Instruction Manual

MCF Series
Video Transmission System

071-0229-02

071022902

Installation and Service

Tektronix

MCF Series
Video Transmission System

071-0229-02

First Printing: November, 1995
Revised Printing: June, 1999

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Safety Summary

Read and follow the important safety information below, noting especially those instructions related to risk of fire, electric shock or injury. Additional specific warnings not listed here may be found throughout the manual.

WARNING **Any instructions in this manual that require opening the equipment cover or enclosure are for use by qualified service personnel only. To reduce the risk of electric shock, do not perform any servicing other than that contained in the operating instructions unless you are qualified to do so.**

Safety Terms and Symbols

Terms in This Manual

Safety-related statements may appear in this manual in the following form:

WARNING **Warning statements identify conditions or practices that may result in personal injury or loss of life.**

CAUTION Caution statements identify conditions or practices that may result in damage to equipment or other property.

Terms on the Product

The following terms may appear on the product:

DANGER — A personal injury hazard is immediately accessible as you read the marking.

WARNING — A personal injury hazard exists but is not immediately accessible as you read the marking.

CAUTION — A hazard to property, product, and other equipment is present.

Symbols on the Product

The following symbols may appear on the product:

Indicates that dangerous high voltage is present within the equipment enclosure that may be of sufficient magnitude to constitute a risk of electric shock.

Indicates that user, operator or service technician should refer to product manual(s) for important operating, maintenance, or service instructions.

This is a prompt to note fuse rating when replacing fuse(s). The fuse referenced in the text must be replaced with one having the ratings indicated.

Identifies a protective grounding terminal which must be connected to earth ground prior to making any other equipment connections.

Identifies an external protective grounding terminal which may be connected to earth ground as a supplement to an internal grounding terminal.

Indicates that static sensitive components are present which may be damaged by electrostatic discharge. Use anti-static procedures, equipment and surfaces during servicing.

Warnings

The following warning statements identify conditions or practices that can result in personal injury or loss of life.

Dangerous voltage or current may be present — Disconnect power and remove battery (if applicable) before removing protective panels, soldering, or replacing components.

Do not service alone — Do not internally service this product unless another person capable of rendering first aid and resuscitation is present.

Remove jewelry — Prior to servicing, remove jewelry such as rings, watches, and other metallic objects.

Avoid exposed circuitry — Do not touch exposed connections, components or circuitry when power is present.

Use proper power cord — Use only the power cord supplied or specified for this product.

Ground product — Connect the grounding conductor of the power cord to earth ground.

Operate only with covers and enclosure panels in place — Do not operate this product when covers or enclosure panels are removed.

Use correct fuse — Use only the fuse type and rating specified for this product.

Use only in dry environment — Do not operate in wet or damp conditions.

Use only in non-explosive environment — Do not operate this product in an explosive atmosphere.

High leakage current may be present — Earth connection of product is essential before connecting power.

Dual power supplies may be present — Be certain to plug each power supply cord into a separate branch circuit employing a separate service ground. Disconnect both power supply cords prior to servicing.

Double pole neutral fusing — Disconnect mains power prior to servicing.

Use proper lift points — Do not use door latches to lift or move equipment.

Avoid mechanical hazards — Allow all rotating devices to come to a stop before servicing.

Cautions

The following caution statements identify conditions or practices that can result in damage to equipment or other property

Use correct power source — Do not operate this product from a power source that applies more than the voltage specified for the product.

Use correct voltage setting — If this product lacks auto-ranging power supplies, before applying power ensure that the each power supply is set to match the power source.

Provide proper ventilation — To prevent product overheating, provide equipment ventilation in accordance with installation instructions.

Use anti-static procedures — Static sensitive components are present which may be damaged by electrostatic discharge. Use anti-static procedures, equipment and surfaces during servicing.

Do not operate with suspected equipment failure — If you suspect product damage or equipment failure, have the equipment inspected by qualified service personnel.

Ensure mains disconnect — If mains switch is not provided, the power cord(s) of this equipment provide the means of disconnection. The socket outlet must be installed near the equipment and must be easily accessible. Verify that all mains power is disconnected before installing or removing power supplies and/or options.

Route cable properly — Route power cords and other cables so that they ar not likely to be damaged. Properly support heavy cable bundles to avoid connector damage.

Use correct power supply cords — Power cords for this equipment, if provided, meet all North American electrical codes. Operation of this equipment at voltages exceeding 130 VAC requires power supply cords which comply with NEMA configurations. International power cords, if provided, have the approval of the country of use.

Use correct replacement battery — This product may contain batteries. To reduce the risk of explosion, check polarity and replace only with the same or equivalent type recommended by manufacturer. Dispose of used batteries according to the manufacturer's instructions.

Troubleshoot only to board level — Circuit boards in this product are densely populated with surface mount technology (SMT) components and application specific integrated circuits (ASICS). As a result, circuit board repair at the component level is very difficult in the field, if not impossible. For warranty compliance, do not troubleshoot systems beyond the board level.

Section 1

System Description and Specifications

Introduction

This is the Installation and Service manual for the Tektronix Multi-Channel Fiber (MCF) Series Video Transmission System. The manual is divided into sections identified and briefly described as follows.

- **Section 1 — System Description and Specifications:** A general introduction about MCF. It includes a system description with physical specifications including weight, power requirements, and environmental and regulatory criteria.
- **Section 2 — Installation:** Installation procedures, including a functional check after the physical installation.
- **Section 3 — Controls and Indicators:** Descriptions and illustrations of the various controls and indicators found on the frame rear panel and on the front panels of the MCF modules.
- **Section 4 — Functional Description:** A description of the major components of the modules. It includes block diagrams.
- **Section 5 — Maintenance and Service:** A description of the maintenance procedures, a troubleshooting table, and removal/replacement procedures for the MCF system modules.

System Description

The MCF Video Transmission System provides digital transport of full bandwidth video, and multiple channel audio over fiber. System architecture is modular, which allows channel growth by module addition. The MCF is a point-to-point unidirectional communications link with a transmit and a receive terminus.

Two frame sizes are available—a 6 rack unit (RU) and a 2 RU. Each 6 RU frame requires a fan and deflector assembly. On the 2 RU frame the fan is installed in the frame and no deflector assembly is required. (See Section 2, "Installation," for more information.)

The Audio and Video signals are formatted as follows:

- Each Audio module (and the audio part of the Combined Video/Audio module) provides two stereo audio pairs (four channels) per video signal.
- Each Video module (and the video part of any Combined Video/Audio and Diplexer modules) provides one analog composite video channel.
- Each Serial Digital module provides two AES/EBU serial audio interfaces and formats the video in either a 270 Mbs Component (D1) or 143 Mbs NTSC Composite (D2) serial video channel.
- Each Video/Audio Diplexer module provides monaural analog audio (two channels), which is transmitted on FM subcarriers in the frequency band above the video.

On this and the following pages, you will find information regarding the MCF frames (6 RU frame and 2 RU frame), the fan assembly, and the fan deflector assembly.

MCF Frames

The MCF frame houses the control and signal processing electronics, power supplies, and the backplane. At the transmit end of the system, the frame is configured with a Fiber Transmitter module, Video Input modules, and Audio Input modules or any type of combined video and audio Input modules. At the receive end, the frame is configured with a Fiber Receiver module, Video Output modules, and Audio Output modules or any type of combined video and audio Output modules. Figure 1-1 shows how this works.

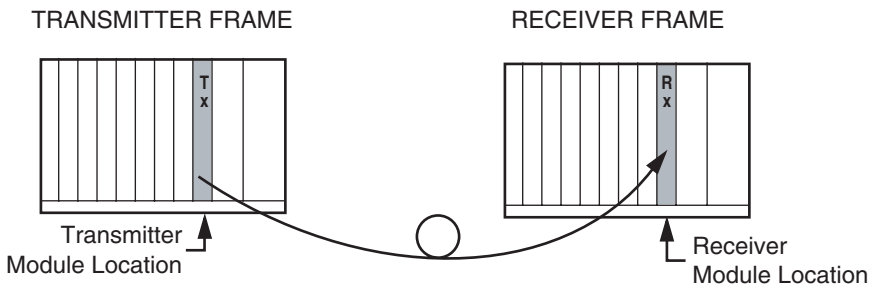


Figure 1-1. Normal MCF Transmission

You can use either the 6 RU or 2 RU MCF frame as a repeater when transmitting over longer distances. The Repeater frame is located somewhere in the middle of the transmission link and uses a Fiber Receiver module to receive the signal and another Fiber Transmitter module to retransmit the signal. Adding an Output module here allows you to monitor (for troubleshooting purposes) the incoming signal with a Drop Monitor function. Figure 1-2 illustrates how this might look functionally.

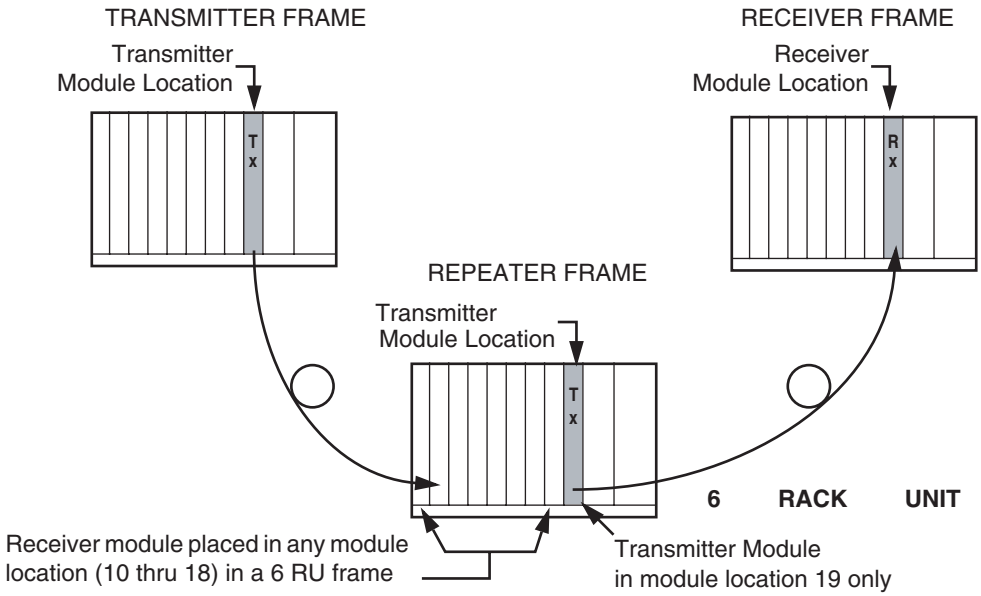


Figure 1-2. MCF Transmission with Repeater and Monitor Function

A Repeater Frame housing Receiver modules running software version 1.06 or later allows add and drop/delete capabilities from any Transmitter frame. Refer to Figure 1-3 for an example of Add/Delete functionality.

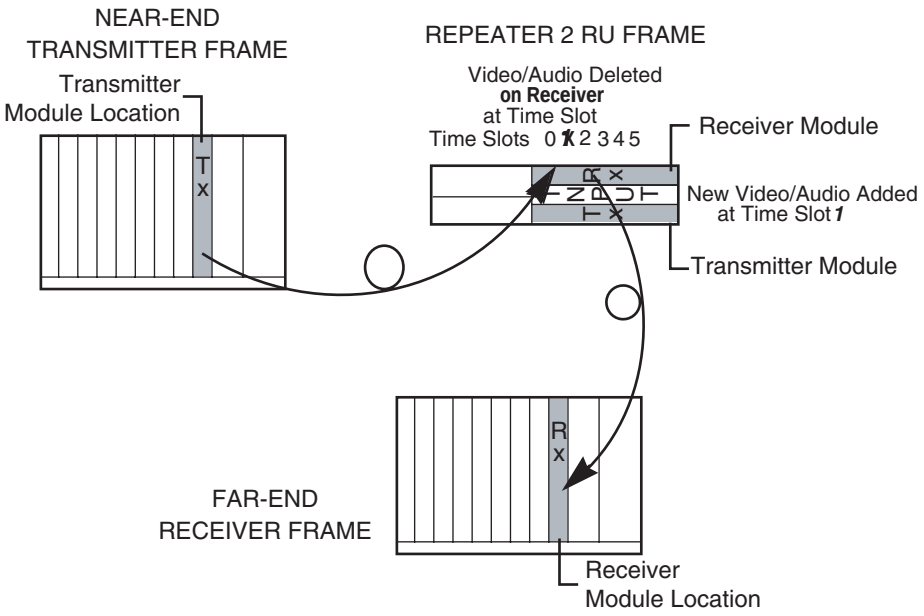


Figure 1-3. MCF Repeater Transmission with Add/Delete Function

Using the Mute and Take commands in software version 1.06 or later, (discussed in the *Operation* manual), you can enhance the Add/Delete functionality to create an Add/Drop function. Refer to Figure 1-4 for an example of the Add/Drop operation.

Note The Add/Drop functionality operates only on later MCF Fiber Receiver modules (Part Number 160294 or later) using version 1.06 or later software.

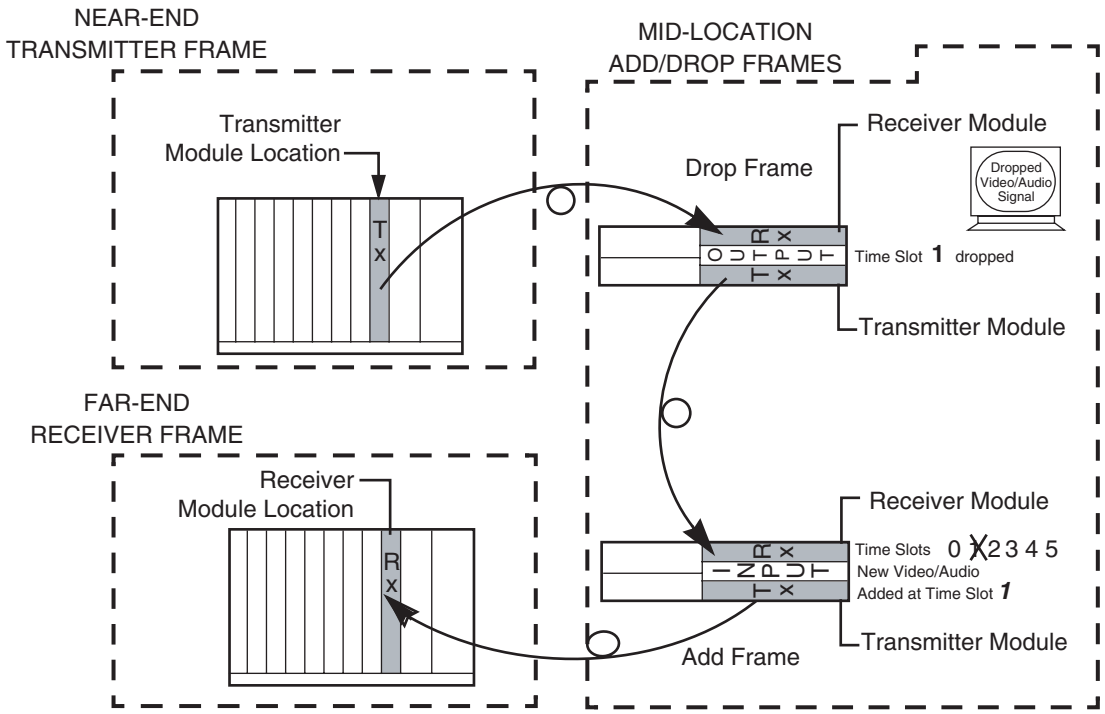


Figure 1-4. MCF Repeater Transmission with Add/Drop Function

Six Rack Unit Frame (10.5 in. or 267 mm high)

Figure 1-5 illustrates a 6 RU MCF frame with the door closed. Figure 1-6 illustrates a fully optioned 6 RU frame with the front door removed. You may remove the front door to simplify any module placement and to connect the fiber cable. The door is hinged and opens from right to left. It is secured closed by turning the crosshead lock screw clockwise until fully secure. To remove the door, turn the screw counterclockwise, open the door fully, and then lift it up and away from the frame.

CAUTION The frame door must be kept closed during operation to ensure proper air flow and system cooling.

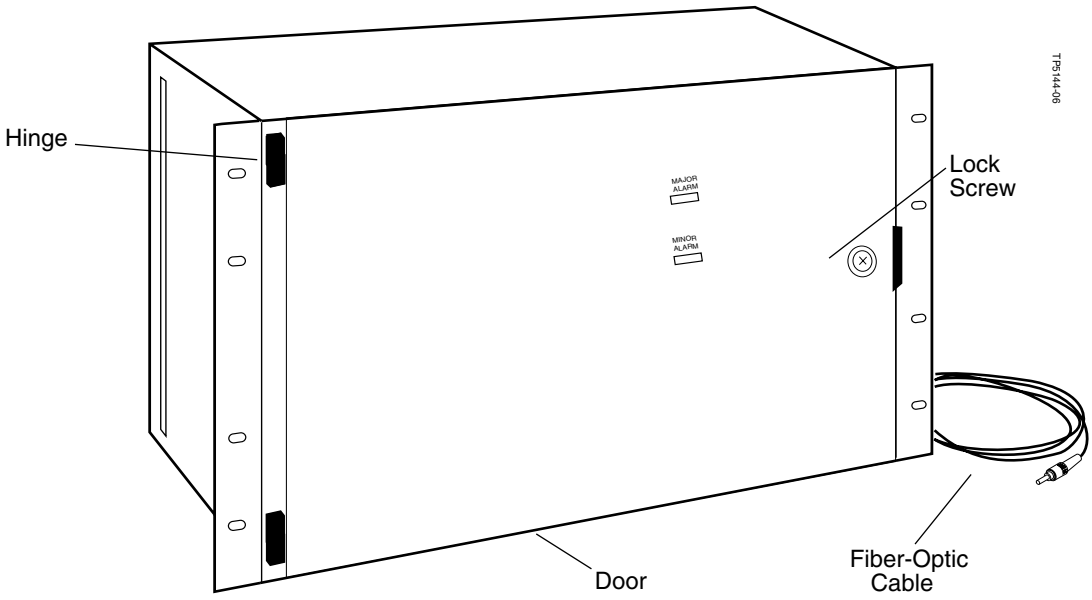


Figure 1-5. MCF 6 RU Frame

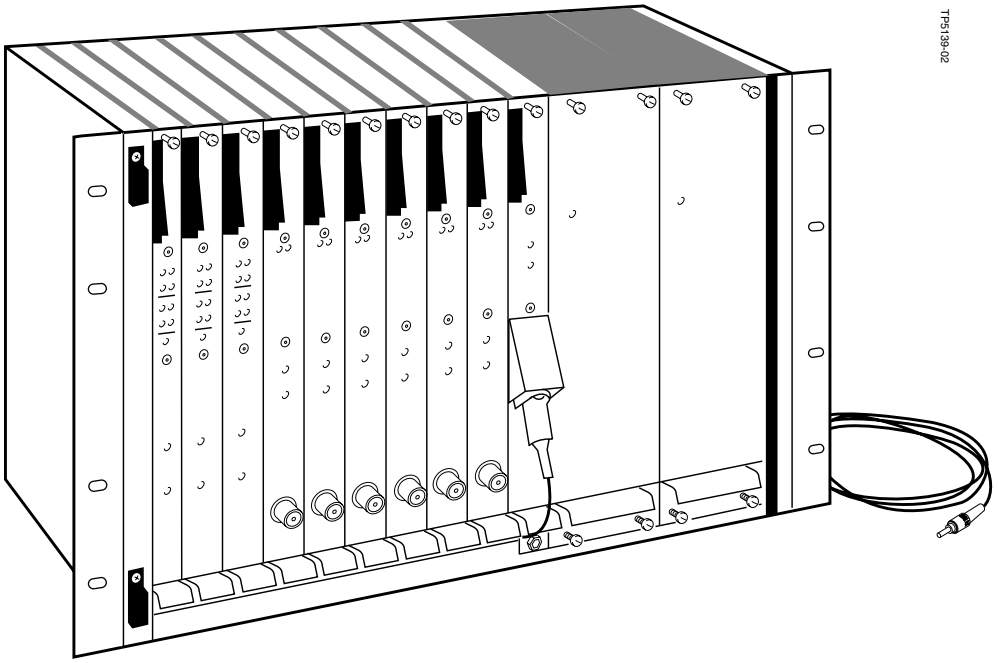


Figure 1-6. Fully Optioned MCF 6 RU Frame (with door removed)

A maximum configuration (**ten module slots**) consists of one Fiber module and nine of the other modules. You can substitute one module of any of the video/audio combination modules (such as Serial/Digital) for the two Video and Audio modules. However, because there are only six time slots available, you can use only six combination modules. Serial digital and baseband analog video and audio signals can be mixed in the system as long as the six time slots are not exceeded. Serial digital requires one or two timeslots depending upon configuration.

Note Slot 19 in the 6 RU frame **must** be used for a Fiber module.

Table 1-1 shows what types of modules you can have in a maximum 6 RU configuration. Except for a Repeater frame (which receives *and* transmits), MCF frames are used for either transmitting or receiving. You cannot mix input and output modules in the same frame.

Table 1-1. MCF 6 RU Frame Configuration

Requirements	Transmitter Frame	Repeater Frame	Receiver Frame
One Required	Fiber Transmitter	Fiber Receiver	Fiber Receiver
One Required	Does Not Apply	Fiber Transmitter	Does Not Apply
From one up to nine modules. Logical types can be mixed within frame. Exceptions: Repeater frame maximum is eight modules because two slots are being used by Fiber modules. Combination modules maximum is six	Video Input Module(s)	Video Output Module[a]	Video Output Module(s)
	Audio Input Module(s)	Audio Output Module[a]	Audio Output Module(s)
	Serial Digital Input Module(s)	Serial Digital Output Module[a]	Serial Digital Output Module(s)
	Combined Video/Audio Input Module(s)	Combined Video/Audio Output Module[a]	Combined Video/Audio Output Module(s)
	Video/Audio Input Module(s)		Video/Audio Output Module(s)

[a] Optional. Used only for monitoring purposes in this type of frame.

Two Rack Unit Frame (3.5 in. or 89 mm high)

Figure 1-7 illustrates a 2 RU MCF frame with the door closed. Figure 1-8 illustrates a 2 RU frame with the front door removed. You may remove the front door to simplify any module placement and to connect the fiber cable. The door panel is secured closed by turning the two crosshead lock screws at the sides of the frame until fully locked. To remove the door panel, turn both screws in the direction of the arrows, and then pull the door away from the frame.

CAUTION The frame door must be kept closed during operation to ensure proper air flow and system cooling.

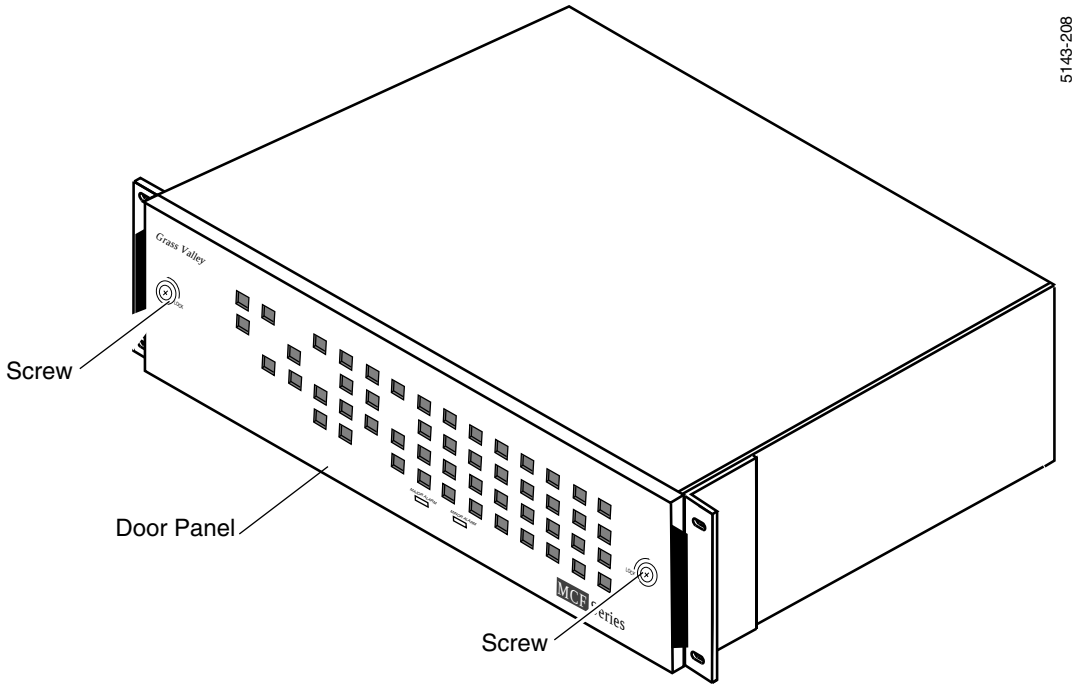


Figure 1-7. MCF 2 RU Frame

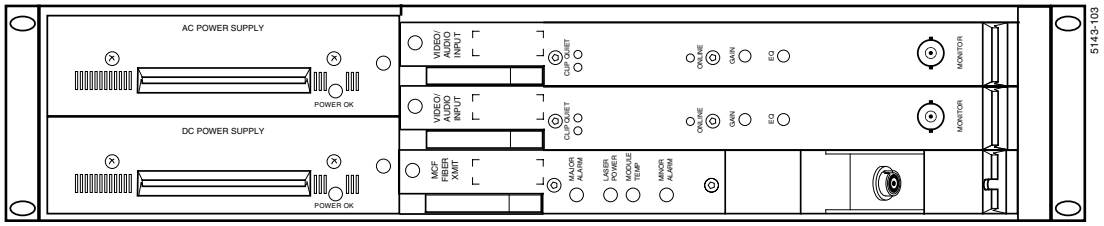


Figure 1-8. Fully Optioned MCF 2 RU Frame (with door removed)

A maximum configuration (**three slots**) is one Fiber module and up to two of the other modules. You can substitute one module of any of the video/audio combination modules (such as Combined Video/Audio) for the two Video and Audio modules. Slot 12 in the 2 RU frame must be used for a Fiber module.

Table 1-2 shows what types of modules you can have in a maximum 2 RU configuration. Except for a Repeater frame (which receives *and* transmits), MCF frames are used for either transmitting or receiving. You cannot mix input and output modules in the same frame.

Table 1-2. MCF 2 RU Frame Configuration

Requirements	Transmitter Frame	Repeater Frame	Receiver Frame
One Required	Fiber Transmitter	Fiber Receiver	Fiber Receiver
One Required	Does Not Apply	Fiber Transmitter	Does Not Apply
One or two modules. Logical types can be mixed within frame Exception: Repeater frame maximum is one module because two slots are being used by Fiber modules.	Video Input Module(s)	Video Output Module[a]	Video Output Module(s)
	Audio Input Module(s)	Audio Output Module[a]	Audio Output Module(s)
	Serial Digital Input Module(s)	Serial Digital Output Module[a]	Serial Digital Output Module(s)
	Combined Video/Audio Input Module(s)	Combined Video/Audio Output Module[a]	Combined Video/Audio Output Module(s)
	Video/Audio Input Module(s)		Video/Audio Output Module(s)

[a] Optional. Used only for monitoring purposes in this type of frame.

On the following pages, we discuss each of the frame components: Fiber modules, Video modules, Audio modules, Serial Digital modules, Video/Audio Diplexer modules, power supplies, and the backplane.

Fiber Modules

Fiber modules can be used as transmitters, receivers, or repeaters. As a transmitter, the Fiber module transmits the MCF signal at the near end. As a receiver, the Fiber module receives the MCF signal at the far end. A repeater receives the MCF signal at one or more locations in the transmission link and then retransmits it again so it can be sent over longer distances. Refer to Section 1 of the *MCF Operation Reference* for more information about the different operations.

The maximum optical loss budget of a current MCF system is 23 or 29 dB when 0 dBm is launched. Fiber Transmitter modules operate in 1300 or 1550 nm wavelengths. Each Fiber module comes with FC/PC, SC, or ST connectors. Except for the fiber-optic connector on the front of the board, communication with the system passes through the backplane. The time slot interchange function found on these modules allows time slot manipulation for greater flexibility.

It is also possible to drop signals for monitoring and distribution from either the Repeater or Receiver MCF frame.

See Table 1-7 on page 19 for a list of functional specifications.

Combined Video/Audio Modules

The Video/Audio Input and Output modules consolidate the functions of two MCF modules—they are the functional equivalent of the separate Video and Audio Input and Output modules. Using these modules, up to six video and 24 audio channels can be accommodated in the MCF system's 6 RU frame. In the 2 RU frame, up to two video and eight audio channels can be accommodated. MCF bus data for each module occupies one video and one audio time slot.

The following descriptions for the separate Video and Audio Input and Output modules are functionally the same and have more details. Refer to them if you need more information. Also see Table 1-7 on page 1-19 for a list of functional specifications.

Video Modules Input and Output

The MCF System bandwidth allows up to six video channels (one per module) to be transported over a single fiber. Video is digitized and half-band filtered with a signal-to-noise ratio of >67 dB. Video is sampled at 31.054 MHz, which yields a flat video passband maximum of approximately 6.89 MHz.

MCF is format independent—NTSC, PAL, and other video formats can be passed through these modules. Other video parameters are per EIA/TIA-250-C Short Haul. Video and audio travel in separate time slots and are switched separately.

Audio Modules Input and Output

The MCF System bandwidth allows up to twenty-four analog baseband audio channels to be transported over a single fiber. Each audio module provides two stereo audio pairs, or four channels.

Audio channels are digitized at 18-bits. Current interfaces are discrete analog. Signal-to-noise ratio is approximately 90 dB. Other audio parameters are per EIA/TIA-250-C Short Haul, and ANSI T1.505.

Serial Digital Modules

The Serial Digital Input and Serial Digital Output modules are designed to provide component serial video at 270 MHz (D1) or NTSC composite serial video at 143 MHz (D2) and two AES/EBU serial audio interfaces to the MCF transmission system. The AES/EBU audio may be embedded in the serial digital video signal, or carried separately.

Audio uses two asynchronous stereo pairs. The audio input data clock is 48 kHz (± 400 ppm) for both audio inputs. Each channel can be independently enabled or disabled by software commands through the Fiber module.

Component (270 MHz, D1) serial video has a higher data rate that requires more bandwidth, so two time slots are required. The audio that goes along with the component video is not split between two time slots but is assigned to the primary time slot. NTSC composite (143 MHz, D2) serial video requires only one time slot.

See Table 1-8 on page 21 for a list of the video and audio performance specifications.

Video/Audio Diplexer Modules Input and Output

The Video/Audio Diplexer module occupies one MCF video time slot. The video carried in this module is baseband analog (see the previously described Video modules description for details). However, the audio is different. The Diplexer uses an audio-follow-video scheme to add subcarriers with video in a common time slot. This analog audio is not meant to replace digital audio—but to provide more channels. The audio input stage accommodates 600 Ohm balanced +18 dBm peak level signals.

Audio subcarriers of 5.8 and 6.4 MHz are diplexed onto traditional TV1 video signals. The center frequencies of the FM subcarriers are fixed at 5.8 and 6.4 MHz using slow feedback phase locked loops (PLLs). The peak-to-peak deviation is 370 kHz at maximum modulation. The subcarriers are summed with the filtered video at a relative level of –20 dBV (100 mV peak-to-peak) per carrier.

See Table 1-7 on page 1-19 for a list of functional specifications and see Table 1-9 on page 22 for a list of the audio performance specifications.

Backplanes

The following text describes the attributes of the system in the 6 RU frame and 2 RU frame configurations.

Backplane for the 6 RU Frame

Except for the fiber-optic cable connector and monitor connectors on the Video Input/Output modules, connections to the MCF 6 RU frame are made through the backplane. In addition to the communication connections, the backplane connector groupings for the 12 slots. Two are dedicated for power supplies and one for the Fiber module (either the Receiver or Transmitter). The remaining nine slots are used for combinations of video and audio type modules. Remember, you cannot mix input and output modules in the same frame.

Each module connects to the backplane through two connectors. One connector is dedicated to analog interfaces. The second connector supports the internal communications bus. All video and audio type modules connect to this bus. On the rear of the backplane, each non-Fiber module has three BNC connections (two video inputs for loop-through, and one video I/O) and a screw strip connector for the two stereo audio pairs. Serial/Digital modules use the loop-through connectors separately (loop-through disabled) for I/O monitoring. Figure 1-9 illustrates the 6 RU backplane.

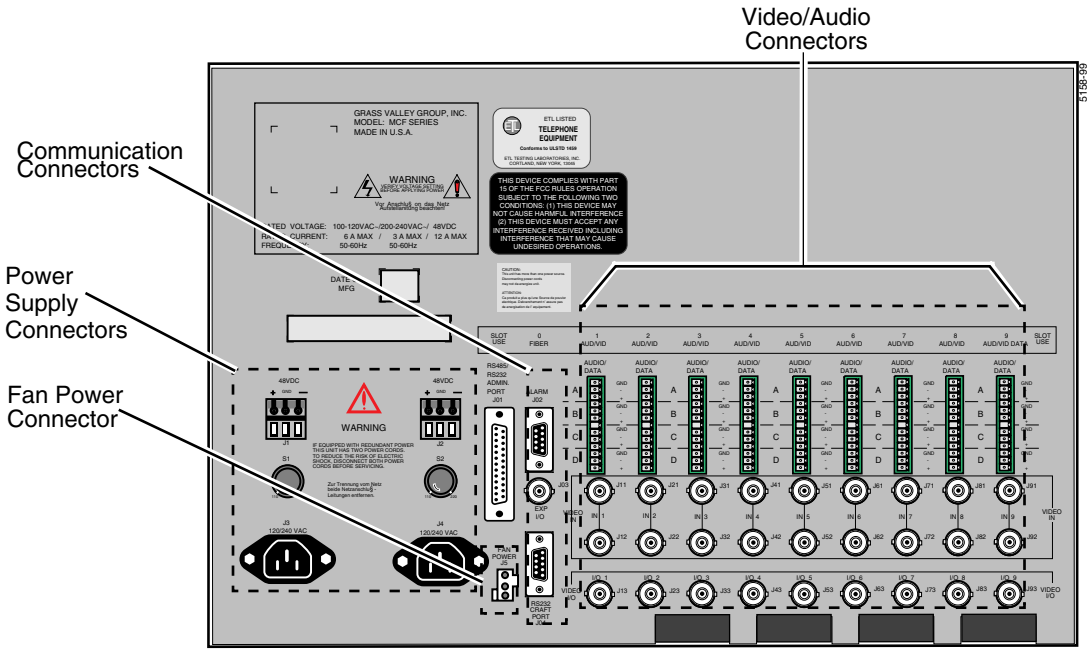


Figure 1-9. Backplane for the 6 RU Frame

Backplane for the 2 RU Frame

Except for the fiber-optic cable connector and monitor connectors on the Combined Video/Audio and standard video modules, connections to the MCF 2 RU frame are made through the backplane. Two slots are dedicated for power supplies and one slot is dedicated for the Fiber module (either Receiver or Transmitter). The remaining two slots are used for combinations of video and audio type modules. Remember, you cannot mix input and output modules in the same frame.

Each module connects to the backplane through two connectors. One connector is dedicated to analog interfaces. The second backplane connector supports the internal communications bus. All video and audio type modules connect to this bus. On the rear of the backplane, each non-Fiber type module has three video BNC connections (two for loop-through [J2-J3 or J5-J6] and one for I/O [J1 or J4]) and a screw strip connector for the two

stereo audio pairs. Serial/Digital module use the loop-through connections (J2-J3 or J5-J6) separately (loop-through disabled) for I/O monitoring. Figure 1-10 illustrates the 2 RU backplane.

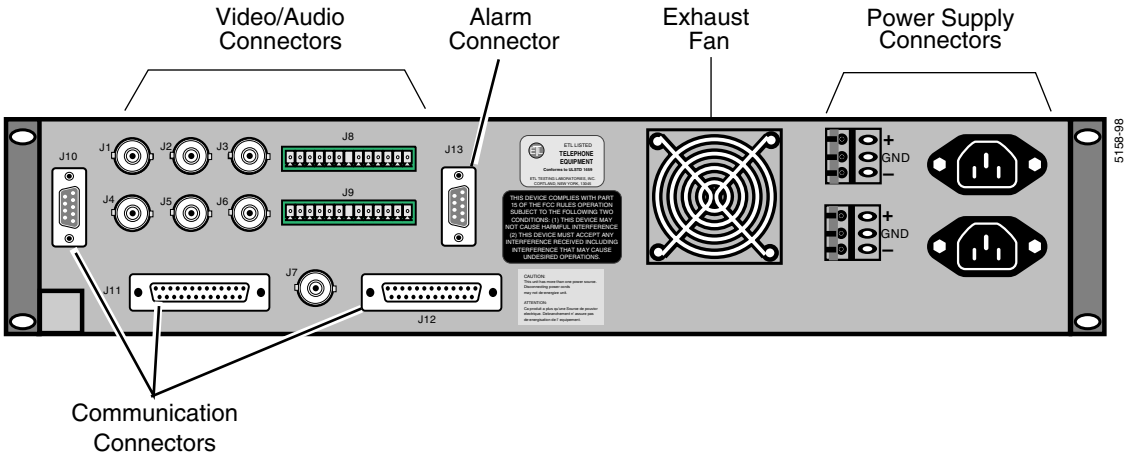


Figure 1-10. Backplane for the 2 RU Frame

Fan Assembly (6 RU only)

The fan assembly consists of three (3) muffin fans in a housing which is mounted immediately *above* the frame in the equipment rack. A removable air filter is in the front panel. Warm air is drawn up through the frame and

exhausted out the back of the equipment rack. Power to the fan assembly is supplied from a connector on the backplane of the frame. Figure 1-11 illustrates the fan assembly.

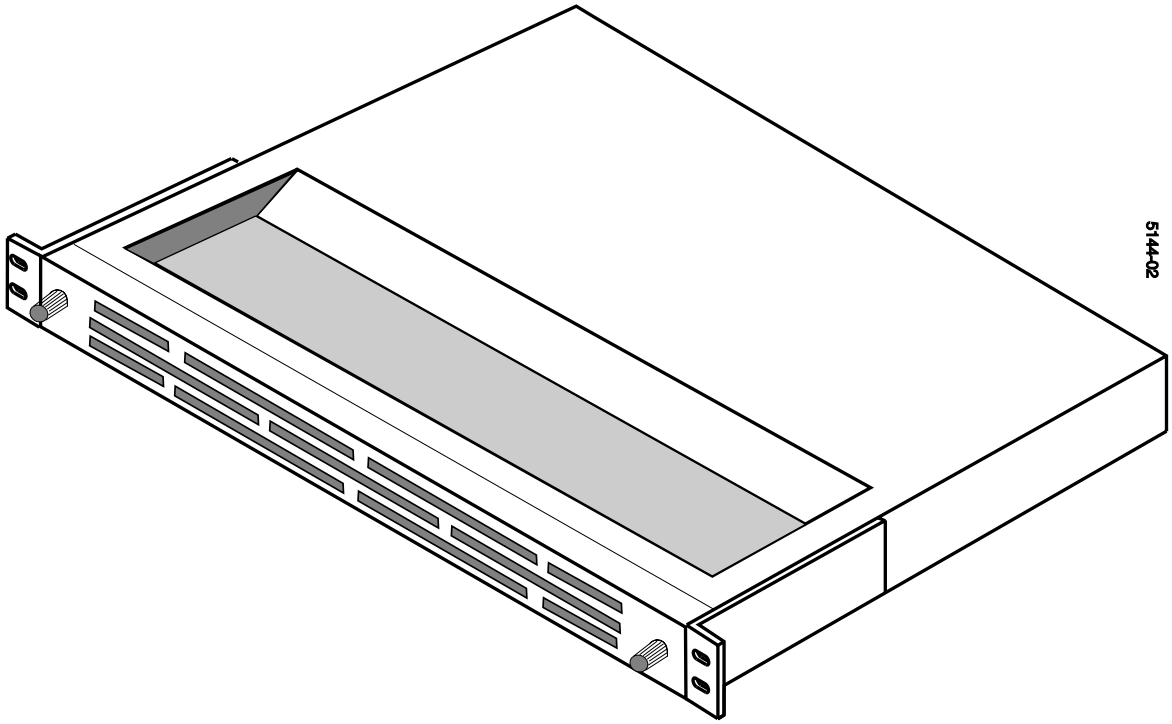


Figure 1-11. MCF Fan Assembly

Deflector Assembly (6 RU only)

The deflector assembly consists of the same housing and air filter as the fan assembly, except without fans. It is mounted immediately *below* the frame. Ambient air is drawn in through a filter and deflected up through the frame.

Physical Specifications

The physical specifications of each component of the MCF are listed in Table 1-3.

Table 1-3. MCF System Physical Specification

Component	Height	Width	Depth	Weight[a]	Rack Units
2 RU Frame	3.5 in. (88.9 mm)	17.25 in (438 mm)	10.5 in. (267 mm)	20.0 lbs (9.1 kg)	2
6 RU Frame	10.5 in. (267 mm)	17.25 in (438 mm)	10.5 in. (267 mm)	35.0 lbs (15.9 kg)	6
Fan Assembly	1.75 in. (44.4 mm)	17.25 in. (438 mm)	10.5 in. (267 mm)	8.5 lbs (3.9 kg)	1
Deflector Assembly	1.75 in. (44.4 mm)	17.25 in. (438 mm)	10.5 in. (267 mm)	7.5 lbs (3.4 kg)	1

[a] Fully optioned

Power Specifications

Source power to the frame enters through connectors on the rear of the backplane. Power for frame components is from one or two AC power supplies, one or two DC power supplies, or one of each, depending on your facility requirements. Table 1-4 lists the power supply specifications.

Table 1-4. MCF Power Specifications

Parameter	Value
Primary Power (AC, DC, or mixed AC/DC) AC DC	 90–132 or 180–264 VAC, 47–63 Hz –42 to –56.7 VDC
Power Capability 6 RU frame 2 RU frame	 15W per module (nominal), 250W total 15W per module (nominal), 45W total
Redundancy (hot pluggable)	Each AC or DC supply will support entire load

Regulatory Compliance

The MCF System meets the following regulatory requirements:

- UL 1459
- UL 1950
- CSA 22.2 #950
- EN 60950
- NEBS TR-NWT-000063
- FCC 15A
- EN 55022 (CISPR–22A)
- EN 50082-1 (IEC 801-2, -3, -4)
- GR-1089 (sec. 2,3,4,7,9)
- GR-63-CORE (sec. 2,3,4)

Environmental Criteria

The MCF System meets the environmental criteria listed in Table 1-5.

Table 1-5. MCF System Environmental Criteria

	Temperature	Humidity
Operating	0° to 50° C (per NEBS)	0–95% non-condensing
Non-Operating (Storage)	–10° to 70° C	0–95% non-condensing
Cooling (6 RU)	Forced air, 1 RU Active Vent, 1 RU Passive Filter	

Alarm Indicators

The MCF system is equipped with both visual alarms and system (monitor) indications. These alarms and messages are designated as Minor (possible deterioration of system performance) and Major (loss of system operation).

Note that you can see the Minor and Major alarm indicators through the MCF frame door. For the 6 RU frame, refer to Figure 1-12. For the 2 RU frame, refer to Figure 1-13.

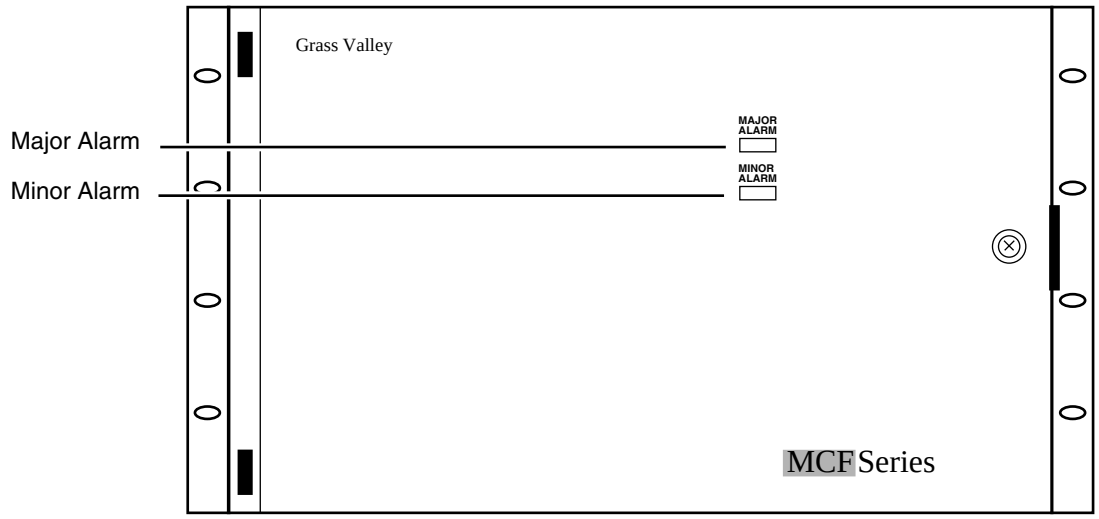


Figure 1-12. Alarm Indicators for the 6 RU Frame

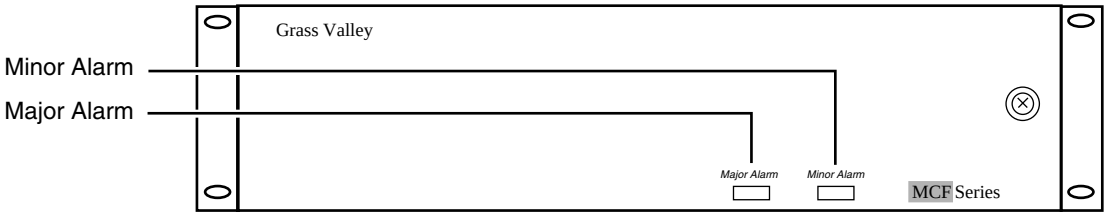


Figure 1-13. Alarm Indicators for the 2 RU Frame

Table 1-6 lists the source of an alarm, the visual alarm indicator, and the system Minor and Major Alarm designations.

Table 1-6. MCF System Alarm Indications

Indicator	Status	System Indication (Minor/Major)
Fiber Transmitter		
Major Alarm (red)	On	RF drive not present or invalid
Laser Power (red)	On	Laser Power out of limits (minor)
Module Temp (red)	On	Module temp out of limits (minor)
Minor Alarm (amber)	On	Power supply failed or not present and out of current or temperature limits
Fiber Receiver		
Major Alarm (red)	On	Optical input not present
Module Temp (red)	On	Module temp out of limits (minor)

Table 1-6. MCF System Alarm Indications - (continued)

Indicator	Status	System Indication (Minor/Major)
Input Pwr (green)	Flash	Optical input power too high (minor)
Input Pwr (red)	On	Optical input power too low (major)
Input Pwr (amber)	On	Bit error rate has degraded (minor)
Minor Alarm (amber)	On	Power supply failed or not 'present and out of current or temperature limits
Combined Video/Audio Modules Input/Output		
Clip (amber)	On	Module overdriven
Quiet (green)	On	No Input/Output
LOS (amber) (Video/Audio Output module only)	On	Video or Audio signal not present
Online (green)	Off	Module muted (offline) or inoperative
Video Modules Input/Output		
Clip (amber)	On	Module overdriven
Quiet (green)	On	No Input/Output
LOS (amber) Video (Output module only)	On	Data signals not present
Online (green)	Off	Module muted (offline) or inoperative
Audio Modules Input/Output		
Clip, 4 each (amber)	On	Channel(s) overdriven
Quiet, 4 each (green)	On	Input/Output to channel(s) –50 dB from full scale
LOS Audio (amber, Output module only)	On	Audio carrier not present
Online (green)	Off	Module muted (offline) or inoperative
Serial Digital Modules Input/Output		
Video Online (green)	Off	Time slots not assigned or muted
270 MB/S 2 Timeslots (green)	Off	Component video not being used, 270/143 jumper set incorrectly, or input video not present
143 MB/S 1 Timeslots (green)	Off	NTSC composite video not being used, 270/143 jumper set incorrectly, or input video not present
Video Present (green, Input module only)	Off	Input video not present
Video Loss of Power (red, Output module only)	On	Input module muted or unplugged, input video not present. If just a flash, auto reset by the system
1/2 or 3/4 Audio Channel (green)	Off	Audio not present or time slots not assigned or muted
1/2 or 3/4 Audio Present (green, Input module only)	Off	Muted time slots on Input module or invalid ASE/EBU audio input stream
Audio Loss of Power (green, Output module only)	On	No data on the bus, or Input module unplugged or muted
Video/Audio Diplexer Modules Input/Output		
Video Clip (amber)	On	Module overdriven
Video Quiet (green)	On	No input/output
Audio Clip (amber)	On	Channel(s) overdriven above +18 dBm
Audio Quiet A or B (green)	On	No input/output to channel(s)
Video Online (green)	Off	Module muted or inoperative

Table 1-6. MCF System Alarm Indications - (continued)

Indicator	Status	System Indication (Minor/Major)
A/B Online (green)	Off	Subcarriers muted or inoperative
DPLX (green, Output module only)	On	Subcarriers not being separated from video
Video/Audio LOS (amber, Output module only)	On	Invalid data stream or subcarriers not present
Power Supplies		
AC OK/DC OK (green)	Off	Power supply failed (minor) Power supply present and out of limits (minor)

Functional Specifications

Table 1-7 lists the MCF system functional specifications. These specifications meet or exceed EIA/TIA-RS-250-C Short Haul and ANSI T1.505 requirements. Table 1-8 lists only the serial digital functional specifications for the MCF Serial/Digital module that are different from the general specifications listed for the MCF system. Table 1-9 lists only the audio functional specifications for the MCF Video/Audio Diplexer module that are different from the general audio functional specifications listed for the MCF system.

Table 1-7. MCF System Functional Specifications

Parameter	Value
Optical Characteristics	
Launch Power: 9 µm fiber core (typical) 1310 or 1550 nm, Laser ±5 nm	0 dBm
Receive power for $1x10^{-10}$ 1310/1550nm	–23 dBm or –29 dBm
Optical Connector Options	FC/PC, SC, or ST (9/125 µm cable)
Recommended Maximum Optical Back Reflection	Less than –30 dB
Receiver Operation and Survivability	Fiber Receiver meets specifications with optical inputs between –23dBm and –10dBm
Bit Error Rate	$< 1x10^{-10}$
High Speed Bus Architecture Characteristics	
Transmission Rate	1.25 GBaud
Data Rate	1.0 Gb/sec
Video	Six 10-bit time slots
Audio	Twelve 20-bit audio pairs (AES/EBU)
Video In/Out, Video/Audio In/Out, and Diplexer Characteristics	
Video Sample Rate	31.054 MHz
Quantization	10-bit linear, digitally half-band filtered
Effective Number of Bits (ENOB)	9.25 bits
Cable Equalization	Up to 300 meters of selected coaxial cable types

Table 1-7. MCF System Functional Specifications - (continued)

Parameter	Value
Frequency Response	Meets or exceeds EIA/TIA-RS-250-C Short Haul requirement
Chroma to Luma Gain Inequality	< ±2 IRE
Chroma to Luma Delay Inequality	< ±15 nanoseconds
Field Time Waveform Distortion	< 2 IRE peak-to-peak
Line Time Waveform Distortion	< 0.5 IRE peak-to-peak
Short Time Waveform Distortion	< 2%
Bounce	< 8 IRE, 3 second settling time
Line-by-Line DC Offset	< 2 IRE
Insertion Gain	0 dB
Insertion Gain Variation	±0.15 dB
Luminance Nonlinearity	< 4%
Differential Gain	< 1.5%
Differential Phase	< 0.7°
Chrominance to Luminance Intermodulation	< 1 IRE
Chrominance Nonlinear Gain	< 1 IRE
Chrominance Nonlinear Phase	< 1°
Dynamic Variation of Synchronizing Signal	< 1.2 IRE
Transient Sync Signal Nonlinearity	< 1 IRE
Video Signal/Noise Ratio	Better than 67 dB
Signal to Low Frequency Noise Ratio	Better than 55 dB
Signal to Periodic Noise Ratio	Better than 67 dB
Return Loss	30 dB, 0–4.2 MHz
Audio Input/Output and Video/Audio Input /Output Module Characteristics	
Audio Sample Rate	48 kHz
Quantization	18-bit linear, digitally filtered from 1-bit delta sigma at 64 times over-sampling
Input Impedance	150Ω, 600Ω, >10 KΩ, balanced
Frequency Response	±0.20 dB, 20 Hz–20 kHz, reference 1 kHz @ –15 dB from full code (no weighting)
Maximum Audio Level (full code)	Switch selectable in 4 dB steps between +24 dBm and +8 dBm
Total Harmonic Distortion + Noise	< 0.05%, 400 Hz at 24 dBm
Intemodulation Distortion	< 0.05 percent per T1.505
Signal-to-Idle Channel Noise Ratio	≥ 88 dB, reference 1 kHz at full code
Channel-to-Channel Crosstalk	≤ –84 dB at 1 kHz
Interchannel Crosstalk	≤ –84 dB at 1 kHz
Gain Difference Between Stereo A and B Channels	0.25 dB, 20 Hz–20 kHz
Phase Difference Between Stereo A and B Channels	2°, 20 Hz–20 kHz
Audio-to-Video Transmission Time Differential	< 10 ms maximum lead or lag
Common Mode Rejection Ratio	> 60 dB @ 60 Hz, > 50 dB @ 20 Hz to 20 kHz

Table 1-7. MCF System Functional Specifications - (continued)

Parameter	Value
Data Performance	
Maximum Slew Rate	30 V/µs
Bit Error Rate	< 10^{-9} errors per second
Baud Rate	19.2 kB/sec, limited by mechanical interface requirement of EIA-232D
Power Consumption	
Input Module	< 9 watts
Output Module	< 12.5 watts

Table 1-8. Serial/Digital Functional Specifications

Parameter	Value
Video Performance	
Input Signal Description	Conforms to SMPTE 259M (except cable EQ). Interface for 10-bit 4:2:2 component and 4 fsc NTSC composite digital signals
Cable Equalization	Using pathological signals from GVG M9900 module. Automatic to < 250 meters for D2 and < 200 meters for D1 of Belden 8281 or equivalent type coax cable
Cable Output Drive	> 300m of 8281 into TEK 601i
Input Signal Data Type	8-/10-bit serial video. **Note:** The Input module has one additional front panel monitor output BNC to monitor the presence of an input signal
Number of Outputs	One. **Note:** The Output module has two additional monitor outputs. One is at the front panel and the other at the MCF frame backplane
Impedance	75 Ohms
Return Loss	> 15 dB (10 MHz to 270 MHz)
Rise and Fall Times (20% to 80%)	0.4 nanoseconds to 1.5 nanoseconds when terminated into 75 Ohms
Rise and Fall Differential	< 0.5 nanoseconds
Connector Type	75 Ohm BNC
Signal Amplitude	800 mV ±10% when terminated into 75 Ohms
DC Offset	< ± 0.5V
Video Output Serial Component Jitter Serial Composite Jitter	 < 740 picoseconds peak-to-peak < 1.1 nanoseconds peak-to-peak
Audio Performance	
Digital Inputs (2) and Outputs (2)	Differential, biphase-mark encoded AES3-1992
Signal Amplitude	200 mv to 7V ± 10% when driving 110 Ohm differential load
DC Offset	< ± 0.5V

Table 1-8. Serial/Digital Functional Specifications - (continued)

Parameter	Value
Rise and Fall Times (20% to 80%)	5 nanoseconds to 130 nanoseconds when terminated into 110 Ohm differential load
Connector Type	Phoenix four 12 station block
Impedance	110 Ohms
Input Common Mode Voltage	7 VDC 20 kHz
Audio Output Jitter	< 20 nanoseconds peak-to-peak

Table 1-9. Video/Audio Diplexer Audio Functional Specifications

Parameter	Value
Frequency Response	Meets or exceeds template in EIA/TI RS-250-C
Input/Output Level	+ 18 dBm nominal, five discrete 3 dBm gain steps plus continuous ±6 dBm adjust
Total Harmonic Distortion	< 0.25%, 400 Hz at +18 dBm
Signal-to-Noise Ratio	> 70 dB, reference 400 Hz at full deviation
Gain Difference between Stereo A and B Channels	50–100 Hz 1.0 dB 100–7500 Hz 0.5 dB 7.5–15 kHz 1.0 dB
Phase Difference between Stereo A and B Channels	50–100 Hz < 10° 100–7500 Hz < 3° 7.5–15 kHz < 10°
Interchannel/Stereo Channel-to-Channel Crosstalk	< –56 dB, 50 Hz to 15kHz
Subcarrier Injection Level	100 mV peak-to-peak (–20 dBV) per carrier (nominal)
Availability of the Audio Signal	99.99%
Audio-to-Video Transmission Time Differential	25 ms lead to 40 ms lag
Audio Pre-emphasis/De-emphasis	75 µsec
Common Mode Rejection Ratio	> 60 dB, 60 Hz > 50 dB, 20 Hz to 10 kHz
Input DC Common Mode Voltage	±25 VDC
FM Deviation	185 kHz peak, 400 Hz test tone at +18 dBm
Input Impedance	150, 500, >30K Ohms differential (DIP switch select)
Audio Inputs	Differential Analog (DC to 15 kHz)
Audio Outputs	Differential Analog (DC to 15 kHz)
Maximum Output Level	+18 dBm
Output Impedance	15 Ohms differential

Terms Used

The following is a list of terms used in this manual.

