

OPTOCORE



OPTOCORE Technology Overview

OPTOCORE is a synchronous, redundant, optical ring network capable to transport audio, video, control data and word clock over extremely long distances. The large variety of OPTOCORE modules can all be combined and offer maximum flexibility in terms of layout, number of channels, safety as well as the type of signals which can be transmitted.

The bandwidth of the 1Gbps network allows the transmission of 512 audio channels at a sample rate of 48 kHz by using a single fiber optical cable. In order to transmit audio, video and data simultaneously, the different data types share the bandwidth.

Audio and video are continuous signals. The OPTOCORE® OPTICAL DIGITAL NETWORK SYSTEM uses a digital Time Division Multiplex technology (TDM) with a fiber channel based 8B10B-NRZI-coding. Static time slots guarantee the synchronous transmission of all channels at any time with no demand for dynamic bandwidth or buffers. All signals attached to the audio, video, word clock and auxiliary ports of the device are transmitted simultaneously. All devices (Optocore and non Optocore) integrated in the network run with the same word clock.

One of the big advantages of this method is the extremely low latency of the network. The Optocore system delay including the matrix is fixed to 41.6 μ s for all channels. The transport delay per Optocore unit (<200 ns) in the network is insignificant. The transmission delay is constant from any point to any point. Overall delay depends on converters and fiber cable lengths. The delay caused by fiber cables can also be considered as marginal when using 'normal' cable lengths of <700 m.

For more details, please visit <http://www.optocore.com>.

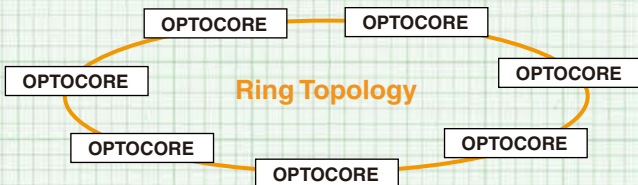
Yamaha Corporation provides neither sales nor customer-support services for these products. Please visit the manufacturer's web site for technical specifications and other product-related information.

URL: <http://www.optocore.com>

Till von Hofmann
OPTOCORE GmbH — Marketing

Topology and Connection Set-up

The Optocore Network System is based on a ring topology. The devices are linked via optical fiber cables. All the Optocore network devices are equipped with dual optical interfaces in order to build dual redundant ring structures. The standard type of fiber is the multimode 50/125 μ m fiber, with SC- or LC-type connectors. Other options are available on request (i.e. single mode fiber).



The ring structure offers multiple advantages. Once a signal is received at any point in the network, it is available at any other point. Each input can be assigned to as many outputs as are demanded by an application. A ring network topology is most suitable to build in redundancy. The dual redundant ring structure of the Optocore network provides maximum safety. All the devices in the ring have the same importance and do not require a central unit (or main hub). In the unlikely case of a defective unit, the remaining network will continue working.

The fiber cables weigh only a fraction of the copper cables used in a conventional analog audio system. Optical fiber cables not only reduce the cable weight, but also increase the quality of the transmitted signals. Electromagnetic interference and cable capacity are no longer an issue. Galvanic isolation between the devices is given, thus ground loops do not exist. The cables only need very little space; installation becomes very easy and comfortable. Using the Optocore Network System and its optical fiber connections offers the highest standards in regard to control and complexity. Control signals such as the OPTOCORE CONTROL remote data, third party control and Ethernet data, word clock signals or video can be included and sent using the same fiber cable as used for the audio signals.

Yamaha Emulation Mode (YEM)

Optocore offers a unique function called Special Mode. It enables the control of Optocore devices by third party devices. The premise is that the control protocol of the third party devices is previously adapted to Optocore. The control of Optocore preamps by Yamaha consoles is possible. No special mode is necessary, if a third party device communicates with another third party device of the same manufacture, the protocol is compatible to the RS485 ports and the RS485 ports are only used to transport the data, e.g. if a Yamaha console at FOH communicates with Yamaha preamps on stage via Optocore.

The special mode for controlling the Optocore preamps by Yamaha consoles is called Yamaha Emulation Mode (YEM). It emulates the presence of Yamaha AD8HR (8 channels Mic-preamp and A/D device). Taking the consoles point of view, the Optocore preamps are 8-channel AD8HRs, each AD8HR with eight inputs and a specific Yamaha ID between 1 and 12 (Maximum number of AD8HRs controllable by a Yamaha desk). Therefore up to 96 Optocore inputs are controllable from the console.

