

TECHNICAL MANUAL
888-2612-001

ZD24/32HD+
Controller System

ZD24/32HD+

HARRIS

T.M. No. 888-2612-001

© Copyright Harris Corporation 2008
All rights reserved

Technical Assistance

Technical and troubleshooting assistance, for HARRIS Transmission products, is available from HARRIS Field Service (factory location: Quincy, Illinois, USA) during normal business hours (8:00 AM - 5:00 PM Central Time). Telephone **+1-217-222-8200** to contact the Field Service Department. **Emergency service is available 24 hours a day, seven days a week, by telephone only.**

HARRIS Service may also be contacted via FAX at **+1-217-221-7086**.

E-mail support questions to tsupport@harris.com.

Other on-line assistance, including technical manuals, white papers, software downloads, and service bulletins, is available at <https://premier.harris.com/broadcast> (log-in required).

Address written correspondence to Field Service Department, HARRIS Broadcast Communications Division, P.O. Box 4290, Quincy, Illinois 62305-4290, USA.

For other global service contact information, please visit: <http://www.broadcast.harris.com/contact>.

Replaceable Parts Service

Replacement parts are available from HARRIS Service Parts Department from 7:00 AM to 11:00 PM Central Time, seven days a week. Telephone **+1-217-222-8200** or email servicepartsreq@harris.com to contact the Service Parts Department.

Emergency replacement parts are available by telephone only, 24 hours a day, seven days a week by calling +1-217-222-8200.

Unpacking

Carefully unpack the equipment and perform a visual inspection to determine if any apparent damage was incurred during shipment. Retain the shipping materials until it has been verified that all equipment has been received undamaged. Locate and retain all PACKING CHECK LISTS. Use the PACKING CHECK LIST to help locate and identify any components or assemblies which are removed for shipping and must be reinstalled. Also remove any shipping supports, straps, and packing materials prior to initial turn on.

Returns And Exchanges

No equipment can be returned unless written approval and a Return Authorization is received from HARRIS Broadcast Communications Division. Special shipping instructions and coding will be provided to assure proper handling. Complete details regarding circumstances and reasons for return are to be included in the request for return. Custom equipment or special order equipment is not returnable. In those instances where return or exchange of equipment is at the request of the customer, or convenience of the customer, a restocking fee will be charged. All returns will be sent freight prepaid and properly insured by the customer. When communicating with HARRIS Broadcast Communications Division, specify the HARRIS Order Number or Invoice Number.

Manual Revision History

ZD24/32HD+ Technical Manual

REV.	DATE	ECN	Pages Affected

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:

<u>Replaceable Parts List Index</u>	<u>Part Number</u>	<u>Page</u>	
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.

⚠ 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.

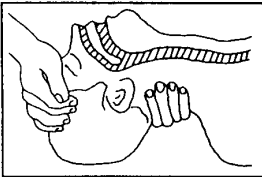
TREATMENT OF ELECTRICAL SHOCK

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

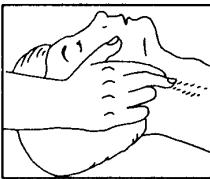
(A) AIRWAY

IF UNCONSCIOUS,
OPEN AIRWAY



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

CHECK
CAROTID PULSE



IF PULSE ABSENT,
BEGIN ARTIFICIAL
CIRCULATION

(B) BREATHING

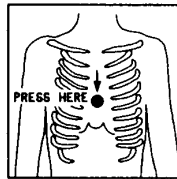
IF NOT BREATHING,
BEGIN ARTIFICIAL BREATHING



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

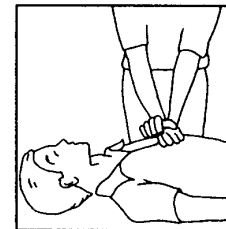
(C) CIRCULATION

DEPRESS STERNUM 1 1/2 TO 2 INCHES



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

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



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

CALL FOR MEDICAL ASSISTANCE AS SOON AS POSSIBLE.

2. IF VICTIM IS RESPONSIVE.

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

FIRST-AID

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

Table of Contents

Section 1 Operator Guide

Introduction	1-1
Installation Instruction	1-2
Returns And Exchanges	1-2
Unpacking	1-2
Installation	1-3
Transmitter Operation	1-4
RF Metering	1-6
Control Functions	1-7
Status Indicators	1-7
Remote Control	1-8
Switchless Combiner	1-8
Interlock Considerations	1-10
Drive Functions	1-10
HDx Exciter/BoostPro Control	1-11
Analog Exciter Control	1-11
Controller Alignments	1-13
Meter Calibration	1-14

Section II Parts List

Parts List	2-1
------------------	-----

Table of Contents

Section 1

Operator Guide

1

1.1 Introduction

This manual is to provide information regarding the ZD24/32HD+ Dual Transmitter System's operation. In addition to the System Controller, other System-specific functions are discussed. Any further *site*-specific functionality will be discussed in the site-specific data packages provided with the ZD24/32HD+ Transmitter System, including the individual Z12/16HD+ transmitter manuals.

Operation of the ZD24/32HD+ in any of several modes can be accomplished from the System Controller.

There are several methods of combining the analog (FM) and digital (HD) RF to create an IBOC signal, and there may be up to four possible modes of operation - also known as Modulation Format - that may be used in a typical IBOC system including a backup mode. The four modes of operation are:

FM - Analog RF only; this could be the analog backup mode in the event of a digital failure.

FM+HD - Analog & digital (at -20dB) RF, also known as Common Combining.

HD - Digital RF only, used for Separate Combining, such as 10dB combined, dual-feed and interleaved antenna, and dual antennas.

SLC - Analog & digital (at various ratios) RF, also known as Split-level or Mid-level Combining.

This manual will discuss these IBOC systems as well as Hybrid and Switchless type high-level RF summing of two dual transmitters.

Transmitter operation can be initiated or terminated as desired by depressing the ON HI, ON LOW, or OFF push-buttons. Both transmitters will be commanded into the selected mode when the corresponding System Controller switch is depressed.



The System Controller also provides the necessary RF metering, common external transmitter interlock and transmitter interface, and combined transmitter remote control functions. APC function is retained by the individual transmitter.

- ZD System Controller P/N 992-8850-005
 - System Control Board
 - Assembly # 992-8853-001
 - PWB # 843-5293-076
 - Schematic # 839-8118-181
 - Display Board
 - Assembly # 992-8388-005
 - PWB # 843-5215-004
 - Schematic # 839-8025-004
- Note: Parts list is in Section II.

1.2 Installation Instruction

1.2.1 Returns And Exchanges

Damaged or undamaged equipment should not be returned unless a Return Authorization is issued. When communicating with Harris Corporation, Broadcast Division, specify the order number or invoice number. Include complete details regarding circumstances and reasons for return in the request. Custom or special order equipment is not returnable. In instances where return or exchange of equipment is at the request or convenience of the customer, a restocking fee will be charged. Special shipping instructions and coding will be provided to insure proper handling. All returns will be sent freight prepaid and properly insured by the customer.

1.2.2 Unpacking

Carefully unpack the transmitter and save all packing material. Inspect thoroughly for any damage incurred in shipment. Retain all PACKING CHECK LISTS to help locate and identify any components or assemblies removed for shipping. Remove any shipping supports, and straps prior to initial turn on.

Before cabinet placement takes place, it is important to determine which cabinet is transmitter A (left side as viewed from the front) and transmitter B (right side). This can be determined by looking at the tags on the front of the transmitter or matching serial numbers of the cabinet to the provided test data. The serial numbers of the cabinets can



be found on the left side wall inside the module compartment. A typical system will have the System Controller in the left cabinet.

1.2.3 Installation

The cabinets may be mounted together using two Cabinet Brackets and hardware provided with the system. The Cabinet Brackets mount between the transmitters on top using the 3/8" hardware into threads found near the front and back of the two cabinets. 1/2" hardware is provided to bolt the two cabinets together near the bottom. These holes may be accessed inside the power supply compartments of both cabinets. The supply may need to be pushed forward a few inches in order to gain access to the back hole.

Several cables will be secured inside the cabinets that need routed to the other cabinet. A hole located in each cabinet is provided for cable routing between cabinets. If a hole cap is still in place, remove cap from both cabinets for interconnecting cables. Refer to the wiring diagrams in the System Drawing Package for wire destinations. Each wire will be marked with a wire or cable number located near the end of each wire. After routing, cables may be permanently attached to other existing cabling. Keep in mind some units are mounted on slides and cables are long enough to slide out with the unit for continuous operation.

The exciter interconnect consists of various cables. Not all of these cables are necessary in some applications. Depending on how many exciters and what type of IBOC system, some cables may not be needed. See drawings in the Z12/16HD+ manual or drawing package for further information.

The combiner and load can be placed usually where specified by the layout diagram in the System Schematic Package. Placement of Directional Coupler assemblies are also specified by the layout diagram. A provided coax cable should be connected between the System Controller and three couplers; the forward power, reflected power, and the reject load forward power.

The reject load (if provided) interlock cable should be connected. Connections for addition station interlocks may be provided depending on the configuration of the system. Refer to the System Drawing Package for further information.

AC connections for the transmitters are located near the top in the back left side of each cabinet. See the Z12/16HD+ manual for further information. One AC connection must be made for the ZD24/32HD+ controller(s). This TB7 terminal block is located inside the AC input compartment of transmitter cabinet A. This input should be on a separate AC feed in case one transmitter breaker is off, the controller(s) can operate the remaining operating transmitter at a reduced power level. Another AC feed must be connected to the exciter rack (if provided) or each piece of equipment if a rack is not provided. This AC feed should again be on a separate AC feed from the transmitter in case one transmitter breaker is off. Each Harris-made piece of equipment to be placed in



an existing rack can be operated at 120 or 240 VAC depending on the AC input card position.

Connect transmission line between the transmitters and the combiner per the layout supplied in the System Drawing Package. Any unequal change to the transmission line length from transmitter to combiner will have to be adjusted for in the drive circuit. Combiner input phasing is important for proper operation. Also connect transmission line to the reject load. Placement of the load and length of line to the load is not critical. Only transmission line for the typical layout is supplied with the system unless otherwise specified with the order.