Communication Ports

The Craft and Administration serial data ports (RS-232, RS-485) on the back of the MCF system that allow you to communicate with the system. The ports are also referred to as control data ports.

Cross-Connect

A connection between any I/O board and a time slot in the fiber signal.

Dark Fiber

Dedicated optical fiber leased from a common carrier.

Diplex Operation

The simultaneous transmission or reception of two messages on a single carrier.

Drop Monitor

The ability to drop off a signal from the Repeater frame for monitoring purposes. This can be used for troubleshooting.

Earth Ground

A ground connection from the equipment frame to a metal rod driven into the earth.

Error Messages

Messages generated by the control system indicating fault conditions. Messages are displayed on a monitor connected to the Craft or Admin port. See the Protocol and User's manuals for more information.

FC/PC Connector

A low-loss fiber connector option provided on the front of the Fiber Receiver and Transmitter modules.

FIFO

First In First Out. Holds video data samples. The FIFO also separates the system clock from the video sample clock.

LOS

Loss of Signal. When there is no valid signal present in the selected time slot of an output board, or at the input of the Fiber Transmitter module.

Loss Budget

The amount of anticipated signal loss over a given fiber optic path, including attenuation, connector loss, splice loss, and other losses.

One-to-Many Connection/Transmission

One time slot on the fiber bus is associated with multiple Output boards. Available in the Receiver frame only.

One-to-One Connection/Transmission

Only one video and /or audio input board is associated with the same time slot on the fiber bus. Available in the Transmitter frame or Receiver frame.

Optical Receiver Sensitivity

The minimum level of optical power required at the receiver input to guarantee satisfactory operation.

Optical Receive Power

The level of optical power arriving at the receiver as measured with an optical power meter.

Ramp Signal

Test signal that graduates from low DC level to high DC level; used to test signal path.

SC Connector

A low-loss fiber connector option provided on the front of the Fiber Receiver and Transmitter modules.

ST Connector

A low-loss fiber connector option provided on the front of the Fiber Receiver and Transmitter modules.

STUFF

“Place Holder Data” inserted to correct for uncertainty in real data time of arrival.

Time-Division Multiplexing

A method of multiplexing in which a common transmission path is shared by a number of channels on a cyclical basis. This is accomplished by enabling each channel to use the path exclusively for a short time slot.

Time Slot

Any cyclic time interval which can be recognized and uniquely defined.

TV1 Diplexed Signal

Industry standard for transmission of Audio subcarriers above Video baseband.

Unidirectional Signal

A signal that only goes in one direction. A one-way connection or transmission.

Video Cable Equalization

Use of hybrid equalizers to correct the high frequency loss associated with signals transmitted over long lengths of coaxial cable.

Section 2

Installation

Installation Overview

The following topics are covered in this section:

- Pre-Installation Planning
- Unpacking and Inspecting the Equipment
- Installing the MCF System
  - Six Rack Unit Frame (6 RU)
  - Two Rack Unit Frame (2 RU)
- Making Connections
  - Video
  - Audio
  - Fiber-Optic
- Making Jumper and DIP Switch Selections and Required Adjustments for Each Module
- NRZ/NRZI Modes and Compatibility
- Installing Modules in the Frame
- Turning Power On
- Operational Checkout

Note MCF systems are shipped with the modules already installed in the MCF frames.

Pre-Installation Planning

Some preplanning is required before installing your MCF system. The following paragraphs describe specific items you need to address.

Calculating Optical Fiber Path Loss Budget

Before installing your equipment it is important to calculate the optical loss budget, which determines the amount of optical energy available at the MCF Receiver unit. If the energy is too low, the noise floor rises and causes excessive bit error rates. If the energy is too high, the Receiver's optical detector will be overdriven and cause excessive bit error rates.

To achieve specified performance in your current MCF system, the optical power arriving at the receiver must be greater than –23 dBm (or -29 dBm on recently-produced receiver boards) and less than –10 dBm (that is, between –10 dBM and –23 dBm), as measured with an optical power meter. The received power equals the difference between fiber path losses in your facility and the output power transmitted into the fiber.

Output Power Transmitted	=	+ 0.0 dB
Fiber Path Loss	=	–20.0 dB
Receive Power	=	–20.0 dB

If the received power exceeds –10 dBm (typical on very short fiber paths), a fixed value optical attenuator can be inserted into the fiber path. To calculate your system's total optical fiber path loss budget, see the following example.

The total fiber path loss budget possible with the MCF system is 23 dB (or 29 with recent-production receivers) calculated according to the following formula:

Device Loss Budget Allowance

9 µm Singlemode (1300nm) Cable 0.5 dB per kilometer
FC/PC Singlemode Connector 1.0 db per connector
Singlemode Splice 0.5 dB per splice

Note Manufacturer's specified connector and splice losses are typically less than those shown here. These losses are intended for use in Loss Budget calculations and, therefore, include allowance for degradation.

This example illustrates a fiber path loss budget calculation:

25 km single mode fiber @ 0.5 dB per kilometer	=	+12.5 dB
Four FC/PC connectors @ 1 dB per connector	=	+ 4.0 dB
Ten splices @ 0.5 dB per splice	=	+ 5.0 dB
Total loss budget	=	+21.5 dB

This loss budget is within the range of the MCF system (between 0 dBm and –23 (or -29) dBm).

For output power of the optical transmitter, refer to the specification table found in Section 1 of this manual.

Space Planning

The MCF system installs in a standard 19-inch equipment rack where a rack unit (RU) equals 1.75 inches (44.5 mm). The large MCF frame occupies 6 RUs and the required fan and deflector assemblies occupy 1 RU each for a total of 8 RUs. (See the following subsection, "Installation of the MCF system in the Equipment Rack," for additional information.) The small MCF frame occupies 2 RU. The 2 RU frame exhaust fan is inside the frame. No additional fan or deflector assemblies are required, so the overall frame height is 2 RUs.

Power Requirements

For DC operation, a –48 volt supply is required. For AC operation, nominal line voltage of 120 or 240 volts, 50–60Hz is required. The 6 RU frame AC operating voltage is selectable (110/220 VAC) via a switch at the rear of the frame. The 2 RU frame is self-selecting. (See the following "Power Connection" subsection for additional information.)

Heat Considerations

The MCF system operates in an ambient temperature range of 0° to 50° C.

Humidity

This equipment operates within an ambient non-condensing humidity range of 0% to 95%.

Unpacking the Equipment

Follow the steps given here and on the following page as you unpack the Tektronix equipment.

Receiving Inspection

Inspect all shipping containers for any signs of damage. If any damage is found, notify the shipping company immediately.

Unpacking

Follow the safety precautions found in Steps 1 through 4 when unpacking the Tektronix equipment.

1. Place the shipping containers on a flat, level surface with enough room to move the containers around as needed.
2. Locate the shipping container with the small plastic pouch and remove the Packing List.

CAUTION When handling the Fiber Transmitter and Fiber Receiver, avoid unnecessary handling of the fiber pigtail and connector which can be broken or damaged by improper handling. Damage due to mishandling is not covered by warranty.

3. Open the shipping containers, carefully remove the contents, and place the contents on a flat, level surface.
4. Compare the contents in each shipping container with the packing list to ensure there are no missing items. Make notes of any discrepancies.

For a single 6 RU system, each terminus should have a

- Frame
- Fan Assembly
- Deflector Assembly (identical to the fan assembly but lighter as it does not have the fans)

For multiple 6 RU frame systems mounted in a telco-rack, separate deflector assemblies are not required.

The 2 RU frame system is entirely self contained. No fan or deflector assemblies are included.

If there are any discrepancies between the packing list and items received, contact Tektronix Customer Service.

Equipment Inspection

Inspect all equipment for any visible damage. Items which should specifically be checked are

- Connectors for bent or broken pins
- Cables for crimped or broken wires
- Glass fibers for breaks and kinks
- Equipment chassis for any visible damage

If any damage is found, contact Tektronix Customer Service.

Note If an item is damaged, DO NOT make any power or signal connections unless otherwise advised by Tektronix Customer Service.

Test Equipment and Tools Required

No specific test equipment required for the initial installation and setup of your MCF system. A flat-blade and cross-head screwdriver are the tools required to complete the installation.

Installation of a 6 RU Frame in the Equipment Rack

The 6 RU frame installs in a 19-inch (483 mm) equipment rack. A wider 23-inch (584 mm) rack can be used with an optional 23-inch mounting bracket kit (part number MCF-BRK-236). Figure 2-1 illustrates installation of a

basic system and Figure 2-2 is an example of a multiple frame system. Four bolts and the appropriate screwdriver are needed for installation of each component.

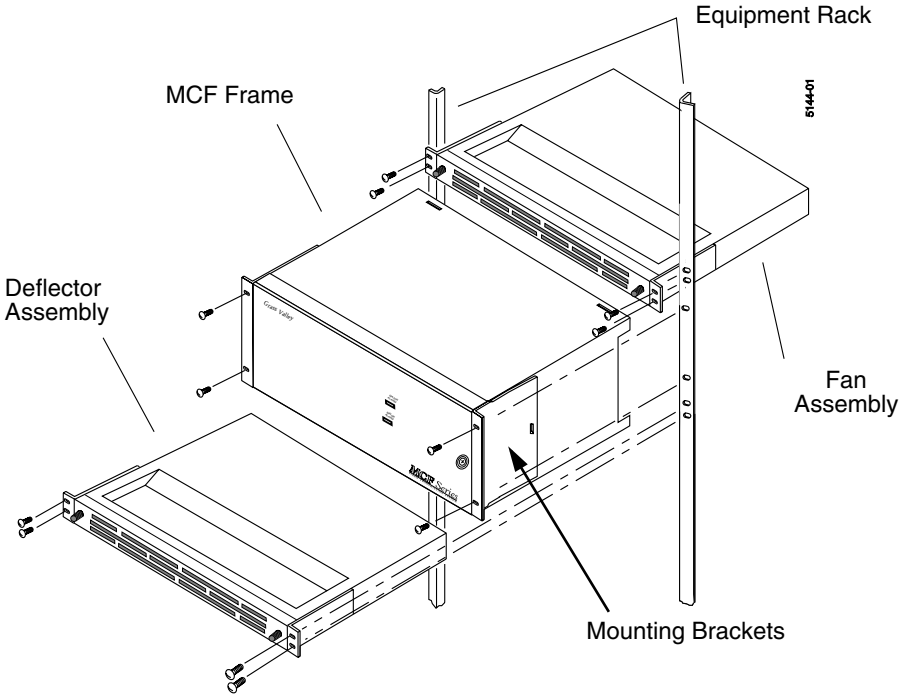


Figure 2-1. Installation in the 19-Inch Equipment Rack for the 6 RU Frame

Installing a 6 RU Frame

To install the 6 RU frame in the 19-inch equipment rack, see Figure 2-1 and perform the following:

1. Position the frame in the equipment rack at the desired height and secure it to the equipment rack with two bolts on each side.
2. Position the fan assembly immediately above the frame and secure it to the equipment rack with two bolts on each side.
3. Position the deflector assembly immediately below the frame and secure it to the equipment rack with two bolts on each side.

Note For installation into a 23-inch rack, fan and deflector assemblies mounting brackets may be reversed.

The large MCF system requires eight contiguous rack units in the equipment rack: 6 RUs for the frame and 1 RU each for the fan and deflector assemblies.

Installing Multiple 6 RU Frames

To install multiple 6 RU frames in the 19-inch equipment rack, see Figure 2-2 and ensure the following items:

- 6 RUs are available for each frame
- 1 RU is available for each fan assembly
- 1 RU is available for the deflector assembly
- In a stack of frames and fan assemblies, the deflector assembly is installed at the bottom of the stack
- A fan assembly fits above each frame

For example, the multiple frame example shown in Figure 2-2 would require 15 contiguous rack units: 6 RUs for each frame (total of 12 RUs); 1 RU for each fan assembly (total of 2 RUs); and 1 RU for the deflector assembly, for a total of 15 RUs.

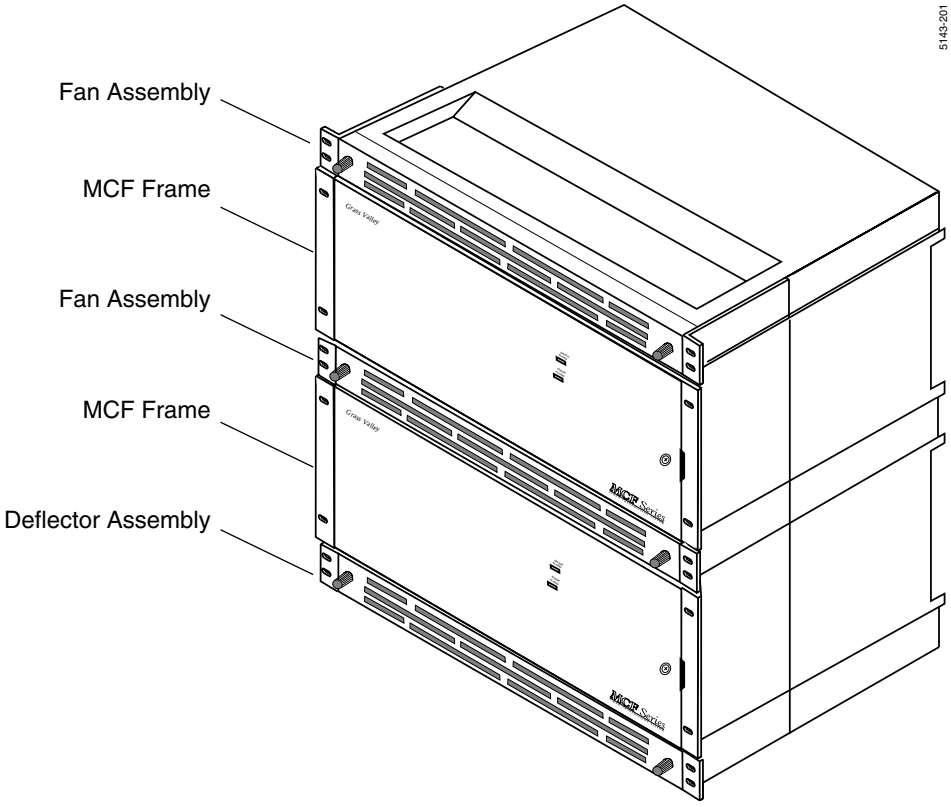


Figure 2-2. Multiple MCF Systems in the Equipment Rack

Maximum 6RU Frame Configuration

In a 7 ft. bay there are 44 mounting spaces available; therefore, up to six 6 RU frames can be installed in the bay—36 spaces are taken up by the 6 RU frames, six spaces are used for the Fan Assemblies, and one space is used

for the Deflector Assembly at the bottoms (see Figure 2-3). Up to twenty-two 2 RU frames can be installed in a 7 ft. bay, taking up all 44 spaces—no deflector or fan assemblies are required with the 2 RU frames.

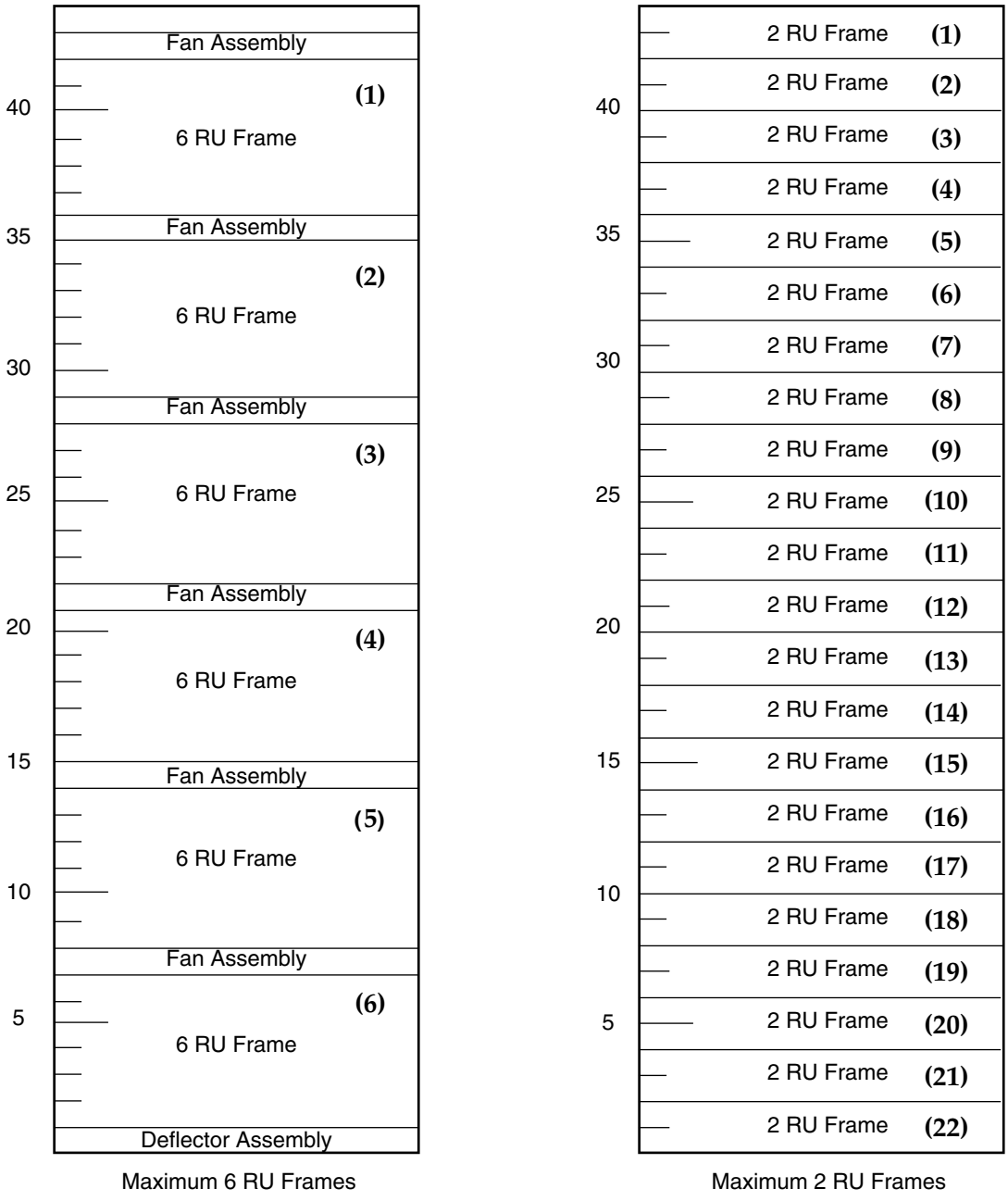


Figure 2-3. Maximum 6RU and 2RU Configurations in a 7 ft. Bay

Installation of a 2 RU Frame in the Equipment Rack

The 2 RU frame installs in a 19-inch (483 mm) equipment rack. A wider 23-inch (584 mm) rack can be used with an optional 23-inch mounting bracket kit (part number MCF-BRK-232). Figure 2-4 illustrates installation of a two rack system. Four bolts and the appropriate screwdriver are needed for installation of each frame.

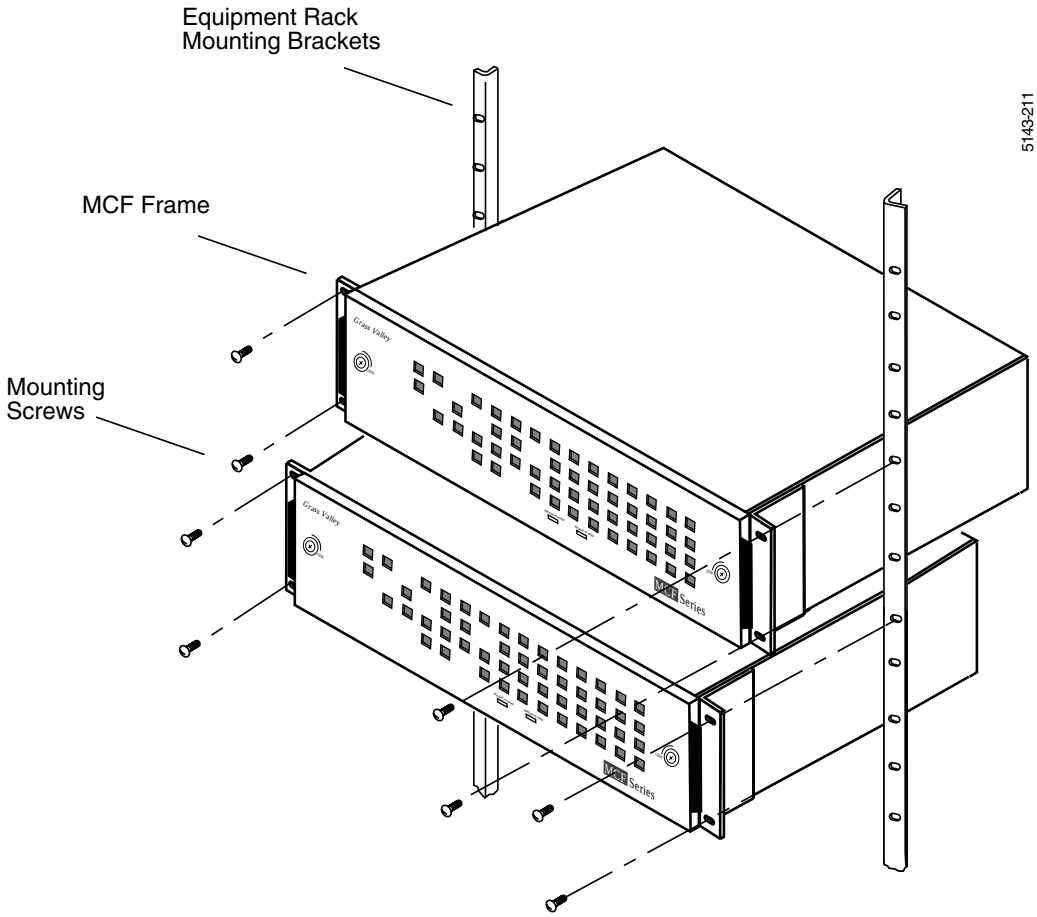


Figure 2-4. Multiple 2 RU Frame Installation in the 19-Inch Equipment Rack

Installing a 2 RU Frame

To install the 2 RU frame in the 19-inch equipment rack, follow these steps:

1. Position the frame in the equipment rack at the desired height.
2. Secure it to the equipment rack with two bolts on each side.

You may attach any number of 2 RUs in your equipment rack. The 2 RU frame is self-contained and does not require the fan and deflector assemblies for cooling.

Installing Multiple 2 RU Frames

To install multiple 2 RU frames in the 19-inch equipment rack, see Figure 2-4. The 2 RU frame is self-contained and does not require the fan and deflector assemblies for cooling.

Making Frame Connections

With the exceptions of the fiber-optic cable and monitors, all connections are made at the rear of the frame. See Figure 2-5 for an illustration of a 6 RU MCF system backplane. These connections for the 6 RU backplane include the following:

- Frame ground connections
- Alarm connections
- Power connections—DC and AC
- Fan power connection
- Video and audio signal connections (9 each)

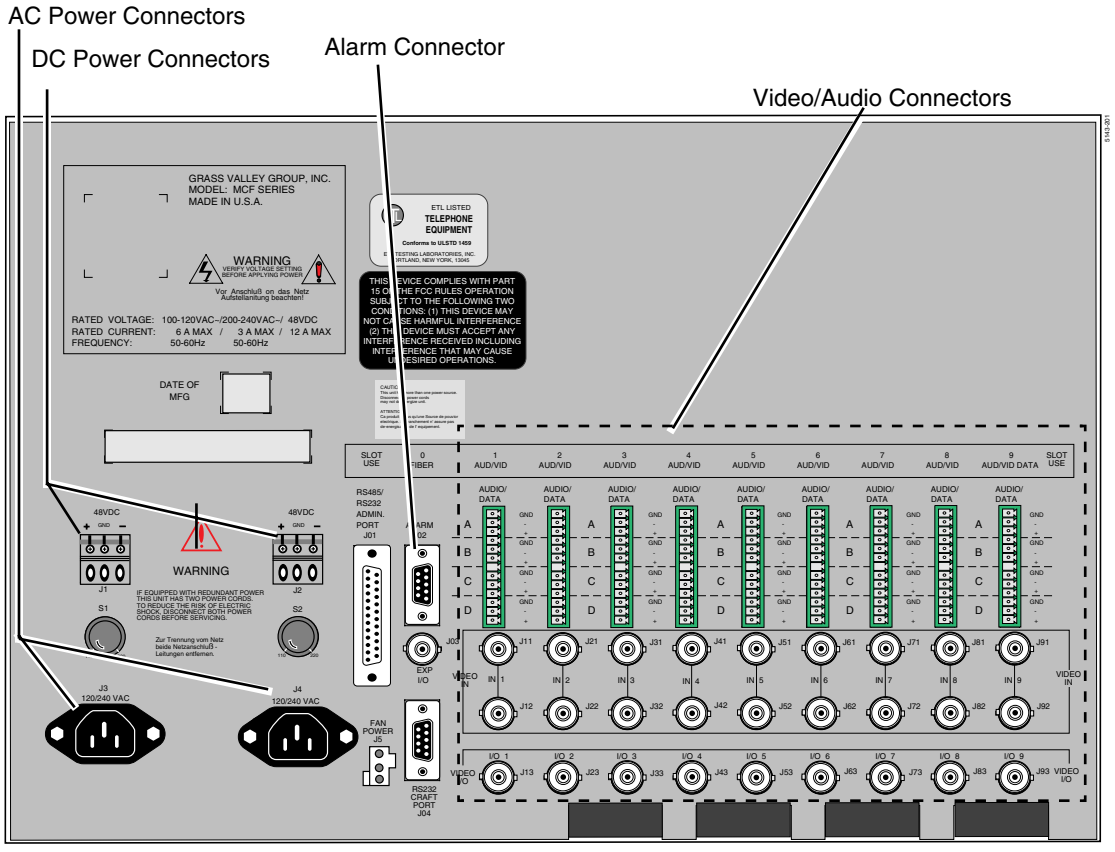


Figure 2-5. Backplane Frame for 6 RU

Backplane for the 2 RU Frame

With the exceptions of the fiber-optic cable and monitors, all connections are made at the rear of the frame. These connections for the 2 RU backplane include the following:

- Frame ground connections
- Video and audio signal connections (2)
- Alarm connections
- Power connections—DC and AC

See Figure 2-6 for an illustration of a 2 RU system backplane.

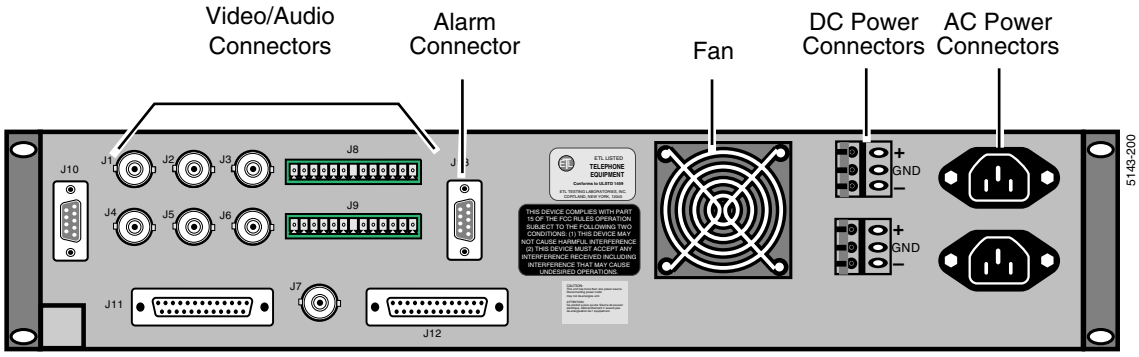


Figure 2-6. Backplane for the 2 RU Frame

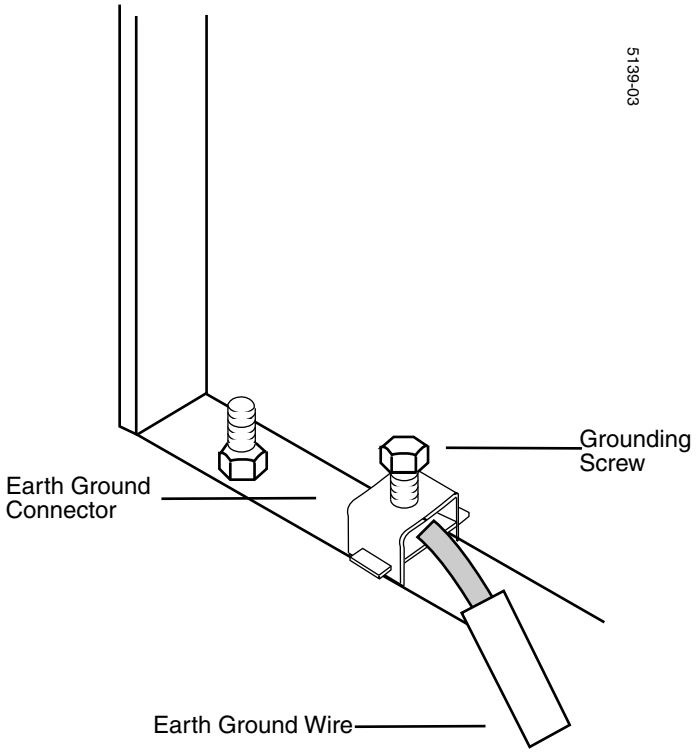
Grounding the Frame

It is recommended that the chassis of the frame be connected to earth ground. A grounding connector is provided on the back of each MCF frame. To make the connection, see Figure 2-7 and perform the following steps:

1. Loosen the grounding screw.
2. Insert the earth ground wire as shown in Figure 2-7.

3. Firmly tighten the grounding screw until snug.

Figure 2-7. Earth Ground Wire Attachment



Making Alarm Connections

Alarm outputs correspond to the alarm indicators on the front of the power supplies and MCF system modules. Alarm outputs from the Fiber module are routed to the ALARM connector on the rear of the frame. See Figure 2-8 for the connector location for a 6 RU frame. See Figure 2-9 for the connector location for a 2 RU frame.

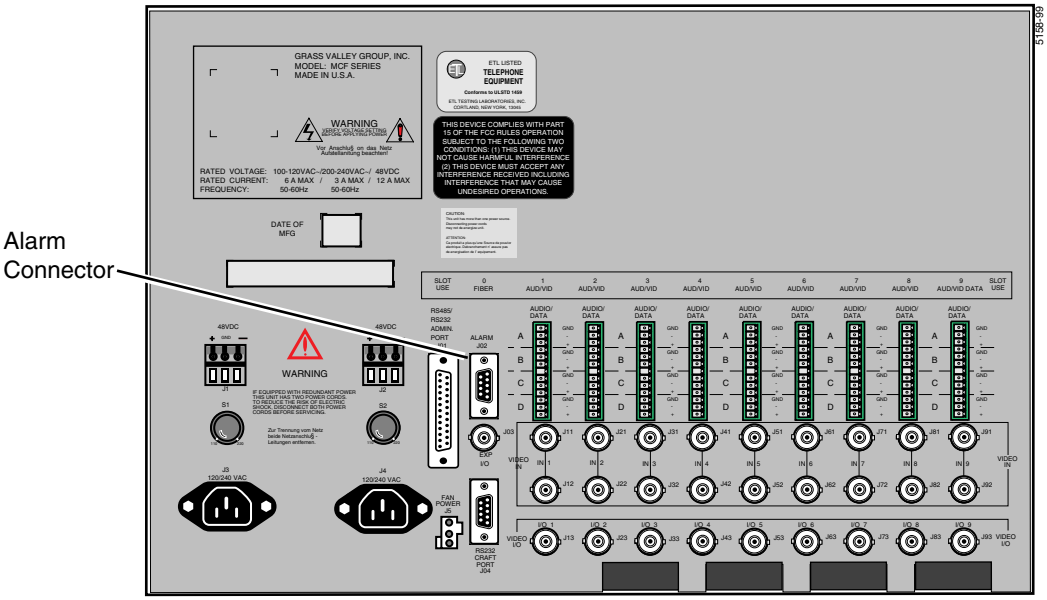


Figure 2-8. Backplane Alarm Connections for 6 RU Frame

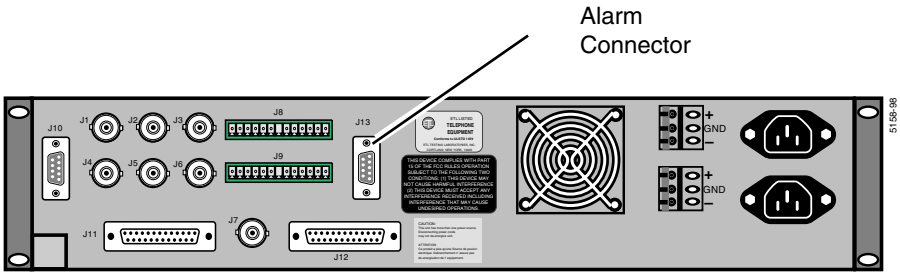


Figure 2-9. Backplane Alarm Connections for 2 RU Frame

This connector is a DB-9 (9-pin D female) socket connector. It provides relay closures to ground when an alarm condition exists. A cable from an external indicator, such as a light, can be attached to this connector. This cable must be supplied by the customer. Table 2-1 lists the pinouts for the DB9-F connector.

Table 2-1. Alarm Connector Pinout

Pin	Signal
1	Minor Alarm Relay Common
2	Minor Alarm Relay Normally Open
3	Minor Alarm Relay Normally Closed
4	Blank
5	Major Alarm Relay Normally Closed
6	No connection
7	Major Alarm Relay Normally Open
8	Major Alarm Relay Common
9	Earth Ground

Making Power Connections

CAUTION Do not apply power until you have completed all of the cabling procedures.

The rear of the frame provides one of three connector configurations for AC and DC power sources:

- two AC,
- two DC, or
- one AC and one DC.

Connections of both sources are discussed in the following text. If the frame has one of each or only one power supply, verify that you are connecting power to the correct slot location(s) in the frame before making connections.

Verify that the proper type of frame power supply is installed to the power source in your in your installation.

WARNING **Any instructions in this manual that require opening the equipment cover or enclosure are for use by qualified service personnel only. To reduce the risk of electric shock, do not perform any servicing other than that contained in the operating instructions unless you are qualified to do so.**

AC Power Connections

The AC power connections for the 2 RU or 6 RU frame are slightly different. Those difference are noted in the following text.

Six RU Frame

AC power may be connected to either J3 or J4 or both, depending on your MCF system configuration. Setting the line (source) voltage level is done with either S1 or S2, or both, again depending on whether you have a redundant power supply installed. Figure 2-10 illustrates the location of S1 and S2. To connect AC power, see Figure 2-5 (for location of the AC connector on the backplane) and Figure 2-10 (for S1 or S2 location), and perform the following steps:

CAUTION Set S1 and/or S2 only when the AC power source is disconnected. Changing the setting with the AC power connected causes catastrophic damage to your MCF system.

1. Using a small, regular screwdriver, set the Line Voltage Selector Switch, S1 and/or S2, as shown in Figure 2-10, to the correct level of AC source power (110 or 220 Volts nominal).

2. Attach the socket (female) end of the supplied power cord(s) to the AC connector(s), J3 and/or J4. If only one supply is installed, ensure the cord is inserted into a connector that connects to a Power Supply module. Do not apply power until the remainder of the cabling has been completed.

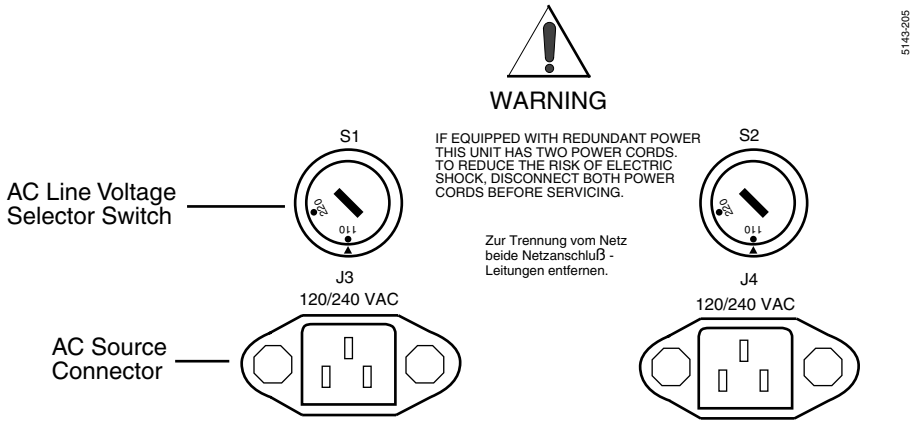


Figure 2-10. AC Line (Source) Voltage Selection

Two Rack Unit Frame

3. The AC power supply for the 2 RU frame is auto-ranging. The unit will adjust itself automatically for 100 or 220 VAC. Simply plug the unit into the appropriate power source, and the selection is made. See Figure 2-11 for the AC power connector location. Do not apply power until the remainder of the cabling has been completed.

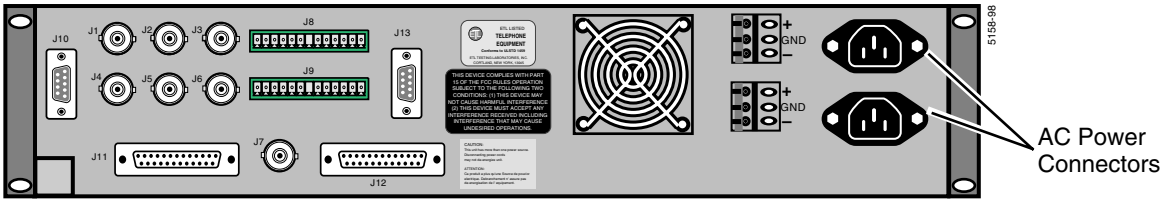


Figure 2-11. AC Power Connector for the 2 RU Frame

DC Power Connections

The DC power connections for the 2 RU and 6 RU frames are identical. The installation process is noted in the following text.

DC Power for the 6 RU Frame

DC power may be connected to either J1 or J2 or both, depending on the system configuration. Connect to a 48 VDC Safety Extra-Low Voltage (SELV) source (as defined by Underwriter's Laboratories) or to a 48 VDC source that is electrically isolated from the AC source and is reliably connected to earth.

To connect DC power, see Figure 2-5 (for location of the DC connector on the backplane) and Figure 2-12 for location of the DC positive (+) and negative (–) connectors. Perform the following steps:

1. Ensure that the 48 VDC Power source is turned off.
2. Using a small, flat-blade screwdriver, loosen the three screws in the 48 VDC connector (J1).
3. Strip enough of the ends of the wires from the 48 VDC power source to allow easy insertion into the DC connector on the MCF backplane.

4. Insert the positive (+) and negative (–) wires from the –48 VDC power source into the appropriate connector slots and tighten the screws previously loosened in Step 1.

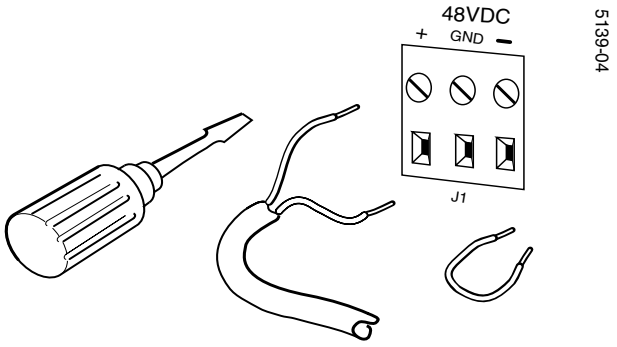


Figure 2-12. DC Power Connection Detail

5. If desired, a NRZ may be used between the GND connection and either the + or – connection.
   a. Connect the jumper between GND and + if your 48 VDC supply has its positive side tied to earth ground.

      or

   b. Connect the jumper between GND and – if your 48 VDC supply has its negative side tied to earth ground.

6. Tighten all screws in the connector to secure the DC leads.

Note Do not connect the DC power cord to the DC source power at this time. Frame Power is applied when making source power connection at the end of the installation process.

DC Power for the 2 RU Frame

Do not connect the DC power cord to the source power at this time. Simply plug the unit into the appropriate frame and the DC selection is made. See Figure 2-13 for the DC power connector location.

See Steps 1 through 6 to make the DC power connections.

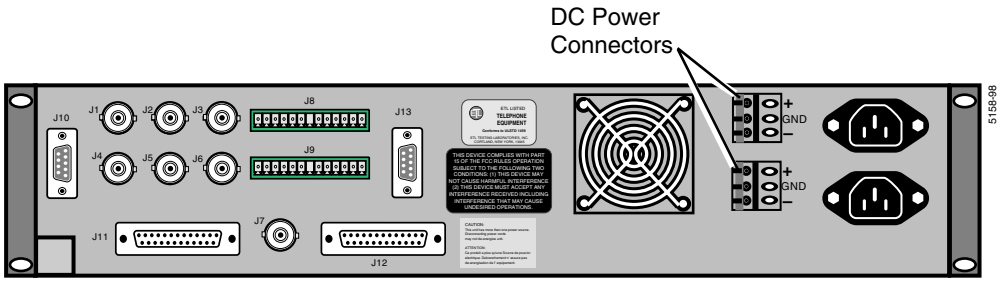


Figure 2-13. DC Power Connector for the 2 RU Frame

Fan Power Connection

The fan power connection on the 6 RU frame is described in the following text. The 2 RU frame has the exhaust fan mounted directly on the back-plane—the fan is in place and powered when the frame is powered. For the 2 RU frame, no fan installation instructions are required.

Fan for the 6 RU Frame

To connect power to the exhaust fan assembly, a cable is provided with the frame. (This cable is approximately 15 inches long.)

1. Attach the fan power cable to the FAN POWER connector, J5, on the rear of the MCF frame.

2. Connect the other end of the power cable to the power connector on the fan assembly. Note that the connectors are keyed to prevent mismating. See Figure 2-14 for connector location.

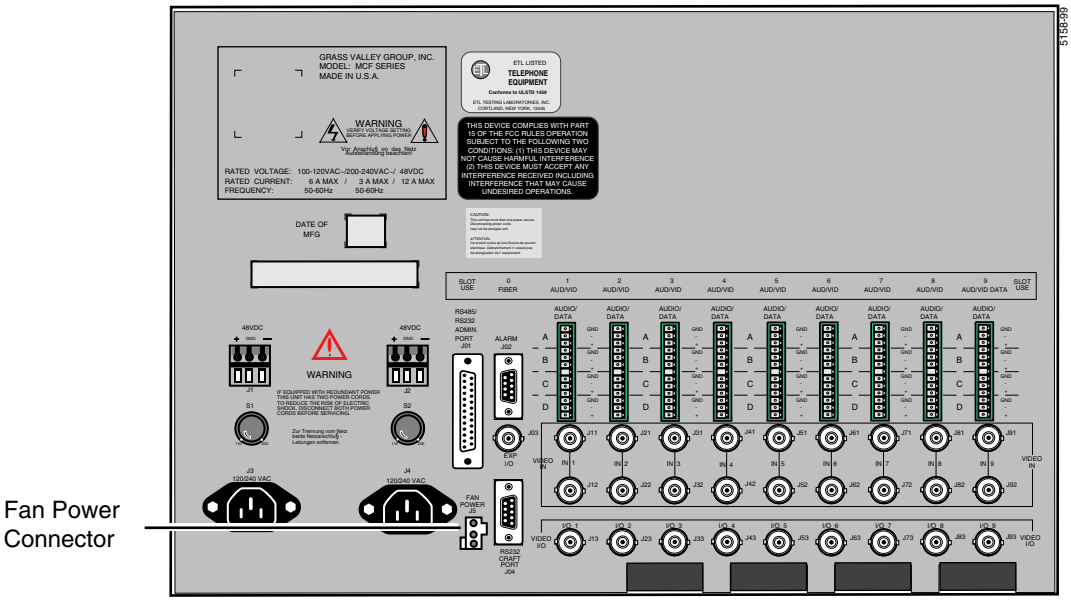


Figure 2-14. Backplane Fan Power Connector for 6 RU Frame

Making Signal Connections

Signal connections consist of video and audio signal connectors and the fiber-optic connector. If a terminal is to be used (recommended but not required), signal connections include those for Craft and Administration port connectors. These connections are described in the following text.

Note The EXP I/O port (J03 on the 6 RU frame, and J7 on the 2 RU frame) is for factory use only.

Administration Port Connection

The RS-485/RS-232 ADMIN PORT connector (J01 on the 6 RU frame, and J12 on the 2 RU frame) is a DB-25F socket connector. This connector connects the frame to a computer. A commercially available 25-pin, null modem cable may be used for the RS-232 application; however, the RS-485 cable must be constructed. The pinouts for both cables are listed in Table 2-2.

Table 2-2. RS-232/RS-485 Administration Port J01 Pinouts

Pin	Direction	RS-232 Signal	RS-485 Signal
1	----	Earth Ground	Earth Ground
2	Out	TX Data	TX Data+
3	In	RX Data	RX Data+
4	Out	RTS (request to send)	NC (no connection)
5	In	CTS (clear to send)	NC
6	In	DSR (data set ready)	NC
7	----	Signal Ground	Signal Ground
8–13	----	NC (no connection)	NC
14	Out	NC	TX Data–
15	----	NC	NC
16	In	NC	RX Data–
17–19	----	NC	NC
20	Out	DTR (data terminal ready)	NC
21–25	----	NC	NC

RS-485 Communication

To preserve the shape and integrity of a waveform traveling along a cable, the cable must be terminated in an impedance equal to its characteristic impedance. In a system such as this, where data travels in both directions, both physical ends of the cable must be terminated into a 120 Ohm impedance. Stubs leading to each Transmitter should be as short as possible. Circuit ground of all transmitters must be connected via a dedicated wire within the cable.

Leaving off the terminations generally results in reflections that can have amplitudes of several volts above V_{CC} or below ground. These overshoots and undershoots can disrupt the Transmitter operation, create false data, and in some cases possibly damage components on the bus.

Figure 2-15 illustrates an example of RS-485 cabling.

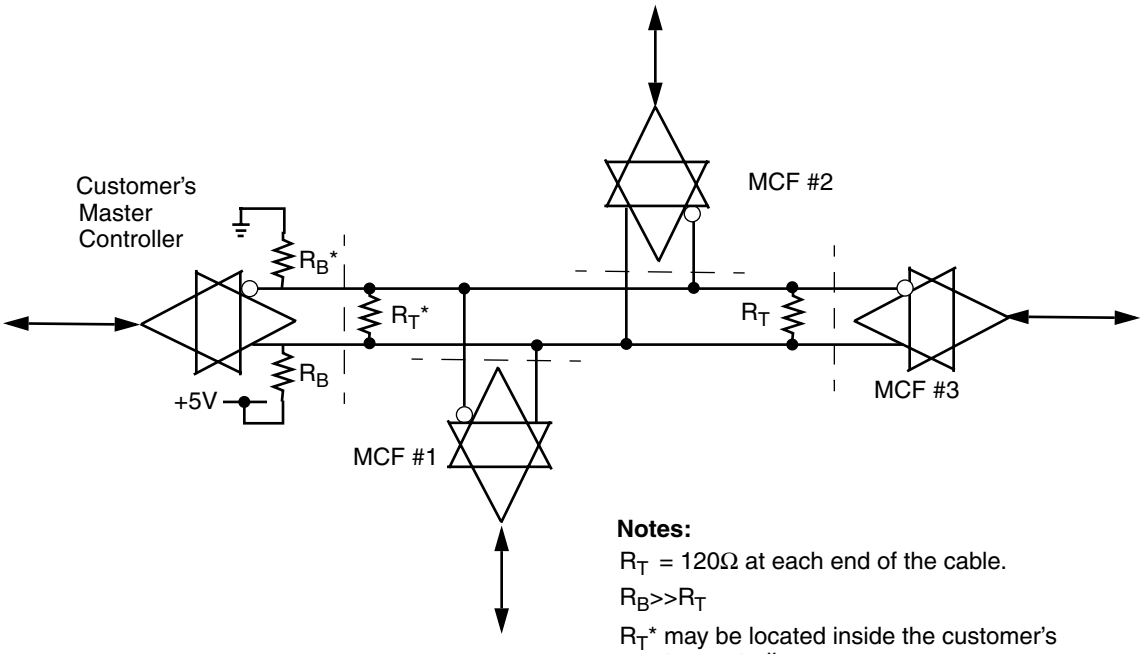


Figure 2-15. RS-485 Communications Cabling

See Figures 2-5 (for 6 RU frame) or 2-6 (for 2 RU frame) and Figures 2-16 or 2-17 for connecting and cabling information. Figure 2-16 is for a 4-wire cable and Figure 2-17 is for a 2-wire cable.

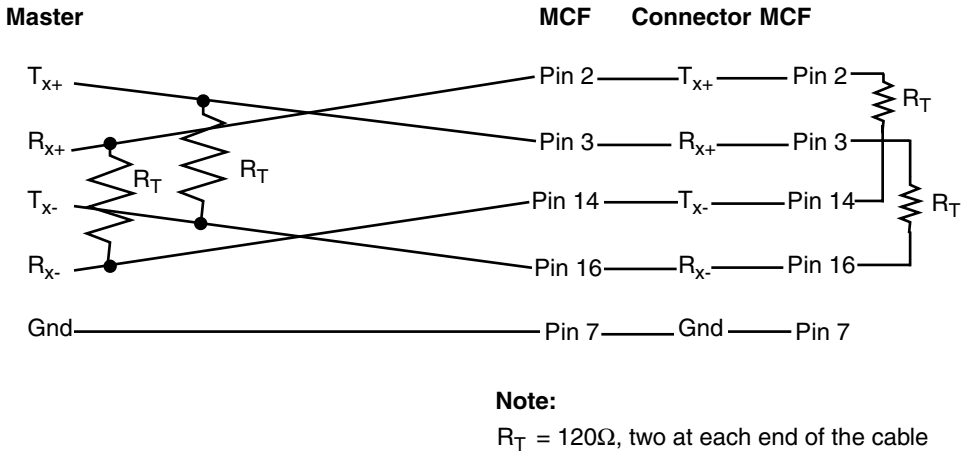


Figure 2-16. Four-Wire RS-485 Cable Pinouts

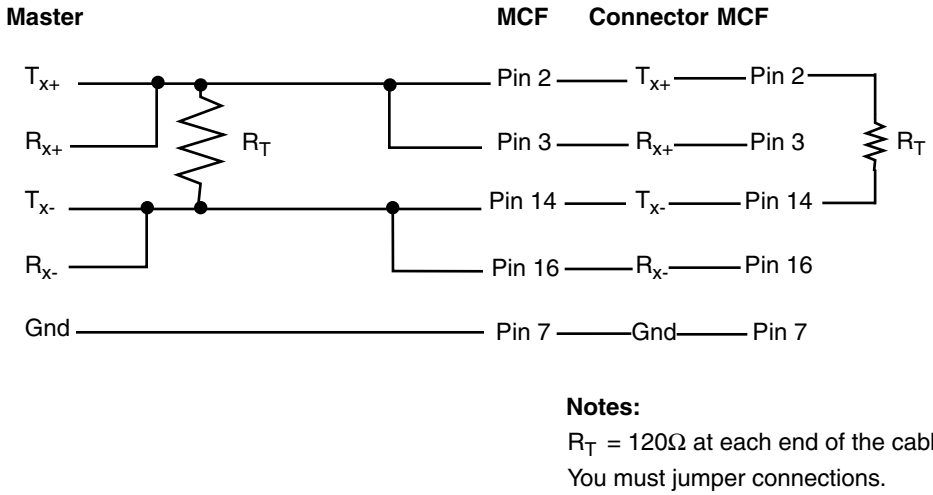


Figure 2-17. Two-Wire RS-485 Cable Pinouts

Biasing RS-485

Biasing is required to force –200mV for V_{AB} to generate a line idle condition. See Figure 2-18.

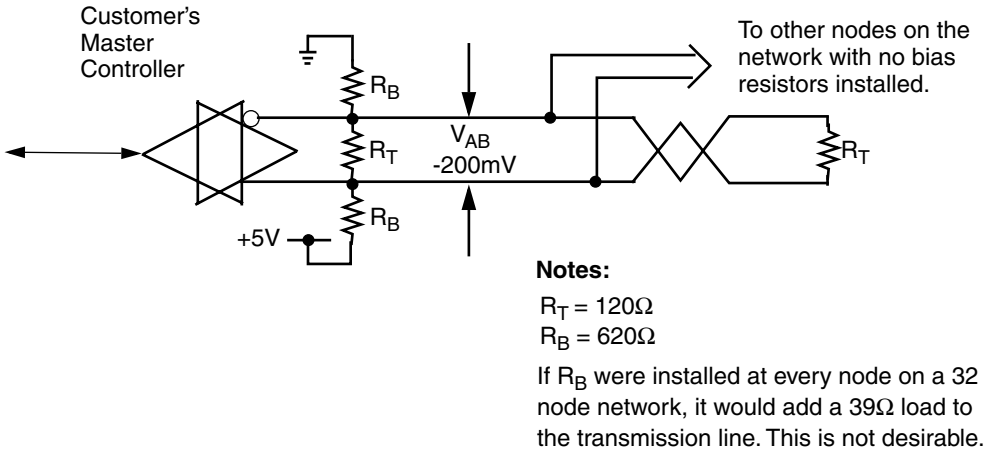


Figure 2-18. Single Node Bias — Normal Termination

RS-232 Communication

Figure 2-19 illustrates how the serial data signals at the MCF interconnect with those of the peripheral equipment. Pin numbering varies widely with RS-232 implementation; therefore, only numbering for the Administration port connection is shown. A standard RS-232 null modem cable may work in many cases. Note that the names of the RS-232 signals depend on whether they are being received or transmitted. For example, TX Data leaving the peripheral equipment is renamed RX Data where it is received at the MCF unit.

Data connections are provided through a connector serving a bidirectional channel. The data signal interface conforms to the RS-232-C standard. (The EIA standard on Interface Between Data Terminal Equipment and Data Communication Equipment Employing Binary Data Exchange.)

Make interconnections as illustrated in Figure 2-19.

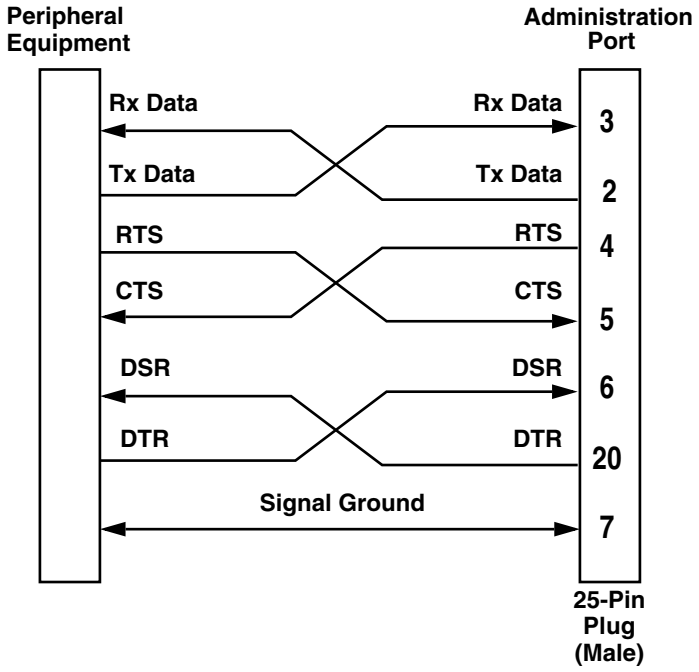


Figure 2-19. RS-232 Administration Port Cabling Interface

The RS-232 Administration port connector (J01 on the 6 RU frame, and J12 on the 2 RU frame) is a DB25-F socket connector. It connects the MCF frame to a computer. The cable for the Administration port must be constructed by the customer. The tabled titled *RS-232/RS-485 Administration Port J01 Pinouts* on page 2-20 lists the pinouts.

The minimum configuration for the Administration port RS-232 communication is illustrated in Figure 2-20.

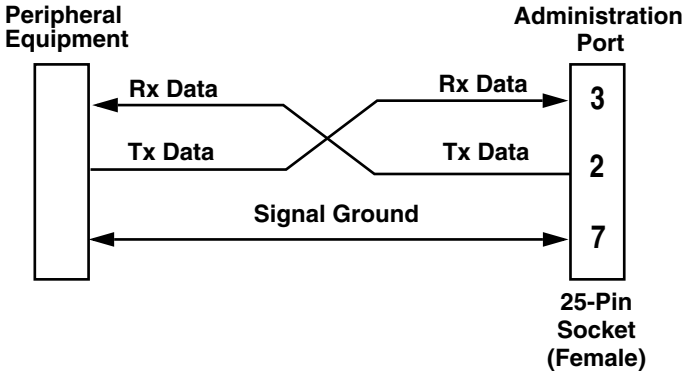


Figure 2-20. Minimum RS-232 Administration Port Cable

Craft Port Connection

Figure 2-21 shows how the serial data signals at the frame's Craft port interconnect with those of the peripheral equipment. Because pin numbering varies widely with RS-232 implementation, only numbering for the Craft port connection is shown. Note that the names of the RS-232 signals depend on whether they are being received or transmitted. For example, TX Data leaving the peripheral equipment is renamed RX Data where it is received at the MCF unit.

