



Model 412

FIBER TRANSPORT SYSTEM

The Model 412 Fiber Transport System is a high-performance portable or rack-mounted solution for transporting multiple digital video signals and an Ethernet connection over single-mode optical fiber. The system is compatible with all common broadcast serial digital video formats as well as MAD1 multi-channel digital audio. Up to six digital video or MAD1 signals can be transported. The Model 412 also provides gigabit Ethernet-over-fiber transport capability along with a 4-port 10/100/1000 Ethernet switch. Model 412 units are ideal for use in remote trucks, live-event video distribution, and fixed links associated with broadcast and production facilities. Three Model 412 versions are available, offering a range of SDI/MADI input and output configurations. The combination of SDI/MADI and Ethernet transport capabilities, along with extensive user support features and a lightweight, compact form factor, make the Model 412 a highly unique product.

Digital Video/MADI Features:

- Multi-channel electrical-to-optical (E2O) and optical-to-electrical (O2E) capability
- Six format-independent SDI/MADI signal paths over two single-mode optical fibers
- Supports 3G-SDI (SMPTE 424M), HD-SDI (SMPTE 292), and SD-SDI (SMPTE 259M), DVB-ASI, and MADI (AES10) signals
- Utilizes single-mode fiber with 10 km distance capability
- Monitoring of optical transmit and receive levels, signal status, and format recognition

Ethernet Features:

- Gigabit Ethernet transport over single-mode fiber with 10 km distance capability (1000BASE-LX10)
- 4-port 10/100/1000 Ethernet switch with auto MDI/MDI-X
- Four RJ45 UTP ports (1000BASE-T) with LED status indicators
- “Jumbo” frame support
- Monitoring of optical transmit and receive levels, port link status, and port rates

General Features:

- Front-panel features include status display, navigation buttons, and power switch
- 10/100 Ethernet maintenance port provides system configuration and performance monitoring using web pages or SNMP
- Powered by a 10-18 volt DC external source
- Compact “half-rack” 2-rack-space (2U) enclosure weighs less than 3 pounds (1.4 kg)
- Optional rack-mounting front panels available



Model 412 Front View (identical for all versions)

Overview

The Model 412 Fiber Transport System is a half-rack, “2U” high unit that is intended for portable or fixed broadcast and related applications. Energy efficient, the Model 412 requires little power for operation and runs “cool” to the touch. Units are factory configured from among three available choices. All versions contain identical Ethernet support capabilities but differ in their SDI/MADI transport offerings. The Model 412-6T/E serves as a 6-channel electrical-to-optical (E2O) converter, allowing connection of up to six SDI or MADI signals by way of standard BNC connectors. The six channels are converted to optical and multiplexed onto two single-mode fibers; three complete SDI or MADI signals are carried per fiber. The Model 412-6R/E is a 6-channel optical-to-electrical (O2E) converter. Two optical fibers bring the multiplexed signals into the unit which converts them into six electrical SDI or MADI outputs on BNC connectors. For “transceiver” applications the Model 412-3T/3R/E provides three channels of electrical-to-optical (E2O) and three channels of optical-to-electrical (O2E) conversion. Three BNC connectors are used to interface with three SDI/MADI sources and another three BNC connectors provide the SDI/MADI outputs.

The front panel of each Model 412 version features a day/night-readable color backlit display, menu navigation buttons, and power on/off switch. The back panels include connections for DC power, four ST optical connectors, six BNC connectors for SDI/MADI signals, four RJ45 jacks associated with the Ethernet switch functions, and an RJ45 jack for connection with the Ethernet monitor interface.

Technology

The Model 412 uses a novel hardware implementation to transport three SDI or MADI signals over each of two single-mode optical fibers. The three SDI or MADI signals, at rates of up to 2.97 Gb/s, are transported over one fiber at wavelengths of 1310, 1490, and 1550 nm. In typical applications the launch power and receive sensitivity are such that signals can be transported over a minimum distance of 10 kilometers.

SDI input signals can be SD (270 Mb/s), HD (1.485 Gb/s), or 3G (2.97 Gb/s). 3G signals can be in either Level A or Level B format. DVB-ASI (270 Mb/s) signals are also compatible. To meet the needs of contemporary broadcast and production applications support for MADI digital audio signals is provided. Typical video-over-fiber products are not compatible with MADI signals as they have a unique modulation scheme and rate. Each of the Model 412’s SDI/MADI channels is independent, allowing any combination of type, rate, and format to be transported.

Advanced components support the Ethernet switch and transport-over-fiber functions. Auto MDI/MDI-X and auto rate selection capability helps to ensure compatibility with virtually all twisted-pair Ethernet signals. Ethernet signals at 10, 100, and 1000 Mb/s can co-exist on the four UTP ports including support for “jumbo” frames. The media conversion process (UTP-to/from-fiber) has been tested for actual “GigE” performance with rates approaching 800 Mb/s having been measured.

Operating Power

The Model 412 is powered using an external source of 10-18 volts DC that is connected via a broadcast-standard 4-pin XLR connector. Included with each unit is a compact 100-240 volt input/12 volt DC output power supply. Optional Model 412 cover assemblies provide Anton/Bauer® QR-Gold Mount or V-Mount battery support, allowing direct attachment of broadcast-standard rechargeable batteries. With the Model 412’s modest energy requirement, 7 watts maximum, one battery will typically support operation for many, many hours.