The Optocore device connected directly to the Yamaha console, will translate the Yamaha commands into Optocore commands and vice-versa. The mapping and setup is stored in this device. After the definition is finished and the YEM is activated, the console will take over the control automatically disabling the control by OPTOCORE CONTROL. This is necessary to ensure that only one control device is controlling the network. A PC connected to the Optocore device enables to turn the YEM ON/OFF.

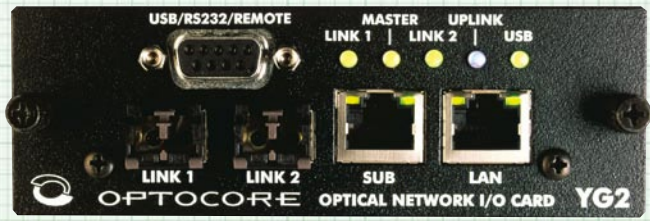
Products

Yamaha General Digital Audio Interface I/O Card

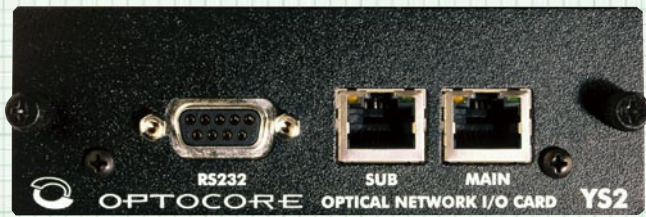
YG2

YS2

The Y-Series Network Modules are designed for the use in all Yamaha devices with Mini-YGDAI-Slots. The main card YG2 includes the 'heart of Optocore' allowing a direct connection of Yamaha digital consoles and other devices to the OPTOCORE® OPTICAL DIGITAL NETWORK SYSTEM. The YS2 is used as sub-card. With one YG2 and three YS2, simply connected by standard Cat5 cables, a total of 64 in- and 64 output channels can be achieved. Up to seven YS2 sub cards can be connected to a single YG2 main card if the 8-channel mode is enabled (PM1D).

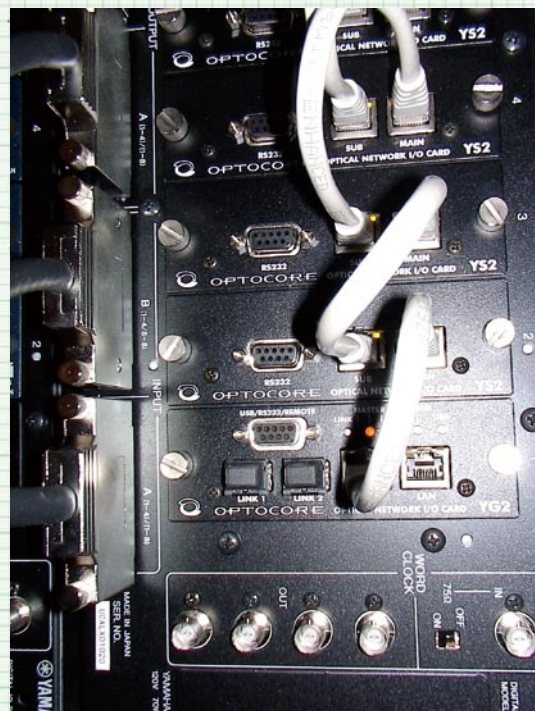
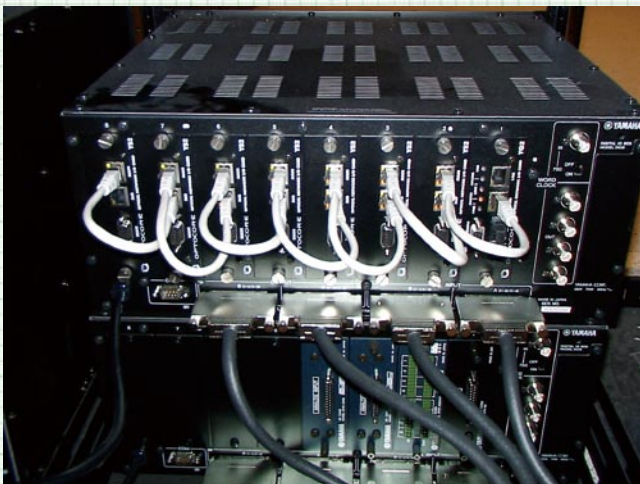


