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FX-50, FX-50E
50 WATT
FM Exciter
Instruction Manual

597-1050
Rev B
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FX-50, FX-50E. 50 WATT FM Exciter
Instruction Manual

Broadcast Electronics
Product Warranty (Two-Year Limited)

BE hereby warrants all new products manufactured by BE against any defects in material or workmanship at the time of delivery thereof, or that develop under normal use within a period of two (2) years from the date of shipment.

BE reserves the right to repair equipment under warranty with new or refurbished equipment or parts. BE's sole responsibility with respect to any equipment or parts not conforming to this warranty is to replace or repair such equipment upon the return thereof F.O.B. to BE's factory in Quincy, Illinois, U.S.A. In the event of replacement pursuant to the foregoing warranty, only the unexpired portion of the warranty from the time of the original purchase will remain in effect for any such replacement.

This warranty shall exclude the following products, component parts and/or assemblies:

(a) Transmitter power output tubes shall only carry the original manufacturers' or suppliers' standard warranty in effect on their original shipment date.

(b) All computers, computer peripherals, cables, hard disk drives, etc., shall only carry the manufacturers' or suppliers' standard warranty in effect on their original shipment date.

(c) "Components", defined as separate and individual parts (e.g. transistors, integrated circuits, capacitors, resistors, inductors, fans, etc), resold by BE from another manufacturer or supplier, shall only carry a 90 day warranty, effective the date of shipment. Any such 'Components' being returned for warranty claim must be (1) returned in their original packaging and (2) must be in new, unused condition.
BE is unable to process or resolve component defects or performance concerns on components that have been soldered, installed, wired or in any way altered from new their new condition.

(d) "Resale Equipment", defined as equipment purchased from another manufacturer or supplier, then resold by BE, shall only carry such manufacturers' or suppliers' standard warranty in effect as of the original shipment date. All warranty claims against any and all 'resale equipment' sold by BE must be filed directly with the original equipment manufacturer. BE is unable to process or resolve equipment defects or performance concerns on products or services not manufactured by BE.

This warranty shall not extend to claims resulting from any acts of God, terrorism, war, defects or failures caused by Purchaser or user abuse or misuse, operator error, or unauthorized attempts to repair or alter the equipment in any way.

Under no circumstances shall BE be responsible for indirect, incidental or consequential damages, including, but not limited to transportation costs, non-authorized repair or service costs, downtime costs, costs for substituting equipment or loss of anticipated profits or revenue incurred by Purchaser, whether based in contract, tort or for negligence or breach of statutory duty or otherwise.
The terms of the foregoing warranty shall be null and void if the equipment has been altered or repaired without specific written authorization from BE, or if not installed according to BE's instruction manuals including, but not limited to, the absence of proper grounding, surge (TVSS) protection on the AC circuit panel or proper lightning protection/grounding on all output circuits, or if equipment is operated under environmental conditions or circumstances other than those specifically described in BE's product literature or instruction manual which accompany the equipment. **The warranty shall be voided if the product or subassembly is equipped with a tamper seal and that tamper seal is broken.** BE shall not be liable for any expense of any nature whatsoever incurred by the original user without prior written consent of BE.

The warranty provided herein shall terminate at the end of the period set forth above. This warranty extends only to the original Purchaser and is not transferable. There are no third party beneficiaries of any of the provisions of this warranty. If the equipment is described as “used” equipment, it is sold as is and where is and no warranty applies unless authorized in writing.

EXCEPT AS SET FORTH HEREIN, AS TO TITLE AND AS SPECIFICALLY REQUIRED BY LAW, THERE ARE NO OTHER WARRANTIES, OR ANY AFFIRMATIONS OF FACT OR PROMISES BY BE, WITH REFERENCE TO THE EQUIPMENT, OR TO MERCHANTABILITY, FITNESS FOR A PARTICULAR APPLICATION, SIGNAL COVERAGE, INFRINGEMENT, OR OTHERWISE, WHICH EXTEND BEYOND THE DESCRIPTION OF THE EQUIPMENT ON THE FACE HEREOF.

IMPORTANT INFORMATION

EQUIPMENT LOST OR DAMAGED IN TRANSIT -

When delivering the equipment to you, the truck driver or carriers' 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, PARTS -

Technical assistance is available from Broadcast Electronics by letter, prepaid telephone 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 RF Technical Services Department for a shipping container. Do not mail the equipment. We can assume no liability for inbound damage, and necessary repairs become the obligation of the shipper. Prior arrangement is necessary. Contact the RF Technical Services 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 at the number shown below.

RF TECHNICAL SERVICES -

Telephone: +1 (217) 224-9617
E-Mail: rfservice@bdcast.com
Fax: +1 (217) 224-6258

FACILITY CONTACTS -

Broadcast Electronics, Quincy Facility
4100 N. 24th St. P.O. BOX 3606
Quincy, Illinois 62305
Telephone: +1 (217) 224-9600
Fax: +1 (217) 224-6258
General E-Mail: bdcast@bdcast.com
Web Site: www.bdcast.com

PARTS -

Telephone: +1 (217) 224-9617
E-Mail: parts@bdcast.com

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.

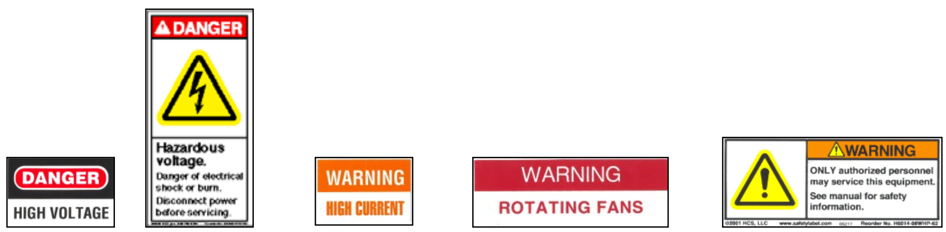
MODIFICATIONS -

Broadcast Electronics, 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.

SAFETY PRECAUTIONS

PLEASE READ AND OBSERVE ALL SAFETY PRECAUTIONS//

ALL PERSONS WHO WORK WITH OR ARE EXPOSED TO POWER TUBES, POWER TRANSISTORS, OR EQUIPMENT WHICH UTILIZES SUCH DEVICES MUST TAKE PRECAUTIONS TO PROTECT THEMSELVES AGAINST POSSIBLE SERIOUS BODILY INJURY. EXERCISE EXTREME CARE AROUND SUCH PRODUCTS. UNINFORMED OR CARELESS OPERATION OF THESE DEVICES CAN RESULT IN POOR PERFORMANCE, DAMAGE TO THE DEVICE OR PROPERTY, SERIOUS BODILY INJURY, AND POSSIBLY DEATH.



DANGEROUS HAZARDS EXIST IN THE OPERATION OF POWER TUBES AND POWER TRANSISTORS -

The operation of power tubes and power transistors involves one or more of the following hazards, any one of which, in the absence of safe operating practices and precautions, could result in serious harm to personnel.

A. HIGH VOLTAGE Normal operating voltages can be deadly. Additional information follows.

B. RF RADIATION Exposure to RF radiation may cause serious bodily injury possibly resulting in Blindness or death. Cardiac pacemakers may be affected. Additional information follows.

C. HOT SURFACES Surfaces of air-cooled radiators and other parts of tubes can reach temperatures of several hundred degrees centigrade and cause serious burns if touched. Additional information follows.

D. RF BURNS Circuit boards with RF power transistors contain high RF potentials. Do not operate an RF power module with the cover removed.

HIGH VOLTAGE –

Many power circuits operate at voltages high enough to kill through electrocution. Personnel should always break the primary AC Power when accessing the inside of the transmitter.

RADIO FREQUENCY RADIATION

Exposure of personnel to RF radiation should be minimized, personnel should not be permitted in the vicinity of open energized RF generating circuits, or RF transmission systems (waveguides, cables, connectors, etc.), or energized antennas. It is generally accepted that exposure to “high levels” of radiation can result in severe bodily injury including blindness. Cardiac pacemakers may be affected.

The effect of prolonged exposure to “low level” RF radiation continues to be a subject of investigation and controversy. It is generally agreed that prolonged exposure of personnel to RF radiation should be limited to an absolute minimum. It is also generally agreed that exposure should be reduced in working areas where personnel heat load is above normal. A 10 mW/cm^2 per one tenth hour average level has been adopted by several U.S. Government agencies including the Occupational Safety and Health Administration (OSHA) as the standard protection guide for employee work environments. An even stricter standard is recommended by the American National Standards Institute which recommends a 1.0 mW/cm^2 per one tenth hour average level exposure between 30 Hz and 300 MHz as the standard employee protection guide (ANSI C95.1-1982).

RF energy must be contained properly by shielding and transmission lines. All input and output RF connections, such as cables, flanges and gaskets must be RF leak proof. Never operate a power tube without a properly matched RF energy absorbing load attached. Never look into or expose any part of the body to an antenna or open RF generating tube or circuit or RF transmission system while energized. Monitor the tube and RF system for RF radiation leakage at regular intervals and after servicing.

HOT SURFACES –

The power components in the transmitter are cooled by forced-air and natural convection. When handling any components of the transmitter after it has been in operation, caution must always be taken to ensure that the component is cool enough to handle without injury.

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1 OVERVIEW

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

1.1 RELATED PUBLICATIONS.

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

1.2 EQUIPMENT DESCRIPTION.

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.

1.3 FX-50 AND FX-50E MODELS.

The FX-50 and the FX-50E FM exciters are nearly identical in construction 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 amplifier 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).

1.4 PHYSICAL DESCRIPTION.

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.

Figure 1-1. FX-50/E Exciter

1.5 ELECTRICAL DESCRIPTION.

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.

1.5.1 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%.

1.5.2 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.

1.5.3 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.

1.5.4 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.

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.

1.6 EQUIPMENT SPECIFICATIONS.

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

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).
SYNCHRONOUS AM SIGNAL-TO-NOISE RATIO	60 dB Below Equivalent Reference Carrier with 100% Amplitude Modulation @ 1 kHz (FM Modulation: $\pm$75 kHz @ 400 Hz).
MULTIMETER	5 Function LCD Plus Diagnostic Aid, $\pm$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 $\pm$75 kHz Deviation.
COMPOSITE FM SIGNAL-TO-NOISE RATIO	90 dB Below $\pm$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	$\pm$0.025 dB, 30 Hz to 53 kHz.

RESPONSE	
COMPOSITE PHASE RESPONSE	$\pm$0.1° from Linear Phase 30 Hz to 53 kHz.
COMPOSITE GROUP DELAY VARIATION	$\pm$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 INTER-MODULATION DISTORTION	0.005% or Less, 15 kHz/14 kHz, 1:1 ratio.
SCA INPUT LEVEL	3.5V p-p Nominal for $\pm$7.5 kHz Deviation.
SCA AMPLITUDE RESPONSE	$\pm$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 $\pm$75 kHz Deviation @ 400 Hz, Adaptable to Other Levels.
AUDIO FREQUENCY RESPONSE	$\pm$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 $\pm$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.

2 INSTALLATION

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

2.1 UNPACKING.

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.

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.

2.2 INSTALLATION.

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.

2.2.1 PRELIMINARY INSTALLATION.

ENVIRONMENTAL CONSIDERATIONS. Table 1-2 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

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.

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

Place the exciter on a work surface.

Remove any packing material from the outside of the exciter.

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

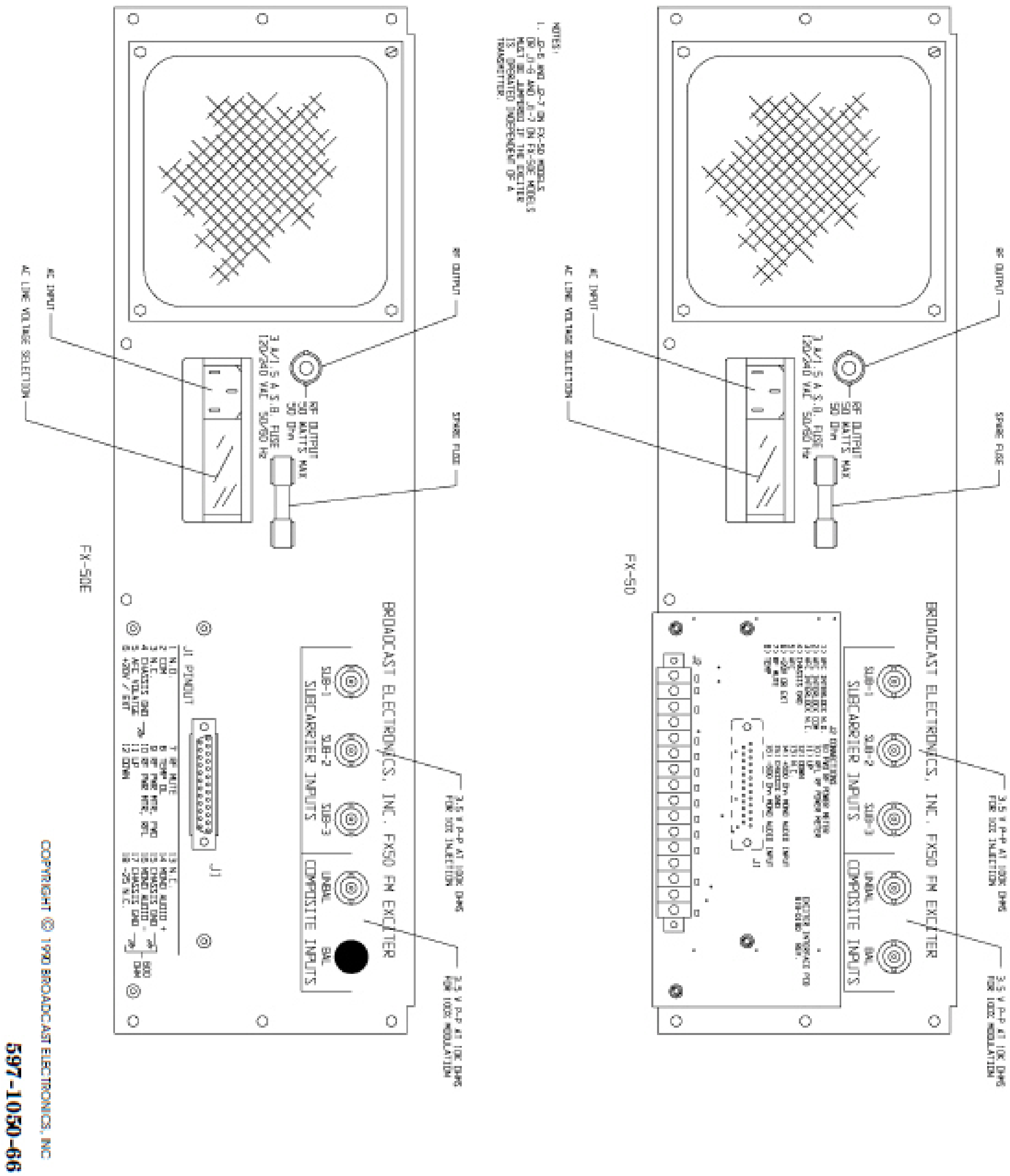

Figure 2-1. FX-50/E REAR-PANEL CONNECTIONS (SHEET 1 OR 2)

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 PWR 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 OR 2)

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.

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.

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.

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 14-2, SECTION VII, DRAWINGS and secure the slide rail mounting brackets to the respective side of the rack cabinet with the hardware supplied.

CAUTION

CAUTION

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

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.

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.

Pull the exciter forward until the slide rail stops are encountered.

Loosen the eight turn-lock fasteners on the top of the exciter and remove the top cover.

Remove any packing material from the inside of the exciter.

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.

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.

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.

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

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

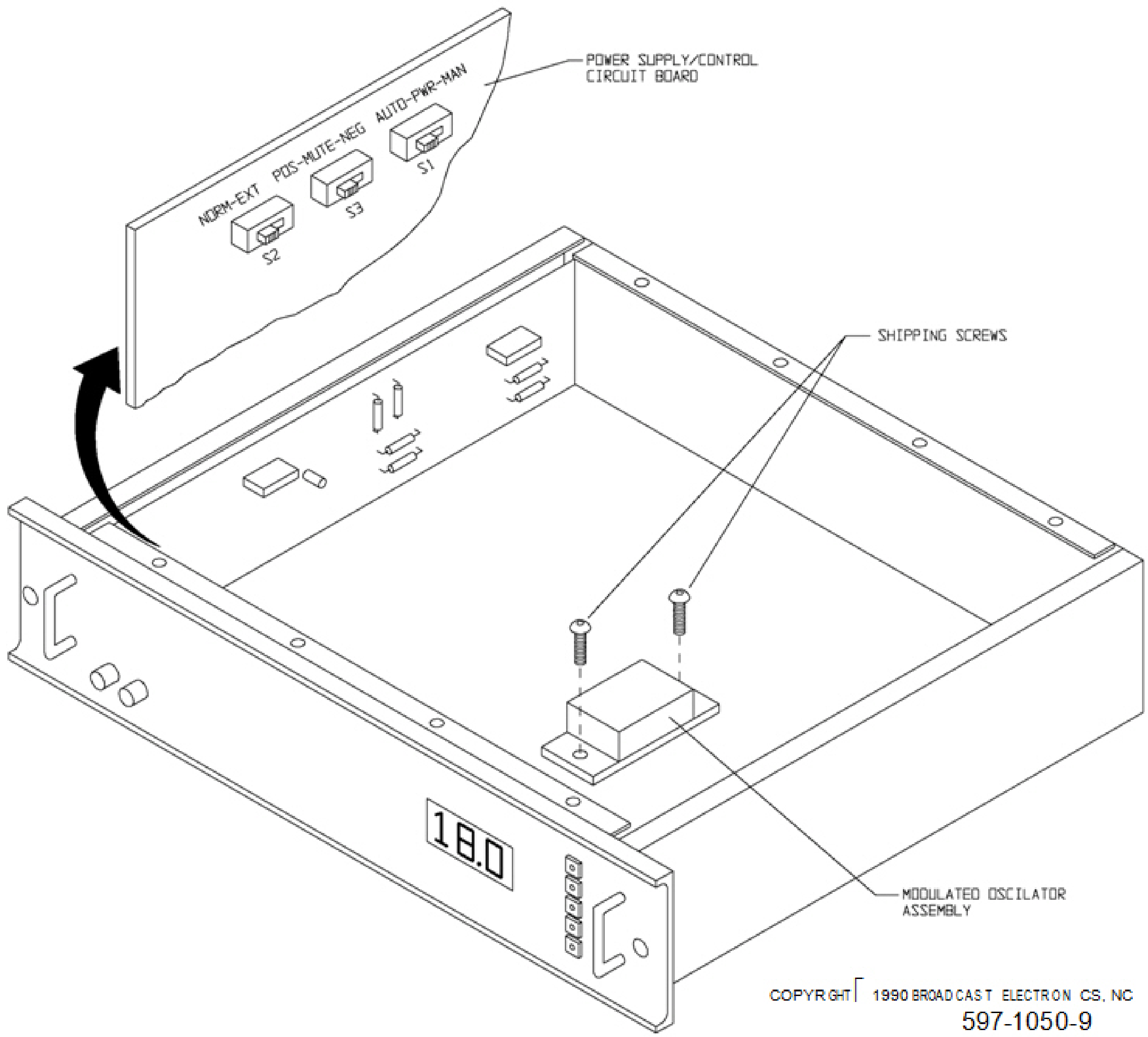

Figure 2-2. FX-50/E COMPONENT LOCATION DIAGRAM

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

2.3 WIRING.

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.

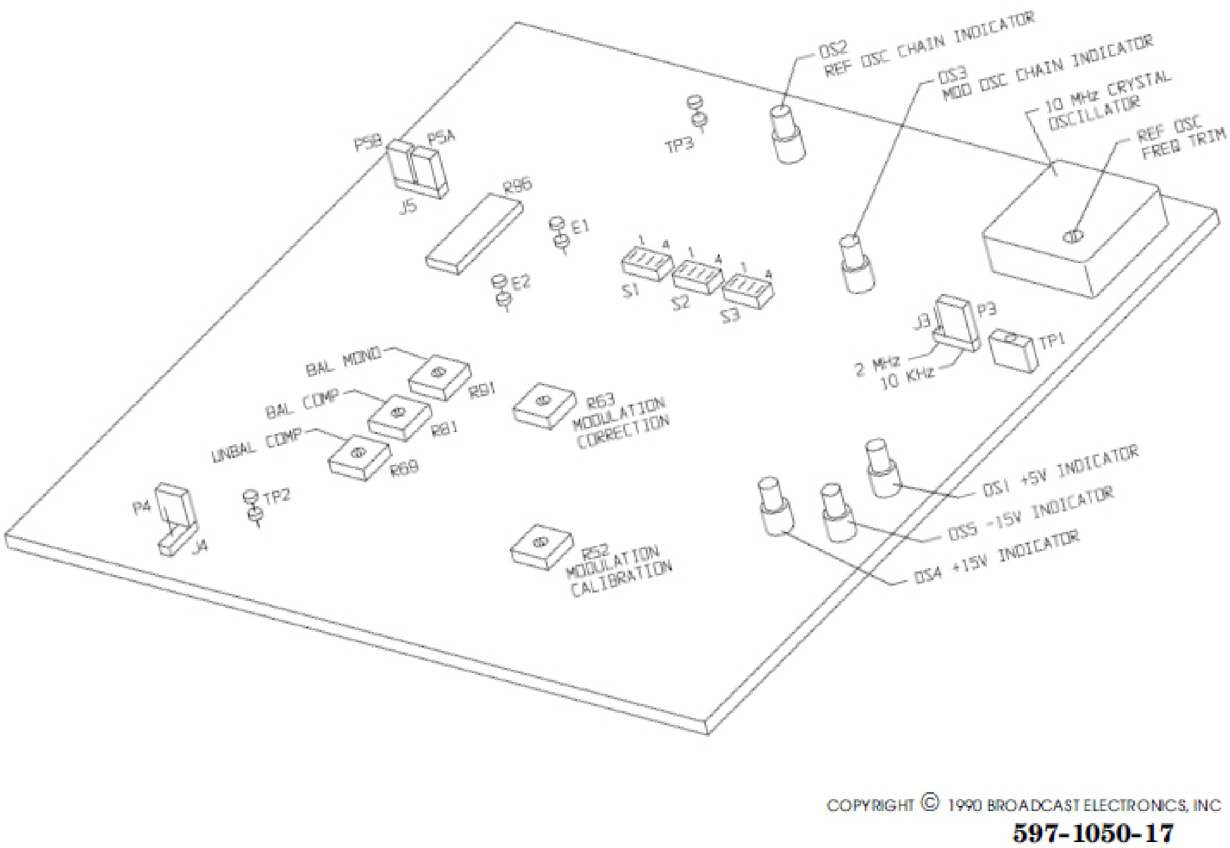

Figure 2-3. AFC/PLL CIRCUIT BOARD GAIN CONNECTIONS

WARNING **ENSURE THE EXCITER CASE ISCONNECTED TO EARTH GROUND.**

WARNING

GROUND. Ensure a ground wire is connected from terminal 4 of the exciter rear-panel terminal board to earth ground.

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.

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.

Automatic Frequency Control Indicator. The automatic frequency control indicator pro vides 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.

+20 Or Ext. The +20/EXT terminal functions as a +20V supply or an analog RF control in put 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.

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.

Over-Temperature Indicator. Both the FX-50 and FX-50E are equipped with an overtemperature 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.

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.

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.

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

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 un balanced composite input. A coaxial cable is provided in the accessory kit for the connections of a composite stereo or SCA signal to the transmitter.

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).

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.

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.

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.

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.

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.

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.

2.4 EXCITER CHECKOUT.

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

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.

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.

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).

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).

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

Disconnect ac primary power from the exciter.

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

LOW-PASS FILTER INSTALLATION.

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.

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.

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.

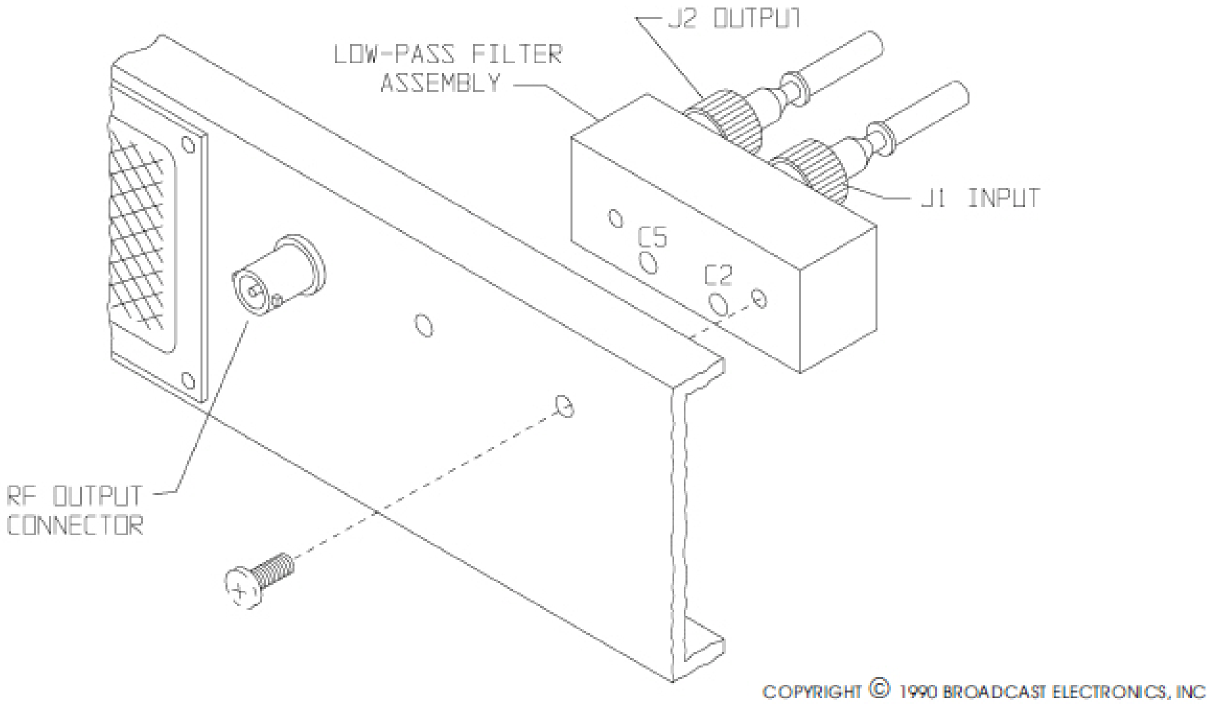

Figure 2-4. LOW-PASS FILTER INSTALLATION

REMOTE EXCITER CONNECTIONS.

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	J1-6
247	J2-9	J1-9
246	J2-10	J1-10

3 OPERATION

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

3.1 CONTROLS AND INDICATORS.

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.

3.2 OPERATION.

NOTE

NOTE

THE FOLLOWING PROCEDURE ASSUMES THAT THE

EXCITER IS COMPLETELY INSTALLED AND IS FREE

OF ANY DISCREPANCIES.

3.2.1 TURN ON.

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.

Observe the modulation indicator to ensure programming is applied to the exciter.

Operate the multimeter forward switch to illuminate the FWD indicator and record the multimeter output power indication .

Operate the multimeter reflected switch to illuminate the RFL indicator and record the multimeter reflected power indication .

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.

3.2.2 TURN OFF.

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

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.
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 $\pm$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

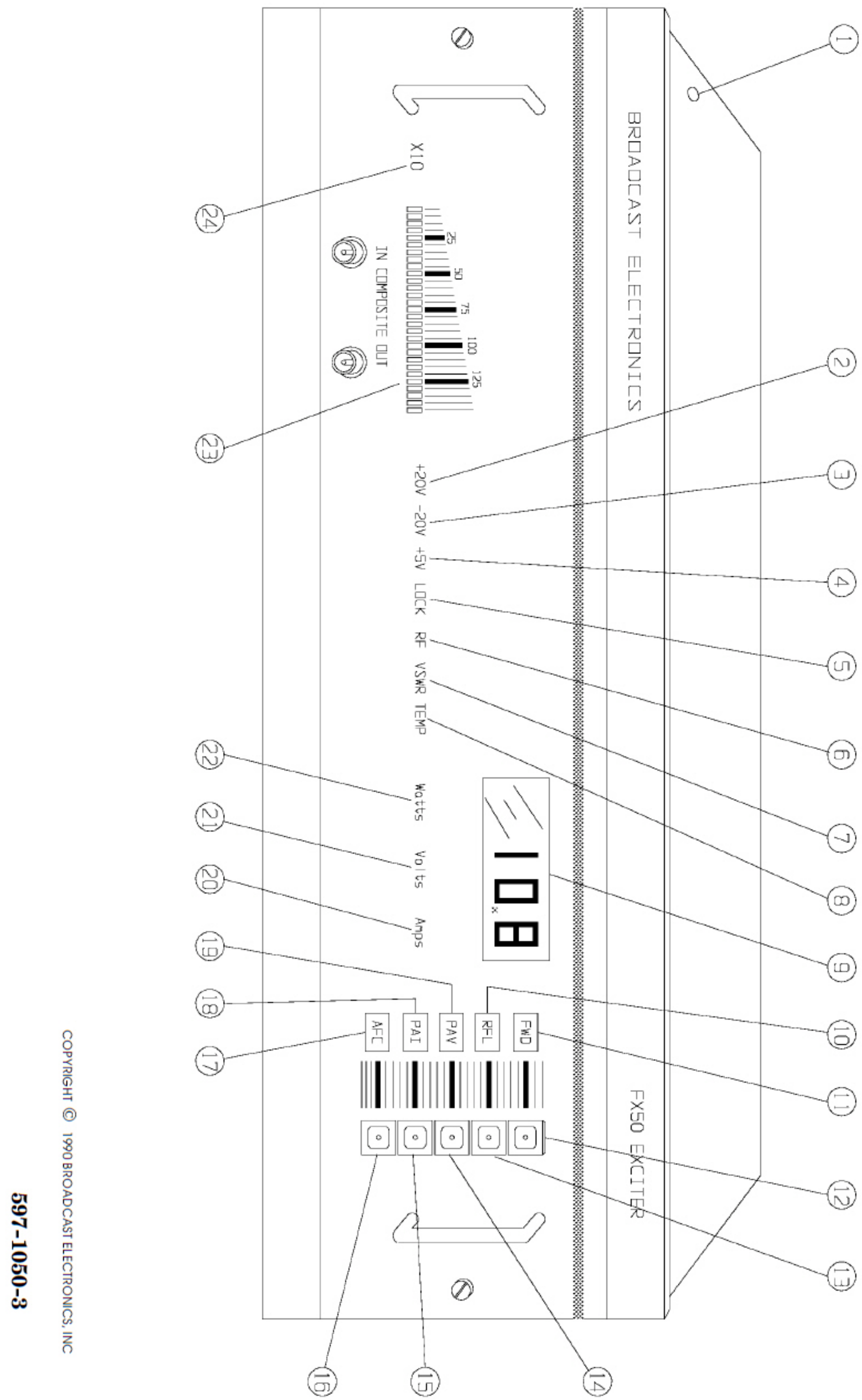

Figure 3-1. FX-50/E CONTROLS AND INDICATORS

4 THEORY OF OPERATION

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

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.

4.1 FUNCTIONAL DESCRIPTION.

4.1.1 POWER SUPPLY/CONTROL CIRCUITS.

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.

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 ex citer 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.

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.

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.

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.

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.

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.

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.

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.

4.1.2 REMOTE CONTROL/STATUS INTERFACING AND RFI FILTER NETWORK.

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 COM POSITE TEST IN and COMPOSITE TEST OUT circuits are not routed through this circuit board.

4.1.3 METERING CIRCUIT.

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.

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.

4.1.4 AFC/PLL CIRCUIT.

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.

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.

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.

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.

4.1.5 MODULATED OSCILLATOR CIRCUIT.

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.

4.1.6 RF AMPLIFIER ASSEMBLY.

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.

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 pro vides 8 watts of RF to the power amplifier which outputs an adjustable RF level of 3 to 50 watts.

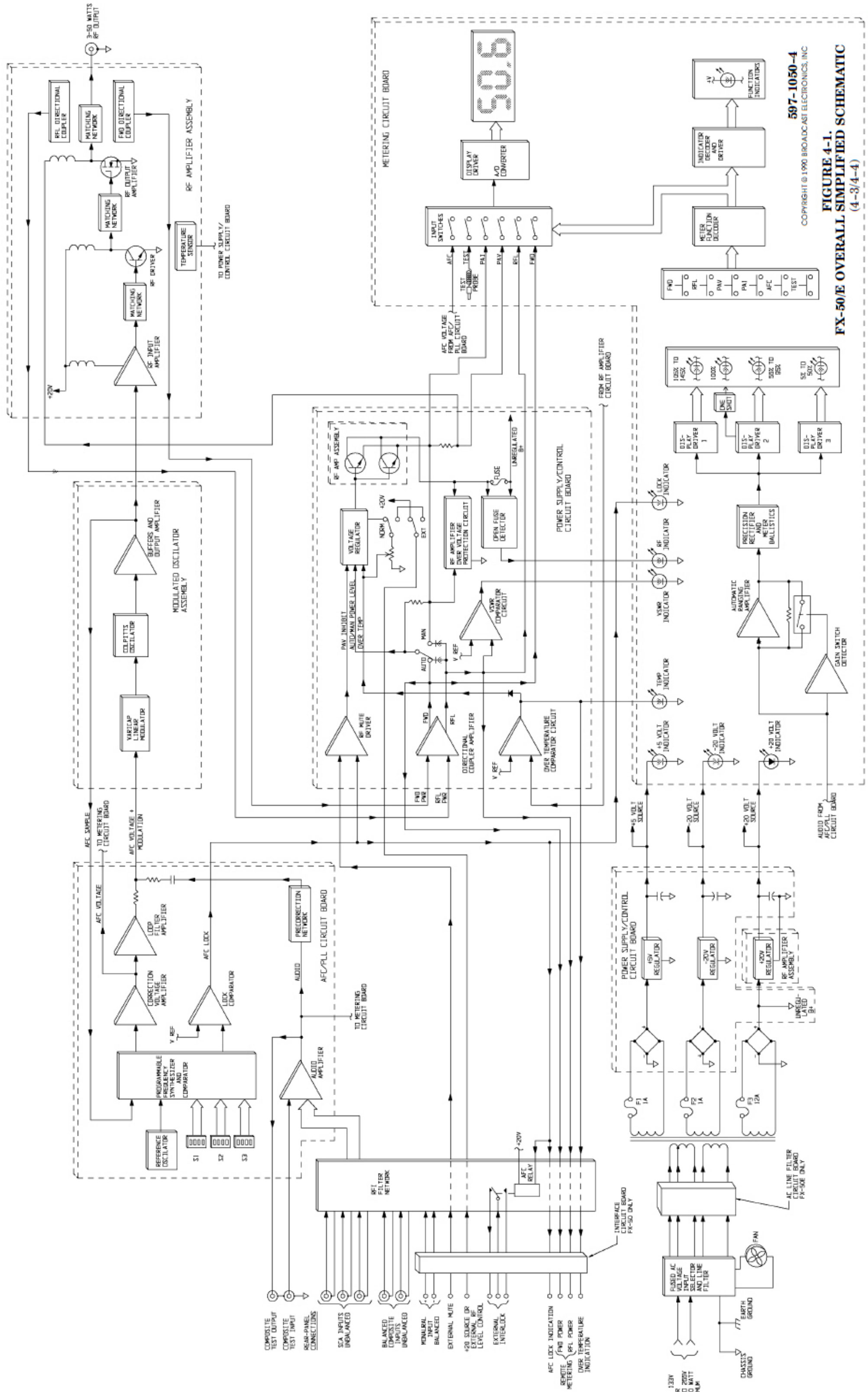

Figure 4-1. FX-50/E OVERALL SIMPLIFIED SCHEMATIC

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.

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.

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.

5 MAINTENANCE

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

5.1 SAFETY CONSIDERATIONS.

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 TRANSISTERS MOUNTED ON THE RF AMPLIFIER HEAT SINK ASSEMBLY.

WARNING WARNING — NEVER OPERATE THE EXCITER WITHOUT THE GUARDS.

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

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

5.2 FIRST LEVEL MAINTENANCE.

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

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.

5.3 SECOND LEVEL MAINTENANCE.

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

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. for repair or replacement.

5.3.1 ADJUSTMENTS.

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

5.4 TROUBLESHOOTING.

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

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.

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.

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	.097 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

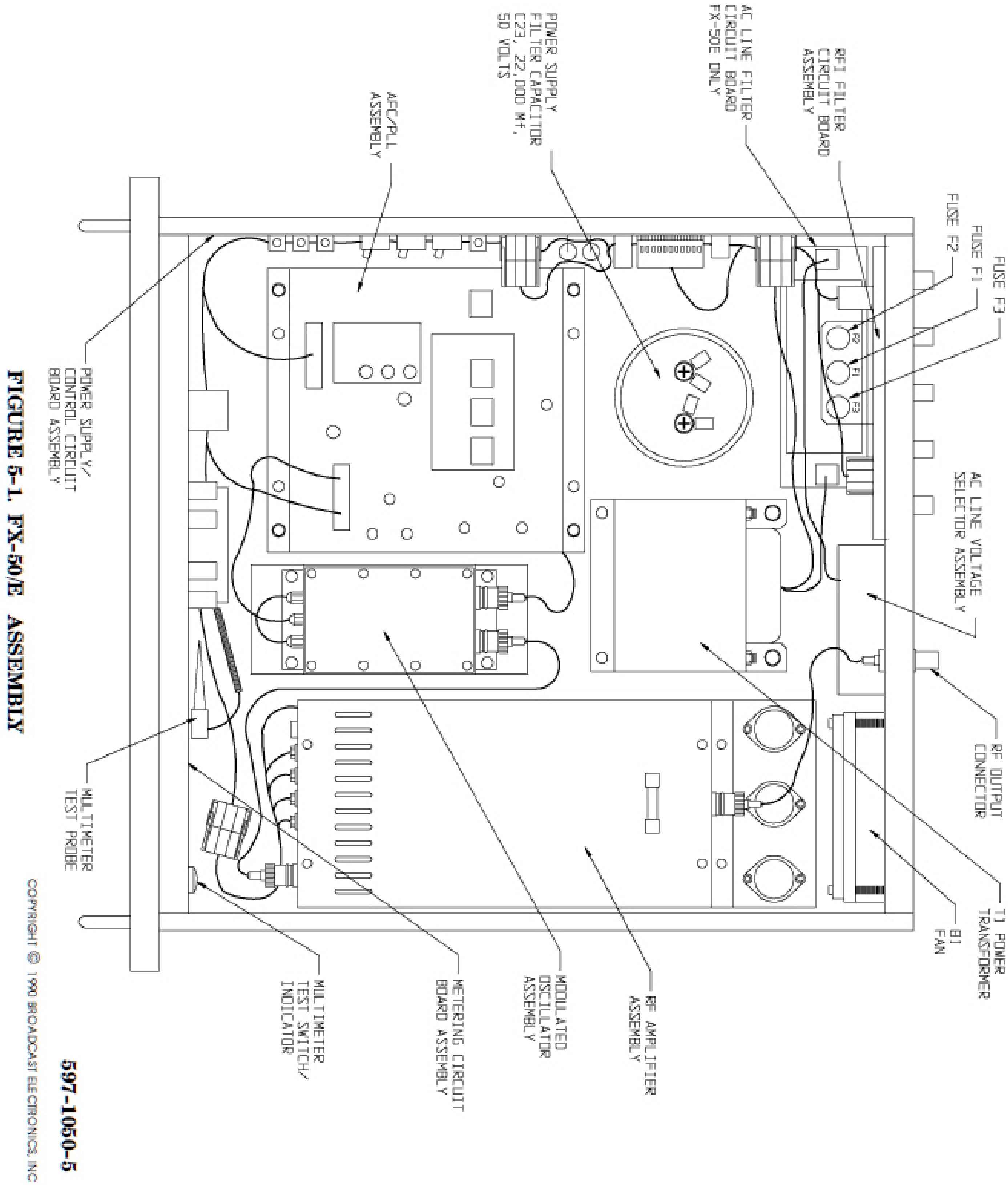

Figure 5-1. FX-50/E ASSEMBLY

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 GRINGING, 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

COMPONENT REPLACEMENT. The circuit boards used in the FX-50/E exciters 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.

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.

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.

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 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, INLCUDING CIGARETTES AND SOLDER IRONS.

WARNING

WARNING

OBSERVE THE MANUFACTURERS CAUTIONARY INSTRUCTIONS.

WARNING

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

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.

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.

5.4.1 EXCITER PREPARATION FOR SHIPMENT.

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.

5.4.2 EXCITER FREQUENCY CHANGE.

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.

6 POWER SUPPLY/CONTROL CIRCUIT

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

6.1 DESCRIPTION.

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.

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.

6.2 ELECTRICAL CHARACTERISTICS.

Refer to Table 6-1 for electrical characteristics relative to the power supply/control circuit board.

Table 6-1. POWER SUPPLY/CONTROL CIRCUIT 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.

6.3 REMOVAL AND INSTALLATION

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

6.3.1 REMOVAL PROCEEDURE

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

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

WARNING ***ENSURE ALL SYSTEM POWER IS DISCONNECTED 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.

6.3.2 INSTALLATION PROCEDURE.

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

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

WARNING

A. Disconnect the primary power to the exciter.

B. Follow the REMOVAL PROCEDURE in reverse order.

6.4 THEORY OF OPERATION

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

6.4.1 FUNCTIONAL DESCRIPTION.

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

6.4.2 CONTROL CIRCUITRY.

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

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.

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.

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.

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.

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.

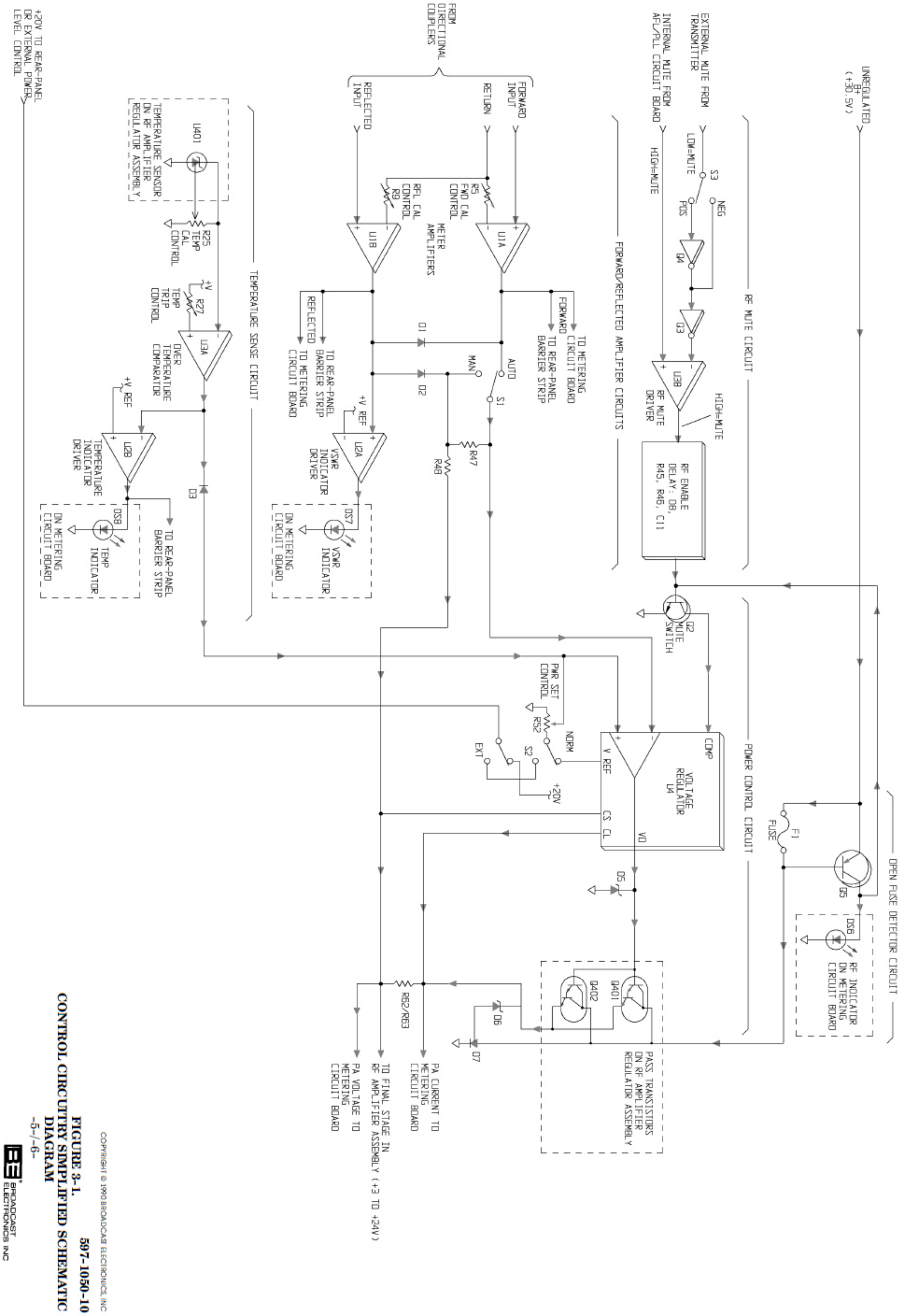

Figure 6-1. CONTROL CIRCUITRY SIMPLIFIED SCHEMATIC

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.

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.

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.

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 out put a HIGH to illuminate TEMP indicator DS8. This HIGH is also routed to the rear panel barrier strip.

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.

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, di odes D5, D6, and D7, resistors R47, R48, and R62/R63, and pass transistors Q401 and Q402.

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.

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.

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.

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.

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.

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.

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.

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.

6.4.3 POWER SUPPLY CIRCUITRY.

Figure 6-2 presents a simplified schematic of the power supply components on the power supply/control circuit board and exciter chassis. Refer to Figure 6-2 as required for the following description of the exciter power supply.

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 alows 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.

+5 VOLT SUPPLY. The 9.0 volt ac potential is routed to a full-wave rectifier and filter net work 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.

-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.

+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.

