OWNERS MANUAL/
MAINTENANCE MANUAL
***DIGIT*™ FM EXCITER**
994 9410 001
988-2333-001

T.M. No. 888-2333-001

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Returns And Exchanges

Damaged or undamaged equipment should not be returned unless written approval and a Return Authorization is received from HARRIS CORPORATION, Broadcast Systems Division. Special shipping instructions and coding will be provided to assure proper handling. Complete details regarding circumstances and reasons for return are to be included in the request for return. Custom equipment or special order equipment is not returnable. In those instances where return or exchange of equipment is at the request of the customer, or convenience of the customer, a restocking fee will be charged. All returns will be sent freight prepaid and properly insured by the customer. When communicating with HARRIS CORPORATION, Broadcast Systems Division, specify the HARRIS Order Number or Invoice Number.

Unpacking

Carefully unpack the equipment and preform a visual inspection to determine that no apparent damage was incurred during shipment. Retain the shipping materials until it has been determined that all received equipment is not damaged. Locate and retain all PACKING CHECK LISTs. Use the PACKING CHECK LIST to help locate and identify any components or assemblies which are removed for shipping and must be reinstalled. Also remove any shipping supports, straps, and packing materials prior to initial turn on.

Technical Assistance

HARRIS Technical and Troubleshooting assistance is available from HARRIS Field Service during normal business hours (8:00 AM - 5:00 PM Central Time). Emergency service is available 24 hours a day. Telephone 217/222-8200 to contact the Field Service Department or address correspondence to Field Service Department, HARRIS CORPORATION, Broadcast Systems Division, P.O. Box 4290, Quincy, Illinois 62305-4290, USA. Technical Support by e-mail: *tsupport@harris.com*. The HARRIS factory may also be contacted through a FAX facility (217/221-7096).

Replaceable Parts Service

Replacement parts are available 24 hours a day, seven days a week from the HARRIS Service Parts Department. Telephone 217/222-8200 to contact the service parts department or address correspondence to Service Parts Department, HARRIS CORPORATION, Broadcast Systems Division, P.O. Box 4290, Quincy, Illinois 62305-4290, USA. The HARRIS factory may also be contacted through a FAX facility (217/221-7096).

NOTE

The # symbol used in the parts list means used with (e.g. #C001 = used with C001).

MANUAL REVISION HISTORY DIGIT™ 888-2333-XXX			
Rev.	ECN	Date	Pages Changed
001-A	TBD	03-17-95	Title Page and page 2-4 Added MRH-1/MRH-2
001-B	39911	05-08-95	Title Page, MRH-1/MRH-2 and pages 7-1 & 7-2
001-C	39900	05-09-95	Title Page, MRH-1/MRH-2 and pages 7-4 to 7-6
001-D	39948	06-23-95	Title Page, MRH-1/MRH-2 and pages 7-4 to 7-6
001-E	40104	09-19-95	Title Page, MRH-1/MRH-2 and pages 7-4 to 7-6
001-F	41546	10-09-96	Title Page, MRH-1/MRH-2 and page 2-3

WARNING

THE CURRENTS AND VOLTAGES IN THIS EQUIPMENT ARE DANGEROUS. PERSONNEL MUST AT ALL TIMES OBSERVE SAFETY WARNINGS, INSTRUCTIONS AND REGULATIONS.

This manual is intended as a general guide for trained and qualified personnel who are aware of the dangers inherent in handling potentially hazardous electrical/electronic circuits. It is not intended to contain a complete statement of all safety precautions which should be observed by personnel in using this or other electronic equipment.

The installation, operation, maintenance and service of this equipment involves risks both to personnel and equipment, and must be performed only by qualified personnel exercising due care. HARRIS CORPORATION shall not be responsible for injury or damage resulting from improper procedures or from the use of improperly trained or inexperienced personnel performing such tasks.

During installation and operation of this equipment, local building codes and fire protection standards must be observed. The following National Fire Protection Association (NFPA) standards are recommended as reference:

- Automatic Fire Detectors, No. 72E
- Installation, Maintenance, and Use of Portable Fire Extinguishers, No. 10
- Halogenated Fire Extinguishing Agent Systems, No. 12A

WARNING

ALWAYS DISCONNECT POWER BEFORE OPENING COVERS, DOORS, ENCLOSURES, GATES, PANELS OR SHIELDS. ALWAYS USE GROUNDING STICKS AND SHORT OUT HIGH VOLTAGE POINTS BEFORE SERVICING. NEVER MAKE INTERNAL ADJUSTMENTS, PERFORM MAINTENANCE OR SERVICE WHEN ALONE OR WHEN FATIGUED.

Do not remove, short-circuit or tamper with interlock switches on access covers, doors, enclosures, gates, panels or shields. Keep away from live circuits, know your equipment and don’t take chances.

WARNING

IN CASE OF EMERGENCY ENSURE THAT POWER HAS BEEN DISCONNECTED.

WARNING

IF OIL FILLED OR ELECTROLYTIC CAPACITORS ARE UTILIZED IN YOUR EQUIPMENT, AND IF A LEAK OR BULGE IS APPARENT ON THE CAPACITOR CASE WHEN THE UNIT IS OPENED FOR SERVICE OR MAINTENANCE, ALLOW THE UNIT TO COOL DOWN BEFORE ATTEMPTING TO REMOVE THE DEFECTIVE CAPACITOR. DO NOT ATTEMPT TO SERVICE A DEFECTIVE CAPACITOR WHILE IT IS HOT DUE TO THE POSSIBILITY OF A CASE RUPTURE AND SUBSEQUENT INJURY.

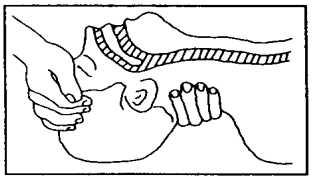
TREATMENT OF ELECTRICAL SHOCK

1. IF VICTIM IS NOT RESPONSIVE FOLLOW THE A-B-CS OF BASIC LIFE SUPPORT.

PLACE VICTIM FLAT ON HIS BACK ON A HARD SURFACE

(A) AIRWAY

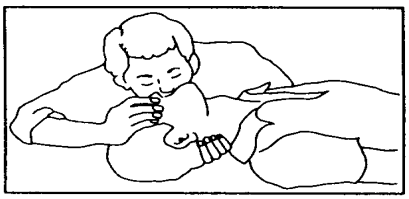
IF UNCONSCIOUS,
OPEN AIRWAY



LIFT UP NECK
PUSH FOREHEAD BACK
CLEAR OUT MOUTH IF NECESSARY
OBSERVE FOR BREATHING

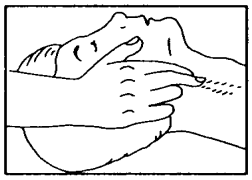
(B) BREATHING

IF NOT BREATHING,
BEGIN ARTIFICIAL BREATHING



TILT HEAD
PINCH NOSTRILS
MAKE AIRTIGHT SEAL
4 QUICK FULL BREATHS
REMEMBER MOUTH TO MOUTH
RESUSCITATION MUST BE
COMMENCED AS SOON AS POSSIBLE

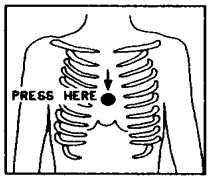
CHECK
CAROTID PULSE



IF PULSE ABSENT,
BEGIN ARTIFICIAL
CIRCULATION

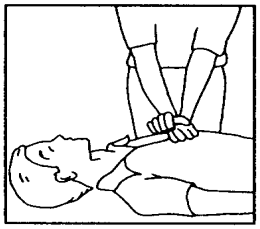
(C) CIRCULATION

DEPRESS STERNUM 1 1/2 TO 2 INCHES



APPROX. RATE OF COMPRESSIONS --80 PER MINUTE
- ONE RESCUER
- 15 COMPRESSIONS
- 2 QUICK BREATHS

APPROX. RATE OF COMPRESSIONS --60 PER MINUTE
- TWO RESCUERS
- 5 COMPRESSIONS
- 1 BREATH



NOTE: DO NOT INTERRUPT RHYTHM OF COMPRESSIONS
WHEN SECOND PERSON IS GIVING BREATH

CALL FOR MEDICAL ASSISTANCE AS SOON AS POSSIBLE.

2. IF VICTIM IS RESPONSIVE.

A. KEEP THEM WARM
B. KEEP THEM AS QUIET AS POSSIBLE
C. LOOSEN THEIR CLOTHING
D. A RECLINING POSITION IS RECOMMENDED

FIRST-AID

Personnel engaged in the installation, operation, maintenance or servicing of this equipment are urged to become familiar with first-aid theory and practices. The following information is not intended to be complete first-aid procedures, it is a brief and is only to be used as a reference. It is the duty of all personnel using the equipment to be prepared to give adequate Emergency First Aid and thereby prevent avoidable loss of life.

Treatment of Electrical Burns

1. Extensive burned and broken skin
   a. Cover area with clean sheet or cloth. (Cleanest available cloth article.)
   b. Do not break blisters, remove tissue, remove adhered particles of clothing, or apply any salve or ointment.
   c. Treat victim for shock as required.
   d. Arrange transportation to a hospital as quickly as possible.
   e. If arms or legs are affected keep them elevated.

NOTE

If medical help will not be available within an hour and the victim is conscious and not vomiting, give him a weak solution of salt and soda: 1 level teaspoonful of salt and 1/2 level teaspoonful of baking soda to each quart of water (neither hot or cold). Allow victim to sip slowly about 4 ounces (a half of glass) over a period of 15 minutes. Discontinue fluid if vomiting occurs. (Do not give alcohol.)

2. Less severe burns - (1st & 2nd degree)
   a. Apply cool (not ice cold) compresses using the cleanest available cloth article.
   b. Do not break blisters, remove tissue, remove adhered particles of clothing, or apply salve or ointment.
   c. Apply clean dry dressing if necessary.
   d. Treat victim for shock as required.
   e. Arrange transportation to a hospital as quickly as possible.
   f. If arms or legs are affected keep them elevated.

REFERENCE:

ILLINOIS HEART ASSOCIATION

AMERICAN RED CROSS STANDARD FIRST AID AND PERSONAL SAFETY MANUAL (SECOND EDITION)

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WARNING: Disconnect primary power prior to servicing.

Section VII
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ADDITIONAL INFORMATION SUPPLIED AT END OF MANUAL

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MAINTAINING A 100% DIGITAL PATH FROM THE STUDIO TO THE “ON AIR” SIGNAL

PRE-EMPHASIS AND FM LIMITING CONSIDERATIONS FOR AUDIO PROCESSORS AND DIGI-

WARNING: Disconnect primary power prior to servicing.

1.1 Introduction

This technical manual contains the information needed to install, operate and maintain the DIGIT™, Digital FM Exciter. This highly-reliable product will require little adjustment or attention. DIGIT™ is backed by an unprecedented 3 year warranty exchange program. Exchange or replacement modules are available through Harris-Allied Broadcast Products if any component ever fails.

1.2 Equipment Purpose

DIGIT™ is a high-performance FM exciter, utilizing modern digital component technology and innovative design techniques to produce an FM signal of exceptional quality and reliability. The DIGIT™, Digital Exciter inputs a digital composite stereo signal and generates an on carrier FM signal at power levels up to 55 watts. The FM modulation process is fully digital and is extremely stable. DIGIT™ is also frequency agile and can be used in N+1 configurations. DIGIT™ can be supplied in new transmitting equipment or may be purchased as an upgrade for nearly any FM transmitter. The exciter's small size, 55 watt output capability and versatile interfacing make it an ideal choice for installation to replace an older exciter in most existing FM transmitters.

DIGIT™ is also FCC Type-Notified for use as a low-power or emergency backup transmitter when it is used with the Stand-Alone Transmitter Option, Harris Part #994-9506-001. (The option includes the required Low-Pass Filter).

1.2.1 Input Interface Modules

Either of the following two input modules may be installed at the exciter input, depending on the type of input signal to be used

1.2.1.1 The Digital Stereo Generator Module

This is considered the standard interface for the exciter. It can also be used as an upgrade or replacement for the optional Analog I/O Module. It allows the Harris DIGIT™ exciter to accept a 24 bit AES/EBU compatible digital stereo audio signal input, along with two analog SCA inputs and one RBDS (Radio Broadcast Data Signal) input. It includes a DSP based stereo generator that will provide the exciter with a "CD" quality digital composite signal. All stereo encoding functions are implemented in the digital domain. This gives the broadcaster the advantage of a completely digital link from the studio source to the transmitter for the first time. The unit has level adjustments for all inputs as well as user adjustable composite limiting. The module can also be operated in the analog backup mode which allows the use of an analog composite audio input in the case of a loss of the digital audio signal, and the module can be used in either the stereo or mono mode of operation.

1.2.1.2 The Analog I/O Module

The purpose of the Analog I/O Module is to allow analog inputs to the digital exciter. This is done by converting the standard analog inputs into a digital format compatible with the digital exciter. This module provides input connections for conventional Monaural and/or Composite (balanced or unbalanced) audio inputs and 3 SCA signals. The unit then converts the combined inputs into the 16-Bit digital input required by the DIGIT™ exciter. The assembly is removable allowing the module to be replaced by the Digital Stereo Generator Module, quickly and easily.

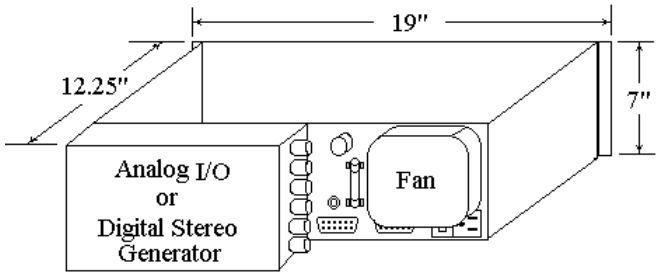


Figure 1-1. DIGIT™ Exciter Mechanical Dimensions

1.2.2 Available Options

- Stand Alone Transmitter Kit - Part #994-9506-001 - This includes the Harmonic Filter/RF Sample necessary to use the exciter as a stand alone transmitter.
- Remote Cable Adapter Kit - Part #992-8941-001 - This includes a prewired 5 ft. cable with D connectors on both ends and a terminal strip with a D connector on the back. This kit can be used to facilitate remote interfacing with non-Harris transmitters.
- Remote Frequency Control Kit - Part #994-9478-001 - For N+1 applications only.

There are also various Spare Parts Kits and Mounting Kits available as shown on the Digital FM Exciter Family Tree, DWG #843-5295-022.

1.3 Physical Description

DIGIT™ is supplied in a fully-enclosed case, which may be used as a free-standing enclosure or mounted in a standard 19 inch rack, 7 inches (4 Rack Units) high, see Figure 1-1. A rack mount kit assembly is included with the exciter. Optional rack mount kits are also available to allow installation of DIGIT™ into existing Harris HT or PT Series FM transmitters. A complete listing of the available rack mount kits, and Harris part numbers, can be found on the Digital FM Exciter Family Tree, drawing #843-5295-022.

All connections are made at the rear and consist of:

- AC Power Input (110, 120, 220 or 240 Volt, 50 or 60 Hz)
- Digital Input, J1 (Includes the necessary voltages and interconnects for the Digital Stereo Generator Module or the Analog I/O Module).
- RF Output (50 ohm BNC)

WARNING: Disconnect primary power prior to servicing.

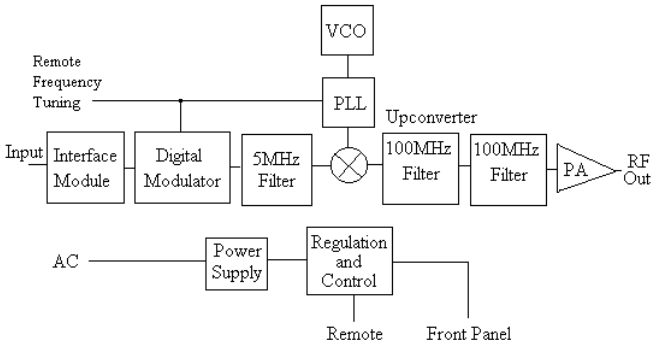


Figure 1-2. DIGIT™ Exciter System Block Diagram

- Remote Control and Status, J2 (15-pin "D" connector, with isolation filter)
- Remote Frequency Tuning Input J3, an optional 25-pin "D" connector with isolation filter. (If this option is not included, J3 is omitted.)
- All audio and SCA inputs will connect to either the Digital Stereo Generator Module or the Analog I/O Module which is plugged into the Digital Input J1, on the back panel of the exciter.

1.4 Functional Description

For the following discussion, refer to Figure 1-2.

1.4.1 Input Options

Input to the exciter is through J1 - Data Input, on the Digital Modulator Board, which is accessed through the back panel of the exciter. Either the Digital Stereo Generator or the Analog I/O Module will be mounted on the rear of the exciter (See Available Options earlier in this section). The purpose of these modules is to convert the digital or analog input signals (depending on which one you have) into the 16 bit parallel data used by DIGIT™. The data input J1 also provides power and timing connections for the Digital Stereo Generator or the Analog I/O Module.

1.4.2 Digital Modulation Process

DIGIT™ uses a fully-digital modulation process to convert the digital input (from the input module) to a digital FM carrier, at approximately 5.6MHz. This is then filtered, and up-converted to the desired carrier frequency. The on-channel signal is filtered, then amplified by the 55 watt output PA before being supplied to the BNC output connector on the back of the exciter.

1.4.2.1 Frequency Selection

Both the up-converter local oscillator frequency (from the PLL and VCO) and the digital modulator frequency are digitally controlled, with a minimum frequency increment of 50 Hz. Thus, there is no field tuning or factory pre-tuning required for this exciter. Setting to the desired FM channel or changing the channel is accomplished by setting DIP switches. For More information on setting frequency, refer to Section V, Maintenance and Alignment, under the heading "Channel Setting and Frequency Adjustment", and to the frequency chart at the end of that Section.

It should also be noted that while the PLL and VCO functions used in the DIGIT™ exciter are also used in conventional analog exciters, the important distinction of DIGIT™ is that the program modulation is NOT applied to this loop. Program is applied to the Digital Modulator only. Therefore low frequency audio does not affect the PLL circuitry in DIGIT™, and all associated low frequency distortion effects are eliminated.

1.4.2.2 N+1, Frequency Agile Configuration

Digital frequency control is also extended to J3, an optional Remote Frequency Tuning Input, on the rear of the exciter, permitting the use of DIGIT™ in "N+1" mode, in which a single exciter or transmitter may be used as back up for several transmitters, moving to the required frequency as it is switched on-line to substitute for a failed transmitter.

1.4.3 Controls and Indicators

The front panel includes the power output controls, and a digital metering display which can select forward power (FWD PWR), reflected power (RFL PWR), PA AMPS or PA VOLTS. The panel also includes an LED bargraph style modulation meter and four status alarm indicators. The exciter also has a rear panel Remote Connector which includes the following:

- Remote metering signals
- Remote status indicator drives
- Remote interlock signals and remote muting
- RF level control lines

1.5 Explanation of Terms

Each board in the exciter has an assembly number, such as A1, or A10 etc.. These numbers will be referred to in many places in the manual. The following is a complete listing of the boards in the exciter and their assembly numbers (this information can also be found in the exciter drawing package on drawing number, 843-5295-022, Digital FM Exciter Family Tree):

- A1 - RF PA Module
- A2 - Regulator Board
- A3 - Digital Modulator Board
- A4 - Upconverter Board
- A5 - Analog I/O Module or the Digital Stereo Generator Module (depending on which module is installed on your unit).
- A6 - VCO Module
- A7 - PLL Board
- A8 - 5 MHz Filter Board
- A9 - 100 MHz Filter Board

1.6 Performance Specifications

NOTE

Specifications subject to change without notice.

WARNING: Disconnect primary power prior to servicing.

See Sales Brochure at beginning of manual for listing of the Performance Specifications for DIGIT™.

2.1 Unpacking

Carefully unpack the exciter and perform a visual inspection to determine that no apparent damage was incurred during shipping Retain all shipping materials until it has been determined that the unit is not damaged.

The contents of the shipment should be as indicated on the packing list. If the contents are incomplete or if the unit is damaged mechanically, or electrically, notify the carrier and Harris Allied Broadcast (217) 222-8200.

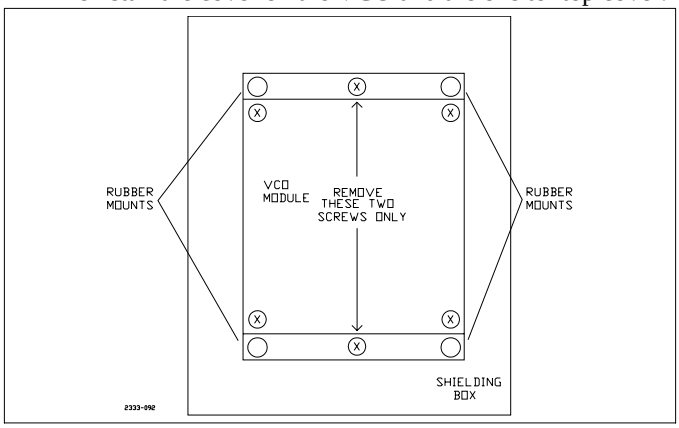
All packing materials must be removed from the equipment before installation. For general domestic shipment of DIGIT™, no parts are removed before shipment. If for some special reason parts are removed, then all removed components are marked to permit easy reinstallation.

Symbol numbers and descriptions are provided on each removed component corresponding to the schematic diagram, parts list, packing list and reference designator or nomenclature stenciled at the cabinet location of each removed item. Cables and small parts may be taped or tied in place for shipment. Remove all tape, string and packing materials used for this purpose.

2.1.1 Removal of VCO Shipping Screws

The VCO is mounted on rubber grommets to provide mechanical isolation from vibration during operation. For shipment, two screws are installed on the outside of the VCO box to hold the VCO in place. These must be removed prior to installation. The hardware on these screws is captive but the screws are not, and therefore must be removed completely from the exciter. See the drawing below.

- Remove the screws holding the top cover of the exciter. The top cover of the exciter is hinged on the left side of the exciter (looking from the front).
- Remove the lid covering the VCO assembly by simply lifting it up.
- Remove the two screws indicated in the figure below.
- Reinstall the cover on the VCO and the exciter top cover.



Top View of VCO with Cover Removed

2.2 Introduction

DIGIT™ is a digitally-modulated FM broadcast transmitter exciter, operating in the 87 to 108MHz band, with a guaranteed output power capability of 55 watts. The exciter can be operated with the Digital Stereo Generator Module, allowing full digital processing of the program signal or the optional Analog I/O Module can be used in place of the Digital Stereo Generator Module allowing the use of standard analog audio input connections (Mono or Stereo and SCA's). In either configuration, modulation is done in the digital domain. DIGIT™ measures 19" wide, 7" high and 12.5" deep and may be installed directly in most modern FM transmitters. Interface to the host transmitter should not be a difficult task.

2.3 Physical Mounting

A front-panel area 7" (4 Rack Units) high by 19" wide is required for DIGIT™. A convenient rackmount kit with extender rails is provided. Rack mount kits are also available to allow installation of DIGIT™ into existing Harris HT or PT Series FM transmitters. A complete listing of the available rack mount kits, and Harris part numbers, can be found on the Digital FM Exciter Family Tree, drawing #843-5295-022.

2.4 Cooling Airflow

The rear-mounted cooling fan for DIGIT™ draws cooling air into the left side of the rear panel, and the heated air is exhausted from the right-hand side of the exciter. The space chosen to mount DIGIT™ should provide for this airflow.

2.5 Installation

All connections are made to the rear of the exciter. The space behind the exciter should be deep enough to permit all cable connections to retract into the transmitter or cabinet as the exciter is slid in, and to extend smoothly as the exciter is slid out on its extender rails.

2.5.1 Power

DIGIT™ will operate with an AC power source which is 50 Hz or 60 Hz, and at a variety of voltages ranging from 90V to 132V, or from 198V to 264V. Before applying power to DIGIT™ for the first time, check the indicator window next to the power input connector on the rear of the exciter to make sure the power input is set to your supply voltage. The settings are:

- 100Vac (For 90 to 110 Vac service)
- 120Vac (For 108 to 132 Vac service)
- 220Vac (For 198 to 242 Vac service)

WARNING: Disconnect primary power prior to servicing.

- 240Vac (For 216 to 264 Vac service)

If you need to change the equipment to a different line voltage setting, remove the power cord from the power input connector and open the cover over the voltage indicator using a small screwdriver or similar tool. Rotate the cylinder inside so that the desired voltage shows in the window. If you are changing from a 220/240 Vac to a 100/120 Vac range, you should also change the fuse.

Only one fuse is used in DIGIT™. It is located in the upper fuse holder beneath the cover. The correct values are:

- 220/240Vac: Use 2 Ampere SlowBlow
- 100/120Vac: Use 4 Ampere SlowBlow

Both fuse values are supplied with the exciter. The value not installed in the fuseholder is mounted to a clip on the rear of the case.

NOTE:

Some 220/240 Vac users require both conductors of the power lead to be fused. The lower fuse-holder in the power input connector is not used, but can be equipped with a second 2 Ampere Slowblow fuse, and the second conductor may be routed through this fuse.

When the line voltage setting and the fuse value have been correctly selected for your service, close the cover and reinsert the power cord.

2.5.2 Digital Stereo Generator Module (A5)

The Digital Stereo Generator Module requires an AES/EBU compatible digital stereo audio signal, with the option of two SCA and a RBDS (Radio Broadcast Data System) input. The module attaches to the right rear panel of the exciter. All inputs are on the side of the interface module next to the fan.

