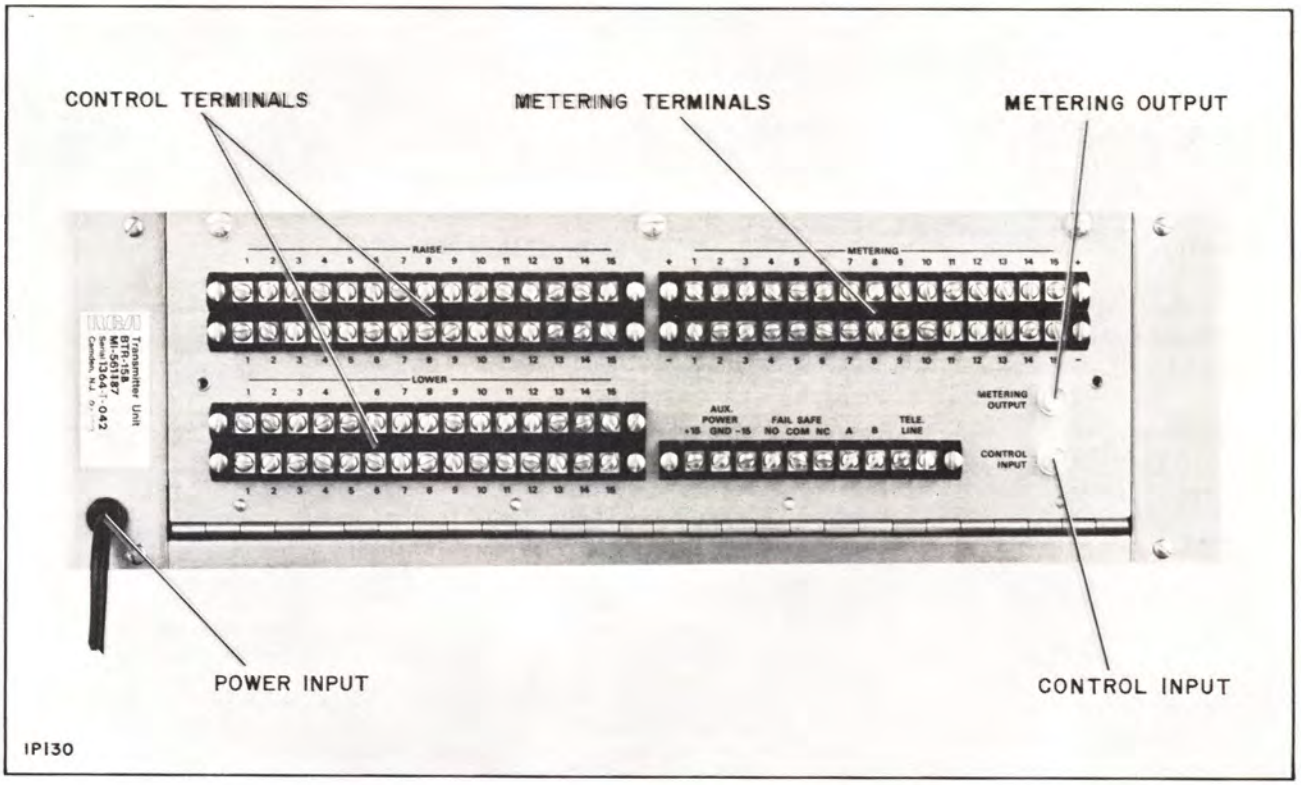


Figure 23. Transmitter Unit, Rear View

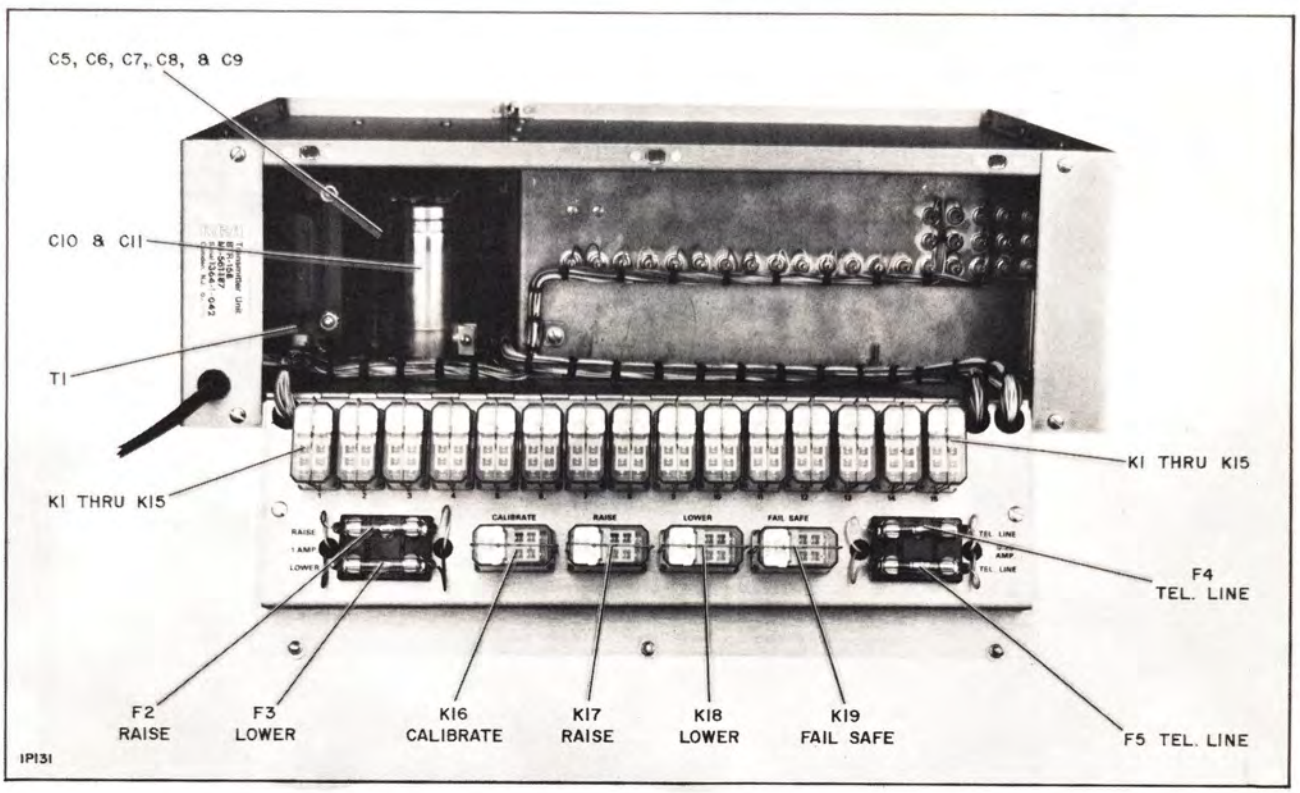


Figure 24. Transmitter Unit, Rear View, Panel Open

PARTS ORDERING INFORMATION

REPLACEMENT PARTS

When ordering replacement parts, please give Stock or Master Item (MI) Number, Description, and Symbol of each item ordered.

The part which will be supplied against an order for a replacement item may not be an exact duplicate of the original part. However, it will be a satisfactory replacement differing only in minor mechanical or electrical characteristics. Such differences will in no way impair the operation of the equipment.

EMERGENCY SERVICE

For emergency service after working hours, contact RCA Parts and Accessories, Telephone 609-963-8000 or 609-848-5900.

LOCATION	ORDERING INSTRUCTIONS
Continental United States, including Alaska and Hawaii	Replacement Parts bearing a STOCK NUMBER should be ordered from RCA Parts and Accessories – 2000 Clements Bridge Road – Deptford, New Jersey 08096. Replacement Parts bearing a MASTER ITEM (MI) NUMBER should be ordered from RCA, Commercial Electronics Systems Division – Attention Commercial Service – Camden, New Jersey 08102 or your nearest RCA Regional Office. Replacement Parts with NO STOCK or MASTER ITEM (MI) NUMBER are standard components. They are not stocked by RCA and should be obtained from your local electronics distributor.
Dominion of Canada	Order from your local RCA Sales Representative or his office or from: RCA Victor Company Limited, 1001 Lenoir Street, Montreal, Quebec.
Outside of Continental United States, Alaska Hawaii, and the Dominion of Canada	Order from your local RCA Sales Representative or from: RCA International Division, Clark, New Jersey – U.S.A. – Wire: RADIOINTER **Emergency:** Cable RADIOPARTS, DEPTFORD, N.J.

REPLACEMENT PARTS

Symbol	*Stock No.*	*Drawing No.*	*Description*
			BTR-15B REMOTE CONTROL SYSTEM ES-561157 OR ES-561158-*
			STUDIO UNIT (SU) MAIN FRAME MI-561188
			SU MAIN FRAME
C1	427450		CAPACITOR, 2600MF 50V
C2	427450		CAPACITOR, 2600MF 50V
C3	425874		CAPACITOR, 9200MF 15V
C4	425874		CAPACITOR, 9200MF 15V
F1	427383		FUSE, AGC 1/4A SLO BLO, POWER
F2	426710		FUSE, AGC 1/4A - TELEPHONE LINE
F3	426710		FUSE, AGC 1/4A - TELEPHONE LINE
I1	424279		INDICATOR, READ - LIGHT EMITTING DIODE
I2	424279		INDICATOR, READ - LIGHT EMITTING DIODE
M2	MI-561444-120		METER W/BEZEL 100UA
R3	427385		POTENTIOMETER, 1K OHMS ZERO SET
R4	427384		POTENTIOMETER, 5K CALIB
SW1	427387		SWITCH, BINARY
SW2	427386		SWITCH, DB
T1	421042		TRANSFORMER, POWER
T2	426792		TRANSFORMER, LINE
XV1	248369		SOCKET, TRANSISTOR
XV2	248369		SOCKET, TRANSISTOR
	223973		CONNECTOR BNC
	229658		FUSE, HOLDER
			SU POWER SUPPLY BOARD
			SEMICONDUCTORS
CR1 THRU CR4	234552		DIODE - TYPE 10D2
CR5	426764		DIODE - TYPE 1N4745, ZENER 16 V 1 W
CR6	423780		DIODE - TYPE 1N4734, ZENER 5.6 V 1 W
Q1	426183		TRANSISTOR - TYPE 2N3054
Q2	426183		TRANSISTOR - TYPE 2N3054
			RESISTORS - FIXED COMPOSITION, UNLESS NOTED
R1	522122		220 OHMS 10% 2 W
R2	522110		100 OHMS 10% 2 W
			SU CONTROL GENERATOR
			SEMICONDUCTORS
CR1	242220		DIODE - TYPE 1N4154
CR2	242220		DIODE - TYPE 1N4154
CR3	242220		DIODE - TYPE 1N4154
CR4	234552		DIODE - TYPE 10D2
CR5	242220		DIODE - TYPE 1N4154
CR6	242220		DIODE - TYPE 1N4154
CR7	426763		DIODE - TYPE 1N4740, ZENER 10 V 1 W
CR8	424594		DIODE - TYPE 1N4744, ZENER 15 V 1 W
CR9	424594		DIODE - TYPE 1N4744, ZENER 15 V 1 W
Q1	248024		TRANSISTOR - TYPE 2N2924
Q2	422415		TRANSISTOR - TYPE 2N4990
Q3	248024		TRANSISTOR - TYPE 2N2924
Q4	248024		TRANSISTOR - TYPE 2N2924
Q5	249612		TRANSISTOR - TYPE 2N5293
IC1	423790		INTEGRATED CIRCUIT - TYPE SN7485N
IC2	425797		INTEGRATED CIRCUIT - TYPE SN7493N

Symbol	Stock No.	Drawing No.	Description
IC3	426765		INTEGRATED CIRCUIT - TYPE SN74123N
IC4	423789		INTEGRATED CIRCUIT - TYPE SN74121N
IC5 THRU			
IC8	425801		INTEGRATED CIRCUIT - TYPE SN7402N
IC9	425797		INTEGRATED CIRCUIT - TYPE SN7493N
IC10	425797		INTEGRATED CIRCUIT - TYPE SN7493N
IC11	425801		INTEGRATED CIRCUIT - TYPE SN7402N
IC12	425797		INTEGRATED CIRCUIT - TYPE SN7493N
IC13	423797		INTEGRATED CIRCUIT - TYPE SN72741P
IC14	423797		INTEGRATED CIRCUIT - TYPE SN72741P
IC15	423797		INTEGRATED CIRCUIT - TYPE SN72741P
			CAPACITORS
C1 THRU			
C4	425863		.01 MF 600 V
C5 THRU			
C8	248381		DISC, .01 MF 100 V
C9	223777		47 MF 20 V
C10	237797		15 MF 20 V
C11	245168		100 MF 20 V
C12 THRU			
C15	248381		DISC, .01 MF 100 V
C16	242035		10 MF 20 V
C17	420553		.033 MF 3% 100 V
C18	420553		.033 MF 3% 100 V
C19	420553		.033 MF 3% 100 V
C20	426768		.0182 MF 3% 100 V
C21	423699		0.101 MF 3% 100 V
C22	079191		330 PF
C23	225770		150 MF 15 V
C24	242035		10 MF 20 V
C25	227444		DISC, 0.1 MF 25 V
C26	225770		150 MF 15 V
C27	242035		10 MF 20 V
C28	225770		150 MF 15 V
C29	248381		DISC, .01 MF 100 V
C30	248381		DISC, .01 MF 100 V
C31	248381		DISC, .01 MF 100 V
			RESISTORS - FIXED COMPOSITION, UNLESS NOTED
R1 THRU			
R4	502122		220 OHMS 10% 1/2 W
R5	502322		22,000 OHMS 10% 1/2 W
R6	502322		22,000 OHMS 10% 1/2 W
R7	502247		4700 OHMS 10% 1/2 W
R8	502222		2200 OHMS 10% 1/2 W
R9	502233		3300 OHMS 10% 1/2 W
R10	502122		220 OHMS 10% 1/2 W
R11	502222		2200 OHMS 10% 1/2 W
R12	502222		2200 OHMS 10% 1/2 W
R13	502247		4700 OHMS 10% 1/2 W
R14	502122		220 OHMS 10% 1/2 W
R15	502122		220 OHMS 10% 1/2 W
R16	502222		2200 OHMS 10% 1/2 W
R17	502233		3300 OHMS 10% 1/2 W
R18	502222		2200 OHMS 10% 1/2 W
R19	502233		3300 OHMS 10% 1/2 W
R20	502122		220 OHMS 10% 1/2 W
R21	502268		6800 OHMS 10% 1/2 W
R22	502410		100,000 OHMS 10% 1/2 W
R23	502268		6800 OHMS 10% 1/2 W
R24	502222		2200 OHMS 10% 1/2 W
R25	502222		2200 OHMS 10% 1/2 W
R26	502282		8200 OHMS 10% 1/2 W
R27	426766		POTENTIOMETER, 5000 OHMS
R28	502247		4700 OHMS 10% 1/2 W
R29	502422		220,000 OHMS 10% 1/2 W
R30	502415		150,000 OHMS 10% 1/2 W

Symbol	*Stock No.*	*Drawing No.*	*Description*
R31	502422		220,000 OHMS 10% 1/2 W
R32	502422		220,000 OHMS 10% 1/2 W
R33	502368		68,000 OHMS 10% 1/2 W
R34	502368		68,000 OHMS 10% 1/2 W
R35	522122		220 OHMS 10% 2 W
R36	502210		1000 OHMS 10% 1/2 W
R37	502222		2200 OHMS 10% 1/2 W
R38	502310		10,000 OHMS 10% 1/2 W
R39	502247		4700 OHMS 10% 1/2 W
R40	502247		4700 OHMS 10% 1/2 W
R41	426767		POTENTIOMETER, 10,000 OHMS
R42	502222		2,200 OHMS 10% 1/2 W
R43	502347		47,000 OHMS 10% 1/2 W
R44	512147		470 OHMS 10% 1 W
R45	502156		560 OHMS 10% 1/2 W
R46	502222		2200 OHMS 10% 1/2 W
R47	502222		2200 OHMS 10% 1/2 W
TP1	425996		JACK - TEST, RED
TP2	425991		JACK - TEST, BROWN
TP3	425993		JACK - TEST, ORANGE
TP4	425992		JACK - TEST, YELLOW
TP5	425994		JACK - TEST, GREEN
TP6	425990		JACK - TEST, BLUE
TP7	425989		JACK - TEST, VIOLET
TP8	425988		JACK - TEST, GREY
XV1	422416		SOCKET - TRANSISTOR
XV2	422416		SOCKET - TRANSISTOR
XV3	422416		SOCKET - TRANSISTOR
	423743		SOCKET - INTEGRATED CIRCUIT, 7 PIN
	425965		SOCKET - INTEGRATED CIRCUIT, 8 PIN
			SU AUDIBLE METERING DEMODULATOR
			SEMICONDUCTORS
CR1	424594		DIODE - TYPE 1N4744, ZENER 15 V 1 W
CR2	424594		DIODE - TYPE 1N4744, ZENER 15 V 1 W
CR3 THRU CR9	242220		DIODE - TYPE 1N4154
Q1 THRU Q4	248024		TRANSISTOR - TYPE 2N2924
Q5	420558		TRANSISTOR - TYPE 2N3819
IC1 THRU IC6	423797		INTEGRATED CIRCUIT - TYPE SN72741P
			CAPACITORS
C2	426760		.031 MF 3% 100 V
C3	426760		.031 MF 3% 100 V
C4	425884		.012 MF 3% 100 V
C5	426758		.0175 MF 3% 100 V
C6	426759		.025 MF 3% 100 V
C7	426758		.0175 MF 3% 100 V
C8	425884		.012 MF 3% 100 V
C9	426760		.031 MF 3% 100 V
C10	426760		.031 MF 3% 100 V
C11	240846		DISC, .001 MF 1000 V
C12	227444		DISC, 0.1 MF 25 V
C13	225770		150 MF 15 V
C14	227444		DISC, 0.1 MF 25 V
C15	426229		100 PF
C16	227444		DISC, 0.1 MF 25 V
C17	242035		10 MF 20 V
C18 THRU C21	227444		DISC, 0.1 MF 25 V
C22	420553		.033 MF 3% 100 V
C23	242035		10 MF 20 V
C24	426761		.0377 MF 3% 100 V