1.3 Transmitter Operation

- a. Ensure all RF connections are tight, and that all control and AC service (mains) connections are correct and secure using the correct voltage and frequency settings.
- b. Set the REMOTE/DISABLE switches on both transmitters to the REMOTE position.
- c. Select the MANUAL mode on the Combiner Controller (if applicable) by depressing the manual push-button switch. Select the A+B AIR mode on the front of the Combiner Controller.
- d. Start transmitter A by depressing the ON HI pushbutton on the transmitter cabinet A. Operate transmitter at or near 100%. The System Controller FWD PWR should read near 25%. Press LOWER button until transmitter cabinet A FWD PWR is near 20%. Turn off transmitter cabinet A by depressing the OFF pushbutton.
- e. Start transmitter B by depressing the ON HI pushbutton on the transmitter cabinet B. Operate transmitter at or near 100%. The System Controller FWD PWR should again read near 25%. Press LOWER button until transmitter cabinet B FWD PWR is 20%. Turn off transmitter cabinet B by depressing the OFF pushbutton.
- f. Start combined transmitter operation by depressing the ON HI push-button switch on the System Controller. Both transmitters should begin operation and be producing RF power.
- g. The System Controller FWD PWR meter should be reading near 20%. Select the REJ PWR meter position on the System Controller and verify it's reading is near 0%. If this reading is more than 2-3%, this may be the result of either amplitude or phase mismatch between the combiner inputs. Adjust the power level 2-3% out of just one transmitter. If this minimizes the reject power to near zero, continue on to the next step. If power from each transmitter is back to the same and more



than 10% reject power exists, a phase mismatch may be adjusted by Phase Adjust on either the HDx exciter, or BoostPro amplifier. Usually, no adjustment of amplitude or phase will be necessary.

- h. Once reject power is down below 5%, raise power in both transmitters to 100% watching that reject power does not exceed 10%. If any reject power exists, repeat the above steps for adjustment of amplitude or phase of combiner inputs. Some fluctuation of power will be noticed due to this type of detection used for an IBOC signal and its peaks.
- i. Select the RFL PWR position on the transmitters and the System Controller and verify that they all read at or near 1.01 VSWR.
- j. Depress the LOW ON push-button switch on the System Controller and verify that both transmitter output levels drop to approximately 50% and that the System Controller also indicates 50% in the FWD PWR position.

The remaining portion of this section only applies to the switchless combiner configuration.

- k. Depress the HI ON push-button switch on the System Controller. Verify both transmitters start and that the FWD PWR meter readings on the transmitters and on the System Controller all read 100%. This is the A+B AIR mode.
- l. Select the A AIR mode of the Combiner Controller by depressing the A AIR mode switch. Verify the combiner motorized phasing unit operates and moves to the A AIR position. On the System Controller verify the FWD PWR now reads approximately 50%.
- m. Select the REJ PWR meter position and verify that the meter reading is at or near 100%.
- n. On the Combiner Controller select the B AIR position and verify the same meter readings as done in the A AIR mode.
- o. On the Combiner Controller select the A+B AIR mode. Verify that the motorized phasing unit in the Switchless Combiner moves to the A+B position. Verify the same meter reading as in the above A+B AIR mode of operation.

The AUTOMATIC mode of the Combiner Controller may now be selected for automatic recovery from a failure.

To turn the system off, depress the OFF push-button on the System Controller. Both transmitters should return to the OFF position. The Combiner Controller will automatically be returned to the Manual mode with a System Controller local or remote OFF command.

See Combiner Controller or Switchless Combiner technical manuals for further information.



1.3.1 RF Metering

Three metering functions are provided by the System Controller. They are: Forward output power in percent (FWD PWR); reflected power displayed as load VSWR (RFL PWR); and combiner reject load power in percent of normal (REJ PWR). Below are the approximate values of the normal average RF levels for a ZD24/32HD+ combined transmitter system calibrated at full output in the dual combined mode. See Table 1-1.

Table 1-1 System Controller Average Power Metering

	Indication		
	FWD PWR 100%	RFL PWR 1.00	REJ PWR 100%
ZD24HD+ w/Switchless Combiner		As Indicated	
FM Mode	15.6kW		7.8kW
HD Mode	5.2kW		2.6kW
FM+HD Mode	12.0kW		6.0kW
ZD24HD+ w/Hybrid Combiner		As Indicated	
FM Mode	15.6kW		3.9kW
HD Mode	5.2kW		1.3kW
FM+HD Mode	12.0kW		3.0kW
ZD32HD+ w/Switchless Combiner		As Indicated	
FM Mode	21kW		10.5kW
HD Mode	7.0kW		3.5kW
FM+HD Mode	16.0kW		8.0kW
ZD32HD+ w/Hybrid Combiner		As Indicated	
FM Mode	21kW		5.25kW
HD Mode	7.0kW		1.75kW
FM+HD Mode	16.0kW		4.0kW

⇒ NOTE:

For power outputs other than those listed above, the following information can be used for calculations: The REJ PWR reading of 100% will be half the total output power when the switchless combiner is used. A REJ PWR reading of 100% will be one-fourth the total output power when a 3 dB hybrid combiner is used.

The System Controller displays values of the selected function on a 3-1/2" digit panel meter. Three momentary push-button switches allow selection of the metering mode for the System Controller. A momentary depression of one of the three meter select switches will put the digital metering system into the desired mode. The meter will remain in that selected mode until another metering selection push-button switch is depressed. Following an AC power interruption the metering system will automatically restart in the FWD PWR mode, displaying the forward output power level, in percent of normal.



1.3.2 Control Functions

Three momentary push-button switches allow system ON and OFF control functions to be exercised from the front of the System Controller. These push-buttons are: OFF, ON HI, and ON LOW. Depressing one of these three push-button switches will simultaneously command both Z12/16HD+ transmitters into the selected ON mode or will return both transmitters to the OFF mode simultaneously.

Three LEDs indicate actual transmitter status, LOW, HI and OFF. The indicators are controlled by the transmitter status outputs in both transmitters.

NOTE:

In order for these System Controller commands to be accepted by the individual transmitter control units, the REMOTE/DISABLE switches on each individual transmitter MUST be in the REMOTE position (red LED off).

1.3.3 Status Indicators

The System Controller incorporates four LED status indicators to provide important information about the operation conditions of the combined transmitter system. These indicators are RF POWER, SWR, EXT INTERLOCK, and REJ LOAD.

The RF POWER indicator illuminates red if the system is in operation and the forward output power level at combiner output drops below a preset level, usually 90%. The indicator will extinguish if the level rises above the preset level or the system is turned off.

The SWR FAULT LED indicator will illuminate if the reflected RF power level at the combiner output rises above a preset level, 1.3:1. If this level has been exceeded, the LED will illuminate. The System Controller takes no action but the transmitters themselves will either foldback or turn off depending on the level of VSWR. The indicator will extinguish with the next System Controller ON command.

The EXT INTLK LED indicator will illuminate if the connection between J1-6 and J1-25 is broken. System operation will automatically be terminated and returned to the OFF state. Once the connection between J1-6 and J1-25 is restored, an ON command is required to restore operation.

The REJ LOAD LED indicator is actually two indicators in one. One half of the indicator is an amber LED, the other is a red LED. If the RF power delivered to the combiner reject load exceeds a preset warning level, usually 90%, the amber portion of the LED will illuminate. It will remain illuminated until the RF level drops below the preset level. If the RF power delivered to the reject load exceeds the safe operation level for the load, the System Controller will terminate transmitter operation and the red



portion of the REJ LOAD will be illuminated. It will remain illuminated until the next ON command is exercised.

1.3.4 Remote Control

The REMOTE/LOCAL push-button switch on the front panel of the System Controller allows the operator to determine if the unit will accept remote system level ON or OFF commands. In the LOCAL mode (red LED illuminated) only the front panel switches on the System Controller may be used to turn the system on or off.

Remote system level command, status and metering functions are available at J1 and J11 on the System Controller. System commands are active when the REMOTE/LOCAL switch on the front of the System Controller is in the REMOTE position. Status and metering information is always available at J1 and J11 regardless of the position of the REMOTE/LOCAL switch.

Table 1-8, System Controller Remote Connections, gives details of the commands, status and metering functions available at J1 and J11 on the rear of the system controller. It is recommended that J1 be used only for fail-safe/interlock and J11 be connected to a remote control (if used) for remote metering and remote commands.

1.4 Switchless Combiner

When the ZD24/32HD+ is summed using a switchless combiner, a “Combiner Controller” has control of the operation of the combiner unit. Four modes of operation are provided.

In the A+B mode, the RF outputs of the Z12/16HD+ transmitters are combined and the summed output appears at the antenna port of the combiner. Any large differences in amplitude or phase between the two transmitter outputs will cause some of the RF power to appear at the reject load.

In the A AIR mode, the RF output of transmitter A will be directed to the antenna port of the combiner while the entire RF output of transmitter B will be dissipated in the reject load. In the B AIR mode, the opposite will take place, the output of transmitter B will be applied to the antenna while the output of transmitter A will be directed to the reject load.

The A+B TEST mode, which is enabled with the addition of an optional RF coaxial switch, will allow the summed RF output of the two transmitters to be applied to an optional station load.



 **NOTE:**

When operating the Combiner Controller in the AUTOMATIC mode, the MANUAL mode of operation should be selected on the Combiner Controller before any portion of the transmitter system is turned off. If the Combiner Controller is left in the AUTOMATIC mode and a portion of the system is turned off, a switch alarm will be initiated by the Combiner Controller and a switch to the ON transmitter will be initiated by the Combiner Controller.

Switching between the three standard modes of operation can be done manually at any time, with the transmitters in operation, or with them turned off. Note, however, that in transferring from the A AIR mode to the B AIR mode, the combiner unit will pass through the A+B AIR position. At that time, the full combined output of the transmitters will be present at the antenna port of the combiner.

