FM–10S 10 KILOWATT FM
FMi 703 7 KILOWATT FM + HD
2.8 KILOWATT HD ONLY
BROADCAST TRANSMITTER

January, 2004 **IM No. 597–1012**

IMPORTANT INFORMATION

EQUIPMENT LOST OR DAMAGED IN TRANSIT.

When delivering the equipment to you, the truck driver or carrier's agent will present a receipt for your signature. Do not sign it until you have: 1) inspected the containers for visible signs of damage and 2) counted the containers and compared with the amount shown on the shipping papers. If a shortage or evidence of damage is noted, insist that notation to that effect be made on the shipping papers before you sign them.

Further, after receiving the equipment, unpack it and inspect thoroughly for concealed damage. If concealed damage is discovered, immediately notify the carrier, confirming the notification in writing, and secure an inspection report. This item should be unpacked and inspected for damage WITHIN 15 DAYS after receipt. Claims for loss or damage will not be honored without proper notification of inspection by the carrier.

RF PRODUCT TECHNICAL ASSISTANCE – REPAIR SERVICE – REPLACEMENT PARTS.

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

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

FACILITY CONTACTS –

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

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

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

NON–EMERGENCY REPLACEMENT PARTS –

Fax: (217) 224–9609

RETURN, REPAIR, AND EXCHANGES.

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

WARRANTY ADJUSTMENT.

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

PROPRIETARY NOTICE.

MODIFICATIONS.

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

WARNING

OPERATING HAZARDS

READ THIS SHEET AND OBSERVE ALL SAFETY PRECAUTIONS

ALL PERSONS WHO WORK WITH OR ARE EXPOSED TO POWER TRANSISTORS 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 TRANSISTORS

The operation of 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 power transistors are highly toxic and can cause serious injury or death. Additional information follows.

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

HIGH VOLTAGE

The transmitter operates at voltages high enough to kill through electrocution. Personnel should always break the primary circuits when access to the transmitter 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, open RF generating 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 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.

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SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. Information presented by this section provides a general description of the Broadcast Electronics FM-10S and FMi 703 transmitter and lists equipment specifications.

1-3. FM–10S RELATED PUBLICATIONS.

PUBLICATION NUMBER	EQUIPMENT
597-1050	FX-50 Exciter Technical Manual
597-0541	FXI 60/250 Digital Exciter Technical Manual
597-0008-004	FC-30 SCA Generator Technical Manual
597-9900	LYNX FM Digital Stereo Generator Manual

1-4. FMi 703 RELATED PUBLICATIONS.

PUBLICATION NUMBER	EQUIPMENT
597-0541	FXi 60/250 Digital Exciter Technical Manual
597-0542-002	FSi 10 IBOC Signal Generator Technical Manual
597-0551	AES Bypass Configuration Technical Manual

FIGURE 1-1. FM-10S TRANSMITTER

1-5. EQUIPMENT DESCRIPTION.

1-6. FM–10S GENERAL.

1-7. The Broadcast Electronics FM-10S transmitter is a 10 kW solid-state FM transmitter designed for continuous operation in the 87.5 MHz to 108 MHz broadcast band (refer to FIGURE 1-1). The FM-10S transmitter is equipped with: 1) an FX-50 FM exciter, 2) four 5kW modular switching power supply assemblies, 3) 16 modular solid-state broadband plug-in RF power amplifier modules, 4) one modular solid-state broadband plug-in IPA module, 5) two low-pass filters, 6) one 2-way and two 8-way combiner assemblies, 7) one output combiner assembly, 8) one 600-watt reject load assembly, 9) one 2-way IPA splitter and two 8-way motherboard splitter assemblies, 10) one reject load assembly, and 11) one microprocessor-controlled system controller and one module controller.

Components are housed in one cabinet. An extensive redundancy and protection system keeps a signal on the air even in the most extreme conditions.

FIGURE 1-2. FMi 703 TRANSMITTER

1-8. FMi 703 GENERAL.

The Broadcast Electronics FMi 703 transmitter is a 7 kW FM+IBOC and 2.8 kW IBOC only solid-state transmitter based largely on the FM-10S architecture and is designed for continuous operation in the 87.5-108MHz broadcast band (refer to FIGURE 1-2). The FMi 703 is equipped with: 1) FXi 60 FM/IBOC Digital Exciter, 2) FSi 10 IBOC Signal Generator, 3) four 5kW modular switching power supplies, 4) 16 modular solid-state broadband plug-in RF power amplifier modules biased for linear operation, 5) One modular solid-state broadband plug-in IPA module with an option for a second configured for standby operation, 6) One built in 2-way combiner with built in reject load 7) Microprocessor base controller to control TX operation..

Components are housed in one cabinet. An extensive redundancy and protection system keeps a signal on the air even in the most extreme conditions.

Specific FM–10S/FMi 703 features include:

- ***BROADBAND DESIGN.*** A broadband design eliminates tuning controls.
- ***MODULAR SWITCHING POWER SUPPLY UNITS.*** Four 5 kW modular switching power supply units provide operating potentials for the RF power amplifier modules. Separate switching power supply units provide ±12 and +5 volt operating potentials for the controllers, RF power amplifier modules, and IPA. An auto power supply backup option allows fifth power amplifier power supply modules to be installed in each transmitter cabinet.
- ***MODULAR RF AMPLIFIER UNITS.*** A total of 16 modular solid–state broadband plug–in RF amplifier modules. The modules are accessible from the front of the transmitter and output 700 watts of RF power. In the event of an RF amplifier module failure, each module can be inserted or removed from the transmitter during on–air operation. RF drive for the RF amplifier modules is provided by two solid–state broadband plug–in 500 watt IPA modules.
- ***SOFT–FAILURE FEATURE.*** A powerful soft–failure feature. If one RF amplifier module fails, the transmitter combiner automatically re–configures to output 95% of the RF output power.
- ***SYSTEM/MODULE CONTROLLERS.*** One system controller and two module controllers. The module controllers monitor and control 32 RF amplifier modules and two IPA modules. The system controllers monitor and control the module controllers and system functions such as VSWR foldback.
- ***OPTIONS.*** Several options allow the transmitter to be equipped with: 1) an automatic exciter switcher, 2) a fifth switching power supply assembly, 3) an automatic IPA switcher, and 4) RTDS (available at a future date).
- ***REDUNDANT DESIGN.*** Redundant design for superior reliability. The modularity of the RF amplifier modules, power supply modules, IPA, and transmitter options allow for redundant circuitry in critical areas. If a failure occurs, this redundancy allows the transmitter to maintain on–air operation.
- ***IEC 215 COMPLIANT.*** IEC 215 safety compliant.

1–9. **FX–50 EXCITER.** The FM–10S comes standard with the FX–50 solid–state wideband FM exciter providing a continuously variable RF output at any frequency within the 87.5 MHz to 108 MHz broadcast band in 10 kHz increments. The FX–50 is designed to accept multiple wideband composite inputs from a stereo generator or SCA generator. In addition, the FX–50 is equipped with a 600 ohm balanced monaural input. A tapped dual primary power transformer and a voltage selector allows operation from a wide range of ac input potentials.

The FX–50 is equipped with a digitally programmed frequency synthesizer which generates and maintains the phase and frequency of the carrier. A temperature compensated reference oscillator and a dual–speed phase–locked–loop control circuit locks the frequency of a modulated oscillator to a precision frequency oscillator allowing prompt on–frequency operation. A solid–state broadband 3 to 50 watt RF amplifier provides amplification of the FM signal. Exciter operating parameters are monitored and displayed by a front–panel digital LCD multimeter and an LED display.

1–10. **FXi 60 DIGITAL EXCITER.** The FM–10S may also be equipped with the optional FXi 60 digital FM exciter. The FXi 60 is a solid–state wideband FM digital exciter providing a continuously variable RF output at any frequency within the 87.5 to 108 MHz FM broadcast band in 10 kHz increments. The FXi 60 is divided into several board assemblies. The assemblies include: 1) DSP (Digital–Signal–Processor) Modulator, 2) Controller, 3) Oscillator/Filter, 4) RF Power Amplifier, 5) Power Supply, and 6) Color GUI Interface. For an FM–10S transmitter, the FXi 60 will be equipped with a 60 watt RF power amplifier module.

The FXi 60 is highly integrated and comes with the following standard features: 1) AES Input, 2) L & R Analog Inputs, 3) Balanced and Unbalanced Composite Inputs, 4) Two internal SCA Generators, 5) Internal RDS Generator, and 6) External SCA/RDS Input. The FXi 60 also has a built in stereo generator, compressor, and limiter all of which are software programmable and defeatable. The exciter can also be operated in Mono (L+R), Mono L, or Mono R modes. The digital exciter also provides modulation Directly To Channel (DTC) 87.5 – 108MHz, eliminating any analog up converter processes. The chassis of the FXi 60 requires 7 inches of a 19 inch rack cabinet. Refer to publication 597–0541 for a detailed explanation of the FXi 60 features.

1–11. **FXi 60 EXCITER (IBOC).** When used in a FMi 703 the FXi 60 exciter is configured for IBOC operation with a plug in IBOC card. With the IBOC card installed the FXi 60 can be set for FM + IBOC or IBOC only mode. This mode is selectable from the front panel of the FXi 60 exciter. The FXi 60 can also be set for FM only mode in a 703 with the power output limited at 7 kW. This is also selectable from the front panel of the exciter.

1–12. **FSi 10 IBOC SIGNAL GENERATOR.** The FSi 10 IBOC Signal Generator is required for IBOC transmission and is standard in a FMi 703 transmitter. The FSi 10 works in conjunction with the FXi 60 to provide the IBOC signal to the FMi 703. In order to produce the IBOC signal you must have both the FXi 60 and FSi 10 installed an operating in the FMi 703 TX.

1–13. **POWER SUPPLY.** The FM–10S/FMi 703 transmitter is equipped with four 5 kW modular switching power supply assemblies. The supplies provide DC operating potentials for the transmitter power amplifier circuitry. A separate modular switching power supply provides ±12 and +5 volt operating potentials for the controller, IPA, and RF amplifier modules. Each supply is equipped with overload protection, over–voltage protection, high temperature protection, and a soft–start feature which minimizes in–rush currents. A fifth 5 kW modular switching power supply can be installed as a backup if the transmitter is equipped with the backup power supply option.

1–14. **RF POWER AMPLIFIER MODULES.** The FM–10S/FMi 703 transmitter is equipped with 16 RF power amplifier modules.

The PA and IPA modules in the FMi 703 are solid–state amplifiers biased for linear operation. There are the same number of modules and the architecture is the same as those used in the FM–10S.

1–15. Each module consists of an interface circuit board, 2 RF amplifier circuit boards, and a combiner. Each RF amplifier circuit board: 1) contains a single dual MOSFET power transistor operated in a push–pull configuration and 2) outputs 350 watts of RF power. RF amplifier operations are monitored by the interface circuit board. The interface circuit board is designed to monitor over–current, over–voltage, high reflected power, and high temperature conditions. A limit circuit is designed to limit the RF output during high reflected power, high temperature, over–current, or high forward power demand conditions. The operating status of each module parameter is routed to a module controller circuit board for display. The output from each RF amplifier module is combined to produce 700 watts of RF power.

1–16. **RF SPLITTER AND IPA MODULES.** RF power from the exciter is fed into the IPA module. This module is identical to the RF power amplifiers and output 500 watts of RF power. The transmitter can be equipped with a second “standby IPA module” and an automatic IPA switcher if the ”Standby IPA option” is installed.

1–17. **CONTROLLER.** The FM–10S/FMi 703 controller (located in the Control cabinet) consists of a supervisor circuit board, two module control circuit boards, a front–panel display circuit board, and an input/output circuit board. The controller utilizes extensive RFI filtering and 3 microprocessors to ensure maximum reliability. A battery back–up system is incorporated into the design to maintain the controller memory during AC power interruptions. Operating potentials for the controller circuitry are provided by a modular switching power supply. The supply provides the controller circuitry with stable ±12 and +5 VDC supplies.

1–18. The supervisor controller circuit board is equipped with a Z–World(c) microprocessor module. The supervisor circuit board controls and monitors the module control circuit board and performs all system type control operations such as on/off control, power trim, automatic power control, and remote control interfacing. The automatic power control function responds to reflected power and internal temperature conditions. If the reflected power or internal temperature increases above the thresholds, the transmitter will automatically foldback the output power to maintain on–air operation. The soft–failure feature controls the combiner in response to RF module failures. In the event of an RF module failure, the controller automatically re–configures the combiner to provide maximum RF output power.

1–19. The supervisor circuit board controls the operation of all the controller front panel displays and switches. Transmitter forward power, reflected power, PA voltage, air inlet temperature, and exciter forward/reflected power samples are routed to the circuit board. The samples are displayed or used as status information by the microprocessor. System parameters are displayed by a 4–character LCD display. Module parameters are displayed by a 2–line 16 character LCD display.

1–20. The module control circuit board reports to and responds to commands from the supervisor circuit board. The module control circuit board is equipped with two 80C31 microprocessors. The circuit board provides monitoring, control, and display functions for 32 RF amplifier modules and two IPA modules. The module control circuit board is also responsible for the combiner re–configuration during soft–failure conditions. RF power amplifier module forward power, reflected power, current, voltage, and temperature samples are routed to the circuit board for monitoring and display.

1–21. The FM–10S/FMi 703 can also be equipped with RTDS (available at a future date). RTDS is a system designed to monitor, control, and troubleshoot transmitter operations from a remote location using a PC. The system consists of an RTDS microprocessor module and the RTDS PC software.

1–22. **COMBINER.** The FM–10S/FMi 703 is equipped with an auto–configurable combiner system. This unique system matches the combiner to the number of operating modules in the transmitter. In the event of a failure in an RF amplifier module, the combiner will automatically re–configure to provide maximum output power from the remaining modules. For example, if one RF amplifier module encounters a failure, the combiner will automatically re–configure to provide approximately 95% of the rated output power. The combiner system is controlled by the transmitter module control circuit board.

1–23. The combiner system consists of two 8–way combiners and one 2–way combiner. Each 8–way combiner sums the outputs of 8 RF amplifier modules to produce 5 kW output. One 2–way combiner sums the 5 kW outputs from two 8–way combiners to produce the 10 kW output. The unique features of the combiner include: 1) very low loss, 2) broadband, and 3) no cable connections.

1-24. **TRANSMITTER CONFIGURATIONS.**

1-25. The FM-10S transmitter can be ordered in the following configurations:

Part Number	DESCRIPTION
909-1010-206	FM-10S 10 kW solid-state FM transmitter for operation in the 87.5 MHz to 108 MHz broadcast band, 196 to 252 VAC 50/60 Hz three-phase supply. Includes FX-50 FM exciter, 196 to 252 VAC 50/60 Hz.
909-1010-226 (available as customer special)	FM-10S 10 kW solid-state FM transmitter for operation in the 87.5 MHz to 108 MHz broadcast band, 196 to 252 VAC 50/60 Hz single-phase supply. Includes FX-50 FM exciter, 196 to 252 VAC 50/60 Hz.
909-1010-386	FM-10S 10 kW solid-state FM transmitter for operation in the 87.5 MHz to 108 MHz broadcast band, 341 to 435 VAC 50/60 Hz three-phase WYE supply. Includes FX-50 FM exciter, 196 to 252 VAC 50/60 Hz.

1-26. The FMi 703 transmitter can be ordered in the following configurations:

Part Number	DESCRIPTION
909-0703-206	FMi 703 HD XMTR 220V 3PH Delta
909-0703-226	FMi 703 HD XMTR 220V 1PH
909-0703-386	FMi 703 HD XMTR 380V 3PH 4-WIRE WYE

1-27. **OPTIONAL EQUIPMENT AND SPARE PARTS KITS.**

1-28. The following text presents the optional equipment and spare parts kits available for use with the FM-10S transmitter.

Part Number	DESCRIPTION
909-0051-204	FC-30 FM SCA generator.
979-1010	Recommended spare parts kit for FM-10S/FMi 703 solid-state transmitter. Does not include spare parts for the FX-50.
979-1011	Recommended semiconductor kit for FM-10S/ FMi 703 solid-state transmitter. Does not include semiconductors for the FX-50.
909-9000	LYNX FM digital stereo generator.
979-0600	Upgrade FXi 60 Digital FM Exciter
969-1011-001	Standby FXi 60 Digital FM Exciter
907-9091	RTDS (Remote Transmitter Diagnostic System), factory installation.
907-9091-001	RTDS (Remote Transmitter Diagnostic System), field installation.
969-1011	Main/alternate exciter switcher option, FX-50.
969-1013	Backup power supply module option.
969-1022	Main/alternate IPA switcher option.

1–29. The following list presents optional equipment and spare parts kits for use with the FMi 703 transmitter.

979–1010	Recommended spare parts kit for use with the FM–10S/FMi 703 solid–state transmitter.
979–1011	Recommended semiconductor kit for FM–10S/ FMi 703 solid–state transmitter.
969–1013	Backup power supply module option.
969–1022	Main/alternate IPA switch optoin.
979–0551	Kit, HD Radio AES Bypass, Dual Processors.
979–0551–001	Kit, HD Radio AES Bypass, Omnia HDFM single processor.
979–0551–002	Kit, HD Radio AES Bypass, Orban HDFM single processor.

1–30. EQUIPMENT SPECIFICATIONS.

1–31. Refer to TABLE 1–1 for electrical specifications or TABLE 1–2, beginning on page 1–17, for physical specifications of the FM–10S transmitter.

TABLE 1–1. FM–10S ELECTRICAL SPECIFICATIONS
(Sheet 1 of 9)

PARAMETER	SPECIFICATION
RF POWER OUTPUT	5 kW to 11 kW (as specified)
FREQUENCY RANGE	87.5 to 108 MHz (as specified). Exciter programmable in 10 kHz increments.
RF OUTPUT IMPEDANCE	50 ohms.
RF OUTPUT CONNECTOR	3 1/8 inch EIA female field flange.
MAXIMUM VSWR	Rated power into 1.5 : 1 maximum. Capable of operating into higher VSWR conditions with automatic power reduction. Open and short circuit protected at all phase angles.
EXCITER	Model FX–50, solid–state 50 watt output with digitally programmed synthesizer. 10 kHz increment programming. Optional FXi 60 digital exciter, 60 watt output, 10 kHz increment programming.
FREQUENCY STABILITY FX–50 Exciter Optional FXi 60 Exciter	 ±300 Hz. 0 to 50 degrees C. ±300 Hz, (–10°C to +50°C). Can be locked to an external reference source such as GPS (Global Positioning System).

TABLE 1-1. FM-10S ELECTRICAL SPECIFICATIONS
(Sheet 2 of 9)

PARAMETER	SPECIFICATION
MODULATION TYPE	
FX–50 Exciter	Direct modulation of carrier frequency.
Optional FXi 60 Digital FM Exciter	Direct To Channel modulation.
MODULATION CAPABILITY	
FX–50 Exciter	Greater than ±350 kHz.
Optional FXi 60 Digital FM Exciter	±300 kHz maximum.
AM SIGNAL–TO–NOISE RATIO:	
Asynchronous	55 dB (65dB typical) below an equivalent refer ence carrier with 100% AM modulation @ 400 Hz, 75 microsecond deemphasis (no FM modulation present).
Synchronous	50 dB (60dB Typical) below an equivalent 10 kW reference carrier @ 100% AM modulation @ 400Hz. 75 uS deemphasis with ±75 kHz FM mod ulation @ 400 Hz and a 10 kW output power.
IMD PROTECTION	20 dB or better turn–around–loss or mixing loss to interfering signals.
RF HARMONIC SUPPRESSION	Meets all FCC/IC requirements and CCIR recommendations.
AC POWER REQUIREMENTS	196 to 252V ac 50/60 Hz Hz three phase. 196 to 252V ac 50/60 Hz single phase. 341 to 435V ac 50/60 Hz three phase WYE.
AC POWER CONSUMPTION	17.3 kW nominal at a 10 kW RF power output, 50 Ohm resistive load, 230V ac input. 21 kW at a 10 kW RF power output, 1.5 : 1 VSWR load, 230V ac input.
POWER FACTOR	0.98 at 230 VAC. 20 kW RF output power into 50 ohm resistive load.
OVERALL EFFICIENCY	55% or greater at 230 VAC (AC line input to RF output). 20 kW RF output power into a 50 ohm resistive load, 58% typical.
SURGE PROTECTION	Tested with IEEE C62.41–1991 recommended waveforms for location categories B3 and IEC 801–4 standard waveforms for severity level 4.
RF SAMPLE OUTPUTS	5, BNC. One additional output with optional FXi 60 exciter.

TABLE 1-1. FM-10S ELECTRICAL SPECIFICATIONS
(Sheet 3 of 9)

PARAMETER	SPECIFICATION
DIRECTIONAL COUPLERS	
Transmitter Output	3 total, 1 forward power, 1 reflected power and 1 forward sample for modulation monitor.
Exciter Output	2 total, 1 forward power and 1 reflected power.
Low-Pass Filter Output	4 total, 1 forward power and 1 reflected power each for low-pass filter A, low-pass filter B.
RF Module Output	16 total, 1 forward power and 1 reflected power for each module.
IPA Module Output	2 total, 1 forward power and 1 reflected power.
COMPOSITE OPERATION WITH FX-50 AND FXi 60	
COMPOSITE INPUTS	3 total, BNC. One unbalanced, one balanced, and one front panel test. Optional FXi 60. One balanced and one unbalanced.
COMPOSITE INPUT IMPEDANCE	10 k ohms or 50 ohms nominal, resistive selectable.
COMPOSITE INPUT LEVEL	3.5 V p-p nominal for ±75 kHz deviation.
FM SIGNAL-TO-NOISE RATIO:	
Composite	85 dB below ±75 kHz deviation @ 400 Hz measured in a 20 Hz to 30 kHz bandwidth with 75 microsecond de-emphasis.
DISTORTION	
Harmonic	0.02% or less at 400 Hz.
SMPTE Intermodulation Distortion	0.02% or less, 60 Hz/7 kHz, 1:1 ratio.
CCIF Intermodulation Distortion	0.02% or less, 15 kHz/14 kHz, 1:1 ratio.
Transient Intermodulation Distortion	0.02% or less, sine wave/square wave.
COMPOSITE OPERATION WITH FX-50 AND FXi 60 (Con't)	
COMPOSITE AMPLITUDE RESPONSE	±0.1 dB, 30 Hz to 53 kHz.
COMPOSITE PHASE RESPONSE	±0.25 degrees from linear phase, 30 Hz to 53 kHz.
COMPOSITE GROUP DELAY	125 nanoseconds.
COMPOSITE SLEW RATE	9 volts/microsecond (symmetrical).

TABLE 1-1. FM-10S ELECTRICAL SPECIFICATIONS
(Sheet 4 of 9)

PARAMETER	SPECIFICATION
ANALOG L & R STEREO OPERATION WITH FX-50 AND FXi 60	
AUDIO INPUT IMPEDANCE	600 ohms balanced, resistive, floating. adaptable to other impedances.
AUDIO INPUT LEVEL	+10 dBm, ±1 dBm for 100% modulation At 400 Hz.
AUDIO INPUT FILTERS	15 kHz low-pass filters with delay equalization for minimum overshoot.
FREQUENCY RESPONSE	±0.5 dB, 30 Hz to 15 kHz, 75 microsecond pre-emphasis (flat, 25 or 50 microsecond selectable).
TOTAL HARMONIC DISTORTION	0.05% or less @ 400 Hz.
SMPTE INTERMODULATION DISTORTION	0.05%, 60 Hz/7 kHz; 4:1 ratio.
CCIF INTERMODULATION DISTORTION	0.05% Or Less, 15 kHz/14 kHz; 1:1 ratio.
TRANSIENT INTERMODULATION DISTORTION	0.05% (square wave/sine wave).
FM SIGNAL TO NOISE	80 dB or greater below left or right channel 100% modulation @ 400 Hz, 75 microsecond de-emphasis.
STEREO SEPARATION	50 dB or greater from 30 Hz to 15 kHz (sine wave). FXi 60 – 60 dB or better.
DYNAMIC STEREO SEPARATION	40 dB or greater from 30 Hz to 15 kHz (normal program content). FXi 60 – 50 dB or better.
LINEAR CROSSTALK (MAIN TO SUB/SUB TO MAIN DUE TO AMPLITUDE AND PHASE MATCHING OF LEFT AND RIGHT CHANNELS)	45 dB below 100% modulation, 30 Hz to 15 kHz. FXi 60 – 55 dB or better.
NON-LINEAR CROSSTALK (MAIN TO SUB/SUB TO MAIN DUE TO DISTORTION PRODUCTS).	70 dB minimum below 100% modulation.

TABLE 1-1. FM-10S ELECTRICAL SPECIFICATIONS
(Sheet 5 of 9)

PARAMETER	SPECIFICATION
ANALOG L & R STEREO OPERATION WITH FX-50 AND FXi 60 (Con't)	
38 kHz SUPPRESSION	80 dB minimum below 100% modulation.
PILOT STABILITY	±0.5 Hz, +32°F to +122°F (0°C to +50°C).
STEREOPHONIC SEPARATION	50 dB, 30 Hz To 15 kHz (Sinewave).
MODES OF OPERATION	Stereo, Mono L+R, Mono L, and Mono R. Remote control accessible.
MONAURAL OPERATION WITH FX-50 and FXi 60	
AUDIO INPUT IMPEDANCE	600 ohms balanced, resistive, adaptable to other impedances, 60 dB common mode suppression.
AUDIO INPUT LEVEL	+10 dBm nominal for ±75 kHz deviation @ 400 Hz.
AUDIO FREQUENCY RESPONSE	±0.5 dB, 30 Hz to 15 kHz, selectable flat, 25, 50 or 75 microsecond pre-emphasis.
THD PLUS NOISE	0.02% or less at 400 Hz.
SMPTE IMD	0.02% or less, 60 Hz to 7 kHz, 4:1 ratio.
CCIF IMD	0.02% or less, 15 kHz/14 kHz 1:1 ratio.
TRANSIENT IMD	0.02% or less (sine wave/square wave).
FM SIGNAL-TO-NOISE RATIO	85 dB below ±75 kHz deviation @ 400 Hz measured in a 20 Hz to 30 kHz bandwidth with 75 microsecond de-emphasis.
SCA OPERATION WITH FX-50	
MODULATION TYPE	Direct FM.
SUBCARRIER FREQUENCY	67 kHz (39 to 95 kHz optional).
SUBCARRIER FREQUENCY STABILITY	±0.5% (330 Hz @ 67 kHz), 0°C to +50°C
SUBCARRIER HARMONIC CONTENT	Less than 0.3%.
SUBCARRIER ENVELOPE DECAY	Greater than 100 milliseconds from 90% to 10% subcarrier level.
MODULATION CAPABILITY	±20% of subcarrier frequency, maximum.

TABLE 1-1. FM-10S ELECTRICAL SPECIFICATIONS
(Sheet 6 of 9)

PARAMETER	SPECIFICATION
SCA OPERATION WITH FX-50 (Con't)	
INPUT IMPEDANCE	
AUDIO	600 ohms, balanced, resistive.
DATA	75 ohms, unbalanced, resistive, DC coupled.
INPUT LEVEL	
AUDIO	Adjustable +10 dBm to –10 dBm for ±6 kHz deviation @ 400 Hz.
DATA	Adjustable 1.0 to 4.0 V p–p for ±6 kHz deviation, DC coupled.
PRE–EMPHASIS:	
AUDIO	150 microseconds standard (75 microseconds with internal jumper).
DATA	No pre–emphasis.
FREQUENCY RESPONSE:	
AUDIO	±0.5% dB, 10 Hz to 10 kHz, exclusive of low pass filter.
DATA	±0.5 dB, DC to 10 kHz.
LOW–PASS FILTER	
AUDIO	Sixth order, –3 dB at 4.3 kHz standard (resistor changes for other values).
DATA	Sixth Order, –3 dB At 4.3 kHz standard (resistor changes for other values). May be bypassed.
TOTAL HARMONIC DISTORTION	Less than 0.5% throughout AF pass band.
SMPTE INTERMODULATION DISTORTION	Less than 0.5% 60 Hz/7 kHz, 1:1 ratio (low–pass and pre–emphasis filter bypassed).
CROSSTALK SCA TO STEREO	–60 dB or better below 100% modulation of left or right. 75 microsecond de–emphasis.
CROSSTALK STEREO TO SCA	–50 dB or better below ±6 kHz deviation of SCA using 150 microsecond de–emphasis and FS–30 stereo generator.
FM SIGNAL–TO–NOISE RATIO	62 dB below ±6 kHz deviation @ 400 Hz (150 microsecond de–emphasis).

TABLE 1-1. FM-10S ELECTRICAL SPECIFICATIONS
(Sheet 7 of 9)

PARAMETER	SPECIFICATION
AES INPUT STEREO OPERATION	
with FXi 60	
INPUT IMPEDANCE	110 Ohms, Balanced.
INPUT LEVEL	-2 dBFS for 100% modulation @ 400Hz, adjust able. (32, 44.1, 48, and 96kHz sampling rates.
CONNECTOR	Wire - XLR, Optical - Toshiba (TosLink)
FREQUENCY RESPONSE	±0.5 dB; 20Hz to 15kHz.
THD + NOISE:	0.03%; 20Hz to 15kHz.
SMPTE IMD	0.03%; 60Hz/7kHz, 4:1 Ratio.
CCIF IMD	0.03%; 15kHz/14kHz, 1:1 Ratio.
TRANSIENT IMD	0.03%; Square Wave/Sine Wave.
FM SINGAL TO NOISE RATIO	80dB or better. 100% modulation @ 400Hz.
SEPARATION	60dB; 20Hz to 15kHz.
DYNAMIC SEPARATION	50dB; 20Hz to 15kHz.
LINEAR CROSSTALK	60dB below 100% modulation; 20Hz to 15kHz.
NON-LINEAR CROSSTALK	70dB below 100% modulation.
38kHz SUPPRESSION	.80dB below 100% modulation.
PILOT STABILITY	.±0.3Hz.
MODES OF OPERATION	Stereo, Mono (L+R), Mono L, and Mono R.
INTERNAL SCA OPERATION	
with FXi 60	
AUDIO INPUT IMPEDANCE	600 ohms or 10k ohms selectable.
AUDIO INPUT LEVEL	+10dBm for 10% Injection, adjustable.
CONNECTOR	D-Sub. 9-position female.
FREQUENCY RESPONSE	±0.5 dB; 20Hz to 5kHz.
SIGNAL TO NOISE RATIO	55dB or better
FREQUENCY	20kHz to 99kHz; programmable.
PRE-EMPHASIS	0, 50, 75, and 150usec.
DEVIATION	2.5kHz to 10kHz; programmable.
INJECTION LEVEL	2% to 15%; programmable.

TABLE 1-1. FM-10S ELECTRICAL SPECIFICATIONS
(Sheet 8 of 9)

PARAMETER	SPECIFICATION
INTERNAL SCA OPERATION	
with FXi 60 (Con't)	
AUDIO INPUT IMPEDANCE	600 ohms or 10k ohms selectable.
AUDIO INPUT LEVEL	+10dBm for 10% Injection, adjustable.
CONNECTOR	D-Sub. 9-position female.
FREQUENCY RESPONSE	±0.5 dB; 20Hz to 5kHz.
SIGNAL TO NOISE RATIO	55dB or better
FREQUENCY	20kHz to 99kHz; programmable.
PRE-EMPHASIS	0, 50, 75, and 150usec.
DEVIATION	2.5kHz to 10kHz; programmable.
INJECTION LEVEL	2% to 15%; programmable.
INTERNAL RDS OPERATION	
with FXi 60	
FREQUENCY	57kHz.
INJECTION LEVEL	2% to 15%; programmable.
MODES OF OPERATION	PS (Program Service Name), PI (Program Identi fication), PTY (Program Type), AF (Alternate Fre quency List), and DI (Decoder Identification).
EXTERNAL SCA/RDS OPERATION	
with FXi 60	
INPUT IMPEDANCE	10k ohms unbalanced.
INPUT LEVEL	3.5Vp-p for 10% Injection.
CONNECTOR	BNC female.
FREQUENCY RESPONSE	±0.5 dB; 50kHz to 100kHz.
19kHz OUTPUT	.2.5Vp-p into 50 ohms for external synch.

TABLE 1-1. FM-10S ELECTRICAL SPECIFICATIONS
(Sheet 9 of 9)

PARAMETER	SPECIFICATION
PHYSICAL	
DIMENSIONS:	
FX–50 Exciter	Width: 19.0 inches (48.3 cm). Height: 5.25 inches (13.3 cm). Depth: 19.00 inches (48.3 cm).
Optional FXi 60 Digital Exciter	Width: 19.0 inches (48.3 cm). Height: 7.0 inches (17.78 cm). Depth: 22.5 inches (57.15 cm).
Transmitter	Width: 44.5 inches (113 cm). Height: 70 inches (178 cm). Depth: 26.5 inches (68 cm).
WEIGHT	
FX–50 Exciter	38 pounds (17.2 kg) unpacked.
Optional FXi 60 Digital Exciter	38 pounds (17.2 kg) unpacked.
Transmitter	713 lbs (324 kg) standard unpacked.
SAFETY	Meets IEC 215.
ENVIRONMENTAL	
HEAT DISSIPATION	8 kW (27,354 BTU/hr) nominal at 10 kW RF output, 50 ohm resistive load. 11 kW (37,570 BTU/hr) at 10 kW RF output into a 1.5:1 VSWR load with 230 VAC input.
COOLING AIR REQUIREMENTS	2700 CFM (28.3 m^3/min)
AMBIENT TEMPERATURE RANGE	+32°F to +122°F (0°C to +50°C).
MAXIMUM ALTITUDE	
50 Hz Operation	0 to 7,500 feet above sea level (0 to 2286 meters).
60 Hz Operation	0 to 10,000 feet above sea level (0 to 3048 meters).

TABLE 1-2. FMi 703 ELECTRICAL SPECIFICATIONS
(Sheet 1 of 3)

PARAMETER	SPECIFICATION
RF POWER OUTPUT RANGE IBOC ONLY FM + IBOC	1,000–2,800W 3,000–7,000W
OUTPUT IMPEDANCE	50 ohms nominal
OUTPUT CONNECTOR	3 1/8" EIA flange, 1 5/8" flange optional.
OVERALL EFFICIENCY IBOC ONLY FM+IBOC	 >25% >50%
VSWR	Rated Power into 1.5:1 VSWR . Capable of operating in to higher VSWR with automatic power reduction. Open and short circuit protected at all phase angles.
FREQUENCY RANGE	87.5MHz to 108MHz; 10kHz increments
Frequency Stability Internal 10MHz Ref. External 10MHz Ref. (GPS)	 +/–300Hz, 0–50 degrees C Determined by source
Modulation Capability	+/–300kHz FM Mode
Modulation Modes	FM Only, FM + IBOC, and IBOC Only
Asynchronous AM S/N Ratio	55dB below rated power with 100% AM at 400Hz and 75usec de–emphasis (no modulation present)
Synchronous AM S/N Ratio	50dB below rated power with 100% AM modulation at 400Hz and 75usec de–emphasis (+/–75kHz modulation)
IMD Protection	20dB or better turn–around loss or mixing loss to interfering signals.
Spurious and Harmonic	Meets or exceeds all FCC requirements
Altitude	10,000 ft. (3048M) @ 60Hz; 7,500 ft. (2286M) @ 50Hz
Cooling Air Requirement	2700 CFM
Output Connector Weight	3 1/8" EIA female (1 5/8" optional) 713 lbs. standard unpacked
AC Input AC Voltage Requirements 3–Phase	 196 to 252VAC, 50/60Hz, 3–phase, Closed Delta or WYE (3 or 4 wire) 340 to 435VAC, 50/60Hz, 3–phase, 4 wire, WYE only
Single Phase	196 to 252VAC, 50/60Hz, Single Phase
Power Factor	0.98 at 230VAC

TABLE 1-2. FMi 703 ELECTRICAL SPECIFICATIONS
(Sheet 2 of 3)

PARAMETER	SPECIFICATION
Disconnect Size	
3–Phase	
IBOC Only	55Amp fuse disconnect recommended
FM + IBOC	70Amp fuse disconnect recommended
Single Phase	
IBOC Only	80Amp fuse disconnect recommened
FM + IBOC	100Amp fuse disconnect recommended
Actual Amperage draw at:	
3–Phase	
IBOC Only	25A average
FM + IBOC	35A average
Single Phase	
IBOC Only	40A average
FM + IBOC	60A average
AC Wire Size	
3–phase	
IBOC Only	#6 AWG, Copper, THHN or equivalent
FM + IBOC	#4 AWG, Copper, THHN or equivalent
Single Phase	
IBOC Only	#3 AWG, Copper, THHN or equivalent
FM + IBOC	#1 AWG, Copper, THHN or equivalent
AC Power Consumption	
IBOC Only	10kW @ 2.8kW RF output
FM + IBOC	14kW @ 7kW RF output
Heat Dissipation	
IBOC Only	7,200W (24,573BTU/hr) nominal at 2.8kW RF output
FM + IBOC	7,000W (23,891BTU/hr) nominal at 7kW RF output
FM Audio Performance	
AES Input FM +IBOC Mode	
Input Level	–2dBFS for 100% modulation
Input Frequency	32, 44.1, 48, or 96kHz; 16–24bits
Impedance	110ohms
Connector	Wire – XLR, Optical – TosLink
Amplitude Response	+/–0.5dB; 20Hz to 15kHz
IMD Distortion	0.03% or better
THD + Noise	
Stereo	0.03% or better
Mono	0.005% or better

TABLE 1-2. FMi 703 ELECTRICAL SPECIFICATIONS
(Sheet 3 of 3)

PARAMETER	SPECIFICATION
S/N Ratio	
Stereo	85dB or better below 100% modulation @ 400Hz
Mono	90dB or better below 100% modulation @ 400Hz
Stereo Separation	65dB; 20Hz to 15kHz
Pilot Stability	+/–0.3Hz; 0–50 degrees C
Internal SCAs (2)	
Frequency	20kHz to 99kHz software programmable
Deviation	2.5kHz to 10kHz
Injection Level	2% to 15%
Pre–Emphasis	0, 50usec, 75usec, or 150usec.

SECTION II
INSTALLATION

2-1. INTRODUCTION.

2-2. This section contains information required for the installation and preliminary checkout of the Broadcast Electronics FM-10S/FMi 703 transmitter.

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. If the contents are incomplete, or if the unit is damaged electrically or mechanically, notify both the carrier and Broadcast Electronics.

2-6. ENVIRONMENTAL REQUIREMENTS.

2-7. TABLE 1-1, beginning on page 1-8, provides environmental conditions which must be considered prior to transmitter installation. Refer to TABLE 1-1 in SECTION I, GENERAL INFORMATION and ensure the transmitter is to be installed in an acceptable environment.

2-8. COOLING AIR REQUIREMENTS.

2-9. The FM-10S/FMi 703 transmitter requires a source of cooling air to maintain an acceptable operating temperature. The transmitter requires a cooling air flow of 5400 cubic feet per minute or 2700 cubic feet per minute per cabinet (refer to FIGURE 2-1, page 2-3). The cooling air source must be dry and well filtered.

2-10. 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 a minimum air flow of 5400 cubic feet of air per minute (2700 cubic feet per minute for each cabinet).

2-11. If an exhaust system is desired, an exhaust hood must be designed. A paper titled "TRANSMITTER COOLING SYSTEMS: DESIGN, OPERATION, AND MAINTENANCE " provides information on the design and maintenance of transmitter exhaust systems. The paper can be obtained by locating the document on the Transmitter Technical Data CD supplied with this manual or by contacting Broadcast Electronics Customer Service.

2-12. PRIMARY POWER.

2-13. The standard FM-10S/FMi 703 transmitter operates from a three-phase AC power source. The transmitter must be connected to a closed-delta or WYE three-phase power source. Operation from an unsatisfactory power source will void the warranty on the transmitter as any resulting damage is beyond the control of the manufacturer. Before attempting installation of the transmitter, assure that the proper power source is installed. Acceptable power input configurations are shown in NO TAG, page 2-21.

2-14. An open-delta, V-to-V, T-to-T, T-to-L, or Scott connected power source will provide unsatisfactory transmitter performance as transients and unstable power can damage components of the transmitter and provide degraded specifications. Any of these systems will develop a considerable imbalance between phases in voltage, phase angle, or both voltage and phase angle. These problems can result in premature failure of power supply and RF circuit components.

2-15. It is important that the local electric utility be consulted to ensure that the correct service is provided before connection of the transmitter to a primary power source. The proper power source can be readily identified by the use of three transformers with one winding each or one transformer with three windings instead of the use of two transformers as required for the unacceptable configurations.

2-16. INSTALLATION.

2-17. 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 the operation, circuitry, nomenclature, and installation requirements. Installation is accomplished as follows: 1) equipment placement, 2) equipment installation, 3) wiring, and 4) preliminary operation.

2-18. EQUIPMENT PLACEMENT.

WARNING ***ENSURE NO PRIMARY POWER IS CONNECTED TO THE TRANSMITTER BEFORE PROCEEDING.***

WARNING

2-19. The FM-10S/FMi 703 transmitter is designed with access holes in the top of the cabinet to allow for over-head ducting of AC power and control wiring (refer to FIGURE 2-1 and FIGURE 2-2, pages 2-3 and 2-5). The floor must be capable of supporting the total transmitter weight of 713 lbs (324 kg).

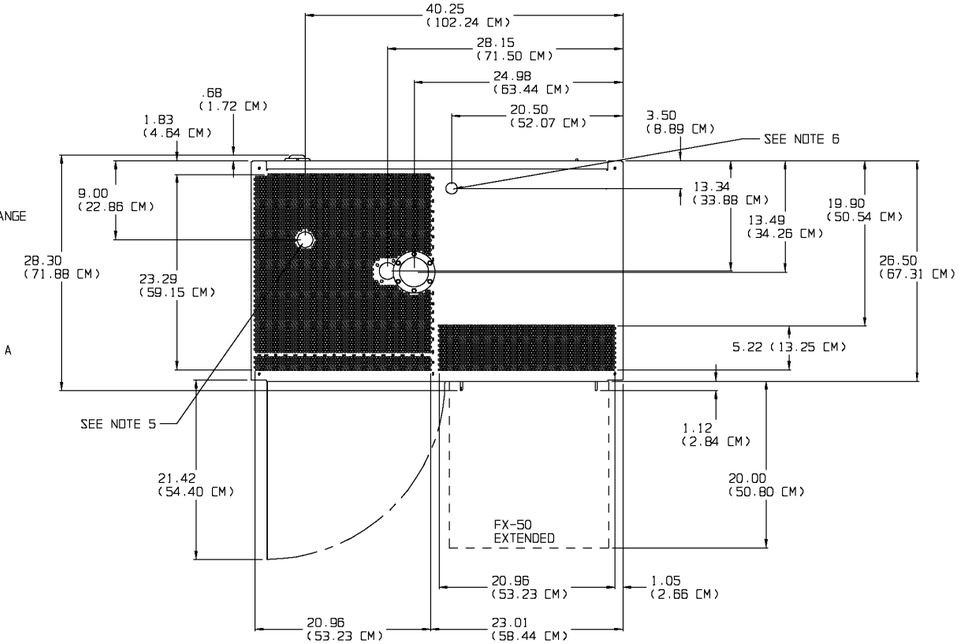
2-20. Evaluate the installation site and determine location of the transmitter. Once the location is determined, use a forklift to move the transmitter to the desired location. After the transmitter is placed in the desired location, slide the transmitter off the skid. Remove the shipping skid and slide the transmitter to the exact location.

