

**TECHNICAL MANUAL**  
**888-2763-001**

*FlexStar HD-Radio*  
*Generating Platform*

*FlexStar HD-Radio*  
*Generating Platform*



T.M. No. 888-2763-001

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Revision  
Preliminary



## 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; FAX **+1-217-221-7086**; or E-mail questions to ***tsupport@harris.com***.

**Emergency service is available 24 hours a day, seven days a week, by telephone only.**

On-line assistance, including technical manuals, white papers, software downloads, and service bulletins, is available at ***http://support.broadcast.harris.com/eservice\_enu***.

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***.

**NOTE:** For all service and parts correspondence, you will need to provide the Sales Order number, as well as the Serial Number for the transmitter or part in question. For future reference, record those numbers here: \_\_\_\_\_/\_\_\_\_\_

Please provide these numbers for any written request, or have these numbers ready in the event you choose to call regarding any Service, or Parts requests. For warranty claims it will be required, and for out of warranty products, this will help us to best identify what specific hardware was shipped.

## 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*

### *FlexStar HD-Radio Generating Platform Technical Manual*

REV.	DATE	ECN	Pages Affected
Preliminary			Created
0			Review Copy to Service, Engineering, & Safety
A			Release Rev. A



## Guide to Using Harris Parts List Information

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

Example of Replaceable Parts List Index and equivalent tree structure:

Replaceable Parts List Index	Part Number	Page	
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	

```

graph TD
    T["Transmitter  
994 9283 001"] --> CC["Control Cabinet  
992 9244 002"]
    T --> PA_C["PA Cabinet  
992 9400 002"]
    T --> OC["Output Cabinet  
992 9450 001"]
    CC --> CB["Controller Board  
992 8344 002"]
    PA_C --> PA_A["PA Amplifier  
992 7894 002"]
    PA_A --> PA_AB["PA Amplifier Board  
992 7904 002"]
  
```

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.).

**NOTE: 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.*

# FIRST-AID

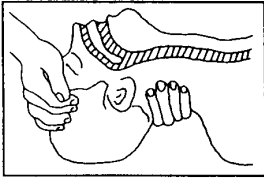
## TREATMENT OF ELECTRICAL SHOCK

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

PLACE VICTIM FLAT ON HIS BACK ON A HARD SURFACE

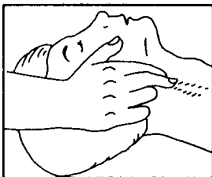
### **(A) AIRWAY**

IF UNCONSCIOUS,  
OPEN AIRWAY



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

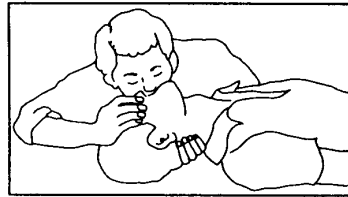
CHECK  
CAROTID PULSE



IF PULSE ABSENT,  
BEGIN ARTIFICIAL  
CIRCULATION

### **(B) BREATHING**

IF NOT BREATHING,  
BEGIN ARTIFICIAL BREATHING



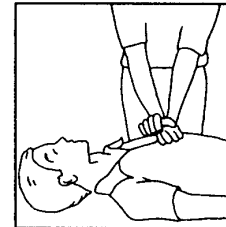
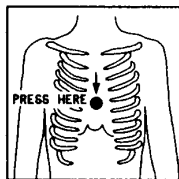
TILT HEAD  
PINCH NOSTRILS  
MAKE AIRTIGHT SEAL  
4 QUICK FULL BREATHS  
REMEMBER MOUTH TO MOUTH  
RESUSCITATION MUST BE  
COMMENCED AS SOON AS POSSIBLE

### **(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

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)



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# Section-1

## Introduction

# 1

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### 1.1 Harris Flexstar Overview

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The HD-Radio components Offered by Harris are a product of the FLEXSTAR line, which includes the HDX FM exciter, HDE-200 Exporter, and the HDI-100 Embedded Importer.

### 1.2 HDx Exciter

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The FlexStar™ HDx is a versatile exciter. The Exciter has a high power (55 watt) main RF output and a low level (10 mw) Aux. RF output. The inputs and outputs are used defined through the touch screen menus. When driven with an Exporter, the outputs can be configured for FM, HD, FM+HD depending on transmitter configuration. The input for HD, from the Exporter (possibly through an STL) is 300 kbps Ethernet for the digital carriers, connected to the "EXPORTER LINK" input. Enter in the Exporter link IP to match that on the Exporter screen

The audio inputs for the FM "analog" must be defined on the set-up screens Select the audio input to correspond with the input provided through your STL link, typically AES audio.

