

picoLink series

FIO-991p
Standalone 3Gbps/HD/SD/MADI SDI
optical-to-electrical
/ electrical-to-optical converter
Guide to Installation and Operation

M947-9900-101
31 Jan 2013



A **BELDEN** BRAND

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Radio Frequency Interference and Immunity

FC This equipment has been tested for verification of compliance with FCC Part 15, Subpart B requirements for Class A digital devices.

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

CE This equipment has been tested and found to comply with the requirements of the EMC directive 2004/108/CE:

- EN 55022 Conducted emissions, Class A
- EN 55022 Radiated emissions, Class A
- EN 61000-4-2 Electrostatic discharge immunity
- EN 61000-4-3 Radiated electromagnetic field immunity - RF
- EN 61000-4-8 Power frequency magnetic field immunity
- EN 61000-4-11 Voltage dips, short-interruption and voltage variation immunity
- ENV50204 Radiated EMF immunity – RF 900MHz pulsed

Power supplies:

pL-tray frame power supply

5VDC, 3.0A, I.T.E. external power supply

- CSA/UL 60950-1 for Information Technology Equipment

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1 FIO-991p Standalone 3G/HD/SD/MADI electrical/optical converter

1.1 Introduction

The FIO-991p series are flexible serial digital video to/from fiber converters. They are designed for SD, HD and 3G serial video as well as compressed bit-streams (DVB-ASI) and MADI digital audio. The series supports any data rate within the range of 19.4 Mbps to 2.97 Gbps and provides a reclocked serial digital video from 270Mbps to 2.97 Gbps. The FIO-991p series offers eight different main configurations: Single or dual channels Tx, single or dual channels Rx, bi-directional Rx/Tx and an Rx/Tx repeater with electrical drop. The series is based on hot-swappable SFP modules that provide easy product maintenance and flexibility when multiple wavelengths are needed (as for CWDM).

1.2 Features

- Convenient 3gbps/HD/SD and MADI standalone fiber interfaces
- Supports any serial data rate from 19.4 Mbps (ATSC) to 2.97Gbps (3G SDI)
- Re-clocked serial digital video from 270Mbps to 2.97Gbps
- Provides unidirectional or bi-directional interface between serial digital and fiber optics
- Single or Dual Tx, Single or Dual Rx or combined Rx/Tx configurations
- Supports Multiple wavelength from the standard 1310 nm, 1550 nm to multiple CWDM wavelengths
- Well integrated WDM (1310/1550) solution for dual Tx, Dual Rx and Rx/Tx cards
- Ideal for long video run with "Hum" immunity
- Presence/loss of signal alarm
- Optical Power level out-of-range warning (receiver only)
- The SFP modules are fully hot swappable.
- Operation from 5 Volts DC.

1.3 Product Overview

Figure 1 illustrates the FIO-991p's major parts and their locations. The SFP module is inserted into the socket on the end of the FIO-991p chassis, and the fiber is plugged into the SFP module. The 3G/HD/SD digital video inputs and outputs appear on BNC connectors at the opposite end of the chassis. Input status and SFP module status are provided by the status LEDs. Finally, the power source is connected to the lockable power connector.