YG2



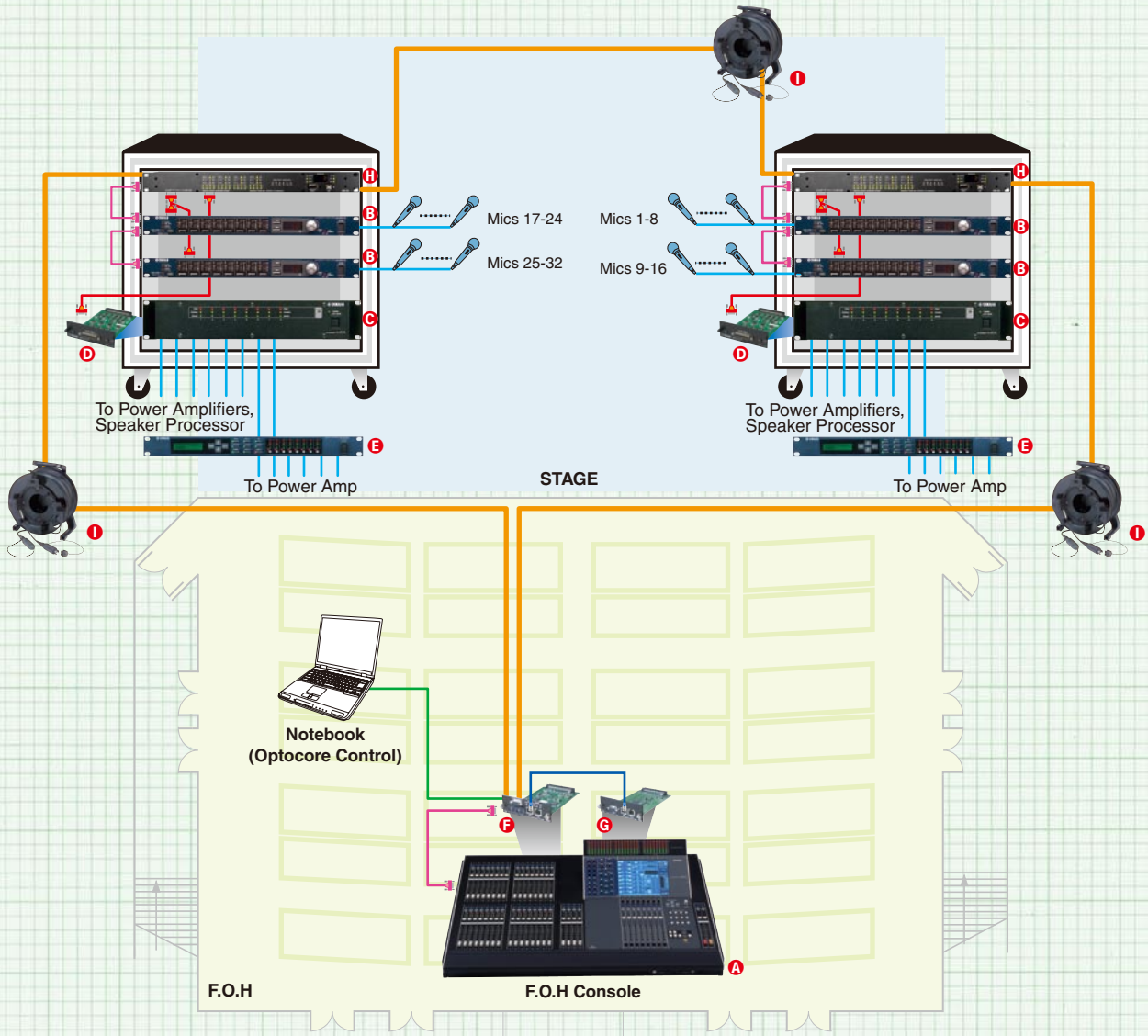
YS2

Example



Mid-size Live SR

This application example below illustrates how easy a synchronous and straight forward fiber optic connection can be established between the FOH console and the AD converters on stage using OPTOCORE YGDAI cards (YG2 and YS2) and DD32E multi I/O AES devices. These example applications provide enough leeway for additional outputs on stage as only three of the DD32E ports are used. The system provides redundancy offering maximum safety with an extreme low latency of 41.6µs.