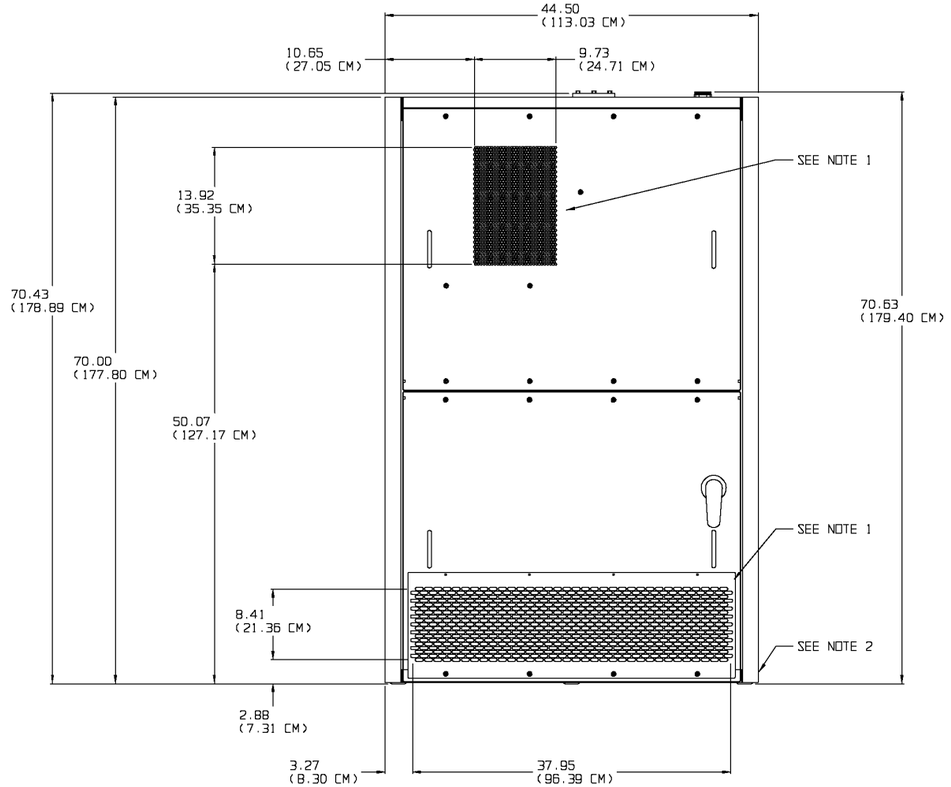
NOTES:

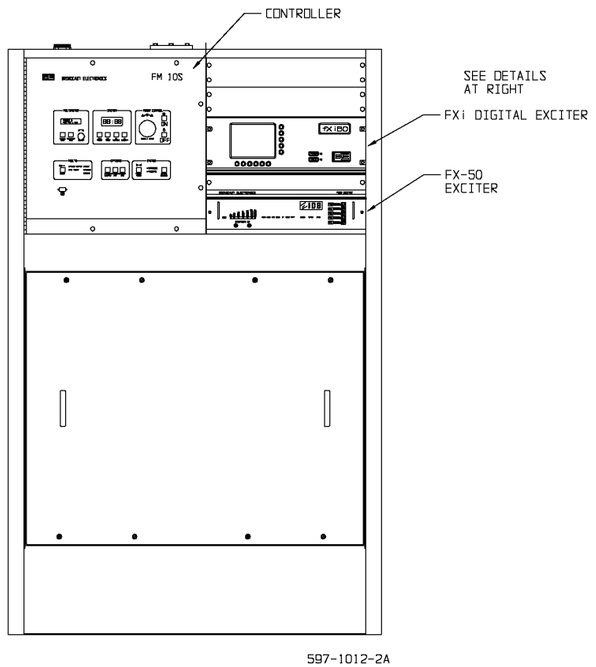
1. AIR INLET AT REAR OF CABINET 2000 CFM (56.6 3M ³/MIN) REUSABLE FILTERS PROVIDED.
2. GROUND STRAP ENTRY IN LOWER RIGHT CORNER AT REAR OF CABINET.
3. RF OUTPUT CONNECTION- 3-1/8 INCH EIA 50 OHM FEMALE FIELD FLANGE (3-1/8 INCH TO 1-5/8 INCH EIA FLANGE ADAPTER OPTIONAL)
4. AIR OUTLET AT TOP OF CABINET.
5. ACCESS FOR AC POWER THROUGH CABINET TOP ACCESS HOLE.
6. ACCESS FOR REMOTE CONTROL, MODULATION MONITOR, AND AUDIO CONNECTIONS THROUGH TOP OF CABINET.
7. HEAT DISSIPATION:
   8 KW (27,354 BTU/H) NOMINAL AT A 10 KW RF OUTPUT, 50 OHM RESISTIVE LOAD. 11 KW (37,570 BTU/H) AT A 10 KW RF OUTPUT INTO A 1.5:1 VSWR LOAD.
8. WEIGHT: 713 LBS (324 Kg) UNPACKED WITH OPTIONAL EXCITER, IPA, AND POWER SUPPLY UNITS.
9. AC POWER CONSUMPTION:
   17.3 KW NOMINAL AT A 10 KW RF OUTPUT INTO A 50 OHM RESISTIVE LOAD WITH A 230 VAC INPUT.
   21 KW AT A 10 KW RF OUTPUT INTO A 1.5:1 VSWR LOAD WITH A 230 VAC INPUT.
10. AC POWER INPUT:
    196 TO 252VAC 50/60Hz SINGLE PHASE, 110 AMPERES (MAX. CONDITIO
    196 TO 252 VAC (OR 339 TO 437 VAC) THREE PHASE, 64 AMPERES (MAXIMUM CONDITION).
    FUSE DISCONNECT SWITCH RECOMMENDED. FOR PROPER SIZING OF FUSES, REFER TO FOLLOWING TEXT, NATIONAL ELECTRIC CODES, AND LOCAL CODES.
11. PRIMARY AC FUSED DISCONNECT:

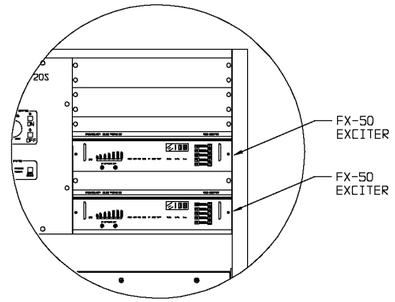
SINGLE PHASE:	THREE PHASE:
FUSE SIZE - 150 AMP	FUSE SIZE - 100 AMP
WIRE SIZE - 2/0 COPPER AWG. TYPE THHN	WIRE SIZE - #1 COPPER AWG. TYPE THHN

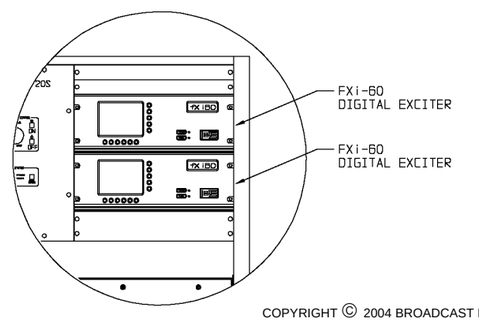
12. POWER FACTOR - BETTER THAN .95 @ 230VAC WITH A 10KW RF OUTPUT INTO A A 50 OHM LOAD.











597-1012-2A

597-1020-15

FIGURE 2-1. INSTALLATION DIAGRAM, FM-10S

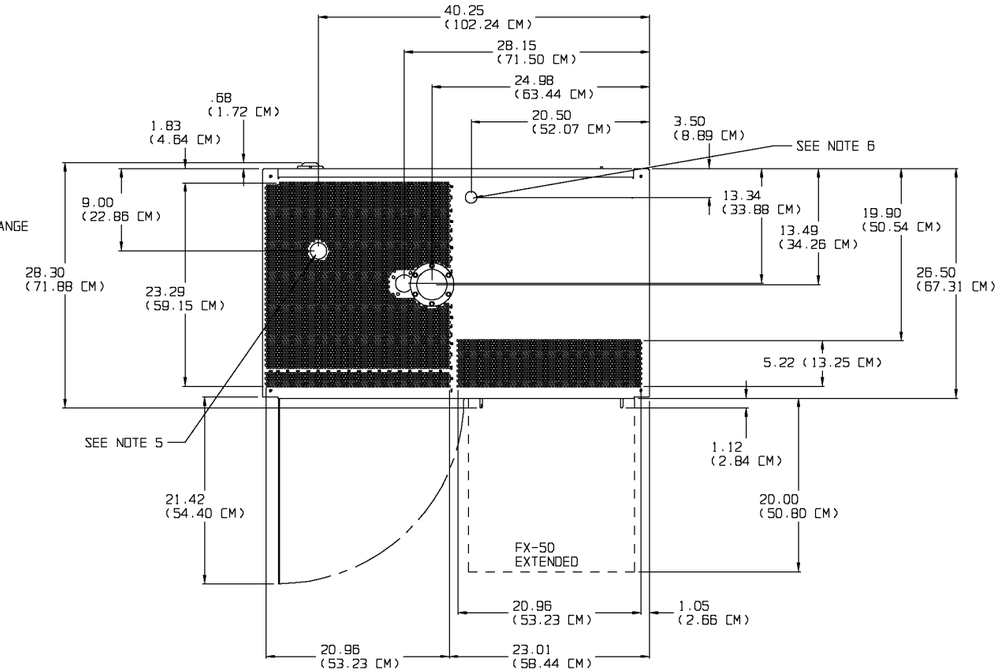
NOTES:

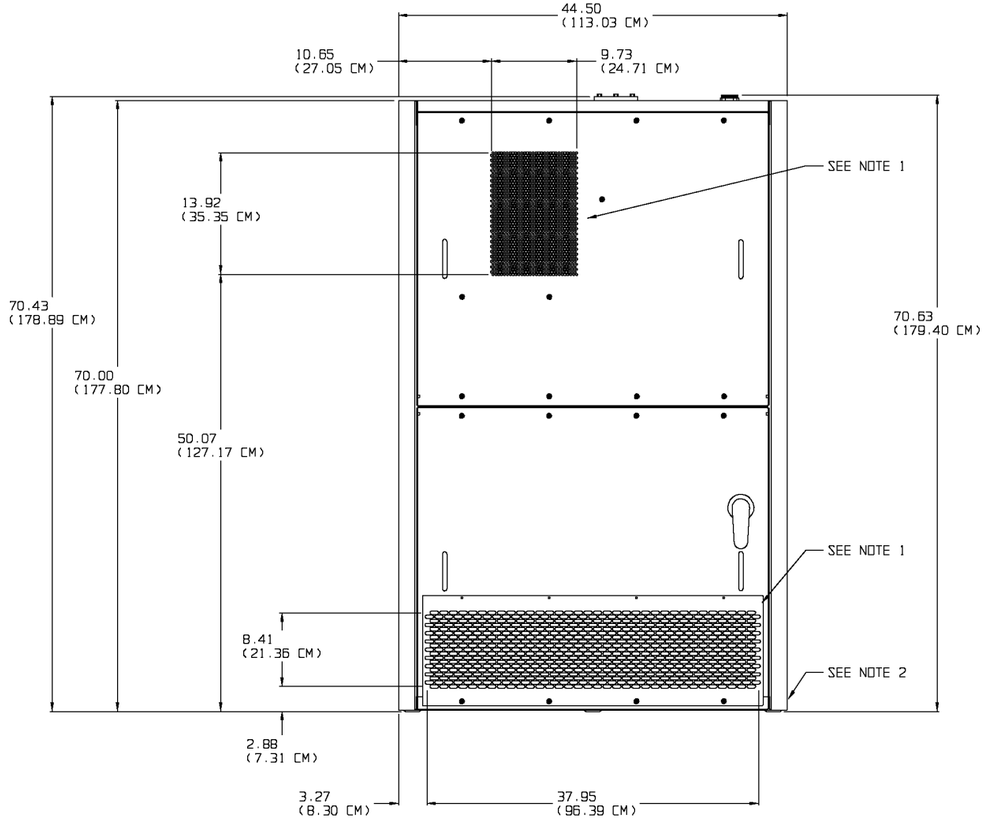
1. AIR INLET AT REAR OF CABINET 2000 CFM (56.6 3M ^{3}/MIN) REUSABLE FILTERS PROVIDED.
2. GROUND STRAP ENTRY IN LOWER RIGHT CORNER AT REAR OF CABINET.
3. RF OUTPUT CONNECTION- 3-1/8 INCH EIA 50 OHM FEMALE FIELD FLANGE (3-1/8 INCH TO 1-5/8 INCH EIA FLANGE ADAPTER OPTIONAL)
4. AIR OUTLET AT TOP OF CABINET.
5. ACCESS FOR AC POWER THROUGH CABINET TOP ACCESS HOLE.
6. ACCESS FOR REMOTE CONTROL, MODULATION MONITOR, AND AUDIO CONNECTIONS THROUGH TOP OF CABINET.
7. HEAT DISSIPATION:
   7.2 KW (24,573 BTU/H) NOMINAL AT A 2.8 KW RF OUTPUT, IBOC ONLY.
   7 KW (23,891 BTU/H) NOMINAL AT A 7 KW RF OUTPUT, FM & IBOC.
8. WEIGHT: 713 LBS (324 Kg) UNPACKED WITH OPTIONAL EXCITER, IPA, AND POWER SUPPLY UNITS.
9. AC POWER CONSUMPTION:
   10 KW NOMINAL AT A 2.8 KW RF OUTPUT, IBOC ONLY.
   14 KW AT A 7 KW RF OUTPUT, FM & IBOC.
10. AC POWER INPUT:
    196 TO 252VAC 50/60Hz SINGLE PHASE, 110 AMPERES (MAX. CONDITION)
    196 TO 252 VAC (OR 339 TO 437 VAC) THREE PHASE, 64 AMPERES (MAXIMUM CONDITION).
    FUSE DISCONNECT SWITCH RECOMMENDED. FOR PROPER SIZING OF FUSES, REFER TO FOLLOWING TEXT, NATIONAL ELECTRIC CODES, AND LOCAL CODES.
11. PRIMARY AC FUSED DISCONNECT:

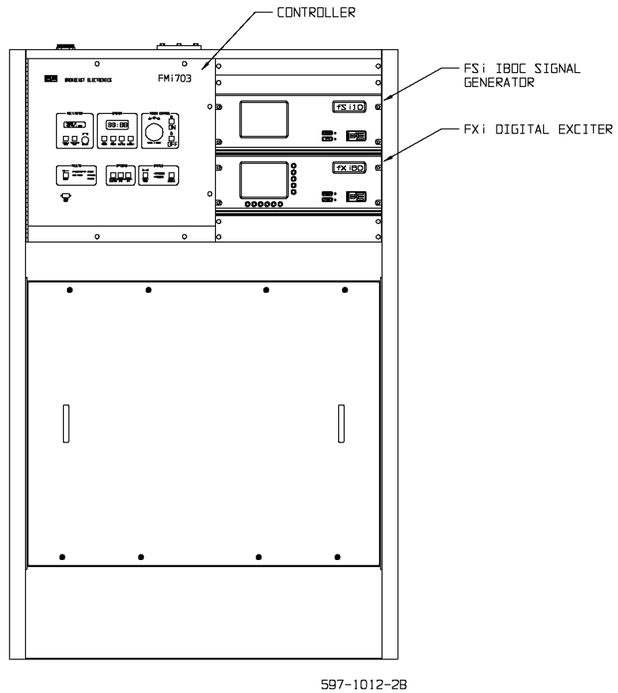
    SINGLE PHASE:
    FUSE SIZE - 100 AMP (FM & IBOC), 80 AMP (IBOC ONLY)
    WIRE SIZE - #1 AWG (FM & IBOC), #3 AWG (IBOC ONLY)

    THREE PHASE:
    FUSE SIZE - 70 AMP (FM & IBOC), 55 AMP (IBOC ONLY)
    WIRE SIZE - #4 AWG (FM & IBOC), #6 AWG (IBOC ONLY)

12. POWER FACTOR - BETTER THAN .95 @ 230VAC WITH A 10KW RF OUTPUT INTO A A 50 OHM LOAD.







597-1012-2B

597-1020-15

FIGURE 2-2. INSTALLATION DIAGRAM, FMi 703

(2-5/2-4)

2–21. **EQUIPMENT INSTALLATION.**

WARNING ***ENSURE NO PRIMARY POWER IS CONNECTED TO THE TRANSMITTER BEFORE PROCEEDING.***

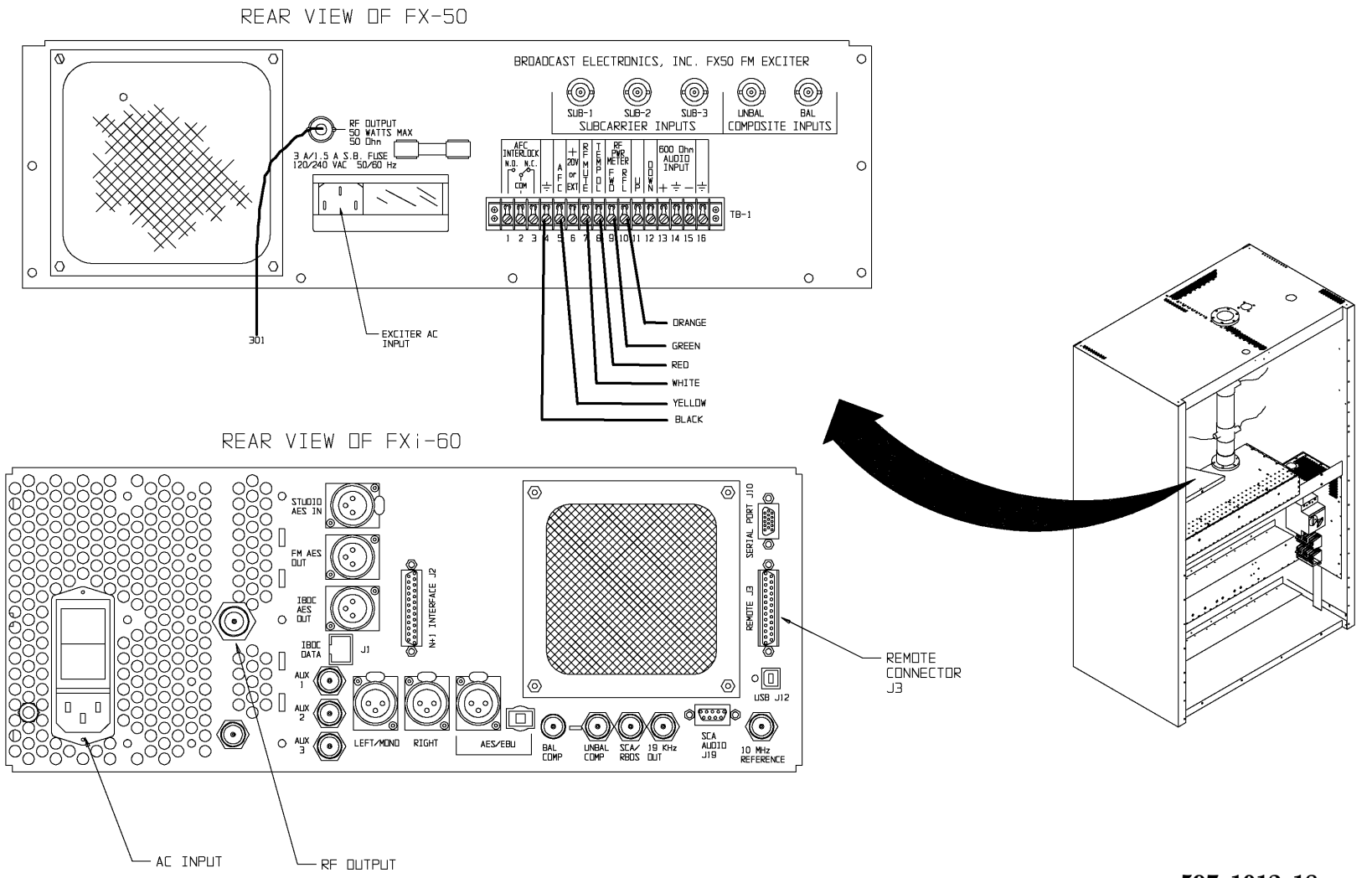
WARNING

2–22. **FM Exciter Installation (FM–10S).** The transmitter may be equipped with the standard FX–50 exciter or the optional FXi 60 digital exciter. For transmitters equipped with an FX–50 or FXi 60 exciter, perform the following installation procedure.

1. Locate the FX–50 or optional FXi 60 exciter.
2. Refer to FX–50 exciter manual 597–1050 and perform the PRELIMINARY INSTALLATION PROCEDURES to unpack and configure the exciter for the desired operation. For an FXi 60, refer to exciter manual 597–0541.
3. Place the exciter on the slide–rails (FX–50 only).
4. Refer to FIGURE 2–3, page 2–8 and re–connect the FX–50 or FXi 60 wiring as shown.

WARNING ***ENSURE NO PRIMARY POWER IS CONNECTED TO THE TRANSMITTER BEFORE PROCEEDING.***

WARNING



597-1012-18

FIGURE 2-3. FX-50 WIRING

2–23. **HD Radio Exciter Installation.** The FMi 703 is equipped with a FSi 10 HD Radio Signal Generator and a FXi 60 FM/HD Radio Exciter. Locate these two units and install in the transmitter. Reference FIGURE 2–2, page 2–5. Note that these can be re–arranged to allow installation of audio processing if necessary.

Utilize the following check list as well as FIGURE 2–4, page 2–10 to complete the interconnections between the FXi 60, FSi 10, and FMi 703.

☐ Install FXi 60 in the transmitter.

☐ Install FSi 10 in the transmitter.

☐ Connect 1PPS Out on FSi 10 to 1PPS In on FSi 10

☐ Connect GPS Data Out on FSi 10 to GPS Data In on FSi 10

☐ Connect FSi 10 LVDS IBOC Data to FXi 60 IBOC Data

☐ Connect J3 on FXi 60 Exciter to J1 on the FMi 703 Remote Interface board and to Output 13 (+/–) on the FSi 10.

☐ Connect 10MHz Out on FSi 10 to 10MHz Reference on FXi 60

☐ Connect Main Audio Feed from studio into Studio AES In on FXi 60 (This must be AES/EBU format at 32, 44.1, 48, or 96kbps).

☐ In a low–level combined system or when your existing FM transmitter can take AES input connect FM AES Out from FXi 60 to your FM Audio Processor AES Input. In a high–level combined or separate antenna installation where your existing transmitter requires a composite input, connect the FM AES Out from the FXi 60 directly to the AM/FM AES In on the FSi 10.

☐ Connect IBOC AES Out from FXi 60 to you HD Radio Audio Processor AES Input.

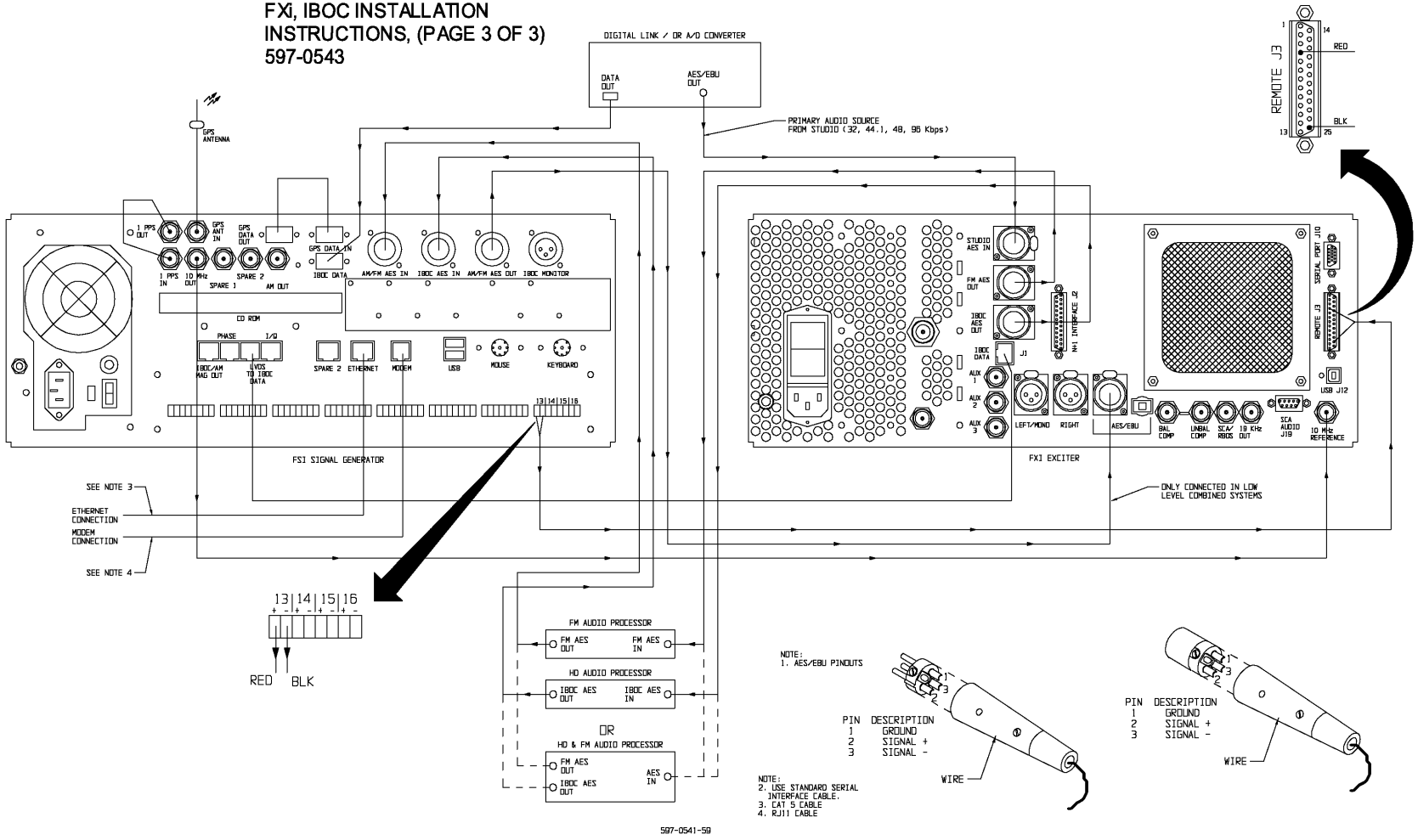
Note: When utilizing one processor for both FM and HD Radio you can use either the FM AES Out or IBOC AES Out from the FXi 60 to drive the AES input on your processor.

☐ In a low–level combined system or when your existing FM transmitter can take AES input connect the FM Audio Processor AES Out to the AM/FM AES input on FSi 10. In a high–level combined or separate antenna installation where your existing transmitter requires a composite input, connect the FM AES Out from the FXi 60 directly to the AM/FM AES In on the FSi 10.

☐ Connect the HD Radio Audio Processor AES Out to the IBOC AES In on FSi 10.

☐ In a low–level combined system connect the AM/FM AES Out to the AES/EBU input on the FXi 60. In a high–level combined or separate antenna system this output would go to your existing FM transmitter. If your existing FM transmitter requires a composite input, connect the AM/FM AES Out from the FSi 10 to the AES input on your FM Audio Processor and connect the composite output to your existing FM transmitter.

☐ If your Studio to Transmitter Link (STL) can support 4kbps of data you can send song artist and title information over the link. Connect the data output from the STL to the IBOC data input on the FSi 10. This type of data can also be sent via Ethernet or Modem.



597-1020-2

FIGURE 2-4. INTERCONNECTIONS BETWEEN FXi 60, FSi 10 AND FMi 703

2-24. **REMOTE CONTROL/STATUS I/O WIRING.**

2-25. **REMOTE CONTROL.** The FM-10S/FMi 703 transmitter is designed for complete remote control operation. The transmitter will interface with almost any remote control unit or a diagnostic system. The following text presents a description of the FM-10S/FMi 703 remote control functions and indications.

2-26. Remote control connections are interfaced to the transmitter at TB1/TB2 on the remote interface circuit board (refer to FIGURE 2-5, page 2-12). Route and connect the cables to TB1/TB2 as shown. Refer to FIGURE 2-6, page 2-13 and the following paragraphs for detailed connections to the remote control I/O board as well as teh configuration and setup.

2-27. The transmitter controller: 1) provides positive or negative control logic and 2) +4/+2 volt dc remote full-scale meter indications. Positive/negative control is determined by jumper J10 on the supervisor circuit board assembly. Positive control requires the use of a momentary contact to a +5 volt to +12 volt dc signal to activate the function. Negative control requires the use of a momentary contact to ground to activate the function. Remote indication functions: 1) require current limiting resistors and 2) provide up to 100 mA of current for the indicators. +4/+2 volt operation is determined by header J12 on the supervisor circuit board assembly. Refer to FIGURE 2-6, page 2-13 and the following text to connect remote control equipment to the system. The transmitter is programmed from the factory for positive remote control operations and +4 volt dc remote meter indications.

2-28. **Remote Forward/Reflected Power Meter Indications.** Remote transmitter forward/reflected power meter indications are located at TB2-1 and TB2-2. The indications can be programmed for +4 volt dc full-scale or +2 volt dc full-scale operation. The transmitter is shipped with the remote forward and reflected power meter indications programmed for +4 volt full-scale operation. The meter full-scale indication is equal to: 1) forward power: +3.92V dc = 10 kW and 2) reflected power: +4V dc = 400 watts. Metering ground is recommended for remote meter ground connections.

2-29. **Remote PA Power Supply Bus Voltage/Inlet Temperature Meter Indications.** Remote PA power supply bus voltage/temperature meter indications are located at TB2-3 and TB2-4. The PA power supply bus voltage indication monitors the transmitter PA power supply bus voltage. The temperature indication monitors the transmitter inlet air temperature. The indications can be programmed for +4 VDC full-scale or +2 VDC full-scale operation. +4/+2 volt operation is determined by header J12 on the supervisor circuit board assembly. The transmitter is shipped with the remote PA power supply bus voltage/inlet temperature meter indications programmed for +4 volt full-scale operation. The meter indications are as follows: 1) Power Supply Bus Voltage + 3.48 V = 45 V and 2) Temperature + 1.25 V = 25 °C. Metering ground is recommended for remote meter ground connections.

2-30. **Remote PA Current Meter Indications.** The remote PA current meter indication is located at TB2-5. The PA current indication monitors the transmitter PA power supply bus current. The indication can be programmed for +4 VDC full-scale or +2 VDC full-scale operation. +4/+2 volt operation is determined by header J12 on the supervisor circuit board assembly. The transmitter is shipped with the remote PA current meter indication programmed for +4 volt full-scale operation. The meter indication is equal to 4V @ 450 A. Metering ground is recommended for remote meter ground connections.

2-31. **Fail-Safe Out/Fail-Safe In Connection.** The FM-10S/FMi 703 provides for two different external fail-safe loops. The fail-safe connection is used for the interfacing of an external interlock to the transmitter such as a test load interlock, motorized coaxial switch, or a remote control unit. The first fail-safe connection is provided at TB2-10 and TB2-11. The fail-safe out connection is located at TB2-10. The fail-safe in connection is located at TB2-11. If a fail-safe connection is desired, connect the device between TB2-10 and TB2-11. The second fail-safe loop has its output on TB1-11, and its return on TB1-10. If the second fail-safe loop is needed, it can be added by cutting off a jumper wire on the board in the place provided and labeled W2.

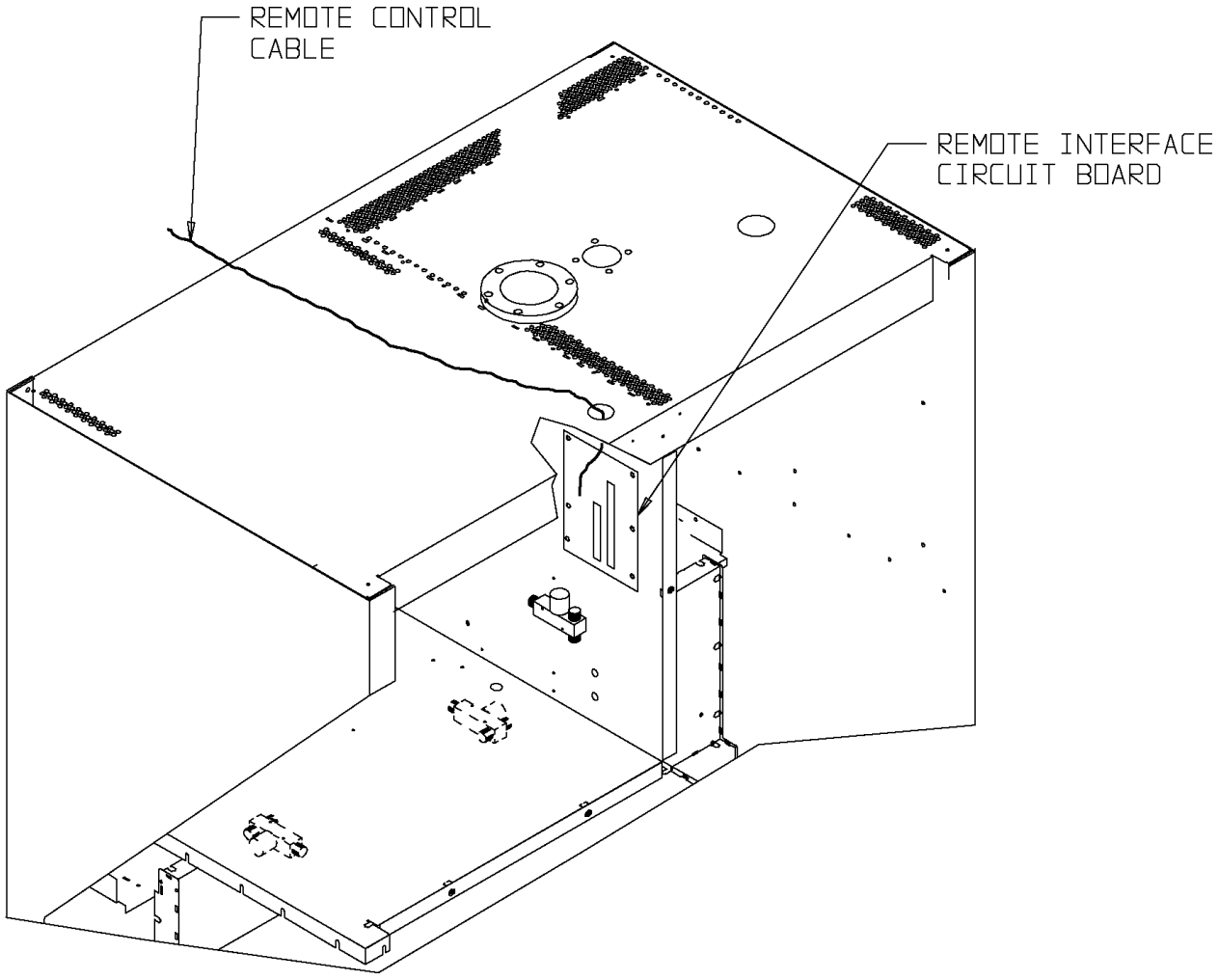


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FIGURE 2-5. REMOTE INTERFACE CIRCUIT BOARD/CONNECTOR LOCATION

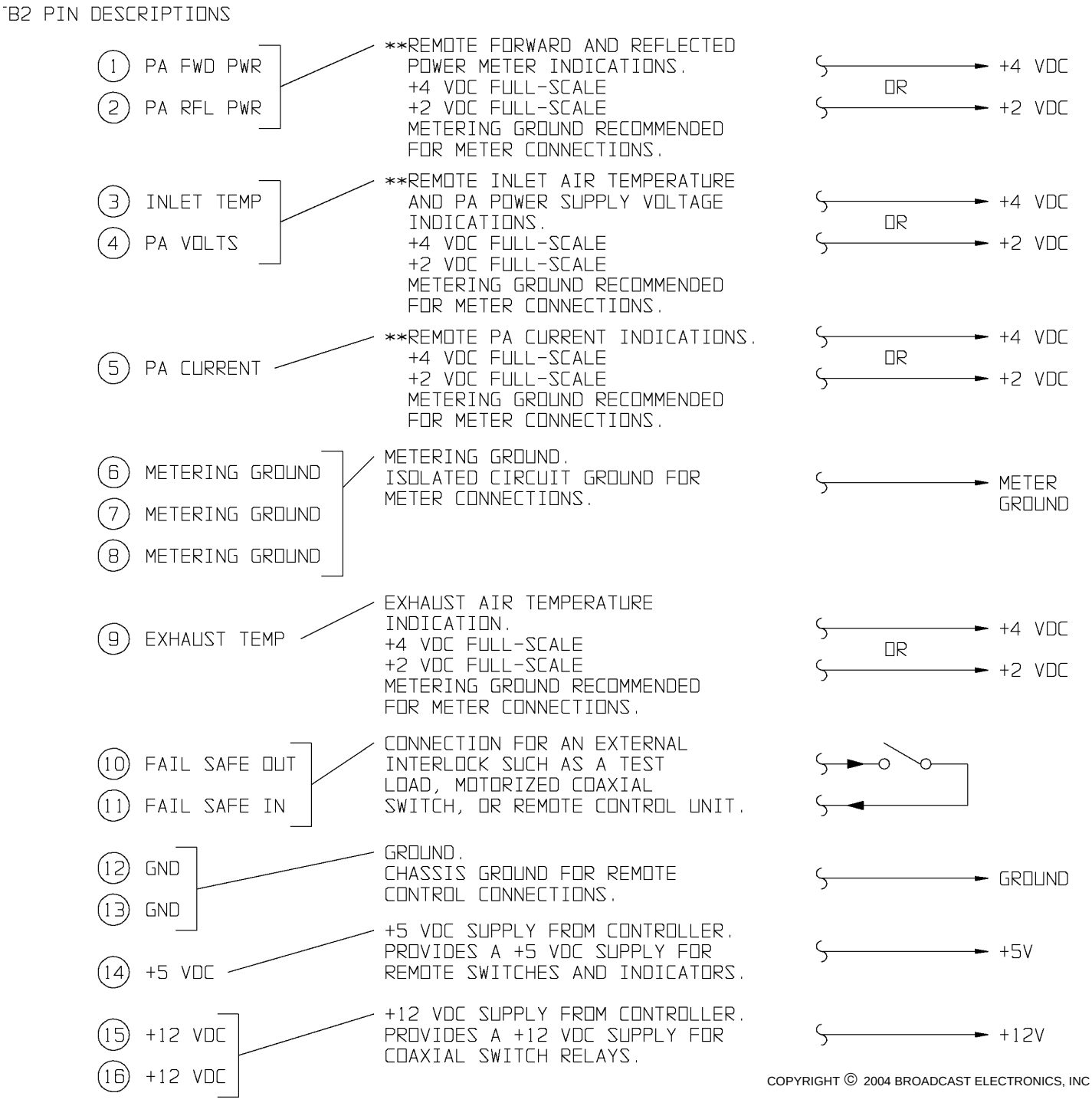

FIGURE 2-6. REMOTE CONTROL DIAGRAM (SHEET 1 OF 3)

TB1 PIN DESCRIPTIONS

(1) STANDBY EXCITER ——— * STANDBY EXCITER ON CONTROL.
POSITIVE CONTROL: MOMENTARY CONTACT TO +5 TO +12 VDC REQUIRED TO SWITCH AND ENABLE STANDBY EXCITER.
NEGATIVE CONTROL: MOMENTARY CONTACT TO GROUND REQUIRED TO SWITCH AND ENABLE STANDBY EXCITER.

(2) STANDBY IPA ——— * STANDBY IPA ON CONTROL.
POSITIVE CONTROL: MOMENTARY CONTACT TO +5 TO +12 VDC REQUIRED TO SWITCH AND ENABLE STANDBY IPA.
NEGATIVE CONTROL: MOMENTARY CONTACT TO GROUND REQUIRED TO SWITCH AND ENABLE STANDBY IPA.

(3) NC ——— NO CONNECTION

(4) TRANSMITTER ON ——— * TRANSMITTER ON CONTROL.
POSITIVE CONTROL: MOMENTARY CONTACT TO +5 TO +12 VDC REQUIRED TO OPERATE TRANSMITTER TO ON.
NEGATIVE CONTROL: MOMENTARY CONTACT TO GROUND REQUIRED TO OPERATE TRANSMITTER TO ON.

(5) TRANSMITTER OFF ——— * TRANSMITTER OFF CONTROL.
POSITIVE CONTROL: MOMENTARY CONTACT TO +5 TO +12 VDC REQUIRED TO OPERATE TRANSMITTER TO OFF.
NEGATIVE CONTROL: MOMENTARY CONTACT TO GROUND REQUIRED TO OPERATE TRANSMITTER TO OFF.

(6) RAISE PA PWR ——— * TRANSMITTER RAISE POWER CONTROL.
POSITIVE CONTROL: MOMENTARY CONTACT TO +5 TO +12 VDC REQUIRED TO RAISE TRANSMITTER POWER.
NEGATIVE CONTROL: MOMENTARY CONTACT TO GROUND REQUIRED TO RAISE TRANSMITTER POWER.

(7) LOWER PA PWR ——— * TRANSMITTER LOWER POWER CONTROL.
POSITIVE CONTROL: MOMENTARY CONTACT TO +5 TO +12 VDC REQUIRED TO LOWER TRANSMITTER POWER.
NEGATIVE CONTROL: MOMENTARY CONTACT TO GROUND REQUIRED TO LOWER TRANSMITTER POWER.

(8) PRESET PA PWR ——— * PRESET POWER ON CONTROL.
POSITIVE CONTROL: SUSTAINED CONTACT TO +5 TO +12 VDC REQUIRED TO ENABLE PRESET POWER.
NEGATIVE CONTROL: SUSTAINED CONTACT TO GROUND REQUIRED TO ENABLE PRESET POWER.

(9) FAULT RESET ——— * TRANSMITTER FAULT RESET CONTROL.
POSITIVE CONTROL: MOMENTARY CONTACT TO +5 TO +12 VDC REQUIRED TO RESET THE FAULT CIRCUIT.
NEGATIVE CONTROL: MOMENTARY CONTACT TO GROUND REQUIRED TO RESET THE FAULT CIRCUIT.

NOTES:

* POSITIVE/NEGATIVE CONTROL -

1. POSITIVE CONTROL: J10 ON SUPERVISOR CIRCUIT BOARD IN POSITION 2-3. FACTORY DEFAULT.
2. NEGATIVE CONTROL: J10 ON SUPERVISOR CIRCUIT BOARD IN POSITION 1-2.

** +4V/+2V DC FULL SCALE METER INDICATIONS -

1. +4V DC FULL SCALL METER INDICATIONS - REMOVE P12 ON SUPERVISOR CIRCUIT BOARD.
2. +2V DC FULL SCALL METER INDICATIONS - IINSTALL P12 ON SUPERVISOR CIRCUIT BOARD.