Symbol	*Stock No.*	*Drawing No.*	*Description*
C25	420340		2.2 MF 35 V
C26	227444		DISC, 0.1 MF 25 V
C27	420340		2.2 MF 35 V
C28	420552		.068 MF 3% 100 V
C29	423903		0.257 MF 3% 100 V
C30	242035		10 MF 20 V
C32	237797		15 MF 20 V
C33	225770		150 MF 15 V
L1 THRU L5	426762		INDUCTOR - 496 MH
			RESISTORS - FIXED COMPOSITION, UNLESS NOTED
R1	502247		4700 OHMS 10% 1/2 W
R2	502247		4700 OHMS 10% 1/2 W
R3	502310		10,000 OHMS 10% 1/2 W
R4	502222		2200 OHMS 10% 1/2 W
R5	502410		100,000 OHMS 10% 1/2 W
R6	502410		100,000 OHMS 10% 1/2 W
R7	502310		10,000 OHMS 10% 1/2 W
R8	502447		470,000 OHMS 10% 1/2 W
R9	502247		4700 OHMS 10% 1/2 W
R10	502222		2200 OHMS 10% 1/2 W
R11	502310		10,000 OHMS 10% 1/2 W
R12	502312		12,000 OHMS 10% 1/2 W
R13	502310		10,000 OHMS 10% 1/2 W
R14	502422		220,000 OHMS 10% 1/2 W
R15	502247		4700 OHMS 10% 1/2 W
R16	502310		10,000 OHMS 10% 1/2 W
R17	502310		10,000 OHMS 10% 1/2 W
R18	502310		10,000 OHMS 10% 1/2 W
R19	502510		1 MEGOHM 10% 1/2 W
R20	502247		4700 OHMS 10% 1/2 W
R21 THRU R24	502310		10,000 OHMS 10% 1/2 W
R25	502410		100,000 OHMS 10% 1/2 W
R26	502247		4700 OHMS 10% 1/2 W
R27	502247		4700 OHMS 10% 1/2 W
R28	502310		10,000 OHMS 10% 1/2 W
R29	502247		4700 OHMS 10% 1/2 W
R30	502222		2200 OHMS 10% 1/2 W
R31	502122		220 OHMS 10% 1/2 W
R32	502210		1000 OHMS 10% 1/2 W
R33	502410		100,000 OHMS 10% 1/2 W
R34	502410		100,000 OHMS 10% 1/2 W
R35	502310		10,000 OHMS 10% 1/2 W
R36	502347		47,000 OHMS 10% 1/2 W
R37	502222		2200 OHMS 10% 1/2 W
R38	502310		10,000 OHMS 10% 1/2 W
R39	502222		2200 OHMS 10% 1/2 W
R40	502322		22,000 OHMS 10% 1/2 W
R41	502347		47,000 OHMS 10% 1/2 W
R42	426767		POTENTIOMETER, 10,000 OHMS
R43	502215		1500 OHMS 10% 1/2 W
R44	502327		27,000 OHMS 10% 1/2 W
R45	426766		POTENTIOMETER, 5000 OHMS
R46	502215		1500 OHMS 10% 1/2 W
R47	502210		1000 OHMS 10% 1/2 W
R48	502310		10,000 OHMS 10% 1/2 W
TPA	425993		JACK - TEST, ORANGE
TPB	425992		JACK - TEST, YELLOW
TPC	425994		JACK - TEST, GREEN
TPD	425989		JACK - TEST, VIOLET
TPE	425988		JACK - TEST, GREY
TPF	425997		JACK - TEST, WHITE
XV1 THRU XV5	422416		SOCKET - TRANSISTOR

Symbol	Stock No.	Drawing No.	Description
	425965		SOCKET - INTEGRATED CIRCUIT, 8 PIN
			SU SUBAUDIBLE METERING DEMODULATOR
			SEMICONDUCTORS
CR1 THRU			
CR7	242220		DIODE - TYPE 1N4154
Q1	420558		TRANSISTOR - TYPE 2N3819
Q2	248024		TRANSISTOR - TYPE 2N2924
Q3	248024		TRANSISTOR - TYPE 2N2924
Q4	248024		TRANSISTOR - TYPE 2N2924
Q5	420558		TRANSISTOR - TYPE 2N3819
IC1 THRU			
IC7	423797		INTEGRATED CIRCUIT - TYPE SN72741P
			CAPACITORS
C1	242035		10 MF 20 V
C2	223777		47 MF 20 V
C3	426772		0.15 MF 3% 100 V
C4	426773		.0783 MF 3% 100 V
C5	426774		.0056 MF 3% 100 V
C6	423904		0.119 MF 3% 100 V
C7	426769		2870 PF 2%
C8	426772		0.15 MF 3% 100 V
C9	079191		330 PF
C10 THRU			
C16	242035		10 MF 20 V
C17	423899		0.1 MF 3% 100 V
C18	223777		47 MF 20 V
C19	426771		1.56 MF 3% 100 V
C20	423903		0.257 MF 3% 100 V
C21	423907		.044 MF 3% 100 V
C22	426770		0.47 MF 3% 100 V
C23	242035		10 MF 20 V
C24	240340		2.2 MF 35 V
C25	242035		10 MF 20 V
			RESISTORS - FIXED COMPOSITION, UNLESS NOTED
R1	426767		POTENTIOMETER, 10,000 OHMS
R2	502322		22,000 OHMS 10% 1/2 W
R3	502322		22,000 OHMS 10% 1/2 W
R4	502347		47,000 OHMS 10% 1/2 W
R5	502447		470,000 OHMS 10% 1/2 W
R6	502447		470,000 OHMS 10% 1/2 W
R7	502447		470,000 OHMS 10% 1/2 W
R8	502433		330,000 OHMS 10% 1/2 W
R9	502433		330,000 OHMS 10% 1/2 W
R10	502468		680,000 OHMS 10% 1/2 W
R11	502468		680,000 OHMS 10% 1/2 W
R12	502410		100,000 OHMS 10% 1/2 W
R13	502322		22,000 OHMS 10% 1/2 W
R14	502322		22,000 OHMS 10% 1/2 W
R15	502310		10,000 OHMS 10% 1/2 W
R16	502422		220,000 OHMS 10% 1/2 W
R17	502333		33,000 OHMS 10% 1/2 W
R18	502347		47,000 OHMS 10% 1/2 W
R19	502247		4700 OHMS 10% 1/2 W
R20	502110		100 OHMS 10% 1/2 W
R21 THRU			
R24	502310		10,000 OHMS 10% 1/2 W
R25	502410		100,000 OHMS 10% 1/2 W
R26	502222		2200 OHMS 10% 1/2 W
R27	502247		4700 OHMS 10% 1/2 W
R28	502247		4700 OHMS 10% 1/2 W
R29	502310		10,000 OHMS 10% 1/2 W
R30	502247		4700 OHMS 10% 1/2 W

Symbol	Stock No.	Drawing No.	Description
R31	502222		2200 OHMS 10% 1/2 W
R32	502122		220 OHMS 10% 1/2 W
R33	502210		1000 OHMS 10% 1/2 W
R34	502433		330,000 OHMS 10% 1/2 W
R35	502433		330,000 OHMS 10% 1/2 W
R36	502433		330,000 OHMS 10% 1/2 W
R37	502312		12,000 OHMS 10% 1/2 W
R38	502327		27,000 OHMS 10% 1/2 W
R39	502310		10,000 OHMS 10% 1/2 W
R40	502322		22,000 OHMS 10% 1/2 W
R41	502310		10,000 OHMS 10% 1/2 W
R42	502247		4700 OHMS 10% 1/2 W
R43	502347		47,000 OHMS 10% 1/2 W
R44	502215		1500 OHMS 10% 1/2 W
R45	502210		1000 OHMS 10% 1/2 W
TPA	425993		JACK - TEST, ORANGE
TPB	425992		JACK - TEST, YELLOW
TPC	425994		JACK - TEST, GREEN
TPD	425990		JACK - TEST, BLUE
TPE	425989		JACK - TEST, VIOLET
TPF	425996		JACK - TEST, GREY
XV1 THRU XV5	422416		SOCKET - TRANSISTOR
	425965		SOCKET - INTEGRATED CIRCUIT, 8 PIN
			SU AND TU SUBCARRIER GENERATOR
			SEMICONDUCTORS
Q1	241778		TRANSISTOR - TYPE 2N3563
Q2	241778		TRANSISTOR - TYPE 2N3563
Q3	426236		TRANSISTOR - TYPE 2N4058
Q4	248024		TRANSISTOR - TYPE 2N2924
Q5	248024		TRANSISTOR - TYPE 2N2924
Q6	426224		TRANSISTOR - TYPE 2N3053
CR1	242220		DIODE - TYPE 1N4154
CR2	242220		DIODE - TYPE 1N4154
CR3	242220		DIODE - TYPE 1N4154
CR4	426763		DIODE - TYPE 1N4740, ZENER 10V 1 W
			CAPACITORS
C1	242035		10 MF 20 V
C2	248391		DISC, .01 MF 100 V
C3	227444		DISC, 0.1 MF 25 V
C4	223777		47 MF 20 V
C5	242035		10 MF 20 V
C6	248391		DISC, .01 MF 100 V
C7	227444		DISC, 0.1 MF 25 V
			RESISTORS - FIXED COMPOSITION, UNLESS NOTED
R1	426767		POTENTIOMETER, 10,000 OHMS
R2	502247		4700 OHMS 10% 1/2 W
R3	502247		4700 OHMS 10% 1/2 W
R4	426851		POTENTIOMETER, 1000 OHMS
R5	502247		4700 OHMS 10% 1/2 W
R6	502215		1500 OHMS 10% 1/2 W
R7	423732		THERMISTOR, 5000 OHMS
R8	502315		15,000 OHMS 10% 1/2 W
R9	502210		1000 OHMS 10% 1/2 W
R10	502147		470 OHMS 10% 1/2 W
R11	502247		4700 OHMS 10% 1/2 W
R12	502315		15,000 OHMS 10% 1/2 W
R13	502315		15,000 OHMS 10% 1/2 W
R14	502168		680 OHMS 10% 1/2 W
R15	502239		3900 OHMS 10% 1/2 W
R16	502233		3300 OHMS 10% 1/2 W

Symbol	Stock No.	Drawing No.	Description
R17	502210		1000 OHMS 10% 1/2 W
R18	502310		10,000 OHMS 10% 1/2 W
R19	502168		680 OHMS 10% 1/2 W
R20	502133		330 OHMS 10% 1/2 W
R21	502210		1000 OHMS 10% 1/2 W
R22	502233		3300 OHMS 10% 1/2 W
R23	522122		220 OHMS 10% 2 W
R24	502322		22,000 OHMS 10% 1/2 W
R25	502239		3900 OHMS 10% 1/2 W
R26	502222		2200 OHMS 10% 1/2 W
R27	502168		680 OHMS 10% 1/2 W
R28	502010		10 OHMS 10% 1/2 W
R29	502047		47 OHMS 10% 1/2 W
R30	502147		470 OHMS 10% 1/2 W
R31	426851		POTENTIOMETER, 1000 OHMS
TP1	425993		JACK - TEST, ORANGE, MOD. IN
TP2	425992		JACK - TEST, YELLOW, OSC. OUT
TP3	425994		JACK - TEST, GREEN, SUB. OUT
XV1 THRU XV7	422416		SOCKET - TRANSISTOR
			SU AND TU SUBCARRIER DEMODULATOR
CR1	242220		DIODE - TYPE 1N4154
CR2	242220		DIODE - TYPE 1N4154
CR3	242220		DIODE - TYPE 1N4154
IC1	423797		INTEGRATED CIRCUIT - TYPE SN72741P
Q1 THRU Q5	241778		TRANSISTOR - TYPE 2N3563
C1	424320		CAPACITOR, 0.1 MF 20 V
C2	240340		CAPACITOR, 2.2 MF 35 V
C3	242035		CAPACITOR, 10 MF 20 V
C4	424320		CAPACITOR, 0.1 MF 20 V
C5	426860		CAPACITOR, 2700 PF
C7	423893		CAPACITOR, .022 100V 10%
C8	420553		CAPACITOR, .047 100V 10%
C9	221678		CAPACITOR, 470PF
C10	423893		CAPACITOR, .022 100V 10%
C11	240340		CAPACITOR, 2.2 35V
C12	240340		CAPACITOR, 2.2 35V
C13	223377		CAPACITOR, 47 20V
C14	426979		CAPACITOR, .001 PF 1000 V
C15	242035		CAPACITOR, 10 20V
C16	242035		CAPACITOR, 10 20V
L1	426861		INDUCTOR, 47MH
L2	245182		INDUCTOR 100MH
R1	502247		RESISTOR, CARBON 4700 OHMS 1/2W 10%
R2	502247		RESISTOR, CARBON 4700 OHMS 1/2W 10%
R3	502333		RESISTOR, CARBON 33K OHMS 1/2W 10%
R4	502310		RESISTOR, CARBON 10K OHMS 1/2W 10%
R5	502310		RESISTOR, CARBON 10K OHMS 1/2W 10%
R6	502247		RESISTOR, CARBON 4700 OHMS 1/2W 10%
R7	502122		RESISTOR, CARBON 220 OHMS 1/2W 10%
R8	522210		RESISTOR, CARBON 1000 OHMS 2W 10%
R9	426767		POTENTIOMETER, 10K
R10	502222		RESISTOR, CARBON 2200 OHMS 1/2W 10%
R11	502210		RESISTOR, CARBON 1000 OHMS 1/2W 10%
R12	502210		RESISTOR, CARBON 1000 OHMS 1/2W 10%
R13	502410		RESISTOR, CARBON 100K OHMS 1/2W 10%
R14	502347		RESISTOR, CARBON 47K OHMS 1/2W 10%
R15	502347		RESISTOR, CARBON 47K OHMS 1/2W 10%
R16	502133		RESISTOR, CARBON 330 OHMS 1/2W 10%
R17	426767		POTENTIOMETER, 10K
R18	502310		RESISTOR, CARBON 10K OHMS 1/2W 10%
R19	502347		RESISTOR, CARBON 47K OHMS 1/2W 10%
R20	502218		RESISTOR, CARBON 1800 OHMS 1/2W 10%
R21	502133		RESISTOR, CARBON 330 OHMS 1/2W 10%
R22	502222		RESISTOR, CARBON 2200 OHMS 1/2W 10%
R23	502222		RESISTOR, CARBON 2200 OHMS 1/2W 10%

Symbol	Stock No.	Drawing No.	Description
R24	502147		RESISTOR, CARBON 470 OHMS 1/2W 10%
R25	502122		RESISTOR, CARBON 220 OHMS 1/2W 10%
R26	502247		RESISTOR, CARBON 4700 OHMS 1/2W 10%
R27	502233		RESISTOR, CARBON 3300 OHMS 1/2W 10%
R28	502147		RESISTOR, CARBON 470 OHMS 1/2W 10%
XV1	422416		SOCKET - TRANSISTOR
XV2	422416		SOCKET - TRANSISTOR
	425965		SOCKET, IC 8 PIN
TP1	425993		TEST JACK, TIMING ORANGE
TP2	425992		TEST JACK, DEMOD OUT YELLOW
TP3	425994		TEST JACK, AMP OUT GREEN
			SU AND TU AC LINE FILTER
C1 THRU C4	425663		CAPACITOR, DISC, .01 MF 600 V
L1	423803		CHOKE - RF, 10 UH
L2	423803		CHOKE - RF, 10 UH
			TRANSMITTER UNIT (TU) MAIN FRAME MI-561187
			TU MAIN FRAME
C5 THRU C9	427450		CAPACITOR, 2600MF 50V
C10	425674		CAPACITOR, 9200MF 15V
C11	425674		CAPACITOR, 9200MF 15V
C12	425663		CAPACITOR, .01 600V
C13	425663		CAPACITOR, .01 600V
C14	242035		CAPACITOR, 10UF 20V
FL1 THRU FL32	427389		CAPACITOR, FEED THRU 3000PF 500V
CR1	426766		DIODE, ZENER 1N2979
CR17	234552		DIODE - TYPE 1002
CR35	234552		DIODE - TYPE 1002
F1	427390		FUSE-SLO BLO AGC 1/2 AMP, POWER
F2	426973		FUSE AGC 1 AMP CONTROL
F3	426973		FUSE AGC 1 AMP CONTROL
F4	426710		FUSE AGC 1/4 AMP TELEPHONE LINE
F5	426710		FUSE AGC 1/4 AMP TELEPHONE LINE
I1, I2	430630		INDICATOR, LOCAL/REMOTE - #388
I3 THRU I19	424279		INDICATOR, CAL - CHANNEL, LIGHT EMITTING DIODE
K1 THRU K19	426787		RELAY
Q1	426193		TRANSISTOR - TYPE 2N3054
Q2	426193		TRANSISTOR - TYPE 2N3054
R1	427384		RESISTOR, 100 OHMS 10W
R7 THRU R21	421035		POTENTIOMETER, 10 TURN 25K
SW1A	426781		SWITCH
T1	426786		TRANSFORMER, POWER
T2	421037		TRANSFORMER, LINE
	223473		CONNECTOR, BNC
	240678		DUAL FUSE BLOCK
	229654		FUSE HOLDER
	242353		SOCKET
			TU POWER SUPPLY BOARD
			SEMICONDUCTORS

Symbol	Stock No.	Drawing No.	Description
CR2 THRU CR11 CR12 TO	234552		DIODE - TYPE 1002
CR15	424594		DIODE - TYPE 1N4744, ZENER 15 V 1 W
CR16	423780		DIODE - TYPE 1N4734, ZENER 5.6 V 1 W
			RESISTORS - FIXED COMPOSITION, UNLESS NOTED
R2	522110		100 OHMS 10% 2 W
R3	522115		150 OHMS 10% 2 W
R4	522122		220 OHMS 10% 2 W
R5	522122		220 OHMS 10% 2 W
R6	522122		220 OHMS 10% 2 W
			TU CONTROL DEMODULATOR
			SEMICONDUCTORS
CR1 THRU CR22	242220		DIODE - TYPE 1N4154
CR23	426763		DIODE - TYPE 1N4740, ZENER 10V 1 W
CR24 TO CR31	242220		DIODE - TYPE 1N4154
CR32 TO CR66	234552		DIODE - TYPE 1002
Q1	248024		TRANSISTOR - TYPE 2N2924
Q2	248024		TRANSISTOR - TYPE 2N2924
Q3	426224		TRANSISTOR - TYPE 2N3053
Q4	248024		TRANSISTOR - TYPE 2N2924
Q5	248024		TRANSISTOR - TYPE 2N2924
Q6	426236		TRANSISTOR - TYPE 2N4058
Q7 THRU Q10	248024		TRANSISTOR - TYPE 2N2924
Q11 THRU Q28	426224		TRANSISTOR - TYPE 2N3053
IC1	423797		INTEGRATED CIRCUIT - TYPE SN72741P
IC2	423797		INTEGRATED CIRCUIT - TYPE SN72741P
IC3	423797		INTEGRATED CIRCUIT - TYPE SN72741P
IC4	423799		INTEGRATED CIRCUIT - TYPE SN7413
IC5 THRU IC8	423797		INTEGRATED CIRCUIT - TYPE SN72741P
IC9	423789		INTEGRATED CIRCUIT - TYPE SN74121N
IC10	423799		INTEGRATED CIRCUIT - TYPE SN7413
IC11	425601		INTEGRATED CIRCUIT - TYPE SN7402N
IC12 TO IC15	423797		INTEGRATED CIRCUIT - TYPE SN72741P
IC16	425601		INTEGRATED CIRCUIT - TYPE SN7402N
IC17	426765		INTEGRATED CIRCUIT - TYPE SN74123N
IC18	425797		INTEGRATED CIRCUIT - TYPE SN7493N
IC19	426649		INTEGRATED CIRCUIT - TYPE SN7475N
IC20	425796		INTEGRATED CIRCUIT - TYPE SN7404N
IC21	426765		INTEGRATED CIRCUIT - TYPE SN74123N
IC22	425601		INTEGRATED CIRCUIT - TYPE SN7402N
IC23	425601		INTEGRATED CIRCUIT - TYPE SN7402N
IC24	426775		INTEGRATED CIRCUIT - TYPE SN74154N
IC25	425796		INTEGRATED CIRCUIT - TYPE SN7404N
IC26	425796		INTEGRATED CIRCUIT - TYPE SN7404N
			CAPACITORS
C1	240846		.001 MF 1000 V
C2	227444		0.1 MF 25 V
C3	426228		270 PF
C4	227444		0.1 MF 25 V
C5	245163		2.2 MF 20 V