Data connections are provided through a connector serving a bidirectional channel. The data signal interface conforms to the RS-232-C standard. (The Electronic Industries Association Recommended Standard RS-232-C, Interface Between Data Terminal Equipment and Data Communication Equipment Employing Binary Data Exchange.) Make interconnections for the 9-pin connector for either the 6 RU or 2 RU frames as illustrated in Figure 2-21.

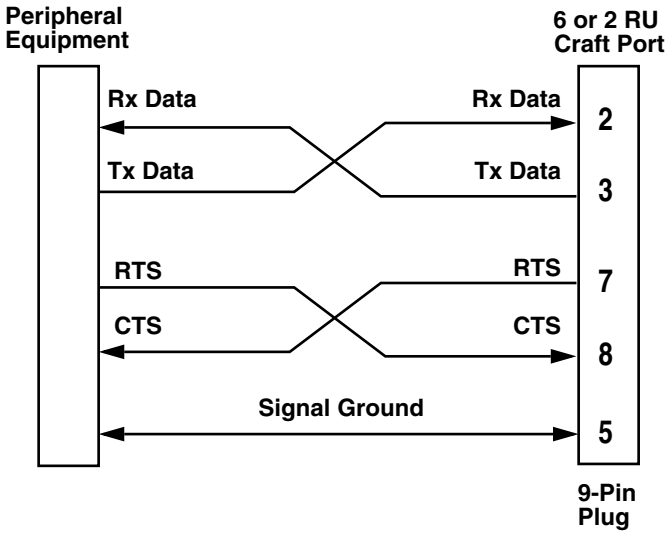


Figure 2-21. Craft Port Connector Pinout (9-pin plug) for 6 or 2 RU Frame

CAUTION On the 2 RU frame, you may use either the 9-pin or the 25-pin Craft port connector, but you may not use both for communication purposes. If you do, your system will malfunction.

The 2 RU frame backplane has a 9-pin and a 25-pin connector for Craft port communication. The 9-pin connector is J10; the 25-pin connector is J11. See Figure 2-22 for 25-pin connector.

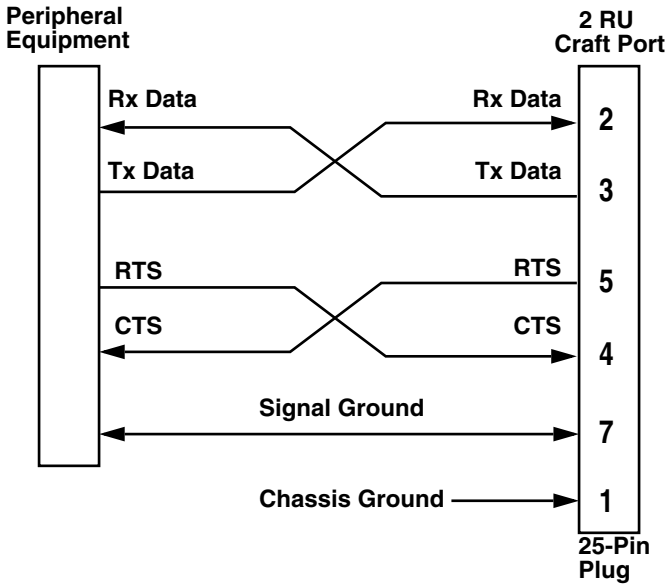


Figure 2-22. Two RU Frame Craft Port Connector Pinout (25-pin plug)

The minimum configuration for the Craft port communication for either the 6 RU or 2 RU frame is illustrated in Figure 2-23.

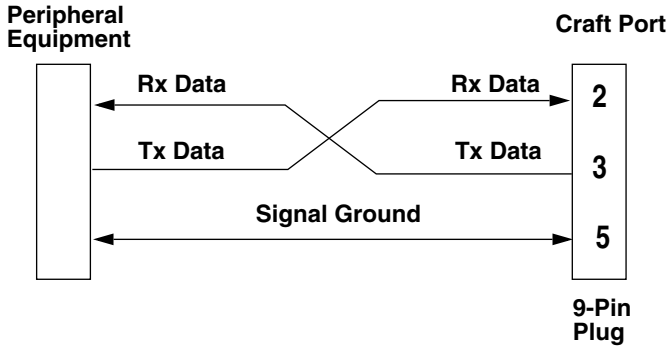


Figure 2-23. Minimum Craft Port Configuration

The 9-pin RS-232 Craft Port connector (J04 on the 6 RU frame, and J10 on the 2 RU frame) is a DB9-M plug connector. It connects the frame to a terminal. The cable for the Craft port must be constructed. The pinouts are

listed in Table 2-3. Note that the 2 RU frame has DB25-M Craft connector (J11) also. The pinout information for the 25-pin connector is found in Table 2-3.

Table 2-3. RS-232 Craft Port DB9-M Pinouts

Pin	Direction	Signal
1	----	No connection
2	In	RX Data
3	Out	TX Data
4	----	No connection
5	----	Signal Ground
6	----	No connection
7	Out	RTS (ready to send)
8	In	CTS (clear to send)
9	----	No connection

The RS-232 25-pin Craft Port connector (J11 on the 2 RU frame) is a DB25-M plug connector. It connects the frame to a terminal. The cable for the Craft port must be constructed. The pinouts are listed in Table 2-4.

Table 2-4. RS-232 Craft Port DB25-M Pinouts

Pin	Direction	Signal
1	----	Chassis Ground
2	In	RX Data
3	Out	TX Data
4	In	CTS (clear to send)
5	Out	RTS (ready to send)
6	----	No connection
7	---	Signal Ground
8-25	---	No connection

Video Connections

Video connections to the rear of the frame are made with BNC coaxial cables that are not supplied with your system. The number of cables and the number of connections are determined by the system configuration. See Figure 2-24 for connector locations on the 6 RU frame. BNC connectors IN 1 through 9 are used for loop-through.

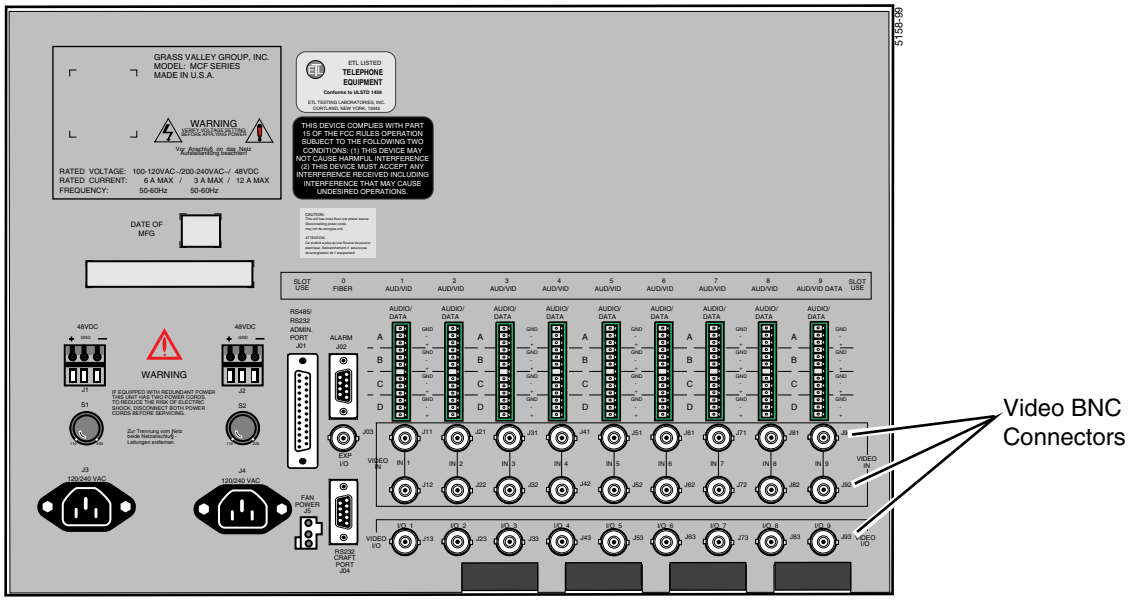


Figure 2-24. Backplane Video Connections for the 6 RU Frame

See Figure 2-25 for Video BNC connector locations on the 2 RU frame. BNC connectors J2-J3 and J5-J6 are used for loop-through.

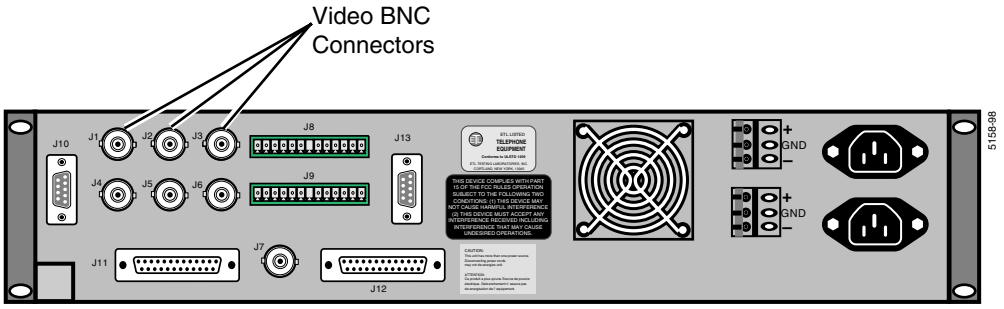


Figure 2-25. Backplane Video Connections for the 2 RU Frame

Serial Digital Video Connections

Using the Serial Digital module's video connections when on the 6 RU frame require that you use the lower Video I/O BNC connectors (I/O 1 through 9), not the loop-through connectors (IN 1 through 9). However,

connectors IN 1–9 can be used one at a time (not as loop-through) for I/O monitoring. See Figure 2-24 to see where the Video I/O connectors are located.

On the 2 RU frame, when using a Serial Digital module, video connections use J1 and J4. Connectors J2-J3 and J5-J6 can be used for I/O monitoring. (Not as loop-through).

Other Video Connections

At the **Transmitter frame**, video connections are made from video sources to one of the loop-through VIDEO IN paired BNC connectors on the Transmitter frame's backplane. On the 6 RU frame these connectors are numbered as follows:

- J11-J12
- J21-J22
- J31-J32
- J41-42
- J51-J52
- J61-J62
- J71-J72
- J81-J82
- J91-J92

On the 2 RU frame the video connectors are numbered as follows:

- J2-J3
- J5-J6

It is important to note that the unused connector of each pair must be terminated into 75 Ohm (or have an internal 75 Ohm termination enabled on the Video Input module jumper J11).

It is also important to note that the DC Restore function should be enabled by placing jumper J13 (also located on the Video Input module) in the ON position. This is the factory default setting.

Note that jumper settings should always be checked before installing modules.

The actual number of connections depends on your system configuration.

NRZ and NRZI Modes and Compatibility

Recent production MCF Transmitters operate in two modes: Non-return to zero (NRZ) and non-return to zero, inverted (NRZI). Earlier-generation MCF Transmitters operate in NRZ mode only. Depending on when they were manufactured, some MCF Receivers operate only in NRZ mode while others operate only in NRZI mode. See the following two paragraphs and Table 2-5 for a quick reference on compatibility of various transmitter and receiver pairs. Also see Table 2-6 for similar data with greater detail on board modification and NRZ versus NRZI modes of operation.

Incompatible Systems

The following systems are incompatible:

- A new 160293-00 Transmitter (set to NRZ mode) or 160293-01 with an old 066040 -00, -01, -10, -20, -21 Receiver.
- An old 066039 Transmitter with a new 160294-00, -01 Receiver.

Compatible Systems

- An old 066039 Transmitter and an old 066040 Receiver (except 066040-30).
- A modified 066039-series Transmitter with a new 160294-00, -01 Receiver or old 066040-30 Receiver.
- A new 160293-00 Transmitter (set to NRZI mode) and an old 066040-series Receiver (except 066040-30).
- A new 160293-00 Transmitter (set to NRZ mode) or 160293-01 and an old 066040-00, -01, -10, -20, -21 modified Receiver or an 066040-30 Receiver.

Table 2-5. Compatibility of Various Transmitter and Receiver Pairs

Transmitter	Receiver	Compatibility
066039	066040 (except 066040-30)	Compatible
066039-series (if modified)	160294-00	Compatible
066039-series (if modified)	160294-01	Compatible
066039-series (if modified)	066040-30	Compatible
160293-00 (set to NRZI mode)	066040 (except 066040-30)	Compatible
160293-00 (set to NRZ mode) or 160293-01	066040-series (except -30, if modified)	Compatible
160293-00 (set to NRZ mode)	066040-30	Compatible
160293-01	066040-30	Compatible
160293-01	066040-series (except -30, if modified)	Compatible
160293-00 (Set to NRZ mode)	066040-series (except -30)	Incompatible
160293-01	066040-series (except -30)	Incompatible
066039-series (unmodified)	160294-00	Incompatible
066039-series (unmodified)	160294-01	Incompatible

Table 2-6. Receivers and Transmitters in NRZ and NRZI Modes

Part Number	Name	Mode	Early	Recent	Comments
066039-00	Fiber, Tx	NRZI	X		Note [a]
066039-01	Fiber, 10, Tx	NRZI	X		“
066039-10	Fiber, TX 1310 nm, 0dbm	NRZI	X		“
066039-11	Fiber, TX 1310 nm, 0dbm, SC	NRZI	X		“
066039-30	Fiber, Tx, 1550 nm, 0dbm	NRZI	X		“
160293-00	Fiber, Tx, 1310 nm	NRZ / NRZI		X	(jumper)
160293-01	Fiber, Tx, 1310 nm	NRZ Only		X	
160267-00	Fiber, Tx, 1550 nm	NRZ / NRZI		X	(jumper)
066040-00	Fiber, Rx	NRZI	X		Note [b]
066040-01	Fiber, 10, Rx	NRZI	X		“
066040-10	Fiber, Rx	NRZI	X		“
066040-20	Fiber, Rx, 29dbm, FC	NRZI	X		“
060040-21	Fiber, Rx, 29dbm, SC	NRZI	X		“
066040-30	Fiber, Rx	NRZ only	X		Note [c]
160294-00	Fiber, Rx	NRZ Only		X	
160294-01	Fiber, Rx	NRZ only		X	“

[a] Board can be modified for NRZ operation as specified in this section. All of these boards use Vitesse VSC7101.

[b] Board can be modified for NRZ operation as specified in this section. All of these boards use Vitesse VSC7102.

[c] These boards use Vitesse VSC7106. This part does not have provision for NRZ / NRZI selection. It is capable of operating only in the NRZ mode.

Modification of 066039-00 and -01 Transmitters

For the early-production Transmitter module (GVP Part # 066039-00 and -01) to interface correctly with the new Receiver modules (160294-00, -01), you must make a modification. You must lift resistor R38 and attach a wire from the lifted side of resistor R38 to the PECLL side of resistor R41. See Figure 2-26 for the location of these two resistors.

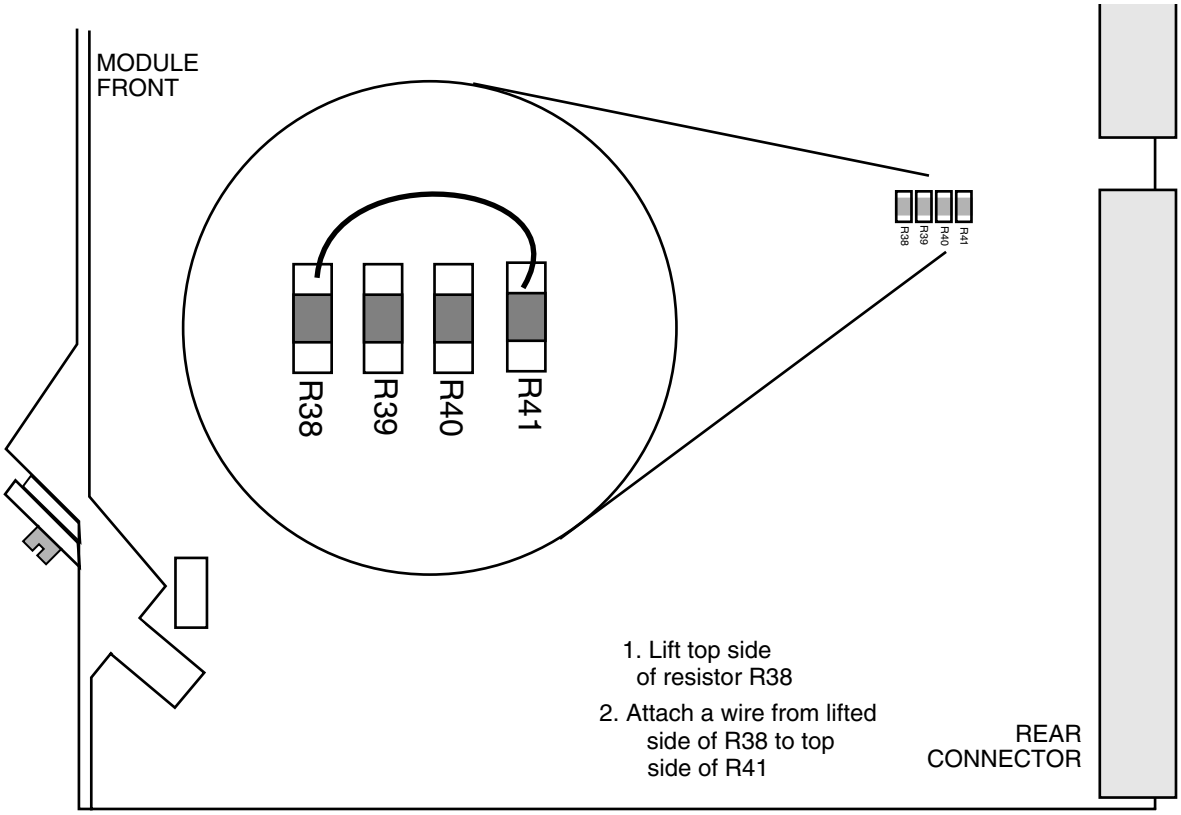


Figure 2-26. MCF Transmitter 066039 -00 and -01 Modification

CAUTION You need special skills and equipment to change surface-mount parts in the field. For detailed information about Surface Mount Part replacement, refer to the ANSI/IPC-R-700, Suggested Guidelines for Modification, Rework and Repair of Printed boards and Assemblies (Sections 5.1.4.3, 5.1.10, 5.1.10.1, 5.1.10.2, 5.1.10.3 and 5.4.1 through 5.4.5). Any damage incurred to the module or its components as a result of the installation of this modification is entirely the responsibility of the customer and may void the warranty.

Modification of 066039-10, -11, and -30 Transmitters

For the early-production Transmitter module (GVP Part # 066039-10, -11, and -30) to interface correctly with the new Receiver modules (160294-00, -01), you must make a modification. You must lift resistor R104 and attach a wire from the lifted side of resistor R104 to the PECLL side of resistor R110. See Figure 2-27 for the location of these two resistors.

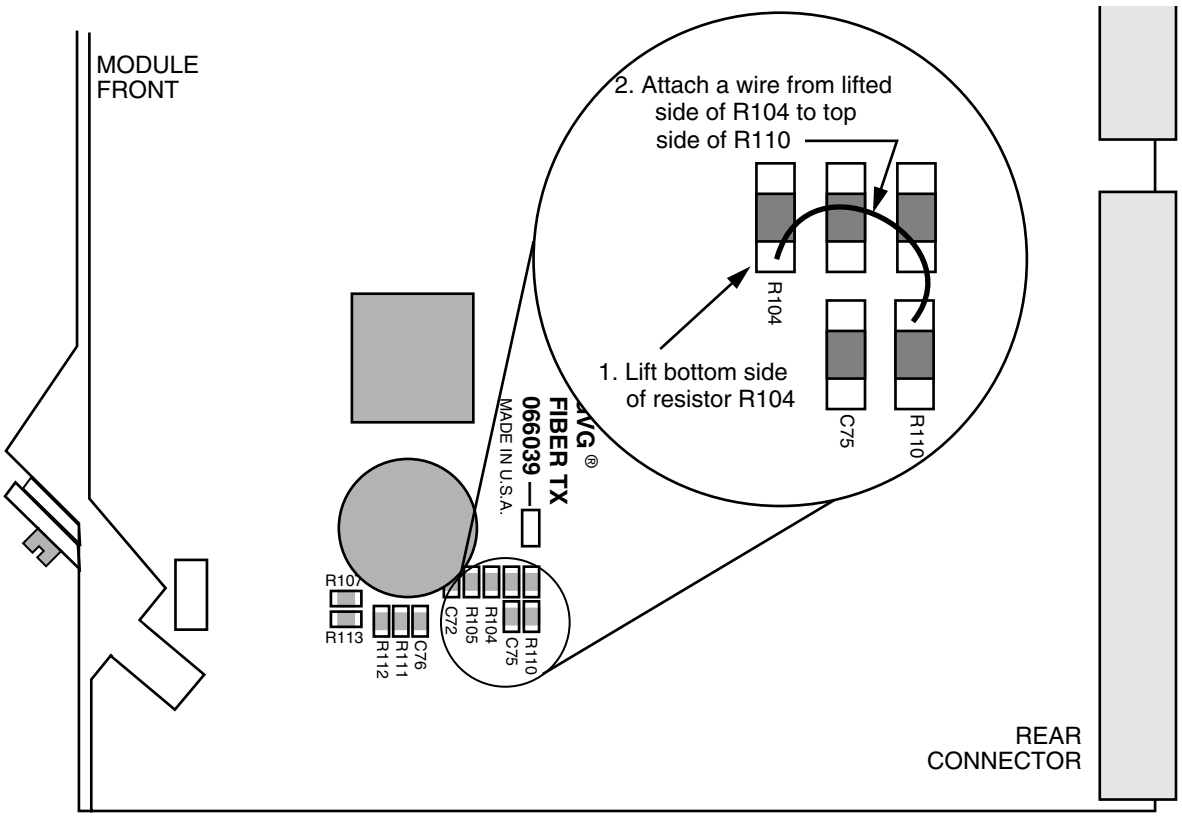


Figure 2-27. MCF Transmitter 066039 -10, -11, and -30 Modification

Modification of 066040-00, -01, -10, -20, and -21 Receivers

Early-production Receiver modules (GVP part # 066040-00, -01, -10, -20, and -21) operate only in NRZI mode. If you wish to use a new 160293-00, or -01 Transmitter with any of these old Receivers, set the new Transmitter's jumper to the NRZI mode. See Figure 2-29 on page 2-35 for detailed information.

If you wish to operate any of these old Receiver types with a new 160293-00 or -01 Transmitter in NRZ mode, modify the Receiver as shown in Figure 2-28 and as follows. Remove R53 and add a wire from R46 (ECLL side) to U30 pin 24 (VSC7102 NRZ/NRZI pin.)

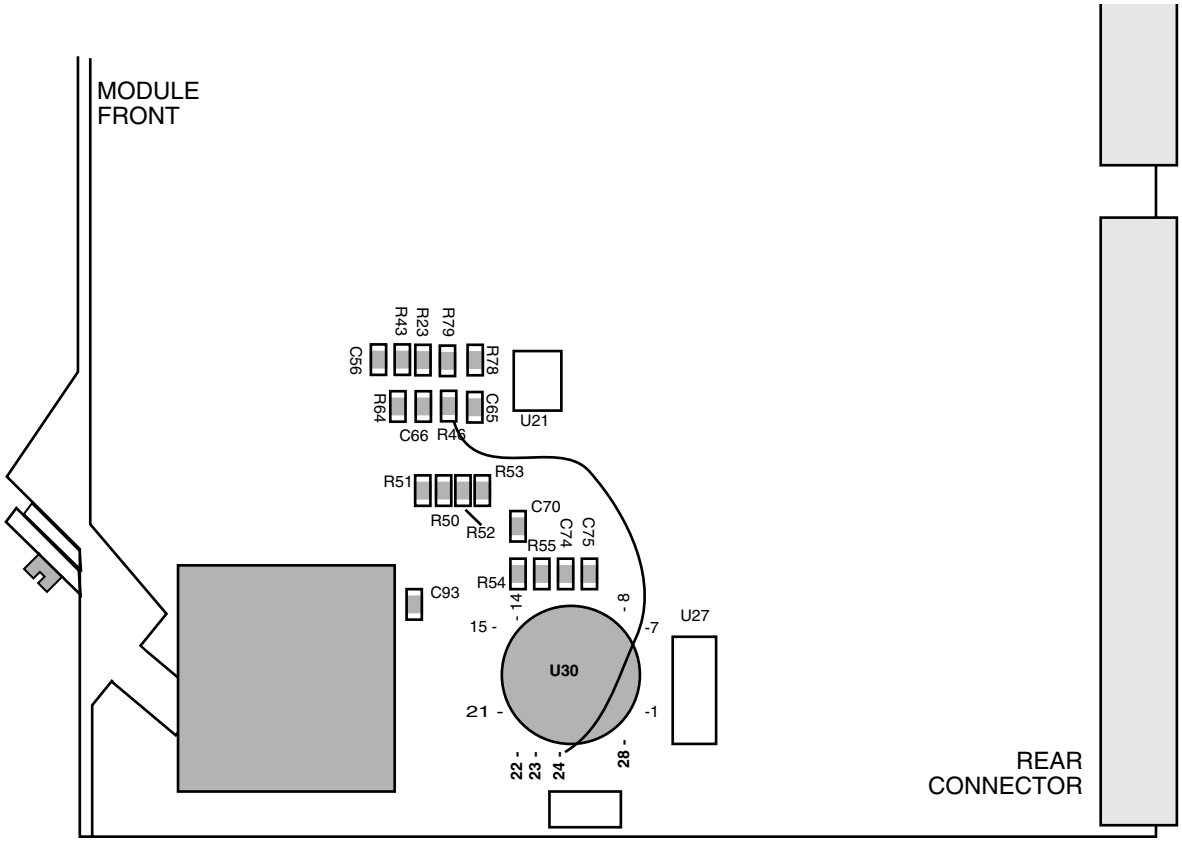


Figure 2-28. MCF Receiver 066040-00, -10, -20, and -21 Modification

160293-00 Transmitter NRZ Jumper Setting

The 066040-30 receiver operates in NRZ mode. It is compatible with the 160293-00 or -01 Transmitters, when jumper P4 (on 160293) is set to NRZ. See Figure 2-29 for the location of the jumper.

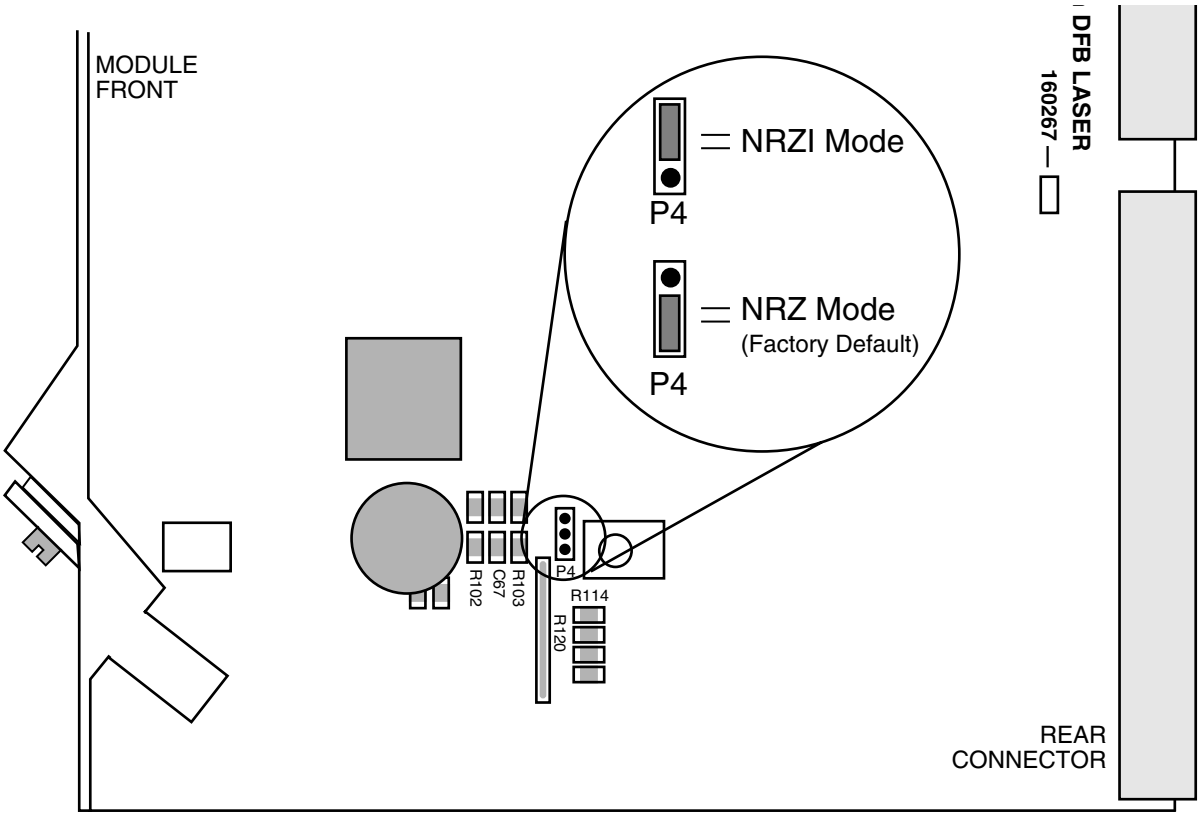


Figure 2-29. MCF Transmitter 160293 P4 Jumper Setting

Video Connections at Receiver Frame

At the **Receiver frame**, video connections are made from the VIDEO I/O connectors on the receiver frame's backplane to video receivers. On the 6 RU frame these BNC connectors are numbered as follows:

- J13
- J23
- J33
- J43
- J53
- J63
- J73
- J83
- J93

On the 2 RU frame the video connectors are numbered as follows:

- J1
- J4

The actual number of connections depends on your system configuration.

The DC Restore function should be enabled by placing jumper J16 (located on the Video Output module) in the ON position. This is the factory default setting.

Also see the Video module cable equalization information in the text that follows.

Note that the MONITOR connector on the front panels of the Video modules may be used to connect a monitor. On a Video Input module, this monitor can be used to check the video coming in at the backplane. On a Video Output module, it can be used to see the video being decoded on the Fiber module.

Audio Connections

Audio connections are available for four channels (A, B, C, and D) with stereo pairs A/B and C/D. These connectors can also be used for AES/EBU audio bit streams, with a few limitations, when using Serial Digital modules in the frame.

Connecting audio to the MCF frame is a two-phase operation. The first step is insertion of audio leads into a mating connector. Each connector accommodates twelve leads, three for each channel. The second step is installing that connector with leads attached to the appropriate pins at the rear of the MCF frame.

See Figure 2-30 for location of the audio connectors on the 6 RU frame backplane.

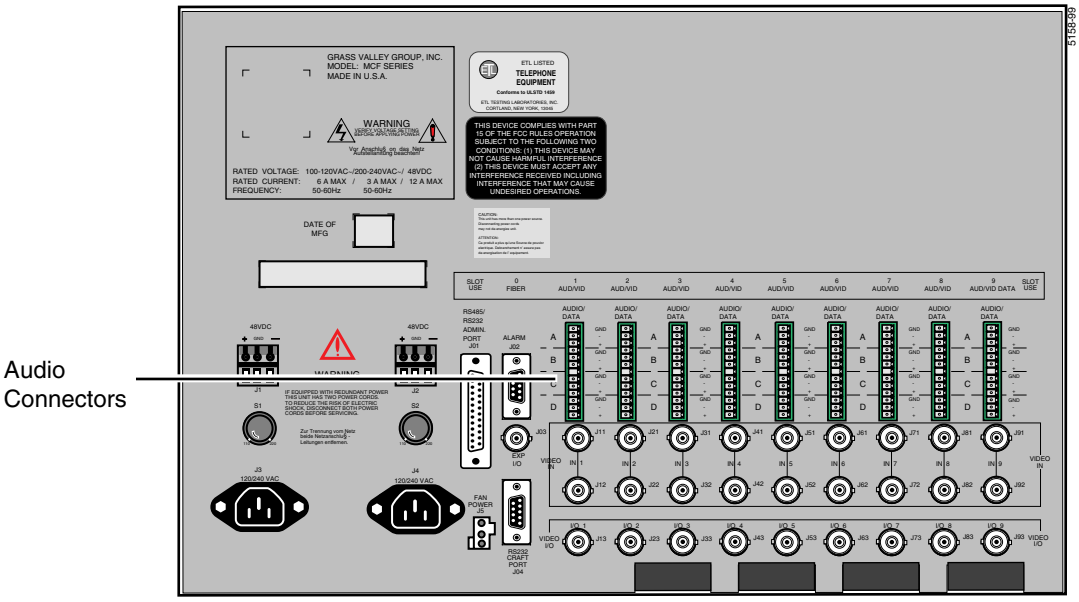


Figure 2-30. Backplane Audio Connections for the 6 RU Frame

See Figure 2-31 for location of the audio connectors on the 2 RU frame backplane.

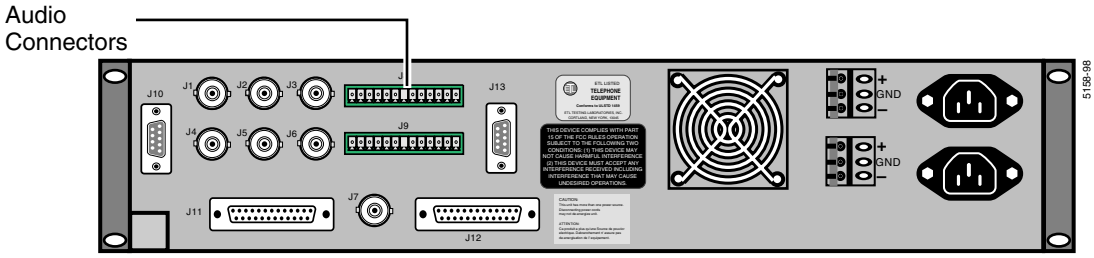


Figure 2-31. Backplane Audio Connections for the 2 RU Frame

Figure 2-31 illustrates the method of making the audio connections. To make these connections, refer to Figures 2-30 and 2-31 (for connector locations). See Figure 2-32 and perform the following steps:

CAUTION Do **not** use Channels B or D with **Serial Digital** audio connections. Use Channel A on the audio connector for audio channels 1/2. Use Channel C for audio channels 3/4.

1. Strip the connecting ends of the shielded twisted pair of audio leads enough for easy insertion into the connector.

2. With a small screwdriver, loosen the screws in the connector.

3. Starting with the desired channel leads, insert them one at a time into the connector slots and tighten each screw.

4. When all audio leads have been attached, and while observing the slot location(s) of the Audio modules, press the connector onto the MCF frame connector pins. Note that the connectors are keyed to prevent an error, and that once the connectors are seated, removing them is difficult.

Audio Connector Orientation for the 6 RU Frame

Note that in the 6 RU frame, the three Channel A connections are at the top of the connector and the three Channel D connections are at the bottom, with orientation as follows: Ground, Low (–), and High (+) for each channel. See Figure 2-32

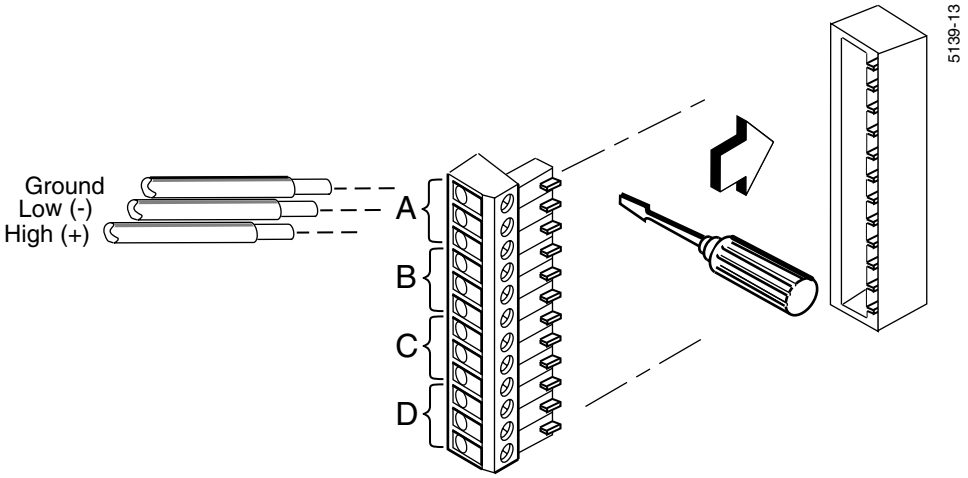


Figure 2-32. Making Audio Connections (6 RU frame)

Audio Connector Orientation for the 2 RU Frame

Note that in the 2 RU frame, the three Channel A connections are at the far right on the connector and the three Channel D connections are at left, with orientation as follows from right to left: Ground, Low (–), and High (+) for each channel. See Figure 2-33.

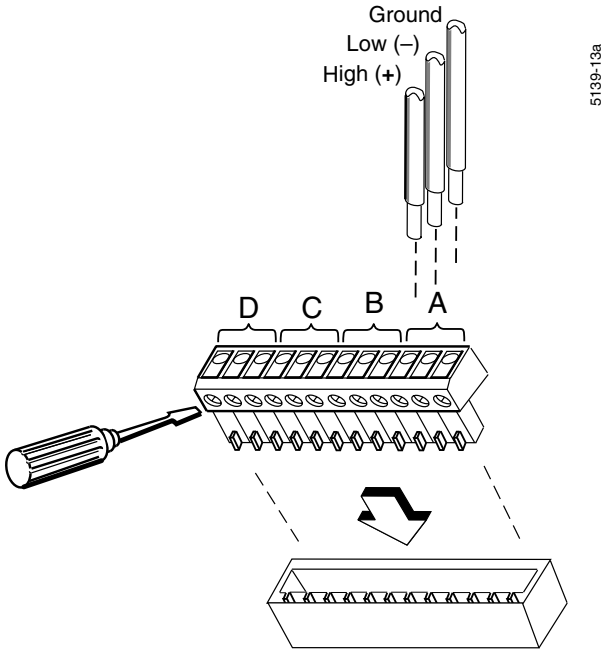


Figure 2-33. Making Audio Connections (2 RU frame)

Audio Clip Level

Each MCF system has user-selectable Audio Input and Output signal levels. These levels are adjusted by turning the gain adjustment potentiometer and viewing the Clip and Quiet LED indicators located on the front of the modules.

The LED indicators at the front of the Audio Input and/or Output module signify excessive input or output signal levels that result in signal distortion. If a clip indicator is illuminated only occasionally or momentarily, no action is required. If clipping is continuous, the input/output signal should be attenuated or the gain reduced. If the desired headroom is +16 dB, the desired clip level calculation would be as follows:

Nominal Input	=	+ 8 dBm
Desired Headroom	=	+16 dB
Clip Level Setting	=	+24 dBm

Set the front panel clip level by rotating the switches located on the front of the module. See Figure 2-34. Refer to page 2-63, for more detailed information about setting clip levels.

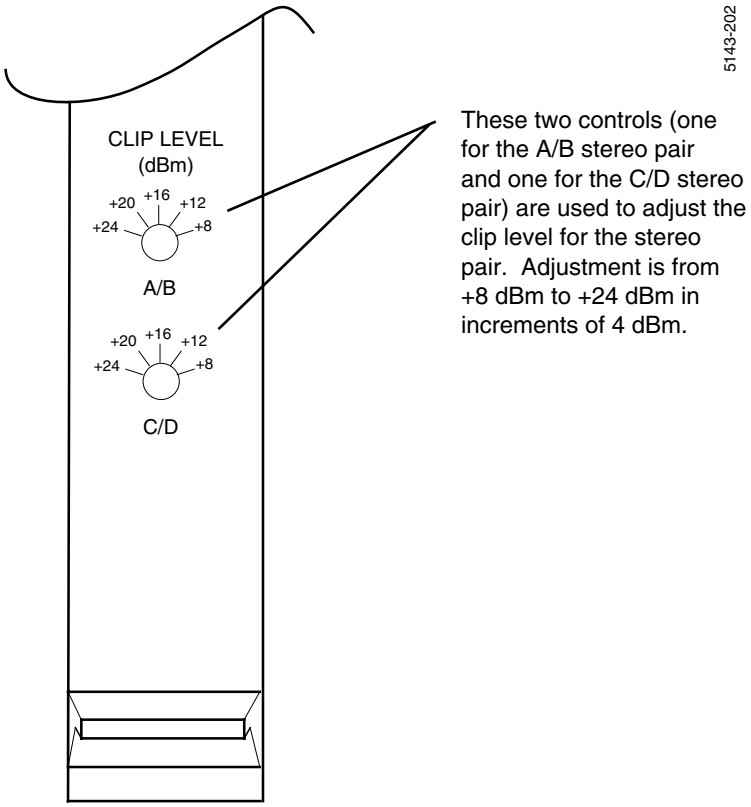


Figure 2-34. Audio Input/Output Clip Adjustment

Fiber-Optic Connection

Before making the fiber-optic connection, ensure that the cable end and termination are clean. Use of a precision-spray duster is recommended. (A typical product is Miller-Stephenson Aero-Duster, part number MS-220.)

To make the connection:

1. Carefully push the cable connector into the connector on the Fiber module.

2. Hand-tighten the cable nut to the Fiber module connector. See Figure 2-35.

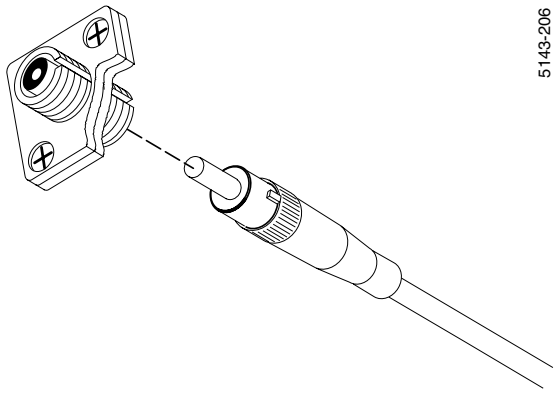


Figure 2-35. Fiber-Optic FC/PC Connector

If you wish to install optical attenuators in your system, follow the installation instructions sent with the attenuator connectors. Refer to Section 5, Table 5-2 for specific attenuator connector model numbers.

Figure 2-36 shows the three types of fiber connectors available with the MCF system—FC, ST, and SC.

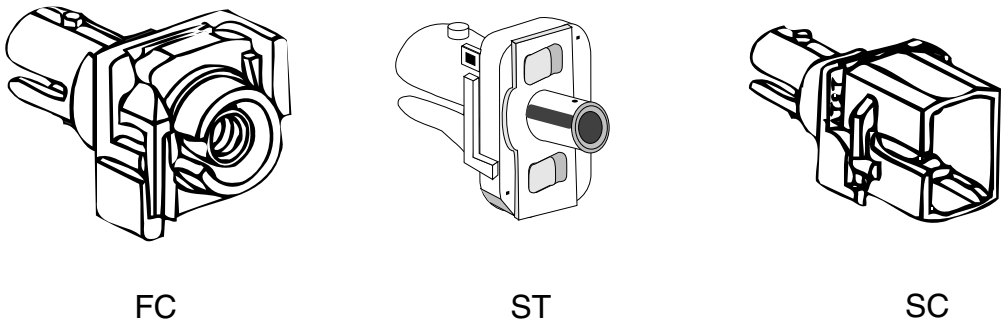


Figure 2-36. Fiber-Optic FC, ST, and SC Connectors

Fiber Module Settings

- The Fiber Receiver and Transmitter modules have two DIP switches that must be set:
  - Craft Port Parity and Baud Rate Selection
  - Transmitter or Receiver Frame Address ID

Jumper 401 (mode) at the top of the Fiber Receiver module is not user-selectable. It should always be set across pins 1–6 (which is the factory default) for the module to work correctly.

The following text describes how to set up the two DIP switches.

Craft Port Parity and Baud Rate

Craft port configuration is accomplished by setting its baud rate and parity through DIP switch S2 on the Fiber Transmitter and Receiver modules. The DIP switch location on both Fiber modules is illustrated in Figure 2-37.

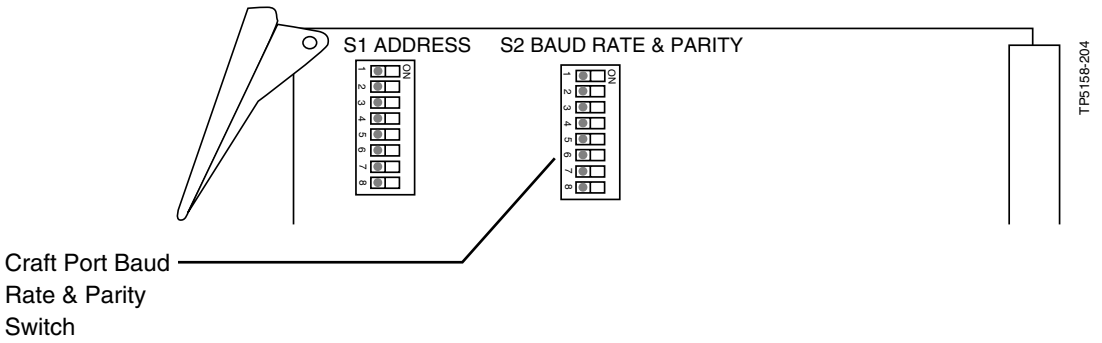


Figure 2-37. Craft Port Baud Rate and Parity DIP Switch on Either Fiber Module

Both the baud rate and parity are set on the Fiber Transmitter or Receiver module using the 8-segment DIP switch S2, where segments 1, 2, and 3 are used for baud rate selection and segment 4 is used for parity.

Figure 2-38 illustrates DIP switch S2 with all possible **baud rates** and the positions of the switch segments. Table 2-7 on page 2-43 lists the positions of S2 with the various baud rates available.

Note that 9600 baud is selectable with segments 1, 2, and 3 all set to Open (Off) or all set to Closed (On).

To set **Parity,** DIP switch S2, segment 4 is Closed (On) for no Parity and Open (Off) for odd Parity.

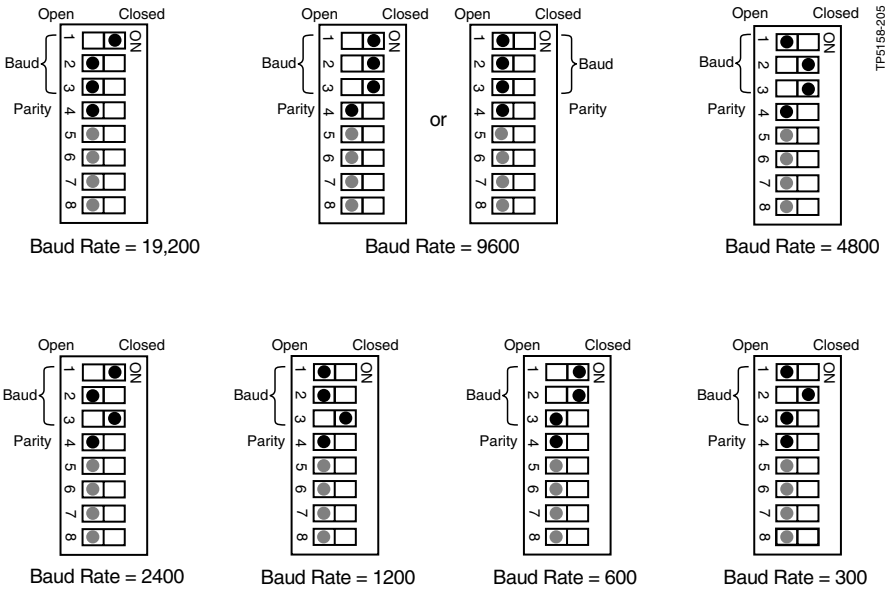


Figure 2-38. Baud Rate and Parity Selection Switch, S2

Table 2-7. Baud Rate Selection, S2

Baud Rate	Position 1	Position 2	Position 3
19,200	Closed	Open	Open
9600	Open	Open	Open
9600	Closed	Closed	Closed
4800	Open	Closed	Closed
2400	Closed	Open	Closed
1200	Open	Open	Closed
600	Closed	Closed	Open
300	Open	Closed	Open

Transmitter or Receiver Frame Address

Each MCF frame must have a unique address assigned from 0 (zero) to 255. This frame identifier is set on the Fiber Transmitter and Receiver modules. Switch S1 is an 8-position DIP switch used to set the address for the MCF frame within which the Fiber module resides. Figure 2-39 illustrates the location of S1 on the Transmitter or Receiver module.

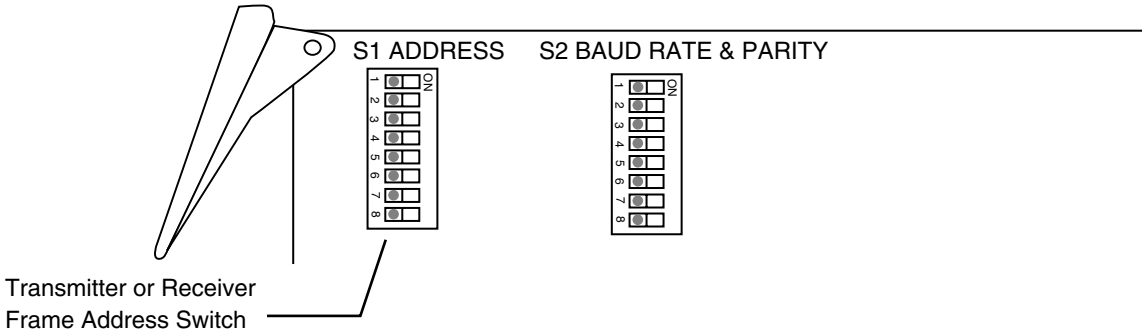


Figure 2-39. Frame Address DIP Switch

Each segment of the DIP switch has a numeric (binary) value. The left side of Figure 2-40 illustrates the numeric value for each segment on the DIP switch, and the right side illustrates an example of a specific address. In the example shown, frame address 83 is selected. Selections are made by setting the desired switch segment to the appropriate Closed (On) or Open (Off) position. So, you may assign any address number (between zero and 255) by turning on or off different binary switch combinations.

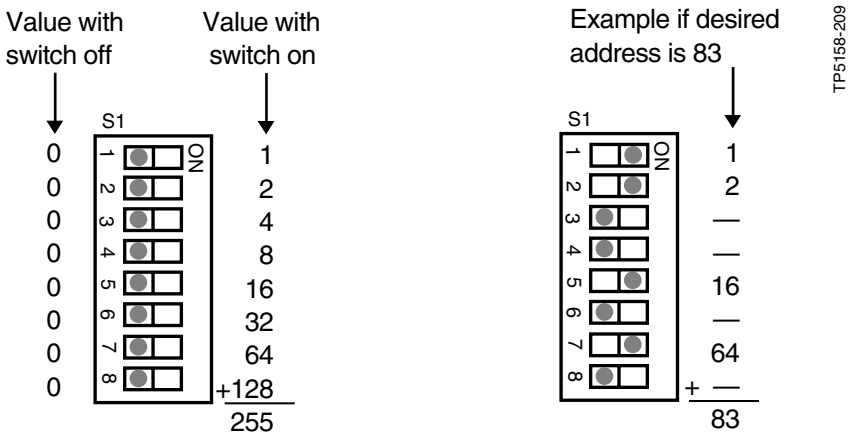


Figure 2-40. Address DIP Switch, S1

Slave Function (Transmitter Module only)

Segment 7 on DIP Switch 2 (S2) on the enhanced Transmitter module allows the Transmitter to operate as a slaved Transmitter in the Repeater frame. This segment must be in the ON position for the Repeater operation to function. Refer to Figure 2-41 for the DIP switch location.

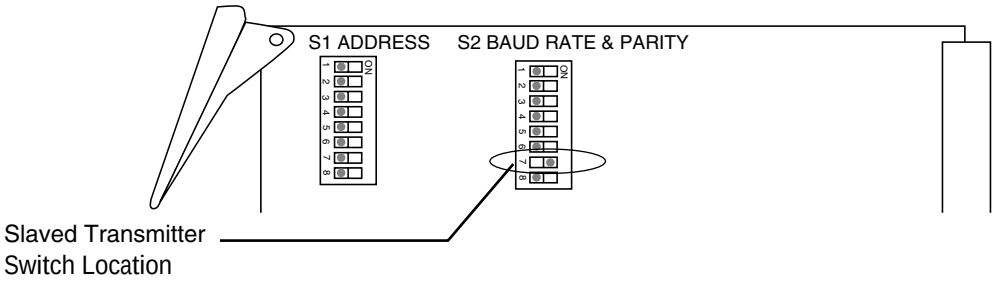


Figure 2-41. Slaved Transmitter Switch Location, S2

Boot Function (Transmitter/Receiver Module)

Segment 8 on DIP Switch 2 (S2) on both fiber modules allows the software to start up in boot mode. This allows you to upload new operational software from a PC to the FLASH ROM on the Transmitter or Receiver module. The segment's normal operational position is in the OFF or disabled position. This allows the software to start up in the normal operation mode. Refer to Figure 2-42 for the DIP switch locations on both the Transmitter and Receiver modules.

Note Most commands are disabled when operating in the boot mode.

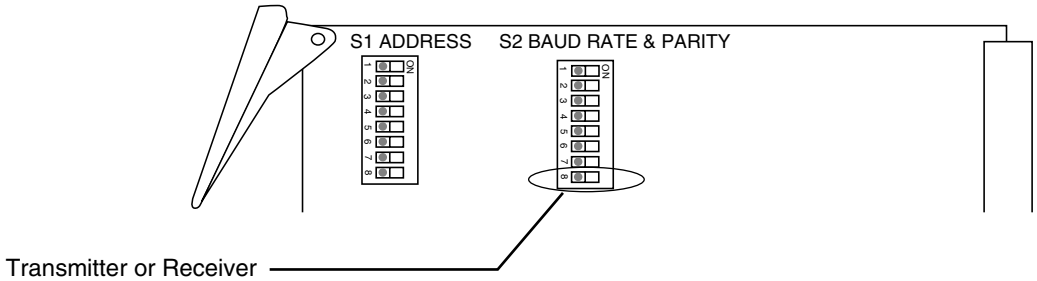


Figure 2-42. Boot Function Switch Location, S2

Video Input and Output Module Settings

Various jumper selections on the Video Input and Output modules are required for proper system operation:

- Cable Equalization Selection
- External or Internal Video Termination (75 Ohm)
- Video Signal Squelch
- DC Restore

The following text describes how to select these settings.

Cable Equalization

A Video module may need cable equalization to compensate for cable length. Each Video module has an equalization (EQ) potentiometer on the front panel which may be adjusted for this compensation. Adjustment pre-equalizes from an Output module or equalizes from an Input module. Measurement is taken with a waveform monitor at the front panel MONITOR connector for a Video Input module and at the backplane VIDEO I/O connector for a Video Output module.

The EQ potentiometer is enabled/disabled by a jumper at either J10 (on a Video Input module) or J14 (on a Video Output module). See Figures 2-43 and 2-44 for jumper locations on the modules. If equalization is flat (no equalization necessary), EQ is disabled by installing the jumper block across positions one and two. This setting is the factory default. To enable EQ, install the jumper block across positions two and three.

If cable equalization is required, it will be necessary to install one or two Hybrid Equalization boards, depending on the cable length, and to change and/or add a jumper block on the affected module. Hybrid Equalization modules must be ordered separately, as needed. See Table 2-8 on page 2-47.

Video Input Module Cable Equalization

Cable equalization is attained by installing the Hybrid boards U29 and U37 and setting up the jumper block at J9 on the Video Input module. Cable length determines whether one or two Hybrid boards need to be installed and also determines the position of the jumper block. Lengths of 0–500 feet require one board and lengths of 500–1000 feet require both Hybrid boards. In addition, the Hybrid boards are video cable I.D. specific. See Table 2-8 on page 2-47 for specific cable model numbers.

For a Video Input module, Figure 2-43 illustrates the locations of the EQ jumper J10, the Hybrid board plug-ins, and the Hybrid boards' jumper, J9. Table 2-8 on page 2-47 lists the Hybrid boards by cable I.D. for U 37 (0–500 feet) and U 29 (500–1000 feet).

The procedure for installation of the Hybrids and jumper blocks follows. Figure 2-44 and the table titled *Video Input Cable Equalization Hybrids* on page 2-47.

