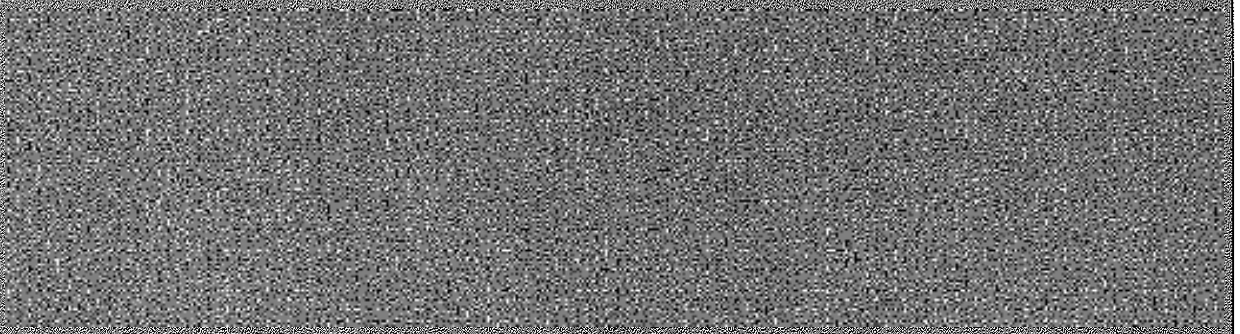
INSTRUCTION MANUAL



FM-100B
FM-250B
FM-300B
VERY-LOW POWER FM TRANSMITTERS

100 Watts through 300 Watts

February, 1992 **IM No. 597-0092-004**

BROADCAST ELECTRONICS, INC.

BE®

IMPORTANT INFORMATION

EQUIPMENT LOST OR DAMAGED IN TRANSIT

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

TECHNICAL ASSISTANCE AND REPAIR SERVICE

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

FOR TECHNICAL ASSISTANCE

Phone (217) 224-9600 Customer Service

WARRANTY ADJUSTMENT

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

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.

REPLACEMENT PARTS

Replacement and Warranty Parts may be ordered from the address below. Be sure to include equipment model and serial number and part description and part number.

Broadcast Electronics, Inc.
4100 N. 24th St., P.O. Box 3606
Quincy, Illinois 62305
Tel: (217) 224-9600
Telex: 25-0142
Cable: BROADCAST
Fax: (217) 224-9607

PROPRIETARY NOTICE

MODIFICATIONS

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

WARNING

OPERATING HAZARDS

READ THIS SHEET 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. BERYLLIUM-OXIDE POISONING - Dust or fumes from BeO ceramics used as thermal links with conduction cooled power tubes and power transistors are highly toxic and can cause serious injury or death. Additional information follows.

D. 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.

HIGH VOLTAGE

Many power tubes operate at voltages high enough to kill through electrocution. Personnel should always break the primary circuits of the power supply and discharge high voltage capacitors when direct access to the tube is required.

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 leakproof. 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.

DANGER--BERYLLIUM OXIDE CERAMICS (BeO) - AVOID BREATHING DUST OR FUMES

BeO ceramic material is used as a thermal link to carry heat from a tube or transistor to the heat sink. Do not perform any operation on any BeO ceramic which might produce dust or fumes, such as grinding, grit blasting, or acid cleaning. Beryllium oxide dust or fumes are highly toxic and breathing them can result in serious personal injury or death. BeO ceramics must be disposed of only in a manner prescribed by the device manufacturer.

HOT SURFACES

The anode portion of power tubes is often air-cooled or conduction-cooled. The air-cooled external surface normally operates at a high temperature (up to 200° to 300°C). Other portions of the tube may also reach high temperatures, especially the cathode insulator and the cathode/heater surfaces. All hot surfaces may remain hot for an extended time after the tube is shut off. To prevent serious burns, take care to prevent and avoid any bodily contact with these surfaces both during and for a reasonable cool-down period after tube operation.

SCOPE OF MANUAL

This manual comprises two parts providing the following information for the Broadcast Electronics B–Series very–low–power line of FM transmitters.

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

B. PART II – Contains detailed information for the transmitter power amplifier(s).

PART I – TABLE OF CONTENTS

LIST OF TABLES

LIST OF ILLUSTRATIONS

PART II – TABLE OF CONTENTS

SECTION I
GENERAL INFORMATION

1–1. INTRODUCTION.

1–2. Information presented in this section provides a general description of the Broadcast Electronics B–series very–low–power line of FM transmitters and lists equipment specifications.

1–3. RELATED PUBLICATIONS.

1–4. The following list of publications provides data for equipment associated with the Broadcast Electronics B–series very–low–power line of FM transmitters.

PUBLICATION NUMBER	EQUIPMENT
597–1050	FX–50 FM Exciter
597–0008	FC–30 SCA Generator
597–0009	FS–30 Stereo Generator

1–5. EQUIPMENT DESCRIPTION.

1–6. The Broadcast Electronics B–series very–low–power line of FM transmitters consists of three models available in single–transmitter configurations as well as main/alternate configurations. Each transmitter is designed for continuous operation in the 87.5 to 108 MHz FM broadcast band and is completely self–contained in a single rack cabinet. The equipment design incorporates solid–state control circuitry, a solid–state power amplifier, and a solid–state exciter with digital frequency synthesization.

1–7. TRANSMITTER CONFIGURATIONS.

1–8. The Broadcast Electronics B–series very–low–power line of FM transmitters may be ordered in the following configurations.

MODEL	PART NUMBER	DESCRIPTION
FM–100B	909–0100–204	100 Watt FM transmitter including exciter, solid–state power amplifier, ac power control panel, transmitter con–troller, and low–pass filter, single phase 194 to 266V ac 60 Hz operation, 36 inch (91.4 cm) height cabinet.
FM–100B	909–0100–214	Same as 909–0100–204 less exciter.
FM–100B	909–0100–274	100 Watt FM transmitter including exciter, solid–state power amplifier, ac power control panel, transmitter con–troller, and low–pass filter, single phase 194 to 266V ac 60 Hz operation, 70 inch (177.8 cm) height cabinet.
FM–100B	909–0100–304	100 Watt FM transmitter including exciter, solid–state power amplifier, ac power control panel, transmitter con troller, and low–pass filter, single phase 194 to 266V ac 50 Hz operation, 36 inch (91.4 cm) height cabinet.
FM–100B	909–0100–314	Same as 909–0100–304 less exciter.

MODEL	PART NUMBER	DESCRIPTION
FM–100BM/A	909–2100–204	Two 909–0100–204 transmitters in automatic main/alternate configuration including system controller, test load, and RF transfer switch, single phase 194 to 266Vac 60 Hz operation.
FM–100BM/A	909–2100–214	Same as 909–2100–204 less exciter.
FM–100BM/A	909–2100–304	Two 909–0100–304 transmitters in automatic main/alternate configuration including system controller, test load, and RF transfer switch, single phase 194 to 266Vac 50 Hz operation.
FM–100BM/A	909–2100–314	Same as 909–2100–304 less exciter.
FM–250B	909–0250–204	250 Watt FM transmitter including exciter, solid–state power amplifier, ac power control panel, transmitter controller, and low–pass filter, single phase 194 to 266V ac 60 Hz operation, 36 inch (91.4 cm) height cabinet.
FM–250B	909–0250–214	Same as 909–0250–204 less exciter.
FM–250B	909–0250–274	250 Watt FM transmitter including exciter, solid–state power amplifier, ac power control panel, transmitter controller, and low–pass filter, single phase 194 to 266V ac 60 Hz operation, 70 inch (177.8 cm) height cabinet.
FM–250B	909–0250–304	250 Watt FM transmitter including exciter, solid–state power amplifier, ac power control panel, transmitter controller, and low–pass filter, single phase 194 to 266V ac 50 Hz operation, 36 inch (91.4 cm) height cabinet.
FM–250B	909–0250–314	Same as 909–0250–304 less exciter.
FM–250BM/A	909–2250–204	Two 909–0250–204 transmitters in automatic main/alternate configuration including system controller, test load, and RF transfer switch, single phase 194 to 266Vac 60 Hz operation.
FM–250BM/A	909–2250–214	Same as 909–2250–204 less exciter.
FM–250BM/A	909–2250–304	Two 909–0250–304 transmitters in automatic main/alternate configuration including system controller, test load, and RF transfer switch, single phase 194 to 266Vac 50 Hz operation.
FM–250BM/A	909–2250–314	Same as 909–2250–304 less exciter.
FM–300B	909–0300–204	300 Watt FM transmitter including exciter, solid–state power amplifier, ac power control panel, transmitter controller, and low–pass filter, single phase 194 to 266V ac 60 Hz operation, 50 inch (127 cm) height cabinet.
FM–300B	909–0300–214	Same as 909–0300–204 less exciter.

MODEL	PART NUMBER	DESCRIPTION
FM–300B	909–0300–274	300 Watt FM transmitter including exciter, solid–state power amplifier, ac power control panel, transmitter controller, and low–pass filter, single phase 194 to 266V ac 60 Hz operation, 70 inch (177.8 cm) height cabinet.
FM–300B	909–0300–304	300 Watt FM transmitter including exciter, solid–state power amplifier, ac power control panel, transmitter controller, and low–pass filter, single phase 194 to 266V ac 50 Hz operation, 50 inch (127 cm) height cabinet.
FM–300B	909–0300–314	Same as 909–0300–304 less exciter.
FM–300BM/A	909–2300–204	Two 909–0300–204 transmitters in automatic main/alternate configuration including system controller, test load, and RF transfer switch, single phase 194 to 266V ac 60 Hz operation.
FM–300BM/A	909–2300–214	Same as 909–2300–204 less exciter.
FM–300BM/A	909–2300–304	Two 909–0300–304 transmitters in automatic main/alternate configuration including system controller, test load, and RF transfer switch, single phase 194 to 266V ac 50 Hz operation.
FM–300BM/A	909–2300–314	Same as 909–2300–304 less exciter.

1–9. OPTIONAL EQUIPMENT AND SPARE PARTS KITS.

1–10. The following optional equipment and spare parts kits are available for use in the B–series very–low–power FM transmitter line.

PART NUMBER	DESCRIPTION
909–0050–204	FS–30 FM stereo generator.
909–0051–204	FC–30 FM SCA generator.
979–0024–004	Recommended spare parts kit for the B–series very–low–power transmitterline and FX–50 exciter. Includes selected meters, switches, relays, etc. Does not include semiconductors.
979–0026–004	Recommended semiconductor kit for the B–series very–low–power transmitter line and FX–50 exciter.

1–11. ELECTRICAL DESCRIPTION.

1–12. Each system consists of modular sub–assemblies to allow ease of maintenance and maximum reliability (see Figures 1–1 through 1–4). Critical units such as the exciter(s) and power amplifier(s) are mounted on slide–rails for ease of maintenance.

1–13. AC power for each transmitter is connected to the ac power control panel at the bottom of the transmitter cabinet. The ac power control panel protects the internal cabinet wiring and provides on–off control for the various assemblies within the system.

1–14. The individual heat–producing assemblies within each system such as the exciter(s) and the power amplifier(s) are individually cooled by self–contained fans. The FM–250B and FM–300B models are equipped with two cabinet–mounted fans to provide sufficient air exchange for cool and efficient operation.

1–15. **FM–100B OR FM–250B SINGLE CONFIGURATION.** This transmitter consists of a transmitter controller, one power amplifier, a low–pass filter, and a directional coupler (see Figure 1–1). Each of these models function as a basic transmitter with few automatic features.

1–16. The transmitter control panel allows both local and remote on–off control and metering functions. Additionally, a battery–powered memory retains the operational configuration during power failures and will automatically restore the transmitter to operation when power returns. The battery supply for this feature is maintained at full charge during normal operation.

1–17. The RF output of the exciter is amplified by the PA stage. The output of the PA stage is routed through a low–pass filter to reduce the harmonic emissions to the appropriate level. The output of the low–pass filter is routed through a directional coupler which allows measurement of both forward and reflected power. An RF sample port is provided at the input and output of the low–pass filter for the connection of a modulation monitor or other test equipment.

1–18. **FM–100B OR FM–250B MAIN/ALTERNATE CONFIGURATION.** This transmitter consists of one system controller, two transmitter controllers, two power amplifiers, two low–pass filters, two directional couplers, an RF transfer switch, and an RF test load (see Figure 1–2). These models function as single transmitters with automatic back–up.

1–19. The system controller allows both local and remote on–off control and automatic switching of the entire system. In the event of a failure of one transmitter, the system may be configured to automatically connect the alternate transmitter to the antenna and connect the defective transmitter to the test load in a deenergized state. Additionally, a battery–powered memory retains the operational configuration during power failures and will automatically restore the transmitter to operation when power returns. The battery supply for this feature is maintained at full charge during normal operation.

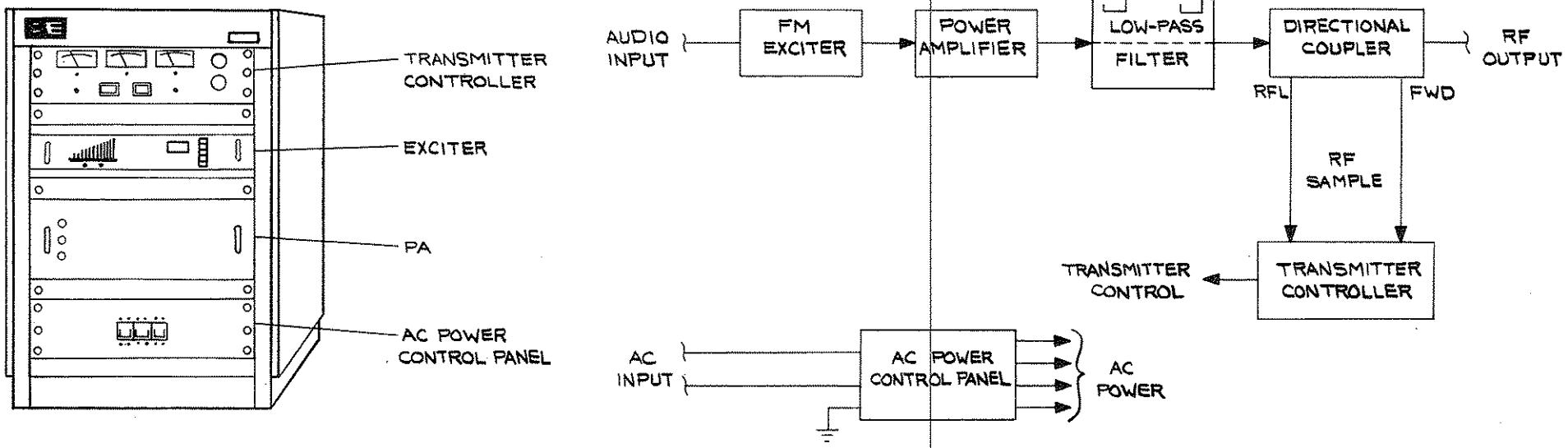
1–20. Each transmitter controller allows both local and remote control and metering of each individual transmitter.

1–21. The RF output of each exciter is amplified by the PA stage. The output of each PA stage is routed through a low–pass filter to reduce the harmonic emissions to the appropriate level. The output of each low–pass filter is routed through a directional coupler which allows measurement of both forward and reflected power. An RF sample port is provided at the input and output of each low–pass filter for connection of a modulation monitor or other test equipment.

1–22. **FM–300B SINGLE CONFIGURATION.** This transmitter consists of a transmitter controller, two power amplifiers, a hybrid splitter and a hybrid combiner, a reject load, a low–pass filter, and a directional coupler (see Figure 1–3). This model functions as a basic transmitter with few automatic features.

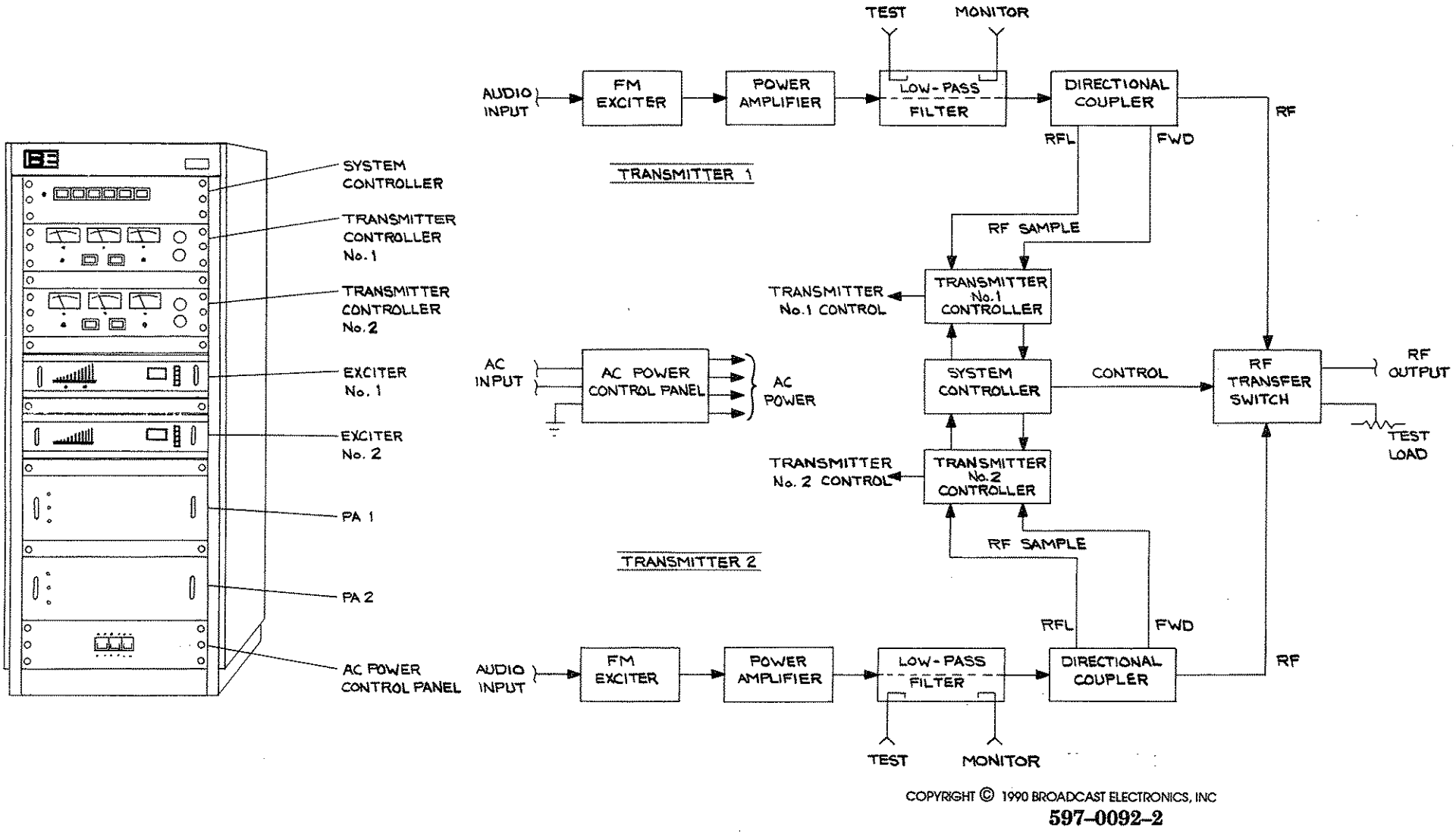
1–23. The transmitter control panel allows both local and remote on–off control and metering functions. Additionally, a battery–powered memory retains the operational configuration during power failures and will automatically restore the transmitter to operation when power returns. The battery supply for this feature is maintained at full charge during normal operation.

1–24. The RF output of the exciter is split into two equal components by a 90 degree hybrid splitter which provides two equal–amplitude signals displaced in time by 90 degrees or one–quarter cycle of the operating frequency. Each output is routed to one power amplifier. The outputs of the power amplifiers are operated in–phase with the 90 degree differential at the splitter made up by precise cable lengths at the amplifier inputs.



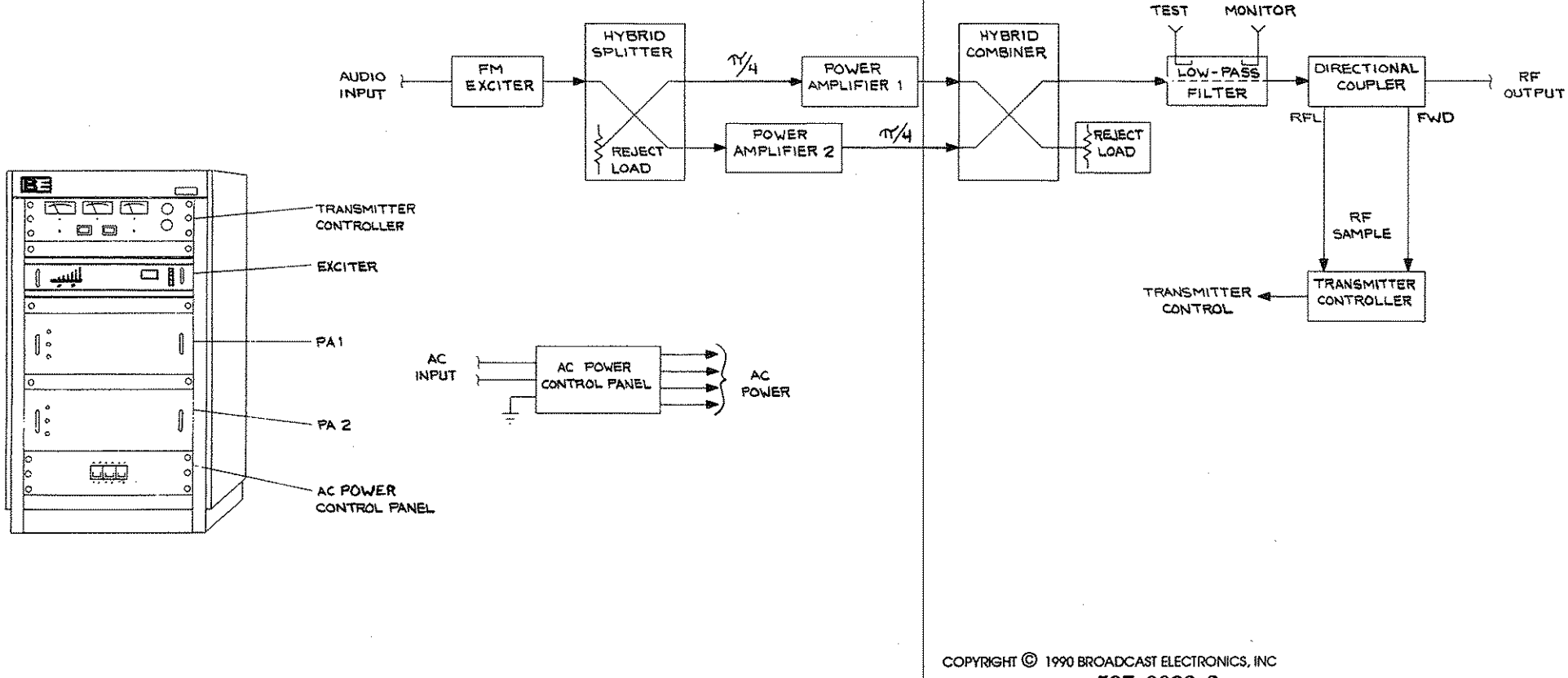
597-0092-1

FIGURE 1–1. FM–100B OR FM–250B SINGLE CONFIGURATION



597-0092-2

FIGURE 1-2. FM-100B OR FM-250B MAIN/ALTERNATE CONFIGURATION



597-0092-3

FIGURE 1–3. FM–300B SINGLE CONFIGURATION

1–25. The outputs of the two power amplifiers are then combined through the appropriate lengths of cable and an additional 90 degree hybrid combiner. The outputs of the two amplifiers are added indirectly in the combiner to produce 300 watts at the combiner output.

1–26. As long as both amplifiers produce the proper power level and are in the proper phase relationship at the combiner inputs, there will be no power dissipated in the combining or reject load. Should an amplifier develop a fault and not produce the proper power level, the remaining power will be divided between the antenna load and the reject load.

1–27. The output of the PA stage is routed through a low–pass filter to reduce the harmonic emissions to the appropriate level. The output of the low–pass filter is routed through a directional coupler which allows measurement of both forward and reflected power. An RF sample port is provided at the input and output of the low–pass filter for connection of a modulation monitor or other test equipment.

1–28. **FM–300B MAIN/ALTERNATE CONFIGURATION.** This transmitter consists of one system controller, two transmitter controllers, four power amplifiers, two reject loads, two low–pass filters, two directional couplers, an RF transfer switch, and an RF test load (see Figure 1–4). This model functions as a single transmitter with automatic back–up.

1–29. The system controller allows on–off control and automatic switching. In the event of a failure of one transmitter, the system may be configured in such a manner that the alternate transmitter will automatically be connected to the antenna and the defective transmitter will be automatically connected to the test load in a deenergized state. Additionally, a battery–powered memory retains the operational configuration during power failures and will automatically restore the transmitter to operation when power returns. The battery supply for this feature is maintained at full charge during normal operation.

1–30. Each transmitter controller allows both local and remote control and metering of each individual transmitter.

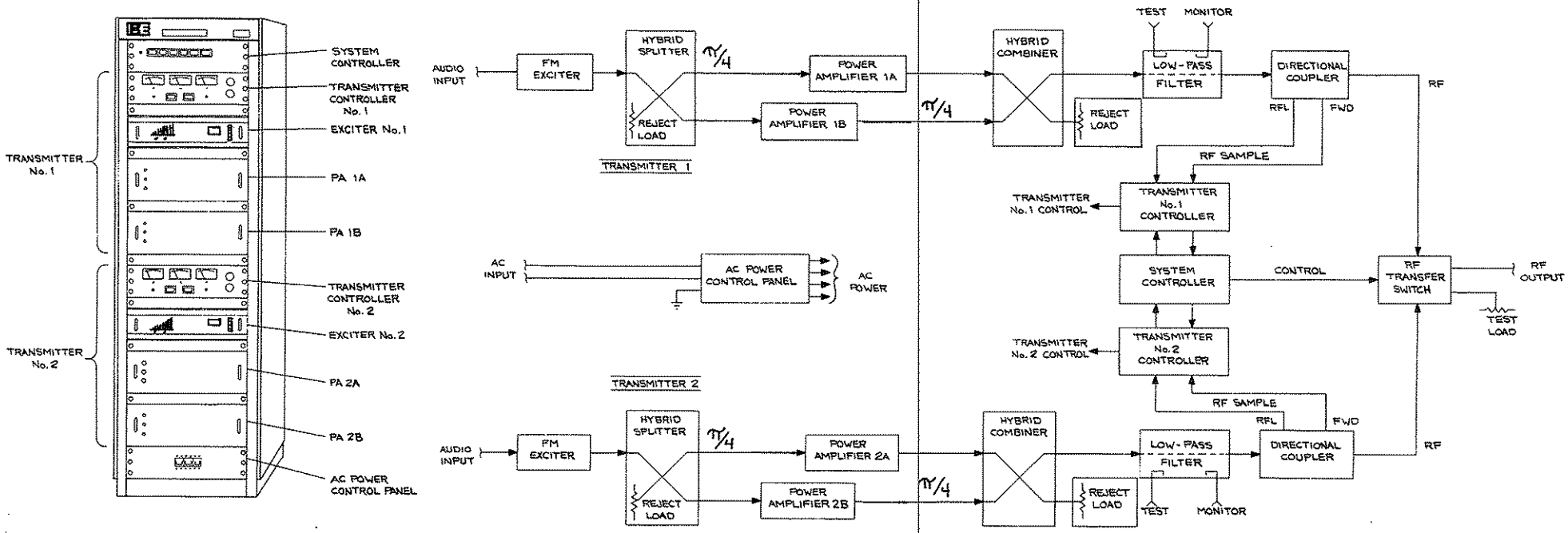
1–31. The RF output of each exciter is split into two equal components by a 90 degree hybrid splitter which provides two equal–amplitude signals displaced in time by 90 degrees or one–quarter cycle of the operating frequency. Each output is routed to a power amplifier. The outputs of the power amplifiers are operated in–phase with the 90 degree differential at the splitter made up by precise cable lengths at each amplifier input. The outputs of the two power amplifiers are then combined through the appropriate lengths of cable and an additional 90 degree hybrid combiner. The outputs of the two amplifiers are added directly in the combiner to produce 300 watts at the combiner output.

1–32. As long as both amplifiers produce the proper power level and are in the proper phase relationship at the combiner inputs, there will be no power dissipated in the combining or reject load. Should an amplifier develop a fault and not produce the proper power level, the remaining power will be divided between the antenna load and the reject load. When the system controller is operating in the automatic mode, it will sense this condition and automatically transfer operation to the alternate transmitter.

1–33. The output of each PA stage is routed through a low–pass filter to reduce the harmonic emissions to the appropriate level. The output of each low–pass filter is routed through a directional coupler which allows measurement of both forward and reflected power. An RF sample port is provided at the input and output of the low–pass filter for connection of a modulation monitor or other test equipment.

1–34. EQUIPMENT SPECIFICATIONS.

1–35. Refer to Table 1–1 for electrical specifications or Table 1–2 for physical specifications for the B–series very–low–power line of FM Transmitters.



597-0092-4

FIGURE 1–4. FM–300B MAIN/ALTERNATE CONFIGURATION

TABLE 1–1. ELECTRICAL CHARACTERISTICS
(Sheet 1 of 3)

PARAMETER	SPECIFICATIONS
RF POWER OUTPUT	FM–100B: 50 to 125 Watts. FM–250B: 90 to 250 Watts. FM–300B: 90 to 400 Watts.
RF FREQUENCY RANGE	87.5 to 108 MHz (as ordered). Exciter programmable in 10 kHz increments.
RF OUTPUT IMPEDANCE	50 Ohms Resistive (others available by special request).
MAXIMUM VSWR	
FM–100B/FM–300B	1.2:1 (Will operate into higher VSWR with automatic power reduction).
FM–250B	1.1:1 (Will operate into higher VSWR with automatic power reduction).
FM SIGNAL–TO–NOISE RATIO	
FM–100B/FM–250B Mono/Composite	85 dB below 100% modulation @ 400 Hz measured in a 20 Hz to 30 kHz bandwidth with 75 microsecond deemphasis.
Stereo	82 dB below 100% modulation @ 400 Hz measured in a 20 Hz to 30 kHz bandwidth with 75 microsecond deemphasis.
FM–300B Mono/Composite	82 dB below 100% modulation @ 400 Hz measured in a 20 Hz to 30 kHz bandwidth with 75 microsecond deemphasis.
Stereo	80 dB below 100% modulation @ 400 Hz measured in a 20 Hz to 30 kHz bandwidth with 75 microsecond deemphasis.
AM SIGNAL–TO–NOISE RATIO	
Asynchronous	70 dB below equivalent reference carrier with 100% AM modulation @ 400 Hz, 75 microsecond deemphasis (no FM modulation present).
Synchronous FM–100B	50 dB below equivalent 100 watt reference carrier with 100% AM modulation @ 1 kHz, no deemphasis (FM modulation +75 kHz @ 1 kHz).
FM–250B	50 dB below equivalent 250 watt reference carrier with 100% AM modulation @ 1 kHz, no deemphasis (FM modulation +75 kHz @ 1 kHz).

TABLE 1–1. ELECTRICAL CHARACTERISTICS
(Sheet 2 of 3)

PARAMETER	SPECIFICATIONS
FM–300B	50 dB below equivalent 300 watt reference carrier with 100% AM modulation @ 1 kHz, no deem–phasis (FM modulation +75 kHz @ 1 kHz).
RF HARMONIC SUPPRESSION	Meets all FCC/DOC requirements and CCIR rec–ommendations.
DISTORTION	
Mono/Composite	
Harmonic	0.02% or less at 400 Hz.
SMPTE Intermodulation Distortion	0.02% or less, 60 Hz/7 kHz, Ratio: 4:1 Monophonic, 1:1 Composite.
CCIF Intermodulation Distortion	0.02% or less, 15 kHz/14 kHz, 1:1 ratio.
Transient Intermodulation Distortion	0.01% or less, sine wave/square wave.
Stereo	
Harmonic	0.03% or less at 400 Hz.
SMPTE Intermodulation Distortion	0.03% or less, 60 Hz/7 kHz, 4:1 ratio.
CCIF Intermodulation Distortion	0.02% or less, 15 kHz/14 kHz, 1:1 ratio.
Transient Intermodulation Distortion	0.05% or less, sine wave/square wave.
STEREO SEPARATION	
FM–100B	60 dB or better, 30 Hz to 15 kHz.
FM–250B/FM–300B	60 dB or better, 30 Hz to 5 kHz. 52 dB or better, 5 kHz to 15 kHz.
LINEAR CROSSTALK (Main to Sub/Sub to Main Due to Phase Matching)	45 dB minimum below 100% modulation, 30 Hz to 15 kHz.
NON–LINEAR CROSSTALK (Main to Sub/Sub to Main Due to Phase Matching)	70 dB minimum below 100% modulation.
AC INPUT POWER	194 to 266 VRMS, 50/60 Hz, single phase ac.

TABLE 1–1. ELECTRICAL CHARACTERISTICS
(Sheet 3 of 3)

PARAMETER	SPECIFICATIONS
AC POWER CONSUMPTION	
FM–100B	524W Maximum for a 100W RF output.
FM–250B	830W Maximum for a 250W RF output.
FM–300B	1200W Maximum for a 300W RF output.

TABLE 1–2. PHYSICAL CHARACTERISTICS
(Sheet 1 of 2)

PARAMETER	SPECIFICATIONS
AMBIENT TEMPERATURE RANGE	+32°F to +122°F (0°C to +50°C).
MAXIMUM ALTITUDE	
60 Hz Models	10,000 feet above sea level (3048 Meters).
50 Hz Models	7500 feet above sea level (2286 Meters).
MAXIMUM HUMIDITY	95%, Non–condensing.
HEAT DISSIPATION	
FM–100B	425 Watts typical at a 100 Watt RF power output.
FM–100BM/A	450 Watts typical at a 100 Watt RF power output.
FM–250B	650 Watts typical at a 250 Watt RF power output.
FM–250BM/A	675 Watts typical at a 250 Watt RF power output.
FM–300B	800 Watts typical at a 300 Watt RF power output.
FM–300BM/A	825 Watts typical at a 300 Watt RF power output.
COOLING AIR REQUIREMENT	
SINGLE CONFIGURATION	250 ft^3/min overall (7.08 m^3/min).
MAIN/ALTERNATE CONFIGURATION	500 ft^3/min overall (14.15 m^3/min).
SIZE	
FM–100B/FM–250B	23.3 inches W X 30.75 inches D X 36.6 inches H (59.2 cm X 78.1 cm X 92.9 cm).
FM–300B	23.3 inches W X 30.75 inches D X 50.6 inches H (59.2 cm X 78.1 cm X 128.4 cm).
FM–100BM/A OR FM–250BM/A	23.3 inches W X 30.75 inches D X 69.8 inches H (59.2 cm X 78.1 cm X 177.2 cm).

TABLE 1–2. PHYSICAL CHARACTERISTICS
(Sheet 2 of 2)

PARAMETER	SPECIFICATIONS
FM–300BM/A	23.3 inches W X 31.4 inches D X 78.6 inches H (59.2 cm X 78.1 cm X 199.5 cm). Anti–Tip legs extend out an additional 11.37 inches (28.88 cm) in front of transmitter.
CUBAGE	
FM–100B/FM–250B	15.2 ft^3 (0.43 m^3).
FM–300B	20.9 ft^3 (0.59 m^3).
FM–100BM/A OR FM250BM/A	28.9 ft^3 (0.82 m^3).
FM–300BM/A	33.3 ft^3 (0.94 m^3).
WEIGHT (Unpacked)	
FM–100B/FM–250B	225 pounds (102 kg).
FM–100BM/A OR FM–250BM/A	500 pounds (227 kg).
FM–300B	275 pounds (125 kg).
FM–300BM/A	550 pounds (250 kg).

SECTION II
INSTALLATION

2–1. INTRODUCTION.

2–2. This section contains information required for installation and preliminary checkout of the Broadcast Electronics B–series very–low–power line of FM transmitters.

2–3. UNPACKING.

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

2–5. The contents of the shipment should be as indicated on the packing list (see Table 2–1). If the contents are incomplete, or if the unit is damaged electrically or mechanically, notify both the carrier and Broadcast Electronics, Inc.

2–6. ENVIRONMENTAL REQUIREMENTS.

2–7. Table 1–2 provides environmental conditions which must be considered prior to transmitter installation.

2–8. COOLING AIR REQUIREMENTS.

2–9. If the heated transmitter air is to be ducted from the room, the duct system must not introduce any back–pressure on the equipment. Proper allowances for air flow will ensure that only a limited amount of heat is dissipated into the equipment interior. The duct system must allow for the minimum air flow listed in Table 1–2.

2–10. As a minimum requirement, any duct work must have a cross–sectional area equal to the exhaust area of the cabinet (refer to Figure 2–1). Sharp bends in the duct system will introduce back pressure and are not permissible. A radius bend must be used if a right angle turn is required. An exhaust fan may be used to overcome duct losses or overcome wind pressures if the duct is vented to the outside.

TABLE 2–1. VERY–LOW–POWER TRANSMITTER PACKING LIST

ITEM	DESCRIPTION	BE PART NO.	QTY.
1	Transmitter, Very–Low–Power, Assembled	909–XXXX–XXX	1
2	Hex Wrench	710–0219	1
3	Test Data Sheets	NPN	1
4	FX–50 Accessory Parts Kit	957–0003	1
5	Instruction Manual, B–Series Very–Low–Power Transmitter	979–0100–004	1

2–11. INSTALLATION.

2–12. Each transmitter is wired, 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 an understanding of transmitter operation, circuit nomenclature, and installation requirements. Installation is accomplished as follows: 1) placement, 2) component installation, 3) remote control connections, 4) ac wiring, and 5) initial checkout.

2–13. EQUIPMENT PLACEMENT.

2–14. Access holes in the top and bottom of the cabinet allow either overhead or under–floor ducting of interconnecting wiring (refer to Figure 2–1). The floor must be capable of supporting the total transmitter weight as described below. The support should be more than marginal to maintain proper cabinet alignment and reduce vibration.

TRANSMITTER	FLOOR LOAD
FM–100B OR FM–250B	44 pounds per square foot
FM–100BM/A OR FM–250BM/A	98 pounds per square foot
FM–300B	54 pounds per square foot
FM–300BM/A	108 pounds per square foot

2–15. After it has been determined where and how the cabinet will be positioned, level the cabinet and bolt the base to the mounting surface.

2–16. COMPONENT INSTALLATION.

WARNING *ENSURE PRIMARY POWER IS DISCONNECTED BEFORE PROCEEDING.* *WARNING*

2–17. Interconnecting wires and cables are tied in for shipment. Remove all tape, wire ties, string, and packing material used for shipment.

2–18. The exciter, the power amplifier, all cables, connectors, and miscellaneous components to be installed are shipped in separate containers. The following text provides information concerning the installation of these items. The exact procedure may differ from the following steps due to the method and requirements for shipping.

NOTE *ENSURE CONTROLS ARE NOT MOVED FROM THE FACTORY PRESET POSITIONS DURING INSTALLATION.* *NOTE*

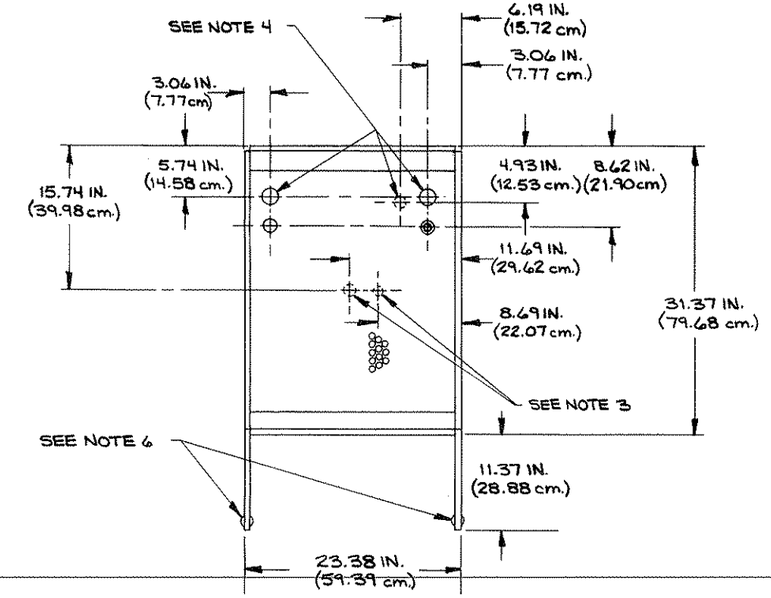
2–19. Remove the transmitter rear panel. The panel is removed by simply lifting the panel up and off the cabinet.

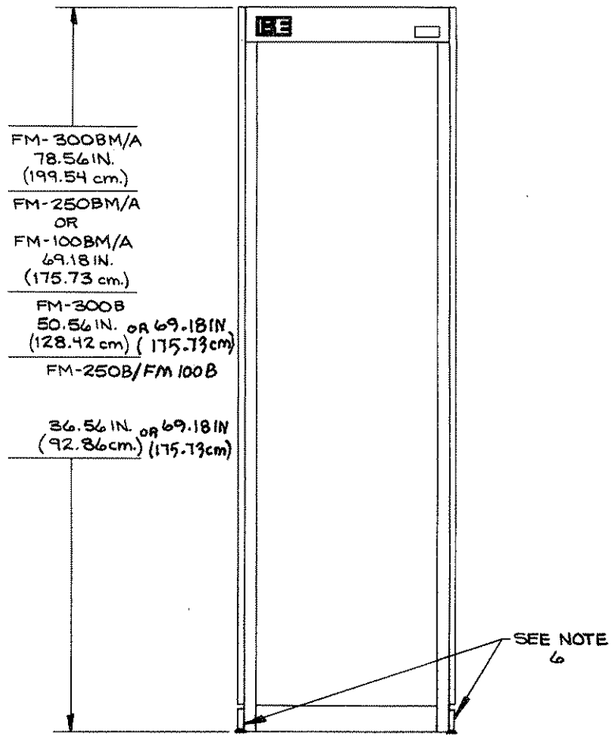
2–20. Remove both side panels. Each panel is secured by one bolt for the single transmitters or two bolts for the dual transmitters. A 3/8 inch (10 mm) hex nut driver is required. After the bolts are removed, each panel lifts up and off the cabinet.

2–21. Remove all ties from each set of slide rails.

2–22. Install the PA(s) and exciter(s) in the rack by placing the units onto the slide rails.

2–23. Connect the wiring between the exciter(s) and PA(s) as directed by tags attached to the wiring.





NOTES:

1. AIR INLET AT REAR OF CABINET, 7.75 IN. X 14 IN. (19.69 cm X 35.56 cm) P/N 407-0062 FILTER REQUIRED.
2. AIR OUTLET AT TOP OF CABINET, 21 3/4 IN. X 23 1/2 IN. (55.25 cm X 64.77 cm).
3. ACCESS FOR AC POWER THROUGH BASE PLATE. (MAY BE ACCESSED THRU TOP, REAR, OR SIDES BY ADDING ACCESS HOLE.)
4. ACCESS FOR REMOTE CONTROL AND AUDIO CONNECTIONS THROUGH TOP OR BOTTOM OF CABINET.
5. OUTPUT RF CONNECTOR IS AMPHENOL 82-66 (UG30/N) TYPE N CONNECTOR.
6. ANTI-TIP LEGS USED ON FM-300M/A TRANSMITTER ONLY.
7. IT IS RECOMMENDED THAT THIS TRANSMITTER BE BOLTED TO THE MOUNTING SURFACE.
8. WEIGHT UNPACKED:

FM-100B OR FM-250B	225 lbs. (102 kg)
FM-100BM/A OR FM-250BM/A	500 lbs. (227 kg)
FM-300B	275 lbs. (125 kg)
FM-300BM/A	550 lbs. (250 kg)

597-0092-5

FIGURE 2-1. TRANSMITTER OUTLINE DRAWING

2–24. Connect the antenna load to the transmitter.

2–25. **CIRCUIT BOARD PROGRAMMING.**

2–26. **SYSTEM CONTROLLER.** The system controller is designed with programmable circuits which determine the control and operating characteristics of the unit. Figure 2–2 presents several control and operating parameters. Refer to Figure 2–2 and program the system controller circuit board as required for the following operations.

2–27. **Automatic Mode Disable Control.** Control circuitry is provided which will disable the automatic mode when the remote system off switch is operated. To disable the automatic mode, install jumper W1. To enable the automatic mode, remove jumper W1. The unit is shipped from the factory with jumper W1 installed.

2–28. **Automatic Mode Enable Control.** Control circuitry is provided which will enable the automatic mode when the **XMTR ON** switch/indicator is operated. To enable the automatic mode, install jumper W2. To disable the automatic mode, remove jumper W2. The unit is shipped from the factory with jumper W2 installed.

2–29. **Delay Time Select Operation.** The delay time prior to automatic switching is determined by programmable jumper P9. To select 0.05 second delay, install P9 in position 1–2. To select 5 second delay, install P9 in position 2–3. The unit is shipped from the factory with P9 installed in position 1–2.

2–30. **Sample Voltage Reduction Operation.** The maximum required sample voltage from the transmitter is selected by programmable jumpers P7 and P8. If +5 volts is desired, remove P7 and P8. To reduce the sample voltage to +2.5 volts, install P7 and P8. The unit is shipped from the factory with P7 and P8 installed.

2–31. **PA ASSEMBLY.** The power amplifier assembly is designed with programmable circuits which determine the control and operating characteristics of the unit. Check the PA circuit board programming as follows:

A. Extend the PA forward and remove the top–panel.

B. Refer to Figure 2–3 and ensure all circuit board jumpers are correctly positioned.

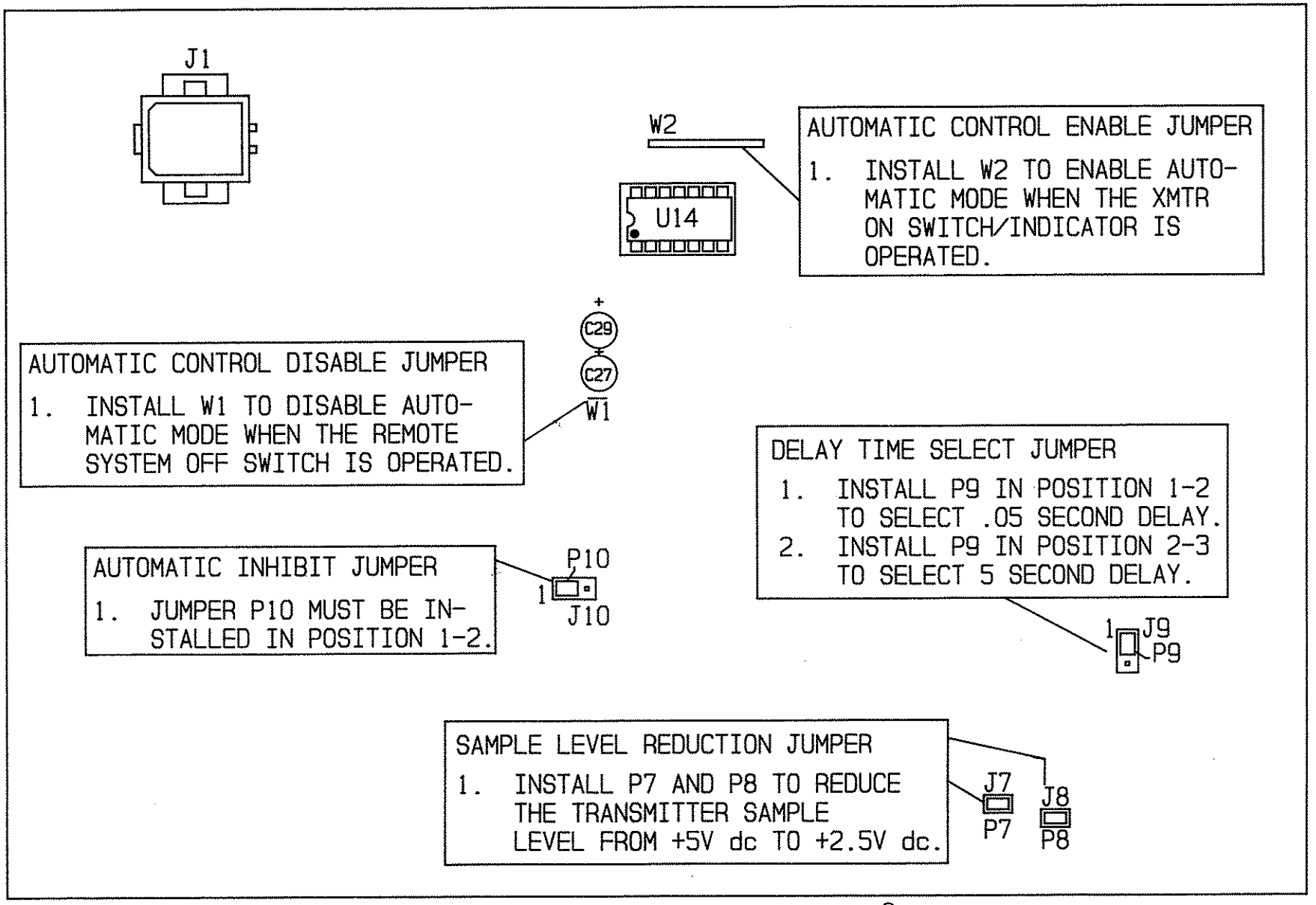
C. Replace the top–panel.

2–32. **TRANSMITTER CONTROLLER.** The transmitter controller assembly is designed with programmable circuits which determine the operating characteristics of the unit. The transmitter controller circuit board assembly diagram in SECTION VII, DRAWINGS provides the locations of the transmitter controller programmable jumpers. Refer to the transmitter controller assembly diagram and perform the following procedure to check the transmitter controller programming.

2–33. **Meter Circuit.** The transmitter forward and reflected power metering sensitivity is determined by jumpers J6 and J7. For FM–100B, FM–100BM/A, FM–250B, and FM–250BM/A transmitters, install jumpers J6 and J7 in position 2–3. For FM–300B and FM–300BM/A transmitters, install jumpers J6 and J7 in position 1–2.

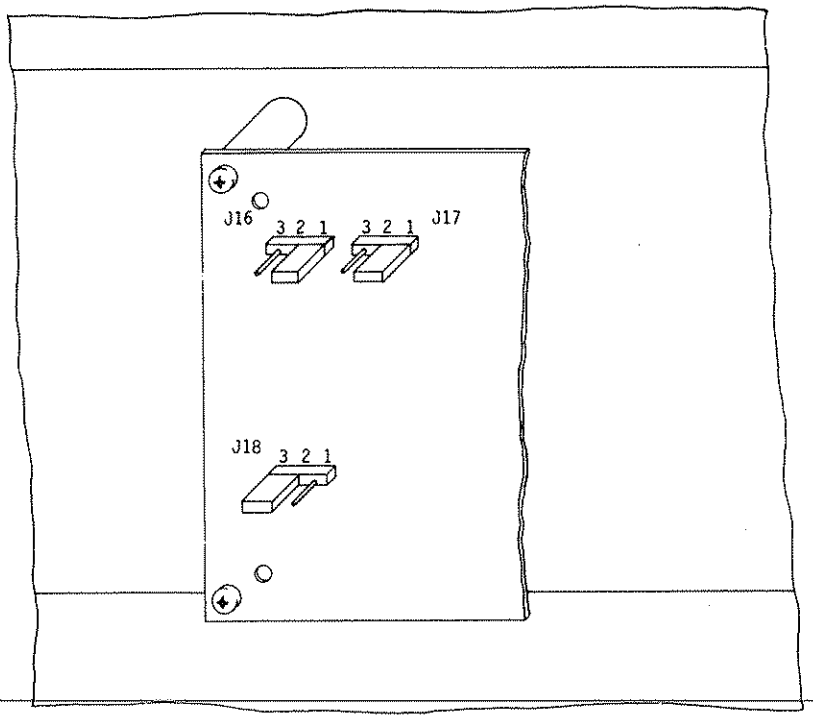
2–34. **REMOTE CONTROL.**

2–35. Many transmitter control and monitoring functions are available as remote control features (see Table 2–2). Also, the transmitter will interface with most modern remote control units such as the sixteen channel Moseley MRC–1600.



597-0092-50

FIGURE 2-2. SYSTEM CONTROLLER BOARD JUMPER PROGRAMMING



597–0092–51

FIGURE 2–3. PA JUMPER PROGRAMMING

WARNING *ENSURE PRIMARY POWER IS DISCONNECTED BEFORE PROCEEDING.*

WARNING

2–36. **VOLTAGE TAPS.** Ensure the transmitter is wired for the input voltage to be used. The PA units, the system controller, the transmitter controllers and the FM exciters must be checked and changed if required.

2–37. Check the PA voltage taps per Figure 2–4 and change the wiring if required.

2–38. The system controller, the transmitter controllers, and the FM exciters should be checked as follows:

A. The primary ac line voltage with which the transmitter will be used must be visible on the ac line voltage selector circuit board (220V or 230/240V).

B. If an ac line voltage selector must be changed, remove the ac line voltage selector circuit board with a small pair of needle–nose pliers. Reinsert the circuit board so that the correct ac line voltage is visible when the circuit board is reinserted into the receptacle.

2–39. **SIGNAL INPUTS.** Refer to the applicable technical manual for the exciter, and wire the input connections to each unit.

TABLE 2-2. REMOTE INTERFACE CONNECTIONS

SYSTEM CONTROLLER (MAIN/ALTERNATE TRANSMITTERS)

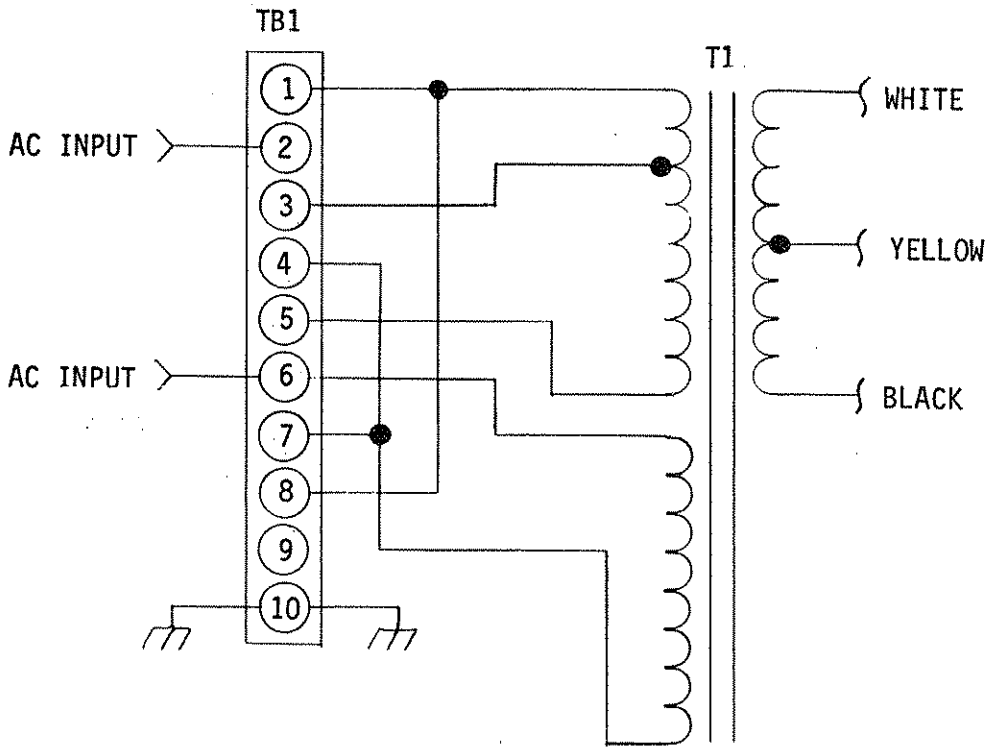
TB1-	FUNCTION	STATUS
1	System On	Momentary connection to ±5V to ±24V required to activate function.
2	System Off	
3	Manual Mode	
4	Automatic Mode	
5	Transmitter No. 1 Select	
6	Transmitter No. 2 Select	
7	Control Common (Isolated)	
8	Manual Status	Current sink to ground when active.
9	Automatic Status	
10	Transmitter No. 1 Status	
11	Transmitter No. 2 Status	
12	Status Common (Chassis Ground)	

TRANSMITTER CONTROLLER (ALL TRANSMITTERS)

TB1	FUNCTION	STATUS
1	TRANSMITTER ON	POSITIVE LOGIC: ±5 TO ±24V; NEGATIVE LOGIC: ±5 TO ±24V
2	TRANSMITTER OFF	
3	FAILSAFE INPUT	
4	REMOTE CONTROL COMMON	
5	POWER RAISE	MOMENTARY CONNECTION TO PIN 7 REQUIRED TO RAISE OR LOWER RF POWER.
6	POWER LOWER	
7	POWER COMMON	
8	+24 VOLTS	
9	COMMON	
10	NOT USED	

TB2-	FUNCTION	STATUS
1	Forward Power	+5 VDC @ 100% forward power.
2	Reflected Power	+5 VDC @ 3:1 reflection.
3	Power Common	
4	PA No. 1 Collector Voltage	+5 VDC @ 30 VDC PA voltage.
5	PA No. 1 Collector Current	+5 VDC @ 15 A PA current.
6	PA No. 1 Meter Common	
7 *	PA No. 2 Collector Voltage	+5 VDC @ 30 VDC PA voltage.
8 *	PA No. 2 Collector Current	+5 VDC @ 15 A PA current.
9 *	PA No. 2 Meter Common	
10	Not Used	

* FM-300B AND FM-300BM/A ONLY



597-0092-6

LINE VOLTAGE	JUMPER	SECONDARY WIRING
194-223V	2-3, 4-5, 8-9	BLACK AND WHITE
213-256V	2-3, 4-5, 8-9	BLACK AND YELLOW
208-250V	1-2, 4-5, 8-9	BLACK AND WHITE
229-275V	1-2, 4-5, 8-9	BLACK AND YELLOW

597-0092-6

FIGURE 2–4. PA VOLTAGE TAPS

WARNING ***ENSURE PRIMARY POWER IS DISCONNECTED BEFORE PROCEEDING.***

WARNING

2–40. **AC POWER CONNECTIONS.** A single–phase source of 194 to 266V ac, 60 Hz, at 15 Amperes is required for the transmitter ac input. For operating safety, the power source must be routed to the transmitter through a fused power disconnect (refer to Figure 2–5).