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

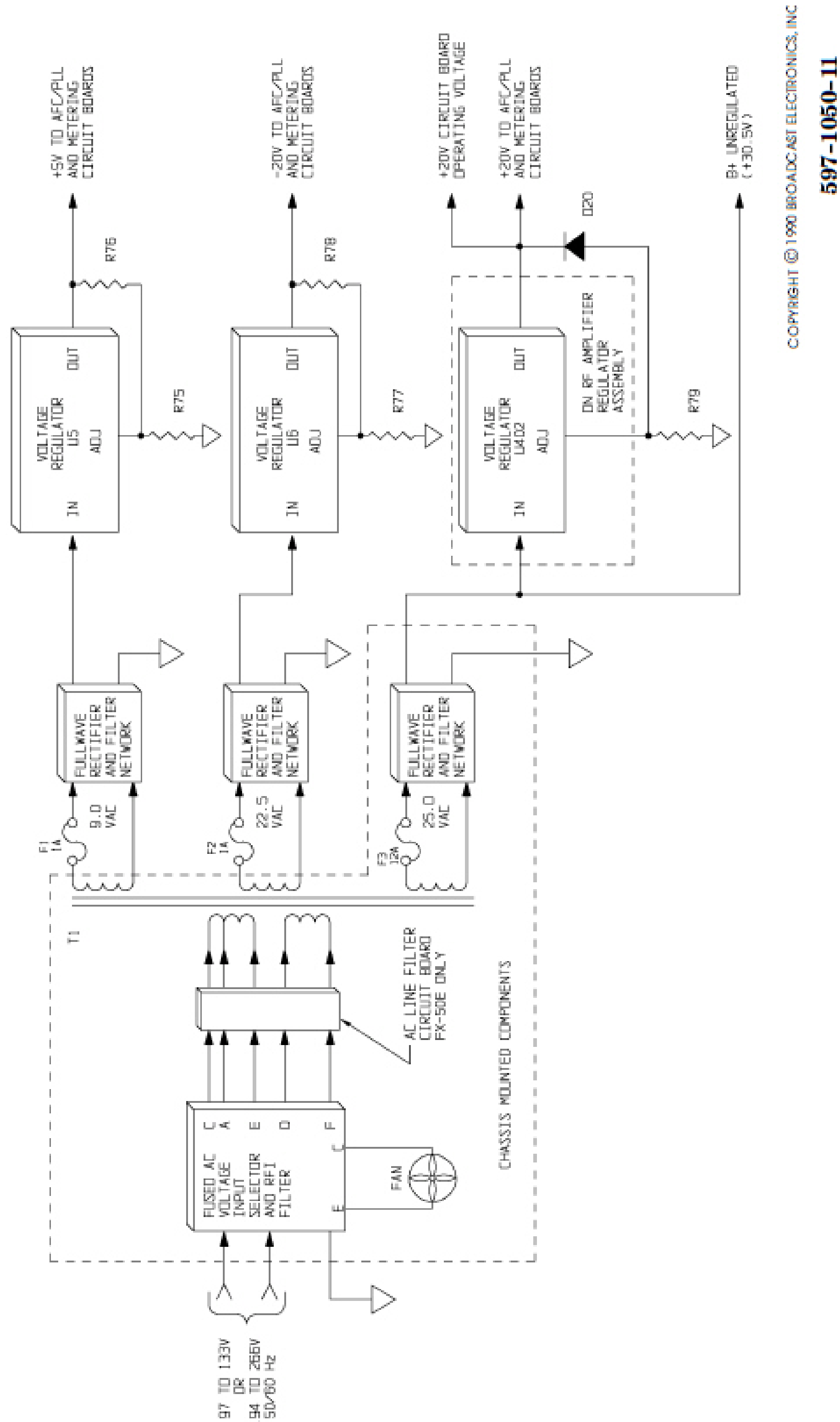

Figure 6-2. POWER SUPPLY SIMPLIFIED SCHEMATIC DIAGRAM

6.5 MAINTENANCE

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

6.5.1 ELECTRICAL ADJUSTMENTS.

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.

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.

Procedure. To adjust controls R5 and R9, proceed as follows:

A. Apply primary power and record the front-panel FWD meter indication

WARNING

DISCONNECT EXCITER PRIMARY POWER 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 6-3 and operate AUTO-PWR-MAN switch S1 to the MAN position.

E. Apply primary power and operate the exciter.

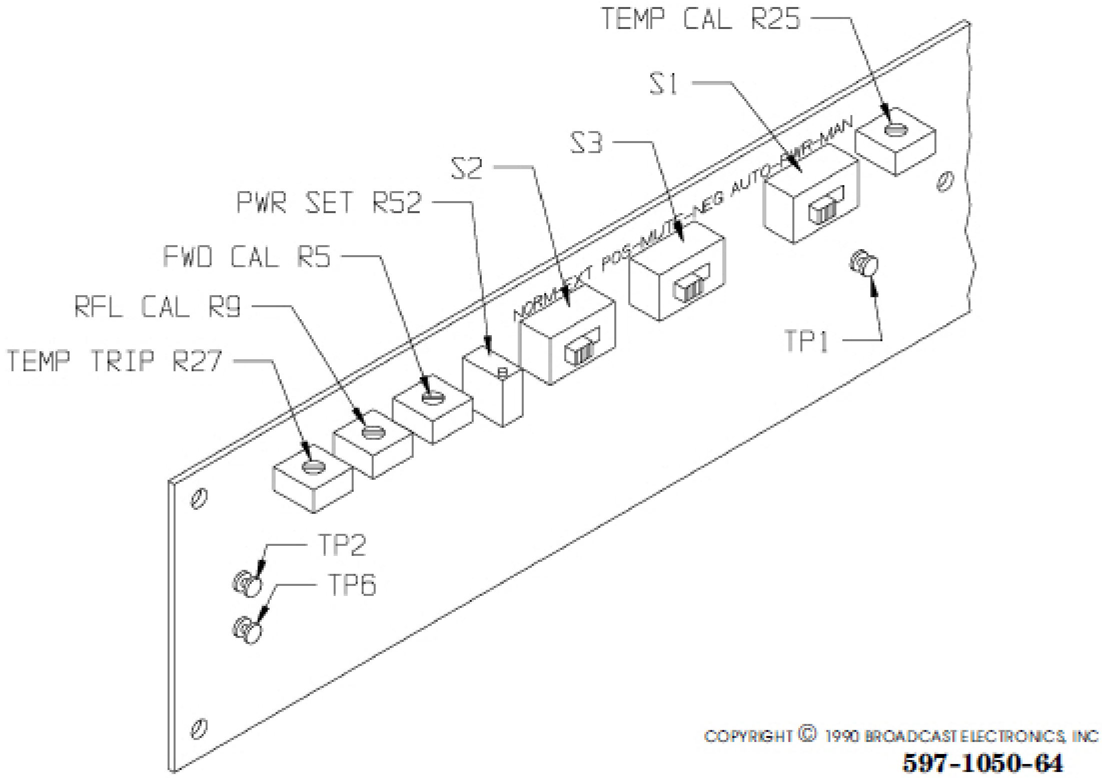

Figure 6-3. POWER SUPPLY/CONTROL CIRCUIT BOARD CONTROLS

WARNING

DONOT TOUCH ANY COMPONENT WITHIN THE EXCITER WITH POWER APPLIED.

WARNING

F. Refer to Figure 6-3 and adjust PWR SET control R52 for a 40 watt output power indication on the external meter.

G. Refer to Figure 6-3 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 6-4 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

DONOT TOUCH ANY COMPONENT WITHIN THE EXCITER WITH POWER APPLIED.

WARNING

J. Depress the RFL meter function switch. Refer to Figure 6-3 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. Connect the normal load to the exciter and depress the front-panel FWD meter function switch.

WARNING

DONOT TOUCH ANY COMPONENT WITHIN THE EXCITER WITH POWER APPLIED.

WARNING

M. Refer to Figure 6-3, adjust PWR SET control R52 until the meter indicates the value recorded in step A.

N. Disconnect the exciter primary power.

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

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.

Procedure. To adjust TEMP CAL control R25, proceed as follows:

WARNING

DISCONNECT EXCITER PRIMARY POWER 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 6-3 and connect a voltmeter between TP1 and TP6 (ground).

F. Apply primary power to the exciter.

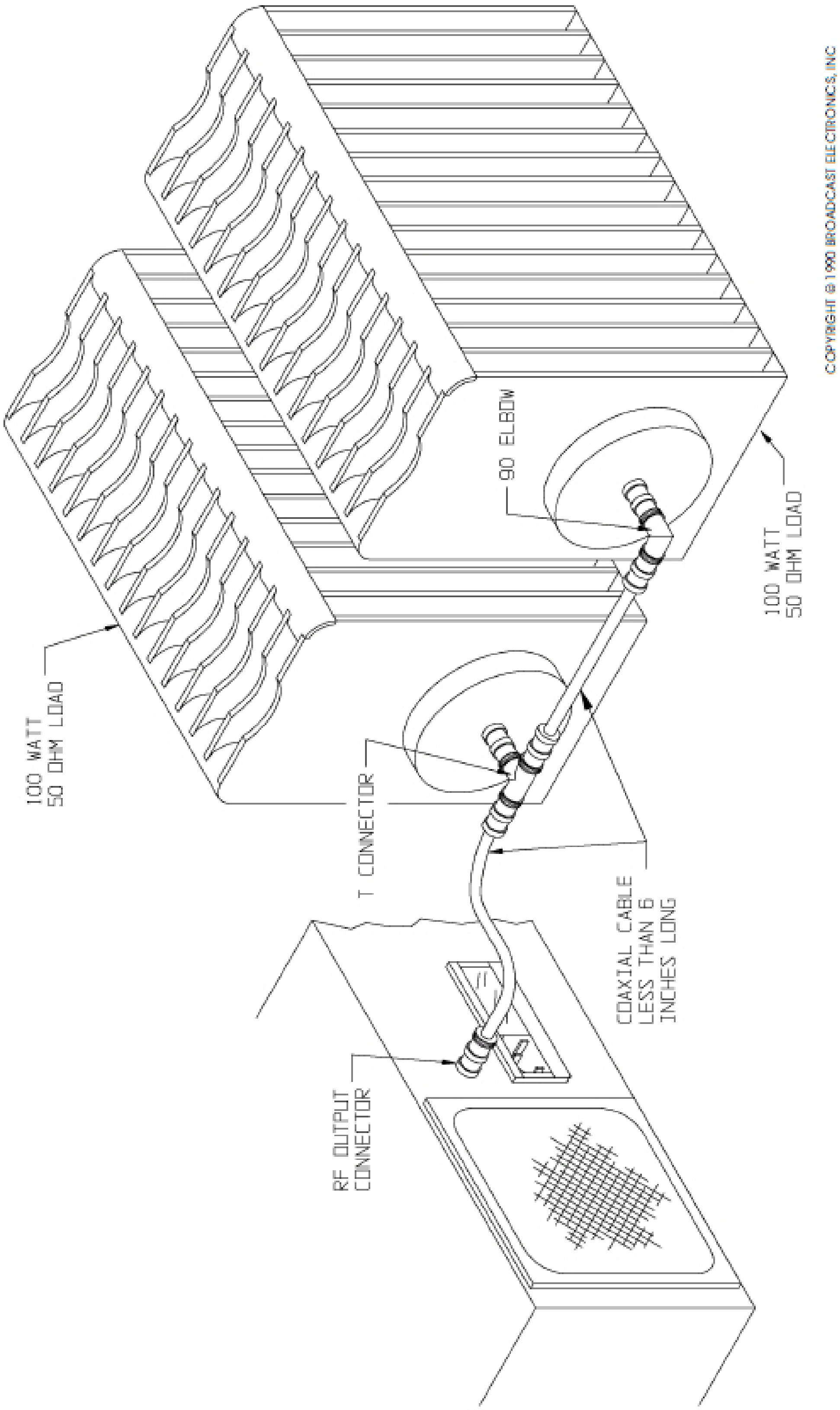

Figure 6-4. PARALLEL LOAD CONNECTION

WARNING

DONOT TOUCH ANY COMPONENT WITHIN THE EXCITER WITH POWER APPLIED.

WARNING

G. Refer to Figure 6-3, 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 EXCITER PRIMARY POWER BEFORE PROCEEDING.

WARNING

H. Disconnect the primary power to the exciter.

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

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.

Procedure. To adjust control R27, proceed as follows:

WARNING

DISCONNECT EXCITER PRIMARY POWER BEFORE PROCEEDING.

WARNING

A. Disconnect the primary power to the exciter.

B. Remove the top-cover. Refer to Figure 6-3 and connect a voltmeter between TP2 and TP6 (ground).

C. Apply primary power and operate the exciter.

WARNING

DONOT TOUCH ANY COMPONENT WITHIN THE EXCITER WITH POWER APPLIED.

WARNING

D. Refer to Figure 6-3 and adjust R27 until the voltmeter indicates +3.65V dc.

WARNING

DISCONNECT EXCITER PRIMARY POWER BEFORE PROCEEDING.

WARNING

E. Disconnect the primary power to the exciter.

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

6.5.2 TROUBLESHOOTING THE POWER SUPPLY/CONTROL BOARD CIRCUITRY.

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 6-5 which presents troubleshooting information.

WARNING

DISCONNECT PRIMARY POWER FROM THE EXCITER BEFORE REMOVING ANY COMPONENTS.

WARNING

CAUTION

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

CAUTION

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. for repair or replacement.

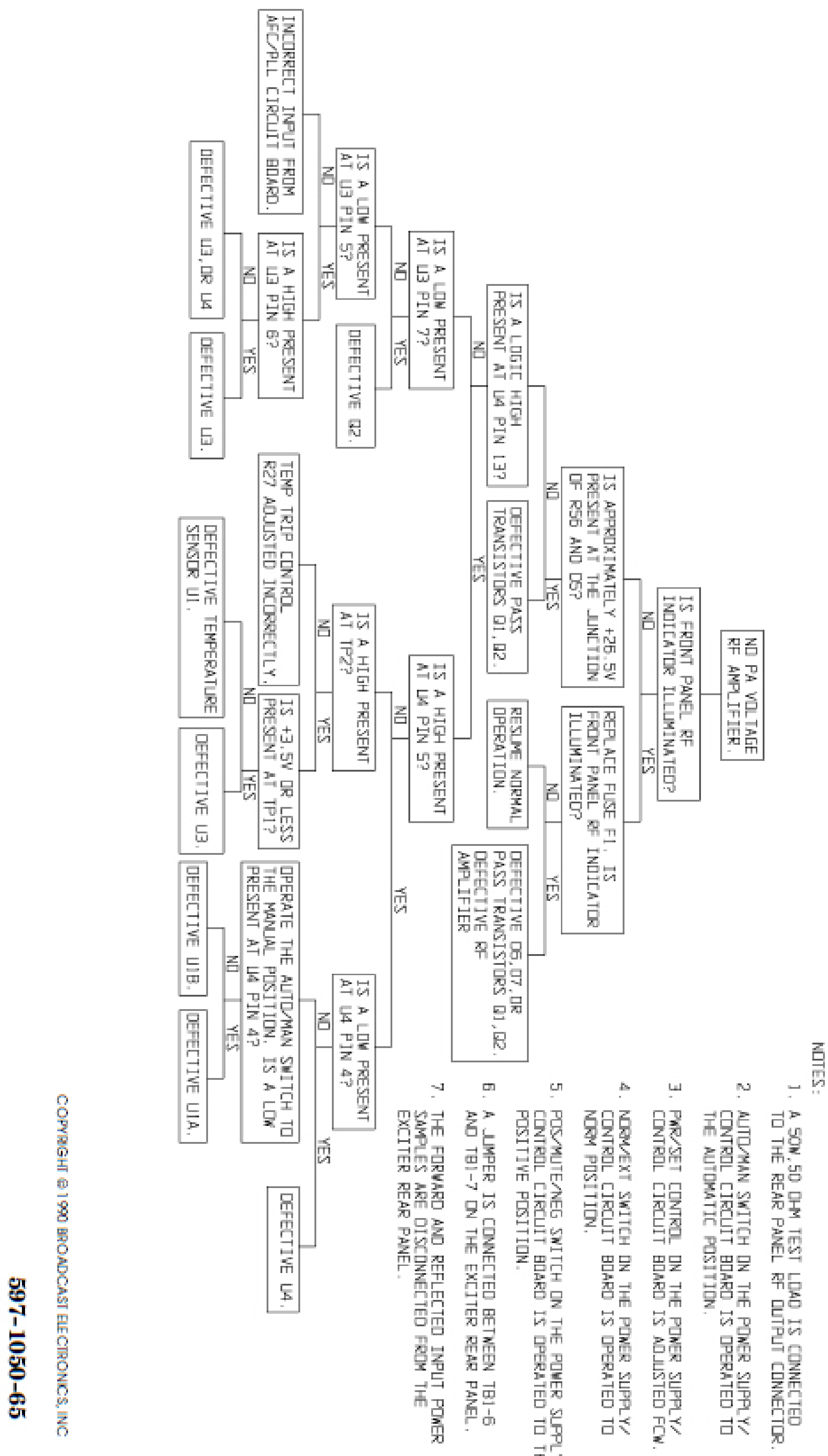

Figure 6-5. NO PA VOLTAGE TO THE RF AMPLIFIER

7 EXCITER METERING CIRCUIT BOARD

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

7.1 DESCRIPTION.

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%.

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.

7.2 INTERNAL VOLTMETER CHARACTERISTICS.

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

7.3 REMOVAL AND INSTALLATION

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

7.3.1 REMOVAL PROCEDURE.

REQUIRED EQUIPMENT. The following equipment is required to remove the metering circuit board assembly.

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

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

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

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 7-1 and proceed as follows:

WARNING

DISCONNECT EXCITER PRIMARY POWER 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.

7.3.2 INSTALLATION PROCEDURE.

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

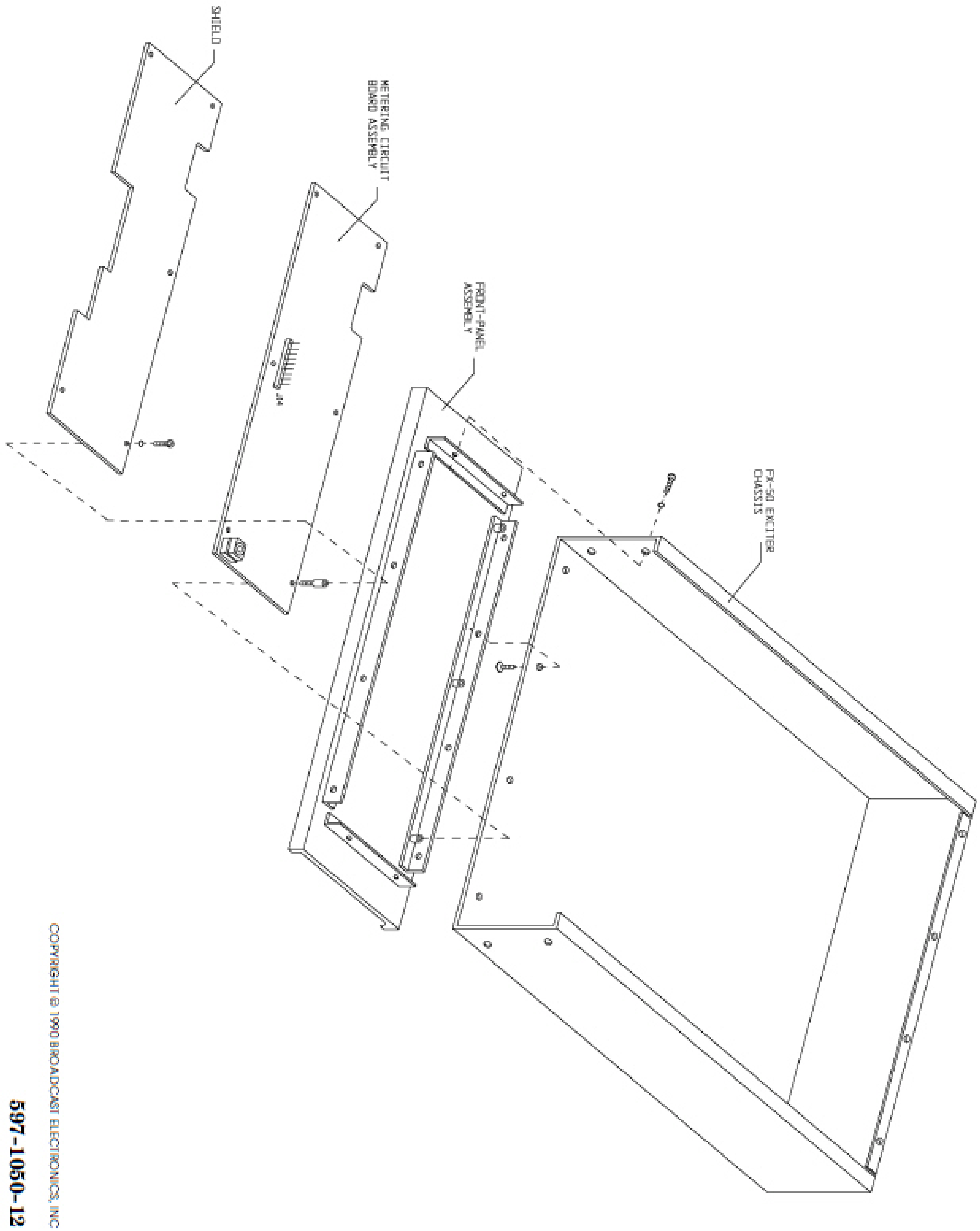

Figure 7-1. METERING CIRCUIT REMOVAL AND INSTALLATION DIAGRAM

WARNING

DISCONNECT EXCITER PRIMARY POWER BEFORE PROCEEDING.

WARNING

A. Disconnect the primary power from the exciter.

B. Follow the REMOVAL PROCEDURE in reverse order.

7.4 THEORY OF OPERATION

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

7.4.1 FUNCTIONAL DESCRIPTION.

The metering circuit board contains four circuits. A simplified schematic diagram of the metering circuit board is presented in Figure 7-2. Refer to Figure 7-2 as required for a description of the following circuits.

A. Status Indicator Circuits

B. Multimeter Circuit

C. Modulation Display Circuit

D. Voltage Regulator Circuits

7.4.2 STATUS INDICATOR CIRCUITS.

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.

7.4.3 MULTIMETER CIRCUIT.

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.

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.

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 de coder/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).

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.

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.

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.

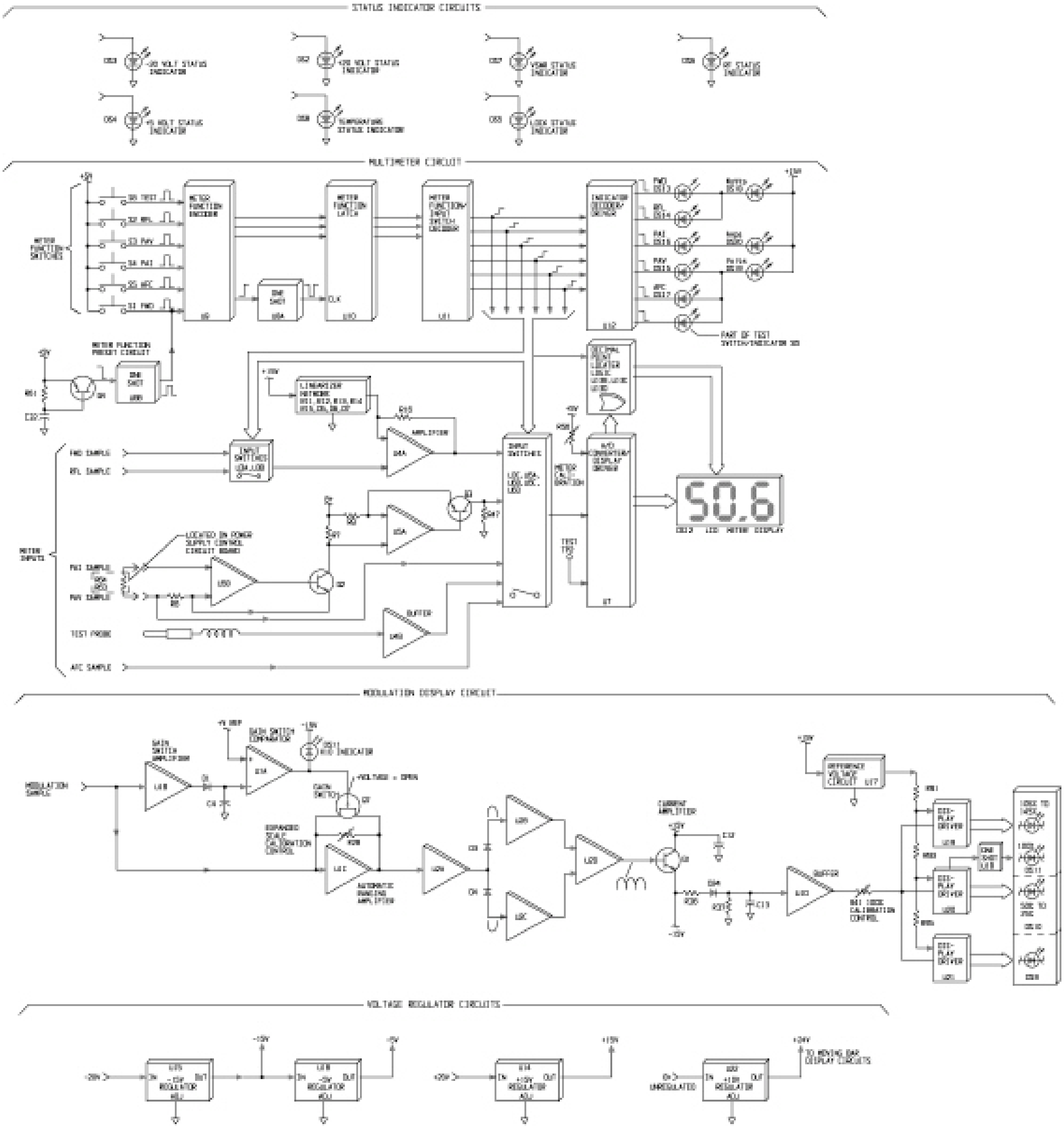

Figure 7-2. METTERING BOARD SIMPLIFIED SCHEMATIC

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.

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

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.

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).

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.

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.

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.

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.

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.

7.4.4 MODULATION DISPLAY CIRCUIT.

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.

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 interated circuit U2, diodes D3 and D4, and transistor Q1 and associated components.

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.

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.

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.

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.

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.

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.

7.4.5 VOLTAGE REGULATOR CIRCUITS.

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.

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.

7.5 MAINTENANCE

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

7.5.1 ELECTRICAL ADJUSTMENTS.

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.

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 7-3 as required and proceed as follows.

Procedure. To adjust meter calibration control R56, proceed as follows:

WARNING

DISCONNECT EXCITER PRIMARY POWER 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

DONOT 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 EXCITER PRIMARY POWER 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.

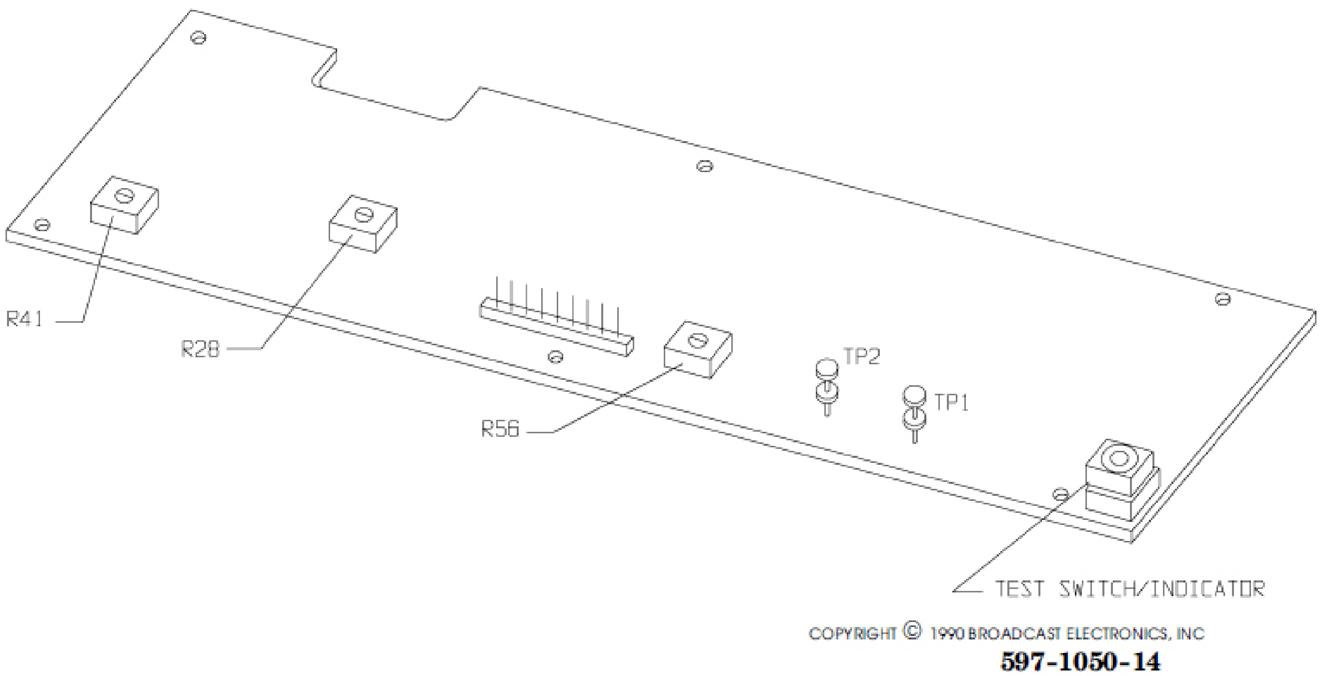

Figure 7-3. METERING CIRCUIT BOARD CONTROLS AND TEST POINTS

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.

Procedure. To adjust R41 and R28, refer to Figure 7-3 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

DONOT 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

DONOT 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.

7.5.2 TROUBLESHOOTING.

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 7-1 which presents troubleshooting information for the metering circuit board.

WARNING

DISCONNECT PRIMARY POWER FROM THE EXCITER BEFORE REMOVING ANY COMPONENTS.

WARNING

CAUTION

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

CAUTION

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 for repair or replacement.

Table 7-1. METERING CIRCUIT BOARD TROUBLESHOOTING

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.
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 UNTI 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.

8 MODULATED OSCILLATOR

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

8.1 DESCRIPTION.

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.

8.2 ELECTRICAL CHARACTERISTICS.

Refer to Table 8-1 for electrical characteristics relative to the modulated oscillator assembly.

Table 8-1. MODULATED OSCILLATOR ELECTRICAL CHARACTERISTICS

PARAMETER	SPECIFICATION
SIGNAL INPUTS	
MODULATION AND AFC VOLTAGE	35 m V 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.

8.3 REMOVAL AND INSTALLATION

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

8.3.1 REMOVAL AND INSTALLATION PROCEDURES.

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

PROCEDURE. To remove the modulated oscillator assembly, proceed as follows:

WARNING

DISCONNECT EXCITER PRIMARY POWER 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.

8.3.2 INSTALLATION PROCEDURE.

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

WARNING

DISCONNECT EXCITER PRIMARY POWER BEFORE PROCEEDING.

WARNING

A. Disconnect the primary power to the exciter.

B. Follow the REMOVAL PROCEDURE in reverse order.

8.4 THEORY OF OPERATION

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

8.5 FUNCTIONAL DESCRIPTION.

MECHANICAL ASSEMBLY.

The modulated oscillator circuit board is enclosed in a cast aluminum housing which is se cured 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.

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.

ELECTRICAL DESCRIPTION.

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

A. Modulator/Oscillator

B. Buffers and Output Amplifier

C. Power Supply

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.

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.

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

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.

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.

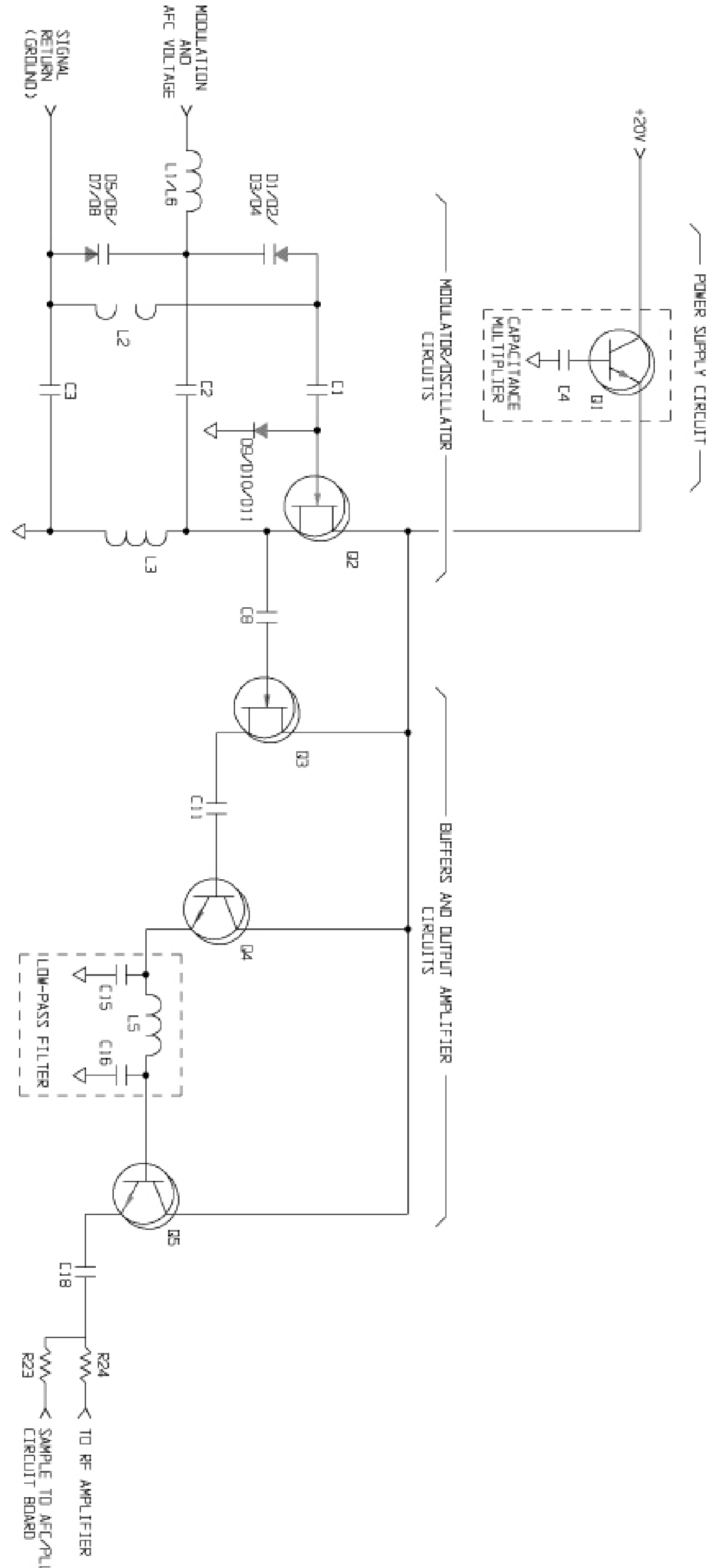

Figure 8-1. MODULATED OSCILLATOR SIMPLIFIED SCHEMATIC DIAGRAM

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.

8.6 MAINTENANCE

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

8.6.1 MAINTENANCE.

ELECTRICAL ADJUSTMENTS.

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

8.7 TROUBLESHOOTING.

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.

9 AFC/PLL

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

9.1 DESCRIPTION.

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.

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.

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.

9.2 ELECTRICAL CHARACTERISTICS.

Refer to Table 9-1 for electrical characteristics relative to the AFC/PLL circuit board.

Table 9-1. AFC/PLL 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.

9.3 REMOVAL AND INSTALLATION

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

9.3.1 REMOVAL PROCEDURE.

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

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 EXCITER PRIMARY POWER 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.

9.3.2 INSTALLATION PROCEDURE.

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

WARNING

DISCONNECT EXCITER PRIMARY POWER BEFORE PROCEEDING.

WARNING

A. Disconnect the primary power to the exciter.

B. Follow the REMOVAL PROCEDURE in reverse order.

9.4 THEORY OF OPERATION

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

9.5 FUNCTIONAL DESCRIPTION.

The AFC/PLL circuit board contains nine circuits. Figure 9-1 presents a simplified schematic of the AFC/PLL circuit board. Refer to Figure 9-1 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

9.5.1 REFERENCE DIVIDER CIRCUIT.

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.

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.

9.5.2 REFERENCE OSCILLATOR ACTIVITY MONITOR.

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.

9.5.3 RF SAMPLE DIVIDER CIRCUIT.

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.

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.

9.5.4 COMPARATOR CIRCUIT.

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.

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.

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.

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.

9.5.5 LOOP FILTER CONTROL CIRCUIT.

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.

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 auto matic frequency control (AFC) voltage to the modulated oscillator through resistor R31.

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.

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) en able the AFC relay.

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.

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.

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 lowpass 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.

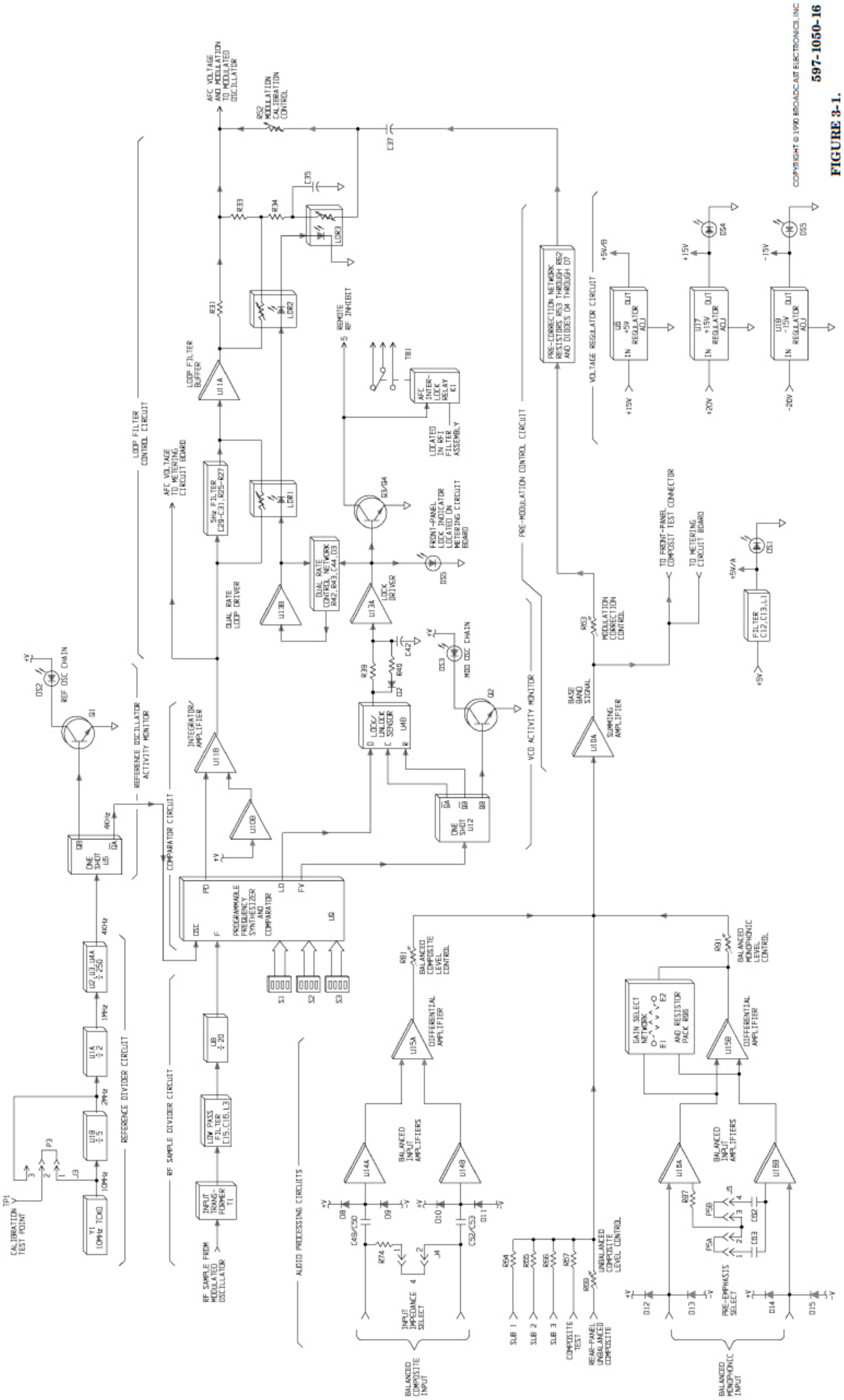

Figure 9-1. AFC/PLL CIRCUIT BOARD SIMPLIFIED SCHEMATIC

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.

9.5.6 VCO ACTIVITY MONITOR.

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.

9.5.7 AUDIO PROCESSING CIRCUITS.

BALANCED INPUTS. A balanced composite audio input circuit and a balanced mono phonic 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 in put through rear-panel barrier strip TB1.

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.

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.

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.

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.

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.

9.5.8 PREMODULATION CONTROL CIRCUIT.

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.

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.

9.5.9 VOLTAGE REGULATOR CIRCUITS.

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.

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.

9.6 MAINTENANCE

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

9.7 ELECTRICAL ADJUSTMENTS.

Figure 9-2 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.

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.

9.7.1 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.

Procedure. To adjust BAL MONO control R91, refer to Figure 9-2 as required and proceed as follows:

WARNING

DISCONNECT EXCITER PRIMARY POWER 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.

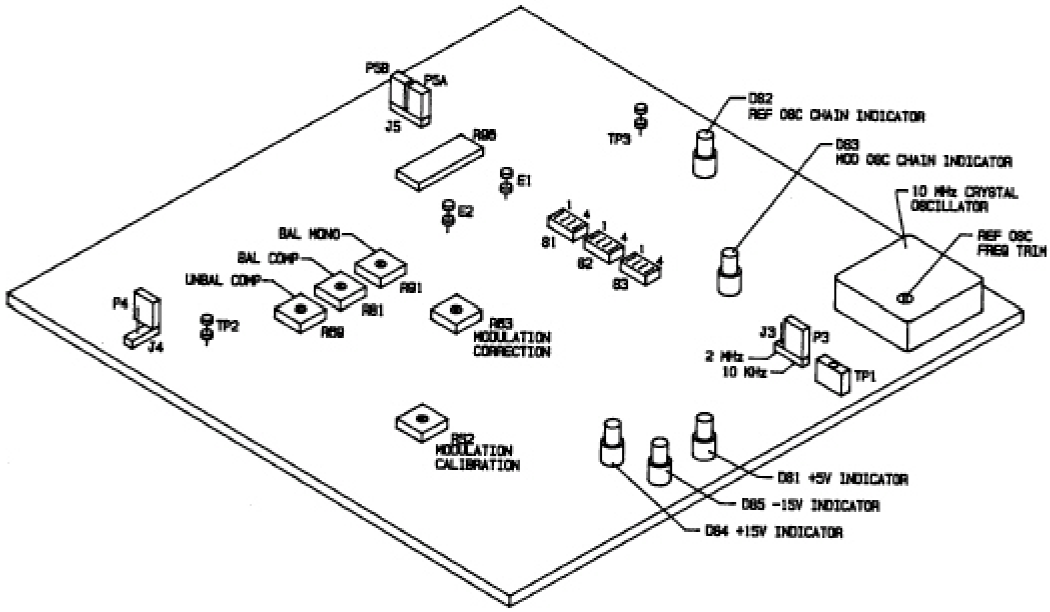

Figure 9-2. AFC/PLL CIRCUIT BOARD CONTROLS AND INDICATORS

WARNING

DISCONNECT EXCITER PRIMARY POWER BEFORE PROCEEDING.

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.

9.7.2 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.

Procedure. To adjust BAL COMP control R81, refer to Figure 9-2 as required and proceed as follows:

WARNING

DISCONNECT EXCITER PRIMARY POWER 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

DONOT 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.

9.7.3 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.

Procedure. To adjust UNBAL COMP control R69, refer to Figure 9-2 as required and proceed as follows:

WARNING

DISCONNECT EXCITER PRIMARY POWER 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

DONOT 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.

9.7.4 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.

Procedure. To adjust MODULATION CORRECTION control R63, refer to Figure 9-2 as required and proceed as follows:

WARNING

DISCONNECT EXCITER PRIMARY POWER 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

DONOT 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.

9.7.5 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.

Procedure. To adjust MODULATION CALIBRATION control R52, refer to Figure 9-2 as required and proceed as follows:

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

WARNING

DISCONNECT EXCITER PRIMARY POWER 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

DONOT 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.

9.7.6 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.

Procedure. To adjust the REF OSC FREQ TRIM control, refer to Figure 9-2 as required and proceed as follows:

WARNING

DISCONNECT EXCITER PRIMARY POWER 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

DONOT 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.

9.7.7 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 9-3). The position of each switch corresponds to a weighted binary number (refer to Table 9-2).

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.

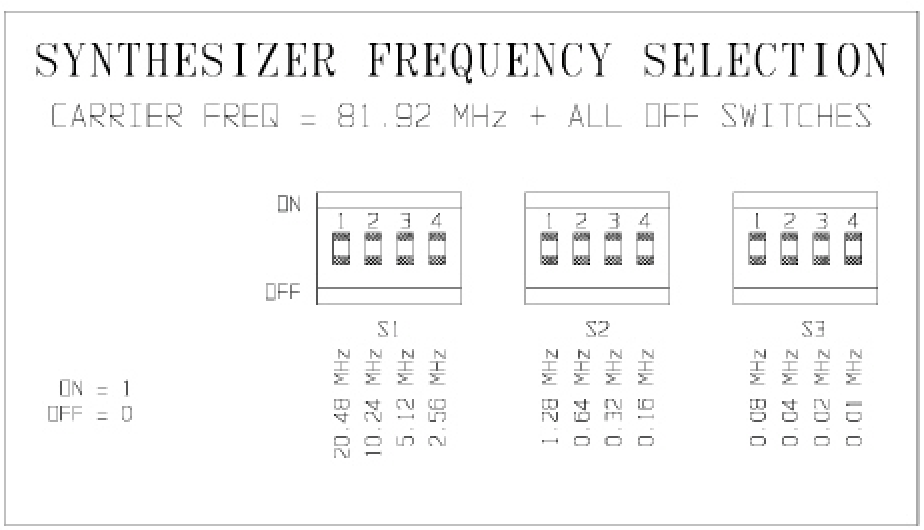

Figure 9-3. FREQUENCY SELECTION

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 9-2. FREQUENCY SYNTHESIZER PROGRAMMING

Procedure. To change the exciter carrier frequency, proceed as follows.

WARNING

DISCONNECT EXCITER PRIMARY POWER BEFORE PROCEEDING.