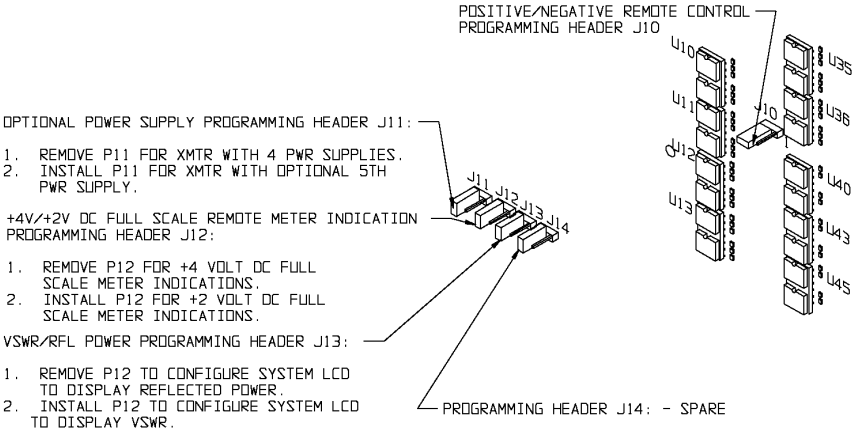

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FIGURE 2-6. REMOTE CONTROL DIAGRAM (SHEET 2 OF 3)

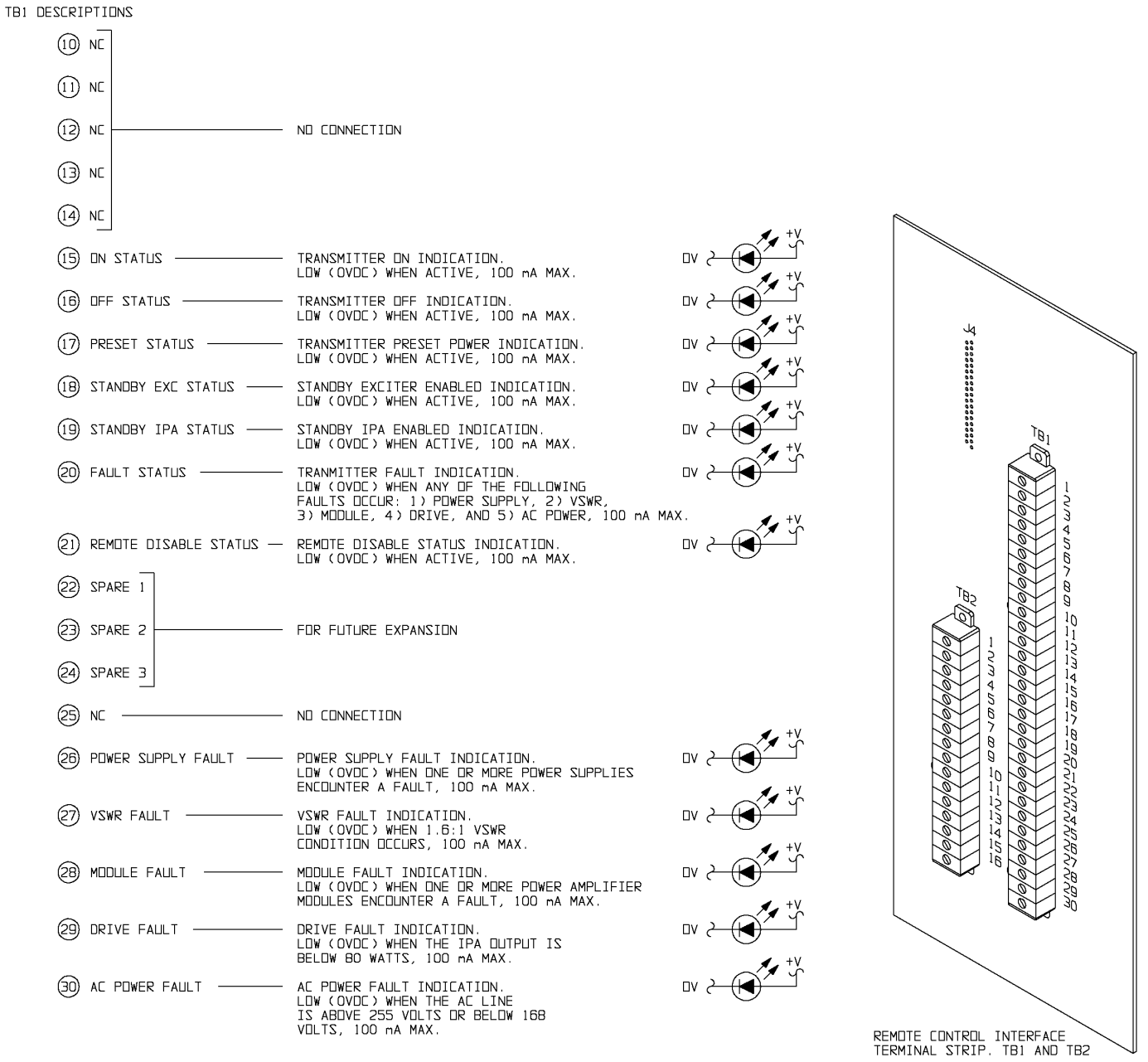

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FIGURE 2-6. REMOTE CONTROL DIAGRAM (SHEET 3 OF 3)

2–32. **Remote Standby Exciter On Control.** The standby exciter on function is located at TB1–1. The function can be activated using positive or negative control. Positive control requires the use of a momentary contact to a +5 to +12 VDC signal to operate the standby exciter to on. Negative control requires the use of a momentary contact to ground to operate the standby exciter to on. Positive/negative remote control operation is determined by header J10 on the supervisor circuit board.

2–33. **Remote Standby IPA On Control.** The standby IPA on function is located at TB1–2. The function can be activated using positive or negative control. Positive control requires the use of a momentary contact to a +5 to +12 VDC signal to operate the standby IPA to ON. Negative control requires the use of a momentary contact to ground to operate the standby IPA to ON. Positive/negative remote control operation is determined by header J10 on the supervisor circuit board.

2–34. **Remote Transmitter On Control.** The transmitter on function is located at TB1–4. The function can be activated using positive or negative control. Positive control requires the use of a momentary contact to a +5 to +12 VDC signal to operate the transmitter to on. Negative control requires the use of a momentary contact to ground to operate the transmitter to on. Positive/negative remote control operation is determined by header J10 on the supervisor circuit board.

2–35. **Remote Transmitter Off Control.** The transmitter off function is located at TB1–5. The function can be activated using positive or negative control. Positive control requires the use of a momentary contact to a +5 to +12 VDC signal to operate the transmitter to off. Negative control requires the use of a momentary contact to ground to operate the transmitter to off. Positive/negative remote control operation is determined by header J10 on the supervisor circuit board.

2–36. **Remote Power Level Raise Control.** The transmitter power level raise control is located at TB1–6. The function can be activated using positive or negative control. Positive control requires the use of a momentary contact to a +5 to +12 VDC signal to raise the transmitter power level. Negative control requires the use of a momentary contact to ground to raise the transmitter power level. Positive/negative remote control operation is determined by header J10 on the supervisor circuit board.

2–37. **Remote Power Level Lower Control.** The transmitter power level lower control is located at TB1–7. The function can be activated using positive or negative control. Positive control requires the use of a momentary contact to a +5 to +12 VDC signal to lower the transmitter power level. Negative control requires the use of a momentary contact to ground to lower the transmitter power level. Positive/negative remote control operation is determined by header J10 on the supervisor circuit board.

2–38. **Remote Preset PA Power Control.** The transmitter can be operated to a preset power level by using the preset PA power control function. The preset power function is located at TB1–8. The function can be activated using positive or negative control. Positive control requires the use of a sustained contact to a +5 to +12 VDC signal to operate the transmitter to a preset power level. Negative control requires the use of a sustained contact to ground to operate the transmitter to a preset power level. Positive/negative remote control operation is determined by header J10 on the supervisor circuit board.

2–39. **Remote Fault Reset Control.** The fault reset control is designed to reset the transmitter circuitry following a problem. The reset control is located at TB1–9. The function can be activated using positive or negative control. Positive control requires the use of a momentary contact to a +5 to +12 VDC signal to reset the transmitter fault circuitry. Negative control requires the use of a momentary contact to ground to reset the transmitter fault circuitry. Positive/negative remote control operation is determined by header J10 on the supervisor circuit board.

2–40. **Transmitter On Indications.** The transmitter on indicator provides a signal to indicate when the transmitter is enabled. The transmitter on indicator is located at TB1–15. The indicator will go LOW (0 VDC) to indicate when the transmitter is enabled.

2–41. **Transmitter Off Indications.** The transmitter off indicator provides a signal to indicate when the transmitter is disabled. The transmitter off indicator is located at TB1–16. The indicator will go LOW (0 VDC) to indicate when the transmitter is disabled.

2–42. **Preset Power Indications.** The transmitter preset power indicator provides a signal to indicate when the transmitter is operated to the preset power mode. The preset power indicator is located at TB1–17. The indicator will go LOW (0 VDC) to indicate when the transmitter has been operated to the preset power mode.

2–43. **Standby Exciter Indications.** The standby exciter indicator provides a signal to indicate when the standby exciter has been enabled. The standby exciter indicator is located at TB1–18. The indicator will go LOW (0 VDC) to indicate when the standby exciter has been enabled.

2–44. **Standby IPA Indications.** The standby IPA indicator provides a signal to indicate when the standby IPA has been enabled. The standby IPA indicator is located at TB1–19. The indicator will go LOW (0 VDC) to indicate when the standby IPA has been enabled.

2–45. **Transmitter Fault Indications.** The transmitter fault indicator provides a signal to indicate when any of the following faults occur: 1) power supply, 2) VSWR, 3) module, 4) RF drive, or 5) AC power. The transmitter fault indicator is located at TB1–20. The indicator will go LOW (0 VDC) when active.

2–46. **Remote Disable Status Indications.** The remote disable indicator provides a signal to indicate when the transmitter remote control disable feature is active. The transmitter remote disable status indicator is located at TB1–21. The indicator will go LOW (0 VDC) when active.

2–47. **+5 VDC Supply.** A +5 VDC supply is provided for the remote control switches and indicators. The +5 volt dc supply is located at TB2–14. The supply can provide up to 20 mA for indicator and switch operations.

2–48. **+12 VDC Supply.** A +12 VDC supply is provided for coaxial switch control relays. The +12 VDC supply is located at TB2–15 and TB2–16. The supply can provide up to 50 mA for control operations.

2–49. **PA Power Supply Fault Indications.** The PA power supply fault indicator provides a signal to indicate when one or more power supplies encounter a fault. The PA power supply fault indicator is located at TB1–26. The indicator will go LOW (0 VDC) when active.

2–50. **VSWR Indications.** The VSWR fault indicator provides a signal to indicate when a 1.45 : 1 VSWR condition occurs. The VSWR fault indicator is located at TB1–27. The indicator will go LOW (0 VDC) to indicate the presence of a 1.45 : 1 VSWR condition.

2–51. **PA Module Fault Indications.** The PA module fault indicator provides a signal to indicate when one or more PA RF power modules encounter a fault. The PA RF power module fault indicator is located at TB1–28. The indicator will go LOW (0 VDC) when active.

2–52. **Drive Fault Indications.** The drive fault indicator provides a signal to indicate when the IPA output is below 80 watts. The drive fault indicator is located at TB1–29. The indicator will go LOW (0 VDC) to indicate when the IPA output is below 80 watts.

2–53. **AC Power Fault Indications.** The AC power supply fault indicator provides a signal to indicate when: 1) the AC line is above 255 volts or below 168 volts or 2) a loss–of–phase condition occurs. The AC power supply fault indicator is located at TB1–30. When the transmitter is re–energized following a fault, the indicator will go LOW (0 VDC) to indicate an ac power fault condition.

2–54. **Metering Ground.** Metering ground is an isolated circuit ground for remote control meter connections. Metering ground is to be used to remedy ground loops or to eliminate RFI conditions. Metering ground is located at TB2–6 through TB2–8.

2–55. **Chassis Ground.** Chassis ground is designed to be used for remote control connections. Chassis ground is located at TB2–12 and TB2–13.

2–56. **No Connection.** No connection at TB1–3, TB1–10 through TB1–14 and TB1–25.

2–57. **Spare Connections.** Connections for future additional remote control or indications are located at TB1–22 through TB1–24.

2–58. **OPTIONAL POWER SUPPLY PROGRAMMING.** The FM–10S/FMi 703 transmitter can be equipped with an optional power supply in each cabinet. If the unit is equipped with fifth power supply assemblies, jumper P11 on the supervisor circuit board must be installed. Refer to FIGURE 2–6, page 2–13 and ensure P11 is installed on the supervisor circuit board.

2–59. **VSWR/REFLECTED POWER DISPLAY PROGRAMMING.** The FM–10S/FMi 703 transmitter output power is displayed by the SYSTEM LCD display. The LCD display presents transmitter forward power, reflected power, PA voltage, and PA current. The reflected power can be displayed using a VSWR or reflected power format. Header P13 programs the display to present reflected power or VSWR (refer to FIGURE 2–6, page 2–13). When P13 is removed, the display will present reflected power. When P13 is installed, VSWR will be displayed. The transmitter is shipped from the factory programmed for reflected power display operation.

2–60. **MODULATION MONITOR RECEPTACLE.** The FM–10S/FMi 703 transmitter is equipped with a modulation monitor receptacle. The receptacle is located near the RF output transmission line. Refer to FIGURE 2–7, page 2–19 and connect the modulation monitor to the modulation monitor receptacle. The receptacle provides a 2 V RMS sample in a 50 ohm load at 20 kW for monitoring operations.

2–61. **AUDIO INPUT CONNECTIONS.** Audio input connections for the FM–10S/FMi 703 transmitter are located on the exciter rear panel. For an FX–50, refer to FX–50 manual 597–1050 and perform the WIRING procedures in SECTION II, INSTALLATION. For an FXi 60, refer to manual 597–0541

WARNING

ENSURE NO PRIMARY POWER IS CONNECTED TO THE TRANSMITTER BEFORE PROCEEDING.

WARNING

2–62. **RF OUTPUT TRANSMISSION LINE CONNECTION.** The FM–10S/FMi 703 transmitter RF output connection is located on the transmitter auxiliary cabinet top–panel (refer to FIGURE 2–7, page 2–19). The connection is a 3 1/8 inch female EIA field flange. Refer to FIGURE 2–7, page 2–19 and connect the RF transmission line to the transmitter using a 3 1/8 inch male EIA field flange and a bullet.

WARNING

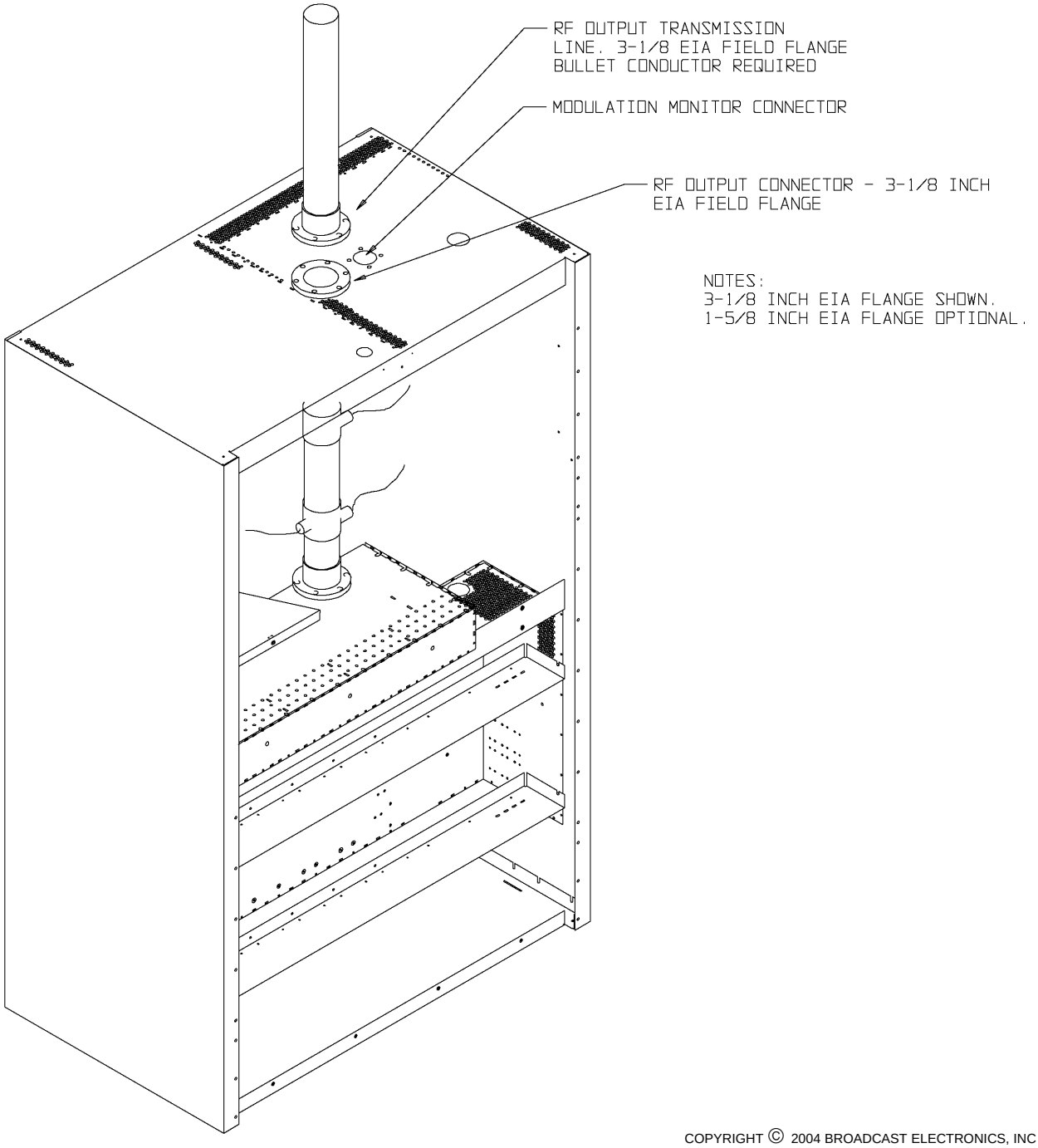
ENSURE PRIMARY POWER IS DISCONNECTED BEFORE PROCEEDING.

WARNING

WARNING

ENSURE AN EARTH GROUND CONDUCTOR IS SECURELY CONNECTED TO THE TRANSMITTER CHASSIS GROUND LUG.

WARNING



597-1012-6

FIGURE 2-7. MODULATION MONITOR/RF OUTPUT CONNECTIONS

2–63. **GROUND.** The FM–10S/FMi 703 transmitter is equipped with a chassis ground system for operating safety (refer to FIGURE 2–9 and FIGURE 2–10, pages 2–22 and 2–23). The ground system requires the connection of an earth ground for both sides of the chassis. Refer to FIGURE 2–9 and FIGURE 2–10, pages 2–22 and 2–23 and connect an earth ground to the chassis ground lugs using 2 inch (5.08 cm) wide copper straps.

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

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

2–64. **AC POWER CONNECTIONS.** The FM–10S/FMi 703 can be configured to operate from: 1) a 196 to 252 VAC three–phase closed delta or WYE supply at 100 A per phase, or 2) a 340 to 435 VAC three–phase 4–wire WYE supply at 100 A per phase. Refer to FIGURE 2–8, page 2–21. The FM–10S/FMi 703 transmitter requires two 100 A disconnect service boxes – one for each side of the transmitter – as well as a 200 A master disconnect service box. For operating safety, the power source must be routed to the transmitter through a fused power disconnect (refer to FIGURE 2–9 and FIGURE 2–10, pages 2–22 and 2–23).

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

2–65. **Exciter AC Power Connections.** The exciter AC power source is provided by the transmitter. The line cord is located near the exciter rear–panel inside the accessory equipment enclosure. Connect the AC power cord from the transmitter to the exciter. The FX–50 operates from a 194V to 266V 50/60 Hz power source. The FXi 60 operates from a 90V to 264V 50/60 Hz power source.

2–66. **FSi 10 AC Power Connections.** It is recommended that the FSi 10 power source be supplied by a UPS due to the long boot–up time of this device. The FSi 10 power supply can be configured to operate on either 110VAC or 220VAC via a switch on the rear of the unit. Prior to connecting AC to this device ensure switch is in proper position for the AC power source being used. The unit comes configured from the factory with this switch set at the 220VAC postion.

WARNING ***THE FSI 10 CAN OPERATE ON EITHER 110VAC OR 220VAC. IT IS CONFIGURED FROM THE FACTORY FOR 220VAC OPERATION.***
WARNING

WARNING ***IF YOU ARE USING A UPS TO BACK UP THE FSI 10, ENSURE THE VOLTAGE INPUT SWITCH IS IN THE PROPER POSITION PRIOR TO APPLYING POWER AND TURNING ON THE UNIT.***
WARNING

2–67. **Main AC Input – Single Phase.** Refer to FIGURE 2–9 page 2–22 and connect the 150 A single phase service to the AC input panel through a fused service disconnect as shown. Connect the utility company ground conductor securely to the ground terminal as shown.

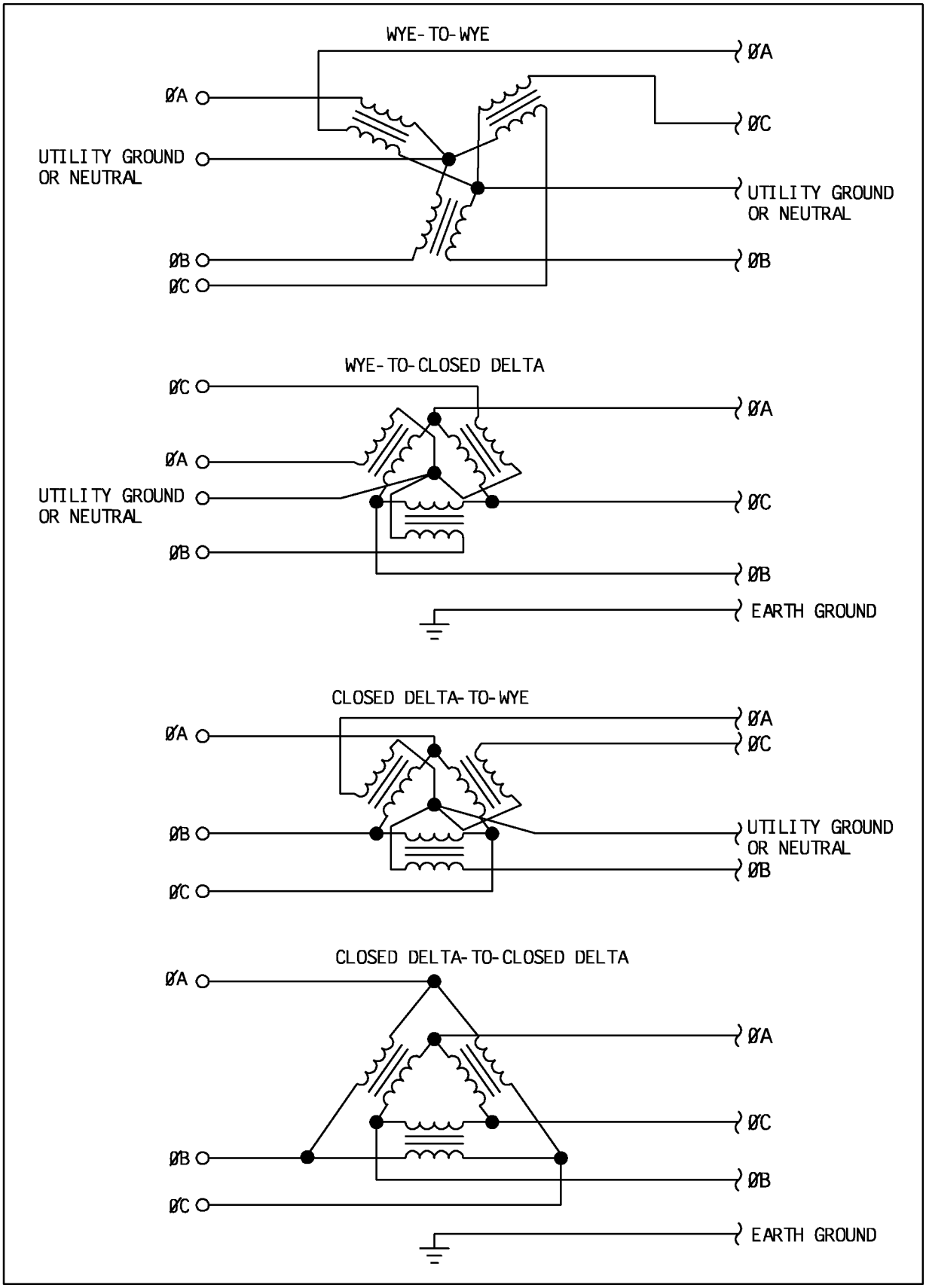


FIGURE 2-8. ACCEPTABLE AC POWER INPUT CONFIGURATIONS **597-0099-11**

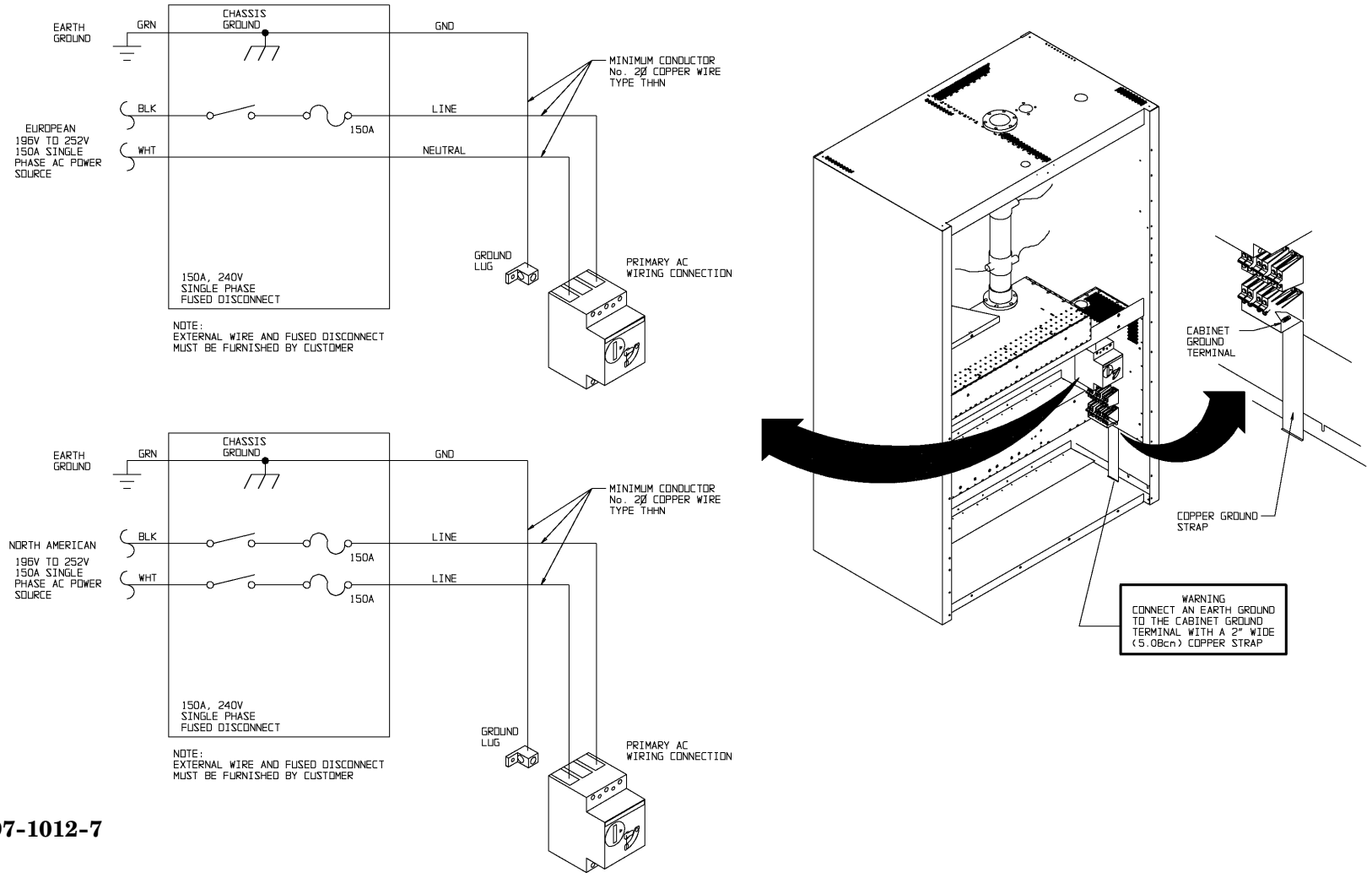


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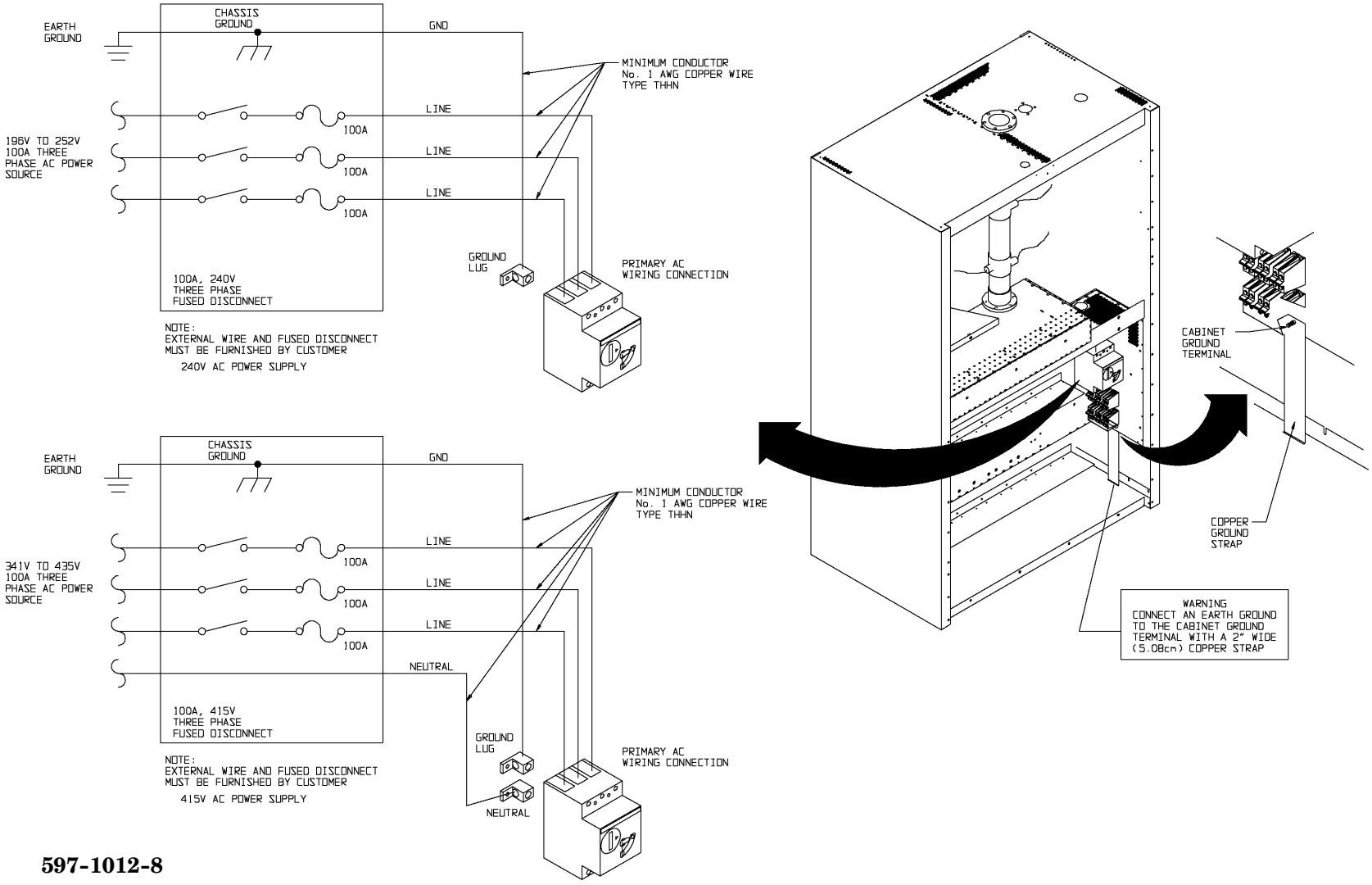
FIGURE 2-9. FM-10S SINGLE PHASE AC POWER CONNECTIONS



597-1012-8

FIGURE 2-10. FM-10S THREE PHASE AC POWER CONNECTIONS

2-68. **Main AC Input – Three Phase.** Refer to FIGURE 2-10, page 2-23 and connect the 100 A three phase service to the AC input panel through a fused service disconnect as shown. For 380 volt WYE systems, ensure the neutral conductor is connected to the **NEUTRAL** terminal. Connect the utility company ground conductor securely to the ground terminal as shown.

2-69. **Optional Equipment AC Power Connections.** The FM-10S/FMi 703 transmitter is designed for the installation of optional equipment such as a stereo generator, SCA generator, or a remote control system. If optional equipment is installed in the transmitter, connect the optional equipment line cords to the AC receptacles located near the exciter rear-panel.

2-70. PRELIMINARY OPERATION.

NOTE

DO NOT REDUCE THE EXCITER OUTPUT POWER PRIOR TO ENABLING THE TRANSMITTER.

NOTE

2-71. The following text presents procedures for the preliminary operation of the FM-10S/FMi 703 transmitter. The procedures will reference the factory test data sheets which are shipped with the transmitter. Locate the factory test data sheets. Differences in the values obtained during actual operation may be noted due to differences in primary power and antenna systems. Refer to the following text and perform the procedures to initially operate the FM-10S/FMi 703 transmitter.

2-72. Ensure the appropriate AC power supply is applied to the transmitter.

2-73. Operate the rear panel AC ON/OFF switch to ON. The following events will occur:

1. The **MULTIMETER MODULE MODE** switch/indicator will illuminate.
2. The **SYSTEM FWD PWR** switch/indicator will illuminate.
3. The **POWER CONTROL OFF** switch/indicator will illuminate.
4. The **STATUS FAILSAFE/INTERLOCK** indicators will illuminate.

2-74. If no transmitter front-panel indicators illuminate, the transmitter may have detected an AC power line problem. If this condition occurs, ensure: 1) the AC power supply is between 255 and 168 volts and 2) all three AC line phases are present.

2-75. If the **FAIL-SAFE** indicator does not illuminate, perform the following procedure.

WARNING

DISCONNECT ALL TRANSMITTER PRIMARY POWER BEFORE PROCEEDING.

WARNING

1. Disconnect the AC power.
2. Check the fail-safe switch and connection to TB2-10 and TB2-11 on the remote control interface circuit board.
3. Once the problem is located and repaired, continue the preliminary operation procedure.

2-76. Ensure the transmitter **SYSTEM FWD POWER** switch/indicator is illuminated. The **MULTIMETER** will indicate 0 watts forward power.

2-77. Depress the **SYSTEM ON** switch/indicator to illuminate the switch/indicator.

2-78. For an FX-50, depress the exciter **MULTIMETER FWD** switch. The exciter **MULTIMETER** will indicate the forward power recorded in the factory test data sheets. For an FXi 60, the forward power is displayed on the GUI interface. The GUI display will indicate the forward power recorded in the factory test data sheets.

2-79. Adjust the **POWER CONTROL** knob until the **MULTIMETER** indicates the forward power level recorded in the factory test data sheets. If the **FAULTS RESET** switch/indicator illuminates, proceed as follows:

1. If the **RESET** switch/indicator illuminates, proceed as follows:

   A. If the **POWER SUPPLY** indicator illuminates, the **MULTIMETER** will automatically display the number of the power supply containing the fault. Once the power supply number is determined, refer to SECTION V, MAINTENANCE and perform the TROUBLESHOOTING procedures to locate the problem.

   B. If the **VSWR** indicator illuminates, a 1.45 : 1 **VSWR** condition or greater is present at the transmitter output. Disconnect the transmitter AC power and remove the condition from the transmitter output.

   C. If the **MODULE** indicator illuminates, one of the transmitter RF amplifier or IPA modules contains a fault. Operate the **MULTIMETER MODULE MODE** and **FUNCTION** switches to locate the module with the fault. The **MULTIMETER** will indicate **MODULE OUT**, **HIGH CURRENT**, or **LOW POWER**.

   D. If the **DRIVE** indicator illuminates, the IPA module or the exciter output power is low. Refer to SECTION V, MAINTENANCE and perform the TROUBLESHOOTING procedures to locate the problem.

2-80. When the desired transmitter output power is obtained, depress the following switch/indicators and compare the indications with the values recorded in the factory test data sheets. The values should be approximately equal to the values recorded in the test data sheets.

1. **SYSTEM FWD POWER**
2. **SYSTEM RFL POWER**
3. **PA VOLTAGE**
4. **PA CURRENT**

SECTION III
OPERATION

3-1. INTRODUCTION.

3-2. This section identifies all controls and indicators associated with the FM-10S/FMi 703 transmitter and provides standard operating procedures.

3-3. CONTROLS AND INDICATORS.

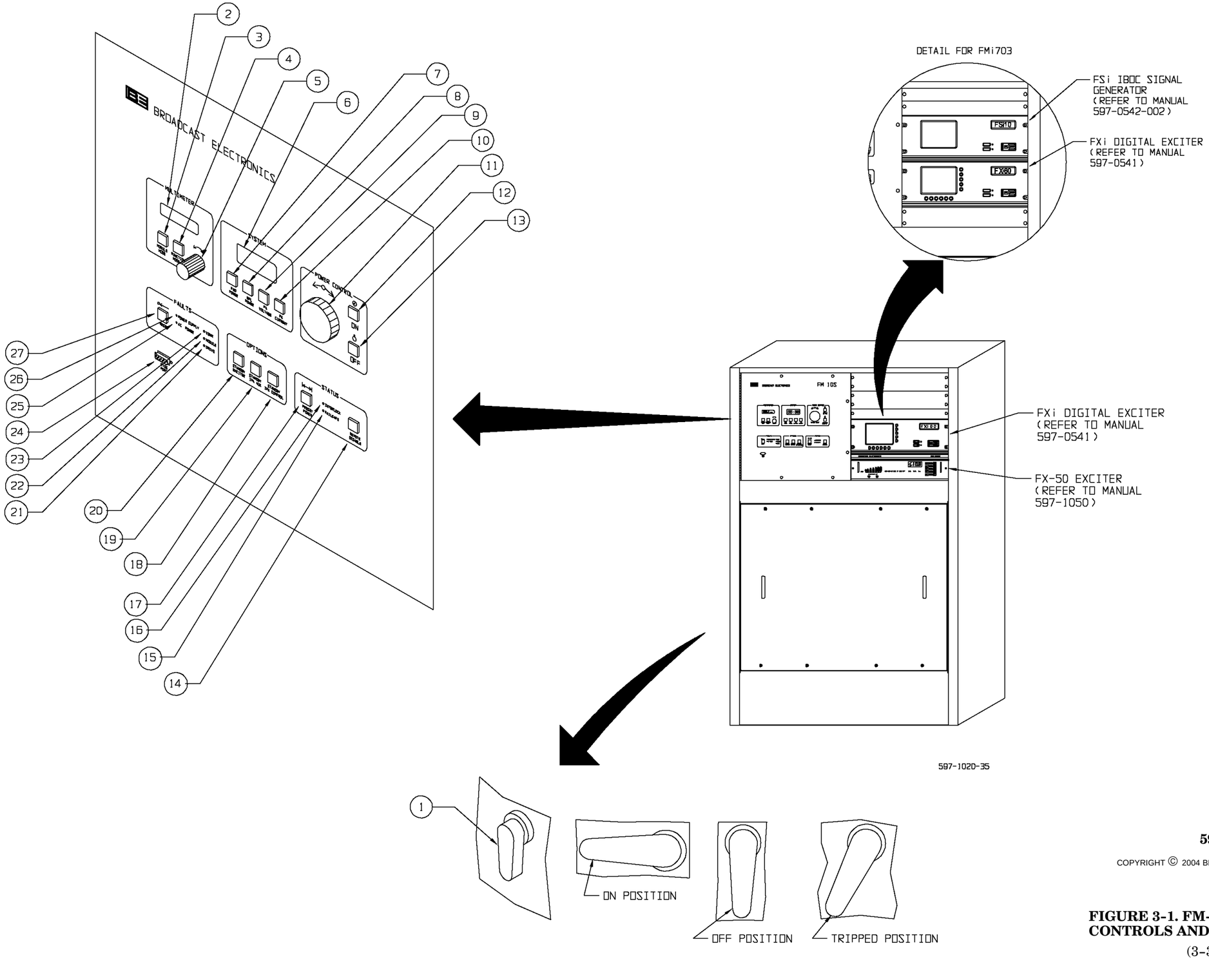
3-4. FIGURE 3-1, page 3-3, presents the location of all controls and indicators associated with normal operation of the FM-10S/FMi 703 transmitter. TABLE 3-1 presents the function of each control or indicator. Refer to FIGURE 3-1, page 3-3, and TABLE 3-1 for a description of the controls and indicators associated with the FM-10S/FMi 703 transmitter.

TABLE 3-1. FM-10S/FMi 703 CONTROLS AND INDICATORS
(Sheet 1 of 5)

INDEX NO.	NOMENCLATURE	FUNCTION
1	AC ON/OFF Switch/ Circuit Breaker	Controls the application of ac power to the transmitter. The switch/circuit breaker is equipped with three positions: 1) On, 2) Off, and 3) tripped.
2	**MULTIMETER** LCD	A 2-line 16 character LCD used to present the module operating parameters.
3	**MULTIMETER MODULE MODE**	When illuminated, used to select module 1 through 16, the on-air IPA, the on-air exciter, the PAV/PAI, the reject load, low-pass filter 1 or 2, or the power supply 1 through 5 for display on the MULTIMETER.

TABLE 3-1. FM-10S/FMi 703 CONTROLS AND INDICATORS
(Sheet 2 of 5)

INDEX NO.	NOMENCLATURE	FUNCTION
4	**MULTIMETER FUNCTION MODE**	When illuminated, used to select several operating functions for modules 1 through 16, the on-air IPA, the on-air exciter, reject load, low-pass filter 1 and 2 and power supplies 1 through 5. The following text presents the device and the functions to be displayed. Module – Forward Power Reflected Power Current Temperature in °C IPA – Forward Power Reflected Power Current Temperature in °C Exciter – Forward Power Reflected Power Temperature (°C)– Reject Load (IPA Splitter) Inlet Low-Pass Filter 1 and 2 – Forward Power Power Supply – Selects power supply 1 through 5
5	**MULTIMETER** Rotary Select Control	Used to select module mode or function mode options as determined by the **MODULE MODE** and **FUNCTION MODE** switch/indicators. When the **MODULE MODE** switch/indicator is illuminated, the control can be used to select a device such as a module or the exciter. When the **FUNCTION MODE** switch/indicator is illuminated, the control can be used to select a function parameter.
6	**SYSTEM** LCD	A 4-digit LCD used to show system operating parameters, which include: transmitter forward power, reflected power, PA voltage, and PA current.



597-1020-9

FIGURE 3-1. FM-10S/FMi 703 CONTROLS AND INDICATORS

BROADCAST ELECTRONICS INC

TABLE 3-1. FM-10S/FMi 703 CONTROLS AND INDICATORS
(Sheet 3 of 5)

INDEX NO.	NOMENCLATURE	FUNCTION
7	**SYSTEM FORWARD POWER** Switch/Indicator	When illuminated, used to configure the **SYSTEM** LCD to display the transmitter forward power in kilowatts.
8	**SYSTEM REFLECTED POWER** Switch/Indicator	When illuminated, used to configure the **SYSTEM** LCD to display the transmitter reflected power in watts.
9	**SYSTEM PA VOLTAGE** Switch/Indicator	When illuminated, used to configure the **SYSTEM** LCD to display the transmitter average PA power supply voltage of right and left cabinets.
10	**SYSTEM PA CURRENT** Switch/Indicator	When illuminated, used to configure the **SYSTEM** LCD to display the total transmitter PA power supply current in amperes (sum of right and left cabinets).
11	**POWER CONTROL** Rotary **LOWER/RAISE** Control	Used to raise or lower the transmitter output power as shown on the **SYSTEM** LCD. Clockwise rotation raises the transmitter output power. Counterclockwise rotation lowers the transmitter output power.
12	**POWER CONTROL ON** Switch/Indicator	**SWITCH**: Enables the transmitter RF output by unmuting the exciter, power amplifier modules, and the PA power supplies. **INDICATOR**: Illuminates to indicate the transmitter RF output is enabled.
13	**POWER CONTROL OFF** Switch/Indicator	**SWITCH**: Disables the transmitter RF output by muting the exciter, power amplifier modules, and the PA power supplies. **INDICATOR**: Illuminates to indicate the transmitter RF output is disabled.
14	**STATUS REMOTE DISABLE** Switch/Indicator	**SWITCH**: Controls the transmitter remote control operations. **INDICATOR**: Illuminates to indicate transmitter remote control operation is disabled. Extinguishes to indicate transmitter remote control operation is enabled.
15	**STATUS FAIL-SAFE** Indicator	Illuminates to indicate the fail-safe interlocks in both the right and left cabinets are closed. Equipment typically connected to the failsafe interlock include: 1) a test load, 2) a motorized coaxial switch, or 3) a remote control unit. Extinguishes to indicate the fail-safe interlocks are open.
16	**STATUS INTERLOCK**	Not used. Illuminates green.

