TECHNICAL MANUAL
888-2515-001

ZD24/32 System
994-9712-xxx

T.M. No. 888-2515-001

Returns And Exchanges

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

Unpacking

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

Technical Assistance

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

Replaceable Parts Service

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

NOTE

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

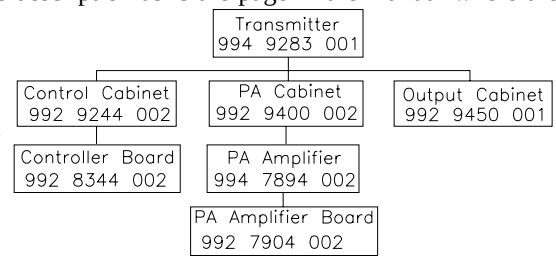
Guide to Using Harris Parts List Information

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:
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

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



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.

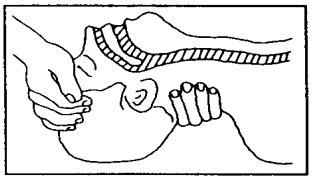
TREATMENT OF ELECTRICAL SHOCK

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

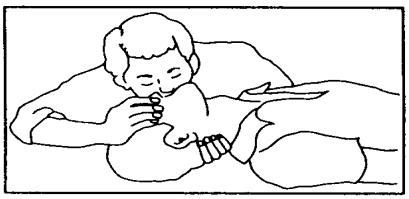
IF UNCONSCIOUS,
OPEN AIRWAY



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

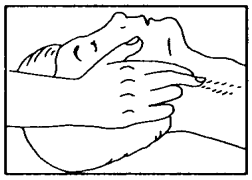
(B) BREATHING

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

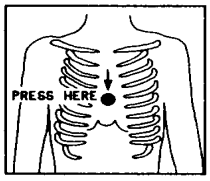
CHECK
CAROTID PULSE



IF PULSE ABSENT,
BEGIN ARTIFICIAL
CIRCULATION

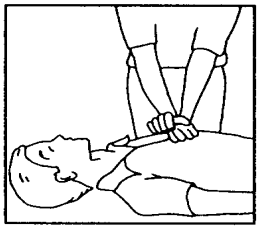
(C) CIRCULATION

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

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)

TABLE OF CONTENTS

1.1 Introduction

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

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

An IBOC transmission is accomplished with two different types of systems. One is the 'separate' (s) system where the IBOC signal is generated with one transmitter(s), the Analog signal with another transmitter, and then combined at their outputs. With this mode of operation, the dual transmitter discussed in this manual will be the IBOC transmitter only and not combining of the Analog and IBOC RF power. The 'common' (c) system combines the IBOC and Analog signal at a low level, usually the exciter outputs, and that signal drives a transmitter or transmitters. This manual will discuss both 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 # 992-9511-326
  - PWB # 843-5400-653
  - Schematic # 839-5400-651

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 system exciter(s) are either mounted and wired in a provided rack or will be placed in existing equipment racks on site. The exciter interconnect consists of RF and multi-conductor cables. Not all of these cables are necessary in some applications. Depending on how many exciters and what type of IBOC system, Separate (s) or Common (c), some cables may not be needed but are provided for potential future expansion with additional exciters. The interconnecting cables go from the exciter rack I/O panel (provided) to the transmitter I/O panel located in transmitter cabinet A, top right rear near the TB1 remote terminal block. See drawings in the Z12/16 manual drawing package for futther information.

WARNING: Disconnect primary power prior to servicing.

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 Z12/16 manual for further information. One AC connection must be made for the ZD24/32 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 transmiter 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. The UPS provided with the DEXSTAR exciter is operated only at the specified voltage as labeled near the AC input of the UPS and the associated DEXSTAR should be operated on the same voltage. Refer to AC power diagram in the System Drawing Package and the Exciter Rack Wiring Diagram in the Z12/Z16 drawing package for proper AC voltage.

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

- 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.
- Set the REMOTE/DISABLE switches on both transmitters to the REMOTE position.
- 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.
- 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.
- 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.
- 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.
- 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 changing the physical length of W900 or W901 in the drive circuit. Some experimentation will be required. Add or remove BNC elbow adaptors or a very short length of cable (2-6 inches) to one or the other existing cables at the transmitter A I/O panel, J1 or J2. Any reject power may be the result of a different connection from what was originally done at the Harris test facility. Usually, no adjustment of amplitude or phase will be necessary.
- 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.
- Select the RFL PWR position on the transmitters and the System Controller and verify that they all read at or near 1.01VSWR.
- 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.