WARNING

A. Disconnect the exciter primary power.

B. Remove the exciter top-cover. Refer to Table 9-2 and select the desired frequency and corresponding binary code.

C. Refer to Figure 9-3 and program four-segment switches S1, S2, and S3 for the desired frequency.

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

9.7.8 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.

9.7.9 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.

Procedure. To select an alternate pre-emphasis, refer to Figure 9-2 as required and proceed as follows:

WARNING

DISCONNECT EXCITER PRIMARY POWER 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.

9.8 TROUBLESHOOTING.

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 Figure 9-5 and Figure 9-6 which present troubleshooting information.

WARNING

DISCONNECT PRIMARY POWER FROM THE EXCITER BEFORE REMOVING ANY COMPONENTS.

WARNING

CAUTION

CAUTION

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

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 for repair or replacement.

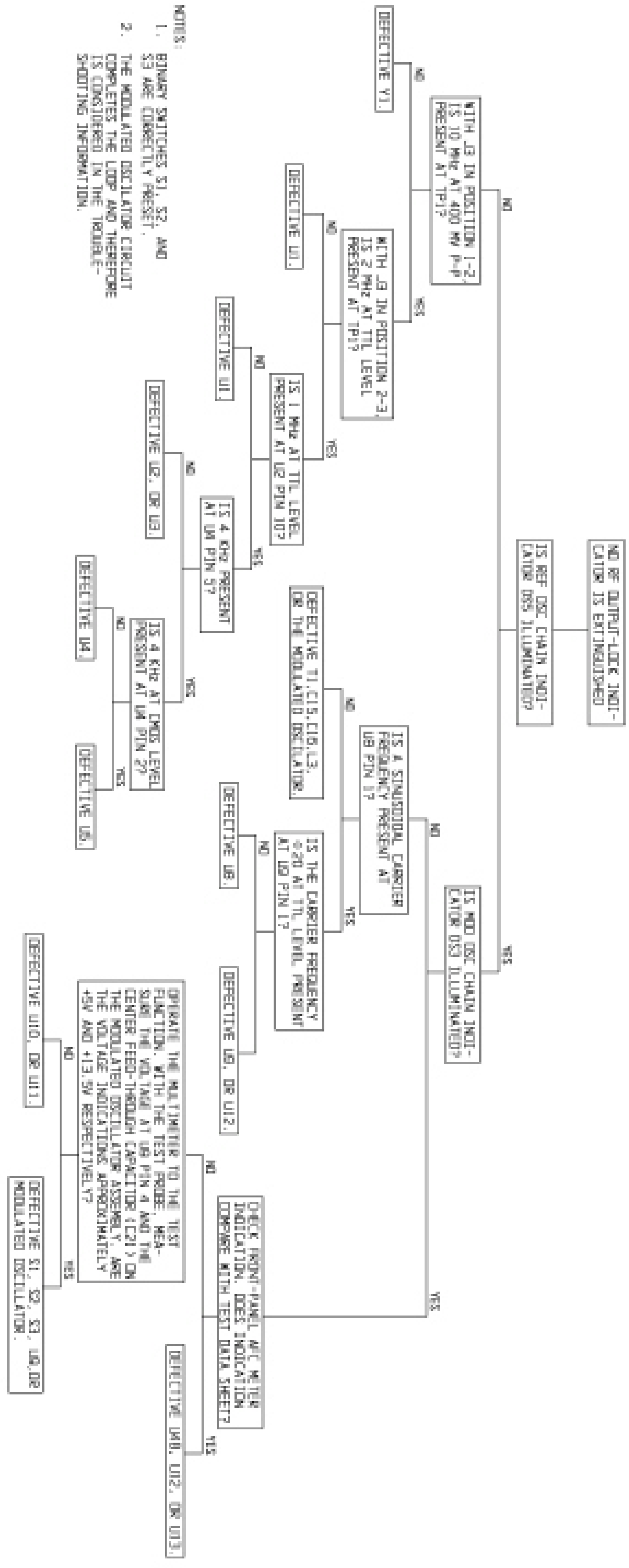

Figure 9-4. NO RF OUTPUT-LOCK IS EXTINGUISHED.

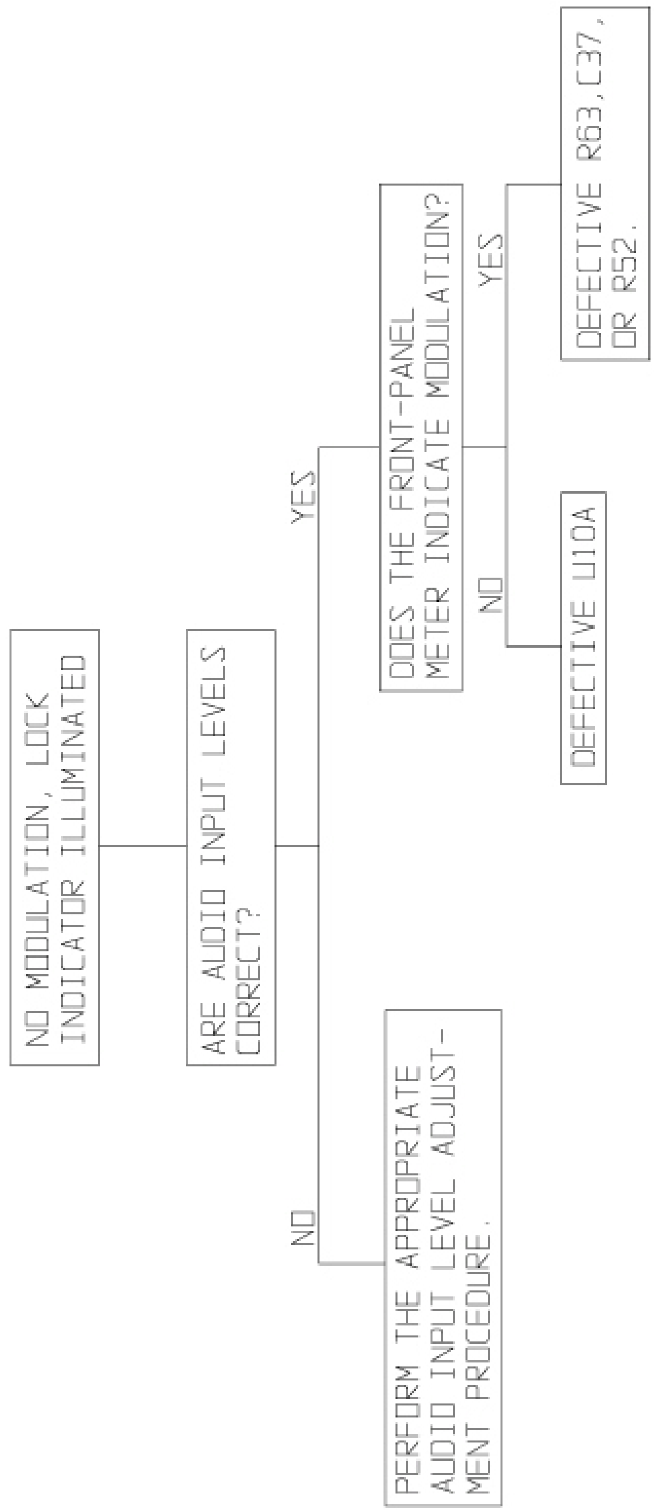

Figure 9-5. NO MODULATION, LOCK INDICATOR ILLUMINATED.

10 RF AMPLIFIER

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

10.1 DESCRIPTION.

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.

10.2 ELECTRICAL SPECIFICATIONS.

Refer to Table 10-1 for electrical specifications of the RF amplifier assembly.

Table 10-1. RF AMPLIFIER ELECTRICAL SPECIFICATIONS

PARAMETER	SPECIFICATIONS
SIGNAL LEVELS:	
RF AMPLIFIER	
INPUT	0.0 dBm at 50 Ohms.
OUTPUT	3 to 50 Watts RF at 50 Ohms.
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.

10.3 REMOVAL AND INSTALLATION

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

10.3.1 REMOVAL PROCEDURE.

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

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 EXCITER PRIMARY POWER 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.

10.3.2 INSTALLATION PROCEDURE.

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

WARNING

DISCONNECT EXCITER PRIMARY POWER BEFORE PROCEEDING.

WARNING

A. Disconnect the primary power from the exciter.

B. Follow the REMOVAL PROCEDURE in reverse order.

10.4 THEORY OF OPERATION

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

10.4.1 RF AMPLIFIER ASSEMBLY DESCRIPTION.

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.

10.4.2 RF AMPLIFIER CIRCUIT BOARD DESCRIPTION.

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.

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.

10.4.3 FUNCTIONAL DESCRIPTION.

A simplified schematic diagram of the RF amplifier circuit board is presented in Figure 10-1. Refer to Figure 10-1 as required for a description of the following circuits.

A. RF amplifier circuit.

B. Directional coupler circuits.

C. Input mute circuit.

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.

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.

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.

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.

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.

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.

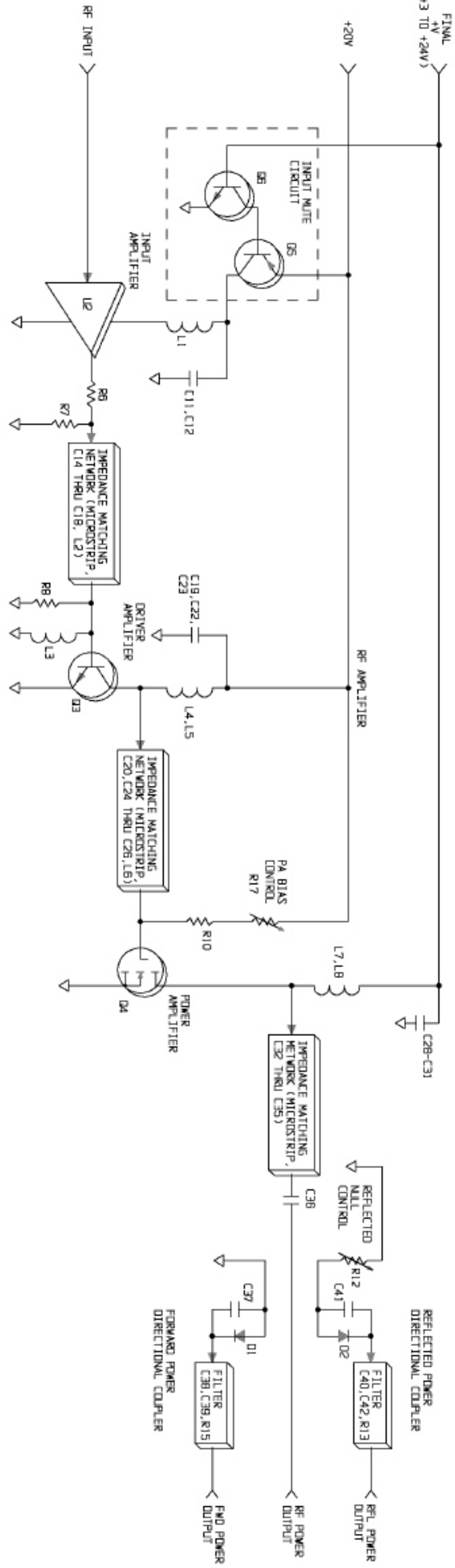

Figure 10-1. RF AMPLIFIER SIMPLIFIED SCHEMATIC.

The drain of Q4 connects to an impedance matching network which operates as: 1) a broad band 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.

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.

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.

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.

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.

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.

10.5 MAINTENANCE

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

10.5.1 ELECTRICAL ADJUSTMENTS.

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)

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).

10.5.2 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.

Procedure. To adjust reflected power null control R12, proceed as follows:

WARNING

DISCONNECT EXCITER PRIMARY POWER 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 10-2).

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 CONSDIERED HAZARDOUS AND THEREFORE CUATION 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 10-2 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.

10.5.3 PA BIAS (R17).

PA BIAS control R17 on the RF amplifier circuit board adjusts the PA quiescent current. Potentiometer R17 is adjusted as follows.

Procedure. To adjust PA bias control R17, proceed as follows:

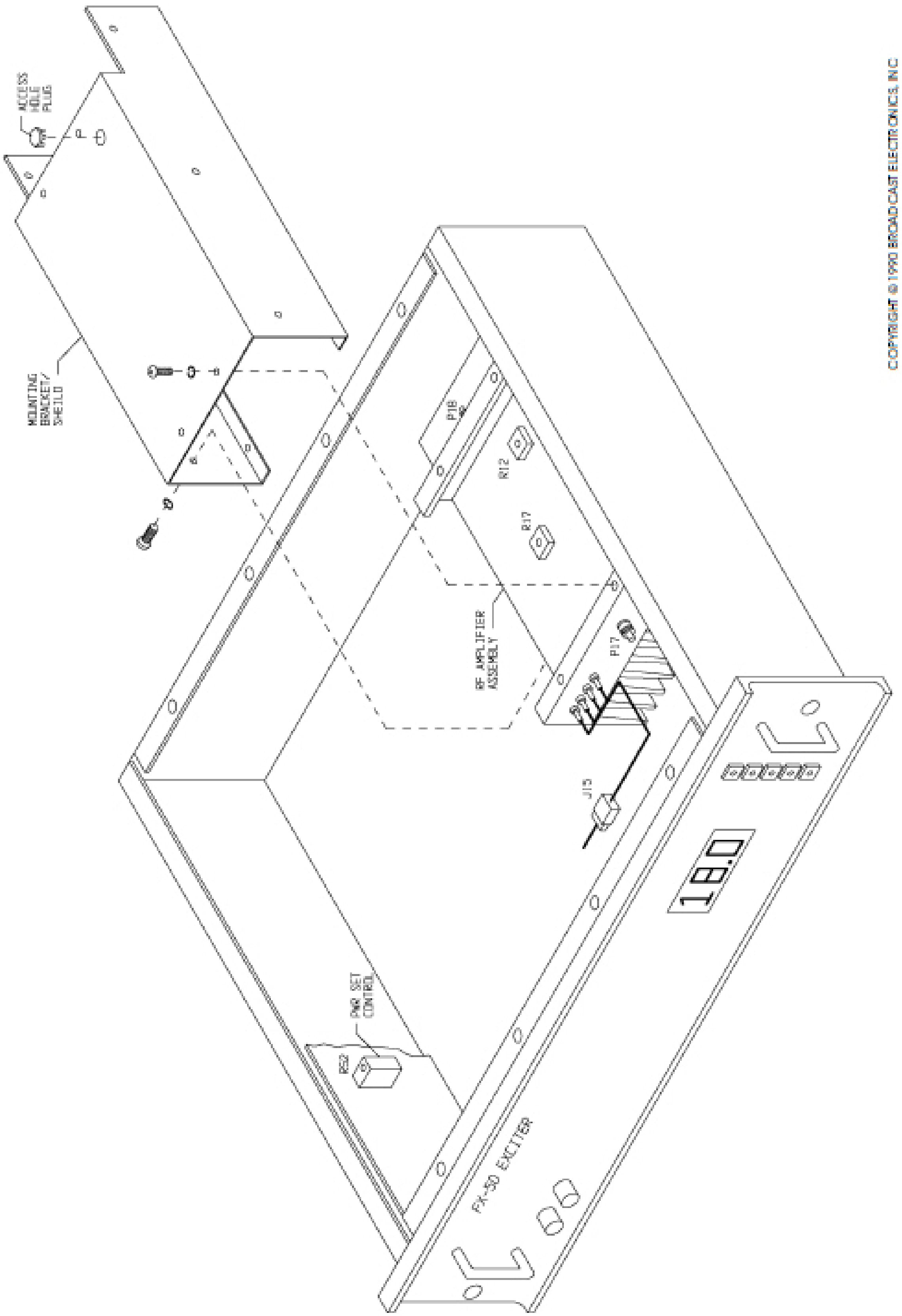

Figure 10-2. RF AMPLIFIER CIRCUIT BOARD CONTROLS.

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 10-2 and remove the 10 screws securing the RF amplifier assembly to the mounting bracket/shield.

D. Refer to Figure 10-2 and position the RF amplifier assembly in the chassis as shown.

E. Refer to Figure 10-2 and connect J15 to P15 of the RF amplifier assembly power/ control cable.

F. Refer to Figure 10-2 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

WARNING

MAINTENANCE WITH POWER APPLIED IS ALWAYS CONSDIERED HAZARDOUS AND THEREFORE CUATION 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 10-2 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 10-2 and adjust R17 for 300 milliamps (0.30) as indicated on the front-panel meter.

M. Refer to Figure 10-2 and connect P17 to the RF amplifier.

N. Refer to Figure 10-2, adjust PWR SET control R52 until the meter indicates the value recorded in step H.

WARNING

DISCONNECT THE 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.

10.6 TROUBLESHOOTING.

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 10-3 which presents troubleshooting information for the RF amplifier assembly.

WARNING

DISCONNECT PRIMARY POWER FROM THE EXCITER BEFORE REMOVING ANY COMPONENTS.

WARNING

CAUTION

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

CAUTION

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 for repair or replacement.

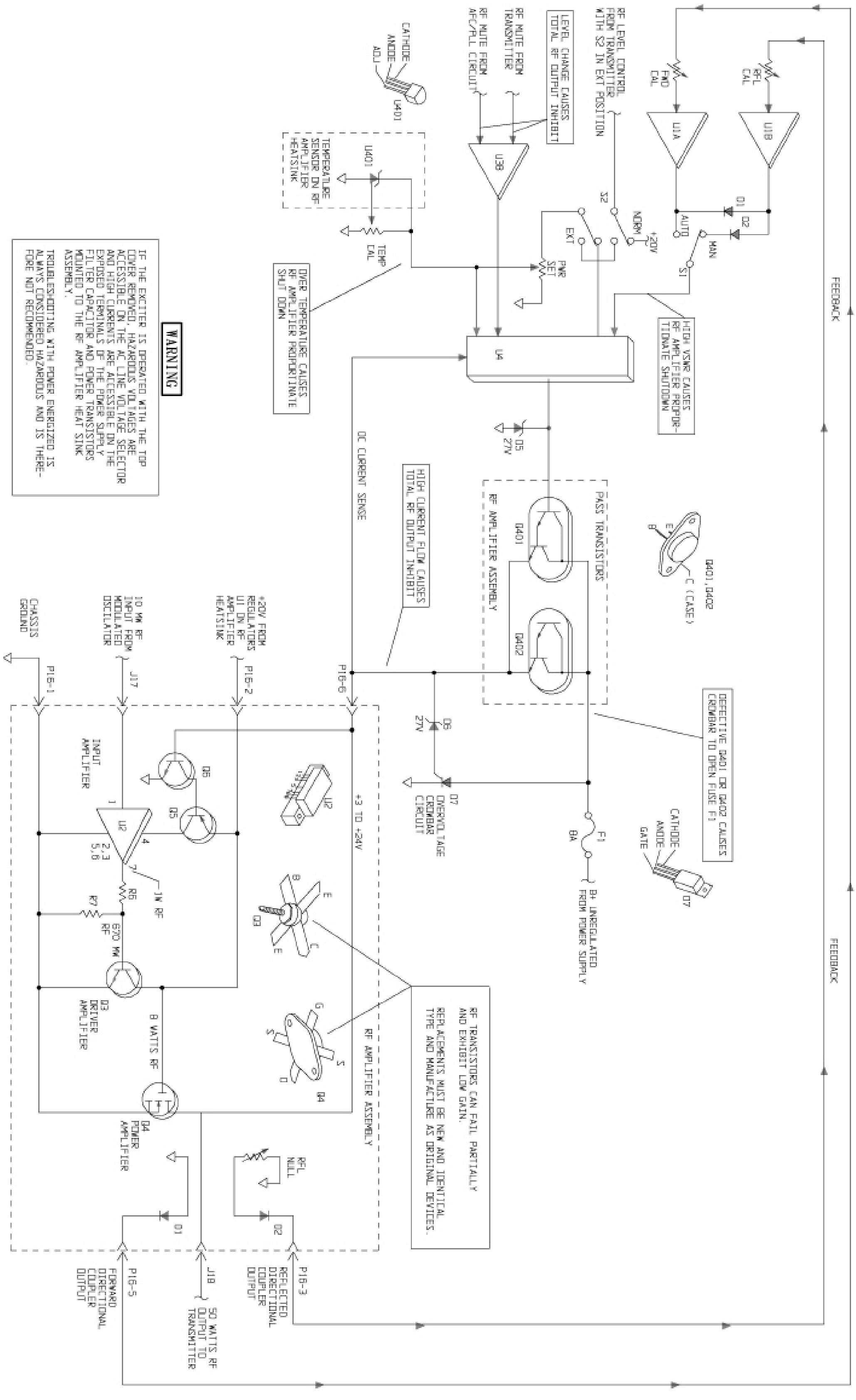

Figure 10-3. RF AMPLIFIER TROUBLESHOOTING INFORMATION.

11 SYNCHRONOUS FM BOOSTER

This section provides general information and specifications relative to operation of the optional synchronous FM booster system.

11.1 SYSTEM DESCRIPTION.

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).

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.

11.2 SYSTEM CONFIGURATIONS.

The optional synchronous FM booster circuit boards may be ordered in the following con figurations:

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.

11.3 ELECTRICAL SPECIFICATIONS.

Refer to Table 11-1 for synchronous FM booster system electrical specifications.

Table 11-1. FM BOOSTER ELECTRICAL SPECIFICATIONS

PARAMETER	SPECIFICATION
POWER REQUIREMENTS	-20V and +5V supplied by the FX-50 Power Supply/Control Circuit Board.
REFERENCE FREQUENCIES	
STANDARD	125 kHz, $\pm$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 $\pm$300 HZ, 0° TO 50°C.
SLAVE	Carrier Frequency $\pm$300 Hz When Locked to Master. Carrier Frequency $\pm$1000 Hz When Unlocked from Master, 0° to 50°C.

11.4 INSTALLATION

This section contains information required for installation of the Broadcast Electronics synchronous FM booster system.

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

Disconnect the primary power to the exciter.

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

Remove the four screws securing the AFC/PLL assembly cover to the circuit board. Re move the cover and ground strap.

Secure two card guides to the AFC/PLL assembly cover using the hardware provided.

Install two ribbon cable press clips on the side of the AFC/PLL assembly cover.

Remove and discard intergrated circuit U1 from the AFC/PLL circuit board.

Align pin 1 of the ribbon cable connector with pin 1 of socket XU1 and insert into the socket.

Install the AFC/PLL assembly cover and ground strap with the hardware provided.

Install the booster circuit board into J1 on the AFC/PLL assembly.

Route the ribbon cable through the two press clips and connect to J10 on the booster circuit board.

Connect P1 to J1 on the booster circuit board.

Connect P8 to J8, and P2 to J2 on the AFC/PLL assembly.

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.

Connect P13 to J13 on the power supply/control circuit board.

Connect P12 to J12 on the booster circuit board. Replace the exciter top-cover.

11.5 INSTALLATION ADJUSTMENTS.

11.5.1 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

Disconnect the exciter primary power.

Remove the top-cover and connect a 600 Ohm load and oscilloscope to the FX-50 rear panel SUB-1 connector.

Apply primary power to the exciter.

WARNING

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

WARNING

Refer to Figure 11-3, and adjust R26 for the level required by the transmission equipment.

Remove the test equipment and replace the top-cover.

11.6 THEORY OF OPERATION

This section presents the theory of operation for the Broadcast Electronics optional synchronous FM booster system.

11.6.1 FUNCTIONAL DESCRIPTION.

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.

11.6.2 SLAVE CIRCUIT BOARD.

Figure 11-1 presents a simplified schematic of the slave synchronous FM booster circuit board. Refer to Figure 11-1 as required for the following functional description.

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.

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.

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.

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.

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 accept able limits.

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.

11.6.3 MASTER CIRCUIT BOARD.

Figure 11-2 presents a simplified schematic of the master synchronous FM booster circuit board. Refer to Figure 11-2 as required for the following functional description.

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. 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.

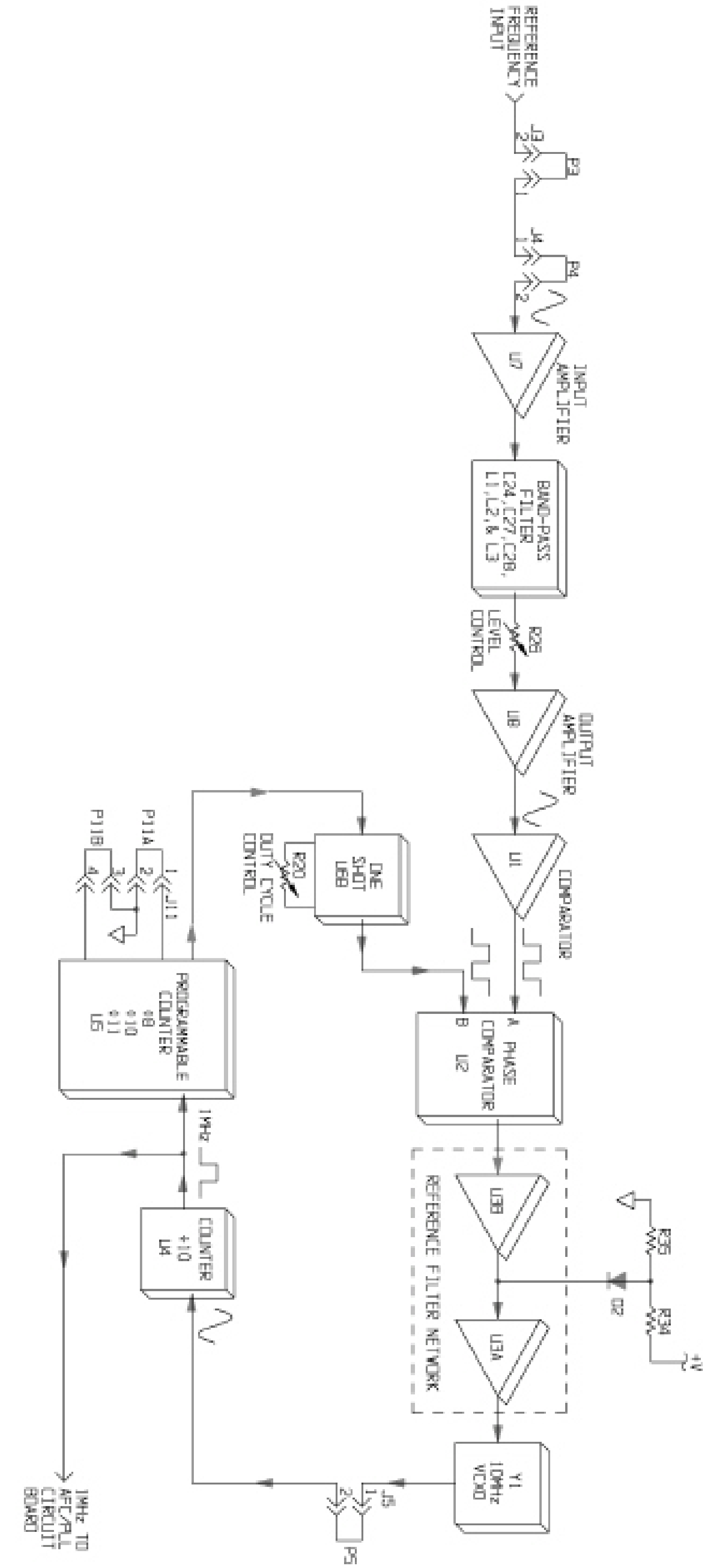

Figure 11-1. SLAVE FM BOOSTER SIMPLIIFED SCHEMATIC.

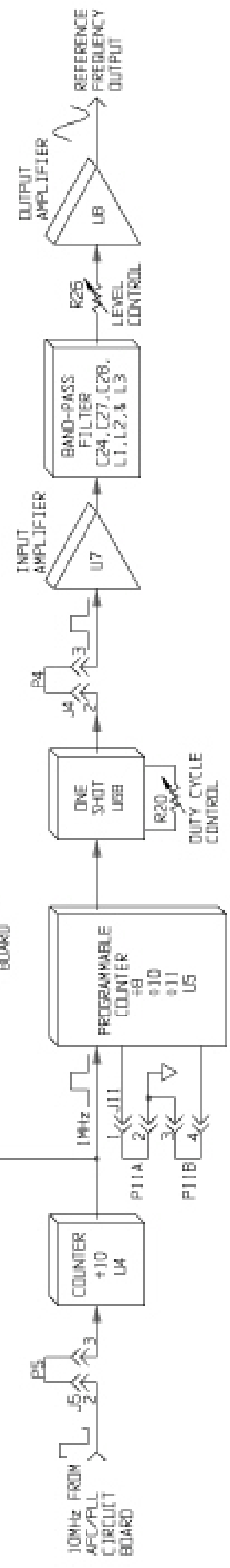

Figure 11-2. MASTER FM BOOSTER SIMPLIFIED SCHEMATIC.

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.

11.7 MAINTENANCE

This section provides maintenance information, electrical adjustment procedures, and troubleshooting information for the synchronous FM booster circuit boards.

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.

11.7.1 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.

Procedure. To adjust duty cycle control R20, 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. Refer to Figure 11-3 and connect an oscilloscope between TP2 and ground.

C. Apply primary power to the exciter.

WARNING

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

WARNING

D. Refer to Figure 11-3 and adjust R20 for a 50% duty cycle as indicated on the oscilloscope.

WARNING

DISCONNECT THE PRIMARY POWER TO THE EXCITER BEFORE PROCEEDING.

WARNING

E. Disconnect the exciter primary power.

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

11.7.2 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.

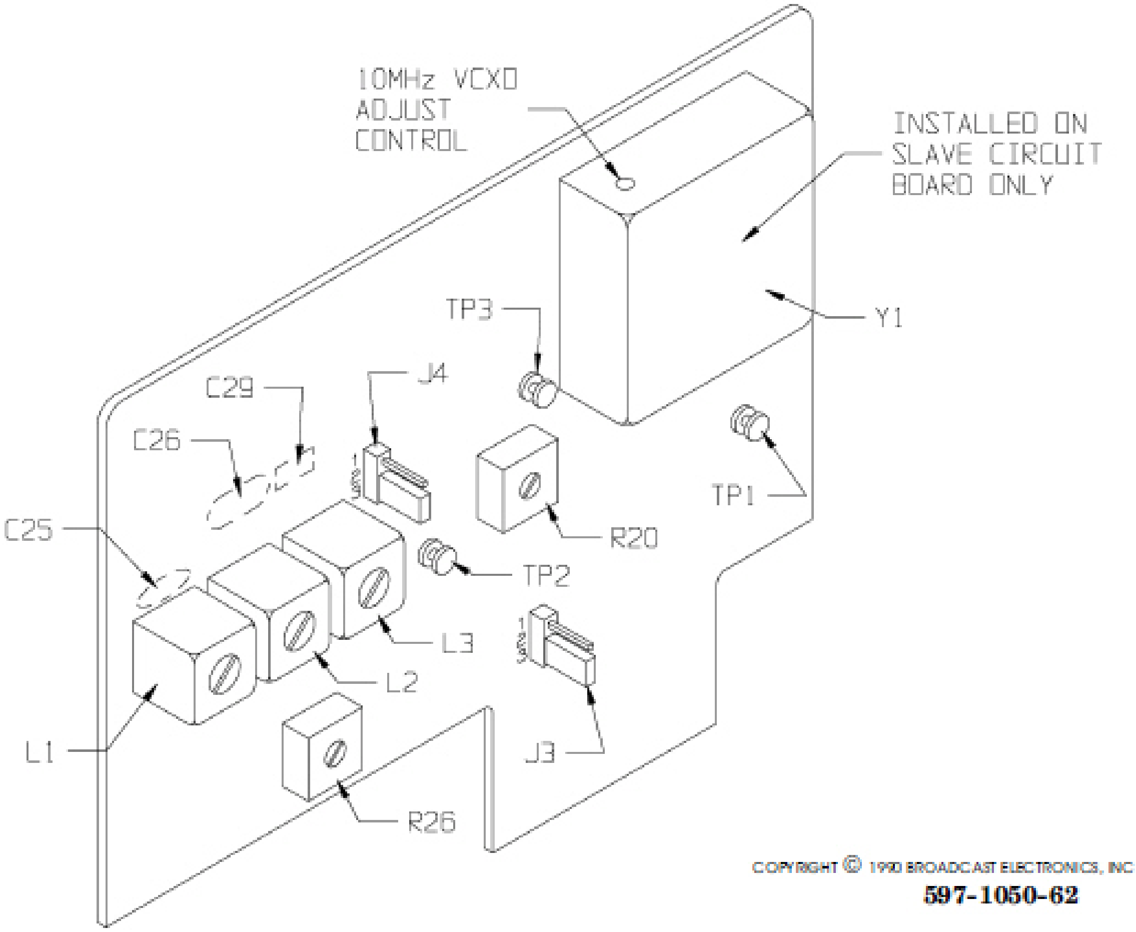

Figure 11-3. SLAVE/MASTER CIRCUIT BOARD CONTROLS

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 11-3 and operate programmable jumpers J3 and J4 to position 2-3.

C. Refer to Figure 11-3 and adjust output level control R26 to midrange position.

D. Refer to Figure 11-3 and connect an oscilloscope to exciter rear-panel SUB-1 receptacle.

E. Apply primary power to the exciter.

WARNING

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

WARNING

F. Refer to Figure 11-3 and adjust L1, L2, and L3 for a maximum indication on the oscilloscope. Repeat if necessary.

WARNING

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

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.

11.7.3 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.

Procedure. To adjust the VCXO, proceed as follows:

A. Perform the DUTY CYCLE ADJUSTMENT procedure.

WARNING

DISCONNECT THE PRIMARY POWER TO THE EXCITER BEFORE PROCEEDING.

WARNING

B. Disconnect the exciter primary power.

C. Remove the top-cover. Refer to Figure 11-3 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 COMPONENT WITHIN THE EXCITER WITH POWER APPLIED.

WARNING

F. Refer to Figure 11-3 and adjust the 10 MHz VCXO adjust control for 10 MHz +/-5 Hz as indicated on the frequency counter.

WARNING

DISCONNECT THE 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.

11.7.4 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 11-3 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

12 BE Part Numbers

This section provides parts lists for the FX-50/E Exciter. The parts lists provide descriptions and part numbers of electrical components, assemblies, and selected mechanical parts required for maintenance. Each parts list entry in this section is indexed by reference designators appearing on the applicable schematic diagrams.

This bill of material uses an indented structure to show relationships of parts into sub assemblies. Example; all BOM LEVEL 2 parts are contained in the BOM LEVEL 1 part immediately above it.

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
0	909-1050-529	FX-50E,EXCITER,220V,CE,NICKEL GRAY		
..1	027-2200	CAP,LYTIC,22000UF,50V (NOTE)	1	
..1	140-0008	VARISTOR,V250LA20A GE	2	
..1	230-3502	RECT,ASSY,35A 200V	1	
..1	330-1200	FUSE, 12A, 250V, CERAMIC, SLO-BLOW	1	
..1	334-0100	FUSE,1A MDL SLO BLO 250V	2	
..1	334-0150	FUSE,3AG,1.5 AMP,SLO-BLO	1	
..1	360-0003	FERRITE BEAD,.291 DIA	2	
..1	360-6504	FUSE,LINE FILTER MOD,120/240V	1	
..1	376-0050	XFMR,POWER, FX50 AM13377B	1	
..1	380-4600	FAN,4 1/2	1	
..1	380-5502	FILTER,FAN	1	
..1	380-6307	FINGER GUARD,FAN,4.125 CENTERS	1	
..1	400-0024	SHOCK MT,MODULATED OSC FX50	1	
..1	402-0000	TY-RAP	7	
..1	402-0008	MTG DEVICE,FOR #6SCR,TIE CBL	2	
..1	407-0023	SHIELD,CAP FX30	1	
..1	410-0057	LUG,TERM,#10 RING CRIMP14-16GA	1	
..1	410-1421	LUG,QUICK DISCONNECT #18-22	2	
..1	415-1010	FUSE CLIP,LITTLEFUSE,101002	2	
..1	415-1011	FUSE CLIP,LITTLEFUSE,105002	1	
..1	415-2012	FUSEHOLDER,PANEL MOUNT, 10A	2	XF2, XF3

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
..1	415-2012-020	FUSEHOLDER,PANEL MOUNT, 20A	1	XF1
..1	417-0016	CONN,BNC,RF,UG1094A/U,AMPHENOL	2	
..1	417-0017	RECP,BNC,BULKHEAD,UG-492A/U	1	
..1	417-0053	SKT,CONN 641294-1 AMP	11	
..1	418-0240	PLUG,FEM,4PIN	1	
..1	418-0670	HOUSING,CONN,6PIN FEM	1	
..1	420-0108	SCREW,10-32X.500,S.S. PHH	2	
..1	420-0817	ASSY,FEMALE SCREWLOCK 205817-1	1	
..1	420-4105	SCREW,4-40X.312,S.S. PH	2	
..1	420-4110	SCREW,4-40X.625,S.S. PH	8	
..1	420-6104	SCREW,6-32X.250,S.S. PH	8	
..1	420-6105	SCREW,6-32X.312,S.S. PH	14	
..1	420-6108	SCREW,6-32X.500,S.S. PH	2	
..1	420-6112	SCREW,6-32X.750,S.S. PH	2	
..1	420-6605	SCREW,6-32X.312,S.S. PH FH UC	11	
..1	420-8107	SCREW,8-32X.437,S.S. PHH	12	
..1	420-8116	SCREW,8-32X.250,S.S. PH FLH UC	6	
..1	421-1102	RIV,BLD,DOMED 3/32	2	
..1	421-1113	RIV,CLOSED-END .125 X .316L	1	
..1	421-4008	4-40 KEP NUT	12	
..1	421-6001	6-32 S.S. HEX THIN NUT	7	
..1	421-6008	6-32 KEP NUT	1	
..1	421-8001	8-32 S.S. HEX NUT	8	
..1	421-8028	NUT,JAM,1/2-28 UNEF-2B	4	
..1	422-6106	SCREW,SEMS 6-32 X 3/8 PAN PH. ST."	8	
..1	423-0001	WASHER,FLAT,#10 SST,.438 X .203 X .065	5	
..1	423-0003	#10 LOCK INT TOOTH	2	

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
..1	423-3004	5/16 LOCK INT TOOTH THIN	2	
..1	423-6002	#6 LOCK SPLIT	29	
..1	423-6003	#6 LOCK INT TOOTH	6	
..1	423-6011	#6 FLAT .310 X .160 X .030	4	
..1	423-8001	#8 FLAT .375 X .170 X .025	7	
..1	423-8002	#8 LOCK SPLIT	21	
..1	423-8004	#8 LOCK EXT TOOTH	1	
..1	423-9002	WASH,INT TOOTH,1/2	4	
..1	441-0012	STOFF,#6-32 MALE-FEMALE 1/4	6	
..1	441-0089	STOFF,ALUM 1/4 HEX X 1/2 6-32	4	
..1	441-8217	STOFF,ALUM 1/4HEX X 5/8 6-32	5	
..1	450-1700	PLUG,HOLE,1/2 NYL BLACK 2643	1	
..1	453-6701	CAP,MTG,BRKT,MALLORY,VR12	1	
..1	465-0090-101	ANGLE,UPPER FRT PNL,CE EXCITER	1	
..1	465-0091-100	ANGLE,LOWER FRT PNL,FX50	1	
..1	466-0093	ANGLE,FRONT PANEL MOUNT,FX50	2	
..1	467-0178	BOOT,INSULATING FOR 360-6504	1	
..1	467-1003	OVERLAY,FX50	1	
..1	469-0365	FINGER STOCK,1S197520A	32	
..1	469-0365-1	STRIP,RFI SHIELD	2	
....2	469-0365	FINGER STOCK,1S197520A	2.75	
..1	469-0366-1	STRIP,RFI SHIELD 1.25	4	
....2	469-0366	FINGER STOCK (NOTE!!!!!)	1.25	
..1	469-0366-2	STRIP,RFI SHIELD 4.25	6	
....2	469-0366	FINGER STOCK (NOTE!!!!!)	4.25	
..1	471-0360	COVER,AFC/PLL PCB FX50	1	
....2	471-0360-009	COVER,AFC/PLL PCB UNSCREENED	1	
..1	471-0584-100	COVER,TOP,FM250C/E	1	

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
..1	471-0631	SHIELD,XFMR FX50	1	
..1	471-0795	SHIELD,FRONT PANEL PCB,FX-50	1	
....2	471-0795-009	SHLD,FRT PNL PCB,FX-50,UNSCRND	1	
..1	471-0962-100	PANEL,REAR,FX-50E/FX-50,SCREENED	1	
..1	471-5289-001	BRACKET,FUSE HOLDER,FX50,SCREENED	1	
....2	471-5289	BRACKET,FUSE HOLDER,FX50,FM100,FM250,UNSCREEN ED	1	
..1	471-6269-300	PANEL,STATUS,FX50,HD COLORS	1	
..1	474-0300	PLATE,MODULATED OSC FX50	1	
..1	486-0004	HANDLE 1 3/4	2	
..1	486-0014	FERRULE,BLK,FOR .25 DIA HANDLE	4	
..1	488-0010	LATCH,LO-PROFILE 27-10-501-50	2	
..1	520-0034-100	CHASSIS,FX50/FX50E	1	
..1	591-0001	PLATE,FCC ID	1	
..1	594-0095	LABEL,1EC LINE RCPT 700-0152	1	
..1	594-0250	LABEL,CAUTION,TOP COVER,FM EXC	1	
..1	594-0500	LABEL,DANGER	1	
..1	601-1802	WIRE,AWG18,19/30 RED (*NOTE)	0.25	
..1	611-1250	TUB,HT SHK,1/8	0.01	
..1	611-5000	TUB,HT SHK 1/2	0.25	
..1	700-0145	FILM,2 DOUBLE ADHESIVE #467	0.003	
..1	919-0104	ASSY PCB,AFC/PLL	1	
....2	000-3302	CAP,CER,DISC,3.3PF,1000V	1	C59
....2	001-5004	CAP,CER,DISC,5PF,500V,NPO	4	C15, C16, C56, C57
....2	003-1054	CAP,CER,MNLY,.1uF,50V,20%	24	C1, C3, C5, C6, C7, C8, C10, C12, C13, C21, C24, C27, C32, C33, C39, C43, C51, C55, C58, C60, C61, C64, C66, C41

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
....2	020-4793	CAP,LYTIC,4700UF,16V,LOW LEAK	1	C35
....2	023-1076	CAP,LYTIC,10uF,50V,STDUP	5	C42, C68, C70, C72, C73
....2	023-1084	CAP,LYTIC,100MFD,35V,STDUP,RAD	11	C4, C15, C22, C23, C25, C49, C50, C52, C53, C69, C71
....2	024-1064	CAP,LYTIC,1UF,50V,RAD	1	C29
....2	024-3364	CAP,LYTIC,3.3UF,50V,NP	1	C30
....2	024-3374	CAP,LYTIC,33UF,35V,STDUP	1	C37
....2	024-4764	CAP,LYTIC,4.7UF,50V,20%,STDUP	1	C28
....2	030-1053	CAP,MYLAR FILM,.1uF,100V,RAD	1	C31
....2	030-2253	CAP,MYLAR FILM,.22UF,100V,RAD	4	C34, C38, C48, C54
....2	031-1043	CAP,MYLAR FILM,.01UF,100V,RAD	3	C9, C11, C40
....2	031-2243	CAP,MYLAR FILM,.022UF,200V,RAD	1	C26
....2	038-4753	CAP,PYST,.47UF,100V	1	C44
....2	040-2422	CAP,MICA,240PF	3	C45, C46, C47
....2	042-2531	CAP,MICA,2500PF,500V,1%	1	C62
....2	042-3312	CAP,MICA,33PF,500V,5%	2	C65, C67
....2	042-3922	CAP,MICA,390PF,100V,5%	6	C2, C17, C18, C19, C20, C36
....2	042-5031	CAP,MICA,5000PF,500V,1%	1	C63
....2	100-1031	RES,100 OHM,1/4W,1%,METAL	1	R22
....2	100-1041	RES,1K OHM,1/4W,1%	7	R10, R42, R40, R44, R23, R84, R85
....2	100-1051	RES,10K OHM,1/4W,1%	15	R6, R13, R37, R15, R16, R24, R46, R47, R48, R95, R75, R76, R50, R103, R67,
....2	100-1111	RES,118 OHM,1/4W,1%	1	R32
....2	100-1231	RES,121 OHM,1/4W,1%	3	R21, R97, R99
....2	100-1551	RES,15K OHM,1/4W,1%	4	R25, R26, R27, R51
....2	100-1731	RES,174 OHM,1/4W,1%	1	R59

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
....2	100-2723	RES,27 OHM,1/4W,5%	1	R34
....2	100-3031	RES,301 OHM,1/4W,1%	1	R57
....2	100-3951	RES,39.2K OHM,1/4W,1%	1	R9
....2	100-4773	RES,4.7MEG OHM,1/4W,5%	1	R43
....2	100-5041	RES,4.99K OHM,1/4W,1%	4	R29, R30, R88, R90
....2	100-5663	RES,560K OHM,1/4W,5%	1	R19
....2	103-1007	RES,1 MEG OHM,1/4W,1%,METAL	8	R71, R72, R79, R77, R86, R89, R70, R78
....2	103-1021	RES,10 OHM,1/4W,1%,METAL	1	R1
....2	103-1062	RES,100K OHM,1/4W,1%,METAL	5	R17, R18, R64, R65, R66
....2	103-1215	RES,12.1K OHM,1/4W,1%,METAL	1	R11
....2	103-1331	RES,1.33K OHM,1/4W,1%,METAL	2	R98, R100
....2	103-1375	RES,13.7K OHM,1/4W,1%,METAL	1	R101
....2	103-1504	RES,1.5K OHM,1/4W,1%,METAL	1	R28,
....2	103-1745	RES,17.4K OHM,1/4W,1%,METAL	1	R82
....2	103-1825	RES,18.2K OHM,1/4W,1%,METAL	1	R92
....2	103-2213	RES,221 OHM,1/4W,1%,METAL	1	R33
....2	103-2673	RES,267 OHM,1/4W,1%,METAL	5	R7, R14, R38, R93, R94
....2	103-3014	RES,3.01K OHM,1/4W,1%,METAL	1	R83
....2	103-3323	RES,332 OHM,1/4W,1%,METAL	2	R2, R8
....2	103-3324	RES,3.32K OHM,1/4W,1%,METAL	2	R4, R5
....2	103-3631	RES,365 OHM,1/4W,1%,METAL	1	R20
....2	103-3836	RES,383K OHM,,1/4W,1%,METAL	1	R39
....2	103-4361	RES,432K OHM,1/4W,1%,METAL	1	R53
....2	103-4753	RES,475 OHM,1/4W,1%,METAL	2	R45, R61
....2	103-4755	RES,47.5K OHM,1/4W,1%,METAL	1	R31
....2	103-4951	RES,49.9K OHM,1/4W,1%,METAL	2	R36, R12

