FX–50
FX–50E
50 WATT
FM EXCITERS

June, 2001 IM No. 597–1050

IMPORTANT INFORMATION

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: 1) inspected the containers for visible signs of damage and 2) counted the containers and compared with the amount shown on the shipping papers. If a shortage or 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. Claims for loss or damage will not be honored without proper notification of inspection by the carrier.

RF PRODUCT TECHNICAL ASSISTANCE – REPAIR SERVICE – REPLACEMENT PARTS.

Technical assistance is available from Broadcast Electronics by letter, prepaid telephone, fax, or E–mail. Equipment requiring repair or overhaul should be sent by common carrier, prepaid, insured, and well protected. If proper shipping materials are not available, contact the Customer Service Department for a shipping container. Do not the mail equipment. We can assume no liability for inbound damage, and necessary repairs become the obligation of the shipper. Prior arrangement is necessary. Contact the Customer Service Department for a Return Authorization.

Emergency and warranty replacement parts may be ordered from the following address. Be sure to include the equipment model number, serial number, part description, and part number. Non–emergency replacement parts may be ordered directly from the Broadcast Electronics stock room by fax at the number shown below.

FACILITY CONTACTS –

Broadcast Electronics, Inc. – Quincy Facility
4100 N. 24th St. P.O. BOX 3606
Quincy, Illinois 62305
Telephone: (217) 224–9600
Fax: (217) 224–9607
E–Mail: General – bdcast@bdcast.com
Web Site: www.bdcast.com

RF PRODUCT TECHNICAL ASSISTANCE – REPAIR – EMERGENCY/WARRANTY REPLACEMENT PARTS –

Telephone: (217) 224–9600
E–Mail: rfservice@bdcast.com
Fax: (217) 224–9607

NON–EMERGENCY REPLACEMENT PARTS –

Fax: (217) 224–9609

RETURN, REPAIR, AND EXCHANGES.

Do not return any merchandise without our written approval and Return Authorization. We will provide special shipping instructions and a code number that will assure proper handling and prompt issuance of credit. Please furnish complete details as to circumstances and reasons when requesting return of merchandise. All returned merchandise must be sent freight prepaid and properly insured by the customer.

WARRANTY ADJUSTMENT.

Broadcast Electronics, Inc. warranty is included in the Terms and Conditions of Sale. In the event of a warranty claim, replacement or repair parts will be supplied F.O.B. factory. At the discretion of Broadcast Electronics, the customer may be required to return the defective part or equipment to Broadcast Electronics, Inc. F.O.B. Quincy, Illinois. Warranty replacements of defective merchandise will be billed to your account. This billing will be cleared by a credit issued upon return of the defective item.

PROPRIETARY NOTICE.

MODIFICATIONS.

Broadcast Electronics, Inc. reserves the right to modify the design and specifications of the equipment in this manual without notice. Any modifications shall not adversely affect performance of the equipment so modified.

SCOPE OF MANUAL

This manual comprises two sections providing the following information for the Broadcast Electronics FX–50/E FM Exciter.

A. PART I – Contains information relative to installation, operation, and maintenance of the overall exciter.

B. PART II – Contains detailed information for the following assemblies within the exciter and any optional equipment:

1. Power Supply/Control Circuit Board
2. Metering Circuit Board
3. Modulated Oscillator Assembly
4. AFC/PLL Circuit Board
5. RF Amplifier Assembly
6. Optional Synchronous FM Booster System

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SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. Information presented by this section provides a general description of the FX-50/E FM Exciter features and lists equipment specifications.

1-3. RELATED PUBLICATIONS.

1-4. The following list of publications provides data for equipment and options associated with the FX-50/E FM Exciters.

PUBLICATION NUMBER	EQUIPMENT
597-0008-004	FC-30 SCA Generator
597-9900	LYNX FM Digital Stereo Generator

1-5. EQUIPMENT DESCRIPTION.

1-6. The FX-50/E exciters are available in several configurations. Refer to the following list for various exciter models, spare parts kits, and options available.

MODEL	PART NO.	DESCRIPTION
FX-50	909-1051-225	3-50 Watt FM exciter, 120V ac, 50/60 Hz, solid-state with automatic power control and synthesized frequency control, rack mount.
FX-50	909-1051-325	3-50 Watt FM exciter, 220V/240V ac, 50/60 Hz, solid-state with automatic power control and synthesized frequency control, rack mount.
FX-50E	909-1050-329	3-50 Watt FM exciter, 240V ac, 50 Hz, CE compliant. Solid-state with automatic power control and synthesized frequency control, rack mount.
----	909-0124	Optional Low-Pass Filter.
----	909-0131	Optional Master Synchronous FM Booster Circuit Board.
----	909-0132	Optional Slave Synchronous FM Booster Circuit Board.
----	979-1053	100% Spare Semiconductor Kit.
----	979-1052	Recommended Spare Semiconductor Kit.
----	979-1051	Spare Parts Kit.
----	979-0152	Remote Exciter Kit.
----	959-0315	Optional FM Notch Filter.

1-7. FX-50 AND FX-50E MODELS.

1-8. The FX-50 and the FX-50E FM exciters are nearly identical in contruction and features (refer to Figure 1-1). However, the FX-50E meets stringent CE standards for locations requiring CE certification. Both units contain identical control, metering, and RF ampifier circuitry. The units both exhibit excellent performance specifications. However, FX-50E models are equipped with: 1) additional input/output and ac line filtering, 2) a 25-pin D-type remote interface connector, and 3) only a single rear-panel composite audio input receptacle (unbalanced).

1-9. PHYSICAL DESCRIPTION.

1-10. The FX-50/E chassis is equipped with slide rails to allow easy access to all assemblies when the unit is extended from the rack. Removal and installation of assemblies within the exciter is facilitated by the semimodular mechanical construction. Each assembly is firmly mounted to the main chassis and electrically connected to the main wiring harness with plugs and jacks. Front-panel test receptacles allow measurements of the composite signal without removing the top-cover. On FX-50 units, input and output connections are routed to a rear-panel terminal strip and several BNC connectors. On FX-50E units, input and output connections are routed to a rear-panel 25-pin D-Type connector and several BNC connectors.

597-1050-1

FIGURE 1-1. FX-50/E EXCITER

1-11. ELECTRICAL DESCRIPTION.

1-12. The Broadcast Electronics FX-50/E exciters are solid-state wideband FM units providing a continuously variable RF output from 3 to 50 watts into a 50 Ohm load at any frequency within the 87 to 109 MHz FM broadcast band in 10 kHz increments. The FX-50/E accepts multiple wideband composite inputs from a stereo generator or SCA generator in addition to a 600 Ohm balanced monaural input. Typical performance exhibits extremely low distortion with THD and IMD less than 0.003% and a typical signal-to-noise ratio of 94 dB. A tapped dual primary power transformer and a voltage selector allows operation from a wide range of ac input potentials.

1-13. **METERING.** Exciter operating parameters are monitored by a front-panel digital LCD multimeter and an LED display. Multimeter functions are identified by large **LED** indicators which illuminate when a function switch is operated. The multimeter can also be operated as a high-impedance test meter for internal measurements. In addition, a color coded moving bar LED display is incorporated to indicate peak modulation percentage in increments of 5%.

1-14. **STATUS DISPLAYS.** The FX-50/E exciters are designed with front-panel LEDs to indicate the status of three main exciter operating potentials, three preset limits, and operating frequency stabilization. Additional LEDs are incorporated on the AFC/PLL circuit board assembly to indicate the status of operating potentials and monitor reference oscillator and modulated oscillator circuit conditions.

1-15. **AUTOMATIC FREQUENCY CONTROL.** A temperature compensated reference oscillator and a dual-speed phase-locked-loop controlling the carrier frequency locks the frequency of the modulated oscillator to the precision reference frequency oscillator allowing prompt on-frequency operation of the exciter from a cold start. The FX-50/E will achieve frequency lock from a cold start in less than five seconds.

1-16. **CONTROL CIRCUIT.** The control circuitry provides automatic control of RF output to maintain a preset power output. In addition, the control circuitry eliminates adjustments after the initial setup, protects the RF output circuitry from excessive temperatures, high VSWR conditions, over-voltage conditions, and short circuit conditions.

1-17. **RF AMPLIFIER.** The RF amplifier is a broadbanded 3 to 50 watt amplifier covering the entire commercial FM broadcast band. Tuning of the amplifier is not required. An optional low-pass filter can be installed in the exciter to convert the exciter to a low power transmitter for connection to an antenna.

1-18. EQUIPMENT SPECIFICATIONS.

1-19. Refer to Table 1-1 for electrical specifications and Table 1-2 for physical and environmental specifications of the FX-50/E FM Exciters.

TABLE 1-1. FX-50/E EXCITER SPECIFICATIONS
(Sheet 1 of 3)

PARAMETER	SPECIFICATIONS
AC INPUT POWER REQUIREMENTS	
FX-50	97 to 133V ac or 194 to 266V ac, 50/60 Hz, 230W Maximum.
FX-50E	240V ac Nominal, 50/60 Hz, 230W Maximum.
RF OUTPUT IMPEDANCE	50 Ohms.
POWER OUTPUT	3 Watts to 50 Watts, Continuously Variable (BNC Connector) Open and Short Circuit Protected.
R.F. HARMONIC AND SPURIOUS SUPPRESSION (CONDUCTED)	Meets or exceeds all FCC, DOC, and CCIR standards.
FREQUENCY RANGE	87 MHz to 109 MHz Digitally Programmable in 10 kHz Increments.
FREQUENCY STABILITY	±300 Hz, +32°F to +122°F (0°C to +50°C).
MODULATION TYPE	Direct FM at the Carrier Frequency.
MODULATION CAPABILITY	±350 kHz.
MODULATION INDICATION	Peak Reading, Color Coded, LED Display with Baseband Over-Modulation Indicator.
ASYNCHRONOUS AM SIGNAL-TO-NOISE RATIO	80 dB Below Equivalent Reference Carrier with 100% Amplitude Modulation @ 400 Hz and 75 Microsecond Deemphasis (No FM Modulation Present).

TABLE 1-2. FX-50/E EXCITER SPECIFICATIONS
(Sheet 2 of 3)

PARAMETER	SPECIFICATIONS
SYNCHRONOUS AM SIGNAL-TO-NOISE RATIO	60 dB Below Equivalent Reference Carrier with 100% Amplitude Modulation @ 1 kHz (FM Modulation: ±75 kHz @ 400 Hz).
MULTIMETER	5 Function LCD Plus Diagnostic Aid, ±3% Accurate.
TEST METERING	Internal High Input Impedance Multimeter with Probe for Internal dc Measurements.
FRONT PANEL TEST CONNECTIONS	Composite Input and Composite Output.
AUDIO/CONTROL CONNECTIONS	
FX-50	16 Terminal Barrier Strip and 5 BNC Connectors.
FX-50E	25-Pin D-Type Connector and 4 BNC Connectors.
WIDEBAND COMPOSITE OPERATION	
COMPOSITE INPUTS	
FX-50	3 Total, Unbalanced (1) and Balanced (1) Plus Front Panel Test Provision (1) (BNC Connectors).
FX-50E	2 Total, Unbalanced (1) and Front Panel Test Provision (1) (BNC Connectors)
COMPOSITE INPUT IMPEDANCE	
UNBALANCED	10 k Ohm, Nominal, Resistive.
BALANCED	10 k Ohm or 50 Ohm, Programmable Jumper Selected.
COMPOSITE INPUT LEVEL	3.5V p-p Nominal, for ±75 kHz Deviation.
COMPOSITE FM SIGNAL-TO-NOISE RATIO	90 dB Below ±75 kHz Deviation @ 400 Hz (93 dB Typical). Measured within a 20 Hz to 200 kHz Bandwidth with 75 Microsecond Deemphasis.
	94 dB (96 dB Typical) with A weighting.
COMPOSITE HARMONIC DISTORTION PLUS NOISE	0.005% or Less (0.003% Typical) at 400 Hz.
COMPOSITE SMPTE INTER-MODULATION DISTORTION	0.005% or Less (0.003% Typical), 60 Hz/7 kHz 1:1 ratio.
COMPOSITE TRANSIENT IMD	0.01% or Less (Square Wave/Sine Wave).
COMPOSITE AMPLITUDE RESPONSE	±0.025 dB, 30 Hz to 53 kHz.
COMPOSITE PHASE RESPONSE	±0.1° from Linear Phase 30 Hz to 53 kHz.

TABLE 1-1. FX-50/E EXCITER SPECIFICATIONS
(Sheet 3 of 3)

PARAMETER	SPECIFICATIONS
COMPOSITE GROUP DELAY VARIATION	±5 Nanoseconds, 30 Hz to 100 kHz.
STEREOPHONIC SEPARATION	52 dB, 30 Hz to 15 kHz and 60 dB, 30 Hz to 5 kHz (Measured using BE FS-30 Stereo Generator).
SCA INPUTS	3 Total, Unbalanced BNC Connectors.
SCA INPUT IMPEDANCE	100 k Ohm, Nominal, Resistive.
COMPOSITE CCIF INTERMODULATION DISTORTION	0.005% or Less, 15 kHz/14 kHz, 1:1 ratio.
SCA INPUT LEVEL	3.5V p-p Nominal for ±7.5 kHz Deviation.
SCA AMPLITUDE RESPONSE	±0.2 dB, 40 kHz to 100 kHz.
MONAURAL OPERATION	
AUDIO INPUT IMPEDANCE	600 Ohms Balanced, Resistive, Adaptable to Other Impedances, 60 dB Common Mode Suppression.
AUDIO INPUT LEVEL	+10 dBm Nominal for ±75 kHz Deviation @ 400 Hz, Adaptable to Other Levels.
AUDIO FREQUENCY RESPONSE	±0.5 dB, 30 Hz to 15 kHz, Selectable Flat, 25, 50 or 75 Microsecond Preemphasis.
HARMONIC DISTORTION PLUS NOISE	0.005% or Less at 400 Hz.
SMPTE INTERMODULATION DISTORTION	0.005% or Less, 60 Hz to 7 kHz, 4:1 Ratio.
CCIF INTERMODULATION DISTORTION	0.005% or Less, 15 kHz/14 kHz 1:1 Ratio.
TRANSIENT INTERMODULATION DISTORTION	0.01% or Less (Square Wave/Sine Wave).
FM SIGNAL-TO-NOISE RATIO	90 dB Below ±75 kHz Deviation @ 400 Hz (93 dB Typical) Measured in a 20 Hz to 15 kHz Bandwidth with 75 Microsecond Deemphasis. 94 dB (96 dB Typical) with A weighting.
REGULATORY	
FX-50E ONLY	Meets CE Specifications.
SAFETY	
FX-50/FX-50E	Meets IEC 215 Specifications.

TABLE 1-2. PHYSICAL AND ENVIRONMENTAL SPECIFICATIONS

PARAMETER	SPECIFICATION
PHYSICAL	
WEIGHT:	
PACKED	46 Pounds (20.8 kg).
UNPACKED	38 Pounds (17.2 kg).
DIMENSIONS:	
HEIGHT	5.25 Inches (13.3 cm).
WIDTH	17.70 Inches (44.9 cm).
DEPTH	19.00 Inches (48.3 cm).
ENVIRONMENTAL	
AMBIENT OPERATING TEMPERATURE	+32°F to +122°F (0°C to +50°C) Operational to −20°C.
HUMIDITY	95% Maximum, Non−Condensing.
ALTITUDE	0 to 15,000 Feet (4572 m) Above Sea Level.

SECTION II
INSTALLATION

2–1. INTRODUCTION.

2–2. This section contains information required for installation and preliminary checkout of the Broadcast Electronics FX–50/E FM Exciters.

2–3. UNPACKING.

2–4. The equipment becomes the property of the customer when the equipment is delivered to the carrier. Carefully unpack the exciter. Perform a visual inspection to determine that no apparent damage has been incurred during shipment. All shipping materials should be retained until it is determined that the unit has not been damaged. Claims for damaged equipment must be promptly filed with the carrier or the carrier may not accept the claim.

2–5. The contents of the shipment should be as indicated on the packing list. If the contents are incomplete, or if the unit is damaged electrically or mechanically, notify both the carrier and Broadcast Electronics, Inc.

2–6. INSTALLATION.

2–7. Each exciter is assembled, operated, tested, and inspected at the factory prior to shipment and is ready for installation when received. Prior to installation, this publication should be studied to obtain a thorough understanding of the operation, circuitry, nomenclature, and installation requirements. Installation is accomplished as follows: 1) Preliminary Installation, 2) Wiring, and 3) Exciter Checkout.

2–8. PRELIMINARY INSTALLATION.

2–9. **ENVIRONMENTAL CONSIDERATIONS.** Table 1–2 (SECTION I, GENERAL INFORMATION) provides physical and environmental conditions which should be considered prior to FX–50/E installation.

WARNING	***ENSURE ALL RACK POWER IS DEENERGIZED BEFORE ATTEMPTING EXCITER INSTALLATION.***
WARNING	

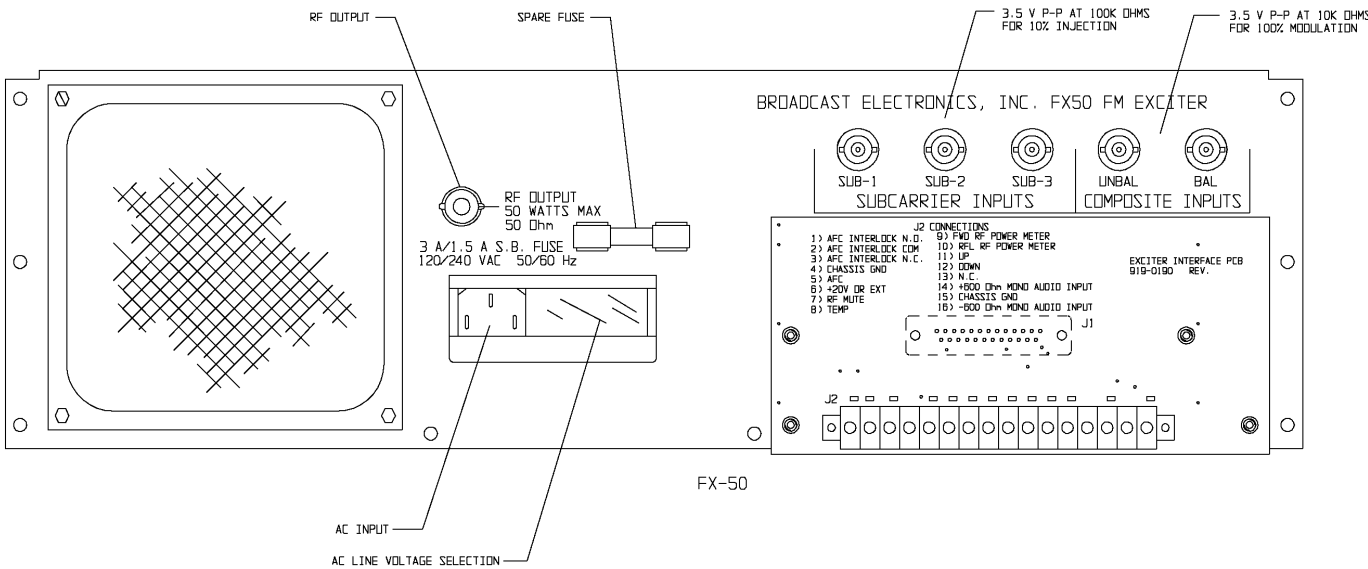
CAUTION	***THE FX-50E CAN ONLY OPERATE FROM A 240V AC SUPPLY. THEREFORE, ENSURE THE LINE VOLTAGE SELECTOR IS CONFIGURED TO 240V.***
CAUTION	

2–10. **AC LINE VOLTAGE PROGRAMMING.** The FX–50/E exciters are programmed for the appropriate line voltage when shipped from the factory. The FX–50E can only operate from a 240V ac supply. Therefore, ensure the line voltage selector is configured to 240V.

2–11. For FX–50 models, the unit can be operated from a 110V or 220V ac supply. Check the ac line voltage programming as follows:

2–12. Place the exciter on a work surface.

2–13. Remove any packing material from the outside of the exciter.



NOTES:

1. J2-6 AND J2-7 ON FX-50 MODELS OR J1-6 AND J1-7 ON FX-50E MODELS MUST BE JUMPERED IF THE EXCITER IS OPERATED INDEPENDENT OF A TRANSMITTER.

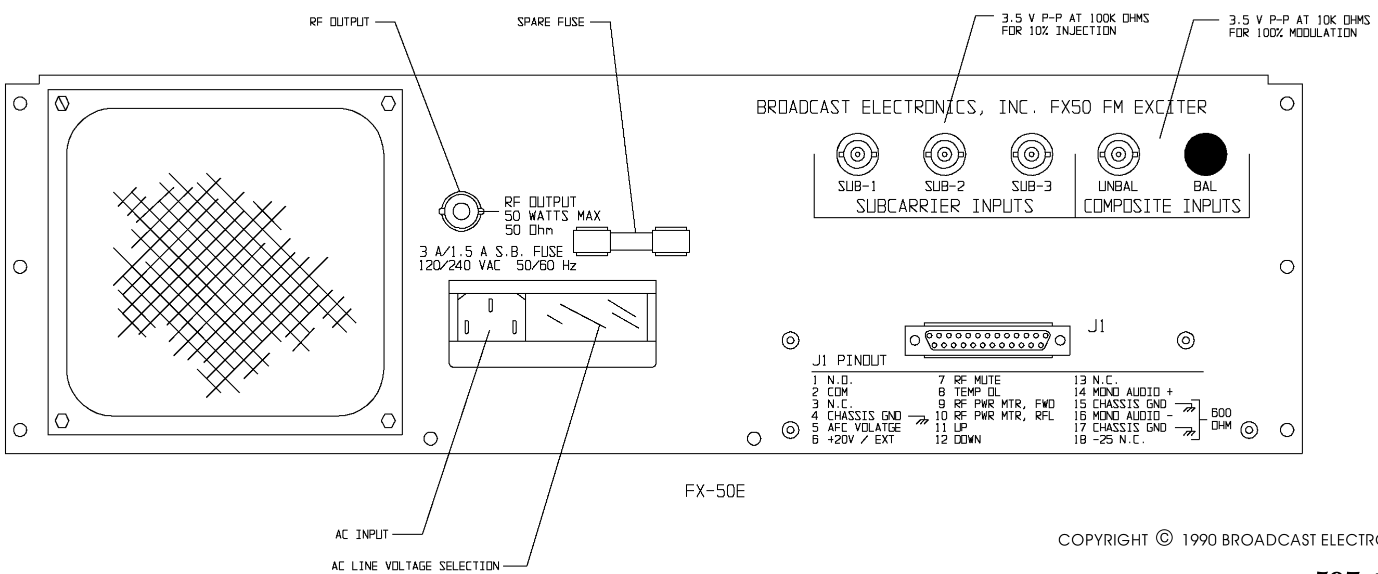


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FIGURE 2-1. FX-50/E REAR-PANEL CONNECTIONS (SHEET 1 OF 2)

FX-50 J2	FX-50 J1		DECRIPTION	
J2-1	J1-1	AFC N.O.	AUTOMATIC FREQUENCY CONTROL INTERLOCK RELAY. AUXILIARY SWITCHING PROVISION. RELAY ENERGIZES WHEN AFC CIRCUIT ACHIEVES LOCK.	
J2-2	J1-2	AFC COM		
J2-3	J1-3	AFC N.C.		
J2-4	J1-4	CHASSIS GND	CHASSIS GROUND.	
J2-5	J1-5	AFC VOLTAGE	AUTOMATIC FREQUENCY CONTROL STATUS. LOCKED - 20 mA SINK DURING NORMAL (LOCKED) OPERATION. UNLOCKED - OPEN CIRCUIT IF PHASE LOCKED LOOP UNLOCKS (30V MAXIMUM).	
J2-6	J1-6	+20V / EXT	+20V / EXT DETERMINED BY S2 ON THE POWER SUPPLY / CONTROL CIRCUIT BOARD. +20V - WHEN S2 IS IN NORM, PROVIDES +20V IN SERIES WITH 240 Ohm FOR RF MUTE PULL-UP. EXT - WHEN S2 IN IN EXT, PROVIDES AN EXTERNAL RF CONTROL INPUT.	+20VDC RF CONTROL 0-6 VDC
J2-7	J1-7	RF MUTE	RF MUTE CONTROL INPUT. MUTE INPUT LOGIC IS DETERMINED BY S3 ON POWER SUPPLY / CONTROL CIRCUIT BOARD. POSITIVE - WHEN S3 IS IN POS POSITION, 0V INPUT TO MUTE EXCITER RF OUTPUT. > + 3V INPUT TO ENABLE EXCITER RF OUTPUT. NEGATIVE - WHEN S3 IS IN NEG POSITION, +5V OR OPEN INPUT TO MUTE EXCITER RF OUTPUT. 0V INPUT TO ENABLE RF OUTPUT.	0V TO MUTE +5V OR OPEN TO MUTE
J2-8	J1-8	TEMP OL	TEMPERATURE OVERLOAD STATUS. +18V IN SERIES WITH 10K Ohm LOGIC LEVEL OUTPUT WHEN EXCITER EXCEEDS A PRESET TEMPERATURE LIMIT.	+18V
J2-9	J1-9	RF FWR MTR, FWD	FORWARD POWER METER OUTPUT. +11.5 VDC = 50W	+11.5 VDC
J2-10	J1-10	RF PWR MTR, RFL	REFLECTED POWER METER OUTPUT. +2 VDC = 4W	+2.0 VDC
J2-11	J1-11	UP	REMOTE RAISE POWER CONTROL FUTURE OPTION.	
J2-12	J1-12	DOWN	REMOTE LOWER POWER CONTROL FUTURE OPTION.	
——	J1-13	N/C	NO CONNECTION.	
J2-13	J1-14	MONO AUDIO +	MONO AUDIO INPUT + 600 Ohm IMPEDANCE.	+
J2-14	J1-15	CHASSIS GROUND	AUDIO INPUT SHIELD GROUND.	SHLD
J2-15	J1-16	MONO AUDIO -	MONO AUDIO INPUT - 600 Ohm IMPEDANCE.	-
J2-16	J1-17	CHASSIS GROUND	CHASSIS GROUND.	
	J1-18	N/C	NO CONNECTION	
	J1-19	N/C		
	J1-20	N/C		
	J1-21	N/C		
	J1-22	N/C		
	J1-23	N/C		
	J1-24	N/C		
	J1-25	N/C		

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FIGURE 2-1. FX-50/E REAR-PANEL CONNECTIONS (SHEET 2 OF 2)

2–14. Refer to Figure 2–1 and ensure the appropriate primary ac line voltage is visible on the AC LINE VOLTAGE SELECTOR circuit board (115/120V or 230/240V). The following text presents the ac line voltage programming:

LINE VOLTAGE	VOLTAGE SELECTOR PROGRAMMING
97–115V	100V
115–133V	120V
194–230V	220V
230–266V	240V

2–15. If an alternate ac line voltage is required, remove the AC LINE VOLTAGE SELECTOR circuit board with a small pair of needle nose pliers. Re–insert the circuit board so that the correct ac line voltage is visible when the circuit board is inserted into the receptacle.

2–16. Ensure the line fuse and spare fuse are both slow–blow types and rated at 3.0 amperes for the 100 to 120 volt range or 1.5 ampere for the 220 to 240 volt range.

2–17. **PLACEMENT.** The FX–50/E exciters may be installed in any convenient location in a 19 inch (48.3 cm) rack within reach of signal and power cables. The exciter should not be installed directly above or below heat generating equipment, otherwise no special requirements need be observed.

2–18. **SLIDE-RAIL INSTALLATION AND TRANSMITTER MOUNTING.** The FX–50/E is designed to be mounted in a rack using slide rails. To install the slide rails, proceed as follows:

A. Locate the slide rail mounting brackets and the movable portion of each slide rail in the accessory kit.

B. Refer to Figure 7–6, SECTION VII, DRAWINGS and secure the slide rail mounting brackets to the respective side of the rack cabinet with the hardware supplied.

CAUTION ***ENSURE THE SLIDE RAILS ARE PARALLEL TO EACH OTHER AND LEVEL BEFORE DRILLING ANY HOLES TO MOUNT THE REAR OF THE SLIDE RAILS.***

CAUTION

C. Secure the movable portion of the slide rail to the mounting brackets with the hardware supplied.

D. After the slide rails are mounted, lift the exciter onto the rails over the slide stops and push the exciter into the rack.

2–19. **OPERATING FUNCTION PROGRAMMING.** The FX–50/E exciters are equipped with several programmable operating functions. Refer to the following text and program the operating functions as desired.

2–20. Pull the exciter forward until the slide rail stops are encountered.

2–21. Loosen the eight turn–lock fasteners on the top of the exciter and remove the top cover.

2–22. Remove any packing material from the inside of the exciter.

2–23. Refer to Figure 2–2 and ensure **AUTO-PWR-MAN** switch S1 and **NORM-EXT** switch S2 on the power supply/control circuit board assembly are operated to AUTO and to NORM respectively.

2–24. **POS-MUTE-NEG** switch S3 on the power supply/control circuit board is provided to select the RF mute input logic polarity (refer to Figure 2–2). S3 must be in the POS position when the FX–50/E is operated with a Broadcast Electronics transmitter or as a stand–alone unit. Switch S3 is factory operated to the POS position prior to shipping.

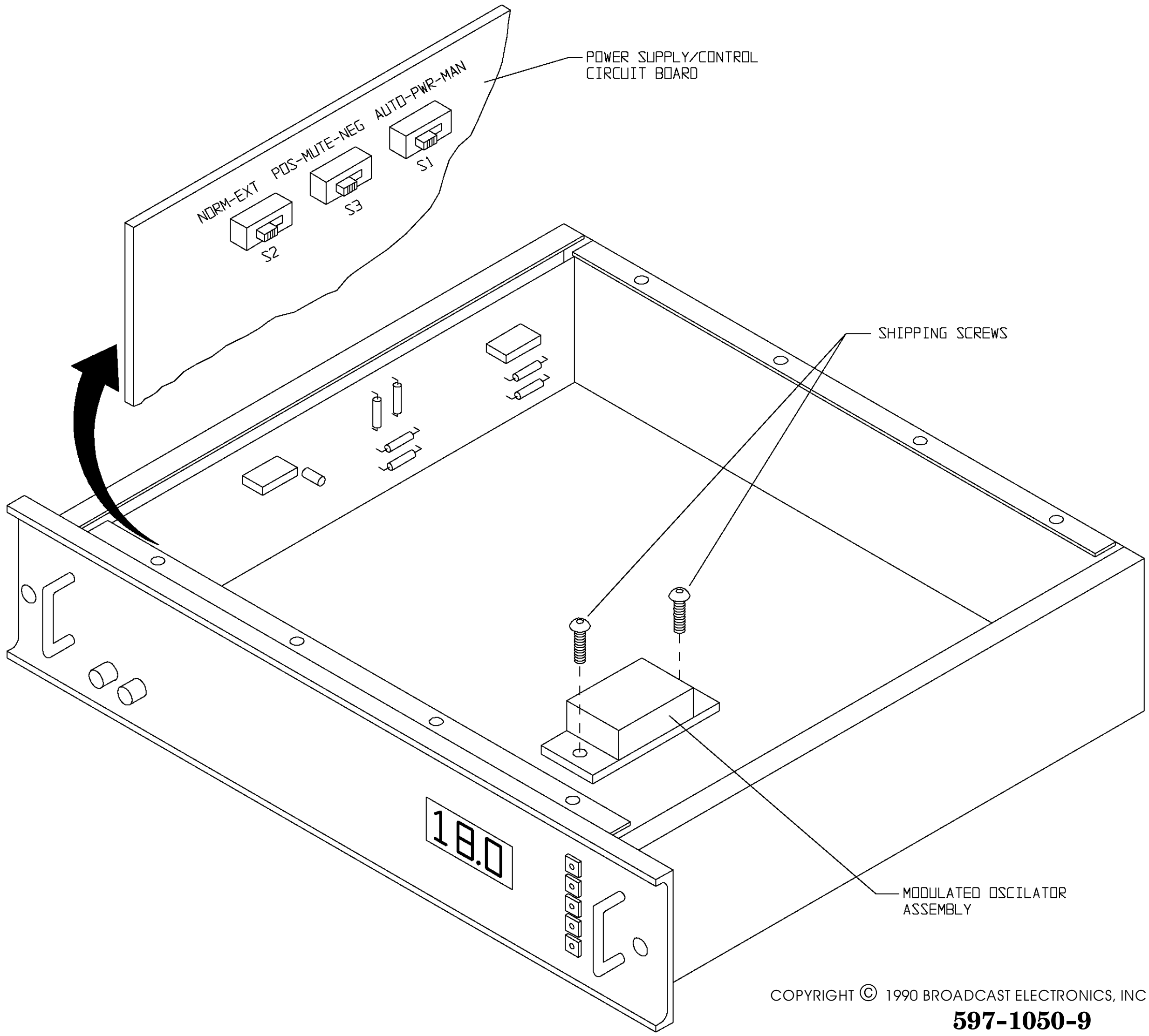

FIGURE 2-2. FX-50/E COMPONENT LOCATION DIAGRAM

2-25. Refer to the final test data sheets shipped with the exciter and ensure the 3 **SYNTHESIZER FREQUENCY SELECTION** switches on the AFC/PLL assembly are correctly positioned.

2-26. Refer to Figure 2-2 and remove the two shipping screws which secure the modulated oscillator assembly to operate the shock mounts.

2-27. Replace the top cover on the exciter and secure the eight turn-lock fasteners on the top of the cover.

2-28. **GAIN SELECTION.** The gain of the balanced monophonic audio processing circuit on the AFC/PLL circuit board is selectable for input levels ranging from 0.0 dB to +10 dB. The FX-50/E is shipped from the factory for an input level of +10 dB. If an alternate level is required, refer to Figure 2-3 and connect the appropriate resistor between terminals E1 and E2 as determined by the following information.

INPUT LEVEL	RESISTOR VALUE
+10 dBm	OMIT
+8 dBm	39k Ohm
+4 dBm	10k Ohm
0.0 dBm	4.7k Ohm

WARNING ***ENSURE ALL SYSTEM POWER IS DISCONNECTED BEFORE PROCEEDING.***

WARNING

2–29. **WIRING.**

2–30. **RF OUTPUT.** Refer to Figure 2–1 and connect a coaxial cable (located in the accessory kit) between the **RF OUTPUT** connector on the exciter rear–panel and a 50 Ohm RF load capable of dissipating the output of the exciter.

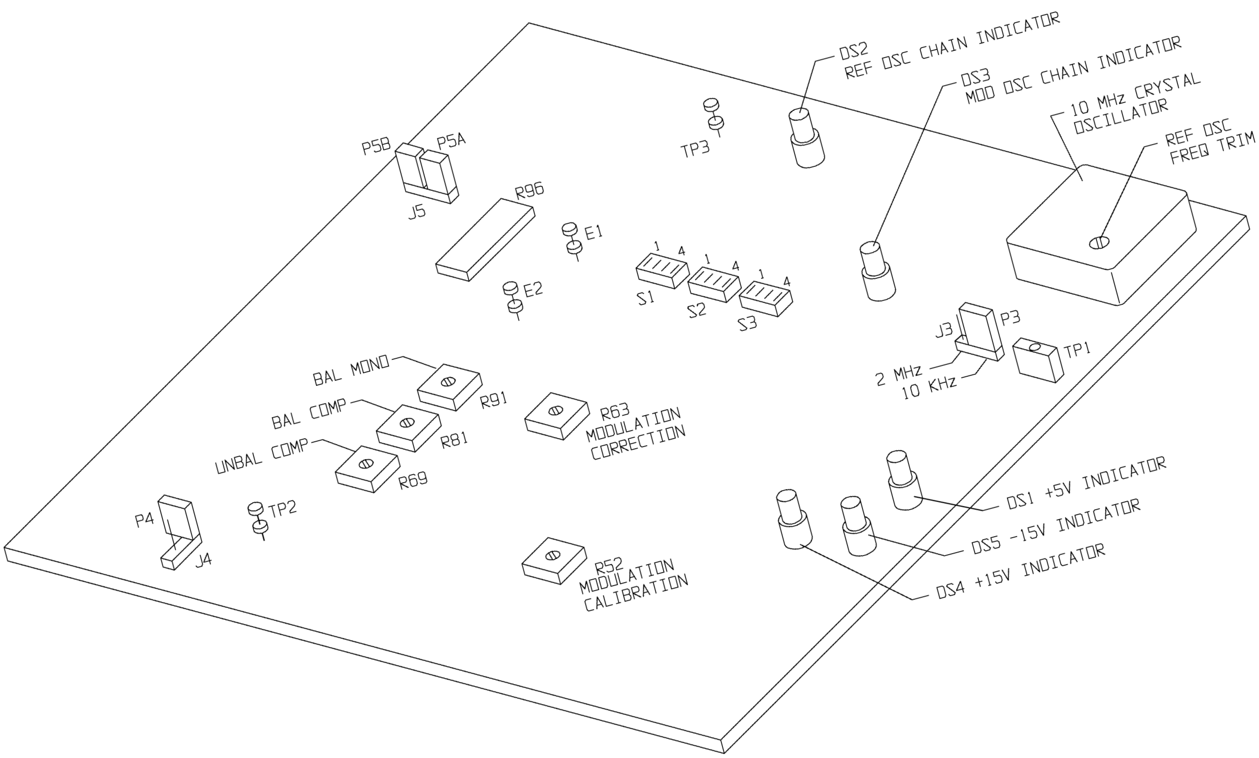

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FIGURE 2-3. AFC/PLL CIRCUIT BOARD GAIN CONNECTIONS

WARNING ***ENSURE THE EXCITER CASE IS CONNECTED TO EARTH GROUND.***

WARNING

2–31. **GROUND.** Ensure a ground wire is connected from terminal 4 of the exciter rear–panel terminal board to earth ground.

2–32. **REMOTE CONTROL.** The FX–50/E exciters are designed for remote control operation (refer to Figure 2–1). The exciter will interface with almost any remote control unit or panel. The following text presents a description of the remote control and indicator functions.

2–33. **Automatic Frequency Control Relay.** An Automatic–Frequency–Control relay is provided to control equipment connected external to the unit. When the FX–50/E is installed as an exciter in a transmitter system, the relay is used for the connection of an interlock to disable the transmitter RF power supply. When the FX–50/E is operating as an independent unit, the relay can be used to control an external alarm. The relay contacts are rated at 125V @ .5 Amps and are located at J2–1, J2–2, and J2–3 on FX–50 units and J1–1, J1–2, and J1–3 on FX–50E units. When the AFC circuit is locked, the relay is closed. When the AFC circuit unlocks, the relay will open.

2–34. **Automatic Frequency Control Indicator.** The automatic frequency control indicator provides a signal to indicate when the transmitter AFC circuit is locked. The AFC indicator is located at J2–5 on FX–50 units and J1–5 on FX–50E units. The indicator will be open when the AFC circuit is unlocked.

2–35. **+20 Or Ext.** The +20/EXT terminal functions as a +20V supply or an analog RF control input port. When S2 on the power supply/control board is operated to NORM, the terminal operates as a +20V supply. When S2 is operated to EXT, the terminal operates as an analog RF control input port. The control range is from 0–6 V dc. If desired, control the transmitter RF output power by: 1) constructing a remote power control circuit to output a specific DC voltage to select a transmitter power level, 2) operating switch S2 to EXT, and 3) connecting the remote power supply circuit to J2–6 on FX–50 units and J1–6 on FX–50E units.

2–36. **RF Mute.** The FX–50/E is equipped with an RF mute control input. Switch S3 on the power supply/control circuit board is provided to select the RF mute input logic polarity. When S3 is operated to POS, a +0V signal is required to mute the transmitter output. When S3 is operated to NEG, a greater than +5V signal is required to mute the transmitter output. To mute the transmitter, proceed as follows:

1. Refer to Figure 2–1 and remove the jumper between J2–6 and J2–7 on FX–50 units and J1–6 and J1–7 on FX–50E units.
2. Operate switch S3 on the power supply/control circuit board to POS.
3. Connect a normally closed switch between J2–6 and J2–7 on FX–50 units and J1–6 and J1–7 on FX–50E units.

2–37. **Over-Temperature Indicator.** Both the FX–50 and FX–50E are equipped with an over–temperature indicator. The indicator will output a HIGH (+18V dc) when the RF amplifier heat–sink temperature exceeds approximately 65°C. Refer to Figure 2–1 and connect the wiring to J2–8 on FX–50 units and J1–8 on FX–50E units.

2–38. **Remote RF Power Metering.** The FX–50/E units are equipped with remote reflected/forward power meter indications. The forward power meter indication will provide a 11.5 VDC signal at 50W. The reflected power meter indication will provide a 2.0 VDC signal at 4W. Connect the remote metering to J2–9/J2–10 on FX–50 units and J1–9/J1–10 on FX–50E units.

2–39. **Remote Power Control Option.** A down remote power control option is provided at J2–12 on FX–50 units and J1–12 on FX–50E units. An up remote power control option is provided at J2–11 on FX–50 units and J1–11 on FX–50E units. The option will be available at a future date.

2–40. **MONOPHONIC AUDIO CONNECTIONS.** The FX–50/E units are equipped with a balanced 600 ohm monophonic audio input (refer to Figure 2–1). The input is designed to accept a +10 dBm signal at 600 Ohms. Connect audio to the transmitter as follows:

AUDIO SIGNAL	***FX-50***	***FX-50E***
+	J2–13	J1–14
SHIELD	J2–14	J1–15
–	J2–15	J1–16

2–41. **CONNECTION OF COMPOSITE STEREO SIGNAL SOURCES.** The FX–50 is equipped with one balanced and one unbalanced composite input on the rear–panel (**COMPOSITE INPUT BAL** and **UNBAL**). The FX–50E is equipped with a single unbalanced composite input (**COMPOSITE INPUT UNBAL**). These inputs are for the connection to a composite stereo source such as a stereo generator or composite STL receiver (refer to Figure 2–1). A front–panel **COMPOSITE TEST IN** connector functions in the same manner as the unbalanced composite input. A coaxial cable is provided in the accessory kit for the connections of a composite stereo or SCA signal to the transmitter.

2–42. Both the **COMPOSITE INPUT UNBAL** and **BAL** receptacles require a level of 3.5V p–p (1.24 VRMS) to modulate the carrier at ±75 kHz. These jacks may be used entirely independent of each other and will accept frequencies of less than 1 Hz to 100 kHz. If these inputs are used, the output level on the composite source must be adjusted to obtain 100% peak modulation as indicated by the modulation display (145% range).

2–43. The **BAL** input is ac coupled at the input and equipped with common mode rejection circuitry. Therefore, the **BAL** input must be used if ground loops and hum are present between the exciter and composite source.

2–44. **CONNECTION OF SCA SIGNAL SOURCES.** SCA unbalanced input receptacles **SUB–1, SUB–2,** and **SUB–3** are provided on the rear–panel. Each input is ac coupled and accepts frequencies from 40 kHz to 100 kHz. An input of 3.5V P–P (1.24 VRMS) will modulate the FM carrier 10% at ±7.5 kHz. A coaxial cable is provided in the accessory kit for the connections of a composite stereo or SCA signal to the transmitter.

2–45. If the unit is equipped with the FM synchronous booster system, rear–panel receptacle **SUB–1** is used as the input/output connection for a reference frequency.

2–46. When using an SCA input, the output level of the source must be adjusted to obtain the desired peak modulation as indicated by the modulation display (14.5% range). Each input is also compatible with any SCA generator using a dc coupled input for the transmission of data.

2–47. **SYNCHRONOUS FM BOOSTER OPTION.** The transmitter can be equipped with a synchronous FM booster system option. The option consists of a: 1) master configuration and 2) slave configuration. The FM booster system configures a slave booster to be locked to the frequency of the master booster. Typically, the master/slave booster options are installed at the factory. If the synchronous FM booster option is to be installed in the field, installation and operating information is provided in the SYNCHRONOUS FM BOOSTER SYSTEM section of this manual. Refer to the SYNCHRONOUS FM BOOSTER SYSTEM section of this manual and perform the installation procedures as required.

2–48. Refer to Figure 2–1 and connect the external signal inputs and remote control wiring as required. A second coaxial cable is provided to connect an SCA or composite input to the exciter.

2–49. **EXCITER CHECKOUT.**

2–50. Before proceeding, check the following:

A. Ensure all connections are secure.

B. Ensure primary power is properly programmed.

C. Ensure the chassis ground connection is secure.

D. Ensure all signal inputs are secure.

E. Ensure the RF output is properly connected.

F. Ensure all external cabling is properly dressed and secured.

CAUTION ***THE PRIMARY AC POWER USED MUST BE THE SAME AS DISPLAYED ON THE AC LINE VOLTAGE SELECTOR CIRCUIT BOARD.***

CAUTION

2–51. Connect the exciter to an appropriate power source with the power cord provided. The following events will occur.

A. The fan will begin to operate.

B. The +20V, –20V, and +5V status indicators will illuminate. After approximately 5 seconds, the **LOCK** status indicator will illuminate.

C. The multimeter **WATTS** and **FWD** indicators will illuminate.

D. The multimeter will indicate approximately 5 watts.

2–52. Depress the multimeter **AFC** switch.

A. The multimeter **VOLTS** and **AFC** indicators will illuminate.

B. The multimeter will indicate a potential within the range of +2.0 volts to +9.0 volts, dependent upon carrier frequency. Refer to the final test data sheets for the correct voltage indication.

2–53. Depress the multimeter **PAV** switch.

A. The multimeter **VOLTS** and **PAV** indicators will illuminate.

B. The multimeter will indicate a potential within the range of +5.0 volts to +7.0 volts (assuming an RF output power of 5 Watts).

2–54. Depress the multimeter **PAI** switch.

A. The multimeter **AMPS** and **PAI** indicators will illuminate.

B. The multimeter will indicate approximately 1.0 amperes (assuming an RF output power of 5 Watts).

2–55. Depress the multimeter **FWD** switch.

A. Extend the exciter forward on the slide rails to expose the **R.F. POWER OUTPUT ADJ.** control access hole in the left side of the top cover.

B. Using an insulated adjustment tool, adjust the exciter output power to the level required by the transmitter.

WARNING ***DISCONNECT EXCITER PRIMARY POWER BEFORE PROCEEDING.***

WARNING

2–56. Disconnect ac primary power from the exciter.

2–57. Disconnect the RF load and connect the exciter output to the transmitter RF input connector.

2–58. **LOW-PASS FILTER INSTALLATION.**

2–59. The FX–50/E can be equipped with an optional low–pass filter to allow the unit to operate as a low power transmitter. The optional low–pass filter is installed as follows.

2–60. Remove the exciter top–panel. Refer to Figure 2–4 and secure the low–pass filter to the inside rear–panel with the hardware supplied.

2–61. Remove the coaxial cable from the **RF OUTPUT** receptacle and connect to filter input receptacle J1. Connect the short coaxial cable (supplied) between filter receptacle J2 and the **RF OUTPUT** receptacle. When installation is complete, replace the exciter top–panel.

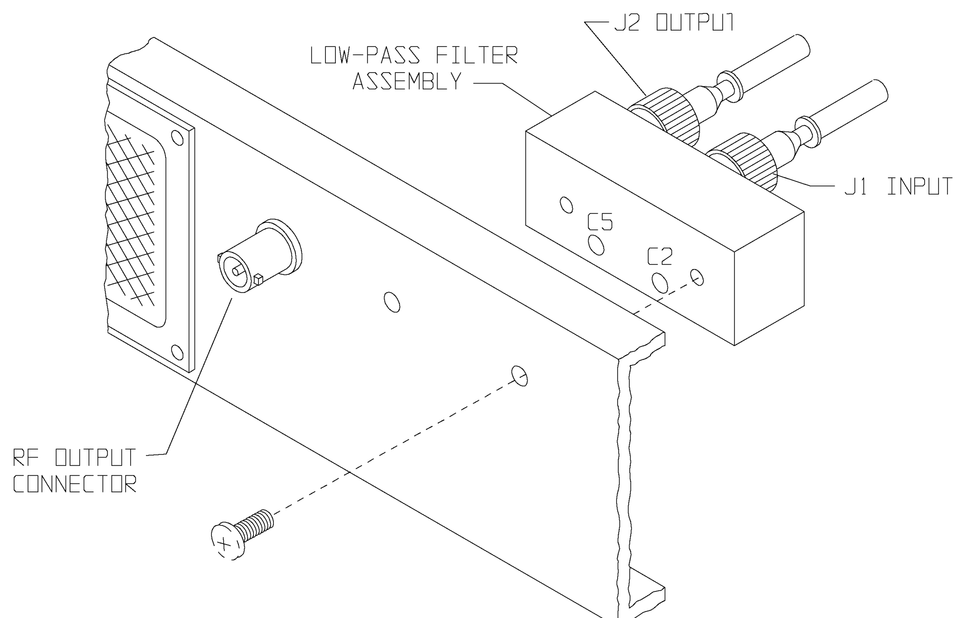


FIGURE 2-4. LOW-PASS FILTER INSTALLATION **597-1050-20**

2–62. **REMOTE EXCITER CONNECTIONS.**

2–63. The following text provides information required to connect a remote FX–50/E exciter to a tube–type B/T series FM transmitter. The exciter interface cable is stored in the transmitter cabinet for shipment. Refer to Table 2–1 and connect the cable to the exciter rear–panel as described.

TABLE 2-1. REMOTE FX-50/E EXCITER CONNECTIONS

WIRE	***FX-50***	***FX-50E***
283	J2–4	J1–4
244	J2–5	J1–5
245	J2–7	J1–7
246	J2–8	J1–8
247	J2–9	J1–9
248	J2–10	J1–10

SECTION III
OPERATION

3-1. INTRODUCTION.

3-2. This section identifies all controls and indicators associated with the FX-50/E FM Exciters and provides standard operating procedures.

3-3. CONTROLS AND INDICATORS.

3-4. Refer to Figure 3-1 for the location of all controls and indicators associated with normal operation of the FX-50/E Exciters. The function of each control or indicator is described in Table 3-1.

3-5. OPERATION.

NOTE | ***THE FOLLOWING PROCEDURE ASSUMES THAT THE EXCITER IS COMPLETELY INSTALLED AND IS FREE OF ANY DISCREPANCIES.*** | *NOTE*

3-6. TURN ON.

3-7. Primary power will be applied to the FX-50/E when the transmitter filament supply is energized. Operate the transmitter filament power to ON. The following events will occur:

A. The flushing fan will operate.

B. The +20V, -20V, and +5V operating voltage status indicators will immediately illuminate.

C. After a delay of approximately 5 seconds, the **LOCK** indicator will illuminate to indicate operating frequency stabilization.

D. The multimeter will be operated to the forward power function and indicate a previously adjusted RF output level.

3-8. Observe the modulation indicator to ensure programming is applied to the exciter.

3-9. Operate the multimeter forward switch to illuminate the **FWD** indicator and record the multimeter output power indication ______________.

3-10. Operate the multimeter reflected switch to illuminate the **RFL** indicator and record the multimeter reflected power indication ______________.

3-11. The exciter forward and reflected power indications may be converted to a VSWR ratio using Table 3-2. To use the table, divide the multimeter reflected power indication by the multimeter forward power indication. Locate the quotient in the POWER RATIO column. The VSWR is listed across from the POWER RATIO entry.

3-12. TURN OFF.

3-13. If the exciter primary circuit is connected to the transmitter filament supply, the exciter will deenergize when the transmitter is turned off. The FX-50/E exciter does not require constant primary power.

Table 3-1. FX-50/E CONTROL AND INDICATORS
(Sheet 1 of 2)

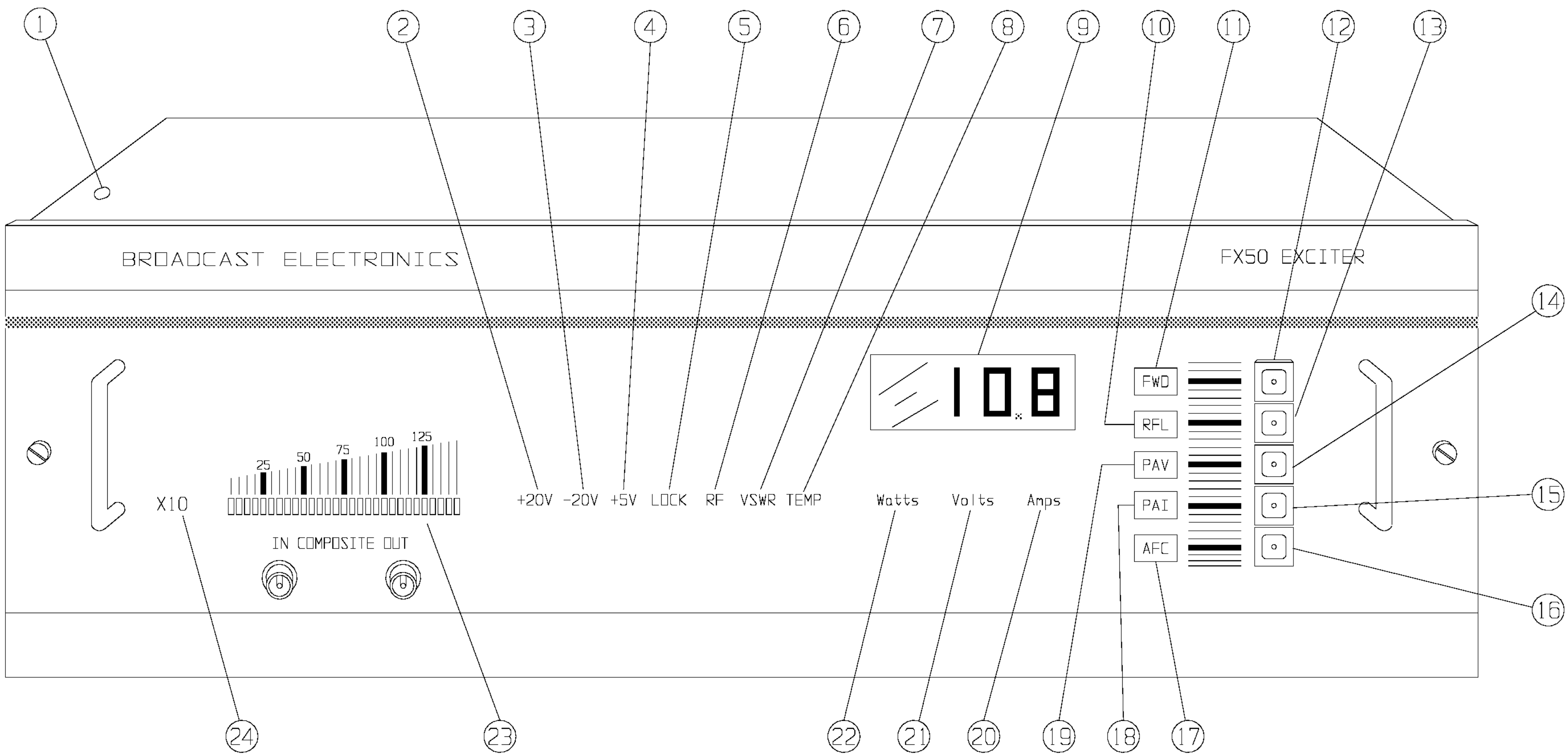
ITEM NO.	NOMENCLATURE	FUNCTION
1	RF Power Output Level Control	Adjusts exciter RF output level. CW adjustment increases output level.
2	**+20V** Status Indicator	Illuminates to indicate the presence of the +20 volt operating potential.
3	**-20V** Status Indicator	Illuminates to indicate the presence of the –20 volt operating potential.
4	**+5V** Status Indicator	Illuminates to indicate the presence of the +5 volt operating potential.
5	**LOCK** Status Indicator	Illuminates to indicate the operating frequency is stabilized.
6	**RF** Status Indicator	Illuminates to indicate an RF amplifier malfunction.
7	**VSWR** Status Indicator	Illuminates to indicate reflected power exceeds 5.5 watts.
8	**TEMP** Status Indicator	Illuminates to indicate the RF amplifier heat–sink temperature exceeds a preset limit.
9	Multimeter LCD Display	Indicates units of voltage, power, or current as selected by the multimeter switches.
10	**RFL** Multimeter Indicator	Illuminates to indicate the reflected power multimeter function is selected.
11	**FWD** Multimeter Indicator	Illuminates to indicate the forward power multimeter function is selected.
12	Forward Multimeter Switch	Selects the forward power multimeter function when depressed.
13	Reflected Multimeter Switch	Selects the reflected power multimeter function when depressed.
14	PA Voltage Multimeter Switch	Selects the PA voltage multimeter function when depressed.
15	PA Current Multimeter Switch	Selects the PA current multimeter function when depressed.
16	Automatic Frequency Control Multimeter Switch	Selects the AFC voltage multimeter function when depressed.
17	**AFC** Multimeter Indicator	Illuminates to indicate the AFC multimeter function is selected.

Table 3-1. FX-50/E CONTROL AND INDICATORS
(Sheet 2 of 2)

ITEM NO.	NOMENCLATURE	FUNCTION
18	**PAI** Multimeter Indicator	Illuminates to indicate the PA current multimeter function is selected.
19	**PAV** Multimeter Indicator	Illuminates to indicate the PA voltage multimeter function is selected.
20	Amps Multimeter Unit Indicator	Illuminates when the multimeter indicates units of current.
21	Volts Multimeter Unit Indicator	Illuminates when the multimeter indicates units of voltage.
22	Watts Multimeter Unit Indicator	Illuminates when the multimeter indicates units of power.
23	Modulation Indicator	Indicates peak composite baseband modulation level. Scale is calibrated for 100% at ±75 kHz deviation.
24	X10 Scale Indicator	Illuminates when modulation display input level is multiplied by 10.

TABLE 3-2. POWER/VSWR CONVERSION

$\frac{\text{Reflected Power in Watts}}{\text{Forward Power in Watts}}$ = POWER RATIO	VSWR
0.000	1.0:1
0.002	1.1:1
0.008	1.2:1
0.017	1.3:1
0.028	1.4:1
0.040	1.5:1
0.053	1.6:1
0.074	1.75:1
0.111	2.0:1
0.183	2.5:1
0.250	3.0:1
0.360	4.0:1



597-1050-3

FIGURE 1. FX-50/E CONTROLS AND INDICATORS

SECTION IV
THEORY OF OPERATION

4-1. INTRODUCTION.

4-2. This section presents overall theory of operation for the FX-50/E FM Exciters.

4-3. For the purpose of definition, the FX-50/E Exciter is divided into functional subassemblies in the following text. A detailed description of each subassembly is presented in Part II of this manual. A block diagram of the FX-50/E FM Exciter is presented in Figure 4-1.

4-4. FUNCTIONAL DESCRIPTION.

4-5. POWER SUPPLY/CONTROL CIRCUITS.

4-6. The power supply/control circuit board contains the exciter power supply and control circuitry. The proceeding text will describe the power supply circuitry followed by the control circuitry.

4-7. **POWER SUPPLY CIRCUIT.** Primary ac power to the exciter is applied through a voltage selector and line filter module. This device provides overload protection for the entire exciter and allows selection of a wide range of ac input potentials. On FX-50E models, the ac power is routed through an additional ac line filter to meet CE ac line related specifications.

4-8. All dc circuitry in the exciter operates from an unregulated potential of +30V dc and three pre-regulated potentials of +20 volts, -20 volts and +5 volts. All supplies are full-wave rectified, filtered, and electronically regulated to assure stable equipment operation.

4-9. The +20 volt, -20 volt, and +5 volt supplies are low-current circuits which are protected from over-voltage, over-current, reverse-voltage, and short-circuit conditions. These potentials are distributed throughout the exciter to various subassemblies and re-regulated to lower voltages on each circuit board. Front-panel LEDs provide status indication of the +20 volt, -20 volt, and +5 volt operating potentials.

4-10. The filtered +20 volt supply associated with the RF amplifier is regulated by the control circuitry in response to preset level controls and feedback loops. This supply contains over-voltage, over-current, reverse-voltage, short-circuit, and over-temperature circuitry to protect the exciter sub-assemblies.

4-11. **CONTROL CIRCUIT.** The control circuitry regulates operation of the RF amplifier within preset limits dependent upon several parameters such as forward RF power output, reflected power, RF amplifier heat sink temperature, dc current, dc supply voltage, an external mute control potential, and an external RF power adjust potential. The control circuit assembly also contains amplifiers for the forward and reflected power directional couplers, over temperature circuitry, and the VSWR circuitry.

4-12. The control circuit compares the sum of the forward and reflected powers to a reference for automatic control of power output. If the reflected power becomes excessive, the power output will be reduced by the amount required to maintain safe operation of the RF output transistor. If excessive VSWR exists, a front-panel **VSWR** indicator will illuminate.

4-13. In addition, the control circuit monitors the total RF amplifier assembly heat sink temperature and limits RF output accordingly. This assures operation at safe transistor temperatures under the worst case conditions of high VSWR, high ambient temperatures, or failure of the cooling fan. If an over-temperature condition exists, a front-panel **TEMP** indicator will illuminate.

4–14. Automatic protection of the RF devices from excessive voltage is provided by an MOV and crowbar circuit, and short circuit protection is provided by foldback current limiting and a fuse. If an over–current condition exists, a front–panel **RF** indicator will illuminate.

4–15. REMOTE CONTROL/STATUS INTERFACING AND RFI FILTER NETWORK.

4–16. Remote control and status interfacing is accomplished by: 1) an interface circuit board on FX–50 models and 2) a 25–pin D–Type connector on the RFI filter circuit board for FX–50E models. The RFI filter circuit board prevents interference from signals of 500 kHz and above by filtering and bypassing the audio, control, and status input and output circuits. Transient protection for the signals is provided by transorbs. The front–panel **COMPOSITE TEST IN** and **COMPOSITE TEST OUT** circuits are not routed through this circuit board.

4–17. METERING CIRCUIT.

4–18. Metering of important exciter operating parameters is provided by a digital multimeter. Five steady–state parameters are selected by front–panel switches and displayed on a liquid crystal display (LCD). Additional circuitry on the metering circuit board converts the multimeter into a high–impedance test instrument for internal voltage measurements.

4–19. A digitally controlled moving–bar LED display constantly monitors the ac composite signal applied to the modulated oscillator. Indication of short transient peaks exceeding 100% modulation is provided by a one–shot multivibrator connected to the 100% digital display segment. Accuracy to 5% on signals from dc to a one–cycle burst of a 100 kHz tone is provided by a high–speed peak detector. An automatic scaling circuit provides expansion of the meter scale from 145% to 14.5% to measure SCA and pilot injection signal levels.

4–20. AFC/PLL CIRCUIT.

4–21. The AFC/PLL circuit synthesizes the exciter carrier frequency and maintains the phase and frequency of the carrier. The frequency synthesizer and comparator circuit provides 2000 synthesized frequencies within the commercial FM broadcast band in 10 kHz increments.