Symbol	*Stock No.*	*Drawing No.*	*Description*
C6	245163		2.2 MF 20 V
C7	245163		2.2 MF 20 V
C8	420561		0.47 MF 3% 100 V
C9	227444		0.1 MF 25 V
C10	423906		.0565 MF 3% 100 V
C11	420553		.047 MF 3% 100 V
C12	423899		0.1 MF 3% 100 V
C13	425885		.01 MF 3% 100 V
C14	223777		47 MF 20 V
C15	423901		.00496 MF 3% 100 V
C16	420561		0.47 MF 3% 100 V
C17	245163		2.2 MF 20 V
C18	227444		0.1 MF 25 V
C19	426303		.01 MF 100 V
C20	240645		.001 MF 1000 V
C21	240823		10 MF 20 V
C22	426308		.01 MF 100 V
C23	223777		47 MF 20 V
C24	223777		47 MF 20 V
C25	426303		.01 MF 100 V
C26	426303		.01 MF 100 V
C27	223777		47 MF 20 V
C28	227444		0.1 MF 25 V
C29	426303		.01 MF 100 V
C30	245163		100 MF 20 V
			RESISTORS - FIXED COMPOSITION, UNLESS NOTED
R1	502310		10,000 OHMS 10% 1/2 W
R2	502310		10,000 OHMS 10% 1/2 W
R3	502447		470,000 OHMS 10% 1/2 W
R4	502310		10,000 OHMS 10% 1/2 W
R5	502310		10,000 OHMS 10% 1/2 W
R6	502310		10,000 OHMS 10% 1/2 W
R7	502422		220,000 OHMS 10% 1/2 W
R8	502310		10,000 OHMS 10% 1/2 W
R9	502322		22,000 OHMS 10% 1/2 W
R10	502222		2200 OHMS 10% 1/2 W
R11	502122		220 OHMS 10% 1/2 W
R12	502222		2200 OHMS 10% 1/2 W
R13	502247		4700 OHMS 10% 1/2 W
R14	502222		2200 OHMS 10% 1/2 W
R15	502522		2.2 MEGOHM 10% 1/2 W
R16	502422		220,000 OHMS 10% 1/2 W
R17	502310		10,000 OHMS 10% 1/2 W
R18	502222		2200 OHMS 10% 1/2 W
R19	502210		1000 OHMS 10% 1/2 W
R20	502122		220 OHMS 10% 1/2 W
R21	502210		1000 OHMS 10% 1/2 W
R22	502310		10,000 OHMS 10% 1/2 W
R23	502310		10,000 OHMS 10% 1/2 W
R24	502310		10,000 OHMS 10% 1/2 W
R25	502522		2.2 MEGOHM 10% 1/2 W
R26	502310		10,000 OHMS 10% 1/2 W
R27	426767		POTENTIOMETER, 10,000 OHMS
R28	502222		2200 OHMS 10% 1/2 W
R29	502410		100,000 OHMS 10% 1/2 W
R30	502410		100,000 OHMS 10% 1/2 W
R31	502410		100,000 OHMS 10% 1/2 W
R32	502310		10,000 OHMS 10% 1/2 W
R33	502347		47,000 OHMS 10% 1/2 W
R34	502510		1 MEGOHM 10% 1/2 W
R35	502347		47,000 OHMS 10% 1/2 W
R36	502510		1 MEGOHM 10% 1/2 W
R37	502310		10,000 OHMS 10% 1/2 W
R38	502210		1000 OHMS 10% 1/2 W
R39	502247		4700 OHMS 10% 1/2 W
R40	502222		2200 OHMS 10% 1/2 W
R41	426776		POTENTIOMETER, 100,000 OHMS
R42	502339		39,000 OHMS 10% 1/2 W

Symbol	Stock No.	Drawing No.	Description
R43	502222		2200 OHMS 10% 1/2 W
R44	502322		22,000 OHMS 10% 1/2 W
R45	502210		1000 OHMS 10% 1/2 W
R46	502168		680 OHMS 10% 1/2 W
R47	502222		2200 OHMS 10% 1/2 W
R48	502410		100,000 OHMS 10% 1/2 W
R49	502222		2200 OHMS 10% 1/2 W
R50	502247		4700 OHMS 10% 1/2 W
R51	502247		4700 OHMS 10% 1/2 W
R52	502222		2200 OHMS 10% 1/2 W
R53	502047		47 OHMS 10% 1/2 W
R54	502222		2200 OHMS 10% 1/2 W
R55	502247		4700 OHMS 10% 1/2 W
R56	502222		2200 OHMS 10% 1/2 W
R57	502222		2200 OHMS 10% 1/2 W
R58 THRU			
R61	502410		100,000 OHMS 10% 1/2 W
R62	522122		220 OHMS 10% 2 W
R63	502315		15,000 OHMS 10% 1/2 W
R64	502268		6800 OHMS 10% 1/2 W
R65	502227		2700 OHMS 10% 1/2 W
R66	502222		2200 OHMS 10% 1/2 W
R67	502210		1000 OHMS 10% 1/2 W
R68	502168		680 OHMS 10% 1/2 W
R69	502122		220 OHMS 10% 1/2 W
R70	502168		680 OHMS 10% 1/2 W
R71	502122		220 OHMS 10% 1/2 W
R72	502168		680 OHMS 10% 1/2 W
R73	502122		220 OHMS 10% 1/2 W
R74	502168		680 OHMS 10% 1/2 W
R75	502122		220 OHMS 10% 1/2 W
R76	502333		33,000 OHMS 10% 1/2 W
R77	502333		33,000 OHMS 10% 1/2 W
R78	502322		22,000 OHMS 10% 1/2 W
R79	502322		22,000 OHMS 10% 1/2 W
R80 THRU			
R98	502210		1000 OHMS 10% 1/2 W
R99	522168		680 OHMS 10% 2 W
R100	502222		2200 OHMS 10% 1/2 W
R101	502222		2200 OHMS 10% 1/2 W
TPA	425991		JACK - TEST, BROWN
TPB	425996		JACK - TEST, RED
TPC	425993		JACK - TEST, ORANGE
TPD	425992		JACK - TEST, YELLOW
TPE	425994		JACK - TEST, GREEN
TPF	425990		JACK - TEST, BLUE
TPG	425999		JACK - TEST, VIOLET
TPH	425998		JACK - TEST, GREY
TPJ	425993		JACK - TEST, ORANGE
TPK	425992		JACK - TEST, YELLOW
TPL	425994		JACK - TEST, GREEN
TPM	425990		JACK - TEST, BLUE
XV1 THRU			
XV27	422416		SOCKET - TRANSISTOR
	423743		SOCKET - INTEGRATED CIRCUIT, 7 PIN
	425965		SOCKET - INTEGRATED CIRCUIT, 8 PIN
			SOCKET - INTEGRATED CIRCUIT, 24 PIN
			TU AUDIBLE METERING GENERATOR
			SEMICONDUCTORS
CR1 THRU			
CR5	242220		DIODE - TYPE 1N4154
CR6	424594		DIODE - TYPE 1N4744, ZENER 15 V 1 W
CR7	424594		DIODE - TYPE 1N4744, ZENER 15 V 1 W
CR8	426763		DIODE - TYPE 1N4740, ZENER 10 V 1 W
CR9	426763		DIODE - TYPE 1N4740, ZENER 10 V 1 W

Symbol	Stock No.	Drawing No.	Description
CR10	423780		DIODE - TYPE 1N4734, ZENER 5.6 V 1 W
Q1	248024		TRANSISTOR - TYPE 2N2924
Q2	249612		TRANSISTOR - TYPE 2N5295
IC1	423797		INTEGRATED CIRCUIT - TYPE SN72741P
IC2	423810		INTEGRATED CIRCUIT - TYPE SN72748
IC3, IC4	423797		INTEGRATED CIRCUIT - TYPE SN72741P
IC5	423999		INTEGRATED CIRCUIT - TYPE TIL-112
IC6	423799		INTEGRATED CIRCUIT - TYPE SN7415[illegible]
IC7	423797		INTEGRATED CIRCUIT - TYPE SN72741P
IC8	423797		INTEGRATED CIRCUIT - TYPE SN72741P
IC9	423797		INTEGRATED CIRCUIT - TYPE SN72741P
			CAPACITORS
C1	227444		DISC, 0.1 MF 25 V
C2	227444		DISC, 0.1 MF 25 V
C3	426621		DISC, .01 MF 1000V
C4	245163		2.2 MF 20 V
C5	426780		3300 PF
C6	227444		DISC, 0.1 MF 25 V
C7	227444		DISC, 0.1 MF 25 V
C8	426621		DISC, .01 MF 1000V
C9	242035		10 MF 20 V
C10	423907		.044 MF 3% 100 V
C11	426776		0.101 MF 3% 100 V
C12	423896		.0033 MF 3% 100 V
C13	426777		0.135 MF 3% 100 V
C14	426779		.0013 MF 3% 100 V
C15	242035		10 MF 20 V
C16	227444		DISC, 0.1 MF 25 V
C17	225770		150 MF 15 V
C18	242035		10 MF 20 V
C19	225770		150 MF 15 V
C20	245168		100 MF 20 V
C21	245168		100 MF 20 V
C22	242035		10 MF 20 V
C23	242035		10 MF 20 V
C24	428195		5 PF
			RESISTORS - FIXED COMPOSITION, UNLESS NOTED
R1	502447		470,000 OHMS 10% 1/2 W
R2	502333		33,000 OHMS 10% 1/2 W
R3	502333		33,000 OHMS 10% 1/2 W
R4	426767		POTENTIOMETER, 10,000 OHMS
R5	502268		6800 OHMS 10% 1/2 W
R6	502368		68,000 OHMS 10% 1/2 W
R7	502247		4700 OHMS 10% 1/2 W
R8	502247		4700 OHMS 10% 1/2 W
R9	502468		680,000 OHMS 10% 1/2 W
R10	502315		15,000 OHMS 10% 1/2 W
R11	426767		POTENTIOMETER, 10,000 OHMS
R12	502322		22,000 OHMS 10% 1/2 W
R13	502433		330,000 OHMS 10% 1/2 W
R14	502247		4700 OHMS 10% 1/2 W
R15	502315		15,000 OHMS 10% 1/2 W
R16	502410		100,000 OHMS 10% 1/2 W
R17	502410		100,000 OHMS 10% 1/2 W
R18	502222		2200 OHMS 10% 1/2 W
R19	502122		220 OHMS 10% 1/2 W
R20	502310		10,000 OHMS 10% 1/2 W
R21	502410		100,000 OHMS 10% 1/2 W
R22	502410		100,000 OHMS 10% 1/2 W
R23 THRU			
R27	502310		10,000 OHMS 10% 1/2 W
R28	502222		2200 OHMS 10% 1/2 W
R29	502347		47,000 OHMS 10% 1/2 W
R30	502310		10,000 OHMS 10% 1/2 W
R31	502247		4700 OHMS 10% 1/2 W
R32	502247		4700 OHMS 10% 1/2 W
R33	426767		POTENTIOMETER, 10,000 OHMS

Symbol	Stock No.	Drawing No.	Description
R34	502222		2,200 OHMS 10% 1/2 W
R35	502347		47,000 OHMS 10% 1/2 W
R36	512147		470 OHMS 10% 1 W
R37	502156		560 OHMS 10% 1/2 W
R38	522122		220 OHMS 10% 2 W
R39	522122		220 OHMS 10% 2 W
R40	522147		470 OHMS 10% 2 W
R41	502312		12,000 OHMS 10% 1/2 W
R42	502210		1000 OHMS 10% 1/2 W
TP1	425993		JACK - TEST, ORANGE
TP2	425992		JACK - TEST, YELLOW
TP3	425994		JACK - TEST, GREEN
TP4	425995		JACK - TEST, BLUE
TP5	425996		JACK - TEST, VIOLET
TP6	425998		JACK - TEST, GREY
TP7	425997		JACK - TEST, WHITE
XV1	422416		SOCKET - TRANSISTOR
	425965		SOCKET - INTEGRATED CIRCUIT, 8 PIN
	423743		SOCKET - INTEGRATED CIRCUIT, 7 PIN
			TU SUBAUDIBLE METERING GENERATOR
			SEMICONDUCTORS
CR1 THRU CR5	242220		DIODE - TYPE 1N4154
CR6	426763		DIODE - TYPE 1N4740, ZENER 10 V 1 W
CR7	426763		DIODE - TYPE 1N4740, ZENER 10 V 1 W
CR8	423760		DIODE - TYPE 1N4734, ZENER 5.6 V 1 W
Q1	248024		TRANSISTOR - TYPE 2N2924
Q2	249612		TRANSISTOR - TYPE 2N5293
IC1	423797		INTEGRATED CIRCUIT - TYPE SN72741P
IC2	423810		INTEGRATED CIRCUIT - TYPE SN72748
IC3, IC4	423797		INTEGRATED CIRCUIT - TYPE SN72741P
IC5	423994		INTEGRATED CIRCUIT - TYPE TIL-112
IC6	423799		INTEGRATED CIRCUIT - TYPE SN7413N
IC7	422417		INTEGRATED CIRCUIT - TYPE SN7490N
IC8	425797		INTEGRATED CIRCUIT - TYPE SN7493N
IC9	423797		INTEGRATED CIRCUIT - TYPE SN72741P
IC10	423797		INTEGRATED CIRCUIT - TYPE SN72741P
IC11	423797		INTEGRATED CIRCUIT - TYPE SN72741P
			CAPACITORS
C1	227444		DISC, 0.1 MF 25 V
C2	227444		DISC, 0.1 MF 25 V
C3	426621		DISC, .01 MF 1000V
C4	242035		10 MF 20 V
C5	426780		3300 PF
C6	227444		DISC, 0.1 MF 25 V
C7	227444		DISC, 0.1 MF 25 V
C8	426621		DISC, .01 MF 1000V
C9	242035		10 MF 20 V
C10	423907		.044 MF 3% 100 V
C11	426778		0.101 MF 3% 100 V
C12	423896		.0033 MF 3% 100 V
C13	426777		0.135 MF 3% 100 V
C14	426779		.0013 MF 3% 100 V
C15	242035		10 MF 20 V
C16	242035		10 MF 20 V
C17	225770		150 MF 15 V
C18	242035		10 MF 20 V
C19	225770		150 MF 15 V
C20	245168		100 MF 20 V
C21	245168		100 MF 20 V
C22	242035		10 MF 20 V
C23	242035		10 MF 20 V
C24	428195		5 PF

Symbol	Stock No.	Drawing No.	Description
			RESISTORS - FIXED COMPOSITION, UNLESS NOTED
R1	502447		470,000 OHMS 10% 1/2 W
R2	502410		100,000 OHMS 10% 1/2 W
R3	502410		100,000 OHMS 10% 1/2 W
R4	426767		POTENTIOMETER, 10,000 OHMS
R5	502268		6800 OHMS 10% 1/2 W
R6	502366		68,000 OHMS 10% 1/2 W
R7	502247		4700 OHMS 10% 1/2 W
R8	502247		4700 OHMS 10% 1/2 W
R9	502466		680,000 OHMS 10% 1/2 W
R10	502310		10,000 OHMS 10% 1/2 W
R11	426767		POTENTIOMETER, 10,000 OHMS
R12	502315		15,000 OHMS 10% 1/2 W
R13	502433		330,000 OHMS 10% 1/2 W
R14	502247		4700 OHMS 10% 1/2 W
R15	502315		15,000 OHMS 10% 1/2 W
R16	502410		100,000 OHMS 10% 1/2 W
R17	502410		100,000 OHMS 10% 1/2 W
R18	502222		2200 OHMS 10% 1/2 W
R19	502122		220 OHMS 10% 1/2 W
R20	502310		10,000 OHMS 10% 1/2 W
R21	502410		100,000 OHMS 10% 1/2 W
R22	502410		100,000 OHMS 10% 1/2 W
R23 THRU			
R27	502439		390,000 OHMS 10% 1/2 W
R28	502310		10,000 OHMS 10% 1/2 W
R29	502310		10,000 OHMS 10% 1/2 W
R30	502247		4700 OHMS 10% 1/2 W
R31	502247		4700 OHMS 10% 1/2 W
R32	426767		POTENTIOMETER, 10,000 OHMS
R33	502310		10,000 OHMS 10% 1/2 W
R34	502347		47,000 OHMS 10% 1/2 W
R35	512147		470 OHMS 10% 1 W
R36	502156		560 OHMS 10% 1/2 W
R37	522122		220 OHMS 10% 2 W
R38	522122		220 OHMS 10% 2 W
R39	522147		470 OHMS 10% 2 W
R40	502312		12,000 OHMS 10% 1/2 W
R41	502210		1000 OHMS 10% 1/2 W
TP1	425993		JACK - TEST, ORANGE
TP2	425992		JACK - TEST, YELLOW
TP3	425994		JACK - TEST, GREEN
TP4	425990		JACK - TEST, BLUE
TP5	425989		JACK - TEST, VIOLET
TP6	425988		JACK - TEST, GREY
TP7	425997		JACK - TEST, WHITE
XV1	422416		SOCKET - TRANSISTOR
	423743		SOCKET - INTEGRATED CIRCUIT, 7 PIN
	425965		SOCKET - INTEGRATED CIRCUIT, 8 PIN
			TU CONTROL BANDPASS FILTER
			SEMICONDUCTORS
CR1	424594		DIODE - TYPE 1N4744, ZENER 15 V 1 W
CR2	424594		DIODE - TYPE 1N4744, ZENER 15 V 1 W
			CAPACITORS
C1	423910		0.247 MF 3% 100 V
C2	426781		0.296 MF 3% 100 V
C3	423910		0.247 MF 3% 100 V
C4	426782		0.350 MF 3% 100 V
C5	423910		0.247 MF 3% 100 V
C6	426782		0.350 MF 3% 100 V
C7	423910		0.247 MF 3% 100 V
C8	426781		0.296 MF 3% 100 V

Symbol	Stock No.	Drawing No.	Description
C9	423910		0.247 MF 3% 100 V
L1	426783		INDUCTOR - 1.3 HY
L2	426784		INDUCTOR - 1.79 HY
L3	426785		INDUCTOR - 1.70 HY
L4	426784		INDUCTOR - 1.79 HY
L5	426783		INDUCTOR - 1.3 HY
			RESISTORS - FIXED COMPOSITION, UNLESS NOTED
R1	502233		3300 OHMS 10% 1/2 W
R2	502222		2200 OHMS 10% 1/2 W
R3	502210		1000 OHMS 10% 1/2 W
			SUBCARRIER GENERATOR JUMPER BOARD
	426971		PRINTED CIRCUIT BOARD - 6 TERMINAL
			SUBCARRIER DEMODULATOR JUMPER BOARD
	426970		PRINTED CIRCUIT BOARD - 5 TERMINAL
			SUBCARRIER GENERATOR F.D. PARTS
			26 KHZ FREQUENCY DETERMINING PARTS
LA	420556		CHOKE, 22 MH
LB	420555		CHOKE, 15 MH
CA	218777		CAPACITOR, 1500 PF
CB	218777		CAPACITOR, 1500 PF
CC	218777		CAPACITOR, 1500 PF
CD	426228		CAPACITOR, 270 PF
CE	426780		CAPACITOR, 3300 PF
CF	426855		CAPACITOR, 680 PF
CG	426858		CAPACITOR, 2000 PF
			39 OR 41 KHZ FREQUENCY DETERMINING PARTS
LA	420570		CHOKE, 10 MH
LB	245146		CHOKE, 4.7 MH
CA	219195		CAPACITOR, 1000 PF
CB	219195		CAPACITOR, 1000 PF
CC	218091		CAPACITOR, 750 PF
CD	426227		CAPACITOR, 150 PF
CE	218777		CAPACITOR, 1500 PF
CF	218249		CAPACITOR, 1200 PF
CG	218777		CAPACITOR, 1500 PF
			67 KHZ FREQUENCY DETERMINING PARTS
LA	245146		CHOKE, 4.7 MH
LB	245147		CHOKE, 3.9 MH
CA	426865		CAPACITOR, 560 PF
CB	426865		CAPACITOR, 560 PF
CC	238220		CAPACITOR, 470 PF
CD	426711		CAPACITOR, 120 PF
CE	219195		CAPACITOR, 1000 PF
CF	238220		CAPACITOR, 470 PF
CG	426866		CAPACITOR, 820 PF
			110 KHZ FREQUENCY DETERMINING PARTS
LA	245147		CHOKE, 3.9 MH
LB	420557		CHOKE, 2.2 MH
CA	079191		CAPACITOR, 330 PF
CB	079191		CAPACITOR, 330 PF
CC	238220		CAPACITOR, 470 PF
CD	215197		CAPACITOR, 68 PF
CE	426855		CAPACITOR, 680 PF
CF	426228		CAPACITOR, 270 PF
CG	426637		CAPACITOR, 220 PF
			135 KHZ FREQUENCY DETERMINING PARTS
LA	420557		CHOKE, 2.2 MH
LB	420557		CHOKE, 2.2 MH