- 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.
- 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%.
- Select the REJ PWR meter position and verify that the meter reading is at or near 100%.
- On the Combiner Controller select the B AIR position and verify the same meter readings as done in the A AIR mode.
- On the Combiner Controller select the A+B AIR mode. Verify that the motorized phasing unit in the Switchless

WARNING: Disconnect primary power prior to servicing.

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 and 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 of allowed forward power (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 ZD24/32 combined transmitter system calibrated at full output in the combined mode. See Table 1-1.

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 power on 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 Z12/16 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; or 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

Table 1-1. System Controller Average Power Metering

	Indication		
	FWD PWR 100%	RFL PWR 1.00	REJ PWR 100%
ZD24HDs w/Switchless Combiner	5.2kW	As Indicated	2.6kW
ZD24HDs w/Hybrid Combiner	5.2kW	As Indicated	1.3kW
ZD24HDc w/Switchless Combiner	10kW	As Indicated	5kW
ZD24HDc w/Hybrid Combiner	10kW	As Indicated	2.5kW
ZD32HDs w/Switchless Combiner	7kW	As Indicated	3.5kW
ZD32HDs w/Hybrid Combiner	7kW	As Indicated	1.75kW
ZD32HDc w/Switchless Combiner	14kW	As Indicated	7kW
ZD32HDc w/Hybrid Combiner	14kW	As Indicated	3.5kW

WARNING: Disconnect primary power prior to servicing.

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 ZD24/32 is summed using a floor mounted 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 Z12/16 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 Z12/16 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, the line length from the exciter splitter through the IP1D to the IPA Splitter board in each transmitter is critical. A BNC elbow adapter 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.

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

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

Exciter 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 exciter 1 or exciter 2.

For exciter main/alternate operation, all exciters' 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 exciter(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 exciter. 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 exciter will continue to operate from the transmitter B un-mute line routed through the latched relay.

If during operation, the on air exciter fails, a ten second window exists to allow the exciter 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 Exciter muting signals.

Exciter RF power is combined and split on the Rack I/O panel. See Z12/16 manual for more information. These outputs feed each IP1D Pre-corrector. Phase will be shifted within the IP1D therefore some line length adjustment may be necessary for proper transmitter output phasing. Drive phasing is important since there is no phasing adjustment before the final combining stage except for transmission line length. The difference in line length between the two drive paths must compensate for splitter, IP1D, transmitter, and combiner phase delays. As discussed earlier, W900 and W901 length can be changed or BNC elbow adapters can be removed or added at the transmitter A I/O panel.

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 DEXSTAR Control

If a common mode (c) of IBOC operation is used and dual exciters are present, the digital and analog exciters will be configured in banks. If one or the other exciter in a particular bank fails, operation will automatically switch to the other bank of exciters.

DEXSTAR control is routed through the relay panel TB8 & TB9 located in the upper right rear of transmitter A just below the remote control terminal block TB1.

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

DEXSTAR Fault indicators are routed through steering diodes CR1-CR4 located between TB8 & TB9 to both transmitters. Diode steering is required to keep each transmitter power supply from feeding the other when one transmitter's AC is off. Transmitter A inputs are individual fault signals from each DEXSTAR and Transmitter B is a summed signal of both fault lines from each exciter.

K1 latching relay is used for routing Mute and Active signals to the proper exciter. 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 exciter should be active. The Active is a ground when exciter bank 2 is selected. This signal is routed to the DEXSTAR exciters through diodes CR5 and CR6. This is a ground signal routed through the DEXSTAR and on to the ePAL (if used) for audio routing. Position two is active low.

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 the K1 relay contacts. Either transmitter may then 'un-mute' whichever exciter 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. For a separate (s) system, parts only used in the common (c) system may not be present such as analog exciter routing.

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

Table 1-2 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 IBOC exciter. Dual IBOC exciter = 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 Z12/16 transmitter manual and schematics for more detail.	

WARNING: Disconnect primary power prior to servicing.

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 the Analog Exciters as the IBOC DEXSTAR exciters. The Analog Exciter mute is routed through CR8 and CR10 from the K1 contacts.