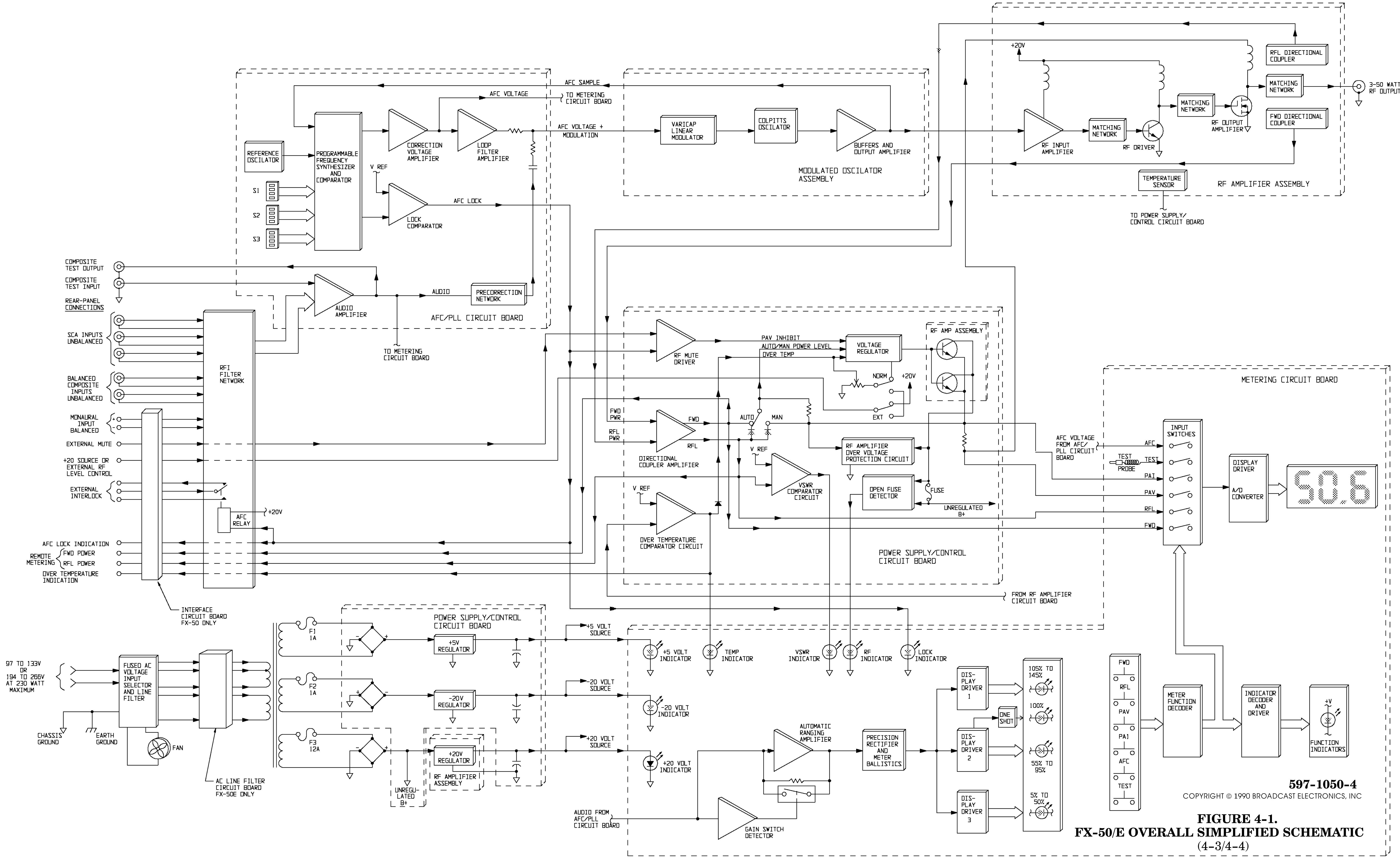
4–22. Carrier sampled at the output of the modulated oscillator is returned to the AFC/PLL circuit as feedback. This feedback is divided and compared to a scaled–down reference frequency within a programmable frequency synthesizer and comparator logic circuit to develop a correction signal.

4–23. During normal operation, the AFC/PLL circuit constantly modifies the correction signal applied to the modulated oscillator to maintain the stability of the carrier. If the carrier is off frequency, the AFC/PLL circuit will mute the RF output and deenergize the AFC relay until the carrier is locked in phase and frequency to the reference oscillator. A dual–speed loop filter provides rapid stabilization of the carrier and allows modulation from 1 Hz to 100 kHz. When frequency stabilization is attained, a front–panel status indicator will illuminate.

4–24. As a secondary function, the assembly accepts all audio inputs, corrects the audio, and sums the corrected audio with AFC tuning bias which linearizes the modulation and adjusts the carrier frequency of the modulated oscillator.

4–25. MODULATED OSCILLATOR CIRCUIT.

4–26. The modulated oscillator circuit generates the final carrier frequency, frequency modulates the carrier, and amplifies the modulated RF carrier to a level sufficient to drive the RF amplifier. Additional circuitry interfaced with the AFC/PLL circuit maintains the RF carrier center frequency as part of a phase–locked–loop.



597-1050-4

FIGURE 4-1.
FX-50/E OVERALL SIMPLIFIED SCHEMATIC
(4-3/4-4)

4–27. **RF AMPLIFIER ASSEMBLY.**

4–28. The RF amplifier assembly consists of three stages of amplification designed to increase the 2 milliwatt RF input signal from the modulated oscillator to an adjustable RF power level of 3 to 50 watts as required to drive an associated transmitter.

4–29. The first stage employs a broadband thick–film hybrid amplifier which provides a saturated output of approximately one watt to the input of the driver stage. The driver provides 8 watts of RF to the power amplifier which outputs an adjustable RF level of 3 to 50 watts.

4–30. A microstrip directional coupler on the RF amplifier printed circuit board supplies information to the exciter control circuitry to automatically maintain RF power output and provide protection during high VSWR operating conditions.

4–31. The RF amplifier transistors are mounted on a large heat sink positioned in the direct air flow from a cooling fan. Heat sink temperature is monitored by the control circuitry. If an over–temperature condition exists, the control circuit will automatically reduce RF power to maintain safe operation of the RF devices.

4–32. The broadband characteristics of the amplifier eliminates the necessity for adjustments for any frequency within the FM band, assures that the exciter output is transparent to the signal generated by the modulated oscillator, and enhances amplifier stability under varying load conditions.

SECTION V
MAINTENANCE

5-1. INTRODUCTION.

5-2. This section provides general maintenance information, electrical adjustment procedures, and troubleshooting information for the FX-50/E FM Exciters.

5-3. SAFETY CONSIDERATIONS.

WARNING
WARNING
WARNING
WARNING

THE EXCITER CONTAINS GUARDS FOR HAZARDOUS VOLTAGES PRESENT AT THE AC LINE SELECTOR AND HIGH CURRENTS ON THE TERMINALS OF THE POWER SUPPLY FILTER CAPACITOR AND POWER TRANSISTORS MOUNTED ON THE RF AMPLIFIER HEAT SINK ASSEMBLY. NEVER OPERATE THE EXCITER WITHOUT THE GUARDS.

WARNING
WARNING

USE THE INSULATED TUNING TOOL PROVIDED FOR ANY ADJUSTMENTS AND DO NOT TOUCH ANY COMPONENT WITHIN THE EXCITER WHEN POWER IS ENERGIZED.

5-4. Low voltages are used throughout the exciter circuitry; however, maintenance with power energized is always considered hazardous and caution should be observed. It is possible to receive minor RF burns from the high impedance points of the RF power amplifier with the exciter top-panel removed.

WARNING
WARNING

ENSURE ALL PRIMARY POWER IS DISCONNECTED FROM THE EXCITER BEFORE ATTEMPTING EQUIPMENT MAINTENANCE.

5-5. FIRST LEVEL MAINTENANCE.

5-6. First level maintenance consists of precautionary procedures applied to equipment to prevent future failures. These procedures are performed on a regular basis and the results recorded in a performance log.

5-7. Periodically, the exciter chassis and fan filter should be cleaned of accumulated dust using a brush and vacuum cleaner. Check for overheated components, tighten loose hardware, and lubricate mechanical surfaces (such as the slide rails) as required. Check performance levels by utilizing the multimeter functions and status indicators provided.

5-8. SECOND LEVEL MAINTENANCE.

5-9. Second level maintenance consists of procedures required to restore the FX-50/E to operation after a fault has occurred.

5-10. The maintenance philosophy of the FX-50/E FM Exciters consists of problem isolation to a specific assembly. Subsequent troubleshooting is provided by each applicable assembly publication in Part II of this manual to isolate specific components. If desired, the entire assembly may be returned to Broadcast Electronics, Inc. for repair or replacement.

5–11. **ADJUSTMENTS.**

5–12. Adjustment procedures for all controls on all circuit boards are provided by each applicable assembly publication in Part II of this manual.

5–13. **TROUBLESHOOTING.**

5–14. Most troubleshooting consists of visual checks. The various exciter indicators (meters, LED's, and fuses) should be observed to isolate the malfunction to a specific area as listed below. Typical meter indications are presented in Table 5–1 and exciter power demand requirements are listed in Table 5–2.

A. Exciter Input
B. Power Supply Circuit
C. Metering Circuit
D. Modulated Oscillator Circuit
E. AFC/PLL Circuit
F. RF Amplifier
G. Control Circuit
H. Exciter Output

5–15. **DC VOLTMETER.** The FX–50/E is equipped with a high impedance voltmeter which can be employed to measure internal dc potentials. To convert the front–panel multimeter to a dc test instrument, refer to Figure 5–1 and the following procedure.

5–16. **Procedure.** To convert the multimeter to a test instrument, proceed as follows:

A. Extend the exciter forward and remove the top–cover.

WARNING ***DO NOT TOUCH ANY FEED THROUGH CAPACITORS OR COMPONENTS ON THE RF AMPLIFIER MODULE WITH POWER APPLIED.***

WARNING

B. Operate the test switch/indicator on the metering circuit board assembly to illuminate the switch/indicator. All multimeter function indicators will extinguish and the LCD display will indicate zero volts.

C. To restore normal operation of the meter, depress any front–panel multimeter function switch. Replace the top–cover.

5–17. Once the trouble is isolated, refer to the applicable section discussing the theory of operation and providing troubleshooting for the respective assembly to assist in problem resolution. All internal components may be accessed through a removable top cover (refer to Figure 5–1).

TABLE 5-1. TYPICAL METER INDICATIONS

MULTIMETER SWITCH POSITION		MULTIMETER INDICATION		
TEST				
+20 V		+19 to +21 V dc		
−20 V		−19 to −21 V dc		
+5 V		+4.8 to +5.2 V dc		
AFC		+2.0 to +9.0 V dc, dependent upon RF carrier frequency		
PAV	**RF POWER**	**88.1 MHz**	**98.1 MHz**	**108.1 MHz**
	5 Watts	+5.5 V dc	+6.0 V dc	+5.7 V dc
	10 Watts	+7.8 V dc	+8.9 V dc	+8.5 V dc
	20 Watts	+10.7 V dc	+12.1 V dc	+11.8 V dc
	30 Watts	+13.4 V dc	+15.0 V dc	+14.8 V dc
	50 Watts	+18.9 V dc	+20.3 V dc	+20.6 V dc
PAI	**RF POWER**	**88.1 MHz**	**98.1 MHz**	**108.1 MHz**
	5 Watts	1.10 Ampere	0.97 Ampere	1.00 Ampere
	10 Watts	1.59 Ampere	1.40 Ampere	1.39 Ampere
	20 Watts	2.20 Ampere	1.92 Ampere	1.88 Ampere
	30 Watts	2.77 Ampere	2.40 Ampere	2.34 Ampere
	50 Watts	3.87 Ampere	3.30 Ampere	3.27 Ampere
FWD		3 to 50 Watts		
RFL		Less than 2 Watts		

TABLE 5-2. AC POWER REQUIREMENTS

RF POWER OUTPUT MIDBAND	AC INPUT	POWER REQUIREMENTS
50 W	230 V ac	0.70 Ampere
30 W	230 V ac	0.60 Ampere
20 W	230 V ac	0.55 Ampere
10 W	230 V ac	0.50 Ampere
50 W	115 V ac	1.40 Ampere
30 W	115 V ac	1.20 Ampere
20 W	115 V ac	1.10 Ampere
10 W	115 V ac	1.00 Ampere

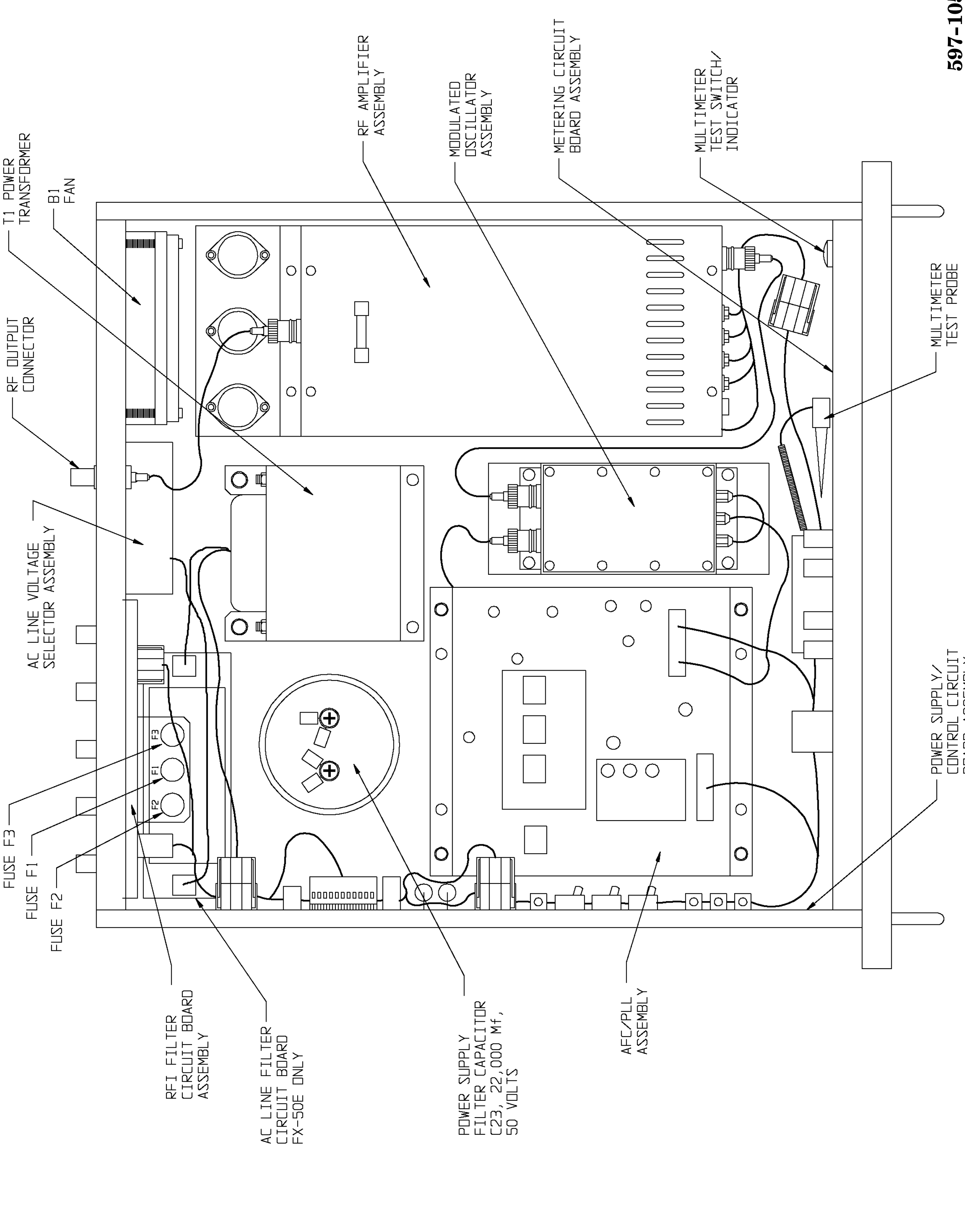


FIGURE 5-1. FX-50/E ASSEMBLY

WARNING *BERYLLIUM OXIDE CERAMICS (BeO) - AVOID BREATHING DUST OR FUMES.*

WARNING

WARNING *THE WHITE CASE MATERIAL OF THE FX-50/E RF AMPLIFIER TRANSISTORS IS MADE OF BeO CERAMIC MATERIAL. DO NOT PERFORM ANY OPERATION ON ANY BeO CERAMIC WHICH MIGHT PRODUCE DUST OR FUMES, SUCH AS GRINDING, GRIT BLASTING, OR ACID CLEANING. BERYLLIUM OXIDE DUST OR FUMES ARE HIGHLY TOXIC AND BREATHING THEM CAN RESULT IN SERIOUS PERSONAL INJURY OR DEATH. BeO CERAMICS MUST BE DISPOSED OF ONLY IN A MANNER PRESCRIBED BY THE DEVICE MANUFACTURER. USE CARE IN REPLACING TRANSISTORS OF THIS TYPE.*

WARNING

5-18. **COMPONENT REPLACEMENT.** The circuit boards used in the FX-50/E exciers are double-sided boards with plated-through holes. Because of the plated-through holes, solder fills the holes by capillary action. These conditions require that defective components be removed carefully to avoid damage to the board.

5-19. On all circuit boards, the adhesion between the copper trace and the circuit board fails at almost the same temperature as solder melts. A circuit board trace can be destroyed by excessive heat or lateral movement during soldering. Use of a small iron with steady pressure is required for circuit board repairs.

5-20. To remove a soldered component from a circuit board, cut the leads from the body of the defective component while the device is still soldered to the board. Grip each component lead with long nose pliers. Touch the soldering iron to the lead at the solder connection on the circuit side of the board. When the solder begins to melt, push the lead through the back side of the board and cut off the clinched end of the lead. Each lead may now be heated independently and pulled out of each hole. The holes may be cleared of solder by carefully re-heating with a low wattage iron and removing the residual solder with a soldering vacuum tool.

5-21. Install the new component and apply solder from the circuit side of the board. If no damage has been incurred to the plated-through holes, soldering of the component side will not be required.

WARNING

WARNING

MOST SOLVENTS WHICH WILL REMOVE ROSIN FLUX ARE VOLATILE AND TOXIC BY THEIR NATURE AND SHOULD BE USED ONLY IN SMALL AMOUNTS IN A WELL VENTILATED AREA, AWAY FROM FLAME, INCLUDING CIGARETTES AND HOT SOLDERING IRONS.

WARNING

WARNING

OBSERVE THE MANUFACTURERS CAUTIONARY INSTRUCTIONS.

5–22. After soldering, remove residual flux with a suitable solvent. Rubbing alcohol is highly diluted and is not effective.

5–23. The board should be checked to ensure the flux has been removed. Rosin flux is not normally corrosive; however, the flux will absorb enough moisture in time to become conductive and cause problems.

5–24. **INTEGRATED CIRCUITS.** Special care should be exercised with integrated circuits. Each integrated circuit must be installed by matching the integrated circuit notch with the notch on the socket. Do not attempt to remove an integrated circuit from a socket with your fingers. Use an integrated circuit puller to lightly pry the component from the socket.

5–25. **EXCITER PREPARATION FOR SHIPMENT.**

5–26. If the exciter is removed from service to be shipped to another location, ensure the following steps are accomplished prior to shipping:

A. Secure the modulated oscillator assembly in place with two 6–32 X 3/4 inch (1.27 cm) screws in the tapped holes provided.

B. Ensure the top–cover is secured to the exciter.

C. Pack the exciter in a carton, allowing 2 inches (5.08 cm) minimum of packing material all around the exciter.

D. Provide adequate insurance coverage.

5–27. **EXCITER FREQUENCY CHANGE.**

5–28. If modification of the exciter frequency is required, perform the following procedures in sequence as listed.

A. FREQUENCY SELECTION procedure in the AFC/PLL section of this manual.

B. MODULATION CALIBRATION procedure in the AFC/PLL section of this manual.

C. MODULATION CORRECTION procedure in the AFC/PLL section of this manual.

D. FWD CAL (R5) AND RFL CAL (R9) procedure in the POWER SUPPLY/CONTROL section of this manual.

SECTION VI
PARTS LIST

6-1. INTRODUCTION.

6-2. This section provides descriptions and part numbers of electrical components, assemblies, and selected mechanical parts required for maintenance of the Broadcast Electronics FX-50/E FM Exciter. Each table entry in this section is indexed by reference designators appearing on the applicable schematic diagram.

6-3. Parts associated with modular assemblies are listed in Part II of this manual.

TABLE 6-1. REPLACEABLE PARTS LIST INDEX

TABLE 6-2. FX-50 FINAL ASSEMBLY - 909-1051-225, 909-1051-325

REF. DES.	DESCRIPTION	PART NO.	QTY.
D1	Full-Wave Bridge Rectifier, MDA3502, Silicon, 200 V, 35 Amperes	230-3502	1
	120V 50/60 Hz		
F1,SPARE	Fuse, 3AG, 3 Amperes, 125V, Slow-Blow	334-0300	2
----	AC Line Cord, N.E.M.A. 3-Wire North American Plug	682-0001	1
	220V 50/60 Hz		
F1,SPARE	Fuse, 3AG, 1.5 Ampere, Slow-Blow	334-0150	2
----	AC Line Cord, CEE 7/7 3-Wire European Plug	682-0003	1
J19	Receptacle, BNC	417-0017	1
T1	Transformer, Power Primary: 117V/230V ac ±10%, 50/60 Hz Secondary: 1) 22.5V DC @ 0.18 Ampere, 2) 8.94V DC @ 0.15 Ampere, 3) 24.86V DC @ 5.5 Amperes	376-0050	1
----	Fan, 115V, 50/60 Hz, 18W, 120 ft^3/min, 3100 r/min, 4.5 inch (11.43 cm)	380-4600	1
----	Fan Filter	380-5502	1
----	Fused Power Connector/Voltage Selector/EMI Filter, 120/240V	360-6504	1
----	Fuse Clip, Littlefuse	415-1010	2
----	Fuse Clip (Test Probe Holder)	415-1011	1
----	Receptacle, BNC	417-0016	2
----	Pins, Connector	417-0053	4
----	Ferrite Bead	360-0003	2
----	Top Cover Retainer		
	Stud (Front Turn-lock)	420-0019	4
	Stud (Rear Turn-lock)	420-0015	4
	Retainer	420-0021	8
	Receptacle	420-0022	8
----	Capacitor, Electrolytic, 22,000 uF, 50V	027-2200	1
----	Metal Oxide Varistor, V350LA15A, 250V ac RMS, 15 Joules	140-0008	1
----	RF Amplifier Assembly	959-0204	1
----	Modulated Oscillator Assembly	959-0203	1
----	RFI Filter Circuit Board Assembly	919-0445	1
----	AFC/PLL Circuit Board Assembly	919-0104	1
----	Metering Circuit Board Assembly	919-0108	1
----	Power Supply/Control Circuit Board Assembly	919-0107	1
----	Interface Circuit Board Assembly	919-0190	1
----	Assembly, Fuse Holder	959-0447-001	1
----	Harness Assembly	949-0149	1
----	Accessory Parts Kit	957-0003	1

TABLE 6-3. FX-50E FINAL ASSEMBLY - 909-1050-329 (Sheet 1 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
D1	Full-Wave Bridge Rectifier, MDA3502, Silicon, 200 V, 35 Amperes	230-3502	1
F1,SPARE	Fuse, 3AG, 1.5 Ampere, Slow-Blow	334-0150	2

TABLE 6-3. FX-50E FINAL ASSEMBLY - 909-1050-329
(Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	AC Line Cord, CEE 7/7 3-Wire European Plug	682-0003	1
J19	Receptacle, BNC	417-0017	1
T1	Transformer, Power Primary: 117V/230V ac ±10%, 50/60 Hz Secondary: 1) 22.5V DC @ 0.18 Ampere, 2) 8.94V DC @ 0.15 Ampere, 3) 24.86V DC @ 5.5 Amperes	376-0050	1
----	Fan, 115V, 50/60 Hz, 18W, 120 ft^3/min, 3100 r/min, 4.5 inch (11.43 cm)	380-4600	1
----	Fan Filter	380-5502	1
----	Fused Power Connector/Voltage Selector/EMI Filter, 120/240V	360-6504	1
----	Fuse Clip, Littlefuse	415-1010	2
----	Fuse Clip (Test Probe Holder)	415-1011	1
----	Receptacle, BNC	417-0016	2
----	Pins, Connector	417-0053	4
----	Ferrite Bead	360-0003	2
----	Top Cover Retainer		
	Stud (Front Turn-lock)	420-0019	4
	Stud (Rear Turn-lock)	420-0015	4
	Retainer	420-0021	8
	Receptacle	420-0022	8
----	Capacitor, Electrolytic, 22,000 uF, 50V	027-2200	1
----	Metal Oxide Varistor, V350LA15A, 250V ac RMS, 15 Joules	140-0008	1
----	RF Amplifier Assembly	959-0204	1
----	Modulated Oscillator Assembly	959-0203	1
----	RFI Filter Circuit Board Assembly	919-0445-309	1
----	AC Line Filter Circuit Board Assembly	919-0446	1
----	AFC/PLL Circuit Board Assembly	919-0104	1
----	Metering Circuit Board Assembly	919-0108	1
----	Power Supply/Control Circuit Board Assembly	919-0107	1
----	Assembly, Fuse Holder	959-0447-001	1
----	Harness Assembly	949-0149	1
----	Accessory Parts Kit	957-0003	1

TABLE 6-4. FX-50 RFI FILTER CIRCUIT BOARD ASSEMBLY - 919-0445
(Sheet 1 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C301 thru C303	Capacitor, Ceramic, 0.001 uF, 1 kV	002-1034	3
C304 thru C311	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	8
C312, C313	Capacitor, Polyester, 0.0022 uF ±10%, 100V	031-2033	2
C316, C318, C320, C322	Capacitor, Silvered Mica, 100 pF ±5%, 500V	040-1022	4
FL301 thru FL311	Filter, EMI Suppession, 10,000 pF, 3-Pin	411-0001	11
FL313	Filter, EMI Suppession, 1000 pF, 3-Pin	047-1035	1
FL314 thru FL318	Filter, EMI Suppession, 10,000 pF, 3-Pin	411-0001	5
R301	Resistor, 240 Ohm ±5%, 2W	130-2423	1

TABLE 6-4. FX-50 RFI FILTER CIRCUIT BOARD ASSEMBLY - 919-0445
(Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R302	Resistor, 1 k Ohm ±1%, 1/4W	100-1041	1
R303	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	1
R304, R305	Resistor, 8.25 k Ohm ±1%, 1/4W	103-8254	2
R306, R307	Resistor, 1 k Ohm ±1%, 1/4W	100-1041	2
R308	Resistor, 604 Ohm ±1%, 1/4W	100-6031	1
R309	Resistor, 240 Ohm ±5%, 2W	130-2423	1
R310, R311	Resistor, 51.1 Ohm ±1%, 1/4W	103-5112	2
D301	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203-4005	1
D302 thru D305	Diode, Zener Voltage Suppressor, ±27V	201-0027	4
D306 thru D309	Diode, Zener Voltage Suppressor, ±18V	201-0040	4
D311 thru D316	Diode, Zener Voltage Suppressor, ±12V	201-0012	6
K301	Relay, SPDT, 12VDC, Dual-In-Line Package	270-0065	1
P308, P309	Switch, Jumper Programmable	340-0004	2
L303	Inductor, 1.0 mH	364-4662	1
L305	Inductor, 1.0 mH	364-4662	1
J1	Connector, D-Type, 25-Pin, Female, PCB Mount	417-2502	1
J301 thru J305	Receptacle, BNC, PCB Mount, Metal	417-0039-MTL	5
J306	Receptacle, 12-Pin	417-1276	1
J307	Receptacle, Male, 20-Pin In-Line	417-0200	1
J308, J309	Connector, Header, 3-Pin	417-0003	2
----	Shield, PCB, RFI Filter Circuit Board	519-0445-002	1
----	Blank RFI Filter Circuit Board	519-0445-001	1

TABLE 6-5. FX-50E RFI FILTER CIRCUIT BOARD ASSEMBLY - 919-0445-309
(Sheet 1 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C301 thru C303	Capacitor, Ceramic, 0.001 uF, 1 kV	002-1034	3
C304 thru C311	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	8
C312, C313	Capacitor, Polyester, 0.0022 uF ±10%, 100V	031-2033	2
C316, C318, C320, C322	Capacitor, Silvered Mica, 100 pF ±5%, 500V	040-1022	4
FL301 thru FL311	Filter, EMI Suppession, 10,000 pF, 3-Pin	411-0001	11
FL313	Filter, EMI Suppession, 1000 pF, 3-Pin	047-1035	1
FL314 thru FL318	Filter, EMI Suppession, 10,000 pF, 3-Pin	411-0001	5
R301	Resistor, 240 Ohm ±5%, 2W	130-2423	1
R302	Resistor, 1 k Ohm ±1%, 1/4W	100-1041	1
R303	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	1

TABLE 6-5. FX-50E RFI FILTER CIRCUIT BOARD ASSEMBLY - 919-0445-309
(Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R304, R305	Resistor, 8.25 k Ohm ±1%, 1/4W	103-8254	2
R306, R307	Resistor, 1 k Ohm ±1%, 1/4W	100-1041	2
R308	Resistor, 604 Ohm ±1%, 1/4W	100-6031	1
R309	Resistor, 240 Ohm ±5%, 2W	130-2423	1
R310, R311	Resistor, 51.1 Ohm ±1%, 1/4W	103-5112	2
D301	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203-4005	1
D302 thru D305	Diode, Zener Voltage Suppressor, ±27V	201-0027	4
D306 thru D309	Diode, Zener Voltage Suppressor, ±18V	201-0040	4
D311 thru D316	Diode, Zener Voltage Suppressor, ±12V	201-0012	6
K301	Relay, SPDT, 12VDC, Dual-In-Line Package	270-0065	1
P308, P309	Switch, Jumper Programmable	340-0004	2
L303	Inductor, 1.0 mH	364-4662	1
L305	Inductor, 1.0 mH	364-4662	1
J1	Connector, D-Type, 25-Pin, Female, PI Filter, PCB Mount	417-2502-FIL	1
J301 thru J304	Receptacle, BNC, PCB Mount, Metal	417-0039-MTL	4
J306	Receptacle, 12-Pin	417-1276	1
J307	Receptacle, Male, 20-Pin In-Line	417-0200	1
J308, J309	Connector, Header, 3-Pin	417-0003	2
----	Shield, PCB, RFI Filter Circuit Board	519-0445-002	1
----	Blank RFI Filter Circuit Board	519-0445-001	1

TABLE 6-6. EXCITER INTERFACE CIRCUIT BOARD - 919-0190

REF. DES.	DESCRIPTION	PART NO.	QTY.
J1	Receptacle, 25-Pin D-Type, Male	417-2503	1
J2	Barrier Strip, 16 Position, PCB Mount	412-1600	1

TABLE 6-7. AC LINE FILTER CIRCUIT BOARD - 919-0446

REF. DES.	DESCRIPTION	PART NO.	QTY.
F1	Filter, AC Line, EMC, 250V, 6.3 Ampere	339-7818	1
J1, J2	Connector, 4-Pin Male, MR	418-0255	2
----	Blank AC Line Filter Circuit Board	519-0446	1

TABLE 6-8. ASSEMBLY, FUSE HOLDER - 959-0447-001

REF. DES.	DESCRIPTION	PART NO.	QTY.
F1, F2	Fuse, MDL-1, 1 Ampere, 250 Volt	330-0101	2
F3	Fuse, 12 Ampere, 250 Volt, Slo-Blow, 3AB	330-1200	1
----	Connector, 6-Pin, MR	418-0006	1
----	Pins, Connector	417-0036	6

TABLE 6-9. HARNESS ASSEMBLY - 949-0149

REF. DES.	DESCRIPTION	PART NO.	QTY.
P1	Plug, Housing, 16 Contact	417-0123	1
P2	Socket, Housing, 10-Pin	417-0148	1
P10	Connector Plug, 9-Pin	417-0059	1
P11	Connector, Housing, 15-Pin	417-2379	1
P12,P13	Plug, Housing, 14-Pin	417-1401	2
P14	Plug, Housing, 20-Pin	417-0122	1
P15	Receptacle, 20-Pin	417-0176	1
P20	Connector, Housing, 2-Pin	418-0701	1
P306	Plug, Connector Housing, 12-Pin	418-1271	1
P307	Plug, Housing, 20-Pin	417-0122	1
----	Pins, Connector	417-0053	49
----	Contact, Crimp Type	417-8766	72
----	Plug, BNC, Dual Crimp	418-0034	4

TABLE 6-10. ACCESSORY PARTS KIT - 957-0003

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Fuse, 3AG, 125V @ 3 Amperes, Slow-Blow	334-0300	1
----	AC Line Cord, N.E.M.A. 3-Wire North American Plug	682-0001	1
----	BNC Access Cable Assembly	947-0020	2

TABLE 6-11. BNC ACCESS CABLE ASSEMBLY - 947-0020

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Connector, BNC, Crimp Type, RG58U Cable	417-0094	2
----	Cable, Shielded, 50 Ohm, RG-58/CU	682-0050	2.5

TABLE 6-12. OPTIONAL LOW-PASS FILTER - 909-0124

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	RF Low-Pass Filter Assembly	955-0051	1

TABLE 6-13. RF LOW-PASS FILTER ASSEMBLY - 955-0051

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1	Capacitor, Mica Compression, 27 pF ±5%, 250V dc	046-0027	1
C2	Capacitor, Ceramic Trimmer, 2-8 pF, 350V dc, Non-Polarized	096-0008	1
C3	Capacitor, Mica Compression, 45 pF ±5%, 250V dc	046-0045	1
C4	Capacitor, Mica Compression, 7 pF ±5%, 250V dc	046-0007	1
C5	Capacitor, Ceramic Trimmer, 2-8 pF, 350V dc, Non-Polarized	096-0008	1
C6	Capacitor, Mica Compression, 22 pF ±5%, 250V dc	046-0022	1
J1,J2	Receptacle, BNC	417-0203	2
L1	Coil, Airwound 7 Turns of No. 18 AWG Wire, 0.20 inches ID (0.51 cm), 0.42 inches long (1.1 cm)	601-0018	1
L2	Coil, Airwound 6 Turns of No. 18 AWG Wire, 0.20 inches ID (0.51 cm), 0.42 inches long (1.1 cm)	601-0018	1
P1,P2	Plug, BNC, Dual Crimp	418-0034	2
----	Blank Circuit Board	517-0036	1

TABLE 6-14. FX-50/E EXCITER REMOTE KIT - 979-0152

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Barrier Strip, 7 Terminals	412-0007	1
----	Cable, Remote Exciter Assembly, FM Transmitters	949-0184	1

SECTION VII
DRAWINGS

7-1. INTRODUCTION.

7-2. This section provides assembly drawings, schematic diagrams, and wire lists as indexed below for the FX-50 FM Exciter.

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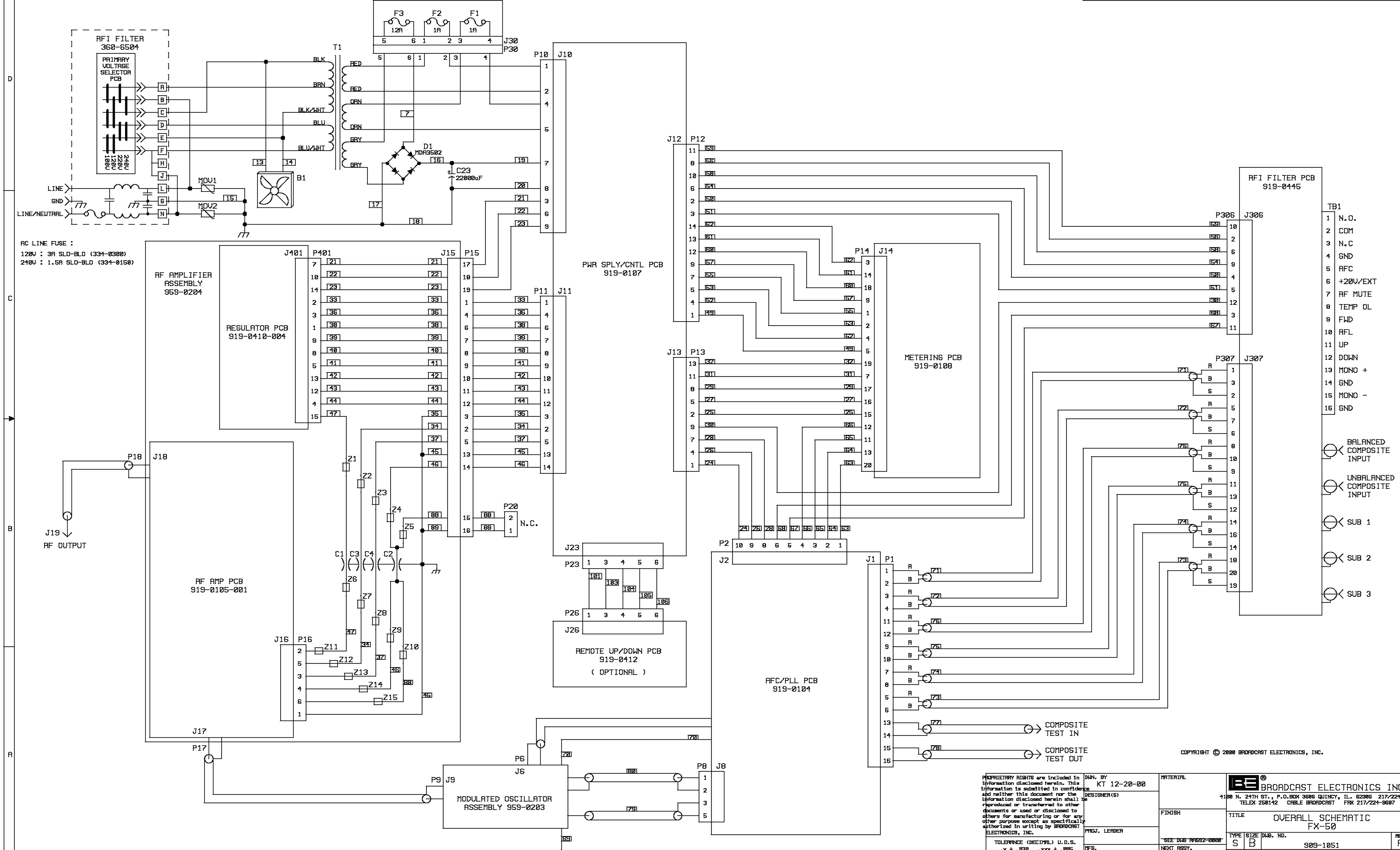


TOLERANCE (DECIMAL) U.O.S. .x ± .030 .xxx ± .005 .xx ± .015 ANGLES ± 1

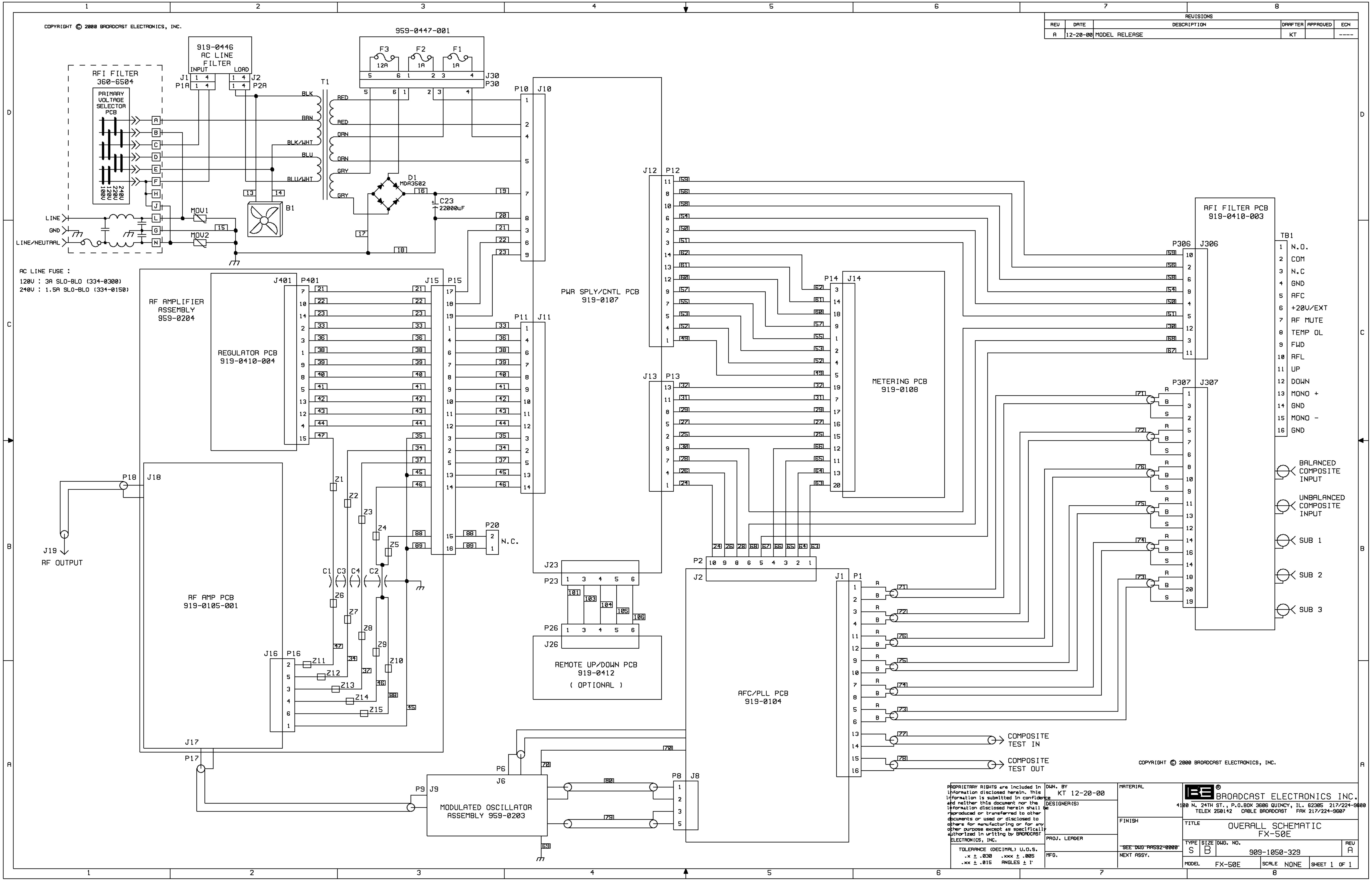
DWN. BY KT 12-20-00
DESIGNER(S)
PROJ. LEADER
MFG.
MATERIAL
FINISH
SEE DWG AA602-0000
NEXT ASSY.

BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O.BOX 3606 QUINCY, IL. 62305 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE OVERALL SCHEMATIC FX-50

TYPE	SIZE	DWG. NO.	REV
S	B	909-1051	A

MODEL FX-50 | SCALE NONE | SHEET 1 OF 1


COPYRIGHT © 2000 BROADCAST ELECTRONICS, INC.
REVISIONS
REV | DATE | DESCRIPTION | DRAFTER | APPROVED | ECN
A | 12-20-00 | MODEL RELEASE | KT | | ----
RFI FILTER 360-6504
PRIMARY VOLTAGE SELECTOR PCB
240V 220V 120V 100V
919-0446 AC LINE FILTER
INPUT LOAD
959-0447-001
F3 12A
F2 1A
F1 1A
T1
D1 MDA3502
C23 22000uF
B1
MOV1
MOV2
LINE
GND
LINE/NEUTRAL
AC LINE FUSE :
120V : 3A SLO-BLO (334-0300)
240V : 1.5A SLO-BLO (334-0150)
RF AMPLIFIER ASSEMBLY 959-0204
REGULATOR PCB 919-0410-004
RF AMP PCB 919-0105-001
J19 RF OUTPUT
PWR SPLY/CNTL PCB 919-0107
METERING PCB 919-0108
RFI FILTER PCB 919-0410-003
TB1
N.O.
COM
N.C
GND
AFC
+20V/EXT
RF MUTE
TEMP OL
FWD
RFL
UP
DOWN
MONO +
GND
MONO -
GND
BALANCED COMPOSITE INPUT
UNBALANCED COMPOSITE INPUT
SUB 1
SUB 2
SUB 3
P20 N.C.
REMOTE UP/DOWN PCB 919-0412 (OPTIONAL)
AFC/PLL PCB 919-0104
COMPOSITE TEST IN
COMPOSITE TEST OUT
MODULATED OSCILLATOR ASSEMBLY 959-0203
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TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°
DWN. BY KT 12-20-00
DESIGNER(S)
PROJ. LEADER
MFG.
MATERIAL
FINISH
SEE DWG AA592-0000
NEXT ASSY.
BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O.BOX 3606 QUINCY, IL. 62305 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607
TITLE OVERALL SCHEMATIC FX-50E
TYPE S SIZE B DWG. NO. 909-1050-329 REV A
MODEL FX-50E SCALE NONE SHEET 1 OF 1

REVISIONS					
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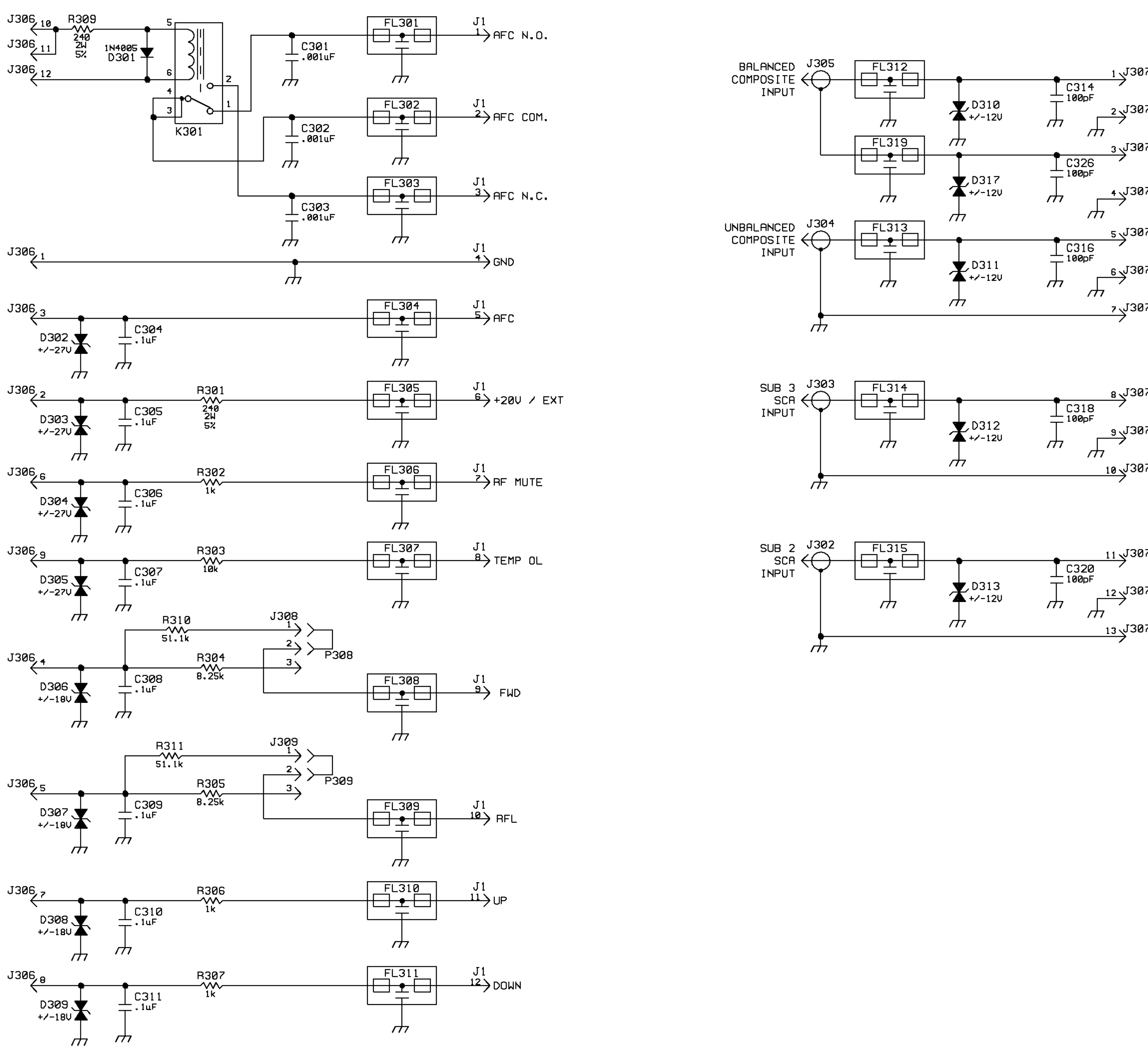

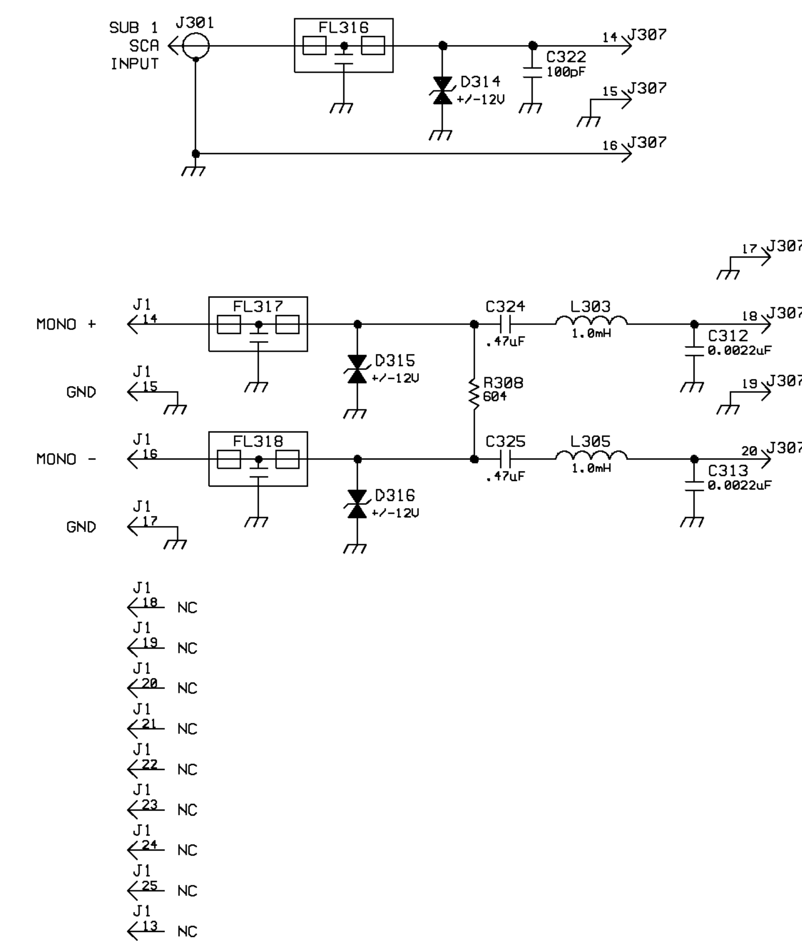

NOTES:

1. ALL REFERENCE DESIGNATORS, EXCEPT J1, START AT 301.
2. ALL RESISTORS IN OHMS, 1/4W, 1%, UNLESS OTHERWISE SPECIFIED.
3. LAST COMPONENT USED: C326, D317, E305, FL319, J309, K301, L305, R311
4. COMPONENTS NOT USED: C315, C317, C319, C321, C323, L301, L302, L304, J2-J300
5. SEE ASSEMBLY: AC919-0445

TOLERANCE (DECIMAL) U.O.S. .x ± .030 .xxx ± .005 .xx ± .015 ANGLES ± 1°

DWN. BY KWT 9-27-99	MATERIAL SEE BOM 919-0445	BROADCAST ELECTRONICS INC. 4100 N. 24TH ST., P.O.BOX 3606 QUINCY, IL. 62305 217/224-9600 FAX 217/224-9607
DESIGNER(S)	FINISH	TITLE RFI FILTER PCB
PROJ. LEADER		TYPE S SIZE B DWG. NO. 919-0445 REV 1
MFG.	NEXT ASSY.	MODEL NNNN SCALE NONE SHEET 1 OF 1

REVISIONS

REV	DATE	DESCRIPTION	DRAFTER	APPROVED	ECN
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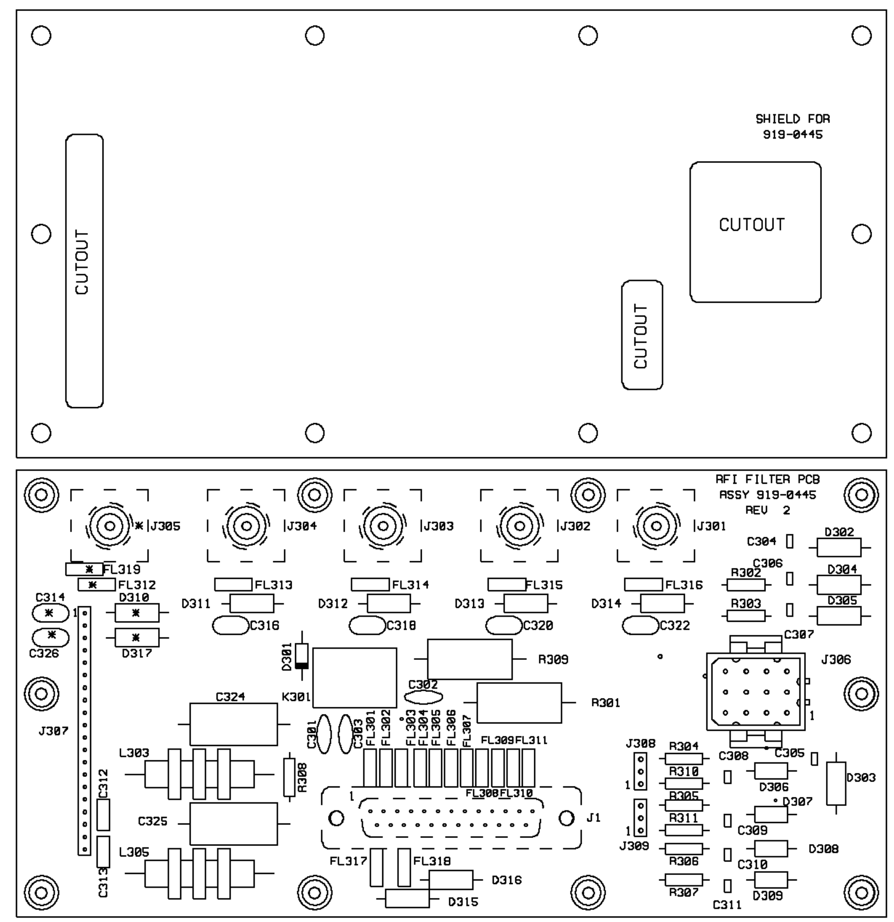
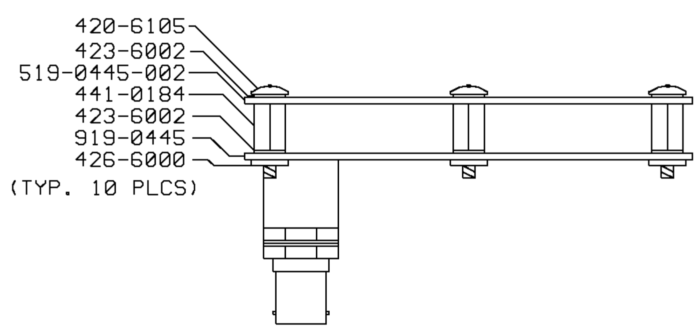
2	11-3-00	ADDED DETAIL "A" AND NOTE 3	KT		----





DETAIL "A"

NOTES:

1) J1,J301,J302,J303,J304 & J305 ARE MOUNTED ON THE SOLDER SIDE OF PCB.
2) PEM NUTS ARE PRESSED INTO SOLDER SIDE OF PCB; SEE DETAIL A FOR ASSEMBLY OF SHIELD PCB (519-0445-002) TO 919-0445-309.
3) * INDICATES PARTS NOT USED ON ASSEMBLY 919-0445-309. (C314,C326,D310,D317,FL312, FL319,J305)

TOLERANCE (DECIMAL) U.O.S.
.X ± .030 .XXX ± .005
.XX ± .015 ANGLES ± 1°

DWN. BY: KWT 10-4-99
DESIGNER(S):
PROJ. LEADER:
MFG.:

MATERIAL: SEE BOM 919-0445
FINISH:
NEXT ASSY.:

BROADCAST ELECTRONICS INC.
4100 N. 24TH ST. P.O.BOX 3606 QUINCY,IL. 62305
217/224-9600 FAX 217/224-9607

TITLE: RFI FILTER PCB

TYPE: A | SIZE: C | DWG No.: 919-0445-309 | REV: 2

MODEL NNNN | SCALE 1/1 | SHEET 1 OF 1

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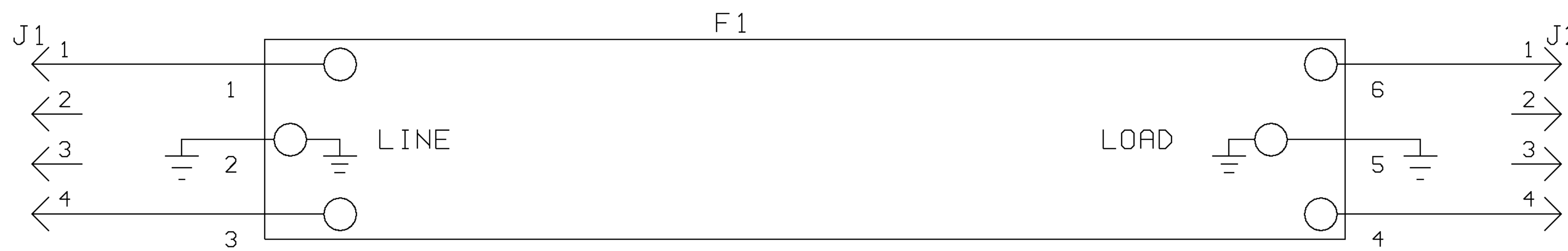
REVISIONS					
REV	DATE	DESCRIPTION	DRAFTER	APPROVED	ECN
1	11-7-00	PROTOTYPE RELEASE	KT		-----



TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°

DWN. BY KT 11-7-00
DESIGNER(S)
PROJ. LEADER
MFG.

MATERIAL SEE BOM 919-0446
FINISH
NEXT ASSY.

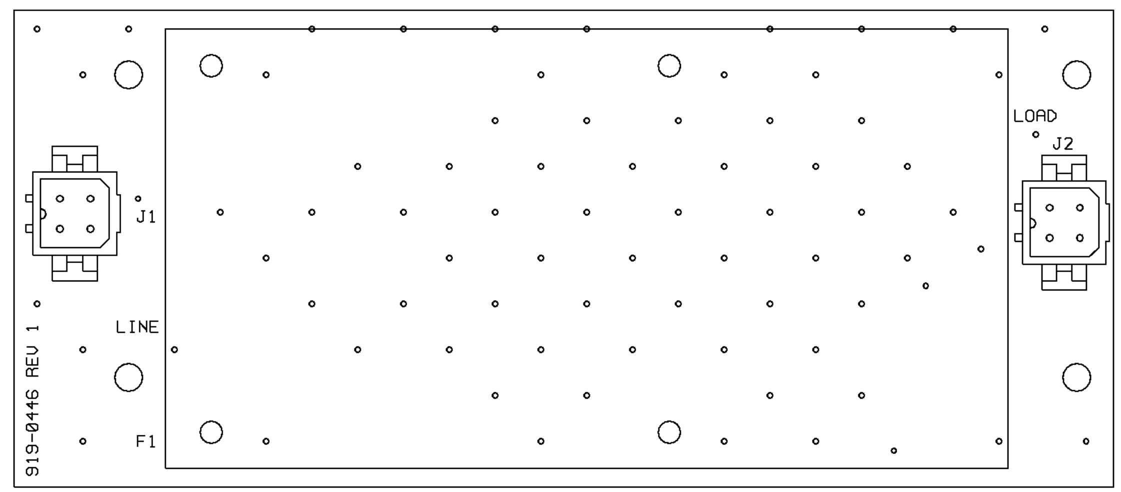
BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O.BOX 3606 QUINCY, IL. 62305
217/224-9600 FAX 217/224-9607

TITLE AC LINE FILTER

TYPE	SIZE	DWG. NO.	REV
S	B	919-0446	1

MODEL NNNN | SCALE NONE | SHEET 1 OF 1

REVISIONS					
REV	DATE	DESCRIPTION	DRAFTER	APPROVED	ECN
1	11-8-00	PROTOTYPE RELEASE	KT		-----



TOLERANCE (DECIMAL) U.O.S.
.X ± .030 .XXX ± .005
.XX ± .015 ANGLES + 1°

DWN. BY KT 11-8-00

DESIGNER(S)

PROJ. LEADER

MFG.

MATERIAL SEE BOM 919-0446

FINISH

NEXT ASSY.

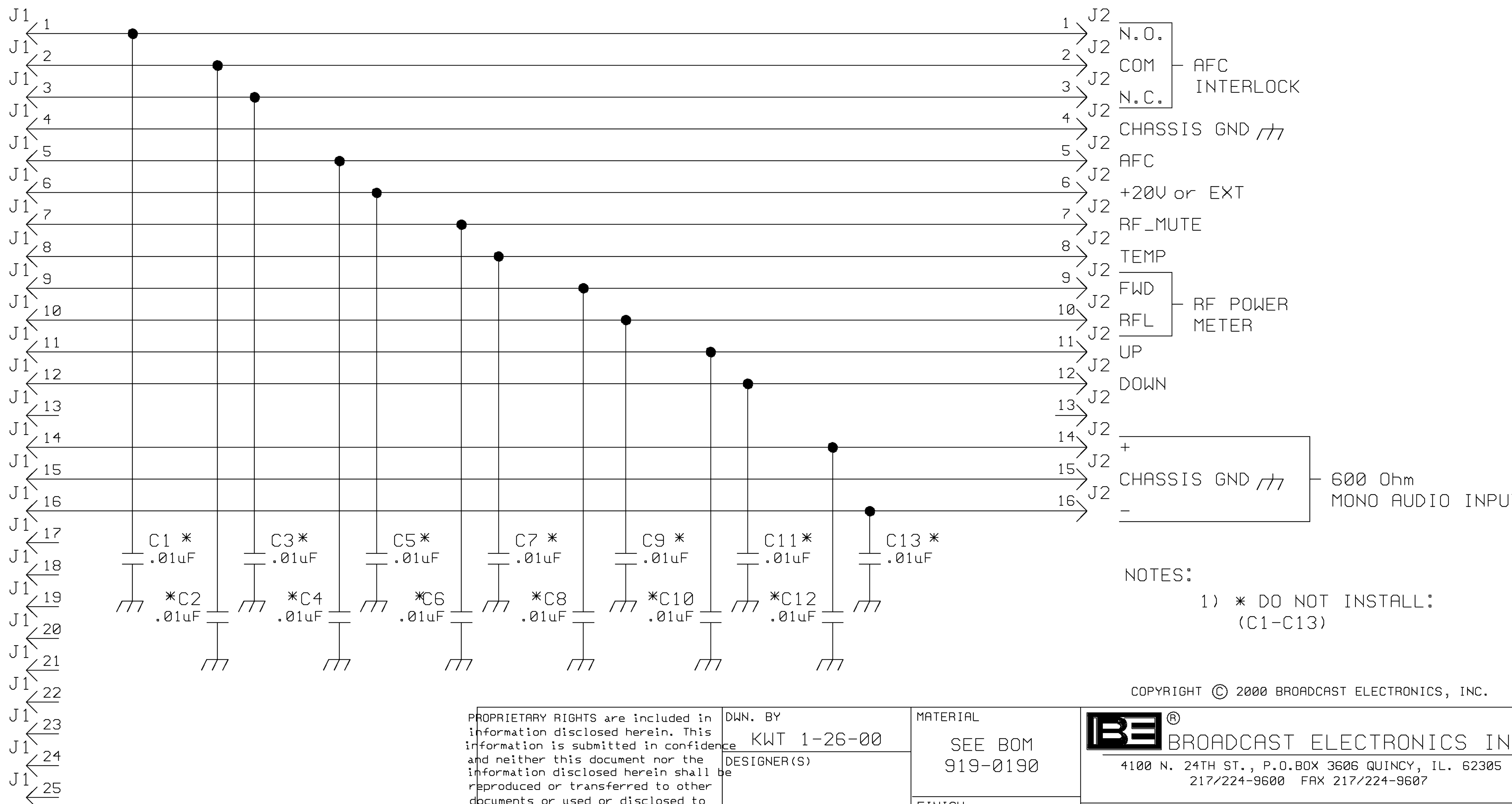
BROADCAST ELECTRONICS INC.
4100 N. 24TH ST. P.O.BOX 3606 QUINCY,IL. 62305
217/224-9600 FAX 217/224-9607

TITLE AC LINE FILTER

TYPE	SIZE	DWG No.	REV
A	B	919-0446	1

MODEL FM-250C | SCALE 1/1 | SHEET 1 OF 1

REVISIONS					
REV	DATE	DESCRIPTION	DRAFTER	APPROVED	ECN
1	1-26-00	PROTOTYPE RELEASE.	KT		



NOTES:

1) * DO NOT INSTALL:
(C1-C13)

TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°

DWN. BY KWT 1-26-00

DESIGNER(S)

PROJ. LEADER

MFG.