Symbol	Stock No.	Drawing No.	Description
CA	426228		CAPACITOR, 270 PF
CB	426228		CAPACITOR, 270 PF
CC	079191		CAPACITOR, 330 PF
CD	426864		CAPACITOR, 91 PF
CE	426854		CAPACITOR, 620 PF
CF	426637		CAPACITOR, 220 PF
CG	426867		CAPACITOR, 240 PF
			185 KHZ FREQUENCY DETERMINING PARTS
LA	420557		CHOKE, 2.2 MH
LB	420557		CHOKE, 2.2 MH
CA	426637		CAPACITOR, 220 PF
CB	426637		CAPACITOR, 220 PF
CC	426711		CAPACITOR, 120 PF
CD	220259		CAPACITOR, 36 PF
CE	426228		CAPACITOR, 270 PF
CF	228718		CAPACITOR, 75 PF
CG	426227		CAPACITOR, 150 PF
			SUBCARRIER DEMODULATOR F.D. PARTS
			26 KHZ FREQUENCY DETERMINING PARTS
LA	421953		INDUCTOR
LB	421953		INDUCTOR
LC	421953		INDUCTOR
LD	421953		INDUCTOR
CA	218777		CAPACITOR, 1500PF
CB	426857		CAPACITOR, 2000PF
CC	426862		CAPACITOR, 250PF
CD	426855		CAPACITOR, 680PF
CE	238230		CAPACITOR, 160PF
CF	426855		CAPACITOR, 680PF
CG	426862		CAPACITOR, 250PF
CH	426857		CAPACITOR, 2000PF
CI	218777		CAPACITOR, 1500PF
			39 KHZ FREQUENCY DETERMINING PARTS
LA	421953		INDUCTOR, 33MH
LB	421953		INDUCTOR, 33MH
LC	421953		INDUCTOR, 33MH
LD	421953		INDUCTOR, 33MH
CA	426858		CAPACITOR, 1110PF 2%
CB	426855		CAPACITOR, 680PF
CC	228718		CAPACITOR, 75PF
CD	426853		CAPACITOR, 390PF
CE	426152		CAPACITOR, 51PF
CF	426853		CAPACITOR, 390PF
CG	228718		CAPACITOR, 75PF
CH	426855		CAPACITOR, 680PF
CI	426858		CAPACITOR, 1110PF 2%
			41 KHZ FREQUENCY DETERMINING PARTS
LA	421953		INDUCTOR, 33MH
LB	421953		INDUCTOR, 33MH
LC	421953		INDUCTOR, 33MH
LD	421953		INDUCTOR, 33MH
CA	426858		CAPACITOR 1110PF 2%
CB	426854		CAPACITOR, 620PF
CC	215197		CAPACITOR, 68PF
CD	227692		CAPACITOR, 360PF
CE	218434		CAPACITOR, 43PF
CF	227692		CAPACITOR, 360PF
CG	215197		CAPACITOR, 68PF
CH	426854		CAPACITOR, 620PF
CI	426858		CAPACITOR 1110PF 2%
			67 KHZ FREQUENCY DETERMINING PARTS
LA	246632		INDUCTOR
LB	246632		INDUCTOR

Symbol	Stock No.	Drawing No.	Description
LC	246032		INDUCTOR
LD	246032		INDUCTOR
CA	426056		CAPACITOR, 910PF
CB	219195		CAPACITOR, 1000PF
CC	218221		CAPACITOR, 82PF
CD	248286		CAPACITOR, 430PF
CE	228718		CAPACITOR, 75PF
CF	248286		CAPACITOR, 430PF
CG	218221		CAPACITOR, 82PF
CH	219195		CAPACITOR, 1000PF
CI	426056		CAPACITOR, 910PF
			110 KHZ FREQUENCY DETERMINING PARTS
LA	421950		INDUCTOR, 3.3MH
LB	421950		INDUCTOR, 3.3MH
LC	421950		INDUCTOR, 3.3MH
LD	421950		INDUCTOR, 3.3MH
CA	426056		CAPACITOR, 910PF
CB	218777		CAPACITOR, 1500PF
CC	228718		CAPACITOR, 75PF
CD	426059		CAPACITOR, 510PF
CE	221678		CAPACITOR, 47PF
CF	426059		CAPACITOR, 510PF
CG	228718		CAPACITOR, 75PF
CH	218777		CAPACITOR, 1500PF
CI	426856		CAPACITOR, 910PF
			185 KHZ FREQUENCY DETERMINING PARTS
LA	421950		INDUCTOR, 3.3MH
LB	421950		INDUCTOR, 3.3MH
LC	421950		INDUCTOR, 3.3MH
LD	421950		INDUCTOR, 3.3MH
CA	426712		CAPACITOR, 180PF
CB	426856		CAPACITOR, 910PF
CC	228718		CAPACITOR, 75PF
CD	426229		CAPACITOR, 100PF
CE	426152		CAPACITOR, 51PF
CF	426229		CAPACITOR, 100PF
CG	228718		CAPACITOR, 75PF
CH	426856		CAPACITOR, 910PF
CI	426712		CAPACITOR, 180PF

BTR-15BR SUGGESTED EQUIPMENT SPARES

Stock No.	Quantity	Description
RO-428	1	Kit, containing all items listed below in quantity shown
234552	10	Diode, 10D2
426789	1	Diode, 1N2979
242220	8	Diode, 1N4154
423780	1	Diode, Zener, 1N4734A, 5.6V, 1W
426763	1	Diode, Zener, 1N4740A, 10V, 1W
424594	2	Diode, Zener, 1N4744A, 15V, 1W
426764	1	Diode, Zener, 1N4745A, 16V, 1W
425801	2	Integrated circuit, SN7402N
425796	3	Integrated circuit, SN7404N
423799	3	Integrated circuit, SN7413N
426849	1	Integrated circuit, SN7475N
423790	1	Integrated circuit, SN7485N
422417	1	Integrated circuit, SN7490N
425797	1	Integrated circuit, SN7493N
423797	5	Integrated circuit, SN72741P
423789	1	Integrated circuit, SN74121N
426765	1	Integrated circuit, SN74123N
426775	1	Integrated circuit, SN74154N
423999	1	Integrated circuit, TIL-112
248024	3	Transistor, 2N2924
426224	3	Transistor, 2N3053
426183	1	Transistor, 2N3054
241778	1	Transistor, 2N3563
420558	1	Transistor, 2N3819
426236	1	Transistor, 2N4058
422415	1	Transistor, 2N4990
249612	1	Transistor, 2N5293
427450	2	Capacitor, 2600 Mf, 50 VDC
425874	2	Capacitor, 9200 Mf, 15 VDC
426710	10	Fuse, AGC 1/4 ampere - telephone line
427383	5	Fuse, AGC 1/4 ampere, Slo Blo-Power, SU
427390	5	Fuse, AGC 1/2 ampere, Slo Blo-Power, TU
426973	5	Fuse, AGC 1 ampere-Raise and Lower
424279	2	Indicator, light emitting diode
430630	2	Lamp, Indicator, #388
421035	2	Potentiometer, 25,000 ohms, 10 turns
426787	4	Relay
421042	1	Transformer, power, T1-SU
426792	1	Transformer, line, T2-SU
426786	1	Transformer, power, T1-TU
421037	1	Transformer, line, T2-TU

BTR-15BW SUGGESTED EQUIPMENT SPARES

Stock No.	Quantity	Description
RO-427	1	Kit, containing all item listed below in quantity shown
234552	10	Diode, 10D2
426789	1	Diode, 1N2979
242220	8	Diode, 1N4154
423780	1	Diode, Zener, 1N4734A, 5.6V, 1W
426763	1	Diode, Zener, 1N4740A, 10V, 1W
424594	3	Diode, Zener, 1N4744A, 15V, 1W
426764	1	Diode, Zener, 1N4745A, 16V, 1W
425801	2	Integrated circuit, SN7402N
425796	1	Integrated circuit, SN7404N
423799	1	Integrated circuit, SN7413N
426849	1	Integrated circuit, SN7475N
423790	1	Integrated circuit, SN7485N
425797	1	Integrated circuit, SN7493N
423797	5	Integrated circuit, SN72741P
423789	1	Integrated circuit, SN74121N
426765	1	Integrated circuit, SN74123N
426775	1	Integrated circuit, SN74154N
423999	1	Integrated circuit, TIL-112
248024	4	Transistor, 2N2924
426224	4	Transistor, 2N3053
426183	1	Transistor, 2N3054
420558	1	Transistor, 2N3819
426236	1	Transistor, 2N4058
422415	1	Transistor, 2N4990
249612	1	Transistor, 2N5293
427450	2	Capacitor, 2600 Mf, 50 VDC
425874	2	Capacitor, 9200 Mf, 15 VDC
426710	10	Fuse, AGC 1/4 ampere - telephone line
427383	5	Fuse, AGC 1/4 ampere, Slo Blo - Power SU
427390	5	Fuse, AGC 1/2 ampere, Slo Blo - Power TU
426973	5	Fuse, AGC 1 ampere - Raise and Lower
424279	2	Indicator, light emitting diode
430630	2	Lamp, indicator, #388
421035	2	Potentiometer, 25,000 ohms, 10 turns
426787	4	Relay
421042	1	Transformer, power, T1 - SU
426792	1	Transformer, line, T2 - SU
426786	1	Transformer, power, T1 - T2
421037	1	Transformer, line, T2 - TU