WARNING *ENSURE PRIMARY POWER IS DISCONNECTED BEFORE PROCEEDING.*

WARNING

WARNING *ENSURE AN EARTH GROUND CONDUCTOR IS SECURELY CONNECTED TO THE TRANSMITTER GROUND SYSTEM.*

WARNING

2–41. **Main AC Input.** Refer to Figure 2–5 and connect the ac service to TB1 on the rear of the transmitter ac power distribution panel through a fused service disconnect. Ensure a utility company ground conductor is securely connected to the transmitter ground system and the neutral wire is securely connected to TB1–3.

2–42. **INITIAL CHECKOUT.**

WARNING *ENSURE PRIMARY POWER IS DISCONNECTED BEFORE PROCEEDING.*

WARNING

2–43. Ensure that the transmitter is completely installed, the transmitter is connected to a suitable RF load, and the station monitor is connected to the RF sample port in the low–pass filter. Check the following:

A. Ensure primary power is correctly wired.

B. Ensure all ground connections are secure.

C. Ensure all RF connections are secure.

D Ensure all connections at terminal boards are secure.

E. Rotate the fan(s) by hand to ensure no obstructions are present.

F. Ensure an earth ground conductor is securely connected to the transmitter ground system.

2–44. Remove any extra hardware and wire lying within the cabinet.

2–45. Replace the cabinet side panels and secure each side panel with one or two bolts (as applicable) through the cabinet rear support rails.

2–46. The following procedures will refer to the factory final test data sheets supplied with the transmitter. Some differences in the actual operation may be noted due to differences in primary power and/or antenna systems. Ensure any controls specified are preset to the positions indicated on the final test data sheets.

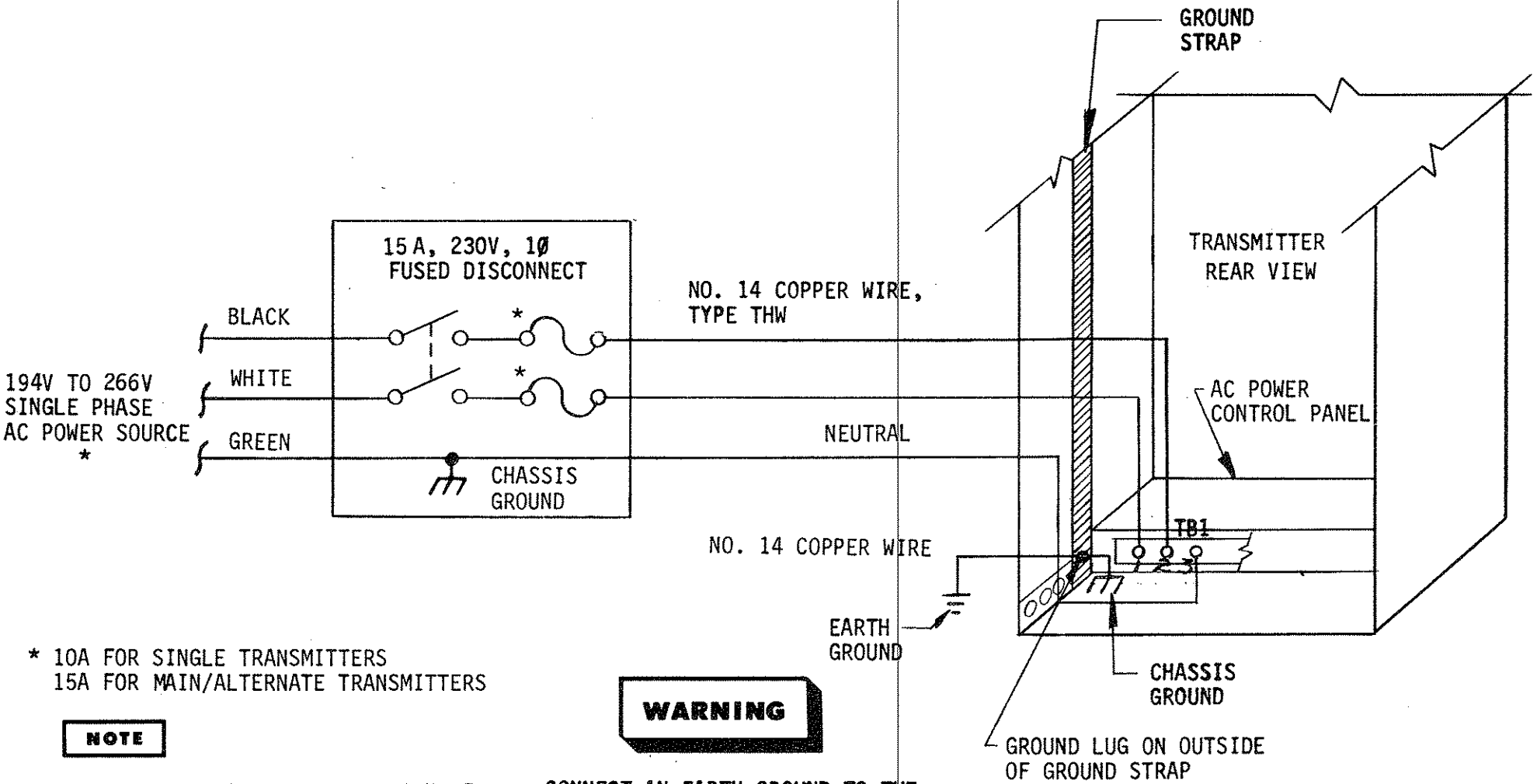
2–47. **SINGLE TRANSMITTER CHECKOUT.** The following checkout is presented for the single–transmitter configurations. Refer to the final test data sheets as required during the initial checkout.

2–48. Adjust the transmitter controller **POWER ADJUST** control fully counterclockwise and the **POWER METERING** switch to **XMTR FWD**.

2–49. Operate the transmitter controller **RMT/LCL** switch to **LCL**.

2–50. Operate the transmitter controller **BATTERY ON/OFF** switch to **ON**.

2–51. Depress the exciter **FWD** meter switch.



* 10A FOR SINGLE TRANSMITTERS
15A FOR MAIN/ALTERNATE TRANSMITTERS

NOTE

EXTERNAL WIRE AND FUSED DISCONNECT MUST BE FURNISHED BY CUSTOMER.

WARNING

CONNECT AN EARTH GROUND TO THE CABINET GROUND WITH NO. 14 COPPER WIRE.

597-0092-7

FIGURE 2–5. PRIMARY AC WIRING

2–94. Adjust the transmitter No. 1 controller **POWER ADJUST** control fully counterclockwise. After a delay, the system will switch to transmitter No. 2 and will not automatically switch back to transmitter No. 1, even though transmitter No. 2 is inoperative.

2–95. The transmitter is now ready for operation.

SECTION III
OPERATION

3–1. INTRODUCTION.

3–2. This section identifies all controls and indicators associated with the Broadcast Electronics B–series very–low–power line of FM transmitters and provides standard operating procedures.

3–3. CONTROLS AND INDICATORS.

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

3–5. MAIN/ALTERNATE TRANSMITTER OPERATION.

NOTE ***THE FOLLOWING PROCEDURE IS PRESENTED UNDER THE ASSUMPTION THAT THE TRANSMITTER IS FULLY INSTALLED AND IS FREE OF ANY DISCREPANCIES.***

NOTE

3–6. TURN ON.

3–7. Operate the system controller **RMT/LOCAL CONTROL** switch to **LOCAL** and operate both transmitter controller **LCL/RMT CONTROL** switches to **LCL.**

3–8. Operate the **BATTERY ON/OFF** switch on the rear of the system controller to **ON** and operate the **BATTERY ON/OFF** switches on the rear of the two transmitter controllers to **ON.**

3–9. Close the wall–mounted fused switch.

3–10. Operate all three circuit breakers on the ac power control panel to **ON.**

3–11. The transmitter will energize in either the manual or automatic mode of operation. Both transmitters will be off–the–air and transmitter No. 1 or transmitter No. 2 will be selected.

3–12. Depress the system controller **AUTO MODE** switch/indicator. The **AUTO MODE** switch/indicator will illuminate.

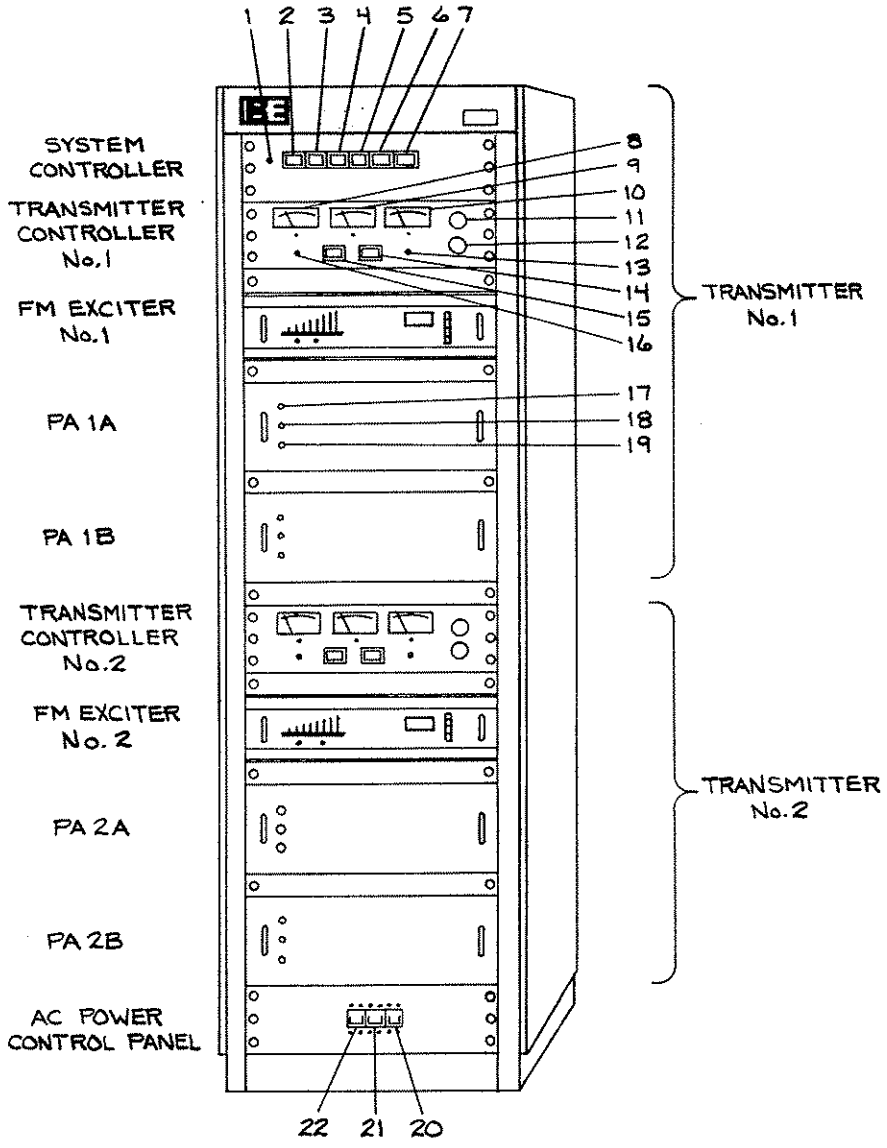
3–13. If operation of transmitter 1 is desired, depress the system controller **TX–1 SELECT** switch/indicator.

NOTE ***A DELAY OF TEN SECONDS IS REQUIRED BETWEEN SELECTION OF TRANSMITTERS.***

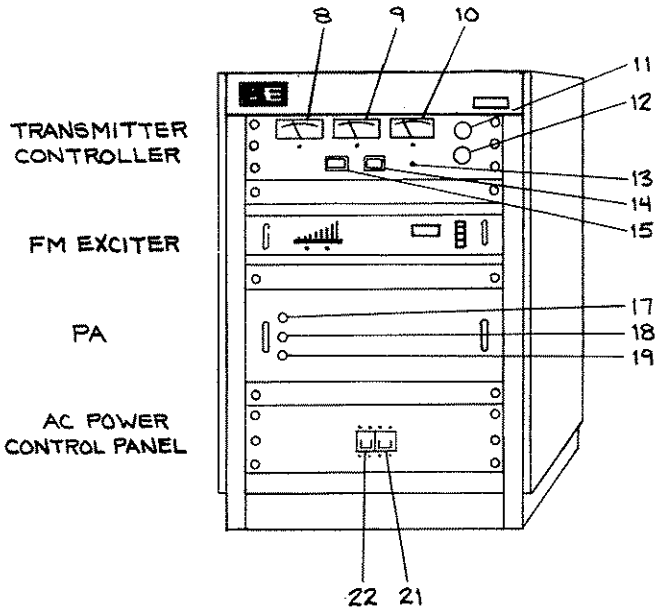
NOTE

3–14. If operation of transmitter 2 is desired, depress the system controller **XMTR ON** switch.

3–15. Depress the **ON** switch/indicator on the selected transmitter controller. The **ON** indicator will illuminate, the **FWD POWER** indicator on the selected PA stage(s) will illuminate, and the LOCK, +20V, –20V, and +5V indicators on the selected exciter will illuminate steadily.



TYPICAL MAIN/ALTERNATE TRANSMITTER CONFIGURATION



TYPICAL SINGLE TRANSMITTER CONFIGURATION

597-0092-8

FIGURE 3-1. CONTROLS AND INDICATORS

3–16. Observe and record all meter indications and illuminated indicators.

3–17. **TURN OFF.**

3–18. Depress the system controller **XMTR OFF** switch.

3–19. The **OFF** switch/indicator on the operating transmitter will illuminate.

3–20. Operate all three circuit breakers on the ac power control panel to **OFF**.

3–21. Open the wall–mounted fused switch.

3–22. Operate the **BATTERY ON/OFF** switch on the rear of the system controller to **OFF** and operate the **BATTERY ON/OFF** switches on the rear of the two transmitter controllers to **OFF**.

3–23. SINGLE TRANSMITTER OPERATION.

NOTE

NOTE

THE FOLLOWING PROCEDURE IS PRESENTED UNDER THE ASSUMPTION THAT THE TRANSMITTER IS FULLY INSTALLED AND IS FREE OF ANY DISCREPANCIES.

3–24. **TURN ON.**

3–25. Operate the transmitter controller **RMT/LCL CONTROL** switch to **LCL**.

3–26. Operate the **BATTERY ON/OFF** switch on the rear of the transmitter controller to **ON.**

3–27. Close the wall–mounted fused switch.

3–28. Operate both circuit breakers on the ac power control panel to **ON.**

3–29. The transmitter controller will energize with the transmitter off–the–air and the **OFF** switch/indicat or illuminated.

3–30. Depress the transmitter controller **ON** switch/indicator. The **ON** switch/indicator will illuminate and the **OFF** switch/indicator will extinguish. The exciter **LOCK, +20V, –20V** and **+5V** indicators will illuminate steadily.

3–31. Observe and record all meter indications and illuminated indicators.

3–32. **TURN OFF.**

3–33. Depress the transmitter controller **OFF** switch/indicator.

3–34. The **OFF** switch/indicator will illuminate and the **ON** switch/indicator will extinguish.

3–35. Operate both circuit breakers on the ac power control panel to **OFF.**

3–36. Open the wall–mounted fused switch.

3–37. Operate the **BATTERY ON/OFF** switch on the rear of the transmitter controller to **OFF.**

TABLE 3–1. CONTROLS AND INDICATORS
(Sheet 1 of 2)

INDEX NO.	NOMENCLATURE	FUNCTION
1	**RMT/LOCAL CONTROL** Switch	Allows both remote and local control of the system controller when operated to **RMT**. Local control only is enabled when operated to **LOCAL**.
2	**MAN MODE** Switch/ Indicator	SWITCH: Configures system to allow manual control. INDICATOR: Indicates system is configured in manual mode when illuminated.
3	**AUTO MODE** Switch/ Indicator	SWITCH: Configures system to allow automatic control. INDICATOR: Indicates system is configured in automatic mode when illuminated.
4	**TX–1 SELECT** Switch/Indicator	SWITCH: Selects transmitter No. 1 for on–air operation when depressed. INDICATOR: Indicates transmitter No. 1 is operational when illuminated.
5	**TX–2 SELECT** Switch/Indicator	SWITCH: Selects transmitter No. 2 for on–air operation when depressed. INDICATOR: Indicates transmitter No. 2 is operational when illuminated.
6	**XMTR OFF** Switch	Deenergizes both transmitters and configures the control circuitry for manual operation.
7	**XMTR ON** Switch	Energizes the selected transmitter and configures the control circuitry for automatic operation.
8	**PA VOLTAGE** Meter	Indicates PA voltage for the associated amplifier.
9	**PA CURRENT** Meter	Indicates PA current for the associated amplifier.
10	**POWER** Meter	Indicates RF power output for the associated amplifier.
11	**POWER METERING** Switch	Selects parameter to be displayed by the **POWER** meter.
12	**POWER ADJUST** Control	Allows adjustment of transmitter output power.
13	**LCL/RMT CONTROL** Switch	Allows both remote and local control of the associated transmitter system.

TABLE 3–1. CONTROLS AND INDICATORS
(Sheet 2 of 2)

INDEX NO.	NOMENCLATURE	FUNCTION
14	**ON** Switch/ Indicator	SWITCH: Energizes the associated transmitter. INDICATOR: Indicates the associated transmitter is energized when illuminated.
15	**OFF** Switch/ Indicator	SWITCH: Deenergizes the associated transmitter. INDICATOR: Indicates the associated transmitter is deenergized when illuminated.
16	**PA–A/PA–B METERS** Switch	Selects PA–A or PA–B display of current and voltage.
17	**FWD POWER** Indicator	Indicates the PA stage forward output power exceeds 75 Watts when illuminated.
18	**VSWR** Indicator	Indicates the PA output stage VSWR exceeds 10 Watts when illuminated.
19	**OVER TEMP** Indicator	Indicates a PA regulator heatsink over–temperature condition exists when illuminated.
———		—— MAIN/ALTERNATE TRANSMITTERS ——
20	**XMTR–2** Circuit Breaker	Provides overload protection and power control for transmitter No. 2.
21	**XMTR–1** Circuit Breaker	Provides overload protection and power control for transmitter No. 1.
22	**CONTROL** Circuit Breaker	Provides overload protection and power control for the system controller and cabinet fan(s).
———		—— SINGLE TRANSMITTERS ——
21	**XMTR** Circuit Breaker	Provides overload protection and power control for the exciter and PA.
22	**CONTROL** Circuit Breaker	Provides overload protection and power control for the transmitter controller and cabinet fan(s).

SECTION IV
THEORY OF OPERATION

4–1. INTRODUCTION.

4–2. This section presents theory of operation for the Broadcast Electronics B–series very–low–power line of FM transmitters.

4–3. The following text provides detailed circuit theory for all models. All theory is provided with little regard as to which model uses what circuitry. Section I of this manual should be referenced for the exact equipment compliment of each transmitter.

4–4. ELECTRICAL DESCRIPTION.

NOTE ***REFER TO THE SCHEMATIC DIAGRAMS IN SECTION VII AS REQUIRED FOR THE FOLLOWING DESCRIPTIONS.***

NOTE

4–5. FM EXCITER.

4–6. The Broadcast Electronics FX–50 is a totally solid–state wideband FM exciter providing a continuously variable RF output from 3 to 50 Watts. The FX–50 operates into a 50 Ohm load at any frequency within the 87.5 to 108 MHz FM broadcast band. The exciter may be programmed to any frequency within this band in 10 kHz increments. The FX–50 exciter is mounted with slide–rails to allow easy access to the internal semi–modular circuitry.

4–7. The FX–50 will accept multiple wideband composite inputs from a stereo generator or SCA generator as well as a 600 Ohm balanced audio input. Refer to publication 597–1050 for a detailed explanation of the FM exciter.

4–8. HYBRID SPLITTER/COMBINER.

4–9. A hybrid combiner/splitter is a four–port device. When an RF source is applied to one port, the device will split the applied RF input equally between the two opposite ports (see Figure 4–1A).

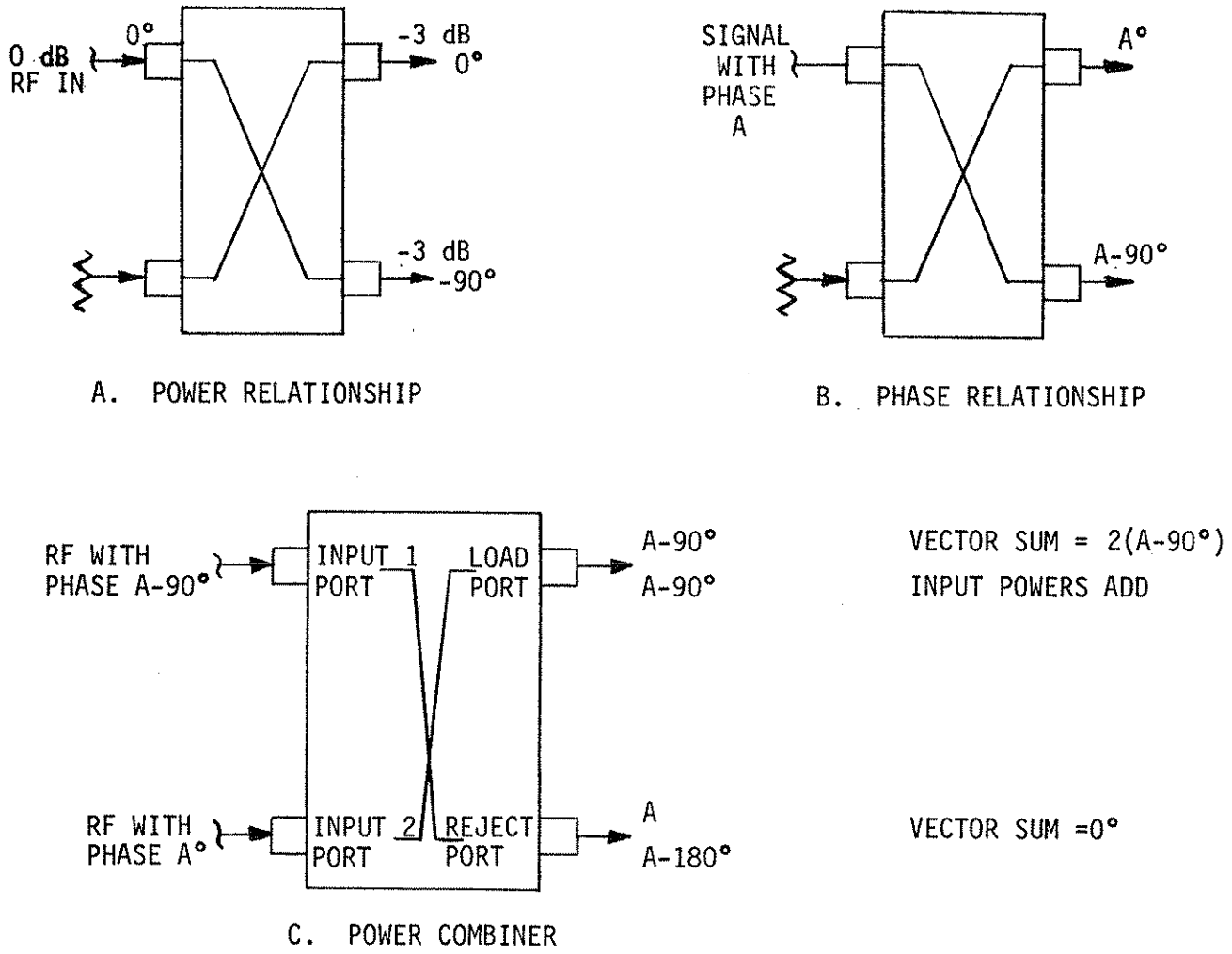
4–10. Assuming the same input conditions, the phase of the two outputs will be 90 degrees out–of–phase with respect to each other. The port directly opposite the input port will be in phase with the input port (see Figure 4–1B).

4–11. If two RF signals of the same amplitude and frequency, but 90 degrees out–of–phase are applied to two ports of a hybrid combiner, the two signals will completely combine at the output port and no power will appear at the reject port. Any difference in input phase (other than 90 degrees) or any difference in amplitude between the two inputs will appear as power at the reject port (see Figure 4–1C).

4–12. The FM–300BM/A employs a hybrid splitter to develop RF drive for both power amplifiers from the single exciter. Both the FM–300B and FM–300BM/A employ hybrid combiners to sum the output of the two power amplifiers into a single output.

4–13. POWER AMPLIFIER.

4–14. The power amplifier consists of a broadband solid–state amplifier assembly and a regulated power supply with over–voltage and over–current protection circuitry. The PA is mounted on slide–rails for ease of maintenance. Both the amplifier and the regulator circuit boards are mounted on easily removable heat sinks and a fan which provides forced–air cooling.



597-0092-9

FIGURE 4–1. HYBRID SPLITTER/COMBINER

4–15. The PA RF stage consists of two bipolar RF power transistors operated as a push–pull class C amplifier. A stripline directional coupler provides forward and reflected power samples. The PA exhibits a power gain of 10 to output approximately 250 Watts maximum per module.

4–16. A green **FWD PWR** indicator on the front panel illuminates to indicate sufficient RF output level exists for normal operation. A yellow **VSWR** illuminates to indicate excessive PA stage reflected power. A red **OVER TEMP** indicator indicates that an over–temperature condition exists within the PA. After the stage has cooled, ac power must be removed to reset the over–temperature logic and restore the PA to operation.

4–17. For additional information concerning the power amplifier, refer to Part II of this manual.

4–18. **TRANSMITTER CONTROLLER.**

4–19. **GENERAL DESCRIPTION.** The transmitter controller circuitry utilizes CMOS family logic which provides high noise immunity and reliability. Backup power is provided for the control circuits in the form of a battery supply which provides memory retention in the event of a power failure. In the single transmitter models, this battery supply is contained in the transmitter controller. In the main/alternate configurations, the battery supply is contained in the system controller.

4–20. The transmitter controller provides remote control of on–off functions along with fail–safe provisions for each single transmitter. Transmitter power output control is provided by the front–panel **POWER ADJUST** control in the local mode and through provisions wired to the rear panel in the remote mode.

4–21. Meters are provided on the transmitter controller to measure power amplifier collector voltage and current as well as PA power output and the total system RF output. A **POWER METERING** switch allows selection of forward or reflected power from the PA output or transmitter output. A two–position **METER** switch added to the FM–300B and FM–300BM/A selects between parameters of power amplifier A and power amplifier B. Low–level dc outputs are provided for remote metering of power amplifier collector voltage, current, total forward power, and reflected power.

4–22. **DETAILED DESCRIPTION.** The on and off functions of the transmitter are controlled by a flip–flop implemented with cross connected NAND gates U4B/U4C. The state of the latch is changed by applying a momentary LOW or ground to one input of the device. When one input is driven LOW, the corresponding output is forced HIGH. This action causes the input of the opposite gate to go HIGH which applies a LOW to the companion input of the first gate. This action maintains the first gate in a LOW state. The control circuit inputs are purposely delayed by input filters (R7/C5 and R10/C6) which minimize susceptibility to transients and external noise.

4–23. The front panel **ON** and **OFF** push switches provide momentary closures to ground to activate a function. The input filter minimizes the effects of contact bounce and any stray noise which may be coupled through the wiring harness. The remote on and off inputs are isolated with optical isolators U1, U2, and U3 which prevent ground loops and provide an interface system insensitive to polarity and voltage of the remote control. The remote inputs operate with any polarity or voltage from 5 to 28 volts ac or dc. Control functions may be switched in either leg of the interface as desired by the installer.

4–24. The output of U4C is inverted and compared with the fail–safe and interlock information in U4D. When a valid interlock/fail–safe command and a valid on command are received by U4D, the output will go LOW. This LOW is inverted by U5E and applied to emitter–follower Q5 which drives the ac power control panel circuitry. The ac power control panel applies ac power to the exciter and the power amplifier(s). The **ON** indicator is illuminated by transistor Q4 which is also driven by inverter U5E.

4–25. The fan is activated by emitter–follower Q2 connected to inverter U5D. The output of Q2 is coupled to the control circuits for cabinet fan control.

4–26. The remote fail–safe input is buffered by optical isolator U1. When the device has a voltage present at the input, the transistor output stage saturates and conducts, forcing the input of gate U4A to go HIGH. In the LCL position, the five–volt bus is directly connected to the fail–safe input of the gate. The interlock inputs (internally wired to +24V) are connected to the second gate of U4A.

4–27. The controller contains circuitry to automatically initialize the transmitter to the off state upon initial application of power. This is useful when a power failure occurs or during maintenance. Normally, the controller system operates from a battery back–up system during a power failure and the transmitter will return to operation in the state at which the power failure occurred. However, if the battery should become discharged, the automatic off circuit will still operate. This circuit consists of transistor Q1, inverters U5B and U5C, and associated circuitry. Capacitor C7 is normally charged to five volts. This forces the input to U5B to go HIGH which is repeated at the output of U5C. In this state, the circuit is isolated by diode D13. In the event of a power failure causing a loss of the five volt bus, transistor Q1 will conduct, quickly discharging capacitor C7. The capacitor will charge slowly upon re–application of power. While capacitor C7 is charging, the output of inverter U5C will go LOW and cause the system to deenergize. The time constant of this circuit is purposely made longer than that of the low–pass input filters so the circuit will over–ride the other inputs. When operation is normal, transistor Q1 is biased off and discharge of capacitor C7 cannot occur.

4–28. **TRANSMITTER CONTROLLER POWER CONTROL.** When the **RMT/LCL** switch is operated to **LCL**, transmitter RF power output may be adjusted with the front–panel **POWER ADJUST** control. When the **RMT/LCL** switch is operated to **RMT**, the front–panel **POWER ADJUST** control is disabled and power can be adjusted from a remote location.

4–29. When remote control is selected, the transmitter power output may be adjusted by applying a ground (TB1–7) to either the power raise terminal (TB1–5) or the power lower terminal (TB1–6).

4–30. A ground applied to TB1–5 or TB1–6 is routed to interface relays within the transmitter controller. These relays apply a potential to a motorized potentiometer. The polarity of the potential determines the direction of motor rotation which varies the position of the potentiometer. A voltage from the potentiometer is applied to the FM exciter to adjust exciter output power and thereby adjusts the transmitter RF output.

4–31. **TRANSMITTER CONTROLLER METERING CIRCUITS.** The **PA VOLTAGE** and **PA CURRENT** meters indicate the collector voltage and collector current for each power amplifier. In the FM–300B and FM–300BM/A, these meters are switched as a group by the **POWER METERING** switch. The voltage dividers and current shunts for the power amplifiers are located in each amplifier assembly. Remote metering of both functions is available on terminal board TB2.

4–32. Forward and reflected power for each power amplifier and the combined output of the amplifiers is displayed by the **POWER** meter. The parameter to be displayed is selected by the **POWER METERING** switch. This switch allows metering of PA forward and reflected output before and after the low–pass filter.

4–33. The in–line directional coupler used with the transmitter provides continuous outputs for both forward and reflected power at a low level. The outputs of both couplers are amplified by dc operational amplifiers U11 and U12. The outputs of the amplifiers are buffered by identical amplifiers operating as unity gain followers to provide a low output impedance and adequate isolation for the three outputs provided. An output is provided to the front panel **POWER** meter and the remote power meter provision.

4–34. **TRANSMITTER CONTROLLER POWER SUPPLIES.** Three power supplies are provided to power the logic, the meter amplifiers, and to charge the self–contained battery back–up. The power supply potentials are derived from two full–wave bridge rectified supplies. In the single transmitter models, the battery supply is contained in the transmitter controller. In the main/alternate configurations, the battery supply is contained in the system controller.

4–35. The 24–volt power supply is used to supply power to the metering and control circuits. It is regulated by a three–terminal regulator mounted to the main circuit board. The rectifier and filter components (D16 through D19, C15, and DT1) are also mounted to the main circuit board.

4–36. The ten–volt power supply is used to charge the self–contained battery back–up and the five–volt power supply is used to power the logic. Both potentials are regulated by three–terminal regulators. The ten–volt regulator (U1) is mounted to a sub–chassis and the five–volt regulator (U10) is mounted to the main circuit board. The rectifier and filter (D1 and C1) are mounted to the main circuit board.

4–37. The input to U1 is connected through diode D25. The battery assembly is connected in parallel at the output of U1 and the five–volt regulator is connected in series at this point. The ten–volt output of U1 keeps the battery back–up charged and comparator U9 monitors the ten–volt supply. In the event of a long–term power outage sufficient to severely discharge the battery assembly, comparator U9 will deenergize relay K1 which disconnects the battery assembly from the ten–volt source. This will prevent damage to the battery assembly from excessive discharge.

4–38. **SYSTEM CONTROLLER.**

4–39. **GENERAL.** The system controller is used to activate the alternate transmitter automatically in the event of a failure in the operational transmitter. The system controller provides monitoring facilities for sensing RF energy from each transmitter and contains facilities to deenergize both transmitters prior to switching action. When the RF output of each transmitter falls below a preset level, the system will initiate a transfer command and monitor the transfer switch interlocks for a valid transfer indication. Upon receipt of a valid transfer indication from the RF transfer switch, the system will automatically energize the selected transmitter. Control facilities are provided for selection of manual or automatic operation and for transmitter on/off control. Status indications are provided for manual or automatic operation and for transmitter selection. Remote control and status indication of all functions is provided through rear panel terminal strip TB1.

4–40. A battery back–up system consisting of four sealed lead–acid cells is provided for memory retention in the event of a power failure. In the single transmitter models, this battery supply is contained in the transmitter controller. In the main/alternate configurations, the battery supply is contained in the system controller.

4–41. **DETAILED DESCRIPTION.** Two inputs are provided for RF detection purposes. These are low level dc inputs derived from the directional couplers in the associated RF power amplifiers. Each transmitter sensor output is in the range of one to five volts dc and is applied to integrated circuit comparators U1A, B, C, and D.

4–42. Comparators U1B and U1D are supplied with a fixed dc level to allow sensing of low–level RF presence while U1A and U1C are biased to a higher adjustable level for failure–threshold sensing purposes. The threshold is normally adjusted to a level approximately three decibels below the rated output. U1A will output a HIGH with the transmitter operating normally and will switch to a LOW upon failure. When this happens, light emitting diode DS1 will extinguish.

4–43. If the system has been operated to the automatic mode, a pulse will be generated by timer U3 which will cause a delay of approximately five seconds before initiating a transfer pulse to be generated by timer U4. When U4 generates the transfer pulse, a transmitter off command is generated by timer U6 and is routed to both transmitters. A transfer command is also applied to flip–flop U5A forcing U5A to change states. The OFF command is indicated by DS5 for troubleshooting purposes. When comparators U1B and U1D have switched to a LOW state indicating both transmitters are off, RF presence LED DS3 will extinguish and the RF presence line will go LOW, allowing NOR gates U13A and U13B to transfer the switching information from U5A to U5B. At this time, the transfer relay is operated to its new position and the interlock outputs are compared with the output states of U5B for correct conditions. If the transfer switch followed the commands from the flip–flop correctly, the output of NOR gate U13D will now be HIGH causing the transmitter 2 indicator to illuminate. The control input to NAND gate U15C will also go HIGH enabling an on command to be routed from timer U7 to transmitter two. The on command is generated from the interlock transition through inverter U11A. The output of U11A is ac coupled to NAND gate U8B to generate a momentary output pulse to trigger timer U7. The on pulse momentarily illuminates DS5 to aid in troubleshooting. The on pulse generator may also be triggered by the **ON** switch on the front panel or by remote control.

4–44. The system may be operated in either the manual or automatic mode as desired. The switching action for mode selection is determined by a flip–flop composed of NAND gates U15A and U15B. The inputs to the flip–flop are controlled by the front–panel **MAN** and **AUTO** push switches. A momentary pulse through the remote control inputs for these functions will also cause a switching action to occur. The flip–flop outputs are routed to local and remote status indicators as well as the inhibit bus. The on input is diode–coupled through jumper 2 to allow automatic operation when the transmitter system is turned on. Similarly, the off input is diode–coupled through jumper 1 to operate the unit to manual mode when the system is turned off. This is necessary to prevent endless switching actions when a transmitter is turned off. Switching to the manual mode blocks initiation of a fault indication.

4–45. Remote control operation is possible through momentary commands. These commands may be in the form of momentary pulses of either polarity or momentary grounds applied to the remote control terminals. The remote control equipment is interfaced to the system through optical isolators U17–U22 to minimize the opportunity for stray coupling within the system. A **RMT/LOCAL** switch is provided on the front panel to disable remote control for test purposes.

4–46. **SYSTEM CONTROLLER POWER SUPPLIES.** Three power supplies are provided to power the system controller and to charge the self–contained battery back–up. The power supply potentials are derived from two full–wave bridge rectified supplies. In the single transmitter models, the battery supply is contained in the transmitter controller. In the main/alternate configurations, the battery supply is contained in the system controller.

4–47. The 24–volt power supply provides power to the transfer relay. It is regulated by three–terminal regulator U25 mounted to the main circuit board. The rectifier and filter components assembly (D29 through D32, C35, DT1) are also mounted to the main circuit board.

4–48. The ten–volt power supply provides voltage to charge the self–contained battery back–up and the five–volt power supply provides power for the logic. Both potentials are regulated by three–terminal regulators. Both the ten–volt regulator (U2) and the five–volt regulator (U1) are mounted to the main circuit board. The rectifier and filter (D1, C1, and C2) are mounted to the main circuit board.

4–49. The input to U2 is connected through diode D37. The battery assembly is connected in parallel at the output of U2 and the five–volt regulator is connected in series at this point. The ten–volt output of U1 keeps the battery back–up charged and comparator U23 monitors the ten–volt supply. In the event of a long–term power outage sufficient to severely discharge the battery assembly, comparator U23 will deenergize relay K1 which disconnects the battery assembly from the ten–volt source. This will prevent damage to the battery assembly from excessive discharge.

4–50. **Power Failure Detection Circuit.** A power failure detection circuit consisting of one–shots U30A/B, NAND gates U8B/D, and inverters U11B/U16A is provided to prevent inadvertent transmitter switching in the event of a power failure. When ac power is applied to the unit, an unfiltered full–wave rectified positive dc voltage is routed through level adjust potentiometer R100 to schmitt trigger inverter U11B. U11B will output a LOW to one–shot U30A. The output of U30A will go HIGH which is inverted at U16A to illuminate indicator DS6.

4–51. When a power failure condition occurs, the output of U11B will go HIGH to trigger U30A. U30A will respond by routing a LOW to extinguish indicator DS6. The LOW is also routed through NAND gates U8B/D to maintain the transmitter switching logic in the current state. When ac power is re–applied to the unit, the output of U30A will go HIGH to illuminate indicator DS6 and trigger one–shot U30B. After a one second delay to allow the exciters to generate RF power, the output of U30B will go HIGH. The HIGH is NANDed with a HIGH from U30A at U8B. The output of U8B will go LOW which is inverted at U8D to output a HIGH to the switching control logic.

4–52. **AC POWER CONTROL PANEL.**

4–53. The ac power control panel supplies primary power to each transmitter assembly. The control panel in the single transmitter models contains two circuit breakers. One circuit breaker protects the transmitter and the remaining circuit breaker protects the transmitter controller and the cabinet fan. The control panel in the main/alternate models contain three circuit breakers. One circuit breaker protects each transmitter and the third circuit breaker protects the system controller and the cabinet fans.

4–54. All ac power connections are made to a barrier type terminal strip on the rear of the panel. The terminal strip is provided with a protective cover for personnel safety. The control inputs are made through a multi–pin connector on the rear panel.

4–55. The ac power control panel receives power at 200 to 250 volts, 50 to 60 Hz, and distributes the power through the appropriate circuit breakers and contactors to the individual assemblies in the transmitter. The first circuit breaker, **CONTROL**, protects the internal wiring associated with the system controller and the cabinet air flushing fan(s). Contactor K1 is energized by a low–level dc voltage from the transmitter controller(s). A Darlington transistor pair composed of Q1 and Q2 amplifies the low–level output of the transmitter controller(s) to a current level sufficient to activate contactor K1. The 24–volt dc control voltage is supplied to contactor K1 through gating diode D3 from the transmitter controller (and through diode D2 from transmitter controller 2 in the main/alternate configuration).

4–56. The second circuit breaker, **XMTR** (**XMTR 1** in the main/alternate configuration), protects the wiring associated with the transmitter (1) system components. The circuit breaker directly feeds the transmitter controller, and through contactor K2, feeds the exciter and the power amplifier(s). Contactor K2 is energized by a low–level dc command from the transmitter controller.

4–57. The third circuit breaker, **XMTR 2**, and contactor K3 are used only in the main/alternate configuration. This circuit breaker protects the wiring associated with the transmitter 2 system components. The circuit breaker directly feeds the transmitter controller, and through contactor K3, feeds the exciter and the power amplifiers. Contactor K3 is activated by a low–level dc command from transmitter controller No. 2.

SECTION V
MAINTENANCE

5–1. INTRODUCTION.

5–2. This section provides general maintenance information, electrical adjustment procedures, and troubleshooting information for the Broadcast Electronics B–series very–low–power line of FM transmitters.

5–3. SAFETY CONSIDERATIONS.

WARNING ***NEVER OPEN THE EQUIPMENT UNLESS ALL TRANSMITTER PRIMARY POWER IS DISCONNECTED.***

WARNING

5–4. All transmitters contain high voltages and currents which, if regarded carelessly, could be fatal. Each transmitter has many built–in safety features, however good judgement, care, and common sense are the best accident preventives. The maintenance information contained in this section should be performed only by trained and experienced maintenance personnel.

5–5. It is very dangerous to attempt to make measurements or replace components with power energized, therefore such actions are not recommended. AC power to the entire cabinet may be disconnected by operating the front–panel circuit breakers to off.

5–6. FIRST LEVEL MAINTENANCE.

WARNING ***BEFORE ATTEMPTING TRANSMITTER MAINTENANCE ASSURE THE RMT/LCL SWITCH(ES) IS OPERATED TO LCL. THERE ARE THREE SWITCHES ON THE MAIN/ALTERNATE TRANSMITTERS.***

WARNING

WARNING ***NEVER OPEN THE EQUIPMENT UNLESS ALL TRANSMITTER PRIMARY POWER IS DISCONNECTED.***

WARNING

5–7. First level maintenance consists of procedures applied to equipment to forestall future failures. The procedures are performed on a regular basis and the results recorded in a performance log.

5–8. Preventive maintenance of each transmitter falls into the category of good housekeeping and is limited to whatever cleaning may be necessary and checking the performance levels using the meters and various indicators built into the equipment.

5–9. On a regular basis, clean the equipment of accumulated dust. Check for overheated components, tighten loose hardware, and lubricate mechanical surfaces as required.

5–10. AIR FILTER.

5–11. The rear access panel must be removed to replace the air filter. As only half the filter is exposed to air flow when installed, the filter may be removed and the clean end inserted in the filter housing. A new filter should be ordered at this time. The filter should be checked once each week with replacement done on an as–needed basis. A dirty filter could result in dirt accumulation leaking into the cabinet from seams, door jambs, etc.

5–12. The transmitter uses one disposable type air filter 1 inch X 16 inches X 20 inches (2.54 cm X 40.64 cm X 50.8 cm) mounted in the rear access panel of the cabinet. Additional filters may be ordered for replacement (P/N 407–0062) or purchased locally. Always mount the filter with the air flow arrow pointing towards the fan.

5–13. **FAN MAINTENANCE.**

WARNING ***NEVER OPEN THE EQUIPMENT UNLESS ALL TRANSMITTER PRIMARY POWER IS DISCONNECTED.***

WARNING

5–14. Inspect the cabinet flushing fan for dust accumulation and periodically clean the fan. The fan bearings are sealed and do not permit lubrication. If a bearing fails, the fan must be replaced. Also, inspect the fan mounting bolts to ensure all are secure.

5–15. The fan motor is cooled by the air passing around the fan. If the ambient air temperature is too high or if the air flow is restricted, then the lubricant will gradually vaporize from the motor bearings and bearing failure will occur. If very dirty air passes over the fan, accumulated dust will impair the motor cooling unless the accumulation is wiped from and blown out of the motor.

5–16. The fan impeller blades should be inspected and cleaned periodically. If the transmitter is operated in a very dusty environment, dust will build up on the concave side of the fan impellers. If this happens, air flow will be reduced and unbalance will result with a pos–sibility of damage to the fan.

5–17. **TRANSMITTER COOLING.**

WARNING ***NEVER OPEN THE EQUIPMENT UNLESS ALL TRANSMITTER PRIMARY POWER IS DISCONNECTED.***

WARNING

5–18. To prevent improper air flow in the transmitter, ensure the filler panel directly above the power amplifier assembly is not removed or replaced with additional equipment. This will allow proper cooling of the transmitter to be maintained and prevent future failures.

5–19. SECOND LEVEL MAINTENANCE.

5–20. **ADJUSTMENTS.**

5–21. **SYSTEM CONTROLLER.** System controller adjustments are shown by Figure 5–1.

5–22. **TRANSMITTER CONTROLLER.** Transmitter controller adjustments are shown by Figure 5–2.

5–23. **PA.** Refer to Part II of this manual.

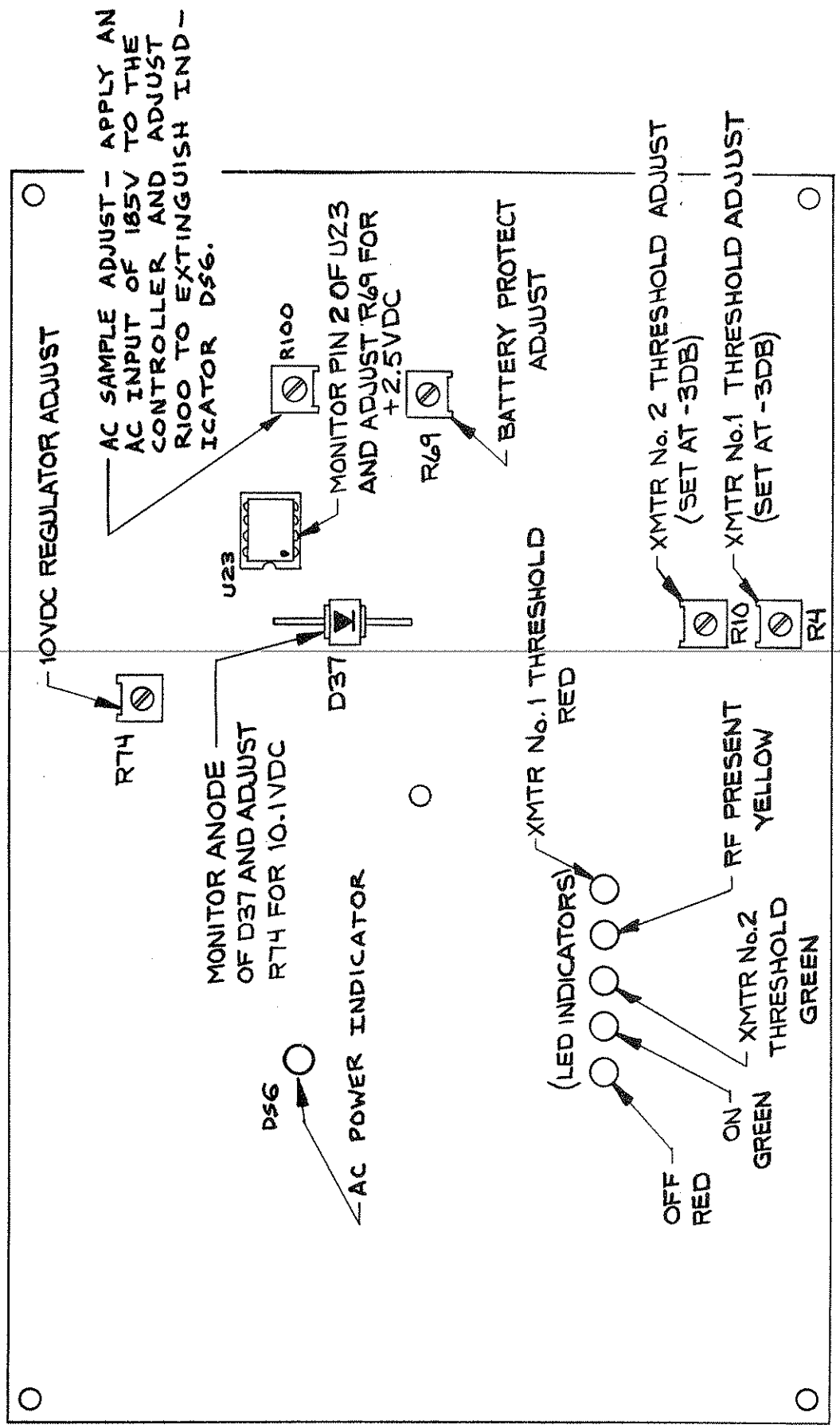
5–24. **EXCITER.** Refer to publication 597–1050.

5–25. **TRANSMITTER FREQUENCY CHANGE PROCEDURE.**

CAUTION ***CONSULT THE FACTORY BEFORE ATTEMPTING TO CHANGE THE TRANSMITTER OPERATING FREQUENCY.***

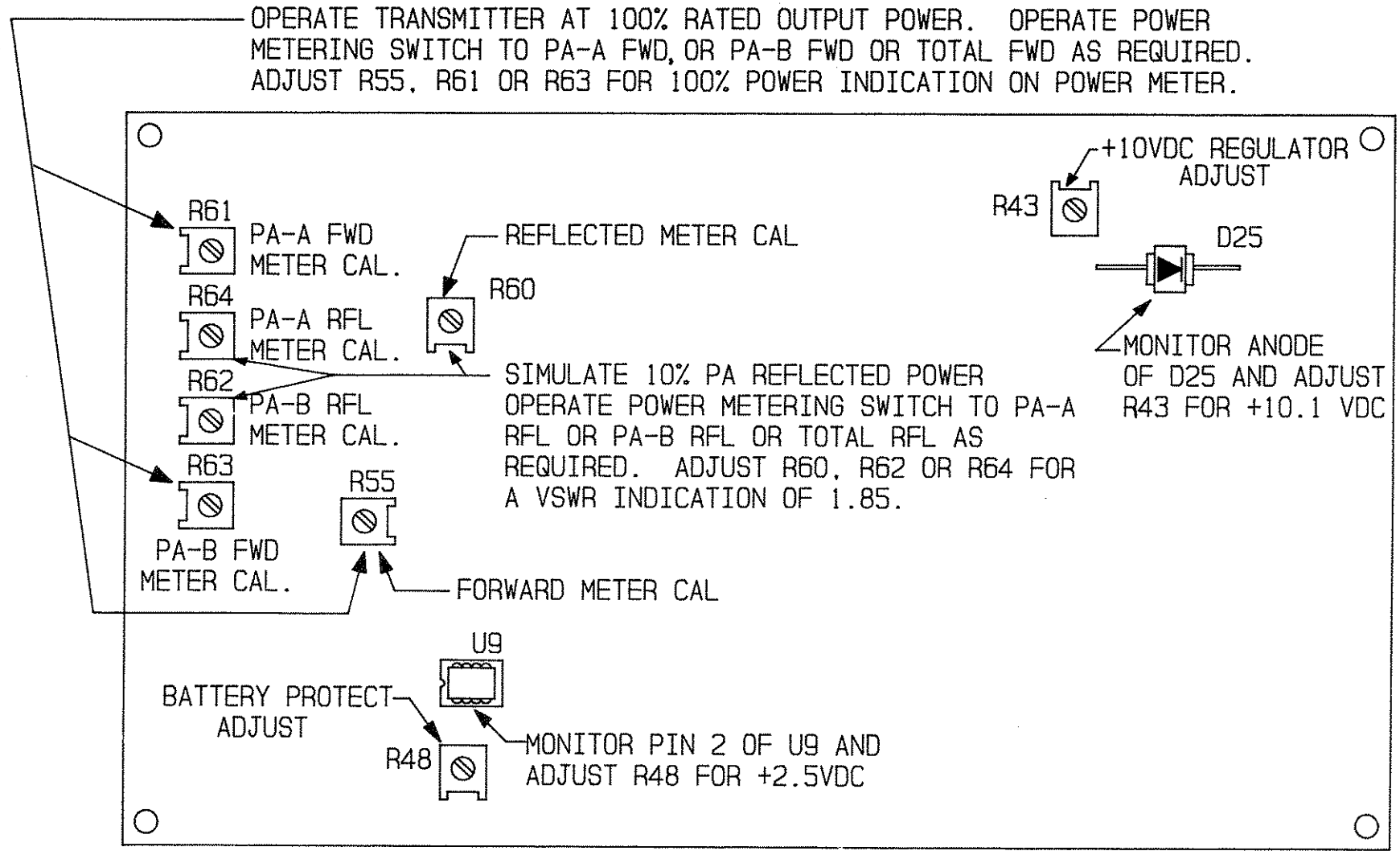
CAUTION

5–26. **GENERAL.** The following text presents an overall procedure to change the transmitter operating frequency. The procedure specifies operational adjustment procedures located throughout this publication and FX–50 exciter publication 597–1050. To change the transmitter operating frequency, proceed as follows.



597-0092-18

FIGURE 5-1. SYSTEM CONTROLLER ADJUSTMENT



597–0092–10

FIGURE 5–2. TRANSMITTER CONTROLLER ADJUSTMENT

5–27. **Procedure.** To change the transmitter operating frequency, proceed as follows:

WARNING ***DISCONNECT ALL TRANSMITTER PRIMARY POWER BEFORE PROCEEDING.***

WARNING

5–28. Refer to FX–50 exciter publication 597–1050, PART II SECTION IV, AFC/PLL ASSEMBLY and perform the FREQUENCY SELECTION procedure. Operate and test the exciter independently from the transmitter.

5–29. Refer to PART II, PA MAINTENANCE and perform the RF AMPLIFIER TUNING procedure.

5–30. Refer to PART II, PA MAINTENANCE and perform the REFLECTED POWER NULL, FWD CALIBRATION, and RFL CALIBRATION adjustment procedures.

5–31. Refer to the TRANSMITTER CONTROLLER ADJUSTMENTS in the preceding text and perform: 1) the REFLECTED METER CAL and FWD METER CAL adjustments for FM–100B and FM–250B transmitters or 2) the PA–A FWD METER CAL, PA–A RFL METER CAL, PA–B FWD METER CAL, and PA–B RFL METER CAL adjustments for FM–300B transmitters.

5–32. Refer to SECTION II, INSTALLATION and perform the SINGLE TRANSMITTER CHECKOUT or MAIN/ALTERNATE TRANSMITTER CHECKOUT procedure as required.

