TECHNICAL MANUAL

Platinum Series®
Television Transmitters
988-2365-001

HARRIS

T.M. No. 888-2365-001

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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

PLATINUM SERIES

888-2354-XXX

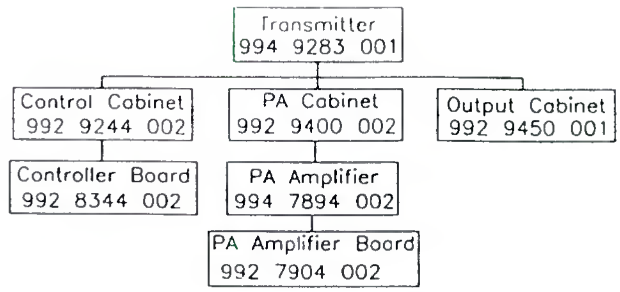
Revision #	Date	ECN #	Pages Affected
001-A	02-24-97	41684	Replaced Title Page and pages 2-5 to 2-10 Added MRH-1/MRH-2
001-A1	06-30-97	39922	Replaced Title Page, MRH-1/MRH-2 and pages 7-13 & 7-14
001-A2	12-16-97	42056	Replaced Title Page, MRH-1/MRH-2 and pages 7-15 & 7-21
001-A2	06-19-98	42231	Replaced Title Page, MRH-1/MRH-2 and pages 7-15 to 7-17 and 7-21 to 7-23
001-B	01-11-99	42538A	Replaced Title Page, MRH-1/MRH-2 and pages iv, v, 3-9 and all of Section V

Guide to Using Harris Parts List Information

The Harris Replaceable Parts List Index portrays a tree structure with the major items being leftmost in the index. The example below shows the Transmitter as the highest item in the tree structure. If you were to look at the bill of materials table for the Transmitter you would find the Control Cabinet, the PA Cabinet, and the Output Cabinet. In the Replaceable Parts List Index the Control Cabinet, PA Cabinet, and Output Cabinet show up one indentation level below the Transmitter and implies that they are used in the Transmitter. The Controller Board is indented one level below the Control Cabinet so it will show up in the bill of material for the Control Cabinet. The tree structure of this same index is shown to the right of the table and shows indentation level versus tree structure level.

Example of Replaceable Parts List Index and equivalent tree structure:

	Replaceable Parts List Index		
Table 7-1.	Transmitter	994 9283 001	7-2
Table 7-2.	Control Cabinet	992 9244 002	7-3
Table 7-3.	Controller Board	992 8344 002	7-6
Table 7-4.	PA Cabinet	992 9400 002	7-7
Table 7-5.	PA Amplifier	994 7894 002	7-9
Table 7-6.	PA Amplifier Board	992 7904 002	7-10
Table 7-7.	Output Cabinet	992 9450 001	7-12



The part number of the item is shown to the right of the description as is the page in the manual where the bill for that part number starts.

Inside the actual tables, four main headings are used:

Table #-#. ITEM NAME - HARRIS PART NUMBER - this line gives the information that corresponds to the Replaceable Parts List Index entry;

HARRIS P/N column gives the ten digit Harris part number (usually in ascending order);

DESCRIPTION column gives a 25 character or less description of the part number;

REF. SYMBOLS/EXPLANATIONS column 1) gives the reference designators for the item (i.e., C001, R102, etc.) that corresponds to the number found in the schematics (C001 in a bill of material is equivalent to C1 on the schematic) or 2) gives added information or further explanation (i.e., "Used for 208V operation only," or "Used for HT 10LS only," etc.).

Inside the individual tables some standard conventions are used:

A # symbol in front of a component such as #C001 under the REF. SYMBOLS/EXPLANATIONS column means that this item is used on or with C001 and is not the actual part number for C001.

In the ten digit part numbers, if the last three numbers are 000, the item is a part that Harris has purchased and has not manufactured or modified. If the last three numbers are other than 000, the item is either manufactured by Harris or is purchased from a vendor and modified for use in the Harris product.

The first three digits of the ten digit part number tell which family the part number belongs to - for example, all electrolytic (can) capacitors will be in the same family (524 xxxx 000). If an electrolytic (can) capacitor is found to have a 9xx xxxx xxx part number (a number outside of the normal family of numbers), it has probably been modified in some manner at the Harris factory and will therefore show up farther down into the individual parts list (because each table is normally sorted in ascending order). Most Harris made or modified assemblies will have 9xx xxxx xxx numbers associated with them.

The term "SEE HIGHER LEVEL BILL" in the description column implies that the reference designated part number will show up in a bill that is higher in the tree structure. This is often the case for components that may be frequency determinant or voltage determinant and are called out in a higher level bill structure that is more customer dependent than the bill at a lower level.

HARRIS Broadcast Systems Division
P.O. Box 4290, QUINCY, IL 62305

PARTS ORDER FORM

HARRIS PHONE: 217-222-8200
HARRIS FAX: 217-221-7096

BILLING INFORMATION

CUSTOMER NAME: ______________________

ADDRESS: ______________________

____

____

____

TELEPHONE NUMBER: ______________________

FAX NUMBER: ______________________

PREFERRED PAYMENT METHOD: ______________________

SHIPPING INFORMATION

SHIP TO: (if different from billing information) ______________________

ADDRESS: ______________________

____

____

____

TELEPHONE NUMBER: ______________________

FAX NUMBER: ______________________

SHIPPING METHOD PREFERRED: ______________________

FREQUENCY (If required): ______________________

EQUIPMENT NAME: ______________________

EQUIPMENT PART NUMBER: ______________________

EQUIPMENT SERIAL NUMBER: ______________________

GUIDE FOR ORDERING PARTS

Please use the following parts order form, filling is as much information as possible. The complete informaiton will allow double checking the part number for correctness or locating a substitude if the part is not available.
The equipment name, part number, and serial number will be found on the metal ID plate on the back of the unit. The serial number MUST be included for any parts ordered under warranty.
Describe the part using the description in the parts list if possible. Include the schematic information, schematic number, or number of next higher assembly. The next higher assembly is usually a 992-xxxx-00x type.

ITEM #	QTY ORD	HARRIS PART NUMBER	DESCRIPTION OF PART (PART'S NAME, DESCRIPTION, SPECIFICATION FROM PARTS LIST IF AVAILABLE)	SCHEMATIC REFERENCE REFERENCE NAME (e.g. C001, R100, etc)	ITEM USED ON (NEXT HIGHER ASSEMBLY IF KNOWN) (e.g. C001 used on 992 8025 001, SCHEMATIC 839 8099 991)	COMMENTS

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.

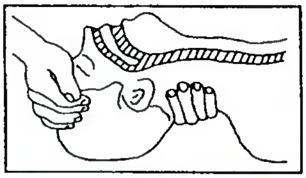
TREATMENT OF ELECTRICAL SHOCK

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

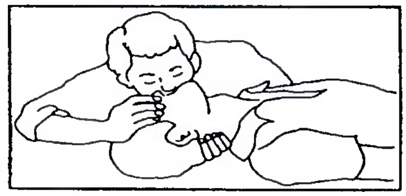
IF UNCONSCIOUS,
OPEN AIRWAY



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

(B) BREATHING

IF NOT BREATHING,
BEGIN ARTIFICIAL BREATHING

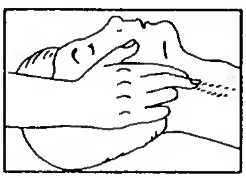


TILT HEAD
PINCH NOSTRILS
MAKE AIRTIGHT SEAL

4 QUICK FULL BREATHS

REMEMBER MOUTH TO MOUTH
RESUSCITATION MUST BE
COMMENCED AS SOON AS POSSIBLE

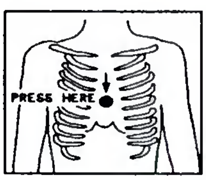
CHECK
CAROTID PULSE



IF PULSE ABSENT,
BEGIN ARTIFICIAL
CIRCULATION

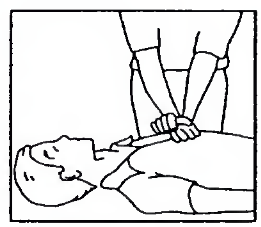
(C) CIRCULATION

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

WARNING: Disconnect primary power prior to servicing.

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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1.1 Introduction

This section contains a general description of *Platinum Series®* television transmitters, their control systems, signal paths, and system specifications.

1.2 General Description

Platinum Series® transmitters employ rugged field effect transistors (FETs), parallel amplifier modules, multiple power supplies, and a high-resolution flat display screen for metering.

The control and monitor system includes storage of up to 32 fault events with time, date, and description. VSWR foldback automatically reduces power during high VSWR operation, such as that encountered with antenna icing.

Available options include dual exciters and an automatic exciter switcher, redundant drive chains, and 20% aural power on some models.

Each transmitter consists of a control cabinet and one or more amplifier cabinets. Transmitters from 1-10 kW have a single amplifier cabinet containing the aural path, the visual drive chain, and the visual final. 20 kW transmitters have two amplifier cabinets like those used in the 10 kW transmitter.

15 kW transmitters have two amplifier cabinets: one for the aural path and visual drive chain, and one for the visual final. 30 kW transmitters have one cabinet for aural path and visual drive chain, and two 15 kW visual final cabinets. 45 kW units have two aural path/visual drive chain cabinets and three 15 kW visual finals. Finally, 60 kW transmitters have six cabinets, doubling the 30 kW architecture.

In transmitters with multiple visual amplifier cabinets, outboard hybrids are used to combine the outputs of the visual finals. Optional notch or hybrid diplexers are available for all models to combine aural and visual signals to permit using a common antenna system.

1.2.1 AC Power Distribution

Refer to AC Power Distribution drawing for the following discussion. Each cabinet has its own AC power source. Control cabinet breaker CB-1, located behind the control panel left of the controller boards, protects the wiring in the control cabinet (see Figure 1-1). A phase monitor guards against low voltage, loss of one phase, and reversal of the phase sequencing. Line voltage samples are provided for the system monitor. All logic supplies, exciter power and fan in the control cabinet are controlled by CB-1.

Each amplifier cabinet's AC power is fed through CB-1 to the logic supply (see Figure 1-3). AC Contactor K-1 feeds the 50 volt supplies and fan breaker CB-2 (see Figure 1-4). Aux relay K-2 activates the AC contactor through commands from the slave controller.

1.2.2 Transmitter Control System

See Figure 1-5. The control system for the transmitter consists of a main controller mounted in the control cabinet, plus individual slave controllers mounted in each amplifier cabinet. Data from the system is interfaced through the monitor board to the display controller, and shown on the front panel flat display screen as bar graphs and numerical readings.

Transmitter ON/OFF, LOCAL/REMOTE, and power RAISE/LOWER switches are located on the control cabinet, to the right of the display panel.

1.2.3 Display Panel

The monitor system samples each cabinet and gathers all of the status and analog data for the display. The Monitor board interfaces the main and slave controller information to the display controller. The display is menu-driven, with "soft keys" below the display panel for accessing and maneuvering through the various pages of information.

A HELP key below and to the right of the display panel provides a short description of the page of information being viewed, to assist non-technical personnel in interpreting the data.

1.2.4 Fault Indicators

Fault lamps are located below the display and switches. Each light, when illuminated, indicates a problem in one of the following areas: exciter, VSWR fault, VSWR foldback, power supply, controller, air, door, failsafe, phase loss, module, monitor, visual drive fault, aural drive fault, and external interlock.

1.2.5 Main Controller

The transmitter main control unit provides a central point for control and monitoring the entire system. The main controller interfaces with the slave controller(s) for the amplifier cabinets' ON/OFF commands, and with the exciter for power RAISE/LOWER commands.

Peak detectors collect aural and visual RF samples and send them to the main controller for power metering. The main controller also directs VSWR foldback action.

The main controller has a battery backup to restore the transmitter to its previous operating condition after a temporary AC power failure. A power down timer will automatically turn the transmitter off if the power is not restored within approximately two hours.

Remote status and analog outputs are provided by the main controller to a series of D connectors in the rear of the control cabinet.

1.2.6 Slave Controllers

The slave controllers are mounted in the upper left-hand slot of each amplifier cabinet. Each is responsible for controlling and monitoring its PA cabinet. The controllers interface the cabinet to the main controller and monitor in the control cabinet.

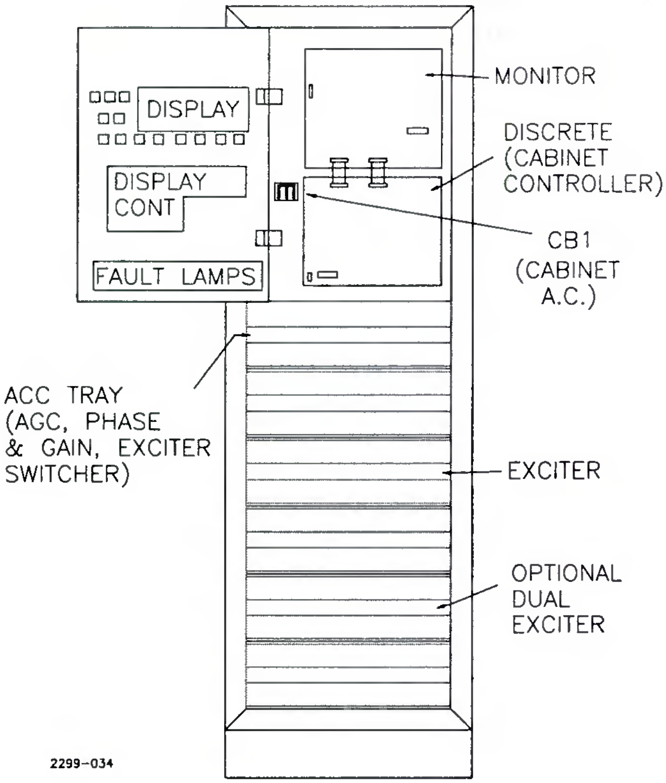


Figure 1-1. Location of CB1 Inside Front Door on Control Cabinet

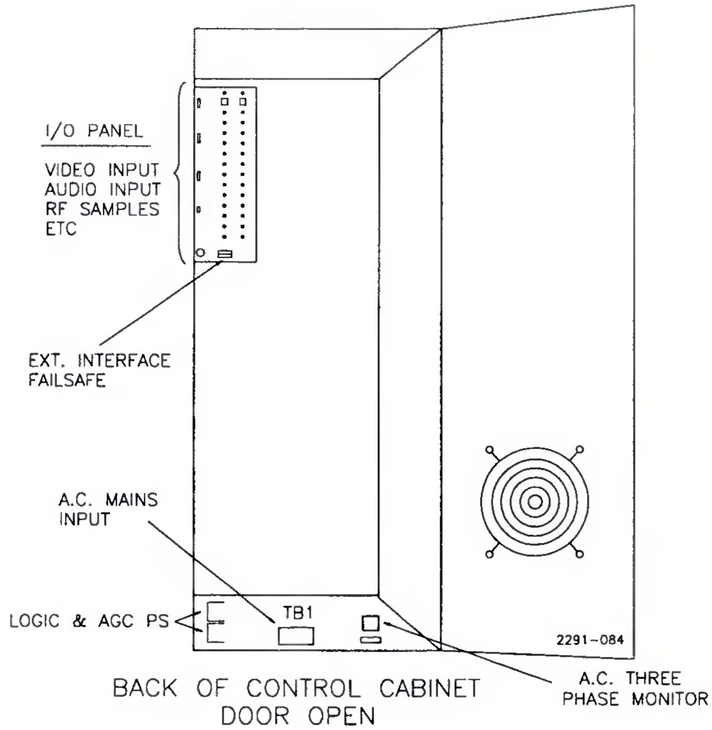


Figure 1-2. Location of I/O Panel & TB1 at Rear of Control Cabinet

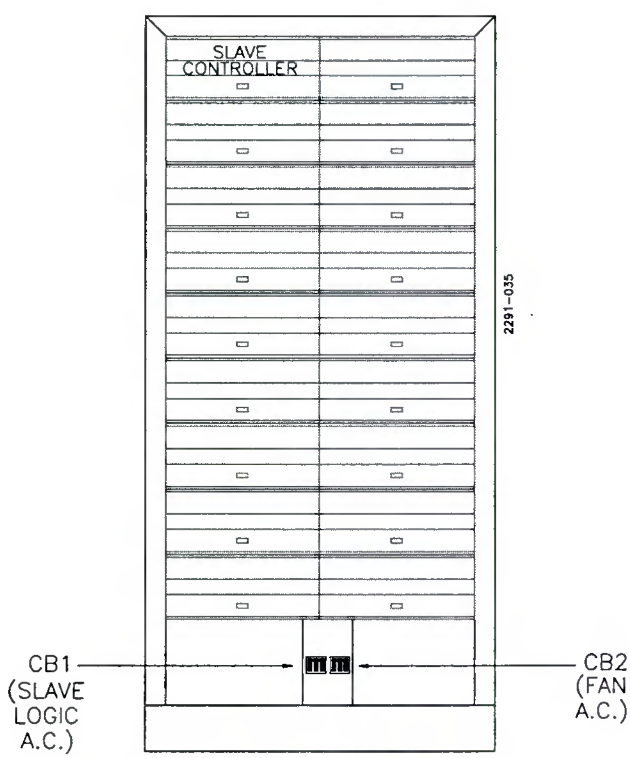


Figure 1-3. Location of CB1 and CB2 at Front of PA Cabinet(s)

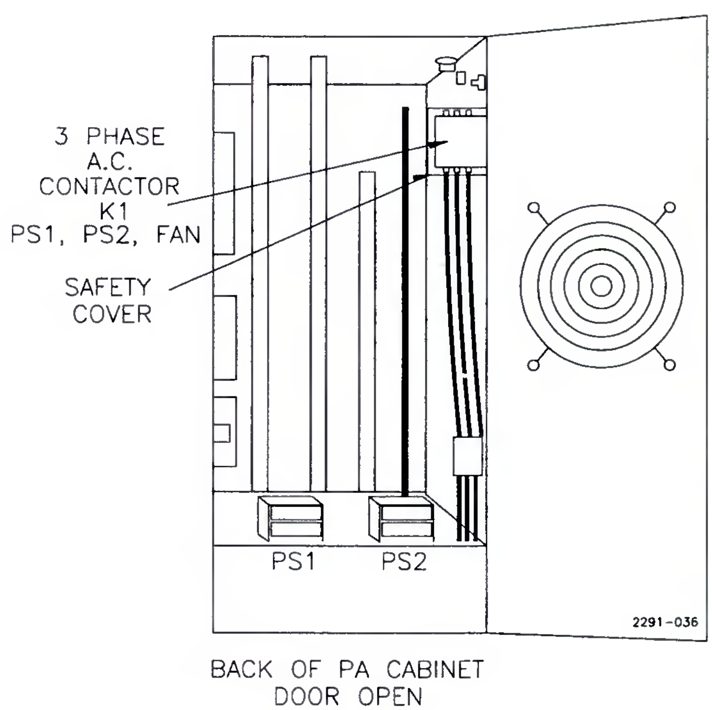


Figure 1-4. Location of K1 at Rear of PA Cabinet(s)

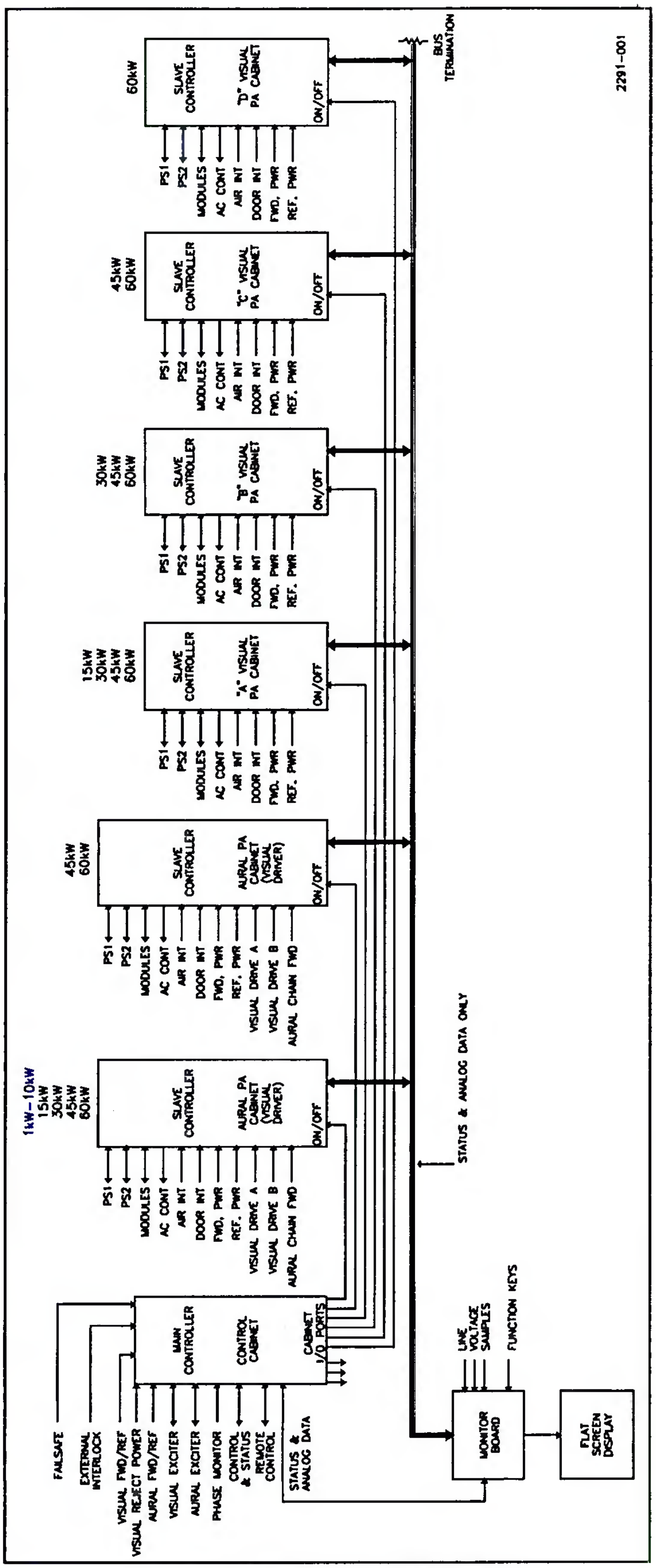


Figure 1-5. Control System Block Diagram

Each slave controller controls a cabinet's fan motor, 50 volt DC supplies, and RF amplifier modules. Slave controllers also report cabinet door interlock status, air interlock status, module faults, and power supply faults to the main controller.

Cabinet input drive and RF power output samples, collected by RF peak detectors, are relayed to the main controller through the slave controllers as well.

In the event of loss of the main controller, each slave may be used to operate its amplifier cabinet for emergency service.

1.2.7 50 Volt Power Supplies

Each PA cabinet has one or two 50 volt supplies, depending on system configuration. These supplies convert the AC power to 50 volts DC for the RF amplifier modules. Each is rated at 300 amps, and regulated to hold the transmitter power stable despite power line voltage changes. Internal fault protection is interfaced to the slave controller.

1.2.8 RF Amplifier Modules

Only two types of RF amplifier modules are used in the aural and visual chains of any given Platinum transmitter system:

1.2.8.1 Power Amplifiers (PAs)

PAs are used primarily as final amplifiers. Each is capable of supplying 1050 watts RF output, either aural CW or visual peak sync. PAs are also used as interstage amplifiers in larger visual cabinets, to drive several subsequent parallel PA modules.

PAs are single-stage amplifiers, consisting of paralleled class AB amplifiers, in both high and low band transmitters.

1.2.8.2 Driver Modules

Driver modules provide high gain. Primarily used in preamp applications to drive PAs, they are also used as aural final amplifiers in low power applications. Driver modules are keyed so that they cannot be plugged into a PA slot.

Low band drivers contain two cascaded class A stages. High band drivers contain two class A stages and one class AB stage. In both cases, the final stage in a driver consists of two paralleled amplifier blocks.

1.2.9 Visual Signal Flow Path

A basic visual signal flow topology is common to all *Platinum Series®* transmitters. For the following discussion, refer to the transmitter block diagram in the drawing package.

1.2.9.1 Exciter

Video is applied to the exciter where it is clamped, pre-corrected for differential gain and differential phase, and modulated onto the IF carrier (37 MHz for system M/NTSC, 38.9 MHz for B/PAL). Next, frequency response and group delay are corrected. Vestigial sideband filtering follows. The IF signal then passes through an AGC amplifier to correctors for linearity and ICPM.

A local oscillator and mixer in the exciter upconvert the IF signal to the transmit frequency, and the resulting signal is bandpass filtered and amplified. The exciter's final amplifier is capable of supplying up to 1 watt peak sync to subsequent stages, and a sample of its output is routed to the exciter's AGC circuit to hold the exciter's power output constant.

If optional dual exciters and an exciter switcher are used, both exciters are fed a video signal, and each exciter's visual output feeds the switcher.

1.2.9.2 Transmitter AGC Module
The exciter switcher output or single exciter output then passes to the transmitter AGC module, whose job is to maintain a constant gain loop by monitoring a sample of transmitter visual output, and correspondingly controlling exciter drive.

1.2.9.3 Phase and Gain Module
In transmitters with multiple visual PA cabinets, the AGC module passes the RF signal to one or more phase and gain modules. Each phase and gain module splits the drive into two parts whose relative amplitude and phase are adjustable. This allows trimming to compensate for small gain and phase differences between cabinets, so that the cabinet outputs maintain the proper phase and amplitude relationships when passed to final hybrid combiner(s).

The number of phase and gain modules used depends on the number of visual PA cabinets. In transmitters with a single visual PA cabinet (15 kW and below), no phase and gain modules are necessary; the output of the AGC module passes directly to the RF chain.

Since phase and gain modules introduce loss into the system, additional preamps are sometimes necessary. The locations of phase and gain modules and preamps varies by configuration; for details, see the descriptions in the following section on visual RF chain configurations.

1.2.9.4 Visual RF Amplifier Chains
The Visual RF amplifier chains in the various models vary in complexity from as few as two amplifier modules to over sixty. Following are synopses of the various combinations:

- 1 kW (standard)

The AGC output feeds a driver module, whose output is split in a two-way divider. The two outputs each drive a PA module. The PA outputs are recombined in a two-way combiner, whose output becomes the cabinet's visual output.

- 2 kW (standard)

The AGC output feeds a driver module, whose output passes through a three-way divider to three PA modules. The PA outputs are recombined in a three-way combiner, whose output becomes the cabinet's visual output.

- 5 kW, 10 kW, and 20 kW (standard)

The AGC output feeds a driver module, whose output passes through a PA module. In a 5 kW transmitter, this PA's output passes through a six-way divider to six more PA modules. In a 10 kW transmitter, a twelve-way divider and twelve PA modules are used.

The PA outputs are recombined in a six-way (5 kW) or twelve-way (10 kW) combiner, whose output becomes the cabinet's visual output.

In a 20 kW system, the AGC module feeds a phase and gain module, whose outputs feed two 10 kW visual cabinets like those described above. A 3 dB quadrature hybrid then combines the two cabinet outputs.

- 15 kW (standard)

In a 15 kW system, the AGC module's output feeds a driver module, which drives a PA module. In a low band transmitter, the PA's output is split in a 16-way divider, whose outputs feed 16 PA modules. The outputs are recombined in a 16-way combiner, whose output becomes the cabinet's visual output.

In high band transmitters, the same principle applies, except that 17 PA modules and 17-way dividers and combiners are used.

The 30, 45, and 60 kW transmitter visual chains are multiples of this basic 15 kW architecture.

- 30 kW (standard)

In a 30 kW transmitter, the AGC output passes through a phase and gain module. In high band systems, the two outputs are sent to two preamps. In low band systems, the preamps are not necessary.

The resulting outputs are sent to two 15 kW visual cabinets (see 15 kW system, above). The cabinet outputs are combined with a 3 dB quadrature hybrid combiner.

- 45 kW (standard)

In a 45 kW system, one phase and gain module feeds one visual cabinet and a preamp, whose output feeds a second phase and gain module. Three outputs are thus obtained. In high band systems, a preamp is inserted in each path at this point, and the three outputs pass to the aural PA and visual driver cabinet. In low band systems, these three preamps are omitted.

The three outputs are each fed to driver modules. In low band systems, the driver outputs are each passed to one of three PA modules, whose outputs each drive a 15 kW visual PA cabinet (see 15 kW system, above).

In high band systems, each of the three drivers supplies input to a pair of PA modules. The PAs are paralleled into pairs using two-way power dividers and combiners. The three outputs then pass to three 15 kW visual cabinets (see 15 kW system, above).

At the outputs of the three visual PA cabinets, a 3 dB hybrid combines the first two visual cabinet outputs, which combine with the third in a 4.77/1.76 dB asymmetrical hybrid combiner. The combined output passes through a harmonic and color notch filter on its way to the optional diplexer.

- 60 kW (standard)

The AGC module output feeds a phase and gain module, whose outputs feed two more phase and gain modules.

In low band systems, the four outputs are sent to four driver modules, which in turn are used to drive four PA modules. These four outputs drive four 15 kW visual PA cabinets (see 15 kW system, above).

In high band transmitters, the four phase and gain module outputs are passed through preamps to four driver modules. Each driver module output is split using a two-way divider, whose outputs each drive a PA module. The PA module outputs are recombined using four two-way combiners, before passing to the four 15 kW PA cabinets (see 15 kW system, above).

The visual cabinet outputs are recombined in pairs, using two 3 dB quadrature hybrids. Finally, the pairs are recombined with a final 3 dB hybrid.

1.2.9.5 Parallel Visual Drive Paths

Parallel visual drive paths are available as an option on many models. This option eliminates the possibility of a single-point visual drive failure.

In some lower power transmitters, the option simply consists of using a two-way divider and a two-way combiner, plus two driver modules, to replace the single driver module found in standard systems. In the event of the failure of one driver, the AGC module increases the system gain to allow full-power transmission to continue.

In transmitters 15 kW and higher, a switchable 6 dB pad is inserted before the two-way splitter, and this pad is controlled by the slave controller in the cabinet containing the visual driv chain. If one driver fails, the slave controller senses the failure and disables the pad to compensate for the decreased system gain.

In some higher power systems, where the drive chain consists of a cascaded driver and PA module, both the driver and PA are duplicated in each path.

1.2.10 Aural Signal Path

Again, the basic topologies of the aural paths in the various models are similar. As in the visual path, the exciter aural output passes to an AGC module which monitors a sample of the aural system output. The AGC module output then drives the aural RF chain. (Refer to the transmitter block diagram in the drawing package for this discussion.)

1.2.10.1 Exciter

Either monaural audio and SCA, or externally generated composite stereo, is fed to the exciter and modulated onto an IF frequency, which is lower than that of the visual IF by an amount equal to the difference between the desired aural and visual carriers. The modulator is a voltage-controlled oscillator whose center frequency is held constant by a phase-locked loop (PLL).

IF group delay correction (optional) can be used at this point to improve stereo separation in systems where notch diplexers are used. The IF signal is converted up to channel using a mixer and the same LO as in the visual chain. The resulting signal is bandpass filtered and amplified, becoming the exciter's aural output. As in the visual path, if dual exciters (optional) are used, each exciter's aural output is routed to the exciter switcher.

1.2.10.2 Dual-Carrier Systems

In systems where dual aural carriers are generated, the exciter path takes a different form. The two signals are modulated onto two different IF carriers, and the modulated carriers are added together. Linearity pre-correction is added to prevent intermodulation of the two carriers. The resulting signal is mixed up to channel with the same LO as used in the visual chain, and is bandpass filtered and amplified, becoming the exciter output.

1.2.10.3 AGC Module

As in the visual path, the exciter switcher output or single exciter feeds an AGC module, which holds the aural transmitter gain constant by controlling aural RF drive based on samples of exciter drive and transmitter aural output.

1.2.10.4 Phase and Gain Module

As in the visual signal path, in higher-powered systems, it may become necessary to feed parallel signal paths through one or more phase and gain modules. These modules allow the gain and phase of each path to be trimmed, so that the proper phase and amplitude relationships are obtained at the final combiner input.

1.2.10.5 Aural RF Amplifier Chains

The aural RF amplifier chains vary in complexity depending on visual peak power output, 10% or 20% aural power, and single or parallel paths. The following configurations are used in the various transmitter models:

- 1 kW Systems, 10% or 20% Aural

In these systems, the aural AGC output drives a driver module, which alone produces enough output power to serve directly as the transmitter aural output.

- 2 kW Systems, 10% or 20% Aural

The AGC module output passes through a preamp, to a driver module. The driver produces enough output power to serve as the transmitter aural output.

- 5 kW Systems, 10% or 20% Aural

In a 5 kW system, the aural AGC output is fed to a driver module, whose output drives a PA module. The PA module output becomes the transmitter's aural output.

- 10 kW and 15 kW Systems, 10% Aural (standard)

In these systems, the aural AGC output feeds a driver module, whose output is split in a two-way splitter and sent to two PA modules. The PA outputs are recombined in a two-way combiner, whose output passes through a harmonic filter before reaching the optional diplexer.

- 15 kW Systems, 20% Aural (optional)

In 15 kW systems with the 20% aural option, the aural AGC output is split in a two-way divider, and the two signals are input to two driver modules, whose outputs are recombined in a two-way combiner.

The drive signal is then split four ways in a four-way splitter, whose outputs drive four parallel PA modules. The outputs are recombined in a four-way combiner and passed through a harmonic filter before being sent to the optional diplexer.

- 20 kW Systems, 10% Aural (standard)

The aural AGC module output passes through a phase and gain module. Each of the two outputs passes to an aural chain in one of the PA cabinets.

Once inside the PA cabinets, the two signals are sent to driver modules. Their outputs are split using two-way dividers, and the resulting outputs feed an array of four PA modules. The two PAs in each cabinet feed two-way combiners, and the combiner outputs feed a 3 dB hybrid used as a final two-way combiner. The resulting signal passes through a harmonic filter before being sent to the optional diplexer.

• 30 kW Systems, 10% Aural (standard)
In a high band system, the AGC module output first passes through a preamp. In low-band systems, the preamp is not necessary.

The resulting output drives a driver module. The driver output is divided in a four-way divider, and fed to four parallel PA modules. The outputs are recombined in a four-way combiner, whose output passes through a harmonic filter on its way to the optional diplexer.

• 30 kW Systems, 20% Aural (optional)
The aural AGC module output passes to a phase and gain module. In a high band system, two outputs pass through preamps; in low band, the preamps are omitted.

Each signal then passes through a driver module, whose output is split in a four-way divider. Eight outputs are thus obtained, each feeding the input of one of eight PA modules. The outputs are recombined, first into two signals with a pair of four-way combiners, then into a single output using a 3 dB hybrid. The combined output passes through a harmonic filter before being passed to the optional diplexer.

• 45 kW Systems, 10% Aural (standard)
In a 45 kW low band system, the AGC module output drives a phase and gain module, whose outputs drive two driver modules. In high band systems, preamps are added between the phase and gain module outputs and driver module inputs.

The two signals each pass through three-way power dividers, whose outputs feed a total of six aural PA modules. The PA module outputs are recombined using three-way combiners and a 3 dB quadrature hybrid, whose output passes through a harmonic filter to the optional diplexer.

• 45 kW Systems, 20% Aural (optional)
The AGC module output feeds a phase and gain module. One of the phase and gain module's outputs feeds a preamp and a second phase and gain module, creating a total of three output signals.

In a low-band transmitter, these outputs are sent directly to the aural PA/visual driver cabinets; in a high-band system, the three outputs pass through preamps located in the control cabinet before passing to the amplifier cabinets.

Each of the three signals is input to a driver module, whose output passes through a four-way splitter. This yields twelve outputs, each of which feeds an aural PA module. Three four-way combiners combine the twelve PA outputs into three signals. The first two are recombined using a 3 dB quadrature hybrid, whose output is combined with the remaining signal in a 4.77/1.76 dB asymmetrical hybrid. The combined output passes through a harmonic filter on its way to the optional diplexer.

• 60 kW Systems, 10% Aural (standard)
The AGC module output feeds a phase and gain module. In high band systems, the two outputs are then fed to two preamps. In low band transmitters, the preamps are not necessary.

Each of the two outputs feeds a driver module. The driver outputs are each split in four-way dividers, for a total of eight outputs, and the outputs drive an array of eight PA modules.

The PA outputs pass to four-way power combiners, whose outputs are combined in a 3 dB quadrature hybrid used as a two-way combiner. The combined output passes through a harmonic filter before being sent to the optional diplexer.

• 60 kW Systems, 20% Aural (optional)
The AGC module output passes through a phase and gain module, whose outputs pass to two preamps. The preamp outputs are each divided in half, using 3 dB hybrids, producing a total of four outputs which are sent to the aural cabinet.

Each signal feeds one of four driver modules, whose outputs feeds four-way splitters. The outputs drive sets of four paralleled PA modules, for a total of 16 PA modules.

The outputs are recombined in the same manner in which the inputs were divided: four four-way combiners are used. Then, the four outputs pass to two 3 dB quadrature hybrids, whose two outputs are finally combined in another 3 dB hybrid. The combined output passes through a harmonic filter on its way to the optional notch diplexer.

1.2.10.6 Parallel Aural Drive Paths
As in the visual path, parallel aural drive paths are available as an option on many models to eliminate the possibility of a single-point aural drive failure.

In some lower power transmitters, the option consists of using a two-way divider and a two-way combiner, plus two driver modules, to replace the single driver module found in standard systems. In transmitters 15 kW and higher, a switchable 6 dB pad is added before the two-way splitter, which is controlled by the slave controller in the aural cabinet.

1.2.11 Transmitter Output Networks
The transmitter output network performs three functions: filtering harmonics from the outputs, removing color subcarrier remnants from the vestigial sideband, and combining the aural and visual outputs into a common antenna feed for transmission. Two common configurations exist:

• 1-10 kW Systems
A combination color notch filter/notch diplexer (optional) receives the aural and visual outputs and combines them. The output then passes through a harmonic filter to the antenna system.

• 15-60 kW Systems
Two harmonic filters are used: one in the visual path, and one in the aural path. The output of the visual harmonic filter feeds a color notch filter. The outputs of the aural harmonic and visual color notch filters feed a notch diplexer (optional), whose output passes to the antenna system.

1.3 Specifications
Table 1-1 contains the transmitter specifications.

NOTE

These specifications are subject to change without notice.

Table 1-1. Specifications

1. Visual Specifications	
Power Output:	Availible in 1, 2, 5, 10, 15, 20, 30, 45, and 60 kW models, peak sync power. *(Measured at output of optional diplexer.)*
RF Load Impedance:	50 Ohms
Output Connector	
1-10 kW:	$1^5/_8$" EIA
15-60 kW LS:	$3^1/_8$" EIA
15-30 kW HS:	$3^1/_8$" EIA
45-60 kW HS:	$4^1/_{16}$" EIA
Systems:	M/NTSC, B/PAL, B/SECAM
Frequency Range	
LS (low band):	System M: 54-88 MHz System B: 47-68 MHz
HS (high band):	System M: 174-216 MHz System B: 174-230 MHz
Carrier Frequency Stability	Standard: ±250 Hz maximum variation per 30 days. *After 60 days initial aging.* Optional: ±2 Hz with precise frequency control.
Video Input	
Impedance:	75 Ohms, return loss 32 dB min. to 5.5 MHz.
Level:	0.7 - 2.0 Volts, peak to peak
Visual Modulation Capability:	0%. *(Measured using synchronous detector.)*
Visual Sideband Response	*(Measured at output of color notch filter, with transmitter operating into a resistive load, VSWR = 1.05:1 or better.)*
NTSC/M	
-1.25 to -4.25 MHz:	-23 dB or better
-3.58 MHz:	-42 dB or better
-0.75 to +4.10 MHz:	±0.5 dB
+4.18 MHz:	+0.5 to -1.0 dB
+4.50 MHz:	-30 dB or better
+4.75 to + 7.75 MHz:	-40 dB or better
B/PAL and B/SECAM	
-1.25 MHz and lower:	-20 dB or better
-4.43 MHz:	-30 dB or better
-0.75 to +5.0 MHz:	±0.5 dB
+5.5 MHz:	-30 dB or better
Frequency Response vs. Brightness:	±0.75 dB or better. *Measured using a 20% p.p. swept video modulation on a pedestal at 10%, 50% and 90% APL (all percentages relative to a blanking to white excursion).*
Differential Gain:	3% or better. *Measured with a 5-step staircase signal from 75% to 12.5% peak-sync power, with 12.5% p.p. chroma subcarrier modulation.*
Differential Gain vs. APL:	±5% or better. *APL defined as the pedestal level over four lines at 10%, 50%, and 90% of maximum white level, with a standard 5-step chrominance-modulated staircase inserted every fifth line.*
Differential Phase:	±1° or better. *Measured with the same 5-step staircase signal as in Differential Gain.*
Incidental Carrier Phase Modulation (ICPM):	±1.5° or better. *Carrier phase variation from reference white to sync tip, referenced to 0 at blanking, and measured with the same 5-step staircase signal as in Differential Gain.*
Luminance Non-linearity:	1.0 dB or better. *Measured with a 5-step staircase signal, Test Signal #3 CCIR Rec. 421-3.*

Table 1-1. Specifications (Continued)

Equivalent Envelope Delay	
NTSC/M *(referenced to FCC standard curve)*	
0.2 to 2.1 MHz:	±40 nS
+3.58 MHz:	±30 nS
+4.18 MHz:	±60 nS
B/PAL and B/SECAM:	Complies with CCIR report 624, Figure 3, curve A or B.
2T Pulse K-Factor	
M/NTSC:	1.5% maximum
B/PAL and B/SECAM:	2% maximum
20T Pulse Gain/Delay Response *(measured as total baseline distortion)*	
M/NTSC:	3% maximum
B/PAL and B/SECAM:	5% maximum
Signal-to-Noise:	-55 dB RMS or better. *Total random and periodic noise unweighted, relative to peak sync.*
Variation of Output:	2% or less. *Total peak-to-peak variation of peak sync voltage during one field, using a field square wave test signal.*
Regulation of Output Power:	3% or less. *Variation of peak output power with a change in average picture level from black to white (0% to 100%).*
Harmonic Radiation:	-70 dB RMS, relative to peak sync power.

2. Aural Specifications

Power Output:	10% of peak-sync visual output power standard. 20% optional on 15, 30, 45, and 60 kW models. *Measured at output of optional notch or hybrid diplexer.*
RF Output	
Impedance:	50 Ohms
Connector	
1-10 kW models:	Type N, female
15-30 kW models:	$1^5/_8$" EIA
10% aural HT45LS and HT60LS:	$1^5/_8$" EIA
All other 45, 60 kW models:	$3^1/_8$" EIA
Audio Performance, Inputs	
1. Monaural	*(Performance based on ±25 kHz peak deviation, 75 uS pre-emphasis. Measurements taken after de-emphasis.)*
Level:	0 to +16 dBm, adjustable.
Impedance:	600 Ohms, balanced.
Pre-emphasis:	Choice of flat, 50uS, 75uS.
Frequency Response	30 Hz to 15 kHz: ±0.5 dB.
Harmonic Distortion	30 Hz to 15 kHz: 0.2% or less.
FM Signal-to-Noise	60 dB RMS or better.
AM Signal-to-Noise	55 dB or better. *Relative to 100% amplitude modulation.*
AM Synchronous Noise	40 dB or better. *Relative to 100% amplitude modulation; measured before optional diplexer.*
2. Wideband (stereo)	*(Performance based on ±75 kHz peak deviation, 75 uS pre-emphasis. Measurements taken after de-emphasis, measured before optional diplexer.)*
Level:	1 volt RMS nominal.
Impedance:	75 Ohms, unbalanced.
Response	50 Hz - 50 kHz: ±0.1 dB. 50 Hz - 110 kHz: ±0.5 dB.
FM Signal-to-Noise:	70 dB RMS or better.

Table 1-1. Specifications (Continued)

Distortion (THD)	50 Hz to 15 kHz: 0.25% or less. 15 kHz to 50 kHz: 0.75% or less.
Distortion (IMD):	0.5% or less. *SMPTE 4:1 test signal.*
Stereo Separation	50 Hz to 15 kHz: 45 dB or better. *Equivalent mode (uncompanded).*
Crosstalk	50 dB or better. *Stereo or Main channel into SAP.*
3. SCA (2 inputs)	
Level:	1 volt RMS, adjustable.
Impedance:	75 Ohms, unbalanced.
Frequency Response	20 Hz - 110 kHz: ±0.5 dB.
3. Service Conditions	
Environmental Requirements	
Operating Ambient Temperature Range:	0° to +50°C (+32° to +122°F). *Derate 2°C per 1,000 feet (305 m) above sea level.*
Altitude:	0 to 10,000 feet (3,084 meters) above sea level.
Ambient Humidity:	0 to 95% relative humidity, non-condensing.
Power Requirements	
Input:	208/240 volts ±10%, 3-phase, 50/60 Hz or 380/415 volts ±10%, 3-phase, 50 Hz. *Single-phase optional on 1 kW, 2 kW.*
Regulation:	±10% or better, no load to full load.
Phase Unbalance:	±3% maximum.
Air System Requirements	
Inlet Air Openings:	Rear doors.
Exhaust Air Openings:	Each amplifier cabinet top, approx. 34" x 24".
Exhaust Temperature:	10°C maximum temperature rise above inlet.
Allowable Back Pressure:	-0.25" H_2O at each cabinet exhaust stack.

2.1 Introduction

This section contains information necessary to install and to perform initial checkout procedures on *Platinum Series®* television transmitters. Drawings not otherwise identified may be found in the drawing package accompanying this manual under separate cover.

2.2 Installation Planning

The information in this section is intended to be used only as a general guideline in planning installation. Since all installations differ in some respects, and in order to conform to local building and electrical codes, the information contained herein must be adapted for each particular installation.

2.2.1 Space Requirements

(Refer to Transmitter Outline drawing.)

To allow for servicing the transmitter, a minimum clearance of 4 feet in front of and 5 feet behind the cabinets is recommended. Minimum clearances are shown in the drawing.

Planning for the transmitter room should allow space for program input, monitoring, remote control, and test equipment as well as the transmitter. Additional area may also be required for tower lighting, HVAC equipment, storage, and a workbench.

2.2.2 Weights

Weights are listed below each cabinet on the Transmitter Outline drawing. Be sure to include this information in your planning for the building and verify that the structure is capable of safely supporting the total weight of the transmitter and its peripheral equipment.

2.2.3 RF System Layout

Refer to the RF Layout drawing for the transmitter and notch diplexer floor plan. A system of overhead supports and hangers is needed to support the coaxial lines, filters, and other RF components. The support system should be installed so that the RF components are completely supported by the hangers, to minimize the weight carried by the output connectors at the top of the cabinets.

An overhead grid of unistrut or angle iron and 3/8" threaded rod is most commonly used. Pipe hangers for steam pipe may be used to hold the coax, combiners, etc. Pay special attention to the different types of materials being used. For example, if galvanized parts are used to support copper RF plumbing, the two must be separated using adhesive-backed rubber strips or tape to prevent corrosion.

Notch diplexers are generally supplied on a frame with rollers, which rests on the floor.

The basic transmitter generally includes harmonic filters, a color notch filter, and directional couplers for metering and AGC. One or more hybrid visual combiners are present in multiple-cabinet systems. All other RF line components are purchased separately. Be sure to obtain all components necessary for your installation.

2.2.4 Air System

The Transmitter Outline drawing shows a typical exhaust duct and blower system, and the total transmitter requirement for cooling air. The minimum ceiling height to properly handle exhaust air as shown is 12 feet.

The outline drawing also shows a typical air intake and prefilter system.

The intake blower should be sized to provide slight positive room pressure. A manometer installed to sense pressure drop across the filters can be used to indicate when prefilter replacement is due.

If the existing space on site will not permit construction of the recommended air system, then care must be taken to modify the design to fit the available space and still properly cool the transmitter.

Keep in mind that the recommended system is sized only for cooling the transmitter. Any additional cooling load in the building must be considered when selecting the air system components.

The transmitter exhaust should not be the only exhaust in the room, as heat from the peripheral equipment would then be drawn through the transmitter. Additional flushing air is recommended for the removal of heat from any equipment surrounding the transmitter. A good guideline is to keep input air no greater than 5°C above ambient. The maximum transmitter operating temperature is 50°C at sea level (derate 2°C for each 1000 feet above sea level).

Service Bulletin VHF-140 contains general information on air handling and some tips for analyzing typical problems in air systems. To obtain a copy of this bulletin, contact Harris Field Service department.

Appendix B contains information useful to those intending to use air conditioning equipment to control transmitter building temperature.

2.2.5 Electrical Power

Two standards are commonly used as a source of data for AC power systems: the National Electrical Code published by the National Fire Protection Association in the United States, and the Canadian Electrical Code published by the Canadian Standards Association. These standards should be followed since they are referenced in most state and local codes. See Appendix C for information about lightning and surge protection.

The transmitter is designed to operate from 208 or 240 volts, 60 Hz or 380/415 volts, 50 Hz. If voltage variations in excess of ±10% are anticipated, the transmitter power input must be equipped with automatic voltage regulators (optional) capable of correcting the primary potential.

All wiring and signal inputs are at the top of the cabinets. Overhead cabling is used. No access is provided in the cabinet floors.

AC power to the transmitter should be run in metallic conduit, connected to earth ground for safety and to provide shielding against interference. All phases should be run within the same conduit to cancel induced magnetic fields. The power run must be terminated in a power distribution panel, whose case must also be connected to earth ground.

2.2.6 Circuit Breaker Selection

Refer to AC Distribution drawing and Recommended AC Circuit Breaker drawing for the connection and breaker information.

Each cabinet is fed from the distribution panel through a separate circuit breaker.

The transmitter requires a relatively stable source of input power. For this reason, the primary power for the transmitter should originate at the main power distribution system and remain isolated from other electrical distributions.

Other input AC power requirements include the following:

2.2.7 Starting Surge Requirement

A short-duration starting surge, due to transformer inrush current, will last for a portion of the first half-cycle after power is turned on. During this half-cycle surge, the line voltage at the cabinets must not drop below 80% of the rated line voltage. See Recommended AC Circuit Breaker Drawing for sizing information. A second surge of longer duration also occurs at power-on and will last up to 10 cycles of the line frequency. During this surge the equipment will draw 400% or more of the rated load. The line voltage at the cabinets must not drop below 90% of the rated line voltage during this 10-cycle surge.

2.2.8 Power Input Isolation

If a separate isolation transformer is used, it should be connected to the highest potential primary source available to minimize voltage fluctuations on the secondary. The isolation transformer must have both primary and secondary taps so that power input variations and changes in loads can be compensated. The isolation transformer must maintain the rated output during the transmitter starting surge. The transformer should be located as closely as possible to the transmitter.

No load other than the transmitter should be connected to the transformer secondary. The feed line to the transformer must be protected by a main line circuit breaker to protect against a transformer short.

Branch circuit breakers should be provided for peripheral equipment and other loads. These loads should not be connected to the secondary of the isolation transformer used for the transmitter. Branch circuits should terminate within six feet of peripheral equipment.

2.2.9 Disconnect Location

The circuit breaker panel should be located near the transmitter in a well lighted area. As a safety precaution, controls for disconnecting the main power service supplying the transmitter must be convenient to the operator and maintenance personnel. Provisions for emergency lighting should be made.

2.3 Unpacking and Equipment Inventory

When the transmitter is delivered to the site, the shipment should be inspected and inventoried before installation is begun. This section provides information to assist unpacking and inventory.

2.3.1 Inventory and Inspection

2.3.1.1 Packing Check List

Each transmitter shipment will be accompanied by a packing check list identifying which equipment is packed in the various crates and boxes. Be sure to locate this document when the shipment arrives.

The contents of the shipment should be as indicated on the packing lists. If the contents are incomplete, or if the unit is damaged electrically or mechanically, notify the Harris Customer Service Department by phone at 1-217-222-8200, or at the following address:

Harris Corporation,
Broadcast Division
P.O. Box 4290
Quincy, Il 62305
Attn. Customer Service Department

The equipment becomes the property of the customer when the unit is delivered to the carrier. Carefully unpack the unit and perform a visual inspection to determine that no apparent damage has been incurred during shipment. Retain all shipping materials until it has been determined that no damage occurred during shipment. Claims for damaged equipment must be filed promptly; otherwise, the carrier may not accept the claim.

2.3.1.2 Factory Test Data Sheets

A set of factory test data is supplied with each transmitter. It lists parameters for operation of the transmitter at your power level and channel. These readings were recorded during factory testing. Locate the test data, copy, and file the original so that copies may be made as needed.

Record the same readings periodically to establish and maintain an information base from which to work in the event of future changes or problems.

2.3.2 Equipment Required for Unloading

Before the truck arrives with the new transmitter, have ready on site a fork lift truck or a suitable unloading dock, a pallet jack, heavy duty two wheel cart, and any other equipment necessary to unload up to 1100 pounds (500 kg) at the site in question. The cabinets and power supplies are too heavy to be safely unloaded by hand.

A area large enough to store the boxes should be prepared in advance to help the unloading process.

Remove the cabinets from the truck and set in a location where they cannot be damaged.

CAUTION

DO NOT USE THE ROUNDED EDGES OF THE CABINETS FOR PUSHING, PULLING OR LIFTING!!

The boxes that contain the RF amplifier modules weigh approximately 40 pounds (18 kg) each. Do not be stack them too high, and handle with care.

The Control cabinet and skid together weigh approximately 470 pounds (215 kg). The skid itself weighs 30 pounds (14 kg).

An aural PA/visual driver cabinet for a 30 kW transmitter weighs approximately 860 pounds (390 kg) including the skid. Each 15 kW visual PA cabinet with skid weighs approximately 990 pounds (450 kg). Single amplifier cabinets for transmitters below 10 kW will weigh somewhat less. The amplifier cabinet skids weigh 65 pounds (30 kg) each.

The 50 volt power supplies weigh approximately 450 pounds (205 kg) each. Most are shipped two per skid, with any odd unit sent on a final skid. Be prepared for 900+ pounds (410+ kg).

Weights are generally marked on each box. Check the markings on each container before lifting.

2.4 Cabinet Placement and Leveling

Four bolts hold each cabinet to its skid. They are located two per side, front and rear. Also, remove the blocks that support the bottom of each rear door.

Use a chalk line or similar method to mark the floor position for each cabinet to ensure even alignment.

CAUTION

DO NOT USE THE ROUNDED EDGES OF THE CABINETS FOR PUSHING, PULLING OR LIFTING!!

Two bars with lifting lugs are provided to remove the cabinets from the skids (839-7900-183 arm, cabinet lifting). Using proper lifting equipment, remove each cabinet from its skid and transfer the bars to the next cabinet. The bars bolt to the side of the cabinet through the holes normally used to bolt the cabinets together. These holes are located 1 inch from top of each cabinet, and 6 inches and 22 inches from the each cabinet front.

If equipment is not available to lift the cabinet off the skid, you may want to remove the back doors to lighten the load.

CAUTION

THE DOOR WEIGHS 175 POUNDS (80 kg).

Removing doors will require three people. Remove the block used to support the door during shipment. Open the door and block it up at the bottom. Disconnect the fan wiring. Two people wearing gloves should support the door while the third person removes the hinge pins starting at the bottom and working up. Then, the door may be set aside and rollers (pipe) and a ramp used to remove the cabinet from the skid.

CAUTION

Slide cabinet off to the front or back of skid (NOT THE SIDE) to avoid bending bottom panel.

Then, replace the door after the cabinet is set in place. Have two people position the door on suitable blocking material while the third person inserts the hinge pins starting from the top down. Reinstall the fan wiring.

Starting with one end cabinet, move each cabinet to the approximate location.

When each cabinet is in its final position, you may need to level the cabinet. Check the level in all three planes. Metal plates shimmed under the cabinet edges can be used for levelling.

Bolt the cabinets together using the two holes at the top and two at the bottom of each cabinet.

2.5 Grounding

The ground strap runs along the top of the cabinets, then forward and over to the control cabinet. The station ground may be installed up the side of the far PA cabinet or between the first PA and control cabinet. For additional information on station grounding requirements refer to Appendix C.

2.6 Installation of 50 Volt Supplies

The 50 volt power supplies weigh about 450 pounds (205 kg) each. Use a mechanical lifting device to remove them from the skid. Two access holes in the top are provided to attach lifting eyes to the transformer. Use a spreader bar to prevent bending the lugs. A wide strap under the unit will also work.

NOTE

The center of gravity is in line with bolt holes.

The power supplies are furnished with metal wheels for easy movement and installation in the transmitter.

Consider the type of floor on which the power supply will rest. The weight is carried on brass wheels, which will possibly mar the floor. Long-term weight may damage the floor, making power supply removal for maintenance very difficult. Protection of tiled floors should be considered.

Roll one supply into the cabinet, allowing room for the other supply. The terminal boards should face the rear of the cabinet. After both supplies are positioned, install the rear panel and feed the cables through the holes and up to the terminal board. Each supply should be centered in its slot and tight against the panel. This forms an air seal needed to maintain proper air flow throughout the cabinet.

Use hardware as supplied with washers (1-split, 1-flat) to connect (+) to left side of the 50 V bus bar, and (-) to the right side.

2.6.1 Tap Transformers

The two power supplies in the control cabinet, the supply with each slave controller in the PA cabinets, the supply in the exciter, and the 50 volt power supplies should be tapped for the correct line voltage. See the following drawings:

1. Wiring Diagram for Control cabinet
2. Wiring Diagram for Aural PA cabinet
3. Wiring Diagram for Visual PA cabinet
4. Power Supply Schematic for HX-1V exciter
5. Wiring Diagram for 50 Volt Power Supply

2.7 RF Output Coax

CAUTION

WHEN INSTALLING RF PLUMBING OR AIR SYSTEM WIRING, DO NOT STEP ON THE CONNECTORS ON TOP OF THE CABINETS.

(Refer to RF Plumbing Layout drawing.)

Because almost every station is different, refer to the suggested layout for information for location of hybrids, loads, couplers etc. Install the directional couplers for each cabinet first, and work from there out toward the loads and antenna. Be sure to make any desired VSWR measurements of the RF plant before making final connections to the cabinets.

2.8 Primary Wiring

(Refer to AC Power Distribution drawing.)

Three phase AC power wiring for each amplifier cabinet can be installed through the hole provided for conduit directly above the main contactor. Removal of the safety shield over the contactor is required, and the shield must be replaced after completing the AC power wiring in each cabinet.

All cabinets must be phased identically; that is, each phase connects to the same point in each cabinet, and each 50 volt power supply is connected like the others. For example, at PS1-TB-1,4 connects to phase A on all supplies, etc. All logic must be powered from the same phase.

The power for the control cabinet is fed through the conduit hole in the left rear top of the cabinet. The three phase power runs to the terminal block in the center bottom of cabinet. Again, the safety shield must be removed before installation, and replaced after completion.

2.9 Inter-cabinet Wiring

(Refer to the Cabinet Interconnect Drawing)

A cable tray (not furnished) should be installed along the top of the transmitter for cabinet interconnecting. Install the control and monitor cables in this tray. It may be plastic or metal, and attached to the top of the cabinet with screws or bolts.

Run the cables from the control cabinet through the cable tray to each PA cabinet. On the monitor bus cable (flat ribbon cable), be sure to insert pin 1 of the cable into socket 1 of the jack. The cable terminator must be installed in the last PA cabinet, again paying close attention to pin numbers.

The RF sample lines may be installed in the cable tray as well. Make sure each pair of RF sample lines is of equal length. The line length is not critical but should be kept reasonably short. Directional couplers are set to level with maximum length of 50 feet for RG58/U coax. Make forward and reflected sample cable pairs from the same roll of coax if possible to keep insertion losses equal. If the transmitter architecture utilizes two drive paths, the cables used for Visual Drive A & B samples should be of equal length as well.

2.10 Input Signal Wiring

Video, aural, and subcarrier input signal lines are connected from signal sources to signal inputs on the I/O panel as required. Video inputs are terminated into 75 Ohms. Mono aural input is a standard XLR connector with pin 1 grounded. Aural wideband inputs can be jumper selected to terminate 75 or 1000 Ohms.

2.11 Interlocks and Interfaces

External and failsafe interlocks are connected to TB1 located near the bottom of the I/O panel in the back of the control cabinet. Refer to the Cabinet Interconnect drawing.

2.11.1 External Interlock: TB1-1,2

When open, the external interlock prevents the transmitter from being started up. For units with Rev. E or earlier main control boards, it will turn the transmitter off if opened during operation, and a manual ON command (either local or remote) is required to restart the transmitter.

On rev F. or later main controller boards, the external interlock is user selectable by J24. It can either shut the transmitter off (as an OFF command) when the interlock is opened, or temporarily hold the transmitter off while the interlock is open.

> J24 jumper pins 1-2 for automatic return to ON when interlock is restored.
> J24 jumper pins 2-3 for transmitter off, manual restart ("ON" command) required.

The external contact closure or other device must sink 50 microamps to less than 0.5 volts. Open circuit voltage at TB1-2 is +5 V, and TB1-1 is ground.

2.11.2 Failsafe Interlock: TB1-3,4

When open, the failsafe interlock will mute both visual and aural RF outputs of the exciter. Normal operation will resume when closed. This interlock may be used for the remote control system failsafe interlock, diplexer air switch, or reject load thermal cut out. Current in the loop should be above 5 mA. The open circuit voltage of TB 1-3 is +12 volts and TB1-4 is 0 volts.

2.11.3 External Blower Control: TB4-1,2 (located in bottom of control cabinet)

The external blower control is a set of normally-open contacts that close when the transmitter is turned on. They may be used for a diplexer blower, or other contactor control as desired. The contacts are rated 5 amps, 240 volts AC maximum.

2.11.4 Remote Control I/O:

Three "D" connectors for remote control interface can be plugged directly into the Harris Sentinel remote control system ACIO Termination modules. These are:

Transmitter	Sentinel
J31 Command in	J1 Command out
J32 Status out	J2 Status in
J33 Analog out	J3 Analog in

Refer to Control Cabinet Wiring Diagram.

2.11.4.1 J31: Command In

The Command inputs are all optocoupled and require a current source to energize the loop. This can be gotten either within the transmitter or externally.

The Main Controller board internal current source can be activated with J20 jumper placed in the 1-2 position, which will supply +12 volts from the internal supply for the optocouplers.

If J20 is placed in the 2-3 position the optocouplers must be supplied a voltage on pins 19 & 37 of J31. This is the preferred connection when interfacing to a Harris Sentinel control system.

The optocouplers require a minimum current of 5 mA, and the maximum current should be less than 20 mA. Open-circuit voltage with the internal source (J20 connected 1-2) is +12 volts. Any external source (J20 connected 2-3) should be less than 36 volts.

J31 COMMAND INPUTS:

1	TRANSMITTER ON
2	TRANSMITTER OFF
3	VISUAL POWER RAISE
4	VISUAL POWER LOWER
5	AURAL POWER RAISE
6	AURAL POWER LOWER
7	SELECT EXCITER A (OPT)
8	SELECT EXCITER B (OPT)
9	SELECT MANUAL (OPT)
10	SELECT AUTO (OPT)
11	SELECT COMPOSITE
12-18	NO CONNECTION
20-36	GROUNDS
19 & 37	EXTERNAL SUPPLY (from J31-19,37; J20 2-3)

The functions marked (OPT) are supplied when the optional exciter switcher is installed.

Command Functions:

TRANSMITTER ON: Turns transmitter on and enables RF output.

TRANSMITTER OFF: Turns transmitter off and disables RF output.

RAISE/LOWER: Raises or lowers visual or aural power output of the transmitter.

SELECT EXCITER (OPT): Selects exciter "A" or "B" via the optional exciter switcher.

SELECT MANUAL/AUTO (OPT): Selects the mode of operation for the exciter switcher. MANUAL mode requires that the selection be done manually. When in AUTO mode, if an exciter failure is detected, the switcher will automatically switch to the alternate exciter if not in a foldback or muted state.

2.11.4.2 J32: Status Outputs

The Status outputs are open-collector drivers with a 100 Ohm resistor in series and a 24 volt zener (avalanche) diode clamp to ground.

If the equipment connected to J32 requires a voltage source for opto-couplers, an internal voltage source of +12 volts can be made available to the outputs (pins 1 to 16) by placing main controller optional status jumper J21 in the 1-2 position. When J21 is in the 2-3 position, an external voltage source must be supplied to pins 19 & 37.

When interfaced to a Harris Sentinel remote control system the J21 1-2 position is preferred, and the Sentinel ACIO Termination board should be programmed at J10 using only the "B" jumper position.

The open collector stand-off voltage is 30 volts DC, and maximum current sink is 48 mA. Each output is asserted low for status true condition.

J32 STATUS OUTPUTS:

20	TRANSMITTER ON
21	LOCAL
22	VSWR FOLDBACK ACTIVE
23	VSWR FAULT
24	MONITOR FAULT
25	CONTROL FAULT
26	EXTERNAL INTERLOCK
27	PHASE LOSS
28	EXCITER MUTE
29	EXCITER FAULT
30	SUPPLY FAULT
31	MODULE FAULT
32	AIR LOSS
33	DOOR INTERLOCK
34	SPARE FAULT
35	NOT USED
36	GROUND
19 & 37	EXTERNAL VOLTAGE
1 to 16	VOLTAGE SOURCE (for Opto Couplers)

WARNING: Disconnect primary power prior to servicing.

Status Functions:

TRANSMITTER ON: Indicates the state of the transmitter. The line will be asserted low when the transmitter is on.

LOCAL: Indicates the transmitter will not accept remote command inputs. This line will be asserted low when the transmitter is in the LOCAL mode.

VSWR FOLDBACK ACTIVE: Indicates antenna VSWR has caused the transmitter to reduce its output power by some amount. It will be asserted low while the foldback is active.

VSWR FAULT: Indicates the modules have not come up to power at the end of three seconds after a VSWR overload set point has been exceeded. Note that active fold-back will inhibit VSWR overload detection. Upon detection of an overload, this line will be asserted low.

MONITOR FAULT: Indicates the monitor has failed and all calculated readings may be incorrect. Upon monitor failure, the line will be asserted low.

CONTROL FAULT: Indicates one of the cabinet controllers has failed and not responding to requests for data from the monitor bus. Upon failure, the line will be asserted low.

EXTERNAL INTERLOCK: Indicates the status of the external interlock. If the interlock is open, a low will be asserted.

PHASE LOSS: Indicates status of the internal AC phase loss detector. If detector senses loss of one of the three phase power lines, PHASE LOSS will be asserted low.

EXCITER MUTE: Indicates that some function has muted the exciter. Asserted low for mute.

EXCITER FAULT: Indicates exciter fault directly in single exciter configuration. Indicates exciter fault from optional exciter switcher if used. Asserted low for fault.

SUPPLY FAULT: Indicates one or more of the 50 volt power supplies has failed. Asserted low upon fault.

MODULE FAULT: Indicates one or more of the cabinet RF modules has faulted off. Asserted low upon fault.

AIR LOSS: Indicates one or more of the cabinets has lost air supply. Asserted low upon loss of cabinet pressure.

DOOR INTERLOCK: Asserted low if one or more of the cabinet doors is open.

SPARE FAULT: Not used at this time.

2.11.4.3 J33: Analog Outputs

The analog outputs on the I/O panel provide both calibrated and un-calibrated readings for some functions. The calibrated outputs are a function of the monitoring system. The raw outputs come directly from the RF peak detectors. Each output is buffered by a voltage follower, with a 1 kOhm resistor in series with the signal, before leaving the main controller board.

