GRASS VALLEY GROUP

Instruction Manual

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8916
AES/EBU AUTO-TRACKING DELAY DA

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Preface

About This Manual

This manual describes the features of a specific module of the 8900 Series Modular Products family. As part of this module family, it is subject to Safety and Regulatory Compliance described in the 8900 Series frame and power supply documentation (see the *8900TX/8900TF/8900TFN Frames Instruction Manual*).

8916 AES/EBU Auto-Tracking Delay DA

Introduction

The 8916 Auto-Tracking DA is a 1 x 7 distribution amplifier for AES/EBU serial digital audio. It delays digital audio to correct lip-sync errors. The 8916 offers two forms of delay, which are summed:

- A fixed delay up to 0.5 seconds
- A variable delay based on the signal input from a Grass Valley video frame synchronizer

The 8916 can correct a large, fixed lip-sync error while continuously adjusting audio delay to match video delay created by a frame sync's asynchronous video input.

The 8916 offers the following features:

- Up to 0.5 second delay in 2 ms increments
- Auto-tracks Grass Valley video frame sync delays (models 8900FSS, SMS 8121-FS, 8981FS, VFS211, and 8960DEC)

Note Early versions of the 8960DEC did not support the export of the auto-track signal. Contact Grass Valley customer service for more information regarding 8960DEC frame sync.

- Seven 75 Ω outputs
- Module is part of the 8900 family of audio and video modules
- Supports remote control in 8900 networking frames
- Offers remote control lockout using an on-board jumper

Installation

Installation of the 8916 module is a process of:

- Placing the module in the proper frame slot, and
- Cabling and terminating signal ports.

The 8916 module can be plugged in and removed from an 8900 Series frame with power on. When power is applied to the module, LED indicators reflect the initialization process (see *Power Up* *on page 5*).

Frame Capacity

The maximum number of 8900 modules allowed in a frame is determined by frame cooling capacity. Table 1 provides the power capacity, cooling capacity, and maximum module count for the 8916 in each frame type.

Table 1. Power, Cooling, and Module Capacity of 8900 Frames

Capacity Calculated	8900T2 Frame	8900T2-F Frame	8900TX Frame	8900TF Frame	8900TFN Frame
Power (W)	60	60	100	100	100
Recommended Module Cooling (W)	30	60	30	90	90
8916 Modules	8	10	8	10	10

Note Module capacity figures assume no other modules are in the frame. If the maximum number of modules a frame can handle is less than ten, provide as much space between the modules as possible.

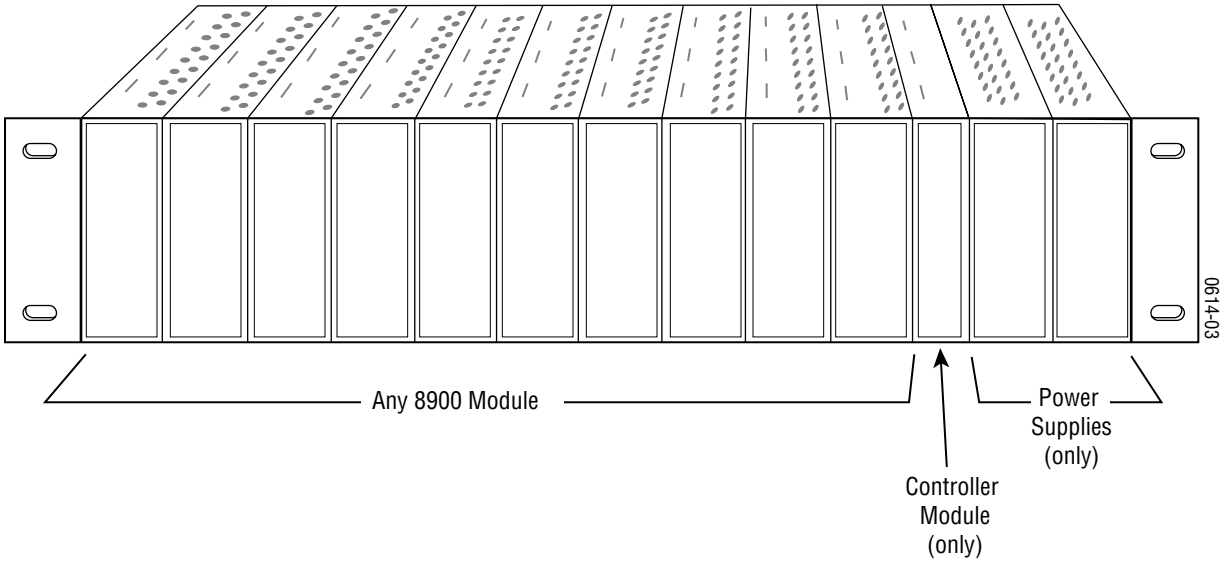
Module Placement in the 8900 Frame

There are ten slot locations in the frame to accommodate either analog or digital modules. These are the left ten locations. Refer to Figure 1.