5–33. **TROUBLESHOOTING.**

WARNING ***BEFORE ATTEMPTING TRANSMITTER MAINTENANCE, ASSURE THE RMT/LCL SWITCH(ES) IS OPERATED TO LCL. THERE ARE THREE SWITCHES ON THE MAIN/ALTERNATE TRANSMITTERS.***

WARNING

WARNING ***NEVER OPEN THE EQUIPMENT UNLESS ALL TRANSMITTER PRIMARY POWER IS DISCONNECTED.***

WARNING

5–34. Most troubleshooting consists of visual checks. Because of the voltages and high currents in the equipment, it is considered hazardous to work with power energized. Therefore, the various transmitter indicators (meters, LEDs, fuses, and circuit breakers) should be used to isolate the malfunction to one of the specific areas listed below. Typical meter indications are presented in Table 5–1 for the FM–100B and FM–250B and Table 5–2 for the FM–300BM/A.

A. Exciter

B. Power Amplifier

C. System Controller (Main/Alternate Models Only)

D. Transmitter Controller

E. Transmitter Load

CAUTION

CAUTION

MANY COMPONENTS IN THE TRANSMITTER ARE MOUNTED TO HEAT SINKS UTILIZING A FILM OF HEAT–SINK COMPOUND FOR THERMAL CONDUCTION.

CAUTION

CAUTION

IF ANY SUCH COMPONENT IS REPLACED, ENSURE A THIN FILM OF A ZINC–BASED HEAT–SINK COMPOUND IS USED (BE P/N 700–0028) TO ASSURE GOOD HEAT DISSIPATION.

5–35. Once the trouble is isolated, refer to the appropriate sections of this manual for the theory of operation to assist in problem resolution.

5–36. **EXTENDER CABLES.** A 15 foot (4.6 m) extender cable kit (BE P/N 949–0107) is available for use with all very–low–power transmitter models. The cable kit consists of two multiple–conductor cables (logic), two coaxial cables (directional coupler), a single–conductor cable (ground), and two ac extension cords (power).

5–37. The intended use of this cable kit is to provide a method to check operation of a transmitter controller or the system controller after repair, before the repaired controller is replaced in the rack. Troubleshooting with power energized is always considered hazardous and is therefore not recommended.

TABLE 5–1. TYPICAL METER INDICATIONS (FM–100 AND FM–250)
(Sheet 1 of 2)

TRANSMITTER CONTROLLER				
METER	**INDICATION**			
	100W		250W	
PA VOLTAGE	20 V		28 V	
PA CURRENT	7.75 A		10 A	
POWER	PA		XMTR	
	FWD	RFL	FWD	RFL
		LESS THAN		LESS THAN
	100%	1.2:1	100%	1.2:1

TABLE 5–1. TYPICAL METER INDICATIONS (FM–100 AND FM–250)
(Sheet 2 of 2)

FM EXCITER		
SWITCH	**INDICATION**	
	100W	250W
FWD	17 W	30 W
RFL	LESS THAN 1.5 W	LESS THAN 1.5 W

TABLE 5–2. TYPICAL METER INDICATIONS (FM–300M/A, 300W OUTPUT)

TRANSMITTER CONTROLLER						
METER	**INDICATION**					
	PA–A		PA–B			
PA VOLTAGE	28 V		28 V			
PA CURRENT	10.5 A		10.5 A			
POWER	PA–A		PA–B		TOTAL	
	FWD	RFL	FWD	RFL	FWD	RFL
	100%	LESS THAN 1.2:1	100%	LESS THAN 1.2:1	100%	LESS THAN 1.4:1

FM EXCITER	
SWITCH	**INDICATION**
FWD	35 W
RFL	LESS THAN 1.5 W

5–38. **COMPONENT REPLACEMENT ON CIRCUIT BOARDS.** Circuit board repair requires that defective components be removed carefully to avoid damage to the board.

5–39. On all circuit boards, the adhesive securing the copper track to the board melts at almost the same temperature at which solder melts. A circuit board track can be destroyed by excessive heat or lateral movement during soldering. Use of a small iron with steady pressure is required for circuit board repairs.

5–40. To remove a component from a circuit board, cut the leads from the body of the defective component while the device is still soldered to the board.

5–41. Grip each component lead, one at a time, with long nose pliers. Turn the board over and touch a soldering iron to the lead at the solder connection. When the solder begins to melt, push the lead through the back side of the board and cut off the bent–over outer 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 low wattage iron and removing the residual solder with a soldering vacuum tool.

5–42. Install the new component and apply solder from the bottom side of the board.

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

WARNING

WARNING ***OBSERVE THE MANUFACTURER'S CAUTIONARY INSTRUCTIONS.***

WARNING

5–43. After soldering, remove flux with a cotton swab moistened with a suitable solvent. Rubbing alcohol is highly diluted and is not effective.

5–44. The board should be checked to ensure the flux has been removed and not just smeared about. Rosin flux is not normally corrosive, but rosin will absorb enough moisture in time to become conductive and cause problems.

5–45. **Integrated Circuits.** Extra care should be exercised with integrated circuits. Each integrated circuit must be oriented so that its notch matches the notch on the socket when replaced. Do not attempt to remove an integrated circuit with fingers. Use an integrated circuit puller or a small Allen wrench to lightly pry the integrated circuit from its socket.

SECTION VI
PARTS LISTS

6–1. INTRODUCTION.

6–2. This section provides descriptions and part numbers of electrical components, assemblies, and selected mechanical parts required for maintenance of the Broadcast Electronics B–series very–low–power line of FM transmitters. Each table entry in this section is indexed by reference designators appearing on the applicable schematic diagram.

TABLE 6–1. PARTS LIST INDEX
(Sheet 1 of 2)

TABLE 6–1. PARTS LIST INDEX
(Sheet 2 of 2)

TABLE 6–2. VERY–LOW–POWER FM TRANSMITTERS, SINGLE CONFIGURATION 909–0100–XXX/909–0250–XXX/909–0300–XXX

REF. DES.	DESCRIPTION	PART NO.	QTY.
DC1	Directional Coupler Assembly	951–1012–001	1
FL1	Low–Pass Filter	959–0177	1
J1A/B	Bulkhead Receptacle, Type N, Jack–to–Jack, UG30/U (Transmitter Output Connector)	418–0035	1
R3A THRU R3D	Resistor Network, PA (listed in PA Section)	959–1000–015	1
——	Air Filter, 16 X 20 X 1 inch (40.64 X 50.8 X 2.54 cm)	407–0062	1
——	Power Cord, 3 Conductor, 7.5 feet (2.29 m)	682–0001	2
——	Screw, 1/4–20 X 1 inch, Button Head, Hex Socket Stainless Steel, Black (Front Panel Screws)	420–1001	14
——	Hex Wrench, 5/32 inch (For Front Panel Screws)	710–0219	1
——	FX–50 Exciter, 220V ac 50/60 Hz Operation	909–1050–304	1
——	Power Amplifier	959–0285	1
——	Transmitter Controller	959–0284	1
——	AC Power Control Panel	959–0286	1
——	Wiring Harness	949–0087	1
——	RF Cables Assembly (909–0100–204/304 Assemblies)	949–0100–004	1
——	RF Cables Assembly (909–0100–274 Assemblies)	949–0109–001	1
——	Attenuator, Broadband, 3 dB, 20W (909–0100–XXX Assemblies Only)	339–0018	1
——	Adaptor, BNC To Type N (909–0100–XXX Assemblies Only)	417–0225	1

DIFFERENCES FOR 250 WATT FM TRANSMITTER, SINGLE CONFIGURATION, 909–0250–204/909–0250–304/909–0250–274

B1	Fan, 6 inch (15.24 cm), 250 ft³ min, 220V ac 50/60Hz, 40 Watts	380–7650	1
——	Pins, Connector	417–0036	2
——	Connector, Housing, 9–Pin	418–0055	1
——	RF Cables Assembly (909–0250–204/304 Assemblies)	949–0085	1
——	RF Cables Assembly (909–0250–274 Assembly)	949–0085–001	1

DIFFERENCES FOR 300 WATT FM TRANSMITTER, SINGLE CONFIGURATION, 909–0300–204/909–0300–304/909–0300–274

B1,B2	Fan, 6 inch (15.24 cm), 250 ft3min, 220V ac, 50/60 Hz, 40 Watts	380–7650	2
R2	Reject Load, 50 Ohm, 150 Watts, Type N Receptacle	140–0010	1
R3A THRU R3D	Resistor Network, PA (Listed in PA Section)	959–1000–015	2
——	Right Angle Plug–Jack, Type N	417–0105	3
——	Power Cord, 3 Conductor, 7.5 feet (2.29 m)	682–0001	3
——	Screw, 1/4–20 X 1 inch, Button Head, Hex Socket Stainless Steel, Black (Front Panel Screws)	420–1001	22
——	Pins, Connector	417–0036	2
——	Connector, Housing, 9–Pin	418–0055	1
——	Wiring Harness	949–0078	1
——	RF Cables Assembly (909–0300–204/304 Assemblies)	949–0081	1
——	RF Cables Assembly (909–0300–274 Assembly)	949–0081–001	1
——	Power Amplifier	959–0263	2
——	AC Power Control Panel	959–0288	1
——	Hybrid Combiner	959–0175	1
——	Hybrid Splitter	959–0176	1
——	Transmitter Controller	959–0282	1

TABLE 6–3. VERY–LOW–POWER FM TRANSMITTER, MAIN/ALTERNATE CONFIGURATION 909–2100–XXX/909–2250–XXX/909–2300–XXX (Sheet 1 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
B1,B2	Fan, 6 inch (15.24 cm), 250 ft³min, 220V ac, 50/60 Hz, 40 Watts	380–7650	2
DC1,DC2	Directional Coupler Assembly	951–1012–001	2
FL1,FL2	Low–Pass Filter	959–0177	2
J1A/B	Bulkhead Receptacle, Type N, Jack–to–Jack, UG30/U (Transmitter Output Connector)	418–0035	1
K1	Electrical RF Transfer Switch, 28V dc coil @ 0.1 Ampere RF Contacts: Type N Receptacles, 2 X SPDT, 1 kW RF @ 50 Ohms Auxiliary Contacts: Wire Terminals, 28V dc Resistive Load	340–0024	1
R1	Test Load, 50 Ohm, 150 Watt, Type N Receptacle	140–0010	1
R3A THRU R3D	Resistor Network, PA (Listed in PA Section)	959–1000–015	2
——	Pins, Connector	417–0036	2
——	Connector, Housing, 9–Pin	418–0055	1
——	Screw, 1/4–20 X 1 inch, Button Head, Hex Socket Stainless Steel, Black (Front Panel Screws)	420–1001	34
——	Hex Wrench, 5/32 inch (For Front Panel Screws)	710–0219	1
——	Right Angle Plug–Jack, Type N, UG27C/U	417–0105	7
——	Power Cord, 3 Conductor, 7.5 feet (2.29 m)	682–0001	5
——	Air Filter, 16 X 20 X 1 inch (40.64 X 50.8 X 2.54 cm)	407–0062	1
——	FX–50 Exciter, 220V ac 50/60 Hz Operation	909–1050–304	2
——	Power Amplifier	959–0285	2
——	Transmitter Controller	959–0283	2
——	System Controller	959–0280	1
——	AC Power Control Panel	959–0290	1
——	Wiring Harness	949–0088	1
——	RF Cables Assembly	949–0108	1
——	Instruction Manual, Very–Low–Power with FX–50 Exciter	979–0100–004	1
——	Attenuator, Broadband, 3 dB, 25W (909–2100–XXX Assemblies Only)	339–0018	2
——	Adaptor, BNC To Type N (909–2100–XXX Assemblies Only)	417–0225	2

DIFFERENCES FOR 250 WATT FM TRANSMITTER, MAIN/ALTERNATE CONFIGURATION 909–2250–204/909–2250–304

R1	Test Load, 50 Ohm, 500 Watt, Type N Receptacle	140–0009	1
——	RF Cables Assembly	949–0086	1

DIFFERENCES FOR 3000 WATT FM TRANSMITTER, MAIN/ALTERNATE CONFIGURATION 909–2300–204/909–2300–304

R1	Test Load, 50 Ohms, 500 Watts, Type N Receptacle	140–0009	1
R2,R2	Reject Load, 50 Ohms, 150 Watts, Type N Receptacle	140–0010	2
R3A THRU R3D	Resistor Network, PA (Listed in PA Section)	959–1000–015	4
——	Right Angle Plug–Jack, Type N, UG27C/U	417–0105	12
——	Screw, 1/4–20 X 1 inch, Button Head, Hex Socket Stainless Steel, Black (Front Panel Screws)	420–1001	30
——	Power Cord, 3 Conductor, 7.5 feet (2.29 m)	682–0001	7
——	Wiring Harness	949–0079	1
——	RF Cables Assembly	949–0080	1

TABLE 6–3. VERY–LOW–POWER FM TRANSMITTER, MAIN/ALTERNATE CONFIGURATION 909–2100–XXX/909–2250–XXX/909–2300–XXX (Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
	DIFFERENCES FOR 3000 WATT FM TRANSMITTER, MAIN/ALTERNATE CONFIGURATION 909–2300–204/909–2300–304		
——	Power Amplifier	959–0263	4
——	Transmitter Controller	959–0281	2
——	AC Power Control Panel	959–0289	1
——	Hybrid Combiner	959–0175	2
——	Hybrid Splitter	959–0176	2

TABLE 6–4. WIRING HARNESS – 949–0078/949–0079/949–0087/949–0088

REF. DES.	DESCRIPTION	PART NO.	QTY.
	949–0078 ASSEMBLY		
——	Plug, 25–Pin	418–3219	5
——	Strain Relief/Hood	418–3223	5
——	Pins, Connector	417–0053	2
——	Receptacle, Housing, 9–Pin	417–0059	1
	949–0079 ASSEMBLY		
——	Plug, 25–Pin	418–3219	10
——	Strain Relief/Hood	418–3223	10
——	Pins, Connector	417–0053	2
——	Receptacle, Housing, 9–Pin	417–0059	1
	949–0087 ASSEMBLY		
——	Plug, 25–Pin	418–3219	4
——	Strain Relief/Hood	418–3223	4
——	Pins, Connector	417–0053	2
——	Receptacle, Housing, 9–Pin	417–0059	1
	949–0088 ASSEMBLY		
——	Plug, 25–Pin	418–3219	8
——	Strain Relief/Hood	418–3223	8
——	Pins, Connector	417–0053	2
——	Receptacle, Housing, 9–Pin	417–0059	1

TABLE 6–5. RF CABLES ASSEMBLIES
949–0080/949–0081/949–0085/949–0086/949–0108/949–0109

REF. DES.	DESCRIPTION	PART NO.	QTY.
	949–0080 ASSEMBLY		
——	Plug, BNC, for RG58/U Cable	417–0095	6
——	Plug, Type N, for RG8/U Cable	417–0102	16
——	Plug, BNC, Right Angle for RG142/U Cable	417–0213	12
——	Plug, Type N, for RG142/U Cable	418–0031	6
——	Plug, BNC, for RG142/U Cable	417–0094	4
	949–0081 ASSEMBLY		
——	Plug, BNC, for RG58/U Cable	417–0095	3
——	Plug, Type N, for RG8/U Cable	417–0102	6
——	Plug, BNC, Right Angle for RG142/U Cable	417–0213	6
——	Plug, Type N, for RG142/U Cable	418–0031	3
——	Plug, BNC, for RG142/U Cable	417–0094	2
	949–0085 ASSEMBLY		
——	Plug, BNC, for RG58/U Cable	417–0095	2
——	Plug, Type N, for RG8/U Cable	417–0102	6
——	Plug, BNC, for RG142/U Cable	417–0094	2
	949–0086 ASSEMBLY		
——	Plug, BNC, for RG58/U Cable	417–0095	4
——	Plug, Type N, for RG8/U Cable	417–0102	16
——	Plug, BNC, for RG142/U Cable	417–0094	4
	949–0108 ASSEMBLY		
——	Plug, BNC, for RG142/U Cable	417–0094	6
——	Plug, Type N, for RG142/U Cable	417–0031	16
——	Plug, Type N, for RG58/U Cable	417–0226	2
	949–0109 ASSEMBLY		
——	Plug, BNC, for RG142/U Cable	417–0094	3
——	Plug, Type N, for RG142/U Cable	417–0031	6
——	Plug, Type N, for RG58/U Cable	417–0226	1

TABLE 6–6. DIRECTIONAL COUPLER ASSEMBLY – 951–1012–001

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1,C2	Capacitor, Ceramic, 1000 pF ±20%, 500V	008–1033	2
D2,D2	Diode, HP5082–2800, High Voltage, Shottky Barrier Type, 70V, 15 mA	201–2800	2
J2,J3	Receptacle, Type N	417–0204	2
R1	Potentiometer, 100 Ohm ±10%, 1/2W	177–1034	1

TABLE 6–7. TRANSMITTER CONTROLLER – 959–0282/959–0284/959–0283/959–0281 (Sheet 1 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
B101	Motor, Reversible, 2 RPM, 30 in/oz output torque 117V ac, 50/60 Hz, 5.5 VA, Magnetic Clutch	380–0530	1
C1	Capacitor, 4700 uF, 35V	014–4795	1
C2,C3	Capacitor, Electrolytic, 10 uF, 50V	023–1076	2
D1	Full–Wave Bridge Rectifier, MDA2502, Silicon, 200 PIV, 25 Amperes	239–0006	1
D2	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203–4005	1
DS2	Subminiature Lamp, No. 327, T–1 3/4 Base, 28V @ 0.04 Ampere	321–0327	2
F1, F1 SPARE	Fuse, AGC, 1.5 Ampere, 250V, Slow–Blow	334–0150	2
FL1	Fused Power Connector, 120/240V Voltage Selector, EMI Filter	360–6504	1
J3,J4	Receptacle, BNC Chassis Mount	417–0016	2
M1	PA VOLTAGE Meter, 3.5 inch (8.89 cm) Taut Band Type, FS= 1 mA ±2%, 15 Ohm Movement	310–0028	1
M2	PA CURRENT Meter, 3.5 inch (8.89 cm) Taut Band Type, FS= 1 mA ±2%, 15 Ohm Movement	310–0029	1
M3	POWER Meter, 3.5 inch (8.89 cm) Taut Band Type, FS= 200 uA ±2%, 230 Ohm Movement	310–0020–001	1
R1	Resistor, 1 k Ohm ±5%, 2W	130–1043	1
R2	Resistor, 10 k Ohm ±5%, 1/2W	110–1053	1
R3	Potentiometer, 10 k Ohm ±10%, 1W (POWER ADJUST)	192–1052	1
R4	Resistor, 1 k Ohm ±5%, 1/2W	110–1043	1
R5	Resistor, 100 Ohm ±1%, 1/4W	100–1031	1
R6	Potentiometer, 10 k Ohm ±10%, 1W	192–1052	1
S2	Switch, Rotary, 6 Position non–shorting, 1 Section, 1 Pole 2.75A @ 15V dc, 0.350A @ 115V ac	340–0040–001	1
S3,S4	Switch, Push, SPST, N.O. Contacts 10A @ 125/250V ac (ON and OFF)	343–0003	2
S5	Switch, Toggle, Miniature, 3PDT, 5A @ 120V ac or 28V dc (CONTROL)	340–0062	1
T1	Transformer, Power, PRIMARY: Dual 115V, One Winding Tapped at 95V, 50/60 Hz SECONDARY: 25.5V @ 1A, 13.2V @ 3A	376–0218	1
TB1,TB2	Terminal Strip, 10 Terminals	412–0010	2
U1	Integrated Circuit, LM317K, Adjustable Positive Voltage Regulator, 1.2V to 37V, 1.5 Amperes Maximum, TO–3 Case	227–0318	1
XU1	Socket, TO–3 Transistor	417–0298	1
——	Raise/Lower Motor Circuit Board Assembly	919–0089	1
——	Insulator, TO–3	418–0010	1
——	Knob, (POWER METERING and POWER ADJUST)	482–0029	2
——	Standoff Terminal	413–2013	10
——	Nylon Locking Standoff (for Circuit Board)	441–9311	5
——	Switch Cap, Red (S3)	343–0007	1
——	Switch Cap, Green (S4)	343–0006	1

TABLE 6–7. TRANSMITTER CONTROLLER – 959–0282/959–0284/959–0283/959–0281 (Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
	ADDITIONAL PARTS FOR 959–0282 ASSEMBLY		
BT1 THRU BT4	Battery, Rechargeable, X–Cell, 5 Ampere–Hour, 2 Volt	357–6900	4
S1,S6	Switch, Toggle, Miniature, DPDT, 0.4 VA Contacts at 20V Maximum, ac or dc (S1 METERS, S6 POWER METERING)	348–7201	2
——	Fuse Clip (for spare fuse)	415–1001	2
——	Transmitter Controller Circuit Board Assembly	919–0072	1
——	Transmitter Controller Cable Harness	949–0084	1
	ADDITIONAL PARTS FOR 959–0284 ASSEMBLY		
BT1 THRU BT4	Battery, Rechargeable, X–Cell, 5 Ampere–Hour, 2 Volt	357–6900	4
S6	Switch, Toggle, Miniature, DPDT, 0.4 VA Contacts at 20V Maximum, ac or dc (METERS)	348–7201	1
——	Fuse Clip (for spare fuse)	415–1001	2
——	Hole Plug, Blue, 1/4 Inch	450–0650–1	1
——	Transmitter Controller Circuit Board Assembly	919–0072	1
——	Transmitter Controller Cable Harness	949–0077–001	1
	ADDITIONAL PARTS FOR 959–0283 ASSEMBLY		
S6	Switch, Toggle, Miniature, DPDT, 0.4 VA Contacts at 20V Maximum, ac or dc (METERS)	348–7201	1
——	Hole Plug, Blue, 1/4 Inch	450–0650–1	1
——	Transmitter Controller Circuit Board Assembly	919–0072–001	1
——	Transmitter Controller Cable Harness	949–0077–001	1
	ADDITIONAL PARTS FOR 959–0281 ASSEMBLY		
S1,S6	Switch, Toggle, Miniature, DPDT, 0.4 VA Contacts at 20V Maximum, ac or dc (S1 METERS, S6 POWER METERING)	348–7201	2
——	Transmitter Controller Circuit Board Assembly	919–0072–001	1
——	Transmitter Controller Cable Harness	949–0084	1

TABLE 6–8. TRANSMITTER CONTROLLER CABLE HARNESS – 949–0084/949–0077/949–0077–001 (Sheet 1 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
P1	Plug, 12–Pin	418–1271	1
P2	Plug, 6–Pin	418–0670	1
P3 THRU P5	Plug, 12–Pin	418–1271	3
P6	Plug, 6–Pin	418–0670	1
J1,J2	Plug, 25–Pin	417–0015	2

TABLE 6–8. TRANSMITTER CONTROLLER CABLE HARNESS – 949–0084/949–0077/949–0077–001 (Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
	ADDITIONAL PARTS FOR 959–0284 ASSEMBLY		
——	Pins for P1 THRU P6	417–0053	54
	ADDITIONAL PARTS FOR 959–0277–001 ASSEMBLY		
——	Pins for P1 THRU P6	417–0053	50

TABLE 6–9. RAISE/LOWER MOTOR CIRCUIT BOARD ASSEMBLY – 919–0089

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1,C2	Capacitor, Mylar, 0.47 uF, 1kV	031–4753	2
D1 THRU D4	Diode, Silicon, 1N4005, 600V, 1 Ampere	203–4005	4
J6	Receptacle, 6–Pin	418–0006	1
K1,K2	Relay, Plug–in Coil: 24V dc, 700 Ohms Contacts: DPDT, 2A @ 28V dc or 115V ac, Resistive	270–0003	2
MOV1, MOV2	Metal Oxide Varistor, V130LA10A, 130V ac RMS, 10 Joules	140–0006	2
R1,R2	Resistor, 560 Ohm ±5%, 2W	130–5623	2
XK1,XK2	Relay Socket	417–1230	2
——	Pins for J6	417–0036	5
——	Blank Circuit Board	519–0017	1

TABLE 6–10. TRANSMITTER CONTROLLER CIRCUIT BOARD ASSEMBLY – 919–0072/919–0072–001 (Sheet 1 of 3)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1 THRU C6	Capacitor, Electrolytic, 10 uF, 35V	023–1076	6
C7	Capacitor, Electrolytic, 47 uF, 25V	020–4773	1
C8,C9	Capacitor, Mylar Film, 0.1 uF ±10%, 100V	030–1053	2
C10	Capacitor, Mica, 390 pF ±5%, 100V	042–3922	1
C11	Capacitor, Mylar Film, 0.1 uF ±10%, 100V	030–1053	1
C12,C13	Capacitor, Mica, 390 pF ±5%, 100V	042–3922	2
C14	Capacitor, Mylar Film, 0.1 uF ±10%, 100V	030–1053	1
C15	Capacitor, Electrolytic, 4700 uF, 50V	014–4793	1
C16	Capacitor, Electrolytic, 33 uF, 35V, Low–Leakage	024–3335	1
C17	Capacitor, Mylar Film, 0.1 uF ±10%, 100V	030–1053	1
C20 THRU C22	Capacitor, Electrolytic, 10 uF, 35V	023–1076	3
C23	Capacitor, Electrolytic, 100 uF, 25V	023–1084	1
C24	Capacitor, Electrolytic, 10 uF, 35V	023–1076	1
C25	Capacitor, Electrolytic, 100 uF, 25V	023–1084	1
C26	Capacitor, Mylar Film, 0.1 uF ±10%, 100V	030–1053	1
C27	Capacitor, Ceramic, 0.01 uF ±10%, 100V	031–1043	1
D1 THRU D15	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203–4148	15
D16 THRU D19	Diode, MR502, Silicon, 200V, 3 Amperes	202–0502	4

TABLE 6–10. TRANSMITTER CONTROLLER CIRCUIT BOARD ASSEMBLY – 919–0072/919–0072–001 (Sheet 2 of 3)

REF. DES.	DESCRIPTION	PART NO.	QTY.
D20 THRU D24	Diode, 1N4005, Silicon, 600V, 1 Ampere	203–4005	5
D25	Diode, MR751, Silicon, 100V, 6 Amperes	202–0751	1
D26 THRU D28,D30	Diode, 1N4005, Silicon, 600V, 1 Ampere	203–4005	4
DT1	Transient Voltage Suppressor, 1N6284A, 36V ±1.8V, Maximum Peak Current: 30A	206–0002	1
DT2	Transient Absorber, 1N6279A, 22V ±0.1V Maximum Peak Current: 49A	206–0001	1
J1	Receptacle, 12–Pin	417–1276	1
J2	Receptacle, 6–Pin	417–0677	1
J3 THRU J5	Receptacle, 12–Pin	417–1276	3
J6,J7	Receptacle, Male, 3–Pin In–Line	417–0003	2
K1	Relay, Circuit Board Mount Contacts: SPDT, 100V dc @ 8 Amperes Maximum Coil: 12V dc, 140 mA, 85 Ohms ±10 Ohms	272–0106	1
P6,P7	Jumper, Programmable, 2–Pin	340–0004	2
Q1	Transistor, 2N3906, Silicon, PNP, TO–92 Case	210–3906	1
Q2 THRU Q5	Transistor, 2N3904, Silicon, NPN, TO–92 Case	211–3904	4
Q6	Transistor, MPSU05, Silicon, NPN, TO–202N Case	211–0005	1
R1 THRU R3	Resistor, 1 k Ohm ±5%, 1/4W	100–1043	3
R4	Resistor, 5.6 k Ohm ±5%, 1/4W	100–5643	1
R5 THRU R7	Resistor, 1 k Ohm ±5%, 1/4W	100–1043	3
R8,R9	Resistor, 10 k Ohm ±5%, 1/4W	100–1053	2
R10,R11	Resistor, 1 k Ohm ±5%, 1/4W	100–1043	2
R12	Resistor, 100 k Ohm ±5%, 1/4W	100–1063	1
R13	Resistor, 4.7 k Ohm ±5%, 1/4W	100–4743	1
R14	Resistor, 1 k Ohm ±5%, 1/4W	100–1043	1
R15 THRU R17	Resistor, 15 k Ohm ±5%, 1/4W	100–1553	3
R18	Resistor, 1 k Ohm ±5%, 1/4W	100–1043	1
R19	Resistor, 270 Ohm ±5%, 1/4W	100–2733	1
R20	Resistor, 15 k Ohm ±5%, 1/4W	100–1553	1
R21	Resistor, 49.9 k Ohm ±1%, 1/4W	103–4951	1
R22	Resistor, 243 Ohm ±1%, 1/4W	103–2431	1
R24	Resistor, 113 k Ohm ±1%, 1/4W	103–1136	1
R25	Resistor, 49.9 k Ohm ±1%, 1/4W	103–4951	1
R26	Resistor, 1 k Ohm ±1%, 1/4W	103–1041	1
R28	Resistor, 169 k Ohm ±1%, 1/4W	103–1696	1
R29,R30	Resistor, 100 Ohm ±5%, 1/4W	100–1033	2
R32	Resistor, 8.66 k Ohm ±1%, 1/4W	100–8641	1
R33,R34	Resistor, 100 Ohm ±5%, 1/4W	100–1033	2
R36	Resistor, 8.66 k Ohm ±1%, 1/4W	100–8641	1
R37 THRU R40	Resistor, 470 Ohm ±5%, 1/4W	100–4733	4
R41	Resistor, 30 Ohm ±5%, 1W	120–3023	1
R42	Resistor, 820 Ohm ±5%, 1/4W	100–8233	1
R43	Potentiometer, 100 Ohm ±10%, 1/2W	177–1034	1
R44	Resistor, 121 Ohm ±1%, 1/4W	100–1231	1
R45	Resistor, 10 Ohm ±5%, 1/4W	100–1023	1

TABLE 6–10. TRANSMITTER CONTROLLER CIRCUIT BOARD ASSEMBLY – 919–0072/919–0072–001 (Sheet 3 of 3)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R46	Resistor, 3.9 k Ohm ±5%, 1/4W	100–3943	1
R47	Resistor, 2.32 k Ohm ±1%, 1/4W	103–2341	1
R48	Potentiometer, 10 k Ohm ±10%, 1/2W	177–1054	1
R49	Resistor, 1.33 k Ohm ±1%, 1/4W	103–1331	1
R50	Resistor, 20 k Ohm ±5%, 1/4W	100–2053	1
R51	Resistor, 4.7 k Ohm ±5%, 1/4W	100–4743	1
R52	Resistor, 2 k Ohm ±5%, 1/4W	100–2043	1
R53	Resistor, 365 Ohm ±1%, 1/4W	103–3631	1
R54	Resistor, 121 Ohm ±1%, 1/4W	103–1231	1
R55	Potentiometer, 1 Meg Ohm ±10%, 1/2W	177–1074	1
R56	Resistor, 33 k Ohm ±5%, 1/4W	100–3353	1
R57	Resistor, 15 k Ohm ±5%, 1/4W	100–1553	1
R60	Potentiometer, 100 k Ohm ±10%, 1/2W	177–1064	1
R61	Potentiometer, 5 k Ohm ±10%, 1/2W	177–5044	1
R62	Potentiometer, 20 k Ohm +10%, 1/2W	177–2054	1
R63	Potentiometer, 5 k Ohm ±10%, 1/2W	177–5044	1
R64	Potentiometer, 20 k Ohm ±10%, 1/2W	177–2054	1
R65,R66	Resistor, 41.2 k Ohm ±1%, 1/4W	103–4125	2
U1 THRU U3	Integrated Circuit, 4N33, Optical Isolator, NPN Photo–Transistor/Infrared Diode, 6–Pin DIP	229–0033	3
U4	Integrated Circuit, MC4011BCP, Quad 2–Input NAND Gate, CMOS, 14–Pin DIP	228–4011	1
U5	Integrated Circuit, CD4069CN, Hex Inverter, CMOS, 14–Pin DIP	228–4069	1
U7	Integrated Circuit, MC7824ACT, Fixed Positive Voltage Regulator, 24V @ 1.5A, TO–220 Case	227–7824A	1
U8	Integrated Circuit, LM3362Z–2.5, Precision Voltage Reference, 2.5V ±4%, 0 to +70°C, TO–92 Case	229–0336	1
U9	Integrated Circuit, TL311P, JFET–Input Differential Comparator, 8–Pin DIP	220–0311	1
U10	Integrated Circuit, LM317T, Adjustable Positive Voltage Regulator, 1.2 to 37V, 1.5A Maximum, TO–220 Case	227–0317	1
U11,U12	Integrated Circuit, LM358N, Dual Operational Amplifier, 8–Pin DIP	221–0358	2
XU4,XU5	Socket, 14–Pin	417–1404	2
XU9,XU11, XU12	Socket, 8–Pin	417–0804	3
——	Blank Circuit Board	519–0072	1
	ADDITIONAL PARTS FOR 919–0072–001 ASSEMBLY		
D29	Diode, 1N4005, Silicon, 600V, 1 Ampere	203–4005	1

TABLE 6–11. HYBRID SPLITTER ASSEMBLY – 959–0176

REF. DES.	DESCRIPTION	PART NO.	QTY.
J1,J2,J3	Receptacle, BNC	417–0203	3
R1	Resistor, 50 Ohm, 150W, Non–Inductive	131–5027	1

TABLE 6–12. HYBRID COMBINER ASSEMBLY –959–0175

REF. DES.	DESCRIPTION	PART NO.	QTY.
J1,J2,J3	Receptacle, BNC	417–0203	1
J4	Receptacle, Type N	417–0204–001	1

TABLE 6–13. SYSTEM CONTROLLER – 959–0280

REF. DES.	DESCRIPTION	PART NO.	QTY.
BT1 THRU BT4	Battery, Rechargeable, X–Cell, 5 Ampere–Hour, 2 Volt	357–6900	4
C1,C2	Capacitor, Electrolytic, 4700 uF, 35V	014–4795	2
C4 THRU C7	Capacitor, Electrolytic, 10 uF, 50V	023–1076	4
D1	Full–Wave Bridge Rectifier, MDA2502, Silicon, 200 PIV, 25 Amperes	239–0006	1
DS1 THRU DS6	Subminiature Lamp, No. 327, T–1 3/4 Base, 28V @ 0.04 Amperes	321–0327	6
DT1	Transient Voltage Suppressor, 1N6279A, 22V ±0.1V, Maximum Peak Pulse Current: 49A	206–0001	1
F1, F1 SPARE	Fuse, AGC, 1.5 Amperes, 250V, Slow–Blow	334–0150	2
FL1	Fused Power Connector, 120/240V, Voltage Selector, EMI Filter	360–6504	1
R1	Resistor, 47 Ohm ±5%, 1/2W	110–4723	1
S1 THRU S6	Switch, Push, SPST, N.O. Contacts, 10A @ 125/250V ac **(MAN/AUTO MODE, TX–1/TX–2 SELECT, XMTR OFF/XMTR ON)**	343–0003	6
S7,S8	Switch, Toggle, Miniature DPDT, 0.4 VA Contacts at 20V Maximum ac or dc	348–7201	2
T1	Transformer, Power Primary: Dual 115V, One Winding Tapped at 95V, 50/60 Hz Secondary: 25.5V @ 1A, 13.2V @ 3A	376–0218	1
TB1	Barrier Strip, 14 Terminals	412–0014	1
U1,U2	Integrated Circuit, LM317K, Adjustable Positive Voltage Regulator, 1.2V to 37V, 1.5 Ampere Maximum, TO–3 Case	227–0318	2
——	Switch Cap, Green (S1,S2,S3,S5,S6)	343–0006	5
——	Switch Cap, Red (S4)	343–0007	1
——	Standoff Terminal	413–2013	8
——	Fuse Clip (for spare fuse)	415–1001	2
XU1,XU2	Socket, TO–3 Transistor	417–0298	2
——	Insulator, TO–3 (for U1,U2)	418–0010	2
——	Nylon Locking Standoff (for circuit board)	441–9311	5
——	System Controller Circuit Board Assembly	919–0073	1
——	System Controller Wiring Harness	949–0076	1

TABLE 6–14. SYSTEM CONTROLLER CABLE HARNESS – 949–0076

REF. DES.	DESCRIPTION	PART NO.	QTY.
J1	Receptacle, 25–Pin	417–0015	1
P1,P2	Plug, 12–Pin	418–1271	2
P3	Plug, 6–Pin	418–0670	1
P4,P5	Plug, 12–Pin	418–1271	2
——	Pins for P1 thru P5	417–0053	51

TABLE 6–15. SYSTEM CONTROLLER CIRCUIT BOARD ASSEMBLY – 919–0073
(Sheet 1 of 4)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1 THRU C5	Capacitor, Mylar Film, 0.1 uF ±10%, 100V	030–1053	5
C6	Capacitor, Electrolytic, 100 uF, 25V	023–1084	1
C7	Capacitor, Ceramic, 0.01 uF ±10%, 200V	030–1043	1
C8	Capacitor, Mylar Film, 0.1 uF ±10%, 100V	030–1053	1
C9	Capacitor, Electrolytic, 10 uF, 35V	023–1076	1
C10	Capacitor, Ceramic, 0.01 uF ±10%, 200V	030–1043	1
C11 THRU C13	Capacitor, Mylar Film, 0.1 uF ±10%, 100V	030–1053	3
C14,C15	Capacitor, Electrolytic, 10 uF, 35V	023–1076	2
C16	Capacitor, Mylar Film, 0.1 uF ±10%, 100V	030–1053	1
C17	Capacitor, Electrolytic, 10 uF, 35V	023–1076	1
C18	Capacitor, Ceramic, 0.01 uF ±10%, 200V	030–1043	1
C19,C20	Capacitor, Electrolytic, 10 uF, 35V	023–1076	2
C21 THRU C24	Capacitor, Mylar Film, 0.1 uF ±10%, 100V	030–1053	4
C25	Capacitor, Electrolytic, 10 uF, 35V	023–1076	1
C26	Capacitor, Ceramic, 0.01 uF ±10%, 200V	030–1043	1
C27 THRU C34	Capacitor, Electrolytic, 10 uF, 35V	023–1076	8
C35	Capacitor, Electrolytic, 4700 uF, 50V	014–4793	1
C36	Capacitor, Mylar Film, 0.1 uF ±10%, 100V	030–1053	1
C37	Capacitor, Electrolytic, 33 uF, 35V, Low Leakage	024–3335	1
C38,C39	Capacitor, Electrolytic, 10 uF, 35V	023–1076	2
C40	Capacitor, Electrolytic, 100 uF, 25V	023–1084	1
C41	Capacitor, Electrolytic, 1 uF, 50V, Non– Polarized	020–1064	1
C42	Capacitor, Electrolytic, 1 uF, 50V	024–1064	1
C43	Capacitor, Electrolytic, 100 uF, 35V	023–1084	1
D1 THRU D28	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203–4148	28
D29 THRU D36	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203–4005	8
D37	Diode, MR751, Silicon, 100V @ 6 Amperes	202–0751	1
D38 THRU D40	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203–4005	3
D41 THRU D46	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203–4148	6
D47 THRU D53	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203–4005	7
D54	Diode, Zener, 1N4733A, 5.1V ±5%, 1W	200–4733	1
DS1	Indicator, LED, Red, CM6–86B, 2.2V @ 0.1 Ampere Maximum, T–1 3/4 Size	323–0023	1
DS2	Indicator, LED, Green, 521–9175, 3V @ 40 mA Maximum, T–1 3/4 Size	323–9224	1
DS3	Indicator, LED, Yellow, 521–9176, 3V @ 30 mA Maximum, T–1 3/4 Size	323–9225	1
DS4	Indicator, LED, Red, CM6–86B, 2.2V @ 0.1 Ampere Maximum, T–1 3/4 Size	323–0023	1
DS5,DS6	Indicator, LED, Green, 521–9175, 3V @ 40 mA Maximum, T–1 3/4 Size	323–9224	2
DT1	Transient Voltage Suppressor, 1N6284A, 36V ±1.8V, Maximum Peak Pulse Current: 30A	206–0002	1
J1,J2	Receptacle, 12–Pin	417–1276	2
J3	Receptacle, 6–Pin	417–0677	1
J4,J5,J6	Receptacle, 12–Pin	417–1276	3
J7,J8	Receptacle, Male, 2–Pin	417–4004	2

TABLE 6–15. SYSTEM CONTROLLER CIRCUIT BOARD ASSEMBLY – 919–0073
(Sheet 2 of 4)

REF. DES.	DESCRIPTION	PART NO.	QTY.
J9,J10	Receptacle, Male, 3–Pin In–line	417–0003	2
K1	Relay, Circuit Board Mount Contacts: SPDT, 100V dc @ 8 Amperes Maximum Coil: 12V dc, 140 mA, 85 Ohms ±10 Ohms	272–0106	1
P7 THRU P10	Jumper, Programmable, 2–Pin	340–0004	4
Q1	Transistor, 2N3904, Silicon, NPN, TO–92 Case	211–3904	1
Q2,Q3	Transistor, MPSU05, Silicon, NPN, TO–202N Case	211–0005	2
Q4	Transistor, 2N3053, Silicon, NPN, TO–39 Case	211–3053	1
Q5	Transistor, 2N4036, Silicon, PNP, TO–39 Case	210–4036	1
R1	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R2,R3	Resistor, 1 k Ohm ±5%, 1/4W	100–1043	2
R4	Potentiometer, 5 k Ohm ±10%, 1/2W	177–5044	1
R5 THRU R7	Resistor, 1 k Ohm ±5%, 1/4W	100–1043	3
R8	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R9	Resistor, 1 k Ohm ±5%, 1/4W	100–1043	1
R10	Potentiometer, 5 k Ohm ±10%, 1/2W	177–5044	1
R11,R12	Resistor, 1 k Ohm ±5%, 1/4W	100–1043	2
R13 THRU R16	Resistor, 10 Meg Ohm ±5%, 1/4W	100–1083	4
R17	Resistor, 330 Ohm ±5%, 1/4W	100–3333	1
R18,R19	Resistor, 10 k Ohm ±5%, 1/4W	100–1053	2
R20	Resistor, 330 Ohm ±5%, 1/4W	100–3333	1
R21,R22	Resistor, 10 k Ohm ±5%, 1/4W	100–1053	2
R23	Resistor, 47 k Ohm ±5%, 1/4W	100–4753	1
R24	Resistor, 15 k Ohm ±5%, 1/4W	100–1553	1
R25	Resistor, 10 k Ohm ±5%, 1/4W	100–1053	1
R26	Resistor, 22 k Ohm ±5%, 1/4W	100–2253	1
R27,R28	Resistor, 100 k Ohm ±5%, 1/4W	100–1063	2
R29,R30	Resistor, 1.5 k Ohm ±5%, 1/4W	100–1543	2
R31	Resistor, 22 k Ohm ±5%, 1/4W	100–2253	1
R32	Resistor, 330 Ohm ±5%, 1/4W	100–3333	1
R33,R34	Resistor, 100 k Ohm ±5%, 1/4W	100–1063	2
R35,R36	Resistor, 1.5 k Ohm ±5%, 1/4W	100–1543	2
R37,R38	Resistor, 22 k Ohm ±5%, 1/4W	100–2253	2
R39,R40	Resistor, 10 k Ohm ±5%, 1/4W	100–1053	2
R41	Resistor, 330 Ohm ±5%, 1/4W	100–3333	1
R42	Resistor, 22 k Ohm ±5%, 1/4W	100–2253	1
R43	Resistor, 10 Ohm ±5%, 1/4W	100–1023	1
R44	Resistor, 100 k Ohm ±5%, 1/4W	100–1063	1
R45,R46	Resistor, 1.5 k Ohm ±5%, 1/4W	100–1543	2
R47 THRU R49	Resistor, 100 k Ohm ±5%, 1/4W	100–1063	3
R50	Resistor, 22 k Ohm ±5%, 1/4W	100–2253	1
R51	Resistor, 10 k Ohm ±5%, 1/4W	100–1053	1
R52	Resistor, 330 Ohm ±5%, 1/4W	100–3333	1
R53,R54	Resistor, 22 k Ohm ±5%, 1/4W	100–2253	2
R55	Resistor, 100 k Ohm ±5%, 1/4W	100–1063	1
R56	Resistor, 1.5 k Ohm ±5%, 1/4W	100–1543	1

TABLE 6–15. SYSTEM CONTROLLER CIRCUIT BOARD ASSEMBLY – 919–0073
(Sheet 3 of 4)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R57	Resistor, 1 k Ohm ±5%, 1/4W	100–1043	1
R58	Resistor, 1.5 k Ohm ±5%, 1/4W	100–1543	1
R59	Resistor, 100 k Ohm ±5%, 1/4W	100–1063	1
R60 THRU R64	Resistor, 1 k Ohm ±5%, 1/4W	100–1043	5
R65	Resistor, 3.9 k Ohm ±5%, 1/4W	100–3943	1
R66	Resistor, 2.32 k Ohm ±1%, 1/4W	103–2341	1
R67	Resistor, 10 Ohm ±5%, 1/4W	100–1023	1
R68	Resistor, 30 Ohm ±5%, 1W	120–3023	1
R69	Potentiometer, 10 k Ohm ±10%, 1/2W	177–1054	1
R70	Resistor, 1.33 k Ohm ±1%, 1/4W	103–1331	1
R71	Resistor, 20 k Ohm ±5%, 1/4W	100–2053	1
R72	Resistor, 4.7 k Ohm ±5%, 1/4W	100–4743	1
R73	Resistor, 2 k Ohm ±5%, 1/4W	100–2043	1
R74	Potentiometer, 100 Ohm ±10%, 1/2W	177–1034	1
R75	Resistor, 820 Ohm ±5%, 1/4W	100–8233	1
R76	Resistor, 121 Ohm ±1%, 1/4W	100–1231	1
R77	Resistor, 365 Ohm ±1%, 1/4W	103–3631	1
R79	Resistor, 121 Ohm ±1%, 1/4W	100–1231	1
R80 THRU R83	Resistor, 10 k Ohm ±5%, 1/4W	100–1053	4
R84	Resistor, 330 Ohm ±5%, 1/4W	100–3333	1
R85 THRU R87	Resistor, 680 Ohm ±5%, 1/4W	100–6833	3
R88	Resistor, 1 k Ohm ±5%, 1/2W	110–1043	1
R89	Resistor, 10 k Ohm ±5%, 1/2W	110–1053	1
R90	Resistor, 47 Ohm ±5%, 1/2W	110–4723	1
R91	Resistor, 680 Ohm ±5%, 1/4W	100–6833	1
R92,R93	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	2
R94,R95	Resistor, 10 k Ohm ±5%, 1/4W	100–1053	2
R96	Resistor, 100 k Ohm ±5%, 1/4W	100–1063	1
R98,R99	Resistor, 10 k Ohm ±5%, 1/4W	100–1053	2
R100	Potentiometer, 10 k Ohm ±10%, 1/2W	177–1054	1
R101	Resistor, 330 Ohm ±5%, 1/4W	100–3333	1
R102	Resistor, 51 k Ohm ±5%, 1/4W	100–5153	1
U1	Integrated Circuit, LM339AN, Quad Comparator, 14–Pin DIP	221–0339	1
U2	Integrated Circuit, ULN2003, 7 NPN Darlington Driver Pack, 16–Pin DIP	229–2003	1
U3,U4	Integrated Circuit, NE555V, Timer, 8–Pin DIP	229–0555	2
U5	Integrated Circuit, CD4027BE, Dual JK Master–Slave Flip–Flop, 16–Pin DIP	225–0003	1
U6,U7	Integrated Circuit, NE555V, Timer, 8–Pin DIP	229–0555	2
U8,U9	Integrated Circuit, MC4011BCP, Quad 2–Input NAND Gate, CMOS, 14–Pin DIP	228–4011	2
U10	Integrated Circuit, CD4069CN, Hex Inverter, CMOS, 14–Pin DIP	228–4069	1
U11	Integrated Circuit, MC14584, Hex Schmitt Trigger Inverter, CMOS, 14–Pin DIP	228–4584	1
U12,U13	Integrated Circuit, MC14001BCP, Quad 2–Input NOR Gate, CMOS, 14–Pin DIP	228–4001	2
U14	Integrated Circuit, CD4069CN, Hex Inverter, CMOS, 14–Pin DIP	228–4069	1

TABLE 6–15. SYSTEM CONTROLLER CIRCUIT BOARD ASSEMBLY – 919–0073
(Sheet 4 of 4)

REF. DES.	DESCRIPTION	PART NO.	QTY.
U15	Integrated Circuit, MC4011BCP, Quad 2–Input NAND Gate, CMOS, 14–Pin DIP	228–4011	1
U16	Integrated Circuit, ULN2003, 7 NPN Darlington Driver Pack, 16–Pin DIP	229–2003	1
U17 THRU U22	Integrated Circuit, 4N33, Optical Isolator, NPN Photo–Transistor/Infrared Diode, 6–Pin DIP	229–0033	6
U23	Integrated Circuit, TL311P, JFET–Input Differential Comparator, 8–Pin DIP	220–0311	1
U24	Integrated Circuit, LM3362Z–2.5, Precision Voltage Reference, 2.5V ±4%, –0 to +705C, TO–92 Case	229–0336	1
U25	Integrated Circuit, MC7824ACT, Fixed Positive Voltage Regulator, 24V @ 1.5A, TO–220 Case	227–7824A	1
U26 THRU U29	Integrated Circuit, 4N33, Optical Isolator, NPN Photo–Transistor/Infrared Diode, 6–Pin DIP	229–0033	4
U30	Integrated Circuit, MC14538B, Dual Retriggerable Resetting Monostable Multivibrator, CMOS, 16–Pin DIP	228–4538	1
XU1	Socket, 14–Pin DIP	417–1404	1
XU2	Socket, 16–Pin DIP	417–1604	1
XU3,XU4	Socket, 8–Pin DIP	417–0804	2
XU5	Socket, 16–Pin DIP	417–1604	1
XU6,XU7	Socket, 8–Pin DIP	417–0804	2
XU8 THRU XU15	Socket, 14–Pin DIP	417–1404	8
XU16	Socket, 16–Pin DIP	417–1604	1
XU23	Socket, 8–Pin DIP	417–0804	1
——	Nylon Washer (for Q2,Q3)	423–6015	2
——	Transistor Pad, TO–5	409–0005	1
——	Blank Circuit Board	519–0073	1

TABLE 6–16. AC POWER CONTROL PANEL – 959–0289/959–0288/959–0286/959–0290
(Sheet 1 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
CB1	Circuit Breaker, 2 Pole, 2 Amperes, 250V ac (CONTROL)	341–0009	1
MOV1	Metal–Oxide Varistor, V250LA40A, 250V, 30 Joules	140–0012	1
TB1	Terminal Strip, 15 Terminals	412–0015–001	1
——	AC Power Control Panel Circuit Board	919–0074	1
	ADDITIONAL PARTS FOR 959–0289 ASSEMBLY		
CB2,CB3	Circuit Breaker, 2 Pole, 10 Amperes, 250V ac (XMTR–1, XMTR–2)	341–0030	2
K1 THRU K3	Relay Coil: 24V dc @ 0.08 Ampere, Resistance = 290 Ohms Contacts: DPST, 750 Watts, 1 hP Maximum	270–0040	3
——	AC Power Control Harness Assembly	949–0075	1

TABLE 6–16. AC POWER CONTROL PANEL – 959–0289/959–0288/959–0286/959–0290 (Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
	ADDITIONAL PARTS FOR 959–0288 ASSEMBLY		
CB2	Circuit Breaker, 2 Pole, 7 Amperes, 250V ac	341–0030	1
K1,K2	Relay Coil: 24V dc @ 0.08 Ampere, Resistance = 290 Ohms Contacts: DPST, 750 Watts, 1 hP Maximum	270–0040	2
——	AC Power Control Harness Assembly	949–0074	1
	ADDITIONAL PARTS FOR 959–0290 ASSEMBLY		
CB2,CB3	Circuit Breaker, 2 Pole, 7 Amperes, 250V ac (XMTR–1,XMTR–2)	341–0025	2
K1 THRU K3	Relay Coil: 24V dc @ 0.08 Ampere, Resistance = 290 Ohms Contacts: DPST, 750 Watts, 1 hP Maximum	270–0040	3
——	AC Power Control Harness Assembly	949–0075	1
	ADDITIONAL PARTS FOR 959–0286 ASSEMBLY		
CB2	Circuit Breaker, 2 Pole, 7 Amperes, 250V ac	341–0025	1

TABLE 6–17. AC POWER CONTROL PANEL CIRCUIT BOARD ASSEMBLY – 919–0074

REF. DES.	DESCRIPTION	PART NO.	QTY.
D1 THRU D5	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203–4005	5
Q1	Transistor, 2N3904, Silicon, NPN, TO–92 Case	211–3904	1
Q2 THRU Q4	Transistor, 2N3054, Silicon, NPN, TO–80 Case	211–3054	3
R1,R2	Resistor, 100 Ohm ±5%, 1/2W	110–1033	2
R3	Resistor, 10 k Ohm ±5%, 1/2W	110–1053	1
R4	Resistor, 100 Ohm ±5%, 1/2W	110–1033	1
R5	Resistor, 1 k Ohm ±5%, 1/2W	110–1043	1
R6	Resistor, 100 Ohm ±5%, 1/2W	110–1033	1
R7	Resistor, 1 k Ohm ±5%, 1/2W	110–1043	1
XQ2 THRU XQ4	Socket, TO–66 Transistor	417–0012	3
——	Insulator, TO–66	407–0100	3
——	Blank Circuit Board	519–0074	1

TABLE 6–18. AC POWER CONTROL HARNESS ASSEMBLY – 949–0074, 949–0075

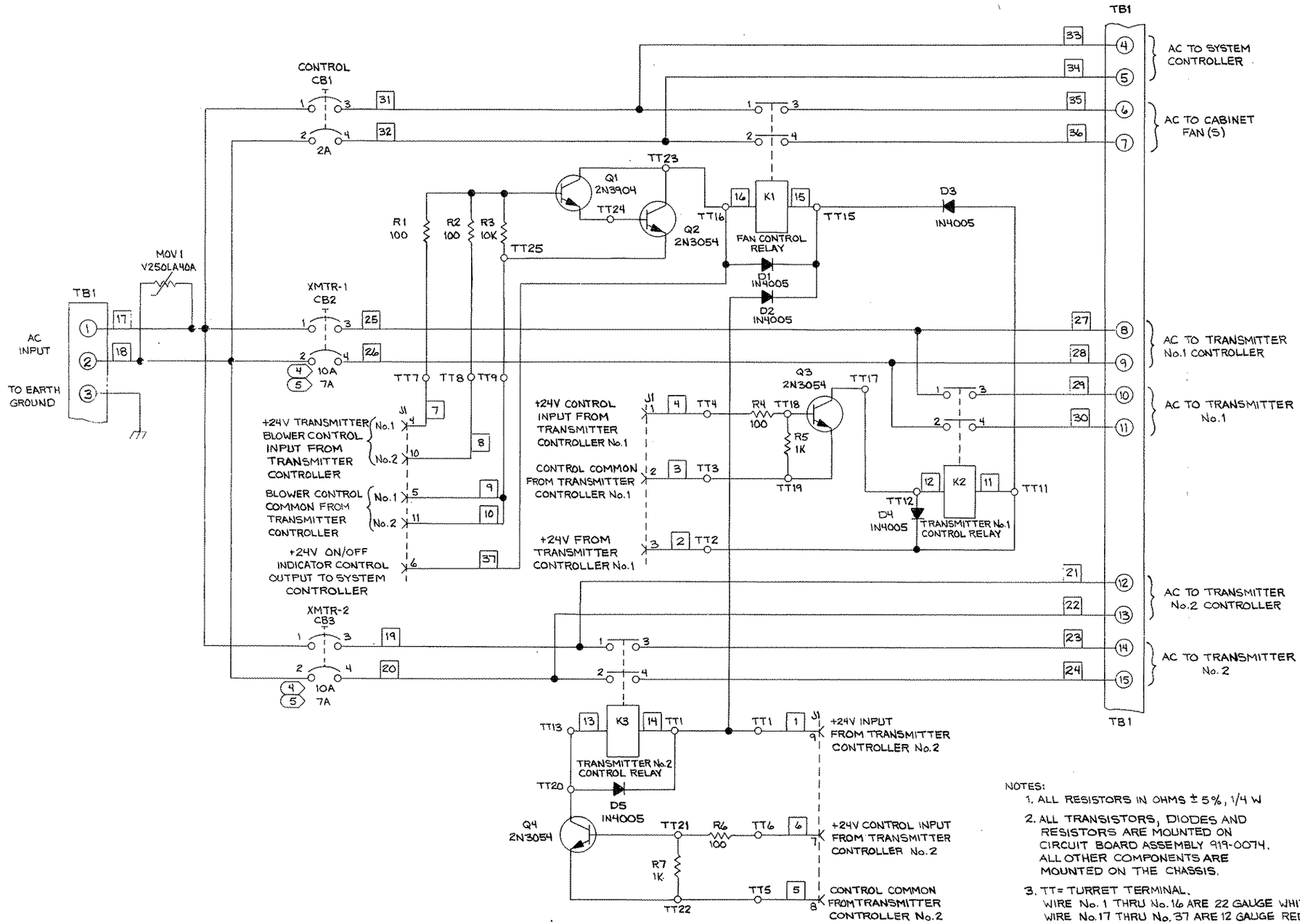
REF. DES.	DESCRIPTION	PART NO.	QTY.
——	Connector, 25–Pin	417–0015	1

SECTION VII
DRAWINGS

7–1. INTRODUCTION.