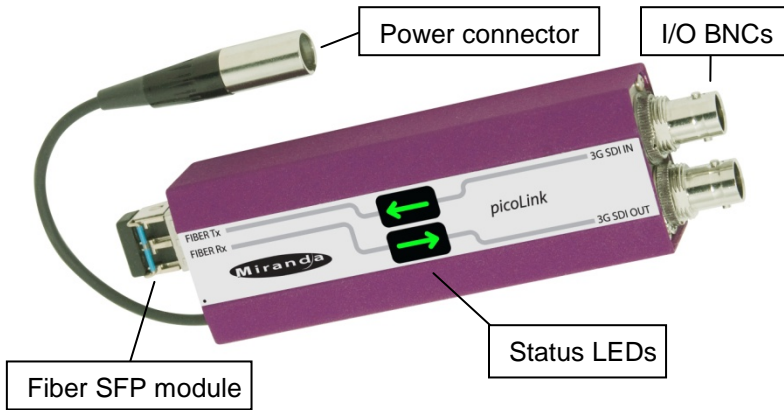


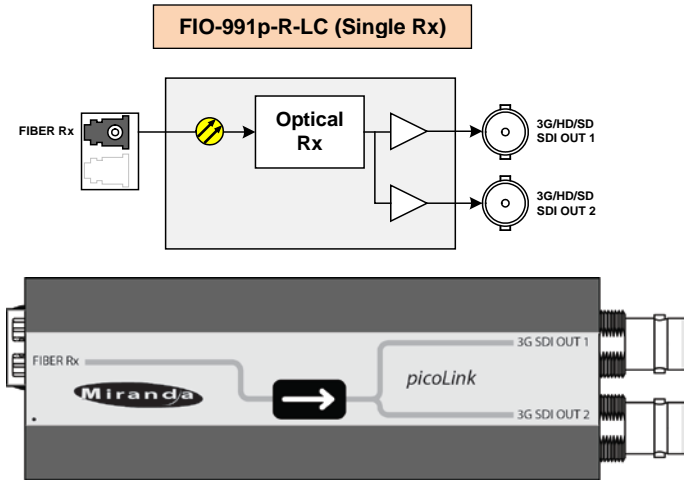
Figure 1: Overall view of the FIO-991p

1.4 Product Variants

The FIO-991p is available in eight different versions, based on the I/O configuration. They are distinguished by the model designation on the label. Within each version, some variations in functionality may be available by selecting the SFP module.

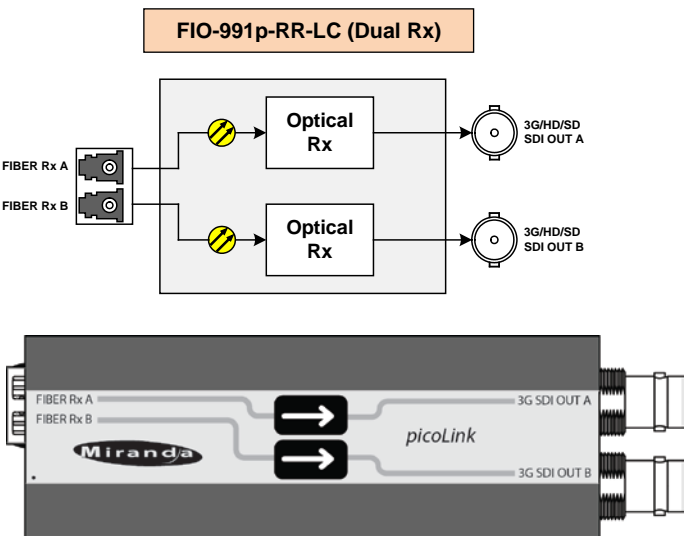
FIO-991p-R-LC

Single optical receiver, double 3G/HD/SD SDI output

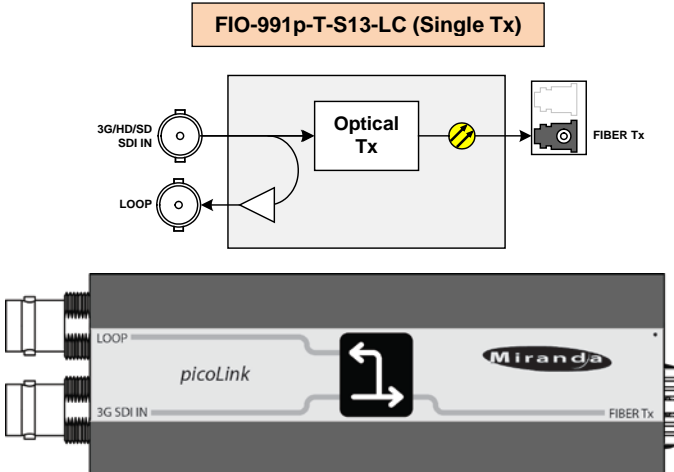
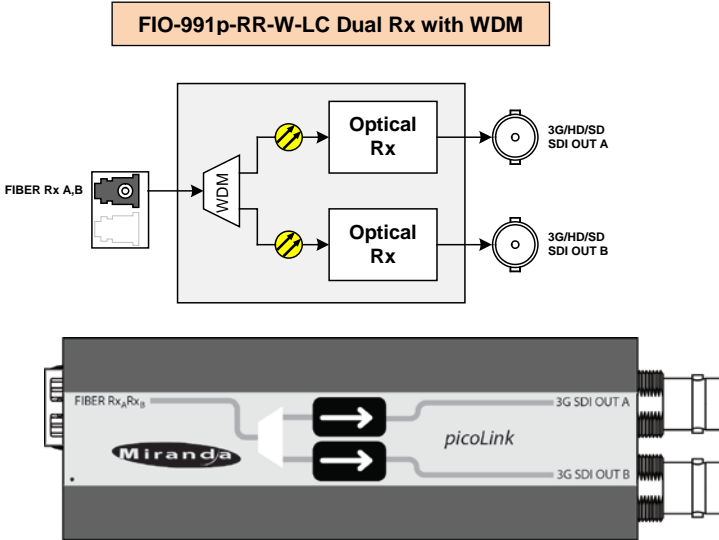


