Optiva DVI

Product Manual & User's Guide

OTP-1DVIT2AT
OTP-1DVIR2AR

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Optiva DVI Product Manual & User's Guide

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Table of Contents

Introduction

In This Chapter

This chapter contains the following sections:

- Overview
- OTP-1DVIT2AT Functional Block Diagrams
- OTP-1DVIR2AR Functional Block Diagrams
- Documentation Terms and Conventions

A Word of Thanks

Congratulations on choosing Optiva Optical Converters. By choosing an Optiva product, you have joined a growing family of professionals who appreciate the enhanced performance and ultimate versatility that Optiva products provide. Your Optiva cards are part of a full line of video transport and processing products within the Optiva Platform. This fiber optic transport system is backed by EMCORE's experience in engineering and design expertise since 1984.

The engineers at Emcore have designed your new OTP-1DVIT2AT and OTP-1DVIR2AR cards to conveniently fit into your overall working environment. Our commitment to product excellence allows us to design products that provide the highest performance quality, reliability and versatility in their respective product categories.

Should you have a question about the installation or operation of your Optiva cards, please contact us at the numbers listed on the front of this manual.

Overview

Optiva OTP-1DVIT2AT and OTP-1DVIR2AR cards are capable of carrying digital or analog video signals across a wide variety of resolutions up to 2560x1600. With support for both VESA and SMPTE video signals, the OTP-1DVIT2AT and OTP-1DVIR2AR are the ideal solution for professional video/audio and optionally, KVM applications.

The OTP-1DVI2A cards provide the ability to transport digital video signals over a fiber optic link, providing longer transport distances. The electrical to optical (OTP-1DVIT2AT) and optical to electrical (OTP-1DVIR2AR) conversions use specific small form-factor pluggable (SFP) transceivers.

The transmit card accepts DVI, VGA, RGBHV, RGsB (sync on green) or Component YPbPr as an input signal and will output any of those signals on the receiver card allowing for seamless format conversion across the fiber link. LED indicators on the front of the card identifies incoming video and displays the status of the optical link.

The OT-CC or OT-DTCR series enclosures are used with OTP-1DVI2A products. The transmitter and receiver each occupy 1 slot in any of the enclosures. Using the OT-CC-16 allows up to 16 channels of video in a 3RU space. The XX designator at the end of the model number is meant to indicate one of SC, FC, ST or LC optical connectors.

Features

The following features are standard for Optiva OTP-1DVIT2AT and OTP-1DVIR2AR cards.

- Uses all-digital processing for crystal clear picture with no signal degradation
- Convert Analog -> Digital or Digital -> Analog across the fiber optic link
- Keyboard/Mouse/Serial Data Extension (KVM) (See model: OTP-1DVI2A1D1KM)
- Multimode or Singlemode fiber options (up to 43 miles/70 km over one fiber)
- Supports single / dual-link DVI resolutions up to 2560 x 1600
- Supports VGA resolutions up to 1920 x 1200
- Supports Component Video (YPbPr) up to 1080p
- H & V Sync Frequency range of 50 to 85 Hz
- 1/8" (2.5mm) Stereo Audio Connector
- Standard DVI-I video connector
- Choice of optical connectors (LC, SC, FC, ST)
- Choice of enclosure styles
- 3-Year Warranty

Optiva DVI Model Numbers

Optiva model numbers are coded to indicate the number and types of signals supported as well as the direction in which they may be transported over optical fiber. The model number is also is encoded with the type of optics that are used in the link (see "Optical Codes," page 35).
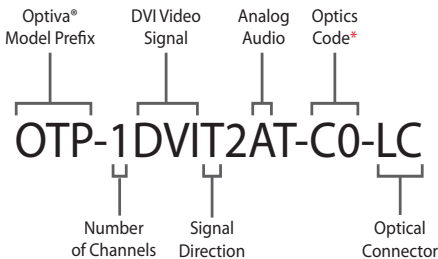
* For additional optics codes, see the "Optical Codes" section on Pg. 34

Figure 1.1: Optiva DVI / Audio Model Number Analysis
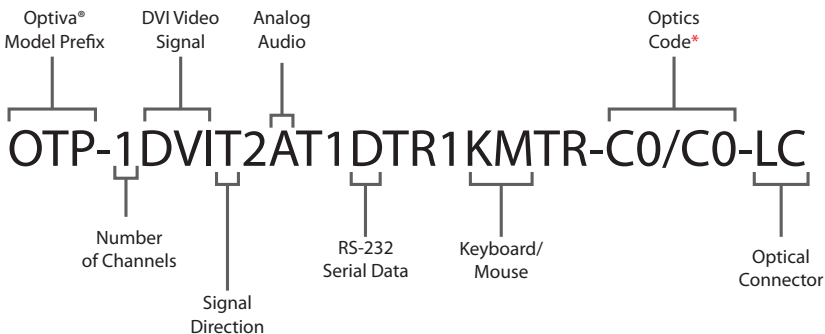
Figure 1.2: Optiva DVI / Audio / KVM Model Number Analysis

Signal Codes

Each Optiva model includes a "T" (for Transmit), "R" (for Receive), "TR" (for Transmit and Receive, i.e. Duplex Operation), or "RT" (for Receive and Transmit, i.e. Duplex Operation in the reverse side) to indicate the function carried out by each card. These codes also indicate the connection sequence of the electrical signals for optical transmission.

Documentation Terms & Conventions

The following terms and conventions are used throughout this manual:

- "Chassis" or "Enclosure" refers to the OT-CC or OT-DTCR frame that houses the Optiva cards.

- "Module", and "Card" refer to Optiva pluggable devices within Optiva enclosures, including all components and switches.

- "System" and "Video system" refer to the mix of interconnected production and rack equipment in your environment.

- The "Operating Tips" and "Note" boxes are used throughout this manual to provide additional user information.

Installation

Before You Begin

Before proceeding with the instructions in this chapter, make sure that your Optiva chassis is properly installed according to the instructions in the Optiva Series Product Manual.

Static Discharge

When installing your Optiva product, please be aware that static electricity is a potential cause of damage to any electronic device:

ESD Susceptibility
Static discharge can cause serious damage to sensitive semiconductor devices. Avoid handling circuit boards in environments where static electricity can be generated (such as carpeted areas and when wearing synthetic fiber clothing). Always exercise proper grounding precautions when working on circuit boards and related equipment.

Unpacking

Carefully unpack each Optiva card from its shipping container. If the unit is damaged or items are missing, contact your sales representative or EMCORE directly.

Working with Fiber Optic Connectors

Keep the following in mind when working with fiber optic connectors:

- You must clean a connector every time you insert it into a device or mating sleeve. All exposed surfaces of the ceramic ferrule must be clean. Follow standard professional practices for cleaning fiber optic connectors.

- Connectors must always be inserted into a device or have a dust cap on.

- A poor optical connection is often similar to a poor electrical connection. If you experience poor optical performance, try removing the connector, cleaning it thoroughly and then reinserting it. A bad connection can result in signal instability, high loss, or a noisy signal.

Installing Optiva Cards

This section describes how to properly install a card into an Optiva chassis.

⚠ **Important Laser Safety Measures:**
Turn off all laser sources before attempting installation.