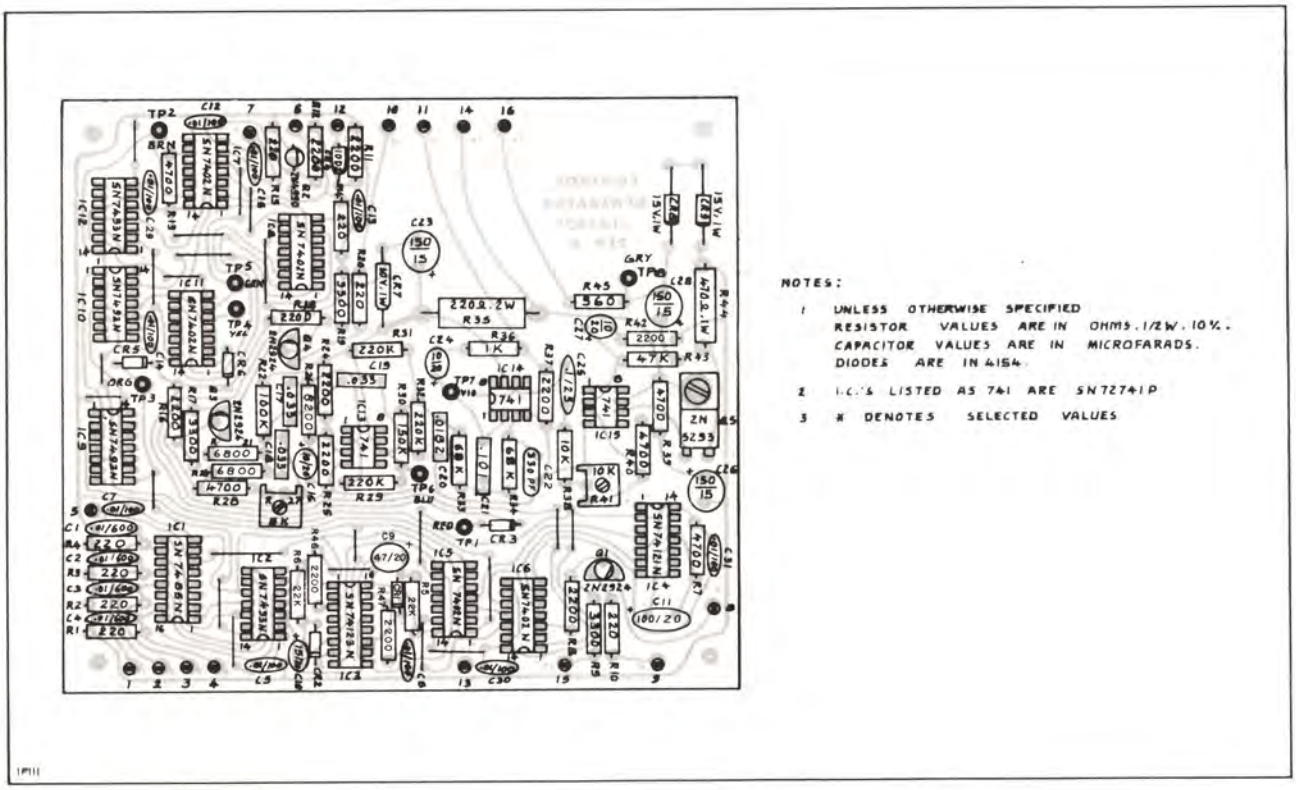


Figure 25. SU Control Generator, Parts Location

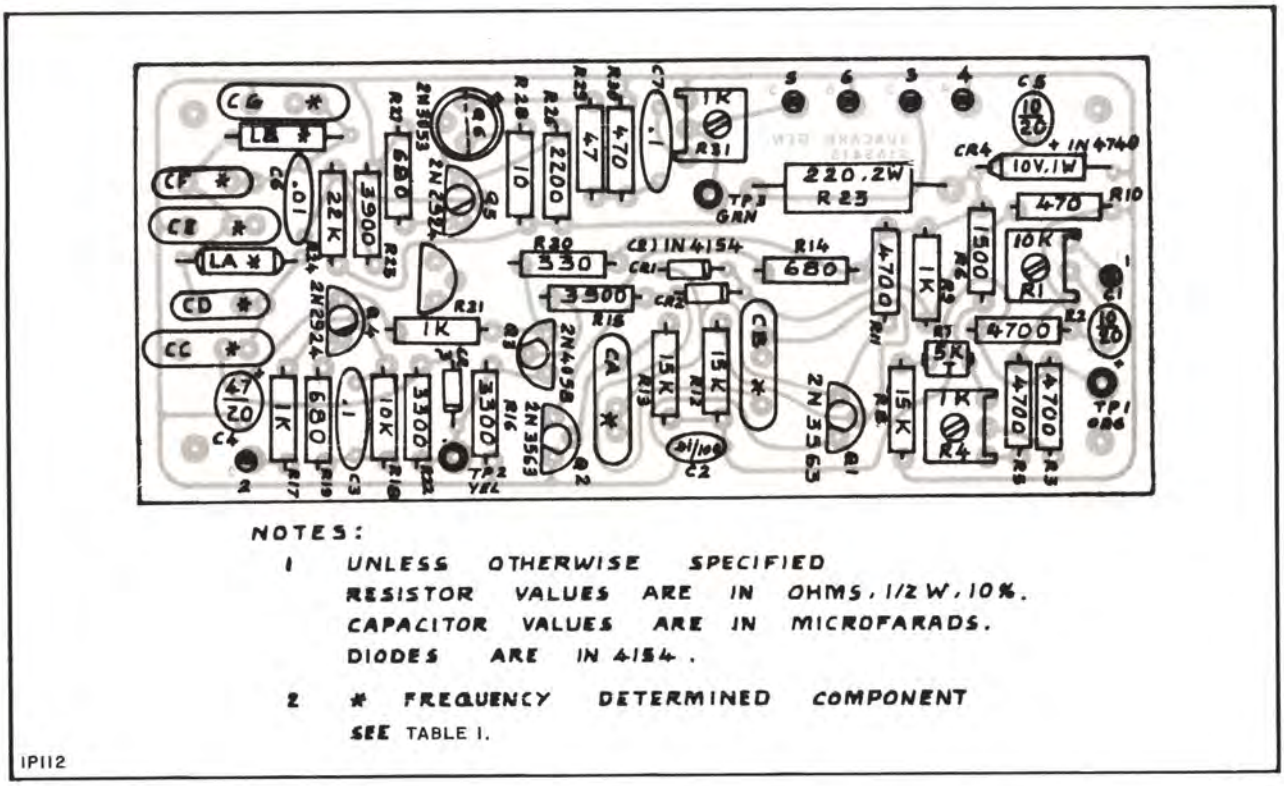


Figure 26. SU and TU Subcarrier Generator, Parts Location

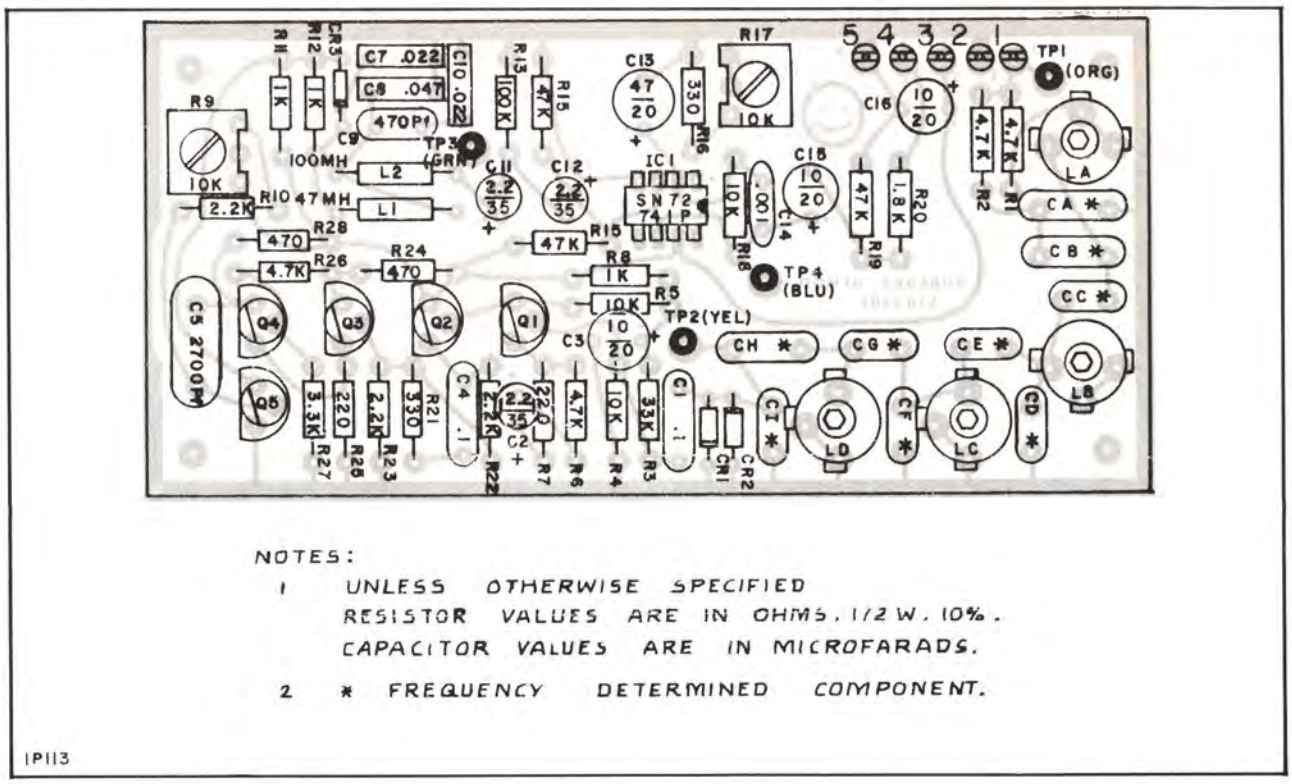


Figure 27. SU and TU Subcarrier Demodulator, Parts Location

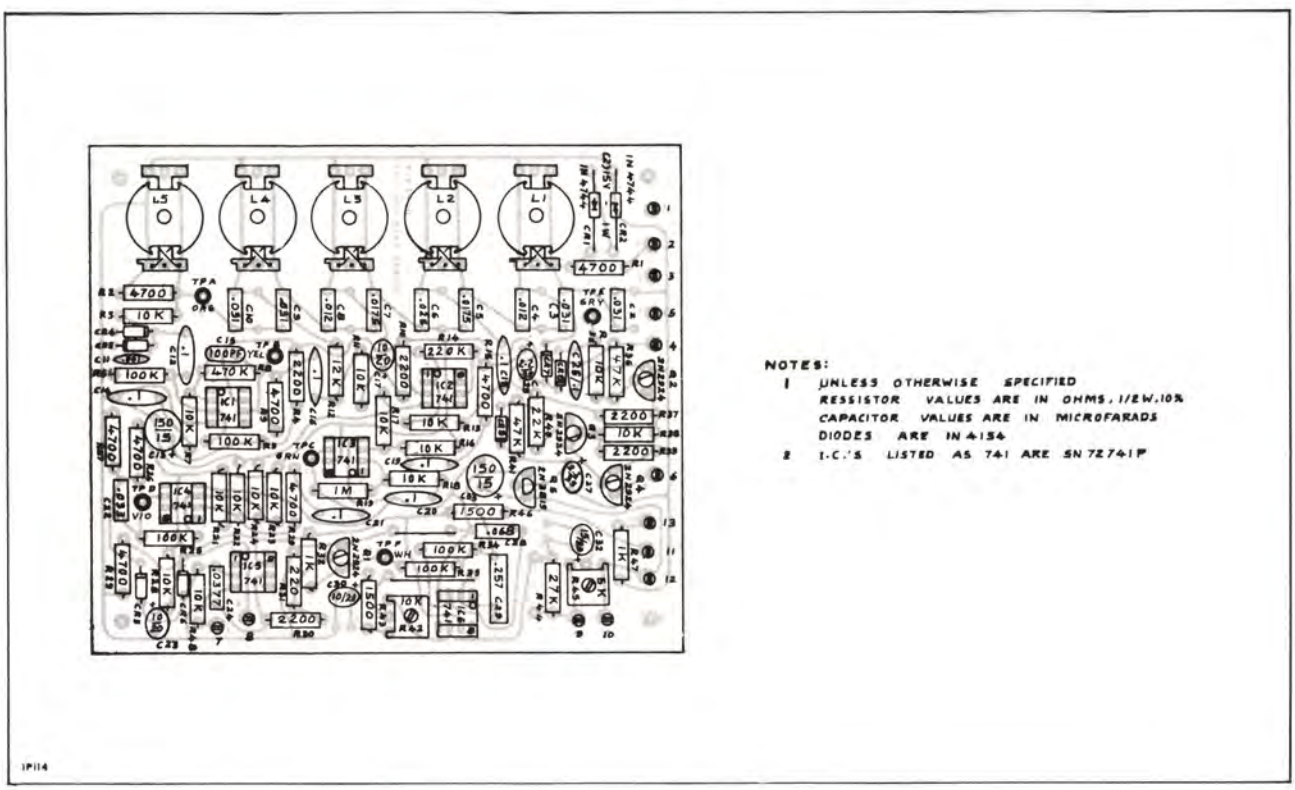


Figure 28. SU Audible Metering Demodulator, Parts Location

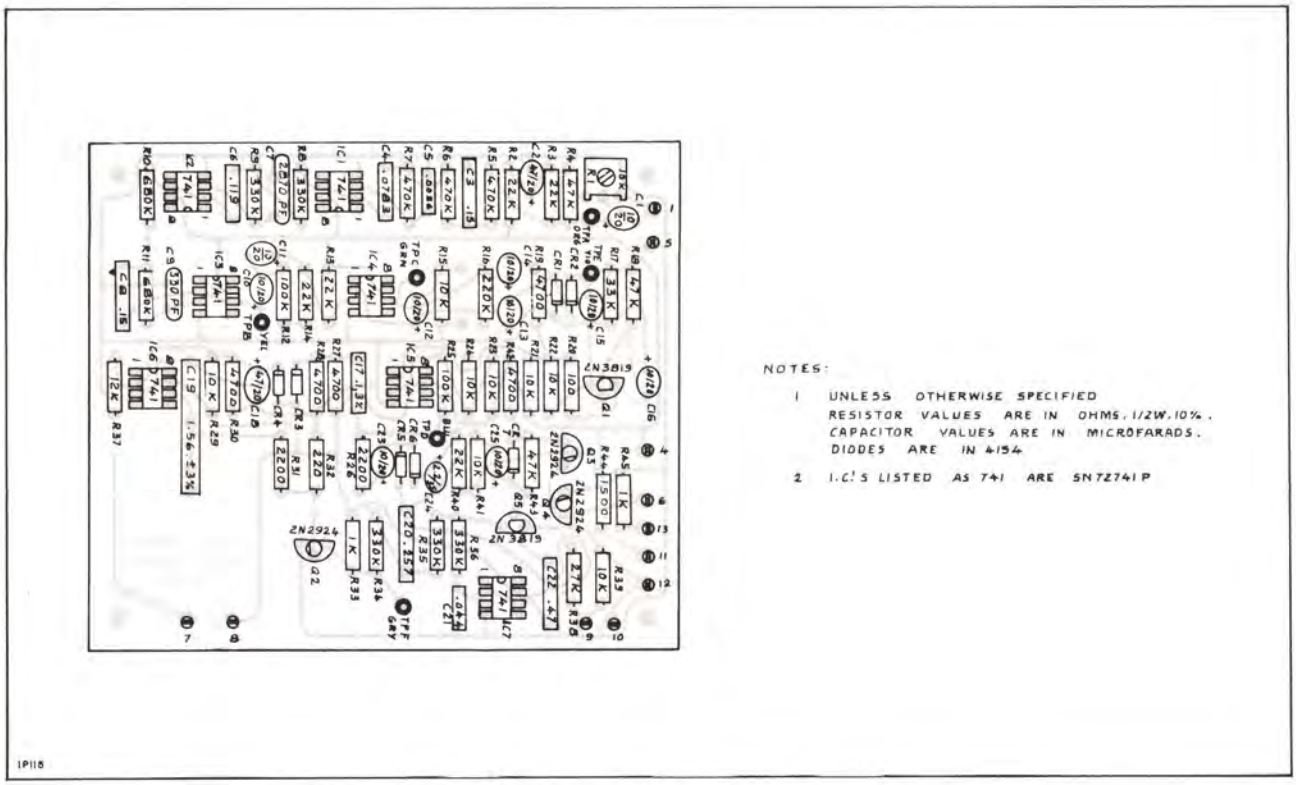


Figure 29. SU Subaudible Metering Demodulator, Parts Location

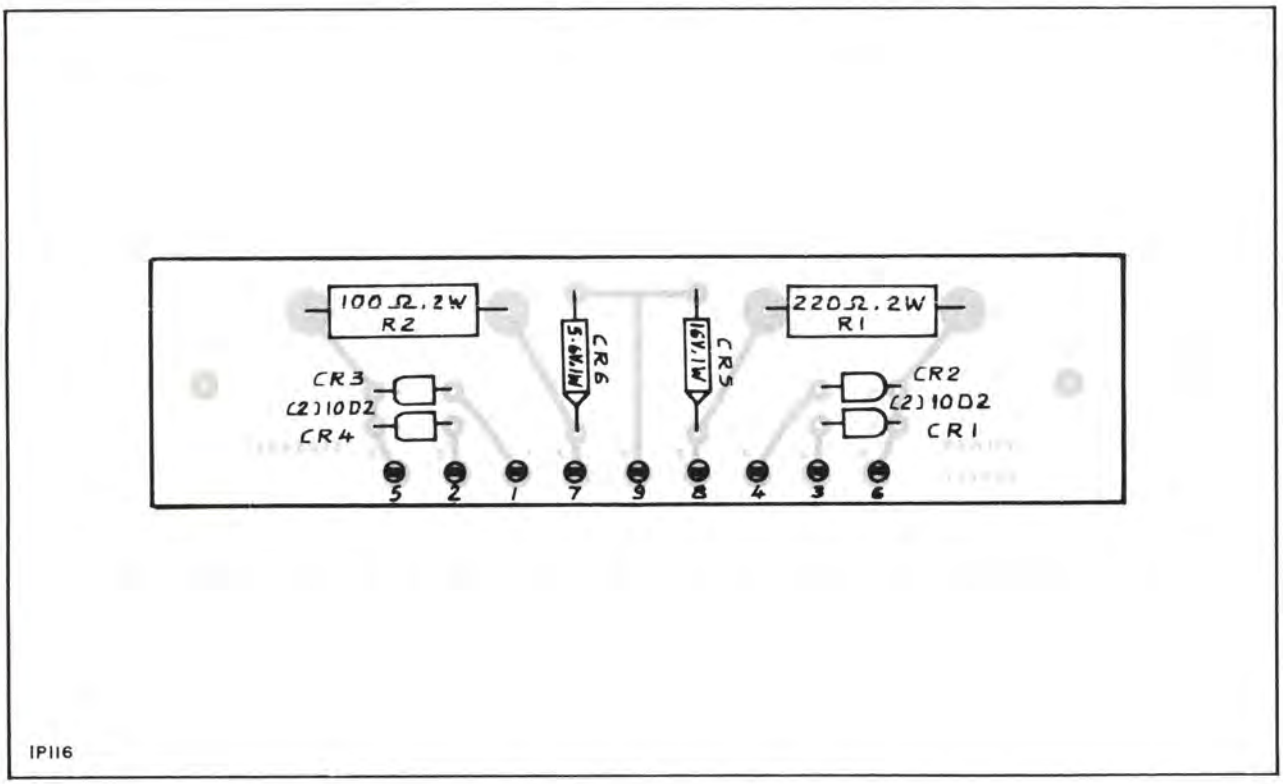
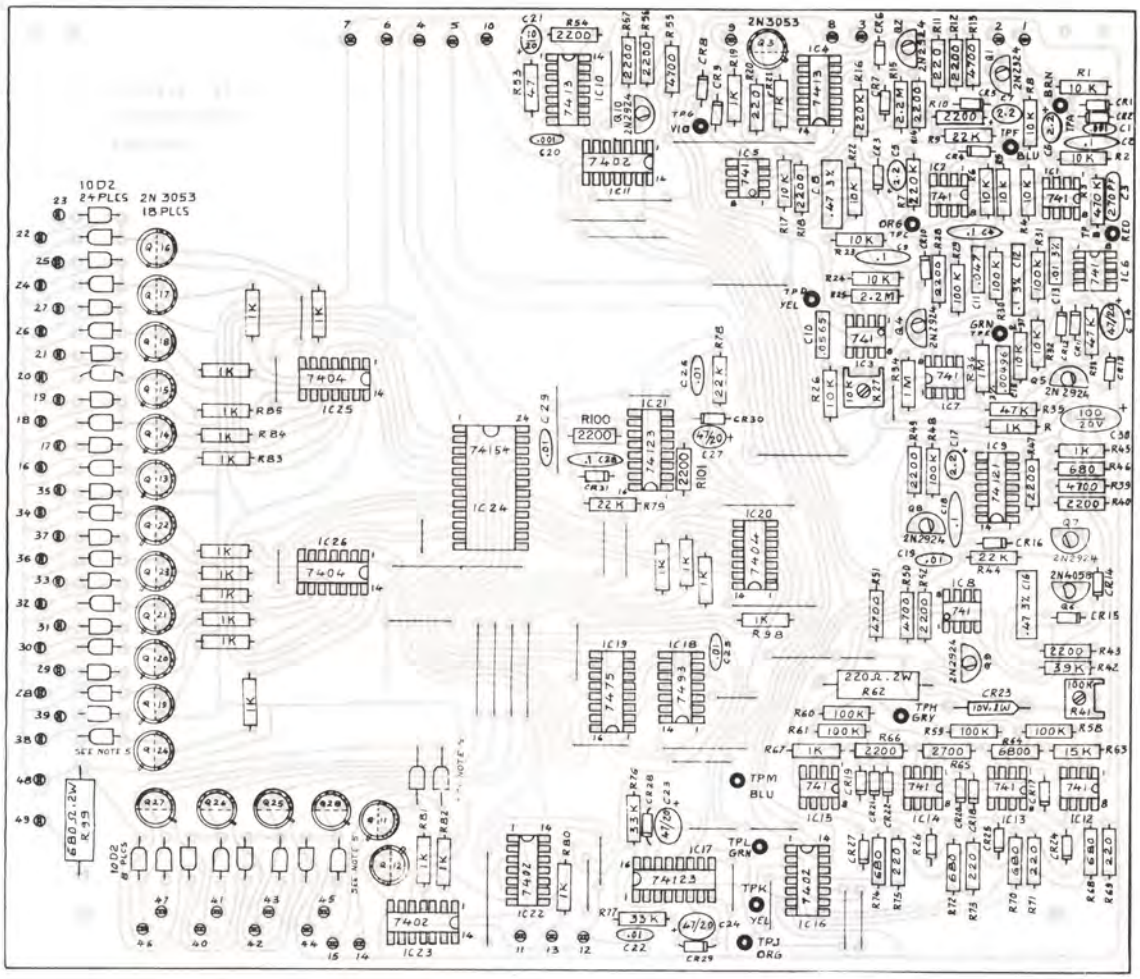


Figure 30. SU Power Supply, Parts Location



NOTES :

1. UNLESS OTHERWISE SPECIFIED
   RESISTOR VALUES ARE IN OHMS, 1/2W, 10%.
   CAPACITOR VALUES ARE IN MICROFARADS
   DIODES ARE IN4154
2. I.C.'S LISTED AS 741 ARE SN72741P
3. POSITION 10D2 DIODES APPROX. 3/16" ABOVE BOARD.