FIO-991p-RR-LC

Dual optical receivers, dual 3G/HD/SD SDI outputs

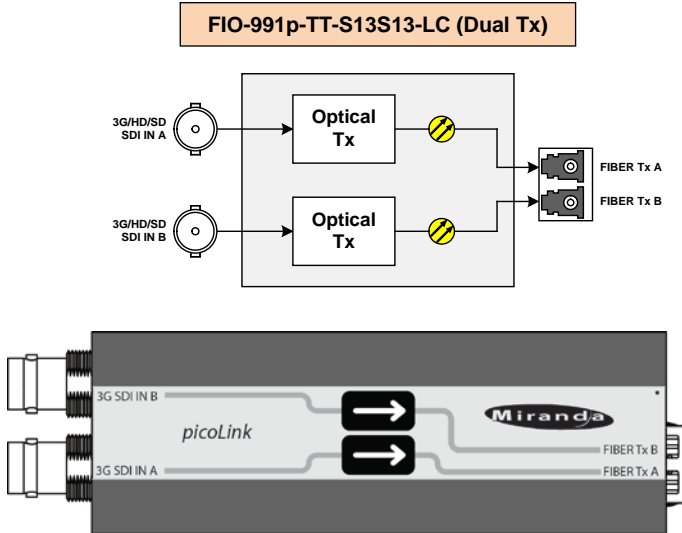


The WDM version receives two signals which are wave division multiplexed onto a single fiber (one at 1310 nm and one at 1550 nm), and optically splits them into the two receivers, each of which has an electrical output.

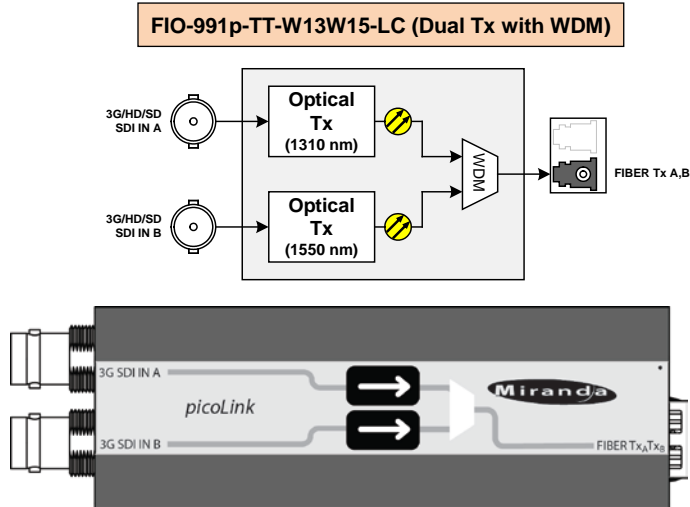


FIO-991p-TT-LC

Dual 3G/HD/SD SDI inputs, dual optical transmitters.

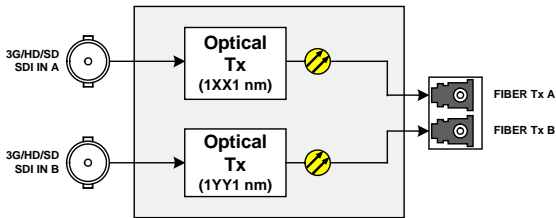


The WDM version has optical transmitters at 1310 nm and 1550 nm, to allow the two signals to be wave-division multiplexed onto a single fiber.