High power visible or invisible (infrared, ultraviolet) laser light can cause permanent eye injury. Never look down the barrel of a connected fiber or device transmitting an optical signal as it is potentially damaging.

CAUTION

LASER RADIATION
AVOID DIRECT EXPOSURE

CLASS 1 LASER PRODUCT

Use the following procedure to install Optiva cards in an Optiva chassis:

1. Ensure that the exposed surface of the ceramic ferrule of the connector is clean. Refer to the section "Working with Fiber Optic Connectors" on page 10 for more information.

2. Hold the card by the edges and carefully align the card edges with the slots in the frame.

3. Fully insert the card into the frame until the rear connection plug is properly seated in the chassis backplane. You will feel a click when the card is properly mated with the backplane. Make sure that the EMI gaskets (if present) do not snag or get bent during this process.

4. Tighten the 2 screws on the top and bottom to secure the card in the slot.

5. Remove the dust cap from the fiber port connector on the card faceplate.

6. When the card's RED LED is lit on each card, it means power is present. Note that on unidirectional fiber links the RECEIVER's GREEN LED will not light until optical link communication is obtained.

7. Ensure the ceramic ferrule of the fiber port connector is clean.

8. Cable the insert card as outlined in the section "Cabling for the OTP-1DVIT2AT and OTP-1DVIR2AR" on page 12.

This completes the proper installation of Optiva cards in an Optiva Platform chassis.

Cabling for OTP-1DVIT2AT and OTP-1DVIR2AR Cards

This section provides information for connecting cables to the installed insert cards in the Optiva Platform enclosure. Connect the input and output cables as indicated in the following diagrams.

The optical connectors are designed for a direct interface connection. All fiber interfaces are either singlemode or multimode fibers; please refer to the Optical Code chart to confirm fiber type.

The OTP-1DVI has DVI-I Dual link connector and will work with any standard single (provided with the product) or dual link cables.

For VGA, an adapter is required (provided with the product).

> **Notice:**
> Every time you are required to insert a fiber connector into a device or mating sleeve, you must clean the connector. All exposed surfaces of the ceramic ferrule must be clean. Follow your facility practices of cleaning fiber optic connectors.

OTP-1DVIT2AT Cabling Overview

The OTP-1DVIT2AT provides the following connections:

DVI, RGBHV or YPbPr Input (May require adapter)

Stereo Analog Audio Input

Keyboard, Mouse & RS-232 Input

Optical Output (ST, FC, ST or LC)
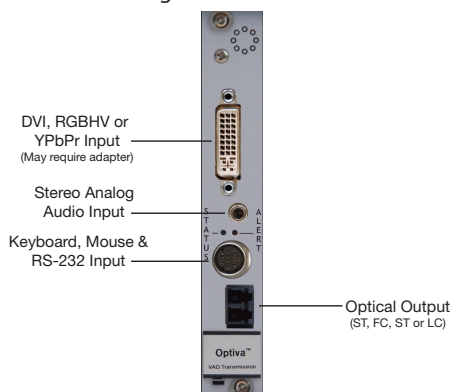
OTP-1DVIR2AR Cabling Overview

The OTP-1DVIR2AR has the following connections available:

DVI, RGBHV or YPbPr Output (May require adapter)

Stereo Analog Audio Output

Keyboard, Mouse & RS-232 Output

Optical Input (ST, FC, ST or LC)
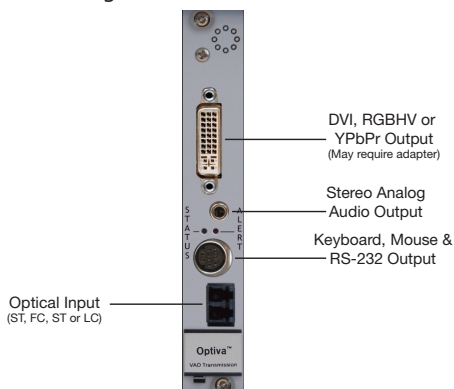
Powering on OTP-1DVIT2AT and OTP-1DVIR2AR Cards

This section provides instructions for powering up your Optiva cards for the first time.

Initial Power Up

Important: Please use the installation procedure below. Improper or no operation may result if the start-up sequence is not correctly followed.

Step 1 :

Verify that the system power is off.

Make sure that insert card is properly inserted and the card is seated in the enclosure.

Remove the optical dust cover(s) and connect optical port (LC/FC/DLC/ST/SC) to appropriate fiber cable (SMF or MMF {50μm or 62.5μm}).

Make sure the connectors are fully engaged. If your system has Dual LC connectors please follow the label on the side of the Optiva card for fiber polarity (TX vs RX) and connect the TX port on the Transmitter to the RX port of the receiver side.

Step 2:

With system power turned off, connect the Transmitter unit to the source by the appropriate cable (see "User Control" Chapter). A single link DVI-D copper cable and VGA to DVI-I adapter are included with the product.

If your Optiva DVI product configuration includes Keyboard, Mouse and Data (RS-232) you should also make the appropriate electrical connections at this time for the signals you wish to use (Keyboard/Mouse cables are included only when you order a KVM option). You must connect the transmitter's Keyboard/Mouse cables to the computer while it's off, so that proper input device detection will occur.

Step 3:

In the same way as above, connect the Receiver unit to the monitor/display. If your Optiva DVI product configuration includes Keyboard, Mouse and RS-232 Data, please connect your peripherals to the provided breakout cable and plug it into the Optiva DVI Receiver unit.

Step 4:

Turn the enclosure power for the transmitter/receiver unit on and verify that status LEDs on transmitter and receiver are green. Turn on your input source and output monitor. Based on the connected cable type the system will auto detect and determine your video mode, then it will pass the video signal from the source to the display.

Important note: It is essential to use the correct cable, otherwise the system will pass a video mode that may not be compatible with the display. For manual cable configurations, please refer to the section "Operational Modes" on page 15.

This completes the procedure to powering on the OTP-1DVIT2AT and OTP-1DVIR2AR. Your system is now operational and ready for use.

User Controls

In This Chapter

This chapter provides a general overview of the user controls available on the Optiva OTP-1DVI-T2AT and OTP-1DVIR2AR cards.

The following topics are discussed:

- Operational Modes
- Dip Switch Settings

Operational Modes

The transmit card can operate with one of four video source types: DVI, RGBHV, RGsB (sync on green) or Component (YPbPr) Video. By default, the card will attempt to auto-detect the mode based on the type of cable present at the video input connector as follows:

Operating modes:

1. Cable Auto-detect (Factory Default)

2. DVI-D

3. RGBHV / VGA (requires VGA to DVI adapter)

4. YPbPr (requires BNC to DVI or RCA to DVI adapter)

5. RGsB (requires BNC to DVI or RCA to DVI adapter)

If the system is cabled in a manner that does not support auto-detection (for example, using a DVI-I cable to pass RGBHV), the video operation mode may be "forced" by setting Dip Switches 1–4 as shown in the tables that follow on page 16.
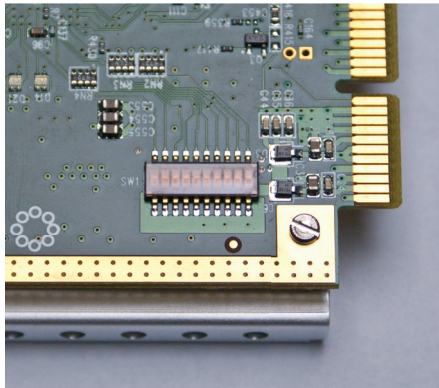
Figure 2.1: Dip Switches are located on the back corner of Optiva Insert Cards

Also note that for auto detection of DVI or RGBHV to function properly, the DVI cable or adapter must have 5VDC present on pin 14 (DDC power). Most modern PC video cards provide this signal. However, some other sources such as scalers and switches may not connect this pin, so the Dip Switches need to be set correctly to one of the "forced modes."