2.5.2.1 Program, SCA and RBDS Inputs

The program and SCA inputs to DIGIT™ will connect to the Digital Stereo Generator Module, mounted on the right rear of the exciter cabinet. The digital audio input requires a male XLR connector while the SCA and RBDS input connections are BNC. The connections available are: (See Figure 2-1)

- J2 SCA1
- J3 SCA2 (Also serves as Analog Backup Input)
- J4 RBDS Input
- J9 AES/EBU Digital Input

2.5.2.2 Digital Audio Input Connector, J9

J9, XLR pinout is as follows: (refer to sheet 1, Digital Stereo Generator Schematic)

J9-1 - Ground
J9-2 - (+)
J9-3 - (-)
J9-4 - Ground

2.5.2.3 I/O and Remote Control, J7

Some of the inputs on this connector are in parallel with the S1 dip switches shown in Figure 2-1. If this connector is used, the corresponding sections of dipswitch S1 should be placed in the open or "OFF" position (this is the way the unit is shipped). The pre-emphasis switches, S1-2 and S1-3 are not affected by connector J7.

- J7-1 - Supplies +5Vdc for pull up use.
- J7-9 - Ground

Status Output

- J7-3 - This is a PLL Unlock status output. Any unlock conditions or any AES/EBU communication faults bring this output high, or +5V. For example, a disconnected AES/EBU cable will activate this fault.

Control Inputs

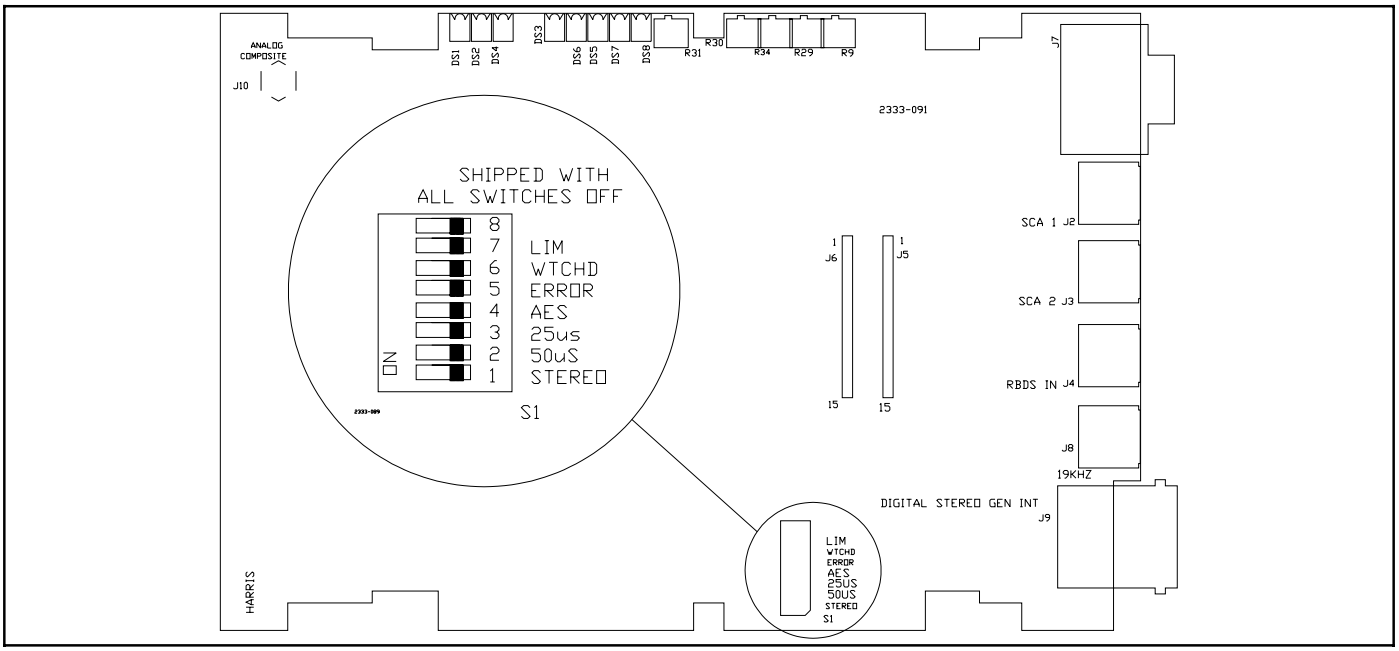


Figure 2-1. Digital Stereo Generator Component Locator

WARNING: Disconnect primary power prior to servicing.

- J7-2 - A high on this input will place the unit in stereo mode. A low will place the unit in mono mode.
- J7-4 - A high on this input will select the digital audio input at J9. A low will select the Analog backup input at J3, which is normally the SCA2 input. This does not automatically switch the SCA2 input to a backup analog signal. The normal SCA2 input must be removed from J3 and an appropriate analog composite signal connected. To make the analog backup function completely remote controlled, an external analog sorce switch, such as a coaxial relay, will need to be used to switch from the normal SCA2 subcarrier signal to the backup analog composite signal. The external analog source switch should be made to activate after or at the same time as the switching signal to J7-4. The analog source switch should not be activated before the interface module is switched to the backup mode.
- J7-5 - A high selects internal control of limiting level, via LIMIT pot on top of the module. A low selects the use of an external limit level input voltage at J7-6, to control the limiting level instead of the internal control pot.
- J7-6 - Can be used to input a voltage which will control the amount of composite limiting. The voltage on this input will only be used to control limiting when J7-5 is pulled low. The input range of this voltage is 0 to +5V, and should never exceed the +5V level. A higher voltage means more limiting.
- J7-8 - A high selects limiting to be displayed on the LED meter on top of the module. A low selects percent deviation to be displayed on the LED meter on top of the module.

Note

A high can be either a +5V input or high impedance for all J7 inputs.

For more information on the these controls refer to Section IV, Theory of Operation.

2.5.2.4 Pre-emphasis Selection

The exciter may be operated at flat response, or with 25, 50 or 75us pre-emphasis on the AES/EBU input. Two sections of S1, located inside the interface module, are used to make the selection per Table 2-1. For switch location refer to Figure 2-1.

S1-2	S1-3	Pre-emphasis
off	off	No pre-emphasis
off	on	25us pre-emphasis
on	off	50us pre-emphasis
on	on	75us pre-emphasis

Table 2-1. Pre-Emphasis Switch Selection for Digital Stereo Generator Module

2.5.3 Digital Stereo Generator Module Alignment Procedure

2.5.3.1 Select Operational Mode (Dip Switch settings)

The factory setting for the Digital Stereo Generator Module is the following:

Stereo mode selected
AES/EBU input mode selected
No Pre-emphasis

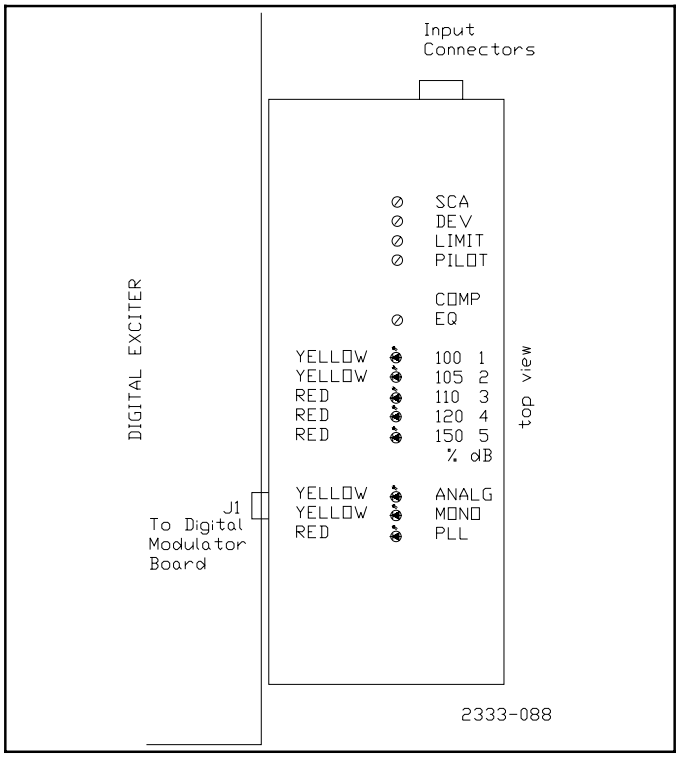


Figure 2-2. Digital Stereo Generator Module Adjustments and LED Locations

2.5.3.1.1 Mono Mode

If the exciter is going to be used in Mono Mode, then it is recommended that the remote connector J7 be used to put the exciter in the Mono Mode of operation. Mono mode is selected by grounding J7-2.

2.5.3.1.2 Analog Backup Mode

The module also has a backup or emergency analog composite input mode. If the digital signal link is interrupted for some reason, maybe the loss of the digital STL link, the module may be placed in the analog backup mode either locally, with a dip switch setting inside the module, or remotely via J7, on the side of the module. An analog composite signal may then be input in place of the SCA2 signal. Broadcasters who do not yet have a full digital link to the transmitter site can use the exciter in this mode indefinetly, or until such time as they can upgrade their system from analog to digital.

NOTE: SCA inputs can still be used in this mode but must be reduced in amplitude by 16dB due to the increased gain required to accommodate the analog composite input.

More information is given in Section 4, Theory of operation, and an emergency change over procedure is included in Section III, under Emergency Operating Procedure.

It is recommended that the remote connector J7 be used to select the Analog Backup Mode of operation (if so desired). Analog Backup mode is selected by grounding J7-4.

WARNING: Disconnect primary power prior to servicing.

2.5.3.1.3 Pre-Emphasis and Permanent Mode Selection

If the pre-emphasis setting needs modification or a permanent switch setting is desired for the MONO or ANALOG backup mode then do the following:

- Disconnect power from the exciter and all connections from the Digital Stereo Generator Module.
- Remove the four large mounting screws holding the Digital Stereo Generator Module to the back of the DIGIT™ exciter.
- Remove the module from the exciter by gently pulling the module straight out from the back of the exciter.
- Position the stereo generator so that the connector pins are facing up.
- With a small screw-driver, unscrew the four screws recessed in the black modular box. Gently separate the modular box by removing the top half from the bottom half.
- Identify the 8 position dip switch S1 on the PC board, as shown in Figure 2-1.
- Position the S1-2 and S1-3 dip switches for the desired pre-emphasis using Table 2-1.
- Position the mode switches, S1-1 and S1-4, for the desired operational mode, per Table 2-2.

Switch	Position	Mode
S1-1	OFF	Stereo
	ON	Mono
S1-4	OFF	AES/EBU Digital Audio Input
	ON	Analog Backup Mode

Table 2-2. Digital Stereo Generator Module Mode Selection

- Carefully replace the top cover on the box making sure all dividers are inserted properly.
- Screw the box together again using the four recessed screws.
- Check the connector pins to ensure there are no bent or crooked pins.
- Carefully mount the box onto the exciter using the four alignment pins as guides. Be careful during the initial mating of the connector pins.
- Secure the box onto the exciter using the four mounting bolts.
- Reconnect cables and re-apply power.

2.5.3.2 Setting SCA and Pilot levels

All SCA inputs are preset to accept a 1.5V peak-to-peak nominal input for 10% injection. The Pilot control is preset to provide 10% injection. All adjustments are on the top of the interface module and are clearly silkscreened. A drawing of the top of the module is shown in Figure 2-2. To verify that the SCA and Pilot levels are correct, or to change the SCA and/or Pilot levels do the following:

- Disconnect or turn off the AES/EBU input.
- Adjust the pilot pot all the way counter-clockwise (this sets the pilot level to 0).
- Apply the desired analog signal (1.5Vpp nominal) to either SCA1, SCA2, or the RBDS input.
- Adjust the SCA pot for the desired deviation as read on the exciter front panel modulation meter.
- Disconnect the SCA input.
- Adjust the Pilot level to the desired deviation as read on the exciter front panel modulation meter.
- Re-apply the SCA input signal and the AES/EBU input.

2.5.3.3 Setting the Output Deviation and Limiting Level

Refer to Figure 2-2 for the following adjustments. The output deviation is factory preset to 100% (assumes 10% pilot and no SCAs). The limiter is factory pre-set for 1dB of limiting, but this assumes a full scale AES/EBU input of 0dBFS (0dB Full Scale, HEX 7FFF). If your nominal digital input level is 0dBFS, then you need only to set the amount of composite limiting desired with the LIMIT level pot. The limiting can be set anywhere from no limiting to a maximum of 18dB. To verify these settings or to change them do the following (minimum input level is -10dBFS):

- Disconnect or turn off any SCA inputs.
- Apply a nominal AES/EBU input to the Digital Stereo Generator Module.
- Turn the LIMIT level pot fully CW.
- Adjust the DEV level pot until the desired output modulation reading on the exciter front panel modulation meter is obtained.

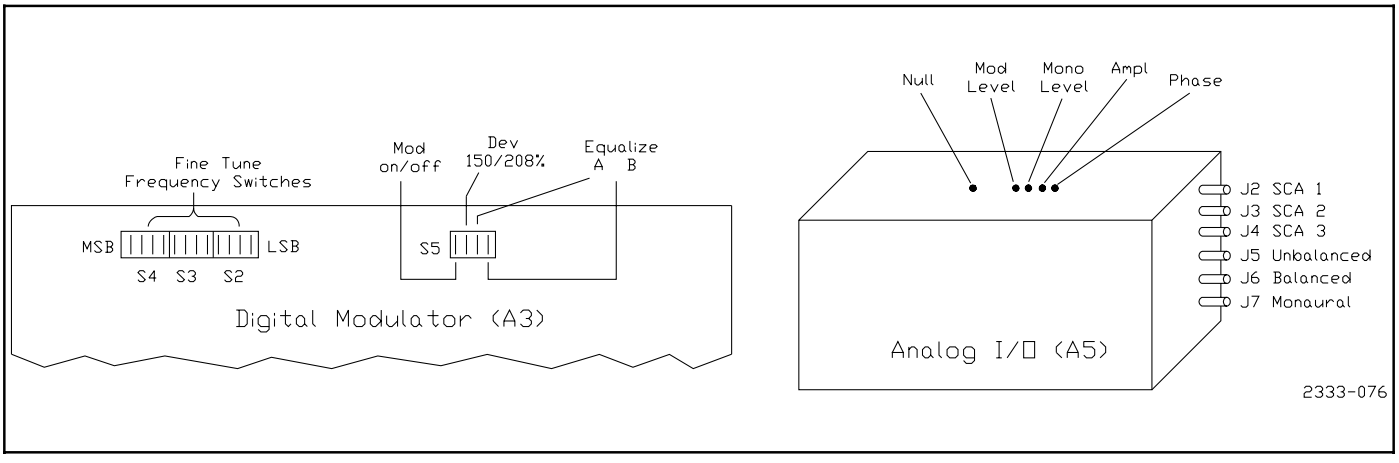


Figure 2-3. Analog I/O Module Inputs

WARNING: Disconnect primary power prior to servicing.

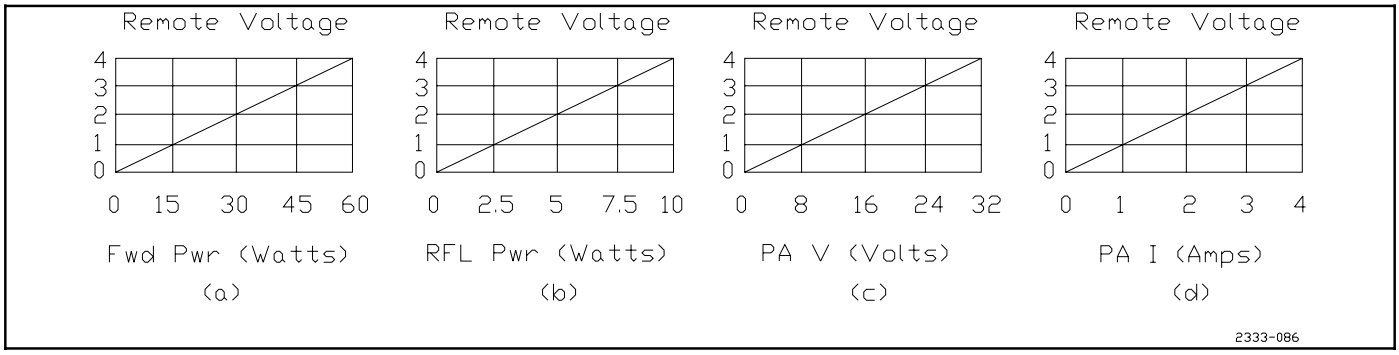


Figure 2-4. Remote Voltage Output Versus Fwd Pwr, RFL Pwr, PAV and PAI

- Re-adjust the LIMIT pot until the desired limit reading is obtained on the Stereo Generator Module LED display. The five LEDs represent 1dB, 2dB, 3dB, 4dB and 5dB of limiting. If the LIMIT pot is turned further CW, the amount of limiting can be increased up to 18dB (only the LED display is limited to 5dB).
- Use the DEV level pot and the exciter front panel modulation meter to fine tune the deviation if required.
- Re-apply any SCA input signals.

The Digital Stereo Generator Module is now aligned.

2.5.4 Analog I/O Module (A5)

In the analog input configuration, DIGIT™ has an Analog I/O module attached to the right rear of the enclosure and all analog inputs are on the edge of the interface.

2.5.4.1 Program and SCA inputs

The program and SCA inputs to DIGIT™ will connect to the Analog I/O Module, mounted on the right rear of the exciter cabinet. All input connections are BNC, located on the left side of the Analog I/O Module, between it and the cooling fan. The connections available are:

- J2 SCA1
- J3 SCA2
- J4 SCA3
- J5 Unbalanced Composite
- J6 Balanced Composite
- J7 Monaural Input

2.5.4.2 Input Specifications

- Monaural: +10 dBm, 600 ohms (75 kHz)
- Composite: 3.5 V P-P 10K ohms (75 kHz)
- SCA: 1.5 V P-P 10K ohms (7.5 kHz)

Note

There is no internal adjustment for the SCA input levels. Each SCA input is set to provide 7.5kHz deviation with a 1.5Vp-p input.

2.5.4.3 Pre-emphasis Jumper

The exciter may be operated at flat response, or with 25, 50 or 75us pre-emphasis in the Monaural channel. JP1 and JP2 are used to make the selection per Table 2-3. The unit is shipped with no pre-emphasis.

JP1	JP2	Pre-emphasis
off	off	No pre-emphasis
off	on	25us pre-emphasis
on	off	50us pre-emphasis
on	on	75us pre-emphasis

Table 2-3. Pre-Emphasis Jumper Selection for Analog I/O Module

2.5.4.4 Input Cables

All input connections to Analog I/O Module A5 are to BNC connectors along the edge of the module adjacent to the blower, see Figure 2-3.

Coaxial cables with BNC connectors may be used to connect to the unbalanced inputs. If right-angle BNC connectors are not available for the DIGIT™ end of the cables, right-angle BNC adapters may be used to connect the cables to the Analog I/O Module connectors. These may be obtained locally.

To connect to the balanced inputs (Monaural or Balanced Composite), a special cable must be constructed, with the outer shield isolated from the connector and terminated in a pigtail which connects to the ground stud nearby. These cables may be ordered ready-made in several standard lengths from Harris-Allied, with BNC connectors installed on both ends. Use the following part numbers when ordering:

922-0014-001 - 2.5 ft.
922-0014-002 - 5 ft.
922-0014-003 - 10 ft.
922-0014-004 - 15 ft.
922-0014-005 - 25 ft.
922-0014-006 - 40 ft.

2.5.4.5 Setting Modulation Level

The Balanced and Unbalanced Composite, and the SCA input levels are basically fixed (see Input Specifications above). The MOD LEVEL control should not be moved unless a different Composite and SCA input level is required, as the MOD LEVEL is an overall gain control which will change both at the same time. There is no separate gain control for the Composite and SCA inputs. If the Composite and SCA inputs are requiring other than the levels stated above in “Input Specifications”, then refer

WARNING: Disconnect primary power prior to servicing.

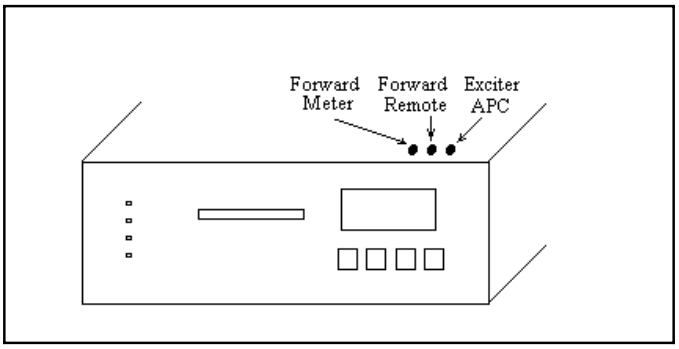


Figure 2-5. Exciter Front Panel & Forward Power Calibration & Adjustment Pot Position

to Section V, Maintenance and Alignment under the heading "Input Signal Level Calibration".

- Modulation level should be set by adjusting the input signal level to the Analog I/O Module until the desired modulation is obtained, NOT by adjusting the MOD LEVEL control as this will also affect SCA injection.

Note

If the SCAs have already been combined into the composite input, then the MOD LEVEL pot may be used to set deviation.

2.5.4.5.1 Setting Monaural Level

The Monaural audio input does have a separate gain control. It is factory set to give a 100% modulation reading with a nominal +10dBm input at 400Hz. Input adjustment is provided via R19 and allows inputs to range between -9.17dBm and 14.4dBm assuming the Modulation Level adjustment (R26) is set at the nominal setting of 0dB gain. Inputs above 14.4dBm are clipped.

- Input a nominal line level signal into the monaural input and adjust the MONO LEVEL pot, R19, for a 100% reading on the front panel modulation meter. If the MOD LEVEL control is changed, the monaural level will have to be re-adjusted.

2.5.5 Exciter RF Output

The RF output from the exciter is a BNC connector, J1, on the rear panel of the exciter. Connect J1 to the drive input of the system being driven by DIGIT™. The front panel buttons are used to set the power output of the exciter to the level required by the transmitter. For more information on how to set exciter output power level, refer to Section III, Operation. If an external power control (APC) will be used, refer to Section V, under the heading "Exciter APC."

2.5.6 Remote Metering and Control, J2

A 15-pin "D" REMOTE connector, J2, is located on the rear panel of the exciter. J2 contains remote metering signals, remote status indicator drives, remote interlock signals and remote muting and RF level control lines (APC).

There is an optional Remote Cable Adaptor Kit, Part# 992-8941-001, which can be used to facilitate remote interfacing, especially with non-Harris transmitters. It basically consists of a 5ft. cable and a breakout terminal strip.

The connections available at J2 are as follows:

- J2-1 Ground
- J2-2 Remote FWD PWR Meter Drive
- J2-3 Remote RFL PWR Meter Drive
- J2-4 Remote PAV Meter Drive
- J2-5 Remote PAI Meter Drive

The remote meter drives each provide outputs of 0 to +4 Volts which may be used to operate a remote metering device such as a remote control system, see Figure 2-4.

Remote FWD PWR Meter Drive Level Adjustment

The Remote FWD PWR Meter Drive level at J2-2 is adjustable via R55 on the Regulator Board. This adjustment is accessible from the top of the exciter on the front right hand corner. See Figure 2-5. With the exciter output power set to 50 Watts, connect the VOM to J2-2. Adjust R55, Forward Remote, as needed to produce 3.33 VDC at J2-2 (Maximum output is 4 VDC at 60 watts).

Note

To accommodate HT35 transmitter requirements, set the exciter output to 8.2 Watts. R55 should be adjusted to provide a 1.34 Volt output for normal HT35 operation.

- J2-6 Remote FAULT

Remote FAULT is an open collector output capable of sinking 100mA through a pull-up resistor connected to +5V. The FAULT signal is true if a PLL Unlock, Temperature Fault or VSWR Fault exists. The Fault True condition may be set to be either a HIGH or a LOW by setting JP3 on the Regulator board. 1-2 selects active LOW (the fault condition produces a LOW), and 1-3 selects active HIGH. The factory setting is active low, pins 1-2 (except for exciters installed in PT series transmitters which are required to have active high outputs).

- J2-7 Ground
- J2-8 Exciter APC

This is an input used to control exciter power remotely. 4V applied to this terminal should produce an exciter output of 60 watts. Output decreases linearly as the voltage at Pin 8 is lowered. The remote APC control feature is enabled by setting Regulator board jumper JP2 to 2-3. Setting the Jumper to 1-2 disables the remote power control.

APC Adjustment

This adjustment is required only if your transmitter or your system uses the exciter APC connection, J2-8, to control the exciter output power. This potentiometer adjusts the APC voltage when external power control is being used. The adjustment provides only attenuation and cannot increase the APC voltage. The APC voltage must be greater than 2.5V to achieve 50 Watts of output power. Adjustment is best performed at the system level.

The adjustment procedure is as follows:

Using the transmitter or a test power supply, connect to J2-8 the DC voltage which is to cause the exciter output to be 50 Watts. Adjust R6, Exciter APC, until the exciter output is 50 watts, as read on the front panel display. R6 is located on the front right corner of the exciter, see Figure 2-5.

- J2-9 RF MUTE

WARNING: Disconnect primary power prior to servicing.

MUTE is a TTL/CMOS compatible input which may be used to interrupt the exciter's RF output. JP1 on the Regulator board can be set to select whether MUTE takes place when Pin 9 is either HIGH or LOW. Connecting JP1, 1-2 causes a LOW on pin 9 to mute the exciter; connecting JP1, 2-3 causes a HIGH to mute the exciter. The factory setting is active low, pins 1-2 (except for exciters installed in PT series transmitters which are required to have active high outputs).

- J2-10 AFC INTERLOCK COMMON
- J2-11 AFC INTERLOCK NC
- J2-12 AFC INTERLOCK NO

Automatic Fault Control (AFC) Interlock turns off the exciter when an exciter fault occurs, and also switches relay K1 on the Regulator board. NC, Common, and NO connections from K1 are brought out to Pins 10, 11 and 12 to allow interfacing to external equipment. The relay contacts are capable of switching 0.25 Amperes at 100 Volts.

- J2-13 NOPGM

NOPGM is an open collector output capable of sinking 100mA through a pull-up resistor connected to +5V. A High (Open) at this pin indicates there is no digital modulation input to the exciter.