### 1.3 HDE-100 Exporter

---

The FlexStar™ HDE-100 Exporter is required for Main Program Services (MPS). A DexStar Exciter may be repurposed to serve this function but one of the two must be used. The recommended installation location of the Exporter is at the studio. Studio installation requires an STL capable of delivering MPS data to the transmitter site. Examples would be an Intraplex STL or a Mosley Starlink 9003Q with the LAN option. A method of delivering AES audio for main analog and SCA must also be considered. The main input is the AES3 audio (32 kHz to 96 kHz) signal for the MPS (main program service) HD digital program. The Exporter also has an AES3 (32kHz to 96kHz

input and corresponding output for the main FM channel (analog) with a fully adjustable diversity delay. Another input is the MPS PAD data. Secondary input from the HDI-100 Importer is only for supplemental program services (SPS). The outputs of the Exporter are the delayed main channel AES audio and an HD stream of up to 300 kbps (currently this is about 128 kbps) unidirectional UDP Ethernet for the digital carriers.

## 1.4 HDI-100 Importer

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The FlexStar™ HDI-100 Importer is required for any Supplemental Program Services (SPS). It accepts, manages, encodes and multiplexes all Advanced Application Services (AAS) including supplemental audio channels and program associated data (PAD) for transport to the HDE-100 Exporter or to an existing DEXSTAR Exciter. It also manages system bandwidth allocation.

The Importer is a dedicated server running several programs for this purpose. Do not use the Importer for other functions as data collisions resulting in audio drop-outs will result. The Importer will manage the bandwidth allocated for each of the inputs for the digital carriers. The Importer must be co-located with the Exporter. You will need a keyboard, monitor and mouse to set up the software applications. The platform is typically a Pentium 4 PC with windows XP operating system. The Importer works best when not subject to automatic updates or a continuous connection to the public Internet. The inputs are AES audio for each SPS channel to be configured. The Importer output is an Ethernet connection to an Ethernet switch.

## 1.5 The Harris 3 Logical Installation

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### Figure 1-1 Standard System Configuration

Figure 1-1 shows a Logical layout of a "basic system", this system is assumed to be co-located with the FM transmitter and individual audio paths delivered to the transmitting site via co-located studios or other audio\data delivery platforms.

Analog(fm) audio is fed directly from the processor in discrete L\R, Composite, or AES format to the HDX exciter. Diversity delay is accomplished in the Audio processor. (the HDE-200 offers a built-in delay, see the diversity delay portion of this quick start guide for more detail)

HD-1 Audio is fed directly from the processor in AES format to the HDE-200 exporter.

The exporter is directly connected to a Network Switch for Data packet delivery of HD-audio directly to the HDX exciter

HD-2 and 3, Or "Multicasting" Audio is fed to the HDI-100 Importer Via the Lynx audio card inputs 5 and 6 which incorporate an on-board sample rate converter. The HDI-100 importer connects directly to the HDE-200 via the network switch.

44.1khz Word clocking is used to maintain proper AES clock sync between the HDI-100 and the HDE-200 (see section #-# for more information on Audio Sample Rate Sync

10mhz Clock reference is used between the HDE-200 and HDX exciter to maintain proper PLL sync. (see section #-# for more information on PLL sync)

HDE-200 Exporter is GPS Time Locked, Valid GPS signal is required to achieve stable HD audio quality (see Section #-# for more information on GPS connectivity)

### **Figure 1-2 Uni-Directional System Configuration**

Figure 1-2 Shows a Logical layout of a "Uni-directional system", this system is assumed to be off location with the exciter co-located with the FM transmitter and individual FM audio and Data paths delivered to the transmitting site via STL or other Uni-directional path

Option1: Analog(fm) audio is fed directly from the processor in discrete L\R, Composite, or AES format to the STL. Diversity delay is accomplished in the Audio processor. (the HDE-200 offers a built-in delay, see the diversity delay portion of this quick start guide for more detail)

Option 2: Analog audio is sourced from the HDX exciter HAX card, Decoded HD-1 audio transformed into AES audio and routed directly to the Exciters AES input

HD-1 Audio is fed directly from the processor in AES format to the HDE-200 exporter.

The exporter is directly connected to a Network Switch for Data packet delivery of HD-audio directly to STL

HD-2 and 3, Or "Multicasting" Audio is fed to the HDI-100 Importer Via the Lynx audio card inputs 5 and 6 which incorporate an on-board sample rate converter. The HDI-100 importer connects directly to the HDE-200 via the network switch.

44.1khz Word clocking is used to maintain proper AES clock sync between the HDI-100 and the HDE-200 (see section #-# for more information on Audio Sample Rate Sync)

PLL sync is accomplished Via Exporter Sync Packets or Optional exciter GPS (see section #-# for more information on PLL sync)

Uni-Directional Data path requires minimum of 300kb for UDP data delivery (see section #-# for more information on Networking considerations and Section #-# on STL considerations)

HDE-200 Exporter is GPS Time Locked, Valid GPS signal is required to achieve stable HD audio quality (see Section #-# for more information on GPS connectivity)

### Figure 1-3 Bi-Directional System Configuration

Figure 1-3 Shows a Logical layout of a "Bi-directional system", this system is assumed to be off location with the exciter co-located with the FM transmitter and individual FM audio and Data paths delivered to the transmitting site via STL or other Bi-directional path

Option 1: Analog(fm) audio is fed directly from the processor in discrete L\R, Composite, or AES format to the STL. Diversity delay is accomplished in the Audio processor. (the HDE-200 offers a built-in delay, see the diversity delay portion of this quick start guide for more detail)

Option 2: Analog audio is sourced from the HDX exciter HAX card, Decoded HD-1 audio transformed into AES audio and routed directly to the Exciters AES input

HD-1 Audio is fed directly from the processor in AES format to the HDE-200 exporter.