The two slots on the right are allocated for the power supplies. For additional information concerning the Power Supply module, refer to the 8900 Power Supply manual.

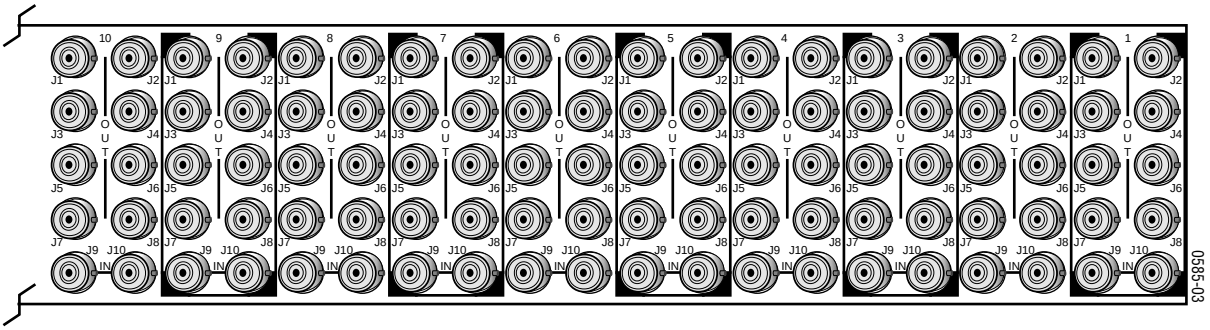
The third slot from the right is allocated for the Controller module. This module provides an interface for the SMPTE 269M fault reporting (health alarm). For additional information concerning the Controller module, refer to the 8900 Controller manual.

Figure 1. 8900 Series Frame



8900 modules are interchangeable within the module slots. There are 10 BNC connectors in each slot's I/O group. The functional assignment of each connector in a group is determined by the module that is placed in that slot. The maximum number of modules an 8900 frame can accept is ten. Figure 2 illustrates the rear connectors for an 8900 Series frame.

Figure 2. 8900 Series Frame Rear Connector



Note At the back of this manual are die-cut overlay cards that can be placed over the rear connector BNCs to identify the specific 8916 connector functions.

To install a module in the frame:

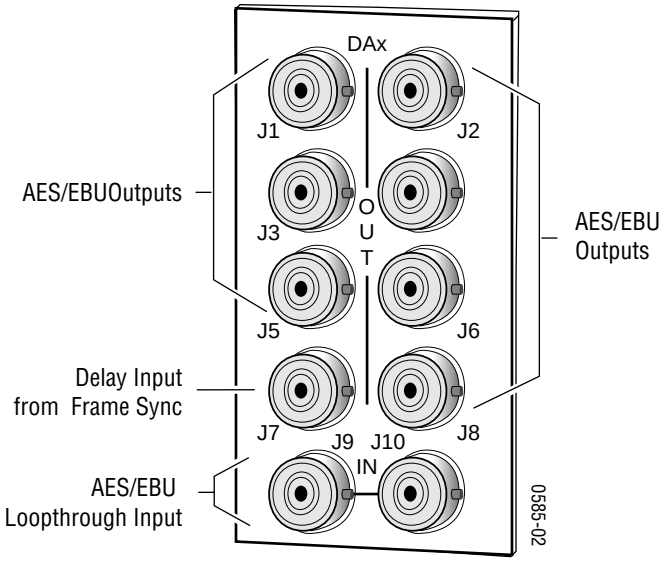
1. Insert the module, connector end first, with the component side of the module facing to the right and the ejector tab to the top.
2. Verify that the module connector seats properly against the backplane.
3. Press the ejector tab in to seat the module in place.

Cabling

Loop-through Input

Connect an input source to one of the loop-through input connectors, J9 or J10 (see Figure 3). The 8916 input will accept AES3id/EBU audio. Terminate the unused connector into 75 Ω if the signal is not looped to other equipment.

Figure 3. 8916 *Input/Output Connectors*



Outputs

The 8916 has seven AES/EBU serial digital output connectors—J1 through J6, and J8. The destination equipment should have a 75 Ω input impedance or loop through inputs that are terminated into 75 Ω.

Delay Input

A delay signal input BNC (J7) is provided for a reference signal from a Grass Valley video sync generator (see Note page 1).