Automatic mode switching in the event of transmitter failure is also provided by the Combiner Controller. When operating in the A+B AIR mode, the AUTOMATIC mode of operation may be selected. In this mode, a reduction in RF output below a preset threshold (factory set at 50%) will result in the Combiner Controller automatically switching to a single transmitter mode. This will put the operational unit into the antenna and route the failed unit into the reject load. At the end of the switching sequence the failed unit will be turned off and the Combiner Controller will switch to the Manual Mode.

A forward power sample is taken from each transmitter remote sample port to operate the Combiner Controller automatic switching and front panel sense LEDs. A set of samples are also taken from directional couplers on the combiner outputs to display power levels on the System Controller. These samples, in some cases, are attenuated to assist with linearity. A diode detector at the coupler is used to present a DC input to the System Controller.

Matching of the transmitter RF output levels can be done using the RAISE and LOWER controls on each of the Z12/16HD+ transmitter controllers. Matching these power levels can help minimize RF power delivered to the reject load.

Since the phase of each transmitter's output also affects reject load power, a Phase Adjust is provided within the BoostPro amplifier. Adjust accordingly for the lowest possible reject load power. If, due to a significant line length difference, the Phase Adjust in the either the BoostPro, or HDx exciter cannot compensate for phase differences, one or more BNC elbow adapters may be added or removed from one transmitter's drive input at the transmitter A I/O panel. Some experimentation may be required to minimize reject power, if necessary. This should not be necessary unless, somehow, drive wires were switched or damaged.



1.4.1 Interlock Considerations

In a hybrid combiner system, if the reject load presents an open interlock, both transmitters will be interlocked off in all modes of operation. In the switchless combiner system, if the reject load presents an open interlock, the A+B mode will interlock both transmitters off. When in the single mode however, the on air transmitter will be operational and only the standby transmitter will be interlocked off. This routing is accomplished in the switchless combiner controller panel located on the front of the switchless combiner.

1.4.2 Drive Functions

⇒ NOTE:

Due to the different hardware configurations, there are many possibilities of RF signal origination within the transmitter. The RF chain may begin with either an HDx-FM exciter, or a BoostPro amplifier output. Or, in FM backup mode it may begin with any one of several Harris FM exciters. To simplify terminology this RF origination will be called RF Source by the controller, and throughout this manual. However, there may be times when text discussing certain circuitry may still use the original term exciter. Also, there may be certain pieces of hardware that still contain the word exciter in the part description, on its silkscreen labeling, or as part of the schematic representation.

RF Source muting and main/alternate functions are controlled by transmitter A of the ZD24/32HD+. This is the cabinet where the System Controller is located.

RF Source Main/Alternate control can be accessed through the transmitter A controller LCD display screen. From HOME, press STATUS/MORE/EXCITER/SWITCH. Observe status ON indicators for RF Source 1 or RF Source 2.

For RF Source main/alternate operation, all RF Sources' AC should be on at all times regardless if either TX is shut down. This is accomplished by a separate AC feed for transmitter and RF Source(s). Transmitter A also contains a separate AC input for the System Controller and Combiner Controller.

When either transmitter is turned on, the power supply starts to ramp up and as soon as it is at full voltage, the mute line is pulled low by an open collector output and un-mutes the on air exciter. This mute line is routed through the K1 located on the relay panel inside transmitter cabinet A to the on-air RF Source. The control for K1 comes from the Auxiliary Set and Reset lines on the transmitter A Life Support Board J4. K1 is a latching relay. Even if the power for the transmitter A is turned off, the on-air RF Source will continue to operate from the transmitter B un-mute line routed through the latched relay.



If during operation, the on-air RF Source fails, a ten second window exists to allow the RF Source to retry and come back on line by itself. If after 10 seconds power still does not exist, a command from transmitter A Life Support Board energizes K1, rerouting the RF Source muting signals.

In certain configurations, an HDx Exciter's AUX output is used to drive a BoostPro boost amplifier in the other TX cabinet. Phase of this drive will be shifted within the BoostPro and there is Phase adjustments in both the HDx and the BoostPro. If there is a phase delay beyond what these two adjustments can compensate for, some line length adjustment may be necessary for proper transmitter output phasing. W900 and W901 length can be changed or BNC elbow adapters can be removed or added inline. See Z12/16HD+ manual for more information.

⇒ NOTE:

Care should be taken never to replace these cables with an unknown cable, possibly causing full combined transmitter power output to go to a combiner reject load only designed to carry half or quarter total power.

1.4.3 HDx Exciter/BoostPro Control

The Forward Power sample is routed directly through TB8 & TB9. Transmitter A will use these samples and determine if there is an RF Source failure. The sample is not available on transmitter B therefore the reading on the front LED display of transmitter B should not be used.

K1 latching relay is used for routing Mute and Active signals to the proper RF Source. The control for K1 comes from the Life Support Board J4 in transmitter A. Using the display inputs, input signals, and internal logic; transmitter A controller determines which RF Source should be active. The Active signal is a low (ground) when RF Source bank 2 is selected.

The Mute signal out of the transmitter controllers is an open collector type output. Two Mute outputs, one typically for each RF Source, are combined with the transmitter B Mute output and routed through the K1 relay contacts. Either transmitter may then 'unmute' whichever RF Source bank is active as determined by the latched position of K1.

1.4.4 Analog Exciter Control

The Analog Exciter control is also routed through the relay panel TB8 & TB9 located in the upper right rear of transmitter A just below the remote control terminal block TB1. Some capabilities may or may not be present depending on configuration type.

The Forward Power sample is routed directly through TB8 & TB9 for transmitter A controller. Transmitter A will use these samples and determine if there is an exciter



failure. The samples are also available on transmitter B through CR11 and CR12 as a reading on the front LED display.

The Analog Exciter Fault inputs are grounded at J18 and J19. The fault indicators from the Analog Exciters are not needed for proper operation of a dual transmitter system. A fault indicator will be illuminated on the exciter itself should a fault exist.

The same mute circuit is used for all RF Sources. The Analog Exciter mute is routed through CR8 and CR10 from the K1 contacts.

The Mute signal out of the transmitter controllers is an open collector type output. Two Mute outputs, one typically for each exciter, are combined with the transmitter B Mute output and routed through K1 relay contacts. Either transmitter may then 'un-mute' whichever exciter bank is active as determined by the latched position of K1.

Table 1-2 Analog Exciter Muting-Related Jumper Settings

	DIGIT CD: (if used)
JP1 2-3	Mute Sense, Active high
JP2 2-3	Control, Internal
JP3 2-3	Fault Sense status, Active high
JP4 1-2	N+1 Mute, Disabled
JP5 2-3	Mute-Pull, Pull up
JP6 1-2	Crowbar, 70 Watt
B TRANSMITTER CONTROLLER:	
Life Support Board	
JP1 1-2	High = Mute (Only required if DIGIT exciter is used)
JP2 1-2	High = Mute (Only required if DIGIT exciter is used)
JP7 1-2	For Single RF Source. Dual RF Source = 2-3
Backplane (Only required if DIGIT exciter is used)	
JP2 2-3	Exciter Normal Mute
JP3 2-3	Exciter Normal Mute
Note: Jumpers, other than those required for Dual transmitter listed above, may need to be set. See Z12/16HD+ transmitter manual and schematics for more detail	



1.5 Controller Alignments

⇒ NOTE:

All adjustments required have been made at the factory using calibrated test loads and power meters to verify operating power levels. The following alignments are to be performed only in the event of a field replacement involving any of these components.

Three RF to DC sample transducers in conjunction with RF directional couplers are used to monitor the RF power levels in the system. The DC samples are routed through coaxial cables to the input jacks on the back of the System Controller.

The linearizer test point voltages are initially set using Tables 1-3, 1-4, 1-5 or 1-6 as determined by the type of system with adjustments made using the corresponding sample calibration pot (R37, R45 or R78) on the Controller board. Variation of these voltages will exist depending on desired high power output and linearity of circuit. *Choose the configuration that is your primary modulation mode.*

Table 1-3 HD Mode Configuration ZD24HD+

TEST POINT	TARGET VOLTAGE	SET UP CONDITION	SAMPLE CAL
TP2	0.200 Volts	5.2kW of system forward power	R37
TP3	0.056 Volts	200 Watts of simulated reflected power	R45
TP4	0.200 Volts	100% of reject power; either 1.3kW or 2.6kW	R78

Table 1-4 FM+HD Mode Configuration ZD24HD+

TEST POINT	TARGET VOLTAGE	SET UP CONDITION	SAMPLE CAL
TP2	0.200 Volts	10kW of system forward power	R37
TP3	0.056 Volts	400 Watts of simulated reflected power	R45
TP4	0.200 Volts	100% of reject power; either 2.5kW or 5kW	R78



Table 1-5 HD Mode Configuration ZD32HD+

TEST POINT	TARGET VOLTAGE	SET UP CONDITION	SAMPLE CAL
TP2	0.275 Volts	7.5kW of system forward power	R37
TP3	0.075 Volts	280 Watts of simulated reflected power	R45
TP4	0.275 Volts	100% of reject power; either 1.75kW or 3.5kW	R78

Table 1-6 FM+HD Mode Configuration ZD32HD+

TEST POINT	TARGET VOLTAGE	SET UP CONDITION	SAMPLE CAL
TP2	0.275 Volts	14kW of system forward power	R37
TP3	0.075 Volts	560 Watts of simulated reflected power	R45
TP4	0.275 Volts	100% of reject power; either 3.5kW or 7kW	R78

1.5.1 Meter Calibration

To set the forward power metering calibration, set the transmitters as follows (see Table 1-7 on page 1-15):

1. Set transmitter system to operate at 100% of normal operating power (not necessarily full power capability).
2. Adjust R88, FWD PWR CAL, for 100% forward power reading on the front panel. Some fluctuation of power will be noticed due to this type of detection used for an IBOC signal and its peaks.
3. Set transmitter power to zero and adjust R90, FWD PWR METER ZERO, for a reading of 0%.
4. Repeat previous steps as needed.