OTP-1DVIT2AT Dip Switch Settings

Auto Cable Detection (Factory Default Setting) Dip Switch 1-4									
Hex	Dip Switch #					Input Cable			
	4	3	2	1	Input Signal	DVI-I	DVI-D	VGA (DVI-A)	Component (5V DDC not present)	RGsB (5VDDCnot present)
0	Off	Off	Off	Off	DVI-D	✓	✓			
					VGA			✓		
					Component (YPbPr)				✓	✓
					RGsB				✓	✓

Force RGBHV signal									
Hex	Dip Switch #					Input Cable			
	4	3	2	1	Input Signal	DVI-I	DVI-D	VGA-5BNC (Adaptor required)	Component (5V DDC not present)	RGsB (5VDDCnot present)
5h	Off	On	Off	On	RGBHV	✓		✓		

Force DVI-D signal									
Hex	Dip Switch #					Input Cable			
	4	3	2	1	Input Signal	DVI-I	DVI-D	VGA (DVI-A)	Component (5V DDC not present)	RGsB (5VDDCnot present)
7h	Off	On	On	On	DVI-D	✓	✓			

Force Component YPbPr									
Hex	Dip Switch #					Input Cable			
	4	3	2	1	Input Signal	DVI-I	DVI-D	VGA (DVI-A)	Component (5V DDC not present)	RGsB (5VDDCnot present)
9h	On	Off	Off	On	Component	✓		✓	✓	✓

Force RGsB									
Hex	Dip Switch #					Input Cable			
	4	3	2	1	Input Signal	DVI-I	DVI-D	VGA (DVI-A)	Component (5V DDC not present)	RGsB (5VDDCnot present)
13h	On	On	Off	On	RGsB	✓		✓	✓	✓

DIP Switch # 10: Shall be on when duplex optics is selected, this enables bidirectional link.

This is applicable for bidirectional optics only!

DIP Switch # 9: When on it prevents EDID copy.

Dip Switch # 8, 7, 6, 5: Reserved - should be in off position.

OTP-1DVIR2AR Dip Switch Settings

The Optiva DVI system converts video input from the transmit side into any selected video formats on the receive side.

Operating modes:

1. Cable Auto-detect (Factory Default)

2. DVI-D

3. RGBHV / VGA (Requires DVI-to-VGA adapter)

4. YPbPr (Requires DVI-to-BNC adapter)

5. RGsB (Requires DVI-to-VGA adapter)

6. Color space conversion

Factory Default Setting of Dip-Switch 1- 6											
Hex	Dip Switch#						Incoming VideoSignal	Output Cable/Signal:			
	6	5	4	3	2	1		DVI-I	DVI-D	VGA	Component (YPbPr)	RGsB (5V DDC not present)
0	Off	Off	Off	Off	Off	Off	DVI-D	DVI-D	DVI-D	VGA	Component	
							RGsB	DVI-D	DVI-D	VGA	Component (YPbPr)	
							Component (YPbPr)	DVI-D	DVI-D	VGA	Component (YPbPr)	
							RGsB	DVI-D	DVI-D	VGA		RGsB

Force DVI-D signal on the output (automatically converts incoming BT.601 stream to RGsB)									
#	Dip Switch #						Incoming Video Signal	Output Connector	
	6	5	4	3	2	1		DVI-I	DVI-D
01h	Off	Off	Off	Off	Off	On	DVI-D	DVI-D	DVI-D
							VGA	DVI-D	DVI-D
							Component YPbPr	DVI-D	DVI-D

Force VGA (RGBHV) signal on the output (automatically converts incoming BT.601 stream to RGsB)								
#	Dip Switch #						Incoming Video Signal	Output Connector
	6	5	4	3	2	1		DVI-A (VGA w/5V DDC)
01h	Off	Off	Off	Off	Off	On	DVI-D	RGBHV
							VGA	RGBHV
							Component YPbPr	RGBHV

Force Component YPbPr signal on the output (automatically converts incoming BT.709 stream to RGsB)								
#	Dip Switch #						Incoming Signal	Output Connector
	6	5	4	3	2	1		Component (YPbPr) RCA
24h	On	Off	Off	On	Off	Off	ComponentYPbPr	Component YPbPr

Force Component YPbPr signal on the output (automatically converts incoming RGsB stream to BT.709 stream)								
#	Dip Switch #						Incoming Signal	Output Connector
	6	5	4	3	2	1		Component (YPbPr) RCA
34h	On	On	Off	On	Off	Off	DVI-D	Component YPbPr
							VGA	Component YPbPr

Force 'Digital Separate syncs' on the output (turn OFF Component video on the output)								
#	Dip Switch #						Incoming Signal	Output Connector	
	6	5	4	3	2	1		DVI-I	DVI-D
01h	Off	Off	Off	Off	Off	On	DVI-D	DVI-D	DVI-D
							VGA	DVI-D	DVI-D
							Component YPbPr	DVI-D	DVI-D

Dip Switch Settings for Color Space Conversion on RX card			
#	Dip Switch #		Notes
	6	5	4	
7h	On	On	On	Convert RGsB to BT.601 (on analog)
6h	On	On	Off	Convert RGsB to BT.709 (on analog)
5h	On	Off	On	Convert BT.601 to RGsB (on digital)
4h	On	Off	Off	Convert BT.709 to RGsB (on digital)
3h	Off	On	On	Convert BT.601 to RGsB (on both)
2h	Off	On	Off	Convert BT.709 to RGsB (on both)
1h	Off	Off	On	RESERVED
0h	On	Off	Off	AUTO

Dip Switch 10, 9, 8, 7: Reserved; should be in the off position .