Table 1-3 Seperate (s) Configuration ZD24HDs

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 Common (c) Configuration ZD24HDc

TEST POINT	TARGET VOLTAGE	SET UP CONDITION	SAMPLE CAL
TP2	0.200 Volts	10kW of system forward power	R37
TP3	0.113 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 Seperate (s) Configuration ZD32HDs

TEST POINT	TARGET VOLTAGE	SET UP CONDITION	SAMPLE CAL
TP2	0.275 Volts	7kW 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 Common (c) Configuration ZD32HDc

TEST POINT	TARGET VOLTAGE	SET UP CONDITION	SAMPLE CAL
TP2	0.275 Volts	14 kW of system forward power	R37
TP3	0.150 Volts	560 Watts of simulated reflected power	R45
TP4	0.275 Volts	100% of reject power; either 3.5kW or 7kW	R78

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.

1.5 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). Variation of these voltages will exist depending on desired high power output and linearity of circuit.

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

- Set transmitter system to operate at 100% of normal operating power (not necessarily full power capability).
- 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.
- Set transmitter power to zero and adjust R90, FWD PWR METER ZERO, for a reading of 0%.
- Repeat previous steps as needed.

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

- For the 3dB hybrid configuration; turn one transmitter to full power and the other to 0 kW to force one-fourth full

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

WARNING: Disconnect primary power prior to servicing.

power into the reject load.

- For the switchless combiner configuration; configure combiner to direct full power from one transmitter into the reject load.
- Adjust R80, REJ PWR CAL, for a 100% reject power reading.
- 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:

- 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.
- 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.
- 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.
- 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.
- 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.
- Verify that the VSWR reading is 1.50:1.
- 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 approximatly 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 approximatly 15VDC.
J1-3	J11-2	TX OFF COMMAND	Momentary connection to ground sets the system to OFF mode. Maximum open circuit voltage is approximatly 15VDC.
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 this 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 reject load power.
J1-11	J11-6	IPA A PWR SAMPLE	Not used.
J1-12	J11-19	IPA B PWR SAMPLE	Not used.
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 15VDC.
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 LO 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 15VDC.
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 +15VDC used for external interlock and fail-safe signaling.

WARNING: Disconnect primary power prior to servicing.

Section II
Parts List

Replaceable Parts List Index

Table 2-1. XMTR, ZD24HDS-HYB - 994 9712 xxx

Harris PN	*Description*	*QTY UM*	*Reference Designators (D)*
358 3197 000	SLIDES 10" PAIR	1.0 PR	#SYS CNTRL
358 3466 000	END PLATE W/FIXING FLANGE	2.0 EA	#TB8 #TB9
384 0357 000	RECTIFIER 1N4004 ESD	10.0 EA	TXATB1, TXBTB1 CR1 CR2 CR3 CR4 CR5 CR6 CR7 CR9
404 0863 000	SOCKET, RELAY 11 PIN	1.0 EA	#K1
408 0212 000	SHIELD 15 POSITION &	8.0 EA	#W303A, #W304 #J18 #J19 #J22 #J23 #SYS CNTRL J2 #SYS CNTRL J3 #TXBJ3 #TXBJ5
408 0223 000	SHIELD 15 POSITION	2.0 EA	#W303 #TXAJ5 #TXAJ6
574 0418 000	RELAY, LATCHING 12VDC	1.0 EA	K1
606 0866 000	BREAKER, CIRCUIT 10A	1.0 EA	CB2
610 0538 000	PLUG 15 POS	8.0 EA	W303A, W304 J18 J19 J22 J23 SYS CNTRL J2 SYS CNTRL J3 TXBJ3 TXBJ5
612 0543 000	RECEPTACLE 205205-1	2.0 EA	W303 TXAJ5 TXAJ6
614 0048 000	TERM BD 4 TERM	1.0 EA	A1TB7
614 0884 000	MODULAR TERMINAL BLOCK 2C	14.0 EA	#TB8 #TB9
614 0885 000	MODULAR TERMINAL BLOCK	2.0 EA	#TB8 #TB9
614 0886 000	MODULAR TERMINAL BLOCK 4C	13.0 EA	#TB8 #TB9
620 0124 000	ADAPTER BNC UG306U	2.0 EA	PHASE ADJUSTMENT
620 0498 000	ADAPTOR 3-1/8	6.0 EA	
620 0544 000	CONN, ANCHOR INS 3-1/8; 50 OHM	2.0 EA	
620 0581 000	COUPLING ASSY, 3-1/8	13.0 EA	
620 0675 000	COUPLER, PI/2 HYBRID	1.0 EA	
620 2275 000	ELBOW, 3-1/8 90 DEG UFLG	10.0 EA	
700 1414 000	LOAD, 8898-315, 115VAC	1.0 EA	(0-1) 115V CNTRL OPTION
917 2332 741	CABLE PKG, RF & CTLR	1.0 EA	W4, W5, W28, W30, W31, W32
927 8096 010	ASSY, DIR COUPLER	1.0 EA	
927 8096 012	ASSY, DIR COUPLER	1.0 EA	
928 5652 003	ASSY, DETECTOR	3.0 EA	
939 8013 022	TUBING COAX	1.0 EA	
939 8013 039	TUBE,COAX 3.125 X 14.0 LG	2.0 EA	
939 8013 120	TUBE, COAX 3.125 X 34.25 LG	1.0 EA	
939 8013 311	TUBE, COAX 3.125 X 82.00 LG	1.0 EA	
939 8014 022	TUBE, COAX 1.315 X 8.22LG	1.0 EA	
939 8014 039	TUBE,COAX 1.315 X 12.47 LG	2.0 EA	
939 8014 120	TUBE, COAX 1.315 X 32.72 LG	1.0 EA	