7–2. This section provides assembly drawings, wiring diagrams, and schematic diagrams as listed below for the Broadcast Electronics B–series very–low–power line of FM transmitters.

FIGURE	TITLE	NUMBER
7–1	SCHEMATIC, AC POWER CONTROL PANEL, MAIN/ ALTERNATE TRANSMITTERS	597–0092–19
7–2	SCHEMATIC, AC POWER CONTROL PANEL, SINGLE CONFIGURATION TRANSMITTERS	597–0092–20
7–3	ASSEMBLY, AC POWER CONTROL PANEL	597–0092–21
7–4	SCHEMATIC, TRANSMITTER CONTROLLER CHASSIS, FM–100B, FM–250B	SD959–0283/ –0284
7–5	SCHEMATIC, TRANSMITTER CONTROLLER CHASSIS, FM–300B	SD959–0281/ –0282
7–6	WIRING DIAGRAM, TRANSMITTER CONTROLLER CHASSIS	597–0092–25
7–7	SCHEMATIC, TRANSMITTER CONTROLLER CIRCUIT BOARD	SD919–0072/ –0072–001
7–8	ASSEMBLY, TRANSMITTER CONTROLLER CIRCUIT BOARD	AD919–0072/ –0072–001
7–9	SCHEMATIC, REMOTE RAISE/LOWER MOTOR CONTROL	SC919–0089
7–10	ASSEMBLY, REMOTE RAISE/LOWER MOTOR CONTROL	AB919–0089
7–11	SCHEMATIC, SYSTEM CONTROLLER CHASSIS	SD959–0280
7–12	WIRING DIAGRAM, SYSTEM CONTROLLER CHASSIS	AD959–0280
7–13	SCHEMATIC, SYSTEM CONTROLLER CIRCUIT BOARD	SD919–0073
7–14	ASSEMBLY, SYSTEM CONTROLLER CIRCUIT BOARD	AD919–0073
7–15	WIRING DIAGRAM, RF CABLES, FM–100B/FM–250B	WD909–0100–204/ –304, WD909–0250–204/ –304
7–16	WIRING DIAGRAM, SYSTEM INTERCONNECT, FM–100B/FM–250B	WD909–0100–204/ –304, WD909–0250–204/ –304
7–17	WIRING DIAGRAM, RF CABLES, FM–100BM/A & FM–250BM/A	WD909–2100–204/ –304, WD909–2250–204/ –304
7–18	WIRING DIAGRAM, SYSTEM INTERCONNECT, FM–100BM/A & FM–250BM/A	WD909–2100–204/ –304, WD909–2250–204/ –304
7–19	WIRING DIAGRAM, RF CABLES, FM–300B	WD909–0300–204/ –304



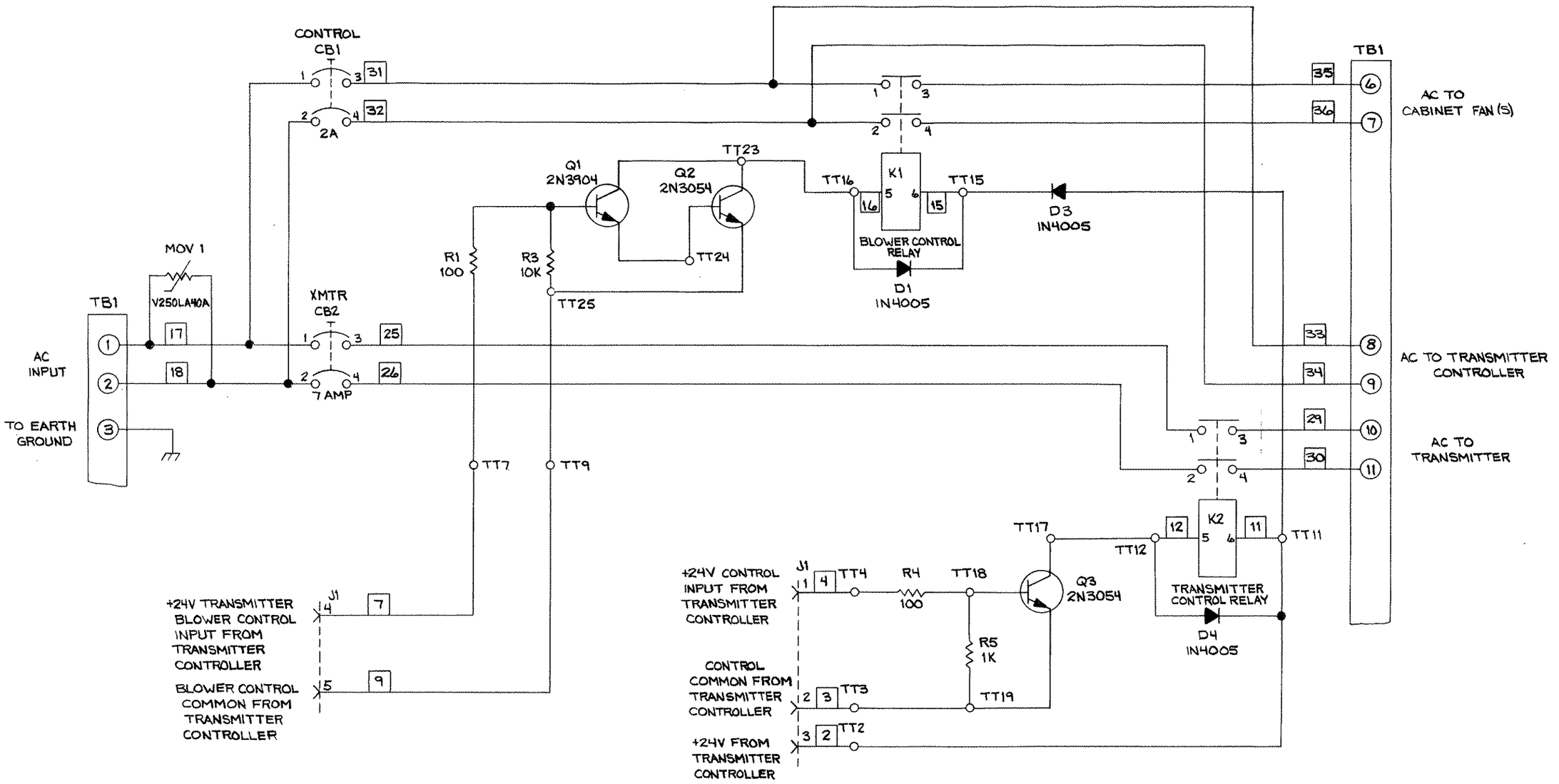
NOTES:

1. ALL RESISTORS IN OHMS ± 5%, 1/4 W
2. ALL TRANSISTORS, DIODES AND RESISTORS ARE MOUNTED ON CIRCUIT BOARD ASSEMBLY 919-0074. ALL OTHER COMPONENTS ARE MOUNTED ON THE CHASSIS.
3. TT= TURRET TERMINAL. WIRE No. 1 THRU No. 16 ARE 22 GAUGE WHITE. WIRE No. 17 THRU No. 37 ARE 12 GAUGE RED. [XX] INDICATES WIRE NUMBER
4. FM-250 M/A AND FM-300 M/A
5. FM-100 M/A

597-0092-19

FIGURE 7-1.
SCHEMATIC, AC POWER CONTROL PANEL, MAIN/ALTERNATE TRANSMITTERS

BROADCAST ELECTRONICS INC

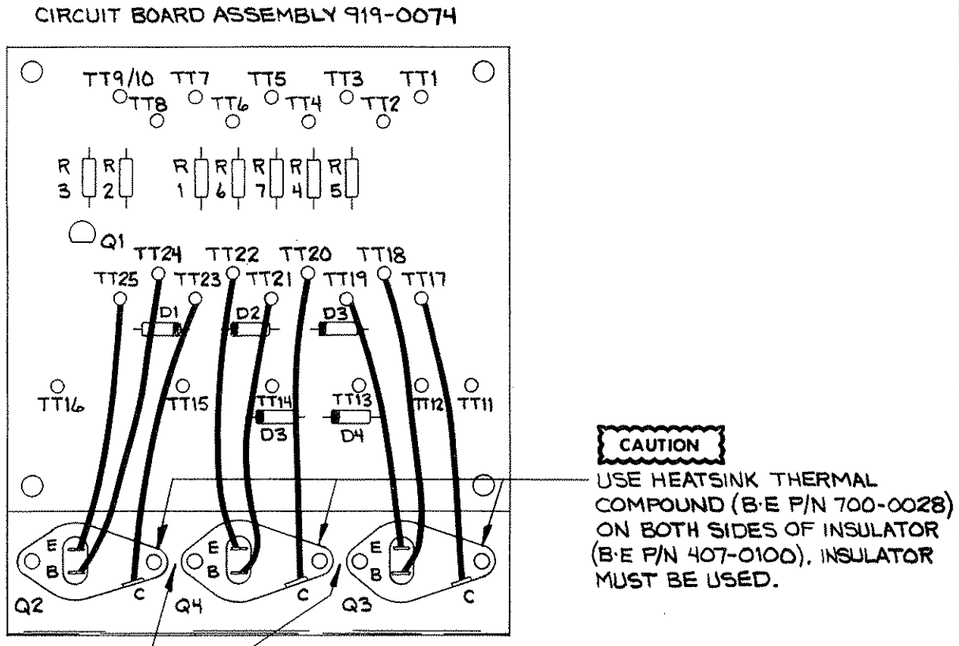


NOTES:

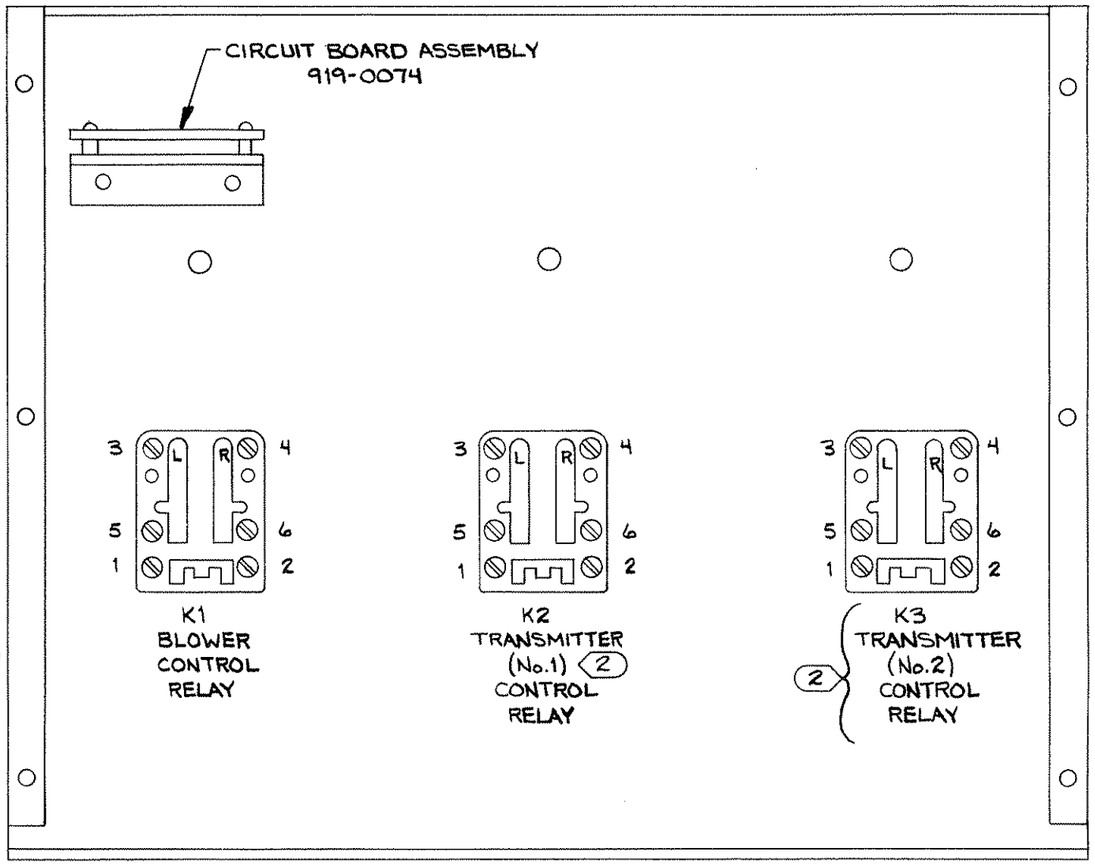
1. ALL RESISTORS IN OHMS ± 5%, 1/4 WATT
2. ALL TRANSISTORS, DIODES AND RESISTORS ARE MOUNTED ON CIRCUIT BOARD ASSEMBLY 919-0074, ALL OTHER COMPONENTS ARE MOUNTED ON THE CHASSIS. COMPONENTS MOUNTED ON ASSEMBLY 919-0074 AND NOT ILLUSTRATED ON THIS SCHEMATIC ARE NOT USED.
3. TT = TURRET TERMINAL
   WIRES No. 1 THRU No. 16 ARE 22 GAUGE WHITE,
   WIRES No. 17 THRU No. 37 ARE 12 GAUGE RED.
   [XX] INDICATES WIRE NUMBER
4. SEE ASSY DRAWING 597-0092-21

597-0092-20

FIGURE 7-2.
SCHEMATIC, AC POWER CONTROL PANEL, SINGLE CONFIGURATION TRANSMITTERS



WIRE FROM	WIRE TO
Q2-E	TT-25
Q2-B	TT-24
Q2-C	TT-23
Q4-E	TT-22
Q4-B	TT-21
Q4-C	TT-20
Q3-E	TT-19
Q3-B	TT-18
Q3-C	TT-17

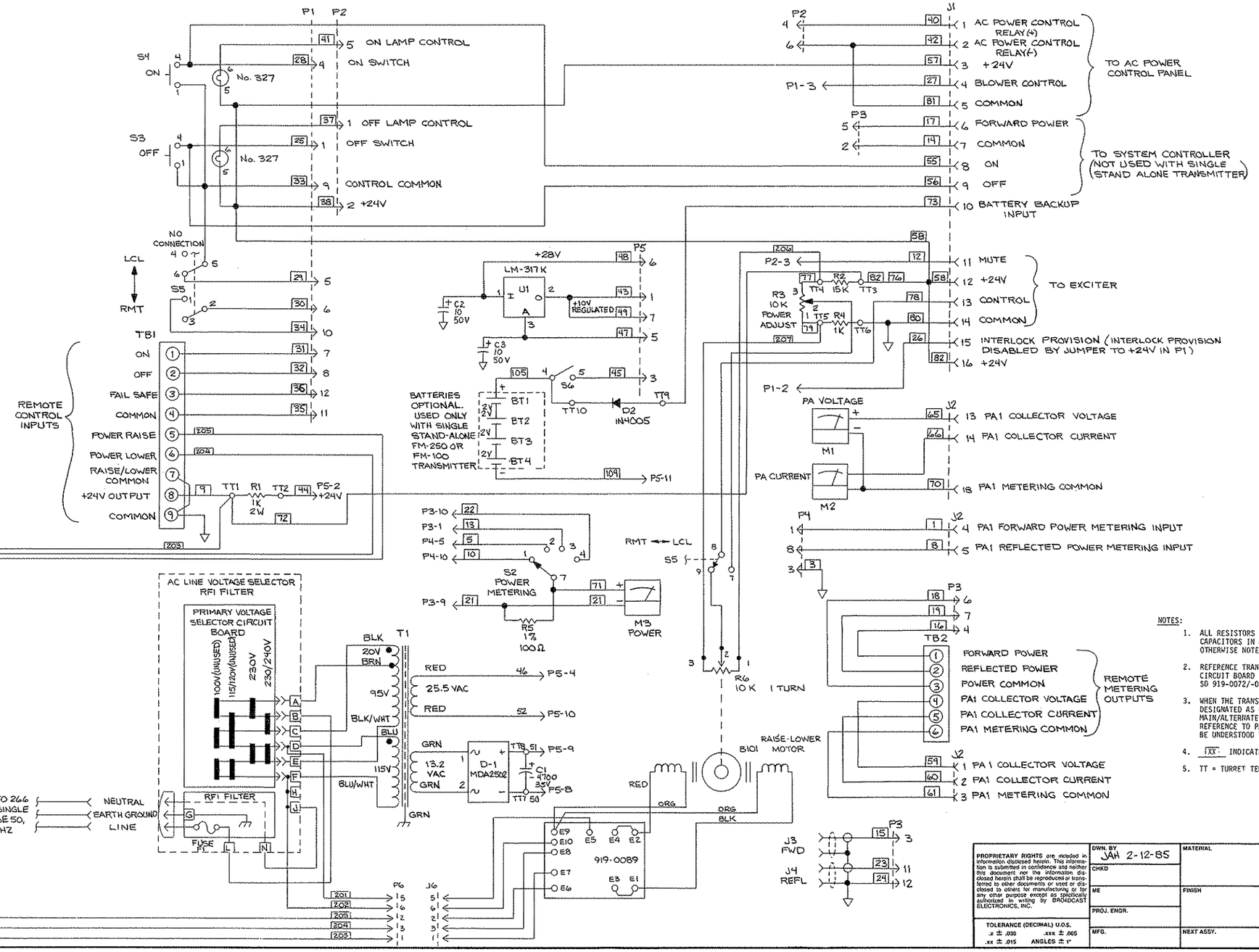


CHASSIS ASSEMBLY

NOTES:
1. SEE SCHEMATIC DRAWINGS 597-0092-19 & 597-0092-20
2. MAIN/ALTERNATE TRANSMITTERS ONLY

597-0092-21

FIGURE 7-3. POWER PANEL ASSEMBLY



NOTES:

1. ALL RESISTORS IN OHMS, 1/4 WATT; ALL CAPACITORS IN MICROFARADS, UNLESS OTHERWISE NOTED.
2. REFERENCE TRANSMITTER CONTROLLER CIRCUIT BOARD SCHEMATIC DIAGRAM NO. SD 919-0072/-001.
3. WHEN THE TRANSMITTER CONTROLLER IS DESIGNATED AS CONTROLLER NO. 2 IN A MAIN/ALTERNATE CONFIGURATION, ALL REFERENCE TO PA1-A AND PA1-B SHALL BE UNDERSTOOD TO BE PA2-A AND PA2-B.
4. [XX] INDICATES WIRE NUMBER.
5. TT = TURRET TERMINAL.

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

DWN. BY JAH 2-12-85
CHKD
ENG
PROJ. ENGR.
MFG.
MATERIAL
FINISH
NEXT ASSY.

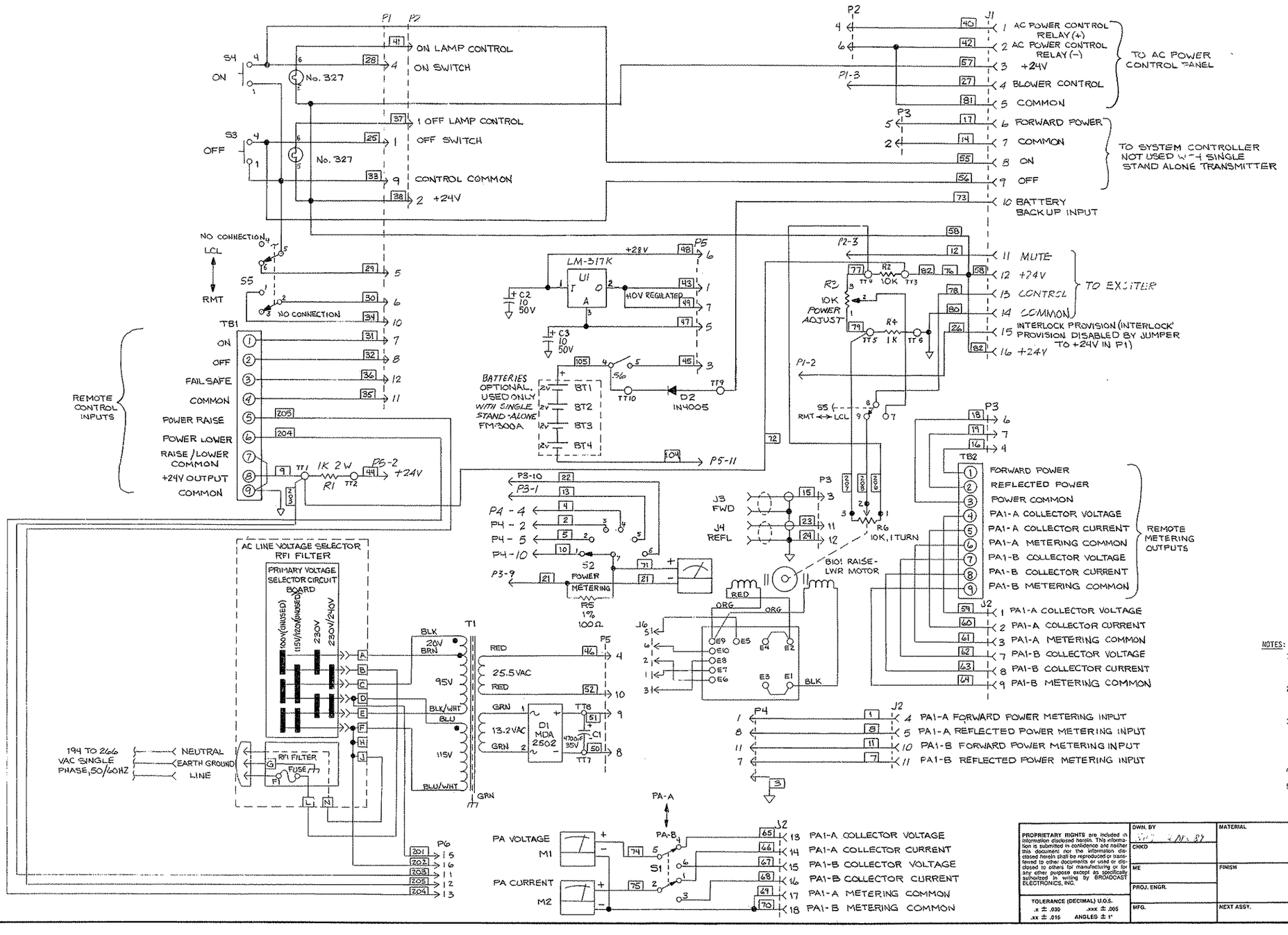
BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O.BOX 3606 QUINCY, IL 62305 217/224-9600
TELEX 250142 CABLE BROADCAST

TITLE SCHEMATIC TRANSMITTER CONTROLLER CHASSIS

TYPE S SIZE D DWG. NO. 959-0201/-0202 959-1283/-0284 REV F

MODEL FM 250MA, 250 SCALE — SHEET 1 OF 1

FM100B/250B:M/A



NOTES:

1. ALL RESISTORS IN OHMS, 1/4 WATT; ALL CAPACITORS IN MICROFARADS, UNLESS OTHERWISE NOTED.
2. REFERENCE TRANSMITTER CONTROLLER CIRCUIT BOARD SCHEMATIC DIAGRAM NO. SD 919-0072/-001.
3. WHEN THE TRANSMITTER CONTROLLER IS DESIGNATED AS CONTROLLER NO. 2 IN A MAIN/ALTERNATE CONFIGURATION, ALL REFERENCE TO PA1 SHALL BE UNDERSTOOD TO BE PA2.
4. [XX] L INDICATES WIRE NUMBER.
5. TT = TURRET TERMINAL.

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

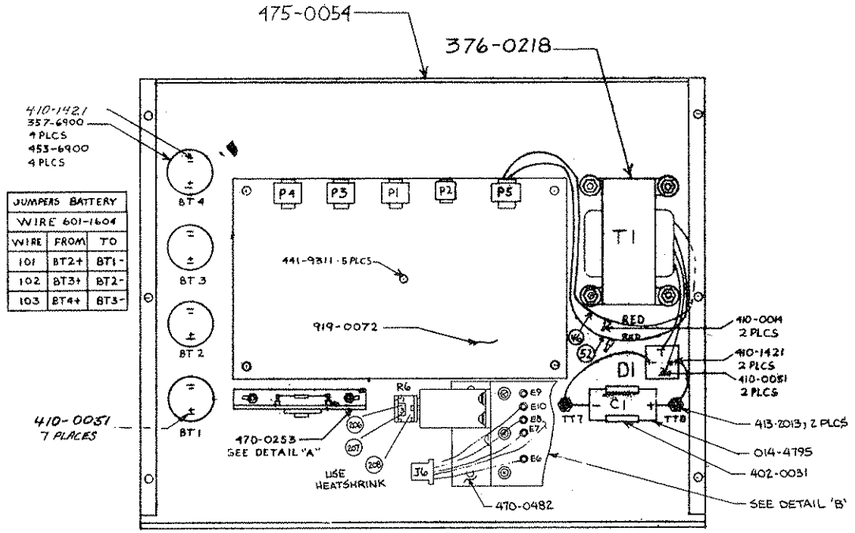
DWN. BY
CHKD
ME
PROJ. ENGR.
MFG.
MATERIAL
FINISH
NEXT ASSY.

BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O. BOX 3806 QUINCY, IL 62305 217/224-9600
TELEX 250142 CABLE BROADCAST

TITLE SCHEMATIC TRANSMITTER CONTROLLER CHASIS

TYPE S SIZE D DWG. NO. 959-0172/-0197 959-0251/-0282 REV G

MODEL FM300MA FM 300A FM300G E M/A SCALE SHEET 1 OF 1



JUMPERS BATTERY		
WIRE 601-1604		
WIRE	FROM	TO
101	BT2+	BT1-
102	BT3+	BT2-
103	BT4+	BT3-

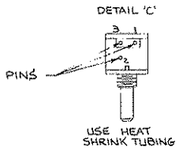
NOTE: INSTALL JUMPERS FIRST ALL WIRE 601-2209 EXCEPT WHERE NOTED # USE 601-1800

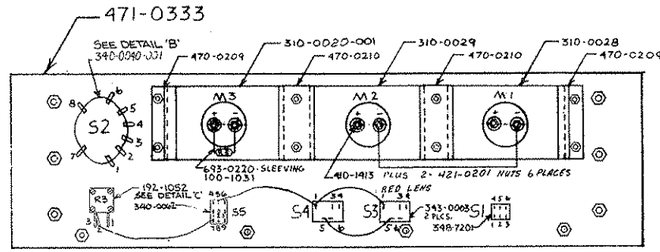
CHASSIS WIRING		WIRING P3		WIRING P1		WIRING P2		WIRING P5		WIRING P6	
WIRE 601-1800		WIRE 601-2209		WIRE 601-2209		WIRE 601-2209		WIRE 601-2209		WIRE 601-2209	
TERMINAL	WIRE #	TERMINAL	WIRE #	TERMINAL	WIRE #	TERMINAL	WIRE #	TERMINAL	WIRE #	TERMINAL	WIRE #
TT7	# 50	P3-1	13	P1-1	25	P2-1	37	P5-1	#43	P6-1	203
TT8	#51	P3-2	14	P1-2	26	P2-2	38	P5-2	44	P6-2	206
D1-1	T1 GREEN	P3-3	15	P1-3	27	P2-4	40	P5-3	#45	P6-3	204
D1-2	T1 GREEN	P3-4	16	P1-4	28	P2-5	41	P5-4	46	P6-4	NOT USED
WIRING P4		P3-5	17	P1-5	29	P2-6	42	P5-5	47	P6-5	* 201
WIRE 601-2209		P3-6	18	P1-6	30	P2-3	12	P5-6	# 48	P6-6	* 202
P4-1	1	P3-7	19	P1-7	31			P5-7	#49	WIRING R6	
P4-2	2	P3-9	21	P1-8	32			P5-8	# 50	TERMINAL	WIRE #
P4-3	3	P3-10	22	P1-9	33			P5-9	#51	R6-1	206
P4-5	5	P3-11	23	P1-10	34	BT4-	104	P5-10	52	R6-2	208
P4-7	7	P3-12	24	P1-11	35	BT1+	105	P5-11	104 *	R6-3	207
P4-8	8			P1-12	36			JUMPERS			
P4-10	10							WIRE 601-1800			
P4-11	11							TT7 TO D1-			
								TT8 TO D1+			
P4-4	4	NOTE: SPLICE T1 RED TO 46. SPLICE T1 RED TO 52									

FM-300MA HARDWARE

Transmitter Controller

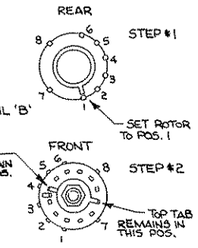
Item Assembled	Hardware Qty.	Hardware Part Number
Top Cover	9	420-6106
471-0339	9	423-6002
Front to Chassis	10	421-6001
471-0333	10	423-6002
Support	2	420-6106
470-0253	½	421-6001
	2	423-6002
Rear Panel	1	420-6110
471-0334	7	420-6106
	9	421-6001
	9	423-6002
Meter Brackets	8	421-6001
470-0209	8	423-6002
470-0210		
Terminal Strip	8	420-6110
412-0010	8	423-6001
	8	423-6002
	8	421-6001
Clamp Cap	2	420-4105
402-0031	2	423-4002
	2	423-4001
	2	421-4001
Terminal	10	420-4104
413-2013	10	423-4002
Rectifier	1	420-8004
239-0006	1	423-8001
	1	423-8002
	1	421-8001
Transformer	4	420-0108
376-0218	4	423-0001
	4	423-0002
	4	421-0201
Fuse Clip	2	420-4105
415-1001	2	421-4001
	2	423-4002
Socket	2	420-6038
417-0298	2	423-6002
Standoffs	5	420-6104
441-9311	5	423-6002
Battery Clamp	8	420-6106
	12	423-6002
	12	421-6001
	12	423-6001
	4	420-6108
CABLE J2 & J1	2	420-0817
METERS	12	421-0201
MOTOR BRACKET 470-0482	2	420-8106
	2	423-8002
	2	423-8001

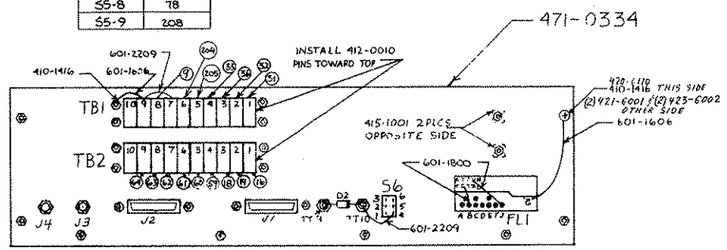




NOTE: ADD R5 M3+ TO M3- ADD JUMPERS 601-2209, 5PLCS. S5-5 TO S4-1, S4-1 TO S3-1, S4-5 TO S3-5, M2- TO M1-, S5-7 TO R3-2

WIRING OF FRONT PANEL 471-0333 ALL WIRE 601-2209							
TERMINAL	WIRE #	TERMINAL	WIRE #	TERMINAL	WIRE #	TERMINAL	WIRE #
S2-1	10	M3+	71	S4-4	28 & 55	S1-1	66
S2-2	5	M3-	21	S4-5	58 & 76	S1-2	75
S2-3	2	M2+	75	S4-6	91	S1-3	68
S2-4	4	M2-	70	S3-1	33	S1-4	65
S2-5	13	M1+	74	S3-4	25 & 56	S1-5	74
S2-6	22	M1-	69	S3-5	38 & 57	S1-6	67
S2-7	71	S5-1	34	S3-6	37		
R3-1	79	S5-2	30				
		S5-6	29				
R3-3	77	S5-7	JUMPER R3-2				
		S5-8	78				
		S5-9	208				

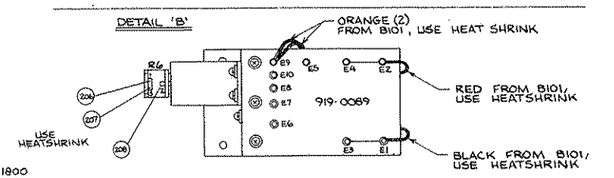


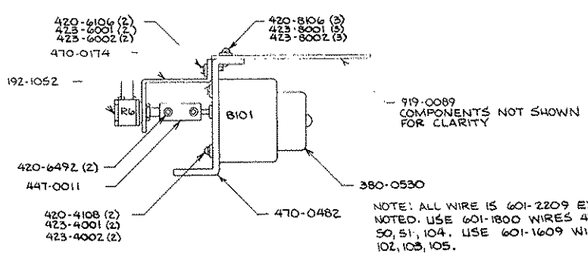


NOTE: INSTALL D2, TT9 TO TT10 INSTALL JUMPERS, 2 - 601-1606, 1 - 601-2209, 2 - 601-1800
ALL WIRE 601-2209 EXCEPT WHERE NOTED # USE 601-1800

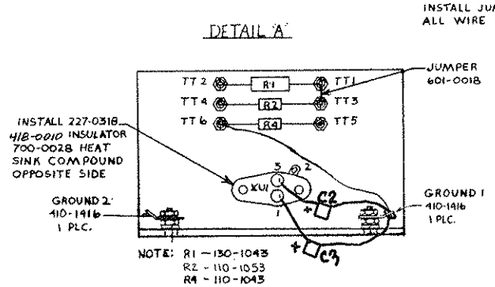
WIRING REAR PANEL 471-0334							
TERMINAL	WIRE	TERMINAL	WIRE	TERMINAL	WIRE	TERMINAL	WIRE
TB1-1	31	J2-2	60	J1-1	40	J1-6	82
TB1-2	32	J2-3	61	J1-2	42	S6-5	454
TB1-3	36	J2-4	1	J1-3	57	J3	15
TB1-4	35	J2-5	8	J1-4	27	J4	23
TB1-8	9	J2-7	62	J1-5	81	TT9	73
TB2-1	16	J2-8	63	J1-6	17	FL1-A	BRN OF T1
TB2-2	19	J2-9	64	J1-7	14	FL1-C	BLK OF T1
TB2-3	18	J2-10	11	J1-8	55	FL1-D	BLU OF T1 201 &
TB2-4	59	J2-11	7	J1-9	56	FL1-E	BLK/WHT OF T1
TB2-5	60	J2-13	65	J1-10	73	FL1-F	BLU/WHT OF T1 202 &
TB2-6	61	J2-14	66	J1-11	12	FL1-G	CHASSIS
TB2-7	62	J2-15	67	J1-12	58	TT10	105
TB2-8	63	J2-16	68	J1-13	78	TB1-5	205
TB2-9	64	J2-17	69	J1-14	80	TB1-6	204
J2-1	59	J2-18	70	J1-15	26		

APPLY SHRINK TUBING





NOTE: ALL WIRE IS 601-2209 EXCEPT AS NOTED. USE 601-1800 WIRES 43, 45, 48, 49, 50, 51, 104. USE 601-1609 WIRES 101, 102, 103, 105.

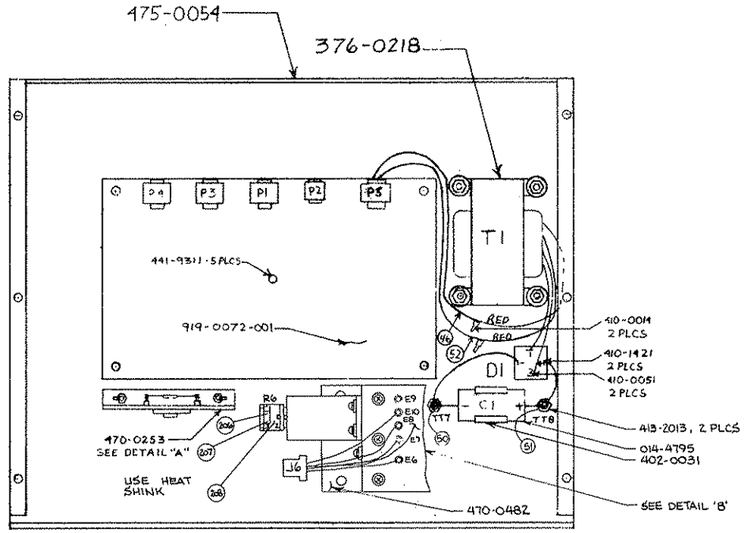


NOTE: INSTALL JUMPER 601-2209 TT6 TO GROUND 1
INSTALL JUMPER 601-0018 TT1 TO TT3
ALL WIRE 601-2209 EXCEPT WHERE NOTED # USE 601-1800

WIRING OF 470-0253	
TERMINAL	WIRE #
TT1	9, 203
TT2	44
TT3	76 & 82
TT4	77, 206
TT5	79, 207
TT6	80
XU1-1	#48
XU1-2	#43 & #49
XU1-3	47
GROUND 1	3 & JUMPER
GROUND 2	24 & 81

597-0092-25

FIGURE 7-6. WIRING DIAGRAM, TRANSMITTER CONTROLLER, SINGLE CONFIGURATION (Sheet 1 of 2)



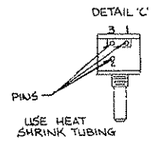
NOTE: INSTALL JUMPERS FIRST ALL WIRE 601-2209 EXCEPT WHERE NOTED * USE 601-1800

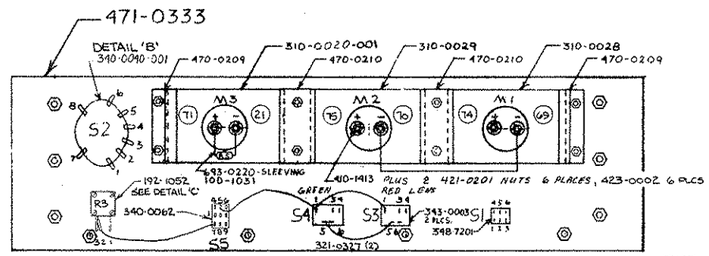
CHASSIS WIRING		WIRING P3		WIRING P1		WIRING P2		WIRING P5		WIRING P6	
WIRE 601-1800		WIRE 601-2209		WIRE 601-2209		WIRE 601-2209		WIRE 601-2209		WIRE 601-2209	
TERMINAL	WIRE #	TERMINAL	WIRE #	TERMINAL	WIRE #	TERMINAL	WIRE #	TERMINAL	WIRE #	TERMINAL	WIRE #
TT7	*50	P3-1	13	P1-1	25	P2-1	37	P5-1	*43	P6-1	203
TT8	*51	P3-2	14	P1-2	26	P2-2	38	P5-2	44	P6-2	205
D1-1	T1 GREEN	P3-3	15	P1-3	27	P2-4	40	P5-3	*45	P6-3	204
D1-2	T1 GREEN	P3-4	16	P1-4	28	P2-5	41	P5-4	46	P6-4	NOT USED
WIRING P4		P3-5	17	P1-5	29	P2-6	42	P5-5	47	P6-5	* 201
WIRE 601-2209		P3-6	18	P1-6	30	P2-3	12	P5-6	*48	P6-6	* 202
P4-1	1	P3-7	19	P1-7	31	WIRING R6		P5-7	*49		
P4-2	2	P3-9	21	P1-8	32	TERMINAL	WIRE #	P5-8	*50		
P4-3	3	P3-10	22	P1-9	33	R6-1	206	P5-9	*51		
P4-5	5	P3-11	23	P1-10	34	R6-2	208	P5-10	52		
P4-7	7	P3-12	24	P1-11	35	R6-3	207	P5-11	104		
P4-8	8			P1-12	36			JUMPERS			
P4-10	10							WIRE 601-1800			
P4-11	11							TT7 TO D1-			
								TT8 TO D1+			
P4-4	4	NOTE: SPLICE T1 RED TO 46 SPLICE T1 RED TO 52									

FM-300MA HARDWARE

Transmitter Controller

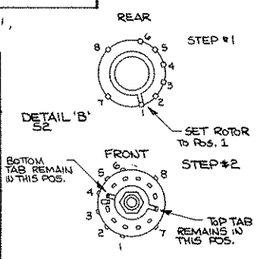
Item Assembled	Hardware Qty.	Hardware Part Number
Top Cover 471-0339	9	420-6106
	9	423-6002
Front to Chassis 471-0333	10	421-6001
	10	423-6002
Support 470-0253	2	420-6108
	4	421-6001
	2	423-6002
Rear Panel 471-0334	1	420-6110
	7	420-6106
	9	421-6001
	9	423-6002
Meter Brackets 470-0209 470-0210	8	421-6001
	8	423-6002
Terminal Strip 412-0010	8	420-6110
	6	423-6001
	8	423-6002
	8	421-6001
Clamp Cap 402-0031	2	420-4105
	2	423-4002
	2	423-4001
	2	421-4001
Terminal 413-2013	10	420-4104
	10	423-4002
Rectifier 239-0006	1	420-8004
	1	423-8001
	1	423-8002
	1	421-8001
Transformer 376-0218	4	420-0108
	4	423-0001
	4	423-0002
	4	421-0201
Fuse Clip 415-1001	2	420-4105
	2	421-4001
	2	423-4002
Socket 417-0298	2	423-6002
	2	420-6108
J1 + J2	4	420-4306, (4) 423-4002, (4) 417-0000, (4) 421-4001
Standoffs 441-9311	5	420-6104
	5	423-6002
METERS	12	421-0201
MOTOR BRACKET 470-0482	2	420-8106
	2	423-8002
	2	423-8001

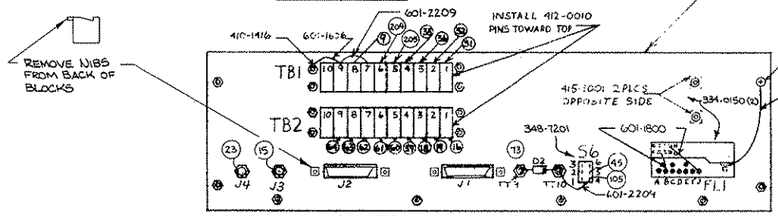




NOTE: ADD R5 M3+ TO M3- ADD JUMPERS 601-2209, 5PLCS. S5-5 TO S4-1, S4-1 TO S3-1, S4-5 TO S3-5, M2- TO M1-, S5-7 TO R3-2

WIRING OF FRONT PANEL 471-0333 ALL WIRE 601-2209							
TERMINAL	WIRE #	TERMINAL	WIRE #	TERMINAL	WIRE #	TERMINAL	WIRE #
S2-1	10	M3+	71	S4-4	28 & 55	S1-1	66
S2-2	5	M3-	21	S4-5	58 & 76	S1-2	75
S2-3	2	M2+	75	S4-6	41	S1-3	68
S2-4	4	M2-	70	S3-1	33	S1-4	65
S2-5	13	M1+	74	S3-4	25 & 56	S1-5	74
S2-6	22	M1-	69	S3-5	38 & 57	S1-6	67
S2-7	71	S5-1	34	S3-6	37		
R3-1	T9	S5-2	30				
		S5-6	29				
R3-2	T7	S5-7	JUMPER R3-2				
		S5-8	78				
		S5-9	208				



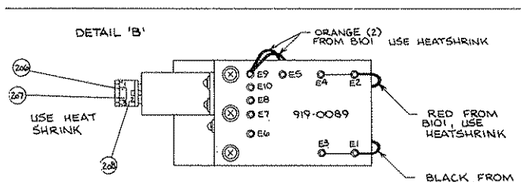


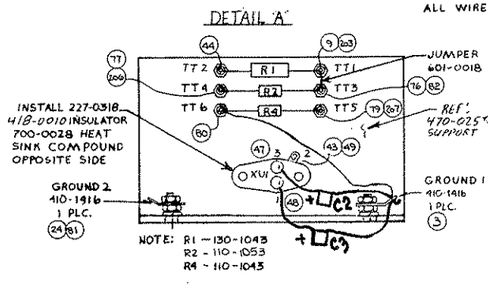
NOTE: INSTALL D2, TT9 TO TT10 INSTALL JUMPERS 2 - 601-1606, 1 - 601-2209, 2-601-1800 ALL WIRE 601-2209 EXCEPT WHERE NOTED * USE 601-1800

WIRING REAR PANEL 471-0334								
TERMINAL	WIRE	TERMINAL	WIRE	TERMINAL	WIRE	TERMINAL	WIRE	
TB1-1	31	J2-2	60	J1-1	40	J1-16	82	
TB1-2	32	J2-3	61	J1-2	42	S6-5	45*	
TB1-3	36	J2-4	1	J1-3	57	J3	15	
TB1-4	35	J2-5	8	J1-4	27	J4	23	
TB1-8	9	J2-7	62	J1-5	81	TT9	73	
TB2-1	16	J2-8	63	J1-6	17	FL1-A	BRN OF T1	APPLY SHRINK TUBING
TB2-2	19	J2-9	64	J1-7	14	FL1-C	BLK OF T1	
TB2-3	18	J2-10	11	J1-8	55	FL1-D	BLU OF T1 * 201	
TB2-4	59	J2-11	7	J1-9	56	FL1-E	BLK/WHT OF T1	
TB2-5	60	J2-13	65	J1-10	73	FL1-F	BLU/WHT OF T1 * 202	
TB2-6	61	J2-14	66	J1-11	12	FL1-G	CHASSIS	
TB2-7	62	J2-15	67	J1-12	58	TB1-5	205	
TB2-8	63	J2-16	68	J1-13	78	TB1-6	204	
TB2-9	64	J2-17	69	J1-14	80	S6-4	105	
J2-1	59	J2-18	70	J1-15	26			

APPLY HEAT SHRINK TO OTHER END OF 105 + COIL UP.

APPLY HEAT SHK. TO OTHER END OF 104 + COIL UP

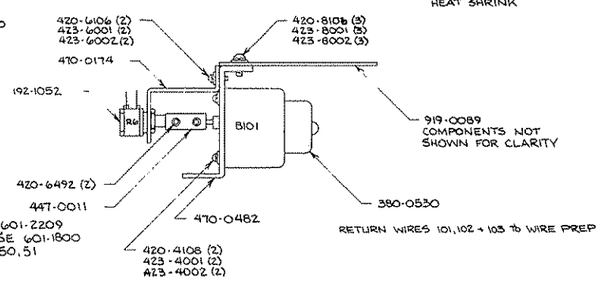




NOTE: R1 - 130-1043
R2 - 110-1053
R4 - 110-1043

NOTE: INSTALL JUMPER 601-2209 TT6 TO GROUND 1
INSTALL JUMPER 601-0018 TT1 TO TT3
ALL WIRE 601-2209 EXCEPT WHERE NOTED * USE 601-1800

WIRING OF 470-0253	
TERMINAL	WIRE #
TT1	9,203
TT2	44
TT3	76 & 82
TT4	77,206
TT5	79,207
TT6	80
XU1-1	*48
XU1-2	*43 & *49
XU1-3	47
GROUND 1	3 & JUMPER
GROUND 2	24 & 81

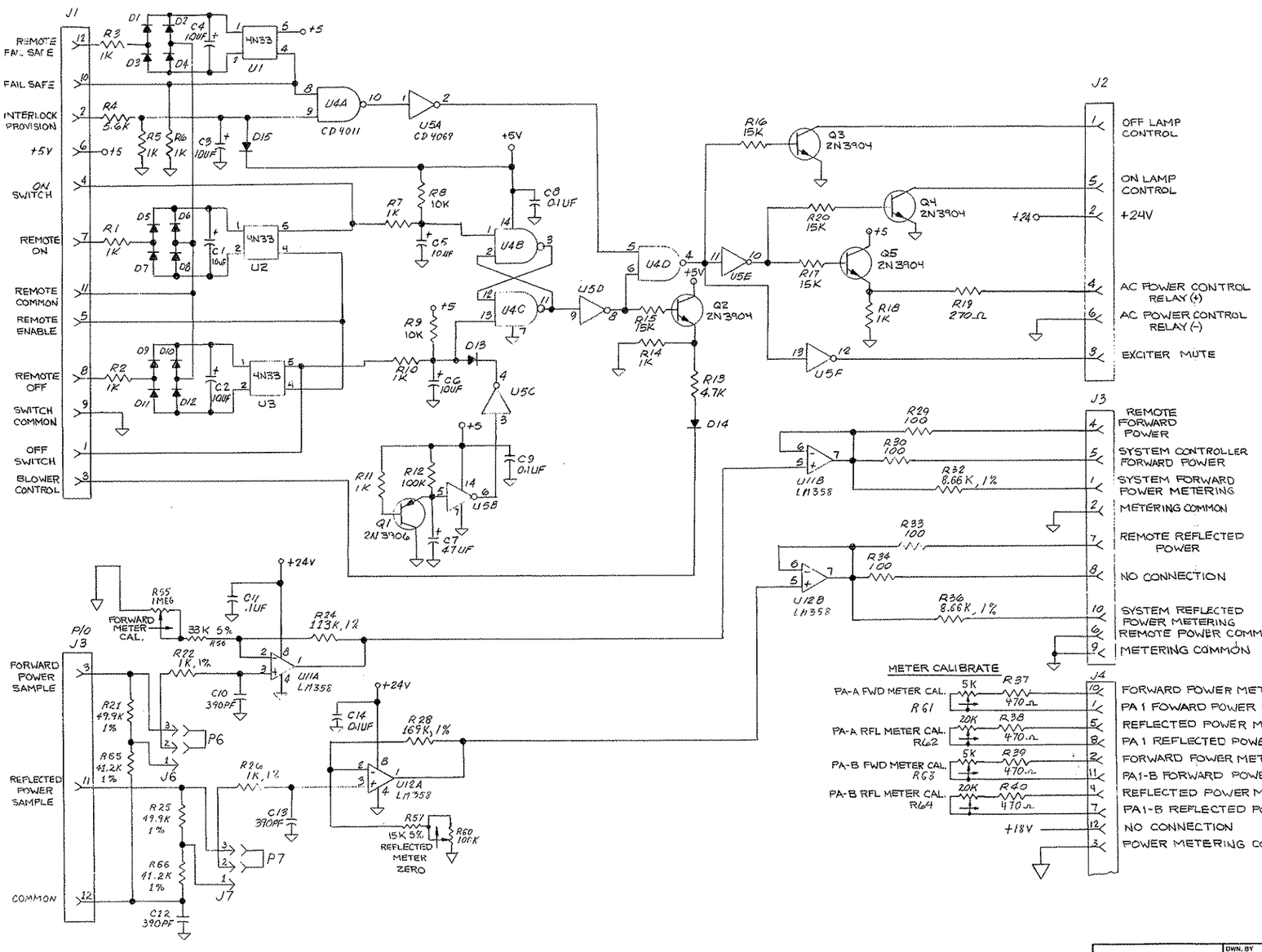


NOTE: ALL WIRE IS 601-2209 EXCEPT AS NOTED. USE 601-1800 WIRES 43, 45, 48, 49, 50, 51

597-0092-25

FIGURE 7-6. WIRING DIAGRAM, TRANSMITTER CONTROLLER, SINGLE CONFIGURATION (Sheet 2 of 2)

BROADCAST ELECTRONICS INC



NOTES:

1. ALL RESISTORS IN OHMS, 1/4 WATT; ALL CAPACITORS ARE IN MICROFARADS, 0.01 UF; ALL DIODES ARE 1N4148, UNLESS OTHERWISE NOTED.
2. REFERENCE TRANSMITTER CONTROLLER CHASSIS SCHEMATIC DIAGRAM NO. SD 959-0172/SD 959-0197 AND SD 959-0201/959-0202.
3. WHEN A TRANSMITTER CONTROLLER IS DESIGNATED AS CONTROLLER NO. 2 IN A MAIN/ALTERNATE CONFIGURATION, ALL REFERENCE TO PA1-A AND PA1-B SHALL BE UNDERSTOOD TO BE PA2-A AND PA2-B.
4. [XX] INDICATES WIRE NUMBER.
5. TT = TURRET TERMINAL.
6. DIODE D29 IS INSTALLED WHEN BATTERIES ARE NOT USED IN THE TRANSMITTER CONTROLLER (P/N 919-0072-001). REMOVE DIODE D29 IN TRANSMITTER CONTROLLER P/N 919-0072.

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

DWN. BY RHR 12 MAY 84
CHKD
ME
PROJ. ENGR. JS
MFG.
MATERIAL
FINISH
NEXT ASSY.

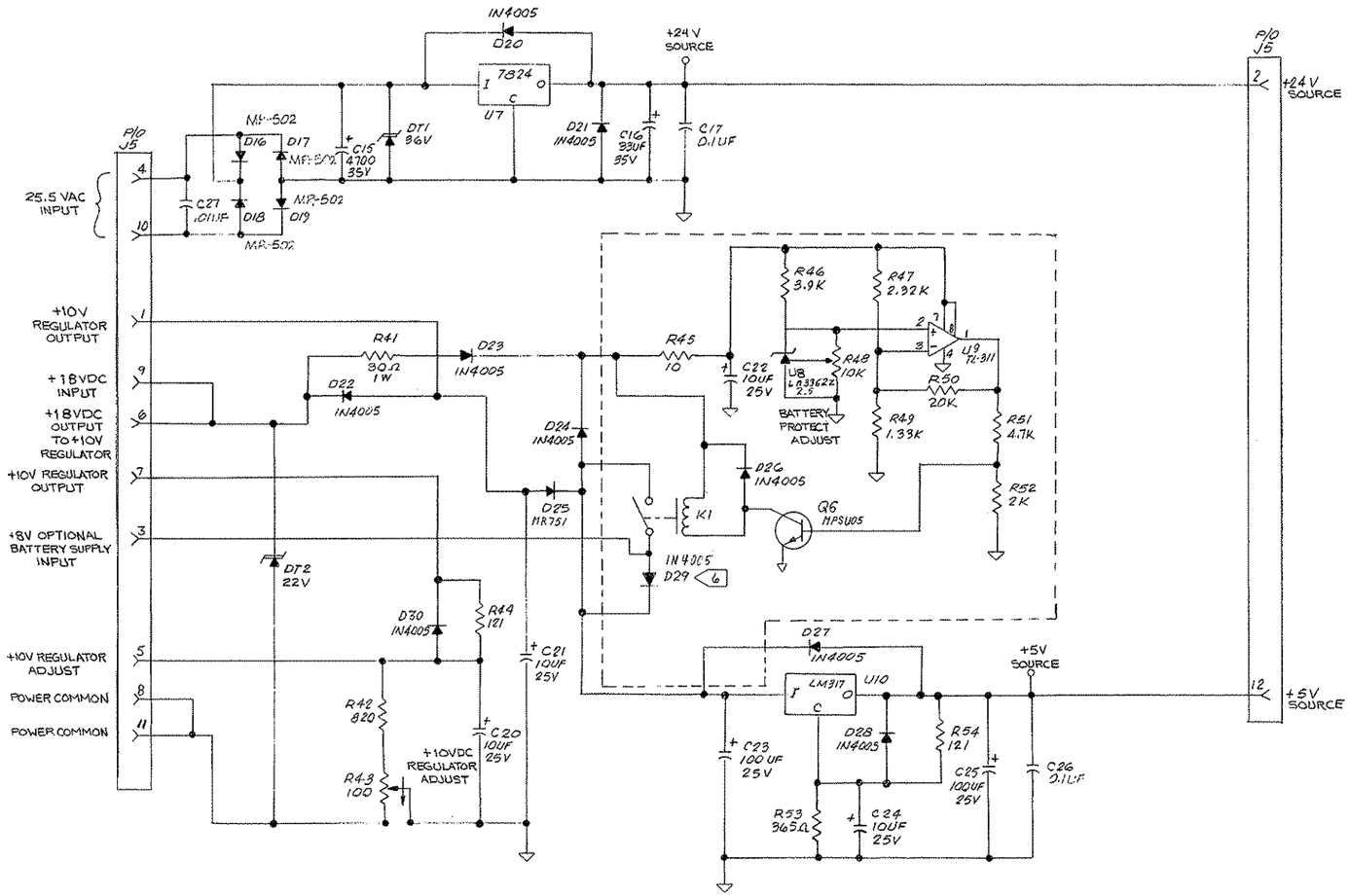
BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O.BOX 3606 QUINCY, IL 62305 217/224-9600
TELEX 250142 CABLE BROADCAST

TITLE SCHEMATIC TRANSMITTER CONTROLLER P.C.