Video Resolutions

In This Chapter

This chapter provides a summary of the video resolutions available for the Optiva card, including::

- DVI-D
- Component YPbPr
- RGBHV (VGA)

DVI-D

The following resolutions are supported when transporting a DVI-D signal:

#	Resolution	24Hz	25Hz	30Hz	50Hz	60Hz	72Hz	96Hz	100Hz	120Hz
1	640 x 480				✓	✓	✓	✓	✓	✓
2	800 x 600				✓	✓	✓	✓	✓	✓
3	852 x 480				✓	✓	✓	✓	✓	
4	1024 x 768				✓	✓	✓	✓		
5	1024 x 852				✓	✓	✓	✓		
6	1024 x 1024				✓	✓	✓			
7	1280 x 768				✓	✓	✓	✓		
8	1280 x 1024				✓	✓	✓			
9	1360 x 765				✓	✓	✓			
10	1365 x 768				✓	✓	✓			
11	1366 x 768				✓	✓	✓			✓
12	1365 x 1024				✓	✓				
13	1400 x 1050				✓	✓	✓			
14	1600 x 1200				✓	✓				
15	480p (720 x 483)				✓					
16	576p (720 x 576)			✓				✓		
17	720p (1280 x 720)	✓	✓	✓	✓					
18	1080i (1920 x 1080)	✓	✓	✓	✓					
19	1080p (1920 x 1080)	✓	✓	✓	✓					
20	1864 x 1050				✓	✓				
21	1680 x 1050			✓	✓					
22	1920 x 1200 (CVT)			✓	✓					
23	2048 x 1536				✓	✓				
24	2560 x 1600 (CVR2560D)			✓	✓					

* DMT, CVT, CVR resolutions supported

Component YPbPr

The following resolutions are supported when transporting a Component YPbPr signal:

480i, 480p, 576i, 576p, 720p, 1035i, 1080i and 1080p.

#	Resolution	24Hz	25Hz	30Hz	50Hz	60Hz	72Hz	96Hz	100Hz	120Hz
1	480i					✓				
2	480p					✓				
3	576i				✓					
4	576p				✓					
5	720p		✓	✓	✓	✓				
6	1035i			✓						
7	1080i		✓	✓	✓	✓				
8	1080p	✓	✓	✓	✓	✓			✓	✓

RGBHV (VGA)

The following resolutions are supported when transporting an analog RGBHV signal:

#	Resolution	25Hz	30Hz	50Hz	60Hz	72Hz	75Hz	Type
1	640 x 480			✓	✓		✓	DMT
2	720 x 576			✓	✓			576p/i
3	800 x 600			✓	✓	✓		DMT
4	1024 x 768			✓	✓		✓	CVT
5	1152 x 720			✓	✓		✓	CVT
6	1152 x 864						✓	DMT
7	1366 x 768			✓	✓		✓	CVT
8	1280 x 720			✓	✓			720p
9	1280 x 960			✓	✓			CVT
10	1280 x 1024				✓			DMT
11	1224 x 768						✓	CVT
12	1400 x 1050			✓	✓		✓	CVT
13	1536 x 960			✓	✓		✓	CVT
14	1680 x 1050				✓			DMT
15	1920 x 1080			✓	✓			1080p
16	1920 x 1080i	✓	✓					1080i
17	1864 x 1050				✓			CVT
18	1600x 1200			✓	✓			DMT/CVT

* DMT, CVT resolutions supported.

* For non-compliant VESA resolutions, please contact Emcore or use EDID copy function.

Video Mode Configuration

In This Chapter

This chapter provides an overview of the user settings/configurations available with your Optiva cards.

The following topics are discussed:

- Auto detection of video modes
- Cable types and DCC support
- EDID
- Loading EDID defaults (Factory Settings)

Auto Detection of Video Modes

EDDC (Enhanced Display Data Channel) is a communication protocol between HOST (DVI-RX card) and Computer Display. This protocol makes it possible for DVI-RX card to communicate with the DISPLAY device and understand its capabilities and supported graphic modes.

It is critical to use appropriate cable types when auto sensing video modes for DVI, VGA or component video applications. It is possible to force a mode of operation on DVI-TX card. Please refer the chapter on "DIP SWITCH Settings" on the previous pages.

For Quick reference (when auto-sensing the video format):

1. DVI-I cable defaults to DVI-D.
2. DVI-D cable defaults to DVI-D.
3. DVI-A cable defaults to VGA.
4. VGA cable (DDC +5V present) defaults to RGBHV.
5. VGA cable (DDC+5V missing) defaults to Component YPbPr mode.
6. RGBHV cable (DDC+5V missing) defaults to Component YPbPr mode.

Cables Types & DDC Support

This section reviews the various cable types, connectors and supported video modes.

DDC is supported for the following DVI/VGA cable types:
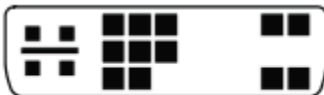
1. DVI-I Cable (supports DDC):

DVI-I (Single Link)
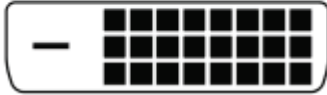
DVI-I (Dual Link)
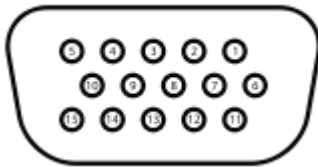
2. DVI-A Cable:

DVI-A

3. DVI-D Cable

DVI-D (Single Link)

DVI-D (Dual Link)

4. VGA Cable:

DDC is not supported for the following DVI/VGA cable types:
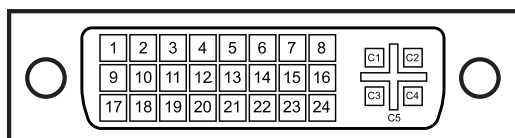
1. RGBHV (doesn't support DDC):

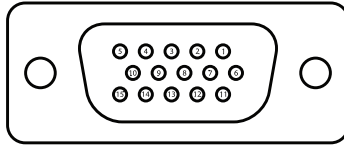2. Component YPbPr cable

3. RGsB cable

DDC Connections on DVI-I Dual Link Connector

Pin	Description
1	DVI TMDS PAIR #2 DATA 2-
2	DVI TMDS PAIR #2 DATA 2+
3	DVI TMDS DATA2/4 Shield
4	DVI TMDS PAIR #4 DATA 4-
5	DVI TMDS PAIR #4 DATA 4+
6	SCL (DDC Clock line)
7	SDA (DDC Serial Data line)
8	Analog vertical sync (VSync VGA)
9	DVI TMDS PAIR #1 DATA 1-
10	DVI TMDS PAIR #1 DATA 1+
11	DVI TMDS DATA 1/3 Shield
12	DVI TMDS PAIR #3 DATA 3-
13	DVI TMDS PAIR #3 DATA 3+
14	+5V DDC (critical for Optiva Video Format auto detection feature)
15	Ground (for +5V Power)
16	DVI Hot Plug Detect (critical for Optiva Video Format auto detection feature)
17	DVI TMDS PAIR #0 DATA 0-
18	DVI TMDS PAIR #0 DATA 0+
19	DVI TMDS DATA 0/5 Shield
20	DVI TMDS PAIR #5 DATA 5-
21	DVI TMDS PAIR #5 DATA 5+
22	TMDS CLOCK SHIELD
23	TMDS CLOCK+ DIGITAL CLOCK+ (for primary and secondary link)
25	TMDS CLOCK- DIGITAL CLOCK- (for primary and secondary link)
C1	Analog Red (Red VGA)
C2	Analog Green (Green VGA)
C3	Analog Blue (Blue VGA)
C4	Analog HSync (HSync VGA)

DDC Connections on VGA D-SUB Connector

Pin	Description
1	Red VGA
2	Green VGA
3	Blue VGA
4	Reserved
5	Ground
6	Red Ground
7	Green Ground
8	Blue Ground
9	+5V DDC (critical for Optiva Video Format auto-detection feature)
10	Sync Ground
11	Monitor ID0 (optional)
12	SDA (DDC Serial Data line)
13	HSync VGA
14	VSync VGA
15	SCL (DDC Clock line)

EDID

The Optiva DVI is pre-configured with factory EDID (extended display identification data) that addresses all supported resolutions.