WARNING: Disconnect primary power prior to servicing.

939 8014 311	TUBE, COAX 1.315 X 80.47 LG	1.0 EA
939 8221 045	PNL, 19.0X8.718X0.125 HF146	1.0 EA
943 5523 845	PANEL, MTG, WAGO	1.0 EA
988 2514 001	DWG PKG, ZD24/32 HYBRID COMB	1.0 EA
988 2515 001	DP, SYSTEM ZDHD	1.0 EA
992 8850 005	CONTROLLER, SYSTEM	1.0 EA

Table 2-2. CABLE PKG, RF & CTLR - 917 2332 741

Harris PN	*Description*	*QTY UM*	*Reference Designators (A)*
922 1203 425	CABLE, COAX, W30	1.0 EA	
922 1203 426	CABLE, COAX, W31	1.0 EA	
922 1203 427	CABLE, COAX, W32	1.0 EA	
922 1203 432	CABLE, CONTROL W28	1.0 EA	
922 1203 908	CABLE, CONTROL, W4	1.0 EA	
922 1203 909	CABLE, CONTROL, W5	1.0 EA	

Table 2-3. ASSY, DIR COUPLER - 927 8096 010

Harris PN	*Description*	*QTY UM*	*Reference Designators (E)*
358 0498 000	CLAMP, HOSE	2.0 EA	
620 0581 000	COUPLING ASSY, 3-1/8	1.0 EA	
827 8096 010	ASSY INSTR, DIR COUPLER	0.0 EA	
839 7900 147	INNER COND. 3-1/8	1.0 EA	
939 8118 901	OUTER CONDUCTOR 2 HOLES,	1.0 EA	
992 9701 002	ASSY, DIRECTIONAL COUPLER,42DB	1.0 EA	
992 9701 005	ASSY, DIRECTIONAL COUPLER,49DB	2.0 EA	

Table 2-4. ASSY, DIR COUPLER - 927 8096 012

Harris PN	*Description*	*QTY UM*	*Reference Designators (A)*
358 0498 000	CLAMP, HOSE	2.0 EA	
620 0581 000	COUPLING ASSY, 3-1/8	1.0 EA	
827 8096 011	ASSY INSTR, DIR COUPLER	0.0 EA	
839 7900 147	INNER COND. 3-1/8	1.0 EA	
939 8118 902	OUTER CONDUCTOR, 1 HOLE,	1.0 EA	
992 9701 002	ASSY, DIRECTIONAL COUPLER,42DB	1.0 EA	

Table 2-5. ASSY, DETECTOR - 928 5652 003

Harris PN	*Description*	*QTY UM*	*Reference Designators (A)*
254 0003 000	WIRE, BUS CU 18AWG	0 FT	
384 0321 000	*DIODE 5082-2800 ESD	1.0 EA	CR1
448 0875 000	BOX SHIELDED	1.0 EA	
508 0261 000	CAP .022UF 200V 10%	1.0 EA	C2
516 0375 000	CAP 0.01UF 50V -20/+80% Z5U	1.0 EA	C1
516 0781 000	CAP 220PF 5% 100V C0G	1.0 EA	C3
540 1600 208	RES 200 OHM 3W 5%	4.0 EA	R1 R2 R3 R4
548 2400 382	RES 6.98K OHM 1/2W 1%	1.0 EA	R5
817 2332 769	ASSY INSTR, DETECTOR ASSY	0.0 EA	
817 2332 770	SCHEM, DETECTOR ASSY	0.0 EA	