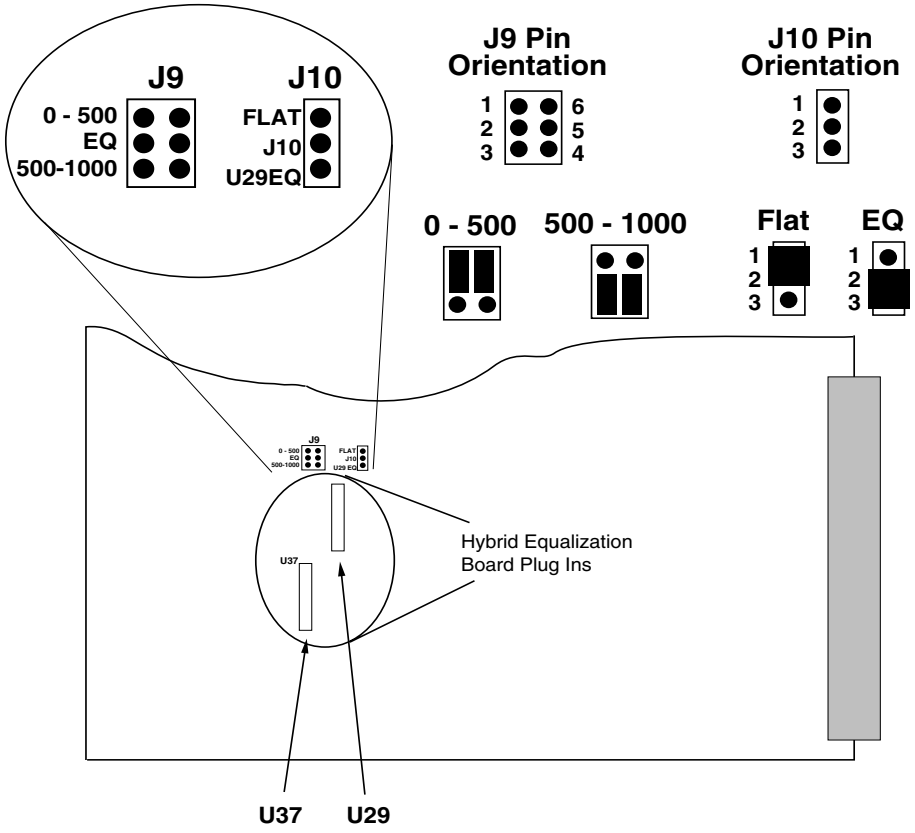


Figure 2-43. Video (only) Input Module Cable Equalization

Table 2-8. Video Input Cable Equalization Hybrids

Cable I.D.	0 - 500 feet (qty = 1)	500 - 1000 feet (qty = 2)
8281	HB9054-00	HB9055-00
RG59B/U	HB9057-00	HB9058-00
9259	HB9062-01	HB9062-02
8238	HB9062-04	HB9062-05
CHESTER 23	HB9062-09	HB9062-10
AF 0.8/3.7	HB9062-11	HB9062-12
PSF 1/3	HB9062-13	HB9062-14
F & G 0.6/3/7	HB9062-15	HB9062-16
F & G 1.0/6.6	HB9054-10	HB9055-10

Video Output Module Cable Equalization

Cable equalization is attained by installing the Hybrid boards U28 and U29 and setting up the jumper block at J12 on the Video Output module. Cable length determines whether one or two Hybrid boards need to be installed and also determines the position of the jumper block. Lengths of 0–500 feet require one board and lengths of 500–1000 feet require both Hybrid boards. In addition, the Hybrid boards are video cable I.D. specific. See Table 2-10 on page 2-66 for specific model numbers.

For a Video Output module, Figure 2-44 illustrates the locations of the EQ jumper J14, the Hybrid board plug ins, and the Hybrid boards' jumper, J12. Table 2-10 on page 2-66 lists the Hybrid boards by cable I.D for U28 (0–500 feet only) and U29 (500–1000 feet).

A procedure for installation of Hybrids and jumper blocks follows Figure 2-44 and Table 2-10 on page 2-66.

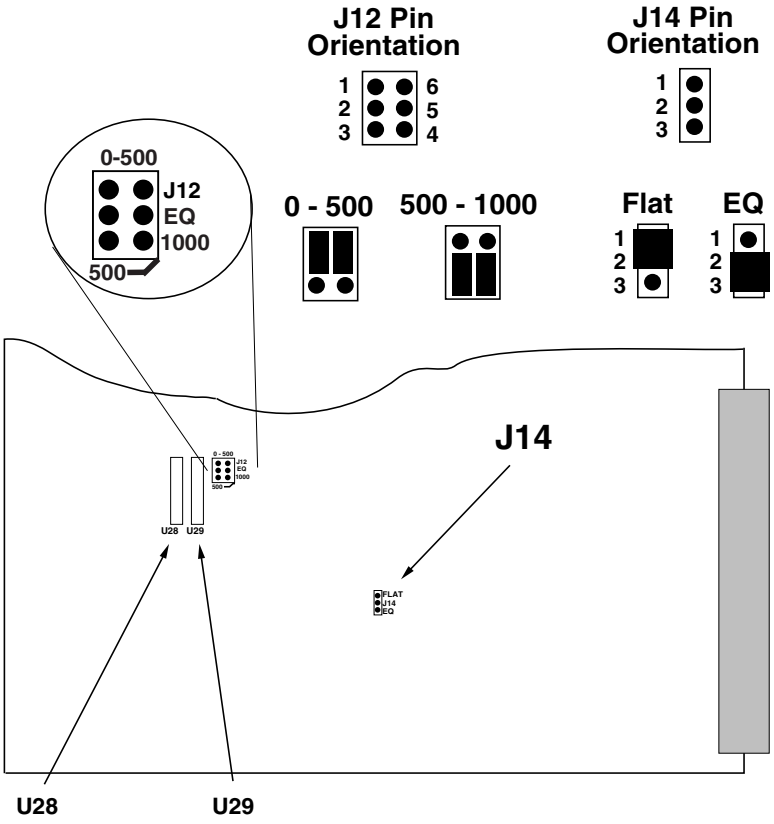


Figure 2-44. Video (only) Output Module Cable Equalization

Installation of Hybrid Boards

For the following procedure, refer to Figure 2-43 and Table 2-8 on page 2-47 for a Video Input module and to Figure 2-44 and Table 2-10 on page 2-66 for a Video Output module. Install equalization Hybrid boards and jumper blocks per the following steps:

CAUTION This equipment contains static sensitive components. Use anti-static grounding equipment whenever handling modules and components. When circuit modules are removed from the frame, place them on a flat static-controlled surface. Failure to follow this precaution can result in component damage due to electrostatic discharge.

1. Remove the appropriate Video Input/Output module and place on a flat, level, static-free surface with the orientation as shown in either Figure 2-43 or 2-44.

2. To enable the EQ potentiometer on either J10 (for the input module) or J14 (for the Output module), move the jumper from pins 1 and 2 and place it over pins 2 and 3. (See either Figure 2-43 or 2-44.) If no Hybrid is to be installed, skip to Step 5. Otherwise, proceed with Step 3.

3. Install the Hybrid(s) appropriate to the Video I/O module and cable type. (See the tables and figures in previous text for correct Hybrid location and Hybrid part number.) Note that the Hybrid board is installed with Pin 1 toward the top of the module as illustrated in Figure 2-45.

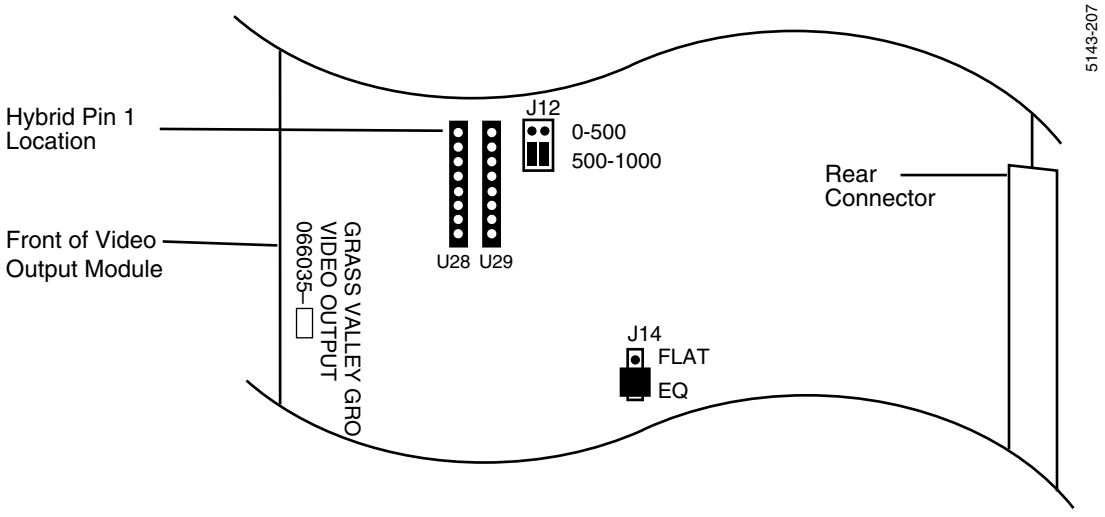


Figure 2-45. Video Output Hybrid Pin Orientation

4. Install/move the jumper block at either J9 or J12 to the appropriate position for either 0–500 feet of cable length or 500–1000 feet cable length as shown in Figure 2-46 below.

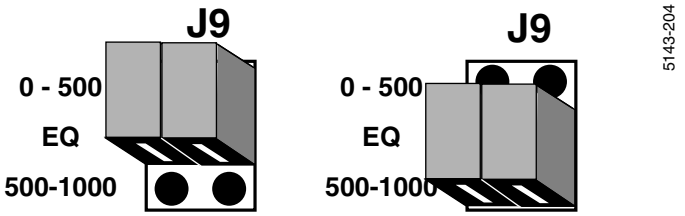


Figure 2-46. Jumper Block Orientation

Video Signal Termination

To preserve the shape and integrity of a video waveform traveling along a cable, the cable must be terminated in an impedance equal to its characteristic impedance. In the MCF system, the physical ends of the video cable must be terminated with a 75 Ohm resistor. Leaving off the terminations generally results in poor video signal operation. If loop-through video operation is desired, termination is not required.

Video Squelch Jumper

When no video signal is present, the MCF Receiver module outputs a high level of unquieted noise. Because this is not desirable, squelch circuitry can blank the video output. Refer to Figure 2-47 for the location of the video

squelch jumper J10 on the Video Output module. The default setting is Video Output squelch disabled. Note that there is no Video Squelch jumper on the Video Input module.

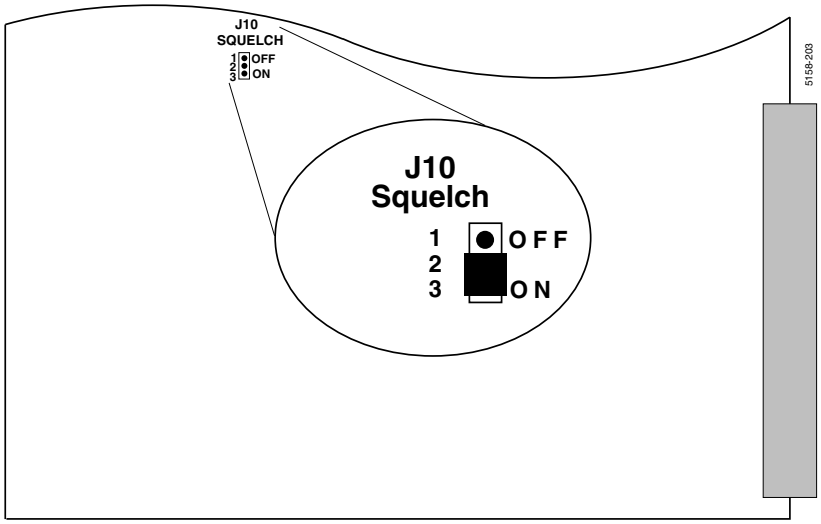


Figure 2-47. Video Output Squelch Jumper

DC Restore Jumper

The MCF system's DC restoration circuitry provides a slow return of the base level of the video signal to a fixed DC reference voltage. Due to the design of DC restore circuitry, rapid corrections of the video signal are not possible. However, the signal's DC component is restored without introducing the distortion caused by clamping.

Both the Video Input and Output modules have DC restoration circuitry, and you must set jumpers on both modules to enable the DC restore operation. See the following text for details.

Video Input DC Restore Jumper

When the jumper is set to ON, the MCF system's DC restoration circuitry provides a slow return of the video input signal to a fixed DC reference voltage. Figure 2-48 illustrates the location of jumper J13 on the Video Input module.

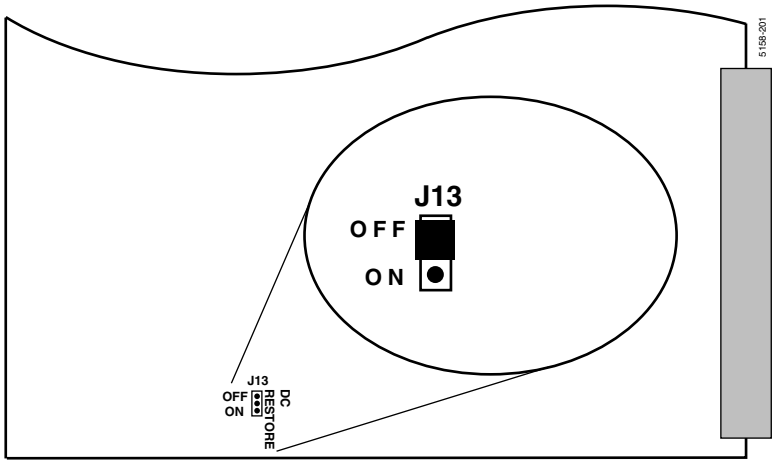


Figure 2-48. Video Input DC Restore Jumper

Video Output DC Restore Jumper

Likewise, on the Video Output module when jumper J16 is set to ON, the video output signal is fixed to a DC reference voltage. Figure 2-49 illustrates the location of jumper J16 on the Video Output module.

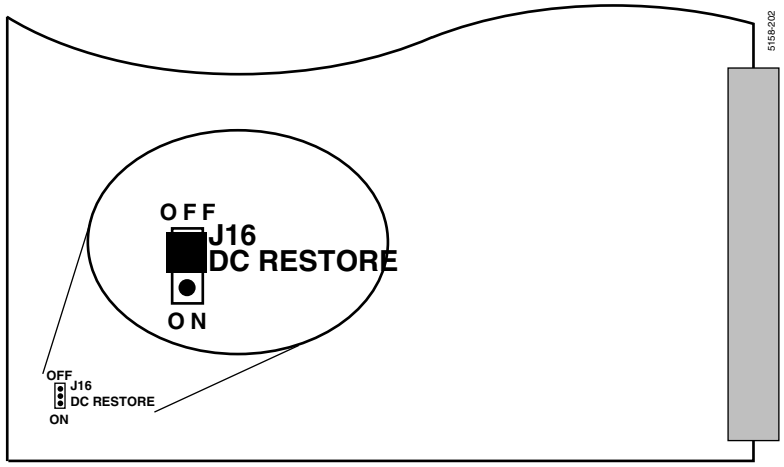


Figure 2-49. Video Output DC Restore Jumper

Audio Input Module Setting

The Audio Input module has a single jumper setting—audio input attenuation. The following text describes this jumper setting and jumper location.

Input Audio Attenuation

The MCF system is designed with an audio gain of unity into a 600 Ohm impedance load. However, your facility may require a different setting. The input impedance may be changed from 600 to 150 Ohm or HIGH Ohm (30 Kowloon differential) impedance (for bridging applications).

To set jumpers J7, J8, J9, and J10 on the Audio Input module, follow the steps listed below:

1. Remove the Audio Input module from the frame, and place on a flat, level, static-free surface with the module orientation as shown in Figure 2-50.
2. Select the appropriate impedance jumper settings for Channels A (J7), B (J8), C (J9), and D (J10).
3. Reinstall the module into the frame and resume operation.

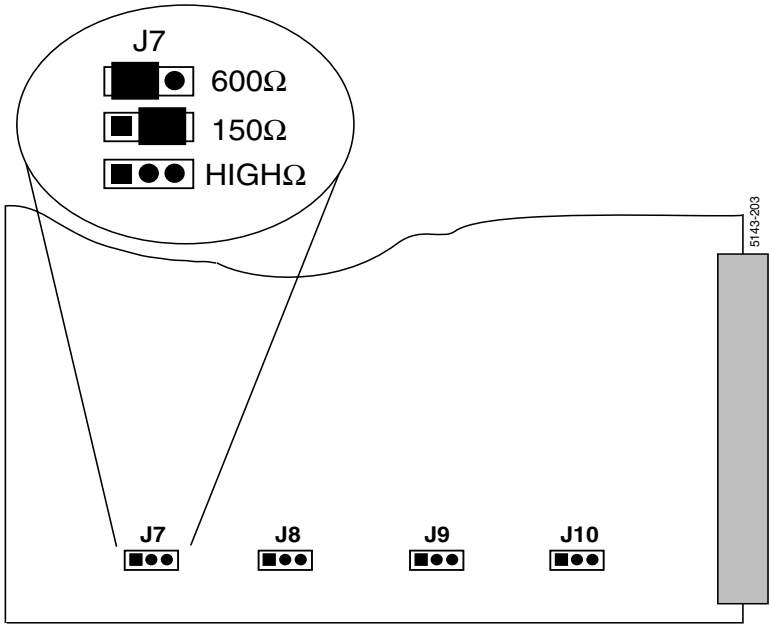


Figure 2-50. Audio Input Jumper Settings

Combined Video/Audio Module Settings

The Combined Video/Audio modules have numerous user-selectable settings:

- Cable Equalization Selection
- External or Internal Video Termination (75 Ohm)
- EQ Adjustment
- DC Restore Settings (Early Production Boards)
- Video Clamp Settings (Recent Production Boards)
- Audio Impedance Settings
- Audio Attenuation Clip Selections

The following text describes how to select these settings.

Input Cable Equalization

A Video/Audio Input module may need cable equalization (video only) to compensate for your cable length. Each Video/Audio Input module has an equalization (EQ) potentiometer on the front panel which may be adjusted for this compensation. The adjustment equalizes the video input. Measurements are taken with a waveform monitor at the front panel MONITOR connector.

The EQ circuit is enabled/disabled by jumper J14 (on the Input module). See Figure 2-51 for the location of J14 on the module.

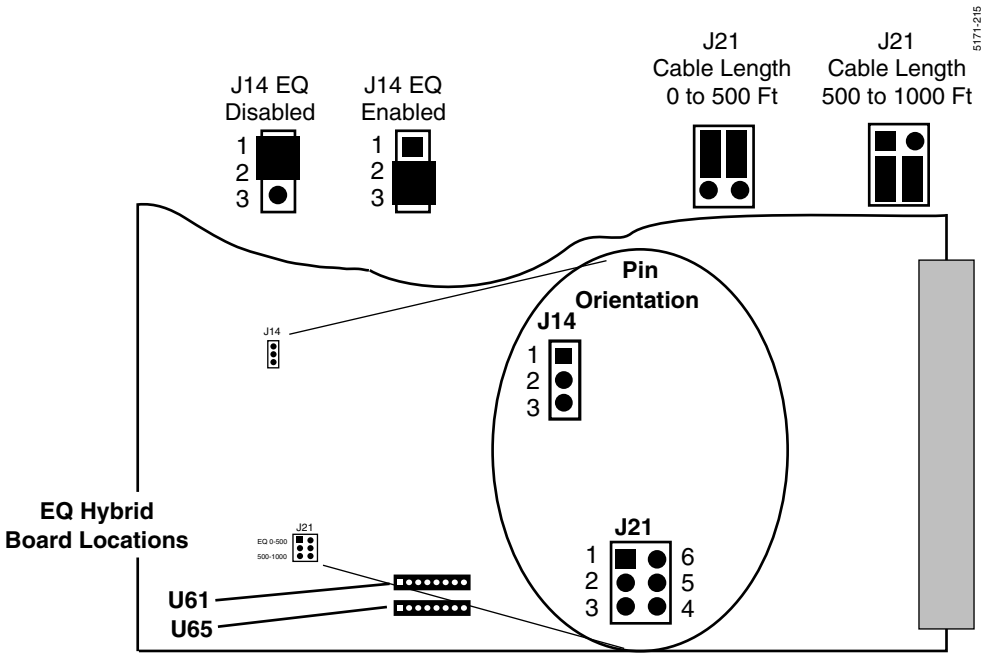


Figure 2-51. Combined Video/Audio Input Module Video Cable Equalization Jumper Location

The EQ circuit is disabled by installing the jumper block across positions one and two of jumper J14. This setting is the factory default. EQ is enabled when you install the jumper block across pins 2 and 3.

If cable equalization is required, it will be necessary to install one or two Hybrid Equalization boards (depending on the length) and to change and/or add a jumper block on the Input module.

Cable equalization is attained by installing the Hybrid boards, U61 (0-500 feet) or U65 (500-1000 feet) and by setting up the jumper block at J21. Refer to Figure 2-51 for the equalization hybrid board plug-ins and jumpers J14 and J21 locations.

Whether one or two Hybrid boards need to be installed and the position of the jumper block depends on the cable length. Lengths of 0–500 feet require one board and lengths of 500–1000 feet require both Hybrid boards. In addition, the Hybrid boards are video cable I.D. specific by length. Table 2-8 on page 2-47 gives specific cable model numbers.

Output Cable Equalization

A Video/Audio Output module may need cable pre-equalization (video only) to compensate for your cable length. Each Video/Audio Output module has an equalization (EQ) potentiometer on the front panel which may be adjusted for this compensation. The adjustment pre-equalizes the video output. Measurements are taken with a waveform monitor at the backplane VIDEO I/O connector.

The EQ circuit is enabled/disabled by jumper J17 (on the Video/Audio Output module). See Figure 2-52 for the jumpers J15 and J17 locations.

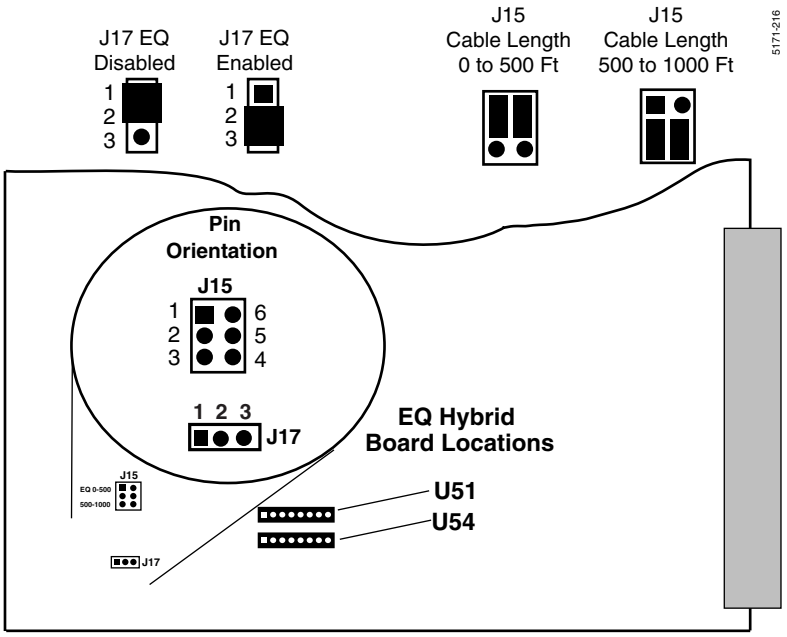


Figure 2-52. Combined Video/Audio Output Module Video Cable Equalization Jumper Location

The EQ circuits are disabled by installing the jumper block across positions one and two of jumper J17. This setting is the factory default. EQ is enabled when you install the jumper block across positions two and three.

If cable pre-equalization is required, it will be necessary to install one or two Hybrid Equalization boards (depending on the length) and to change and/or add a jumper block on the Output module.

Cable equalization is attained by installing the Hybrid boards, U51 (500-1000 feet) or U54 (0-500 feet), and setting up the jumper block at J15. Refer to Figure 2-52 for the equalization hybrid board plug-ins and jumpers J15 and J17 locations.

Cable length determines whether one or two Hybrid boards need to be installed and also determines the position of the jumper block. Lengths of 0–500 feet require one board and lengths of 500–1000 feet require both Hybrid boards. In addition, the Hybrid boards are video cable I.D. specific by length. Table 2-8 on page 2-47 gives specific cable model numbers.

Video Signal Termination

To preserve the shape and integrity of a video waveform traveling along a cable, the cable must be terminated in an impedance equal to its characteristic impedance. In the MCF system, the physical ends of the video cable must be terminated with a 75 Ohm resistor. Leaving off the terminations generally results in poor video signal operation. If loop-through video operation is desired, termination is not required.

Because the video signal on the Video/Audio Input module must be terminated, this termination may be done in one of two ways:

- You may terminate the signal using a 75 Ohm terminator on one of the two Video input BNC connectors on the MCF backplane.
- Make sure the termination jumper (J20) is on the two and three position for external termination. loop-through video operation also requires external termination.
- Or, you may set the termination jumper (J20) on the one and two position on the Video/Audio Input module for internal termination. Refer to Figure 2-53 for the J20 jumper location.

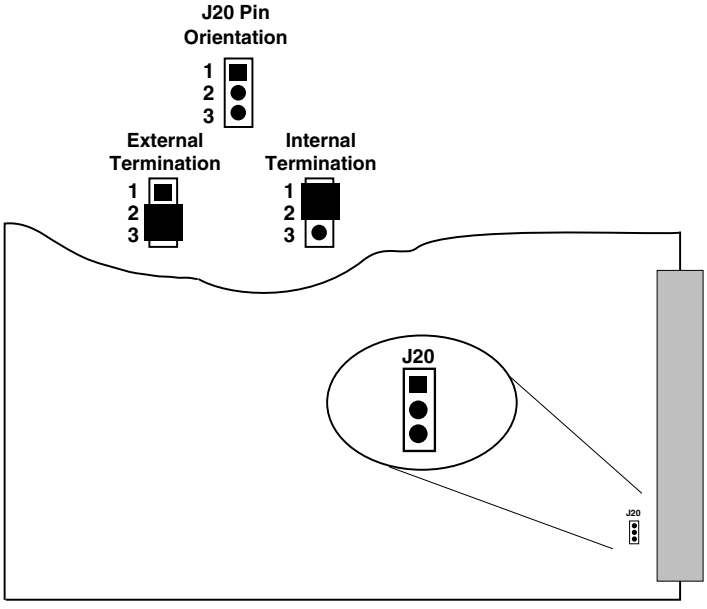


Figure 2-53. Combined Video/Audio Input Module's 75 Ohm Termination Jumper Location

DC Restore Jumper

The combined Video/Audio input and output boards found on early-generation MCF systems have DC restoration circuitry that provides a slow return of the base level of the video signal to a fixed DC reference voltage. This feature is found on systems with Video/Audio Input board #160096-01 (or earlier 066036-series) and Video/Audio Output board #160097-01 (or earlier 066035-series.) The most recently-manufactured MCF systems have Video/Audio Input board #160096-02 and Video/Audio Output board #160097-02. These more recently-produced boards have a sampled clamp circuit instead of a continuously-operating DC restore circuit.

Due to the design of DC restore circuitry, rapid corrections of the video signal are not possible. However, with this method the signal's DC component is restored without introducing the artifacts associated with sampled clamping. Again, the clamping function is available only on the latest generation boards. (See the following section for details.)

Both the Video Input and Output modules have DC restoration circuitry, and you must set jumpers on both modules to enable the DC restore operation. See the following text for details.

Video/Audio Input DC Restore Jumper

Note Check to see whether your system is equipped with #160096-01 or #160096-02 modules before making this jumper setting. If you have a -02 module, it has Video Clamp circuitry instead of DC Restore circuitry. Refer to Figure 2-56 on page 2-61 for details on making Video Clamp settings.

When the jumper is set to ON, the MCF system's DC restoration circuitry provides a slow return of the video input signal to a fixed DC reference voltage. In the OFF position, the video signal is AC coupled. Figure 2-54 illustrates the location of jumper J13 on the #160096-01 version of the Video/Audio Input module.

Note The silk screen marking on the board incorrectly labels jumper J13 as a "CLAMP". In actuality, jumper J13 sets a DC Restore circuit.

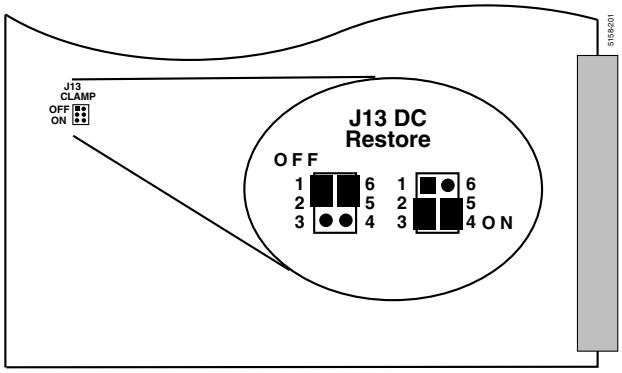


Figure 2-54. Video /Audio Input DC Restore Jumper (-01 version only)

Video/Audio Output DC Restore Jumper

Note Check to see whether your system is equipped with #160097-01 or #160097-02 modules before making this jumper setting. If you have a -02 module, it has Video Clamp circuitry instead of DC Restore circuitry. Refer to Figure 2-57 on page 2-62 for details on making Video Clamp settings.

On the #160097-01 version of the Video/Audio Output module when jumper J16 is set to ON, the video output signal is fixed to a DC reference voltage. In the OFF position, the video signal is AC coupled. Figure 2-55 illustrates the location of jumper J16 on the -01 Video/Audio Output module.

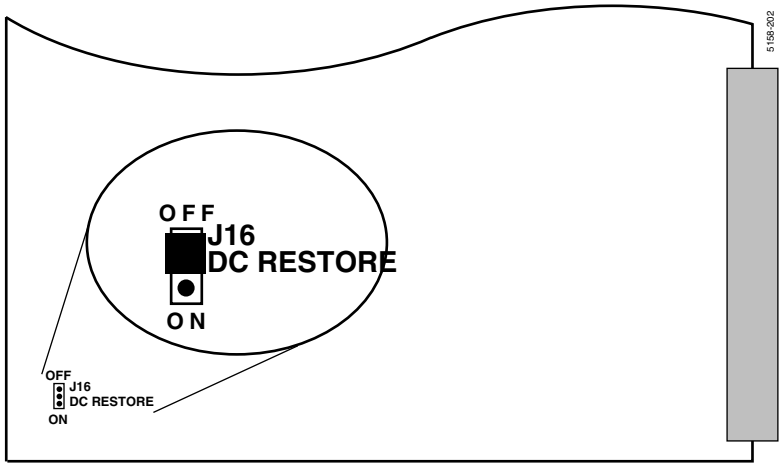


Figure 2-55. Video /Audio Output DC Restore Jumper (-01 version only)

Video Clamp Jumper

The most-recently released versions of the MCF Video/Audio Input Board (#160096-02) and the MCF Video/Audio Output Board (#160097-02) provide video clamping, via a jumper setting, replacing the DC Restore function found on earlier-generation boards. (Described in the previous paragraphs.)

Note Earlier generations of the MCF Video only and combined Video/Audio Input and Output Boards do not have sampled video clamp capability.

Unlike the slow DC restore approach, video clamping uses a sample/hold approach to provide adjustment to the DC voltage. Clamping differs fundamentally from the DC restore approach. The clamp operates periodically over a very brief time (1-to-2 microseconds). In contrast, the DC restore approach operates continuously. Video clamping corrects the blanking DC level very quickly. This allows it to remove high frequency contamination signals such as AC hum.

You must set jumpers on both modules to enable the video clamping operation, and to set the clamping speed. See the following text for details.

Video/Audio Input Video Clamp Jumper

The most recently-manufactured MCF systems have Video/Audio Input board #160096-02. This board has a sampled clamp circuit instead of the continuously-operating DC restore circuit found on earlier-generation boards.

When the jumper is set to CLAMP, the MCF system's Video Clamp circuitry provides a sampled return of the video input signal to a fixed DC reference voltage. Figure 2-56 illustrates the location of jumper J13 on the Video Input module. To set fast, medium, slow, and very slow clamping speeds, adjust the jumpers on J22 and J23, as shown on the guide that is silk-screened onto the board. For See Figure 2-56.

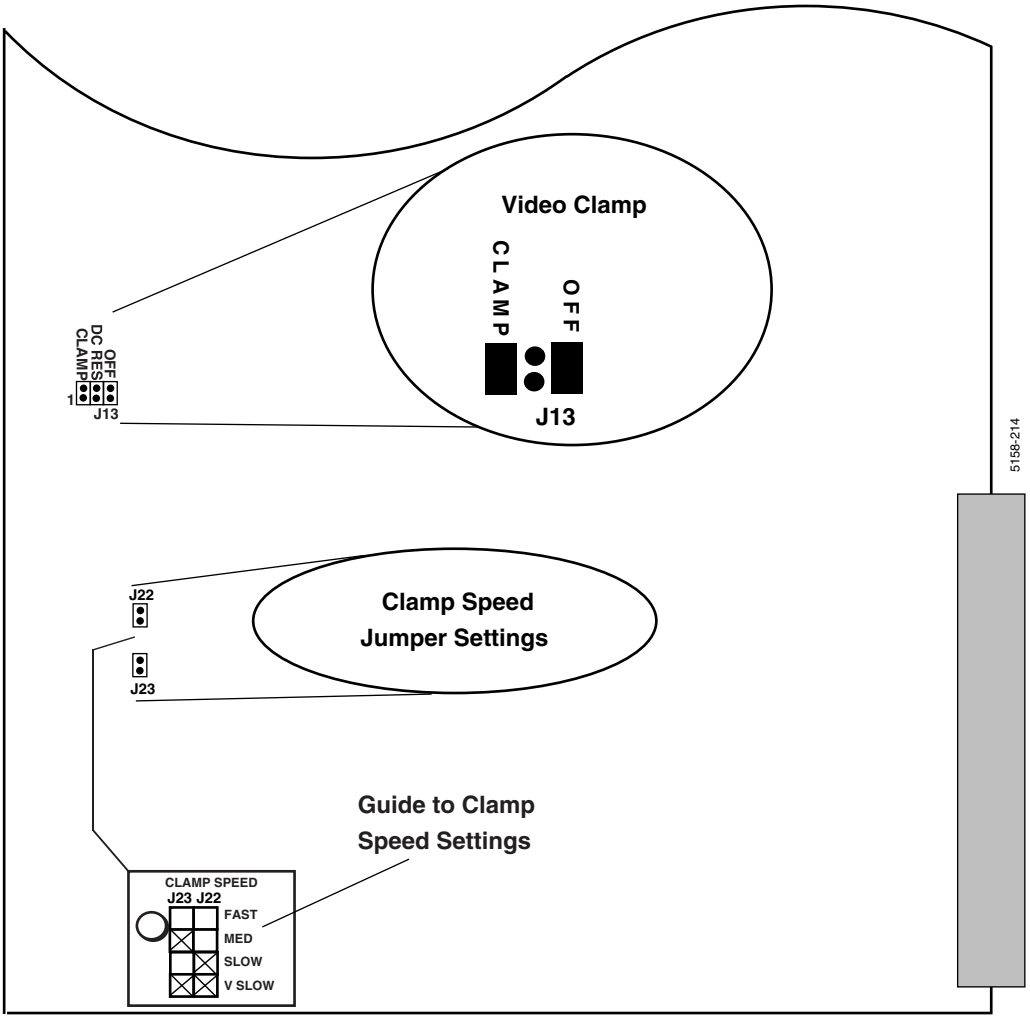


Figure 2-56. Video Input Clamp On/Off and Clamp Speed Jumpers

Video/Audio Output Video Clamp Jumper

On the later-generation Video/Audio Output board (#160097-02), when jumper J20 is set to ON, the video output signal is fixed to a DC reference voltage using a sampled video clamp. To set fast, medium, slow, and very slow clamping speeds, adjust the jumpers on J18 and J19, as shown on the guide that is silk-screened onto the board. Figure 2-57 illustrates the location of the on/off and speed setting jumpers.

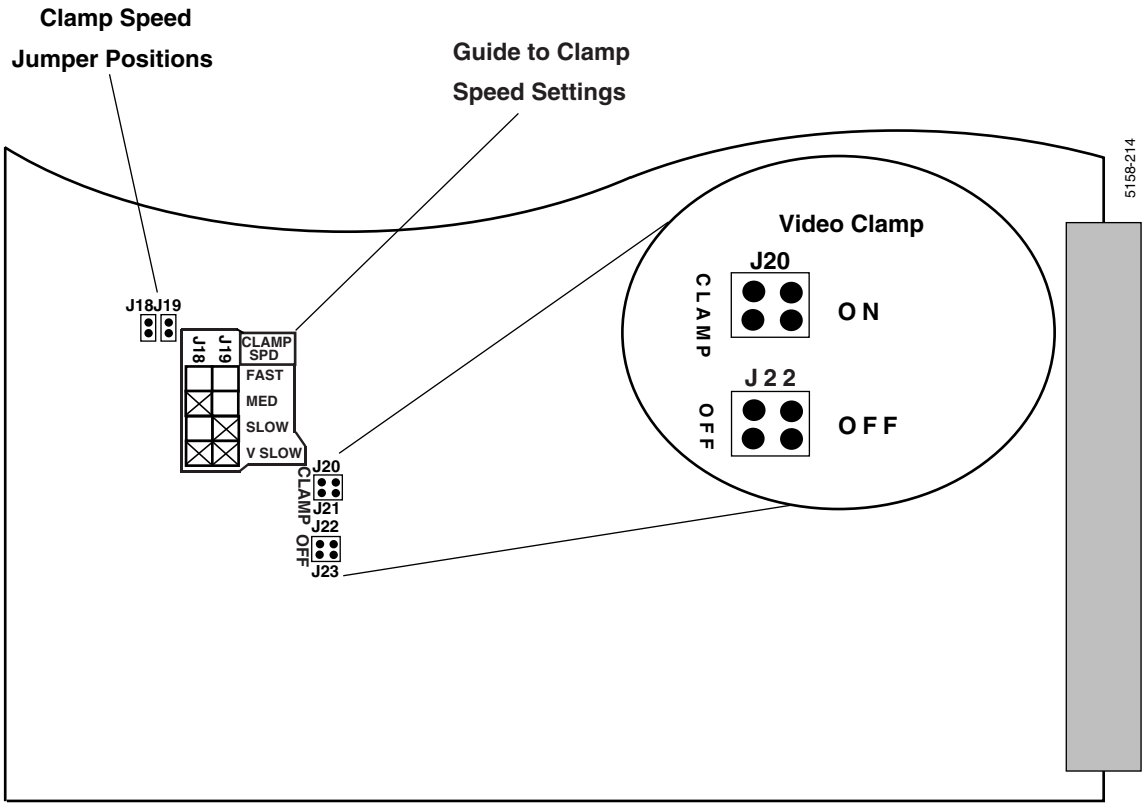


Figure 2-57. Video Output Clamp On/Off and Clamp Speed Jumpers

Audio Input Impedance Selection

The MCF system is designed with an audio gain of unity into a 600 Ohm impedance load. However, your facility may require a different setting. The input impedance may be changed from 600 Ohm to 150 Ohm or HIGH Ohm (>30kiloOhm differential) impedance (for bridging applications).

To set jumpers J15, J16, J17, and J18 on the Combined Video/Audio Input module, follow the steps listed below:

1. Remove the Video/Audio Input module from the frame, and place on a flat, level, static-free surface with the module orientation as shown in Figure 2-58.

2. Select the appropriate impedance jumper settings for Channels A (J15), B (J16), C (J17), and D (J18). Set the jumpers accordingly.

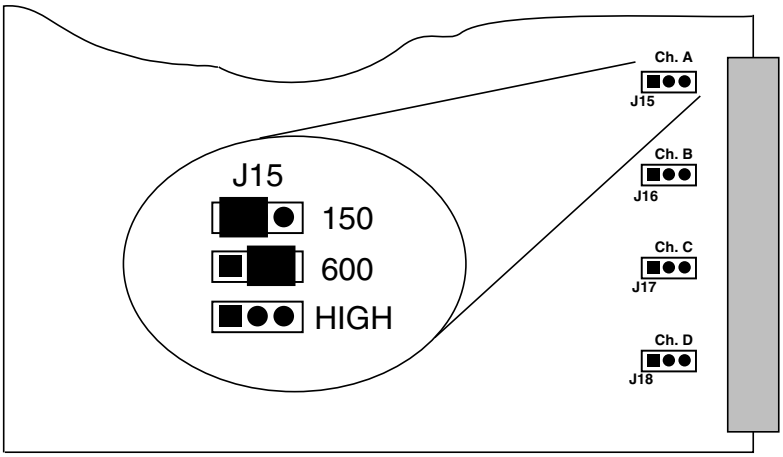


Figure 2-58. Combined Video/Audio Impedance Jumper Locations

Audio Attenuation Clip Selection

The LED indicators on the front panel of the Combined Video/Audio Input module signify excessive input signal levels that result in signal distortion. If a clip indicator is illuminated only occasionally or momentarily, no action is required. If clipping is continuous, the input signal should be attenuated or the gain reduced using the attenuator selection. If the desired headroom is +16 dB, the desired clip level calculation would be as follows:

Nominal Input =+ 8 dBm
Desired Headroom =+16 dB
Clip Level Setting =+24 dBm

Note that you may set invalid gain settings by placing the switch segments in inappropriate positions. The system notifies you (when checking status using a remote terminal) that you have invalid gain settings selected. Refer to Table 2-10 on page 2-66 (for input attenuation) or Table 2-10 on page 2-66 (for output attenuation) to correctly set switch segments.

To set the clip level, follow the steps listed in the following text:

1. Remove the Combined Video/Audio Input or Output module from the frame, and place on a flat, level, static-free surface. Refer to Figure 2-59 for the Input module S1 switch location. Or refer to Figure for the Output module S1 switch location.

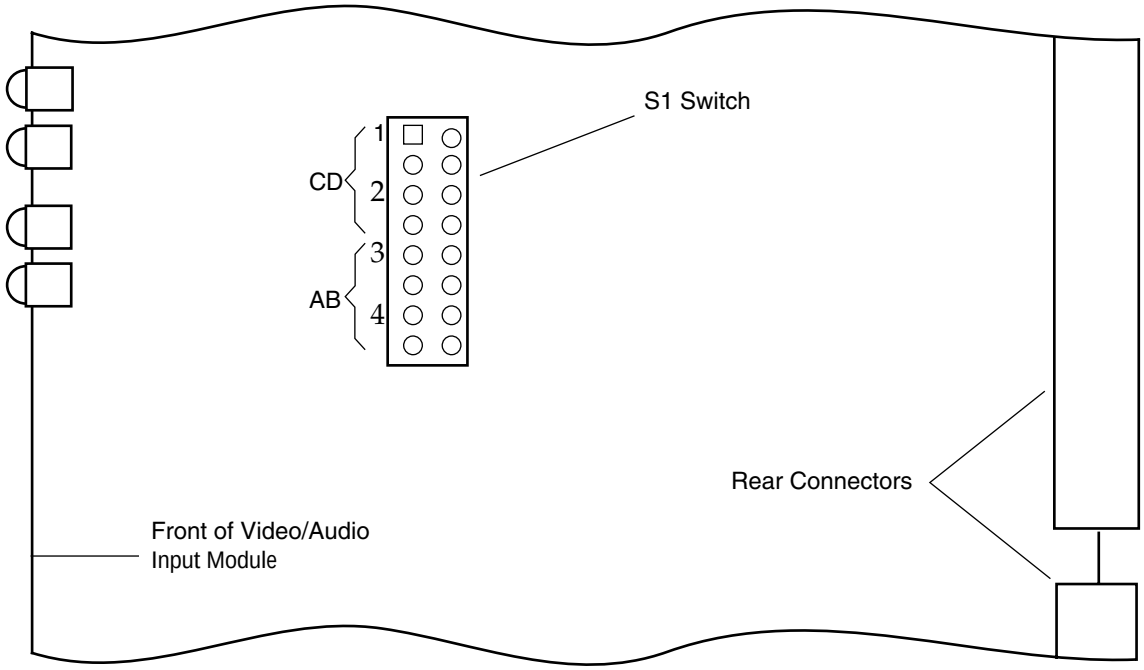


Figure 2-59. Combined Video/Audio Input Module Audio Attenuator Switch S1 Location

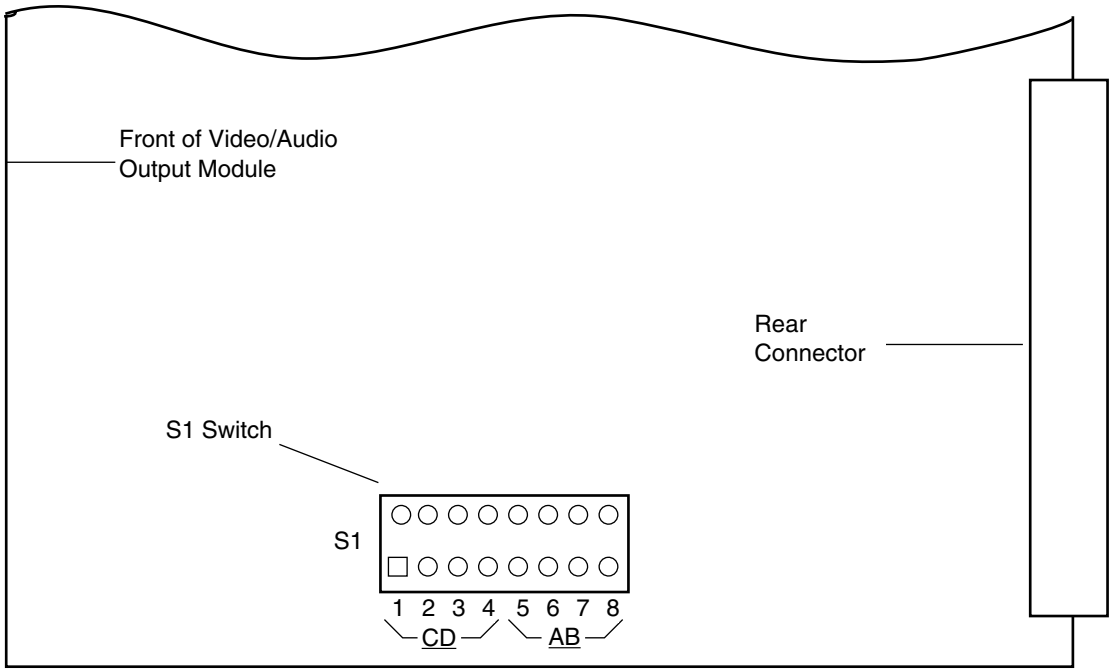


Figure 2-60. Combined Video/Audio Output Module Audio Attenuator Switch S1 Location

2. Locate DIP switch S1 on either module. Note that on S1 for both modules the switch settings for Channels C and D are segments 1 through 4, and that the settings for Channels A and B are segments 5 through 8.

3. Set the input clip level segments for the Input module (according to Table 2-9), or for the Output module (according to Table 2-10 on page 2-66).

Table 2-9. Combined Video/Audio Input Attenuation Settings

Channels C and D						Channels A and B					
Switch Segment #		1	2	3	4	Switch Segment #		5	6	7	8
Clip Levels	+24 dBm	Off	On	On	On	Clip Levels	+24 dBm	Off	On	On	On
	+20 dBm	On	Off	On	On		+20 dBm	On	Off	On	On
	+16 dBm	On	On	Off	On		+16 dBm	On	On	Off	On
	+12 dBm	On	On	On	Off		+12 dBm	On	On	On	Off
	+ 8dBm	On	On	On	On		+ 8dBm	On	On	On	On

Table 2-10. Combined Video/Audio Output Attenuation Settings

Channels C and D						Channels A and B					
Switch Segment #		1	2	3	4	Switch Segment #		5	6	7	8
Clip Levels	+24 dBm	On	On	On	On	Clip Levels	+24 dBm	On	On	On	On
	+20 dBm	On	On	On	Off		+20 dBm	On	On	On	Off
	+16 dBm	On	On	Off	On		+16 dBm	On	On	Off	On
	+12 dBm	On	Off	On	On]		+12 dBm	On	Off	On	On
	+ 8dBm	Off	On	On	On		+ 8dBm	Off	On	On	On

Serial Digital Module Settings

The Serial Digital Input and Output modules have three user-selectable settings:

- 270/143 mbps Mode Select (Input module)
- SixSlot Mode (both modules)
- System/Backplane Mode (Output module)

All other headers found on the modules are used by Tektronix for testing and should not have jumpers on them. The following text describes the three user-selectable jumper settings.

Cable Equalization

Input cable equalization is automatic to compensate for your cable length. The Input module operates in Component Video (D1) mode with up to 200 meters of cable or in Composite Video (D2) mode with up to 250 meters of cable.

270/143 Mode Selection on the Input Module

Jumper P4 selects the video data format mode to match what your facility uses, either 270 Mbps Component or RS-259 NTSC 143 Mbps Composite Video mode. See Figure 2-61 for the jumper location.

- Place the jumper on the one and two position to select 143 Mbps NTSC Composite Video mode (D2). This is the factory default setting.
- Place the jumper on the two and three position to select 270 Mbps Component Video mode (D1)

Note Component Video format (D1) requires **two** consecutive time slots, that is, in the Transmit frame if you assign a Serial Input module to time slot Ø (zero), by default the video is placed on time slot Ø **and** time slot 1. At the Receiver frame, the Serial Output module takes the D1 formatted video from time slot Ø and 1.

When using Component Video mode and multiple Serial Input or Output modules, the Frame's time slot assignments are as follows: time slots Ø & 1 are paired, time slots 2 & 3 are paired, and time slots 4 & 5 are paired.

If you are using the 2 RU frame for Component Video format (D1), one of the frame's module locations **must** remain empty. This is because component video uses two time slots and 2 RUs only have two.

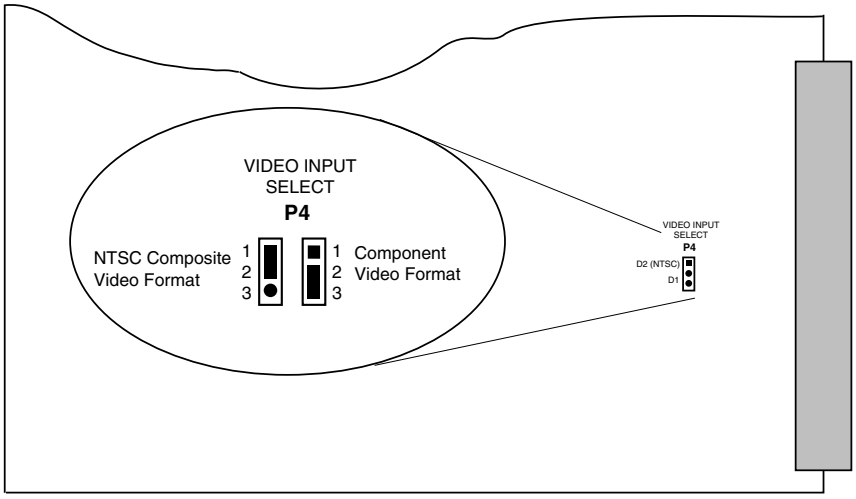


Figure 2-61. 270/143 Mbps Mode Jumper Location on Serial Digital Input Module

MCF Six Slot Mode Selection for Both Input and Output

This jumper (P5 on the Input module and P4 on the Output module) selects the 6 slot mode. Six slot is the default.

- Place the jumper on the one and two position to select the 6 slot mode (which is the default)
- If you place the jumper on positions two and three, *the module will not work in this mode,* so place the jumper on the one and two position.

See Figure 2-62 to see where this jumper is located on the Input module. See Figure 2-63 to see its location on the Output module.

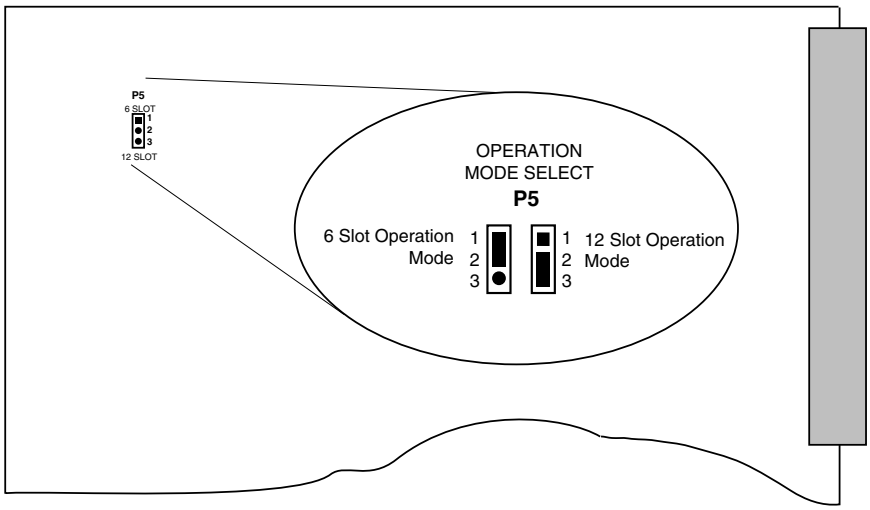


Figure 2-62. Slot Mode Jumper Location on Serial Digital Input Module

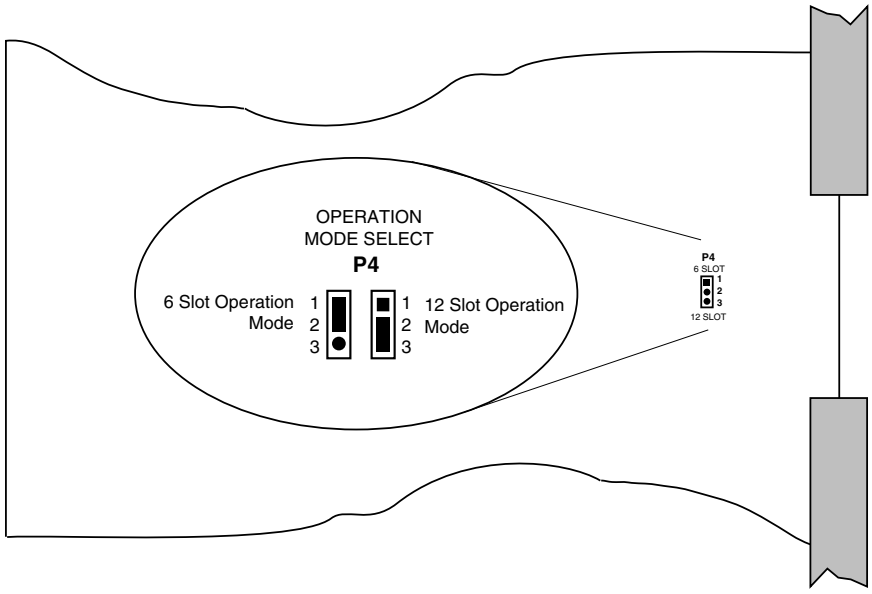


Figure 2-63. 6 Slot Mode Jumper Location on Serial Digital Output Module

System/Backplane Mode Selection on the Output Module

This jumper header (J8) selects between the System or Backplane mode. The Backplane mode is used by Tektronix for factory test. System mode is the transmitting and receive mode. The default is no jumper (which provides System mode). See Figure 2-64 to see where this header is located.

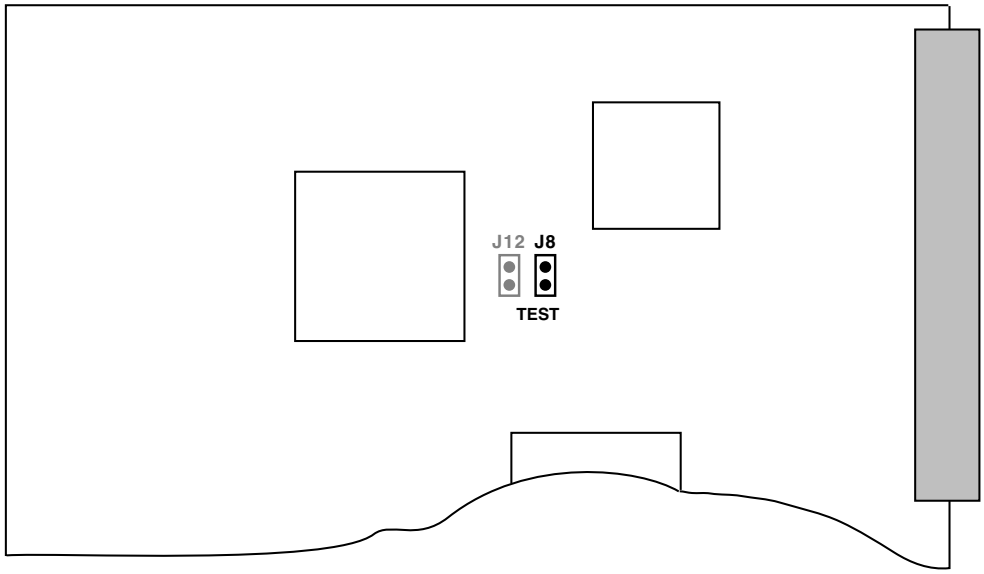


Figure 2-64. System/Backplane Mode Jumper Locations Serial Digital Output Module

Video/Audio Diplexer Module Settings

The Video/Audio Diplexer Input and Output modules have multiple user-selectable settings:

- Video Cable Equalization
- Output Cable Equalization
- Video Signal Termination
- DC Restore Jumpers
  - Input DC Restore Jumper
  - Output DC Restore Jumper
- Impedance Selection
- Audio Gain Selection
- Ramp Enable/Disable on DIP Switch 3 for Input Module
- Subcarrier Enable/Disable on DIP Switch 3 for Input Module
- OC-3/MCF Selection for Both Input and Output Modules
- MCF 6 Slot Mode Selection for Both Input and Output Modules
- Mute Video Disable/Enable Selection on the Output Module
- Mute Audio Disable/Enable Selection on the Output Module
- Filtered/Diplexed Mode Selection on the Output Module
- System/Backplane Mode Selection on the Output Module

The following text describes how to select the settings.