- J2-14 (Unused)
- J2-15 Ground

2.5.7 Remote Frequency Select, J3 (Optional)

DIGIT™ may be ordered with J3, an additional 25-Pin "D" connector, installed, allowing the exciter's frequency to be set remotely. This feature is used for "N+1, Frequency-Agile applications. The connections from J3 are routed to the Digital Modulator and the PLL boards and are connected in parallel with the frequency select DIP switches on those boards.

- Pins 1 through 12 of J3 select the Digital Modulator frequency using the same selection chart used for S2, S3 and S4 on the Digital Modulator. N0 (N-zero), the low-order bit, is Pin 1, and N11, the High-Order bit, is pin 12.
- Pins 16 through 25 of J3 select the LO frequency using the selection charts used for S1, S2 And S3 on the PLL board. M0, the Low-Order bit, is Pin 16, and M9, the High-Order bit, is Pin 25.
- The frequency selection chart is included at the end of Section V, Maintenance and Alignment.

If remote frequency select is to be used, a suitable remote select switch must be connected to J3, and the internal select switches (S2, S3 and S4 on the Digital Modulator and S1, S2 and S3 on the PLL) must all be set to OPEN. The external select switch can then be used to set the exciter to any frequency between 87.8 Mhz and 108 Mhz. A Remote Frequency Control Kit is available, Part# 994-9478-001

- J3-13 supplies +5 volts through a 100 ohm current-limiting resistor to the external switching circuits.
- J3-14 supplies ground.
- J3-15 Provides an additional MUTE connection for use by N+1 or other remote frequency-control circuitry. When used, the mute connection requires a LOW to enable the exciter output, and a HIGH (or an open wire) disables the output. When this MUTE circuit is not needed, placing regulator board jumper JP4 in the 1-2 position supplies the ground, permitting the exciter to operate.

For more information on frequency selection, both remote and local, refer to Section V, Maintenance And Alignment.

3.1 Introduction

The DIGIT™ front panel is shown in Figure 3-1. The panel includes a 3 1/2 segment LCD display window with four control buttons directly below it, a bar-graph displaying percent of modulation with an indicator directly below it which lights when modulation is below 15%, and four red fault status indicators.

3.2 Fault Indicators

There are four red LED fault indicators at the left of the front panel.

- RF MUTE lights if the exciter output is muted by:
- An exciter fault condition which lights the PLL indicator (see PLL below).
- an external command from Remote connector J2-9
- an external command from the optional Remote Frequency Control connector J3-15 (N+1 Mute).
- SWR lights if the coupler in the output of the 55 Watt PA detects more than 5 watts reflected power.
- TEMPERATURE lights if the PA heat sink temperature exceeds 80 degrees C.
- PLL lights and the exciter output is muted if one of the following conditions exists:
  PLL Board unlock
  Upconverter Fault
  100 MHz Filter fault
  5 MHz Filter fault

3.3 Modulation Level

The bar-graph at the center of the LCD display is made up from 3 10-segment LED's. The Left and center LED's are green and the right LED is red.

The bar-graph displays % modulation in 5% steps, and the first red LED indicator represents 100%.

Below the bar-graph is an additional "/10" indicator which lights if modulation level is below 15%. When the "/10" indicator is lit, the first red LED indicates 10%, and each step represents 0.5%. The display sensitivity is auto ranging so as soon as a modulation peak exceeds 15% the "/10" light goes out and the bar-graph returns to the normal 100% display.

3.4 Metering and Control

The LCD display and the four buttons below it select:

- FWD PWR (SET)
- RFL PWR
- PA AMPS
- PA VOLTS

3.5 Power Adjustment

The middle two buttons are used along with the FWD PWR or SET button to adjust the power output.

To raise power output, press and hold SET and momentarily press the Raise (up-arrow) button. The exciter power will raise

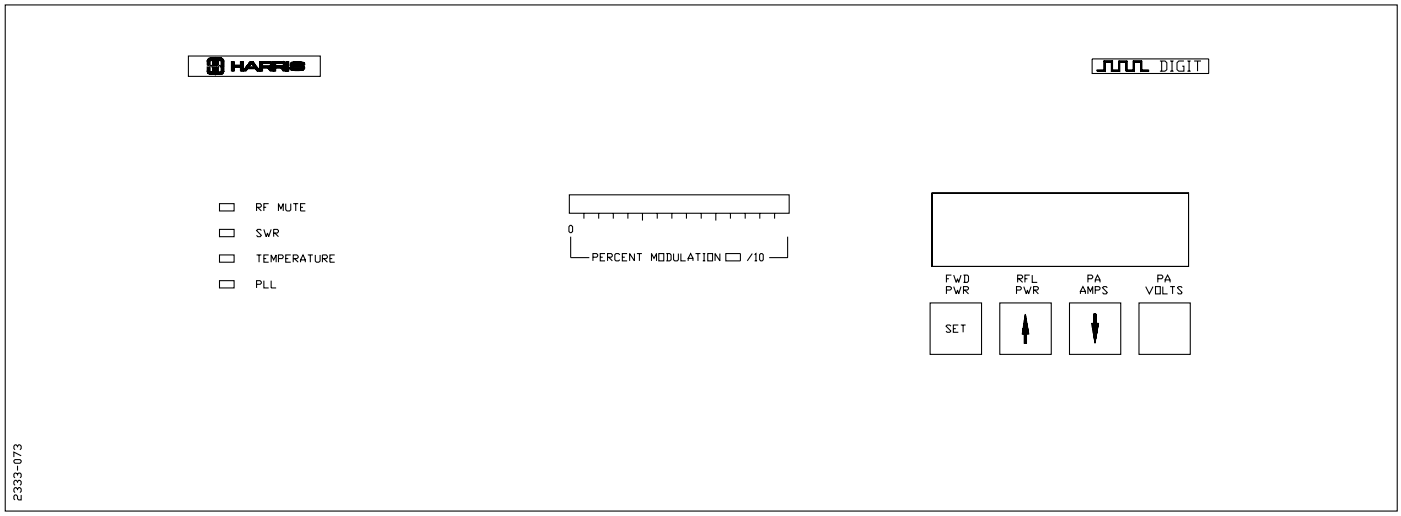


Figure 3-1. DIGIT Exciter Front Panel

WARNING: Disconnect primary power prior to servicing.

slightly. Continue to pulse the Raise button until the desired output is reached. If the Raise button is pressed and held the power will change more rapidly.

To lower power output, press and hold SET and momentarily press the Lower (down arrow) button. The exciter power will lower slightly. Continue to pulse the Lower button until the desired output is reached. Pressing and holding the Lower button will lower power more rapidly.

3.6 Display Test

The LCD display and the four Fault indicators may be tested by pressing and holding the FWD PWR button, and also pressing the right-hand (PA VOLTS) button. This will turn on all segments of the LCD display and the fault indicators for as long as both buttons are held.

3.7 DC Power Indicators

The illuminated front-panel DIGIT™ logo in the upper right corner also serves as the DC power indicator. All four voltage regulators within DIGIT™ are used to power the LED's behind the logo, and failure of any of the supply voltages will cause part of the logo to be dark. The LED's powered by each voltage are:

+17V	-17V	+6.5V	-6.5V

3.8 Emergency Operating Procedure

If the exciter is using the Digital Stereo Generator module and the digital audio input, and the digital audio signal is lost, the module may be placed in the Analog Backup Mode. This will allow the insertion of an analog composite signal into the SCA2 input, to get the exciter, and the transmitter, back on the air. All other audio input signals must either be reduced by 16dB or be disconnected (turned off) while in the Analog Backup Mode.

3.8.1 Switching to the Analog Backup Mode

There are two ways to switch to the Analog Backup Mode.

a. The first method is to ground pin 4 of J7, the Remote connector on the side of the Digital Stereo Generator Module. This will place the interface module in the analog backup mode, and turns the SCA2 input, J3, into an analog composite input. The signal source for J3 must be switched externally by the user, after the interface module is placed in the analog backup mode.

b. The second method is only to be used if the Digital Stereo Generator Module is to be used for an extended period of time in the analog backup mode. For this method it is necessary to remove and open the Digital Stereo Generator Module, and set S1-4 to the ON position. The use of the remote connector J7, is preferred if the units normal mode of operation is to use the digital audio input.

Now that the Module is in the Analog Backup Mode:

c. A 3.5Vpp (nominal for 75kHz deviation) analog composite signal, should be applied to the SCA2 input as the backup signal. Other SCA/RBDS inputs can be used, but each one must be reduced in amplitude by 16dB due to the increased gain required to accommodate the analog composite input. S/N will also be reduced by 16dB for these inputs. If over modulation occurs, reduce the input level to the exciter.

WARNING: Disconnect primary power prior to servicing.

4.1 General Description

The DIGIT™ Digital FM Exciter inputs a digital composite stereo signal from one of two input interface modules and generates an on carrier FM signal at power levels up to 55W. It is frequency agile and can be used in N+1 configurations. Performance limitations of the Digital to Analog (DAC) technology require the digital FM generation be done at a low frequency IF, then upconverted to the desired channel frequency. The exciter is adaptable to all analog exciter applications by using the optional Analog I/O Module.

4.2 Block Diagram Description

Figure 4-1 is the simplified overall block diagram for DIGIT™. DIGIT™ is enclosed in a cabinet containing power supplies, control logic and all signal processing and amplification needed to convert the 16-bit digital audio source into an on-channel frequency modulated signal. The input to DIGIT™ is a 16 bit composite digital signal. All inputs to DIGIT™, whether digital (AES/EBU compatible) or analog, must be converted to a compatible 16 bit signal. This can be done by either the Digital Stereo Generator Module, for digital signal inputs, or with the Analog I/O Module, for conventional analog signals.

4.2.1 Input Options

There are two input modules available for use with DIGIT™. The Digital Stereo Generator Module and the Analog I/O Module.

4.2.1.1 Digital Stereo Generator Module (A5)

The Digital Stereo Generator Module accepts one AES/EBU 24-bit digital stereo input and convert it to the 16-bit digital composite stereo signal which is then be supplied to J1 and the Digital Modulator. It also provides for an analog composite input as a backup for the digital AES/EBU input. The interface features a DSP based stereo generator that delivers a “CD” quality digital composite signal to the exciter. Two analog SCA inputs and an RBDS input are also provided. The analog SCA and RBDS inputs are digitized and added to the high quality digital composite signal. (A 19kHz pilot sync is output for RBDS generator use). A low distortion composite limiter is also provided, along with an LED display on top of the module to show the amount of limiting being used. User adjustments are available for pilot injection, composite limiting, output deviation, composite equalization, and SCA/RBDS level controls. The Digital Stereo Generator mounts on the DIGIT™ back panel. All input signals are summed, converted to 16-bit composite digital and routed to the Digital Modulator board in the exciter.

4.2.1.2 Analog I/O Module (A5)

If the exciter is to receive an analog input, the Analog I/O Module Option is installed on the right rear panel, instead of the Digital Stereo Generator Module, connecting to the Data Input connector J1. The Analog Interface Module provides 6 analog inputs

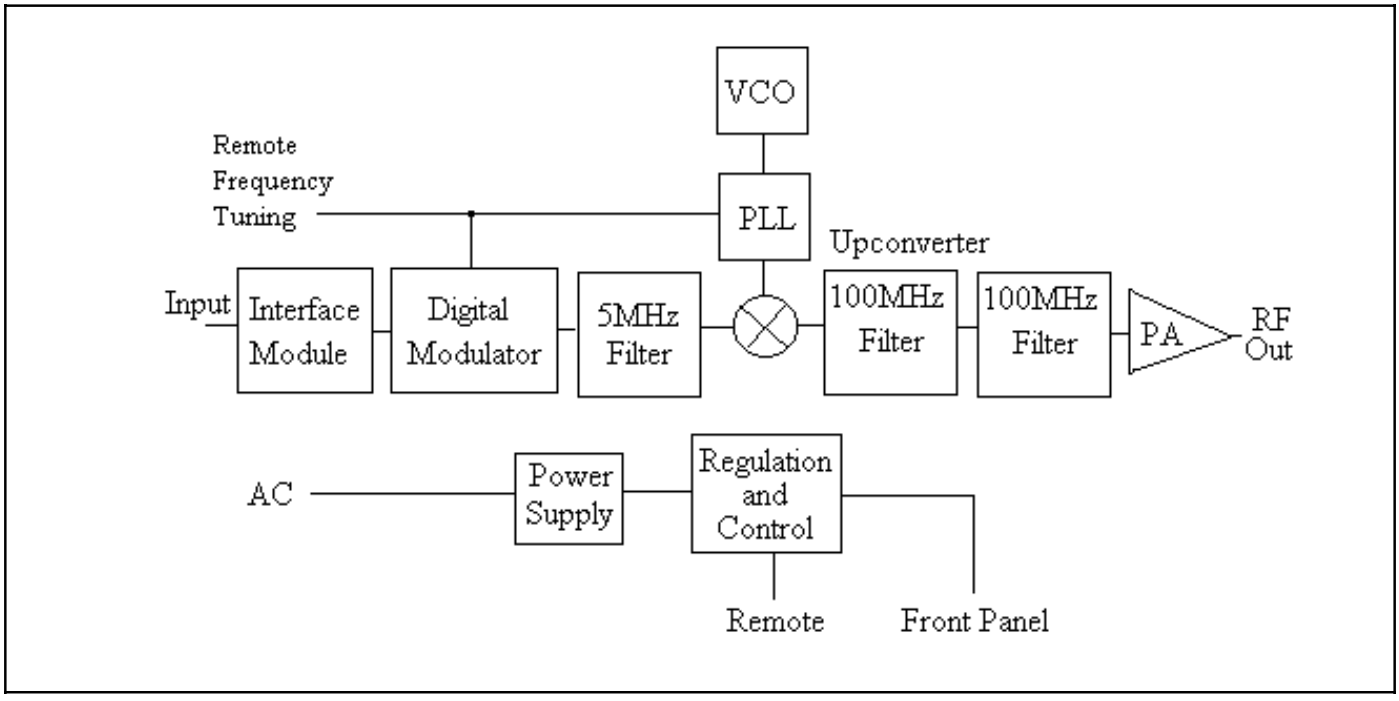


Figure 4-1. Overall Block Diagram

WARNING: Disconnect primary power prior to servicing.

via external BNC connectors. They are the Balanced Composite Input, the Unbalanced Composite Input, SCA 1, SCA 2, SCA 3, and the Monaural input. Any combination of these inputs may be connected to the Analog I/O Module, and the signals are summed, converted to 16-bit composite digital and routed to J1 and the Digital Modulator board.

4.2.2 Digital Modulator Board (A3)

This module receives and processes the 16-bit parallel digital audio signal and generates a 5.6 Mhz frequency-modulated carrier. The carrier is filtered to remove the alias frequency components. "Fine Frequency" switches (S2, S3 and S4) are used to select the exact frequency (approximately 5.6 MHz) of the digital modulator board output. When Remote Frequency Tuning (N+1) operation is used, the remote command sets this frequency, with all sections of S2, S3 and S4 set to OPEN. The exact output frequency of this board can be found using the information in Section V, under the heading, Digital Modulator Switches.

Also included in the Digital Modulator Board are a Digital Peak Detector and drive circuits for the front panel bargraph modulation meter.

4.2.3 5 MHz Filter Board (A8)

The 5.6 MHz FM output signal from the digital modulator is filtered in the 5 MHz filter board. The filter attenuates any undesired modulation products.

4.2.4 PLL Board (A7)

DIGIT™ uses frequency synthesis techniques to avoid the need for channel-specific crystal selection. The PLL board uses a 10MHz reference oscillator for the phase locked loop. The Phase Locked Loop (PLL) is set to the correct frequency by setting DIP switches S1, S2 and S3. These are the "Course Frequency" switches, which set the PLL frequency to at least within 125kHz of the carrier frequency. The "Fine Frequency" switches on the Digital Modulator, are then used to set the exact exciter output frequency from 87.8 MHz to 108 MHz.

When Remote Frequency Tuning (N+1) operation is used, the remote command sets this frequency as well as the Digital Modulator frequency, and all sections of S1, S2 and S3 are set to OPEN.

4.2.5 VCO Module (A6)

The error voltage from the PLL board is applied to varactors which control the frequency of the VCO. The VCO output is buffered and fed back to the PLL Board. The VCO output is the LO (Local Oscillator) frequency for the upconverter. The VCO Frequency will be determined by the frequency setting dip switches on the PLL board. All inputs and outputs for the VCO Module come from the PLL Board (including supply voltages).

4.2.6 Upconverter Board (A4)

The Up-converter is supplied with the 5.6 MHz (approximately) modulated FM input from the 5 MHz Filter board, and also the Local Oscillator input from the PLL Board. Both signals are amplified, filtered and then applied to a mixer which produces a product 5.6 MHz above, and a product 5.6 MHz below, the LO frequency. Only the upper product is used.

The mixer output is filtered and fed to the first 100MHz Filter Board (actually part of the Upconverter assembly, A4) to remove mixing products.

4.2.7 100 MHz Filter Board (A9)

To ensure purity of the output signal, the on-frequency carrier signal is filtered again on this, the second 100 MHz Filter board. This circuit is identical to the first 100MHz filter circuit on the Up-converter board. The output of this board feeds the RF PA input.

4.2.8 55 Watt PA Module (A1)

All signal processing to this point in DIGIT™ has been at low levels. The input level to the 55 Watt PA is approximately +0dBm. The PA amplifies the second 100 MHz filter output to the required output level. The amplifier utilizes a hybrid amplifier device to achieve high input gain, followed by a bipolar transistor, driving an FET output device. Forward and Reflected directional couplers are included in the output circuit.

Design of the amplifier is very conservative, with power capability beyond the 55 Watt level.

4.2.9 Regulator Board (A2)

The regulator board, mounted to the back of the front panel, contains the bargraph modulation meter and LCD displays with their drivers, the fault indicators, the microprocessor controller, the remote control interfacing circuits, and the power regulators. The regulator board contains the following adjustments, which may be reached through the top of the case: (see Figure 4-2)

- R6 - Exciter APC - adjusts the range of the APC input voltage to allow it to generate the required power output.
- R56 - Forward Meter - calibrates the front-panel forward power meter display.
- R55 - Forward Remote - calibrates the remote metering voltage for forward power.

For adjustment information refer to Section V, under the heading, Exciter Power Level and Power Metering.

4.2.10 Remote Frequency Tuning Input, J3 (Optional)

A Filtered rear mounted 25 pin D connector provides the interface for Remote Frequency Tuning. A Remote Frequency Control Kit is available for N+1 applications, Part# 994-9478-001.

Note

If the exciter is meant for fixed frequency operation (will not be used for N+1) then the J3 connector will not be installed on the exciter.

The input must be driven by a TTL/CMOS compatible interface. Changes in the tuning number may be done asynchronously but the settling time for any tuning changes is required to be less than 400ns to avoid large transitional errors in output frequency. Each line is active high. The inputs at J3 are used to replace the internal frequency dip switches on the Digital Modulator Board and the PLL Board. When the remote frequency tuning is used, the frequency switches on those two boards are placed in the open

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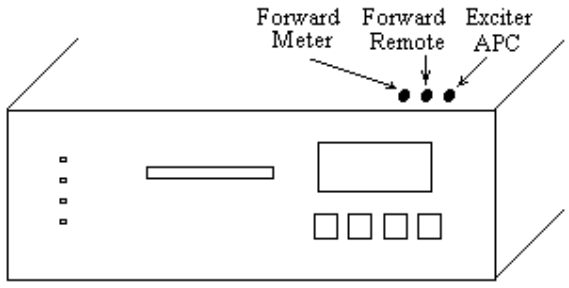


Figure 4-2. Exciter Front Panel & Forward Power Calibration & Adjustment Pot position

position. A complete pinout of J3 can be found on the Interconnect Diagram in the drawing package (Drawing #843-5295-001). The recommended switch settings for all channels is given in Section V, Maintenance and Alignments, in a chart at the end of the section.

4.2.11 Remote Control and Status, J2

Remote control inputs and exciter status outputs are provided via a filtered 15 pin rear mounted D connector, J2.

Status outputs include:

- Forward power
- Reflected power
- PA voltage
- PA current
- Exciter Fault Indication
- No program data

The control inputs are:

- Automatic Power Control (APC)
- Exciter Mute
- Automatic Fault Control (AFC) interlock

4.2.11.1 Exciter PA Status (FWD PWR, RFL PWR, PAV, PAI)

These status outputs provide an output voltage which varies linearly between 0 and +4V as shown in Figure 4-3. For example if the PA voltage was 16 volts, then 2.0V would be applied to J2-4. The Remote PA volts and remote PA current are specified accurate to within 2% at full scale. The Remote Forward Power can be set to within 1% at full scale assuming a VSWR of 1:1. There is no accuracy specification for Reflected Power.

4.2.11.2 Exciter Fault and No Program Status (Fault, NoPgm)

These status outputs are open collector outputs capable of sinking over 100mA with a pull up resistor to +5 Volts. A high (+5V) on J2-6 indicates that an exciter fault (PLL unlock, Temperature fault, or VSWR fault) has occurred. A high (+5V) on J2-13 indicates that there is no digital modulation input to the exciter. The no program (NoPgm) status is useful in determining input source faults. If the exciter has no digital modulation input for at least 4.2 seconds then this remote output is driven high. The signal will return to 0 volts as soon as a digital input is again detected, at the input to the Digital Modulator Board.

4.2.11.3 Exciter Mute (Mute)

This input must be TTL/CMOS compatible and can be active low or high depending on the position of jumper JP1 on the exciter's regulator board. When activated it will mute the exciter (disable output power).

4.2.11.4 Automatic Power Control (APC)

This input is used to control the exciter power remotely. The input requires at least a 4V level (into a 10k ohm load) to achieve an exciter power level of 60W. Higher input voltages are acceptable as long as the APC adjustment pot (R6) on the regulator board is correctly adjusted to provide the required 4V dc at the A/D input (the A/D voltage is clamped at 5.1Vdc in case of accidental excess voltage). The exciter output power will increase linearly relative to the APC input voltage assuming the previously mentioned conditions are met. The scale is identical to the forward power curve of Figure 4-3.

4.2.11.5 Automatic Fault Control Interlock (AFC Com, AFC NC, AFC NO)

A reed relay switch is provided for the use of the transmitter. When an exciter fault occurs, the exciter will shut off output power and switch the relay. The relay is capable of switching a maximum of 0.25 Amps at 100V. The voltage must not exceed 250V, and the current must not exceed 1A.

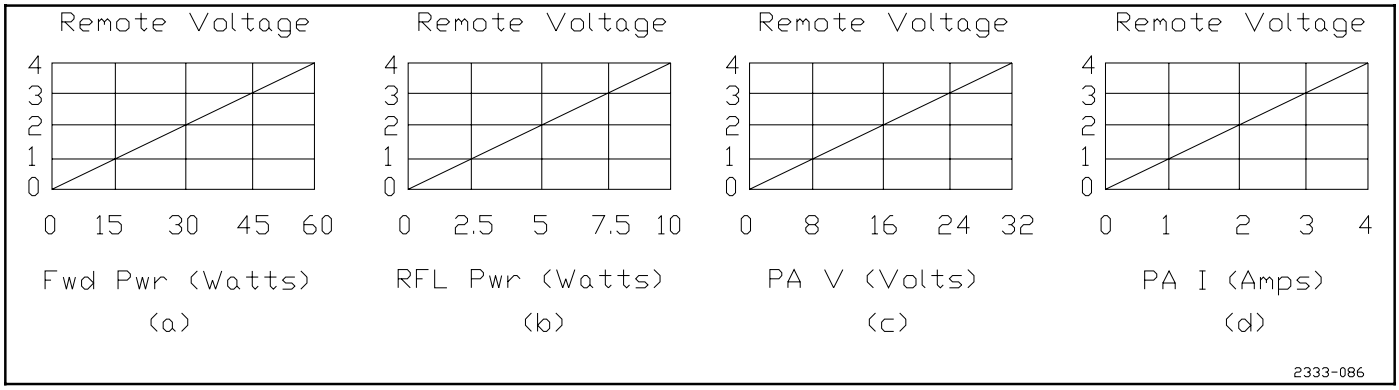


Figure 4-3. Remote Voltage Output Versus Fwd Pwr, RFL Pwr, PAV and PAI

WARNING: Disconnect primary power prior to servicing.

4.2.12 RF Output

The RF output is a 50 ohm BNC output with optional N-type connector. The output power is variable from 3 Watts to 55 Watts. Frequency can range from 87MHz to 108MHz.

4.2.13 AC Input

The AC input will accept either 110V or 240V, 50Hz or 60Hz. Voltage ranges from 90Vac to 132Vac or 198Vac to 264Vac are accommodated by high and low line voltage settings in the ac input. The ac input is fused at 10A.

4.2.14 Regulated Power Supplies

There are four regulated supplies, +17VDC, -17VDC, +6.5VDC and -6.5VDC, which are distributed throughout the exciter. These are in turn regulated down to 15 and 5 volts respectively, on each individual board.

4.3 Detailed Description

4.3.1 Front Panel Interface

The front panel provides a 3-segment LCD display for metering, and a 30 LED modulation meter. In addition 4 user buttons to change metering functions, 4 fault indicators, and a 10% modulation indicator are provided. Finally, four dc power indicators comprising the logo LED are visible for easy power supply failure detection.

4.3.1.1 Front Panel Controls

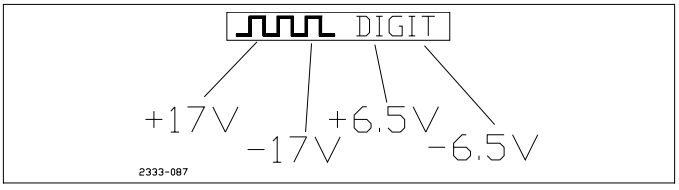
The four front panel buttons control the following functions as given below:

Function	Action
Display PA volts	Press [PA VOLTS] Button
Display PA Current	Press [PA AMPS] Button
Display Reflected Power	Press [RFL PWR] Button
Display Forward Power	Press [FWD PWR] Button
Increment Forward Power	Press [FWD PWR] and [RFL PWR] Buttons
Decrement Forward Power	Press [FWD PWR] and [PA AMPS] Buttons
Test Mode	Press [FWD PWR] and [PA VOLTS] Buttons

Turn on all display lamps and indicators. All other combinations result in No action.