Power Up

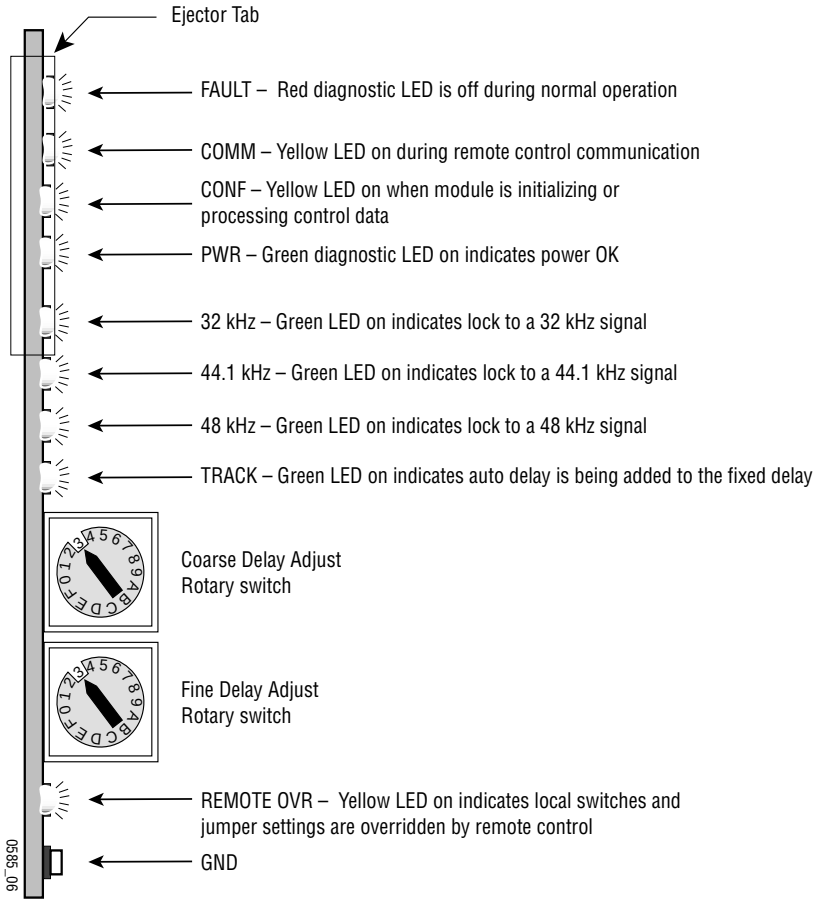
The various front LED indicators and configuration switches are illustrated in Figure 4. Upon power-up, the green PWR LED should light and the yellow CONF LED should illuminate for the duration of module initialization.

Operation Indicator LEDs

With factory default configuration and a valid input signal connected, the green PWR LED, the yellow TRACK, and one of the green signal rate LEDs should illuminate (refer to Table 2 on page 6 to see the possible operating indicator combinations).

Audio input presence is indicated by the 32 kHz, 44.1 kHz, or 48 kHz LED (indicating the module has locked to the indicated signal rate).

Figure 4. LEDs and Configuration Switches



A red FAULT LED indicates an error situation and, with the previously described LEDs, can indicate the operational conditions presented in Table 2. The table describes signal output and LED indications for various input/reference combinations and user settings.

Table 2. Indicator LEDs and Conditions Indicated

LED	Indication	Condition
Fault (red)	Off	Normal operation
	On continuously	Module has detected internal fault
	Long flash	Configuration problem: Check inputs and settings
	Short flash	CRC (cyclic redundancy check) error detected
COMM (yellow)	Off	No activity on frame communication bus
	Long flash	Location Command received by the module from a remote control system
	Short flash	Activity present on the frame communication bus
CONF (yellow)	Off	Module is in normal operating mode
	On continuously	Module is initializing, changing operating modes or updating firmware

Table 2. Indicator LEDs and Conditions Indicated - (continued)

LED	Indication	Condition
PWR (green)	Off	No power to module or module's DC/DC converter failed
	On continuously	Normal operation, module is powered
32 kHz (green)	Off	Sample rate is not near 32 kHz
	On Continuously	Sample rate is 32 kHz ±400 ppm
	Flashing	Sample rate is 32 kHz ±4%
44.1 kHz (green)	Off	Sample rate is not near 44.1 kHz
	On Continuously	Sample rate is 44.1 kHz ±400 ppm
	Flashing	Sample rate is 44.1 kHz ±4%
48 kHz (green)	Off	Sample rate is not near 48 kHz
	On Continuously	Sample rate is 48 kHz ±400 ppm
	Flashing	Sample rate is 48 kHz ±4%
REM OVR (yellow)	Off	Module configuration is by the module's on-board switches and jumpers
	On continuously	Module configuration is by remote control and on-board switches and jumpers are overridden
Tracking (yellow)	Off	Fixed delay only
	On continuously	Total operating delay is the sum of fixed and auto delay from frame sync delay input. Front panel switches do not indicate total delay in this mode.

Configuration

The 8916 can be configured locally using onboard switches or remotely using the 8900NET network interface. Configuration establishes:

- Delay setting
- Active or locked out remote control

Onboard Module Configuration

The 8916 can be configured using the rotary switches illustrated in Figure 5.