J33 CALIBRATED OUTPUTS RANGE:

1 VIS FORWARD POWER
0 - 3.0 VOLTS = 0 -100 %

2 VIS VSWR
0 - 2.0 VOLTS = 1.0 - 2.0 VSWR

3 AURAL FORWARD POWER
0 - 3.0 VOLTS = 0 -100 %

4 AURAL VSWR
1 - 2.0 VOLTS = 1.0 - 2.0 VSWR

The above four selections follow the A/D edit function (part of user setup).

RAW UN-CALIBRATED OUTPUTS:

5 REJECT LOAD 1 POWER
0-2.5 volts = 0 to max reject power

6 REJECT LOAD 2 POWER
0-2.5 volts = 0 to max reject power

7 REJECT LOAD 3 POWER
0-2.5 volts = 0 to max reject power

8 VISUAL FORWARD POWER
0-2.5 volts = 0-100% power[1]
0-1.8 volts = 0-100% power[2]

9 AURAL FORWARD POWER
0-2.5 volts = 0-100% power[1]
0-0.8 volts = 0-100% power[2]

10 VISUAL REFLECTED POWER
0-2.5 volts = 1.0-3.0 VSWR[1]
0-1.8 volts = 1.0-3.0 VSWR[2]

11 AURAL REFLECTED POWER
0-2.5 volts = 1.0-3.0 VSWR[1]
0-1.8 volts = 1.0-3.0 VSWR[2]

12-19,37 NC

20-36 ANALOG GROUND SIDE OF 1-11

[1] For High Power Transmitters (>HT10)
[2] For Low Power Transmitters (<=HT10)

2.11.4.4 Optional Remote Status

The optional exciter switcher supplies an output showing which exciter is selected. Each line is asserted low to indicate the corresponding condition.

These drivers have the same ratings as the other status outputs. J34, pin 9 is the current source for the opto couplers in the connected equipment, and is supplied the voltage selected by J21.

J34 will not connect plug-for-plug into a Sentinel ACIO Termination panel, but can be wired through a Sentinel Fan-Out panel.

J34 OPTIONAL STATUS
(from J-17 MAIN CONTROLLER):

1	EXCITER A SELECTED
2	EXCITER B SELECTED
3	MANUAL SELECTED
4	FUTURE OPTION
5	FUTURE OPTION
6	GROUND
7	GROUND
8	GROUND
9	VOLTAGE SOURCE for Opto Couplers (Connected to J32-19 & 37)

Refer to drawing 839-7900-143.

Optional Status Functions:

EXCITER A SELECTED: Indicates exciter "A" is selected.

EXCITER B SELECTED: Indicates exciter "B" is selected.

MANUAL SELECTED: Indicates the switcher is in the manual mode.

2.12 Transmitter Check Out

CAUTION

BEFORE PROCEEDING WITH CHECK OUT, INSPECT THE TRANSMITTER FOR AC POWER SHORTS, LOOSE HARDWARE, WIRING ERRORS, UNCONNECTED WIRES, MISSING PARTS, AND DEBRIS.

The following procedures are the sequential steps to safely turn on the transmitter for the first time, and should be performed in the order listed. It is recommended that the installation personnel read the general description in section one, the controls and operation material in section three, and these procedures before starting.

2.12.1 Control Cabinet Pre-Operational Check Out

a. (Press, then release the right side of the panel to open the front panel. Make sure CB1, on the left side of the inner panel, next to the Control circuit board, is turned off before proceeding.) The monitor board battery and the controller board batteries are disconnected before shipping. This prevents total discharge during shipping and storage. Connect the monitor board battery cable to J6. Connect the controller board battery to J25.

b. See Table 5-6 for Monitor board S3 and S4 DIP configuration switch positions. Check the switch positions against those listed in the chart.

c. Apply 3 phase power to the control cabinet only.

d. Check for correct AC power line voltage. If the voltage does not correspond to the values for the DC supplies as wired, then re-tap for the correct voltage.

e. Turn on circuit breaker CB1 (located behind the display panel left of the control boards) in the control cabinet.

f. Check that the phase monitor red LED is on. If not, first check that its voltage range is adjusted to the correct settings. Next, reverse any two phases to cause the LED to come on. Refer to the AC Distribution Drawing as required. If the phases are wrong, the PHASE LOSS lamp on the display panel should light.

NOTE

All cabinets must be phased the same. Correct phasing of each PA cabinet is a part of the PA cabinet Operational Checkout.

g. The control fault will be on. The failsafe and external interlocks are active and may be on or off. External site system wiring must be connected to these interlock terminals or jumpers must be added at the terminals to turn these indicators off before the transmitter can be turned on. The exciter should indicate mute.

h. Refer to the Control Cabinet Wiring Diagram. Check the voltages of the logic power supplies with a VOM or DVM and on the meter display. (From the Bar Graph screen press METER, then SUPPLY, then NEXT to access the logic supply readings. Press EXIT when done.)

i. Check PS-2 for 12V.

j. Check the meter display for the correct AC voltage readings. (From the bar graph press METER, then press LINE. Press EXIT when done.)

k. Set the time and date on the display. (Press SETUP, then TIME. Refer to section three for additional information on date/time entry if needed. Press EXIT once when done.)

l. Press SETPOINT to access the setpoint screen. Enter the station's licensed power outputs to be used by the bar graph page. (Refer to system setpoint entry in section three if needed.)

m. Check the external interlock by operating whatever is connected to it, or place jumper at TB1-3 and 4 on I/O panel.

n. Apply 1 volt p-p video to exciter video input.

o. Press transmitter ON pushbutton.

p. Check for the external blower (diplexer or exhaust blowers) to start if used, and for the failsafe indicator to go out if tied to diplexer air switch.

q. The failsafe lamp should go out when the diplexer fan gets up to speed. The exciter should un-mute a few seconds after ON command is given and all interlocks are normal.

r. Open the failsafe circuit. The Failsafe lamp should light and the exciter should mute. Re-close the failsafe circuit. The failsafe lamp and exciter mute LED should go out.

s. Open the external interlock. The external interlock lamp should be on and the transmitter should shut off. Press ON button. The transmitter should not come on. Re-close the circuit. The external interlock lamp should go out. If Main Controller J24 is set 1-2, the transmitter should come back on. If Main Controller J24 is set 2-3, the transmitter should not come back on until a manual ON command is given.

t. Check operation of RAISE and LOWER switches, both on the control cabinet and on the exciter.

u. If the system has a remote control, place transmitter in the REMOTE mode and check for operation of transmitter ON/OFF and RAISE/LOWER from the remote.

v. Check that LOCAL mode locks out remote commands.

w. Temporarily remove video input. The exciter should mute, then return to normal after the video is restored.

x. Return exciter to minimum power when done by depressing and holding LOWER commands for about 15 seconds.

y. Press OFF pushbutton at the control cabinet.

2.12.2 PA Cabinet Pre-Operational Check Out

CAUTION

CHECK 50V BUS BAR CABLES FOR TIGHT CONNECTION AND INSPECT FOR CABLES WHICH MIGHT SHORT BUS BAR TO GROUND.

Perform the following for each PA cabinet:

a. TURN OFF BOTH BREAKERS located behind the lower pop-off panel on the front of the PA cabinet.
b. Unplug the three pin plug at J2 on the slave controller board. This places the local slave controller in control of the cabinet.

NOTE

Unplugging J2 on the Slave Controller removes external interlock control of the PA cabinet.

c. Turn on the AC power to the cabinet.
d. Turn on CB1 located behind the lower left panel. Check for 5 volts at U15 pin 14 on the slave controller board. (U15 is in the middle of the front row.)
e. Press cabinet ON. You should hear the contactor energize. Air loss, PS-1, and PS-2 LEDs should be on (PS-2 may not be used). Press cabinet OFF.
f. Turn on CB2, located behind the lower right panel. Press the cabinet on switch on the slave controller. Check for proper blower rotation. The negative pressure at the exhaust may be measured by placing a small sample hole in the exhaust ducting system directly above the transmitter, or by temporarily disconnecting the air pressure switch, S2, and connecting the measuring device at this point. See Figure 5-2 for the air switch location. The positive pressure inside the cabinet may be measured by temporarily removing a mounting screw from one of the cover plates on the top rear of the cabinet. (The fan blows air into the cabinet.) The air loss LED should go out, and the PS LEDs will go out as the 50 volt power supplies come on. (If the air loss LED remains on, insert the amplifier modules most of the way into the cabinet to provide more back pressure, without engaging the connectors yet, and try again.)
g. Check air switch operation by momentarily shutting off CB2.
h. Check door interlock operation by opening the rear door while cabinet is running. It should shut down and not come back on until a new cabinet 'ON' command is given.
i. Check the 50 volt supplies. Measure the voltage at pin 3 or 4 of a module connector from the front of the cabinet. (PS-1 powers the right column, and PS-2 the left.)
j. Turn off cabinet and both breakers. Reconnect cable at J2 and proceed to next cabinet.

2.12.3 Module Installation

The modules may now be installed. Refer to factory test data for placement of modules by serial number and slot number. There are only two types of modules, DRIVERS and PAs. The drivers are keyed and will not fit into a PA slot. Although each type is interchangeable from aural to visual and will work in any like socket, when starting out it is best to reassemble them in the same locations as tested. Keep a record of any changes for future reference.

Make sure each module is completely seated.

CAUTION

DO NOT USE EXCESSIVE FORCE OR SLAM MODULES INTO THE SLOTS.

2.12.4 Control System Check Out

a. Apply power to all cabinets and peripherals.
b. Turn on all cabinet breakers.
c. Check the CABINET SELECT LED on each slave controller. For systems with single PA cabinets, the LED should illuminate continuously. For multiple-cabinet systems (20kW and up), the LEDs should be flashing.
d. Momentarily switch off each PA cabinet logic breaker CB1 and look for CONTROL FAULT lamp on the control cabinet while the breaker is off. After switching all PA logic breakers, check the alarms queue for SLAVE FAULTS. (From the Bar Graph screen, press ALARM.) Alarms are received and stored in memory while viewing the alarms screen, but the display is not updated until you leave the alarms page. DELETE the alarms and press EXIT after each test before preceding the next event.
e. Depress and hold power LOWER controls for 15 seconds each to ensure that exciters are turned all the way down.
f. Press transmitter ON pushbutton.
g. Check air system for proper operation. There should be slight negative air pressure above transmitter, and positive pressure inside the cabinets of approximately 0.7 inches H_20 column.
h. Check that all modules are enabled. Drivers will show a full green LED. PA modules will illuminate half of the green LED. It is normal for the red module LEDs to come on momentarily as the transmitter 50 volt supplies come up to voltage at turn on. They also will come on at shutdown, gradually fading out as the supplies discharge.
i. Open each PA cabinet rear door momentarily. The cabinet should shut down, then re-start a few seconds after the door is closed. Check for DOOR INTERLOCK lamp at control cabinet while the door is open, and check for DOOR OPEN in alarms queue on the display panel.
j. Similarly, check AIR LOSS lamps and AIR FAULT ALARMS by momentarily shutting off each cabinet fan breaker CB2.
k. Check MODULE FAULT status for each module. Check to see that all modules are enabled (green LED on); press transmitter ON to enable any modules that are not already on.
l. Squeeze the disable switch in the handle of the first module. The module LEDs should go out. You should see the MODULE FAULT lamp on at the control cabinet, and a module fault in the alarms queue. Re-enable the module by pressing transmitter ON at the control cabinet. The MODULE FAULT lamp on the control cabinet should go out. DELETE the alarm from the queue. Repeat for each module in turn.

2.12.5 VSWR Foldback And VSWR Fault Check Out

This exercise involves using the exciter as a source for forward and reflected power samples in order to test for proper VSWR foldback operation and fault detection.

It is recommended that you read and understand this procedure and that you make notes of the original jumper positions and cable connections before starting.

2.12.5.1 Visual

a. Depress and hold both exciter LOWER buttons for 15 seconds to ensure minimum output.
b. Connect visual exciter output to J6 on the back of the main controller.
c. Temporarily remove the remote I/O cable on back of the exciter to enable the exciter without running the transmitter.
d. Slowly raise visual exciter power until the bar graph on the master controller display indicates 100% visual power.
e. Move the cable now at J6 to a spectrum analyzer and set a reference level. Reconnect the cable to J6.
f. Connect the aural exciter output to the analyzer and set the level 26 dB less than visual.
g. Connect the aural exciter to J8 on the Main Controller.
h. The VSWR should read approximately 1.11:1. If substantially different from this reading, perform procedure in paragraphs 5.11.1 through 5.11.3.1 as required to adjust the reflected power calibration.
i. Set Visual foldback jumper J18 to connect pins 2 and 3 (disabled).
j. Slowly raise the aural exciter power.The VSWR FAULT lamp should illuminate at approximately 1.4:1. R51 adjusts the threshold of the VSWR FAULT lamp.
k. LOWER aural exciter power. Reinstall J18 to pins 1 and 2 (enabled).
l. Slowly raise aural power until FOLD BACK ACTIVE lamp just comes on.
m. Note the visual VSWR reading. It should be approximately 1.2:1. R20 adjusts the visual foldback threshold.

2.12.5.2 Aural

a. Depress and hold both exciter LOWER buttons for 15 seconds to ensure minimum output.
b. Connect visual exciter output to J7 on the back of the main controller.
c. Temporarily remove the remote I/O cable on back of the exciter to enable the exciter without running the transmitter.
d. Slowly raise visual exciter power until the bar graph on the master controller display indicates 100% aural power.
e. Move the cable now at J7 to a spectrum analyzer and set a reference level. Reconnect the cable to J7.
f. Connect the aural exciter output to the analyzer and set the level 26 dB less than visual.
g. Connect the aural exciter to J9 on the Main Controller.
h. The VSWR should read approximately 1.11:1. If substantially different from this reading, perform procedure in paragraphs 5.11.1 through 5.11.3.1 as required to adjust the reflected power calibration.
i. Set Aural foldback jumper J19 to connect pins 2 and 3 (disabled).
j. Slowly raise the aural exciter power. The VSWR FAULT lamp should illuminate at approximately 1.6:1. R63 adjusts the threshold of the VSWR FAULT lamp.
k. LOWER aural exciter power. Reinstall J19 to pins 1 and 2 (enabled).
l. Slowly raise aural power until FOLD BACK ACTIVE lamp just comes on.
m. Note the Aural VSWR reading. It should be approximately 1.4:1. R33 adjusts the Aural foldback threshold.

NOTE

Reconnect exciter remote I/O cable when done to restore correct operation of the protection circuits. Verify that all forward and reflected samples are properly reconnected.

2.13 Initial Application of RF Power

2.13.1 Visual

a. For systems with multiple visual PA cabinets (20 kW and up), refer to the factory test data for initial setting of the phase control for the Phase and Gain module. Place switch on the phase and gain module in the SET position. Set the A and B gain pots fully clockwise.
b. Check that aural and visual AGC modules are on.
c. LOWER the exciter to minimum drive and apply a ramp or staircase test signal.
d. Press transmitter ON pushbutton.
e. Check to see that all RF amplifier modules are enabled.
f. Slowly raise visual power while observing VSWR, FORWARD POWER, and, in a multiple visual PA cabinet system, REJECT POWER. Stop at approximately 25% forward power. In some cases where transmitter power is significantly less than 30 kW, the PA modules used in the drive chain may illuminate only half of the green LED even though RF drive is applied.
g. Phase and Gain module alignment: For systems below 20 kW, skip the following procedure. 20 kW and 30 kW systems have only one phase and gain module, so the procedure is performed only once. In 45 kW systems, perform this sequence on the lower level (A / B) phase and gain module, then proceed to the top level ([A+B] / C) module. In 60 kW systems, begin with the (A / B) and (C / D) phase and gain modules, then proceed to the top level ([A+B] / [C+D]) module.
   1. Adjust phase and gain module INIT phase control in SET position for minimum reject power.

CAUTION

INIT PHASE MUST BE PROPERLY SET TO MINIMIZE REJECT POWER UPON RETURN FROM A POWER FAILURE.

2. Alternately adjust A and B gain pots for minimum reject power.
3. Set phase to RUN position and adjust +/- phase control for minimum reject power.
4. This completes the phase and gain module alignment in 20 kW and 30 kW systems. For larger systems, proceed to the next phase and gain module.

h. Using an external power meter to confirm power output, slowly increase visual power to 50%.

   If external power meter and user display panel readings do not agree, refer to the power calibration procedures in Section V.

i. Increase power slowly to 100%. In 20 kW and higher systems, watch the reject load power while increasing drive, and make slight readjustments to the phase and gain module controls as above if necessary. Note that the second half of the green LED on each visual PA module illuminates, indicating presence of RF drive. In some cases where transmitter power is significantly less than 30 kW, the PA modules used in the drive stage may illuminate only half of the green LED even though full RF drive is applied.

j. Compare DC INPUT POWER and 50 volt supply currents to factory test data.

k. LOWER power to 66%. Switch AGC off and RAISE power back up to 100%.

l. Check all modules for output one at a time by squeezing the disable switch for each module and noting a drop in power output of the cabinet as seen on the visual (or aural) information screen. Re-enable each module using a transmitter ON command before proceeding to the next.

m. Switch AGC back ON when done and RAISE power to 100%.

n. Compare AGC reading on the display and voltages at the test points on front of the module to the factory test data.

o. Refer to AGC adjustments in Section V if needed.

p. Refer to exciter manual for adjustment of the following:
   Depth of modulation
   Differential gain
   Incidental phase (ICPM)
   Differential phase
   Amplitude response and group delay compensation (Exciter Group Delay Compensator and Notch Diplexer Equalizer adjustments)
   Power limit
   Frequency

2.13.2 Aural

a. Slowly apply aural exciter drive while watching VSWR and FORWARD power. If a notch diplexer or hybrid output combiner is used, check its reject load power as well. Stop at about 50% and use external power metering to confirm power.

b. In higher power systems, if one or more phase and gain modules are used in the aural paths, adjust them as in the visual procedure above.

c. While watching reject load power(s) if applicable, slowly RAISE power to 100%. If the system has aural phase and gain module(s), recheck their adjustments.

d. Check the user display panel readings against the external meter. Refer to power calibration in Section V if needed.

e. Check each aural PA module for output using the same procedure as outlined for visual PAs (steps 2.12.1.k-m).

f. Apply either mono audio (and SCA, if used), or a composite MTS signal, to the appropriate exciter input(s). Referring to exciter manual, adjust the input level(s).

3.1 Control Cabinet

3.1.1 Cabinet Circuit Breaker

CB-1 is located behind the control panel on the left. To open the panel, press on its right-hand edge.

3.1.2 Front Panel Pushbutton Switches

TRANSMITTER ON: Pressing the transmitter ON button turns on the transmitter. The exciter is unmuted and all main controller functions are enabled. Cabinet ON signals are sent to the slave controllers in the amplifier cabinets, which will in turn activate the cabinets. The ON button is illuminated green to indicate ON command given.

TRANSMITTER OFF: Depressing the red transmitter OFF button starts the shut down sequence. The exciter is muted and cabinet OFF signals are sent to the SLAVE controllers in the amplifier cabinets.

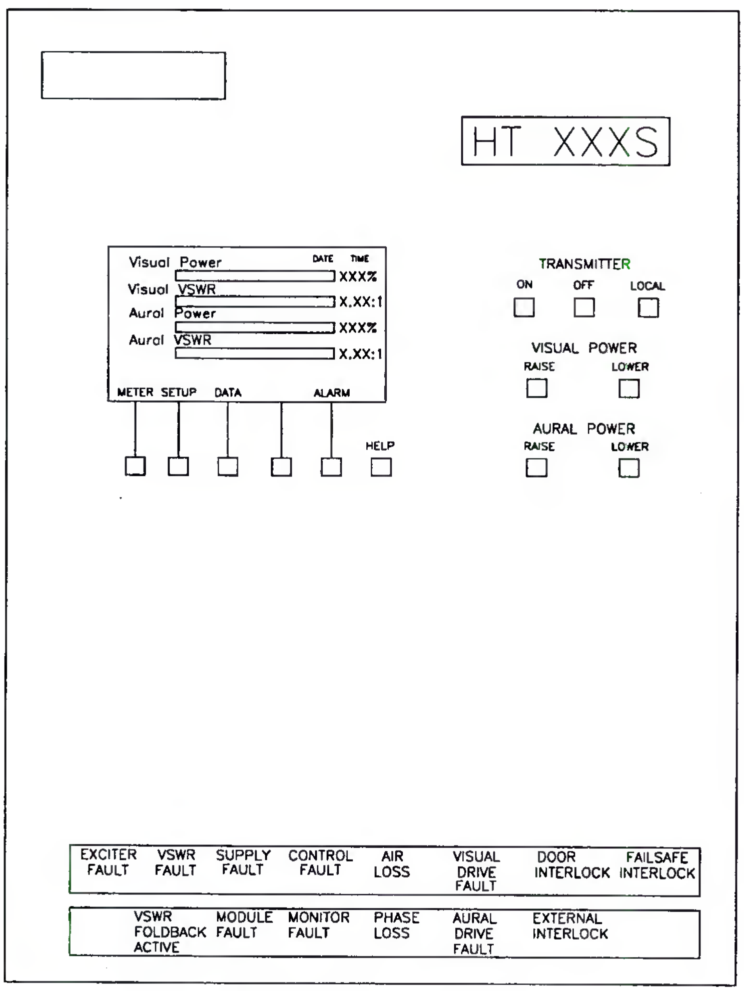


Figure 3-1. Main Control Panel

LOCAL: Activation of the LOCAL switch disables the remote control system's commands. Status and analog information will continue to be made available. The yellow lamp will be illuminated if LOCAL mode is activated. Pressing the switch a second time will re-enable remote control and extinguish the indicator.

POWER RAISE/LOWER SWITCHES: Pressing the raise or lower buttons will affect the visual or aural power output of the transmitter by adjusting the exciter power output.

3.1.3 Fault Status Indicators

During normal operation, none of the fault and interlock lamps should be on. In the event of malfunction or interruption of an interlock the lamp will turn on.

EXCITER FAULT: Indicates an exciter fault or exciter switcher fault.

VSWR FAULT: If VSWR foldback is enabled the VSWR FAULT logic in the Main Controller is disabled and the VSWR fault detection in the RF modules will protect them from damage. If a VSWR condition causes VSWR foldback to activate, the FOLDBACK ACTIVE fault indicator will light and the power output of the transmitter will be reduced. If the VSWR condition exceeds the VSWR overload setpoint, the VSWR FAULT light will flash on for 3 seconds indicating the overload setpoint has been passed even if the foldback has reduced the transmitter output.

SUPPLY FAULT: Indicates one or more of the 50 volt power supplies has failed.

CONTROL FAULT: Indicates one of the slave controllers has failed and not responding to bus request from the monitor for data.

AIR LOSS: Indicates one or more of the amplifier cabinets has lost air supply.

VISUAL DRIVE CHAIN FAULT (optional): Indicates a visual driver has failed in the parallel driver chain.

DOOR INTERLOCK: Indicates one or more of the amplifier cabinet doors is open. If the amplifier cabinet was previously on, it will return to normal operation approximately two seconds after the door is closed.

FAILSAFE INTERLOCK: If opened, the failsafe interlock will mute the exciter's visual and aural RF outputs. Therefore, a MUTE indication should appear on the exciter LED display in addition to the FAILSAFE INTERLOCK light. Normal operation will resume when the failsafe interlock circuit is closed. This interlock is

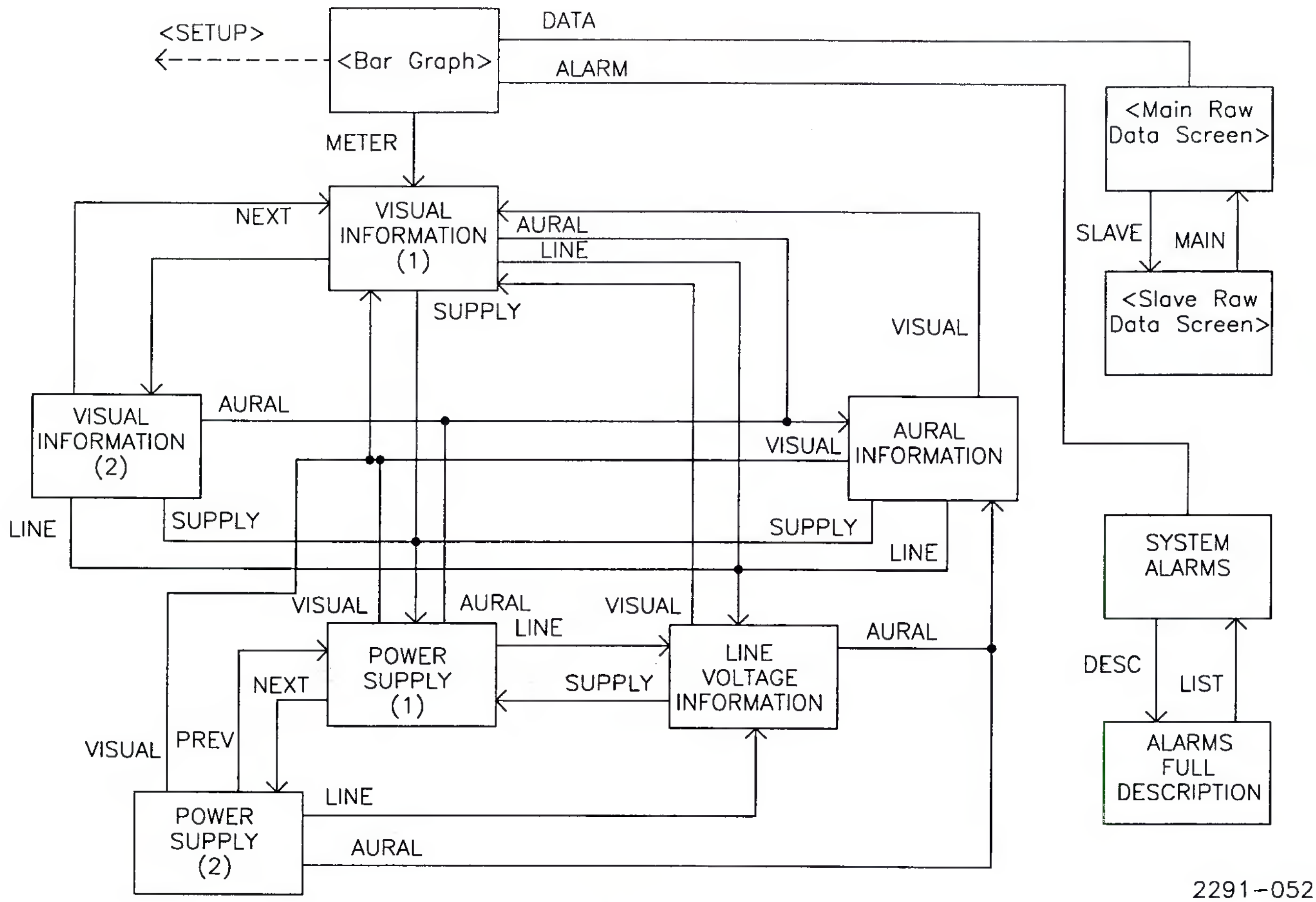


Figure 3-2. Monitor Screen Flow

used most often for the remote control system failsafe interlock, diplexer air switch, etc.

VSWR FOLDBACK ACTIVE: Indicates elevated VSWR has caused the transmitter to reduce its output power by some amount. Foldback allows uninterrupted operation if the VSWR slowly increases. If the VSWR exceeds a certain threshold, the foldback will begin to operate. As the VSWR increases, forward power will be reduced to maintain a constant level of reflected power. If the VSWR decreases, power output will increase toward the original setting. Foldback will end and the lamp will be extinguished if the VSWR drops below the threshold.

While VSWR foldback is active, VSWR fault detection is inhibited. However, protection from high VSWR is then provided by the individual module VSWR fault circuits.

MODULE FAULT: Indicates one or more of the cabinet RF amplifier modules is reporting a fault.

MONITOR FAULT: Indicates the monitor has failed and all calculated readings may be incorrect.

PHASE LOSS: Indicates the control cabinet phase loss detector senses loss of one of the three phase power lines, voltage below threshold, or reversal of the phase sequencing. (If all cabinet indications are dark the phase feeding the logic power supplies is probably lost.)

AURAL DRIVE CHAIN FAULT (optional): Indicates an aural driver has failed in the parallel aural driver chain.

EXTERNAL INTERLOCK: When open, the External Interlock will prevent the transmitter from turning on. The circuit must be closed through the external interlock device for normal operation. The External interlock will turn the transmitter off if it is opened. It can be programmed either to require a manual ON command to restart the transmitter, or to restart the transmitter automatically (check Main Controller) after the interlock is re-closed.

3.1.4 User Display Panel

This section contains instructions for the user display panel. Refer to Figures 3-2 and 3-3.

NOTE

Screen Blanking Option - Refer to Figure 5-7 for information on setting Screen Blanking on or off. If screen blanking is enabled, the screen will blank after 1 hour of inactivity on the display function keys. Any display function keypress after screen blanking will redisplay last screen. ***While screen is blanked, alarms that are normally shown on the screen will not be displayed on the screen until the screen is unblanked.***

WARNING: Disconnect primary power prior to servicing.

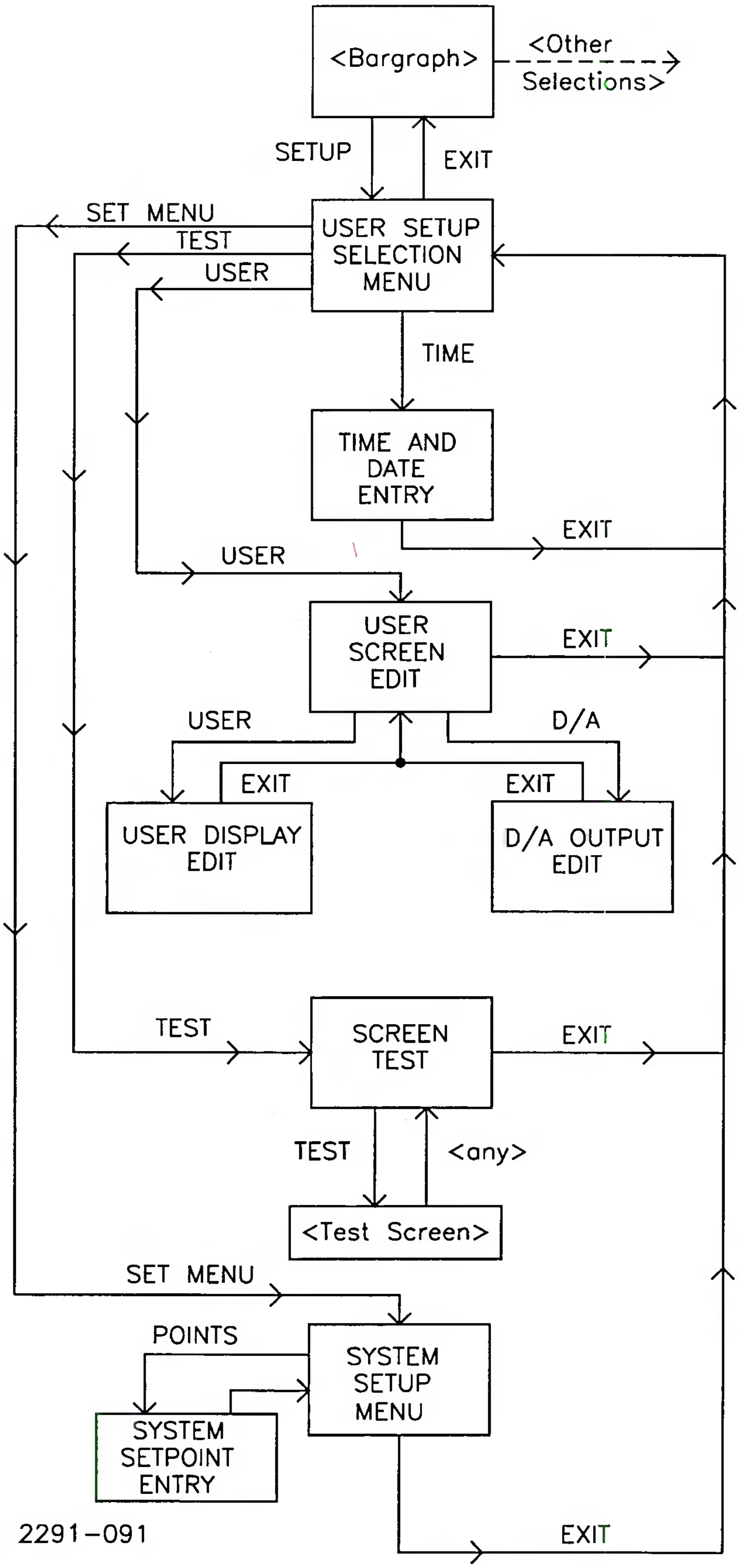


Figure 3-3. Monitor Setup Screen FLow

3.1.4.1 General Description:

The user display panel allows the information to be displayed in both graphic and digital form. The information is displayed in a series of "screens."

The screens are arranged in a "tree" structure: starting with the bargraph display screen (default), each screen contains a menu, and the subsequent screens contain more menus. After performing an operation in one of the screens, the user can then return to the default bargraph screen by selecting EXIT through each of the intervening screens or menus.

Directly below the panel are the six keys used to input information to the system or to maneuver through the various screens. Five "soft keys" have functions that are automatically programmed according to the contents of the current screen. Their functions are indicated on each information screen along the bottom edge of the display screen.

The sixth key is always used to access the HELP mode. The HELP key can be used at any time to get a brief description of the current screen. In the HELP mode, a description of the function of any of the soft keys may be obtained by pressing that soft key. A message will then appear on the display to explain the function of that soft key. To exit the help mode, press the HELP key again and the display will return to its previous screen.

A total of 13 different display screens are contained in the display system. (Refer to Figures 3-2 and 3-3.) Each is briefly described in the next section, and detailed descriptions and illustrations are given in Section 3.1.4.3.

3.1.4.2 Display Screens: Brief Descriptions

- Bargraph Meter - This is the default screen from which all other screens are accessed. This screen displays four meter values in both graphic and digital forms. These four meter values may be selected by the user on the USER DISPLAY SETUP screen. The soft keys on this screen (METER, DATA, ALARM, and SETUP) are used to access other sets of information screens.

METER key associated screens:

(Refer to figure 3-2.)

- Visual Information (1) - This screen is displayed when the METER key is selected from the Bargraph Meter screen.

Information about the visual system, such as percent power, forward and reflected power, VSWR, etc., is displayed.

- Visual Information (2) (if required) - This screen is displayed when the NEXT key is selected on the Visual Information (1) screen. Visual forward and reflected power measurements for each cabinet in the system are displayed. This screen also shows the power being dissipated by the reject load.
- Aural Information - This screen is displayed when the AURAL key is selected while viewing either of the Visual Information screens. It displays information about the aural system such as percent power, forward and reflected power, VSWR, etc.
- Power Supply (1) - This is the first screen displayed after the SUPPLY key is selected from any visual or information meter screen. This screen shows the power supply current & voltage output for each supply in each cabinet.
- Power Supply (2) - This screen is accessed when the NEXT key is selected on the Power Supply (1) screen. It displays the voltages of the monitor system's +5, +12, -12, and UNREG supplies and backup battery.
- Line Voltage Information - This screen is displayed when the LINE key is selected from one of the power supply, visual, or aural information screens. The phase voltages of each of the three AC phases, as sampled at the control cabinet, are displayed.

<u>DATA key associated screens:</u>

(Refer to figure 3-2.)

- Main Raw Data Screen - This screen is accessed by selecting DATA on the main bargraph screen. The raw voltage readings of various samples from sent to the main controller are displayed. The display controller uses this raw data as the basis for calculating and metering several transmitter operating parameters.
- Slave Raw Data Screen - This screen is accessed by selecting SLAVE on the Main Raw Data screen. Raw voltage samples sent to the slave controllers are displayed.

<u>ALARM key associated screens:</u>

(Refer to Figure 3-2.)

- System Alarms - This screen is displayed when the ALARM key is selected from the Bargraph Meter screen. It displays a list of any faults that have occurred in the system, along with the times at which they occurred. It also displays whether the alarm is currently active or inactive.
- Alarms Full Description - This screen is displayed by using the DESC key from the Systems Alarms screen. This screen displays more fully detailed descriptions of each alarm.

<u>SETUP key associated screens:</u>

(Refer to Figure 3-3.) Pressing the SETUP key in the bargraph display screen passes control to the User Setup Selection Menu.

- Time & Date Entry - This screen is displayed when the TIME selection key is selected on the User Setup Selection Menu screen. This screen is used to enter the time and date into the system.
- User Display & D/A Output Edit - This intermediate screen is displayed when the USER key is selected on the User Setup Selection Menu. It is used to access the User Display Edit and the D/A Output Edit screens.
- User Display Edit screen - This screen is displayed when the USER key is selected on the User Display & D/A Output Edit screen. This screen is used to select the four data values to be displayed on the Bargraph screen.
- D/A Output Edit - This screen is displayed by selecting D/A key from the User Display & D/A Output Edit screen. It is used to select the sources for remote analog readings for channels 1-4.
- Display Test - This screen is displayed when the TEST key is selected on the User Setup Selection Menu. Pressing the TEST key on this menu illuminates all the elements or "pixels" on the display panel, in order to test for non-functioning pixels. The test is ended by pressing any soft key. A Sentry software setup screen <u>may</u> replace this selection. Check Sentry Technical Manual for Sentry information.
- System Setpoint Entry - This screen is displayed when the SETPOINT key is selected on the User Setup Selection Menu screen. It is used to enter the visual and aural 100% power set points, which are used to calculate output power in percentage form.

3.1.5 Detailed Screen Descriptions:

The figures that follow and their accompanying blocks of information show the various screens, along with the information they contain and their interactions with other screens.

For illustrative purposes, nominal data for a 30 kW transmitter is shown. Check the transmitter data sheets provided with your transmitter for the correct values for your transmitter.

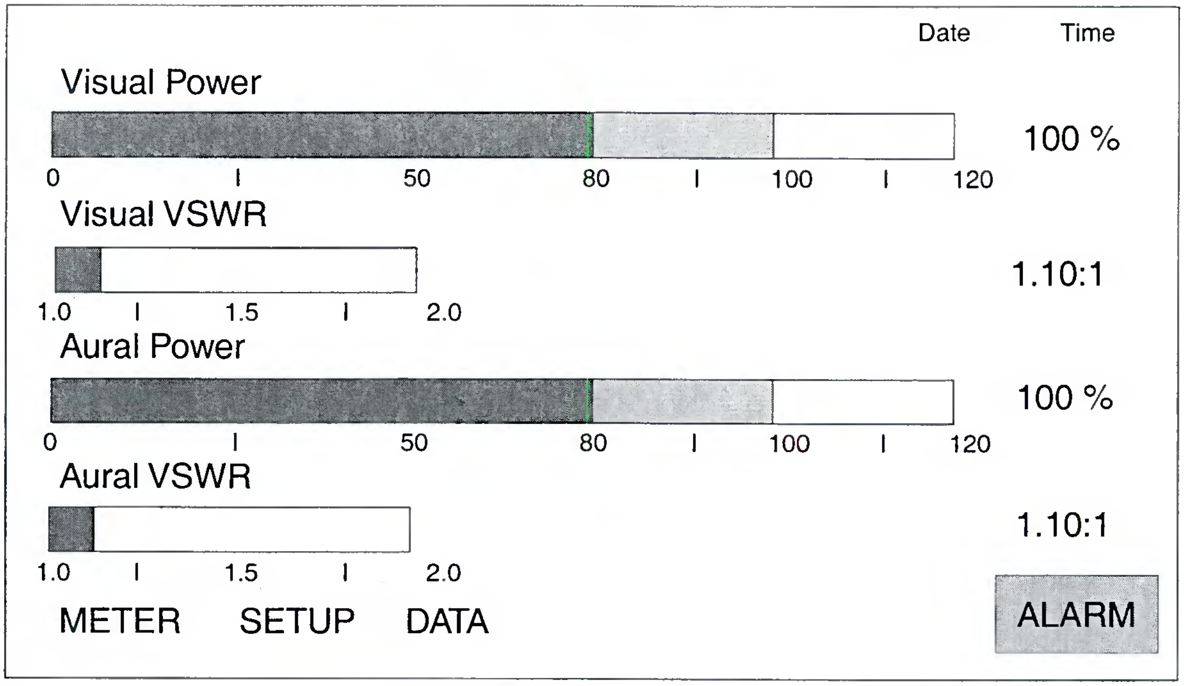


Figure 3-4. Bargraph Meter Screen

Bargraph Meter Screen

This screen is the initial screen displayed on power-up and will likely be the screen that is displayed the most. This screen displays 4 meter values in both graphic and digital forms. The default values shown are Visual forward power, Visual VSWR, Aural forward power, and Aural VSWR. This is the default screen from which all other screens are accessed. These 4 meters value may be selected by the user on the USER DISPLAY SETUP screen.

This screen has 4 active softkeys; METER, SETUP, DATA, and ALARM. The HELP key is always available on each screen. Generally visual/aural power and VSWR will be selected, but other signals may be chosen for trouble shooting.

The ALARM key has a special function. When the ALARM label is flashing this indicates that there is an active alarm in the alarms queue. If the ALARM is on solid, it means that there are alarms in the queue that are inactive, they occurred but the condition has gone away. If there are no alarms in the queue, the ALARM will be blank and no access will be allowed into the Alarms page.

The METER key will take the user to the multi-meter information in the system. The first information displayed by invoking the METER key are the Visual data in the system. From this screen the rest of the metering information of the system may be accessed.

The SETUP key will take the user to the user setup menu. From this screen the user may select from the 4 user definable items; Time & Date entry, user informaiton edit, screen test, and the power setpoints edit.

The DATA key will call up the raw data used by the system monitor. There are two pages. The first is the MAIN raw data screen and from it you may access the SLAVE raw data screen.

Use of the data pages is a troubleshooting function and is not normally required by the operator. Some monitor system functions are not active while viewing the data pages.

VISUAL INFORMATION		ALARM
Power	97%	9.8 kW
Reflected Power		22 W
VSWR	1.07:1	
Drive A		3 W
Combined Reflected		6705 W
AGC Voltage		12.15 V

NEXT AURAL SUPPLY LINE EXIT

2291-064

Figure 3-5. Visual Information Screen

Visual Info 1 - This is the 1st of 2 Visual information screens. This screen is displayed when the METER key is Selected on the Bargraph Meter screen. This screen displays the Visual information within the system such as percent power, forward & reflected power, VSWR, etc.

Visual Information Screen 1

There are 5 active softkeys on this screen. They are:

NEXT - This key displays the 2nd visual information screen. This screen has detailed cabinet information pertaining to the visual system.

AURAL - This key displays the aural information in the system.

SUPPLY - This key will display the Power Supply information of the transmitter system.

LINE - This key will display the line voltages of the 3 phase input power.

EXIT - This key will return the user to the Bargraph Meter screen.

NOTE

This and the following screens are shown for a 30kW transmitter. Other power levels may display more or less information depending on configuration.

AURAL INFORMATION		ALARM
Power Forward	100 %	6.0 kW
Reflected Power		16 W
VSWR	1.1:1	
* Chain A Power		3000 W
* Chain B Power		3000 W
AGC Voltage		5.77 V
* Reject Load		10 W

VISUAL SUPPLY LINE EXIT

* = Option 20% Aural ONLY

Figure 3-6. Aural Information Screen

Aural Information - This screen is displayed when the AURAL key is selected while viewing either VISUAL INFORMATION screen. This screen displays the Aural information within the system such as percent power, forward & reflected power, VSWR, etc.

There are 4 active softkeys on this screen. They are:

VISUAL - This key will display the Visual information screen 1.

SUPPLY - This key will display the Power Supply information of the transmitter system.

LINE - This key will display the line voltages of the 3 phase input power.

EXIT - This key will return the user to the Bargraph Meter screen.

POWER SUPPLY INFORMATION			ALARM
	Supply 1	Supply 2	
AURAL A	50.3 V 157 A	50.3 V 131 A	
PA A	50.2 V 237 A	50.0 V 226 A	
PA B	50.5 V 234 A	50.1 V 217 A	

NEXT VISUAL AURAL LINE EXIT

Figure 3-7. Power Supply Information Screen #1

Power Supply Information Screen 1 - This is the first screen displayed when the SUPPLY key is selected while viewing any visual or information meter screen. This screen displays the Power Supply information for each cabinet showing the current & voltage output for each supply.

There are 5 active softkeys on this screen. They are:

NEXT - This key will display the 2nd power supply information screen.

VISUAL - This key will display the Visual information screen 1.

AURAL - This key displays the aural information in the system.

LINE - This key will display the line voltages of the 3 phase input power.

EXIT - This key will return the user to the Bargraph Meter screen.

POWER SUPPLY INFORMATION ALARM	
Main Logic Supply Voltages:	
(+5)	+5.19
(+12)	+12.0
(-12)	-12.1
(UNREG)	+1.3
MAIN BATT	+4.35
MON BATT	+4.18

PREV VISUAL AURAL LINE EXIT

Figure 3-8. Power Supply Information Screen #2

Power Supply Screen 2 - This screen is displayed when the NEXT key is selected on the Power Supply information first screen. This screen displays the +5, +12, -12, UNREG, and battery voltages for the monitor system.

There are 5 active softkeys on this screen. They are:

PREV - This key will display the 1st power supply information screen.

VISUAL - This key will display the Visual information screen 1.

AURAL - This key displays the aural information in the system.

LINE - This key will display the line voltages of the 3 phase input power.

EXIT - This key will return the user to the Bargraph Meter screen.

LINE VOLTAGE INFORMATION ALARM

Line Voltages:

Phase A-B	Phase B-C	Phase A-C
208 V	208 V	208 V

VISUAL AURAL SUPPLY EXIT

Figure 3-9. Line Voltage Information Screen

Line Voltage Information screen - This screen is displayed when the LINE key is selected while viewing either power supply information screen or a visual or aural information screen. This screen displays each phase voltage of the three phases in the system. These voltages are sampled at the control cabinet.

There are 4 active softkeys on this screen. They are:

VISUAL - This key will display the Visual information screen 1.

AURAL - This key displays the aural information in the system.

SUPPLY - This key will display the Power Supply information of the transmitter system.

EXIT - This key will return the user to the Bargraph Meter screen.

USER SETUP SELECTION MENU ALARM

1. Enter Time and Date
2. Edit User Display & D/A Output
3. Test Display (or Sentry Setup)
4. Edit Setpoints

TIME USER TEST SETPOINT EXIT

2291-090

Figure 3-10. User Setup Selection Menu

User Setup Selection Menu screen

This screen is called up when SETUP key is depressed while viewing the bargraph meter screen (default).

This screen is used to select 1 of the 4 user available options.

There are 5 active softkeys on this screen. They are:

TIME - This key selects the Time and Date entry screen.

USER - This key selects the User Display Edit screen

TEST - This key selects the display panel test screen or Sentry Setup.

SETPOINT - This key selects the Power Setpoints Edit System.

EXIT - This key will return the user to the Bargraph Meter screen.

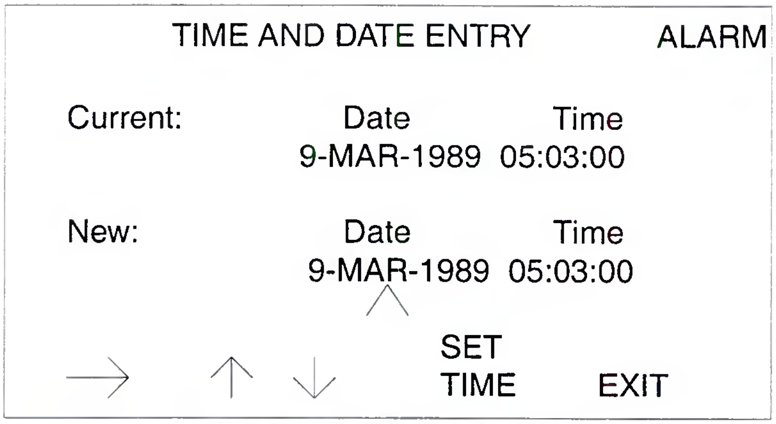


Figure 3-11. Time and Date Entry

Time & Date Entry - This screen is displayed when the TIME selection key is selected on the USER SETUP SELECTION MENU screen. This screen is used to enter the time and date into the system.

The time and date are recordered by the monitor system each time fault occurs.

There are 5 active softkeys on this screen. They are:

→- This key will move the field indicator to the next field of the time and date group of fields. Use this key to select the field that is to be edited. In the example shown, the field indicator is below MAR.

- This key increments the value in the selected field by 1.

↓ - This key decrements the value in the selected field by 1.

SET TIME - This key updates the Time and Date with the user edited value.

EXIT - This key will return the user to the User Setup Menu.

Use 24 hour format to enter pm times (i.e. 2:00pm = 14:00)

NOTE

DATE does not advance to a new year on January 1, and does not automatically include Feb. 29 during a leap year. The year entry must be changed maually at the beginning of each year. The Day entry must be reset to March 1 on that date during a leap year.

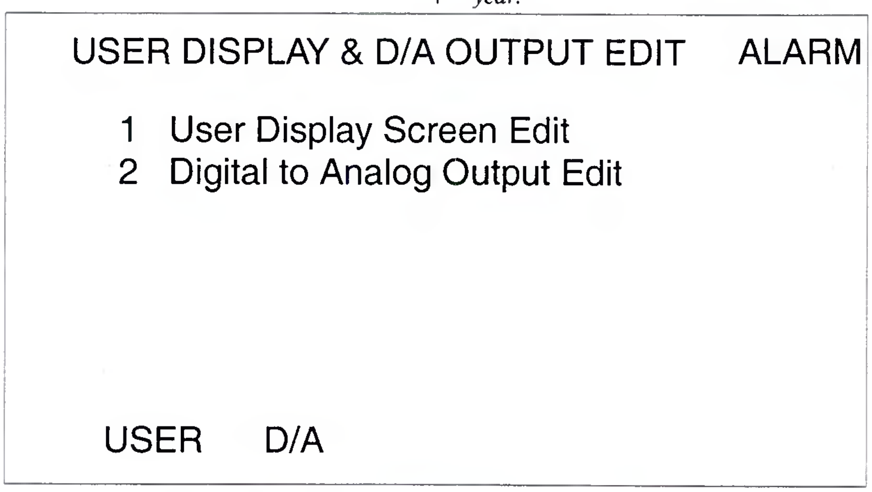


Figure 3-12. User Display & D/A Output Edit

User Display & D/A Output Edit

USER - Used to display the Edit Bargraph Analog Source.

D/A - Used to display the D/A Output Edit Screen.

```
USER DISPLAY EDIT          ALARM

(2) Visual Reflected Power
 1  Visual Power
 -  Visual VSWR
 3  Aural Power
 4  Aural VSWR
>2  Visual Reflected Power
 -  Aural Reflected Power
 -  Visual Driver  A Power
 -  Aural Chain A Power

   DOWN   UP   SWAP   NEXT   EXIT
```

Figure 3-13. User Display Edit

User Display Edit - This screen is displayed when the USER DISPLAY EDIT key is selected on the USER SETUP SELECTION MENU screen. This screen is used to select the 4 data values to be displayed on the Bargraph screen.

Any 4 values can be selected for display on the Bargraph Meter screen.

There are 5 active softkeys on this screen. They are:

DOWN - This key moves the cursor downward through the list of displayable values.

UP - This key moves the cursor upward through the list of displayable values.

SWAP - This key swaps the value to be displayed with the value that is currently being displayed.

NEXT - This key cycles the user through the 4 displayable items currently being displayed.

EXIT - This key will return the user to the User Setup Menu.

```
D/A OUTPUT EDIT

(1) Visual Power
>1  Visual Power
 2  Visual VSWR
 3  Aural Power
 4  Aural VSWR
 -  Visual Reflected Power
 -  Aural Reflected Power
 -  Visual Drive A Power
 -  Aural Chain A Power
DOWN   UP   SWAP   NEXT   EXIT
```

Figure 3-14. D/A Output Edit

D/A Output Edit - This screen is displayed when the USER DISPLAY EDIT key is selected on the USER SETUP SELECTION MENU screen. This screen is used to select the 1-4 remote analog sources.

NOTE

The 4 values selected appear as the first 4 remote analog samples. A change of selection will send new data to the remote.

There are 5 active softkeys on this screen. They are:

DOWN - This key moves the cursor downward through the list of displayable values.

UP - This key moves the cursor upward through the list of displayable values.

SWAP - This key swaps the value to be displayed with the value that is currently being displayed.

NEXT - This key cycles the user through the 4 displayable items currently being displayed.

EXIT - This key will return the user to the User Setup Menu.

Items now shown as 1-4 on the screen are the default selections.

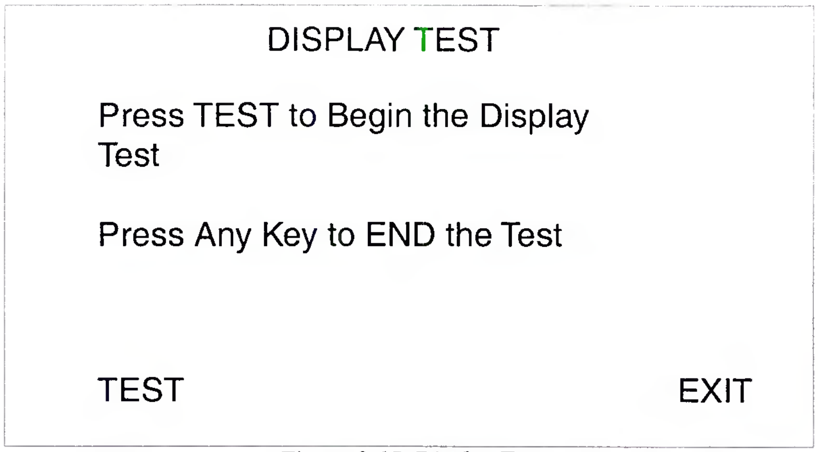


Figure 3-15. Display Test

Display Test or Sentry Setup - This screen is displayed when the SCREEN TEST key is selected on the USER SETUP SELECTION MENU screen. This screen is replaced by a Sentry setup screen when Sentry is used.

This screen allows the user to test the display panel for any display problems such as a burned out pixel.

There are 2 active softkeys on this display. They are:

TEST - This key will cause every pixel on the screen to be turned on. Thus, if any pixels are burned out, they should be easily seen.

*NOTE - After the TEST key has been selected, striking any of the softkeys will end the test and return the user to the previous test screen.

EXIT - This key will return the user to the User Setup Menu.

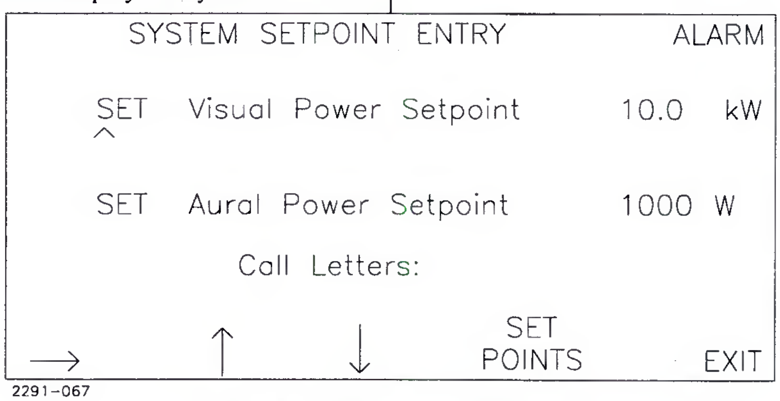


Figure 3-16. System Setpoint Entry

System Setpoint Entry - This screen is displayed when the POINTS key is selected on the SYSTEM SETUP MENU screen.

This screen allows the user to enter the Visual and Aural forward powers for the transmitter. These values are used to calculate the digital display of power and do not increase or decrease the amount of power output.

New setpoints <u>cannot</u> be entered while the transmitter is on.

There are 5 active softkeys on this screen. They are:

→ - This key advances the cursor through the Visual and Aural setpoint fields.

 - This key increments the value by 1 if you're in a numeric field or toggles between PASS and SET.

↓ - This key decrements the value by 1 if you're in a numeric field or toggles between PASS and SET.

SET POINTS- This key saves the user entered setpoints in the database. If the Visual or Aural fields are preceded by PASS, depressing the SET POINTS command will not change the system setpoints for the field(s) preceded by PASS. The SET toggle must be selected and the transmitter must be off for the system to read the new setpoints when the SET POINTS command is given.

EXIT - This key will return the user to the System Setup Menu screen.

```
SYSTEM ALARMS
>024 VPA A Slave Fault       27-OCT 12:00  I
  025 VPA B Slave Fault      27-OCT 12:00  I
  027 Visual VSWR Overld     27-OCT 12:00  I
  037 Visual VSWR Overld     27-OCT 12:00  I
  038 Visual VSWR Overld     27-0CT 12:00  I
  039 Aural VSWR Overld      27-0CT 12:00  I
  040 VPA A Slave Fault      27-0CT 12:00  A
  041 VPA B Slave Fault      27-0CT 12:00  A
  042 Brownout Condition     27-0CT 12:00  I
  043 Brownout Condition     27-0CT 12:00  I
  \/   /\     DELETE  DESC  EXIT
```

Figure 3-17. System Alarms

System Alarms - This screen is displayed by using the ALARM key while viewing the Bargraph Meter screen.

This screen displays the summary alarms queue. This information displays the Fault that occurred, the time and date. An A indicates alarm is still active and cannot be deleted. An I indicates an alarm that has now returned to normal and may be deleted or retained in memory for future reference.

In the left column alarms are numbered sequentially (001-999) as they are picked up in memory. Numbering will start over after 1000 events. A monitor reset will cause counting to start again at 001.

There are 5 active softkeys on this screen. They are:

DOWN - This key moves the cursor down through the alarms list and is indicated by the cursor arrow.

UP - This key moves the cursor up through the alarms list and is indicated by the cursor arrow.

DELETE - This key will delete the selected alarm, IF and only IF the alarm is inactive.

DESC - This key will display the Detailed Alarms screen. The information for the selected alarm will be displayed in a detailed format.

EXIT - This key will return the user to the Bargraph Meter screen.

```
ALARMS FULL DESCRIPTION

>042 Brownout Condition  27-OCT 12:00   I
Alarm is INACTIVE and can be deleted

A Low AC Voltage Condition was Sensed
at 12:00 on 27-OCT-89

\/    /\     DELETE   LIST   EXIT
```

Figure 3-18. Alarms Full Description

Alarms Full Description - This screen is displayed by using the DESC key from the Systems Alarms screen. This screen displays a more detailed description of the alarm.

The summary alarms screen displays a description and short alarm indication. The detail screen provides more detailed information on the nature of the alarm, along with the summary alarm for clarification.

There are 5 active softkeys on this screen. They are:

DOWN - This key moves the cursor down through the alarms list.

UP - This key moves the cursor up through the alarms list.

DELETE - This key will delete the selected alarm, IF and only IF the alarm is inactive.

LIST - This key will display the Summary Alarms screen.

EXIT - This key will return the user to the Bargraph Meter screen.

3.1.6 Exciter Switcher (Optional)

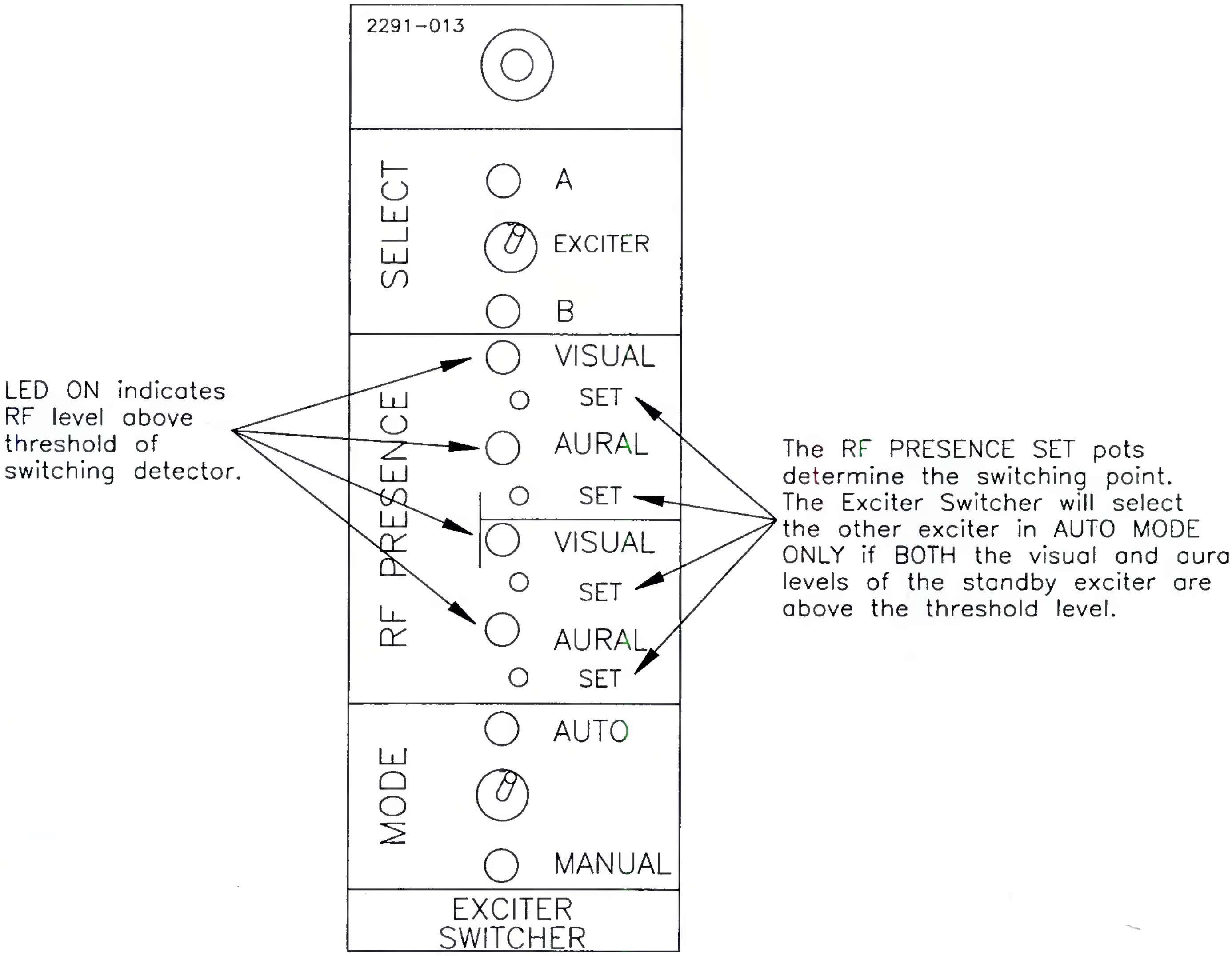


Figure 3-19. Optional Exciter Switcher

Table 3-1. Optional Exciter Switcher

SELECT: Selects exciter 'A' or 'B' via the optional exciter switcher.
MODE MANUAL/AUTO: Selects the mode of operation for the exciter switcher. When in Manual exciter selection must be done manually. When in Auto a detected exciter failure by the switcher will automatically switch to the alternate exciter. If VSWR foldback is active, the exciter switcher will be held in the manual mode until the foldback is no longer active.
EXCITER A SELECTED: Indicates exciter 'A' is selected.
EXCITER B SELECTED: Indicates exciter 'B' is selected.
MANUAL SELECTED: Indicates the switcher is in the manual mode.

3.2 AGC Module

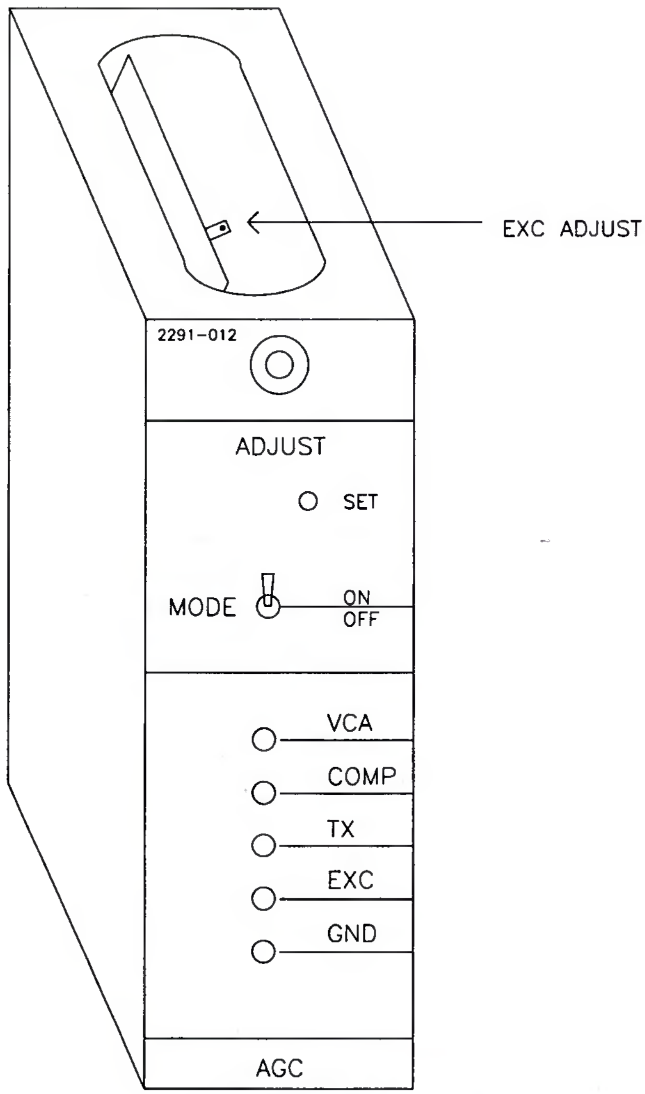


Figure 3-20. AGC Module

VERIFICATION OF AGC OPERATION

1. Reduce transmitter power to 50%.

2, Set AGC MODE switch to OFF.

3. Raise transmitter power back to 100%.

4. Set AGC MODE switch to ON.

5. Verify AGC action reduces transmitter power.

6. If AGC does not reduce transmitter power, contact maintenance personnel and have them set AGC per section 5.15.

Table 3-2. AGC Module Controls and Indicators

EXC ADJUST	R-51 adjusts exciter sample to proper range.
SET	R-21 adjusts AGC overdrive.
LED	Indicates AGC on when lit.
MODE SWITCH	Switches AGC on/off
VCA	Test point 5, a sample of dc voltage to the Voltage Controlled Amplifier
COMP	Test point 2, dc voltage output of comparator
TX	Test point 8, detected sample of pa output.
EXC	Test point 7, detected sample of exciter drive.
GND	Ground

WARNING: Disconnect primary power prior to servicing.