Table 2-6. CONTROLLER, SYSTEM - 992 8850 005

Harris PN	*Description*	*QTY UM*	*Reference Designators (E)*
250 0274 000	CORD, AC, 3C, NEMA/IEC PLUG	1.0 EA	
358 3223 000	FEMALE SCREWLOCK .56"4-40	1.0 EA	
398 0081 000	FUSE,SLO CART 2A 250V	1.0 EA	
472 1693 000	XFMR, PWR, DP241-6-28	1.0 EA	
484 0296 000	* FILTER RFI POWER LINE	1.0 EA	
813 4999 023	STDOFF 6-32X5/16 1/4 HEX	14.0 EA	
839 8118 218	SCHEM, OVERALL PTD SYS	0.0 EA	
917 2435 050	HANDLE, CTLR/DIGIT	2.0 EA	
922 1085 071	CABLE, PT CONTROLLER	1.0 EA	
922 1200 002	CABLE ASSY, RIBBON, 25C	1.0 EA	
922 1203 113	WINDOW, SYSTEM CONTROLLER	1.0 EA	
939 8118 180	COVER, SYSTEM CONTROLLER	1.0 EA	
943 5293 071	FRAME, FRONT PANEL MTG.	1.0 EA	
943 5293 072	REAR PNL, SYSTEM CONTROL	1.0 EA	
943 5293 075	CHASSIS, SYSTEM CONTROL	1.0 EA	
943 5293 646	FRONT PANEL, SYSTEM CONTROL,	1.0 EA	
992 8853 001	PWA, SYSTEM CONTROLLER	1.0 EA	
992 9511 326	DISPLAY BD, ZFM SYSTEM CNTRLR	1.0 EA	

Table 2-7. PWA, SYSTEM CONTROLLER - 992 8853 001

Harris PN	*Description*	*QTY UM*	*Reference Designators (L)*
000 0000 010	B/M NOTE:	0.0 EA	C42 NOT USED
354 0309 000	TERM SOLDER	25.0 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, FEMALE	5.0 EA	
380 0189 000	XSTR, NPN 2N3904 ESD	15.0 EA	Q001 Q002 Q003 Q004 Q005 Q006 Q007 Q009 Q010 Q011 Q014 Q015 Q016 Q017 Q018
380 0190 000	XSTR, PNP 2N3906 ESD	7.0 EA	Q008 Q012 Q013 Q019 Q020 Q021 Q022
382 0184 000	IC, 340T-5/7805 +5V REG ESD	1.0 EA	U019
382 0359 000	IC, 7815 ESD	1.0 EA	U016
382 0360 000	IC, 7915 ESD	1.0 EA	U017
382 0465 000	IC, 74C74 ESD	1.0 EA	U012
382 0605 000	IC 7905C ESD	1.0 EA	U018
382 0711 000	*PRECISION IC MULTIPLIER ESD	1.0 EA	U009
382 0719 000	IC LM324AN ESD	4.0 EA	U005 U006 U007 U008
382 1016 000	*IC, MM74C240N ESD	2.0 EA	U004 U011
382 1017 000	IC, MM74C244N ESD	2.0 EA	U003 U013
382 1070 000	IC, ILQ-1 OPTO-ISOLATOR ESD	1.0 EA	U001
382 1084 000	IC, LP339N ESD	1.0 EA	U010
384 0205 000	DIODE SILICON 1N914/4148 ESD	38.0 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 5082-2800 ESD	15.0 EA	