The CWDM version is designed to be used with an external optical multiplexer, and is available with pairs of transmitters at the industry-standard frequencies for this application.

FIO-991p-TT-CXXCY-LC (Dual Tx with CWDM)
FIO-991p-THTH-CXXCY-LC (Dual High Power Tx with CWDM)

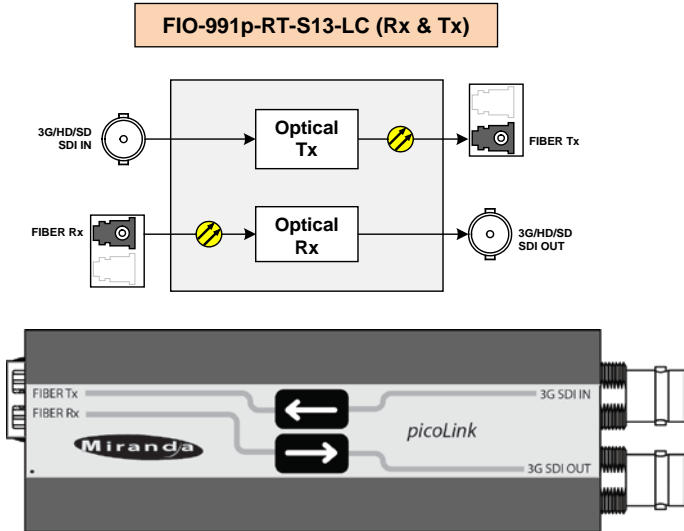


The XX and YY values in the product designation identify the wavelengths. Note that the clasp handle on the SFP transmitter module is color-coded to identify its operating wavelengths.

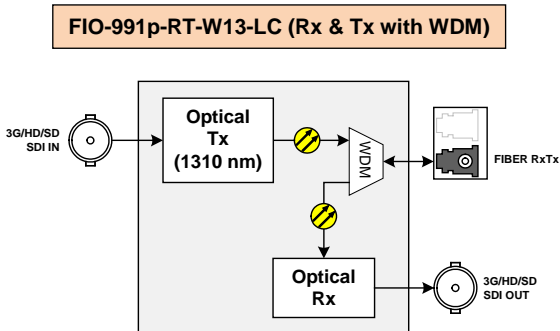
XX	YY	Optical Signal Wavelengths	Clasp Color Code
27	29	1271 / 1291 nm	Light Purple
31	33	1311 / 1331 nm	Yellow Green
35	37	1351 / 1371 nm	Pink
39	41	1391 / 1411 nm	White
43	45	1431 / 1451 nm	Black
47	49	1471 / 1491 nm	Gray
51	53	1511 / 1531 nm	Blue
55	57	1551 / 1571 nm	Yellow
59	61	1591 / 1611 nm	Red

FIO-991p-RT-LC

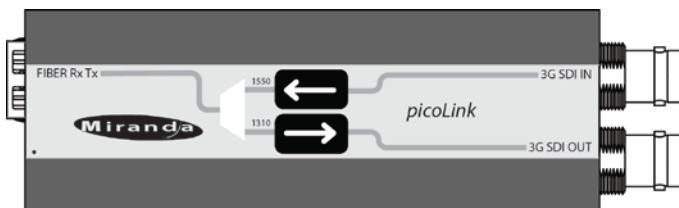
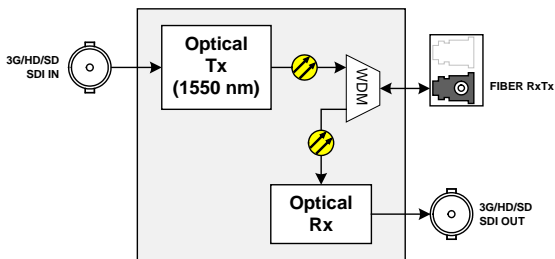
Single 3G/HD/SD SDI input, single optical transmitter, plus single optical receiver, single 3G/HD/SD SDI output.



WDM versions use a single fiber for input and output. The optical transmitter can be selected to work at 1310 nm or 1550nm, while the optical receiver functions at the other wavelength. The Tx wavelength is used to specify the version (W13 for 1310 nm and W15 for 1550 nm).