3.3 Phase and Gain Module

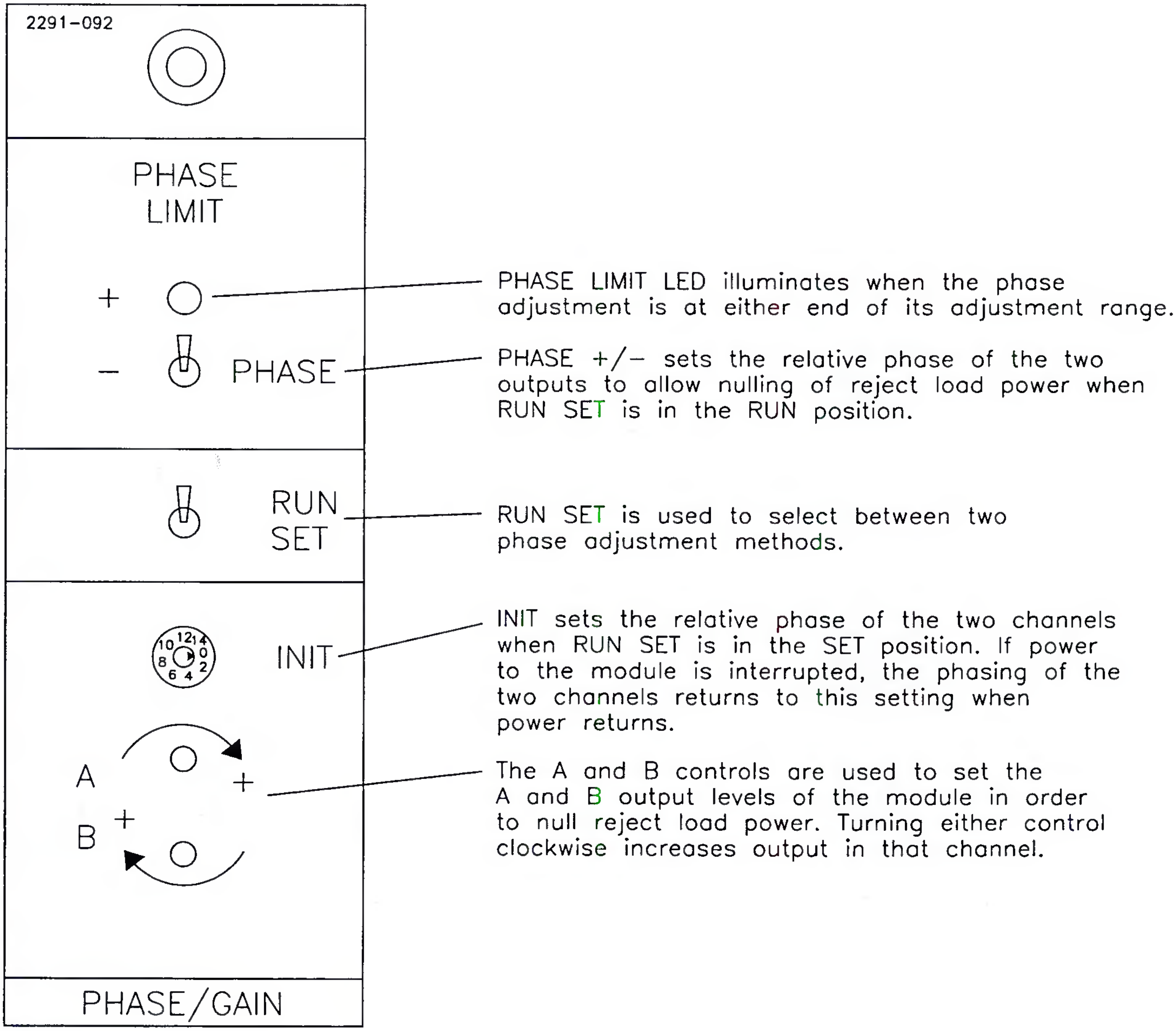


Figure 3-21. Phase and Gain Module

Table 3-3. Phase and Gain Module Set-Up

1. Place RUN/SET switch in SET position.
2. Adjust INIT control (COARSE PHASE) for minimum reject load power.
3. Adjust A or B GAIN as necessary for minimum reject load power.
4. Place RUN/SET switch in RUN position and adjust +/- PHASE for minimum reject load power.

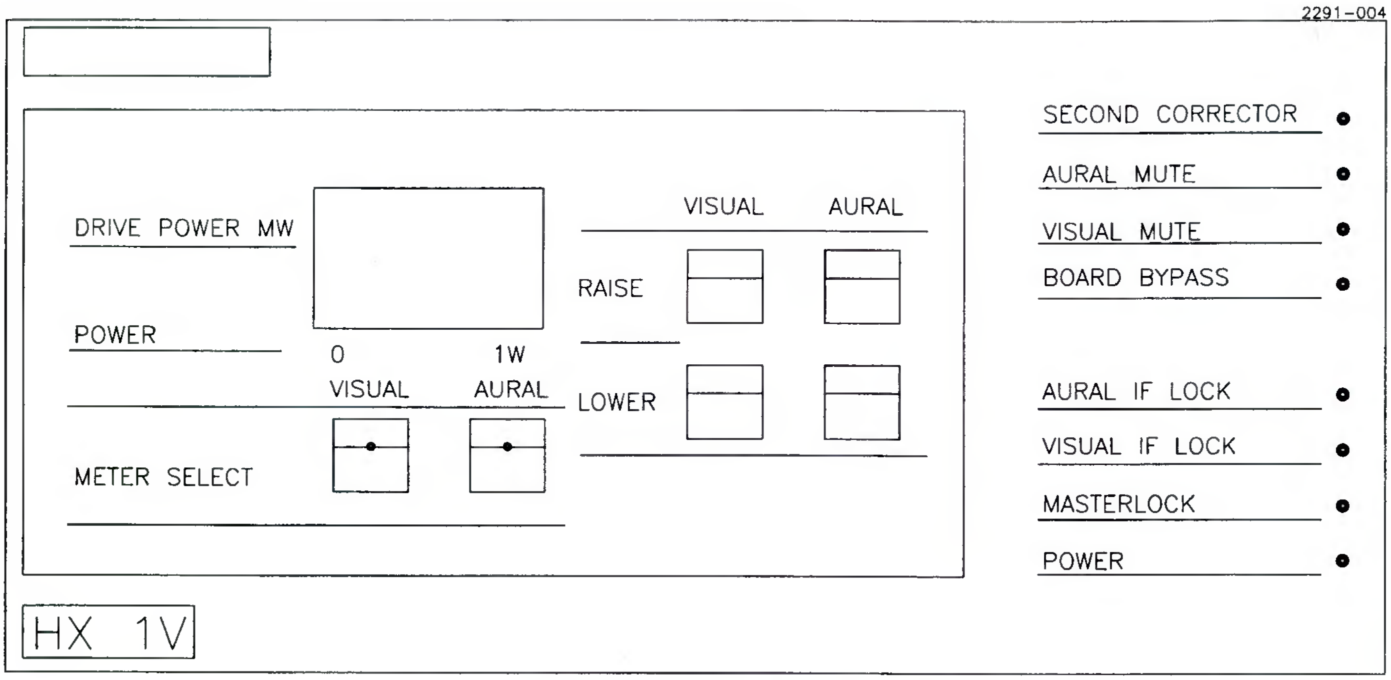


Figure 3-22. HX 1V Exciter Front Panel

Table 3-4. HX 1V Exciter Controls and Indicators

ITEM	FUNCTION
DRIVE POWER MW	Displays exciter drive power in milliwatts.
POWER BAR GRAPH	Displays power 0-1 watt. Visual power ref. peak sync. Aural power C.W.
METER SELECT	Selects Visual or Aural output for display on DRIVE POWER digital display and power bar graph. Will default to Aural after ac power failure.
VISUAL/AURAL POWER RAISE/LOWER	Momentary switch to raise or lower the exciter output power. This is a two speed control. When first depressed the power will change slowly, but if it is then held down for approximately 5 seconds the power will change at a faster rate until released. It will return to the slower rate upon release. The power adjustment commands are independent of the meter select. Be sure to check metering before making exciter power adjustments to see if VIS or AUR PWR is being monitored. The controller power fail circuits maintain control for hours after an ac power outage. During this time the power controls are active and will raise or lower the power if depressed even though ac is not present.
STATUS LED's	
SECOND CORRECTOR	Indicates optional corrector for dual power level is in use.
AURAL MUTE	Indicates aural exciter is muted either internally (PLL failure) or externally (MAIN CONTROLLER on/off or overload.)
VISUAL MUTE	Indicates VISUAL exciter is muted either internally (PLL failure) or externally (MAIN CONTROLLER on/off or overload.)
BOARD BYPASS	Indicates one of the correction modules has been left in bypass position.(i.e. VSB, DELAY COMP) Jumpers are provided on the individual boards to disable its bypass status if a particular board is not needed for normal operation.
AURAL IF LOCK	Illuminated when AURAL PLL is unlocked.
VISUAL IF LOCK	Illuminated when VISUAL IF PLL is unlocked.
MASTER LOCK	Illuminated when the MASTER PLL is unlocked.
POWER	Illuminated when AC power is on. (AC POWER SWITCH/BREAKER IS LOCATED ON BACK PANEL OF UNIT.)

3.4 Exciter Operation

3.4.1 Controls and Indicators

Refer to Figure 3-23 for the location of controls and indicators associated with day-to-day standard operation of the HX-1V exciter. The function of each control and indicator is listed in Table 3-4.

3.5 PA Cabinets

3.5.1 Circuit Breakers

Circuit breakers are located behind the lower panel of each amplifier cabinet.

CB-1: Logic breaker
CB-2: Fan breaker

3.5.2 Slave Controller

The slave controller is located in the upper left corner of each PA cabinet.

Refer to Figure 3-24.

3.5.2.1 Green Bar LED

Indicates AC power present to cabinet and controller, and +12 V supply is operating.

3.5.2.2 Red Bar LED

Summary fault indicator is illuminated when any one or more of the slave controller faults in sensed. Opening the front panel reveals LED indicators for the various types of faults.

3.5.2.3 Door Open

Rear cabinet door is open or SCR crowbar is firing.

3.5.2.4 Air Loss

Fan is not running, or air pressure is below the threshold of the air pressure sensing switch.

3.5.2.5 PS-1 Fault

The power supply controller for 50 volt supply PS-1 has sensed a fault within the supply.

3.5.2.6 PS-2 Fault

The power supply controller for 50 volt supply PS-2 has sensed a fault within the supply.

3.5.2.7 Cabinet Select

In transmitters with multiple amplifier cabinets, this LED should blink indicating the monitor board has accessed the slave controller for data. In transmitters with only a single amplifier cabinet, the monitor board only monitors one slave controller; it does so continuously, and the LED should remain lighted continuously.

3.5.2.8 Cabinet ON Switch

This is a local ON switch for emergency and troubleshooting purposes. A local ON command is not possible while the control cabinet main controller is in the OFF state and sending this OFF command to the slave controller. Removing the cable at J-2 disables the main controller's authority over the slave controller, allowing independent control.

3.5.2.9 Cabinet ON LED

Indicates cabinet ON status.

3.5.2.10 Cabinet Off Switch

A local OFF switch for emergency use and troubleshooting. It will shut the cabinet down only momentarily if the main controller is connected and in the ON state.

Removing the cable at J-2 gives the cabinet slave controller independent control, but external interlock protection to the cabinet is lost.

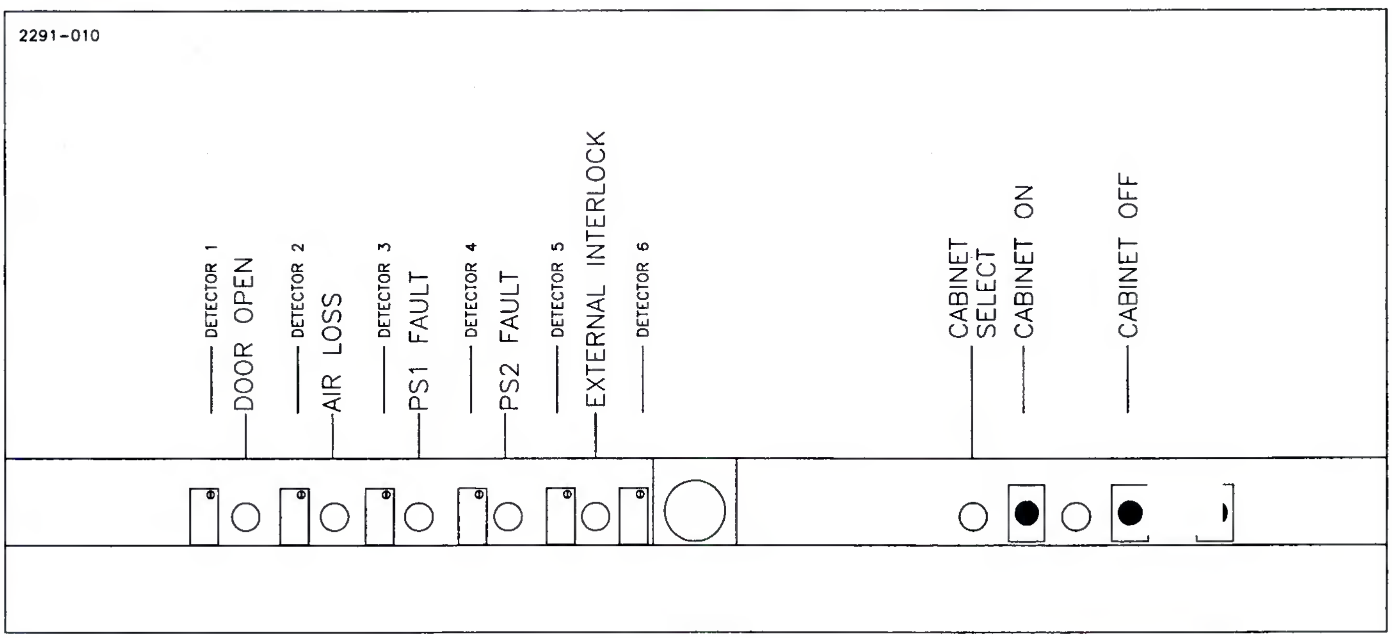


Figure 3-23. Slave Controller

WARNING: Disconnect primary power prior to servicing.

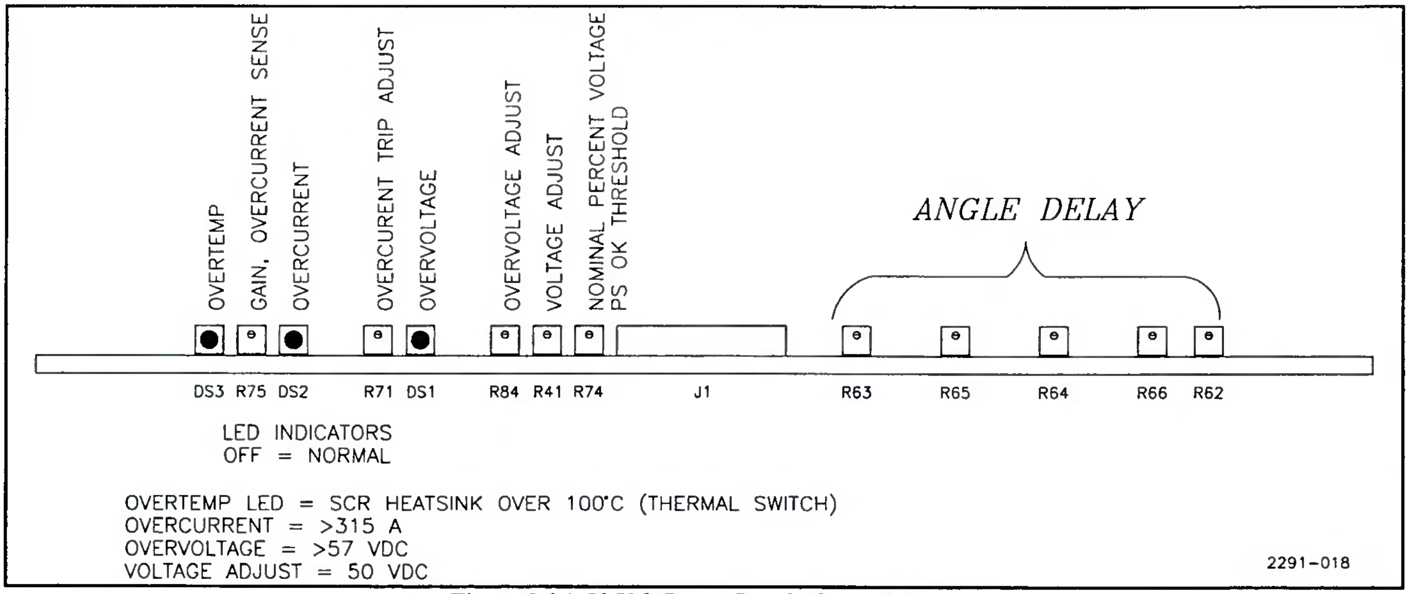


Figure 3-24. 50 Volt Power Supply Control Board Controls and Indicators

3.5.3 RF PA Module LED Display

3.5.3.1 Green Bar LED

The left half of the green LED indicates that the module is enabled, and the right half indicates the presence of RF drive. Both halves off indicates that the module has been disabled due to a "mechanical disable" (initiated by the flapper switch on the front of the module), a fault condition (in which the red LED will illuminate and show a fault code, as described below), or lack of 50 volt supply. If the module is replaced after removal, a transmitter ON command is needed to cancel the "mechanical disable" and re-enable the module.

In some cases where transmitter power is significantly less that 30 kW, the PA modules used in the driver stage may be operating at a low power level and therefore illuminate only half of the green LED, even though proper RF drive is applied.

3.5.3.2 Red Bar LED

If the LED is flashing, the number of flashes indicates the type of module fault:

1. High VSWR
2. RF Overdrive
3. ISO (Isolation resistor voltage sensed due to unbalanced module stages)
4. VOLTAGE (50 volt supply below 44 volts or above 54 volts)
5. TEMP (One or more of the quarter modules inside the module has overheated)
6. PASS FET (Problem in the PA module power supply pass transistor circuit)

NOTE

The module fault display is given priority in numerical order. If more than one fault is present, the fault with the smallest number of blinks is displayed. For example, if both VSWR and RF overdrive conditions exist, the red LED will blink once in each cycle. Once VSWR fault is removed, the RF overdrive code of two blinks per cycle will appear until the overdrive fault is removed.

3.5.4 50 Volt Power Supplies

Figure 3-26 provides a list of the controls and indicators for the 50 volt DC power supplies.

3.6 Operation

3.6.1 Turn ON Sequence

The normal transmitter turn-on cycle begins by depressing the ON switch on the main controller, or by providing a remote ON command. This starts a chain of events. ON commands are sent to the amplifier cabinets, AC contactors are energized, and the exciter is unmuted. When the fans provide sufficient air to close the air pressure sense switches, the 50 volt DC supplies are enabled. The RF amplifier modules are enabled when the DC supply reaches 48 volts. Transmitter output will revert to the power level last selected by the exciter controller. The system will return to the previous drive condition as long as the exciter power controls have not been disturbed while the transmitter was off. It will take about three seconds for the transmitter to complete this cycle.

At turn on, the operator should check the overall operation, adjust power if needed, and make initial inspection of the video and audio levels. About 15 minutes warm-up should be allowed for the modules to stabilize before making adjustment to any RF level-dependent parameters, such as the controls in the Phase and Gain module, AGC module, or exciter precorrection circuits.

3.6.2 Turn OFF Sequence

Pressing the OFF button starts the shut down sequence. The main controller sends a MUTE command to the exciter, and a cabinet OFF command to the slave controller in each amplifier cabinet.

3.6.3 Power RAISE/LOWER

The power RAISE and LOWER buttons on the main control panel duplicate the exciter RAISE and LOWER switches. Upon depressing one of these switches on the main controller, the appropriate command is relayed to the exciter.

In transmitters with optional dual exciters, the RAISE/LOWER commands are routed only to the exciter currently enabled; the standby exciter power is not changed while making adjustments to the on-air exciter.

In dual exciter operation, after one exciters has been adjusted for correct visual and aural power, switch to the standby exciter and adjust visual and aural power again. The second exciter will then immediately begin running at the correct drive level when exciters are switched at a later time.

The exciter power controls are active even if AC power is removed. Thus, avoid RAISE commands if the transmitter is not actually on. If any doubt as to the exciter level setting exists, depress and hold the LOWER command for about 15 seconds to assure a safe low drive condition upon turn-on.

The RAISE/LOWER controls are dual-speed controls. The rate of power level change will be slow for the first few seconds after a button is pressed and held. The power level will change at a faster rate if the button is held down longer. To return to the slower rate, release the button momentarily; the control will revert to the slow speed when the button is pressed again.

4.1 Introduction

This section provides detailed, technical descriptions of the operation of various circuits in the transmitter. For a more general description of transmitter operation, refer to Section I.

4.2 RF Circuits

4.2.1 Exciter

For detailed descriptions of the circuits contained in the HX-1V exciter, please refer to the exciter manual.

4.2.2 Exciter Switcher (optional)

The exciter switcher consists of two sections: the logic is mounted in the accessory tray above the exciters, and the relay panel is mounted on the cabinet side wall. (Refer to the exciter switcher logic board and relay panel schematics.)

The visual and aural RF outputs of each exciter are detected, and the detected DC samples are routed to the exciter logic board. When the switcher is in automatic mode, if one of the output samples drops below a preset threshold, the logic board signals the relay panel to switch to the other exciter. However, this switching action will only occur if the second exciter's outputs are both above its preset thresholds as well. These threshold controls are marked "RF Presence" on the front of the switcher logic panel.

In manual mode, either exciter may be selected regardless of its output level.

LEDs indicate automatic mode, exciter A or B active, and faults (output below threshold) on exciter A or B. Besides switching the aural and visual RF signal paths, the relay panel also switches the I/O paths between the main controller and exciters, so that power adjustment, mute, and VSWR foldback commands from the control system are automatically routed to the active exciter.

4.2.3 Hybrids

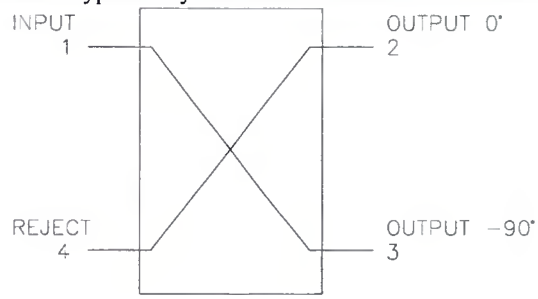
Hybrids are a special RF circuit, whose properties are useful for combining RF power from two sources, and for attenuating and phase-shifting RF signals.

The AGC module, Phase and Gain module, hybrid combiners and dividers, and hybrid (notch) diplexers all incorporate hybrids. Therefore, it is important to understand the rules under which hybrids operate, before trying to analyze the subsystems in which they are applied.

A 3 dB quadrature hybrid is the most commonly encountered type. It is typically drawn as shown in the diagram below. The four ports are (1) input, (2) 0° output, (3) -90° output, and (4) reject. This type of hybrid is symmetrical, which means that the device operates by the same rules for waves incident on either pair of ports.

Other types of hybrids, with different amplitude and phase relationships, also exist and are useful for non-symmetrical combining, subtracting one signal from another, etc.

The rules for the operation of 3 dB quadrature hybrids are listed below. Rules number 4 and beyond may be derived from the first three. Other types of hybrids follow similar sets of rules.



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SPLITTING

1) A signal incident upon any one of the four symmetrical ports will split equally between the opposite and cross ports.

2) In a 3 dB hybrid, each output terminated in Z_0 (normally 50 Ohms) will receive an amount of power 3 dB below the power into the input port. If both outputs are terminated in 50 Ohms, half of the input power will be passed to each output port. In this case, the voltage amplitude at each output port will be 0.707 times that at the input port.

3) The signal at the opposite port will be in phase with the input, while the signal at the cross (diagonal) port will be in quadrature (phase shifted by -90°).

4) Any mismatch at an output port will result in power reflected back into the hybrid. Signals reflected back into the hybrid by a mismatch are treated in the same manner as input signals incident upon that port.

COMBINING

5) Two equal-amplitude signals applied in quadrature to adjacent ports will sum and reappear at one opposite port.

6) The sum port will be the port directly opposite the input port with lagging relative phase, and diagonally across from the input port with leading phase.

7) Any amplitude difference, or any phase difference other than 90° between the two input signals, will result in power appearing at the fourth, or "reject," port.

HYBRIDS IN ATTENUATORS AND PHASE SHIFTERS

A special case occurs if a signal is input to port 1, and the two output ports see mismatches whose impedances are identical in magnitude and phase. By rule 1, the power is split and appears in quadrature at ports 2 and 3. Since the impedances at ports 2 and 3 are identical, the signals reflected back into ports 2 and 3 have the same amplitude and are still in quadrature. By rule 5, the reflected signals add together, with the sum appearing at port

4, the reject port. This is the basis for attenuator and phase-shifter operation.

An adjustable attenuator can be made from a 3 dB hybrid and two 50 ohm potentiometers ganged together. Power is input to port 1, and ports 2 and 3 are each terminated with one section of the potentiometer, so that each sees the same impedance. Port 4 is taken as the attenuator output.

If the pots are both set for 50 ohms, ports 2 and 3 see matched terminations, and the pots absorb all of the power, with no power being reflected from them back into the hybrid; this gives maximum attenuation. If the pots are set for zero ohms (a short circuit), the signals that appear at ports 2 and 3, still in quadrature and equal in amplitude, are completely reflected back into the hybrid. Thus all of the input power appears at port 4, and the attenuation is minimum. Intermediate settings give intermediate values of attenuation.

In our applications, PIN diodes in parallel with 50 ohm resistors are used instead of potentiometers. The amount of bias current through the diodes controls their RF impedance. The impedances seen at ports 2 and 3 are the parallel combination of the 50 ohm and PIN diode impedances. When the PIN diodes are biased "off", they appear as open circuits, resulting in 50 ohm loads seen at ports 2 and 3. Thus, all of the RF power is absorbed in the 50 ohm resistors, giving maximum attenuation. If the diodes are biased "on," they appear as short circuits, resulting in short circuits appearing at ports 2 and 3. This causes complete reflection of the RF power incident on ports 2 and 3, and the RF recombines at port 4, resulting in minimum attenuation. Varying the bias current in the PIN diodes varies their impedance and, hence, the amount of attenuation.

An adjustable phase shifter can be constructed in a similar manner, by using equal reactive terminations (i.e. ganged variable capacitors) instead of resistive terminations at ports 2 and 3. The amount of reactance determines the phase difference between a signal incident on one of the reactive loads, and the resulting reflection back into the hybrid. Since no power is dissipated in the reactive loads, the power appears unattenuated at port 4, but phase-shifted by an amount determined by the reactance at ports 2 and 3.

4.2.4 AGC Module

(Refer to AGC schematic.)

An RF sample of the PA output is fed to J1, detected by D6, buffered, and applied to the noninverting (+) input of the comparator section of U2.

The exciter output is input to J2 and sampled by directional coupler DC1. The sample is detected by D5, buffered, and applied to R51, the exciter reference adjust potentiometer. The arm of R51 is connected to the inverting (-) input of the comparator.

The comparator's DC output, pin 7 on U2, represents the difference between the exciter sample and the transmitter sample. This difference is integrated by R30 and C16, buffered, and applied to base of Q1, a Darlington transistor whose emitter drives a PIN diode attenuator.

R1 through R9 form fixed pi attenuators, used to bring the exciter drive level to within the desired range. U1, a 3 dB 90° hybrid, is connected to PIN diodes CR1 through CR4 and resistors R11 and R14 to form a variable attenuator. (Hybrid/PIN diode attenuator operation is described above.) Q1 controls the amount of forward bias supplied to the diodes, which controls the amount of attenuation.

Switch S1 disables the AGC by providing a fixed DC voltage to Q1, from a voltage divider formed by R26 and R27.

Set control R21 adjusts the amount of compression by the AGC during normal transmitter operation.

4.2.5 Phase and Gain Module

(Refer to Phase and Gain schematic.)

The phase and gain module consists of two subsystems: the RF path, and the control/logic circuit.

4.2.5.1 Radio Frequency Path

The major elements in the RF portion of the circuit are hybrids U1 through U5. One is used as a power splitter, two as variable attenuators (as in the AGC module above), and two as variable phase shifters.

The signal entering J1 passes to port 1 of U1, and is split equally between the two main signal paths. This first hybrid split also establishes a quadrature phase relationship between the two paths, which will be necessary when the PA cabinet outputs are recombined in a hybrid combiner.

With both paths properly terminated, little power is misdirected to R1, the reject load. Both paths behave in an identical manner. Each path contains an adjustable attenuator and an adjustable phase shifter.

Hybrids U2 and U4 are configured as variable attenuators. (Hybrid/PIN diode variable attenuator operation is discussed in 4.23 above.) Parallel networks consisting of 56 ohm resistors and PIN diodes provide the variable terminations. In the upper path on the schematic, pin 1 of hybrid U2 is the attenuator input, and pin 6 is its output. R57 controls the current in Darlington transistor Q1, whose emitter biases PIN diodes CR1, CR2, CR39, and CR40. As R57 is adjusted clockwise, the current through Q1 increases, reducing the impedance of the PIN diodes, which reduces the amount of attenuation. In the lower circuit path, R58 controls the attenuation through the attenuator formed by hybrid U4 in an identical manner.

Hybrids U3 and U5 form the basis for the variable phase shift networks. (Hybrid phase shifters are discussed in 4.23 above.) In the upper path on the schematic, U3 pin 1 is the phase shifter RF input, and pin 6 is the output. Logic signals at points A through L are used to turn PIN diodes CR3 through CR15 on or off. Each PIN diode is an RF switch, which either grounds or floats one end of a capacitor C4 through C19. The remaining end of each capacitor is connected to the hybrid.

For example, if point A is at a logic "high," current will flow through CR3, which will become an RF short circuit to ground. The hybrid port at U3 pin 2 will then see C4 as an RF impedance to ground. If point A is low, CR3 will look like an open circuit, and no RF current can flow through C4. The capacitance seen by that hybrid port will be maximum when points A through F are all at logic "high," and minimum when points A-F are at logic low.

The control logic ensures that the binary "word" sent through points A-F to PIN diodes CR3 through CR8 is the same as the binary "word" sent through points G-L to PIN diodes CR10 through CR15. Thus the impedances seen at pins 2 and 5 of hybrid U3 will be the same, and all of the power reflected back into the hybrid will pass to the output or "reject" port at pin 6, with none of it being reflected back to the input at pin 1.

Hybrid U5, PIN diodes CR18 through CR29, capacitors C23 through C38, and points M through X form an identical phase shift network for the lower RF path.

4.2.5.2 Control Logic and Hardware

The control hardware includes digital phase control, switch debouncing, current buffering, and gain path balancing. An LED (DS1) indicates when a phase setting beyond the range capability is requested.

A phase count is maintained with two presettable four-bit bidirectional counters (U7, U8). The preset inputs allow the 16 position rotary switch (S2) to act as non-volatile memory for the phase setting on power-up.

When the module is in OPERATE mode, U6 generates a clock frequency used by the counters. When the front panel switch (S1, "Phase +/-") is depressed, impulses at the clock frequency are sent to the counters. The direction of count (up or down) is logically steered from the same switch, and determines the direction of the phase change.

The counter output is sent directly to one of the phase shifters. Phase count lines for the second phase shifter are driven by a ones-complement inversion (performed by U9 and U10), so that as the phase through one phase shifter smoothly increases, the phase shift through the other decreases, and vice versa.

Switch debouncing is performed with RC low-pass filters. Op-amps configured as comparators (U15) are used sense when the low-pass output voltage exceeds a transition level. A single output transition is ensured by establishing a 33% comparator hysteresis window.

Current buffering for the LED and PIN diodes is performed using discrete Darlington transistors (Q1, Q2, Q3) and DIP transistor arrays (U11 through U14).

4.2.6 Preamp

(Refer to Preamp schematic)

An RF preamp is used in some transmitter configurations to compensate for multiple-way power division.

The preamp input is taken from the exciter or optional exciter switcher. Its output feeds the aural or visual drive chain. The preamp module can provide up to 1 watt of drive power. Gain is adjustable from 4 to 24 dB, and its nominal setting depends on the transmitter configuration.

Idle current is 700 mA or less at 24 volts DC. The supplies used by the preamps are powered whenever AC is supplied to the cabinet.

4.2.7 Cabinet-Level Splitter And Combiner Circuits

4.2.7.1 Visual Chain

In 15, 30, 45, and 60 kW systems, the visual drive is applied to a power divider in each visual PA cabinet. Each divider splits the signal 16 ways in a low band system, or 17 ways in a high band system, and applies these signals to the visual PA modules.

The PA modules amplify the outputs of the divider by 18.5 dB at low band, or 13.2 dB at high band.

The outputs are then combined by a 16- or 17-way Gysel Network combiner to provide a combined output from each cabinet.

In systems at other power levels, the number of ports on the combiner or divider vary. For example, in 10 kW and 20 kW systems, 12-way dividers and combiners are used. 5 kW systems have a 6-way divider and a 6-way combiner.

The combiner contains isolation resistors attached to a heat pipe. These loads provide isolation between module ports, allowing shut off and removal of any module without affecting the performance of the remaining modules.

Under normal operation with all modules installed and operating, these loads absorb minimal power. Should one or more of the modules be disabled, shut off, disconnected from its power

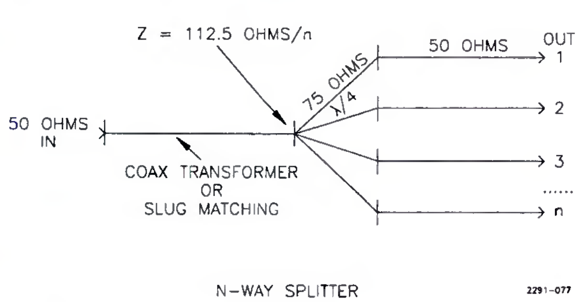


Figure 4-1. N-Way Splitter

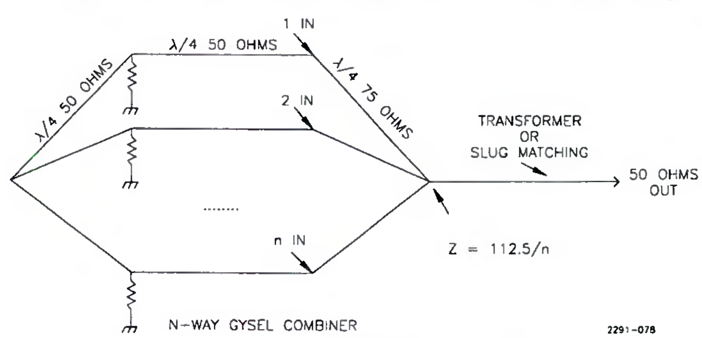


Figure 4-2. N-Way Gysel Combiner

connector or removed from the cabinet, the load resistors will absorb some power.

The amount absorbed is slightly higher when the modules are disconnected and removed than when they are merely shut off. This is because removing a module presents an open circuit to that combiner port, as opposed to merely disabling the module, in which the combiner sees the isolation resistors present in the module's output combiner.

The amount of power absorbed by any single load is highest when a single module is removed. The total amount of power absorbed by all the resistors is highest when half of the modules are removed.

4.2.7.2 Aural Chain

As in the visual chain, the aural drive output is split multiple ways and sent to parallel PA modules. The number of ports in the combiner and divider depend on system power output and options, such as 20% aural power or parallel aural drive.

The outputs are recombined in a similar combiner. As in the visual chain, the combiner reject loads are mounted on a heatpipe located on the cabinet side wall.

4.2.8 Control Circuits

4.2.8.1 Inter-Cabinet Control Wiring

(See Cabinet Interconnect Wiring diagram)

The inter-cabinet wiring connects the control system to the other cabinets in the transmitter system. Each cabinet has Monitor Data Bus and Transmitter OFF/ON line connections. One end of the first section of the monitor data bus connects to J4 on the monitor board in the control cabinet, and the other end connects to J1-A or B in the top of the next cabinet to the right of the control cabinet.

Each subsequent section of the monitor bus connects J1-A or B of two adjacent cabinets. The end cabinet will have either J1-A or B connected to the monitor data bus, and the other jack connected to a bus terminator, to prevent control signals from reflecting back into the system from the far end.

The transmitter ON/OFF cable connects to J3 of the Main Controller board. It contains a cable for each cabinet in the system, and connects to J13 at top of each cabinet.

4.2.8.2 Main Controller

(See Main Controller schematic.)

The transmitter Main Controller and monitoring system are located in the control cabinet. No microprocessor is used; the digital circuitry is constructed entirely of discrete logic gates. A battery back-up for the transmitter ON/OFF logic is included to restore the transmitter to its prior operating condition after a brief power interruption. A power down timer will automatically reinitialize the transmitter to the OFF state if AC power is not restored within about two hours.

The MAIN CONTROLLER interfaces to the remote control, front panel controls, monitoring system, interlocks, exciter or exciter switcher, and cabinet ON/OFF controls.

It also contains the VSWR Foldback circuit, VSWR Overload fault logic, and RF peak detectors for sampling. These circuits work together to protect the transmitter in the event of elevated antenna system VSWR, in order to prevent danger to the transmitter.

4.2.8.2.1 Debounce (sheet 1)

Inputs with pulsed raising or falling edges can cause problems if the transitions are slow or if multiple transitions are present. These signals are debounced for about 40 mS before being passed on to the other logic. U1, the debounce IC, has six I/O debounce buffers. The time of debounce is set by C2 to 4 or 5 cycles of the master clock oscillator.

The remote ON/OFF commands, failsafe interlock, phase loss, and spare inputs are all optocoupled. On the other hand, External interlock is coupled directly into U1. Thus the voltage drop in this loop must not be greater than 0.5 volts for a low, nor more than 5 volts for a high. Be sure to check that the interlock satisfies these limits before connecting it.

The +12 volts required to turn on the other interlocks is supplied by the controller.

4.2.8.2.2 Transmitter ON/OFF (sheet 1)

The ON/OFF state of the transmitter is controlled by U5, the TX ON/OFF latch. This latch is an R/S latch with Reset (CLEAR) connected to the OFF logic signal, and Set (PRESET) connected to the ON logic. The ON and OFF signals are interlocked in such a way that an ON command cannot be asserted while the OFF command is being asserted. The inputs come from U1, the debounce IC.

The AC off timer, U4 and U5, reinitializes the transmitter to the off state after an approximately 2 hour AC power failure. U4, the timer IC, contains a 1 Hz oscillator and a binary counter. If the counter reaches 2^{13} before AC is restored, U4 pin 2 clocks U5 pin 11, the AC OFF latch, which returns the controller to the OFF state even if the power has not yet returned.

All of the logic on sheet 1 of the schematic is battery-backed for power failure conditions. If the battery fails, the transmitter will come up in the OFF state when AC is restored. The battery is monitored by the system monitor, and its voltage can be read on the display.

The output of the TX ON/OFF latch is passed through U8 to U3, the BAT BUFFER, and on to the cabinet on/off driver and other logic on the board. U8 gates the TX PULSE one shot U2, which pulses the cabinet ON command lines each time the ON push button is pressed. This feature is used to re-enable a faulted cabinet power supply or module when the CAB ON line is pulsed.

4.2.8.2.3 Battery Buffer (sheet 1)

The BATTERY BUFFER U3 is used to turn off output drive to all ICs that are not battery backed on power down conditions, to reduce battery drain. U2, the PHASE STRETCHER, is a one-shot with a three second duration, used so that short phase losses can be logged by remote control equipment.

The output of U3 is supplied to the monitor and other on-board logic.

4.2.8.2.4 *Power Up Detector (sheet 1)*

This logic is made up of U7, CR1, C3, and several resistors. The power up/reset detector monitors the +5 volts applied to the controller. If the +5 falls below about 4.35 volts, certain logic functions are forced to a reset condition. When the +5 volts goes above about 4.5 volts the reset line is released to its normally high state. Capacitor C3 provides a time delay on power returns, holding the reset line low for a short time.

4.2.8.2.5 *VSWR Fold-back (sheet 2)*

The detection and control circuits for both aural and visual foldback are the same.

The VSWR Foldback works in conjunction with the exciter to reduce the power output of the transmitter under varying VSWR conditions. This circuit is normally set to become active around 1.2:1 visual VSWR, or 1.4:1 aural VSWR, but the exact value at which fold-back starts will vary somewhat with the angle of the reflection coefficient, the location of the reflected directional coupler on the transmission line, and the amount of aural-visual cross-coupling through the diplexer.

A reflected visual power RF sample is fed to J8 on the main controller board (see sheet 6), where it is peak detected by CR21 and C31-C32-C33 and passed on to calibration pot R87. The arm of R87 is connected to U36, a voltage follower, to buffer the DC signal for distribution to the VSWR system and monitor. The bias adjust pot R86 is set to compensate for the forward voltage drop of CR21 with no RF signal applied, and is normally about 30 mV at the cathode of CR21. The input trap, consisting of L5 and C52 in series, is set to shunt the 2nd harmonic away from the detector. (This trap is deleted in later equipment.)

Returning to sheet 2, the Foldback Amp (U10A) provides gain for the foldback control voltage to the exciter, and will try to maintain the transmitter output at the threshold set by R20. R20 sets the threshold, keeping U10's output in saturation until the positive input is raised above the value of the inverting input. At that point, the amplifier has a gain of 10.

Diode CR75 provides a diode drop to compensate for op-amp input offset errors, which cause the output of U10A to rise above ground as the threshold set point of U10A is increased. The output of U10A is connected through R23 to the exciter, and through R22 to the U10B, the Foldback Active detector. The inverting (-) input to the active detector is biased to about 0.175 mV by CR71, R145, & R144, so that the hysteresis induced by R22 and R24 will not keep the detector output on when the output of U10A is at ground level.

The output of active detector U10B is connected to U53, a CMOS buffer, which drives several ICs. The active detector output goes high when the noninverting (+) input is raised about 175 mV above the inverting (-) input. The output will swing to a logic high level, causing U53 to drive the U13 and U12 inputs high. This in turn will cause LED DS1 and the front panel FOLD-BACK ACTIVE fault indicator to illuminate. This signal is also passed to the VSWR overload logic to disable the forward power memory detector, so that if foldback is active, a VSWR fault will not be latched by O/L latch U24.

4.2.8.2.6 *Fault Status Drivers (sheet 3)*

The front panel indicators are driven by high-current buffers which allow logic signals to control the indicator lamps on the front panel. Test switch S3 is used to test the lamps by turning on all indicators in the fault display.

4.2.8.2.7 *VSWR Overload (sheet 4)*

Both the aural and visual VSWR Overload (O/L) detectors are the same.

The VSWR Overload logic works in conjunction with the module VSWR protection circuits. When the reflected power is greater than the O/L set point, comparator U23A will turn on, clocking U22A, a one-shot with an output duration of three seconds. This will cause the foldback output to the exciter to reduce power to zero for about 100 mS, than ramp back up to normal power level in 300 mS if the foldback is not active. If the reflected power is still above the foldback set point, the power will return to some lower power level controlled by the foldback circuit, and the overload detection circuit will be disabled.

The module VSWR circuit will also turn off the module and a module fault will be sent to the monitoring system and a module summary fault will be indicated on the fault indicator.

If the foldback circuit has been disabled by jumpers J18-2 to 3 or J19, the exciter will not reduce the output level as above; it will instead continue to produce output power. At the end of the three second window established by U22A, U22B is fired, clocking U24 to the state of its "D" input. With foldback disabled, the former level of the forward power detector voltage sample is stored on capacitor C17. If the voltage at the noninverting (+) input to U23B is not above the stored sample voltage at the inverting (-) input, a logic high is clocked into U24 indicating a VSWR fault. However, if the noninverting input voltage is above the inverting input voltage, the logic low clocked in to U24 will indicate no VSWR fault condition. The VSWR O/L indicator will have been active for three seconds, however, which allows a remote control system to log the intermittent VSWR condition.

R51 is used to set the overload detection threshold to a given VSWR.

4.2.8.2.8 *Remote Control Inputs (sheet 5)*

All of the remote control inputs from J14 are conditioned upon the position of the LOCAL switch on the control cabinet front panel. When the transmitter is in LOCAL mode, the yellow indicator is lighted and all remote inputs are disabled.

The remote inputs are conditioned by optocouplers U30-U32, inverted by U52 and applied to the inputs of U33, the remote command buffer. The command buffer is a tri-state driver that interfaces to the local command functions. When the LOCAL switch is active, its signal inhibits outputs from U33, disabling all of the remote command signals.

4.2.8.2.9 *Peak Detectors (sheet 6)*

RF peak detectors are used for power and VSWR measurement.

L1 and C50 form a series resonant trap that prevents the second harmonic from causing errors in the level detected. (This trap is deleted in recently produced units.) Nominal input level is +12 dBm (17 mW). The input transformer steps up the voltage to approximately 3 volts DC at the detector cathode.

CR26 and R28 provide bias for CR19. R79 is the channel calibrate control.

4.2.8.2.10 *Remote Analog Outputs (sheet 7)*

All remote analog outputs are buffered by voltage followers before being passed to J16. The voltage follower outputs have 0.01 uF shunt capacitors and 1k Ohm series resistors. The calibrated outputs supply voltage levels from the monitor system as follows:

4.2.8.2.11 *Calibrated Outputs*

Visual Forward	0 to 3.0 volts
Aural Forward	for full scale.
Visual VSWR	1 to 2 volts
Aural VSWR	1:1 to 2:1.

4.2.8.2.12 *Un-Calibrated Outputs*

For Transmitters over 10 kW Visual power:

Visual Forward	2.5 volts = 100%
Aural Forward	
Visual Reflected	
Aural Reflected	
Reject Load 1	2.5 volts = 7.5 kW
Reject Load 2	
Reject Load 3	

For Transmitters or = 10 kW Visual power

Visual Forward	1.8 volts = 100%
Visual Reflected	
Aural Forward	0.8 volts = 100%
Aural Reflected	

4.2.8.2.13 *Remote Status Outputs (sheet 8)*

All remote status outputs are buffered by 7406 open collector inverters and passed to J15 through networks consisting of 0.01 F grounded shunt capacitors and 100 2 series resistors. Each output is coupled through a diode to a 24 volt zener clamp, which prevents the output voltages from going above 24 volts.

4.2.8.2.14 *Cabinet Tx ON/OFF (sheet 10)*

The cabinet Tx ON/OFF circuit buffers the ON/OFF commands to the cabinets. Each cabinet has a 7406 open collector driver to sink current of the Tx ON or OFF line supplied to the optocoupler in the cabinet controller. IC U48 is the cabinet OFF driver and U49 is the cabinet ON driver. The +12 volts to supply the cabinets is supplied through 220 2 1 watt resistors R118 through R123 located on the main controller PC. When the transmitter ON button is pressed, the TXD* signal is set to a logic 0 and TXD1 is forced to a logic 1 causing the CAB ON line to sink current from the cabinet from an optocoupler in the PA cabinets. The CAB OFF line is open circuited when OFF button is pressed.

IC U54 is a driver for the external blower control which follows the cabinet ON state. This output drives a relay in the exciter cabinet and can be used for peripheral equipment that needs to be turned on when the transmitter is turned on.

4.2.8.3 Slave Controller

Slave controllers are mounted in the upper left hand slot each PA cabinet. They interface all the cabinet control and monitoring circuits to the main controller and monitoring system. See Slave Controller schematic.

The slave controller is connected to the monitoring system by a 26-wire twisted pair cable that allows bi-directional communication between the two sections of the transmitter monitoring logic. This 13 pair bus is called the MONITOR BUS, and is daisy chained from cabinet to cabinet.

Each cabinet ON/OFF control is handled by a three connector cable to the Main Controller in the Control cabinet. The status of these lines (CAB ON or CAB OFF) signals the slave to turn on or off the AC power to the 50 volt supplies and blower, which in turn enables the modules, placing them on the air. The ON or OFF status of the controller is indicated by the TX ON light on the front edge on the slave board.

The slave controller interfaces with the cabinet AC power contactor, 50 volt supply, air and door interlocks, RF modules, and RF samples for the peak detectors. The status of the interlocking signals can be seen by the fault indicators on the front edge of the slave board.

The bus interface is dynamic logic controlled by the Monitoring System (MS) in the control cabinet. Each time the monitor accesses the bus to read data from or write data to a slave, the slave's cabinet SELECT indicator illuminates.

Two switches on the front edge of each slave allow manual control of the cabinets. CAB ON and CAB OFF control the cabinet ON/OFF state when the cabinet ON/OFF cable is removed.

The power supply for the slave is mounted in the back of the slide out module and operates from 208/220/230/240 volts AC, 50/60 Hz. It supplies +5 and ±12 volts DC for the slave controller and cabinet interlocks.

4.2.8.4 Bus Interface (sheet 1)

The bus interface is a RS485 differential interface, which uses a balanced twisted pair transmission line. The use of twisted pair cable minimizes common mode magnetic coupling into the cable. The bus driver ICs, 75172, produce a differential signal of about 2 volts on the A and B outputs. The receivers are 75173 ICs, which have a ±200 mV sensitivity to the differential signal.

Since the bus is really a transmission line, both ends of the bus must be terminated to prevent signal reflections. The monitor end of the bus is terminated on the monitor board. The far end of the bus is terminated on the last cabinet's bus output connector with a bus terminator, which provides a 47 2 termination on each line.

4.2.8.5 Bus Protocol

The bus is controlled by the Monitor in the control cabinet. The monitor issues an address on the Address/Data 0-7 (A/D 0-7) lines, and asserts the Command/Data* (C/D*) line to the C level and the Write (WR*) line to the WR* level. Each slave controller passes AD0-7 through U2, U4 to the Address Latch U6 where it is latched on the raising edge of WR*. The output of U6 is applied to P inputs of U7 address comparator. If the addresses set in S1 and applied to the Q inputs of U7 are equal, the P=Q output pin of U7 will assert low lighting the slave Select LED and indicating the monitor is accessing the cabinet data. The monitor can than read or write to the slave to access status and analog channels.

CABINET ADRRD*	FUNCTION
0	Status modules 1-8
01	Status modules 9-16
02	Status module 17
	Spare 1-3
	PS 1 & 2 faults
	Door & Air
03	Options to be determined
04	Options to be determined
05	Options to be determined
06	Options to be determined
07	Options to be determined

The various status points can be read by the monitor by first issuing an address, then reading the data from the cabinet controller.

4.2.8.6 Cabinet ON/OFF Control (sheet 2)

Cabinet ON/OFF control is connected to the slave controller at J-2 by a three conductor cable to optocoupler U23 and passed on to U2, the TX ON/OFF latch. The TX ON/OFF latch controls the state of the AC contactor and 50 volt power supplies in the cabinet. The TX latch cannot be set to the ON state if is a RESET, DOOR, or CAB OFF command is present at the reset input of U2. However, pressing the slave CAB OFF button will override the main controller CAB ON command as long as the button is held in. When the button is released, the main controller CAB ON command will turn the cabinet back on.

The STSET one shot U22 is used to re-enable modules that have faulted without turning off the other on-air modules. A module is re-enabled by asserting its enable line low; however, momentarily asserting the enable lines low for all modules in the cabinet would disable them for the length of the pulse. Pressing the transmitter ON button will cause a short pulse on the CAB ON line, causing U22 to fire and thus pulsing only the enable lines of faulted modules.

4.2.8.7 Power Supply Control (sheet 2)

The two 50 volt power supplies are enabled by U58, closing the current loop to the optocouplers on the 50 volt supply control board which starts a controlled ramp up to 50 volts DC. In order for U58 to enable the supplies, the following conditions must be met:

a. The TX ON/OFF latch must be set to ON.

b. The blower must be running and the AIR switch closed.

c. The door must be closed.

The above conditions will enable U58, closing the power on loop. If a power supply faults off, it can be re-enabled by pressing the transmitter ON button. This will cause the CAB ON lines to pulse, which in turn will fire the STSET one-shot gated to U15. This will cause the failed power supply PS1 CTRL signal to pulse high for about 500 mS to reset the fault logic and enable the supply again.

4.2.8.8 Fault Detection Logic (sheet 2)

The fault detection circuitry detects status from AIR SWITCH, DOOR OPEN, POWER SUPPLY 1, and POWER SUPPLY 2 in order to interlock the cabinet AC or DC control signals. All these faults are summed together through U17, U18, and U25 to the red LED on the front panel of the slave controller. When the transmitter is in the OFF state, only the door interlock is reported by the monitoring system.

When the transmitter ON button is pressed, the TXD line is set to a logic 1, allowing the air fault to light the air loss and power supply fault indicators. When the blowers have established cabinet pressure, the air switch will close, cancelling the air loss fault. After about 0.8 seconds, the 50 volt power supplies should return

STATE	TXD	MODF	STSET	PS1SET	PS2SET	OUT	
1	1	X	X	X	X	X	FORCE ALL ENABLES TO OFF (1)
2	0	1	X	X	X	0	MODULE NOT SELECTED (EN=1)
3	0	0	X	X	X	1	MODULE IS ENABLED (EN=0)
4	0	1	0	X	X	0	FORCE MODULE RESET (EN=1)
5	0	1	X	0	X	0	
6	0	1	X	X	0	0	
Asserting STSET will enable any module with MODF=1							
Asserting PS1SET will enable any odd numbered module that has a MODF=1							
Asserting PS2SET will enable any even numbered module that has a MODF=1							
If MODF=0 STSET, PS1SET, PS2SET will not affect module operation and the module will stay on the air							
If MODF=1 the module is not enabled or a module fault has disabled the module							
If MODF=0 the module ENABLE/RESET line is also = 0							

Table 4-1. PAL Logic
Slave Controller Module ENABLE

a PS OK signal to the controller, removing the PS faults and turning off the fault indicators. All of these signals are supplied to the monitoring system as status points.

4.2.8.9 Module Enable (sheet 8)

The module enable PAL circuit performs the required gating to enable modules with PS-1&2 OK or STSET. The output of the PAL is passed through U50, an inverting buffer, to the module enable lines.

The logic for the PALs can be seen in Table 4-1 for the normal conditions. Signals from the drive chain change-over logic alter the gating of the PALs in the Aural/Driver PA cabinet. When the parallel drive chain option is used, the PALs are programmed differently.

4.2.8.10 Analog Channels (sheet 6)

The analog channels on the slave controller pass analog values over the bus to the A/D converter on the monitor board, where they are digitized and calibrated for display. The slave address for a channel is sent from the monitor to the slave, where it is latched in U9. This address selects the analog channel to be returned on the bus to the monitor.

4.2.8.11 Analog Channel

CABINET ADRANALOG	FUNCTION
00	RF 1 peak detector
01	RF 2 peak detector
02	RF 3 peak detector
03	RF 4 peak detector
04	RF 5 peak detector
05	RF 6 peak detector
06	Not used
07	Power supply 1 volts
17	Power supply 1 current
27	Power supply 2 volts
37	Power supply 2 current
47	Not used
57	Not used
67	Not used
77	Not used

Analog channels 07 through 77 have a trim adjustment to calibrate the power supply readings. Channels 00 through 05 have calibration pots on each peak detector.

4.2.8.12 Status Ports (sheets 3 and 4)

The status ports enable the Monitor to read the fault status of the modules and other functions of the cabinet controller over the monitor bus. The fault lines are optocoupled to U28, U31 & U36 to U26 & U27. When the RD* select line is asserted low, the latch will freeze the data at its input and place it on D0 -D7 bus to the monitor bus drivers, which in turn place the data on the monitor bus for the monitor to read.

In systems with parallel drive paths, data indicating aural and visual changeover faults is latched in U33-U34 for aural faults, and U42-U43 for visual faults. These latches are clocked by the respective changeover logic. Once a driver faults, the slave must be manually reset to restore the driver chain to the normal state.

The other status port, U35, is a tri-state buffer. It does not latch the data on the input pins.

4.3 Basler 50 Volt DC Power Supply

(See 50 V power supply and control board schematics)

The Basler Electric 15 kW power supply operates from a three phase AC line (208/240 volts AC), delivering 50 volts DC at a rated current of 300 amps.

The three phase AC input can be connected for the following voltages:

a. 208 Delta, 220 Delta, 240 Delta

b. 360/208 WYE, 381/220 WYE and 416/240 WYE

The primary of T1, T2, and the cooling fan are paralleled from terminal block 1. Also connected in parallel to TB1 are power factor correction circuits consisting of C38, C39, and C40 (model 100 and 101) and an additional inductor L2 (model 102 only).

The low voltage secondary of power transformer T1 is applied to a six SCR bridge mounted on the heat sink assembly consisting of power blocks 1, 2, and 3. Also at this point, the snubber PC board, consisting of R1 to R9 and C1 to C9, is connected. The snubber assembly protects the SCRs from noise and line transients, and limits the rate of change of voltage across the SCRs to prevent breakdown.

The heat sink assembly also contains catch diode CR1 and thermal cutout switch S1. The regulated DC output of the six SCR bridge is filtered by inductor L1, and by an exteranl bank of six parallel capacitors totalling 0.72 farad. The DC current is sensed by R100, a 300 amp to 50 mV shunt.

Transformer T2 provides power for the electronics on the control board assembly, as well as the synchronization for the firing pulses to the SCR bridge. Power is provided by Q8, and its associated circuitry supplies all the devices located on the control board assembly. A 12 VDC signal applied to J1-2 (positive) and J1-1 (return) energizes optocoupler U4. As U4 conducts, it turns off Q16, Q17, and Q18 which turn off DS1 (overvoltage LED), DS3 (overcurrent LED), and DS2 (overcurrent LED) respectively. Also, Q7 turns off, which allows the 24V regulator to start, thus beginning the power supply's start-up sequence.

When the 24 VDC turns on, Vcc is applied to error amplifier U5, and sequence synchronizing amplifiers: U1, U2, Q1 to Q6, Q10 to Q15, and T1 to T6. Phase voltages provided by T2 secondaries are filtered and rectified. This rectified signal is summed with a delay angle balance adjust, R62 to R66, then applied to the sequence synchronizing comparators. The sequence synchronizing comparator's other input is from the error amplifier and soft start circuit. The error amplifier composed of U5, U3, and associated circuit components senses the DC output of the SCR bridge. If the output voltage sensed by the error amplifier is too low, the sequence synchronizing amplifier will pulse the SCRs with the correct phase polarity in order to increase the output voltage.

The firing sequence of the six SCR bridge is diagramed below. The shaded area is the allowable conduction angles for correct phasing.

Catch diode, CR1, provides a current path when all six SCR's are off.

Voltage adjust pot R41 adjusts the power supply's output voltage from a minimum above 46 VDC (maximum CCW) to a maximum below 51 VDC (maximum CW). The output voltage regulation is less than 0.5% from no-load to full-load.

To reduce output ripple, the delay angle balance adjust, R62 to R66, are adjusted for even firing angles on all six SCRs in the bridge. The output ripple is less than 150 mV p-p.

The output current is sensed by R100 and applied to U5 and R75. Gain adjust, R75, scales the output current to 1V per 100 Amps at J1-3 (positive) to J1-4 (return).

R71 is adjusted to give an overcurrent trip when output current exceeds 315 amps. R71 controls the overcurrent threshold. If the threshold is exceeded, U5 pin 14 will cause CR41 to fire which turns on DS2, overcurrent LED. CR41 also allows CR27 and CR56 to conduct and shut down the 24V regulator. With the 24V regulator circuit off, all power to SCR bridge firing circuits is removed. Thus, the output goes to zero, remaining there until the 24V regulator is reset by first removing, then reapplying, the three phase AC input.

R84 is adjusted to give an overvoltage trip when the DC output voltage exceeds 57 VDC. If the output voltage exceeds the threshold set by R84, U1 pin 13 will cause CR40 to fire, which turns on DS1, the overvoltage LED. CR40 also allows CR32 and CR55 to conduct and shuts down the 24 volt regulator. As with the overcurrent trip, shutting off the 24 volt regulator will shut of the SCR bridge until the AC is removed and reapplied.

If the temperature of the heat sink assembly reaches 100°C, thermal switch S1 will close. When S1 closes, CR42 fires, which turns on DS3, the over temperature LED, and allows CR29 and CR59 to conduct which again shuts off the 24 volt regulator. As with the other faults, an over temperature trip causes the output to go to zero and remain until the three phase input voltage is removed and reapplied.

R74 is adjusted so that Q19 is ON (sinks current) from J1-7 to J1-8, the OPTO GO/NO GO terminals, when the output voltage is between 48 and 49 volts DC.

An output voltage signal provided between J1-6 and common J1-4 is a scaled DC output voltage sample, equal to 5% of the power supply DC output voltage.

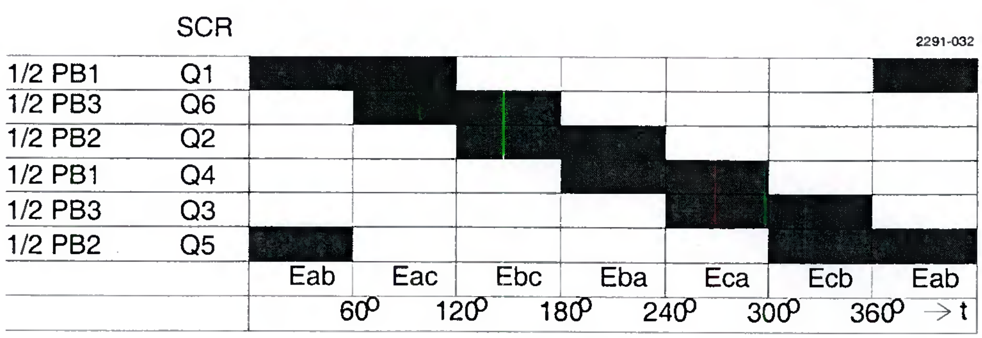


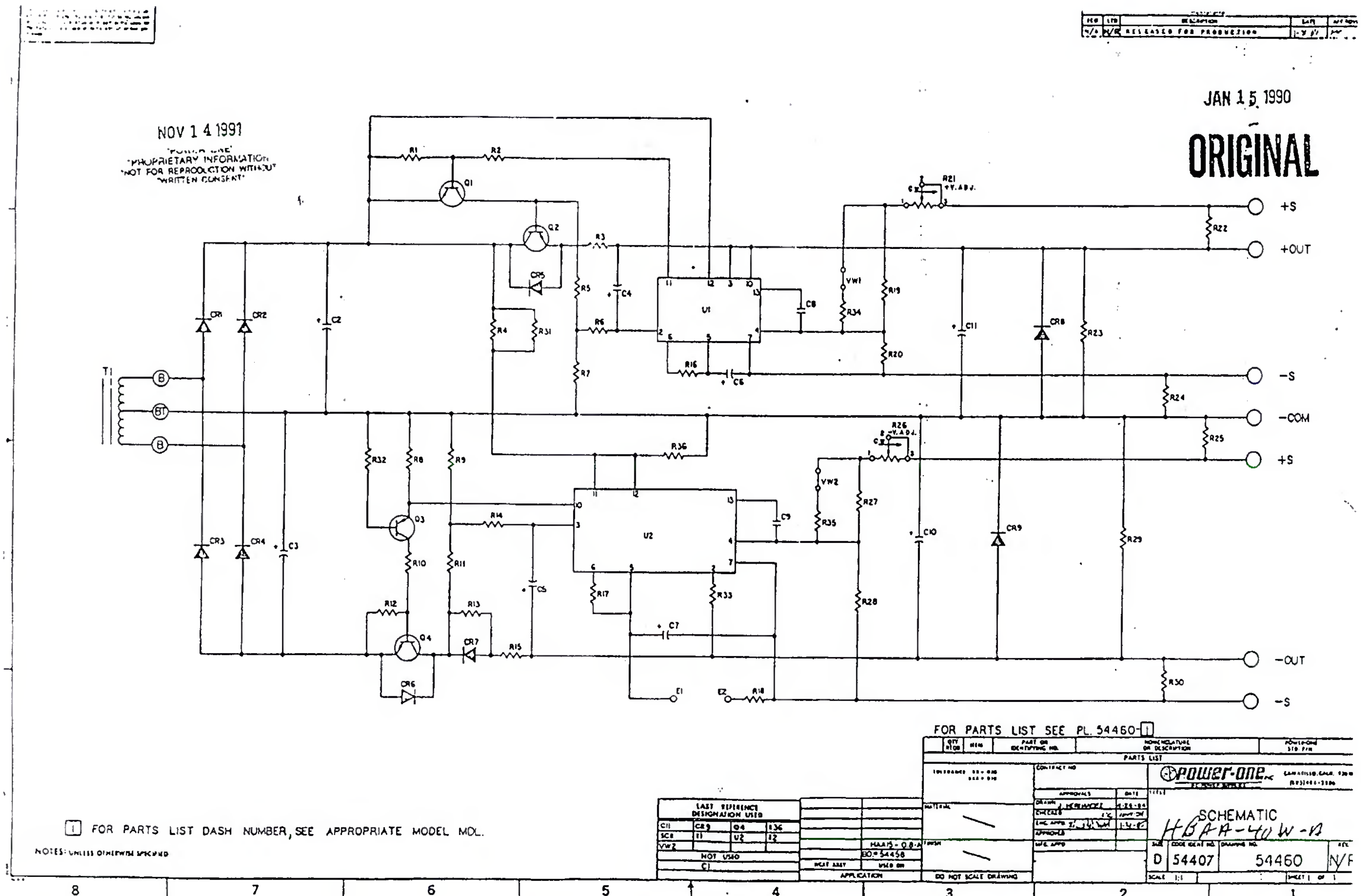
Figure 4-3. SCR Firing Sequence

WARNING: Disconnect primary power prior to servicing.