Equipment List

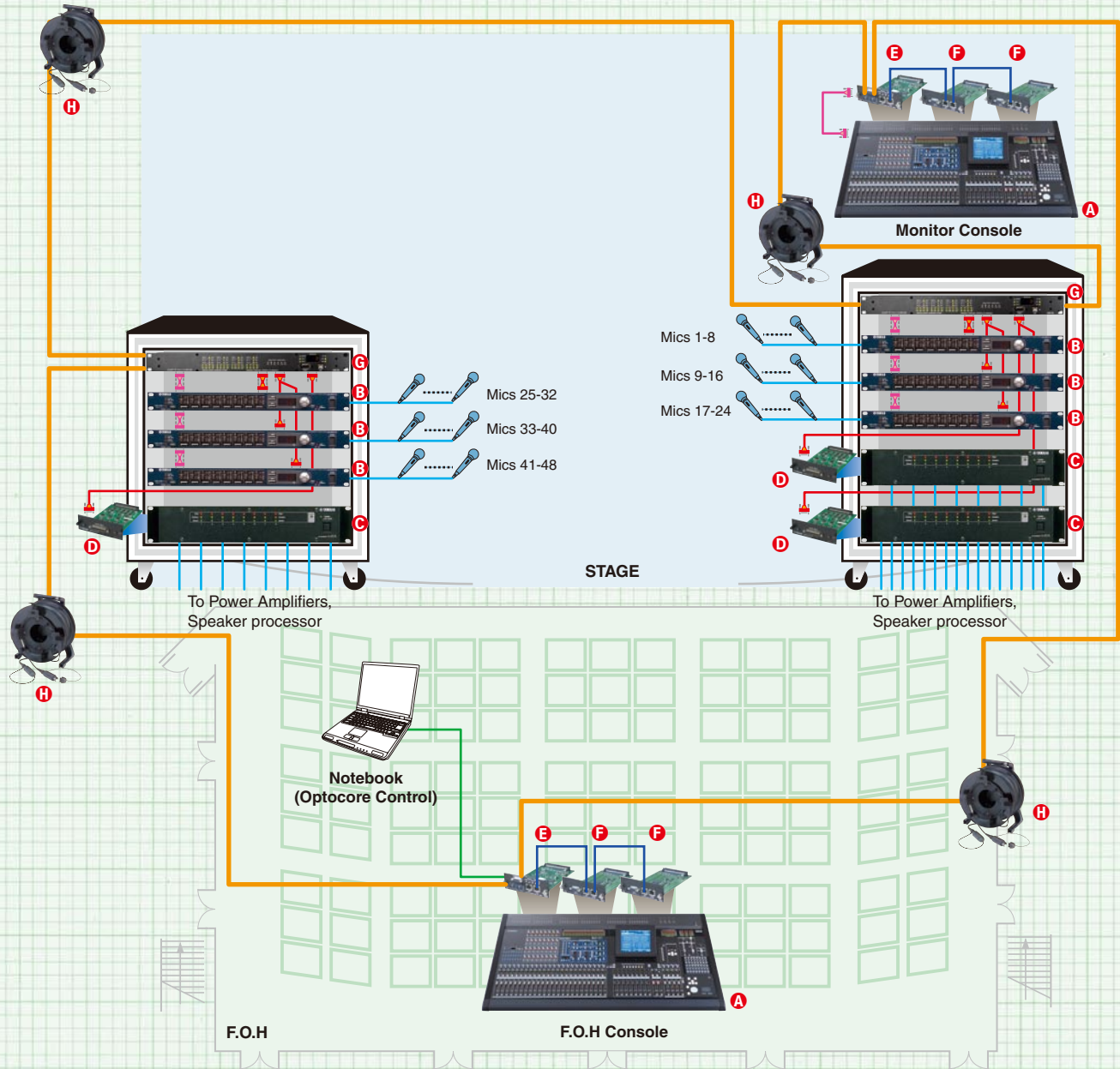
	Manufacturer	Equipment	Model	Qty.	Note
A	Yamaha	Digital Mixing Console	M7CL-32	1	
B		ADC/8ch Remote PreAmp	AD8HR	4	
C		DA Converter	DA824	2	
D		Digital I/O Card	MY8-AE	2	
E		Speaker Processor	SP2060	2	
F	Optocore	Digital Audio Interface I/O Card (Main)	YG2	1	
G		Digital Audio Interface I/O Card (Sub)	YS2	1	
H		Network I/O Device	DD32E	2	
I		Optical Multi Fiber Cable	OptoCable	3	

- Optical cable (Multi mode)
- Cat5e cable (STP only)
- D-sub 25-pin (male) cable
- HA Remote (D-sub 9-pin)
- Analog
- USB

Large Live SR

This application illustrates a large location with extremely long distances, as it may be the case in a stadium (i.e. Olympic Games in Athens 2004 or Beijing 2008). It brings along all the advantages of the previously illustrated mid-size system. A second console, for example as monitoring desk, is integrated into the system.