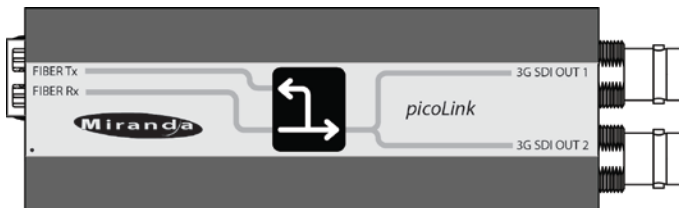
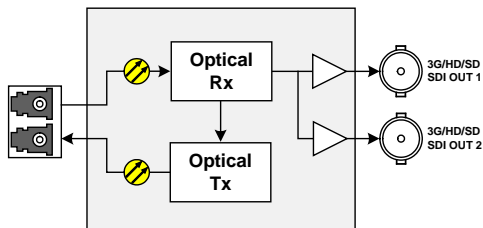
FIO-991p-RT-W15-LC (Rx & Tx with WDM)



FIO-991p-RD-LC

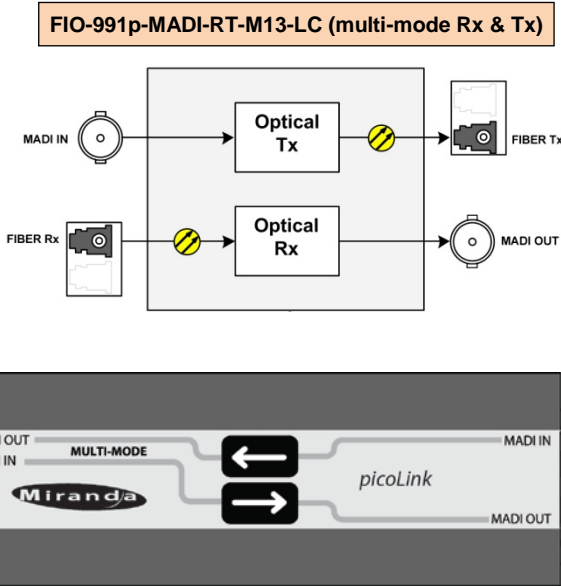
Single optical receiver with double 3G/HD/SD SDI outputs, with the optical input linked to a single optical transmitter. Functionally, an optical repeater with electrical drop.

FIO-991p-RD-S13-LC (O Repeater / E drop)



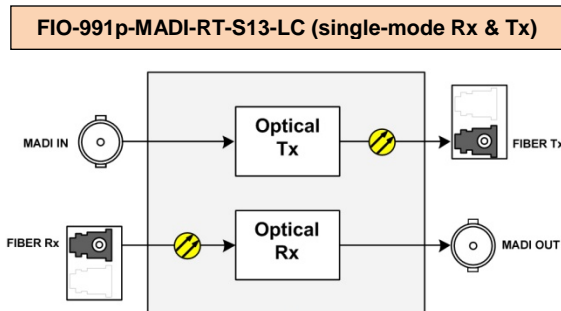
FIO-991p-MADI-RT-M13-LC

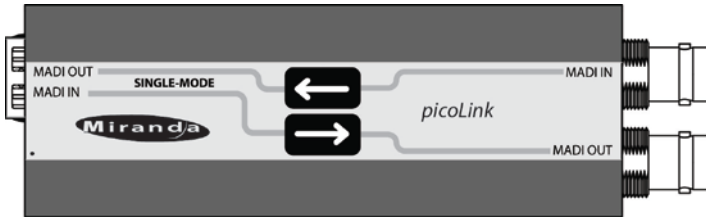
Single MADI input, single optical transmitter on multi-mode fiber, plus single optical receiver, single MADI output.



FIO-991p-MADI-RT-S13-LC

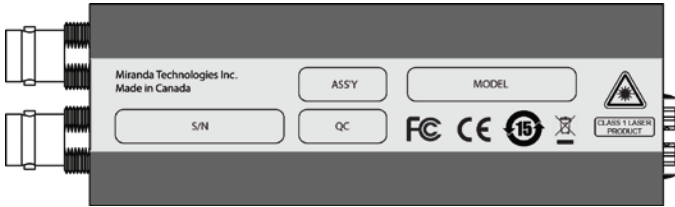
Single MADI input, single optical transmitter on single-mode fiber, plus single optical receiver, single MADI output.