Table 1-7 System Controller RF Metering Inputs

JACK	PURPOSE	LINEARIZER TEST POINT	SAMPLE CAL	METER CAL	METER ZERO
J6	System Forward Power	TP2	R37	R88	R90
J7	System Reflected Power	TP3	R45	N/A	R132
J8	System Reject Load Power	TP4	R78	R80	R70

To set the reject power metering calibration, set the transmitters as follows:

1. For the 3dB hybrid configuration; turn one transmitter to full power and the other to 0 kW to force one-fourth full power into the reject load.
2. For the switchless combiner configuration; configure combiner to direct full power from one transmitter into the reject load.
3. Adjust R80, REJ PWR CAL, for a 100% reject power reading.
4. Turn the transmitter power output to zero and adjust R70, REJ PWR METER ZERO, for a reading of 0%. Repeat as needed until both conditions are met.

To set the *reflected* power meter calibration and overload:

1. Adjust each transmitter to operate at a forward power of half the stated reflected power in Tables 1-3, 1-4, 1-5, or 1-6 so that the system combined power is the stated reflected power from the appropriate table. If total power output (100% forward power) is different than stated in table, set transmitter for 0.04 times total power out. Adjust target voltage proportionally.
2. Reverse the reflected power coupler by loosening it from the transmission line and reattaching it to the line in its reverse position. This must be done without disassembling the coupler itself.
3. Use R45, RFL PWR SAMPL CAL, to set test point TP3 voltage to the target voltage in Tables 1-3, 1-4, 1-5 or 1-6. Return the coupler to its original position.
4. Adjust R132, VSWR ZERO, to read 1.01 reflected power on the front panel while the system is operating at full power and operating with no reflected power.



5. Verify the VSWR metering circuit by operating system at full power and forcing TP3 to read the target voltage from the tables with an external voltage source connected to J7.
6. Verify that the VSWR reading is 1.50:1.
7. Set the system controller VSWR trip threshold with R158, SWR TRIP SET, to trip at a VSWR of 1.30:1.

To set other overloads and set points:

- Turn the system power output power to 90% and adjust R197, LO RF TRIP SET, until the low power LED just turns on. Raise and lower the power above and below 90% and verify the LED comes on at the 90% point, adjust as needed.
- Using an external voltage source connected to J8; force the reject power meter to read 90% and set R161, REJ PWR WARNING SET, until the reject warning LED comes on.
- Set the reject power meter to read 116% with an external voltage source and adjust R169, REJ PWR TRIP SET, until transmitters receive an OFF command.



Table 1-8 System Controller Remote Connections

Terminal Remote	Terminal Serial	Function	Remarks
J1-1	J11-1	TX ON LOW COMMAND	Momentary connection to ground sets the system to LOW POWER ON mode. Maximum open circuit voltage is approximately 15VDC
J1-2	J11-14	TX ON HIGH COMMAND	Momentary connection to ground sets the system to HIGH POWER ON mode. Maximum open circuit voltage is approximately 15 VDC.
J1-3	J11-2	TX OFF COMMAND	Momentary connection to ground sets the system to OFF mode. Maximum open circuit voltage is approximately 15 VDC.
J1-4	J11-15	SPARE COMMAND	Not used.
J1-5	N/A	MASTER FAIL-SAFE	Switchless combiner: Connection to +15 VDC source at J1-25 through a normally closed contact set, in customer equipment, allows transmitter operation. If not used, a jumper must be installed between this terminal and J1-25. Hybrid combiner: Not available for use. This input is used for the combiner reject load in tis configuration.
J1-6	N/A	MASTER INTERLOCK	Connection to +15 VDC source at J1-25 through a normally closed contact set, in customer equipment, allows transmitter operation. If not used, a jumper must be installed between this terminal and J1-25.
J1-7	J11-4	R/C STATUS	Provides a connection to ground through 200 Ohms when the REMOTE mode has been selected.
J1-8	J11-17	FWD PWR SAMPLE	Provides 0-4 VDC sample through 2k Ohms of the RF forward output power.
J1-9	J11-5	RFL PWR SAMPLE	Provides 0-4 VDC sample through 2k Ohms of the RF reflected output power.
J1-10	J11-18	REJ PWR SAMPLE	Provides 0-4 VDC sample through 2k Ohms of the RF reject load power.
J1-11	J11-6	IPA A PWR SAMPLE	Not used.
J1-12	J11-19	IPA B PWR SAMPLE	Not used.



Table 1-8 System Controller Remote Connections

J1-13	J11-7	SWR FAULT STATUS	Provides ground connection through 200 Ohms when the reflected output RF power level has exceeded the safe operating level, and the system controller has terminated transmitter operation. Can sink 25mA to ground and is suitable for use with circuits up to 15 VDC.
J1-14	J11-20	LOW RF STATUS	Provides ground connection through 200 Ohms when the forward RF output power level drops below a preset level.
J1-15	J11-8	REJ PWR WARNING	Provides ground connection through 200 Ohms when the forward RF output power to the combiner reject load exceeds a preset level.
J1-16	J11-21	REJ PWR FAULT	Provides ground connection through 200 Ohms when the forward RF output power to the combiner reject load exceeds the safe operating level and the system controller has terminated transmitter operation.
J1-17	J11-9	TX ON STATUS	Provides ground connection through 200 Ohms when either transmitter is in the ON mode.
J1-18	J11-22	TX LOW POWER STATUS	Provides ground connection through 200 Ohms when either transmitter is in LOW POWER ON mode. Can sink 25mA to ground and is suitable for use with circuits up to 15 VDC.
J1-19	J11-10	N/C	
J1-20	J11-23	N/C	
J1-21	J11-11	N/C	
J1-22	J11-24	N/C	
J1-23	J11-12	GROUND	Provides connection to circuit ground.
J1-24	J11-25	GROUND	Provides connection to circuit ground.
J1-25		+15 VDC	Provides connection to a current limited +15 VDC used for external interlock and fail-safe signaling.



Section II

Parts List

2

2.1 Parts List

Table 2-1	XMTR, ZD24/32HD+HYB, FORMAT - 994 9712 003 (A) - 2-2
Table 2-2	XMTR, ZD24/32HD+SWL, FORMAT - 994 9712 004 (B) - 2-2
Table 2-3	FLEXSTAR BOOST AMP - 971 0027 006 (H) - - - - - 2-5
Table 2-4	PWA, BOOST AMP CONTROLLER - 901 0207 211 (J) - 2-6
Table 2-5	PWA, BOOST DISPLAY INTERFACE - 901 0207 221 (B) 2-7
Table 2-6	CONTROLLER, SYSTEM - 992 8850 005 (F)- - - - - 2-7
Table 2-7	DISPLAY BD, DUAL TX CNTRL - 992 8388 005 (E) - - 2-7
Table 2-8	PWA, SYSTEM CONTROLLER - 992 8853 001 (M)- - - 2-9
Table 2-9	CTLR, XMTR COMB - NICKEL GRAY - 994 9381 006 (D1) 2-11

Section II Parts List

Table 2-1 XMTR, ZD24/32HD+HYB, FORMAT - 994 9712 003 (A)

Harris PN	Description	Qty UM	Reference Designators
2520003000A	*WIRE, MIL, 20AWG 1000V WHITE	0.3 FT	#J2,#J3
354 0384 000	CONTACT, PIN	4 EA	J2,J3
358 2635 000	CABLE TIE, PUSH MOUNT SNAP IN	7 EA	
358 3197 000	SLIDES 10" PAIR	1 PR	
384 0357 000	DIODE, RECT 1N4004	2 EA	
408 0212 000	BACKSHELL, D-SUB 15C NO-SHIELD	2 EA	#J2,#J3
606 0866 000	BREAKER, CIRCUIT 10A	1 EA	A1CB2
610 0538 000	PLUG, DSUB 15PIN CRIMP-POKE	2 EA	J2,J3
614 0048 000	TERM BLK, 2ROW 4-TERM 20A	1 EA	A1TB7
620 0498 000	ADAPTOR 3-1/8	6 EA	
620 0544 000	CONN, ANCHOR INS 3-1/8; 50 OHM	2 EA	
620 0581 000	COUPLING, SLEEVE, 3-1/8	11 EA	
620 0675 000	COUPLER, PI/2 HYBRID	1 EA	
620 2275 000	ELBOW, EQUAL, 3-1/8, 90 DEG	10 EA	
646 0972 000	*LABEL 117V	0 EA	#A1TB7
646 0973 000	*LABEL, 230V	0 EA	#A1TB7
700 1414 000	LOAD, 8898-315, 115VAC	0 EA	
700 1415 000	LOAD, 5KW 230VAC 3-1/8	0 EA	
822 1346 014	XMTR LAYOUT, ZD24/32HD+, HYBRID, W/FLEXSTAR0 DWG		
822 1346 073	XMTR LAYOUT, ZD-HYB 1PH	0 DWG	
901 0207 271	PWA, CAN ADAPTER	2 EA	
917 2332 280	SPACER SYS CTLR MOUNTING	8 EA	
917 2332 741	CABLE PKG, RF & CTLR	1 EA	W4,W5,W28,W30,W31,W32
917 2332 879	CABLE PKG, COAX, ZDHD+	1 EA	W147,W902,W903,W901A,W901B
917 2435 098	STRAP, SHIPPING	2 EA	
922 1203 406	SHIELD 4POS TERM BLK,	1 EA	#A1TB7
922 1260 239	CABLE, RIBBON W211B	0 EA	
922 1260 240	CABLE, RIBBON W212B	0 EA	
927 8096 010	ASSY, DIR COUPLER	1 EA	
927 8096 012	ASSY, DIR COUPLER	1 EA	
928 5652 003	ASSY, DETECTOR	3 EA	
939 8013 022	TUBING COAX	1 EA	
939 8013 120	TUBE, COAX 3.125 X 34.25 LG	1 EA	
939 8013 254	TUBE, COAX 3.125 X 67.75 LG	1 EA	
939 8014 022	TUBE, COAX 1.315 X 8.22LG	1 EA	
939 8014 120	TUBE, COAX 1.315 X 32.72 LG	1 EA	
939 8014 254	TUBE, COAX 1.315 X 66.22 LG	1 EA	
971 0027 006	FLEXSTAR BOOST AMP	1 EA	
988 2514 003	DWG PKG, ZD24/32HD+, HYBRID	1 EA	
988 2515 001	DP, SYSTEM ZDHD	1 EA	
992 8850 005	CONTROLLER, SYSTEM	1 EA	
992 9854 012	KIT, PLAT Z MOUNTING, HDX-FM	1 EA	
995 0034 012	! XMTR, Z12HD+, FORMAT	0 EA	
995 0034 016	! XMTR, Z16HD+, FORMAT	0 EA	