TABLE 3-1. FM-10S/FMi 703 CONTROLS AND INDICATORS
(Sheet 4 of 5)

INDEX NO.	NOMENCLATURE	FUNCTION
17	**STATUS PRESET POWER** Switch/Indicator	**SWITCH**: Selects transmitter operation at a preset RF power output level. **INDICATOR**: Illuminates to indicate transmitter operation at a preset RF power level (such as half power) when illuminated.
18	**OPTIONS STANDBY IPA CONTROL** Switch/Indicator	**SWITCH**: Selects and enables the transmitter control cabinet standby IPA. This is accomplished by: 1) de-energizing the main IPA, 2) operating the coaxial switch to the standby IPA position, and 3) enabling the standby IPA. **INDICATOR**: Illuminates to indicate the standby IPA is enabled.
19	**OPTIONS STANDBY IPA CONTROL** Switch/Indicator	**SWITCH**: Selects and enables the transmitter auxiliary cabinet standby IPA. This is accomplished by: 1) de-energizing the main IPA, 2) operating the coaxial switch to the standby IPA position, and 3) enabling the standby IPA. **INDICATOR**: Illuminates to indicate the standby IPA is enabled.
20	**OPTIONS STANDBY EXCITER** Switch/Indicator	**SWITCH**: Selects and enables the transmitter standby exciter. This is accomplished by: 1) de-energizing the main exciter, 2) operating the coaxial switch to the standby exciter position, and 3) enabling the standby exciter. **INDICATOR**: Illuminates to indicate the standby exciter is enabled.
21	**FAULTS DRIVE** Indicator	Illuminates to indicate IPA output is below 80 watts.
22	**FAULTS MODULE** Indicator	Illuminates to indicate a fault in one or more RF power amplifier modules.
23	**FAULTS VSWR** Indicator	Illuminates to indicate a 1.5:1 or greater VSWR condition is present at the RF output.
24	**RTDS PORT**	A modem port used for the connection of the Broadcast Electronics RTDS (remote transmitter diagnostic system).
25	**FAULTS AC POWER** Indicator	Illuminates to indicate: 1) the AC power supply is below 168 volts or above 255 volts or 2) a loss-of-phase condition is present. The indicator will not illuminate until ac power is returned to the transmitter.
26	**FAULTS POWER SUPPLY** Indicator	Illuminates to indicate a fault in one or more PA power supply modules.

TABLE 3-1. FM-10S/FMi 703 CONTROLS AND INDICATORS
(Sheet 5 of 5)

INDEX NO.	NOMENCLATURE	FUNCTION
27	**FAULTS RESET** Switch/Indicator	**SWITCH**: Clears the transmitter fault circuitry if: 1) the switch is depressed and 2) the fault condition is removed. **INDICATOR**: Illuminates to indicate: 1) an RF power amplifier module fault, 2) a power supply module fault, 3) a high reflected power condition, 4) a drive fault, or 5) an ac power fault.

3-5. OPERATION.

NOTE
NOTE

ENSURE THE TRANSMITTER IS COMPLETELY INSTALLED PRIOR TO PERFORMING THE FOLLOWING PROCEDURES.

NOTE
NOTE

THE TRANSMITTER WILL NOT OPERATE WITH MORE THAN 4 RF POWER AMPLIFIER MODULES REMOVED FROM MODULE LOCATIONS 1 THRU 8 OR 9 THRU 16. ENSURE NO MORE THAN 4 RF POWER AMPLIFIER MODULES ARE REMOVED FROM MODULE LOCATIONS 1 THRU 8 OR 9 THRU 16 IN EITHER THE RIGHT OR LEFT CABINET.

3-6. TURN–ON.

3-7. Operate the rear panel AC ON/OFF switch/circuit breaker to ON. The following events will occur:

1. The **MULTIMETER MODULE MODE** switch/indicator will illuminate.
2. The **SYSTEM FWD PWR** switch/indicator will illuminate.
3. The **POWER CONTROL OFF** switch/indicator will illuminate.
4. The **STATUS FAILSAFE/INTERLOCK** indicators will illuminate.

3-8. If no front-panel indicators illuminate the transmitter may have detected an AC line problem. Refer to AC LINE INTERRUPT - HIGH/LOW AC LINE AND LOSS-OF-PHASE CONDITIONS in the following text.

3-9. Observe the transmitter front-panel switches and indicators. The transmitter switches and indicators will display normal operating conditions. If the **FAULTS RESET** indicator displays a fault condition, depress the **FAULTS RESET** switch/indicator. If the fault condition is not cleared: 1) operate the AC ON/OFF switch/circuit breaker to OFF and 2) Refer to SECTION V, MAINTENANCE and perform the TROUBLESHOOTING procedures to locate the problem.

3–10. Depress the **POWER CONTROL ON** switch/indicator to activate the transmitter. The **POWER CONTROL ON** switch/indicator will illuminate.

3–11. Operate the **SYSTEM** LCD to observe the transmitter forward and reflected power indications by performing the **SYSTEM LCD OPERATION** procedure in the following text.

3–12. Operate the **MULTIMETER** to observe the transmitter control and auxiliary PAV/PAI (R and L) modules, on–air (R and L) IPA, on–air exciter, low–pass filter, reject load, and control and auxiliary power supply module operating parameters by performing the **MULTIMETER OPERATION** procedure in the following text.

3–13. Adjust the transmitter output power by performing the **POWER ADJUST** procedure presented in the following text.

3–14. If remote control operation is desired, operate the **REMOTE DISABLE** switch/indicator to extinguish the switch/indicator. This will enable both local and remote operation. If remote control operation is to be disabled, operate the **REMOTE DISABLE** switch/indicator to illuminate the switch/indicator.

3–15. **TURN–OFF.**

3–16. Operate the transmitter to off by depressing the **POWER CONTROL OFF** switch/indicator. The **POWER CONTROL OFF** switch/indicator will illuminate. The transmitter RF output will be disabled.

3–17. Operate the AC ON/OFF switch to **OFF** to remove AC power from the transmitter.

3–18. **MULTIMETER OPERATION.**

3–19. The **MULTIMETER** is designed to display the status of several transmitter device operating parameters. To operate the multimeter, perform the following procedures.

1. The device is selected using the: 1) **MODULE MODE** switch/indicator or 2) the **MODULE MODE** switch/indicator and the **MULTIMETER** rotary select control. Select the transmitter device such as a module or the exciter as follows:

   A. To select a device using the **MODULE MODE** switch/indicator, proceed as follows:

      1. Depress the **MODULE MODE** switch/indicator to illuminate the switch/indicator. A device will appear on the **MULTIMETER** display.

      2. The displayed device changes each time the **MODULE MODE** switch/indicator is depressed. To locate a specific device, depress the **MODULE MODE** switch/indicator as required to locate the desired device. The following text presents the device sequence.
         1. Module 1 through 16
         2. IPA
         3. Exciter
         4. Temperature
         5. Low–pass filter 1
         6. Low–pass filter 2
         7. Power supply 1 through 5

   B. To select a device using the **MODULE MODE** switch/indicator and the **MULTIMETER** rotary select control, proceed as follows:

      1. Depress the **MODULE MODE** switch/indicator to illuminate the switch indicator. A device will appear on the **MULTIMETER** display.

2. Observe the **MULTIMETER** display and operate the **MULTIMETER** rotary select control clockwise to move forward in the device sequence. Observe the **MULTIMETER** display and operate the **MULTIMETER** rotary select control counterclockwise to move backward in the device sequence.

2. Once a device is selected, a device operating parameter can be viewed. This is accomplished using the: 1) **FUNCTION MODE** switch/indicator or 2) the **FUNCTION MODE** switch/indicator and the **MULTIMETER** rotary select control. Select the operating parameter such as the forward power of a module as follows:

   A. To select a device using the **FUNCTION MODE** switch/indicator, proceed as follows:

      1. Depress the **FUNCTION MODE** switch/indicator to illuminate the switch indicator. A device operating parameter will appear on the **MULTIMETER** display.

      2. The operating changes each time the **FUNCTION MODE** switch/indicator is depressed. To locate a specific operating parameter for a device, depress the **FUNCTION MODE** switch/indicator as required to locate the desired operating parameter. The following text presents the operating parameter sequence.
         1. Module –
            Forward Power – (Wait approximately 10 seconds for a stable indication)
            Reflected Power
            Current
            Temperature in °C
         2. IPA –
            Forward Power – (Wait approximately 10 seconds for a stable indication)
            Reflected Power
            Current
            Temperature in °C
         3. Exciter –
            Forward Power
            Reflected Power
         4. Temperature in °C
            Right reject load (IPA Splitter)
            Left reject load (IPA Splitter)
            Inlet
         5. Low-pass filter 1 –
            Forward power
         6. Low-pass filter 2 –
            Forward power
         7. Power supply 1 through 5 –
            Operating status – OK or FAULT

   B. To select a device operating parameter using the **FUNCTION MODE** switch/indicator and the **MULTIMETER** rotary select control, proceed as follows:

      1. Depress the **FUNCTION MODE** switch/indicator to illuminate the switch indicator. A device operating parameter will appear on the **MULTIMETER** display.

2. Observe the **MULTIMETER** display and operate the **MULTIMETER** rotary select control clockwise to move forward in the device operating parameter sequence. Observe the **MULTIMETER** display and operate the **MULTIMETER** rotary select control counterclockwise to move backward in the device operating parameter sequence.

3-20. **SYSTEM LCD OPERATION.**

3-21. The **SYSTEM** LCD is used to display forward power, reflected power, PA current, and PA voltage. To select and present information on the **SYSTEM** LCD, proceed as follows:

1. To display system forward power, depress the **FWD POWER** switch/indicator to illuminate the switch/indicator. The power is displayed in kilowatts.
2. To display system reflected power, depress the **RFL POWER** switch/indicator to illuminate the switch/indicator. Reflected power can be displayed in reflected power or VSWR as determined by header J13 on the supervisor circuit board (refer to SECTION II, INSTALLATION - VSWR/REFLECTED POWER DISPLAY PROGRAMMING). When the unit is programmed for reflected power, the power is displayed in watts. Depending on the antenna, a normal reflected power indication is 100 watts.
3. To display system PA current, depress the **PA CURRENT** switch/indicator to illuminate the switch/indicator. The current is displayed in amperes. Depending on the TPO, a typical current indication is 320 A with a transmitter configured for a 10 kW RF output level and an operating frequency of 98 MHz.
4. To display system PA voltage, depress the **PA VOLTAGE** switch/indicator to illuminate the switch/indicator. The voltage is displayed in volts. A typical system voltage indication is 41.5 volts with a transmitter configured for a 10 kW RF output level and an operating frequency of 98 MHz.

3-22. **POWER ADJUST.**

3-23. The output power is adjusted using the **POWER CONTROL** rotary control. To adjust the transmitter output power, proceed as follows:

1. Operate the **POWER CONTROL** rotary control clockwise to increase the transmitter output power. Observe the transmitter output power indications on the **SYSTEM** LCD.
2. Operate the **POWER CONTROL** rotary control counterclockwise to decrease the transmitter output power. Observe the transmitter output power indications on the **SYSTEM** LCD.

3-24. **POWER CONTROL.**

3-25. Power control on the FM-10S and FMi 703 transmitters are adjusted via the power control knob as described above. However, the implementation is very different between the two models.

Power control on the FM-10S is accomplished by varying the power supply voltage when the power control knob on the front of the unit is turned. The PAV will rise when the knob is turned clockwise and lower when the knob is turned counter clockwise. The power output from the exciter, or drive, does not change during the power control process.

Power control on the FMi 703 is accomplished by varying the exciter power, or drive. The exciter forward power will rise when the knob is turned clockwise and lower when the knob is turned counter clockwise. The PAV on the transmitter does not change during the power control process and sets at ~42.5V.

Since the power control is accomplished in the exciter there is an interface from the transmitter to the exciter that indicates when the knob is being turned and in what direction. The supervisor board sends a voltage that goes to the I/O board. On the I/O board this voltage is on J1–7 for the main exciter and J2–7 for the standby exciter. This voltage is connected to J3–24 on the exciter.

The lower command is typically 1.5V on this pin and the range for this command is 0.5V to 2.2V. When the voltage is in this range the exciter power will lower, thus lowering the transmitter power. The raise command is typically 4.5V on this pin and the range for this command is any voltage above 2.68. When the voltage is above 2.68V the exciter power will raise, thus raising the transmitter power. There are two hold regions where the exciter does nothing. These are voltages between 2.2V and 2.68V and any voltage below 0.5V. When the voltage is in the hold range the exciter power will remain stable.

The FMi 703 is designed for HD Radio operation which requires that the transistors be biased for Class AB operation rather than Class C. When the transistors are biased at the higher current point the drive requirements go down due to the fact that the gain of the devices goes up. Therefore, the drive requirements from the exciter are quite low and it is normal to see the exciter running between 1 and 5Watts. This is in contrast to the 25Watts when the transmitter is running in Class C mode (FM–10S).

3–26. EXCITER OPERATION.

3–27. For transmitters equipped with an FX–50, refer to the FX–50 instruction manual (597–1050) for a complete description of the FX–50 operating procedures. Perform the procedures to configure the FX–50 for the desired operation. For transmitters equipped with an FXi 60, refer to the FXi 60 instruction manual (597–0541) for a complete description of the FXi 60 operating procedures. Perform the procedures to configure the FXi 60 for the desired operation.

3–28. PRESET POWER.

3–29. The transmitter can be operated to a lower preset power level using the **PRESET POWER** switch/indicator. The preset power function is typically used when the transmitter is switched to a secondary antenna or during icing conditions. The preset power level is recorded in the factory test data sheet. To operate the transmitter to the preset power level, depress the **PRESET POWER** switch/indicator to illuminate the switch/indicator.

3–30. REMOTE DISABLE.

3–31. Transmitter remote operation can be disabled using the **REMOTE DISABLE** switch/indicator. To disable remote control operation, depress the **REMOTE DISABLE** switch/indicator to illuminate the switch/indicator. Local operation will remain enabled. To enable remote control operation, depress the **REMOTE DISABLE** switch/indicator to extinguish the switch/indicator. This will enable both local and remote operation.

3–32. STANDBY EXCITER OPERATION.

3–33. If the transmitter is equipped with a standby exciter, the exciter can be manually switched into the transmitter RF chain using the **STANDBY EXCITER** switch/indicator. To manually switch the standby exciter into the RF chain, depress the **STANDBY EXCITER** switch/indicator to illuminate the switch/indicator. To switch the normal exciter into the RF chain, depress the **STANDBY EXCITER** switch/indicator to extinguish the switch/indicator.

3–34. **STANDBY IPA OPERATION.**

3–35. If the transmitter is equipped with standby IPAs, the standby IPA can be manually switched into the transmitter RF chain using the **STANDBY IPA** switch/indicators. To manually switch the standby IPA into the RF chain, depress the **STANDBY IPA** switch/indicator to illuminate the switch/indicator. To switch the normal IPA into the RF chain, depress the **STANDBY IPA** switch/indicator to extinguish the switch/indicator.

3–36. **FAULT RESET AND FAULT INDICATORS.**

3–37. The transmitter is equipped with 5 fault indicators. The **VSWR** indicator will illuminate if a 1.45 : 1 or greater VSWR condition is present at the RF output. The **MODULE** indicator will illuminate if a fault occurs in one or more modules. The **DRIVE** indicator illuminates if the IPA output is below 250 watts. The **POWER SUPPLY** indicator illuminates if a fault occurs in one or more power supply modules. The **AC POWER** indicator illuminates if: 1) the AC power line is below 168 volts or above 255 volts or 2) a loss–of–phase condition has occurred. The indicator will illuminate when ac power is returned to the transmitter (refer to AC LINE INTERRUPT – HIGH/LOW AC LINE AND LOSS–OF–PHASE CONDITIONS in the following text).

3–38. If a fault occurs, the **FAULTS RESET** switch/indicator will illuminate. To reset a transmitter fault condition, depress the **FAULTS RESET** switch/indicator. If the fault condition is remedied, the **FAULT RESET** indicator will extinguish.

3–39. If the fault condition is not remedied, operate the ac switch/circuit breaker to Off and locate the problem.

3–40. Once the fault condition is remedied, depress the **FAULTS RESET** switch/indicator. The indicator will extinguish.

3–41. **AC LINE INTERRUPT – HIGH/LOW AC LINE AND LOSS–OF–PHASE CONDITIONS.**

3–42. The transmitter is equipped with AC line monitor circuit boards. The circuit boards will de–energize the transmitter in the event: 1) the AC power line is below 168 volts or above 255 volts or 2) a loss–of–phase condition occurs. If one of these conditions occurs, AC power will be removed from the transmitter. As a result, the transmitter output power will be disabled and all transmitter indicators will be extinguished. The transmitter will automatically re–energize when the AC line is between 168 and 255 volts or the AC line phase is restored. High/low AC line voltage or loss–of–phase on any one or more phases of the AC input is indicated by illumination of RED PHASE 1, 2 or 3 LED on the lower front panel of each cabinet. Once the transmitter re–energizes, the **FAULT AC POWER** indicator and the **FAULT RESET** switch/indicator will illuminate to indicate an AC line fault condition.

3–43. **FAILURE CONDITIONS.**

3–44. The FM–10S/FMi 703 is designed with the ability to provide output power when power supply and RF amplifier modules fail. This “soft failure” operation allows the transmitter to remain on–the–air until the transmitter can be de–energized for repair. In the event of an RF amplifier module failure, the module can be removed from the transmitter chassis with power energized.

3–45. A complete description of failure mode operation is presented in SECTION V, MAINTENANCE. Refer to FAILURE MODE OPERATION for a description of transmitter performance during failure modes.

SECTION IV
THEORY OF OPERATION

4-1. INTRODUCTION.

4-2. This section presents the theory of operation for the Broadcast Electronics FM-10S/FMi 703 transmitter.

4-3. OVERALL OPERATION.

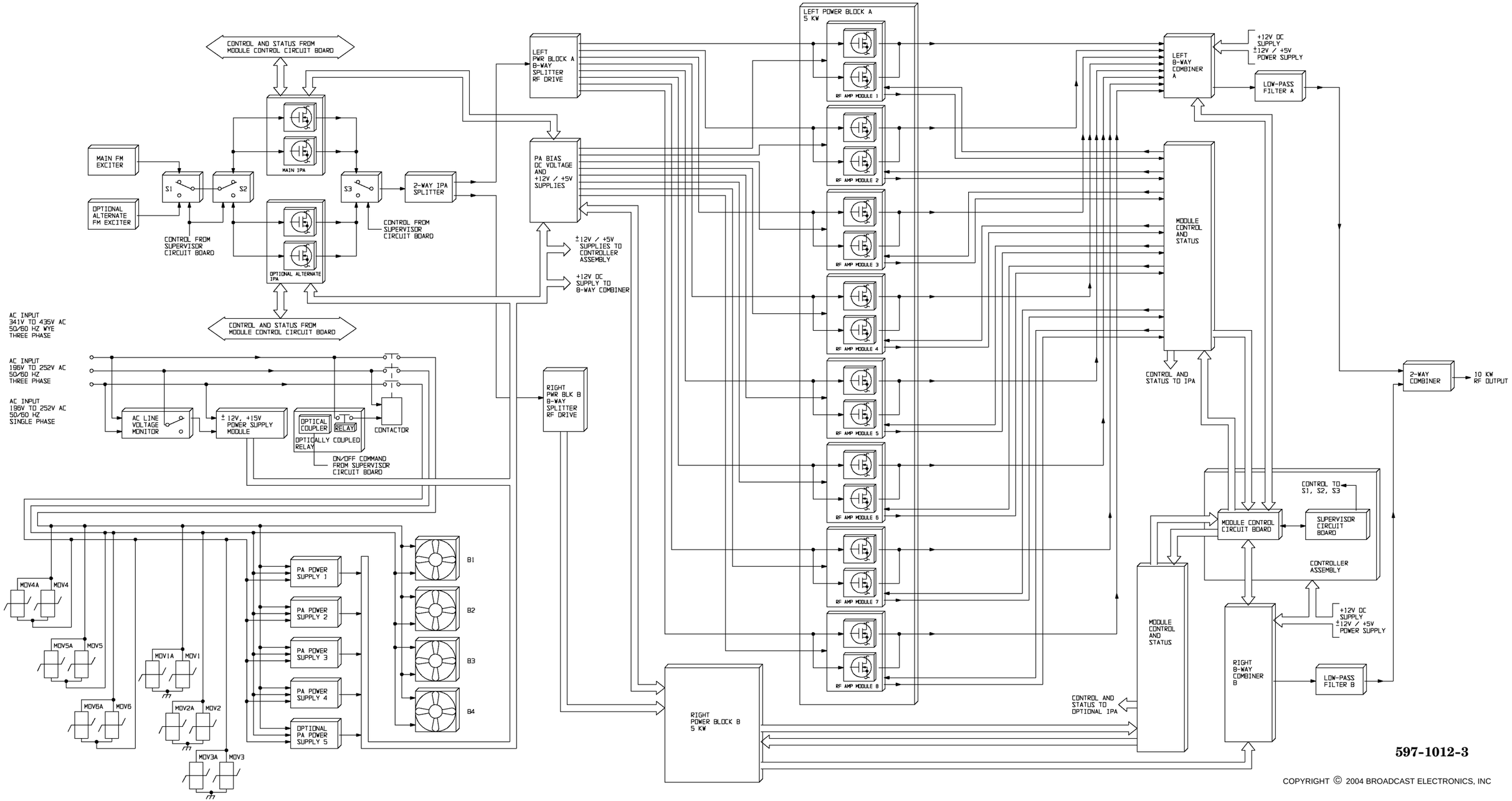
4-4. Information on overall FM-10S/FMi 703 transmitter operation is presented in FIGURE 4-1, beginning on page 4-3. Refer to FIGURE 4-1 for information on overall FM-20S/FMi 703 transmitter operation.

4-5. POWER SUPPLY OPERATION.

4-6. A description of the FM-20S/FMi 703 power supply is presented in FIGURE 4-2, beginning on page 4-5. Refer to FIGURE 4-2 for FM-10S/FMi 703 power supply information.

4-7. RF CIRCUIT OPERATION.

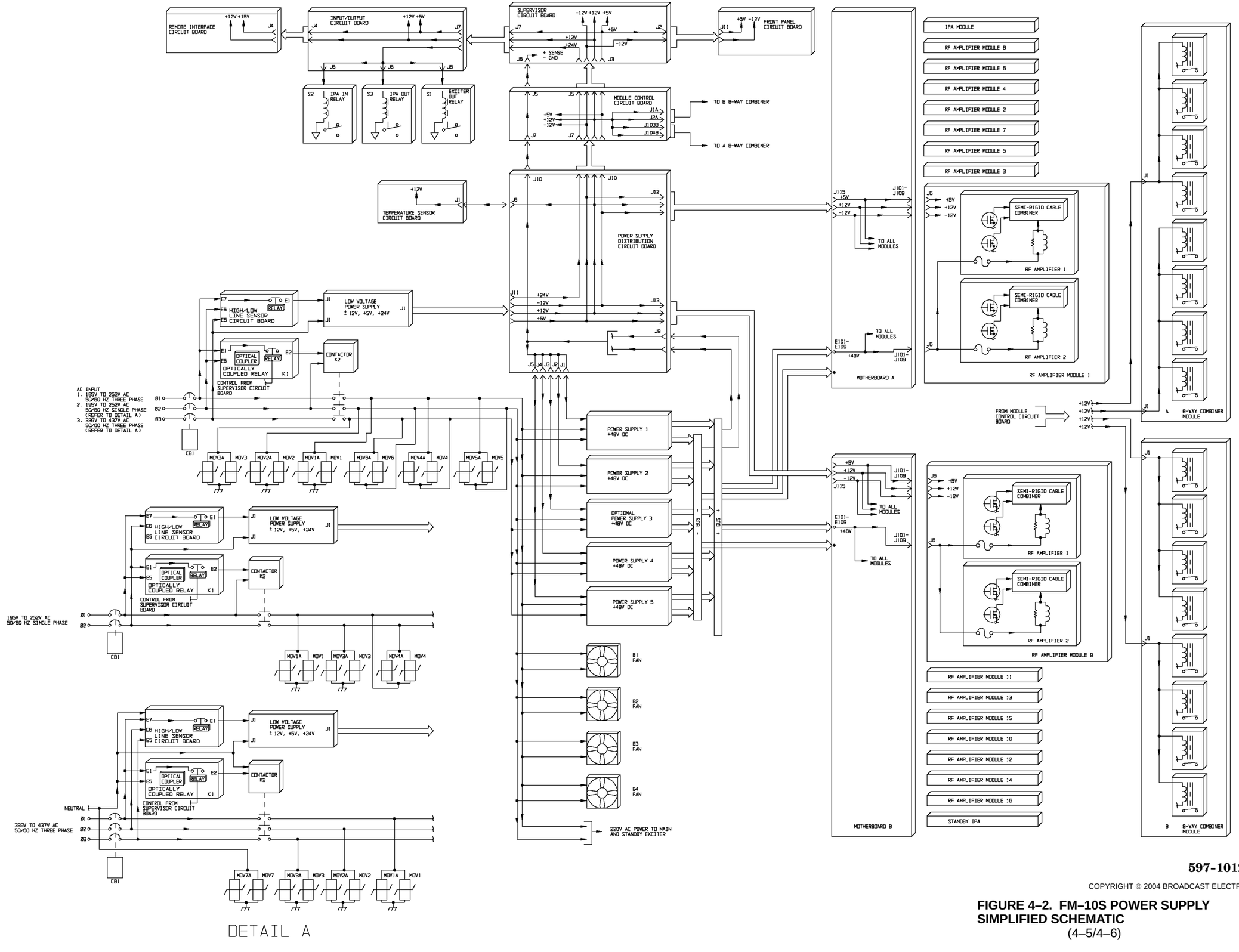
4-8. A description of the FM-10S/FMi 703 RF circuitry is presented in FIGURE 4-3, beginning on page 4-7. Refer to FIGURE 4-3 for FM-10S/FMi 703 RF circuitry information.



597-1012-3

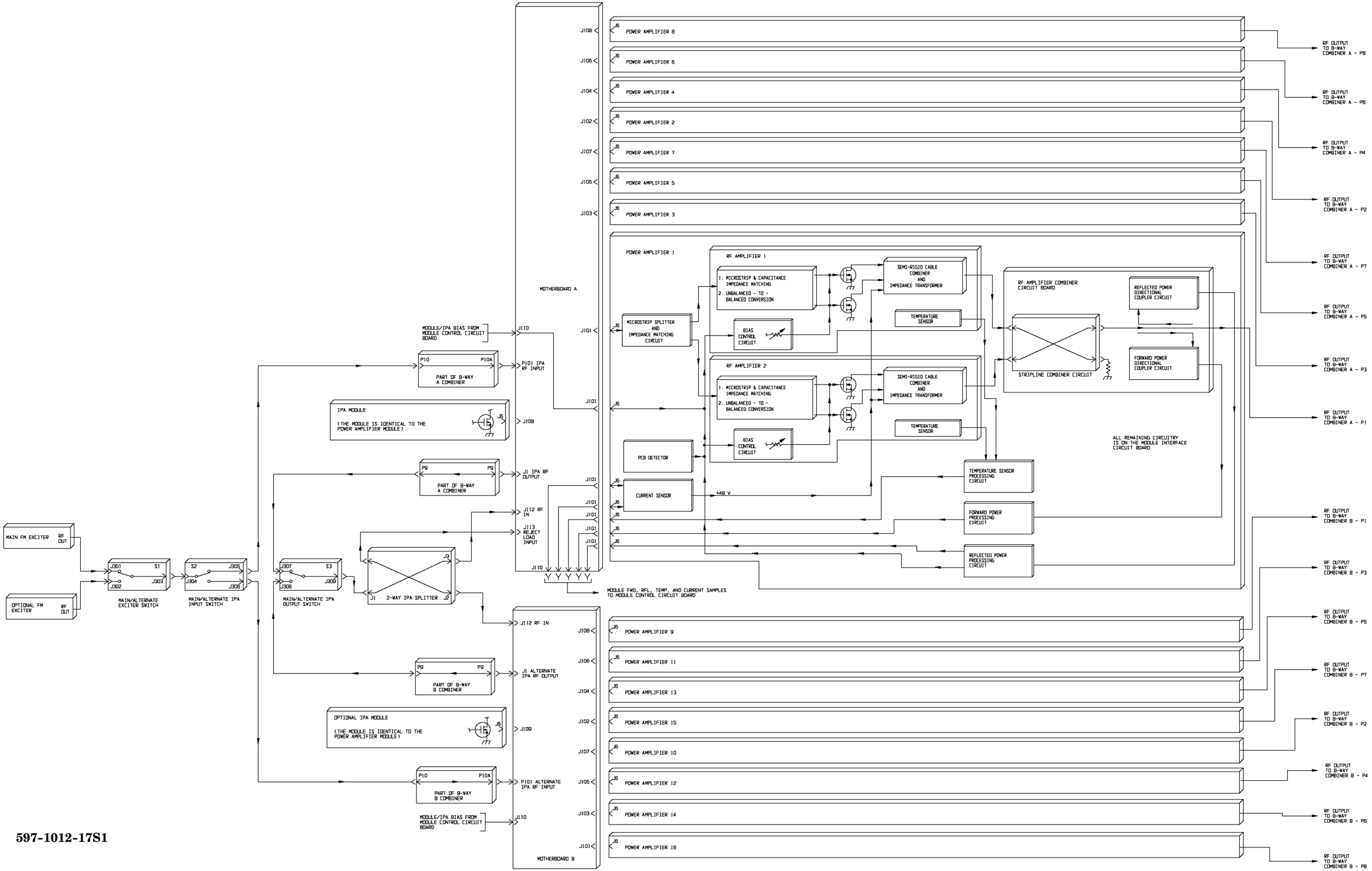
FIGURE 4–1. BLOCK DIAGRAM, FM–10S (4–3/4–4)

BROADCAST ELECTRONICS INC



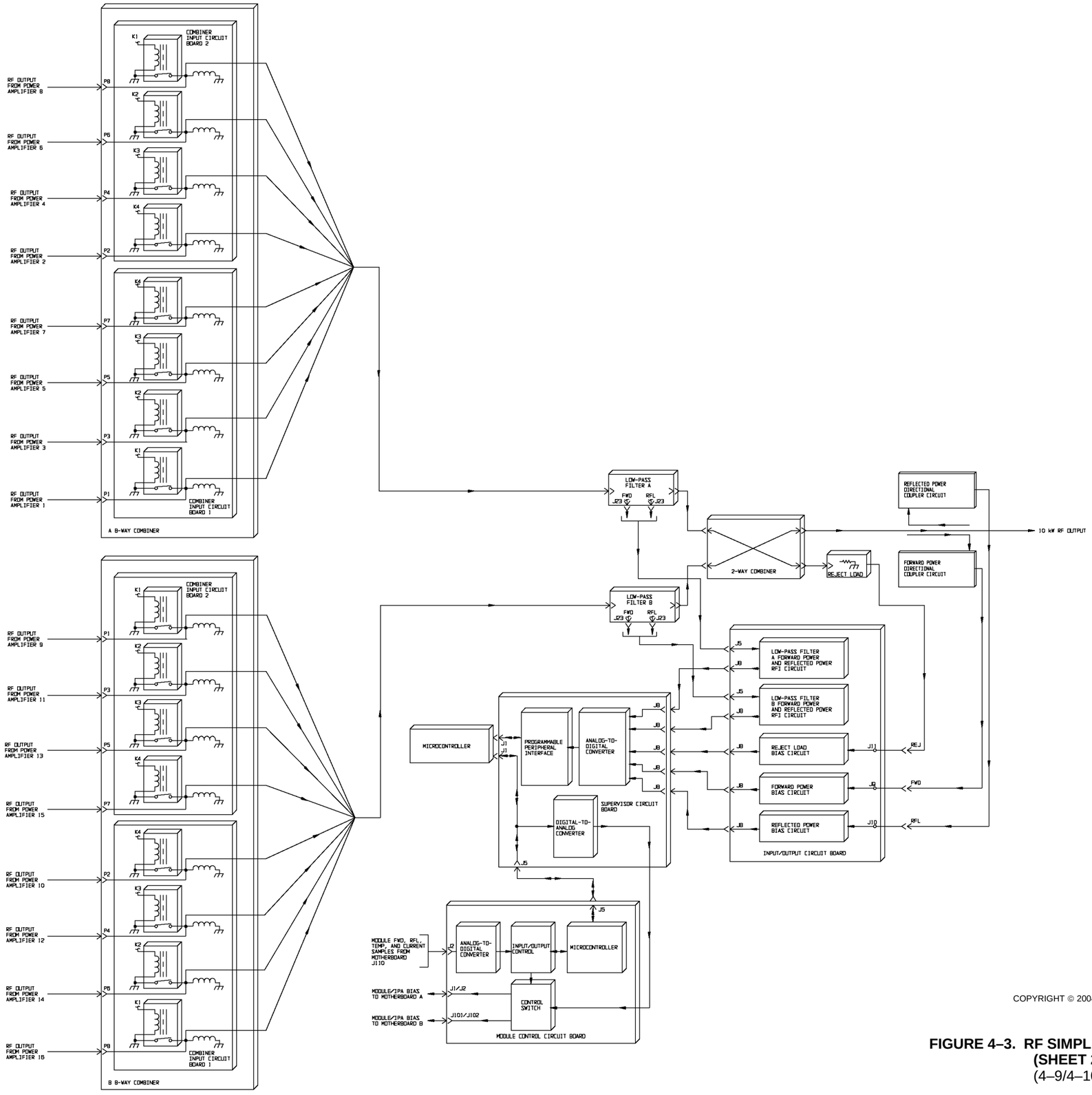
597-1012-16

FIGURE 4–2. FM–10S POWER SUPPLY SIMPLIFIED SCHEMATIC
(4–5/4–6)



597-1012-17S1

FIGURE 4–3. FM–10S RF SIMPLIFIED SCHEMATIC (SHEET 1 OF 2)
(4–7/4–8)



597-1012-17S2

FIGURE 4–3. RF SIMPLIFIED SCHEMATIC (SHEET 2 OF 2)
(4–9/4–10)

SECTION V
MAINTENANCE

5-1. INTRODUCTION.

5-2. This section provides maintenance information, electrical adjustment procedures, and troubleshooting information for the Broadcast Electronics FM-10S/FMi 703 transmitter.

5-3. SAFETY CONSIDERATIONS.

WARNING ***NEVER OPEN THE EQUIPMENT UNLESS ALL TRANSMITTER PRIMARY POWER IS DISCONNECTED. ENSURE ALL TRANSMITTER PRIMARY POWER IS DISCONNECTED BEFORE ATTEMPTING MAINTENANCE ON ANY AREA WITHIN THE TRANSMITTER.***

WARNING

5-4. The FM-10S/FMi 703 transmitter contains high voltages and currents. If safety precautions are not practiced, contact with the high voltages and currents could cause serious injury or death. Never operate the transmitter unless all transmitter doors and access panels are installed. The transmitter is equipped with built-in safety features, however good judgement, care and common sense must be practiced to prevent accidents. The maintenance procedures contained in this section should be performed only by trained and experienced maintenance personnel.

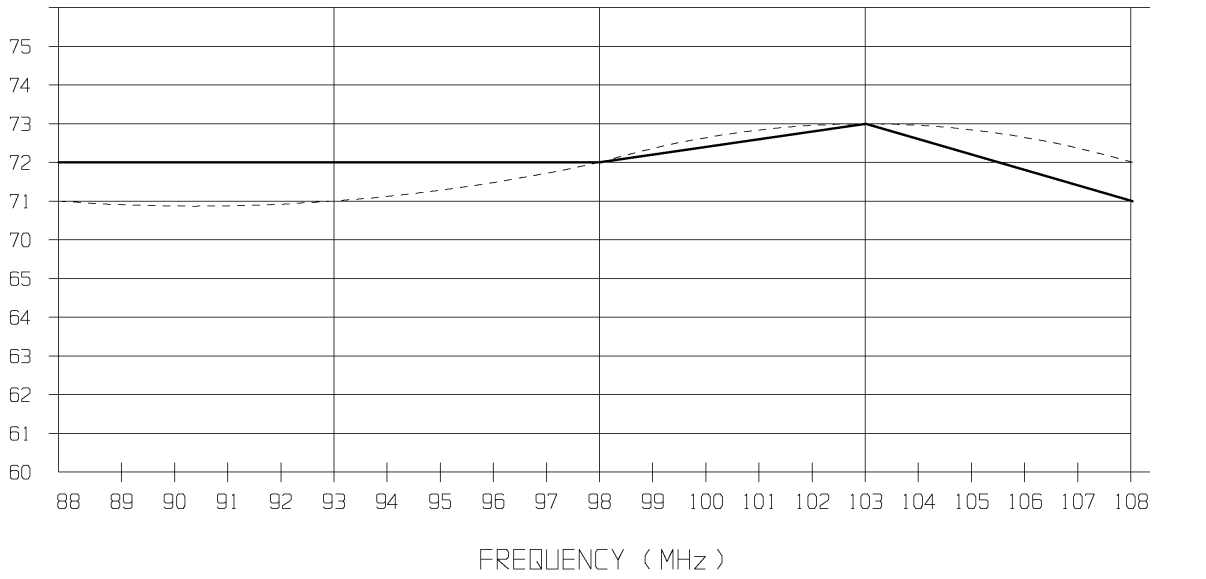
5-5. It is dangerous to measure voltages inside the cabinet or replace components with power energized. Therefore, do not measure voltages inside the cabinet or replace components with power energized. Always operate the transmitter rear door AC switch/circuit breaker to OFF prior to performing any maintenance within the transmitter. Measurements with the power energized can be performed in the controller enclosure if required.

5-6. POWER AMPLIFIER EFFICIENCY.

5-7. The FM-10S/FMi 703 power amplifier stage consists of solid-state power amplifier devices. FIGURE 5-1, page 5-2, presents typical FM-10S/FMi 703 PA stage efficiency values. The PA stage efficiency will vary slightly from the values presented in FIGURE 5-1 due to component tolerances. Refer to FIGURE 5-1, page 5-2, as required for typical PA stage efficiency values.

5-8. FIRST LEVEL MAINTENANCE.

5-9. First level maintenance consists of procedures applied to the equipment to prevent future failures. The procedures are performed on a regular basis and the results recorded in a maintenance log. Preventive maintenance of the transmitter consists of good housekeeping and checking performance levels using the meters and various indicators built into the equipment.



597-1020-37

FIGURE 5-1. FM-10S TYPICAL PA EFFICIENCY

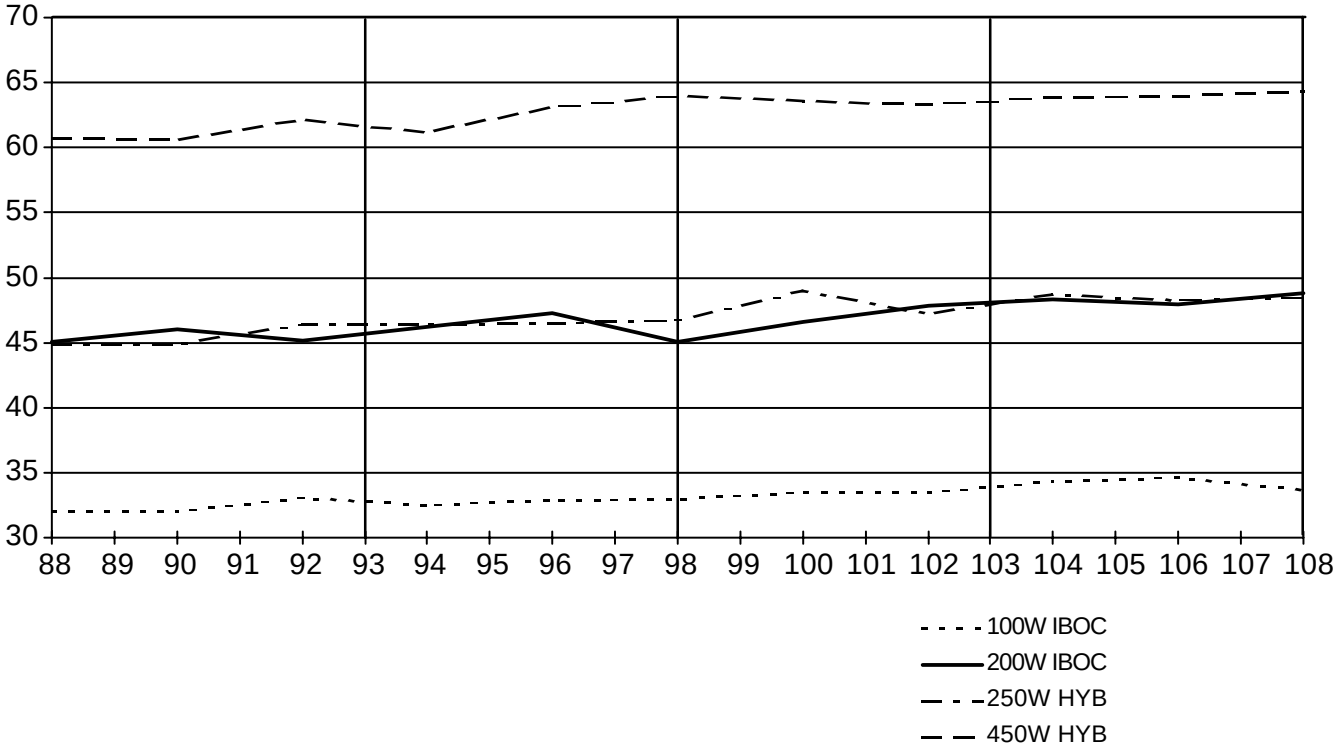


FIGURE 5-2. FMi 703 TYPICAL PA EFFICIENCY

5–10. **ROUTINE MAINTENANCE.**

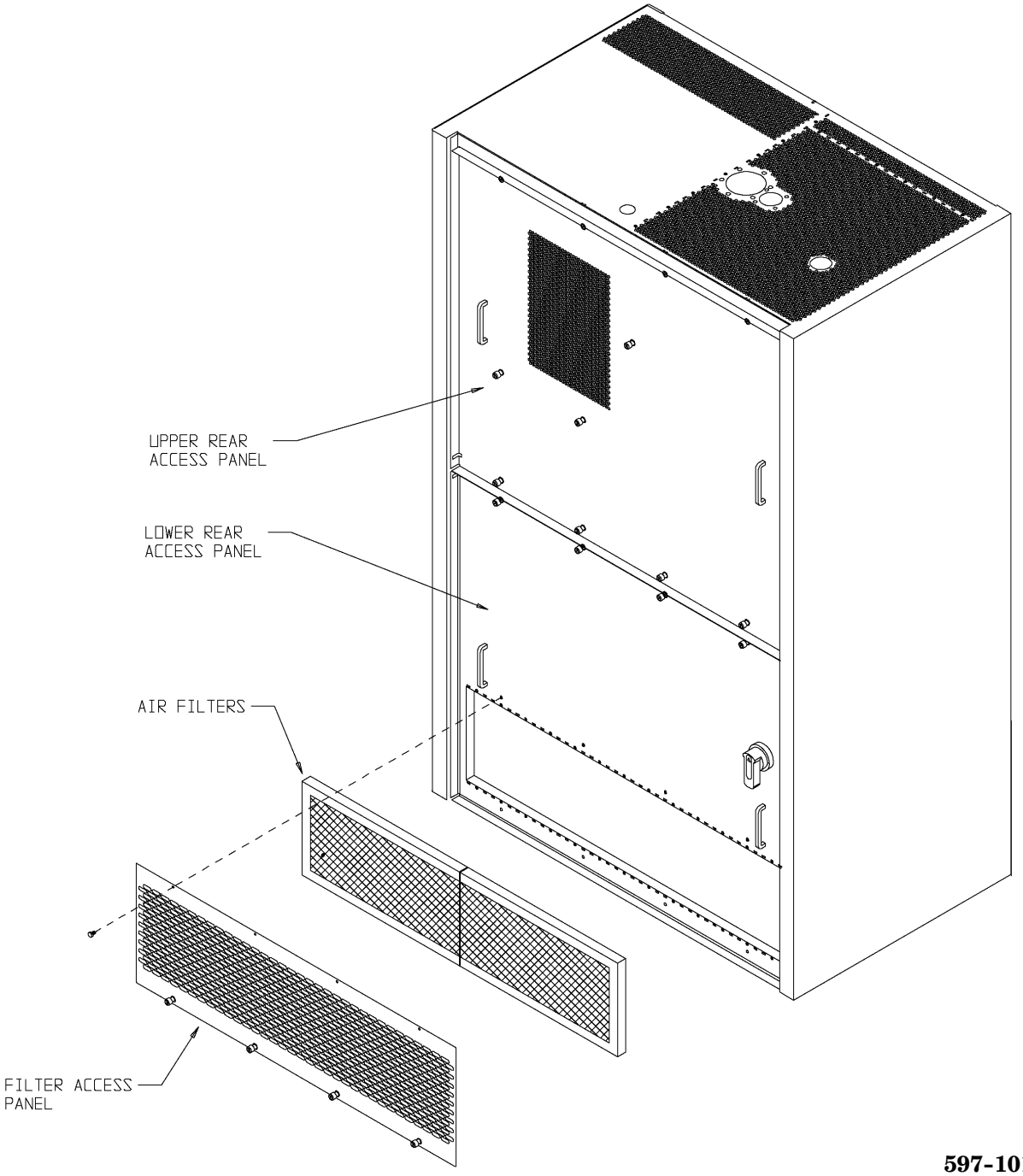
WARNING ***NEVER OPEN THE EQUIPMENT UNLESS ALL TRANSMITTER PRIMARY POWER IS DISCONNECTED. ENSURE ALL TRANSMITTER PRIMARY POWER IS DISCONNECTED BEFORE ATTEMPTING MAINTENANCE ON ANY AREA WITHIN THE TRANSMITTER.***

WARNING

5–11. **INSPECTION AND CLEANING.** On a regular basis, clean the equipment of accumulated dust using a brush and vacuum cleaner. Inspect the RF amplifier modules and the power supplies for damage caused by component overheating. Overheated components are identified by circuit board discoloration near the component leads. Inspect the circuit boards for loose hardware as required.