Rear View

The back side of the unit shows the model type, serial number and other details.



2 Installation

2.1 Power Supply

The LKS-WSU power supply provides power to the FIO-991p for 110 V and 220 V operation. The power supply is a regulated +5 VDC@2.4 A power source. The FIO-991p employs a mini XLR-3 connector for its power needs. Figure 2 shows a detailed pinout of the male connector.

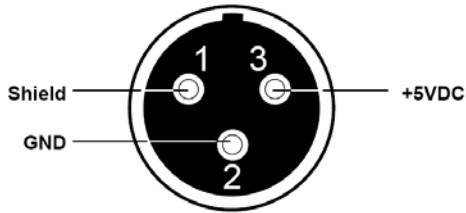


Figure 2: Power connector pinout

2.2 Power Adapter

The Pico-PA is a 12V-to-5V power adapter that can be used to power the FIO-991p from a 12V battery supply in production applications.

2.3 Installation in the pL Tray

The FIO-991p can be installed in Miranda's pL Tray, a 1 RU frame with built-in power supply that can hold up to 10 picoLink devices.

The FIO-991p is installed with the BNC video connectors facing the front of the tray, and the fiber optic and power supply connections on the back. See the pL Tray manual for more details.



2.4 Fiber Optic Interface

Installing and removing the Fiber I/O interface cartridge requires special care.

The optical interface of the FIO-991p consists of two parts:

- A socket on one end of the chassis into which an SFP interface module is plugged
- An SFP (Small Form-factor Pluggable) module into which the optical fibers are plugged, and which incorporates the optical/electrical interface

Cautions and Warnings



SFP Transmitter modules contain a class 1 laser, which emits invisible radiation whenever the module is powered up. Because the SFP is hot-swappable, the module may be powered up as soon as it is installed.

DO NOT LOOK INTO AN OPERATING SFP MODULE'S CONNECTORS, AS EYE DAMAGE MAY RESULT.



The SFP module is sensitive to electrostatic discharge (ESD). It is recommended that you use a grounded ESD-preventive wrist strap while handling the SFP module.



SFP modules are subject to wear, and their useful lifetime is reduced each time they are inserted or removed. Do not remove them more often than is absolutely necessary.



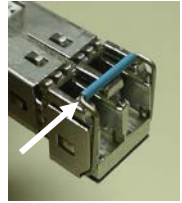
Never remove or install an SFP module with the fiber optic cables connected. Damage to the cables could result.



The presence of dust and debris can seriously degrade the performance of an optical interface. It is recommended that you insert a dust plug into the SFP module whenever a fiber optic cable is not connected.

Installing an SFP module

1. Make sure that the bale clasp lever is in the closed position



2. Position the SFP module so that the recessed slot is lined up with the tab side of the socket.
3. Slide the module straight into the socket, and push gently until it clicks into position.

Connecting the fiber optic cables

1. Remove the dust plug from the SFP module if present
2. Verify that the exposed end of the optical fiber in the LC connector is clean
 - Carefully remove any debris if necessary.
3. Plug the LC-terminated fiber optic cable into the SFP module

Removing the fiber optic cables

1. Grasp the LC fiber optic connector that is plugged into the SFP module, and pull it straight out to disengage the optical fiber from the SFP.
 - Never pull the fiber optic cable itself, as catastrophic damage may occur.
2. Insert a dust plug into the SFP module.

Removing the SFP module

1. Move the bale clasp lever to the open position.



2. Grasp the SFP module between your thumb and forefinger, and pull it straight out of the slot.

- Do NOT pull on the bale clasp lever to remove the module, as it is easily damaged
 - You may find that you need to wiggle the module, or perhaps push it into the slot a bit, before it will release and slide out.
3. Insert a dust plug into the SFP module.

2.5 3G/HD/SD Digital Video and MADl Digital Audio Connections

The input and output electrical signals are connected via BNC connectors on the end of the FIO-991p chassis. The connectors are labeled to identify inputs and outputs.

The FIO-991p supports 3G, HD-SDI, SD-SDI, and DVB-ASI digital video signals, and MADl digital audio signals. See the Specifications on page 16 for more details.

3 Operation

There are no operating controls on the FIO-991p.

Configuration is automatic, depending on the model and the installed SFP module.