2P090

Figure 31. TU Control Demodulator, Parts Location

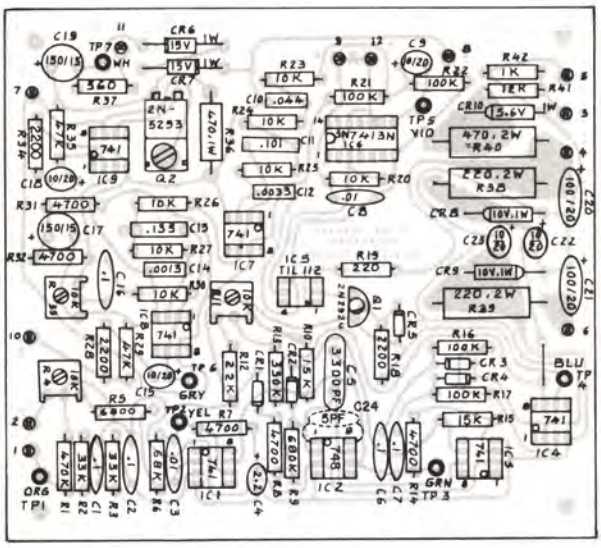


Figure 32. TU Audible Metering Generator, Parts Location

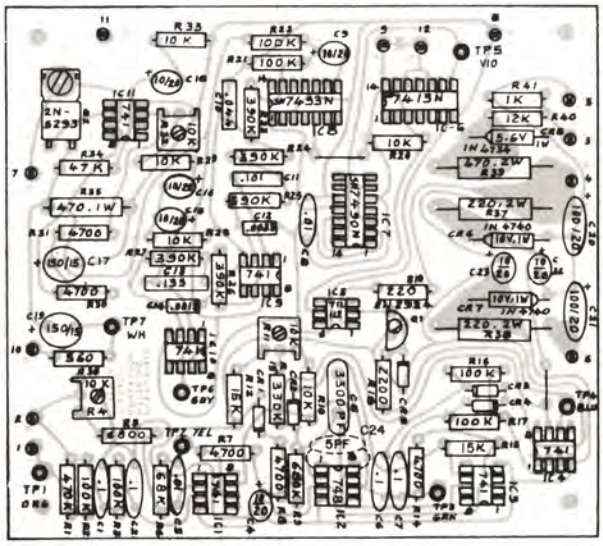


Figure 33. TU Subaudible Metering Generator, Parts Location

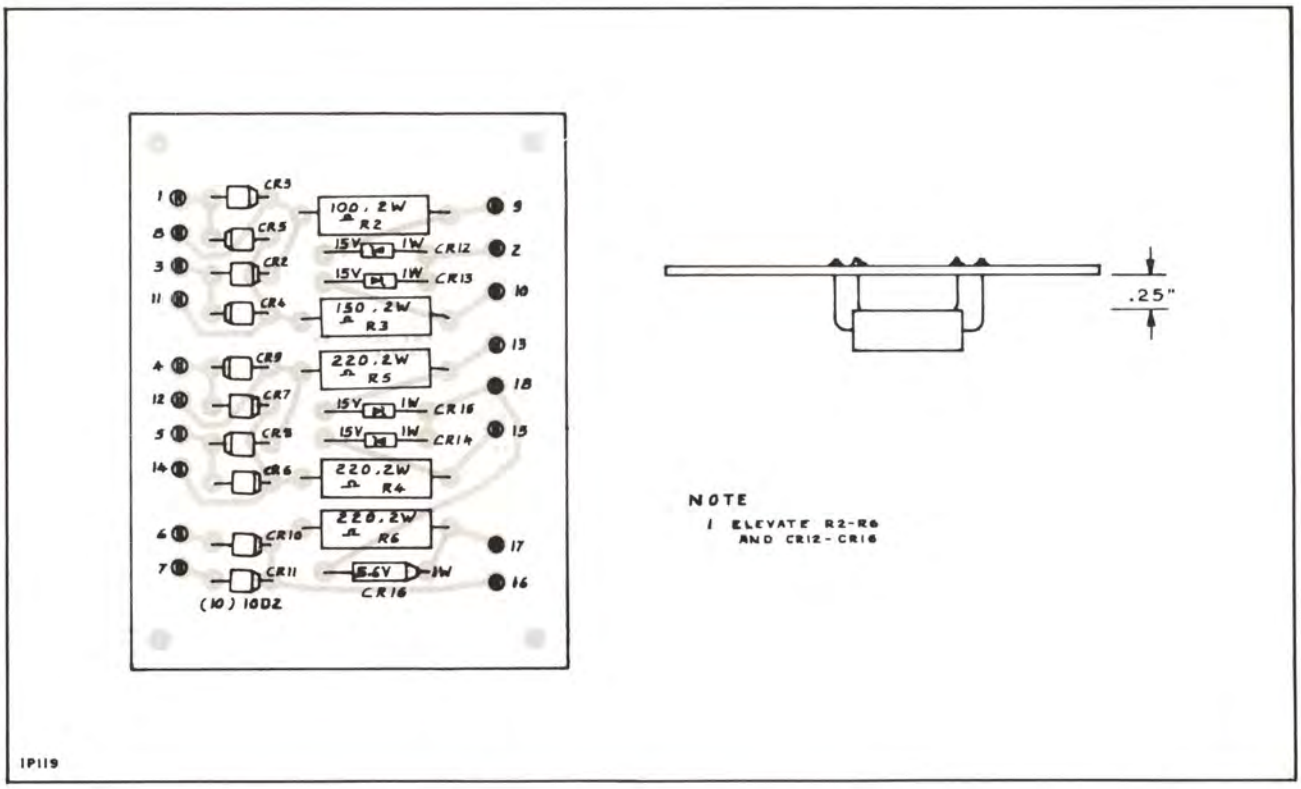


Figure 34. TU Power Supply, Parts Location

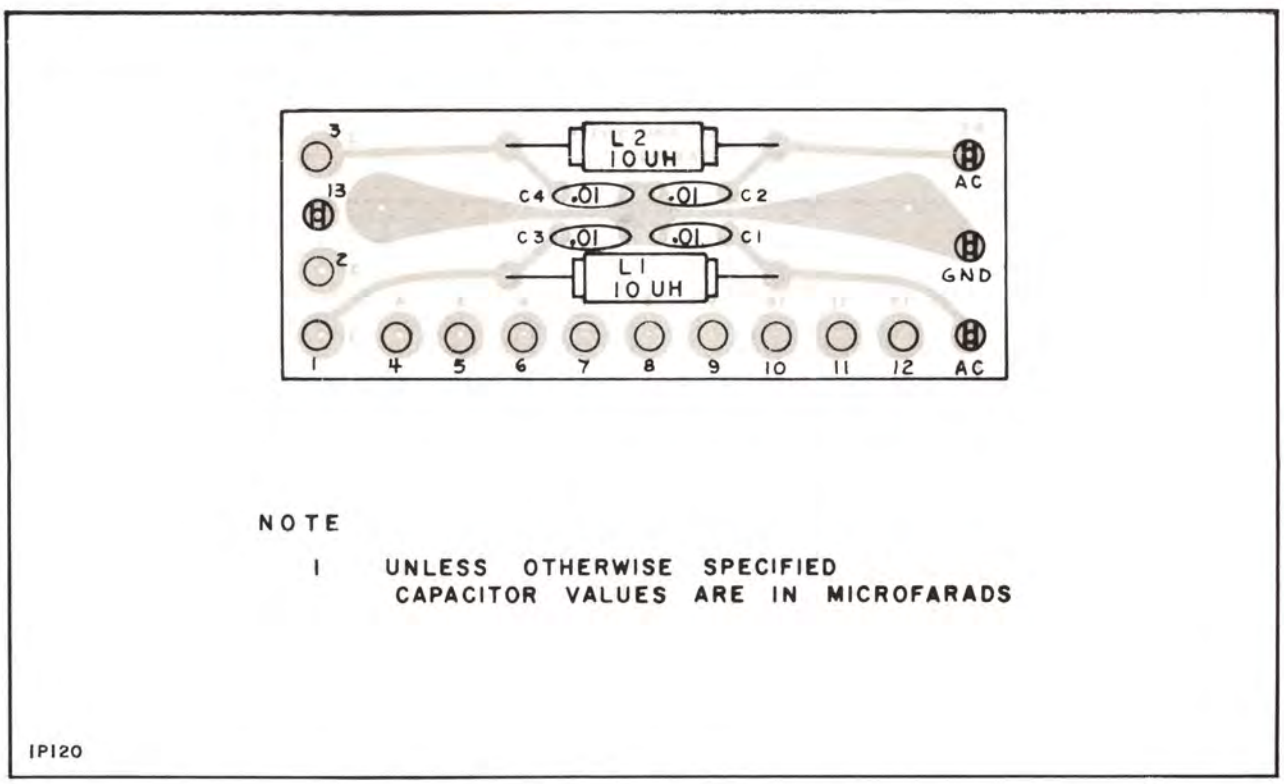


Figure 35. SU and TU AC Line Filter, Parts Location

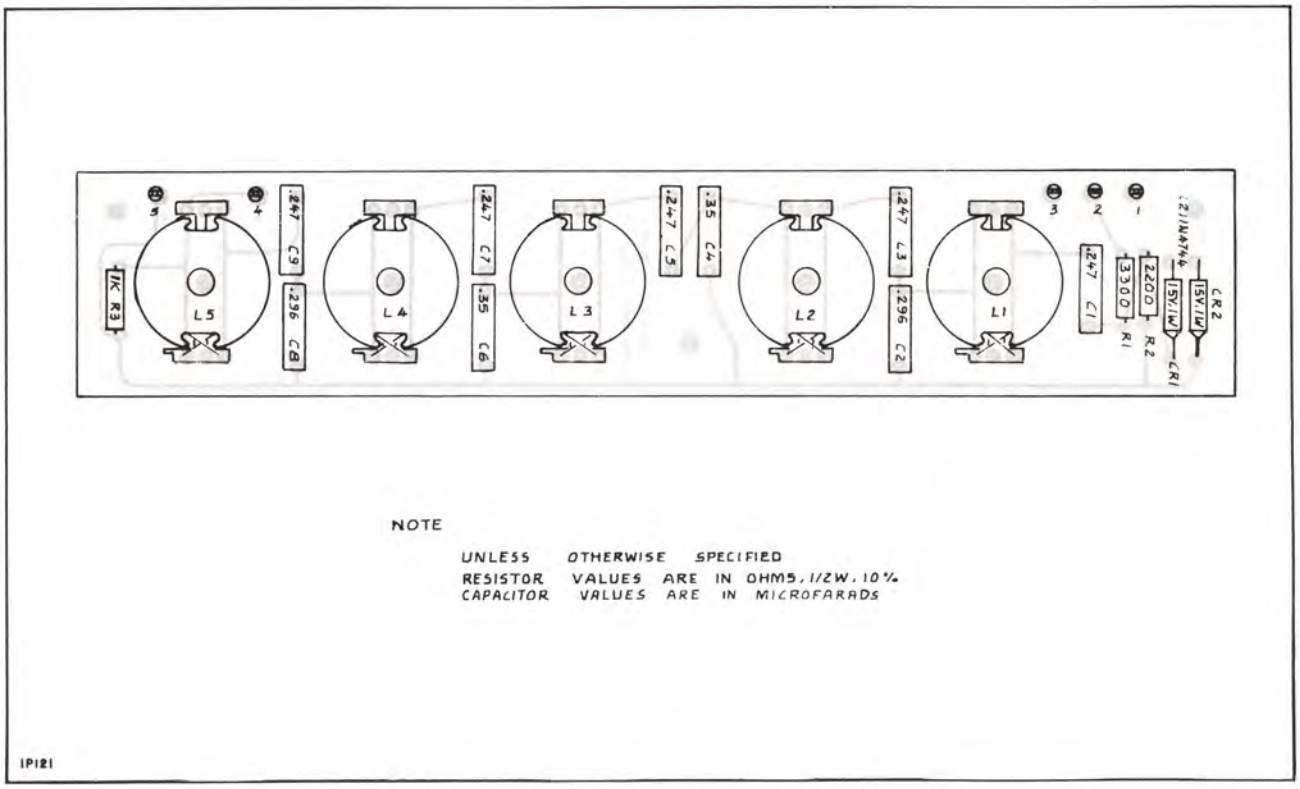


Figure 36. TU Control Bandpass Filter, Parts Location

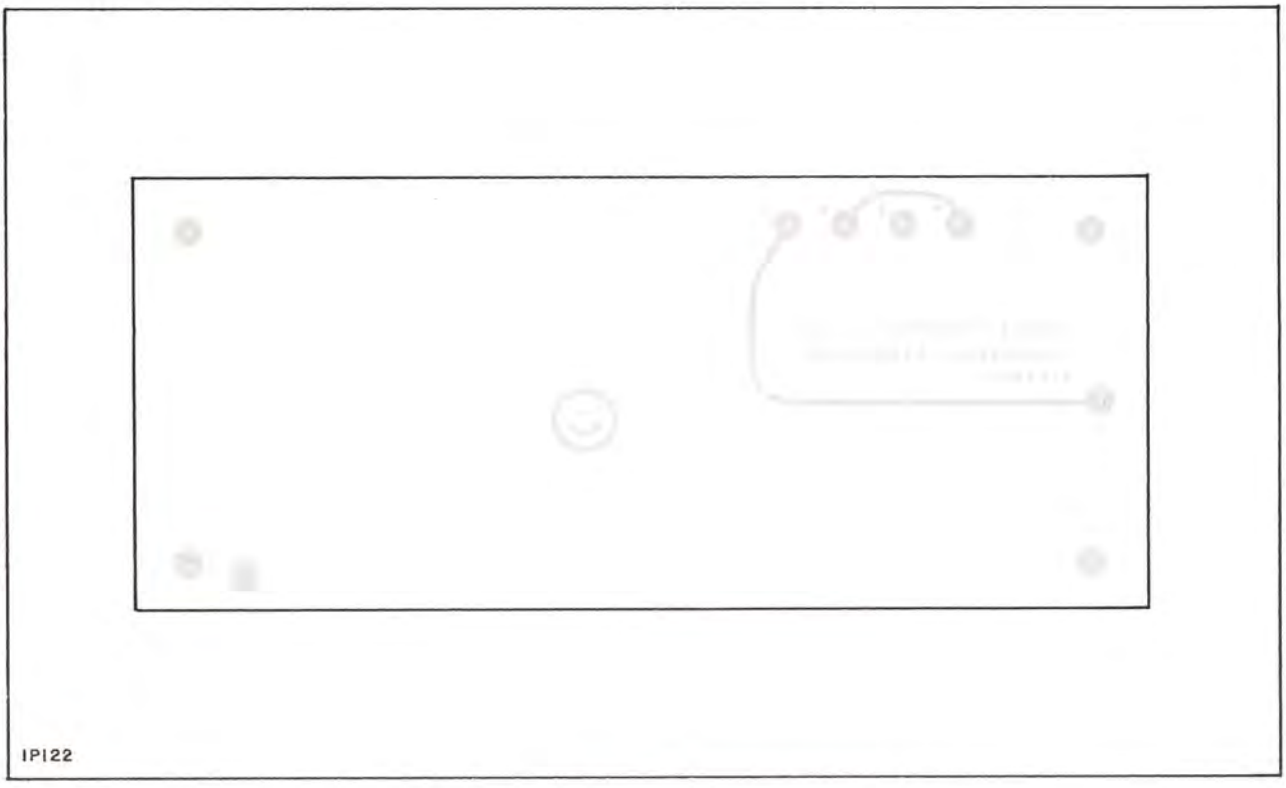


Figure 37. SU and TU Subcarrier Generator Jumper Board

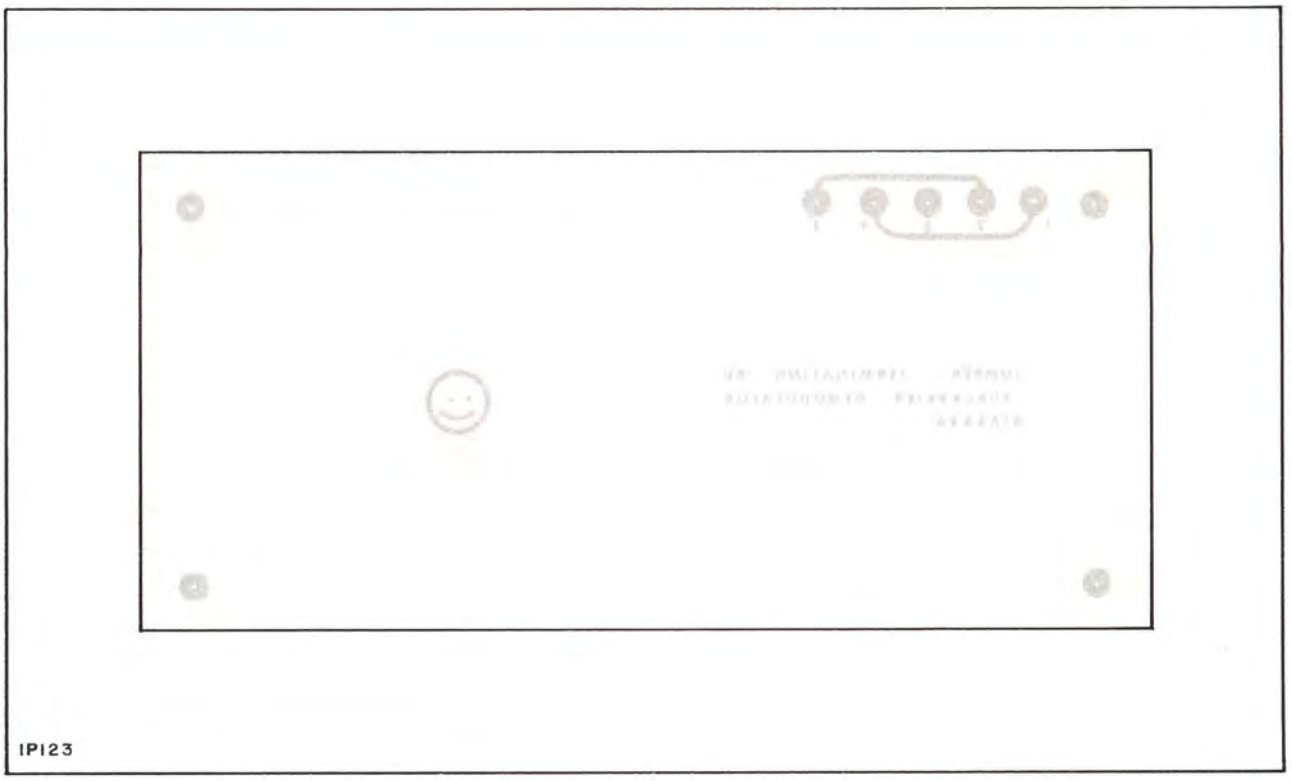
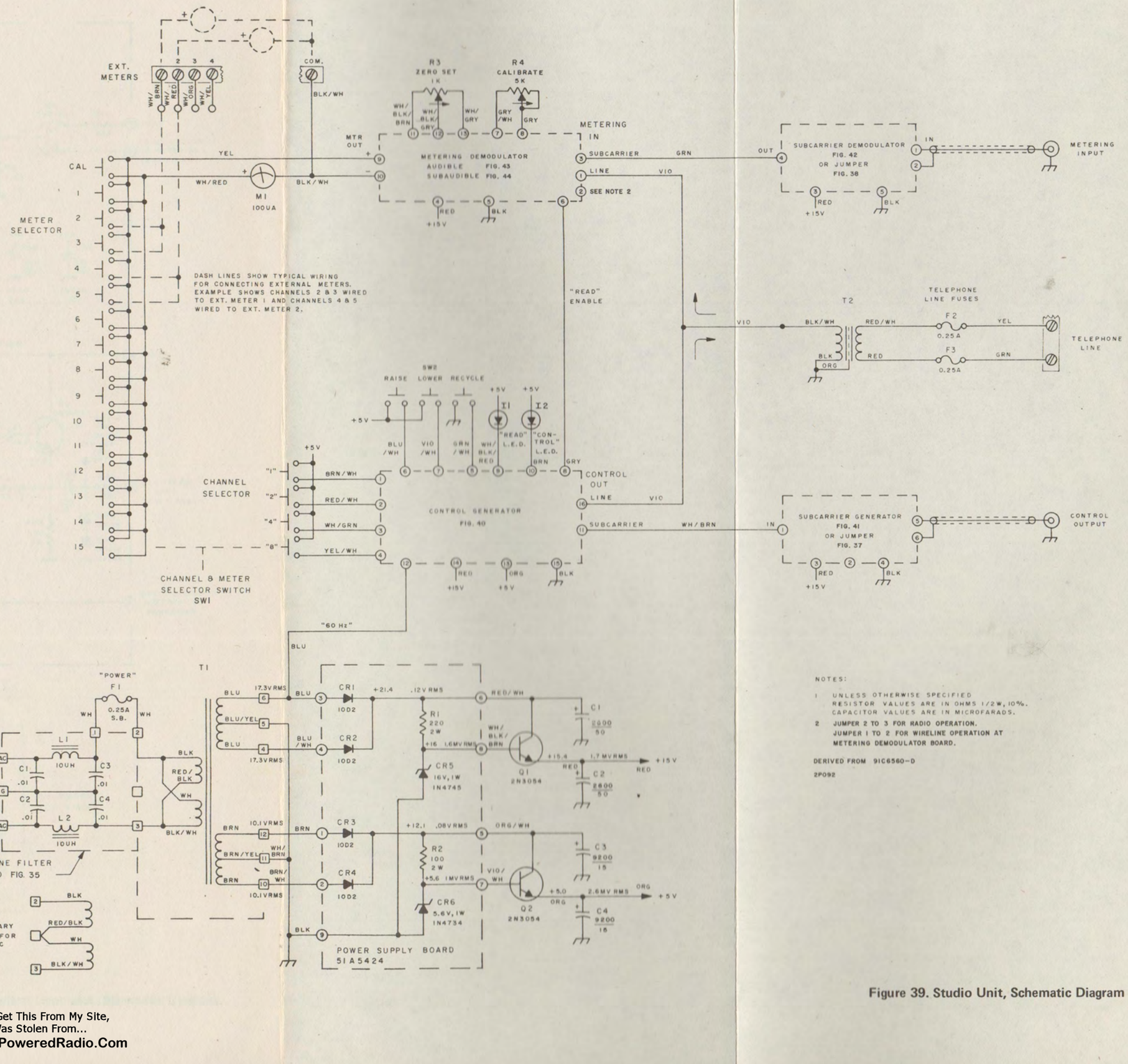


Figure 38. SU and TU Subcarrier Demodulator Jumper Board



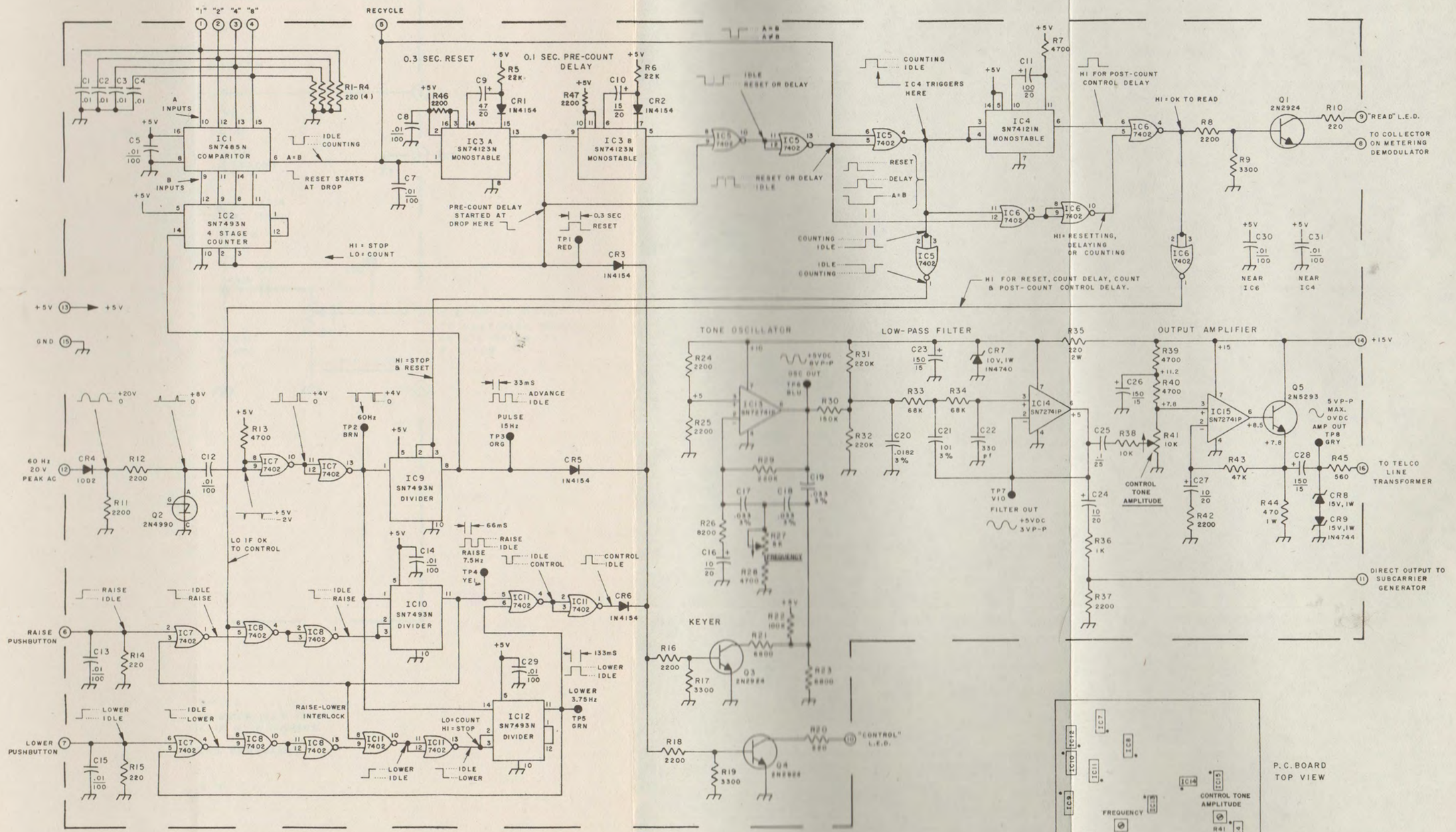
NOTES:

1. UNLESS OTHERWISE SPECIFIED RESISTOR VALUES ARE IN OHMS 1/2W, 10%. CAPACITOR VALUES ARE IN MICROFARADS.
2. JUMPER 2 TO 3 FOR RADIO OPERATION. JUMPER 1 TO 2 FOR WIRELINE OPERATION AT METERING DEMODULATOR BOARD.