4.3.1.2 Power Supply indicators

The logo LED is divided into four sections each drawing power from the four regulated voltages in the exciter. If any dc voltage fails the corresponding section of the logo LED will be turned off.



4.3.1.3 Modulation level

The bargraph modulation meter allows 5% modulation increments in full scale mode, and 0.5% increments in 10% (/10 indicator lit) scale mode. It uses a precise digital peak detection circuit that provides a 100% modulation reading with an accuracy of approximately 0.2%.

4.3.2 Digital Stereo Generator Module, A5

The Digital Stereo Generator Module is the interface between the AES/EBU audio data standards and the DIGIT™ input requirements and also includes a fully integrated digital stereo generator. A block diagram of the board is shown in Figure 4-4. It accepts one AES/EBU digital stereo audio signal at any arbitrary data rate between 20.8kHz and 56kHz. It also has inputs for two analog SCA and one analog RBDS input, as well as an analog backup input mode (it uses the SCA2 input) which can be used to bypass a failed digital link. The module outputs include, one digital composite output, J1 to the Digital Modulator Board in the exciter, one 19kHz sync output, J8 for RBDS use, and a simple remote status/control interface, J7. All power and synchronization signals for the module come from the Digital Modulator Board in the exciter, via J1.

The stereo generation and processing is accomplished by use of industry standard general purpose DSP (Digital Signal Processing) devices. The processing maintains greater than 16 bits of resolution so that round-off and truncation errors fall well below the 16 bit threshold. The module can be operated in both the standard stereo and sub channel mode or in Mono mode. The Mono mode is switchable in real time, both locally and remotely via J7, and provides a single L+R channel. 100% modulation is maintained with either a two channel or one channel input.

The Digital Stereo Generator has several key functions:

a. Data Rate Conversion
b. Stereo Encoding
c. SCA and RBDS Injection
d. Composite Compression (Limiting)
e. Operational Mode Control

4.3.2.1 Data Rate Conversion

The Digital Stereo Generator takes the arbitrary data rate of the received AES/EBU input (between 20.8kHz and 56kHz) and converts it to a rate compatible with the DIGIT™, Digital Modulator Board input. The conversion is done with a VLSI rate converter.

4.3.2.2 Analog SCA and RBDS Injection

The SCA and RBDS inputs are summed together then digitized to provide a single digital input for the stereo generator. Full scale input is 30% injection (in stereo mode, the SCA and RBDS injection may not exceed 20%). Digital filtering is used to maintain the stereo SNR level of -80dB.

4.3.2.3 Composite Compression

Adjustment of composite compression level is accomplished in the digital domain without generating any switching transients or noticeable noise during adjustment. The limiter uses a proprietary algorithm which achieves higher signal density with much

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lower distortion than conventional composite clipping. The limiter achieves absolute maximum modulation levels because it is based on the composite signal rather than the audio. Composite compression is controlled by an externally accessible multiturn pot. The adjustment provides the means for up to 18dB of peak limiting relative to:

a. 100% modulation with no SCAs
b. 105% modulation with 1 SCA
c. 110% modulation with 2 SCAs

The adjustment allows 0.1dB of limiting resolution. The composite compression can also be disabled by turning the LIMIT pot CCW until the deviation level just begins to drop.

4.3.2.4 Analog Backup Mode

The module also has a backup or emergency analog composite input mode. If the digital signal link is interrupted for some reason, maybe the loss of the digital STL link, the module may be placed in the analog backup mode either locally, with a dip switch setting inside the module, or remotely, via J7 on the side of the module, by grounding pin 4. An analog composite signal may then be input in place of the SCA2 signal. More information is given in the following paragraphs, and in Section III, under the heading, Emergency Operating Procedures.

4.3.2.5 Operational Mode Control

The Digital Stereo Generator Module provides the user with the ability to select between various operational modes both locally, with a dip switch inside the module, S1, and remotely via J7 on the side of the module. It also allows user control of pilot level, modulation level, and composite limiting.

4.3.2.5.1 LED Meter

There is an LED meter display on top of the Digital Stereo Generator Module, see Figure 4-5. This LED meter can be used to read the amount of Composite Limiting or Percent Deviation. With switch S1-7, inside the interface module, in the OFF (normal) position, the LED meter displays the amount of composite limiting in dB. The LEDs then correspond to the labels 1dB, 2dB, 3dB, 4dB and 5dB. The total amount of limiting available (if the LIMIT pot is turned fully clockwise) is 18dB, but the display only reads up to 5dB.

The LED meter can be made to read percent deviation if S1-7 is switched to the ON position. The LEDs in this mode now correspond to the other set of labels, 100, 105, 110, 120 and 150%, which are deviation levels. In this mode the LED meter reading and the front panel bargraph display should read approximately the same percent of modulation, or deviation. The Deviation mode on the LED meter can be useful for comparison with the front panel bargraph display, if the bargraph is suspected to be faulty. S1-7 should normally be left in the OFF or LIMIT position since the LED Deviation meter and the front panel bargraph display read basically the same thing.

The remote I/O connector J7 can also be used to switch the function of the meter, provided S1-7 is in the open or OFF position. Leave J7-8 open, and the meter will read the amount of limiting. Ground J7-8 and the meter will read percent deviation.

4.3.2.5.2 ANALOG (Switch)

- Off: AES/EBU Mode (Default)
- On: Analog Backup Mode (ANALOG status LED is lit when in Analog mode).

When the ANALOG switch is open (off), the stereo generator is enabled and the AES/EBU digital input is used to provide the left and right channel digital audio source. See Figure 4-5.

When the ANALOG switch is closed (on), the stereo generator is disabled and the SCA2 analog input, J3, will become the analog composite (program) input. Once the unit is in the analog backup mode, it is necessary for the operator to remove the normal SCA2 signal source from J3, and connect the backup composite input signal.

DO NOT apply the analog backup signal to the SCA2 input, J3, until the unit has been switched into the analog backup mode. If the analog backup signal is applied to the SCA2 input before the

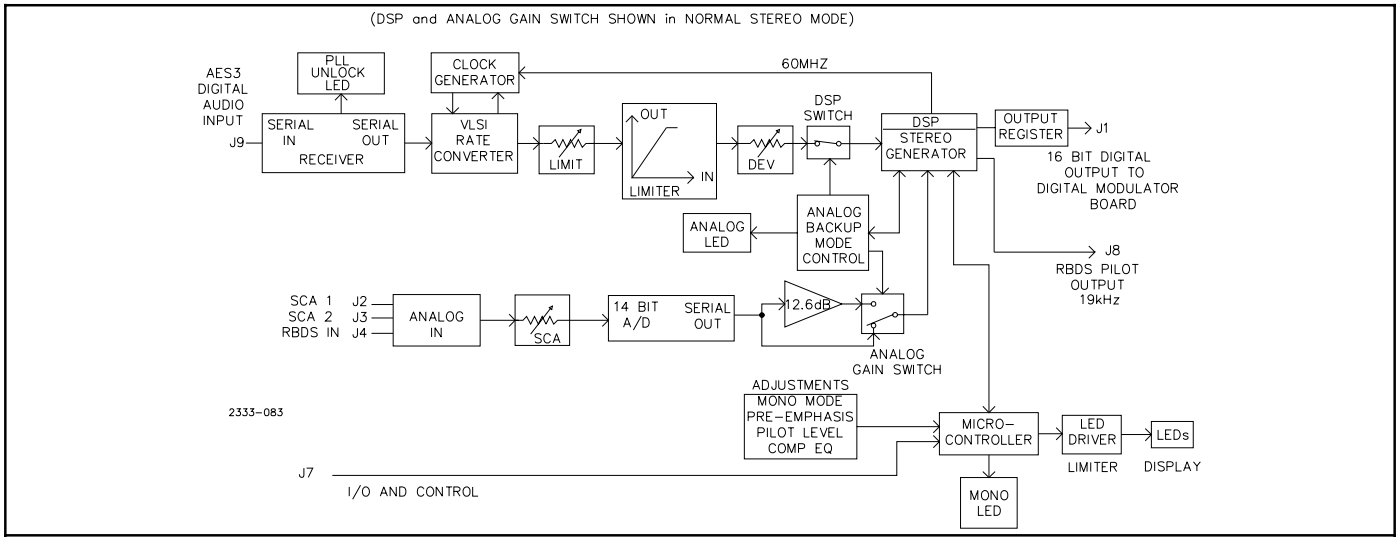


Figure 4-4. Block Diagram Digital Stereo Generator Module, A5

WARNING: Disconnect primary power prior to servicing.

unit is switched to the backup mode, overdeviation and interference could occur.

This mode is designed to be a backup operational mode, allowing a convenient way to bypass a failed digital link. This mode can also be used to allow the use of analog inputs until such time as the station installs a full digital link to the transmitter site. A 3.5Vpp (nominal for 75kHz deviation) analog composite signal should be applied to SCA2 as the backup signal. Other SCA/RBDS inputs will have to be reduced in amplitude by 16dB because of the increased gain required to accommodate the analog composite input. It is also important to note that only the SCA2 input provide the necessary bandwidth for the analog composite signal. SCA1 and the RBDS inputs both have high pass filters that limit low frequency response. The performance of this mode is degraded from the published spec (S/N = 84dB, THD = 0.008% typical).

AES/ANALOG Remote Input J7-4

The ANALOG mode can be selected remotely via the AES/ANALOG control input (J7-4) as long as the ANALOG switch is in the open position (factory setting). When a low impedance or 0V signal is applied to this input, the Analog mode is selected. A high impedance or +5V input selects the default AES/EBU mode. It is recommended that this input be driven by an open collector source. A TTL/CMOS compatible source is also acceptable.

4.3.2.5.3 MONO (Switch)

- Off: Stereo Mode (Default)
- On: Monaural Mode (MONO status LED is lit when in Mono mode).

When the MONO switch is open (off), the stereo generator operates in stereo mode. Both the L+R Main channel and a 38kHz double sideband suppressed carrier L-R Sub-Channel are generated along with the 19khz pilot. Analog SCA/RBDS inputs are also accommodated.

When the MONO switch is closed (on), the stereo generator operates in Mono mode. The generator will provide only the L+R Main channel and pilot. The 38khz Sub-Channel is not provided. The pilot can be turned off by adjusting the PILOT pot all the way counter-clockwise if desired. Because it is assumed that either the left or right channel is not available in mono mode, an additional 6dB of gain is provided for the L+R signal. Therefore if both the left and right channels are to be used, then their amplitude must be reduced by 6dB.

MONO/STEREO Remote Input, J7-2

The Mono mode can be selected remotely via the MONO/STEREO control input (J7-2) as long as the MONO switch is in the open or OFF position (factory setting). When a low impedance or 0V signal is applied to this input, the Mono mode is selected. A high impedance or +5V input selects the default Stereo mode. It is recommended that this input be driven by an open collector source. A TTL/CMOS compatible source is also acceptable.

4.3.2.5.4 25uS, 50uS (Switches)

The switches are two sections of DIP switch S1 on the Digital Stereo Generator board. The 25us and 50us switches can accommodate all of the standard pre-emphasis response adjustments.

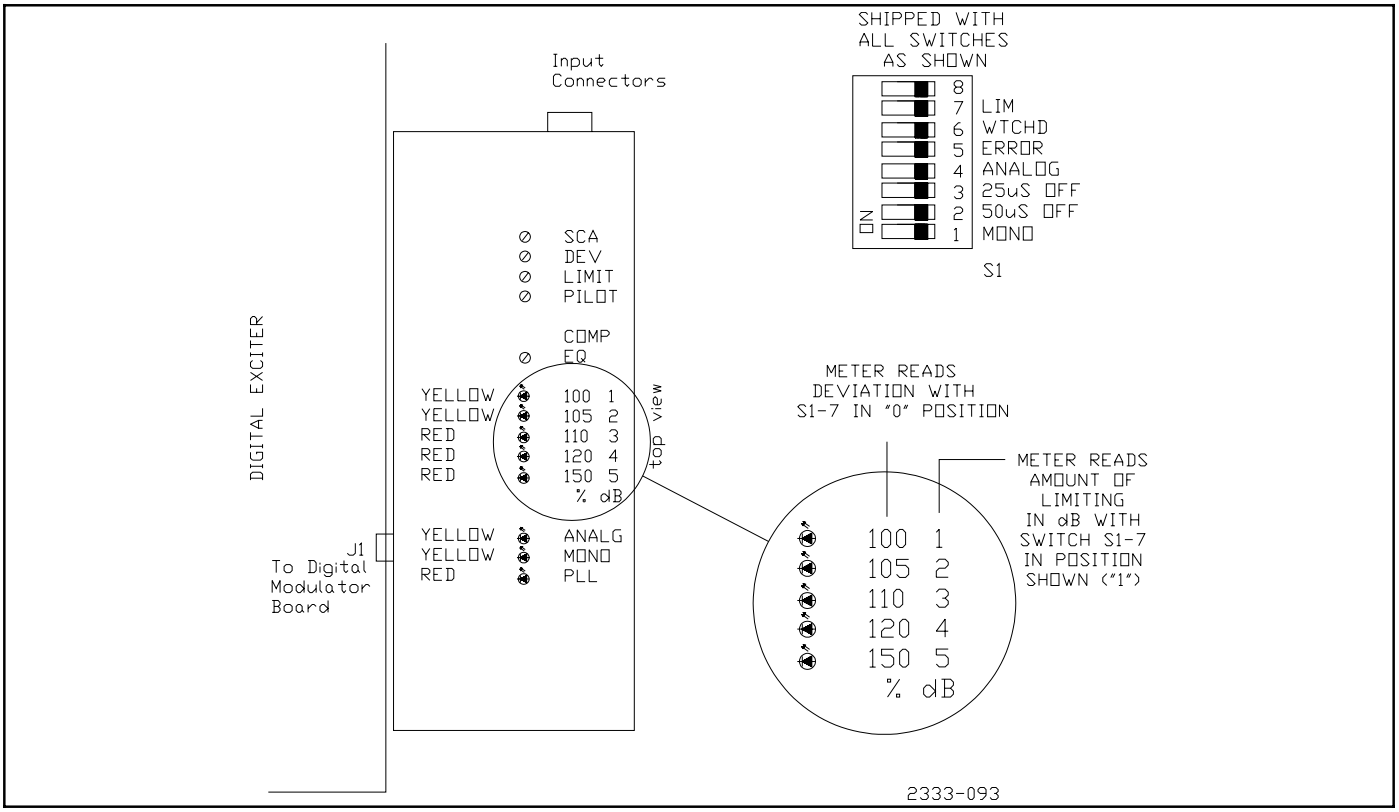


Figure 4-5. Digital Stereo Generator Module LED Meter

WARNING: Disconnect primary power prior to servicing.

The pre-emphasis is applied in Stereo and Mono modes. For proper switch setting and switch location refer to Section II Figure 2-1 and Table 2-1.

4.3.2.5.5 ERR (Switch)

- Off: No repeat on error (Default)
- On: Repeat on error

When the ERR switch is closed (on) the AES/EBU receiver repeats the last valid data byte if an error occurs. When the error is removed, the data is transmitted again as normal. When the ERR switch is open (off) the AES/EBU receiver will not repeat the last valid byte, but will transmit the data as received regardless of the error. This switch is mostly used as a diagnostic tool.

4.3.2.5.6 WATCHDOG (Switch)

- Off: Watchdog disabled (Default)
- On: Watchdog enabled

When the WATCHDOG switch is open (off) the Watchdog circuit only monitors the +5V dc voltage. When the WATCHDOG switch is closed (on) the Watchdog circuit monitors the RBDS Sync output signal as well as the +5V dc voltage. This provides a way to monitor the DSP function on board for possible failure modes.

4.3.2.6 Digital Stereo Generator Module User Adjustments

4.3.2.6.1 SCA (Pot Adjustment)

- Clockwise = more gain

The SCA pot (R9) is a gain adjustment for the SCA1, SCA2, and RBDS analog inputs. The gain adjustment ranges from -6.6dB to +18.8dB. SCA1 and SCA2 have nominal inputs of 1.5Vpp for 10% (+/- 7.5kHz) deviation. The RBDS input has a nominal input of 1.5Vpp for 5% (+/-3.75kHz) deviation. When in ANALOG backup mode, SCA2 has a nominal input of 3.5Vpp for 100% (+/-75kHz) deviation.

4.3.2.6.2 DEV (Pot Adjustment)

- Clockwise = more deviation

The DEV pot (R29) is used to set the “ceiling” for the output deviation level. It tells the stereo generator what the digital stereo output level should be (does not include SCA inputs) for a full scale input. For example, with a full scale input signal applied, the DEV pot would be adjusted to give the desired deviation on the front panel bargraph meter. The deviation range extends from 95% to 208% (assuming 10% pilot and a full scale digital input) relative to +/-75kHz deviation. There is also an LED meter on top of the Digital Stereo Generator Module which can be used to read deviation instead of the front panel meter. The LED meter is normally set to read “Limiting” (OFF). The LED meter can be switched to read deviation by setting S1-7 to the ON position. The LEDs now correspond to the 100 through 150% labels. The Deviation mode on the LED meter can also be selected remotely via J7-8. A high on this input causes the meter to read percent deviation.

INT DEV LEVEL Remote Output, J7-7

The setting of the DEV pot is available via the INT DEV LEVEL remote output (J7-7). The output will be between 0V and +5V, depending on the amount of deviation and exciter input level. For example, if the audio input level is 0dB, then a 0V output indicates a 95% deviation setting while a +5V signal represents a 208% deviation setting (relative to +/-75kHz). The output deviation setting can be linearly interpolated between 0V and 5V.

4.3.2.6.3 PILOT (Pot Adjustment)

- Clockwise = more deviation

The PILOT pot (R30) is used to set the pilot injection level. The injection level range extends from 0% to 12% deviation relative to +/-75kHz deviation.

4.3.2.6.4 EQ (Pot Adjustment)

The EQ pot (R31) is available as a composite equalization adjustment to compensate for various system (exciter, transmitter, etc.) non-linearities. It is a subtle adjustment that is factory pre-set depending on the system and customer frequency. The adjustment affects phase response only.

4.3.2.6.5 LIMIT (Pot Adjustment)

- Clockwise = more limiting

The LIMIT pot (R34) is used to set the amount of composite limiting. The limiter can accommodate input level ranges between 0dB and -12dB. An additional 12 dB of headroom is allowed for pre-emphasis. The limiter is psycho-acoustically designed to provide minimal audible distortion for high levels of limiting (5dB or greater). The LED meter display on top of the

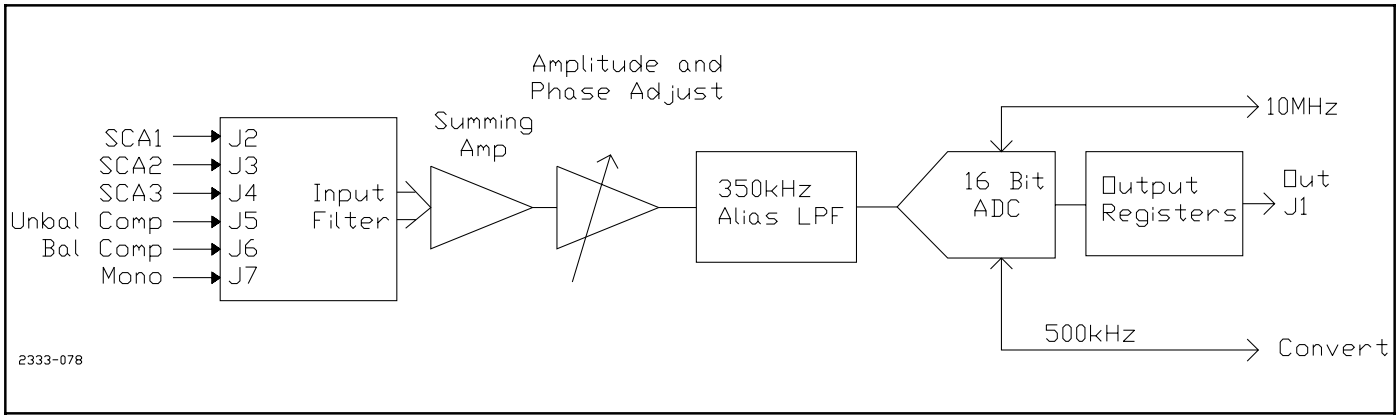


Figure 4-6. Analog I/O Board Block Diagram

WARNING: Disconnect primary power prior to servicing.

Digital Stereo Generator Module is normally set to read the amount of composite limiting being used, provided S1-7 is in the OFF (normal) position. The remote input J7-8 must also be low for the LED meter to be in the LIMIT display mode. The total amount of limiting available is 18dB, but the display only goes to 5dB. The limiter has no affect on the pilot or SCAs.

Remote EXT LIMIT LEVEL Input & EXT/INT CONTROL Input: The LIMIT control can be set remotely via the EXT LIMIT LEVEL input (J7-6). Local Limit control is overridden and remote limiting initiated when a low impedance or 0V input is applied to the EXT/INT CONTROL input (J7-5). When the EXT/INT CONTROL input is brought low, the limit level is derived from the dc voltage applied to the EXT LIMIT LEVEL input. The voltage range of the EXT LIMIT LEVEL input is 0V to 5V. A higher voltage will provide increased limiting. The voltage should never exceed +5V.

4.3.2.7 Digital Stereo Generator Module Outputs

4.3.2.7.1 PLL UNLOCK (Output)

PLL status LED is lit when an Unlock condition occurs

A PLL UNLOCK status output is available on the remote output connector J7-3. Any DSP unlock conditions, or any AES/EBU communication faults, bring this output high (+5V). For example, a disconnected AES/EBU cable will activate this output.

4.3.2.7.2 RBDS SYNC (Output)

A 19kHz signal is provided for synchronizing the RBDS signal to the stereo generator. This signal is phase coherent with the stereo generator pilot. The RBDS sync output is inverted (180^{o} out of phase) relative to the stereo generator pilot. Filtering of the RBDS Sync signal may be required. The nearest and largest alias component is 14dB down at 64.3kHz.

4.3.3 Analog I/O Module

The purpose of the Analog I/O Module is to allow connection of conventional analog inputs to the digital exciter. This is done by summing all of the inputs and then converting them into a 16 bit composite digital format compatible with the digital exciter. A block diagram of the board is shown in Figure 4-6. The analog interface is a module that attaches to the back of the DIGIT™ exciter. Composite level and stereo adjustments are accessible through the top of the analog interface box. If a digital audio input is desired, this module can be removed and the Digital Stereo Generator Module used in its place.

4.3.3.1 Analog Inputs (J2 through J7)

The Analog I/O Module provides 6 analog inputs via external BNC connectors. They are:

1. Balanced Composite Input
2. Unbalanced Composite Input
3. SCA 1
4. SCA 2
5. SCA 3
6. Monaural input

4.3.3.1.1 Balanced Composite (J6)

The Balanced Composite Input is a 10k ohm input impedance. The nominal input level for 75kHz (100%) deviation is 3.5Vpp. The Balanced Composite input accommodates a maximum 5Vpp signal without clipping, assuming the Modulation Level adjustment (R26) is set at the nominal setting of 0dB gain. The maximum continuous input voltage without damage is 7.5Vpp.

To connect to the balanced inputs (Monaural or Balanced Composite), a special cable must be constructed, with the outer shield isolated from the connector and terminated in a pigtail which connects to the ground stud nearby. These cables may be ordered ready-made in several standard lengths from Harris-Allied, with

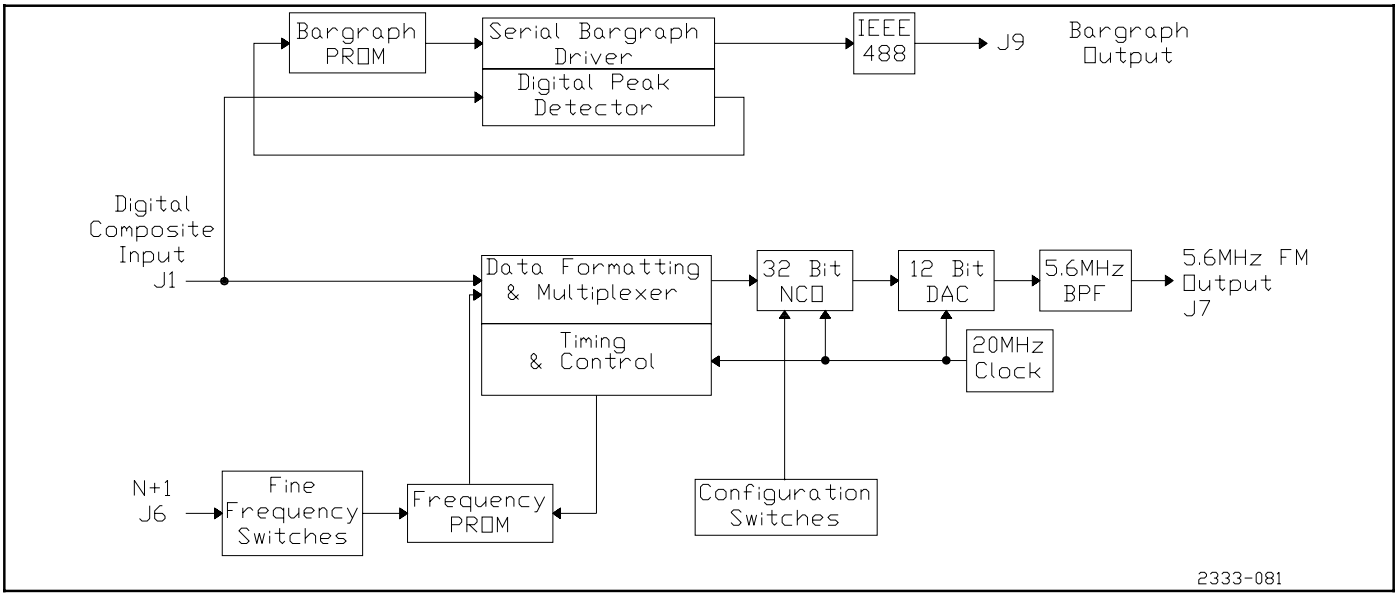


Figure 4-7. Digital Modulator Board Block Diagram

WARNING: Disconnect primary power prior to servicing.