			CR022 CR023 CR024 CR025 CR026 CR027 CR028 CR029 CR030 CR031 CR032 CR033 CR036 CR037 CR038
384 0357 000	RECTIFIER 1N4004 ESD	14.0 EA	CR007 CR008 CR013 CR014 CR049 CR050 CR061 CR062 CR064 CR065 CR066 CR067 CR072 CR075
384 0610 000	* LED, GREEN T-1 3/4 ESD	4.0 EA	DS001 DS002 DS003 DS004
384 0719 000	TRANSZORB 1N6373 5V 5W ESD	1.0 EA	CR063
384 0720 000	TRANSZORB 1N6377 15V 5W ESD	3.0 EA	CR068 CR074 CR077
384 0743 000	DIODE ARRAY DUAL 8 ESD	3.0 EA	U002 U014 U015
384 0838 000	TRANSZORB 1N6380 36V 5W ESD	2.0 EA	CR070 CR078
384 0854 000	DIODE ARRAY, 8 ISOLATED ESD	2.0 EA	CR001 CR046
386 0085 000	ZENER, 1N4740A 10V ESD	1.0 EA	CR015
404 0303 000	SOCKET IC 10 PIN	1.0 EA	XU009
404 0513 000	HEAT SINK PA1-1CB	4.0 EA	#U016 #U017 #U018 #U019
404 0674 000	SOCKET, DIP, 14 PIN (DL)	9.0 EA	XU002 XU005 XU006 XU007 XU008 XU010 XU012 XU014 XU015
404 0675 000	SOCKET, DIP, 16 PIN (DL)	3.0 EA	XU001 CR001 CR046
404 0767 000	SOCKET, DIP, 20 PIN (DL)	4.0 EA	XU003 XU004 XU011 XU013
494 0218 000	CHOKE, WIDE BAND 2.5 TURN	2.0 EA	RFOC1 RFOC2
506 0230 000	CAP .001UF 100VAC 5%	36.0 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 .1UF 100V 20% X7R	23.0 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%	1.0 EA	C075
522 0524 000	CAP 10 UF 100V 20% NON-POLAR	1.0 EA	C076
522 0548 000	CAP 10UF 50V 20%	6.0 EA	C026 C029 C049 C053 C070 C071
522 0586 000	CAP 3300UF 50V 20%	2.0 EA	C050 C069
526 0109 000	CAP 22UF 25V 20%	2.0 EA	C024 C027
526 0349 000	CAP 2.2UF 50V 20%	4.0 EA	C052 C055 C057 C073
540 0618 000	*RES 2K OHM 2W 10%	2.0 EA	R216 R217
540 1357 000	RES NETWORK 1000 OHM 2%	4.0 EA	R001 R004 R005 R006
540 1366 000	RES NETWORK 100 OHM 2%	6.0 EA	R002 R003 R007 R008 R009 R010
548 2051 000	RES ZERO OHM	5.0 EA	R038 R048 R076 R099 R140
548 2400 201	RES 100 OHM 1/2W 1%	2.0 EA	R020 R163
548 2400 209	RES 121 OHM 1/2W 1%	2.0 EA	R207 R208
548 2400 268	RES 499 OHM 1/2W 1%	1.0 EA	R229 (CR011)
548 2400 273	RES 562 OHM 1/2W 1%	2.0 EA	R220 R221
548 2400 281	RES 681 OHM 1/2W 1%	4.0 EA	R016 R017 R226 R227
548 2400 301	RES 1K OHM 1/2W 1%	13.0 EA	R012 R015 R018 R022 R023 R025 R027 R029 R121 R122 R129 R159 R170
548 2400 318	RES 1.5K OHM 1/2W 1%	3.0 EA	R058 R218 R219
548 2400 327	RES 1.87K OHM 1/2W 1%	5.0 EA	R044 R064 R079 R096 R144
548 2400 330	RES 2K OHM 1/2W 1%	5.0 EA	R154 R164 R166 R174 R176
548 2400 335	RES 2.26K OHM 1/2W 1%	5.0 EA	R036 R054 R069 R106 R117
548 2400 336	RES 2.32K OHM 1/2W 1%	1.0 EA	R130
548 2400 338	RES 2.43K OHM 1/2W 1%	1.0 EA	R057
548 2400 358	RES 3.92K OHM 1/2W 1%	4.0 EA	R071 R089 R104 R135
548 2400 366	RES 4.75K OHM 1/2W 1%	7.0 EA	R019 R034 R056 R067 R108 R111 R187
548 2400 368	RES 4.99K OHM 1/2W 1%	12.0 EA	R035 R049 R055 R066 R068 R075 R086 R087 R107 R110 R114 R133

WARNING: Disconnect primary power prior to servicing.