3.1 Status LED assignments

The FIO-991p includes two arrow-shaped status LEDs, integrated into the case's graphics and labeled appropriately, which monitor the status of the inputs. The arrow shows the direction of signal flow, and the color shows the status of the associated input. The functionality of the LEDs varies with the model type, as shown in this chart:

FIO-991p model	LED 1	LED 2
TT	Electrical In A	Electrical In B
T	Electrical In A	
RR	Optical In A	Optical In B
R	Optical In A	
RT	Electrical In A	Optical In A
RD	Optical In A	
MADI-RT	Electrical In A	Optical In A

3.2 Status LED behavior

LEDs assigned to monitor *Electrical Inputs* display this behavior:

- Green = SDI signal OK
- Yellow = No lock
- Red = No signal

LEDs assigned to monitor *Optical Inputs* display this behavior:

- Green = Optical signal OK
- Yellow = No lock
- Flashing Yellow = Input level too high or too low
- Red = No signal

In addition, LEDs in all models monitor the status of the installed SFP module. The LEDs on any FIO-991p will flash red in the following cases:

- No SFP module
- SFP mismatch – wrong SFP type for the FIO-991p model
- Tx laser fault (SFP transmitter modules only – faulty channel LED will flash)

4 Specifications

ELECTRICAL

Signal:	3G/HD/SD SDI SMPTE 424M, 292M, and 259M-C compliant Supports data rates of 270, 1483.5, 1485, 2967, 2970 Mbps EN50 83-9 DVB-ASI 270 Mbps MADI-compliant, AES10-2008
Connectors:	75 ohm BNC (IEC 60169-8, Annex A)
Return Loss: Video	>15 dB up to 1.5 GHz >10 dB from 1.5 GHz to 3 GHz
MADI	

COAXIAL INPUT

Cable length (Belden 1694A):	3G: 100 m (325') @ 3Gbps HD: 150 m (500') @ 1.5 Gbps SD: 350 m (1150') @ 270 Mbps MADI: 100 m (325')
Signal amplitude:	MADI : 150 to 1200 mV p-p ; 4 V p-p tolerant

COAXIAL OUTPUT

Jitter (wideband):	HD/SD: <0.2 UI 3Gbps: <0.3 UI
Rise / Fall time:	135 ps max., 20% to 80%, for HD 400-800 ps, 20% to 80%, for SD or non-reclocked 1-3 ns, 20% to 80%, for MADI
Signal amplitude:	MADI: 550 ± 50 mV p-p

OPTICAL I/O

Video:	SMPTE-297M-2006 compliant
MADI:	ISO/IEC 9314-3 compliant (FDDI)
Connectors:	LC <i>(note – these are not the connectors prescribed by the FDDI and MADI standards)</i>

Rx CHANNEL (pathological bitstream)

Video

Sensitivity: 270 Mbps and 1.5 Gbps: -20 dBm
 3Gbps: -18 dBm

MADI	(single-mode)	(multi-mode)
Sensitivity @ 1310 nm:	-31 dBm	-31 dBm
Maximum level:	-8 dBm	-14 dBm
Fiber length:	10 km (6.25 miles).	2 km (1.25 miles)

Tx CHANNEL (single-mode)

	Wavelength	Min	Max
FIO-991-T-S13-LC:	1310 nm	-5 dBm	0 dBm
FIO-991-TT-S13S13-LC:	1310 nm	-5 dBm	0 dBm
FIO-991-RT-S13-LC:	1310 nm	-7 dBm	0 dBm
FIO-991-TT-W13W15-LC:	1310 nm	-5 dBm	0 dBm
	1550 nm	-8 dBm	-3 dBm
FIO-991-TT-CXXCYY-LC:		-6 dBm	-3 dBm
FIO-991-THTH-CXXCYY-LC:		0 dBm	4 dBm
FIO-991p-MADI-RT-S13-LC	1310 nm	-15 dBm	-8 dBm

Tx CHANNEL (multi-mode)

	Wavelength	Min	Max
FIO-991p-MADI-RT-M13-LC	1310 nm	-20 dBm	-14 dBm

PROCESSING PERFORMANCE

Signal path: 10 bits
 Latency: <6 ns

ELECTRICAL

Voltage: 5 VDC
 Power: ≤3 W