Video Cable Equalization

If the Video/Audio Diplexer Input module needs cable equalization (video only) to compensate for your cable length, adjust the equalization (EQ) potentiometer on the front panel. The video input EQ potentiometer located on the front panel of this module is always enabled. There is no internal adjustment required for this function. Measurements can be taken with a waveform monitor at the front panel MONITOR connector.

Note If equalization is not required, make certain the EQ potentiometer on the front panel is fully turned clockwise (off).

If cable equalization is required, it will be necessary to install one or two Hybrid Equalization boards (depending on the length) and to change and/or add a jumper block on the Input module.

Cable equalization is attained by installing the Hybrid boards, U66 or U67 and by setting up the jumper block at P5. Refer to Figure 2-65 for the equalization hybrid board plug-ins and jumper P5 locations.

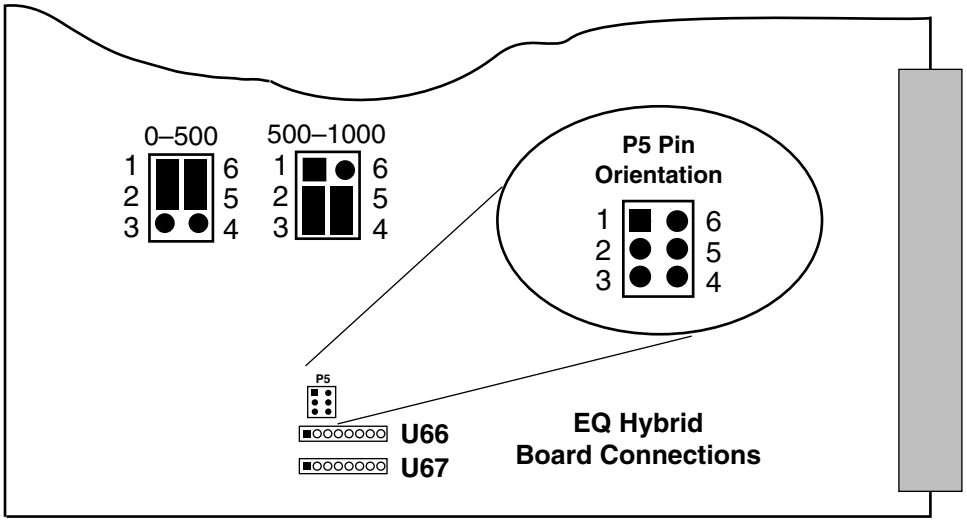


Figure 2-65. Diplexer Input Module Video Cable Equalization Jumper Location

Cable length determines whether one or two Hybrid boards need to be installed and also determines the position of the jumper block. Lengths of 0–500 feet require one board and lengths of 500–1000 feet require both Hybrid boards. In addition, the Hybrid boards are video cable I.D. specific by length. Table 2-8 gives specific cable model numbers

Output Cable Equalization

If the Video/Audio Diplexer Output module needs cable pre-equalization (video only) to compensate for your cable length, adjust the equalization (EQ) potentiometer on the front panel. The video output EQ potentiometer located on the front panel of this module is always enabled. There is no internal adjustment required for this function. Measurements can be taken with a waveform monitor at the backplane VIDEO I/O connector.

Note If equalization is not required, make certain the EQ potentiometer on the front panel is turned fully clockwise (off).

If cable equalization is required, it will be necessary to install one or two Hybrid Equalization boards (depending on the length) and to change and/or add a jumper block on the Input module.

Cable equalization is attained by installing the Hybrid boards, U58 or U59 and to setting up the jumper block at J12. Refer to Figure 2-66 for the equalization hybrid board plug-ins and jumper J12 locations.

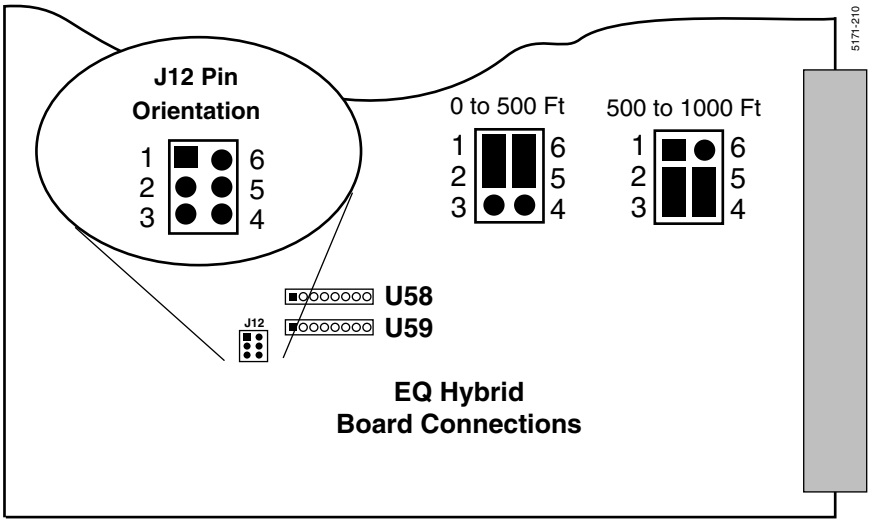


Figure 2-66. Diplexer Output Module Video Cable Equalization Jumper Location

Cable length determines whether one or two Hybrid boards need to be installed. It also determines the position of the jumper block. Lengths of 0–500 feet require one board and lengths of 500–1000 feet require both Hybrid boards. In addition, the Hybrid boards are video cable I.D. specific by length. Table 2-10 on page 2-66 gives specific cable model numbers.

Video Signal Termination

To preserve the shape and integrity of a video waveform traveling along a cable, the cable must be terminated in an impedance equal to its characteristic impedance. In the MCF system, the physical ends of the video cable must be terminated with a 75 Ohm resistor. Leaving off the terminations generally results in poor video signal operation. If loop-through video operation is desired, termination is not required.

If the video signal on the Diplexer Input module must be terminated, this termination may be done in one of two ways:

- You may terminate the signal using a 75 Ohm terminator on one of the two Video input BNC connector on the MCF backplane.
- Or, you may set the Termination jumper (P6) on the Diplexer Input module in the enable position. Refer to Figure 2-67 for the P6 jumper location.

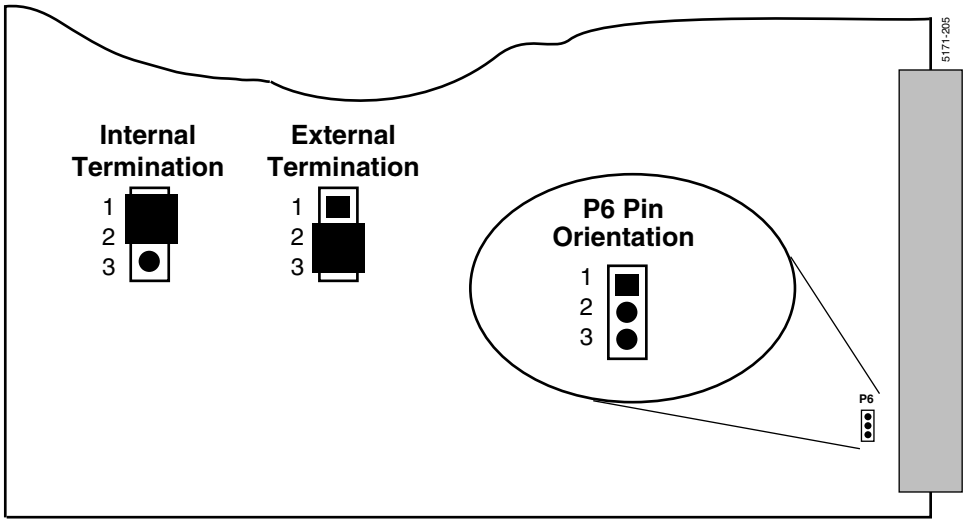


Figure 2-67. Diplexer Input Module's 75 Ohm Termination Jumper Location

DC Restore Jumpers

The Diplexer DC restoration circuitry provides a slow return of the base level of the video signal to a fixed DC reference voltage. Due to the design of DC restore circuitry, rapid corrections of the video signal are not possible. However, the DC component is restored in the signal without introducing the distortion caused by clamping. Both the Diplexer Input and Output modules have DC restoration circuitry, and you must set jumpers on both modules to enable the DC restore operation. See the following text for details.

Diplexer Input DC Restore Jumper

When the jumper is set to ON, the DC restoration circuitry provides a slow return of the video input signal to a fixed DC reference voltage. Figure 2-68 illustrates the location of jumper P4 on the Diplexer Input module.

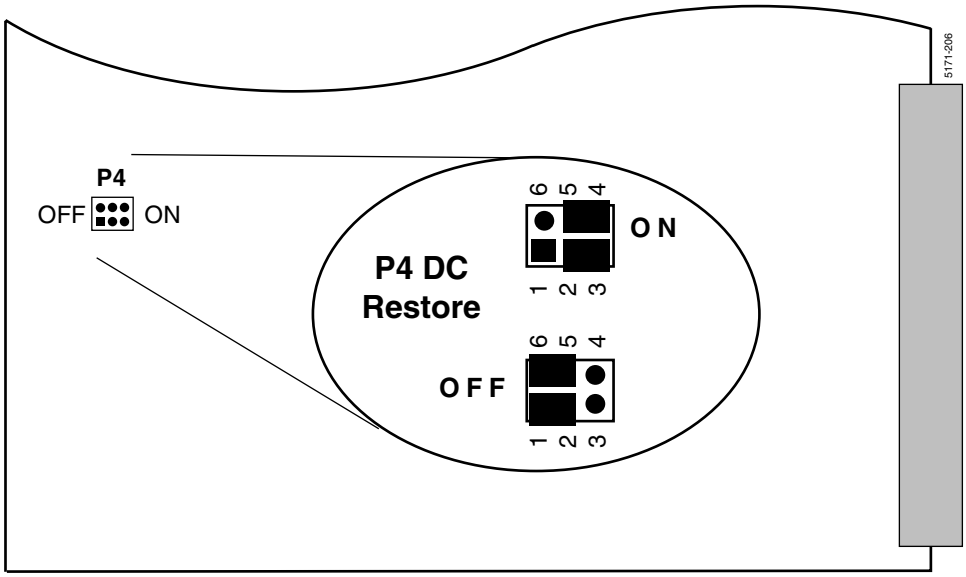


Figure 2-68. Diplexer Input DC Restore Jumper

Diplexer Output DC Restore Jumper

Likewise, on the Diplexer Output module when jumper P4 is set to ON, the video output signal is fixed to a DC reference voltage. Figure 2-69 illustrates the location of jumper P4 on the Diplexer Output module.

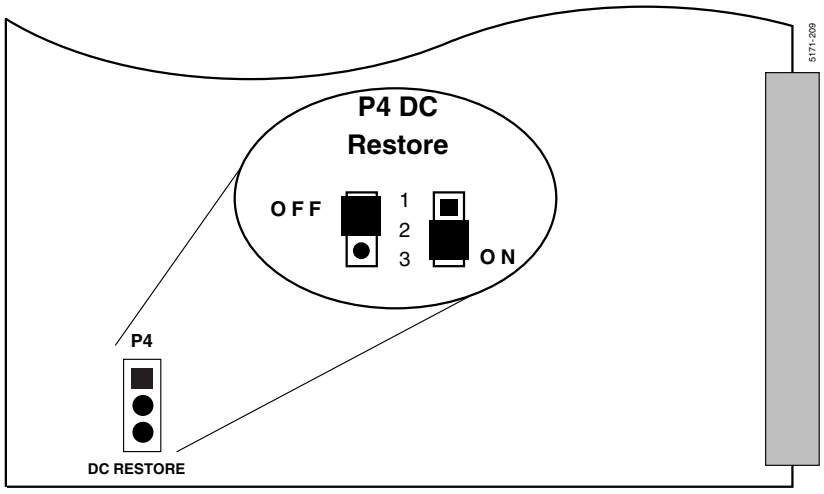


Figure 2-69. Diplexer Output DC Restore Jumper

Impedance Selection

The MCF system is designed with an audio gain of unity into a 600 Ohm impedance load. However, your facility may require a different setting. The input impedance may be changed from 600 Ohm to 150 Ohm or HIGH Ohm (>30KOhm differential) impedance (for bridging applications).

To set DIP switch S4 on the Diplexer Input module, follow the steps listed below:

1. Remove the Diplexer Input module from the frame, and place on a flat, level, static-free surface with the module orientation as shown in Figure 2-70.
2. Select the appropriate impedance segment setting for Channel A or B per Table 2-11 (the information is also found on the back of the module). Set the segments accordingly.

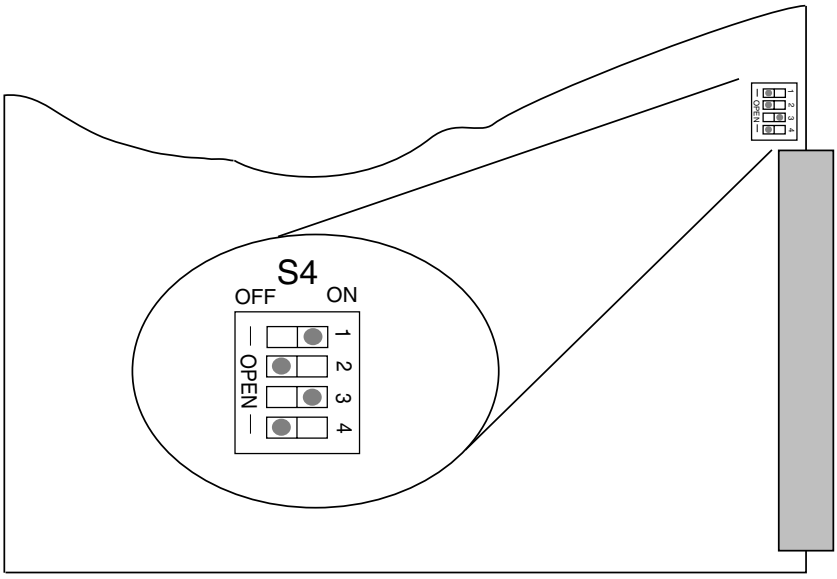


Figure 2-70. Diplexer Impedance Jumper Locations

Table 2-11. Diplexer DIP Switch S4, Input Impedance

	Segment	150Ω	600Ω	High ZΩ
Channel A	1	Off	On	Off
	2	On	Off	Off
Channel B	3	Off	On	Off
	4	On	Off	Off

Audio Gain Selection

The LED indicators at the front of the Diplexer Input module signify excessive input signal levels that result in signal distortion. If a clip indicator is illuminated only occasionally or momentarily, no action is required. If clipping is continuous, the input signal should be attenuated or the gain reduced using the attenuator selection. To avoid clipping, never set clip level above +18 dBm. If the desired headroom is +16 dB, the desired clip level calculation would be as follows:

Nominal Input	=	+ 2 dBm
Desired Headroom	=	+16 dB
Clip Level Setting	=	+18 dBm

Note You may set invalid gain settings by placing the segments in appropriate positions. Refer to Table 2-12 for correct segment settings.

To set the clip level, follow the steps listed in the following text:

1. Remove the Diplexer Input module from the frame, and place on a flat, level, static-free surface with the module orientation as shown in Figure 2-71.

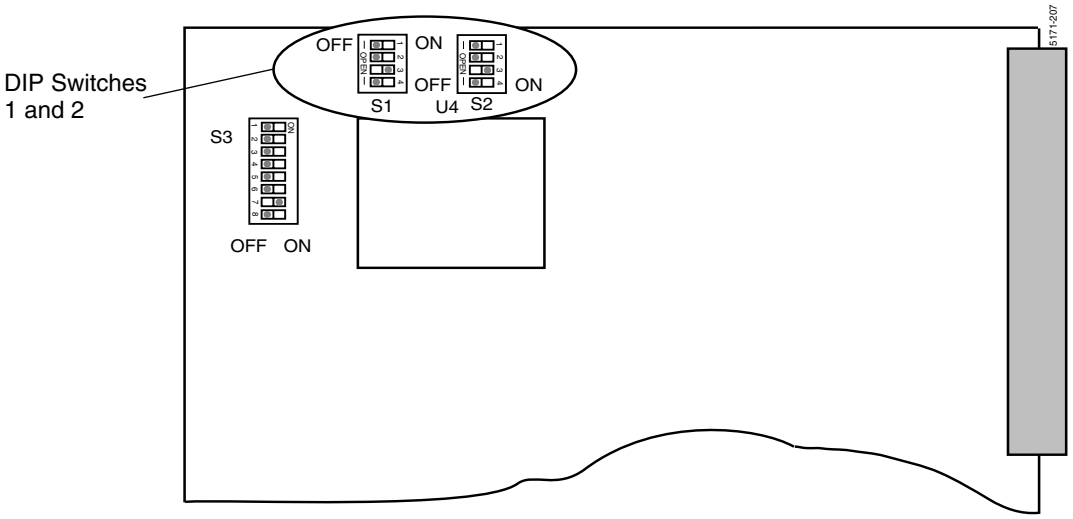


Figure 2-71. Diplexer Input Module Audio Attenuator Switch S1 Location

2. Locate DIP switches S1 and S2 on the Input module.

3. Set the segments according to Table 2-12 for specific gain settings.

Table 2-12. Diplexer Input Audio Gain A & B for DIPs S1 & S2

Segment	+6 dB	+3 dB	0 dB	–3 dB	–6 dB
1	On	On	On	On	Off
2	On	On	On	Off	On
3	On	On	Off	On	On
4	On	Off	On	On	On

4. To set the Diplexer *Output* module gain, follow Steps 1 through 3 using the Output module (see Figure 2-72 to locate DIP switches 2 and 3) instead of the Input module and substituting Table 2-13 for Table 2-12.

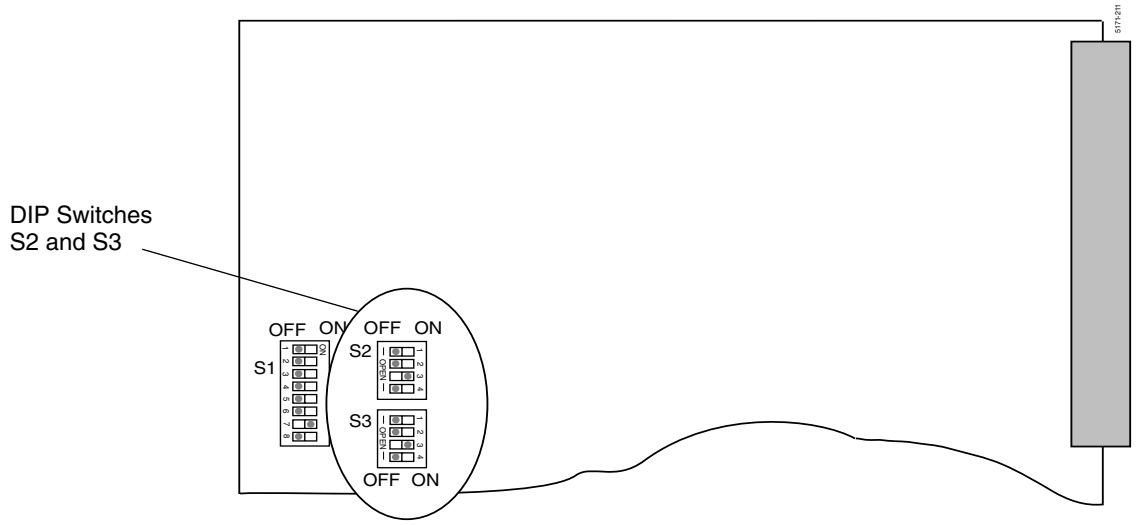


Figure 2-72. Diplexer Output Module Audio Gain Switches S1 & S2 Locations

Table 2-13. Diplexer Output Audio Gain A & B for DIPs S2 & S3

Segment	+6 dB	+3 dB	0 dB	–3 dB	–6 dB
1	On	On	On	Off	On
2	On	On	Off	On	On
3	On	Off	On	On	On
4	Off	On	On	On	On

Ramp Enable/Disable on DIP Switch 3 for Input Module

This DIP switch segment selects ramp enable or disable. Ramp disable is the default.

- Set segment 1 of S3 (Input module) OFF to select ramp disable
- Set segment 1 of S3 (Input module) ON to select ramp enable

See Figure 2-73 to see where this switch is located. Table 2-14 on page 2-82 has a list of segments selections for DIP Switch S3.

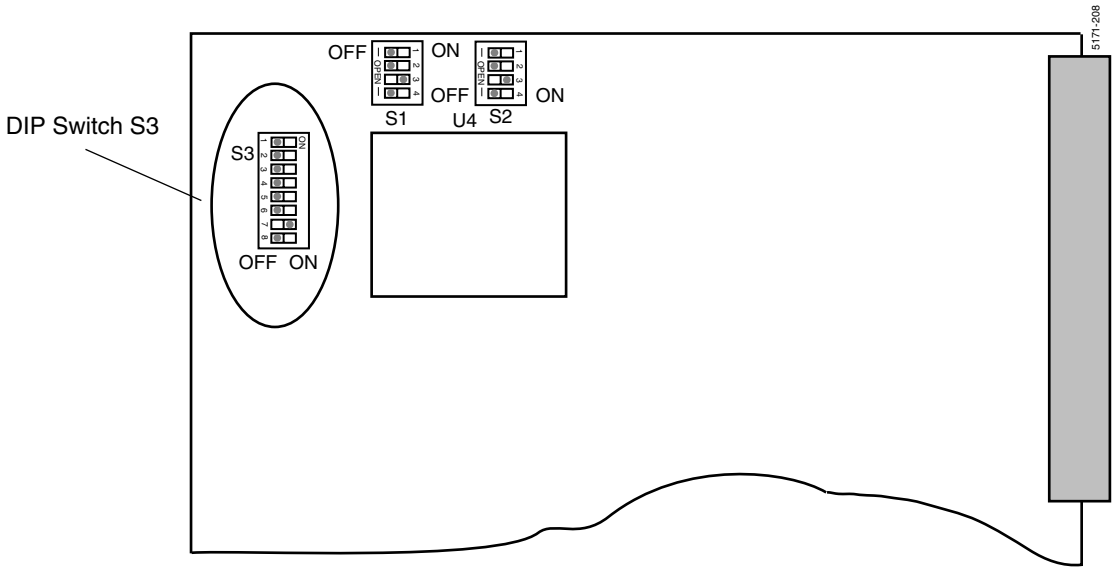


Figure 2-73. DIP S3 on Diplexer Input Module

Subcarrier Enable/Disable on DIP Switch 3 for Input Module

This DIP switch segment selects subcarrier enable or disable. Subcarrier enable is the default.

- Set segment 2 of S3 (Input module) OFF to select the subcarrier disable
- Set segment 2 of S3 (Input module) ON to select the subcarrier enable

See Figure 2-73 to see where this switch is located. Table 2-14 on page 2-82 has a list of segments selections for DIP switch S3.

OC-3/MCF Selection for Both Input and Output Modules

DIP switches (segment 4 on S3 for the Input module and segment 4 on S1 for the Output module) select between OC-3 and MCF. MCF is the default.

- Set segment 4 of S3 (Input module) and of S1 (Output module) to OFF to select MCF
- Set segment 4 of S3 (Input module) and of S1 (Output module) to ON to select OC-3

See Figure 2-74 to see where this switch is located on the Input module. See Figure 2-75 to see its location on the Output module. Table 2-15 on page 2-82 and Table 2-14 on page 2-82 have lists of segments selections for DIP Switches S1 and S3.

MCF Six Slot Mode Selection for Both Input and Output Modules

These DIP switches (segment 5 on S3 for the Input module and segment 5 on S1 for the Output module) select the 6 slot. Six slot is the default.

- Set segment 5 of S3 (Input module) and of S1 (Output module) to OFF to select the 6 slot mode
- If segment 5 of S3 (Input module) and S1 (Output module) are set in the ON position, the modules will not work in this mode

See Figure 2-74 to see where this switch is located on the Input module. See Figure 2-75 to see its location on the Output module.

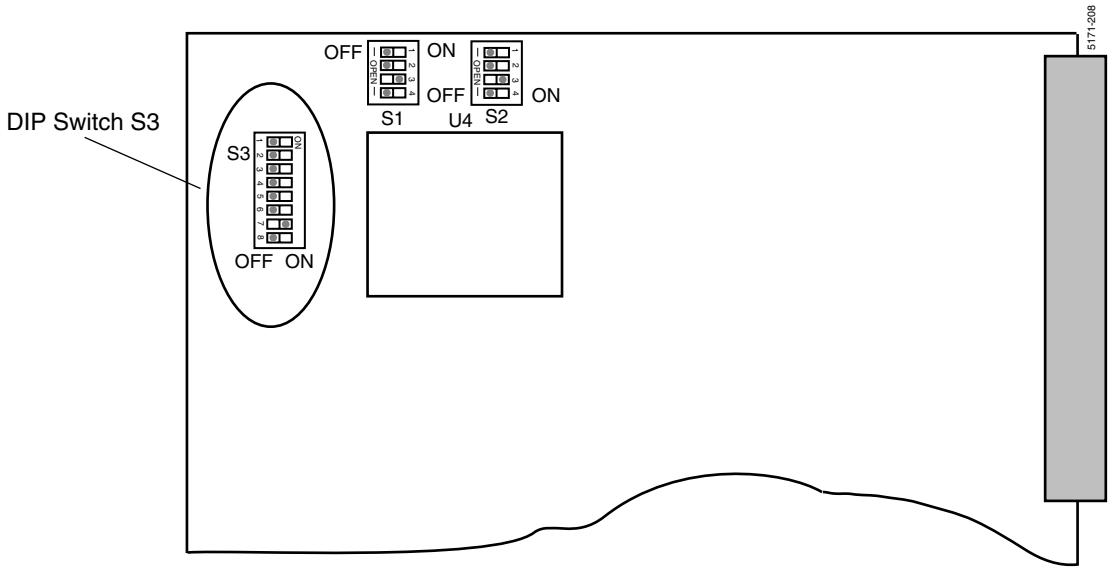


Figure 2-74. DIP S3 on Diplexer Input Module

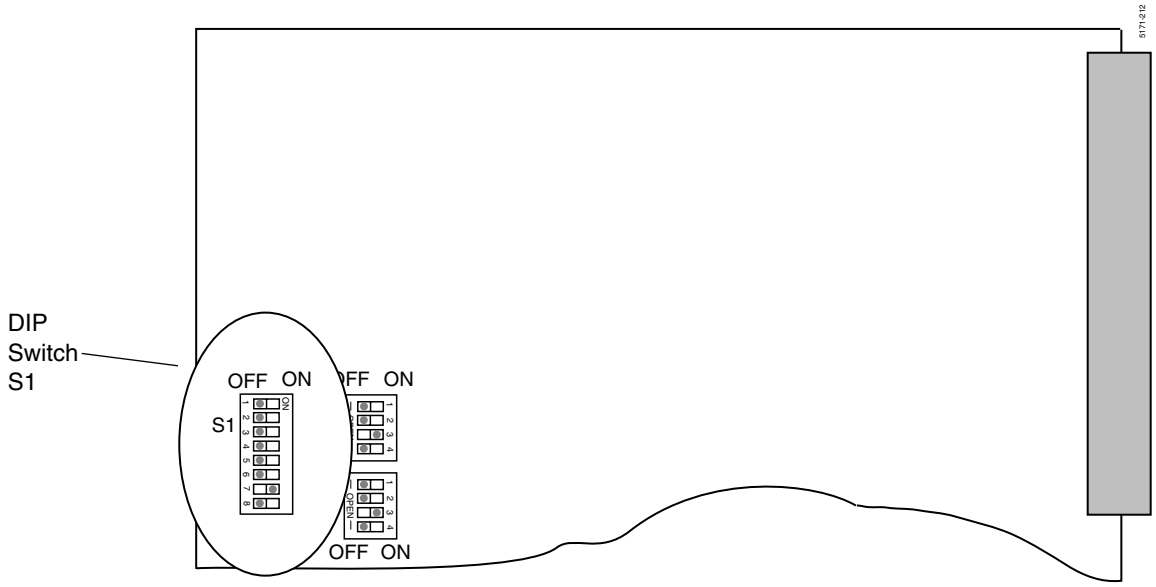


Figure 2-75. DIP S1 on Diplexer Output Module

Refer to Table 2-15 and Table 2-14 for a list of segments selections for DIP Switches S1 and S3.

Table 2-14. Diplexer Input DIP S3 Configuration

Pos	On	Off
1	Ramp Enable	Ramp Disable
2	Subcarrier Enable	Subcarrier Disable
3	Not used	Not used
4	OC-3	MCF
5	12 Slot (GVG test only)	6 Slot
6	Not used	Not used
7	Not used	Not used
8	Not used	Not used

Table 2-15. Diplexer Output DIP S1 Configuration

Pos	On	Off
1	Mute Video Disable	Mute Video Enable
2	Mute Audio Disable	Mute Audio Enable
3	Filtered	Diplexed
4	OC-3	MCF
5	12 Slot (GVG test only)	6 Slot
6	Backplane (GVG test only)	System
7	Not used	Not used
8	Not used	Not used

Mute Video Disable/Enable Selection on the Output Module

This DIP switch segment selects between mute video disable and enable. Default is enable.

- Set segment 1 of S1 (Output module) in the ON position to select disable video mute
- Set segment 1 of S1 (Output module) in the OFF position to select enable video mute

See Figure 2-76 to see where this switch is located. Refer to Table 2-15 for a list of segments selections for DIP Switch S1.

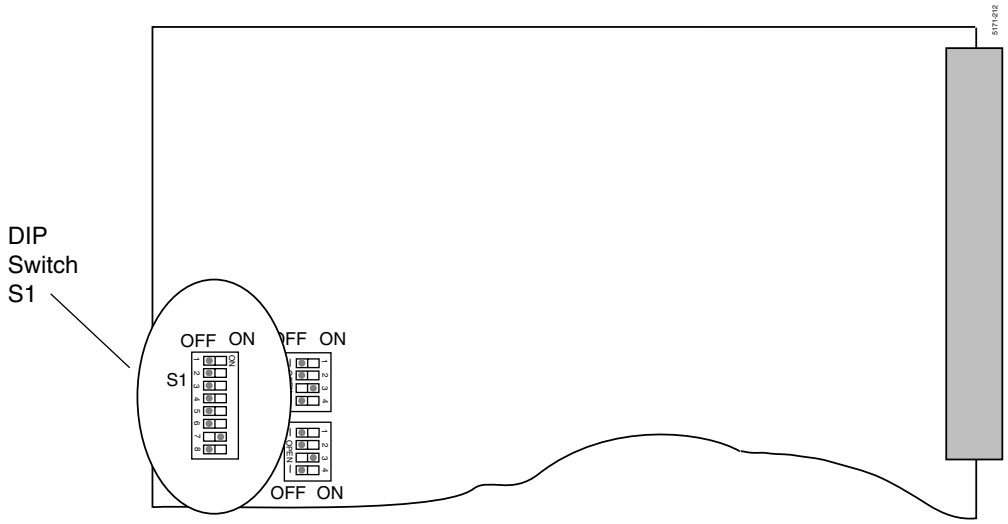


Figure 2-76. DIP S1 on Diplexer Output Module

Mute Audio Disable/Enable Selection on the Output Module

This DIP switch segment selects between mute audio disable and enable. If subcarriers are lost, the audio won't work and the audio becomes noisy. If you want to hear when this happens, make sure this option is OFF. Default is enable (off).

- Set segment 2 of S1 (Output module) in the ON position to select disable audio mute
- Set segment 2 of S1 (Output module) in the OFF position to select enable audio mute

See Figure 2-76 to see where this switch is located. Refer to Table 2-15 for a list of segments selections for DIP Switch S1.

Filtered/Diplexed Mode Selection on the Output Module

This DIP switch segment selects between the Filtered and Diplexed mode. If you just want to use the baseband audio without the subcarriers, you would select Filtered mode. There is no default for this option.

- Set segment 3 of S1 (Output module) in the ON position to select Filtered mode
- Set segment 3 of S1 (Output module) in the OFF position to select Diplexed mode

See Figure 2-77 to see where this switch is located. Refer to Table 2-15 for a list of segments selections for DIP Switch S1.

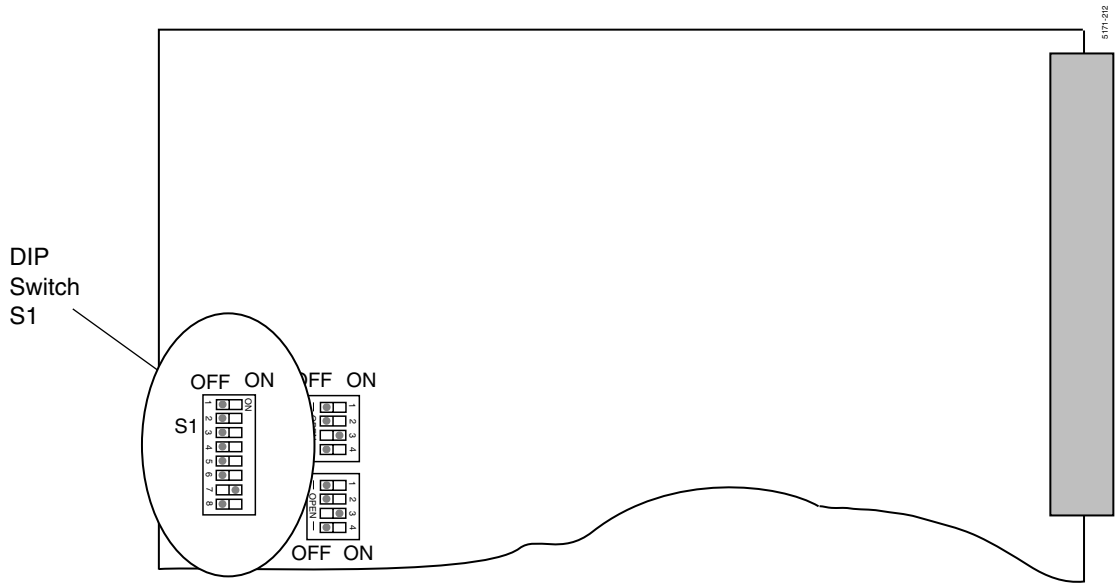


Figure 2-77. DIP S1 on Diplexer Output Module

System/Backplane Mode Selection on the Output Module

This DIP switch segment selects between System and Backplane modes. The Backplane mode is used by Tektronix for test. System mode is the transmitting and receive mode and is the default.

- Set segment 6 of S1 (Output module) in the OFF position to select System mode
- If segment 6 of S1 (Output module) is set in the ON position, it is in the Backplane mode. The module will not work in this mode

See Figure 2-77 to see where this switch is located. Refer to Table 2-15 for a list of segment selections for DIP Switch S1.

Installing Modules in the Frame

Modules (labelled “Boards”) may be removed and inserted without interrupting power. There is a notch in the frame above and below each slot to assist in aligning modules as they are inserted. After insertion, auto reset automatically kicks in and the inserted module’s LEDs flash for a few seconds until normal operation begins.

Make sure you place the Fiber Receiver and Transmitter modules in slot 19 in the 6 RU frame and slot 12 in the 2 RU frame. All other modules can be placed in any of the other frame module locations.

Each location in a 6 RU frame has a *module address.* These addresses are used for time slot assignments and are referred to in any system messages having to do with the modules, including the power supplies. Figure 2-78 illustrates the frame numbers and module address locations for a 6 RU frame. These addresses must be used when commanding or interrogating individual modules from the Craft or Administration ports.

Note In the 6 RU frame, the Fiber module is always placed in module address number 19.

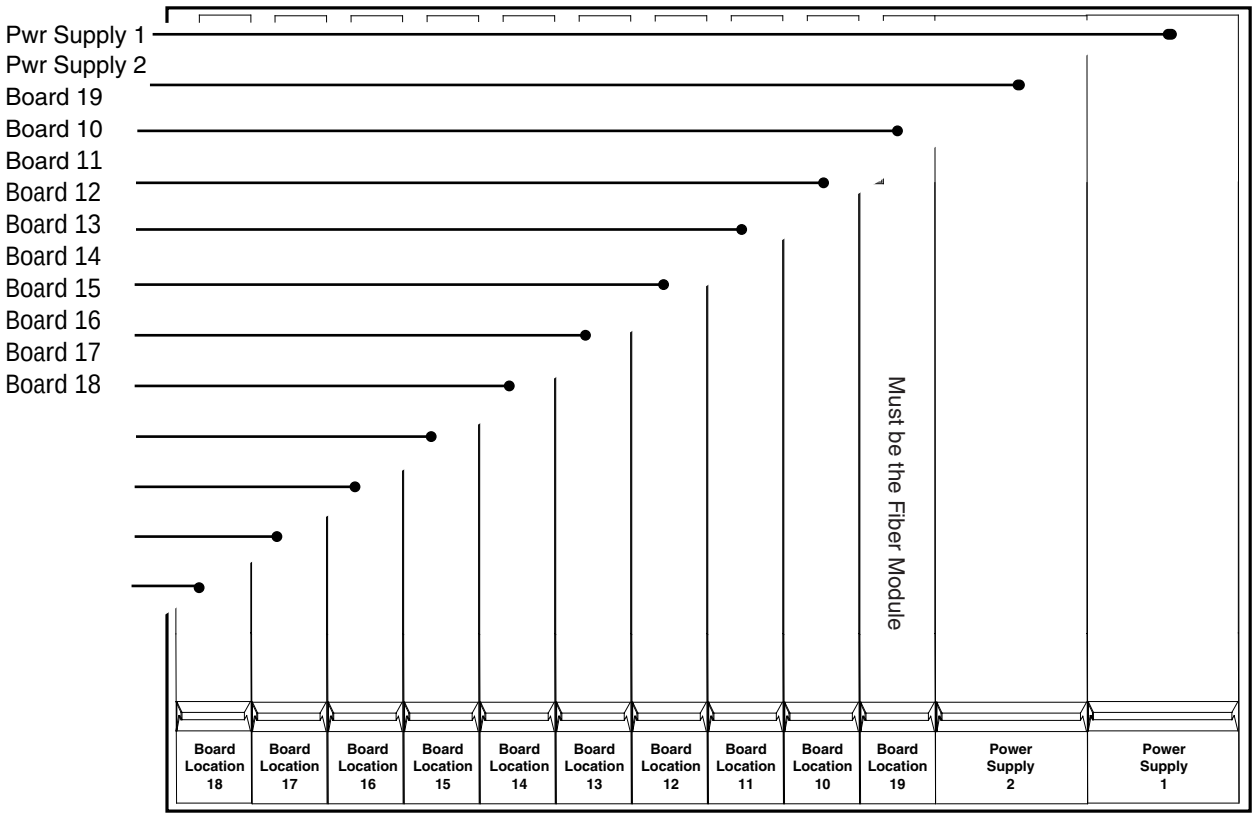


Figure 2-78. Board Location for 6 RU frame

Note If you are using the 2 RU frame for component (D1) video, one of the frame slots **must** remain empty. This is because component video uses two time slots and 2 RUs only have two.

Figure 2-79 illustrates the location of frame slot numbers and module addresses for the 2 RU frame.

Note In the 2 RU frame, the Fiber module is always placed in module address number 12.

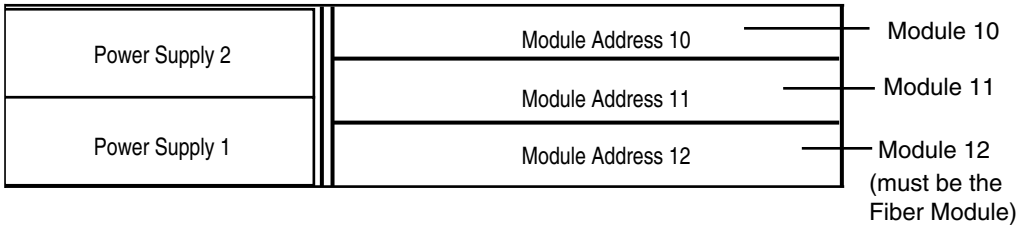


Figure 2-79. Module Location for 2 RU frame

Applying Power

Figure 2-80 illustrates the front panels of the 6 RU frame AC and DC power supplies.

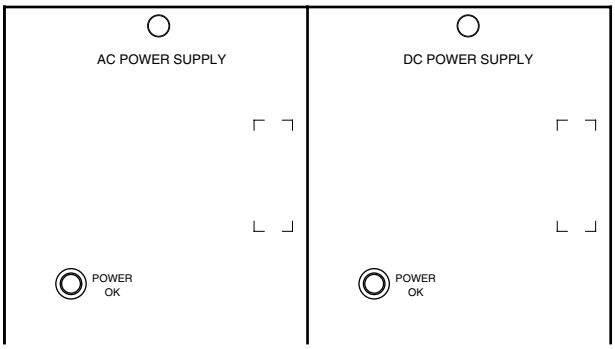


Figure 2-80. Power Supply Front Panels (partial view) for the 6 RU Frame

Figure 2-81 illustrates the front panel of the 2 RU frame AC and DC power supplies.

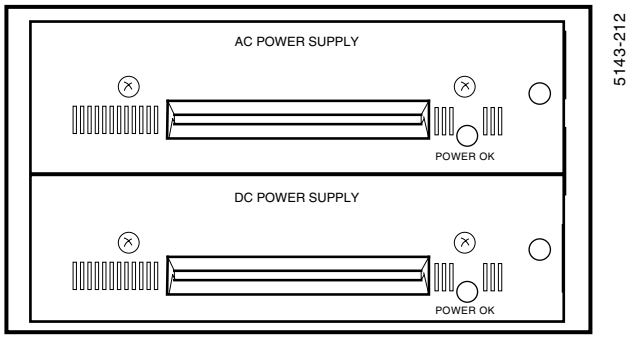


Figure 2-81. Power Supplies for the 2 RU Frame

To apply power to the MCF system, perform the following:

1. Open the door of the MCF frame.
2. If using AC power (or a combination of AC and DC power), attach the plug end of the power cable to the AC power source. The green POWER OK indicator on the front of the AC power supply light. Note that with a redundant power system, the MINOR ALARM indicator lights if one power supply is inoperative.

If the POWER OK indicator does not light, check AC source power and power cord. If they are at fault, replace and proceed; if they are not at fault, verify fuse operation. See Section 5, "Maintenance and Service." If fuse operation is not correct, contact your Tektronix representative.

3. If using DC power (or a combination of AC and DC), turn the 48 VDC Power Supply On. The green POWER OK indicator on the front of the DC power supply lights. Note that with a redundant power system, the MINOR ALARM indicator lights if one power supply is inoperative.

If the POWER OK indicator does not light, check DC source power and power cords. If they are at fault, replace and proceed; if they are not at fault, verify fuse operation. See Section 5, "Maintenance and Service." If fuse operation is not correct, contact your Tektronix representative.

Operational Checkout

You may monitor the operational status of your MCF system or change your system configuration using a *dumb* terminal or computer running a terminal emulation software program. Refer to the *MCF Operation Reference* for procedures and software commands.

When a terminal is connected to the Administration or Craft port on the MCF Transmitter or Receiver frame and is configured for RS-232 operation, the operational checkout described here may be used.

This operational checkout assumes you have connected the CRT display to the Transmitter frame's Administration or Craft port. Upon completion of the Transmitter frame checkout, the terminal must be connected to the Receiver frame, and the procedure repeated. Successful completion of the following procedure in both frames ensures basic operation of the MCF system.

1. A few moments after application of power, the system prompt shown below appears on the monitor.

```
>:
```

If the prompt does not appear:

   a. Check all installation procedures. If a fault is found, correct the fault and proceed to Step 2.

   b. If a fault is not found, disconnect the source power, reseat all modules, reapply power, and if the fault persists, proceed to Step 2.

   c. Contact your Tektronix service representative.

2. Enter **SOS1** (Set Operational Switch 1) and press the **[RETURN]** key. (This allows extended, or verbose, messages to appear on the monitor.)

3. Enter **DBS** (Display Board Status) and press **[RETURN]**. The status of the modules appears on the monitor. See Figure 2-82 for an example of the Transmitter system's monitor display. Note that the Receiver's display indicates Video and Audio Output modules are placed in the frame.

   a. If the status of any Video or Audio module indicates **Board absent**, reseat the module in the frame, reissue the **DBS** command, and proceed to Step 3b.

   b. If the status of the Fiber module indicates an alarm condition for a power supply failure, go to Step 4. If the alarm condition indicates a RF Out Failure, Tx E.O.L. Alarm, or Overtemp Alarm, reseat the Fiber module, reissue the **DBS** command, and if fault persists, proceed to Step 3c.

c. Contact your Tektronix representative.

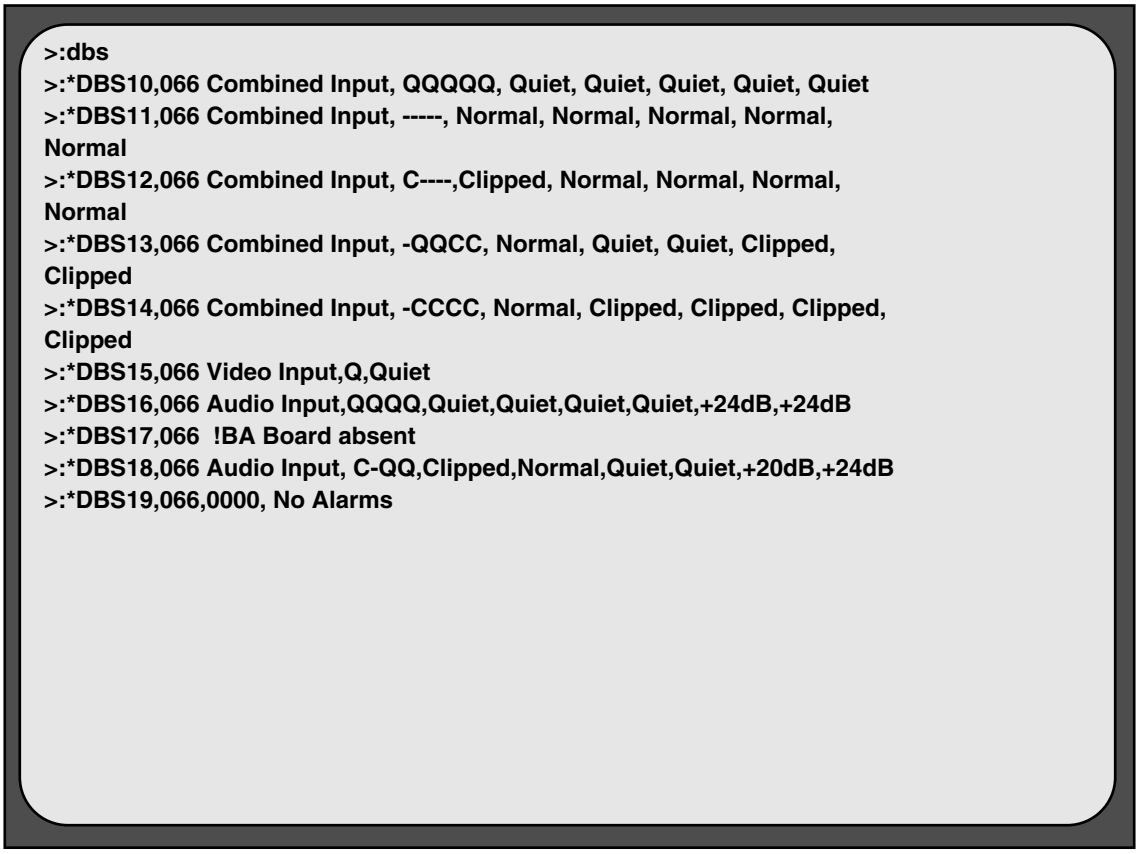


Figure 2-82. Display Board Status Screen of the Transmitter Frame

4. Enter **DPS** (Display Power supply Status) and press the **[RETURN]** key. The status of the power supplies appears on the monitor. See Figure 2-83 for an example of the monitor display.

a. If an installed power supply is indicated as either absent or failed, re-seat the power supply, reissue the **DPS** command, and proceed to Step 4b.

b. If the fault persists, re-seat the Fiber module, and reissue the **DBS** command. If the fault persists, proceed to Step 4c.

c. Contact your Tektronix representative.

```
>:dbs
>:*DBS10,066CI, QQQQQ, +24, +24
>:*DBS11,066CI, -----, +8, +24
>:*DBS12,066CI, C----, +16, +0
>:*DBS13,066CI, -QQCC, +20, +20
>:*DBS14,066CI, -CCCC, +0, +16
>:*DBS15,066VI,Q
>:*DBS16,066AI,QQQQ,+24,+24
>:*DBS17,066!BA
>:*DBS18,066DI,-QQ,+00,+00,ON,RE,SM
>:*DBS19,066,0000
>:dps
>:*DPS254,1,1, P.S. 1 o.k. , P.S. 2 o.k.
```

Figure 2-83. Display Power Supply Status Screen

5. Enter **DTS** (Display Time Slot assignment) and press the **[RETURN]** key. The time slot assignment of all modules in the Transmitter frame appears on the monitor. See Figure 2-84.

```
>:dbs
>:*DBS10,066Combined Input, QQQQQ, Quiet, Quiet, Quiet, Quiet, Quiet
>:*DBS11,066Combined Input, -----, Normal, Normal, Normal, Normal, Normal
>:*DBS12,066Combined Input, C----,Clipped, Normal, Normal, Normal, Normal
>:*DBS13,066Combined Input, -QQCC, Normal, Quiet, Quiet, Clipped, Clipped
>:*DBS14,066Combined Input, -CCCC, Normal, Clipped, Clipped, Clipped,
Clipped
>:*DBS15,066Video Input,Q,Quiet
>:*DBS16,066Audio Input,QQQQ,Quiet,Quiet,Quiet,Quiet,+24dB,+24dB
>:*DBS17,066!BA Board absent
>:*DBS18,066ADiplexer Input,-
QQ,Normal,Quiet,Quiet,ONLINE,RAMPON,SMUTE
>:*DBS19,066,0000,No Alarms
>:dps
>:*DPS255, 0,1, P.S. 1 o.k.,   P.S. 2 o.k.
>:*DTS10,5,5,254 Module 10 is assigned video slot 5 & audio slot 5
>:*DTS11,4,4,254 Module 11 is assigned video slot 4 & audio slot 4
>:*DTS12,3,3,254 Module 12 is assigned video slot 3 & audio slot 3
>:*DTS13,2,2,254 Module 13 is assigned video slot 2 & audio slot 2
>:*DTS14,1,1,254 Module 14 is assigned video slot 1 & audio slot 1
>:*DTS15,0,0,254 Module 15 is assigned video slot 0 & audio slot 0
>:*DTS16,M,M,254 Module 16 is assigned video slot M & audio slot M
>:*DTS17,4,4,254 Module 17 is assigned video slot 4 & audio slot 4
>:*DTS18,3,3,254 Module 18 is assigned video slot 3 & audio slot 3
```

Figure 2-84. Display Time Slot Assignment Screen of the Transmitter Frame

Note When two or more modules are assigned the same time slot in a **Transmitter** frame, transmission errors occur. Refer to the Operation manual for reassignment procedure. However, assignment of two or more modules to the same time slot is allowable in a **Receiver** frame.

Upon completion of the Transmitter frame checkout, the terminal must be connected to the Receiver frame, and the procedure repeated. Successful completion of the procedure in both frames ensures basic operation of the MCF system.

This completes installation of the MCF system. See the *MCF Operation Reference* for operational information.

Section 3

Controls and Indicators

Section Overview

This section illustrates and describes the controls and indicators for the MCF System. Table 3-1 lists the illustrations of the controls and indicators by module with the applicable figure number and page number in this section.