However in some cases, there is a need to copy the EDID of the display into the TX side .

The following procedures describe how to re-program EDID.

Before proceeding:

1. DDC (+5V) power line, SCL (DDC Clock) line and SDA (DDC Serial Data) line are required to query the EDID of Display/Monitor.

2. Make sure that the DVI cable being used supports DDC lines.

Procedure

Copy EDID of DISPLAY to DVI-RX card.

This will emulate EDID (of DISPLAY) from DVI-RX card to DVI-TX card.

Note: this is done automatically

1. Install DVI-RX card in a chassis.

2. Make sure that DVI-RX card is POWERED OFF.

3. Use any DVI (or VGA) cable that supports DDC to make a connection between DVI-RX card and the Display.

4. POWER ON DVI-RX card.

5. As soon as the card POWERS-UP, the STATUS or ALERT LED will light up and display the (default) status of Optical Sync.

6. If new EDID data is available, the Green LED will blink on DVI-RX card indicating the progress of EDID-copy from DISPLAY device to DVI-RX card.

7. Once the EDID-copy process has completed, the Green LED stops blinking and shows the status of Optical Sync (default). Note: whenever DVI-RX card detects a new Display, new EDID data is copied (almost) instantaneously.

Emulate EDID (of Display) from DVI-RX card to DVI-TX card

1. Install DVI-RX card in a chassis.

2. Make sure that DVI-RX card is POWERED OFF.

3. Make sure that DVI-TX card is POWERED OFF.

4. Use any DVI (or VGA) cable that supports DDC to make a connection between DVI-RX card and DVI-TX card.

5. Don't supply any POWER to the DVI-TX card. To Emulate EDID, power is supplied by +5V DDC power line (from DVI-RX card).

6. POWER-ON DVI-RX card.

7. Green LED will blink on the RX card to indicate the status of EDID-emulation.

8. Green LED stops blinking and returns to its default status on completion of process.

Loading EDID defaults (Factory Settings)

<u>DVI-RX card:</u>

EDID data on DVI-RX card is updated when as a display/monitor is disconnected and re-connected.

<u>DVI-TX card:</u>

If, for some reason, the EDID-emulation procedure fails, factory default EDID settings can be loaded on DVI-TX card by connecting PS2-RS232 cable to the Serial port of computer and accessing the Service Menu using HYPETERMINAL.

<u>Accessing the Service Menu</u>

1. Install DVI-TX card in a chassis. Turn POWER-OFF.

2. DVI-RX card doesn't get affected by this process. If the Optical Sync is "OK," there is no need to disconnect the fiber (or disturb the setup).

3. Connect the supplied PS2 Cable to DVI-TX card.

4. Connect the RS232 connector of PS2 cable to a serial port on the PC.

5. Make sure that PC is Powered ON.

6. Launch HYPERTERMINAL application and configure as:
   Bits per second: 115200
   Data bits: 8
   Parity: None
   Stop bits: 1
   Flow Control: None

7. Click on the CALL icon to make connection with the RS232 port.

8. POWER-ON DVI-TX card.

9. Type the serial config key "EmcoreDviConfig." (Upon power-up, you have 40 keystrokes to enter the right key. More than 40 strokes will return the card into regular operation mode).

10. SERVICE MENU should appear. If it doesn't, recycle power and enter serial config key again.

Load default EDID settings from Service Menu

1. Log-in to the service menu. See "Accessing the Service Menu" for notes/procedure.

2. Selecting Menu option # 3 from the service menu allows you to reset EDID settings to factory defaults.

3. Follow the on-screen instructions to load default EDID settings.

4. When the default EDID settings are loaded, LED D29 (located on the rear side of the card) blinks green.

5. Service Menu will return to the default screen when EDID copy is complete.

6. Selecting Menu option # 4 will restart DVI-TX board (or the DVI link if fiber is connected).

Firmware Updates

In This Chapter

This chapter provides an overview of the firmware update process for the Optiva cards.

The following topics are discussed:

- Updating the firmware

Firmware Update Procedure

1. Install DVI-TX card in the chassis. Do not POWER UP.

2. Install DVI-RX card in the chassis. Do not POWER UP.

3. Connect optical-fiber between the cards.

4. POWER-UP DVI-TX card and DVI-RX card (in any order).

5. If the DVI cable is connected, it need not be disconnected.

6. The LED must be solid-green on both TX and RX card at this time. This confirms that optical sync is OK. The firmware update process for the RX card is initiated over fiber. If for any reason the update process fails on either of the cards, you can try again. Note: Don't turn power off during firmware update .

7. Log-in to the service menu. Refer "Accessing the Service Menu" for notes/procedure.

8. As soon as the SERVICE menu screen shows up, DVI-video playback is interrupted. It will resume as soon as the firmware process is completed.

9. Check firmware revision (Menu Option #1). The firmware being updated must be newer than the one already installed on card.

10. Select "update firmware" Menu Option #4.

11. Enter "y" to continue. Green LED blinks on DVI-TX card and DVI-RX card.

12. Green LED slow blinks to indicate that the card is in programming mode.

13. Green LED fast blinks to indicate the receipt of binary file.

14. Follow the on-screen instructions and transfer the file (*.bin) using X-Modem transfer protocol.

15. Be patient with the firmware update process. It may take up to 15 minutes to complete.

16. This process will also update the firmware on RX card (as mentioned earlier).

17. The boards should restart automatically.

18. Upon POWER-UP, Green LED on the TX-card will blink longer than the RX-card (about 2 minutes). This is normal.

19. DVI-Video playback should continue (if connected).

What to do if an update fails:

If update failed due to loss of power or optical connection, the failed card will restart with a blinking red status LED, indicating that it has booted in fail-safe mode. If the TX card upload failed, the serial terminal will display a message that the card is operating in recovery mode (the user may have to press the 'enter' key a few times for this to be displayed). To retry the upload, press 'y' twice as prompted to begin the process, then proceed from step 6 above as normal.

If only the RX upload failed, no message will be displayed, but the RX status LED will still be blinking red. To retry upload, simply repeat the original process starting with step 4. If upload fails on the second try, there may be a hardware or optical issue, and the user should contact Emcore Technical Support.

Specifications

In This Chapter

This chapter includes the technical specifications for the Optiva cards. Note that, since Emcore is involved in ongoing product and design improvements, specifications are subject to change without notice.