TYPE S | SIZE D | DWG. NO. 919-0072 / 919-0072-001 | REV L

MODEL FM-300 / FM-350 | SCALE — | SHEET 1 OF 2

FM 300 W/TIMER



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

DWN. BY DHR 12 APR 84
CHKD
ME
PROJ. ENGR.
MFG.

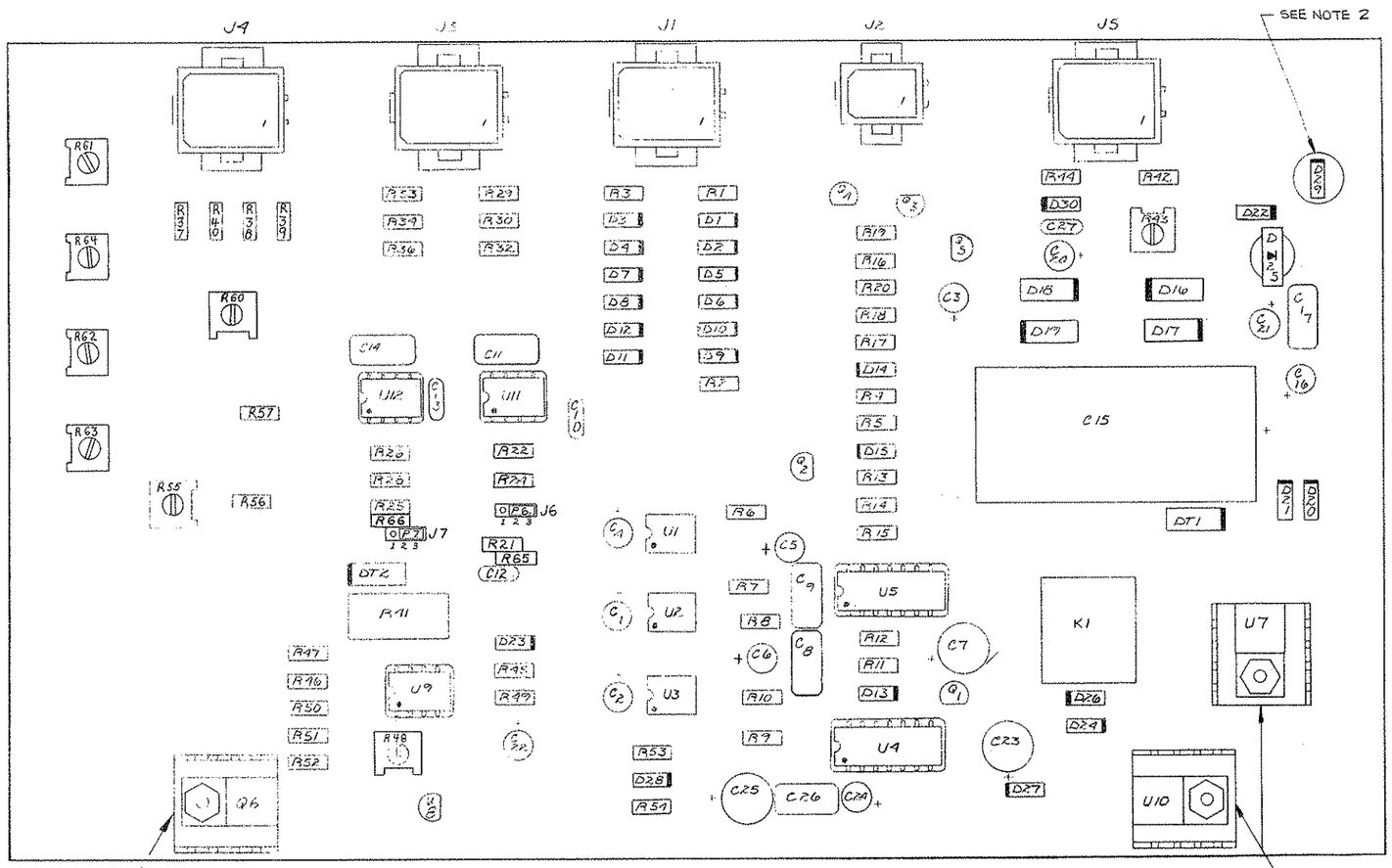
MATERIAL
FINISH
NEXT ASSY.

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

TITLE
SCHEMATIC TRANSMITTER CONTROLLER PCB.

TYPE S | SIZE D | DWG. NO. 917-0072 917-0072-001 | REV L

MODEL FM25A, FM25B/TR, FM35A, FM35B/TR SCALE · SHEET 2 OF 2



USE HEAT SINK COMPOUND
420-4106
421-4001
423-4002
423-0001 SPACER UNDER TAB OF Q6

USE HEAT SINK COMPOUND
420-4106
421-4001
423-4002

NOTES:

1. REFERENCE TRANSMITTER CONTROLLER CIRCUIT BOARD SCHEMATIC DIAGRAM No. SD 919-0072/-001.
2. DIODE D29 IS INSTALLED WHEN BATTERIES ARE NOT USED IN THE TRANSMITTER CONTROLLER (P/N 919-0072-001). REMOVE DIODE D29 IN TRANSMITTER CONTROLLER P/N 919-0072.

DWN BY: RHS 12 MAR 84
CHKD:
ME:
PROJ ENGR: JS
QPC:
MATERIAL:
FINISH:
NEXT ASSY:

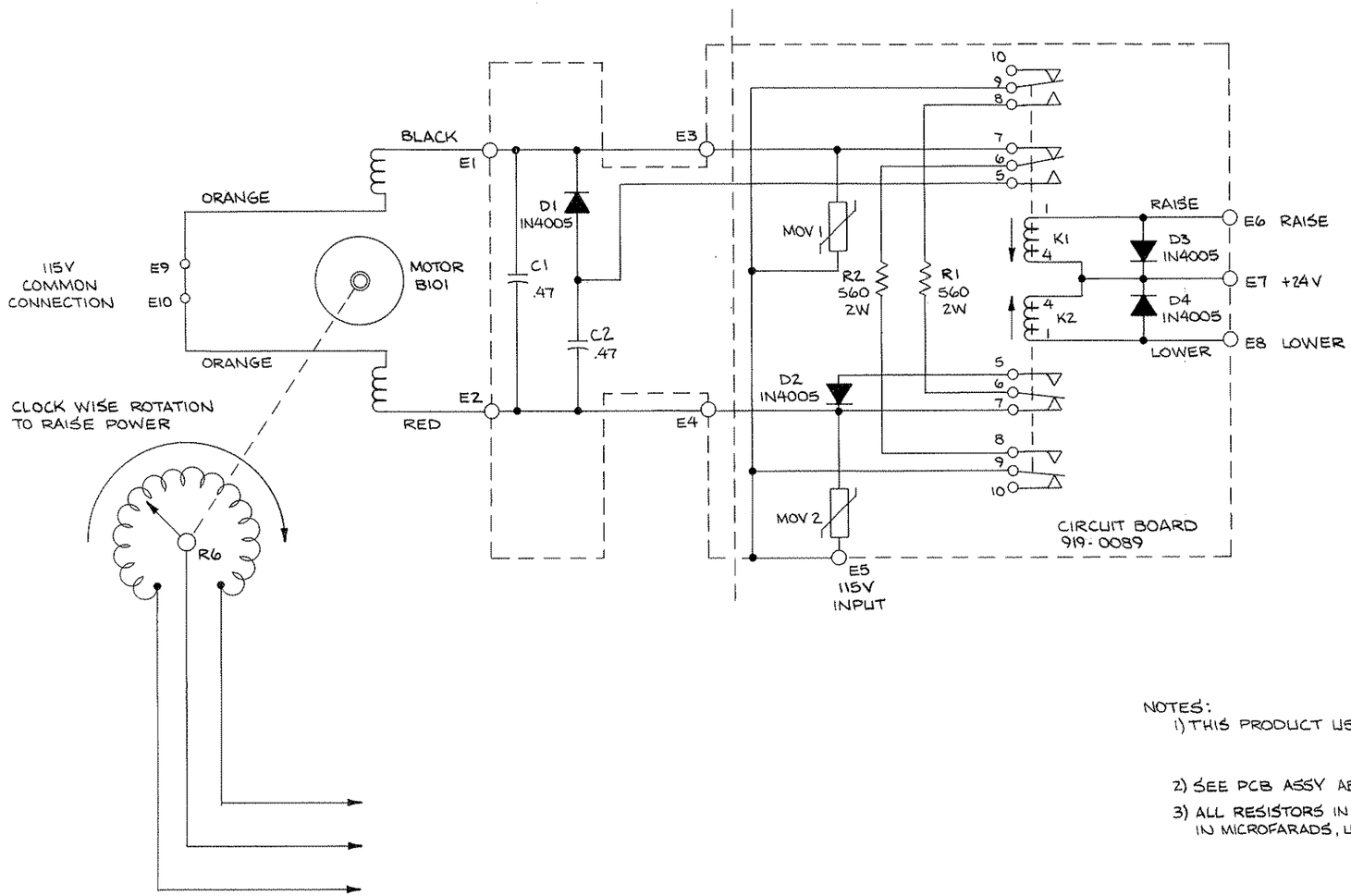
BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O. BOX 3606 QUINCY, IL 62305 217 224-9600
TELEX 250147 CABLE BROADCAST

TITLE: ASSY, PCB TRANSMITTER CONTROLLER

TYPE A | SIZE D | DWG NO: 919-0072 919-0072-C01 | REV M

MODEL: FM 250/FM 250 MA | SCALE 2/1 | SHEET 1 OF 1

FM 300/FM 300 MA



NOTES:

1) THIS PRODUCT USED ON FM100/100 MA
FM250/250 MA
FM300/300 MA

2) SEE PCB ASSY AB 919-0089

3) ALL RESISTORS IN OHMS, 1/4 W, 5%; ALL CAPACITORS IN MICROFARADS, UNLESS OTHERWISE NOTED.

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

DWN. BY MSE 8-6-85
CHKD MH 8-28-85
ME
PROJ. ENGR. JHS
MFG.

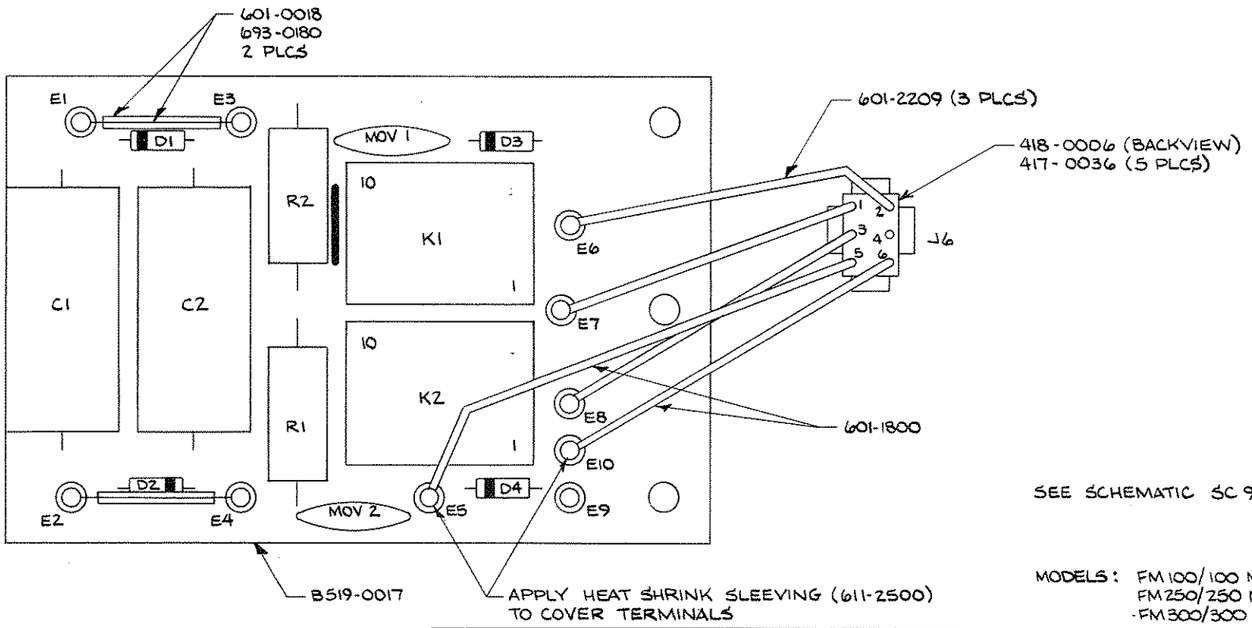
MATERIAL
FINISH
NEXT ASSY.

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

TITLE SCHEMATIC, REMOTE RAISE-LOWER MOTOR CONTROL

TYPE	SIZE	DWG. NO.	REV
S	C	919-0089	A

MODEL SEE NOTE #1 | SCALE ~ | SHEET 1 OF 1



SEE SCHEMATIC SC 919-0089

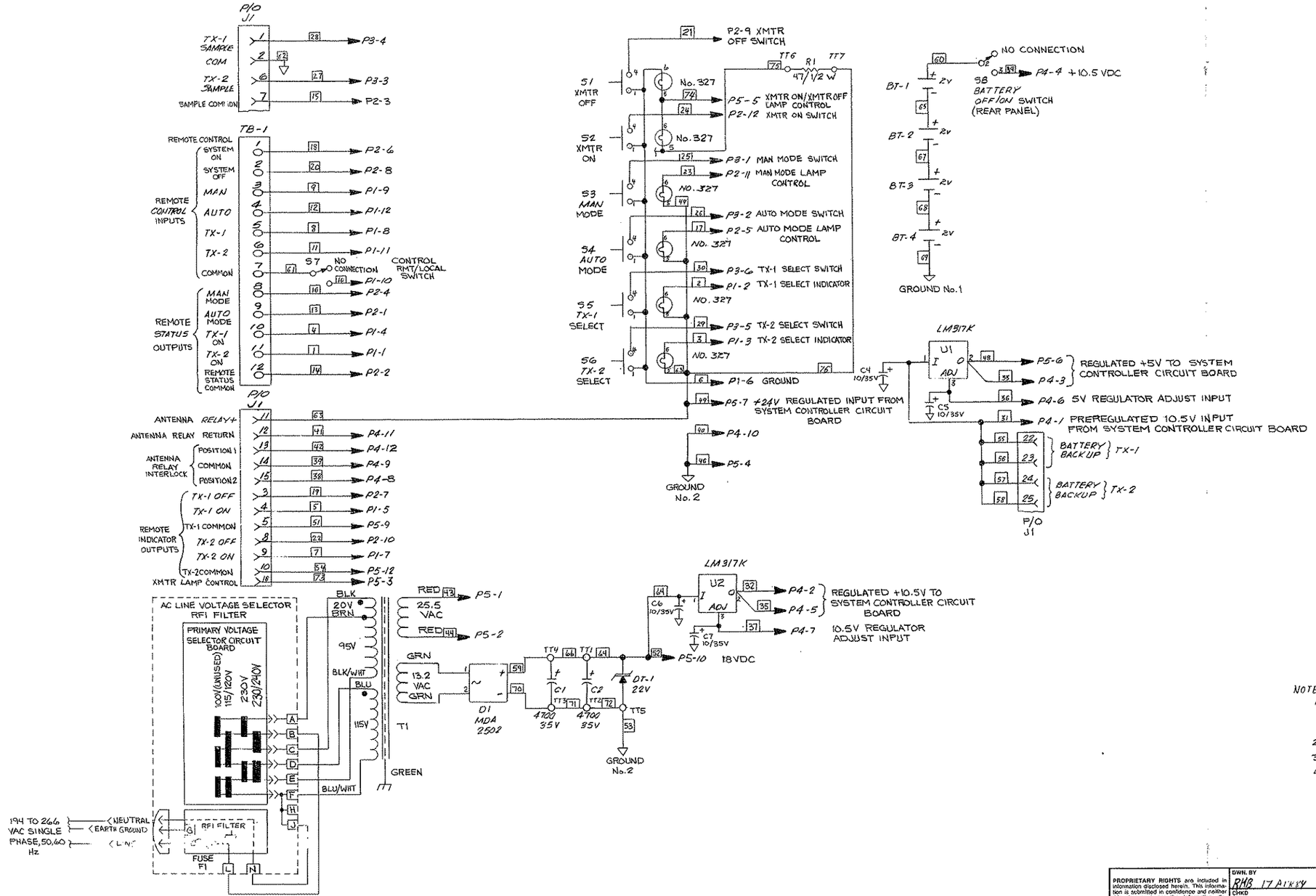
MODELS: FM100/100 MA
FM250/250 MA
FM300/300 MA

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

DWN. BY	MSE 8-6-85
CHKD	MH 8-28-85
ME	
PROJ. ENGR.	
MFG.	
MATERIAL	SEE B/M 919-0089
FINISH	
NEXT ASSY.	

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

TITLE	ASSY, RAISE-LOWER MOTOR CONTROL		
TYPE A	SIZE B	DWG. NO. 919-0089	REV A
MODEL		SCALE 2/1	SHEET 1 OF 1



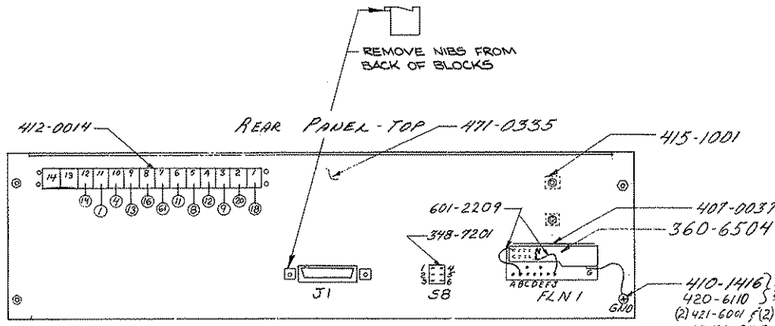
NOTES:
1. TT= TURRET TERMINAL
   XX INDICATES WIRE NUMBER
2. SEE SCHEMATIC D919-0073
3. SEE ASSEMBLY D919-0073
4. CAPACITORS IN UF, RESISTORS IN OHMS.

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

DWN. BY RHB 17 AUG 84
CHKD
ME
PROJ. ENGR. JS
MFG.
MATERIAL
FINISH
NEXT ASSY.

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

TITLE SCHEMATIC, SYSTEM CONTROLLER CHASIS
TYPE S SIZE D DWG. NO. 959-0173/-0280 REV D
MODEL FM300MA FM250MA FM1008/2508/3008 M/A
SCALE — SHEET 1 OF 1



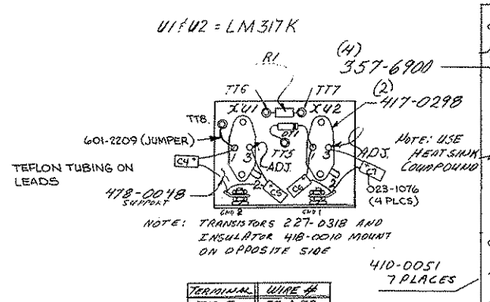
TERMINAL	WIRE #	TERMINAL	WIRE #	TERMINAL	WIRE #	TERMINAL	WIRE #
TB1-12	14	J1-2	62	J1-14	38	FL1-E	BLK/WHT OF T1
TB1-11	1	J1-3	19	J1-22	55		
TB1-10	4	J1-4	5	J1-23	56	FL1-F	BLU/WHT OF T1
TB1-9	13	J1-5	51	J1-24	57		
TB1-8	16	J1-6	27	J1-25	58		
TB1-7	61	J1-7	15	S8-1	60		
TB1-6	11	J1-8	22	S8-5	64		
TB1-5	8	J1-9	9	FL1-A	BLK OF T1		
TB1-4	12	J1-10	54				
TB1-3	9	J1-11	63	FL1-C	BLACK OF T1		
TB1-2	20	J1-12	41				
TB1-1	18	J1-13	42	FL1-D	BLUE OF T1		
J1-1	28	J1-14	39				
		J1-16	73				

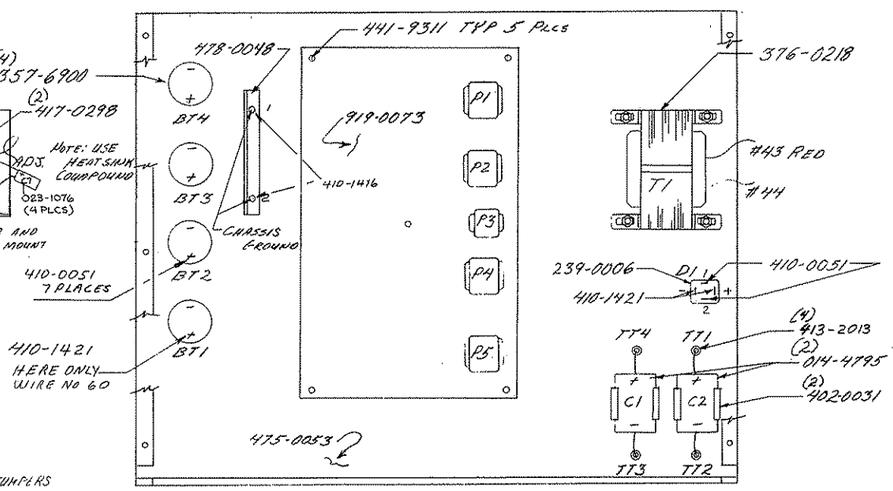
APPLY SHRINK TUBING

APPLY SHRINK TUBING

NOTE: ADD 3 JUMPERS SHOWN. ALL 22 GAGE, 601-2209

NOTE: ALL WIRES ARE 22 GAGE (601-2209) EXCEPT 32, 43, 44, 48, 52, 53, 66, 70, 71, & 72, 34, 59, & 60 WHICH ARE 601-1800 AND '65 67, 68, & 69 WHICH ARE 601-1604





TERMINAL	WIRE #
BT1 +	60
TT1	64
TT2	72

NOTE:
CONNECT TWO T1 GREEN WIRES TO D1-1 & D1-2 WITH 410-0051
BUTT SPLICE WIRE 43 TO T1 RED WITH 410-0014
BUTT SPLICE WIRE 44 TO T1 RED WITH 410-6014

ADD THE FOLLOWING JUMPERS

WIRE NO.	FROM	TO	GAGE
59	D1-+	TT4	18
66	TT4	TT1	18
70	D1-—	TT3	18
71	TT3	TT2	18

TERMINAL	WIRE #	TERMINAL	WIRE #	TERMINAL	WIRE #
P1-1	1	P2-6	18	P4-5	35
P1-2	2	P2-7	19	P4-6	36
P1-3	3	P2-8	20	P4-7	37
P1-4	4	P2-9	21	P4-8	38
P1-5	5	P2-10	22	P4-9	39
P1-6	6	P2-11	23	P4-10	40
P1-7	7	P2-12	24	P4-11	41
P1-8	8	P3-1	25	P4-12	42
P1-9	9	P3-2	26	P5-1	43
P1-10	10	P3-3	27	P5-2	44
P1-11	11	P3-4	28	P5-4	46
P1-12	12	P3-5	29	P5-6	48
P2-1	13	P3-6	30	P5-7	49
P2-2	14	P4-1	31	P5-9	51
P2-3	15	P4-2	32	P5-10	52
P2-4	16	P4-3	33	P5-11	53
P2-5	17	P4-4	34	P5-12	54
				P5-3	73
				P5-5	74

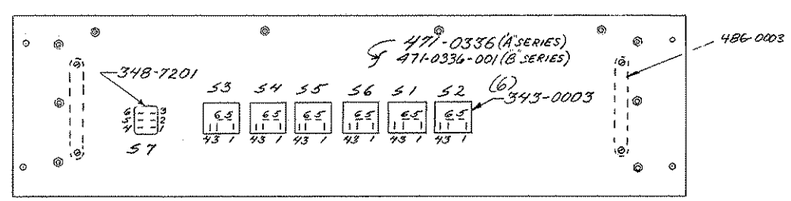
TERMINAL	WIRE #
TT5	53 & 72
XU1-1	31, 55, C4
TT8	57, 58, 56
XU1-2	33 & 48
XU1-3	36
XU2-1	52 & 69
XU2-2	35 & 32
XU2-3	37
CHASSIS GROUND2	40, 46, 62
TT6	75
TT7	76

NOTE: ADD THE FOLLOWING JUMPERS

WIRE #	FROM	TO	GAGE
59	BT4+	CHASSIS GROUND	16
65	BT2-	BT1-	16
67	BT3+	BT2-	16
68	BT4+	BT3-	16

410-0051 7 PLACES

410-1421 HERE ONLY WIRE NO 60



NOTE:
INSTALL THE FOLLOWING JUMPERS USING 601-2209

53-1	TO 54-1
54-1	TO 55-1
55-1	TO 56-1
56-1	TO 51-1
51-1	TO 52-1
53-5	TO 54-5
54-5	TO 55-5
55-5	TO 56-5
51-5	TO 52-6
51-1	TO 51-6

NOTE: S4 USES RED LENS.

TERMINAL	WIRE #	TERMINAL	WIRE #
52-4	24	54-6	17
51-4	21	53-1	6
56-4	29	53-4	25
56-5	63	53-5	49
56-6	3	53-6	23
55-4	30	57-2	61
55-6	2	57-3	10
54-4	26	51-5	74
52-5	75	56-5	76

Item Assembled	Qty.	Hardware Part Number
Top Cover 471-0339	9	420-6106
	9	423-6002
Front Panel 471-0336	10	421-6001
	10	423-6002
Support 478-0048	2	420-6108
	4	423-6002
	4	421-6001
Rear Panel 471-0335	1	420-6110
	7	420-6106
	9	421-6001
	9	423-6002
Battery Clamp 453-6900	8	420-6106
	12	423-6002
	12	421-6001
	12	423-6001
	4	420-6108
Terminal Strip 412-0014	4	420-6110
	4	423-6001
	4	423-6002
	4	421-6001
Transformer 376-0218	4	420-0108
	4	423-0001
	4	423-0002
	4	421-0201
J1	2	420-4306
	2	417-0000

Item Assembled	Qty.	Hardware Part Number
Handle 486-0003	4	420-8105
	4	423-8002
Rectifier 239-0006	1	420-8004
	1	423-8001
	1	423-8002
	1	421-8001
Fuse Clip 415-1001	2	420-4105
	2	421-4001
	2	423-4002
Terminal 413-2013	8	420-4104
	8	423-4002
Clamp Capacitor 402-0031	4	423-4002
	4	420-4105
	4	423-4001
	4	421-4001
PC Standoffs 441-9311	5	420-6104
	5	423-6002
Socket 417-0298	4	423-6001
	4	423-6002
	4	421-6001
	4	420-6110

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

DWN. BY	DHF
CHKD	
ME	
PROJ. ENGR.	JS
MFG.	
MATERIAL	
FINISH	
NEXT ASSY.	

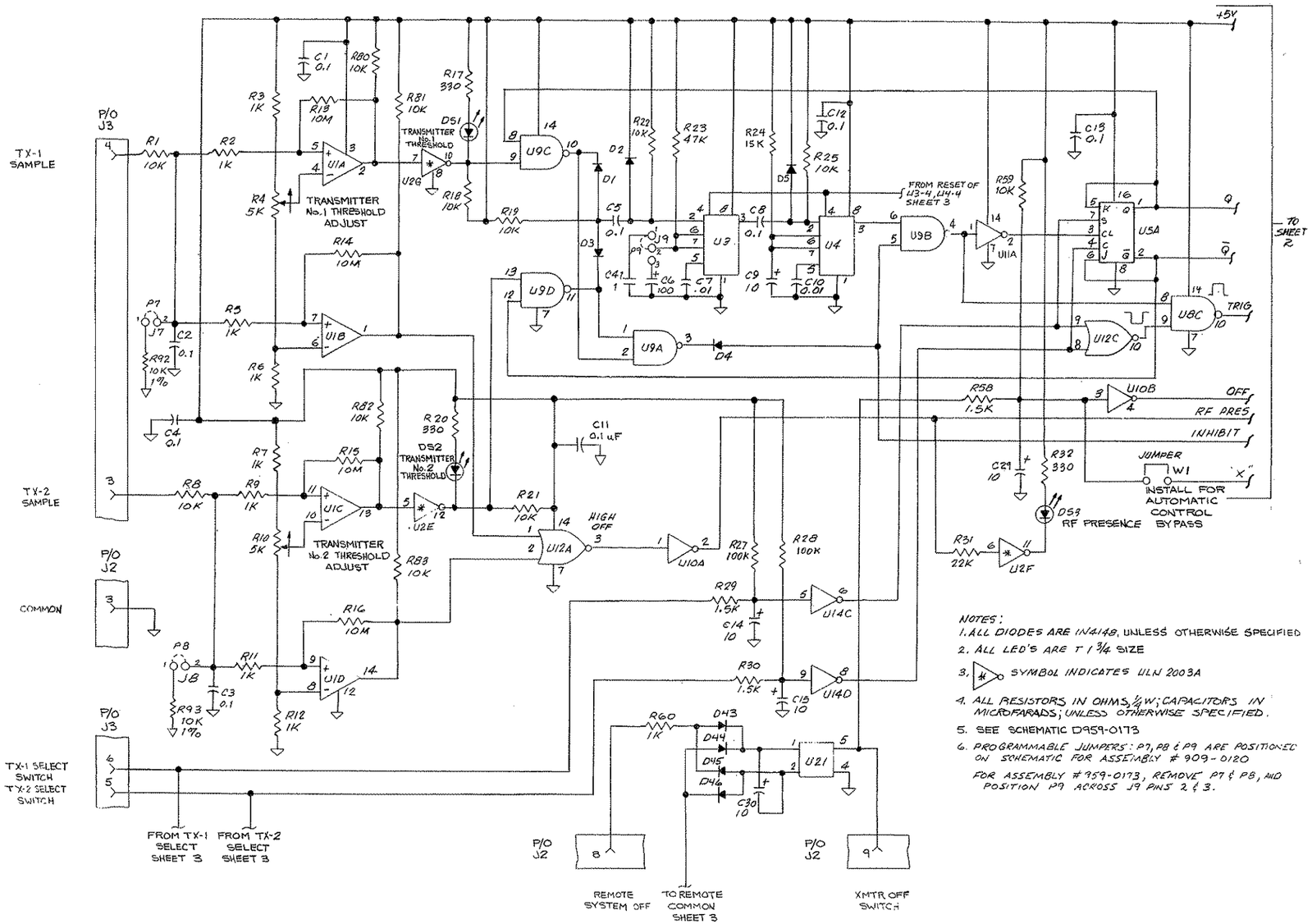
BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O. BOX 3606 QUINCY, IL 62305 217/224-9600
TELEX 250142 CABLE BROADCAST

TITLE WIRING DIAGRAM SYSTEM CONTROLLER

TYPE	SIZE	DWG. NO.	REV
A	D	959-0173/-0280	H

MODEL FM300B/A SCALE 2.0 SHEET 1 OF 1

FM300B M/A



NOTES:

1. ALL DIODES ARE IN4148, UNLESS OTHERWISE SPECIFIED
2. ALL LED'S ARE T 1 3/4 SIZE
3. ✳ SYMBOL INDICATES ULN 2003A
4. ALL RESISTORS IN OHMS, ¼ W; CAPACITORS IN MICROFARADS; UNLESS OTHERWISE SPECIFIED.
5. SEE SCHEMATIC D959-0173
6. PROGRAMMABLE JUMPERS: P7, P8 & P9 ARE POSITIONED ON SCHEMATIC FOR ASSEMBLY # 909-0120

   FOR ASSEMBLY # 959-0173, REMOVE P7 & P8, AND POSITION P9 ACROSS J9 PINS 2 & 3.

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

DWN. BY RHF 17APR 84
CHKD
ME
PROJ. ENGR. JS
MFG.
MATERIAL
FINISH
NEXT ASSY.

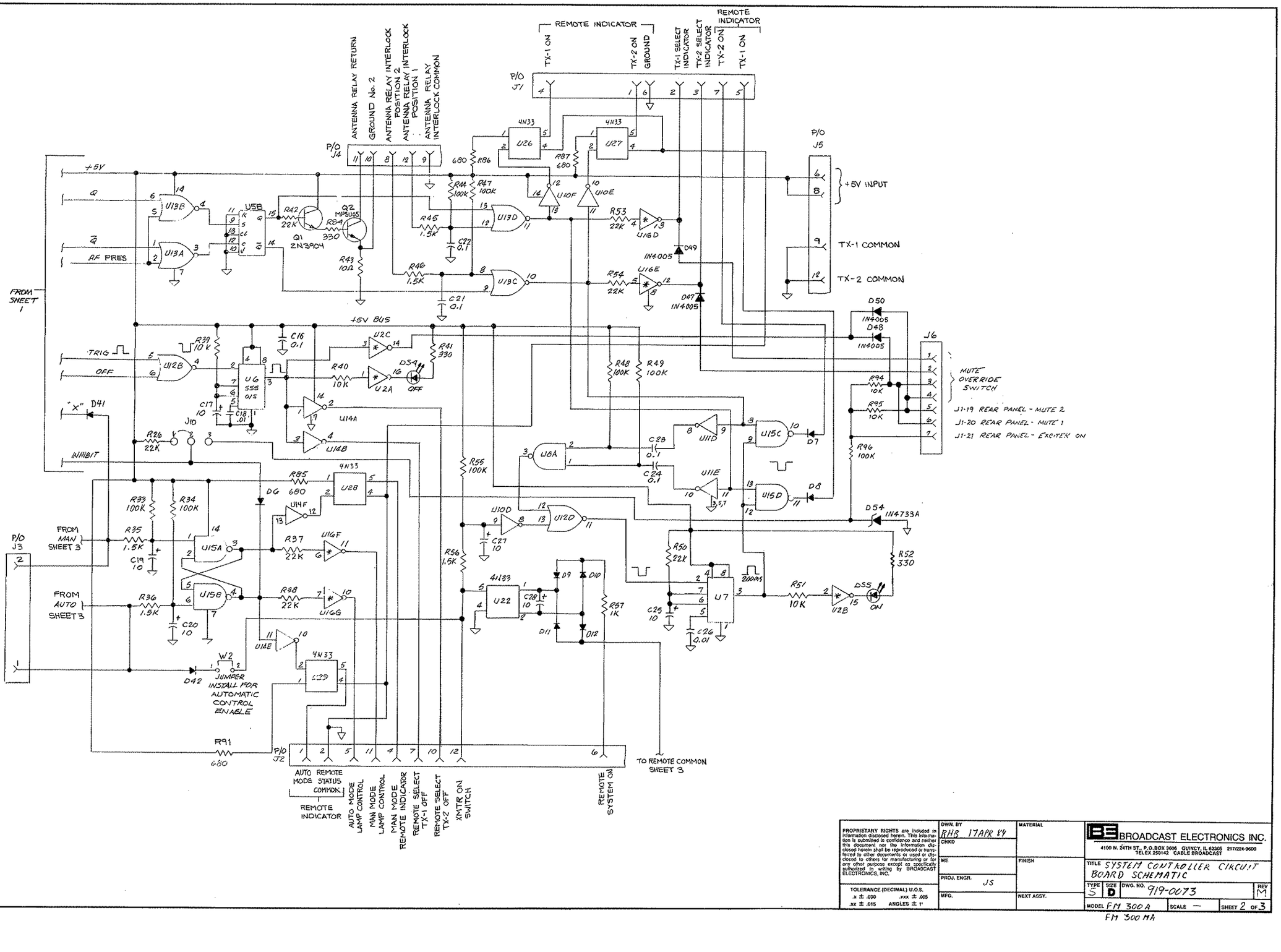
BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O.BOX 3606 QUINCY, IL 62305 217/224-9600
TELEX 250142 CABLE BROADCAST

TITLE SYSTEM CONTROLLER CIRCUIT BOARD SCHEMATIC

TYPE S SIZE D DWG. NO. 919-0073 REV M

MODEL FM 300A SCALE — SHEET 1 OF 3

FM 300 MA



PROPRIETARY RIGHTS are included in information disclosed herein. This information is submitted in confidence and neither this document nor the information disclosed herein shall be reproduced or transferred to other documents or used or disclosed to others for manufacturing or for any other purpose except as specifically authorized in writing by BROADCAST ELECTRONICS, INC.

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

DWN. BY RHB 17APR 84
CHKD
ME
PROJ. ENGR. JS
MFG.

MATERIAL
FINISH
NEXT ASSY.

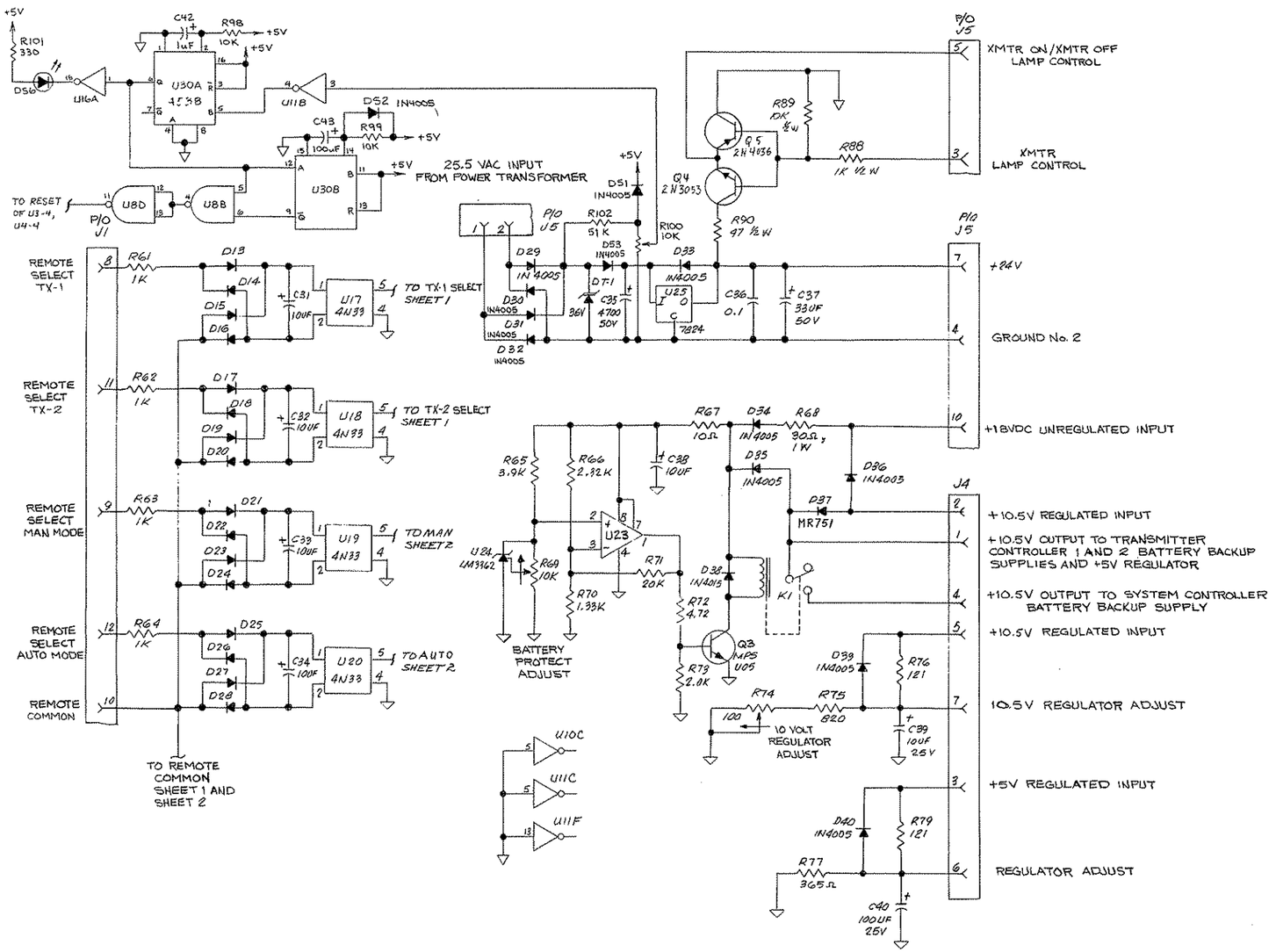
BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O. BOX 3606 QUINCY, IL 62305 217/224-9600
TELEX 25N142 CABLE BROADCAST

TITLE SYSTEM CONTROLLER CIRCUIT BOARD SCHEMATIC

TYPE S SIZE D DWG. NO. 919-0073 REV M

MODEL FM 300A SCALE — SHEET 2 OF 3

FM 300 MA



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

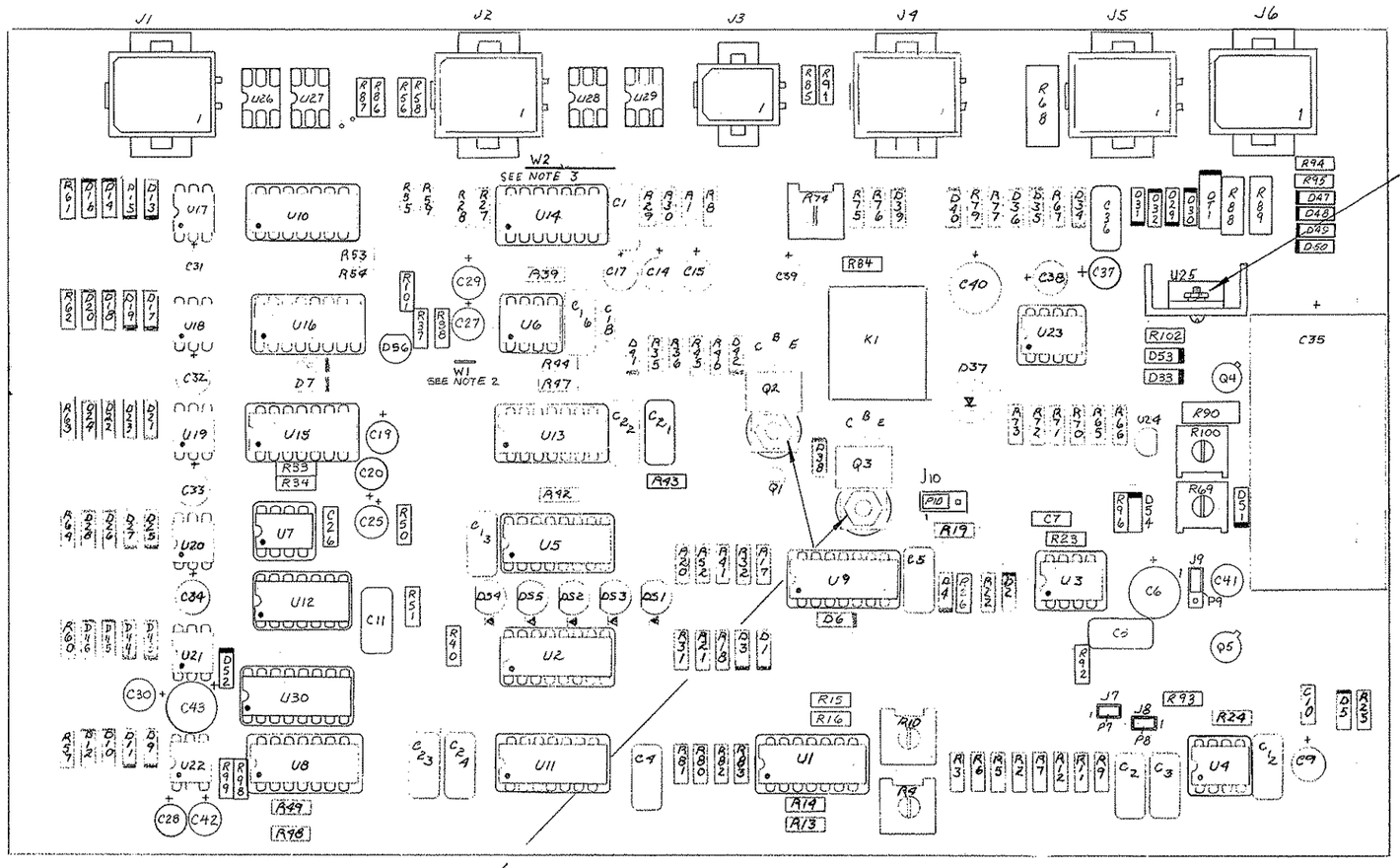
DWN. BY	RHB 17 APR 84
CHKD	
ME	
PROJ. ENGR.	JS
MFG.	
MATERIAL	
FINISH	
NEXT ASSY.	

BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O.BOX 2606 QUINCY, IL 62305 217/224-9600
TELEX 250142 CABLE BROADCAST

TITLE SYSTEM CONTROL CIRCUIT BOARD SCHEMATIC

TYPE S | SIZE D | DWG. NO. 919-0073 | REV M

MODEL FM 300 MA FM 30. A | SCALE — | SHEET 3 OF 3



NOTES:

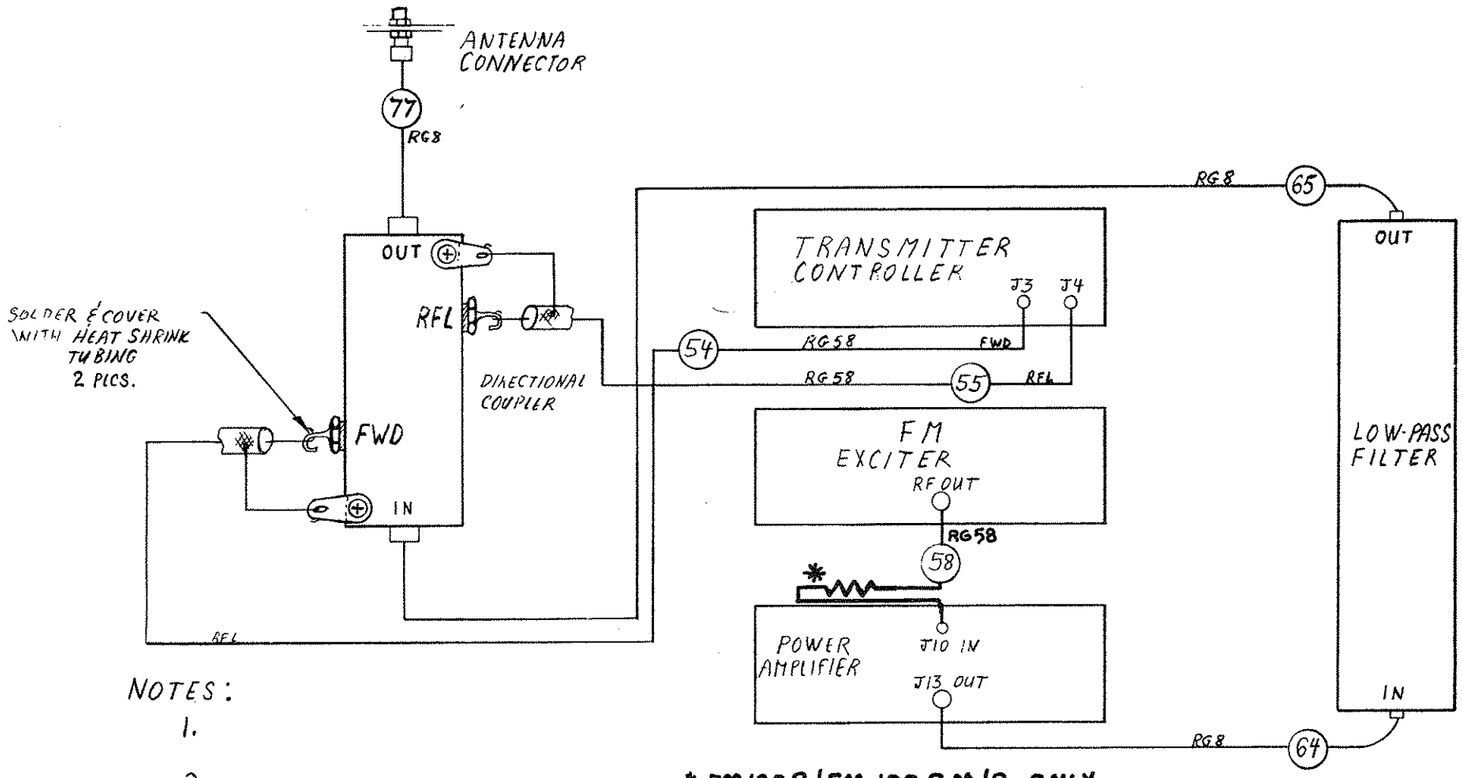
5. PROGRAMMABLE JUMPERS P7, P8 & P9 ARE POSITIONED ON PCB FOR ASSEMBLY # 909-0120
6. IF PCB IS TO BE USED FOR ASSEMBLY 954-0173, REMOVE P7 & P8, AND JUMPER P9 ACROSS J9 PINS 2 & 3.

(2) 420-4106
(4) 421-4001
(2) 423-4002
(2) 423-4101 -(CIRCUIT SIDE)
(2) 423-6015

NOTES:

1. SEE SCHEMATIC SD 917-0073 PAGE 1,2 +3
2. 22 GA. JUMPER WITH TEFLON SLEEVING
3. 22 GA. JUMPER
4. ALL 1/4 WATT COMPONENTS ARE FORMED .50 "A" DIM.

	FILE 23 [illegible]	MATERIAL	BROADCAST ELECTRONICS INC 4100 N 24TH ST. P.O BOX 3606 QUINCY IL 62305 217 224-9600 TELEX 250192 CABLE BROADCAST
		FINISH	TITLE SYSTEM CONTROL PCB ASSEMBLY
		NEXT ASSY	TYPE 1 SIZE D DWG NO 919-0673 REV M
			WORK FM30 / [illegible] 2/1



NOTES:

1.

2.

3. ◯ = WIRE NUMBER

4. REF. AD 949-0085 FOR CABLE ASSY'S.

5. RG 142/U CABLE USED ON FM-100

* FM100B/FM 100 B M/A ONLY

RF WIRING DIAGRAM, FM-100B/FM-250B

WD 909-0100-204/-304
WD 909-0250-204/-304

AC POWER & CONTROL (PP)

PAIR OF WIRES	FUNCTION
FACTORY	PRIMARY AC INPUT
CB1, CB2	PRIMARY AC INPUT
	SYSTEM GROUND
CB1; K1, Q1, Q2	CABINET BLOWER POWER
CB1, K1, Q1, Q2	CABINET BLOWER POWER
CB1	XMTR CONTROLLER POWER
CB1	XMTR CONTROLLER POWER
CB2, K2, Q3	EXCITER & P.A. POWER
CB2, K2, Q3	EXCITER & P.A. POWER

TB1

200-250 VAC SYSTEM AC POWER INPUT

16GA (14) TO: TB5-1

16GA (101) TO: TB5-3

BLACK (15) WHITE (15) TO: TC

BLACK (16) (17) WHITE (14) (17) TO EX & PA

J1

Q3, K2	XMTR. CONTROL INPUT +	TO: TC J1-1
Q3, K2	XMTR CONTROL COMMON -	TO: TC J1-2
K1, K2	XMTR +24V INPUT	TO: TC J1-3
Q1, Q2, K1	BLOWER CONTROL INPUT	TO: TC J1-4
Q1, Q2, K1	BLOWER CONTROL COMMON	TO: TC J1-5

GND 1 GND 2

GRN (35) GRN (36) GRN (37)

1Ω J5 9Ω

(109) (34)

P5

BLUE BLUE B1 16GA

POWER AMP (PA)

J9

AC LINE IN (17) LINE CORD TO PP TB1-10/11

(113) (5)	MUTE
(4)	+15V OUT
TO: TC J2-2 (18) (10)	IPA COLLECTOR CURRENT (15A = +15VDC)
TO: TC J2-14 (19) (11)	REMOTE COLLECTOR 'I' METER (15A = 1mAFS)
TO: TC J2-3 (11) (12)	GND
TO: TC J2-18 (7) (14)	GND
TO: TC J2-1 (17) (15)	IPA COLLECTOR VOLTAGE (30V = +5VDC)
TO: TC J2-13 (17) (16)	REMOTE COLLECTOR 'E' METER (30VDC = 1mAFS)
TO: TC J2-4 (32) (14)	REMOTE FWD PWR METER (100W/200W = 1mAFS)
TO: TC J2-5 (31) (21)	REMOTE REFL. PWR METER (20W = 1mAFS)

TO: TC J1-13 (27) TO: TC J1-11 (25)

TB-1 (1)(2)(3)(4)(5)(6)(7)(8)(9)(10)(11)(12)(13)(N)

POWER CONTROL INPUT MUTE INPUT

AC LINE IN (16)

LINE CORD TO PP TB1-10/11

EXCITER (EX)

TO: PP J1-1 (20) TO: PP J1-2 (21) TO: PP J1-3 (22) TO: PP J1-4 (23) TO: PP J1-5 (24)

TO: EX TB1-7 (25) TO: EX TB1-6 (27) (28)

TO: PA J9-15 (17) TO: PA J9-10 (18) TO: PA J9-13 (19) TO: PA J9-16 (32) TO: PA J9-21 (31)

TO: PA J9-16 (17) TO: PA J9-11 (18) TO: PA J9-14 (19)

J1 (1)(2)(3)(4)(5)(6)(7)(8)(9)(10)(11)(12)(13)(14)(15)(16)

J2 (17)(18)(19)(32)(31)(17)(18)(19)

TB1 (1)(2)(3)(4)(5)(6)(7)(8)(9)(10)(11)(12)(13)(14)(15)(16)(17)(18)

REMOTE CONTROL TB2 (1)(2)(3)(4)(5)(6)(7)(8)(9)(10)

REMOTE STATUS (1)(2)(3)(4)(5)(6)(7)(8)(9)(10)

AC LINE IN (15)

LINE CORD TO PP TB1-8/9

P2-4	P2-6	S4	P1-3	P2-6	P2-3	R3	P1-2	P2-2	TB2-4	TB2-5	TB2-6	PH-1	PH-8	S1-4	S1-1	M2(-)	P1-7
AC CONTROL OUTPUT +	AC CONTROL COMMON -	+24 VOLT OUTPUT	BLOWER CONTROL OUTPUT	BLOWER CONTROL COMMON	MUTE OUTPUT	POWER CONTROL OUT	INTERLOCK INPUT	+24V OUTPUT	PA COLLECTOR 'E' INPUT	PA COLLECTOR 'I' INPUT	PA METER COMMON	PA FWD PWR METER IN	PA REFL PWR METER IN	PA COLLECTOR 'E' METER	PA COLLECTOR 'I' METER	PA METER COMMON	REMOTE ON
																	REMOTE OFF
																	REMOTE FS
																	REMOTE COMMON
																	OPT. REMOTE RAISE
																	OPT. REMOTE LOWER
																	OPT. REMOTE COMMON
																	OPT. +24V OUT
																	R1 COMMON
																	GND

P3-4	P3-7	P3-6	J2-1	J2-2	J2-3
XMTR FWD POWER	XMTR REFL POWER	POWER COMMON	PA COLLECTOR "E"	PA COLLECTOR "I"	PA METER COMMON

TRANSMITTER CONTROLLER (TC)

NOTES:

1. ALL WIRE IS 22 GAUGE WHITE NUMBERED EXCEPT WHERE OTHERWISE NOTED.
2. REF SHEET 2 FOR RF WIRING
3. BLOWER B1 IS REMOVED FOR FM-100 CONFIGURATION.

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

DWN. BY	JAH 2-14-85
CHKD	
ENG	
PROJ. ENGR.	
MFG.	
MATERIAL	
FINISH	
NEXT ASSY.	