Table 3-1. MCF Controls & Indicators

Module	Figure No.	Page No.
Fiber Transmitter	3-1	page 3-2
Fiber Receiver	3-2	page 3-3
Combined Video/Audio Input	3-3	page 3-4
Combined Video/Audio Output	3-4	page 3-5
Video Input	3-5	page 3-6
Video Output	3-6	page 3-7
Audio Input	3-7	page 3-8
Audio Output	3-8	page 3-9
Serial Digital Input	3-9	page 3-10
Serial Digital Output	3-10	page 3-11
Video/Audio Diplexer Input	3-11	page 3-12
Video/Audio Diplexer Output	3-12	page 3-13
AC/DC Power Supply 6 RU (Six Rack Unit)	3-13	page 3-14
AC/DC Power Supply 2 RU (Two Rack Unit)	3-14	page 3-14

Fiber Transmitter

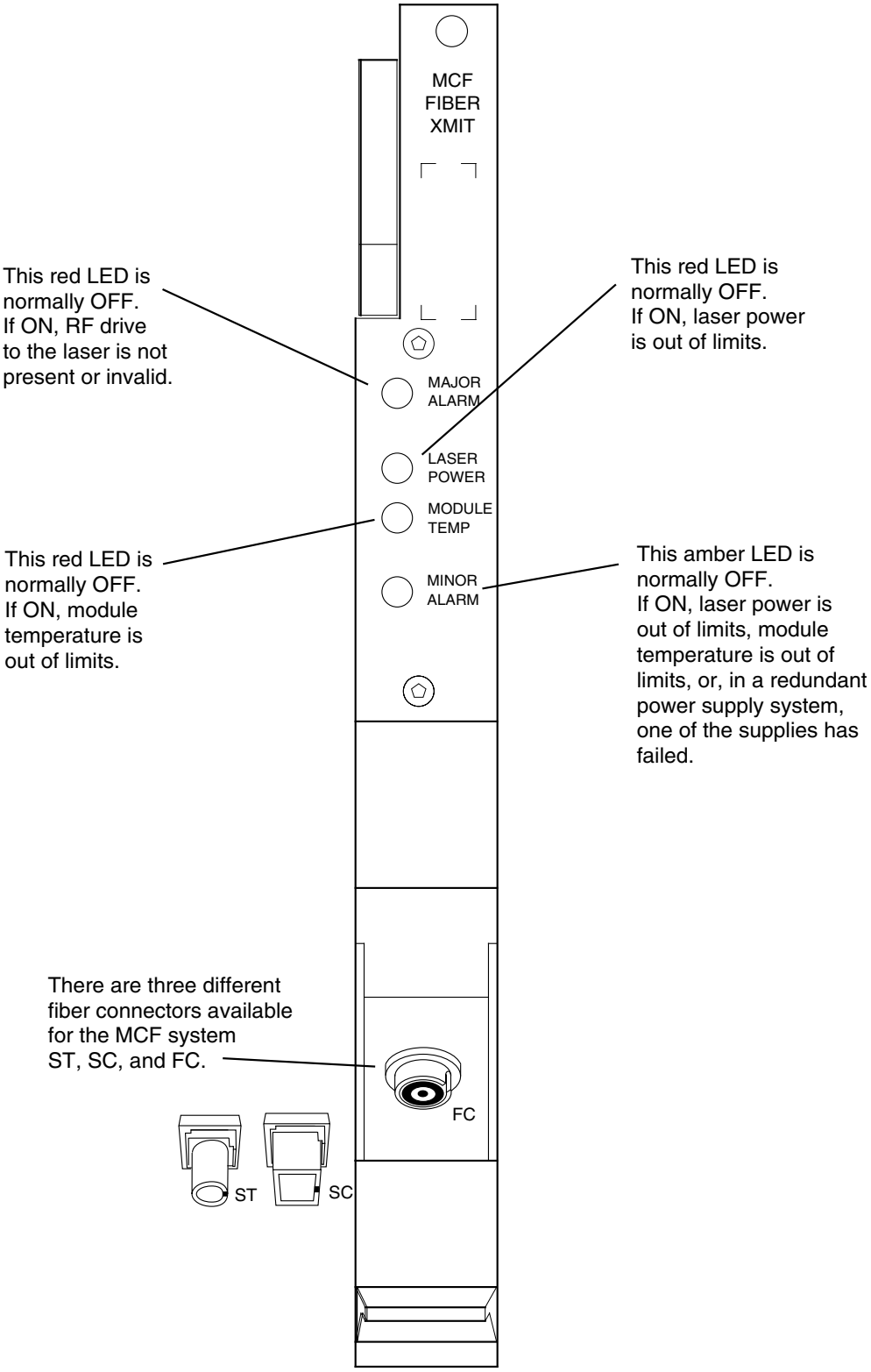


Figure 3-1. Fiber Transmitter Module Controls & Indicators

Fiber Receiver

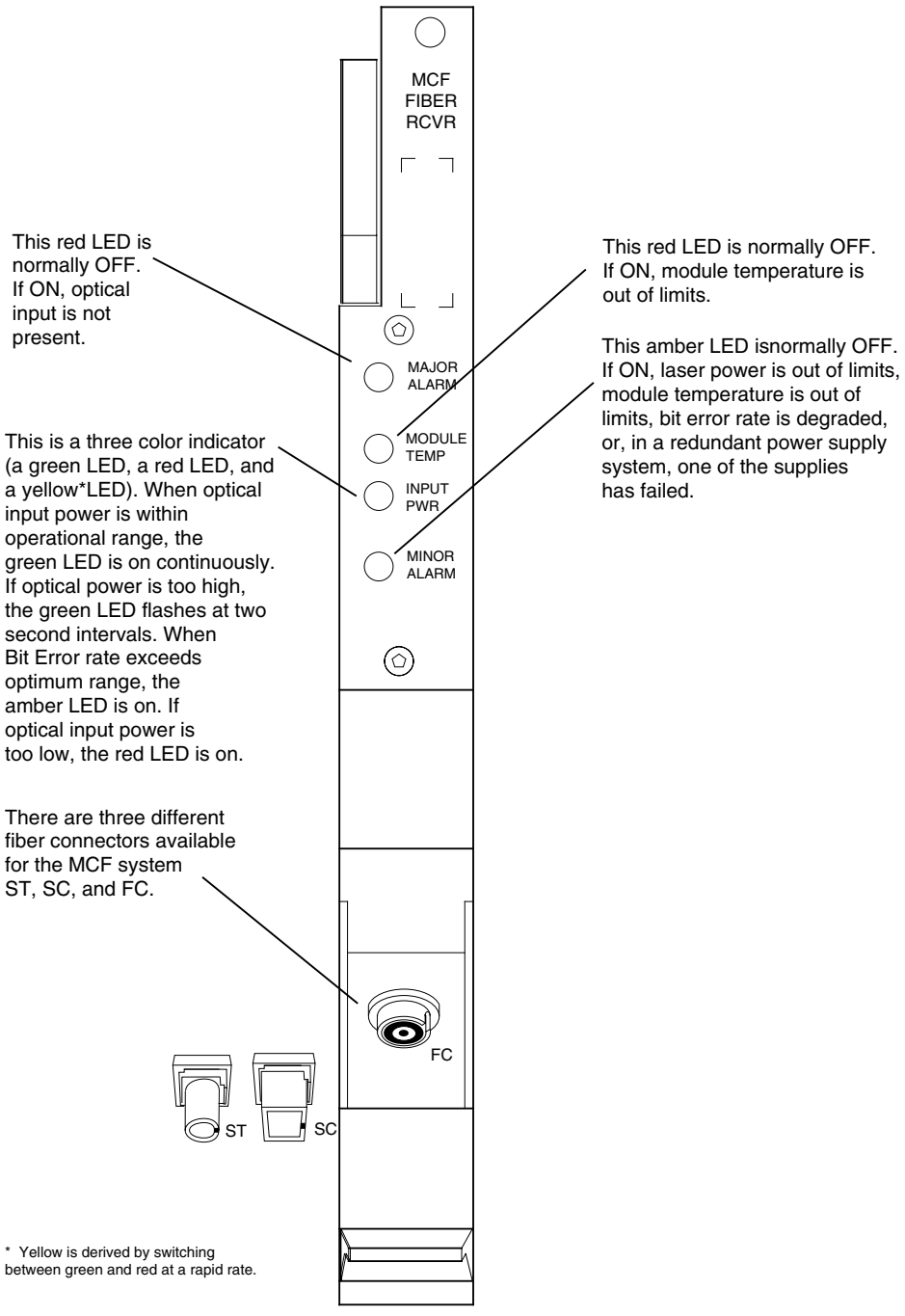


Figure 3-2. Fiber Receiver Module Controls & Indicators

Combined Video/Audio Input

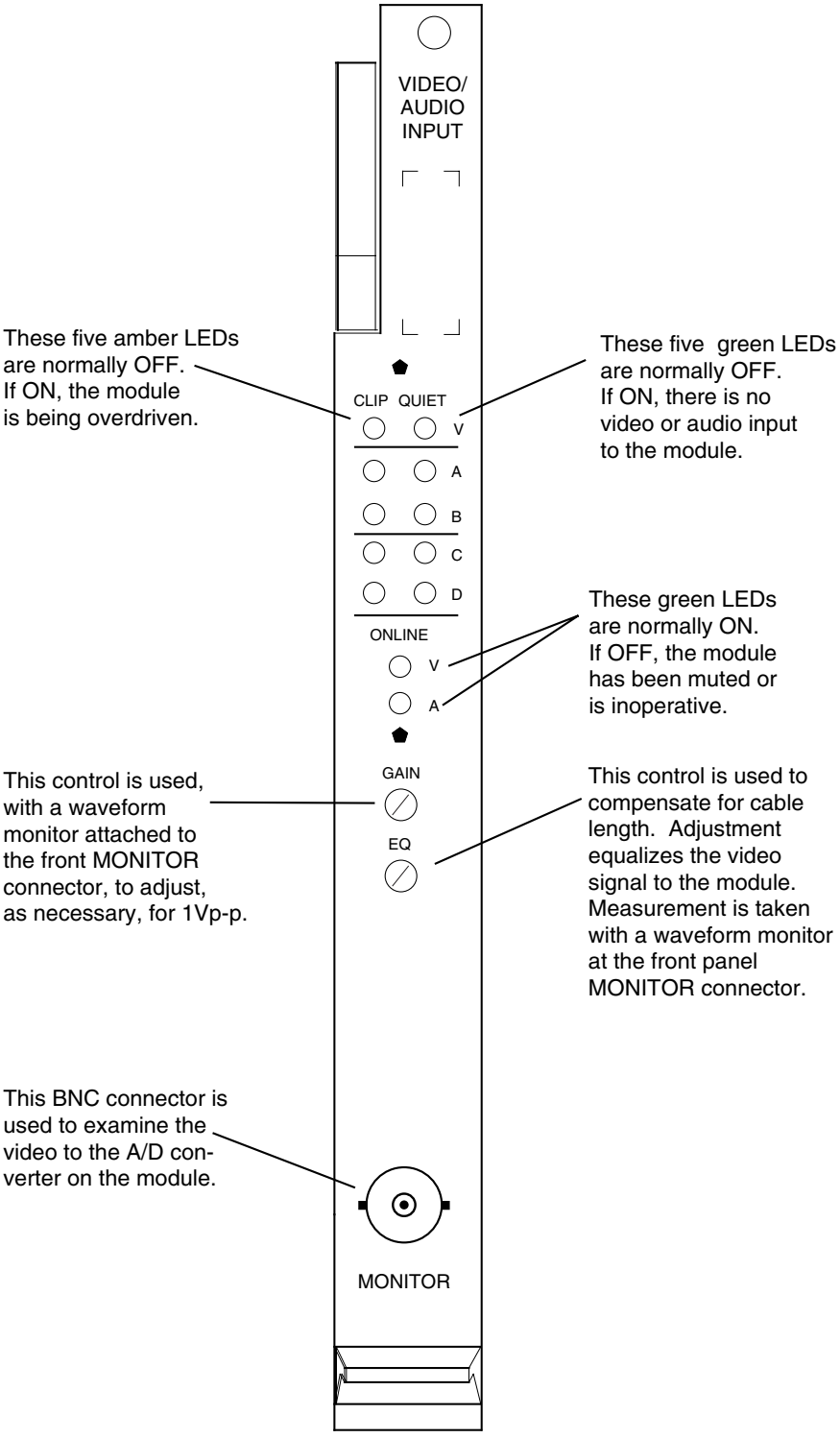


Figure 3-3. Combined Video/Audio Input Module Controls & Indicators

Combined Video/Audio Output

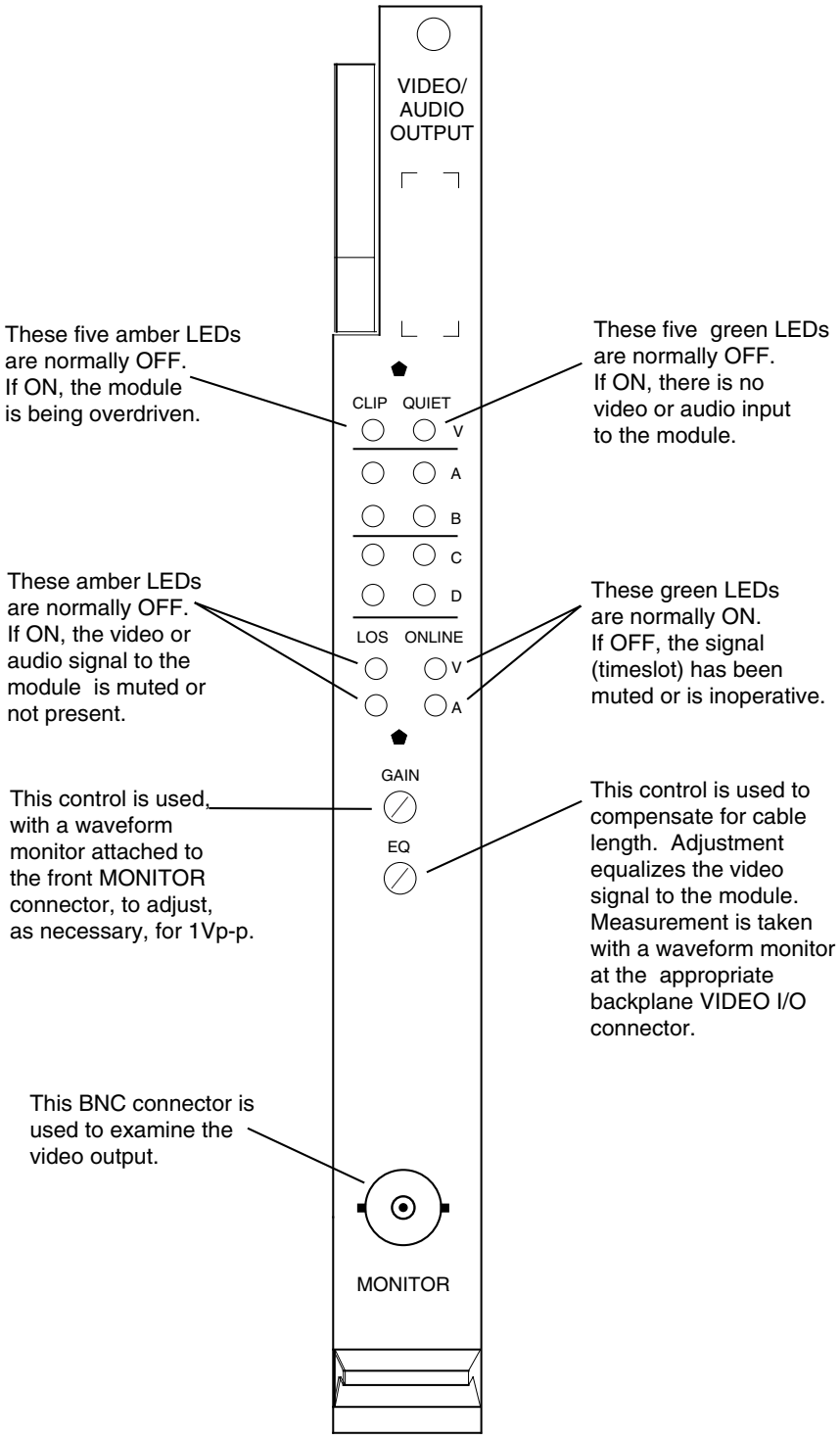


Figure 3-4. Combined Video/Audio Output Module Controls & Indicators

Video Input

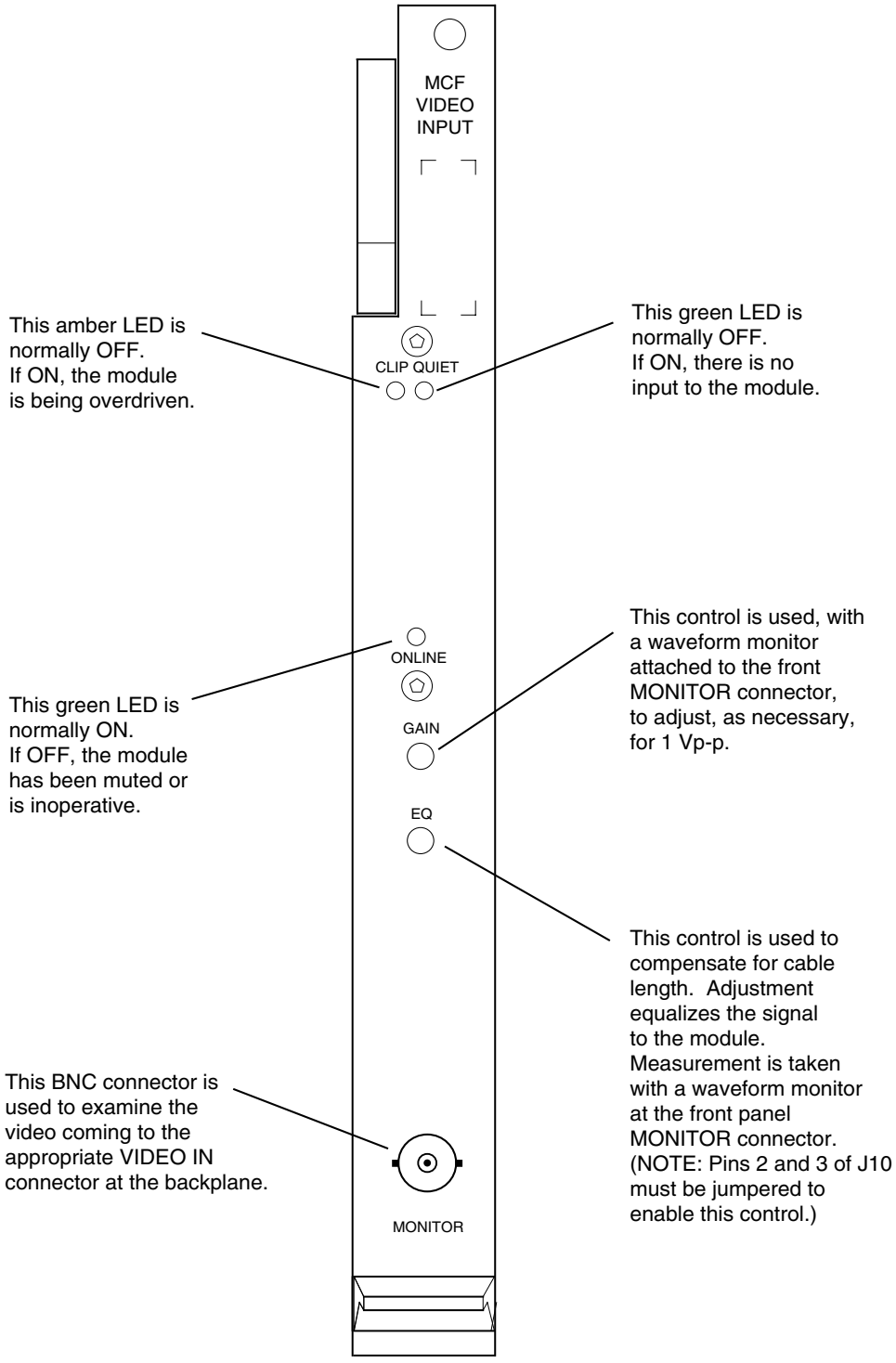


Figure 3-5. Video Input Module Controls & Indicators

Video Output

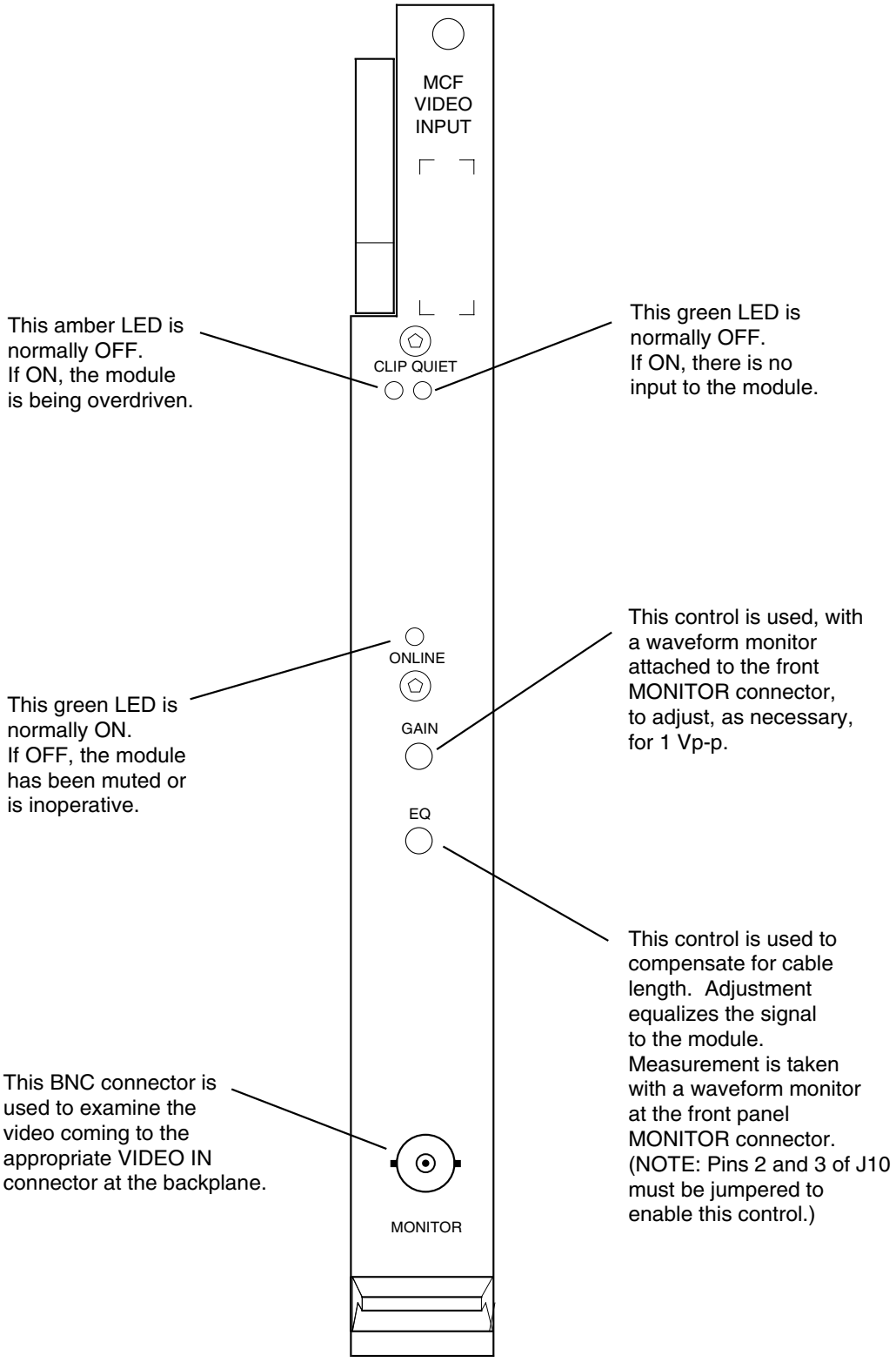


Figure 3-6. Video Output Module Controls & Indicators

Audio Input

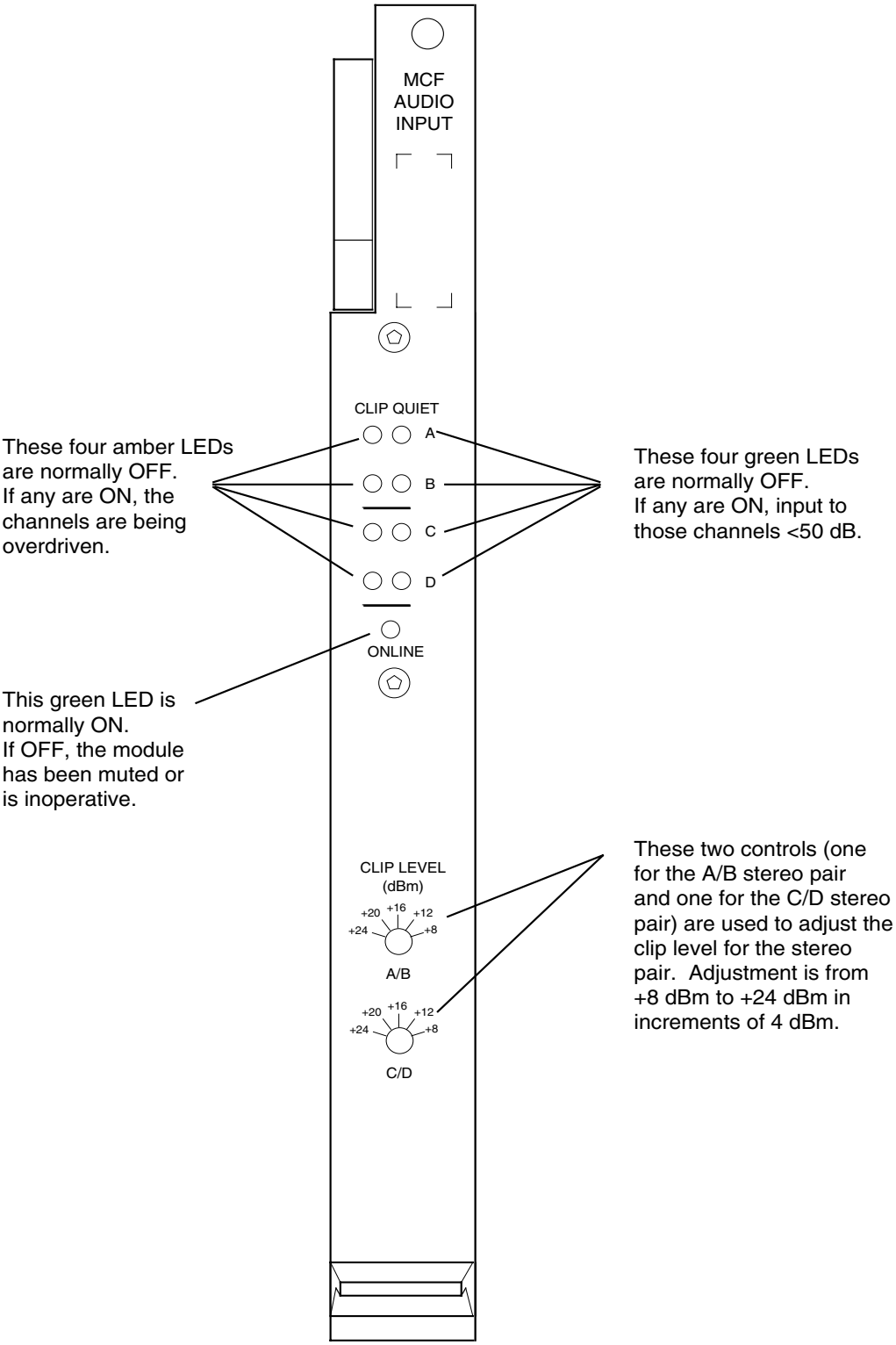


Figure 3-7. Audio Input Module Controls & Indicators

Audio Output

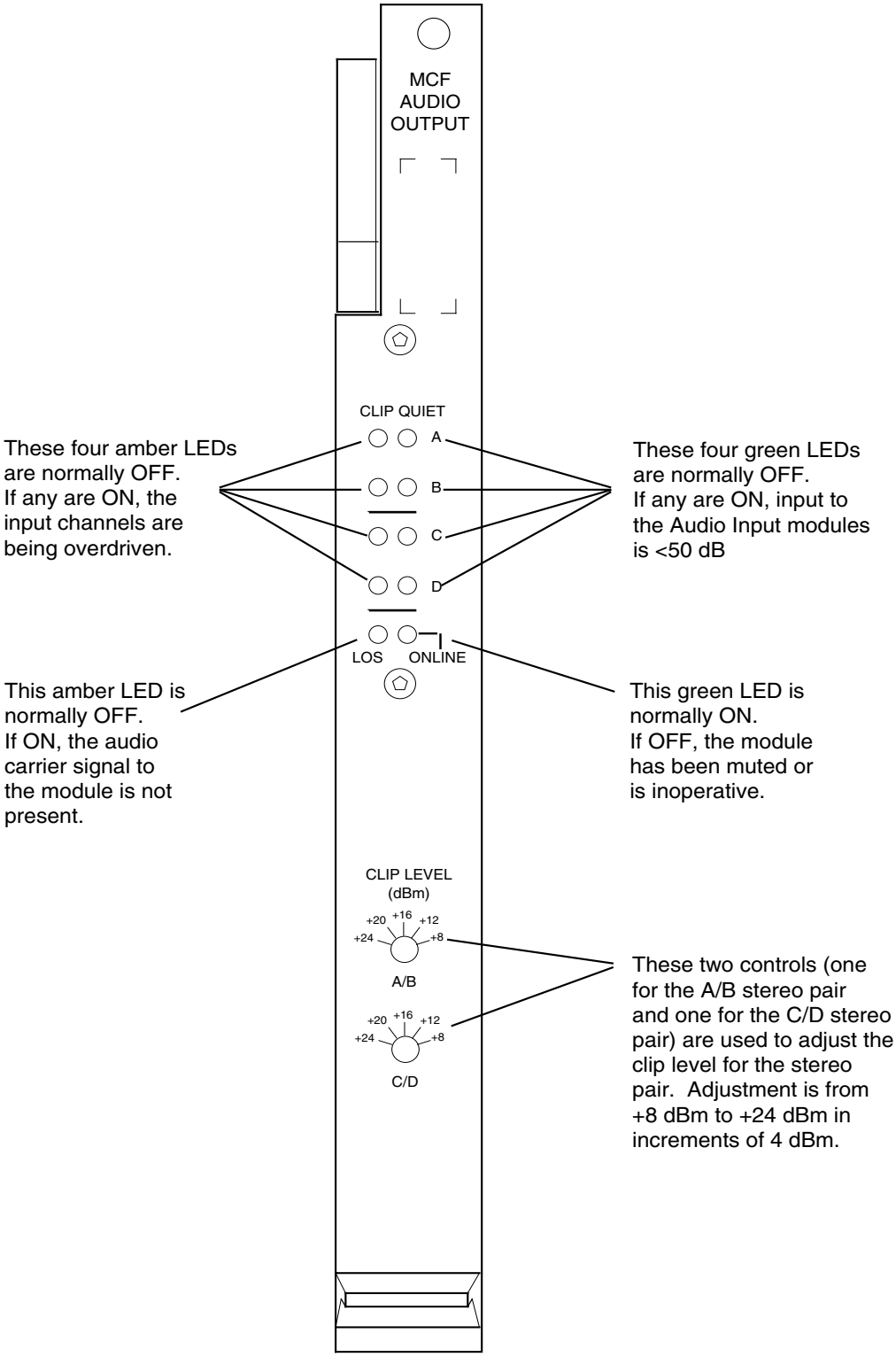


Figure 3-8. Audio Output Module Controls & Indicators

Serial Digital Input

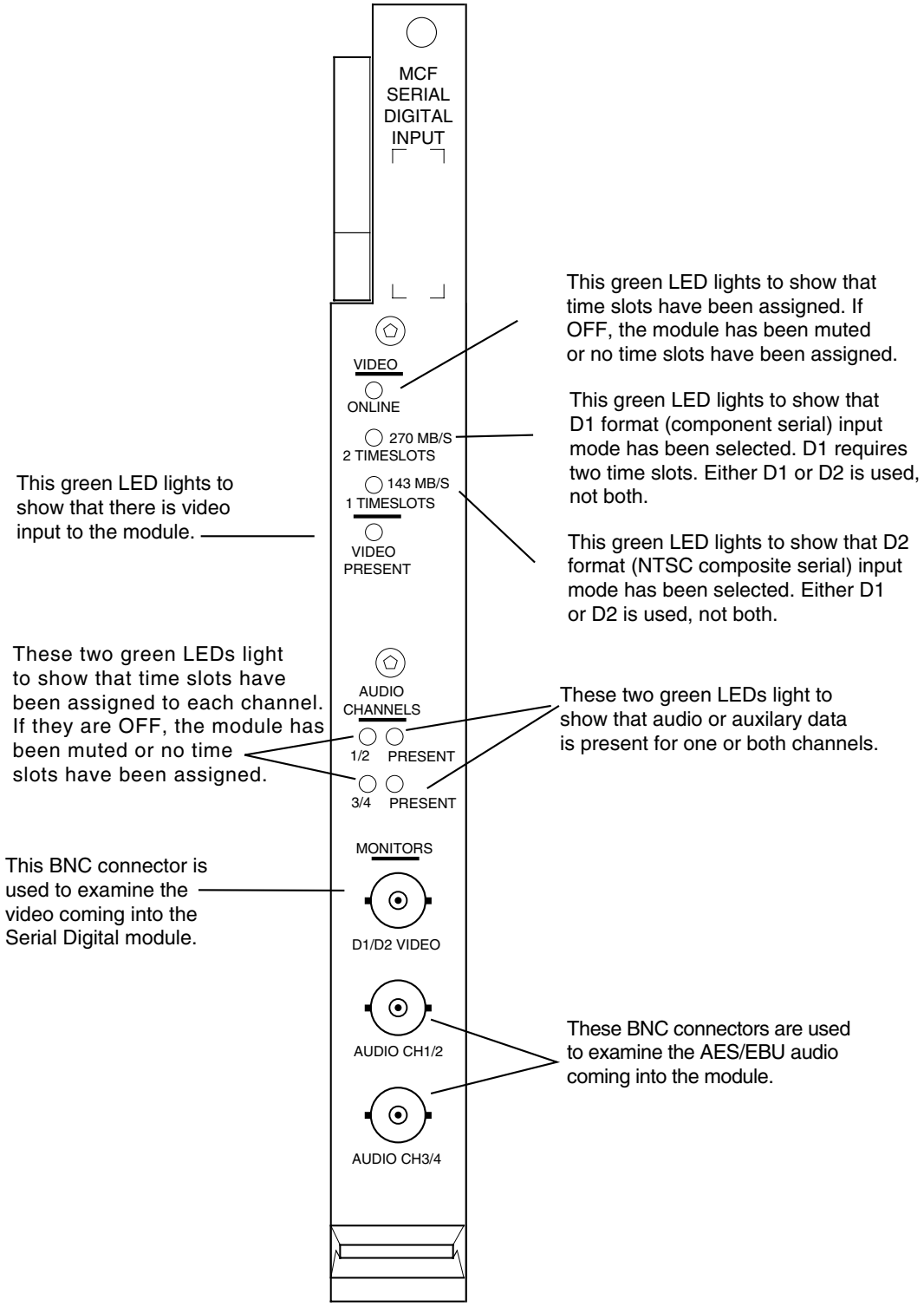


Figure 3-9. Serial Digital Input Module Controls & Indicators

Serial Digital Output

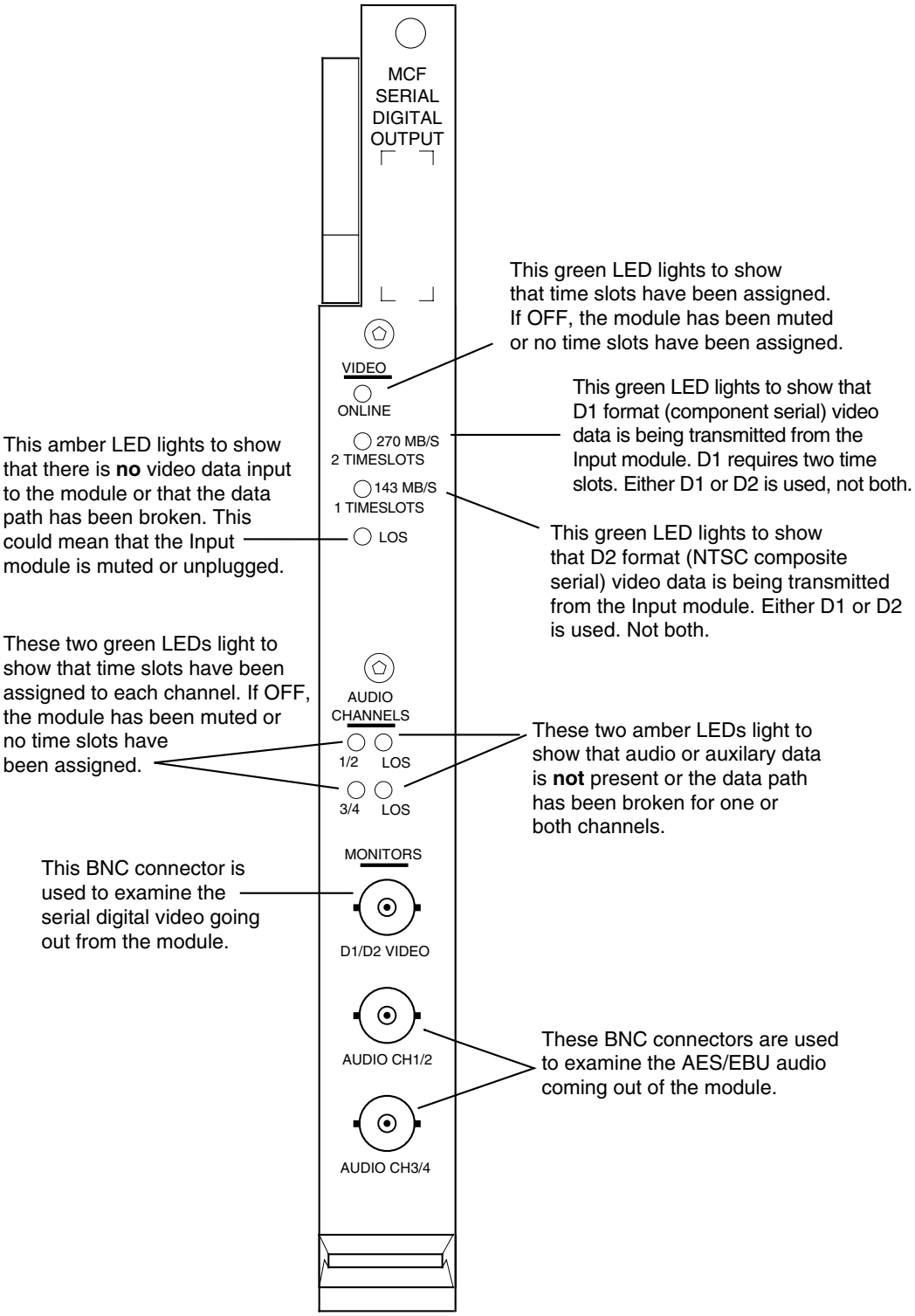


Figure 3-10. Serial Digital Output Module Controls & Indicators

Video/Audio Diplexer Input

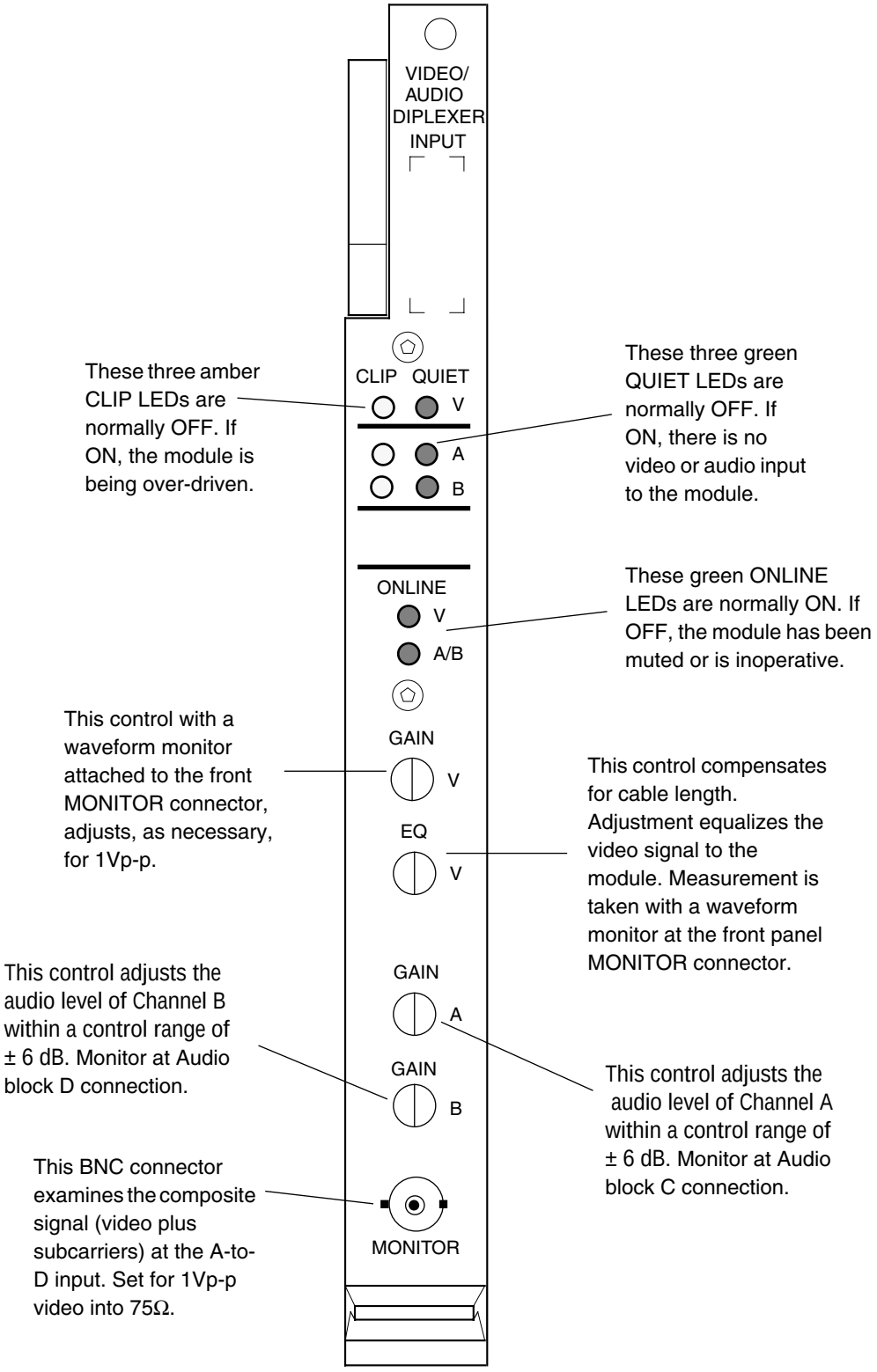


Figure 3-11. Video/Audio Diplexer Input Module Controls & Indicators

Video/Audio Diplexer Output

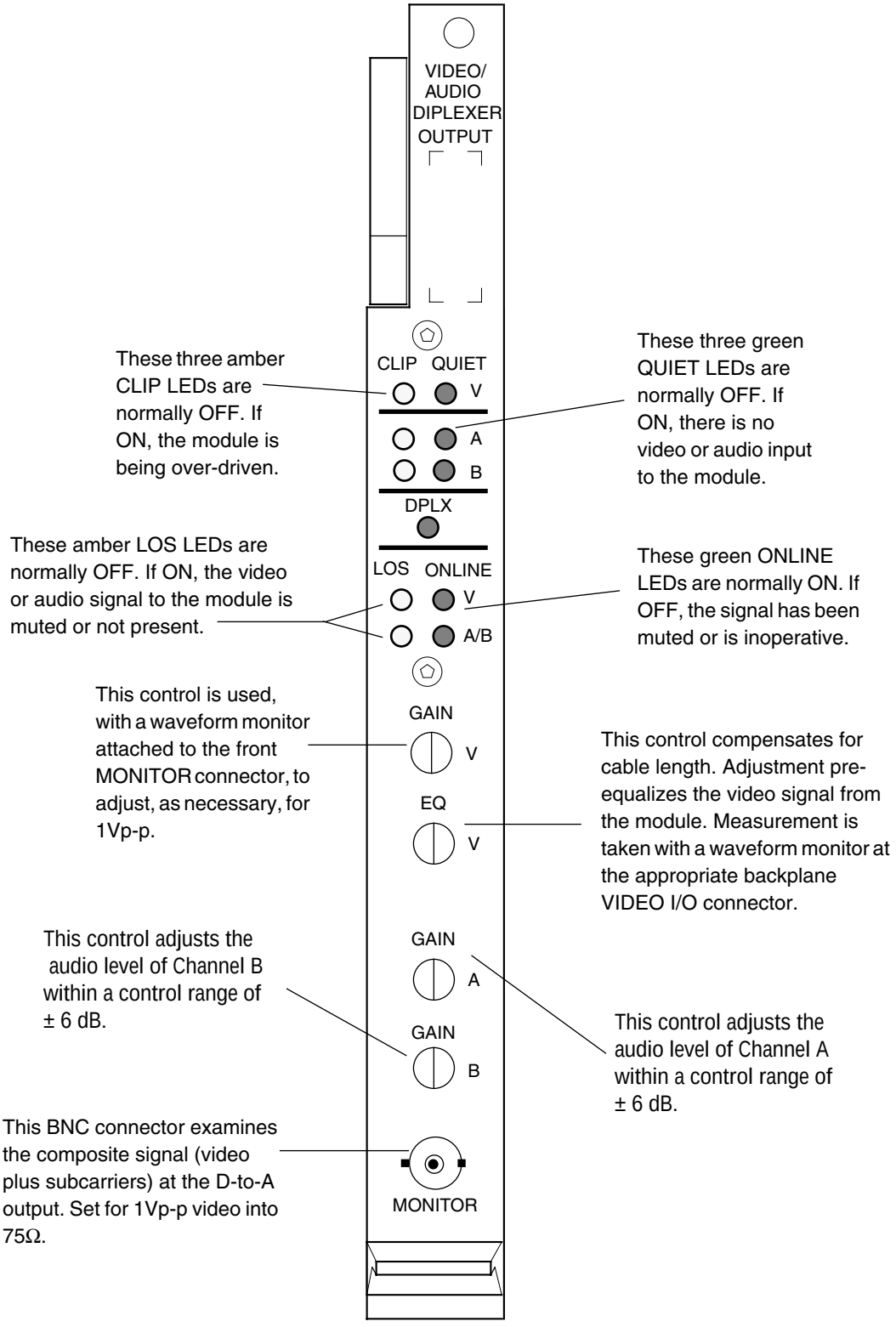


Figure 3-12. Video/Audio Diplexer Output Module Controls & Indicators

Power Supplies

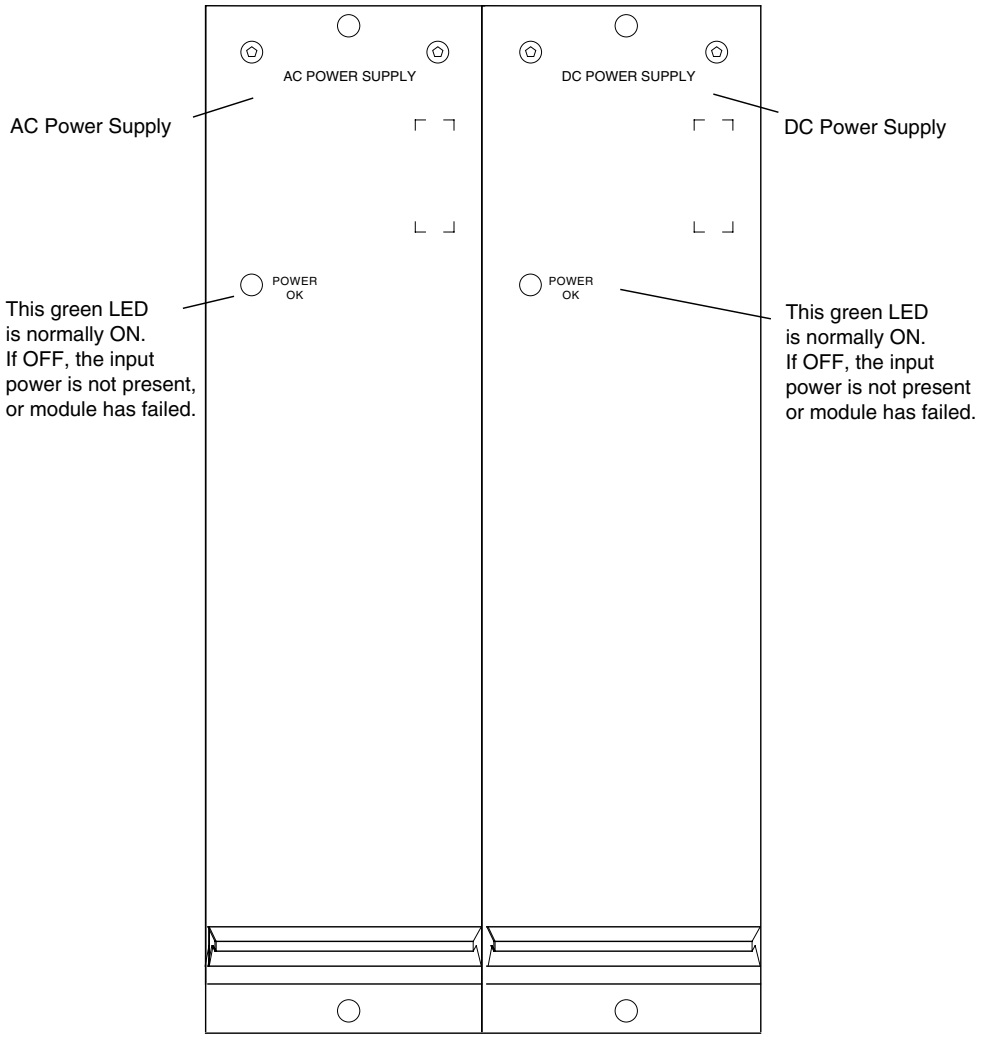


Figure 3-13. Six Rack Unit Frame AC and DC Power Supplies

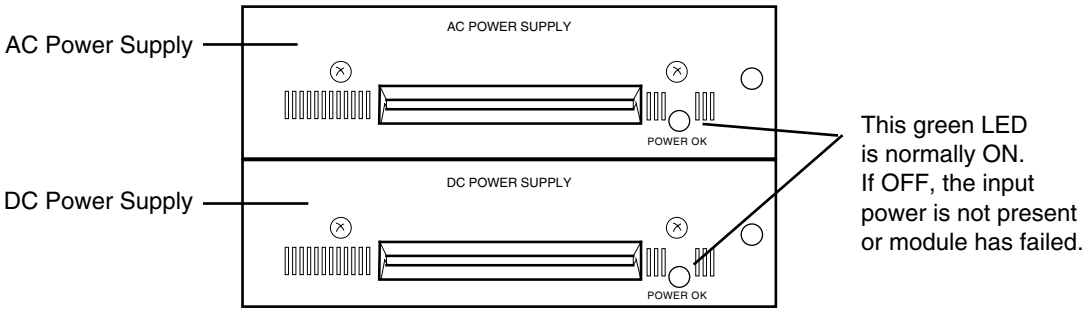


Figure 3-14. Two Rack Unit Frame AC and DC Power Supplies

Section 4

Functional Description

Functional Overview

Figure 4-1 shows a block diagram of the MCF Series System. The Video Input modules sample and digitize the incoming video data. They format the data according to the MCF bus protocol and place it onto the 40-bit MCF bus in their assigned time slots.

The Audio Input modules place their data on the bus in the same manner. All Video and Audio Input modules share the MCF bus using the Time Division Multiplexed method. The Transmitter Fiber module reads all bus data, multiplexes it into a serial stream and transmits it onto the fiber-optic cable.

The MCF Receiver Fiber module receives the data from the fiber-optic cable, extracts clocking information, demultiplexes it, and distributes it onto the MCF bus. The Video and Audio Output modules read data from their assigned time slots and convert it back into the analog domain.

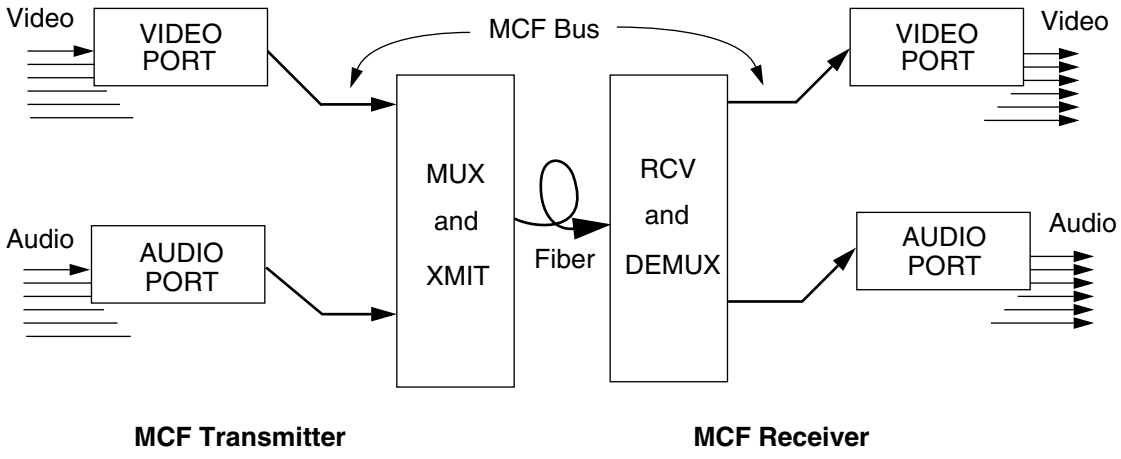


Figure 4-1. MCF System Functional Block Diagram

MCF components include video, audio, and fiber interfaces, packaging, and power supplies. Each Broadcast Quality (10-bit) video channel can have four analog audio channels. The audio information is multiplexed in a synchronous fashion with other audio channels and is mapped into the Time Division Multiplexed (TDM) frame structure, prior to transmission. Note that the TDM frame structure is independent from the video information.

Each system component in the MCF system contains a slave micro-processor that performs diagnostic testing and collect alarm information. All the data gathered is transmitted across the bus to the Fiber module master microprocessor. The master microprocessor is responsible for compiling the information and presenting it to the user, as well as receiving incoming command instructions, processing these commands, and sending instructions to the appropriate slave modules. Therefore, it is called the master microprocessor.

System Protocol Description

The data on the fiber is arranged in units of transmission called frames. The frame is one word (40-bits) wide, 128 words long. Consecutive frames are serialized and transmitted. Figure 4-2 shows the conceptualized composition of a frame.

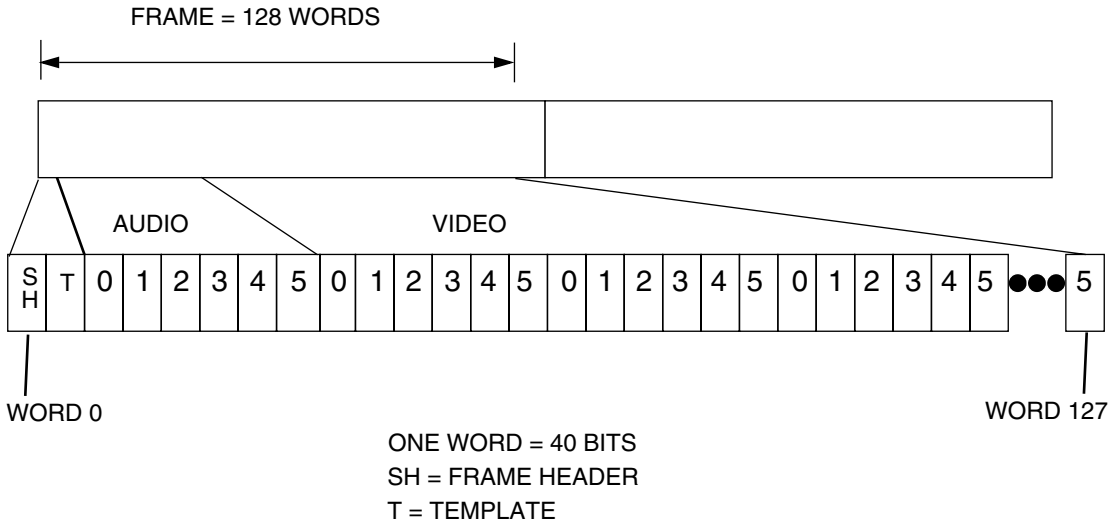


Figure 4-2. Transmission Protocol

Word 0 is the frame header, word 1 is the template, words 2 through 7 are audio words (one from each Audio module), and words 8 through 127 are video words (one from each Video module repeated in a modulo-6 pattern).

The frame header contains a unique bit pattern used by the receiver to synchronize to the incoming bit stream. This synchronization occurs every frame.

The template has the following three functions:

- Flag non-valid STUFF data from the video ports
- Carry the Bit Error Rate information
- Carry in-band control channel

Words 8 through 13 contain video data. They may also contain three samples of video data and one sample of non-valid STUFF data. The STUFF data is used as an elastic buffer to absorb potential clock speed differences between the video modules and the fiber module, thus allowing synchronous system operation.

The receiving system must know when STUFF data is present so the Video modules can disregard it. The template carries six STUFF bits, one from each Video module, that indicate whether or not words 8 through 13 contain STUFF data.

The template also contains one bit for the serial in-band communications channel. This channel can be used to transmit system status and commands to downstream receivers.

Fiber Transmitter Module

The Fiber Transmitter module is the main clock source for the MCF system. This module collects and merges (multiplexes) the data from the Video and Audio modules, then serializes and formats the data. The module interfaces the high-speed data stream with the laser where the data modulates the laser intensity.

Optical interface occurs via the front panel mounted optical connector. The module has the MCF System data collection and control interface to the Craft port and the Administration port. Figure 4-3 identifies the major functional areas of the Fiber Transmitter. The functional blocks are:

- Timing Generator
- Multiplexer and Serializer
- Repeater Function
- Microcontroller
- Monitor A to D
- Bus Interface Logic
- Laser Driver
- Laser Temperature Control Loop
- Control Port Interface
- Video Sample Oscillator

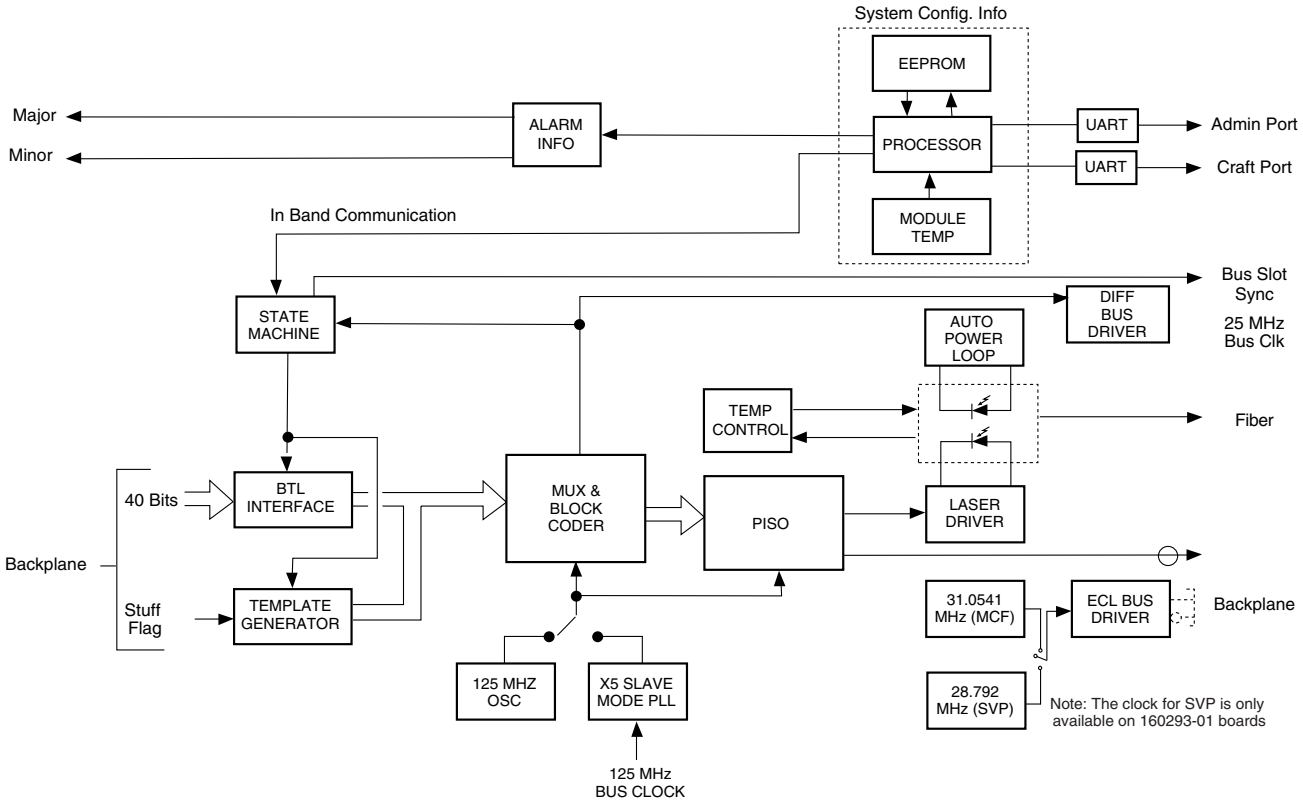


Figure 4-3. Fiber Transmitter Module Block Diagram

Timing Generator

The timing generator consists of the 125 MHz temperature compensated crystal oscillator, a divide-by-5 circuit in the multiplexer IC, a differential positive emitter coupled logic (PECL) clock interface to drive the MCF backplane, and a slot sync generator which synchronizes the gating of data onto the backplane bus. Other timing signals provided include the video sample rate clock. These clock signals are differential PECL which drive the MCF backplane bus.