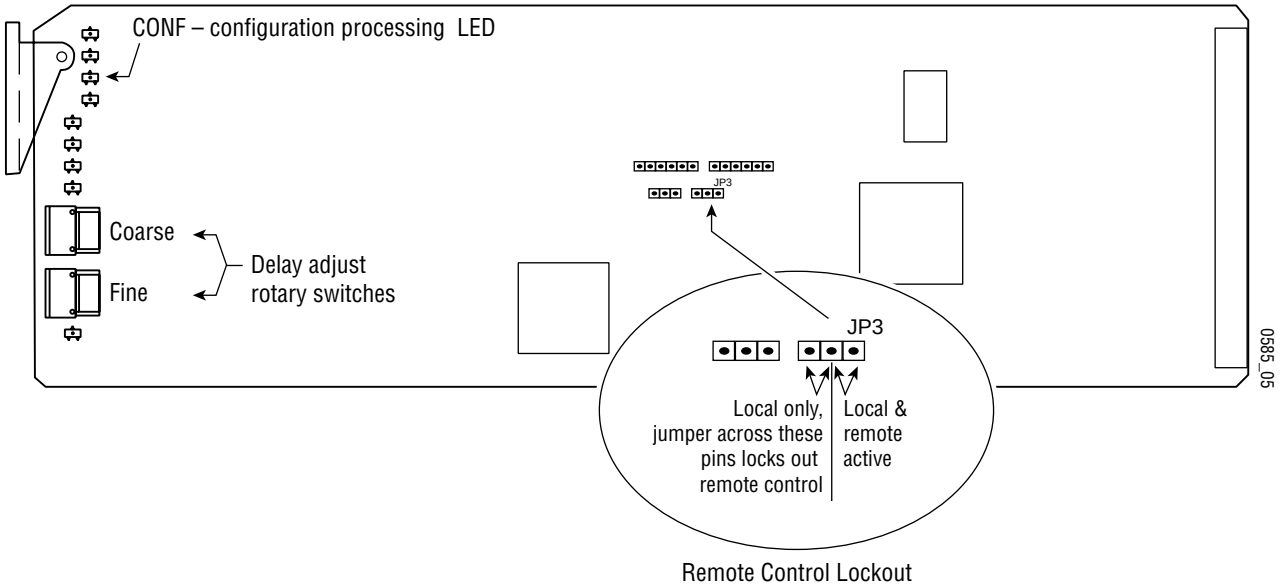
Delay Setting

For an AES/EBU signal the FINE switch delay increments are 2 ms (1/16 video frame), and the COARSE switch delay increments are 32 ms (one video frame). Each switch can select up to 15 times its increment to create a total delay of approximately 510 ms.

Remote Control Lockout

To make the 8916 module delay settings adjustable from the on-board switches only, place a jumper across the Local Only pins on jumper block JP3 illustrated in Figure 5. To have both Local and Remote access, set the jumper on the two pins on the right side of the three-pin block.