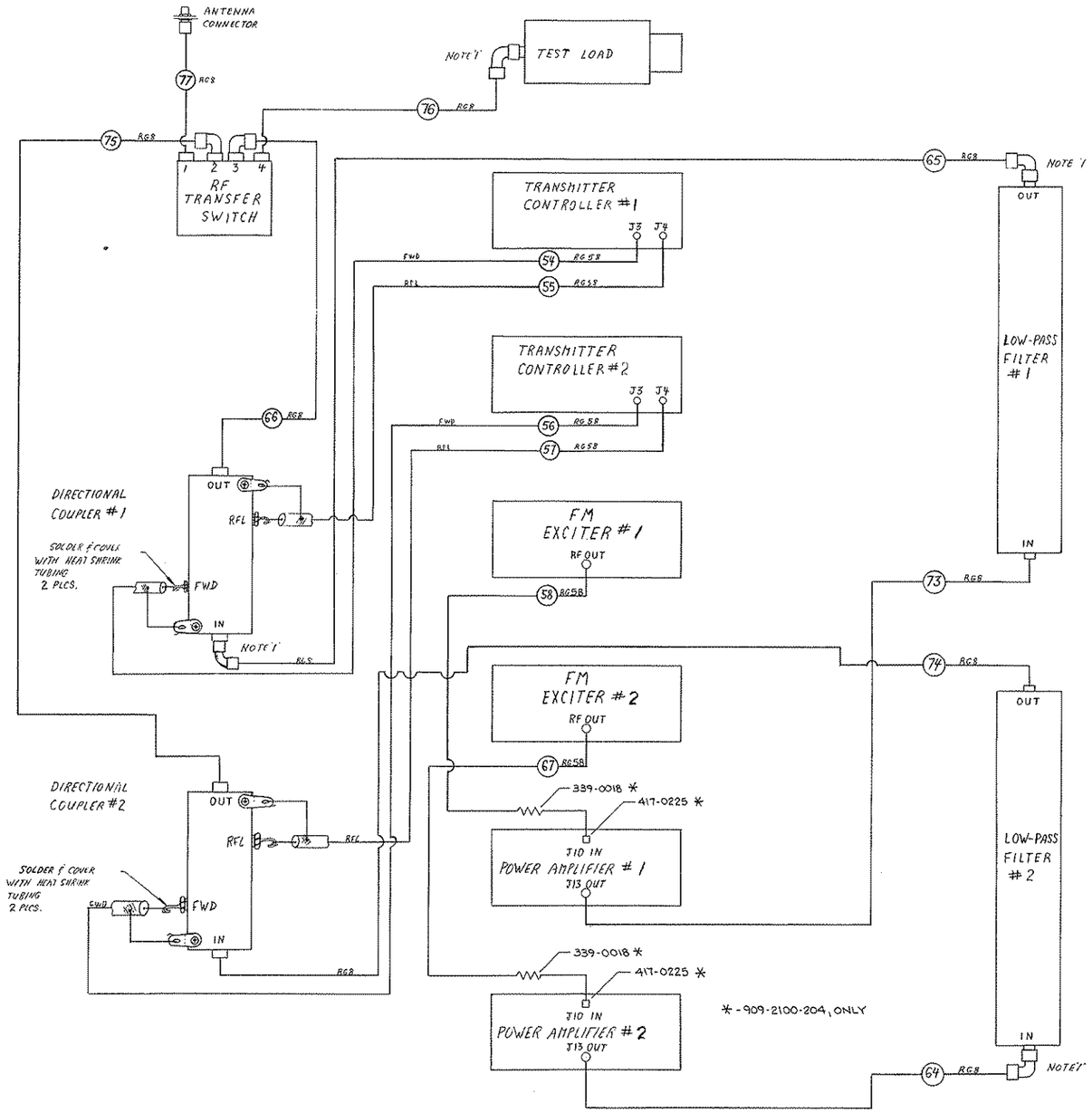
BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O. BOX 3606 QUINCY, IL 62305 217/224-9600
TELEX 250142 CABLE BROADCAST

TITLE SYSTEM INTERCONNECT FUNCTIONAL WIRING DIAGRAM

TYPE W | SIZE D | DWG. NO. 909-0100/6250-200,-204 | REV K

MODEL FM100/-250 | SCALE — | SHEET 3 OF 3

FM100B/FM250B



NOTES:

1. = 90° 'N' TYPE ADAPTER PN. 417-0105 (7 REQ.)
2.
3. ◯ = WIRE #
4. REF. AD949-00856 FOR CABLE ASSYS.
5. RG 142/U CABLE USED ON FM-100 M/A

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

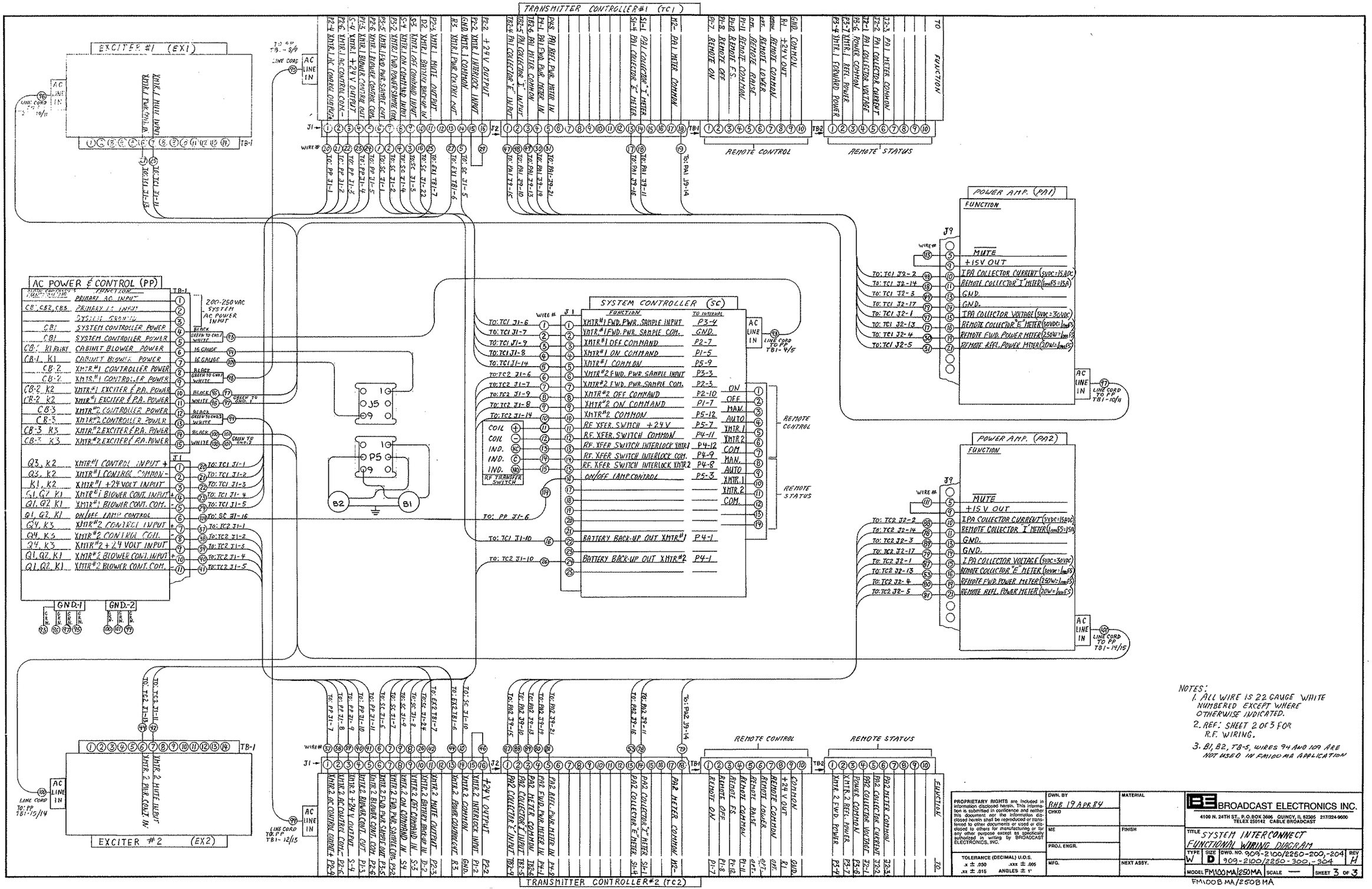
DWN. BY RHB 30 MAR 84	MATERIAL
CHKD	
ME	FINISH
PROJ. ENGR.	
MFG.	NEXT ASSY.

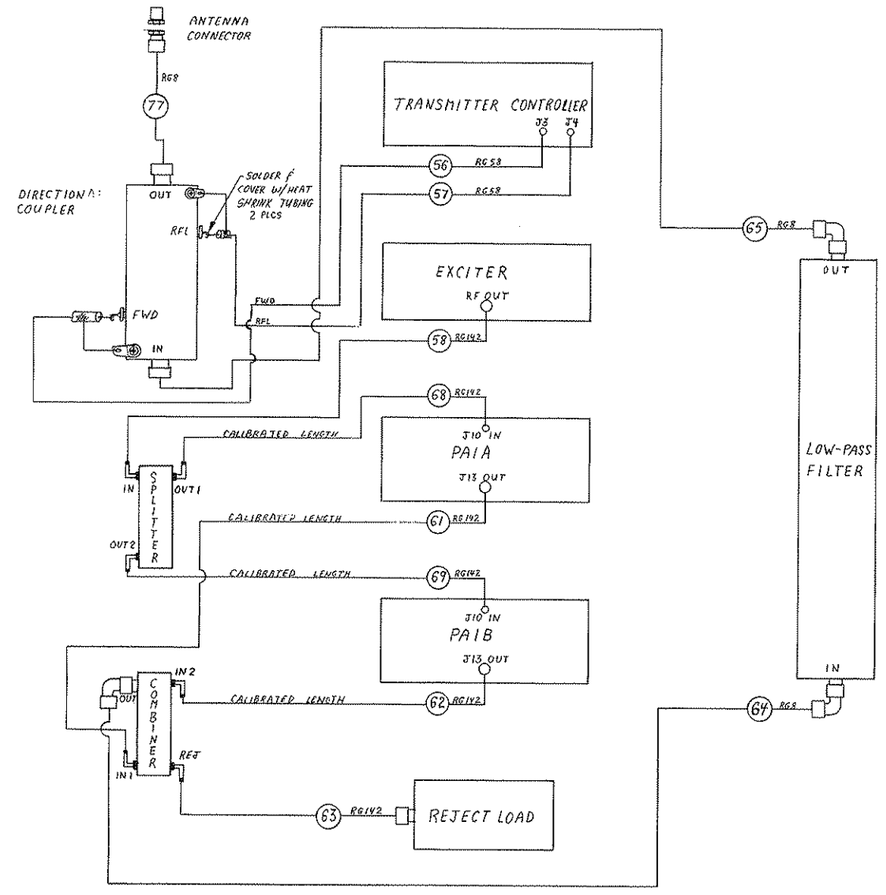
BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O. BOX 3606 QUINCY, IL 62305 217/224-9600
TELEX 250142 CABLE BROADCAST

TITLE RF WIRING DIAGRAM

TYPE	SIZE	DWG. NO.	REV
W	D	909-2100/2250-200,-204	G

MODEL FM100MA/250MA SCALE — SHEET 2 OF 3


TRANSMITTER CONTROLLER #1 (TC1)
EXCITER #1 (EX1)
AC POWER & CONTROL (PP)
SYSTEM CONTROLLER (SC)
POWER AMP. (PA1)
POWER AMP. (PA2)
REMOTE CONTROL
REMOTE STATUS
EXCITER #2 (EX2)
TRANSMITTER CONTROLLER #2 (TC2)
200-250 VAC SYSTEM AC POWER INPUT
NOTES:
1. ALL WIRE IS 22 GAUGE WHITE NUMBERED EXCEPT WHERE OTHERWISE INDICATED.
2. REF: SHEET 2 OF 3 FOR R.F. WIRING.
3. B1, B2, TB-5, WIRES 94 AND 109 ARE NOT USED IN FM100MA APPLICATION
PROPRIETARY RIGHTS are included in information disclosed herein. This information is submitted in confidence and neither this document nor the information disclosed herein shall be reproduced or transferred to other documents or used or disclosed to others for manufacturing or for any other purpose except as specifically authorized in writing by BROADCAST ELECTRONICS, INC.
TOLERANCE (DECIMAL) U.O.S. .x ± .030 .xxx ± .005 .xx ± .015 ANGLES ± 1°
DWN. BY RHB 19 APR 84
CHKD
ME
PROJ. ENGR.
MFG.
MATERIAL
FINISH
NEXT ASSY.
BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O. BOX 3606 QUINCY, IL 62305 217/224-9600
TELEX 250142 CABLE BROADCAST
TITLE SYSTEM INTERCONNECT FUNCTIONAL WIRING DIAGRAM
TYPE W SIZE D DWG. NO. 909-2100/2250-200,-204 REV H
MODEL FM100MA/250MA SCALE — SHEET 3 OF 3
FM100MA/250MA



NOTES:

1. = 90° 'N' TYPE ADAPTER (3 REQ.) P.N. 417-0170
2.
3. ◯ = WIRE NUMBER
4. = 90° BNC TYPE CONNECTOR (PART OF CABLE ASSY.)
5. REF. AD 949-0051 FOR CABLE ASSYS.

COPYRIGHT © 1986 BROADCAST ELECTRONICS, INC.

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

DWN. BY RHB
CHKD
ME
PROJ. ENGR. JS
MFG.

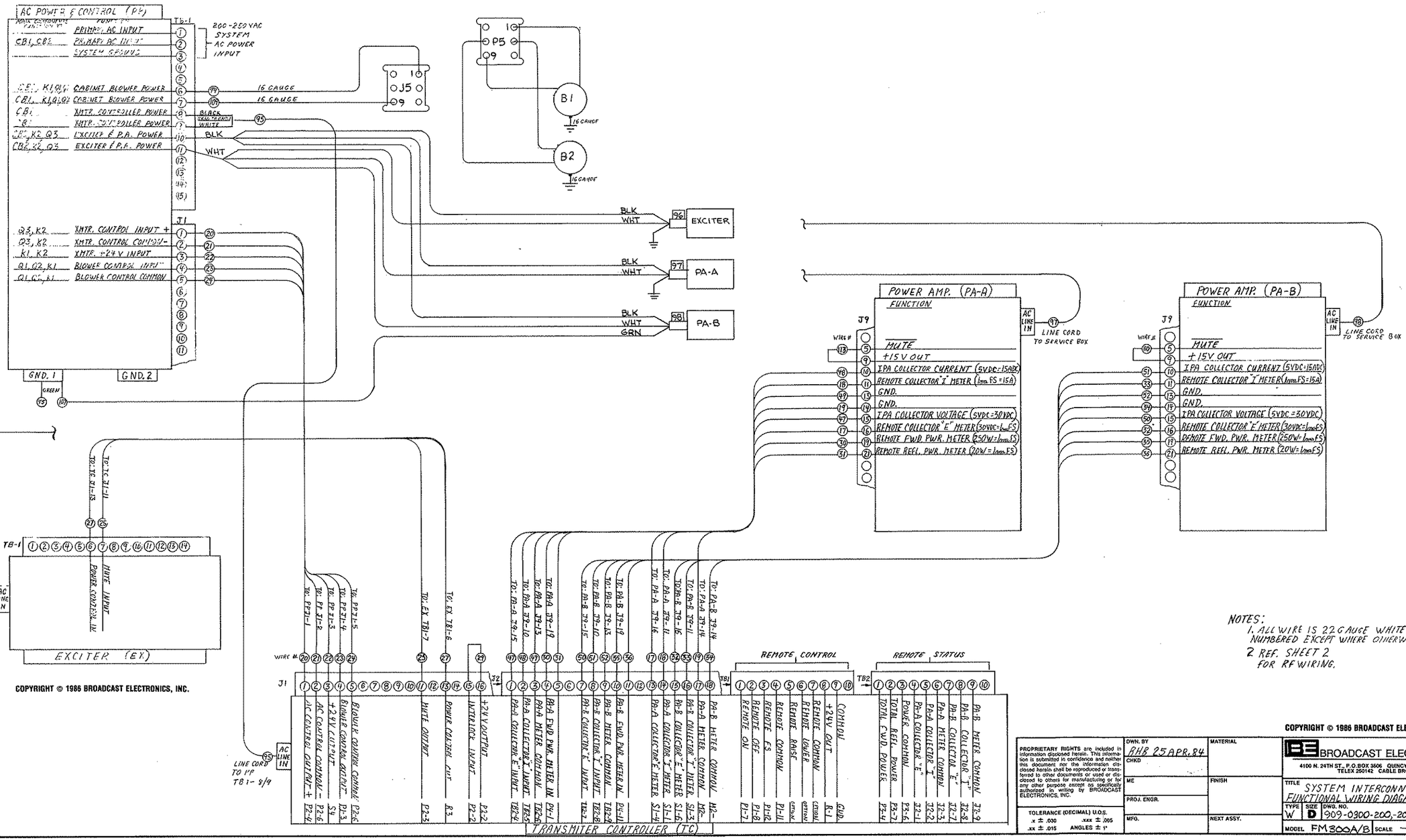
MATERIAL
FINISH
NEXT ASSY.

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

TITLE RF WIRING DIAGRAM

TYPE W | SIZE D | DWG. NO. 909-0300-200,-204,-300,-304 | REV F

MODEL FM300A/B | SCALE ~ | SHEET 2 OF 3



NOTES:
1. ALL WIRE IS 22 GAUGE WHITE NUMBERED EXCEPT WHERE OTHERWISE NOTED.
2 REF. SHEET 2 FOR RF WIRING.

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

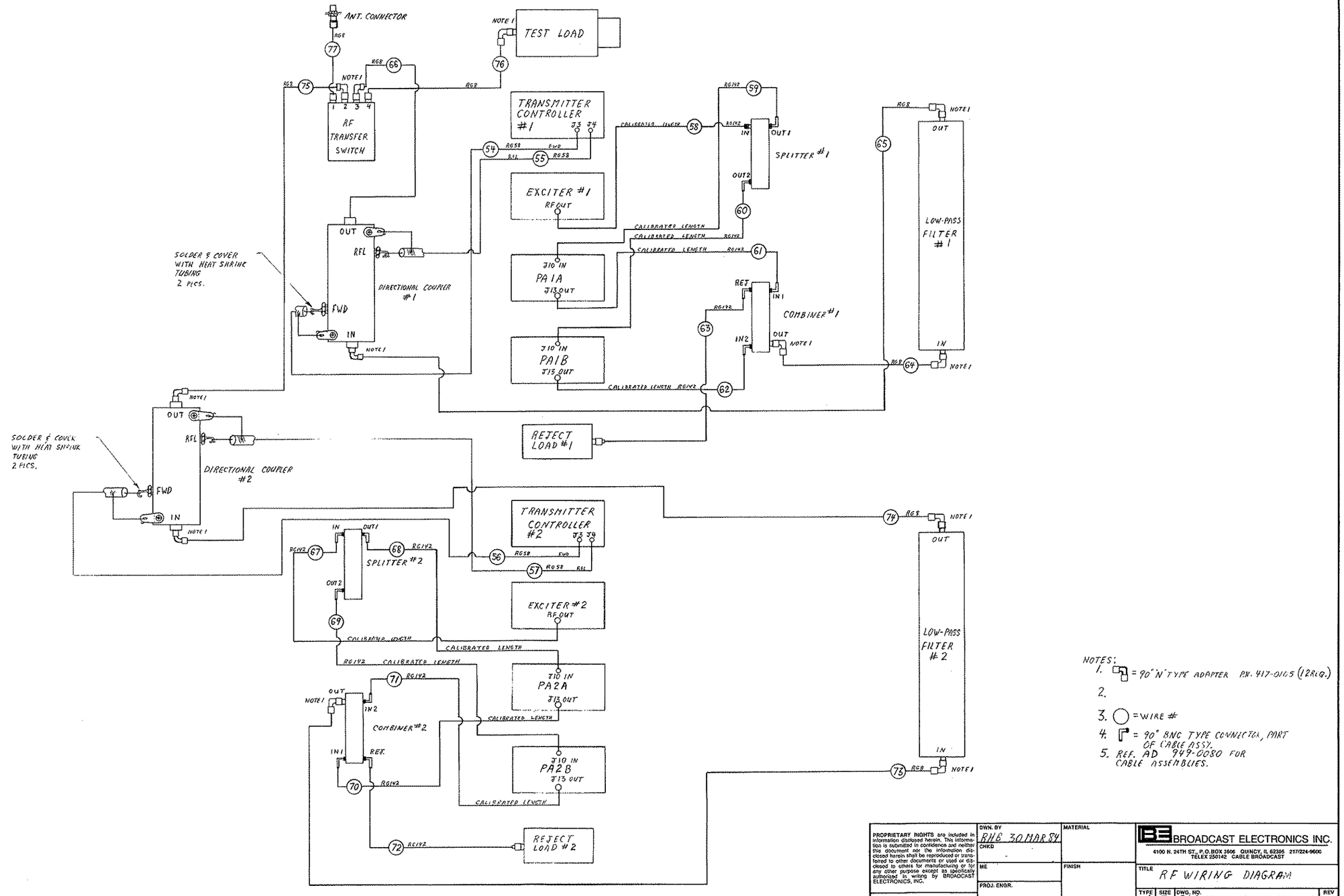
DWN. BY RHR 25APR.84
CHKD
ME
PROJ. ENGR.
MFG.
MATERIAL
FINISH
NEXT ASSY.

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

TITLE SYSTEM INTERCONNECT FUNCTIONAL WIRING DIAGRAM

TYPE W SIZE D DWG. NO. 909-0300-200,-204,-300,-304 REV G

MODEL FM300A/B SCALE — SHEET 3 OF 3



NOTES:
1. = 90° 'N' TYPE ADAPTER P/N. 417-0105 (12 REQ.)
2.
3. ◯ = WIRE #
4. = 90° BNC TYPE CONNECTOR, PART OF CABLE ASSY.
5. REF. AD 949-0080 FOR CABLE ASSEMBLIES.

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

DWN. BY RHE 30 MAR 84
CHKD
ME
PROJ. ENGR.
MFG.
MATERIAL
FINISH
NEXT ASSY.

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

TITLE RF WIRING DIAGRAM

TYPE W | SIZE D | DWG. NO. 909-2300-200,-204,-300,-304 | REV E

MODEL FM 300 M/A, FM 300B M/A | SCALE — | SHEET 2 OF 3

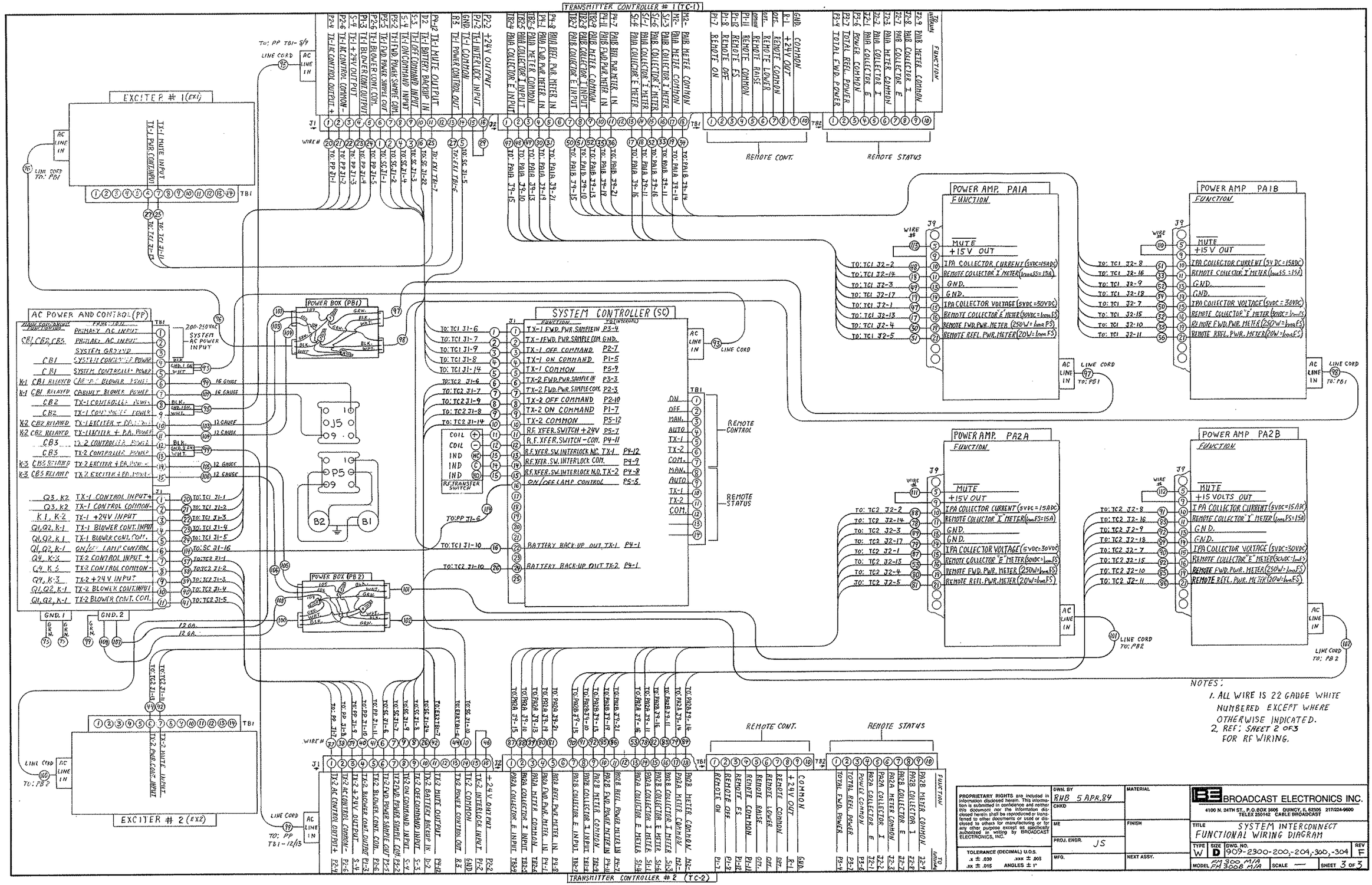

TRANSMITTER CONTROLLER # 1 (TC-1)
EXCITER # 1 (EX1)
AC POWER AND CONTROL (PP)
SYSTEM CONTROLLER (SC)
POWER BOX (PB1)
POWER BOX (PB2)
POWER AMP PA1A
POWER AMP PA1B
POWER AMP PA2A
POWER AMP PA2B
REMOTE CONT.
REMOTE STATUS
EXCITER # 2 (EX2)
TRANSMITTER CONTROLLER # 2 (TC-2)
NOTES:
1. ALL WIRE IS 22 GAUGE WHITE NUMBERED EXCEPT WHERE OTHERWISE INDICATED.
2. REF: SHEET 2 OF 3 FOR RF WIRING.
PROPRIETARY RIGHTS are included in information disclosed herein. This information is submitted in confidence and neither this document nor the information disclosed herein shall be reproduced or transferred to other documents or used or disclosed to others for manufacturing or for any other purpose except as specifically authorized in writing by BROADCAST ELECTRONICS, INC.
TOLERANCE (DECIMAL) U.O.S.
DWN. BY RHB 5 APR. 84
CHKD
ME
PROJ. ENGR. JS
MFG.
MATERIAL
FINISH
NEXT ASSY.
BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O. BOX 3606 QUINCY, IL 62305 217/224-9600
TELEX 250142 CABLE BROADCAST
TITLE SYSTEM INTERCONNECT FUNCTIONAL WIRING DIAGRAM
TYPE W SIZE D DWG. NO. 909-2300-200,-204,-300,-304 REV F
MODEL FM 300 M/A FM 300B M/A
SCALE —
SHEET 3 OF 3

TABLE OF CONTENTS

LIST OF TABLES

LIST OF ILLUSTRATIONS

SECTION I
PA THEORY OF OPERATION

1–1. INTRODUCTION.

1–2. The following text provides detailed theory of operation with supporting diagrams for the power amplifier (PA) stage used in the Broadcast Electronics B–series very–low–power line of FM transmitters. For purposes of definition, the text is divided into functional circuits.

1–3. GENERAL DESCRIPTION.

1–4. The PA stage is a totally self–contained solid–state wideband FM amplifier providing a continuously variable output from 50 to 250 Watts. The unit is mounted on slide rails for ease of maintenance.

1–5. The IPA consists of: 1) a power supply, 2) a voltage regulator circuit, and 3) an RF amplifier module (refer to Figure 1–1). Three front–panel indicators provide status information on module forward power, reflected power, and temperature conditions. The following text presents a detailed description of the IPA circuitry.

1–6. POWER SUPPLY.

1–7. The PA power supply consists of a conventional full–wave bridge–rectified supply, a capacitor filter and bleeder, and a series regulator. The transformer primary has multiple taps which must be preset to minimize over–voltage and consequent over–dissipation of the regulator devices. This allows optimum efficiency to be obtained through the supply.

1–8. The power supply operates from an input of 194 to 275V ac at 2 Amperes and produces the following potentials:

A. +40 Vdc @ 18 Amperes, filtered.

B. +40 Vdc @ 0.5 Amperes, filtered.

C. +28 Vdc @ 0.5 Amperes, regulated.

D. +15 Vdc @ 0.5 Amperes, regulated.

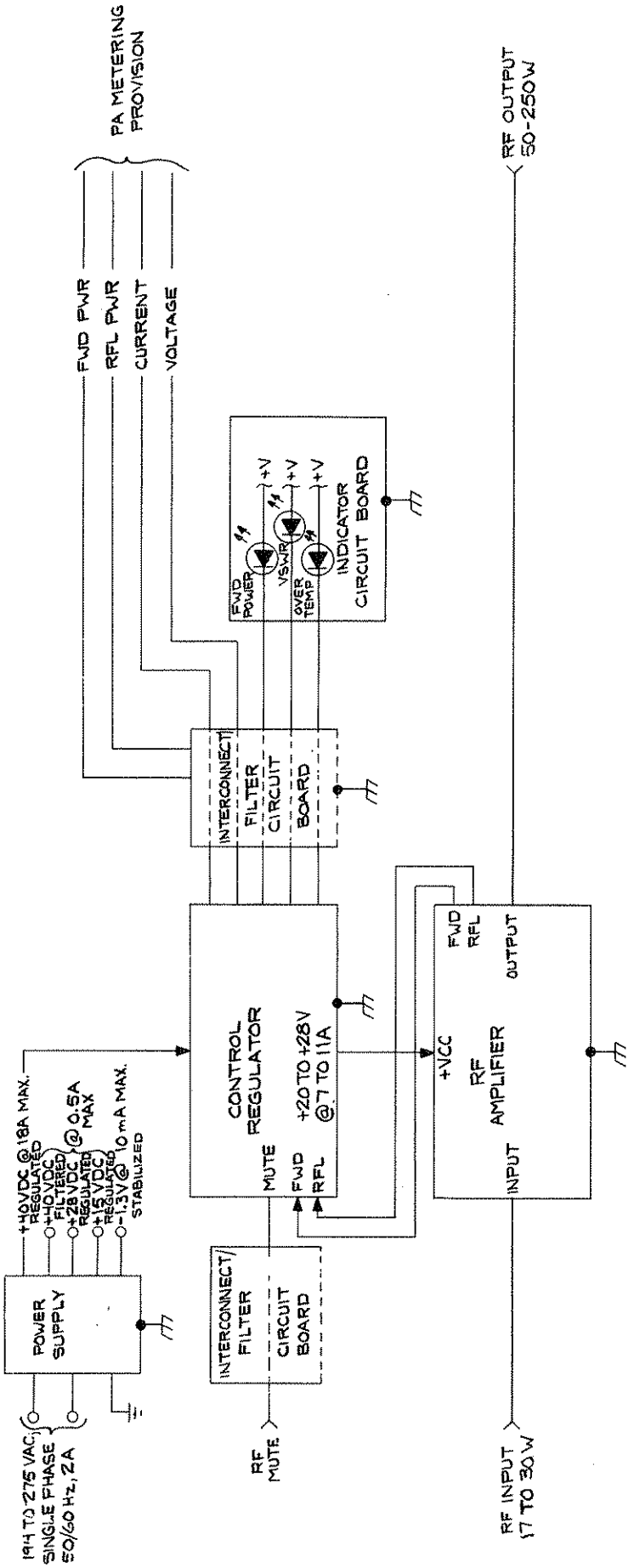
E. –1.3 Vdc @ 10 mA, stabilized.

1–9. INTERCONNECT/FILTER CIRCUIT BOARD.

1–10. The interconnection filter circuit board provides internal connections between circuit boards, provides RFI filtering for the PA status outputs, and provides interfacing for selected control inputs.

1–11. CONTROL CIRCUIT BOARD.

1–12. The control circuit board regulates the operation of the RF amplifier within preset limits dependent upon several parameters such as reflected power and forward power or dc voltage, control regulator heatsink temperature, dc current, and an external mute input. The control circuit board also contains amplifiers for the forward and the reflected directional couplers, the over–temperature circuit, and the PA metering circuitry.



597-0092-11

FIGURE 1–1. PA BLOCK DIAGRAM

1–13. The regulator and control circuitry is contained on a printed circuit board with the output pass transistors mounted on an attached heatsink. Multiple paralleled devices are used to enhance reliability. The regulator is capable of supplying 28 volts dc at 18 Amperes maximum. Voltage foldback will occur when excessive current is drawn or a high reflected power sample is evident. This protects the RF power transistors against output mismatch–induced damage. The drive signal or ac power must be momentarily removed to restore normal voltage from the regulator after foldback has occurred. A yellow front–panel mounted **VSWR** indicator indicates excessive reflected power into the output of the PA with possible voltage foldback occurring when illuminated.

1–14. **TEMPERATURE SENSOR.** A temperature sensor is bonded to the regulator heatsink. This protects the output pass transistors from over–dissipation in the event of a fault by latching off the regulator driver circuit upon excessive temperature. A red front–panel mounted **OVER TEMP** indicator indicates this condition when illuminated. Removal of dc power is required to reset the operation of the regulator after an over–temperature condition has occurred.

1–15. **RF AMPLIFIER.**

1–16. The RF circuitry consists of two bipolar RF power transistors conservatively operated as a push–pull class C amplifier. Wide–band transmission–line matching sections transform impedances on the printed circuit board while providing for balanced push–pull operation of the transistors. Stripline networks along with chip capacitors match the base and collector elements of both transistors to the transmission line sections. A stripline directional coupler provides forward and reflected power samples. The PA exhibits a minimum power gain of 10.

1–17. Normal PA stage operation is indicated by illumination of the green front–panel **FWD POWER** indicator (approximately 75 Watts of forward power). A high reflection is indicated by illumination of the yellow front–panel **VSWR** indicator (approximately 10 Watts of reflected power) with possible foldback of the control regulator. Removal of the dc or RF input to the PA stage is required to reset a foldback condition.

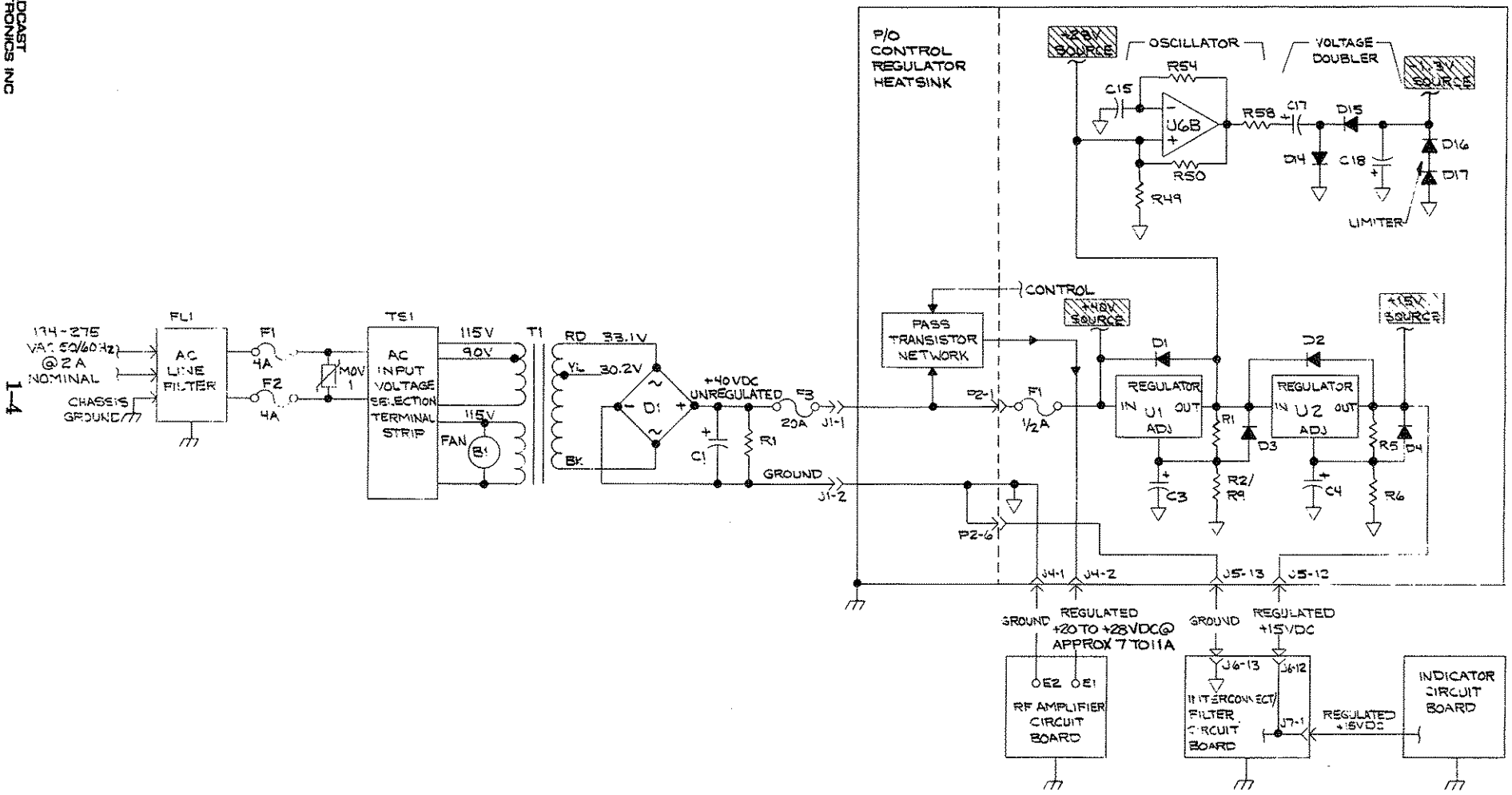
1–18. DETAILED DESCRIPTION.

1–19. **POWER SUPPLY.**

1–20. **PRIMARY CIRCUIT.** The PA power supply operates from an input of 194 to 275 volts ac at a maximum of 2 Amperes (see Figure 1–2). AC power is input through RFI filter FL1 which provides 55 dB of attenuation to frequencies of 10 MHz and above. A special power transformer with a tapped dual primary allows operation from both 50 and 60 Hz as well as a wide range of ac input voltages without component changes. Compensation for different input voltages is accomplished by wiring changes to terminal strip TS1 and a power transformer secondary tap. If the supply is ever operated from a single–line input such as 120 volts ac, the fuse in the common side of the ac input must be jumpered out of the circuit for safety reasons. Refer to schematic diagram D959–0263 for input potentials and required wiring changes.

1–21. The cooling fan is connected across one primary of transformer T1 and runs continuously whenever ac power is applied. Fuses F1 and F2 provide overload protection for the primary circuit and metal–oxide varistor MOV1 provides suppression of voltage surges in excess of 250 volts.

1–22. **SECONDARY CIRCUIT.** The tapped secondary of T1 produces an ac voltage which is full–wave rectified into a +40 volt supply. C1 provides filtering, R1 acts as a bleeder, and fuse F3 provides overload protection for the secondary circuit. The +40 volt dc output is routed to the control regulator assembly where it is distributed and re–regulated into several different potentials.



597-0092-12

FIGURE 1–2. PA POWER DISTRIBUTION

1–23. **Regulators.** The 40 volt dc potential is fed directly to the pass transistor network mounted on the control regulator heat sink and to the regulators on the control regulator circuit board through fuse F1. The pass transistor network outputs a regulated potential to the RF amplifier to maintain a constant RF output in response to control parameters measured by the control regulator circuit board.

1–24. The 40 volt input to U1 is regulated into a +28 volt source. The +28 volt source is re–regulated by U2 into a +15 volt source. Regulators U1 and U2 are both three–terminal adjustable positive regulators containing internal thermal–overload protection and short–circuit current limiting features. Further protection for the regulators is provided by diodes D3 and D4, each which protects its respective regulator from a reverse polarity potential applied to the output and diodes D1 and D2, each which protects its respective regulator from a short circuit applied to the input.

1–25. **Negative 1.3 Volt Supply.** A negative 1.3 volt potential required for the metering circuit is developed from the output of U6B which is configured as an oscillator. The sinusodial output of U6B is rectified by a voltage doubler consisting of C17, D14, and D15. The output of this supply is stabilized by diodes D16 and D17, each which provides a constant 0.65 volt drop to maintain the output at a constant –1.3 volts.

1–26. **CONTROL REGULATOR.**

1–27. The control regulator consists of a circuit board and a heatsink assembly which forms part of a closed loop with the RF amplifier. Jumper–plug programming allows feedback selection of either dc voltage and VSWR or forward RF power and VSWR for feedback (see Figure 1–3).

1–28. The regulator output voltage is established by a precision voltage drop, a series string of resistors, and the output voltage adjust control (R17). For a regulator output voltage of 28 volts, R17 must be adjusted to 14.8 volts on the wiper.

1–29. P17 allows selection of a dc voltage as a regulator reference or an external reference. Resistor R20 provides an input to error amplifier U5A if P17 is inadvertently removed. The potential from P17 is applied to the non–inverting input to error amplifier U5A. Error amplifier U5A compares this input to the regulator output which is applied through a voltage divider to the inverting input. If the regulator output decreases, the output of U5A will increase. If the regulator output increases, the output of U5A will decrease. This control voltage is routed through steering diode D9 and level–shift diode D10 to a constant–current source.

1–30. Q1 and Q2 form a constant–current source which produces a stable current independent of the 40 volt regulator supply. The constant–current generator assures that the current through R47 remains constant and independent of the foldback, mute, or over temperature circuits connected in parallel to the mute line. Diode D13 prevents an excessive voltage applied to the mute line from exceeding a limit which might damage Q1.

1–31. Regulator drive is applied to the base of Q1 which in turn drives regulator pass transistors Q2, Q3, and Q4. The dc supply for the regulator drive and the pass transistors is routed directly from the power supply high current 40 volt source. A current balancing network for the pass transistors is provided by the output resistor network. The output of the output resistor network is applied to the RF amplifier load.

1–32. Either forward and reflected power feedback or dc voltage and reflected power feedback may be selected with jumper P18. When P18 is set to dc, a dc sample of the output voltage will be applied to the inverting input of U5A through R31 and R34. Resistor R24 provides an input to error amplifier U5A if P17 is inadvertently removed. A reflected power control signal will be added through diode D6 when the reflection is great enough to exceed the 0.7 volt drop across D6, approximately 15 volts at R22.

1–33. When P18 is set to **FWD PWR**, a dc potential representative of the PA forward power level will be applied to the inverting input of U5A. Reflected power control will be added through Diode D5 when the reflection is great enough to exceed the 0.7 volt drop across D5.

1–34. **CURRENT FOLDBACK.** The output resistor network and the foldback resistor network function together to provide the current foldback action when the output current reaches 18 Amperes. If the regulator output is at the correct level, R51 will be essentially out of the circuit as there will be practically no current flow through the resistor. As the voltage across R59, R60, and R62 increases due to current increase, the voltage summed at the junction of R52 and R53 will increase with respect to the emitter of Q4. As Q4 is biased on, current will begin to flow through R51 which saturates Q4. This action grounds the mute line which removes the dc output. DC power must be interrupted to reset the foldback condition or removal of RF drive is required.

1–35. **METERING.** Current through the pass transistor output resistor network is used to generate the voltage used to meter output current. The transistor emitter connections are summed into the non–inverting input of U7A and the output side of the emitter resistor is connected to the inverting input of differential amplifier U7A. The current bal control (R72) adjusts the offset on U7A so that with zero current, the output will be zero. The output of U7A is applied to U7B which acts as a meter driver. R76 allows adjustment of the stage calibration. The –1.3 volt supply is connected to the –Vcc connection of U7B so that a meter connected to U7B will properly register zero with no input. This below–ground reference is required with zero volt operation of the operational amplifier.

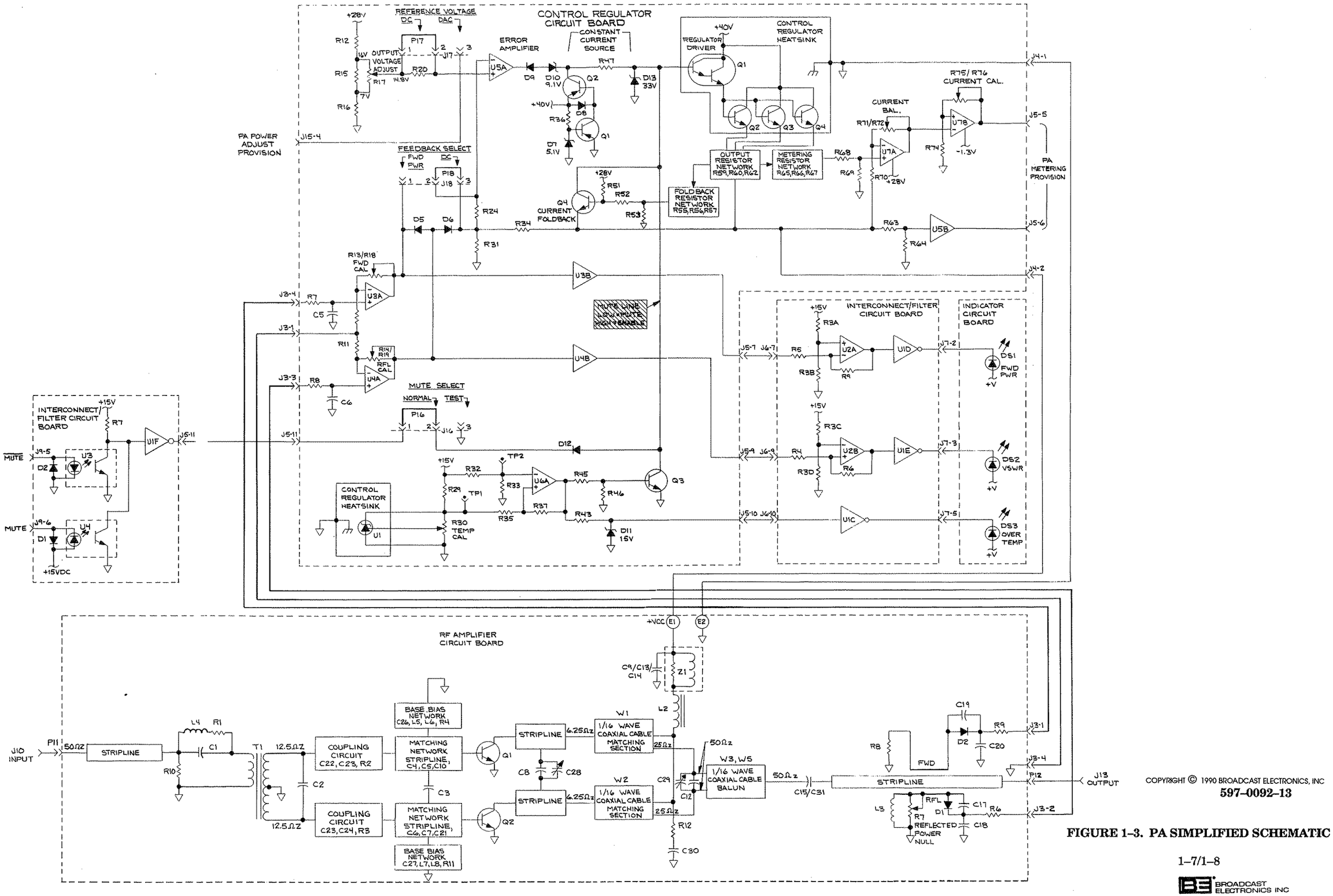
1–36. **Forward Amplifier.** The rectified output of the forward port of the directional coupler is applied to the forward meter amplifier of the control regulator circuit board. Non–inverting amplifier U3A has a high input impedance and high gain. The exact gain of the amplifier is adjusted by potentiometer R18. RF is filtered from the signal before entering the forward power meter amplifier by R7 and C5.

1–37. **Reflected Amplifier.** The reflected meter amplifier (U4A) works in a manner similar to the forward amplifier section except that the voltage gain of this amplifier is higher than the forward amplifier which compensates for the differences in the coupling factor of the directional coupler sampling lines. RF is filtered from the signal before entering the reflected amplifier by R8 and C6. U4A is calibrated by potentiometer R19.

1–38. The 15 volt full–scale output of U3A and U4A are routed through 3:1 dividers and voltage follower stages U3B and U4B to amplifiers U2A and U2B on the interconnect filter circuit board. The forward power signal is routed through comparator U1D and the reflected power output is routed through comparator U1E and applied to the front panel **VSWR** indicator. This indicator illuminates when 10 Watts of power is reflected back into the PA from the load. The **FWD PWR** indicator illuminates when the forward power is 50 Watts or greater.

1–39. **REMOTE PA MUTE.** Provisions exist which allow the PA stage RF output to be externally muted using either a positive voltage or ground connection for control.

1–40. The mute input is applied to J9–5 if a positive voltage is used for muting or J9–6 if a ground is used for muting. When an input is applied, the optical coupler (U3 or U4) will pull the input to inverter U1F which inhibits the drive applied to regulator driver Q1 and mutes the PA RF output. The mute select jumper (P16) must be in the normal position to allow external muting. Diode D12 steers the input to prevent external devices from loading the mute line.



597-0092-13

FIGURE 1–3. PA SIMPLIFIED SCHEMATIC

1–41. **TEMPERATURE SENSOR.** An electronic temperature sensing circuit consisting of U1 and U6A senses the control regulator heatsink temperature. If an over–temperature condition occurs, dc output will automatically be removed to prevent damage to the RF output transistors. Under normal conditions, the **OVER TEMP** indicator (DS3) on the front panel will remain off. As a visual indication that an over–temperature condition exists, the **OVER TEMP** indicator will illuminate.

1–42. Temperature sensor U1 is mounted on and is thermally coupled to the control regulator heatsink. U1 functions much as if it were a zener diode with a calibrated positive temperature coefficient. The sensor is calibrated by the **TEMP CAL** control (R30) so that the voltage between test point TP1 at the non–inverting input to U6A and ground is set to +2.98 volts when the heatsink temperature is +25 degrees Celsius and +2.73 volts at 0 degrees Celsius. U6A operates as a voltage comparator with +3.61 volts at test point TP2. This corresponds to an 88 degree Celsius comparison threshold.

1–43. At normal heatsink temperatures, the voltage output of U6A will hold Q3 biased off. As the voltage from U1 increases with heat rise at the rate of 10 millivolts per degree Celsius, U6A will trigger at the point preset by R30 and bias Q3 into conduction. Q3 will inhibit the drive applied to the regulator driver (Q1) and inhibit RF output.

1–44. In this manner, the PA is allowed to operate until a predetermined temperature is reached, then the RF output will be inhibited. An over–temperature condition is signaled by illumination of the **OVER TEMP** indicator (DS3) through inverter U1C. Zener diode D11 limits the input to U1C to a safe operating level if U6A should internally short. The PA can be restored to operation after the temperature cools by interrupting the dc supply.

1–45. **RF AMPLIFIER.**

1–46. The RF amplifier is a broadband stripline–matched amplifier covering the FM broadcast band (see Figure 1–3). By adjusting the RF drive and/or the dc supply voltage, the RF power is variable over a range of 50 to 250 Watts.

1–47. The dc power input and the directional coupler outputs are connected to the circuit board through the chassis with feed–through capacitors to prevent RF interference. All wiring connects to the PA assembly with plugs to aid in maintenance.

1–48. **POWER AMPLIFIER.** Approximately 17 to 30 Watts of drive is input to the 50 Ohm primary of transformer T1 through a section of stripline. R10 acts as a swamping resistor to improve the input match and capacitor C1 tunes out the series reactance in the primary circuit of transformer T1. The series combination of L4 and R1 effectively lowers the Q of the input circuit to allow a broadband match.

1–49. Transformer T1 provides a 4:1 step–down in impedance from 50 Ohms to two 12.5 Ohm sources which are 180° out–of–phase. The output of T1 is capacitively coupled by a low–Q circuit to a matching network which further reduces the 12.5 Ohm impedance to approximately 1.5 Ohms to match the base impedance of Q1 and Q2. Base bias networks stabilize gain while C2 and C3 function as lumped matching elements in the impedance transformation. Capacitors C4/C5 and C6/C7 cancel out the inductive base reactance of Q1 and Q2.

1–50. Q1 and Q2 are NPN RF power transistors operated as a class C push–pull stage. The collector of each transistor feeds a stripline section which acts as a broadband impedance step–up transformer to convert the 0.5 Ohm collector impedance of each transistor to 6.25 Ohms. Capacitors C8 and C28 assist in the impedance transformation. Parallel connected inputs and series connected outputs of 25 Ohm coaxial cable raise the 6.25–6.25 Ohm push–pull outputs up to the 25–25 Ohm level. The series combination of R12 and C30 assure stable amplifier operation.

1–51. A coaxial cable balance–to–unbalance (balun) transformer converts the two 25 Ohm impedances to a single 50 Ohm unbalanced RF output. Capacitors C12 and C29 provide balanced transistor operation and paralleled capacitors C15/C31 block dc in the RF output line.

1–52. **DIRECTIONAL COUPLER.** The directional coupler provides two dc signals, each signal obtained by rectifying a portion of the RF output signal, coupled from a transmission line section etched into the circuit board. Due to the polarity of the two samples, one signal will be proportional to the forward traveling RF wave and the other signal will be proportional to the reflected traveling RF wave.

1–53. **Forward Directional Coupler Port.** The forward port of the directional coupler is broadbanded across the FM broadcast band. The voltage sample obtained is rectified by diode D2 and filtered by a PI–section filter. C19 improves the match due to the presence of D2. This output is routed to the control regulator for use in the control and metering circuits.

1–54. **Reflected Directional Coupler Port.** The reflected port of the directional coupler is broadbanded across the FM broadcast band. The voltage sample obtained is rectified by diode D1 and filtered by a PI–section filter. C27 improves the match due to the presence of D1. Inductor L3 in parallel with variable resistor R7 improves the linearity of the coupler across the band. R7 is adjusted to maximize directivity at the frequency of operation. This output is routed to the control regulator for use in the control and metering circuits.

SECTION II
PA MAINTENANCE

2–1. INTRODUCTION.

2–2. This section provides PA maintenance information for the Broadcast Electronics B–series very–low–power line of FM transmitters.

2–3. SAFETY CONSIDERATIONS.

2–4. All transmitters contain high voltages and currents which, if regarded carelessly, could be fatal. Each transmitter has many built–in safety features, however good judgement, care, and common sense are the best accident preventives. The maintenance information contained in this section should be performed only by trained and experienced maintenance personnel.

2–5. It is very dangerous to attempt to make measurements or replace components with power energized, therefore such actions are not recommended. AC power to the entire cabinet may be disconnected by operating the transmitter front–panel circuit breakers to off.

2–6. MAINTENANCE.

WARNING

WARNING

BEFORE ATTEMPTING TRANSMITTER MAINTENANCE ASSURE THE RMT/LCL SWITCH(ES) IS OPERATED TO LCL. THERE ARE THREE SWITCHES ON THE MAIN/ ALTERNATE TRANSMITTERS.

WARNING

WARNING

NEVER OPEN THE EQUIPMENT UNLESS ALL TRANSMITTER PRIMARY POWER IS DISCONNECTED.

2–7. The power amplifier maintenance philosophy consists of preventative maintenance such as cleaning applied to the equipment to forestall future failures and second level maintenance consisting of procedures required to restore the equipment to operation after a fault.

2–8. ADJUSTMENTS.

WARNING

WARNING

NEVER OPEN THE EQUIPMENT UNLESS ALL TRANSMITTER PRIMARY POWER IS DISCONNECTED.

2–9. The following procedures present information required to adjust all controls in the PA stage. These adjustments are factory preset and therefore will require readjustment only if components on the individual circuit boards have been replaced. Adjustments for the control regulator circuit board are presented first, followed by an adjustment procedure for the RF amplifier circuit board. The adjustments may be accessed by extending the PA chassis forward on its slide rails out of the rack and removing the top cover.

2–10. **OUTPUT VOLTAGE ADJUST.** To adjust output voltage control R17 on the control regulator circuit board, proceed as follows.

2–11. **Required Equipment.** The following equipment is required to adjust output voltage adjust control R17.

A. Flat blade screwdriver, 1/4 inch tip.

B. Insulated adjustment tool, flat tip (BE P/N 407–0083).

C. Digital voltmeter (Fluke 75 or equivalent).

2–12. **Procedure.** To adjust the control, proceed as follows:

WARNING ***DISCONNECT ALL TRANSMITTER PRIMARY POWER BEFORE PROCEEDING.***

WARNING

2–13. Disconnect primary power.

2–14. Connect the voltmeter between J4 pin 1 and chassis ground.

2–15. Apply power and operate the PA.

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

WARNING

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

WARNING

2–16. Using the insulated adjustment tool, adjust **V OUT** control R17 to obtain a voltmeter indication per the following list.

MODEL	VOLTAGE
FM–100B	+20V DC
FM–250B/FM–300B	+28V DC

WARNING ***DISCONNECT ALL TRANSMITTER PRIMARY POWER BEFORE PROCEEDING.***

WARNING

2–17. Disconnect primary ac power.