Bus Interface Logic

Bus interface logic consists of the 40-bit-wide Futurebus line receivers, bus control signal interface, and bus slave data interface.

Multiplexer and Serializer

The transmit half of the Fiber interface chip set is the multiplexer and serializer. Its purpose is to accept data on a 40-bit wide bus, route it (one byte at a time) to the 8/10 block code substitution, and gate the 10-bit block codes to the serializer IC. The serializer accepts the 10-bit block code and generates a 10x clock signal. This 10x clock serializes the block code data. The high-speed serial data rate is 1.2 Gb/second.

Laser Driver

The laser driver encompasses the laser drive control and the automatic laser bias control loop. Its purpose is to maintain the average laser output power over fluctuations in temperature and device aging. To maintain a constant extinction ratio and to avoid generating even-order distortion terms, the laser drive must track the changes in DC bias.

Repeater Function

Data and system timing are sourced by a Fiber Receiver module which is plugged into the same MCF frame. The Transmitter module provides the interface for Craft and Administration port connections in repeater mode.

Laser Temperature Control Loop

A control loop maintains the laser die at a constant temperature. This is desirable because the laser threshold current is temperature sensitive and the laser lifetime is related to the operating current. The laser incorporates an internal thermoelectric heater/cooler and a thermistor mounted to the

laser die. The thermoelectric cooler is a dual mode device that can either heat or cool the laser die depending upon the direction of current flow through it. Early-generation fiber modules use it only in a cooling mode. The latest-production units use it for both heating and cooling. The cooling power source is obtained from the +5 Volt rail. The laser package is heat sinked to the Fiber Transmitter module front panel.

Microcontroller

The microcontroller monitors housekeeping functions for the MCF system and controls drop and insert system functions. Some of the parameters monitored are power supply status, primary and secondary alarm inputs, module presence sensing, and module time slot assignment.

Communication Port Interfaces

The Administration port and Craft port are the communication mechanisms to the microcontroller and the MCF System. The craft port is RS-232 compatible up to 19.2 kilobaud. The administration port is RS-485 or RS-232 also compatible up to 19.2 kilobaud. Both ports are buffered from the microcontroller with a UART. The UART for the Administration port is internal in the microprocessor. There are 2 DIP switches associated with the microcontroller and craft ports UART. The function of one DIP switch is to select the Craft port baud rate and parity. The second DIP switch sets the chassis ID number. Commands addressed to a chassis other than the current Transmit chassis are forwarded, via the In-Band data link, to the next chassis in line.

Monitor A to D

The laser module currents and backplane power supply voltages are digitized and the values made available through the Craft and Admin ports.

Video Sample Oscillator

The video sample oscillator generates the master sampling clock for all video input cards in a frame. This clock is distributed as a distributed PECL signal. The later generation fiber transceiver (Part number 160293-01) has two selectable rates 31.054 (for MCF), or 28.792 MHz (for SVP.)

Fiber Receiver Module

The Fiber Receiver module is the main timing source for the MCF Series Receiving System. The module receives optical energy via the front panel mounted fiber connector. Figure 4-4 identifies the major functional areas of the Fiber Receiver module. The functional blocks are:

- Optical Preamplifier
- Data Low Pass Filter
- Timing Generator
- Microcontroller
- Gain Block
- Deserializer and Demultiplexer
- Bus Interface Logic
- Control Port Interface

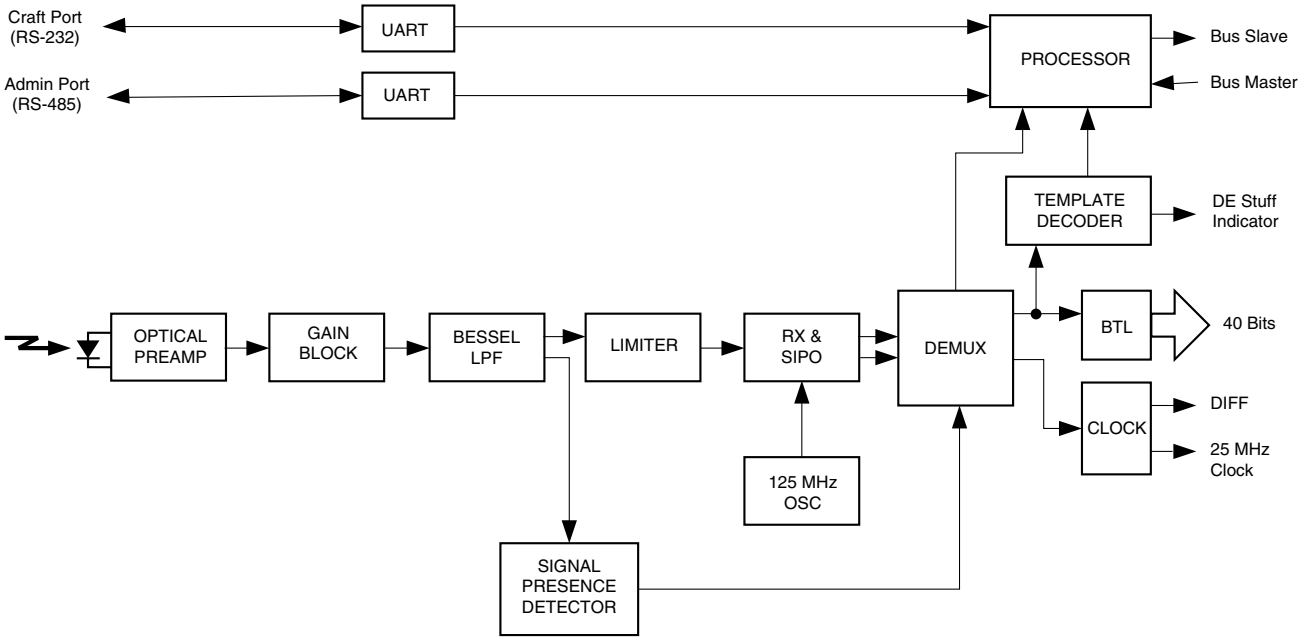


Figure 4-4. Fiber Receiver Module Block Diagram

Optical Preamplifier

The detector/optical preamplifier is a hybrid assembly supplied with a fiber pigtail. The preamplifier is a monolithic gallium arsenide (GaAs) device which performs the low noise, transimpedance process. The amplifier converts the detector's photogenerated current into a low impedance signal voltage. The preamplifier has an internal AGC (automatic gain control) function to limit the dynamic range of the output signal voltage.

Gain Block

The gain block is a commercial monolithic microwave integrated circuit (MMIC).

Data Low Pass Filter

The filter removes the out-of-band spurious products and excess thermal noise. The filter's group delay flatness performance is as important as its passband/stopband amplitude performance.

Deserializer and Demultiplexer

The second half of the chip set accepts the 1.2 Gbit data stream, extracts and regenerates clock information, and performs a 10b/8b block code substitution. It also detects and extracts synchronization information and outputs data in 40-bit-wide words.

The deserializer accepts an external fixed-frequency reference of 125 MHz to help in the regeneration of the incoming clock and data. If an error is detected during the 10b/8b decoding, an interrupt notifies the receiver. This interrupt indicates errors by detecting data encoding violations.

Timing Generator

The timing generator consists of the 125 MHz temperature compensated crystal oscillator, a x10 frequency multiplier and phase locked loop (PLL), and a data clock extractor. Also included is a divide-by-5 circuit in the demultiplexer IC, a differential PECL clock interface to drive the MCF backplane, and a slot sync generator which synchronizes the gating of data onto the backplane bus. These clock signals are differential PECL and are provided on the MCF backplane bus.

Bus Interface Logic

This consists of the 40-bit-wide Futurebus line transmitters and receivers. The bus control signal interface and bus slave data interface are controlled by a PGA-state machine.

Microcontroller

The microcontroller monitors housekeeping functions for the MCF System and controls drop and insert system functions. Some of the parameters monitored are power supply status, primary and secondary alarm inputs, module presence sensing, module time slot assignment, loss of optical power, and data synchronizing problems.

Communication Port Interfaces

The Administration and Craft ports are the communication mechanisms to the microcontroller and the MCF System. The Craft port is RS-232 compatible up to 19.2 kilobaud. The Administration port is RS-485 or RS-232 compatible up to 19.2 kilobaud. Each port is buffered from the microcontroller with a UART (serial data/control interface hardware).

Combined Video/Audio Input Module

Figure 4-5 identifies the major functional areas of the Video/Audio Input module. The Video and Audio Input functional blocks are:

- Input Circuitry
- Analog-to-Digital Converter
- FIFO and FIFO Loader
- Microcontroller (PIC16C57)
- Video Test Ramp Generator
- Digital (H/B) Filter
- Bus Interface Logic

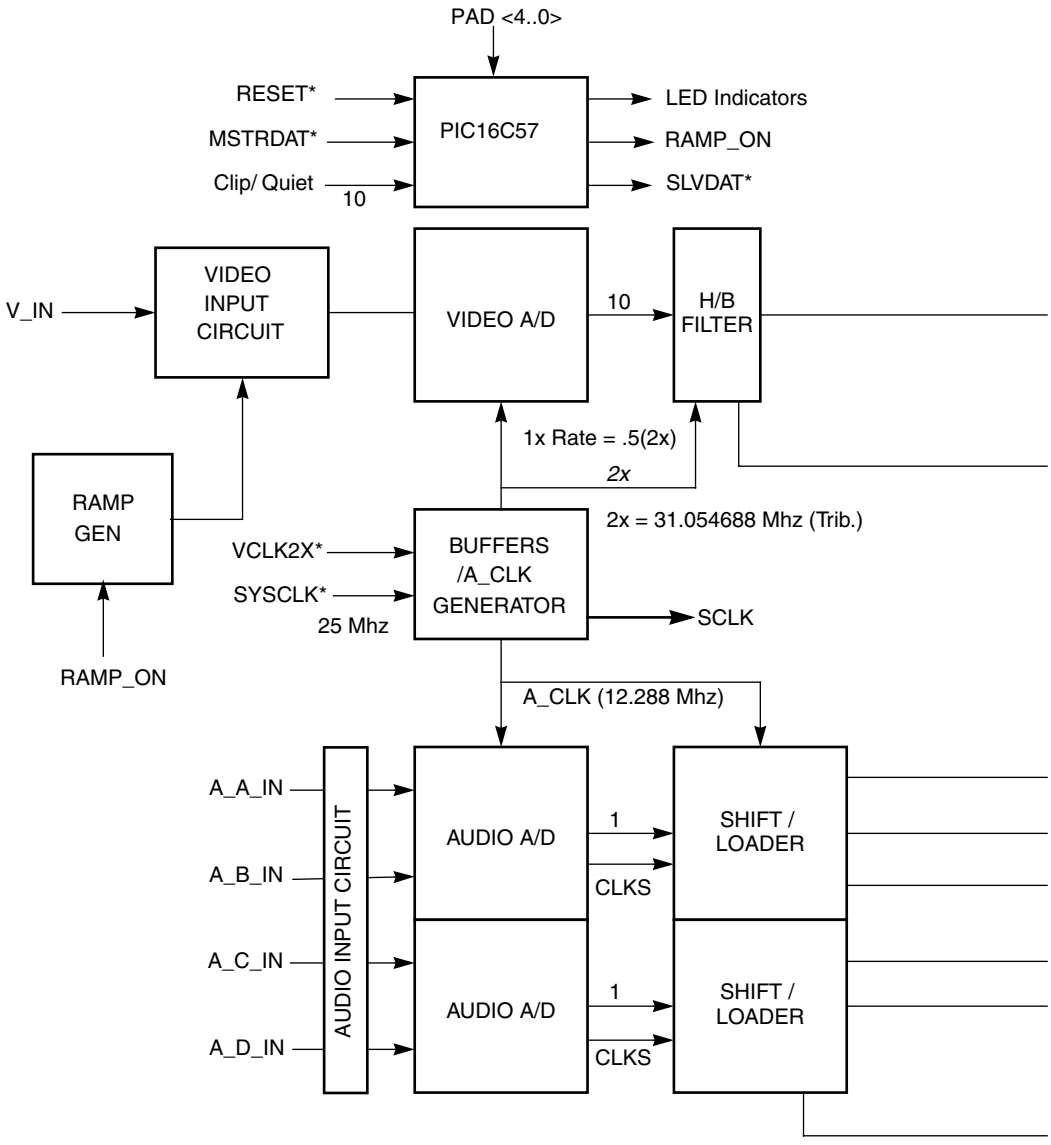
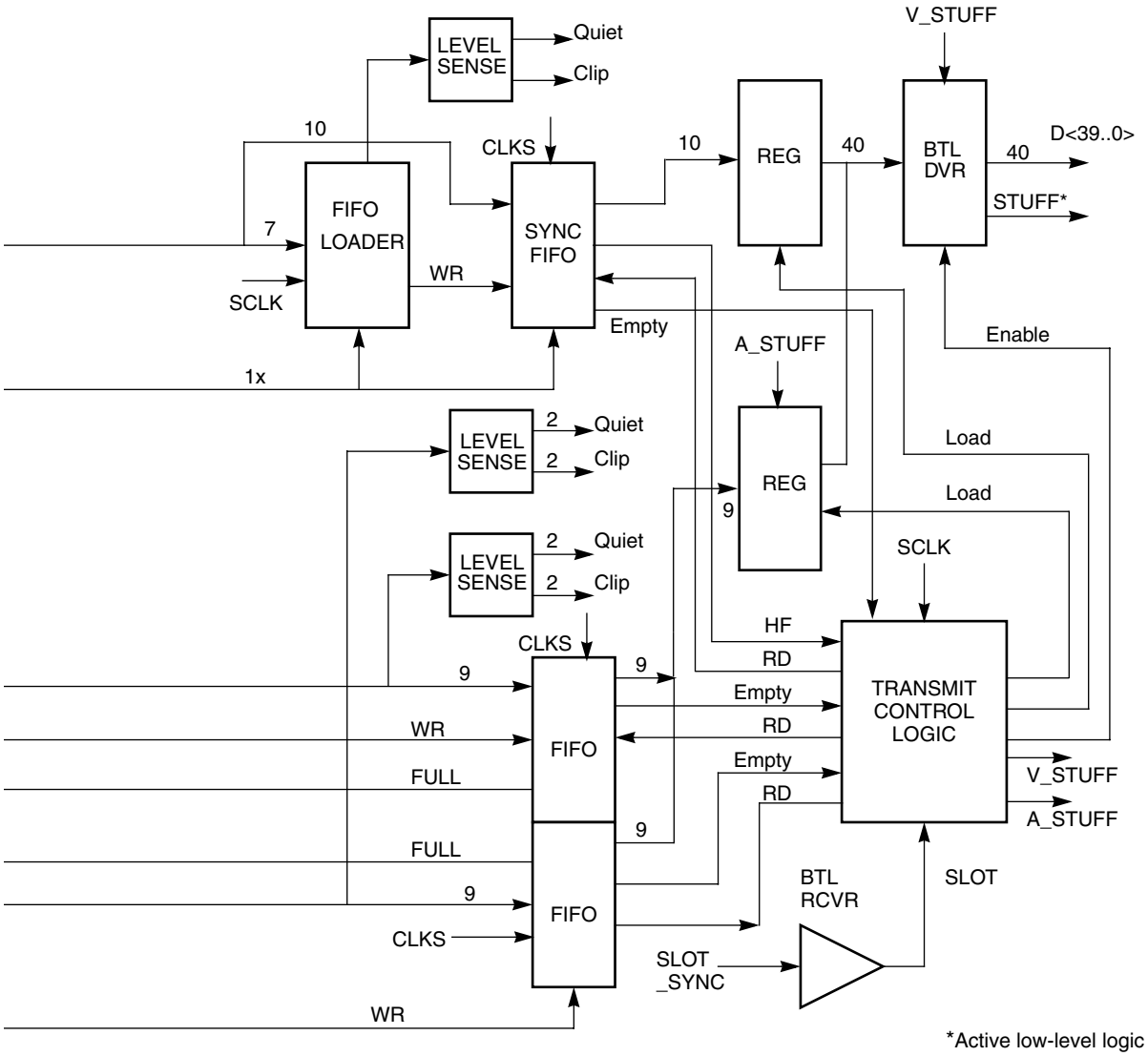


Figure 4-5. Combined Video/Audio Input Module Block Diagram


LEVEL SENSE
Quiet
Clip
V_STUFF
10
CLKS
10
REG
40
BTL DVR
40
D<39..0>
STUFF*
FIFO LOADER
7
SYNC FIFO
WR
SCLK
Empty
Enable
A_STUFF
1x
LEVEL SENSE
2
Quiet
2
Clip
Load
REG
9
Load
SCLK
LEVEL SENSE
2
Quiet
2
Clip
HF
CLKS
RD
9
9
Empty
TRANSMIT CONTROL LOGIC
WR
FIFO
RD
Empty
FULL
RD
V_STUFF
A_STUFF
9
FULL
BTL RCVR
SLOT
9
FIFO
CLKS
SLOT _SYNC
WR
*Active low-level logic

Video Input Circuit

An input circuit provides jumper-selectable termination and common mode rejection for a 75 Ohm unbalanced video input. An A/D driver is an amplifier with a user-controlled gain setting that allows the video signal to be adjusted to a 1 volt peak-to-peak level.

A Tektronix-designed cable equalizer hybrid follows the amplifier and compensates the video signal for the cable type and length used by the customer. The specific hybrid used is based upon customer ordering information.

A low pass filter is used for antialiasing with the goal of limiting rolloff to ± 0.1db within the 6MHz frequency range. On early-generation boards, a a slow feedback DC restorer adjusts the DC offset so that the video signal is centered within the desired A/D range. On later boards, (part number 160294-01) a sampled video clamp is provided.

DC restoration/clamping can be selected or deselected via a jumper to ease testability (and to accommodate non-video signals). At this point the video baseband signal is brought out to a 75 Ohm BNC monitor output on the front panel.

Video Test Ramp Generator

When a loss-of-video condition is detected, the microcontroller enables a 15.75 kHz sawtooth ramp generator which is connected to the input circuit. This signal provides a visual indication of link integrity, but is not usable for proof-of-performance measurements. The microcontroller gates the ramp on and off at approximately a 0.5 Hz rate. During the off interval the microcontroller checks for normal video input.

Video Analog-to-Digital Converter

A 10-bit A/D converter, using a 31.054 MHz sample clock for MCF applications converts the video from analog to 10-bit parallel data. The video is sampled asynchronously, using a clock provided by the MCF Transmitter through the backplane. This allows the same video PCB to transport analog video regardless of format.

Video Digital Filter

The Tektronix Half Band (H/B) filter is used for divide-by-two decimation of the digital video signal. In MCF applications this allows us to pass video with two diplexed audio signals. As noted in the TV1 specification, the signal bandwidth of this diplexed signal is 6.4 MHz, plus or minus a 185

kHz deviation. This gives a maximum signal frequency of 6.585 MHz, within the flat response range of the MCF Video/Audio In card video channel.

Video FIFO Loader

A FIFO loader function is implemented in an EPLD (erasable, programmable logic device). Its function is to generate the proper strobes for loading the A/D output samples into a FIFO. The FIFOs used are 18 bits wide; therefore, one FIFO is necessary to accommodate the 10-bit data stream.

Video FIFO

The FIFO holds samples of video data until they are ready to be moved to the MCF system bus. It also separates the video sample clock from the system clock.

Video Bus Interface

The bus interface is implemented in another EPLD. Three functions are required for this part: a load enable to load a set of registers from the FIFOs, a V_STUFF indication, and a bus enable to write data onto the bus.

The FIFOs contain the data to be transmitted in the appropriate time slot. This data is transferred from the FIFOs to a set of flip-flops for transfer to the bus drivers. The intermediate set of flip-flops provides a convenient point to view the data for testing purposes before it is written to the bus.

The system allows for STUFF data to match the data rate to the channel rate. The bus interface circuitry generates a V_STUFF indicator if it detects a FIFO underflow. In this case a STUFF sample is inserted into the appropriate register and a STUFF signal is asserted on the backplane.

The bus interface also generates a bus enable signal at the correct time. This signal is generated from the SLOT_SYNC signal based on the slot assignment of the module. In this system the video channel time slot is every sixth bus cycle, therefore this counter is a modulo six counter. An on-module jumper (6/12 Slot Select) allows the user to scale the system (MCF) for either 6 (current MCF) or 12 (future product) usable time slots.

Microcontroller

A local microcontroller performs card initialization, samples and reports bus address, slot assignment, audio gain switch settings, on-line, and clip/quiet conditions. A processor clock is generated by dividing the system clock by eight (8). This function is also located in the bus interface EPLD.

Audio Input Circuit

A differential input circuit terminates the line into 150 Ohm, 600 Ohm, or 30 K Ohm, and a differential line receiver provides common mode rejection of 60 Hz and other common mode signals impressed upon the twisted shielded input line, attenuates the signals by 6 dB and references them to local analog ground.

A selectable (via DIP switch) gain stage scales the input to allow user control of the headroom over nominal operating level (input level vs. clip level).

The DIP switch sets the clip level gain of the input audio for each stereo channel. There are four settings per stereo channel.

Audio A/D Converter

An 18-bit analog-to-digital converter digitizes the analog input at a 48 kHz rate when given a 12.288 MHz clock. One of the A/Ds is configured as a master, meaning that it is the source of the module timing. The other A/D is configured as a slave device taking its timing from the master.

Audio FIFO Loader

A FIFO loader function is implemented in an EPLD. Its function is to organize the serial bitstream from the A/D as bytes of parallel data and generate the proper strobes for loading these bytes into a FIFO.

Audio FIFO

The FIFO holds bytes of audio data until they are ready to be moved to the MCF data bus. It also separates the audio sample clock from the system clock.

Audio Bus Interface

Bus interface logic is implemented in an EPLD. Two functions are included—a timeslot access counter and a FIFO unloader. The time slot access counter is referenced to SLOT_SYNC and generates an MCF bus enable at the time slot requested by the local controller processor. The FIFO unloader function fills the bus interface registers from the data FIFOs. The FIFO unloader function runs after the assigned slot has passed, and if unable to fill the registers due to a FIFO underflow, indicates this condition by asserting an A_STUFF flag.

Combined Video/Audio Output Module

Figure 4-6 identifies the major functional areas of the Video/Audio Output module. The Video/Audio Output functional blocks are:

- Output Bus Interface Logic
- Digital Filter (Half Band FIlter)
- Output Circuitry
- FIFO and FIFO Unloader
- Digital-to-Analog Converter
- Microcontroller (PIC16C57)

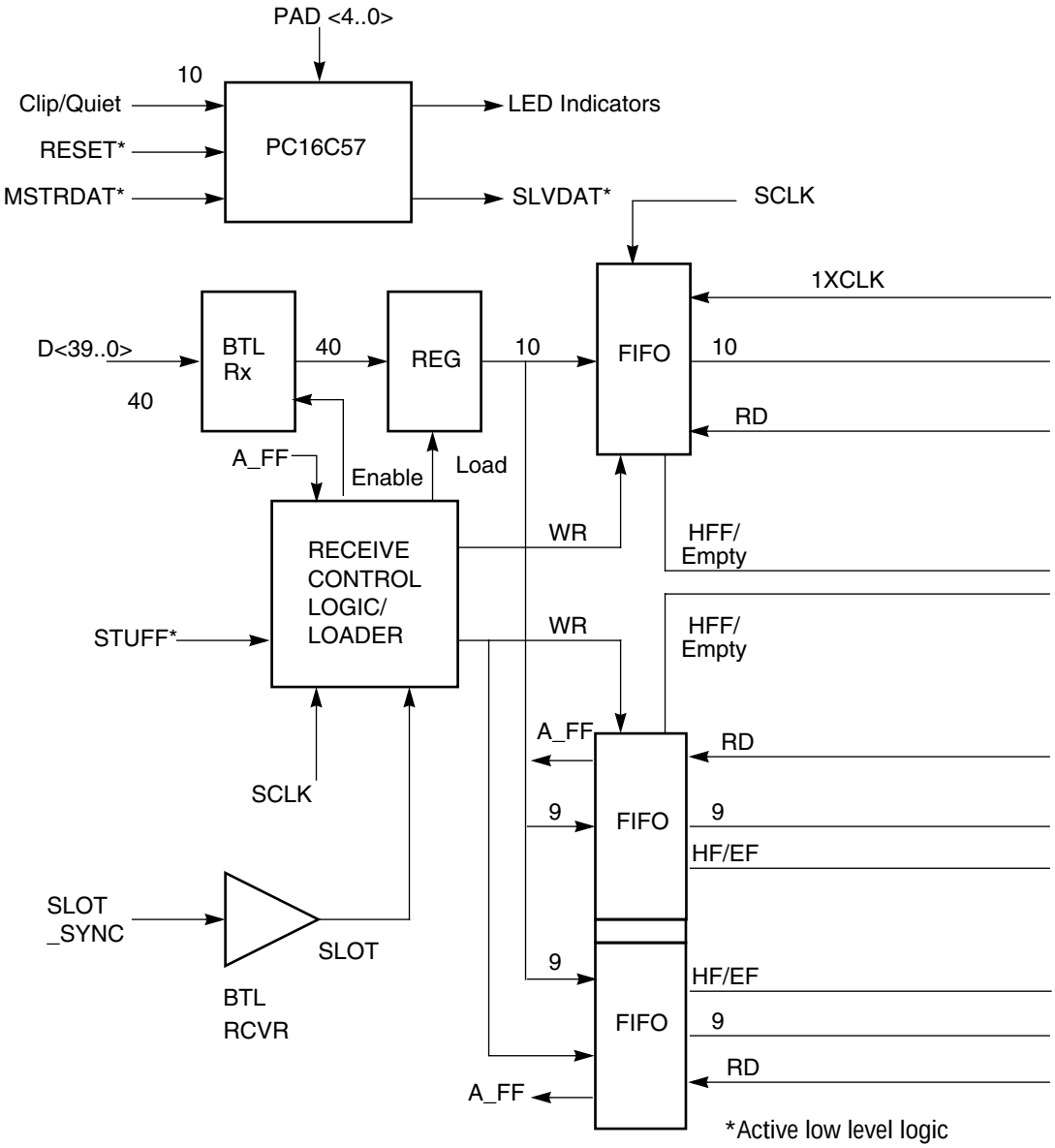
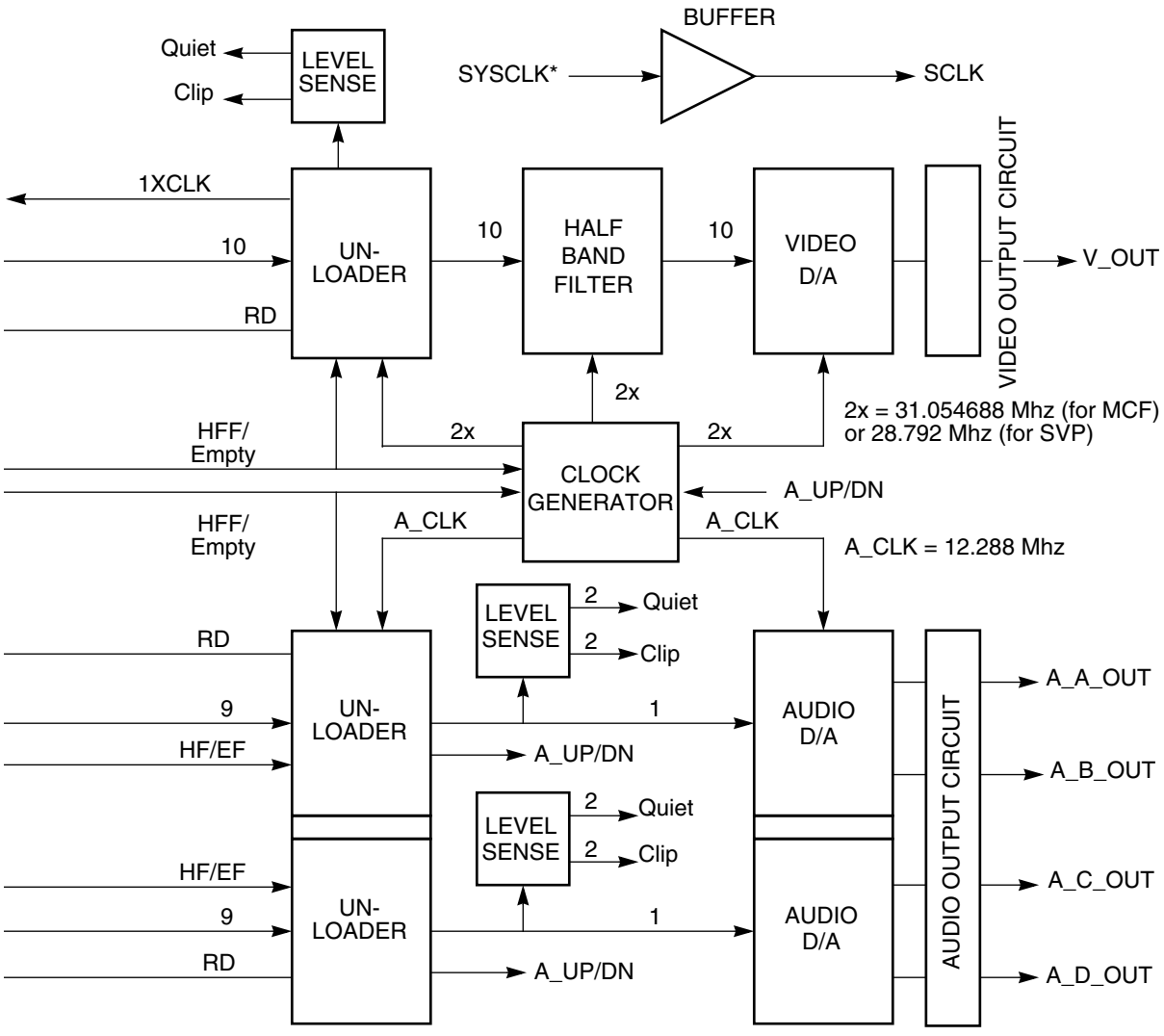


Figure 4-6. Combined Video/Audio Output Module Block Diagram


BUFFER
Quiet
Clip
LEVEL SENSE
SYSCLK*
SCLK
1XCLK
10
RD
UN-LOADER
10
HALF BAND FILTER
10
VIDEO D/A
VIDEO OUTPUT CIRCUIT
V_OUT
2x
2x = 31.054688 Mhz (for MCF)
or 28.792 Mhz (for SVP)
HFF/ Empty
2x
2x
CLOCK GENERATOR
A_UP/DN
HFF/ Empty
A_CLK
A_CLK
A_CLK = 12.288 Mhz
LEVEL SENSE
2
Quiet
2
Clip
RD
9
HF/EF
UN-LOADER
1
A_UP/DN
AUDIO D/A
AUDIO OUTPUT CIRCUIT
A_A_OUT
A_B_OUT
A_C_OUT
A_D_OUT
LEVEL SENSE
2
Quiet
2
Clip
HF/EF
9
RD
UN-LOADER
1
A_UP/DN
AUDIO D/A

Video Output Bus Interface

The Bus Interface logic is implemented in an EPLD that loads data samples from the MCF bus at the assigned time slot, performs de-stuffing, and demultiplexes the data into 10-bit words that are loaded into a FIFO. The Bus Interface logic also generates a bus enable signal at the correct time.

This signal is generated from the SLOT_SYNC signal and is based on the time slot assignment of the module. In this system, the video output time slot is every sixth bus cycle, therefore the field programmable gate array (FPGA) device contains a modulo six counter.

An on-module jumper (6/12 Slot Select) allows the user to scale the system for either 6 (current MCF) or 12 (future product) usable time slots. The data is transferred from the bus receivers to a set of flip-flops and then into the FIFO. The intermediate set of flip-flops provides a convenient point to view the data for testing purposes as it is received from the bus. The STUFF* signal indicates that a STUFF sample is present in the data stream. The Bus Interface logic removes this sample before the data is written into the FIFO.

Video FIFO

A FIFO holds the video data samples. The samples are queued up waiting for conversion to the analog domain. The FIFO also separates the system clock from the video sample clock.

Video FIFO Unloader

The FIFO unloader moves the data from the FIFO to the D/A converter. The FIFOs used are 18 bits wide, therefore one FIFO is necessary to accommodate the 10-bit data stream.

Video Digital Filter

The Tektronix Half Band filter is used for times-two interpolation of the digital video signal.

Video Digital-to-Analog Converter

A 10-bit D/A converter converts the video from the digital to the analog domain. The sample rate is 31.054 MHz for MCF applications. The D/A used is the Analog Devices AD9713. The sample clock is recovered from the input data by a narrow-band phase-locked loop.

Video Output Circuit

The output circuit begins at the output of the D/A with a low pass filter to provide waveform smoothing. This stage is followed by a gain scaling amplifier. A SIN(x)/x compensator corrects for high frequency roll-off inherent to the D/A process.

The output amplifier allows the user to adjust the video signal to a 1 volt peak-to-peak level. In early-production systems, a slow feedback DC restoration circuit removes offsets which are introduced primarily at the A/D. Later-production systems employ sampled video clamping. DC restoration and DC Restore are jumper selectable as on the video input card.

At this point the video signal is brought out to a 75 Ohm BNC monitor point on the front panel for testing purposes. A Tektronix-designed cable equalizer hybrid optimizes the video signal for the coaxial cable type and length used by the customer. The specific hybrid used is based upon customer ordering information. A jumper selection sources pre-equalized or flat video to a backplane BNC output.

Microcontroller

A local microcontroller performs card initialization, samples and reports bus address, slot assignment, audio gain switch settings, on-line, and clip/quiet conditions. A Processor clock is generated by dividing the system clock by eight (8). This function is also located in the bus interface EPLD. Two read-back functions and local processor address decoding is performed by a programmable logic device.

Audio Bus Interface

Bus interface logic loads data samples from the MCF bus during the assigned time slot, performs de-stuffing, and demultiplexes the data as it loads the correct FIFO for a particular D/A.

Audio FIFO

A small FIFO holds data samples for each stereo channel. The samples are queued up waiting for conversion to the analog realm.

Audio FIFO Unloader

A D/A unloader pulls data from the FIFO and serializes it for D/A conversion. If a parity error is detected in the data stream, the loader suppresses the data load strobe to the D/A converter, causing the converter to reuse its old data.

Audio Digital-to-Analog Converter

The D/A converter selected contains the oversampled interpolation filter, a stereo converter, and low pass output filtering incorporated in the part's design. The output is suitable for use without additional filtering.

Audio Output Circuitry

An adjustable gain block restores the output to its original level which was determined at the Audio Input card. The goal is to have a 0 dB end-to-end gain, transparent audio transmission system. Differential output buffers drive the complementary signals.

Audio Conversion Clock

A clock recovery scheme tracks the reconversion rate by comparing the data arrival rate with the present clock rate and adjusting it to drive the local oscillator error to zero. A crystal controlled voltage control oscillator is used for this purpose.

Video Input Module

Figure 4-7 identifies the major functional areas of the Video Input module. The functional blocks are:

- Input Circuit
- Analog-to-Digital Converter
- FIFO Loader
- Bus Interface
- Microcontroller
- Test Ramp Generator
- Digital Filter
- FIFO
- Processor Clock

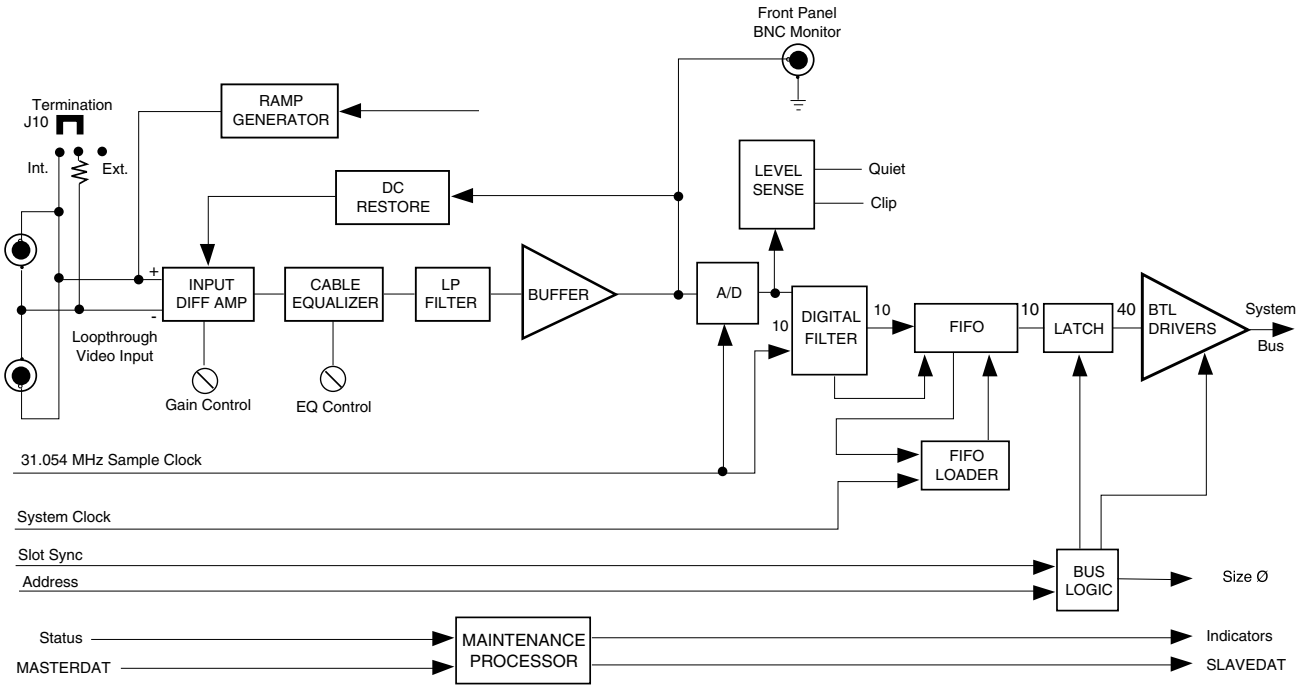


Figure 4-7. Video Input Module Block Diagram

Input Circuit

An input circuit provides jumper-selectable termination and common mode rejection for a 75 Ohm unbalanced video input. A high impedance input amplifier with a user-controlled gain setting allows the video signal to be adjusted to a 1 volt peak-to-peak level. A Tektronix cable equalizer hybrid follows the amplifier and may be used to compensate the video signal for cable type and length. The specific hybrid used is based upon customer ordering information.

A low-pass filter is used for antialiasing to limit roll-off to 0.1 dB within the 6 MHz frequency range. A slow feedback DC restorer adjusts the DC offset so that the video signal is centered within the desired A/D range. DC res-

toration can be selected or deselected via a jumper to ease testability (and to accommodate non-video signals). The video baseband signal is then brought out to a 75 Ohm BNC monitor output on the front panel.

Test Ramp Generator

When a loss-of-video condition is detected, the microcontroller enables a 15.75 kHz ramp generator, which is connected to the input circuit. This signal provides a visual indication of link integrity, but is not usable for proof-of-performance measurements. The microcontroller gates the ramp-on and ramp-off at approximately a 0.5 Hz rate. During the off interval, the microcontroller checks for normal video input. Ramp insertion is enabled/disabled by hardware (jumper J4), or by software (commands to the Fiber module).

Analog-to-Digital Converter

A 10-bit A/D converter using a 31.054 MHz sample clock converts the video from analog to a 10-bit digital stream. The video is sampled asynchronously, using a clock provided by the Fiber module through the backplane. This allows the same video PCB (printed circuit board) to transport analog video regardless of format.

Digital Filter

The Tektronix Half-Band filter is used for divide-by-two division of the digital video signal. This allows video with two diplexed audio signals to be passed. The signal bandwidth of this diplexed signal is 6.4 MHz, plus or minus a 185 kHz deviation. This gives a maximum signal frequency of 6.585 MHz, within the flat response range of the MCF Video Input module.

FIFO Loader

A FIFO loader function is implemented in a PLD (programmable logic device). It organizes the bitstream from the A/D as samples of parallel data and generates the strobes for loading these samples into a FIFO. The FIFOs used are 9 bits wide; therefore, two FIFOs are necessary to accommodate the 10-bit data stream.

FIFO

The FIFO holds samples of video data until they are strobed out to the MCF System bus. It also separates the video sample clock from the system clock.

Bus Interface

Bus interface is implemented in a PLD. Three functions are required, a load-enable to load a set of registers from the FIFOs, a STUFF indication, and a bus-enable to write data onto the bus. The FIFOs contain the data to be transmitted in the appropriate time slot. This data is transferred from the FIFOs to the Futurebus drivers.

The system allows for STUFF data to correct for any uncertainties in the data time-of-arrival. The bus interface circuitry generates a STUFF indicator if it detects a FIFO underflow. In this case, a STUFF sample is inserted into the appropriate register and a SIZEØ signal is asserted on the backplane. The bus interface also generates a bus enable signal at the correct time. This signal is generated from the SLOT_SYNC signal, based on the slot assignment of the module. The video modules have a time slot every sixth bus cycle, which requires a modulo-6 counter.

Processor Clock

A processor clock is generated by dividing the system clock by eight. This function is also located in the micro-interface PLD.

Microcontroller

A local microcontroller performs module initialization, samples and reports bus address, slot assignment, clip, and quiet conditions.

Video Output Module

Figure 4-8 identifies the major functional areas of the Video Output Module. The functional blocks are:

- Video Output Bus Interface
- FIFO Unloader
- Digital-to-Analog Converter
- Processor Clock
- FIFO
- Digital Filter
- Output Circuit
- Microcontroller

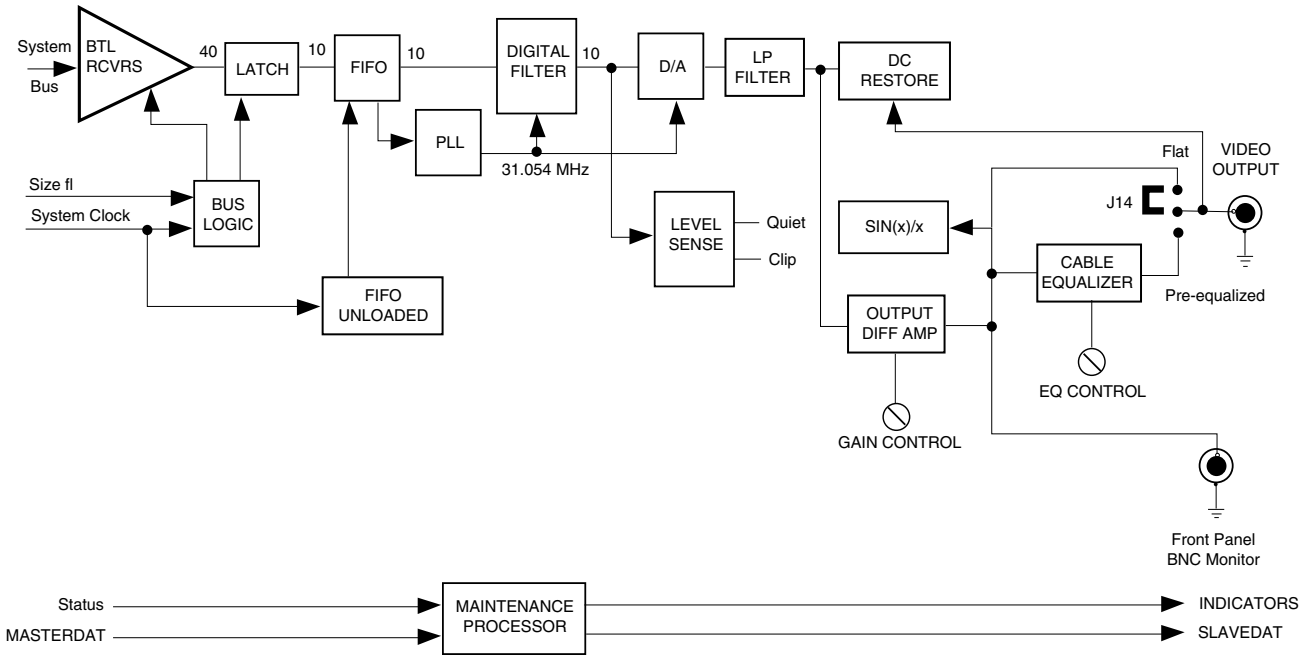


Figure 4-8. Video Output Module Block Diagram

Video Output Bus Interface

The MCF bus is converted to TTL levels by Futurebus transceivers, which are monitored by a bus interface logic block and clocked by the system clock.

The Bus Interface logic is implemented in a PLD, it loads data samples from the MCF bus at the assigned time slot, performs destuffing, and demultiplexes the data into 10-bit words as it loads it into the FIFO.

The Bus Interface generates a bus-enable signal at the correct time. This signal is generated from the SLOT_SYNC signal based on the slot assignment of the module. In this system the video modules have a time slot every sixth bus cycle; therefore, this counter is a modulo-6 counter.

This data is transferred from the bus receivers to a set of flip-flops and then into the FIFO. The intermediate set of flip-flops provides a convenient point to view the data for testing purposes as it is received from the bus.

The SIZEØ signal indicates that a STUFF sample is present in the data stream. The Bus Interface logic removes this sample before the data is written into the FIFO.

FIFO

A FIFO holds the video data samples. The samples are queued-up waiting for conversion to the analog domain. The FIFO also separates the system clock from the video sample clock.

FIFO Unloader

The FIFO unloader moves the data from the FIFO to the D/A converter. The FIFOs used are 9 bits wide, therefore two FIFOs are necessary to accommodate the 10-bit data stream.

Digital Filter

The Tektronix Half-Band filter is used for times-two interpolation of the digital video signal.

Digital-to-Analog Converter

A 10-bit D/A converter, using a 31.054 MHz sample clock, converts the video from the digital to the analog domain. The 31.054 MHz clock is recovered from the input data by a narrow-band phase-locked loop.

Output Circuit

The output circuit begins at the output of the D/A with a low pass filter to provide waveform smoothing. This stage is followed by a gain scaling amplifier. A SIN(x)/x compensator corrects for high frequency roll-off inherent to the D/A process. The output amplifier allows the user to adjust the video signal to a 1 volt peak-to-peak level.

A slow feedback DC restoration circuit removes offsets which are introduced primarily at the A/D. DC restoration is jumper selectable on the Video Input module. At this point the video signal is brought out to a 75 Ohm BNC monitor point on the front panel for testing purposes.

A Tektronix-designed cable equalizer hybrid optimizes the video signal for the coaxial cable type and length used by the customer. The specific hybrid used is based upon customer ordering information. By making a jumper selection on the module, pre-equalized or flat video is available at a BNC connector on the system backplane.

The video output can be squelched if a loss of input conditions occurs. This function is enabled/disabled by jumper J10.

Processor Clock

A processor clock is generated by dividing the system clock by eight. This function is also located in the micro interface PLD.

Microcontroller

The maintenance processor implemented by a microcontroller performs module initialization, samples and reports bus address, slot assignment, clip, and quiet conditions.

Audio Input Module

Figure 4-9 identifies the major functional areas of the Audio Input Module. The functional blocks are:

- Input Circuit
- FIFO Loader
- FIFO
- Processor Clock
- A/D Converter
- C-Bit Generator
- Bus Interface
- Microcontroller

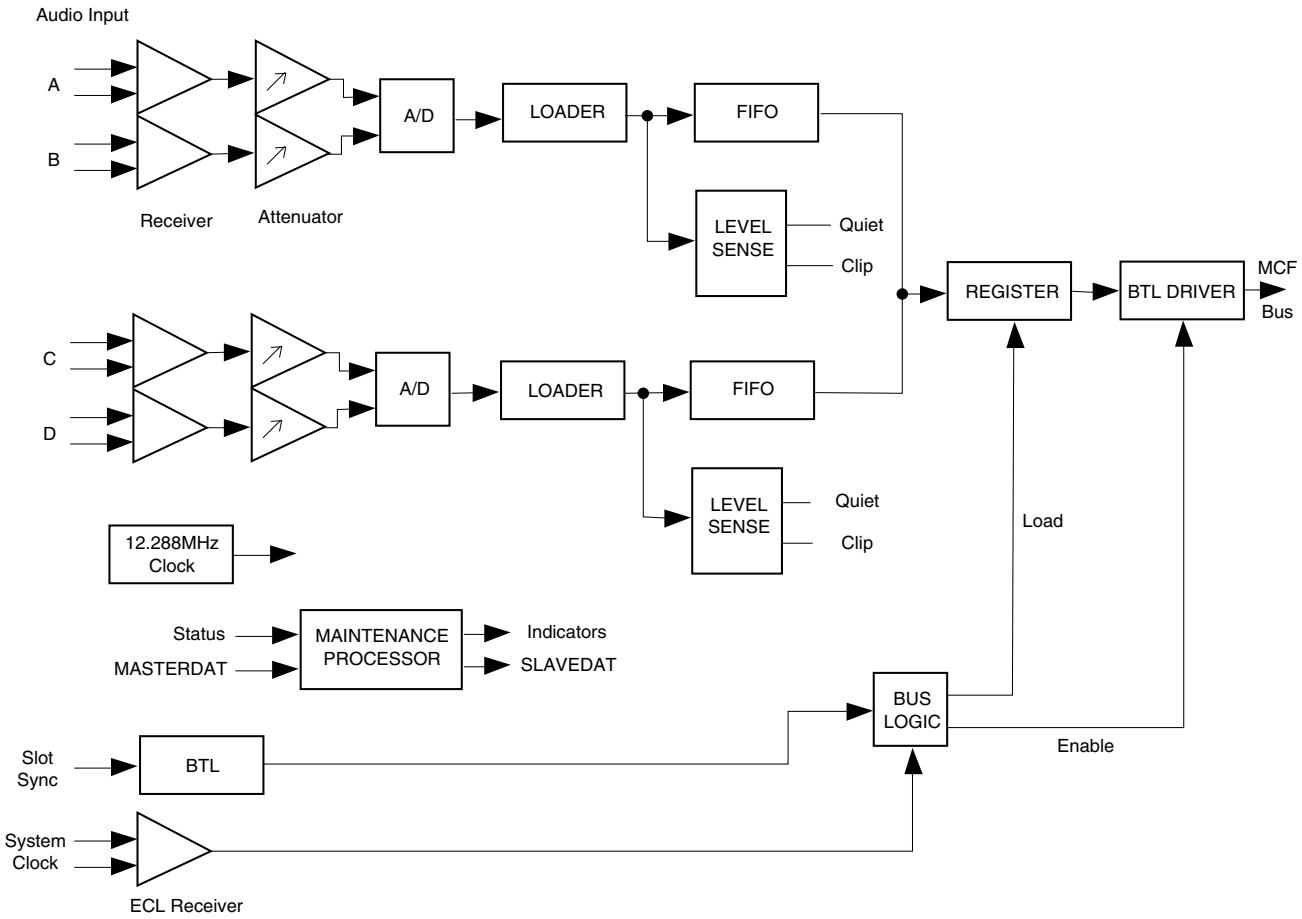


Figure 4-9. Audio Input Module Block Diagram

Input Circuit

A differential input circuit terminates the line into 150 Ohm, 600 Ohm, or 30 K Ohms, and a differential line receiver provides common mode rejection of 60 Hz and other common mode signals impressed upon the twisted shielded input line, attenuates the signals, and references them to local analog ground. A selectable gain stage scales the input to allow user control of the headroom over nominal operating level. This is specified as input level vs. clip level.

A/D Converter

An 18-bit analog-to-digital converter digitizes the analog input at a 48 kHz rate when given a 12.288 MHz clock. One of the A/Ds is configured as a master, meaning that it is the source of the module timing. The other A/D is configured as a slave device, taking its timing from the master.

FIFO Loader

A FIFO loader function is implemented as a PLD. Its function is to organize the serial bit stream from the A/D as bytes of parallel data and generate the proper strobes for loading these bytes into a FIFO.

FIFO

The FIFO holds bytes of audio data until they are ready to be moved to the MCF data bus, and separates the audio sample clock from the system clock.

Bus Interface

A bus interface is implemented in another PLD. Two functions are included, a time slot access counter and a FIFO unloader. The time slot access counter is referenced to SLOT_SYNC and generates an MCF bus-enable at the time slot requested by the local controller processor.

The FIFO unloader function fills the bus interface registers from the data FIFOs. The FIFO unloader function runs after the assigned slot has passed, and, if unable to fill the registers due to a FIFO underflow, indicates this condition by asserting a STUFF flag.

Processor Clock

A processor clock is generated by dividing the system clock by eight. This function is housed in the bus interface PLD.

Microcontroller

A local microcontroller performs module initialization, samples and reports bus address, gain switch settings, slot assignment, clip, and quiet conditions.

Audio Output Module

Figure 4-10 identifies the major functional areas of the Audio Output Module. The functional blocks are:

- Bus Interface and Logic
- FIFO Unloader
- C-Bit Receiver
- Output Drivers
- Maintenance Processor
- FIFO
- Processor Interface
- D/A Converter
- Audio Conversion Clock

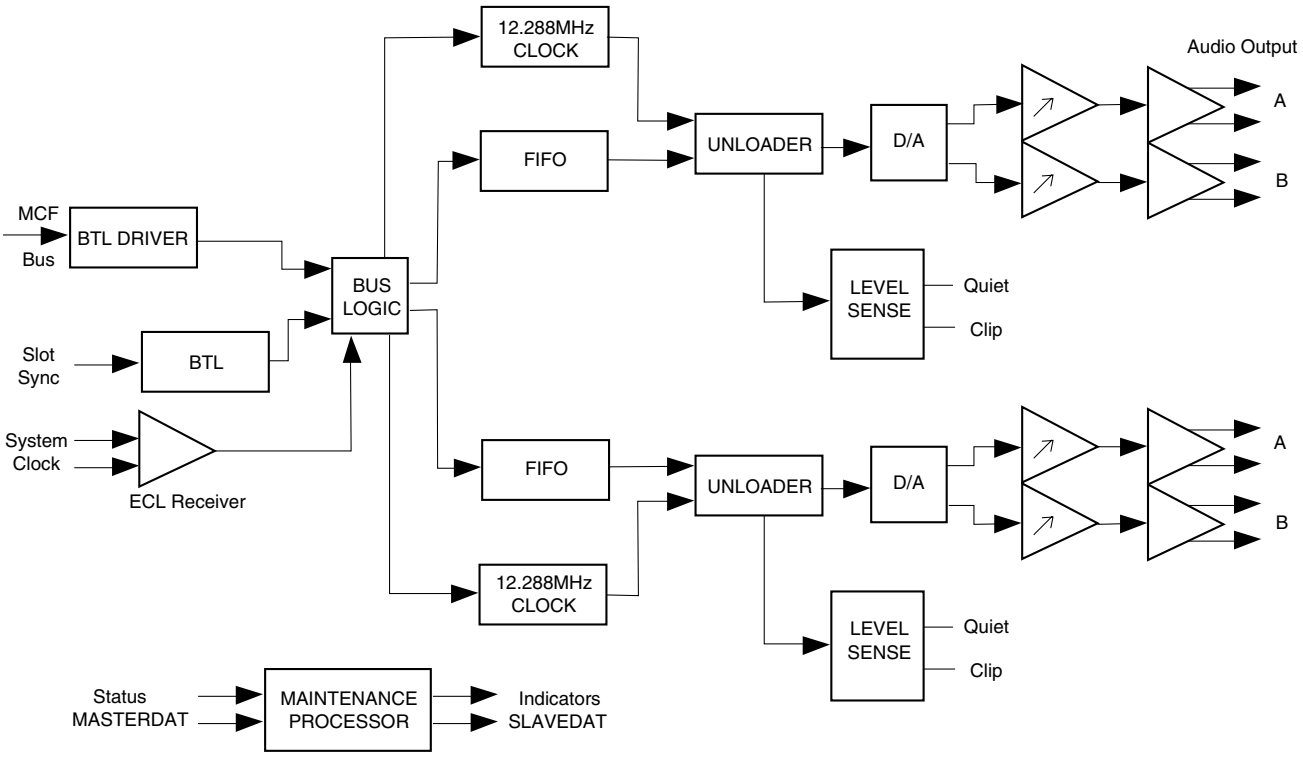


Figure 4-10. Audio Output Module Block Diagram

Bus Interface Logic

The MCF bus is converted to TTL levels by Futurebus transceivers which are monitored by the bus interface logic and clocked by the system clock. Bus interface logic loads data samples from the MCF bus at the assign time slot, performs destuffing, and demultiplexes the data as it loads the correct FIFO for a particular D/A.

FIFO

A small FIFO holds data samples for each stereo channel. The samples are queued-up waiting for conversion to the analog realm.

FIFO Unloader

A D/A unloader pulls data from the FIFO and serializes it for D/A conversion. If a parity error is detected in the data stream, the loader suppresses the data load strobe to the D/A converter, causing the converter to reuse its old data.