The exporter is directly connected to a Network Switch for Data packet delivery of HD-audio directly to STL

HD-2 and 3, Or "Multicasting" Audio is fed to the HDI-100 Importer via the Lynx audio card inputs 5 and 6 which incorporate an on-board sample rate converter. The HDI-100 importer connects directly to the HDE-200 via the network switch.

44.1khz Word clocking is used to maintain proper AES clock sync between the HDI-100 and the HDE-200 (see section #-# for more information on Audio Sample Rate Sync

PLL sync is accomplished Via Exporter Sync Packets or Optional exciter GPS (see section #-# for more information on PLL sync)

Bi-Directional Data path requires minimum of 512kb for TCP data delivery (see section #-# for more information on Networking considerations and Section #-# on STL considerations)

HDE-200 Exporter is GPS Time Locked, Valid GPS signal is required to achieve stable HD audio quality (see Section #-# for more information on GPS connectivity)

## 1.6 FlexStar Components:

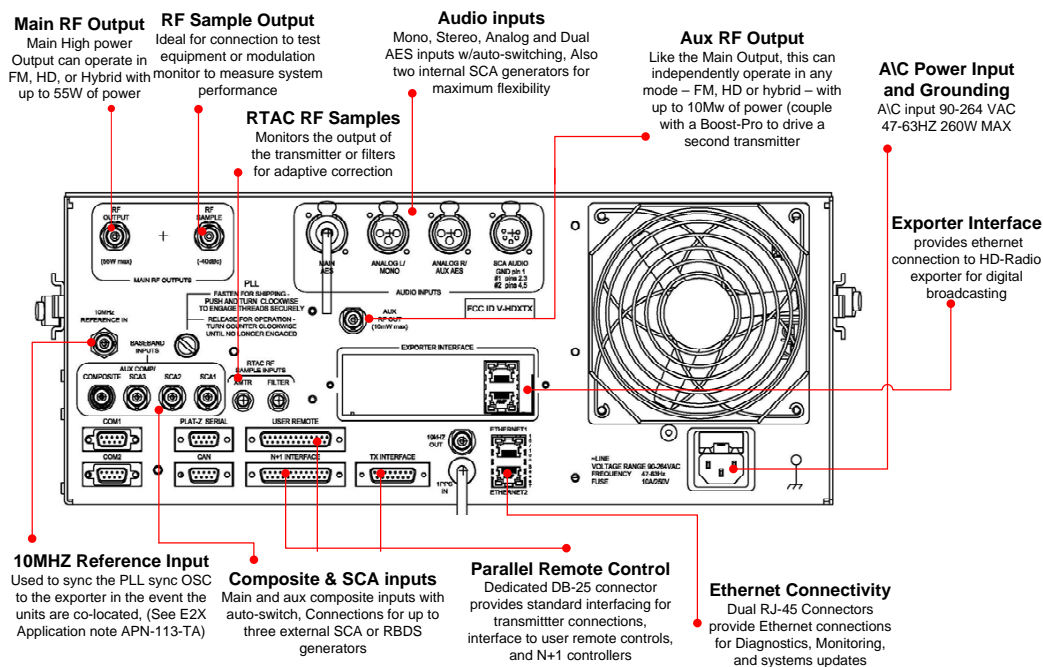
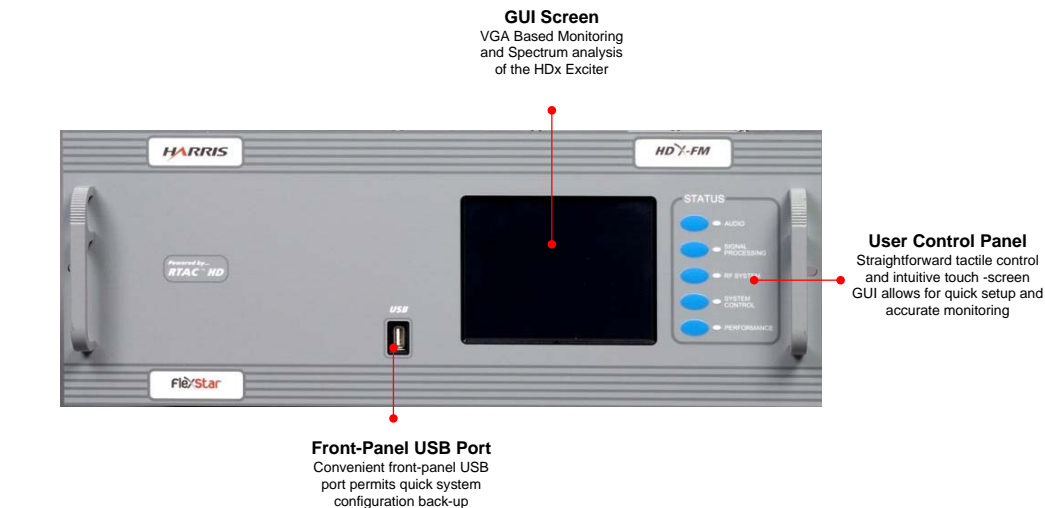
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The FlexStar portion of the system may include one or more of the following devices depending on the studio, STL, and site configuration:

- HDx-FM Exciter
- HDE-200 Exporter
- HDI-100 Embedded Importer

These pieces of equipment will have a their own documentation, possibly including a Corresponding technical manual and schematic package. See that documentation for detailed information regarding specifications, installation, operation, maintenance, theory, and troubleshooting for each specific device.

### 1.6.1 Exciter



**Figure 1-4 Exciter**

(Bench Testing you HDX FM exciter is recommended by Harris Field service for more information please visit Section 2.2 in the HDX instructional book P\N 888-2570-001).

This is an example of the main page; it is a summary screen for the Exciter. Future screens may look different, refer to the on-screen HELP files for specific information on your revision. From the main screen, there are two selections; set-up and status.

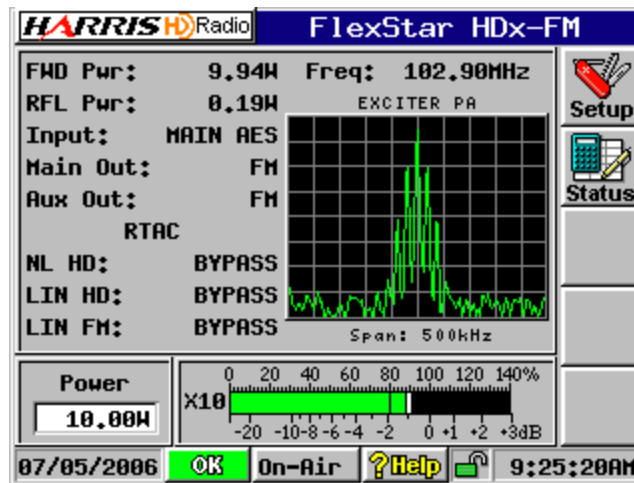


Figure 1-5 Main Screen

The Exciter setup screens are broken down into sub sections; Input, Output, RTAC, Display, Serial, USB, RBDS, Restore Defaults and Setup unlocked. There is also an icon at the bottom of every page which indicates whether setup is locked or unlocked.

⇒ **NOTE:**

When the setup is locked, some setup items are grayed out and cannot be changed.

⇒ **IMPORTANT:**

DO NOT LOCK THE SET UP SCREENS UNTIL YOU HAVE ENTERED A PASSWORD ON THE DISPLAY SETUP SCREEN. KEEP THE PASSWORD IN A SAFE PLACE FOR FUTURE REFERENCE.

When it is unlocked and you press the Setup LOCK button, a popup window will ask you whether you really want to lock the exciter. If you press YES, the setup screens will be locked to prevent further adjustments. Have a password entered in the display setup screen ahead of time.





Figure 1-6 Exciter Setup Screen

When the setup screens are locked and you press the setup unlock button, a popup keyboard will allow you to enter the password to unlock the setup screens.

### 1.6.1.1 Input Setup

#### ⇒ NOTE:

Window parameters will be grayed out when they are not available for adjustment. Example; when the Composite input is disabled, the adjustments associated with it are grayed out since they are irrelevant. When enabled, these windows will not be grayed out and will allow user interaction.

The Input Setup screens select the input audio sources and you select the priority of the sources; primary and backup. These inputs are physically at the XLR and BNC boards on the rear of the Exciter. Select between; Main AES, Aux. AES or the main composite as the primary inputs. This switching can be automatic or manual. Select the length of time the exciter waits until it switches and the threshold that the input must fall to before it switches (in automatic switch mode). It is a one-way switch - main to backup - it will NOT switch back to the main if that signal resumes. That requires operator intervention.