MATERIAL SEE BOM 919-0190

FINISH

NEXT ASSY.

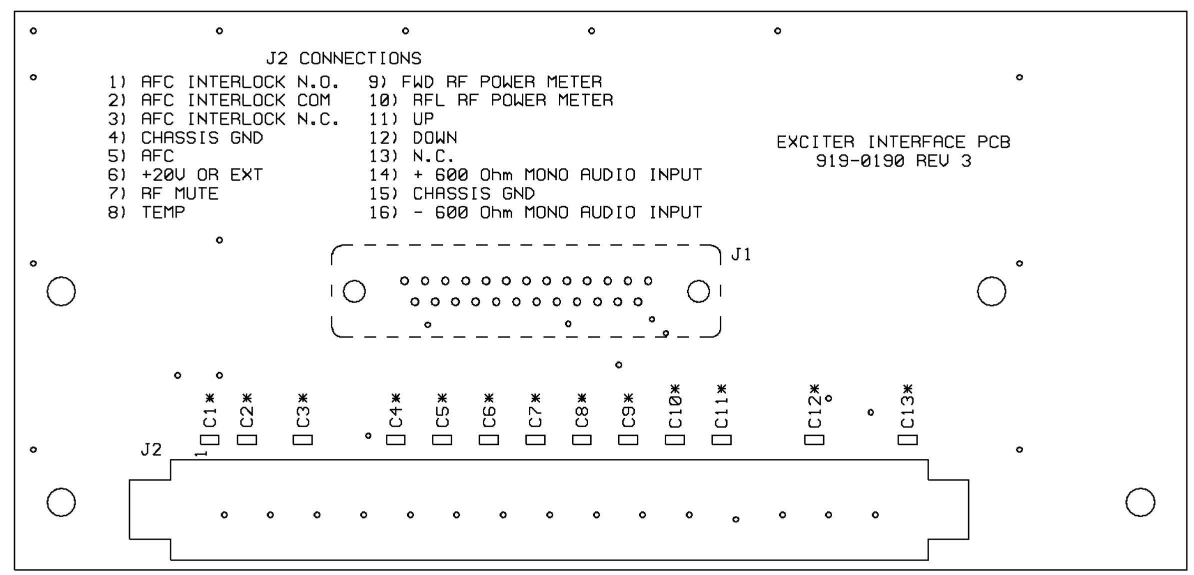
BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O.BOX 3606 QUINCY, IL. 62305
217/224-9600 FAX 217/224-9607

TITLE FM EXCITER INTERFACE

TYPE S | SIZE B | DWG. NO. 919-0190 | REV 1

MODEL EXCITERS | SCALE NONE | SHEET 1 OF 1

REVISIONS					
REV	DATE	DESCRIPTION	DRAFTER	APPROVED	ECN
1	3-17-00	PROTOTYPE RELEASE.	KT		-----
2	9-6-00	MOVED C12 & C13	KT		-----
3	10-5-00	CHANGED BOARD OUTLINE	KT		-----



NOTES:
1) * DO NOT INSTALL
(C1-C13)

TOLERANCE (DECIMAL) U.O.S.
.X ± .030 .XXX ± .005
.XX ± .015 ANGLES + 1°

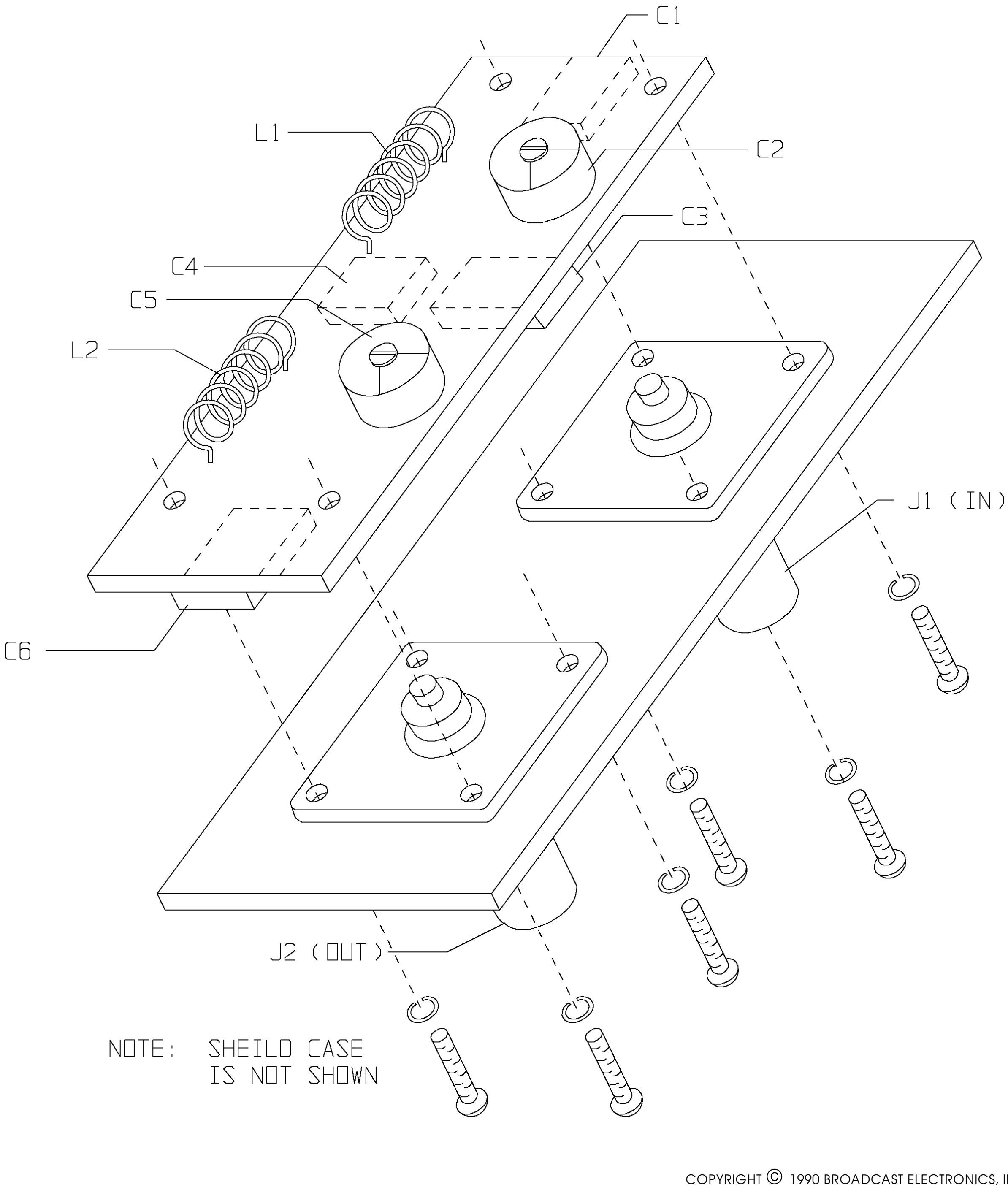
DWN. BY	KWT 3-17-00
DESIGNER(S)	
PROJ. LEADER	
MFG.	
MATERIAL	SEE BOM 919-0190
FINISH	
NEXT ASSY.	

BE ® BROADCAST ELECTRONICS INC.
4100 N. 24TH ST. P.O.BOX 3606 QUINCY,IL. 62305
217/224-9600 FAX 217/224-9607

TITLE EXCITER INTERFACE PCB

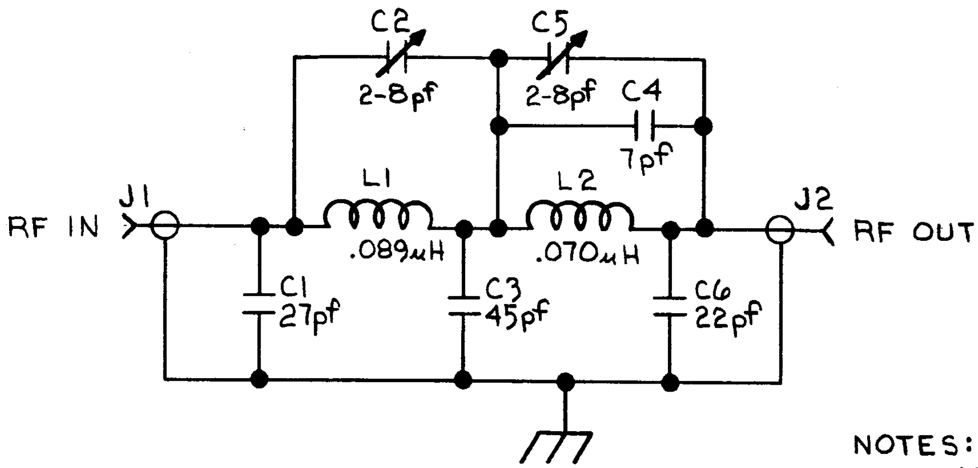
TYPE	SIZE	DWG No.	REV
A	B	919-0190	3

MODEL NNNN | SCALE 1/1 | SHEET 1 OF 1



597-1050-6

FIGURE 7-9. OPTIONAL RF LOW-PASS FILTER ASSEMBLY - B955-0051



NOTES:
1. LAST COMPONENTS USED: C6, L2, P2.

FIGURE 7-10. RF LOW-PASS FILTER SCHEMATIC DIAGRAM - A909-0036

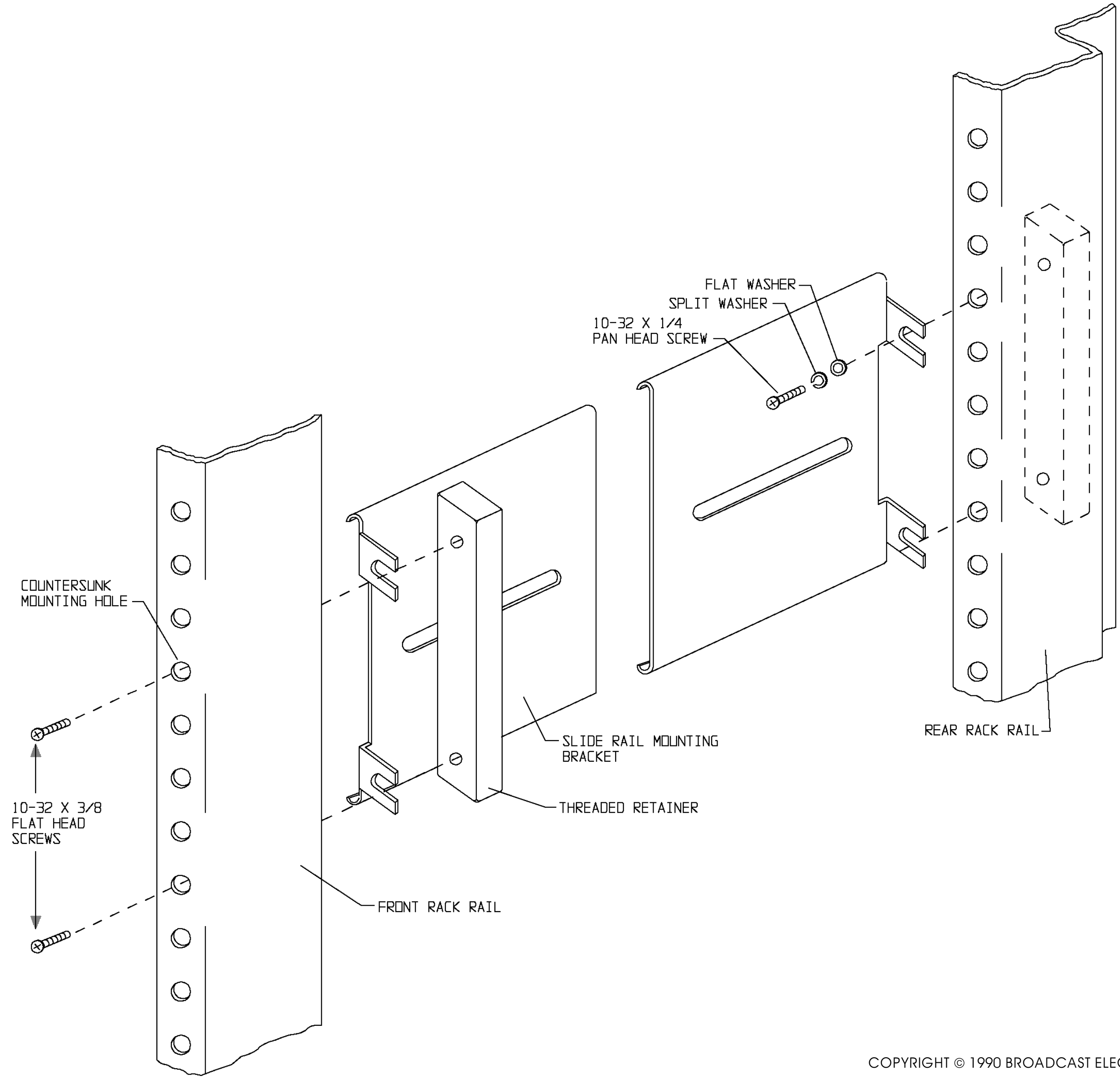


FIGURE 7-11. EXCITER FRONT RAIL MOUNTING APPLICATIONS 597–1050–8

TABLE 7–1. FX–50/E WIRING HARNESS LIST
(Sheet 1 of 4)

WIRE NO.	FROM	TO	FUNCTION
1 THRU 12	NOT USED		
BLK	LINE FILTER (C)	TRANSFORMER	AC INPUT
BRN	LINE FILTER (A)	TRANSFORMER	AC INPUT
BLK/ WHT	LINE FILTER (E)	TRANSFORMER	AC INPUT
BLU	LINE FILTER (D)	TRANSFORMER	AC INPUT
BLU/ WHT	LINE FILTER (F)	TRANSFORMER	AC INPUT
GRY	MDA2502 AC IN	TRANSFORMER	23 VAC
GRY	MDA2502 AC IN	TRANSFORMER	23 VAC
RED	PS/CONTROL P10–2	TRANSFORMER	21 VAC
RED	PS/CONTROL P10–1	TRANSFORMER	21 VAC
ORN	PS/CONTROL P10–4	TRANSFORMER	9 VAC
ORN	PS/CONTROL P10–5	TRANSFORMER	9 VAC
13	LINE FILTER (C)	FAN	FAN AC
14	LINE FILTER (E)	FAN	FAN AC
15	LINE FILTER GND	CHASSIS	GROUND
16	MDA2502 (+)	22,000 uF CAP (+)	B+ UNREGULATED
17	MDA2502 (–)	22,000 uF CAP (–)	GROUND
18	22,000 uF CAP (–)	CHASSIS	GROUND
19	PS/CONTROL P10–7	22,000 uF CAP (+)	B+ UNREGULATED
20	PS/CONTROL P10–8	22,000 uF CAP (–)	GROUND
21	PS/CONTROL P10–3	RF AMP P15–17	B+ UNREGULATED LM338 INPUT
22	PS/CONTROL P10–6	RF AMP P15–18	LM338 ADJUST
23	PS/CONTROL P10–9	RF AMP P15–19	LM338 OUTPUT +20V REGULATED
24	PS/CONTROL P13–1	AFC/PLL P2–10	+5 VOLT SUPPLY

TABLE 7–1. FX–50/E WIRING HARNESS LIST
(Sheet 2 of 4)

WIRE NO.	FROM	TO	FUNCTION
25	PS/CONTROL P13–2	METERING P14–15	+5 VOLT INDICATOR
26	PS/CONTROL P13–4	AFC/PLL P2–9	–20 VOLT SUPPLY
27	PS/CONTROL P13–5	METERING P14–16	–20 VOLT SUPPLY
28	PS/CONTROL P13–7	AFC/PLL P2–8	+20 VOLT SUPPLY
29	PS/CONTROL P13–8	METERING P14–17	+20 VOLT SUPPLY
30	PS/CONTROL P13–9	RFI FILTER C20	+20 VOLT RELAY CONTROL
31	PS/CONTROL P13–11	METERING P14–7	GROUND
32	PS/CONTROL P13–13	METERING P14–19	B+ UNREGULATED LM317 INPUT
33	PS/CONTROL P11–1	RF AMP P15–1	MJ3000 Q2 EMITTER
34	PS/CONTROL P11–2	RF AMP P15–2	FWD DIRECTIONAL COUPLER
35	PS/CONTROL P11–3	RF AMP P15–3	DIRECTIONAL COUPLER RETURN
36	PS/CONTROL P11–4	RF AMP P15–4	MJ3000 Q1 EMITTER
37	PS/CONTROL P11–5	RF AMP P15–5	RFL DIRECTIONAL COUPLER
38	PS/CONTROL P11–6	RF AMP P15–6	LM335 ADJUST
39	PS/CONTROL P11–7	RF AMP P15–7	MJ3000 Q1 COLLECTOR
40	PS/CONTROL P11–8	RF AMP P15–8	LM335 CATHODE
41	PS/CONTROL P11–9	RF AMP P15–9	LM335 ANODE
42	PS/CONTROL P11–10	RF AMP P15–10	MJ3000 Q2 COLLECTOR
43	PS/CONTROL P11–11	RF AMP P15–11	MJ3000 Q1 BASE CONTROL
44	PS/CONTROL P11–12	RF AMP P15–12	MJ3000 Q2 BASE CONTROL
45	PS/CONTROL P11–13	RF AMP P15–13	GROUND
46	PS/CONTROL P11–14	RF AMP P15–14	FINAL AMP VOLTAGE SUPPLY
47	RF AMP C1	LM338 OUTPUT	+20V TO RF DRIVER
48	NOT USED		

TABLE 7–1. FX–50/E WIRING HARNESS LIST
(Sheet 3 of 4)

WIRE NO.	FROM	TO	FUNCTION
49	PS/CONTROL P12–1	METERING P14–5	FWD POWER METER INPUT
50	PS/CONTROL P12–2	RFI C14	REMOTE FWD POWER OUTPUT
51	PS/CONTROL P12–3	RFI C13	REMOTE RFL POWER OUTPUT
52	PS/CONTROL P12–4	METERING P14–4	RFL POWER METER INPUT
53	PS/CONTROL P12–5	METERING P14–2	VSWR INDICATOR
54	PS/CONTROL P12–6	RFI C15	REMOTE OVER TEMP OUTPUT
55	PS/CONTROL P12–7	METERING P14–1	TEMPERATURE INDICATOR
56	PS/CONTROL P12–8	RFI C17	+20V/EXTERNAL
57	PS/CONTROL P12–9	METERING P14–9	INDICATOR GROUND
58	PS/CONTROL P12–10	RFI C16	RF MUTE CONTROL
59	PS/CONTROL P12–11	RFI C19	AFC LOCK (RELAY CONTROL)
60	PS/CONTROL P12–12	METERING P14–18	PA CURRENT METER INPUT
61	PS/CONTROL P12–13	METERING P14–14	PA VOLTAGE METER INPUT
62	PS/CONTROL P12–14	METERING P14–3	RF INDICATOR
63	AFC/PLL P2–1	METERING P14–20	COMPOSITE AUDIO
64	AFC/PLL P2–2	METERING P14–13	AFC VOLTAGE
65	AFC/PLL P2–3	METERING P14–11	LOCK INDICATOR
66	AFC/PLL P2–4	METERING P14–12	INDICATOR GROUND
67	AFC/PLL P2–5	RFI C19	AFC LOCK (RELAY CONTROL)
68	AFC/PLL P2–6	RFI C18	REMOTE AFC LOCK
69	MOD OSC	CHASSIS	GROUND
70	MOD OSC	CHASSIS	GROUND
71	AFC/PLL P1–1 RED P1–2 BLK	RFI C2 RFI C1	BAL COMPOSITE INPUT + BAL COMPOSITE INPUT –
72	AFC/PLL P1–3 BLK P1–4 RED	RFI C3 RFI C4	UNBAL COMPOSITE INPUT GND UNBAL COMPOSITE INPUT +

TABLE 7–1. FX–50/E WIRING HARNESS LIST
(Sheet 4 of 4)

WIRE NO.	FROM	TO	FUNCTION
73	AFC/PLL P1–5 RED	RFI C12	BAL MONOPHONIC INPUT +
	P1–6 BLK	RFI C11	BAL MONOPHONIC INPUT –
74	AFC/PLL P1–7 BLK	RFI C5	SUB 1 INPUT GROUND
	P1–8 RED	RFI C6	SUB 1 INPUT +
75	AFC/PLL P1–9 RED	RFI C8	SUB 2 INPUT +
	P1–10 BLK	RFI C7	SUB 2 GROUND
76	AFC/PLL P1–11 BLK	RFI C9	SUB 3 GROUND
	P1–12 RED	RFI C10	SUB 3 INPUT +
77	AFC/PLL P1–13 SHIELD		
	P1–14 CTR	FRONT PANEL BNC	COMPOSITE TEST INPUT +
78	AFC/PLL P1–15 CTR	FRONT PANEL BNC	COMPOSITE TEST OUTPUT +
	P1–16 SHIELD		
79	AFC/PLL P8–5 CTR	MOD OSC C19	+20V
	P8–3 SHIELD		
80	AFC/PLL P8–1 CTR	MOD OSC C21	AFC VOLTAGE
	P8–2 SHIELD	C20	AFC GROUND

APPENDIX A
MANUFACTURERS DATA

A–1. INTRODUCTION.

A–2. This appendix lists technical data applicable to the operation and maintenance of the FX–50 FM Exciter. Information contained in this section is listed in the following order:

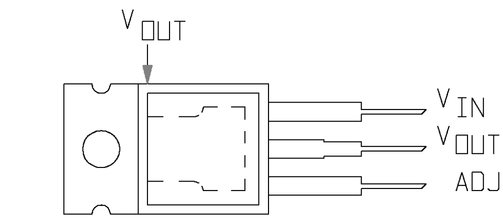
1. Integrated Circuit pin identification diagrams.

INTEGRATED CIRCUIT CONNECTION DIAGRAM

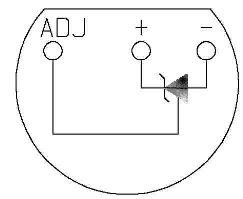
NOTE

TOP VIEW SHOWN FOR ALL DEVICES
UNLESS OTHERWISE NOTED.

LM317 T
ADJUSTABLE POSITIVE
VOLTAGE REGULATOR

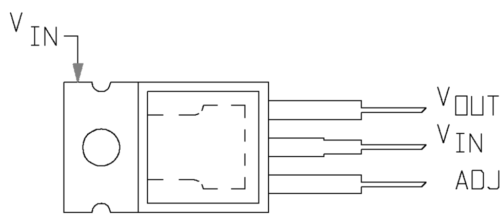


LM335Z
PRECISION TEMPERATURE
SENSOR

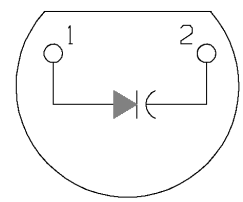


BOTTOM VIEW

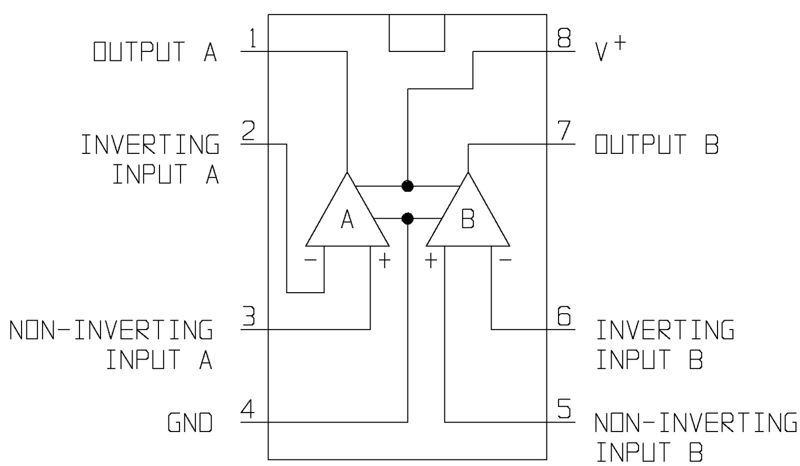
LM337T
ADJUSTABLE NEGATIVE
VOLTAGE REGULATOR



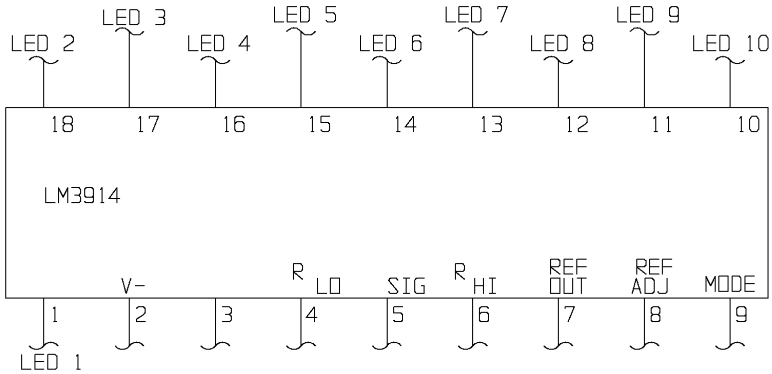
MV209
VOLTAGE VARIABLE
CAPACITANCE DIODE



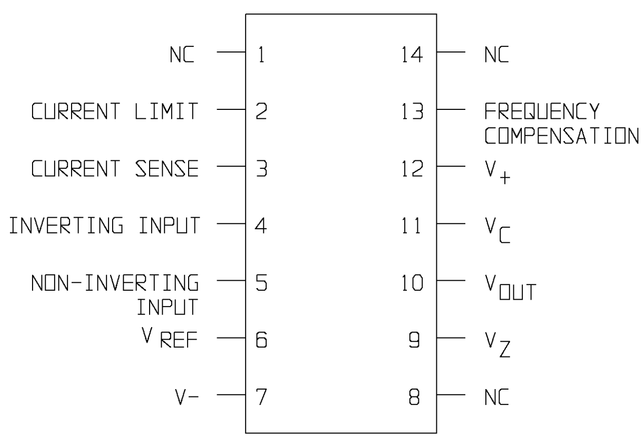
LM358N
DUAL OPERATIONAL AMPLIFIER



LM3914N DOT/BAR DISPLAY DRIVER

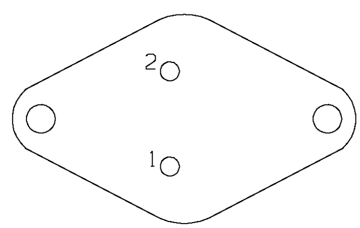


MC723CL
ADJUSTABLE POSITIVE
VOLTAGE REGULATOR



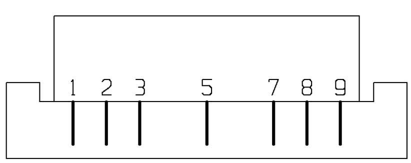
LM338K
ADJUSTABLE
VOLTAGE REGULATOR
PIN 1 - ADJUST
PIN 2 - INPUT
CASE - OUTPUT

MJ3000
MEDIUM POWER
NPN TRANSISTOR
PIN 1 - BASE
PIN 2 - EMITTER
CASE - COLLECTOR



BOTTOM VIEW

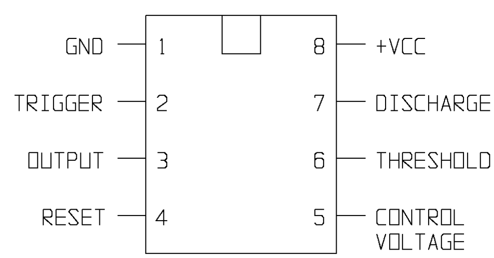
MHW592
RF HYBRID AMPLIFIER



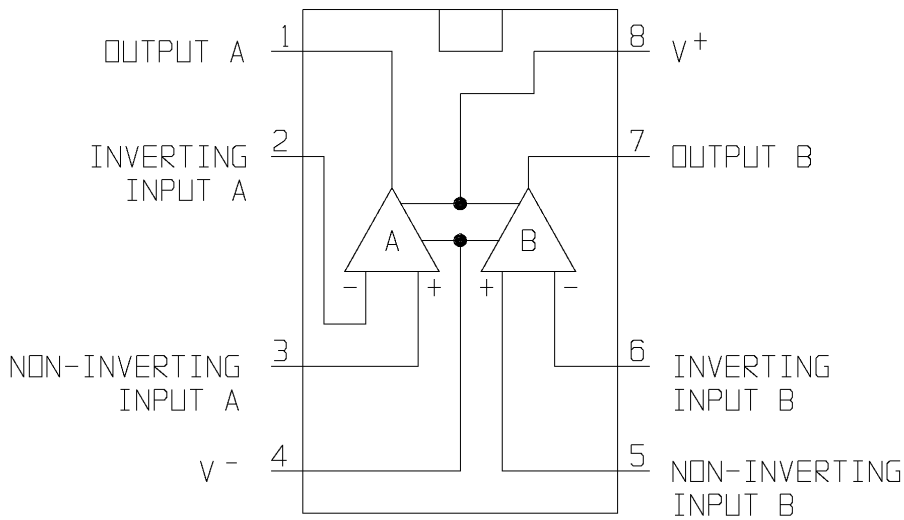
SIDE VIEW

PIN	
1	RF INPUT
5	+ V DC
2,3,7,8	GROUND
9	RF OUTPUT

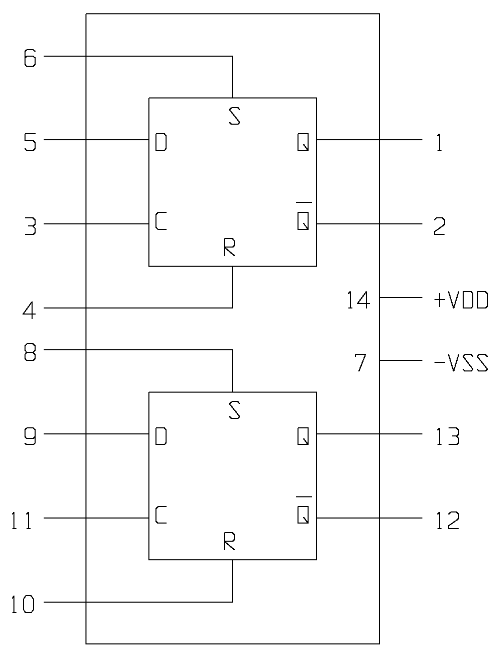
NE555V
TIMER



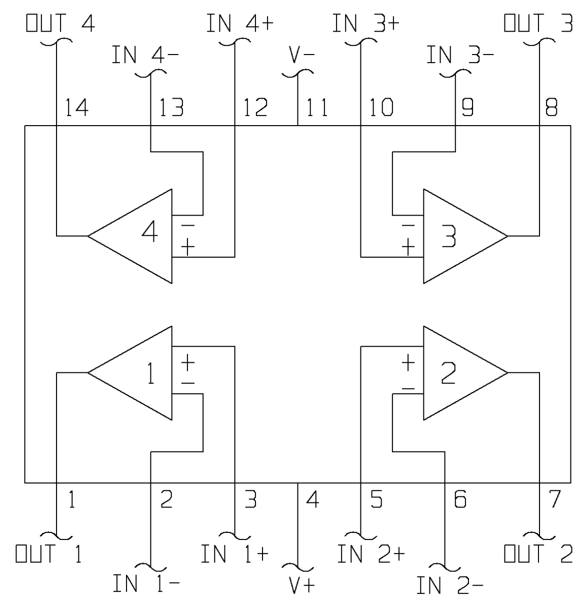
TL072/LF353N
BI-FET OPERATIONAL AMPLIFIER



MC14013B/MC4013
DUAL-D FLIP-FLOP



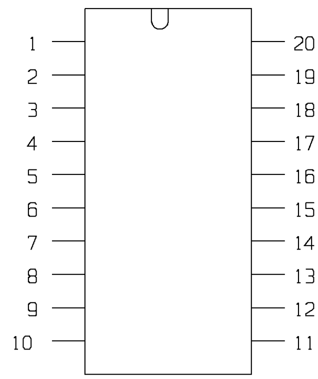
TL074CN/LF347N
QUAD INPUT JFET OPERATIONAL AMPLIFIER



597-1050-28C

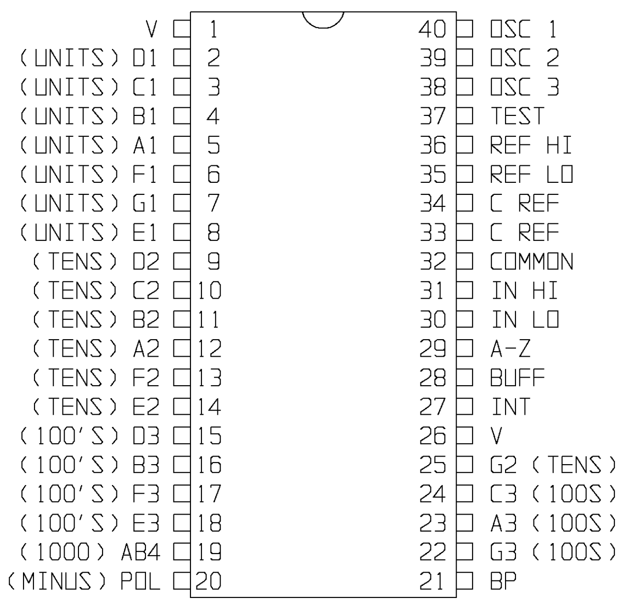
MV54164/MV57164
LED BAR DISPLAY

PIN NO.	ELECTRICAL CONNECTIONS
1	BAR 1 ANODE
2	BAR 2 ANODE
3	BAR 3 ANODE
4	BAR 4 ANODE
5	BAR 5 ANODE
6	BAR 6 ANODE
7	BAR 7 ANODE
8	BAR 8 ANODE
9	BAR 9 ANODE
10	BAR 10 ANODE

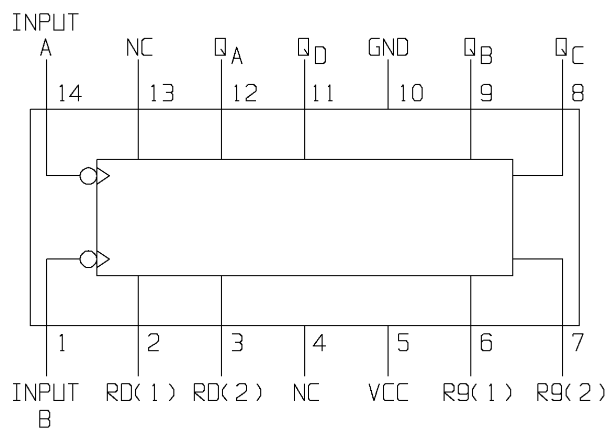


PIN NO.	ELECTRICAL CONNECTIONS
11	BAR 10 CATHODE
12	BAR 9 CATHODE
13	BAR 8 CATHODE
14	BAR 7 CATHODE
15	BAR 6 CATHODE
16	BAR 5 CATHODE
17	BAR 4 CATHODE
18	BAR 3 CATHODE
19	BAR 2 CATHODE
20	BAR 1 CATHODE

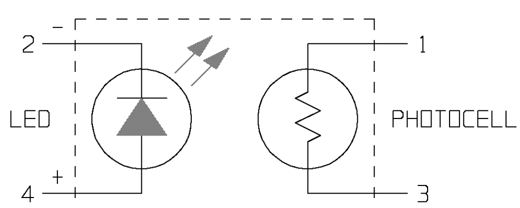
ILC7136
A/D CONVERTER AND DISPLAY DRIVER



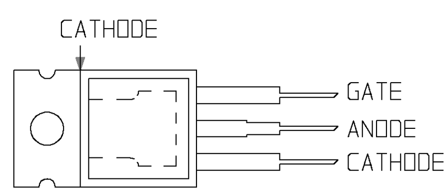
74LS90N
DECADE COUNTER



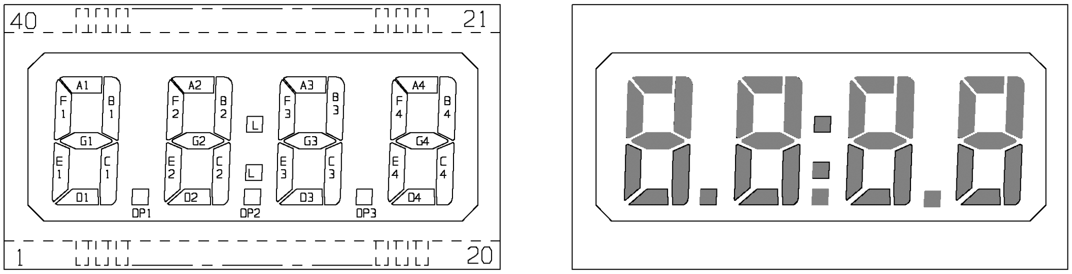
VTL5C2
OPTICAL ISOLATOR, LDR TYPE



2N6395
SCR



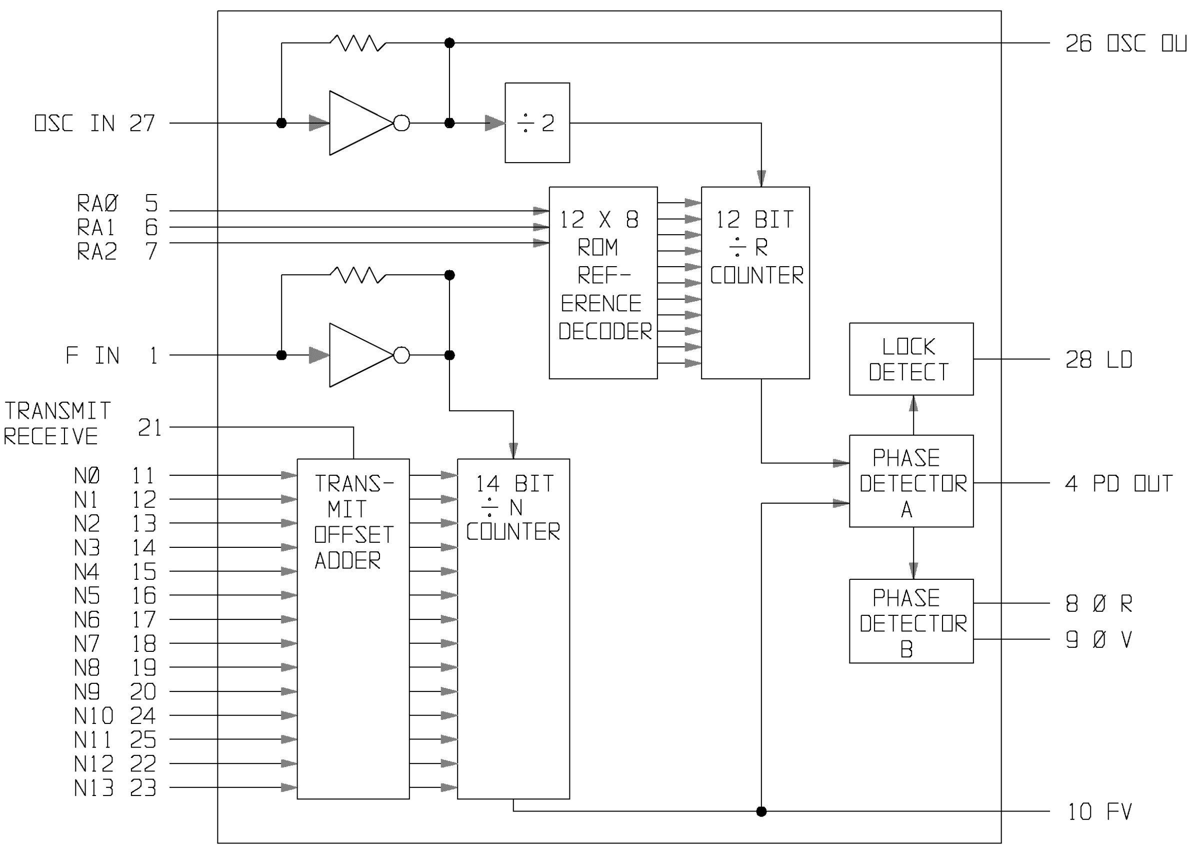
FE0502
LIQUID CRYSTAL DISPLAY



PIN NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
SEGMENT	BP	N/C	N/C	N/C	E1	D1	C1	dp1	E2	D2	C2	dp2	E3	D3	C3	dp3	E4	D4	C4	B4

PIN NO.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
SEGMENT	A4	F4	G4	B3	A3	F3	G3	L	B2	A2	F2	G2	N/C	B1	A1	F1	G1	N/C	N/C	BP

MC145151-1
PARALLEL INPUT PLL
FREQUENCY SYNTHESIZER



POWER SUPPLY/CONTROL CIRCUITS
TABLE OF CONTENTS

LIST OF TABLES

LIST OF ILLUSTRATIONS

SECTION I
GENERAL INFORMATION

1–1. INTRODUCTION.

1–2. This section provides general information and specifications relative to the operation of the power supply/control circuit board.

1–3. DESCRIPTION.

1–4. The control circuitry on the power supply/control circuit board regulates the operation of the RF amplifier within preset limits depending on the forward power output, reflected power output, PA voltage and current, and RF amplifier assembly temperature. The circuit board is designed with over temperature, over voltage, and short circuit protection circuits, and a VSWR foldback circuit.

1–5. The power supply circuitry provides regulated dc potentials of +20V, –20V, and +5V required by all the exciter circuit boards. An unregulated +30V dc potential is also provided by the power supply. Each power supply is full–wave rectified, filtered, and electronically regulated to assure stable equipment operation.

1–6. ELECTRICAL CHARACTERISTICS.

1–7. Refer to Table 1–1 for electrical characteristics relative to the power supply/control circuit board.

TABLE 1-1. ELECTRICAL CHARACTERISTICS

PARAMETER	SPECIFICATION
INPUTS	
AC POWER REQUIREMENTS	
FX-50	97 to 133V ac or 194 to 266V ac, 50/60 Hz, 230W Maximum.
FX-50E	240V Nominal ac, 50/60 Hz, 230W Maximum.
RF MUTE FROM TRANSMITTER	
NEG POS LOGIC SWITCH POSITION	
POSITIVE	0V = RF mute. +5V = RF enable.
NEGATIVE	+5V or High Impedance = RF mute. 0V = RF enable.
EXTERNAL RF POWER CONTROL	Positive potential, varies with adjustment of **PWR SET** control R52. Nominally 0-6V DC with R52 fully CW for 3-50W.
OUTPUTS	
FWD POWER	+11.45V at 10 K Ohm for 50W RF.
RFL POWER	Approximately +1V at 10K Ohm for 2W RF.
TEMP OL DRIVE	+18V at 5 mA, Maximum.
PA VOLTAGE	Approximately +20.8V at 3.25 Amperes for 50W RF.

SECTION II
REMOVAL AND INSTALLATION

2-1. INTRODUCTION.

2-2. This section provides removal and installation procedures for the power supply/control circuit board.

2-3. REMOVAL AND INSTALLATION PROCEDURES.

2-4. REMOVAL PROCEDURE.

2-5. **REQUIRED EQUIPMENT.** A number 2 Phillips screwdriver with a 4 inch (10.16 cm) blade is required to remove the power supply/control circuit board from the exciter chassis.

2-6. **PROCEDURE.** To remove the power supply/control circuit board, proceed as follows:

WARNING ***DISCONNECT THE PRIMARY POWER TO THE EXCITER BEFORE PROCEEDING.***
WARNING

A. Disconnect the primary power to the exciter.

B. Remove the exciter top-cover. Disconnect P10 and P11 from the circuit board.

C. Observe the orientation of P12 and P13 and disconnect from the circuit board.

D. Remove the screw near J11 securing the circuit board to the chassis.

E. With slight pressure, pull the circuit board from the mounting stud at each corner.

2-7. INSTALLATION PROCEDURE.

2-8. To install the power supply/control circuit board after repairs have been completed, proceed as follows:

WARNING ***DISCONNECT THE PRIMARY POWER TO THE EXCITER BEFORE PROCEEDING.***
WARNING

A. Disconnect the primary power to the exciter.

B. Follow the REMOVAL PROCEDURE in reverse order.

SECTION III
THEORY OF OPERATION

3-1. INTRODUCTION.

3-2. This section presents the theory of operation for the exciter power supply/control circuit board.

3-3. FUNCTIONAL DESCRIPTION.

3-4. The power supply/control circuit board will be described as follows: 1) the control circuitry, and 2) the power supply circuitry.

3-5. CONTROL CIRCUITRY.

3-6. The control circuitry consists of five circuits. Figure 3-1 presents a simplified schematic of the control circuits on the power supply/control circuit board. Refer to Figure 3-1 as required for a description of the following circuits.

A. RF Mute Circuit

B. Forward/Reflected Amplifier Circuits

C. Temperature Sense Circuit

D. Open Fuse Detector Circuit

E. Power Control Circuit

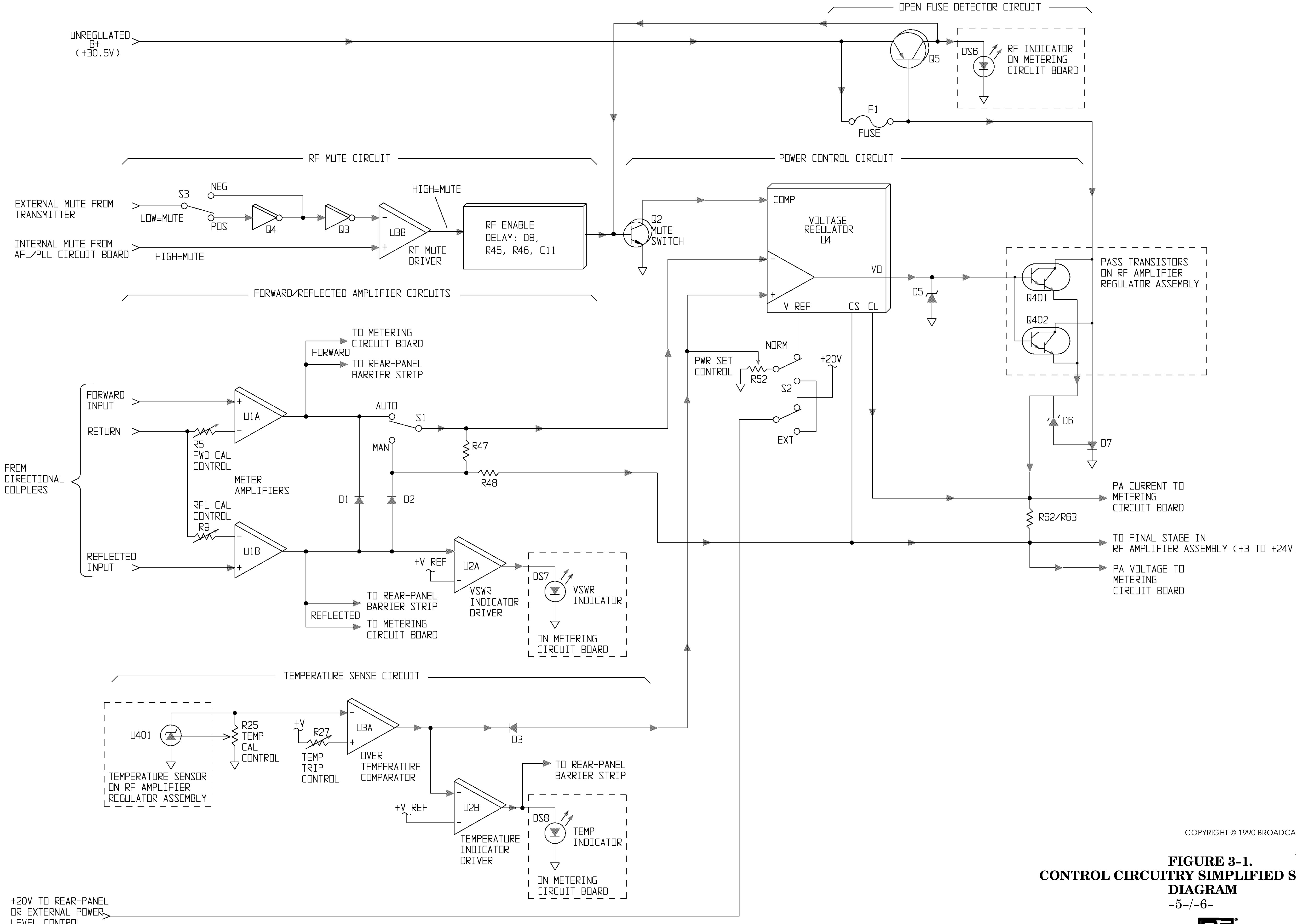
3-7. **RF MUTE CIRCUIT.** The RF mute circuit automatically inhibits exciter RF output if the AFC circuit is unlocked or if the transmitter is not ready to accept RF drive. This circuit consists of logic input switch S3, inverters Q3 and Q4, RF mute driver U3B, and mute switch Q2.

3-8. With S3 in the positive logic input position, U3B will output a HIGH to the base of Q2 when a LOW from a transmitter is applied to the inverting input of U3B through Q3 and Q4. This HIGH biases Q2 ON which applies a LOW to voltage regulator U4 compensation input to disable the RF. A HIGH from the AFC circuit (unlocked condition) applied to U3B non-inverting input will also inhibit the RF.

3-9. **FORWARD/REFLECTED AMPLIFIER CIRCUITS.** The forward/reflected amplifier circuits provide information from the directional couplers to the power control circuit and the metering circuit board. The forward amplifier circuit consists of meter amplifier U1A, **FWD CAL** control R5, diode D1, and **AUTO/MAN** switch S1. The reflected amplifier circuit consists of meter amplifier U1B, **RFL CAL** control R9, diodes D1 and D2, and **VSWR** indicator driver U2A.

3-10. **Forward Amplifier.** Output from the forward directional coupler is applied to the non-inverting input of U1A which operates as a voltage follower with the gain determined by potentiometer R5. The output of U1A is routed to: 1) the metering circuit board for display, 2) a rear-panel barrier strip for remote metering, 3) diode D1, and 4) the inverting input of voltage regulator U4 through S1.

3-11. **Reflected Amplifier.** Output from the reflected directional coupler is applied to the non-inverting input of U1B which operates as a voltage follower with the gain determined by potentiometer R9. The output of U1B is routed to: 1) diodes D1 and D2, 2) the metering circuit board for display, and 3) the rear-panel barrier strip for remote metering.



597-1050-10

FIGURE 3-1.
CONTROL CIRCUITRY SIMPLIFIED SCHEMATIC DIAGRAM

BROADCAST ELECTRONICS INC

3–12. Output from U1B is also routed to the inverting input of voltage regulator U4 through S1 and D1, and the non–inverting input of U2A which operates as a comparator circuit. If the reflected power level at U2A non–inverting input exceeds the reference potential at the inverting input, U2A will output a HIGH to illuminate **VSWR** indicator DS7.

3–13. **TEMPERATURE SENSE CIRCUIT.** The temperature sense circuit provides automatic RF power reduction if the RF amplifier assembly temperature exceeds a preset level. This circuit consists of temperature sensor U401, **TEMP CAL** control R25, over temperature comparator U3A, **TEMP TRIP** control R27, diode D3, temperature indicator driver U2B, and **TEMP** indicator DS8.

3–14. The output of U401 on the RF amplifier regulator assembly is calibrated by R25 and applied to the inverting input of U3A. As the temperature increases, the output level of U1 increases. If this potential exceeds a threshold level established by R27, the output of U3A will be reduced and applied to the non–inverting input of U4 through D3. U4 will reduce the RF power output to stabilize the temperature.

3–15. The output of U3A is also routed to the inverting input of U2B which operates as a comparator circuit. If this level decreases below the reference potential at U2B, U2B will output a HIGH to illuminate **TEMP** indicator DS8. This HIGH is also routed to the rear–panel barrier strip.

3–16. **OPEN FUSE DETECTOR CIRCUIT.** This circuit provides a visual indication of an RF amplifier malfunction. If the PA transistor current is excessive, fuse F1 will open to bias transistor switch Q5 ON which outputs a HIGH to illuminate **RF** indicator DS6. In addition, Q5 applies a HIGH to mute switch Q2 to enable the mute circuit.

3–17. **POWER CONTROL CIRCUIT.** The power control circuit provides automatic power control, over voltage protection, and short circuit protection for the RF power transistor. This circuit consists of voltage regulator U4, **PWR SET** control R52, **NORM/EXT** switch S2, diodes D5, D6, and D7, resistors R47, R48, and R62/R63, and pass transistors Q401 and Q402.

3–18. **Pass Transistors.** Parallel pass transistors Q401 and Q402 operate as an emitter follower circuit. Voltage regulation is provided by a control voltage from U4. The regulated voltage at the emitter is routed to the PA transistor through meter resistors R62/R63. Zener diode D5 will limit the control voltage to 27 volts if voltage regulator U4 fails.

3–19. Further protection is provided by a crowbar circuit consisting of zener diode D6 and SCR D7. If Q401 and/or Q402 short circuits and the output voltage exceeds 27V, D6 will apply gate voltage to D7 which conducts to open fuse F1.

3–20. Voltages sampled across meter resistors R62/R63 are routed to the metering circuit board for display. These potentials are also applied to the current limit (CL) and current sense (CS) inputs of U4 to automatically control the PA current.

3–21. **Power Set Control Operation.** With **NORM/EXT** switch S2 in the normal position: 1) +20V is routed to the rear–panel barrier strip, and 2) **PWR SET** control R52 is connected between the VREF output and non–inverting input of U4. As R52 is adjusted, U4 output will increase or decrease the PA output power.

3–22. With the **NORM/EXT** switch in the external position, a reference voltage can be applied to **PWR SET** control R52 through the rear–panel external power level control connection to control power externally.

3–23. **Automatic Power Control Operation.** With **AUTO/MAN** switch S1 in the automatic position, the outputs of U1A and U1B are connected to the inverting input of regulator U4. Resistors R47 and R48 establish the gain for U4. The forward voltage sample from U1A will increase or decrease the output of regulator U4 to maintain constant RF output power.

3–24. Proportional VSWR foldback is provided by diode D1. If the reflected voltage sample at U1B output exceeds the output of U1A, reflected power will be added to the forward power input of U4 through D1. U4 will reduce the RF output power until VSWR is normal.

3–25. With the **AUTO/MAN** switch in the manual position, only the reflected voltage sample at U1B is connected to the input of U4 through D2 to provide proportional VSWR foldback. In addition, resistor R47 is shunted to decrease the gain of U4.

3–26. **POWER SUPPLY CIRCUITRY.**

3–27. Figure 3–2 presents a simplified schematic of the power supply components on the power supply/control circuit board and exciter chassis. Refer to Figure 3–2 as required for the following description of the exciter power supply.

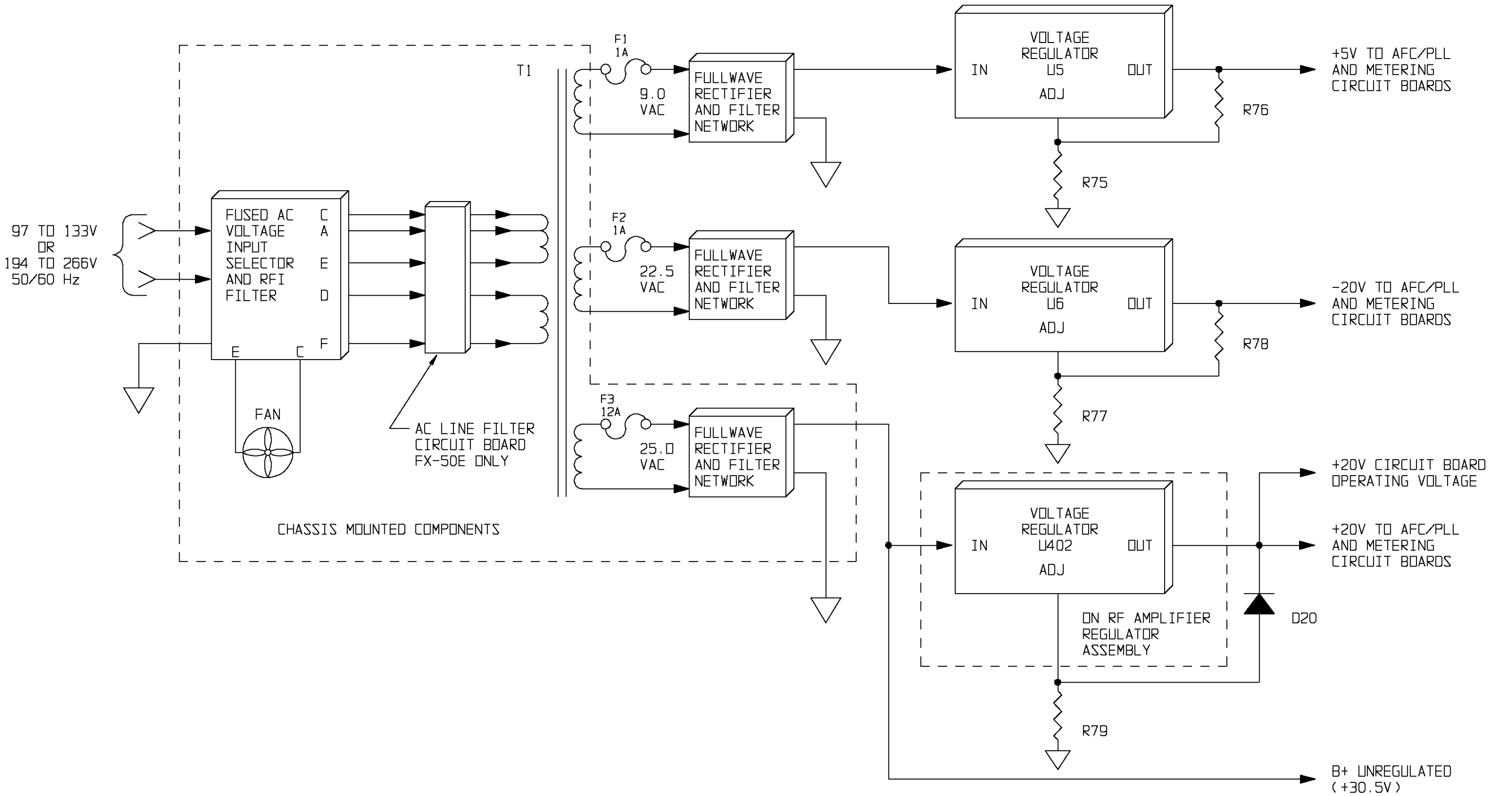
3–28. Primary power is applied to the FX–50/E through an RFI filter and ac receptacle module. On FX–50E models, the ac line routed through an additional ac line filter. This filter allows the FX–50E to meet CE ac line specifications. Power from the receptacle is routed to the flushing fan and the primary of power transformer T1 to provide 9.0 volt, 22.5 volt, and 25.0 volt ac potentials at the secondaries. Fuses F1, F2, and F3 protect transformer T1 in the event of a short circuit in a secondary winding.

3–29. **+5 VOLT SUPPLY.** The 9.0 volt ac potential is routed to a full–wave rectifier and filter network and applied to voltage regulator U5. Resistors R75 and R76 adjust the output of U5 for a regulated +5 volt dc potential. The supply is applied to the AFC/PLL circuit board and metering circuit board.

3–30. **-20 VOLT SUPPLY.** The 22.5 volt ac potential is routed to a full–wave rectifier and filter network and applied to voltage regulator U6. Resistors R77 and R78 adjust the output of U6 for a regulated –20 volt dc potential. The supply is applied to the AFC/PLL circuit board and metering circuit board.

3–31. **+20 VOLT SUPPLY.** The 25.0 volt ac potential is routed to a full–wave rectifier and filter network and applied to voltage regulator U402 on the RF amplifier regulator assembly. Resistor R79 and diode D20 adjust the output of U1 for a regulated +20 volt dc potential. The +20 volt potential is distributed to the AFC/PLL circuit board, metering circuit board, and power supply/control circuit board.

3–32. In addition, the power supply provides a +30 volt unregulated potential for input to pass transistors Q1 and Q2 on the RF amplifier assembly.



597-1050-11

FIGURE 3-2. POWER SUPPLY SIMPLIFIED SCHEMATIC DIAGRAM

SECTION IV
MAINTENANCE

4–1. INTRODUCTION.

4–2. This section provides maintenance information, electrical adjustment procedures and troubleshooting information for the power supply/control circuit board.

4–3. MAINTENANCE.

4–4. ELECTRICAL ADJUSTMENTS.

4–5. **REQUIRED EQUIPMENT.** The following tools and equipment are required for electrical adjustment procedures.

A. Insulated adjustment tool, shipped with the exciter (P/N 407–0083).

B. Non–inductive, 100 watt, 50 Ohm test load.

C. Adapter, BNC jack–to–jack N plug, for test load (P/N 417–3288).

D. Adapter, BNC jack–to–jack N plug, for test load (P/N 417–3841).

E. Coaxial Accessory Cable, BNC connectors, shipped with exciter (P/N 949–0017–2).

F. Calibrated 50 Ohm in–line wattmeter.

G. Digital voltmeter, Fluke 75 or equivalent.

H. Temperature probe, Fluke 80T–150 or equivalent.

4–6. **FWD CAL (R5) AND RFL CAL (R9).** **FWD CAL** control R5 and **RFL CAL** control R9 on the power supply/control circuit board must be adjusted in proper sequence. Potentiometers R5 and R9 are adjusted as follows.

4–7. **Procedure.** To adjust controls R5 and R9, proceed as follows:

A. Apply primary power and record the front–panel **FWD** meter indication ____________.

WARNING ***DISCONNECT THE PRIMARY POWER TO THE EXCITER BEFORE PROCEEDING***

WARNING

B. Disconnect the exciter primary power.

C. Connect a 100 watt, 50 Ohm test load and in–line wattmeter to the rear–panel RF **OUTPUT** receptacle.

D. Remove the top–cover. Refer to Figure 4–1 and operate **AUTO-PWR-MAN** switch S1 to the **MAN** position.

E. Apply primary power and operate the exciter.

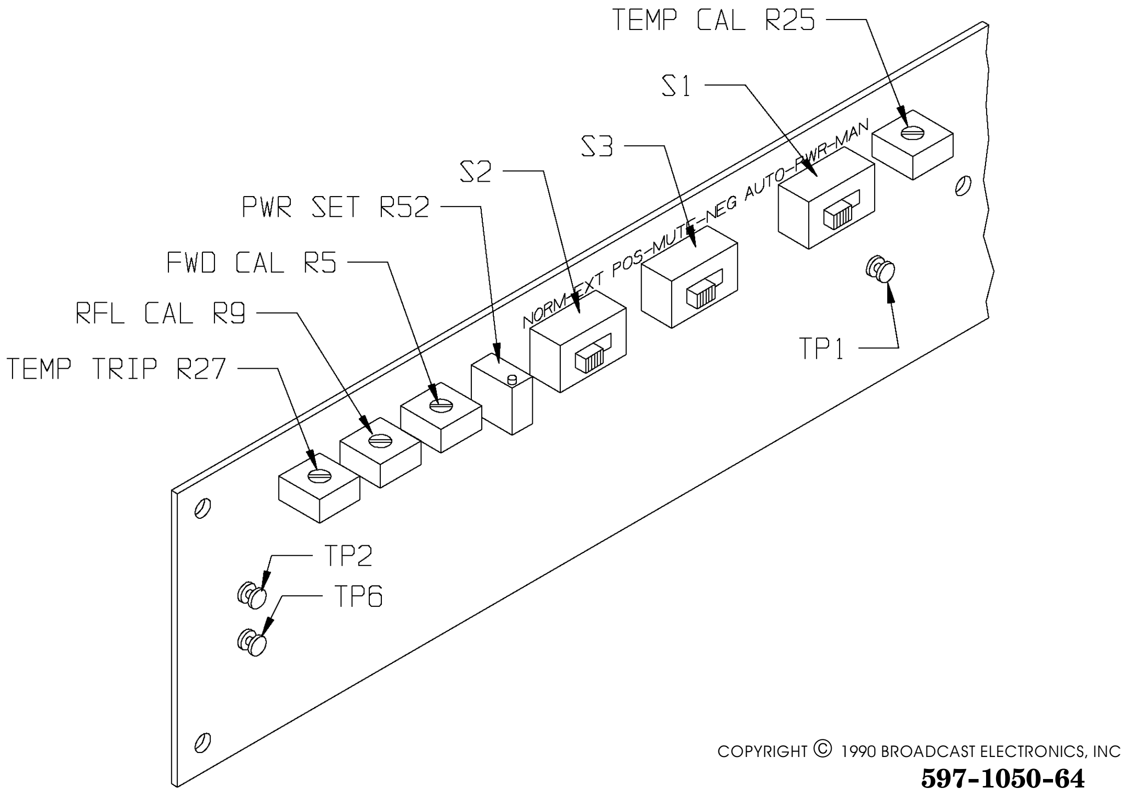


FIGURE 4-1. POWER SUPPLY/CONTROL CIRCUIT BOARD CONTROLS

WARNING ***DO NOT TOUCH ANY COMPONENT WITHIN THE EXCITER WITH POWER APPLIED.***

WARNING

F. Refer to Figure 4–1 and adjust **PWR SET** control R52 for a 40 watt output power indication on the external meter.

G. Refer to Figure 4–1 and adjust **FWD CAL** control R5 for 40 watts as indicated on the front–panel **FWD** meter.

H. Remove the external wattmeter. Refer to Figure 4–2 and connect two 100 watt, 50 Ohm test loads (in parallel) to the **RF OUTPUT** receptacle as shown.