POWER-ONE, INC. HBAA-40W-A PARTS LIST

ENGINEERING PARTS LIST FOR MODEL HBAA-40W-A, DWG #PL54460-102 Rev. B

ITEM	PART NUMBER	QTY	DESCRIPTION	VENDOR P/N	REF. DES.
1	505-54459	1	Printed Wiring Board	BD.#54458	A1
2					
3	154-20020	2	Potentiometer 2K		R21,26
4	158-10081	2	Resistor, .39Ω, 2W,10%, BWH		R3,15
5	150-20364	2	Resistor, 1.6k, 1/4W, 5%, C.F.		R1,17
6	150-20349	3	Resistor, 390Ω, 1/4W, 5%, C.F.		R2,8,33
7	150-20361	5	Resistor, 1.2K, 1/4W, 5%, C.F.		R4,12,18,31,32
8	150-20348	1	Resistor, 360Ω, 1/4W, 5%, C.F.		R5
9	150-20339	3	Resistor, 150Ω, 1/4W, 5%, C.F.		R6,10,14
10	150-20380	1	Resistor, 7.5K, 1/4W, 5%, C.F.		R7
11	150-20369	2	Resistor, 2.7K, 1/4W, 5%, C.F.		R9,36
12	150-20341	1	Resistor, 180Ω, 1/4W, 5%, C.F.		R11
13	150-20307	5	Resistor, 6.8Ω, 1/4W, 5%, C.F.		R13,22,24,25,30
14	150-20343	1	Resistor, 220Ω, 1/4W, 5%, C.F.		R16
15	150-20366	2	Resistor, 2K, 1/4W, 5%, C.F.		R23,29
16	152-21795	2	Resistor, 4.22K, 1/4W, 1%, M.F.		R19,27
17	152-21796	4	Resistor, 4.75K, 1/4W, 1%, M.F.		R20,28,34,35
18	130-10287	2	I.C. Voltage Regulator	µA 723	U1,2
19	172-10248	2	Transistor, PNP T0-18	2N2907A	Q1,3
20	171-10261	Ref	Transistor, NPN	2N6569	Q2,4
21					
22	111-20590	9	Diode, 1.5A, 100V	1N5392	CR1-9
23					
24					
25	101-20934	2	Capacitor, Elect. 2200 µf/35V		C2,3
26	101-10114	3	Capacitor, Elect. 10 µf/25V		C4,5,6
27	101-10111	1	Capacitor, Elect. 1 µf/50V		C7
28	101-10110	2	Capacitor, Elect. 100 µf/35V		C10,11
29	104-10093	2	Capacitor, Mylar .001 µf/100V		C8,9
30					
31	914-21022	1	Wire, 20 AWG. WHT 5 1/2"		BT
32	914-21249	2	Wire, 20 AWG. BRN 5"		B,B
33					
34	261-16570	2	Jumper Bare, 0.22 GA. 0.438"		VW1,2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+OUT
-S
-COM
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-OUT
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R21 +V. ADJ.
R26 -V. ADJ.
U1
U2
T1
FOR PARTS LIST SEE PL 54460-1
1 FOR PARTS LIST DASH NUMBER, SEE APPROPRIATE MODEL MDL.
NOTES: UNLESS OTHERWISE SPECIFIED
LAST REFERENCE DESIGNATION USED
NOT USED
C1
APPLICATION
DO NOT SCALE DRAWING
power-one
SCHEMATIC
HBAA-40W-A
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SHEET 1 OF 1
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POWER-ONE, INC. DATE: 3-16-93KAC

HBAA-40W-A PARTS LIST, (5VDC OUTPUT)

ENGINEERING PARTS LIST FOR MODEL HBAA-40W-A, DRAWING NUMBER PL52918-106 Rev. A

ITEM	PART NUMBER	NOTE	QTY	DESCRIPTION	VENDOR P/N	REF. DES.
0	081-52918-106		1	PWB ASSEMBLY NUMBER 52916, HB5-3/OVP-A		A1
1	505-52917		1	PWB NUMBER 52916 W/HDW, HB5-3/OVP-A		PWB
2	101-20933		1	CAPACITOR, ELECT, 10,000µF/16V		C1
3	101-10110		1	CAPACITOR, ELECT, 100µF/35V		C2
4	104-10092		1	CAPACITOR, MYLAR, 0.0033µF/100V		C3
5	101-10111		1	CAPACITOR, ELECT, 1µF/50V		C4
6	101-10107		1	CAPACITOR, ELECT, 220µF/16V		C5
7	111-10251		4	DIODE, PW, 200V, 1A	1N4003	CR1, 2, 5, 7
8	111-10252		2	DIODE, PW, 100V, 3A	1N5401	CR3, 4
9	112-10006		1	DIODE, ZENER, 500mW, 5.6V	1N752A	CR6
10	171-10261	REF	1	TRANSISTOR, NPN, TO-3, 60V, 115W	2N3055	Q1
11	172-10247		1	TRANSISTOR, NPN, TO-92, 40V, 625mW	MPS2222A	Q2
12	154-20937		1	POTENTIOMETER, CC, 0.15W, 500Ω	PT 10LV	R1
13	150-20367		3	RESISTOR, CF, 1/4W, 5%, 2.2kΩ		R2, 3, 9
14	158-10077		1	RESISTOR, MO, 2W, 5%, 0.12Ω		R4
15	150-20327		2	RESISTOR, CF, 1/4W, 5%, 47Ω		R5, 10
16	154-20020		1	POTENTIOMETER, CERMET, 0.33W, 2kΩ	PTC 10LV	R6
17	150-20356		1	RESISTOR, CF, 1/4W, 5%, 750Ω		R7
18	150-20372		1	RESISTOR, CF, 1/4W, 5%, 3.6kΩ		R8
19	150-20307		3	RESISTOR, CF, 1/4W, 5%, 6.8Ω		R11, 12, 13
20	150-20343		1	RESISTOR, CF, 1/4W, 5%, 220Ω		R14
21	160-10258		1	SCR, ISOLATED TAB, TO-220, 30V, 3A	S0303LS3	SCR1
22	130-10287		1	I.C., VOLTAGE REGULATOR, LM723CN	MC1723CP	U1
31	321-10679	2	1	SOCKET, I.C., 14 PIN		FOR: U1
23	914-21026		2	WIRE, 20AWG, BRN, 6.5", 1/4 x 1/4 T		FOR A1: A, A
24	914-21021		1	WIRE, 20AWG, WHT, 6.5", 1/4 x 1/4 T		FOR A1: AT
25	412-55229	REF	1	CHASSIS 50129 W/SS, HBAA-40W-A		CH1
26	082-50222	REF	1	TRANSFORMER, HBAA-40W-A		T1

NOTE:

1.) FOR SCHEMATIC SEE DRAWING NUMBER 52918.

2.) OPTIONAL; MAY OR MAY NOT BE USED IN THIS ASSEMBLY.

WARNING: Disconnect primary power prior to servicing.

REVISIONS				
ECO	LTR	DESCRIPTION	DATE	APPROVED
	A	RELEASED TO PRODUCTION	2-15-83	KC

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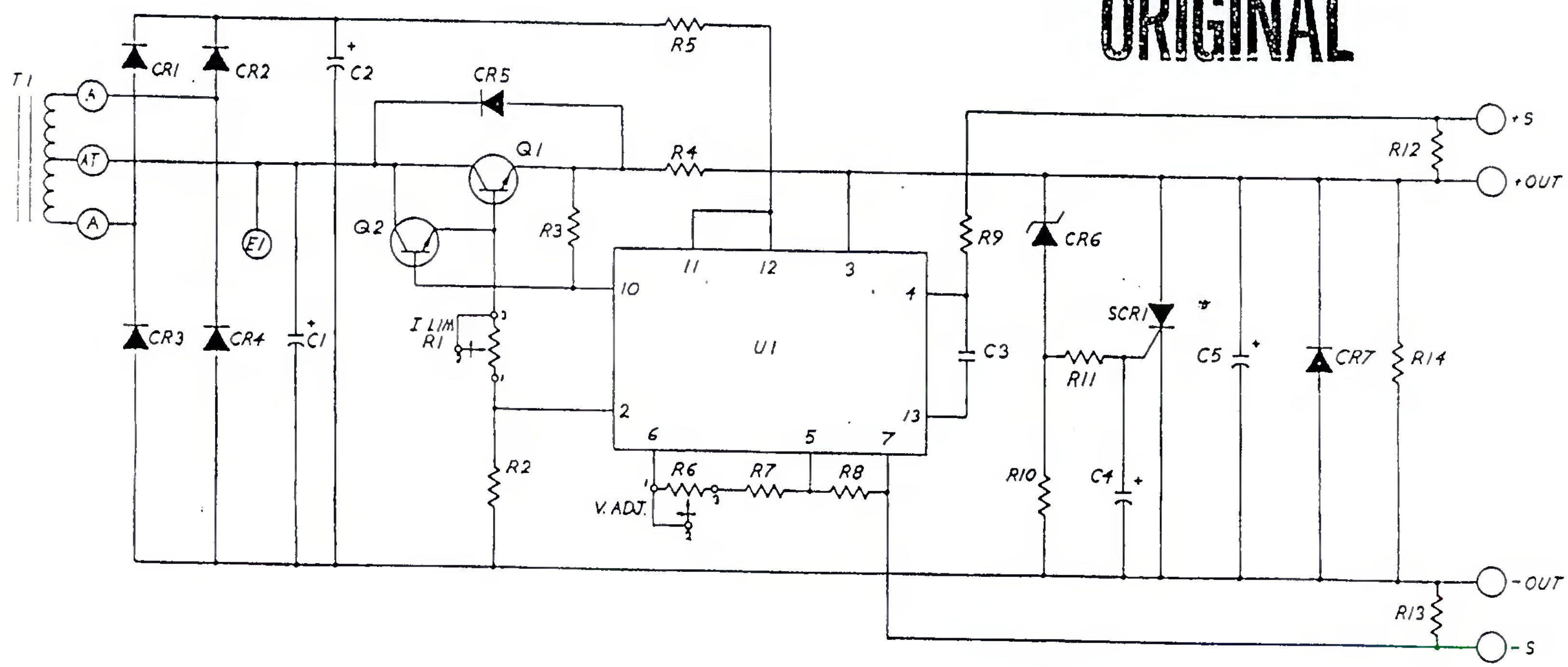
ORIGINAL



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FOR PARTS LIST SEE DWG. # 52918 - 1

QTY REQD	ITEM	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	POWER ONE STD PART NO.

PARTS LIST

1 FOR DASH # SEE APPROPRIATE MODEL MDL

NOTES: UNLESS OTHERWISE SPECIFIED

NEXT ASSY	USED ON
	HBAA-40W-A
	HB5-3/OVPA

APPLICATION

TOLERANCE .XX = .030 .XXX = .010

MATERIAL

FINISH

DO NOT SCALE DRAWING

APPROVALS		DATE
DRAWN		12-23-82
CHECKED	KC	4-28-83
ENG. APPD.		4-28-83
APPROVED		
MFG. APPD.		

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TITLE: P.W.B. SCHEMATIC HBAA-40W-A (5VDC OUTPUT)

SIZE: C | CODE IDENT NO.: 54407 | DRAWING NO.: 52918 | A

SCALE ~ | SHEET 1 OF 1

4 3 2 1

WARNING: Disconnect primary power prior to servicing.

888-2365-001

5.1 Introduction

Maintaining a *Platinum Series®* transmitter consists of three phases:

- Routine mechanical maintenance
- Routine performance checks and adjustments
- Verification of control and calibration of circuits

A suggested list of tasks is provided in Table 5-1, Sample Maintenance Log.

Since each transmitter operates in a different environment, you should adjust the schedule of maintenance as necessary to suit the particular on-site conditions.

448-

5.2 Air Filter Replacement

Disposable filter media is used for the cabinet air filters. They must be changed as necessary to allow sufficient air movement through the cabinet. To establish baseline performance, make the following measurements:

a. Connect a sensitive manometer (such as Dwyer model 40-1) to the small hole in the rear door near the top (see Figure 5-1).

b. Measure the pressure drop across the filters when new. Then, block one side of the air input to the cabinet and measure again.

c. Record these values for future reference.

d. Change the filters when the restriction is equal to 50% of pressure drop measured above. Use Harris part number 448-0921-000, American Air Filter #627130500, or equivalent filter for replacement.

5.3 Air Switch Adjustment

Turn transmitter OFF and open rear door of the cabinet requiring adjustment.

Remove the tubing connecting the air switch to the port on the divider panel.

Connect a length of tubing from the air switch tube to a tee connector at the manometer. See Figure 5-2.

Check for +12 volts at J-3 pin 12 on the slave controller, then connect the volt meter to pin 2.

Connect a source of vacuum to the tee at the manometer, and gradually supply vacuum until +12 volts appears at J-3 pin 2.

Note the manometer reading when the air switch closes.

Adjust the air switch threshold to -0.25 inches H_2O column. Turn the adjustment screw in top of cabinet clockwise to increase the pressure differential required to activate the switch, or counter-clockwise to decrease the differential.

Remove vacuum and check to see that J-3 pin 2 falls to 0 volts.

Reconnect the air tubing in the cabinet and check for normal operation. Press transmitter ON, and confirm air switch opera-

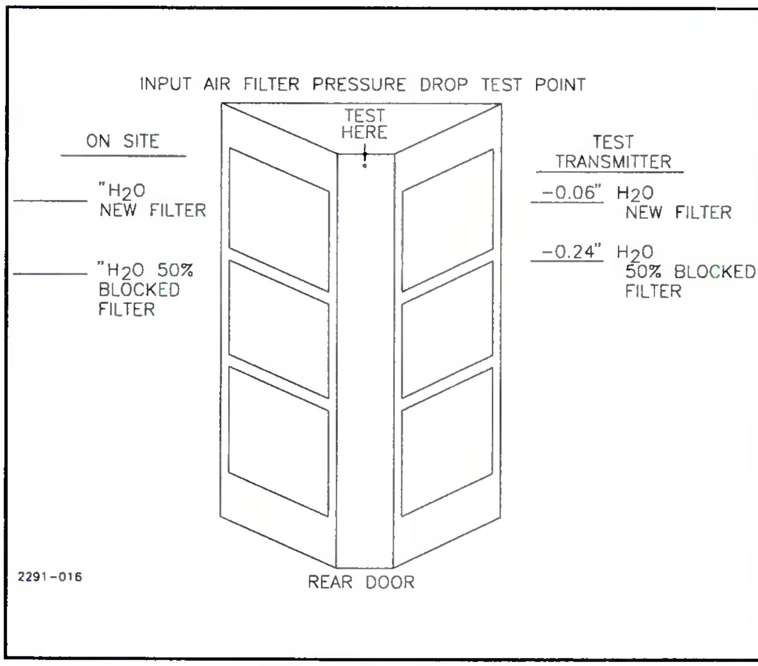

Figure 5-1. Air Test Location

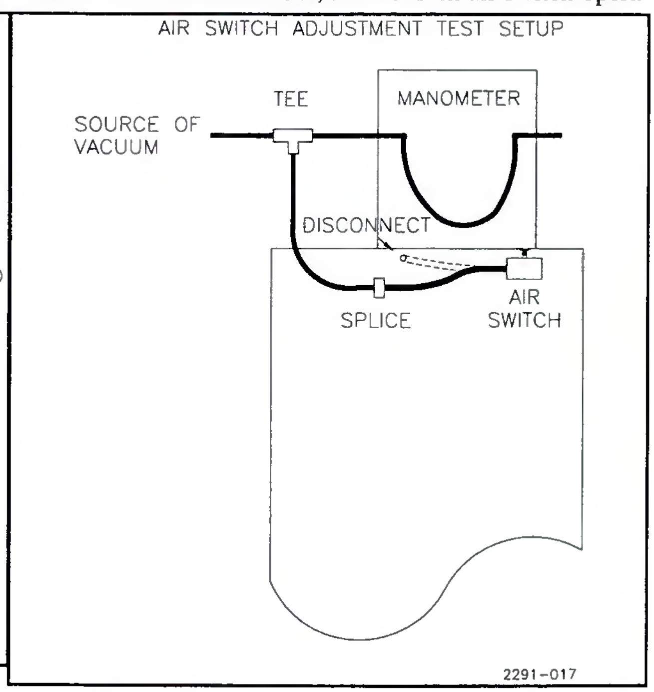

Figure 5-2. Air Switch Adjustment Test Setup

WARNING: Disconnect primary power prior to servicing.

Table 5-1. Sample Maintenance Log

ITEM	INTERVAL RECOMMENDED			
MAINTENANCE LOG SCHEDULED SERVICE MECHANICAL PRE-FILTER MANOMETER READINGS	Weekly			
INSPECT PRE-FILTERS	Weekly			
REPLACE PRE-FILTERS	As Required			
EXHAUST STACK MANOMETER READINGS	6 months			
CABINET INPUT AIR MANOMETER READINGS	Weekly			
INSPECT TX AIR FILTERS	Weekly			
REPLACE TX AIR FILTERS	As Required			
VACUUM CABINETS	Monthly, As Required			
CLEAR MODULE FINS OF ACCUMULATED DUST	6 months, As Required			
MEASURE BLOWER CURRENTS	6 months			
CLEAN FAN BLADES AND MOTOR WINDINGS	6 months, As Required			
CONNECTIONS CHECKED FOR TIGHT	6 months			
INSPECTION OF MOV'S	6 months, As Required			
SCHEDULED SERVICE PERFORMANCE RECORD DATA ALL PARAMETERS ON DISPLAY PANEL ON AIR	Weekly			
RECORD DC INPUT AND 50 VOLT SUPPLY				
CURRENTS IN BLACK, IDLE, 50% APL	Monthly			
VISUAL PERFORMANCE CHECKS VIDEO LEVEL	Weekly			
SYNC RATIO	Weekly			
DIFF GAIN	Weekly			
ICPM	Weekly			
DIFF PHASE	Weekly			
GROUP DELAY (T PULSES)	Weekly			
POWER CALIBRATION	6 months			
AGC SET UP	6 months			
SWEEP RESPONSE	6 months			
AURAL PERFORMANCE CHECKS MODULATION LEVELS	Weekly			
SCA LEVELS	Weekly			
POWER CALIBRATION	6 months			
AGC SET UP	6 months			
RESPONSE	6 months, As Required			
DISTORTION	6 months, As Required			
SEPARATION (STEREO ONLY)	6 months, As Requried			
CROSSTALK	6 months, As Requried			
CONTROL CHECKOUT (SECTION II VSWR FOLDBACK, FAULTS, ETC)	Annually			
Set DATE to new year using SETUP screen	Anually			
Set day to March 1	On March 1, (Leap Year only)			

WARNING: Disconnect primary power prior to servicing.

Table 5-2. Line Voltages and Currents

LINE VOLTAGES	
A-B	
B-C	
A-C	
CURRENTS	
AURAL PA FAN MOTOR	AURAL PA FAN MOTOR
A	A
B	B
C	C
VISUAL PA A FAN MOTOR	VISUAL PA C FAN MOTOR
A	A
B	B
C	C
VISUAL PA B FAN MOTOR	VISUAL PA D FAN MOTOR
A	
B	
C	
INPUT BLOWER MOTOR	EXHAUST BLOWER MOTOR
A	A
B	B
C	C

tion by momentarily switching the fan breaker off while observing the air loss LED.

5.4 Cleaning

Use a vacuum cleaner as required to clean the cabinets. Be aware of static discharge problems with the use of high velocity air in dry climates when cleaning any circuit-board with static sensitive components. A variety of static-safe vacuum equipment is available at most computer supply dealers.

A soft natural bristled paint brush with metal binding and wood handle can be used to dislodge dust with minimum static generation. Hold the metal binding and touch a grounded surface to discharge any difference in potential before working on the board. Do not use nylon brushes with plastic handles.

Printed circuit board edge connectors may be cleaned using a commercial cleaner such as Cramolin. Apply a small amount of the cleaner to the contacts, then remove it with a clean, lint-free cloth. Do not use a pencil eraser to clean contacts, as gold or silver contact plating will be removed.

To clean motherboard sockets, wrap cloth around a small plastic or metal card slightly thinner than the circuit boards. Apply a small amount of the cleaner, and insert the cloth-covered card into the connector. Reposition the cloth to a dry area to remove the cleaner.

Inspect the RF amplifier module fins for accumulated dirt that may have gone past the air filters. Remove using a brush and vacuum.

Do not spray any liquids that may seep into the circuit board area.

Outside panel surfaces may be cleaned with a damp cloth using water or mild household cleaners.

5yrs life — watch out for fan bearing failure

5.5 Fan Motor Currents

To measure fan motor current, use a remote clamp-on current probe such as Fluke style B or C. Route its leads out through top of cabinet. The gasket will compress around the leads when door is shut.

Measure the cabinet intake blower currents. If an exhaust blower is used, measure its currents as well.

Note the AC line voltage readings at this time as well, and record the current and voltage data for future reference in Table 5-2.

As the motor bearings wear, the motor current may increase. A periodic check will alert you to this change, indicating that service is needed and preventing an untimely failure.

5.6 Motor Lubrication

The original blower has sealed, permanently lubricated bearings. No routine service is required. In the event an alternate supplier was used for motor replacement, check for grease fittings on the motors. If found, lubricate motor annually using any of the following:

- Shell "Dolium R"
- Chevron "SRI No 2"
- Texaco "Premium RB"

Excess grease can cause premature bearing failure. Do not allow the grease to be contaminated. Turn the motor off and allow it to stop rotating before greasing the bearings. Do not mix petroleum and silicone grease.

5.7 Check Connections

WARNING

DISCONNECT ALL POWER TO TRANSMITTER BEFORE PERFORMING THE FOLLOWING STEP.

All wiring should be periodically checked for tight connections. This is most important in the high-current circuits (cabinet AC feed, AC breaker to DC power supplies, power supply to DC bus, DC bus to module connectors, etc.). Also check wires for lead dress and abrasions. High-current wires may be physically jolted from their positions by current surges at turn-on.

RF cables rarely give trouble, but should be checked for tight connection. Inspect for signs of cables being pinched at sliding assemblies (exciter and slave controllers).

Table 5-3. Recommended Test Equipment

Vestigial Sideband Demodulator Tektronix 1450 or Equivalent
Option 1 37 MHz IF, NTSC CCIR-M (USA and others)
Option 2 38.9 MHz IF, CCIR-G, PAL
Tektronix Sideband Analyzer
Consisting of:
1405 Sideband Adaptor
2710, 490, or 2750 Spectrum Analyzer
Tektronix 1910 Signal Generator or equivalent
Tektronix 1780 Video Measurement Set
Aural Stereo Generator, Orban 8182A ro equivalent
Aural Demodulator Tektronix 751, TFT-850, or equivalent for stereo
Time & Frequency Technology 701, 702, or equivalent for monaural
A method of measuring transmitter frequency with two sources. (Frequency Counter, Frequency Counter on Demodulator, Outside Frequency Measuring Service.)
Audio Oscillator and Distortion Analyzer (Sound Technology 1710A or equivalent).
Boonton 92C RF Voltmeter with 50 ohm adaptor
Asaca 201-1 Envelope Delay Measuring Set
Scope Camera
Various RF Adaptors and Connectors
Type N plug to BNC jack
Type BNC plug to Subminiax Plug
Type BNC plug to Subminiax Jack
Type BNC barrel
Bird Model 43 Wattmeter with elements from 1W to 1000W
Adaptor 1 5/8" coax to N connector
Manometer Dwyer model 40-1 (range 0.1-0-1.0"WC) or equal
Tee kit Dwyer A-604T or equal
Fluke Multimeter and Style C Current Probe

5.8 Inspect MOVs

Periodically visually inspect all MOVs to ensure proper transient protection. Replace if any damage is suspected, especially after thunderstorms.

5.9 Recommended Test Equipment

See Table 5-3.

5.10 Annual and Leap Year Clock Adjustment

The 24-hour clock/calendar function in the transmitter needs to be set to the new year annually.

The calendar does not recognize Feb 29. In a leap year, the date advances to March 1 on that date and must be reset to March 1 the following day.

Use the Enter Time and Date selection in the front panel SETUP menu to display the TIME AND DATE ENTRY SCREEN. The procedure for using this screen to set the date and time may be found in Section III of this technical manual.

5.11 RF Power Measurements

5.11.1 Through-Line Meters

Through-line wattmeters of known accuracy are acceptable for power measurements. However, once calibrated, the line section, sensing element, and meter must be used together as a set. The meter range should be chosen so that the measurement falls in the upper third of the scale movement. Different power range elements may be required for aural or individual visual PA measurements.

5.11.2 Calorimetric Measurements

Three measurements are required to use a water-cooled calorimetric RF load to determine average power: flow rate through the load in gallons per minute (G.P.M.), and water temperatures in degrees Celsius at the calorimeter inlet (T_{in}) and outlet (T_{out}). If water is used to cool the load, the following formula applies:

$$P_{average}\ (kW) = 0.264 \times (T_{out} - T_{in}) \times \text{G.P.M.}$$

CAUTION

The factor 0.264 in the above formula applies only if water is used as the coolant in the load. If a glycol coolant mixture is used, consult the glycol supplier to obtain the correct specific gravity factor based on their coolant formulation.

The formula listed in paragraph 5.11.3 for your transmitter system can then be used to convert the resulting average power figure to a peak-of-sync power level.

Carefully performed calorimetric power measurements are generally considered more accurate than through-line wattmeter measurements.

Higher accuracy is obtained if the flow gauge reading is close to full scale, but reduced flow is usually required to calibrate aural power levels because the lower power results in a smaller temperature differential.

If the flow rate is uniform, a volume meter (which measures total cubic feet of water) of may be connected in series with a sight glass flow gauge. The flow measurement in G.P.M. may then be confirmed by reading the number of cubic feet of water passing through the meter in a timed period, converting the cubic feet to gallons, (1 cu. ft = 7.48 gal.), and dividing by the length of the timed period in minutes.

Before selecting a flow meter, calculate a flow rate that will result in a 10°C temperature differential, based on visual average power. Use this figure as a starting point when selecting a flow gauge.

Thermometers are commonly available with 0.1°C accuracy. Since some digital thermometers have resolution in larger steps than the specified accuracy, check the resolution as well before selecting. Since some digital units are disrupted by RF fields, laboratory grade mercury thermometers may be necessary in hostile RF environments.

5.11.3 Visual Peak-Sync to Average Power Conversion Formulas

The transmitter's visual power meters read peak-of-sync power, but through-line meters and calorimeters yield average power measurements.

If a test signal consisting of only blanking and sync (black picture) is used, the following formulas apply:

For M/NTSC systems:

$P_{average} = P_{peak\text{-}sync} \times 0.595$

$P_{peak\text{-}sync} = P_{average} \times 1.68$

For B/PAL and B/SECAM systems:

$P_{average} = P_{peak\text{-}sync} \times 0.568$

$P_{peak\text{-}sync} = P_{average} \times 1.76$

5.12 Power Calibrations

The following procedure is used to calibrate the RF power detectors for each of the PA cabinets. The calibration procedure consists of using a known good power indicator as a reference, driving a cabinet to a known output power, and calibrating the forward and reflected peak detector output samples to a voltage which corresponds to full cabinet power output when seen by the monitor system.

Single cabinet systems are calibrated with the visual portion running at full peak-sync power. Multiple cabinet systems are calibrated with one cabinet on at a time, based on known relationships between power out of a single cabinet and power out of the transmitter.

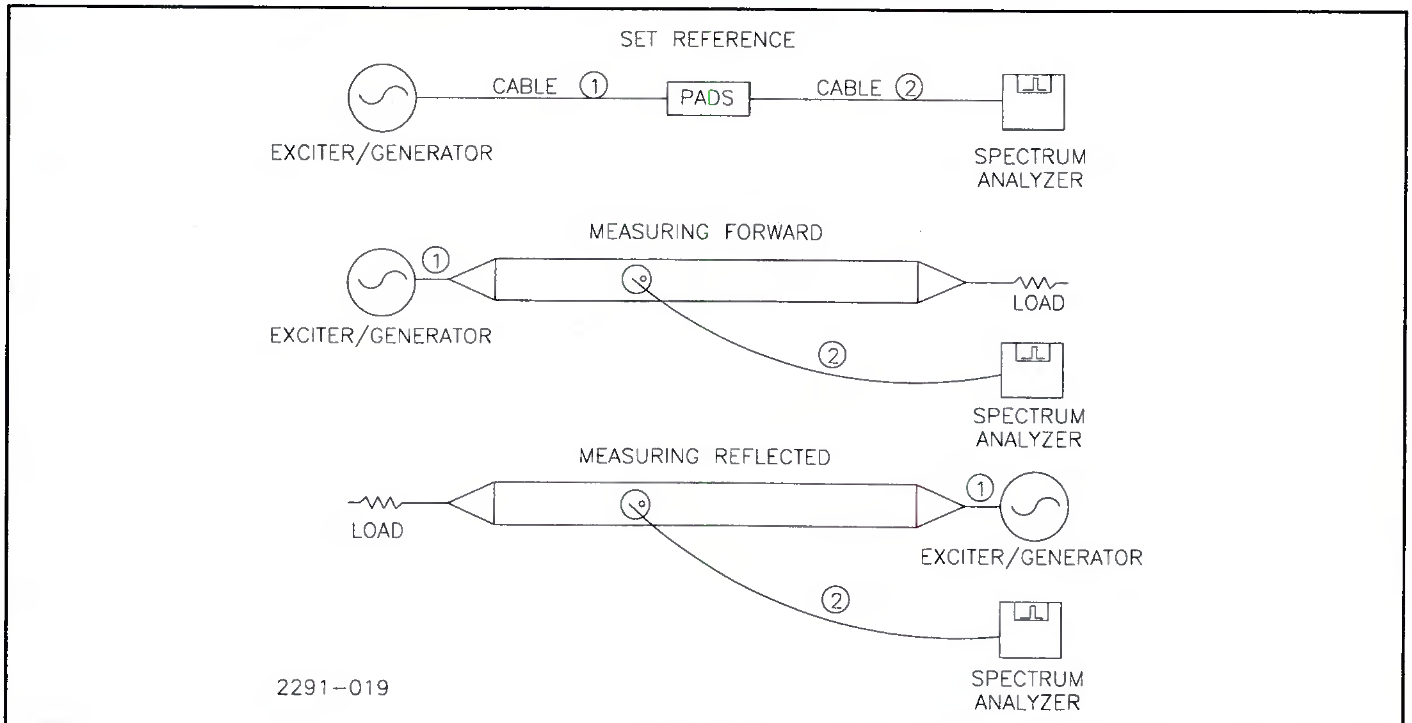

Figure 5-3. Directional Coupler Alignment Setups

For transmitter models which use one or more 10 kW or 15 kW cabinets, the individual PA cabinets are calibrated at their rated peak of sync power levels, and the peak detectors are calibrated to 2.5 volts at this power level.

HT1, HT2, and HT5 transmitters use different calibration voltage values for the peak detectors. The visual peak detectors are set to 1.8 volts, and the aural peak detectors to 0.8 volts, at the rated power. This is necessary because of the tradeoff required when adjusting couplers for desired coupling and maximum directivity at these lower power levels. A low coupling factor (typically 37.5 dB) must be used to achieve adequate forward to reflected directivity. If the directivity is too low, forward power flow will affect reflected power readings, resulting in errantly high VSWR readings for low values of reflected power.

If directional coupler detector bias adjustments are necessary, perform them using the procedudre provided in paragraph 5.11.2 before calibrating forward power. If a reflected peak detector adjustment is necessary, it is performed after forward power calibration, if necessary.

5.12.1 Directional Coupler Alignment

The directional couplers have been factory set and will not require any adjustment. Some special systems may use adjustable couplers. The coupling ratio and directivity must be selected to provide an in-range sample with good directivity for monitoring forward or reflected power.

The peak detectors on the Slave and Main controllers require +12 dBm (17 mW) at the input jack to deliver approximately 3 volts DC at the cathode of the detector diode. This allows some headroom in setting the 2.5 volt calibrate points.

If a coupler must be set in the field, use the following procedure:

a. Measure the loss in the sample cable. Calculate the ratio of 17 mW to the stage power being measured, in dB. The result will be negative.

b. 10 log(0.017/power in watts)=
-______dB.

c. Compensate the coupling ratio for the cable loss by adding the cable loss as a positive value. This gives the forward coupling needed.

d. Remove the directional coupler line section from the system, and set up the equipment per Figure 5-3.

e. Connect the exciter and spectrum analyzer input cables together through attenuator pads equal in value to the coupling ratio. Set a reference on the analyzer.

f. Remove the pads. Re-connect the exciter to the line section and the coupler to the analyzer.

g. Adjust depth of coupling in the forward mode to the reference level.

h. Reverse the connection of the exciter and the load, and adjust the coupler rotation for minimum reflected indication, noting the directivity. A minimum of 30 dB directivity is needed for measurements used to control interlocks, but more directivity gives better accuracy.

i. Repeat the depth and rotation adjustments until the desired coupling ratio and directivity values are reached.

j. Re-install the line section in the system and calibrate power of the stage.

5.12.2 Peak Detector Bias

The bias of each detector diode has been set at the factory, and should not be disturbed unless a component is replaced or a specific problem is noted. With no RF input applied, read the power indicated by the display panel for the detector being calibrated. Use a DMM to read the voltage of the detector diode cathode. Slowly increase the bias of the cathode (10-30mV approximately) until the last digit of the display reading changes from 0 to 1; then back off slightly, returning the reading to 0.

When bias is adjusted, the calibration of the detector in question must be checked as well.

5.12.3 Reflected Power Peak Detector Calibration

The forward power calibration of the peak detector is outlined later in this chapter. To calibrate the reflected power, first calibrate the forward power peak detector meter reading. Disable the exciter foldback on the Main Controller board by placing DISABLE JUMPERS J18 & J19 in the 2-3 positions. Next, rotate the reflected coupler sample element located in the line section to read forward power and calibrate (R87 Vis Ref & R91 Aur Ref) the reflected power reading to read the same power as the forward power meter reading. Rotate the reflected coupler sample elements back to the reflected power position. Return jumpers J18 & J19 to the foldback enable position 1-2. This completes the reflected power calibration.

5.12.3.1 Rev. H Main Controller

With version E11 or later software, the forward and reflected power meter readings can indicate a small power reading (<10 watts) when the transmitter is off. This is because the peak detector voltage follower output does not track the detector voltage near 0 volts. Later models (Rev. "H") of the Main Controller PC board use a ±12 volt supply for the voltage followers, which allows each follower output to track the peak detector input near the 0 volt level.

5.13 Visual RF Power Calibration

5.13.1 Single-Cabinet Transmitters

Turn the transmitter ON and apply blanking and sync test signal to the exciter. Be sure no "SET-UP" is used. Use external metering at the output port and adjust the average output power to the corresponding value below:

Model	M/NTSC	B/PAL B/SECAM
HT1	.595 kW	.568 kW
HT2	1.19 kW	1.14 kW
HT5	2.98 kW	2.84 kW
HT10	5.95 kW	5.68 kW
HT15	8.93 kW	8.52 kW

Table 5-4. Peak Detector Power Calibration

		FORWARD	*REFLECTED*
HT30LS/HT30HS	VISUAL PA (INDIVIDUAL CABINETS AS REQUIRED)	R60 @TP3 (VISUAL PA SLAVE CONTROLLER)	R74 @TP4 (VISUAL PA SLAVE CONTROLLER)
	VISUAL REJECT POWER	R95 @ TP5 MAIN CONTROLLER)	
	COMBINED VISUAL POWER	R79 @TP1 (MAIN CONTROLLER)	R87 @TP3 MAIN CONTROLLER)
	AURAL POWER	R83 @TP2 (MAIN CONTROLLER)	R91 @TP4 (MAIN CONTROLLER)
	VISUAL DRIVE POWER	R75 VISUAL DRIVE A @TP5 (AURAL PA SLAVE CONTROLLER) OR R76 VISUAL DRIVE B @TP6 (AURAL PA SLAVE CONTROLLER)	
	AURAL CHAIN POWER	R60 CHAIN A @TP3 (AURAL PA SLAVE CONTROLLER)	
		R74 CHAIN B @TP4 (AURAL PA SLAVE CONTROLLER)	

Check for correct sync ratio at the PA output. Connect a high impedance voltmeter to TP-1 on the Main controller 1A3 of the PA cabinet energized and adjust R-79 for the value in the table below:

Model	TP-1 voltage
HT1, HT2, HT5	1.8 V
HT10, HT15	2.5 V

The display panel should now indicate rated peak of sync power on the visual meter page.

Now connect the forward cable at J-7 to J-8 and adjust reflected calibrate control R-74 to the same voltage as above.

When finished, restore cables to their original positions.

5.13.2 HT20, HT30, HT60 Transmitters

For these transmitters, energize one visual PA cabinet at a time, and apply blanking and sync test signal to the exciter. Be sure no "SET-UP" is used. Use external metering at the combined port and adjust the combined average power to the value listed in the table below:

Model	M/NTSC	B/PAL B/SECAM
HT20	2.98 kW	2.84 kW
HT30	4.46 kW	4.26 kW
HT60	2.23 kW	2.13 kW

Check for correct sync ratio at the PA output. Connect a high impedance voltmeter to TP-3 on the slave controller of the PA cabinet energized and adjust R-60 for 2.5 Volts. The display panel should now indicate the rated cabinet peak of sync power (10 kW for HT20, 15 kW for HT30 and HT60) on the appropriate visual meter page. Connect the forward cable at J-7 to J-8 and adjust reflected calibrate control R-74 for 2.5 Volts at TP-4.

Restore the cables to the original configuration, then repeat the procedure for the remaining cabinet(s).

5.13.3 HT45 Transmitters

For 45 kW transmitters, energize one visual PA cabinet at a time. Apply blanking and sync test signal to the exciter. Be sure no "SET-UP" is used. Using external metering at the combined port, adjust the transmitter output power to the values of combined average power indicated in the correct table below. Use the table that corresponds to your system (M/NTSC, B/PAL, or B/SECAM). Check for correct sync ratio at the PA cabinet output.

Connect a high impedance voltmeter to TP-3 on the slave controller and adjust R-60 for 2.5 Volts. The display panel should indicate 15 kW on the appropriate visual meter page. Connect the forward cable at J-7 to J-8 and adjust reflect calibrate control R-74 for 2.5 Volts at TP-4. Restore cables to normal configuration.

Repeat the above procedure for each cabinet.

Combined Average Power Out Versus PA Cabinet Combinations
M/NTSC Systems

Cabinets ON			Average Combined Power Output
A	B	C	
15	0	0	2.98
0	15	0	2.98
0	0	15	2.98
15	15	0	11.9
15	0	15	11.9
0	15	15	11.9
15	15	15	26.8

Table 5-5. Setup Jumper Functions

This table lists the jumper settings for normal operation with a * before the jumper settings		
MAIN CONTROLLER		
*	J18-1 > 2	Enable visual foldback action.
	J18-2 > 3	Disable visual foldback action.
*	J19-1 > 2	Enable aural foldback action.
	J19-2 > 3	Disable aural foldback action
*	J20-1 > 2	Use internal +12 volts to power remote command inputs.
	J20-2 > 3	Use external power for the remote command inputs.
*	J21-1 > 2	Use internal +12 volts to remote status outputs.
	J21-2 > 3	Use external power for the remote status outputs.
*	J22-1 > 2	Normal operating position Battery in.
	J22-2 > 3	Battery disconnected normal storage position.
*	J23-1 > 2	Normal operation for AC OFF TIMER.
	J23-2 > 3	Used in factory test.
	J24-2 > 3	Turn transmiter off if interlock is opened.
SLAVE CONTROLLER		
	J16-1 > 2	Used when cabinet has only one 50 volt supply.
	J16-2 > 3	Used if cabinet has two 50 volt supplies.
MONITOR		
*	J50-1>2	Connects 5V charge current to battery.
*	J50-3>4	Connects WDOG to U27.
	J50-5>6	Connects (+) Bat to A/D.
	J50-7>8	Connects (+) side of battery to ground.
*	J50-9>10	Connects (-) side of battery to ground.

Combined Average Power Out Versus PA Cabinet Combinations B/PAL and B/SECAM Systems			
Cabinets ON			Average Combined Power Output
A	B	C	
15	0	0	2.84
0	15	0	2.84
0	0	15	2.84
15	15	0	11.4
15	0	15	11.4
0	15	15	11.4
15	15	15	25.6

5.14 Aural RF Power Calibration

The same general approaches used in calibrating the peak detectors for visual power monitoring are also used to calibrate the peak detectors for the aural transmitter.

5.14.1 1-20 kW Transmitters

Using external metering, adjust the power output from the transmitter to the rated aural power. Display the aural PA page on the front panel screen. Connect a high impedance voltmeter to TP-2 on the main controller board and adjust R-83 to 0.8 volts for the HT1, HT2, or HT5, or 2.5 volts for HT10, HT15, or HT20. The front panel display should read rated aural output power. Connect the forward cable at J-7 to J-9 and adjust reflected calibrate control R-91 for the same voltage as above at TP-4. Restore cables to normal configuration.

5.14.2 30 kW Transmitters

For 30 kW transmitters with 10% aural power, adjust the power output from the transmitter to 3 kW. Display the aural PA page on the front panel screen. Connect a high impedance voltmeter to TP-2 on the main controller board and adjust R-83 to 2.5 volts. The front panel display should read 3 kW. Connect the forward cable at J-7 to J-9 and adjust reflected calibrate control R-91 for 2.5 Volts at TP-4. Restore cables to normal configuration.

If the 20% aural power option is installed in the transmitter, energize only one of the RF chains and set the combined output power to 1.5 kW. Next, adjust R-60 on the slave controller for 2.5 volts at TP-3. The aural RF chain display should read 1.5 kW. De-energize that aural RF chain and energize the other chain. Repeat the procedure, this time adjusting R-74 and monitoring TP-4.

5.14.3 45 kW Transmitters

For the 45 kW transmitters with 10% aural, each RF chain is calibrated at 2.25 kW, and the combined transmitter output will be 1.125 kW. Thus, the same procedure, controls and test points are used as outlined in the 30 kW 20% aural calibration section, except that the controls are adjusted for 2.5 volts when the combined power measured is 1.125 kW.

For 20% aural, the aural path consists of three aural chains. Thus, the calibration process is the same as the visual power calibration process, except that an aural input signal and the combined aural output power readings in the table below are used. Note that unit 1 houses aural PA's A & B, and unit 2 houses aural PA C.

Display the aural PA front panel screen and energize each of the three aural RF chains separately (disable the appropriate driver module by squeezing its front panel switch, in order to de-energize a particular chain). Measure the combined aural output power, looking for the values listed in table below. Next, adjust R-60 for the aural RF chain 'A' (when that RF chain is energized) on the slave controller unit 1 for 2.5 volts at TP-3. The display should read 3.0 kW. Repeat the procedure for RF chains 'B' and 'C' and adjusting R-74 for 2.5 volts at TP-4 for RF chain 'B' and adjusting R-60 of unit 2 for RF chain 'C'.

Aural Power Out Versus Aural RF Chain Power			
Aural Chains Energized			Combined Output Power
A	B	C	
3	0	0	1.0
0	3	0	1.0
0	0	3	1.0
3	3	0	4.0
3	0	3	4.0
0	3	3	4.0
3	3	3	9.0

5.14.4 60 kW Transmitters

For 60 kW transmitters with 10% aural power, energize each aural RF chain separately and adjust the power to obtain 1.5 kW at the combined output of the transmitter. Display the appropriate aural PA page on the front panel screen. Connect a high impedance voltmeter to TP-3 on the slave controller board associated with that RF chain and adjust R-60 to 2.5 volts. The aural RF chain front panel display should read 3 kW.

If the 20% aural power option is installed, energize one of the RF chains in one of the cabinets and set the combined output power to 0.75 kW. Next, adjust R-60 on the slave controller for 2.5 volts at TP-3. The aural RF chain display should read 3.0 kW. De-energize that aural RF chain and energize the other chain in that cabinet and repeat the procedure except adjusting R-74 at TP-4. Repeat the process for the other aural PA cabinet.

5.15 Reject Load Calibration

This section covers calibration of the reject load power peak detectors for those transmitters with external reject loads.

5.15.1 20 kW Transmitters

5.15.1.1 Visual Reject Load

Energize one visual PA cabinet and apply a blanking and sync video signal. Drive the cabinet to 10 kW peak sync and adjust calibrate control R-95 on the main controller for 2.5 Volts at TP-5. The display should then read 5.0 kW on the visual meter page 2. De-energize that cabinet and energize the other. The display should show the same reading.

5.15.1.2 Aural Reject Load

An external reject load is used in the aural combiner system as well. Energize one of the RF chains and set the combined output power to 0.5 kW. Next, adjust R-103 on the main controller for 2.5 volts at TP-7. The aural RF reject power display should read 0.5 kW. De-energize that aural RF chain and energize the other chain, checking the calibration using the same procedure.

5.15.2 30 kW Transmitters

5.15.2.1 Visual Reject Load

Energize one visual PA cabinet and apply a blanking and sync video signal. Drive the cabinet to 15 kW peak sync and adjust calibrate control R-95 on the main controller for 2.5 Volts at TP-5. The display should then read 7.5 kW on the visual meter page 2. De-energize that cabinet and energize the other. The display should show the same reading.

5.15.2.2 20% Aural Reject Load

If the 20% aural power option is installed, an external reject load is used in the aural combiner system as well. Energize one of the RF chains and set the combined output power to 1.5 kW. Next, adjust R-103 on the main controller for 2.5 volts at TP-7. The aural RF reject power display should read 1.5 kW. De-energize that aural RF chain and energize the other chain, checking the calibration using the same procedure.

Table 5-6. Slave Controller S1 Settings

ADR	CABINET	SWITCH POSITION
		8 7 6 5 4 3 2 1
01	Aural 1	x x x o o o o c
02	Aural 2	x x x o o o c o
03	Visual A	x x x o o o c c
04	Visual B	x x x o o c o o
05	Visual C	x x x o o c o c
06	Visual D	x x x o o c c o

c= CLOSED o=OPEN x=UNUSED

WARNING: Disconnect primary power prior to servicing.

5.15.3 45 kW Transmitters

5.15.3.1 Visual Reject Loads

For 45 kW transmitters, each visual PA cabinet should be energized separately. Apply blanking and sync test signal to the exciter. Using external metering at the combined output port, adjust the combined power as indicated in the correct table below. Use the table which corresponds to your system (M/NTSC, B/PAL, or B/SECAM). Check for correct sync ratio at the PA cabinet output. Be sure no "SET-UP" is used. Connect a high impedance voltmeter to TP-3 on the slave controller and adjust R-60 for 2.5 Volts. The display panel should indicate 7.5 kW on the appropriate visual reject load display.

Repeat the above procedure for all three cabinets.

Reject Load Average Power Versus PA Cabinet Peak Sync Power M/NTSC Systems

Cabinets Energized			Peak Power Reject Load 1	Peak Power Reject Load 2	Peak Combined Power	Average Combined Power
A	B	C				
15	0	0	7.5	2.5	5.0	2.98
0	15	0	7.5	2.5	5.0	2.98
0	0	15	0	10.0	5.0	2.98
15	15	0	0	10.0	20.0	11.9
15	0	15	7.5	2.5	20.0	11.9
0	15	15	7.5	2.5	20.0	11.9
15	15	15	0	0	45.0	26.8

Peak Reject Load Power Versus PA Cabinet Peak Sync Power B/PAL and B/SECAM Systems

Cabinets Energized			Peak Power Reject Load 1	Peak Power Reject Load 2	Peak Combined Power	Average Combined Power
A	B	C				
15	0	0	7.5	2.5	5.0	2.84
0	15	0	7.5	2.5	5.0	2.84
0	0	15	0	10.0	5.0	2.84
15	15	0	0	10.0	20.0	11.4
15	0	15	7.5	2.5	20.0	11.4
0	15	15	7.5	2.5	20.0	11.4
15	15	15	0	0	45.0	25.6

5.15.3.2 Aural Reject Loads

For 45 kW transmitters with 10% aural, each aural RF chain should be energized separately. Using external metering at the combined output port, adjust the power to 1.125 kW. Connect a high impedance voltmeter to TP-7 on the main controller and adjust R-103 for 2.5 Volts. The display panel should now indicate 1.125 kW.

Repeat the above procedure for both cabinets.

For 45 kW transmitters with the 20% aural power option, the calibration process is the same as it was for the visual reject loads, except that different points are monitored and adjusted. The power levels for 20% aural will be those indicated in table below. The reject load monitoring points are located in the Aural PA cabinets, with reject load 1 being monitored in the Aural PA "A" cabinet and reject load 2 being monitored in the Aural PA "B" cabinet. For calibrating reject load 1 power, the high impedance voltmeter should be connected to TP-7 and R-77 should be adjusted for 2.5 volts with one of the RF chains energized. For calibrating reject load 2 power, the high impedance voltmeter should be connected to TP-7 and R-77 should be adjusted for 2.5 volts with one of the RF chains energized.

Reject Load Power Versus Aural RF Chain Power

Cabinets ON			Reject Load 1	Reject Load 2	Combined Output Power
A	B	C			
3	0	0	1.50	0.50	1.00
0	3	0	1.50	0.50	1.00
0	0	3	0	2.00	1.00
3	3	0	0	2.00	4.00
3	0	3	1.50	0.50	4.00
0	3	3	1.50	0.50	4.00
3	3	3	0	0	9.00

5.15.4 60 kW Transmitters

5.15.4.1 Visual Reject Loads

For the 60 kW transmitter, the reject load associated with the visual A & B cabinets may be calibrated by the same method used for the visual reject load calibration process for the 30 kW transmitter, except that R-78 in the aural PA "A" cabinet should be adjusted for 2.5 Volts at TP-8. The front panel display page indicating the reject load powers should indicate 7.5 kW. In like manner, the reject load associated with the visual C & D cabinets may also be adjusted for 7.5 kW on the display panel except that the adjustments may be made in aural PA "B" cabinet.

The final reject load for the combined visual cabinets may be calibrated by energizing visual PA cabinet "A" and "B" at 15 kW (peak) each and adjust calibrate control R-95 on the main controller for 2.5 Volts at TP-5. The display should then read 15 kW on the appropriate visual meter page.

5.15.4.2 20% Aural Reject Loads

For the 60 kW transmitter with 20% aural power option, the reject load associated with the aural A cabinet may be calibrated in the same method as the 30 kW transmitter with the 20% aural option, except that R-77 in the aural PA "A" cabinet should be adjusted for 2.5 Volts at TP-8. The front panel display page indicating reject load powers should indicate 1.5 kW. In like manner, the reject load power associated with the aural "B" cabinet can be calibrated using R-77 in the B cabinet slave.

Table 5-7. SS Monitor Switch Settings
(Software versions VHFSS01-S or later)

```
            OPTION SWITCH SETTINGS FOR SS VHF MONITOR

    Option Switch S3

S3  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
    |___|___|___|___|___|___|___|___|
      |   |   |   |   |   |   |   |
      |   |   |   |   |   |   |   |__8 {
      |   |   |   |   |   |   |______7      Transmitter
      |   |   |   |   |   |__________6      Size
      |   |   |   |   |______________5 }
      |   |   |   |__________________4 Redundant Aural
      |   |   |______________________3 Redundant Visual
      |   |__________________________2 20% Aural
      |______________________________1 High Band

    * To select the desired configuration,
      switches should be SET (bit n = 1)

    Transmitter Size Settings

    | 5 | 6 | 7 | 8 |
    |___|___|___|___|

      0   0   0   0    -    1kW
      1   0   0   0    -    2kW
      0   1   0   0    -    5kW
      1   1   0   0    -   10kW
      0   0   1   0    -   15kW
      1   0   1   0    -   20kW
      0   1   1   0    -   30kW
      1   1   1   0    -   45kW
      0   0   0   1    -   60kW

    Option Switch S4

S4  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
    |___|___|___|___|___|___|___|___|
      |   |   |   |   |   |   |   |
      |   |   |   |   |   |   |   |__8 {  AC Power
      |   |   |   |   |   |   |______7    selection  }
      |   |   |   |   |   |__________6 Exciter Switcher
      |   |   |   |   |______________5 Screen Blanker
      |   |   |   |__________________4        (On-Enabled,
      |   |   |______________________3         Off-Disabled)
      |   |__________________________2
      |______________________________1  DUAL SUPPLY
                                        HT 1 & HT 2
    AC Power Selections

    | 7 | 8 |
    |___|___|

      0   0    -   230 VAC +/- 20%
      1   0    -   345 VAC +/- 20%
      0   1    -   460 VAC +/- 20%
```

SCREEN BLANKER - Blanks the screen, when enabled, after 1 hour of inactivity on the function keys. Any key press after blanking redisplays last screen.

WARNING: Disconnect primary power prior to servicing.

The final reject load for the combined aural cabinets may be calibrated by energizing aural PA cabinet "A" at 3 kW (or 6 kW for 20% aural power option) and adjust calibrate control R-103 on the main controller for 2.5 volts at TP-7. The front panel display page indicating the reject load powers should then read 1.5 kW (or 3 kW for 20% aural option) on the appropriate aural meter page.

5.16 AGC Setup

The transmitter should be operating at normal ambient temperature and warmed up approximately 30 minutes. This procedure is the same for visual and aural.

NOTE

The twelve turn potentiometers used for EXC ADJUST and SET can be from different manufactures. Electrically they have the same value but differ in the direction the control is rotated to increase the voltage.

a. Reduce exciter power to zero, and switch AGC MODE switch to OFF.
b. Increase exciter power for 100% transmitter power output.
c. Measure the exciter sample at the EXC test point. The value should be between 1.2 and 1.5 volts DC.
d. Rotate the EXC ADJUST pot on top of AGC card to bring the voltage within this range if needed.
e. Measure the transmitter sample at test point TX, and adjust SET pot for the same or slightly less voltage that the exciter sample.

NOTE

It may be necessary to add or delete attenuation pad(s) in transmitter sample line to obtain proper voltage.

f. Reduce transmitter power to zero.
g. Switch AGC MODE switch to ON.
h. Increase exciter power until transmitter power is 100%.
i. Adjust SET pot to reduce transmitter power to about 70% for room temperatures near 70°F. If room temperature is near 110°F adjust to 95%, and if near 50°F adjust for 65%.
j. Increase exciter drive to 100% power.

If there are problems with module overdrive faults when turning ON the transmitter when the room is cold, adjust SET pot for less power reduction.

If the transmitter sample voltage is much less than the exciter sample, there may not be enough range for power reduction adjustment.

NOTE

If adjusting the visual AGC changed the drive level, check adjustment of the exciter precorrection for differential gain, ICPM, and differential phase. Refer to the exciter manual.

5.17 Monitor Configuration Switches

Two eight-bit configuration switches on the monitor board are used to configure the monitor system for use in a given transmitter model. See Table 5-7 on page 5-11.

5.18 Lamp Test

The Main Controller board has a press-to-test switch to turn on all Fault Status Indicator lamps.

5.19 AC Line Sample Calibration

The monitor board has three controls for calibration of the line voltage readings. They are located just above and to the right of the battery on the Monitor board.

WARNING

WHEN MEASURING THE LINE VOLTAGES, REMOVE ALL POWER FROM THE CABINET, ATTACH THE TEST PROBES, CLOSE THE CABINET, AND RE-ENERGIZE THE POWER TO THE CABINET.

Measure line voltage at line sample kits. Adjust R-90 for phase A-B to read the correct voltage on the display panel line information screen.

Adjust R-91 for phase B-C, and R-92 for phase AC.

5.20 Slave Addressing

If the Slave Controller board is replaced or swapped for troubleshooting purposes, the address must be set using S1. Addresses are shown in Table 5-6.

5.21 Slave Analog Channels Calibration

Disconnect the cable at J-6 on the slave controller. Measure the voltage at pins 3 and 4, then reconnect the cable.

Call up the supply information page on the display panel, and adjust R-46 to calibrate the PS-1 current reading to 100 amps per 1 volt measured.

Check that the other analog functions are being correctly displayed. The ratio of sample voltage to displayed supply voltage value is 2.5 V with the cable removed = 50 V on the display.

J-6 functions	1-2	PS-1 volts
	3-4	PS-1 current
	5-6	PS-2 volts
	7-8	PS-2 current

5.22 VSWR Protection Adjustments

5.22.1 Foldback

VSWR Foldback provides protection for the external RF system, hybrids, diplexers, filters, reject loads, as well as the Gysel combiners and the Gysel combiner reject loads. It is recommended that the VSWR foldback threshold adjustments not be changed from the factory settings, 1.20:1 visual and 1.40:1 aural.

NOTE

The following adjustments assume correct calibration of the forward and reflected power metering.

5.22.2 Visual Foldback and Fault Adjustment

a. Depress and hold both exciter lower buttons for 15 seconds to insure minimum output

b. Temporarily remove the remote I/O cable from J9 on the back of the exciter to enable the exciter without running the transmitter.

c. Connect the visual exciter output for the visual forward power sample at J6 on the back of the main controller.

d. Connect the aural exciter output to the visual transmitter reflected power sample input J8 on the back of the main controller, 1A3.

e. Adjust the visual exciter output for 100% power on the front panel transmitter meter.

f. Set the level of the reflected signal (aural exciter) such that the front panel display indicates a visual VSWR of 1.20:1.

g. If the front panel FOLDBACK ACTIVE fault indicator is on, adjust the visual foldback threshold adjust (R20 on the main controller) until the foldback indicator turns off.

h. Now adjust R20 until the FOLDBACK ACTIVE fault indicator just comes on.

i. Set Visual foldback jumper J18 to connect pins 2 and 3 (disabled)

j. Slowly raise the aural exciter power. The VSWR FAULT lamp should illuminate at approximately 1.4:1. R51 adjusts the threshold of the VSWR fault.

k. Lower the aural exciter power. Reinstall J18 to pins 1 and 2 (enabled).

5.22.3 Aural Foldback and Fault Adjustment

a. Connect the aural exciter output to the aural forward power sample at J7 on the main controller.

b. Connect the visual exciter output to the aural transmitter reflected power sample input J9.

c. Adjust the aural exciter output for 100% power on the front panel transmitter meter.

d. Set the level of the reflected signal (visual power) such that the front panel display indicates a aural VSWR of 1.40:1.

e. If the front panel FOLDBACK ACTIVE fault indicator is on, adjust the aural foldback threshold adjust (R33 on the main controller) until the foldback indicator turns off.

f. Now adjust R33 until the FOLDBACK ACTIVE fault indicator just comes on.

g. Set Aural foldback jumper J19 to connect pins 2 and 3 (disabled).

h. Slowly raise the aural exciter power. The VSWR FAULT lamp should illuminate at approximately 1.6:1. R63 adjusts the threshold of the VSWR fault.

i. Lower the aural exciter power. Reinstall J19 to pins 1 and 2 (enabled).

j. Restore the normal inputs to the main controller J6 through J9. Reconnect P9 to the back of the exciter, this connection is vital for VSWR protection.

5.23 Slave Controller RF Detectors

5.23.1 Slave Controller

The Slave Controller has 6 RF peak detectors for use in the various system configurations. They are normally used to read the visual drive power to the visual PA final amplifiers, but in some configurations are used to read the aural PA output samples.

5.23.2 Visual Driver Calibration

To calibrate the visual drive, set the transmitter up for normal operation using a black picture signal, and check for proper sync level. Then, disconnect the coax drive line to the final PA splitter and patch it into a 50 Ohm dummy load with a wattmeter. Finally, set the Slave Controller peak detector calibration potentiometer so that the display panel visual drive wattmeter peak of sync power reading corresponds to the average power level read on the patched-in wattmeter. (Multiply the wattmeter reading by 1.68 for M/NTSC systems, or 1.76 for systems B/PAL and B/SECAM, to convert the average power measurement to a peak-of-sync power figure.) Return the drive line coax cable to the PA splitter input.

6.1 Introduction

This section contains procedures for troubleshooting problems in a *Platinum Series®* transmitter system.

The transmitter architecture is modular, consisting of several subsystems. The basic approach to troubleshooting a problem in the transmitter is to isolate the faulty subsystem.

Many transmitter problems can be identified by the fault and status indicators on the front panel of the control cabinet. Information given by the display can also assist in localizing the source of the problem.

If a module failure is suspected, the easiest way to confirm or disprove the possibility is by swapping the suspected faulty module with a properly operating module from another slot. If the fault follows the module, the problem is probably internal to the module. If the fault remains at the same slot after substituting modules, then the search for the problem should focus on the rest of the transmitter system.

It is suggested that a chart be kept, showing a diagram of the transmitter cabinet slots and the serial number of the module in each slot. Also, keep a log of maintenance and repair performed on both the modules and the transmitter system. This information can be useful in isolating recurring problems.

6.2 50 Volt Power Supply Troubleshooting

Troubleshooting the 50 volt power supply may be done by a process of elimination. First, a visual inspection of the power supply should be performed to identify any overheated components.

When a power supply exhibits a fault condition, swap the control board with one from another power supply or a different control board if a spare board exists. If the problem follows the control board, replace the control board.

NOTE

There is always a small risk in substituting boards; that a circuit defect can result in board damage.

If the problem stays with the power supply, disconnect all power to the cabinet containing the power supply, remove the power supply from the cabinet and remove the lid. The next step is to check for failed SCRs.

Removing the control card will allow access to the SCRs and CR1. Using an ohmmeter, check each SCR and CR1 for a shorted condition. A normal SCR will measure very high resistance with the ohmmeter test leads configured in both directions. CR1 should measure a low resistance with test leads configured in one direction and a very high resistance with test leads configured in the other direction.

6.3 Cabinet Complete Power Down

It may be desirable in some cases to perform maintenance on one visual PA while operating at reduced power using the remaining cabinet.

When no power is available to a cabinet slave controller, it may load down the data bus in early versions of the slave controller and cause errors in the analog values displayed for the remaining cabinet in use. Slave controller boards beginning with Revision F contain a relay, K1, which automatically disconnects the slave controller analog lines from the data bus when power is removed from the board.

Disconnect the slave monitor ribbon cable at J1 on the slave controller during service to lift it from the data bus and allow normal readings for the cabinets still in use.

6.4 Monitor System RESET

S2 on the monitor board may be used to restart the system in the event of lock up due to noise or transient from some external source. User programming should remain intact.

6.5 Monitor System ABORT

S1 on the monitor board will restart the processor. Any user programming must be reentered. The power set points will default to the NORMAL values determined by the switch settings. All alarms in the alarms queue will be cleared and will start a new sequence of numbering the faults. The bargraph page and D/A Edit selections will return to the default parameters.

6.6 Contents of Raw Data Screens

Here is an explanation of the data contained on the Monitor Raw Data screens. There are three major types of data presented on these screens:

a. Analog converted to Digital (A/D)
b. Bit wise Status Information
c. Monitor Microprocessor Exception status.

The A/D data is a decimal number in the range of 0 to 4095, representing an analog voltage from 0 to 5 volts (4.99877..volts). This can also be interpreted as 819 counts per volt.

The Status information is presented on the MAIN Screen as ON or OFF while on the SLAVE Screen the information is presented as 1 or 0. In general 1 corresponds to ON and 0 corresponds to OFF.

The Microprocessor Exception status is displayed as Hexadecimal digits. The status appears when a processing exception is sensed by the microprocessor and it automatically resets itself. The information displayed is as follows:

- Exception Number: This is a code for the exception that occurred. In most cases this is meaningless to the user and should be recorded along with the Exception Status and Exception Address and reported to Harris Service.

One exception number of which the user should be aware is 4444. This exception is recorded when the ABORT button is pushed and the Monitor resets itself. This does not indicate any monitor problem, but the pushing the ABORT switch does reset the monitor back to its default state and settings.

- Exception Status: This is the record of the Microprocessor State when the exception occurred.
- Exception Address: This is the value of the Microprocessor Program Counter when the exception occurred.

Except in the case of exception number 4444, the Exception information should be recorded and returned to Harris. The Exception display can then be cleared by depressing the CLEAR softkey, otherwise this exception will be displayed each time this screen is displayed. Whenever a Watchdog Timer Alarm is logged in the Alarm queue, the MAIN raw data screen should be checked for a record of an Exception.

6.7 Main Raw Data Screen Information

a. Column 1: Analog Information (Divide by 819 to get raw analog voltage)

1. VIS FWD PWR: Total Visual Power Output Peak Detector Voltage. REJ LOAD 1: Reject Load 1 Peak Detector Voltage.
2. AUR FWD PWR: Total Aural Power Output Peak Detector Voltage. REJ LOAD 2: Reject Load 2 Peak Detector Voltage.
3. VIS REF PWR: Visual Output Reflected Power Peak Detector
4. REJ LOAD 3: Reject Load 3 Peak Detector Voltage.
5. AUR REF PWR: Aural Output Reflected Power Peak Detector
6. EXC VIS SENSE: Exciter Visual Sense Voltage
7. VIS REF O SET: Visual Reflected Power Overload Set Point Voltage EXC AUR SENSE: Exciter Aural Sense Voltage
8. AUR REF O SET: Aural Reflected Power Overload Set Point Voltage CONTR BATTERY: Discrete Controller Battery Voltage
9. VIS FB SET: Visual Foldback Set Point Voltage
10. AUR FB SET: Aural Foldback Set Point Voltage
11. ZERO SCALE: A/D Zero Scale Calibration Potentiometer Voltage GROUND REF: Analog Ground Reference

b. Column 2: Analog Information

1. AC LINE 1: AC Line Monitor 1 Output Voltage
2. AC LINE 2: AC Line Monitor 2 Output Voltage
3. AC LINE 3: AC Line Monitor 3 Output Voltage
4. VIS AGC V: Visual AGC Voltage Monitor Voltage
5. AUR AGC V: Aural AGC Voltage Monitor Voltage
6. UNUSED 21:
7. UNUSED 22:
8. VIS PWR SET:
9. AUR PWR SET:
10. MON BATTERY: Monitor Battery Voltage
11. V UNREG: Logic Power Supply Unregulated Output Monitor Voltage FULL SCALE: A/D Full Scale Calibration Potentiometer Voltage
12. 5 V: Logic Power Supply 5 Volt Output Monitor Voltage
13. 12 V: Logic Power Supply +12 Volt Output Monitor Voltage
14. NEG 12 V: Logic Power Supply -12 Volt Output Monitor Voltage
15. CABINET BUS: Value currently read from the slave cabinet analog bus (This is a rapidly changing value and is normally meaningless)

c. Column 3 Status

1. TXON: ON = Transmitter is ON
2. UNUSED 1:
3. LOCAL: ON = LOCAL/REMOTE switch is in LOCAL
4. VIS EXC MUTED: ON = Visual Exciter is Muted
5. AUR EXC MUTED: ON = Aural Exciter is Muted
6. VIS EXC UNLCK: ON = Visual Exciter has lost Phase Lock
7. AUR EXC UNLCK: ON = Aural Exciter has lost Phase Lock
8. EXT ILK: ON = External Interlock is Active
9. FAILSAFE: ON = Failsafe Interlock is Active
10. VIS REF OVLD: ON = Visual Reflected Overload Condition
11. VIS FB ACT: ON = Visual Foldback is Active
12. AUR REF OVLD: ON = Aural Reflected Overload Condition
13. AUR FB ACT: ON = Aural Foldback is Active
14. VIS FB ENBLD: ON = Visual Foldback is Enabled
15. AUR FB ENBLD: ON = Aural Foldback is Enabled
16. PHASE LOSS: ON = AC line Phase Monitor has detected loss of phase

d. Column 4 Status

1. EXC A SELECTED: ON = Exciter A is selected to be active
2. EXC B SELECTED: ON = Exciter B is selected to be active
3. EXC SW MAN: ON = Exciter Switcher is in manual mode

4. EXC A FAULT: ON = Exciter A is in a Fault condition
5. EXC B FAULT: ON = Exciter B is in a Fault condition
6. SPARE 1:
7. SPARE 2:
8. SPARE 3:
9. SPARE 4:
10. VIS AGC EN: ON = Visual AGC is enabled
11. AUR AGC EN: ON = Aural AGC is enabled
12. UNUSED 010b:
13. PFAIL: ON = Monitor has detected an impending power failure
14. WDOGFAIL: ON = Monitor Watchdog timer has expired
15. AD STATUS: ON = Analog to Digital Converter has conversion failure
16. UNUSED 010f:

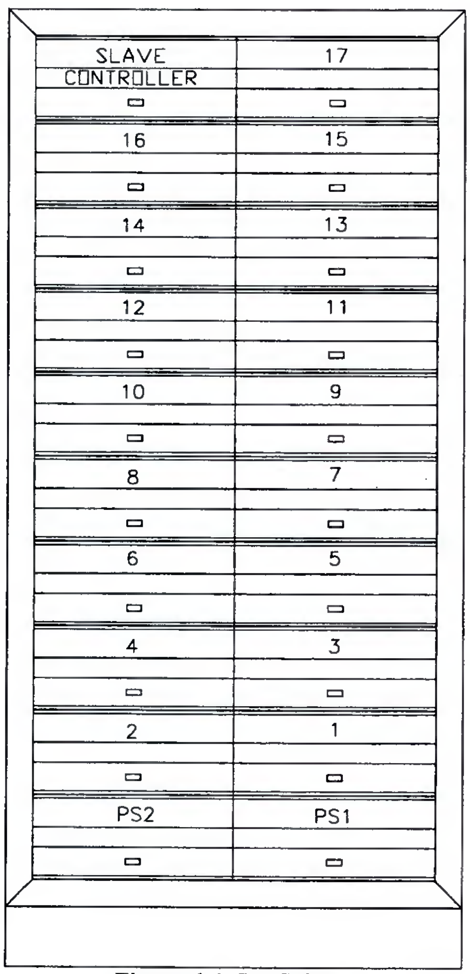

Figure 6-1. PA Cabinet Module Slot Numbers

6.8 Slave Raw Data Screen Information

The same information is reported for all active slave cabinets on this screen. Each Column containing a cabinets information is headed by a cabinet designator:

- AURA: Aural Cabinet A
- AURB: Aural Cabinet B
- VISA: Visual Cabinet A
- VISB: Visual Cabinet B
- VISC: Visual Cabinet C
- VISD: Visual Cabinet D

NOTE

(Not all cabinets present in all configurations.)