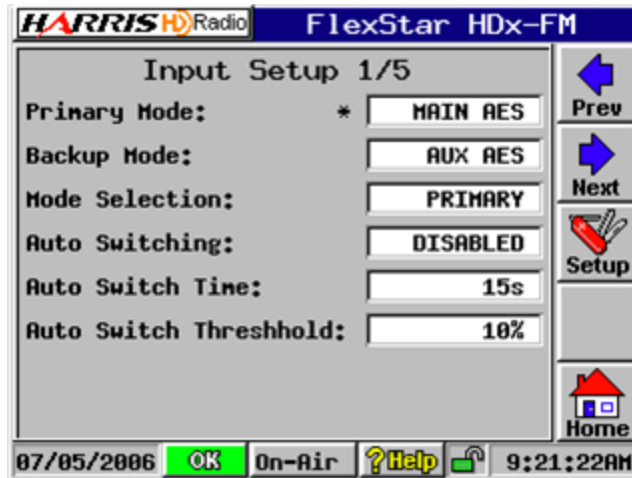


Figure 1-7 Input Setup Page-1

⇒ **NOTE:**  
Composite Baseband inputs are NOT automatically switched

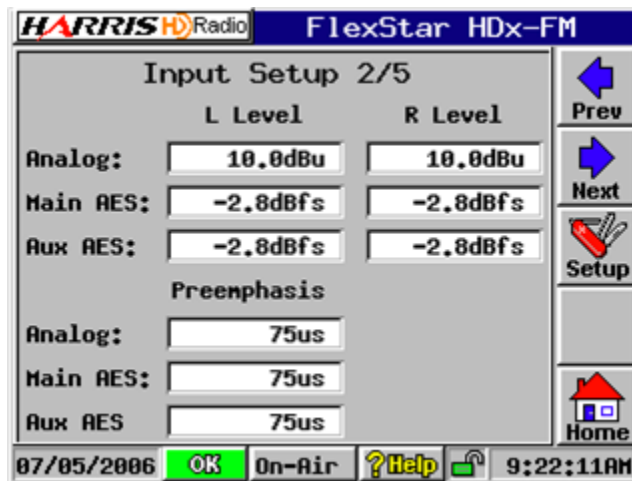


Figure 1-8 Input Setup Page-2

The pre-emphasis is selectable between 50 microseconds, 75 microseconds or no equalization.

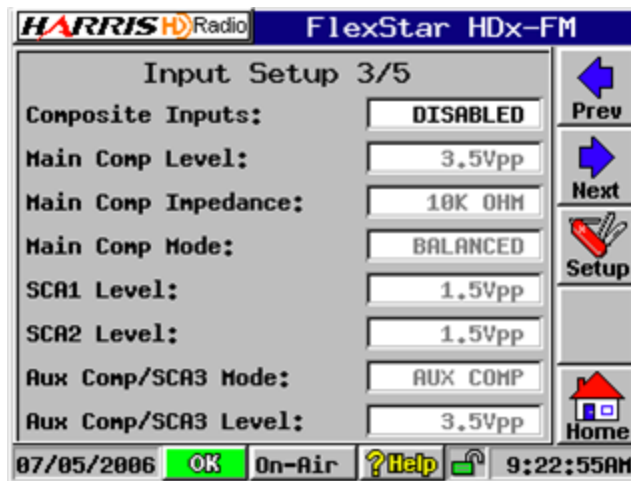


Figure 1-9 Input Setup Page-3

On this page, you can ENABLE/DISABLE the wideband composite inputs. There are separate input level adjustments for SCA1 and SCA2, to attain 10% modulation. When applying an externally modulated composite signal, you can configure that input for balanced or unbalanced input, input impedance of 50 ohms or 10k ohms. The Main Comp Level sets the gain of the total composite signal before the NCO, which controls the total deviation of the FM signal. Refer to the on-screen HELP files or the list at the end of this chapter for assistance in these settings.

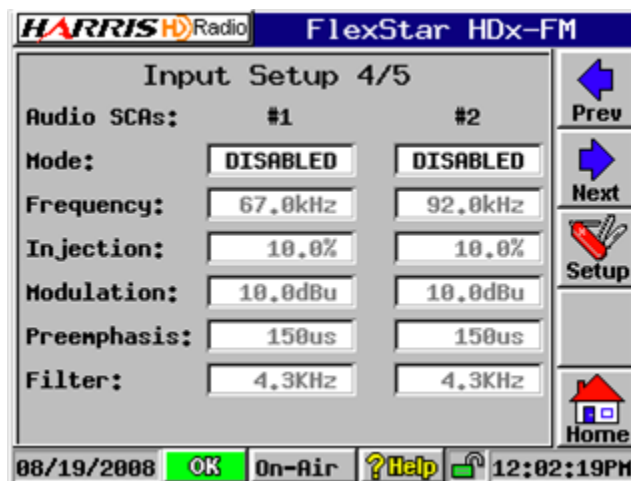


Figure 1-10 Input Setup Page-4

This page sets the 2 dedicated SCA inputs' parameters.



Figure 1-11 Input Setup Page-5

The Audio Low Pass Filter is selectable between 15 kHz, 17 kHz, or BYPASS.