DERIVED FROM 91C6560-D

2P092

Figure 39. Studio Unit, Schematic Diagram



NOTES

1 UNLESS OTHERWISE SPECIFIED RESISTOR VALUES ARE IN OHMS, 1/2W, 10%. CAPACITOR VALUES ARE IN MICROFARADS.

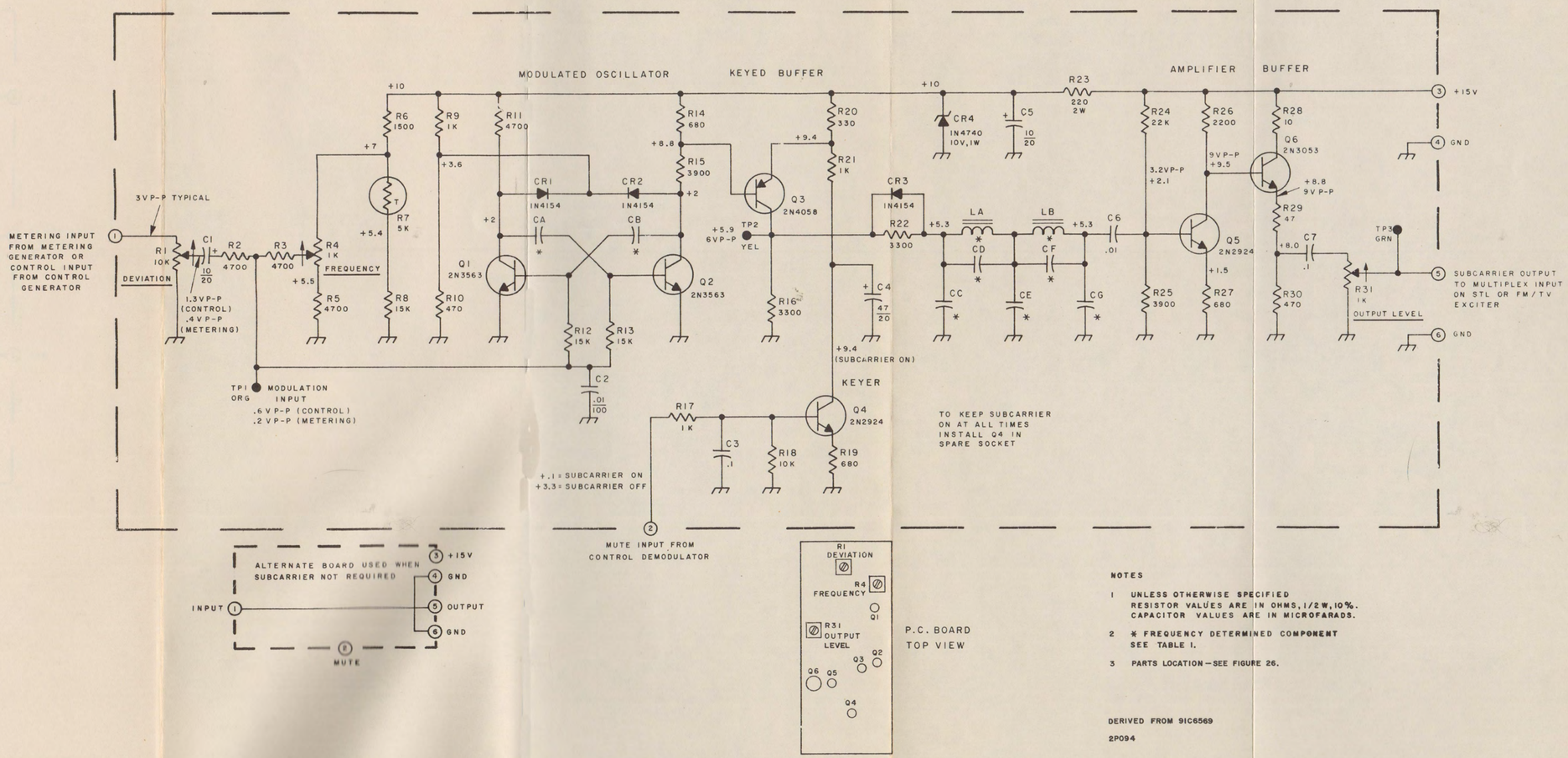
2 I.C.'S LISTED AS 7402 ARE SN7402N. PIN 14 IS +5V, PIN 7 IS GND.

TYPICAL DIGITAL IC OUTPUT WAVEFORM
"HI" +2.4V OR HIGHER
"LO" +0.4V OR LOWER

PARTS LOCATION — SEE FIGURE 25.

DERIVED FROM 91C6562-B
2P093

Figure 40. Control Generator, Schematic Diagram



NOTES

1 UNLESS OTHERWISE SPECIFIED RESISTOR VALUES ARE IN OHMS, 1/2W, 10%. CAPACITOR VALUES ARE IN MICROFARADS.

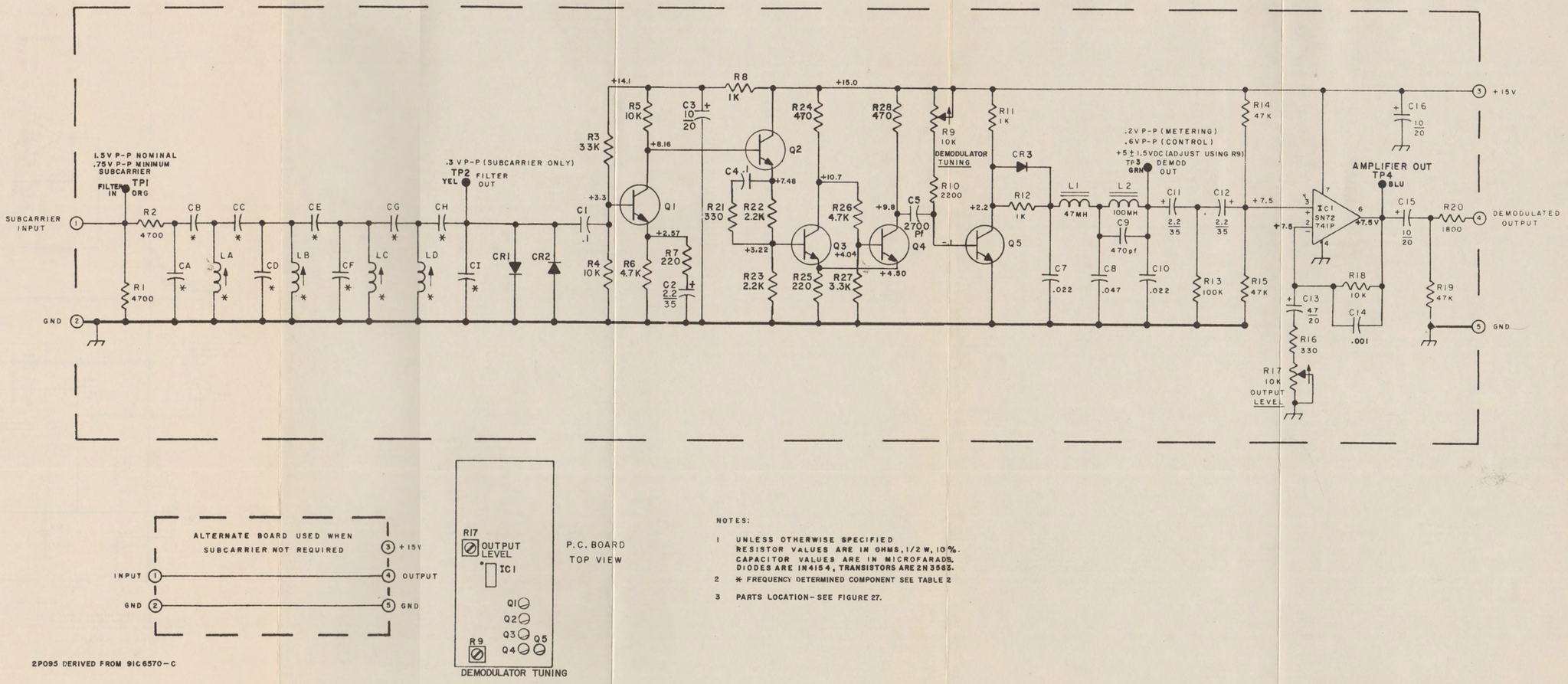
2 * FREQUENCY DETERMINED COMPONENT SEE TABLE I.

3 PARTS LOCATION — SEE FIGURE 26.

DERIVED FROM 91C6569

2P094

Figure 41. Subcarrier Generator, Schematic Diagram



2P095 DERIVED FROM 91C6570-C

P.C. BOARD TOP VIEW

NOTES:

1 UNLESS OTHERWISE SPECIFIED RESISTOR VALUES ARE IN OHMS, 1/2 W, 10%. CAPACITOR VALUES ARE IN MICROFARADS. DIODES ARE IN4154, TRANSISTORS ARE 2N3563.

2 * FREQUENCY DETERMINED COMPONENT SEE TABLE 2

3 PARTS LOCATION - SEE FIGURE 27.

Figure 42. Subcarrier Demodulator, Schematic Diagram

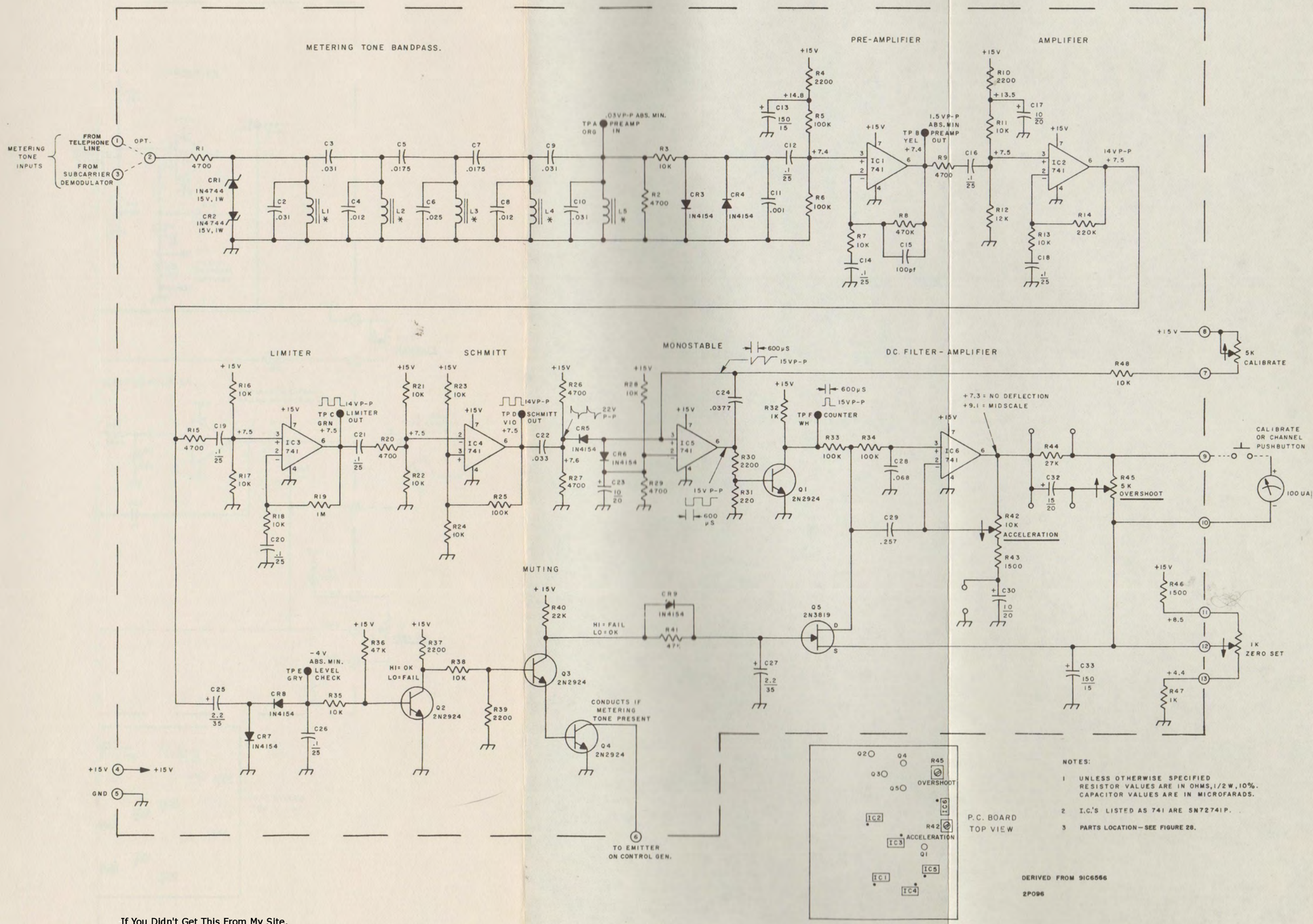


Figure 43. Audible Metering Demodulator, Schematic Diagram

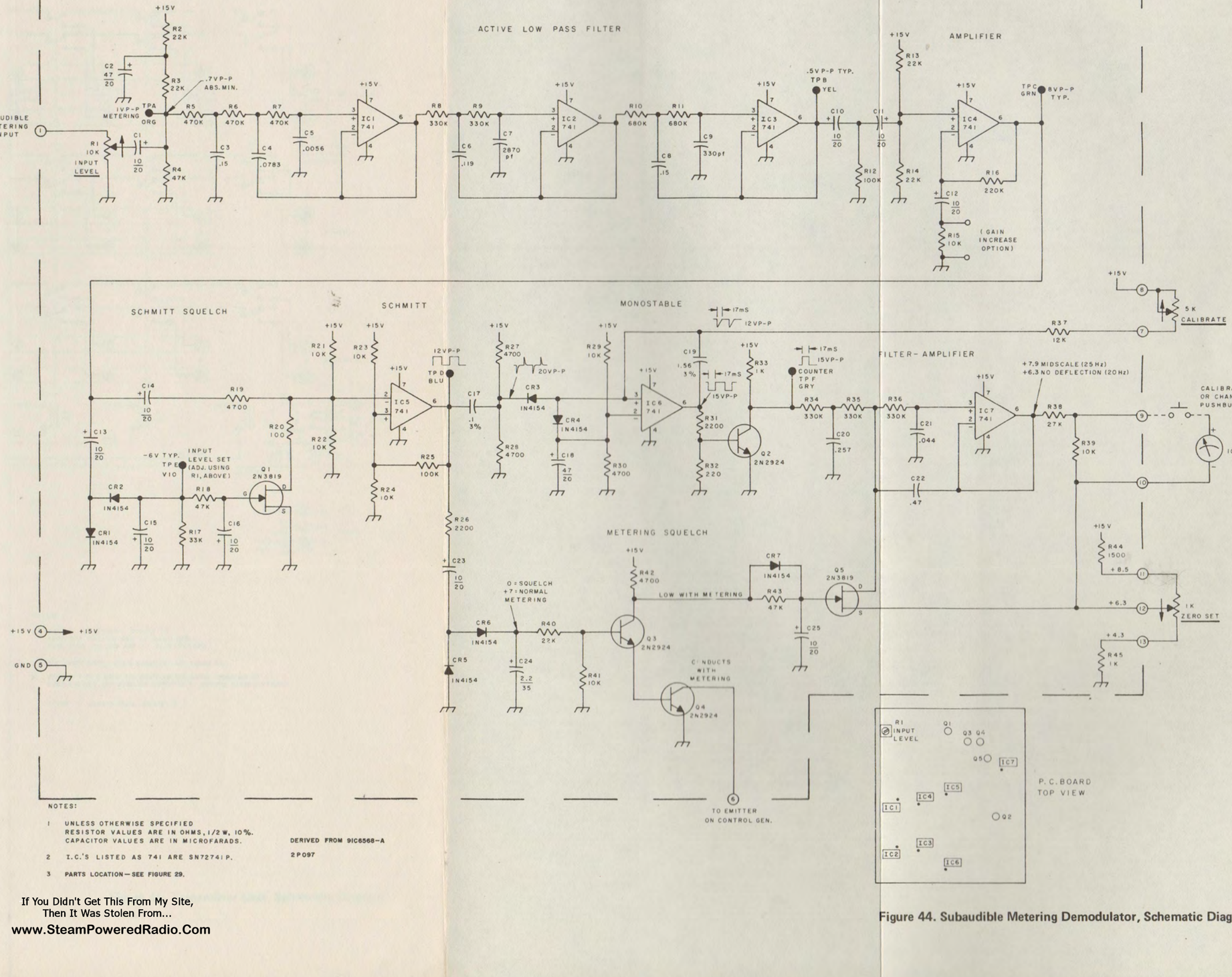
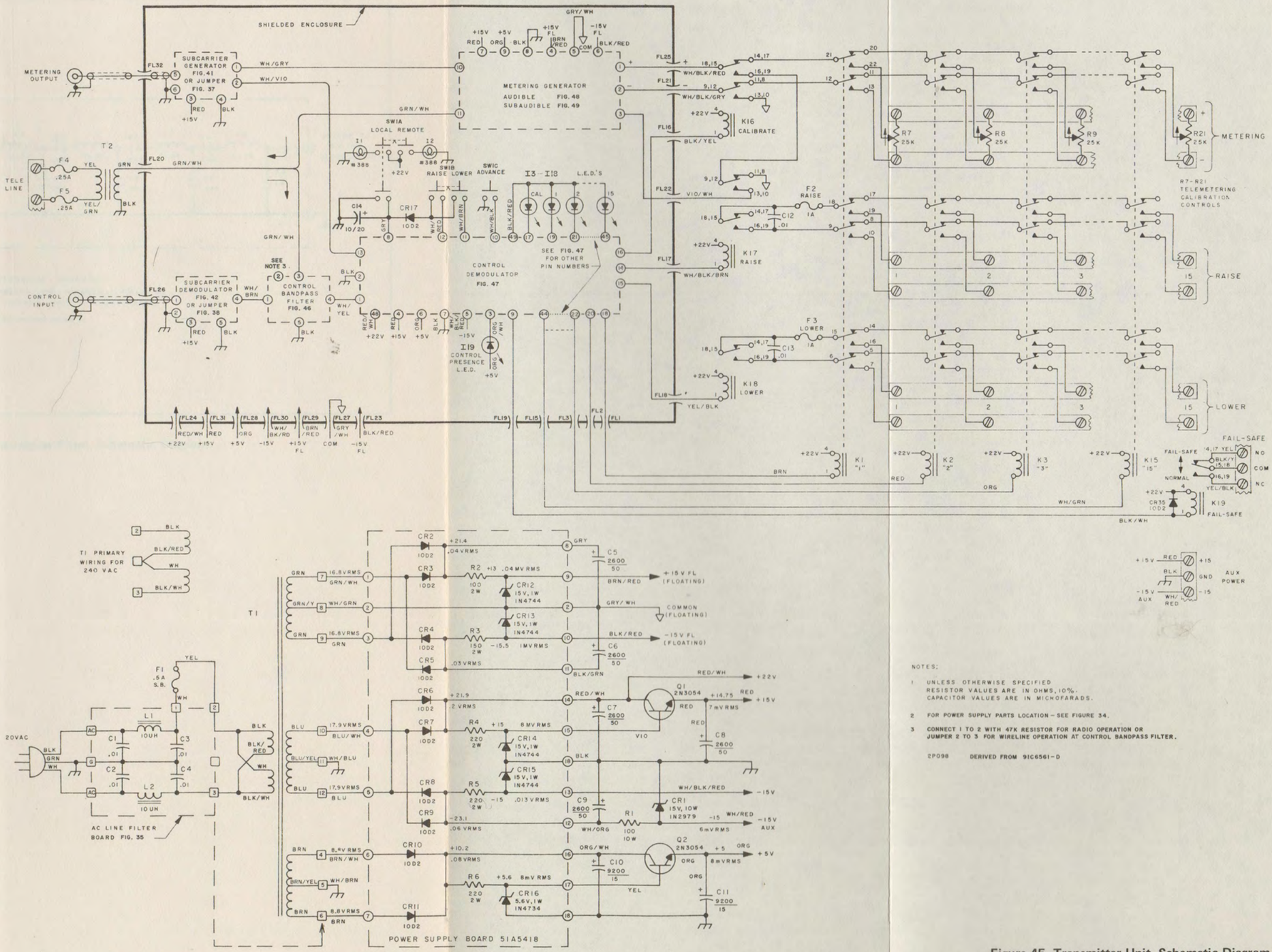


Figure 44. Subaudible Metering Demodulator, Schematic Diagram



NOTES:

1 UNLESS OTHERWISE SPECIFIED RESISTOR VALUES ARE IN OHMS, 10%. CAPACITOR VALUES ARE IN MICROFARADS.

2 FOR POWER SUPPLY PARTS LOCATION – SEE FIGURE 34.

3 CONNECT 1 TO 2 WITH 47K RESISTOR FOR RADIO OPERATION OR JUMPER 2 TO 3 FOR WIRELINE OPERATION AT CONTROL BANDPASS FILTER.