The information presented for each cabinet is:

- AIRF: 1 = Air Fault
- DORF: 1 = Door Fault
- PS1F: 1 = Power Supply 1 Fault
- PS2F: 1 = Power Supply 2 Fault
- SPAR1: Spare
- SPAR2: Spare
- SPAR3: Spare
- TXD: 1 = Cabinet is OFF
- MODF: This is a Hexadecimal number with each bit of each hex digit corresponding to a module slot in the cabinet. The low order bit of the low order digit refers to slot one, the next high order bit refers to slot two, and so on up to slot 17. A bit equal to one means that the module in the referenced slot has a fault. See Figure 6-1 and Table 6-1.
- ID: This is the hexadecimal representation of the cabinet address as entered in the DIP switches on the Slave Controller. RF1: Peak Detector 1 Output Voltage
- RF2: Peak Detector 2 Output Voltage
- RF3: Peak Detector 3 Output Voltage
- RF4: Peak Detector 4 Output Voltage
- RF5: Peak Detector 5 Output Voltage
- RF6: Peak Detector 6 Output Voltage
- PS1V: Power Supply 1 Voltage Output Monitor voltage
- PS1A: Power Supply 1 Current Output Monitor voltage
- PS2V: Power Supply 2 Voltage Output Monitor voltage
- PS2A: Power Supply 2 Current Output Monitor voltage

Table 6-1. MODF Hexadecimal Coding vs Slot Faults

The MODF number shows which slots are reporting faults. Five digits allow complete coding of the 17 slots as follows:

Module slots #1 to #4 are represented by the lowest digit (0 0 0 0 **X**)
Modules slots #5 to #8 by the second lowest digit (0 0 0 **X** 0)
Modules slots #9 to #12 by the third lowest digit (0 0 **X** 0 0)
Modules slots #13 to #16 by the fourth lowest digit (0 **X** 0 0 0)
Module slot #17 only is represented by the fifth lowest digit (**X** 0 0 0 0)

Each of the module slots is represented by a bit in a hexadecimal number, and each bit is either on or off (off = 0 = no fault, on = 1 = fault).

The lower four hexadecimal numbers represent four modules each while the fifth hexadecimal number represents only module slot 17. Therefore the fifth digit can only be a 1 or a 0 depending upon the fault condition of module in slot 17 only.

The four lower hexadecimal numbers each show the conditions of four module slot positions as follows:

0 = no faults in any of the four module slots represented in that group of four slots
1 = fault in the lowest slot number in that digits group of four slots
2 = fault in the second lowest slot number in that digits group of four slots
4 = fault in the third lowest slot number in that digits group of four slots
8 = fault in the highest slot number in that digits group of four slots

The hexadecimal number in each digit represents the sum of the four fault bits for that group, i.e., if slots #2 and #4 have faults, the lowest digit will show an A which represents the sum of 8 and 2 in hexadecimal. If all four slots in a group have faults then the digit will show an F (1 + 2 + 4 + 8 = 15 = F).

If the hexadecimal number shown is 1 0 0 F 0, modules in slots #5 through #8 and module in slot #17 are giving fault indications.

Some examples of fault conditions follow:

SLOT NUMBERS					
17	13-16	9-12	5-8	1-4	
0	0	0	0	0	No faults detected
0	1	0	6	0	Faults detected in slots #13, #6, and #7 (First slot represented by digit four and second and third slots represented by digit 2)
1	0	F	0	0	Fault detected in slot #17 and in slots #9, #10, #11, & #12
0	0	2	2	0	Faults detected in slots #10 and #6
0	C	0	0	0	Faults detected in slots #15 and #16 (8 +4 = 12 = C)
1	F	F	F	F	Faults detected in all 17 slots

Decimal #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Hexadecimal #	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F

Section VII
Transmitter Parts List

7-1. Replaceable Parts Service

Refer to the Replaceable Parts Service clause on back side of manual title page.

NOTE

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

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WARNING: Disconnect primary power prior to servicing.

Table 7-1. CONTROL CAB - 992 7078 001

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
041 1310 030	GASKET, RUBBER	12.60 FT	
299 0012 000	NYLON ROPE 1/8 IN D	1.0 FT	#CUT 8.5 IN LENGTH TO BEUSED WITH EXCITER UNIT AND CUT 3.0 IN LENGTH TOBE USED WITH ACCESSORY UNIT
302 0699 000	SCR, 10-24 X 1/4	4.0 EA	#HINGES
302 0700 000	SCR 10-24 X 1/4	4.0 EA	#HINGES ON DOOR
350 0105 000	RIVET 3/16 ALUM .126/.25	38.0 EA	
350 0128 000	RIVET, POP 3/16" DIA	6.0 EA	#USE WITH 939-7900-531 Z-BRKT
354 0035 000	SOLDER LUG 6 MTG HOLE	10.0 EA	#MOV
354 0260 000	LUG #6 RECT YEL 12-10AWG	4.0 EA	#USED WITH WIRE ROPE
356 0208 000	CLAMP, FLAT CABLE 2"	10.0 EA	
356 0214 000	CLAMP, FLAT CABLE 1 IN.	2.0 EA	
358 1022 000	SLIDE, DRAWER	2.0 EA	#USED WITH ACCESSORY PANEL
358 1214 000	SCREWLOCK, FEMALE	1.0 EA	#1A7J34
358 1866 000	BUMPER, MOLDED	2.0 EA	#USED TO PROVIDE STOP AND PRESSURE POINT FOR HINGED MASTER CONTROL PANEL.
358 2040 000	S HOOK	2.0 EA	#USED WITH EXCITER AND ACCESSORY UNITS
358 2995 000	END PLATE, 261 TERM BD	4.0 EA	#I/O 1TB001 1TB002 1TB003 1TB004
358 3000 000	END STOP, RAIL MTG MODULE	2.0 EA	TB001
358 3139 000	STUD, BRS 1/4-20 X 3	2.0 EA	#GND
358 3190 000	PLUG, WHT .500" HOLE	8.0 EA	
358 3203 000	BOLT, CARRIAGE, 1/2-13X8"	2.0 EA	#SKID BOLTS
358 3223 000	FEMALE SCREWLOCK .56"4-40	3.0 EA	#1A7J31 #1A7J32 #1A7J33
358 3283 000	SLIDE, FULL EXT DRAWER	0.0 EA	#USED WITH EXCITER BOX PART NO EQUALS ONE PAIR
384 0431 000	RECT. 1N4001 ESD	1.0 EA	CR101
404 0578 000	SOCKET RELAY, 4PDT	1.0 EA	XUK2
424 0502 000	BUMPER 5/8 DIA X 1/4 THK	2.0 EA	
430 0031 000	FAN CARAVEL CL3T2/020191	1.0 EA	1B001
430 0202 000	SCREEN GUARD, WIRE FORM	1.0 EA	#1B001
448 0729 000	STRIKE MAGNETIC CATCH	1.0 EA	
448 0906 000	HINGE DOOR POSITIONING	2.0 EA	#REAR DOOR
448 0937 000	HINGE DOOR POSITIONING	2.0 EA	#DOOR
448 1005 000	CATCH, CONCEALED TOUCH	1.0 EA	
559 0054 000	*THERMISTOR, NTC 25K @ 25C	4.0 EA	1RT1 1RT2
560 0049 000	MOV 4500A 75J 275VAC	2.0 EA	#P/S CR013 CR014
574 0156 000	RELAY 12VDC 4PDT	1.0 EA	1K002
606 0825 000	CKT BKR 15A 3P 480VAC	1.0 EA	1CB001
614 0147 000	TERM STRIP 6 TERM 2 GND	1.0 EA	1TS1
614 0786 000	TERM BD, 2C MODULAR 261	20.0 EA	1TB004 (14) #I/O (6)
614 0787 000	TERM BD, 4C MODULAR 261	23.0 EA	1TB002 (9) 1TB003 (12) 1TB004 (2)
614 0808 000	TERM BLOCK MODULAR 283 FT	4.0 EA	1TB001
620 2109 000	JACK, BNC 75 OHM BULKHEAD	4.0 EA	#I/O-J001 J002 J003 J004
620 2583 000	DIRECTIONAL COUPLER	1.0 EA	DC001
646 0665 000	INSPECTION LABEL	1.0 EA	
646 1426 000	END PLATE 283 FRONT ENTRY	1.0 EA	#1TB001
736 0216 000	PWR SUPPLY 12V, 6.8AMP DC	1.0 EA	
736 0217 000	PWR SUPPLY TRIPLE OUTPUT	1.0 EA	
740 1139 000	PHASE MONITOR 208V-240V	0.0 EA	FD PART 1K1
822 0900 174	SPACER-SAFETY COVER	1.0 EA	#USED WITH DISPLAY COVER
822 0900 182	SPACER-SAFETY COVER	1.0 EA	#USED WITH DISPLAY COVER
827 6893 001	PLATE	1.0 EA	#GND
829 9135 301	MTG. TERM BOARD	1.0 EA	TB001
839 7900 095	HINGE, PLATE	2.0 EA	

839 7900 098	GROUND STRAP, CAB	1.0 EA	#GND
839 7900 261	GND STRAP-CONT CAB	1.0 EA	
843 4999 148	PANEL I/O CONTROLLER CAB	1.0 EA	
852 9200 139	CBL LAY, CTRL CAB COAX	0.0 EA	
852 9200 140	CBL LAY, CTRL CAB COAX	0.0 EA	
917 2100 090	CABLE, RIBBON 20C	1.0 EA	#CONTROLLER
917 2100 091	CABLE, RIBBON FAULT	1.0 EA	
917 2100 113	CABLE, 50 COND, MAST.CONT	1.0 EA	JUMPER
917 2100 114	CABLE, EXCITER CONTROL	1.0 EA	
917 2100 115	CABLE, CONTROL	1.0 EA	
917 2100 116	CABLE, STATUS	1.0 EA	
917 2100 117	CABLE, ANALOG	1.0 EA	
917 2100 118	DOOR ASSY	1.0 EA	
917 2100 272	CABLE GND CONT CAB	1.0 EA	#USED TO CONNECT FRONT PANEL TO SIDE OF CABINET SKIN FOR GND CONNECTION
917 2100 571	CABLE PKG, MAIN	1.0 EA	
917 2501 003	BRAKE, SLIDE BRACKET	2.0 EA	
922 0900 099	EXC/CONT-TOP/BASE TRIM	2.0 EA	
922 0900 100	CAB VERTICAL TRIM	2.0 EA	
922 0900 121	TRIM MOUNTING PLATE	12.0 EA	
922 0900 444	BRKT MOV BD CONTROL CAB	1.0 EA	#BRKT FOR MOV P.C.
939 7900 531	BRKT-Z-HINGE MST CONT PNL	2.0 EA	
939 7900 839	CABLE RETRACTOR	2.0 EA	
943 4999 087	BLANK 19.0" EXTRUSION	3.0 EA	
943 4999 105	KICKPLATE, FRONT	1.0 EA	
943 4999 107	BRK'T, SLIDE SUPPORT	2.0 EA	#USED WITH ACCESSORY PANEL
943 4999 156	PLATE,MTG,SPARE EXTRUSION	3.0 EA	
943 4999 164	COVER, CABINET BASE	1.0 EA	
943 4999 172	COVER, CIRCUIT BREAKER	1.0 EA	
943 4999 173	COVER, CABINET BASE	1.0 EA	
943 4999 174	COVER, DISPLAY BOARD	1.0 EA	
943 4999 258	BRKT, SLIDE - RIGHT	2.0 EA	#USED WITH EXCITER BOX
943 4999 267	BOX, FAN MTG	1.0 EA	
952 9200 004	CABINET ASSY CONT.	1.0 EA	
952 9200 012	PANEL BD MTG CONTROLLER	1.0 EA	
952 9200 013	PANEL, LEFT SIDE CONT CAB	1.0 EA	
952 9200 014	PANEL,RIGHT SIDE CONT CAB	1.0 EA	
992 6975 001	CONNECTOR KIT, 37 PIN D	1.0 EA	#BAG THIS CONNECTOR KIT AND ATTACH TO I/O PANEL 843-4999-148. USE WITH REMOTE CONTROL CONNECTIONS.
992 8008 001	MASTER CONTROLLER ASSY	1.0 EA	1A003
992 8009 001	ACCESSORY CARD CAGE ASSY	1.0 EA	1A005
992 8553 001	MOV-AC PROTECTOR ASSY	1.0 EA	MOV'S P.C.
994 8935 002	BASIC LINE VOLTAGE SAMPLE	3.0 EA	1A008
999 2596 001	HARDWARE LIST	1.0 EA	
999 2597 001	WIRE/TUBING LIST	1.0 EA	

Table 7-2. MASTER CONTROLLER ASSY - 992 8008 001

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
384 0828 000	LED,GREEN,AML21 SW SERIES	1	#ON
384 0829 000	LED,YELLOW,AML21 SW	1	#LOCAL
406 0510 002	INTERFACE PCB, RS232	1	#DISPLAY
406 0510 005	AMBER CIR POL FILTER	1	#DISPLAY

406 0510 006	ADAPTER	1	#DISPLAY
540 0868 000	RES 15 OHM 1/4W 5%	2	#DS001 #DS002 R001 R002
604 1095 000	SWITCH, SPDT, ALT ACTION	1	LOCAL
604 1096 000	SWITCH, MOMENTARY SPDT	10	"FUNCTION, HELP, RAISE, LOWER"
604 1097 000	SWITCH, MOMENTARY SPDT	2	"ON, OFF"
604 1098 000	BUTTON, SWITCH, RED	1	OFF
604 1099 000	BUTTON, SWITCH, YELLOW	1	LOCAL
604 1100 000	BUTTON, SWITCH, GREEN	1	ON
604 1101 000	BUTTON, SWITCH, WHITE	10	#FUNCTION, HELP, RAISE, LOWER
646 1467 000	OVERLAY HT SERIES BASIC	1	
839 7900 071	BOX, LIGHT - SMALL	2	
839 7900 290	INSERT HOLDER ASSY	1	
843 4999 116	BOX, LIGHT - LARGE	1	
917 2252 001	* KIT, ELECTROLUMINESCENT	1	
952 9200 009	PANEL, BACKING-OVERLAY	1	
992 8027 001	FAULT LAMP PC ASSY	1	
992 8032 001	BASIC DISCRETE CONT PCB	1	
992 8040 002	PROGRAMMED MONITOR BD	1	
992 8050 001	PWB, LOGO LAMP BD.	2	

Table 7-3. FAULT LAMP PC ASSY - 992 8027 001

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
396 0247 000	LAMP, FUSE TYPE, 6V 150MA	14	
402 0129 000	CLIP, 1/4 DIA FUSE	28	
540 0581 000	RES 56.0 OHM 2W 5%	14	R001 R002 R003 R004 R005 R006 R007 R008 R009 R010 R011 R012 R013 R014
610 1079 000	HEADER 20 PIN STRAIGHT	1	
839 7900 052	SCHEMATIC, FAULT LAMPS	0	
843 4999 119	PWB, FAULT LAMPS	1	

Table 7-4. BASIC DISCRETE CONT PCB - 992 8032 001

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
354 0685 000	TERMINAL, MALE	9	J001
358 3223 000	FEMALE SCREWLOCK .56"4-40	7	
380 0126 000	XSTR, PNP 2N4403	1	Q007
380 0349 000	XSTR, 2N4124	1	Q006
380 0459 000	XSTR, 2N4126	4	Q001 Q002 Q003 Q004
382 0081 000	IC, 7406	8	U013 U035 U041 U042 U043 U048 U049 U054
382 0409 000	IC, 74C221 ESD	5	U011 U022 U025 U055 U056
382 0510 000	* IC, ILQ-74 OPTO ISOL	6	U030 U031 U032 U044 U045 U047
382 0522 000	IC, LM393N	3	U007 U023 U026
382 0661 000	IC, 75464	9	U014 U015 U016 U017 U018 U019 U020 U021 U057
382 0719 000	IC LM324AN	6	U010 U036 U037 U038 U039 U040
382 0768 000	IC, 74HC00	2	U008 U051
382 0769 000	IC 74HC02 ESD	1	U034
382 0770 000	IC, 74HC04	3	U009 U027 U050
382 0771 000	IC 74HC08	2	U028 U053
382 0775 000	IC, 74HC20	1	U046
382 0778 000	IC, 74HC32	1	U012

382 0781 000	IC, 74HC74 ESD	2	U005 U024
382 0854 000	IC 74HC4060 ESD	1	U004
382 0855 000	IC, 74HC4075	1	U029
382 0865 000	IC, 74HC4538	1	U002
382 0976 000	IC, 14490 ESD	1	U001
382 1045 000	IC, 74HC541	1	U003
382 1073 000	IC, DP8311N OCTAL LATCH	1	U033
382 1152 000	IC 74HC11 (ESD)	1	U006
382 1171 000	IC 74HC540 OCTAL (ESD)	1	U052
384 0205 000	DIODE SILICON 1N914/4148	13	CR002 CR003 CR006 CR009 CR010 CR051 CR063 CR065 CR066 CR067 CR075 CR076 CR077
384 0252 000	DIODE HP5082-2900/AHR2900	22	CR004 CR005 CR007 CR008 CR019 CR020 CR021 CR022 CR023 CR024 CR025 CR026 CR027 CR028 CR029 CR030 CR031 CR032 CR034 CR069 CR071 CR074
384 0431 000	RECT. 1N4001	2	CR053 CR070
384 0719 000	TRANSZORB 1N6373 5V 5W	1	CR072
384 0725 000	RECT 1N5818	1	CR068
384 0834 000	LED RED T1-3/4 HLMP4700	2	DS001 DS002
384 0837 000	TRANSZORB 1N6376 12V 5W	2	CR073 CR078
384 0854 000	DIODE ARRAY, 8 ISOLATED	5	CR011 CR033 CR041 CR049 CR055
386 0032 000	ZENER, 1N747A 3.6V	1	CR001
386 0077 000	ZENER, 1N4749A 24V	1	CR054
404 0673 000	SOCKET 8 PIN DIP (DL)	12	XU007 XU014 XU015 XU016 XU017 XU018 XU019 XU020 XU021 XU023 XU026 XU057
404 0674 000	SOCKET 14 PIN DIP (D-L)	28	XU005 XU006 XU008 XU009 XU010 XU012 XU013 XU024 XU027 XU028 XU029 XU034 XU035 XU036 XU037 XU038 XU039 XU040 XU041 XU042 XU043 XU046 XU048 XU049 XU050 XU051 XU053 XU054
404 0675 000	SOCKET IC 16 CONT	19	U056 XU001 XU002 XU004 XU011 XU022 XU025 XU030 XU031 XU032 XU044 XU045 XU047 XU055 XCR011 XCR033 XCR041 XCR055 XCR049
404 0704 000	SOCKET IC 20 PIN	3	XU003 XU033 XU052
478 0392 000	XFMR, RF MODEL T4-1	7	T001 T002 T003 T004 T005 T006 T007
506 0239 000	CAP .022UF 100V 5%	7	C024 C028 C032 C036 C040 C044 C048
506 0244 000	CAP .22UF 63V 5%	4	C010 C011 C109 C110
515 0034 000	CAP CHIP 10PF 5% 50V	7	C102 C103 C104 C105 C106 C107 C108
516 0453 000	CAP .1UF 100V 20% X7R	44	C001 C006 C012 C013 C016 C020 C062 C063 C064 C065 C069 C070 C071 C072 C073 C074 C075 C076 C077 C078 C079 C080 C081 C082 C083 C084 C085 C086 C087 C088 C089 C090 C091 C092 C094 C095 C096 C097 C099 C100 C101 C111 C112 C113
516 0530 000	CAP .01UF 10% 100V X7R	3	C002 C015 C019
516 0736 000	CAP .001UF 10% 100V X7R	14	C022 C023 C026 C027 C030 C031 C034 C035 C038 C039 C042 C043 C046 C047

516 0813 000	NTWK, CAP .01UF 50V SIP	6	C057 C058 C059 C061 C066 C067 (C060 USED ON SOME VERSIONS)
518 0057 000	CAP, VAR 9-35PF	0	C050 C051 C052 C053 C054 C055 C056 #SOME VERSIONS
522 0524 000	CAP 10 UF 25V 30%	1	C005
522 0548 000	CAP 10UF 50V ELECTROLYTIC	5	C003 C004 C017 C021 C068
522 0550 000	CAP 100U 25V ELECTROLYTIC	2	C093 C114
526 0049 000	CAP 6.8UF 35V 20%	3	C014 C018 C098
526 0050 000	CAP 1UF 35V 20%	2	C008 C009
526 0108 000	CAP 4.7UF 35V 20%	7	C025 C029 C033 C037 C041 C045 C049
540 0316 000	RES 220.0 OHM 1W 5%	9	R115 R116 R117 R118 R119 R120 R121 R122 R123
540 0888 000	RES 100 OHM 1/4W 5%	5	R023 R028 R044 R133 R144
540 0891 000	RES 130 OHM 1/4W 5%	1	R005
540 0895 000	RES 200.0 OHM 1/4W 5%	1	R145
540 0897 000	RES 240 OHM 1/4W 5%	7	R076 R080 R084 R088 R092 R096 R099
540 0907 000	RES 620.0 OHM 1/4W 5%	2	R027 R037
540 0912 000	RES 1.0K OHM 1/4W 5%	5	R071 R125 R127 R130 R146
540 0918 000	RES 1.8K OHM 1/4W 5%	3	R073 R110 R140
540 0920 000	RES 2.2K OHM 1/4W 5%	5	R021 R034 R052 R064 R153
540 0922 000	RES 2.7K OHM 1/4W 5%	7	R077 R081 R085 R089 R093 R097 R100
540 0936 000	RES 10.0K OHM 1/4W 5%	41	R004 R007 R010 R012 R016 R018 R022 R025 R026 R030 R032 R036 R039 R040 R042 R046 R047 R049 R050 R053 R054 R055 R059 R060 R062 R065 R066 R068 R070 R111 R124 R126 R141 R142 R143 R147 R148 R150 R151 R152 R163
540 0949 000	RES 36.0K OHM 1/4W 5%	2	R008 R011
540 0952 000	RES 47.0K OHM 1/4W 5%	1	R014
540 0960 000	RES 100.0K OHM 1/4W 5%	13	R001 R002 R003 R019 R031 R104 R105 R106 R107 R114 R160 R161 R162
540 0970 000	RES 270K OHM 1/4W 5%	6	R017 R029 R048 R056 R061 R067
540 0976 000	RES 470.0K OHM 1/4W 5%	6	R013 R015 R038 R041 R045 R058
540 0977 000	RES 510K OHM 1/4W 5%	3	R006 R009 R158
540 0984 000	RES 1.0M OHM 1/4W 5%	1	R134
540 0994 000	RES 2.7M OHM 1/4W 5%	2	R024 R035
540 1000 000	RES 4.7M OHM 1/4W 5%	2	R057 R069
540 1357 000	RES NETWORK 1000 OHM 2%	2	R131 R132
540 1366 000	RES NETWORK 100 OHM 2%	5	R128 R129 R135 R136 R137
540 1373 000	RES NETWORK 680 OHM 2%	1	R043
540 1386 000	RES NETWORK 10K OHM 2%	2	R074 R138
540 1430 000	RES NETWORK, 10K OHM 2%	1	R112
540 1494 000	RES NETWORK 1.8K 8 DIP	2	R072 R139
540 1495 000	RES NETWORK 1.8K	1	R113
550 0947 000	POT 1K OHM 1/2W 10%	7	R078 R082 R086 R090 R094 R101 R102
550 0949 000	POT 100K OHM 1/2W 10%	7	R079 R083 R087 R091 R095 R098 R103
550 0956 000	POT 2000 OHM 1/2W 10%	5	R020 R033 R051 R063 R154
604 0866 000	SW, TGL SPDT	3	S001 S002 S003

WARNING: Disconnect primary power prior to servicing.

610 0900 000	HEADER 3 CKT STRAIGHT	7	J018 J019 J020 J021 J022 J023 J024
610 0910 000	HOUSING, PLUG 9 POS	1	J001
610 0933 000	JUMPER, PWB TEST POINT	26	JP001 JP002 JP003 JP004 JP005 JP006 JP007 TP001 TP002 TP003 TP004 TP005 TP006 TP007 TP008 TP009 TP010 TP019 GND001 GND002 GND003 GND004 GND005 GND006 GND007 GND008
610 1078 000	HEADER 14 PIN STRAIGHT	1	J002A
610 1079 000	HEADER 20 PIN STRAIGHT	1	J002B
610 1080 000	HEADER 26 PIN STRAIGHT	1	J013A
610 1081 000	HEADER 50 PIN STRAIGHT	1	J013B
612 1184 000	JUMPER .1" CENTERS	7	J018 J019 J020 J021 J022 J023 J024
612 1295 000	CON 37 PIN D RECEPTACLE	4	J004 J014 J015 J016
612 1296 000	CON 9 PIN D RECEPTACLE	2	J005 J017
612 1297 000	CON 25 PIN D RECEPTACLE	1	J003
620 1677 000	RECEPTACLE, PC MT, BNC	7	J006 J007 J008 J009 J010 J011 J012
660 0036 000	BATTERY, NI CD, 3.6V NOM	1	BT001
822 0900 024	COIL, PEAK POWER DETECTOR	0	L001 L003 L005 L007 L009 L011 L013 #LB ASSY ON SOMEVERSIONS
822 0900 245	INDUCTOR.HARMONIC TRAP	0	L001 L003 L005 L007 L009 L011 L013 #HB ASSY ON SOMEVERSIONS
839 7900 072	SCHEM, DISCRETE CONT.	0	
843 4999 118	PWB, DISCRETE CONT.	1	

Table 7-5. PROGRAMMED MONITOR BD - 992 8040 002

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
746 0140 000	LICENSE, PSOS KERNAL	0	#BASE OPERATING SYSTEM LICENSE FEE. PAID BASED ON NUMBER OF CONTROL CABINETS.
917 2100 222	PAL, I/O DECODE 1	1	U010
917 2100 224	PAL, I/O CABINET	1	U011
917 2100 225	PAL, I/O DECODE 2	1	U012
917 2100 282	PAL, I/O CLOCK	1	U013
917 2100 283	PAL, INSTR REQUEST	1	U015
917 2100 284	PAL, INSTR ACKNOWLEDGE	1	U016
917 2100 285	PAL RESTART/BUSS TIMEOUT	1	U084
917 2100 286	PAL, DTACK DELAYS	1	U087
917 2235 001	SENTRY MONITOR PROM SET	0	"SELECT THIS PART # FOR SENTRY OPTION".
917 2235 002	MONITOR PROM SET, U17,U18	1	
917 2236 001	PAL I/O ADDRESS DECODER	1	U008
992 8040 001	BOARD ASSY 68K MONITOR	1	

Table 7-6. BOARD ASSY 68K MONITOR - 992 8040 001

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
335 0044 000	WASHER NYLON .120 ID	4	#J005 #J009
354 0685 000	TERMINAL, MALE	12	#J001
358 3223 000	FEMALE SCREWLOCK .56"4-40	2	#J005 #J009
380 0125 000	XSTR, NPN 2N4401	1	Q002
380 0126 000	XSTR, PNP 2N4403	1	Q001
380 0644 000	* XSTR, N-MOSFET 3N169	1	Q003

382 0510 000	* IC, ILQ-74 OPTO ISOL	2	U039 U097
382 0562 000	IC, 74LS125AN	1	U002
382 0621 000	IC, 74LS11N	1	U028
382 0626 000	IC, 4093B/14093B ESD	1	U043
382 0744 000	IC, SE5514N	2	U031 U045
382 0838 000	IC, 74HC563	7	U088 U089 U090 U091 U092 U093 U094
382 0865 000	IC, 74HC4538	1	U085
382 0940 000	IC, 75172	3	U070 U071 U072
382 0999 000	IC, 12 BIT A/D CONVERTER	1	U052
382 1073 000	IC, DP8311N OCTAL LATCH	2	U081 U082
382 1080 000	IC 74HCT04 HEX INVERTER	1	U050
382 1112 000	IC, 74HCT74N ESD	1	U053
382 1113 000	IC, 74HCT139E ESD	1	U086
382 1148 000	IC 75173 (ESD)	2	U073 U074
382 1164 000	IC PAL20RA10-20CNS (ESD)	0	U013 U084 U087 SEE PAL SPECS
382 1165 000	IC PALC20R8Z-40CNS (ESD)	0	U015 SEE PAL SPECS
382 1166 000	IC 32K X 8 CMOS SRAM, ESD	4	U019 U020 U021 U022
382 1167 000	IC PALC20L8Z-40CNS (ESD)	0	U008 U010 U011 U012 U016 SEE PAL SPECS
382 1168 000	IC SN74ACT11032N (ESD)	1	U009
382 1169 000	IC AD585A ESD	1	U051
382 1170 000	IC AD767JN (ESD)	4	U059 U060 U061 U062
382 1172 000	IC 74HCT32 (ESD)	1	U007
382 1173 000	IC 74HCT00 (ESD)	1	U014
382 1174 000	IC MAX696CPE (ESD)	1	U027
382 1175 000	IC 68000P12 (ESD)	1	U001
382 1176 000	IC 74HCT138 (ESD)	1	U080
382 1177 000	IC 74HCT259 (ESD)	4	U075 U076 U077 U078
382 1178 000	IC 74HCT373 (ESD)	2	U056 U057
382 1179 000	IC 74HCT574 (ESD)	3	U049 U054 U055
382 1180 000	IC 14C89A (ESD)	2	U037 U038
382 1181 000	IC 14C88 (ESD)	2	U033 U034
382 1182 000	IC MM58167 (ESD)	1	U044
382 1183 000	IC 68681 DUAL UART (ESD)	1	U030
382 1184 000	IC ADG506A ANALOG (ESD)	2	U046 U047
384 0205 000	DIODE SILICON 1N914/4148	5	CR003 CR004 CR005 CR006 CR007
384 0719 000	TRANSZORB 1N6373 5V 5W	1	CR013
384 0780 000	LED, RED	3	DS001 DS002 DS003
384 0837 000	TRANSZORB 1N6376 12V 5W	5	CR008 CR009 CR010 CR011 CR012
404 0509 000	SOCKET IC 28 PIN	3	XU046 XU047 XU052
404 0511 000	SOCKET IC 40 PIN	1	XU030
404 0674 000	SOCKET 14 PIN DIP (D-L)	14	XU002 XU007 XU014 XU028 XU031 XU033 XU034 XU037 XU038 XU043 XU045 XU050 XU051 XU053
404 0675 000	SOCKET IC 16 CONT	16	XU009 XU027 XU039 XU070 XU071 XU072 XU073 XU074 XU075 XU076 XU077 XU078 XU080 XU085 XU086 XU097
404 0704 000	SOCKET IC 20 PIN	14	XU049 XU054 XU055 XU056 XU057 XU081 XU082 XU088 XU089 XU090 XU091 XU092 XU093 XU094
404 0768 000	SOCKET 24 PIN DIP (DL)	1	XU044
404 0797 000	SOCKET IC 24 PIN .300 MTG	13	XU008 XU010 XU011 XU012 XU013 XU015 XU016 XU059 XU060 XU061 XU062 XU084 XU087

WARNING: Disconnect primary power prior to servicing.

404 0805 000	SOCKET 64 PIN DIP .900	1	XU001
404 0806 000	SOCKET 32 PIN DIP .600	6	XU017 XU018 XU019 XU020 XU021 XU022
444 2774 000	XTAL 3.6864 MHZ	1	Y001
444 2782 000	XTAL 32.768KHZ	1	Y002
500 0804 000	CAP 10PF 500V +/-.5PF	3	C012 C013 C016
506 0237 000	CAP .0068UF 100V 5%	2	C026 C027
516 0453 000	CAP .1UF 100V 20% X7R	89	C006 C007 C008 C009 C010 C014 C025 C030 C040 C041 C042 C043 C044 C045 C046 C047 C048 C049 C050 C051 C052 C053 C054 C055 C056 C057 C058 C059 C060 C061 C064 C065 C066 C067 C068 C069 C070 C071 C072 C073 C074 C075 C076 C077 C079 C080 C081 C082 C083 C084 C085 C086 C087 C088 C089 C090 C091 C092 C093 C094 C095 C096 C097 C098 C099 C100 C101 C102 C103 C104 C105 C106 C107 C108 C109 C110 C111 C112 C113 C114 C115 C116 C117 C118 C119 C121 C122 C123 C124
516 0768 000	CAP 18PF 5% 100V C0G	4	C017 C018 C019 C020
516 0773 000	CAP 47PF 5% 100V C0G	1	C011
516 0792 000	CAP NETWORK .1UF 10%	2	C028 C029
518 0100 000	CAP VAR 7-40PF 25V	1	C015
522 0548 000	CAP 10UF 50V ELECTROLYTIC	5	C001 C002 C003 C004 C005
522 0554 000	CAP 4.7UF 50V 20%	4	C032 C033 C062 C063
540 0025 000	RES 100 OHM 1/2W 5%	3	R004 R012 R065
540 0065 000	RES 4.7K OHM 1/2W 5%	2	R079 R080
540 0912 000	RES 1.0K OHM 1/4W 5%	3	R096 R097 R098
540 0918 000	RES 1.8K OHM 1/4W 5%	4	R007 R062 R063 R064
540 0928 000	RES 4.7K OHM 1/4W 5%	1	R037
540 0936 000	RES 10.0K OHM 1/4W 5%	10	R002 R006 R046 R047 R075 R076 R078 R099 R100 R105
540 0960 000	RES 100.0K OHM 1/4W 5%	1	R081
540 0984 000	RES 1.0M OHM 1/4W 5%	3	R005 R082 R083
540 1008 000	RES 10.0M OHM 1/4W 5%	1	R025
540 1016 000	RES 22.0M OHM 1/4W 5%	1	R038
540 1386 000	RES NETWORK 10K OHM 2%	15	R031 R032 R048 R049 R050 R051 R052 R053 R054 R070 R071 R072 R073 R074 R077
540 1391 000	RES NETWORK 220 OHM 2%	2	R060 R088
540 1392 000	RES NETWORK 4700 OHM 2%	1	R001
540 1497 000	RES NETWORK 47 OHMS SIP	2	R042 R044
548 1098 000	RES 100 OHM 1/4W 1%	1	R028
548 1110 000	RES 51.1 OHM 1/4W 1%	4	R033 R034 R035 R036
548 1148 000	RES 100K OHM 1/4W 1%	1	R029
548 1167 000	RES 10.2K OHM 1/4W 1%	14	R010 R014 R017 R020 R021 R022 R066 R067 R084 R085 R101 R102 R103 R104
548 1240 000	RES 182K OHM 1/4W 1%	1	R040
548 1332 000	RES 301K OHM 1/4W 1%	2	R003 R039
548 2069 000	RES 49.9K OHM 1/4W 1%	3	R008 R018 R019
548 2134 000	RES 3.4K OHM 1/4W 1%	4	R015 R016 R068 R069
550 0949 000	POT 100K OHM 1/2W 10%	4	R027 R090 R091 R092

WARNING: Disconnect primary power prior to servicing.

550 0958 000	POT 10K OHM 1/2 W 10%	5	R009 R011 R023 R086 R087
550 1070 000	POT 100 OHM 1/2 W 10%	1	R030
604 0851 000	SW, RKR 8PST DIP	2	S003 S004
604 0866 000	SW, TGL SPDT	1	S001
604 0935 000	SW, PB SINGLE SECT	1	S002
610 0833 000	HOUSING, PLUG 12 POS	1	J001
610 0900 000	HEADER 3 CKT STRAIGHT	7	J051 J060 J061 J063 J064 J066 J067
610 0902 000	HDR 10 PIN STRAIGHT	1	J050
610 0933 000	JUMPER, PWB TEST POINT	34	TP001 TP015 TP020 TP021 TP022 TP023 TP024 TP025 TP026 TP027 TP028 TP029 TP030 TP031 TP032 TP033 TPTXDA TPTXDB TPRXDA TPRXDB TPCLK TPVUNR TP+5V TP+12V TP-12V TP+12A TP-12A TPAGND TPGND1 TPGND2 TPGND3 TPGND4 TPGND5 TPGND6
610 1080 000	HEADER 26 PIN STRAIGHT	3	J003 J004 J008
610 1081 000	HEADER 50 PIN STRAIGHT	1	J002
610 1095 000	HEADER 28 POS DUAL	1	J065
610 1096 000	HEADER 12 POS DUAL	8	J052 J053 J054 J055 J056 J057 J058 J059
612 1184 000	JUMPER .1" CENTERS	30	P001 P002 P003 P004 P005 P006 P007 P008 P009 P010 P011 P012 P013 P014 P015 P016 P017 P018 P019 P020 P021 P022 P023 P024 P025 P026 P027 P028 P029 P030
612 1296 000	CON 9 PIN D RECEPTACLE	1	J005
612 1297 000	CON 25 PIN D RECEPTACLE	1	J009
660 0036 000	BATTERY, NI CD, 3.6V NOM	1	B001 REMOVE FOR SHIPMENT/STORAGE
700 1233 000	OSCILLATOR 10.0 MHZ CMOS	1	U005
839 7900 065	SCHEM, MONITOR BD	0	
843 4999 111	PWB, MONITOR	1	
999 2565 001	HARDWARE LIST	1	

Table 7-7. PWB, LOGO LAMP BD. - 992 8050 001

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
354 0309 000	TERM SOLDER	2	
396 0247 000	LAMP, FUSE TYPE, 6V 150MA	4	
402 0129 000	CLIP, 1/4 DIA FUSE	8	
843 4999 157	PWB LOGO LAMP	1	

Table 7-8. AGC MODULE, LOW BAND - 992 8012 001

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
952 9200 006	AGC TRAY ASSY	1	
992 8014 001	*PWB, SS VHF AGC,LOW BAND	1	
999 2581 001	HARDWARE LIST	1	

Table 7-9. *PWB, SS VHF AGC,LOW BAND - 992 8014 001

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS
000 0000 008	SELECT IN TEST COMPONENT	0	R004 R005 R006 R007 R008 R009
358 1214 000	SCREWLOCK, FEMALE	1	
380 0125 000	XSTR, NPN 2N4401	1	Q002
380 0527 000	XSTR, TIP120	1	Q001
382 0409 000	IC, 74C221 ESD	1	U003
382 0523 000	IC, 4066/14066 ESD	1	U004
382 0594 000	IC TL074ACN ESD	1	U002
382 1155 000	PWR DIVIDER, 2 WAY 90 DEG	1	U001
384 0321 000	DIODE 5082-2800/1N5711	3	CR005 CR006 CR010
384 0355 000	DIODE HP5082-3081/A5S139	4	CR001 CR002 CR003 CR004
384 0661 000	LED, GRN, T 1-3/4, RT ANG	1	CR007
384 0837 000	TRANSZORB 1N6376 12V 5W	2	CR008 CR009
404 0674 000	SOCKET 14 PIN DIP (D-L)	2	XU002 XU004
404 0675 000	SOCKET IC 16 CONT	1	U003
410 0405 000	INSULATOR XSTR TO220	1	#Q1
494 0398 000	CHOKE RF 10.0UH	2	L001 L002
516 0516 000	CAP 1UF 100V 20%	1	C009
516 0530 000	CAP .01UF 10% 100V X7R	12	C001 C002 C003 C004 C005 C007 C010 C011 C012 C014 C017 C019
516 0736 000	CAP .001UF 10% 100V X7R	1	C018
522 0550 000	CAP 100U 25V ELECTROLYTIC	2	C008 C015
526 0049 000	CAP 6.8UF 35V 20%	1	C020
526 0325 000	CAP .1UF 35V 20%	1	C016
526 0342 000	CAP 2.7UF 35V 10%	2	C006 C013
540 0290 000	RES 18 OHM 1W 5%	1	R001
540 0319 000	RES 300.0 OHM 1W 5%	2	R002 R003
540 0584 000	RES 75.0 OHM 2W 5%	2	R012 R013
548 2400 169	RES 51.1 OHM 1/2W 1%	3	R015 R019 R037
548 2400 173	RES 56.2 OHM 1/2W 1%	2	R011 R014
548 2400 273	RES 562 OHM 1/2W 1%	1	R036
548 2400 301	RES 1K OHM 1/2W 1%	5	R018 R022 R029 R034 R053
548 2400 309	RES 1.21K OHM 1/2W 1%	1	R040
548 2400 326	RES 1.82K OHM 1/2W 1%	1	R042
548 2400 330	RES 2K OHM 1/2W 1%	1	R039
548 2400 339	RES 2.49K OHM 1/2W 1%	1	R017
548 2400 358	RES 3.92K OHM 1/2W 1%	1	R026
548 2400 373	RES 5.62K OHM 1/2W 1%	1	R030
548 2400 401	RES 10K OHM 1/2W 1%	4	R033 R035 R054 R056
548 2400 405	RES 11K OHM 1/2W 1%	1	R031
548 2400 418	RES 15K OHM 1/2W 1%	1	R032
548 2400 469	RES 51.1K OHM 1/2W 1%	1	R038
548 2400 501	RES 100K OHM 1/2W 1%	9	R043 R044 R045 R046 R047 R048 R049 R050 R052
548 2400 558	RES 392K OHM 1/2W 1%	1	R027
548 2400 577	RES 619K OHM 1/2W 1%	2	R016 R020
550 0966 000	POT 2K OHM 1/2W/.3W 10%	2	R021 R051
550 0968 000	POT 20K OHM 1/2W 10%	1	R055
604 0859 000	SW, TGL DPDT	1	S001
610 0679 000	PLUG, SHORTING, .25" CTRS	6	
610 0750 000	TEST PROBE, TYPE C	5	TP001 TP002 TP003 TP004 TP005
610 0905 000	PLUG, D, 9 PIN, RT ANG	1	J004
610 0933 000	JUMPER, PWB TEST POINT	5	TP006 TP007 TP008 TP009 TP010
612 0904 000	JACK, PC MT GOLD PLATED	12	
620 2518 000	DIR COUPLER, .5-500 MHZ	1	DC-1

620 2543 000	RECEPTACLE,PC MT BNC R.A.	3	J001 J002 J003
839 7900 040	SCHEMATIC AGC	0	

Table 7-10. AGC MODULE, HIGH BAND - 992 8012 002

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS
952 9200 006	AGC TRAY ASSY	1	
992 8014 002	*PWA SS VHF AGC HIGH BAND	1	
999 2581 002	HARDWARE LIST	1	

Table 7-11. *PWA SS VHF AGC HIGH BAND - 992 8014 002

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS
000 0000 008	SELECT IN TEST COMPONENT	0	R004 R005 R006 R007 R008 R009 PARTS SUPPLIED BY TEST LAB
358 1214 000	SCREWLOCK, FEMALE	1	
380 0125 000	XSTR, NPN 2N4401	1	Q002
380 0527 000	XSTR, TIP120	1	Q001
382 0409 000	IC, 74C221 ESD	1	U003
382 0523 000	IC, 4066/14066 ESD	1	U004
382 0594 000	IC TL074ACN ESD	1	U002
382 1156 000	PWR DIVIDER, 2 WAY 90 DEG	1	U001
384 0321 000	DIODE 5082-2800/1N5711	3	CR005 CR006 CR010
384 0355 000	DIODE HP5082-3081/A5S139	4	CR001 CR002 CR003 CR004
384 0661 000	LED, GRN, T 1-3/4, RT ANG	1	CR007
384 0837 000	TRANSZORB 1N6376 12V 5W	2	CR008 CR009
404 0674 000	SOCKET 14 PIN DIP (D-L)	2	XU002 XU004
404 0675 000	SOCKET IC 16 CONT	1	U003
410 0405 000	INSULATOR XSTR TO220	1	#Q001
494 0398 000	CHOKE RF 10.0UH	2	L001 L002
516 0516 000	CAP 1UF 100V 20%	1	C009
516 0530 000	CAP .01UF 10% 100V X7R	12	C001 C002 C003 C004 C005 C007 C010 C011 C012 C014 C017 C019
516 0736 000	CAP .001UF 10% 100V X7R	1	C018
522 0550 000	CAP 100U 25V ELECTROLYTIC	2	C008 C015
526 0049 000	CAP 6.8UF 35V 20%	1	C020
526 0325 000	CAP .1UF 35V 20%	1	C016
526 0342 000	CAP 2.7UF 35V 10%	2	C006 C013
540 0290 000	RES 18 OHM 1W 5%	1	R001
540 0319 000	RES 300.0 OHM 1W 5%	2	R002 R003
540 0584 000	RES 75.0 OHM 2W 5%	2	R012 R013
548 2400 169	RES 51.1 OHM 1/2W 1%	3	R015 R019 R037
548 2400 173	RES 56.2 OHM 1/2W 1%	2	R011 R014
548 2400 273	RES 562 OHM 1/2W 1%	1	R036
548 2400 301	RES 1K OHM 1/2W 1%	5	R018 R022 R029 R034 R053
548 2400 309	RES 1.21K OHM 1/2W 1%	1	R040
548 2400 326	RES 1.82K OHM 1/2W 1%	1	R042
548 2400 330	RES 2K OHM 1/2W 1%	1	R039
548 2400 339	RES 2.49K OHM 1/2W 1%	1	R017
548 2400 358	RES 3.92K OHM 1/2W 1%	1	R026
548 2400 373	RES 5.62K OHM 1/2W 1%	1	R030
548 2400 401	RES 10K OHM 1/2W 1%	4	R033 R035 R054 R056
548 2400 405	RES 11K OHM 1/2W 1%	1	R031
548 2400 418	RES 15K OHM 1/2W 1%	1	R032

548 2400 469	RES 51.1K OHM 1/2W 1%	1	R038
548 2400 501	RES 100K OHM 1/2W 1%	9	R043 R044 R045 R046 R047 R048 R049 R050 R052
548 2400 558	RES 392K OHM 1/2W 1%	1	R027
548 2400 577	RES 619K OHM 1/2W 1%	2	R016 R020
550 0966 000	POT 2K OHM 1/2W/.3W 10%	2	R021 R051
550 0968 000	POT 20K OHM 1/2W 10%	1	R055
604 0859 000	SW, TGL DPDT	1	S001
610 0679 000	PLUG, SHORTING, .25" CTRS	6	
610 0750 000	TEST PROBE, TYPE C	5	TP001 TP002 TP003 TP004 TP005
610 0905 000	PLUG, D, 9 PIN, RT ANG	1	J004
610 0933 000	JUMPER, PWB TEST POINT	5	TP006 TP007 TP008 TP009 TP010
612 0904 000	JACK, PC MT GOLD PLATED	12	
620 2518 000	DIR COUPLER, .5-500 MHZ	1	DC-1
620 2543 000	RECEPTACLE,PC MT BNC R.A.	3	J001 J002 J003
839 7900 040	SCHEMATIC AGC	0	

Table 7-12. EXCITER SWITCHER MODULE - 992 8013 001

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
952 9200 005	EXCITER SWITCHER TRAY ASY	1	
992 8022 001	PWA, EXCITER SW. LOGIC	1	
999 2585 001	HARDWARE LIST	1	

Table 7-13. PWA, EXCITER SW. LOGIC - 992 8022 001

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
358 1214 000	SCREWLOCK, FEMALE	1.0 EA	
380 0527 000	XSTR, TIP120 ESD	1.0 EA	Q001
382 0440 000	IC, 3083 ESD	3.0 EA	U005 U006 U007
382 0521 000	IC, 339 ESD	1.0 EA	U001
382 0587 000	IC, CD4011/MC14011 ESD	2.0 EA	U003 U004
382 0972 000	IC, 4071B ESD	1.0 EA	U002
384 0205 000	DIODE SILICON 1N914/4148 ESD	8.0 EA	CR006 CR007 CR008 CR009 CR011 CR019 CR020 CR028
384 0431 000	RECT. 1N4001 ESD	4.0 EA	CR012 CR013 CR014 CR018
384 0661 000	LED, GRN, T 1-3/4, RT ANG ESD	7.0 EA	CR002 CR003 CR004 CR005 CR010 CR015 CR021
384 0662 000	LED RED ESD	1.0 EA	CR016
384 0837 000	TRANSZORB 1N6376 12V 5W ESD	1.0 EA	CR017
386 0032 000	ZENER, 1N747A 3.6V ESD	1.0 EA	CR029
386 0085 000	ZENER, 1N4740A 10V ESD	5.0 EA	CR001 CR022 CR023 CR024 CR025
404 0513 000	HEAT SINK PA1-1CB	1.0 EA	#Q001
404 0674 000	SOCKET 14 PIN DIP (D-L)	4.0 EA	XU001 XU002 XU003 XU004
404 0675 000	SOCKET IC 16 CONT	3.0 EA	XU005 XU006 XU007
516 0375 000	CAP .01UF 50V	17.0 EA	C001 C003 C004 C005 C007 C008 C010 C011 C013 C014 C015 C016 C017 C018 C020 C021 C022
516 0530 000	CAP .01UF 10% 100V X7R	1.0 EA	C030
522 0550 000	CAP 100UF 25V 20%	1.0 EA	C031
526 0057 000	CAP 100UF 20V 20%	1.0 EA	C019
526 0311 000	CAP 2.2UF 35V 10%	4.0 EA	C002 C006 C009 C012
526 0318 000	CAP 10UF 35V 20%	2.0 EA	C023 C024
540 1332 000	RES NETWORK 100K OHM	1.0 EA	R001
540 1356 000	RES NETWORK 10K OHM 2%	4.0 EA	R002 R003 R004 R005
540 1357 000	RES NETWORK 1000 OHM 2%	1.0 EA	R006
548 2400 201	RES 100 OHM 1/2W 1%	5.0 EA	R007 R016 R017 R019 R021

548 2400 330	RES 2K OHM 1/2W 1%	1.0 EA	R032
548 2400 401	RES 10K OHM 1/2W 1%	3.0 EA	R020 R024 R028
548 2400 409	RES 12.1K OHM 1/2W 1%	1.0 EA	R031
548 2400 442	RES 26.7K OHM 1/2W 1%	4.0 EA	R030 R033 R034 R035
548 2400 466	RES 47.5K OHM 1/2W 1%	1.0 EA	R022
548 2400 701	RES 10MEG OHM 1/2W 1%	4.0 EA	R008 R009 R010 R011
550 0955 000	POT 5K OHM 1/2W 10%	4.0 EA	R012 R013 R014 R015
578 0022 000	RLY 12V DPDT LATCHING	2.0 EA	K001 K002
604 1103 000	SW, TGL SPDT MOM-OFF-MOM	2.0 EA	S001 S002
610 0907 000	PLUG, D, 25 PIN, RT ANG	1.0 EA	J001
839 7900 043	SCHEM, EXCITER SW. LOGIC	0.0 EA	
843 4999 081	PWB, EXCITER SWITCHER	1.0 EA	

Table 7-14. MOV-AC PROTECTOR ASSY - 992 8553 001

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
560 0049 000	MOV 4500A 75J 275VAC	12	CR001 CR002 CR003 CR004 CR005 CR006 CR007 CR008 CR009 CR010 CR011 CR012
610 1066 000	CONN, .25 FASTON PC MOUNT	3	A, B, C
839 7900 604	SCHEM, MOV-AC PROTECTOR	0	
839 7900 605	PWB, MOV-AC PROTECTOR	1	
999 2710 001	WIRE/TUBING LIST	0	QTY 1 NEEDED FOR SERVICEREPLACEMENT.

Table 7-15. MOV-AC PROTECTOR ASSY - 992 8553 002

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
560 0042 000	MOV 6500A 190J 510VAC	6	CR007 CR008 CR009 CR010 CR011 CR012
560 0049 000	MOV 4500A 75J 275VAC	6	CR001 CR002 CR003 CR004 CR005 CR006
610 1066 000	CONN, .25 FASTON PC MOUNT	3	A, B, C
839 7900 606	PWB, MOV-AC PROTECTOR	1	
839 7900 614	SCHEM, MOV-AC PROTECTOR	0	
999 2711 001	WIRE/TUBING LIST	0	QTY 1 NEEDED FOR SERVICEREPLACEMENT.

Table 7-16. BASIC LINE VOLTAGE SAMPLE - 994 8935 002

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
358 0976 000	BUSHING, STRAIN RELI	1	
384 0431 000	RECT. 1N4001	1	CR001
398 0039 000	FUSE,SLOW CART .100A 250V	1	F001
402 0129 000	CLIP, 1/4 DIA FUSE	2	XF001
472 1597 000	XFMR, PWR 16V 70MA	2	T001 T002
522 0555 000	CAP 100UF 16WV -10/+75%	1	C001
540 0908 000	RES 680.0 OHM 1/4W 5%	1	R001
540 0912 000	RES 1.0K OHM 1/4W 5%	1	R002
540 0935 000	RES 9.1K OHM 1/4W 5%	1	R003
614 0771 000	TERM STRIP 3 TERM	1	TB002
614 0772 000	TERM STRIP 6 TERM	1	TB001
646 0665 000	INSPECTION LABEL	1	
839 9291 001	PWB, LINE V SAMPLE	1	
839 9295 001	TOP COVER	1	
839 9297 001	SCH, LINE VOLT SAMPLE	0	
999 2461 001	HARDWARE LIST	1	

Table 7-17. AURAL PA CABINET - 992 7079 001

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS
041 1310 030	GASKET, RUBBER	20.920 FT	#REAR SEAL
055 0120 004	CONDUIT LKNUT .5	1.0 EA	#FOR AIR SWITCH
088 0020 015	TAPE, SCOTCH FOAM	4.750 RL	
296 0344 000	TUBG, POLYETHYLENE 1/4 OD	1.60 FT	
324 0077 000	NUT U TYPE 6-32 STL	4.0 EA	#CB COVER
357 0089 000	GUIDE, MODULE	36.0 EA	#MODULE SLOTS
358 2037 000	BALL STUD 6-32X 3/16	6.0 EA	#P/S COVER
358 2635 000	CABLE TIE, PUSH MOUNT SNAP IN	14.0 EA	
358 3240 000	NUT, 3/8-16 HEX NYLON	3.0 EA	#BUSS BAR
358 3304 000	BOLT-NYLON,3/8-16 X 1-1/2	3.0 EA	
359 0180 000	ELBOW MALE 90 DEG	1.0 EA	#AIR SW
384 0431 000	RECT. 1N4001 ESD	1.0 EA	CR001 #SLAVE RELAY
384 0674 000	RECTIFIER 70A 400 PIV ESD	2.0 EA	CR002 CR003
404 0578 000	SOCKET RELAY, 4PDT	1.0 EA	
448 0834 000	CATCH SPR	6.0 EA	#P/S COVER
448 0920 000	HINGE, CONCEALED, 120 DEG	3.0 EA	#REAR DOOR ASSY
524 0378 000	CAP 240,000 UF 60VDC	6.0 EA	C001 C002 C003 C004 C005 C006 #C007 #C008 #C009 #C010 #C011 #C012 #REF ONLY
542 0121 000	RES 150 OHM 5% 20W	6.0 EA	R001 R002 R003 R004 R005 R006 #R007 #R008 #R009 #R010 #R011 #R012 #REF ONLY
570 0314 000	CNTOR 110A 208V 60HZ 3PH	0.0 EA	FORMAT SELECTED PART
574 0156 000	RELAY 12VDC 4PDT	1.0 EA	K002
604 0525 000	SW, PRESS.	1.0 EA	S002
604 1044 000	SW, INTLK DPDT	1.0 EA	S001 DOOR INTERLOCK
606 0824 000	CKT BKR 7.5A 3P 480VAC	1.0 EA	CB002
606 0963 000	CIRCUIT BREAKER 1A 277V/480 2P	1.0 EA	CB101
614 0811 000	BARRIER BLOCK, 3POLE 1X4	1.0 EA	TB001
614 0812 000	BARRIER BLOCK, 1 POLE,1X4	1.0 EA	TB2 #GND CONNECTION BY CONTACTOR
620 2537 000	PLUG HOUSING, 12 POS	9.0 EA	2A17J2 2A15J2 2A13J2 2A11J2 2A9J2 2A7J2 2A5J2 2A3J2 2A1J2
813 5001 066	STDOFF 10-32X3/4 3/8 HEX	4.0 EA	#4W/HEATPIPE
813 5002 049	STDOFF 10-32X1 1/2 HEX	1.0 EA	USED WITH MOV
822 0900 016	PIN, ALIGNMENT	15.0 EA	#MODULE SLOTS ODD #'S A17-A1 1 PER DRIVER 2 PER PA
822 0900 096	INSULATOR, SUPPORT	3.0 EA	#BUSS BAR
822 0900 136	GND STRAP	1.0 EA	#TOP GND
822 0900 248	BRK'T, HONEY COMB	32.0 EA	#MODULE SLOTS ODD #'S A17-A1 4 PER SLOT
822 0900 249	HONEY COMB VERTICAL	16.0 EA	
822 0900 360	BRKT DIODE MTG	1.0 EA	
827 6893 001	PLATE	1.0 EA	#TOP GND
839 7900 056	STRAP, POSITIVE	1.0 EA	#CAP
839 7900 057	STRAP, NEGATIVE	1.0 EA	#CAPS
839 7900 073	BRKT, INTERLOCK	1.0 EA	
839 7900 093	GROUND STRAP	1.0 EA	#MODULES
839 7900 097	COVER, SLAVE REAR	1.0 EA	
839 7900 117	STRAP, MODULE GND	7.0 EA	#MODULE SLOTS
839 7900 148	STRAP, MODULE GND-LONG	1.0 EA	#BOTTOM SLOT
843 4999 083	INSULATOR, BUS BAR	1.0 EA	
843 4999 091	CAPACITOR RACK COVER	1.0 EA	
843 4999 124	SEAL PLATE, POWER SUPPLY	2.0 EA	#PS001 PS002
843 4999 153	PWB, CAP BANK	1.0 EA	#CAP BANK
843 4999 188	DUCT, HEAT PIPE AIR	1.0 EA	#HEAT PIPE
917 2100 093	CABLE, SLAVE BUSS	1.0 EA	

WARNING: Disconnect primary power prior to servicing.

917 2100 095	CABLE, VIS PA PWR	1.0 EA	W052
917 2100 096	CABLE, AURAL MODULE	1.0 EA	W051
917 2100 120	CABLE LWR PWR SUP AUR	1.0 EA	
917 2100 122	CABLE, SLAVE RF DET.	1.0 EA	
917 2100 152	CABLE, TX ON/SLAVE BD	1.0 EA	J10 - A18J2
917 2100 159	CABLE, PS/SLAVE PA CAB	1.0 EA	W55
922 0900 100	CAB VERTICAL TRIM	2.0 EA	
922 0900 101	PA CAB HORIZ TRIM	2.0 EA	
922 0900 121	TRIM MOUNTING PLATE	10.0 EA	
922 0900 418	BUSHING ALIGNMENT PIN	1.0 EA	#MOUNT 922-0900-418 BEFORE MTG SIDEPANELS TO CABI-NET
939 7900 076	INTERLOCK COVER ASSY	1.0 EA	
939 7900 083	GROUND SWITCH ASSY	1.0 EA	S003
939 7900 839	CABLE RETRACTOR	1.0 EA	
943 4999 053	SHELF ASSY, MODULE	16.0 EA	
943 4999 054	PLENUM ASS'Y, MODULE	8.0 EA	
943 4999 058	BRACKET ASSY, CONNECTOR	1.0 EA	
943 4999 060	KICKPLATE, REAR PA CAB	1.0 EA	
943 4999 061	POST ASSY, UPPER CENTER	2.0 EA	#CAB/MODULES SHELVES
943 4999 062	PLENUM ASSY, TOP	1.0 EA	
943 4999 063	KICKPLATE ASSY, FRONT	1.0 EA	
943 4999 085	BLANK MODULE EXTRUSION	2.0 EA	#P/S COVER
943 4999 090	CAPACITOR RACK BASE	1.0 EA	#REAR FAN ASSY
943 4999 114	SCR BLEEDER ASSY, VIS	1.0 EA	A028
943 4999 125	LINER ASSY LEFT	1.0 EA	
943 4999 126	LINER ASSY, RIGHT VISUAL	1.0 EA	
943 4999 147	PANEL EXT MTG-PWR SUPPLY	2.0 EA	#P/S COVER
943 4999 151	SAFETY COVER, CONTACTOR	1.0 EA	
943 4999 154	ANGLE LEFT LINER	1.0 EA	
943 4999 155	ANGLE, RIGHT LINER	1.0 EA	
943 4999 167	COVER, CIRCUIT BREAKER	1.0 EA	
943 4999 175	PLENUM ASSY, SLAVE TOP	1.0 EA	
943 4999 322	BUSS BAR 1/8"	1.0 EA	
943 4999 323	BUSS BAR 1/8" LF	1.0 EA	
943 5285 269	BRACKET, 'MOV' BD MTG	1.0 EA	
952 9200 002	CABINET ASSY, PA	1.0 EA	
992 8010 001	SLAVE CONTROLLER MODULE	1.0 EA	A018
992 8553 001	PWA, MOV-AC 198-250 VAC	1.0 EA	BOARD WITH MOV'S
992 9965 001	PA REAR DOOR ASSY	1.0 EA	
999 2612 002	HARDWARE LIST, PA CABINET	1.0 EA	
999 2613 002	WIRE/TUBING LIST FOR	1.0 EA	

Table 7-18. SCR BLEEDER ASSY, VIS - 943 4999 114

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS
335 0252 000	WASHER, TEFLON	1	
354 0577 000	TERMINAL .250 HOLE	2	
358 0003 000	BRACKET RESISTOR MTG	6	#R001 R002 R003
384 0615 000	RECT. SCR	1	CR004
384 0674 000	RECTIFIER 70A 400 PIV	2	CR002 CR003
386 0092 000	ZENER, 1N4744 15V	1	CR001
404 0807 000	RELAY SOCKET	1	XK001
404 0808 000	WIRE RETAINER, RELAY SOCK	1	#XK001
410 0377 000	INSULATOR WASHER	2	
516 0411 000	CAP .1UF 50V DISC	1	C001
540 0017 000	RES 47.0 OHM 1/2W 5%	2	R008 R009
540 0035 000	RES 270.0 OHM 1/2W 5%	1	R007
540 0041 000	RES 470 OHM 1/2W 5%	2	R004 R005
540 0049 000	RES 1K OHM 1/2W 5%	1	R006
542 0282 000	RES 1 OHM 5% 100W	3	R001 R002 R003
574 0362 000	RELAY 2PDT 12VDC	1	K001
614 0048 000	TERM BD 4 TERM	1	TB001
839 7900 070	SCHEM, SCR BLEEDER ASSY	0	
943 4999 113	BRKT, SCR BLEEDER ASSY	1	

Table 7-19. SLAVE CONTROLLER MODULE - 992 8010 001

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS
304 0089 000	NUT, HEX 6-32	2	#FL001
306 0014 000	NUT, STOP 1/4-20	4	
312 0047 000	WASHER, SPLIT-LOCK 6	2	#FL001
312 0075 000	WASHER, SPRING 1/4	24	#3 PER STUD
384 0831 000	LED LIGHT BAR MOUNT	2	
560 0049 000	MOV 4500A 75J 275VAC	1	#736-0196-000
736 0196 000	*PWR SUPPLY +5V +/-15VDC	1	
813 5000 014	STDOFF 6-32X1-3/4 5/16 H	2	#736-0196-000
917 2100 156	CABLE, SLAVE J4/PS	1	
917 2100 157	CABLE, LED TO SLAVE BD	1	
939 7900 099	HINGE RIGHT (SLAVE)	1	
939 7900 100	HINGE, LEFT (SLAVE)	1	
939 7900 101	BRACKET, SLAVE P.S.	1	
939 7900 392	COVER, SLAVE P.S. SAFETY	1	#736-0196-000
939 7900 728	ASSY, AC LINE FILTER	1	FL001
943 4999 084	MODULE FACE EXTRUSION	1	
943 4999 169	CHASSIS,PC BD MTG.(SLAVE)	1	
943 4999 170	CHASSIS, SLAVE	1	
992 8003 004	BASIC SLAVE CONT. PCB	0	FD ASSY FORMAT: PART
992 8023 001	PWA, LED BOARD	1	

Table 7-20. ASSY, AC LINE FILTER - 939 7900 728

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS
252 0004 000	WIRE, STRD 18AWG WHT/YEL	2 FT	
296 0264 000	TUBING, SHRINK 1/2 WHITE	.2 FT	
354 0001 000	LUG #6 RING RED 22-18 AWG	1	
354 0624 000	TERMINAL, MALE	3	
354 0625 000	TERMINAL, FEMALE	3	
354 0749 000	TERM FOR .250 X .032 TAB	5	
484 0297 000	FILTER RFI POWER LINE	1	
610 0738 000	PLUG HOUSING	1	
612 0885 000	RECEPTACLE HOUSING	1	
839 7900 728	ASSY INSTR, AC LINE FLTER	0	

Table 7-21. BASIC SLAVE CONT. PCB - 992 8003 004

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS
254 0001 000	WIRE, BUS CU 22AWG	.2 FT	
354 0685 000	TERMINAL, MALE	25	
382 0409 000	IC, 74C221 ESD	5	U021 U022 U048 U056 U061
382 0510 000	* IC, ILQ-74 OPTO ISOL	8	U023 U024 U028 U029 U030 U031 U036 U055
382 0522 000	IC, LM393N	1	U013
382 0596 000	IC DG507A ESD	1	U038
382 0768 000	IC, 74HC00	1	U018
382 0769 000	IC 74HC02 ESD	1	U011
382 0774 000	IC 74HC14 ESD	1	U010
382 0778 000	IC, 74HC32	1	U015
382 0781 000	IC, 74HC74 ESD	1	U020

382 0791 000	IC, 74HC138	1	U008
382 0840 000	IC 74HC573	5	U006 U009 U026 U027 U032
382 0940 000	IC, 75172	2	U001 U003
382 0983 000	IC, 75462	3	U014 U019 U025
382 1002 000	IC DG508A ESD	1	U037
382 1045 000	IC, 74HC541	1	U035
382 1073 000	IC, DP8311N OCTAL LATCH	3	U050 U052 U054
382 1148 000	IC 75173 (ESD)	3	U002 U004 U005
382 1149 000	IC AD7512DI (ESD)	1	U041
382 1150 000	IC 74HC682 (ESD)	1	U007
382 1152 000	IC 74HC11 (ESD)	1	U017
382 1160 000	IC 74HC27 (ESD)	1	U012
382 1161 000	IC, OP-07C/LT1097 ESD	2	U039 U040
384 0205 000	DIODE SILICON 1N914/4148	6	CR002 CR003 CR004 CR005 CR006 CR007
384 0252 000	DIODE HP5082-2900/AHR2900	12	CR028 CR029 CR030 CR031 CR032 CR033 CR034 CR035 CR036 CR037 CR038 CR039
384 0661 000	LED, GRN, T 1-3/4, RT ANG	2	DS001 DS006
384 0662 000	LED RED	5	DS002 DS003 DS004 DS005 DS007
384 0719 000	TRANSZORB 1N6373 5V 5W	1	CR040
384 0837 000	TRANSZORB 1N6376 12V 5W	2	CR041 CR042
384 0854 000	DIODE ARRAY, 8 ISOLATED	6	CR008 CR009 CR010 CR011 CR012 CR013
386 0032 000	ZENER, 1N747A 3.6V	1	CR001
404 0509 000	SOCKET IC 28 PIN	1	XU038
404 0673 000	SOCKET 8 PIN DIP (DL)	6	XU013 XU014 XU019 XU025 XU039 XU040
404 0674 000	SOCKET 14 PIN DIP (D-L)	8	XU010 XU011 XU012 XU015 XU017 XU018 XU020 XU041
404 0675 000	SOCKET IC 16 CONT	26	XU001 XU002 XU003 XU004 XU005 XU008 XU021 XU022 XU023 XU024 XU028 XU029 XU030 XU031 XU036 XU037 XU048 XU056 XU061 XCR008 XCR009 XCR010 XCR011 XCR012 XCR013 U055
404 0704 000	SOCKET IC 20 PIN	10	XU006 XU007 XU009 XU026 XU027 XU032 XU035 XU050 XU052 XU054
404 0797 000	SOCKET IC 24 PIN .300 MTG	5	XU044 XU045 XU049 XU051 XU053
478 0392 000	XFMR, RF MODEL T4-1	6	T001 T002 T003 T004 T005 T006
506 0239 000	CAP .022UF 100V 5%	6	C023 C026 C029 C032 C035 C038
515 0013 000	CAP CHIP 10PF 5% 50V	6	C090 C091 C092 C093 C094 C095
516 0453 000	CAP .1UF 100V 20% X7R	33	C001 C002 C003 C004 C005 C006 C042 C043 C045 C046 C047 C048 C049 C050 C051 C052 C053 C054 C055 C056 C057 C058 C060 C061 C062 C063 C064 C071 C072 C073 C074 C075 C076
516 0736 000	CAP .001UF 10% 100V X7R	13	C022 C025 C028 C031 C034 C037 C065 C066 C067 C068 C069 C070 C080
516 0813 000	NTWK, CAP .01UF 50V SIP	2	C013 C014
522 0548 000	CAP 10UF 50V ELECTROLYTIC	3	C077 C078 C079
526 0049 000	CAP 6.8UF 35V 20%	3	C040 C041 C084
526 0108 000	CAP 4.7UF 35V 20%	6	C024 C027 C030 C033 C036 C039
526 0318 000	CAP 10UF 35V 20%	1	C097
526 0342 000	CAP 2.7UF 35V 10%	3	C007 C008 C009
540 0316 000	RES 220.0 OHM 1W 5%	2	R063 R079
540 1372 000	RES NETWORK 680 OHM 2%	1	R027
540 1386 000	RES NETWORK 10K OHM 2%	3	R031 R032 R035

540 1492 000	RES NETWORK 1.8K 9 SIP	3	R033 R034 R037
548 2400 105	RES 11 OHM 1/2W 1%	1	R096
548 2400 201	RES 100 OHM 1/2W 1%	3	R016 R018 R097
548 2400 212	RES 130 OHM 1/2W 1%	1	R003
548 2400 230	RES 200 OHM 1/2W 1%	6	R047 R048 R049 R050 R051 R052
548 2400 277	RES 619 OHM 1/2W 1%	7	#R005 R019 R022 R023 R024 R025 R038
548 2400 301	RES 1K OHM 1/2W 1%	4	R083 R094 R095 R098
548 2400 326	RES 1.82K OHM 1/2W 1%	4	R008 R011 R012 R014
548 2400 342	RES 2.67K OHM 1/2W 1%	6	R053 R069 R070 R071 R072 R073
548 2400 401	RES 10K OHM 1/2W 1%	13	R001 R006 R007 R009 R010 R013 R015 R017 R040 R041 R042 R061 R066
548 2400 405	RES 11K OHM 1/2W 1%	1	R045
548 2400 454	RES 35.7K OHM 1/2W 1%	1	R004
548 2400 542	RES 267K OHM 1/2W 1%	4	R020 R021 R026 R147
548 2400 566	RES 475K OHM 1/2W 1%	3	R064 R065 R088
548 2400 569	RES 511K OHM 1/2W 1%	1	R002
550 0949 000	POT 100K OHM 1/2W 10%	6	R060 R074 R075 R076 R077 R078
550 0956 000	POT 2000 OHM 1/2W 10%	1	R046
550 0970 000	POT 1K OHM 1/2W 10%	6	R054 R055 R056 R057 R058 R059
578 0023 000	RLY, 12V DPDT	1	K001
604 0851 000	SW, RKR 8PST DIP	1	S001
604 0866 000	SW, PB SNAP ACTION SPDT	2	S002 S003
610 0738 000	PLUG HOUSING	1	J002
610 0833 000	HOUSING, PLUG 12 POS	1	J003
610 0836 000	HOUSING, PLUG 6 POS	1	J004
610 0900 000	HEADER 3 CKT STRAIGHT	2	J015 J016
610 0933 000	JUMPER, PWB TEST POINT	16	GND001 GND002 GND003 GND004 TP001 TP002 TP003 TP004 TP005 GND005 TP006 TP007 TP008 TP009 TP010 TP011
610 0939 000	HOUSING, PLUG 4 CKT	1	J014
610 1079 000	HEADER 20 PIN STRAIGHT	1	J005
610 1080 000	HEADER 26 PIN STRAIGHT	2	J001 J013
610 1082 000	HEADER 16 PIN STRAIGHT	1	J006
612 1184 000	JUMPER .1" CENTERS	2	FOR #J015 J016
620 0700 000	*RECPT, MALE SMB,PC MOUNT	6	J007 J008 J009 J010 J011 J012
839 7900 200	SCHEMATIC SLAVE CONT.	0	
843 4999 207	PWB SLAVE CONT.	1	
917 2100 495	VIS20A VIS CAB INTERLOCK	1	U049 U051 U053

Table 7-22. PWA, LED BOARD - 992 8023 001

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
384 0826 000	LED LIGHT BAR, RED	1	CR001
384 0827 000	LED LIGHT BAR, GREEN	1	CR002
610 0852 000	HEADER 8 PIN SINGLE ROW	0	J001
610 0877 000	HDR, STR, 2 PIN, SQ	1	J003
610 0902 000	HDR 10 PIN STRAIGHT	1	J002
839 7900 047	SCHEM, LED BOARD	0	
843 4999 094	PWB LED BOARD	1	

Table 7-23. MOV-AC PROTECTOR ASSY - 992 8553 001

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS
560 0049 000	MOV 4500A 75J 275VAC	12	CR001 CR002 CR003 CR004 CR005 CR006 CR007 CR008 CR009 CR010 CR011 CR012
610 1066 000	CONN, .25 FASTON PC MOUNT	3	A, B, C
839 7900 604	SCHEM, MOV-AC PROTECTOR	0	
839 7900 605	PWB, MOV-AC PROTECTOR	1	
999 2710 001	WIRE/TUBING LIST	0	QTY 1 NEEDED FOR SERVICEREPLACEMENT.