### 1.6.1.2 Output Setup

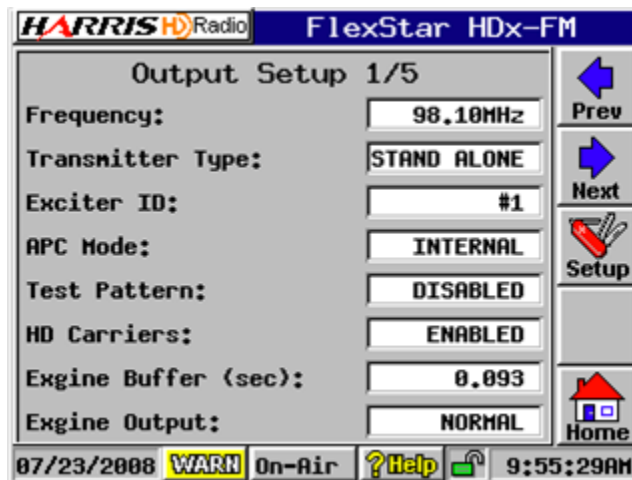


Figure 1-12 Output Setup Page-1

The output setup screens are where you select the carrier frequency of the Exciter and the power output desired for each available mode of operation. Select the transmitter type, this will preset parameters in the Exciter to optimum values for that particular transmitter type. After those have been loaded, you may modify the settings from that

starting point and save them as a "Custom" setting. It's advisable to save these to a USB jump drive (DO NOT use a jump drive previously formatted for Linux operating system). If your transmitter is not listed, select the transmitter most similar to your transmitter and customize it from there.

With version 2.43 of the FlexStar Engine, support for TCP/IP communications is now available. Detection of either UDP or TCP is done automatically within the Engine (Note status in upper right hand of Figure 3-13 on page 3-20). Support for TCP connections required additional buffering of the E2X data stream coming from the Exporter. A maximum of 1400 ms of buffering was added to assure robust connection across typical networks. This additional buffering may now place the total required diversity delay beyond the capabilities for some 3rd party external delay units. A configuration control has been added on page 1 of 5 of the output setup screen to allow reduced buffering to accommodate diversity delay units of less than 10 seconds duration.

In TCP mode, the default buffer depth is 15 blocks or (15 x .93 sec.) 1.4 seconds. In UDP mode, the default buffer depth is 2 blocks or 185ms. Adjustment of the buffer depth is accomplished by using the dropdown box on the Engine Buffer box and may be decreased in 93ms steps. It is suggested that this setting be left to DEFAULT unless absolutely necessary, only the minimum reduction required to accommodate the delay as reducing this buffer may have an adverse affect on network connections resulting in digital signal dropouts.

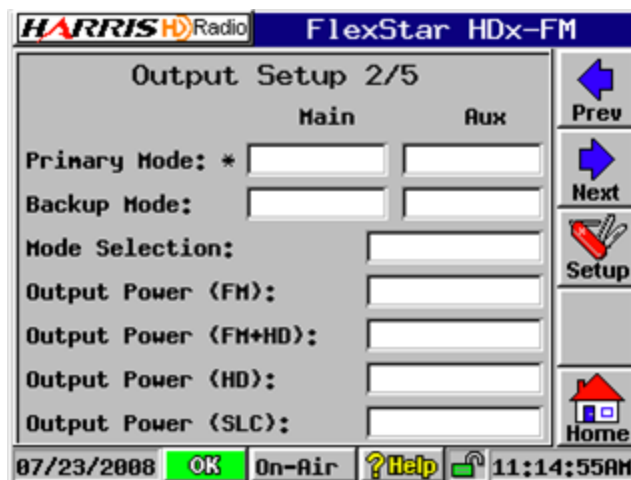


Figure 1-13 Output Setup Page-2

On page 2, you also configure the main and auxiliary outputs by selecting the desired signals; FM only, HD only or FM+HD.

**⇒ NOTE:**

**TEST PATTERN:** is for testing only. Be sure to restore the Exciter to "normal" operation upon completion of testing that may have changed any of the following settings. *If one or more of these parameters are set incorrectly, it will result in loss of HD carriers.*

**TEST MODE:** The HD carriers can be internally generated for initial testing by making the following parameter selections on the exciter's Output Setup, page 1:

- Test Pattern: ENABLED
- HD Carriers: ENABLED
- Exgine Input: INTERNAL
- Exgine output: PATTERN

**NORMAL OPERATION:** The following settings must be in place in order to transmit digital carriers.

- Test Pattern: DISABLED
- HD Carriers: ENABLED
- Exgine Input: EXPORTER
- Exgine Output: NORMAL

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 that may be used in a typical IBOC system including a backup mode.

1. FM - Analog RF only. This could be the analog backup mode used during a digital failure.
2. HD - Digital RF only. Used for Separate combining.
3. FM+HD - Analog and digital (at -20dB ratio) RF. Also used for common amplification.
4. SLC - Analog and digital (at various ratios) RF. Also known as Split-Level Combining. A "Feature Key" must be obtained to enable this feature. Using pull-down menus, both the main and auxiliary outputs can be configured with different signals. An Exciter that has the optional Exgine board and dual D/A converter and dual D/A filter boards has the most flexibility on output configuration. Refer to the table below. On the upgraded Exciter with Exgine, the main path can be configured for FM only, HD only, FM+HD or SLC FM modes. For each of those modes, the auxiliary pull-down windows will configure to the allowable choices listed below.