BNC connectors installed on both ends. Use the following part numbers when ordering:

922-0014-001	2.5 ft.
922-0014-002	5 ft.
922-0014-003	10 ft.
922-0014-004	15 ft.
922-0014-005	25 ft.
922-0014-006	40 ft.

4.3.3.1.2 Unbalanced Composite (J5)

The Unbalanced Composite Input has a 10k ohm input impedance. The nominal input level for 75kHz (100%) deviation is 3.5Vpp. The input supports a maximum 5Vpp signal without clipping, assuming the Modulation Level adjustment (R26) is set at the nominal setting of 0dB gain. The maximum continuous input voltage without damage is 7.5Vpp.

4.3.3.1.3 SCA1 SCA2 SCA3 (J2, J3, J4).

The three SCA inputs have 10k ohm input impedances. The nominal input level for 10% (7.5kHz) deviation is 1.5Vpp. The maximum continuous input voltage without damage is 15Vpp.

4.3.3.1.4 Monaural (J7)

The Monaural Input has a 600 ohm input impedance. The nominal input level for 75kHz deviation at 400Hz is +10dBm into 600 ohms. Input adjustment is provided via R19 and allows inputs to range between -9.17dBm and 14.4dBm assuming the Modulation Level adjustment (R26) is set at the nominal setting of 0dB gain. Inputs above 14.4dBm are clipped. The continuous maximum input voltage without damage is 14.5dBm. Pre-emphasis is provided via jumpers JP1 and JP2 according to table provided earlier in this section.

4.3.3.2 Data Output Connector (J1)

The 34 pin header, J1, outputs 16 bits (M0, M1, ... M15) of digital modulation, and receives a 10MHz clock and 500kHz Convert pulse from the Digital Modulator board. The connector also supplies power (+17V, -17V, +6.5V, and -6.5V) to the Analog I/O Module.

4.3.3.2.1 Digital Modulation Output (M0, M1, ... , M15)

The modulation output is a 16 bit parallel format (pin 1 through pin 16). The data is digital composite stereo with a data rate of 500kHz and coherent with the Convert clock supplied by the digital modulator board. The data is 2's complement format with M0 the LSB and M15 the MSB.

4.3.3.3 Analog I/O Module Power (+17V, -17V, +6.5V, and -6.5V)

J1 also must supply the Analog Interface board with +17V (pin 27), -17V (pin 29), +6.5V (pin 31), and -6.5V (pin 33). Each voltage is required to be no worse than 5% from nominal voltage.

4.3.4 Digital Modulator Board

A block diagram of the Digital Modulator Board is shown in Figure 4-7. The Digital Modulator board synthesizes a digital FM signal using a 32 bit numerically controlled oscillator (NCO). The NCO requires a digital modulation input (from one of the interface modules), a frequency tuning number from the configuration switches and a 20MHz system clock (located on this board). Manual frequency tuning is achieved by on board DIP switches. Remote frequency control is also accommodated by an optional remote frequency input connector, J3 on the back panel, which can be connected to the Digital modulator board connector J6, for use in N+1 frequency agile systems. The digital FM signal, from the NCO, is converted to analog by use of a 12 bit Digital to Analog Converter (DAC). The DAC output is an FM IF signal at approximately 5.6MHz. The exact frequency is determined by the actual carrier frequency. For more information on frequency selection refer to Section V, Maintenance and Alignment. The DAC output is bandpass filtered before final output to the 5MHz Filter Board.

The Digital Modulator Board also contains a digital peak detector and a serial bargraph driver which drives the front panel bargraph display (the display is actually located on the Regulator Board).

4.3.4.1 Data Input connector (J1)

The 34 pin connector J1 accepts 16 bits (M0, M1, ... M15) of digital modulation (from either the Digital Stereo Generator Module or the Analog I/O Module), connects various clocks and control signals for the interface modules, and provides power to the interface modules (+17V, -17V, +6.5V, and -6.5V).

4.3.4.2 Interface Module Power (+17V, -17V, +6.5V, and -6.5V)

Power is supplied to the interface modules (pins 27, 29, 31, and 33). Each voltage can accommodate at least 500mA of current, except for the +6.5V pin which can supply 1 amp.

4.3.4.3 Remote Frequency Input (J6 Optional)

J6, a 16 pin ribbon connector accepts a 12 bit TTL/CMOS compatible frequency tuning word (pins 1 through 12) from J3 on the back panel, for optional remote frequency tuning (only used for N+1 operation). All J6 connections are shown in the same general area on sheet 1 of the Digital Modulator schematic. J6-13 supplies +5V power for external use. Resistor R4 current limits the output. J6-14 is connected to ground. A remote frequency mute signal is input on J6-15, and J6-16 is not connected. Changes in the tuning number may be done asynchronously and the settling time for any tuning changes is required to be less than 400ns to avoid large transitional errors in output frequency. The tuning algorithm and a Frequency Tuning Chart are provided in Section V, Maintenance and Alignment.

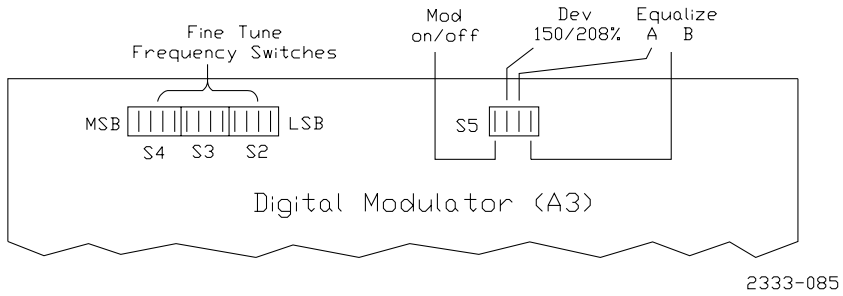
4.3.4.4 Power Input, Serial Data, and Status (J9)

A 26 pin ribbon connector is used to supply the board with +6.5V (pins 7 and 9), and -6.5V (pin 5). Other voltages +17V, -17V, are supplied only for the Digital Stereo Generator Module or the Analog I/O Module (whichever is installed). The +6.5V input uses two pins (pin 7 and 9) because of potentially large current draw. Each voltage is required to be no worse than 5% from nominal voltage.

4.3.4.5 Serial Bargraph Interface

The front panel bargraph display is driven, via connector J9, by the following signals:

- MOD CLOCK (pin 13, 14)
- MOD DATA (pin 15, 16)
- MOD STROBE (pin 17, 18)
- 10% SCALE (pin 19, 20)



Setting	Mod on/off	Deviation Level	Eq A,B	Equalization response
Closed (0)	Modulation off	208% Deviation		
Open (1)	Modulation on (Normal setting)	150% Deviation (Normal Setting)	1 1 (Both open)	Total system equalized (Normal operation)

Figure 4-8. Digital Modulator Switch Settings

Each output uses two differential lines consisting of a positive and negative signal. Data is a serial data stream 32 bits long, each bit being latched into the parallel bargraph buffer (U9 on the Regulator Board) by MOD CLOCK, a 1.95kHz clock. The MOD DATA is a Data word which contains a contiguous number of "ones" proportional to the modulation level. MOD STROBE is a pulse that goes high every 61Hz and clocks the 32 bit serial Data word from the bargraph buffer to the bargraph driver.

4.3.4.6 NOPGM Fault

NOPGM is a TTL compatible output indicating that there is no digital programming input into the exciter when high. This is for remote information and can be used as a test point for system troubleshooting. If the exciter has no digital modulation input (to the Digital Modulator Board) for at least 4.2 seconds then this remote output is driven high. The signal will return to a low level (0 volts) as soon as a digital input is again detected.

4.3.4.7 Remote Frequency Mute Input (N+1 Mute)

For remote frequency control fault protection an exciter RF mute control is supplied to the Regulator board via J9-12. This input is received from the optional remote frequency control cable (J6) which connects the Digital Modulator Board to the optional 25 pin D connector, J3, on the back panel. Further functionality is discussed in the paragraphs entitled Regulator Board later in this section.

4.3.4.8 FM Output (J7)

The FM output signal is a 50 ohm output using an SMB connector. The output level is +2dBm (+/-0.5dB) to the 5MHz Filter Board. In normal operation the output is an FM signal with center frequency range between 5.55MHz to 5.65MHz. Harmonic and spurious signals are filtered to levels less than -70dBc.

4.3.4.9 DAC Test Output (J8)

A 50 ohm DAC test output is provided to allow sweeping of the final output filter. It uses an SMB connector and can be connected to a frequency source (with the board out of the exciter) so that frequency response measurements of the output filter can be made at the FM output (J7).

4.3.4.10 Adjustments/Settings

4.3.4.10.1 Functional Settings (S5)

S5, a four pole switch is used for testing and deviation control, see Figure 4-8. The first switch (Modulation on/off) turns the FM modulation on and off. The second switch selects the maximum deviation level of the exciter. The final two switches are only used during system set-up and alignment. The table at the bottom of Figure 4-8 shows each setting.

The Modulation on/off setting is useful when the exciter center frequency needs to be measured, or when the carrier level is desired. A 208% deviation setting provides the user with 108% (6.38dB) deviation overhead; but with some loss in S/N (2.84dB) relative to 100% (75kHz) deviation. The recommended setting is the 150% setting. During normal operation, both Eq A and Eq B should be in the open position.

Note

The input Interface Modules are normally calibrated with Maximum Deviation Level set to 150%. If the Deviation level is then set to 208%, the modulation level will increase 2.84dB unless the input level is reduced.

4.3.4.10.2 Frequency Setting Switches (S2, S3, S4)

When the Remote Frequency option is not in use, frequency selection is accomplished by 12 switches comprising S2, S3, and S4, see Figure 4-8 and Table 4-1 below. The switches are

Table 4-1. Digital Modulator Board Frequency Switch Weighting Table (Frequency in Hz)

MSB		S4		S3				S2			LSB
N11	N10	N9	N8	N7	N6	N5	N4	N3	N2	N1	N0
102,400	51,200	25,600	12,800	6400	3200	1600	800	400	200	100	50

WARNING: Disconnect primary power prior to servicing.

Table 4-2. PLL Board Coarse Frequency Switch Weighting Table (Frequency in MHz)

S3				S2				S1			
M9	M8	M7	M6	M5	M4	M3	M2	M1	M0	-	-
80/40	20	10	5	2.5	1.25	1	0.5	0.25	0.125	0	0

arranged in binary format with the LSB (S2 position D) providing a 50Hz frequency step. Position A of S4 is the MSB. There is a base offset of 5.5MHz programmed into the frequency algorithm. Table 4-1 shows the relative weights of each switch. The Digital Modulator board's output frequency can then be found by adding 5.5MHz to the accumulative weights of every switch. The proper switch settings can be found in the frequency selection chart at the end of Section V, Maintenance and Alignment.

Note

For more information on how to set the exciter on the proper frequency, refer to Section V, under the heading Selecting a Frequency.

The Frequency of the Digital Modulator output should be within 15Hz of the desired setting.

4.3.5 5MHz Filter Board

The input to this board is the 5.6MHz FM output from the Digital modulator Board. The input level is approximately 2dBm. The 5MHz Filter board provides very narrow and relative distortion free filtering of the 5.6MHz FM IF signal. There is approximately a 10dB signal loss through the filter.

4.3.5.1 Power Connector (J1)

A 10 pin ribbon connector is used to supply the board with +17V (pin 1), -17V (pin 3), and -6.5V (pin 5). Each voltage is required to be no worse than 5% from nominal voltage.

4.3.5.2 5MHz Fault

The fault indication is output on J1-9, to the Regulator Board. This fault is summed in with the Upconverter and 100MHz Filter Board faults. These are then summed in with the phase locked loop fault from the PLL Board. Therefore, a fault on any of these four boards is displayed as a PLL fault on the front panel. For more information on faults refer to Section VI, Troubleshooting.

4.3.5.3 FM Input (J2)

The FM input is from the Digital Modulator Board. The input carrier power level must be at least -5dBm. The center frequency must be 5.6MHz (+/- 1MHz). Harmonics or spurious signals within 2MHz of any harmonic frequency of the carrier must be kept below -80dBc. Other spurious components must be no greater than -40dBc.

4.3.5.4 FM Output (J3)

The FM output is a 50 ohm -9dBm signal (+/- 0.5dB), which is sent to the Upconverter Board. Harmonics of the fundamental FM signal should be below -70dBc.

4.3.6 PLL Board

The PLL board serves as a coarse tuning LO for the digital exciter. A block diagram of the PLL Board is shown in Figure 4-9. It divides the 10MHz TCXO reference oscillator signal to obtain a 125kHz reference frequency for the phase detector. This reference frequency serves as the minimum frequency step that can be obtained by the PLL board. An external low noise VCO is used to provide the final LO frequency. The VCO input (from the VCO Board, A6) is sent to a splitter. One output of the splitter is amplified and routed to the LO (Local Oscillator) output, J5. This is to become the LO signal for the Upconverter Board. The second output from the power splitter is divided by a number determined by the settings of S1, S2 and S3, the Coarse Fre-

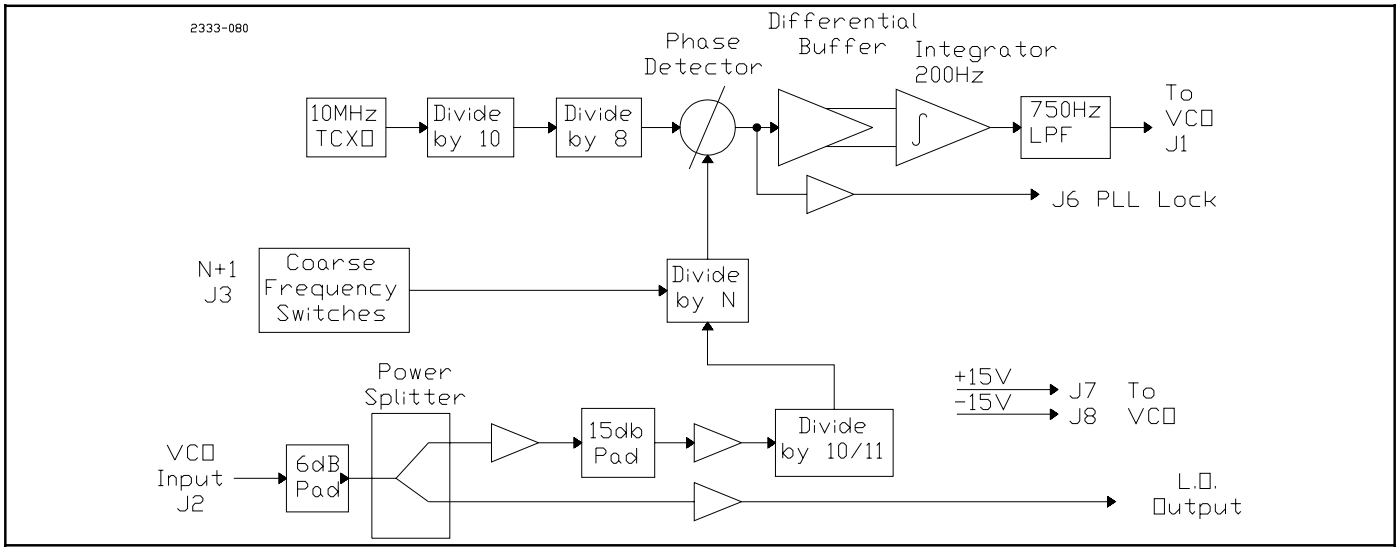


Figure 4-9. PLL Board Block Diagram

WARNING: Disconnect primary power prior to servicing.

quency Setting Switches. The resulting low frequency is supplied to the phase detector, along with the divided output of the 10Mhz TCXO. The resulting DC phase-error signal is bandwidth-limited and fed to the VCO to lock it to the proper LO frequency.

4.3.6.1 Coarse Frequency Setting

When the N+1 option is not in use, frequency selection is accomplished by 12 switches comprised of S1, S2 and S3. When using N+1, the switches must all be left open. The switches are weighted as shown in Table 4-3. Note that the MSB selects 80MHz when the switch is open and 40MHz when closed. All other switches select the given amount below when open and 0Hz when closed. The last two switches are not connected. All the numbers in Table 4-3 are in MHz. The PLL output frequency can be found by adding all the weights of the open switches. For example if switches M9, M6, M5 and M1 were open, the output frequency would be (80 + 5 + 2.5 + 0.25) MHz = 87.75 MHz.

4.3.6.2 Power Connector (J6)

A 14 pin ribbon connector is used to supply the PLL board with +17V (pin 1) and -17V (pin 3). Each voltage is required to be no worse than 5% from nominal voltage.

4.3.6.3 PLL Loss of Lock

The PLL lock indication is output on J6-9. A loss of lock indication is a low output voltage. The signal requires an external pull-up resistor on the regulator board to operate properly. This fault signal is summed in with the fault signals from the Upconverter, 5MHz Filter and 100MHZ Filter Boards. A fault from any of these boards will cause the front panel PLL fault to light.

4.3.6.4 N+1 connector (J3 Optional)

A 10 pin ribbon connector accepts a 10 bit TTL compatible N+1 input word for optional remote frequency tuning in N+1 installations. Changes in the tuning number may be done asynchronously and the settling time for any tuning changes is required to be less than 400ns to avoid large transitional errors in output frequency. The tuning algorithm is given in Section V, under the heading, Selecting a Frequency.

4.3.6.5 VCO Tuning Voltage (J1)

The VCO tuning voltage controls the frequency of the VCO. The tuning voltage falls between the range of 4V and 10V for the normal operating frequency range (82MHz to 102MHz LO frequency).

4.3.6.6 VCO Input (J2)

This input receives the VCO output at a nominal level of 2.8dBm. The input must be well padded (6dB nominal) so that no pulling of the VCO is suffered. This signal is approximately 5.6MHz below the actual on-channel carrier frequency. This signal is then buffered and sent to the Upconverter Board as the LO input, and is also divided down and used as the second input to the phase detector (the reference 125kHz being the other input).

4.3.6.7 Notch Output (J4)

A notch filter tuning voltage is supplied to the Upconverter board and is set via the Frequency dip switches on the PLL board.

4.3.6.8 PLL Board Output (J5)

The PLL output is an ac coupled 50 ohm output and is the LO signal for the Upconverter Board. The level is nominally +4dBm. The output frequency range of the VCO is from 80MHz to 105MHz.

4.3.6.9 +15V Output to VCO (J7)

All power to the VCO comes from the PLL Board. The VCO draws about 25mA of +15V which is supplied via connector (J6) on the PLL board. The voltage is required to be no worse than 5% from nominal voltage.

4.3.6.10 -15V Output to VCO (J8)

The VCO draws about 35mA of -15V which is supplied via connector (J6) on the PLL board. The voltage is required to be no worse than 5% from nominal voltage.

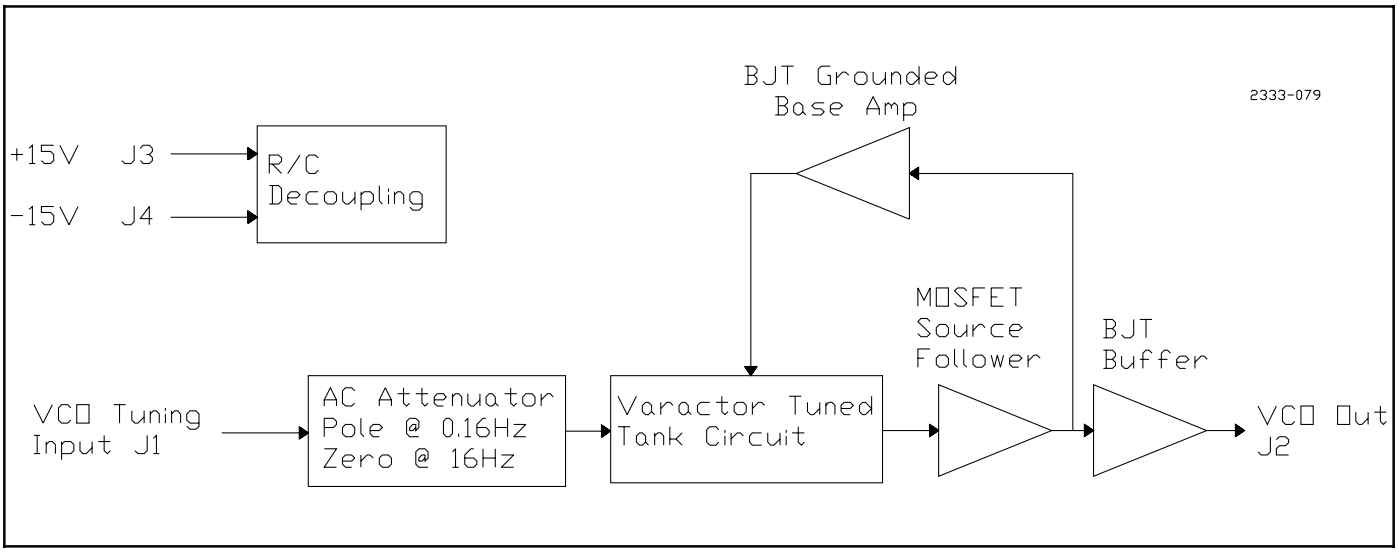


Figure 4-10. Block Diagram VCO Board

WARNING: Disconnect primary power prior to servicing.

4.3.7 VCO Board

A block diagram of the VCO is shown in Figure 4-10. The VCO board is a low noise Voltage Controlled Oscillator which inputs power and a tuning voltage from the PLL board, and outputs an RF signal to the same PLL board. It is completely enclosed with a tight RF shielded box. The box is also shock mounted to prevent microphonic distortion. This board is shipped with stabilizer screws to prevent shipping damage which must be removed prior to installation. For more information refer to "Unpacking" in Section 2, Installation.

4.3.7.1 VCO Output (E1)

The VCO output is connected to a bulk mounted SMB connector on the VCO box via hook-up wire. The output is a nominal 2.8dBm over the frequency range of 85MHz to 112MHz.

4.3.7.2 VCO Tuning Input (E2)

The VCO Input is connected to a bulk mounted SMB connector on the VCO box via a 4.99k ohm 1% resistor. The input accepts any voltage between 0 Volts and 10 Volts, but the normal operational voltage is 3 Volts to 9 Volts.

4.3.7.3 VCO Power Supply +15V. -15V (E3, E4)

The VCO +/-15 Volt supply inputs are connected to bulk mounted SMB connectors on the VCO box via hook-up wire. Each supply is heavily lowpass filtered with an R/C network to maintain the low noise properties of the VCO.

4.3.8 Upconverter & 100MHz Filter (A4)

The Upconverter and 100MHz Filter are on the same PC board (A4). The two circuits are kept somewhat separate though, so that the 100MHz Filter part of the board can be broken away from the Upconverter and be used as the stand alone 100MHz Filter Board, A9 (the Upconverter section is discarded). Figure 4-11 shows a simplified drawing of the complete Upconverter Board and 100MHz Filter Board assembly.

The Upconverter board utilizes a single upconversion to change the 5.6MHz FM signal to the final FM channel frequency in the 88MHz to 108MHz band. It requires a 5.6MHz FM signal input, from the 5MHz Filter board, as well as a Local Oscillator (LO) input, from the PLL board, to perform the necessary upconversion. The output of the Upconverter board contains the on-channel FM carrier as well as all of the various mixing products. The Upconverter although physically connected to the 100MHz Filter, has no signal connection from its output at J8, to the 100MHz Filter input at J4. A short coax jumper cable is used to make the connection. The primary purpose of the 100MHz Filter is to attenuate the mixing products. The 100MHz Filter output is then connected to the input of the stand alone 100MHz Filter Board (A9). The output of this second filter is sent to the 55 watt RF PA.

4.3.8.1 Power Connector (J2)

A 10 pin ribbon connector, from the Regulator Board, is used to supply the Upconverter board with +17V (pin 1), -17V (pin 3), and -6.5V (pin 5). Each voltage is required to be no worse than 5% from these nominal voltages.

4.3.8.2 Upconverter Fault

The Upconverter Fault is output on J2-9 to the Regulator Board. It is a summary fault of both the Upconverter Board (A4) and the 100MHz Filter board (A9). A the fault signal is a low output to the Regulator Board. The signal requires an external pull-up resistor on the Regulator Board to operate properly.