Table 7-24. PA REAR DOOR ASSY - 992 9965 001

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS
041 6065 010	RUBBER CHANNEL X 319	7.140 FT	#FAN VENTURI
299 0015 000	TAPE, PVC VINYL CLOSED	0.20 RL	
324 0188 000	NUT, PUSH PS188307	4.0 EA	#FAN GUARD
424 0022 000	GROMMET 3/4 MTG DIA	4.0 EA	#FAN VENTURI
424 0024 000	GROMMET 3/4 MTG DIA	1.0 EA	#FAN MOTOR
430 0047 000	CIRCULATOR GUARD, 24 IN.	1.0 EA	
430 0204 000	FAN BLADE, 24"DIA, 4 BLADE	1.0 EA	
436 0295 000	MOTOR 1HP 1140RPM 3 PHASE	1.0 EA	
448 0921 000	FILTER MEDIA 16 X 20 X 1	12.0 EA	
448 0922 000	FILTER FRAME, 16 X 20 X 1	6.0 EA	
448 1125 000	LATCH, RAISED, ADJ LEVER	3.0 EA	
843 4999 072	CLAMP, FILTER SUPPORT	2.0 EA	#REAR FAN ASSY
917 2100 082	CABLE, MOTOR, PA	1.0 EA	W053 #REAR FAN ASSY
917 2382 001	ANGLE, MTG FAN GUARD	4.0 EA	#ANGLE FAN GUARD
922 0900 402	BLOCK HINGE REAR DOOR	3.0 EA	#REAR FAN ASSY DOOR HINGE
922 0900 407	PIN ALIGNMENT	1.0 EA	
943 4999 073	MODIFICATION, VENTURI	1.0 EA	
943 4999 428	CLAMP, FILTER CENTER	1.0 EA	#REAR FAN ASSY
943 4999 429	CLAMP FILTER END	2.0 EA	#REAR FAN ASSY
943 4999 432	WRAP ASSY FILTER	1.0 EA	#REAR FAN ASSY
943 4999 433	PANEL FAN MOUNTING	1.0 EA	#REAR FAN ASSY
999 2910 001	HARDWARE LIST, PA REAR DOOR	1.0 EA	

Table 7-25. VISUAL PA CABINET - 992 7080 001

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS
041 1310 030	GASKET, RUBBER	25.040 FT	
055 0120 004	CONDUIT LKNUT .5	1.0 EA	#FOR AIR SWITCH
296 0344 000	TUBG, POLYETHYLENE 1/4 OD	1.60 FT	
324 0077 000	NUT U TYPE 6-32 STL	4.0 EA	#CB COVER
357 0089 000	GUIDE, MODULE	36.0 EA	#MODULE SLOTS
358 1866 000	BUMPER, MOLDED	2.0 EA	#ON REAR DOOR AT TOP
358 2037 000	BALL STUD 6-32X 3/16	6.0 EA	#P/S COVER
358 2635 000	CABLE TIE, PUSH MOUNT SNAP IN	14.0 EA	
358 3240 000	NUT, 3/8-16 HEX NYLON	6.0 EA	#BUSS BAR
358 3304 000	BOLT-NYLON,3/8-16 X 1-1/2	6.0 EA	
359 0180 000	ELBOW MALE 90 DEG	1.0 EA	#AIR SW
384 0431 000	RECT. 1N4001 ESD	1.0 EA	#CR001
384 0674 000	RECTIFIER 70A 400 PIV ESD	4.0 EA	CR002 CR003 CR004 CR005

404 0578 000	SOCKET RELAY, 4PDT	1.0 EA	
424 0004 000	GROMMET 5/8 MTG DIA	1.0 EA	
424 0007 000	GROMMET 13/16 MTG DI	1.0 EA	#AIR SWITCH
424 0013 000	GROMMET .381 MTG DIA	1.0 EA	
424 0018 000	GROMMET 1-1/2 MTG DI	1.0 EA	
424 0033 000	GROMMET 1-1/16 MTG D	3.0 EA	
448 0834 000	CATCH SPR	6.0 EA	#P/S COVER
448 0920 000	HINGE, CONCEALED, 120 DEG	3.0 EA	#REAR DOOR ASSY
524 0378 000	CAP 240,000 UF 60VDC	12.0 EA	C001 C002 C003 C004 C005 C006 C007 C008 C009 C010 C011 C012
542 0121 000	RES 150 OHM 5% 20W	12.0 EA	R001 R002 R003 R004 R005 R006 R007 R008 R009 R010 R011 R012
570 0314 000	CNTOR 110A 208V 60HZ 3PH	0.0 EA	FORMAT SELECTED PART
574 0156 000	RELAY 12VDC 4PDT	1.0 EA	#1K2
604 0525 000	SW, PRESS.	1.0 EA	S002
604 1044 000	SW, INTLK DPDT	1.0 EA	S001 DOOR INTERLOCK
606 0824 000	CKT BKR 7.5A 3P 480VAC	1.0 EA	CB002
606 0963 000	CIRCUIT BREAKER 1A 277V/480 2P	1.0 EA	
614 0811 000	BARRIER BLOCK, 3POLE 1X4	1.0 EA	TB001
614 0812 000	BARRIER BLOCK, 1 POLE,1X4	1.0 EA	TB002 (GND BLOCK)
620 2537 000	PLUG HOUSING, 12 POS	17.0 EA	A1J2 A2J2 A3J2 A4J2 A5J2 A6J2 A7J2 A8J2 A9J2 A10J2 A11J2 A12J2 A13J2 A14J2 A15J2 A16J2 A17J2
813 5001 066	STDOFF 10-32X3/4 3/8 HEX	4.0 EA	#4W/HEATPIPE
822 0900 016	PIN, ALIGNMENT	34.0 EA	
822 0900 096	INSULATOR, SUPPORT	6.0 EA	#BUSS BARS
822 0900 136	GND STRAP	1.0 EA	#TOP GND
822 0900 248	BRK'T, HONEY COMB	64.0 EA	#MODULE HONEY COMB
822 0900 249	HONEY COMB VERTICAL	32.0 EA	#MODULE HONEY COMB
822 0900 360	BRKT DIODE MTG	2.0 EA	
827 6893 001	PLATE	1.0 EA	#TOP GND
839 7900 056	STRAP, POSITIVE	2.0 EA	# CAPS
839 7900 057	STRAP, NEGATIVE	2.0 EA	
839 7900 073	BRKT, INTERLOCK	1.0 EA	
839 7900 093	GROUND STRAP	1.0 EA	#MODULE
839 7900 097	COVER, SLAVE REAR	1.0 EA	#SLAVE CABLE
839 7900 117	STRAP, MODULE GND	15.0 EA	
839 7900 148	STRAP, MODULE GND-LONG	2.0 EA	
843 4999 083	INSULATOR, BUS BAR	2.0 EA	
843 4999 091	CAPACITOR RACK COVER	2.0 EA	
843 4999 124	SEAL PLATE, POWER SUPPLY	2.0 EA	
843 4999 153	PWB, CAP BANK	2.0 EA	#CAP BANK
843 4999 188	DUCT, HEAT PIPE AIR	1.0 EA	
917 2100 092	CABLE, VIS MODULE	1.0 EA	W051
917 2100 093	CABLE, SLAVE BUSS	1.0 EA	
917 2100 095	CABLE, VIS PA PWR	1.0 EA	W052
917 2100 119	CABLE, LOWER PWR SUP. VIS	1.0 EA	#PS001 #PS002 W054
917 2100 122	CABLE, SLAVE RF DET.	1.0 EA	#SLAVE CONTROLLER
917 2100 152	CABLE, TX ON/SLAVE BD	1.0 EA	(J010-A18J2)
917 2100 159	CABLE, PS/SLAVE PA CAB	1.0 EA	W055
922 0900 100	CAB VERTICAL TRIM	2.0 EA	
922 0900 101	PA CAB HORIZ TRIM	2.0 EA	
922 0900 121	TRIM MOUNTING PLATE	10.0 EA	
922 0900 418	BUSHING ALIGNMENT PIN	1.0 EA	#MOUNT 922-0900-418 BEFORE MTG SIDEPANELS TO CABI-NET
939 7900 076	INTERLOCK COVER ASSY	1.0 EA	

939 7900 083	GROUND SWITCH ASSY	1.0 EA	S003
939 7900 839	CABLE RETRACTOR	1.0 EA	
943 4999 053	SHELF ASSY, MODULE	16.0 EA	
943 4999 054	PLENUM ASS'Y, MODULE	16.0 EA	
943 4999 058	BRACKET ASSY, CONNECTOR	2.0 EA	
943 4999 060	KICKPLATE, REAR PA CAB	1.0 EA	
943 4999 061	POST ASSY, UPPER CENTER	2.0 EA	#CAB/MODULE SHELVES
943 4999 062	PLENUM ASSY, TOP	1.0 EA	
943 4999 063	KICKPLATE ASSY, FRONT	1.0 EA	
943 4999 085	BLANK MODULE EXTRUSION	2.0 EA	#P/S COVER
943 4999 090	CAPACITOR RACK BASE	2.0 EA	
943 4999 114	SCR BLEEDER ASSY, VIS	1.0 EA	A028
943 4999 125	LINER ASSY LEFT	1.0 EA	
943 4999 126	LINER ASSY, RIGHT VISUAL	1.0 EA	
943 4999 147	PANEL EXT MTG-PWR SUPPLY	2.0 EA	#P/S COVER
943 4999 151	SAFETY COVER, CONTACTOR	1.0 EA	
943 4999 154	ANGLE LEFT LINER	1.0 EA	
943 4999 155	ANGLE, RIGHT LINER	1.0 EA	
943 4999 167	COVER, CIRCUIT BREAKER	1.0 EA	
943 4999 175	PLENUM ASSY, SLAVE TOP	1.0 EA	
943 4999 322	BUSS BAR 1/8"	2.0 EA	
943 4999 323	BUSS BAR 1/8" LF	2.0 EA	
943 5285 269	BRACKET, 'MOV' BD MTG	1.0 EA	
952 9200 002	CABINET ASSY, PA	1.0 EA	
992 8010 001	SLAVE CONTROLLER MODULE	1.0 EA	A018
992 8553 001	PWA, MOV-AC 198-250 VAC	1.0 EA	BOARD WITH MOV'S
992 9965 001	PA REAR DOOR ASSY	1.0 EA	
999 2612 001	HARDWARE LIST, P.A. VIS,	1.0 EA	
999 2613 001	WIRE/TUBING LIST FOR	1.0 EA	

Table 7-26. PHASE AND GAIN MODULE LB - 992 8011 001

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
952 9200 007	PHASE & GAIN TRAY ASSY	1	
992 8020 001	* PWB, PHASE/GAIN BD. LB	1	
999 2578 001	HARDWARE LIST	1	

Table 7-27. * PWB, PHASE/GAIN BD. LB - 992 8020 001

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
358 1214 000	SCREWLOCK, FEMALE	1	
380 0319 000	XSTR, MPS-A14	1	Q003
380 0527 000	XSTR, TIP120	2	Q001 Q002
380 0678 000	XSTR, ARRAY QUAD 2222	4	U011 U012 U013 U014
382 0285 000	IC CD4029BE ESD	2	U007 U008
382 0287 000	IC, 4001/14001 ESD	2	U009 U010
382 0323 000	IC, 1458 ESD	1	U015
382 0402 000	IC, CD4030/MC14507 ESD	1	U006
382 1155 000	PWR DIVIDER, 2 WAY 90 DEG.	5	U001 U002 U003 U004 U005
384 0355 000	DIODE HP5082-3081/A5S139	32	CR001 CR002 CR003 CR004 CR005 CR006 CR007 CR008 CR010 CR011 CR012 CR013 CR014 CR015 CR016 CR017 CR018 CR019 CR020 CR021 CR022 CR023 CR024 CR025 CR026 CR027 CR028 CR029 CR039 CR040

			CR041 CR042
384 0612 000	DIODE 1N3070	9	CR031 CR032 CR033 CR034 CR035 CR036 CR037 CR038 CR045
384 0662 000	LED RED	1	DS001
384 0837 000	TRANSZORB 1N6376 12V 5W	2	CR043 CR044
404 0673 000	SOCKET 8 PIN DIP (DL)	1	XU015
404 0674 000	SOCKET 14 PIN DIP (D-L)	7	XU006 XU009 XU010 XU011 XU012 XU013 XU014
404 0675 000	SOCKET IC 16 CONT	2	XU007 XU008
494 0196 000	CHOKE RF 100UH	24	L007 L008 L009 L010 L011 L012 L013 L014 L015 L016 L017 L018 L019 L020 L021 L022 L023 L024 L025 L026 L027 L028 L029 L030
494 0214 000	CHOKE RF 1.8UH	1	L005
494 0398 000	CHOKE RF 10.0UH	5	L001 L002 L003 L004 L006
500 1249 000	CAP 1PF 100V +/-1PF	4	C004 C012 C023 C031
500 1250 000	CAP 2PF 100V +/-.5PF	4	C005 C013 C024 C032
500 1252 000	CAP 4PF 100V +/-.5PF	4	C006 C014 C025 C033
500 1255 000	CAP 7PF 100V +/-.5PF	4	C007 C015 C026 C034
500 1256 000	CAP 8PF 100V +/-.5PF	4	C010 C018 C029 C037
500 1258 000	CAP 10PF 100V +/-.5PF	8	C008 C011 C016 C019 C027 C030 C035 C038
516 0453 000	CAP .1UF 100V 20% X7R	21	C001 C002 C003 C020 C021 C022 C039 C040 C042 C043 C045 C046 C047 C048 C049 C050 C051 C052 C053 C058 C059
516 0736 000	CAP .001UF 10% 100V X7R	1	C060
522 0550 000	CAP 100U 25V ELECTROLYTIC	2	C041 C044
540 0037 000	RES 330.0 OHM 1/2W 5%	24	R021 R022 R023 R024 R025 R026 R027 R028 R029 R030 R031 R032 R033 R034 R035 R036 R037 R038 R039 R040 R041 R042 R043 R044
540 0584 000	RES 75.0 OHM 2W 5%	4	R004 R005 R009 R010
540 0881 000	RES 51.0 OHM 1/4W 5%	1	R001
540 0882 000	RES 56.0 OHM 1/4W 5%	4	R002 R003 R007 R008
540 0912 000	RES 1.0K OHM 1/4W 5%	1	R020
540 0912 000	RES 1.0K OHM 1/4W 5%	1	R050
540 0930 000	RES 5.6K OHM 1/4W 5%	2	R006 R011
540 0936 000	RES 10.0K OHM 1/4W 5%	3	R012 R013 R019
540 0944 000	RES 22.0K OHM 1/4W 5%	3	R014 R018 R051
540 0960 000	RES 100.0K OHM 1/4W 5%	1	R017
540 0978 000	RES 560.0K OHM 1/4W 5%	2	R015 R016
540 1433 000	RES NETWORK 20K OHM 2%	3	R045 R046 R049
540 1449 000	RES NETWORK 18K OHM 2%	2	R047 R048
550 0967 000	POT 10K 1/2W/.3W 10%	2	R057 R058
600 0579 000	SW, ROTARY 4PDT	1	S002
604 1103 000	SW, TGL SPDT MOM-OFF-MOM	1	S001
604 1104 000	SW, TGL SPDT ON-NONE-ON	1	S003
610 0905 000	PLUG 9 PIN D RT ANGLE	1	J004
620 2543 000	RECEPTACLE,PC MT BNC R.A.	3	J001 J002 J003
839 7900 041	SCHEM, PHASE/GAIN BD	0	
843 4999 064	PWB, PHASE/GAIN BD.	1	

Table 7-28. PHASE & GAIN MODULE HB - 992 8011 002

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS
952 9200 007	PHASE & GAIN TRAY ASSY	1	
992 8020 002	* PHASE & GAIN PC ASSY HB	1	
999 2578 002	HARDWARE LIST	1	

Table 7-29. * PHASE & GAIN PC ASSY HB - 992 8020 002

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS
358 1214 000	SCREWLOCK, FEMALE	1	
380 0319 000	XSTR, MPS-A14	1	Q003
380 0527 000	XSTR, TIP120	2	Q001 Q002
380 0678 000	XSTR, ARRAY QUAD 2222	4	U011 U012 U013 U014
382 0285 000	IC CD4029BE ESD	2	U007 U008
382 0287 000	IC, 4001/14001 ESD	2	U009 U010
382 0323 000	IC, 1458 ESD	1	U015
382 0402 000	IC, CD4030/MC14507 ESD	1	U006
382 1156 000	PWR DIVIDER, 2 WAY 90 DEG.	5	U001 U002 U003 U004 U005
384 0355 000	DIODE HP5082-3081/A5S139	32	CR001 CR002 CR003 CR004 CR005 CR006 CR007 CR008 CR010 CR011 CR012 CR013 CR014 CR015 CR016 CR017 CR018 CR019 CR020 CR021 CR022 CR023 CR024 CR025 CR026 CR027 CR028 CR029 CR039 CR040 CR041 CR042
384 0612 000	DIODE 1N3070	9	CR031 CR032 CR033 CR034 CR035 CR036 CR037 CR038 CR045
384 0662 000	LED RED	1	DS001
384 0837 000	TRANSZORB 1N6376 12V 5W	2	CR043 CR044
404 0673 000	SOCKET 8 PIN DIP (DL)	1	XU015
404 0674 000	SOCKET 14 PIN DIP (D-L)	7	XU006 XU009 XU010 XU011 XU012 XU013 XU014
404 0675 000	SOCKET IC 16 CONT	2	XU007 XU008
494 0196 000	CHOKE RF 100UH	24	L007 L008 L009 L010 L011 L012 L013 L014 L015 L016 L017 L018 L019 L020 L021 L022 L023 L024 L025 L026 L027 L028 L029 L030
494 0214 000	CHOKE RF 1.8UH	1	L005
494 0398 000	CHOKE RF 10.0UH	5	L001 L002 L003 L004 L006
500 1249 000	CAP 1PF 100V +/-1PF	4	C004 C012 C023 C031
500 1250 000	CAP 2PF 100V +/-.5PF	4	C005 C013 C024 C032
500 1252 000	CAP 4PF 100V +/-.5PF	4	C006 C014 C025 C033
500 1255 000	CAP 7PF 100V +/-.5PF	4	C007 C015 C026 C034
500 1256 000	CAP 8PF 100V +/-.5PF	4	C010 C018 C029 C037
500 1258 000	CAP 10PF 100V +/-.5PF	8	C008 C011 C016 C019 C027 C030 C035 C038
516 0453 000	CAP .1UF 100V 20% X7R	21	C001 C002 C003 C020 C021 C022 C039 C040 C042 C043 C045 C046 C047 C048 C049 C050 C051 C052 C053 C058 C059
516 0736 000	CAP .001UF 10% 100V X7R	1	C060
522 0550 000	CAP 100U 25V ELECTROLYTIC	2	C041 C044
540 0037 000	RES 330.0 OHM 1/2W 5%	24	R021 R022 R023 R024 R025 R026 R027 R028 R029 R030 R031 R032 R033 R034 R035 R036 R037 R038

WARNING: Disconnect primary power prior to servicing.

			R039 R040 R041 R042 R043 R044
540 0584 000	RES 75.0 OHM 2W 5%	4	R004 R005 R009 R010
540 0881 000	RES 51.0 OHM 1/4W 5%	1	R001
540 0882 000	RES 56.0 OHM 1/4W 5%	4	R002 R003 R007 R008
540 0912 000	RES 1.0K OHM 1/4W 5%	1	R020
540 0912 000	RES 1.0K OHM 1/4W 5%	1	R050
540 0930 000	RES 5.6K OHM 1/4W 5%	2	R006 R011
540 0936 000	RES 10.0K OHM 1/4W 5%	3	R012 R013 R019
540 0944 000	RES 22.0K OHM 1/4W 5%	3	R014 R018 R051
540 0960 000	RES 100.0K OHM 1/4W 5%	1	R017
540 0978 000	RES 560.0K OHM 1/4W 5%	2	R015 R016
540 1433 000	RES NETWORK 20K OHM 2%	3	R045 R046 R049
540 1449 000	RES NETWORK 18K OHM 2%	2	R047 R048
550 0967 000	POT 10K 1/2W/.3W 10%	2	R057 R058
600 0579 000	SW, ROTARY 4PDT	1	S002
604 1103 000	SW, TGL SPDT MOM-OFF-MOM	1	S001
604 1104 000	SW, TGL SPDT ON-NONE-ON	1	S003
610 0905 000	PLUG 9 PIN D RT ANGLE	1	J004
620 2543 000	RECEPTACLE,PC MT BNC R.A.	3	J001 J002 J003
839 7900 041	SCHEM, PHASE/GAIN BD	0	
843 4999 064	PWB, PHASE/GAIN BD.	1	

Table 7-30. EXC SWITCHER RELAY PNL 1A6A1 - 992 8025 001

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
252 0003 000	WIRE, STRD 20AWG WHT	2.8 FT	
253 0059 000	CABLE, 2C 22AWG AUDIO	3 FT	
296 0262 000	TUBING, SHRINKABLE .25	.8 FT	
620 2546 000	RF TRANSFER SWITCH	2	S001 S002
700 0116 000	RES, LOAD 50 OHM 2W	2	RL001 RL002
839 7900 080	SCHEM, EXIT. SW RELAY PNL	0	
839 7900 228	SCHEMATIC EX SW OPTION	0	
917 2100 081	CABLE, RF JUMPER	4	
939 1250 003	R.F. DETECTOR ASSY	4	D001 D002 D003 D004
943 4999 255	PANEL EX SW RELAY	1	
992 8036 001	PWB EXC SWIT RELAY 1A6A2	1	
999 2595 001	HARDWARE LIST	1	
999 2690 001	WIRE/TUBG LIST	1	

Table 7-31. R.F. DETECTOR ASSY - 939 1250 003

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
540 0908 000	RES 680.0 OHM 1/4W 5%	1	R003
915 1924 002	BLOCK ASSY	1	
612 0233 000	RECEPTACLE N UG-58A/U	2	
916 2945 001	BOARD ASSY	1	
815 4449 001	SPACER	4	
916 7256 001	INNER COND ASSY	1	
302 0110 000	SCR, 6-32 X 3/4	4	
314 0005 000	WASHER, SPLIT-LOCK 6	4	
302 0054 000	SCR, 4-40 X 3/8	5	
516 0437 000	CAP 0.005UF 100V 20%	1	C1
526 0076 000	CAP .68UF 35V 10%	1	C2
302 0052 000	SCR, 4-40 X 1/4	8	
314 0003 000	WASHER, SPLIT-LOCK 4	13	

WARNING: Disconnect primary power prior to servicing.

310 0003 000	WASHER, FLAT NO. 4	2	
354 0055 000	SOLDER LUG 6 MTG HOLE	4	
540 0936 000	RES 10.0K OHM 1/4W 5%	1	R1
540 0976 000	RES 470.0K OHM 1/4W 5%	1	R004
384 0321 000	DIODE 5082-2800/1N5711	1	CR1
815 5476 003	SCHEMATIC, RF DETECTOR	0	

Table 7-32. INNER COND ASSY - 916 7256 001

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
816 7255 001	CENTER CONDUCTOR	1.0	
540 0912 000	RES 1.0K OHM 1/4W 5%	1.0	R2

Table 7-33. PWB EXC SWITCHER RELAY 1A6A2 - 992 8036 001

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
358 1726 000	SPRING, HOLD DOWN	5	#K001 #K002 #K003 #K004 #K005
358 1928 000	JUMPER 1/4 LG 1/8H	2	J007 J008
358 2997 000	END PLATE,236 TERM MODULE	1	#TB001
384 0431 000	RECT. 1N4001	6	CR001 CR002 CR003 CR004 CR005 CR006
384 0725 000	RECT 1N5818	2	CR007 CR008
404 0161 000	SOCKET RELAY 9KH2	5	XK001 XK002 XK003 XK004 XK005
574 0156 000	RELAY 12VDC 4PDT	5	K001 K002 K003 K004 K005
610 1083 000	CON 37 PIN D PLUG	2	P001 P002
612 1131 000	RECEPTACLE 25 POS D	1	J002
612 1163 000	RECEPTACLE 37 POS D	1	J001
614 0790 000	TERM MODULE,1C PC MTG 236	14	14#TB001
839 7900 080	SCHEM, EXIT. SW RELAY PNL	0	
843 4999 129	PWB, EXCIT. SW RELAY PNL	1	

Table 7-34. DC POWER SUPPLY BASLER 50 V 300 A - 736 0215 000

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
384 0841 000	DUAL THYRISTOR	3	Q1 Q2 Q3 Q4 Q5 Q6 550A RMS 250A IF AVG 400 PIV INT'L RECT. CORP. IRKT 250-4 BASLER ELEC. P/N 22991
430 0272 000	FAN, 220 VAC 112 CFM	1	4.68" SQ. X 1.53" DEEP BASLER ELEC. P/N 9-2264-05-002
484 0404 000	LINE FILTER (ZUCKER)	1	L2 BASLER ELEC. P/N 23883-001
735 0001 000	CONTROL PWA	1	BASLER ELEC. P/N 9-2264-01-100
736 0215 000	COMPLETE PWR SUPP 50V 300A		PS1 PS2 BASLER ELEC. P/N 9-2264-00-100

Table 7-35. * KIT, ELECTROLUMINESCENT - 917 2252 001

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
817 2252 001	ASSY INSTR, KIT,	0	
406 0510 000	DISPLAY, DOT MATRIX	0	
406 0510 001	DC/DC PWR CONVERTER PCB	0	
406 0510 003	POWER CABLE, 14 COND	0	
406 0510 004	VIDEO CABLE	0	

406 0510 007	VIDEO CONNECTOR	0	

Table 7-36. PREAMP 40-225 MHZ 1W - 992 8087 001

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
304 0089 000	NUT, HEX 6-32	6	USED AS P.C. BOARD SPACERS
382 0734 000	*IC, CA2830C/MHW592	2	U001 U002
620 2409 000	RECEPTACLE, BNC JACK	2	J001 J002
817 2121 001	SPEC PREAMP 40-225 MHZ	0	
839 7900 195	SCH, PREAMP	0	
839 7900 244	BRKT GND FINAL AMP	2	#J001 #J002
943 4999 033	HEATSINK, RF AMP	1	
943 4999 034	COVER-FINAL AMPL	1	
992 8088 001	PWB, PREAMP	1	
736 0150 000	PRE-AMP POWER SUPPLY	1	
999 2582 001	HARDWARE LIST	1	

Table 7-37. PWB, PREAMP - 992 8088 001

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
382 0411 000	IC, PSC-2-1	2	HY001 HY002
382 1126 000	IC 78L12A ESD.	1	U005
384 0355 000	DIODE HP5082-3081/A5S139	3	CR002 CR003 CR004
384 0838 000	TRANSZORB 1N6380 36V 5W	1	CR009
386 0123 000	ZENER, 1N4732A 4.7V	1	CR001
494 0261 000	CHOKE RF 3.3UH	2	L001 L002
494 0262 000	CHOKE RF 10UH 10%	1	L003
516 0453 000	CAP .1UF 100V 20% X7R	5	C007 C008 C012 C014 C015
516 0530 000	CAP .01UF 10% 100V X7R	6	C001 C002 C003 C004 C005 C006
526 0097 000	CAP 47UF 35V 20%	2	C011 C013
540 0878 000	RES 39 OHM 1/4W 5%	1	R007
540 0892 000	RES 150 OHM 1/4W 5%	2	R006 R008
540 0912 000	RES 1.0K OHM 1/4W 5%	1	R004
540 0928 000	RES 4.7K OHM 1/4W 5%	2	R001 R002
540 0935 000	RES 9.1K OHM 1/4W 5%	1	R003
550 1035 000	POT 5K OHM 1/2W 10%	1	R005
610 0978 000	HDR 10C 2ROW RT ANG	1	J003
843 4999 191	PWB, PREAMP	1	

8-1. Replaceable Parts Service

See the Replaceable Parts Service clause on back side of manual title page.

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MODULE PART NUMBERS				
DRIVER Modules	**992-8964-XXX**	**where XXX for CH2 = 002**	**where XXX for E2 = 102**	**where XXX for A2 = 202**
PA Modules				
1/4 MODULES HB & LB	**992-8960-XXX**	**where XXX for CH2 = 002**	**where XXX for E2 = 102**	**where XXX for A2 = 202**

MODULE PART NUMBERS Examples

Insert the last 3 digits, SXX, where S is system, 0 for system M, 1 for system E and 2 for for system A. Follow with the channel number XX.

Examples:	System M Ch. 2	E12 is -112	A10 is -210
Driver Modules	992-8964-002	992-8964-112	992-8964-210
1/4 Modules	992-8960-002	992-8960-112	992-8960-210
525W Driver/PA	992-8965-002	992-8965-112	992-8965-210
Power Amplifier	992-8969-002	992-8969-112	992-8969-210

Table 8-1. MODULE, RF, BASIC PA, LB1 - 992 8966 001

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS
007 4060 079	BRZ, FGR STK 97-606-02	.32	* 0.313 OF 16" = 5" 2 PIECES 2.5" REQ FOR LOGIC COVER
054 0014 103	CARTON, SHIPPING	1	
054 0014 107	INSERT, FOAM PACKAGING	1 ST	
252 0420 000	WIRE, RIBBON 5 X 100 MIL	.4 FT	FT #TO/FROM 1/4 MODS
252 0423 000	TEFLON INSULATED HOOK-UP	2 FT	
302 0052 000	SCR, 4-40 X 1/4	11	6#LOGIC PWB, 2# LOGIC REG, 3# LOGIC CHASSIS
302 0053 000	SCR, 4-40 X 5/16	3	3# DUMP LOADS
302 0054 000	SCR, 4-40 X 3/8	4	4# CABLE CLAMPS
302 0058 000	SCR, 4-40 X 3/4	4	2# PASS FETS 2# BUSS BARS
302 0106 000	SCR, 6-32 X 3/8	2	2# OUTPUT COUPLER
302 0108 000	SCR, 6-32 X 1/2	10	2#I/O CONNECTOR 8# COVER
302 0364 000	SCR, 4-40 X 3/16	6	6# CHASSIS COVER
302 0380 000	SCR, 6-32 X 5/16	11	#FRONT PANEL
302 0401 000	SCR, 4-40 X 1/4	6	6# DUMP LOADS
306 0003 000	NUT, HEX 4-40	10	2 PASS FET 2 BUSS BAR 2# CLAMP PASS FETS 4# DC FEED CLAMPS
306 0004 000	NUT, HEX 6-32	4	1# GRD WIRES, 1# COUPLER, 2# LOGIC CHASSIS
306 0071 000	NUT, HEX #6-32 UNDERSIZE	16	16# QTR MOD MTG
306 0072 000	NUT, HEX #4-40 UNDERSIZE	3	3# RF LOADS
310 0003 000	WASHER, FLAT NO. 4	18	2# CLAMP PASS FETS, 4# PASS FETS, 6# LOGIC, 2# REG, 4 CLAMP STANDOFFS
310 0012 000	WASHER FLAT 6	30	2# MAIN CONNECTOR, #5 - 2 X 2 COMBINER #5 - 2 X 2 DIVIDER, #5 - 2-WAY COMBINER #5 - 2-WAY DIVIDER, 8# COVER
310 0017 000	WASHER FLAT #6	7	2# LOGIC CHASSIS, 5# COUPLER
312 0006 000	WASHER, INT LOCK 8	5	#508-0560-000
314 0003 000	WASHER, SPLIT-LOCK 4	21	
314 0005 000	WASHER, SPLIT-LOCK 6	44	
314 0037 000	WASHER, SPLIT-LOCK 4 SS	9	#9 LOAD RESISTORS
336 1239 000	SCREW 6-32 X 3/8	12	5# 2 X 2 DIVIDER 5# 2 X 2 COMBINER 2# COUPLER
344 0009 000	SCREW, SET 8-32 X 3/16	2	#EXT/FLAPPER
350 0105 000	RIVET 3/16 ALUM .126/.25	4	4# FRONT PANEL
350 0155 000	RIVET POP .156 X .392	10	5# DIVIDER PWB 5# COMBINER PWB
354 0386 000	TERM, LOCKING #10 RING	1	#FRONT PANEL GND
356 0235 000	CABLE TIE 0.75" DIA.	20	
356 0237 000	CLAMP CABLE 1/4" DIA	1	#TAPE SWITCH
356 0241 000	CABLE CLAMP TIE	6	
358 1214 000	SCREWLOCK, FEMALE	1	* FILTERED D
380 0715 000	XSTR MOSFET IXTH67N10 ESD	2	Q001 Q002
384 0831 000	LED LIGHT BAR MOUNT	2	
386 0438 000	ZENER, 1N5243, 13V 0.5W	1	#BUSS BAR CR001
410 0335 000	INSULATOR SCREW	1	#A2U011
410 0413 000	INSULATOR PAD FOR TO-247	3	#A2U011, 2# PASS FETS
410 0414 000	THERMAL PAD 1.000 X .800	2	
414 0292 000	CORE, BALUN 2500 PERM	4	L014 L015 L016 L017
424 0013 000	GROMMET .381 MTG DIA	1	
424 0598 000	BUSHING, SPLIT, GUIDE PIN	2	
508 0560 000	CAP, FEEDTHRU 1000PF	5	C001 C002 C003 C004 C005
508 0561 000	EMI FILTER FEEDTHRU	2	FL001 FL002
516 0417 000	CAP 1000PF 10% 200V	2	2# BUSS BAR C023 C028

516 0831 000	CAP 0.010UF 10% 100V	4	4# BUSS BAR, C024, C025,C026, C027
519 0011 000	CAP RF CHIP 2.4PF 500V	1	A5A1C003
540 0858 000	RES 5.6 OHM 1/4W 5%	2	#PASS FET, R001, R002
544 1654 000	RES 100 OHM 250W 5%	3	A5R001 A6R001 A6R002
544 1660 000	RES 100 OHM 20W 5%	3	A4R001 A4R002 A3R001
610 1222 000	PLUG/RECP, D, 25 PIN	1	
646 0665 000	INSPECTION LABEL	1	
646 1519 000	LABEL, RF RADIATION WARN	1	
843 4999 528	PWB, PASS FET GATE BIAS	1	
843 4999 637	SCH, PA MODULE	0	
843 4999 644	FAMILY TREE, LB, PA MOD,	0	
917 2100 146	TAPE SWITCH ASSY	1	
917 2100 386	CABLE, LED BOARD	1	
917 2100 627	CABLE ASSEMBLY, DC FEED	1	
917 2100 747	MAIN I/O CONN ASSY	1	
939 7900 054	EXTRUSION, FLAPPER	1	
943 4999 084	MODULE FACE EXTRUSION	1	
943 4999 454	MODULE FRONT PANEL	1	
943 4999 456	MODULE COVER	1	
943 4999 518	BUSS BAR, DC (VERTICAL)	2	
943 4999 526	INSULATOR, BUSS BAR	3	
943 4999 585	ANGLE, HEATSINK MOUNTING	2	
943 4999 650	CHASSIS, MODULE	1	
943 4999 651	LOGIC CHASSIS	1	
943 4999 652	LOGIC COVER	1	
943 4999 653	CABLE, MODULE, MAIN	1	
943 5140 015	SPACER, INSULATOR	2	#BUSS BAR
992 8023 001	PWA, LED BOARD	1	A007
992 8127 002	PWA, LOGIC/CONTROL BD	1	A002
992 8557 102	DIVIDER, 2-WAY, LB1	1	A003
992 8558 102	COMB, LB1, 2 X 2 WAY	1	A006
992 8559 102	COMB, LB1, 2-WAY	1	A005
992 8560 102	DIVIDER, LB1, 2 X 2 WAY	1	A004
992 8976 001	COUPLER ASSY, LB MODULE	1	A001, NEED NEW NO. L.W.
992 9018 001	RF PLUG ASSY	1	J001

Table 8-2. MODULE, DRIVER BASIC LB1, - 992 8961 001

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
007 4060 079	BRZ, FGR STK 97-606-02	.32	* 0.313 OF 16" = 5" 2 PIECES 2.5" REQ FOR LOGIC COVER
054 0014 103	CARTON, SHIPPING	1	
054 0014 107	INSERT, FOAM PACKAGING	1 ST	
086 0004 056	SOLDER, SN96/AG4	0	#OUTPUT CABLES
252 0420 000	WIRE, RIBBON 5 X 100 MIL	.4 FT	FT #TO/FROM 1/4 MODS
252 0423 000	TEFLON INSULATED HOOK-UP	2 FT	
254 0005 000	WIRE, BUS CU 14AWG	.033 FT	
302 0052 000	SCR, 4-40 X 1/4	11	6# LOGIC PWB, 2# LOGIC REG, 3# LOGIC CHASSIS
302 0053 000	SCR, 4-40 X 5/16	3	6#A2 3# LOAD RES
302 0054 000	SCR, 4-40 X 3/8	3	3# CABLE CLAMPS
302 0058 000	SCR, 4-40 X 3/4	4	2# PASS FETS, 2# BUSS BARS
302 0106 000	SCR, 6-32 X 3/8	2	2# OUTPUT COUPLER
302 0108 000	SCR, 6-32 X 1/2	10	2#I/O CONNECTOR 8# COVER
302 0364 000	SCR, 4-40 X 3/16	6	6# CHASSIS COVER
302 0380 000	SCR, 6-32 X 5/16	11	#FRONT PANEL

302 0401 000	SCR, 4-40 X 1/4	1	1# ATTEN
306 0003 000	NUT, HEX 4-40	9	2# PASS FET 2# BUSS BAR 3# DC FEED CLAMPS 2# CLAMP PASS FETS
306 0004 000	NUT, HEX 6-32	4	1# GRD WIRES, 2# LOGIC CHASSIS, 1# COUPLER
306 0071 000	NUT, HEX #6-32 UNDERSIZE	16	16# QTR MOD MTG
306 0072 000	NUT, HEX #4-40 UNDERSIZE	3	3# RF LOADS
310 0003 000	WASHER, FLAT NO. 4	17	2# CLAMPS PASS FETS, 4# PASS FETS, 6# LOGIC, 2# REG, 3# CLAMPS STANDOFFS
310 0012 000	WASHER FLAT 6	30	2# MAIN CONNECTOR, 8# COVER, 20# PWB
310 0017 000	WASHER FLAT #6	7	2# LOGIC CHASSIS 5# COUPLER
312 0006 000	WASHER, INT LOCK 8	5	#508-0560-000
314 0003 000	WASHER, SPLIT-LOCK 4	20	
314 0005 000	WASHER, SPLIT-LOCK 6	44	
314 0037 000	WASHER, SPLIT-LOCK 4 SS	4	3# RF LOADS 1# ATTEN
336 1239 000	SCREW 6-32 X 3/8	12	5# 2 X 2 DIVIDER 5# 2 X 2 COMBINER 2# COUPLER
344 0009 000	SCREW, SET 8-32 X 3/16	2	
350 0105 000	RIVET 3/16 ALUM .126/.25	4	4# FRONT PANEL
350 0155 000	RIVET POP .156 X .392	10	5# DIVIDER PWB 5# COMBINER PWB
354 0386 000	TERM, LOCKING #10 RING	1	
356 0235 000	CABLE TIE 0.75" DIA.	15	
356 0237 000	CLAMP CABLE 1/4" DIA	1	
356 0241 000	CABLE CLAMP TIE	5	
358 1214 000	SCREWLOCK, FEMALE	1	* FILTERED D
358 3322 000	PLUG BUTTON, 0.50" HOLE	1	
380 0715 000	XSTR MOSFET IXTH67N10 ESD	2	Q001 Q002
384 0831 000	LED LIGHT BAR MOUNT	2	
386 0438 000	ZENER, 1N5243, 13V 0.5W	1	#BUSS BAR CR001
410 0335 000	INSULATOR SCREW	1	#A2U011
410 0413 000	INSULATOR PAD FOR TO-247	3	#A2U011, 2# PASS FETS
410 0414 000	THERMAL PAD 1.000 X .800	2	
414 0292 000	CORE, BALUN 2500 PERM	4	L014 L015 L016 L017
424 0013 000	GROMMET .381 MTG DIA	1	
424 0598 000	BUSHING, SPLIT, GUIDE PIN	1	
508 0560 000	CAP, FEEDTHRU 1000PF	5	C001 C002 C003 C004 C005
508 0561 000	EMI FILTER FEEDTHRU	2	FL001 FL002
516 0417 000	CAP 1000PF 10% 200V	2	2# BUSS BAR C023 C028
516 0831 000	CAP 0.010UF 10% 100V	4	4# BUSS BAR, C024 C025 C026 C027
519 0011 000	CAP RF CHIP 2.4PF 500V	1	A5A1C003
540 0858 000	RES 5.6 OHM 1/4W 5%	2	#PASS FET, R001, R002
544 1654 000	RES 100 OHM 250W 5%	1	A5R001
544 1660 000	RES 100 OHM 20W 5%	1	A3R001
556 0126 200	ATTEN 2.00 DB 30W INPUT	1	AT001
610 1222 000	PLUG/RECP, D, 25 PIN	1	
646 0665 000	INSPECTION LABEL	1	
646 1519 000	LABEL, RF RADIATION WARN	1	
843 4999 528	PWB, PASS FET GATE BIAS	1	
843 4999 638	SCH, LB DRIVER MODULE	0	
843 4999 645	FAMILY TREE, LB DRIVER,	0	
917 2100 146	TAPE SWITCH ASSY	1	
917 2100 386	CABLE, LED BOARD	1	
917 2100 627	CABLE ASSEMBLY, DC FEED	1	
917 2100 631	COAX TRIM, 12.5"	1	TL004
917 2100 633	COAX TRIM, 3.5"	1	TL007

WARNING: Disconnect primary power prior to servicing.

917 2100 635	COAX TRIM, 48.5"	1...	TL005
917 2100 637	COAX TRIM, 39"	1...	TL006
917 2100 747	MAIN I/O CONN ASSY	1...	
939 7900 054	EXTRUSION, FLAPPER	1...	
943 4999 084	MODULE FACE EXTRUSION	1...	
943 4999 454	MODULE FRONT PANEL	1...	
943 4999 456	MODULE COVER	1...	
943 4999 518	BUSS BAR, DC (VERTICAL)	2...	
943 4999 526	INSULATOR, BUSS BAR	3...	
943 4999 585	ANGLE, HEATSINK MOUNTING	2...	
943 4999 650	CHASSIS, MODULE	1...	
943 4999 651	LOGIC CHASSIS	1...	
943 4999 652	LOGIC COVER	1...	
943 4999 653	CABLE, MODULE, MAIN	1...	
943 5140 015	SPACER, INSULATOR	2...	#BUSS BAR
943 5140 022	COVER, 1/4 MODULE, DRIVER	1...	
992 8023 001	PWA, LED BOARD	1...	A007
992 8127 002	PWA, LOGIC/CONTROL BD	1...	A002
992 8557 102	DIVIDER, 2-WAY, LB1	1...	A003
992 8559 102	COMB, LB1, 2-WAY	1...	A005
992 8568 001	DIVIDER, LB, RF INTRA-	1...	A004
992 8568 002	COMB, LB, RF INTRACONNECT	1...	A006
992 8976 001	COUPLER ASSY, LB MODULE	1...	A001
992 9018 001	RF PLUG ASSY	1...	J001

Table 8-3. MOD, 1/4, BASIC, LB, - 992 8958 001

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
055 0190 009	* COATING 3140 RTV	0...	#T009
086 0001 010	* SEALANT GLYPTOL	0... QT	
086 0004 055	SOLDER, SN62/PB36/AG2	0...	#CHIP CAPS
302 0052 000	SCR, 4-40 X 1/4	8...	#MTG PWB
302 0053 000	SCR, 4-40 X 5/16	2...	#ANGLE MOUNTING
302 0132 000	SCR, 8-32 X 5/8	2...	#Q001/Q002, Q003/Q004
302 0401 000	SCR, 4-40 X 1/4	3...	#R005 #R015 #RT001
310 0006 000	WASHER FLAT 8	2...	#Q001/Q002, #Q003/Q004
310 0016 000	WASHER FLAT #4	1...	#RT001
310 0048 000	WASHER, FLAT #4 UNDERSIZE	8...	#MTG PWB
314 0003 000	WASHER, SPLIT-LOCK 4	10..	#MTG PWB, #ANGLES
314 0006 000	WASHER, SPLIT-LOCK 8	2...	#Q001/Q002, #Q003/Q004
314 0037 000	WASHER, SPLIT-LOCK 4 SS	3...	#R005 #R015 #RT001
356 0235 000	CABLE TIE 0.75" DIA.	16..	
358 3435 000	LEVELER, RF FET	4...	#Q001 Q002 Q003 Q004
358 3436 000	SPACER, 0.305" LONG	2...	#Q001/Q002, Q003/Q004
358 3438 000	SPRING, LEAF	2...	#Q001/Q002, Q003/Q004
404 0818 000	HEATSINK, 1/4 MODULE	1...	
414 0286 000	TOROID FERRITE	10..	
414 0287 000	TOROID FERRITE	20..	
646 0665 000	INSPECTION LABEL	1...	
700 1252 000	RES 200 OHM 10W 5%	2...	R005 R015
839 7900 701	SCH, LB 1/4 MODULE	0...	
843 4999 644	FAMILY TREE, LB, PA MOD,	0...	
843 4999 645	FAMILY TREE, LB DRIVER,	0...	
917 2100 331	TRIMMED COAX 5.9"	4...	
917 2100 332	TRIMMED COAX 2.9"	4...	

917 2100 334	TRIMMED COAX 3.85"	4	
917 2100 619	TRIMMED COAX	4	#T006 T007
917 2100 682	MOSFET RF PWR ON4402H ESD	4	Q001 Q002 Q003 Q004
943 5140 013	BRACKET, MTG	2	#CABLE CLAMPING
992 8608 001	THERMISTER ASSEMBLY	1	RT001 #SCREWED TO SINK
992 8956 001	PWA, 1/4 MOD LB RF,	1	

Table 8-4. PWA, 1/4 MOD LB RF, - 992 8956 001

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
254 0001 000	WIRE, BUS CU 22AWG	.1 .. FT	#T009
296 0310 000	TUBING TEFLON 20 AWG	.1 .. FT	#T009
358 3288 000	POWER TAP, PC MOUNT 25AMP	1	TB001
384 0843 000	DIODE 1N4154	1	CR001
516 0417 000	CAP 1000PF 10% 200V	12	C001 C002 C003 C012 C013 C014 C035 C043 C044 C045 C046 C048
516 0484 000	CAP 0.1UF 100V 10%	4	C024 C025 C032 C034
516 0831 000	CAP 0.010UF 10% 100V	9	C006 C009 C017 C020 C029 C036 C047 C051 C052
516 0890 000	CAP 470PF 10% 200V	12	C004 C015 C026 C027 C028 C030 C031 C037 C038 C039 C040 C041
516 0891 000	CAP 0.100UF 10% 50V	4	C007 C010 C018 C021
524 0375 000	CAP 100UF 63V	2	C049 C050
540 0001 000	RES 10 OHM 1/2W 5%	2	R014 R018
540 0300 000	RES 47.0 OHM 1W 5%	2	R019 R020
540 0880 000	RES 47.0 OHM 1/4W 5%	1	R017
540 0888 000	RES 100 OHM 1/4W 5%	1	R030
540 1405 000	RES NETWORK 2700 OHM 2%	1	R036
544 1652 000	RES 100 OHM 2W 5%	4	R001 R004 R006 R009
544 1667 000	RES 5.1 OHM 2W 5%	4	R002 R003 R007 R008
548 1102 000	RES 1.5K OHM 1/4W 1%	1	R031
548 1120 000	RES 2K OHM 1/4W 1%	1	R029
548 1508 000	RES 715 OHM 1/4W 1%	1	R032
548 2069 000	RES 49.9K OHM 1/4W 1%	2	R034 R035
548 2158 000	RES 1.65K OHM 1/4W 1%	1	R033
550 0913 000	POT, 5K OHM	4	R025 R026 R027 R028
550 0957 000	POT 500 OHM 1/2 W 10%	1	R016
610 1223 000	HEADER 3 POSITION	1	J001
839 7900 701	SCH, LB 1/4 MODULE	0	
843 4999 642	PWB, 1/4 MOD RF, LB,	1	
917 2100 336	XMFR 150W SAMPLE	1	T009
917 2100 640	AIR COIL, 8 TURN	4	L009 L010 L011 L012

Table 8-5. DIVIDER, 2-WAY, LB1 - 992 8557 102

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
000 0000 010	B/M NOTE:	0	THIS ITEM USED AT HIGHERLEVEL, RES, 100 OHM, 20W, R001, 544-1660-000
384 0321 000	DIODE 5082-2800/1N5711	1	CR001
515 0038 000	CAP CHIP 22PF 5% 50V	1	C001
515 0041 000	CAP CHIP 39PF 5% 50V	1	C002
516 0417 000	CAP 1000PF 10% 200V	1	C003
540 0912 000	RES 1.0K OHM 1/4W 5%	1	R003
548 0049 000	RES 100 OHM .5W 1%	1	R002

843 4999 492	PWB, DIVIDER 2-WAY	1 . . .	

Table 8-6. COMB, LB1, 2 X 2 WAY - 992 8558 102

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS
000 0000 010	B/M NOTE:	0 . . .	THIS ITEM USED AT HIGHERLEVEL, RES, 100 OHM, 250W, R1, R2, 544-1654-000
500 1337 000	CAP 18PF 5% 250V	2 . . .	C001 C004
519 0041 000	CAP RF CHIP 43PF 5% 500V	2 . . .	C002 C003
843 4999 495	PWB, LB COMB/DIV 2X2,	1 . . .	

Table 8-7. COMB, LB1, 2-WAY - 992 8559 102

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS
000 0000 010	B/M NOTE:	0 . . .	THIS ITEM USED AT HIGHERLEVEL, RES, 100 OHM, 250W, R1, 544-1654-000
500 1337 000	CAP 18PF 5% 250V	1 . . .	C001
519 0041 000	CAP RF CHIP 43PF 5% 500V	1 . . .	C002
843 4999 485	PWB, LB COMB 2-WAY	1 . . .	

Table 8-8. DIVIDER, LB1, 2 X 2 WAY - 992 8560 102

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS
000 0000 010	B/M NOTE:	0 . . .	THIS ITEM USED AT HIGHERLEVEL, RES, 100 OHM, 20W, R1, R2, 544-1660-000
515 0038 000	CAP CHIP 22PF 5% 50V	2 . . .	C001 C004
515 0041 000	CAP CHIP 39PF 5% 50V	2 . . .	C002 C003
843 4999 495	PWB, LB COMB/DIV 2X2,	1 . . .	

Table 8-9. DC PWA, LB COUPLER - 992 8843 001

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS
384 0321 000	DIODE 5082-2800/1N5711	2 . . .	CR001 CR002
516 0831 000	CAP 0.010UF 10% 100V	2 . . .	C001 C002
540 0321 000	RES 360.0 OHM 1W 5%	1 . . .	R005
544 1651 000	RES 51 OHM 2W 5%	1 . . .	R001
548 2103 000	RES 100 OHM 2W 1%	1 . . .	R002
548 2192 000	RES, 49.9 OHM, 2W, 1%	2 . . .	R003 R004
843 4999 479	PWB, LB COUPLER DC BD	1 . . .	

Table 8-10. MODULE, RF, BASIC PA, LB2 - 992 8967 001

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS
007 4060 079	BRZ, FGR STK 97-606-02	.32 .	0.313 OF 16" = 5, 2 PIECES 2.5" REQ FOR LOGIC COVER
054 0014 103	CARTON, SHIPPING	1 . . .	
054 0014 107	INSERT, FOAM PACKAGING	1 . . . ST	
252 0420 000	WIRE, RIBBON 5 X 100 MIL	.4 . . FT	FT #TO/FROM 1/4 MODS
252 0423 000	TEFLON INSULATED HOOK-UP	2 . . . FT	
302 0052 000	SCR, 4-40 X 1/4	11 . .	6# LOGIC PWB, 2# LOGIC REG, 3# LOGIC CHASSIS
302 0053 000	SCR, 4-40 X 5/16	3 . . .	3# DUMP LOADS
302 0054 000	SCR, 4-40 X 3/8	4 . . .	4# CABLE CLAMPS
302 0058 000	SCR, 4-40 X 3/4	4 . . .	2# PASS FETS, 2# BUSS BARS

302 0106 000 .	SCR, 6-32 X 3/8	5 ..	2# OUTPUT COUPLER
302 0108 000 .	SCR, 6-32 X 1/2	10 .	2#I/O CONNECTOR 8# COVER
302 0364 000 .	SCR, 4-40 X 3/16	6 ..	6# CHASSIS COVER
302 0380 000 .	SCR, 6-32 X 5/16	11 .	#FRONT PANEL
302 0401 000 .	SCR, 4-40 X 1/4	6 ..	6# DUMP LOADS
306 0003 000 .	NUT, HEX 4-40	10 .	#2 PASS FET #2 BUSS BAR 2# CLAMP PASS FETS 4# DC FEED CLAMPS
306 0004 000 .	NUT, HEX 6-32	4 ..	1# GRD WIRES 2# LOGIC CHASSIS, 1# COUPLER
306 0071 000 .	NUT, HEX #6-32 UNDERSIZE	16 .	16# QTR MOD MTG
306 0072 000 .	NUT, HEX #4-40 UNDERSIZE	3 ..	3# RF LOADS
310 0003 000 .	WASHER, FLAT NO. 4	18 .	2# CLAMP PASS FETS, 4# PASS FETS, 6# LOGIC, 2# REG, 4# CLAMPS STANDOFFS
310 0012 000 .	WASHER FLAT 6	30 .	2# MAIN CONNECTOR, #5 2 X 2 COMBINER #5 2 X 2 DIVIDER, #5 2-WAY COMBINER #5 2-WAY DIVIDER, 8# COVER
310 0017 000 .	WASHER FLAT #6	7 ..	2# LOGIC CHASSIS, 5# COUPLER
312 0006 000 .	WASHER, INT LOCK 8	5 ..	#508-0560-000
314 0003 000 .	WASHER, SPLIT-LOCK 4	21 .	
314 0005 000 .	WASHER, SPLIT-LOCK 6	44 .	
314 0037 000 .	WASHER, SPLIT-LOCK 4 SS	9 ..	#9 LOAD RESISTORS
336 1239 000 .	SCREW 6-32 X 3/8	12 .	5# 2 X 2 DIVIDER 5# 2 X 2 COMBINER 2# COUPLER
344 0009 000 .	SCREW, SET 8-32 X 3/16	2 ..	#EXT/FLAPPER
350 0105 000 .	RIVET 3/16 ALUM .126/.25	4 ..	4# FRONT PANEL
350 0155 000 .	RIVET POP .156 X .392	10 .	5# DIVIDER PWB 5# COMBINER PWB
354 0386 000 .	TERM, LOCKING #10 RING	1 ..	#FRONT PANEL GND
356 0235 000 .	CABLE TIE 0.75" DIA.	20 .	
356 0237 000 .	CLAMP CABLE 1/4" DIA	1 ..	#TAPE SWITCH
356 0241 000 .	CABLE CLAMP TIE	6 ..	
358 1214 000 .	SCREWLOCK, FEMALE	1 ..	#FILTERED D
380 0715 000 .	XSTR MOSFET IXTH67N10 ESD . .	2 ..	Q001 Q002
384 0831 000 .	LED LIGHT BAR MOUNT	2 ..	
386 0438 000 .	ZENER, 1N5243, 13V 0.5W	1 ..	#BUSS BAR CR001
410 0335 000 .	INSULATOR SCREW	1 ..	#A2U011
410 0413 000 .	INSULATOR PAD FOR TO-247 ...	3 ..	#A2U011, 2# PASS FETS
410 0414 000 .	THERMAL PAD 1.000 X .800	2 ..	
414 0292 000 .	CORE, BALUN 2500 PERM	4 ..	L014 L015 L016 L017
424 0013 000 .	GROMMET .381 MTG DIA	1 ..	
424 0598 000 .	BUSHING, SPLIT, GUIDE PIN	2 ..	
508 0560 000 .	CAP, FEEDTHRU 1000PF	5 ..	C001 C002 C003 C004 C005
508 0561 000 .	EMI FILTER FEEDTHRU	2 ..	FL001 FL002
516 0417 000 .	CAP 1000PF 10% 200V	2 ..	2# BUSS BAR C023 C028
516 0831 000 .	CAP 0.010UF 10% 100V	4 ..	4# BUSS BAR, C024, C025,C026, C027
519 0011 000 .	CAP RF CHIP 2.4PF 500V	1 ..	A5A1C003
540 0858 000 .	RES 5.6 OHM 1/4W 5%	2 ..	#PASS FET, R001, R002
544 1654 000 .	RES 100 OHM 250W 5%	3 ..	A5R001 A6R001 A6R002
544 1660 000 .	RES 100 OHM 20W 5%	3 ..	A4R001 A4R002 A3R001
610 1222 000 .	PLUG/RECP, D, 25 PIN	1 ..	
646 0665 000 .	INSPECTION LABEL	1 ..	
646 1519 000 .	LABEL, RF RADIATION WARN ...	1 ..	
843 4999 528 .	PWB, PASS FET GATE BIAS	1 ..	
843 4999 637 .	SCH, PA MODULE	0 ..	
843 4999 644 .	FAMILY TREE, LB, PA MOD, ...	0 ..	
917 2100 146 .	TAPE SWITCH ASSY	1 ..	

WARNING: Disconnect primary power prior to servicing.