5–12. **TRANSMITTER AIR FILTERS.** The FM–10S/FMi 703 transmitter is equipped with four screen–type air filters (refer to FIGURE 5–3, page 5–4,). The air filters are located on the rear–doors. Ensure the filters are installed with the air flow indicator pointing towards the flushing fans. The filters can be checked and cleaned without interrupting transmitter operation.

5–13. Check the filter approximately once a week. When dirt is to be removed from the filter, proceed as follows:



597-1012-21

FIGURE 5-3. AIR FILTER REMOVAL

1. Refer to FIGURE 5–3 and remove the transmitter rear filter access panel.
2. Remove the filters from the chassis by lifting the filter from the chassis.
3. Clean the filter using a: 1) brush and vacuum or 2) brush and soapy water.

4. Replace the filter with the air flow indicator pointing towards the flushing fans.
5. Replace the rear filter access panel.

5-14. **EXCITER AIR FILTER.** The FX-50 and the optional FXi 60 exciter are also equipped with a screen-type air filter. The FX-50 and FXi 60 air filters can be checked and cleaned without interrupting transmitter operation.

5-15. The FXi 60 and FX-50 air filters can be accessed from the rear of the transmitter without interrupting transmitter operation. The FX-50 filter can also be accessed by sliding the unit out-of-the-rack. To access and clean the exciter filter, proceed as follows:

1. Refer to FIGURE 5-3, page 5-4 and remove the transmitter upper rear access panel.
2. Remove the filter from the chassis by removing the screws securing the filter to the chassis.
3. Clean the filter using a: 1) brush and vacuum or 2) brush and soapy water.
4. Replace the filter.
5. Replace the rear upper access panel.

5-16. **FLUSHING FANS.** Inspect the transmitter flushing fans for dust accumulation and periodically clean the fans using a brush and vacuum cleaner. The fans are cooled by air passing around each motor. If dust is allowed to accumulate on the motors, the ambient air temperature will increase due to restricted air flow. When the ambient air temperature increases, the fan motor bearing lubricant will gradually vaporize and bearing failure will occur.

5-17. It is recommended the flushing fan mounting hardware be periodically checked. The flushing fans are equipped with sealed bearings which do not permit lubrication. If a bearing fails, the motor must be replaced.

5-18. **CONTROLLER BATTERY.** The transmitter controller is equipped with a Lithium battery. The battery has a useful life of approximately 5 years. After approximately five years of service, replace the controller battery using BEI part number 350-2032.

5-19. SECOND LEVEL MAINTENANCE.

5-20. Second level maintenance consists of procedures required to adjust the transmitter circuitry or restore the transmitter to operation after a fault has occurred. The procedures consist of electrical adjustments, troubleshooting, and component replacement procedures. All electrical adjustments with the exception of the transmitter frequency re-programming procedure are required only when components are replaced in the transmitter circuitry.

WARNING ***NEVER OPEN THE EQUIPMENT UNLESS ALL TRANSMITTER PRIMARY POWER IS DISCONNECTED. ENSURE ALL TRANSMITTER PRIMARY POWER IS DISCONNECTED BEFORE ATTEMPTING MAINTENANCE ON ANY AREA WITHIN THE TRANSMITTER.***

5-21. The maintenance philosophy for the FM-10S/FMi 703 transmitter consists of isolating a problem to a specific area. Once the specific area is located, subsequent troubleshooting using the information in the following text will assist in problem isolation to a replaceable assembly or component. If required, the replaceable assembly may be: 1) returned to the factory for repair or exchange or 2) repaired locally.

5-22. **ELECTRICAL ADJUSTMENTS.**

WARNING ***NEVER OPEN THE EQUIPMENT UNLESS ALL TRANSMITTER PRIMARY POWER IS DISCONNECTED. ENSURE ALL TRANSMITTER PRIMARY POWER IS DISCONNECTED BEFORE ATTEMPTING MAINTENANCE ON ANY AREA WITHIN THE TRANSMITTER.***

WARNING

5-23. **MULTIMETER CONTRAST ADJUSTMENT.** Potentiometer R28 on the controller front panel circuit board adjusts the multimeter display contrast. The following text presents the procedure to adjust the multimeter contrast.

5-24. **Required Equipment.** The following equipment is required to adjust the multimeter display calibration control.

1. Insulated adjustment tool.

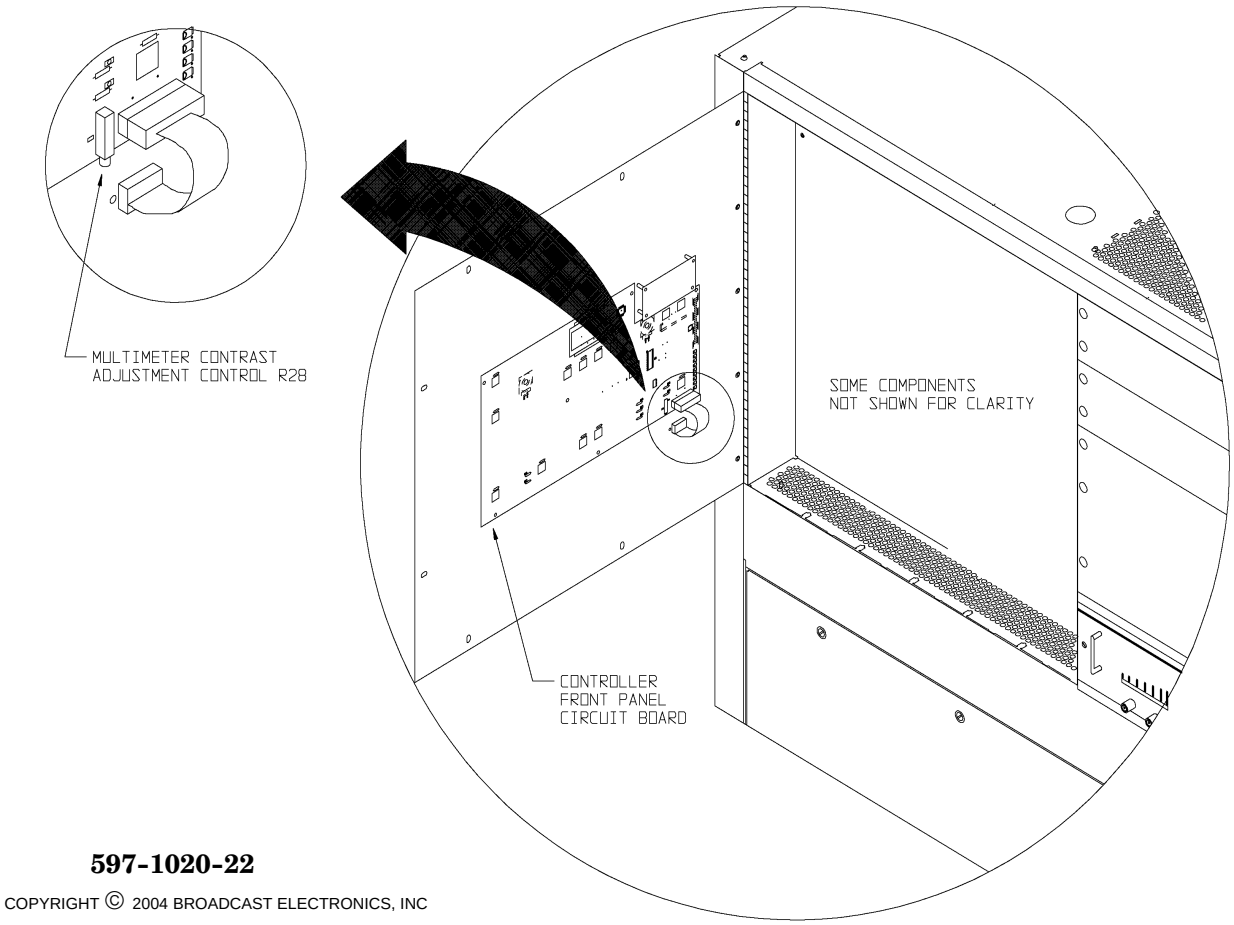
5-25. **Procedure.** To calibrate the multimeter display, proceed as follows:

5-26. Open the controller door.

5-27. Refer to FIGURE 5-4 and locate resistor R28.

5-28. Observe the MULTIMETER display and adjust R28 for the desired contrast.

5-29. Close the controller door.



597-1020-22

FIGURE 5-4. CONTROLLER FRONT PANEL CIRCUIT BOARD CONTROLS

5-30. **MICROPROCESSOR MODULE FIRMWARE UPGRADE.**

CAUTION

CAUTION

SOME OF THE PROCEDURES PERFORMED USING THE UTILITY PROGRAM CAN TEMPORARILY DISABLE THE TRANSMITTER. THEREFORE, CONTACT THE BROADCAST ELECTRONICS CUSTOMER SERVICE DEPARTMENT PRIOR TO PERFORMING ANY METER CALIBRATION OR FIRMWARE UPLOAD.

CAUTION

CAUTION

FOR MICROPROCESSOR FIRMWARE UPGRADES, THE TRANSMITTER METER VALUES MUST BE RECORDED PRIOR TO ATTEMPTING ANY UPGRADE PROCEDURE. DO NOT PERFORM FM-10S/FMi 703 UTILITY PROGRAM TASKS UNLESS SPECIFIED BY A PROCEDURE.

5-31. **GENERAL.** The FM-10S/FMi 703 controller is equipped with a modular microprocessor module (refer to FIGURE 5-5, page 5-8). The module is located on the supervisor circuit board and contains: 1) the main transmitter operating code and 2) transmitter calibration values. For a microprocessor module firmware upgrade, the microprocessor module must be replaced. When this is required, the controller must be re-calibrated.

5-32. The re-calibration process is performed using the FM-10S/FMi 703 utility program. The utility program allows the user to calibrate the multimeter display, calibrate the system LCD display, and change the firmware in the module control circuit board. The utility program requires Windows 95 HyperTerminal (or Windows Terminal), a null modem cable, and a PC to communicate with the operator.

5-33. The utility program allows the user to perform the following functions: 1) set all meter calibrations to the factory defaults, 2) calibrate the multimeter parameters, 3) calibrate the system LCD display parameters, 4) upload firmware to the module control circuit board microprocessors, 5) adjust the module bias level, and 6) adjust the IPA bias level.

5-34. Some of the operations can be performed by the transmitter user. Some of the operations can only be performed by the user when instructed by the Broadcast Electronics Customer Service Department. Some of the operations can not be performed by the user. The following text presents the utility program operations.

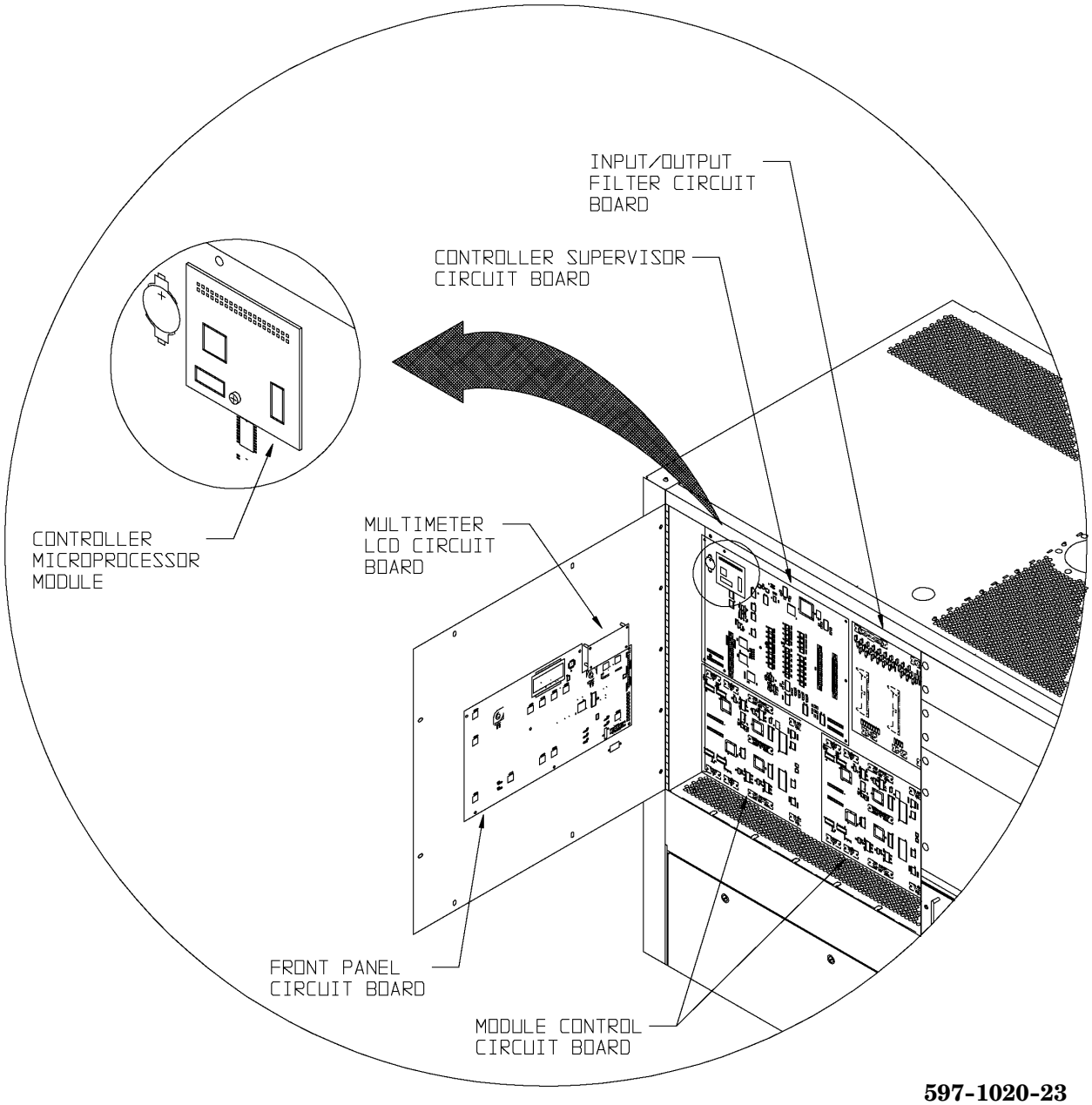


FIGURE 5-5. CONTROLLER MICROPROCESSOR MODULE

CODE	*DESCRIPTION*	*COMMENTS*
A	Dumps all TX parameters to the front panel serial port for viewing.	Allows access to all the information displayed on the multi-meter and LCD display on the front panel of the TX through at one time.
B	Adjust the module full bias level.	Do not perform unless instructed to do so by the Broadcast Electronics Customer Service Department.
D	Set the drive power fault level.	Establishes the IPA RF drive level at which the DRIVE fault indicator will illuminate.
E	Enable/Disable reflected power readings from filters.	When pressed this feature toggles between enabling or disabling the reflected power readings from the filters.
F	Resets all meter calibration parameters to the factory defaults	Can be used independently by the operator to reset all meter calibrations.
C	Set TX to FM only mode.	Sets the TX to operate in FM only mode.
G	Set TX to IBOC only mode, no FM carrier.	Sets TX to IBOC only mode and is only valid if the TX is a FMi 703 or 1405.
H	Set TX to Hybrid mode, FM + IBOC.	Sets TX to FM + IBOC mode and is only valid if the TX is a FMi 703 or 1405.
I	Adjust the IPA full bias level.	Do not perform unless instructed to do so by the Broadcast Electronics Customer Service Department.
K	Set the minimum exciter power reading for operation.	To be used by the operator only when instructed by the Broadcast Electronics Customer Service Department.
L	Calibrates the LCD display.	Do not perform unless instructed to do so by the Broadcast Electronics Customer Service Department.
M	Calibrates the multimeter display.	To be used by the operator only when instructed by the Broadcast Electronics Customer Service Department.
O	Enable/Disable standby exciter option.	When pressed this feature toggles between enabling or disabling the standby exciter option.
R	Establishes the reflected power level at which automatic power foldback will occur.	To be used by the operator only when instructed by the Broadcast Electronics Customer Service Department.
S	Enable/Disable standby IPA option.	When pressed this feature toggles between enabling or disabling the standby IPA option.
U	Uploads new firmware to the module control circuit board microprocessors.	To be used by the operator only when instructed by the Broadcast Electronics Customer Service Department.
V	Set the PA Supply Voltage when in IBOC only and FM + IBOC mode.	Do not perform unless instructed to do so by the Broadcast Electronics Customer Service Department.
Q	Terminates the utility program operations	Used to terminate the utility program operation.

5–35. **FIRMWARE UPGRADE – PROCEDURE.** When a firmware upgrade requires the supervisor circuit board to be replaced, the transmitter and module values must be recorded. To perform a microprocessor module firmware upgrade, proceed as follows:

5–36. **Step 1 – Record The Transmitter And Module Values.** Record the transmitter and module values by performing the following procedure. The re–calibration procedure requires a Bird wattmeter. Therefore, record the wattmeter values also.

5–37. Operate the transmitter at a normal output power.

5–38. Operate the **MULTIMETER** to record the following values for an RF amplifier module. Select only one module such as module 1 and record the values.

MODE/FUNCTION	*TRANS. METER VALUE*	*BIRD WATTMETER VALUE*
Module Forward Power		N/A
Module Reflected Power		N/A
Module Temp		N/A
Module Current		N/A
R Combiner		N/A
L Combiner		N/A
Control PAV		N/A
Auxiliary PAV		N/A
Control PAI		N/A
Auxiliary PAI		N/A

5–39. Operate the **SYSTEM** LCD to record the following values.

MODE/FUNCTION	*TRANS. METER VALUE*	*BIRD WATTMETER VALUE*
System Forward Power		
System Reflected Power		
PA Voltage		N/A
System PA Current		N/A

5–40. **Step 2 – Replace the Microprocessor Module.** Replace the microprocessor module as follows:

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

WARNING

5–41. Disconnect all transmitter primary power before proceeding.

5–42. Open the transmitter controller door and locate the microprocessor module (refer to FIGURE 5–5, page 5–8).

5-43. Replace the microprocessor module as follows:

1. Using a #1 Philips screwdriver, remove the microprocessor mounting screw.
2. Using your hands, gently pull the module from the header.
3 Orient the new microprocessor module as shown and insert the module in header J1 (refer to FIGURE 5-5, page 5-8).
4 Re-install the mounting screw and close the controller door.

5-44. **Step 3 – PC Connections.** Once the microprocessor module is replaced, a PC must be connected to the transmitter. The utility program requires a PC and a null modem cable to communicate with the user. Refer to FIGURE 5-6, page 5-11 and connect a null modem cable between a computer COM port and the FM-10S/FMi 703 front-panel RTDS port as shown. If a pre-constructed null modem cable cannot be located, a cable can be manufactured using 2 female D-Type connectors and a 3 conductor cable (refer to FIGURE 5-7, page 5-12).

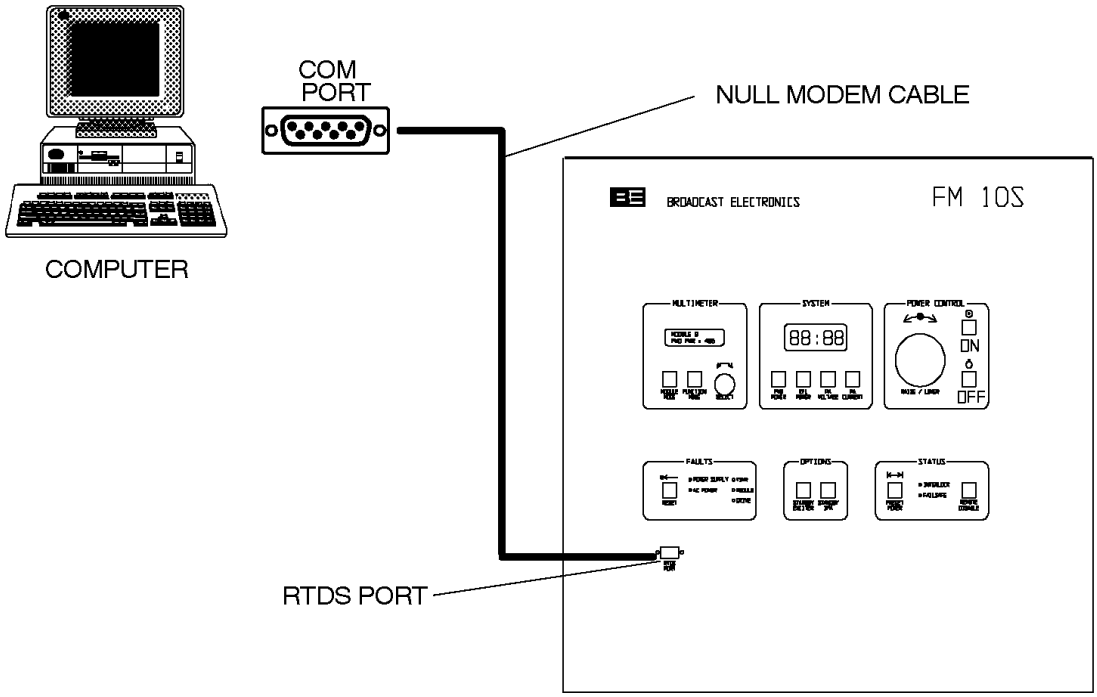


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FIGURE 5-6. PC CONNECTIONS - FM-10S UTILITY PROGRAM

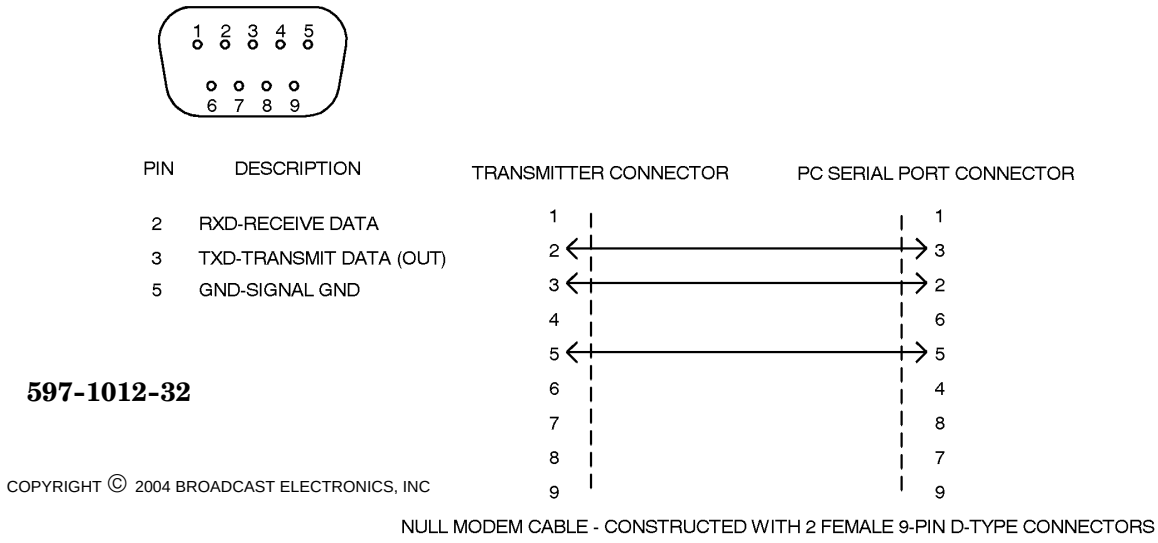

FIGURE 5-7. NULL MODEM CABLE CONSTRUCTION

5-45. **Step 4 – Utility Program Initial Operation.** The utility program requires Windows 95/98 HyperTerminal or Windows Terminal. To establish a connection to the FM-10S/FMi 703 transmitter using the terminal program, proceed as follows:

1. Apply AC power and operate the transmitter.
2. Move the cursor to PROGRAMS→ACCESSORIES→HYPERTERMINAL and click the mouse.
3. Move the cursor to the HYPERTERMINAL shortcut and double-click the mouse.

   The HYPERTERMINAL program will appear.
4. Simultaneously depress the FM-10S/FMi 703 FORWARD POWER and PA CURRENT switch/indicators to illuminate the switch/indicators.

   The FM-10S/FMi 703 utility program main display will appear (refer to FIGURE 5-8, page 5-13).

Setup menu, software version 1.0.25
A-All transmitter meter readings dumped to this port
B-Adjust the module full bias level
D-Set drive power fault level
E-Enable/disable reflected power readings from filters
F-Factory default values for meters calibration
C-Set transmitter in FM only mode
G-Set transmitter in IBOC only mode, no FM carrier
H-Set transmitter in hybrid FM plus IBOC mode
I-Adjust the IPA full bias level
K-Set the minimum exciter power reading for operation
L-Calibrate LCD meter parameter
M-Calibrate multimeter parameter
O-Enable/disable standby exciter option
R-Set reflected power reading that causes foldback
S-Enable/disable standby IPA option
U-Upload new software to module control processors
V-Set the PA supply voltage when in the IBOC mode
Q-Quit setup

Please type your selection now: **597-1012-39**

FIGURE 5-8. UTILITY PROGRAM MAIN DISPLAY

5–46. **Step 5 – System LCD Calibration.** All the parameters displayed by the SYSTEM LCD are calibrated by the L command. The command calibrates the function selected on the transmitter SYSTEM LCD at the time of calibration. For example, if the SYSTEM LCD is configured to display FORWARD POWER, the value entered using the L command will calibrate the forward power. To re–calibrate the SYSTEM LCD, proceed as follows:

1. To calibrate the transmitter forward power, the transmitter output power must be adjusted to normal using an external wattmeter such as a Bird 4720 Thruline with a 25 kW element. Connect the transmitter to the wattmeter and adjust the forward power as follows:

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

WARNING

   A. Disconnect all transmitter primary power before proceeding.

   B. Connect the wattmeter to the transmitter.

   C. Apply AC power to the transmitter.

   D. Enable the transmitter and operate the **POWER CONTROL** rotary switch to adjust the output power until the forward power value recorded in Step 1 is present on the external wattmeter.

2. Calibrate the forward power as follows:

   A. On the **SYSTEM** LCD, select **FORWARD POWER**.

   B. Depress: L

The system calibration display will appear(refer to FIGURE 5-9).

Setup menu, software version 1.0.25
A-All transmitter meter readings dumped to this port
B-Adjust the module full bias level
D-Set drive power fault level
E-Enable/disable reflected power readings from filters
F-Factory default values for meters calibration
C-Set transmitter in FM only mode
G-Set transmitter in IBOC only mode, no FM carrier
H-Set transmitter in hybrid FM plus IBOC mode
I-Adjust the IPA full bias level
K-Set the minimum exciter power reading for operation
L-Calibrate LCD meter parameter
M-Calibrate multimeter parameter
O-Enable/disable standby exciter option
R-Set reflected power reading that causes foldback
S-Enable/disable standby IPA option
U-Upload new software to module control processors
V-Set the PA supply voltage when in the IBOC mode
Q-Quit setup

597-1012-40

Please type your selection now: L
Next, enter new reading, ignoring the decimal point:

FIGURE 5-9. UTILITY PROGRAM SYSTEM CALIBRATION

C. Enter the forward power meter value recorded in Step 1. For example, to enter a forward power value of 20.1 kW, enter: 20.1.

D. Depress: Enter.

The forward power parameter will be calibrated.

3. Repeat the preceding forward power calibration step for reflected power and PA voltage. Enter the transmitter values recorded in Step 1.

5-47. **Step 6 – Multimeter Calibration.** All the parameters displayed by the **MULTIMETER** are calibrated by the M command. The command calibrates the function selected on the transmitter **MULTIMETER** LCD at the time of calibration. For example, if the **MULTIMETER** LCD is configured to display **MODULE FORWARD POWER**, the value entered using the M command will calibrate the module forward power. To re-calibrate the multimeter, proceed as follows:

1. Calibrate the module forward power as follows:

A. On the **MULTIMETER** LCD, select **MODULE FORWARD POWER**.

B. Depress: M

The multimeter calibration display will appear(refer to FIGURE 5-10, psge 5-15).

Setup menu, software version 1.0.25
A-All transmitter meter readings dumped to this port
B-Adjust the module full bias level
D-Set drive power fault level
E-Enable/disable reflected power readings from filters
F-Factory default values for meters calibration
C-Set transmitter in FM only mode
G-Set transmitter in IBOC only mode, no FM carrier
H-Set transmitter in hybrid FM plus IBOC mode
I-Adjust the IPA full bias level
K-Set the minimum exciter power reading for operation
L-Calibrate LCD meter parameter
M-Calibrate multimeter parameter
O-Enable/disable standby exciter option
R-Set reflected power reading that causes foldback
S-Enable/disable standby IPA option
U-Upload new software to module control processors
V-Set the PA supply voltage when in the IBOC mode
Q-Quit setup

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Please type your selection now: M
Next, enter new reading, ignoring the decimal point:

FIGURE 5-10. UTILITY PROGRAM MULTIMETER CALIBRATION

C. Enter the module forward power meter value recorded in Step 1. Typically, only module currents contain decimal points.
For example, to enter a current of 18.5 Amperes, enter: 18.5. To enter a forward power value of 570 watts, enter: 570.

D. Depress: Enter.

The module forward power parameter will be calibrated.

2. Repeat the procedure for module reflected power, module current, L combiner, and R combiner. Enter the transmitter values recorded in Step 1.

5-48. **Step 7 – Quit Utility Program.** Once the values are entered, the re-calibration process is complete. Exit the utility program as follows:

1. Depress: Q

The utility program will terminate operation.

5-49. **SYSTEM LCD AND MULTIMETER RE–CALIBRATION.**

CAUTION ***SOME OF THE PROCEDURES PERFORMED USING THE UTILITY PROGRAM CAN TEMPORARILY***

CAUTION ***DISABLE THE TRANSMITTER. THEREFORE, CONTACT THE BROADCAST ELECTRONICS CUSTOMER SERVICE DEPARTMENT PRIOR TO PERFORMING ANY METER CALIBRATION OR FIRMWARE UPLOAD.***

5–50. **GENERAL.** The FM–10S/FMi 703 **SYSTEM** and **MULTIMETER** displays can be re–calibrated if required. The re–calibration is accomplished using the FM–10S/FMi 703 utility program. A complete description of the program is presented in MICROPROCESSOR MODULE FIRMWARE UPGRADE (refer to the preceding text).

5–51. **SYSTEM LCD RE–CALIBRATION – PROCEDURE.** The **SYSTEM** LCD re–calibration process is described in the MICROPROCESSOR MODULE FIRMWARE UPGRADE procedure in the preceding text. To re–calibrate a **SYSTEM** LCD meter parameter, proceed as follows:

5–52. **Step 1 – PC Connections.** To calibrate the **SYSTEM** meter, a PC must be connected to the transmitter. The utility program requires a PC and a null modem cable to communicate with the user. Refer to FIGURE 5–6, page 5–11, and connect a null modem cable between a computer COM port and the FM–10S/FMi 703 front–panel RTDS port as shown. If a pre–constructed null modem cable cannot be located, a cable can be manufactured using 2 female D–Type connectors and a 3 conductor cable (refer to FIGURE 5–7, page 5–12).

5–53. **Step 2 – Utility Program Initial Operation.** Refer to **Step 4 - Utility Program Initial Operation** in FIRMWARE UPGRADE – PROCEDURE (refer to the preceding text) to establish a connection to the FM–10S/FMi 703 transmitter using the terminal program.

5–54. **Step 3 – System LCD Calibration.** All the parameters displayed by the **SYSTEM** LCD are calibrated by the L command. Typically, only the forward power, reflected power, and the PA voltage require calibration. The command calibrates the function selected on the transmitter **SYSTEM** LCD at the time of calibration. For example, if the **SYSTEM** LCD is configured to display FORWARD POWER, the value entered using the L command will calibrate the forward power. To re–calibrate the **SYSTEM** LCD, refer to **Step 5 - System LCD Calibration** in FIRMWARE UPGRADE – PROCEDURE (refer to the preceding text) to calibrate the **SYSTEM** LCD.

5–55. **Step 4 – Quit Utility Program.** Once the values are entered, the re–calibration process is complete. Exit the utility program as follows:

1. Depress: Q

The utility program will terminate operation.

5–56. **MULTIMETER RE–CALIBRATION – PROCEDURE.** The **MULTIMETER** re–calibration process is described in the MICROPROCESSOR MODULE FIRMWARE UPGRADE procedure in the preceding text. To re–calibrate a **MULTIMETER** parameter, proceed as follows:

5–57. **Step 1 – PC Connections.** To calibrate the **MULTIMETER**, a PC must be connected to the transmitter. The utility program requires a PC and a null modem cable to communicate with the user. Refer to FIGURE 5–6, page 5–11, and connect a null modem cable between a computer COM port and the FM–10S/FMi 703 front–panel RTDS port as shown. If a pre–constructed null modem cable cannot be located, a cable can be manufactured using 2 female D–Type connectors and a 3 conductor cable (refer to FIGURE 5–7, page 5–12).

5–58. **Step 2 – Utility Program Initial Operation.** Refer to **Step 4 - Utility Program Initial Operation** in FIRMWARE UPGRADE – PROCEDURE (refer to the preceding text) to establish a connection to the FM–10S transmitter using the terminal program.

5–59. **Step 3 – Multimeter Calibration.** All the parameters displayed by the **MULTIMETER** are calibrated by the M command. The command calibrates the function selected on the transmitter **MULTIMETER** at the time of calibration. For example, if the **MULTIMETER** is configured to display **MODULE FORWARD POWER**, the value entered using the M command will calibrate the module forward power. To re–calibrate the **MULTIMETER**, refer to **Step 6 - Multimeter Calibration** in FIRMWARE UPGRADE – PROCEDURE (refer to the preceding text) to calibrate the **MULTIMETER**.

5-60. **Step 4 – Quit Utility Program.** Once the values are entered, the re-calibration process is complete. Exit the utility program as follows:

1. Depress: Q

The utility program will terminate operation.

5-61. **SYSTEM LCD AND MULTIMETER RESET.**

CAUTION ***SOME OF THE PROCEDURES PERFORMED USING THE UTILITY PROGRAM CAN TEMPORARILY DISABLE THE TRANSMITTER. THEREFORE, CONTACT THE BROADCAST ELECTRONICS CUSTOMER SERVICE DEPARTMENT PRIOR TO PERFORMING ANY METER CALIBRATION OR FIRMWARE UPLOAD.***

CAUTION

5-62. **GENERAL.** In the event the meter calibrations become inadvertently mis-calibrated, the F command can be used to reset all calibration parameters to the factory defaults. The factory defaults are the values prior to the factory test setup. As a result, each system LCD or multimeter parameter must be re-entered. The values for the parameters can be located in the factory test data sheets. The SYSTEM LCD parameters include: 1) forward power, 2) reflected power, and 3) PA voltage. The MULTIMETER parameters include: 1) module forward power, 2) module reflected power, 3) module current, and 4) module temperature. The command can be used during on-air operation. The reset is accomplished using the FM-10S/FMi 703 utility program. A complete description of the program is presented in MICROPROCESSOR MODULE FIRMWARE UPGRADE (refer to the preceding text).

5-63. **SYSTEM LCD AND MULTIMETER RESET – PROCEDURE.** To reset the **SYSTEM** LCD and **MULTIMETER** parameters, proceed as follows:

5-64. **Step 1 – PC Connections.** To reset the **SYSTEM** LCD and **MULTIMETER**, a PC must be connected to the transmitter. The utility program requires a PC and a null modem cable to communicate with the user. Refer to FIGURE 5-6, page 5-11, and connect a null modem cable between a computer COM port and the FM-10S/FMi 703 front-panel RTDS port as shown. If a pre-constructed null modem cable cannot be located, a cable can be manufactured using 2 female D-Type connectors and a 3 conductor cable (refer to FIGURE 5-7, page 5-12).

5-65. **Step 2 – Utility Program Initial Operation.** Refer to **Step 4 - Utility Program Initial Operation** in FIRMWARE UPGRADE - PROCEDURE (refer to the preceding text) to establish a connection to the FM-10S/FMi 703 transmitter using the terminal program.

5-66. **Step 3 – Reset And Quit.** To reset all the meter calibrations, proceed as follows:

1. Depress: F

All meter calibration parameters will be reset to the factory defaults.

2. Depress: Q

The utility program will terminate operation.

5-67. **Step 4 – Re–Enter The System LCD and Mulitmeter Values.** Refer to SYSTEM LCD AND MULTIMETER RE-CALIBRATION in the preceding text and perform the procedure to re-enter the meter parameter values.

5-68. **REFLECTED POWER FOLDBACK CALIBRATION.**

CAUTION ***SOME OF THE PROCEDURES PERFORMED USING THE UTILITY PROGRAM CAN TEMPORARILY***

CAUTION ***DISABLE THE TRANSMITTER. THEREFORE, CONTACT THE BROADCAST ELECTRONICS CUSTOMER SERVICE DEPARTMENT PRIOR TO PERFORMING ANY METER CALIBRATION OR FIRMWARE UPLOAD.***

5-69. **GENERAL.** The FM-10S/FMi 703 utility program R command establishes the reflected power level when the transmitter will begin automatic foldback operation. The factory default is 600 watts. The command: 1) is to be used only when instructed by the Broadcast Electronics Customer Service Department and 2) can be executed during on-air operation. A complete description of the program is presented in MICROPROCESSOR MODULE FIRMWARE UPGRADES (refer to the preceding text).

5-70. **REFLECTED POWER FOLDBACK CALIBRATION – PROCEDURE.** To establish the level when the transmitter will begin automatic foldback operation, proceed as follows:

5-71. **Step 1 – PC Connections.** To calibrate the reflected power foldback level, a PC must be connected to the transmitter. The utility program requires a PC and a null modem cable to communicate with the user. Refer to FIGURE 5-6, page 5-11, and connect a null modem cable between a computer COM port and the FM-10S/FMi 703 front-panel RTDS port as shown. If a pre-constructed null modem cable cannot be located, a cable can be manufactured using 2 female D-Type connectors and a 3 conductor cable (refer to FIGURE 5-7, page 5-12).

5-72. **Step 2 – Utility Program Initial Operation.** Refer to **Step 4 - Utility Program Initial Operation** in the FIRMWARE UPGRADE - PROCEDURE (refer to the preceding text) to establish a connection to the FM-10S/FMi 703 transmitter using the terminal program.

5-73. **Step 3 – Calibrate And Quit.** To calibrate the reflected power foldback level, proceed as follows:

1. Select the reflected power level when the transmitter is to begin automatic foldback operation.
2. Depress: R

   The reflected power foldback level display will appear.
3. Enter the reflected power value as directed by the Broadcast Electronics Customer Service Department. Enter the values without the decimal point. For example, to enter a reflected power value of 500 watts, enter: 500.
4. Depress: Enter.

   The reflected power value will be saved.

Setup menu, software version 1.0.25
A-All transmitter meter readings dumped to this port
B-Adjust the module full bias level
D-Set drive power fault level
E-Enable/disable reflected power readings from filters
F-Factory default values for meters calibration
C-Set transmitter in FM only mode
G-Set transmitter in IBOC only mode, no FM carrier
H-Set transmitter in hybrid FM plus IBOC mode
I-Adjust the IPA full bias level
K-Set the minimum exciter power reading for operation
L-Calibrate LCD meter parameter
M-Calibrate multimeter parameter
O-Enable/disable standby exciter option
R-Set reflected power reading that causes foldback
S-Enable/disable standby IPA option
U-Upload new software to module control processors
V-Set the PA supply voltage when in the IBOC mode
Q-Quit setup

Please type your selection now: R
Old value is: 500 **597-1012-41**
Enter a new value:

FIGURE 5-11. UTILITY PROGRAM MULTIMETER CALIBRATION

5. Depress: Q

The utility program will terminate operation.

5–74. **UPLOADING FIRMWARE TO THE MODULE CONTROL CIRCUIT BOARDS.**

CAUTION ***SOME OF THE PROCEDURES PERFORMED USING THE UTILITY PROGRAM CAN TEMPORARILY DISABLE THE TRANSMITTER. THEREFORE, CONTACT THE BROADCAST ELECTRONICS CUSTOMER SERVICE DEPARTMENT PRIOR TO PERFORMING ANY METER CALIBRATION OR FIRMWARE UPLOAD.***

CAUTION

5–75. **GENERAL.** The FM–10S utility program U command uploads new firmware to the module control microprocessors. The command: 1) is to be used only when instructed by the Broadcast Electronics Customer Service Department and 2) can be executed only during a maintenance period (no on–air broadcast). The new firmware file *MCF.BIN* must be at the PC prior to beginning the upload procedure. The procedure immediately deletes the current firmware installed in the memory. When this occurs, the transmitter will not operate until the new file is installed. A complete description of the program is presented in MICROPROCESSOR MODULE FIRMWARE UPGRADE (refer to the preceding text).

5–76. **UPLOADING FIRMWARE TO THE MODULE CONTROL CIRCUIT BOARDS – PROCEDURE.** To upload new code to the module control circuit boards, proceed as follows:

5–77. **Step 1 – PC Connections.** To upload firmware to the module control circuit boards, a PC must be connected to the transmitter. The utility program requires a PC and a null modem cable to communicate with the user. Refer to Figure 5–5 and connect a null modem cable between a computer COM port and the FM–10S front–panel RTDS port as shown. If a pre–constructed null modem cable cannot be located, a cable can be manufactured using 2 female D–Type connectors and a 3 conductor cable (refer to Figure 5–6).

5–78. **Step 2 – Utility Program Initial Operation.** Refer to **Step 4 - Utility Program Initial Operation** in FIRMWARE UPGRADE – PROCEDURE (refer to the preceding text) to establish a connection to the FM–10S transmitter using the terminal program.

5–79. **Step 3 – Upload Firmware To The Module Control Circuit Boards And Quit.** To upload firmware to the module control microprocessors, proceed as follows:

CAUTION ***THE TRANSMITTER MUST BE REMOVED FROM ON-AIR OPERATION PRIOR TO PERFORMING THE UPLOAD PROCEDURE.***

CAUTION ***THE NEW MCF.BIN FIRMWARE FILE MUST BE AT THE PC PRIOR TO BEGINNING THE UPLOAD PROCEDURE. THE PROCEDURE IMMEDIATELY DELETES THE FIRMWARE INSTALLED IN THE MEMORY.***

1. Locate the new *MCF.BIN* firmware file to be installed.
2. Depress: U

   The upload display will appear (refer to FIGURE 5-12).

Setup menu, software version 1.0.25
A-All transmitter meter readings dumped to this port
B-Adjust the module full bias level
D-Set drive power fault level
E-Enable/disable reflected power readings from filters
F-Factory default values for meters calibration
C-Set transmitter in FM only mode
G-Set transmitter in IBOC only mode, no FM carrier
H-Set transmitter in hybrid FM plus IBOC mode
I-Adjust the IPA full bias level
K-Set the minimum exciter power reading for operation
L-Calibrate LCD meter parameter
M-Calibrate multimeter parameter
O-Enable/disable standby exciter option
R-Set reflected power reading that causes foldback
S-Enable/disable standby IPA option
U-Upload new software to module control processors
V-Set the PA supply voltage when in the IBOC mode
Q-Quit setup **597-1012-41**

Please type your selection now: Upload will erase the software on the module control card. Are you sure this is what you want to do? Enter Y or N to respond . .