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
....2	103-5112	RES,51.1 OHM,1/4W,1%,METAL	2	R3, R74
....2	103-5113	RES,511 OHM,1/4W,1%,METAL	1	R49
....2	103-5624	RES,5.62K OHM,1/4W,1%,METAL	1	R41
....2	103-6193	RES,619 OHM,1/4W,1%,METAL	1	R87
....2	103-6194	RES,6.19K OHM,1/4W,1%,METAL	2	R54, R62
....2	103-6346	RES,634K OHM,1/4W,1%,METAL	1	R60
....2	103-7326	RES,732K OHM,1/4W,1%,METAL	1	R58
....2	103-7503	RES,750 OHM,1/4W,1%,METAL	1	R55
....2	103-7541	RES,7.50K OHM,1/4W,1%,METAL	2	R68, R80
....2	103-8255	RES,82.5K OHM,1/4W,1%,METAL	1	R35
....2	103-8256	RES,825K OHM,1/4W,1%,METAL	1	R56
....2	175-1034	RES,TRMR,1K,VERT ADJ	1	R63
....2	177-5044	RES,TRMR,5K,VERT ADJ	3	R69, R81, R91
....2	177-5054	RES,TRMR,50K,VERT ADJ	1	R52
....2	200-0009	DIODE,ZENER,1N 4739A	2	D17, D19
....2	203-4005	DIODE,1N4005	2	D16, D18
....2	203-4148	DIODE,1N4148	7	D1, D2, D3, D4, D5, D6, D7,
....2	211-3904	TSTR,2N3904	4	Q1, Q2, Q3, Q4
....2	220-0317	VR,LM317LZ TO92	1	U6
....2	220-4040	IC,MC14040B 12-BIT BINARY	1	U2
....2	220-5151	IC,MC145151 SYNTHESIZER	1	U9
....2	220-8658	IC,SP8658 PRESCALER,DIVIDE/20	1	U8
....2	221-0072	AMP,OP,BIFET TLO72CP	1	U11
....2	221-0358	AMP,DUAL OP,LM358	1	U13
....2	221-5532-001	IC,NE-5532AN	4	U10, U14, U15, U16
....2	226-0392	RES NETWORK, 10K	2	R73, R96
....2	227-0317	VR,LM317T,LM317KC	1	U17

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
....2	227-0337	VOLTAGE REGULATOR,3 TERM, NEG	1	U18
....2	228-0290	IC, 74LS90N (N)	1	U1
....2	228-4013	IC,MC14013B	1	U4
....2	228-4073	IC,MC14073B	1	U3
....2	228-4538	IC,MC14538B NATL SEMICONDUCTOR	2	U5, U12
....2	323-7345	LDR,LED TYPE,VACTEC VTL 5C2	3	LDR1, LDR2, LDR3
....2	323-9224	IND,LED,GRN,521-9270	5	DS1, DS2, DS3, DS4, DS5
....2	340-0002	SW,4 POS,SPST,8-PIN DIP	3	S1, S2, S3
....2	340-0004	SW,JUMPER PROGRAMMABLE	5	P3, P4, P5A, P5B, P10
....2	360-2200	CHOKE,RF 2.2UH 550MA	2	L1, L2
....2	364-0047	COIL, MOLDED .47UH	1	L3
....2	370-0002	XMFR,RF,MCL,T4-1 (NOTE)	1	T1
....2	390-0001	OSC,XTAL PC MT TCXO 10MHZ	1	Y1
....2	402-0000	TY-RAP	2	
....2	407-0074	SPR,LED .25 ODX.147 1D X.22L	5	
....2	413-1597	TERM,TURRET,2 SHLDR,.219,GOLD FLASH	5	
....2	417-0003	CONN,HEADER 3 PIN	3	J3.J4, J10
....2	417-0004	JACK,TEST,RIGHT ANGLE PC MT	1	TP1
....2	417-0200	CONN,HEADER 20 PIN	2	J5, J8, J2, J1,
....2	417-0804	SOCKET,8-PIN DIP,BURNDY	6	XU10, XU11, XU13, XU14, XU15, XU16
....2	417-1404	SOCKET,14-PIN DIP	3	XU1, XU3, XU4
....2	417-1604	SKT,16-PIN,DIP	5	XU2, XU5, XU12, XR73, XR96
....2	417-2804	SOCKET,IC 28-PIN,DIP,HI RELIABILITY	1	XU9
....2	420-6104	SCREW,6-32X.250,S.S. PH	2	
....2	423-6002	#6 LOCK SPLIT	2	

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
....2	426-6000	PEM NUT,#6-32 KFS2-632	6	
....2	519-0104	PCB,BLANK,AFC/PLL (scan)	1	
....2	700-0148	TAPE,JOINING 3/4	0.001	
....2	949-1050-001	ASSY, CABLE, AFC-PLL (SBCM)	1	
......3	402-0051	TY-RAP, W/FLAG	1	
......3	418-0034	PLUG,BNC DUAL CRIMP 1-227079-6	1	
......3	621-1359	CBL,COAX,RG316/U,50 OHM	1.25	
......3	690-0023	TUB,PVC105/7 BLK,ALPHA	1.25	
..1	919-0107	ASSY PCB,P.S./CNTL	1	
....2	001-1014	CAP,CER,DISC,10pF,1KV,10%,NPO	2	C3, C4
....2	003-1054	CAP,CER,MNLY,.1uF,50V,20%	9	C5, C6, C7, C16, C25, C28, C30, C33, C37
....2	014-1084	CAP,LYTIC,100UF,50V,INS	1	C15
....2	014-1094	CAP,LYTIC,1000UF,50V,INS	2	C24, C29
....2	023-1076	CAP,LYTIC,10uF,50V,STDUP	1	C17
....2	023-1084	CAP,LYTIC,100MFD,35V,STDUP,RAD	6	C26, C27, C31, C32, C35, C36
....2	024-1064	CAP,LYTIC,1UF,50V,RAD	2	C11, C23
....2	024-2274	CAP,LYTIC,22UF,100V,STDUP	1	C34
....2	030-1033	CAP,CER MOLDED,.001UF,200V,10%	2	C12, C20
....2	031-1043	CAP,MYLAR FILM,.01UF,100V,RAD	2	C8, C10
....2	040-5013	CAP,MICA,50PF,500V,5%	1	C13
....2	042-3922	CAP,MICA,390PF,100V,5%	5	C1, C2, C14, C18, C19
....2	100-1013	RES,1 OHM,1/4W,5%	1	R64
....2	100-1031	RES,100 OHM,1/4W,1%,METAL	1	R72
....2	100-1041	RES,1K OHM,1/4W,1%	7	R6, R73, R61, R37, R12, R50, R59

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
....2	100-1051	RES,10K OHM,1/4W,1%	10	R4, R8, R30, R28, R32, R33, R42, R43, R55, R65
....2	100-1231	RES,121 OHM,1/4W,1%	2	R76, R78
....2	100-1551	RES,15K OHM,1/4W,1%	3	R15, R24, R22
....2	100-1841	RES,1.82K OHM,1/4W,1%	6	R77, R79, R1, R2, R36, R11
....2	103-1007	RES,1 MEG OHM,1/4W,1%,METAL	5	R21, R34, R44, R45, R87
....2	103-1021	RES,10 OHM,1/4W,1%,METAL	2	R60, R51
....2	103-1062	RES,100K OHM,1/4W,1%,METAL	5	R3, R7, R23, R47, R41
....2	103-1215	RES,12.1K OHM,1/4W,1%,METAL	1	R14
....2	103-1261	RES,121K OHM,1/4W,1%,METAL	2	R82, R86
....2	103-1504	RES,1.5K OHM,1/4W,1%,METAL	1	R10
....2	103-1561	RES,150K OHM,1/4W,1%,METAL	1	R31
....2	103-2212	RES,22.1 OHM,1/4W,1%,METAL	1	R54
....2	103-2241	RES,2.21K OHM,1/4W,1%,METAL	1	R39
....2	103-3324	RES,3.32K OHM,1/4W,1%,METAL	1	R29
....2	103-3325	RES,33.2K OHM,1/4W,1%,METAL	3	R35, R40, R48
....2	103-3631	RES,365 OHM,1/4W,1%,METAL	1	R75
....2	103-3924	RES,3.92K OHM,1/4W,1%,METAL	2	R16, R18
....2	103-4755	RES,47.5K OHM,1/4W,1%,METAL	8	R38, R85, R80, R81, R83, R84, R26, R57
....2	103-5141	RES,5.11K OHM,1/4W,1%,METAL	2	R13, R49
....2	103-6194	RES,6.19K OHM,1/4W,1%,METAL	2	R17, R19
....2	103-6346	RES,634K OHM,1/4W,1%,METAL	1	R46
....2	103-6813	RES,681 OHM,1/4W,1%,METAL	1	R53
....2	103-6814	RES,6.81K OHM,1/4W,1%,METAL	1	R20
....2	110-2233	RES,220 OHM,1/2W,5%	1	R56
....2	132-0114	RES,1.5 OHM,10W,5%,WW	1	R74

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
....2	132-2003	RES,.2 OHM,5W,5%,WW	4	R70, R71, R62, R63
....2	140-0018	VARISTOR,V477A1 47V GE	1	MOV1
....2	178-1054	RES,TRMR,10K,HORZ ADJ	1	R25
....2	178-2044	RES,TRMR,2K,HORZ ADJ	2	R5, R27
....2	178-5044	RES,TRMR,5K,HORZ ADJ	1	R9
....2	178-5046	RES,TRMR,5K,1/2W,MT	1	R52
....2	200-0015	DIODE,ZENER,15V,1W,1N4744A	1	D27
....2	200-0027	DIODE,ZENER,1N4750A,27V	1	D5
....2	200-4751	DIODE,ZENER,IN4751A 30V 1W	1	D6
....2	201-4728	DIODE,ZENER,1N4728	2	D29, D30
....2	202-0502	RECT,3A,200V,IN5402	1	D18
....2	203-4005	DIODE,1N4005	14	D13, D14, D16, D17, D19, D20, D12, D15, D21, D22, D23, D24, D25, D26
....2	203-4148	DIODE,1N4148	8	D1, D2, D3, D4, D8, D11, D28, D31
....2	210-3906	2N3906 PNP 40V 2A .35W 250MHZ	2	Q3, Q5
....2	211-3904	TSTR,2N3904	2	Q4, Q2
....2	221-0358	AMP,DUAL OP,LM358	3	U1, U2, U3
....2	227-0317	VR,LM317T,LM317KC	1	U5
....2	227-0337	VOLTAGE REGULATOR,3 TERM, NEG	1	U6
....2	227-0723	IC,VR,UA723	1	U4
....2	237-0007	SCR,25A,100V,2N6505	1	D7
....2	330-0802	FUSE,FAST ACTING,8A,GBB-8,BUSS	1	F1
....2	340-0004	SW,JUMPER PROGRAMMABLE	1	P22
....2	345-0863	SW,SLD,DPDT,SWCFT C56206L2	3	S1, S2, S3
....2	360-0003	FERRITE BEAD,.291 DIA	2	
....2	407-0141	COVER,FUSE,STD 840836 RICHCO	1	

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
....2	413-0025	TERM,TURRET,2 SHLDR,.360,GOLD FLASH	8	E1, E2, E3, E4, E5, E6, E7, E8,
....2	413-0106	TERM,TEST POINT,OVAL,RED	8	TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8
....2	415-2068	CLIP,FUSE,15AMP,LITTLEFUSE,102071	2	XF1, XF2
....2	417-0003	CONN,HEADER 3 PIN	1	J22
....2	417-0169	CONN 15 PIN 640503-1 AMP	1	J11
....2	417-0200	CONN,HEADER 20 PIN	2	J12, J13, J23,
....2	417-0804	SOCKET,8-PIN DIP,BURNDY	3	XU1, XU2, XU3
....2	417-1404	SOCKET,14-PIN DIP	1	XU4
....2	418-0900	CONN,9 PIN 640501-5 AMP	1	J10
....2	420-6105	SCREW,6-32X.312,S.S. PH	3	
....2	423-6002	#6 LOCK SPLIT	3	
....2	426-6000	PEM NUT,#6-32 KFS2-632	3	
....2	455-7805	HEATSINK,TO-220PKG,LOW PROFILE	2	
....2	519-0107-001	PCB,MACH,P.S./CNTL,FM-100C (scan)	1	
..1	919-0108	ASSY PCB,METERING	1	
....2	001-5004	CAP,CER,DISC,5PF,500V,NPO	2	C8, C11
....2	003-1054	CAP,CER,MNLY,.1uF,50V,20%	35	C2, C3, C4, C9, C10, C15, C17, C18, C19, C21, C22, C24, C27, C28, C30, C31, C34, C35, C36, C37, C38, C39, C40, C41, C42, C43, C44, C45, C50, C52, C54, C56, C57, C61, C63
....2	020-1085	CAP,LYTIC,100UF,50V,STDUP,NP	1	C1
....2	023-1076	CAP,LYTIC,10uF,50V,STDUP	9	C12, C32, C33, C51, C53, C55, C58, C60, C62
....2	023-1084	CAP,LYTIC,100MFD,35V,STDUP,RAD	4	C46, C47, C48, C49
....2	024-2274	CAP,LYTIC,22UF,100V,STDUP	1	C59

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
....2	030-4743	CAP,POLYESTER FILM,.047UF,100V,RAD	1	C29
....2	031-1043	CAP,MYLAR FILM,.01UF,100V,RAD	1	C13
....2	040-5013	CAP,MICA,50PF,500V,5%	1	C26
....2	042-3312	CAP,MICA,33PF,500V,5%	1	C14
....2	042-3922	CAP,MICA,390PF,100V,5%	6	C6, C7, C16, C20, C23, C25
....2	100-1041	RES,1K OHM,1/4W,1%	13	R18, R20, R98, R99, R100, R101, R102, R103, R104, R105, R106, R107, , R16
....2	100-1051	RES,10K OHM,1/4W,1%	15	R1, R3, R23, R19, R29, R38, R42, R52, R60, R66, R67, R68, R69, R70, R71,
....2	100-1083	RES,10MEG OHM,1/4W,5%	1	R26
....2	100-1111	RES,118 OHM,1/4W,1%	1	R110
....2	100-1231	RES,121 OHM,1/4W,1%	5	R78, R80, R82, R88, R108
....2	100-1873	RES,1.8MEG OHM,1/4W,5%	1	R59
....2	100-2041	RES,2K OHM,1/4W,1%	1	R40
....2	100-2283	RES,22MEG OHM,1/4W,5%	2	R21, R37
....2	100-3051	RES,30.1K OHM,1/4W,1%	1	R55
....2	100-6031	RES,604 OHM,1/4W,1%	1	R89
....2	100-7132	RES,715 OHM,1/4W,1%	1	R13
....2	103-1007	RES,1 MEG OHM,1/4W,1%,METAL	3	R9, R39, R54,
....2	103-1021	RES,10 OHM,1/4W,1%,METAL	3	R33, R34, R36
....2	103-1062	RES,100K OHM,1/4W,1%,METAL	8	R5, R31, R53, R64, R65, R87, R97, R111
....2	103-1105	RES,11K OHM,1/4W,1%,METAL	1	R14
....2	103-1214	RES,1.21K OHM,1/4W,1%,METAL	3	R90, R92, R94
....2	103-1274	RES,1.27K OHM,1/4W,1%,METAL	1	R15

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
....2	103-1331	RES,1.33K OHM,1/4W,1%,METAL	2	R79, R81
....2	103-1504	RES,1.5K OHM,1/4W,1%,METAL	2	R47, R25
....2	103-1695	RES,16.9K OHM,1/4W,1%,METAL	1	R48
....2	103-1826	RES,182K OHM,1/4W,1%,METAL	1	R58
....2	103-1914	RES,1.91K OHM,1/4W,1%,METAL	1	R12
....2	103-2003	RES,200 OHM,1/4W,1%,METAL	2	R75, R76
....2	103-2264	RES,2.26K OHM,1/4W,1%,METAL	1	R109
....2	103-2673	RES,267 OHM,1/4W,1%,METAL	1	R63
....2	103-2675	RES,26.7K OHM,1/4W,1%,METAL	3	R22, R84, R86
....2	103-2751	RES,27.4K OHM,1/4W,1%,METAL	1	R45
....2	103-3061	RES,301K OHM,1/4W,1%,METAL	1	R24
....2	103-3631	RES,365 OHM,1/4W,1%,METAL	1	R83
....2	103-4741	RES,4.75K OHM,1/4W,1%,METAL	1	R43
....2	103-4755	RES,47.5K OHM,1/4W,1%,METAL	5	R57, R61, R62, R85, R96
....2	103-4993	RES,499 OHM,1/4W,1%,METAL	6	R6, R91, R93, R95, R7, R8
....2	103-4996	RES,499K OHM,1/4W,1%,METAL	1	R10
....2	103-5112	RES,51.1 OHM,1/4W,1%,METAL	2	R77, R112
....2	103-5141	RES,5.11K OHM,1/4W,1%,METAL	1	R35
....2	103-5363	RES,536 OHM,1/4W,1%,METAL	1	R11
....2	103-5364	RES,5.36K OHM,1/4W,1%,METAL	2	R2, R4
....2	103-6193	RES,619 OHM,1/4W,1%,METAL	3	R72, R73, R74
....2	103-8254	RES,8.25K OHM,1/4W,1%,METAL	1	R30
....2	103-8255	RES,82.5K OHM,1/4W,1%,METAL	1	R27
....2	103-8453	RES,845 OHM,1/4W,1%,METAL	4	R44, R46, R49, R51
....2	103-8454	RES,8.45K OHM,1/4W,1%,METAL	1	R50
....2	103-9314	RES,9.31K OHM,1/4W,1%,METAL	1	R17
....2	177-1054	RES,TRMR,10K,VERT ADJ	1	R56

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
....2	177-2044	RES,TRMR,2K,VERT ADJ	1	R41
....2	177-2054	RES,TRMR,20K,VERT ADJ	1	R28
....2	200-4733	DIODE,ZENER,1N4733A, 5%	1	D14
....2	200-4742	DIODE,ZENER,1N4742A	2	D18, D19
....2	200-5363	DIODE,ZENER,IN5363 30V SW	1	D25
....2	201-2800	DIODE,HOT CARRIER	3	D3, D4, D24
....2	203-4005	DIODE,1N4005	3	D20, D21, D23
....2	203-4148	DIODE,1N4148	15	D1, D2, D5, D6, D7, D8, D9, D10, D11, D12, D13, D15, D16, D17, D22
....2	210-0271	TSTR,FET J271	1	Q7
....2	210-3906	2N3906 PNP 40V 2A .35W 250MHZ	3	Q3, Q4, Q5
....2	211-3904	TSTR,2N3904	3	Q1, Q2, Q6
....2	220-0317	VR,LM317LZ TO92	1	U17
....2	220-7136	A/D,3-1/2 DIGIT LCD,ICL7136CPL	1	U7
....2	221-0074	AMP,OP,BIFET TLO74CW	2	U1, U2
....2	221-4227	AMP,DUAL OP	2	U4, U5
....2	225-0004	IC,CD4066BE	2	U3, U6
....2	226-0392	RES NETWORK, 10K	1	R32
....2	226-2004	MC1416,ULN2004 7-DRLNGTNS DP16	1	U12
....2	227-0317	VR,LM317T,LM317KC	2	U14, U22
....2	227-0337	VOLTAGE REGULATOR,3 TERM, NEG	2	U15, U16
....2	228-4028	IC,MC14028B	1	U11
....2	228-4071	IC,MC14070 QUAD EXCLUSIVE OR	1	U13
....2	228-4076	IC,MC14076 QUAD REGISTER	1	U10
....2	228-4532	IC,MC14532B 8-BIT PRIOR ENCOD	1	U9
....2	228-4538	IC,MC14538B NATL SEMICONDUCTOR	1	U8
....2	229-0555	IC,TIMER,NE555N	1	U18

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
....2	229-3914	DRIVER,DOT/BAR DISPLAY LM3914N	3	U19, U20, U21
....2	320-0016	LED,GRN PANEL INDICATOR	7	DS2, DS3, DS4, DS5, DS18, DS19, DS20
....2	320-0017	LED,RED MV57173 I OR H	9	DS1, DS6, DS7, DS8, DS13, DS14, DS15, DS16, DS17
....2	320-0021	DISP,LCD,4-DIGIT,0.7	1	DS12
....2	320-4164	LED ARRAY,GRN,10 BAR	2	DS9, DS10
....2	320-7164	LED ARRAY RED MV57164 INTEN G OR H	1	DS11
....2	340-0107	KEYSWITCH,SI20601H1 SECME (NOTE)	6	S1, S2, S3, S4, S5, S6
....2	402-0000	TY-RAP	1	
....2	413-1597	TERM,TURRET,2 SHLDR,.219,GOLD FLASH	7	E1, TP1, TP2, TP3, TP4, TP5, TP6
....2	417-0172	SKT, 20 PIN SINGLE ROW,SAMTEC	2	
....2	417-0200	CONN,HEADER 20 PIN	1	J14
....2	417-0804	SOCKET,8-PIN DIP,BURNDY	3	XU4, XU5, XU18
....2	417-1404	SOCKET,14-PIN DIP	5	XU1, XU2, XU3, XU6, XU13
....2	417-1604	SKT,16-PIN,DIP	6	XU8, XU9, XU10, XU11, XU12, XR32
....2	417-1804	SOCKET,18-PIN,DIP,HIGH RELIABILITY	3	XU19, XU20, XU21
....2	417-4005	SOCKET,40-PIN,DIP,HIGH RELIABILITY	1	XU7
....2	420-6104	SCREW,6-32X.250,S.S. PH	4	
....2	423-6002	#6 LOCK SPLIT	5	
....2	426-6000	PEM NUT,#6-32 KFS2-632	5	
....2	449-0006	TEST CLIP,COILED	1	
....2	519-0108	PCB,BLANK,METERING (scan)	1	
..1	919-0445-309	ASSY,PCB,RFI FILTER,CE	1	
....2	417-0039-VLX	CONN,BNC,PCB,VERT MOUNT,VALOX BODY	-1	REMOVE J305

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
....2	417-2502-FER	RCPT,25 PIN D,FEMALE,FERITE FILTER	-1	REMOVE J1
....2	417-2502-FIL	RCP, 25 PIN D, FEMALE, PI FILTER	1	J1
....2	420-4105	SCREW,4-40X.312,S.S. PH	2	
....2	423-4002	#4 LOCK S.S. SPLIT	2	
....2	441-4000	STOFF,4-40 X .50L,3/16 HEX ALUM	2	
....2	919-0445	ASSY,PCB,RFI FILTER (SBCM)	1	
......3	002-1034	CAP,CER,DISC,.001UF,1000V	3	C301, C302, C303
......3	003-1054	CAP,CER,MNLY,.1uF,50V,20%	8	C304, C305, C306, C307, C308, C309, C310, C311
......3	031-2033	CAP,MYLAR FILM,.0022uF,100V,10%	2	C312, C313,
......3	038-4750	CAP,POLY,.47MFD,50V,10% OR BETTER	2	C324, C325
......3	040-1022	CAP,MICA,100PF,500V,RAD	10	C314, C316, C318, C320, C322, C326, C327, C328, C329, C330
......3	047-1035	CAP,FIL,EMI SUPPR,1000pF,3-PIN	3	FL312, FL313, FL319
......3	100-1041	RES,1K OHM,1/4W,1%	3	R302, R306, R307,
......3	100-1051	RES,10K OHM,1/4W,1%	1	R303,
......3	100-6031	RES,604 OHM,1/4W,1%	1	R308,
......3	103-5112	RES,51.1 OHM,1/4W,1%,METAL	2	R310, R311
......3	103-8254	RES,8.25K OHM,1/4W,1%,METAL	2	R304, R305,
......3	130-2423	RES,240 OHM,2W,5%	2	R301, R309,
......3	201-0012	ZENER VOLTAGE SUPPRESSOR,+/-12V	12	D310, D311, D312, D313, D314, D315, D316, D317, D318, D319, D320, D321
......3	201-0027	ZENER VOLTAGE SUPPRESSOR,+/-27V	4	D302, D303, D304, D305
......3	201-0040	ZENER VOLTAGE SUPPRESSOR,+/-18V	4	D306, D307, D308, D309

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
......3	203-4005	DIODE,1N4005	1	D301,
......3	270-0065	REL,SPDT,12VDC,DIP	1	K301,
......3	340-0004	SW,JUMPER PROGRAMMABLE	2	P308, P309
......3	364-4662	INDU,1.0MH	2	L303, L305,
......3	411-0001	FILTER,EMI 10,000PF 3PIN	21	FL301, FL302, FL303, FL304, FL305, FL306, FL307, FL308, FL309, FL310, FL311, FB312, FB313, FL314, FL315, FL316, FL319, FL320, FL321, FL322, FL323
......3	417-0003	CONN,HEADER 3 PIN	2	J308, J309
......3	417-0039-VLX	CONN,BNC,PCB,VERT MOUNT,VALOX BODY	5	J305, J301, J302, J303, J304
......3	417-0200	CONN,HEADER 20 PIN	1	J307,
......3	417-1276	CONN,PCB,12 PIN	1	J306
......3	417-2502-FER	RCPT,25 PIN D,FEMALE,FERITE FILTER	1	J1
......3	420-6105	SCREW,6-32X.312,S.S. PH	10	
......3	423-6002	#6 LOCK SPLIT	20	
......3	426-6000	PEM NUT,#6-32 KFS2-632	10	
......3	441-0184	STOFF,6-32,MALE-FEMALE,3/8	10	
......3	519-0445-001	PCB,MACH,RFI FILTER	1	
........4	519-0445	PCB,MACH,RFI FILTER BREAKAWAY	0.5	
......3	519-0445-002	PCB,MACH,RFI FILTER SHIELD	1	
........4	519-0445	PCB,MACH,RFI FILTER BREAKAWAY	0.5	
..1	919-0446	ASSY, PCB, AC LINE FILTER	1	
....2	339-7818	FILTER, EMC, AC LINE, 250V, 6.3 AMP	1	F1

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
....2	418-0255	CONN,MALE,4PIN	2	J1, J2
....2	420-4106	SCREW,4-40X.375,S.S. PH	4	
....2	423-4002	#4 LOCK S.S. SPLIT	4	
....2	519-0446	PCB, RAW, AC LINE FILTER	1	
..1	949-0149-001	WIRE HARNESS, FX-50E	1	
....2	402-0000	TY-RAP	40	
....2	402-0051	TY-RAP, W/FLAG	15	
....2	410-0065	LUG,TERM #6 RING CRIMP #22 AWG	4	
....2	410-1421	LUG,QUICK DISCONNECT #18-22	3	
....2	410-1552	LUG,TERM #8 RING CRIMP 16-22	2	
....2	410-1553	LUG,TERM #10 RING CRIMP 16-22	5	
....2	417-0036	PIN CONN,AMP,350967-1	6	
....2	417-0053	SKT,CONN 641294-1 AMP	52	
....2	417-0059	CONN,9 PIN 1-640521-0 AMP	1	P10
....2	417-0122	HSNG,20 POS MOD IV 3-87499-7	2	P14, P307,
....2	417-0123	HSNG,16 POS MOD IV 2-87499-9	1	P1
....2	417-0148	HSNG,10 POS MOD 1V 1-87499-7	1	P2
....2	417-0176	CONN,20 PIN FEM,AMP 1-350245-9	1	P15
....2	417-0224	KEYING PLUG MOD IV 87077 AMP	3	
....2	417-1401	HOUSING,SKT,14PIN,AMP MOD IV	2	P12, P13,
....2	417-2379	CONN,155OC HOUSING,AMP,MR	1	P11
....2	417-8766	CONTACT,CRIMP,MOD-IV 87809-1	49	
....2	418-0006	HSNG,CONN 6 PIN 1-640510 AMP	1	
....2	418-0034	PLUG,BNC DUAL CRIMP 1-227079-6	4	
....2	418-0240	PLUG,FEM,4PIN	1	
....2	418-0701	CONN,HOUSING,2 PIN	1	P20
....2	418-1271	CONN,HOUSING,12PIN	1	P306
....2	601-1604	WIRE,AWG16, 19/29 YEL	2	

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
....2	601-1604-006	WIRE,AWG 16,STRANDED,LIGHT BLUE	1	
....2	601-1800	WIRE,AWG18 19/30 BLK	30.6	
....2	601-1800-006	WIRE,AWG 18,STRANDED,LIGHT BLUE	1	
....2	601-1800-054	WIRE,AWG 18,STRANDED,GREEN/YELLOW	1	
....2	601-2209	WIRE,AWG22,19/34 WHT	85	
....2	621-1359	CBL,COAX,RG316/U,50 OHM	2.292	
....2	622-8451	WIRE,BELD 8451,SHIELD,1PR	12.75	
..1	957-0003-329	KIT, ACCESSORY PARTS, FX-50E	1	
....2	330-1200	FUSE, 12A, 250V, CERAMIC, SLO-BLOW	1	
....2	334-0100	FUSE,1A MDL SLO BLO 250V	1	
....2	334-0150	FUSE,3AG,1.5 AMP,SLO-BLO	1	
....2	682-0003	CORD,PWR EUROPEAN RIGHT ANGLE, 6'	1	
....2	701-0001	ENVELOPE,COIN 2-1/2 X 4-1/4	3	
....2	701-0019	ANTISTATIC ZIPLOC BAG 13X18 4M	1	
....2	947-0020	ASSY,CBL BNC ACCESS (SBCM)	2	
......3	417-0094	CONN,BNC RG/U58 31-320 AMPH	2	
......3	622-0050	CBL,SH,50 OHM,RG-58/CU	2.5	
....2	979-9983	KIT,BIND+MAN,FX-50	1	
......3	597-1050	INSTRUCTION MANUAL, FX 50/FX 50E FM EXCITER	1	
......3	598-0010-001	BINDER,1 IN, BLUE,W CD POCKET	1	
..1	959-0203	ASSY MODL,MODLTD. OSC. (SBCM)	1	
....2	008-1020	CAP,FEEDTHRU,100PF 20% 250V	1	C21
....2	008-1033	CAP,FEEDTHRU,1000PF,20%,500V	2	C19, C20
....2	040-6223	CAP,MICA,620PF,300V,5%	1	C23
....2	360-0003	FERRITE BEAD,.291 DIA	3	
....2	364-0002	CHOKE,VK200-20/4B FERROXCUBE	1	L7

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
....2	402-0000	TY-RAP	5	
....2	402-0006	MT,ADH BACKED,FOR CBL TIES	1	
....2	402-0008	MTG DEVICE,FOR #6SCR,TIE CBL	1	
....2	410-1419	LUG,SOLDER 7/8	1	
....2	417-0016	CONN,BNC,RF,UG1094A/U,AMPHENOL	2	J6, J9
....2	420-4404	SCREW,4-40X.250,S.S. SHCS	7	
....2	420-4504	SCREW,4-40X.250,S.S. PH	1	
....2	420-4506	SCREW,4-40X.375,BR FLH SC	4	
....2	423-4004	#4 LOCK EXT TOOTH	7	
....2	470-0328	BRKT,BNC,MOD OSC	1	
....2	479-6443-003	BOX,MOD.,MODULATED OSC FX50	1	
....2	601-0022	WIRE,AWG22,BUSS	0.166	
....2	611-2500	TUB,HT SHK,1/4	0.083	
....2	693-0220	TUB,TEFLON,TW,AWG22 NTL	0.249	
....2	919-0106	ASSY PCB,MODLTD.OSC FX-50	1	
......3	000-3302	CAP,CER,DISC,3.3PF,1000V	1	C16
......3	001-5004	CAP,CER,DISC,5PF,500V,NPO	1	C15
......3	009-4723	CAP,CER CHIP,470PF,200V,5%	2	C3, C22
......3	023-1076	CAP,LYTIC,10uF,50V,STDUP	1	C6
......3	023-1084	CAP,LYTIC,100MFD,35V,STDUP,RAD	2	C4, C7
......3	040-1213	CAP,MICA,12PF,500V,5%	1	C2
......3	042-3312	CAP,MICA,33PF,500V,5%	2	C1, C8
......3	042-3922	CAP,MICA,390PF,100V,5%	9	C5, C9, C10, C11, C12, C13, C14, C17, C18
......3	100-1031	RES,100 OHM,1/4W,1%,METAL	2	R12, R6
......3	100-1041	RES,1K OHM,1/4W,1%	3	R7, R13, R14
......3	100-1111	RES,118 OHM,1/4W,1%	1	R22
......3	100-4561	RES,453K OHM,1/4W,1%	1	R10

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
......3	103-1007	RES,1 MEG OHM,1/4W,1%,METAL	1	R9
......3	103-1021	RES,10 OHM,1/4W,1%,METAL	4	R1, R11, R15, R20
......3	103-1062	RES,100K OHM,1/4W,1%,METAL	1	R5
......3	103-2213	RES,221 OHM,1/4W,1%,METAL	5	R4, R17, R18, R19, R21
......3	103-2673	RES,267 OHM,1/4W,1%,METAL	1	R8
......3	103-2744	RES,2.74K OHM,1/4W,1%,METAL	1	R16
......3	103-3324	RES,3.32K OHM,1/4W,1%,METAL	1	R3
......3	103-5112	RES,51.1 OHM,1/4W,1%,METAL	2	R23, R24
......3	201-2800	DIODE,HOT CARRIER	3	D9, D10, D11
......3	203-4005	DIODE,1N4005	1	D12
......3	205-0109	DIODE,VARI-CAP TUNING	6	D2, D3, D4, D6, D7, D8
......3	205-3201	DIODE,VARACTOR,KV3201 2-11PF	2	D1, D5
......3	211-0006	MPS-A06 NPN 80V .5A .3W 100MHZ	1	Q1
......3	211-5109	TSTR,RF 2N5109 NPN	2	Q4, Q5
......3	212-0310	TSTR,FET N CHAN RF J3100	2	Q2, Q3
......3	360-3300	CHOKE,RF,3.3UH,380MA,9230-32	3	L1, L3, L6
......3	364-0047	COIL, MOLDED .47UH	2	L4, L5
......3	370-0106	COIL, MOD OSC., L2	1	L2
........4	555-0106	LABOR, 370-0106	1	
........4	610-0026	SMALL TRANS LINE	0.708	
......3	409-0012	PAD,TSTR 520-021 BIVAR TO-5	2	
......3	413-1597	TERM,TURRET,2 SHLDR,.219,GOLD FLASH	6	E1, E2, E3, E4, E5, E6
......3	440-0018	STOFF,ANTI ROT 7/32 RND X 1/4	4	
......3	519-0106	PCB,BLANK,MODLTD.OSC. (scan)	1	
....2	949-1050	ASSY, CABLE, MOD OSC. (SBCM)	1	

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
......3	402-0051	TY-RAP, W/FLAG	1	
......3	417-0165	HSNG,5POS MOD IV S.ROW 87499-9	1	
......3	417-0224	KEYING PLUG MOD IV 87077 AMP	1	
......3	417-8766	CONTACT,CRIMP,MOD-IV 87809-1	4	
......3	611-1250	TUB,HT SHK,1/8	2	
......3	621-1359	CBL,COAX,RG316/U,50 OHM	2	
..1	959-0204	ASSY MODL,RF AMP	1	
....2	008-1033	CAP,FEEDTHRU,1000PF,20%,500V	4	C1, C2, C3, C4
....2	040-3312	CAP,MICA,33PF,350V,10%	1	C33
....2	046-0005	CAP,MICA,150PF,350V,10%	1	C32,
....2	130-3333	RES,330 OHM,2W,5%	1	R19
....2	210-2860	TSTR,RF,DU2860U 60W DMOS	1	Q4
....2	213-6198	TSTR,RF PWR,2N6198	1	Q3
....2	219-3000	TSTR, DARLINGTON, SI, NPN	2	Q1, Q2
....2	227-0339	VR,LM338K,5AMP ADJUSTABLE	1	U1
....2	229-2830	AMP,RF,HYBRID,MHW5342A	1	U2
....2	330-0802	FUSE,FAST ACTING,8A,GBB-8,BUSS	1	
....2	360-0003	FERRITE BEAD,.291 DIA	15	
....2	402-0000	TY-RAP	1	
....2	402-0835	CLAMP,CBL,3/8	1	
....2	407-0186	TOOL,ADJ 8 T000/5 SPECTROL	1	
....2	407-3000	COVER,TSTR	3	
....2	415-1010	FUSE CLIP,LITTLEFUSE,101002	4	
....2	417-0017	RECP,BNC,BULKHEAD,UG-492A/U	2	J17, J18
....2	418-0010	INSULATOR,MICA,TSTR,TO-3PKG	3	
....2	420-0305	SCREW,4-40X.375,BR PH SC	2	
....2	420-0509	SCREW,10-32X.500,BR SL PAN HD	1	
....2	420-4104	SCREW,4-40X.250,S.S. PH	4	

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
....2	420-6105	SCREW,6-32X.312,S.S. PH	13	
....2	420-6106	SCREW,6-32X.375,S.S. PH	2	
....2	420-6110	SCREW,6-32X.625,S.S. PH	6	
....2	420-6112	SCREW,6-32X.750,S.S. PH	2	
....2	420-8100	SCREW,8-32X.250,BR SL PAN HD	6	
....2	421-0801	#10-32 BR HEX NUT	1	
....2	421-8002	8-32 HEX NUT, BRASS	1	
....2	423-0005	#10 LOCK SPLIT (BRONZE)	1	
....2	423-1011	#4 LOCK SPLIT (BRONZE)	2	
....2	423-4002	#4 LOCK S.S. SPLIT	4	
....2	423-6002	#6 LOCK SPLIT	24	
....2	423-6011	#6 FLAT .310 X .160 X .030	1	
....2	423-8005	#8 LOCK SPLIT	6	
....2	441-0184	STOFF,6-32,MALE-FEMALE,3/8	1	
....2	450-0651	PLUG,HOLE,5/16	1	
....2	455-0049-001	HEATSINK,RF AMP,FX50	1	
....2	471-0585	COVER,RF AMP FX50	1	
......3	471-0585-009	COVER,RF AMP,UNSCREENED FX50	1	
....2	474-0301	PLATE,FRT,RF AMP PCB COVER	1	
....2	474-0302	PLATE,BACK,RF AMP PCB COVER	1	
....2	919-0105-001	ASSY PCB,RF AMP FX-50	1	
......3	002-1034	CAP,CER,DISC,.001UF,1000V	1	C26
......3	009-6813	CAP,CER CHIP,68PF,500V,5%	1	C43
......3	024-3374	CAP,LYTIC,33UF,35V,STDUP	2	C23, C31,
......3	038-4753	CAP,PYST,.47UF,100V	2	C22, C30,
......3	040-3312	CAP,MICA,33PF,350V,10%	1	C35,
......3	040-5013	CAP,MICA,50PF,500V,5%	2	C37, C41,
......3	040-6813	CAP,MICA,68PF,500V,5%	1	C13,

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
......3	042-2000	CAP,MICA,200PF,350V,10%	4	C14, C15, C25, C36,
......3	042-3922	CAP,MICA,390PF,100V,5%	12	C8, C9, C11, C12, C19, C21, C28, C29, C38, C39, C40, C42,
......3	046-0003	CAP,MICA,RF,80PF,350V,10%	2	C17, C18,
......3	046-0004	CAP,MICA,47PF,350V,10%	2	C34, C20,
......3	046-0005	CAP,MICA,150PF,350V,10%	2	C16, C24,
......3	100-1031	RES,100 OHM,1/4W,1%,METAL	2	R14, R20,
......3	100-1051	RES,10K OHM,1/4W,1%	3	R4, R13, R15,
......3	100-2041	RES,2K OHM,1/4W,1%	1	R5,
......3	103-2212	RES,22.1 OHM,1/4W,1%,METAL	2	R8, R21,
......3	103-4324	RES,4.32K OHM,1/4W,1%,METAL	1	R2,
......3	103-4755	RES,47.5K OHM,1/4W,1%,METAL	1	R3,
......3	103-4993	RES,499 OHM,1/4W,1%,METAL	1	R18,
......3	103-5112	RES,51.1 OHM,1/4W,1%,METAL	1	R7,
......3	103-7541	RES,7.50K OHM,1/4W,1%,METAL	1	R16,
......3	110-3623	RES,36 OHM,1/2W,5%	1	R6,
......3	130-2223	RES,22 OHM,2W,5%	2	R9, R11,
......3	130-4723	RES,47 OHM,2W,5%	1	R10
......3	177-2034	RES,TRMR,200 OHM,VERT ADJ	1	R12
......3	177-2045	RES,TRMR,2K,10T,TOP ADJ 3299W	1	R17
......3	201-2800	DIODE,HOT CARRIER	2	D1, D2
......3	211-3904	TSTR,2N3904	1	Q6
......3	218-0032	TSTR,TIP32A,2N6125	1	Q5
......3	330-0200	FUSE,3AG,2 AMP	1	F1
......3	360-0010	FERRITE TOROID 5961001101	1	L7
......3	364-0002	CHOKE,VK200-20/4B FERROXCUBE	2	L1, L4
......3	364-0010	CHOKE,MOLDED RF 10UHY 10%	1	L3
......3	364-0032	COIL,MOLDED .032UH	1	L6

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
......3	364-0051	COIL,MOLDED .051UH	1	L2
......3	415-2068	CLIP,FUSE,15AMP,LITTLEFUSE,102071	2	
......3	417-0677	CONN,PCB MT,6PIN MALE	1	J16
......3	417-5022	SKT,LEAD .020 D,SAMTEC SEP-266	1	
......3	519-0105	PCB,BLANK RF AMP FX50	1	
......3	601-0022	WIRE,AWG22,BUSS	0.083	W1
......3	640-1800	WIRE AWG 18 EN MAGNET	0.031	L5, L8
......3	693-0220	TUB,TEFLON,TW,AWG22 NTL	0.083	
....2	919-0410-004	ASSY,PCB,REGULATOR,FM-100C (SBCM)	1	
......3	030-1053	CAP,MYLAR FILM,.1uF,100V,RAD	4	C404, C405, C406, C407,
......3	042-3922	CAP,MICA,390PF,100V,5%	3	C401, C402, C403,
......3	100-1231	RES,121 OHM,1/4W,1%	1	R401
......3	229-0335	IC,LM335,TEMPERATURE SENSOR	1	U401
......3	360-0001	FERRITE BEADS,F-R 2643000301	13	FB401, FB402, FB403, FB404, FB405, FB406, FB407, FB408, FB409, FB410, FB411, FB412, FB413,
......3	417-0169	CONN 15 PIN 640503-1 AMP	1	J401
......3	417-0299	SOCKET,TO-3,PCB MT	3	XU402, XQ401, XQ402
......3	519-0410-004	PCB,MACH,REGULATOR,FM-100C	1	
......3	601-0022	WIRE,AWG22,BUSS	0.8	
....2	949-0144	ASSY, WIRE HRNS,FX50 RF AMP (SBCM)	1	
......3	402-0000	TY-RAP	11	
......3	410-0060	LUG,TERM,#10 RING CRIMP 10-12G	1	
......3	410-1553	LUG,TERM #10 RING CRIMP 16-22	1	

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
......3	417-0036	PIN CONN,AMP,350967-1	19	
......3	417-0053	SKT,CONN 641294-1 AMP	19	
......3	417-0175	CONN, HOUSING, 20 PIN	1	J15
......3	417-2379	CONN,155OC HOUSING,AMP,MR	1	
......3	418-0034	PLUG,BNC DUAL CRIMP 1-227079-6	2	
......3	418-0670	HOUSING,CONN,6PIN FEM	1	P16
......3	601-1800	WIRE,AWG18 19/30 BLK	20	
......3	601-2209	WIRE,AWG22,19/34 WHT	20	
......3	621-1359	CBL,COAX,RG316/U,50 OHM	1	
......3	693-0002	SLVG,1/4 EXPANDO FR BLACK"	1	
..1	961-0003-100	KIT, HARDWARE RACK, FX50	1	
....2	402-0001	TY-RAP,T+B TY24M,1-1/4 DIA	4	
....2	420-0108	SCREW,10-32X.500,S.S. PHH	4	
....2	420-0508	SCREW,10-32X.500,S.S. FLH	8	
....2	420-8006	SCREW,8-32X.375,S.S. PH FLH UC	4	FOR CUSTOMER TO MOUNT OUTER SLIDE RAILS.
....2	420-8110	SCREW,8-32X.625,S.S. PHH	4	
....2	421-0102	10-32 KEP NUT	8	
....2	423-0001	WASHER,FLAT,#10 SST,.438 X .203 X .065	8	
....2	459-0138-001	RETAINER,SLIDE BRKT	2	
....2	469-0415	SLIDE, EXCITER CHASSIS	1	
....2	470-0102	BRKT,MTG,EXCITER SLIDES	4	
....2	701-0005	ANTISTATIC ZIPLOC BAG 4X6 4MIL	1	

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
0	909-1051-525	FX-50,EXCITER,220V,NICKEL GRAY		
..1	334-0150	FUSE,3AG,1.5 AMP,SLO-BLO	2	
..1	334-0300	FUSE,3AG,3A,125V,SLOW BLOW	-2	
..1	682-0001	CORD LINE,3 COND,DETACH 7.5FT	-1	
..1	682-0003	CORD,PWR EUROPEAN RIGHT ANGLE, 6'	1	
..1	909-1051-425	FX-50 EXCITER 117V,NICKEL GRAY	1	
....2	027-2200	CAP,LYTIC,22000UF,50V (NOTE)	1	
....2	140-0008	VARISTOR,V250LA20A GE	2	
....2	230-3502	RECT,ASSY,35A 200V	1	
....2	330-1200	FUSE, 12A, 250V, CERAMIC, SLO-BLOW	1	
....2	334-0100	FUSE,1A MDL SLO BLO 250V	2	
....2	334-0300	FUSE,3AG,3A,125V,SLOW BLOW	1	
....2	360-0003	FERRITE BEAD,.291 DIA	2	
....2	360-6504	FUSE,LINE FILTER MOD,120/240V	1	
....2	376-0050	XFMR,POWER, FX50 AM13377B	1	
....2	380-4600	FAN,4 1/2	1	
....2	380-5502	FILTER,FAN	1	
....2	380-6307	FINGER GUARD,FAN,4.125 CENTERS	1	
....2	400-0024	SHOCK MT,MODULATED OSC FX50	1	
....2	402-0000	TY-RAP	11	
....2	402-0008	MTG DEVICE,FOR #6SCR,TIE CBL	2	
....2	402-0051	TY-RAP, W/FLAG	1	
....2	407-0023	SHIELD,CAP FX30	1	
....2	410-0057	LUG,TERM,#10 RING CRIMP14-16GA	1	
....2	410-1421	LUG,QUICK DISCONNECT #18-22	1	
....2	415-1010	FUSE CLIP,LITTLEFUSE,101002	2	
....2	415-1011	FUSE CLIP,LITTLEFUSE,105002	1	