- FM Main output mode

The FM only output is used for analog FM broadcasting only. The dual FM mode (FM on Main and on Auxiliary output) is used for dual-transmitter operation. For high level combining FM Main and HD Aux is selected. Use of the aux output with any signal other than the same as the main requires dual D/A converter and dual D/A filter boards.

- HD Main output mode

The HD only mode is for stand alone HD operation. HD Main and HD Aux is selected for dual-transmitter HD operation. Use of the aux output requires a dual D/A filter board.

- FM+HD mode

FM+HD mode is used for low level combining, common amplification or dual transmitter low level combining. The HD carriers are typically 20 dB below the analog carriers and are adjustable.

- SLC mode

FM on the main and FM+HD with various ratios on the auxiliary would be used for Split Level Combining where there is an FM transmitter and an FM/HD transmitter combined with a high power combiner. Use of the aux output requires dual D/A converter and dual D/A filter boards along with a Boost Pro amplifier. The feature key is on a label on the side of units shipped with this feature enabled.

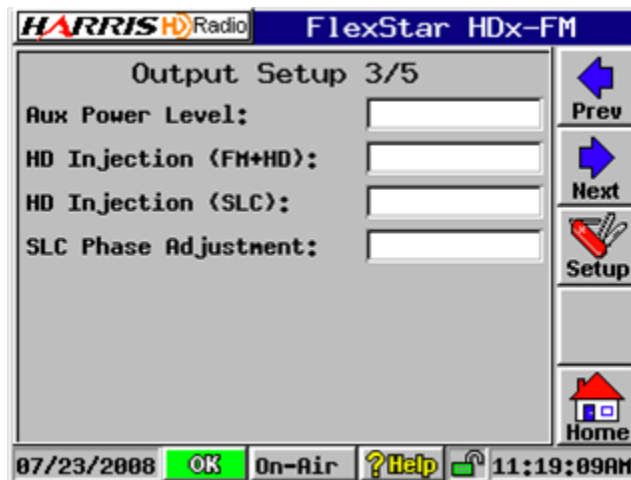


Figure 1-14 Output Setup Page-3

Pilot injection level adjusts the 19kHz pilot injection. HD Injection level sets the ratio of the HD carriers to the FM carrier.

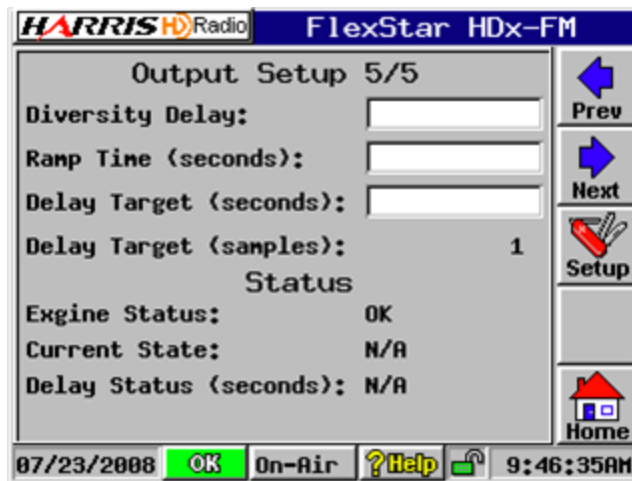


Figure 1-15 Output Setup Page-5

### 1.6.1.3 RTAC

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The HDx-FM Exciter is designed to be able to cope with different signals, (IBOC, FM and IBOC+FM), in different transmitters (Z's and tubes), in radically different installations (SLC vs. Separate combine for instance) and with several different sampling rates. All of these factors require of a very broad set of system characteristics that both the algorithm and pre-corrector must cope with for successful operation of the adaptive pre-correction (RTAC).

With all these demands, it is not possible to model and solve all possible combinations using a single set of parameters. Therefore, simple systems will require fewer parameters while more complex ones will require more. For instance, to deal with the equalization of a mild output filter is not as much of a problem, and doesn't require as many coefficients to equalize as it would be the case of a sharp tune filter. As an example, 3 to 5 coefficients are used to resolve a "memory-less" non linear amplifier/transmitters while 6-8 coefficients are used to cope with more complicated, "memoryfull" amplifiers. Although it might appear as if selecting the highest number of coefficients will work as a "snake oil" to all problems, reality (and theory as well) has shown to be completely the opposite. Selecting a number of coefficient greater than required, besides making the estimation slower, tends to render coefficients with higher numerical error and more general instability, so this makes the estimation from one run to the next more prone to variation in results and ultimately instable. Hence the golden rule for the number of coefficients is: Use as many coefficients as you need but not more. A common sense approach will be for the nonlinear case to start by using 3 coefficients and wait. If after ~5 runs a sufficient degree of correction is obtained then you're finished. Only switch to a higher number of coefficients if sufficient correction was not achieved. A typical indication of a system where too many coefficients are



being used is the occurrence of error 261 (COEFFICIENT OUT OF BOUND) for 25% or more of the counts.

## 1.7 Exporter

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## 1.8 Importer

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The Importer is server-grade PC running Windows XP Professional operating system, with software provided by iBiquity.