FIGURE 5-12. UTILITY PROGRAM MULTIMETER CALIBRATION

3. Move the cursor to TRANSFERS→SEND BINARY FILE and click the mouse.
4. Use the BROWSE dialog box to select the MCF.BIN file.
5. Move the cursor to OK and click the mouse.

   The download process will begin.
6. Refer to Figure 5–12 depress the supervisor circuit board microprocessor reset switch.
7. Depress: Q

   The utility program will terminate operation.

5–80. **RF POWER AMPLIFIER MODULE ADJUSTMENTS.**

5–81. The RF power amplifier module amplifier and interface circuit boards contain calibration controls. The power amplifier circuit board is equipped with bias level control R109 and matching control C116. The interface circuit board is equipped with forward calibration control R1, reflected power calibration control R2, current offset adjust control R26, current calibration control R27, amplifier A input match control C29, and amplifier B input match control C23. Due to the critical nature and specialized test equipment required to adjust the controls, the controls are not considered field adjustable. If the controls are to be adjusted, contact the Broadcast Electronics Customer Service Department.

5–82. **LOW–PASS FILTER ADJUSTMENTS.**

5–83. The low–pass filter is equipped with a reflected power null control. Due to the critical nature and specialized test equipment required to adjust the control, the control is not considered field adjustable. If the control is to be adjusted, contact the Broadcast Electronics Customer Service Department.

5–84. **TRANSMITTER FREQUENCY RE–PROGRAMMING.**

5–85. The FM–10S/FMi 703 transmitter is configured for a specific frequency when shipped from the factory. However, the transmitter can be re–programmed for a different frequency in the field if required. The following text presents the procedure to change the transmitter operating frequency.

5–86. **Required Equipment.** The following equipment is required to re–program the transmitter operating frequency.

1. Calibrated in–line wattmeter with 25kW element (Bird 4720 or equivalent).
2. Test load and cable (50 Ohm Non–Inductive, 3 1/8 connector).

5–87. **Procedure.** To re–program the transmitter operating frequency, proceed as follows:

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

WARNING

5–88. Disconnect all transmitter primary power before proceeding.

5–89. Connect the test load and wattmeter to the transmitter output.

5–90. For an FX–50 exciter, refer to SECTION 4, AFC/PLL ASSEMBLY in FX–50 publication 597–1050 and perform the FREQUENCY SELECTION procedure. For an FXi 60, refer to publication 597–0541 and follow the GUI interface for changing the frequency. Operate and test the exciter independently from the transmitter.

5-91. Energize the transmitter primary AC power and operate the transmitter at the desired output power level as indicated by the in-line wattmeter.

5-92. If a difference in values presented on the in-line wattmeter and the transmitter multimeter is observed, the transmitter forward power display may be re-calibrated. To re-calibrate the forward power meter, refer to METER CALIBRATION/FIRMWARE UPLOADING in the preceding text and perform the **System LCD Calibration** procedure. Perform the procedure to calibrate the system FWD POWER parameter. Ensure the in-line wattmeter has been recently calibrated at the factory prior to calibrating the transmitter multimeter display.

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

WARNING

5-93. Disconnect all transmitter primary power.

5-94. Remove the test equipment and reconnect the transmitter output to the antenna.

5-95. **TROUBLESHOOTING.**

5-96. **TYPICAL METER INDICATIONS.** Typical meter indications for the FM-10S/FMi 703 transmitter are presented in the factory final test data sheets shipped with each transmitter. Some typical meter indications are presented in TABLE 5-1, beginning on page 5-23. For specific meter indications, refer to the factory test data sheets (located in the final text data sheet envelope).

TABLE 5-1. FM-10S TYPICAL METER INDICATIONS - 98.1 MHz

RF PWR	*PWR SUP V*	*PWR SUP I*	*REJ PWR*	*FILT 1 RFL*	*FILT 2 RFL*	*REJ TEMP*	*INLET TEMP*	*AC V*	*AC I*
10 kW	40.0	322	7	5.3	5.3	31	33	212	39

MOD	*FWD*	*RFL*	*I*	*TEMP*
1	569	1	19.9	53
2	595	1	20.6	47
3	579	1	20.3	54
4	576	0	20.3	47
5	562	1	20.6	54
6	573	1	20.6	49
7	570	1	20.2	51
8	573	1	20.0	48
9	554	0	19.1	54
10	568	0	20.6	48
11	565	0	20.1	54
12	595	0	20.6	48
13	557	0	19.4	55
14	577	0	20.1	48
15	538	0	19.3	55
16	557	1	19.7	46
IPA	558	1	19.8	47

NOTE

NOTE

THE TRANSMITTER WILL NOT OPERATE WITH MORE THAN 4 RF POWER AMPLIFIER MODULES REMOVED FROM MODULE LOCATIONS 1 THRU 8 OR 9 THRU 16 IN EITHER CABINET. ENSURE NO MORE THAN 4 RF POWER AMPLIFIER MODULES ARE REMOVED FROM MODULE LOCATIONS 1 THRU 8 OR 9 THRU 16 IN EITHER CABINET.

5-97. **FAILURE MODE OPERATION** The FM-10S/FMi 703 is designed with the ability to provide output power when power supply and RF amplifier modules fail. This "soft failure" operation allows the transmitter to remain on-the-air until the transmitter can be de-energized for repair. In the event of an RF amplifier module failure, the module can be removed from the transmitter chassis with power energized.

5–98. The output power provided during the failure mode is determined by the type and location of the failure. For example, if only one module fails on the “A” motherboard/combiner portion of the transmitter control cabinet, the transmitter output power will remain at 20.0 kW. If only one module failes on the “C” motherboard/combiner portion of the transmitter auxiliary cabinet, the transmitter will output approximately 19 kW. If two modules fail on only the “C” motherboard/combiner portion of the transmitter auxiliary cabinet, the transmitter output power will output approximately 17.4 kW. TABLE 5–2 presents the failure combinations of RF power modules in each cabinet, the total number of failed modules and the typical transmitter output power.

TABLE 5-2. POWER OUTPUT WITH FAILED RF AMPLIFIER MODULES

NUMBER FAILED MODULES		***POWER OUTPUT kW***
MTHRBD. A (LEFT)	***MTHRBD B (RIGHT)***	
1	0	9.5
0	1	9.5
2	0	7.5
0	2	7.5
3	0	4
0	3	4
4	0	2.4
0	4	2.4
1	1	9
2	2	5.4
3	3	2.5
4	4	1.0
2	1	6
1	2	6
3	2	2.4
2	3	2.4
4	3	1.1
3	4	1.1

5–99. The transmitter will also output power if a power supply module fails. TABLE 5–3 presents the failure combinations of power supply modules in each cabinet, the total number of failed power supply modules and the typical transmitter output power.

TABLE 5-3. POWER OUTPUT WITH FAILED POWER SUPPLY MODULES

NUMBER FAILED MODULES	***POWER OUTPUT kW***
1	6
2	3
3	500 Watts

NOTE

NOTE

THE TRANSMITTER WILL NOT OPERATE WITH MORE THAN 4 RF POWER AMPLIFIER MODULES REMOVED FROM MODULE LOCATIONS 1 THRU 8 OR 9 THRU 16 IN EITHER CABINET. ENSURE NO MORE THAN 4 RF POWER AMPLIFIER MODULES ARE REMOVED FROM MODULE LOCATIONS 1 THRU 8 OR 9 THRU 16 IN EITHER CABINET.

5-100. **TRANSMITTER TROUBLESHOOTING PROCEDURES.** TABLE 5-4 presents troubleshooting information for the FM-10S/FMi 703 transmitter. Refer to TABLE 5-4 to isolate the problem to a specific assembly. Once the trouble is isolated, refer to the theory of operation and schematic diagrams to assist in problem resolution.

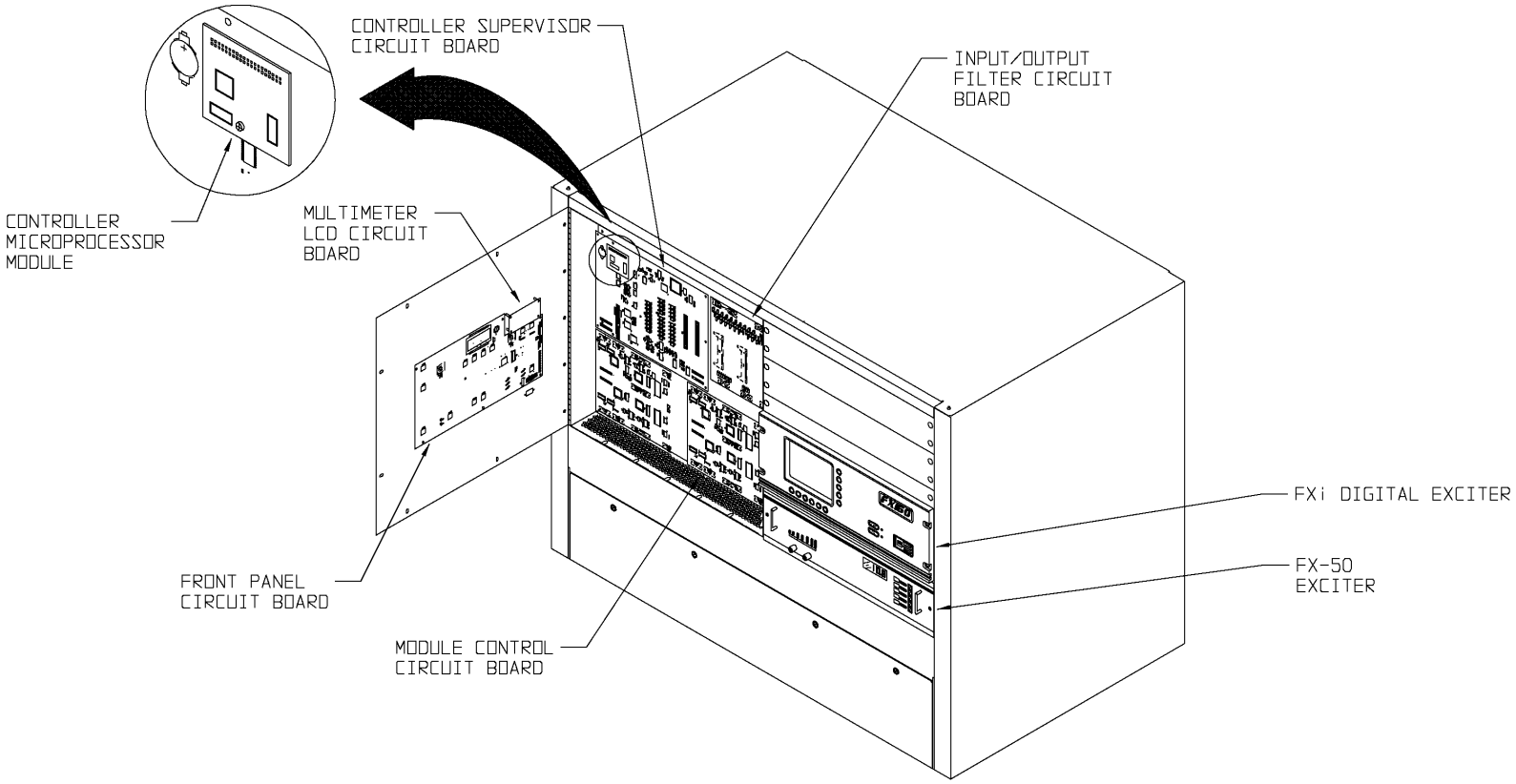
5-101. **TRANSMITTER COMPONENT LOCATIONS.** FIGURE 5-13, beginning on page 5-27, presents the transmitter component locations. Refer to FIGURE 5-13 as required during the troubleshooting procedures to locate components within the transmitter.

TABLE 5-4. FM-10S/FMi 703 TROUBLESHOOTING
(Sheet 1 of 2)

SYMPTOM	CIRCUITRY TO CHECK
1. TRANSMITTER OFF WITH NO FRONT PANEL INDICATIONS	1. Ensure primary AC power is applied to the unit and ensure the ON/OFF/circuit breaker is operated to ON. 2. If the primary AC power is on, the transmitter is in an AC line interrupt condition. In this condition, the transmitter has detected: 1) the AC line is below 168 volts or above 255 volts or 2) a loss-of-phase. During an AC line interrupt condition, AC power is removed from the transmitter. The transmitter will automatically return to operation when the AC line is between 168 and 255 volts or the AC line phase is restored. When power is returned to the unit, the front panel **FAULTS - AC LINE** indicator and the **FAULTS RESET** switch/indicator will illuminate to indicate a fault condition. 3. If the primary AC power is with between 168 and 255 volts and all three phases are operational, check the controller power supply. 4. The controller battery missing or defective. Replace the battery. 5. The controller MCF.BIN file has been erased. Contact the Broadcast Electronics Customer Service Department.
1. NO OUTPUT POWER 2. FX-50 LOCK INDICATOR EXTINGUISHED OR FXi 60 FAULT INDICATOR ILLUMINATED	1. FX-50 - AFC is unlocked. FXi 60 - exciter fault. Refer to the exciter manual and troubleshoot the exciter.

TABLE 5-4. FM-10S/FMi 703 TROUBLESHOOTING
(Sheet 2 of 2)

SYMPTOM	CIRCUITRY TO CHECK
1. NO OUTPUT POWER 2. STATUS FAIL-SAFE INDICATOR EXTINGUISHED	1. Check the equipment connected to the fail-safe interlock such as the test load, motorized coaxial switch, or remote control unit.
1. NORMAL OUTPUT POWER 2. FAULTS - AC POWER INDICATOR ILLUMINATED AND FAULTS - RESET SWITCH/INDICATOR ILLUMINATED	1. Indicates: 1) the AC power input is below 168 volts or above 255 volts or 2) a loss-of-phase condition has occurred. The transmitter will automatically re-energize when the AC input voltage is between 168 to 255 volts or the AC line phase is restored.
1. LOW OUTPUT POWER 2. FAULTS - DRIVE INDICATOR ILLUMINATED AND FAULTS - RESET SWITCH/INDICATOR ILLUMINATED	1. Check the exciter forward power. The forward power must be 25 watts (30 watts maximum). 2.. If the exciter forward power is low, increase the exciter output power. 3. If the exciter forward power is normal, ensure cable 301 is connected between the exciter RF output and the bulk head connector on the bottom of the exciter enclosure.
1. LOW OUTPUT POWER 2. FAULTS - MODULE INDICATOR ILLUMINATED AND FAULTS - RESET SWITCH/INDICATOR ILLUMINATED	1. An RF amplifier or IPA module has a fault. Locate the failed module using the transmitter **MULTIMETER**, **MODULE MODE**, and **FUNCTION MODE** controls. If the failed module is the result of a defective RF amplifier circuit board, refer to POWER AMPLIFIER MODULE AND IPA MODULE RF AMPLIFIER CIRCUIT BOARD REPLACEMENT in the following text to replace the defective RF amplifier circuit board. The failed module can be removed from the chassis with the power energized if required.
1. LOW OUTPUT POWER 2. FAULTS - VSWR INDICATOR ILLUMINATED AND FAULTS - RESET SWITCH/INDICATOR ILLUMINATED	1. A greater than 1.5:1 VSWR condition is present at the RF output. Check the antenna.
1. LOW OUTPUT POWER 2. FAULTS - POWER SUPPLY INDICATOR ILLUMINATED	1. A power supply has a fault. Locate the failed power supply using the transmitter **MULTIMETER**, **MODULE MODE**, and **FUNCTION MODE** controls.
1. TRANSMITTER WILL NOT AUTOMATICALLY RETURN TO RATED POWER AFTER AN AC POWER LOSS	1. Replace the battery in the controller.
1. LOW OR NO OUTPUT POWER 2. FAULTS - NONE	1. Ensure cable from J1-7 (or J2-7 for standby exciter) on I/O board is connect to J3 pin 24 on Exciter 2. Ensure cable is connected between LVDS to IBOC Data on FSi 10 and IBOC Data on FXi exciter 3. Check RF output from the exciter



597-1020-26

FIGURE 5-13. FM-10S/FMi 703 COMPONENT LOCATOR (SHEET 1 OF 10)

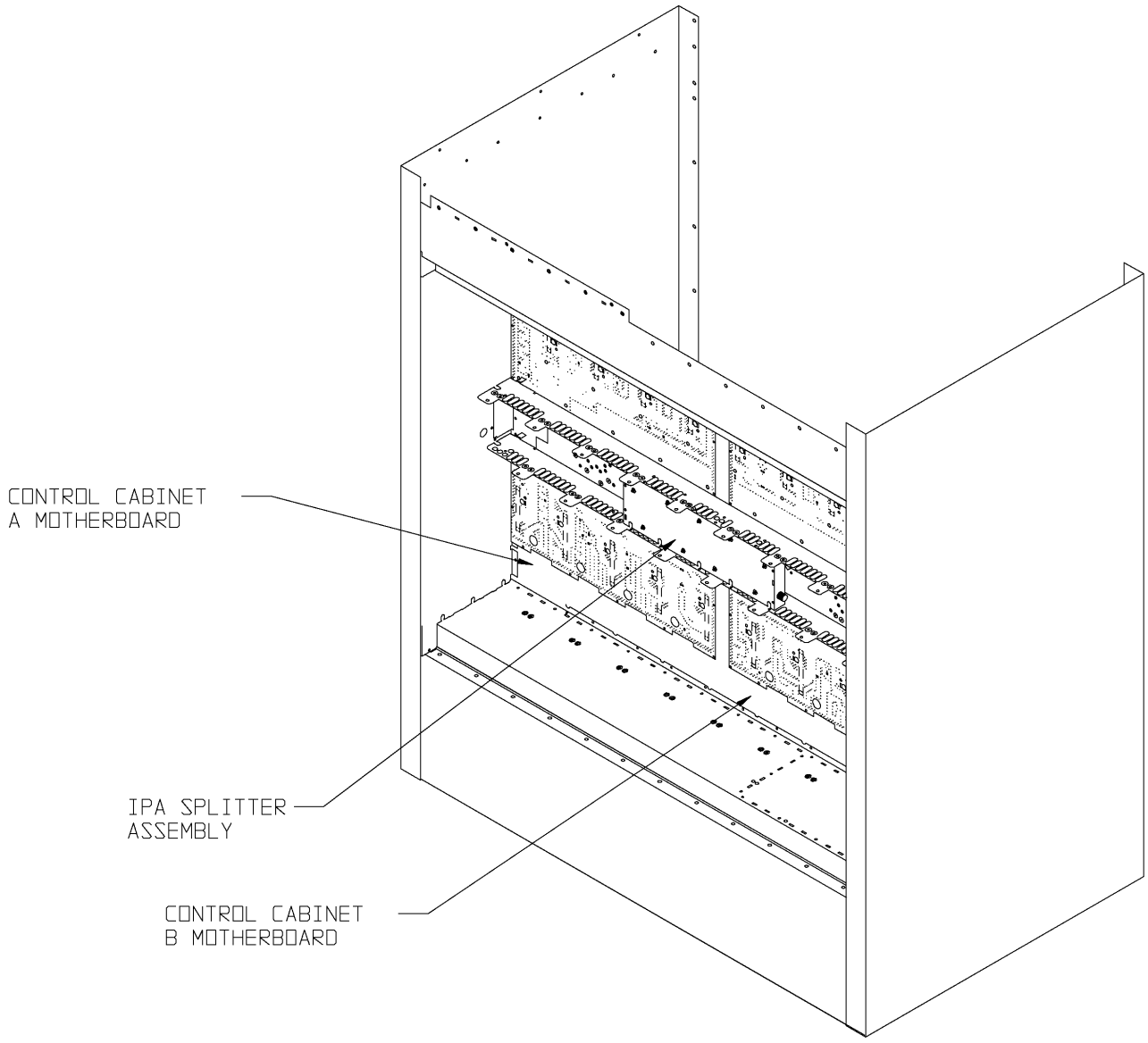


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FIGURE 5-13. FM-10S/FMi 703 COMPONENT LOCATOR (SHEET 2 OF 10)

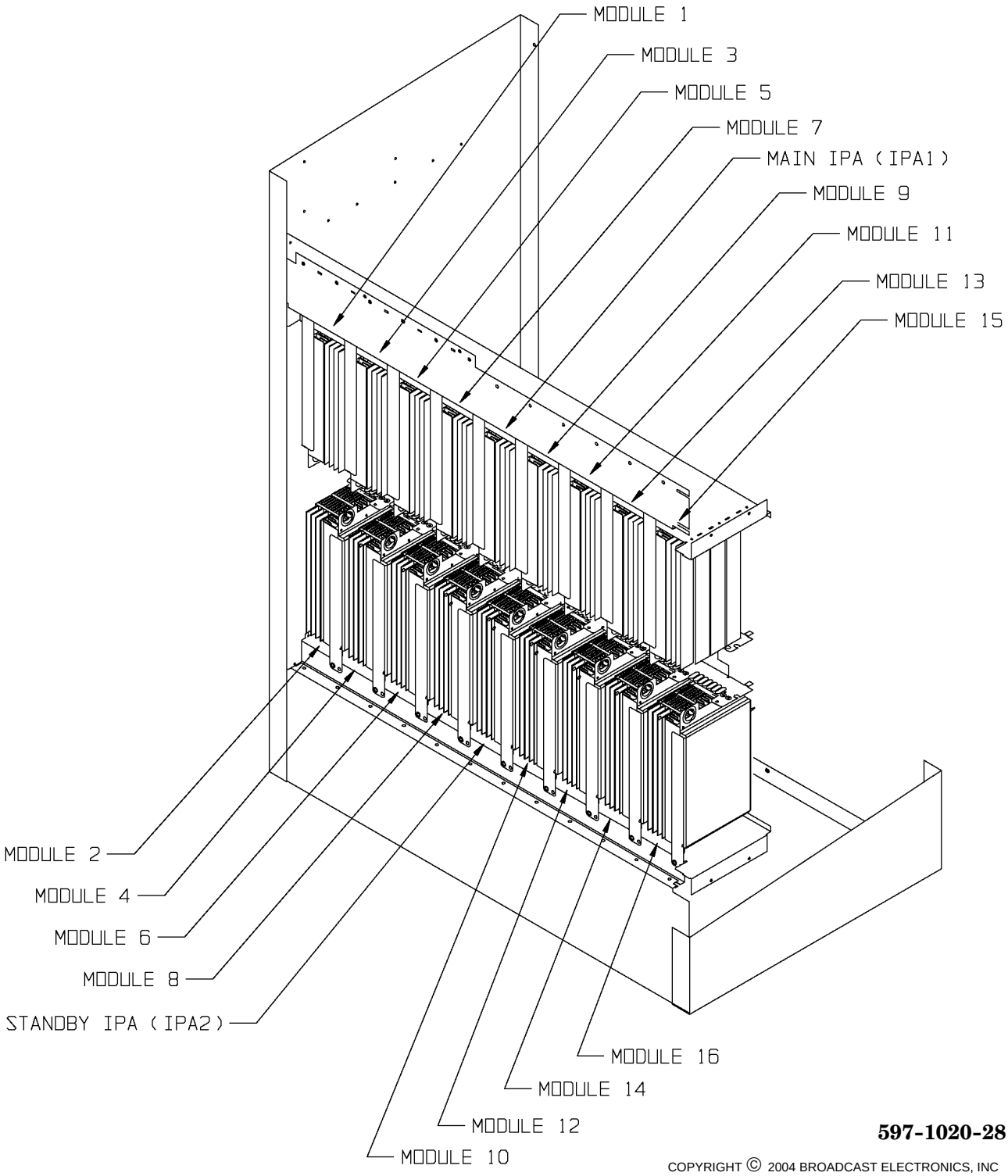
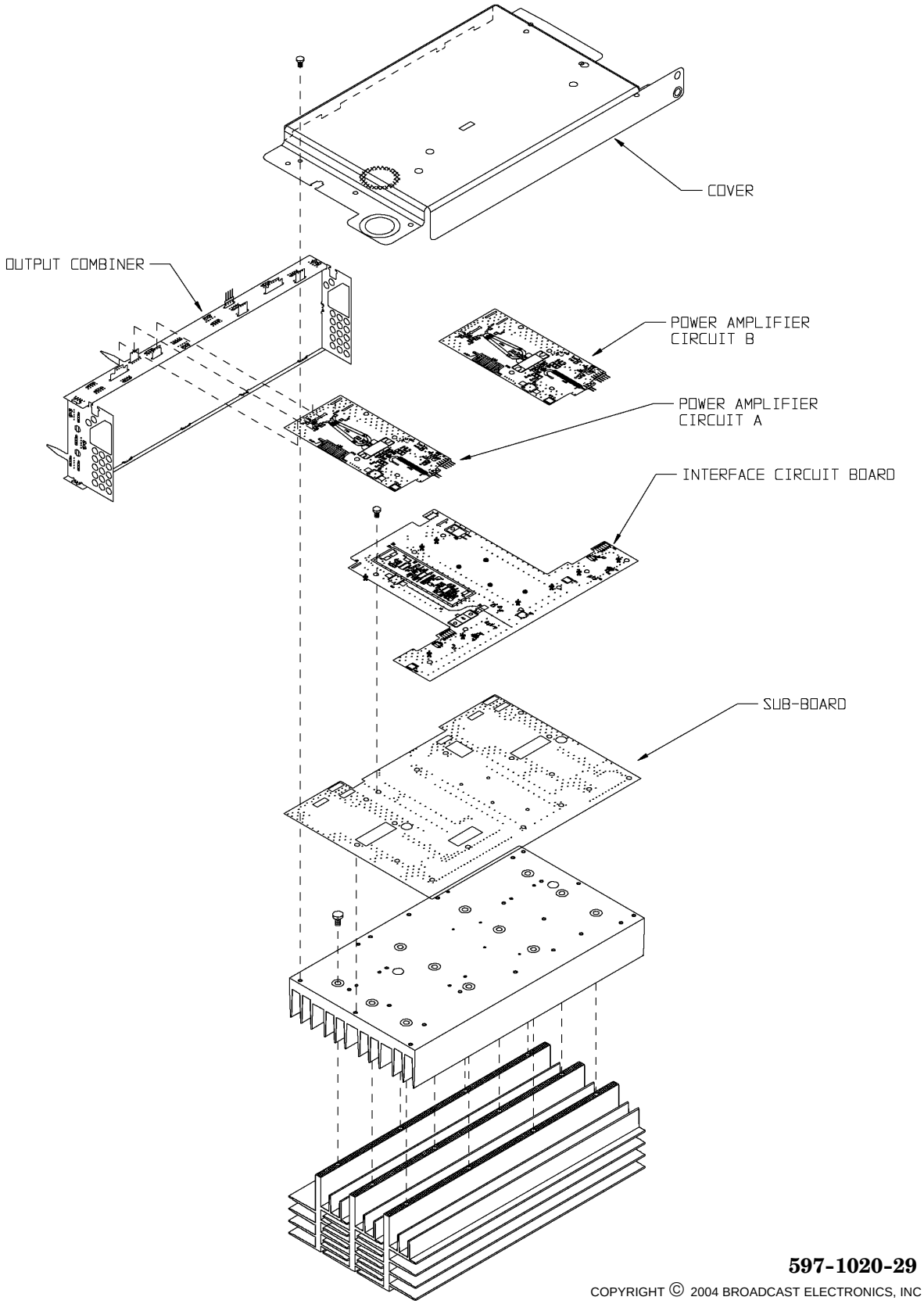
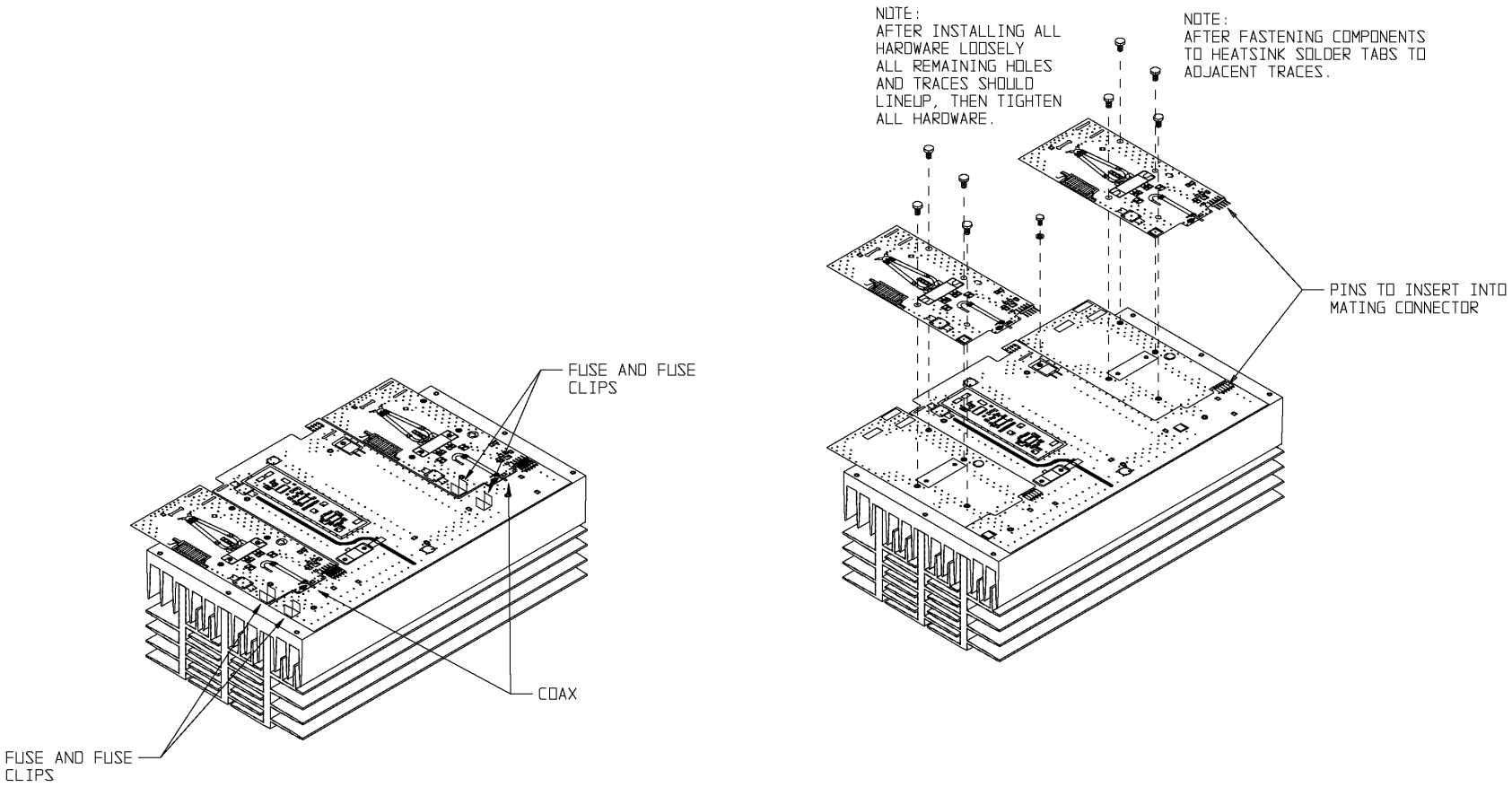


FIGURE 5-13. FM-10S/FMi 703 COMPONENT LOCATOR (SHEET 3 OF 10)



597-1020-29

FIGURE 5-13. FM-10S/FMi 703 COMPONENT LOCATOR (SHEET 4 OF 10)



597-1020-30

Figure 5-13 FM-10S/FMi 703 COMPONENT LOCATOR (SHEET 5 OF 10)

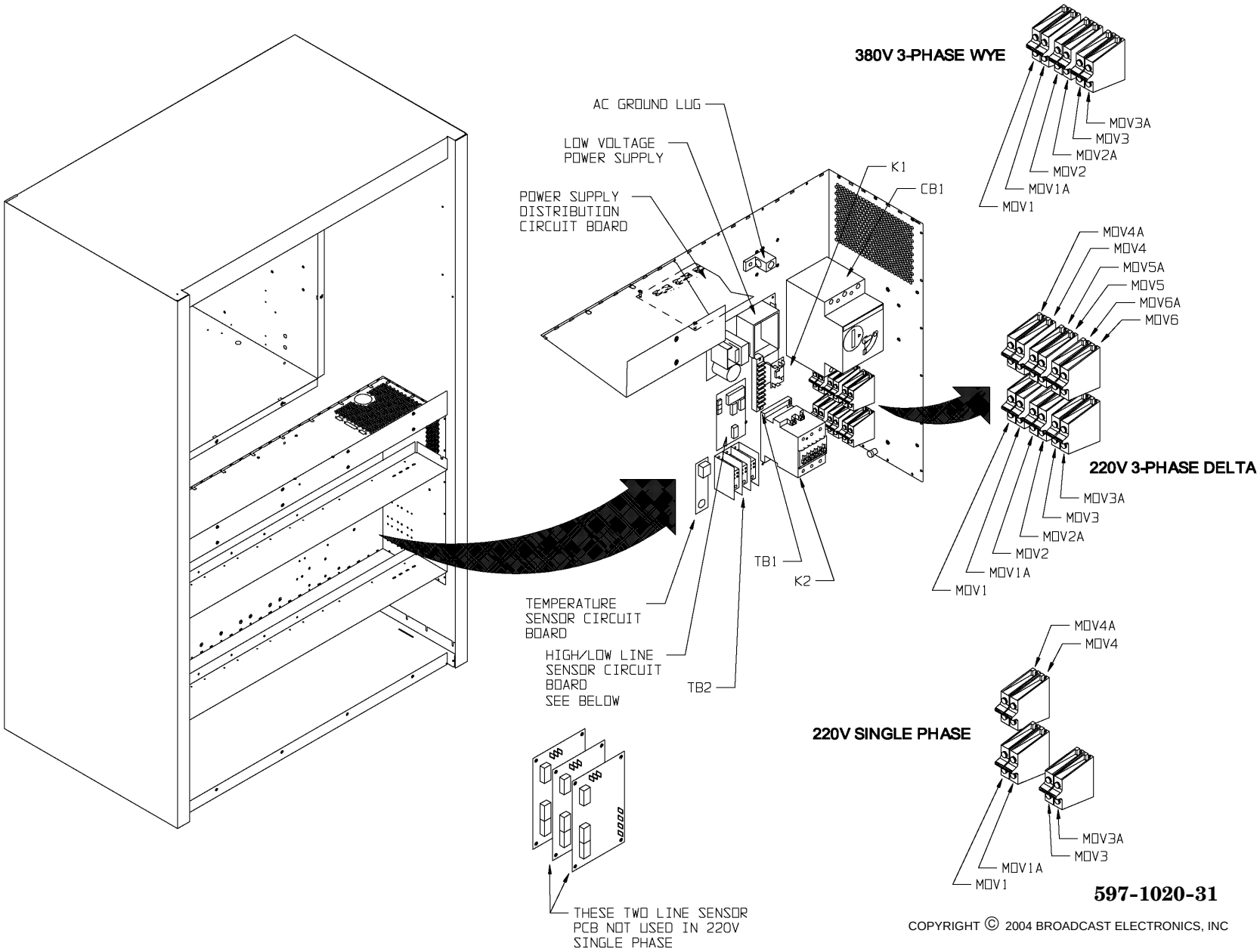


Figure 5-13 FM-10S/FMi 703 COMPONENT LOCATOR (SHEET 6 OF 10)

597-1020-32

Figure 5-13 FM-10S/FMi 703 COMPONENT LOCATOR (SHEET 7 OF 10)

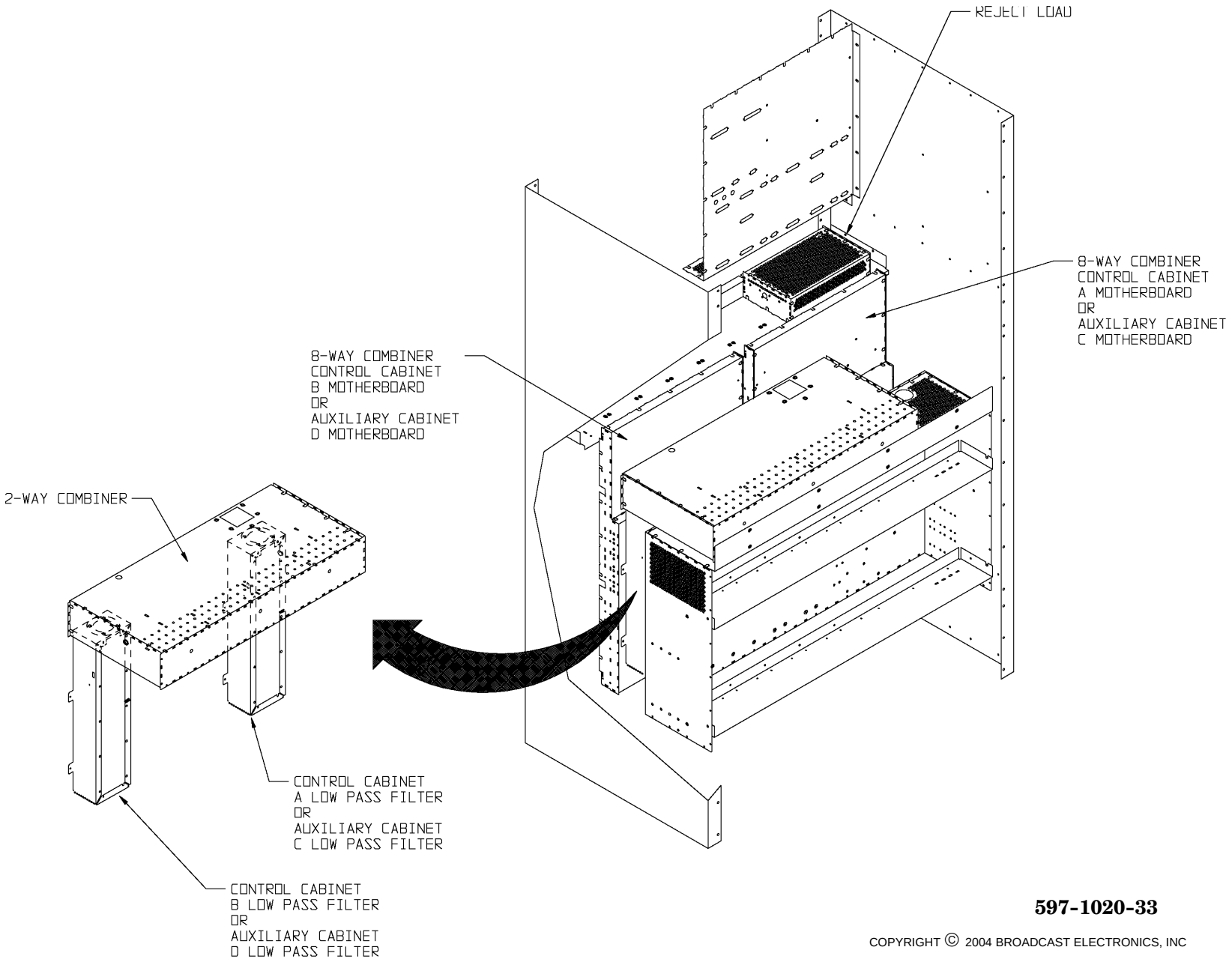


Figure 5-13 FM-10S/FMi 703 COMPONENT LOCATOR (SHEET 8 OF 10)

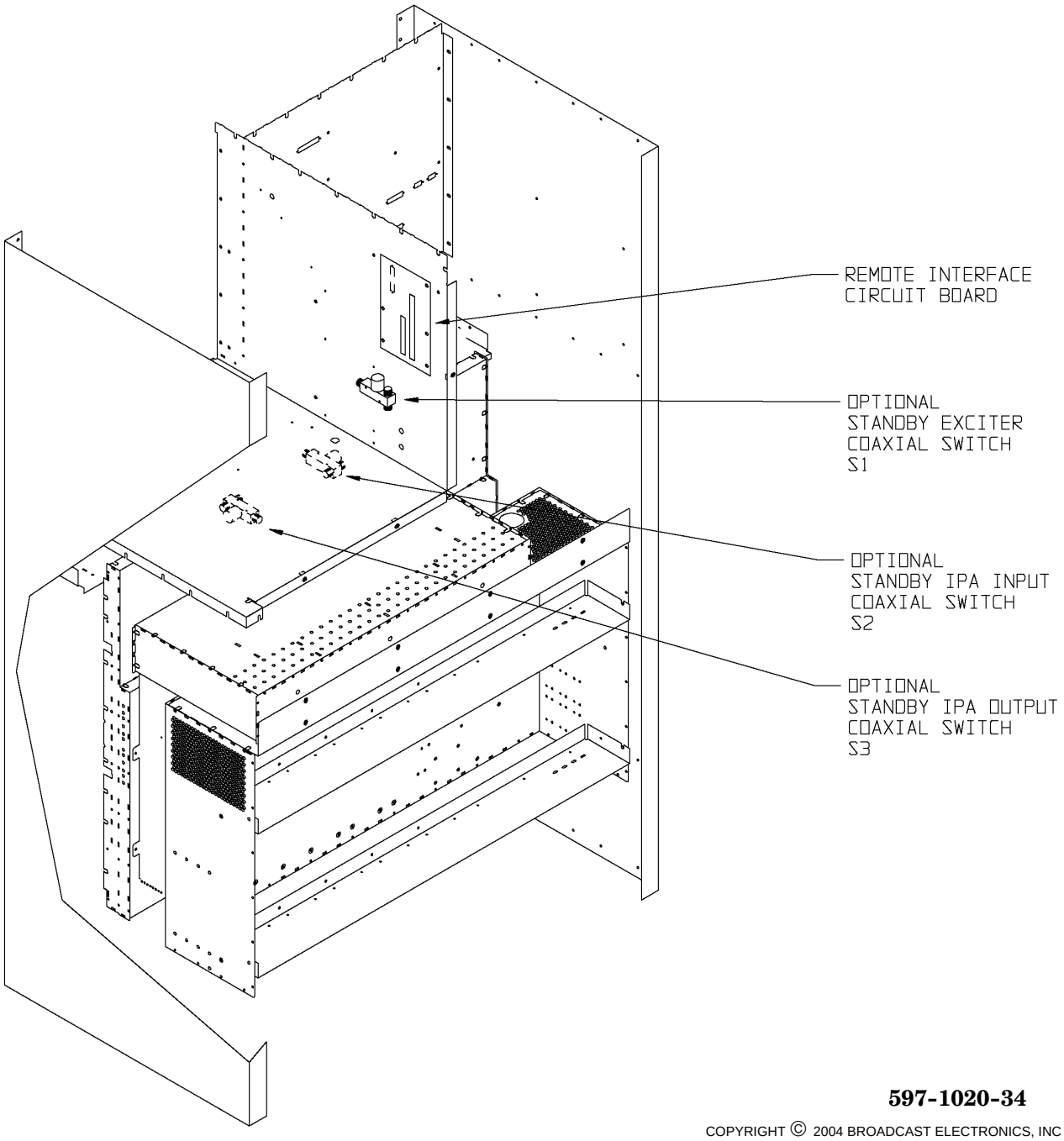
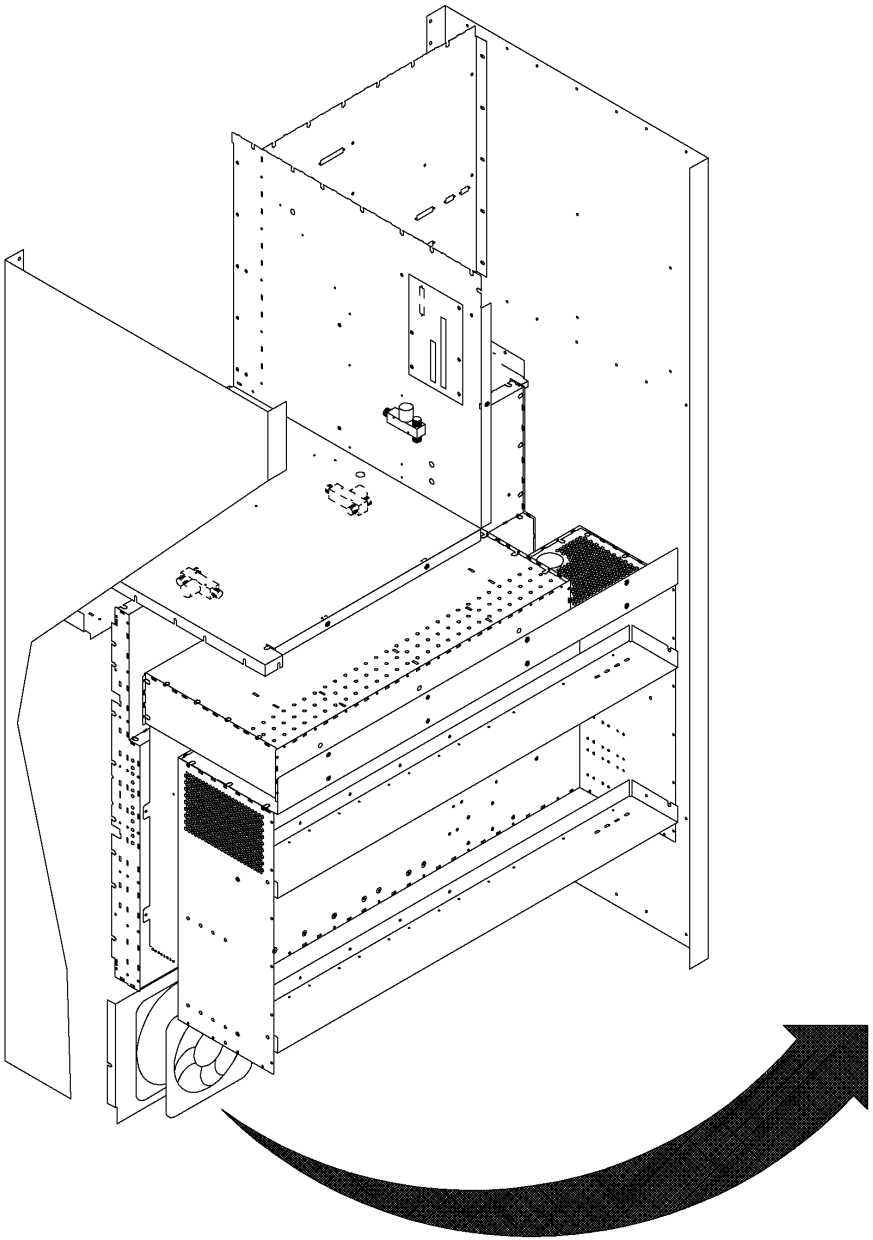
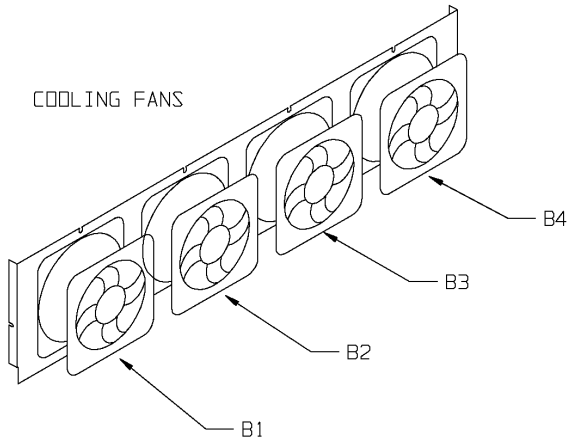


Figure 5-13 FM-10S/FMi 703 COMPONENT LOCATOR (SHEET 9 OF 10)





597-1020-35

Figure 5-13 FM-10S/FMi 703 COMPONENT LOCATOR (SHEET 10 OF 10)

5-102. **POWER AMPLIFIER POWER SUPPLY MODULES.** The FM-10S/FMi 703 is equipped with modular switching power supply units (refer to FIGURE 5-13, beginning on page 5-27). The power supplies are equipped with internal protection for high AC line voltage, high temperature conditions, and over-current conditions. If a supply is suspected to contain a fault, contact the Broadcast Electronics Customer Service Department.