Remote Monitoring and Configuration

The Model 412 has an embedded web server that allows users to monitor system status through web-enabled devices such as a personal computers, tablets, or smartphones. System status can also be communicated over Ethernet networks using SNMP, making it possible to integrate the unit’s monitoring information into a networked alarm and control software application.

The Model 412’s front-panel status screen lets users or technicians observe the status of SDI/MADI input and output channels. Information provided includes optical transmit and receive levels as well as the type of signals being transported. Ethernet-related functions such as link status and optical transmit and receive power are also provided. Optical signal levels are reported directly in dBm, making it particularly useful in conjunction when remote system troubleshooting.

The embedded web server also provides a configuration menu, allowing a variety of monitoring parameters to be set. These include



Model 412-6R/E Back View

enabling alarms for loss of SDI/MADI inputs and outputs, low optical transmit and receive levels, and excessive temperature. Additional menu screens provide access to SNMP, network IP address, and front-panel display configurations. Advanced features include the ability to remotely update the Model 412’s system firmware via an Ethernet connection to the maintenance port.

Simple Installation

While the Ethernet-accessed monitoring and configuration functions enhance the utility of the Model 412 they are not necessary for basic SDI/MADI-over-fiber and Ethernet transport operation. Model 412 units will deliver reliable, high-quality performance with no other user actions outside of making SDI/MADI, UTP (twisted-pair) Ethernet, single-mode fiber, and power connections. All back-panel connectors are clearly labeled for simple, fast, and intuitive use. And the front-panel display provides direct access to the unit’s most important status information.

The Model 412 is housed in a compact, lightweight aluminum enclosure that is designed to be “road ready.” It can be used in this manner as a standalone portable unit for “throw-down” applications. Two rack-mount options are also available allowing one or two units to be mounted in two spaces (2U) of a standard 19-inch rack enclosure. With the Model 412’s low power consumption and passive airflow vents no special cooling methods are required.

Model 412 Specifications

Digital Video/MADI Inputs:

Quantity: 6 (Model 412-6T/E)
Quantity: 3 (Model 412-3T/3R/E)
Data Rate: 125 Mb/s to 2.97 Gb/s
Supported Standards: 3G-SDI (SMPTE 424M), HD-SDI (SMPTE 292), SD-SDI (SMPTE 259M), DVB-ASI, MADI (AES10)
Connectors: BNC, 3G-SDI optimized, gold plating on center pin, per IEC 61169-8 Annex A
Type: unbalanced
Impedance: 75 ohms

Digital Video/MADI Outputs:

Quantity: 6 (Model 412-6R/E)
Quantity: 3 (Model 412-3T/3R/E)
Data Rate: 125 Mb/s to 2.97 Gb/s
Supported Standards: 3G-SDI, HD-SDI, SD-SDI, DVB-ASI, MADI
Connectors: BNC, 3G-SDI optimized, gold plating on center pin, per IEC 61169-8 Annex A
Type: unbalanced
Impedance: 75 ohms
Level (Video Mode): 800 mV p-p, nominal
Level (MADI Mode): 400 mV p-p, nominal

Video-over-Fiber Transport:

Compliance: SMPTE 297 (as applicable)
Number of Fibers: 2; one transmit, one receive
Fiber Type: single-mode

Fiber Length: 10 km minimum (typical)
Connectors: ST PC
Multiplexed Wavelengths: 1310 nm (FP), 1490 nm (DFB), 1550 nm (DFB)
Launch Power: -3 dBm nominal @ 1310 and 1550 nm; -1 dBm nominal @ 1490 nm
Receive Sensitivity: -17 dBm, nominal @ 2.97 Gb/s
Maximum Input Power: -3 dBm, nominal

Ethernet Switch Function:

Number of Ports: 4
Port Type: 10BASE-T (10), 100BASE-TX (10/100), 1000BASE-T (10/100/1000 “GigE”)
Technical Details: auto MDI/MDI-X, audio type select (10, 100, or 1000), jumbo frames supported
Connectors: 4; RJ45 (8-pin modular)

Ethernet-over-Fiber Transport (“Media Converter”):

Type: 1000BASE-LX10 (“GigE”)
Fiber Type: single-mode
Fiber Length: 10 km minimum (typical)
Numbers of Fibers: 2; one transmit, one receive
Connectors: ST PC
Transmit Wavelength: 1310 nm (FP)
Launch Power: -5 dBm, nominal
Receive Sensitivity: -22 dBm, nominal
Maximum Input Power: -3 dBm, nominal

Maintenance Ethernet Interface:

Type: 10/100, auto MDI/MDI-X
Connector: RJ45 (8-pin modular)

Status LEDs: 2; link and activity
Supported Protocols: HTTP, SNMP, DHCP, DNS

Display: vacuum fluorescent (emissive) with color LED backlighting

Power Requirement:

10 to 18 volts DC, 7 watts maximum; universal mains input/12 volt DC output power supply shipped with each unit
Connector: 4-pin male XLR (pin 1 -, pin 4 +)
Battery Operation: optional covers with Anton/Bauer® QR-Gold Mount and V-Mount available

Dimensions (Overall):

8.7 inches wide (22.1 cm)
3.47 inches high (8.1 cm)
8.0 inches deep (20.3 cm)

Mounting Options: single-unit (M412RM-1) or dual-unit (M412RM-2) rack-mount front panels; each uses two spaces (2U) in a standard 19-inch rack

Weight: 2.6 pounds (1.2 kg)

Specifications subject to change without notice.

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