I. Depress the **FWD** meter function switch and record the meter indication ______________.

WARNING ***DO NOT TOUCH ANY COMPONENT WITHIN THE EXCITER WITH POWER APPLIED.***

WARNING

J. Depress the **RFL** meter function switch. Refer to Figure 4–1 and adjust **RFL CAL** control R9 until the meter indicates 11% of the value recorded in step I.

K. Repeat steps I and J as required until the 11% rate is established.

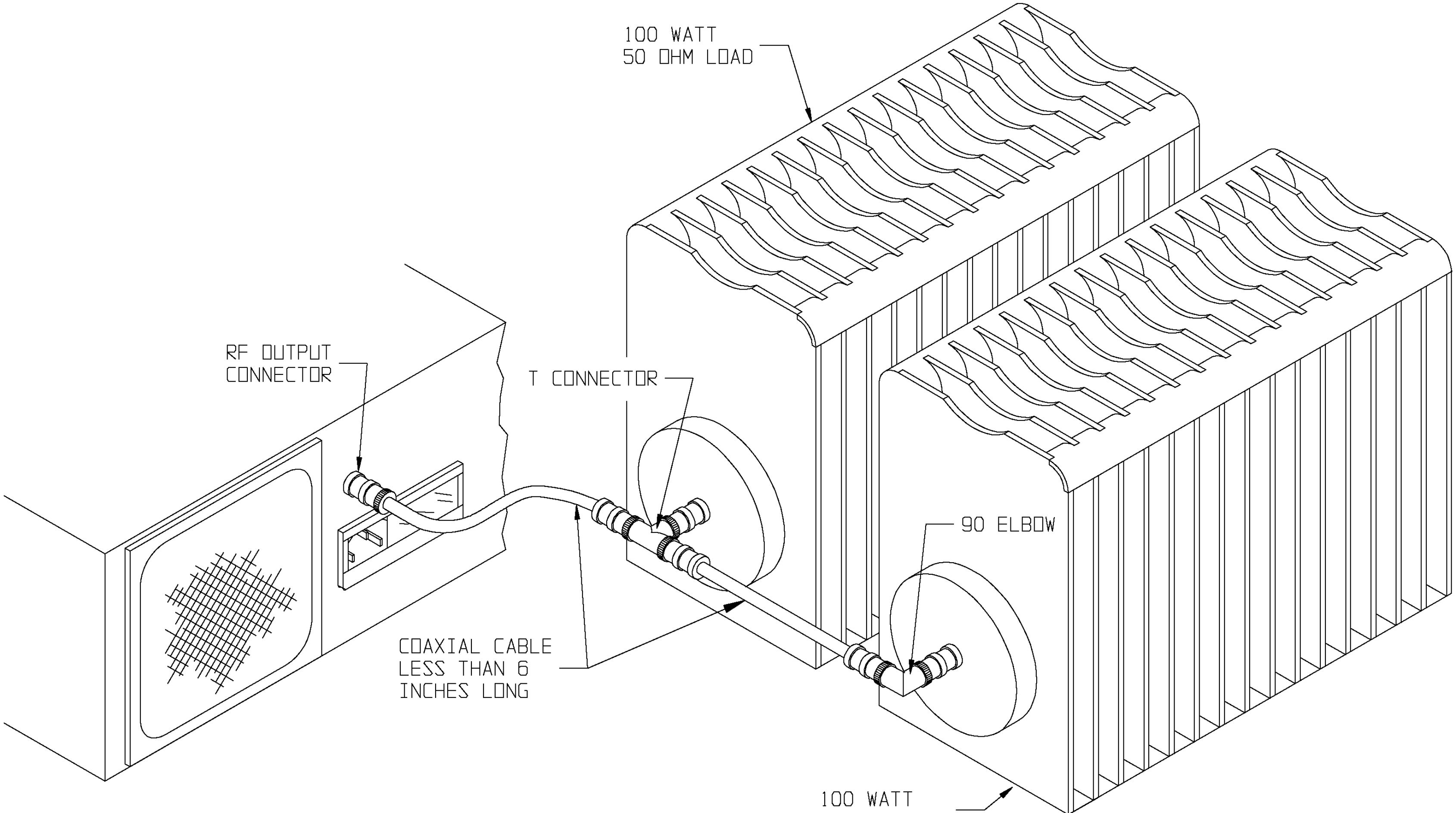


FIGURE 4-2. PARALLEL LOAD CONNECTION

597-1050-63

L. Connect the normal load to the exciter and depress the front–panel **FWD** meter function switch.

WARNING ***DO NOT TOUCH ANY COMPONENT WITHIN THE EXCITER WITH POWER APPLIED.***
WARNING

M. Refer to Figure 4–1 and adjust **PWR SET** control R52 until the meter indicates the value recorded in step A.

WARNING ***DISCONNECT THE PRIMARY POWER TO THE EXCITER BEFORE PROCEEDING.***
WARNING

N. Disconnect the exciter primary power.

O. Disconnect all test equipment, and replace the top–cover.

4–8. **TEMP CAL (R25).** **TEMP CAL** control R25 on the power supply/control circuit board calibrates the output voltage of temperature sensor U1 on the RF amplifier assembly in relation to temperature. Potentiometer R25 is adjusted as follows.

4–9. **Procedure.** To adjust **TEMP CAL** control R25, proceed as follows:

WARNING ***DISCONNECT THE PRIMARY POWER TO THE EXCITER BEFORE PROCEEDING.***
WARNING

A. Disconnect the primary power to the exciter.

B. Remove the top–cover and attach a temperature probe to the RF amplifier heatsink assembly near U1.

C. Connect the probe to a voltmeter and record the temperature indication (TI) ______________.

D. Using the following equation and information from step C, calculate and record the voltage (V) ______________.

$$V = \frac{TI + 273}{100}$$

E. Refer to Figure 4–1 and connect a voltmeter between TP1 and TP6 (ground).

F. Apply primary power to the exciter.

WARNING ***DO NOT TOUCH ANY COMPONENT WITHIN THE EXCITER WITH POWER APPLIED.***
WARNING

G. Refer to Figure 4–1 and adjust **TEMP CAL** control R25 until the voltmeter indicates the value recorded in step D.

EXAMPLE: $\frac{25°C + 273}{100} = \frac{298}{100} = 2.98V$

WARNING *DISCONNECT THE PRIMARY POWER TO THE EXCITER BEFORE PROCEEDING.* *WARNING*

H. Disconnect the primary power to the exciter.

I. Remove the test equipment and replace the top–cover.

4–10. **TEMP TRIP (R27).** **TEMP TRIP** control R27 on the power supply/control circuit board adjusts the threshold of the over temperature circuit. Potentiometer R27 is adjusted as follows.

4–11. **Procedure.** To adjust control R27, proceed as follows:

WARNING *DISCONNECT THE PRIMARY POWER TO THE EXCITER BEFORE PROCEEDING.* *WARNING*

A. Disconnect the primary power to the exciter.

B. Remove the top–cover. Refer to Figure 4–1 and connect a voltmeter between TP2 and TP6 (ground).

C. Apply primary power and operate the exciter.

WARNING *DO NOT TOUCH ANY COMPONENT WITHIN THE EXCITER WITH POWER APPLIED.* *WARNING*

D. Refer to Figure 4–1 and adjust R27 until the voltmeter indicates +3.65V dc.

WARNING *DISCONNECT THE PRIMARY POWER TO THE EXCITER BEFORE PROCEEDING.* *WARNING*

E. Disconnect the primary power to the exciter.

F. Remove the test equipment and replace the top–cover.

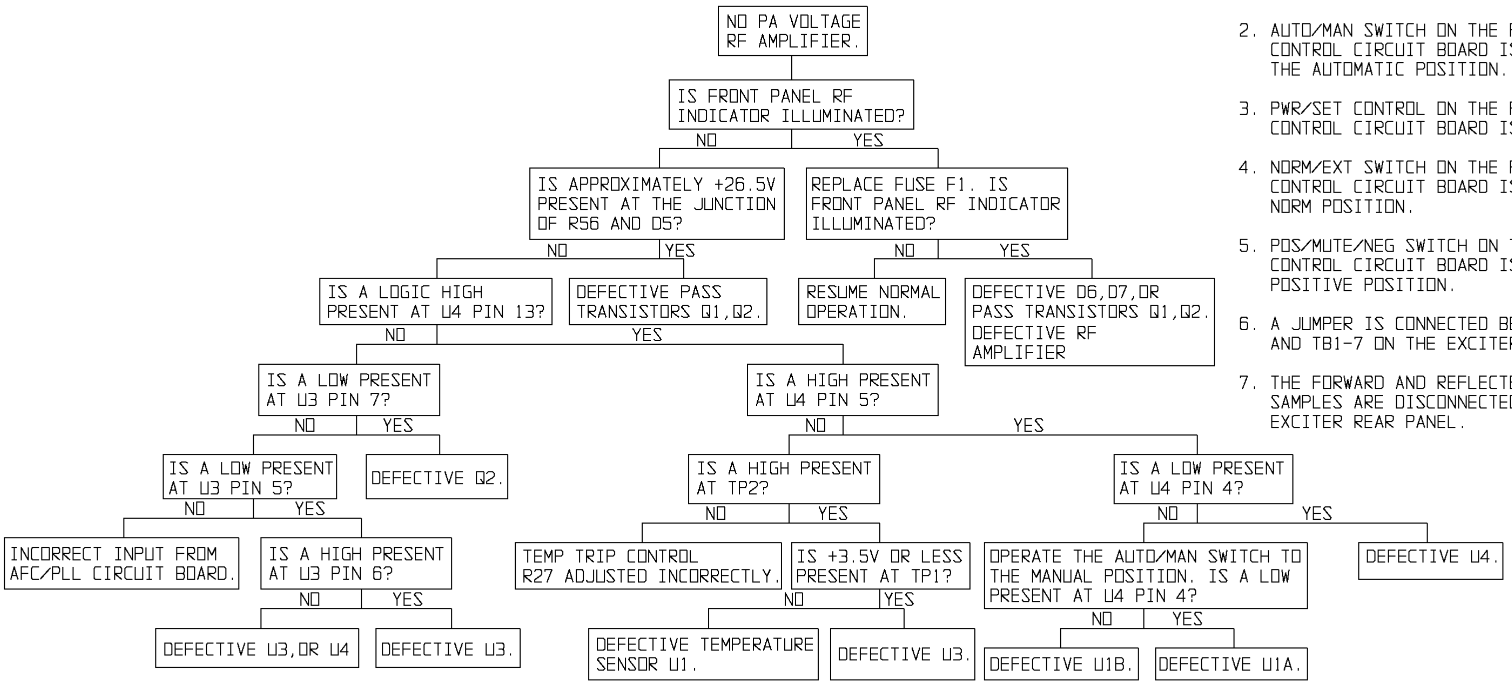
4–12. **TROUBLESHOOTING.**

4–13. The troubleshooting philosophy for the power supply/control circuit board consists of isolating a problem to a specific circuit. The problem may be further isolated by referencing the following information and Figure 4–3 which presents troubleshooting information.

WARNING ***WARNING*** ***DISCONNECT PRIMARY POWER FROM THE EXCITER BEFORE REMOVING OR REPLACING ANY COMPONENTS.***

CAUTION ***CAUTION*** ***INADVERTENT CONTACT BETWEEN ADJACENT COMPONENTS AND CIRCUIT TRACES MAY DAMAGE THE POWER SUPPLY/CONTROL CIRCUIT BOARD.***

4–14. After the problem is isolated and power is totally deenergized, refer to the schematic diagrams and the theory of operation to facilitate in problem resolution. The defective circuitry may be repaired locally or the circuit board may be returned to Broadcast Electronics, Inc. for repair or replacement.



NOTES:

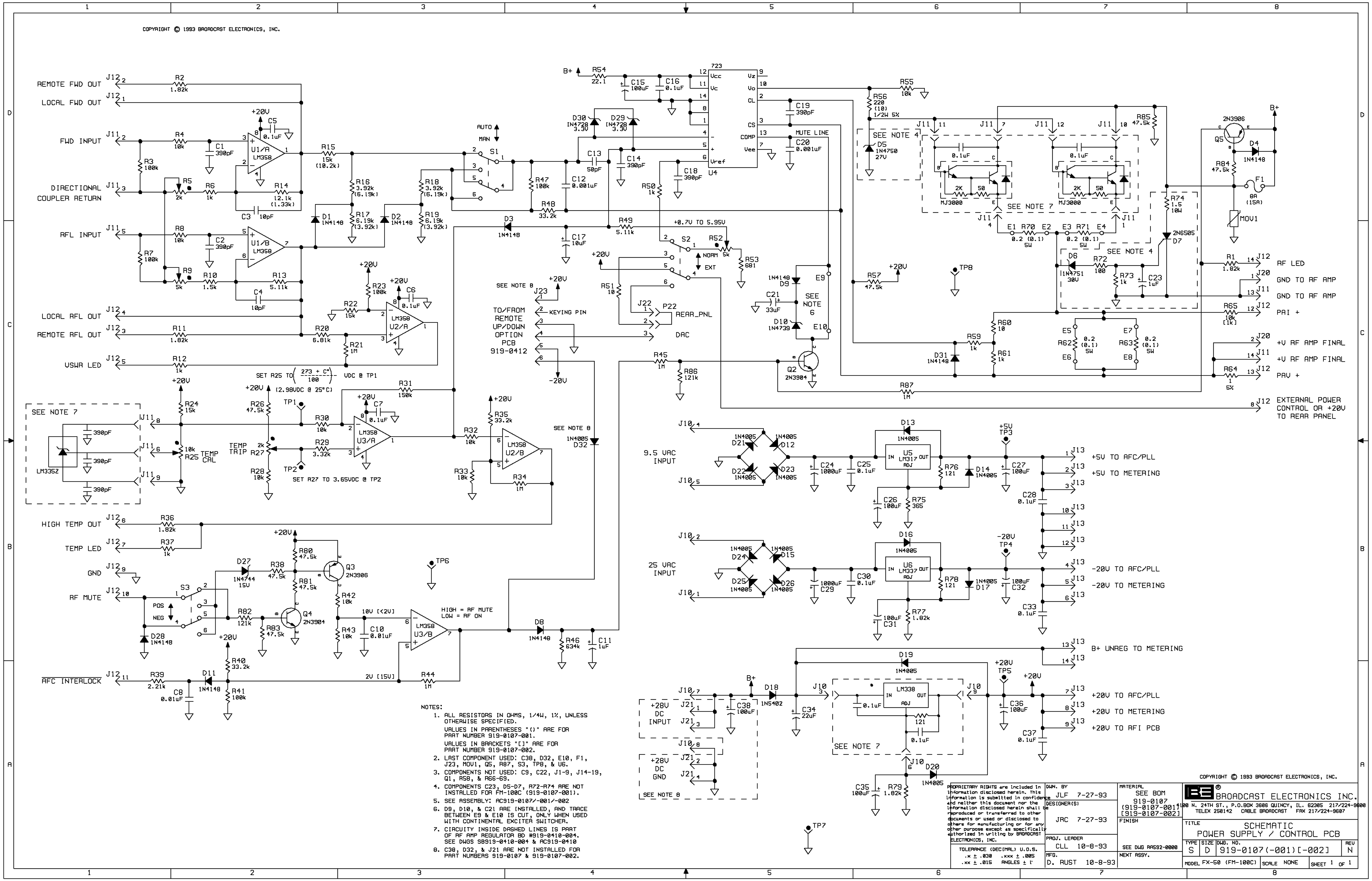
1. A 50W,50 OHM TEST LOAD IS CONNECTED TO THE REAR PANEL RF OUTPUT CONNECTOR.
2. AUTO/MAN SWITCH ON THE POWER SUPPLY/ CONTROL CIRCUIT BOARD IS OPERATED TO THE AUTOMATIC POSITION.
3. PWR/SET CONTROL ON THE POWER SUPPLY/ CONTROL CIRCUIT BOARD IS ADJUSTED FCW.
4. NORM/EXT SWITCH ON THE POWER SUPPLY/ CONTROL CIRCUIT BOARD IS OPERATED TO NORM POSITION.
5. POS/MUTE/NEG SWITCH ON THE POWER SUPPLY/ CONTROL CIRCUIT BOARD IS OPERATED TO THE POSITIVE POSITION.
6. A JUMPER IS CONNECTED BETWEEN TB1-6 AND TB1-7 ON THE EXCITER REAR PANEL.
7. THE FORWARD AND REFLECTED INPUT POWER SAMPLES ARE DISCONNECTED FROM THE EXCITER REAR PANEL.

FIGURE 4-3. NO PA VOLTAGE TO THE RF AMPLIFIER

SECTION V
DRAWINGS

5-1. INTRODUCTION.

5-2. This section provides assembly drawings, wiring diagrams, and schematic diagrams as listed below for the power supply/control circuit board.



NOTES:

1. ALL RESISTORS IN OHMS, 1/4W, 1%, UNLESS OTHERWISE SPECIFIED.
   VALUES IN PARENTHESES "()" ARE FOR PART NUMBER 919-0107-001.
   VALUES IN BRACKETS "[]" ARE FOR PART NUMBER 919-0107-002.
2. LAST COMPONENT USED: C38, D32, E10, F1, J23, MOV1, Q5, R87, S3, TP8, & U6.
3. COMPONENTS NOT USED: C9, C22, J1-9, J14-19, Q1, R58, & R66-69.
4. COMPONENTS C23, D5-D7, R72-R74 ARE NOT INSTALLED FOR FM-100C (919-0107-001).
5. SEE ASSEMBLY: AC919-0107/-001/-002
6. D9, D10, & C21 ARE INSTALLED, AND TRACE BETWEEN E9 & E10 IS CUT, ONLY WHEN USED WITH CONTINENTAL EXCITER SWITCHER.
7. CIRCUITY INSIDE DASHED LINES IS PART OF RF AMP REGULATOR BD #919-0410-004. SEE DWGS SB919-0410-004 & AC919-0410
8. C38, D32, & J21 ARE NOT INSTALLED FOR PART NUMBERS 919-0107 & 919-0107-002.

TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°

DWN. BY JLF 7-27-93
DESIGNER(S) JRC 7-27-93
PROJ. LEADER CLL 10-8-93
MFG. D. RUST 10-8-93
MATERIAL SEE BOM 919-0107 (919-0107-001) [919-0107-002]
FINISH SEE DWG RA592-0000
NEXT ASSY.

BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O.BOX 3606 QUINCY, IL. 62305 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

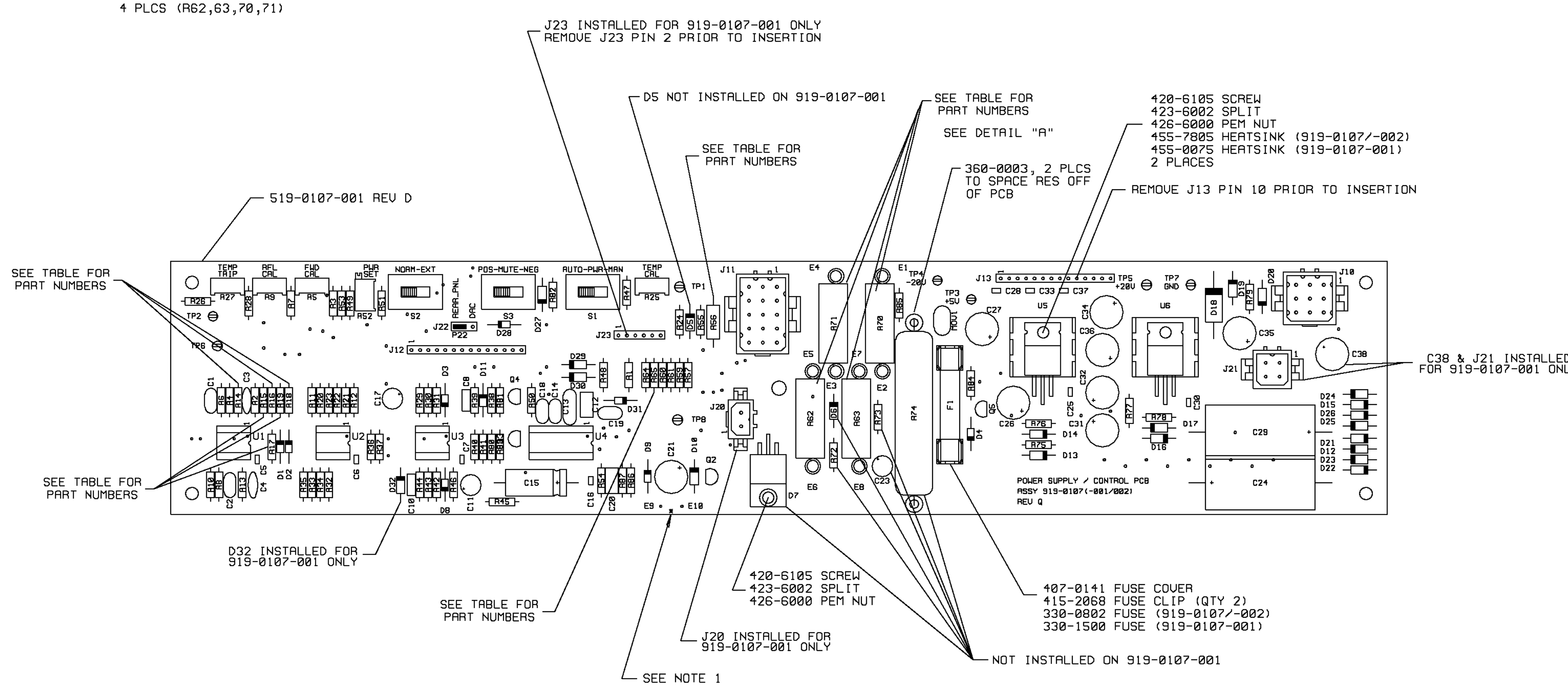
TITLE SCHEMATIC POWER SUPPLY / CONTROL PCB

TYPE	SIZE	DWG. NO.	REV
S	D	919-0107(-001)[-002]	N

MODEL FX-50 (FM-100C) SCALE NONE SHEET 1 OF 1

INSTALL (2) TURRETS #413-0025 AND SOLDER INTO PLACE TOP & BOTTOM. MOUNT RESISTOR TO TURRETS AS SHOWN. RESISTOR LEADS SHOULD BE AS SHORT AND STRAIGHT AS POSSIBLE WITHOUT BENDING TURRETS.

DETAIL "A"
4 PLCS (R62,63,70,71)



NOTES:

1. D9, D10, & C21 ARE INSTALLED, AND TRACE MARKED "*" IS TO BE CUT, ONLY WHEN USED WITH CONTINENTAL EXCITER SWITCHER.
2. LAST COMPONENTS USED: C38, D32, E10, F1, J13 MOV1, Q5, R87, S3, TP8, & U6.
3. COMPONENTS NOT USED: C9, C22, J1-9, J14-19, Q1, R58, & R66-69.
4. SEE SCHEMATIC: SD919-0107/-001/-002

	919-0107	919-0107-001	919-0107-002
R14	103-1215	103-1331	103-1215
R15	100-1551	103-1025	100-1551
R16 & R18	103-3924	103-6194	103-3924
R17 & R19	103-6194	103-3924	103-6194
R56	110-2233	110-1023	110-2233
R65	100-1051	100-1051	100-1013
R62-63,R70-71	132-2003	130-1000	132-2003

TOLERANCE (DECIMAL) U.O.S.
.X ± .030 .XXX ± .005
.XX ± .015 ANGLES ± 1°

DWN. BY: JLF 7-27-93
DESIGNER(S): JRC 7-27-93
PROJ. LEADER: CLL 10-8-93
MFG.: D. RUST 10-8-93

MATERIAL: SEE BOM: 919-0107 919-0107-001 919-0107-002
FINISH
~~SEE DWG AA592-0000~~
NEXT ASSY.

BROADCAST ELECTRONICS INC.
4100 N.24TH ST. P.O.BOX 3606 QUINCY,IL. 62305 PH. 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE: PCB ASSEMBLY POWER SUPPLY / CONTROL

TYPE	SIZE	DWG No.	REV
A	C	919-0107/-001/-002	Q

MODEL FX-50/FM-100C SCALE 1:1 SHEET 1 OF 1

SECTION VI
REPLACEMENT PARTS

6-1. INTRODUCTION.

6-2. This section provides replacement parts lists for the FX-50/E power supply/control circuit board as indexed below. Chassis mounted components of the power supply are listed as parts of the exciter basic assembly located in PART I of this manual.

TABLE 6-1. POWER SUPPLY/CONTROL CIRCUIT BOARD ASSEMBLY - 919-0107 (Sheet 1 of 4)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1,C2	Capacitor, Mica, 390 pF ±5%, 100V	042-3922	2
C3,C4	Capacitor, Ceramic Disc, 10 pF ±10%, 1kV, Non-Polarized	001-1014	2
C5 THRU C7	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	3
C8,C10	Capacitor, Mylar, 0.01 uF ±10%, 100V	031-1043	2
C11	Capacitor, Electrolytic, 1 uF, 50V	024-1064	1
C12	Capacitor, Ceramic, 0.001 uF ±10%, 200V	030-1033	1
C13	Capacitor, Mica, 50 pF ±5%, 500V	040-5013	1
C14	Capacitor, Mica, 390 pF ±5%, 100V	042-3922	1
C15	Capacitor, Electrolytic, 100 uF, 40V	014-1084	1
C16	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	1
C17	Capacitor, Electrolytic, 10 uF, 35V	023-1076	1
C18,C19	Capacitor, Mica, 390 pF ±5%, 100V	042-3922	2
C20	Capacitor, Ceramic, 0.001 uF ±10%, 200V	030-1033	1
C23	Capacitor, Electrolytic, 1 uF, 50V	024-1064	1
C24	Capacitor, Electrolytic, 1000 uF, 50V	014-1094	1
C25	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	1
C26,C27	Capacitor, Electrolytic, 100 uF, 35V	023-1084	2
C28	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	1
C29	Capacitor, Electrolytic, 1000 uF, 50V	014-1094	1
C30	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	1
C31,C32	Capacitor, Electrolytic, 100 uF, 35V	023-1084	2
C33	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	1
C34	Capacitor, Electrolytic, 22 uF, 50V	024-2274	1
C35,C36	Capacitor, Electrolytic, 100 uF, 35V	023-1084	2
C37	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	1
D1 THRU D4	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	4
D5	Diode, 1N4750A, Zener, 27V ±10%, 1 Watt	200-0027	1
D6	Diode, 1N4751A, Zener, 30V ±10%, 1 Watt	200-4751	1

TABLE 6-1. POWER SUPPLY/CONTROL CIRCUIT BOARD ASSEMBLY - 919-0107 (Sheet 2 of 4)

REF. DES.	DESCRIPTION	PART NO.	QTY.
D7	Silicon Controlled Rectifier, 2N6505, 100V @ 25 Amperes	237-0007	1
D8,D11	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	2
D12 THRU D17	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203-4005	6
D18	Diode, MR502, Silicon, 200V @ 3 Amperes	202-0502	1
D19 THRU D26	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203-4005	8
D27	Diode, Zener, 1N4744A, 15V, 1W	200-0015	1
D28	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	1
D29,D30	Diode, Zener, 1N4728, 3.3V ±10%, 1 Watt	201-4728	2
D31	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	1
E1 thru E8	Terminal, Turret, Double Shoulder	413-0025	8
F1	Fuse, GBB-8, 8 Amperes, Fast-Blow	330-0802	1
J10	Connector, 9-Pin	418-0900	1
J11	Connector, 15-Pin	417-0169	1
J12,J13	Receptacle, Male, 20-Pin In-Line	417-0200	2
J22	Receptacle, Male, 3-Pin In-Line	417-0003	1
J23	Receptacle, Male, 20-Pin In-Line	417-0200	1
MOV1	Metal Oxide Varistor, V47ZA1, 47V	140-0018	1
P22	Switch, Jumper Programmable, 2-Pin	340-0004	1
Q2	Transistor, 2N3904, NPN, Silicon, TO-92 Case	211-3904	1
Q3	Transistor, 2N3906, PNP, Silicon, TO-92 Case	210-3906	1
Q4	Transistor, 2N3904, NPN, Silicon, TO-92 Case	211-3904	1
Q5	Transistor, 2N3906, PNP, Silicon, TO-92 Case	210-3906	1
R1,R2	Resistor, 1.8 k Ohm ±1%, 1/4W	100-1841	2
R3	Resistor, 100 k Ohm ±1%, 1/4W	103-1062	1
R4	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	1
R5	Potentiometer, 2 k Ohm ±10%, 1/2W	178-2044	1
R6	Resistor, 1 k Ohm ±1%, 1/4W	100-1041	1
R7	Resistor, 100 k Ohm ±1%, 1/4W	100-1062	1
R8	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	1
R9	Potentiometer, 5 k Ohm ±20%, 3/4W	178-5044	1
R10	Resistor, 1.5 k Ohm ±1%, 1/4W	103-1504	1
R11	Resistor, 1.82 k Ohm ±1%, 1/4W	100-1841	1
R12	Resistor, 1 k Ohm ±1%, 1/4W	100-1041	1
R13	Resistor, 5.11 k Ohm ±1%, 1/4W	100-5141	1
R14	Resistor, 12.1 k Ohm ±1%, 1/4W	103-1215	1
R15	Resistor, 15 k Ohm ±1%, 1/4W	100-1551	1
R16	Resistor, 3.92 k Ohm ±1%, 1/4W	100-3943	1
R17	Resistor, 6.19 k Ohm ±1%, 1/4W	103-6194	1
R18	Resistor, 3.92 k Ohm ±1%, 1/4W	103-3924	1
R19	Resistor, 6.19 k Ohm ±1%, 1/4W	103-6194	1
R20	Resistor, 6.81 k Ohm ±1%, 1/4W	103-6814	1
R21	Resistor, 1 Meg Ohm ±1%, 1/4W	103-1007	1
R22	Resistor, 15 k Ohm ±1%, 1/4W	100-1551	1
R23	Resistor, 100 k Ohm ±1%, 1/4W	103-1062	1
R24	Resistor, 15 k Ohm ±1%, 1/4W	100-1551	1
R25	Potentiometer, 10 k Ohm ±10% 1/2W	178-1054	1
R26	Resistor, 47.5 k Ohm ±1%, 1/4W	103-4755	1
R27	Potentiometer, 2 k Ohm ±10%, 1/2W	178-2044	1
R28	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	1
R29	Resistor, 3.32 k Ohm ±1%, 1/4W	103-3324	1
R30	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	1

TABLE 6-1. POWER SUPPLY/CONTROL CIRCUIT BOARD ASSEMBLY - 919-0107
(Sheet 3 of 4)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R31	Resistor, 150 k Ohm ±1%, 1/4W	103–1561	1
R32,R33	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	2
R34	Resistor, 1 Meg Ohm ±1%, 1/4W	103–1007	1
R35	Resistor, 33.2 k Ohm ±1%, 1/4W	103–3325	1
R36	Resistor, 1.82 k Ohm ±1%, 1/4W	100–1841	1
R37	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	1
R38	Resistor, 47.5 k Ohm ±1%, 1/4W	103–4755	1
R39	Resistor, 2.21 k Ohm ±1%, 1/4W	103–2241	1
R40	Resistor, 33.2 k Ohm ±1%, 1/4W	103–3325	1
R41	Resistor, 100 k Ohm ±1%, 1/4W	103–1062	1
R42,R43	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	2
R44,R45	Resistor, 1 Meg Ohm ±1%, 1/4W	103–1007	2
R46	Resistor, 634 k Ohm ±1%, 1/4W	103–6346	1
R47	Resistor, 100 k Ohm ±1%, 1/4W	103–1062	1
R48	Resistor, 33.2 k Ohm ±1%, 1/4W	103–3325	1
R49	Resistor, 5.11 k Ohm ±1%, 1/4W	103–5141	1
R50	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	1
R51	Resistor, 10 Ohm ±1%, 1/4W	103–1021	1
R52	Potentiometer, 5 k Ohm ±10%, 1/2W	178–5046	1
R53	Resistor, 681 Ohm ±1%, 1/4W	103–6813	1
R54	Resistor, 22.1 Ohm ±1%, 1/4W	103–2212	1
R55	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R56	Resistor, 220 Ohm ±5%, 1/2W	110–2233	1
R57	Resistor, 47.5 k Ohm ±1%, 1/4W	100–4755	1
R59	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	1
R60	Resistor, 10 Ohm ±1%, 1/4W	103–1021	1
R61	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	1
R62,R63	Resistor, 0.2 Ohm ±5%, 5W, W/W	132–2003	2
R64	Resistor, 1 Ohm ±5%, 1/4W	100–1013	1
R65	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R70,R71	Resistor, 0.2 Ohm ±5%, 5W, W/W	132–2003	2
R72	Resistor, 100 Ohm ±1%, 1/4W	100–1031	1
R73	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	1
R74	Resistor, 1.5 Ohm ±5%, 10W, W/W	132–0114	1
R75	Resistor, 365 Ohm ±1%, 1/4W	103–3631	1
R76	Resistor, 121 Ohm ±5%, 1/4W	100–1231	1
R77	Resistor, 1.82 k Ohm ±1%, 1/4W	100–1841	1
R78	Resistor, 121 Ohm ±5%, 1/4W	100–1231	1
R79	Resistor, 1.82 k Ohm ±1%, 1/4W	100–1841	1
R80,R81	Resistor, 47.5 k Ohm ±1%, 1/4W	103–4755	2
R82	Resistor, 121 k Ohm ±1%, 1/4W	103–1261	1
R83,R84,R85	Resistor, 47.5 k Ohm ±1%, 1/4W	103–4755	3
R86	Resistor, 121 k Ohm ±1%, 1/4W	103–1261	1
R87	Resistor, 1 Meg Ohm ±1%, 1/4W	103–1007	1
S1 THRU S3	Switch, Slide, DPDT, Circuit Board Mount, 0.5A, 115V ac or dc	345–0863	3
TP1 THRU TP8	Terminal, Turret, Double Shoulder	413–1597	8
U1 THRU U3	Integrated Circuit, LM358N, Dual Operational Amplifier, 8–Pin DIP	221–0358	3
U4	Voltage Regulator, UA723, 14–Pin DIP	227–0723	1
U5	Integrated Circuit, LM317T, Adjustable Positive Voltage Regulator, 1.2V to 37V, 1.5 Ampere, TO–220 Case	227–0317	1

TABLE 6-1. POWER SUPPLY/CONTROL CIRCUIT BOARD ASSEMBLY - 919-0107 (Sheet 4 of 4)

REF. DES.	DESCRIPTION	PART NO.	QTY.
U6	Integrated Circuit, LM337T, Adjustable Negative Voltage Regulator, 1.2V to 37V, 1.5 Ampere, TO-220 Case	227-0337	1
XF1, XF2	Fuse Clips, AGC	415-2068	2
XU1 THRU XU3	Socket, 8-Pin DIP	417-0804	3
XU4	Socket, 14-Pin DIP	417-1404	1
----	Fuse Cover	407-0141	1
----	Blank Power Supply/Control Circuit Board	519-0107-001	1

METERING CIRCUIT
TABLE OF CONTENTS

LIST OF TABLES

LIST OF ILLUSTRATIONS

SECTION I
GENERAL INFORMATION

1–1. INTRODUCTION.

1–2. This section provides general information and specifications relative to operation of the exciter metering circuit board.

1–3. DESCRIPTION.

1–4. The metering circuit board is equipped with LED status indicators for the +5 volt, +20 volt, –20 volt, TEMP, VSWR, RF, and LOCK operating parameters. Modulation percentage from 5% to 145% is indicated by a color coded moving bar LED display with an automatic ranging amplifier to convert the meter full scale indication to 14.5%.

1–5. The metering circuit board also includes a multimeter circuit with an LCD display for measuring five steady–state operating parameters. In addition, the multimeter can be converted into a high–impedance dc voltmeter for troubleshooting purposes.

1–6. INTERNAL VOLTMETER CHARACTERISTICS.

1–7. The internal voltmeter input impedance is 1.5 Meg Ohms. The meter is capable of measuring dc potentials from 0 to ±45 volts.

SECTION II
REMOVAL AND INSTALLATION

2-1. INTRODUCTION.

2-2. This section provides removal and installation procedures for the FX-50/E metering circuit board assembly.

2-3. REMOVAL AND INSTALLATION PROCEDURES.

2-4. REMOVAL PROCEDURE.

2-5. **REQUIRED EQUIPMENT.** The following equipment is required to remove the metering circuit board assembly.

A. Flat tip screwdriver, 4 inch (10.16 cm) blade with 1/4 inch tip.

B. Number 2 Phillips screwdriver, 4 inch (10.16 cm) blade.

C. Number 1 Phillips screwdriver, 4 inch (10.16 cm) blade.

2-6. **PROCEDURE.** The removal of the metering circuit board assembly requires the exciter be placed on a suitable work surface. To remove the metering circuit board assembly, refer to Figure 2-1 and proceed as follows:

WARNING ***DISCONNECT THE PRIMARY POWER FROM THE EXCITER BEFORE PROCEEDING.***

WARNING

A. Disconnect the primary power from the exciter.

B. Remove the FX-50 top-cover and disconnect P14 from the metering circuit board.

C. Remove the two front-panel mounting screws on each side of the chassis.

D. Remove the four front-panel mounting screws on the underside of the chassis and lower the front-panel.

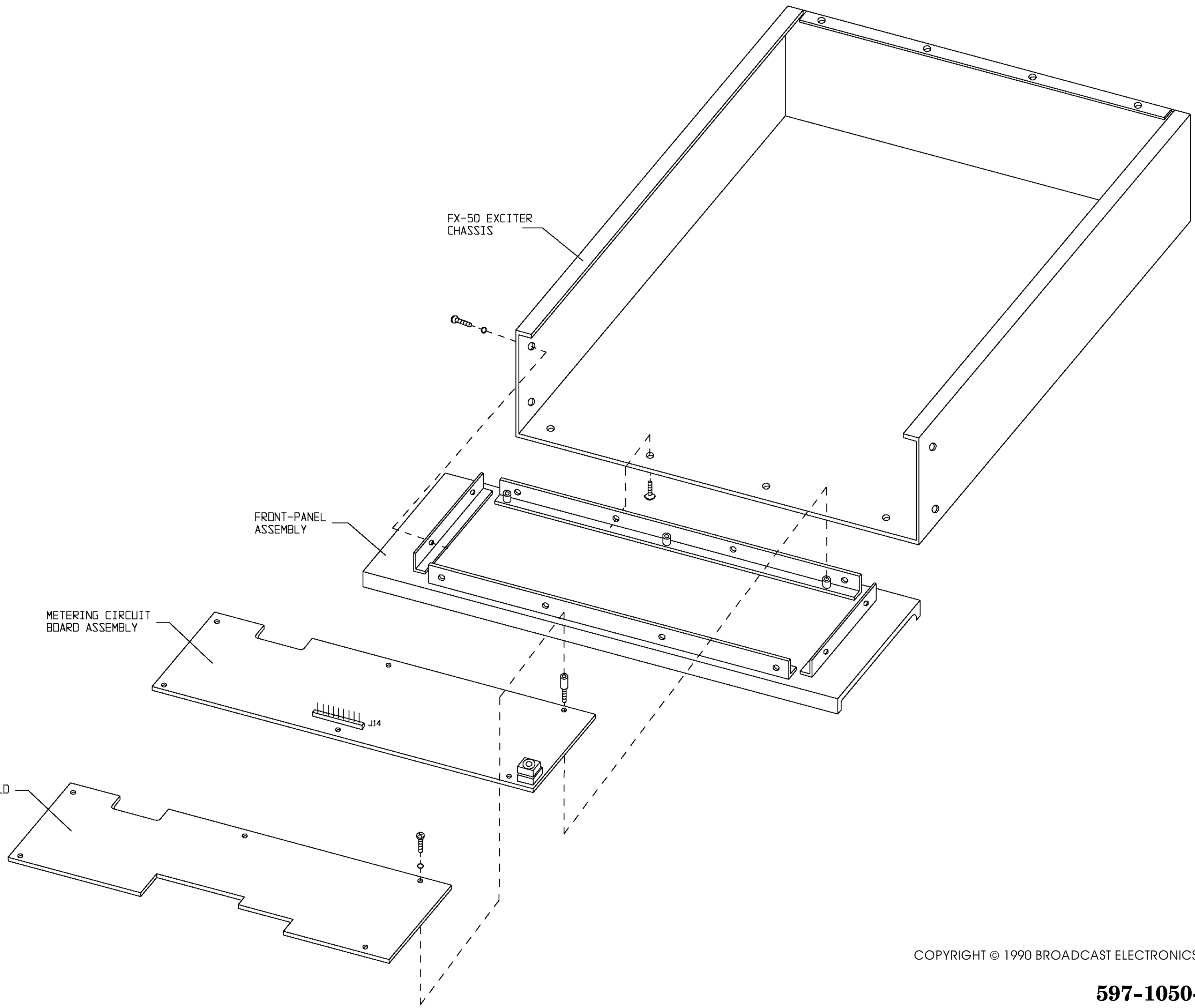
E. Remove the five screws securing the shield to the circuit board assembly.

F. Remove the five stand-offs and one screw securing the circuit board assembly to the front-panel.

G. Lift the circuit board assembly from the front-panel by applying light pressure on the multimeter function switches.

2-7. INSTALLATION PROCEDURE.

2-8. To install the metering circuit board assembly after repairs have been completed, proceed as follows:



597-1050-12

FIGURE 2-1. METERING CIRCUIT BOARD REMOVAL AND INSTALLATION DIAGRAM

WARNING ***DISCONNECT THE PRIMARY POWER FROM THE EXCITER BEFORE PROCEEDING.***

WARNING

A. Disconnect the primary power from the exciter.

B. Follow the REMOVAL PROCEDURE in reverse order.

SECTION III
THEORY OF OPERATION

3-1. INTRODUCTION.

3-2. This section presents the theory of operation for the FX-50/E metering circuit board.

3-3. FUNCTIONAL DESCRIPTION.

3-4. The metering circuit board contains four circuits. A simplified schematic diagram of the metering circuit board is presented in Figure 3-1. Refer to Figure 3-1 as required for a description of the following circuits.

A. Status Indicator Circuits

B. Multimeter Circuit

C. Modulation Display Circuit

D. Voltage Regulator Circuits

3-5. STATUS INDICATOR CIRCUITS.

3-6. The metering circuit board contains seven LEDs to provide exciter status indications. DS2 through DS4 will illuminate to indicate the presence of +20V, -20V, and +5V primary operating potentials. DS5 through DS8 will illuminate to indicate frequency lock, RF amplifier malfunction, excessive VSWR, and excessive RF amplifier temperature.

3-7. MULTIMETER CIRCUIT.

3-8. The multimeter circuit and LCD display provides a visual indication of five exciter steady state operating parameters. Meter function switches S1 through S6 are routed directly to the input of meter function encoder U9. When a function switch is depressed, a momentary HIGH is input to U9.

3-9. U9 will generate a three digit BCD code to the input of meter function latch U10 and a HIGH to one shot U8A. U8A outputs a momentary LOW to the clock input of U10 which latches the information and routes the BCD code to the input of meter function/input switch decoder U11.

3-10. U11 will decode the information and output logic HIGHs to operate the appropriate input switch(es) for the selected meter function. These HIGHs are also routed to indicator decoder/driver U12 and the decimal point locator logic. U12 outputs a LOW to illuminate a function indicator and appropriate unit of measure indicator (Watts, Amps, or Volts).

3-11. **FWD/RFL METER OPERATION.** When the forward or reflected power meter function is selected, input switches U6A and U3A or U3B will operate and route a sample voltage to the input of amplifier U4A. This sample voltage is non-linear. However, U4A output is maintained linear by a resistor/diode linearization network in combination with feedback resistor R16.

3-12. The linear output of U4A is routed through input switch U6A to A/D converter/display driver U7. U7 converts the analog voltage to digital information by activating the appropriate display segment control lines to DS12. LCD meter display DS12 will indicate a value as numerical characters.

3–13. A/D converter/display driver U7 also routes information to a decimal point locator logic circuit consisting of U13B, U13C, and U13D. With information from U11 and U7, this circuit will position the decimal point within the displayed value.

3–14. Test point TP2 is employed to determine the condition of the LCD display. When +5 volts is applied to TP2, U7 will activate all segment control lines which illuminates all DS12 display segments.

3–15. Meter calibration control R56 is provided to adjust the multimeter for an accurate indication in the test meter mode of operation.

3–16. **PAV METER OPERATION.** When the PA voltage function is selected, input switch U6B will operate and route a sample voltage to the input of A/D converter/display driver U7.

3–17. **PAI METER OPERATION.** The PAI meter circuit utilizes two voltage–to–current converter circuits. The first consists of integrated circuit U5B, current amplifier Q2, resistors R6, R7, and meter shunt R62/R63 (located on the power/supply control circuit board).

3–18. When PA current flows, a voltage is developed across R62/R63 and routed to the input of U5B through R6. The output of U5B is routed to amplifier Q2 which applies feedback to the inverting input of U5B to maintain circuit stabilization. The amplified current through Q2 will develop a voltage across R7 in proportion to the collector current for application to a second converter.

3–19. The second converter consists of integrated circuit U5A, current amplifier Q3, resistors R8, R47, and input switch U6C. The operation of this circuit is similar to the previous circuit with the following exception. The voltage developed across Q3 collector resistor R47 is routed to the A/D converter/display driver through input switch U6C.

3–20. **AFC METER OPERATION.** When the AFC voltage meter function is selected, input switch U6D will operate and route a sample voltage to the input of A/D converter/display driver U7.

3–21. **TEST METER OPERATION.** When the test meter function is selected, input switch U3C will operate and route test probe potentials to the input of U7 through buffer U4B.

3–22. **METER FUNCTION PRESET CIRCUIT.** A meter function preset circuit consisting of resistor R61, capacitor C32, transistor switch Q4, and one shot U8B automatically selects the forward power meter function when exciter primary power is applied. Q4 will output a LOW to U8B as C32 charges through R61. U8B outputs a momentary HIGH to forward power meter function switch S1 and the input of meter function encoder U9.

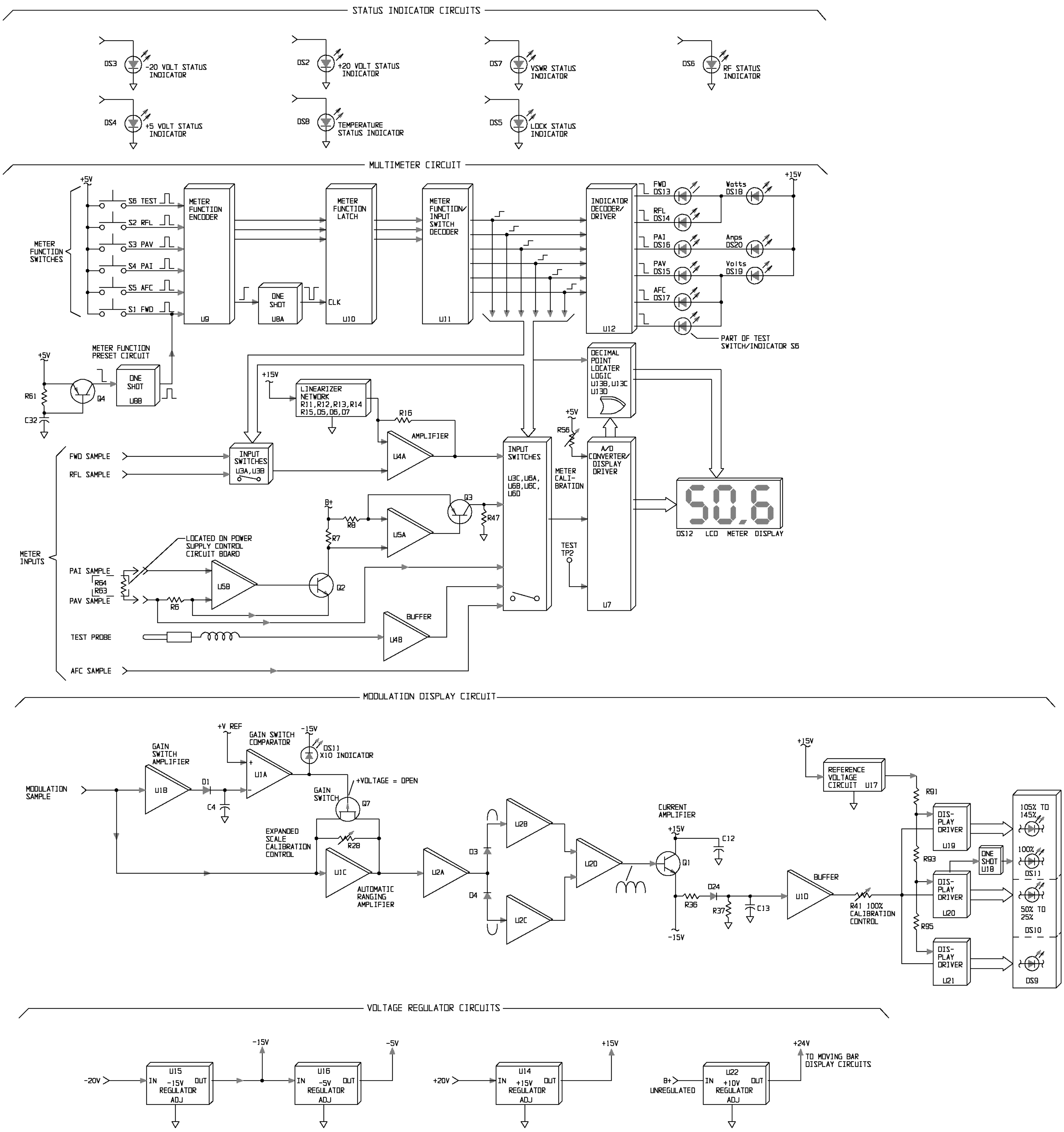
3–23. **MODULATION DISPLAY CIRCUIT.**

3–24. The modulation display circuit and moving bar LED display provides a visual indication of the modulation percentage. A sample of the audio signal is input to gain switch amplifier U1B and automatic ranging amplifier U1C. Gain switch Q7 is normally closed for high levels of audio signal.

3–25. With Q7 closed, U1C operates as an inverting unity gain amplifier. The output of U1C is applied to a precision rectifier and meter ballistics circuit. This circuit consists of integrated circuit U2, diodes D3 and D4, and transistor Q1 and associated components.

3–26. The positive excursions of the signal at the output of U2A are applied to buffer U2B through diode D3. The negative excursions are applied to buffer U2C through diode D4. The output of U2B and U2C are routed to U2D which differentially amplifies the full–wave rectified signal.

3–27. The output of U2D is applied to current amplifier Q1 which transfers the positive charge on capacitor C12 to C13 through resistor R36 and diode D24. The rate at which the charge is transferred is determined by R36. C13 discharges through R37 at a slower rate to provide the display with a gradual decay time and a rapid rise time.



597-1050-13

FIGURE 3-1. SIMPLIFIED SCHEMATIC

BROADCAST ELECTRONICS INC

3–28. The signal at capacitor C13 is routed to display drivers U19, U20, and U21 through buffer U1D and 100% calibration control R41. Each display driver contains a resistive ladder network and comparator circuits which sequentially activate output lines in direct proportion to the input voltage. Integrated circuit U17, resistors R91, R93, and R95 provide a reference voltage for the display drivers.

3–29. The output lines of the display drivers are connected to LED displays DS9, DS10, and DS11 which illuminate when the lines are activated. An output line from U20 is routed to one shot U18 which generates a one second pulse to illuminate the 100% LED.

3–30. **AUTOMATIC RANGING CIRCUIT OPERATION.** The automatic ranging circuit provides expanded scale meter indication for low level modulation signals. During low level signal conditions, the output of gain switch amplifier U1A insufficiently charges capacitor C4 through diode D1.

3–31. This minimal charge on C4 is applied to gain switch comparator U1B which outputs a positive voltage to bias gain switch Q7 OFF and illuminate indicator DS11. With Q7 OFF (open), expanded scale calibration control R28 operates as a feedback resistor for automatic ranging amplifier U1C. This converts the circuit into an inverting amplifier with a gain of 10.

3–32. **VOLTAGE REGULATOR CIRCUITS.**

3–33. The metering circuit board contains four voltage regulator circuits which convert the FX–50/E primary operating voltages to potentials required for circuit board operation. All regulators are equipped with overload protection, thermal overload protection, and current limiting circuits.

3–34. Voltage regulator circuit U15 converts a –20 volt potential into a –15 volt source. This –15 volts is also applied to the input of regulator circuit U16 which provides a –5 volt potential. Voltage regulator circuit U14 converts a +20 volt potential into a +15 volt source. Finally, voltage regulator circuit U22 converts the +30 volt unregulated voltage (B+) to provide a +24 volt potential.

SECTION IV
MAINTENANCE

4-1. INTRODUCTION.

4-2. This section provides maintenance information, electrical adjustment procedures and troubleshooting information for the metering circuit board assembly.

4-3. MAINTENANCE.

4-4. ELECTRICAL ADJUSTMENTS.

4-5. **REQUIRED EQUIPMENT.** The following tools and equipment are required for electrical adjustment procedures.

A. Insulated adjustment tool, shipped with the exciter (P/N 407-0083).

B. Digital voltmeter, Fluke 75 or equivalent.

C. Low distortion audio generator.

D. Calibrated oscilloscope.

4-6. **METER CALIBRATE CONTROL (R56).** Potentiometer R56 on the metering circuit board adjusts the multimeter circuitry for an accurate indication in the test meter mode. To adjust R56, refer to Figure 4-1 as required and proceed as follows.

4-7. **Procedure.** To adjust meter calibration control R56, proceed as follows:

WARNING ***DISCONNECT THE PRIMARY POWER TO THE EXCITER BEFORE PROCEEDING.***
WARNING

A. Disconnect the exciter primary power.

B. Remove the top-cover. Connect an external voltmeter and exciter test probe to test point TP1 (+5V).

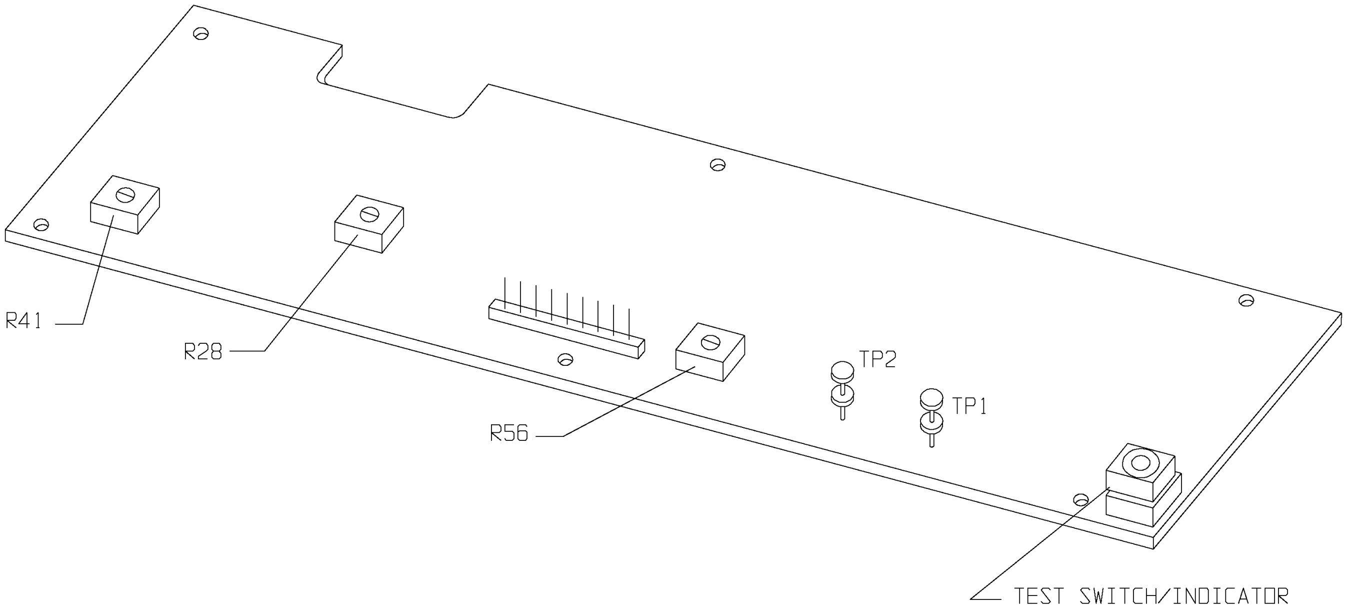
C. Apply exciter primary power and operate the test switch/indicator on the metering circuit board to illuminate the switch/indicator.

WARNING ***DO NOT TOUCH ANY COMPONENT WITHIN THE EXCITER WITH POWER APPLIED.***
WARNING

D. With an insulated adjustment tool, adjust R56 until the front-panel and external meter indications are equal.

WARNING ***DISCONNECT THE PRIMARY POWER TO THE EXCITER BEFORE PROCEEDING.***
WARNING

E. Disconnect the power to the exciter, remove the test equipment, replace the test probe in the clip provided, and replace the top-cover.



597-1050-14

FIGURE 4-1. METERING CIRCUIT BOARD CONTROLS AND TEST POINTS

4-8. **DISPLAY CALIBRATE (R41) AND X10 CALIBRATE (R28) CONTROLS.** Display calibrate control R41 and X10 calibrate control R28 on the metering circuit board must be adjusted in proper sequence. R41 and R28 are adjusted as follows.

4-9. **Procedure.** To adjust R41 and R28, refer to Figure 4-1 as required and proceed as follows:

A. Remove the top-cover and connect an audio generator to the front-panel COMPOSITE IN connector.

B. Connect an oscilloscope to the front-panel COMPOSITE OUT connector.

C. Adjust the audio generator for 400 Hz at 6 volts peak-to-peak (2.12V RMS) as indicated on the oscilloscope.

WARNING ***DO NOT TOUCH ANY COMPONENT WITHIN THE EXCITER WITH POWER APPLIED.***

WARNING

D. With an insulated adjustment tool, adjust R41 fully counterclockwise, then clockwise until the 100% modulation indicator just illuminates.

E. Adjust the audio generator for 0.6V peak-to-peak (0.212V RMS). The front-panel X10 indicator will illuminate.

WARNING ***DO NOT TOUCH ANY COMPONENT WITHIN THE EXCITER WITH POWER APPLIED.***

WARNING

F. With an insulated adjustment tool, adjust R28 fully counterclockwise, then clockwise until the 100% modulation indicator just illuminates.

G. Remove all test equipment and replace the top–cover.

4–10. **TROUBLESHOOTING.**

4–11. The troubleshooting philosophy for the metering circuit board consists of isolating a problem to a specific circuit. The problem may be further isolated by referencing the following information and Table 4–1 which presents troubleshooting information for the metering circuit board.

WARNING ***DISCONNECT THE POWER FROM THE EXCITER BEFORE REMOVING OR REPLACING ANY COMPONENTS.***

WARNING

CAUTION ***INADVERTENT CONTACT BETWEEN ADJACENT COMPONENTS AND CIRCUIT TRACES MAY DAMAGE THE METERING CIRCUIT BOARD.***

CAUTION

4–12. After the problem is isolated and power is totally deenergized, refer to the schematic diagrams and the theory of operation to facilitate in problem resolution. The defective circuitry may be repaired locally or the circuit board may be returned to Broadcast Electronics, Inc. for repair or replacement.

TABLE 4-1. METERING CIRCUIT BOARD TROUBLESHOOTING
(Sheet 1 of 2)

SYMPTOM	DEFECT/REMEDY
NO MODULATION AND MULTIMETER DISPLAY	1. Check the +15V regulator circuit U14.
	2. Check the –15V regulator circuit U15.
	3. Check the –5V regulator circuit U16.
NO MODULATION DISPLAY	1. Check the +24V regulator circuit U22.
	2. Check integrated circuit U1C.
	3. Check integrated circuit U2 and associated components.
	4. Check transistor Q1 and associated components.
NO 100% MODULATION INDICATOR	1. Check integrated circuit U18.
	2. Check transistors Q5 and Q6.