5-103. **LOW VOLTAGE POWER SUPPLY.** The FM-10S/FMi 703 transmitter low voltage power supply provides DC power for the controller circuitry (refer to FIGURE 5-13, beginning on page 5-27). The power supply is equipped with a fuse and should be checked if a failure occurs. To check the low voltage power supply module, proceed as follows:

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

WARNING

5-104. Disconnect all transmitter primary power.

5-105. Operate the AC switch/circuit breaker to OFF.

5-106. Refer to FIGURE 5-3, page 5-4 and remove the lower rear access panel.

5-107. Check the power supply fuse. If the power supply fuse has not blown, contact the Broadcast Electronics Customer Service Department.

5-108. Once the power supply troubleshooting has been completed, re-install the supply by reversing the preceding procedure.

NOTE ***A POWER AMPLIFIER MODULE CAN BE REMOVED OR INSTALLED WITH POWER APPLIED TO THE TRANSMITTER. IT IS STRONGLY RECOMMENDED A MODULE BE REMOVED/INSTALLED WITH POWER ENERGIZED ONLY WHEN A MODULE HAS FAILED AND MUST BE REPAIRED DURING A NON-MAINTENANCE PERIOD.***

NOTE

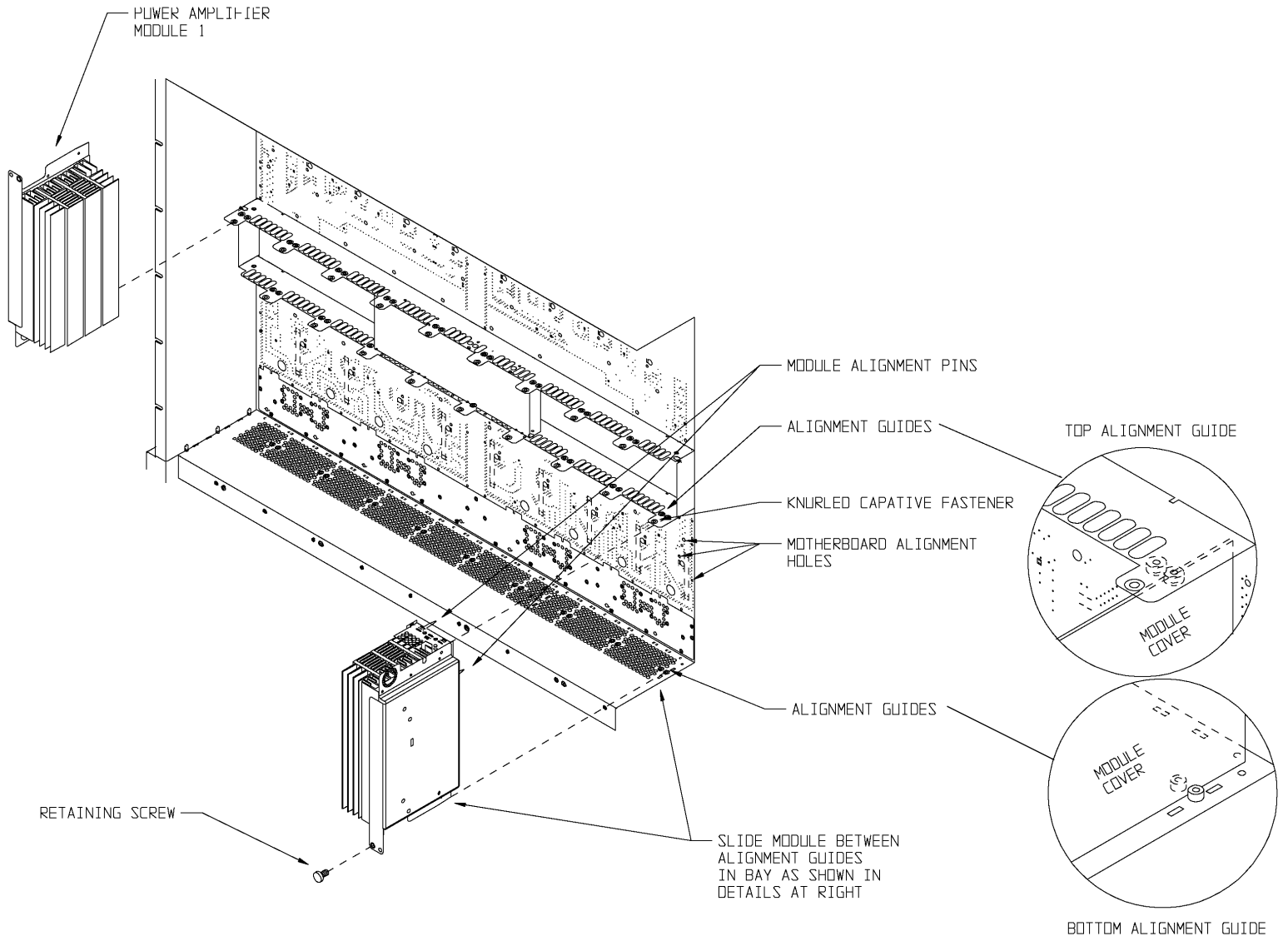
5-109. **POWER AMPLIFIER AND IPA MODULE TROUBLESHOOTING.** Each transmitter power amplifier module contains circuitry requiring specialized equipment and test procedures for troubleshooting and repair operations. However, if it is determined that a power amplifier circuit board has failed, the repair can be performed in the field. For all other types of failures, contact the Broadcast Electronics Customer Service department to: 1) exchange a defective module for a reconditioned module or 2) obtain a module on loan during the repair of the defective module.

5-110. **POWER AMPLIFIER MODULE AND IPA MODULE RF AMPLIFIER CIRCUIT BOARD REPLACEMENT.** If a power amplifier module or IPA module is determined to be defective with a power amplifier circuit board fault, the circuit board can be replaced in the field. To replace an RF amplifier circuit board, proceed as follows:

NOTE ***A POWER AMPLIFIER MODULE CAN BE REMOVED OR INSTALLED WITH POWER APPLIED TO THE***

NOTE ***TRANSMITTER. IT IS STRONGLY RECOMMENDED A MODULE BE REMOVED/INSTALLED WITH POWER ENERGIZED ONLY WHEN A MODULE HAS FAILED AND MUST BE REPAIRED DURING A NON-MAINTENANCE PERIOD.***

1. Refer to FIGURE 5-3, page 5-4, and determine the power amplifier module to be removed.
2. Remove the power amplifier module as follows:
   A. Remove the retaining screw and the loosen the knurled captive fastener.
   B. Remove the power amplifier module from the chassis.
3. Remove the 8 screws securing the cover to the power amplifier module and remove the cover.
4. Remove the defective RF amplifier circuit board as follows:
   A. Remove the 4 screws securing the RF amplifier circuit board to the heatsink.
   B. Remove the fuse.
   C. Unsolder the ground and RF output tabs from the combiner. Unsolder each tab as follows:
      1. Apply heat to the tab using a soldering iron.
      2. While heating the tab, carefully insert a knife or flat-balde screwdriver between the bottom of the module circuit board and the top of the sub-circuit board. Apply pressure and carefully pry-up to separate the module circuit board from the combiner.
   D. Slide the amplifier circuit board from J1 and J2 on the interface circuit board and remove circuit board from the module.
5. Replace the circuit board by performing the above removal procedure in reverse order.
6. Replace the module cover.
7. Refer to FIGURE 5-14, beginning on page 5-39, and replace the power amplifier module as follows:
   A. Orient and align the module as shown between the guides. Slide the module into the chassis.
   B. Ensure the module alignment pins are centered in the alignment holes in the motherboard and firmly push the module into the motherboard.
   C. Secure the module to the chassis using the retaining screw and the knurled captive fastener.



597-1012-30

FIGURE 5-14. POWER AMPLIFIER/IPA MODULE INSTALLATION (SHEET 1 OF 2)

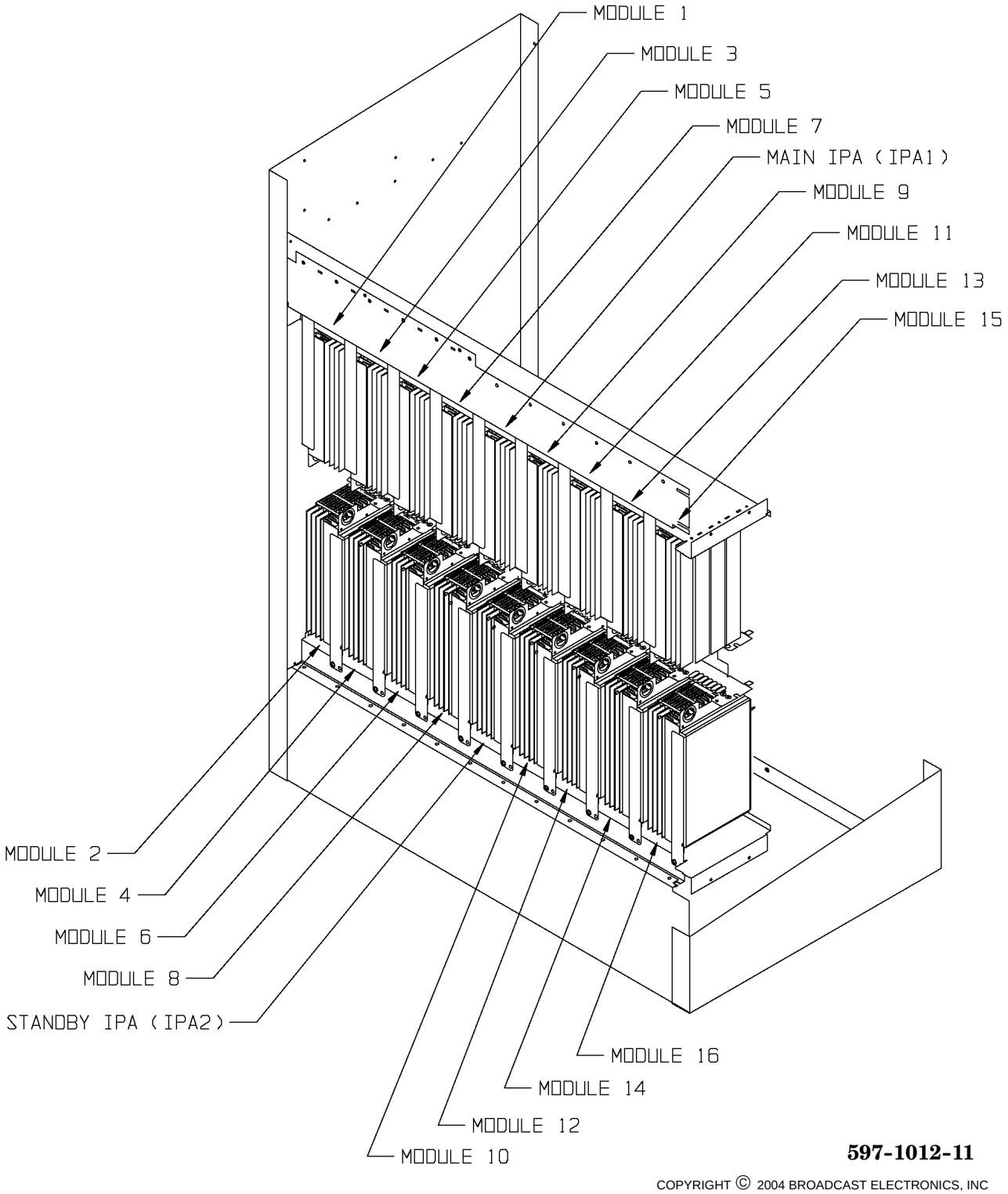


FIGURE 5-14. POWER AMPLIFIER/IPA MODULE INSTALLATION (SHEET 2 OF 2)

5–111. **COMPONENT REPLACEMENT PROCEDURE.** Component replacement on printed circuit boards require extreme care to avoid damage to the circuit board traces. The following text describes the procedure to replace components on FM–10S/FMi 703 circuit boards.

5–112. On all circuit boards, the adhesive securing the copper trace to the board melts at almost the same temperature at which solder melts. A circuit board trace can be destroyed by excessive heat or lateral movement during soldering. Use of a small iron with steady pressure is required for circuit board repairs.

5–113. 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.

5–114. Grip each component lead, one at a time, with long–nose pliers. Rotate the circuit board 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. Each lead may now be heated independently and pulled out of each hole. The holes may be cleared of solder by carefully re–heating each hole with a low wattage iron and removing the residual solder with a soldering vacuum tool.

WARNING ***WARNING*** ***WARNING*** ***WARNING***

MOST SOLVENTS WHICH WILL REMOVE ROSIN FLUX ARE VOLATILE AND TOXIC BY THEIR NATURE AND SHOULD BE USED ONLY IN SMALL AMOUNTS IN A WELL VENTILATED AREA, AWAY FROM FLAME SUCH AS FROM A SOLDERING IRON OR SMOKING MATERIALS. OBSERVE THE MANUFACTURER'S CAUTIONARY INSTRUCTIONS.

5–115. Install the new component and apply solder from the bottom side of the circuit board. After soldering, remove flux with a cotton swab moistened with a suitable solvent. Rubbing alcohol is highly diluted and is not effective.

5–116. The board should be checked to ensure the flux has been removed and not just smeared. Rosin flux is not normally corrosive, but rosin will absorb enough moisture in time to become conductive and cause problems.

SECTION VI
PARTS LIST

6-1. INTRODUCTION.

6-2. This section provides parts lists for the FM-10S transmitter. The parts lists provide descriptions and part numbers of electrical components, assemblies, and selected mechanical parts required for maintenance. Each parts list entry in this section is indexed by reference designators appearing on the applicable schematic diagrams.

TABLE 6-1. FM-10S REPLACEABLE PARTS LIST INDEX
(Sheet 1 of 2)

TABLE	DESCRIPTION	PART NO.	PAGE
6-2	FM-10S Transmitter, 220V Three-Phase	909-1010-206	6-3
6-3	FM-10S Transmitter, 380V WYE Three-Phase	909-1010-386	6-4
6-4	FM-10S Transmitter, Single-Phase	909-1010-226	6-5
6-5	FMi 703 HD XMTR 220V 3 PH Delta	909-0703-206	6-6
6-6	FMi 703 HD XMTR 380V 3 PH 4 Wire Wye	909-0703-386	6-7
6-7	FMi 703 HD XMTR 220V 1 PH	909-0703-226	6-8
6-8	Module Control Circuit Board Assembly	919-0515	6-9
6-9	Kit, Software, FM-10S Module Control PAL U4	979-0515-004	6-9
6-10	Kit, Software, FM-10S Module Control ROM U5	979-0515-005	6-10
6-11	Assembly, Front Panel	959-0530	6-10
6-12	Cable Assembly, Front Panel	949-0517	6-10
6-13	Front Panel Circuit Board Assembly	919-0530	6-10
6-14	Supervisor Circuit Board Assembly	919-0531	6-11
6-15	Kit, Software, FM-10S Supervisor U5	979-0518-005	6-12
6-16	Kit, Software, FM-10S Supervisor U4	979-0518-004	6-12
6-17	Kit, Software, FM-10S Supervisor U3	979-0518-003	6-12
6-18	Kit, Software, FM-10S Supervisor U2	979-0518-002	6-12
6-19	Input/Output Circuit Board Assembly	919-0527	6-12
6-20	Remote Interface Circuit Board Assembly	919-0528	6-13
6-21	Directional Coupler Circuit Board Assembly	919-0529-001	6-13
6-22	Ribbon Cable Assembly	949-0425	6-14
6-23	DC Power & Data Cable Assembly	949-0426	6-14
6-24	Wire Harness Assembly	949-0427	6-14
6-25	RF Cable Assembly	949-0428	6-15
6-26	Low-Pass Filter Assembly	959-0414-002	6-15
6-27	Low-Pass Filter Circuit Board Assembly	919-0421-002	6-15
6-28	8-Way Combiner A (Left) Assembly	959-0501	6-16
6-29	8-Way Combiner B (Right) Assembly	959-0501-001	6-16
6-30	Combiner Input Bottom Left Circuit Board Assembly	919-0502-001	6-16
6-31	Combiner Input Top Left Circuit Board Assembly	919-0502-002	6-17
6-32	Motherboards & IPA Splitter Assembly	959-0504	6-17

TABLE 6-1. FM-10S REPLACEABLE PARTS LIST INDEX
(Sheet 2 of 2)

TABLE	DESCRIPTION	PART NO.	PAGE
6-33	IPA Splitter Assembly	959-0503	6-17
6-34	Motherboard Assembly	959-0504-001	6-17
6-35	Motherboard Circuit Board Assembly	919-0504	6-18
6-36	Motherboard RF Input Circuit Board Assembly	919-0506	6-18
6-37	Motherboard DC Connector Circuit Board	919-0510-001	6-18
6-38	Heatsink Temperature Sensor Circuit Board	919-0516-002	6-19
6-39	2-Way Combiner Assembly	959-0502	6-19
6-40	Reject Load, 2-Way Combiner Assembly	959-0506	6-19
6-41	Power Supply Assembly, 220V Three Phase	959-0507	6-19
6-42	Power Supply Distrubution Circuit Board Assembly	919-0511	6-20
6-43	Temperature Sensor Circuit Board Assembly	919-0516-001	6-20
6-44	Optically Coupled Relay Assembly	919-0096-001	6-21
6-45	Optically Coupled Relay Circuit Board Assembly	919-0096	6-21
6-46	DC Filter Circuit Board Assembly	919-0519-001	6-22
6-47	Power Supply Wire Harness Assembly, 220 Volt Three-Phase	949-0507	6-22
6-48	RF Amplifier Module Assembly	959-0509	6-22
6-49	RF Amplifier Module Assembly, No Cover	959-0509-003	6-22
6-50	RF Amplifier Module Assembly, No Combiner	959-0509-002	6-23
6-51	RF Amplifier Module Combiner	959-0508	6-23
6-52	RF Amplifier Module	959-0505	6-23
6-53	Accessory Parts Kit	959-1010	6-23
6-54	Power Supply Assembly, 380 Volt Wye	959-0507-001	6-24
6-55	Power Supply Wire Harness Assembly, 380 Volt Wye	949-0507-001	6-24
6-56	Power Supply Assembly, Single Phase	959-0507-002	6-24
6-57	Power Supply Wire Harness Assembly, Single Phase	949-0507-002	6-25
6-58	Kit, Software, FM-10S Supervisor Circuit Board, CPU	979-0518	6-25

TABLE 6-2. FM-10S TRANSMITTER, 220V THREE-PHASE - 909-1010-206

REF. DES.	DESCRIPTION	PART NO.	QTY.
PS1, PS2, PS3, PS4	Power Supply, Power Factor Corrected, 50 V DC, Adjustable, 5 kW, Single Phase	540–0016–005	4
----	Display, LCD, 16 Character x 2 Lines	320–0100–1	1
----	Core, RF Transformer, 1.3 Inch ID X 1.9 Inch OD	375–0007	4
----	Fan, W2E200–HH38–01, 230 Volts ac 50/60 Hz, 600 CFM	380–9000	4
----	Filter, Air, FXA 9.75" x 19.75" x .86"	407–0168	2
----	BNC Receptacle, Bulkhead, UG492A/U	417–0017	1
----	Right Angle Plug–Jack, Type N	417–0105	1
----	Connector, Plug, 25–Pin, "D", Solder Cups	417–0291	1
----	Kit, Housing, 25–Pin	417–2510	1
----	Bulkhead Receptacle, Type N Jack–to–Jack, UG30/U	418–0035	1
----	Adapter, Transmission Line, 3.125 Inches (7.94 cm) Flange To Clamping Ring	427–0001	1
----	Transmission Line, 10 kW, 3 1/8 Inch X 31.44 Inch	463–5200	1
----	Knob, Rogan PT–7	481–0038	1
----	Knob, Rogan PT–5	481–0039	1
----	FX–50, Exciter 220 V ac	909–1051–325	1
----	Module Control Circuit Board Assembly	919–0515	1
----	Front Panel Assembly, FM–10S	959–0530	1
----	Supervisor Circuit Board Assembly	919–0531	1
----	I/O Circuit Board Assembly	919–0527	1
----	Remote Interface Circuit Board Assembly	919–0528	1
----	Directional Coupler Circuit Board Assembly	919–0529–001	1
----	Ribbon Cable Assembly	949–0425	1
----	DC Power & Data Cable Assembly	949–0426	1
----	Wire Harness Assembly	949–0427	1
----	RF Cable Assembly	949–0428	1
----	Directonal Coupler Assembly, 40DB	959–0082–040	1
----	Directional Coupler Assembly, 45DB	959–0082–045	1
----	Low Pass Filter Assembly	959–0414–002	2
----	8–Way Combiner A (LEFT) Assembly	959–0501	1
----	8–Way Combiner B (RIGHT) Assembly	959–0501–001	1
----	2–Way Combiner Assembly	959–0502	1
----	Motherboards + IPA Splitter Assembly	959–0504	1
----	Reject Load, 2 Way Combiner Assembly	959–0506	1
----	Power Supply Assembly, 220V Three–Phase	959–0507	1
----	RF Amplifier Module Assembly	959–0509–010	17
----	Kit, Accessory Parts	969–1010	1
----	Kit, Software, FM–10S Supervisor Circuit Board, CPU	979–0523	1

TABLE 6-3. FM-10S TRANSMITTER, 380V WYE THREE PHASE - 909-1010-386

REF. DES.	DESCRIPTION	PART NO.	QTY.
PS1, PS2, PS3, PS4	Power Supply, Power Factor Corrected, 50 V DC, Adjustable, 5 kW, Single Phase	540-0016-005	4
----	Display, LCD, 16 Character x 2 Lines	320-0100-1	1
----	Core, RF Transformer, 1.3 Inch ID X 1.9 Inch OD	375-0007	4
----	Fan, W2E200-HH38-01, 230 Volts ac 50/60 Hz, 600 CFM	380-9000	4
----	Filter, Air, FXA 9.75" x 19.75" x .86"	407-0168	2
----	BNC Receptacle, Bulkhead, UG492A/U	417-0017	1
----	Right Angle Plug-Jack, Type N	417-0105	1
----	Connector, Plug, 25-Pin, "D", Solder Cups	417-0291	1
----	Kit, Housing, 25-Pin	417-2510	1
----	Bulkhead Receptacle, Type N Jack-to-Jack, UG30/U	418-0035	1
----	Adapter, Transmission Line, 3.125 Inches (7.94 cm) Flange To Clamping Ring	427-0001	1
----	Transmission Line, 10 kW, 3 1/8 Inch X 31.44 Inch	463-5200	1
----	Knob, Rogan PT-7	481-0038	1
----	Knob, Rogan PT-5	481-0039	1
----	FX-50, Exciter 220 V ac	909-1051-325	1
----	Module Control Circuit Board Assembly	919-0515	1
----	Front Panel Assembly, FM-10S	959-0530	1
----	Supervisor Circuit Board Assembly	919-0531	1
----	I/O Circuit Board Assembly	919-0527	1
----	Remote Interface Circuit Board Assembly	919-0528	1
----	Directional Coupler Circuit Board Assembly	919-0529-001	1
----	Ribbon Cable Assembly	949-0425	1
----	DC Power & Data Cable Assembly	949-0426	1
----	Wire Harness Assembly, 380V WYE	949-0427-001	1
----	RF Cable Assembly	949-0428	1
----	Directional Coupler Assembly, 40DB	959-0082-040	1
----	Directional Coupler Assembly, 45DB	959-0082-045	1
----	Low Pass Filter Assembly	959-0414-002	2
----	8-Way Combiner A (LEFT) Assembly	959-0501	1
----	8-Way Combiner B (RIGHT) Assembly	959-0501-001	1
----	2-Way Combiner Assembly	959-0502	1
----	Motherboards + IPA Splitter Assembly	959-0504	1
----	Reject Load, 2 Way Combiner Assembly	959-0506	1
----	Power Supply Assembly, 380V WYE	959-0507-001	1
----	RF Amplifier Module Assembly	959-0509-010	17
----	Kit, Accessory Parts	969-1010	1
----	Kit, Software, FM-10S Supervisor Circuit Board, CPU	979-0523	1

TABLE 6-4. FM-10S TRANSMITTER, SINGLE PHASE - 909-1010-226

REF. DES.	DESCRIPTION	PART NO.	QTY.
PS1, PS2, PS3, PS4	Power Supply, Power Factor Corrected, 50 V DC, Adjustable, 5 kW, Single Phase	540-0016-005	4
----	Display, LCD, 16 Character x 2 Lines	320-0100-1	1
----	Core, RF Transformer, 1.3 Inch ID X 1.9 Inch OD	375-0007	4
----	Fan, W2E200-HH38-01, 230 Volts ac 50/60 Hz, 600 CFM	380-9000	4
----	Filter, Air, FXA 9.75" x 19.75" x .86"	407-0168	2
----	BNC Receptacle, Bulkhead, UG492A/U	417-0017	1
----	Right Angle Plug-Jack, Type N	417-0105	1
----	Connector, Plug, 25-Pin, "D", Solder Cups	417-0291	1
----	Kit, Housing, 25-Pin	417-2510	1
----	Bulkhead Receptacle, Type N Jack-to-Jack, UG30/U	418-0035	1
----	Adapter, Transmission Line, 3.125 Inches (7.94 cm) Flange To Clamping Ring	427-0001	1
----	Transmission Line, 10 kW, 3 1/8 Inch X 31.44 Inch	463-5200	1
----	Knob, Rogan PT-7	481-0038	1
----	Knob, Rogan PT-5	481-0039	1
----	FX-50, Exciter 220 V ac	909-1051-325	1
----	Module Control Circuit Board Assembly	919-0515	1
----	Front Panel Assembly, FM-10S	959-0530	1
----	Supervisor Circuit Board Assembly	919-0531	1
----	I/O Circuit Board Assembly	919-0527	1
----	Remote Interface Circuit Board Assembly	919-0528	1
----	Directional Coupler Circuit Board Assembly	919-0529-001	1
----	Ribbon Cable Assembly	949-0425	1
----	DC Power & Data Cable Assembly	949-0426	1
----	Wire Harness Assembly	949-0427	1
----	RF Cable Assembly	949-0428	1
----	Directional Coupler Assembly, 40DB	959-0082-040	1
----	Directional Coupler Assembly, 45DB	959-0082-045	1
----	Low Pass Filter Assembly	959-0414-002	2
----	8-Way Combiner A (LEFT) Assembly	959-0501	1
----	8-Way Combiner B (RIGHT) Assembly	959-0501-001	1
----	2-Way Combiner Assembly	959-0502	1
----	Motherboards + IPA Splitter Assembly	959-0504	1
----	Reject Load, 2 Way Combiner Assembly	959-0506	1
----	Power Supply Assembly, Single Phase	959-0507-002	1
----	RF Amplifier Module Assembly	959-0509-010	17
----	Kit, Accessory Parts	969-1010	1
----	Kit, Software, FM-10S Supervisor Circuit Board, CPU	979-0523	1

TABLE 6-5. FM-10S TRANSMITTER, 220V THREE-PHASE - 909-0703-206

REF. DES.	DESCRIPTION	PART NO.	QTY.
PS1, PS2, PS3, PS4	Power Supply, Power Factor Corrected, 50 V DC, Adjustable, 5 kW, Single Phase	540-0016-005	4
----	Display, LCD, 16 Character x 2 Lines	320-0100-1	1
----	Core, RF Transformer, 1.3 Inch ID X 1.9 Inch OD	375-0007	4
----	Fan, W2E200-HH38-01, 230 Volts ac 50/60 Hz, 600 CFM	380-9000	4
----	Filter, Air, FXA 9.75" x 19.75" x .86"	407-0168	2
----	BNC Receptacle, Bulkhead, UG492A/U	417-0017	1
----	Right Angle Plug-Jack, Type N	417-0105	1
----	Connector, Plug, 25-Pin, "D", Solder Cups	417-0291	1
----	Kit, Housing, 25-Pin	417-2510	1
----	Bulkhead Receptacle, Type N Jack-to-Jack, UG30/U	418-0035	1
----	Adapter, Transmission Line, 3.125 Inches (7.94 cm) Flange To Clamping Ring	427-0001	1
----	Transmission Line, 10 kW, 3 1/8 Inch X 31.44 Inch	463-5200	1
----	Knob, Rogan PT-7	481-0038-200	1
----	Knob, Rogan PT-5	481-0039-200	1
	FXi 60, 60W DTC Exciter	909-0060-001	1
	FXi 10, IBOC Signal Generator	909-6025-1MB	1
----	Module Control Circuit Board Assembly	919-0515	1
----	Front Panel Assembly, FM-10S	959-0530	1
----	Supervisor Circuit Board Assembly	919-0531	1
----	I/O Circuit Board Assembly	919-0527	1
----	Remote Interface Circuit Board Assembly	919-0528	1
----	Directional Coupler Circuit Board Assembly	919-0529-001	1
----	Ribbon Cable Assembly	949-0425	1
----	DC Power & Data Cable Assembly	949-0426	1
----	Wire Harness Assembly	949-0427	1
----	RF Cable Assembly	949-0428	1
----	Directonal Coupler Assembly, 40DB	959-0082-040	1
----	Directional Coupler Assembly, 45DB	959-0082-045	1
----	Low Pass Filter Assembly	959-0414-002	2
----	8-Way Combiner A (LEFT) Assembly	959-0501	1
----	8-Way Combiner B (RIGHT) Assembly	959-0501-001	1
----	2-Way Combiner Assembly	959-0502	1
----	Motherboards + IPA Splitter Assembly	959-0504	1
----	Reject Load, 2 Way Combiner Assembly	959-0506	1
----	Power Supply Assembly, 220V Three-Phase	959-0507	1
----	RF Amplifier Module Assembly	959-0509-010	17
----	Kit, Accessory Parts	969-1010-010	1
----	Kit, Software, FM-10S Supervisor Circuit Board, CPU	979-0523	1

TABLE 6-6. FM-10S TRANSMITTER, 380V WYE THREE PHASE - 909-0703-386

REF. DES.	DESCRIPTION	PART NO.	QTY.
PS1, PS2, PS3, PS4	Power Supply, Power Factor Corrected, 50 V DC, Adjustable, 5 kW, Single Phase	540-0016-005	4
----	Display, LCD, 16 Character x 2 Lines	320-0100-1	1
----	Core, RF Transformer, 1.3 Inch ID X 1.9 Inch OD	375-0007	4
----	Fan, W2E200-HH38-01, 230 Volts ac 50/60 Hz, 600 CFM	380-9000	4
----	Filter, Air, FXA 9.75" x 19.75" x .86"	407-0168	2
----	BNC Receptacle, Bulkhead, UG492A/U	417-0017	1
----	Right Angle Plug-Jack, Type N	417-0105	1
----	Connector, Plug, 25-Pin, "D", Solder Cups	417-0291	1
----	Kit, Housing, 25-Pin	417-2510	1
----	Bulkhead Receptacle, Type N Jack-to-Jack, UG30/U	418-0035	1
----	Adapter, Transmission Line, 3.125 Inches (7.94 cm) Flange To Clamping Ring	427-0001	1
----	Transmission Line, 10 kW, 3 1/8 Inch X 31.44 Inch	463-5200	1
----	Knob, Rogan PT-7	481-0038-200	1
----	Knob, Rogan PT-5	481-0039-200	1
	FXi 60, 60W DTC Exciter	909-0060-001	1
	FXi 10, IBOC Signal Generator	909-6025-1MB	1
----	Module Control Circuit Board Assembly	919-0515	1
----	Front Panel Assembly, FM-10S	959-0530	1
----	Supervisor Circuit Board Assembly	919-0531	1
----	I/O Circuit Board Assembly	919-0527	1
----	Remote Interface Circuit Board Assembly	919-0528	1
----	Directional Coupler Circuit Board Assembly	919-0529-001	1
----	Ribbon Cable Assembly	949-0425	1
----	DC Power & Data Cable Assembly	949-0426	1
----	Wire Harness Assembly, 380V WYE	949-0427-001	1
----	RF Cable Assembly	949-0428	1
----	Directional Coupler Assembly, 40DB	959-0082-040	1
----	Directional Coupler Assembly, 45DB	959-0082-045	1
----	Low Pass Filter Assembly	959-0414-002	2
----	8-Way Combiner A (LEFT) Assembly	959-0501	1
----	8-Way Combiner B (RIGHT) Assembly	959-0501-001	1
----	2-Way Combiner Assembly	959-0502	1
----	Motherboards + IPA Splitter Assembly	959-0504	1
----	Reject Load, 2 Way Combiner Assembly	959-0506	1
----	Power Supply Assembly, 380V WYE	959-0507-001	1
----	RF Amplifier Module Assembly	959-0509-010	17
----	Kit, Accessory Parts	969-1010-010	1
----	Kit, Software, FM-10S Supervisor Circuit Board, CPU	979-0523	1

TABLE 6-7. FM-10S TRANSMITTER, SINGLE PHASE - 909-0703-226

REF. DES.	DESCRIPTION	PART NO.	QTY.
PS1, PS2, PS3, PS4	Power Supply, Power Factor Corrected, 50 V DC, Adjustable, 5 kW, Single Phase	540-0016-005	4
----	Display, LCD, 16 Character x 2 Lines	320-0100-1	1
----	Core, RF Transformer, 1.3 Inch ID X 1.9 Inch OD	375-0007	4
----	Fan, W2E200-HH38-01, 230 Volts ac 50/60 Hz, 600 CFM	380-9000	4
----	Filter, Air, FXA 9.75" x 19.75" x .86"	407-0168	2
----	BNC Receptacle, Bulkhead, UG492A/U	417-0017	1
----	Right Angle Plug-Jack, Type N	417-0105	1
----	Connector, Plug, 25-Pin, "D", Solder Cups	417-0291	1
----	Kit, Housing, 25-Pin	417-2510	1
----	Bulkhead Receptacle, Type N Jack-to-Jack, UG30/U	418-0035	1
----	Adapter, Transmission Line, 3.125 Inches (7.94 cm) Flange To Clamping Ring	427-0001	1
----	Transmission Line, 10 kW, 3 1/8 Inch X 31.44 Inch	463-5200	1
----	Knob, Rogan PT-7	481-0038-200	1
----	Knob, Rogan PT-5	481-0039-200	1
	FXi 60, 60W DTC Exciter	909-0060-001	1
	FXi 10, IBOC Signal Generator	909-6025-1MB	1
----	Module Control Circuit Board Assembly	919-0515	1
----	Front Panel Assembly, FM-10S	959-0530	1
----	Supervisor Circuit Board Assembly	919-0531	1
----	I/O Circuit Board Assembly	919-0527	1
----	Remote Interface Circuit Board Assembly	919-0528	1
----	Directional Coupler Circuit Board Assembly	919-0529-001	1
----	Ribbon Cable Assembly	949-0425	1
----	DC Power & Data Cable Assembly	949-0426	1
----	Wire Harness Assembly	949-0427	1
----	RF Cable Assembly	949-0428	1
----	Directional Coupler Assembly, 40DB	959-0082-040	1
----	Directional Coupler Assembly, 45DB	959-0082-045	1
----	Low Pass Filter Assembly	959-0414-002	2
----	8-Way Combiner A (LEFT) Assembly	959-0501	1
----	8-Way Combiner B (RIGHT) Assembly	959-0501-001	1
----	2-Way Combiner Assembly	959-0502	1
----	Motherboards + IPA Splitter Assembly	959-0504	1
----	Reject Load, 2 Way Combiner Assembly	959-0506	1
----	Power Supply Assembly, Single Phase	959-0507-002	1
----	RF Amplifier Module Assembly	959-0509-010	17
----	Kit, Accessory Parts	969-1010-010	1
----	Kit, Software, FM-10S Supervisor Circuit Board, CPU	979-0523	1

TABLE 6-8. MODULE CONTROL CIRCUIT BOARD ASSEMBLY - 919-0515

REF. DES.	DESCRIPTION	PART NO.	QTY.
This circuit board is designed using surface mount technology. As a result, the components can not be changed without the use of specialized surface mount soldering equipment. Therefore, this table only presents any applicable thru-hole components and socketed surface mount components.			
J1, J2	Connector, 25-Pin D, Female, Filtered	417-8825	2
J3, J4	Connector, 9-Pin D, Female Filtered	417-8809	2
J5	Receptacle, Male, 13-Pin Dual In-Line	417-2600	1
J6	Socket, 4-Pin	418-0255	1
J7	Connector, 25-Pin D, Male, Filtered	418-8825	1
J8	Receptacle, Male, 2-Pin In-line	417-4004	1
J101, J102	Connector, 25-Pin D, Female, Filtered	417-8825	2
J103, J104	Connector, 9-Pin D, Female, Filtered	417-8809	2
J105	Receptacle, Male, 13-Pin Dual In-Line	417-2600	1
U2	Integrated Circuit, 80C31BH, Micro Controller, 3.5 to 12 MHz, 44-Pin PLCC Package	229-8031-001	1
U7	IC, Flash Memory, 64K x 8, PLCC, 12V Programming, 120 nS Access, 32-Pin PLCC Package	229-8512	1
U8	Integrated Circuit, 82C55A, Peripheral Interface, 44-Pin PLCC	229-8255-001	1
U11	Integrated Circuit, ULN2003A, 7 Section NPN Darlington Driver, CMOS, 16-Pin DIP	229-2003	2
U12, U13	Integrated Circuit, ULN2003A, 7 Section NPN Darlington Driver, CMOS, 16-Pin DIP	229-2003	2
U102	Integrated Circuit, 80C31BH, Micro Controller, 3.5 to 12 MHz,	229-8031-001	1
U107	IC, Flash Memory, 64K X 8, PLCC, 12V Programming, 120 nS Access, 32-Pin PLCC Package	229-8512	1
U108	Integrated Circuit, 82C55A, Peripheral Interface, 44-Pin PLCC	229-8255-001	1
U112, U113	Integrated Circuit, ULN2003A, 7 Section NPN Darlington Driver, CMOS, 16-Pin DIP	229-2003	2
XU2	Socket, 44-Pin, PLCC, SMD	431-4400	1
XU4	Socket, 20-Pin, DIP, SMD	431-2000	1
XU5	Socket, 28-Pin, IC, SMD	417-2804-001	1
XU7	Socket, 32-Pin, PLCC, SMD	431-3200	1
XU8	Socket, 44-Pin, PLCC, SMD	431-4400	1
XU12, XU13	Socket, 16-Pin, DIP, SMD	431-1600	2
XU102	Socket, 44-Pin, PLCC, SMD	431-4400	1
XU104	Socket, 20-Pin, DIP, SMD	431-2000	1
XU105	Socket, 28-Pin IC, SMD	417-2804-001	1
XU107	Socket, 32-Pin, PLCC, SMD	431-3200	1
XU108	Socket, 44-Pin, PLCC, SMD	431-4400	1
XU112, XU113	Socket, 16-Pin, DIP, SMD	431-1600	2
----	Kit, Software, FM-10S MOD CONT PAL U4	979-0515-004	1
----	Kit, Software, FM-10S MOD CONT ROM U5	979-0515-005	1
----	Blank, Module Control Circuit Board	519-0515	1

TABLE 6-9. KIT, SOFTWARE, FM-10S MODULE CONTROL PAL U4 - 979-0515-004

REF. DES.	DESCRIPTION	PART NO.	QTY.
U4, U104	Integrated Circuit, PLD, 64 X 32 AND-ARRAY, GAL16V8D-7LP	220-0050	2

TABLE 6-10. KIT, SOFTWARE, FM-10S MODULE CONTROL ROM U5 - 979-0515-005

REF. DES.	DESCRIPTION	PART NO.	QTY.
U5, U105	Integrated Circuit, AM27C256-155, 32K X 8 EPROM, CMOS, 28-Pin	229-7256	2

TABLE 6-11. ASSEMBLY, FRONT PANEL - 959-0530

REF. DES.	DESCRIPTION	PART NO.	QTY.
----Front Panel Circuit Board Assembly, FM-10S		919-0517	1
----Cable Assembly, Front Panel, FM-10S		949-0517	1

TABLE 6-12. CABLE ASSEMBLY, FRONT PANEL - 949-0517

REF. DES.	DESCRIPTION	PART NO.	QTY.
----Connector, Housing, 3-Pin		417-0003-001	1
----Pins, Connector		417-8766	1