2–18. Remove the test equipment.

2–19. **FWD CALIBRATION.** This adjustment is required if the **FWD POWER** indicator threshold is incorrect or if either the RF amplifier or control regulator assemblies are replaced. To adjust **FWD CAL** control R18 on the control regulator circuit board, proceed as follows.

2–20. **Required Equipment.** The following equipment is required to adjust **FWD** calibration control R18.

A. Flat blade screwdriver, 1/4 inch tip.

B. Insulated adjustment tool, flat tip (BE P/N 407–0083).

C Digital voltmeter (Fluke 75 or equivalent).

D. Test load and connecting cable (50 Ohm non–inductive, 300 Watt minimum).

E. Calibrated in–line wattmeter and connecting cable (Bird 43 or equivalent with 250 Watt element).

2–21. **Procedure.** To adjust the control, proceed as follows:

2–22. Refer to the preceding text and perform the OUTPUT VOLTAGE ADJUST procedure.

WARNING ***DISCONNECT ALL TRANSMITTER PRIMARY POWER BEFORE PROCEEDING.***

WARNING

2–23. Disconnect primary power.

2–24. Remove the PA top–panel and disconnect the cable from the RF amplifier output receptacle.

2–25. Connect the non–inductive 250 Watt 50 Ohm test load to RF amplifier output receptacle through the in–line wattmeter. Adjust the wattmeter to measure forward power.

2–26. Connect the voltmeter between J9–17 on the PA interconnect filter circuit board and chassis ground.

2–27. Remove the exciter top–panel.

2–28. Operate the exciter **NORM–EXT** switch on the power supply/control assembly to NORM. Replace the exciter top–panel.

2–29. Apply power and operate the PA.

2–30. Depress the exciter **FWD** switch and record the exciter RF output power: _____ Watts.

2–31. Using the exciter **R.F. POWER OUTPUT ADJ** control, obtain a wattmeter indication per the following list.

MODEL	WATTS
FM–100B	100W
FM–250B	250W
FM–300B	250W

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

WARNING

WARNING *USE AN INSULATED TOOL FOR ADJUSTMENT.*

WARNING

2–32. Using the insulated adjustment tool, adjust **FWD** calibration control R18 to obtain a voltmeter indication of +5 volts dc.

2–33. Readjust the exciter RF output power to the level recorded in the preceding text.

WARNING *DISCONNECT ALL TRANSMITTER PRIMARY POWER BEFORE PROCEEDING.*

WARNING

2–34. Disconnect primary ac power.

2–35. Remove the test equipment, operate the exciter **NORM–EXT** switch on the control assembly to **EXT**, and reconnect the cable to the RF amplifier output receptacle.

2–36. **RFL CALIBRATION.** This adjustment is required if 1) the **VSWR** indicator threshold is incorrect, 2) the VSWR foldback limit is incorrect, or 3) if either the RF amplifier or the control regulator assemblies are replaced. To adjust **RFL CAL** control R19 on the control regulator circuit board, proceed as follows.

2–37. **Required Equipment.** The following equipment is required to adjust **RFL** calibration control R19.

A. Flat blade screwdriver, 1/4 inch tip.

B. Insulated adjustment tool, flat tip (BE P/N 407–0083).

C. Digital voltmeter (Fluke model 75 or equivalent).

D. Two 150 watt, non–inductive, 50 Ohm test loads and connecting cables.

E. BNC Tee (Pomona 3285).

F. Calibrated in–line wattmeter and connecting cable (Bird 43 or equivalent with 100 watt element).

2–38. **Procedure.** To adjust the control, proceed as follows:

WARNING *DISCONNECT ALL TRANSMITTER PRIMARY POWER BEFORE PROCEEDING.*

WARNING

NOTE *REFLECTED POWER NULL CONTROL R7 ON THE RF AMPLIFIER CIRCUIT BOARD MUST BE ADJUSTED BEFORE PERFORMING THE FOLLOWING PROCEDURE (SEE REFLECTED POWER NULL).*

NOTE

2–39. Disconnect primary ac power.

2–40. Remove the exciter top–panel.

2–41. Operate the **NORM–EXT** switch on the power/supply control assembly to **NORM.**

2–42. Replace the exciter top–panel and remove the PA top–panel.

2–43. Disconnect the cable from the RF amplifier output receptacle and connect the BNC tee to the receptacle.

2–44. Attach one test load to the BNC tee. Attach the second test load to the BNC tee through the in–line wattmeter. Adjust the wattmeter to measure forward power.

2–45. Connect the voltmeter between J9–20 on the PA interconnect filter circuit board and chassis ground.

2–46. Apply power and operate the transmitter.

2–47. Depress the exciter **FWD** switch and record the RF output power _____ Watts.

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

WARNING

WARNING *USE AN INSULATED TOOL FOR ADJUSTMENT.*

WARNING

2–48. Using the insulated adjustment tool, adjust the exciter R.F. POWER OUTPUT ADJ control clockwise to obtain the output power listed below and adjust **RFL** calibration control R19 to obtain the voltmeter indication per the following list.

	FM–100B	**FM–250B/FM–300B**
OUTPUT POWER	50 WATTS	75 WATTS
VOLTAGE	3.6 VDC	4.75 VDC

WARNING *DISCONNECT ALL TRANSMITTER PRIMARY POWER BEFORE PROCEEDING.*

WARNING

2–49. Adjust the exciter **R.F. POWER OUTPUT ADJ** control to obtain the meter indication recorded in the preceding step.

2–50. Disconnect primary ac power.

2–51. Remove the test equipment, operate the **NORM–EXT** switch on the control assembly to EXT, and reconnect the PA output cable.

2–52. **TEMP CALIBRATION.** This adjustment is required only if temperature sensor U1 is replaced. To adjust **TEMP** calibration control R30 on the control regulator circuit board, proceed as follows.

2–53. **Required Equipment.** The following equipment is required to adjust **TEMP** calibration control R30.

A. Flat blade screwdriver, 1/4 inch tip.

B. Insulated adjustment tool, flat tip (BE P/N 407–0083).

C. Digital voltmeter (Fluke 75 or equivalent).

D. Fluke 80T–150 temperature probe or equivalent Celcius indicating probe.

2–54. **Procedure.** To adjust the control, proceed as follows:

WARNING *DISCONNECT ALL TRANSMITTER PRIMARY POWER BEFORE PROCEEDING.*

WARNING

2–55. Disconnect primary ac power.

2–56. Attach the temperature probe to the control regulator heatsink assembly near U1.

2–57. Connect the probe to the voltmeter. Record the temperature indication_____ °C, add 273, and divide by 100:

FORMULA: $\left(\frac{°C + 273}{100} = \text{VOLTAGE}\right)$.

2–58. Connect the voltmeter between TP1 and ground on the control regulator circuit board.

2–59. Apply power and operate the transmitter.

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

WARNING

WARNING *USE AN INSULATED TOOL FOR ADJUSTMENT.*

WARNING

2–60. Using the insulated adjustment tool, adjust **TEMP** calibration control R30 to obtain an indication equal to the result obtained in the preceding text.

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

WARNING *DISCONNECT ALL TRANSMITTER PRIMARY POWER BEFORE PROCEEDING.*

WARNING

2–61. Disconnect primary ac power.

2–62. Remove the test equipment.

2–63. **CURRENT BALANCE.** To adjust **CURRENT BAL** control R72 on the control regulator circuit board, proceed as follows.

2–64. **Required Equipment.** The following equipment is required to adjust **CURRENT BAL** control R72.

A. Flat blade screwdriver, 1/4 inch tip.

B. Insulated adjustment tool, flat tip (BE P/N 407–0083).

C. Digital voltmeter (Fluke 75 or equivalent).

2–65. **Procedure.** To adjust the control, proceed as follows:

WARNING *DISCONNECT ALL TRANSMITTER PRIMARY POWER BEFORE PROCEEDING.*

WARNING

2–66. Disconnect primary ac power.

2–67. Connect the voltmeter between pin 7 of U7 and chassis ground.

2–68. Apply power and operate the transmitter.

WARNING

MAINTENANCE WITH POWER ENERGIZED IS ALWAYS CONSIDERED HAZARDOUS AND THEREFORE CAUTION SHOULD BE OBSERVED. DO NOT TOUCH COMPONENTS WITHIN THE PA WHEN POWER IS ENERGIZED.

WARNING

WARNING

USE AN INSULATED TOOL FOR ADJUSTMENT.

WARNING

2–69. Using the insulated adjustment tool, adjust **CURRENT BAL** control R72 to obtain a voltmeter indication of 0.00 volts dc.

WARNING

DISCONNECT ALL TRANSMITTER PRIMARY POWER BEFORE PROCEEDING.

WARNING

2–70. Disconnect primary ac power.

2–71. Remove the test equipment.

2–72. **CURRENT CAL** control R76 must now be adjusted. Refer to the following text.

2–73. **CURRENT CALIBRATION.** This adjustment is required if either the RF amplifier or control regulator circuit board is replaced. To adjust **CURRENT CAL** control R76 on the control regulator circuit board, proceed as follows.

NOTE

CURRENT BAL CONTROL R72 ON THE CONTROL REGULATOR CIRCUIT BOARD MUST BE ADJUSTED BEFORE CURRENT CAL CONTROL R76 (REFER TO THE PRECEDING PROCEDURE).

NOTE

2–74. **Required Equipment.** The following equipment is required to adjust **CURRENT CAL** control R76.

A. Flat blade screwdriver, 1/4 inch tip.

B. Insulated adjustment tool, flat tip (BE P/N 407–0083).

C. Digital voltmeter (Fluke 75 or equivalent).

D. Resistor, 5 Ohm ±5%, 160 Watt, Wire Wound (BE P/N 130–0005).

2–75. **Procedure.** To adjust the control, proceed as follows:

WARNING

DISCONNECT ALL TRANSMITTER PRIMARY POWER BEFORE PROCEEDING.

WARNING

2–76. Disconnect primary ac power.

2–77. Unplug P4–1 and P4–2 from J4–1 and J4–2.

2–78. Temporarily connect the 5 Ohm, 160 Watt resistor from J4–1 to J4–2.

2–79. Connect the voltmeter between pin 7 of U7 and chassis ground.

2–80. Apply power and operate the transmitter.

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

WARNING

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

WARNING

2–81. Using the insulated adjustment tool, adjust **CURRENT CAL** control R76 to obtain a voltmeter indication of +1.85 volts dc for FM–250B/FM–300B transmitters and +1.32 volts for an FM–100B transmitter.

WARNING ***DISCONNECT ALL TRANSMITTER PRIMARY POWER BEFORE PROCEEDING.***

WARNING

2–82. Disconnect primary ac power.

2–83. Remove the test equipment and reconnect P4–1 and P4–2 to J4–1 and J4–2.

2–84. **REFLECTED POWER NULL.** This control is factory calibrated and sealed during final test. Adjustment in the field is not normally required unless repairs have been made to the PA directional coupler circuitry, the RF amplifier circuit board has been replaced, or the transmitter operating frequency has been changed. If it is certain adjustment is necessary, proceed as follows.

2–85. **Required Equipment.** The following equipment is required to adjust reflected power null control R7.

A. Flat blade screwdriver, 1/4 inch tip.

B. Insulated adjustment tool, flat tip (BE P/N 407–0083).

C. Digital voltmeter (Fluke 75 or equivalent).

D. Test load and connecting cable (50 Ohm non–inductive, 250 Watt minimum).

E. Calibrated in–line wattmeter and connecting cable (Bird 43 with 250 Watt element or equivalent).

2–86. **Procedure.** To adjust the control, proceed as follows:

WARNING ***DISCONNECT ALL TRANSMITTER PRIMARY POWER BEFORE PROCEEDING.***

WARNING

2–87. Disconnect primary ac power.

2–88. Disconnect the transmitter load and connect the test load to the **PA OUTPUT** connector (J13) through the wattmeter. Adjust the wattmeter to indicate forward power.

2–89. Carefully prop the RF amplifier module in the cooling air path with R7 accessible through the hole provided in the module cover.

2–90. Connect the voltmeter between J9–20 on the PA interconnect filter circuit board and chassis ground.

2–91. Apply power and operate the transmitter.

2–92. Depress the exciter front–panel **FWD** switch and record the exciter RF power output: _____Watts.

2–93. Adjust the exciter **R.F. POWER OUTPUT ADJ** control to obtain a wattmeter indication per the following list.

MODEL	WATTS
FM–100B	100W
FM–250B	250W
FM–300B	250W

WARNING ***MAINTENANCE WITH POWER ENERGIZED IS ALWAYS CONSIDERED HAZARDOUS AND THEREFORE CAUTION SHOULD BE OBSERVED. DO NOT TOUCH COMPONENTS WITHIN THE PA WHEN POWER IS ENERGIZED. EVEN THOUGH LOW VOLTAGES ARE USED THROUGHOUT THE PA, IT IS POSSIBLE TO RECEIVE PAINFUL RF BURNS FROM THE RF AMPLIFIER.***

WARNING

WARNING

WARNING

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

WARNING

2–94. Using the insulated adjustment tool, adjust reflected power null control R7 located on the RF amplifier circuit board to obtain a minimum voltmeter indication.

2–95. Readjust the exciter RF power output to the level recorded in the preceding text.

WARNING ***DISCONNECT ALL TRANSMITTER PRIMARY POWER BEFORE PROCEEDING.***

WARNING

2–96. Disconnect primary ac power.

2–97. Remove the test equipment and reconnect the transmitter load.

2–98. **RF AMPLIFIER TUNING.** The following procedure is part of the TRANSMITTER FREQUENCY CHANGE PROCEDURE presented in PART I SECTION V. The following adjustment is required only if the transmitter operating frequency is changed. To tune the PA RF amplifier, proceed as follows.

2–99. **Required Equipment.** The following equipment is required to tune the PA RF amplifier.

A. Flat blade screwdriver, 1/4 inch tip.

B. No. 1 Phillips Screwdriver, 4 inch (10.16 cm) blade.

C. Insulated adjustment tool, flat tip (BE P/N 407–0083).

D. Test load and connecting cable (50 Ohm non–inductive 300 Watt minimum).

E. Calibrated in–line wattmeter and connecting cable (Bird Model 43 with 250 element or equivalent).

F. Spectrum analyzer (Tektronix model 492 spectrum analyzer or equivalent capable of displaying frequencies at twice the transmitter frequency of operation).

2–100. **Procedure.** To tune the PA RF amplifier, proceed as follows:

WARNING ***DISCONNECT ALL TRANSMITTER PRIMARY POWER BEFORE PROCEEDING.***

WARNING

2–101. Disconnect all transmitter primary power before proceeding.

2–102. Disconnect the cable from the **PA OUTPUT** receptacle and connect the test load to the **OUTPUT** receptacle through the in–line wattmeter. Adjust the wattmeter to indicate forward power.

2–103. Connect the spectrum analyzer to the in–line wattmeter RF sample output.

2–104. Remove the cover from the PA RF amplifier and carefully place the amplifier in the cooling air path with capacitors C28 and C29 accessible from the top of the chassis.

2–105. Energize the transmitter primary ac power and operate the PA.

2–106. Tune the PA RF amplifier as follows:

A. Observe the wattmeter and spectrum analyzer indications.

WARNING ***IT IS POSSIBLE TO RECEIVE SERIOUS RF BURNS FROM THE AMPLIFIER. DO NOT ADJUST THE AMPLIFIER MODULE WITH THE COVER REMOVED AND POWER ENERGIZED.***

WARNING

WARNING ***DEENERGIZE PRIMARY POWER BEFORE PROCEEDING.***

WARNING

B. Disconnect all transmitter primary power.

WARNING ***THE RF AMPLIFIER OPERATES AT HIGH TEMPERTURES. DO NOT TOUCH ANY COMPONENTS ON THE RF AMPLIFIER.***

WARNING

C. Adjust capacitor C28.

D. Energize the transmitter primary ac power and operate the PA.

E. Repeat steps A through D and adjust tuning control C28 for a maximum power output level and a minimum harmonic level.

F. Repeat steps A through D and adjust tuning control C29 for a maximum power output level and a minimum harmonic level.

2–107. Once peak performance is obtained from the RF amplifier, ensure the PA power output level is approximately equal to the value recorded in the factory final test data sheets. If required, adjust the exciter **RF POWER OUTPUT ADJ** control to obtain a satisfactory PA output power indication.

WARNING ***DISCONNECT ALL TRANSMITTER PRIMARY POWER BEFORE PROCEEDING.***

WARNING

2–108. Disconnect all transmitter primary power before proceeding.

2–109. Disconnect all test equipment, replace the RF amplifier cover, and reconnect the cable to the **PA OUTPUT** receptacle.

2–110. **TROUBLESHOOTING.**

WARNING ***NEVER OPEN THE EQUIPMENT UNLESS ALL TRANSMITTER PRIMARY POWER IS DISCONNECTED.***

WARNING

2–111. Most troubleshooting consists of visual checks. Because of the voltages and high currents in the transmitter, it is considered hazardous to work with power energized. Therefore, the various transmitter indicators (meters, LEDs, fuses, and circuit breakers) should be used to isolate the malfunction to one specific area.

2–112. If difficulties are encountered and the PA is suspected as faulty, the first step in troubleshooting should determine whether the exciter, the RF amplifier, the control regulator, the power supply, or the load is at fault. A high VSWR condition or an over–heating condition will cause the control regulator to limit RF output to prevent damage to the PA stage. The observable symptom would be loss of RF power. However, as the control regulator and the RF amplifier are both components of a closed loop, either circuit could cause this symptom. Complete loss of RF output would indicate power supply problems.

2–113. As a first check, the RF input level to the PA stage should be checked and adjusted as required. Next the PA load should be checked. If neither the input level or the output load is at fault, subsequent troubleshooting should determine which circuit is at fault.

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

WARNING

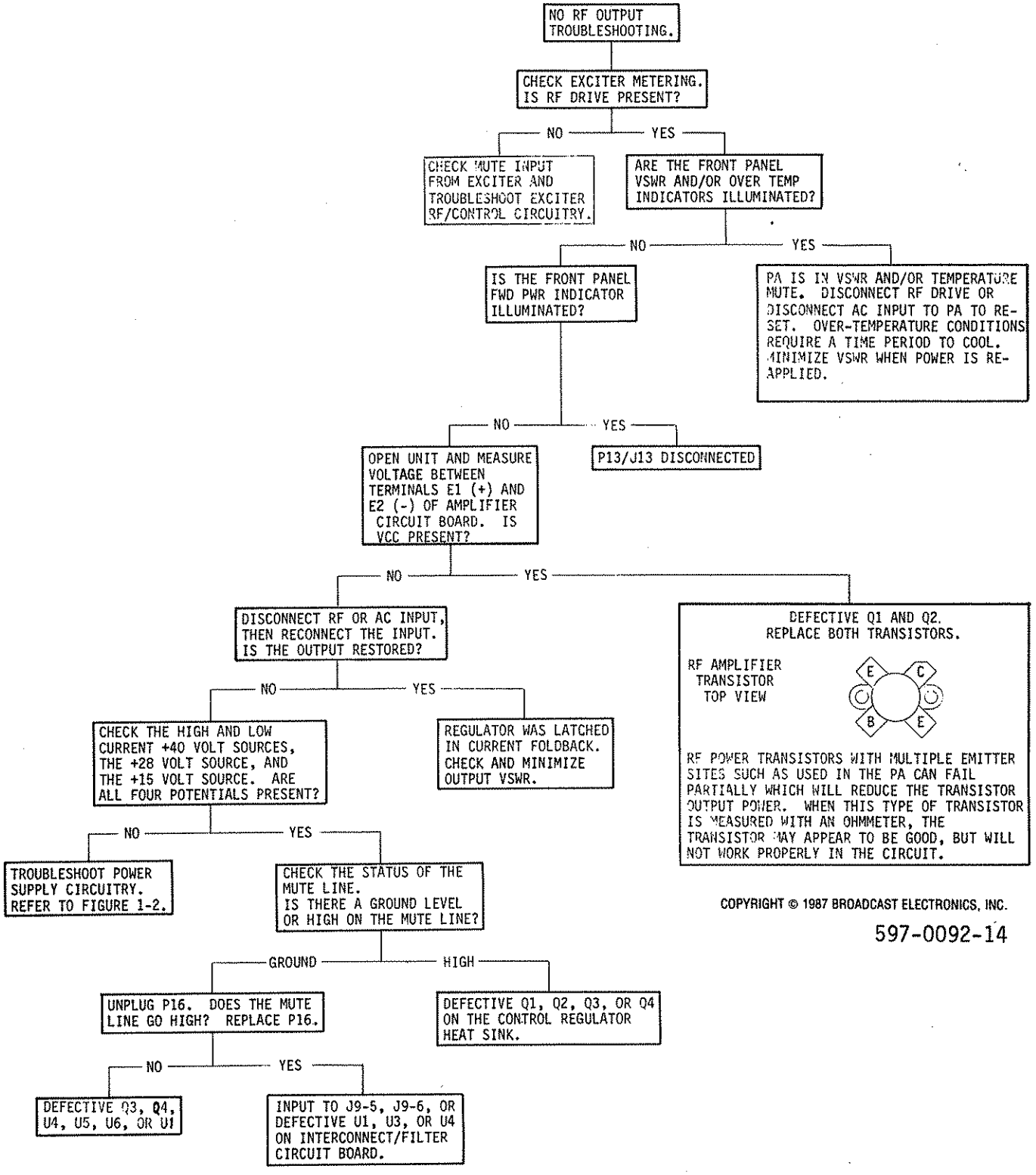
WARNING ***THE WHITE CASE MATERIAL OF THE PA RF AMPLIFIER TRANSISTORS IS MADE OF BeO CERAMIC MATERIAL. DO NOT PERFORM ANY OPERATION ON ANY BeO CERAMIC WHICH MIGHT PRODUCE DUST OR FUMES, SUCH AS GRINDING, GRIT BLASTING, OR ACID CLEANING. BERYLLIUM OXIDE DUST OR FUMES ARE HIGHLY TOXIC AND BREATHING THEM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

WARNING

2–114. Characteristically, the type of RF transistors used in the PA stage can fail partially, but still operate to some extent. If the RF power amplifier transistors are suspected as having inadequate gain, they must be replaced with new devices of the same identical type and manufacture as the original device. The IPA RF amplifier assembly diagrams in Section III contain information relative to the replacement of the RF transistors. The transistors should be replaced in pairs to maintain matched gain for optimum push–pull operation. Due to the difficulty of replacing Q1 and Q2 in the field, it is recommended to return the RF amplifier module to Broadcast Electronics, Inc. for repair as chip capacitors C4 through C7 may have to be removed with Q1 and Q2.

2–115. Once the trouble is isolated and power is totally deenergized, it is suggested that the exact problem be located with resistance checks using the schematic diagrams and theory of operation presented throughout the text. Figures 2–1 and 2–2 should be referenced as troubleshooting aids.

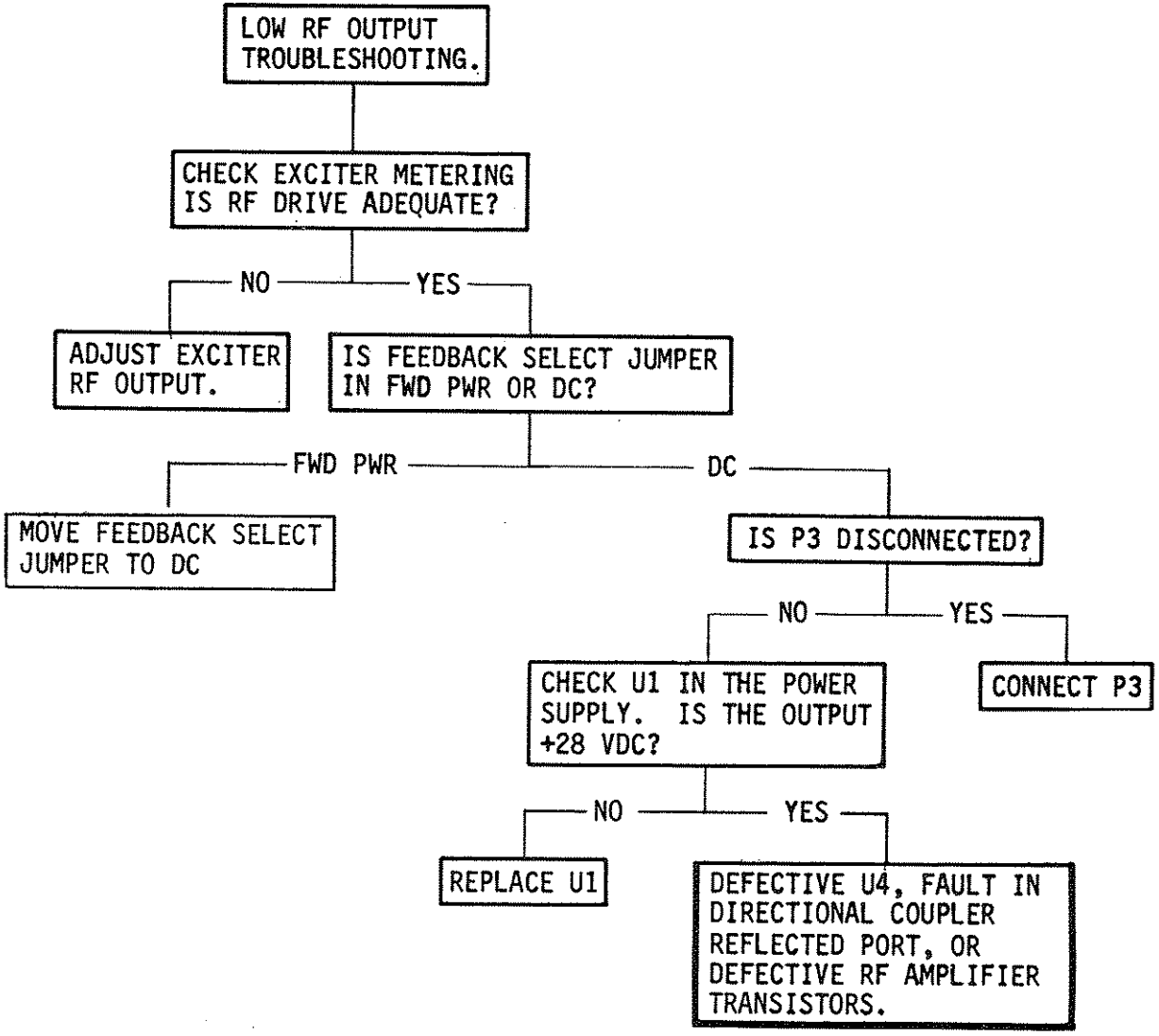
2–116. If a circuit is diagnosed as faulty, the circuit fault may be isolated and repaired locally or the entire device may be returned to Broadcast Electronics, Inc. for exchange, alignment, or replacement. The modular approach used in the construction of the PA allows spare control regulator or RF amplifier modules to be substituted in the system with minimal down time.



597-0092-14

597-0092-14

FIGURE 2–1. NO RF OUTPUT TROUBLESHOOTING



597–0092–15

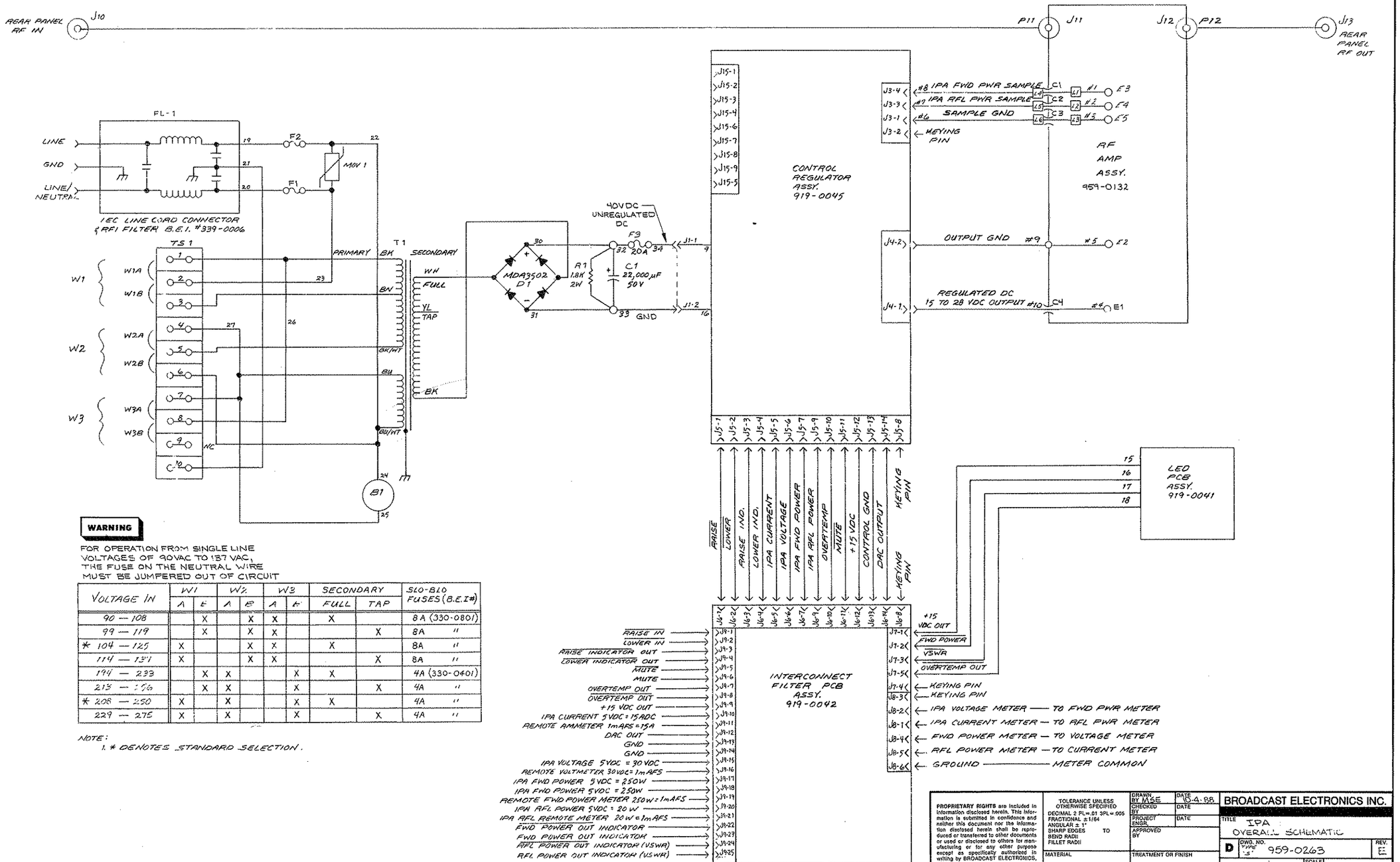
FIGURE 2–2. LOW RF OUTPUT TROUBLESHOOTING

SECTION III
PA DRAWINGS

3–1. INTRODUCTION.

3–2. This section provides assembly drawings and schematic diagrams as listed below for the B–series very–low–power FM transmitter PA module.

FIGURE	TITLE	NUMBER
3–1	SCHEMATIC, PA OVERALL	SD959–0263
3–2	ASSEMBLY, PA OVERALL	597–0092–16
3–3	SCHEMATIC, INTERCONNECT/FILTER CIRCUIT BOARD	SD919–0042
3–4	ASSEMBLY, INTERCONNECT/FILTER CIRCUIT BOARD	AC919–0042
3–5	SCHEMATIC, CONTROL REGULATOR OVERALL	SD919–0045
3–6	ASSEMBLY, CONTROL REGULATOR CIRCUIT BOARD	AD919–0045
3–7	COMPONENT LOCATOR, CONTROL REGULATOR CIRCUIT BOARD	597–0092–17
3–8	SCHEMATIC, RF AMPLIFIER OVERALL	SC919–0065
3–9	ASSEMBLY, RF AMPLIFIER CIRCUIT BOARD	AD959–0132–001
3–10	ASSEMBLY, RESISTOR NETWORK	597–0092–22



WARNING

FOR OPERATION FROM SINGLE LINE VOLTAGES OF 90VAC TO 137 VAC, THE FUSE ON THE NEUTRAL WIRE MUST BE JUMPERED OUT OF CIRCUIT

VOLTAGE IN	W1		W2		W3		SECONDARY		SLO-BLO FUSES (B.E.I#)	
	A	B	A	B	A	B	FULL	TAP		
90 — 108		X		X	X		X		8A (330-0801)	
99 — 119		X		X	X			X	8A	"
* 104 — 125	X			X	X		X		8A	"
114 — 137	X			X	X			X	8A	"
194 — 233		X	X			X	X		4A (330-0401)	
213 — 256		X	X			X		X	4A	"
* 208 — 250	X		X			X	X		4A	"
229 — 275	X		X			X		X	4A	"

NOTE:
1. * DENOTES STANDARD SELECTION.

PROPRIETARY RIGHTS are included in information disclosed herein. This information is submitted in confidence and neither this document nor the information disclosed herein shall be reproduced or transferred to other documents or used or disclosed to others for manufacturing or for any other purpose except as specifically authorized in writing by BROADCAST ELECTRONICS, INC.

TOLERANCE UNLESS OTHERWISE SPECIFIED
DECIMAL 2 PL ±.01 3PL ±.005
FRACTIONAL ±1/64
ANGULAR ± 1°
SHARP EDGES TO BEND RADII
FILLET RADII
MATERIAL
TREATMENT OR FINISH

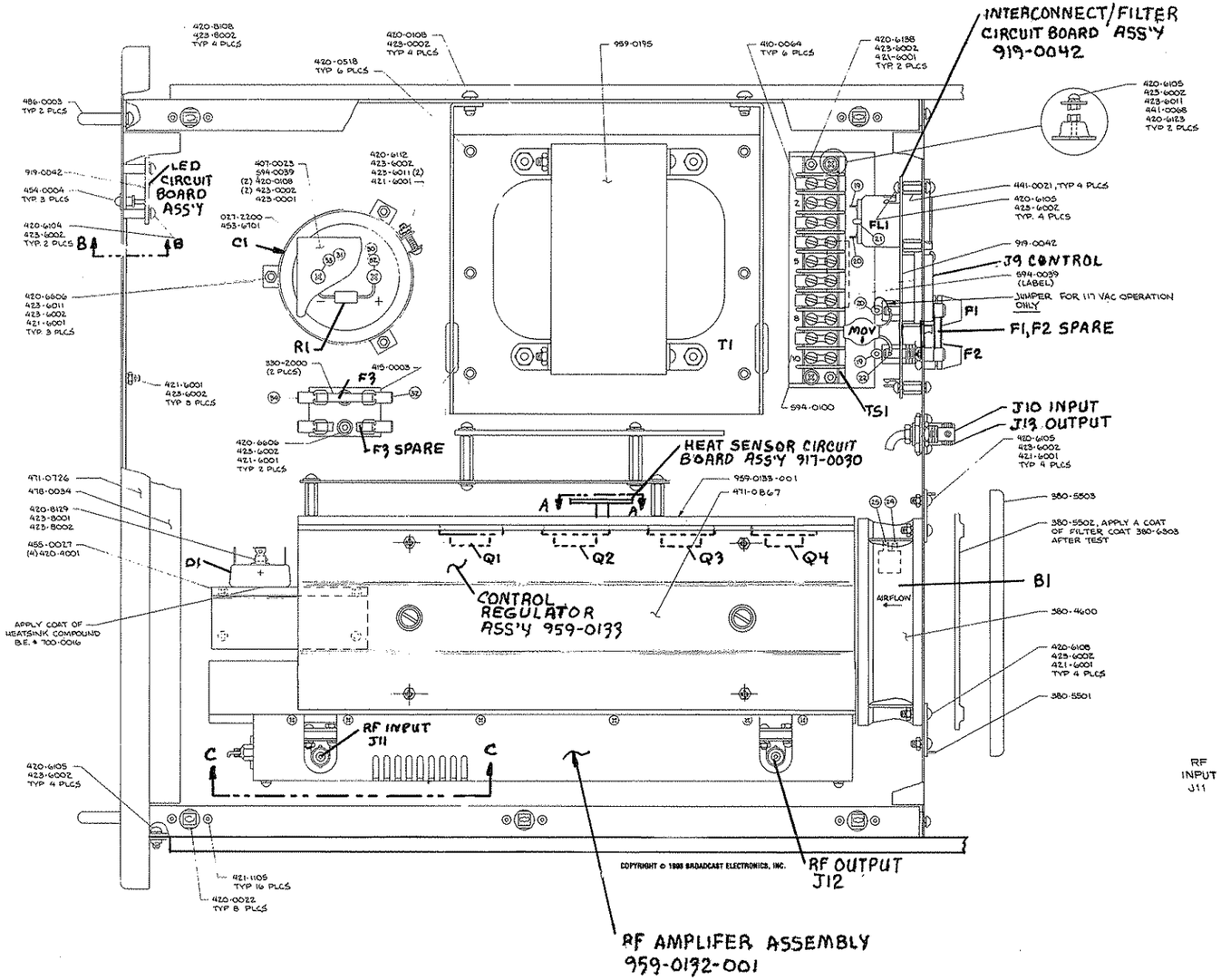
DRAWN BY MSE DATE 10-4-88
CHECKED BY DATE
PROJECT ENGR. DATE
APPROVED BY

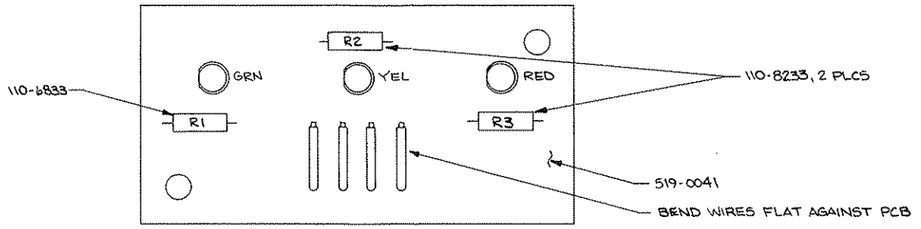
BROADCAST ELECTRONICS INC.

TITLE IPA OVERALL SCHEMATIC

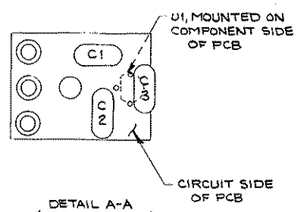
D DWG. NO. TYPE -5 959-0263 REV. E2

SCALE N.S. SHEET 1 OF 1

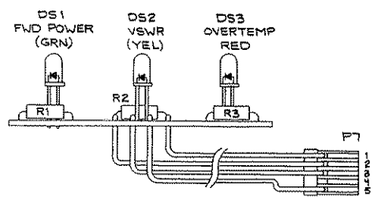




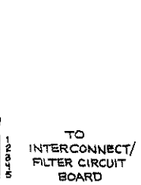
DETAIL E-E

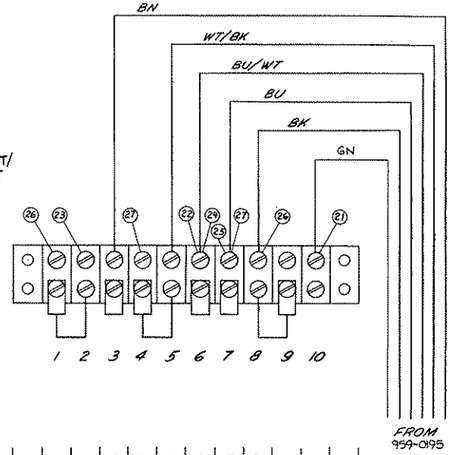


DETAIL A-A
(NOT TO SCALE)



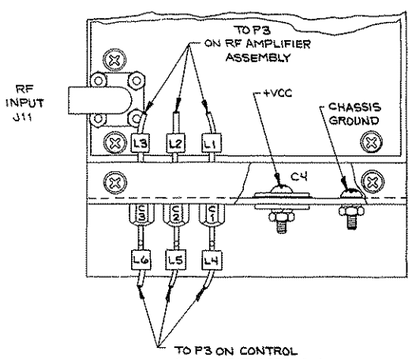
DETAIL B-B
(NOT TO SCALE)





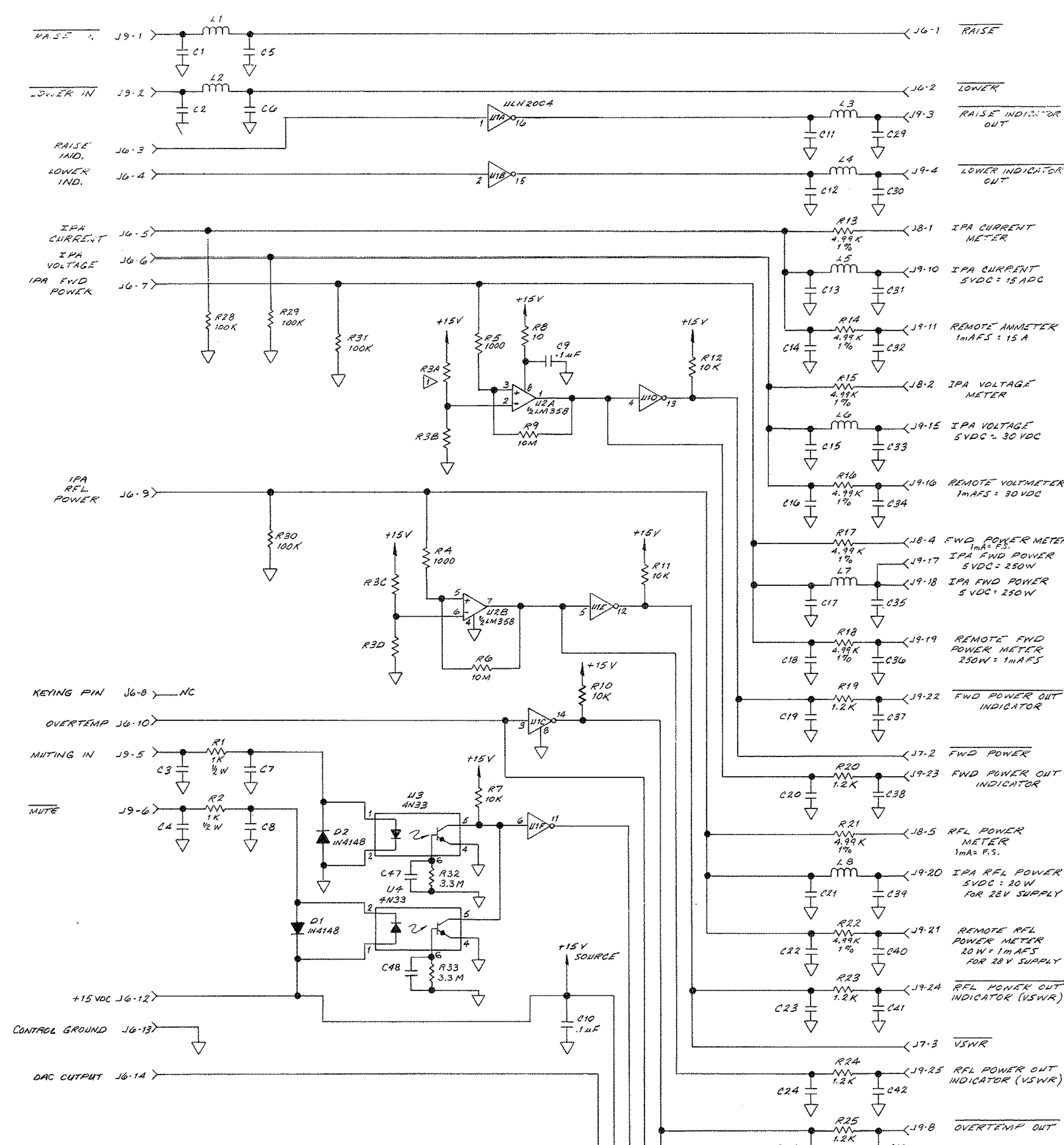
FOR 117 VAC OPERATION

DETAIL D-D



DETAIL C-C
(NOT TO SCALE)

FIGURE 3–2.
INTERMEDIATE POWER AMPLIFIER OVERALL ASSEMBLY



RAISE IN J9-1
LOWER IN J9-2
RAISE IND. J6-3
LOWER IND. J6-4
IPA CURRENT J6-5
IPA VOLTAGE J6-6
IPA FWD POWER J6-7
IPA RFL POWER J6-9
KEYING PIN J6-8 NC
OVERTEMP J6-10
MUTING IN J9-5
MUTE J9-6
+15 VDC J6-12
CONTROL GROUND J6-13
DAC OUTPUT J6-14
J6-1 RAISE
J6-2 LOWER
J9-3 RAISE INDICATOR OUT
J9-4 LOWER INDICATOR OUT
J8-1 IPA CURRENT METER
J9-10 IPA CURRENT 5VDC = 15 ADC
J9-11 REMOTE AMMETER 1mAFS = 15 A
J8-2 IPA VOLTAGE METER
J9-15 IPA VOLTAGE 5VDC = 30 VDC
J9-16 REMOTE VOLTMETER 1mAFS = 30 VDC
J8-4 FWD POWER METER 1mA= F.S.
J9-17 IPA FWD POWER 5VDC = 250W
J9-18 IPA FWD POWER 5 VDC = 250W
J9-19 REMOTE FWD POWER METER 250W = 1mAFS
J9-22 FWD POWER OUT INDICATOR
J7-2 FWD POWER
J9-23 FWD POWER OUT INDICATOR
J8-5 RFL POWER METER 1mA= F.S.
J9-20 IPA RFL POWER 5VDC = 20W FOR 28V SUPPLY
J9-21 REMOTE RFL POWER METER 20W = 1mAFS FOR 28 V SUPPLY
J9-24 RFL POWER OUT INDICATOR (VSWR)
J7-3 VSWR
J9-25 RFL POWER OUT INDICATOR (VSWR)
J9-8 OVERTEMP OUT
J7-5 OVERTEMP OUT
J9-7 OVERTEMP OUT
J6-11 MUTE
J7-1 +15 VDC OUT
J9-9 +15 VDC OUT
J9-12 DAC OUT
J9-13
J9-14 GROUND
J8-6
NC J7-4 KEYING PIN
NC J8-3 KEYING PIN
ULN2004
U2A ½LM358
U2B ½LM358
U3 4N33
U4 4N33
D1 IN4148
D2 IN4148
+15V SOURCE
PIN 9 = N.C.

NOTES:

1. ALL RESISTORS IN OHMS, ¼W, 5% UNLESS OTHERWISE SPECIFIED.
2. ALL CAPACITORS ARE 390 pF, UNLESS OTHERWISE SPECIFIED.
3. ALL COILS ARE 4.7 mH OR 2.2 mH.
4. R3A-R3D DENOTES RESISTOR NETWORK. B.E.I. P/N 959-1000-002, FOR FM1.5A, REFERENCE DWG. A959-1000-002.
   B.E.I. P/N 959-1000, FOR FM3.5A/5A, REFERENCE DWG. A959-1000.
   B.E.I. P/N 959-1000-001, FOR STAND ALONE, REFERENCE DWG. A959-1000-001.
5. J6 CONNECTS TO CONTROL REG. PCB #D919-0045
   J7 CONNECTS TO LED PCB #B919-0041
   J8 CONNECTS TO OPTIONAL FRONT PANEL METERS.
   J9 CONNECTS TO DESIGNATED POINTS IN XMTR.
6. J8 IS NOT PART OF PRINTED CIRCUIT BOARD ASSEMBLY.

SEE ASSEMBLY # C919-0042
SEE B/M # 919-0042

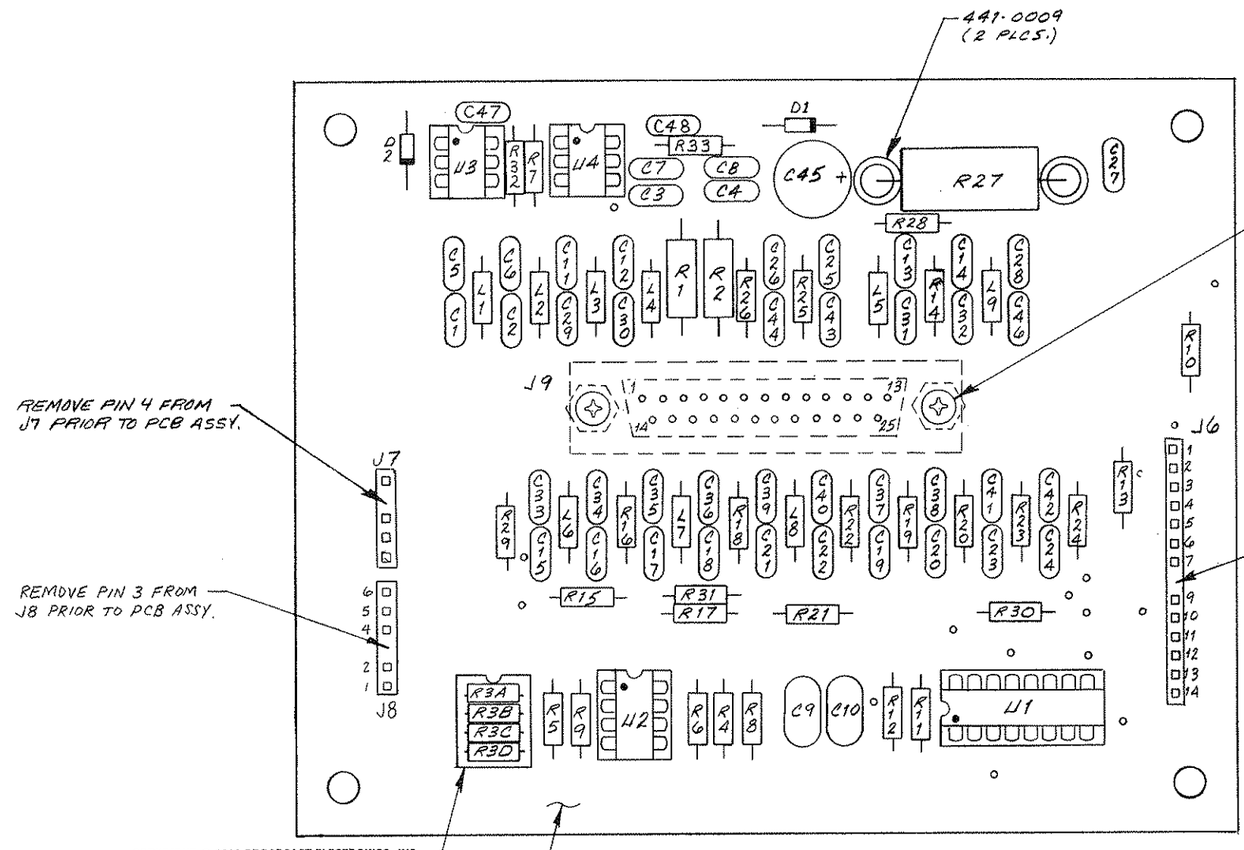
REFERENCE DESIGNATORS	
LAST USED	NOT USED
C48	U1G
D2	
J9	
L9	
R33	
U4	

REFERENCE DESIGNATORS	U1	U2	U3, U4
B.E. PART NO.	226-2004	221-0358	229-0033
VENDOR PART NO.	ULN2004	LM358	4N33
VOLTAGE PIN NO.	—	8	—
GROUND PIN NO.	8	4	—

TOLERANCE UNLESS OTHERWISE SPECIFIED
DECIMAL 2 PL=.01 3PL=.005
FRACTIONAL ±1/64
ANGULAR ± 1°
SHARP EDGES TO
BEND RADII
FILLET RADII
MATERIAL

DRAWN BY MERKEL DATE 2-21-83
CHECKED BY DATE
PROJECT ENGR. DATE 5/1/83
APPROVED BY MH 5-13-83
TREATMENT OR FINISH

BROADCAST ELECTRONICS INC.
TITLE SCHEMATIC - IPA INTERCONNECT/FILTER PCB
D DWG. NO. 919-0042 REV. F
IPA SCALE NA SHEET 1 OF 1



NOTE:

1. L1 - L9 MAY BE EITHER 2.2μH OR 4.7μH UNDER P/N 360-0022.
2. J6 & J7 ARE MADE FROM 417-0200.

SEE SCHEMATIC #D919-0042
SEE B/M # 919-0042

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

DWN. BY	MERKEL 2-26-83
CHKD.	
ME	
EE	
PROJ. ENGR.	S.J. 9/16/83
DFTG. SUPVR.	MH 5-13-83
MFG.	

NEXT ASSY.

PRODUCT USED ON: IFA

FINISH: —

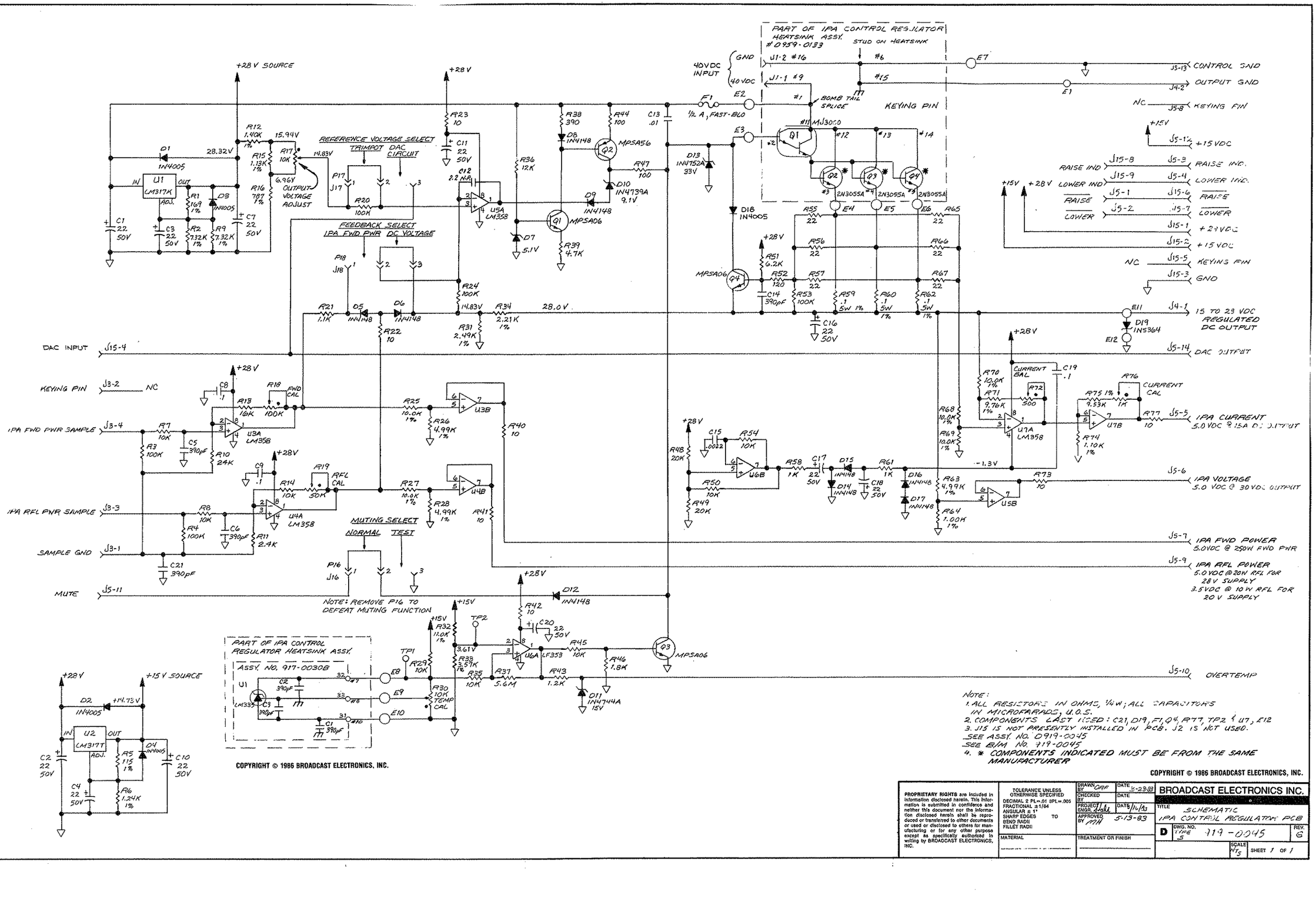
BROADCAST ELECTRONICS INC.
4100 N. 24TH ST. QUINCY, IL 62305 217/224-9600
TELEX 250142 CABLE BCST ELECT QUI

TITLE: PCB ASSEMBLY - IPA INTERCONNECT/ FILTER BOARD

SHEET 1 OF 1

SCALE 2/1 | REV F

TYPE A | SIZE C | DWG. NO. 919-0042



NOTE:
1. ALL RESISTORS IN OHMS, ¼W; ALL CAPACITORS IN MICROFARADS, U.O.S.
2. COMPONENTS LAST ISSUED: C21, D19, F1, Q4, R77, TP2 & U7, E12
3. J15 IS NOT PRESENTLY INSTALLED IN PCB. J2 IS NOT USED.
SEE ASSY. NO. 0919-0045
SEE B/M NO. 719-0045
4. * COMPONENTS INDICATED MUST BE FROM THE SAME MANUFACTURER

COPYRIGHT © 1986 BROADCAST ELECTRONICS, INC.