Figure 5. Delay Adjustment Switches and Remote Lockout Jumper



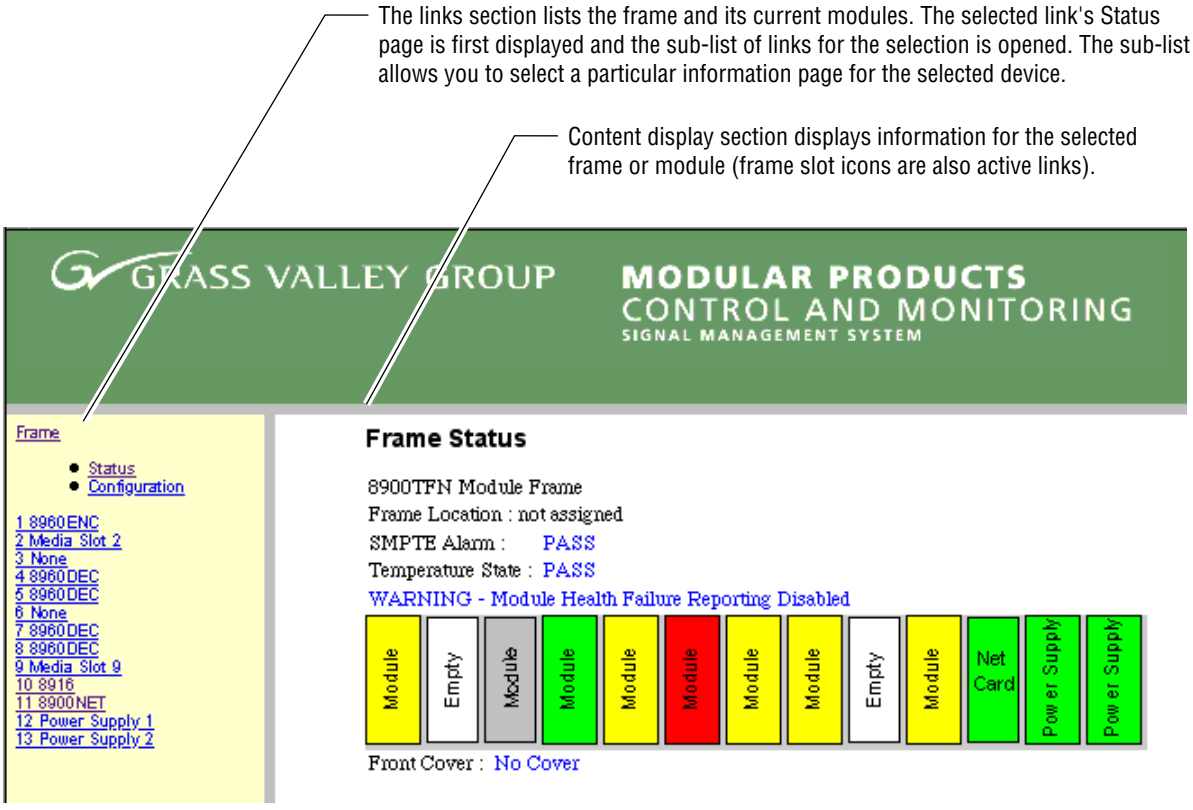
Remote Configuration and Monitoring

8916 configuration and monitoring can be performed using the 8900NET interface in 8900TF or TFN frames (see Figure 6). This section describes the GUI access to the module configuration functions. Refer to the 8900NET Network Interface Module Instruction Manual for information on setting up and operating the 8900 frame network.

For remote access, make sure the jumper block on the module is set to the pins on the right for both Local and Remote access (Figure 5).

Note The physical appearance of the menu displays shown in this manual represent the use of a particular platform, browser and version of 8900NET module software. They are provided for reference only. Displays will differ depending on the type of platform and browser you are using and the version of the 8900NET software installed in your system.

Figure 6. 8900NET GUI



The 8900 modules can be addressed by clicking on a specific module icon in the frame status display or on a module name or slot number in the link list on the left.

The 8916 will indicate a SMPTE Alarm fault on the Frame Status display for the following alarms:

- Lack of valid audio input,
- Internal Fault, or
- Board Failure.

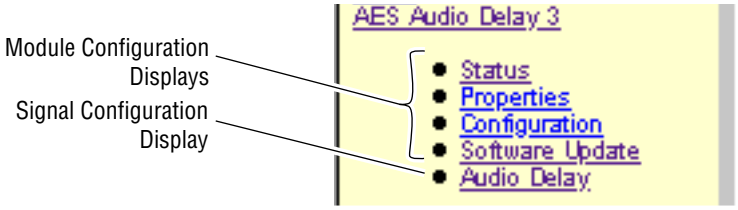
Module Configuration Displays

The 8900 GUI provides the following links and displays for the 8916 module. The module name shown in Figure 7 is "AES Audio Delay 3" (slot number and module type). The name is user determined and is assigned using the module's Configuration display. The four module configuration displays provide:

- Module operational status information,
- Module properties (part and version numbers),
- Module configuration information (location and user assigned names), and
- Software update (file transfer).

These displays are the same for all remote controllable 8900 modules. Refer to the 8900NET manual for more information on these displays. Some functions listed may not be supported by a particular module. These will be indicated as not supported.