2P098 DERIVED FROM 91C6561-D

Figure 45. Transmitter Unit, Schematic Diagram

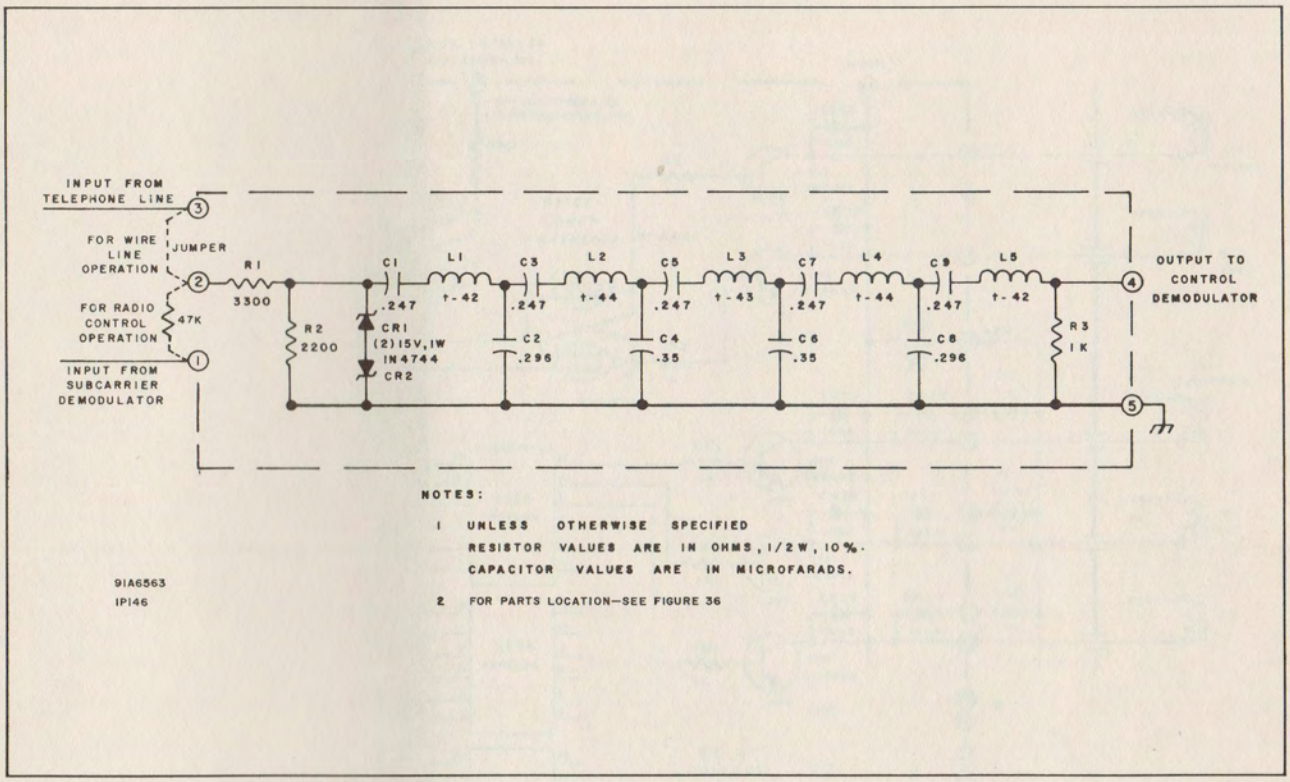


Figure 46. Control Bandpass Filter, Schematic Diagram

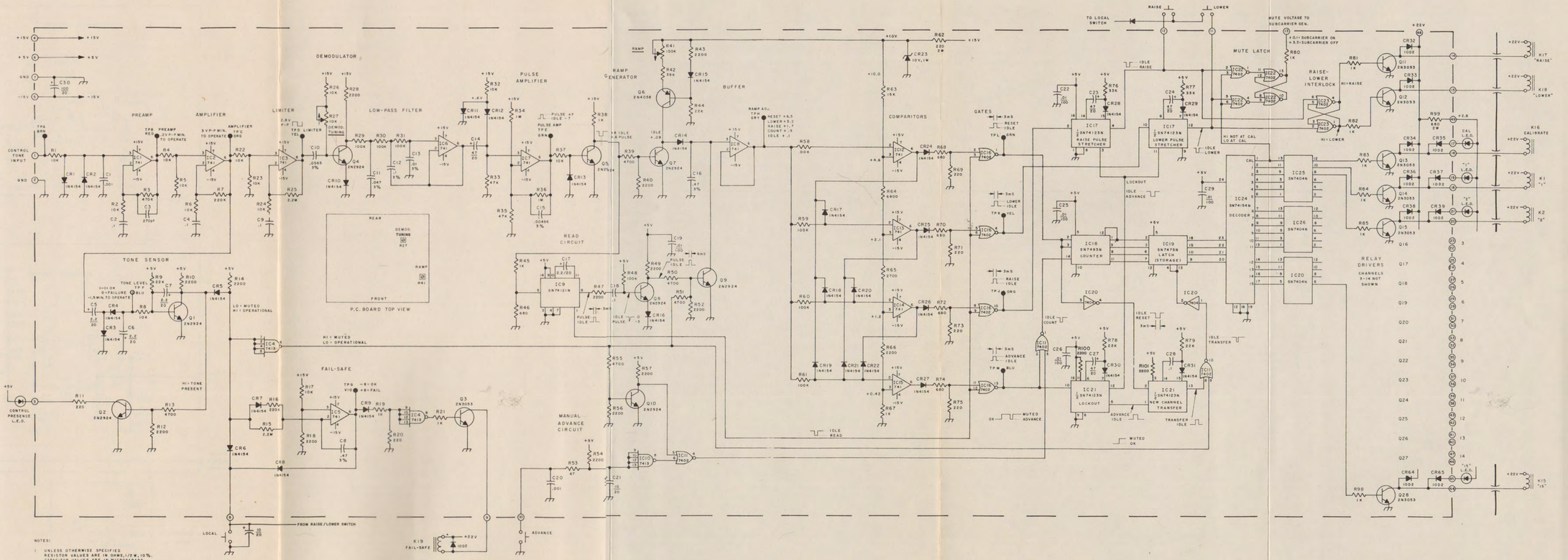
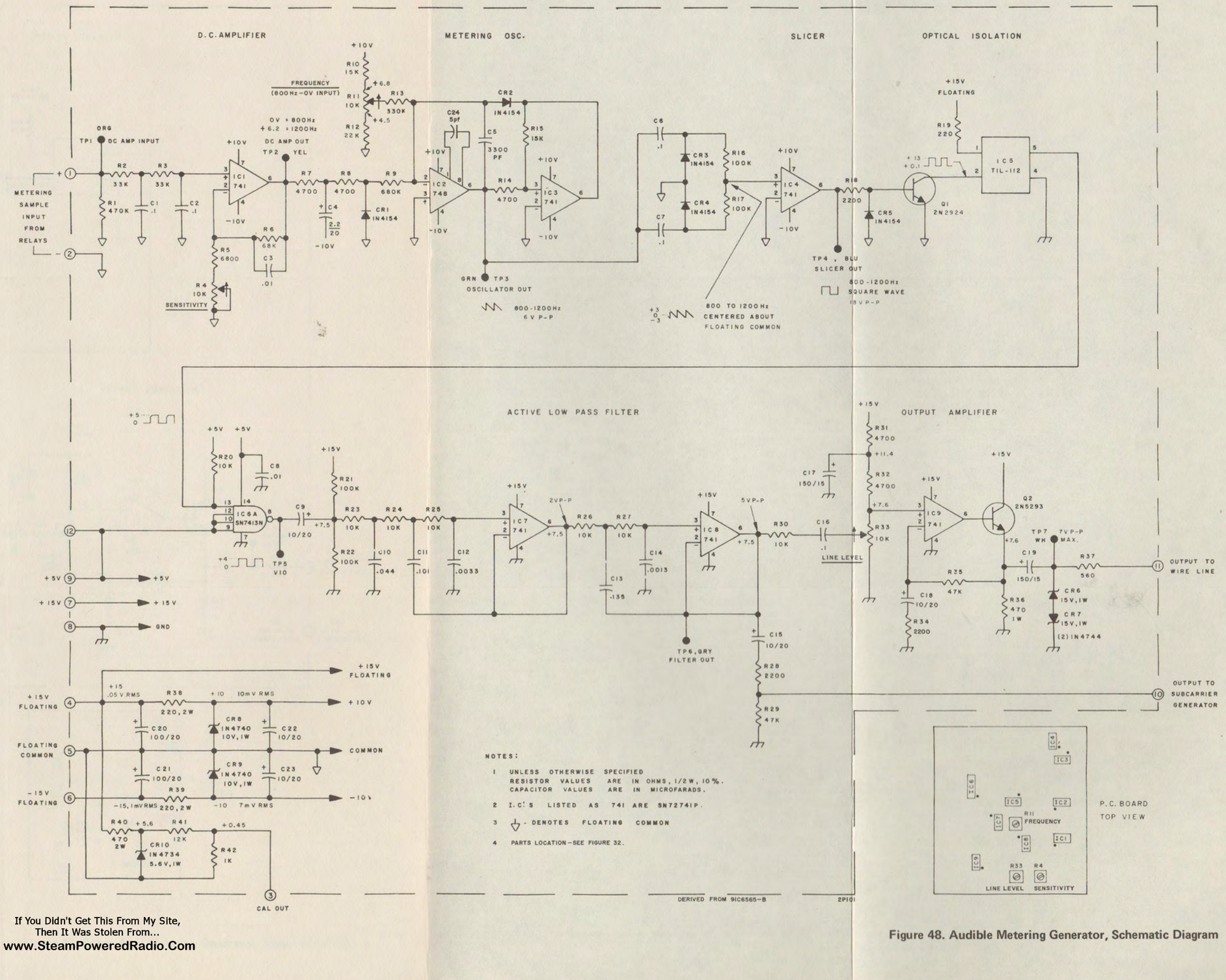


Figure 47. Control Demodulator, Schematic Diagram

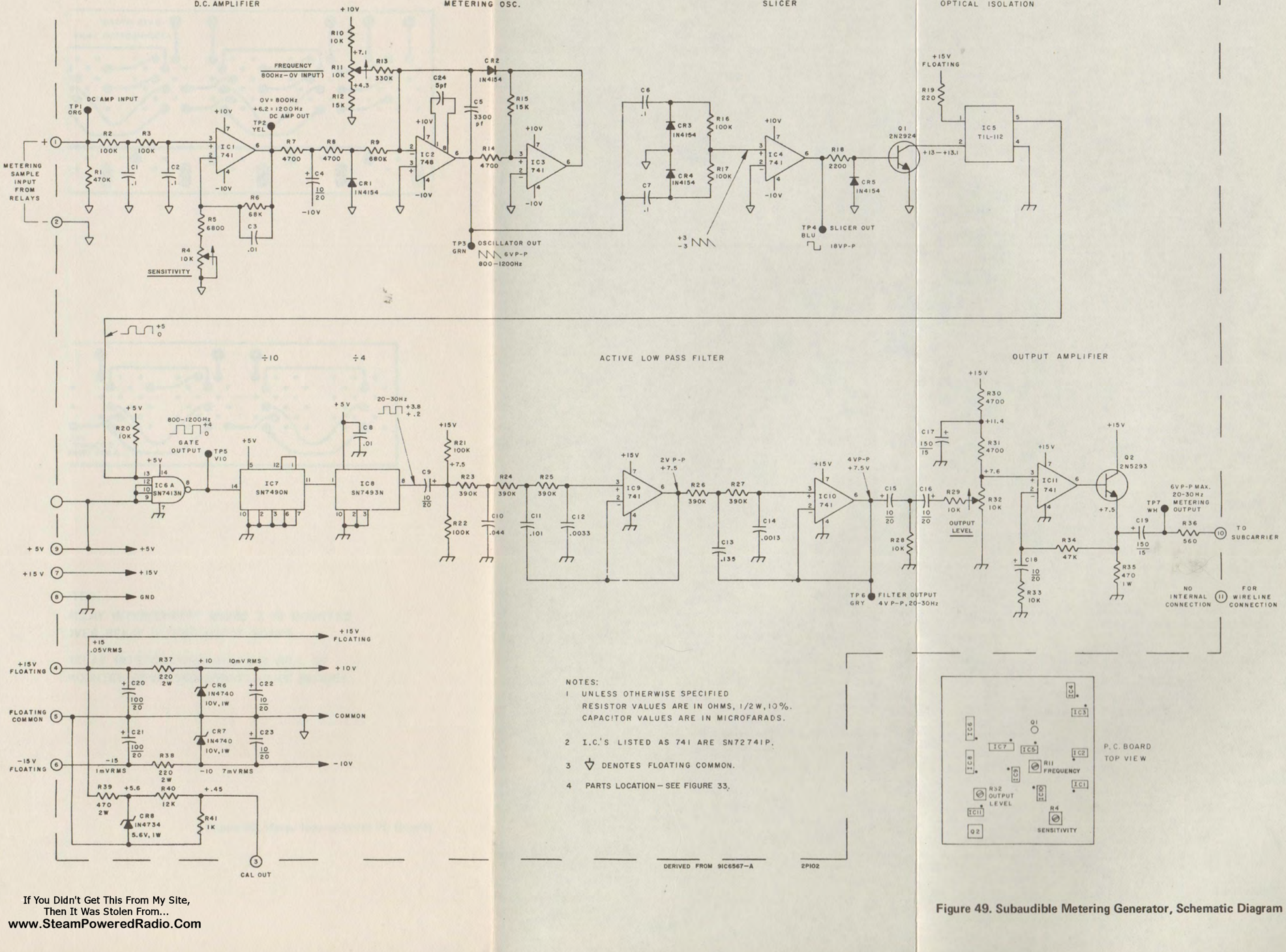


NOTES:

1. UNLESS OTHERWISE SPECIFIED RESISTOR VALUES ARE IN OHMS, 1/2W, 10%. CAPACITOR VALUES ARE IN MICROFARADS.
2. I.C.'S LISTED AS 741 ARE SN7741P.
3. ⏚ - DENOTES FLOATING COMMON
4. PARTS LOCATION - SEE FIGURE 32.

DERIVED FROM 9IC6565-B 2PI01

Figure 48. Audible Metering Generator, Schematic Diagram



NOTES:

1 UNLESS OTHERWISE SPECIFIED RESISTOR VALUES ARE IN OHMS, 1/2W, 10%. CAPACITOR VALUES ARE IN MICROFARADS.

2 I.C.'S LISTED AS 741 ARE SN72741P.

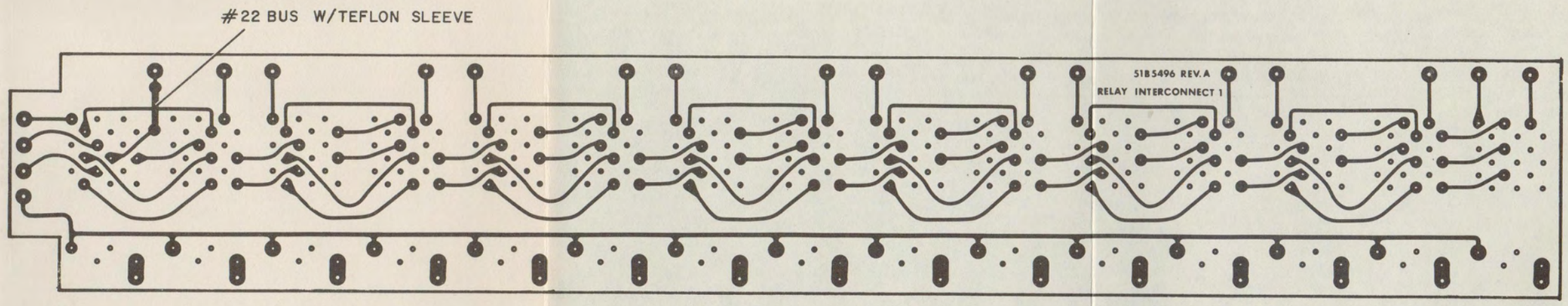
3 ▽ DENOTES FLOATING COMMON.

4 PARTS LOCATION – SEE FIGURE 33.

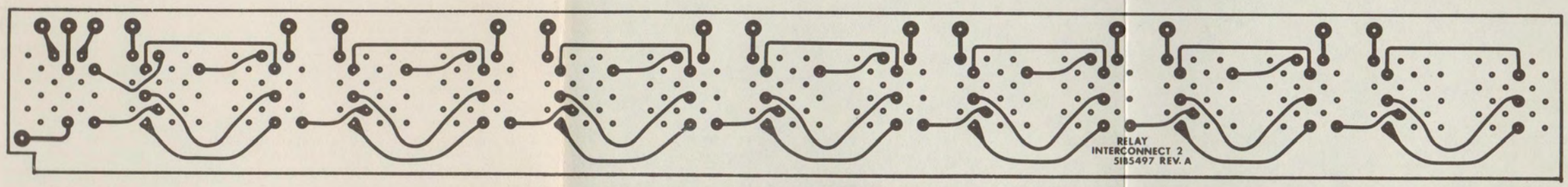
DERIVED FROM 91C6567-A 2P102

P.C. BOARD TOP VIEW

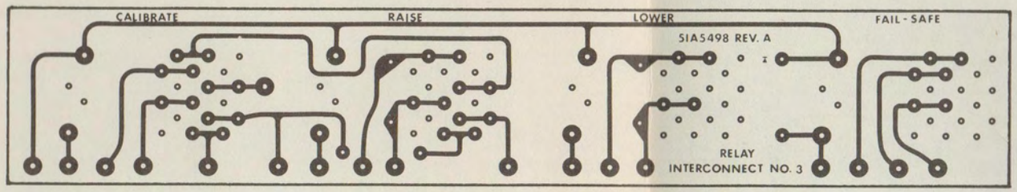
Figure 49. Subaudible Metering Generator, Schematic Diagram



RELAY INTERCONNECT 1



RELAY INTERCONNECT 2



RELAY INTERCONNECT 3

IP148

NOTES:

1. RELAY INTERCONNECT BOARD 2 IS MOUNTED OVER RELAY INTERCONNECT BOARD 1.
2. RELAY INTERCONNECT BOARD 2 WILL BE MOUNTED REVERSED (PRINTED SIDE INSIDE).

Figure 50. Relay Interconnect PC Boards

RCA Communications Systems Division

Communications Systems Division/Front and Cooper Streets/Camden, New Jersey, U.S.A., 08102

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