TABLE 4-1. METERING CIRCUIT BOARD TROUBLESHOOTING
(Sheet 2 of 2)

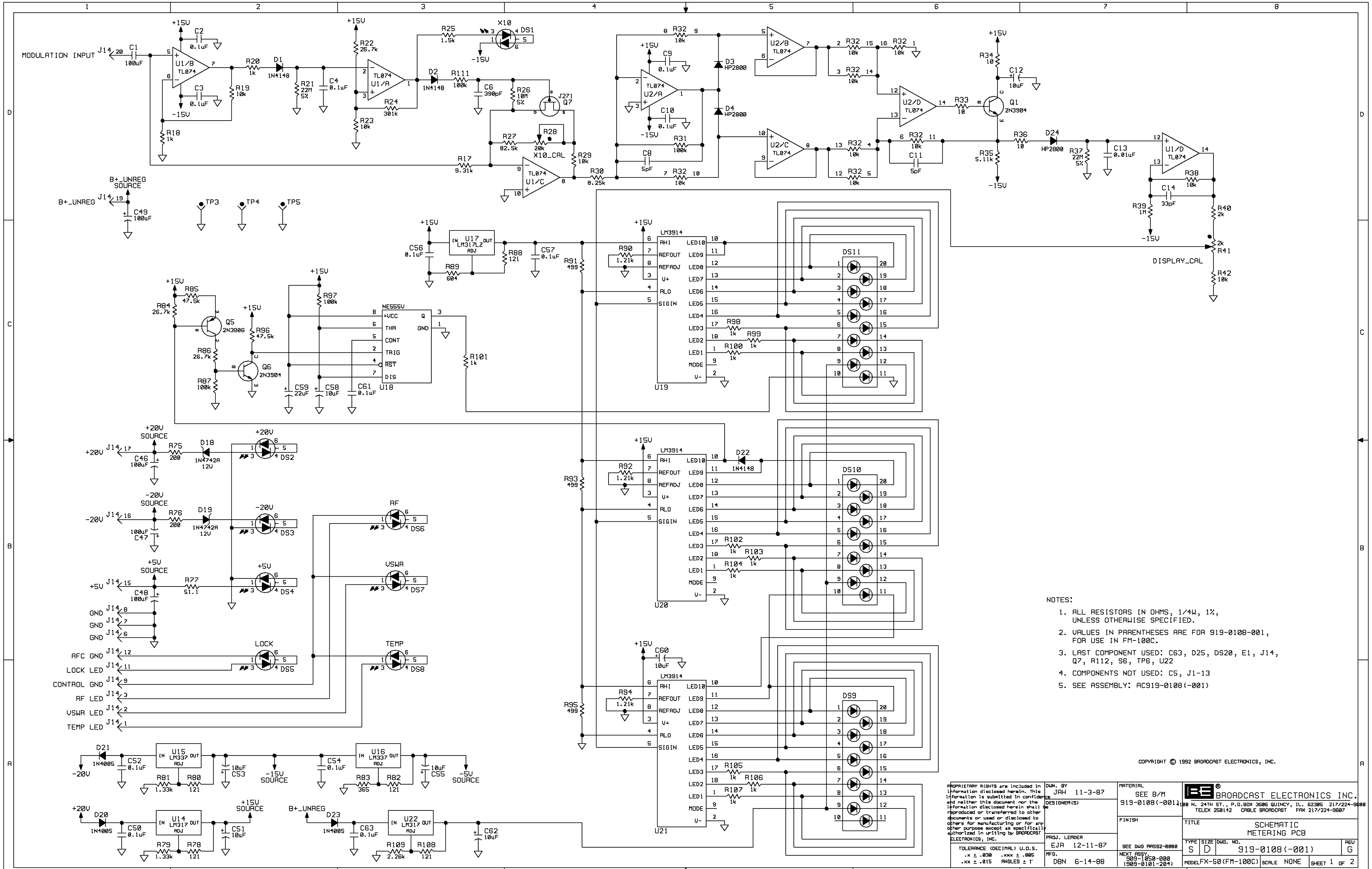
SYMPTOM	DEFECT/REMEDY
ENTIRE MODULATION DISPLAY IS ILLUMINATED	1. Check +7.5V reference voltage circuit U17.
NO X10 METER INDICATOR	1. Check X10 indicator DS1.
NO EXPANDED SCALE METER OPERATION	1. Check FET switch Q7 and associated components.
NO X10 METER INDICATOR AND EXPANDED SCALE METER OPERATION	1. Check integrated circuit U1A/U1B and associated components.
NO 5% TO 50% METER INDICATORS	1. Check display DS10.
	2. Check display driver U20.
NO MULTIMETER FUNCTION SWITCH OPERATION	1. Check integrated circuit U8A.
	2. Check integrated circuit U9.
	3. Check integrated circuit U10.
	4. Check integrated circuit U11.
NO PAV MULTIMETER FUNCTION	1. Check PAV switch S3.
	2. Check input switch U6B.
NO FWD POWER FUNCTION SELECTED WHEN PRIMARY POWER IS APPLIED	1. Check integrated circuit U8B.
	2. Check transistor Q4 and associated components.
NO MULTIMETER FUNCTION AND UNIT MEASURE INDICATORS	1. Check integrated circuit U12.
NO FWD POWER METER INDICATION	1. Check input switch U3A.
NO FWD AND RFL POWER METER INDICATION	1. Check input switch U6A.
	2. Check integrated circuit U4A and associated components.
NO LCD DISPLAY	1. Check integrated circuit U7.
	2. Check display DS12.

SECTION V
DRAWINGS

5-1. INTRODUCTION.

5-2. This section provides assembly drawings, wiring diagrams, and schematic diagrams as listed below for the metering circuit board assembly.

FIGURE	TITLE	NUMBER
5-1	METERING CIRCUIT BOARD SCHEMATIC DIAGRAM	SD919-0108/ -001
5-2	METERING CIRCUIT BOARD ASSEMBLY DIAGRAM	AD919-0108/ -001
5-3	METERING CIRCUIT BOARD COMPONENT LOCATOR	597-1050-71


MODULATION INPUT
B+_UNREG SOURCE
B+_UNREG
TP3
TP4
TP5
X10_CAL
DISPLAY_CAL
+20V SOURCE
-20V SOURCE
+5V SOURCE
+20V
-20V
+5V
GND
AFC GND
LOCK LED
CONTROL GND
RF LED
VSWR LED
TEMP LED
RF
VSWR
LOCK
TEMP
-15V SOURCE
-5V SOURCE
+15V SOURCE
NOTES:
1. ALL RESISTORS IN OHMS, 1/4W, 1%, UNLESS OTHERWISE SPECIFIED.
2. VALUES IN PARENTHESES ARE FOR 919-0108-001, FOR USE IN FM-100C.
3. LAST COMPONENT USED: C63, D25, DS20, E1, J14, Q7, R112, S6, TP6, U22
4. COMPONENTS NOT USED: C5, J1-13
5. SEE ASSEMBLY: AC919-0108(-001)
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TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°
DWN. BY JAH 11-3-87
DESIGNER(S)
PROJ. LEADER EJA 12-11-87
MFG. DBN 6-14-88
MATERIAL SEE B/M 919-0108(-001)
FINISH
SEE DWG AA592-0000
NEXT ASSY. 909-1050-000 (909-0101-204)
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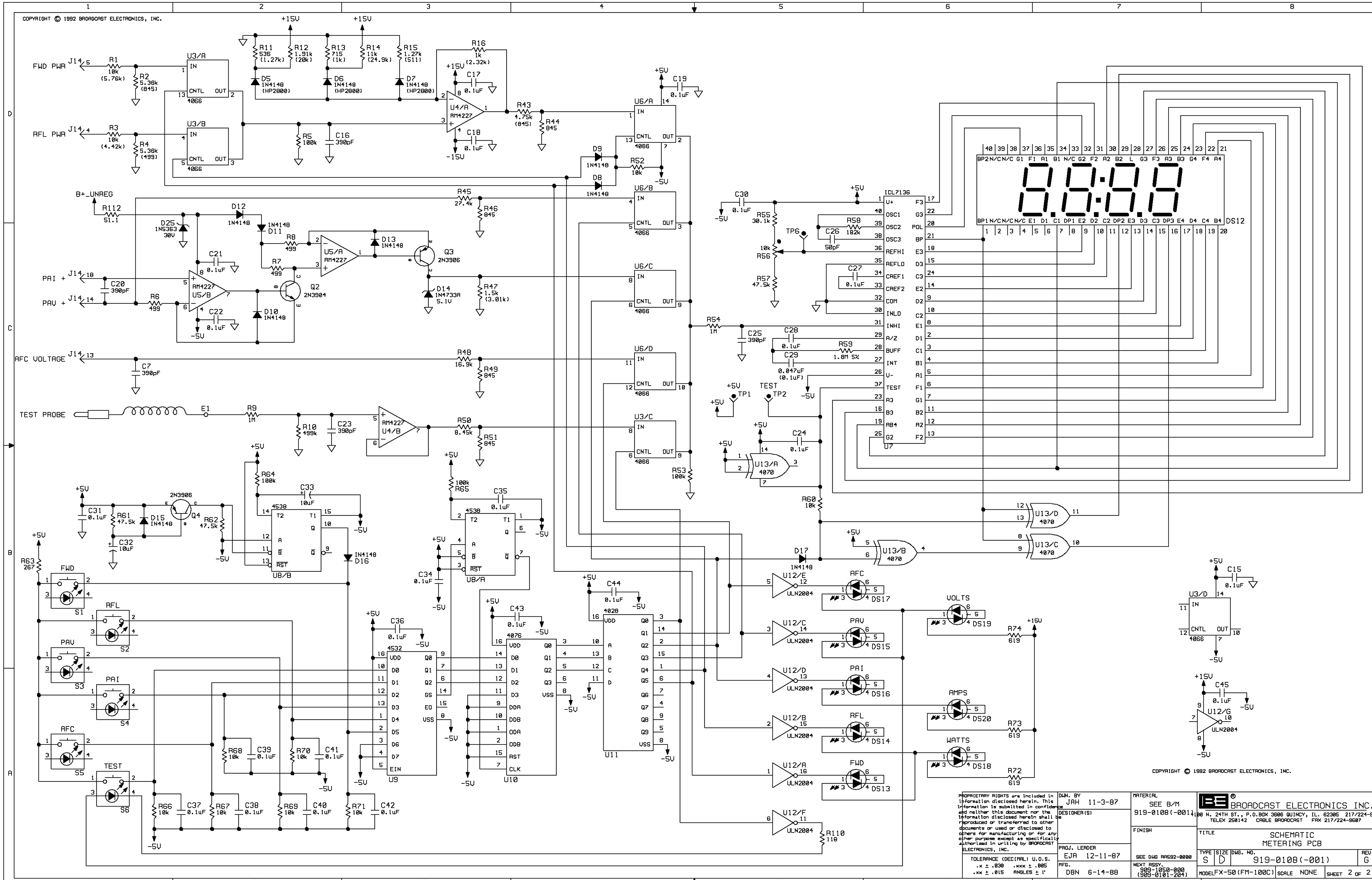
4100 N. 24TH ST., P.O.BOX 3606 QUINCY, IL. 62305 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607
TITLE SCHEMATIC METERING PCB
TYPE S SIZE D DWG. NO. 919-0108(-001) REV G
MODEL FX-50(FM-100C) SCALE NONE SHEET 1 OF 2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FWD PWR
RFL PWR
B+_UNREG
PAI +
PAV +
AFC VOLTAGE
TEST PROBE
ICL7136
FWD
RFL
PAV
PAI
AFC
TEST
VOLTS
AMPS
WATTS
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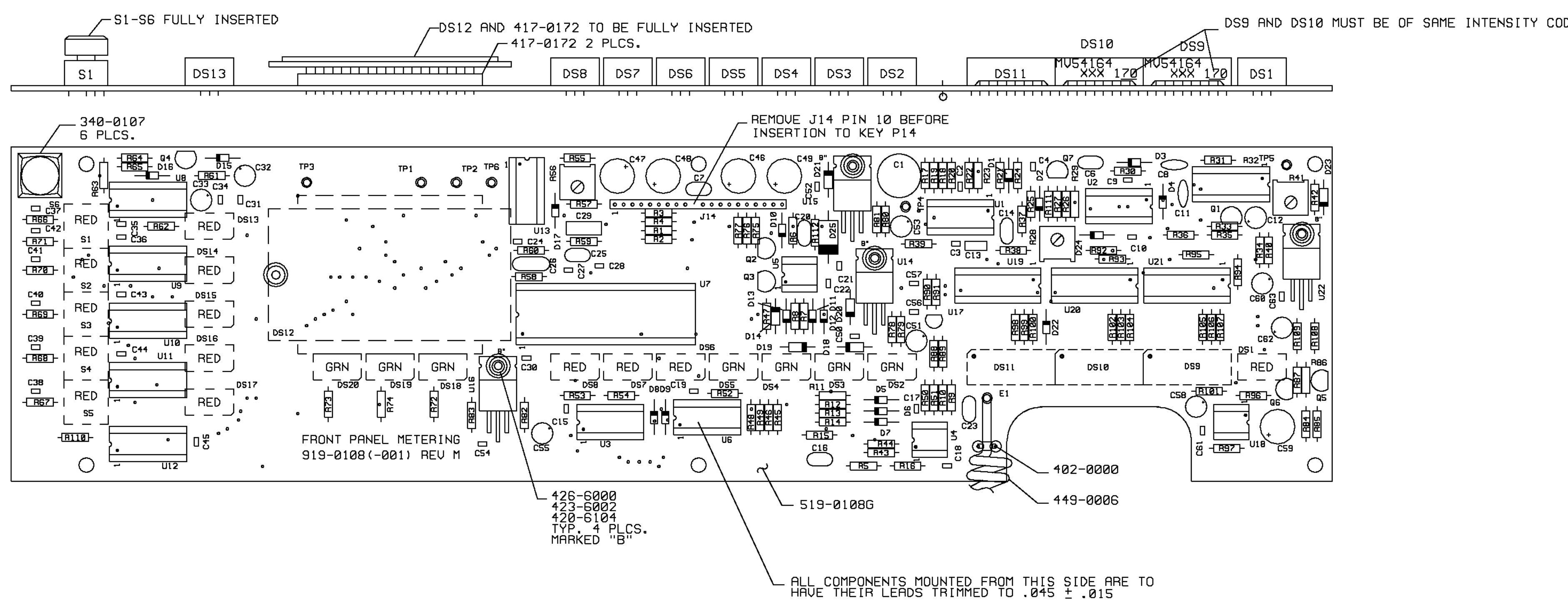
TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°
DWN. BY JAH 11-3-87
DESIGNER(S)
PROJ. LEADER EJA 12-11-87
MFG. DBN 6-14-88
MATERIAL SEE B/M 919-0108(-001)
FINISH
SEE DWG AA592-0000
NEXT ASSY. 909-1050-000 (909-0101-204)
BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O.BOX 3606 QUINCY, IL. 62305 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607
TITLE SCHEMATIC METERING PCB
TYPE S
SIZE D
DWG. NO. 919-0108(-001)
REV G
MODEL FX-50(FM-100C)
SCALE NONE
SHEET 2 OF 2



TOLERANCE (DECIMAL) U.O.S.
.X ± .030 .XXX ± .005
.XX ± .015 ANGLES ± 1°

DWN. BY KLS 10-13-87	MATERIAL SEE B/M 919-0108 919-0108-001	BROADCAST ELECTRONICS INC. 4100 N.24TH ST. P.O.BOX 3606 QUINCY,IL. 62305 PH. 217/224-9600 TELEX 250142 CABLE BROADCAST FAX 217/224-9607	
CHKD MH 6-14-88			
ME JHS 6-20-88	FINISH	TITLE PCB ASSEMBLY FRONT PANEL METERING BD	
PROJ. ENGR. EJA 6-13-88	SEE DWG AA592-0000	TYPE A SIZE C DWG No. 919-0108 919-0108-001	REV M
MFG. DBN 6-14-88	NEXT ASSY.	MODEL FX-50 FM-100C SCALE 1=1	SHEET 1 OF 1

REF	ZONE	REF	ZONE	REF	ZONE	REF	ZONE	REF	ZONE	REF	ZONE	REF	ZONE	REF	ZONE
C1	C6	C49	C5	DS8	B4	R24	C6	R71	C1	S6	C1				
C2	C6	C50	B5-B6	DS9	B7-B8	R25	C6	R72	B3	TP1	C3				
C3	C6	C51	B6	DS10	B7	R26	C7	R73	B3	TP2	C3-C4				
C4	C6	C52	C5	DS11	B6-B7	R27	C7	R74	B3	TP3	C3				
C6	C7	C53	C6	DS12	B2-C2,	R28	C7	R75	C5	TP4	C6				
C7	C5	C54	B3-B4		B3-C3,	R29	C7	R76	C5	TP5	C8				
C8	C7	C55	B4		B4-C4	R30	C7	R77	C5	U1	C6				
C9	C7	C56	B6	DS13	C2	R31	C7-C8	R78	B6	U2	C7				
C10	C7	C57	C6	DS14	C2	R32	C7-C8	R79	B6	U3	B4				
C11	C7	C58	B7	DS15	B2	R33	C7-C8	R80	C6	U4	B6				
C12	C8	C59	B8	DS16	B2	R34	C8	R81	C6	U5	C5				
C13	C6	C60	C8	DS17	B2	R35	C7-C8	R82	B4	U6	B5				
C14	C6	C61	B7	DS18	B3	R36	C7	R83	B3	U7	B4-B5,				
C15	B4	C62	B8	DS19	B3	R37	C6	R84	B8		C4-C5				
C16	B5	C63	B8-C8	DS20	B3	R38	C6	R85	B8	U8	C1-C2				
C17	B6	D1	C6	E1	B6	R39	C6	R86	B8	U9	C1-C2				
C18	B6	D2	C7	J14	C4-C5	R40	C8	R87	B8	U10	B1-B2				
C19	B5	D3	C7	Q1	C8	R41	C8	R88	B6	U11	B1-B2				
C20	C5	D4	C7	Q2	C5	R42	C8	R89	B6	U12	B1-B2				
C21	C5	D5	B6	Q3	C5	R43	B6	R90	B6-C6	U13	C4				
C22	C5	D6	B6	Q4	C2	R44	B6	R91	B6-C6	U14	B6-C6				
C23	B6	D7	B6	Q5	B8	R45	B5	R92	C7	U15	C5-C6				
C24	C4	D8	B4	Q6	B8	R46	B5	R93	C7	U16	B3-B4				
C25	C4	D9	B4	Q7	C7	R47	B5	R94	C8	U17	B6				
C26	C4	D10	C5	R1	C4	R48	B5	R95	C7	U18	B7-B8				
C27	C4	D11	B5	R2	C4	R49	B5	R96	B8	U19	B6-C6				
C28	C4	D12	B5	R3	C4	R50	B6	R97	B7-B8	U20	B7-C7				
C29	C4	D13	B5	R4	C4	R51	B6	R98	B6	U21	B7-C7				
C30	B4	D14	B5	R5	B6	R52	B5	R99	B6	U22	C8				
C31	C2	D15	C2	R6	C5	R53	B4	R100	B6						
C32	C2	D16	C2	R7	B5	R54	B4	R101	B7						
C33	C2	D17	C4	R8	B5	R55	C4	R102	B7						
C34	C2	D18	B5-B6	R9	B6	R56	C4	R103	B7						
C35	C2	D19	B5	R10	B6	R57	C4	R104	B7						
C36	C2	D20	B5	R11	B5	R58	C4	R105	B7						
C37	C1	D21	C5	R12	B5	R59	C4	R106	B7						
C38	B1	D22	B7	R13	B5	R60	C4	R107	B7						
C39	B1	D23	C8	R14	B5	R61	C2	R108	B8						
C40	B1	D24	C7	R15	B5	R62	C2	R109	B8						
C41	C1	D25	C5	R16	B6	R63	C1	R110	B1						
C42	C1	DS1	B8	R17	C6	R64	C2	R111	C7						
C43	C2	DS2	B6	R18	C6	R65	C2	R112	C5						
C44	B2	DS3	B5-B6	R19	C6	R66	C1	S1	C1						
C45	B2	DS4	B5	R20	C6	R67	B1	S2	C1						
C46	C5	DS5	B5	R21	C6	R68	B1	S3	B1-C1						
C47	C4	DS6	B4-B5	R22	C6	R69	B1	S4	B1						
C48	C4-C5	DS7	B4	R23	C6	R70	C1	S5	B1						

FIGURE 5-3. METERING CIRCUIT BOARD COMPONENT LOCATORS

SECTION VI
REPLACEMENT PARTS

6-1. INTRODUCTION.

6-2. This section provides descriptions and part numbers of electrical components, assemblies, and selected mechanical parts required for maintenance of the metering circuit board assembly. Each table entry in this section is indexed by reference designators appearing on the applicable schematic diagram.

TABLE	TITLE	NUMBER	PAGE
6-1	METERING CIRCUIT BOARD ASSEMBLY	919-0108	16

TABLE 6-1. METERING CIRCUIT BOARD ASSEMBLY - 919-0108
(Sheet 1 of 5)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1	Capacitor, Electrolytic, 100 uF, 50V	020-1085	1
C2,C3,C4	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	3
C6,C7	Capacitor, Mica, 390 pF ±5%, 100V	042-3922	2
C8	Capacitor, Ceramic, 5 pF ±5%, 500V, NPO	001-5004	1
C9,C10	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	2
C11	Capacitor, Ceramic, 5 pF ±5%, 500V, NPO	001-5004	1
C12	Capacitor, Electrolytic, 10 uF, 35V	023-1076	1
C13	Capacitor, Mylar, 0.01 uF ±10%, 100V	031-1043	1
C14	Capacitor, Mica, 33 pF ±5%, 500V	042-3312	1
C15	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	1
C16	Capacitor, Mica, 390 pF ±5%, 100V	042-3922	1
C17,C18,C19	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	3
C20	Capacitor, Mica, 390 pF ±5%, 100V	042-3922	1
C21,C22	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	2
C23	Capacitor, Mica, 390 pF ±5%, 100V	042-3922	1
C24	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	1
C25	Capacitor, Mica, 390 pF ±5%, 100V	042-3922	1
C26	Capacitor, Mica, 50 pF ±5%, 500V	040-5013	1
C27,C28	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	2
C29	Capacitor, Mylar Film, 0.047 uF ±10%, 100V	030-4743	1
C30,C31	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	2
C32,C33	Capacitor, Electrolytic, 10 uF, 35V	023-1076	2
C34 THRU C45	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	12
C46 THRU C49	Capacitor, Electrolytic, 100 uF, 35V	023-1084	4
C50	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	1
C51	Capacitor, Electrolytic, 10 uF, 35V	023-1076	1

TABLE 6-1. METERING CIRCUIT BOARD ASSEMBLY - 919-0108
(Sheet 2 of 5)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C52	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	1
C53	Capacitor, Electrolytic, 10 uF, 35V	023-1076	1
C54	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	1
C55	Capacitor, Electrolytic, 10 uF, 35V	023-1076	1
C56,C57	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	2
C58	Capacitor, Electrolytic, 10 uF, 35V	023-1076	1
C59	Capacitor, Electrolytic, 22 uF, 50V	024-2274	1
C60	Capacitor, Electrolytic, 10 uF, 35V	023-1076	1
C61	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	1
C62	Capacitor, Electrolytic, 10 uF, 35V	023-1076	1
C63	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	1
D1,D2	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	2
D3,D4	Diode, HP5082-2800, High Voltage, Schottky Barrier Type, 70V, 15 mA	201-2800	2
D5 THRU D13	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	9
D14	Diode, Zener, 1N4733A, 5.1V ±5%, 1W	200-4733	1
D15,D16,D17	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	3
D18,D19	Diode, Zener, 1N4742A, 12V ±5%, 1W	200-4742	2
D20,D21	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203-4005	2
D22	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	1
D23	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203-4005	1
D24	Diode, HP5082-2800, High Voltage, Schottky Barrier Type, 70V, 15 mA	201-2800	1
D25	Diode, Zener, 1N5363, 30V ±10%, 5W	200-5363	1
DS1	LED, Red, MV57173, Light Intensity G	320-0017	1
DS2 THRU DS5	LED, Green, MV54173, Light Intensity I	320-0016	4
DS6 THRU DS8	LED, Red, MV57173, Light Intensity G	320-0017	3
DS9,DS10	LED, Green, MV54164, High Efficiency 10-Segment Bar Graph Array	320-4164	2
DS11	LED, Red, MV57164, High Efficiency 10-Segment Bar Graph Array	320-7164	1
DS12	LCD Display, 4-Digit	320-0021	1
DS13 THRU DS17	LED, Red, MV57173, Light Intensity G	320-0017	5
DS18 THRU DS20	LED, Green, MV54173, Light Intensity I	320-0016	3
E1	Terminal, Turret, Double Shoulder	413-1597	1
J14	Receptacle, Male, 20-Pin In-Line	417-0200	1
Q1,Q2	Transistor, 2N3904, NPN, Silicon, TO-92 Case	211-3904	2
Q3 THRU Q5	Transistor, 2N3906, PNP, Silicon, TO-92 Case	210-3906	3
Q6	Transistor, 2N3904, NPN, Silicon, TO-92 Case	211-3904	1
Q7	Field Effect Transistor, J271, P-Channel JFET, TO-92 Case	210-0271	1
R1	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	1
R2	Resistor, 5.36 k Ohm ±1%, 1/4W	103-5364	1
R3	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	1
R4	Resistor, 5.36 k Ohm ±1%, 1/4W	103-5364	1
R5	Resistor, 100 k Ohm ±1%, 1/4W	103-1062	1
R6, R7, R8	Resistor, 499 Ohm ±1%, 1/4W	103-4993	3
R9	Resistor, 1 Meg Ohm ±1%, 1/4W	103-1007	1

TABLE 6-1. METERING CIRCUIT BOARD ASSEMBLY - 919-0108
(Sheet 3 of 5)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R10	Resistor, 499 k Ohm ±1%, 1/4W	103-4996	1
R11	Resistor, 536 Ohm ±1%, 1/4W	103-5363	1
R12	Resistor, 1.91 k Ohm ±1%, 1/4W	103-1914	1
R13	Resistor, 715 Ohm ±1%, 1/4W	100-7132	1
R14	Resistor, 11.0 k Ohm ±1%, 1/4W	103-1105	1
R15	Resistor, 1.27 k Ohm ±1%, 1/4W	103-1274	1
R16	Resistor, 1 k Ohm ±1%, 1/4W	100-1041	1
R17	Resistor, 9.31 k Ohm ±1%, 1/4W	103-9314	1
R18	Resistor, 1 k Ohm ±1%, 1/4W	100-1041	1
R19	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	1
R20	Resistor, 1 k Ohm ±1%, 1/4W	100-1041	1
R21	Resistor, 22 Meg Ohm ±5%, 1/4W	100-2283	1
R22	Resistor, 26.7 k Ohm ±1%, 1/4W	103-2675	1
R23	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	1
R24	Resistor, 301 k Ohm ±1%, 1/4W	103-3061	1
R25	Resistor, 1.5 k Ohm ±1%, 1/4W	103-1504	1
R26	Resistor, 10 Meg Ohm ±5%, 1/4W	100-1083	1
R27	Resistor, 82.5 k Ohm ±1%, 1/4W	103-8255	1
R28	Potentiometer, 20 k Ohm ±10%, 1/2W	177-2054	1
R29	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	1
R30	Resistor, 8.2 k Ohm ±1%, 1/4W	103-8254	1
R31	Resistor, 100 k Ohm ±1%, 1/4W	103-1062	1
R32	Resistor Network, 10-10 k Ohm 0.5% Resistors, 0.7W Total Dissipation, 16-Pin DIP	226-0392	1
R33,R34	Resistor, 10 Ohm ±1%, 1/4W	103-1021	2
R35	Resistor, 5.11 k Ohm ±1%, 1/4W	103-5141	1
R36	Resistor, 10 Ohm ±1%, 1/4W	103-1021	1
R37	Resistor, 22 Meg Ohm ±5%, 1/4W	100-2283	1
R38	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	1
R39	Resistor, 1 Meg Ohm ±1%, 1/4W	103-1007	1
R40	Resistor, 2 k Ohm ±1%, 1/4W	100-2041	1
R41	Potentiometer, 2 k Ohm ±10%, 1/2W	177-2044	1
R42	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	1
R43	Resistor, 4.75 k Ohm ±1%, 1/4W	103-4741	1
R44	Resistor, 845 Ohm ±1%, 1/4W	103-8453	1
R45	Resistor, 27.4 k Ohm ±1%, 1/4W	103-2751	1
R46	Resistor, 845 Ohm ±1%, 1/4W	103-8453	1
R47	Resistor, 1.5 k Ohm ±1%, 1/4W	103-1504	1
R48	Resistor, 16.9 k Ohm ±1%, 1/4W	103-1695	1
R49	Resistor, 845 Ohm ±1%, 1/4W	103-8453	1
R50	Resistor, 8.45 k Ohm ±1%, 1/4W	103-8454	1
R51	Resistor, 845 Ohm ±1%, 1/4W	103-8453	1
R52	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	1
R53	Resistor, 100 k Ohm ±1%, 1/4W	103-1062	1
R54	Resistor, 1 Meg Ohm ±1%, 1/4W	103-1007	1
R55	Resistor, 30 k Ohm ±1%, 1/4W	100-3051	1
R56	Potentiometer, 10 k Ohm ±10%, 1/2W	177-1054	1

TABLE 6-1. METERING CIRCUIT BOARD ASSEMBLY - 919-0108
(Sheet 4 of 5)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R57	Resistor, 47.5 k Ohm ±1%, 1/4W	103-4755	1
R58	Resistor, 182 k Ohm ±1%, 1/4W	103-1826	1
R59	Resistor, 1.8 Meg Ohm ±5%, 1/4W	100-1873	1
R60	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	1
R61,R62	Resistor, 47.5 k Ohm ±1%, 1/4W	103-4755	2
R63	Resistor, 267 Ohm ±5%, 1/4W	103-2673	1
R64,R65	Resistor, 100 k Ohm ±1%, 1/4W	103-1062	2
R66 THRU R71	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	6
R72,R73,R74	Resistor, 619 Ohm ±1%, 1/4W	103-6193	3
R75,R76	Resistor, 200 Ohm ±1%, 1/4W	103-2003	2
R77	Resistor, 51.1 Ohm ±1%, 1/4W	103-5112	1
R78	Resistor, 121 Ohm ±1%, 1/4W	100-1231	1
R79	Resistor, 1.33 k Ohm ±1%, 1/4W	103-1331	1
R80	Resistor, 121 Ohm ±1%, 1/4W	100-1231	1
R81	Resistor, 1.33 k Ohm ±1%, 1/4W	103-1331	1
R82	Resistor, 121 Ohm ±1%, 1/4W	100-1231	1
R83	Resistor, 365 Ohm ±1%, 1/4W	103-3631	1
R84	Resistor, 26.7 k Ohm ±1%, 1/4W	103-2675	1
R85	Resistor, 47.5 k Ohm ±1%, 1/4W	103-4755	1
R86	Resistor, 26.7 k Ohm ±1%, 1/4W	103-2675	1
R87	Resistor, 100 k Ohm ±1%, 1/4W	103-1062	1
R88	Resistor, 121 Ohm ±1%, 1/4W	100-1231	1
R89	Resistor, 604 Ohm ±1%, 1/4W	100-6031	1
R90	Resistor, 1.21 k Ohm ±1%, 1/4W	103-1214	1
R91	Resistor, 499 Ohm ±1%, 1/4W	103-4993	1
R92	Resistor, 1.21 k Ohm ±1%, 1/4W	103-1214	1
R93	Resistor, 499 Ohm ±1%, 1/4W	103-4993	1
R94	Resistor, 1.21 k Ohm ±1%, 1/4W	103-1214	1
R95	Resistor, 499 Ohm ±1%, 1/4W	103-4993	1
R96	Resistor, 47.5 k Ohm ±1%, 1/4W	103-4755	1
R97	Resistor, 100 k Ohm ±1%, 1/4W	103-1062	1
R98 THRU R107	Resistor, 1 k Ohm ±1%, 1/4W	100-1041	10
R108	Resistor, 121 Ohm ±1%, 1/4W	100-1231	1
R109	Resistor, 2.26 k Ohm ±1%, 1/4W	103-2264	1
R110	Resistor, 118 Ohm ±1%, 1/4W	100-1111	1
R111	Resistor, 100 k Ohm ±1%, 1/4W	103-1062	1
R112	Resistor, 51.1 Ohm ±1%, 1/4W	103-5112	1
S1 THRU S6	Switch, Push, Illuminated, S120601H1, Contacts: SPST, N.O., 24V ac at 125 mA Nominal	340-0107	6
TP1 THRU TP6	Terminal, Turret, Double Shoulder	413-1597	6
U1,U2	Integrated Circuit, TLO74CN, Quad JFET-Input Operational Amplifier, 14-Pin DIP	221-0074	2
U3	Integrated Circuit, CD4066BE, Quad Bilateral Switch, CMOS, 14-Pin DIP	225-0004	1

TABLE 6-1. METERING CIRCUIT BOARD ASSEMBLY - 919-0108
(Sheet 5 of 5)

REF. DES.	DESCRIPTION	PART NO.	QTY.
U4,U5	Integrated Circuit, RC4227GNB, Monolithic Dual Operational Amplifier, 8-Pin DIP	221-4227	2
U6	Integrated Circuit, CD4066BE, Quad Bilateral Switch, CMOS, 14-Pin DIP	225-0004	1
U7	Integrated Circuit, ICL7136CPL, 3 1/2 Digit LCD A/D Converter, CMOS IC, 40-Pin DIP	220-7136	1
U8	Integrated Circuit, MC14538B, Dual Retriggerable, Resettable Monostable Multivibrator, CMOS, 16-Pin DIP	228-4538	1
U9	Integrated Circuit, MC14532B, 8-Bit Priority Encoder, CMOS, 16-Pin DIP	228-4532	1
U10	Integrated Circuit, MC14076B, Quad D-Type Register with Three State Outputs, CMOS, 16-Pin DIP	228-4076	1
U11	Integrated Circuit, MC14028BCP, BCD-to-Decimal Decoder, CMOS	228-4028	1
U12	Integrated Circuit, ULN2004, 7 NPN Darlington Driver Pack, 16-Pin DIP	226-2004	1
U13	Integrated Circuit, MC14070B, Quad Exclusive OR Gate, CMOS, 14-Pin DIP	228-4071	1
U14	Integrated Circuit, LM317T, Adjustable Positive Voltage Regulator, 1.2V to 37V, 1.5 Ampere, TO-220 Case	227-0317	1
U15,U16	Integrated Circuit, LM337T, Adjustable Negative Voltage Regulator, 1.2V to 37V, 1.5 Ampere, TO-220 Case	227-0337	2
U17	Integrated Circuit, LM317LZ, Adjustable Positive Voltage Regulator, 1.2 to 37V @ 0.1 Ampere, TO-92 Case	220-0317	1
U18	Integrated Circuit, NE555N, Timer, 8-Pin DIP	229-0555	1
U19,U20,U21	Integrated Circuit, LM3914N, Dot/Bar Display Driver, 18-Pin DIP	229-3914	3
XR32	Socket, 16-Pin DIP	417-1604	1
XU1 THRU XU3	Socket, 14-Pin DIP	417-1404	3
XU4,XU5	Socket, 8-Pin DIP	417-0804	2
XU6	Socket, 14-Pin DIP	417-1404	1
XU7	Socket, 40-Pin DIP	417-4005	1
XU8 THRU XU12	Socket, 16-Pin DIP	417-1604	5
XU13	Socket, 14-Pin DIP	417-1404	1
XU18	Socket, 8-Pin DIP	417-0804	1
XU19 THRU XU21	Socket, 18-Pin DIP	417-1804	3
----	Socket, 20-Pin In-line	417-0172	2
----	Blank, Metering Circuit Board	519-0108	1

MODULATED OSCILLATOR

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LIST OF TABLES

LIST OF ILLUSTRATIONS

SECTION I
GENERAL INFORMATION

1–1. INTRODUCTION.

1–2. This section provides general information and specifications relative to the operation of the modulated oscillator assembly.

1–3. DESCRIPTION.

1–4. The modulated oscillator assembly produces the carrier frequency, frequency modulates the carrier, and amplifies the modulated RF carrier to a level sufficient to drive the RF amplifier assembly. Additional circuitry is interfaced to the AFC/PLL circuit board which operates as a phase–locked loop to maintain the RF carrier center frequency.

1–5. ELECTRICAL CHARACTERISTICS.

1–6. Refer to Table 1–1 for electrical characteristics relative to the modulated oscillator assembly.

TABLE 1-1. ELECTRICAL CHARACTERISTICS

PARAMETER	SPECIFICATION
SIGNAL INPUTS	
MODULATION AND AFC VOLTAGE	35 mV p–p Nominal with 2.0V to 9.0V dc Dependent on the RF Center Frequency.
SIGNAL OUTPUTS	
RF	1 mW at 50 Ohms.
AFC SAMPLE	1 mW at 50 Ohms.

SECTION II
REMOVAL AND INSTALLATION

2–1. **INTRODUCTION.**

2–2. This section provides removal and installation procedures for the modulated oscillator assembly.

2–3. **REMOVAL AND INSTALLATION PROCEDURES.**

2–4. **REMOVAL PROCEDURE.**

2–5. **REQUIRED EQUIPMENT.** A number 2 Phillips screwdriver with a 4 inch (10.16 cm) blade is required to remove the modulated oscillator assembly from the exciter chassis.

2–6. **PROCEDURE.** To remove the modulated oscillator assembly, proceed as follows:

WARNING ***DISCONNECT THE PRIMARY POWER TO THE EXCITER BEFORE PROCEEDING.***

WARNING

A. Disconnect the primary power to the exciter.

B. Remove the exciter top–cover. Disconnect P8 from the AFC/PLL circuit board.

C. Disconnect RF sample connector P6 and RF output connector P9 from the rear of the modulated oscillator assembly.

D. Remove the four screws securing the modulated oscillator assembly to the steel mounting plate. Remove the ground straps.

2–7. **INSTALLATION PROCEDURE.**

2–8. To install the modulated oscillator assembly after repairs have been completed, proceed as follows:

WARNING ***DISCONNECT THE PRIMARY POWER TO THE EXCITER BEFORE PROCEEDING.***

WARNING

A. Disconnect the primary power to the exciter.

B. Follow the REMOVAL PROCEDURE in reverse order.

SECTION III
THEORY OF OPERATION

3-1. INTRODUCTION.

3-2. This section presents the theory of operation for the exciter modulated oscillator assembly.

3-3. FUNCTIONAL DESCRIPTION.

3-4. MECHANICAL ASSEMBLY.

3-5. The modulated oscillator circuit board is enclosed in a cast aluminum housing which is secured to a heavy steel plate. Mechanical vibrations are reduced by a foam rubber pad between the steel plate and the chassis. The increased mass of the assembly also lowers the mechanical resonance below the frequency of vibrations from external sources.

3-6. In addition, a foam rubber pad attached to the inside top-cover restricts movement of circuit board components to reduce mechanically introduced noise modulation and increase the frequency stability of the oscillator.

3-7. ELECTRICAL DESCRIPTION.

3-8. Figure 3-1 presents a simplified schematic diagram of the modulated oscillator circuit board. Refer to Figure 3-1 as required for a description of the following circuits.

A. Modulator/Oscillator

B. Buffers and Output Amplifier

C. Power Supply

3-9. **MODULATOR/OSCILLATOR.** The oscillator section is a modified Colpits configuration consisting of transistor Q2, inductors L3 and L2, capacitors C1 and C2, and varactor diodes D1 through D8. C2 provides positive feedback to sustain oscillation. Tuning is accomplished by the 2V to 9V (dependent upon the carrier frequency) potential applied to the varactor diodes from the AFC/PLL circuit board through L1/L6.

3-10. Varactor diodes D1 through D8 also operate as a linear FM modulator. The modulation voltage applied to the diodes through L1/L6 varies the capacitance across the oscillator tank circuit to provide direct FM modulation. Capacitor C3 prevents ground loops between the AFC/PLL circuit board ground and modulated oscillator assembly ground. The oscillator output amplitude is maintained at a constant level by limit diode D9/D10/D11.

3-11. **BUFFERS AND OUTPUT AMPLIFIER.** Three RF stages provide isolation between the oscillator and output load, harmonic suppression, and a low output impedance.

3-12. The modulated RF at Q2 is coupled to the base of buffer/amplifier Q3 through capacitor C8. The output of Q3 is applied to buffer/amplifier Q4 through C11. The output of Q4 is applied to the base of output amplifier Q5 through a low-pass filter consisting of C15, C16, and L5. The output of Q5 is routed through C18 to resistors R23 and R24 which establish a 50 Ohm output impedance.

3-13. Two identical signals are output from the modulated oscillator assembly. The signal at R24 provides drive to the RF amplifier and the signal at R23 provides a frequency sample to the AFC/PLL circuit board.

BROADCAST ELECTRONICS INC

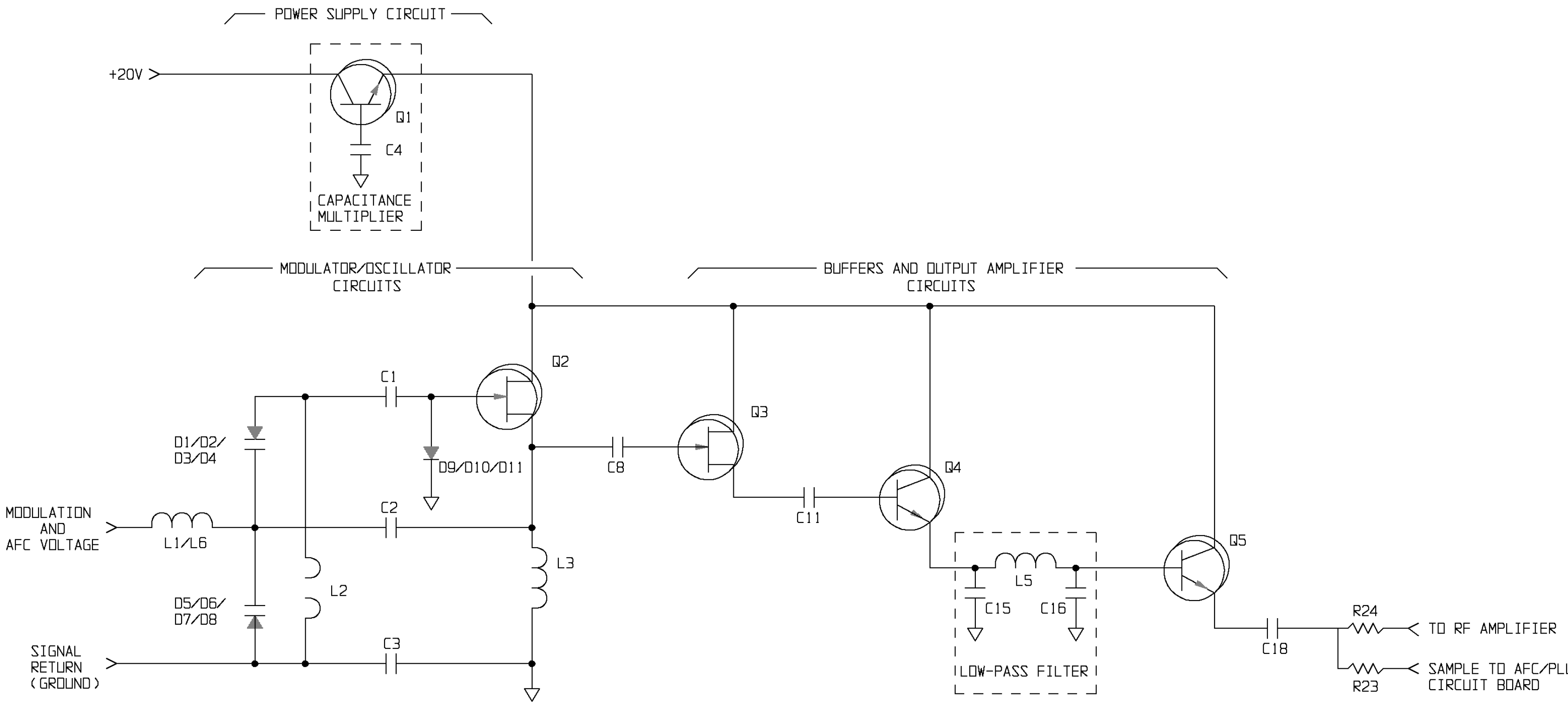

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FIGURE 3-1. MODULATED OSCILLATOR SIMPLIFIED SCHEMATIC DIAGRAM

3–14. **POWER SUPPLY.** +20V dc is applied to the transistors on the modulated oscillator circuit board through transistor Q1. Q1 operates as a capacitance multiplier for dc filter capacitor C4.

SECTION IV
MAINTENANCE

4–1. **INTRODUCTION.**

4–2. This section provides maintenance and troubleshooting information for the exciter modulated oscillator assembly.

4–3. **MAINTENANCE.**

4–4. **ELECTRICAL ADJUSTMENTS.**

4–5. The modulated oscillator assembly contains no controls which require adjustment or calibration.

4–6. **TROUBLESHOOTING.**

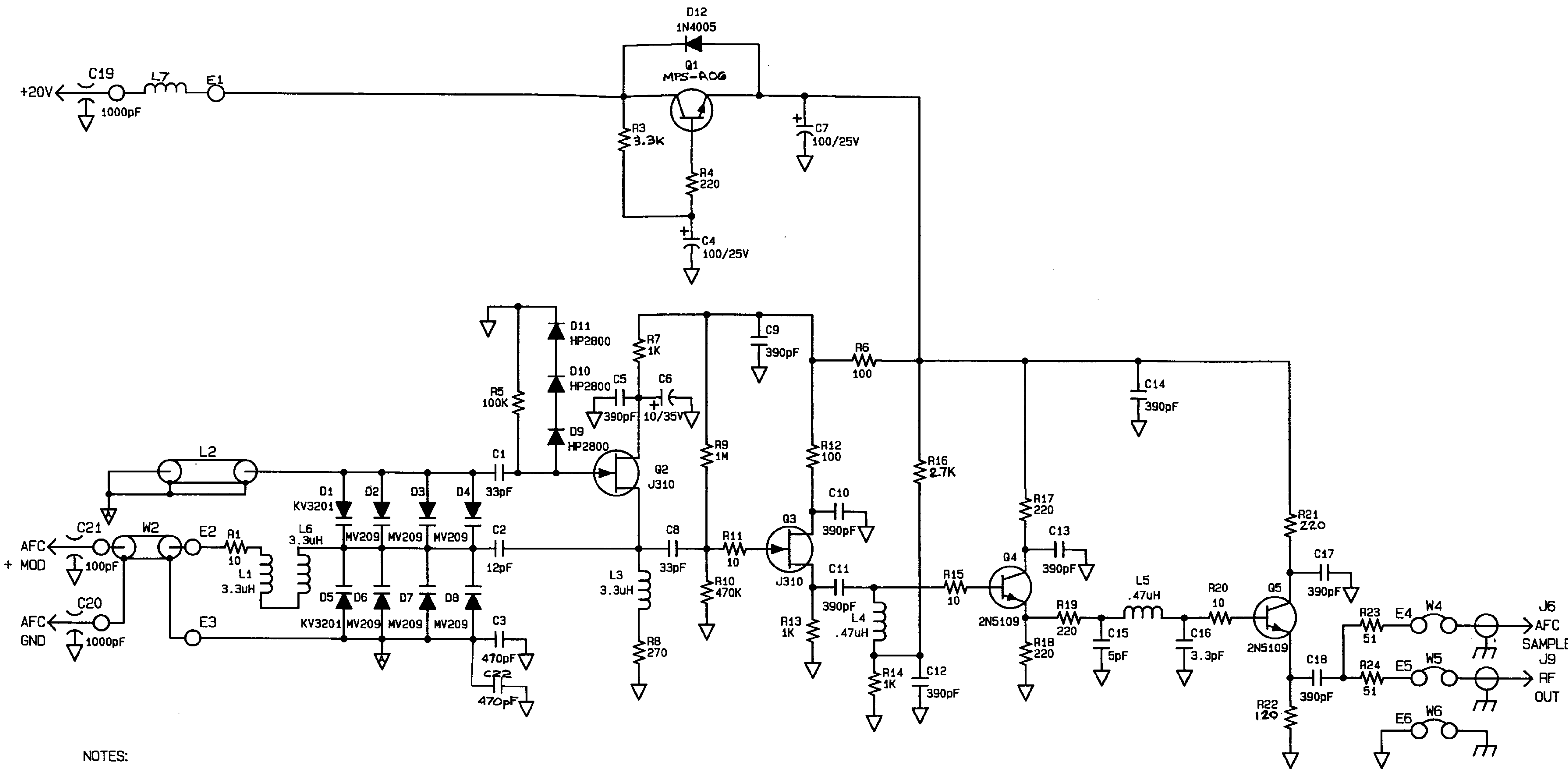
4–7. Field servicing the modulated oscillator assembly is not recommended. Therefore, if difficulties are encountered and the modulated oscillator is suspected as faulty, return the assembly to Broadcast Electronics Inc. for repair or replacement.

SECTION V
DRAWINGS

5-1. INTRODUCTION.

5-2. This section provides assembly drawings, wiring diagrams, and schematic diagrams as listed below the the modulated oscillator assembly.

FIGURE	TITLE	NUMBER
5-1	MODULATED OSCILLATOR SCHEMATIC DIAGRAM	SC959-0203
5-2	MODULATED OSCILLATOR ASSEMBLY DIAGRAM	AB959-0203
5-3.	MODULATED OSCILLATOR CIRCUIT BOARD ASSEMBLY DIAGRAM	AB919-0106



NOTES:

1. ALL RESISTORS IN OHMS, 1/4W, 5%: ALL CAPACITORS IN MICROFARADS, UNLESS OTHERWISE SPECIFIED.
2. LAST COMPONENTS USED: R24, C22, D12, Q5, L7, E6, W6.
3. SEE PCB ASSEMBLY 959-0203
4. COMPONENTS NOT USED: W3, R2, W1

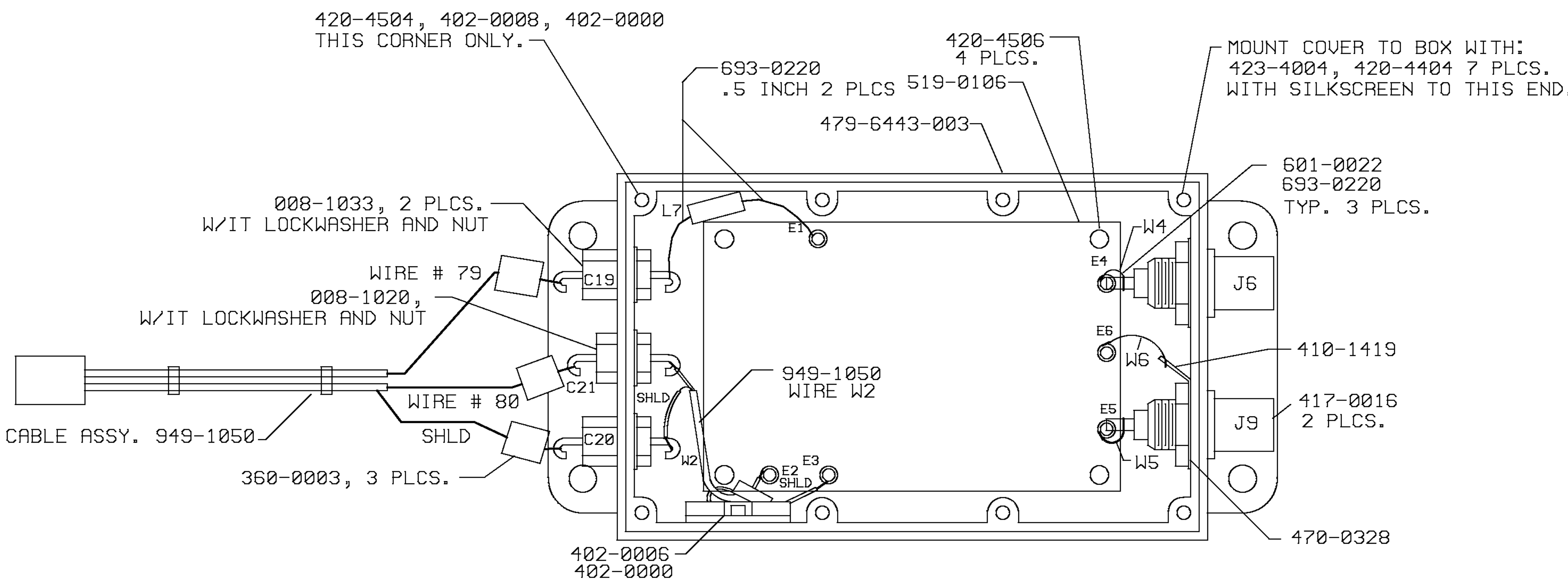
TOLERANCE DECIMAL U.O.S.
.X ± .030 .XXX ± .005
.XX ± .015 ANGLES ± 1°

DWN BY KLS	DATE 6-2-87	MATERIAL SEE B/M 959-0203
CHKD MH	6-14-88	
ME		FINISH
PROJ ENGR E. ANTHONY	6-13-88	
MFG D. NEWLON	6-14-88	NEXT ASSY 909-1050-000

BROADCAST ELECTRONICS INC.
4100 N. 24TH ST. QUINCY, IL. 62305 217/224-9600
TELEX 250142 CABLE "BROADCAST"

TITLE SCHEMATIC
MODULATED OSCILLATOR BOARD

TYPE	SIZE	DWG. NO.	REV
S	C	959-0203	J
MODEL FX-50		SCALE	SHEET 1 OF 1



WIRING OF P8 417-0165	
PIN NO.	WIRE NO.
1	80
2	80 SHLD
3	79 SHLD
4	KEY
5	79

NOTES:

1. WIRES W4,W5, AND W6 TO BE CUT AS SHORT AS POSSIBLE.
2. CUT LEADS ON L7 AS SHORT AS POSSIBLE

TOLERANCE (DECIMAL) U.O.S.
.X ± .030 .XXX ± .005
.XX ± .015 ANGLES + 1°

DWN. BY	JAH 1-29-92
CHKD	MH 6-14-88
ME	JHS 6-20-88
PROJ. ENGR.	EJA 6-13-88
MFG.	DBN 6-14-88

MATERIAL
SEE B/M
959-0203

FINISH

SEE DWG RA592-0000

NEXT ASSY.
909-1050-000

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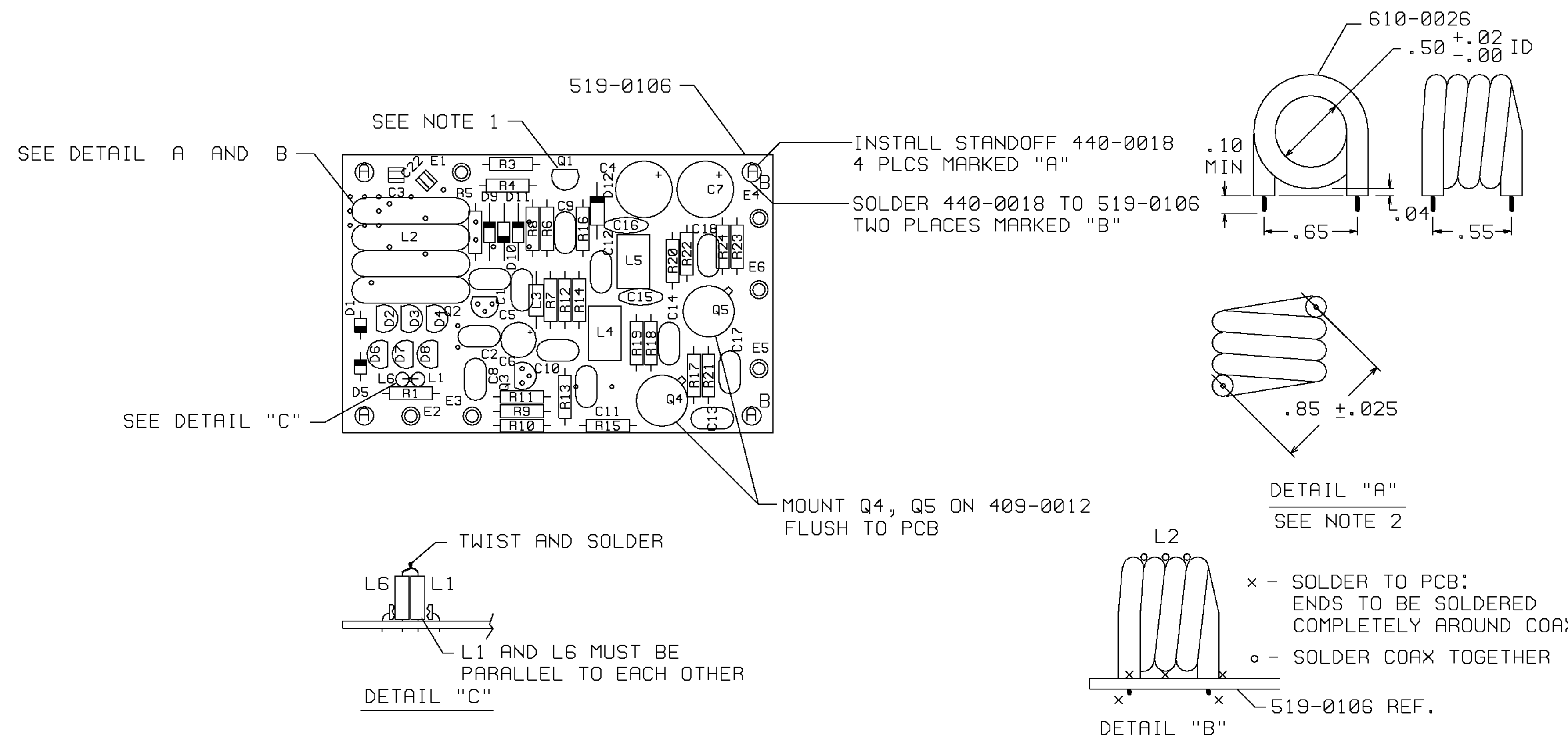
4100 N.24TH ST. P.O.BOX 3606 QUINCY,IL. 62305 PH. 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE
PCB ASSEMBLY
MODULATED OSCILLATOR BD

TYPE	SIZE	DWG No.	REV
A	B	959-0203	W

MODEL FX-50/FM-100C SCALE 1=1 SHEET 1 OF 1



NOTES:

1. STANDOFFS ON LEADS ON Q1-Q3,D2-D4 AND D6-D8 SHOULD BE PUSHED DOWN AGAINST PCB.
2. 3 1/2 TIGHTLY WOUND COUNTER-CLOCKWISE WHILE RECEDING TURNS OF BE610-0026 REF. 8.5 NOMINAL STARTING LENGTH
3. SEE SCHEMATIC AC959-0203

TOLERANCE (DECIMAL) U.O.S.
.X ± .030 .XXX ± .005
.XX ± .015 ANGLES + 1°

DWN. BY M. HAYDEN 11-3-99
CHKD
ME
PROJ. ENGR.
MFG.

MATERIAL SEE B/M 919-0106
FINISH
~~SEE DWG AA592-0000~~
NEXT ASSY. 959-0203

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TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE PCB ASSEMBLY MODULATED OSCILLATOR BD

TYPE	SIZE	DWG No.	REV
A	B	919-0106	B

MODEL FX-50/FM-100C SCALE 1=1 SHEET 1 OF 1

SECTION VI
REPLACEMENT PARTS

6-1. INTRODUCTION.

6-2. This section provides descriptions and part numbers of electrical components, assemblies, and selected mechanical parts required for maintenance of the modulated oscillator assembly. Each table entry in this section is indexed by reference designators appearing on the applicable schematic diagram.

TABLE 6-1. MODULATED OSCILLATOR ASSEMBLY - 959-0203

REF. DES.	DESCRIPTION	PART NO.	QTY.
C21	Capacitor, Ceramic Feed-Thru, 100 pF ±20%, 250V	008-1020	1
C22	Capacitor, Ceramic Chip, 470 pF ±5%, 500V	009-4723	1
L7	Ferrite Choke, 180 MHz, 2.5 Turns, Single Section	364-0002	1
J6,J9	RF Receptacle, BNC	417-0016	2
----	Ferrite Bead, 0.291 Dia	360-0003	3
----	Assembly, Modulated Oscillator Circuit Board	919-0106	1
----	Cable Assembly, Modulated Oscillator	949-1050	1

TABLE 6-2. MODULATED OSCILLATOR CIRCUIT BOARD - 919-0106
(Sheet 1 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1	Capacitor, Mica, 33 pF ±5%, 500V	042-3312	1
C2	Capacitor, Mica, 12 pF ±5%, 500V	040-1213	1
C3	Capacitor, Ceramic Chip, 470 pF ±5%, 200V	009-4723	1
C4	Capacitor, Electrolytic, 100 uF, 35V	023-1084	1
C5	Capacitor, Mica, 390 pF ±5%, 100V	042-3922	1
C6	Capacitor, Electrolytic, 10 uF, 50V	023-1076	1
C7	Capacitor, Electrolytic, 100 uF, 35V	023-1084	1
C8	Capacitor, Mica, 33 pF ±5%, 500V	042-3312	1
C9 THRU C14	Capacitor, Mica, 390 pF ±5%, 100V	042-3922	6
C15	Capacitor, Ceramic Disc, 5 pF ±5%, 500V NPO	001-5004	1
C16	Capacitor, Ceramic Disc, 3.3 pF, 1000V	000-3302	1
C17,C18	Capacitor, Mica, 390 pF ±5%, 100V	042-3922	2
C19,C20	Capacitor, Ceramic Feed-Thru, 1000 pF ±20%, 500V	008-1033	2
D1	Diode, Varactor, KV3201, 2-11 pF Range, 50V dc Maximum Reverse Voltage, DO-34 Case	205-3201	1
D2 THRU D4	Diode, MV209, Voltage Variable Capacitance, 26 pF to 32 pF Range, 30V dc Maximum Reverse Voltage	205-0109	3

TABLE 6-1. MODULATED OSCILLATOR ASSEMBLY - 959-0106
(Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
D5	Diode, Varactor, KV3201, 2–11 pF Range, 50V dc Maximum Reverse Voltage, DO–34 Case	205–3201	1
D6 THRU D8	Diode, MV209, Voltage Variable Capacitance, 26 pF to 32 pF Range, 30V dc Maximum Reverse Voltage	205–0109	3
D9 THRU D11	Diode, HP5082–2800, High Voltage, Schottky Barrier Type, 70V, 15 mA	201–2800	3
D12	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203–4005	1
E1 THRU E6	Terminal, Turret, Double Shoulder	413–1597	6
L1	RF Choke, 3.3 uH ±10%, 0.85 Ohms DC Resistance, 380 mA Maximum	360–3300	1
L2	Coaxial Cable Sections: 50 Ohm rigid coaxial cable matching section	610–0026	1
L3	RF Choke, 3.3 uH ±10%, 0.85 Ohms DC Resistance, 380 mA Maximum	360–3300	1
L4,L5	RF Choke, 0.47 uH, 500 mA Maximum	364–0047	2
L6	RF Choke, 3.3 uH ±10%, 0.85 Ohms DC Resistance, 380 mA Maximum	360–3300	1
Q1	Transistor, MPS–A06, NPN, TO–92 Case	211–0006	1
Q2,Q3	Field Effect Transistor, J3100, RF, N–Channel, TO–92 Case	212–0310	2
Q4,Q5	Transistor, 2N5109, RF, NPN, TO–92 Case	211–5109	2
R1	Resistor, 10 Ohm ±1%, 1/4W	103–1021	1
R3	Resistor, 3.32 k Ohm ±1%, 1/4W	103–3324	1
R4	Resistor, 221 Ohm ±1%, 1/4W	103–2213	1
R5	Resistor, 100 k Ohm ±1%, 1/4W	103–1062	1
R6	Resistor, 100 Ohm ±1%, 1.4W	100–1031	1
R7	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	1
R8	Resistor, 267 Ohm ±1%, 1/4W	103–2673	1
R9	Resistor, 1 Meg Ohm ±1%, 1/4W	103–1007	1
R10	Resistor, 453 k Ohm ±1%, 1/4W	100–4561	1
R11	Resistor, 10 Ohm ±1%, 1/4W	103–1021	1
R12	Resistor, 100 Ohm ±1%, 1/4W	100–1031	1
R13,R14	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	2
R15	Resistor, 10 Ohm ±1%, 1/4W	103–1021	1
R16	Resistor, 2.74 k Ohm ±1%, 1/4W	103–2744	1
R17,R18,R19	Resistor, 221 Ohm ±1%, 1/4W	103–2213	3
R20	Resistor, 10 Ohm ±1%, 1/4W	103–1021	1
R21	Resistor, 221 Ohm ±1%, 1/4W	103–2213	1
R22	Resistor, 118 Ohm ±1%, 1/4W	100–1111	1
R23,R24	Resistor, 51.1 Ohm ±1%, 1/4W	103–5112	2
––––	Blank Modulated Oscillator Circuit Board	519–0106	1

TABLE 6-3. CABLE ASSEMBLY, MODULATED OSCILLATOR - 949-1050

REF. DES.	DESCRIPTION	PART NO.	QTY.
P8	Connector, Housing, 5–Pin In–line	417–0165	1
––––	Pins, Crimp Type	417–8766	4

AFC/PLL ASSEMBLY

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LIST OF ILLUSTRATIONS

SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. This section provides general information and specifications relative to the operation of the automatic frequency control/phase-locked-loop (AFC/PLL) circuit board.

1-3. DESCRIPTION.

1-4. The AFC/PLL circuit board: 1) synthesizes and maintains the desired carrier frequency to a high degree of precision, and 2) processes the audio for modulation.

1-5. A sample of the modulated oscillator output frequency is compared to a precision reference frequency in a comparator circuit which generates a correction voltage. This correction voltage is applied to the modulated oscillator to maintain the stability of the carrier frequency. If the carrier is off frequency (as when power is applied), the AFC/PLL circuitry will mute the RF output until the carrier is locked in-phase with the reference frequency. A dual speed PLL filter ensures rapid stabilization of the carrier frequency.

1-6. In addition, the AFC/PLL circuit board accepts, sums, and precorrects audio input signals to provide a linear response when applied to the modulated oscillator.

1-7. ELECTRICAL CHARACTERISTICS.

1-8. Refer to Table 1-1 for electrical characteristics relative to the AFC/PLL circuit board.