4.3.8.3 Upconverter, J1

Connector J1 on the upconverter board supplies power to J9 on the stand alone 100MHz Filter board (A9). The voltages include:

J1-1 - (+15V)
J1-3 - (-15V)
J1-7 - (-5.2V)

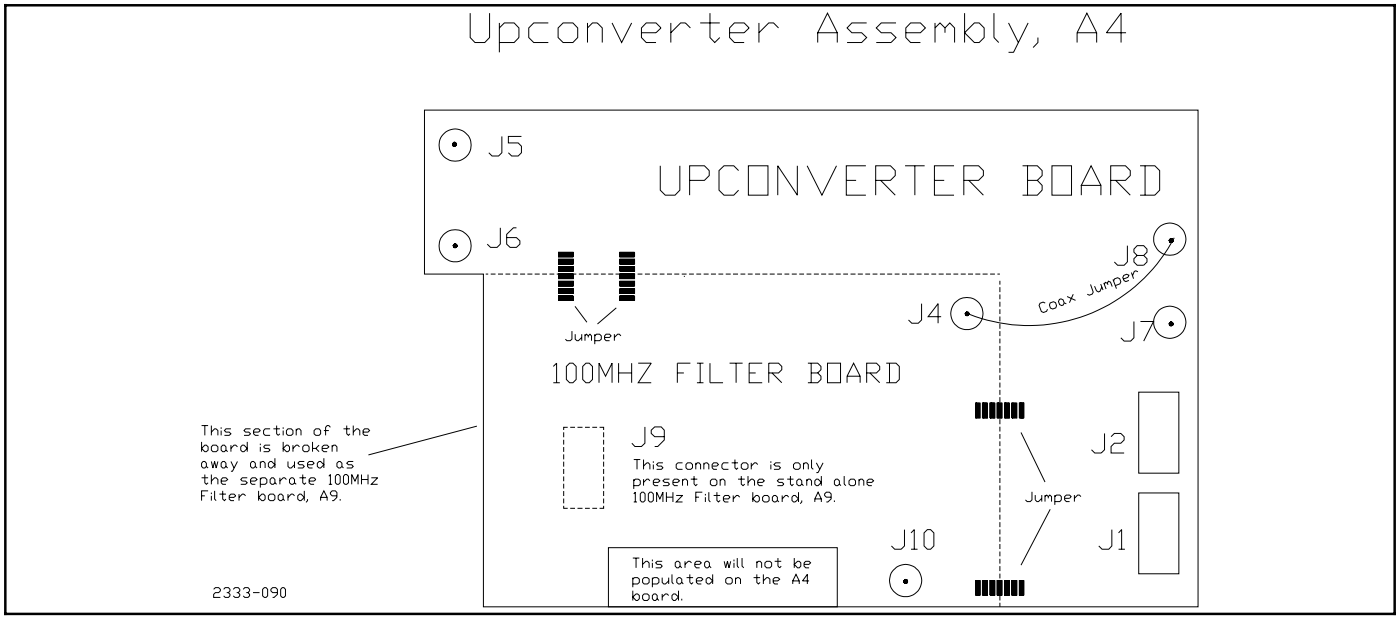


Figure 4-11. Upconverter & 100MHz Filter PC Board Configuration

WARNING: Disconnect primary power prior to servicing.

4.3.8.4 LO (PLL) Input (J5)

The LO input is driven by the PLL Board output. This is a 50 ohm source having a nominal power level of 4dBm and a minimum level of 0dBm. The operational frequency for the LO input must be limited to the 75MHz through 110MHz band.

4.3.8.5 5.6MHz FM Input (J6)

The 5.6MHz FM input is driven by the 5MHz Filter board output. This is a 50 ohm source having a nominal power level of -8dBm and a minimum level of -10dBm. The operational frequency for the LO input must be limited to the 5.5MHz through 5.7MHz band.

4.3.8.6 Upconverter Output (J8)

The upconverter output requires a coaxial connection to J4 of the first 100MHz filter in order to allow the removal of the 100MHz filter part of the board when it is used as a stand alone unit (A9), see Figure 4-11. The 50 ohm output provides a -2dBm signal in the frequency range of 87MHz to 108MHz.

4.3.8.7 100MHz Filter Output (J10)

The 100MHz Filter output is really the Upconverter Board output, since the final output amplifier stage is not used (The 100MHZ Filter output is physically connected, via the PC board, back to the Upconverter board output J10). The output provides a -2dB output to the second 100MHz Filter board (A9). The output frequency range is 87MHz to 108MHz.

4.3.9 100MHz Filter Board, A9

This is the second of the two 100MHz filters, and is identical to the first one (the one attached to the Upconverter) except for a few extra parts which are installed on this board that are not installed on the other. These parts include J9, the power connector and the parts which comprise the RF output amplifier.

4.3.9.1 100MHz Filter Board Power Connector (J9)

When the 100MHz filter portion of the Upconverter board is cut away, connector J9 is installed to supply power to the stand alone 100MHz Filter board. The 10 pin ribbon connector supplies +15V (pin 1), -15V (pin 3), and -5.2V (pin 7) to the board from J1 on the Upconverter.

4.3.9.2 100MHz Filter Output (A9J11)

The output of the second 100MHz filter is a 50 ohm output which drives the 55 watt RF PA. It provides a +0dBm signal within the 87MHz to 108MHz frequency band.

4.3.10 Regulator Board

The block diagram for the Regulator Board is shown in Figure 4-12. The Regulator board handles the system power distribution and metering requirements of the exciter. It also controls the power amplifier (PA), and responds to any fault conditions. The microcontroller based sense and control architecture allows for system changes in software and future upgrades.

4.3.10.1 AC Power Supply Input (J1)

The +/-20VAC and +/-10VAC transformer secondary windings are connected to J1 on the Regulator board. After rectification and filtering, the 20VAC input must provide a minimum of 18.5V dc at full rated load, and the 10VAC input must provide a minimum of 8Vdc at full rated load. This assumes that the appropriate primary tap selection is used for high and low line voltage. Thermal considerations also require that the rectified and filtered dc voltage applied to the regulators does not exceed a voltage which will damage the regulators. These voltages are given below:

Input	Max Current	Nominal Current	Minimum Voltage	Worst Case DC Voltage
+20VAC	1.0A	850mA	+18.5V	+23V
-20VAC	0.5A	320mA	-18V	-25V
+10VAC	1.5A	900mA	+8V	+10.5V
-10VAC	1.0A	850mA	-8V	-12.5V

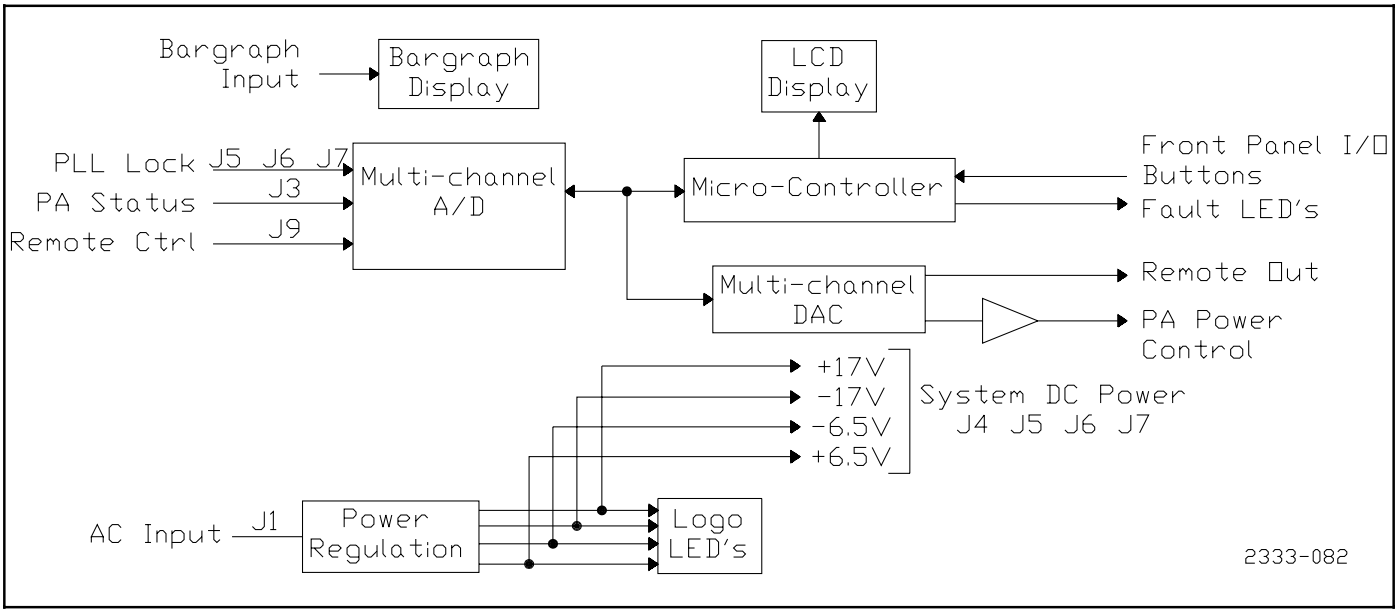


Figure 4-12. Regulator Board Block Diagram

WARNING: Disconnect primary power prior to servicing.

4.3.10.2 B+ Supply Input (J2)

Power for the PA is input on J2, and fused by F1, a 10 amp fuse on the Regulator Board. The current is also measured on this board before being applied to the PA. The Voltage is required to be no less than 23V. If the voltage exceeds 28V, the crowbar circuit will actuate and blow the fuse (F1). The current is monitored and provided as a metered output. The exciter will begin power fold-back for currents exceeding 3.88 amps. The maximum current allowed before full foldback occurs is 4.18 amps. This is used as a fast VSWR response mechanism to protect the Power Amplifier.

4.3.10.3 Power Amplifier I/O (J3)

This connector supplies the PA with power (B+) and inputs various PA status voltages. The forward and reflected power status voltages are derived from the PA directional coupler. A voltage relaying PA temperature information is also input for temperature foldback purposes.

4.3.10.3.1 Forward Power Input (J3-1)

The forward power coupler voltage is sent to the Regulator Board for front panel and remote metering. Variations and errors in the forward power coupler voltage can be calibrated out by adjusting the Forward Power Calibration pot (R56). Refer to Section V, Maintenance and Alignments, for additional information regarding Forward Power Calibration.

4.3.10.3.2 Reflected Power Input (J3-2)

The reflected power coupler voltage is used to fold back the PA output power in the case of high VSWR. The exciter is set to begin foldback for a reflected power coupler voltage of 0.30 Volts. The 0.30V corresponds to approximately 5W reflected power. If the reflected power exceeds 5 Watts the controller will reduce PA power to a point where the reflected power is below 5 Watts. The foldback time is between 250 microseconds and 880 microseconds.

4.3.10.3.3 PA Temperature Input (J3-4)

The PA temperature voltage is required to be a linearly increasing voltage vs. increasing PA temperature. The voltage can be calculated by the following formula. (The voltage accuracy is within 0.03 Volts of nominal at room temperature.)

Temp Input Voltage = 2.98V + (10mV)(PA temperature °C - 25 °C)

The forward power will be folded back until a power level is reached where a temperature below 80°C (3.53V input) can be maintained.

4.3.10.3.4 PA Collector Voltage Input (J3-9)

The PA Collector voltage can be measured to within a 1% accuracy. Normal operational voltages are from 0V to +27V. The controller is set to fold-back the PA if 27 Volts is exceeded. The PA power fold-back time is between 205 and 940 microseconds. If the control foldback fails for any reason then a crow bar circuit is actuated for voltages exceeding +28V. The crow bar circuit will short the B+ supply and blow fuse F1 disconnecting B+ power to the PA.

4.3.10.3.5 PA Base Voltage Output (J3-12)

The PA Base Voltage and consequent output power is controlled by the Regulator Board. This voltage ranges from +B (no output power) to about 1.4V below +B (maximum output power). At initial power-on, the controller senses the forward power setting then ramps the forward power up to the set power level within 1 second.

4.3.10.4 Front Panel Overlay Connector (J8)

This connector provides four active high button inputs from the front panel overlay and four active low fault outputs to the front panel overlay. Another active low output, namely the 10% scale indicator, is also provided. A key return (J8-5) and two fault return outputs (J8-11 and J8-12) provide +5V power to the front panel overlay for button and fault LED operation.

4.3.10.5 Remote Output Connector (J9)

Remote control inputs and exciter status outputs (from J2 on the back panel) are applied to connector J9 on the Regulator Board.

Status outputs include:

- Forward power (FWD PWR)
- Reflected power (REF PWR)
- PA voltage (PAV)
- PA current (PAI)
- Exciter fault indication
- No program data (NOPGM).

The control inputs are:

- Exciter Mute
- Automatic Power Control
- Automatic Fault Control interlock common
- Automatic Fault Control interlock normally closed contact
- Automatic Fault Control interlock normally open contact

4.3.10.5.1 Exciter PA Status (FWD PWR, RFL PWR, PAV, PAI)

These status outputs provide an output voltage which varies linearly between 0 and +4V as shown earlier in Figure 4-3. For example if the PA voltage was 16 volts, then 2.0V would be applied to J9-4. The Remote PA volts and remote PA current are specified accurate to within 2% at full scale. The Remote Forward Power can be set to within 1% at full scale assuming a VSWR of 1:1. The curve shown in Figure 4-3a assumes that pot R55, Remote Forward Power Calibration (accessible from the top of the exciter) is set all the way clockwise (gain of 1). There is no accuracy specification for Reflected Power.

4.3.10.5.2 Exciter Fault and No Program Status (Fault, NoPgm)

These status outputs are open collector outputs capable of sinking over 100mA with a pull up resistor to +5 Volts. A high (+5V) on J9-6 indicates that an exciter fault (PLL unlock, Temperature fault, or VSWR fault) has occurred. A high (+5V) on J9-13 indicates that there is no digital modulation input to the exciter. The no program (NoPgm) status is useful in determining input source faults. If the exciter has no digital modulation input for at least 4.2 seconds then this remote output is driven high. The signal will return to 0 volts as soon as a digital input is again detected.

WARNING: Disconnect primary power prior to servicing.

4.3.10.5.3 Exciter Mute (Mute)

This input should be driven by either a TTL/CMOS compatible source or an open collector source. The input can be either active high or active low depending on the position of jumper JP1. The input voltage is clamped at a maximum of +5V to avoid unpredictable exciter operation and board damage.

4.3.10.5.4 Automatic Power Control (APC)

This input is used to control the exciter power remotely. The input requires at least a 4V level (into a 10k ohm load) to achieve an exciter power level of 60W. Higher input voltages are acceptable as long as the APC adjustment pot (R6) is correctly adjusted to scale the input to the correct voltage. The input is clamped at a maximum +5V to avoid unpredictable exciter operation and board damage. The exciter output power will increase linearly relative to the APC input voltage and is identical to the forward power curve of Figure 4-3a.

4.3.10.5.5 Automatic Fault Interlock Control (AFC Com, AFC NC, AFC NO)

A reed relay switch, K1, is provided for the use of the transmitter. When an exciter fault occurs, the exciter will shut off output power and switch the relay. The relay will switch a maximum of 0.25 Amps at 100V. The voltage must not exceed 250V, and the current must not exceed 1A. Use of either the Normally Open or the Normally Closed contacts is dependent on your system requirements.

4.3.10.6 Power Distribution (J4, J5, J6, J7)

The regulator board supplies power to the Digital Modulator, 5MHz Filter, PLL, and Upconverter boards. +17V, -17V, -6.5V and 6.5V are available using common pin assignments for each board. The voltages are specified to be within 5% of nominal. The voltages were chosen to allow on-board regulation to +15V, -15V, -5.2V, and +5V. This double regulation eliminates the need for substantial filtering on each board and provides improved noise reduction.

4.3.10.7 Digital Modulator Board Interface (J4)

The front panel bargraph display is driven by the MOD CLOCK (J4-13, 14), MOD DATA (J4-15, 16), MOD STROBE (J4-17, 18), and 10% SCALE (J4-19, 20) signals from the Digital Modulator Board. Each input is a differential input. Data is a serial data stream 32 bits long, each bit being latched into the parallel bargraph buffer, U9 by MOD CLOCK. The Data word must be a contiguous number of "ones" proportional to the modulation level. MOD STROBE is a pulse that goes high every 32 MOD CLOCK cycles, and latches the 32 bit serial Data word from the bargraph buffer to the bargraph driver. To activate the 10% indicator a low level must be applied to the 10% SCALE input.

4.3.10.7.1 No Program input (NoPgm)

NoPgm is a single ended TTL compatible input (J4-11) indicating that there is no digital programming input into the exciter when high. This is for remote information and can be used as a failure test point for system debugging. It is output as a remote status signal via J9-13 to the back panel remote connector J2.

4.3.10.7.2 Remote Frequency Mute (N+1 Mute)

An externally generated Mute signal is supplied on J4-12. This is only used for N+1 systems. If jumper JP4 is set to the Mute enable position (pins 2-3), then a high impedance input allows the input to be pulled high (+5V), and the exciter is muted. This protects the exciter from faulty remote frequency controllers or an accidentally disconnected remote cable. If jumper JP4 is set to the Mute disable position (pins 1-2) then the exciter cannot be muted by this input. This is the normal or non-N+1 configuration.

4.3.10.8 PLL Lock Inputs (J5, J6, J7)

The 5MHz filter, PLL, and Upconverter boards must each supply fault status on pin 9 of their respective power supply cable back to the Regulator Board. The 5MHz fault signal produces a fault for voltages above 0.75V. The PLL Lock and Upconverter fault signals must provide a TTL low signal when faulted. After a fault condition occurs the exciter output power is shut down between 65 and 900 microseconds later. The PLL fault light and RF Mute indicators will also be lit.

4.3.10.8.1 Regulator Board Adjustments and Settings

Refer to Section V, Maintenance and Alignments for Regulator Board adjustments and jumper settings.

5.1 Preventative Maintenance

DIGIT™ should require little servicing. Extensive digital processing within the exciter eliminates most causes of drift and ensures stable performance throughout the life of the product. As with any electronic equipment, reliability of DIGIT™ is enhanced if it is kept clean and cool.

5.2 Cleaning

Inspect the intake air fan and the interior of DIGIT™ periodically. Look for dirt deposits, particularly on the PA heatsink, and clean out any dust or dirt which has collected. If dirt build-up occurs, consider adding an intake filter to the cooling fan. Accumulated dirt is the enemy of efficient cooling.

During the inspection, check to see if the fan is turning freely and quietly. Like any moving part, the cooling fan will become worn after a long period of operation and will need to be replaced. Doing so before the fan fails will ensure against outage.

5.3 Cooling

Try to do the cleaning and inspection of DIGIT™ as soon as possible after sign-off and check for elevated temperatures inside. Excessive temperatures are the enemy of reliable operation. If you note signs of excessive temperature, check to see that the exciter receives an adequate supply of cooling air and that the exhaust from the right-hand side can flow away from the exciter without being blocked.

5.4 Periodic Exciter Alignments

There is no recommended periodic alignment for DIGIT™. DIGIT™ has been fully aligned and tested at the factory during manufacture. Very few adjustments should be required subsequently. The following procedures are those you might need to follow for long term maintenance of DIGIT™.

5.5 Channel Setting and Frequency Adjustment

When DIGIT™ is first installed, it may need to be set to the correct operating channel or frequency using dip switches on the Digital Modulator Board and the PLL Board. Later, as the reference oscillator crystal ages, the 10 MHz TCXO (Temperature Compensated Crystal Oscillator), on the PLL Board, may need to be adjusted.

5.5.1 How Frequency is Selected

DIGIT™ uses an advanced method of signal generation and modulation which permits selection of any frequency within the exciter's specification simply by setting a number of switches. The switches are located on two circuit boards inside the exciter, the Digital Modulator board and the PLL board.

The PLL board switches (S1, S2 and S3) set the Local Oscillator (LO) output from the PLL board to the nearest 125 Khz choice, approximately 5.6 MHz below the desired channel.

The Digital Modulator board switches (S2, S3 and S4) set the board output frequency to approximately 5.6 MHz. The exact frequency is chosen to mix with the PLL output to produce the desired exciter channel.

The correct switch settings to produce any desired output frequency may be found using the following method. Most users will also find their desired frequency listed along with the necessary switch settings in the chart at the end of this section.

5.5.2 Digital Modulator Switches

On the Digital Modulator board, S2, S3 and S4 are the frequency select switches. They are located on the top center of the board as follows:

S4				S3				S2			
N11	N10	N9	N8	N7	N6	N5	N4	N3	N2	N1	N0

The N0 - N11 designation appears on the metal cover of the Digital Modulator board. Setting these switches generates a 12-bit binary "word", or number, with N0 as the low-order bit and N11 the high-order bit. Setting any one of these switches to "Open" generates a "1"; closing the switch generates a "0".

Setting these three switches selects the output frequency of the Digital Modulator board to a frequency between 5.55 MHz and 5.65 MHz. The exact frequency is 5.5 MHz plus the frequency steps set by all of the switches which are set to "1". The frequency weighting of the switches is:

N11	102,400 Hz
N10	51,200 Hz
N9	25,600 Hz
N8	12,800 Hz
N7	6400 Hz
N6	3200 Hz
N5	1600 Hz
N4	800 Hz
N3	400 Hz
N2	200 Hz
N1	100 Hz
N0	50 Hz

WARNING: Disconnect primary power prior to servicing.

5.5.3 PLL Board Switches

On the PLL board, S1, S2 and S3 are the frequency select switches. They are located near the center of the board as follows:

S3				S2				S1			
M9	M8	M7	M6	M5	M4	M3	M2	M1	M0	-	-

The two right-hand sections of S1 are not used.

The M0 - M9 designation appears on the metal cover of the PLL board. Setting these switches generates a 10-bit binary "word", or number, with M0 as the low-order bit and M9 the high-order bit. As with the Digital Modulator switches, setting any one of these switches to "Open" generates a "1", closing the switch generates a "0".

Setting these three switches selects the output frequency of the PLL board to a frequency between 82.25 MHz and 102.375 MHz. This is the Local Oscillator frequency, which is mixed with the Digital Modulator board frequency to generate the exciter output frequency.

The exact frequency is 40 MHz plus the frequency steps set by all of the switches which are set to "1" or open. The frequency weighting of the switches is:

M9	80/40	MHz
M8	20	MHz
M7	10	MHz
M6	5	MHz
M5	2.5	MHz
M4	1.25	MHz
M3	1.0	MHz
M2	0.5	MHz
M1	0.25	MHz
M0	0.125	MHz

5.5.4 Selecting a Frequency

Any frequency within the band may be selected, using the following method:

- Determine the desired frequency. Example: 91.0 MHz.
- Subtract 5.55 MHz from the desired frequency.
  91.0 - 5.55 = 85.45 MHz
- Select the Highest frequency possible BELOW this result by setting the switches on the PLL board.

Base Frequency:		40	MHz
M9	Open	40	MHz
M6	Open	5	MHz
M1	Open	0.25	MHz
M0	Open	0.125	MHz
Result:		85.375	MHz

- 85.375 MHz will be our choice for Local Oscillator frequency. To place DIGIT™ on the desired frequency, subtract this LO frequency from the desired frequency:
  91.0 - 85.375 = 5.625 MHz
- To place the exciter on 91.0 MHz, we must select the Digital Modulator switch combination which will place the Digital Modulator on 5.625 MHz. This will be:

Base Frequency:		5,500,000	Hz
N11	Open	102,400	Hz
N8	Open	12,800	Hz
N7	Open	6400	Hz
N6	Open	3200	Hz
N2	Open	200	Hz
		5,625,000	Hz

5.5.5 Frequency Selection Chart

A frequency selection chart is included in this manual, at the end of this section. It contains the most common frequency choices and the switch settings needed to set the exciter to those frequencies.

Note

Use of switch settings calculated by any other method is not recommended. Although some desired frequencies may be generated using more than one combination of switch positions, the settings listed in the chart or calculated by the method in this section, are the only choices which will guarantee DIGIT™ operates as specified.

5.5.6 Setting the TCXO

Once the correct frequency has been selected with the PLL and Digital Modulator switches, the exciter should be on the correct frequency. If any minor frequency error exists, the TCXO may need to be adjusted to place the exciter on the exact desired frequency.

5.5.6.1 Test Equipment You Will Need:

An accurately-calibrated frequency counter is necessary. Supply it with an RF sample of the exciter's output, making sure the sample is within the input level range your counter requires. The sample may be obtained using:

- a suitable attenuator (rated at more than 75 watts), connected to the exciter output.
- an adaptor cable, connected from the 100MHz Filter board output to the counter (adding attenuator pads if necessary). The output of this board is approximately +3dBm.
- a suitable RF sample in the transmitter driven by the exciter.

5.5.6.2 Procedure

- Remove modulation from the exciter, by setting Modulation ON/OFF switch S1 on the Digital Modulator board OFF.
- Measure the exciter output frequency with the frequency counter.
- The PLL board is in the center of the shelf under the top cover of the exciter, and the TCXO is located near the upper left corner of the board. Use a tuning tool to slowly adjust

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the frequency control on the TCXO until the desired frequency is reached. The TCXO control has a range of +/- 1000 Hz.

If the correct frequency selection has been made using the switches on the Digital Modulator board and the PLL Board, you should not have difficulty reaching the required frequency with the control.

- Restore modulation, with S1 on the Digital Modulator Board, and return all connections and switches to the normal settings. If correct frequency cannot be achieved, refer to "How Frequency is Selected" earlier in this section to verify that the switch setting are correct on the Digital Modulator and PLL boards

5.6 Exciter Power Level and Power Metering

There are three user setup controls on the Regulator Board. These are accessible through an opening near the top, right front corner of the exciter: See Figure 5-1.

- Forward Meter (R56) calibrates the LCD display to accurately read forward power.
- Forward Remote (R55) calibrates a DC remote forward power metering voltage for remote-control or remote-metering use.
- Exciter APC (R6) is a calibrate control to adjust the sensitivity of the input used by external equipment to vary the exciter output power.

5.6.1 Test Equipment Setup

To make these adjustments you will need a 100 watt load for the exciter, and an accurate power measuring device to measure the exciter's output. Connect the load and the power measuring device to the exciter output. You will also need an accurate VOM to adjust the Forward Remote output.

5.6.2 Forward Meter

Adjust the exciter output power to 50 Watts as read on an external power meter. Select FWD PWR on the LCD display and adjust R56, Forward Meter, to calibrate the display reading to 50 Watts.

5.6.3 Forward Remote

This adjustment is required only if the Remote FWD Meter Drive connection, J2-2, is used.