Table 2-2 XMTR, ZD24/32HD+SWL, FORMAT - 994 9712 004 (B)

Harris PN	Description	Qty UM	Reference Designators
354 0384 000	CONTACT, PIN	3 EA	J1
358 2635 000	CABLE TIE, PUSH MOUNT SNAP IN	11 EA	
358 3197 000	SLIDES 10" PAIR	1 PR	
384 0357 000	DIODE, RECT 1N4004	6 EA	

408 0216 000	BACKSHELL, D-SUB 25C NO-SHIELD	1 EA	#J1
606 0866 000	BREAKER, CIRCUIT 10A	1 EA	A1CB2
610 0539 000	PLUG, DSUB 25PIN CRIMP-POKE	1 EA	J1
614 0048 000	TERM BLK, 2ROW 4-TERM 20A	1 EA	A1TB7
620 0498 000	ADAPTOR 3-1/8	6 EA	
620 0544 000	CONN, ANCHOR INS 3-1/8; 50 OHM	2 EA	
620 0581 000	COUPLING, SLEEVE, 3-1/8	13 EA	
620 2275 000	ELBOW, EQUAL, 3-1/8, 90 DEG	7 EA	
620 2699 000	COMBINER, FM 22KW CH-XXX	0 EA	
620 2699 201	COMBINER, 88.1MHZ 22KW FM	0 EA	
620 2699 202	COMBINER, 88.3MHZ 22KW FM	0 EA	
620 2699 203	COMBINER, 88.5MHZ 22KW FM	0 EA	
620 2699 204	COMBINER, 88.7MHZ 22KW FM	0 EA	
620 2699 205	COMBINER, 88.9MHZ 22KW FM	0 EA	
620 2699 206	COMBINER, 89.1MHZ 22KW FM	0 EA	
620 2699 207	COMBINER, 89.3MHZ 22KW FM	0 EA	
620 2699 208	COMBINER, 89.5MHZ 22KW FM	0 EA	
620 2699 209	COMBINER, 89.7MHZ 22KW FM	0 EA	
620 2699 210	COMBINER, 89.9MHZ 22KW FM	0 EA	
620 2699 211	COMBINER, 90.1MHZ 22KW FM	0 EA	
620 2699 212	COMBINER, 90.3MHZ 22KW FM	0 EA	
620 2699 213	COMBINER, 90.5MHZ 22KW FM	0 EA	
620 2699 214	COMBINER, 90.7MHZ 22KW FM	0 EA	
620 2699 215	COMBINER, 90.9MHZ 22KW FM	0 EA	
620 2699 216	COMBINER, 91.1MHZ 22KW FM	0 EA	
620 2699 217	COMBINER, 91.3MHZ 22KW FM	0 EA	
620 2699 218	COMBINER, 91.5MHZ 22KW FM	0 EA	
620 2699 219	COMBINER, 91.7MHZ 22KW FM	0 EA	
620 2699 220	COMBINER, 91.9MHZ 22KW FM	0 EA	
620 2699 221	COMBINER, 92.1MHZ 22KW FM	0 EA	
620 2699 222	COMBINER, 92.3MHZ 22KW FM	0 EA	
620 2699 223	COMBINER, 92.5MHZ 22KW FM	0 EA	
620 2699 224	COMBINER, 92.7MHZ 22KW FM	0 EA	
620 2699 225	COMBINER, 92.9MHZ 22KW FM	0 EA	
620 2699 226	COMBINER, 93.1MHZ 22KW FM	0 EA	
620 2699 227	COMBINER, 93.3MHZ 22KW FM	0 EA	
620 2699 228	COMBINER, 93.5MHZ 22KW FM	0 EA	
620 2699 229	COMBINER, 93.7MHZ 22KW FM	0 EA	
620 2699 230	COMBINER, 93.9MHZ 22KW FM	0 EA	
620 2699 231	COMBINER, 94.1MHZ 22KW FM	0 EA	
620 2699 232	COMBINER, 94.3MHZ 22KW FM	0 EA	
620 2699 233	COMBINER, 94.5MHZ 22KW FM	0 EA	
620 2699 234	COMBINER, 94.7MHZ 22KW FM	0 EA	
620 2699 235	COMBINER, 94.9MHZ 22KW FM	0 EA	
620 2699 236	COMBINER, 95.1MHZ 22KW FM	0 EA	
620 2699 237	COMBINER, 95.3MHZ 22KW FM	0 EA	
620 2699 238	COMBINER, 95.5MHZ 22KW FM	0 EA	
620 2699 239	COMBINER, 95.7MHZ 22KW FM	0 EA	
620 2699 240	COMBINER, 95.9MHZ 22KW FM	0 EA	
620 2699 241	COMBINER, 96.1MHZ 22KW FM	0 EA	
620 2699 242	COMBINER, 96.3MHZ 22KW FM	0 EA	
620 2699 243	COMBINER, 96.5MHZ 22KW FM	0 EA	
620 2699 244	COMBINER, 96.7MHZ 22KW FM	0 EA	
620 2699 245	COMBINER, 96.9MHZ 22KW FM	0 EA	

Section II Parts List

620 2699 246	COMBINER, 97.1MHZ 22KW FM	0 EA
620 2699 247	COMBINER, 97.3MHZ 22KW FM	0 EA
620 2699 248	COMBINER, 97.5MHZ 22KW FM	0 EA
620 2699 249	COMBINER, 97.7MHZ 22KW FM	0 EA
620 2699 250	COMBINER, 97.9MHZ 22KW FM	0 EA
620 2699 251	COMBINER, 98.1MHZ 22KW FM	0 EA
620 2699 252	COMBINER, 98.3MHZ 22KW FM	0 EA
620 2699 253	COMBINER, 98.5MHZ 22KW FM	0 EA
620 2699 254	COMBINER, 98.7MHZ 22KW FM	0 EA
620 2699 255	COMBINER, 98.9MHZ 22KW FM	0 EA
620 2699 256	COMBINER, 99.1MHZ 22KW FM	0 EA
620 2699 257	COMBINER, 99.3MHZ 22KW FM	0 EA
620 2699 258	COMBINER, 99.5MHZ 22KW FM	0 EA
620 2699 259	COMBINER, 99.7MHZ 22KW FM	0 EA
620 2699 260	COMBINER, 99.9MHZ 22KW FM	0 EA
620 2699 261	COMBINER, 100.1MHZ 22KW FM	0 EA
620 2699 262	COMBINER, 100.3MHZ 22KW FM	0 EA
620 2699 263	COMBINER, 100.5MHZ 22KW FM	0 EA
620 2699 264	COMBINER, 100.7MHZ 22KW FM	0 EA
620 2699 265	COMBINER, 100.9MHZ 22KW FM	0 EA
620 2699 266	COMBINER, 101.1MHZ 22KW FM	0 EA
620 2699 267	COMBINER, 101.3MHZ 22KW FM	0 EA
620 2699 268	COMBINER, 101.5MHZ 22KW FM	0 EA
620 2699 269	COMBINER, 101.7MHZ 22KW FM	0 EA
620 2699 270	COMBINER, 101.9MHZ 22KW FM	0 EA
620 2699 271	COMBINER, 102.1MHZ 22KW FM	0 EA
620 2699 272	COMBINER, 102.3MHZ 22KW FM	0 EA
620 2699 273	COMBINER, 102.5MHZ 22KW FM	0 EA
620 2699 274	COMBINER, 102.7MHZ 22KW FM	0 EA
620 2699 275	COMBINER, 102.9MHZ 22KW FM	0 EA
620 2699 276	COMBINER, 103.1MHZ 22KW FM	0 EA
620 2699 277	COMBINER, 103.3MHZ 22KW FM	0 EA
620 2699 278	COMBINER, 103.5MHZ 22KW FM	0 EA
620 2699 279	COMBINER, 103.7MHZ 22KW FM	0 EA
620 2699 280	COMBINER, 103.9MHZ 22KW FM	0 EA
620 2699 281	COMBINER, 104.1MHZ 22KW FM	0 EA
620 2699 282	COMBINER, 104.3MHZ 22KW FM	0 EA
620 2699 283	COMBINER, 104.5MHZ 22KW FM	0 EA
620 2699 284	COMBINER, 104.7MHZ 22KW FM	0 EA
620 2699 285	COMBINER, 104.9MHZ 22KW FM	0 EA
620 2699 286	COMBINER, 105.1MHZ 22KW FM	0 EA
620 2699 287	COMBINER, 105.3MHZ 22KW FM	0 EA
620 2699 288	COMBINER, 105.5MHZ 22KW FM	0 EA
620 2699 289	COMBINER, 105.7MHZ 22KW FM	0 EA
620 2699 290	COMBINER, 105.9MHZ 22KW FM	0 EA
620 2699 291	COMBINER, 106.1MHZ 22KW FM	0 EA
620 2699 292	COMBINER, 106.3MHZ 22KW FM	0 EA
620 2699 293	COMBINER, 106.5MHZ 22KW FM	0 EA
620 2699 294	COMBINER, 106.7MHZ 22KW FM	0 EA
620 2699 295	COMBINER, 106.9MHZ 22KW FM	0 EA
620 2699 296	COMBINER, 107.1MHZ 22KW FM	0 EA
620 2699 297	COMBINER, 107.3MHZ 22KW FM	0 EA
620 2699 298	COMBINER, 107.5MHZ 22KW FM	0 EA
620 2699 299	COMBINER, 107.7MHZ 22KW FM	0 EA