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
....2	415-2012	FUSEHOLDER,PANEL MOUNT, 10A	2	
....2	415-2012-020	FUSEHOLDER,PANEL MOUNT, 20A	1	
....2	417-0016	CONN,BNC,RF,UG1094A/U,AMPHENOL	2	
....2	417-0017	RECP,BNC,BULKHEAD,UG-492A/U	1	
....2	417-0053	SKT,CONN 641294-1 AMP	9	
....2	418-0670	HOUSING,CONN,6PIN FEM	1	
....2	420-0108	SCREW,10-32X.500,S.S. PHH	2	
....2	420-0817	ASSY,FEMALE SCREWLOCK 205817-1	1	
....2	420-4105	SCREW,4-40X.312,S.S. PH	2	
....2	420-4110	SCREW,4-40X.625,S.S. PH	4	
....2	420-6104	SCREW,6-32X.250,S.S. PH	8	
....2	420-6105	SCREW,6-32X.312,S.S. PH	14	
....2	420-6108	SCREW,6-32X.500,S.S. PH	1	
....2	420-6112	SCREW,6-32X.750,S.S. PH	2	
....2	420-6605	SCREW,6-32X.312,S.S. PH FH UC	11	
....2	420-8107	SCREW,8-32X.437,S.S. PHH	12	
....2	420-8116	SCREW,8-32X.250,S.S. PH FLH UC	4	
....2	421-1102	RIV,BLD,DOMED 3/32	2	
....2	421-1113	RIV,CLOSED-END .125 X .316L	1	
....2	421-4008	4-40 KEP NUT	8	
....2	421-6001	6-32 S.S. HEX THIN NUT	7	
....2	421-6008	6-32 KEP NUT	1	
....2	421-8001	8-32 S.S. HEX NUT	8	
....2	421-8028	NUT,JAM,1/2-28 UNEF-2B	5	
....2	422-6106	SCREW,SEMS 6-32 X 3/8 PAN PH. ST."	12	
....2	422-6107	SCREW,SEMS 6-32 X 7/16 PAN PH.ST."	1	
....2	423-0001	WASHER,FLAT,#10 SST,.438 X .203 X .065	5	

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
....2	423-0003	#10 LOCK INT TOOTH	2	
....2	423-3004	5/16 LOCK INT TOOTH THIN	2	
....2	423-6002	#6 LOCK SPLIT	27	
....2	423-6003	#6 LOCK INT TOOTH	6	
....2	423-6011	#6 FLAT .310 X .160 X .030	4	
....2	423-8001	#8 FLAT .375 X .170 X .025	7	
....2	423-8002	#8 LOCK SPLIT	21	
....2	423-8004	#8 LOCK EXT TOOTH	1	
....2	423-9002	WASH,INT TOOTH,1/2	5	
....2	441-0012	STOFF,#6-32 MALE-FEMALE 1/4	6	
....2	441-8217	STOFF,ALUM 1/4HEX X 5/8 6-32	5	
....2	453-6701	CAP,MTG,BRKT,MALLORY,VR12	1	
....2	465-0090-101	ANGLE,UPPER FRT PNL,CE EXCITER	1	
....2	465-0091-100	ANGLE,LOWER FRT PNL,FX50	1	
....2	466-0093	ANGLE,FRONT PANEL MOUNT,FX50	2	
....2	467-0178	BOOT,INSULATING FOR 360-6504	1	
....2	467-1003	OVERLAY,FX50	1	
....2	469-0365	FINGER STOCK,1S197520A	32	
....2	469-0365-1	STRIP,RFI SHIELD	2	
......3	469-0365	FINGER STOCK,1S197520A	2.75	
....2	469-0366-1	STRIP,RFI SHIELD 1.25	4	
......3	469-0366	FINGER STOCK (NOTE!!!!!)	1.25	
....2	469-0366-2	STRIP,RFI SHIELD 4.25	6	
......3	469-0366	FINGER STOCK (NOTE!!!!!)	4.25	
....2	471-0360	COVER,AFC/PLL PCB FX50	1	
......3	471-0360-009	COVER,AFC/PLL PCB UNSCREENED	1	
....2	471-0584-100	COVER,TOP,FM250C/E	1	
....2	471-0631	SHIELD,XFMR FX50	1	

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
....2	471-0795	SHIELD,FRONT PANEL PCB,FX-50	1	
......3	471-0795-009	SHLD,FRT PNL PCB,FX-50,UNSCRND	1	
....2	471-0962-100	PANEL,REAR,FX-50E/FX-50,SCREENED	1	
....2	471-5289-001	BRACKET,FUSE HOLDER,FX50,SCREENED	1	
......3	471-5289	BRACKET,FUSE HOLDER,FX50,FM100,FM250,UNSCREENED	1	
....2	471-6269-300	PANEL,STATUS,FX50,HD COLORS	1	
....2	474-0300	PLATE,MODULATED OSC FX50	1	
....2	486-0004	HANDLE 1 3/4	2	
....2	486-0014	FERRULE,BLK,FOR .25 DIA HANDLE	4	
....2	488-0010	LATCH,LO-PROFILE 27-10-501-50	2	
....2	520-0034-100	CHASSIS,FX50/FX50E	1	
....2	591-0001	PLATE,FCC ID	1	
....2	594-0095	LABEL,1EC LINE RCPT 700-0152	1	
....2	594-0250	LABEL,CAUTION,TOP COVER,FM EXC	1	
....2	594-0500	LABEL,DANGER	1	
....2	601-1802	WIRE,AWG18,19/30 RED (*NOTE)	0.25	
....2	611-1250	TUB,HT SHK,1/8	0.01	
....2	690-1200	TUB,BLK,PVC 105C,1/2	0.354	
....2	700-0145	FILM,2 DOUBLE ADHESIVE #467	0.003	
....2	919-0104	ASSY PCB,AFC/PLL	1	
......3	000-3302	CAP,CER,DISC,3.3PF,1000V	1	C59
......3	001-5004	CAP,CER,DISC,5PF,500V,NPO	4	C15, C16, C56, C57
......3	003-1054	CAP,CER,MNLY,.1uF,50V,20%	24	C1, C3, C5, C6, C7, C8, C10, C12, C13, C21, C24, C27, C32, C33, C39, C43, C51, C55, C58, C60, C61, C64, C66, C41

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
......3	020-4793	CAP,LYTIC,4700UF,16V,LOW LEAK	1	C35
......3	023-1076	CAP,LYTIC,10uF,50V,STDUP	5	C42, C68, C70, C72, C73
......3	023-1084	CAP,LYTIC,100MFD,35V,STDUP,RAD	11	C4, C15, C22, C23, C25, C49, C50, C52, C53, C69, C71
......3	024-1064	CAP,LYTIC,1UF,50V,RAD	1	C29
......3	024-3364	CAP,LYTIC,3.3UF,50V,NP	1	C30
......3	024-3374	CAP,LYTIC,33UF,35V,STDUP	1	C37
......3	024-4764	CAP,LYTIC,4.7UF,50V,20%,STDUP	1	C28
......3	030-1053	CAP,MYLAR FILM,.1uF,100V,RAD	1	C31
......3	030-2253	CAP,MYLAR FILM,.22UF,100V,RAD	4	C34, C38, C48, C54
......3	031-1043	CAP,MYLAR FILM,.01UF,100V,RAD	3	C9, C11, C40
......3	031-2243	CAP,MYLAR FILM,.022UF,200V,RAD	1	C26
......3	038-4753	CAP,PYST,.47UF,100V	1	C44
......3	040-2422	CAP,MICA,240PF	3	C45, C46, C47
......3	042-2531	CAP,MICA,2500PF,500V,1%	1	C62
......3	042-3312	CAP,MICA,33PF,500V,5%	2	C65, C67
......3	042-3922	CAP,MICA,390PF,100V,5%	6	C2, C17, C18, C19, C20, C36
......3	042-5031	CAP,MICA,5000PF,500V,1%	1	C63
......3	100-1031	RES,100 OHM,1/4W,1%,METAL	1	R22
......3	100-1041	RES,1K OHM,1/4W,1%	7	R10, R42, R40, R44, R23, R84, R85
......3	100-1051	RES,10K OHM,1/4W,1%	15	R6, R13, R37, R15, R16, R24, R46, R47, R48, R95, R75, R76, R50, R103, R67,
......3	100-1111	RES,118 OHM,1/4W,1%	1	R32
......3	100-1231	RES,121 OHM,1/4W,1%	3	R21, R97, R99
......3	100-1551	RES,15K OHM,1/4W,1%	4	R25, R26, R27, R51

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
......3	100-1731	RES,174 OHM,1/4W,1%	1	R59
......3	100-2723	RES,27 OHM,1/4W,5%	1	R34
......3	100-3031	RES,301 OHM,1/4W,1%	1	R57
......3	100-3951	RES,39.2K OHM,1/4W,1%	1	R9
......3	100-4773	RES,4.7MEG OHM,1/4W,5%	1	R43
......3	100-5041	RES,4.99K OHM,1/4W,1%	4	R29, R30, R88, R90
......3	100-5663	RES,560K OHM,1/4W,5%	1	R19
......3	103-1007	RES,1 MEG OHM,1/4W,1%,METAL	8	R71, R72, R79, R77, R86, R89, R70, R78
......3	103-1021	RES,10 OHM,1/4W,1%,METAL	1	R1
......3	103-1062	RES,100K OHM,1/4W,1%,METAL	5	R17, R18, R64, R65, R66
......3	103-1215	RES,12.1K OHM,1/4W,1%,METAL	1	R11
......3	103-1331	RES,1.33K OHM,1/4W,1%,METAL	2	R98, R100
......3	103-1375	RES,13.7K OHM,1/4W,1%,METAL	1	R101
......3	103-1504	RES,1.5K OHM,1/4W,1%,METAL	1	R28,
......3	103-1745	RES,17.4K OHM,1/4W,1%,METAL	1	R82
......3	103-1825	RES,18.2K OHM,1/4W,1%,METAL	1	R92
......3	103-2213	RES,221 OHM,1/4W,1%,METAL	1	R33
......3	103-2673	RES,267 OHM,1/4W,1%,METAL	5	R7, R14, R38, R93, R94
......3	103-3014	RES,3.01K OHM,1/4W,1%,METAL	1	R83
......3	103-3323	RES,332 OHM,1/4W,1%,METAL	2	R2, R8
......3	103-3324	RES,3.32K OHM,1/4W,1%,METAL	2	R4, R5
......3	103-3631	RES,365 OHM,1/4W,1%,METAL	1	R20
......3	103-3836	RES,383K OHM,,1/4W,1%,METAL	1	R39
......3	103-4361	RES,432K OHM,1/4W,1%,METAL	1	R53
......3	103-4753	RES,475 OHM,1/4W,1%,METAL	2	R45, R61
......3	103-4755	RES,47.5K OHM,1/4W,1%,METAL	1	R31

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
......3	103-4951	RES,49.9K OHM,1/4W,1%,METAL	2	R36, R12
......3	103-5112	RES,51.1 OHM,1/4W,1%,METAL	2	R3, R74
......3	103-5113	RES,511 OHM,1/4W,1%,METAL	1	R49
......3	103-5624	RES,5.62K OHM,1/4W,1%,METAL	1	R41
......3	103-6193	RES,619 OHM,1/4W,1%,METAL	1	R87
......3	103-6194	RES,6.19K OHM,1/4W,1%,METAL	2	R54, R62
......3	103-6346	RES,634K OHM,1/4W,1%,METAL	1	R60
......3	103-7326	RES,732K OHM,1/4W,1%,METAL	1	R58
......3	103-7503	RES,750 OHM,1/4W,1%,METAL	1	R55
......3	103-7541	RES,7.50K OHM,1/4W,1%,METAL	2	R68, R80
......3	103-8255	RES,82.5K OHM,1/4W,1%,METAL	1	R35
......3	103-8256	RES,825K OHM,1/4W,1%,METAL	1	R56
......3	175-1034	RES,TRMR,1K,VERT ADJ	1	R63
......3	177-5044	RES,TRMR,5K,VERT ADJ	3	R69, R81, R91
......3	177-5054	RES,TRMR,50K,VERT ADJ	1	R52
......3	200-0009	DIODE,ZENER,1N 4739A	2	D17, D19
......3	203-4005	DIODE,1N4005	2	D16, D18
......3	203-4148	DIODE,1N4148	7	D1, D2, D3, D4, D5, D6, D7,
......3	211-3904	TSTR,2N3904	4	Q1, Q2, Q3, Q4
......3	220-0317	VR,LM317LZ TO92	1	U6
......3	220-4040	IC,MC14040B 12-BIT BINARY	1	U2
......3	220-5151	IC,MC145151 SYNTHESIZER	1	U9
......3	220-8658	IC,SP8658 PRESCALER,DIVIDE/20	1	U8
......3	221-0072	AMP,OP,BIFET TLO72CP	1	U11
......3	221-0358	AMP,DUAL OP,LM358	1	U13
......3	221-5532-001	IC,NE-5532AN	4	U10, U14, U15, U16
......3	226-0392	RES NETWORK, 10K	2	R73, R96

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
......3	227-0317	VR,LM317T,LM317KC	1	U17
......3	227-0337	VOLTAGE REGULATOR,3 TERM, NEG	1	U18
......3	228-0290	IC, 74LS90N (N)	1	U1
......3	228-4013	IC,MC14013B	1	U4
......3	228-4073	IC,MC14073B	1	U3
......3	228-4538	IC,MC14538B NATL SEMICONDUCTOR	2	U5, U12
......3	323-7345	LDR,LED TYPE,VACTEC VTL 5C2	3	LDR1, LDR2, LDR3
......3	323-9224	IND,LED,GRN,521-9270	5	DS1, DS2, DS3, DS4, DS5
......3	340-0002	SW,4 POS,SPST,8-PIN DIP	3	S1, S2, S3
......3	340-0004	SW,JUMPER PROGRAMMABLE	5	P3, P4, P5A, P5B, P10
......3	360-2200	CHOKE,RF 2.2UH 550MA	2	L1, L2
......3	364-0047	COIL, MOLDED .47UH	1	L3
......3	370-0002	XMFR,RF,MCL,T4-1 (NOTE)	1	T1
......3	390-0001	OSC,XTAL PC MT TCXO 10MHZ	1	Y1
......3	402-0000	TY-RAP	2	
......3	407-0074	SPR,LED .25 ODX.147 1D X.22L	5	
......3	413-1597	TERM,TURRET,2 SHLDR,.219,GOLD FLASH	5	
......3	417-0003	CONN,HEADER 3 PIN	3	J3.J4, J10
......3	417-0004	JACK,TEST,RIGHT ANGLE PC MT	1	TP1
......3	417-0200	CONN,HEADER 20 PIN	2	J5, J8, J2, J1,
......3	417-0804	SOCKET,8-PIN DIP,BURNDY	6	XU10, XU11, XU13, XU14, XU15, XU16
......3	417-1404	SOCKET,14-PIN DIP	3	XU1, XU3, XU4
......3	417-1604	SKT,16-PIN,DIP	5	XU2, XU5, XU12, XR73, XR96
......3	417-2804	SOCKET,IC 28-PIN,DIP,HI RELIABILITY	1	XU9
......3	420-6104	SCREW,6-32X.250,S.S. PH	2	

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
......3	423-6002	#6 LOCK SPLIT	2	
......3	426-6000	PEM NUT,#6-32 KFS2-632	6	
......3	519-0104	PCB,BLANK,AFC/PLL (scan)	1	
......3	700-0148	TAPE,JOINING 3/4	0.001	
......3	949-1050-001	ASSY, CABLE, AFC-PLL (SBCM)	1	
........4	402-0051	TY-RAP, W/FLAG	1	
........4	418-0034	PLUG,BNC DUAL CRIMP 1-227079-6	1	
........4	621-1359	CBL,COAX,RG316/U,50 OHM	1.25	
........4	690-0023	TUB,PVC105/7 BLK,ALPHA	1.25	
....2	919-0107	ASSY PCB,P.S./CNTL	1	
......3	001-1014	CAP,CER,DISC,10pF,1KV,10%,NPO	2	C3, C4
......3	003-1054	CAP,CER,MNLY,.1uF,50V,20%	9	C5, C6, C7, C16, C25, C28, C30, C33, C37
......3	014-1084	CAP,LYTIC,100UF,50V,INS	1	C15
......3	014-1094	CAP,LYTIC,1000UF,50V,INS	2	C24, C29
......3	023-1076	CAP,LYTIC,10uF,50V,STDUP	1	C17
......3	023-1084	CAP,LYTIC,100MFD,35V,STDUP,RAD	6	C26, C27, C31, C32, C35, C36
......3	024-1064	CAP,LYTIC,1UF,50V,RAD	2	C11, C23
......3	024-2274	CAP,LYTIC,22UF,100V,STDUP	1	C34
......3	030-1033	CAP,CER MOLDED,.001UF,200V,10%	2	C12, C20
......3	031-1043	CAP,MYLAR FILM,.01UF,100V,RAD	2	C8, C10
......3	040-5013	CAP,MICA,50PF,500V,5%	1	C13
......3	042-3922	CAP,MICA,390PF,100V,5%	5	C1, C2, C14, C18, C19
......3	100-1013	RES,1 OHM,1/4W,5%	1	R64
......3	100-1031	RES,100 OHM,1/4W,1%,METAL	1	R72
......3	100-1041	RES,1K OHM,1/4W,1%	7	R6, R73, R61, R37, R12, R50, R59

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
......3	100-1051	RES,10K OHM,1/4W,1%	10	R4, R8, R30, R28, R32, R33, R42, R43, R55, R65
......3	100-1231	RES,121 OHM,1/4W,1%	2	R76, R78
......3	100-1551	RES,15K OHM,1/4W,1%	3	R15, R24, R22
......3	100-1841	RES,1.82K OHM,1/4W,1%	6	R77, R79, R1, R2, R36, R11
......3	103-1007	RES,1 MEG OHM,1/4W,1%,METAL	5	R21, R34, R44, R45, R87
......3	103-1021	RES,10 OHM,1/4W,1%,METAL	2	R60, R51
......3	103-1062	RES,100K OHM,1/4W,1%,METAL	5	R3, R7, R23, R47, R41
......3	103-1215	RES,12.1K OHM,1/4W,1%,METAL	1	R14
......3	103-1261	RES,121K OHM,1/4W,1%,METAL	2	R82, R86
......3	103-1504	RES,1.5K OHM,1/4W,1%,METAL	1	R10
......3	103-1561	RES,150K OHM,1/4W,1%,METAL	1	R31
......3	103-2212	RES,22.1 OHM,1/4W,1%,METAL	1	R54
......3	103-2241	RES,2.21K OHM,1/4W,1%,METAL	1	R39
......3	103-3324	RES,3.32K OHM,1/4W,1%,METAL	1	R29
......3	103-3325	RES,33.2K OHM,1/4W,1%,METAL	3	R35, R40, R48
......3	103-3631	RES,365 OHM,1/4W,1%,METAL	1	R75
......3	103-3924	RES,3.92K OHM,1/4W,1%,METAL	2	R16, R18
......3	103-4755	RES,47.5K OHM,1/4W,1%,METAL	8	R38, R85, R80, R81, R83, R84, R26, R57
......3	103-5141	RES,5.11K OHM,1/4W,1%,METAL	2	R13, R49
......3	103-6194	RES,6.19K OHM,1/4W,1%,METAL	2	R17, R19
......3	103-6346	RES,634K OHM,1/4W,1%,METAL	1	R46
......3	103-6813	RES,681 OHM,1/4W,1%,METAL	1	R53
......3	103-6814	RES,6.81K OHM,1/4W,1%,METAL	1	R20
......3	110-2233	RES,220 OHM,1/2W,5%	1	R56

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
......3	132-0114	RES,1.5 OHM,10W,5%,WW	1	R74
......3	132-2003	RES,.2 OHM,5W,5%,WW	4	R70, R71, R62, R63
......3	140-0018	VARISTOR,V477A1 47V GE	1	MOV1
......3	178-1054	RES,TRMR,10K,HORZ ADJ	1	R25
......3	178-2044	RES,TRMR,2K,HORZ ADJ	2	R5, R27
......3	178-5044	RES,TRMR,5K,HORZ ADJ	1	R9
......3	178-5046	RES,TRMR,5K,1/2W,MT	1	R52
......3	200-0015	DIODE,ZENER,15V,1W,1N4744A	1	D27
......3	200-0027	DIODE,ZENER,1N4750A,27V	1	D5
......3	200-4751	DIODE,ZENER,IN4751A 30V 1W	1	D6
......3	201-4728	DIODE,ZENER,1N4728	2	D29, D30
......3	202-0502	RECT,3A,200V,IN5402	1	D18
......3	203-4005	DIODE,1N4005	14	D13, D14, D16, D17, D19, D20, D12, D15, D21, D22, D23, D24, D25, D26
......3	203-4148	DIODE,1N4148	8	D1, D2, D3, D4, D8, D11, D28, D31
......3	210-3906	2N3906 PNP 40V 2A .35W 250MHZ	2	Q3, Q5
......3	211-3904	TSTR,2N3904	2	Q4, Q2
......3	221-0358	AMP,DUAL OP,LM358	3	U1, U2, U3
......3	227-0317	VR,LM317T,LM317KC	1	U5
......3	227-0337	VOLTAGE REGULATOR,3 TERM, NEG	1	U6
......3	227-0723	IC,VR,UA723	1	U4
......3	237-0007	SCR,25A,100V,2N6505	1	D7
......3	330-0802	FUSE,FAST ACTING,8A,GBB-8,BUSS	1	F1
......3	340-0004	SW,JUMPER PROGRAMMABLE	1	P22
......3	345-0863	SW,SLD,DPDT,SWCFT C56206L2	3	S1, S2, S3
......3	360-0003	FERRITE BEAD,.291 DIA	2	

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
......3	407-0141	COVER,FUSE,STD 840836 RICHCO	1	
......3	413-0025	TERM,TURRET,2 SHLDR,.360,GOLD FLASH	8	E1, E2, E3, E4, E5, E6, E7, E8,
......3	413-0106	TERM,TEST POINT,OVAL,RED	8	TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8
......3	415-2068	CLIP,FUSE,15AMP,LITTLEFUSE,102071	2	XF1, XF2
......3	417-0003	CONN,HEADER 3 PIN	1	J22
......3	417-0169	CONN 15 PIN 640503-1 AMP	1	J11
......3	417-0200	CONN,HEADER 20 PIN	2	J12, J13, J23,
......3	417-0804	SOCKET,8-PIN DIP,BURNDY	3	XU1, XU2, XU3
......3	417-1404	SOCKET,14-PIN DIP	1	XU4
......3	418-0900	CONN,9 PIN 640501-5 AMP	1	J10
......3	420-6105	SCREW,6-32X.312,S.S. PH	3	
......3	423-6002	#6 LOCK SPLIT	3	
......3	426-6000	PEM NUT,#6-32 KFS2-632	3	
......3	455-7805	HEATSINK,TO-220PKG,LOW PROFILE	2	
......3	519-0107-001	PCB,MACH,P.S./CNTL,FM-100C (scan)	1	
....2	919-0108	ASSY PCB,METERING	1	
......3	001-5004	CAP,CER,DISC,5PF,500V,NPO	2	C8, C11
......3	003-1054	CAP,CER,MNLY,.1uF,50V,20%	35	C2, C3, C4, C9, C10, C15, C17, C18, C19, C21, C22, C24, C27, C28, C30, C31, C34, C35, C36, C37, C38, C39, C40, C41, C42, C43, C44, C45, C50, C52, C54, C56, C57, C61, C63
......3	020-1085	CAP,LYTIC,100UF,50V,STDUP,NP	1	C1
......3	023-1076	CAP,LYTIC,10uF,50V,STDUP	9	C12, C32, C33, C51, C53, C55, C58, C60, C62

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
......3	023-1084	CAP,LYTIC,100MFD,35V,STDUP,RAD	4	C46, C47, C48, C49
......3	024-2274	CAP,LYTIC,22UF,100V,STDUP	1	C59
......3	030-4743	CAP,POLYESTER FILM,.047UF,100V,RAD	1	C29
......3	031-1043	CAP,MYLAR FILM,.01UF,100V,RAD	1	C13
......3	040-5013	CAP,MICA,50PF,500V,5%	1	C26
......3	042-3312	CAP,MICA,33PF,500V,5%	1	C14
......3	042-3922	CAP,MICA,390PF,100V,5%	6	C6, C7, C16, C20, C23, C25
......3	100-1041	RES,1K OHM,1/4W,1%	13	R18, R20, R98, R99, R100, R101, R102, R103, R104, R105, R106, R107, , R16
......3	100-1051	RES,10K OHM,1/4W,1%	15	R1, R3, R23, R19, R29, R38, R42, R52, R60, R66, R67, R68, R69, R70, R71,
......3	100-1083	RES,10MEG OHM,1/4W,5%	1	R26
......3	100-1111	RES,118 OHM,1/4W,1%	1	R110
......3	100-1231	RES,121 OHM,1/4W,1%	5	R78, R80, R82, R88, R108
......3	100-1873	RES,1.8MEG OHM,1/4W,5%	1	R59
......3	100-2041	RES,2K OHM,1/4W,1%	1	R40
......3	100-2283	RES,22MEG OHM,1/4W,5%	2	R21, R37
......3	100-3051	RES,30.1K OHM,1/4W,1%	1	R55
......3	100-6031	RES,604 OHM,1/4W,1%	1	R89
......3	100-7132	RES,715 OHM,1/4W,1%	1	R13
......3	103-1007	RES,1 MEG OHM,1/4W,1%,METAL	3	R9, R39, R54,
......3	103-1021	RES,10 OHM,1/4W,1%,METAL	3	R33, R34, R36
......3	103-1062	RES,100K OHM,1/4W,1%,METAL	8	R5, R31, R53, R64, R65, R87, R97, R111

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
......3	103-1105	RES,11K OHM,1/4W,1%,METAL	1	R14
......3	103-1214	RES,1.21K OHM,1/4W,1%,METAL	3	R90, R92, R94
......3	103-1274	RES,1.27K OHM,1/4W,1%,METAL	1	R15
......3	103-1331	RES,1.33K OHM,1/4W,1%,METAL	2	R79, R81
......3	103-1504	RES,1.5K OHM,1/4W,1%,METAL	2	R47, R25
......3	103-1695	RES,16.9K OHM,1/4W,1%,METAL	1	R48
......3	103-1826	RES,182K OHM,1/4W,1%,METAL	1	R58
......3	103-1914	RES,1.91K OHM,1/4W,1%,METAL	1	R12
......3	103-2003	RES,200 OHM,1/4W,1%,METAL	2	R75, R76
......3	103-2264	RES,2.26K OHM,1/4W,1%,METAL	1	R109
......3	103-2673	RES,267 OHM,1/4W,1%,METAL	1	R63
......3	103-2675	RES,26.7K OHM,1/4W,1%,METAL	3	R22, R84, R86
......3	103-2751	RES,27.4K OHM,1/4W,1%,METAL	1	R45
......3	103-3061	RES,301K OHM,1/4W,1%,METAL	1	R24
......3	103-3631	RES,365 OHM,1/4W,1%,METAL	1	R83
......3	103-4741	RES,4.75K OHM,1/4W,1%,METAL	1	R43
......3	103-4755	RES,47.5K OHM,1/4W,1%,METAL	5	R57, R61, R62, R85, R96
......3	103-4993	RES,499 OHM,1/4W,1%,METAL	6	R6, R91, R93, R95, R7, R8
......3	103-4996	RES,499K OHM,1/4W,1%,METAL	1	R10
......3	103-5112	RES,51.1 OHM,1/4W,1%,METAL	2	R77, R112
......3	103-5141	RES,5.11K OHM,1/4W,1%,METAL	1	R35
......3	103-5363	RES,536 OHM,1/4W,1%,METAL	1	R11
......3	103-5364	RES,5.36K OHM,1/4W,1%,METAL	2	R2, R4
......3	103-6193	RES,619 OHM,1/4W,1%,METAL	3	R72, R73, R74
......3	103-8254	RES,8.25K OHM,1/4W,1%,METAL	1	R30
......3	103-8255	RES,82.5K OHM,1/4W,1%,METAL	1	R27
......3	103-8453	RES,845 OHM,1/4W,1%,METAL	4	R44, R46, R49, R51

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
......3	103-8454	RES,8.45K OHM,1/4W,1%,METAL	1	R50
......3	103-9314	RES,9.31K OHM,1/4W,1%,METAL	1	R17
......3	177-1054	RES,TRMR,10K,VERT ADJ	1	R56
......3	177-2044	RES,TRMR,2K,VERT ADJ	1	R41
......3	177-2054	RES,TRMR,20K,VERT ADJ	1	R28
......3	200-4733	DIODE,ZENER,1N4733A, 5%	1	D14
......3	200-4742	DIODE,ZENER,1N4742A	2	D18, D19
......3	200-5363	DIODE,ZENER,IN5363 30V SW	1	D25
......3	201-2800	DIODE,HOT CARRIER	3	D3, D4, D24
......3	203-4005	DIODE,1N4005	3	D20, D21, D23
......3	203-4148	DIODE,1N4148	15	D1, D2, D5, D6, D7, D8, D9, D10, D11, D12, D13, D15, D16, D17, D22
......3	210-0271	TSTR,FET J271	1	Q7
......3	210-3906	2N3906 PNP 40V 2A .35W 250MHZ	3	Q3, Q4, Q5
......3	211-3904	TSTR,2N3904	3	Q1, Q2, Q6
......3	220-0317	VR,LM317LZ TO92	1	U17
......3	220-7136	A/D,3-1/2 DIGIT LCD,ICL7136CPL	1	U7
......3	221-0074	AMP,OP,BIFET TLO74CW	2	U1, U2
......3	221-4227	AMP,DUAL OP	2	U4, U5
......3	225-0004	IC,CD4066BE	2	U3, U6
......3	226-0392	RES NETWORK, 10K	1	R32
......3	226-2004	MC1416,ULN2004 7-DRLNGTNS DP16	1	U12
......3	227-0317	VR,LM317T,LM317KC	2	U14, U22
......3	227-0337	VOLTAGE REGULATOR,3 TERM, NEG	2	U15, U16
......3	228-4028	IC,MC14028B	1	U11
......3	228-4071	IC,MC14070 QUAD EXCLUSIVE OR	1	U13
......3	228-4076	IC,MC14076 QUAD REGISTER	1	U10

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
......3	228-4532	IC,MC14532B 8-BIT PRIOR ENCOD	1	U9
......3	228-4538	IC,MC14538B NATL SEMICONDUCTOR	1	U8
......3	229-0555	IC,TIMER,NE555N	1	U18
......3	229-3914	DRIVER,DOT/BAR DISPLAY LM3914N	3	U19, U20, U21
......3	320-0016	LED,GRN PANEL INDICATOR	7	DS2, DS3, DS4, DS5, DS18, DS19, DS20
......3	320-0017	LED,RED MV57173 I OR H	9	DS1, DS6, DS7, DS8, DS13, DS14, DS15, DS16, DS17
......3	320-0021	DISP,LCD,4-DIGIT,0.7	1	DS12
......3	320-4164	LED ARRAY,GRN,10 BAR	2	DS9, DS10
......3	320-7164	LED ARRAY RED MV57164 INTEN G OR H	1	DS11
......3	340-0107	KEYSWITCH,SI20601H1 SECME (NOTE)	6	S1, S2, S3, S4, S5, S6
......3	402-0000	TY-RAP	1	
......3	413-1597	TERM,TURRET,2 SHLDR,.219,GOLD FLASH	7	E1, TP1, TP2, TP3, TP4, TP5, TP6
......3	417-0172	SKT, 20 PIN SINGLE ROW,SAMTEC	2	
......3	417-0200	CONN,HEADER 20 PIN	1	J14
......3	417-0804	SOCKET,8-PIN DIP,BURNDY	3	XU4, XU5, XU18
......3	417-1404	SOCKET,14-PIN DIP	5	XU1, XU2, XU3, XU6, XU13
......3	417-1604	SKT,16-PIN,DIP	6	XU8, XU9, XU10, XU11, XU12, XR32
......3	417-1804	SOCKET,18-PIN,DIP,HIGH RELIABILITY	3	XU19, XU20, XU21
......3	417-4005	SOCKET,40-PIN,DIP,HIGH RELIABILITY	1	XU7
......3	420-6104	SCREW,6-32X.250,S.S. PH	4	
......3	423-6002	#6 LOCK SPLIT	5	
......3	426-6000	PEM NUT,#6-32 KFS2-632	5	
......3	449-0006	TEST CLIP,COILED	1	
......3	519-0108	PCB,BLANK,METERING (scan)	1	

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
....2	919-0190	ASSY,PCB,FM EXITER INTERFACE	1	
......3	103-5141	RES,5.11K OHM,1/4W,1%,METAL	1	R1
......3	340-0004	SW,JUMPER PROGRAMMABLE	1	P3Replaced 417-0309 on 06/21/2007 12:49:19
......3	412-1600	BARR STP,16 POS,BEAU	1	J2
......3	417-0003	CONN,HEADER 3 PIN	1	J3
......3	417-2503	RCPT,25 PIN D, MALE	1	J1
......3	519-0190	PCB,MACH,FM EXCITER INTERFACE	1	
....2	919-0445	ASSY,PCB,RFI FILTER (SBCM)	1	
......3	002-1034	CAP,CER,DISC,.001UF,1000V	3	C301, C302, C303
......3	003-1054	CAP,CER,MNLY,.1uF,50V,20%	8	C304, C305, C306, C307, C308, C309, C310, C311
......3	031-2033	CAP,MYLAR FILM,.0022uF,100V,10%	2	C312, C313,
......3	038-4750	CAP,POLY,.47MFD,50V,10% OR BETTER	2	C324, C325
......3	040-1022	CAP,MICA,100PF,500V,RAD	10	C314, C316, C318, C320, C322, C326, C327, C328, C329, C330
......3	047-1035	CAP,FIL,EMI SUPPR,1000pF,3-PIN	3	FL312, FL313, FL319
......3	100-1041	RES,1K OHM,1/4W,1%	3	R302, R306, R307,
......3	100-1051	RES,10K OHM,1/4W,1%	1	R303,
......3	100-6031	RES,604 OHM,1/4W,1%	1	R308,
......3	103-5112	RES,51.1 OHM,1/4W,1%,METAL	2	R310, R311
......3	103-8254	RES,8.25K OHM,1/4W,1%,METAL	2	R304, R305,
......3	130-2423	RES,240 OHM,2W,5%	2	R301, R309,
......3	201-0012	ZENER VOLTAGE SUPPRESSOR,+/-12V	12	D310, D311, D312, D313, D314, D315, D316, D317, D318, D319, D320, D321

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
......3	201-0027	ZENER VOLTAGE SUPPRESSOR,+/-27V	4	D302, D303, D304, D305
......3	201-0040	ZENER VOLTAGE SUPPRESSOR,+/-18V	4	D306, D307, D308, D309
......3	203-4005	DIODE,1N4005	1	D301,
......3	270-0065	REL,SPDT,12VDC,DIP	1	K301,
......3	340-0004	SW,JUMPER PROGRAMMABLE	2	P308, P309
......3	364-4662	INDU,1.0MH	2	L303, L305,
......3	411-0001	FILTER,EMI 10,000PF 3PIN	21	FL301, FL302, FL303, FL304, FL305, FL306, FL307, FL308, FL309, FL310, FL311, FB312, FB313, FL314, FL315, FL316, FL319, FL320, FL321, FL322, FL323
......3	417-0003	CONN,HEADER 3 PIN	2	J308, J309
......3	417-0039-VLX	CONN,BNC,PCB,VERT MOUNT,VALOX BODY	5	J305, J301, J302, J303, J304
......3	417-0200	CONN,HEADER 20 PIN	1	J307,
......3	417-1276	CONN,PCB,12 PIN	1	J306
......3	417-2502-FER	RCPT,25 PIN D,FEMALE,FERITE FILTER	1	J1
......3	420-6105	SCREW,6-32X.312,S.S. PH	10	
......3	423-6002	#6 LOCK SPLIT	20	
......3	426-6000	PEM NUT,#6-32 KFS2-632	10	
......3	441-0184	STOFF,6-32,MALE-FEMALE,3/8	10	
......3	519-0445-001	PCB,MACH,RFI FILTER	1	
........4	519-0445	PCB,MACH,RFI FILTER BREAKAWAY	0.5	
......3	519-0445-002	PCB,MACH,RFI FILTER SHIELD	1	
........4	519-0445	PCB,MACH,RFI FILTER BREAKAWAY	0.5	

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
....2	949-0149-002	WIRE HARNESS, FX-50E (SBCM)	1	
......3	402-0000	TY-RAP	40	
......3	402-0051	TY-RAP, W/FLAG	15	
......3	410-0051	LUG,TERM,14-16GA,FEMSPADE	1	
......3	410-0065	LUG,TERM #6 RING CRIMP #22 AWG	4	
......3	410-1421	LUG,QUICK DISCONNECT #18-22	2	
......3	410-1552	LUG,TERM #8 RING CRIMP 16-22	2	
......3	410-1553	LUG,TERM #10 RING CRIMP 16-22	5	
......3	417-0036	PIN CONN,AMP,350967-1	6	
......3	417-0053	SKT,CONN 641294-1 AMP	50	
......3	417-0059	CONN,9 PIN 1-640521-0 AMP	1	
......3	417-0122	HSNG,20 POS MOD IV 3-87499-7	2	
......3	417-0123	HSNG,16 POS MOD IV 2-87499-9	1	
......3	417-0148	HSNG,10 POS MOD 1V 1-87499-7	1	
......3	417-0176	CONN,20 PIN FEM,AMP 1-350245-9	1	
......3	417-0224	KEYING PLUG MOD IV 87077 AMP	3	
......3	417-1401	HOUSING,SKT,14PIN,AMP MOD IV	2	
......3	417-2379	CONN,155OC HOUSING,AMP,MR	1	
......3	417-8766	CONTACT,CRIMP,MOD-IV 87809-1	72	
......3	418-0006	HSNG,CONN 6 PIN 1-640510 AMP	1	
......3	418-0034	PLUG,BNC DUAL CRIMP 1-227079-6	4	
......3	418-0701	CONN,HOUSING,2 PIN	1	
......3	418-1271	CONN,HOUSING,12PIN	1	
......3	601-1800	WIRE,AWG18 19/30 BLK	29.272	
......3	601-2209	WIRE,AWG22,19/34 WHT	81.896	
......3	621-1359	CBL,COAX,RG316/U,50 OHM	2.292	
......3	622-8451	WIRE,BELD 8451,SHIELD,1PR	12.75	

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
....2	957-0003	ACCESSORY PARTS KIT FX50	1	
......3	330-1200	FUSE, 12A, 250V, CERAMIC, SLO-BLOW	1	
......3	334-0100	FUSE,1A MDL SLO BLO 250V	2	
......3	334-0300	FUSE,3AG,3A,125V,SLOW BLOW	1	
......3	682-0001	CORD LINE,3 COND,DETACH 7.5FT	1	
......3	701-0001	ENVELOPE,COIN 2-1/2 X 4-1/4	4	
......3	701-0019	ANTISTATIC ZIPLOC BAG 13X18 4M	1	
......3	947-0020	ASSY,CBL BNC ACCESS (SBCM)	2	
........4	417-0094	CONN,BNC RG/U58 31-320 AMPH	2	
........4	622-0050	CBL,SH,50 OHM,RG-58/CU	2.5	
......3	979-9983	KIT,BIND+MAN,FX-50	1	
........4	597-1050	INSTRUCTION MANUAL, FX 50/FX 50E FM EXCITER	1	
........4	598-0010-001	BINDER,1 IN, BLUE,W CD POCKET	1	
....2	959-0203	ASSY MODL,MODLTD. OSC. (SBCM)	1	
......3	008-1020	CAP,FEEDTHRU,100PF 20% 250V	1	C21
......3	008-1033	CAP,FEEDTHRU,1000PF,20%,500V	2	C19, C20
......3	040-6223	CAP,MICA,620PF,300V,5%	1	C23
......3	360-0003	FERRITE BEAD,.291 DIA	3	
......3	364-0002	CHOKE,VK200-20/4B FERROXCUBE	1	L7
......3	402-0000	TY-RAP	5	
......3	402-0006	MT,ADH BACKED,FOR CBL TIES	1	
......3	402-0008	MTG DEVICE,FOR #6SCR,TIE CBL	1	
......3	410-1419	LUG,SOLDER 7/8	1	
......3	417-0016	CONN,BNC,RF,UG1094A/U,AMPHENOL	2	J6, J9
......3	420-4404	SCREW,4-40X.250,S.S. SHCS	7	
......3	420-4504	SCREW,4-40X.250,S.S. PH	1	
......3	420-4506	SCREW,4-40X.375,BR FLH SC	4	

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
......3	423-4004	#4 LOCK EXT TOOTH	7	
......3	470-0328	BRKT,BNC,MOD OSC	1	
......3	479-6443-003	BOX,MOD.,MODULATED OSC FX50	1	
......3	601-0022	WIRE,AWG22,BUSS	0.166	
......3	611-2500	TUB,HT SHK,1/4	0.083	
......3	693-0220	TUB,TEFLON,TW,AWG22 NTL	0.249	
......3	919-0106	ASSY PCB,MODLTD.OSC FX-50	1	
........4	000-3302	CAP,CER,DISC,3.3PF,1000V	1	C16
........4	001-5004	CAP,CER,DISC,5PF,500V,NPO	1	C15
........4	009-4723	CAP,CER CHIP,470PF,200V,5%	2	C3, C22
........4	023-1076	CAP,LYTIC,10uF,50V,STDUP	1	C6
........4	023-1084	CAP,LYTIC,100MFD,35V,STDUP,RAD	2	C4, C7
........4	040-1213	CAP,MICA,12PF,500V,5%	1	C2
........4	042-3312	CAP,MICA,33PF,500V,5%	2	C1, C8
........4	042-3922	CAP,MICA,390PF,100V,5%	9	C5, C9, C10, C11, C12, C13, C14, C17, C18
........4	100-1031	RES,100 OHM,1/4W,1%,METAL	2	R12, R6
........4	100-1041	RES,1K OHM,1/4W,1%	3	R7, R13, R14
........4	100-1111	RES,118 OHM,1/4W,1%	1	R22
........4	100-4561	RES,453K OHM,1/4W,1%	1	R10
........4	103-1007	RES,1 MEG OHM,1/4W,1%,METAL	1	R9
........4	103-1021	RES,10 OHM,1/4W,1%,METAL	4	R1, R11, R15, R20
........4	103-1062	RES,100K OHM,1/4W,1%,METAL	1	R5
........4	103-2213	RES,221 OHM,1/4W,1%,METAL	5	R4, R17, R18, R19, R21
........4	103-2673	RES,267 OHM,1/4W,1%,METAL	1	R8
........4	103-2744	RES,2.74K OHM,1/4W,1%,METAL	1	R16
........4	103-3324	RES,3.32K OHM,1/4W,1%,METAL	1	R3

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
........4	103-5112	RES,51.1 OHM,1/4W,1%,METAL	2	R23, R24
........4	201-2800	DIODE,HOT CARRIER	3	D9, D10, D11
........4	203-4005	DIODE,1N4005	1	D12
........4	205-0109	DIODE,VARI-CAP TUNING	6	D2, D3, D4, D6, D7, D8
........4	205-3201	DIODE,VARACTOR,KV3201 2-11PF	2	D1, D5
........4	211-0006	MPS-A06 NPN 80V .5A .3W 100MHZ	1	Q1
........4	211-5109	TSTR,RF 2N5109 NPN	2	Q4, Q5
........4	212-0310	TSTR,FET N CHAN RF J3100	2	Q2, Q3
........4	360-3300	CHOKE,RF,3.3UH,380MA,9230-32	3	L1, L3, L6
........4	364-0047	COIL, MOLDED .47UH	2	L4, L5
........4	370-0106	COIL, MOD OSC., L2	1	L2
..........5	555-0106	LABOR, 370-0106	1	
..........5	610-0026	SMALL TRANS LINE	0.708	
........4	409-0012	PAD,TSTR 520-021 BIVAR TO-5	2	
........4	413-1597	TERM,TURRET,2 SHLDR,.219,GOLD FLASH	6	E1, E2, E3, E4, E5, E6
........4	440-0018	STOFF,ANTI ROT 7/32 RND X 1/4	4	
........4	519-0106	PCB,BLANK,MODLTD.OSC. (scan)	1	
......3	949-1050	ASSY, CABLE, MOD OSC. (SBCM)	1	
........4	402-0051	TY-RAP, W/FLAG	1	
........4	417-0165	HSNG,5POS MOD IV S.ROW 87499-9	1	
........4	417-0224	KEYING PLUG MOD IV 87077 AMP	1	
........4	417-8766	CONTACT,CRIMP,MOD-IV 87809-1	4	
........4	611-1250	TUB,HT SHK,1/8	2	
........4	621-1359	CBL,COAX,RG316/U,50 OHM	2	
....2	959-0204	ASSY MODL,RF AMP	1	
......3	008-1033	CAP,FEEDTHRU,1000PF,20%,500V	4	C1, C2, C3, C4
......3	040-3312	CAP,MICA,33PF,350V,10%	1	C33

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
......3	046-0005	CAP,MICA,150PF,350V,10%	1	C32,
......3	130-3333	RES,330 OHM,2W,5%	1	R19
......3	210-2860	TSTR,RF,DU2860U 60W DMOS	1	Q4
......3	213-6198	TSTR,RF PWR,2N6198	1	Q3
......3	219-3000	TSTR, DARLINGTON, SI, NPN	2	Q1, Q2
......3	227-0339	VR,LM338K,5AMP ADJUSTABLE	1	U1
......3	229-2830	AMP,RF,HYBRID,MHW5342A	1	U2
......3	330-0802	FUSE,FAST ACTING,8A,GBB-8,BUSS	1	
......3	360-0003	FERRITE BEAD,.291 DIA	15	
......3	402-0000	TY-RAP	1	
......3	402-0835	CLAMP,CBL,3/8	1	
......3	407-0186	TOOL,ADJ 8 T000/5 SPECTROL	1	
......3	407-3000	COVER,TSTR	3	
......3	415-1010	FUSE CLIP,LITTLEFUSE,101002	4	
......3	417-0017	RECP,BNC,BULKHEAD,UG-492A/U	2	J17, J18
......3	418-0010	INSULATOR,MICA,TSTR,TO-3PKG	3	
......3	420-0305	SCREW,4-40X.375,BR PH SC	2	
......3	420-0509	SCREW,10-32X.500,BR SL PAN HD	1	
......3	420-4104	SCREW,4-40X.250,S.S. PH	4	
......3	420-6105	SCREW,6-32X.312,S.S. PH	13	
......3	420-6106	SCREW,6-32X.375,S.S. PH	2	
......3	420-6110	SCREW,6-32X.625,S.S. PH	6	
......3	420-6112	SCREW,6-32X.750,S.S. PH	2	
......3	420-8100	SCREW,8-32X.250,BR SL PAN HD	6	
......3	421-0801	#10-32 BR HEX NUT	1	
......3	421-8002	8-32 HEX NUT, BRASS	1	
......3	423-0005	#10 LOCK SPLIT (BRONZE)	1	
......3	423-1011	#4 LOCK SPLIT (BRONZE)	2	