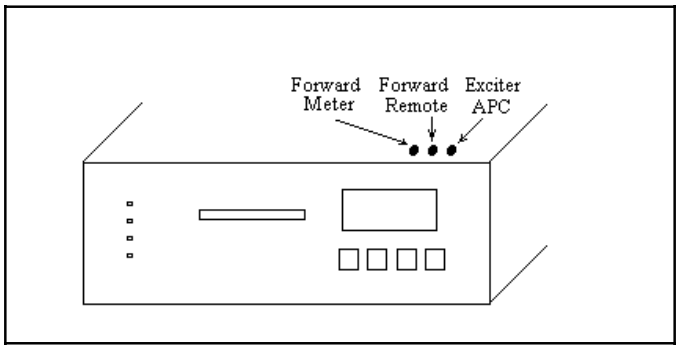

Figure 5-1. Exciter Front Panel & Forward Power Calibration & Adjustment Pot Position

With the exciter output power set to 50 Watts, connect the VOM to J2-2. Adjust R55, Forward Remote, as needed to produce 3.33 VDC at J2-2 (Maximum output is 4 VDC at 60 watts).

Note

To accommodate HT35 transmitter requirements, set the exciter output to 8.2 Watts. R55 should be adjusted to provide a 1.34 Volt output for normal HT35 operation.

5.6.4 Exciter APC (R6)

This adjustment is required only if your transmitter or your system uses the Exciter APC connection, J2-8, to control the exciter output power. This potentiometer adjusts the APC voltage when external power control is being used. The adjustment provides only attenuation and cannot increase the APC voltage. The APC voltage must be greater than 2.5V to achieve 50 Watts of output power. Adjustment is best performed at the system level.

- Using the transmitter or a test power supply, connect to J2-8 the DC voltage which is to cause the exciter output to be 50 Watts. Adjust R6, Exciter APC, until the exciter output is 50 watts, as read on the front panel display.

5.7 Analog I/O Module Adjustments

The following adjustments are factory calibrations which should not be required during installation.

5.7.1 Input Signal Level Calibration

As supplied, the Analog I/O Module is adjusted to produce 100% modulation with either of the following:

- A 400 Hz 3.5V P-P sine-wave at the Unbalanced Composite input.
- A 400 Hz +10 dBm sine-wave at the Monaural (600 ohm) input.

5.7.2 Adjustments

There are two gain adjustments and one offset adjustment in the optional Analog I/O Module:

- R26, Modulation Level (MOD LEVEL) sets the overall gain for all inputs.
- R19, Monaural Level (MONO LEVEL) sets the Monaural gain.
- R35, DC Offset, (NULL) zeros the exciter modulation output with no signal input.

Note

The DELAY and AMPL adjustments in this module are factory-set for best exciter operation and should not need to be adjusted in the field.

5.7.2.1 Equipment Required

An audio test-tone generator with accurate output level metering is the only test equipment required. The generator should be able to supply each of the following outputs:

- 400 Hz Sinewave, 3.5 V P-P, 25 ohms
- 400 Hz Sinewave, +10 dBm, 600 ohms

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5.7.2.2 Setting Modulation Level

The input to the Analog I/O Module is basically fixed at a nominal 3.5Vp-p (at 400Hz) input to either the Unbalanced or Balanced composite inputs. The nominal line level input to the exciter should be adjusted, previous to the exciter, to give 100% modulation at the 3.5Vp-p input level. This will also set the SCA inputs to give 10% injection (7.5kHz deviation) with a nominal 1.5Vp-p input.

- Use Digital Modulator Board switch, S5 to turn Maximum Deviation to the 150% position. See Figure 2-3, in Section 2.
- Set the test-tone generator for unbalanced output, 3.5 V P-P, 400 Hz, and connect to the Unbalanced Composite input (J5).
- Adjust MOD LEVEL (R26) until the exciter front panel modulation meter indicates less than 100%; then increase R26 slowly until the 100% indicator just lights.

5.7.2.3 Setting Monaural Level

- Set the test-tone generator for balanced output, 600 ohms, +10 dBm, 400 Hz, and connect to the Monaural input.
- Adjust MONO LEVEL (R19) until the exciter front-panel modulation meter indicates less than 100%; then increase R19 slowly until the 100% indicator just lights.

This procedure has calibrated the exciter to produce 100% modulation with either 3.5 V. P-P at the Composite input, or +10 dBm at the Monaural input, with the Max. Deviation switch S5 set to 150% (112.5kHz max. deviation). Some users may choose to select the 208% deviation setting, which allows deviation up to a maximum of 156kHz. Changing from 150% to 208% maximum deviation increases exciter headroom by 2.84 dB and may reduce S/N by 2.84 dB. Selecting 208% also increases the overall gain 2.84 dB, causing 100% modulation to occur at 2.52 V P-P composite, or +7.16 dBm from a 400 Hz source.

DIGIT™ can be readjusted to standard input sensitivity after selecting the 208% deviation setting by following the adjustment sequences above, Setting Modulation Level and Setting Monaural Level.

5.8 Digital Stereo Generator Module Adjustments

All adjustments are usually done during the initial installation of the exciter and may be found in Section 2, Installation.

WARNING: Disconnect primary power prior to servicing.

6.1 Faults

The DIGIT™ front panel provides several indicators which can alert you to problems in the unit:

RF MUTE indicates the output of the exciter has been muted by an external signal from the Remote Control connector or the N+1 Connector.

- Check external connections to J2-9 and J3-15, on the back panel of the exciter, to identify the source of the MUTE command.

6.1.1 SWR

SWR indicates an excessive amount of reflected power at the output of the exciter. When reflected power exceeds 5 watts, the SWR light comes on and the exciter reduces it's output power level until the reflected level falls below 5 watts.

- Check the output cable and the match to the input of the transmitter.

6.1.2 TEMPERATURE

TEMPERATURE indicates the presence of too high a temperature in the PA circuit. When the PA heatsink temperature reaches 80^{o}C, the TEMPERATURE light turns on and the exciter begins to lower it's output power to attempt to bring the temperature back below 80.

- Check to see that the exciter and transmitter cooling blowers are operating properly, that there is no blockage to the airstream and that transmitter is receiving an adequate supply of cool air.

6.1.3 PLL

PLL indicates a problem with the PLL Board (the phase locked loop has come unlocked), or that a fault has occurred on the Upconverter, 5MHz Filter or 100MHz Filter Boards. The exciter mutes if this indicator is lit. The four possible causes of a PLL indication:

- 5 Mhz Filter Board fault: This is an operational fault which is signalled by a voltage greater than 0.75 V on J1-9 of the 5 Mhz Filter Board (or J5-9 on the Regulator board).
- PLL Board not locked: This fault means the phase locked loop has come unlocked and is signalled by a LOW on J6-9 of the PLL board (or J6-9 on the Regulator board).
- Upconverter board or 100 Mhz Filter board fault: This is an operational fault which is signalled by a LOW on J2-9 of Upconverter board (or J7-9 on the Regulator board). The faults from these two boards are summed together on the Upconverter Board. To identify whether the Upconverter, A4 or the 100 Mhz Filter, A9 is the cause, temporarily remove JP7 on the Upconverter to disconnect the Upconverter fault signal. BE SURE TO REPLACE THIS JUMPER!

6.1.4 PERCENT MODULATION /10

PERCENT MODULATION /10 means no modulation reaching 15%, which might signal a loss of input. When the /10 indicator is lit, sensitivity of the bargraph scale is increased ten times to permit you to monitor low-level modulation. As long as the /10 indicator remains lit, the first red LED indicator represent 10%.

6.2 RF Output Foldback

Foldback control in the Regulator board is used to protect the PA against damage due to excess reflected power at the output, excessive heatsink temperature and excessive DC current. Foldback automatically reduces the output power if necessary to keep the PA from exceeding these limits:

- Reflected power at the output of 5 watts.
- PA heat sink temperature of 80 degrees C.
- PA current of 4.0 Amperes.

6.3 Fuses

There are two fuses included in DIGIT™. Fuse F1 in the rear-panel power input connector protects the whole exciter against excess current input and possible damage. The size of this fuse is determined by the operating voltage. See Section II, Installation, for more information.

Fuse F1 on the Regulator Board is a 10-ampere, 32 volt fuse, used to protect the PA module. This fuse will open if current flow into the PA power circuits exceeds 10 amperes, several times the normal value. A crowbar circuit is also included in this DC path, set to trip if the PA DC voltage reaches 30 Vdc. The crowbar causes fuse F1 to blow, protecting the PA against potentially damaging excess voltage.

CAUTION

Regulator board fuse F1 should NOT be replaced with a value larger than 10 Amperes or with a SlowBlow fuse.

6.4 DC Power Indicators

The DIGIT™ logo indicator in the upper right corner of the front panel is lit by 4 LED's which also serve as power supply indicators. If any segment is dark, the associated power supply output is low or non-existent. From Left to Right, the 4 indicators signal the following power supplies:

+17V	-17V	+6.5V	-6.5V

6.5 Remote Indicators

Two remote status indications are available at J2 and may be monitored manually or by remote control equipment:

WARNING: Disconnect primary power prior to servicing.

6.5.1 Remote FAULT

Remote FAULT (J2-6) is a summary fault which alarms in the event of PLL Unlock, Temperature Fault or VSWR Fault occurs. Jumper JP3 on the Regulator board may be used to designate whether a LOW or HIGH signals the fault condition.

- Check DIGIT™ front panel to identify source of the fault.

6.5.2 NOPGM

NOPGM (J2-13) indicates there is no digital modulating signal reaching the modulator board. NOPGM is signalled by a HIGH (Open), appearing on J2-13, 4.2 seconds after loss of digital data at the input. The HIGH condition remains until input resumes.

- Check the signal path to the input of DIGIT™ to identify the source of the outage.

6.6 Signal Tracing

Although the digital data within the Digital Modulator does not lend itself to easy signal-tracing methods, the IF, Local Oscillator and on-channel FM signals in DIGIT™ may be traced and checked with a spectrum analyzer or other RF measuring device. Given in Figure 6-1 and below in Table 6-1, is the amplitude and frequency of the signal to be expected at several key points in the IF and RF chain.

6.6.1 Approximate RF and IF Frequencies

For the exact frequencies of the IF and LO signals refer to Section V, under the heading “How to Select Frequency.”

IF	=	Intermediate Frequency	5.6 MHz (approx)
LO	=	Local Oscillator signal	82 to 102 MHz
RF	=	On-Channel RF signal	88 to 108 MHz

6.7 Troubleshooting Flow Charts

The following flow charts are provided for troubleshooting the exciter down to the individual board level. Due to the complex circuitry and the surface mount technology used in the exciter, customer repair of individual boards is not recommended, but rather that the whole board be replaced with either a spare board or an exchange board from Harris. For more information on repair and board exchange please feel free to call the Harris Allied parts department representative.

Table 6-1. Troubleshooting Check Points

Board	Signal Level in dBm	Type of Signal	Approximate Frequency
Digital Modulator A3-J7 (Output)	+ 2.0 dBm	IF	5.6 MHz
5 MHz Filter A8-J3 (Output)	- 9.0 dBm	IF	5.6 MHz
PLL Board A7-J5 (LO Output)	+ 2.9 dBm	LO	82-102 MHz
Upconverter A4-J8 (U/C Output)	- 2.0 dBm	RF	88-108 MHz
Upconverter A4-J10 (Output)	- 2.0 dBm	RF	88-108 MHz
100 MHz Filter Board A9-J11 (Output)	+10.0 dBm	RF	88-108 MHz
DIGIT™ J1 (PA output, RF Output)	55 Watts max.	RF	88-108 MHz

WARNING: Disconnect primary power prior to servicing.

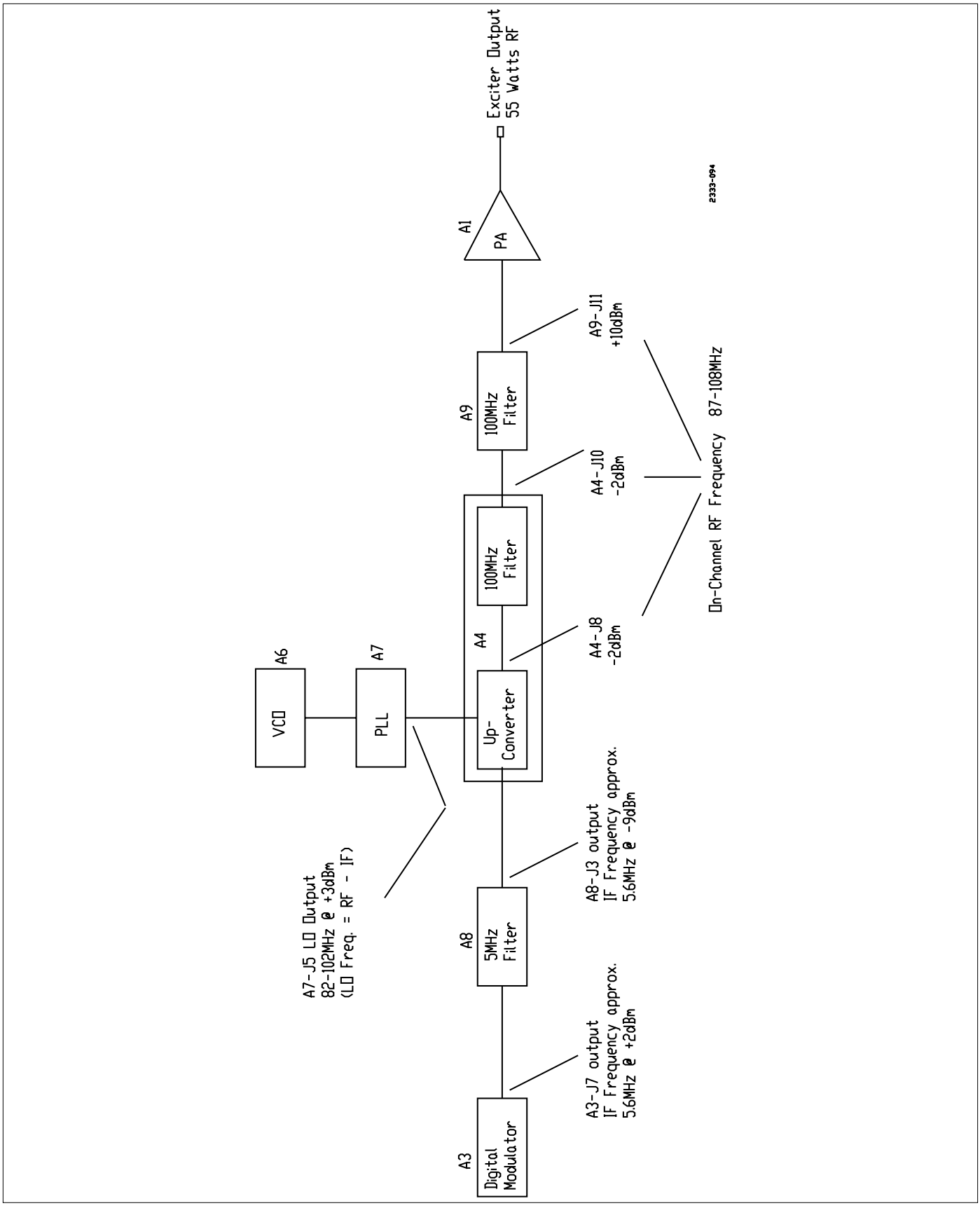
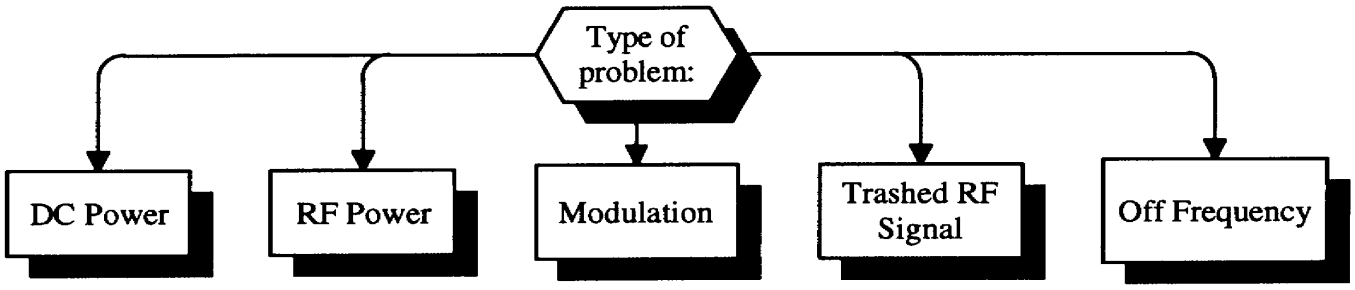


Figure 6-1. Troubleshooting Checkpoints

WARNING: Disconnect primary power prior to servicing.



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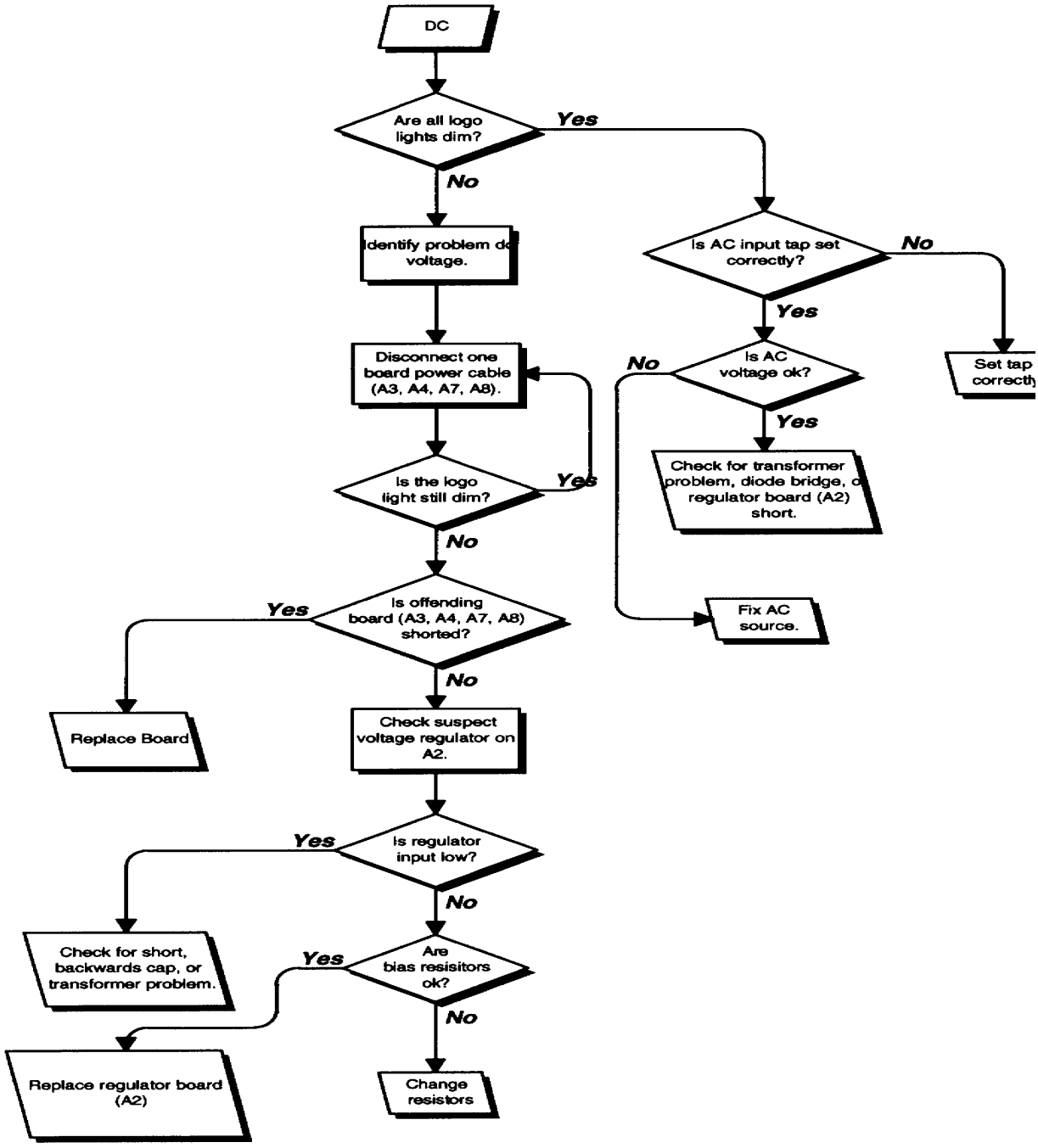

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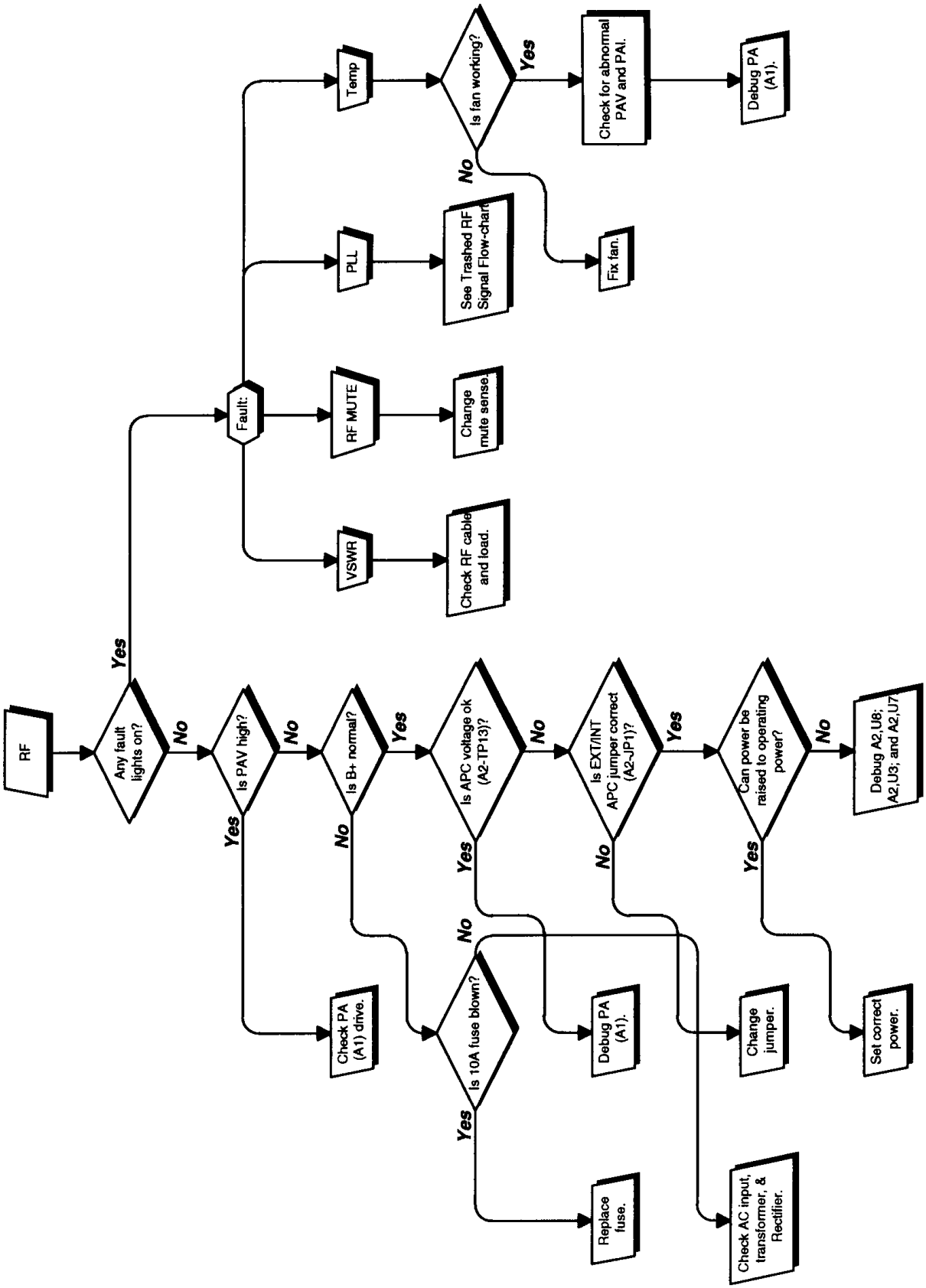

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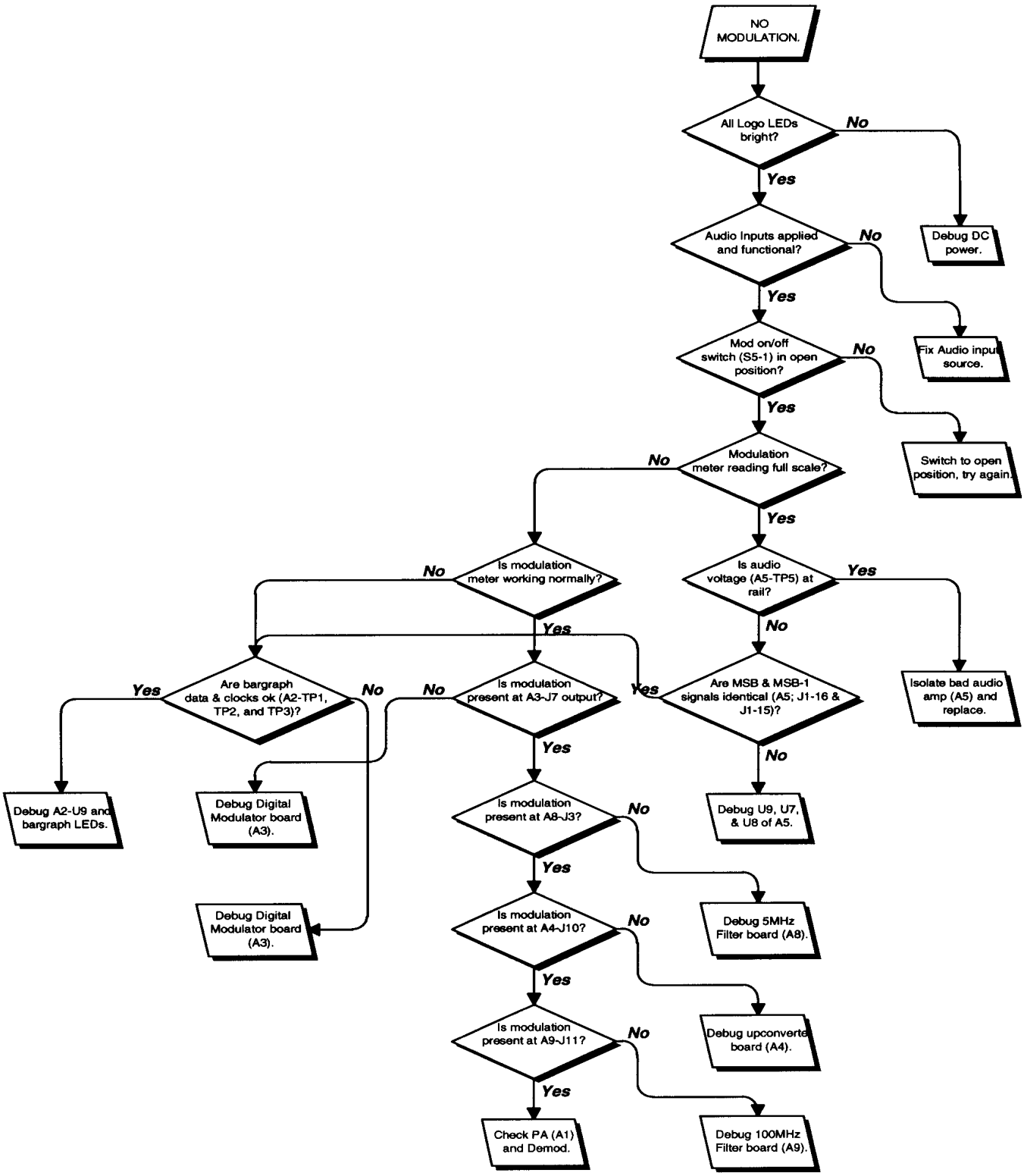