620 2699 300	COMBINER, 107.9MHZ 22KW FM	0 EA	
646 0972 000	*LABEL 117V	0 EA	#A1TB7
646 0973 000	*LABEL, 230V	0 EA	#A1TB7
700 0542 000	RES, LOAD 50 OHM 10KW	0 EA	
700 1408 000	LOAD, 10KW 230VAC 50 OHM	0 EA	
843 5215 593	XMTR LAYOUT, ZD24/32HD+, SWL	0 DWG	
901 0207 271	PWA, CAN ADAPTER	2 EA	
917 2332 280	SPACER SYS CTLR MOUNTING	8 EA	
917 2332 859	CABLE PKG, RF & CTLR	1 EA	JUMPERS,W4,W5,W6,W7,W8,W12,W15 ,W16,W30,W31,W32
917 2332 878	CABLE PKG, EXTENDER CABLES SYS CTRL0	EA	
917 2332 879	CABLE PKG, COAX, ZDHD+	1 EA	W147,W902,W903,W901A,W901B
917 2435 098	STRAP, SHIPPING	2 EA	
922 1203 406	SHIELD 4POS TERM BLK,	1 EA	#A1TB7
922 1260 239	CABLE, RIBBON W211B	0 EA	
922 1260 240	CABLE, RIBBON W212B	0 EA	
928 5652 004	ASSY, DETECTOR	3 EA	
939 8013 002	TUBE,COAX 3.125 X 4.75 LG	2 EA	
939 8013 018	COAX, 8.75"	2 EA	
939 8013 139	TUBE, COAX 3.125 X 39 LG	1 EA	
939 8013 204	TUBE, COAX 3.125 X 55.25 LG	2 EA	
939 8013 212	TUBE, COAX 3.125 X 57.25 LG	1 EA	
939 8014 002	TUBE, COAX 1.315 X 3.22LG	2 EA	
939 8014 018	COAX, 8.75"	2 EA	
939 8014 139	TUBE,COAX 1.315 X 37.47LG	1 EA	
939 8014 204	TUBE, COAX 1.315 X 53.72 LG	2 EA	
939 8014 212	TUBE, COAX 1.315 X 55.72 LG	1 EA	
939 8221 042	PNL, 19.0X3.468X0.125 HF146	1 EA	
971 0027 006	FLEXSTAR BOOST AMP	1 EA	
988 2515 001	DP, SYSTEM ZDHD	1 EA	
988 2543 002	DWG PKG, ZD24/32HD+ SWL	1 EA	
992 8850 005	CONTROLLER, SYSTEM	1 EA	
992 9854 012	KIT, PLAT Z MOUNTING, HDX-FM	1 EA	
994 9381 006	CTLR, XMTR COMB - NICKEL GRAY	1 EA	
995 0034 012	! XMTR, Z12HD+, FORMAT	0 EA	
995 0034 016	! XMTR, Z16HD+, FORMAT	0 EA	

Table 2-3 FLEXSTAR BOOST AMP - 971 0027 006 (H)

Harris PN	Description	Qty UM	Reference Designators
250 0628 000	CABLE/ASSY, USB-A, BULKHEAD	0.500 EA	J4
250 0671 000	CORD, AC, 3C, NEMA/IEC PLUG RT ANGLE	1 EA	
346 0711 000	CARD GUIDE, 6"LG, GROUNDED	2 EA	
358 3197 000	SLIDES 10" PAIR	1 PR	
396 0261 000	DISPLAY, LCD BLUE	1 EA	
398 0552 000	FUSE, CART 5X20MM 10A SLOW	2 EA	FL1F1,FL1F2
424 0012 000	GROMMET 0.250 GROOVE DIA	1 EA	
430 0192 000	FINGER GUARD, 119MM FAN	1 EA	
430 0313 000	FAN, 12V 110CFM 119MM SQ	1 EA	B1
430 0321 000	FILTER ASSY, AIR 120MM FAN	1 EA	
544 1704 000	TERM, 50-OHM SMB 1GHZ	1 EA	R1
548 2389 000	RESISTOR, 2.0 OHM 10% 114W	1 EA	R2
609 0003 000	FILTER, RFI POWER ENTRY, IEC	1 EA	FL1
610 1253 000	HDR, MALE 4C 1ROW STRAIGHT	1 EA	J11

Section II Parts List

646 0665 000	LABEL, INSPECTION	1 EA	
647 0006 000	OVERLAY FLEXSTAR BOOST AMP	1 EA	
736 0444 000	PSU 250W 24V, 5V, +15V, -15V	1 EA	A11
843 5580 082	WIRING DIAGRAM FLEXSTAR BOOST AMP0 DWG		
901 0207 101	PWA, 60W VHF PA	1 EA	A6
901 0207 211	PWA, BOOST AMP CONTROLLER	1 EA	A2
901 0207 221	PWA, BOOST DISPLAY INTERFACE	1 EA	A8
917 2435 050	HANDLE, CTRLR/DIGIT	2 EA	
922 1344 027	SPACER, DISPLAY	4 EA	
943 5580 030	OVERLAY PANEL FRAME, FLEXSTAR	1 EA	
943 5580 031	TOP COVER, FLEXSTAR	1 EA	
943 5580 032	DIVIDER PANEL, FLEXSTAR	1 EA	
943 5580 035	PLENUM BRACKET, P/A, FLEXSTAR	1 EA	
943 5580 036	ANGLED PLENUM BRACKET, LEFT, FLEXSTAR	1 EA	
943 5580 037	ANGLED PLENUM BRACKET, RIGHT, FLEXSTAR	1 EA	
943 5580 073	SIDE PANEL, FLEXSTAR	1 EA	
943 5580 074	COVER, POWER SUPPLY SECTION	1 EA	
943 5580 078	CHASSIS, BOOST AMP	1 EA	
952 9239 012	ASSY, CABLE FLEXSTAR BOOST AMP	1 EA	
988 2607 001	DP, BOOSTPRO	1 EA	

Table 2-4 PWA, BOOST AMP CONTROLLER - 901 0207 211 (J)

Harris PN	Description	Qty UM	Reference Designators
000 0000 010	B/M NOTE:	1 DWG	J15
086 0001 010	*SEALANT GLYPTOL	0 QT	
302 0780 000	SCREW, PHMS, 6-32 X 3/8	1 EA	MTG1
356 0089 000	CABLE TIE, 5.6" NYLON NATURAL	2 EA	L10,L13
356 0240 000	CABLE TIE, 0.145W X 11.4LG	2 EA	L9,L12
357 0037 000	SCREW 6-32 X .25 BHMS	2 EA	
357 0059 000	NUT, HEX 6-32	2 EA	
358 3789 000	STANDOFF, HEX 6-32 X 5/16 M/F	2 EA	
358 3817 001	JACKSCREW, 4-40 FEMALE HEX	10 EA	2/J9,2/J11,2/J12,4/J2
398 0492 000	FUSE, FAST 7.5 AMP 32VDC (ATO)	1 EA	F2
398 0493 000	FUSE, FAST 10 AMP 32VDC (ATO)	1 EA	F1
402 0239 000	FUSEHOLDER, AUTOMOTIVE ATO BLADE, PC MNT2 EAXF1,XF2		
408 0353 000	GASKET, EMI SHIELD DSUB 9C	3 EA	1/J9,2/J2
408 0354 000	GASKET, EMI SHIELD DSUB 15C	1 EA	1/J11
408 0362 000	GASKET, EMI SHIELD DSUB 25C	1 EA	1/J12
409 0001 000	PUSH SPACER, TEARDROP	8 EA	MTG2,MTG4,MTG7,MTG9,MTG16,MTG17,MTG18,MTG19
494 0504 000	CHOKER, 1MH 10% 0.3A RADIAL	1 EA	L7
494 0520 000	IND, 3.0MH 15% 10 AMPS	2 EA	L9,L12
494 0522 000	IND, TOROID, POWER, 10UH 15%	2 EA	L10,L13
522 0593 000	*CAP 3300UF 25V 20% (16X25)	2 EA	C180,C198
526 0325 000	CAP .1UF 35V 20%	7 EA	C3,C4,C116,C146,C151,C162,C212
610 0877 000	HDR, 2C VERT 1ROW UNSHR	1 EA	J14
610 0902 000	HDR, 10C VERT 2ROW UNSHR	1 EA	J7
610 1045 000	HDR, 4C VERT 1ROW 1-WALL	1 EA	J1
610 1067 000	HDR, 5C VERT 1ROW UNSHR	1 EA	J16
610 1107 000	HDR, 12C VERT 1ROW FRICTION	1 EA	J6
610 1160 000	HDR, 4C VERT 1ROW FRICTION	1 EA	J5
610 1287 000	*HDR (RIBBON), 20C 2ROW VERTICAL	1 EA	J10
610 1402 050	*HDR (FFC), 50C 2ROW RT ANG	1 EA	J4

612 1499 001	RECP, D, 9C RT ANG METAL	1 EA	J9
612 1499 002	RECP, D, 15C RT ANG METAL	1 EA	J11
612 1499 003	RECP, D, 25C RT ANG METAL	1 EA	J12
612 2243 009	RECP/RECP, D, 9C/9C, METAL	1 EA	J2
620 0700 000	*RECPT, MALE SMB,PC MOUNT	1 EA	J8
620 2930 000	RECEPTACLE RT ANGLE BNC	1 EA	J3
801 0207 211	SCH, BOOST AMP CONTROLLER	0 DWG	
861 1127 141	S/W, BOOST AMP CONTROLLER	0 DWG	
901 0207 212	PWA, BOOST AMP CONTROLLER, SMT	1 EA	
943 5552 015	ANGLE, SMPTE MTG	1 EA	MTG1
992 7203 001	*PWA, 376 MICRO MODULE	1 EA	

Table 2-5 PWA, BOOST DISPLAY INTERFACE - 901 0207 221 (B)