Figure 7. 8960DEC Display Links



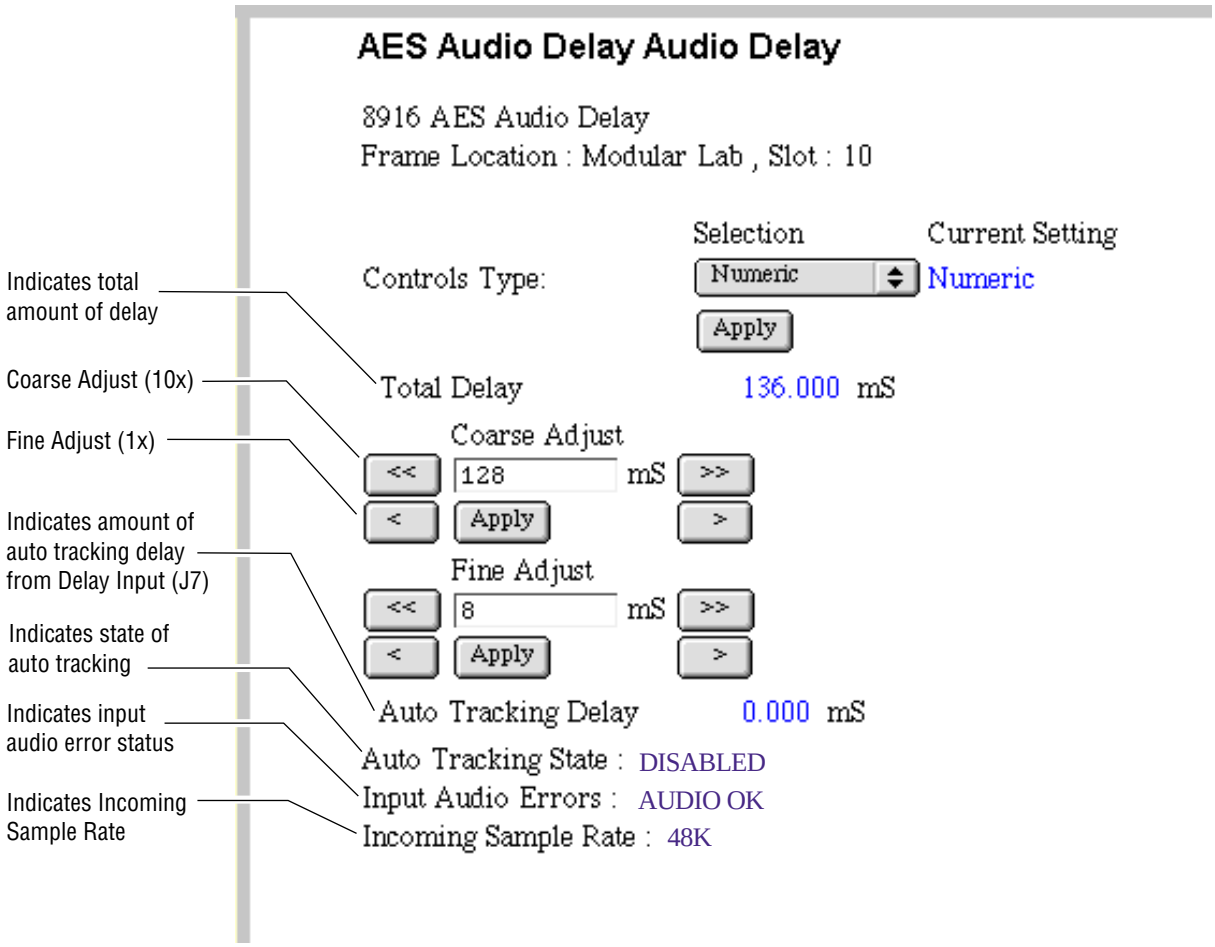
Signal Configuration Display

This section discusses the Audio Delay display in the Signal Configuration Display section used to set the amount of audio delay required in the 8916 module. You may set the audio delay using either the Numeric (Figure 8) or Slider (Figure 9) adjustment mode. In either display mode, the changes do not take place until the Apply button is clicked and the display is refreshed.

For an AES/EBU signal the FINE delay increments are 2 ms (1/16 video frame), and the COARSE delay increments are 32 ms (one video frame). Any settings selected will default to the nearest 2 ms or 32 ms increment. Each adjustment can select up to 15 times its increment to create a total delay of approximately 510 ms.

Figure 8 illustrates the Audio Delay display in numeric adjustment mode.

Figure 8. Audio Delay Display, Numeric Mode



Set the amount of delay in Numeric mode by entering a number in the Coarse Adjust and Fine Adjust boxes or use the arrow keys to change the values. The number will default to an increment of 2mS (Fine) or 32 mS (Coarse). The single arrows will increment the value by 1x and the double arrows will increment the value by 10x.

Note Numeric displays are for approximate values only. Calculation of displayed values are subject to decimal place truncation. Variation from the absolute value increases at higher values.

Use the Apply button to make the selections active.

The sum of the Coarse, Fine and Auto Tracking delay will appear in the Total Delay display above the Coarse and Fine Adjust.

Below the Coarse and Fine Adjust displays are the following indicators giving module information:

- Auto Tracking Delay: Amount of auto tracking delay in mS from the Frame Sync Delay Input BNC (J7).
- Auto Tracking State: Enabled or Disabled.
- Input Audio Errors: Audio OK, Out of Range, GT (Greater Than) 4 Percent 48K, GT 4 Percent 44.1K, or GT 4 Percent 32K.
- Incoming Sample Rate: 48K, 44.1K, 32K or Invalid.

Figure 9 shows the display for setting the delay in Slider mode.