The following topics are discussed:

- OTP-1DVIT2AT Technical Specifications
- OTP-1DVIR2AR Technical Specifications
- Optical Codes

Optiva Insert Cards

General	
Dimensions & Weight	Insert Card (IC): 7.267" L x .787" W x 5.055" H; 11 oz. 18.458 cm x 1.999 cm x 12.839 cm; 311.845 gm
Operating Temperature	-20° C to +50° C
Storage Temperature	-40° C to +85° C
Humidity	0 to 95% non-condensing
Operating Voltage	9-12 VDC
Shock & Vibration	Sinusoidal, 5 to 200Hz at 1.5g peak
System Latency	Less than 1ms
MTBF	>100,000 Hours @ 25°C, Ground Benign, per MIL-HDBK-217F, at card level

Regulatory CE, CSA, FCC Part 15

OTP-1DVIT2AT & OTP-1DVIR2AR Technical Specifications

Video

Specifications	Values
Standards	DVI 1.0/VESA
Resolutions	(See "Video Resolutions" section)
Connector	DVI-I (VGA adapter available)
Color Depth	24 Bit
VGA Video Bandwidth	780 MHz
Analog Video Output Level	1V p-p
Video Signal-to-Noise Ratio	>55 dB

Audio

Specifications	Values
Channels	24-Bit Stereo Audio
Impedance	47k Ohm Unbalanced
Audio Levels	2V p-p Max
Frequency Response	20 Hz to 20 KHz (±0.1 dB)
Signal-to-Noise Ratio	> 85 dB @ 1KHz (weighted)
Total Harmonic Distortion	< 0.1% @ 1KHz
Connector Type	1/8" Stereo Headphone Jack

Optical Codes

Models

Transmitter	Receiver
DVI with audio:	
OTP-1DVIT2AT-YY-XX	OTP-1DVIR2AR-YY-XX
DVI with audio, keyboard/mouse and serial data:	
OTP-1DVIT2AT1DTR1KMTR-YY-XX	OTP-1DVIT2AT1DRT1KMRT-YY-XX

Note:

YY refers to the optics
XX refers to the optical connector

Codes

Ordering Code YY)	Wavelength (nm) & Fiber Type	Optical Budget ((dB))	Range (km)	Typical Output Power (dBm)	RX Overload	Typical RX Sensitivity
C0	850 Multimode	7dB	0.2	-10 to -3	-3	-17
C0/C0*	850 Multimode	7dB	0.2	-10 to -3	-3	-17
C1	1310 Multimode	5dB	0.8	-5.5 to -0.5	0	-17
C1/C1*	1310 Multimode	5dB	0.8	-5.5 to -0.5	0	-17
C1/C3M*	1310/1550 Multimode	5dB	1.5	-2.5 to 2.5	0	-17
C2	1310 Singlemode	7dB	10	-5.5 to -0.5	0	-17
C2D	1310 Singlemode	12dB	20	-5.5 to -0.5	0	-18
C2H	1310 Singlemode	25dB	60	-2.5 to 2.5	8	-28
C2/C2*	1310 Singlemode	7dB	10	-5.5 to -0.5	0	-17
C2D/C2D*	1310 Singlemode	12dB	20	-5.5 to -0.5	0	-18
C2H/C2H*	1310 Singlemode	25dB	60	-2.5 to 2.5	0	-18
C2/C3*	1310/1550 Singlemode	12dB	20	-2.5 to 2.5	0	-17
C2/C3D*	1310/1550 Singlemode	17dB	40	-2.5 to 2.5	-9	-21
C2/C3H*	1310/1550 Singlemode	25dB	60	-2.5 to 2.5	-8	-28
C3	1550 Singlemode	17dB	40	-2.5 to 2.5	0	-21
C3D	1550 Singlemode	25dB	60	-2.5 to 2.5	8	-28
C3/C3*	1550 Singlemode	17dB	40	-2.5 to 2.5	0	-20
C3D/C3D*	1550 Singlemode	25dB	60	-2.5 to 2.5	8	-28
L4X3	1270 to 1610 CWDM Singlemode	25dB	20-70	-2.5 to 2.5	-8	-28
L4X3/L4X3*	1270 to 1610 CWDM Singlemode	25dB	20-70	-2.5 to 2.5	-8	-28

* For DVI model with serial data capability only

CWDM designator where X =	Wavelength
A	1270nm
B	1290nm
C	1310nm
D	1330nm
E	1350nm
F	1370nm*
G	1390nm*
H	1410nm
I	1430nm
J	1450nm
K	1470nm
L	1490nm
M	1510nm
N	1530nm
O	1550nm
P	1570nm
Q	1590nm
R	1610nm

* Wavelength not supported by the MDM series of multiplexing/de-multiplexing cards due to the water-peak wavelengths

Optical Connectors

Ordering Code (XX)	
ST	ST Optical Connector
FC	FC Optical Connector
SC	SC Optical Connector
LC	LC Optical Connector

Note: Single LC connector is not available with duplex laser options

Service Information

In This Chapter

This chapter contains the following sections:

- Toubleshooting Checklist
- Fiber Optic Installation
- Tools and Test Equipment Needed
- Optical Cable Connection
- Testing and Troubleshooting Steps for Installed Cable Plants
- Troubleshooting Fiber
- Hints for Troubleshooting Fiber
- Patch Cords
- Connecting Optiva
- Troubleshooting Optiva
- Cable Plant Problems
- Electrical Interfaces
- SNMP Monitoring and Controls
- LED Status Indicators
- Warranty & Repair Policy

Troubleshooting

Routine maintenance to this Optiva product is not required. In the event of problems with your cards, the following basic troubleshooting checklist may help identify the source of the problem. If the product still does not appear to be working properly after checking all possible causes, please contact your EMCORE products distributor, or the Technical Support department at the numbers listed under the contact information in the front part of the manual.

1. Visual Review — Performing a quick visual check may reveal many problems, such as connectors not properly seated or loose cables. Check the card, the enclosure, and any associated peripheral equipment for signs of trouble.

2. Power Check — Check the power indicator LED on the enclosure's front panel for the presence of power. If the power LED is not illuminated, make sure the power cable is connected to a power source and verify that power is available at the power main. Confirm that the power supplies are fully seated in their slots. If the power LED is still not illuminated, replace the power supply with one that is working properly.

3. Input Signal Status — Verify that source equipment is operating correctly and that a valid signal is being supplied.

4. Output Signal Path — Verify that destination equipment is operating correctly and receiving a valid signal.

5. Unit Exchange — Exchanging a suspect unit with a unit that is known to be working correctly is an efficient method for locating problems in individual components.

Fiber Optic Installation

Once a fiber optic cable plant, network, system or link is installed, it needs to be tested for four reasons:

1. To ensure the fiber optic cable was properly installed to specified industry standards.

2. To ensure the equipment intended for use on the cable plant will operate properly on the cabling.

3. To ensure the communications equipment is working to specifications.

4. To document the cable plant and network for reference in case of future problems.

Tools & Test Equipment Needed

The following tools are needed to test and troubleshoot the fiber optic cable plant, system or link properly:

1. Optical Loss Test Set or power meter and test source with optical ratings matching the specifications of the installed system (fiber type and transmitter wavelength and type) and proper connector adapters.

2. An OLTS that merely tests cable plant loss may not include a calibrated power meter needed for testing transmitter and receiver power, so a calibrated power meter and source are a better choice for link or system testing.

3. Reference test cables with proper sized fiber and connectors and compatible mating

adapters of known good quality. These do not need to be "reference quality," but should be in good condition, generally defined as having connector losses of less than 0.5 dB.

4. Visual fiber tracer and/or visual fault locator (VFL)

5. <u>Optional:</u> OTDR with long launch cable (100 m for Multimode, 1 km or more for singlemode)

Optical Cable Connections

All fiber cable plants require certain basic tests to insure they were installed correctly and meet expected performance values. The most valuable data one can have for troubleshooting is the installation documentation.

