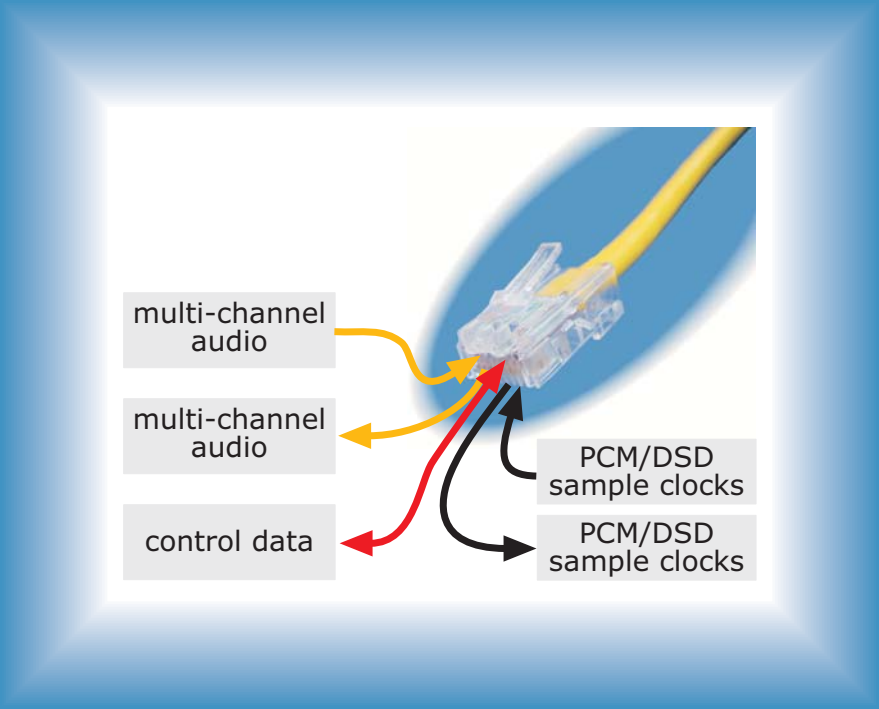


SuperMAC

Super Multi-Channel Audio Connection

SONY

Oxford Technologies

Product Brief

(April 2004)

SuperMAC

Super Multi-Channel Audio Connection

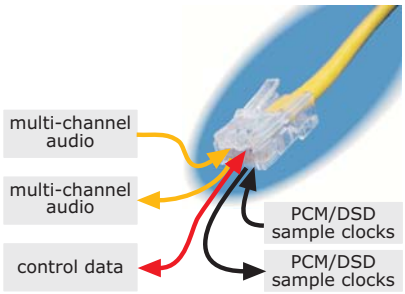
SuperMAC is a high-performance audio interconnection and routing system, designed for a wide range of professional audio applications.

Features

- **Single cable duplex interconnection for audio and sample clocks**
- **Universal PCM and DSD compatibility**
- **Uses Category-5/6/7 cable**
- **Ultra-low latency (typically 50-80 µs)**
- **Ethernet physical layer audio data transmission**
- **Error correction using redundant data**
- **5Mbit/sec auxiliary data channel**

Technology

SuperMAC uses conventional 4-pair Category-5/6/7 data cable, up to 100m in length. Two signal pairs are used to transmit and receive audio data, encoded via Ethernet physical layer technology. The system features robust error correction algorithms, delivering high reliability for professional studio applications. A high-frequency sample clock signal is conveyed in each direction on the remaining two signal pairs. Clock signal conditioning and data scrambling ensures that the sample clock maintains the highest possible quality.



SuperMAC transceiver reference design - life-size

Auxiliary Data

SuperMAC features an auxiliary data channel of approximately 5Mbit/sec bandwidth. This may be implemented as a standard Ethernet interface in software, allowing transport of higher-layer protocols such as TCP/IP. The auxiliary data is multiplexed within the audio stream, but is logically independent. In conjunction with the SuperMAC Router, the Auxiliary Data may be packet-switched between interconnected SuperMAC links, whilst the audio is channel-switched.