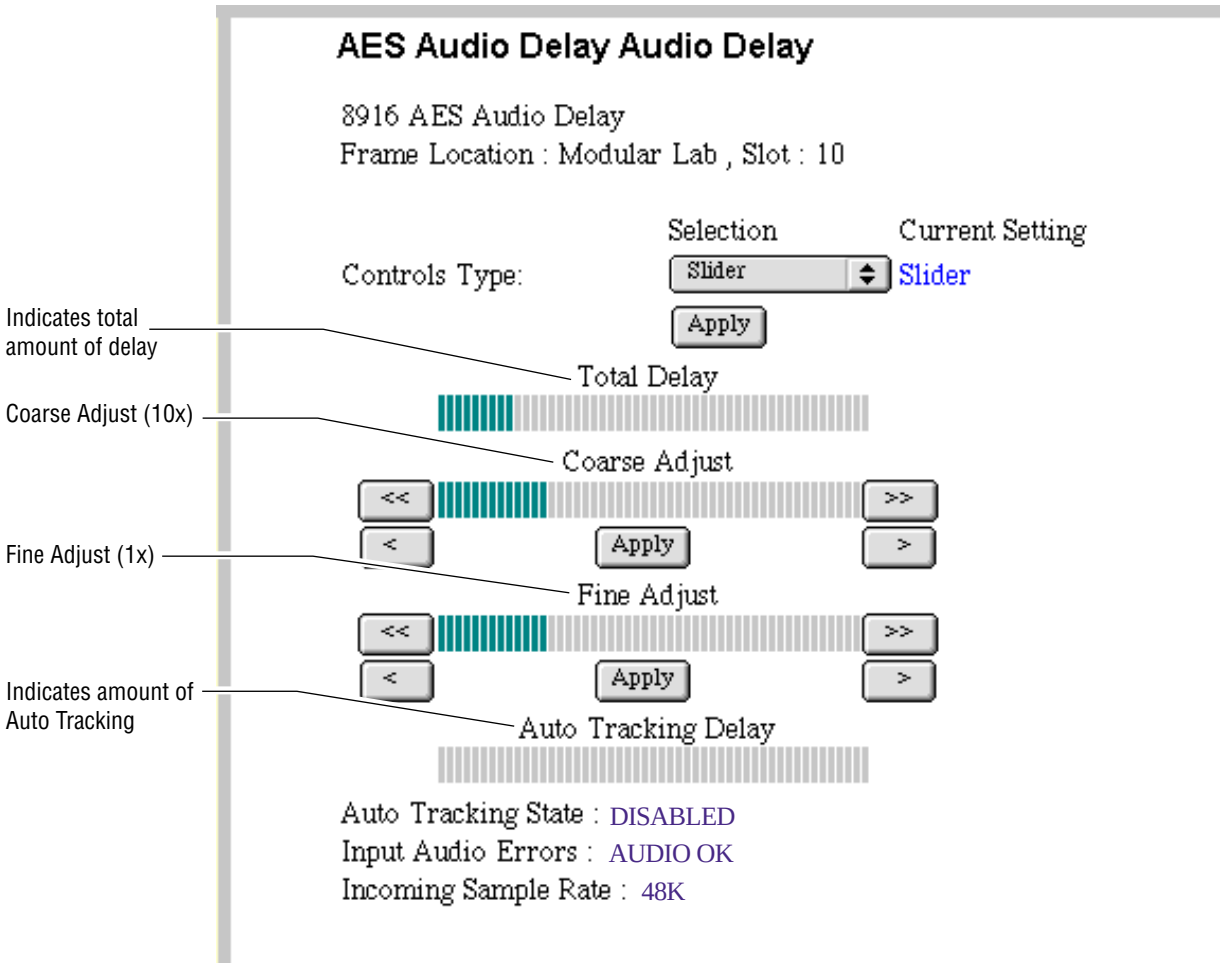
Set Coarse and Fine delay using the arrow keys to increase or decrease the delay. The settings will default to an increment of 2 mS (Fine) or 32 mS (Coarse). The single arrows will change the value by 1x and the double arrows will change the value by 10x.

Use the Apply button to make the selections active.

The sum of all delay is shown in the Total Delay slider display.

The module information below the Coarse and Fine Adjust displays is identical to the information explained in the Numeric section above.

Figure 9. Audio Delay Display, Slider Mode



Specifications

Table 3. 8916 Specifications

Parameter	Value
Digital Input	
Signal type	AES3id (1995)/EBU and SMPTE 276M - transformer coupled
Number of inputs	1 loop-through
Connector type	75 Ω BNC
Input return loss	>25 dB (100 kHz-6 MHz)
Outputs	
Number of outputs	7
Signal type	AES3id (1995)/EBU and SMPTE 276M
Connector type	75 Ω BNC
Return loss	>25 dB (100 kHz-6 MHz)
Intrinsic Jitter	<6 ns
Performance	
Sampling rates	32 kHz, 44.1 kHz, and 48 kHz
On-board delay adjustment	Minimum 2 ms, Maximum 510 ms Minimum delay @ 32 kHz is 3 ms
Delay adjustment increments	2 ms
Tracking delay	20.8 µs to 30 ms
Environmental	
Frame temperature range	0 to 45 degrees C
Operating humidity range	10 to 90% non-condensing
Non-operating temperature	-10 to 70 degrees C
Mechanical	
Frame type	8900 Series
Power Requirements	
Supply voltage	+12 V, -12V
Power consumption	< 3.5 Watts

Service

The 8916 module makes extensive use of surface-mount technology and programmed parts to achieve compact size and adherence to demanding technical specifications. Circuit modules should not be serviced in the field.

If your module is not operating correctly, proceed as follows:

- Check frame and module power and signal present LEDs.
- Check for presence and quality of input signals.
- Verify that source equipment is operating correctly.
- Check cable connections.
- Check output connections for correct I/O mapping (correct input connector is used for the corresponding channel output).

Refer to Figure 4 for the location of PWR LED and Table 2 on page 6 for proper LED indications.