<u>What Can Go Wrong?</u>

There are a number of possible problems with fiber optic cable installations that can be caused by installation procedures.

The most common include:

> »Damage to the cable during installation caused by improper pulling techniques (such as not pulling the fiber cable by the strength member) excess tension, tight bends under tension, kinking or even too many bends. Most of these problems will be seen on all fibers in the cable.

> »Damage to the fibers in the cable during cable preparation for splicing or termination. Fibers may be broken or cracked during cable jacket or buffer tube removal or fiber stripping. This may affect all fibers in the cable or buffer tube or just one fiber.

> »High loss splices caused by improper splicing procedures, especially poor cleaving on mechanical splices or improper programming of fusion splicers. Most fusion splicers give feedback on most problems if the operator is properly trained. Individual fibers can be damaged when being placed in splice trays or tubes of fibers damaged during placement in splice closures.

> »High loss connectors may be caused by bad processes or damage after termination. Adhesive/polish connectors may have poor end finishes or cracks in the fiber at the end of the ferrule or internally. Pre-polished/splice connectors are generally high loss due to poor mechanical splicing processes during termination causing high internal loss.

> »Dirt creating high insertion loss and physical damage.

Testing And Troubleshooting Steps For Installed Cable Plants

Before installation, it is advisable to test all cable as received on the reel for continuity using a visual tracer or fault locator. Cables showing signs of damage in shipment may need OTDR testing to determine if the cable itself is damaged. Obviously, no cable showing damage should be installed. Test insertion loss after installation.

1. After installation, splicing (if applicable) and termination, all cables should be tested for insertion loss using a source and meter or OLTS (optical loss test set) according to standards OFSTP-14 for multimode fiber, OFSTP-7 for singlemode fiber.

2. Generally cables are tested individually (connector to connector for each terminated section of cable and then a complete concatenated cable plant is tested "end-to-end", excluding the patch cords that will be used to connect the communications equipment which are tested separately.

3. It is the concatenated cable test that is used to compare to the link power budget and communications equipment power budget to insure proper operation.

4. Insertion loss testing should be done at the wavelength of intended operation if

known or at two wavelengths with appropriate sources . (e.g.: 1310nm/1550nm).

5. Unless standards call for bidirectional testing, double-ended testing with both launch and receive cables (OFSTP-7/14) is adequate.

6. Data on insertion loss of each fiber should be kept for future comparisons if problems arise or restoration becomes necessary. Recording data on a label inside the patch panel or enclosure is common practice.

7. Long cables with splices may be tested with an OTDR to confirm splice quality and detect any problems caused during installation, but insertion loss testing with an OLTS (light source and power meter) is still required to confirm end-to-end loss. Cables with insertion loss near expected values do not also need OTDR testing. Cables tested with an OTDR should have the data kept on file for future needs in restoration.

Troubleshooting Fiber

» First determine if the problem is with one or all the fibers in the cable. If all fibers are a problem, there is a likelihood of a severe cable installation problem. If all fibers are broken or have higher than expected loss, an OTDR will show the location of the problem on longer cables but premises cables may be too short and need physical inspection of the cable run. If the problem is caused by kinking or too tight a bend, the cable will have to be repaired or replaced.

» High loss fibers have several potential causes, but bad splices or terminations are the most likely cause for field terminated cables. In some cases, using improper termination practices will result in high loss for all fibers, just as in kinking or bending losses, not just one fiber.

» Cables with a fiber or fibers showing very high loss or no light transmission at all should be tested for obvious breaks in the pigtail fiber or cable, generally at the splice or connector, with a visual fault locator or OTDR if of sufficient length (>100m).

» Testing for high loss should start with microscope inspection of terminations for proper polish, dirt, scratches or damage.

» If dirt appears to be the problem, clean the connectors and retest.

» If other connector damage is found on visual inspection, re-termination will probably be necessary. Sometimes scratches can be polished out with diamond film by an experienced technician.

» Pre-polished splice connectors with internal splices will generally look OK when inspected with a microscope unless damaged after installation. The most likely cause of loss with these connectors is high splice loss in the internal splice. They can be tested with a visual fault locator coupled into the fiber at the far end. High light loss will be seen as an illumination of the connector ferrule.

» If the reason for high loss is not obvious and the connectors are adhesive/polish style, the problem may be a fiber break in the back of the connector. A VFL (Visible fault locator) may help in finding fiber breaks, depending on the connector style and the opacity of the cable jacket.

» Splice loss problems can be pinpointed during OTDR testing. Confirmation with a VFL should be done if the length from the end of the cable is short enough (~2-3km)

where a VFL is usable. The VFL can find high loss splices or cracks in fibers caused by handling problems in the splice tray.

Hints for Troubleshooting Fiber

» Having access to design specifications and installation documentation and specifications will greatly assist troubleshooting.

» If possible, interview the installer to help uncover processes that may lead to issues in installation, such as pulling methods, lubrication, intermediate pulls, splicing or termination methods (like improper field termination of singlemode which can lead to high loss and reflection even when connectors look OK in a microscope).

Patch Cords

Patch cords are short factory-terminated cables usually with standard heat-cured epoxy/polish connectors on each end. They are used to connect equipment to the cable plant and as reference cables for testing insertion loss. Most patch cord problems are connector problems, caused by damage due to handling or numerous matings when used as reference cables for testing other cables. Connectors may also be damaged by breaking fibers at the back of the connector due to excess stress during handling or by placing other equipment on top of them in enclosures or patch panels.

All patch cords, especially those used as reference cables for insertion loss testing, should be tested for insertion loss

» Patch cords should be tested with an optical loss test set (optical power meter and source) using single-ended FOTP-171 methods with one reference cable used as a launch cable.

» This will test the connector mated to the reference cable and the fiber in the patch cord, which is short enough it should have no measurable loss

» Since the connector connected to the power meter will not be connected to fiber but presented directly to the detector of the power meter, it effectively has no loss.

» After testing in one direction, reverse the patch cord and test the other end.

» In both directions, factory-made patch cords should have a loss of less than 0.5 or whatever performance the user has specified with patch cord vendors.

» High loss connectors should be inspected with a microscope for dirt or damage.

» If other connector damage is found on visual inspection, re-termination will probably be necessary but may not be cost effective, so the patch cord should be replaced. Sometimes scratches can be polished out with diamond film by an experienced technician.

» Some optical loss test sets include fiber interfaces on both source and meter ports, so all testing is done double-ended, even if the cable under test is directly connected to an input port. A test set such as this makes reverse testing less effective, since reversing test direction may not have any significant effect. Test ports on an OLTS like this should be kept covered when not in use and cleaned periodically. Damaged fibers inside an OLTS will require factory repair.

Connecting Optiva

After the cable plant has been tested, the communications equipment should be properly connected using matching known-good patch cords. If the cable plant loss is within the loss budget of the equipment (including the loss of the patch cords), the communications link should work properly. If the link does not work, most likely potential problems are the following:

»Improper connections

»Cable plant problems

»Malfunctions of communications equipment

Troubleshooting Optiva

In most cases an optical problem will be indicated by a red LED indication on the receiver side.