548 2400 385	RES 7.5K OHM 1/2W 1%	2.0 EA	R160 R171
548 2400 393	RES 9.09K OHM 1/2W 1%	2.0 EA	R128 R131
548 2400 401	RES 10K OHM 1/2W 1%	45.0 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%	1.0 EA	R152
548 2400 439	RES 24.9K OHM 1/2W 1%	5.0 EA	R051 R061 R073 R102 R137
548 2400 447	RES 30.1K OHM 1/2W 1%	5.0 EA	R031 R041 R082 R093 R147
548 2400 466	RES 47.5K OHM 1/2W 1%	22.0 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%	5.0 EA	R042 R062 R081 R094 R146
548 2400 493	RES 90.9K OHM 1/2W 1%	5.0 EA	R032 R040 R083 R092 R148
548 2400 501	RES 100K OHM 1/2W 1%	27.0 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%	5.0 EA	R033 R039 R084 R091 R149
548 2400 566	RES 475K OHM 1/2W 1%	2.0 EA	R162 R172
548 2400 601	RES 1MEG OHM 1/2W 1%	1.0 EA	R194
550 0858 000	TRIMPOT 5K OHM 1/2W 10%	6.0 EA	R080 R088 R095 R145 R158 R197
550 0947 000	TRIMPOT 1K OHM 1/2W 10%	1.0 EA	R132
550 0956 000	TRIMPOT 2K OHM 1/2W 10%	5.0 EA	R037 R045 R078 R097 R143
550 0958 000	TRIMPOT 10K OHM 1/2W 10%	2.0 EA	R161 R169
550 0981 000	TRIMPOT 50 OHM 1/2W 10%	4.0 EA	R070 R090 R105 R134
560 0060 000	MOV, 40WVAC, 3J, 7MM DISC	1.0 EA	RV001
574 0366 000	RELAY DPDT 12VDC	4.0 EA	K001 K002 K003 K004
610 0828 000	*HEADER, 26C TWO ROW VERTICAL	1.0 EA	J011
610 0855 000	*HEADER, 34C TWO ROW VERTICAL	1.0 EA	J013
610 0900 000	HEADER 3 CKT STRAIGHT	9.0 EA	JP001 JP002 JP003 JP004 JP005 JP006 JP007 JP008 JP009
610 1106 000	HDR, 8PIN, 1ROW, STRT,POL	1.0 EA	J012
612 1180 000	*D RECP 15C RT ANGLE	4.0 EA	J002 J003 J004 J005
612 1181 000	*D RECP 25C RT ANGLE	1.0 EA	J001
612 1184 000	SHUNT JUMPER 0.1" CENTERS	9.0 EA	#JP001 #JP002 #JP003 #JP004 #JP005 #JP006 #JP007 #JP008 #JP009
612 1268 000	RECEPTACLE RT ANG BNC	5.0 EA	J006 J007 J008 J009 J010
839 8118 181	SCHEM, PTD SYS CONTROLLER	0.0 EA	
843 5293 076	PWB, PTD SYS CONTROLLER	1.0 EA	

Table 2-8. DISPLAY BD, ZFM SYSTEM CNTRLR - 992 9511 326

Harris PN	*Description*	*QTY UM*	*Reference Designators (B)*
055 0190 009	* COATING 3140 RTV	0.0 EA	
358 3383 000	JUMPER, 0.1" LG, 0.125" H	1.0 EA	JP008
380 0125 000	XSTR, NPN 2N4401 ESD	1.0 EA	Q003
380 0189 000	XSTR, NPN 2N3904 ESD	2.0 EA	Q002 Q004
380 0190 000	XSTR, PNP 2N3906 ESD	2.0 EA	Q001 Q005
382 0401 000	IC, 4028/14028 ESD	1.0 EA	U003
382 0523 000	IC, 4066/14066 ESD	2.0 EA	U009 U010
382 1207 000	IC CD4076B ESD	1.0 EA	U002
382 1208 000	IC CD4070B ESD	4.0 EA	U005 U006 U007 U008