In such a system, it is very important to have an excellent and stable word clock distribution to synchronize all devices. High-Quality word clock and its distribution over the same fiber connections as audio, data and video is guaranteed when using an OPTOCORE network. The system runs entirely on the digital level, is therefore absolutely safe, and eliminates almost any source of defect or malfunction. Any other OPTOCORE device can be integrated into the system, which makes the network extremely flexible.



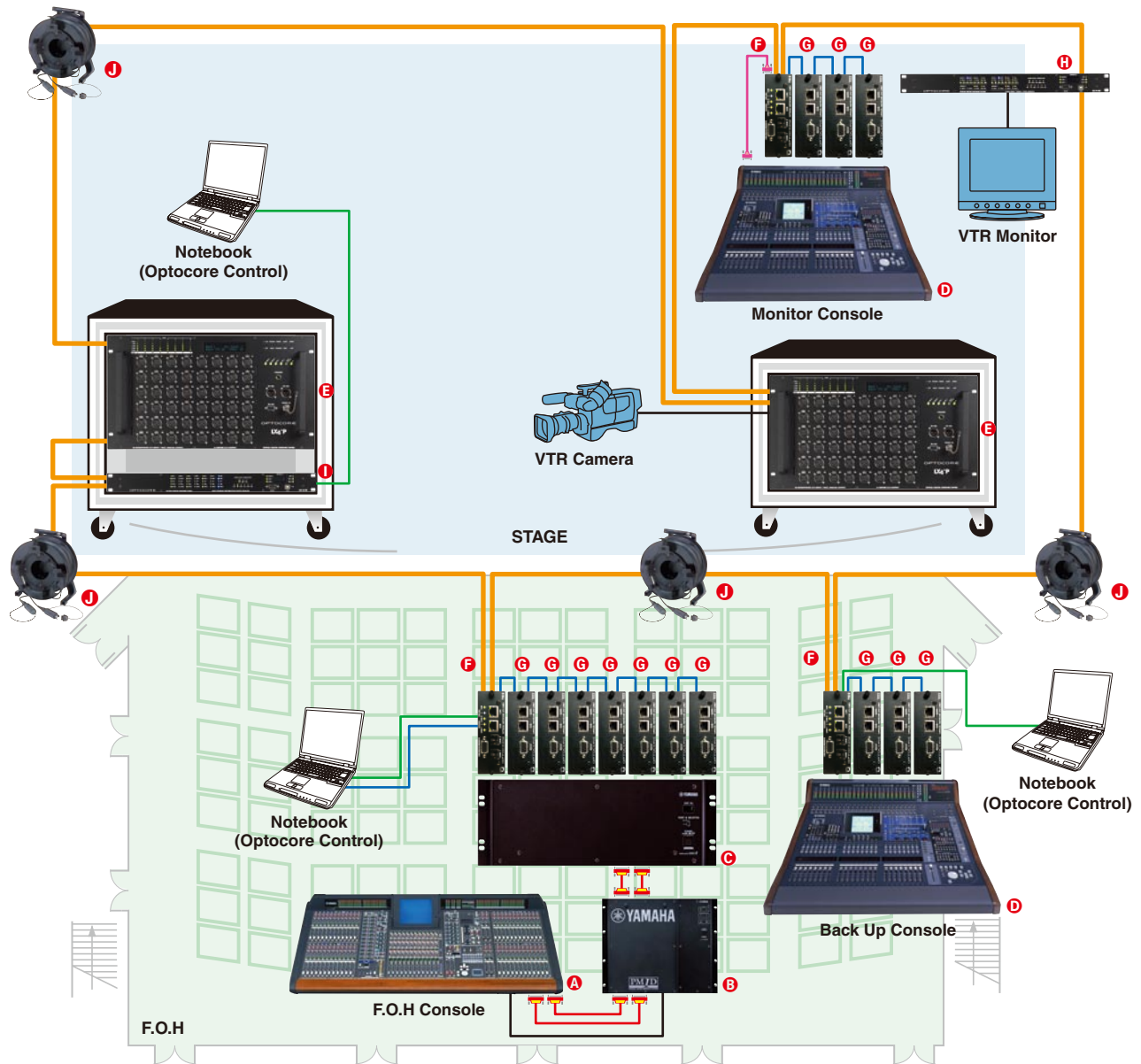
Equipment List

	Manufacturer	Equipment	Model	Qty.	Note
A	Yamaha	Digital Mixing Console	PM5D-RH V2	2	
B		ADC/8ch Remote PreAmp	AD8HR	6	
C		DA Converter	DA824	3	
D		Digital I/O Card	MY8-AE	3	
E	Optocore	Digital Audio Interface I/O Card (Main)	YG2	2	
F		Digital Audio Interface I/O Card (Sub)	YS2	4	
G		Network I/O Device	DD32E	2	
H		Optical Multi Fiber Cable	OptoCable	4	

- Optical cable (Multi mode)
- Cat5e cable (STP only)
- D-sub 25-pin (male) cable
- HA Remote (D-sub 9-pin)
- Analog
- USB

Application Example

As the application grows, OPTOCORE becomes more and more worthwhile. 256 audio channels in the network between the consoles, video, and real 100MBit Fast Ethernet, RS485 control data as well as MADI input and output, all in one single system. The system is redundant and only seven cables are used to interconnect all network devices. The two LX4AP can be remotely controlled via the DM2000 and the fully integrated PM1D can also take over the control of the system using the OPTOCORE Control software. Maximum flexibility is given concerning routing and control. Up to 700 meters of distance between two nodes in the system is absolutely no problem. Using monomode cables distances of up to 110 km are easily possible. The application above shows a real world set up of the First Christian Church Akron Ohio / USA.



Equipment List

	Manufacturer	Equipment	Model	Qty.	Note
A	Yamaha	Control Surface	CS1D	1	
B		DSP Unit	DSP1D	1	
C		Digital I/O Box	DIO8	1	
D		Digital Production Console	DM2000 VCM	2	
E	Optocore	AD/DA Converter	LX4AP	2	
F		Digital Audio Interface I/O Card (Main)	YG2	3	
G		Digital Audio Interface I/O Card (Sub)	YS2	13	
H		Dual MADI/Video/Data Network Device	DD4ME	1	