Configuration consists of both hardware and software configuration for your particular application. The Harris Importer is configurable to perform with one or two audio channels at different bit rate allocations.

See "2.5 Quick Start - Bench Test" on page 2-3 of the Exporter tech manual for more information on first Bench Testing the Exporter and Exciter connectivity.



# Section-2

## Installation

# 2

### 2.1 Installation

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Getting ready for the installation:

#### 2.1.1 10 THINGS TO THINK ABOUT BEFORE INSTALLING HD SYSTEMS

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**1. Have you completed a site survey to determine if any site changes are required?**

- "On-line type UPS for Exciter, Audio Processors, Ethernet, STL, Remote Control, etc
- "AC mains service panel size and OSHA considerations.
- "Remote control capacity and configuration
- "Room lighting
- "Work surface
- "Telephone service with headset phone for accessing support.
- "Size of building
- "Storage of documents and spare parts

**2. Do you have experience in installation of Transmitters and Transmission line?**

- "Site grounding configuration
- "Tools and craft skills to cut and assemble rigid line.
- "Coordinate with electrician to connect AC service to transmitter.
- "Any tower/antenna work considerations/tower crew contacted.

**3. Have you considered the additional heat gain in your building when adding the HD equipment?**

- "Temperature alarm connected to remote control
- "Redundant cooling equipment
- "drip pan with drain for split systems to protect equipment below evaporator

- "Reject loads (if used) location.
  - "Addition HVAC may be needed.
- 4. Do you own or have access to test equipment to measure and monitor HD performance?**
- "High dynamic range digital spectrum analyzer with averaging and narrow RBW.
  - "HD receiver with split mode
  - "Does the site have non-functioning test equipment that needs removal?
- 5. Do you have test equipment to verify AES audio?**
- "Verify; rate, status bits and no errors
  - "Monitor and listen for audio problems
- 6. Have you considered the method that you will transport your HD audio to the transmitter site?**
- "Need two paths for a full system; AES and 300 kbs Ethernet
- 7. Have you considered the integration of the HD equipment with your existing transmitter plant?**
- "AES audio sources in studio
  - "Audio processor with additional output for HD.
  - "IT expertise to connect to an audio automation system for song title and artist name.
  - "Ethernet/LAN integration with sub-netting and routing.
- 8. Have you verified your current antenna system is working properly?**
- "Wide enough bandwidth
  - "Low VSWR across the channel
  - "Centered on channel
  - "Determine if group delay in combiner can be corrected by the FlexStar HDX exciter
- 9. Do you have internet access at your Station and transmitter site?**
- "To access support documents and software updates
- 10. Have you attended a formal training seminar on IBOC theory?**
- "Understanding Digital delivery
  - "Understanding the equipment
  - "Understanding the spectral use

Visit our Harris Service web site for more tips on HD Radio installation, measurements, performance and maintenance.

## 2.1.2 STL considerations

When selecting an STL, the minimum requirements for the STL, it has to pass 32 kHz AES audio and 192Kbps UDP. Future systems with expanded HD capability will need to pass 300 kbps UDP only. Other methods to send the information to the transmitter site include T1/E1, direct fiber or Satellite.

## 2.1.3 Diversity Delay

Analog and Digital stations also known as Hybrid systems carry the same Programming on HD-1 as there traditional FM, the IBOC HD-radio receiver will blend to the FM(MPS) in the event the digital signal is poor. The Blending is intended to mirror the digital and analog audio in a specific delay (in 44.1khz samples) through "Diversity Delay" applied to the Fm audio to compensate for the encoding and Decoding of the HD-1 in the Exporter, Exciter and receiver.

Diversity Delay is actually the sum of all delays in the system including average transit time. A network connection which has considerable time jitter or packet loss may exhibit variable latency which will reduce the systems total diversity delay timing.

## 2.1.4 Networking

The FlexStar Network comprises Ethernet traffic between Importer, Exporter, and engine. Traffic between FlexStar devices



# *Section-3*

## *Operation*

# 3

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### 3.1 Section-3

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#### 3.1.1 Information

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# *Section-4*

## *Parts List*

# 4

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### 4.1 Parts List

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# Section-5

## Troubleshooting

# 5

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### 5.1 Malfunction Resolution

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#### 5.1.1 Restoring/reloading operating system

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**▲ WARNING:**  
*THIS IS AN EMERGENCY OPERATION ONLY. DO NOT ATTEMPT TO LOAD THE OPERATING SYSTEM OR SOFTWARE UNLESS A TOTAL SET UP IS DESIRED. LOADING THESE ONTO YOUR IMPORTER WILL EFFECTIVELY OVER WRITE ALL PREVIOUSLY INSTALLED OPERATING SYSTEMS AND SETTINGS. AFTER THE OPERATING SYSTEM HAS BEEN RESTORED IN THIS MANNER, THEN A SOFTWARE UPGRADE IS NEEDED TO GET IT TO THE CURRENT SOFTWARE VERSION.*

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#### 5.1.1.1 Windows XP Ghost install

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