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
......3	423-4002	#4 LOCK S.S. SPLIT	4	
......3	423-6002	#6 LOCK SPLIT	24	
......3	423-6011	#6 FLAT .310 X .160 X .030	1	
......3	423-8005	#8 LOCK SPLIT	6	
......3	441-0184	STOFF,6-32,MALE-FEMALE,3/8	1	
......3	450-0651	PLUG,HOLE,5/16	1	
......3	455-0049-001	HEATSINK,RF AMP,FX50	1	
......3	471-0585	COVER,RF AMP FX50	1	
........4	471-0585-009	COVER,RF AMP,UNSCREENED FX50	1	
......3	474-0301	PLATE,FRT,RF AMP PCB COVER	1	
......3	474-0302	PLATE,BACK,RF AMP PCB COVER	1	
......3	919-0105-001	ASSY PCB,RF AMP FX-50	1	
........4	002-1034	CAP,CER,DISC,.001UF,1000V	1	C26
........4	009-6813	CAP,CER CHIP,68PF,500V,5%	1	C43
........4	024-3374	CAP,LYTIC,33UF,35V,STDUP	2	C23, C31,
........4	038-4753	CAP,PYST,.47UF,100V	2	C22, C30,
........4	040-3312	CAP,MICA,33PF,350V,10%	1	C35,
........4	040-5013	CAP,MICA,50PF,500V,5%	2	C37, C41,
........4	040-6813	CAP,MICA,68PF,500V,5%	1	C13,
........4	042-2000	CAP,MICA,200PF,350V,10%	4	C14, C15, C25, C36,
........4	042-3922	CAP,MICA,390PF,100V,5%	12	C8, C9, C11, C12, C19, C21, C28, C29, C38, C39, C40, C42,
........4	046-0003	CAP,MICA,RF,80PF,350V,10%	2	C17, C18,
........4	046-0004	CAP,MICA,47PF,350V,10%	2	C34, C20,
........4	046-0005	CAP,MICA,150PF,350V,10%	2	C16, C24,
........4	100-1031	RES,100 OHM,1/4W,1%,METAL	2	R14, R20,
........4	100-1051	RES,10K OHM,1/4W,1%	3	R4, R13, R15,

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
........4	100-2041	RES,2K OHM,1/4W,1%	1	R5,
........4	103-2212	RES,22.1 OHM,1/4W,1%,METAL	2	R8, R21,
........4	103-4324	RES,4.32K OHM,1/4W,1%,METAL	1	R2,
........4	103-4755	RES,47.5K OHM,1/4W,1%,METAL	1	R3,
........4	103-4993	RES,499 OHM,1/4W,1%,METAL	1	R18,
........4	103-5112	RES,51.1 OHM,1/4W,1%,METAL	1	R7,
........4	103-7541	RES,7.50K OHM,1/4W,1%,METAL	1	R16,
........4	110-3623	RES,36 OHM,1/2W,5%	1	R6,
........4	130-2223	RES,22 OHM,2W,5%	2	R9, R11,
........4	130-4723	RES,47 OHM,2W,5%	1	R10
........4	177-2034	RES,TRMR,200 OHM,VERT ADJ	1	R12
........4	177-2045	RES,TRMR,2K,10T,TOP ADJ 3299W	1	R17
........4	201-2800	DIODE,HOT CARRIER	2	D1, D2
........4	211-3904	TSTR,2N3904	1	Q6
........4	218-0032	TSTR,TIP32A,2N6125	1	Q5
........4	330-0200	FUSE,3AG,2 AMP	1	F1
........4	360-0010	FERRITE TOROID 5961001101	1	L7
........4	364-0002	CHOKE,VK200-20/4B FERROXCUBE	2	L1, L4
........4	364-0010	CHOKE,MOLDED RF 10UHY 10%	1	L3
........4	364-0032	COIL,MOLDED .032UH	1	L6
........4	364-0051	COIL,MOLDED .051UH	1	L2
........4	415-2068	CLIP,FUSE,15AMP,LITTLEFUSE,102071	2	
........4	417-0677	CONN,PCB MT,6PIN MALE	1	J16
........4	417-5022	SKT,LEAD .020 D,SAMTEC SEP-266	1	
........4	519-0105	PCB,BLANK RF AMP FX50	1	
........4	601-0022	WIRE,AWG22,BUSS	0.083	W1
........4	640-1800	WIRE AWG 18 EN MAGNET	0.031	L5, L8
........4	693-0220	TUB,TEFLON,TW,AWG22 NTL	0.083	

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
......3	919-0410-004	ASSY,PCB,REGULATOR,FM-100C (SBCM)	1	
........4	030-1053	CAP,MYLAR FILM,.1uF,100V,RAD	4	C404, C405, C406, C407,
........4	042-3922	CAP,MICA,390PF,100V,5%	3	C401, C402, C403,
........4	100-1231	RES,121 OHM,1/4W,1%	1	R401
........4	229-0335	IC,LM335,TEMPERATURE SENSOR	1	U401
........4	360-0001	FERRITE BEADS,F-R 2643000301	13	FB401, FB402, FB403, FB404, FB405, FB406, FB407, FB408, FB409, FB410, FB411, FB412, FB413,
........4	417-0169	CONN 15 PIN 640503-1 AMP	1	J401
........4	417-0299	SOCKET,TO-3,PCB MT	3	XU402, XQ401, XQ402
........4	519-0410-004	PCB,MACH,REGULATOR,FM-100C	1	
........4	601-0022	WIRE,AWG22,BUSS	0.8	
......3	949-0144	ASSY, WIRE HRNS,FX50 RF AMP (SBCM)	1	
........4	402-0000	TY-RAP	11	
........4	410-0060	LUG,TERM,#10 RING CRIMP 10-12G	1	
........4	410-1553	LUG,TERM #10 RING CRIMP 16-22	1	
........4	417-0036	PIN CONN,AMP,350967-1	19	
........4	417-0053	SKT,CONN 641294-1 AMP	19	
........4	417-0175	CONN, HOUSING, 20 PIN	1	J15
........4	417-2379	CONN,155OC HOUSING,AMP,MR	1	
........4	418-0034	PLUG,BNC DUAL CRIMP 1-227079-6	2	
........4	418-0670	HOUSING,CONN,6PIN FEM	1	P16
........4	601-1800	WIRE,AWG18 19/30 BLK	20	
........4	601-2209	WIRE,AWG22,19/34 WHT	20	

BOM LEVEL	PART NO.	DESCRIPTION	QTY	REF. DES.
........4	621-1359	CBL,COAX,RG316/U,50 OHM	1	
........4	693-0002	SLVG,1/4 EXPANDO FR BLACK"	1	
....2	961-0003-100	KIT, HARDWARE RACK, FX50	1	
......3	402-0001	TY-RAP,T+B TY24M,1-1/4 DIA	4	
......3	420-0108	SCREW,10-32X.500,S.S. PHH	4	
......3	420-0508	SCREW,10-32X.500,S.S. FLH	8	
......3	420-8006	SCREW,8-32X.375,S.S. PH FLH UC	4	FOR CUSTOMER TO MOUNT OUTER SLIDE RAILS.
......3	420-8110	SCREW,8-32X.625,S.S. PHH	4	
......3	421-0102	10-32 KEP NUT	8	
......3	423-0001	WASHER,FLAT,#10 SST,.438 X .203 X .065	8	
......3	459-0138-001	RETAINER,SLIDE BRKT	2	
......3	469-0415	SLIDE, EXCITER CHASSIS	1	
......3	470-0102	BRKT,MTG,EXCITER SLIDES	4	
......3	701-0005	ANTISTATIC ZIPLOC BAG 4X6 4MIL	1	

13 RF Technical Services Contact Information

RF Technical Services -

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Fax: **(217) 224-6528**
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14 Drawings

The following pages present the FX-50/E Exciter drawings.

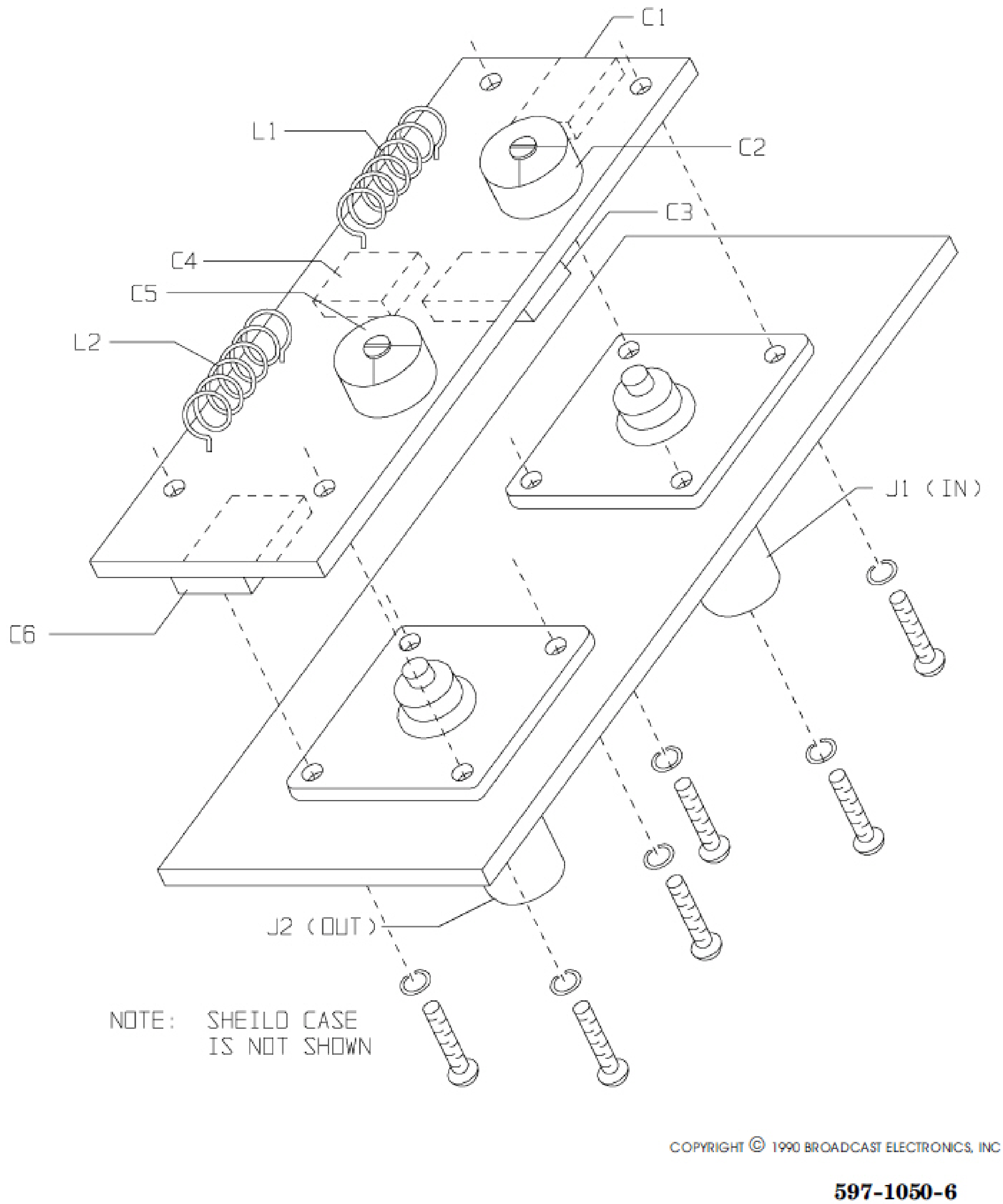

Figure 14-1. OPTIONAL LOW-PASS FILTER ASSEMBLY

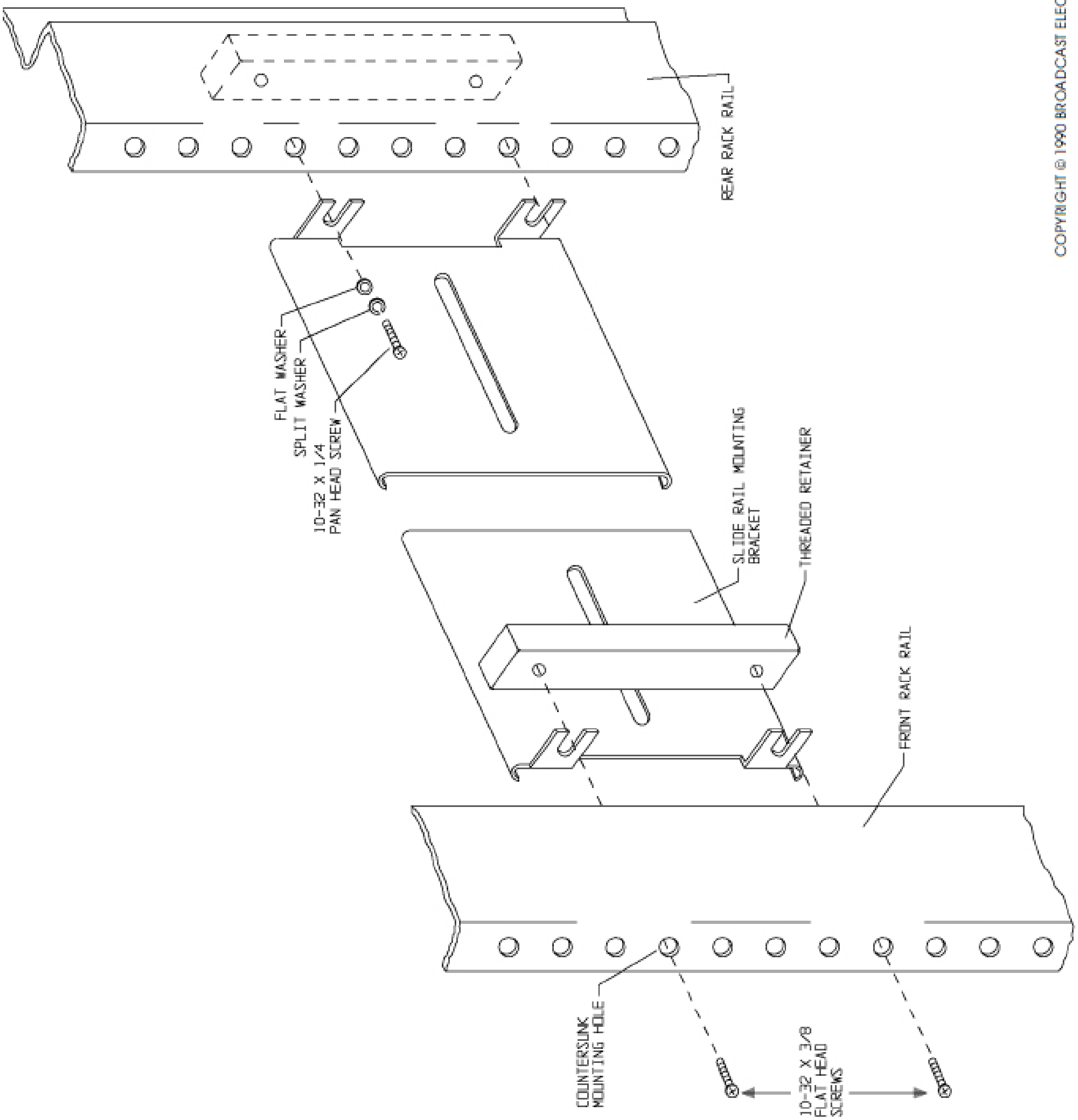

Figure 14-2. EXCITER FRONT RAIL MOUNTING APPLICATIONS

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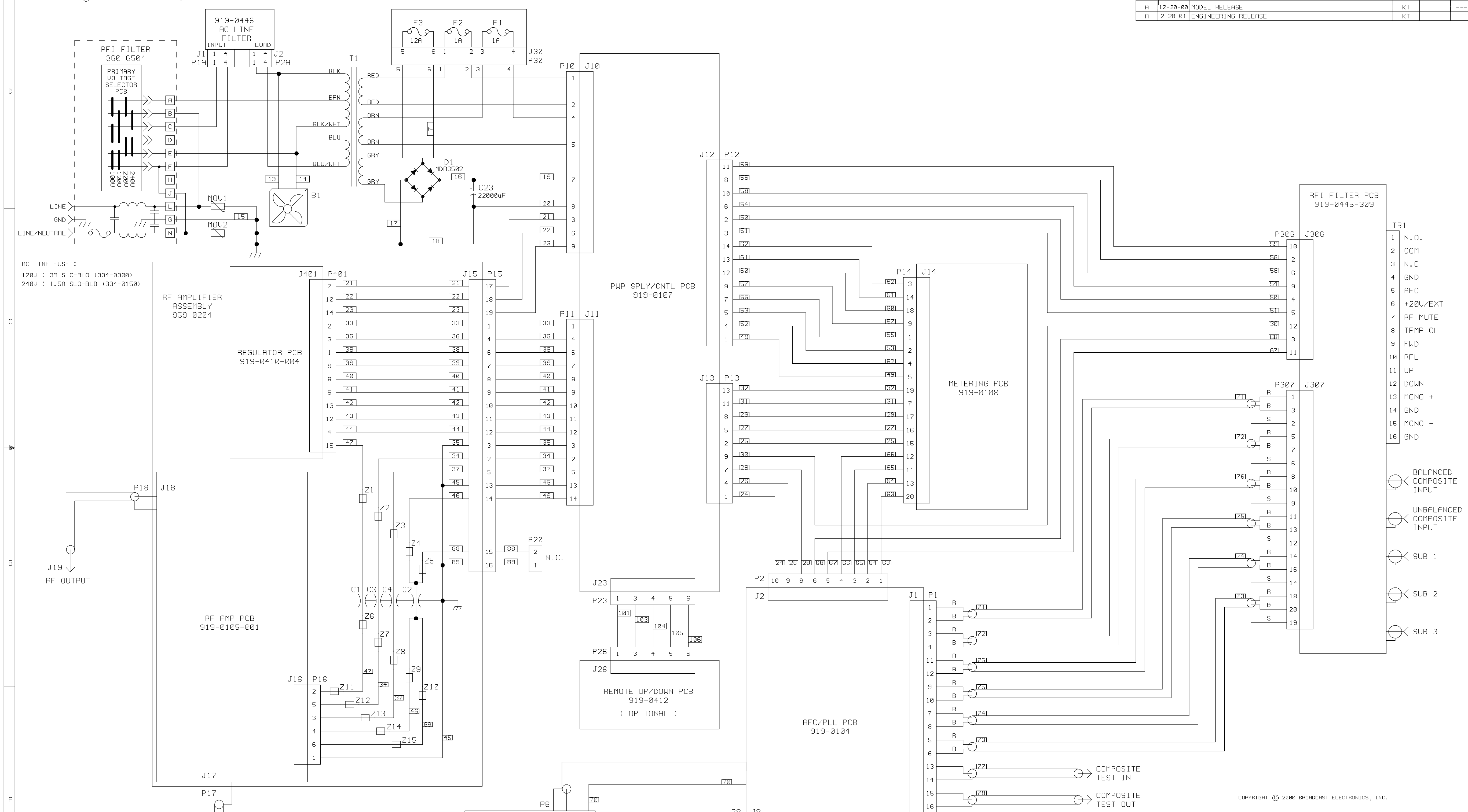
REVISIONS					
REV	DATE	DESCRIPTION	DRAFTER	APPROVED	ECN
A	12-20-00	MODEL RELEASE	KT		----
A	2-20-01	ENGINEERING RELEASE	KT		----



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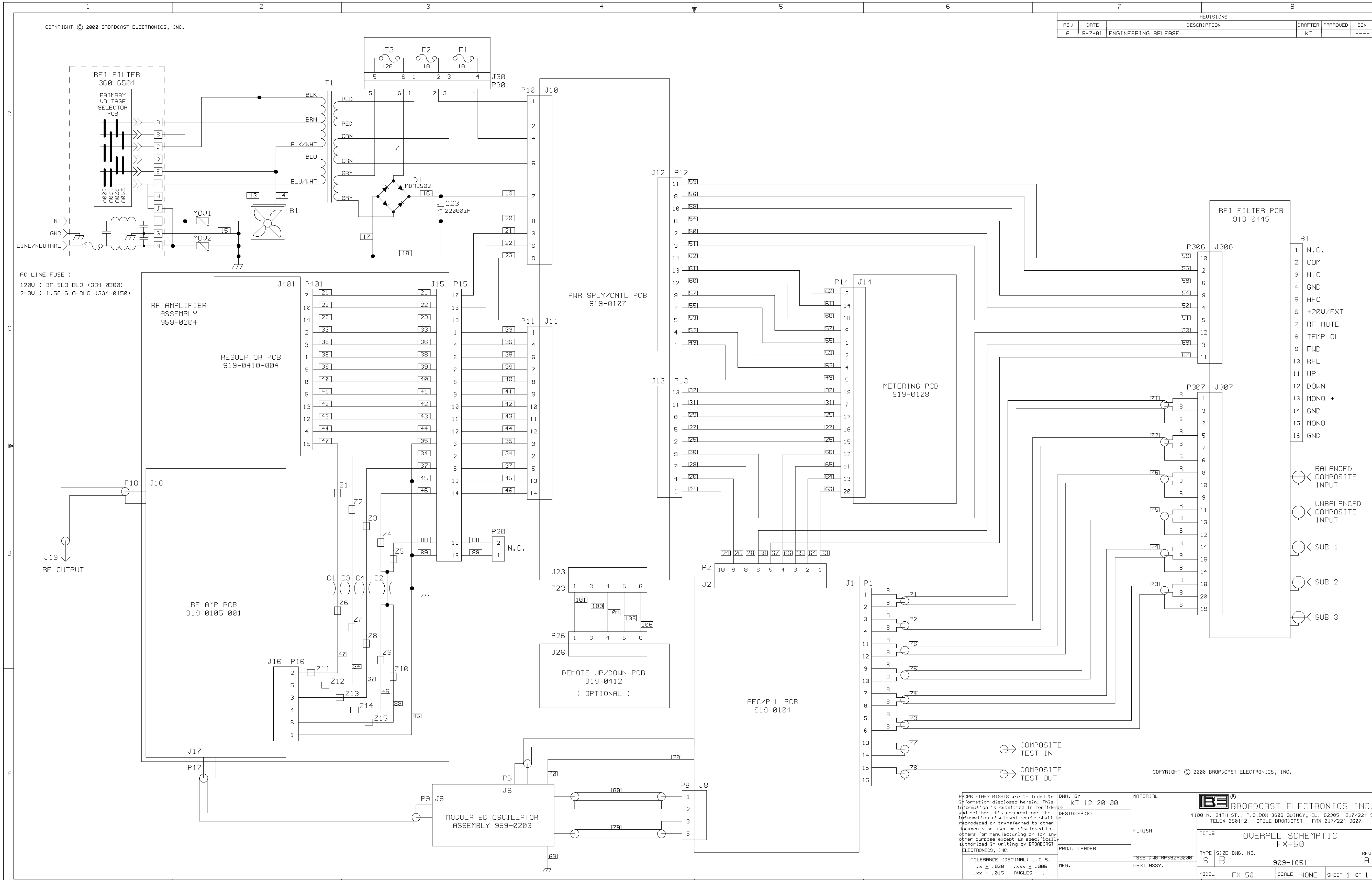
TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1

DWN. BY: KT 12-20-00	MATERIAL	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)	FINISH	TITLE: OVERALL SCHEMATIC FX-50E	
PROJ. LEADER	SEE DWG RAS92-0000	TYPE S / SIZE B / DWG. NO. 909-1050-329	REV A
MFG.	NEXT ASSY.	MODEL FX-50E / SCALE NONE	SHEET 1 OF 1



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REVISIONS
REV | DATE | DESCRIPTION | DRAFTER | APPROVED | ECN
A | 5-7-01 | ENGINEERING RELEASE | KT | | ----
RFI FILTER
360-6504
PRIMARY VOLTAGE SELECTOR PCB
240V 220V 120V 100V
LINE
GND
LINE/NEUTRAL
MDV1
MDV2
B1
T1
BLK
BRN
BLK/WHT
BLU
BLU/WHT
RED
ORN
GRY
F3 12A
F2 1A
F1 1A
J30
P30
D1
MDA3502
C23
22000uF
P10 J10
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
J401 P401
J15 P15
P11 J11
PWR SPLY/CNTL PCB
919-0107
P18 J18
J19
RF OUTPUT
RF AMP PCB
919-0105-001
J16 P16
J17
P17
P20
N.C.
C1 C3 C4 C2
J23
P23
P26
J26
REMOTE UP/DOWN PCB
919-0412
(OPTIONAL)
J12 P12
J13 P13
P14 J14
METERING PCB
919-0108
P2
J2
AFC/PLL PCB
919-0104
J1 P1
P6
J6
P9 J9
MODULATED OSCILLATOR ASSEMBLY 959-0203
P8 J8
COMPOSITE TEST IN
COMPOSITE TEST OUT
RFI FILTER PCB
919-0445
P306 J306
P307 J307
TB1
1 N.O.
2 COM
3 N.C
4 GND
5 AFC
6 +20V/EXT
7 RF MUTE
8 TEMP OL
9 FWD
10 RFL
11 UP
12 DOWN
13 MONO +
14 GND
15 MONO -
16 GND
BALANCED COMPOSITE INPUT
UNBALANCED COMPOSITE INPUT
SUB 1
SUB 2
SUB 3
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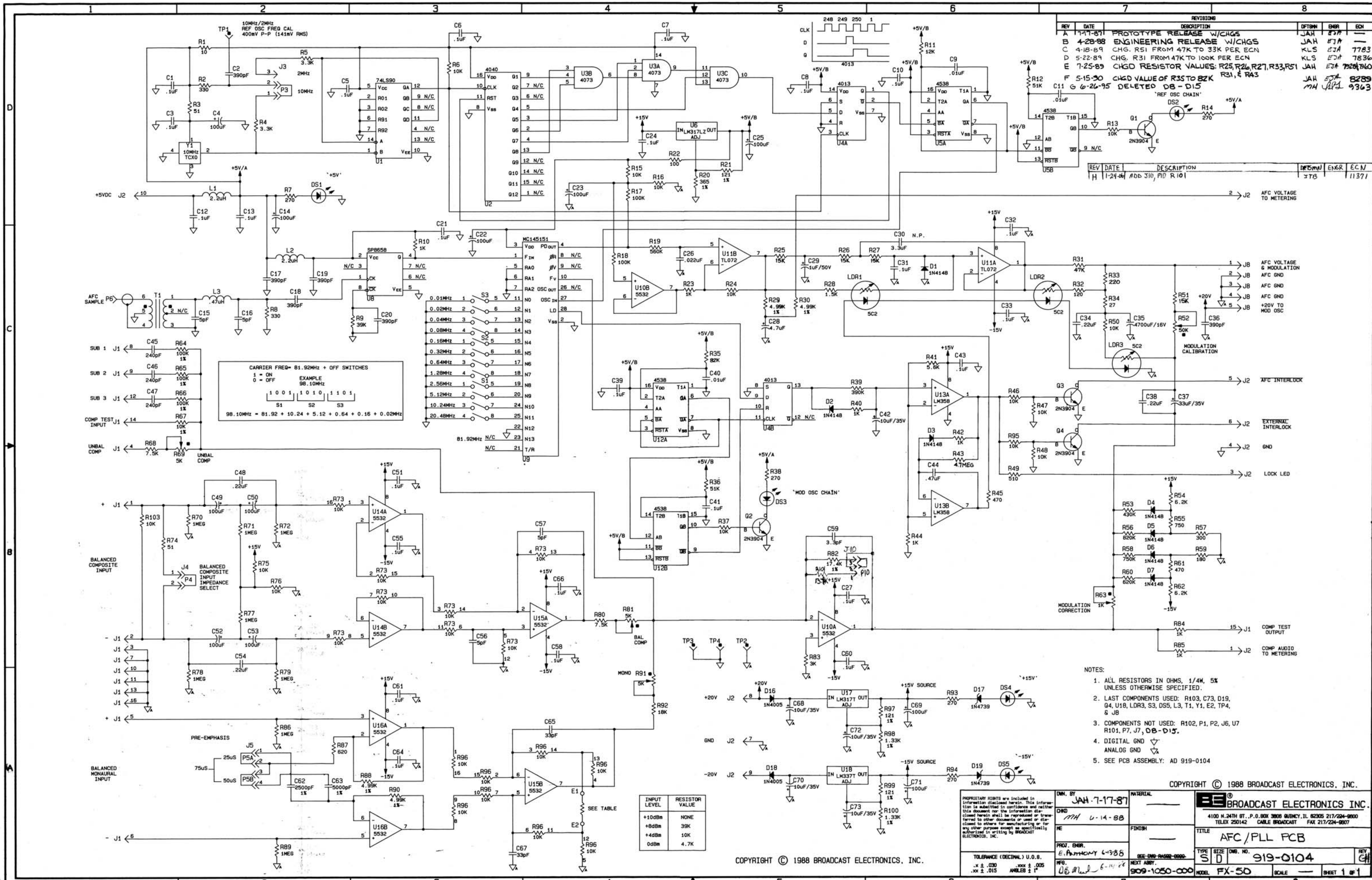
TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1
DWN. BY KT 12-20-00
DESIGNER(S)
PROJ. LEADER
MFG.
MATERIAL
FINISH
SEE DWG AA592-0000
NEXT ASSY.
BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O.BOX 3606 QUINCY, IL. 62305 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607
TITLE
OVERALL SCHEMATIC
FX-50
TYPE S SIZE B DWG. NO. 909-1051 REV A
MODEL FX-50 SCALE NONE SHEET 1 OF 1



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

REVISIONS

REV	DATE	DESCRIPTION	DFTSMN	ENGR	ECN
A	7-17-87	PROTOTYPE RELEASE W/CHGS	JAH	EJA	—
B	4-28-88	ENGINEERING RELEASE W/CHGS	JAH	EJA	—
C	4-18-89	CHG. R51 FROM 47K TO 33K PER ECN	KLS	EJA	7783
D	5-22-89	CHG. R31 FROM 47K TO 100K PER ECN	KLS	EJA	7836
E	7-25-89	CHGD RESISTOR VALUES: R25, R26, R27, R33, R51 R31, & RA3	JAH	EJA	7920/7960
F	5-15-90	CHGD VALUE OF R35 TO 82K	JAH	EJA	8289
G	6-26-95	DELETED DB-D15	MH		9363
H	1-24-06	ADD J10, P10 R101	JTB		11371

NOTES:

1. ALL RESISTORS IN OHMS, 1/4W, 5% UNLESS OTHERWISE SPECIFIED.
2. LAST COMPONENTS USED: R103, C73, D19, Q4, U18, LDR3, S3, DS5, L3, T1, Y1, E2, TP4, & J8
3. COMPONENTS NOT USED: R102, P1, P2, J6, U7 R101, P7, J7, DB-D15.
4. DIGITAL GND
   ANALOG GND
5. SEE PCB ASSEMBLY: AD 919-0104

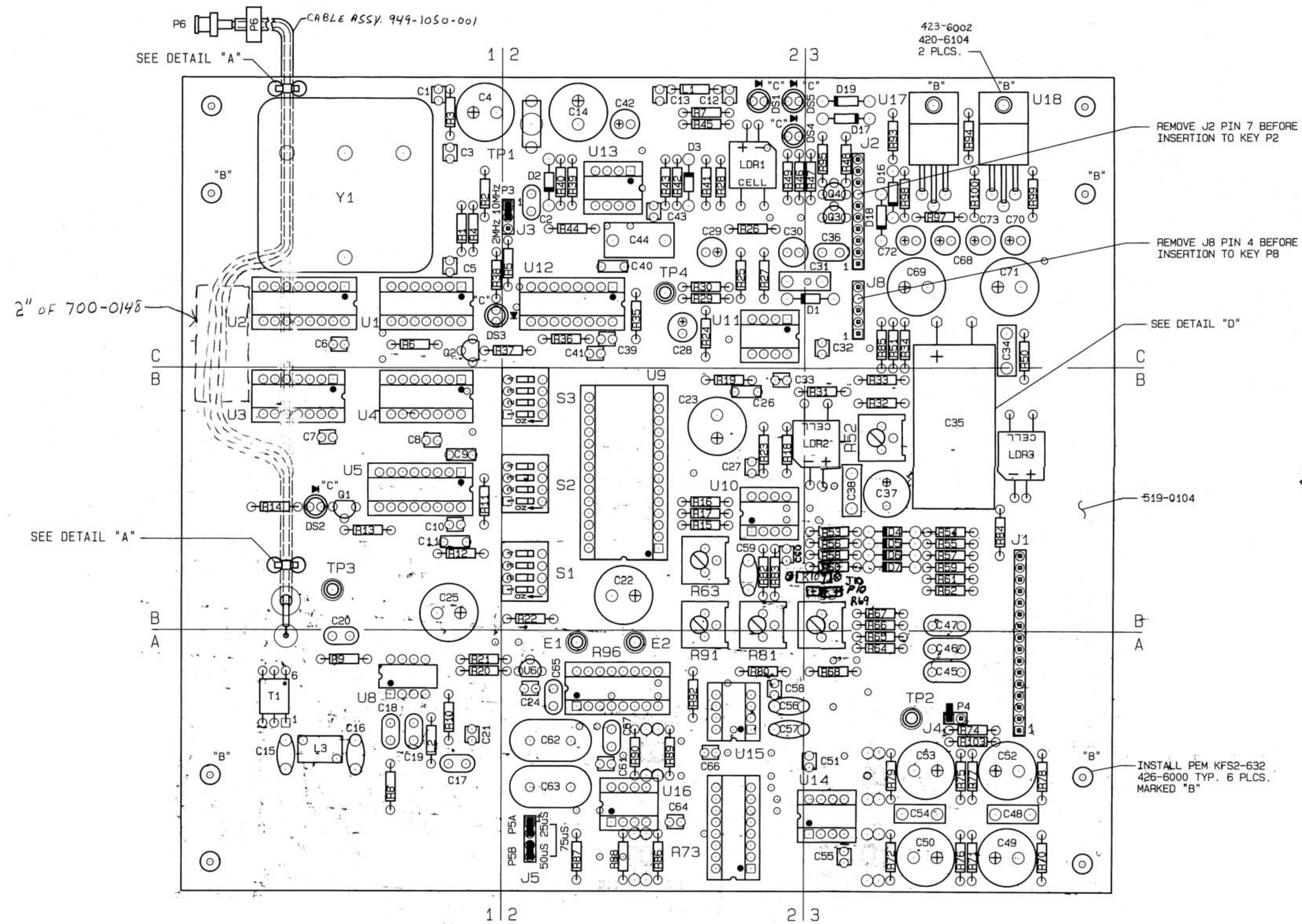
TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°

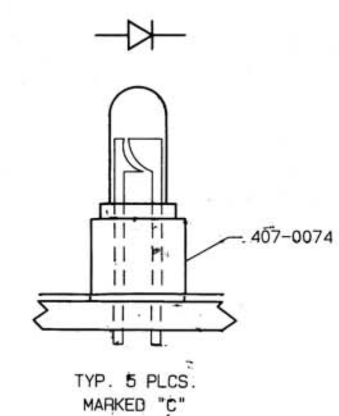
DWN. BY JAH 7-17-87
CHKD MH 6-14-88
ME
PROJ. ENGR. E. Anthony 6-13-88
MFG. DB Mead 6-14-88
MATERIAL —
FINISH —
NEXT ASSY. 909-1050-000

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

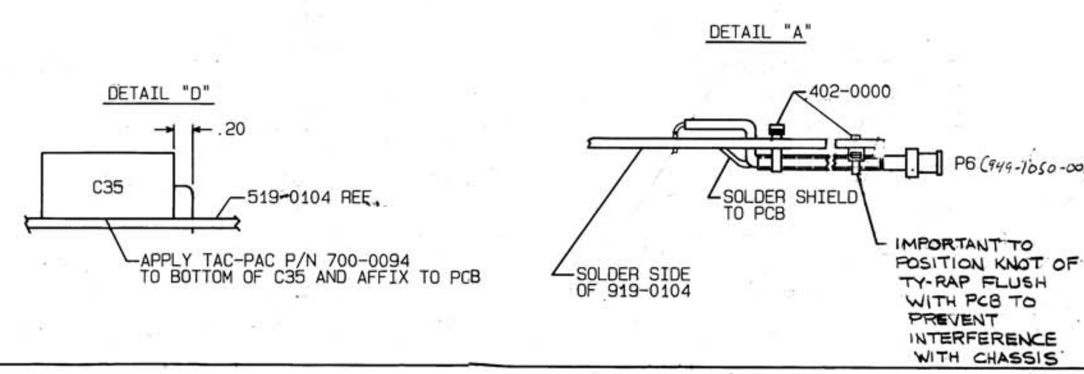
TITLE AFC/PLL PCB
TYPE S SIZE D DWG. NO. 919-0104 REV G/H
MODEL FX-50 SCALE — SHEET 1 OF 1

REVISIONS					
REV	DATE	DESCRIPTION	DFTM	ENGR	ECN
A	6-16-87	PROTOTYPE RELEASE W/CHGS.	KLS	EJA	—
B	6-13-88	ENGINEERING RELEASE W/CHGS.	KLS	EJA	—
C	4-18-89	UPDATE REV. PER R51 VALUE CHG.	KLS	EJA	7783
D	5-22-89	UPDATE REV. PER R31 VALUE CHG.	KLS	EJA	7836
E	7-25-89	CHGD VALUE OF RESISTORS: R25, R26, R27, R33, R51 R31, & R43	JAH	EJA	7928 & 7960
F	5-15-90	CHGD VALUE OF R35 TO 82K	JAH	EJA	8285
G	2-14-92	CHGD DETAIL A	JAH	EJA	8696
H	8-24-93	CABLE IN DETAIL A WAS 9" LG.	JLF		9029
J	6/26/95	DELETED D8 - D15	MH		9363
K	3-14-97	C4, C14, C22, C23, C25, C49, C50, C52, C53 C69, C71	MSE		9783
L	2-3-99	ADDED 2" OF 700-0148 + MOVED COAX AWAY FROM IC'S.	KT		10084
M	10-3-00	CHANGED DETAIL "A" TO CALL OUT 949-1050-001	KT		10362
N	1-25-06	ADD P10, J10, R101	JTB		11371





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

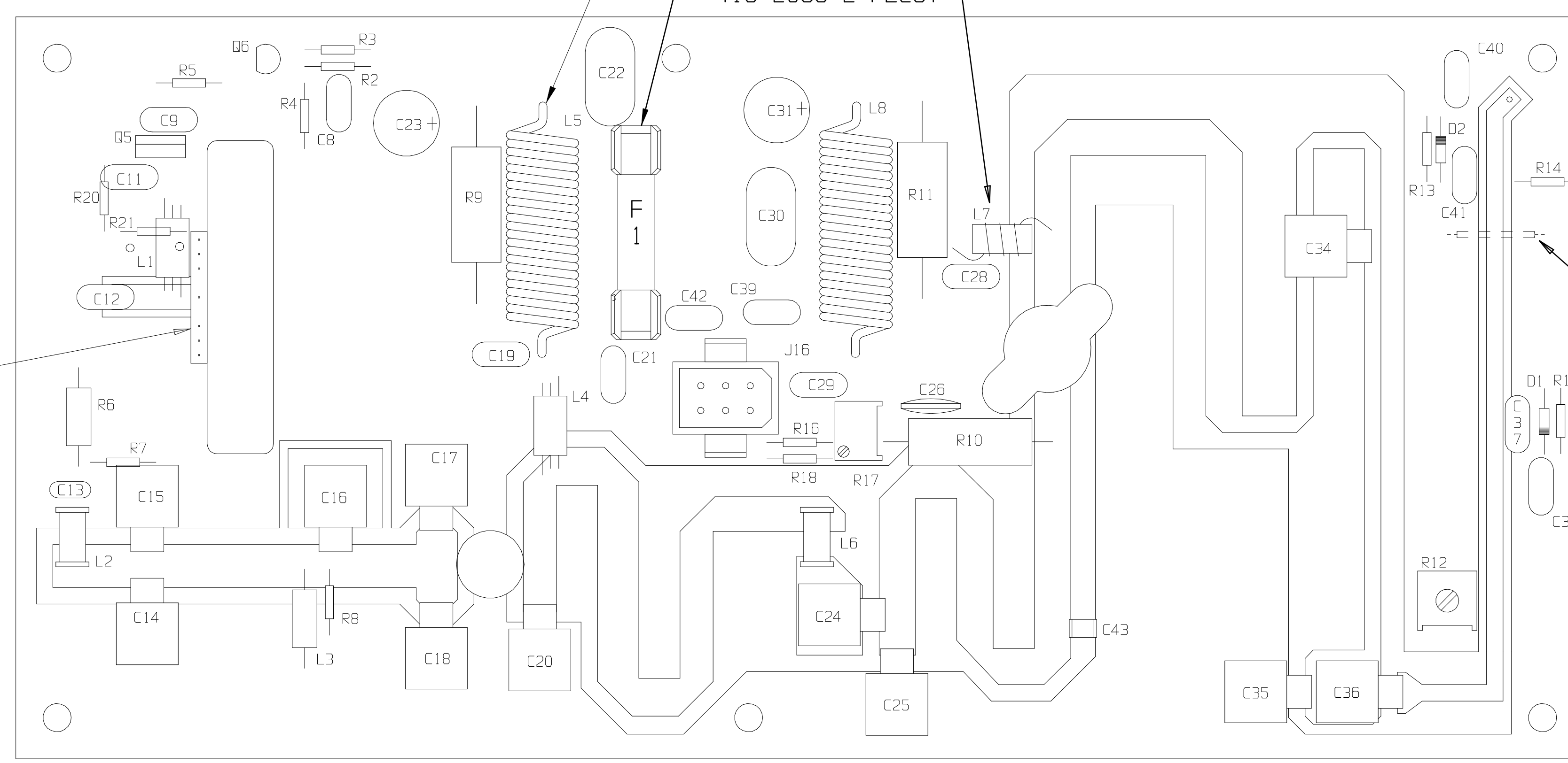


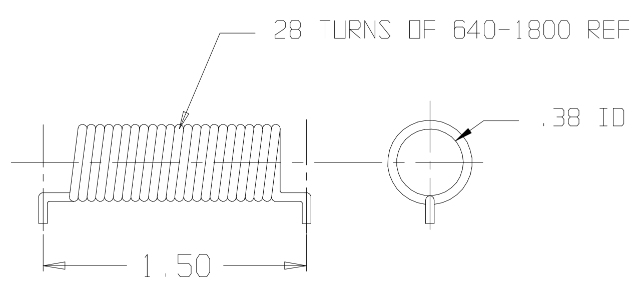
TOLERANCE DECIMAL U.O.S.
.X ± .030 .XXX ± .005
.XX ± .015 ANGLES ± 1°

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
ME 6-20-88			TYPE A SIZE D DWG. NO. 919-0104 REV N
PROJ ENGR E. ANTHONY 6-13-88			
MFG		NEXT ASSY 909-1050-000	MODEL FX-50 SCALE 2/1 SHEET 1 OF 1

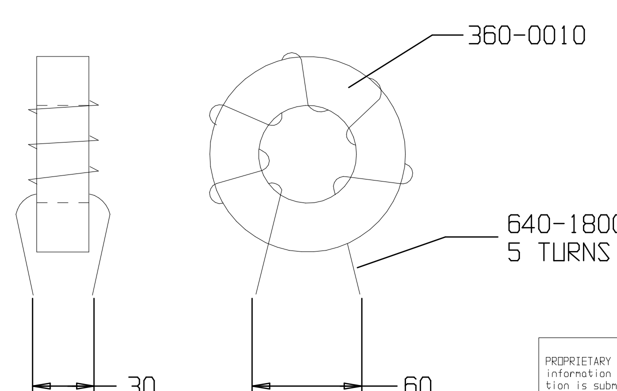
REVISIONS

REV	DATE	DESCRIPTION	DRAFTER	APPROVED	ECN
A	3-10-94	ENGINEERING RELEASE	MH	BG	9168
B	3-7-95	CHGD R18 FROM 100-1041 (1k) TO 103-4993 (499).	JLF	JRC	9305
C	11-3-95	ADDED C43.	JLF	DLL	9408
D	11-16-95	CHGD Q5 FROM 210-0155 TO 218-0032	MH		9498





DETAIL "A"



DETAIL "B"

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

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

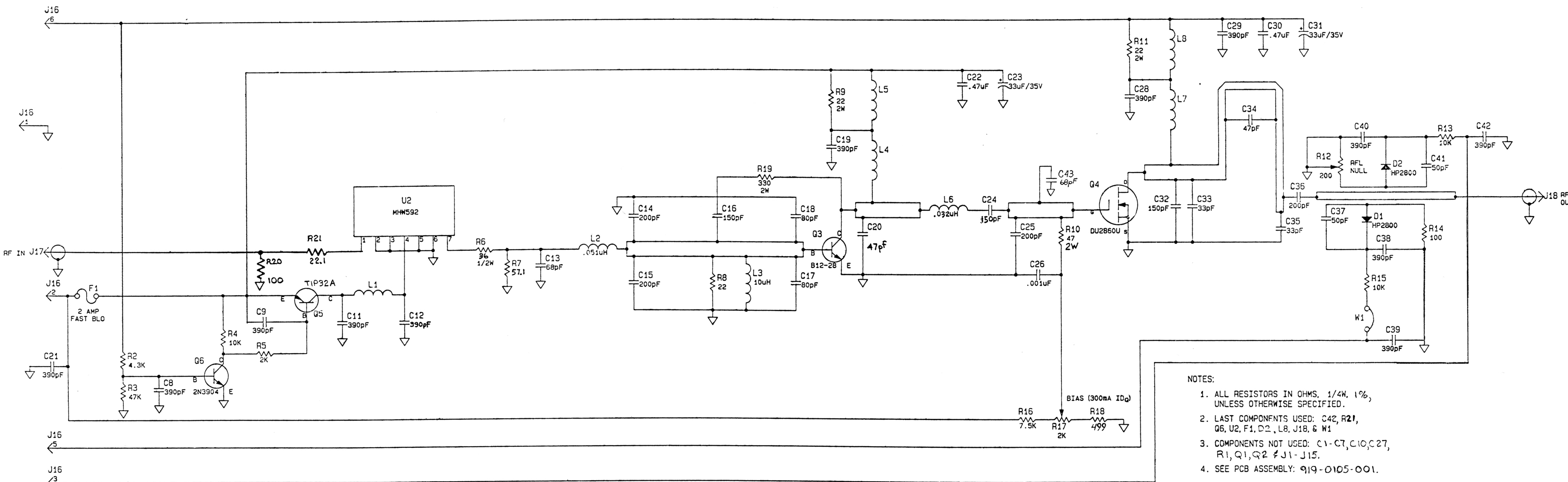
BROADCAST ELECTRONICS INC.
4100 N.24TH ST.,P.O.BOX 3606 QUINCY,IL 62305 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE PCB ASSEMBLY RF AMPLIFIER

TYPE A | SIZE C | DWG. NO. 919-0105-001 | REV D

MODEL FX-50 | SCALE 1.5/1 | SHEET 1 OF 1

REV	DATE	DESCRIPTION			
A	3-8-94	ENGINEERING RELEASE	MH		9166
B	3-7-95	CHGD R18 FROM 1k TO 499.	JLF		9305
C	11-15-95	ADDED C43.	JLF		9408
D	11-16-95	CHGD Q5 TO TIP32A	MH		9498

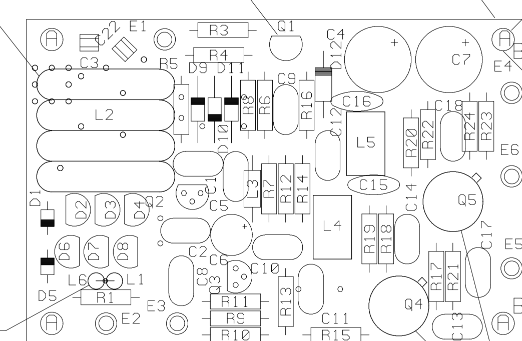


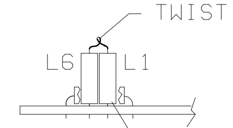
NOTES:

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.