Audio Format Compatibility

Audio Format	Channels
DSD	24
44.1kHz PCM	48
48kHz PCM	48
88.2kHz PCM	24
96kHz PCM	24
176.4kHz PCM	12
192kHz PCM	12
352.8kHz PCM	6
384kHz PCM	6

All PCM audio formats are 24-bit, although 16 or 20-bit data can also be indicated. If AES3 i/o is used, SuperMAC will pass User and Channel Status data correctly.

"What hardware is required for a SuperMAC interface?"

SuperMAC transceiver hardware is based around a Xilinx Spartan-3 FPGA, together with an Ethernet PHY, LVDS clock transceivers and an RJ45 socket with associated transformers. Reference schematics with layout information are available from Sony, as part of the SuperMAC licensing package (see back page). The FPGA design for the SuperMAC logic is supplied in the form of pre-compiled logic "black box" modules, which may be assembled by the licensee to build the FPGA bitfile. Alternatively, if the licensee uses a specific device and pin-out, the bitfile may be supplied by Sony, avoiding the need to use FPGA design tools.

SONY

SuperMAC Router

Audio Channel Routing

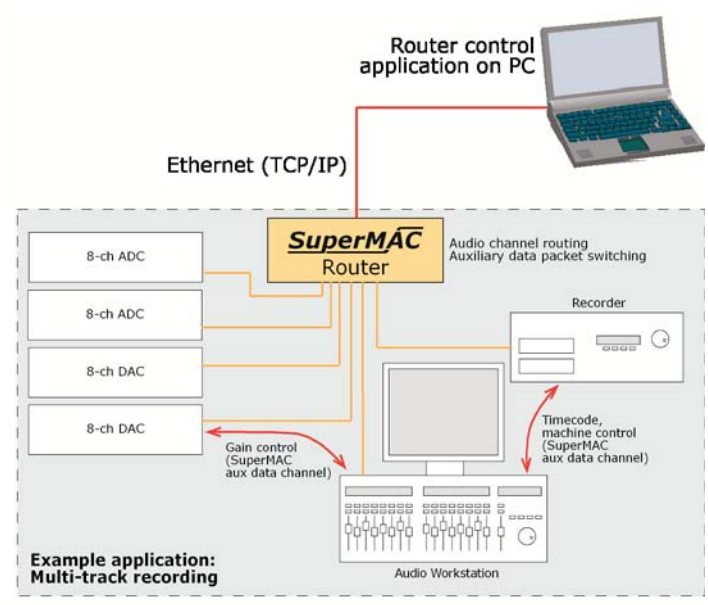
Each of the 16 SuperMAC links carries up to 48 full-duplex digital audio channels (1fs PCM)

- 768-channel (1fs PCM) "virtual patchbay" audio channel router
- High-resolution audio support: up to 384kHz sample rate (6 channels per link)
- Direct Stream Digital support (24 channels per link)
- Ultra-low latency (effectively zero routing latency, beyond the input and output SuperMAC link latencies)
- Flexible sample clock synchronisation: internal, or external from BNC input or SuperMAC port

Auxiliary Data Packet Routing

Each SuperMAC link has a full-duplex 5Mbit channel for packet-switched auxiliary data.

- Auxiliary data routed independently of audio
- Ethernet-based packet switching of auxiliary data
- Ideal for metadata, timecode, remote control and other applications