»Improper connections. The system requires a transmitter be connected to a receiver, of course, so it is important to verify this connection for each link. Even if the cable plant is properly documented, fibers may have been crossed at intermediate connections, so using a visual tracer or visual fault locator will allow quick confirmation of the connection.

»The functioning of the Optiva equipment:

»If it is connected to the cable plant but not operating properly, begin by checking the power at the receiver on one end of the link.

»Disconnect the cable at the receiver input and measure power with an optical power meter. Make sure the equipment is trying to transmit a signal (an Optiva optical port will always send a signal).

»If the receiver power is within specifications, the receiver/transmitter connections beyond the link may be the problem.

»If the receiver power is too high, it may be overloading the receiver and an optical attenuator should be inserted at the receiver end to reduce the- this may also result in intermediate signal reception.

»If the receiver power is lower than required by operating specifications, the cause is either low transmitter power or too much loss in the cable plant.

»To test transmitter power, disconnect the patch cord connecting the transmitter to the cable plant and measure the optical power. If the power is low, there is a problem with the transmitter or patch cord.

»To determine which is the problem, try testing the transmitter with a known good patch cord. If the power is then within spec, replace the bad patch cord and test the link again.

»If the transmitter power is low with a good patch cord, the equipment may need maintenance (cleaning) or replacement of the output port.

»If the transmitter is good but receiver power is low, the problem is probably in the cable plant. First try to switch the communications link to spare fibers to see if that solves the problem. Next test the loss of the suspect fibers in the cable plant with an OLTS to determine if the cable plant loss is excessive.

Cable Plant Problems

1. High loss in the cable plant can be caused by damage after installation and testing. Use a visual tracer or visual fault locator to confirm continuity and an OLTS to test loss. See directions above on testing the loss of the cable plant.

2. If the cable plant is long enough (>100m), it can be tested with an OTDR to pinpoint problems.

3. If the cable plant loss is not the problem, there are other possible issues related to the bandwidth of the cable plant.

4. Multimode cable plants operating at 1300 nm with LED sources may have bandwidth problems caused by the total dispersion due to both chromatic and modal dispersion.

5. Singlemode links may suffer from problems caused by reflections at connectors or mechanical splices.

6. Reflections in singlemode terminations or splices near the source may cause nonlinearity in the laser transmitter which distort pulse shapes, causing high bit error rates (BER).

7. Reflections near the receiver or at both ends can cause multiple reflections in the cable that create "optical noise" that causes BER.

8. Reflections can be tested, if the cable plant is long enough (>100m), with an OTDR to pinpoint problems.

Electrical Interfaces

This chapter describes the steps for troubleshooting an Optiva System when one has verified that there are no optical problems.

1. Check that all electrical connectors are properly installed.

2. Verify the integrity of the source signal and make sure that a signal is present. This usually can be done with an oscilloscope or dedicated analyzer for analog, digital and data signals.

3. Check that Optiva DVI is set to the correct video mode and verify DIP SWITCH setting.

4. Verify that signals are connected to the correct port. For source signal, verify that an input is connected. For receive signal, verify that an output is connected. A side label on the cover indicated the optical transmission direction as well as the electrical interface directions.

5. If you have purchased a Network Management card (SNMP) you can monitor each one of the channels for a faulty condition. Please contact our factory if you detect a faulty condition for video/audio/data.

6. When using Ethernet Video interfaces on Optiva, please note that the NMS interface reports a faulty condition when Ethernet signal is not present. Once signal has been provided, the alarm will return to normal operation in addition the OptivaView reports detected resolutions for DVI products.

SNMP Monitoring and Control

The OPV-CTLR Network Controller Card provides support for remote monitoring of your frame and using Simple Network Management Protocol (SNMP), which is compatible with many third-party monitoring and control tools.

Refer to your OTP-1DVIT2AT and OTP-1DVIR2AR Management Information Base (MIB) files for a breakdown of SNMP controls on this card. Refer to the Optiva Platform User Manual for additional information on SNMP Monitoring and Control. To obtain MIB files for Optiva products, please contact technical support.

LED Status Indicators

Transmitter Card	Status	Alert	Description
1	Off	Off	No Power
2	On	Off	Electrical Sync is OK
3	Off	On	No Electrical Sync
4	On	On	(Contact Factory)

Receiver Card	Status	Alert	Description
1	Off	Off	No Power
2	On	Off	Optical Sync is OK
3	Off	On	No Optical Sync
4	On	On	(Contact Factory)

Warranty and Repair Policy

WARRANTY

Subject to the terms and conditions set forth below, EMCORE warrants the goods to be free from defects in material and workmanship. This warranty shall extend for a period of 36 (thirty-six) months for Opticomm Products from date of shipment.

EMCORE's warranty does not apply if, and EMCORE shall have no liability for goods returned by Buyer as to which EMCORE's examination reveals that: (i) the goods have been exposed to unusual or excessive environmental, mechanical, electrical or thermal stress during the course of installation or use; (ii) the absolute maximum ratings are exceeded for any reason including, but not limited to, equipment variations, environment variations, the effects of changes in operating conditions due to variations in device characteristics, improper equipment design, improper device installation or application; (iii) goods malfunction is the result of misuse, abuse, improper installation or application, alteration, accident, or negligence in use, storage, transportation or handling or if the original identification markings on the goods have been removed, defaced or altered; (iv) goods are tested for Buyer by anyone other than EMCORE unless such procedures have EMCORE's prior written approval; or (v) the goods are classified as other than a commercial production unit, e.g. a design verification unit, sample, preproduction unit, developmental unit, prototype unit, incomplete (with notice) or "fallout" (i.e. out of specification with notice) unit. All warranty claims are subject to verification by EMCORE.

The liability of EMCORE hereunder is solely and exclusively limited to replacement, repair or credit at the purchase price at EMCORE's option for any goods which are returned by Buyer during the applicable warranty period and which are found by EMCORE to be subject to adjustment under this warranty. Buyer must notify EMCORE of any warranty claim within ten (10) days of discovery of the basis therefor, and if Buyer fails to so notify EMCORE by such time, Buyer shall be deemed to have waived such warranty claim.

The foregoing warranties extend to Buyer only, and not to Buyer's customers or to users of Buyer's products. These warranties may not be transferred or assigned, and Buyer shall make no warranty with regard to the goods to any of its customers or other users of Buyer's products, and Buyer shall indemnify and hold EMCORE harmless against any and all claims, demands, liabilities, losses, costs, fees, expenses, damages and injuries (including reasonable attorney fees) (collectively, "Claims") incurred by EMCORE in connection with, or relating to, any such warranty made by Buyer. These warranties are the only warranties made by EMCORE and shall not be enlarged by representations, descriptions, course of dealing, trade usage, rendering of technical advice, service, samples, models, or otherwise, and EMCORE MAKES NO OTHER WARRANTIES EXPRESS, IMPLIED, OR STATUTORY, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Product Repair

For all repair work, contact Emcore Video Sales to obtain a Return Authorization Number:

EMCORE Corporation

2015 Chestnut Street

Alhambra, CA 91803

Phone: +1 626-293-3400

E-mail: video-sales@emcore.com

Technical Support: video-support@emcore.com

Customer Service: +1 626-293-3744

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