Harris PN	Description	Qty UM	Reference Designators
610 0857 000	HDR, 12C VERT 1ROW UNSHR	1 EA	J2
610 1295 000	HDR, 2C VERT 1ROW FRICTION	1 EA	J4
610 1360 000	*HDR (RIBBON), 50C 2ROW VERTICAL	1 EA	J1
801 0207 221	SCH, BOOST DISPLAY INTERFACE	0 DWG	
901 0207 222	PWA, BOOST DISPLAY INTERFACE, SMT	1 EA	

Table 2-6 CONTROLLER, SYSTEM - 992 8850 005 (F)

Harris PN	Description	Qty UM	Reference Designators
250 0274 000	CORD, AC, 3C, NEMA/IEC PLUG	1 EA	
358 3223 000	FEMALE SCREWLOCK .56"4-40	1 EA	
398 0081 000	FUSE,SLO CART 2A 250V	1 EA	
472 1693 000	XFMR, PWR, DP241-6-28	1 EA	
484 0296 000	* FILTER RFI POWER LINE	1 EA	
813 4999 023	STDOFF 6-32X5/16 1/4 HEX	14 EA	
839 8118 218	SCHEM, OVERALL PTD SYS	0 DWG	
917 2435 050	HANDLE, CTRLR/DIGIT	2 EA	
922 1085 071	CABLE, PT CONTROLLER	1 EA	
922 1200 002	CABLE ASSY, RIBBON, 25C	1 EA	
922 1203 113	WINDOW, SYSTEM CONTROLLER	1 EA	
939 8118 180	COVER, SYSTEM CONTROLLER	1 EA	
943 5293 071	FRAME, FRONT PANEL MTG.	1 EA	
943 5293 072	REAR PNL, SYSTEM CONTROL	1 EA	
943 5293 075	CHASSIS, SYSTEM CONTROL	1 EA	
943 5293 646	FRONT PANEL, SYSTEM CONTROL,	1 EA	
992 8388 005	DISPLAY BD, DUAL TX CNTRL	1 EA	
992 8853 001	PWA, SYSTEM CONTROLLER	1 EA	

Table 2-7 DISPLAY BD, DUAL TX CNTRL - 992 8388 005 (E)

Harris PN	Description	Qty UM	Reference Designators
000 0000 010	B/M NOTE:	0 DWG	
358 1928 000	JUMPER 1/4 LG 1/8H	7 EA	JP1,JP4,JP10,JP11,JP12,JP13,JP14
358 3383 000	JUMPER, 0.1" LG, 0.125" H	5 EA	JP015,JP016,JP17
380 0125 000	XSTR, NPN 2N4401 ESD	1 EA	Q003
380 0189 000	*XSTR, NPN, MMBT3904	1 EA	Q002
380 0190 000	*XSTR, PNP, MMBT3906	2 EA	Q001,Q005
382 0401 000	*IC, CD4028B	1 EA	U003
382 0523 000	*IC, CD4066	2 EA	U009,U010
382 1207 000	IC CD4076B ESD	1 EA	U002
382 1208 000	IC CD4070B ESD	4 EA	U005,U006,U007,U008

Section II Parts List

382 1209 000	IC CD4532B ESD	1 EA	U001
382 1210 000	IC CD4538B ESD	1 EA	U004
382 1211 000	IC ICL7136 ESD	1 EA	U011
384 0205 000	*DIODE, RECT 1N4148/914	30 EA	CR001,CR002,CR003,CR004,CR005,CR006,CR007,CR008,CR009,CR010,CR011,CR012,CR013,CR014,CR015,CR016,CR017,CR019,CR020,CR021,CR022,CR023,CR024,CR025,CR026,CR027,CR031,CR033,CR034,CR035
384 0826 000	LED LIGHT BAR, RED ESD	4 EA	DS004,DS005,DS006,DS011
384 0827 000	LED LIGHT BAR, GREEN ESD	2 EA	DS009,DS010
384 0849 000	LED LIGHT BAR, GREEN ESD	1 EA	DS007
384 0850 000	LED LIGHT BAR, RED ESD	2 EA	DS003,DS008
384 0858 000	LED LIGHT BAR, YELLOW ESD	1 EA	DS013
386 0135 000	*ZENER 1N4733A 5.1V 5% 1W	1 EA	CR032
404 0824 000	SOCKET, DIP14, LO PROFILE	6 EA	XU005,XU006,XU007,XU008,XU009,XU010
404 0825 000	SOCKET, DIP16, LO PROFILE	4 EA	XU001,XU002,XU003,XU004
404 0828 000	SOCKET, SIP18, STRAIGHT	4 EA	
406 0529 000	DISPLAY, LCD 3.5 DIGIT CUSTOM	1 EA	DS012
500 1274 000	CAP 51PF 100V 5%	1 EA	C003
506 0262 000	CAP, 0.047UF 100V 5%	1 EA	C006
516 0484 000	CAP 0.100UF 10% 100V X7R CK06	20 EA	C001,C004,C005,C007,C008,C009,C010,C011,C012,C013,C014,C015,C016,C017,C018,C019,C020,C021,C022,C023
522 0581 000	CAP 10UF 35V 20%	2 EA	C002,C026
540 1485 000	RES NETWORK 100K OHM 2%	2 EA	R001,R016
548 2400 234	RES 221 OHM 1/2W 1%	1 EA	R008
548 2400 242	RES 267 OHM 1/2W 1%	1 EA	R034
548 2400 301	RES 1K OHM 1/2W 1%	1 EA	R027
548 2400 312	RES 1.3K OHM 1/2W 1%	10 EA	R017,R018,R019,R020,R021,R022,R023,R024,R031,R032
548 2400 366	RES 4.75K OHM 1/2W 1%	1 EA	R033
548 2400 401	RES 10K OHM 1/2W 1%	10 EA	R006,R007,R010,R012,R013,R014,R015,R025,R026,R035
548 2400 466	RES 47.5K OHM 1/2W 1%	2 EA	R004,R011
548 2400 526	RES 182K OHM 1/2W 1%	1 EA	R003
548 2400 601	RES 1MEG OHM 1/2W 1%	1 EA	R002
548 2400 626	RES 1.82MEG OHM 1/2W 1%	1 EA	R009
550 0953 000	TRIMPOT 20K OHM 1/2W 10%	1 EA	R005
604 1111 000	SW PB GRAY MOM W/O LED	5 EA	S001,S003,S005,S009,S010
604 1119 000	SW PB RED MOM W/O LED	1 EA	S011
604 1261 000	SW PB GRAY ALT-ACTION W/O LED	1 EA	S008
610 0933 000	TEST POINT, OVAL-LOOP THRU	12 EA	TP001,TP002,TP003,TP004,TP005,TP006,TP007,TP008,TP009,TP010,TP011,TP012
610 1106 000	HDR, 8C VERT 1ROW FRICTION	1 EA	J014
610 1441 034	HDR, 34C 2ROW VERTICAL	1 EA	J001
839 8025 004	SCHEM, DISPLAY BD	0 DWG	
843 5215 004	PWB, DISPLAY	1 EA	

Table 2-8 PWA, SYSTEM CONTROLLER - 992 8853 001 (M)

Harris PN	Description	Qty UM	Reference Designators
000 0000 010	B/M NOTE:	0 DWG	
354 0309 000	TERM SOLDER	25 EA	TP001,TP002,TP003,TP004,TP005,TP006,TP007,TP008,TP009,TP010,TP011,TP012,TP013,TP014,TP015,TP016,TP017,TP018,TP019,TP020,TP021,TP022,TP023,TP024,TP025
358 1214 000	SCREWLOCK, M/F 4-40X3/16"	5 EA	
380 0189 000	*XSTR, NPN, MMBT3904	15 EA	Q001,Q002,Q003,Q004,Q005,Q006,Q007,Q009,Q010,Q011,Q014,Q015,Q016,Q017,Q018
380 0190 000	*XSTR, PNP, MMBT3906	7 EA	Q008,Q012,Q013,Q019,Q020,Q021,Q022
382 0184 000	*IC, LM340A/LM7805AC (TO-220)	1 EA	U019
382 0359 000	IC, LM340/LM7815C (TO-220)	1 EA	U016
382 0360 000	IC, LM7915C (TO-220)	1 EA	U017
382 0465 000	IC, 74C74 ESD	1 EA	U012
382 0605 000	IC, LM7905C (TO-220)	1 EA	U018
382 0711 000	*PRECISION IC MULTIPLIER ESD	1 EA	U009
382 0719 000	*IC, LM324A (DIP-14)	4 EA	U005,U006,U007,U008
382 1016 000	*IC, 74C240 (DIP-20)	2 EA	U004,U011
382 1017 000	*IC, 74C244 (DIP-20)	2 EA	U003,U013
382 1070 000	IC, ILQ1	1 EA	U001
382 1084 000	IC, LP339 (DIP-14)	1 EA	U010
384 0205 000	*DIODE, RECT 1N4148/914	38 EA	CR002,CR003,CR004,CR005,CR006,CR009,CR010,CR012,CR016,CR017,CR018,CR019,CR020,CR021,CR034,CR035,CR039,CR040,CR041,CR042,CR043,CR044,CR045,CR047,CR048,CR051,CR052,CR053,CR054,CR055,CR056,CR057,CR058,CR059,CR060,CR069,CR071,CR073
384 0321 000	*DIODE, SCHOTTKY, 5082-2800	15 EA	CR022,CR023,CR024,CR025,CR026,CR027,CR028,CR029,CR030,CR031,CR032,CR033,CR036,CR037,CR038
384 0357 000	DIODE, RECT 1N4004	14 EA	CR007,CR008,CR013,CR014,CR049,CR050,CR061,CR062,CR064,CR065,CR066,CR067,CR072,CR075
384 0610 000	LED, GRN T1-3/4 VERT	4 EA	DS001,DS002,DS003,DS004
384 0719 000	DIODE, TVS (UNIDIR), ICTE-5	1 EA	CR063
384 0720 000	DIODE, TVS (UNIDIR), 1.5KE15A	3 EA	CR068,CR074,CR077
384 0743 000	DIODE ARRAY DUAL 8 ESD	3 EA	U002,U014,U015
384 0838 000	DIODE, TVS (UNIDIR), 1.5KE36A	2 EA	CR070,CR078
384 0854 000	DIODE ARRAY, 8 ISOLATED ESD	2 EA	CR001,CR046
386 0085 000	*ZENER 1N4740A 10V 5% 1W	1 EA	CR015
404 0303 000	SOCKET IC 10 PIN	1 EA	XU009
404 0513 000	HEAT SINK PA1-1CB	4 EA	#U016,#U017,#U018,#U019
404 0674 000	SOCKET, DIP, 14 PIN (DL)	9 EA	XU002,XU005,XU006,XU007,XU008,XU010,XU012,XU014,XU015
404 0675 000	SOCKET, DIP, 16 PIN (DL)	3 EA	CR001,CR046,XU001
404 0767 000	SOCKET, DIP, 20 PIN (DL)	4 EA	XU003,XU004,XU011,XU013
494 0218 000	CHOKE, WIDE BAND 2.5 TURN	2 EA	