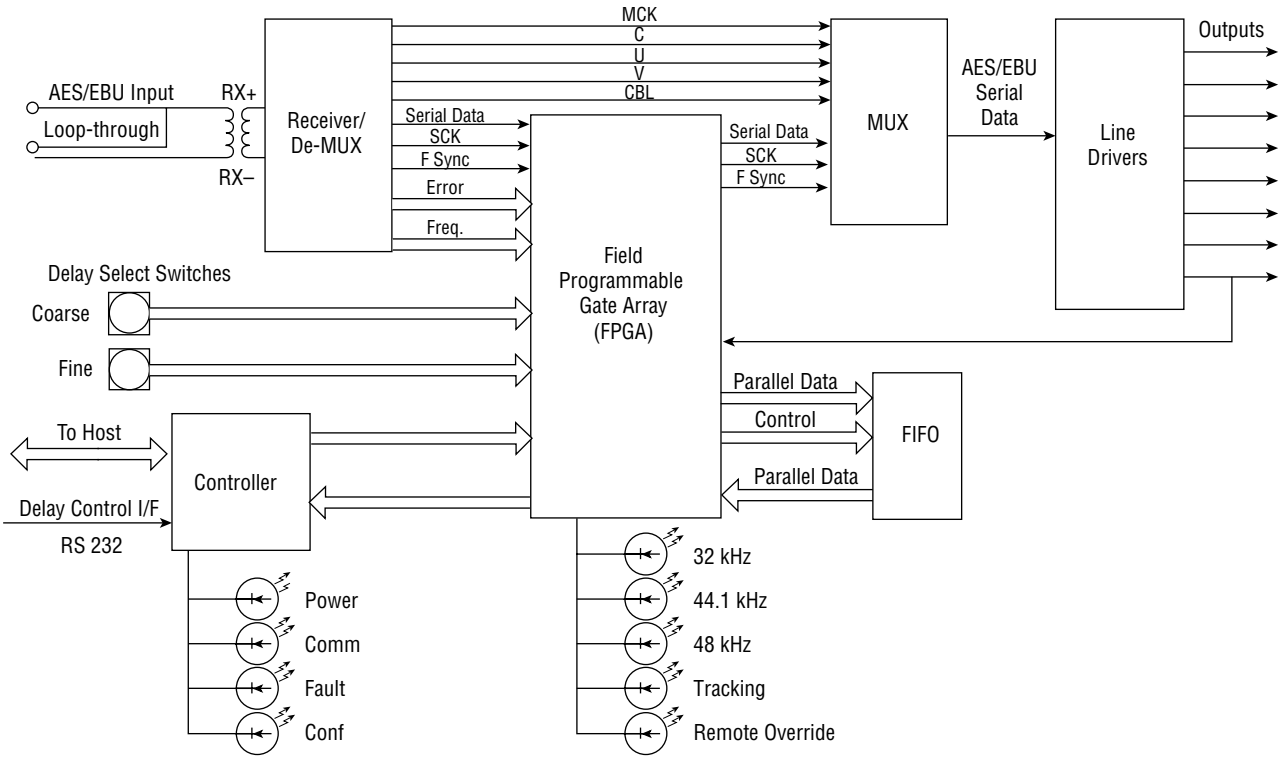
If the module is still not operating correctly, replace it with a known good spare and return the faulty module to a designated Tektronix repair depot. Call your Tektronix representative for depot location.

Refer to the *Contacting Grass Valley Group* at the front of this document for the Tektronix Customer Service Information number.

Functional Description

Refer to the block diagram in Figure 10 while reading the following functional description.

Figure 10. 8916 Block Diagram



Input Receiver

AES/EBU audio data is fed into the 8916 through an isolation transformer where it is received by the receiver chip. The receiver recovers the clock and synchronization signals, and demultiplexes the audio and digital data.

FPGA Delay Section

The delay section receives the 12.29 MHz clock, synchronization information, frequency information, and error status information. It also receives the switch position settings that determine the fixed length of delay.

Delay FIFO

The FIFO receives parallel data from the FPGA. The FPGA provides all clock and control signals. The FIFO output is sent back to the FPGA.

The capacity of the FIFO is 262214 x 12 bits. A single audio sample is 48 bits of data. With a sampling rate of 48 kHz the maximum delay of the card is 510 ms.

Transmitter/Multiplexer Circuit

The serial data, after being delayed, is routed to the Interface Transmitter from the FPGA. The Transmitter multiplexes the channel, user, and validity data from the receiver chip with the serial audio data from the FPGA.

Line Drivers

The line driver chip drives seven output lines. The outputs feed an RC network that:

- Attenuates the signal to one volt peak-to-peak
- Limits the risetime to meet the AES specification, and
- Creates a 75 Ω output resistance to match the cable impedance.

Delay Adjustment Switches

There are two rotary output timing adjustment switches:

- A fine-step adjustment switch provides sixteen 2ms timing steps
- A coarse-step adjustment switch provides sixteen 32ms timing steps

The switches provide output timing adjustable from 2ms to 510ms with respect to the input.

Audio Delay Control Interface

The 8916 auto delay control input consists of a one wire serial signal using RS232 voltage levels, input on a coaxial BNC connector (Delay Input). Delay values can range from 0 to 3FF(hex).

Controller

The controller provides the interface between the user and all the processing logic inside the 8916. It also supports communications between an external host processor and the 8916.

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