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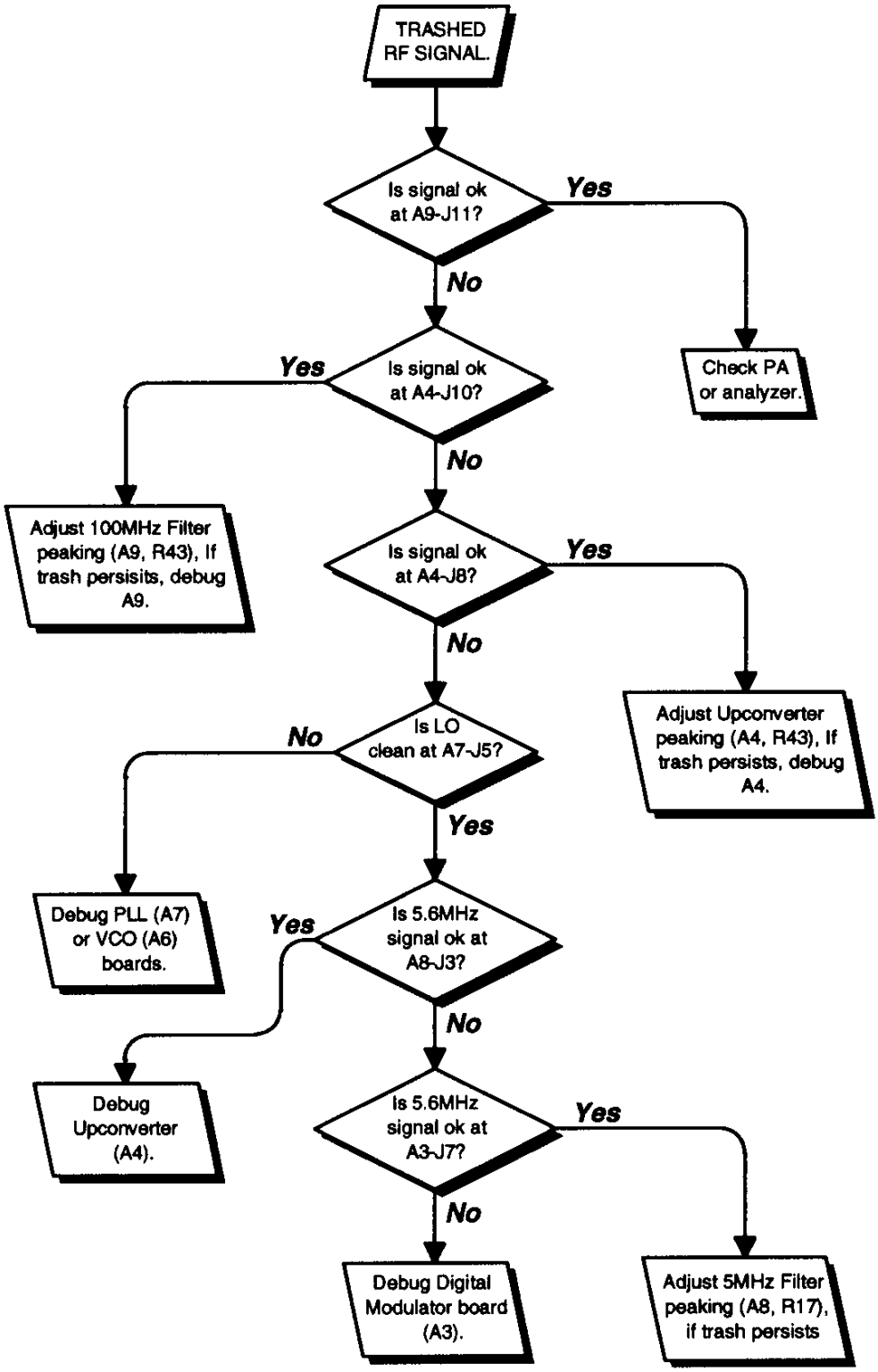

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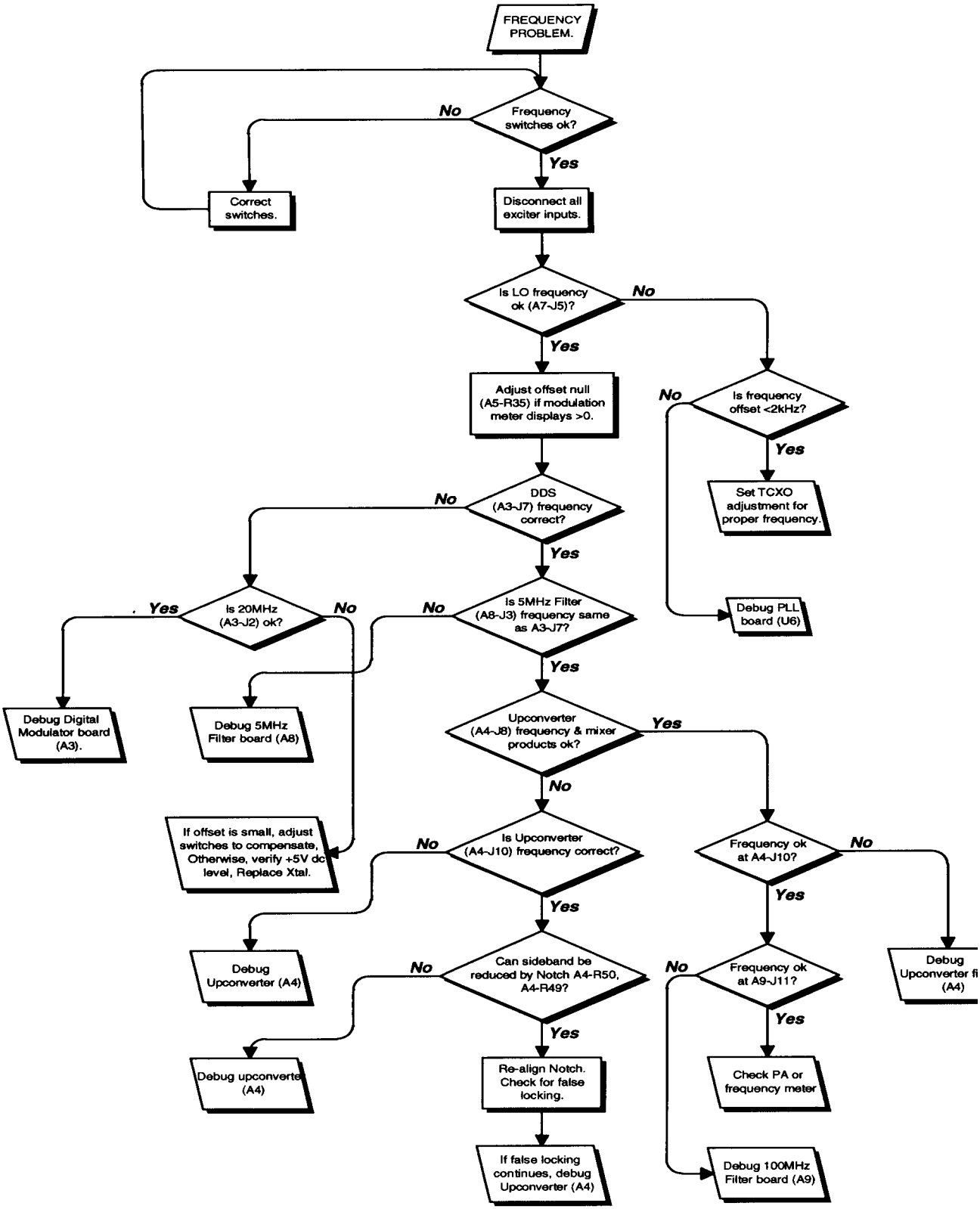

WARNING: Disconnect primary power prior to servicing.

Section VII
Parts List

Replaceable Parts List

Table 7-1. DIGIT EXCITER ANALOG I/O - 994 9410 001

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
000 0000 010	B/M NOTE:	0	THE TAG ON THE REAR OF THIS UNIT TO BE MARKED WITH THE VOLTAGE THAT THE DIGIT IS CONFIGURED
990 1130 001	*R-SC/FUSE KIT,AI DIGIT01	0	
990 1132 001	*C-SC/FUSE KIT,AI DIGIT02	0	
992 8901 001	KIT, PT MOUNTING (OPTION)	0	XMTR MTG OPTION
992 8902 001	KIT, RACK MOUNTING	0	RACK MTG OPTION
992 8941 001	KIT, REMOTE ADAPTER CABLE	0	(OPTION)
992 8990 001	KIT, HT250/500/1 XMTR MTG	0	XMTR MOUNT OPTION
992 8991 001	KIT,HT3.5/5/7/10 XMTR MTG	0	XMTR MOUNT OPTION
992 8992 001	KIT, HT20/HT25 XMTR MTG	0	XMTR MOUNT OPTION
992 8993 001	KIT, HT30/35 XMTR MTG	0	XMTR MOUNT OPTION
992 8994 001	KIT, PT2/5/8/10 RACK MTG	0	RACK MOUNT
992 8995 001	KIT, HT250/500/1 RACK MTG	0	RACK MOUNT
992 8996 001	KIT,HT3.5/5/7/10 RACK MTG	0	RACK MOUNT
992 8997 001	KIT, HT20/25 RACK MTG	0	RACK MOUNT
992 8998 001	KIT, HT30/35 RACK MTG	0	RACK MOUNT
992 9248 001	KIT, 15 PIN D CONNECTOR	1	
994 9410 002	BASIC, DIGIT FM EXCITER	1	
994 9425 001	MODULE, ANALOG I/O	1	A005
994 9478 001	KIT, REMOTE FREQ CONTROL	0	(OPTION)
994 9506 001	KIT, DIGIT XMTR ACCYS	0	(OPTION)
994 9515 001	* R-SP KIT, DIGIT EXCITER	0	
994 9516 001	* R-SB KIT, AI DIGIT	0	

WARNING: Disconnect primary power prior to servicing.

Table 7-2. DIGIT EXCITER DIGITAL I/O - 994 9410 003

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
000 0000 010	B/M NOTE:	0	THE TAG ON THE REAR OF THIS UNIT TO BE MARKED WITH THE VOLTAGE THAT THE DIGIT IS CONFIGURED
990 1133 001	*R-SC/FUSE KIT,DI DIGIT03	0	
990 1134 001	*C-SC/FUSE KIT,DI DIGIT04	0	
992 8901 001	KIT, PT MOUNTING (OPTION)	0	XMTR MTG OPTION
992 8902 001	KIT, RACK MOUNTING	0	RACK MTG OPTION
992 8941 001	KIT, REMOTE ADAPTER CABLE	0	(OPTION)
992 8990 001	KIT, HT250/500/1 XMTR MTG	0	XMTR MOUNT OPTION
992 8991 001	KIT,HT3.5/5/7/10 XMTR MTG	0	XMTR MOUNT OPTION
992 8992 001	KIT, HT20/HT25 XMTR MTG	0	XMTR MOUNT OPTION
992 8993 001	KIT, HT30/35 XMTR MTG	0	XMTR MOUNT OPTION
992 8994 001	KIT, PT2/5/8/10 RACK MTG	0	RACK MOUNT
992 8995 001	KIT, HT250/500/1 RACK MTG	0	RACK MOUNT
992 8996 001	KIT,HT3.5/5/7/10 RACK MTG	0	RACK MOUNT
992 8997 001	KIT, HT20/25 RACK MTG	0	RACK MOUNT
992 8998 001	KIT, HT30/35 RACK MTG	0	RACK MOUNT
992 9248 001	KIT, 15 PIN D CONNECTOR	1	
994 9410 002	BASIC, DIGIT FM EXCITER	1	
994 9478 001	KIT, REMOTE FREQ CONTROL	0	(OPTION)
994 9506 001	KIT, DIGIT XMTR ACCYS	0	(OPTION)
994 9515 001	* R-SP KIT, DIGIT EXCITER	0	
994 9530 001	DIGITAL STEREO	1	A005
994 9543 001	* R-SB KIT, DI DIGIT	0	

WARNING: Disconnect primary power prior to servicing.

Table 7-3. BASIC, DIGIT FM EXCITER - 994 9410 002

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS
250 0274 000	CORD, POWER 3C 7-1/2 FT	1	
302 0733 000	SCR 10-32 X 2-1/2	1	#T001
358 0834 000	RF STRIP 813-9363-001	.9 FT	
358 1214 000	SCREWLOCK, FEMALE	1	#J002
358 3197 000	SLIDES 10" PAIR	1 PR	
358 3424 000	PLUG, 25 PIN D BLACK	1	#J003
384 0702 000	RECT FW BRIDGE 600V 35A	1	CR001
398 0087 000	FUSE, SLOW CART 5A 125V	1	F001 #110V
398 0090 000	FUSE, SLOW CART 3A 250V	1	F001 #220V
402 0020 000	CLIP, FUSE	2	#F001
424 0002 000	GROMMET 7/16 MTG DIA	1	#FAN
424 0004 000	GROMMET 5/8 MTG DIA	1	#XFMR
426 0079 000	ISOLATOR, BALL MOUNT	4	#A006
430 0030 000	*FAN 115VAC 106CFM 4.69SQ	1	B001
430 0192 000	GUARD, FINGER/FAN	2	#B001
472 1689 000	XFMR, POWER, TOROID	1	T001
484 0420 000	FILTER, RFI POWER ENTRY	1	FL001
610 1136 000	ADAPTOR, EMI FILTERED	1	J002
646 0569 000	LABEL 814-2939-001	1	#AC
646 0665 000	INSPECTION LABEL	1	#SIDE
646 1250 000	LABEL H-136	1	#TOP
646 1253 201	LABEL, WARNING	1	#TOP
817 2335 003	FREQUENCY CHART, DIGIT	0	
843 5295 001	INTERCONNECT DIAGRAM	0	
843 5295 022	FAMILY TREE, FM EXCITER	0	
843 5295 041	OVERLAY, FRONT PANEL	1	
843 5295 072	WIRING DIAGRAM,	0	
917 2106 001	TAG, INPUT AC VOLTAGE	1	THIS TAG TO BE ATTACHED TO THE REAR PANEL
922 1205 023	COVER, AC ENTRY	1	
922 1205 030	COVER, SHIELD	1	
939 8120 022	HINGE	1	
939 8120 023	COVER XFMR	1	
939 8120 024	COVER, DIGITAL MOD BD.	1	
939 8120 034	DIVIDER SHIELD	1	
939 8120 040	SHIELD, VCO	1	
943 5295 023	CHASSIS, MAIN	1	
943 5295 044	PANEL ASSEMBLY, FRONT	1	
943 5295 050	COVER	1	
943 5295 051	COVER, 5 MHZ FILTER	1	
943 5295 052	COVER, 100 MHZ FILTER	1	
943 5295 053	COVER, UPCONVERTER	1	
943 5295 054	COVER, PLL	1	
943 5295 057	DIVIDER	1	
943 5295 060	DISCRETE WIRE CABLE PKG	1	
943 5295 061	RIBBON CABLE PKG	1	
988 2333 001	DP, DIGIT INSTAL & OPER	1	
992 8673 001	DIGITAL MODULATOR BD	1	A003
992 8674 001	REGULATOR BD ASSY	1	A002
992 8676 001	PLL BOARD ASSY	1	A007
992 8679 001	RF PA MODULE	1	A001
992 8680 001	FILTER 5 MHZ	1	A008
992 8681 001	FILTER 100MHZ	1	A009
992 8707 001	UPCONVERTER BOARD	1	A004

992 8906 001	MODULE, VCO	1	A006
999 2759 001	HARDWARE LIST, BASIC, DIG	1	

Table 7-4. REGULATOR BD ASSY - 992 8674 001

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
354 0309 000	TERM SOLDER	13	
358 2997 000	END PLATE,236 TERM MODULE	1	#TB001
380 0125 000	XSTR, NPN 2N4401	1	Q001
382 0522 000	IC, LM393N	1	U020
382 0719 000	IC LM324AN ESD	2	U005 U011
382 0905 000	IC, 78L08/78L82	1	U013
382 1043 000	IC UDN2595 ESD	1	U002
382 1126 000	IC 78L12A ESD	1	U004
382 1148 000	IC 75173 (ESD)	1	U050
382 1321 000	IC LM2940CT-5 ESD	1	U014
382 1323 000	IC, 145453 LCD DRIVER ESD	1	U001
382 1325 000	IC UCN5818EPF ESD	1	U009
382 1326 000	IC, 528 DAC ESD	1	U008
382 1327 000	IC, 145051 A/D CNVRTR ESD	1	U007
382 1328 000	IC, 1085 REGULATOR ESD	1	U017
382 1329 000	IC, 1086 REGULATOR ESD	1	U018
382 1330 000	IC, LT1185 ESD	1	U016
382 1355 000	IC, AD626 DIFF AMP ESD	1	U012
382 1356 000	IC, 2991 ADJ VOLT REG ESD	1	U015
382 1369 000	IC REF-02CP ESD	1	U006
382 1418 000	IC 24C04 CMOS EEPROM ESD	1	U010
382 1436 000	IC, MAX705 WATCHDOG ESD	1	U019
384 0205 000	DIODE SILICON 1N914/4148	2	CR001 CR007
384 0321 000	DIODE 5082-2800/1N5711	1	CR009
384 0665 000	RECT, FW BRIDGE 2A 600V	2	CR003 CR004
384 0737 000	SCR,CROWBAR 50V 750A PEAK	1	Q002
384 0827 000	LED LIGHT BAR, GREEN	2	DS001 DS002
384 0838 000	TRANSZORB 1N6380 36V 5W	2	CR005 CR006
384 0847 000	LED 10 SEG BARGRAPH, GRN	2	DS006 DS007
384 0893 000	LED 10 SEG BARGRAPH, RED	1	DS005
386 0112 000	ZENER, 1N4733 5.1V	1	CR008
386 0154 000	ZENER, 1N4751A 30V	1	CR002
398 0031 000	FUSE, FAST CART 10A 32V	1	F001
402 0129 000	CLIP, 1/4 DIA FUSE	2	XF001
404 0513 000	HEAT SINK PA1-1CB	1	SKU015
404 0673 000	SOCKET 8 PIN DIP (DL)	5	XU006 XU010 XU012 XU019 XU020
404 0674 000	SOCKET 14 PIN DIP (D-L)	3	XU005 XU011 XK001
404 0675 000	SOCKET IC 16 CONT	1	XU050
404 0747 000	SOCKET STRIP 16 POS	1	XDS001
404 0766 000	SOCKET 18 PIN DIP (DL)	1	XU002
404 0767 000	SOCKET 20 PIN DIP (DL)	2	XU007 XU008
404 0827 000	SOCKET, DIP20, LO PROFILE	3	XDS005 XDS006 XDS007
404 0830 000	SOCKET PLCC-44	3	XU001 XU003 XU009
404 0842 000	HEATSINK FOR TO220	3	SKU016 SKU017 SKU018
404 0851 000	SOCKET, 18 PIN SIP	2	XDS004
406 0511 000	DISPLAY, LCD	1	DS004
444 2986 000	XTAL 4MHZ HC/49 CASE	1	Y001
516 0453 000	CAP .1UF 100V 20% X7R	22	C002 C003 C004 C005 C006 C007 C010 C012 C013 C014 C018 C019

WARNING: Disconnect primary power prior to servicing.

			C020 C022 C023 C026 C027 C029 C033 C036 C058 C059
516 0736 000	CAP .001UF 10% 100V X7R	1	C030
516 0769 000	CAP 22PF 5% 100V C0G	2	C008 C009
516 0792 000	CAP NETWORK .1UF 10%	1	C028
516 0971 000	CAP 470PF 5% 100V C0G	1	C001
522 0548 000	CAP 10UF 50V ELECTROLYTIC	2	C016 C025
522 0570 000	CAP 2.2UF 50V	2	C015 C024
522 0590 000	CAP 470UF 25V 20%	1	C032
522 0591 000	CAP 47UF 25V 20%	1	C031
522 0592 000	CAP 100UF 20% 25VDC	4	C034 C037 C040 C042
522 0593 000	CAP 3300UF 20% 25VDC	4	C035 C038 C039 C041
522 0601 000	CAP 15,000 UF 50V 20%	3	C011 C017 C021
540 1375 000	RES NETWORK 1000 OHM 2%	3	R028 R029 R064
540 1386 000	RES NETWORK 10K OHM 2%	1	R012
540 1410 000	RES NETWORK 330 OHM 2%	3	R019 R020 R027
540 1416 000	RES NETWORK 10K OHM 2%	1	R011
540 1434 000	RES NETWORK 330 OHM 2%	1	R080
540 1496 000	RES NETWORK 100 OHM	1	R053
542 1593 000	RES. 0.2 OHM 1% 4W	2	R035 R036
548 2252 000	RES 1K OHM 2W 5% FP	2	R021 R022
548 2400 166	RES 47.5 OHM 1/2W 1%	1	R015
548 2400 168	RES 49.9 OHM 1/2W 1%	1	R023
548 2400 173	RES 56.2 OHM 1/2W 1%	1	R014
548 2400 201	RES 100 OHM 1/2W 1%	3	R050 R051 R081
548 2400 239	RES 249 OHM 1/2W 1%	1	R054
548 2400 251	RES 332 OHM 1/2W 1%	5	R016 R017 R018 R026 R033
548 2400 257	RES 383 OHM 1/2W 1%	1	R048
548 2400 268	RES 499 OHM 1/2W 1%	3	R009 R010 R075
548 2400 273	RES 562 OHM 1/2W 1%	1	R032
548 2400 301	RES 1K OHM 1/2W 1%	1	R030
548 2400 308	RES 1.18K OHM 1/2W 1%	1	R046
548 2400 313	RES 1.33K OHM 1/2W 1%	1	R037
548 2400 326	RES 1.82K OHM 1/2W 1%	1	R070
548 2400 341	RES 2.61K OHM 1/2W 1%	4	R007 R008 R025 R063
548 2400 343	RES 2.74K OHM 1/2W 1%	3	R034 R043 R049
548 2400 366	RES 4.75K OHM 1/2W 1%	4	R042 R044 R045 R047
548 2400 394	RES 9.31K OHM 1/2W 1%	1	R038
548 2400 401	RES 10K OHM 1/2W 1%	6	R004 R024 R031 R039 R052 R061
548 2400 410	RES 12.4K OHM 1/2W 1%	1	R041
548 2400 449	RES 31.6K OHM 1/2W 1%	3	R003 R059 R060
548 2400 460	RES 41.2K OHM 1/2W 1%	2	R057 R058
548 2400 501	RES 100K OHM 1/2W 1%	3	R002 R062 R065
548 2400 521	RES 162K OHM 1/2W 1%	1	R040
548 2400 601	RES 1MEG OHM 1/2W 1%	3	R001 R005 R074
548 2400 701	RES 10MEG OHM 1/2W 1%	1	R013
550 0967 000	POT 10K 1/2W/.3W 10%	1	R006
550 0970 000	POT 1K OHM 1/2W 10%	2	R055 R056
560 0094 000	MOV 50VRMS 4500AMP 15J	1	RV001
574 0496 000	RELAY REED SPDT 5VDC	1	K001
604 1147 000	SW PB SPST-N.O. MOM	1	S001
610 0900 000	HEADER 3 CKT STRAIGHT	4	JP001 JP002 JP003 JP004
610 0979 000	HDR 10C 2ROW VERTICAL	3	J005 J006 J007
610 0981 000	HDR 20C 2ROW VERTICAL	1	J004
610 1092 000	HEADER 12 CRKT STRAIGHT	1	J008

610 1108 000	HDR,14PIN,1ROW,STRT,POL	1	J003
610 1145 000	HDR, 6PIN, 1ROW, STRT,POL	1	J001
610 1160 000	HDR 4C 1 ROW STRAIGHT PCB	2	J002 J011
612 1184 000	JUMPER .1" CENTERS	4	XJP001 XJP002 XJP003 XJP004
612 1341 000	RECP, D, 15 PIN STRAIGHT	1	J009
614 0790 000	TERM MODULE,1C PC MTG 236	2	TB1-1 TB1-2
839 8120 005	SCHEM, REGULATOR	0	
843 5295 005	PWB, REGULATOR	1	
917 2335 011	FIRMWARE, A2, U3, CONTROL	1	U003
999 2761 001	HARDWARE LIST, REGULATOR	1	

*** E N D O F R E P O R T ***