TABLE 1-1. ELECTRICAL CHARACTERISTICS

PARAMETER	SPECIFICATIONS
INPUTS:	
RF SAMPLE	1 mW at 50 Ohms.
BALANCED AUDIO	+10 dBm at 600 Ohm for 100% Modulation.
COMPOSITE AUDIO	3.5V p-p (1.24V RMS) for 100% Modulation.
SCA AUDIO	3.5V p-p (1.24V RMS) for 10% Injection.
OUTPUTS:	
MODULATION	35 mV p-p, Nominal for +/- 75 kHz Deviation.
AFC	+2.0V dc to +9.0V dc, Dependent Upon RF Center
Frequency.	
AFC (Metering)	+2.0V dc to +9.0V dc, Dependent Upon RF Center
Frequency.	
AFC INTERLOCK	Open Collector Output.
EXTERNAL LOCK INDICATOR	Open Collector Output.
COMPOSITE AUDIO (Metering)	6.0V p-p at 1 k Ohm.
COMPOSITE TEST	6.0V p-p at 1 k Ohm.

SECTION II
REMOVAL AND INSTALLATION

2-1. INTRODUCTION.

2-2. This section provides removal and installation procedures for the AFC/PLL circuit board assembly.

2-3. REMOVAL AND INSTALLATION PROCEDURES.

2-4. REMOVAL PROCEDURE.

2-5. **REQUIRED EQUIPMENT.** A number 2 Phillips screwdriver with a 4 inch (10.16 cm) blade is required to remove the AFC/PLL circuit board assembly from the exciter chassis.

2-6. **PROCEDURE.** The removal of the AFC/PLL circuit board assembly requires the unit be placed on a suitable work surface. To remove the circuit board, proceed as follows:

WARNING ***DISCONNECT THE PRIMARY POWER TO THE EXCITER BEFORE PROCEEDING.***
WARNING

A. Disconnect the primary power to the exciter.

B. Remove the exciter top-cover. Disconnect J1, J2, and J8 from the AFC/PLL circuit board.

C. Disconnect RF sample BNC connector P6 from the output of the modulated oscillator assembly.

D. Remove the four screws securing the AFC/PLL cover to the circuit board. Remove the cover and the ground straps.

E. Remove the four screws securing the AFC/PLL circuit board to the exciter chassis and remove the circuit board.

2-7. INSTALLATION PROCEDURE.

2-8. To install the AFC/PLL circuit board assembly after repairs have been completed, proceed as follows:

WARNING ***DISCONNECT THE PRIMARY POWER TO THE EXCITER BEFORE PROCEEDING.***
WARNING

A. Disconnect the primary power to the exciter.

B. Follow the REMOVAL PROCEDURE in reverse order.

SECTION III
THEORY OF OPERATION

3-1. INTRODUCTION.

3-2. This section presents the theory of operation for the exciter AFC/PLL circuit board.

3-3. FUNCTIONAL DESCRIPTION.

3-4. The AFC/PLL circuit board contains nine circuits. Figure 3-1 presents a simplified schematic of the AFC/PLL circuit board. Refer to Figure 3-1 as required for a description of the following circuits.

A. Reference Divider Circuit

B. Reference Oscillator Activity Monitor

C. RF Sample Divider Circuit

D. Comparator Circuit

E. Loop Filter Control Circuit

F. VCO Activity Monitor

G. Audio Processing Circuits

H. Pre-modulation Control Circuit

I. Voltage Regulator Circuits

3-5. REFERENCE DIVIDER CIRCUIT.

3-6. This divider circuit provides an accurate and stable reference frequency for input to a comparator circuit. A 10 MHz signal from crystal oscillator Y1 is input to divide-by-five counter U1B to produce 2 MHz. These two frequencies are available at TP1 through programmable jumper J3.

3-7. The 2 MHz signal from U1B is input to divide-by-two counter U1A to produce 1 MHz. Logic circuits U2, U3, and U4A further divide the 1 MHz signal by 250 to provide 4 kHz to one shot U5. The 4 kHz signal at the QA output of U5 is applied to programmable frequency synthesizer and comparator U9.

3-8. REFERENCE OSCILLATOR ACTIVITY MONITOR.

3-9. This circuit provides a visual indication of the reference divider circuit output. When the 4 kHz signal is present, the QB output of U5 will go HIGH which biases LED driver transistor Q1 ON to illuminate indicator DS2.

3-10. RF SAMPLE DIVIDER CIRCUIT.

3-11. This divider circuit provides an RF sample frequency for input to the comparator circuit. An RF sample from the modulated oscillator is input to transformer T1 to reduce ground loop interference. The output of T1 is coupled to a low-pass filter consisting of capacitors C15, C16, and inductor L3 which eliminates any harmonics.

3-12. The sinusoidal output signal from the low-pass filter is applied to the input of counter U8. U8 will divide the sample frequency by 20 and output a digital signal to U9.

3–13. **COMPARATOR CIRCUIT.**

3–14. This circuit compares the signals from both the reference divider and RF sample divider circuits and generates an error signal when a difference exists. Logic circuit U9 is a programmable frequency synthesizer and comparator which will internally divide the 4 kHz signal at the OSC input to provide a frequency of 500 Hz.

3–15. When binary switches S1, S2, and S3 are preset for the appropriate carrier frequency, U9 will divide the RF sample signal at the F input to provide 500 Hz at the FV output which is applied to one shot U12. If an error exists, output FV will vary above or below 500 Hz. This signal and the 500 Hz from the reference division are internally compared for phase and frequency variations.

3–16. When the carrier frequency and reference frequency are equal and in phase, the PD output of U9 will be steady state at approximately +2.5 volts. If the carrier leads or is greater than the reference frequency, the output will pulse LOW. If the carrier lags or is less than the reference frequency, the output will pulse HIGH. These output pulses will vary in width directly in proportion to the degree of phase error. The pulses are applied to U11B.

3–17. Normally, the LD output of U9 will be a logic HIGH for a locked condition. If an unlocked condition exists, the output will pulse LOW. This output is applied to the D input of lock/unlock sensor U4B. With the signal from the FV output of U9, the QA output of one shot U12 will provide a clock pulse to U4B which leads or lags the signal at the D input depending on the phase error direction.

3–18. **LOOP FILTER CONTROL CIRCUIT.**

3–19. The loop filter control circuit increases/decreases the voltage controlled oscillator (VCO) center frequency to maintain accuracy. U10B biases integrator/amplifier U11B at 2.5V to provide a voltage gain of 11 for any differential voltage within the range of the bias. The output of U11B is applied to the metering circuit board for display.

3–20. **ACTIVE FILTER.** The output of U11B is also applied to an active third–order 5 Hz low–pass filter consisting of capacitors C29 through C31, resistors R25 through R27, and loop filter buffer U11A. The filter removes the reference frequency component to provide a dc automatic frequency control (AFC) voltage to the modulated oscillator through resistor R31.

3–21. **LOCK DRIVER.** The output of lock/unlock sensor U4B normally applies a HIGH through resistor R39 to lock driver U13A for a locked–loop condition. U13A is activated by a slow charge/rapid discharge circuit consisting of resistors R39, R40, diode D2, and capacitor C42.

3–22. As long as the output of U4B is HIGH, the potential on C42 will maintain U13A output HIGH. This HIGH will: 1) illuminate front–panel **LOCK** indicator DS5, 2) bias transistor switch Q3/Q4 ON to remove the RF inhibit from the rear–panel terminal strip, and 3) enable the **AFC** relay.

3–23. If an unlock condition exists, the output of U4B will go LOW which rapidly discharges C42 through D2 and R40 and applies a LOW to U13A. When this occurs, the output of U13A will go LOW to extinguish the lock indicator, disable the AFC relay, inhibit the RF, and activate a dual rate loop driver.

3–24. **DUAL RATE LOOP DRIVER.** The LOW output from U13A is routed to a dual rate control network consisting of R42, R43, C44, and D3. This circuit is identical in operation to the slow charge/rapid discharge circuit previously described. The circuit forces the output of U13B HIGH which enables light dependent resistors LDR1, LDR2, and LDR3 in the active filter circuit to increase loop lock response.

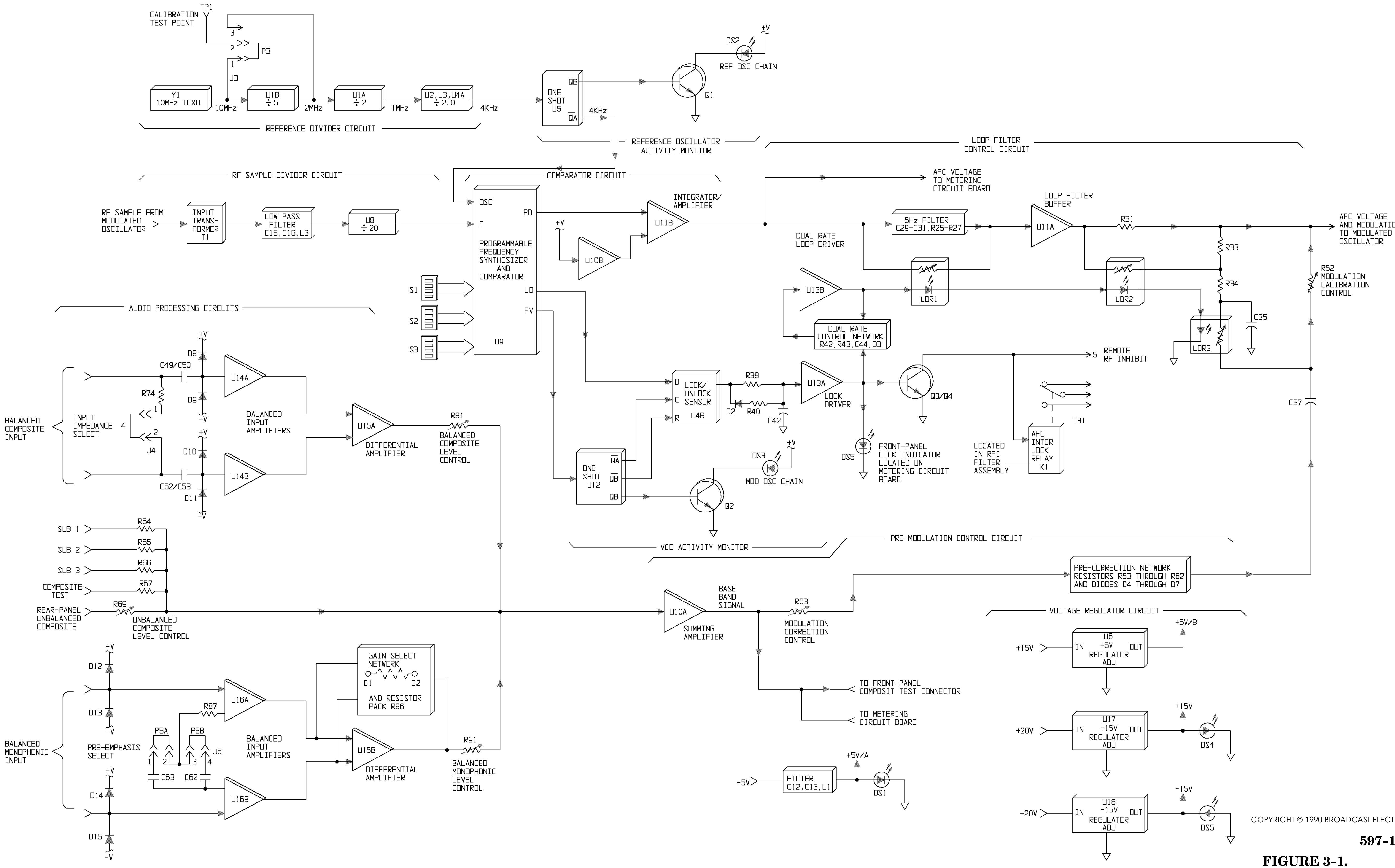

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**FIGURE 3-1.
AFC/PLL CIRCUIT BOARD SIMPLIFIED SCHEMATIC**

3–25. **LOOP LOCK RESPONSE.** Increased loop lock response is accomplished by LDR1, LDR2, and LDR3. When enabled during an unlocked condition, LDR1 will shunt the 5 Hz low-pass filter and route the output from U11B directly to U11A. LDR2 will shunt resistor R31 to rapidly charge capacitor C35 through resistor R34. Modulation coupling capacitor C37 will be rapidly charged through LDR3.

3–26. **LOCK UP.** When the operating frequency and phase output of the modulated oscillator are sufficiently adjusted by the AFC control voltage, the output of U4B will return HIGH which changes the output state of U13A and U13B. The duration between the unlock and lock conditions is less than 5 seconds.

3–27. **VCO ACTIVITY MONITOR.**

3–28. This circuit indirectly provides a visual indication of output from the RF sample divider circuit via the FV output of U9. When the 500 Hz signal is present, the QB output of U12 will go HIGH which biases LED driver transistor Q2 ON to illuminate indicator DS3. If any component within the RF sample divider circuit or modulated oscillator circuit fails, indicator DS3 will extinguish and the QB output of U12 will issue a reset pulse to U4B which inhibits the RF.

3–29. **AUDIO PROCESSING CIRCUITS.**

3–30. **BALANCED INPUTS.** A balanced composite audio input circuit and a balanced monophonic audio input circuit are provided by the FX–50 exciter. Audio for the composite circuit is input through a rear–panel BNC connector. Audio for the monophonic circuit is input through rear–panel barrier strip TB1.

3–31. **Composite Circuit.** When programmable jumper J4 is installed, resistor R74 is connected across the input circuit to convert the impedance from 10 k Ohms to 50 Ohms. Audio from the rear–panel is ac coupled to balanced input amplifiers U14A and U14B through capacitors C49/C50 and C52/C53. Diodes D8 through D11 limit the audio input level.

3–32. The outputs of U14A and U14B are routed to differential amplifier U15A. The output of U15A is routed to summing amplifier U10A through balanced composite level control R81.

3–33. **Monophonic Circuit.** Audio from the rear–panel is ac coupled through capacitors in the RFI assembly to balanced input amplifiers U16A and U16B. Diodes D12 through D15 operate to limit the audio input level. Pre–emphasis is selected by programmable jumpers J5A and J5B which connect capacitor(s) C62 and/or C63 into the circuit through resistor R37.

3–34. The outputs of U16A and U16B are routed to differential amplifier U15B. The voltage gain for U15B is selected by a gain select network consisting of resistor pack R96 and a resistor connected between tie points E1 and E2. The output of U15B is routed to summing amplifier U10A through balanced monophonic level control R91.

3–35. **UNBALANCED INPUTS.** Subcarrier audio from rear–panel connectors SUB1, SUB2, and SUB3 and audio from front–panel composite test connector are input to U10A through summing resistors R64 through R67. Audio from the rear–panel unbalanced composite connector is also input to U10A through unbalanced composite level control R69.

3–36. **PREMODULATION CONTROL CIRCUIT.**

3–37. Audio signals from the balanced and unbalanced input circuits are summed at the input of summing amplifier U10A. The output of U10A is routed to the front–panel composite test connector, the metering circuit board, and a precorrection network through modulation correction control R63.

3–38. The audio precorrection network consisting of resistors R53 through R62 and diodes D4 through D7 adjusts the base band signal to compensate for varactor non–linearity in the modulated oscillator. The output of this network is routed to the modulated oscillator through coupling capacitor C37 and modulation calibration control R52.

3–39. **VOLTAGE REGULATOR CIRCUITS.**

3–40. The AFC/PLL circuit board contains three voltage regulator circuits. +15 volts is applied to regulator circuit U6 to provide a +5 V/B operating potential at the output. +20 volts is applied to regulator circuit U17 to provide an output potential of +15V to the circuit board and indicator DS4. –20 volts is applied to regulator circuit U18 to provide an output potential of –15V to the circuit board and indicator DS5.

3–41. In addition, +5 volts is applied to a filter circuit consisting of capacitors C12, C13, and inductor L1. The output illuminates indicator DS1 and provides a +5V/A operating potential.

SECTION IV
MAINTENANCE

4-1. INTRODUCTION.

4-2. This section provides maintenance information, electrical adjustment procedures, and troubleshooting information for the exciter AFC/PLL circuit board.

4-3. MAINTENANCE.

4-4. ELECTRICAL ADJUSTMENTS.

4-5. Figure 4-1 presents the AFC/PLL circuit board controls and indicators with the cover removed. The following electrical adjustment procedures do not require the cover to be removed.

4-6. **REQUIRED EQUIPMENT.** The following tools and equipment are required for electrical adjustment procedures.

A. Insulated adjustment tool, shipped with the exciter (P/N 407-0038).

B. Digital voltmeter, Fluke 75 or equivalent.

C. Low distortion audio generator and distortion analyzer, Sound Technology 1710A or equivalent.

D. Calibrated oscilloscope.

E. High linearity FM demodulator, Belar FMM-2 or equivalent.

F. 20 dB power attenuator, Bird 8343-200 or equivalent.

G. Calibrated frequency counter, HP-5315B or equivalent.

4-7. **BAL MONO (R91).** The **BAL MONO** level control on the AFC/PLL circuit board adjusts the output level of the balanced monophonic amplifier circuit. **BAL MONO** control R91 is adjusted as follows.

4-8. **Procedure.** To adjust **BAL MONO** control R91, refer to Figure 4-1 as required and proceed as follows:

WARNING ***DISCONNECT PRIMARY POWER TO THE EXCITER BEFORE PROCEEDING.***

WARNING

A. Disconnect the exciter primary power.

B. Remove the top-cover and connect an audio generator to the AUDIO INPUT terminals on rear-panel barrier strip TB1.

C. Connect a digital voltmeter to the front-panel COMPOSITE OUT receptacle.

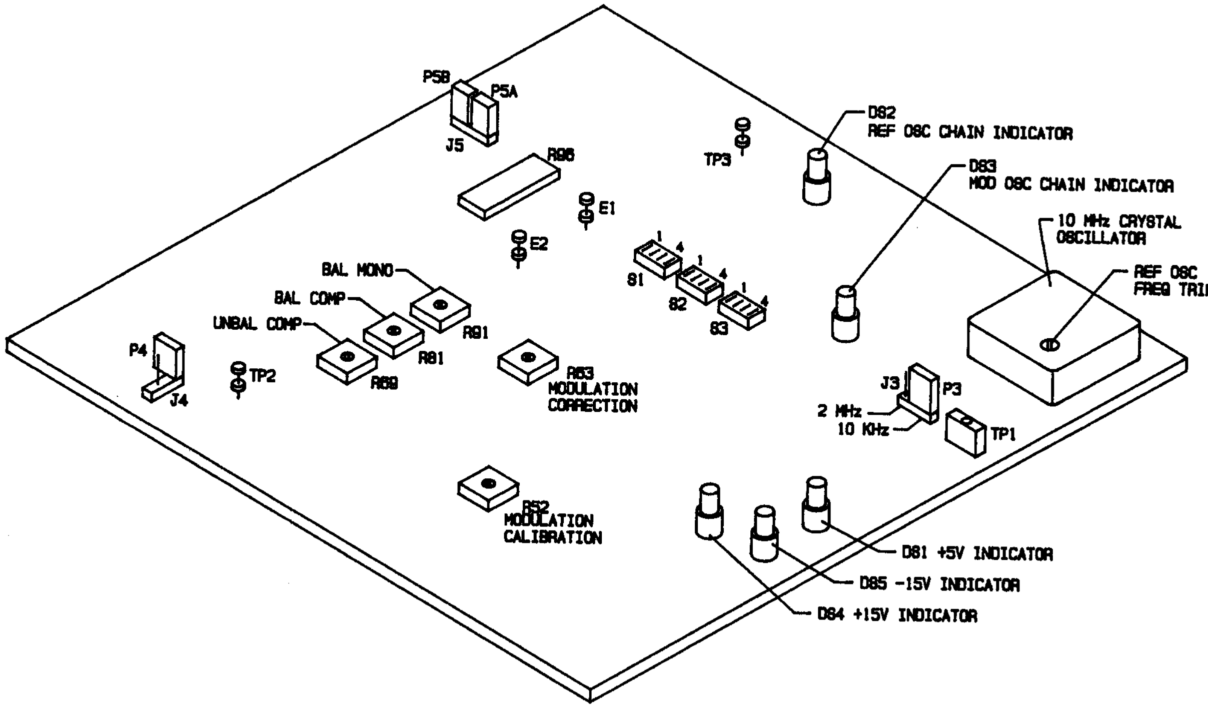

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FIGURE 4-1. AFC/PLL CIRCUIT BOARD CONTROLS AND INDICATORS

WARNING ***DO NOT TOUCH ANY COMPONENT WITHIN THE EXCITER WITH POWER APPLIED.***

WARNING

D. Apply primary power and operate the exciter.

E. Adjust the audio generator for 400 Hz at +10 dBm (2.45V RMS) output.

F. With an insulated adjustment tool, adjust R91 until the voltmeter indicates 2.12V RMS.

G. Disconnect the primary power, remove all test equipment, and replace the top–cover.

4–9. **BAL COMP (R81).** The **BAL COMP** level control on the AFC/PLL circuit board adjusts the output level of the balanced composite amplifier circuit. **BAL COMP** control R81 is adjusted as follows.

4–10. **Procedure.** To adjust **BAL COMP** control R81, refer to Figure 4–1 as required and proceed as follows:

WARNING ***DISCONNECT PRIMARY POWER TO THE EXCITER BEFORE PROCEEDING.***

WARNING

A. Disconnect the exciter primary power.

B. Remove the top–cover and connect an audio generator to the rear–panel BAL COMPOSITE INPUT receptacle.

C. Connect a digital voltmeter to the front–panel COMPOSITE OUT receptacle.

WARNING ***DO NOT TOUCH ANY COMPONENT WITHIN THE EXCITER WITH POWER APPLIED.***

WARNING

D. Apply primary power and operate the exciter.

E. Adjust the audio generator for 400 Hz at 1.24V RMS output.

F. With an insulated adjustment tool, adjust R81 until the voltmeter indicates 2.12V RMS.

G. Disconnect the primary power, remove all test equipment, and replace the top–cover.

4–11. **UNBAL COMP (R69).** The **UNBAL COMP** level control on the AFC/PLL circuit board adjusts the output level of the unbalanced composite amplifier circuit. **UNBAL COMP** control R69 is adjusted as follows.

4–12. **Procedure.** To adjust **UNBAL COMP** control R69, refer to Figure 4–1 as required and proceed as follows:

WARNING ***DISCONNECT PRIMARY POWER TO THE EXCITER BEFORE PROCEEDING.***

WARNING

A. Disconnect the exciter primary power.

B. Remove the top–cover and connect an audio generator to the rear–panel UNBAL COMPOSITE INPUT receptacle.

C. Connect a digital voltmeter to the front–panel COMPOSITE OUT receptacle.

WARNING ***DO NOT TOUCH ANY COMPONENT WITHIN THE EXCITER WITH POWER APPLIED.***

WARNING

D. Apply primary power and operate the exciter.

E. Adjust the audio generator for 400 Hz at 1.24V RMS output.

F. With an insulated adjustment tool, adjust R69 until the voltmeter indicates 2.12V RMS.

G. Disconnect the primary power, remove all test equipment, and replace the top–cover.

4–13. **MODULATION CORRECTION (R63).** The **MODULATION CORRECTION** control on the AFC/PLL circuit board corrects the audio signal prior to application to the modulated oscillator assembly. **MODULATION CORRECTION** control R63 is adjusted as follows.

4–14. **Procedure.** To adjust **MODULATION CORRECTION** control R63, refer to Figure 4–1 as required and proceed as follows:

WARNING ***DISCONNECT PRIMARY POWER TO THE EXCITER BEFORE PROCEEDING.***
WARNING

A. Disconnect the exciter primary power.

B. Remove the top–cover and connect an audio generator to the front–panel COMPOSITE IN receptacle. Connect a digital voltmeter to the front–panel COMPOSITE OUT receptacle.

C. Connect an FM demodulator to the exciter RF OUTPUT receptacle through a 20 dB attenuator and a distortion analyzer to the output of the demodulator.

WARNING ***DO NOT TOUCH ANY COMPONENT WITHIN THE EXCITER WITH POWER APPLIED.***
WARNING

D. Apply primary power and operate the exciter.

E. Adjust the audio generator for 400 Hz at 2.12V RMS output as indicated on the voltmeter.

F. With an insulated adjustment tool, adjust R63 for minimum THD as indicated on the distortion analyzer.

G. Disconnect the primary power, remove all test equipment, and replace the top–cover.

4–15. **MODULATION CALIBRATION (R52).** The **MODULATION CALIBRATION** control on the AFC/PLL circuit board adjusts the exciter percentage of modulation. **MODULATION CALIBRATION** control R52 is adjusted as follows.

4–16. **Procedure.** To adjust **MODULATION CALIBRATION** control R52, refer to Figure 4–1 as required and proceed as follows:

A. Perform the **BAL MONO** (R91), **BAL COMP** (R81), and the **UNBAL COMP** (R69) adjustment procedures.

WARNING ***DISCONNECT PRIMARY POWER TO THE EXCITER BEFORE PROCEEDING.***
WARNING

B. Disconnect the exciter primary power.

C. Remove the top–cover and connect an audio generator to the front–panel COMPOSITE IN receptacle. Connect a digital voltmeter to the front–panel COMPOSITE OUT receptacle.

D. Connect an FM demodulator to the exciter RF OUTPUT receptacle through a 20 dB attenuator.

WARNING ***DO NOT TOUCH ANY COMPONENT WITHIN THE EXCITER WITH POWER APPLIED.***

WARNING

E. Apply primary power and operate the exciter.

F. Adjust the audio generator for 400 Hz at 2.12V RMS output as indicated on the voltmeter.

G. With an insulated adjustment tool, adjust R52 for 100% modulation as indicated on the modulation monitor.

H. Disconnect the primary power, remove all test equipment, and replace the top–cover.

4–17. **REF OSC FREQ TRIM.** The **REF OSC FREQ TRIM** control on the AFC/PLL circuit board adjusts the reference frequency. The **REF OSC FREQ TRIM** control is adjusted as follows.

4–18. **Procedure.** To adjust the **REF OSC FREQ TRIM** control, refer to Figure 4–1 as required and proceed as follows:

WARNING ***DISCONNECT PRIMARY POWER TO THE EXCITER BEFORE PROCEEDING.***

WARNING

A. Disconnect the exciter primary power.

B. Remove the exciter top–cover and connect a frequency counter to TP1 on the AFC/PLL circuit board.

WARNING ***DO NOT TOUCH ANY COMPONENT WITHIN THE EXCITER WITH POWER APPLIED.***

WARNING

C. Apply primary power and operate the exciter.

D. With an insulated adjustment tool, adjust the **REF OSC FREQ TRIM** control until the frequency counter indicates 10 MHz ±5 Hz or 2 MHz ±1 Hz depending on programmable jumper J3.

E. Disconnect the primary power, remove all test equipment, and replace the top–cover.

4–19. **FREQUENCY SELECTION.** The exciter carrier frequency is established by programmable frequency synthesizer switches S1, S2, and S3 on the AFC/PLL circuit board assembly (refer to Figure 4–2). The position of each switch corresponds to a weighted binary number (refer to Table 4–1).

4–20. Table 4–1 lists standard carrier frequencies and corresponding switch binary codes for domestic and European operation. A “1” in the code represents a switch in the ON position and a “0” represents a switch in the OFF position. S1, S2, and S3 are programmed as follows.

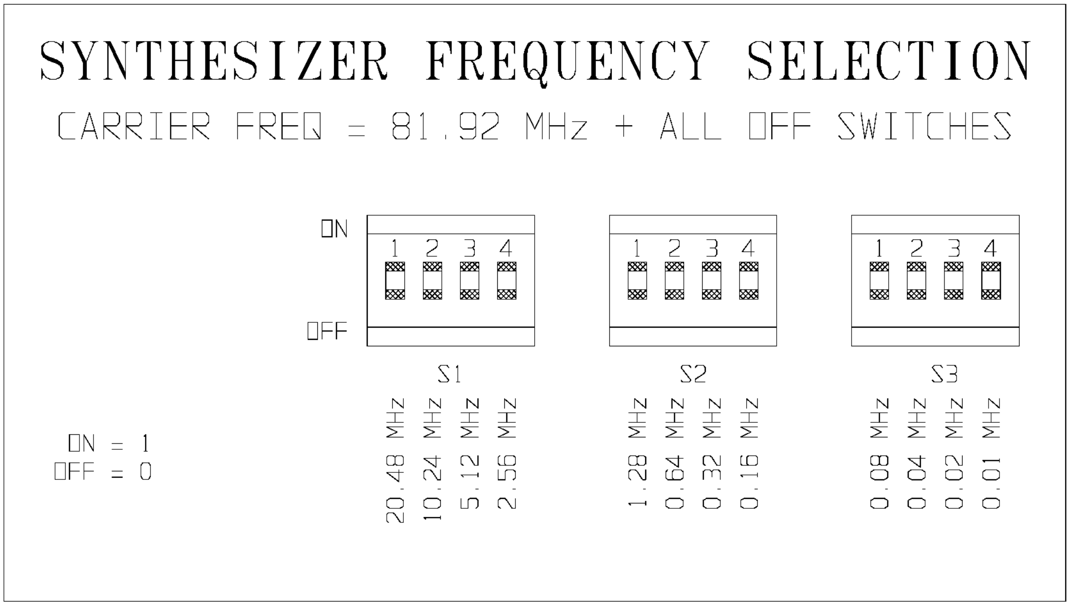

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FIGURE 4-2. FREQUENCY SELECTION

4-21. **Procedure.** To change the exciter carrier frequency, proceed as follows.

WARNING ***DISCONNECT PRIMARY POWER TO THE EXCITER BEFORE PROCEEDING.***

WARNING

A. Disconnect the exciter primary power.

B. Remove the exciter top-cover. Refer to Table 4-1 and select the desired frequency and corresponding binary code.

C. Refer to Figure 4-2 and program four-segment switches S1, S2, and S3 for the desired frequency.

D. Replace the top-cover and return the exciter to service.

4-22. **LOW-PASS FILTER.** An optional low-pass filter can be installed on the FX-50/E exciter rear-panel for stand-alone operation. Due to critical tuning parameters, field adjustment is not recommended. If adjustment is necessary, contact Broadcast Electronics field service for assistance.

4-23. **PRE-EMPHASIS SELECTION.** Programmable jumpers P5A and P5B on the AFC/PLL circuit board establish the exciter pre-emphasis. The exciter is normally shipped with 75 microsecond pre-emphasis. If required,an alternate pre-emphasis can be selected as follows.

4-24. **Procedure.** To select an alternate pre-emphasis, refer to Figure 4-1 as required and proceed as follows:

DOMESTIC							
FREQUENCY IN MHZ	SWITCH S1 1 2 3 4	SWITCH S2 1 2 3 4	SWITCH S3 1 2 3 4	FREQUENCY IN MHZ	SWITCH S1 1 2 3 4	SWITCH S2 1 2 3 4	SWITCH S3 1 2 3 4
87.1	1 1 0 1	1 1 1 1	1 0 0 1	98.1	1 0 0 1	1 0 1 0	1 1 0 1
87.3	1 1 0 1	1 1 1 0	0 1 0 1	98.3	1 0 0 1	1 0 0 1	1 0 0 1
87.5	1 1 0 1	1 1 0 1	0 0 0 1	98.5	1 0 0 1	1 0 0 0	0 1 0 1
87.7	1 1 0 1	1 0 1 1	1 1 0 1	98.7	1 0 0 1	0 1 1 1	0 0 0 1
87.9	1 1 0 1	1 0 1 0	1 0 0 1	98.9	1 0 0 1	0 1 0 1	1 1 0 1
88.1	1 1 0 1	1 0 0 1	0 1 0 1	99.1	1 0 0 1	0 1 0 0	1 0 0 1
88.3	1 1 0 1	1 0 0 0	0 0 0 1	99.3	1 0 0 1	0 0 1 1	0 1 0 1
88.5	1 1 0 1	0 1 1 0	1 1 0 1	99.5	1 0 0 1	0 0 1 0	0 0 0 1
88.7	1 1 0 1	0 1 0 1	1 0 0 1	99.7	1 0 0 1	0 0 0 0	1 1 0 1
88.9	1 1 0 1	0 1 0 0	0 1 0 1	99.9	1 0 0 0	1 1 1 1	1 0 0 1
89.1	1 1 0 1	0 0 1 1	0 0 0 1	100.1	1 0 0 0	1 1 1 0	0 1 0 1
89.3	1 1 0 1	0 0 0 1	1 1 0 1	100.3	1 0 0 0	1 1 0 1	0 0 0 1
89.5	1 1 0 1	0 0 0 0	1 0 0 1	100.5	1 0 0 0	1 0 1 1	1 1 0 1
89.7	1 1 0 0	1 1 1 1	0 1 0 1	100.7	1 0 0 0	1 0 1 0	1 0 0 1
89.9	1 1 0 0	1 1 1 0	0 0 0 1	100.9	1 0 0 0	1 0 0 1	0 1 0 1
90.1	1 1 0 0	1 1 0 0	1 1 0 1	101.1	1 0 0 0	1 0 0 0	0 0 0 1
90.3	1 1 0 0	1 0 1 1	1 0 0 1	101.3	1 0 0 0	0 1 1 0	1 1 0 1
90.5	1 1 0 0	1 0 1 0	0 1 0 1	101.5	1 0 0 0	0 1 0 1	1 0 0 1
90.7	1 1 0 0	1 0 0 1	0 0 0 1	101.7	1 0 0 0	0 1 0 0	0 1 0 1
90.9	1 1 0 0	0 1 1 1	1 1 0 1	101.9	1 0 0 0	0 0 1 1	0 0 0 1
91.1	1 1 0 0	0 1 1 0	1 0 0 1	102.1	1 0 0 0	0 0 0 1	1 1 0 1
91.3	1 1 0 0	0 1 0 1	0 1 0 1	102.3	1 0 0 0	0 0 0 0	1 0 0 1
91.5	1 1 0 0	0 1 0 0	0 0 0 1	102.5	0 1 1 1	1 1 1 1	0 1 0 1
91.7	1 1 0 0	0 0 1 0	1 1 0 1	102.7	0 1 1 1	1 1 1 0	0 0 0 1
91.9	1 1 0 0	0 0 0 1	1 0 0 1	102.9	0 1 1 1	1 1 0 0	1 1 0 1
92.1	1 1 0 0	0 0 0 0	0 1 0 1	103.1	0 1 1 1	1 0 1 1	1 0 0 1
92.3	1 0 1 1	1 1 1 1	0 0 0 1	103.3	0 1 1 1	1 0 1 0	0 1 0 1
92.5	1 0 1 1	1 1 0 1	1 1 0 1	103.5	0 1 1 1	1 0 0 1	0 0 0 1
92.7	1 0 1 1	1 1 0 0	1 0 0 1	103.7	0 1 1 1	0 1 1 1	1 1 0 1
92.9	1 0 1 1	1 0 1 1	0 1 0 1	103.9	0 1 1 1	0 1 1 0	1 0 0 1
93.1	1 0 1 1	1 0 1 0	0 0 0 1	104.1	0 1 1 1	0 1 0 1	0 1 0 1
93.3	1 0 1 1	1 0 0 0	1 1 0 1	104.3	0 1 1 1	0 1 0 0	0 0 0 1
93.5	1 0 1 1	0 1 1 1	1 0 0 1	104.5	0 1 1 1	0 0 1 0	1 1 0 1
93.7	1 0 1 1	0 1 1 0	0 1 0 1	104.7	0 1 1 1	0 0 0 1	1 0 0 1
93.9	1 0 1 1	0 1 0 1	0 0 0 1	104.9	0 1 1 1	0 0 0 0	0 1 0 1
94.1	1 0 1 1	0 0 1 1	1 1 0 1	105.1	0 1 1 0	1 1 1 1	0 0 0 1
94.3	1 0 1 1	0 0 1 0	1 0 0 1	105.3	0 1 1 0	1 1 0 1	1 1 0 1
94.5	1 0 1 1	0 0 0 1	0 1 0 1	105.5	0 1 1 0	1 1 0 0	1 0 0 1
94.7	1 0 1 1	0 0 0 0	0 0 0 1	105.7	0 1 1 0	1 0 1 1	0 1 0 1
94.9	1 0 1 0	1 1 1 0	1 1 0 1	105.9	0 1 1 0	1 0 1 0	0 0 0 1
95.1	1 0 1 0	1 1 0 1	1 0 0 1	106.1	0 1 1 0	1 0 0 0	1 1 0 1
95.3	1 0 1 0	1 1 0 0	0 1 0 1	106.3	0 1 1 0	0 1 1 1	1 0 0 1
95.5	1 0 1 0	1 0 1 1	0 0 0 1	106.5	0 1 1 0	0 1 1 0	0 1 0 1
95.7	1 0 1 0	1 0 0 1	1 1 0 1	106.7	0 1 1 0	0 1 0 1	0 0 0 1
95.9	1 0 1 0	1 0 0 0	1 0 0 1	106.9	0 1 1 0	0 0 1 1	1 1 0 1
96.1	1 0 1 0	0 1 1 1	0 1 0 1	107.1	0 1 1 0	0 0 1 0	1 0 0 1
96.3	1 0 1 0	0 1 1 0	0 0 0 1	107.3	0 1 1 0	0 0 0 1	0 1 0 1
96.5	1 0 1 0	0 1 0 0	1 1 0 1	107.5	0 1 1 0	0 0 0 0	0 0 0 1
96.7	1 0 1 0	0 0 1 1	1 0 0 1	107.7	0 1 0 1	1 1 1 0	1 1 0 1
96.9	1 0 1 0	0 0 1 0	0 1 0 1	107.9	0 1 0 1	1 1 0 1	1 0 0 1
97.1	1 0 1 0	0 0 0 1	0 0 0 1	108.1	0 1 0 1	1 1 0 0	0 1 0 1
97.3	1 0 0 1	1 1 1 1	1 1 0 1	108.3	0 1 0 1	1 0 1 1	0 0 0 1
97.5	1 0 0 1	1 1 1 0	1 0 0 1	108.5	0 1 0 1	1 0 0 1	1 1 0 1
97.7	1 0 0 1	1 1 0 1	0 1 0 1	108.7	0 1 0 1	1 0 0 0	1 0 0 1
97.9	1 0 0 1	1 1 0 0	0 0 0 1	108.9	0 1 0 1	0 1 1 1	0 1 0 1

EUROPEAN							
FREQUENCY IN MHZ	SWITCH S1 1 2 3 4	SWITCH S2 1 2 3 4	SWITCH S3 1 2 3 4	FREQUENCY IN MHZ	SWITCH S1 1 2 3 4	SWITCH S2 1 2 3 4	SWITCH S3 1 2 3 4
87.2	1 1 0 1	1 1 1 0	1 1 1 1	98.2	1 0 0 1	1 0 1 0	0 0 1 1
87.4	1 1 0 1	1 1 0 1	1 0 1 1	98.4	1 0 0 1	1 0 0 0	1 1 1 1
87.6	1 1 0 1	1 1 0 0	0 1 1 1	98.6	1 0 0 1	0 1 1 1	1 0 1 1
87.8	1 1 0 1	1 0 1 1	0 0 1 1	98.8	1 0 0 1	0 1 1 0	0 1 1 1
88.0	1 1 0 1	1 0 0 1	1 1 1 1	99.0	1 0 0 1	0 1 0 1	0 0 1 1
88.2	1 1 0 1	1 0 0 0	1 0 1 1	99.2	1 0 0 1	0 0 1 1	1 1 1 1
88.4	1 1 0 1	0 1 1 1	0 1 1 1	99.4	1 0 0 1	0 0 1 0	1 0 1 1
88.6	1 1 0 1	0 1 1 0	0 0 1 1	99.6	1 0 0 1	0 0 0 1	0 1 1 1
88.8	1 1 0 1	0 1 0 0	1 1 1 1	99.8	1 0 0 1	0 0 0 0	0 0 1 1
89.0	1 1 0 1	0 0 1 1	1 0 1 1	100.0	1 0 0 0	1 1 1 0	1 1 1 1
89.2	1 1 0 1	0 0 1 0	0 1 1 1	100.2	1 0 0 0	1 1 0 1	1 0 1 1
89.4	1 1 0 1	0 0 0 1	0 0 1 1	100.4	1 0 0 0	1 1 0 0	0 1 1 1
89.6	1 1 0 0	1 1 1 1	1 1 1 1	100.6	1 0 0 0	1 0 1 1	0 0 1 1
89.8	1 1 0 0	1 1 1 0	1 0 1 1	100.8	1 0 0 0	1 0 0 1	1 1 1 1
90.0	1 1 0 0	1 1 0 1	0 1 1 1	101.0	1 0 0 0	1 0 0 0	1 0 1 1
90.2	1 1 0 0	1 1 0 0	0 0 1 1	101.2	1 0 0 0	0 1 1 1	0 1 1 1
90.4	1 1 0 0	1 0 1 0	1 1 1 1	101.4	1 0 0 0	0 1 1 0	0 0 1 1
90.6	1 1 0 0	1 0 0 1	1 0 1 1	101.6	1 0 0 0	0 1 0 0	1 1 1 1
90.8	1 1 0 0	1 0 0 0	0 1 1 1	101.8	1 0 0 0	0 0 1 1	1 0 1 1
91.0	1 1 0 0	0 1 1 1	0 0 1 1	102.0	1 0 0 0	0 0 1 0	0 1 1 1
91.2	1 1 0 0	0 1 0 1	1 1 1 1	102.2	1 0 0 0	0 0 0 1	0 0 1 1
91.4	1 1 0 0	0 1 0 0	1 0 1 1	102.4	0 1 1 1	1 1 1 1	1 1 1 1
91.6	1 1 0 0	0 0 1 1	0 1 1 1	102.6	0 1 1 1	1 1 1 0	1 0 1 1
91.8	1 1 0 0	0 0 1 0	0 0 1 1	102.8	0 1 1 1	1 1 0 1	0 1 1 1
92.0	1 1 0 0	0 0 0 0	1 1 1 1	103.0	0 1 1 1	1 1 0 0	0 0 1 1
92.2	1 0 1 1	1 1 1 1	1 0 1 1	103.2	0 1 1 1	1 0 1 0	1 1 1 1
92.4	1 0 1 1	1 1 1 0	0 1 1 1	103.4	0 1 1 1	1 0 0 1	1 0 1 1
92.6	1 0 1 1	1 1 0 1	0 0 1 1	103.6	0 1 1 1	1 0 0 0	0 1 1 1
92.8	1 0 1 1	1 0 1 1	1 1 1 1	103.8	0 1 1 1	0 1 1 1	0 0 1 1
93.0	1 0 1 1	1 0 1 0	1 0 1 1	104.0	0 1 1 1	0 1 0 1	1 1 1 1
93.2	1 0 1 1	1 0 0 1	0 1 1 1	104.2	0 1 1 1	0 1 0 0	1 0 1 1
93.4	1 0 1 1	1 0 0 0	0 0 1 1	104.4	0 1 1 1	0 0 1 1	0 1 1 1
93.6	1 0 1 1	0 1 1 0	1 1 1 1	104.6	0 1 1 1	0 0 1 0	0 0 1 1
93.8	1 0 1 1	0 1 0 1	1 0 1 1	104.8	0 1 1 1	0 0 0 0	1 1 1 1
94.0	1 0 1 1	0 1 0 0	0 1 1 1	105.0	0 1 1 0	1 1 1 1	1 0 1 1
94.2	1 0 1 1	0 0 1 1	0 0 1 1	105.2	0 1 1 0	1 1 1 0	0 1 1 1
94.4	1 0 1 1	0 0 0 1	1 1 1 1	105.4	0 1 1 0	1 1 0 1	0 0 1 1
94.6	1 0 1 1	0 0 0 0	1 0 1 1	105.6	0 1 1 0	1 0 1 1	1 1 1 1
94.8	1 0 1 0	1 1 1 1	0 1 1 1	105.8	0 1 1 0	1 0 1 0	1 0 1 1
95.0	1 0 1 0	1 1 1 0	0 0 1 1	106.0	0 1 1 0	1 0 0 1	0 1 1 1
95.2	1 0 1 0	1 1 0 0	1 1 1 1	106.2	0 1 1 0	1 0 0 0	0 0 1 1
95.4	1 0 1 0	1 0 1 1	1 0 1 1	106.4	0 1 1 0	0 1 1 0	1 1 1 1
95.6	1 0 1 0	1 0 1 0	0 1 1 1	106.6	0 1 1 0	0 1 0 1	1 0 1 1
95.8	1 0 1 0	1 0 0 1	0 0 1 1	106.8	0 1 1 0	0 1 0 0	0 1 1 1
96.0	1 0 1 0	0 1 1 1	1 1 1 1	107.0	0 1 1 0	0 0 1 1	0 0 1 1
96.2	1 0 1 0	0 1 1 0	1 0 1 1	107.2	0 1 1 0	0 0 0 1	1 1 1 1
96.4	1 0 1 0	0 1 0 1	0 1 1 1	107.4	0 1 1 0	0 0 0 0	1 0 1 1
96.6	1 0 1 0	0 1 0 0	0 0 1 1	107.6	0 1 0 1	1 1 1 1	0 1 1 1
96.8	1 0 1 0	0 0 1 0	1 1 1 1	107.8	0 1 0 1	1 1 1 0	0 0 1 1
97.0	1 0 1 0	0 0 0 1	1 0 1 1	108.0	0 1 0 1	1 1 0 0	1 1 1 1
97.2	1 0 1 0	0 0 0 0	0 1 1 1	108.2	0 1 0 1	1 0 1 1	1 0 1 1
97.4	1 0 0 1	1 1 1 1	0 0 1 1	108.4	0 1 0 1	1 0 1 0	0 1 1 1
97.6	1 0 0 1	1 1 0 1	1 1 1 1	108.6	0 1 0 1	1 0 0 1	0 0 1 1
97.8	1 0 0 1	1 1 0 0	1 0 1 1	108.8	0 1 0 1	0 1 1 1	1 1 1 1
98.0	1 0 0 1	1 0 1 1	0 1 1 1	109.0	0 1 0 1	0 1 1 0	1 0 1 1

597-1050-19

TABLE 4-1. FREQUENCY SYNTHESIZER PROGRAMMING

WARNING *DISCONNECT PRIMARY POWER TO THE EXCITER BEFORE PROCEEDING.*

WARNING

A. Disconnect the exciter primary power.

B. Remove the exciter top–panel.

C. Refer to the following information and program P5A and P5B as required.

PRE-EMPHASIS	P5A	P5B
75 us	Install	Install
50 us	Remove	Install
25 us	Install	Remove

D. Replace the exciter top–panel.

4–25. TROUBLESHOOTING.

4–26. The troubleshooting philosophy for the AFC/PLL circuit board consists of isolating a problem to a specific circuit. The problem may be further isolated by referencing the following information and Figures 4–3 and 4–4 which present troubleshooting information.

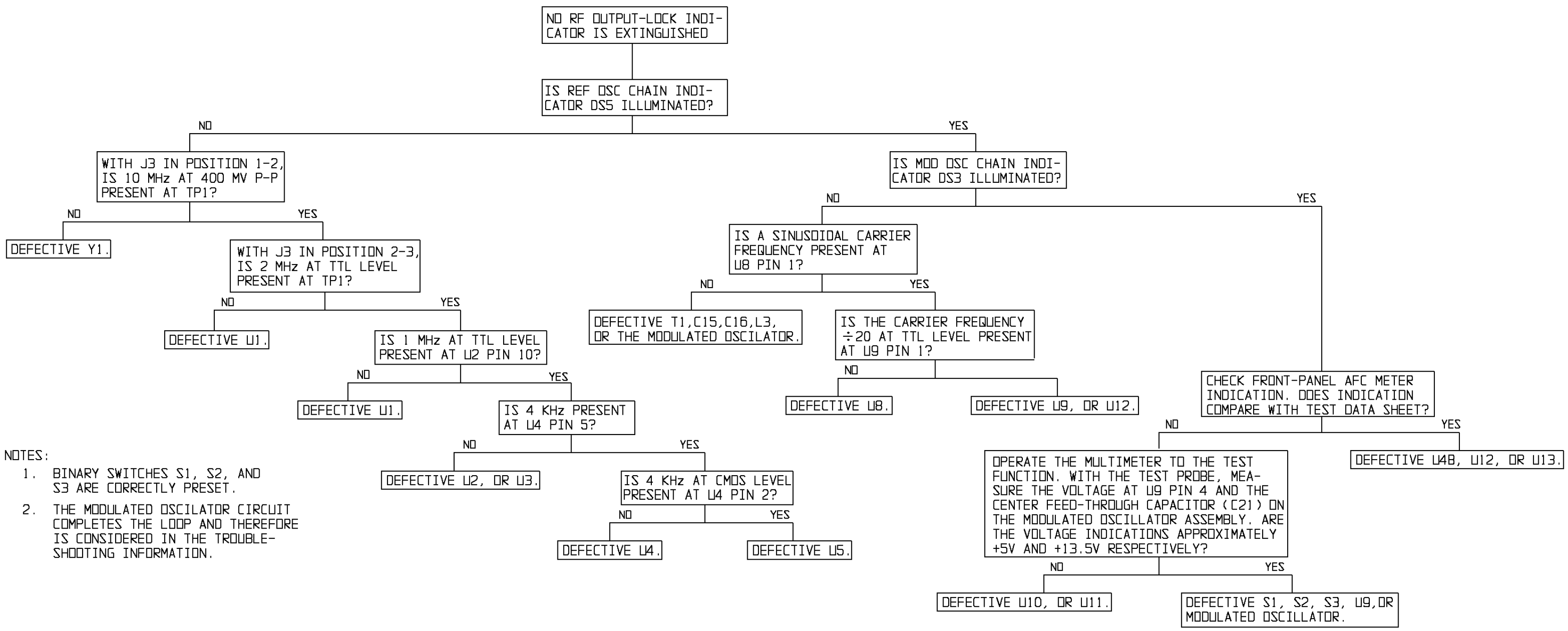
WARNING *DISCONNECT PRIMARY POWER FROM THE EXCITER BEFORE REMOVING OR REPLACING ANY COMPONENTS.*

WARNING

CAUTION *INADVERTENT CONTACT BETWEEN ADJACENT COMPONENTS AND CIRCUIT TRACES MAY DAMAGE THE AFC/PLL CIRCUIT BOARD.*

CAUTION

4–27. After the problem is isolated and power is totally deenergized, refer to the schematic diagrams and the theory of operation to assist in problem resolution. The defective circuitry may be repaired locally or the circuit board may be returned to Broadcast Electronics, Inc. for repair or replacement.

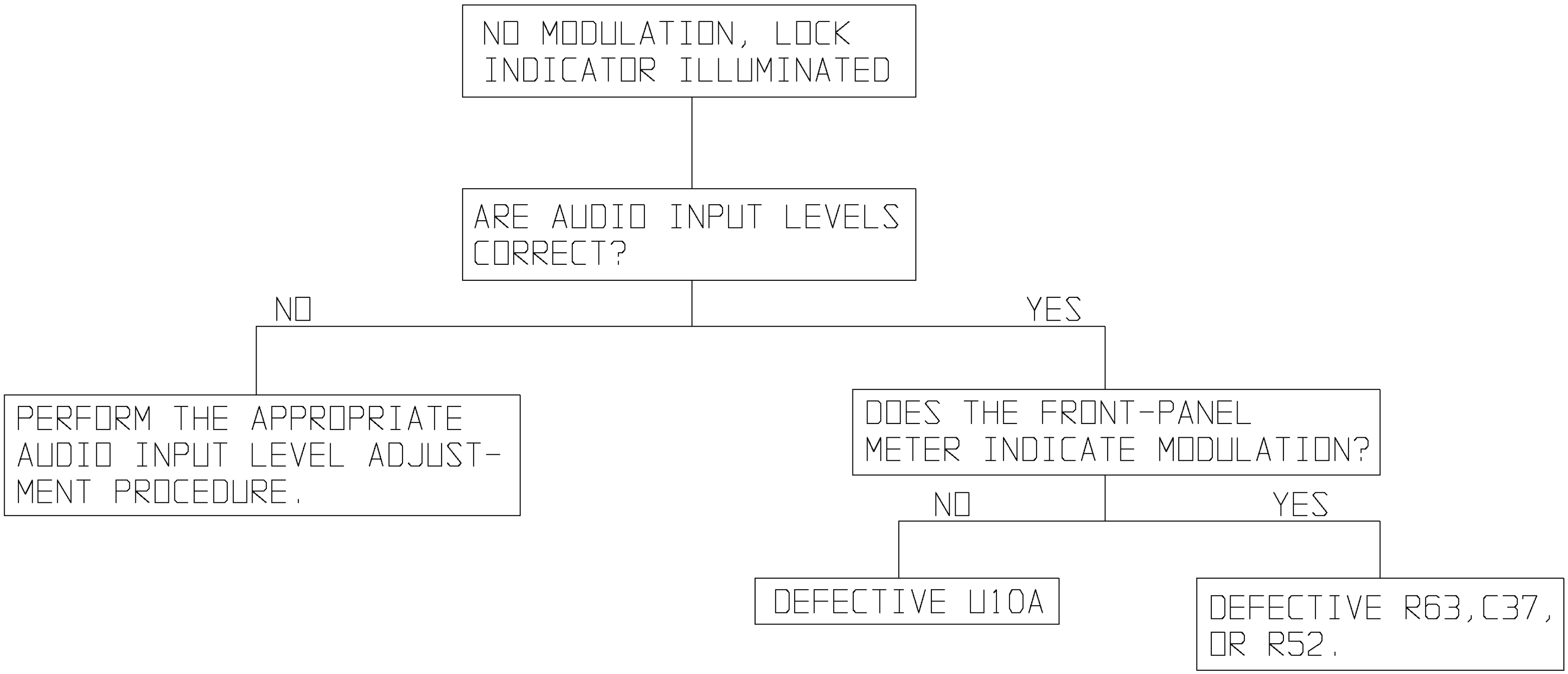


NOTES:

1. BINARY SWITCHES S1, S2, AND S3 ARE CORRECTLY PRESET.
2. THE MODULATED OSCILATOR CIRCUIT COMPLETES THE LOOP AND THEREFORE IS CONSIDERED IN THE TROUBLESHOOTING INFORMATION.

597-1050-21

FIGURE 4-3. NO RF OUTPUT-LOCK IS EXTINGUISHED



597-1050-22

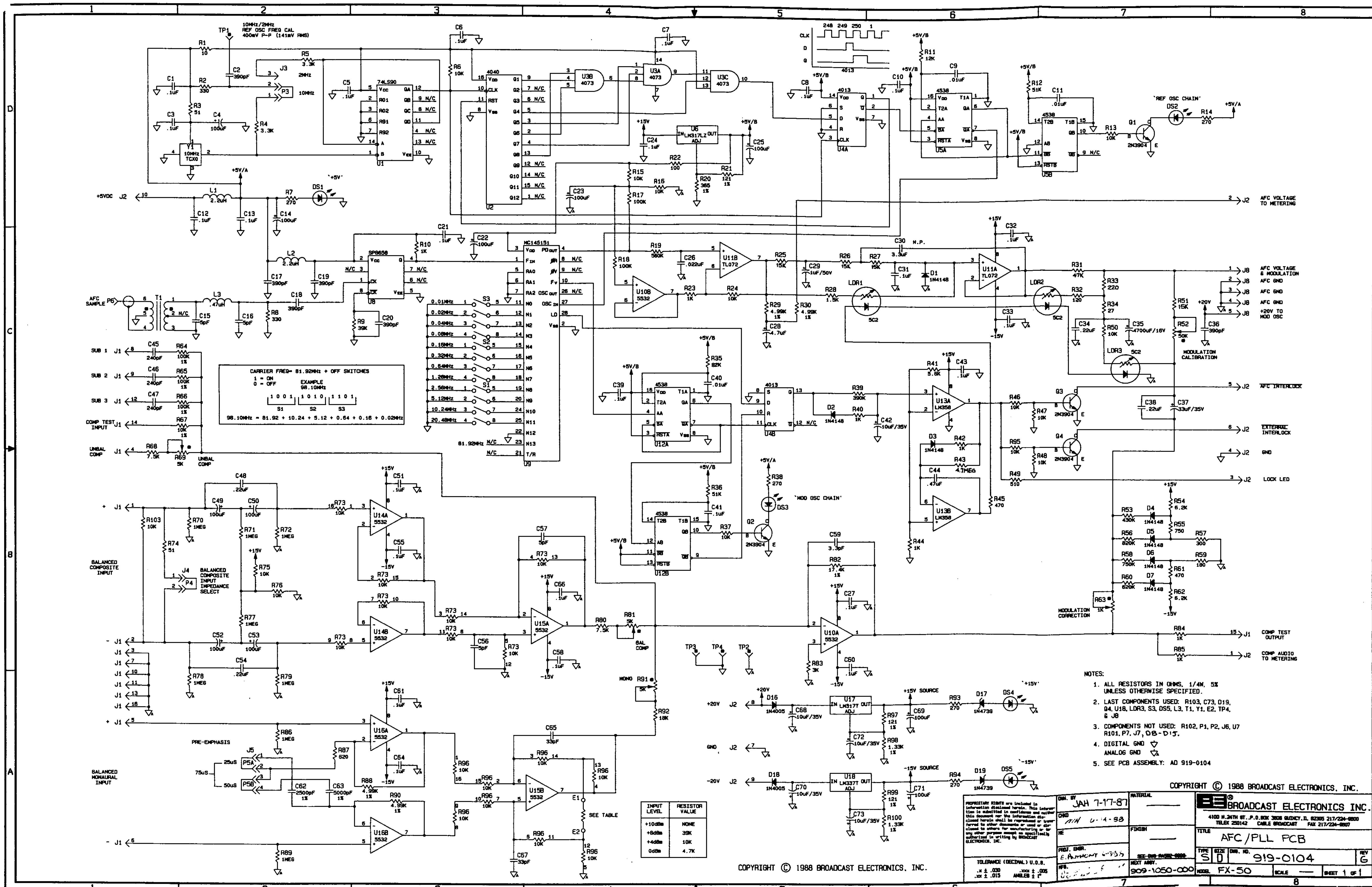
FIGURE 4-4. NO MODULATION, LOCK INDICATOR ILLUMINATED

SECTION V
DRAWINGS

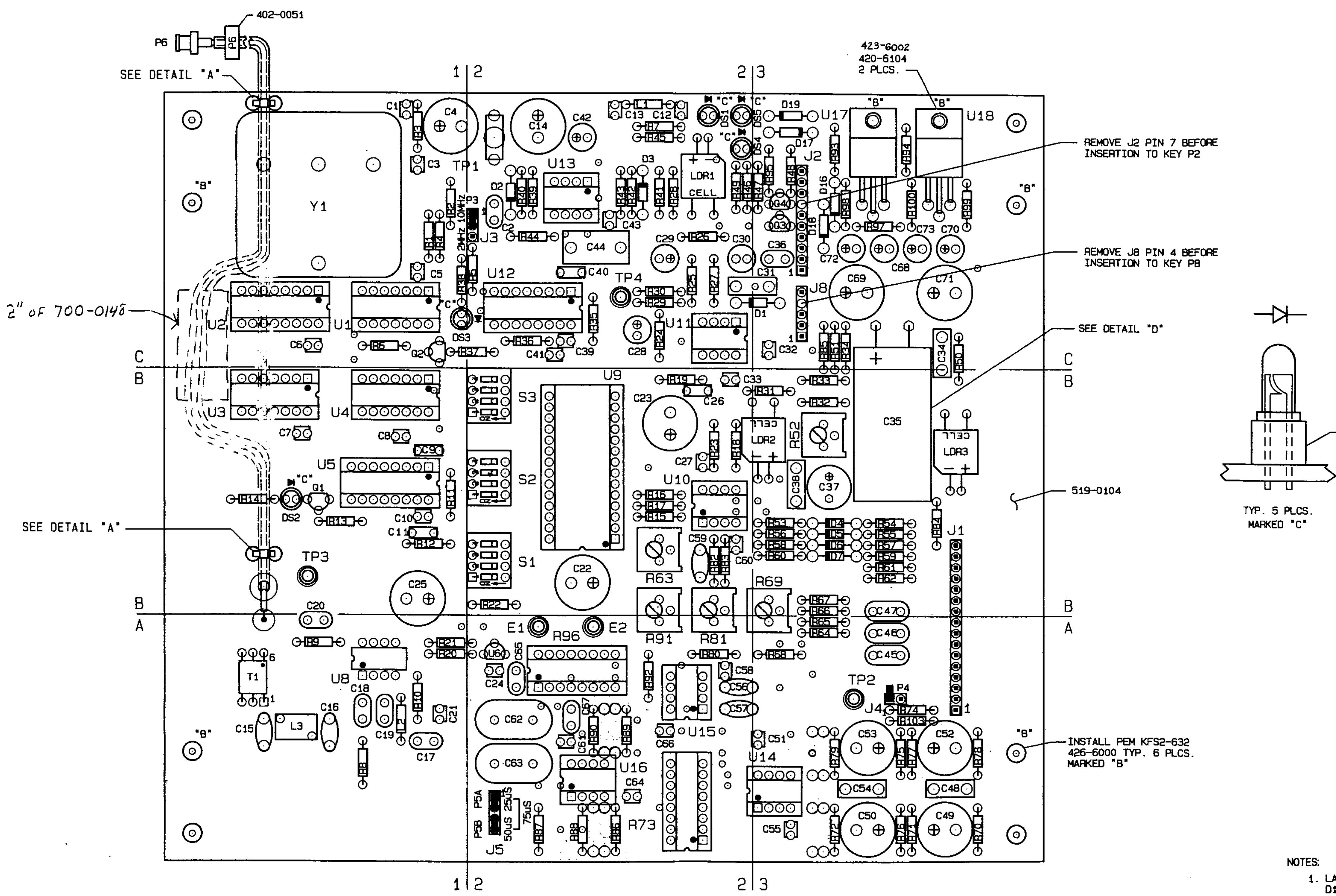
5-1. INTRODUCTION.

5-2. This section provides assembly drawings, wiring diagrams, and schematic diagrams as listed below for the AFC/PLL circuit board.