382 1209 000	IC CD4532B ESD	1.0 EA	U001
382 1210 000	IC CD4538B ESD	1.0 EA	U004
382 1211 000	IC ICL7136 ESD	1.0 EA	U011
384 0205 000	DIODE SILICON 1N914/4148 ESD	22.0 EA	CR001 CR002 CR004 CR005 CR010 CR011 CR012 CR013 CR014 CR015 CR019 CR020 CR021 CR022 CR023 CR024 CR025 CR026 CR027 CR031 CR033 CR034
384 0826 000	LED LIGHT BAR, RED ESD	4.0 EA	DS004 DS005 DS006 DS011
384 0827 000	LED LIGHT BAR, GREEN ESD	2.0 EA	DS009 DS010
384 0849 000	LED LIGHT BAR, GREEN ESD	1.0 EA	DS007
384 0850 000	LED LIGHT BAR, RED ESD	2.0 EA	DS003 DS008
384 0858 000	LED LIGHT BAR, YELLOW ESD	1.0 EA	DS013
386 0083 000	ZENER, 1N4742A 12V ESD	1.0 EA	CR028
386 0135 000	ZENER, 1N4733A 5.1V ESD	1.0 EA	CR032
396 0248 002	* LAMP, ELECTROLUM, BL-GN	1.0 EA	EL001
404 0824 000	SOCKET, DIP14, LO PROFILE	6.0 EA	XU005 XU006 XU007 XU008 XU009 XU010
404 0825 000	SOCKET, DIP16, LO PROFILE	4.0 EA	XU001 XU002 XU003 XU004
404 0828 000	SOCKET, SIP18, STRAIGHT	4.0 EA	XDS003 XDS004 XDS005 XD006 XD007 XDS008 XDS009 XDS010 XDS011 XDS013
406 0512 000	DISPLAY, LCD 3-1/2 DIGIT	1.0 EA	DS012
492 0776 000	IND 10,000 UH 10%	1.0 EA	L001
500 1274 000	CAP 51PF 100V 5%	1.0 EA	C003
506 0262 000	CAP, 0.047UF 100V 5%	1.0 EA	C006
516 0484 000	CAP 0.1UF 100V 10%	19.0 EA	C001 C004 C005 C007 C008 C009 C011 C012 C013 C014 C015 C016 C017 C018 C019 C020 C021 C022 C023
522 0581 000	CAP 10UF 35V 20%	3.0 EA	C002 C024 C026
522 0582 000	CAP 100UF 25V 20%	1.0 EA	C025
540 1485 000	RES NETWORK 100K OHM 2%	2.0 EA	R001 R016
548 2400 230	RES 200 OHM 1/2W 1%	1.0 EA	R028
548 2400 234	RES 221 OHM 1/2W 1%	1.0 EA	R008
548 2400 242	RES 267 OHM 1/2W 1%	1.0 EA	R034
548 2400 301	RES 1K OHM 1/2W 1%	1.0 EA	R027
548 2400 312	RES 1.3K OHM 1/2W 1%	10.0 EA	R017 R018 R019 R020 R021 R022 R023 R024 R031 R032
548 2400 366	RES 4.75K OHM 1/2W 1%	1.0 EA	R033
548 2400 401	RES 10K OHM 1/2W 1%	9.0 EA	R006 R007 R010 R012 R014 R015 R025 R026 R035
548 2400 466	RES 47.5K OHM 1/2W 1%	2.0 EA	R004 R011
548 2400 526	RES 182K OHM 1/2W 1%	1.0 EA	R003
548 2400 601	RES 1MEG OHM 1/2W 1%	1.0 EA	R002
548 2400 626	RES 1.82MEG OHM 1/2W 1%	1.0 EA	R009
550 0953 000	TRIMPOT 20K OHM 1/2W 10%	1.0 EA	R005
566 0015 002	* INVERTER, DC TO AC	1.0 EA	U013
604 1119 000	SW PB RED MOM W/O LED	1.0 EA	S011
604 1121 000	SW PB BLUE MOM W/O LED	5.0 EA	S001 S003 S005 S009 S010
604 1125 000	SW PB BLUE W/O LED	1.0 EA	S008
610 0855 000	*HEADER, 34C TWO ROW VERTICAL	1.0 EA	J001
610 0933 000	JUMPER, PWB TEST POINT	12.0 EA	TP001 TP002 TP003 TP004 TP005 TP006 TP007 TP008 TP009 TP010 TP011 TP012
646 0972 000	*LABEL 117V	1.0 EA	#U013
843 5400 651	SCH, DISPLAY/PTD CTRLR	0.0 EA	
843 5400 653	PWB, DISPLAY	1.0 EA	
917 2205 034	FOAM, “LCD” SPACER	1.0 EA	

WARNING: Disconnect primary power prior to servicing.