Processor Interface

Two read-back functions and local processor address decoding are performed by a programmable logic device.

C-Bit Receiver

A C-bit receiver is implemented in a microcontroller operating at the 12.288 MHz audio clock rate. This receiver may be accessed by the local processor. It receives the C-bits as defined in the AES/EBU3 document, and the associated frame timing and checks the cyclic redundancy clocks (CRCs).

D/A Converter

The D/A converter contains the oversampled interpolation filter, a stereo converter, and low pass output filtering incorporated in the part's design. The output is suitable for use without additional filtering.

Output Drivers

An adjustable gain block restores the output to its original level. Differential output buffers drive the complementary signals.

Audio Conversion Clock

A clock recovery scheme reproduces the input sample clock using a voltage-controlled crystal.

Maintenance Processor

The maintenance processor implemented by a microcontroller performs module initialization, samples and reports bus address, gain switch settings, slot assignment, clip, and quiet conditions.

Serial Digital Input Module

Figure 4-11 identifies the major functional areas of the Serial Digital Input Module. The functional blocks are:

- Digital Video Input Circuits
- FIFO Control
- FIFO
- MCF Video Bus Interface
- Audio Input Interface
- AES/EBU Decoder
- Audio Deserializer & Buffer
- Audio Data Rate & Timing
- Buffering & Bus Transfer
- Maintenance Processor

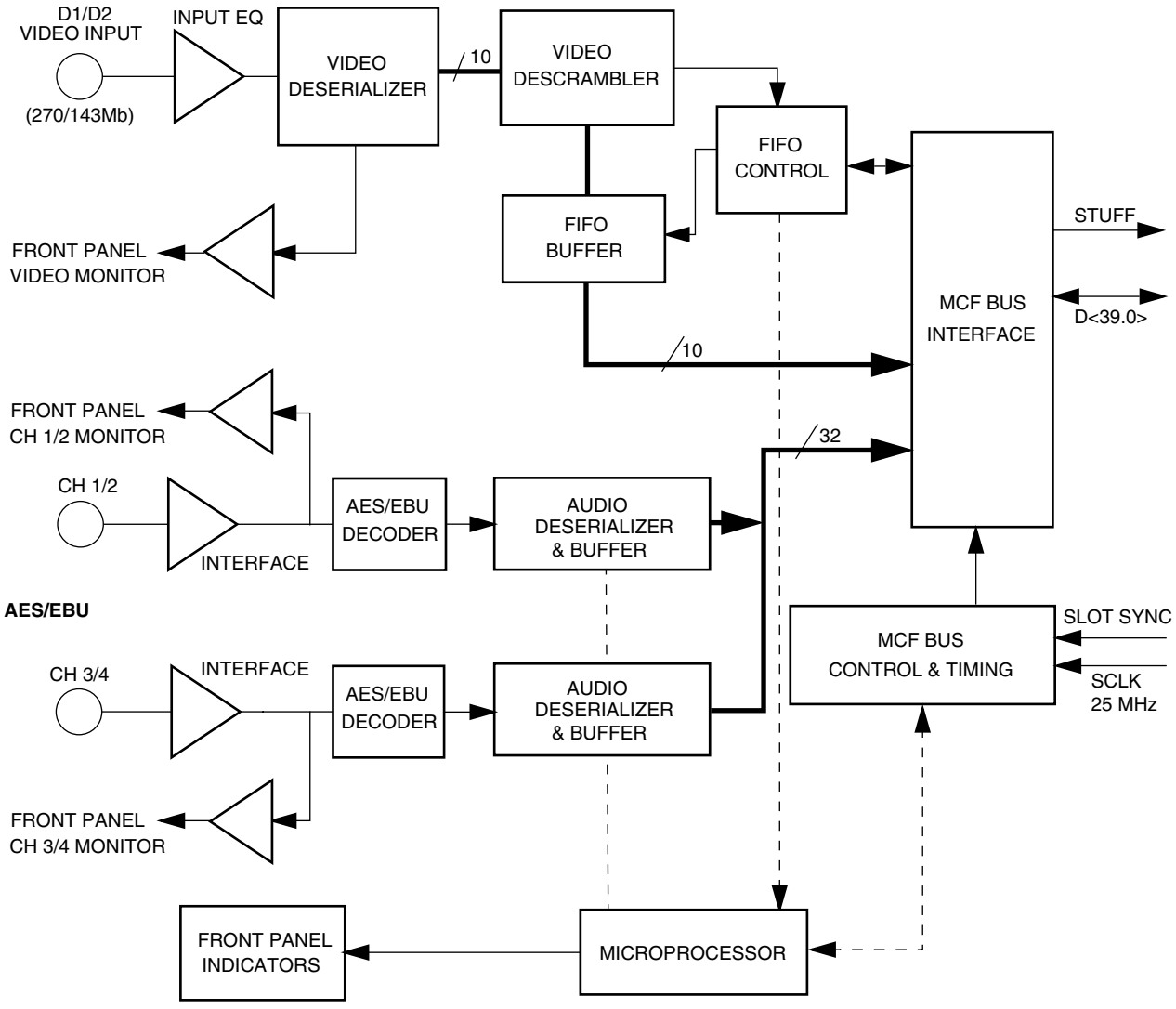


Figure 4-11. Serial Digital Input Module Block Diagram

Digital Video Input Circuit

An input circuit provides 75 Ohm termination and the accompanying circuitry provides the cable EQ function. The Tektronix Deserializer and Encode/Descrambler chipset is used for the front-end serial-to-parallel conversion on the 270/143 MBS (D1/D2) video data. On the input side, the Tektronix Descrambler chip is used in the data path and for input video detect using the TRS pulse output signal available on this chip.

FIFO Control

A FIFO loader function is implemented using an EPLD. Its function is to organize the bitstream of parallel data and generate the proper strobes for loading these samples into a FIFO.

STUFF data corrects for any asynchronous data conditions caused by video data clock to the bus clock translation at the FIFOs. The bus interface circuitry generates a STUFF indicator if it detects a FIFO less than half full condition. In this case a STUFF sample is inserted into the appropriate register and a STUFF signal is asserted on the backplane.

FIFO (D1/D2 Channel)

The FIFO holds samples of video data until they are ready to be moved to the MCF system bus. It also separates the video sample clock from the system clock and provides sufficient throughput capacity for D1 data (270 MBS component) as well. The FIFOs used are 10 bits wide (two 18-bit FIFOs are used to provide the required D1 bandwidth).

MCF Bus Interface

The Serial Digital Input FPGA handles the transfer of digital video and audio data transferred from the Input FIFOs (video) or AES/EBU receivers (audio) to the MCF bus. FPGA control bits can be written to and status read from by the PIC processor. The video portion of the FPGA operates in either D1 mode (270 Mbps component video), where it reads data from both FIFOs and uses two consecutive MCF video time slots to transfer data on the MCF bus, or in D2 mode (143 Mbps NTSC composite video), where it reads data only from FIFO1 and uses one MCF video time slot. The audio portion of the FPGA can accept two independent AES/EBU stereo audio channels and uses one MCF audio time slot.

This part generates a load enable to load a set of registers from the FIFOs and a STUFF flag for the video data. The part also converts the audio data to parallel form and writes video and audio data to the bus.

The bus interface also generates a bus enable signal at the correct time. This signal is generated from the SLOT_SYNC signal based on the slot assignment of the module. In this system the Serial Digital modules have a time slot every sixth bus cycle.

Audio Input Interface

A channel's AES/EBU input is conditioned and then decoded by a commercial audio interface receiver. Decoding consists of data bit clock extraction, left/right channel decoding, frame recognition (that is, sample pairs), and blocking (192 frames).

AES/EBU Decoder

A shift-register/loader function is implemented in an FPGA. Its function is to organize the serial bitstream from the receiver as bytes of parallel data and generate the proper strobes for loading these bytes from the FPGA to the MCF bus.

The decoded output is deserialized (serial to parallel shift register) and mapped into the data format specified for MCF Audio data. This includes setting the CH1/2 and CH3/4 channel identifier bits, which identify the AES/EBU channel of which this data is a member. The assembled and formatted MCF 40-bit audio word is then transferred to the MCF bus at the next available audio time slot allocated to the Serial Digital Input module.

Audio Deserializer and Buffer

A serial to parallel function is implemented in the bus interface FPGA. Its function is to organize the two bitstreams of serial data into 32-bit shift registers based on their respective audio sample clocks and keep track of the fullness of the registers relative to each other.

Both serial data streams are clocked in using separate audio sample rate clocks. No attempt is made to synchronize the two audio streams and the data associated with each audio stream will be allowed to roll past each other at their individual sample clock rates.

The audio buffer holds samples of digitized audio data in a register until they are ready to be moved to the MCF system bus. It allows for separate audio sample clocks to convert the audio data to the system bus clock, which is also an input to the FPGA.

Audio Data Rate and MCF Bus Timing

AES/EBU data sample rate is nominally 48 kHz (20.8 µs). The word rate for a stereo pair is 96 kHz (10.4 µs).

On the MCF bus, one audio sample transfer per MCF frame time is allowed. The MCF frame rate is 195K frames/sec (5.12 µs). Transporting two AES/EBU audio streams means that only one half of this bandwidth is available per stream. In this mode, the MCF bus can transfer a stereo sample pair at 97.5 kHz. Thus, the Serial Digital's AES/EBU uses 96/97.5 = 98.5 percent of the available MCF bandwidth.

MCF data transfers are synchronous—that is, locked to a 25 MHz bus cycle. Thus, approximately 1.5 percent of the MCF audio transfers contain no audio data, assuming both AES/EBU channels are enabled. On those cycles where an audio sample is not ready (that is, has not be assembled), the STUFF bits in the MCF Audio Data word is asserted by the Serial Digital Audio Input logic. This indicates to the MCF system (and ultimately the Serial Digital Audio Output unit) that the associated data should be ignored.

The STUFF mechanism is used also when a channel is disabled at the input or an LOS (Loss Of Signal) condition occurs on the Serial Digital Audio Input side.

Buffering and MCF Bus Transfer

If both audio channels are disabled, the Serial Digital Input module does *not* enable any data onto the MCF Data bus. This allows another module to occupy the same audio time slot if desired.

Maintenance Processor

The maintenance processor implemented by a microcontroller performs module initialization, samples and reports bus address, and slot assignment.

Serial Digital Output Module

Figure 4-12 identifies the major functional areas of the Serial Digital Output Module. The functional blocks are:

- Bus Interface
- FIFO Unloader (video)
- Serial Digital Video Out
- Audio FIFO
- FIFO Unloader (audio)
- Serial Digital Audio Out
- Audio PLLs
- Microcontroller
- Video PLL

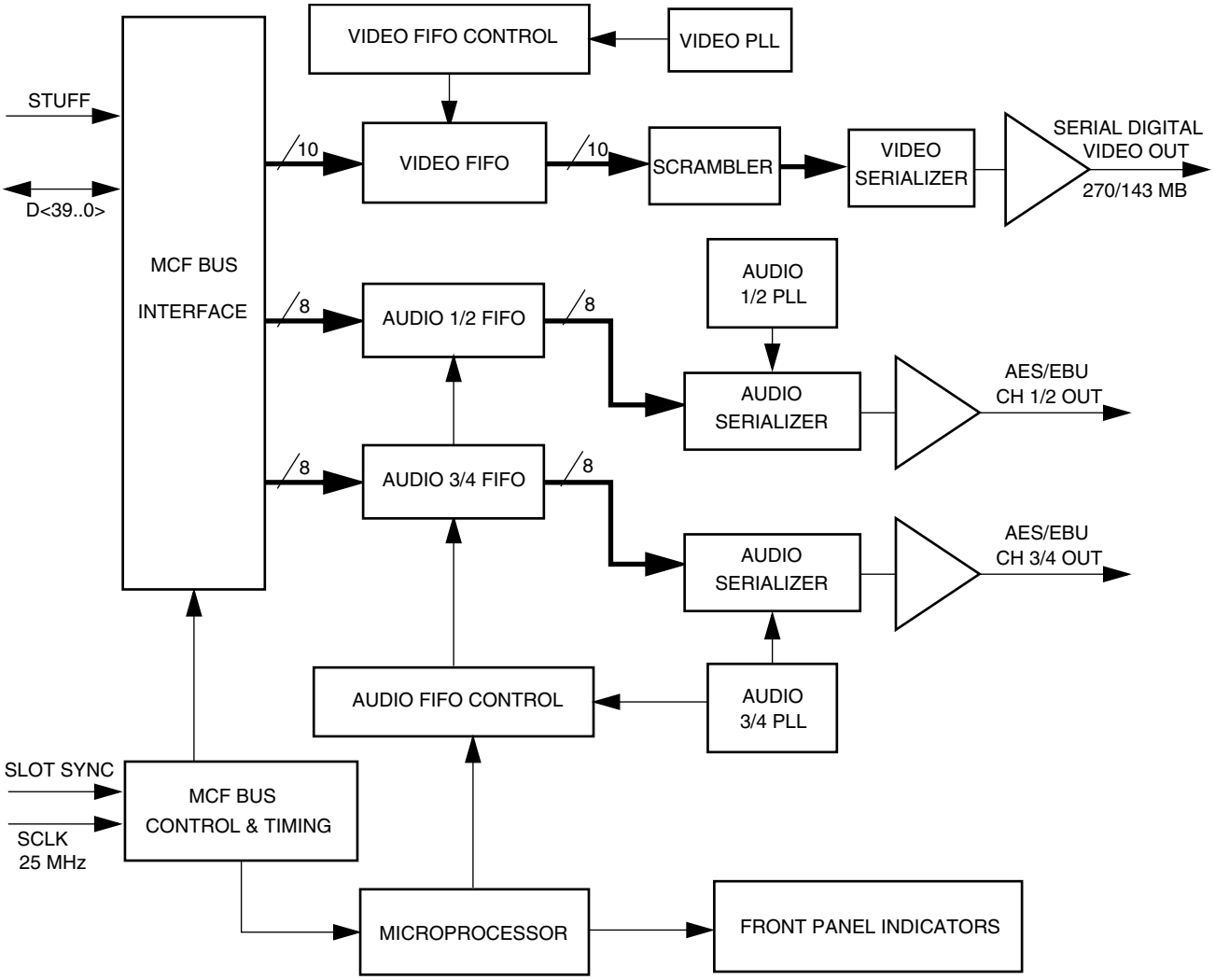


Figure 4-12. Serial Digital Output Module Block Diagram

Bus Interface

The Bus Interface logic is implemented in an FPGA. It loads data samples from the MCF bus at the assigned time slot, performs de-stuffing, and demultiplexes the data into 10-bit video words or 16-bit audio words as it loads them into the FIFOs.

The Bus Interface generates a bus enable signal at the correct time. This signal is generated from the SLOT_SYNC signal, based on the slot assignment of the board. In this system the serial boards have a time slot every sixth bus cycle; therefore, this counter is a modulo six counter.

The MCF bus data is converted to TTL levels by Futurebus transceivers which are monitored by a bus interface logic block and clocked by the system clock.

This audio and video data is transferred from the bus receivers to a set of registers and then into separate FIFOs.

The STUFF signal indicates that a STUFF video sample is present in the data stream. The Bus Interface logic removes this sample before the data is written into the FIFOs. This STUFF bit controls the state of loss of signal (LOS) on the output module.

Video FIFO

A FIFO holds the video data samples and separates system clock data rates from video sample clock data rates.

FIFO Unloader (Video)

The FIFO unloader moves the data from the FIFO to the NRZI Encode/Descrambler ASIC.

Serial Digital Video Output Circuit

Video data from the FIFO goes to an NRZI encoder/descrambler ASIC and is then serialized by the video serializer ASIC. Serial data from the serializer is output by two, 10EL89 output drivers.

Audio FIFO

A FIFO holds the audio data samples. The FIFO separates the system clock data rates from the audio AES/EBU clock data rates.

FIFO Unloaders (audio channel)

The FIFO unloader EPLD moves the data from the FIFO to the output drive circuit.

Video PLL

The video PLL generates the parallel video data sample clock. The loop locks to the half full flag from the FIFO. The clock rates are 27 MHz (D1 mode, 270 MBS component) and 14.31818 MHz (D2 mode, 143 MBS NTSC composite).

Serial Digital Audio Output Circuit

An EPLD (P/O unloader) serializes the data from the audio FIFOs. Serial data is driven to the front panel monitors and the system backplane by LTC1485 drivers. Backplane outputs are impedance matched and AC coupled.

Audio PLLs

A clock recovery scheme corrects the reconversion rate by comparing the data arrival rate with the present clock rate and adjusting it to drive the error to zero. A crystal-controlled voltage-control oscillator is used for this purpose.

Microcontroller

The maintenance processor (PIC16C57 microcontroller) performs card initialization, samples and reports bus address, slot assignment, settings for on-line and LOS conditions.

Video/Audio Diplexer Input Module

Figure 4-13 identifies the major functional areas of the Video/Audio Diplexer Input Module. The functional blocks are:

- Video & Audio Input
- Analog to Digital Converter
- Digital Filter
- FIFO Loader
- FIFO
- Bus Interface
- Processor Clock
- Microcontroller

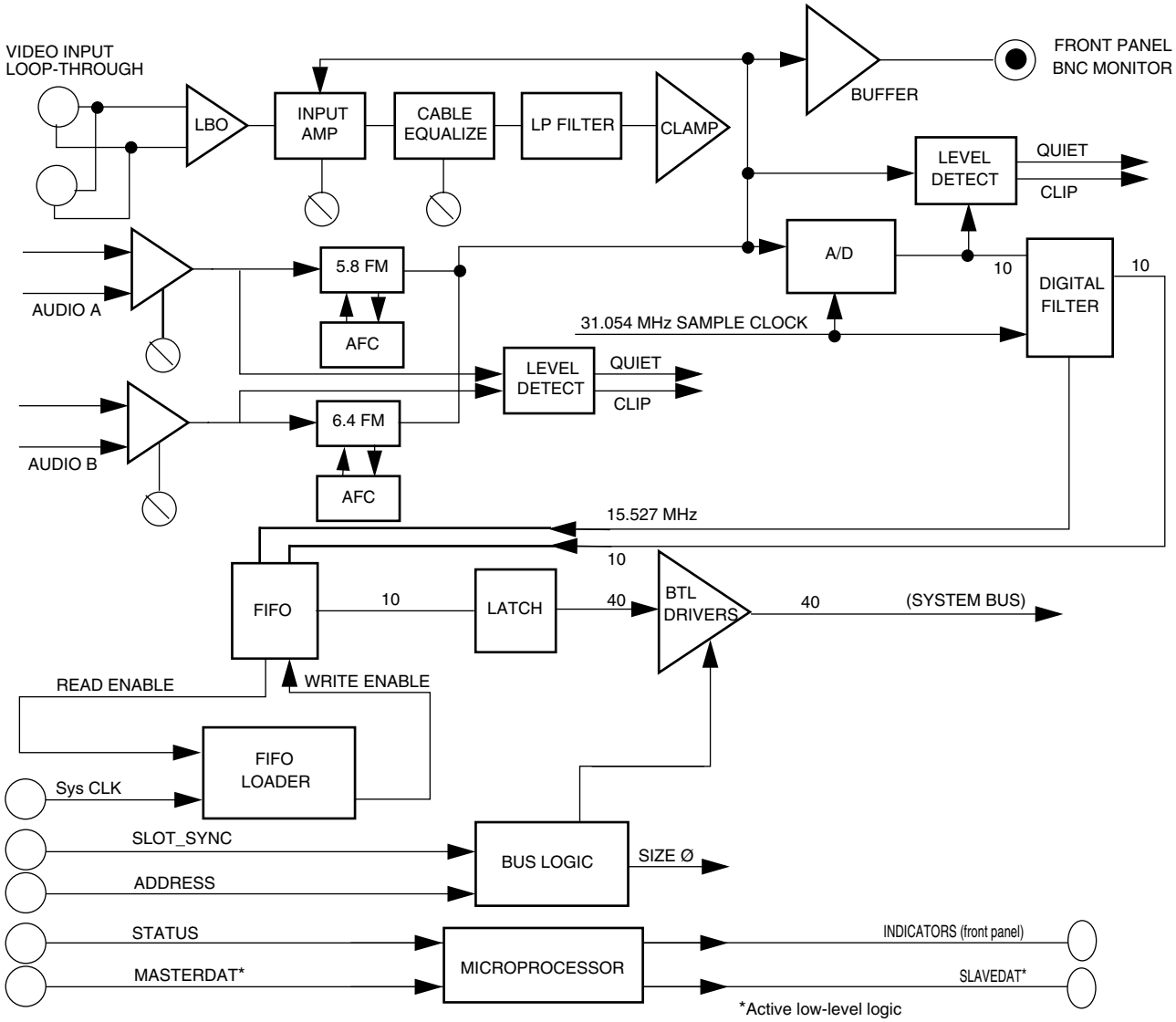


Figure 4-13. Video/Audio Diplexer Input Module Block Diagram

Video Input Processing

An input circuit provides termination and common mode rejection for a 75 Ohm unbalanced video signal. A high impedance input amplifier with a user-controlled gain setting allows the video signal to be optimized to a 1 volt peak-to-peak level. A Tektronix-designed cable equalizer hybrid follows the amplifier and optimizes the video signal to the cable type and length used by the customer. The specific hybrid used is based upon customer ordering information. A delay equalized 4.5 MHz low-pass filter is used for antialiasing and to eliminate noise from the audio subcarrier band. A slow feedback clamp adjusts the DC offset so that the video signal is centered within the desired A/D range. The clamp can be selected or deselected via a jumper to permit transmission of signals which lack video sync. At this point the video baseband signal is brought out through a buffer to a monitor output on the front panel. Circuitry is included to allow for the generation of a luminance ramp signal when there is no input video signal present. This function is for testing video path continuity and is remotely controllable when the function is enabled by the DIP switch.

Audio Input Processing

The audio input stage accommodates 600 Ohm balanced +18 dBm peak level signals. The balanced configuration attenuates common mode components. The front panel gain adjustment range is ± 6 dB. Input monitor amplifiers make the A channel audio available at the C connection and the B channel audio available at the D connection on the backplane audio connector block. The intent is that the monitor outputs be used to set levels and, hence, the FM deviation. The audio is pre-emphasized (standard 75 microsecond) and applied to the FM modulators. The center frequencies of the FM modulators are fixed at 5.8 and 6.4 MHz using slow feedback PLLs. The subcarriers are summed with the filtered video at a relative level of –20 dBV (100 mV peak-to-peak) per carrier.

Analog-to-Digital Converter

A 10-bit A/D converter, using a 31.054 MHz sample clock, converts the video from analog to a 10-bit digital stream. The video is sampled asynchronously, using fiber board clock, through the backplane.

Digital Filter

The Tektronix Half Band filter provides divide-by-two decimation of the digital video signal.

FIFO Loader

A FIFO loader function is implemented in a PLD. Its function is to organize the bitstream from the A/D as samples of parallel data and generate the proper strobes for loading these samples into a FIFO.

FIFO

The FIFO holds samples of video data until they are ready to be moved to the MCF system bus. It also separates the video sample clock from the system clock.

Bus Interface

The bus interface is implemented in another PLD. Three functions are required for this part: a load enable to load a set of registers from the FIFO, a STUFF indication, and a bus enable to write data onto the bus.

The FIFO contains the data to be transmitted in the appropriate time slot. This data is transferred from the FIFO to a set of flip-flops for transfer to the Futurebus drivers. The intermediate set of flip-flops provides a convenient point to view the data for testing before it is written to the bus. The system allows for STUFF data to correct any uncertainties in the data time of arrival. The bus interface circuitry generates a STUFF indicator if it detects a FIFO underflow. In this case a STUFF sample is inserted into the appropriate register and a SIZEØ signal is asserted on the backplane.

The bus interface also generates a bus enable signal at the correct time. This signal is generated from the SLOT_SYNC signal based on the slot assignment of the board. In this system the video boards have a time slot every sixth bus cycle; therefore, this counter is a modulo six counter.

Processor Clock

A processor clock is generated by dividing the system clock by eight. This function is also located in the bus interface PLD.

Microcontroller

A local microcontroller performs module initialization and samples and reports bus address, slot assignment, clip, and quiet conditions.

Video/Audio Diplexer Output Module

Figure 4-14 identifies the major functional areas of the Video/Audio Diplexer Output Module. The functional blocks are:

- FPGA/Bus Interface
- FIFO
- FIFO Loader
- Digital Filter
- Digital to Analog Converter
- Video Output Processing
- Processor Clock
- Microcontroller

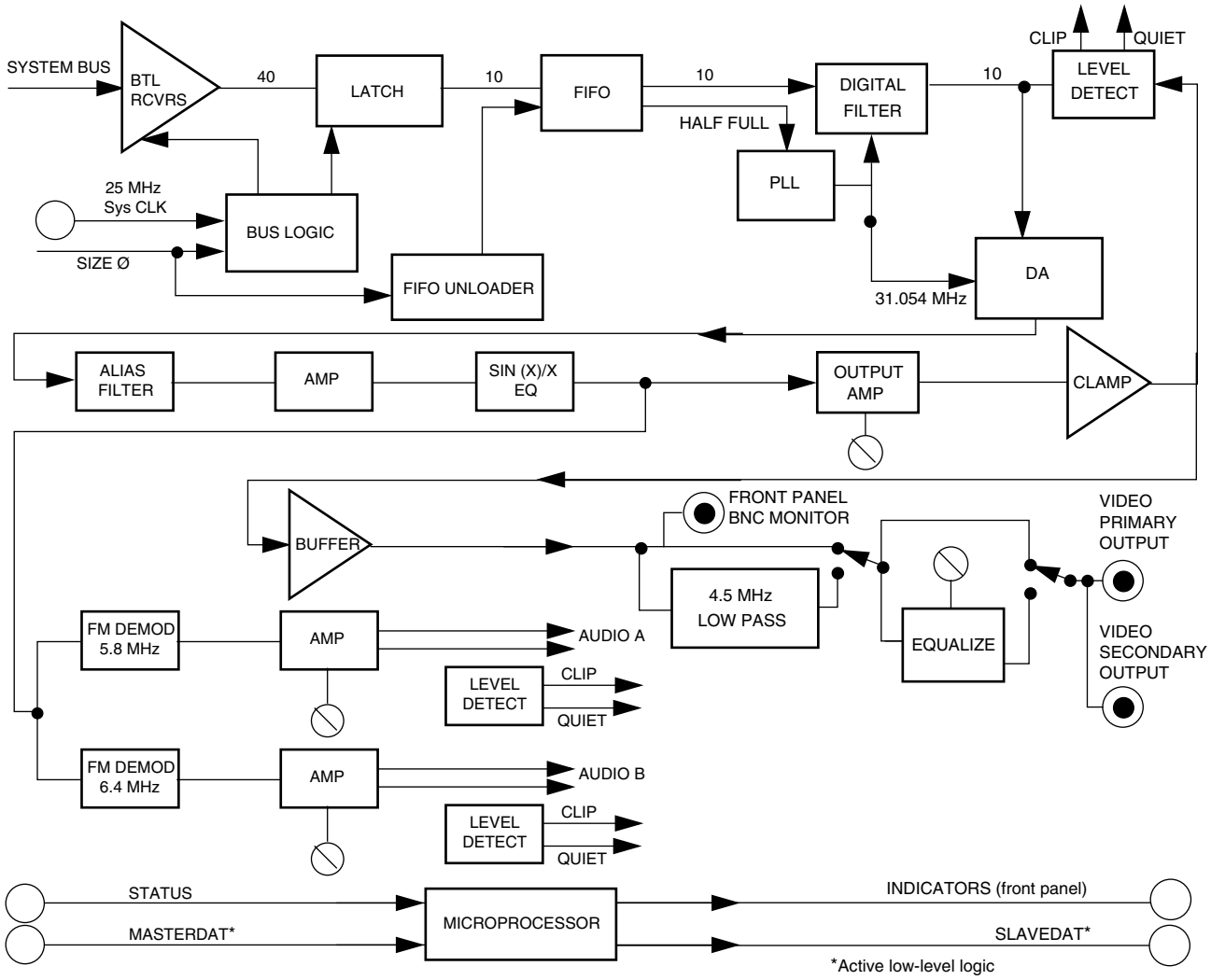


Figure 4-14. Video/Audio Diplexer Output Module Block Diagram

Bus Interface

The MCF bus is converted to TTL levels by Futurebus transceivers which are monitored by the bus interface logic and clocked by the system clock.

The Bus Interface logic is implemented in a PLD, which loads data samples from the MCF bus at the assigned time slot, performs de-stuffing, and demultiplexes the data into 10-bit words as it loads it into the FIFO.

The Bus Interface generates a bus enable signal at the correct time. This signal is generated from the SLOT_SYNC signal based on the slot assignment of the board. In this system the video boards have a time slot every sixth bus cycle; therefore, this counter is a modulo six counter.

This data is transferred from the bus receivers to a set of flip-flops and then into the FIFO. The intermediate set of flip-flops provides a convenient point to view the data for testing purposes as it is received from the bus.

The SIZEØ signal indicates that a STUFF sample is present in the data stream. The Bus Interface logic removes this sample before the data is written into the FIFO.

FIFO

A FIFO holds the video data samples. The samples are queued up waiting for conversion to the analog domain. The FIFO also separates the system clock from the video sample clock.

FIFO Unloader

The FIFO unloader moves the data from the FIFO to the D/A converter.

Digital Filter

The Tektronix Half-Band filter provides rate doubling of the digital video signal.

Digital-to-Analog Converter

A 10-bit D/A converter, using a 31.054 MHz recovered clock, converts the video from the digital domain to the analog domain.

Video Output Processing

The output circuit begins at the output of the D/A with a low pass filter to provide waveform smoothing. This stage is followed by a gain scaling amplifier. A sin(x)/x equalizer corrects for high frequency roll off associated with the sampling process. The output amplifier allows the user to optimize the video signal to a 1 volt peak-to-peak level. A slow feedback

clamp removes undesired DC offsets. At this point the video signal is brought out to a BNC monitor on the front panel. A Tektronix cable equalizer hybrid optimizes the video signal to the cable type and length used by the customer. The specific hybrid used is based upon customer ordering information. The primary backplane output is jumper selectable for flat or pre-equalized video, with subcarriers present (diplex mode) or removed by a 4.5 MHz low pass filter.

Audio Output Processing

FM demodulators recover the audio information from the subcarriers. The audio output level is front panel adjustable ± 6 dB about the nominal level of +18 dBm into 600 Ohms. Low level (–20 dB) monitor outputs are provided for Channel A at the C connection and for Channel B at the D connection on the backplane audio connector block.

Processor Clock

A processor clock is generated by dividing the system clock by eight. This function is also located in the bus interface PLD.

Microcontroller

The maintenance processor implemented by a microcontroller performs module initialization samples and reports bus address, slot assignment, clip, and quiet conditions.

Power Supplies

There are two types of power supplies: the 6 RU and the 2 RU. These supplies are frame specific and can not be substituted. In both instances there is over-voltage, over-current, and thermal protection designed into the power supply circuitry. The following text describes their differences.

Power Supply for the 6 RU Frame

The 6 RU power supply is hot insertable. The input voltages for the AC supply are as follows:

- 90 to 132 VAC on 115 VAC from the source
- 180 to 264 VAC on 230 VAC from the source

The input voltage for the DC supply is – 42 VDC to – 56.7 VDC on – 48 VDC from the source.

Power Supply for the 2 RU Frame

The 2 RU power supply is hot insertable, and can handle the largest single channel load configuration covering the worst case current requirements.

The unit is self-selecting AC/DC (from 90 to 264 VAC and – 42 to – 56.7 VDC).

Section 5

Maintenance & Service

Section Overview

This section describes the maintenance and service procedures for the MCF System. It includes periodic maintenance information, a troubleshooting table, removal/replacement, and service information.

Maintenance

The MCF Series Video Transmission System has been designed so that no particular maintenance is required; however, periodic maintenance is required on the 6 RU fan and deflector assemblies. Occasional maintenance may be required to replace open fuses in 6 RU frame power supply, or to maintain proper operation of the Fiber Transmitter/Receiver modules.

CAUTION Digital components can be extremely static sensitive. To avoid damage by static discharge, ground yourself and your test equipment before handling or checking circuit modules.

Air Intake Filter Maintenance

Check and clean the air intake filters on the 6 RU frame fan and deflector assemblies, and the 2 RU frame cover every 90 days, or as your equipment environment demands. To clean the filter, complete the following steps:

1. Unscrew the air filter on the deflector front grill or remove the 2 RU frame front cover.
2. Gently remove the reticulated-foam filter from the front panel. Wash it an a mild detergent and water solution, and dry the foam completely. Or, vacuum the filter clean.
3. Replace the foam in the air filter or deflector front panel.

4. Replace the air filter on the deflector front grill or the 2 RU frame front cover onto your MCF system.

Should the filter be damaged, contact a Tektronix service representative for a replacement part, or replace it with foam that meets or exceeds UL-900 standards. Refer to Table 5-2 on page 5-12 for replacement foam filter model numbers.

Module Maintenance

Circuit modules must be properly handled and maintained to ensure long, productive service. Static-conscious handling, module connector cleaning, and proper module replacement procedures should be considered.

Fiber Transmitter/Receiver Maintenance

There are no user adjustments on either Fiber module.

There are two types of failure modes for the Fiber Transmitter module, and both modes require replacement of the defective module.

- In one failure mode, the system appears to be operating normally and allows the Transmitter to send laser signals; however, the laser limit condition on the driver circuitry is below the standard setting.
- The other failure mode is catastrophic and no laser signal is transmitted through the system.

In either mode, the red LASER POWER light on the front of the Transmitter module is lit. Replace the module as soon as possible for continued optimum operation.

Status Packet

Status information is automatically gathered and is reported when the local processor is queried through the Administration or Craft port.

Power Supply Maintenance

The following text describes the procedure for servicing the Power Supplies in the MCF system.

Power Supply Service for the 6 RU Frame

An open fuse frequently indicates problems either within the power supply or in one of the modules it is supporting. The fuse on the 6 RU frame can be replaced; however, the cause of the fuse failure should first be determined.

F1 Fuse Replacement

To replace the F1 fuse in the 6 RU frame power supply module, complete the following steps:

1. Remove the two (2) captive screws that secure the power supply in the MCF frame, and remove the power supply from the frame.
2. Place the power supply on a flat, static-free work surface.
3. Unscrew the five (5) crosshead screws that secure the metal plate that covers the component side of the power supply. See Figure 5-1.
4. Remove the nut that holds the plate at the rear of the power supply (beside the bottom rear connector).
5. Remove the plate and locate F1. It is a tall cylinder located beside the bottom rear connector.
6. Using a small straight-blade screwdriver, push down and twist (1/4 turn counterclockwise) the top of the fuse cylinder.
7. Lift the open fuse out of the fuse holder and replace it with the appropriate fuse:

   F1 – AC Supply=8A(F), 250V
   F1 – DC Supply=15 A(F), 250V
8. Reinstall the cover plate making sure the nut and five (5) crosshead screws are all tightly secured.

9. Replace the power supply module into your MCF frame, and resume operation.

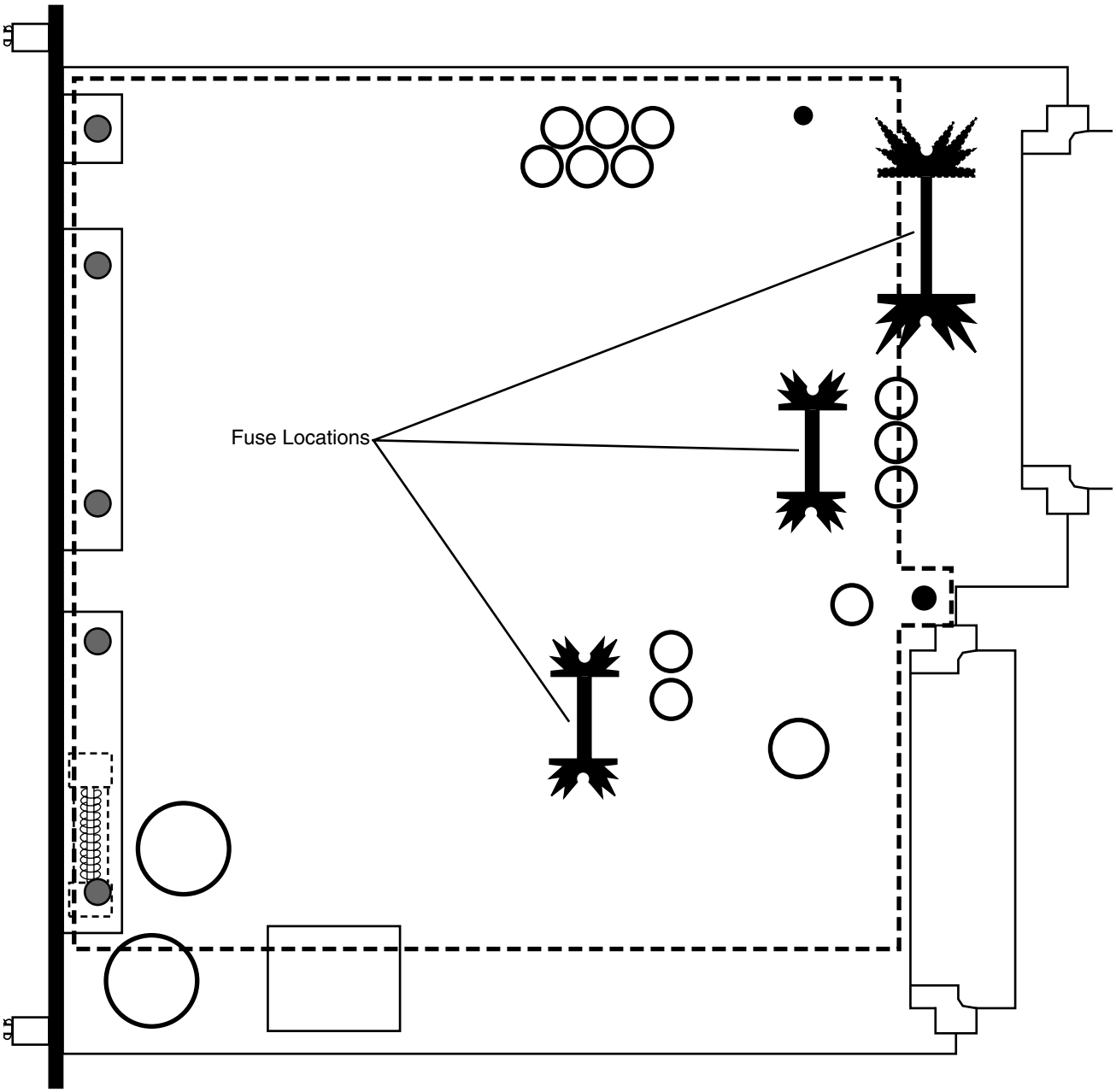


Figure 5-1. Power Supply Fuse Replacement

F2 Fuse Replacement

To replace the F2 fuse in the 6 RU frame power supply module, complete the following steps:

1. Locate F2 at the front edge of the power supply. See Figure 5-1.

2. Using a small screwdriver, remove the fuse from the fuse clips.
3. Replace the open fuse with the following replacement fuse:

   F2 – AC or DC Supply=8A(F), 250V

4. Reinstall the cover plate making sure the nut and five (5) crosshead screws are all tightly secured.
5. Replace the power supply module into your MCF frame, and resume operation.

Power Supply Service for the 2 RU Frame

The 2 RU power supply is not field serviceable. If either fuse requires replacing in your power supply, return it to the Customer Service location nearest you, or ship the unit to the Customer Service address located on the copyright page in this manual.

Troubleshooting

Table 5-1 is a Troubleshooting table that is divided into Symptoms, Probable Causes, and Corrective Actions. It lists some of the more common fault conditions which may occur with the MCF System. Where a symptom may have more than one probable cause or where there may be more than one corrective action, listing is hierarchical.

Note that Table 5-1 is divided into categories starting with general items followed by specific assemblies. The MCF System has been designed to provide indications of fault conditions. Refer to Section 3, "Controls and Indicators," while using Table 5-1.

Table 5-1. MCF System Troubleshooting

Symptom	Probable Cause	Corrective Action
General		
Everything looks in order, but no Video and/or Audio	Time Slot assignments set incorrectly	Check time slot assignments and correct as needed
Fiber Transmitter Module		
Laser Power LED on	Laser or laser driver bad	Replace Fiber module
Module Temp LED on	1. Air flow to unit blocked 2. Fan assembly bad	1. Ensure unrestricted air flow to unit 2. Replace fan assembly

Table 5-1. MCF System Troubleshooting - (continued)

Symptom	Probable Cause	Corrective Action
Comm. with either Craft or Administration Port absent or intermittent	1. Module ID set incorrectly	1. Only in RS-485 mode (Use Craft port to determine ID)
	2. Baud rate or parity incorrect	2. Reset Baud Rate/Parity DIP switch (Craft port only)
	3. Fiber module bad	3. Replace Fiber module
	4. Operational switches set incorrectly	4. Reset operational switches
Minor Alarm LED on	1. One of the redundant power supplies is bad	1. Replace power supply
	2. Temperature out of limits	2. See module temperature
	3. Laser end of life	3. Replace Fiber module
Fiber Receiver Module		
Module Temperature LED on	1. Airflow to unit blocked	1. Ensure unrestricted air flow to unit
	2. Fan assembly bad	2. Replace fan assembly
	3. Loss of power	3. Replace Fiber module
Comm. with either Craft or Administration port absent or intermittent	1. Module ID set incorrectly	1. Only in RS-485 mode (use Craft port to determine module identity)
	2. Baud rate or parity incorrect	2. Reset baud rate/parity DIP switch (Craft port only)
	3. Fiber module bad	3. Replace Fiber module
	4. Operational switches set incorrectly	4. Reset operational switches
Input Power LED flashing green	Optical input power too high	Insert fiber attenuation into line
Input Power LED is amber	Bit error rate exceeds limits	Check for reason bit error rate is excessive
Input Power LED is red	Optical input power is too low	Check for reason of excessive optical path loss
Video and/or Audio errors or module inoperative	Jumper at J401 (MODE) set incorrectly	Set jumper across pins 1–6 (normal)
Major Alarm LED on	No optical input	1. Check fiber cable, replace as needed
		2. Replace Fiber module
Minor Alarm LED on	1. Optical input power too high	1. Insert fiber attenuation into line
	2. One of the redundant power supplies has failed	2. Replace power supply
	3. Temperature is out of limits	3. See module temperature

Table 5-1. MCF System Troubleshooting - (continued)

Symptom	Probable Cause	Corrective Action
Video Input Module		
Clip LED on continuously or intermittently	1. No termination 2. DC Restore not enabled 3. Level too high	1. Use external termination, or set jumper to INTERNAL 2. Enable DC Restore jumper 3. Check incoming (source) signal, or from front panel MONITOR connector, set level for 1 V_{p-p}, or replace Video module
Quiet LED on when video should be present on input connectors	1. Input is absent 2. Bad Video Input module	1. Check connector cables 2. Replace Video Input module
Online LED off	Time slot assignment muted	Reset time slot assignment
Video bounces and/or sync compressed	DC Restore not enabled	Enable DC Restore jumper
Video Output Module		
Clip LED on continuously or intermittently	1. Clipping at Video Input module 2. Channel degraded 3. Video Output module bad	1. Check operation of Video Input module 2. Check Bit Error Rate 3. Replace Video Output module
Quiet LED on when video should be present on input connectors	1. Input is absent 2. Bad Video Input module	1. Check connector cables 2. Replace Video Input module
LOS LED on	1. Video Input module fault 2. Time slot assignment muted	1. Check for presence of Video Input module 2. Reset time slot assignment
Online LED off	Time slot assignment muted	Reset time slot assignment
Video bounces	DC Restore not enabled	Enable DC Restore jumper
Audio Input Module		
Clip LED on	Input level overdriving A/D converter	1. Check input termination 2. Check Gain setting on front panel
Quiet LED on when audio should be present	Input is absent	Check input cables and connectors
Online LED off	Time slot assignment muted	Reset time slot assignment
Audio Output Module		
Clip LED on	Clipping at Audio Input module	Check operation of Audio Input module
Quiet LED on when audio should be present	Input at Audio Input module is too low	Check operation of Audio Input module
LOS LED on	No valid data stream at input	Check time slot assignments of Audio Input and Output modules (correct as needed)
Online LED off	Time slot assignment muted	Reset time slot assignment

Table 5-1. MCF System Troubleshooting - (continued)

Symptom	Probable Cause	Corrective Action
Combined Video/Audio Input Module (Video)		
Clip LED on continuously or intermittently	1. No termination 2. DC Restore not enabled 3. Level too high	1. Use external termination, or set jumper to INTERNAL 2. Enable DC Restore jumper 3. Check incoming (source) signal, or from front panel MONITOR connector, set level for 1 V_{p-p}, or replace Video/ Audio module
Quiet LED on when video should be present on input connectors	1. Input is absent 2. Bad Video Input module	1. Check connector cables 2. Replace Video/Audio Input module
Online LED off	Time slot assignment muted	Reset time slot assignment
Video bounces and/or sync compressed	DC Restore not enabled	Enable DC Restore jumper
Combined Video/Audio Input Module (Audio)		
Clip LED on	Input level overdriving A/D converter	1. Check input termination 2. Check Gain setting on DIP switch
Quiet LED on when audio should be present	Input is absent	Check input cables and connectors
Online LED off	Time slot assignment muted	Reset time slot assignment
Combined Video/Audio Output Module (Video)		
Clip LED on continuously or intermittently	1. Clipping at Video/Audio Input module 2. Channel degraded 3. Video/Audio Output module bad	1. Check operation of Video/Audio Input module 2. Check Bit Error Rate 3. Replace Video/Audio Output module
Quiet LED on when video should be present on input connectors	1. Input is absent 2. Bad Video Input module	1. Check connector cables 2. Replace Video/Audio Input module
LOS LED on	1. Video/Audio Input module fault 2. Time slot assignment muted	1. Check for presence of Video/Audio Input module 2. Reset time slot assignment
Video bounces	DC Restore not enabled	Enable DC Restore jumper
Combined Video/Audio Output Module (Audio)		
Clip LED on	Clipping at Video/Audio Input module	Check operation of Video/Audio Input module
Quiet LED on when audio should be present	Input at Video/Audio Input module is too low	Check operation of Video/Audio Input module
LOS LED on	No valid data stream at input	Check time slot assignments of Audio Input and Output modules (correct as needed)
Online LED off	Time slot assignment muted	Reset time slot assignment
Serial Digital Module (Audio)		
One or Both 1/2 and 3/4 Audio Channel LEDs (green) are off	1. No audio time slots assigned or they have been muted	1. Assign time slots or turn off muting
One or Both Audio Present LEDs (green) for Channel 1/2 or 3/4 are off	Invalid or missing ASE/EBU audio input stream	Check Input audio signal

Table 5-1. MCF System Troubleshooting - (continued)

Symptom	Probable Cause	Corrective Action
One or Both Audio LOS LEDs (amber) lit for Channel 1/2 or 3/4	1. Input module unplugged 2. No data on the bus 3. Muted time slots on Input module	1. Plug in the Input module 2. Check time slot assignment 3. Turn muting off for the Input module
Serial Digital Module (Video) – both Input and Output		
270 MB/S or 143 MB/S mode LED (green) lit but no video out or video is poor	1. 270/143 Mbps jumper set incorrectly 2. No valid 270 MBS component or 143 MBS NTSC composite video present 3. 12 slot mode selected instead of 6 slot mode	1. Change jumper on Input module to match the type of video, 270 Mbps component or 143 Mbps NTSC composite 2. Apply input or correct time slot assignments 3. Check jumpers on Input and Output modules and change if necessary
Video Online LED (green) is off	1. No time slots assigned or they have been muted 2. No incoming video	1. Assign time slots or remove muting 2. Check video connection on Input module
Video Present LED (green) is off	No incoming video or incompatible format	Check that jumper setting on Input module matches source type (270 Mbps or 143 Mbps)
Video LOS LED (amber) lit	1. Input module unplugged 2. No valid data on bus 3. Muted time slots on Input module	1. Plug in the Input module 2. Check time slot assignments 3. Turn muting off for the Input module
Video/Audio Diplexer Input Module (Video & Audio)		
Amber Video Clip LED on continuously or intermittently	1. No termination 2. DC Restore not enabled 3. Level too high	1. Use external termination, or set jumper to INTERNAL 2. Set DC Restore jumper to on 3. Check incoming (source) signal, or from front panel MONITOR connector, set level for 1 V_{p-p}, or replace module
Green Video Quiet LED on when video should be present on input connectors	1. Input is absent 2. Bad Input module	1. Check connector cables 2. Replace module
Green Video Online LED off	Time slot assignment muted or module is inoperative	1. Reset time slot assignment 2. Check the video signal to the bus
Video bounces and/or sync compressed	DC Restore not enabled	Set DC Restore jumper to on
Amber Audio Clip LED on for A or B	Input level overdriving above +18 dBm	1. Check input termination 2. Check Gain setting on DIP switch
Green Audio Quiet LED on when audio should be present	Input is absent	Check input cables and connectors

Table 5-1. MCF System Troubleshooting - (continued)

Symptom	Probable Cause	Corrective Action
Green Audio Online LED off for A or B	Subcarriers are muted or inoperative	1. Turn off muting for the Input module 2. Enable subcarriers with DIP switch selection
Seeing a high frequency boost in video	Front panel EQ pot is not turned off	Turn front panel EQ pot fully clockwise
Audio/Video Diplexer Output Module (Audio & Video)		
Amber Video Clip LED on continuously or intermittently	1. Clipping at Input module 2. Channel degraded 3. Output module bad	1. Check operation of Input module 2. Check Bit Error Rate 3. Replace Output module
Green Video Quiet LED on when video should be present on input connectors	1. Input is absent 2. Bad Video Input module	1. Check connector cables 2. Replace Input module
Amber Video LOS LED on	1. Input module fault 2. Time slot assignment muted	1. Check for presence of Input module 2. Reset time slot assignment
Green Video Online LED off	Input module is muted or inoperative	1. Turn off muting for the Input module 2. Check the video signal to the bus
Video bounces	DC Restore not enabled	Enable DC Restore jumper
Amber Audio Clip LED on for A or B	Input level overdriving above +18 dBm	1. Check input termination 2. Check Gain setting on DIP switch
Green Audio Quiet LED on when audio should be present	Input is absent	Check input cables and connectors
Amber Audio LOS LED on for A or B	1. Input module is muted or inoperative. 2. Subcarriers not present	1. Turn off muting for the Input module or check the audio signal to the bus 2. Enable subcarriers with Input module DIP
Green Audio Online LED off for A or B	1. Muted time slots on Input module for that audio channel 2. Invalid audio input stream	1. Turn muting off for the Input module 2. Check Input audio signal to the bus
Seeing a high frequency boost in video	Front panel EQ pot is not turned off	Turn front panel EQ pot fully clockwise
Power Supplies		
Green LEDs for both supplies Off	Source power not available	1. Ensure power cord(s) connected 2. Reset source power breaker
Green LED for one supply Off	1. Power supply not seated 2. Power supply fuse blown 3. Power not getting to power supply 4. Power supply bad	1. Remove and reseat 2. Replace fuse 3. Ensure power cord(s) connected or reset source power breaker 4. Replace power supply

Service Information

The following provides service and warranty information on the MCF Series System.

Obtaining Service

If repairs are needed and you did not obtain your equipment directly from Tektronix, please contact the distributor from whom your equipment was purchased. In countries other than the United States, always contact your distributor.

If repairs are needed and you obtained your equipment directly from us, contact the Tektronix Service Center at the telephone number noted on the reverse side of the title page of this manual. The service representative will give you directions for returning the equipment.

Note Out-of-warranty repairs cannot begin until a valid purchase order number has been provided.

24-Hour Turnaround Time

Twenty-four hour service can be arranged for an additional charge. It must be requested at the time return instructions are obtained.

Return Packaging

Place equipment in the original shipping carton, or another container which will provide adequate protection against shipping damage.

Shipping Charges

All shipping and related charges are the responsibility of the customer. The Tektronix Group pays shipping only when returning equipment after warranty-covered repairs are made. Tektronix's return address is located at the front of this manual.

Replacement Parts Information

Circuit modules in the MCF system are densely populated with surface mount and ASIC components. Special tools and techniques are required to safely and effectively troubleshoot and repair modules that use SMT or ASIC components. For this reason, service and repair of Tektronix products

incorporating surface mount technology are supported only on a module exchange basis. Customers should not attempt to troubleshoot or repair modules that contain SMT components. Tektronix assumes no liability for damage caused by unauthorized repairs. This applies to both in- and out-of-warranty products.

Ordering Parts From Tektronix

To obtain Tektronix manufactured or selected replacement parts contact the nearest Tektronix sales office or send your order directly to:

Tektronix, Inc.
Customer Service
P.O. Box 1114
Grass Valley, CA 95945 USA

For the fastest service, you should order replacement parts from the Equipment Parts List found in Table 5-2.

Table 5-2. MCF Equipment Part List

Model Number	Model Description
CMCF–FM–6 MCF–FM–2	Frame, 6 RU, (slots for 2 PS, 9 Input/Output and 1 Fiber module) Frame, 2 RU, (slots for 2 PS, 2 Input/Output and 1 Fiber module)
CMCF–PS6–AC MCF–PS2–AC	Power Supply, 6 RU, US Cord Power Supply, 2 RU, US Cord
MCF–PS6–ACINT MCF–PS2–ACINT	Power Supply, 6 RU, Export Cord Power Supply, 2 RU, Export Cord
CMCF–PS6–DC MCF–PS2–DC	Power Supply, 6 RU, –48VDC Power Supply, 2 RU, –48VDC
CMCF–FT–H1306FC MCF–FT–H1306SC MCF–FT–H1306ST	Fiber Transmitter,1300nm, 0dBm, FC Connector Fiber Transmitter,1300nm, 0dBm, SC Connector Fiber Transmitter,1300nm, 0dBm, ST Connector
MCF–FT–1506FC MCF–FT–1506SC MCF–FT–1506ST	Fiber Transmitter,1550nm, 0dBm, FC Connector Fiber Transmitter,1550nm, 0dBm, SC Connector Fiber Transmitter,1550nm, 0dBm, ST Connector
CMCF–FR–06FC MCF–FR–06SC MCF–FR–06ST	Fiber Receiver, –23 dBm,1300/1550nm, FC Connector Fiber Receiver, –23 dBm,1300/1550nm, SC Connector Fiber Receiver, –23 dBm,1300/1550nm, ST Connector
MCF–FR–H06FC MCF–FR–H06SC MCF–FR–H06ST	Fiber Receiver, –29 dBm,1300/1550nm, FC Connector Fiber Receiver, –29 dBm,1300/1550nm, SC Connector Fiber Receiver, –29 dBm,1300/1550nm, ST Connector
MCF–VAI–10B MCF–VAO–10B	Combined Video/Audio Input, 10-bit video/18-bit audio, Baseband Combined Video/Audio Output, 10-bit video/18-bit audio, Baseband
CMCF–VI–10B CMCF–VO–10B	Video Input, 10-bit, Baseband Video Output, 10-bit, Baseband
CMCF–AI–184 CMCF–AO–184	Audio Input, 18-bit, Dual Stereo Pair (4 Ch.) Audio Output, 18-bit, Dual Stereo Pair (4 Ch.)
MCF-SDI MCF-SSDO	Serial Digital Input Serial Digital Output

Table 5-2. MCF Equipment Part List - (continued)

Model Number	Model Description
MCF-VDX1 MCF-VDX0	Video/Audio Diplexer Input Video/Audio Diplexer Output
CMCF–AV1 CMCF–PD1	Active Vent, 1 RU Passive Deflector and Filter, 1 RU
MCF–BRK–236 MCF–BRK–232	23" Rack Mounting Bracket, 6 RU 23" Rack Mounting Bracket, 2 RU
MCF–EXT	Extender board
MCF–MN–10 MCF–MN–I/S MCF–MN–OPER	MCF Manual Set – Operation manual, Installation/Service manual, and Quick Reference Guide Installation Manual Operation Manual
MCF–ATT–FC0 MCF–ATT–FC5 MCF–ATT–FC10 MCF–ATT–FC15	Attenuator, 0dB, FC Connector Attenuator, 5dB, FC Connector Attenuator, 10dB, FC Connector Attenuator, 15dB, FC Connector
MCF–ATT–SC0 MCF–ATT–SC5 MCF–ATT–SC10 MCF–ATT–SC15	Attenuator, 0dB, SC Connector Attenuator, 5dB, SC Connector Attenuator, 10dB, SC Connector Attenuator, 15dB, SC Connector
MCF–ATT–ST5 MCF–ATT–ST10 MCF–ATT–ST15	Attenuator, 5dB, ST Connector Attenuator, 10dB, ST Connector Attenuator, 15dB, ST Connector
HB9054-00 HB9055-00	Hybrid Cable Equalizer (500 feet, 8281) Hybrid Cable Equalizer (500 feet, 8281)

Parts Substitution

Some components may be different from the descriptions in the Functional Description. This occurs because Tektronix sometimes uses alternative suppliers to ensure prompt delivery. Substitute parts will not alter or compromise the performance or the reliability of the equipment.

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