FIGURE	TITLE	NUMBER
5-1	AFC/PLL CIRCUIT BOARD SCHEMATIC DIAGRAM	SD919-0104
5-2	AFC/PLL CIRCUIT BOARD ASSEMBLY DIAGRAM	AD919-0104
5-3	AFC/PLL CIRCUIT BOARD COMPONENT LOCATOR	597-1050-70



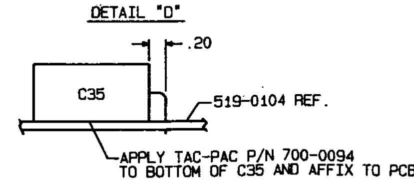
INPUT LEVEL	RESISTOR VALUE
+10dBm	NONE
+8dBm	39K
+4dBm	10K
0dBm	4.7K



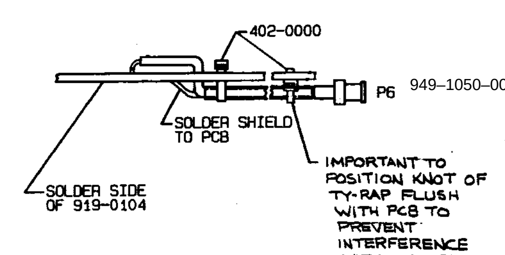
NOTES:

1. LAST COMPONENT USED: R103, C73, Q4, L3, S3, D19, DS5, LDR3, U18, J8, TP4, T1, Y1, E2.
2. COMPONENTS NOT USED: U7, P1, P2, J6, P7, J7, R101, R102.
3. SEE SCHEMATIC SD919-0104

DETAIL "D"



DETAIL "A"



PROPRIETARY RIGHTS are included in information disclosed herein. This information is submitted in confidence and neither this document nor the information disclosed herein shall be reproduced or transferred to other documents or used or disclosed to others for manufacturing or for any other purpose except as specifically authorized in writing by Broadcast Electronics, Inc.	DWN BY KLS / DATE 3-18-87	MATERIAL SEE B/M 919-0104	BROADCAST ELECTRONICS INC. 4100 N. 24TH ST. QUINCY, IL. 62305 217/224-9600 TELEX 250142 CABLE "BROADCAST"
	CHKD MH 6-14-88	FINISH	TITLE PCB ASSEMBLY–AFC/PLL
TOLERANCE DECIMAL U.O.S. .X ± .030 .XX ± .015 .XXX ± .005 ANGLES ± 1°	PROJ ENGR	NEXT ASSY 909-1050-000	TYPE A / SIZE D / DWG. NO. 919-0104 / REV M
	MFG		MODEL FX-50 / SCALE 2/1 / SHEET 1 OF 1

REF	ZONE	REF	ZONE	REF	ZONE	REF	ZONE	REF	ZONE	REF	ZONE	REF	ZONE	REF	ZONE
C1	C1	C41	C2	DS2	B1	R15	B2	R55	B3	R95	C3				
C2	C2	C42	C2	DS3	C1-C2	R16	B2	R56	B3	R96	A2				
C3	C1	C43	C2	DS4	C2	R17	B2	R57	B3	R97	C3				
C4	C1-C2	C44	C2	DS5	C2	R18	B2	R58	B3	R98	C3				
C5	C1	C45	A3	E1	A2	R19	B2	R59	B3	R99	C3				
C6	C1	C46	A3	E2	A2	R20	A1	R60	B3	R100	C3				
C7	B1	C47	B3-A3	J1	B3-A3	R21	A1	R61	B3	R103	A3				
C8	B1	C48	A3	J2	C3	R22	B2	R62	B3	S1	B2				
C9	B1	C49	A3	J3	C2	R23	B2	R63	B2	S2	B2				
C10	B1	C50	A3	J4	A3	R24	C2	R64	A3	S3	B2				
C11	B1	C51	A3	J5	A2	R25	C2	R65	A3	T1	A1				
C12	C2	C52	A3	J8	C3	R26	C2	R66	B3	TP1	C2				
C13	C2	C53	A3	L1	C2	R27	C2	R67	B3	TP2	A3				
C14	C2	C54	A3	L2	A1	R28	C2	R68	A3	TP3	B1				
C15	A1	C55	A3	L3	A1	R29	C2	R69	A3-B3	TP4	C2				
C16	A1	C56	A2-A3	LDR1	C2	R30	C2	R70	A3	U1	C1				
C17	A1	C57	A2-A3	LDR2	B2-B3	R31	B3	R71	A3	U2	C1				
C18	A1	C58	A2	LDR3	B3	R32	B3	R72	A3	U3	B1				
C19	A1	C59	B2	P3	C2	R33	B3	R73	A2	U4	B1				
C20	A1-B1	C60	B2	P4	A3	R34	C3	R74	A3	U5	B1				
C21	A1	D1	C2-C3	P5A	A2	R35	C2	R75	A3	U6	A2				
C22	B2	D2	C2	P5B	A2	R36	C2	R76	A3	U8	A1				
C23	B2	D3	C2	Q1	B1	R37	C1-C2	R77	A3	U9	B2				
C24	A2	D4	B3	Q2	C1	R38	C1	R78	A3	U10	B2				
C25	A1-B1	D5	B3	Q3	C3	R39	C2	R79	A3	U11	C2				
C26	B2	D6	B3	Q4	C3	R40	C2	R80	A2	U12	C2				
C27	B2	D7	B3	R1	C1	R41	C2	R81	B2-A2	U13	C2				
C28	C2	D8	A3	R2	C1	R42	C2	R82	B2	U14	A2-A3				
C29	C2	D9	A3	R3	C1	R43	C2	R83	B2	U15	A2				
C30	C2-C3	D10	A3	R4	C1	R44	C2	R84	B3	U16	A2				
C31	C2-C3	D11	A3	R5	C2	R45	C2	R85	C3	U17	C3				
C32	C3	D12	A2	R6	C1	R46	C2	R86	A2	U18	C3				
C33	B2	D13	A2	R7	C2	R47	C3	R87	A2	Y1	C1				
C34	C3-B3	D14	A2	R8	A1	R48	C3	R88	A2						
C35	B3-C3	D15	A2	R9	A1	R49	C2	R89	A2						
C36	C3	D16	C3	R10	A1	R50	B3-C3	R90	A2						
C37	B3	D17	C3	R11	B1	R51	C3	R91	B2-A2						
C38	B3	D18	C3	R12	B1	R52	B3	R92	A2						
C39	C2	D19	C3	R13	B1	R53	B3	R93	C3						
C40	C2	DS1	C2	R14	B1	R54	B3	R94	C3						

597-1050-70

FIGURE 5-3. AFC/PLL CIRCUIT BOARD COMPONENT LOCATORS

SECTION VI
REPLACEMENT PARTS

6-1. INTRODUCTION.

6-2. This section provides descriptions and part numbers of electrical components, assemblies, and selected mechanical parts required for maintenance of the AFC/PLL circuit board. Each table entry in this section is indexed by reference designators appearing on the applicable schematic diagram.

TABLE 6-1. AFC/PLL CIRCUIT BOARD ASSEMBLY - 919-0104
(Sheet 1 of 5)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	1
C2	Capacitor, Mica, 390 pF ±5%, 100V	042-3922	1
C3	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	1
C4	Capacitor, Electrolytic, 100 uF, 35V	023-1084	1
C5 THRU C8	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	4
C9	Capacitor, Mylar, 0.01 uF ±10%, 100V	031-1043	1
C10	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	1
C11	Capacitor, Mylar, 0.01 uF ±10%, 100V	031-1043	1
C12,C13	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	2
C14	Capacitor, Electrolytic, 100 uF, 35V	023-1084	1
C15,C16	Capacitor, Ceramic, 5 pF ±5%, 500V, NPO	001-5004	2
C17 THRU C20	Capacitor, Mica, 390 pF ±5%, 100V	042-3922	4
C21	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	1
C22,C23	Capacitor, Electrolytic, 100 uF, 35V	023-1084	2
C24	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	1
C25	Capacitor, Electrolytic, 100 uF, 35V	023-1084	1
C26	Capacitor, Mylar Film, 0.022 uF ±10%, 100V	031-2243	1
C27	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	1
C28	Capacitor, Electrolytic, 4.7 uF, 35V	024-4764	1
C29	Capacitor, Electrolytic, 1 uF, 50V	024-1064	1
C30	Capacitor, Electrolytic, 3.3 uF, 50V, Non-Polarized	024-3364	1
C31	Capacitor, Mylar, 0.1 uF ±10%, 100V	030-1053	1
C32,C33	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	2
C34	Capacitor, Mylar, 0.22 uF ±10%, 100V	030-2253	1
C35	Capacitor, Electrolytic, 4700 uF, 16V	020-4793	1
C36	Capacitor, Mica, 390 pF ±5%, 100V	042-3922	1
C37	Capacitor, Electrolytic, 33 uF, 35V	024-3374	1
C38	Capacitor, Mylar, 0.22 uF ±10%, 100V	030-2253	1

TABLE 6-1. AFC/PLL CIRCUIT BOARD ASSEMBLY - 919-0104
(Sheet 2 of 5)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C39	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	1
C40	Capacitor, Mylar, 0.01 uF ±10%, 100V	031-1043	1
C41	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	1
C42	Capacitor, Electrolytic, 10 uF, 35V	023-1076	1
C43	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	1
C44	Capacitor, Polyester, 0.47 uF ±10%, 100V	038-4753	1
C45,C46,C47	Capacitor, Mica, 240 pF, 500V	040-2422	3
C48	Capacitor, Mylar, 0.22 uF ±10%, 100V	030-2253	1
C49,C50	Capacitor, Electrolytic, 100 uF, 35V	023-1084	2
C51	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	1
C52,C53	Capacitor, Electrolytic, 100 uF, 35V	023-1084	2
C54	Capacitor, Mylar, 0.22 uF ±10%, 100V	030-2253	1
C55	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	1
C56,C57	Capacitor, Ceramic, 5 pF ±5%, 500V, NPO	001-5004	2
C58	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	1
C59	Capacitor, Ceramic Disc, 3.3 pF, 1000V	000-3302	1
C60,C61	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	2
C62	Capacitor, Mica, 2500 pF ±1%, 500V	042-2531	1
C63	Capacitor, Mica, 5000 pF ±1%, 500V	042-5031	1
C64	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	1
C65	Capacitor, Mica, 33 pF ±5%, 500V	042-3312	1
C66	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	1
C67	Capacitor, Mica, 33 pF ±5%, 500V	042-3312	1
C68	Capacitor, Electrolytic, 10 uF, 35V	023-1076	1
C69	Capacitor, Electrolytic, 100 uF, 35V	023-1084	1
C70	Capacitor, Electrolytic, 10 uF, 35V	023-1076	1
C71	Capacitor, Electrolytic, 100 uF, 35V	023-1084	1
C72,C73	Capacitor, Electrolytic, 10 uF, 35V	023-1076	2
D1 THRU D7	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	7
D16	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203-4005	1
D17	Diode, Zener, 1N4739A, 9.1V ±5%, 1W	200-0009	1
D18	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203-4005	1
D19	Diode, Zener, 1N4739A, 9.1V ±5%, 1W	200-0009	1
DS1 THRU DS5	Indicator, LED, Green, 521-9175, 3V @ 40 mA Maximum	323-9224	5
E1,E2	Terminal, Turret, Double Shoulder	413-1597	2
J1, J2,	Receptacle, Male, 20-Pin In-Line	417-0200	2
J3	Receptacle, Male, 2-Pin In-Line	417-4004	1
J4	Receptacle, Male, 3-Pin In-Line	417-0003	1
J5, J8	Receptacle, Male, 20-Pin In-Line	417-0200	2
L1,L2	RF Choke, 2.2 uH ±10%, 0.4 Ohms DC Resistance, 550 mA Maximum	360-2200	2
L3	RF Choke, 0.47 uH, 500 mA Maximum	364-0047	1
LDR1 THRU LDR3	Optical Isolator, VTL5C2, LDR/LED Type On Resistance: 500 Ohms Off Resistance: 1 Meg Ohm Cell Voltage: 200V Maximum Cell Current: 10 to 40 mA	323-7345	3
P3,P4	Jumper, Programmable, 2-Pin	340-0004	2
P5A,P5B	Jumper, Programmable, 2-Pin	340-0004	2
Q1 THRU Q4	Transistor, 2N3904, NPN, Silicon, TO-92 Case	211-3904	4
R1	Resistor, 10 Ohm ±5%, 1/4W	100-1023	1
R2	Resistor, 330 Ohm ±5%, 1/4W	100-3333	1

TABLE 6-1. AFC/PLL CIRCUIT BOARD ASSEMBLY - 919-0104
(Sheet 3 of 5)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R3	Resistor, 51 Ohm ±5%, 1/4W	100-5123	1
R4,R5	Resistor, 3.3 k Ohm ±5%, 1/4W	100-3343	2
R6	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	1
R7	Resistor, 270 Ohm ±5%, 1/4W	100-2733	1
R8	Resistor, 330 Ohm ±5%, 1/4W	100-3333	1
R9	Resistor, 39 k Ohm ±5%, 1/4W	100-3953	1
R10	Resistor, 1 k Ohm ±5%, 1/4W	100-1043	1
R11	Resistor, 12 k Ohm ±5%, 1/4W	100-1253	1
R12	Resistor, 51 k Ohm ±5%, 1/4W	100-5153	1
R13	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	1
R14	Resistor, 270 Ohm ±5%, 1/4W	100-2733	1
R15,R16	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	2
R17,R18	Resistor, 100 k Ohm ±5%, 1/4W	100-1063	2
R19	Resistor, 560 k Ohm ±5%, 1/4W	100-5663	1
R20	Resistor, 365 Ohm ±1%, 1/4W	103-3631	1
R21	Resistor, 121 Ohm ±5%, 1/4W	100-1231	1
R22	Resistor, 100 Ohm ±5%, 1/4W	100-1033	1
R23	Resistor, 1 k Ohm ±5%, 1/4W	100-1043	1
R24	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	1
R25,R26,R27	Resistor, 15 k Ohm ±5%, 1/4W	100-1553	3
R28	Resistor, 1.5 k Ohm ±5%, 1/4W	100-1543	1
R29,R30	Resistor, 4.99 k Ohm ±1%, 1/4W	100-5041	2
R31	Resistor, 47 k Ohm ±5%, 1/4W	100-4753	1
R32	Resistor, 120 Ohm ±5%, 1/4W	100-1233	1
R33	Resistor, 220 Ohm ±5%, 1/4W	100-2233	1
R34	Resistor, 27 Ohm ±5%, 1/4W	100-2723	1
R35	Resistor, 82 k Ohm ±5%, 1/4W	100-8253	1
R36	Resistor, 51 k Ohm ±5%, 1/4W	100-5153	1
R37	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	1
R38	Resistor, 270 Ohm ±5%, 1/4W	100-2733	1
R39	Resistor, 390 k Ohm ±5%, 1/4W	100-3963	1
R40	Resistor, 1 k Ohm ±5%, 1/4W	100-1043	1
R41	Resistor, 5.6 k Ohm ±5%, 1/4W	100-5643	1
R42	Resistor, 1 k Ohm ±5%, 1/4W	100-1043	1
R43	Resistor, 4.7 Meg Ohm ±5%, 1/4W	100-4773	1
R44	Resistor, 1 k Ohm ±5%, 1/4W	100-1043	1
R45	Resistor, 470 Ohm ±5%, 1/4W	100-4733	1
R46,R47,R48	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	3
R49	Resistor, 510 Ohm ±5%, 1/4W	100-5133	1
R50	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	1
R51	Resistor, 15 k Ohm ±5%, 1/4W	100-1553	1
R52	Potentiometer, 50 k Ohm ±10%, 1/2W	177-5054	1
R53	Resistor, 430 k Ohm ±5%, 1/4W	100-4363	1
R54	Resistor, 6.2 k Ohm ±5%, 1/4W	100-6243	1
R55	Resistor, 750 Ohm ±5%, 1/4W	100-7533	1
R56	Resistor, 820 k Ohm ±5%, 1/4W	100-8263	1

TABLE 6-1. AFC/PLL CIRCUIT BOARD ASSEMBLY - 919-0104
(Sheet 4 of 5)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R57	Resistor, 300 Ohm ±5%, 1/4W	100-3033	1
R58	Resistor, 750 k Ohm ±5%, 1/4W	100-7563	1
R59	Resistor, 180 Ohm ±5%, 1/4W	100-1833	1
R60	Resistor, 620 k Ohm ±5%, 1/4W	100-6263	1
R61	Resistor, 470 Ohm ±5%, 1/4W	100-4733	1
R62	Resistor, 6.2 k Ohm ±5%, 1/4W	100-6243	1
R63	Potentiometer, 1 k Ohm ±10%, 1/2W	175-1034	1
R64,R65,R66	Resistor, 100 k Ohm ±1%, 1/4W	103-1062	3
R67	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	1
R68	Resistor, 7.5 k Ohm ±5%, 1/4W	100-7543	1
R69	Potentiometer, 5 k Ohm ±10%, 1/2W	177-5044	1
R70,R71,R72	Resistor, 1 Meg Ohm ±5%, 1/4W	100-1073	3
R73	Resistor Network, 10-10 k Ohm 0.5% Resistors, 0.7W Total Dissipation, 16-Pin DIP	226-0392	1
R74	Resistor, 51 Ohm ±5%, 1/4W	100-5123	1
R75,R76	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	2
R77,R78,R79	Resistor, 1 Meg Ohm ±5%, 1/4W	100-1073	3
R80	Resistor, 7.5 k Ohm ±5%, 1/4W	100-7543	1
R81	Potentiometer, 5 k Ohm ±10%, 1/2W	177-5044	1
R82	Resistor, 17.4 k Ohm ±1%, 1/4W	103-1745	1
R83	Resistor, 3 k Ohm ±5%, 1/4W	100-3043	1
R84,R85	Resistor, 1 k Ohm ±5%, 1/4W	100-1043	2
R86	Resistor, 1 Meg Ohm ±5%, 1/4W	100-1073	1
R87	Resistor, 620 Ohm ±5%, 1/4W	100-6233	1
R88	Resistor, 4.99 k Ohm ±1%, 1/4W	100-5041	1
R89	Resistor, 1 Meg Ohm ±5%, 1/4W	100-1073	1
R90	Resistor, 4.99 k Ohm ±1%, 1/4W	100-5041	1
R91	Potentiometer, 5 k Ohm ±10%, 1/2W	177-5044	1
R92	Resistor, 18 k Ohm ±5%, 1/4W	100-1853	1
R93,R94	Resistor, 270 Ohm ±5%, 1/4W	100-2733	2
R95	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	1
R96	Resistor Network, 10-10 k Ohm 0.5% Resistors, 0.7W Total Dissipation, 16-Pin DIP	226-0392	1
R97	Resistor, 121 Ohm ±5%, 1/4W	100-1231	1
R98	Resistor, 1.33 k Ohm ±1%, 1/4W	103-1331	1
R99	Resistor, 121 Ohm ±5%, 1/4W	100-1231	1
R100	Resistor, 1.33 k Ohm ±1%, 1/4W	103-1331	1
R103	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	1
S1 THRU S3	Switch, SPST, 4 Position, 8-Pin DIP	340-0002	3
T1	Wideband RF Transformer, 0.2 to 350 MHz, Impedance Ratio 4:1 Primary Impedance: 50/75 Ohms Secondary Impedance: 200/300 Ohms	370-0002	1
TP1	Jack, Test, Red, Circuit Board Mount	417-0004	1
TP2,TP3,TP4	Terminal, Turret, Double Shoulder	413-1597	3
U1	Integrated Circuit, SN74LS90N, Negative edge-triggered, Divide-by-10 Counter, 14-Pin DIP	228-0290	1
U2	Integrated Circuit, MC14040B, CMOS MSI, 12-Bit Binary Counter, 16-Pin DIP	220-4040	1
U3	Integrated Circuit, MC14073B, Triple 3-Input AND Gate, CMOS, 14-Pin DIP	228-4073	1
U4	Integrated Circuit, MC14013BCP, Dual D-Type Flip-Flop, CMOS, 14-Pin DIP	228-4013	1

TABLE 6-1. AFC/PLL CIRCUIT BOARD ASSEMBLY - 919-0104
(Sheet 5 of 5)

REF. DES.	DESCRIPTION	PART NO.	QTY.
U5	Integrated Circuit, MC14538B, Dual Retriggerable, Resettable Monostable Multivibrator, CMOS, 16-Pin DIP	228-4538	1
U6	Integrated Circuit, LM317LZ, Adjustable Positive Voltage Regulator, 1.2 to 37V @ 0.1 Ampere, TO-92 Case	220-0317	1
U8	Integrated Circuit, SP8658, Prescaler, Divide-by-twenty Counter, 8-Pin DIP	220-8658	1
U9	Integrated Circuit, MC145151P, Parallel Input, PLL Frequency Synthesizer, CMOS, 28-Pin DIP	220-5151	1
U10	Integrated Circuit, NE5532AP, Dual Low Noise Operational Amplifier, 8-Pin DIP	221-5532-001	1
U11	Integrated Circuit, TL072CP, Dual JFET-Input Operational Amplifier, 8-Pin DIP	221-0072	1
U12	Integrated Circuit, MC14538B, Dual Retriggerable, Resettable Monostable Multivibrator, CMOS, 16-Pin DIP	228-4538	1
U13	Integrated Circuit, LM358N, Dual Operational Amplifier, 8-Pin DIP	221-0358	1
U14 THRU U16	Integrated Circuit, NE5532AP, Dual Low Noise Operational Amplifier, 8-Pin DIP	221-5532-001	3
U17	Integrated Circuit, LM317T, Adjustable Positive Voltage Regulator, 1.2V to 37V, 1.5 Ampere, TO-220 Case	227-0317	1
U18	Integrated Circuit, LM337T, Adjustable Negative Voltage Regulator, 1.2V to 37V, 1.5 Ampere, TO-220 Case	227-0337	1
XR73,XR96	Socket, 16-Pin DIP	417-1604	2
XU1	Socket, 14-Pin DIP	417-1404	1
XU2	Socket, 16-Pin DIP	417-1604	1
XU3,XU4	Socket, 14-Pin DIP	417-1404	2
XU5	Socket, 16-Pin DIP	417-1604	1
XU9	Receptacle, 28-Pin DIP	417-2804	1
XU10,XU11	Socket, 8-Pin DIP	417-0804	2
XU12	Socket, 16-Pin DIP	417-1604	1
XU13 THRU XU16	Socket, 8-Pin DIP	417-0804	4
Y1	Oscillator, Crystal, TCXO, 10 MHz ±3 PPM, 05C to 505C, Input: ±5 VDC, Output: TTL Compatible	390-0001	1
----	Blank Circuit Board, AFC/PLL	519-0104	1

TABLE 6-2. CABLE HARNESS, AFC/PLL ASSEMBLY - 949-1050-001

REF. DES.	DESCRIPTION	PART NO.	QTY.
P6	Plug, BNC, Dual Crimp	418-0034	1

RF AMPLIFIER
TABLE OF CONTENTS

LIST OF TABLES

LIST OF ILLUSTRATIONS

SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. This section provides general information and specifications relative to the operation of the RF amplifier assembly.

1-3. DESCRIPTION.

1-4. The RF amplifier assembly consists of three stages of amplification to increase the low-level RF input signal from the modulated oscillator to an adjustable level of 3 to 50 watts as required to drive an associated transmitter. Directional coupler sensing lines on the circuit board provide both forward and reflected power outputs for monitoring and control of amplifier operation.

1-5. ELECTRICAL SPECIFICATIONS.

1-6. Refer to Table 1-1 for electrical specifications of the RF amplifier assembly.

TABLE 1-1. ELECTRICAL CHARACTERISTICS

PARAMETER	SPECIFICATIONS
SIGNAL LEVELS:	
RF AMPLIFIER	
INPUT	0.0 dBm at 50 Ohms.
OUTPUT	3 to 50 Watts RF at 50 Ohms (adjustable).
DIRECTIONAL COUPLER OUTPUT	
FORWARD	2.2V dc at 50 Watts RF Output.
REFLECTED	Less than 1V dc at 50 Watts RF Output at 50 Ohms.

SECTION II
REMOVAL AND INSTALLATION

2–1. INTRODUCTION.

2–2. This section provides removal and installation procedures for the RF amplifier assembly.

2–3. REMOVAL AND INSTALLATION PROCEDURES.

2–4. REMOVAL PROCEDURE.

2–5. **REQUIRED EQUIPMENT.** A number 2 Phillips screwdriver with a 4 inch (10.16 cm) blade is required to remove the RF amplifier assembly from the exciter chassis.

2–6. **PROCEDURE.** The removal of the RF amplifier assembly requires the exciter be placed on a suitable work surface. To remove the RF amplifier assembly, proceed as follows:

WARNING ***DISCONNECT THE PRIMARY POWER FROM THE EXCITER BEFORE PROCEEDING.***

WARNING

A. Disconnect the primary power from the exciter.

B. Remove the exciter top–cover and disconnect J15 from P15 of the RF amplifier power/control cable.

C. Disconnect BNC connector P18 from J18 on the rear of the RF amplifier assembly.

D. Disconnect BNC connector P17 from J17 on the front of the RF amplifier assembly.

E. Remove the six screws from the underside which secure the assembly to the chassis.

F. Remove the RF amplifier assembly from the exciter chassis.

2–7. INSTALLATION PROCEDURE.

2–8. To install the RF amplifier assembly after repairs have been completed, proceed as follows:

WARNING ***DISCONNECT THE PRIMARY POWER FROM THE EXCITER BEFORE PROCEEDING.***

WARNING

A. Disconnect the primary power from the exciter.

B. Follow the REMOVAL PROCEDURE in reverse order.

SECTION III
THEORY OF OPERATION

3–1. INTRODUCTION.

3–2. This section presents the theory of operation for the exciter RF amplifier assembly.

3–3. RF AMPLIFIER ASSEMBLY DESCRIPTION.

3–4. The RF amplifier assembly consists of: 1) two series–pass voltage regulator transistors, 2) a +20V regulator circuit, 3) a temperature sensing circuit, and 4) an RF amplifier circuit board. All wiring to and from the assembly is routed through plugs and jacks to facilitate maintenance. An exhaust fan is installed on the exciter rear–panel to maintain proper operating temperature.

3–5. RF AMPLIFIER CIRCUIT BOARD DESCRIPTION.

3–6. The RF amplifier circuit board contains a three–stage FM broadband amplifier with a maximum output power of 50 watts. Output levels from 3 to 50 watts are attained by adjusting the power transistor control voltage. Due to the broadband characteristics, tuning of the amplifier is not required.

3–7. In addition, the RF amplifier circuit board contains forward and reflected power directional couplers and an input mute circuit. The directional coupler outputs and operating potentials are routed from the circuit board through the chassis with feed–through capacitors to prevent RF interference.

3–8. FUNCTIONAL DESCRIPTION.

3–9. A simplified schematic diagram of the RF amplifier circuit board is presented in Figure 3–1. Refer to Figure 3–1 as required for a description of the following circuits.

A. RF amplifier circuit.

B. Directional coupler circuits.

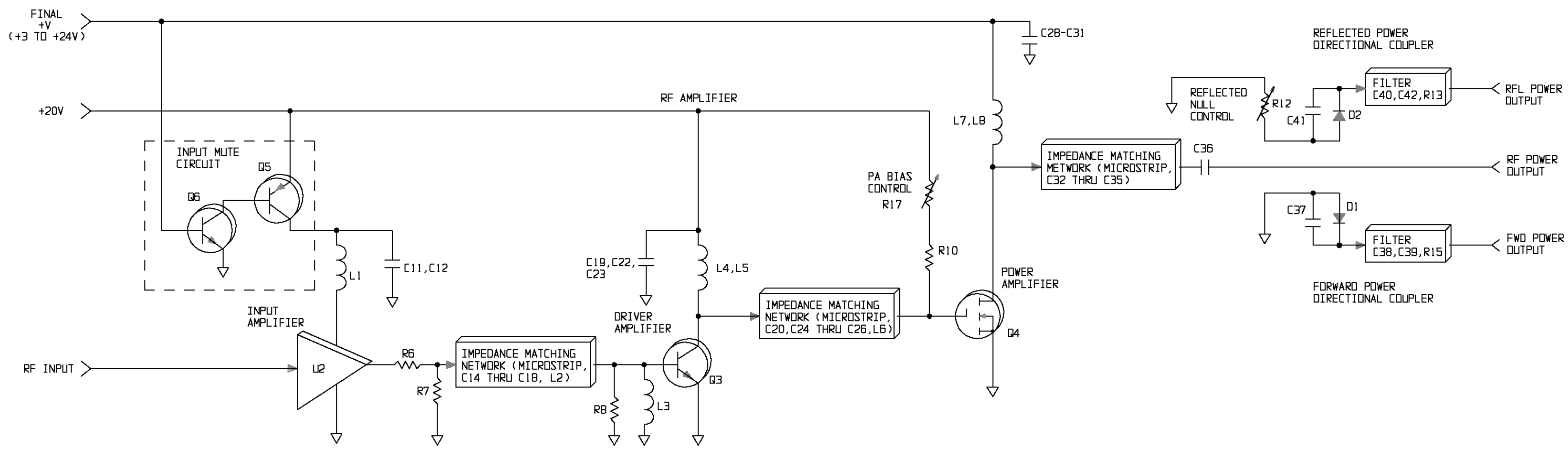
C. Input mute circuit.

3–10. **RF AMPLIFIER CIRCUIT.** The RF amplifier circuit consists of an input amplifier, a driver amplifier, a power amplifier, and associated components. Interstage impedance matching networks are designed with microstrips to provide maximum broadband frequency stabilization.

3–11. **Input Amplifier.** The input amplifier consists of thick–film hybrid amplifier U2, and resistor pad R6 and R7. A 1 milliwatt RF input signal from the modulated oscillator is input to U2. This stage provides approximately 1 watt of output power across R6 and R7 to the following stage.

3–12. Input amplifier U2 operates from a dc potential of +20 volts which is routed through input mute transistor Q5. Inductor L1 and capacitors C11 and C12 provide power supply isolation.

3–13. **Driver Amplifier.** The driver amplifier consists of transistor Q3, an impedance matching network, resistor R8, and inductor L3. The matching network converts the 50 Ohm output of U2 to the low input impedance required by Q3. This stage provides approximately 8 watts of output power to the following stage. L3 provides a dc return path for Q3 and R8 ensures stable amplifier operation.



597-1050-23

FIGURE 3-1. RF AMPLIFIER SIMPLIFIED SCHEMATIC

3–14. Driver amplifier Q3 operates from a dc potential of +20 volts. Inductors L4 and L5, and capacitors C19, C22, and C23 provide power supply isolation.

3–15. **Power Amplifier.** The power amplifier consists of power transistor Q4, an impedance matching network, resistor R10, and PA bias control R17. The matching network converts the output impedance of Q3 to the low input impedance required by Q4. R10 provides isolation from the bias network and R17 establishes the quiescent drain current for Q4. This stage provides 50 watts of output power to the associated transmitter.

3–16. The drain of Q4 connects to an impedance matching network which operates as: 1) a broadband impedance step–up transformer to establish an output impedance of 50 Ohms, and 2) a second harmonic notch filter. Capacitor C36 functions as a dc blocking capacitor.

3–17. Power amplifier Q4 operates from an adjustable dc potential of +3 to +24 volts. The adjustable potential is preset by circuitry on the power supply/control circuit board and is automatically maintained by feedback from the forward directional coupler. Inductors L7 and L8, and capacitors C28 through C31 provide power supply isolation.

3–18. **DIRECTIONAL COUPLER CIRCUITS.** The directional couplers provide two dc signals obtained by rectifying a sample of the RF output signal. Due to the polarity of the samples, one signal will represent the forward output signal and the other will represent the reflected.

3–19. **Forward Directional Coupler.** The forward voltage sample is obtained from a microstrip on the circuit board near the output line. This signal is rectified and filtered by diode D1, capacitors C38 and C39, and resistor R15. Capacitor C37 establishes the broadband characteristics of the circuit.

3–20. **Reflected Directional Coupler.** The reflected voltage sample is obtained from a microstrip on the circuit board near the output line. This signal is rectified and filtered by diode D2, capacitors C40 and C41, and resistor R13. Capacitor C41 establishes the broadband characteristics of the circuit. The directivity of the circuit is adjusted by null control R12.

3–21. **INPUT MUTE CIRCUIT.** The input mute circuit consists of transistors Q5 and Q6. During normal operation, +20 volts is routed to input amplifier U2 through Q5. When the exciter is muted, the final +V supply is terminated. The loss of this potential will bias Q6 OFF and disable Q5 which terminates the +20 volts to U2.

SECTION IV
MAINTENANCE

4-1. INTRODUCTION.

4-2. This section provides maintenance information, electrical adjustment procedures, and troubleshooting information for the RF amplifier assembly.

4-3. MAINTENANCE.

4-4. ELECTRICAL ADJUSTMENTS.

4-5. Although the following controls are not located on the RF amplifier assembly, the controls effect the operation of the RF amplifier. The adjustment procedure for each control is presented in the power supply/control circuit board section of this manual.

A. TEMP TRIP (R27)

B. TEMP CAL (R25)

C. FWD CAL (R5)

D. RFL CAL (R9)

4-6. **REQUIRED EQUIPMENT.** The following tools and equipment are required for electrical adjustment procedures.

A. Insulated adjustment tool, shipped with the exciter (P/N 407-0038).

B. Non-inductive, 100 watt, 50 Ohm test load.

C. Adapter, BNC jack to type N plug for test load (P/N 417-3288).

D. Adapter, type N jack-to-jack for test load (P/N 417-3841).

E. Coaxial accessory cable, BNC connectors, shipped with exciter (P/N 947-0017-2).

4-7. **RFL NULL (R12).** The **RFL NULL** control on the RF amplifier circuit board adjusts the directivity of the reflected power directional coupler. Potentiometer R12 is adjusted as follows.

4-8. **Procedure.** To adjust reflected power null control R12, proceed as follows:

WARNING ***DISCONNECT THE PRIMARY POWER TO THE EXCITER BEFORE PROCEEDING.***

WARNING

A. Disconnect the exciter primary power.

B. Remove the exciter top-cover and the access hole plug at the top and rear of the RF amplifier assembly (refer to Figure 4-1).

C. Connect a 100 watt non-inductive test load to the exciter rear-panel **RF OUTPUT** receptacle.

D. Apply primary power and operate the exciter for 50 watts as indicated on the front-panel meter.

E. Depress the front-panel **RFL** meter function switch.

WARNING ***MAINTENANCE WITH POWER APPLIED IS ALWAYS CONSIDERED HAZARDOUS AND THEREFORE CAUTION SHOULD BE OBSERVED. DO NOT TOUCH ANY COMPONENTS WITHIN THE EXCITER WHEN POWER IS APPLIED.***

WARNING

WARNING ***USE AN INSULATED TOOL FOR ADJUSTMENT.***

WARNING

F. Refer to Figure 4-1 and adjust R12 for minimum reflected power as indicated on the front-panel meter.

WARNING ***DISCONNECT THE PRIMARY POWER TO THE EXCITER BEFORE PROCEEDING.***

WARNING

G. Disconnect the exciter primary power.

H. Remove all test equipment and replace the access hole plug and exciter top-cover.

4-9. **PA BIAS (R17).** **PA BIAS** control R17 on the RF amplifier circuit board adjusts the PA quiescent current. Potentiometer R17 is adjusted as follows.

4-10. **Procedure.** To adjust PA bias control R17, proceed as follows:

WARNING ***DISCONNECT THE PRIMARY POWER TO THE EXCITER BEFORE PROCEEDING.***

WARNING

A. Disconnect the exciter primary power.

B. Refer to the REMOVAL PROCEDURE in SECTION II, REMOVAL AND INSTALLATION and remove the RF amplifier assembly from the exciter chassis.

C. Refer to Figure 4-1 and remove the 10 screws securing the RF amplifier assembly to the mounting bracket/shield.

D. Refer to Figure 4-1 and position the RF amplifier assembly in the chassis as shown.

E. Refer to Figure 4-1 and connect J15 to P15 of the RF amplifier assembly power/control cable.

F. Refer to Figure 4-1 and connect P18 to J18 on the rear of the RF amplifier assembly.

G. Connect a 100 watt non-inductive test load to the exciter rear-panel **RF OUTPUT** receptacle.

H. Apply primary power to the exciter and record the forward power meter indication ______________.

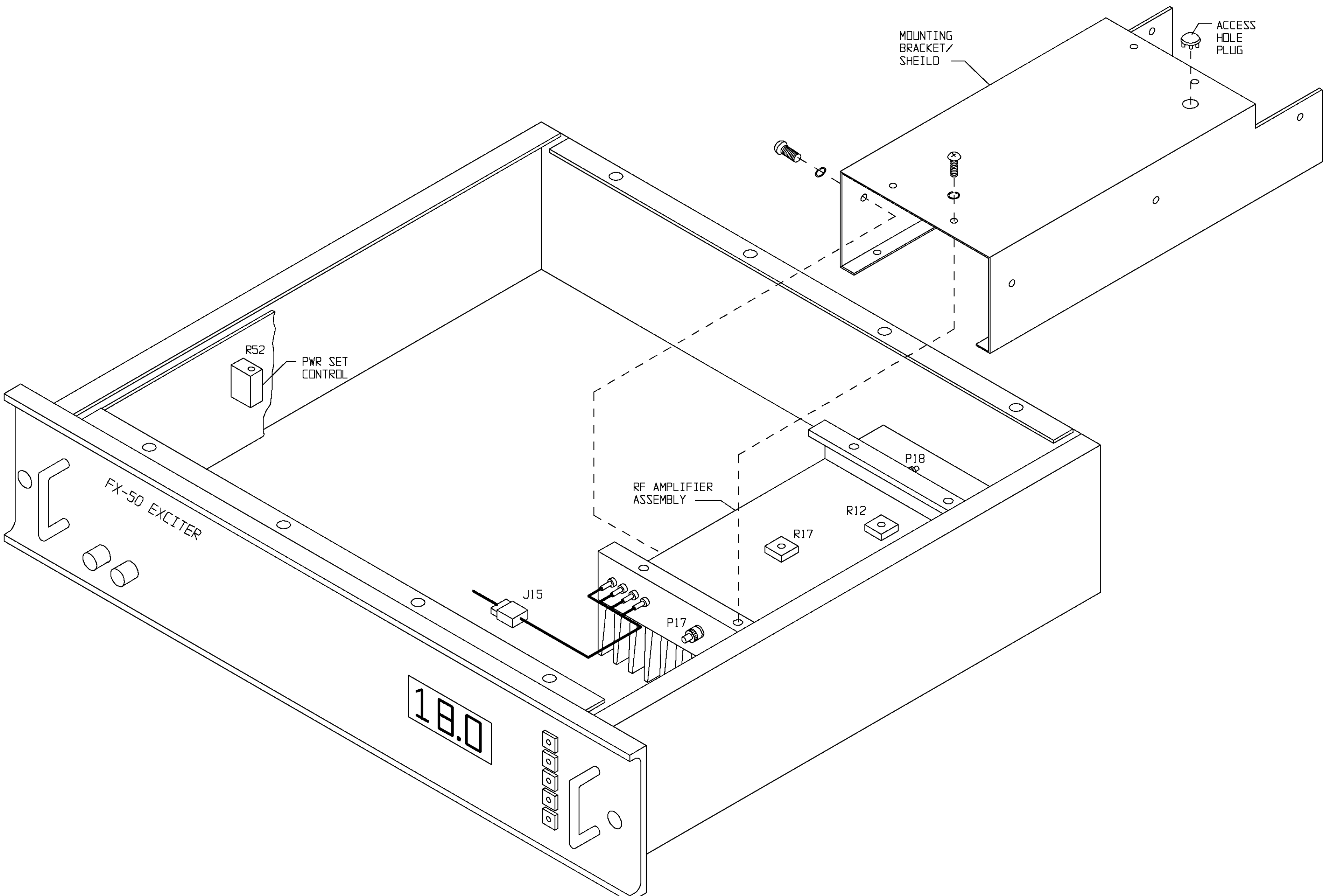


FIGURE 4-1. **597-1050-24**

RF AMPLIFIER CIRCUIT BOARD CONTROLS

WARNING *MAINTENANCE WITH POWER APPLIED IS ALWAYS CON-SIDERED HAZARDOUS AND THEREFORE CAUTION SHOULD BE OBSERVED. DO NOT TOUCH ANY COMPONENTS WITHIN THE EXCITER WHEN POWER IS APPLIED.*

WARNING

WARNING *USE AN INSULATED TOOL FOR ADJUSTMENT.*

WARNING

I. Remove RF drive by disconnecting P17 from the RF amplifier.

J. Refer to Figure 4-1 and adjust **PWR SET** control R52 on the power supply/control circuit board fully clockwise.

K. Depress front-panel **PAI** meter function switch.

L. Refer to Figure 4-1 and adjust R17 for 300 milliamps (0.30) as indicated on the front-panel meter.

M. Refer to Figure 4-1 and connect P17 to the RF amplifier.

N. Refer to Figure 4-1 and adjust **PWR SET** control R52 until the meter indicates the value recorded in step H.

WARNING *DISCONNECT PRIMARY POWER TO THE EXCITER BEFORE PROCEEDING.*

WARNING

O. Disconnect primary power to the exciter.

P. Remove all test equipment and replace the RF amplifier assembly mounting bracket/shield.

Q. Refer to the INSTALLATION PROCEDURE in SECTION II, REMOVAL AND INSTALLATION and install the RF amplifier assembly in the exciter chassis.

4-11. **TROUBLESHOOTING.**

4-12. The troubleshooting philosophy for the RF amplifier assembly consists of isolating a problem to a specific circuit. The problem may be further isolated by referencing the following information and Figure 4-2 which presents troubleshooting information for the RF amplifier assembly.

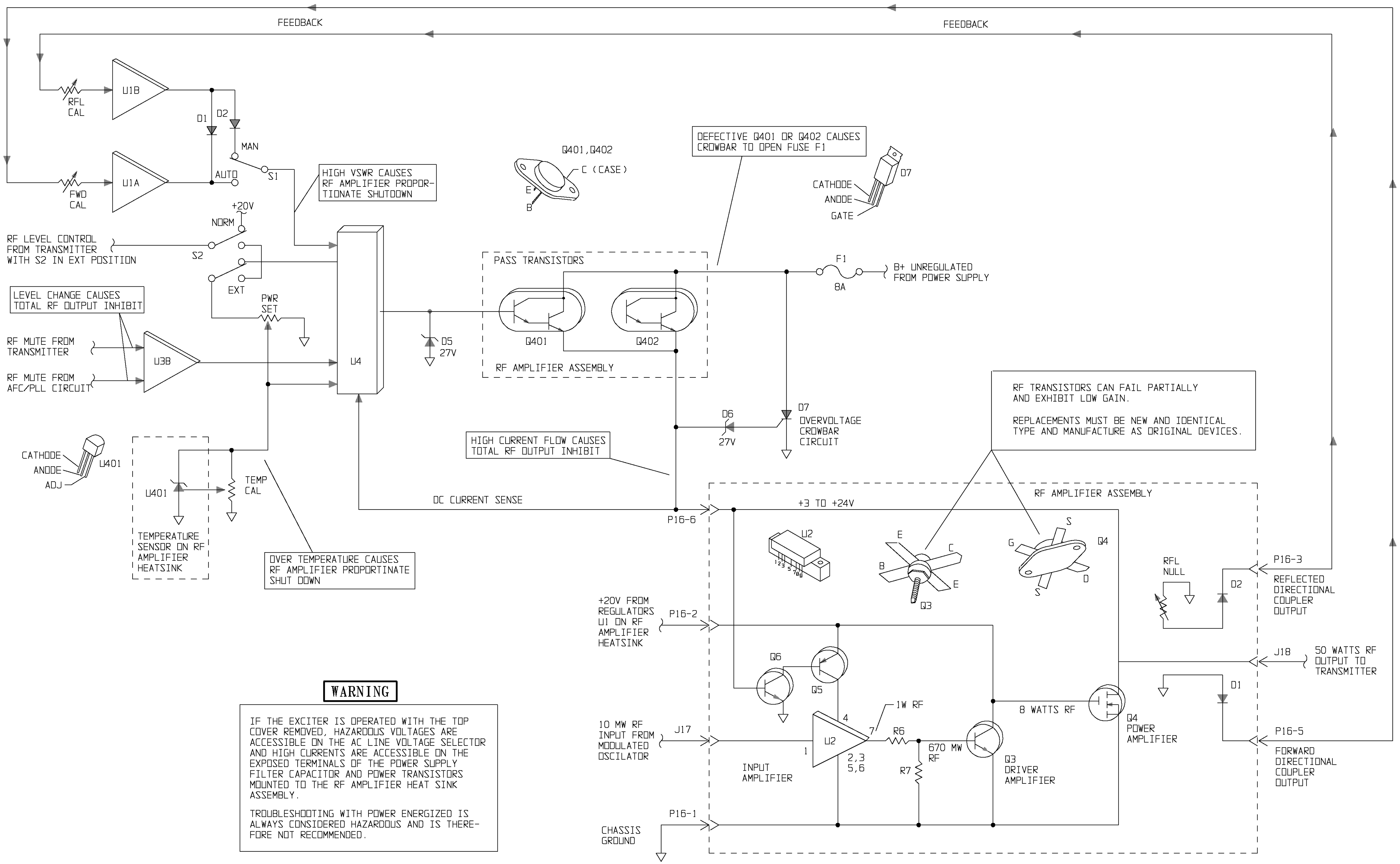
WARNING ***DISCONNECT THE POWER FROM THE EXCITER BEFORE REMOVING OR REPLACING ANY COMPONENTS.***

WARNING

CAUTION ***INADVERTENT CONTACT BETWEEN ADJACENT COMPONENTS AND CIRCUIT TRACES MAY DAMAGE THE RF AMPLIFIER ASSEMBLY.***

CAUTION

4–13. After the problem is isolated and power is totally deenergized, refer to the schematic diagrams and the theory of operation to facilitate in problem resolution. The defective circuitry may be repaired locally or the circuit board may be returned to Broadcast Electronics, Inc. for repair or replacement.



597-1050-25

FIGURE 4-2. RF AMPLIFIER TROUBLESHOOTING INFORMATION

BROADCAST ELECTRONICS INC

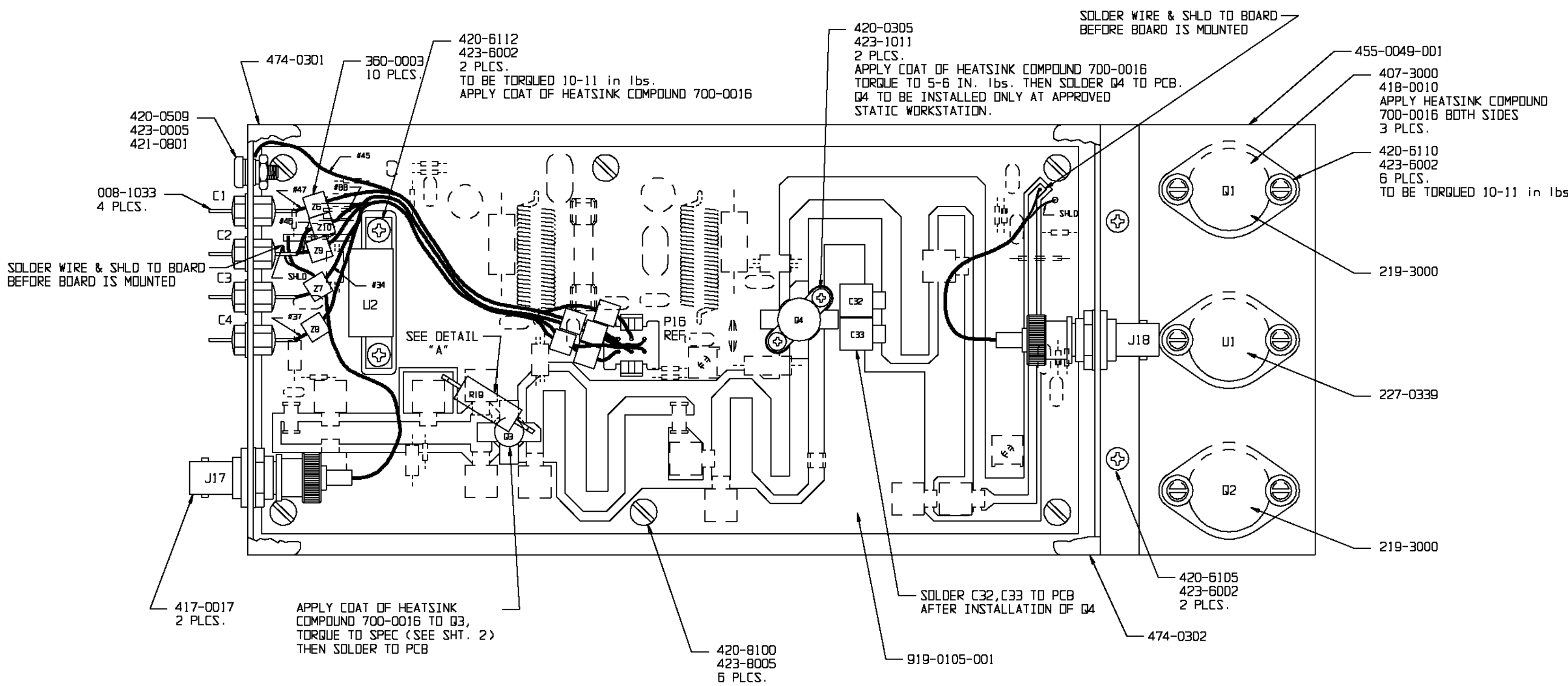
SECTION V
DRAWINGS

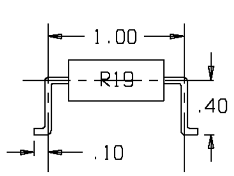
5-1. INTRODUCTION.

5-2. This section provides assembly drawings, wiring diagrams, and schematic diagrams as listed below for the RF amplifier assembly.

FIGURE	TITLE	NUMBER
5-1	RF AMPLIFIER ASSEMBLY DIAGRAM	AD959-0204
5-2	RF AMPLIFIER CIRCUIT BOARD SCHEMATIC DIAGRAM	SD919-0105-001
5-3	RF AMPLIFIER CIRCUIT BOARD ASSEMBLY DIAGRAM	AC919-0105-001
5-4	RF AMPLIFIER REGULATOR CIRCUIT BOARD SCHEMATIC DIAGRAM	SB919-0410-004
5-5	AMPLIFIER INPUT/RFI FILTER/REGULATOR CIRCUIT BOARD ASSEMBLY	AC919-0410-001/ -003/ -004

REV	DATE	DESCRIPTION	DFTSMN	ENGR	ECN
REVISIONS					





DETAIL "A"

TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°

DWN. BY JAH 1-29-88
CHKD MH 6-14-88
ME J.H.STEINKAMP 6-20-88
PROJ. ENGR. E.ANTHONY 6-13-88
MFG. D.B.NEWLON 6-14-88

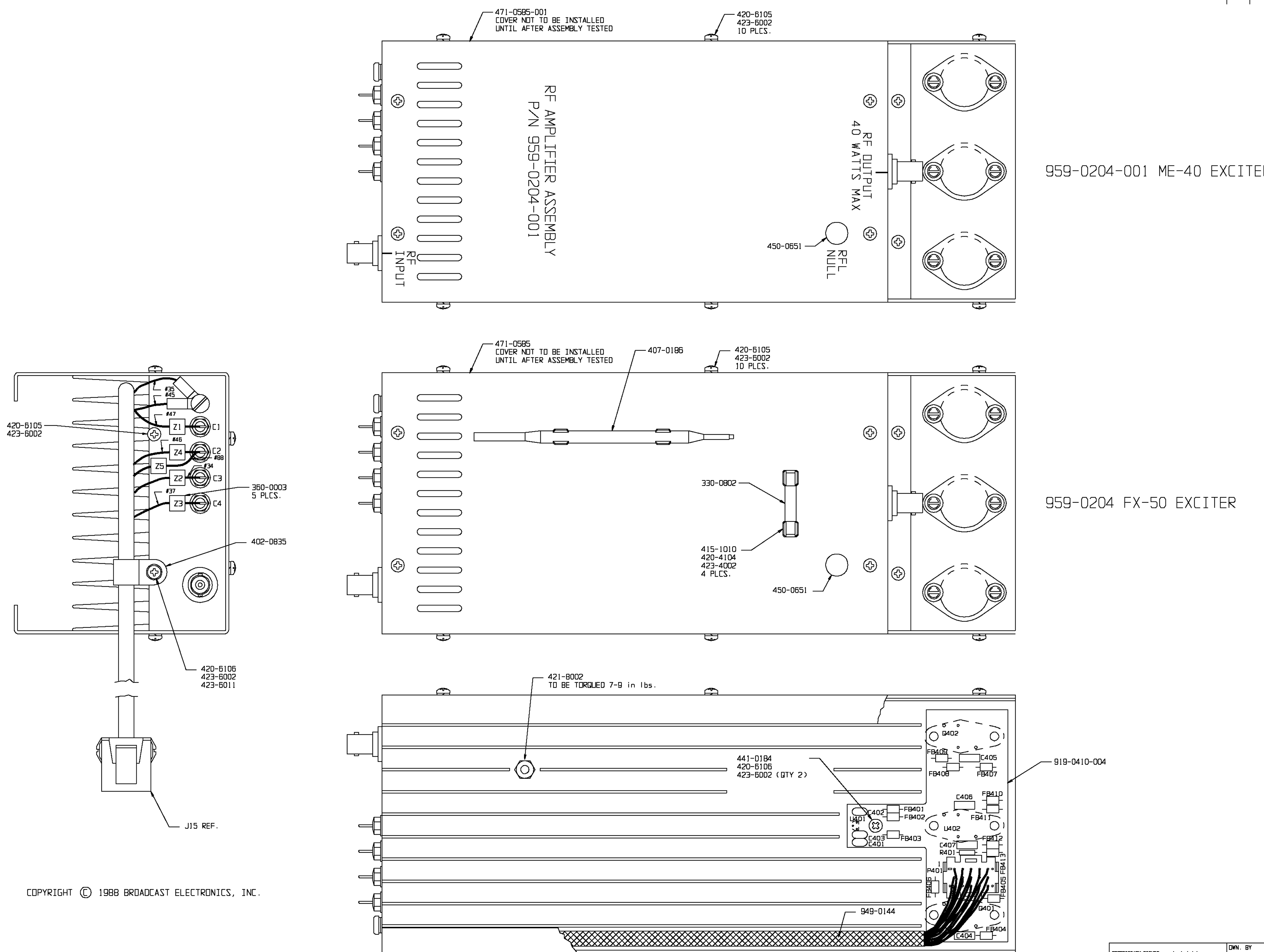
MATERIAL SEE B/M 959-0204
FINISH ------
SEE DWG RA592-0000
NEXT ASSY. 909-1050

BE® BROADCAST ELECTRONICS INC.
4100 N.24TH ST.,P.O.BOX 3606 QUINCY,IL 62305 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE ASSY, RF AMPLIFIER

TYPE A SIZE D DWG. NO. 959-0204 959-0204-001 REV S

MODEL FX-50/ME-40 SCALE 1:1 SHEET 1 OF 2



REV	DATE	DESCRIPTION	DRAFTER	APPROVED	ECN

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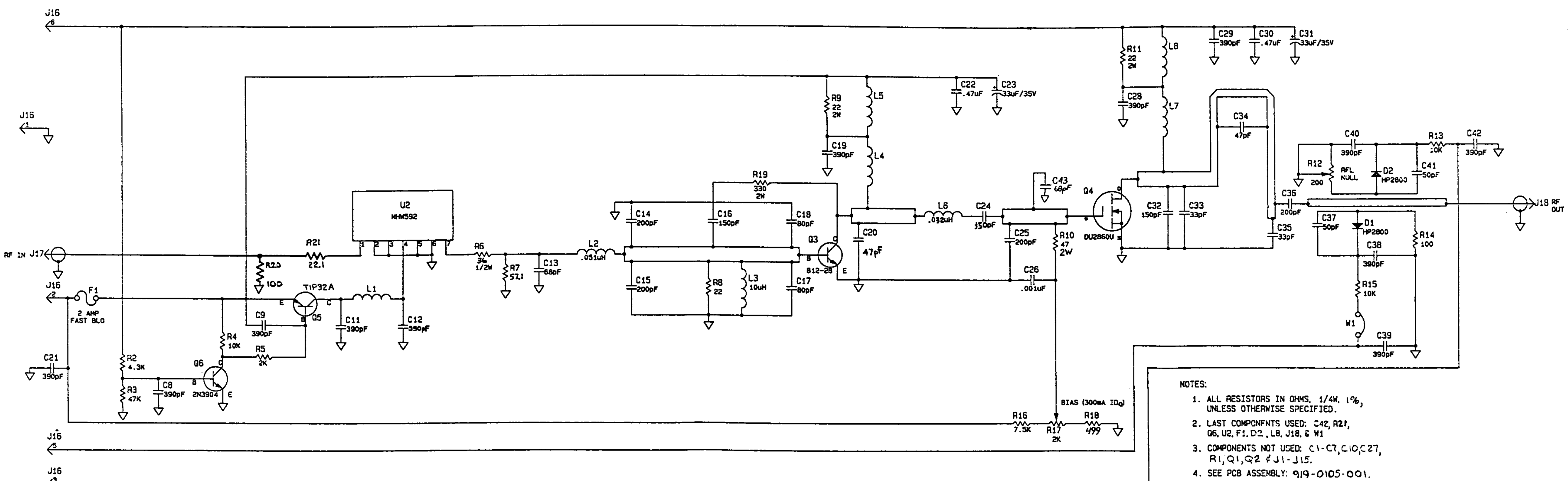
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°

DWN. BY JAH 1-29-88	MATERIAL SEE B/M 959-0204	BROADCAST ELECTRONICS INC. 4100 N.24TH ST., P.O.BOX 3606 QUINCY, IL 62305 217/224-9600 TELEX 250142 CABLE BROADCAST FAX 217/224-9607	
DESIGNER(S) 6-20-88 JH STEINKAMP	FINISH	TITLE ASSEMBLY, RF AMPLIFIER	
PROJ. LEADER EJA 6-13-88	~~SEE DWG RA592-0000~~	TYPE A SIZE D DWG. NO. 959-0204 959-0204-001	REV S
MFG. DBN 6-14-88	NEXT ASSY. 909-1050	MODEL FX-50/ME-40 SCALE 1:1	SHEET 2 OF 2



NOTES:

1. ALL RESISTORS IN OHMS, 1/4W, 1%, UNLESS OTHERWISE SPECIFIED.
2. LAST COMPONENTS USED: C42, R21, Q6, U2, F1, D2, L8, J18, & W1
3. COMPONENTS NOT USED: C1-C7, C10, C27, R1, Q1, Q2 & J1-J15.
4. SEE PCB ASSEMBLY: 919-0105-001.

DWN. BY 3-8-94 M. MANCCH	MATERIAL —	BROADCAST ELECTRONICS INC. 4100 N.24TH ST., P.O.BOX 3606 QUINCY, IL 62305 217/224-9600 TELEX 250142 CABLE BROADCAST	
CHKD			
ME	FINISH —	TITLE SCHEM, RF AMPLIFIER PCB	
PROJ. ENGR.	SEE-DWG-RAS02-COOO-	TYPE S SIZE D DWG. NO. 919-0105-001	REV D
MFG.	NEXT ASSY. 959-0204	MODEL FX-50 SCALE —	SHEET 1 OF 1

TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°

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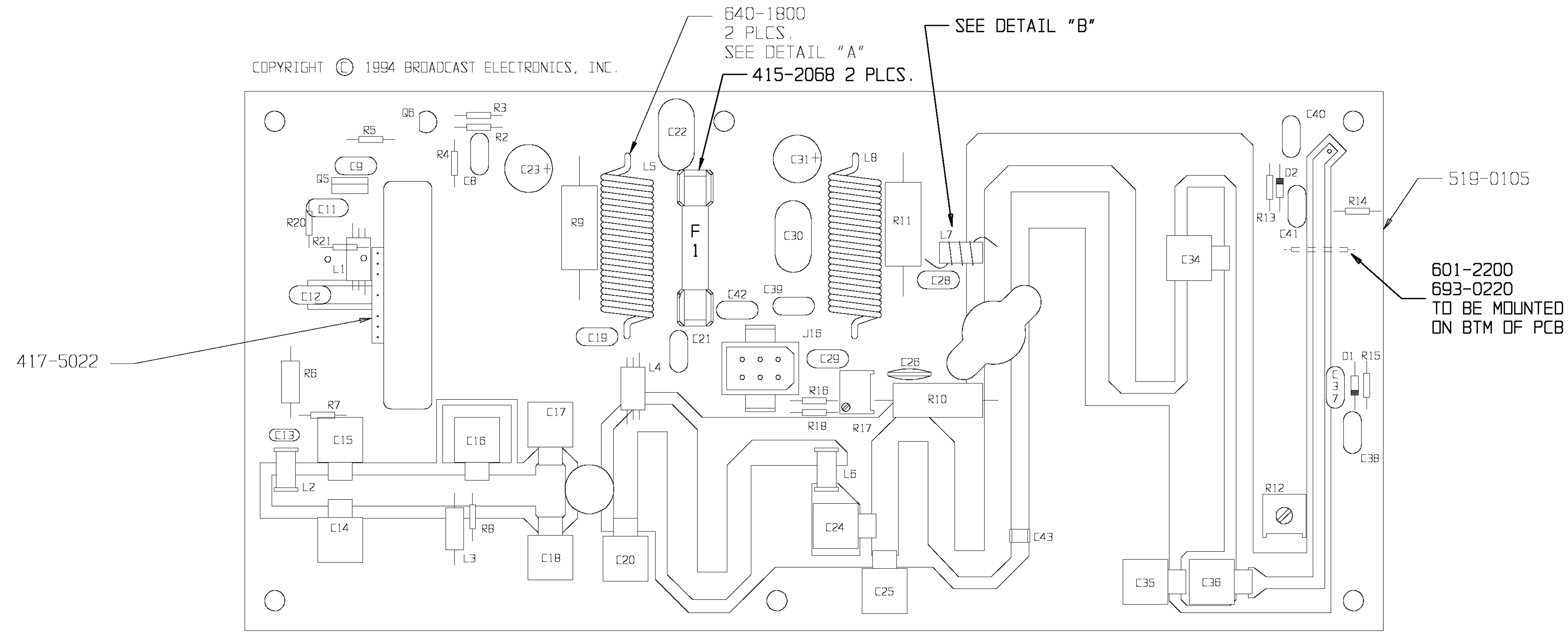

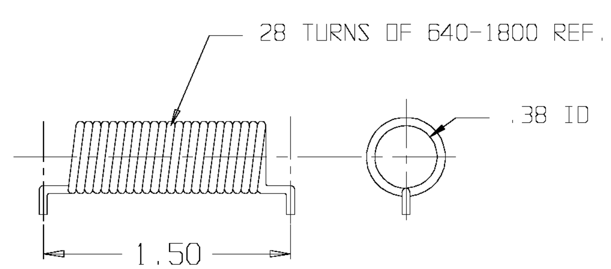

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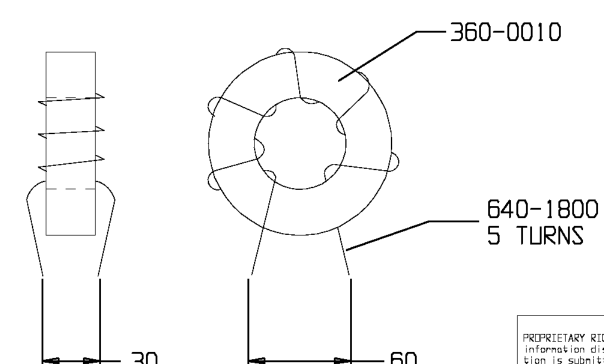

DETAIL "B"

DWN. BY	M. HAYDEN 3-10-94
DESIGNER(S)	
PROJ. LEADER	
MFG.	
MATERIAL	SEE B/M 919-0105-001
FINISH	~~SEE DWG RA592-0000~~
NEXT ASSY.	959-0204

TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°

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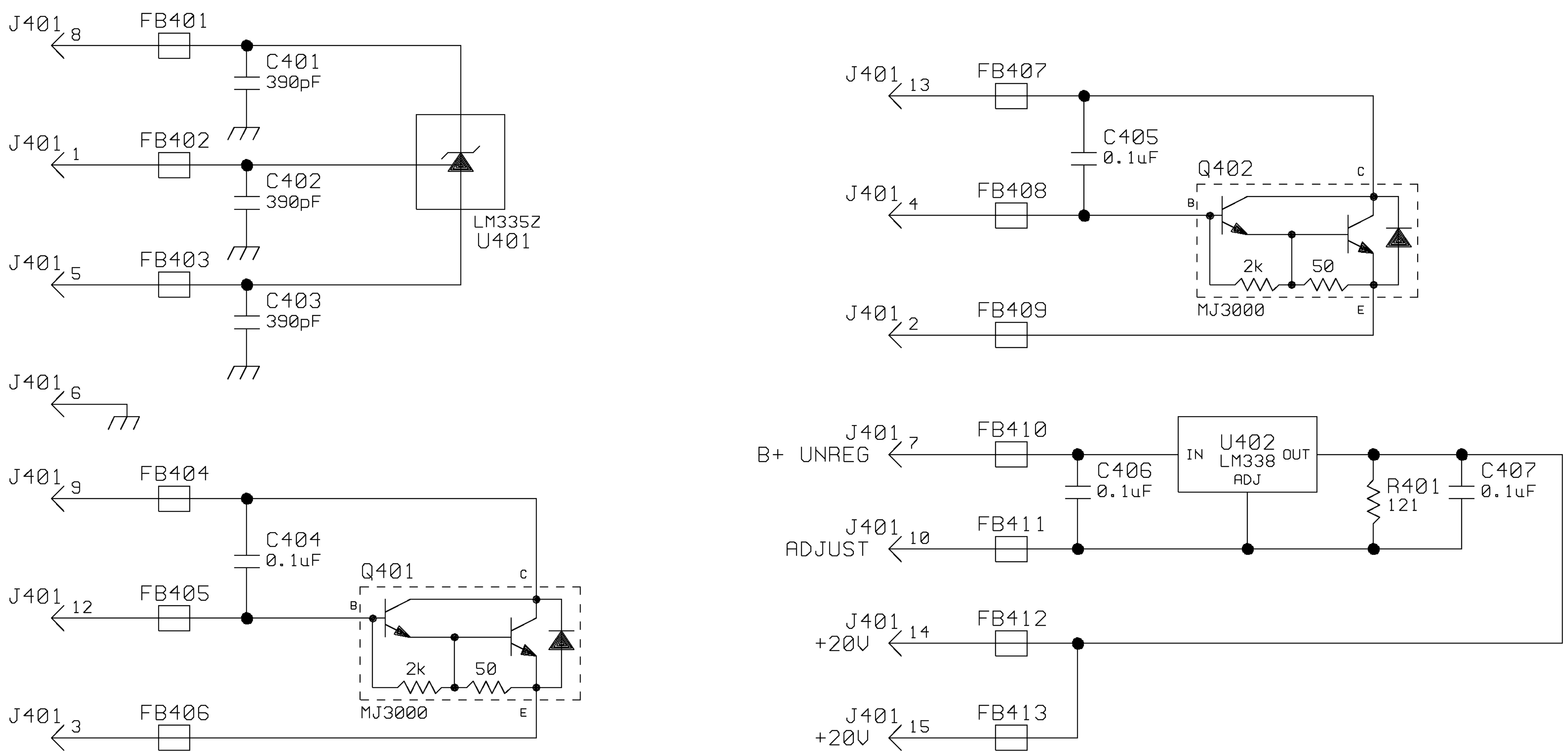
4100 N.24TH ST., P.O.BOX 3606 QUINCY, IL 62305 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE: PCB ASSEMBLY RF AMPLIFIER

TYPE	SIZE	DWG. NO.	REV
A	C	919-0105-001	D

MODEL FX-50 SCALE 1.5/1 SHEET 1 OF 1



NOTES:

1. ALL REFERENCE DESIGNATORS START AT 401.
1. ALL RESISTORS IN OHMS; 1/4W, 1% UNLESS OTHERWISE SPECIFIED.
2. LAST COMPONENT USED: C407, FB413, J401, Q402, R401, U402
3. COMPONENTS NOT USED:
4. SEE ASSEMBLY: AC919-0410-004

TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°

DWN. BY	JLF 3-29-93
DESIGNER(S)	CLL 8/4/93
PROJ. LEADER	
MFG.	
MATERIAL	
FINISH	SEE DWG AA592-0000
NEXT ASSY.	

BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O.BOX 3606 QUINCY, IL. 62305 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE: SCHEMATIC RF AMP REGULATOR PCB

TYPE	SIZE	DWG. NO.	REV
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MODEL	SCALE	SHEET
FM-100C	NONE	1 OF 1

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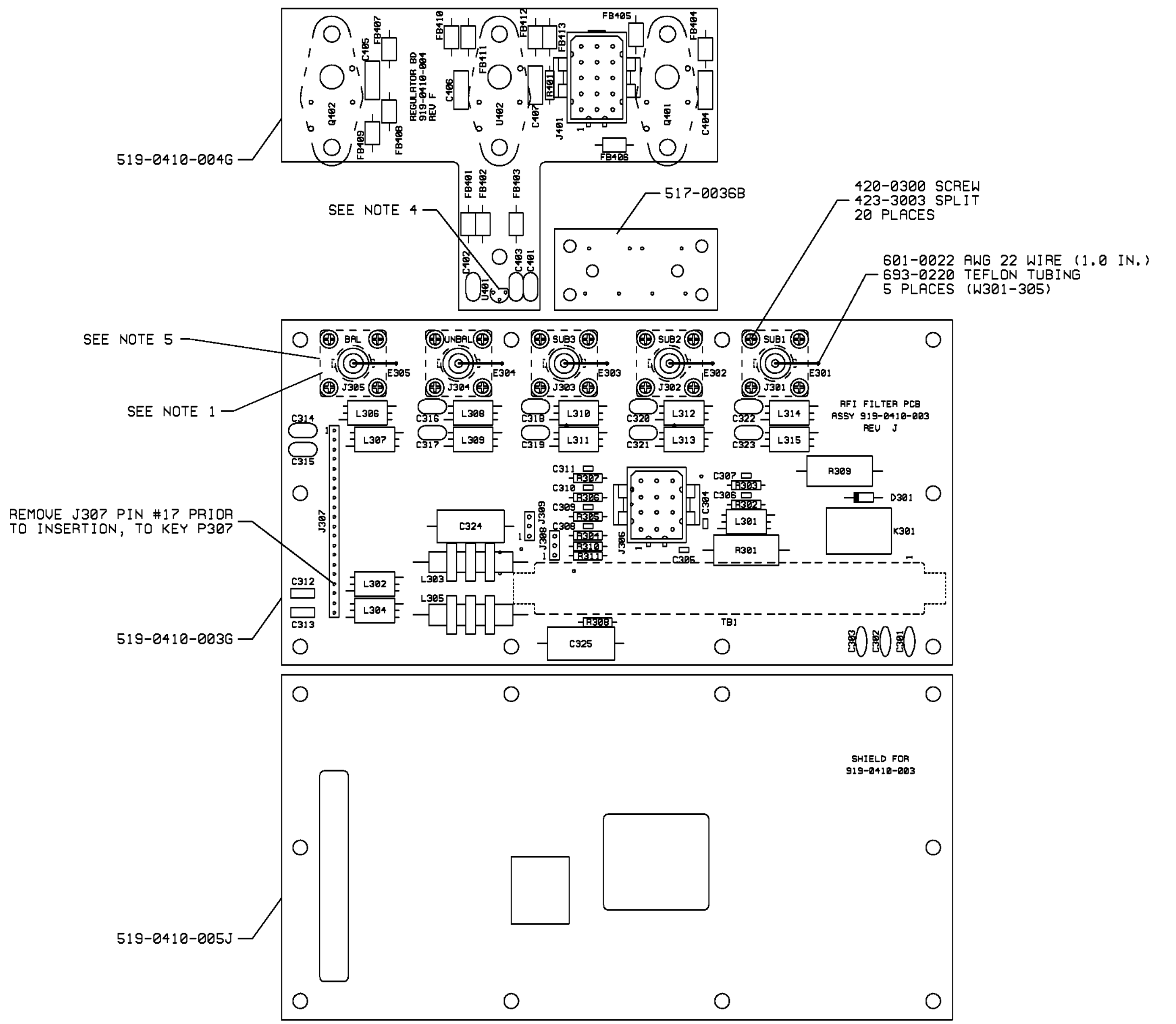
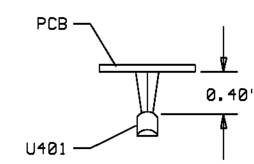


NOTES:

1. COMPONENTS SHOWN WITH DASHED LINES TO BE INSTALLED ON OPPOSITE SIDE.
2. TAPE TO BE PLACED OVER MOUNTING HOLES OF J301-305, Q401-402, TB301, & U401-402 BEFORE SOLDER REFLOW.
3. COMPONENTS Q1 & R1 ON 919-0410-001 ARE INSTALLED DURING RF AMP (959-0411) FINAL ASSEMBLY, AND ARE SHOWN HERE FOR REFERENCE ONLY.
4. U401 TO BE MOUNTED ON OPPOSITE SIDE AND SPACED OFF FROM PCB SURFACE AS SHOWN IN DETAIL "A".
5. J301-305 SHOULD BE MOUNTED AS SHOWN WITH LOCKING TABS ALL ORIENTATED THE SAME.



DETAIL "A"

TOLERANCE (DECIMAL) U.O.S.
.X ± .030 .XXX ± .005
.XX ± .015 ANGLES ± 1°

DWN. BY JLF 7/13/93	MATERIAL SEE BOMs 919-0410-003 919-0410-004	BROADCAST ELECTRONICS INC. 4100 N.24TH ST. P.O.BOX 3606 QUINCY,IL. 62305 PH. 217/224-9600 TELEX 250142 CABLE BROADCAST FAX 217/224-9607
DESIGNER(S) JRC 8/4/93 CLL 8/4/93	FINISH SEE DWG AA592-0000	TITLE PCB ASSEMBLY RFI FILTER/REGULATOR
PROJ. LEADER		TYPE A SIZE C DWG No. 919-0410-003/004 REV K
MFG.	NEXT ASSY. -	MODEL FM-100C SCALE 1:1 SHEET 1 OF 1

SECTION VI
REPLACEMENT PARTS

6-1. INTRODUCTION.

6-2. This section provides descriptions and part numbers of electrical components, assemblies, and selected mechanical parts required for maintenance of the RF amplifier assembly. Each table entry in this section is indexed by reference designators appearing on the applicable schematic diagram.

TABLE	TITLE	NUMBER	PAGE
6-1	RF AMPLIFIER CIRCUIT BOARD ASSEMBLY	959-0204	14
6-2	WIRE HARNESS ASSEMBLY	949-0144	14
6-3	RF AMPLIFIER CIRCUIT BOARD ASSEMBLY	919-0105-001	15
6-4	RF AMPLIFIER REGULATOR CIRCUIT BOARD ASSEMBLY	919-0410-004	16

TABLE 6-1. RF AMPLIFIER MODULE ASSEMBLY - 959-0204

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1 THRU C4	Capacitor, Ceramic Feed-Thru, 1000 pF ±20%, 500V	008-1033	4
C32	Capacitor, Mica, 150 pF ±10%, 350V	046-0005	1
C33	Capacitor, Mica, 33 pF ±10%, 350V	040-3312	1
Q1,Q2	Transistor, MJ3000, Silicon, NPN Darlington, TO-3 Case	219-3000	2
Q3	Transistor, 2N6198, RF Power	213-6198	1
Q4	Transistor, DU2860U, DMOS, 60W	210-2860	1
R19	Resistor, 330 Ohm ±5%, 2W	130-3333	1
U1	Integrated Circuit, LM338K, Adjustable Voltage Regulator, 5 Amperes	227-0339	1
U2	Integrated Circuit, MHW1342, RF Extender Amplifier	229-2830	1
Z1 thru Z9 Z24 thru Z29	Ferrite Bead	360-0003	15
----	Fuse Clip, Littlefuse	415-1010	4
----	Fuse, GBB-8, Buss, Fast Acting, 8A, 250V	330-0802	1
----	Adjustment Tool, extended and recessed flat blades	407-0186	1
----	Insulator, Transistor Mounting, TO-3 Case	418-0010	1
----	Wire Harness Assembly	949-0144	1
----	RF Amplifier Circuit Board Assembly	919-0105-001	1
----	RF Amplifier Regulator Circuit Board Assembly	919-0410-004	1

TABLE 6-2. WIRE HARNESS ASSEMBLY - 949-0144

REF. DES.	DESCRIPTION	PART NO.	QTY.
J15	Connector, Housing, 20-Pin In-line	417-0175	1
P16	Connector, Housing, 6-Pin	418-0670	1
----	Pins, Connector	417-0036	17
----	Pins, Connector	417-0053	5
----	Plug, BNC, Dual Crimp	418-0034	2

TABLE 6-3. RF AMPLIFIER CIRCUIT BOARD ASSEMBLY - 919-0105-001
(Sheet 1 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C8,C9,C11, C12	Capacitor, Mica, 390 pF ±5%, 100V	042-3922	4
C13	Capacitor, Mica, 68 pF ±5%, 500V	040-6813	1
C14,C15	Capacitor, Mica, 200 pF ±10%, 350V	042-2000	1
C16	Capacitor, Mica, 150 pF ±10%, 350V	046-0005	1
C17,C18	Capacitor, Mica, 80 pF ±10%, 300V	046-0003	2
C19	Capacitor, Mica, 390 pF ±5%, 100V	042-3922	1
C20	Capacitor, Mica, 47 pF ±10%, 350V	046-0004	1
C21	Capacitor, Mica, 390 pF ±5%, 100V	042-3922	1
C22	Capacitor, Polyester, 0.47 uF ±10%, 100V	038-4753	1
C23	Capacitor, Electrolytic, 33 uF, 35V	024-3374	1
C24	Capacitor, Mica, 150 pF ±10%, 350V	046-0005	1
C25	Capacitor, Mica, 200 pF ±10%, 350V	042-2000	1
C26	Capacitor, Ceramic, 0.001 uF, 1 kV	002-1034	1
C28,C29	Capacitor, Mica, 390 pF ±5%, 100V	042-3922	2
C30	Capacitor, Polyester, 0.47 uF ±10%, 100V	038-4753	1
C31	Capacitor, Electrolytic, 33 uF, 35V	024-3374	1
C34	Capacitor, Mica, 47 pF ±10%, 350V	046-0004	1
C35	Capacitor, Mica, 33 pF ±10%, 350V	040-3312	1
C36	Capacitor, Mica, 200 pF ±10%, 350V	042-2000	1
C37	Capacitor, Mica, 50 pF ±5%, 500V	040-5013	1
C38,C39,C40	Capacitor, Mica, 390 pF ±5%, 100V	042-3922	3
C41	Capacitor, Mica, 50 pF ±5%, 500V	040-5013	1
C42	Capacitor, Mica, 390 pF ±5%, 100V	042-3922	1
C43	Capacitor, Ceramic Chip, 68 pF ±5%, 500V	009-6813	1
D1,D2	Diode, HP5082-2800, High Voltage, Schottky Barrier Type, 70V, 15 mA	201-2800	2
F1	Fuse, 3AG, 2 Amperes	330-0200	1
J16	Receptacle, 6-Pin	417-0677	1
L1	Ferrite Choke, 180 MHz, 2.5 Turns, Single Section	364-0002	1
L2	RF Choke, 0.051 uH, 1000 mA Maximum	364-0051	1
L3	Molded RF Choke, 10 uH ±20%, DC Resistance 0.9 Ohms, Q= 55 at 7.9 mHz, Maximum Current 445 mA	364-0010	1
L4	Ferrite Choke, 180 MHz, 2.5 Turns, Single Section	364-0002	1
L5	Choke, 18 GA Enameled Wire	640-1800	1
L6	RF Choke, 0.032 uH, 1000 mA Maximum	364-0032	1
L7	Ferrite Core, Toroid, 5961001101	360-0010	1
L8	Choke, 18 GA Enameled Wire	640-1800	1
Q5	Transistor, TIP32A, 2N6125, Silicon, PNP, TO-220 AB Case	218-0032	1
Q6	Transistor, 2N3904, NPN, Silicon, TO-92 Case	211-3904	1
R2	Resistor, 4.32 k Ohm ±1%, 1/4W	103-4324	1
R3	Resistor, 47.5 k Ohm ±1%, 1/4W	103-4755	1
R4	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	1
R5	Resistor, 2 k Ohm ±1%, 1/4W	100-2041	1
R6	Resistor, 36 Ohm ±5%, 1/2W	110-3623	1
R7	Resistor, 51.1 Ohm ±1%, 1/4W	103-5112	1
R8	Resistor, 22.1 Ohm ±1%, 1/4W	103-2212	1
R9	Resistor, 22 Ohm ±5%, 2W	130-2223	1
R10	Resistor, 47 Ohm ±5%, 2W	130-4723	1
R11	Resistor, 22 Ohm ±5%, 2W	130-2223	1
R12	Potentiometer, 200 Ohm ±10%, 1/2W	177-2034	1
R13	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	1
R14	Resistor, 100 Ohm ±1%, 1/4W	100-1031	1

TABLE 6-3. RF AMPLIFIER CIRCUIT BOARD ASSEMBLY - 919-0105-001
(Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R15	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	1
R16	Resistor, 7.5 Ohm ±1%, 1/4W	103-7541	1
R17	Potentiometer, 2 k Ohm ±10%, 1/2W	177-2045	1
R18	Resistor, 499 Ohm ±1%, 1/4W	103-4993	1
R20	Resistor, 100 Ohm ±1%, 1/4W	100-1031	1
R21	Resistor, 22.1 Ohm ±1%, 1/4W	103-2212	1
XU2	Socket	417-5022	1
----	Fuse Clip, Littlefuse	415-2068	2
----	Blank RF Amplifier Circuit Board	519-0105	1

TABLE 6-4. RF AMPLIFIER REGULATOR BOARD ASSEMBLY - 919-0410-004

REF. DES.	DESCRIPTION	PART NO.	QTY.
C401 THRU C403	Capacitor, Mica, 390 pF ±5%, 100V	042-3922	3
C404 THRU C407	Capacitor, Mylar, 0.1 uF ±10%, 100V	030-1053	4
FB401 THRU FB413	Ferrite Bead	360-0001	13
J401	Connector, Housing, 15-Pin	417-0169	1
R401	Resistor, 121 Ohm ±5%, 1/4W	100-1231	1
U401	Integrated Circuit, LM335Z, Precision Temperature Sensor, TO-92 Case	229-0335	1
XQ401, XQ402 XU402	Socket, Transistor, TO-3, PCB Mount	417-0299	3
----	Fuseable Link, 22 AWG	601-0022	1
----	Blank RF Amplifier Regulator Circuit Board	519-0410-004	1

SYNCHRONOUS FM BOOSTER
TABLE OF CONTENTS

LIST OF TABLES

LIST OF ILLUSTRATIONS

SECTION I
GENERAL INFORMATION

1–1. INTRODUCTION.

1–2. This section provides general information and specifications relative to operation of the optional synchronous FM booster system.

1–3. SYSTEM DESCRIPTION.

1–4. The synchronous FM booster system is designed to provide precise and reliable frequency locking of one or more slave FX–50/E exciters to a master FX–50/E exciter. The system features a plug–in circuit board installed in the master exciter which generates a reference signal. This signal is transmitted to a similar circuit board installed in the slave exciter at the booster site to synchronize a 10 MHz voltage controlled crystal oscillator (VCXO).

1–5. If transmission of the reference signal is interrupted or lost, a clamping circuit on the slave circuit board will operate to stabilize the 10 MHz VCXO. The slave exciter will continue to operate reliably and well within the assigned frequency range.

1–6. SYSTEM CONFIGURATIONS.

1–7. The optional synchronous FM booster circuit boards may be ordered in the following configurations:

MODEL NO.	PART NUMBER	DESCRIPTION
FX–50/E	909–0131	Master synchronous FM booster circuit board for the FX–50/E exciter, factory installed.
FX–50/E	909–0132	Slave synchronous FM booster circuit board for the FX–50/E exciter, factory installed.

1–8. ELECTRICAL SPECIFICATIONS.

1–9. Refer to Table 1–1 for synchronous FM booster system electrical specifications.

TABLE 1-1. SYSTEM SPECIFICATIONS

PARAMETER	SPECIFICATION
POWER REQUIREMENTS	−20V and +5V supplied by the FX−50 Power Supply/Control Circuit Board.
REFERENCE FREQUENCIES	
STANDARD	125 kHz, ±0.375 Hz, 0° to 50°C, for STL Subcarrier.
ALTERNATES	100 kHz for Omega International Synchronous Repeater Systems or 90.909 kHz for Composite Subcarrier.
REFERENCE SIGNALS	
INPUT	
LEVEL	500mV to 5V p−p.
IMPEDANCE	100k Ohms, Resistive.
OUTPUT	
LEVEL	−10 to 0 dBM, with 600 Ohm load, Unbalanced, Resistive.
IMPEDANCE	600 Ohms, Resistive.
FREQUENCY STABILITY:	
MASTER	Carrier Frequency ±300 Hz, 0° to 50°C.
SLAVE	Carrier Frequency ±300 Hz When Locked to Master. Carrier Frequency ±1000 Hz When Unlocked from Master, 0° to 50°C.

SECTION II
INSTALLATION

2–1. **INTRODUCTION.**

2–2. This section contains information required for installation of the Broadcast Electronics synchronous FM booster system.

2–3. **INSTALLATION.**

2–4. This procedure is specifically for field installation kits. To install the master or slave circuit board, refer to the following information and sheet 2 of assembly drawing AC909–0131 in SECTION VI, DRAWINGS, as required.

WARNING ***DISCONNECT THE PRIMARY POWER TO THE EXCITER BEFORE PROCEEDING.***

WARNING

2–5. Disconnect the primary power to the exciter.

2–6. Remove the exciter top–cover. Disconnect J1, J2, and J8 from the AFC/PLL assembly.

2–7. Remove the four screws securing the AFC/PLL assembly cover to the circuit board. Remove the cover and ground strap.

2–8. Secure two card guides to the AFC/PLL assembly cover using the hardware provided.

2–9. Install two ribbon cable press clips on the side of the AFC/PLL assembly cover.

2–10. Remove and discard intergrated circuit U1 from the AFC/PLL circuit board.

2–11. Align pin 1 of the ribbon cable connector with pin 1 of socket XU1 and insert into the socket.

2–12. Install the AFC/PLL assembly cover and ground strap with the hardware provided.

2–13. Install the booster circuit board into J1 on the AFC/PLL assembly.

2–14. Route the ribbon cable through the two press clips and connect to J10 on the booster circuit board.

2–15. Connect P1 to J1 on the booster circuit board.

2–16. Connect P8 to J8, and P2 to J2 on the AFC/PLL assembly.

2–17. A partially assembled three conductor cable with 5 position connector P12 will interconnect between the power supply/control circuit board and the booster circuit board. The termination of wires 81, 82, and 83 of this cable assembly is as follows.

A. Remove P13 from J13 on the power supply/control circuit board.

B. Insert wire NO. 81 into P13 pin 6.

C. Insert wire NO. 82 into P13 pin 12.

D. Insert wire NO. 83 into P13 pin 3.

2–18. Connect P13 to J13 on the power supply/control circuit board.

2–19. Connect P12 to J12 on the booster circuit board. Replace the exciter top–cover.

2–20. **INSTALLATION ADJUSTMENTS.**

2–21. **OUTPUT LEVEL ADJUSTMENT (R26).** Potentiometer R26 on the slave circuit board is adjusted fully clockwise. R26 on the master circuit board adjusts the output level from –10 to 0 dBM. To adjust R26 on the master circuit board, proceed as follows.

WARNING ***DISCONNECT THE PRIMARY POWER TO THE EXCITER BEFORE PROCEEDING.***

WARNING

2–22. Disconnect the exciter primary power.

2–23. Remove the top–cover and connect a 600 Ohm load and oscilloscope to the FX–50 rear–panel **SUB–1** connector.

2–24. Apply primary power to the exciter.

WARNING ***DO NOT TOUCH ANY COMPONENT WITHIN THE EXCITER WITH POWER APPLIED.***

WARNING

2–25. Refer to Figure 4–1 in SECTION IV, MAINTENANCE, and adjust R26 for the level required by the transmission equipment.

2–26. Remove the test equipment and replace the top–cover.

SECTION III
THEORY OF OPERATION

3–1. INTRODUCTION.

3–2. This section presents the theory of operation for the Broadcast Electronics optional synchronous FM booster system.

3–3. FUNCTIONAL DESCRIPTION.

3–4. The synchronous FM booster system consists of: 1) a master circuit board which generates a reference frequency, and 2) a slave circuit board which locks to the reference frequency. The master and slave circuit boards are plug–in modules which interface with the AFC/PLL circuit board in the FX–50 exciter.

3–5. SLAVE CIRCUIT BOARD.

3–6. Figure 3–1 presents a simplified schematic of the slave synchronous FM booster circuit board. Refer to Figure 3–1 as required for the following functional description.

3–7. A reference frequency is routed to input amplifier U7 from the exciter rear–panel **SUB–1** connector through programmable jumpers J3 and J4. After amplification, the output of U7 is input to a band–pass filter to remove any low frequency components. The output of the band–pass filter is applied to amplifier U8 through level control R26.

3–8. The sinusoidal output of U8 is applied to U1 which will convert the signal to a square wave for application to phase comparator U2. When this signal and a signal from one shot U6B are compared, a correction voltage is generated and applied to a reference filter network.

3–9. The reference filter network consisting of U3A and U3B removes the reference frequency component from the signal to provide a dc correction voltage to 10 MHz voltage controlled crystal oscillator Y1. The output of Y1 varies in response to the correction voltage and is applied to divide–by–ten counter U4 through programmable jumper J5.

3–10. The output of U4 provides a 1 MHz signal to the AFC/PLL circuit board and to programmable counter U5. Depending on the position of programmable jumper J11, U5 will divide 1 MHz by 8, 10, or 11. The output of U5 is applied to phase comparator U2 through one shot U6B which operates as a pulse stretcher. Duty cycle control R20 adjusts the width of the pulse.

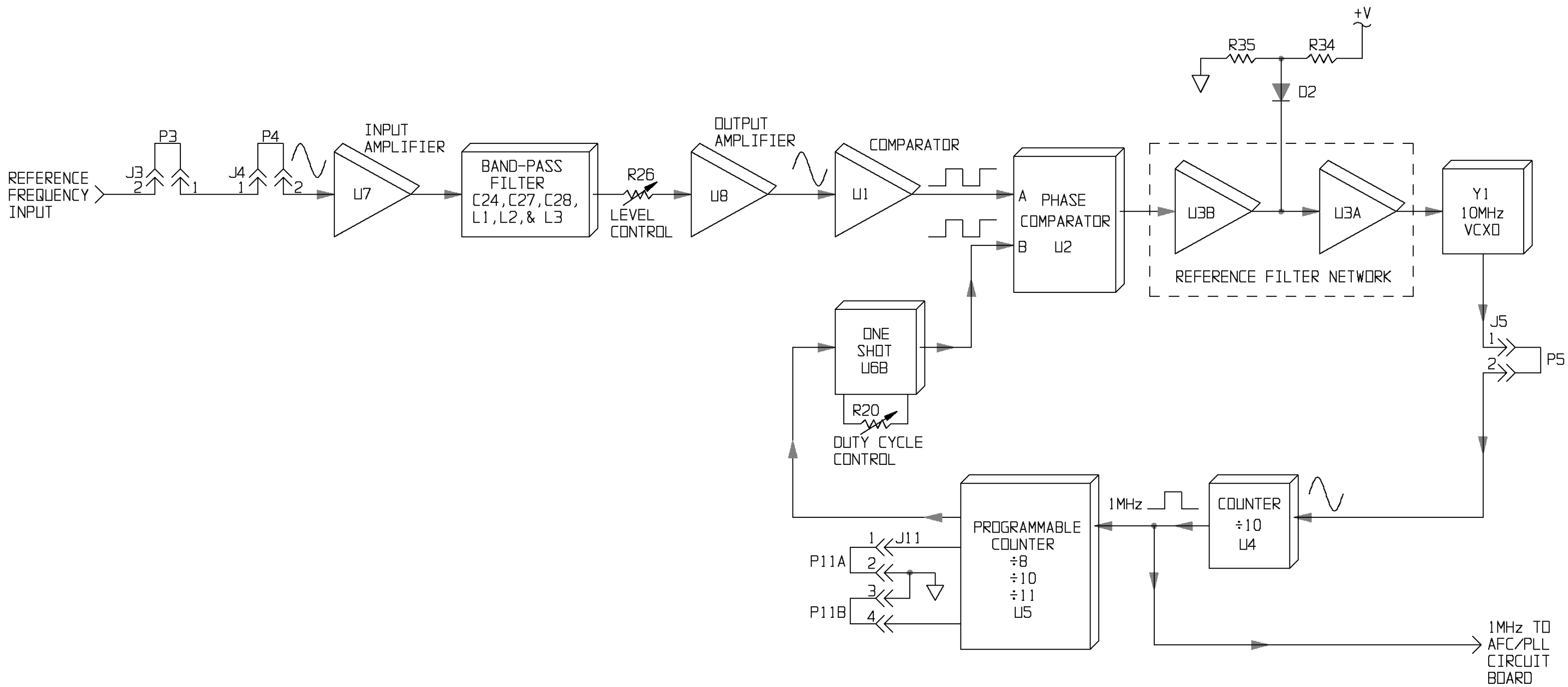
3–11. **PROTECTION CIRCUITRY.** Resistors R34 and R35 operate as a voltage divider network. If phase comparator U2 fails, a clamping voltage of approximately +1.7 volts will be applied to U3A through diode D2 to maintain the output range of the VCXO within acceptable limits.

3–12. If loss of reference frequency occurs, the output pulse of phase comparator U2 will exhibit a 50% duty cycle. This will generate +2.5 volts to maintain the output frequency of the VCXO at a constant 10 MHz.

3–13. MASTER CIRCUIT BOARD.

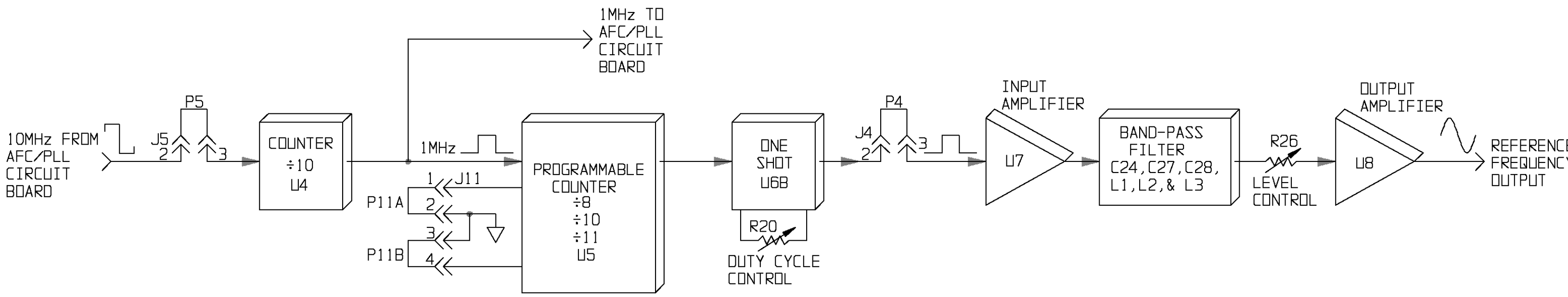
3–14. Figure 3–2 presents a simplified schematic of the master synchronous FM booster circuit board. Refer to Figure 3–2 as required for the following functional description.

3–15. The 10 MHz reference frequency from the AFC/PLL circuit board is applied to divide–by–ten counter U4 through programmable jumper J5. The output of U4 provides a 1 MHz signal to programmable counter U5 and the AFC/PLL circuit board. Depending on the position of programmable jumper J11, U5 will divide the 1 MHz signal to provide a frequency of 125 kHz, 100 kHz, or 90.909 kHz to U6B.



597-1050-60

FIGURE 3-1. SLAVE FM BOOSTER SIMPLIFIED SCHEMATIC



597-1050-61

FIGURE 3-2. MASTER FM BOOSTER SIMPLIFIED SCHEMATIC

3–16. One shot U6B and potentiometer R20 operate as a pulse stretcher to provide an output pulse with a 50% duty cycle. This pulse is applied to input amplifier U7 through programmable jumper J4. Finally, the output of U7 is applied to amplifier U8 through a band–pass filter and level control R26.

3–17. The function of the band–pass filter is to remove harmonics and convert the signal to a sinewave. The reference frequency at the output of U8 is available for application to RF communications equipment for transmission to a booster site.

SECTION IV
MAINTENANCE

4–1. **INTRODUCTION.**

4–2. This section provides maintenance information, electrical adjustment procedures, and troubleshooting information for the synchronous FM booster circuit boards.

4–3. **MAINTENANCE.**

4–4. **ELECTRICAL ADJUSTMENTS.**

4–5. **REQUIRED EQUIPMENT.** The following tools and equipment are required for electrical adjustment procedures.

A. Insulated adjustment tool, shipped with the exciter (P/N 407–0083).

B. Calibrated oscilloscope.

C. Frequency counter.

4–6. **DUTY CYCLE ADJUSTMENT (R20).** Potentiometer R20 on the slave or master circuit board adjusts the duty cycle of the reference signal. Control R20 is adjusted as follows.

4–7. **Procedure.** To adjust duty cycle control R20, proceed as follows:

WARNING *DISCONNECT PRIMARY POWER TO THE EXCITER BEFORE PROCEEDING.*

WARNING

A. Disconnect the exciter primary power.

B. Remove the exciter top–cover. Refer to Figure 4–1 and connect an oscilloscope between TP2 and ground.

C. Apply primary power to the exciter.

WARNING *DO NOT TOUCH ANY COMPONENTS WITHIN THE EXCITER WITH POWER APPLIED.*

WARNING

D. Refer to Figure 4–1 and adjust R20 for a 50% duty cycle as indicated on the oscilloscope.

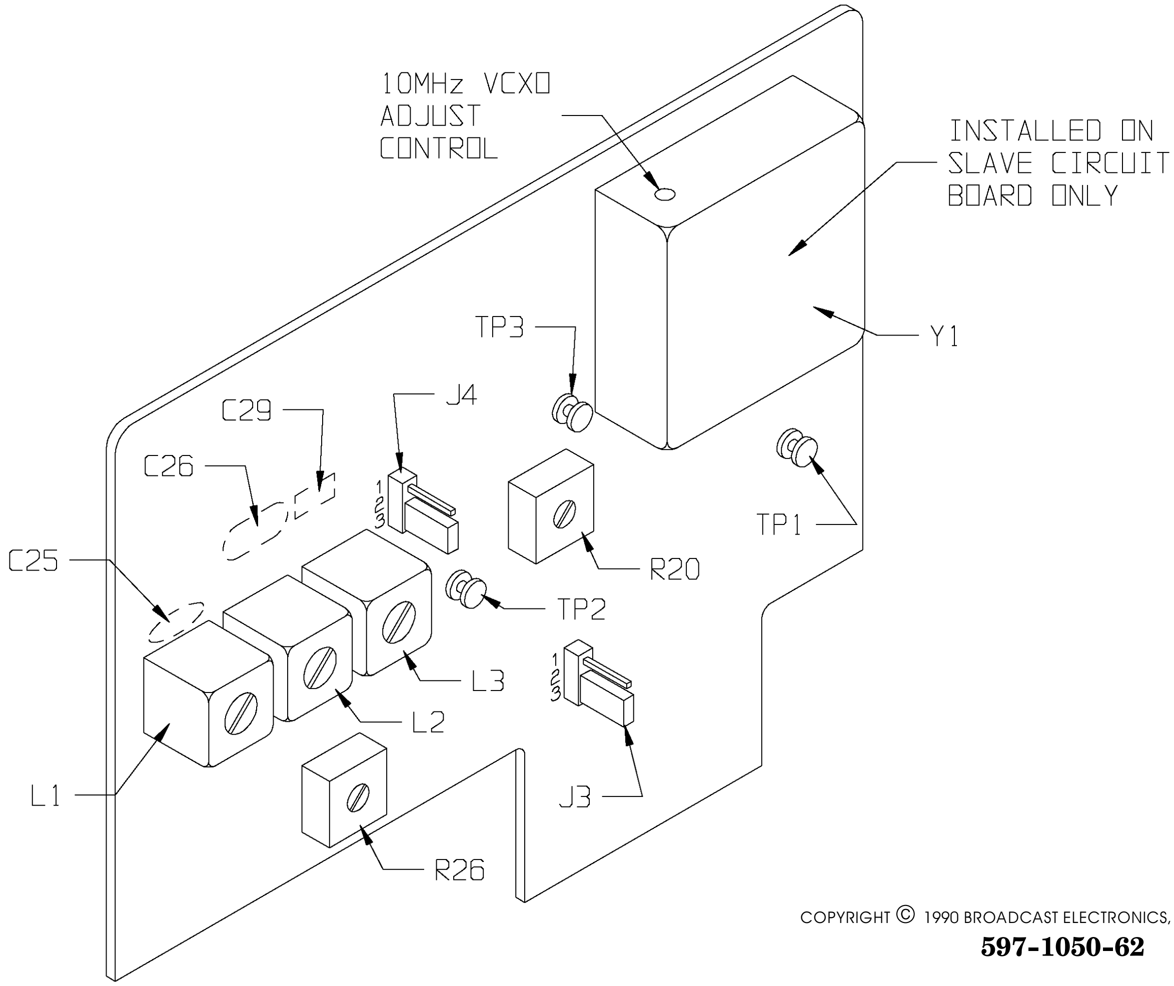
WARNING *DISCONNECT PRIMARY POWER TO THE EXCITER BEFORE PROCEEDING.*

WARNING

E. Disconnect the exciter primary power.

F. Remove the test equipment and replace the top–cover.

4–8. **LOW PASS FILTER (L1, L2, L3).** Inductors L1, L2, and L3 on the slave or master circuit board adjust the sensitivity of the low–pass filter network. Inductors L1, L2, and L3 are adjusted as follows.



597-1050-62

FIGURE 4-1. SLAVE/MASTER CIRCUIT BOARD CONTROLS

4-9. **Procedure.** To adjust L1, L2, and L3, proceed as follows:

A. Perform steps A through E of the DUTY CYCLE ADJUSTMENT procedure.

B. Refer to Figure 4-1 and operate programmable jumpers J3 and J4 to position 2-3.

C. Refer to Figure 4-1 and adjust output level control R26 to midrange position.

D. Refer to Figure 4-1 and connect an oscilloscope to exciter rear-panel **SUB-1** receptacle.

E. Apply primary power to the exciter.

WARNING ***DO NOT TOUCH ANY COMPONENTS WITHIN THE EXCITER WITH POWER APPLIED.***

WARNING

F. Refer to Figure 4-1 and adjust L1, L2, and L3 for a maximum indication on the oscilloscope. Repeat if necessary.

WARNING *DISCONNECT PRIMARY POWER TO THE EXCITER BEFORE PROCEEDING.*

WARNING

G. Disconnect the exciter primary power.

H. If the unit under test is a slave circuit board, adjust R26 fully clockwise. If the unit under test is a master, refer to the OUTPUT LEVEL ADJUSTMENT procedure in SECTION II, INSTALLATION.

I. Remove the test equipment, restore programmable jumpers J3 and J4 to the original position, and replace the top–cover.

4–10. **VCXO ADJUSTMENT.** Due to frequency drift of crystals with age, it is recommended the VCXO frequency on the slave circuit board be periodically checked and adjusted if required. The VCXO frequency is adjusted as follows.

4–11. **Procedure.** To adjust the VCXO, proceed as follows:

A. Perform the DUTY CYCLE ADJUSTMENT procedure.

WARNING *DISCONNECT PRIMARY POWER TO THE EXCITER BEFORE PROCEEDING.*

WARNING

B. Disconnect the exciter primary power.

C. Remove the top–cover. Refer to Figure 4–1 and connect a frequency counter between TP1 and ground.

D. Remove the reference input from the rear–panel **SUB–1** input connector.

E. Apply primary power to the exciter.

WARNING *DO NOT TOUCH ANY COMPONENTS WITHIN THE EXCITER WITH POWER APPLIED.*

WARNING

F. Refer to Figure 4–1 and adjust the 10 MHz VCXO adjust control for 10 MHz +/–5 Hz as indicated on the frequency counter.

WARNING *DISCONNECT PRIMARY POWER TO THE EXCITER BEFORE PROCEEDING.*

WARNING

G. Disconnect the exciter primary power.

H. Remove the test equipment, replace the top–cover, and connect the reference input to the rear–panel **SUB–1** receptacle.

4–12. **REFERENCE FREQUENCY SELECTION.** The removal or installation of capacitors C25, C26, and C29 selects alternate reference frequencies. If an alternate frequency is desired, refer to Figure 4–1 and the following information and install the required combination of capacitors.

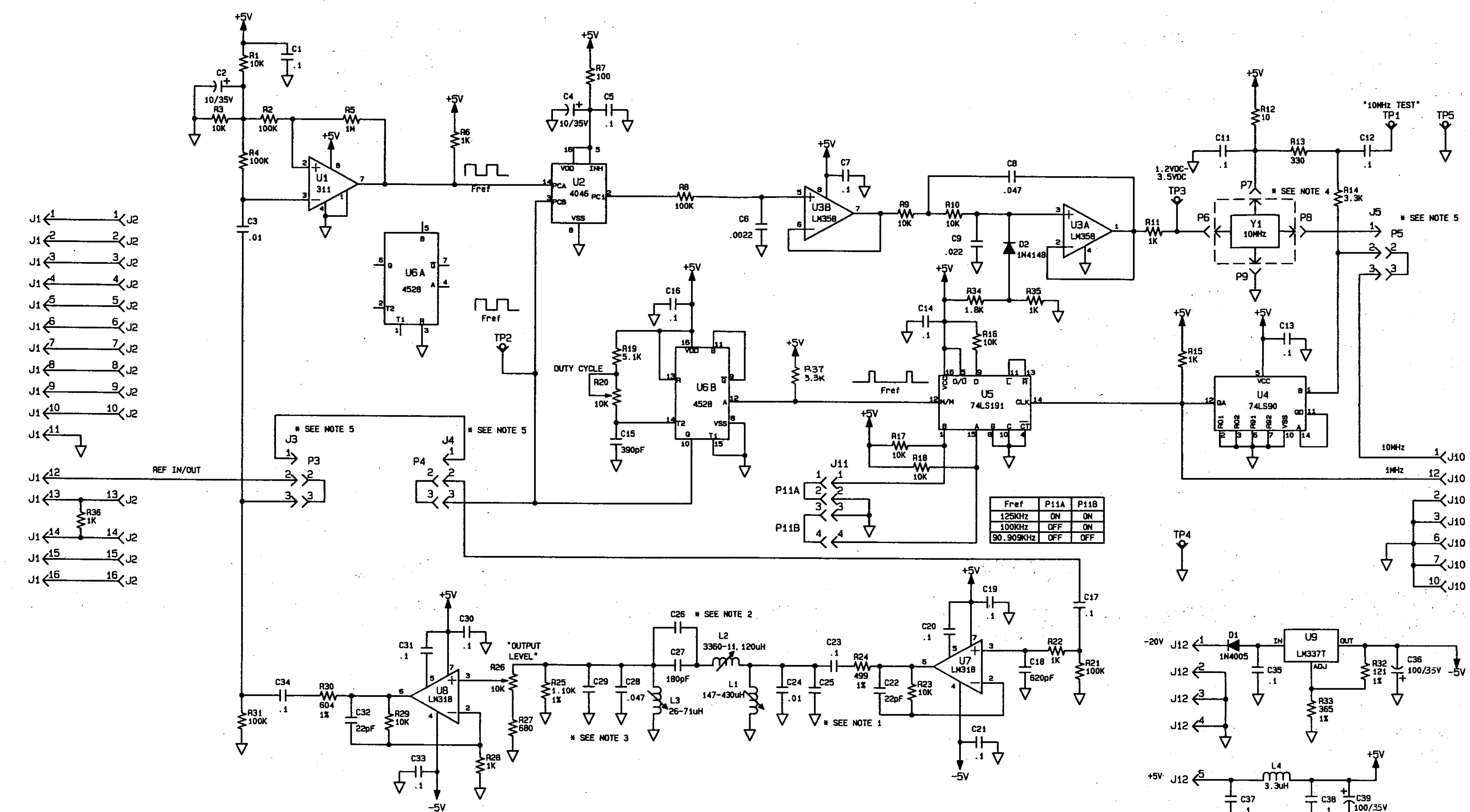
REFERENCE FREQUENCY	C25	C26	C29
125 kHz	Removed	Removed	Removed
100 kHz	Installed	Installed	Removed
90.909 kHz	Installed	Installed	Installed

SECTION V
DRAWINGS

5-1. INTRODUCTION.

5-2. This section provides assembly drawings, wiring diagrams, and schematic diagrams as listed below for the synchronous FM booster circuit boards.

FIGURE	TITLE	NUMBER
5-1	FX-50/E BOOSTER OPTION CIRCUIT BOARD SCHEMATIC	SD909-0131
5-2	FX-50/E BOOSTER CIRCUIT BOARD ASSEMBLY DIAGRAM	AC909-0131



Fref	P11A	P11B
125KHz	ON	ON
100KHz	OFF	ON
90.909KHz	OFF	OFF

NOTES:

1. FOR Fref=100KHz OR 90.909KHz, ADD C25 .005uF. B.E. P/N 000-5034
2. FOR Fref=100KHz, ADD C26 82pF. B.E. P/N 042-8212
   FOR Fref=90.909KHz, ADD C26 240pF. B.E. P/N 040-2422
3. FOR Fref=90.909KHz, ADD C29 .022uF. B.E. P/N 031-2243
4. Y1 NOT INSTALLED WHEN UNIT IS CONFIGURED AS "MASTER".
5. CONFIGURE P3, P4, P5: 1-2 FOR "SLAVE", 2-3 FOR "MASTER".
6. ALL RESISTORS IN OHMS, 1/4W, 5%. ALL CAPACITORS IN MICROFARADS, UNLESS OTHERWISE SPECIFIED.
7. LAST COMPONENTS USED: R37, C39, D2, U9, L4, TP4, J12, P9.
8. SEE PCB ASSEMBLY AC909-0131
9. COMPONENTS NOT USED: C10

TOLERANCE DECIMAL U.O.S.
.X ± .030 .XXX ± .005
.XX ± .015 ANGLES ± 1°

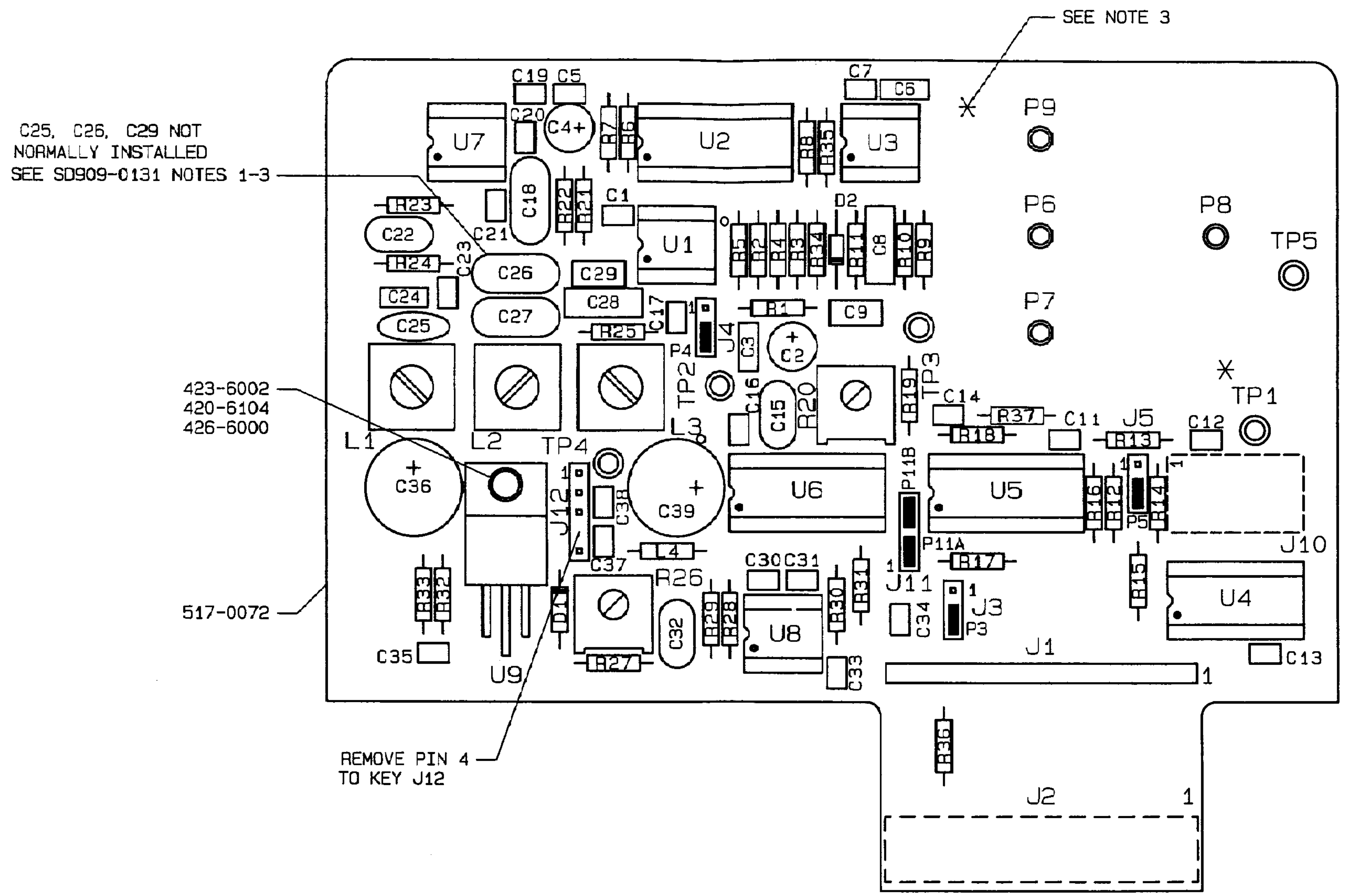
DWN BY: KLS 7-25-88
CHKD: MH 10-12-88
ME:
PROJ. ENGR.:
MFG.:
MATERIAL: SEE B/M 909-0131
FINISH:
NEXT ASSY:

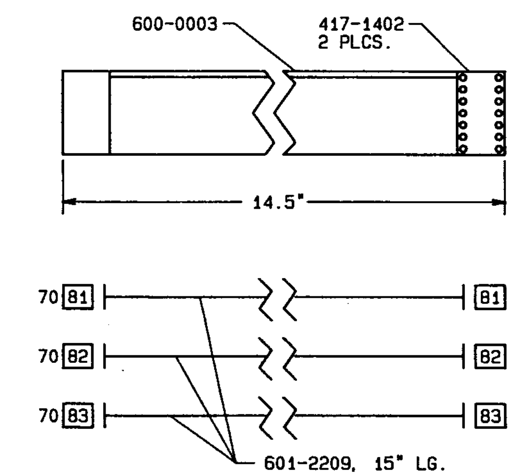
BROADCAST ELECTRONICS INC.
4100 N.24TH ST., P.O.BOX 3606 QUINCY, IL 62305 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE: PCB SCHEMATIC- FX-50 BOOSTER OPTION BD.

TYPE	SIZE	DWG.NO.	REV
S	D	909-0131	F

MODEL FX-50 | SCALE NTS | SHEET 1 OF 1





P12 417-0165	
PIN NO.	WIRE NO.
1	81
2	82
3	OPEN
4	KEY
5	83

✱KEYING PLUG P/N 417-0224

NOTES:

1. SEE SCHEMATIC SD909-0131
2. LAST COMPONENT USED: R37, C39, D2, U9, L4, TP5, J12, P9.
3. INSTALL Y1 P/N 390-0023 ON VERSION 909-0132 AND SOLDER WHERE INDICATED BY ✱. CUT LEADS TO 0.3".
4. COMPONENTS NOT USED: C10
5. FOR FREF=100KHz OR 90.909KHz, ADD C25 .005uF BE P/N 000-5034.
6. FOR FREF=100KHz, ADD C26 82pF BE P/N 042-8212. FOR FREF=90.909KHz, ADD C26 240pF BE P/N 040-2422.
7. FOR FREF=90.909KHz, ADD C29 .022uF BE P/N 031-2243.

TOLERANCE DECIMAL U.O.S.
.X ± .030 .XXX ± .005
.XX ± .015 ANGLES ± 1°

DWN BY KLS 8-4-88
CHKD MH 10-12-88
ME 10-12-88
PROJ. ENGR. 10-12-88
MFG.

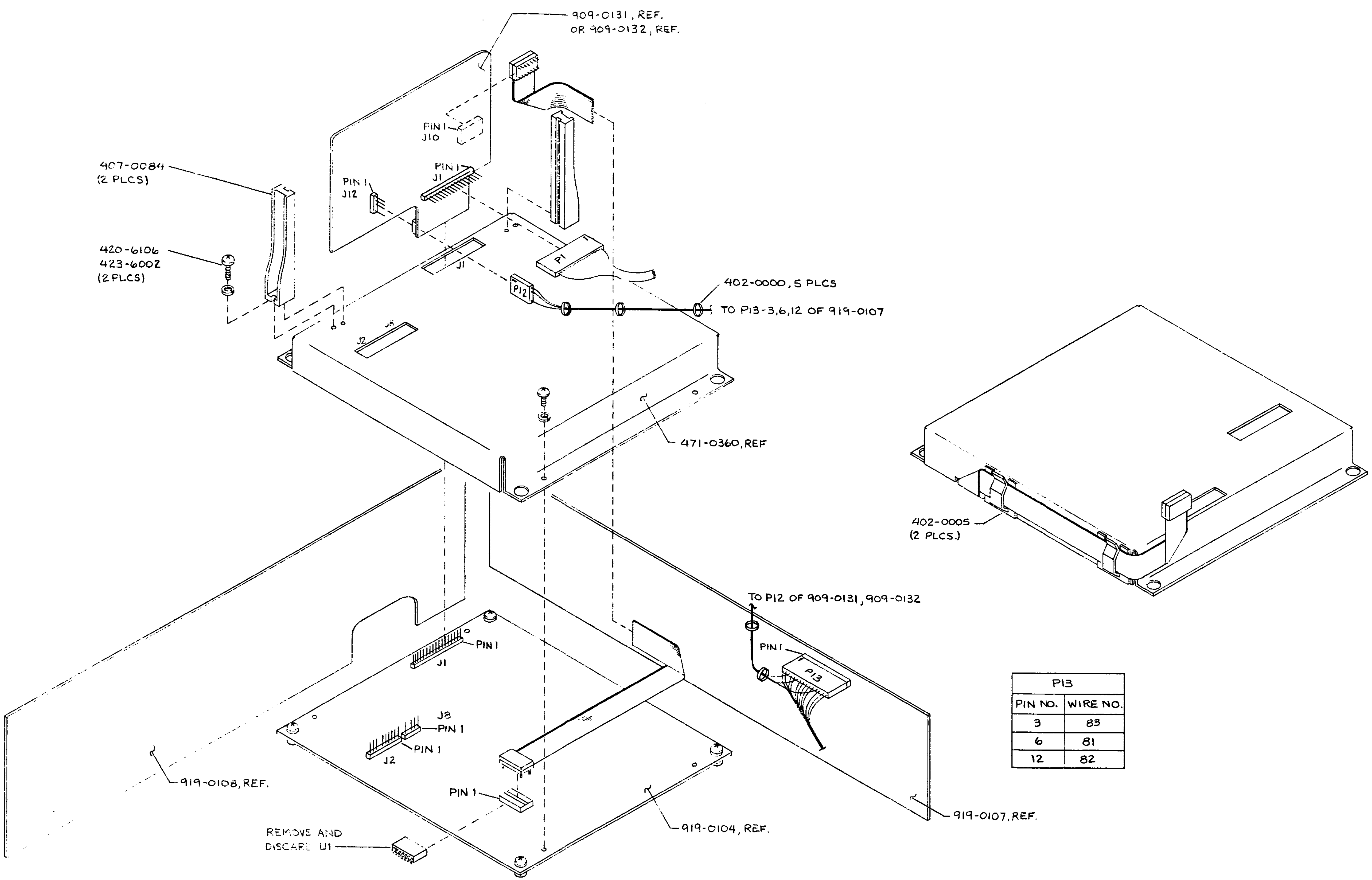
MATERIAL SEE B/M 909-0131
FINISH
NEXT ASSY

BROADCAST ELECTRONICS INC.
4100 N.24TH ST., P.O.BOX 3606 QUINCY, IL 62305 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE PCB ASSEMBLY– FX-50 BOOSTER OPTION BD.

TYPE A | SIZE C | DWG.NO. 909-0131 | REV E

MODEL FX-50 | SCALE 2/1 | SHEET 1 OF 2



P13	
PIN NO.	WIRE NO.
3	83
6	81
12	82

TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1

DWN. BY	KLS 10-11-88
CHKD	MH 10-12-88
ME	10-12-88
PROJ. ENGR.	
MFG.	
MATERIAL	SEE B/M 909-0131
FINISH	SEE DWG RA592-0000
NEXT ASSY.	

BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O. BOX 3606 QUINCY, IL 62305 217/224-9600
TELEX 250142 CABLE BROADCAST

TITLE PCB ASSEMBLY
FX-50 BOOSTER OPTION ASSY.

TYPE	SIZE	DWG. NO.	REV
A	C	909-0131	E

MODEL FX-50 SCALE .5=1 SHEET 2 OF 2

SECTION VI
REPLACEMENT PARTS

6-1. INTRODUCTION.

6-2. This section provides descriptions and part numbers of electrical components, assemblies, and selected mechanical parts required for maintenance of the synchronous FM booster circuit boards. Each table entry in this section is indexed by reference designators appearing on the applicable schematic diagram.

TABLE	TITLE	NUMBER	PAGE
6-1	SYNCHRONOUS FM BOOSTER CIRCUIT BOARDS	909-0131/ -0132	14

TABLE 6-1. SYNCHRONOUS FM BOOSTER CIRCUIT BOARD ASSEMBLIES - 909-0131, 909-0132 (Sheet 1 of 3)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	1
C2	Capacitor, Electrolytic, 10 uF, 50V	023-1076	1
C3	Capacitor, Mylar, 0.01 uF ±10%, 100V	031-1043	1
C4	Capacitor, Electrolytic, 10 uF, 50V	023-1076	1
C5	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	1
C6	Capacitor, Polyester, 0.0022 uF ±10%, 100V	031-2033	1
C7	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	1
C8	Capacitor, Mylar, 0.047 uF ±10%, 100V	030-4743	1
C9	Capacitor, Mylar, 0.022 uF ±10%, 200V	031-2243	1
C11 THRU C14	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	4
C15	Capacitor, Mica, 390 pF ±5%, 100V	042-3922	1
C16,C17	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	2
C18	Capacitor, Mica, 620 pF ±5%, 300V	040-6223	1
C19,C20,C21	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	3
C22	Capacitor, Mica, 22 pF ±5%, 500V	040-2213	1
C23	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	1
C24	Capacitor, Mylar, 0.01 uF ±10%, 100V	031-1043	1
C27	Capacitor, Mica, 180 pF ±5%, 500V	042-1822	1
C28	Capacitor, Mylar, 0.047 uF ±10%, 100V	030-4743	1
C30,C31	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	2
C32	Capacitor, Mica, 22 pF ±5%, 500V	040-2213	1
C33,C34,C35	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	3
C36	Capacitor, Electrolytic, 100 uF, 35V	023-1084	1
C37,C38	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	2
C39	Capacitor, Electrolytic, 100 uF, 35V	023-1084	1
D1	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203-4005	1
D2	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	1

TABLE 6-1. SYNCHRONOUS FM BOOSTER CIRCUIT BOARD ASSEMBLIES - 909-0131, 909-0132 (Sheet 2 of 3)

REF. DES.	DESCRIPTION	PART NO.	QTY.
J1	Receptacle, Male, 20-Pin In-line	417-0200	1
J2	Receptacle, 16-Pin In-line	417-0187	1
J3,J4,J5	Connector, Header, 3-Pin In-line	417-0003	3
J10	Socket, 14-Pin DIP	417-1404	1
J11,J12	Receptacle, Male, 20-Pin In-line	417-0200	2
L1	Shielded Adjustable Coil, 147-430 uH, 121 mA Maximum, 16.32 Ohms DC Resistance	360-0035	1
L2	Shielded Adjustable Coil, 120 uH, 55 mA Maximum, 78.92 Ohms DC Resistance	360-0071	1
L3	Shielded Adjustable Coil, 26-71 uH, 185 mA Maximum, 6.97 Ohms DC Resistance	360-0062	1
L4	RF Choke, 3.3 uH ±10%, 380 mA Maximum, 0.85 Ohms DC Resistance	360-3300	1
P3,P4,P5	Jumper, Programmable, 2-Pin	340-0004	3
P6 THRU P9	Receptacle, Single Pin	417-0071-001	4
P11A,P11B	Jumper, Programmable, 2-Pin	340-0004	2
P12	Connector, Housing, 5-Pin In-line	417-0165	1
R1	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	1
R2	Resistor, 100 k Ohm ±5%, 1/4W	100-1063	1
R3	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	1
R4	Resistor, 100 k Ohm ±5%, 1/4W	100-1063	1
R5	Resistor, 1 Meg Ohm ±5%, 1/4W	100-1073	1
R6	Resistor, 1 k Ohm ±5%, 1/4W	100-1043	1
R7	Resistor, 100 Ohm ±5%, 1/4W	100-1033	1
R8	Resistor, 100 k Ohm ±5%, 1/4W	100-1063	1
R9,R10	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	2
R11	Resistor, 1 k Ohm ±5%, 1/4W	100-1043	1
R12	Resistor, 10 Ohm ±5%, 1/4W	100-1023	1
R13	Resistor, 330 Ohm ±5%, 1/4W	100-3333	1
R14	Resistor, 3.3 k Ohm ±5%, 1/4W	100-3343	1
R15	Resistor, 1 k Ohm ±5%, 1/4W	100-1043	1
R16,R17,R18	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	3
R19	Resistor, 5.1 k Ohm ±5%, 1/4W	100-5143	1
R20	Potentiometer, 10 k Ohm ±10%, 1/2W	177-1054	1
R21	Resistor, 100 k Ohm ±5%, 1/4W	100-1063	1
R22	Resistor, 1 k Ohm ±5%, 1/4W	100-1043	1
R23	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	1
R24	Resistor, 499 Ohm ±1%, 1/4W	103-4993	1
R25	Resistor, 1.10 k Ohm ±1%, 1/4W	103-1104	1
R26	Potentiometer, 10 k Ohm ±10%, 1/2W	177-1054	1
R27	Resistor, 680 Ohm ±5%, 1/4W	100-6833	1
R28	Resistor, 1 k Ohm ±5%, 1/4W	100-1043	1
R29	Resistor, 10 k Ohm ±5%, 1/4W	100-1053	1
R30	Resistor, 604 Ohm ±1%, 1/4W	100-6031	1
R31	Resistor, 100 k Ohm ±5%, 1/4W	100-1063	1
R32	Resistor, 121 Ohm ±1%, 1/4W	100-1231	1
R33	Resistor, 365 Ohm ±1%, 1/4W	103-3631	1
R34	Resistor, 1.8 k Ohm ±5%, 1/4W	100-1843	1
R35,R36	Resistor, 1 k Ohm ±5%, 1/4W	100-1043	2

TABLE 6-1. SYNCHRONOUS FM BOOSTER CIRCUIT BOARD ASSEMBLIES - 909-0131, 909-0132 (Sheet 3 of 3)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R37	Resistor, 3.3 k Ohm ±5%, 1/4W	100-3343	1
TP1 THRU TP5	Turret Terminal, Double Shoulder	413-1597	5
U1	Integrated Circuit, TL311P, JFET-Input Differential Comparator, 8-Pin DIP	220-0311	1
U2	Integrated Circuit, CD4046BE, Phase-Locked Loop, CMOS, 16-Pin DIP	225-0012	1
U3	Integrated Circuit, LM358N, Dual Operational Amplifier, 8-Pin DIP	221-0358	1
U4	Integrated Circuit, SN74LS90N, Negative edge-triggered, Divide-by-10 Counter, 14-Pin DIP	228-0290	1
U5	Integrated Circuit, 74LS191N, Synchronous Binary Counter, TTL Type, 14-Pin DIP	228-0191	1
U6	Integrated Circuit, MC14528BCP, Dual Monostable Multivibrator, CMOS, 16-Pin DIP	224-4528	1
U7,U8	Integrated Circuit, LM318P, Operational Amplifier, 8-Pin DIP	221-0318	2
U9	Integrated Circuit, LM337T, Adjustable Negative Voltage Regulator, 1.2V to 37V, 1.5 Ampere, TO-220 Case	227-0337	1
XU1	Socket, 8-Pin DIP	417-0804	1
XU2	Socket, 16-Pin DIP	417-1604	1
XU3	Socket, 8-Pin DIP	417-0804	1
XU4	Socket, 14-Pin DIP	417-1404	1
XU5,XU6	Socket, 16-Pin DIP	417-1604	2
XU7,XU8	Socket, 8-Pin DIP	417-0804	2
----	Socket, 14-Pin DIP	417-1402	2
----	Pins, Crimp Type	417-8766	7
----	Card Guide, 3 Inch	407-0084	2
----	Blank FX-50 Booster Circuit Board	517-0072	1

ADDITIONAL PARTS FOR ASSEMBLY - 909-0132

Y1	Oscillator, Crystal, VCXO, 10 MHz ±20 PPM, 0°C to 50°C, Input: ±5 VDC Output: TTL Compatible	390-0023	1