SuperMAC Router - a typical application

Router Control

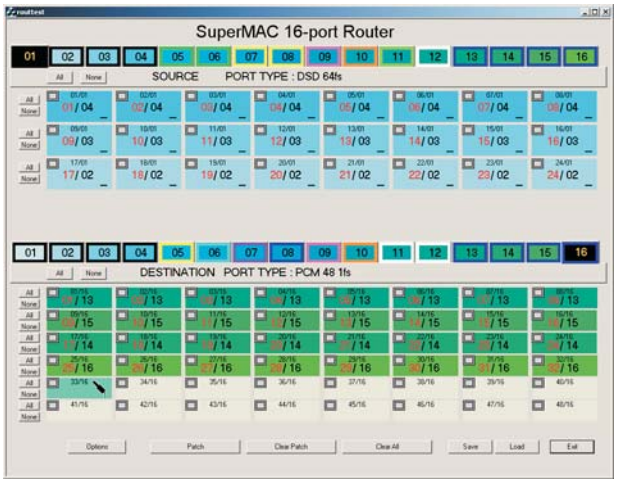
The SuperMAC Router is controlled and monitored remotely via TCP/IP over Ethernet, for example from a PC. It may also be controlled from other SuperMAC-connected devices via the SuperMAC auxiliary data channel.

Router Implementation

The SuperMAC Router pictured above is a prototype and technology demonstrator developed by Sony Pro-Audio Lab, Oxford. The Router is available as a licensed design comprising schematics, software and FPGA logic cores, in a similar manner to the SuperMAC Transceiver licensing. A variety of Router sizes and configurations are possible - please contact us to discuss the options further. The router architecture allows potentially very large routers (>1000 audio channels) to be built in a simple and cost-effective way, using moderately-priced FPGA silicon for the transceiver and switch logic.

SuperMAC and AES47

Sony Pro-Audio Lab, Oxford is working with Nine Tiles Networks to develop a SuperMAC-AES47 bridge. AES47 is an ATM-based audio network, standardised by the AES, and is ideal for large systems and wide-area network links. For more information, please contact Nine Tiles Networks (www.ninetiles.com).



SuperMAC Router - Control GUI for demonstrator

Product Brief

(April 2004)

DSD
Direct Stream Digital

SuperMAC
Super Multi-channel Audio Connection

SuperMAC Licensing

SuperMAC is available under a royalty license agreement. License fees are competitive, with very significant discounts for high volumes (over 100 ports per year). Fees are payable per-port, on licensee products shipped. There is also a modest one-time initial fee.

Under the agreement, the licensee receives:

- SuperMAC transceiver (or router) reference design: schematics, bill of materials, layout information
- Technical development support from Sony Pro-Audio Lab, Oxford development engineers, including design review
- Rights to use Sony IPR contained in the SuperMAC cores
- FPGA logic cores or bit-files (implementation intellectual property), and updates as available
- SuperMAC test data

The SuperMAC Router is available on similar terms, with the license fee payable per-port.

An evaluation kit, comprising a transceiver reference design module, host board, cables and software, is available for loan or purchase from Sony Pro-Audio Lab, Oxford.

AES Standardisation

SuperMAC technology is currently undergoing standardisation with the Audio Engineering Society Standards Committee, as project AES-X140 ("High Resolution Multi-channel Audio Interconnection", or "HRMAI"). It is expected that the standard will be ratified before the end of 2004. For further information, please see the AES Standards website at www.aes.org/standards.

Future Developments

A SuperMAC-compatible interconnection technology using Gigabit Ethernet physical layer, on both copper and optical media, is also in the early stages of development. This will provide 8-10 times the channel count and auxiliary data bandwidth of current SuperMAC technology, and is likely to find use as a "system backbone" connection, linking SuperMAC Routers.

SuperMAC Applications

SuperMAC is highly suitable for audio interconnection and routing in applications such as music recording systems, post-production, on-air broadcast, live sound reinforcement and installed sound.

Further Information

More detailed information is available from the SuperMAC website (see "Contacts" section below), including:

- SuperMAC Protocol Specification, and Companion Document containing background information and implementation tips
- Technical information about the SuperMAC reference design, evaluation module and FPGA Logic Cores
- SuperMAC FAQ, on both technology and implementation topics
- Further information about the SuperMAC reference design and router

For pricing details, or technical information on implementation options, please contact us at supermac@sonyoxford.co.uk.

Contacts

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