TABLE 6-13. FRONT PANEL CIRCUIT BOARD ASSEMBLY - 919-0530
(Sheet 1 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
This circuit board is designed using surface mount technology. As a result, the components can not be changed without the use of specialized surface mount soldering equipment. Therefore, this table only presents any applicable thru-hole components and socketed surface mount components.			
DS1	Display, LCD, 4-Digit, 0.7	320-0021	1
DS2 thru DS6	Led, Red Diffused Chimney, P424, 70 mW, 20 mA, 4V	320-0037	5
DS7, DS8	Led, Green Diffused Chimney	320-0322	2
J1, J2	Receptacle, Male, 3-Pin In-line	417-0003	2
J3	Header, 8-Pin, .100" R.ight Angle Locking	417-2837	1
J10	Receptacle, Male, 20-Pin In-Line	417-0200	1
J11	Connector, Header, 50-Pin, Male	417-0227	1
J12	Header, 10-Pin	417-0179	1
R1 thru R7	Resistor, 150 Ohm ±1%, 1/4W	100-1531	7
R10	Resistor, 10 Ohm, ±1%, 1/4W	103-1021	1
R11	Resistor, 17.8 Ohm, ±1%, 1/4W	103-1782	1
R12	Resistor, 10 Ohm, ±1%, 1/4W	103-1021	1
R13	Resistor, 17.8 Ohm, ±1%, 1/4W	103-1782	1
R14 thru R19	Resistor, 10 Ohm, ±1%, 1/4W	103-1021	6
R20	Resistor, 17.8 Ohm, ±1%, 1/4W	103-1782	1
R21, R22	Resistor, 10 Ohm, ±1%, 1/4W	103-1021	2
R28	Potentiometer, 10 k Ohm, ±10%, 1 1/4W	179-1053	1
R29	Resistor, Metal Film, 12.1 Ohms, ±1%, 1/4W	103-1212	1

TABLE 6-13. FRONT PANEL CIRCUIT BOARD ASSEMBLY - 919-0530
(Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
S1	Switch, Push-Button, Momentary, LED Illuminated, Green	340-0140	1
S2	Switch, Push-Button, Momentary, LED Illuminated, Red	340-0143	1
S3	Switch, Push-Button, Momentary, LED Illuminated, Yellow	340-0139	1
S4	Switch, Push-Button, Momentary, LED Illuminated, Red	340-0143	1
S5 thru S10	Switch, Push-Button, Momentary, LED Illuminated, Yellow	340-0139	6
S11	Switch, Push-Button, Momentary, LED Illuminated, Red	340-0143	1
S12, S13	Switch, Push-Button, Momentary, LED Illuminated, Yellow	340-0139	2
S14, S15	Switch, Encoder, Rotary, Grayhill	340-2522	2
----	Blank, Front Panel Circuit Board	519-0517	1

TABLE 6-14. SUPERVISOR CIRCUIT BOARD ASSEMBLY - 919-0531
(Sheet 1 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
This circuit board is designed using surface mount technology. As a result, the components can not be changed without the use of specialized surface mount soldering equipment. Therefore, this table only presents any applicable thru-hole components and socketed surface mount components.			
----	Cell, Battery, 3V, 190MAH, Lithium	350-2032	1
----	Socket, 14-Pin, DIP, SMD	431-1400	15
----	Software Kit, RTDS, CPU	979-9091	1
J1	Header, Ribbon Cable, 40 Position, Dual In-Line	417-4042	1
J3 thru J6	Receptacle, Male, 13-Pin Dual In-Line	417-2600	4
J9 thru J14	Header, 3-Pin, 0.100 Center, SIP	408-0300	6
P9 thru P11	Jumper, Programmable, 2-Pin	340-0004	3
U2 thru U5	Integrated Circuit, GAL22V10-7LJ, PAL, Erasable, 28-Pin PLCC, SMD	229-2210-2	4
U10A, U10B U11A, U11B U12A, U12B U13A, U13B U16A, U16B	Integrated Circuit, 4N33, Optical Isolator, NPN Photo Transistor/Infared Emitting Diode Type, 1500V Isolation, Response: 30 kHz Maximum, Current: 50 mA Maximum, 6-Pin DIP	229-0033	10
U19	Integrated Circuit, Dual UART, FIFO Printer Port 44-Pin FN Package, SMD	224-0552	1
U35A, U35B U36A, U36B U37A, U37B U38A, U38B	Integrated Circuit, H11AA1, AC Input Optical Isolator, 6-Pin DIP	229-0111	8
U40A, U40B U41A, U41B U42A, U42B U43A, U43B U44A, U44B, U45A, U45B	Integrated Circuit, 4N33, Optical Isolator, NPN Photo Transistor/Infared Emitting Diode Type, 1500V Isolation, Response: 30 kHz Maximum, Current: 50 mA Maximum, 6-Pin DIP	229-0033	12
XU2 thru XU5	Socket, 28-Pin, PLCC, SMD	431-2800	4
XU19	Socket,68-Pin, PLCC, SMD	431-6800	1
----	Kit, Software, FM-10S, Supervisor, U5	979-0518-005	1
----	Kit, Software, FM-10S, Supervisor, U4	979-0518-004	1

TABLE 6-14. SUPERVISOR CIRCUIT BOARD ASSEMBLY - 919-0531
(Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Kit, Software, FM-10S, Supervisor, U3	979-0518-003	1
----	Kit, Software, FM-10S, Supervisor, U2	979-0526-002	1
----	Blank, Supervisor Circuit Board	519-0531	1

TABLE 6-15. KIT, SOFTWARE, FM-10S SUPERVISOR U5 - 979-0518-005

REF. DES.	DESCRIPTION	PART NO.	QTY.
U5	Integrated Circuit, PAL, GAL22V10-7LJ, 28-Pin PLCC, SMD	229-2210-2	1

TABLE 6-16. KIT, SOFTWARE, FM-10S SUPERVISOR U4 - 979-0518-004

REF. DES.	DESCRIPTION	PART NO.	QTY.
U4	Integrated Circuit, PAL, GAL22V10-7LJ, 28-Pin PLCC, SMD	229-2210-2	1

TABLE 6-17. KIT, SOFTWARE, FM-10S SUPERVISOR U3 - 979-0518-003

REF. DES.	DESCRIPTION	PART NO.	QTY.
U3	Integrated Circuit, PAL, GAL22V10-7LJ, 28-Pin PLCC, SMD	229-2210-2	1

TABLE 6-18. KIT, SOFTWARE, FM-10S SUPERVISOR U2 - 979-0518-002

REF. DES.	DESCRIPTION	PART NO.	QTY.
U2	Integrated Circuit, PAL, GAL22V10-7LJ, 28-Pin PLCC, SMD	229-2210-2	1

TABLE 6-19. INPUT/OUTPUT CIRCUIT BOARD ASSEMBLY - 919-0527
(Sheet 1 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C9 thru C16	Capacitor, Polyester, 0.0022 uF +10%, 100V	031-2033	8
D1 thru D6	Zener Voltage Suppressor, ±7.5V, 600 Watts Peak	201-0007	6
D7 thru D42	Zener Voltage Suppressor, ±15V, 600 Watts Peak	201-0015	36
FL1 thru FL63	Filter, EMI 10,000 pF Capacitor, 3-Pin In-Line	411-0001	63
J1,J2	Receptacle, D-Type, 9-Pin, Male	417-0902	2
J3	Receptacle, D-Type, 25-Pin, Female	417-2502	1

TABLE 6-19. INPUT/OUTPUT CIRCUIT BOARD ASSEMBLY - 919-0527
(Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
J4,J5	Receptacle, D-Type, 37-Pin, Female	417-3704	2
J6	Socket, 32-Pin, Single Row	417-3200	1
J7,J8	Header, 50-Pin, Right Angle, 0.100 Center , Dual Row	417-5017	2
R12 thru R21	Resistor, 100 Ohm ±1%, 1/4W	100-1031	10
R22 thru R24	Resistor, 10 Ohm ±1%, 1/4W	103-1021	3
----	Blank Input/Output Circuit Board Assembly	519-0520	1

TABLE 6-20. REMOTE INTERFACE CIRCUIT BOARD ASSEMBLY - 919-0528

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1	Capacitor, Monolythic Ceramic, 0.1 uF +20%, 50V	003-1054	1
J1,J2	Connector, 9-Pin	418-0900	2
J3	Receptacle, 6-Pin	417-0677	1
J4	Receptacle, D-Type, 37-Pin, Male, Ferrite Filter	418-3704-FER	1
J5	Receptacle, D-Type, 25-Pin, Male, Ferrite Filter	418-8825	1
TB1	Barrier Strip, 30 Terminal	412-3000	1
TB2	Barrier Strip, 16-Position	412-1600	1
----	Blank Remote Interface Circuit Board Assembly	519-0521	1

TABLE 6-21. DIRECTIONAL COUPLER CIRCUIT BOARD ASSEMBLY - 919-0529-001
(Sheet 1 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1	Capacitor, Mica, 1000 pF ±1%, 100V	041-1031	1
C2 thru C7	Capacitor, Mica, 390 pF ±5%, 100V	042-3922	6
C8	Capacitor, Polyester, 0.0022 uF ±10%, 100V	031-2033	1
C17 thru C19	Capacitor, Mica, 390 pF ±5%, 100V	042-3922	3
C20	Capacitor, Polyester, 0.0022 uF ±10%, 100V	031-2033	1
D43 thru D49	Diode, HP5082-2800, High Voltage, Schottky Barrier Type, 70V, 15 mA	201-2800	7
J1	Socket, 32-Pin, Single Row	417-3200	1
J9 thru J11	Connector, BNC, PCB Mount	417-0259	3
L1 thru L9	RF Choke, 4.7 uH ±10%, 430 mA, DC Resistance: 0.55 Ohms, 0.43 Amperes Maximum, Resonant at 115 MHz	360-0022	9
R1	Resistor, 499 k Ohm ±1%, 1/4W	103-4996	1
R2	Resistor, 162 k Ohm ±1%, 1/4W	103-1626	1
R3	Resistor, 499 k Ohm ±1%, 1/4W	103-4996	1
R4,R5	Resistor, 56 Ohm, ±5%, 2W	130-5621	2
R6,R7	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	2
R8,R9	Resistor, 475 Ohm ±1%, 1/4W	103-4753	2
R10,R11	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	2
R25	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	1

TABLE 6-21. DIRECTIONAL COUPLER CIRCUIT BOARD ASSEMBLY - 919-0529-001
(Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R26	Resistor, 56 Ohm, ±5%, 2W	130–5621	1
R27	Resistor, 475 Ohm ±1%, 1/4W	103–4753	1
R28	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
----	Blank Directional Coupler Circuit Board	519–0522	1

TABLE 6-22. RIBBON CABLE ASSEMBLY - 949-0425

REF. DES.	DESCRIPTION	PART NO.	QTY.
P1, P1, P1, P1 P1, P1, P1, P1 P1	Connector, Male, 9–Pin	417–0181	9
P2	Socket, Connector, 50–Pin	417–0228	1
P3 thru P5,	Plug, Ribbon Cable, 26–Pin Dual In–line	418–2600	3
P7, P7, P8, P8	Socket, Connector, 50–Pin	417–0228	4
P11	Socket, Connector, 50–Pin	417–0228	1
P12	Connector, 10–Pin	417–0180	1
P105	Plug, Ribbon Cable, 26–Pin Dual In–line	418–2600	1

TABLE 6-23. DC POWER & DATA CABLE ASSEMBLY - 949-0426

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Cable Assembly, Computer, DB9–DB9, Male/Male, 6 FT	849–0901	2
----	Cable Assembly, Computer, DB9–DB9, Male/Female, 6 FT	849–0902	4
----	Cable Assembly, Computer, DB25–DB25, Male/Male, 6 FT	849–2501	4
----	Cable Assembly, Computer, DB25–DB25, Male/Male, 2 FT	849–2525	4
----	Cable Assembly, Computer, DB37–DB37, Male/Female, 3 FT	849–3701	1

TABLE 6-24. WIRE HARNESS ASSEMBLY - 949-0427
(Sheet 1 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
J101, J101	Plug, BNC, Dual Crimp	418–0034	2
P1	Plug, Housing, 4–Pin	418–0240	1
P1, ----	Connector Plug, 9–Pin	417–0059	2
P5	Receptacle, 25–Pin	417–0252	1
P10, ----	Connector Plug, 25–Pin	417–0251	2
P7A	Receptacle, 25–Pin	417–0252	1
P5	Connector, Male, 37–Pin	417–3711	1
P104, P105	Plug, Housing, 4–Pin	418–0240	2

TABLE 6-24. WIRE HARNESS CABLE ASSEMBLY - 949-0427
(Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
P106, P107	Contact Housing, 4-Pin In-line	417-0138	2
P114, ----	Plug, Housing, 4-Pin	418-0240	2
----	Connector Housing, 6-Pin	418-0670	1
----	Pins, Connector	417-0053	15
----	Pins, Crimp Type	417-8766	6
----	Kit, Housing, 25-Pin	417-2510	4
----	Kit, Housing, 37-Pin, D-Type	417-3710	1
----	Pins, Connector	417-0142	41
----	Pins, Socket	417-0143	40

TABLE 6-25. RF CABLE ASSEMBLY - 949-0428

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Plug, BNC for RG-142 cable	417-0095	8
----	Connector, Straight N for 82-340 Cable	417-0120	6
----	Plug, Type N for RG-142 cable	418-0031	2

TABLE 6-26. LOW-PASS FILTER ASSEMBLY - 959-0414-002

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Receptacle, BNC	417-0016	1
----	Low-Pass Filter Circuit Board Assembly	919-0421-002	1

TABLE 6-27. LOW-PASS FILTER CIRCUIT BOARD ASSEMBLY - 919-0421-002
(Sheet 1 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C8	Capacitor, Ceramic, 68 pF ±5%, 50V	003-6812	1
C9,C10	Capacitor, Mica, 390 pF ±5%, 100V	042-3922	2
C11	Capa citor, Ceramic, 27 pF ±2%, 100V	003-2753	1
C12,C13	Capacitor, Mica, 390 pF ±5%, 100V	042-3922	2
C14,C15	Capacitor, Ceramic , 2.2 pF, +1/-0.25pF, 100V	003-2201	2
D1,D2	Diode, HP5082-2800, High Voltage, Schottky Barrier Type, 70V, 15 mA	201-2800	2
J23	Receptacle, Male, Right Angle, 20-Pin In-Line	417-0214	1
L1	Inductor, Low-Pass Filter	360-0145	1
L2	Inductor, Molded, 0.023 uH	364-0023	1
R1	Resistor, 1 k Ohm ±1%, 1/4W	100-1041	1
R2	Resistor, 665 k Ohm ±1%, 1/4W	103-6654	1
R3,R4	Resistor, 124 Ohm ±1%, 2W	122-1241	2

TABLE 6-27. LOW-PASS FILTER CIRCUIT BOARD ASSEMBLY - 919-0421-002
(Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Inductor, Low-Pass Filter, FM-5C	471-5035	1
R5	Resistor, 100 k Ohm ±1%, 1/4W	103-1062	1
R6	Resistor, 665 k Ohm ±1%, 1/4W	103-6654	1
R7,R8	Resitor, 158 Ohm ±1%, 2W	122-1581	2
R9	Potentiometer, 1 k Ohm ±10%, 1/2W	177-1044	1
----	Blank Low-Pass Filter Circuit Board Assembly FM-3C	519-0421	1
----	Fuseable Link, 22 AWG	601-0022	----

TABLE 6-28. 8-WAY COMBINER A (LEFT) ASSEMBLY - 959-0501

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	BNC Receptacle, Bulkhead, UG492A/U	417-0017	2
----	Receptacle, Type-N, Female, Panel Mount	417-0392	8
----	Adapter, Type-N, Jack-To-Jack, 82-66 Amphenol	418-0035	2
----	Combiner Input Bottom Left Circuit Board Assembly	919-0502-001	1
----	Combiner Input Top Left Circuit Board Assembly	919-0502-002	1
----	Blank 8-Way Combiner Circuit Board Assembly	519-0501	1

TABLE 6-29. 8-WAY COMBINER B (RIGHT) ASSEMBLY - 959-0501-001

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Receptacle, Type-N, Female, Panel Mount	417-0392	8
----	Combiner Input Bottom Left Circuit Board Assembly	919-0502-001	1
----	Combiner Input Top Left Circuit Board Assembly	919-0502-002	1
----	Blank 8-Way Combiner Circuit Board Assembly	519-0501	1

TABLE 6-30. COMBINER INPUT BOTTOM LEFT CIRCUIT BOARD ASSEMBLY - 919-0502-001

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1 thru C9	Capacitor, Ceramic, 0.1uF ±10%, 50V	003-1066	9
D1 thru D4	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203-4005	4
FL1 thru FL5	Filter, EMI 10,000 pF Capacitor, 3-Pin In-Line	411-0001	5
J1	Receptacle, D-Type, 9-Pin, Straight, PCB Mount	417-1094	1
K1 thru K4	Relay, PCB Mount Coil: 12V dc, 180 Ohm Contacts: SPST-NO, 15A @ 240V ac or 24V dc	270-1255	4
L1 thru L4	Coil, Combiner Input Circuit Board, FM-10S	360-0158	4
----	Blank Combiner Input Bottom Left Circuit Board	519-0502	1

TABLE 6-31. COMBINER INPUT TOP LEFT CIRCUIT BOARD ASSEMBLY - 919-0502-002

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1 thru C9	Capacitor, Ceramic, 0.1uF ±10%, 50V	003-1066	9
D1 thru D4	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203-4005	4
FL1B thru FL5B	Filter, EMI 10,000 pF Capacitor, 3-Pin In-Line	411-0001	5
J1B	Receptacle, D-Type, 9-Pin, Straight, PCB Mount	417-1094	1
K1 thru K4	Relay, PCB Mount Coil: 12V dc, 180 Ohm Contacts: SPST-NO, 15A @ 240V ac or 24V dc	270-1255	4
L1 thru L4	Coil, Combiner Input Circuit Board, FM-10S	360-0158	4
----	Blank Combiner Input Bottom Left Circuit Board	519-0502	1

TABLE 6-32. MOTHERBOARDS & IPA SPLITTER ASSEMBLY - 959-0504

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Right Angle Plug-Jack, Type N	417-0105	1
----	Bulkhead Receptacle, Type N Jack-to-Jack, UG30/U	418-0035	1
----	Assembly, IPA Splitter	959-0503	1
----	Assembly, Motherboard	959-0504-001	1

TABLE 6-33. IPA SPLITTER ASSEMBLY - 959-0503

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Connector, "N" Female Bulkhead Receptacle Rear Mount Pressurized	417-0321	1
----	Receptacle, Type-N, Female, Panel Mount	417-0392	1
----	IPA Splitter Circuit Board	519-0503	1

TABLE 6-34. MOTHERBOARD ASSEMBLY - 959-0504-001

REF. DES.	DESCRIPTION	PART NO.	QTY.
J110, J111, J110, J111	Connector, D-Type, 25-Pin, Filtered, Right Angle, PCB Mount	417-1253	4
J112, J112, J113	Connector, Type N, Male To Pin, No Nut	417-0384	3
J202, J202	Connector, 10-Pin Single Row Header	417-0044	2
R101 thru R108, R101 thru R108	Resistor, 50 Ohm ±5%, 100W	131-5032	16
R109, R110 R109, R110	Resistor, 100 Ohm ±5%, 250W	131-5031	2
----	Motherboard Assembly	919-0504	1
----	Motherboard DC Connector Circuit Board	919-0510-001	1
----	Heatsink Temperature Sensor Circuit Board	919-0516-002	1

TABLE 6-35. MOTHERBOARD CIRCUIT BOARD ASSEMBLY - 919-0504

REF. DES.	DESCRIPTION	PART NO.	QTY.
C101	Capacitor, Electrolytic, 47 uF, 35V	020–4770	1
C102	Capacitor, Mylar, 0.1 uF ±10%, 100V	030–1053	1
C103	Capacitor, Electrolytic, 47 uF, 35V	020–4770	1
C104	Capacitor, Mylar, 0.1 uF ±10%, 100V	030–1053	1
C105	Capacitor, Electrolytic, 47 uF, 35V	020–4770	1
C106	Capacitor, Mylar, 0.1 uF ±10%, 100V	030–1053	1
C107	Capacitor, Electrolytic, 47 uF, 35V	020–4770	1
C108	Capacitor, Mylar, 0.1 uF ±10%, 100V	030–1053	1
C109	Capacitor, Electrolytic, 47 uF, 35V	020–4770	1
C110	Capacitor, Mylar, 0.1 uF ±10%, 100V	030–1053	1
C111	Capacitor, Electrolytic, 47 uF, 35V	020–4770	1
C112	Capacitor, Mylar, 0.1 uF ±10%, 100V	030–1053	1
C113	Capacitor, Electrolytic, 47 uF, 35V	020–4770	1
C114	Capacitor, Mylar, 0.1 uF ±10%, 100V	030–1053	1
C115	Capacitor, Electrolytic, 47 uF, 35V	020–4770	1
C116	Capacitor, Mylar, 0.1 uF ±10%, 100V	030–1053	1
C117	Capacitor, Electrolytic, 47 uF, 35V	020–4770	1
C118	Capacitor, Mylar, 0.1 uF ±10%, 100V	030–1053	1
C123 thru C130	Capacitor, Ceramic Chip, 47 pF ±5%, 500V	009–4713	8
C131	Capacitor, Ceramic, 4.7PF, ±0.1 pF, 500V	009–4710–001	1
----	Blank Motherboard Circuit Board	519–0504	1
----	Motherboard Shield	519–0510–002	1
----	Motherboard RF Input Circuit Board Assembly, FM–10S	919–0506	1

TABLE 6-36. MOTHERBOARD RF INPUT CIRCUIT BOARD ASSEMBLY - 919-0506

REF. DES.	DESCRIPTION	PART NO.	QTY.
C119	Capacitor, Ceramic Chip, 47 pF ±5%, 500V	009–4713	1
C120	Capacitor, Ceramic, Trimmer, 5.5–18 pF, 350V, NPO	096–0011	1
———	Blank Motherboard RF Input Circuit Board Assembly	519–0506	1

TABLE 6-37. MOTHERBOARD DC CONNECTOR CIRCUIT BOARD - 919-0510-001

REF. DES.	DESCRIPTION	PART NO.	QTY.
C201 thru C204	Capacitor, Ceramic, 0.1 uF ±10% ,50V	003–1066	4
J201	Connector, D–Type, 9–Pin, Filtered, Right Angle, PCB Mount	417–1093	1
J202	Receptacle, Male, 20–Pin In–Line	417–0200	1
----	Blank Motherboard DC Connector Circuit Board	519–0510–001	1

TABLE 6-38. HEATSINK TEMPERATURE SENSOR CIRCUIT BOARD - 919-0516-002

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	1
C2	Capacitor, Mica, 390 pF ±5%, 100V	042-3922	1
C3	Capacitor, Mica, 47 pF ±5%, 500V	040-4713	1
C4	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	1
C5	Capacitor, Mica, 47 pF ±5%, 500V	040-4713	1
C6,C7	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	2
C8	Capacitor, Mica, 390 pF ±5%, 100V	042-3922	1
J1	Socket, 4-Pin	418-0255	1
R1, R3	Resistor, 10 Ohm ±1%, 1/4W	103-1021	2
R4	Resistor, 4.02 k Ohm ±1%,1/4W	103-4024	1
R5	Resistor, 1 k Ohm ±1%, 1/4W	100-1041	1
R6	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	1
U1	Integrated Circuit, TLC072, High Output Drive Operational Amplifier, Single Supply, 8-Pin DIP	220-0072	1
U2	Integrated Circuit, LM35DZ, Celsius Temperature Sensor, TO-92 Case	220-0035	1
———	Blank Heatsink Temperature Sensor Circuit Board	519-0516-001	1

TABLE 6-39. 2- WAY COMBINER ASSEMBLY - 959-0502

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Connector, "N" Female Bulkhead Receptacle Rear Mount Pressurized	417-0321	1
----	Connector, Output Coupling Loop	419-0034	1
----	Flange, 3 1/8 inch	427-0001	1

TABLE 6-40. REJECT LOAD, 2- WAY COMBINER ASSEMBLY - 959-0506

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Resistor, 200 Ohm ±10%, 150W	139-0200	4
----	Connector, "N" Female Bulkhead Receptacle Rear Mount Pressurized	417-0321	1

TABLE 6-41. POWER SUPPLY ASSEMBLY, 220V THREE PHASE - 959-0507
(Sheet 1 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
CB1	Circuit Breaker, 3-Pole, 240 Volt ac, 80 Amperes	341-0072	1
K1	Contactor, 80 Amperes, 220/240Vac, 50/60 Hz	341-0074	1
MOV1 thru MOV6, MOV1A thru MOV6A	Metal-Oxide Varistor, B40K275, 275V, 1680 Joules	140-0021	12
PS7	Power Supply, 80 Watt, Input: 90 to 264 Volts, 50/60 Hz, ac Ouput: +5 Volts dc @ 8A, ±12 Volts dc @ 2.5A, +24 Volts dc @ 2A	540-0015-012	1

TABLE 6-41. POWER SUPPLY ASSEMBLY, 220V THREE PHASE - 959-0507
(Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
TB1	Barrier Strip, 9 Terminal	412-0090	1
TB2	Terminal Block, Gould 63133	412-0050	1.33
----	Fuse Block, 2-Pole, Buss S-8202-02	415-0003	1
----	Phase Monitor Circuit Board, Single-Phase, High/Low Off	470-0351	3
----	Fuse, MDA, 10A, 250V Slo-Blo	330-1000	2
----	Fuse Holder, Dual, 3AB	415-0003	1
----	Optically Coupled Relay Assembly	919-0096-001	1
----	Power Supply Distribution Circuit Board Assembly	919-0511	1
----	Temperature Sensor Circuit Board Assembly	919-0516-001	1
----	DC Filter Circuit Board Assembly	919-0519-001	12
----	Wiring Harness, Power Supply Assembly	949-0507	1

TABLE 6-42. POWER SUPPLY DISTRIBUTION CIRCUIT BOARD ASSEMBLY - 919-0511

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1	Capacitor, Monolythic Ceramic, 0.1 uF +20%, 50V	003-1054	1
J1 thru J5	Receptacle, D-Type, 25-Pin, Female	417-2502	5
J6	Socket, 4-Pin	418-0255	1
J7 thru J9	Connector, 2-Pin	417-0700	3
J10	Receptacle, D-Type, 25-Pin, Female	417-2502	1
J11	Receptacle, 12-Pin	417-1276	1
J12,J13	Receptacle, D-Type, 9-Pin, Female	417-0903	2
R1 thru R5	Resistor, 10 Ohm ±1%, 1/4W	103-1021	5
R8	Resistor, 18.2 k Ohm ±1%, 1/4W	103-1825	1
R9	Resistor, 17.8 k Ohm ±1%, 1/4W	103-1785	1
R10	Resistor, 1 k Ohm ±1%, 1/4W	100-1041	1
R11,R12	Resistor, 25 Ohm ±5%, 5W, W/W	132-2523	2
----	Blank Power Supply Distribution Circuit Board	519-0511	1

TABLE 6-43. TEMPERATURE SENSOR CIRCUIT BOARD ASSEMBLY - 919-0516-001
(Sheet 1 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	1
C2	Capacitor, Mica, 390 pF ±5%, 100V	042-3922	1
C3	Capacitor, Mica, 47 pF ±5%, 500V	040-4713	1
C4	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	1
C5	Capacitor, Mica, 47 pF ±5%, 500V	040-4713	1
C6,C7	Capacitor, Monolythic Ceramic, 0.1 uF ±20%, 50V	003-1054	2
C8	Capacitor, Mica, 390 pF ±5%, 100V	042-3922	1
J1	Socket, 4-Pin	418-0255	1
R1, R3	Resistor, 10 Ohm ±1%, 1/4W	103-1021	2

TABLE 6-43. TEMPERATURE SENSOR CIRCUIT BOARD ASSEMBLY - 919-0516-001
(Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R4	Resistor, 4.02 k Ohm ±1%,1/4W	103-4024	1
R5	Resistor, 1 k Ohm ±1%, 1/4W	100-1041	1
R6	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	1
U1	Integrated Circuit, TLC072, High Output Drive Operational Amplifier, Single Supply, 8-Pin DIP	220-0072	1
U2	Integrated Circuit, LM35DZ, Celsius Temperature Sensor, TO-92 Case	220-0035	1
----	Blank Exhaust Air Temperature Sensor Circuit Board	519-0516-001	1

TABLE 6-44. OPTICALLY COUPLED RELAY ASSEMBLY - 919-0096-001

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Optically Coupled Relay Circuit Board Assembly	919-0096	1
	DELETE PARTS		
C3	Capacitor, Ceramic Disc, 0.1 uF, 600V	000-1051	1
R2	Resistor, 560 Ohm ±5%, 1/2W	110-5633	1

TABLE 6-45. OPTICALLY COUPLED RELAY CIRCUIT BOARD - 919-0096
(Sheet 1 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1	Capacitor, Ceramic, 0.001 uF, 1 kV	002-1034	1
C2	Capacitor, Electrolytic, 47 uF, 35V	020-4773	1
C3	Capacitor, Ceramic Disc, 0.1 uF, 600V	000-1051	1
C4	Capacitor, Ceramic, 0.001 uF, 1 kV	002-1034	1
D1	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203-4005	1
D2	Diode, Zener, 1N5359, 24V ±10%, 5W	200-5359	1
D4	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203-4005	1
D5	Bridge Rectifier, MDA970A3, 4 Amps, 50-200V	239-0003	1
E1 thru E5	Terminal, Male Disconnect	410-0025	5
F1, F2	Fuse, 3 Amps, 250V, Printed Circuit Board Mount	330-0055	2
K1	Relay, Printed Circuit Board Mount Coil: 24V dc, 660 Ohm ±10% Contacts: SPST-NO, 0.5 to 15A @ 12 to 240V ac Resistance	270-0054	1
MOV1	Varistor, 27V, V27ZA60	140-0023	1
R1	Resistor, 2 k Ohm ±3%, 10W, W/W	130-2032	1
R2	Resistor, 560 Ohm ±5%, 1/2W	110-5633	1
R3	Resistor, 820 Ohm ±5%, 1/2W	110-8233	1
R4	Resistor, 51.1 Ohm ±1%, 1/4W	103-5112	1
R5	Resistor, 2 k Ohm ±3%, 10W, W/W	130-2032	1

TABLE 6-45. OPTICALLY COUPLED RELAY CIRCUIT BOARD - 919-0096
(Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
U1	Integrated Circuit, 4N33, Optical Isolator, NPN Photo Transistor/Infared Emitting Diode Type, 1500V Isolation, Response: 30 kHz Maximum, Current: 50 mA Maximum, 6-Pin DIP	229-0033	1
XU1	Socket, 6-Pin DIP	417-0600	1
----	Cover, Dust Relay, 35C620A	270-0054-001	1
----	Blank, Optically Coupled Relay Circuit Board	519-0096	1

TABLE 6-46. DC FILTER CIRCUIT BOARD ASSEMBLY - 919-0519-001

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1 thru C3	Capacitor, Ceramic, 1000 pF ±5%, 100V	009-1032	3
-----	Blank DC Filter Circuit Board	519-0519-001	1

TABLE 6-47. POWER SUPPLY WIRE HARNESS ASSEMBLY, 220 VOLT THREE-PHASE - 949-0507

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Pins, Connector	417-0053	22
----	Connector Housing, 13-Pin In-Line	417-1300	1
----	Connector Housing, 5-Pin In-Line	417-1305	1
----	Plug, Housing, 4-Pin	418-0240	2
----	Connector Housing, 2-Pin, Female	418-0701	2
----	Plug, Connector Housing, 12-Pin	418-1271	1
----	Connector Housing, 3-Pin Amp Innergy 556879-3,	418-6879-003	5

TABLE 6-48. RF AMPLIFIER MODULE ASSEMBLY - 959-0509

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Assembly, RF Amplifier, No Cover	959-0509-003	1

TABLE 6-49. RF AMPLIFIER MODULE ASSEMBLY, NO COVER - 959-0509-003

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Assembly, RF Amplifier, No Combiner	959-0509-002	1
----	Assembly, RF Amplifier Module Combiner	959-0508	1

TABLE 6-50. RF AMPLIFIER MODULE ASSEMBLY, NO COMBINER - 959-0509-002

REF. DES.	DESCRIPTION	PART NO.	QTY.
F1, F2	Fuse, 20A, 3AB, 250V	330–2000	2
----	Assembly, RF Amplifier	959–0505	1
----	Assembly, RF Amplifier Module Interface And Sub Circuit Board	959–0509–001	1

TABLE 6-51. RF AMPLIFIER MODULE COMBINER - 959-0508

REF. DES.	DESCRIPTION	PART NO.	QTY.
J1	Connector, Type N, Male To Pin, No Nut	417–0384	1
P3	Receptacle Header, 12–Pin In–Line	417–1203	1
	Module Support Circuit Board	519–0509	2
	Module Combiner Breakaway Circuit Board	519–0512	1
	Module Combiner Circuit Board Assembly	919–0508	1

TABLE 6-52. RF AMPLIFIER MODULE - 959-0505

REF. DES.	DESCRIPTION	PART NO.	QTY.
C101 thru C104	Capacitor, Ceramic Chip, 470 pF ±5%, 200V	009–4723	4
C109	Capacitor, Ceramic Chip, 1000 pF ±5%, 500V	009–1033	1
C116	Capacitor, Ceramic, Trimmer, 6–50 pF, 50V	090–5010	1
L101	Choke, RF Amplifier Decoupling	360–0146	1
L102	Wire, Teflon, 18 AWG, 600V, 200C	610–2401	1
Q101	Transistor, RF Power Mosfet, MRF–151G, 175 MHz, 50V, 300W	210–0151	1
R108	Resistor, 22 Ohm ±5%, 3W	130–2243	1
T101	Assembly, RF Amplifier Output Transformer	370–0062	1
U101	Integrated Circuit, LM35DZ, Celsius Temperature Sensor, TO–92 Case	220–0035	1
----	RF Amplifier Input Assembly	370–0063	1
----	RF Amplifier Circuit Board Assembly	919–0505	1

TABLE 6-53. ACCESSORY PARTS KIT - 959-1010

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Fuse, MDA, 10A, 250V Slo–Blo	330–1000	2
F1, F2	Fuse, 20A, 3AB, 250V	330–2000	4

TABLE 6-54. POWER SUPPLY ASSEMBLY, 380 VOLT WYE - 959-0507-001

REF. DES.	DESCRIPTION	PART NO.	QTY.
CB1	Circuit Breaker, 3-Pole, 240 Volt ac, 80 Amperes	341-0072	1
K1	Contactor, 80 Amperes, 220/240Vac, 50/60 Hz	341-0074	1
MOV1 thru MOV3, MOV7, MOV1A thru MOV3A, MOV7A	Metal-Oxide Varistor, B40K275, 275V, 1680 Joules	140-0021	8
PS7	Power Supply, 80 Watt, Input: 90 to 264 Volts, 50/60 Hz, ac Ouput: +5 Volts dc @ 8A, ±12 Volts dc @ 2.5A, +24 Volts dc @ 2A	540-0015-012	1
TB1	Barrier Strip, 9 Terminal	412-0090	1
TB2	Terminal Block, Gould 63133	412-0050	0.66
TB4	Terminal Block, 4 Position, 2/0 to 12 AWG	412-0040	0.25
----	Fuse, MDA, 10A, 250V Slo-Blo	330-1000	2
----	Fuse Block, 2-Pole, Buss S-8202-02	415-0003	1
----	Phase Monitor Circuit Board, Single-Phase, High/Low Off	470-0351	3
----	Optically Coupled Relay Assembly	919-0096-001	1
----	Power Supply Distribution Circuit Board Assembly	919-0511	1
----	Temperature Sensor Circuit Board Assembly	919-0516-001	1
----	DC Filter Circuit Board Assembly	919-0519-001	12
----	Wiring Harness, Power Supply Assembly	949-0507-001	1
----	Fuse Holder, Dual, 3AB	415-0003	1

TABLE 6-55. POWER SUPPLY WIRE HARNESS ASSEMBLY, 380 VOLT WYE - 949-0507-001

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Pins, Connector	417-0053	22
----	Connector Housing, 13-Pin In-Line	417-1300	1
----	Connector Housing, 5-Pin In-Line	417-1305	1
----	Plug, Housing, 4-Pin	418-0240	2
----	Connector Housing, 2-Pin, Female	418-0701	1
----	Plug, Connector Housing, 12-Pin	418-1271	1
----	Connector Housing, 3-Pin Amp Innergy 556879-3,	418-6879-003	5

TABLE 6-56. POWER SUPPLY ASSEMBLY, SINGLE PHASE - 959-0507-002
(Sheet 1 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
CB1	Circuit Breaker, 2-Pole, 480 Volt ac, 125 Amperes	341-0073	1
K1	Contactor, 125 Amperes, 220/240Vac, 50/60 Hz	341-0075	1
MOV1, MOV1A, MOV3, MOV3A MOV4, MOV4A	Metal-Oxide Varistor, B40K275, 275V, 1680 Joules	140-0021	6

TABLE 6-56. POWER SUPPLY ASSEMBLY, SINGLE PHASE - 959-0507-002
(Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
PS7	Power Supply, 80 Watt, Input: 90 to 264 Volts, 50/60 Hz, ac Ouput: +5 Volts dc @ 8A, ±12 Volts dc @ 2.5A, +24 Volts dc @ 2A	540-0015-012	1
TB1	Barrier Strip, 9 Terminal	412-0090	1
TB2	Terminal Block, Gould 63133	412-0050	1.33
TB4	Terminal Block, 4 Position, 2/0 to 12 AWG	412-0040	0.25
----	Fuse, MDA, 10A, 250V Slo-Blo	330-1000	2
----	Fuse Block, 2-Pole, Buss S-8202-02	415-0003	1
----	Phase Monitor Circuit Board, Single-Phase, High/Low Off	470-0351	1
----	Optically Coupled Relay Assembly	919-0096-001	1
----	Power Supply Distribution Circuit Board Assembly	919-0511	1
----	Temperature Sensor Circuit Board Assembly	919-0516-001	1
----	DC Filter Circuit Board Assembly	919-0519-001	12
----	Wiring Harness, Power Supply Assembly	949-0507-002	1
----	Fuse Holder, Dual, 3AB	415-0003	1

TABLE 6-57. POWER SUPPLY WIRE HARNESS ASSEMBLY, SINGLE PHASE - 949-0507-002

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Pins, Connector	417-0053	23
----	Connector Housing, 13-Pin In-Line	417-1300	1
----	Connector Housing, 5-Pin In-Line	417-1305	1
----	Plug, Housing, 4-Pin	418-0240	2
----	Connector Housing, 2-Pin, Female	418-0701	2
----	Plug, Connector Housing, 12-Pin	418-1271	1
----	Connector Housing, 3-Pin Amp Innergy 556879-3	418-6879-003	5

TABLE 6-58. KIT, SOFTWARE, FM-10S SUPERVISOR CIRCUIT BOARD, CPU - 979-0518

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Assembly, SmartCore With Flash	544-7220	1

SECTION VII
DRAWINGS

7-1. INTRODUCTION.

7-2. This section provides schematic and assembly diagrams as indexed below for the Broadcast Electronics FM-10S transmitter.

FIGURE	TITLE	NUMBER
7-1	OVERALL SCHEMATIC DIAGRAM, FM-10S TRANSMITTER 220V 50/60 HZ THREE PHASE OPERATION	SD909-1010-206
7-2	OVERALL SCHEMATIC DIAGRAM, FM-10S TRANSMITTER 380V 50/60 HZ THREE PHASE WYE OPERATION	SD909-1010-386
7-3	OVERALL SCHEMATIC DIAGRAM, FM-10S TRANSMITTER 220V 50/60 HZ SINGLE PHASE OPERATION	SD909-1010-226
7-4	OVERALL SCHEMATIC DIAGRAM, FMi 703 TRANSMITTER 220V 50/60 HZ THREE PHASE OPERATION	SD909-0703-206
7-5	OVERALL SCHEMATIC DIAGRAM, FMi 703 TRANSMITTER 380v 50/60 HZ THREE PHASE WYE OPERATION	SD909-0703-386
7-6	OVERALL SCHEMATIC DIAGRAM, FMi 703 TRANSMITTER 220V 50/60 HZ SINGLE PHASE OPERATION	SD909-703-226
7-7	ASSEMBLY DIAGRAM, DC FILTER CIRCUIT BOARD	AB919-0519/-001
7-8	SCHEMATIC DIAGRAM, COMBINER INPUT CIRCUIT BOARD	SB919-0502
7-9	ASSEMBLY DIAGRAM, COMBINER INPUT CIRCUIT BOARD	AC919-0502-001/ -002
7-10	SCHEMATIC DIAGRAM, MOTHERBOARD AND IPA SPLITTER	SB919-0504
7-11	ASSEMBLY DIAGRAM, MOTHERBOARD AND IPA SPLITTER	AD919-0504
7-12	ASSEMBLY DIAGRAM, MOTHERBOARD RF INPUT	AB919-0506
7-13	SCHEMATIC DIAGRAM, MOTHERBOARD DC CONNECTOR	SB919-0510-001
7-14	ASSEMBLY DIAGRAM, MOTHERBOARD DC CONNECTOR	AB919-0510-001
7-15	SCHEMATIC DIAGRAM, POWER SUPPLY DISTRIBUTION CIRCUIT BOARD	SB919-0511
7-16	ASSEMBLY DIAGRAM, POWER SUPPLY DISTRIBUTION CIRCUIT BOARD	AC919-0511
7-17	SCHEMATIC DIAGRAM, MODULE CONTROL CIRCUIT BOARD	SB919-0515
7-18	ASSEMBLY DIAGRAM, MODULE CONTROL CIRCUIT BOARD	AC919-0515
7-19	SCHEMATIC DIAGRAM, TEMPERATURE SENSOR CIRCUIT BOARD	SB919-0516/-001 -002
7-20	ASSEMBLY DIAGRAM, TEMPERATURE SENSOR CIRCUIT BOARD	AC919-0516/-001 -002
7-11	SCHEMATIC DIAGRAM, FRONT PANEL CIRCUIT BOARD	SB919-0530
7-22	ASSEMBLY DIAGRAM, FRONT PANEL CIRCUIT BOARD	AC919-0530

FIGURE	TITLE	NUMBER
7-23	SCHEMATIC DIAGRAM, SUPERVISOR CIRCUIT BOARD	SB919-0531
7-24	ASSEMBLY DIAGRAM, SUPERVISOR CIRCUIT BOARD	AC919-0531
7-25	SCHEMATIC DIAGRAM, REMOTE INTERFACE CIRCUIT BOARD	SB919-0528
7-26	ASSEMBLY DIAGRAM, REMOTE INTERFACE CIRCUIT BOARD	AC919-0528
7-27	SCHEMATIC DIAGRAM, RF AMPLIFIER CIRCUIT BOARD	SC919-0505-012
7-28	ASSEMBLY DIAGRAM, RF AMPLIFIER CIRCUIT BOARD	AB919-0505-012
7-29	SCHEMATIC DIAGRAM, RF AMPLIFIER COMBINER CIRCUIT BOARD	SB919-0508
7-30	ASSEMBLY DIAGRAM, RF AMPLIFIER COMBINER CIRCUIT BOARD	AC919-0508
7-31	SCHEMATIC DIAGRAM, RF AMPLIFIER INTERFACE CIRCUIT BOARD	SB919-0514-002
7-32	ASSEMBLY DIAGRAM, RF AMPLIFIER INTERFACE CIRCUIT BOARD	AC919-0514-002
7-33	SCHEMATIC DIAGRAM, I/O CIRCUIT BOARD	SB919-0527
7-34	ASSEMBLY DIAGRAM, I/O CIRCUIT BOARD	AC919-0527
7-35	SCHEMATIC DIAGRAM, RF AMPLIFIER DIRECTIONAL COUPLER CIRCUIT BOARD	SB919-0529
7-36	ASSEMBLY DIAGRAM, RF AMPLIFIER DIRECTIONAL COUPLER CIRCUIT BOARD	AB919-0529/-001
7-37	ASSEMBLY DIAGRAM, RF AMPLIFIER	AB959-0505/-001 -002
7-38	SCHEMATIC DIAGRAM, LOW-PASS FILTER	SB959-0414/-001 -002
7-39	ASSEMBLY DIAGRAM, LOW-PASS FILTER CIRCUIT BOARD	AC919-0421/-001 -002
7-40	SCHEMATIC DIAGRAM, OPTICALLY-COUPLED-RELAY (OCR) CIRCUIT BOARD	SB919-0096/-001
7-41	ASSEMBLY DIAGRAM, OPTICALLY-COUPLED-RELAY (OCR) CIRCUIT BOARD	AB919-0096/-001