TOLERANCE UNLESS OTHERWISE SPECIFIED
DECIMAL 2 PL=.01 3PL=.005
FRACTIONAL ±1/64
ANGULAR ± 1°
SHARP EDGES TO
BEND RADII
FILLET RADII
MATERIAL
TREATMENT OR FINISH

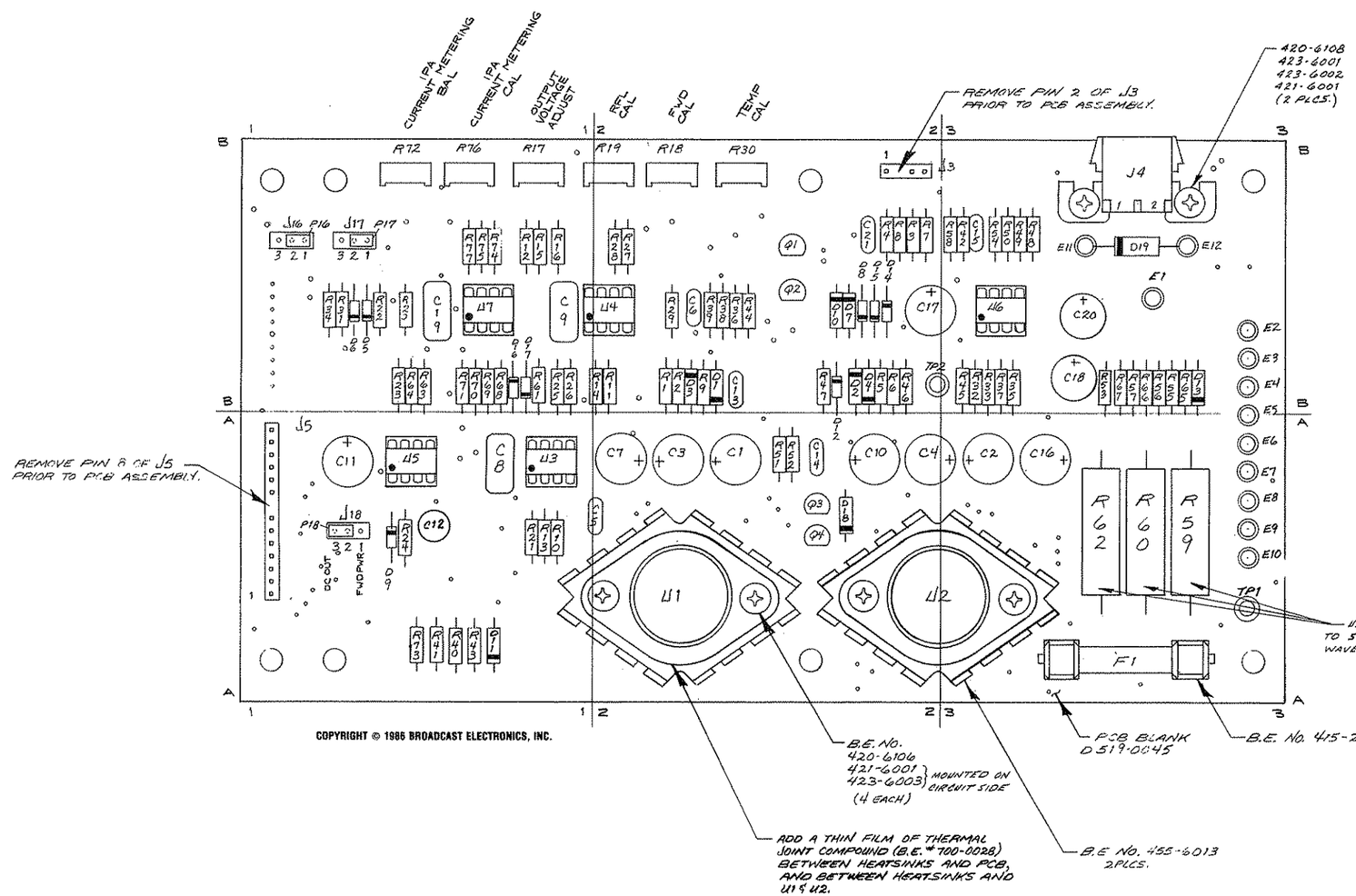
DRAWN BY ORF DATE 3-29-83
CHECKED BY DATE
PROJECT ENGR. DATE 11/1/83
APPROVED BY 5-13-83

BROADCAST ELECTRONICS INC.

TITLE SCHEMATIC IPA CONTROL REGULATOR PCB

D DWG. NO. 719-0045 REV. G

SCALE NTS SHEET 1 OF 1



SEE SCHEMATIC #D919-0045
SEE B/M # 919-0045

NOTE:
1. J3 & J5 ARE MADE FROM 417-0200.

COPYRIGHT © 1986 BROADCAST ELECTRONICS, INC.

TOLERANCE UNLESS OTHERWISE SPECIFIED
DECIMAL 2 PL=.01 3PL=.005
FRACTIONAL ±1/64
ANGULAR ± 1°
SHARP EDGES TO BEND RADII
FILLET RADII

MATERIAL

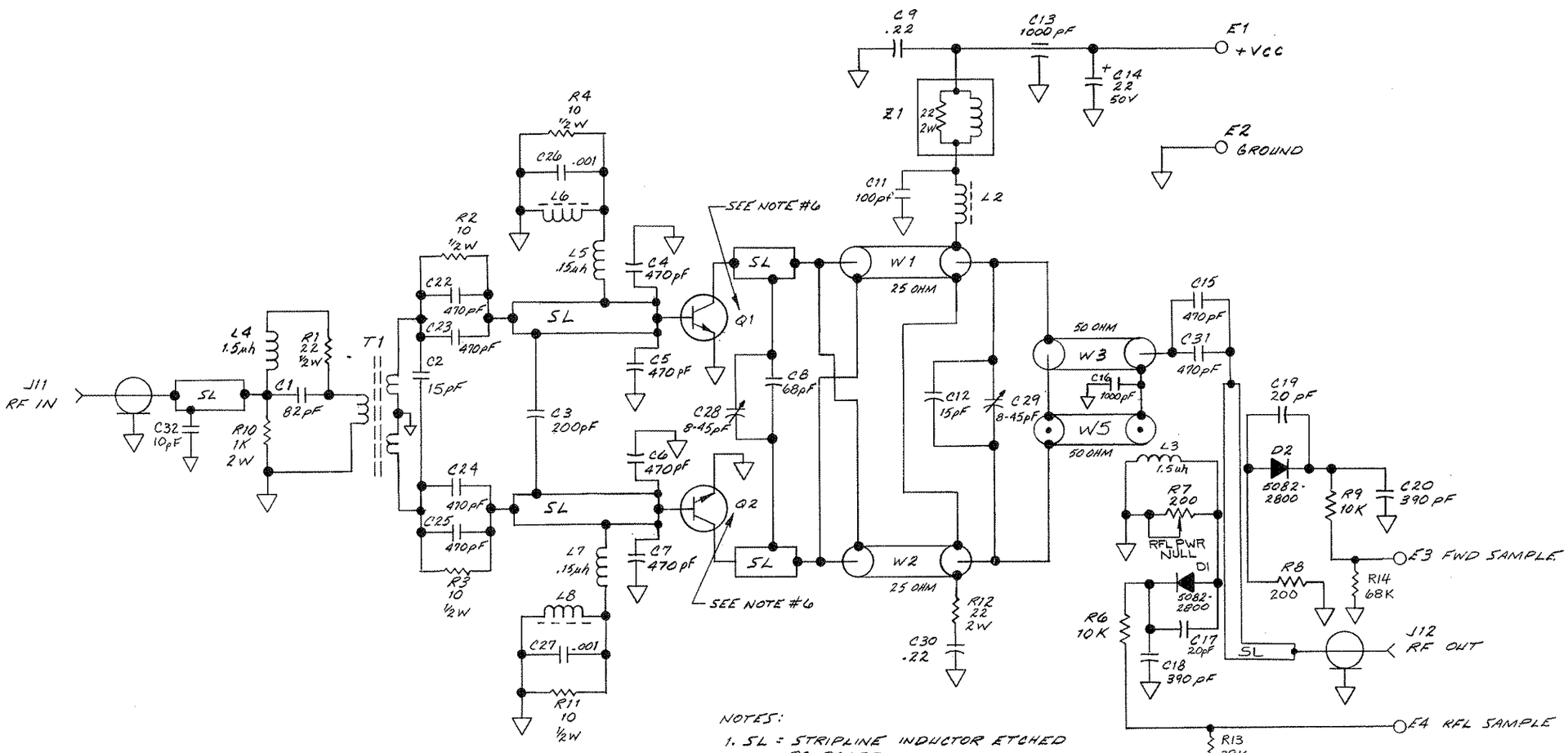
TREATMENT OR FINISH

DRAWN BY DAF	DATE 3-7-83	BROADCAST ELECTRONICS INC.
CHECKED	DATE	
PROJECT ENGR.	DATE 5/16/83	TITLE PCB ASSEMBLY IPA CONTROL REGULATOR P.C.
APPROVED BY MH	5-13-83	D DWG NO. TYPE A 919-0045 REV. F
		FM I.S., S.W. & A.M. RADIO SCALE 2/1 SHEET 1 OF 1

REF	ZONE	REF	ZONE	REF	ZONE	REF	ZONE
C1	A2	D16	B1	R19	B2	R55	B3
C2	A3	D17	B1	R20	B1	R56	B3
C3	A2	F1	A3	R21	A1	R57	B3
C4	A2	---	--	R22	B1	R58	B3
C5	A2	J3	B2	R23	B1	R59	A3
C6	B2	J4	B3	R24	A1	R60	A3
C7	A2	J5	A1	R25	B1	R61	B1
C8	A1	---	--	R26	B1	R62	A3
C9	B1	J16	B1	R27	B2	R63	B1
C10	A2	J17	B1	R28	B2	R64	B1
C11	A1	J18	A1	R29	B2	R65	B3
C12	A1	P16	B1	R30	B2	R66	B3
C13	B2	P17	B1	R31	B1	R67	B3
C14	A2	P18	A1	R32	B3	R68	B1
C15	B3	Q1	B2	R33	B3	R69	B1
C16	A3	Q2	B2	R34	B1	R70	B1
C17	B2	Q3	A2	R35	B3	R71	B1
C18	B3	Q4	A2	R36	B2	R72	B1
C19	B1	R1	B2	R37	B3	R73	A1
C20	B3	R2	B2	R38	B2	R74	B1
C21	B2	R3	B2	R39	B2	R75	B1
D1	B2	R4	B2	R40	A1	R76	B1
D2	B2	R5	B2	R41	A1	R77	B1
D3	B2	R6	B2	R42	B3	TP1	A3
D4	B2	R7	B2	R43	A1	TP2	B2-B3
D5	B1	R8	B2	R44	B2	U1	A2
D6	B1	R9	B2	R45	B3	U2	A2-A3
D7	B2	R10	A1	R46	B2	U3	A1
D8	B2	R11	B2	R47	B2	U4	B2
D9	A1	R12	B1	R48	B3	U5	A1
D10	B2	R13	A1	R49	B3	U6	B3
D11	A1	R14	B2	R50	B3	U7	B1
D12	B2	R15	B1	R51	A2		
D13	B3	R16	B1	R52	A2		
D14	B2	R17	B1	R53	B3		
D15	B2	R18	B2	R54	B3		

597-0092-17

FIGURE 3-7. CONTROL REGULATOR CIRCUIT BOARD COMPONENT LOCATOR



NOTES:

1. SL = STRIPLINE INDUCTOR ETCHED ON PC BOARD.
2. RESISTORS IN OHMS, ¼ WATT, 5% ; CAPACITORS IN MICROFARADS UNLESS NOTED OTHERWISE.
3. LAST COMPONENTS USED: C31, D2, E5, J12, L8, Q2, T1, W5, R12, Z1
4. SEE PCB ASSY. # 0959-0132, SHEET 1 OF 2.
5. COMPONENTS NOT USED: R5, C10, J1-J10
6. Q1 AND Q2 MATCHED PAIR OF B.E. PART NO. 210-1460-001. MUST HAVE SAME COLOR DOT.

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

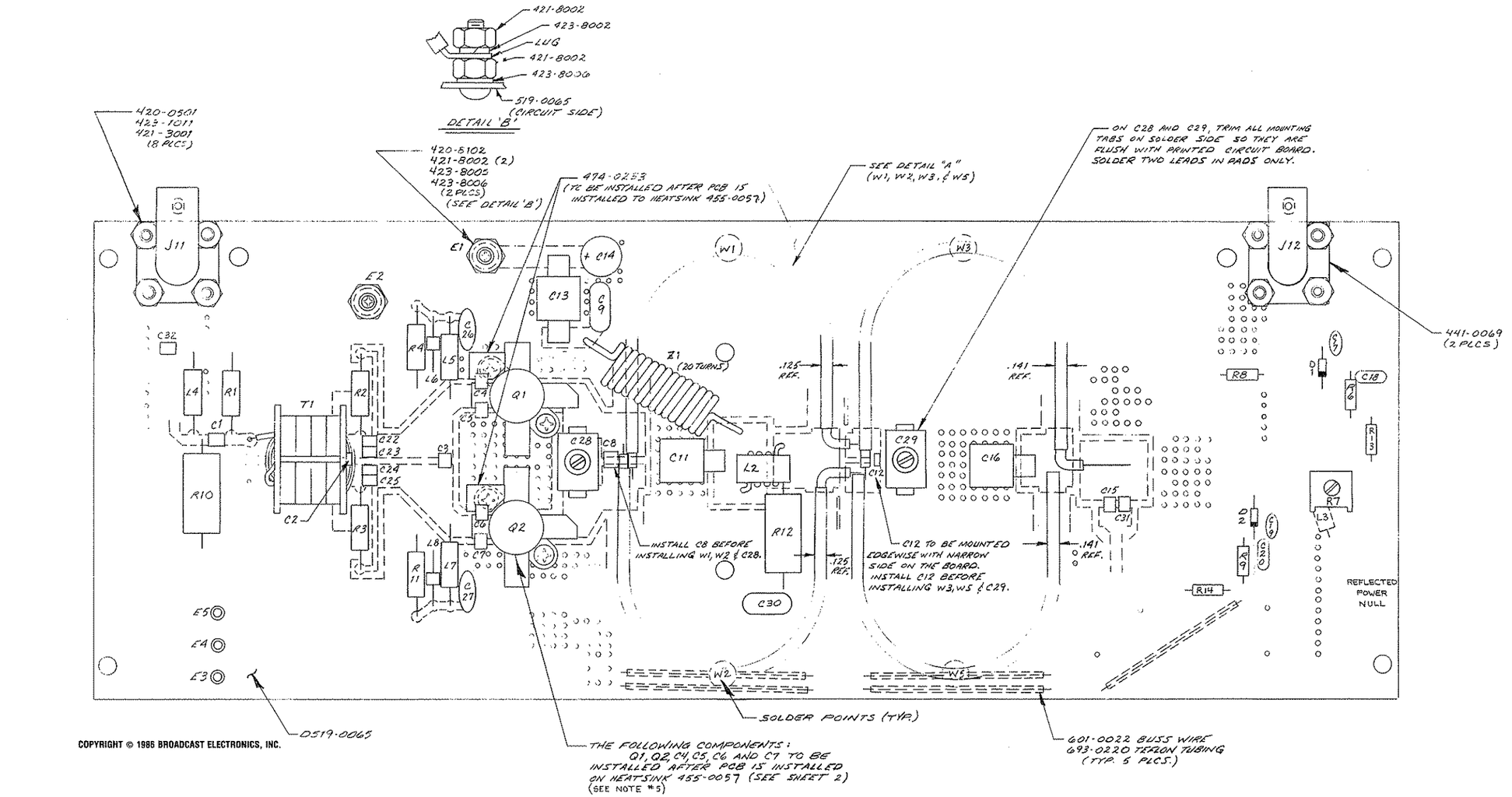
DWN. BY	MERKEL 3-10-83	NEXT ASSY.	
CHKD.			
ME		PRODUCT USED ON	IPA
EE			
PROJ. ENGR.	S.S. 5/16/83	FINISH	
DFTG. SUPVR.	MH 5-19-83		
MFG.			

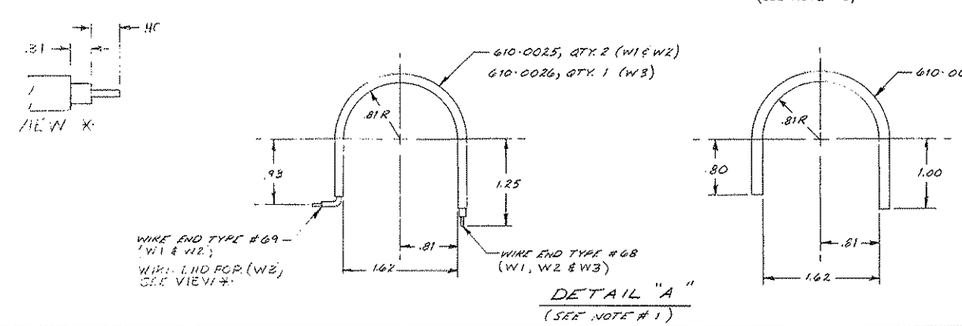
BROADCAST ELECTRONICS INC.
4100 N. 24TH ST. QUINCY, IL 62305 217/224-9600
TELEX 250142 CABLE BCST ELECT QUI

TITLE PCB SCHEMATIC - IPA RF AMP PCB

SHEET 1 OF 1 | SCALE NONE | REV H

TYPE S | SIZE C | DWG. NO. 919-0065





NOTES:

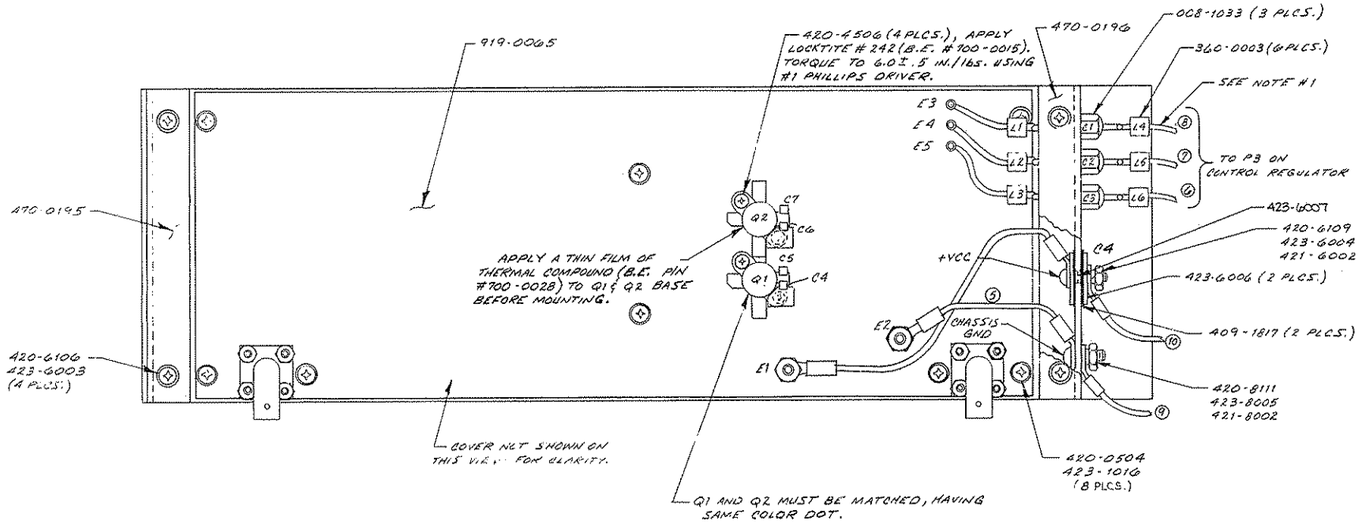
1. USE FIXTURE TO FORM W1, W2, W3, & W5.
2. REFERENCE SCHEMATIC #D959-0131
3. REFERENCE BM 919-0065.
4. REFERENCE RF AMP PCB SCHEMATIC #C919-0065.
5. TRANSISTORS Q1 & Q2 ARE MATCHED PAIRS.

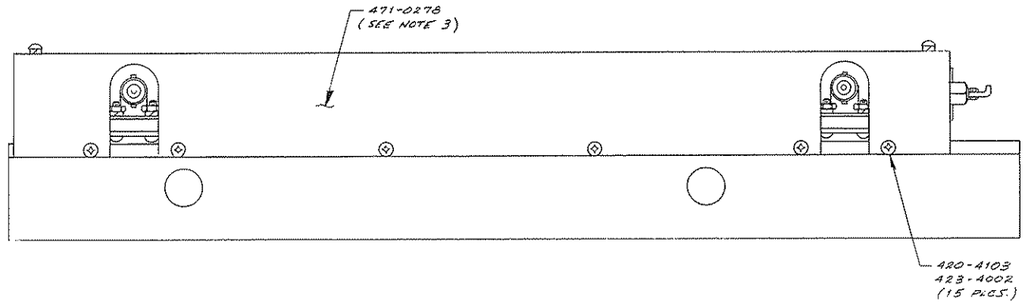
TOLERANCE UNLESS OTHERWISE SPECIFIED
DECIMAL 2 PL ±.01 3PL ±.005
FRACTIONAL ±1/64
ANGULAR ± 1°
SHARP EDGES TO BEND RADII
FILLET RADII

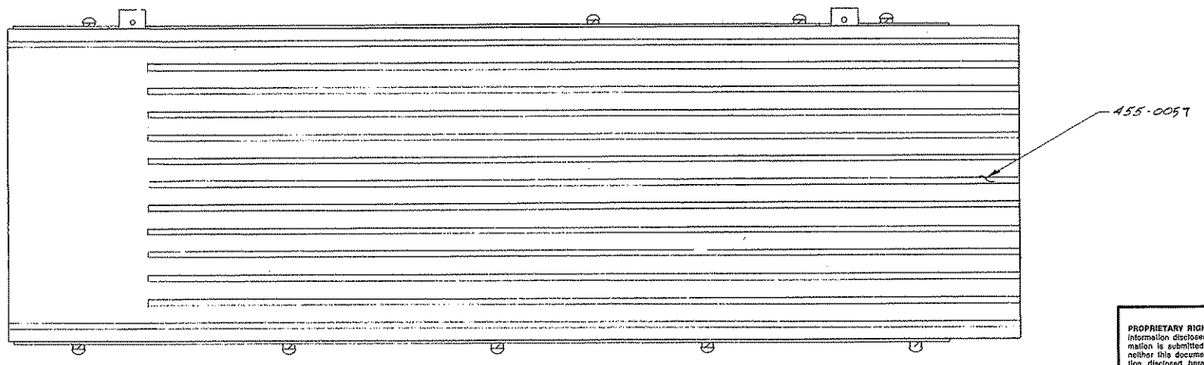
MATERIAL

TREATMENT OR FINISH

DRAWN BY WLF	DATE 2-11-91	BROADCAST ELECTRONICS INC.
CHECKED BY	DATE	
PROJECT ENGR.	DATE	TITLE IPA RF AMP ASSEMBLY
APPROVED BY MH		D DWG. NO. TYPE A 959-0132-001 REV. B
		IPA SCALE 2/1 SHEET 1 OF 2







NOTES:
1. SEE DWG. 0949-0040 FOR WIRING ASSEMBLIES.
2. SEE DWG. 954-0132.
3. ASSEMBLE TOP COVER 471-0278 AFTER TEST.
4. Ⓜ - DENOTES WIRE NUMBERS.

TOLERANCE UNLESS OTHERWISE SPECIFIED
DECIMAL ± PL=.01 3PL=.005
FRACTIONAL ±1/64
ANGULAR ± 1°
SHARP EDGES TO
BEND RADII
FILLET RADII
MATERIAL

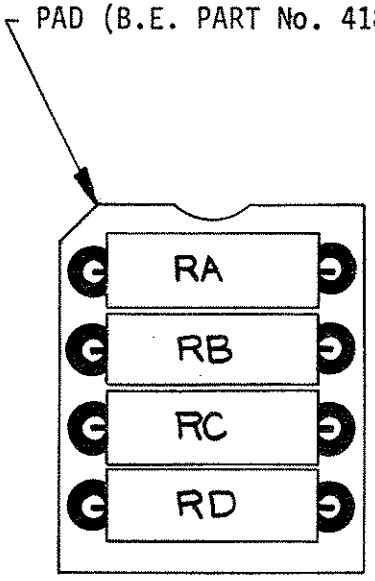
DRAWN BY WLF DATE 7-11-91
CHECKED BY DATE
PROJECT ENGR. DATE
APPROVED BY MH
TREATMENT OR FINISH

BROADCAST ELECTRONICS INC.

TITLE IPA RF ANP ASSEMBLY

D | DWG. NO. TYPE A 954-0132-001 | REV. E

IPA | SCALE 1/1 | SHEET 2 OF 2



P/N 959-1000-015			
R3A	R3B	R3C	R3D
10K OHM	1.5K OHM	10K OHM	2.7K OHM

USED ON: ALL MODELS OF FM-100,FM-250,.. AND FM-300 AS R3

597-0092-22

FIGURE 3-10. ASSEMBLY, PA RESISTOR NETWORK

SECTION IV
PA PARTS LISTS

4–1. INTRODUCTION.

4–2. This section provides descriptions and part numbers of electrical components, assemblies, and selected mechanical parts required for maintenance of the PA module used in the Broadcast Electronics very–low–power line of FM transmitters. Each table entry in this section is indexed by reference designators appearing on the applicable schematic diagram.

TABLE 4–1. PA PARTS LIST INDEX

TABLE 4–2. OVERALL, PA – 959–0263

REF. DES.	DESCRIPTION	PART NO.	QTY.
B1	Fan, 115V, 50/60 Hz, 18W, 120 ft³/min, 3100 r/min, 4.5 inch (11.43 cm)	380–4600	1
C1	Capacitor, Electrolytic, 22,000 uF, 50V	027–2200	1
D1	Bridge Rectifier, MDA3502, 200V, 35 Amperes, Silicon	230–3502	1
	220V AC Input Operation		
F1,F2,SPARE	Fuse, MDA, 250V, Slow–Blow, Ceramic Element, 4 Amperes	330–0401	3
	110V AC Input Operation		
F1,F2,SPARE	Fuse, 250V, Slow–Blow, 8 Amperes	330–0801	3
F3,SPARE	Fuse, 3AG, 250V, 20 Amperes	330–2000	2
FL1	Power Input Connector/RFI Filter, 10 Amperes, 250V ac, 50/60 Hz	339–0006	1
MOV1	Metal Oxide Varistor, V2506A15A, 250V ac RMS, 15 Joules	140–0008	1
TS1	Barrier Strip, 10 Terminal	412–0100	1
XF1,XF2	Fuse Holder, AGC	415–2012	2
XF3	Fuse Holder, Dual, 3AB	415–0003	1
——	Fuse Clips for Spare fuse, AGC	415–1001	2
——	Receptacle, Top Cover Fastener	420–0022	8
——	Turn–Lock Fastener, Long	420–0019	6
——	Turn–Lock Fastener, Short	420–0027	2
——	Retainer, Turn–Lock Fastener	420–0021	8
——	Transformer and Bracket Assembly	959–0195	1
——	Interconnect/Filter Circuit Board	919–0042	1
——	RF Amplifier Assembly	959–0132–001	1
——	Control Regulator Assembly	959–0133–001	1
——	IPA Wiring Assembly	949–0029	1

TABLE 4–3. PA WIRING ASSEMBLY – 949–0029

REF. DES.	DESCRIPTION	PART NO.	QTY.
J10	Receptacle, BNC, Bulkhead UG–909	417–0106	1
J13	Receptacle, Type N	417–0076	1
P1,P2	Plug, BNC, Right Angle	417–0213	2
P1	Plug Assembly:		
	Contact, Male	418–0036	1
	Contact, Female	417–0100	1
	Housing	417–0099	1
P5,P6	Connector, Housing , 14–Pin In–Line	417–1401	2
P7	Connector, Housing, 5–Pin In–Line	417–0165	1
R1	Resistor, 1.8 k Ohm ±5%, 2W	130–1843	1
——	Pins, Receptacle (for Connectors P5, P6, and P7)	417–8766	30

TABLE 4–4. INTERCONNECT/FILTER CIRCUIT BOARD – 919–0042

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1 THRU C8	Capacitor, Mica, 390 pF ±5%, 100V	042–3922	8
C9,C10	Capacitor, Mylar Film, 0.1 uF ±5%, 100V	030–1053	2
C11 THRU C44	Capacitor, Mica, 390 pF ±5%, 100V	042–3922	34
C45	Capacitor, Electrolytic, 22 uF, 50V	024–2274	1
C46	Capacitor, Mica, 390 pF ±5%, 100V	042–3922	1
C47,C48	Capacitor, Mica, 390 pF ±5%, 100V	042–3922	2
D1,D2	Diode, 1N4148, Silicon, 100V, 10 mA	203–4148	2
J6	Receptacle, Header, 20–Pin In–Line	417–0200	.70
J7	Receptacle, Header, 20–Pin In–Line	417–0200	.30
J8	Receptacle, Male, 20–Pin In–Line	417–0200	1
J9	Receptacle, 25–Pin	417–2500	1
L1 THRU L9	Molded Choke, 4.7 uH ±10%, DC Resistance: 0.55 Ohms, 0.43 Amperes Maximum, Resonant at 130 MHz	360–0022	9
R1,R2	Resistor, 1 k Ohm ±5%, 1/2W	110–1043	2
R4,R5	Resistor, 1 k Ohm ±5%, 1/4W	100–1043	2
R6	Resistor, 10 Meg Ohm ±5%, 1/4W	100–1083	1
R7	Resistor, 10 k Ohm ±5%, 1/4W	100–1053	1
R8	Resistor, 10 Ohm ±5%, 1/4W	100–1023	1
R9	Resistor, 10 Meg Ohm ±5%, 1/4W	100–1083	1
R10 THRU R12	Resistor, 10 k Ohm ±5%, 1/4W	100–1053	3
R13 THRU R18	Resistor, 4.99 k Ohm ±1%, 1/4W	100–5041	6
R19,R20	Resistor, 1.2 k Ohm ±5%, 1/4W	100–1243	2
R21,R22	Resistor, 4.99 k Ohm ±1%, 1/4W	100–5041	2
R23 THRU R26	Resistor, 1.2 k Ohm ±5%, 1/4W	100–1243	4
R27	Resistor, 100 Ohm ±5%, 2W	132–1033	1
R28 THRU R31	Resistor, 100 k Ohm ±5%, 1/4W	100–1063	4
R32,R33	Resistor, 3.3 Meg Ohm ±5%, 1/4W	100–3373	2
U1	Integrated Circuit, ULN2004, 7 NPN Darlington Driver Pack, 16–Pin DIP	226–2004	1
U2	Integrated Circuit, 4N33, Optical Isolator NPN Photo Transistor/Infrared Emitting Diode Type, 1500V Isolation, 6–Pin DIP	229–0033	1
U3,U4	Integrated Circuit, LM358N, Dual Operational Amplifier, 8–Pin DIP	221–0358	2
XR3	Receptacle, 8–Pin DIP	417–0088	1
XU1	Receptacle, 16–Pin DIP	417–1604	1
XU2	Receptacle, 8–Pin DIP	417–0804	1
XU3,XU4	Receptacle, 6–Pin DIP	417–0600	2
——	Blank Circuit Board	519–0042	1

TABLE 4–5. TRANSFORMER AND BRACKET ASSEMBLY – 959–0195

REF. DES.	DESCRIPTION	PART NO.	QTY.
T1	Transformer, Power, Single Phase, 50/60 Hz Primary: Dual 115 volt windings, one winding tapped at 90V Secondary: 33.1V @ 15 Amperes Continuous, Tapped at 30.2V	376–0040	1

TABLE 4–6. RF AMPLIFIER ASSEMBLY – 959–0132–001

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1 THRU C3	Capacitor, Ceramic, Feed–Thru, 1000 pF ±20%, 500V	008–1033	3
C4	Capacitor Assembly, Kapton, Feed–Thru, 100 pF		
	Kapton Dielectric	409–1817	2
	Nylon Insulator	423–6007	2
L1 THRU L6	Ferrite Bead	360–0003	6
——	RF Amplifier Wiring Assembly	949–0040	1
——	RF Amplifier Circuit Board	919–0065	1

TABLE 4–7. RF AMPLIFIER WIRING ASSEMBLY – 949–0040

REF. DES.	DESCRIPTION	PART NO.	QTY.
P3	Connector, Housing, 4–Pin In–Line	417–0138	1
P4	Connector Housing, 2–Pin	417–0099	1
——	Pins, Connector (for P4)	417–0100	2
——	Pins, Receptacle (for P3)	417–8766	3

TABLE 4–8. RF AMPLIFIER CIRCUIT BOARD ASSEMBLY – 919–0065
(Sheet 1 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1	Capacitor, Ceramic, Chip, 82 pF ±5%, 500V	009–8013	1
C2	Capacitor, Ceramic, Chip, 15 pF ±5%, 500V	009–1513	1
C3	Capacitor, Ceramic, Chip, 200 pF ±5%, 300V	009–2023	1
C4 THRU C7	Capacitor, Ceramic, Chip, 470 pF ±5%, 200V	009–4723	4
C8	Capacitor, Ceramic, Chip, 68 pF ±5%, 500V	009–6813	1
C9	Capacitor, Mylar, 0.22 uF ±10%, 100V	030–2253	1
C11	Capacitor, Mica, 100 pF ±10%, 350V	046–0001	1
C12	Capacitor, Ceramic, Chip, 15 pF ±5%, 500V	009–1513	1
C13	Capacitor, Mica, Feedthru, 1000 pF ±10%, 350V	046–1030	1
C14	Capacitor, Electrolytic, 22 uF, 50V	024–2274	1
C15	Capacitor, Ceramic, Chip, 470 pF ±5%, 200V	009–4723	1
C16	Capacitor, Mica, 1000 pF ±10%, 350V	046–0002	1
C17	Capacitor, Ceramic, 20 pF ±10%, 1kV	002–2013	1
C18	Capacitor, Mica, 390 pF ±5%, 100V	042–3922	1
C19	Capacitor, Ceramic, 20 pF ±10%, 1kV	002–2013	1
C20	Capacitor, Mica, 390 pF ±5%, 100V	042–3922	1
C22 THRU C25	Capacitor, Ceramic, Chip, 470 pF ±5%, 200V	009–4723	4
C26,C27	Capacitor, Ceramic, 0.001 uF ±10%, 1kV	002–1034	2
C28,C29	Capacitor, Mica, Adjustable Compression, 4 TO 45 pF, 175V	090–0403	2
C30	Capacitor, Mylar, 0.22 uF ±10%, 100V	030–2253	1
C31	Capacitor, Ceramic, Chip, 470 pF ±5%, 200V	009–4723	1
C32	Capacitor, Ceramic, Chip, 10 pF ±5%, 500V	009–1013	1
D1,D2	Diode, HP5082–2800, High Voltage Schottky Barrier Type, 70V, 15 mA	201–2800	2
J11,J12	Receptacle, Right Angle BNC, UG535/U	417–0049	2
L2	RF Choke: 4 Turns of enameled 16 AWG wire on a 1/2 inch OD ferrite torroid form.	360–0025	1

TABLE 4–8. RF AMPLIFIER CIRCUIT BOARD ASSEMBLY – 919–0065
(Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
L3,L4	RF Choke, 1.5 uH ±10%, 580 mA Maximum, DC Resistance = 0.30 Ohms	360–0032	2
L5	RF Choke, 0.15 uH, 1.47A dc Maximum DC Resistance = 0.037 Ohms	360–0151	1
L6	RF Choke, Consists of BE P/N 360–0041 ferrite bead, OD = 0.13 inch, ID = 0.047 inch, L = 0.11 inch	360–0042	1
L7	RF Choke, 0.15 uH, 1.47A dc Maximum DC Resistance = 0.037 Ohms	360–0151	1
L8	RF Choke, Consists of BE P/N 360–0041 ferrite bead, OD = 0.13 inch, ID = 0.047 inch, L = 0.11 inch	360–0042	1
Q1,Q2	Transistor, Pair, SD1460–4, NPN, Silicon, CB–290 Case	210–1460–001	1
R1	Resistor, 22 Ohm ±5%, 1/2W	110–2223	1
R2 THRU R4	Resistor, 10 Ohm ±5%, 1/2W	110–1023	3
R6	Resistor, 10 k Ohm ±5%, 1/4W	100–1053	1
R7	Potentiometer, 200 Ohm ±10%, 1/2W	177–2034	1
R8	Resistor, 200 Ohm ±1%, 1/4W	100–2003	1
R9	Resistor, 10 k Ohm ±5%, 1/4W	100–1053	1
R10	Resistor, 1 k Ohm ±5%, 2W	130–1043	1
R11	Resistor, 10 Ohm ±5%, 1/2W	110–1023	1
R12	Resistor, 22 Ohm ±5%, 2W	130–2223	1
R13	Resistor, 39 k Ohm ±5%, 1/4W	100–3953	1
R14	Resistor, 68 k Ohm ±5%, 1/4W	100–6853	1
T1	RF Input Transformer, Broadcast Electronics Manufacture Primary: 50 Ohms Impedance Secondary: 25 Ohm Impedance, CT	370–0008	1
W1,W2	Coaxial Cable Sections: 25 Ohm rigid coaxial cable matching section	610–0025	2
W3,W5	Coaxial Cable Sections: 50 Ohm rigid coaxial cable matching section	610–0026	2
Z1	Parasitic Suppressor: 20 Turns of enameled 16 AWG wire close wound on a 22 Ohm ±5%, 2W carbon resistor (BE P/N 130–2223)	360–0024	1
——	Blank Circuit Board	519–0065	1

TABLE 4–9. CONTROL REGULATOR ASSEMBLY – 959–0133–001

REF. DES.	DESCRIPTION	PART NO.	QTY.
Q1	Transistor, MJ3000, Silicon, NPN Darlington, TO–3 Case	219–3000	1
Q2 THRU Q4	Transistor, 2N3055A, Silicon, NPN, TO–3 Case	219–3055	3
XQ1 THRU XQ4	Socket, TO–3 Transistor	417–0298	4
——	Insulator, Mica, TO–3 Transistor	418–0010	4
——	Control Regulator Wiring Assembly	949–0039	1
——	Control Regulator Circuit Board	919–0045	1
——	Temperature Sensor Circuit Board	917–0030	1

TABLE 4–10. CONTROL REGULATOR WIRING ASSEMBLY – 949–0039

REF. DES.	DESCRIPTION	PART NO.	QTY.
J1	Jack Assembly:		
	Contact, Male	418–0036	1
	Contact, Female	417–0100	1
	Housing	417–0098	1

TABLE 4–11. CONTROL REGULATOR CIRCUIT BOARD – 919–0045
(Sheet 1 of 3)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1 THRU C4	Capacitor, Electrolytic, 22 uF, 50V	024–2274	4
C5,C6	Capacitor, Mica, 390 pF ±5%, 100V	042–3922	2
C7	Capacitor, Electrolytic, 22 uF, 50V	024–2274	1
C8,C9	Capacitor, Mylar Film, 0.1 uF, 100V	030–1053	2
C10,C11	Capacitor, Electrolytic, 22 uF, 50V	024–2274	2
C12	Capacitor, Electrolytic, 2.2 uF, 50V	020–2264	1
C13	Capacitor, Mylar Film, 0.01 uF, 100V	031–1043	1
C14	Capacitor, Mica, 390 pF ±5%, 100V	042–3922	1
C15	Capacitor, Polyester, 0.0022 uF ±10%, 100V	031–2033	1
C16 THRU C18	Capacitor, Electrolytic, 22 uF, 50V	024–2274	3
C19	Capacitor, Mylar Film, 0.1 uF, 100V	030–1053	1
C20	Capacitor, Electrolytic, 22 uF, 50V	024–2274	1
C21	Capacitor, Mica, 390 pF ±5%, 100V	042–3922	1
D1 THRU D4	Diode, 1N4005, Silicon, 600V, 1 Ampere	203–4005	4
D5,D6	Diode, 1N4148, Silicon, 100V, 10 mA	203–4148	1
D7	Diode, Zener, 1N4733A, 5.1V, 1W	200–4733	1
D8,D9	Diode, 1N4148, Silicon, 100V, 10 mA	203–4148	2
D10	Diode, Zener, 1N4739A, 9.1V, 1W	200–0009	1
D11	Diode, Zener, 1N4744A, 15V, 1W	200–0015	1
D12	Diode, 1N4148, Silicon, 100V, 10 mA	203–4148	1
D13	Diode, Zener, 1N4752A, 33V, 1W	200–4752	1
D14 THRU D17	Diode, 1N4148, Silicon, 100V, 10 mA	203–4148	4
D18	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203–4005	1
D19	Diode, Zener, 1N5363, 30V, 5W	200–5363	1
F1	Fuse, AGC, 250V, 1/2 Ampere	330–0050	1
J3	Receptacle, Header, 20–Pin In–Line	417–0200	.20
J4	Receptacle, Header, 2–Pin	417–0097	1
J5	Receptacle, Header, 20–Pin In–Line	417–0200	.70
J16 THRU J18	Receptacle, Header, 3–Pin	418–0003	3
P16 THRU P18	Plug, Shorting, 2–Pin	340–0004	3
Q1	Transistor, MPSA06, NPN, TO–92 Case	211–0006	1
Q2	Transistor, MPSA56, PNP, TO–92 Case	210–0056	1
Q3,Q4	Transistor, MPSA06, NPN, TO–92 Case	211–0006	2
R1	Resistor, 169 Ohms ±1%, 1/4W	103–1693	1
R2	Resistor, 7.32 k Ohm ±1%, 1/4W	103–7324	1
R3,R4	Resistor, 100 k Ohm ±5%, 1/4W	100–1063	2
R5	Resistor, 115 Ohm ±1%, 1/4W	100–1131	1
R6	Resistor, 1.24 k Ohm ±1%, 1/4W	103–1244	1
R7,R8	Resistor, 10 k Ohm ±5%, 1/4W	100–1053	2

TABLE 4–11. CONTROL REGULATOR CIRCUIT BOARD – 919–0045
(Sheet 2 of 3)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R9	Resistor, 7.32 k Ohm ±1%, 1/4W	103–7324	1
R10	Resistor, 24 k Ohm ±5%, 1/4W	100–2453	1
R11	Resistor, 2.4 k Ohm ±5%, 1/4W	100–2443	1
R12	Resistor, 1.40 k Ohm ±1%, 1/4W	103–1404	1
R13	Resistor, 16 k Ohm ±5%, 1/4W	100–1653	1
R14	Resistor, 10 k Ohm ±5%, 1/4W	100–1053	1
R15	Resistor, 1.13 k Ohm ±1%, 1/4W	103–1134	1
R16	Resistor, 787 Ohm ±1%, 1/4W	103–7873	1
R17	Potentiometer, 10 k Ohm ±10%, 1/2W	178–1053	1
R18	Potentiometer, 100 k Ohm ±10%, 1/2W	178–1064	1
R19	Potentiometer, 50 k Ohm ±10%, 1/2W	178–5053	1
R20	Resistor, 100 k Ohm ±5%, 1/4W	100–1063	1
R21	Resistor, 1.1 k Ohm ±5%, 1/4W	100–1143	1
R22,R23	Resistor, 10 Ohm ±5%, 1/4W	100–1023	2
R24	Resistor, 100 k Ohm ±5%, 1/4W	100–1063	1
R25	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R26	Resistor, 4.99 k Ohm ±1%, 1/4W	100–5041	1
R27	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R28	Resistor, 4.99 k Ohm ±1%, 1/4W	100–5041	1
R29	Resistor, 10 k Ohm ±5%, 1/4W	100–1053	1
R30	Potentiometer, 10 k Ohm ±10%, 1/2W	178–1053	1
R31	Resistor, 2.49 k Ohm ±1%, 1/4W	103–2494	1
R32	Resistor, 11 k Ohm ±1%, 1/4W	103–1105	1
R33	Resistor, 3.57 k Ohm ±1%, 1/4W	103–3574	1
R34	Resistor, 2.21 k Ohm ±1%, 1/4W	103–2241	1
R35	Resistor, 10 k Ohm ±5%, 1/4W	100–1053	1
R36	Resistor, 12 k Ohm ±5%, 1/4W	100–1253	1
R37	Resistor, 5.6 Meg Ohm ±5%, 1/4W	100–5673	1
R38	Resistor, 390 Ohm ±5%, 1/4W	100–3933	1
R39	Resistor, 4.7 k Ohm ±5%, 1/4W	100–4743	1
R40 THRU R42	Resistor, 10 Ohm ±5%, 1/4W	100–1023	3
R43	Resistor, 1.2 k Ohm ±5%, 1/4W	100–1243	1
R44	Resistor, 100 Ohm ±5%, 1/4W	100–1033	1
R45	Resistor, 10 k Ohm ±5%, 1/4W	100–1053	1
R46	Resistor, 1.8 k Ohm ±5%, 1/4W	100–1843	1
R47	Resistor, 100 Ohm ±5%, 1/4W	100–1033	1
R48,R49	Resistor, 20 k Ohm ±5%, 1/4W	100–2053	2
R50	Resistor, 10 k Ohm ±5%, 1/4W	100–1053	1
R51	Resistor, 6.2 k Ohm ±5%, 1/4W	100–6243	1
R52	Resistor, 120 Ohm ±5%, 1/4W	100–1233	1
R53	Resistor, 100 k Ohm ±5%, 1/4W	100–1063	1
R54	Resistor, 10 k Ohm ±5%, 1/4W	100–1053	1
R55 THRU R57	Resistor, 22 Ohm ±5%, 1/4W	100–2223	3
R58	Resistor, 1 k Ohm ±5%, 1/4W	100–1043	1
R59,R60	Resistor, 0.1 Ohm ±1%, 5W, W/W	130–1000	2

TABLE 4–11. CONTROL REGULATOR CIRCUIT BOARD – 919–0045
(Sheet 3 of 3)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R61	Resistor, 1 k Ohm ±5%, 1/4W	100–1043	1
R62	Resistor, 0.1 Ohm ±1%, 5W, W/W	130–1000	1
R63	Resistor, 4.99 k Ohm ±1%, 1/4W	100–5041	1
R64	Resistor, 1 k Ohm ±1%, 1/4W	103–1041	1
R65 THRU R67	Resistor, 22 Ohm ±5%, 1/4W	100–2223	3
R68 THRU R70	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	3
R71	Resistor, 9.76 k Ohm ±1%, 1/4W	103–9764	1
R72	Potentiometer, 500 Ohm ±10%, 1/2W	178–5000	1
R73	Resistor, 10 Ohm ±5%, 1/4W	100–1023	1
R74	Resistor, 1.10 k Ohm ±1%, 1/4W	103–1104	1
R75	Resistor, 9.53 k Ohm ±1%, 1/4W	103–9534	1
R76	Potentiometer, 1 k Ohm ±10%, 1/2W	178–1043	1
R77	Resistor, 10 Ohm ±5%, 1/4W	100–1023	1
U1,U2	Integrated Circuit, LM317K, Three–Terminal Adjustable Positive Voltage Regulator, 1.2 to 37V, 1.5 Ampere Maximum, TO–3 Case	227–0318	1
U3 THRU U5	Integrated Circuit, LM358N, Dual Operational Amplifier, 8–Pin DIP	221–0358	3
U6	Integrated Circuit, LF353N, Dual JFET Input Operational Amplifier, 8–Pin DIP	221–0353	1
U7	Integrated Circuit, LM358N, Dual Operational Amplifier, 8–Pin DIP	221–0358	1
XF1	Fuse Clips, AGC	415–2068	2
XU3 THRU XU7	Socket, 8–Pin DIP	417–0804	5

TABLE 4–12. TEMPERATURE SENSOR CIRCUIT BOARD – 917–0030

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1 THRU C3	Capacitor, Mica, 390 pF 5%, 100V	042–3922	3
U1	Integrated Circuit, LM335Z, Precision Temperature Sensor, TO–92 Case	229–0335	1
——	Blank Circuit Board	517–0030	1

TABLE 4–13. RESISTOR NETWORK ASSEMBLY, PA – 959–1000–015

REF. DES.	DESCRIPTION	PART NO.	QTY.
R3A	Resistor, 10 k Ohm ±5%, 1/4W	100–1053	1
R3B	Resistor, 1.5 k Ohm, ±5%, 1/4W	100–1543	1
R3C	Resistor, 10 k Ohm ±5%, 1/4W	100–1053	1
R3D	Resistor, 2.7 k Ohm ±5%, 1/4W	100–2743	1

TABLE 4–14. LED CIRCUIT BOARD ASSEMBLY, PA – 919–0041

REF. DES.	DESCRIPTION	PART NO.	QTY.
DS1	Indicator, LED, Green, 521–9175, 3V @ 40 mA Maximum (**FWD** Power)	323–9224	1
DS2	Indicator, LED, Yellow, 521–9176, 3V @ 30 mA Maximum (**VSWR**)	323–9225	1
DS3	Indicator, LED, Red, 521–9212, 2V @ 50 mA Maximum (**OVER TEMP**)	323–9217	1
R1	Resistor, 680 Ohm ±5%, 1/2W	110–6833	1
R2,R3	Resistor, 820 Ohm ±5%, 1/2W	110–8233	2
——	Blank Circuit Board, Front Panel LED	519–0041	1

APPENDIX A
PA MANUFACTURERS DATA

A–1. INTRODUCTION.

A–2. This appendix provides the following technical data relative to the operation and maintenance of the PA used in the Broadcast Electronics B–series very–low–power line of FM transmitters. Information contained in this appendix is provided in the following order:

A. SD1460 VHF NPN Power Transistor Data Sheet

THOMSON-CSF
DIVISION SEMICONDUCTEURS DISCRETS

SD 1460

VHF NPN POWER TRANSISTOR FOR CLASS C FM OPERATION

FEATURES

- Gold metallizations
- Glass passivated structure
- Hermetical ceramic package

→ high reliability

- Emitter ballast resistors → severe inpedance mismatch
- Auto-aligned structure → high characteristics reproductibility

APPLICATIONS

Telecommunications up to 108 MHz frequency band.

PARTICULARITES

- *Métallisations "Or"*
- *Structure passivée*
- *Boîtier céramique hermétique*

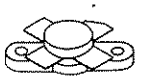
→ *haute fiabilité*

- *Résistances ballast d'émetteur* → *bonne tenue au ROS*
- *Structure auto-alignée* → *bonne reproductibilité des caractéristiques*

APPLICATIONS

Télécommunications dans la bande de fréquences jusqu'à 108MHz

f	=	108 MHz
P_{OUT}	=	160 W
G_P	=	9 dB
η_c	=	75 %
V_{CC}	=	28 V



Case *Boîtier* : CB-290 (.500 4L FL)

ABSOLUTE RATINGS (LIMITING VALUES) *VALEURS LIMITES ABSOLUES D'UTILISATION*		Symbols	Values	Units
Emitter-base (d.c.) voltage *Tension continue émetteur-base*	@ I_E = 20 mA	V_{EBO}	4	V
Collector-base (d.c.) voltage *Tension continue collecteur-base*	@ I_C = 100 mA	V_{CBO}	65	V
Collector-emitter (d.c.) voltage *Tension continue collecteur-émetteur*	@ I_C = 100 mA , R_{BE} = 10 Ω	V_{CES}	60	V
Collector (d.c.) current *Courant continu de collecteur*		I_C	16	A
Storage and junction temperature range *Températures extrêmes de stockage et de jonction*		T_{stg} T_j	− 65 → + 200	°C °C

Thermal resistance (junction-case) *Résistance thermique (jonction-boîtier)*	@ P_D = 100 W , T_c = 25°C	$R_{th(j-c)}$	0,75	°C/W

50, rue Jean-Pierre Timbaud - B.P. 5
F - 92403 Courbevoie Cedex FRANCE
Tél. : (1) 788-50-01 Telex : 610560 F

THOMSON-CSF COMPOSANTS

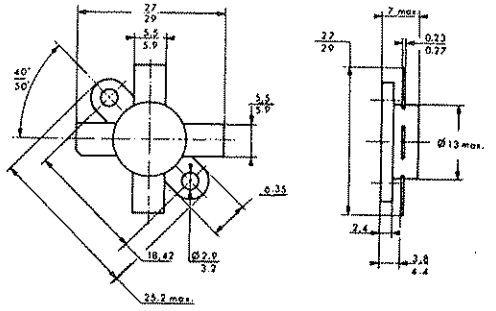
STATIC CHARACTERISTICS at t_{amb} = 25°C
CARACTERISTIQUES STATIQUES à t_{amb} = 25°C

Symbols	Values			Units	Test conditions
	min.	typ.	max.		
$V_{(BR)EBO}$	4			V	I_E = 20 mA
$V_{(BR)CBO}$	65			V	I_C = 100 mA
$V_{(BR)CES}$	60			V	I_C = 100 mA
I_{CBO}				mA	V_{CB} = V
H_{FE}	20		150		I_C = 1 A V_{CE} = 5 V
C_{22b}			150	pF	V_{CB} = 28 V f = 1 MHz

DYNAMIC CHARACTERISTICS at t_{amb} = 25°C
CARACTERISTIQUES DYNAMIQUES à t_{amb} = 25°C

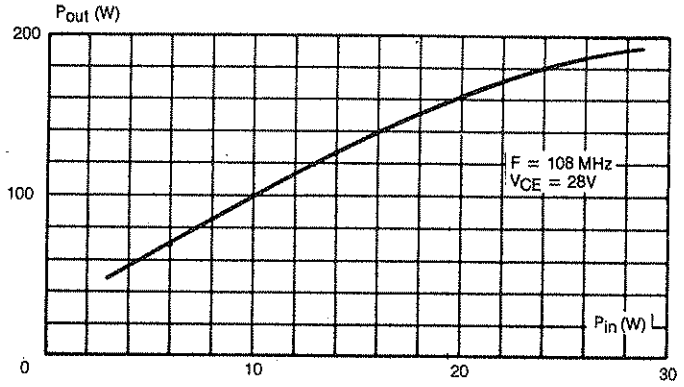
Symbols	Values			Units	Test conditions
	min.	typ.	max.		
P_{OUT}		160		W	f = 108 MHz V_{CB} = 28 V P_{IN} = 20 W
G_P		9		dB	
η_c	70	75		%	

CASE DESCRIPTION
DESCRIPTION DU BOITIER



Dimensions in millimeters

CB-290
(.500 4LFL)



Output power versus input power (typical values)

PRODUCT WARRANTY

LIMITED ONE YEAR

While this warranty gives you specific legal rights, which terminate one (1) year (6 months on turntable motors) from the date of shipment, you may also have other rights which vary from state to state.

Broadcast Electronics, Inc. ("BE"), 4100 North 24th Street, P. O. Box 3606, Quincy, Illinois 62305, hereby warrants cartridge machines, consoles, transmitters and other new Equipment manufactured by BE against any defects in material or workmanship at the time of delivery thereof, that develop under normal use within a period of one (1) year (6 months for turntable motors) from the date of shipment. Other manufacturers' Equipment, if any, shall carry only such manufacturers' standard warranty. This warranty extends to the original user and any subsequent purchaser during the warranty period. BE's sole responsibility with respect to any Equipment or parts not conforming to this warranty is to replace such equipment or parts upon the return thereof F.O.B. BE's factory or authorized repair depot within the period aforesaid.

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. However, the warranty period will be extended for the length of time that the original user is without the services of the Equipment due to its being serviced pursuant to this warranty. The terms of the foregoing warranty shall be null and void if the Equipment has been altered or repaired without specific written authorization of BE, 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 purchased. BE shall not be liable for any expense of any nature whatsoever incurred by the original user without prior written consent of BE.

BE shall not be liable to the original user for any and all incidental or consequential damages for breach of either expressed or implied warranties. However, some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. All express and implied warranties shall terminate at the conclusion of the period set forth herein.

Except as set forth herein, and except as to title, there are no 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 in BE's product literature or instruction manual which accompany the Equipment. Any card which is enclosed with the Equipment will be used by BE for survey purposes only.

BROADCAST ELECTRONICS, INC.
4100 North 24th Street, P. O. Box 3606, Quincy, Illinois 62305