917 2100 386	CABLE, LED BOARD	1	
917 2100 627	CABLE ASSEMBLY, DC FEED	1	
917 2100 747	MAIN I/O CONN ASSY	1	
939 7900 054	EXTRUSION, FLAPPER	1	
943 4999 084	MODULE FACE EXTRUSION	1	
943 4999 454	MODULE FRONT PANEL	1	
943 4999 456	MODULE COVER	1	
943 4999 518	BUSS BAR, DC (VERTICAL)	2	
943 4999 526	INSULATOR, BUSS BAR	3	
943 4999 585	ANGLE, HEATSINK MOUNTING	2	
943 4999 650	CHASSIS, MODULE	1	
943 4999 651	LOGIC CHASSIS	1	
943 4999 652	LOGIC COVER	1	
943 4999 653	CABLE, MODULE, MAIN	1	
943 5140 015	SPACER, INSULATOR	2	#BUSS BAR
992 8023 001	PWA, LED BOARD	1	A007
992 8127 002	PWA, LOGIC/CONTROL BD	1	A002
992 8557 104	DIVIDER, LB2, 2-WAY, SSTV	1	A003
992 8558 104	COMB, LB2, 2X2 WAY, SSTV	1	A006
992 8559 104	COMB, LB2, 2-WAY, SSTV	1	A005
992 8560 104	DIVIDER, LB2, 2X2 WAY	1	A004
992 8976 001	COUPLER ASSY, LB MODULE	1	A001, NEED NEW NO. L.W.
992 9018 001	RF PLUG ASSY	1	J001

Table 8-11. MODULE, DRIVER, BASIC LB2 - 992 8962 001

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
007 4060 079	BRZ, FGR STK 97-606-02	.32	* 0.313 OF 16" = 5" 2 PIECES 2.5" REQ FOR LOGIC COVER
054 0014 103	CARTON, SHIPPING	1	
054 0014 107	INSERT, FOAM PACKAGING	1 ST	
086 0004 056	SOLDER, SN96/AG4	0	#OUTPUT CABLES
252 0420 000	WIRE, RIBBON 5 X 100 MIL	.4 FT	FT #TO/FROM 1/4 MODS
252 0423 000	TEFLON INSULATED HOOK-UP	2 FT	
254 0005 000	WIRE, BUS CU 14AWG	.033 FT	
302 0052 000	SCR, 4-40 X 1/4	11	6# LOGIC, 2# LOGIC REG, 3# LOGIC CHASSIS
302 0053 000	SCR, 4-40 X 5/16	3	3# LOAD RES
302 0054 000	SCR, 4-40 X 3/8	3	3# CABLE CLAMPS
302 0058 000	SCR, 4-40 X 3/4	4	2# PASS FETS 2# BUSS BARS
302 0106 000	SCR, 6-32 X 3/8	2	2# COUPLER
302 0108 000	SCR, 6-32 X 1/2	10	2#I/O CONNECTOR 8# COVER
302 0364 000	SCR, 4-40 X 3/16	6	6# CHASSIS COVER
302 0380 000	SCR, 6-32 X 5/16	11	#FRONT PANEL
302 0401 000	SCR, 4-40 X 1/4	1	1# ATTEN
306 0003 000	NUT, HEX 4-40	9	2# PASS FET 2# BUSS BAR 2# CLAMP PASS FET 3# DC FEED CLAMPS
306 0004 000	NUT, HEX 6-32	4	1# GRD WIRES, 2# LOGIC CHASSIS, 1# COUPLER
306 0071 000	NUT, HEX #6-32 UNDERSIZE	16	16# QTR MOD MTG
306 0072 000	NUT, HEX #4-40 UNDERSIZE	3	3# DUMP LOADS
310 0003 000	WASHER, FLAT NO. 4	17	2# CLAMP PASS FETS, 4# PASS FETS, 6# LOGIC, 2# REG, 3# CLAMP STANDOFFS
310 0012 000	WASHER FLAT 6	30	2# MAIN CONNECTOR, 8# COVER, 20# PWB
310 0017 000	WASHER FLAT #6	7	2# LOGIC CHASSIS, 5# COUPLER
312 0006 000	WASHER, INT LOCK 8	5	#508-0560-000
314 0003 000	WASHER, SPLIT-LOCK 4	20	

314 0005 000	WASHER, SPLIT-LOCK 6	44	
314 0037 000	WASHER, SPLIT-LOCK 4 SS	4	3# RF LOADS 1# ATTEN
336 1239 000	SCREW 6-32 X 3/8	12	5# 2 X 2 DIVIDER 5# 2 X 2 COMBINER 2# COUPLER
344 0009 000	SCREW, SET 8-32 X 3/16	2	
350 0105 000	RIVET 3/16 ALUM .126/.25	4	4# FRONT PANEL
350 0155 000	RIVET POP .156 X .392	10	5# DIVIDER PWB 5# COMBINER PWB
354 0386 000	TERM, LOCKING #10 RING	1	
356 0235 000	CABLE TIE 0.75" DIA.	15	
356 0237 000	CLAMP CABLE 1/4" DIA	1	
356 0241 000	CABLE CLAMP TIE	5	
358 1214 000	SCREWLOCK, FEMALE	1	* FILTERED D
358 3322 000	PLUG BUTTON, 0.50" HOLE	1	
380 0715 000	XSTR MOSFET IXTH67N10 ESD	2	Q001 Q002
384 0831 000	LED LIGHT BAR MOUNT	2	
386 0438 000	ZENER, 1N5243, 13V 0.5W	1	#BUSS BAR CR001
410 0335 000	INSULATOR SCREW	1	#A2U011
410 0413 000	INSULATOR PAD FOR TO-247	3	#A2U011, 2# PASS FETS
410 0414 000	THERMAL PAD 1.000 X .800	2	
414 0292 000	CORE, BALUN 2500 PERM	4	L014 L015 L016 L017
424 0013 000	GROMMET .381 MTG DIA	1	
424 0598 000	BUSHING, SPLIT, GUIDE PIN	1	
508 0560 000	CAP, FEEDTHRU 1000PF	5	C001 C002 C003 C004 C005
508 0561 000	EMI FILTER FEEDTHRU	2	FL001 FL002
516 0417 000	CAP 1000PF 10% 200V	2	2# BUSS BAR, C023 C028
516 0831 000	CAP 0.010UF 10% 100V	4	4# BUSS BAR, C024 C025 C026 C027
519 0011 000	CAP RF CHIP 2.4PF 500V	1	A5A1C003
540 0858 000	RES 5.6 OHM 1/4W 5%	2	#PASS FET, R001, R002
544 1654 000	RES 100 OHM 250W 5%	1	A5R001
544 1660 000	RES 100 OHM 20W 5%	1	A3R001
556 0126 200	ATTEN 2.00 DB 30W INPUT	1	AT001
610 1222 000	PLUG/RECP, D, 25 PIN	1	
646 0665 000	INSPECTION LABEL	1	
646 1519 000	LABEL, RF RADIATION WARN	1	
843 4999 528	PWB, PASS FET GATE BIAS	1	
843 4999 638	SCH, LB DRIVER MODULE	0	
843 4999 645	FAMILY TREE, LB DRIVER,	0	
917 2100 146	TAPE SWITCH ASSY	1	
917 2100 386	CABLE, LED BOARD	1	
917 2100 627	CABLE ASSEMBLY, DC FEED	1	
917 2100 631	COAX TRIM, 12.5"	1	TL004
917 2100 633	COAX TRIM, 3.5"	1	TL007
917 2100 636	COAX TRIM, 39.9"	1	TL005
917 2100 638	COAX TRIM, 30.4"	1	TL006
917 2100 747	MAIN I/O CONN ASSY	1	
939 7900 054	EXTRUSION, FLAPPER	1	
943 4999 084	MODULE FACE EXTRUSION	1	
943 4999 454	MODULE FRONT PANEL	1	
943 4999 456	MODULE COVER	1	
943 4999 518	BUSS BAR, DC (VERTICAL)	2	
943 4999 526	INSULATOR, BUSS BAR	3	
943 4999 585	ANGLE, HEATSINK MOUNTING	2	
943 4999 650	CHASSIS, MODULE	1	
943 4999 651	LOGIC CHASSIS	1	

943 4999 652	LOGIC COVER	1...	
943 4999 653	CABLE, MODULE, MAIN	1...	
943 5140 015	SPACER, INSULATOR	2...	#BUSS BAR
943 5140 022	COVER, 1/4 MODULE, DRIVER	1...	
992 8023 001	PWA, LED BOARD	1...	A007
992 8127 002	PWA, LOGIC/CONTROL BD	1...	A002
992 8557 104	DIVIDER, LB2, 2-WAY, SSTV	1...	A003
992 8559 104	COMB, LB2, 2-WAY, SSTV	1...	A005
992 8568 001	DIVIDER, LB, RF INTRA-	1...	A004
992 8568 002	COMB, LB, RF INTRACONNECT	1...	A006
992 8976 001	COUPLER ASSY, LB MODULE	1...	A001
992 9018 001	RF PLUG ASSY	1...	J001

Table 8-12. DIVIDER, LB2, 2-WAY, SSTV - 992 8557 104

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
000 0000 010	B/M NOTE:	0...	THIS ITEM USED AT HIGHERLEVEL, RES, 100 OHM, 20W, R1, 544-1660-000
384 0321 000	DIODE 5082-2800/1N5711	1...	CR001
515 0036 000	CAP CHIP 15PF 5% 50V	1...	C001
515 0037 000	CAP CHIP 18PF 5% 50V	2...	C002A C002B
516 0417 000	CAP 1000PF 10% 200V	1...	C003
540 0912 000	RES 1.0K OHM 1/4W 5%	1...	R003
548 0049 000	RES 100 OHM .5W 1%	1...	R002
843 4999 493	PWB, DIVIDER 2-WAY	1...	

Table 8-13. COMB, LB2, 2X2 WAY, SSTV - 992 8558 104

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
000 0000 010	B/M NOTE:	0...	THIS ITEM USED AT HIGHERLEVEL. RES, 100 OHM, 250W, R1, R2, 544-1654-000
500 1335 000	CAP 15PF 5% 250V	2...	C001 C004
519 0037 000	CAP RF CHIP 30PF 5% 500V	2...	C002 C003
843 4999 488	PWB, COMB/DIV 2 X 2	1...	

Table 8-14. COMB, LB2, 2-WAY, SSTV - 992 8559 104

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
000 0000 010	B/M NOTE:	0...	THIS ITEM USED AT HIGHERLEVEL. RES, 100 OHM, 250W, R1, 544-1654-000
500 1335 000	CAP 15PF 5% 250V	1...	C001
519 0037 000	CAP RF CHIP 30PF 5% 500V	1...	C002
843 4999 487	PWB, LB COMB 2-WAY	1...	

Table 8-15. DIVIDER, LB2, 2X2 WAY - 992 8560 104

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
000 0000 010	B/M NOTE:	0...	THIS ITEM USED AT HIGHERLEVEL. RES, 100 OHM, 20W, R1, R2 544-1660-000
515 0036 000	CAP CHIP 15PF 5% 50V	2...	C001 C004
515 0040 000	CAP CHIP 33PF 5% 50V	2...	C002 C003
843 4999 488	PWB, COMB/DIV 2 X 2	1...	

Table 8-16. MODULE, RF, BASIC PA HB, - 992 8968 001

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS
007 4060 079	BRZ, FGR STK 97-606-02	.32	0.313 OF 16" = 5" 5"* 2 PIECES 2.5" REQ FOR LOGIC COVER
054 0014 103	CARTON, SHIPPING	1	
054 0014 107	INSERT, FOAM PACKAGING	1 ST	
252 0420 000	WIRE, RIBBON 5 X 100 MIL	.4 FT	FT #TO/FROM 1/4 MODS
252 0423 000	TEFLON INSULATED HOOK-UP	2 FT	
302 0052 000	SCR, 4-40 X 1/4	11	6# LOGIC PWB, 2# LOGIC REG, 3# LOGIC CHASSIS
302 0053 000	SCR, 4-40 X 5/16	3	3# DUMP LOADS
302 0054 000	SCR, 4-40 X 3/8	4	4# CABLE CLAMPS
302 0058 000	SCR, 4-40 X 3/4	4	2# PASS FETS 2# BUSS BARS
302 0106 000	SCR, 6-32 X 3/8	2	2# OUTPUT COUPLER
302 0108 000	SCR, 6-32 X 1/2	10	2#I/O CONNECTOR 8# COVER
302 0364 000	SCR, 4-40 X 3/16	6	6# CHASSIS COVER
302 0380 000	SCR, 6-32 X 5/16	11	#FRONT PANEL
302 0401 000	SCR, 4-40 X 1/4	6	6# DUMP LOADS
306 0003 000	NUT, HEX 4-40	10	2#PASS FET 2#BUSS BAR 2# CLAMP PASS FETS 4# DC FEED CLAMPS
306 0004 000	NUT, HEX 6-32	4	1# GRD WIRE, 2# LOGIC CHASSIS, #1 COUPLER
306 0071 000	NUT, HEX #6-32 UNDERSIZE	16	16# QTR MOD MTG
306 0072 000	NUT, HEX #4-40 UNDERSIZE	3	3# RF LOADS
310 0003 000	WASHER, FLAT NO. 4	18	2# CLAMP PASS FETS 4# PASS FET 6# LOGIC 2#REG. 4# CLAMPS STANDOFFS
310 0012 000	WASHER FLAT 6	30	2# MAIN CONNECTOR, 8# COVER, 20# PWB,
310 0017 000	WASHER FLAT #6	7	2# LOGIC CHASSIS 5# COUPLER
314 0003 000	WASHER, SPLIT-LOCK 4	21	
314 0005 000	WASHER, SPLIT-LOCK 6	44	
314 0037 000	WASHER, SPLIT-LOCK 4 SS	9	9# DUMP LOADS
336 1239 000	SCREW 6-32 X 3/8	12	5# 2 X 2 DIVIDER 5# 2 X 2 COMBINER 2# COUPLER
344 0009 000	SCREW, SET 8-32 X 3/16	2	#EXT/FLAPPER
350 0105 000	RIVET 3/16 ALUM .126/.25	4	4# FRONT PANEL
350 0155 000	RIVET POP .156 X .392	10	5# DIVIDER PWB 5# COMBINER PWB
354 0386 000	TERM, LOCKING #10 RING	1	#FRONT PANEL GND.
356 0235 000	CABLE TIE 0.75" DIA.	20	
356 0237 000	CLAMP CABLE 1/4" DIA	1	#TAPE SWITCH
356 0241 000	CABLE CLAMP TIE	6	
358 1214 000	SCREWLOCK, FEMALE	1	* FILTERED D
380 0715 000	XSTR MOSFET IXTH67N10 ESD	2	Q001 Q002
384 0831 000	LED LIGHT BAR MOUNT	2	
386 0438 000	ZENER, 1N5243, 13V 0.5W	1	#BUSS BAR CR001
410 0335 000	INSULATOR SCREW	1	#A2U011
410 0413 000	INSULATOR PAD FOR TO-247	3	#A2U011, 2# PASS FETS
410 0414 000	THERMAL PAD 1.000 X .800	2	
414 0292 000	CORE, BALUN 2500 PERM	4	L014 L015 L016 L017
424 0013 000	GROMMET .381 MTG DIA	1	
424 0598 000	BUSHING, SPLIT, GUIDE PIN	2	
508 0560 000	CAP, FEEDTHRU 1000PF	5	C001 C002 C003 C004 C005
508 0561 000	EMI FILTER FEEDTHRU	2	FL001 FL002
516 0417 000	CAP 1000PF 10% 200V	2	2# BUSS BAR C023 C028
516 0831 000	CAP 0.010UF 10% 100V	4	4# BUSS BAR, C024, C025,C026, C027
540 0858 000	RES 5.6 OHM 1/4W 5%	2	#PASS FET, R001, R002

544 1654 000	RES 100 OHM 250W 5%	3	A5R001 A6R001 A6R002
544 1660 000	RES 100 OHM 20W 5%	3	A4R001 A4R002 A3R001
610 1222 000	PLUG/RECP, D, 25 PIN	1	
646 0665 000	INSPECTION LABEL	1	
646 1519 000	LABEL, RF RADIATION WARN	1	
843 4999 528	PWB, PASS FET GATE BIAS	1	
843 4999 637	SCH, PA MODULE	0	
843 4999 643	FAMILY TREE, HB, PA MOD,	0	
917 2100 146	TAPE SWITCH ASSY	1	
917 2100 386	CABLE, LED BOARD	1	
917 2100 627	CABLE ASSEMBLY, DC FEED	1	
917 2100 747	MAIN I/O CONN ASSY	1	
939 7900 054	EXTRUSION, FLAPPER	1	
943 4999 084	MODULE FACE EXTRUSION	1	
943 4999 454	MODULE FRONT PANEL	1	
943 4999 456	MODULE COVER	1	
943 4999 518	BUSS BAR, DC (VERTICAL)	2	
943 4999 526	INSULATOR, BUSS BAR	3	
943 4999 585	ANGLE, HEATSINK MOUNTING	2	
943 4999 650	CHASSIS, MODULE	1	
943 4999 651	LOGIC CHASSIS	1	
943 4999 652	LOGIC COVER	1	
943 4999 653	CABLE, MODULE, MAIN	1	
943 5140 015	SPACER, INSULATOR	2	#BUSS BAR
992 8023 001	PWA, LED BOARD	1	A007
992 8127 002	PWA, LOGIC/CONTROL BD	1	A002
992 8557 007	DIVIDER, HB, 2-WAY	1	A003
992 8558 007	COMBINER, HB 2 X 2 WAY	1	A006
992 8559 007	COMB, HB, 2-WAY	1	A005
992 8560 007	DIVIDER, HB, 2 X 2 WAY	1	A004
992 8975 001	COUPLER ASSY, HB MODULE	1	A001
992 9018 001	RF PLUG ASSY	1	J001

Table 8-17. MODULE, DRIVER, BASIC HB, - 992 8963 001

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
007 4060 079	BRZ, FGR STK 97-606-02	.32	* 0.313 OF 16" = 5" 2 PIECES 2.5" REQ FOR LOGIC COVER
054 0014 103	CARTON, SHIPPING	1	
054 0014 107	INSERT, FOAM PACKAGING	1 ST	
086 0004 056	SOLDER, SN96/AG4	0	#OUTPUT CABLES
252 0420 000	WIRE, RIBBON 5 X 100 MIL	.4 FT	FT #TO/FROM 1/4 MODS
252 0423 000	TEFLON INSULATED HOOK-UP	2 FT	
302 0052 000	SCR, 4-40 X 1/4	11	6 LOGIC BD, 2# LOGIC REG3# LOGIC CHASSIS
302 0053 000	SCR, 4-40 X 5/16	3	6#A2 3# LOAD RES
302 0054 000	SCR, 4-40 X 3/8	4	4# CABLE CLAMPS
302 0058 000	SCR, 4-40 X 3/4	4	2# PASS FETS 2# BUSS BARS
302 0106 000	SCR, 6-32 X 3/8	2	2# OUTPUT COUPLER
302 0108 000	SCR, 6-32 X 1/2	10	2#I/O CONNECTOR 8# COVER
302 0364 000	SCR, 4-40 X 3/16	6	6# CHASSIS COVER
302 0380 000	SCR, 6-32 X 5/16	11	#FRONT PANEL
302 0401 000	SCR, 4-40 X 1/4	1	1# ATTEN
306 0003 000	NUT, HEX 4-40	10	2# PASS FET 2# BUSS BAR 2# CLAMP PASS FETS 4# DC FEED CLAMPS
306 0004 000	NUT, HEX 6-32	4	1# GRD WIRES, 2# LOGIC CHASSIS, 1# COUPLER

306 0071 000	NUT, HEX #6-32 UNDERSIZE	16	16# QTR MOD MTG
306 0072 000	NUT, HEX #4-40 UNDERSIZE	3	3# RF LOADS
310 0003 000	WASHER, FLAT NO. 4	18	4 PASS FET 6 LOGIC, 2 REG. 2# CLAMP PASS FETS 4# CLAMPS STANDOFFS
310 0012 000	WASHER FLAT 6	30	2# MAIN CONNECTOR 8# COVER, 20# PWB
310 0017 000	WASHER FLAT #6	7	5# DIR COUPLER 2# LOGIC CHASSIS
312 0006 000	WASHER, INT LOCK 8	5	#508-0560-000
314 0003 000	WASHER, SPLIT-LOCK 4	21	2# PASS FETS 2# BUSS BARS 2# TRANS U11 & U12 6# LOGIC BD 3# LOGIC CHASSIS 4# DC WIRE CLAMPS
314 0005 000	WASHER, SPLIT-LOCK 6	44	
314 0037 000	WASHER, SPLIT-LOCK 4 SS	4	
336 1239 000	SCREW 6-32 X 3/8	12	5# 2 X 2 DIVIDER 2# COUPLER 5# 2 X 2 COMBINER
344 0009 000	SCREW, SET 8-32 X 3/16	2	#EXT/FLAPPER
350 0105 000	RIVET 3/16 ALUM .126/.25	4	4# FRONT PANEL
350 0155 000	RIVET POP .156 X .392	10	5# DIVIDER PWB 5# COMBINER PWB
354 0386 000	TERM, LOCKING #10 RING	1	#FRONT PANEL GND
356 0235 000	CABLE TIE 0.75" DIA.	20	
356 0237 000	CLAMP CABLE 1/4" DIA	1	# TAPE SWITCH
356 0241 000	CABLE CLAMP TIE	6	
358 1214 000	SCREWLOCK, FEMALE	1	* FILTERED D
358 3322 000	PLUG BUTTON, 0.50" HOLE	1	
380 0715 000	XSTR MOSFET IXTH67N10 ESD	2	Q001 Q002
384 0831 000	LED LIGHT BAR MOUNT	2	
386 0438 000	ZENER, 1N5243, 13V 0.5W	1	#BUSS BAR CR001
410 0335 000	INSULATOR SCREW	1	#A2U011
410 0413 000	INSULATOR PAD FOR TO-247	3	#A2U011, 2# PASS FETS
410 0414 000	THERMAL PAD 1.000 X .800	2	
414 0292 000	CORE, BALUN 2500 PERM	4	L014 L015 L016 L017
424 0013 000	GROMMET .381 MTG DIA	1	
424 0598 000	BUSHING, SPLIT, GUIDE PIN	1	
508 0560 000	CAP, FEEDTHRU 1000PF	5	C001 C002 C003 C004 C005
508 0561 000	EMI FILTER FEEDTHRU	2	FL001 FL002
516 0417 000	CAP 1000PF 10% 200V	2	2# BUSS BARS C023 C028
516 0831 000	CAP 0.010UF 10% 100V	4	4# BUSS BAR, C024 C025 C026 C027
540 0858 000	RES 5.6 OHM 1/4W 5%	2	#PASS FET, R001, R002
544 1654 000	RES 100 OHM 250W 5%	1	A5R001
544 1660 000	RES 100 OHM 20W 5%	1	A3R001
556 0126 200	ATTEN 2.00 DB 30W INPUT	1	AT001
610 1222 000	PLUG/RECP, D, 25 PIN	1	
646 0665 000	INSPECTION LABEL	1	
646 1519 000	LABEL, RF RADIATION WARN	1	
843 4999 528	PWB, PASS FET GATE BIAS	1	
843 4999 639	SCH, HB DRIVER MODULE	0	
843 4999 646	FAMILY TREE, HB, DRIVER,	0	
917 2100 146	TAPE SWITCH ASSY	1	
917 2100 386	CABLE, LED BOARD	1	
917 2100 627	CABLE ASSEMBLY, DC FEED	1	
917 2100 631	COAX TRIM, 12.5"	1	TL004
917 2100 632	COAX TRIM, 22.5"	1	TL005
917 2100 633	COAX TRIM, 3.5"	1	TL007
917 2100 634	COAX TRIM, 13.5"	1	TL006
917 2100 747	MAIN I/O CONN ASSY	1	

939 7900 054	EXTRUSION, FLAPPER	1	
943 4999 084	MODULE FACE EXTRUSION	1	
943 4999 454	MODULE FRONT PANEL	1	
943 4999 456	MODULE COVER	1	
943 4999 518	BUSS BAR, DC (VERTICAL)	2	
943 4999 526	INSULATOR, BUSS BAR	3	
943 4999 585	ANGLE, HEATSINK MOUNTING	2	
943 4999 650	CHASSIS, MODULE	1	
943 4999 651	LOGIC CHASSIS	1	
943 4999 652	LOGIC COVER	1	
943 4999 653	CABLE, MODULE, MAIN	1	
943 5140 015	SPACER, INSULATOR	2	#BUSS BAR
992 8023 001	PWA, LED BOARD	1	A007
992 8127 002	PWA, LOGIC/CONTROL BD	1	A002
992 8557 007	DIVIDER, HB, 2-WAY	1	A003
992 8559 007	COMB, HB, 2-WAY	1	A005
992 8568 003	DIV, HB, RF INTRACONNECT	1	A004
992 8568 004	COMB, HB, RF INTRACONNECT	1	A006
992 8975 001	COUPLER ASSY, HB MODULE	1	A001
992 9018 001	RF PLUG ASSY	1	J001

Table 8-18. MOD, 1/4, BASIC, HB, - 992 8959 001

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
055 0190 009	* COATING 3140 RTV	0	
086 0001 010	* SEALANT GLYPTOL	0 QT	
086 0004 055	SOLDER, SN62/PB36/AG2	0	#CHIP CAPS
252 0420 000	WIRE, RIBBON 5 X 100 MIL	.2 FT	
254 0055 000	WIRE, 16AWG, SOLID, 600V	1 FT	L001 L002 L003 L004 CUT TO 2.80" +/- 0.050", STRIP BOTH ENDS 0.15" +/- 0.050"
302 0052 000	SCR, 4-40 X 1/4	8	#MTG PWB
302 0053 000	SCR, 4-40 X 5/16	2	#ANGLE MOUNTING
302 0132 000	SCR, 8-32 X 5/8	2	#Q001/Q002, #Q003/Q004
302 0401 000	SCR, 4-40 X 1/4	3	#R001 #R011 #RT001
310 0006 000	WASHER FLAT 8	2	#Q001/Q002, #Q003/Q005
310 0016 000	WASHER FLAT #4	1	#RT001
310 0048 000	WASHER, FLAT #4 UNDERSIZE	8	#MTG PWB
314 0003 000	WASHER, SPLIT-LOCK 4	10	#MTG PWB
314 0006 000	WASHER, SPLIT-LOCK 8	2	#Q001/Q002, #Q003/Q004
314 0037 000	WASHER, SPLIT-LOCK 4 SS	3	#R001 #R011 #RT001
356 0235 000	CABLE TIE 0.75" DIA.	4	
358 3435 000	LEVELER, RF FET	4	#Q001 Q002 Q003 Q004
358 3436 000	SPACER, 0.305" LONG	2	#Q001/Q002, Q003/Q004
358 3438 000	SPRING, LEAF	2	#Q001/Q002, Q003/Q004
404 0818 000	HEATSINK, 1/4 MODULE	1	
519 0050 000	CAP RF CHIP 100PF 5% 500V	4	C004 C005 C006 C007
519 0080 000	CAP RF CHIP 220PF 5% 200V	4	C013 C015 C017 C019
540 0284 000	RES 10.0 OHM 1W 5%	4	R003 R004 R005 R006
544 1661 000	RES 100 OHM 10W 5%	2	R001 R011
646 0665 000	INSPECTION LABEL	1	
839 7900 702	SCH, HB 1/4 MODULE	0	
843 4999 643	FAMILY TREE, HB, PA MOD,	0	
843 4999 646	FAMILY TREE, HB, DRIVER,	0	
917 2100 682	MOSFET RF PWR ON4402H ESD	4	Q001 Q002 Q003 Q004
943 5140 013	BRACKET, MTG	2	#CABLE CLAMPING

992 8608 001	THERMISTER ASSEMBLY	1	RT001 #SCREWED TO SINK
992 8957 001	PWA, 1/4 MOD, HB RF,	1	

Table 8-19. PWA, 1/4 MOD, HB RF, - 992 8957 001

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS
254 0001 000	WIRE, BUS CU 22AWG	.1 FT	#L010
296 0310 000	TUBING TEFLON 20 AWG	.1 FT	#L010
358 3288 000	POWER TAP, PC MOUNT 25AMP	1	TB001
384 0843 000	DIODE 1N4154	1	CR001
516 0417 000	CAP 1000PF 10% 200V	6	C025 C026 C027 C028 C033 C043
516 0484 000	CAP 0.1UF 100V 10%	2	C029 C030
516 0831 000	CAP 0.010UF 10% 100V	7	C021 C022 C023 C024 C042 C044 C045
516 0890 000	CAP 470PF 10% 200V	4	C009 C011 C034 C035
524 0375 000	CAP 100UF 63V	2	C031 C032
540 0880 000	RES 47.0 OHM 1/4W 5%	1	R012
540 0888 000	RES 100 OHM 1/4W 5%	1	R013
540 0914 000	RES 1.2K OHM 1/4W 5%	4	R007 R008 R009 R010
548 1102 000	RES 1.5K OHM 1/4W 1%	1	R014
548 1116 000	RES 2.74K OHM 1/4W 1%	4	R024 R025 R026 R027
548 1120 000	RES 2K OHM 1/4W 1%	1	R017
548 1508 000	RES 715 OHM 1/4W 1%	1	R015
548 2069 000	RES 49.9K OHM 1/4W 1%	2	R022 R023
548 2158 000	RES 1.65K OHM 1/4W 1%	1	R016
550 0913 000	POT, 5K OHM	4	R018 R019 R020 R021
550 0957 000	POT 500 OHM 1/2 W 10%	1	R002
610 1223 000	HEADER 3 POSITION	1	J001
839 7900 702	SCH, HB 1/4 MODULE	0	
843 4999 641	PWB, TEFLON RF 1/4 MOD HB	1	
917 2100 536	WIRE ASSY, 14 TURN TOROID	1	L009

Table 8-20. DIVIDER, HB, 2-WAY - 992 8557 007

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS
000 0000 010	B/M NOTE:	0	THIS ITEM USED AT HIGHER LEVEL RES, 100 OHM, 20W, R1 544-1660-000
384 0321 000	DIODE 5082-2800/1N5711	1	CR001
516 0929 000	CAP 470PF 10% 200V	1	C001
540 0912 000	RES 1.0K OHM 1/4W 5%	1	R003
548 0049 000	RES 100 OHM .5W 1%	1	R002
843 4999 494	PWB, DIVIDER 2-WAY	1	

Table 8-21. COMBINER, HB 2 X 2 WAY - 992 8558 007

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS
000 0000 010	B/M NOTE:	0	THIS ITEM USED AT HIGHER LEVEL RES,100 OHM, 250W, R1,R2544-1654-000
843 4999 490	PWB, HB COMB/DIV 2X2	1	

Table 8-22. COMB, HB, 2-WAY - 992 8559 007

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS
000 0000 010	B/M NOTE:	0	THIS ITEM USED AT HIGHER LEVEL RES 100 OHM, 250W, R1 544-1654-000
843 4999 489	PWB, HB COMB 2-WAY	1	

Table 8-23. DIVIDER, HB, 2 X 2 WAY - 992 8560 007

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS
000 0000 010	B/M NOTE:	0	THIS ITEM USED AT HIGHER LEVEL RES, 100 OHM, 20W, R1,R2544-1660-000
843 4999 490	PWB, HB COMB/DIV 2X2	1	

Table 8-24. DC PWA, HB COUPLER - 992 8844 001

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS
384 0321 000	DIODE 5082-2800/1N5711	2	CR001 CR002
516 0831 000	CAP 0.010UF 10% 100V	2	C001 C002
544 1651 000	RES 51 OHM 2W 5%	1	R004
548 2103 000	RES 100 OHM 2W 1%	1	R001
548 2192 000	RES, 49.9 OHM, 2W, 1%	2	R002 R003
843 4999 516	PWB, HB COUPLER DC BD	1	

Table 8-25. TAPE SWITCH ASSY - 917 2100 146

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS
296 0262 000	TUBING, SHRINK 1/4 WHITE	.06 FT	
354 0711 000	CONTACT, 24/20 RECEPTACLE	2	
604 1102 000	SWITCH, PRESS SENSING,8OZ	1	
612 1312 000	HOUSING CONTACT 2 PIN	1	
817 2100 146	ASSY INSTR, TAPE SWITCH	0	

Table 8-26. PWA, LED BOARD - 992 8023 001

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS
384 0826 000	LED LIGHT BAR, RED	1	CR001
384 0827 000	LED LIGHT BAR, GREEN	1	CR002
610 0852 000	HEADER 8 PIN SINGLE ROW	0	J001
610 0877 000	HDR, STR, 2 PIN, SQ	1	J003
610 0902 000	HDR 10 PIN STRAIGHT	1	J002
839 7900 047	SCHEM, LED BOARD	0	
843 4999 094	PWB LED BOARD	1	

Table 8-27. PWA, LOGIC/CONTROL BD - 992 8127 002

HARRIS P/N	DESCRIPTION	QTY/UM	REF. SYMBOLS/EXPLANATIONS
380 0219 000	XSTR, 2N2222	1	Q002
380 0591 000	XSTR, 2N5681	1	Q001
382 0184 000	IC, 340T-5/7805 +5V REG	1	U012
382 0428 000	IC, LM358 ESD	1	U004
382 0648 000	IC, LM339A	3	U006 U007 U013
382 1127 000	IC ADJ VOLT REG ESD	1	U011
382 1192 000	IC, MC14584BCP	1	U005

382 1212 000	IC, DS3632 ESD	2	U008 U009
382 1426 000	IC, LM317LZ ESD	1	U010
384 0802 000	TRANSZORB, BIPOLAR 18V 5%	1	CR005
384 0843 000	DIODE 1N4154	5	CR001 CR003 CR004 CR006 CR007
386 0394 000	ZENER, 1N5231A 5.1V .5W	1	CR002
398 0015 000	FUSE,FAST CART .500A 250V	1	F001
402 0129 000	CLIP, 1/4 DIA FUSE	2	#F001
404 0198 000	SPACER TO-5, TO-9, TO-11	1	#Q001
404 0704 000	SOCKET IC 20 PIN	3	#U001 #U002 #U003
516 0453 000	CAP .1UF 100V 20% X7R	8	C002 C008 C009 C014 C031 C032 C033 C034
516 0530 000	CAP .01UF 10% 100V X7R	18	C001 C003 C006 C007 C010 C011 C012 C013 C021 C022 C023 C024 C025 C026 C027 C028 C029 C030
522 0548 000	CAP 10UF 50V ELECTROLYTIC	1	C036
522 0573 000	CAP 47UF 50V 20%	1	C016
526 0048 000	CAP 10UF 20V 20%	3	C004 C019 C020
526 0378 000	CAP 1UF 50V 20%	5	C005 C015 C017 C018 C035
540 0025 000	RES 100 OHM 1/2W 5%	1	R079
540 0332 000	RES 1.0K OHM 1W 5%	1	R039
540 0876 000	RES 33 OHM 1/4W 5%	1	R076
540 0900 000	RES 330.0 OHM 1/4W 5%	5	R009 R012 R030 R032 R058
540 0903 000	RES 430 OHM 1/4W 5%	1	R072
540 0904 000	RES 470.0 OHM 1/4W 5%	3	R021 R049 R050
540 0908 000	RES 680.0 OHM 1/4W 5%	1	R075
540 0914 000	RES 1.2K OHM 1/4W 5%	2	R073 R074
540 0930 000	RES 5.6K OHM 1/4W 5%	1	R060
540 0944 000	RES 22.0K OHM 1/4W 5%	1	R001
540 0956 000	RES 68.0K OHM 1/4W 5%	1	R040
540 0972 000	RES 330.0K OHM 1/4W 5%	1	R055
540 0976 000	RES 470.0K OHM 1/4W 5%	2	R035 R057
540 1386 000	RES NETWORK 10K OHM 2%	1	R004
540 1416 000	RES NETWORK 10K OHM 2%	1	R006
540 1493 000	RES NETWORK 100K 9 SIP	1	R015
544 1649 000	RES 33 OHM 2W 5%	1	R080
548 0295 000	RES 47.5K OHM 1/4W 1%	2	R020 R054
548 0534 000	RES 1M OHM 1/4W 1%	4	R003 R014 R018 R041
548 1094 000	RES 1K OHM 1/4W 1%	4	R036 R037 R059 R061
548 1095 000	RES 12.1K OHM 1/4W 1%	1	R038
548 1098 000	RES 100 OHM 1/4W 1%	1	R033
548 1121 000	RES 10K OHM 1/4W 1%	13	R007 R011 R013 R017 R023 R025 R026 R034 R042 R047 R064 R069 R100
548 1124 000	RES 2.21K OHM 1/4W 1%	3	R043 R070 R071
548 1131 000	RES 1.62K OHM 1/4W 1%	1	R045
548 1144 000	RES 5.62K OHM 1/4W 1%	2	R053 R062
548 1147 000	RES 4.75K OHM 1/4W 1%	6	R002 R028 R046 R056 R066 R068
548 1148 000	RES 100K OHM 1/4W 1%	4	R024 R027 R063 R082
548 1156 000	RES 825 OHM 1/4W 1%	1	R081
548 1171 000	RES 3.32K OHM 1/4W 1%	2	R044 R052
548 2080 000	RES 8.66K OHM 1/4W 1%	4	R005 R010 R016 R022
548 2085 000	RES 6.34K OHM 1/4W 1%	1	R031
548 2162 000	RES 39.2K OHM 1/4W 1%	1	R048
550 0812 000	POT 100 OHM 1/2W 10%	2	R051 R102
550 0922 000	POT 10K OHM 1/2W	2	R008 R101

WARNING: Disconnect primary power prior to servicing.

610 0900 000	. HEADER 3 CKT STRAIGHT	1...	P005
612 1184 000	. JUMPER .1" CENTERS	1...	J005
612 1418 000	. RECP 25C D-SUB PCB MOUNT ..	1...	J001
839 7900 700	. SCH, MODULE CONTROL BOARD	0...	
843 4999 640	. PWB, LOGIC/CONTROL BD	1...	
917 2100 458	. PAL, FAULT LATCH	1...	U001
917 2100 459	. PAL, BLINK COUNTER	1...	U002
917 2100 460	. PAL, FAULT COUNTER	1...	U003

Table 8-28. ATTENUATOR,UNBALANCED PIE - 917 2100 639

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
548 0227 000	. RES, 130 OHM 1/2W 1%	0...	
548 0276 000	. RES 110 OHM 1/2W 1%	0...	
548 0332 000	. RES 124 OHM 1/2W 1%	0...	
548 0363 000	. RES 100 OHM 1/2W 1%	0...	
548 0372 000	. RES 80.6 OHM 1/2W 1%	0...	
548 0576 000	. RES 75 OHM 1/2W 1%	0...	
548 0581 000	. RES 115 OHM 1/2W 1%	0...	
548 0665 000	. RES 61.9 OHM 1/2W 1%	0...	
548 0703 000	. RES 82.5 OHM 1/2W 1%	0...	
548 0712 000	. RES 249 OHM 1/2 1%	0...	
548 0753 000	. RES 68.1 OHM 1/2W 1%	0...	
548 0754 000	. RES 88.7 OHM 1/2W 1%	0...	
548 0756 000	. RES 182 OHM 1/2W 1%	0...	
548 0811 000	. RES 69.8 OHM 1/2W 1%	0...	
548 0813 000	. RES 86.6 OHM 1/2W 1%	0...	
548 0814 000	. RES 93.1 OHM 1/2W 1%	0...	
548 0828 000	. RES 162 OHM 1/2W 1%	0...	
548 0839 000	. RES 221 OHM 1/2W 1%	0...	
548 0856 000	. RES 432 OHM 1/2W 1%	0...	
548 1047 000	. RES 140 OHM 1/2W 1%	0...	
548 1390 000	. RES 1.74K OHM 1/2W 1%	0...	
548 1991 000	. RES 294 OHM 1/2W 1%	0...	
548 2053 000	. RES 178 OHM 1/2W 1%	0...	
548 2054 000	. RES 232 OHM 1/2W 1%	0...	
548 2074 000	. RES 154 OHM 1/2W 1%	0...	
548 2193 000	. RES 11.5 OHM 1/2W 1%	0...	
548 2194 000	. RES 17.8 OHM 1/2W 1%	0...	
548 2195 000	. RES 23.7 OHM 1/2W 1%	0...	
548 2196 000	. RES 30.1 OHM 1/2W 1%	0...	
548 2197 000	. RES 37.4 OHM 1/2W 1%	0...	
548 2198 000	. RES 45.3 OHM 1/2W 1%	0...	
548 2200 000	. RES 71.5 OHM 1/2W 1%	0...	
548 2201 000	. RES 78.7 OHM 1/2W 1%	0...	
548 2202 000	. RES 95.3 OHM 1/2W 1%	0...	
548 2203 000	. RES 105 OHM 1/2W 1%	0...	
548 2204 000	. RES 107 OHM 1/2W 1%	0...	
548 2205 000	. RES 121 OHM 1/2W 1%	0...	
548 2206 000	. RES 137 OHM 1/2W 1%	0...	
548 2207 000	. RES 150 OHM 1/2W 1%	0...	
548 2254 000	. RES 14.7 OHM 1/2W 1%	0...	
548 2256 000	. RES 20.5 OHM 1/2W 1%	0...	
548 2258 000	. RES 34.0 OHM 1/2W 1%	0...	
548 2260 000	. RES 48.7 OHM 1/2W 1%	0...	

WARNING: Disconnect primary power prior to servicing.

548 2261 000	RES 66.5 OHM 1/2W 1%	0	
548 2262 000	RES 73.2 OHM 1/2W 1%	0	
548 2263 000	RES 76.8 OHM 1/2W 1%	0	
548 2264 000	RES 113 OHM 1/2W 1%	0	
548 2265 000	RES 127 OHM 1/2W 1%	0	
548 2266 000	RES 196 OHM 1/2W 1%	0	
548 2267 000	RES 348 OHM 1/2W 1%	0	
548 2268 000	RES 2.87 OHM 1/2W 1%	0	
548 2269 000	RES 5.76 OHM 1/2W 1%	0	
548 2270 000	RES 8.66 OHM 1/2W 1%	0	
548 2271 000	RES 26.7 OHM 1/2W 1%	0	
548 2272 000	RES 41.2 OHM 1/2W 1%	0	
548 2273 000	RES 57.6 OHM 1/2W 1%	0	
548 2274 000	RES 63.4 OHM 1/2W 1%	0	
548 2275 000	RES 64.9 OHM 1/2W 1%	0	
548 2276 000	RES 143 OHM 1/2W 1%	0	
548 2277 000	RES 174 OHM 1/2W 1%	0	
548 2278 000	RES 205 OHM 1/2W 1%	0	
548 2279 000	RES 576 OHM 1/2W 1%	0	
548 2280 000	RES 866 OHM 1/2W 1%	0	
817 2100 639	ASSY INSTR, INPUT	0	

Table 8-29. ATTENUATOR,SELECT IN TEST - 917 2100 612

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
556 0126 075	ATTEN 0.75 DB 30W INPUT	0	
556 0126 100	ATTEN 1.00 DB 30W INPUT	0	
556 0126 125	ATTEN 1.25 DB 30W INPUT	0	
556 0126 150	ATTEN 1.50 DB 30W INPUT	0	
556 0126 175	ATTEN 1.75 DB 30W INPUT	0	
556 0126 200	ATTEN 2.00 DB 30W INPUT	0	
556 0126 225	ATTEN 2.25 DB 30W INPUT	0	
556 0126 250	ATTEN 2.50 DB 30W INPUT	0	
556 0126 275	ATTEN 2.75 DB 30W INPUT	0	
556 0126 300	ATTEN 3.00 DB 30W INPUT	0	
556 0126 325	ATTEN 3.25 DB 30W INPUT	0	
556 0126 350	ATTEN 3.50 DB 30W INPUT	0	
556 0126 375	ATTEN 3.75 DB 30W INPUT	0	
556 0126 400	ATTEN 4.00 DB 30W INPUT	0	
556 0126 425	ATTEN 4.25 DB 30W INPUT	0	
556 0126 450	ATTEN 4.50 DB 30W INPUT	0	
556 0126 475	ATTEN 4.75 DB 30W INPUT	0	
556 0126 500	ATTEN 5.00 DB 30W INPUT	0	
817 2100 611	SPEC, 30 WATT ATTENUATOR	0	

Table 8-30. MOSFET RF PWR ON4402H ESD - 917 2100 682

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
380 0737 000	MOSFET RF PWR ESD	1	NOTE: THE FOLLOWING NUMBERS HAVE BEEN ASSIGNED TO GAIN CODED ON4402H FET. THESE WILL BE STOCKED BY FIELD SERVICE WITH THESE NUMBERS FOR IN HOUSE PURPOSES ONLY.
380 0737 003	*FET ON4402H GAIN #3 ESD	0	

380 0737 004 .	*FET ON4402H GAIN #4 ESD	0. . .	
380 0737 005 .	*FET ON4402H GAIN #5 ESD	0. . .	
380 0737 006 .	*FET ON4402H GAIN #6 ESD	0. . .	
380 0737 007 .	* FET ON4402H GAIN #7 ESD	0. . .	

Table 8-31. THERMISTER ASSEMBLY - 992 8608 001

HARRIS P/N	*DESCRIPTION*	*QTY/UM*	*REF. SYMBOLS/EXPLANATIONS*
051 0001 025 .	ADHESIVE, LOCTITE 392	0. . .	
051 0001 026 .	ACTIVATOR, LOCTITE 792	0. . .	
354 0075 000 .	TERMINAL LUG RING 8	1. . .	
516 0831 000 .	CAP 0.010UF 10% 100V	1. . .	C001
559 0053 000 .	THERMISTOR,NTC,10K@25C,1% .	1. . .	R001

A.1 General Information

This procedure is intended to be used as a guide in isolating faults and troubleshooting *Platinum Series®* TV RF power amplifiers with passive bias.

Module faults are most easily verified by swapping the suspected faulty module with a known working module in another slot. If the fault follows the module, then the problem is probably internal to the module. If the fault remains at the same slot after substituting modules, then the search for the problem should probably focus on the rest of the transmitter system.

A.1.1 Factory Module Repair

If a failure of a module occurs, the module may be returned to the factory for repair.

To return a module, contact Harris Repair Department:

By phone: 217-222-8200

By FAX: 217-224-2840

By mail:

Harris Repair Department
P.O. Box 4290
Quincy, Illinois 62305-4290

Include the part number and serial number of the module when requesting service. Instructions to ship the module will be processed and communicated to you.

Please provide as detailed information as possible about the nature of the failure and the operating condition of the module at the time of failure. This data will help our Repair Department service your module promptly and efficiently.

If you do not stock a spare module and require another unit for operation, a spare may be obtained as a loaner unit from the Harris Repair Department while your unit is shipped to our factory for repair.

If you are located within the United States, you will be billed for shipping charges, and if your warranty has expired a nominal fee will be charged for use of the module.

If you are located outside the United States, the same loaner service will be offered wherever feasible, but in addition to any shipping charges you will be responsible for all import duties, transfer fees or international tariffs.

A.1.2 Local Module Repair

If local repair is necessary, the following troubleshooting guide and repair procedures are recommended. We strongly recommend reading the appropriate parts of the Theory of Operation, paragraph A.2 before proceeding.

Optional PA Module Test Fixture (992-8556-002) is needed for local testing or repair. The fixture will allow testing of a PA or driver module while using the transmitter as the source of DC power and RF drive.

A.2 RF Amplifier Modules Theory of Operation

Three types of RF amplifier modules are used in a *Platinum Series®* transmitter:

- Driver Modules are multiple-stage, high gain RF amplifiers used primarily to amplify an exciter output and drive subsequent amplifier stages.
- 525 Watt PA Modules are built in driver module configuration. High band modules are biased class A for the two series configured quarter modules and class AB for the two parallel output quarter modules.

Low band modules are biased class A for the first quarter module and class AB for the two parallel output quarter modules.

525 Watt PA modules have a polarizing key on the opposite side from driver modules. This will prevent interchanging of driver and 525 Watt PA modules. Due to the differences between 525 Watt PA's and drivers in bias, gain matching pads and the adjustment of the protection circuitry they are not interchangeable without complete testing and readjustment of the protection circuitry.

- PA Modules are single-stage, high-power, high-efficiency amplifiers which use four parallel amplifiers to achieve output power levels in excess of 1 kW each.

Both drivers and PAs share some common features. Drivers and PAs both contain smaller amplifier subassemblies called "quarter modules."

A multi-pin connector on the rear of each module feeds RF drive, 50 Volts DC, and ENABLE commands to the module, and passes a fault status signal back to the slave controller. RF output is passed through a separate coaxial connector. The rear panels of drivers 525 Watt PAs and 1 kW PAs are keyed differently, so that lower power units cannot be plugged into PA slots.

The modules are "hot-pluggable," meaning that they can be removed or inserted during transmitter operation without turning the transmitter off. A disable switch is located in the front handle of each module for this purpose.

The modules protect themselves by automatically disabling themselves if an improper operating condition is detected. A protection, control, and monitor (PCM) system monitors the module's operating conditions. If all of the conditions are acceptable, upon an ENABLE signal from the slave controller, the PCM system will enable the module. If a fault condition arises or the ENABLE signal is interrupted, the PCM system disables the module by shutting off the 50 Volts DC.

Descriptions of the various subsystems of modules are given below. First, the RF signal paths of the modules are traced; then, the subsystems are described in more detail.

Refer to the cover sheet of the drawing package for your transmitter to locate the necessary drawing numbers for the modules and subassemblies.

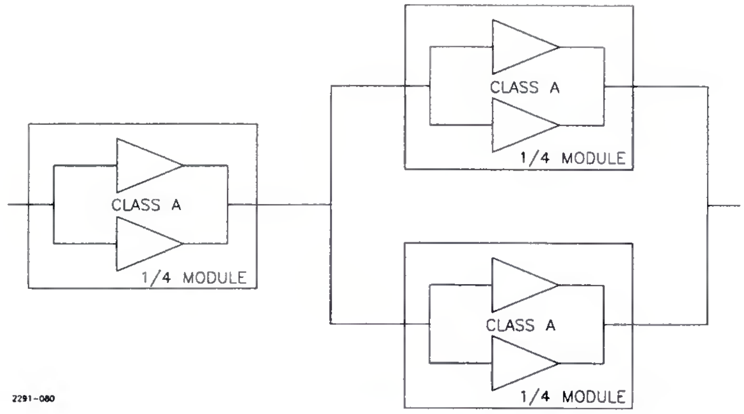


Figure A-1. Low Band Driver Module,
Simplified Block Diagram

A.2.1 Driver Module, Low Band

(Refer to the Low Band Driver Amplifier Schematic 843-4999-638)

The low band driver module consists of a class A stage, driving a second stage consisting of two parallel class A amplifier blocks.

A pi input attenuator (R4, R5, R6 on the Driver RF input assembly) is used to set the overall gain of each low band driver to 35 dB. The input attenuator also serves to improve the module's input return loss.

The attenuator output feeds the first amplifier stage, which produces about 24 dB gain. The output passes to a 2 dB fixed attenuator, used to improve the output match seen by the first stage.

The RF signal then feeds the 2-way Divider assembly. On this divider assembly there is in the signal path a microstrip directional coupler (which provides a forward drive power sample for overdrive protection), a microstrip trombone line section (for phase adjustment), and a foreshortened Wilkinson 2-way microstrip divider. The divider's two outputs drive two parallel Class A amplifiers. The outputs are recombined using a foreshortened Wilkinson microstrip combiner, which passes the signal through a directional coupler to the module output. The directional coupler provides a reflected power sample to the module's protection, control and monitor (PCM) system.

On the input and output Driver RF Intraconnection assemblies are provided optional capacitors for response correction. On the input assembly, A5A4, are C1 and C15. On the driver RF intraconnect assembly is C4. A capacitor may be added where needed for frequency response correction and or input matching.

The low band driver's output is rated at 50 Watts peak-of-sync visual, and 200 Watts CW in aural service.

A.2.2 Driver Module, High Band

(Refer to the High Band Driver Amplifier Schematic 843-4999-639)

The high band driver module consists of two cascaded class A stages, driving a third stage consisting of two parallel class AB amplifier blocks.

A pi input attenuator (R4/R5/R6 on the input Driver RF intraconnection assembly) is used to set the overall gain of each high band driver to 35 dB. The input attenuator also serves to improve the module's input return loss.

The attenuator feeds the first amplifier stage, which produces about 17 dB gain. Its output passes to a 2 dB fixed attenuator, used to improve the output match seen by the first stage. The signal then passes through a L-section matching network to the second class A stage.

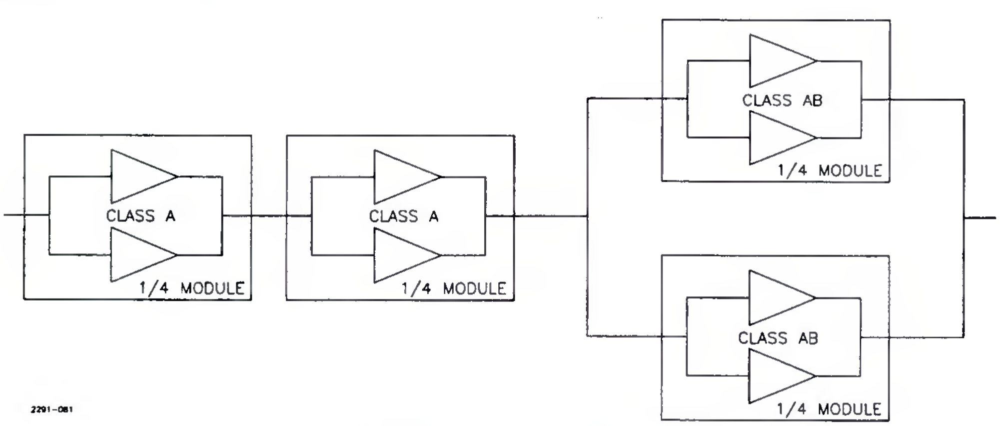


Figure A-2. High Band Driver Module,
Simplified Block Diagram

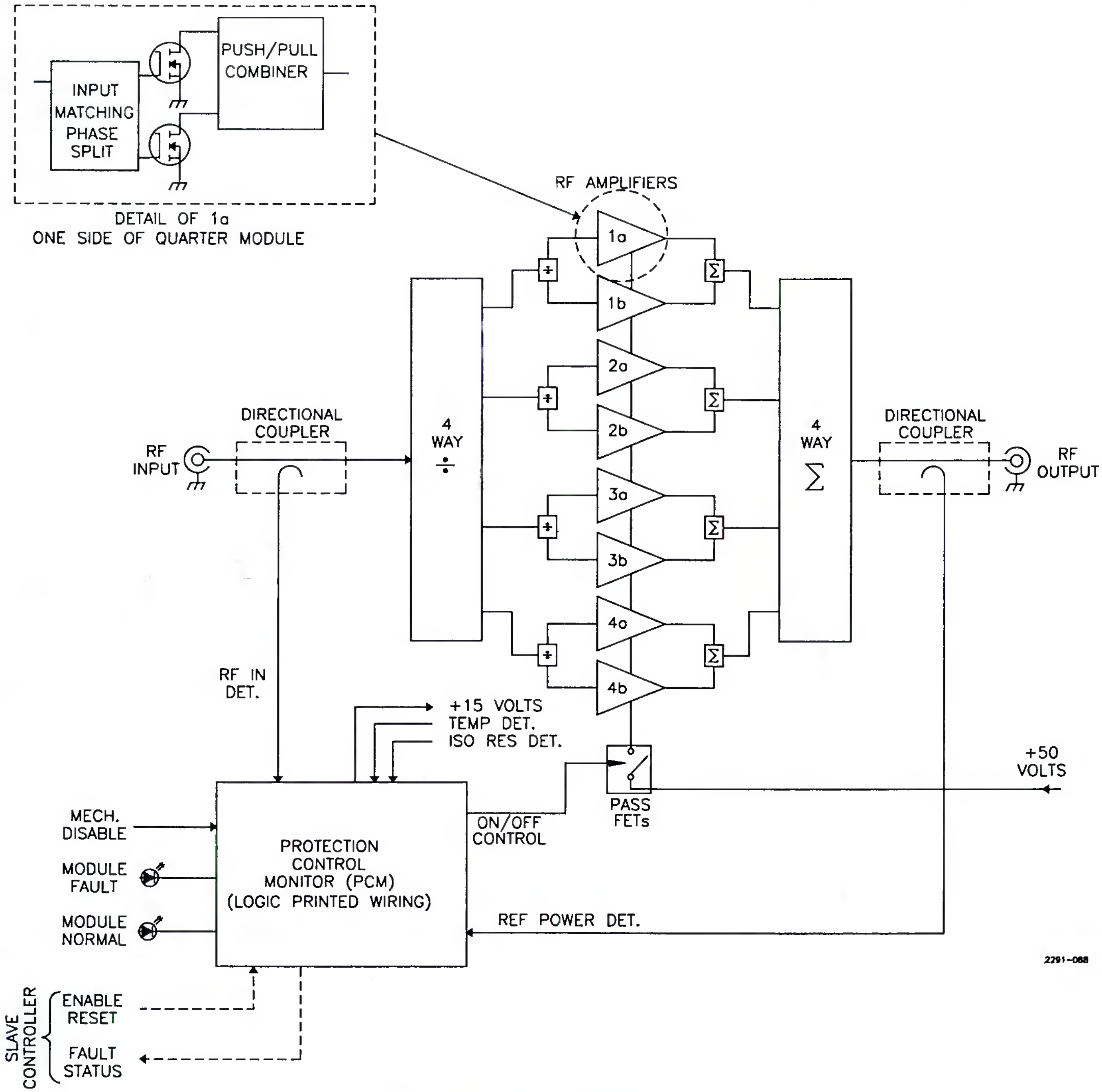


Figure A-3. PA Module Block Diagram

The RF signal then feeds the 2-way Divider assembly. On this divider assembly there is in the signal path a microstrip directional coupler (which provides a forward drive power sample for overdrive protection), a microstrip trombone line section (for phase adjustment), and a Wilkinson 2-way microstrip divider. The divider's two outputs drive two parallel Class AB amplifiers. The outputs are recombined using a Wilkinson microstrip combiner, which passes the signal through a directional coupler to the module output. The directional coupler provides a reflected power sample to the module's protection, control and monitor (PCM) system.

On the input and output Driver RF Intraconnection assemblies are provisions for response correction. On the A5A6 assembly are C4 and C12. On the A5A4 RF intraconnection assembly is C13. On the two way divider RF Intraconnection assembly is C14. These capacitors are added as needed for response correction.

High band drivers have a rated output of 250 Watts peak-of-sync visual, or 500 Watts CW in aural service.

A.2.3 PA Module

(Refer to the RF PA Module Schematic 843-4999-637)

PA modules consist of four parallel class AB amplifier blocks. Low Band PA modules produce 18.5 dB gain overall, and the gain for a high band PA is 13.7 dB.

The module RF input signal feeds the 2-way Divider assembly. On this divider assembly there is in the signal path a microstrip directional coupler (which provides a forward drive power sample for overdrive protection), a microstrip trombone line section (for phase adjustment), and a Wilkinson 2-way microstrip divider.

The Wilkinson combiner in the Low Band module is a foreshortened Wilkinson combiner. Resistors are used in the Wilkinson divider and combiner circuits to provide isolation between ports.

The Wilkinson divider's two outputs feeds the two 2-way Wilkinson microstrip/stripline dividers on the 2X2-Way Divider assembly. The 2X2-Way Divider assembly's four outputs feeds the four class AB amplifiers.

The outputs of the four amplifiers feed into the two 2-way Wilkinson combiners on the 2X2-way Combiner assembly. The output of the two combiners feeds into the two inputs of the 2-way Wilkinson Combiner assembly. The output of this combiner passes through a directional coupler to the RF output jack. The directional coupler sends a voltage sample of the output port reflected power to the PCM system.

The Low Band and High Band PA modules are rated at 1050 Watts peak-of-sync visual, and 1050 Watts CW in aural service.

A.2.4 RF Quarter Modules

The RF amplifier subassemblies within a driver or PA module are called "quarter modules." The quarter modules use n-channel Field Effect Transistors, or FETs, as their active devices. FETs offer several advantages over bipolar junction transistors (BJTs), including improved ruggedness, better linearity, and less susceptibility to thermal runaway.

N-channel FETs operate similarly to NPN Bipolar Junction Transistors. In a common-emitter bipolar amplifier, a small change in base-emitter voltage results in a small change in base current. The base current modulates the collector current, and the output is taken at the collector. Similarly, in a common-source FET amplifier, a small change in gate-source voltage modulates the drain current, and the amplifier output is taken at the drain.

Each quarter module uses four RF FETs. The input contains a gain matching pad, a phase matching coax line and a two-way power divider. Divider outputs each drive a push-pull FET pair. The FET outputs are recombined in a two way combiner, whose output is the output of the quarter module.

Temperature compensated bias voltage for each RF FET is generated from a 15 Volt supply. The supply is part of the module control card (PCM) and switches on with application of 50 Volts to the quarter modules. The quarter module supplies voltages representing temperature and ISO voltage to the module PCM system.

For any given channel, class A and class AB amplifier blocks use the same quarter module circuit. The bias voltage adjustment potentiometer controls the quiescent drain current for each FET, which determines each quarter module's class of operation.

In cases where quarter modules are biased class AB, as in the 1 kW PA module, each quarter module is capable producing 280 Watts output into a 50 ohm load. The excess power is necessary to overcome losses in the combining stage.

When the quarter modules are biased class A, as in driver modules, they exhibit improved linearity and about 1-2 dB higher gain. The tradeoff, however, is lower power output capability and reduced efficiency. Thus, class A stages are used as pre-amp and driver stages, and class AB stages are used as intermediate and final power amplifier stages.

Because low band and high band quarter modules utilize slightly different architectures, the circuits are described individually below.

A.2.5 Low Band Quarter Module

(Refer to Low Band Quarter module Schematic 839-7900-001)

The RF input signal first passes through TL1 (Phase setting coax) and then through AT1 Which sets the gain of the quarter module to 19.25 dB. The RF input signal then passes to T1, a two-way coaxial power divider which also performs an impedance transformation. R5 provides isolation between the two divider output ports.

The upper and lower RF amplifier halves are identical. In the upper circuit, C1 blocks DC from the input. Components T2/T3 continue the impedance transformation from the divider to the gates of RF transistors Q1 and Q2. T3 also establishes a 180 phase relationship between the signal voltages sent to the two transistors, which is the basis for push-pull operation.

R2 and R3 "swamp" the transistor gate input impedances, which are highly capacitive. C6/C7/C9/C10 block the DC gate bias from reaching the quarter module input. C8/C5/C11 complete the input impedance transformation.

An R,L,and C drain-to-gate negative feedback loop exists around each FET. The feedback will ensure stability at low frequencies. C25 and C24 block the 50 Volts present at the drains from reaching the gates through the feedback loops.

L5/L6/C23 form a balanced L-network, which act as both a low-pass filter and an impedance transformer between the FET's and T6. T6 continues the output impedance transformation and combines the transistor outputs in series. C28, C29/R19, and C4 bypass one port of T6 to ground, and C30 and C31 couple the RF to T8.

T8 is a two-way combining transformer which combines the outputs of the upper and lower amplifier halves and completes the output match. R15 provides isolation between T8's input ports.

If any phase or amplitude difference exists between the signal in the upper and lower amplifier halves a voltage will develop across R15.

This RF voltage will be coupled through toroidal transformer T9, to CR1, an RF detector which produces a DC signal proportional to the amount of imbalance. This DC signal is called the ISO voltage sample, and it is sent to the PCM system through J1-2.

A.2.6 High Band Quarter Module

(Refer to High Band Quarter Module Schematic 839-7900-702)

The RF input to the quarter module passes through TL1 (Phase setting coax) and AT1 (Attenuator which sets the gain of the quarter module to 14.25 dB). The RF input then passes through a two-way Wilkinson power divider, consisting of two 75 ohm microstrip sections. R1 provides isolation between the divider outputs.

The upper and lower amplifier halves on the schematic are identical. In the upper amplifier, C9 couples RF into the amplifier while blocking DC. T1 is a coaxial balun transformer, which provides both a step-down impedance transformation and an unbalanced-to-balanced transformation. Its two output signals differ in phase by 180, which establishes push-pull operation in the RF FET pair Q1 and Q2.

R3 and R4 shunt load the highly capacitive gate input impedance of the FET's. C2 completes the input impedance transformation. An adjustable voltage divider feeds bias voltages to the gates of the RF FET's, controlling their quiescent drain currents.

Series induluctors feed 50 Volts to the FET drains, and act as RF chokes, blocking the RF from appearing on the power supply lines.

The sliding short section form small inductances. Together with C4/C5/C37 they form a balanced L-net, which provides both a low-pass response and an impedance step-up transformation between the FET drains and the input of T3.

T3 is a coaxial balun, fabricated from semi-rigid coax. It adds the output voltages of Q1 and Q2 in series, and continues the output impedance transformation. Its outer conductor is grounded by C13, and the RF output is coupled through C15.

The outputs of the two amplifier halves are recombined by a two-way Wilkinson combiner, composed of two 75 ohm microstrip sections.

If any phase or amplitude difference exists between the signal in the upper and lower amplifier halves, an RF voltage develop across R11 and L9. L9 is the primary of a toroidal transformer, whose secondary is L10. Any RF voltage will be coupled through the toroidal transformer to R12/CR1/C33 an RF peak detector which produces a DC signal proportional to the amount of imbalance. This signal is called the ISO voltage sample, and it is sent to the PCM system through J1-2.

A.2.7 Quarter Module Bias

(Refer to Lowband Quarter Module schematic 839-7900-701 and HighBand Quarter Module schematic 839-7900-702.

The +15 Volts for the FET bias voltage divider is furnished by a step-down regulator in the Protection, Monitoring and Control Subsystem. This regulated voltage switches with the switched 50 Volts.

Thermistor R1 is mounted to the heat sink between RF FETS Q2 and Q3 and completes a resistive voltage divider betewwn the +15 Volts and ground. As the hestsink temperature increases the resistance of the thermistor decreases.

The change in thermistor resistance changes the voltage reference for the bias adjustment. This change in reference tracks the change in bias current with temperature. This proportional voltage is divided down by the four bias adjust controls R24, R25, R26 and R27 for precise adjustment of the static current of the individual RF FETS.

The reference voltage is also monitored by the module control board, excessive heat sink temperature will result in a temperature fault. R2(HB)or R16(LB) is used to set the temperature trip point. The voltage is factory adjusted for 5.30 Volts when the heatsink temperature is 25C. Any adjustment of R2 or R16 will affect the FET static current bias settings.

A.2.8 Protection, Control and Monitor Subsystem

(Refer to "Logic Printed Wiring" schematic, 839-7900-700.)

Each module is controlled and monitored by a module protection, control, and monitor (PCM) subsystem. Drivers and PA modules utilize essentially the same PCM subsystem. It consists of sensors and control logic within each module, and provides protection against improper operating conditions. The heart of the module PCM subsystem is a printed circuit assembly commonly known as the "module control board."

The module control board performs protection from different detrimental operating conditions through an essentially common scheme. It collects voltage samples that provide indications of the operating parameters, and compares these samples to reference voltages. Voltage comparators (U4, U6, U7, and U13) are used to compare the samples to the references, and their outputs are digital signals which indicate either a normal operating condition or a fault.

These digital signals drive PALs (Programmable Array Logic) (U1, U2, U3), which are ICs consisting of hundreds of digital logic gates. The PALs perform two functions. They send signals to the pass FETs, which are used as high-current switches to turn on or off the 50 Volts DC supplied to the quarter modules. They also determine the operating status indications given by the front panel LEDs.

Upon a module ENABLE signal, after the cabinet DC power supply reaches 44 Volts, the control logic turns on the pass FETs. If a fault is detected, the control logic will turn off the pass FETs, disabling the module.

The PCM subsystem performs several functions:

* Monitors input power level and protects the module from being overdriven. A sample from the coupler at the input of the power divider is received at J1-9. If the sample is above the reference established by voltage divider R20-R21, U6 pin 14 will go low,

indicating normal drive in a PA module. If the sample goes above the reference set by R101, U6 pin 1 will go low, indicating an overdrive fault.

* Monitors output reflected power, and protects the module from elevated load VSWR. Output reflected samples from the output directional coupler assembly are received at J1-22. The VSWR fault threshold is established by R8. If the voltage at U6 pin 5, determined by the reflected power, is greater than the voltage at pin 4, then pin 2 will go low, indicating a VSWR fault.

* Monitors the DC power supply voltage, and protects the module from high and low voltage extremes. The DC supply is sampled at J1-23, and is scaled down by R48, R47, and R42. A maximum voltage reference is established by the +15 Volt regulated supply, R43, and R44. If the sample exceeds the reference, U7 pin 1 will go high, indicating an overvoltage fault.

Likewise, a minimum voltage reference is established by R45 and R46. If the reference exceeds the DC supply sample, U7 pin 2 is driven high, indicating an undervoltage fault.

* Monitors ISO voltage samples of the quarter modules, protecting the amplifier from damage due to imbalances between the two halves of a quarter module. The ISO voltage samples are combined by a OR circuit and collected at J1-3, 4, 16 and 17 on the controller board.

A reference is established by R38 and R81. If the ISO voltage sample exceeds the reference, U6 pin 13 is driven low, indicating a fault.

* Monitors the temperature of the quarter modules, turning off the amplifier if excessive temperatures are encountered. A voltage is developed on each module by the thermistor circuitry that is proportional to the heat sink temperature. These voltages are routed to the module controller board, J1-5, 6, 7 and 8. The voltages are compared to a reference by comparator U13. If any quarter module temperature voltage is lower than the reference, the comparator output will go low. This switches the output of the Schmitt trigger high.

*Enables the 50 Volts DC to the quarter modules by controlling a pair of high-power switching FETs ("pass FETs") located on the module rear panel. If no faults are present, PAL U1 pin 12 sends a signal to U7 pin 8, which controls a circuit that turns on the pass FETs, a pair of n-channel switching FETs. If a fault condition occurs, the switching FETs are turned off.

The switched 50 Volts dc is reduced to 15 Volts by R39 and U10. This 15 Volts is routed to each quarter module for bias circuitry power.