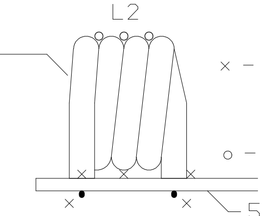
DWN. BY 3-8-94 M. HAYDEN	MATERIAL —	BROADCAST ELECTRONICS INC. 4100 N.24TH ST., P.O.BOX 3606 QUINCY, IL 62305 217/224-9600 TELEX 250142 CABLE BROADCAST	
CHKD		TITLE SCHEM, RF AMPLIFIER PCB	
ME	FINISH —		
PROJ. ENGR.	~~SEE DWG RA592-0000~~	TYPE S SIZE D DWG. NO. 919-0105-001	REV D
TOLERANCE (DECIMAL) U.O.S. .x ± .030 .xx ± .015 .xxx ± .005 ANGLES ± 1°	MFG.	NEXT ASSY. 959-0204	MODEL FX-50 SCALE — SHEET

REVISIONS					
REV	DATE	DESCRIPTION	DFTSMN	ENGR	ECN
A	11-3-99	ENGINEERING RELEASE	MH	DDL	10223
B	1-3-00	ADDED STANDOFF NOTE	KT	DDL	10246
C	8-23-02	REMOVED 370-0106 PART DETAIL FROM DRAWING	KT	DDL	10767





DETAIL "C"



DETAIL "A"

NOTES:

1. STANDOFFS ON LEADS ON Q1-Q3, D2-D4 AND D6-D8 SHOULD BE PUSHED DOWN AGAINST PCB.
2. 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

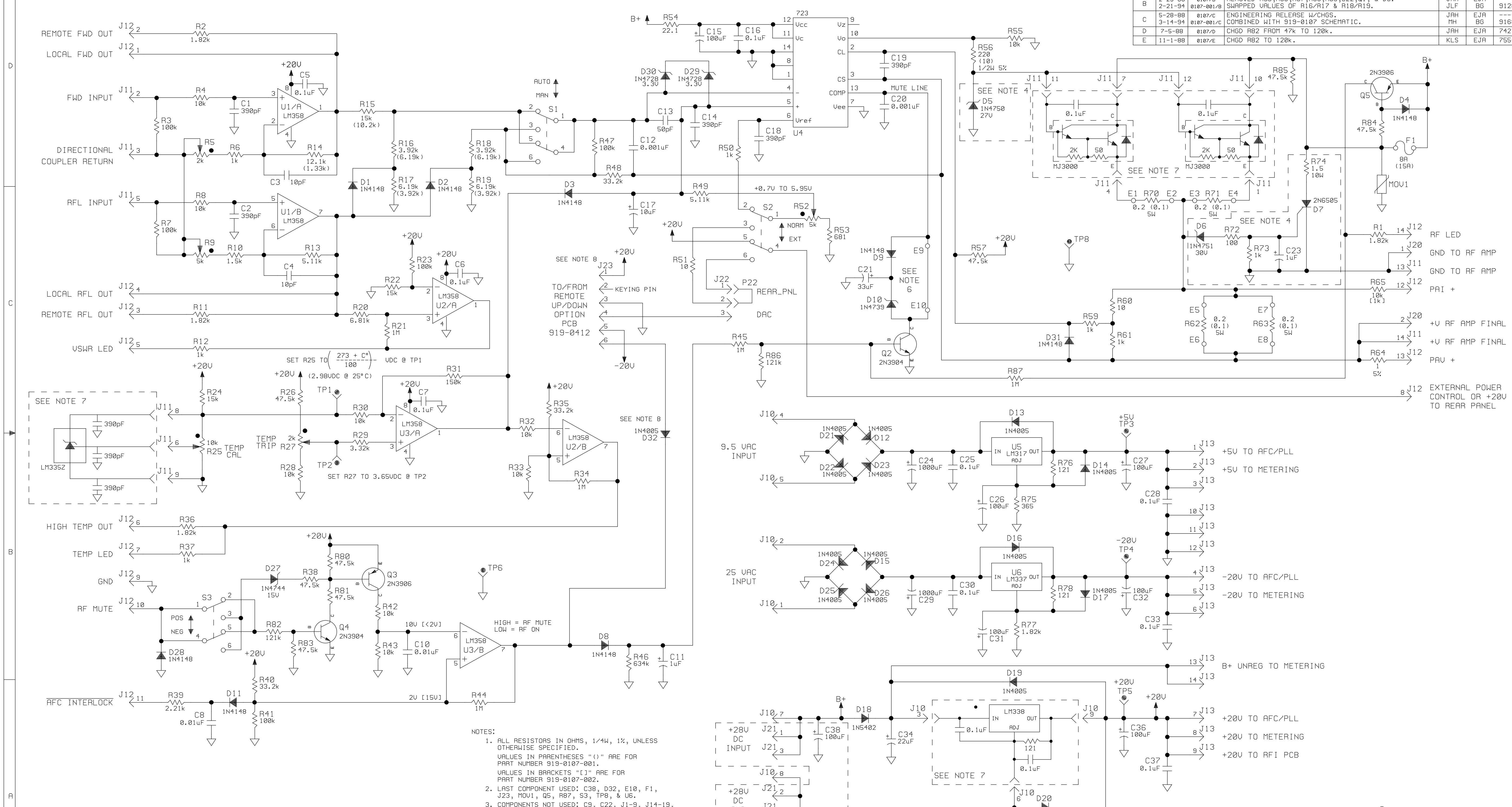
BROADCAST ELECTRONICS INC.
4100 N.24TH ST. P.O.BOX 3606 QUINCY, IL. 62305 PH. 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE: PCB ASSEMBLY MODULATED OSCILLATOR BD

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

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

REVISIONS						
REV	DATE	SUFFIX/REV	DESCRIPTION	DFTSMN	ENGR	ECN
A	12-1-87 7-27-93 10-8-93	0107/A 0107-001/A 0107-001/A	PROTOTYPE RELEASE. MODEL BUILD RELEASE. ENGINEERING RELEASE.	JAH JLF JLF	EJA JRC JRC	---- ---- ----
B	2-29-88 2-21-94	0107/B 0107-001/B	REMOVED A58,A66,R67,R68,R69,C22,Q1, & D8. SWAPPED VALUES OF R16/R17 & R18/R19.	JAH JLF	EJA BG	---- 9128
C	5-20-88 3-14-94	0107/C 0107-001/C	ENGINEERING RELEASE W/CHGS. COMBINED WITH 919-0107 SCHEMATIC.	JAH MH	EJA BG	---- 9160
D	7-5-88	0107/D	CHGD R82 FROM 47k TO 120k.	JAH	EJA	7427
E	11-1-88	0107/E	CHGD R82 TO 120k.	KLS	EJA	7554



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, A58, & A66-69.
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. CIRCUITRY 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.

N	7-20-95	-	ADDED -002 VERSION.	JLF		9477
M	9-13-94	0107-001/M 0107/M	ADDED D32. UPDATED NOTES. UPDATED DWG; ADDED REV NOTES FOR 919-0107.	JLF	BG	9255
L	2-7-90	0107/L	D7 WAS 2N6395, R74 WAS 2.2.	ALC	EJA	8197
K	6-21-89	0107/K	ADDED R87; CHGD R54 CONNECTION.	KLS	EJA	7907
J	5-9-89	0107/J	ADDED D31; VALUE CHG ON R57,R59; CHGD D29,D30.	MERK	EJA	7862 7847
H	4-18-89	0107/H	CHG D6 TO 1N4751, 30V.	KLS	EJA	7818
G	3-16-89	0107/G	ADD R86,D29-30; R9,R46,Q2 VALUE CHGS.	KLS	EJA	7754
F	2-7-89	0107/F	VALUE CHGS ON R16-R19, R22.	KLS	EJA	7719
E	11-1-88	0107/E	CHGD R82 TO 120k.	KLS	EJA	7554

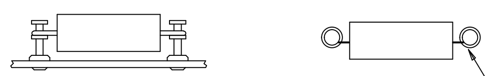
TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°

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.

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: SCHEMATIC POWER SUPPLY / CONTROL PCB
TYPE: S SIZE: D DWG. NO. 919-0107(-001)[-002] REV N
MODEL FX-50 (FM-100C) SCALE NONE SHEET 1 OF 1

SIDE VIEW TOP VIEW



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)

REVISIONS						
REV	DATE	SUFFIX/REV	DESCRIPTION	DRAFTER	APPROVED	ECN
A	1-8-88 7-27-93	0107/A 0107-001/A	PROTOTYPE RELEASE W/CHGS. MODEL BUILD RELEASE.	KLS JLF	EJA JRC	---- ----
B	2-10-88 10-8-93	0107/B 0107-001/B	DELETED R66-R69,R58,D8,C22,Q1 ENGINEERING RELEASE W/CHGS.	KLS JLF	EJA JRC	---- 9085
C	6-13-88 2-21-94	0107/C 0107-001/C	ENGINEERING RELEASE W/CHGS. SWAPPED VALUES OF R16/R17 & R18/R19.	KLS JLF	EJA BG	---- 9128
D	2-8-89	0107/D	R16-R19,R22 VALUE CHGD.	KLS	EJA	7719
E	3-15-89	0107/E	ADDED R86,D29,D30; R9,Q2,R46 VALUE CHGS.	KLS	EJA	7754
F	4-18-89	0107/F	UPDATE REV. PER D6 VALUE CHG.	KLS	EJA	7818
G	5-9-89	0107/G	ADDED D31, VALUE CHG. ON R57,R59,CHGD. D29,D30	MERK	EJA	7847 7862
H	6-21-89	0107/H	ADDED R87	KLS	EJA	7907
J	2-7-90	0107/J	D7 WAS 2N6395, R74 WAS 2.2	RLC	EJA	8197
K	3-14-94	0107/K 0107-001/K	COMBINE 919-0107 BD WITH 919-0107-001 TO USE THE SAME BLANK BOARD (519-0107-001).	MH	BG	9168
L	9-15-94	-	ADD D32 ON -001. CHGD FOOTPRINT OF MOV1. UPDATED NOTES.	JLF	BG	9255
M	7-20-95	-	ADDED CHGS FOR -002 VERSION. TP1-8 WERE #413-1597.	JLF	DLL	9477
N	12-3-96	-	ADDED 360-0003, 2 PLCS	MSE	DLL	9654
P	3-14-97	-	C26, C27, C31, C32, C35, C36, C38, WERE 020-1083	MSE	DLL	9783
Q	8-20-97	-	R62-63, R70-71 WERE 130-0000 IN ERROR, NOW 130-1000	MSE		9846

J23 INSTALLED FOR 919-0107-001 ONLY
REMOVE J23 PIN 2 PRIOR TO INSERTION

D5 NOT INSTALLED ON 919-0107-001

SEE TABLE FOR PART NUMBERS

SEE TABLE FOR PART NUMBERS

SEE DETAIL "A"

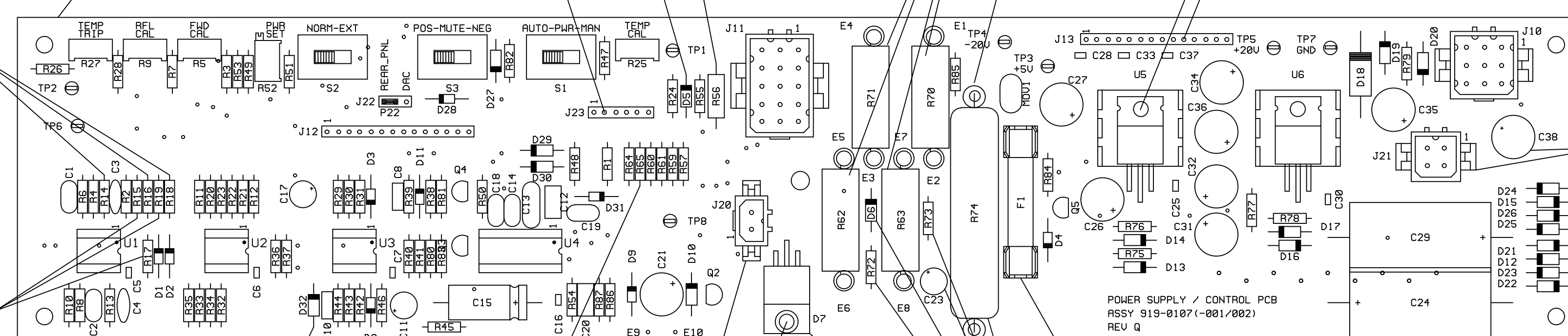
360-0003, 2 PLCS TO SPACE RES OFF OF PCB

420-6105 SCREW
423-6002 SPLIT
426-6000 PEM NUT
455-7805 HEATSINK (919-0107/-002)
455-0075 HEATSINK (919-0107-001)
2 PLACES

REMOVE J13 PIN 10 PRIOR TO INSERTION

519-0107-001 REV D

SEE TABLE FOR PART NUMBERS



C38 & J21 INSTALLED FOR 919-0107-001 ONLY

SEE TABLE FOR PART NUMBERS

D32 INSTALLED FOR 919-0107-001 ONLY

SEE TABLE FOR PART NUMBERS

420-6105 SCREW
423-6002 SPLIT
426-6000 PEM NUT

J20 INSTALLED FOR 919-0107-001 ONLY

SEE NOTE 1

407-0141 FUSE COVER
415-2068 FUSE CLIP (QTY 2)
330-0802 FUSE (919-0107/-002)
330-1500 FUSE (919-0107-001)

NOT INSTALLED ON 919-0107-001

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°

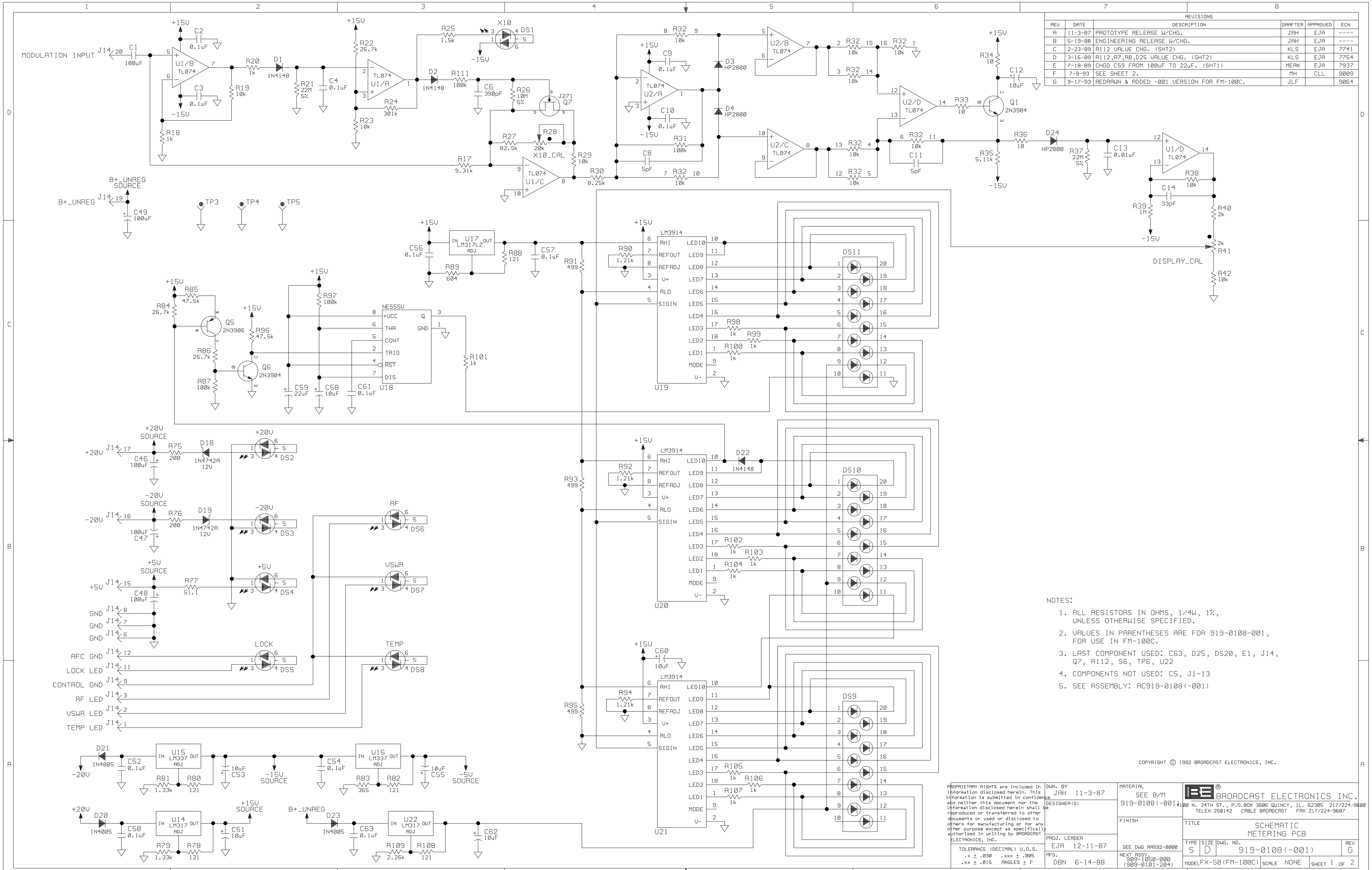
DWN. BY: JLF 7-27-93
DESIGNER(S): JRC 7-27-93
PROJ. LEADER: CLL 10-8-93
MFG.: D. RUST 10-8-93

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

BE® 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 A | SIZE C | DWG No. 919-0107/-001/-002 | REV Q
MODEL FX-50/FM-100C | SCALE 1:1 | SHEET 1 OF 1



REVISIONS					
REV	DATE	DESCRIPTION	DRAFTER	APPROVED	ECN
A	11-3-87	PROTOTYPE RELEASE W/CHG.	JAH	EJA	----
B	5-19-88	ENGINEERING RELEASE W/CHG.	JAH	EJA	----
C	2-23-89	R112 VALUE CHG. (SHT2)	KLS	EJA	7741
D	3-16-89	R112,R7,R8,D25 VALUE CHG. (SHT2)	KLS	EJA	7754
E	7-18-89	CHGD C59 FROM 100uF TO 22uF. (SHT1)	MERK	EJA	7937
F	7-9-93	SEE SHEET 2.	MH	CLL	9009
G	9-17-93	REDRAWN & ADDED -001 VERSION FOR FM-100C.	JLF		9064

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)

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

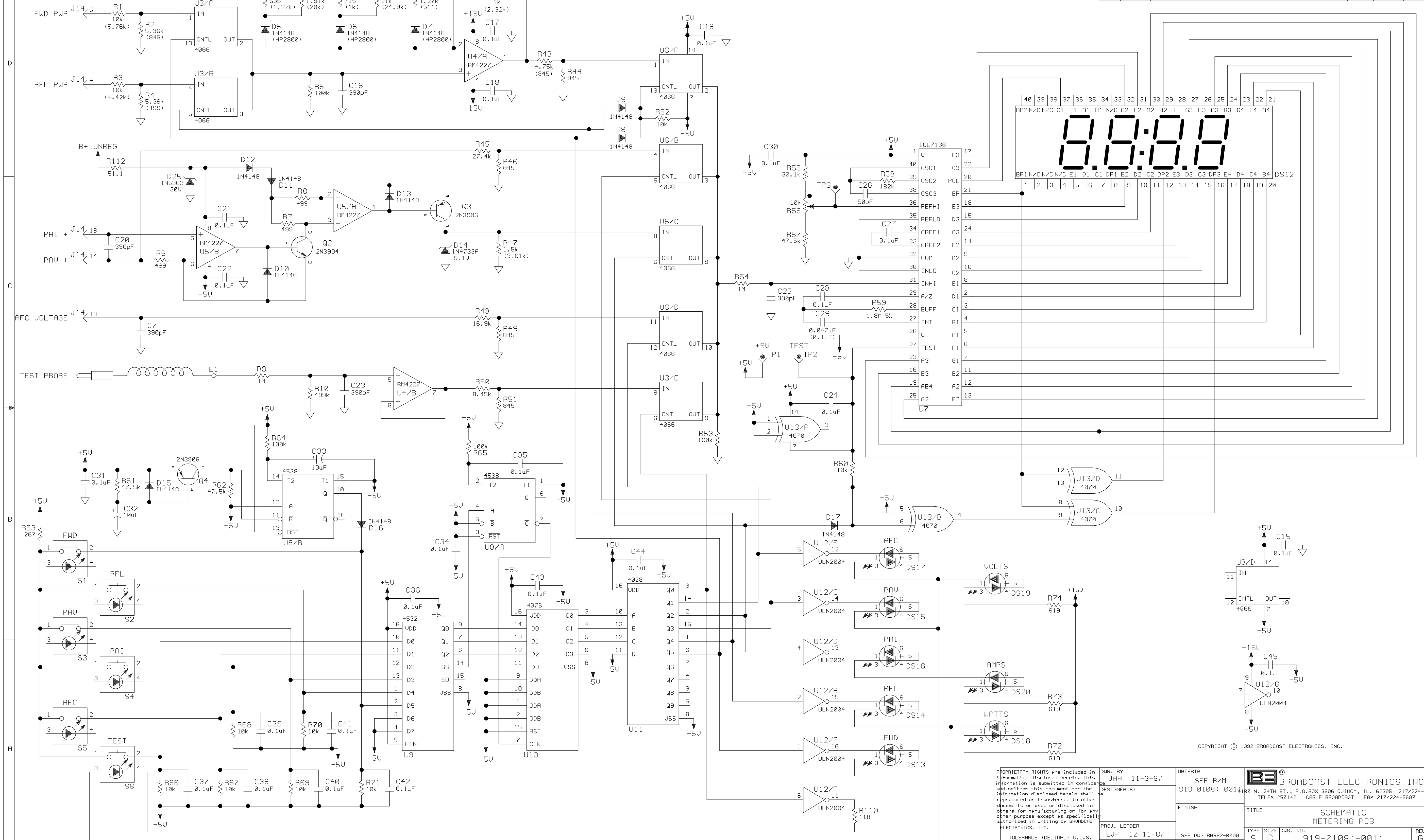
TYPE S | SIZE D | DWG. NO. 919-0108(-001) | REV G

MODEL FX-50(FM-100C) | SCALE NONE | SHEET 1 OF 2

D	3-16-89	R112,R7,R8,D25 VALUE CHGS.	KLS	EJA	7754
F	7-9-93	ADDED TP6;U7 PIN 19 WAS CONNECTED TO DS12 PIN 28.	MH	CLL	9009
G	9-17-93	REDRAWN. ADDED -001 VERSION FOR FM-100C.	JLF		9064

REVISIONS

REV	DATE	DESCRIPTION	DRAFTER	APPROVED	ECN
A	11-3-87	PROTOTYPE RELEASE W/CHG.	JAH	EJA	----
B	5-19-88	ENGINEERING RELEASE W/CHG.	JAH	EJA	----
C	2-23-89	R112 CHGD TO 240 OHM.	KLS	EJA	7741



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 RA592-0000
NEXT ASSY. 909-1050-000 (909-0101-204)

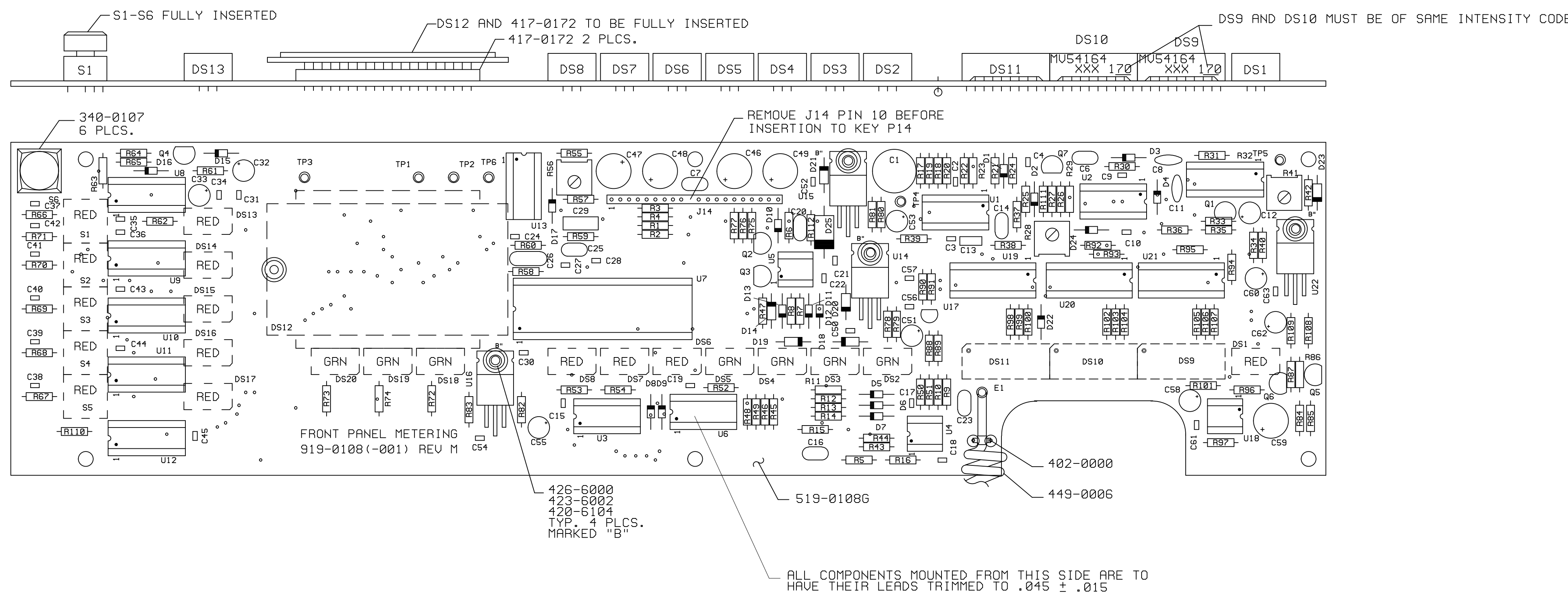
BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O.BOX 3606 QUINCY, IL. 62305 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

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

REVISIONS					
REV	DATE	DESCRIPTION	DFTSMN	ENGR	ECN
A	11-25-87	PROTOTYPE RELEASE W/CHGS	KLS	EJA	---
B	5-23-88	ENGINEERING RELEASE W/CHGS	KLS	EJA	---
C	2-23-88	R112 VALUE CHG PER ECN	KLS	EJA	7741
D	3-20-89	CHGD D25 BODY SIZE: VALUE CHG	KLS	EJA	7754
E	7-18-89	DEL 415-1011: ADD 441-0152, COMP LEAD TRIM NOTE	MERK	EJA	7937
F	6-18-91	TELESIS TO PCAD CONVERSION; ADDED SILKSCREEN	JAH	MH	8393
G	7-8-93	ADDED TP6 AND MOVED TP1 & TP2.	MH	CLL	9009
H	9-17-93	ADDED -001 VERSION FOR FM-100C.	JLF	BG	9064
J	3-7-95	CHGD SOCKET XU7 FROM 417-4001 TO 417-4005.	JLF	DLL	9285
K	12-2-96	REMOVED DIM TO SPACE LED'S OFF OF PCB	MSE	DLL	9643
L	3-14-97	C46, C47, C48, C49 WERE 020-1083	MSE	DLL	9783
M	9-21-97	CHGD ALL 103-1041 RES. TO 100-1041 RES.	KT	DLL	9863



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	
CHKD MH 6-14-88		
ME JHS 6-20-88	FINISH	
PROJ. ENGR. EJA 6-13-88	SEE DWG RA592-0000	
MFG. DBN 6-14-88	NEXT ASSY.	

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TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE PCB ASSEMBLY
FRONT PANEL METERING BD

TYPE	SIZE	DWG No.	REV
A	C	919-0108 919-0108-001	M

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

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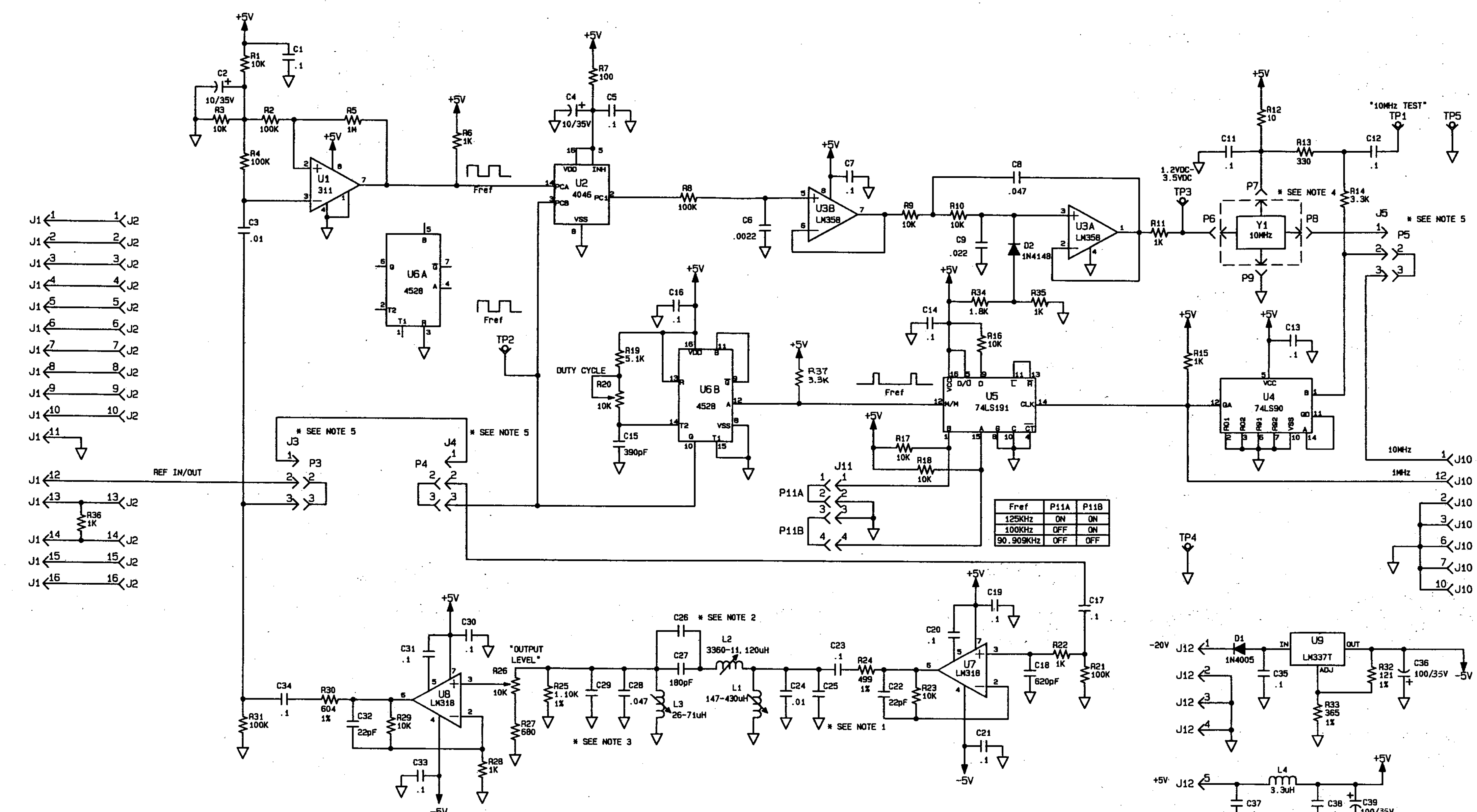


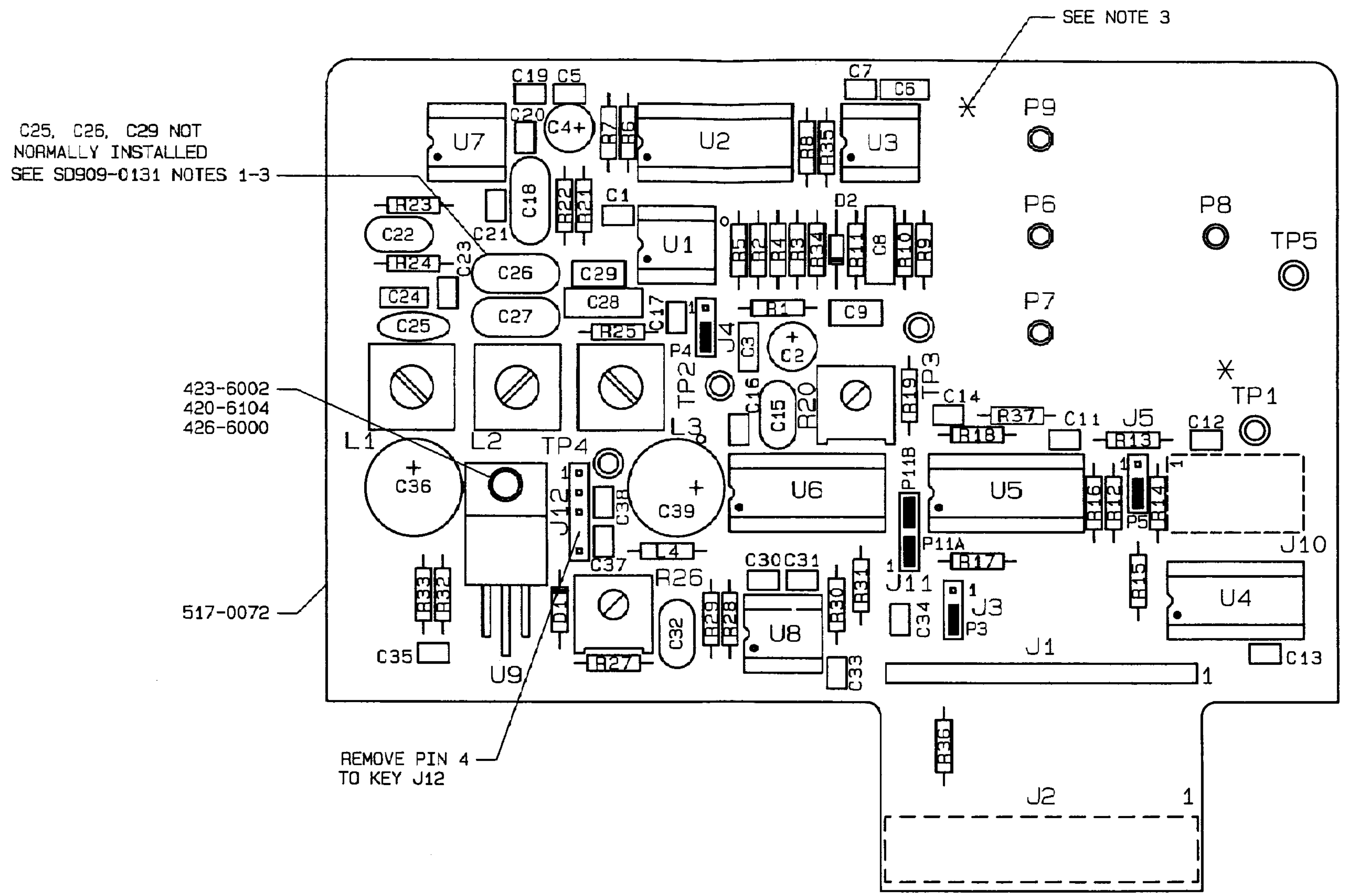
Fref	P11A	P11B
125KHz	ON	ON
100KHz	OFF	ON
90.909KHz	OFF	OFF

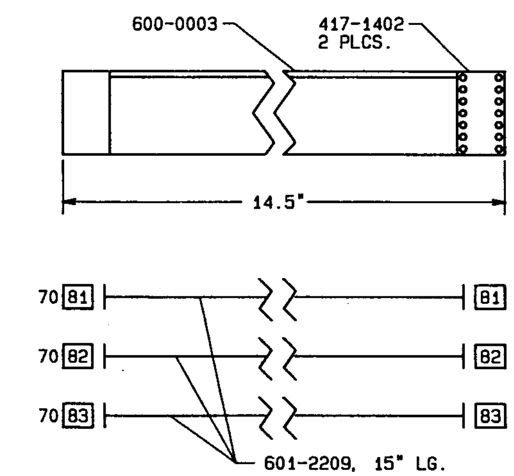
NOTES:

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	MATERIAL: SEE B/M 909-0131	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	
CHKD: MH 10-12-88	FINISH	TITLE: PCB SCHEMATIC- FX-50 BOOSTER OPTION BD.	
PROJ. ENGR.		TYPE: S SIZE: D DWG.NO. 909-0131	REV: F
MFG.	NEXT ASSY	MODEL: FX-50 SCALE: NTS	SHEET 1 OF 1





P12 417-0165	
PIN NO.	WIRE NO.
1	B1
2	B2
3	OPEN
4	KEY
5	B3

✱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.:

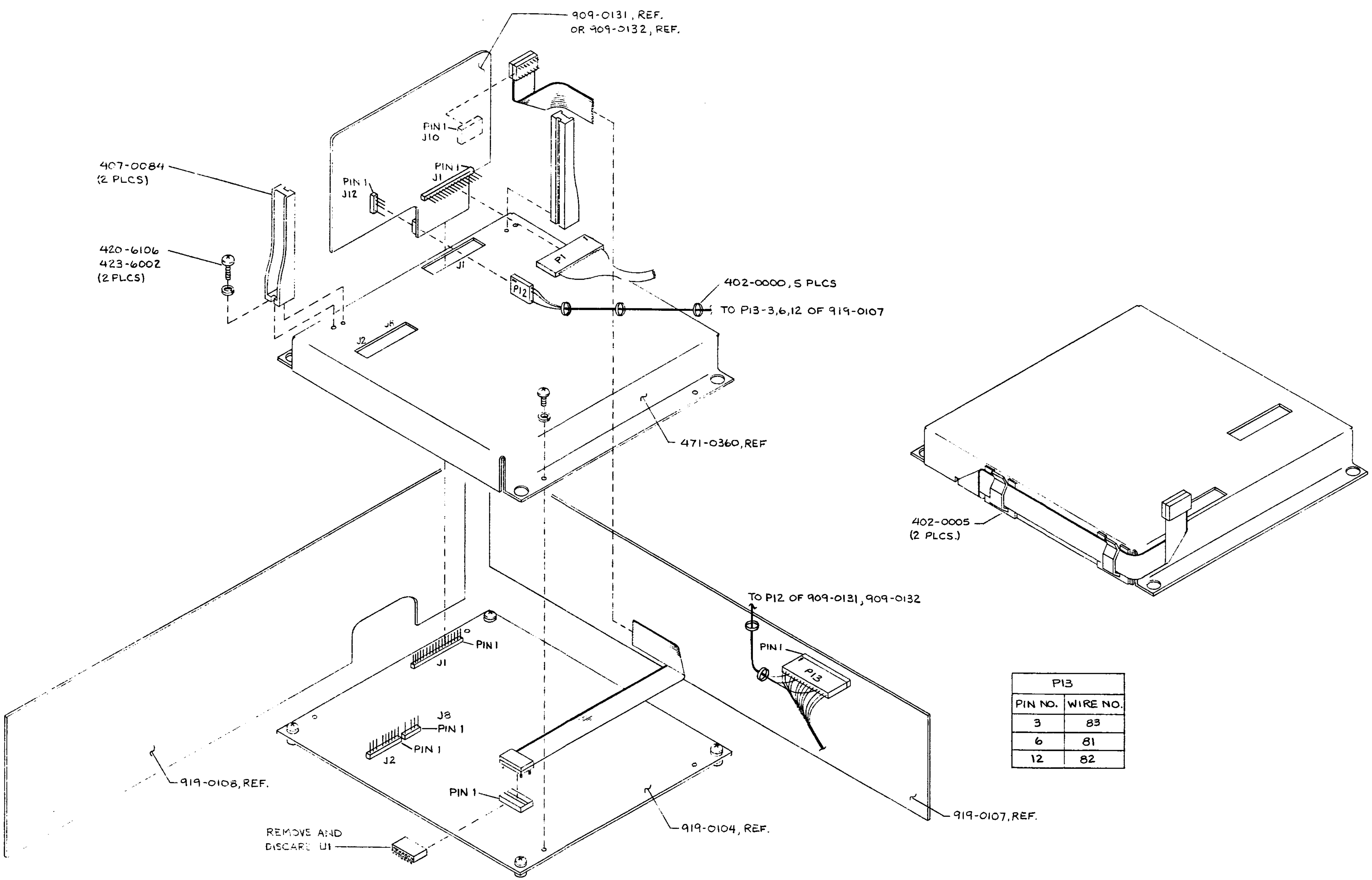
MATERIAL: SEE B/M 909-0131
FINISH:
NEXT ASSY:

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

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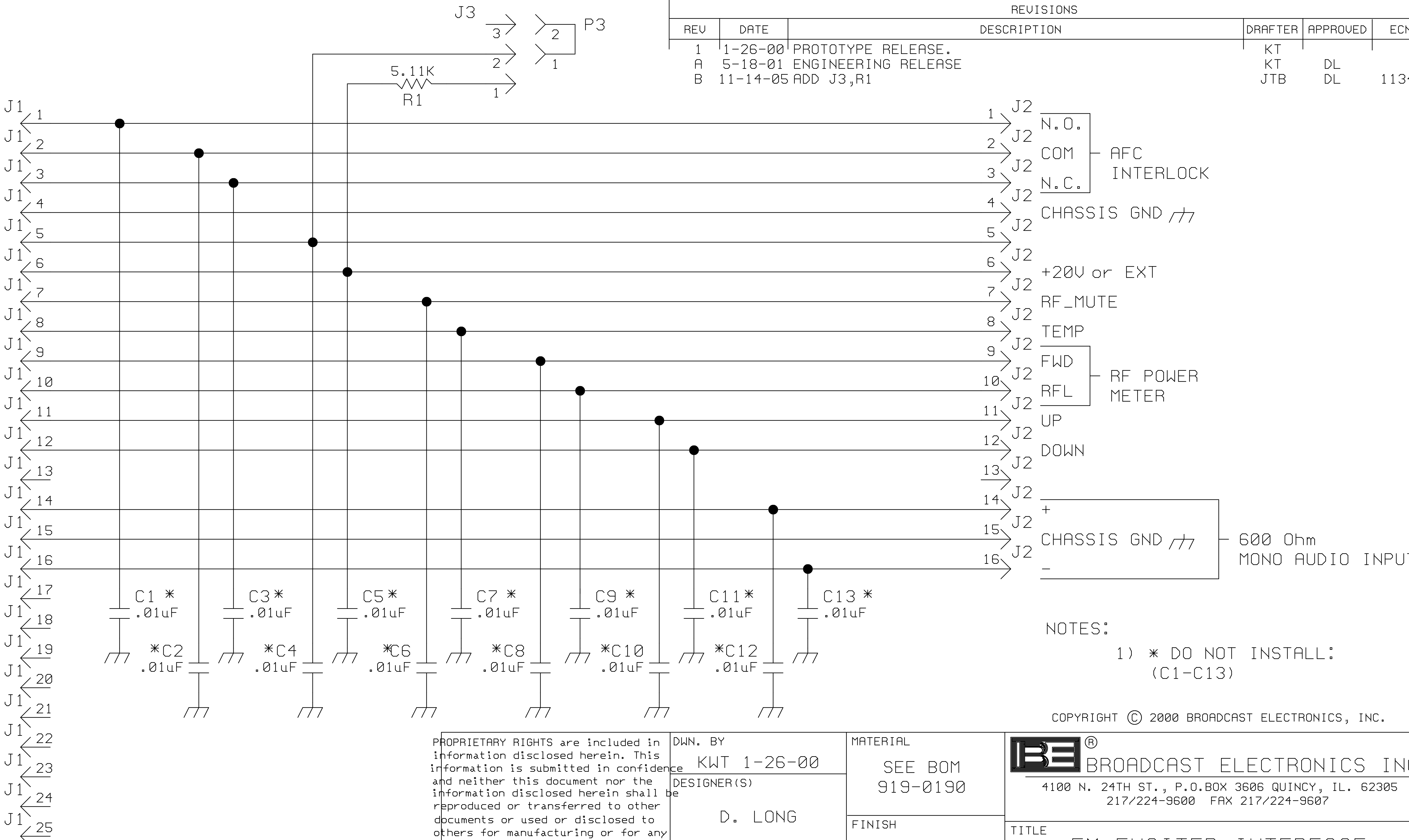
TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1

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	A
SIZE	C
DWG. NO.	909-0131
REV	E
MODEL	FX-50
SCALE	.5=1
SHEET	2 OF 2



REVISIONS

REV	DATE	DESCRIPTION	DRAFTER	APPROVED	ECN
1	1-26-00	PROTOTYPE RELEASE.	KT		
A	5-18-01	ENGINEERING RELEASE	KT	DL	
B	11-14-05	ADD J3,R1	JTB	DL	11340

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): D. LONG
PROJ. LEADER:
MFG.:
MATERIAL: SEE BOM 919-0190
FINISH:
NEXT ASSY.:

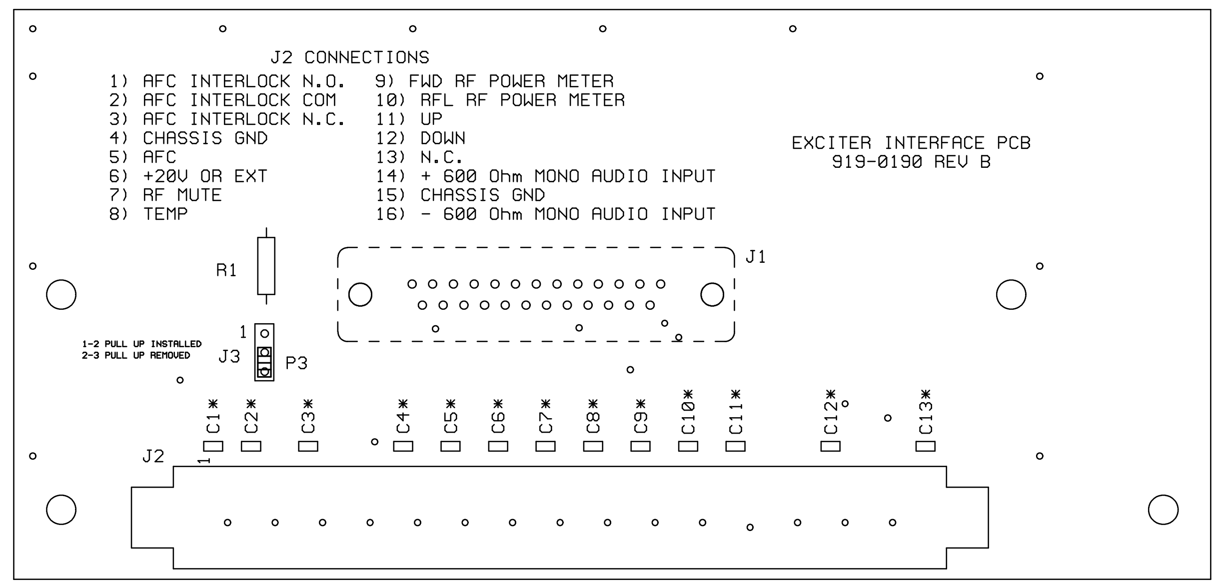
BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O.BOX 3606 QUINCY, IL. 62305
217/224-9600 FAX 217/224-9607

TITLE: FM EXCITER INTERFACE

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

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		-----
A	5-18-01	ENGINEERING RELEASE	KT	DL	-----
B	11-11-05	ADD J3,R1	JTB	DL	11340



NOTES:
1) * DO NOT INSTALL (C1-C13)
2) P3 POS 1-2 FOR S-SERIES
P3 POS 2-3 FOR C & T SERIES

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

DWN. BY KWT 3-17-00
DESIGNER(S) D. LONG
PROJ. LEADER
MFG.