I		Fast Ethernet Network Device	DD6NE	1	
J		Optical Multi Fiber Cable	OptoCable	4	

- Optical cable (Multi mode)
- Cat5e cable
- D-sub 68-pin (male) cable
- D-sub 9-pin (HA Remote)
- USB
- Coaxial Video

Application Example

Optocore and Yamaha devices in less than 10 square meters

Located in Cologno Monzese (MI) Italy, Mediaset is one of Italy's leading TV broadcast networks providing broadcast contributions from various sectors such as news, showbiz, live- and sport events. Optocore and Yamaha devices form the technological heart of one of Mediaset's latest investments. The new Mediaset OB Van 27 is designed for the outside broadcast of soccer and MotoGP sports events and is equipped with the latest state-of-the-art audio-, video- and broadcast technology.

The Mediaset Engineering Group around Aldo Medici and Luciano Consigli were responsible for the technical interior of the van. 12 x DD32E, 3 x YG2 and 15 x YS2 OPTOCORE modules form the core of the new Mediaset Unita 27 HD. It brings together all audio sources (video camera, audio multiplexer and demultiplexer, video tape recorder, jingle machine, microphones, audio monitors etc.) with the main console, offering both transport and matrix functions. Two interconnected Optocore rings form the heart of the system. The first is located inside the OB van and comprises 7 x DD32E digital I/O modules in addition with an YG2 and 7 x YS2 optical digital Mini-YGDAI cards for Yamaha devices. The cards are plugged into a set of Yamaha DIO8s that are part of the PM1D system, the main console of the van. The second ring includes a set of YG2 and YS2 cards hosted by a further pair of DIO8s, also part of the PM1D, and an additional set of YG2 and YS2 cards plugged into a spare DM1000. Supplementary DD32Es complete the second ring for internal and external audio connections. The Yamaha PM1D console is the main crossing point for the audio signals between the two Optocore rings. The van also provides three racks used outside to collect and distribute audio signals. They are each equipped with a DD32E along with Yamaha AD8HRs and DA824 for A/D-D/A conversion. All installed Optocore devices are equipped with single mode (9/125) fiber transceivers.



Mediaset Unita 27 HD Equipment