The incoming 50 Volt DC power is switched on and off by the pass FET assembly, controlling the application of 50 Volts to the Quarter Modules. This switched 50 Volts is reduced to 15 Volts by regulator U10. The +15 is supplied to each module to be used for temperature sensing and FET biasing.

The logic will not allow the module to enable if a fault condition exists, to protect the module from damage.

A.2.9 Module Status LEDs

Each module uses two front panel LEDs to display its current operating status. The LEDs are driven by signals from the PALs and U8 and U9, which are NAND gates configured as buffers. The status can be interpreted from the LEDs as follows:

a. **Steady Red** - 50 Volts applied to the module, but the module is not enabled. This will normally occur if a module is removed and then reinserted in the slot.

   The red LEDs will illuminate then fade out as the supply capacitors discharge each time the transmitter is turned off.

b. **1/2 Green LED Illuminated** - Module is enabled but little or no RF drive is supplied to the module.

Driver modules, because of their low input drive level, do not have a drive level indication. Thus, when a driver module is enabled, both halves of the green LED are illuminated regardless of drive level. This is the only difference between the PCM systems on drivers and PAs.

a. **Full Green LED Illuminated** - A full green LED illuminated indicates normal module operation. - Module is enabled. Additionally, in PA modules, the presence of RF drive is indicated.

b. **No LEDs Illuminated** - The 50 Volt DC power is not reaching the module, or the module has been turned off by pulling on the front handle ("mechanical disable").

In some cases this could be the symptom of a module control fault. If you have not disabled the module turn off the transmitter momentarily while removing the module. This will prevent possible arcing of the input connector pins if the module was in fact on but not lighting any LEDs.

A.2.9.1 Red LED Fault Blink Codes

If a module fault occurs, the red light will "blink" on and off. The number of blinks between pauses is the "blink code," and is used to determine the type of fault. The blink code is as follows:

a. **1 Blink** - High VSWR condition at the module output.
b. **2 Blinks** - RF input overdriven
c. **3 Blinks** - An elevated ISO voltage resulted from an imbalance between halves of a quarter module.
d. **4 Blinks** - The power supply voltage applied to the module is too high or too low.
e. **5 Blinks** - The quarter module temperature is too high.
f. **6 Blinks** - The pass FET transistors that switch the 50 Volts to the quarter modules have failed.

A.3 Module Troubleshooting

CAUTION

Use extreme care when repairing or testing RF amplifier modules. Because they are capable of producing over 1000 Watts of output power, serious RF burns can result from coming in contact with any high power points inside the module while it is operating.

IMPORTANT

These modules operate with 50 Volt power supplies capable of very high currents. Accidental short circuits occurring inside the modules can cause serious damage due to the high currents involved. Carefully inspect the module for any debris that could cause a short to occur after any repair activity.

IMPORTANT

Failure to use proper soldering techniques or materials can cause damage to the replacement components, or may result in joints with poor electrical or mechanical integrity, causing subsequent damage to the module. Please read the section entitled "Soldering Precautions" before attempting any repair activity.

A.3.1 TV Module Test Fixture (992-8556-002)

Refer to Figures A-4 & A-5

The TV Module Test Fixture consists of a table top assembly with a interconnect cable ending in a plug assembly that is inserted into an empty module slot. The cable to the test load is routed through the end cover opposite the fan and connected inside the test fixture by reaching through the cooling slot.

An interlocked Safety Cover must be in place to activate RF drive to the module under test.

Breaker CB1 limits the current to 50 amps, protecting the cable. Breaker CB2 at the test fixture trips from excess module current and can be used as module power switch. Interlock switch S2 and driver relay K1 prevent application of RF drive until the cover is closed.

Fuse F1 provides protection for the small signal wiring in the extender and the 50 Volt DC fan.

Enable switch S1 allows local control of the module on the extender while the transmitter is on.

CAUTION

AN EXTERNAL RF LOAD MUST BE CONNECTED TO THE MODULE AT ALL TIMES DURING TEST.
BE SURE TO DISABLE AND REMOVE THE MODULE OR TURN OFF THE BREAKER BEFORE REMOVING THE EXTENDER FROM THE CABINET.

A.3.2 Troubleshooting Based on Module Swapping

Many situations exist in which a problem exhibited by a module could be due to a problem either with the module itself, or somewhere else in the transmitter. For example, VSWR faults could be due to either a failure or misadjustment of the VSWR sensing circuitry in the module, or due to a problem with the transmitter cabinet RF connector, combiner cables, reject loads, etc. In fact, most fault indications could be caused by either module or system problems. Thus it is desirable to first isolate the problem to the module or system before continuing the troubleshooting process.

Since the modules are designed for interchangeability with other modules of the same type, one easy test to determine whether a problem lies in the system or in the module is the "swap test," which involves swapping the suspect module with another and observing whether the symptom follows the module.

A.3.3 Troubleshooting Based on Module Blink Codes

The general procedure for troubleshooting based on a module blink code involves several steps.

The first is to check for causes consistent with the blink code (such as checking the DC supply voltage if blink code 4 occurs).

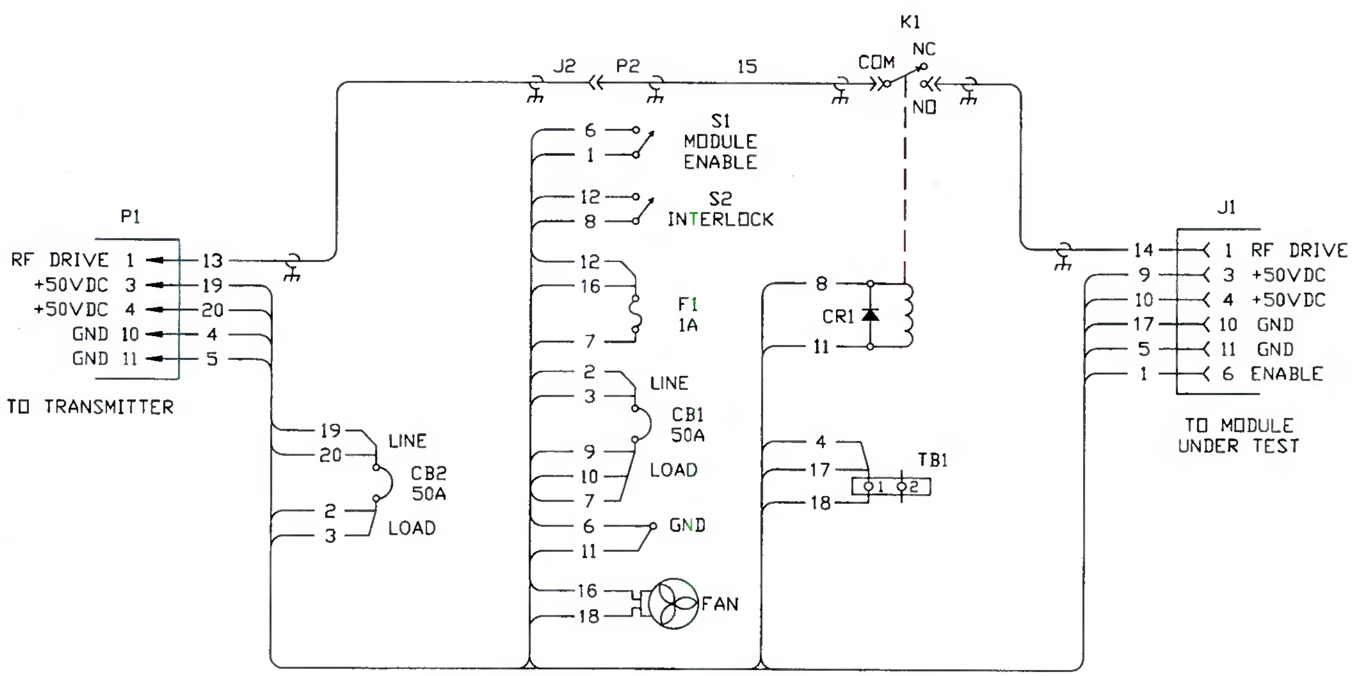


Figure A-4. Wiring Diagram PA Module Extender (Harris PN 992-8556-001) (Drawing 843 5285 162)

Often, this will give an indication of whether the problem lies within the system or the module.

If this does not locate the problem, then the next step is to check for correct threshold voltages on the module logic board. Fault blink codes result from a sample voltage taken within the module exceeding some preset threshold. Thus, if no other module or system problem is found, the problem may be due to an incorrectly set fault threshold (as in the case of thresholds set with potentiometers), or a defective component (such as a resistor) used to establish a threshold. Section A.2.8, on the theory of operation of the module Protection, Control and Monitor subsystem, gives detailed descriptions of how these thresholds are derived and compared against the corresponding voltage samples.

Finally, if neither of these steps yields success, the problem may lie in a PAL or logic gate on the module control board. This type of problem is generally rare. Measuring voltages at various points in the logic circuitry on the module control board can isolate this type of problem.

A set of troubleshooting procedures, one procedure for each fault code, is given below:

High Output VSWR Fault (1 blink) — The cause for this fault is often external to the module. First, check the system VSWR on the display panel, and check for a VSWR foldback or VSWR overload condition on the transmitter. Check the other modules in the same cabinet for VSWR faults as well. If either is found, suspect a problem in the system outside the cabinets.

If not, then the problem is either in the suspect module or its cabinet. The swap test is the easiest way to isolate the problem. Swap the VSWR faulting module with a properly working one from another slot. If the problem remains in the same slot, check the RF output cable, connector, and combiner reject load for that module slot.

If the problem follows the module, check the solder connections at the directional coupler and the RF output jack inside the module. If no problem is found, the problem could be an improperly set VSWR fault threshold or a defective module logic board. See paragraphs giving procedure used to check and set the VSWR threshold located on page A-18.

Input Overdrive Fault (2 blinks) — Normally, this protects the module from damage due to excess RF drive (at least 3 dB above the drive required to drive the module to full power). To isolate the cause of fault, reduce the visual exciter RF output to zero,

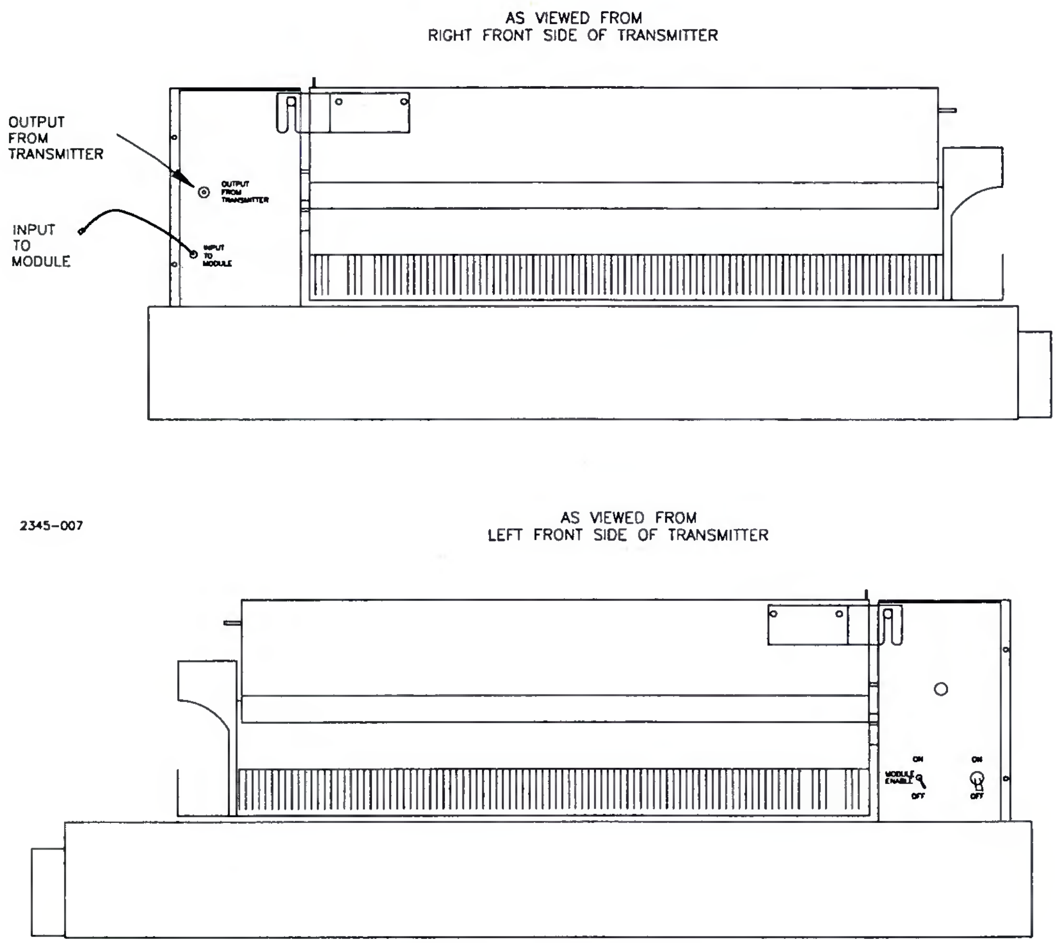


Figure A-5. Module Test Fixture

then enable the module with a transmitter ON command. If the fault remains, the problem is likely to be with the module control board.

If the fault clears when RF drive is removed, check to see that the module is not being overdriven. If not, then the overdrive threshold on the control board may be misadjusted. See procedure located on page A-18 in this section to check the Overdrive Threshold.

ISO Voltage Fault (3 blinks) — The RF input to the quarter module passes through a two-way divider on the quarter module, and is then fed to two parallel amplifiers on the quarter module. The outputs of these two amplifiers are recombined in a two way combiner on the same board. The combiner contains a 10 Watt reject load resistor, called an ISO resistor because it is used to provide isolation between the combiner input ports.

If outputs of the two parallel amplifiers are equal in amplitude and phase, the voltage across the ISO resistor will be very small. Should some component fail on one of the amplifiers, its output would decrease to a level much lower than the other parallel amplifier, which would cause the voltage across the ISO resistor to increase significantly. If the ISO voltage of any quarter module exceeds about 1.9 Volts, the control board shuts the power amplifier module down and indicates an ISO fault.

An ISO fault will almost always be caused by a component failure in a quarter module (RF FET, chip cap, ISO resistor, or open solder connection). The common cause is a damaged RF FET.

Damaged FETs are sometimes caused by problems in the module output combiner, examine this area first before trying to re-enable the module to avoid further damage. With DC power and RF drive removed, visually inspect the connections between the quarter module outputs and combiner inputs, between the combiner sections, between the combiner output and the directional coupler, and between the coupler and the output connector. An inspection mirror aids the examination greatly. Next, use an ohmmeter to confirm an open between the output connector center pin and chassis, and continuity between the center pin and each quarter module output. Also examine each quarter module, especially the area near its output.

If no problems are found with the output circuitry, try to confirm the ISO fault with the module on the test fixture. Put the safety cover down (applying RF drive), switch on the DC power and attempt to enable the module. If the ISO fault does not occur again, there may be a problem in the system rather than with the module (for example, an open cabinet combiner dump load or a damaged module RF power input connector).

If the ISO fault is confirmed, check the bias current of each quarter module, one at a time with no drive applied (lift the safety cover to remove RF drive). A quarter module with blown FET(s) will have lower bias current than the others. Check the section on bias current setting to confirm the correct bias current for each quarter module. If a quarter module with low bias current is found, first record its total bias current, then observe the current while turning off bias to each FET one at a time with the bias adjustment pots. Record the current after turning each pot off and look for one or more FETs whose bias current is zero or lower than the others.

If no quarter modules or FETs indicate low bias current, there are two possibilities: either a shorted, open or damaged component on a quarter module, or a problem with the PCM (logic) board. Try to rule out a problem with the PCM board first. If a storage oscilloscope or peak-holding DMM (e.g. Fluke 87) is available, try to confirm an ISO voltage greater than about 1.9 Volts. Remove DC power, clip a probe onto the ISO voltage line close the safety cover, connect the probe to the scope or DMM, apply DC and enable the module. If the ISO voltage does not appear, look for problems on the module PCM board (check for 0.9-1.0 Volts on U6 pin 10). If no storage scope or peak-holding DMM is available, proceed to looking for problems on the quarter modules after checking for 0.9-1.0 Volts on U6 pin 10 of the PCM board.

To find a problem on a quarter module, first try to locate one quarter module that is the source of the ISO fault. With DC power off and RF drive removed, connect a scope or meter to the ISO voltage line, and disconnect the 50 Volt wires from all but quarter module #1 (nearest the back of the module). Cover the exposed ends of the loose 50 Volt lines with electrical tape to prevent them from shorting within the module. Close the safety cover (applying RF drive), turn on the DC power and try to enable the module, observing whether or not an ISO fault occurs. Shut off the DC, remove the 50 Volt connection from quarter module #1, reconnect the 50 Volt line for quarter module #2, and again try to enable the module. Repeat with each of the remaining quarter modules. The module should ISO fault during one of these trials (the quarter module with the problem is the one with its 50 Volts connected when the fault occurs), and the ISO voltage should read a low value (several tenths of a Volt or less) during the other trials.

Once a quarter module with a problem is located, perform a careful visual inspection, looking for burned or broken components, bad solder joints, solder splashes, loose hardware, open circuit board traces, etc. Check the output ISO resistor (low band R15; high band R11) by lifting one lead and measuring with an ohmmeter (should measure 190 to 2102 for low band, or 95 to 1052 for high band).

See the procedure located on page A-18 in this section to check for the correct ISO Fault Threshold.

Power Supply Voltage Fault (4 blinks) — The RF FET transistors operate on a nominal 50 Volt DC supply. If the power supply voltage is too high or too low, the devices could be damaged. The control board monitors the voltage, and reports a power supply voltage fault if it is not between approximately 44 and 54 Volts.

If several modules exhibit the same fault, check the voltage of the power supply and look for faulty connections. Remember that heavy current draw could cause the supply voltage to drop significantly lower than that measured with only a voltmeter loading the line. If only one module exhibits the fault, check the DC supply voltage and connections, plus the module power supply pins and the wiring to its slot. If no problem is found in the power supply or connections, then the problem could be on the control board, either in the control logic or the comparator thresholds. See the procedure for checking for correct Over/Under Voltage Fault Threshold located on page A-17 in this section.

Over Temperature Fault (5 blinks) — The module can be damaged if it is not cooled properly while operating. To protect the amplifier, each quarter module has a temperature sensing circuit that signals the control board to disable the power amplifier if the temperature of any quarter module temperature exceeds 80°C. When this occurs, the logic disables the module, and commands the red LED to blink five times.

First, check the cabinet air filters and module heatsink for accumulated dust. Verify that the cabinet air plenum is providing proper air flow to the module slot. Measure the air inlet temperature, it should be below the maximum temperature rating of 50C. If the temperture is more than a few degrees above outside temperature, the air supply system may not be adequate. If an improper module fault is is suspected, allow the module to cool for a time, then try the following: Supply +50 Volts to the module and, without enabling it, check the voltages at test point TP-1 on each quarter module center board. This voltage represents the temperature of the heatsink at the location of the temperature sensor. The voltage is calibrated to be 2.30 Volts at a temperature of 25°C. The calibration control is R2 on each quarter module board. The voltage at TP1 is compared against a reference voltage of 5.82 Volts generated by a voltage divider.

Measure the quarter module temperature reporting inputs at U13 pins 5,7,9, and 11. If any quarter module input is lower than the reference check for an overheated quarter module, an incomplete temperature reporting circuit, or failure of a quarter module bias and temperature reporting circuit. If the reference voltage is lower than all the temperature reporting lines, the outputs of U13 should be high, and the output of U5 should be low, and the module should not be reporting a temperature fault. If a temperature fault is reported check for proper operation of comparator U13, Schmitt trigger U5, or possible PAL failure.

Pass FET Failure Fault (6 blinks) — Should one of the pass FET DC switch transistors fail to a shorted condition, the control board will sense it and blink the red LED six times. The pass FETs are 60 amp 100 Volt MOSFETs used as DC switches to enable and disable the module as necessary by applying or removing DC from the quarter modules.

CAUTION

IF A PASS-FET FAILURE IS INDICATED, THE MODULE CANNOT BE TURNED OFF EXCEPT BY TURNING OFF THE PA CABINET OR BY DISABLING THE POWER SUPPLY WHICH POWERS THE PA. A MODULE INDICATING PASS-FET FAILURE SHOULD NOT BE REMOVED FOR SERVICE WITH POWER APPLIED, AS COMPONENT DAMAGE COULD RESULT.

A shorted pass FET (drain-source short) is normally confirmed by measuring the resistance from the red 50 Volt wire of any quarter module to the +50 Volt pins of the input connector with an ohmmeter.

If open pass FETs are suspected check the voltage at collector (case) of Q1 of the Module Control Board as the module is enabled and disabled. This voltage is fed through resistance to the gate of the pass FETs. When Q1 collector is high (enabled), +50 Volts should appear at the quarter modules. When Q1 collector is low (disabled), no voltage should be present at the quarter modules.

If a fault is suspected in the gate voltage circuit, trace signals back through CR4, R58, and C9 to the oscillator U4. Pin 7 should show a triangle wave with peaks at 0 and +15 Volts. Buffer U7 pin 14 should be low if enabled. PAL U1 pin 12 should be low if enabled, and +5 Volts if disabled.

A.3.4 Isolating Other Failures

This section includes troubleshooting procedures for situations where a problem is not indicated as a fault by the module logic and control circuit, and no blink code is given.

Amplifier Module Will Not Enable, Has 50 Volts Applied To It But No LED's Will Light — The cause could be a loss of the 15 Volt DC supply in the module. Check the following:

If fuse F1 on the module control board is open, check for a short circuit on the 15 Volt line after the 15 Volt regulator.

If resistor R80 on the module control board is open, look at the 15 Volt regulator U11 itself. The regulator's tab is internally connected to its output, and thus must be isolated from the chassis. Use an ohmmeter to check whether the regulator tab has shorted to the chassis.

Amplifier Module Will Not Enable, Has a Steady Red LED Illuminated and Will Not Change to the Green LED Illuminated — A possible cause could be that the module control board is not receiving the enable command from the slave controller. Try enabling the module on the bench or on extender, or try the swap test after reading the precautions in section A.3.2. If the module now enables, use a multimeter to check the enable wiring in the transmitter cabinet.

If the module still will not enable while in a different cabinet slot, check the continuity of the yellow enable wire inside the module. This wire runs from the black plastic power connector on the module rear panel to a feedthrough capacitor, then to J1-12 on the module control board. If this wire is intact, then the module control board is probably defective. The module is normally enabled by grounding this control line.

Module Has Only 1/2 Green LED Illuminated and Low or No RF Output The module has been enabled but little or no RF drive has been applied to the quarter modules. This indication is given only in PA modules; drivers have both green LEDs on during an enable condition, regardless of drive level. This indication is sometimes a normal condition in PA modules used in the drive chain of a transmitter whose output power is significantly below 30 kW.

If this is not the case, then the cause for loss of drive could be either in the module or in the transmitter cabinet. First, check for normal exciter and transmitter output levels.

If the exciter drive level seems normal, try the module in a different cabinet slot that is known to have proper RF drive. If the problem doesn't follow the module, then inspect the cables leading to the module RF input for that transmitter slot. If the problem does follow the module, check the RF input cable inside the module, connected between the black power connector on the module inside rear panel and the 4-way power divider.

Module Has Full Green LED Illuminated But No RF Output

PA modules: Since an insufficient drive level causes one of the green LEDs to go out, that cause is ruled out. This condition would most likely be caused by a failure of the pass FET driving circuitry on the module control board. The control board logic has illuminated the green enable LED, but it is not turning on the pass FETs. This will not allow the quarter modules to receive the 50 Volts DC that they need in order to operate. See the paragraphs on Pass FET Failure Fault (6 blinks) located on page A-12 in this section.

Driver modules: The pass FET driving circuitry could also be the culprit, as in PA modules. In driver modules, however, a more likely cause is insufficient or no drive.

Try swapping driver modules, if the problem follows the module, check the module RF path, starting with the RF input cable inside the module, then moving to the input attenuator (R4, R5, R6) on the interconnect board, then to the first stage. Also, check the connections between each stage and the next.

If this doesn't isolate the problem, check the DC voltage and current supplied to each quarter module, through the red wire connected to screw terminal TB1. Measure the applied voltages and normal idle currents for each quarter module.

If a quarter module indicates 50 Volts present but no current, check the 15 Volts supplied through J1-1.

If the problem stays in the same transmitter slot, the problem is within the transmitter (AGC module, phase and gain module if present, preamp if present, power divider if parallel drivers are used, or RF cables).

A.3.5 Locating Failed RF FETs

A.3.5.1 DC Resistance Test

The most common symptom of a bad FET is an ISO fault (3 blinks). Using a Simpson 260 (or equal), measure the DC resistance from the gate to ground of each FET. This is done with the module on the bench with neither RF or DC power applied. Compare the resistance measured from one FET to the next. The resistance indicated will vary with the voltage of the multimeter used. A resistance on one FET significantly lower than the others indicates a bad FET or leakage in a gate chip capacitor.

If no FET indicates a low gate to ground resistance proceed to idle current testing.

A.3.5.2 Idle Current Test

First, it is necessary to determine the original bias current per FET, and to determine on which quarter module the failed FET lies. For this procedure, no RF drive will be applied; however, a load resistor should still be placed at the module output to prevent oscillation.

Starting with the first quarter module (nearest the logic board) and working toward the front handle, measure the total idle current of each quarter module in turn. Either insert a current meter in line with the 50 Volt wire at TB1, or use a clamp-on DC current meter if available. With no RF drive applied, apply 50 Volts and enable the module. Note the quarter module current, disable the module, remove the 50 Volts and move the current meter to the next quarter module.

If no current meter of sufficient range is available, a small resistance can be placed in series with the 50 V line, and the voltage drop used to calculate current from Ohm's Law (I=V/R). Values from 0.1 to 0.2 ohms should be satisfactory. At 0.1 ohms, the voltage drop across the resistor will indicate 0.1 Volts for every 1 amp of current. A sensitive digital meter with a millivolts range is needed to use this technique.

After taking the current measurements on each quarter module, determine the correct bias current setting per FET.

The nominal bias current per FET is given in the Table A-2.

Now that the correct bias current is known and the quarter module with failed FET(s) has been located, one can locate the failed FET. Move the current meter to the quarter module showing abnormally low current. Again, apply DC power only and enable the module. While observing idle current, slowly rotate the bias control for each transistor **counterclockwise**, one at a time; this should reduce the current for the corresponding FET.

If the idle current does not drop when the pot is turned fully counterclockwise, then the RF FET is probably bad. To determine which pot affects the idle current of each FET, refer to Figure A-6. Note the difference between high band and low band quarter modules.

Procedure for setting bias current on a quarter module:

First, determine the correct bias current per FET. Connect a current meter in series with the 50 Volts to the quarter module. Next, set the bias pots fully counterclockwise, apply 50 Volts, and enable the module. The current meter connected to the quarter module being adjusted should read almost zero current (less than 20 mA). **Slowly** turn each bias pot clockwise to set the current for the corrosponding FET, then adjust the next bias pot until a total of twice the current per FET is reached, and so on, until the last FET is adjusted such that the total current is four times the current per FET.

Example: On a low band class AB stage, after determining that the correct bias for a given quarter module is 400 mA per FET, start with all bias pots fully counterclockwise. **Slowly** turn R25 clockwise until 400 mA is reached, then turn R26 clockwise until 800 mA is reached, then R27 until 1.2 A is reached, and finally turn R28, stopping at 1.6 A total.

CAUTION: Adjusting the bias pots too far clockwise or too quickly can destroy an RF FET due to excessive current. Go **slowly**.

Driver modules
1 Amp.

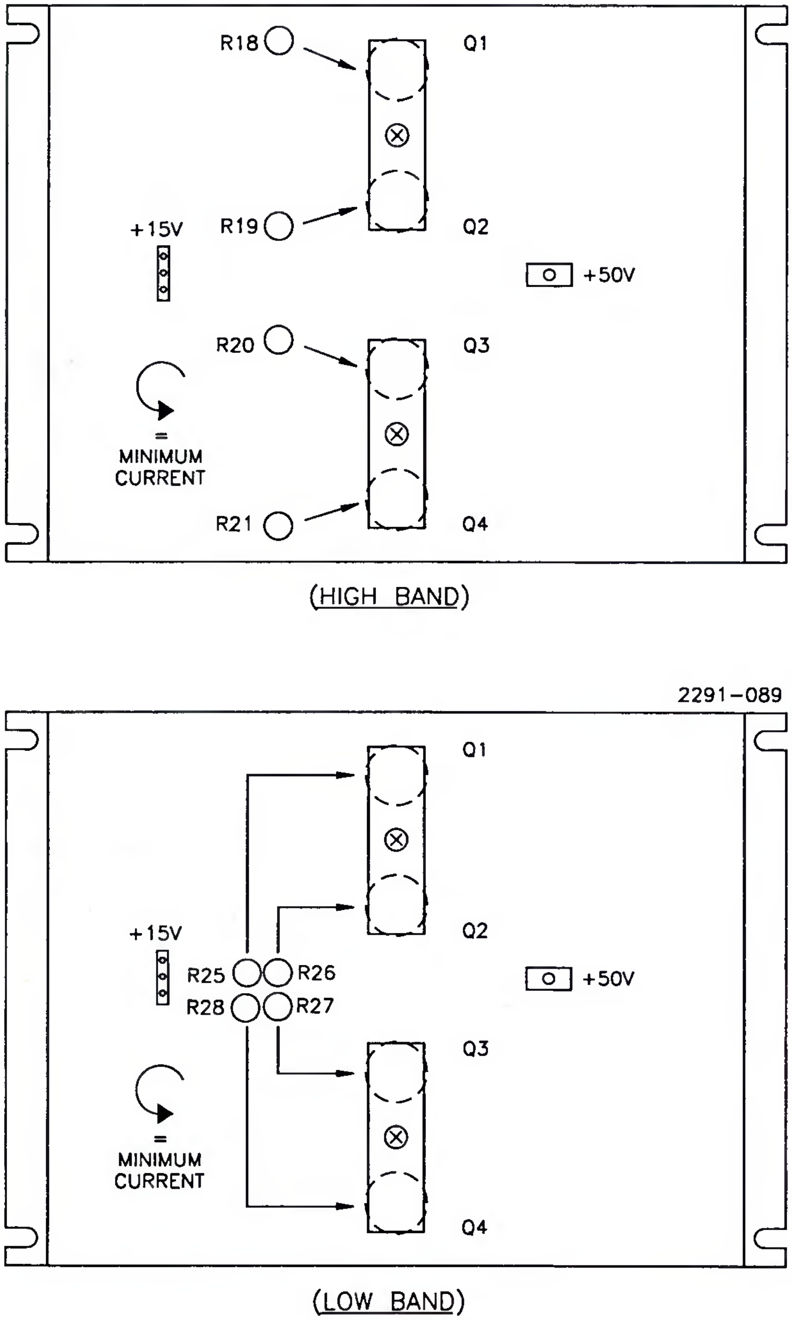
A.4 Parts Replacement Procedures

A.4.1 Soldering Precautions

Please read the following precautions before attempting any repair activity:

a. Be sure to use the correct type of solder depending on the repair being made. For soldering coaxial cables, use a SN 96, AG 4 alloy for lowest loss and best mechanical strength. For all other joints, use SN 63, PB 37 for its low melting point.

b. Always use electrical solder with a rosin flux. Never use plumbing solder or acid fluxes, which can cause copper to corrode. Start with clean, tinned leads, which will minimize the need for flux. If it is necessary to use additional flux, use as little as possible.



PLATINUM TV QUARTER MODULE

Figure A-6. Quarter Module RF FET Bias Pots

c. Choose the correct soldering equipment for the job. Use tips that are the appropriate size for the components involved. Use a grounded iron when installing static-sensitive components (most semiconductors).

d. Choose a soldering temperature just hot enough to melt the solder quickly, while as low as possible to prevent damage to the new components. An iron with a temperature adjustment is best. Typical settings are:

   650°F for small chip caps
   750°F for RF FET tabs
   800°F for coax cables and wiring on large pads.

e. Make the new joint as mechanically sound as possible before making the electrical solder connection. Provide mechanical strain relief for leads on components which are flange-mounted.

f. Clean all flux residue away from the area when finished. When working around devices where thermal compound is used, be sure not to allow solvents to flow between the device and the heat sink, which can cause the heat thermal compound to dissolve.

g. Be sure to search for and remove solder splashes, solder bridges, loose solder wire or wire lead clippings, and screws before replacing the cover. Loose metal inside the module can lead to short circuits, which can cause serious damage to the module and possible injury.

A.4.2 Quarter Module Replacement

CAUTION

DO NOT REPLACE ACTIVE QUARTER MODULES WITH PASSIVE BIAS QUARTER MODULES, THE PCMS ARE INCOMPATIBLE.

Platinum quarter modules can be field replaced with another quarter module FACTORY TUNED to the same channel. The gain of each quarter module is adjusted by the value of the quarter module input pad. The input to output phase relationship is set by TL1, the phase setting coax. This coax must remain with the quarter module, use the replacement cable already attached to the REPLACEMENT quarter module for proper phasing. Replacement quarter modules are furnished with the bias for PA usage, for DRIVER usage the bias must be reset.

A.4.3 RF FET Replacement

IMPORTANT

The RF amplifier FETs are sensitive to damage from static electrical discharge, and should be handled in an anti-static environment. A grounded working surface, grounded iron, and electrostatic discharge bracelet should be used.

IMPORTANT

IN ORDER TO PROTECT THE NEW FETS FROM ACCIDENTAL DAMAGE TO OVERCURRENT, BE SURE TO TURN OFF THE BIAS (FULLY COUNTER-CLOCKWISE) TO ALL FOUR FET POSITIONS ON THE QUARTER MODULE BEFORE INSTALLING THE NEW FETS.

IMPORTANT

WHEN CLEANING THE OLD THERMAL COMPOUND FROM UNDERNEATH THE FET AFTER REMOVAL, USE A SWAB WITH JUST ENOUGH SOLVENT TO CLEAN THE SURFACE. DO NOT USE TOO MUCH SOLVENT, AND DO NOT USE AN AEROSOL SPRAY CLEANER, AS EITHER MAY SEEP UNDERNEATH NEARBY FETS AND DISSOLVE THE THERMAL COMPOUND FROM UNDER THEM, CAUSING PREMATURE FAILURE.

WARNING

RF TRANSISTORS, ISOLATION RESISTORS, AND INPUT ATTENUATORS CONTAIN BERYLLIUM OXIDE (BeO) CERAMIC, A HAZARDOUS MATERIAL. THE LIDS ARE MADE FROM Al2O3 AND ARE HARMLESS. THE BeO IS HARMLESS WHILE INTACT, BUT THE DUST IS TOXIC. AVOID CRUSHING OR BREAKING THE BeO CERAMIC, AND DISPOSE OF FAILED DEVICES PROPERLY.

The Philips FET (ON4402H) is used for both low band and high band modules. Each FET is marked with a gain code and a threshold code. For replacement the gain code is the most important. The quarter module has been assembled in the factory with FET's that have the same gain code. When the quarter module is aligned the gain is set with an attenuator on the input. Therefore the FET being replaced must have the same gain code as the other FET's on the quarter module for proper performance. The gain code is a number (3 through 7) located above and to the left of the ON4402H marking on the cap.

Each gain code has a part number assigned to it. These are shown in the following table:

Gain Code	Harris Part Number
3	380-0737-003
4	380-0737-004
5	380-0737-005
6	380-0737-006
7	380-0737-007

Once a failed FET is isolated, remove it from the board using the following procedure:

a. Turn off the bias to all four FETs by rotating the bias control pots counter-clockwise.

b. Remove the clamp holding down the transistors.

c. Using a 45 Watt soldering iron with a wide blunt tip, desolder the leads lifting them with a small knife. It is important to use enough heat to quickly flow the solder and work quickly so as not to damage the foil.

d. Remove the old heat sink compound. Use a small amount of solvent, such as Isopropyl Alcohol, on a swab, being careful not to allow it to run. Do not use sprays of any kind, as this may dissolve heat sink compound from underneath nearby FETs.

e. Re-flow the solder left on the foil where the tabs will seat. Be sure the surface is smooth and that no solder bridges remain.

To install the new FET:

a. Tin the bottom of the FET leads lightly with solder.

b. Use the following procedure for filling a syringe with thermal compound.
   1. Required Equipment:
      a) A 5mL syringe
      b) Zinc oxide (Wakefield™) thermal compound
      c) A stirrer (clean, no lint)
      d) A clean cloth
   2. Procedure:
      a) On a clean, dry surface open the heat sink compound jar and stir the compound thoroughly with a clean stirrer. Make sure there is no settling in the compound before proceeding.
      b) Assemble the syringe if necessary.
      c) Put syringe tip in the compound up to the beginning of the barrel of the syringe.
      d) Push and pull plunger several times while the tip is in the compound (2 to 4 times) to make sure there are no air gaps when filling the syringe.
      e) With the tip of the syringe still in the compound, begin swirling the tip around in the compound while drawing back the plunger to fill the syringe to 5mL.
      f) Remove syringe from compound and clean off carefully with the clean cloth.

c. Apply heat sink compound on the RF FET.
   1. Required Equipment:
      a) Xacto™ knife (blade #11). Use only a fresh blade for this procedure (no nicks or mars, has not been used for anything else. When in doubt, change the blade)
      b) Cleaning solvent
      c) Q-tip
      d) Wakefield compound in new 5mL syringe
      e) A clean cloth
      f) **ESD equipment**
   2. Procedure:
      a) **Make sure you are ESD safe through the entire procedure.**
      b) Take the FET to be installed and make sure the back side is clean. Make sure that the heat sink mounting surface is clean as well. If the surfaces are not clean, clean them with a Q-tip dipped in cleaning solvent. Make sure solvent is dry before proceeding.
      c) Get the Xacto knife (blade #11). Only use a clean, fresh blade (this blade should only be used for this procedure). Measure out a small amount (1-2mm from the tip of the syringe) of compound from the dispensing syringe onto the Xacto blade.
      d) Apply the compound evenly on the FET by moving the flat side of the blade in a circular motion on the back side of the FET. Clean excess compound off the blade.
      e) Holding the Xacto blade at a 45 degree angle or less from the FET's surface, gently press down with the blade edge.
      f) Continuing to hold the blade at 45 degrees or less, and starting at one end of the FET, sweep slowly across the FET. Made sure the blade does not lift up. There should be a thin opaque film left on the surface after sweeping. The gold flashed back of the FET is slightly concave, the heat sink compound should be thickest in the center. There should be excess heat sink compound on the blade. Carefully wipe the excess compound off on a clean cloth (do NOT try to re-use this compound).
      g) Place FET firmly into the holes of the PC board. Try to pull the FET up, applying moderate force. If the FET resists being pulled up, it is well seated. If it is easily pulled up, clean both surfaces, inspect for surface irregularities, and try again.

d. Install spacer, levelers and leaf spring. Insure that leaf spring and levelers are centered over the FET packages and that the spacer is resting flush with the heatsink. Tighten the screw securely. The leaf spring should bottom out on the spacer and the split washer should be fully compressed.

e. Solder the leads using low-temperature solder. Inspect for solder bridges. Scrape away any flux using a small knife. Do not use any sprays or liquids that may run under the transistor and dissolve the heatsink compound. Inspect for proper flow of solder between the FET leads and the board foil.

f. Check to see that all bias pots of the quarter module have been turned fully counter-clockwise before applying any power.

Refer to the section on Idle Current Testing to set bias controls.

A.4.4 Testing and Replacing Isolation Resistors

WARNING

RF TRANSISTORS, ISOLATION RESISTORS, AND INPUT ATTENUATORS CONTAIN BERYLLIUM OXIDE (BeO) CERAMIC, A HAZARDOUS MATERIAL. THE LIDS ARE MADE FROM Al2O3 AND ARE HARMLESS. THE BeO IS HARMLESS WHILE INTACT, BUT THE DUST IS TOXIC. AVOID CRUSHING OR BREAKING THE BeO CERAMIC, AND DISPOSE OF FAILED DEVICES PROPERLY.

In order to test ISO resistors, it is necessary to desolder one of the leads before testing the resistor with an ohmmeter.

When replacing a flange-mounted ISO resistor, bend the resistor leads curving upward slightly to provide mechanical strain relief to allow for differing expansion between the circuit board and the heat sink. Be sure to clean away the old thermal compound from the heat sink surface, and apply just enough compound to the flange of the new device in order to assure a good thermal interface. After applying reasonable torque to the flange screws, solder the leads quickly using a hot iron.

A.4.5 Pass FET Replacement

If pass FET replacement is necessary, replace both FETs with the matching parts. If this is not done there may be a tendency for one FET to carry more of the current and lead to a repeated failure.

When pass FETs are replaced, change Q1 and R72 on the Module Control Board, and change the 5.6 ohm resistors and the zener diode on the pass FET buss bar assembly. These parts are typically stressed in the event of pass FET failure and replacing them will promote long term reliability.

Use the same ESD procedures outlined in the section on RF FET replacement. The FET drains are insulated from the chassis with "SIL-PADS", silicon insulating pads that need no heat sink compound.

Before enabling the module, check to see that the drains are not shorted to the chassis using an ohmmeter.

A.4.6 Chip Cap Replacement

It is a common technique to use two irons with small tips (one on each side) when removing or installing chip caps. Both sides of the chip cap should be heated simultaneously to avoid residual stresses which might later cause a failure.

Note that the capacitor values listed in the Parts List are typical values. Check the value of the capacitor to be replaced before ordering a replacement part.

A.5 Test Procedure Solid State TV Modules

Install transmitter section of module test fixture into transmitter.

Attach RF output cable to module test fixture through access slot in the fixture, and connect to wattmeter and 50 ohm load (1kW).

Install input wattmeter. Use RF input access cable on side of test fixture.

Attach extension section and install module onto fixture. (Do not install module protective cover at this time.)

Perform a complete visual inspection of the module to be repaired.

Remove red wire from TB1 and install a current meter in line. The current meter needs to be capable of measuring 400 mA steps accurately, and up to 10 Amps total. A clamp-on probe, if available, makes the task easier. Use an ammeter that is resistant to RFI.

A.5.1 Pre-operational Checks

A.5.1.1 Initial Power Up

Close CB2, this breaker is only to protect the wiring between transmitter and test fixture.

Apply 50 Volts DC only to module by turning on circuit breaker CB1. (Red LED on module front panel will be on.)

The +5 and +15 Volt PCM supplies can be checked when 50 Volts is applied.

A.5.1.2 Idle Current Check

The module cover section of the extender assembly should be removed so that no RF drive can be applied.

Enable module with "MODULE ENABLE" switch on test fixture. Red LED will extinguish. On PA modules one half of green LED will illuminate. On driver modules both halves of green LED will be on.

Note the current reading of the quarter module. Compare this reading to the values found in the Table A-1 located at the end of this section. Check all four quarter modules.

If quarter module currents are all OK, the module is ready for RF testing. If the current is incorrect, refer to Idle Current Test procedures.

A.5.1.3 Over/Under Voltage Check

Since there are no adjustments this is an operational check only. Measure the voltages at U7:

Pin 4 = 10.3V +/- 0.2V	50 Volt supply sample approximately 1/5th ratio
Pin 5 = 11.1V +/- 0.2V	Over threshold
Pin 6 = 8.9V +/- 0.2V	Under threshold

To simulate over voltage fault, connect an isolated supply at the junction of R47 and R48. Monitor U7 pin 7 voltage to note trip point.

Inject increasing DC voltage until the circuit trips.

To simulate under voltage fault connect a 100k ohm variable resistor across R47.

Monitor U7 pin 7 and decrease the value of resistance until the circuit trips.

If an external 50 Volt source is available to operate the entire module you may check the trip points for operation at 44 Volts and 53.5 Volts.

A.5.2 RF Testing

CAUTION

IF THE UNIT BEING TESTED IS A DRIVER BE SURE IT IS IN A DRIVER POSITION IN THE TRANSMITTER. EXCESSIVE DRIVE WILL DESTROY THE INPUT ATTENUATOR IF A DRIVER IS OPERATED IN A PA SLOT.

Testing of drivers may be done in a PA slot if the drive cable access loop on the extender is removed and a external source of RF is applied (i.e. the standby exciter in dual configurations).

Note

IF YOU ATTEMPT TO OPERATE A PA IN A DRIVER SLOT, THE DRIVE LEVEL WILL BE INSUFFICIENT TO COMPLETE THE TESTS.

A.5.2.1 Application of Drive

To test a driver module it is recommended to adjust exciter power to minimum before applying RF in the configurations with only one driver in the path.

Install protective cover on the module and note the power output on the wattmeter. PA module output should be in proportion to the others in the system.

A.5.2.2 Gain Check

PA gain is measured in factory test at visual frequency with carrier only operating at 625 Watts.

Low band driver gain is measured at 30 Watts average black power.

High band driver gain is measured at 150 Watts average black power.

Black picture (sync and blanking only) is the best approximation for this test. If possible set power out to 625 Watts average with a black picture. Turn off transmitter and move the wattmeter to the input. Turn on transmitter and using an element of appropriate range measure the input power.

Calculate gain in dB using 10 log(P out/P in).

Since the driver input power is in mW, it will be necessary to use a power meter with an appropriate range to measure input power.

Results should be as shown in Table A-1.

A.5.2.2.1 Alternate method for measurement under program conditions

To measure gain insert a directional coupler of sufficient power capacity in the output coax. Note the sample level on a spectrum analyzer or field strength meter. Move the directional coupler to the input access loop and note the drive level.

On field strength meters peak sync levels may be used as the reference with program present but the gain figure may vary slightly from the standard test method. Blanking level can usually be clearly seen on the spectrum display and would be the preferred reference.

NOTE

The remaining tests of this procedure are performed in an Aural slot.

INPUT/POWER DIVIDER PWA.

In Driver modules the pad is constructed using three resistors. The resistors are selected using Table A-2, (817-2100-639) Input Attenuators/Driver.

A.5.2.3 ISO Volts Check

Adjust PA power to 1050 Watts at aural frequency. For a high band driver use 500 Watts aural and for a low band driver use 200 Watts.

If necessary manually disable some of the other aural modules to bring the drive level up as required.

Measure the voltage at P1-2 on any one of the four quarter modules. (They are wired in parallel.)

Verify the value to be 0.3 Volts DC or less.

To test the fault threshold, remove the RF Drive.

Using an isolated DC supply (possibly a 9 Volt battery and a variable resistance), inject voltage at P1-2 of any quarter module and slowly increase voltage until the module faults.

The module should trip off between 1.7 and 2.1 Volts.

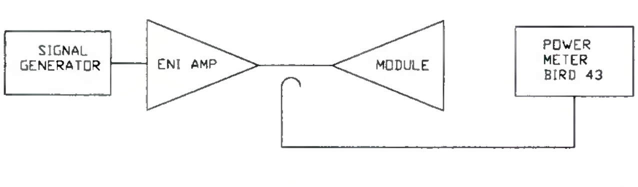


Figure A-7. VSWR Protection Test Setup

A.5.2.4 Overdrive Check

Perform this check only after verifying that the module gain adjustment is correct. See paragraph on Gain Check located elsewhere in this section.

Pre-set the Overdrive Pot R101 fully clockwise

Set the input drive on the aural frequency per the following:

MODULE TYPE	DRIVE LEVEL	TRIP TOLERANCE
High Band PA	120 Watts	2 Watts
Low Band PA	35 Watts	1 Watt
Low and High Band Drivers	370 milliwatts	10 milliwatts

To set the trip point adjust R101 CCW until the module faults and gives a blink code 2 on the red LED.

The red LED display has a few seconds time delay before indicating. It may be helpful to observe the power meter or quarter module current which will react instantaneously, while setting the overdrive trip point.

Check the setting by reducing the power, enable the module, and increase power. The drive power level must trip within the allowed tolerance. If not readjust R101 as required.

A.5.2.5 VSWR Check

<u>VSWR Protection Check</u>

Precise Method:

a. Connect a 50 ohm termination to the module RF input. Connect a signal generator, test amplifier, and power meter to the module output per Figure A-7.
b. Apply 50 V DC and enable the module.
c. Set the signal generator to the Aural carrier frequency and apply 94.5 Watts CW into the PA module RF output.
d. Slowly adjust R8 CCW until the module disables and gives a blink code of one on the red LED.
e. Reduce the signal generator level and enable the module. Slowly raise the signal generator level while monitoring the power applied to the module. The module should disable between 90 and 100 Watts. If not, readjust R8 as required.
f. Turn off the 50 V DC and restore the test setup to normal configuration.

Alternate Procedure for approximated adjustment

PAs are set using 1050 Watts aural output as the forward reference.

For low band driver use 200 Watts and for high band driver 500 Watts.

R8 provides a DC offset to allow turn on in a complete transmitter where some crosstalk may exist.

Apply DC (No RF) to module. Adjust R8 for proper voltage at U6-pin 4.

M/NTSC	B/PAL	U6-4 Voltage
2	E2, E3	.35 Volts
3	E4	.45 Volts
4		.62 Volts
5		.75 Volts
6		.85 Volts
7	E5	.45 Volts
8	E6	.55 Volts
9	E7	.62 Volts
10		.70 Volts
11	E8	.77 Volts
12	E9	.85 Volts
13	E10-E12	.95 Volts

Using a test load with low VSWR, measure the DC voltage of the forward sample at the feed through to the logic printed wiring or at junction of R5 and C4 for reference.

At the reflected sample feedthrough or at the anode of CR1 inject a DC voltage. Slowly increase the voltage until the module faults.

It should trip at a voltage 0.84 times the reference +/-10%.

To adjust the trip threshold set the injected voltage to 0.84 times the forward reference and adjust R101 until the module faults off.

This accounts for the 6 dB pad on the forward sample line and scales the trip point to be the equivalent of 2.5:1 VSWR.

Table A-1. Summary of Module Specifications

BIAS CURRENTS NOTE: Quarter Module #1 is next to the module logic board, QM #4 is next to the front panel

	Zero Signal Current per FET	QM # 1	QM # 2	QM # 3	QM # 4
992-9864-002 thru 112	LB Driver (50-88 MHz)	1.0 amp	1.0 amp	NONE.	1.0 amp
	HB Driver (175-216 MHz)	0.30	0.30	1.0	1.0
	HB Driver (216-230 MHz)	0.30	0.30	1.0	1.0
992-8965-002 thru 112	LB 525 W PA (50-88 MHz)	0.40	0.40	NONE	1.0
	HB 525 W PA (175-216 MHz)	0.30	0.30	1.0	1.0
	HB 525 W PA (216-230 MHz)	0.30	0.30	1.0	1.0
992-8969-002 THRU 112	LB Power Amp (50-88 MHz)	0.40	0.40	0.40	0.40
	HB Power Amp (175-216 MHz)	0.30	0.30	0.30	0.30
	HB Power Amp (216-230 MHz)	0.30	0.30	0.30	0.30

GAIN and OUTPUT POWER

		Vision dB Gain	Sound dB Gain	NTSC Avg Pwr	PAL Avg Pwr	Sound Pwr
992-9864-002 thru 112	LB Driver (50-88 MHz)	35 ± 0.5	35± 1.5	30	28	200
	HB Driver (175-216 MHz)	35 ± 0.5	35± 1.5	150	142	500
	HB Driver (216-230 MHz)	35 ± 0.5	35± 1.5	150	142	500
992-8965-002 thru 112	LB 525 W PA (50-88 MHz)	35 ± 0.5	35± 1.5	312	298	525
	HB 525 W PA (175-216 MHz)	35 ± 0.5	35± 1.5	312	298	525
	HB 525 W PA (216-230 MHz)	35 ± 0.5	35± 1.5	312	298	525
992-8969-002 THRU 112	LB Power Amp (50-88 MHz)	18.5 ± 0.5	16.8 - 19.5	625	595	1050
	HB Power Amp (175-216 MHz)	13.7 ± 0.5	12.0 - 14.7	625	595	1050
	HB Power Amp (216-230 MHz)	13.7 ± 0.5	12.0 - 14.7	625	595	1050

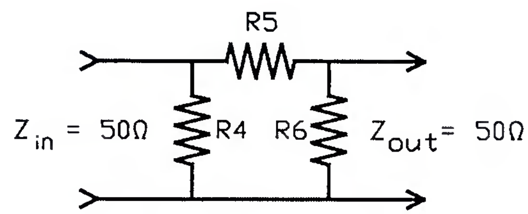
Fault Trip Points

		Overdrive Fault	Reverse Power
992-9864-002 thru 112	LB Driver (50-88 MHz)	140 mW CW	45 - 55 W CW
	HB Driver (175-216 MHz)	350 mW CW	45 - 55 W CW
	HB Driver (216-230 MHz)	350 mW CW	45 - 55 W CW
992-8965-002 thru 112	LB 525 W PA (50-88 MHz)	370 mW CW	45 - 55 W CW
	HB 525 W PA (175-216 MHz)	370 mW CW	45 - 55 W CW
	HB 525 W PA (216-230 MHz)	370 mW CW	45 - 55 W CW
992-8969-002 THRU 112	LB Power Amp (50-88 MHz)	35 ± 1 W CW	90 - 100 W CW
	HB Power Amp (175-216 MHz)	120 ± 2 W CW	90 - 100 W CW
	HB Power Amp (216-230 MHz)	120 ± 2 W CW	90 - 100 W CW

CURRENT REVISION	0			DWG. NO.	817-2100-639	
ZONE	LTR	DATE	REVISION	DFTM	ENG	ECN

Atten.	R4 and R6	R5
0.5	1740Ω 548-1390-000	2.87Ω 548-2268-000
1.0	866Ω 548-2280-000	5.76Ω 548-2269-000
1.5	576Ω 548-2279-000	8.66Ω 548-2270-000
2.0	432Ω 548-0856-000	11.5 Ω 548-2193-000
2.5	348Ω 548-2267-000	14.7Ω 548-2254-000
3.0	294Ω 548-1991-000	17.8Ω 548-2194-000
3.5	249Ω 548-0712-000	20.5Ω 548-2256-000
4.0	221Ω 548-0839-000	23.7Ω 548-2195-000
4.5	196Ω 548-2266-000	26.7Ω 548-2271-000
5.0	178Ω 548-2053-000	30.1Ω 548-2196-000
5.5	162Ω 548-0828-000	34.0Ω 548-2258-000
6.0	150Ω 548-2207-000	37.4Ω 548-2197-000
6.5	140Ω 548-1047-000	41.2Ω 548-2272-000
7.0	130Ω 548-0227-000	45.3Ω 548-2198-000
7.5	124Ω 548-0332-000	48.7Ω 548-2260-000
8.0	115Ω 548-0581-000	52.3Ω 548-2199-000
8.5	110Ω 548-0276-000	57.6Ω 548-2273-000
9.0	105Ω 548-2203-000	61.9Ω 548-0665-000
9.5	100Ω 548-0363-000	66.5Ω 548-2261-000
10.0	95.3Ω 548-2202-000	71.5Ω 548-2200-000
10.5	93.1Ω 548-0814-000	76.8Ω 548-2263-000
11.0	88.7Ω 548-0754-000	82.5Ω 548-0703-000
11.5	86.6Ω 548-0813-000	86.6Ω 548-0813-000
12.0	82.5Ω 548-0703-000	93.1Ω 548-0814-000
12.5	80.6Ω 548-0372-000	100Ω 548-0363-000
13.0	78.7Ω 548-2201-000	107Ω 548-2204-000
13.5	76.8Ω 548-2263-000	113Ω 548-2264-000
14.0	75.0Ω 548-0576-000	121Ω 548-2205-000
14.5	73.2Ω 548-2262-000	127Ω 548-2265-000
15.0	71.5Ω 548-2200-000	137Ω 548-2206-000

Atten.	R4 and R6	R5
15.5	69.8Ω 548-0811-000	143Ω 548-2276-000
16.0	68.1Ω 548-0753-000	154Ω 548-2074-000
16.5	68.1Ω 548-0753-000	162Ω 548-0828-000
17.0	66.5Ω 548-2261-000	174Ω 548-2277-000
17.5	64.9Ω 548-2275-000	182Ω 548-0756-000
18.0	64.9Ω 548-2275-000	196Ω 548-2266-000
18.5	63.4Ω 548-2274-000	205Ω 548-2278-000
19.0	61.9Ω 548-0665-000	221Ω 548-0839-000
19.5	61.9Ω 548-0665-000	232Ω 548-2054-000
20.0	61.9Ω 548-0665-000	249Ω 548-0712-000



NOTE: Not all applications will use the same Resistor Reference Designators as shown above.

QTY.	HOLE	DESCRIPTION
UNLESS NOTED: DIMENSIONS ARE IN INCHES TOLERANCES: .X ± .030 .XX ± .015 .XXX ± .005 ANGLES ± 1 DEG.		HARRIS

DR. BY R.J. Crockett	TITLE
ENG. CHK. R.J. Crockett	Assembly Instruction Input Attenuator
PROJ. ENG. Mortimore	
MFG. ENG. R.J. Crockett	
MAT'L.	SHEET 1 OF 1 — DWG. NO. 817-2100-639

Table A-3. 30 Watt Attenuators

Attenuation - dB	Harris Part No.	KDI Part No.
0.75	556-0126-075	A3RH54-075
1.00	-100	-100
1.25	-125	-125
1.50	-150	-150
1.75	-175	-175
2.00	-200	-200
2.25	-225	-225
2.50	-250	-250
2.75	-275	-275
3.00	-300	-300
3.25	-325	-325
3.50	-350	-350
3.75	-375	-375
4.00	-400	-400
4.25	-425	-425
4.50	-450	-450
4.75	-475	-475
5.00	-500	-500

2.2 MECHANICAL SPECIFICATION

2.2.1 Substrate: Beryllium Oxide Ceramic

2.2.2 Resistive Element: Thin Film

2.2.3 Flange: Copper, Nickel Plated per QQ-N-290

2.2.4 Tabs: Beryllium copper, Gold Plated per MIL-G-45204

2.2.5 Cover: Alumina Ceramic

2.2.6 Outline Drawing: See Figure 1

2.2.7 Marking: Parts to be marked with Attenuation value and date code.

Title: SPEC, 30 WATT ATTENUATOR	Sh 2 of 3	Rev	Dwg: 817-2100-611

B.1 Air Conditioning

A common practice is to set the transmitter into a wall, cooling it with outside air while providing air conditioning for the front side to cool personnel and equipment. In severely polluted areas, however, it may be desirable to run the transmitter on air-conditioned air to avoid bringing in salt spray, soot, gaseous contaminants, etc.

Any electronic system is most reliable and component life longest when operated at moderate temperatures. The amount of air conditioning required will depend on several factors. Sharing the air conditioning load among a distributed system of smaller units, rather than using one large central system, is strongly recommended so that operation can continue in the event of the failure of one unit.

B.2 Heat Load Estimate Guide

Table 2-1 contains a guide that may be useful in estimating the required air conditioning capacity. Air conditioning units are usually rated in "tons" of cooling capacity with one ton equal to 12,000 BTU per hour.

The "sensible heat load" is the sum of heat loads such as solar radiation and heat generated by equipment and personnel in the air-conditioned area. Again, we recommend consulting professionals experienced in the area of HVAC design to ensure satisfactory results.

Table B-1. Heat Loading Guidelines

FACTOR	ITEM BTU-PER-HOUR LOAD
EXTERIOR OR WALL AREAS EXCLUDING WINDOWS.	5 to 11 BTU/hour/square foot, dependent on sun exposure.
INSULATING GLASS (NO COVER).	22 to 77 BTU/hour/square foot, dependent on sun exposure.
INSULATING GLASS (COVERED WITH SHADES OR TINTED.)	21 to 51 BTU/hour/square foot, dependent on sun exposure.
ROOF AREAS WITH CEILING UNDERNEATH.	4 to 7 BTU/hour/square foot, dependent on roof insulation.
INTERIOR WALLS BETWEEN UNCONDITIONED AREAS.	8 to 14 BTU/hour/square foot, dependent on partition material.
FLOOR AREAS EXPOSED TO UNCONDITIONED AREAS.	9 to 50 BTU/hour/square foot dependent on environment.
LIGHTING.	3.4 BTU/hour per watt.
PERSONNEL.	500 BTU/hour per person.
FRESH AIR VENTILATION	340 to 825 BTU/hour/person, dependent on condition of incoming air.
PERIPHERAL EQUIPMENT.	3.4 BTU/hour per watt.
GROWTH AND SAFETY FACTOR.	30% of total BTU/hour.
TOTAL COOLING LOAD.*	130% of total BTU/hour.
MINIMUM SENSIBLE COOLING.*	85% of TOTAL COOLING LOAD.

* The TOTAL HEAT LOAD is calculated as the sum of the sensible-heat load and the latent-heat load.

C.1 Surge and Lightning Protection

A lightning storm can cause transients in excess of 2 kV to appear on power or field signal lines. The duration of these transients varies from a few hundred nanoseconds to a few microseconds. Power distribution system transient protectors can efficiently protect the transmitter from transients of this magnitude. Transients are shunted to ground through the protection devices and do not appear on the output. To protect the transmitter from high transients on field cables, electronic surge protectors are recommended.

All lightning protection is defensive in nature, that is, reacting to a lightning strike that has already occurred; therefore, its effectiveness is limited. Nothing can provide total immunity from damage in the case of a direct lightning strike. However, surge protectors installed immediately after the main power disconnect switch in the power distribution panel will afford some protection from electrical surges induced in the power lines.

Surge protection devices are designed to operate and recover automatically. When operated within specifications, a surge protector does not require testing, adjustment, or replacement. All parts are permanently enclosed to provide maximum safety and flexibility of installation.

To assure the safety of equipment and personnel, primary power line transformers must be protected by lightning arrestors at the service entrance to the building. This will reduce the possibility that excessive voltage and current due to lightning will seek some low impedance path to ground such as the building metallic structure or an equipment cabinet. The most effective type of power line lightning protection is the one in which a spark gap is connected to each primary, secondary, and the case of the power line transformer. Each spark gap is then independently connected to earth ground. In cases where driven ground rods are used for building ground, the primary and secondary neutrals must be separated by a spark gap. If two separate ground rods are used, the rods must be at least 20 feet apart. All connections between lightning arrestors, line connections, and ground must be made as short and straight as possible, with no sharp bends.

C.2 System Grounding

Signals employed in transmitter control systems are on the order of a few microseconds in duration, which translates to frequencies in the megahertz region. They are therefore radio-frequency signals, and may be at levels less than 500 microvolts, making them susceptible to noise appearing on ground wires or adjacent wiring. Thus, all ground wiring must be low in impedance as well as low in resistance, without splices, and as direct as possible. Four basic grounds are required:

a. AC ground
b. DC ground
c. Earth ground
d. RF ground

C.2.1 Ground Wires

Ground wires should be at least as large as specified by the local electrical code. These leads must be low impedance direct runs, as short as possible without splices. In addition, ground conductors should be insulated to prevent intermittent or unwanted grounding points.

Connection to the earth ground connection must be made with copper clamps which have been chemically treated to resist corrosion. Care must be taken to prevent inadvertent grounding of system cabinets by any means other than the ground wire. Cabinets must be mounted on a support insulated from ground.

C.2.2 AC Ground

The suggested grounding method consists of two separately structured ground wires which are physically separated from each other but terminate at earth ground. The green ground wire from the AC power input must connect to the power panel and the ground straps of the equipment cabinets.

The primary electrostatic shield of the isolation transformer, if used, connects to the AC neutral wire (white) so that in the event of a transformer primary fault, fault current is returned directly to the AC source rather than through a common ground system. The AC neutral is connected to earth ground at the service entry.

Use of separate grounds prevents cross-coupling of power and signal currents as a result of any impedance that may be common to the separate systems. It is especially important in low-level systems that noise-producing and noise- sensitive circuits be isolated from each other; separating the grounding paths is one step.

Noise Grounding Plate. Where excessive high-frequency noise on the AC ground is a problem, a metal plate having an area of at least 10 square feet embedded in concrete and connected to the AC ground will assist in noise suppression. The connection to AC ground should be shorter than 5 feet, as direct as possible, and without splices. Local wiring codes will dictate the minimum wire size to be used.

Peripheral Equipment Grounds. All peripherals are supplied with a separate grounding wire or strap. All branch circuit receptacles must permit connection to this ground. This service ground must be connected through the branch circuit to a common grounding electrode by the shortest and most direct path possible. This is a safety ground connection, not a neutral.

Often, circuit common in test equipment is connected to power ground and chassis. In these cases, isolated AC power must be provided from a separate isolation transformer to avoid a ground loop.

C.2.3 DC Ground

DC grounds in the transmitter are connected to a ground bus, which in turn is routed to a common cabinet ground and then connected to an earth ground. The use of separate ground busses is a suggested method of isolation used to prevent cross-coupling of signals. These ground buses are then routed to the cabinet ground and to earth ground.

C.2.4 Earth Ground

The transmitter must be connected to earth ground. The connection must have an impedance of 5 ohms or less. For example, a one-inch metal rod driven 20 feet into moist earth will have a resistance of approximately 20 ohms, and a large ground counterpoise buried in moist earth will exhibit a resistance on the order of 1 to 5 ohms.

The resistance of an electrode to ground is a function of soil resistivity, soil chemistry and moisture content. Typical resistivities of unprepared soil can vary from approximately 500 ohms to 50 k ohms per square centimeter.

The resistance of the earth ground should be periodically measured to ensure that the resistance remains within installation requirements.

C.2.5 RF Ground

Electrical and electronic equipment must be effectively grounded, bonded, and shielded to achieve reliable equipment operation. The facility ground system forms a direct path of low impedance of approximately 10 ohms between earth and various power and communications equipment. This effectively minimizes voltage differentials on the ground plane to below levels which will produce noise or interference to communication circuits.

The basic earth electrode subsystem consist of driven ground rods uniformly spaced around the facility, interconnected with a minimum of 1/0 AWG bare copper cable. The cable and rods should be placed approximately 40 inches (1 meter) outside the roof drip line of the structure, and the cable buried at least 20 inches (0.5 meters). The ground rods should be copper-clad steel, a minimum of eight feet (2.5 meters) in length and spaced apart not more than twice the rod length. Brazing or welding should be used for permanent connections between these items.

Where a resistance of 10 ohms cannot be obtained with the above configuration, alternate methods must be considered.

Ideally, the best building ground plane is an equipotential ground system. Such a plane exists in a building with a concrete floor if a ground grid, connected to the facility ground system at multiple points, is embedded in the floor.

The plane may be either a solid sheet or wire mesh. A mesh will act electrically as a solid sheet as long as the mesh openings are less than 1/8 wavelength at the highest frequencies of concern. When it is not feasible to install a fine mesh, copper-clad steel meshes and wires are available. Each crossover point must be brazed to ensure good electrical continuity. Equipotential planes for existing facilities may be installed at or near the ceiling above the equipment.

Each individual piece of equipment must be bonded to its rack or cabinet, or have its case or chassis bonded to the nearest point of the equipotential plane. Racks and cabinets should also be grounded to the equipotential plane with a copper strap.

RF transmission line from the antenna must be grounded at the entry point to the building with copper wire or strap equivalent to at least no. 6 AWG. Wire braid or fine-stranded wire must not be used.

All building main metallic structural members such as columns, wall frames, roof trusses, and other metal structures must be made electrically continuous and grounded to the facility ground system at multiple points. Rebar, cross over points, and vertical runs should also be made electrically continuous and grounded.

Conduit and power cable shields that enter the building must be bonded at each end to the facility ground system at each termination.