MATERIAL SEE BOM 919-0190
FINISH
NEXT ASSY.

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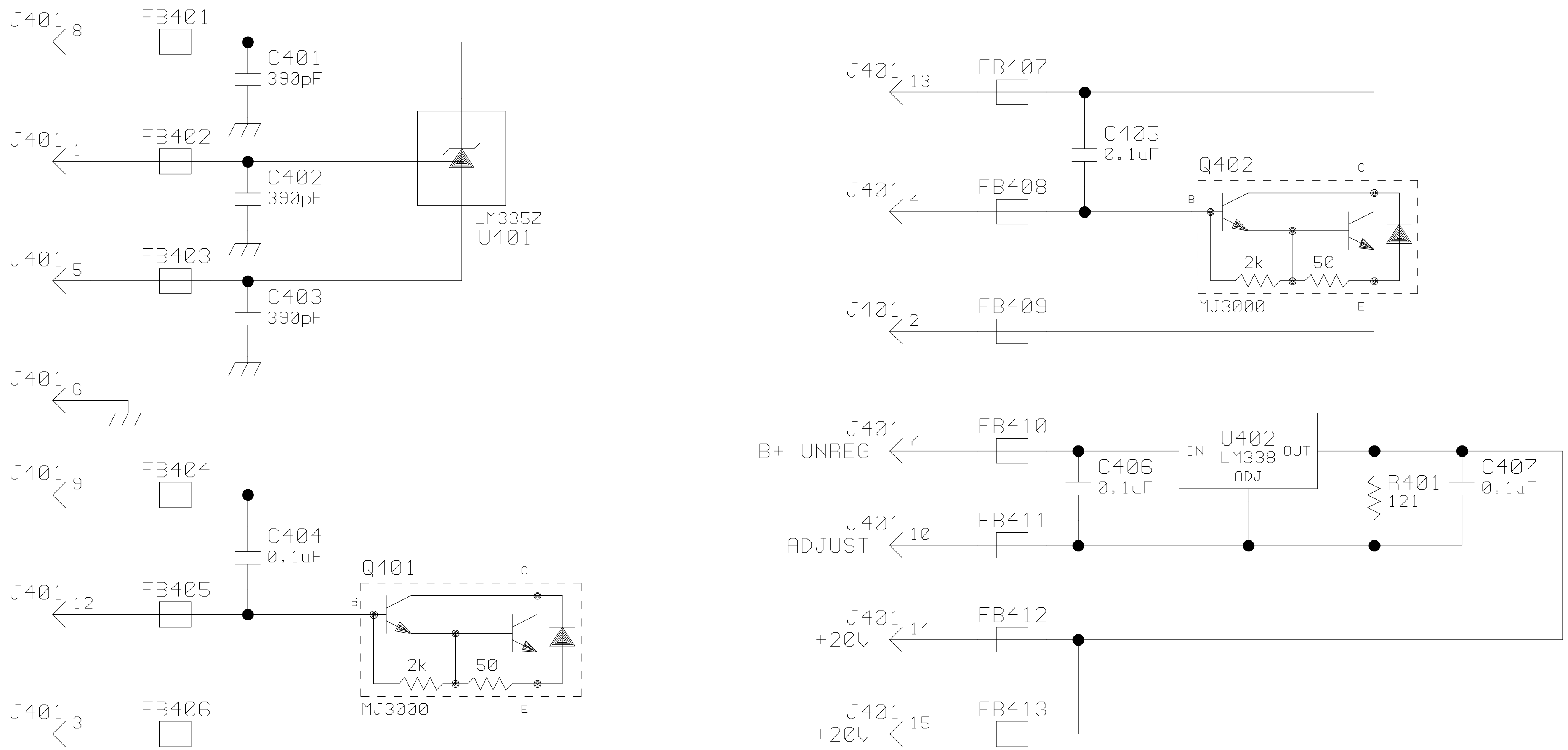
4100 N. 24TH ST. P.O.BOX 3606 QUINCY,IL. 62305
217/224-9600 FAX 217/224-9607

TITLE EXCITER INTERFACE PCB

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

MODEL NNNN SCALE 1/1 SHEET 1 OF 1

REVISIONS					
REV	DATE	DESCRIPTION	DRAFTER	APPROVED	ECN
A	3-29-93	PROTOTYPE RELEASE.	JLF		----
-	8-2-93	MODEL BUILD RELEASE.	JLF	CLL	----
-	10-8-93	ENGINEERING RELEASE.	JLF		----



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 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 RF AMP REGULATOR PCB

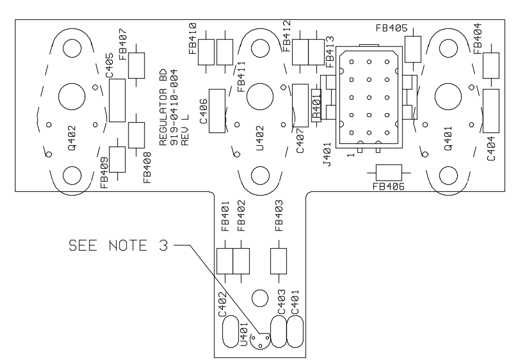
TYPE: S | SIZE: B | DWG. NO.: 919-0410-004 | REV: A

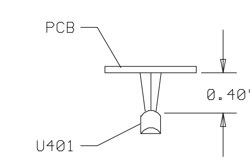
MODEL: FM-100C | SCALE: NONE | SHEET 1 OF 1

REVISIONS						
REV	DATE	SUFFIX/REV	DESCRIPTION	DRAFTER	APPROVED	ECN
C	8-2-93	-	MODEL BUILD RELEASE.	JLF	CLL	----
D	10-5-93	-001 -003	INCREASED PAD CLEARANCES TO GND PLANE ON -001 & -003 BDS. C312-313 WERE 040-1022. ADD DETAIL "B".	JLF	CLL	9085
-	10-8-93	-	ENGINEERING RELEASE.	JLF	CLL	----
E	10-13-94	- -003	SEPARATED -001 BD FRM BRKWY. SEE AB919-0410-001. RENAMED TB301 TO TB1.	JLF	BG	9295 9309
F	6-2-95	-003 -004 -005	UPDATED SILKSCREEN ARTWORK.	JLF	CLL	9444
G	11-13-95	-003	ADDED NOTE AS TO LENGTH OF WIRE FOR J301-J305	MERK		9573
H	11-27-96	-003 -004	ADDED NOTE 5, 1.0 IN WAS .75	MSE	DL	9636
J	1-6-96	-003	ADDED R310, R311, J308, J309	MSE	DL	9703
K	5-7-97	-005	519-0410-005J WAS 519-0410-005G	MSE	DL	9801
L	6-21-01	ALL	OBSOLETED -004 & -005, SEPERARTED 517-0036 & 0410-004	KT		10459

NOTES:

1. COMPONENTS SHOWN WITH DASHED LINES TO BE INSTALLED ON OPPOSITE SIDE.
2. TAPE TO BE PLACED OVER MOUNTING HOLES OF Q401-402 & U401-402 BEFORE SOLDER REFLOW.
3. U401 TO BE MOUNTED ON OPPOSITE SIDE AND SPACED OFF FROM PCB SURFACE AS SHOWN IN DETAIL "A".





DETAIL "A"

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TOLERANCE (DECIMAL) U.O.S. .X ± .030 .XXX ± .005 .XX ± .015 ANGLES + 1°	MFG.	NEXT ASSY. -	MODEL FM-100C SCALE 1:1 SHEET 1 OF 1

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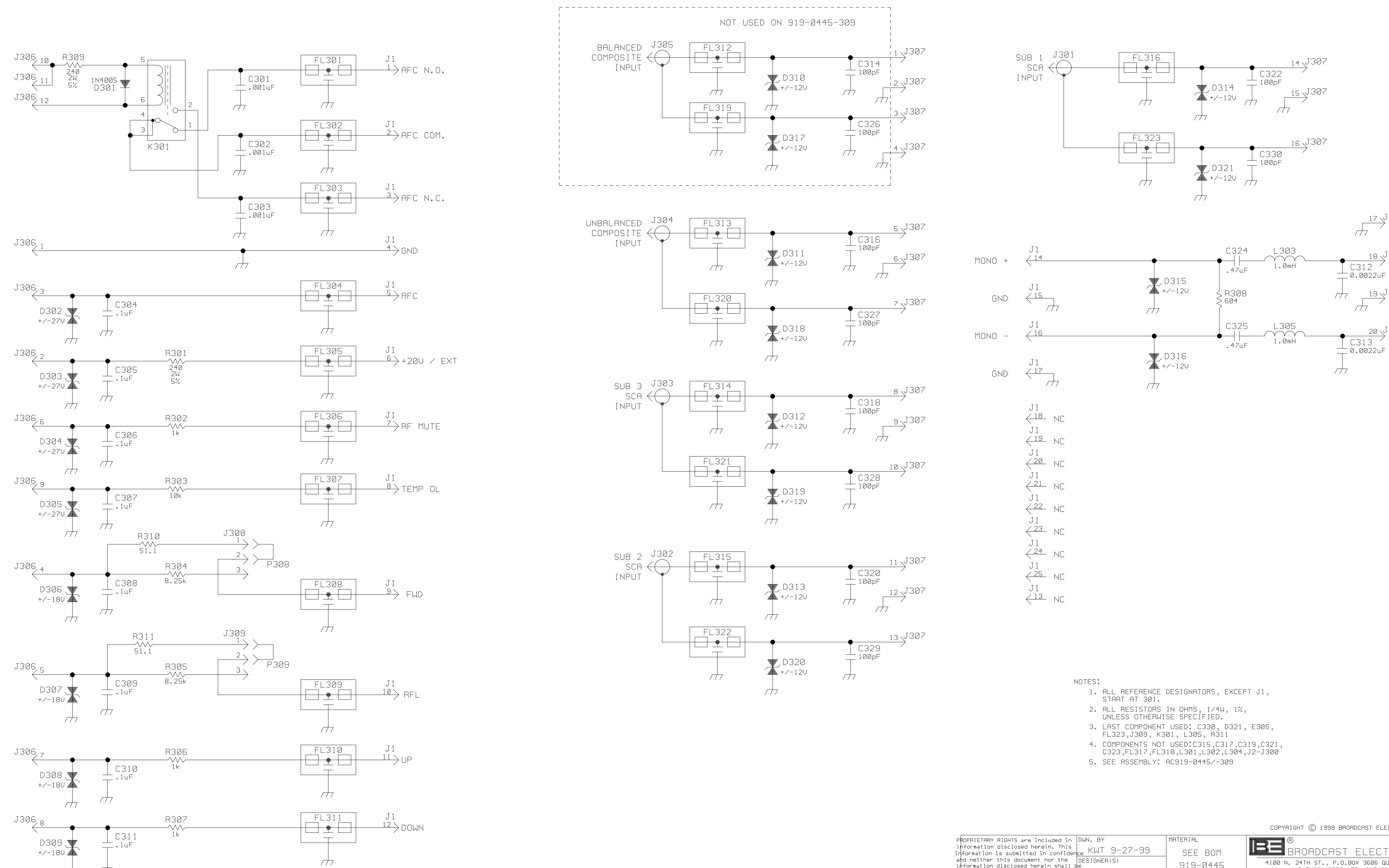
REVISIONS					
REV	DATE	DESCRIPTION	DRAFTER	APPROVED	ECN
1	9-27-99	PROTOTYPE RELEASE.	KT		----
A	2-19-01	ENGINEERING RELEASE WITHOUT CHANGE	KT		----
B	7-10-01	ADDED C327-330,D318-321,FL320-323;DEL FL317-318	KT	DDL	10476
C	2-20-03	CORRECTED VALUE OF R310 & R311	KT	DDL	10889



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: C330, D321, E305, FL323,J309, K301, L305, R311
4. COMPONENTS NOT USED:C315,C317,C319,C321, C323,FL317,FL318,L301,L302,L304,J2-J300
5. SEE ASSEMBLY: AC919-0445/-309

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

DWN. BY KWT 9-27-99
DESIGNER(S)
PROJ. LEADER
MFG.
MATERIAL SEE BOM 919-0445
FINISH
NEXT ASSY.

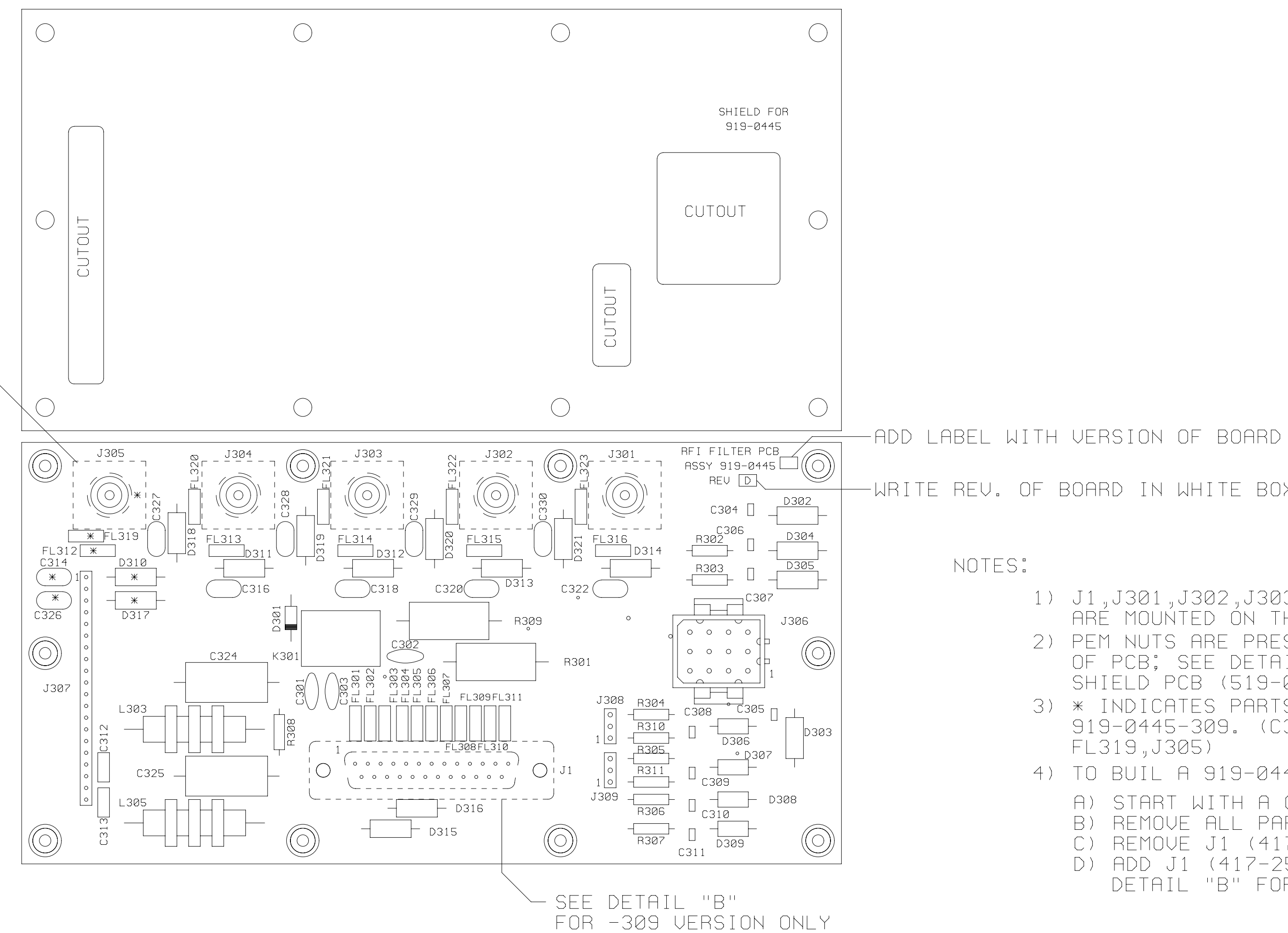
BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O.BOX 3606 QUINCY, IL. 62305
217/224-9600 FAX 217/224-9607

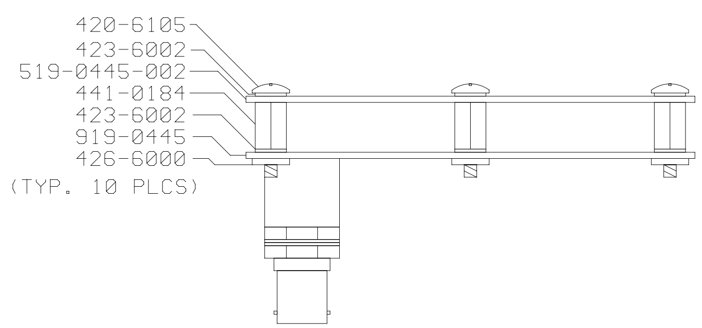
TITLE RFI FILTER PCB

TYPE S | SIZE B | DWG. NO. 919-0445/-309 | REV C

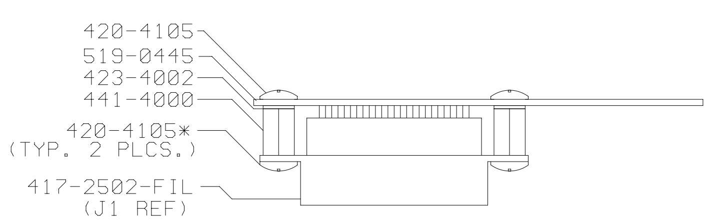
MODEL NNNN | SCALE NONE | SHEET 1 OF 1

REVISIONS					
REV	DATE	DESCRIPTION	DRAFTER	APPROVED	ECN
1	10-4-99	PROTOTYPE RELEASE.	KT		----
2	11-3-00	ADDED DETAIL "A" AND NOTE 3	KT		----
3	2-6-01	ADDED DETAIL "B"	KT		----
A	2-19-01	ENGINEERING RELEASE	KT		----
B	7-10-01	ADDED C327-330,D318-321,FL320-323;DEL FL317-318	KT	DDL	10476
C	8-28-02	UPDATED BOM TO MATCH ASSEMBLY	KT	DDL	10743
D	4-23-07	ADD NOTE 4	JTB		11543





DETAIL "A"



DETAIL "B"

* INDICATES SCREWS TO BE REMOVED AFTER INSTALLATION OF J1.

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)
4) TO BUIL A 919-0445-309
   A) START WITH A COMPLETED 919-0445
   B) REMOVE ALL PARTS LISTED IN NOTE (3)
   C) REMOVE J1 (417-2502-FER)
   D) ADD J1 (417-2502-FIL),NOTE DETAIL "B" FOR MOUNTING INSTRUCTIONS.

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 919-0445-309
FINISH
NEXT ASSY.

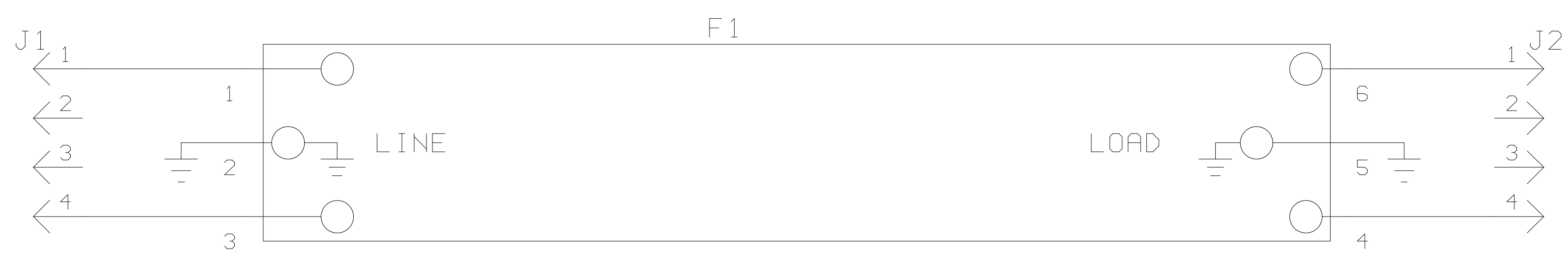
BROADCAST ELECTRONICS INC.
4100 N. 24TH ST. P.O.BOX 3606 QUINCY,IL. 62305
217/224-9600 FAX 217/224-9607

TITLE RFI FILTER PCB

TYPE	SIZE	DWG No.	REV
A	C	919-0445/-309	D

MODEL NNNN SCALE 1/1 SHEET 1 OF 1

REVISIONS					
REV	DATE	DESCRIPTION	DRAFTER	APPROVED	ECN
1	11-7-00	PROTOTYPE RELEASE	KT		-----
A	2-19-01	ENGINEERING RELEASE WITHOUT CHANGE	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.	

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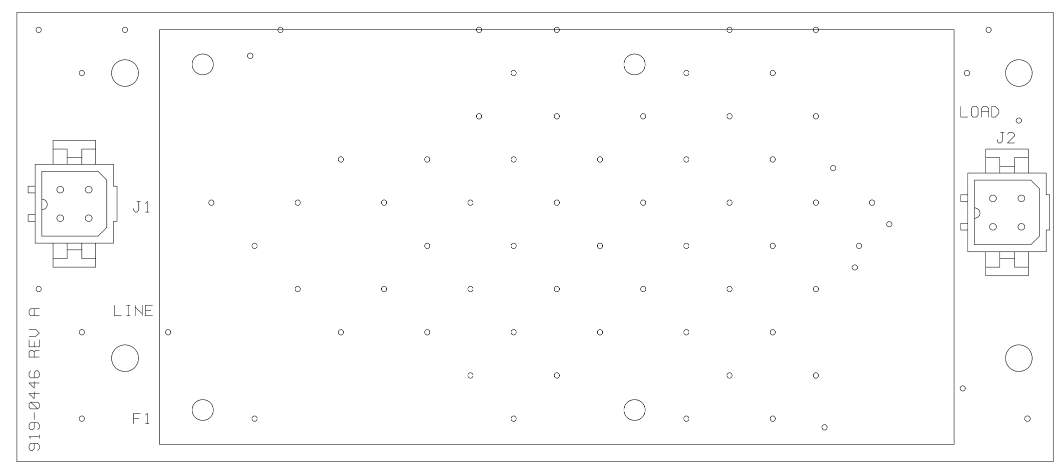
217/224-9600 FAX 217/224-9607

TITLE
AC LINE FILTER

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

MODEL NNNN | SCALE NONE | SHEET 1 OF 1

REVISIONS					
REV	DATE	DESCRIPTION	DRAFTER	APPROVED	ECN
1	11-8-00	PROTOTYPE RELEASE	KT		-----
A	2-19-01	ENGINEERING RELEASE WITHOUT CHANGE	KT		-----



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

DWN. BY KT 11-8-00	MATERIAL SEE BOM 919-0446
DESIGNER(S)	FINISH
PROJ. LEADER	
MFG.	NEXT ASSY.

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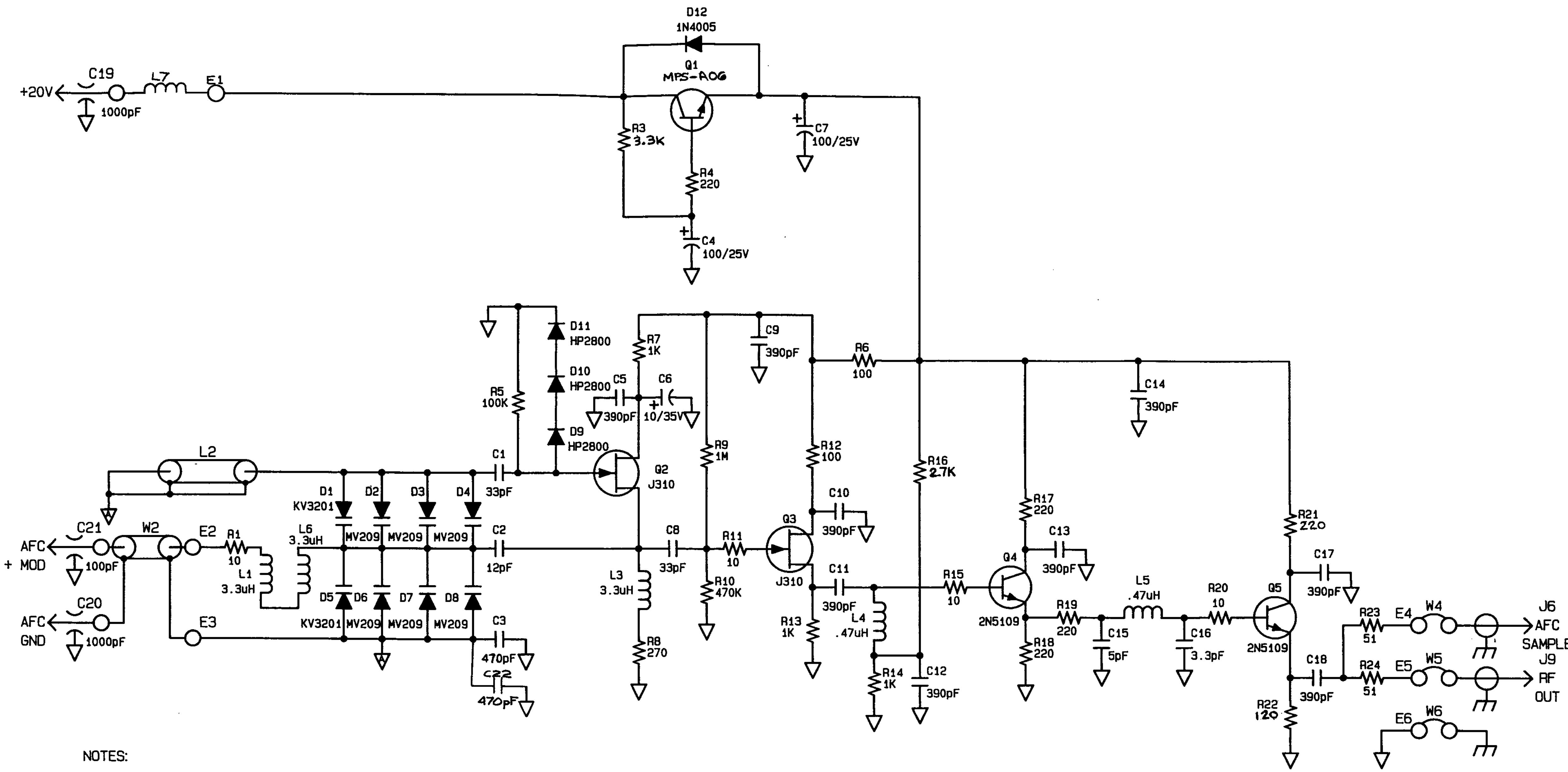
TITLE
AC LINE FILTER

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

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



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

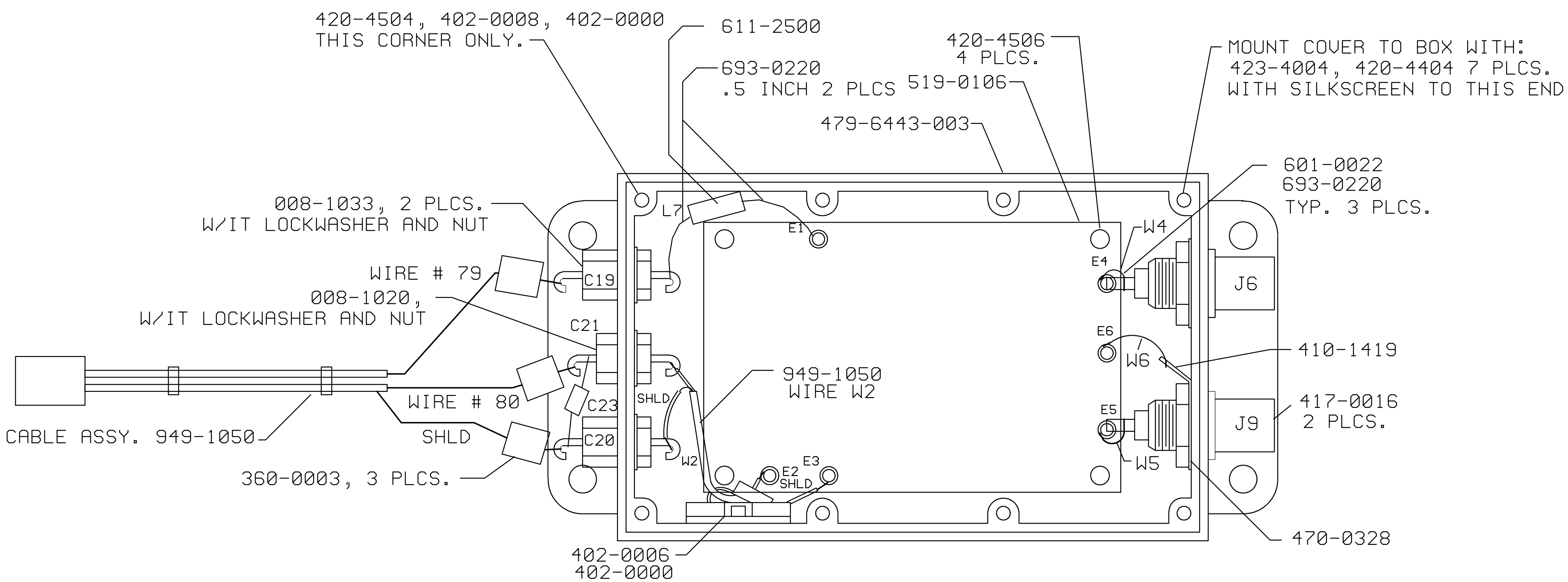
TOLERANCE DECIMAL U.O.S.
.X ± .030 .XXX ± .005
.XX ± .015 ANGLES ± 1°

DWN BY KLS	DATE 6-2-87	MATERIAL SEE B/M 959-0203	BROADCAST ELECTRONICS INC. 4100 N. 24TH ST. QUINCY, IL. 62305 217/224-9600 TELEX 250142 CABLE "BROADCAST"
CHKD MH	6-14-88		
ME		FINISH	TITLE SCHEMATIC MODULATED OSCILLATOR BOARD
PROJ ENGR E.ANTHONY 6-13-88			TYPE S / SIZE C / DWG.NO. 959-0203 / REV J
MFG D.NEWLON 6-14-88		NEXT ASSY 909-1050-000	MODEL FX-50 / SCALE / SHEET 1 OF 1

K	4-6-90	ADDED C22,L7; REMOVED W1,REMOVED "*" NEAR C3	ELP	EJA	8240
L	5-21-91	ADDED 470-0328	JAH	JHS	8527
M	1-30-92	TELESIS TO PCAD CONVER MOVED PINS OF Q1 IN LINE	JAH	EJA	8582
N	3-14-94	LENGTH OF 621-1359 (2 PLCS) WAS 8"	MH	BG	9168
P	10-27-94	ADDED 360-0003, 3 PLCS.	MH	JRC	9254
R	10-30-95	CHGD Q1 FROM 211-0005(MPS-U95) TO 211-0006(MPS-A06)	MERK		9561
S	12-3-96	12" LG WAS 10" LG, ADD 420-4504, 402-0008, 402-0000.	MSE	DL	9685
T	3-26-97	MOVED 420-4504, 423-0008, 402-0000 TO OPP CORNER	MSE	DL	9774

REVISIONS

REV	DATE	DESCRIPTION	DFTSMN	ENGR	ECN
U	12-1-99	SEPERATED 919-0106 ASSEMBLY FROM THIS ONE.	KT	DL	10223
V	1-3-00	CHGD NOTES.	KT	DL	10246
W	10-3-00	ADDED 949-1050 NOTES	KT	DL	10362
Y	8-16-01	ADDED C23	KT		10457
Z	6-7-10	ADD 611-2500(HEATSHRINK NOTE)	JTB		11773



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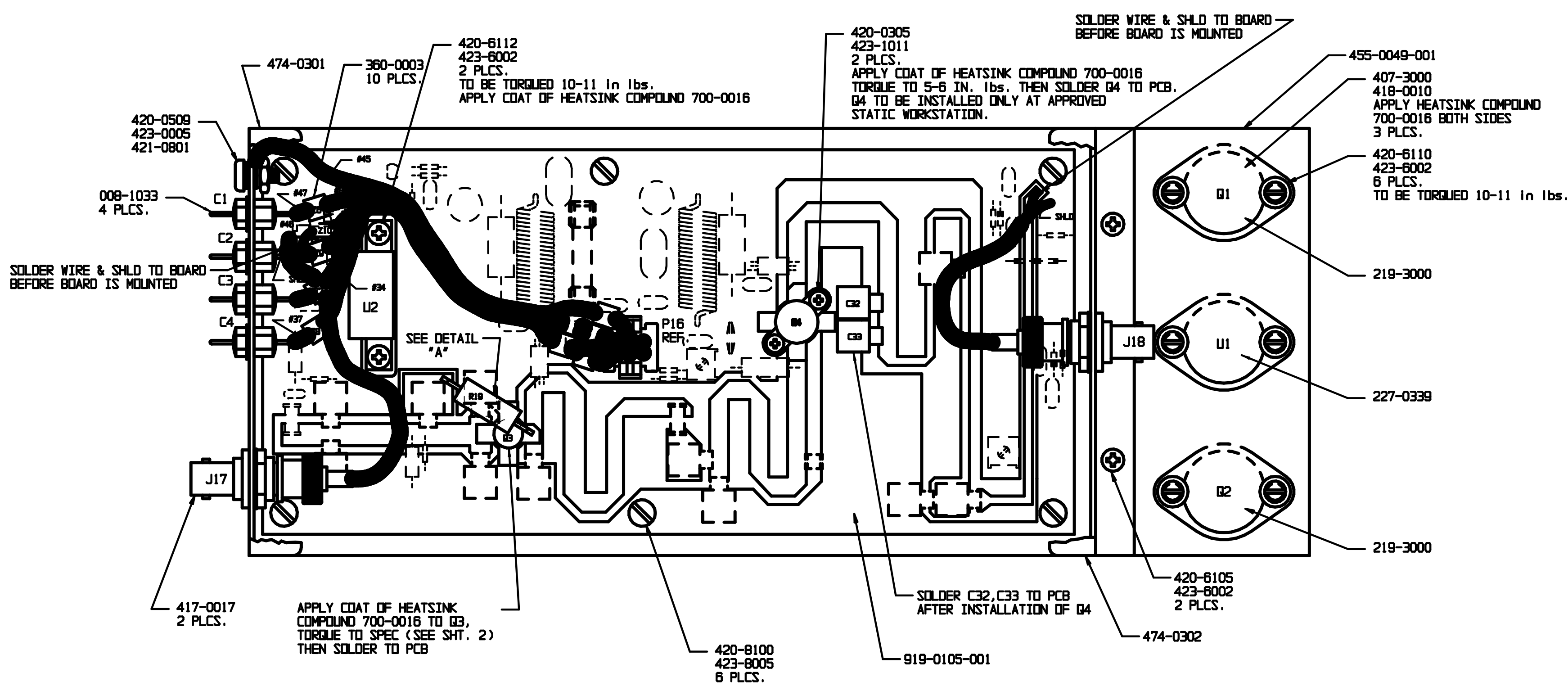
4100 N.24TH ST. P.O.BOX 3606 QUINCY,IL. 62305 PH. 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

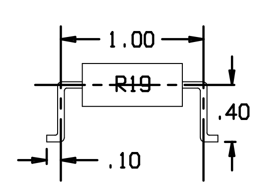
TITLE PCB ASSEMBLY MODULATED OSCILLATOR BD

TYPE A | SIZE B | DWG No. 959-0203 | REV Z

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

REVISIONS					
REV	DATE	DESCRIPTION	DFTSMN	ENGR	ECN
A	1-29-88	PROTOTYPE RELEASE	JAH	EJA	----
B	5-19-88	ENGINEERING RELEASE W/CHGS	JAH	EJA	----
C	4-7-89	REVISED NUT ON J17 & J18, SHTS 1 & 2	MSE	DBN	7793
D	10-2-89	CHGD R6 HOLE SIZES FROM .030 TO .040	ELP	EJA	8027
E	2-7-90	CHGD 330-0800 TO 330-0802 SHT 2	RLC	EJA	8197
F	4-9-90	R10 WAS 1W,R17 WAS HORIZONTAL,ADDED DETAIL "C" ADDED Z5,Z24,Z25,Z26	ELP	EJA	8240
G	10-7-91	CHGD 420-4104 TO 420-4105 (SHT 2)	JAH	EJA	8585
H	7-8-92	ADDED R20,R21	CR	GNM	8721
J	10-1-93	CHGD C20 TO 046-0004,C24 TO 046-0005,R20 TO 100-1031 & R21 TO 103-2212.	MH	BG	9018
K	3-10-94	DELETED PCB ASSY VIEW & DETAILS A&C;RENAMED DETAIL B TO A; ADDED WIRE #88 & Z10;ADDED WIRE SOLDERING NOTES FOR J17 & J18; ALSO SEE SHEET 2.	MH	BG	9168
L	10-31-94	CORRECTED MOUNTING HARDWARE FOR 919-0410-004 (SHT 2)	JLF	JRC	9268
M	3-6-95	REVISED MOUNTING HARDWARE ON (SHT 2)	WLF	JRC	9390
N	3-6-95	ADDED 959-0204-001 (SEE SHEET 2)	WLF	DL	9477
P	11-3-95	ADDED C43 TO 919-0105-001.	JLF	DLL	9408
R	11-16-95	CHGD Q5 TO 218-0032 ON 919-0105-001.	MH	DLL	9498
S	8-31-99	SHT. 1, 360-0003 QTY WAS 5	MSE		10180





DETAIL "A"

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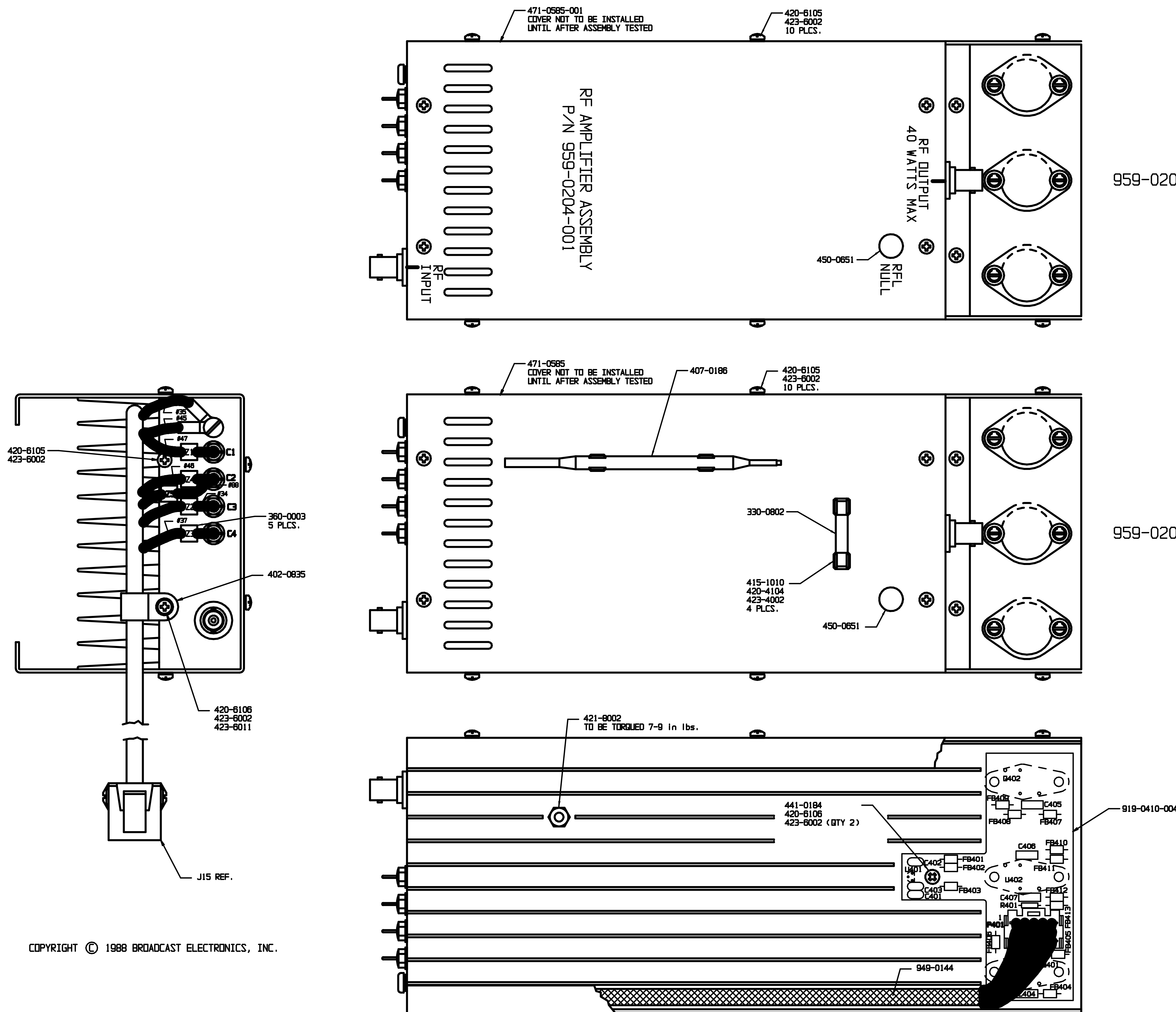
TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°

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
CHKD MH 6-14-88		
ME J.H.STEINKAMP 6-20-88	FINISH ------	TITLE ASSY, RF AMPLIFIER
PROJ. ENGR. E.ANTHONY 6-13-88	SEE DWG RA592-0000	TYPE A SIZE D DWG. NO. 959-0204 959-0204-001 REV S
MFG. D.B.NEWLON 6-14-88	NEXT ASSY. 909-1050	MODEL FX-50/ME-40 SCALE 1:1 SHEET 1 OF 2

REV	DATE	DESCRIPTION	DRAFTER	APPROVED	ECN
A	1-29-88	PROTOTYPE RELEASE	JAH	EJA	----
B	5-19-88	ENGINEERING RELEASE W/CHG	JAH	EJA	----
C	4-7-89	REVERSED NUT ON J17 & J18, SHT. 1 & 2	MSE	DBN	7793
D	10-2-89	CHGD R6 HOLE SIZES FROM .030 TO .040	ELP	EJA	8027
E	2-7-90	330-0802 WAS 330-0800	RLC	EJA	8197
G	10-7-91	CHGD 420-4104 TO 420-4105	JAH	EJA	8585
K	3-14-94	ADDED 919-0410-004, Z5 & WIRE #88	MH	BG	9168
L	10-31-94	CORRECTED MOUNTING HARDWARE FOR 919-0410-004	JLF	JRC	9268
M	3-6-95	REMOVED #4 HARDWARE FOR (3) TRANSISTORS	WLF	JRC	9390
N	3-6-95	ADDED 959-0204-001	WLF	DLL	9477
S	8-31-99	SHT. 2, 471-0585-001 WAS 471-0585	MSE		10180



959-0204-001 ME-40 EXCITER

959-0204 FX-50 EXCITER

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

DWN. BY JAH 1-29-88
DESIGNER(S) 6-20-88 JH STEINKAMP
PROJ. LEADER EJA 6-13-88
MFG. DBN 6-14-88

MATERIAL SEE B/M 959-0204
FINISH
~~SEE DWG RA582-0000~~
NEXT ASSY. 909-1050

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 ASSEMBLY, RF AMPLIFIER

TYPE A | SIZE D | DWG. NO. 959-0204 959-0204-001 | REV S
MODEL FX-50/ME-40 | SCALE 1 : 1 | SHEET 2 OF 2