Section II Parts List

506 0230 000	CAP .001UF 100VAC 5%	36 EA	C001,C002,C003,C004,C005,C006,C007, C008,C010,C012,C013,C014,C015,C017, C018,C020,C021,C023,C030,C031,C032, C033,C034,C035,C036,C037,C038,C039, C040,C041,C043,C044,C045,C046,C047, C048
516 0453 000	CAP 0.100UF 10% 100V X7R	23 EA	C009,C011,C016,C019,C022,C025,C028, C051,C054,C056,C058,C059,C060,C061, C062,C063,C064,C065,C066,C067,C068, C072,C074
516 0511 000	CAP 0.47UF 100V 20%	1 EA	C075
522 0524 000	CAP 10 UF 100V 20% NON-POLAR	1 EA	C076
522 0548 000	CAP 10UF 50V 20% (5X11)	6 EA	C026,C029,C049,C053,C070,C071
522 0586 000	CAP 3300UF 50V 20%	2 EA	C050,C069
526 0109 000	CAP 22UF 25V 20%	2 EA	C024,C027
526 0349 000	CAP 2.2UF 50V 20%	4 EA	C052,C055,C057,C073
540 0618 000	*RES 2K OHM 2W 10%	2 EA	R216,R217
540 1357 000	RES NETWORK 1000 OHM 2%	4 EA	R001,R004,R005,R006
540 1366 000	RES NETWORK 100 OHM 2%	6 EA	R002,R003,R007,R008,R009,R010
548 2051 000	RES ZERO OHM	5 EA	R038,R048,R076,R099,R140
548 2400 201	RES 100 OHM 1/2W 1%	2 EA	R020,R163
548 2400 209	RES 121 OHM 1/2W 1%	2 EA	R207,R208
548 2400 268	RES 499 OHM 1/2W 1%	1 EA	
548 2400 273	RES 562 OHM 1/2W 1%	2 EA	R220,R221
548 2400 281	RES 681 OHM 1/2W 1%	4 EA	R016,R017,R226,R227
548 2400 301	RES 1K OHM 1/2W 1%	13 EA	R012,R015,R018,R022,R023,R025,R027, R029,R121,R122,R129,R159,R170
548 2400 318	RES 1.5K OHM 1/2W 1%	3 EA	R058,R218,R219
548 2400 327	RES 1.87K OHM 1/2W 1%	5 EA	R044,R064,R079,R096,R144
548 2400 330	RES 2K OHM 1/2W 1%	5 EA	R154,R164,R166,R174,R176
548 2400 335	RES 2.26K OHM 1/2W 1%	5 EA	R036,R054,R069,R106,R117
548 2400 336	RES 2.32K OHM 1/2W 1%	1 EA	R130
548 2400 338	RES 2.43K OHM 1/2W 1%	1 EA	R057
548 2400 358	RES 3.92K OHM 1/2W 1%	4 EA	R071,R089,R104,R135
548 2400 366	RES 4.75K OHM 1/2W 1%	7 EA	R019,R034,R056,R067,R108,R111,R187
548 2400 368	RES 4.99K OHM 1/2W 1%	12 EA	R035,R049,R055,R066,R068,R075,R086, R087,R107,R110,R114,R133
548 2400 385	RES 7.5K OHM 1/2W 1%	2 EA	R160,R171
548 2400 393	RES 9.09K OHM 1/2W 1%	2 EA	R128,R131
548 2400 401	RES 10K OHM 1/2W 1%	45 EA	R013,R014,R030,R043,R046,R050,R053, R059,R065,R074,R077,R098,R100,R101, R109,R118,R138,R139,R141,R142,R153, R155,R156,R157,R167,R168,R177,R179, R182,R185,R188,R193,R195,R196,R198, R200,R203,R204,R206,R209,R210,R211, R213,R215,R222
548 2400 430	RES 20K OHM 1/2W 1%	1 EA	R152
548 2400 439	RES 24.9K OHM 1/2W 1%	5 EA	R051,R061,R073,R102,R137
548 2400 447	RES 30.1K OHM 1/2W 1%	5 EA	R031,R041,R082,R093,R147
548 2400 466	RES 47.5K OHM 1/2W 1%	22 EA	R165,R173,R175,R178,R181,R183,R184, R186,R189,R190,R191,R192,R199,R201,

			R202,R205,R212,R214,R223,R224,R225, R228
548 2400 468	RES 49.9K OHM 1/2W 1%	5 EA	R042,R062,R081,R094,R146
548 2400 493	RES 90.9K OHM 1/2W 1%	5 EA	R032,R040,R083,R092,R148
548 2400 501	RES 100K OHM 1/2W 1%	27 EA	R011,R021,R024,R026,R028,R047,R052, R060,R063,R072,R085,R103,R112,R113, R115,R116,R119,R120,R123,R124,R125, R126,R127,R136,R150,R151,R180
548 2400 526	RES 182K OHM 1/2W 1%	5 EA	R033,R039,R084,R091,R149
548 2400 566	RES 475K OHM 1/2W 1%	2 EA	R162,R172
548 2400 601	RES 1MEG OHM 1/2W 1%	1 EA	R194
550 0858 000	TRIMPOT 5K OHM 1/2W 10%	6 EA	R080,R088,R095,R145,R158,R197
550 0947 000	TRIMPOT 1K OHM 1/2W 10%	1 EA	R132
550 0956 000	TRIMPOT 2K OHM 1/2W 10%	5 EA	R037,R045,R078,R097,R143
550 0958 000	TRIMPOT 10K OHM 1/2W 10%	2 EA	R161,R169
550 0981 000	TRIMPOT 50 OHM 1/2W 10%	4 EA	R070,R090,R105,R134
560 0060 000	MOV, 40WVAC, 3J, 7MM DISC	1 EA	RV001
574 0366 000	RELAY, DPDT 12VDC 2A	4 EA	K001,K002,K003,K004
610 0828 000	*HEADER, 26C TWO ROW VERTICAL	1 EA	J011
610 0900 000	HDR, 3C VERT 1ROW UNSHR	9 EA	JP001,JP002,JP003,JP004,JP005,JP006,JP 007,JP008,JP009
610 1106 000	HDR, 8C VERT 1ROW FRICTION	1 EA	J012
610 1441 034	HDR, 34C 2ROW VERTICAL	1 EA	J013
612 1180 000	*D RECP 15C RT ANGLE	4 EA	J002,J003,J004,J005
612 1181 000	*D RECP 25C RT ANGLE	1 EA	J001
612 1184 000	JUMPER SHUNT, 2C, 0.1" PITCH	9 EA	#JP001,#JP002,#JP003,#JP004,#JP005,#J P006,#JP007,#JP008,#JP009
612 1268 000	RECEPTACLE RT ANG BNC	5 EA	J006,J007,J008,J009,J010
839 8118 181	SCHEM, PTD SYS CONTROLLER	0 DWG	
843 5293 076	PWB, PTD SYS CONTROLLER	1 EA	

Table 2-9 CTLR, XMTR COMB - NICKEL GRAY - 994 9381 006 (D1)

Harris PN	Description	Qty UM	Reference Designators
250 0274 000	CORD, AC, 3C, NEMA/IEC PLUG	1 EA	
2520003000A	*WIRE, MIL, 20AWG 1000V WHITE	4 FT	
358 3223 000	FEMALE SCREWLOCK .56"4-40	2 EA	
384 0357 000	DIODE, RECT 1N4004	2 EA	CR001,CR002
398 0017 000	FUSE, FAST CART 1A 250V	1 EA	
404 0807 000	RELAY SOCKET	1 EA	XK001
472 0622 000	XFMR CTL 115/230V 50/60HZ	1 EA	
484 0296 000	* FILTER RFI POWER LINE	1 EA	
574 0362 000	RELAY 2PDT 12VDC	1 EA	K001
576 0095 000	RELAY TIME DELAY ADJ	1 EA	K002
646 1301 000	LABEL, DANGER HI VOLTAGE	1 EA	
839 7994 100	SCHEM, DISPLAY BD.	0 DWG	
839 7994 101	SCHEM, MAIN/ALT CNTRLR	0 DWG	
839 8071 045	SCHEM, MAIN/ALT OR	0 DWG	
917 2461 001	CONTROL MAIN/ALT	1 EA	
922 1046 209	COVER PLATE	1 EA	
922 1200 001	CABLE ASSY, RIBBON 34C	1 EA	
922 1200 002	CABLE ASSY, RIBBON, 25C	2 EA	
939 7968 138	CHASSIS, CONTROLLER	1 EA	

Section II Parts List

939 7968 140	COVER, CONTROLLER	1 EA
939 8118 735	PANEL, FRONT, COMB CTRL, GRAY	1 EA
988 2379 001	DP,COMBINER CONTROLLER FM	1 EA
992 8583 001	PWA, MAIN/ALT CNTRLR	1 EA
992 8584 001	PWB, DISPLAY BD.	1 EA
992 8602 002	KIT, CONNECTOR	1 EA