OPERATIONAL DESCRIPTION

1.1. Product description of EtherSound ES8 in & ES8 OUT

ETHERSOUND ES8IN AND ETHERSOUND ES8OUT

offer an easy and affordable way to install and distribute up to 64 channels of audio by incorporating Digigram's EtherSound™ technology. These Ethernet audio bridges enable the creation of easy-to-implement, 24-bit digital audio distribution networks using standard Ethernet switches and CAT5 cabling.

EtherSound ES8in transforms up to eight analog audio signals into as many EtherSound channels and inserts them into an EtherSound network, while EtherSound ES8out extracts up to eight digital audio channels from the network and transforms them into analog audio signals for playback. Both manage GPIOs and RS232 for bi-directional control and take advantage of EtherSound's simple, nearly instant set-up with or without a PC.

Easy to install

The ability to use EtherSound ES8in/8out units almost anywhere in the audio system breaks through the limitations of analog audio or AES/EBU installation schemes. They eliminate the need to bring all of the audio to a central switching or routing location, reduce cable, cable run, and installation expenses, and greatly simplify system reconfiguration.

Point-to-point connections are replaced by architectures that are easier to design and install: daisy chain, star, or a combination of both. The set-up of a dedicated EtherSound network is as simple as plugging an Ethernet cable into a socket and does not require specific IT skills. An EtherSound system may also run within a VLAN (Virtual Local Area Network) as part of an existing corporate network.

Thanks to the inherent routing capabilities of computer networks, input to output allocations may be easily updated without physical changes to the system's topology. Configuration tasks can be accomplished remotely via a straightforward configuration software (delivered with EtherSound ES8in), or locally on the devices by using built-in rotary switches.

The properties of Ethernet cables (small diameter, no audible electromagnetic interference, etc.) allow for audio systems in areas where a traditional installation is difficult or impossible, as it is frequently the case in existing buildings. A single standard Ethernet CAT5 cable can replace a vast number of traditional cables, patch panels, routing matrixes, or other switching devices.

Costs savings at every stage

With a drastic reduction in design, installation, and configuration time, EtherSound is a simple way to complete complex audio installations at an affordable price. The use of standard Ethernet components lowers considerably the material (cheaper cables, reduced number of cables, smaller cable run, less routing hardware) and labor costs. Remote system reconfiguration frees staff from time-consuming site visits. All of these advantages contribute to reduce the total cost of ownership (TCO).

KEY FEATURES

EtherSound ES8in
EtherSound ES8out

- Stand-alone 1U 19" rack mount unit
- Devices may be daisy-chained via "FROM" and "TO" Ethernet ports
- 8 mono balanced line inputs or outputs
- Channel assignment locally or remotely
- Control and monitoring via
  - 4/4 General Purpose inputs/outputs (GPIO)
  - RS232 port
- EtherSound ES8in supplied with PC management software for:
  - Automatic network detection
  - Remote channel assignment
  - Dynamic reconfiguration
  - Management of control and monitoring ports

About EtherSound

EtherSound technology allows up to 64 channels of 24-bit digital audio, plus bi-directional status and control data, to be distributed among more than 60,000 devices in a network. The patent-pending EtherSound protocol provides fully deterministic, very low-latency transmission of synchronized audio channels over standard Ethernet. Latency between two EtherSound devices is typically less than 120 µs.

EtherSound offers new possibilities to the most demanding professional audio applications, such as:

- **Multi-zone audio distribution**
- **Synchronous high-quality audio signal exchange between studios**
- **Audio distribution for live sound**

EtherSound enabled products will soon be available from a number of leading audio equipment manufacturers for installed sound and pro audio applications.

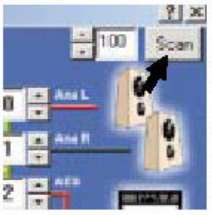
INSTALLATION

Steps for installing an EtherSound network

1. Connect the EtherSound ES8in and EtherSound ES8out units, as well as any other EtherSound devices, using standard CAT5 cables and, if appropriate, Ethernet switches. System topology may be daisy chain, star, or a combination of both.

- EtherSound ES8in/8out each feature two ruggedized Ethernet EtherCon™ RJ45 connectors. The "FROM" port receives EtherSound data from an EtherSound network, while the "TO" port sends EtherSound data to other devices "downstream".
- The first device in a network, such as an EtherSoundES8in, provides the master clock for the entire network. The "FROM" port may be connected directly or via network to a control computer for system configuration.
- Connect the one device's "TO" port to the "FROM" port of the following device (EtherSound ES8in for inserting additional channels or EtherSound ES8out for extracting existing channels). Repeat this step for each device in the network.
- The maximum distance between two devices is 100 meters (328 feet). Intermediate switches or fiber optic links may be used to considerably increase this distance.
- All EtherSound devices "downstream" from an audio source can play the corresponding network channel.

2. Connect the analog audio sources and destinations to the EtherSound devices. EtherSound ES8in/8out are equipped with XLR or terminal block connectors.



3. Detect the EtherSound network to determine the number of devices and inputs/outputs in the network, as well as their availability and their position. The management software supplied with EtherSound ES8in provides for one-click system detection. (Skip this step in case of manual set-up)

4. Configure the system locally using the rotary switches on each EtherSound ES8in/8out or remotely using the management software (once set-up is complete, the EtherSound network can distribute audio without an external PC).

- For EtherSound ES8in: assign an analog input signal to an EtherSound channel.
- For EtherSound ES8out: choose a signal from the EtherSound channels available. The selected channel remains available for all EtherSound devices "downstream".

You're done.
The EtherSound system is now ready to distribute high-quality audio!

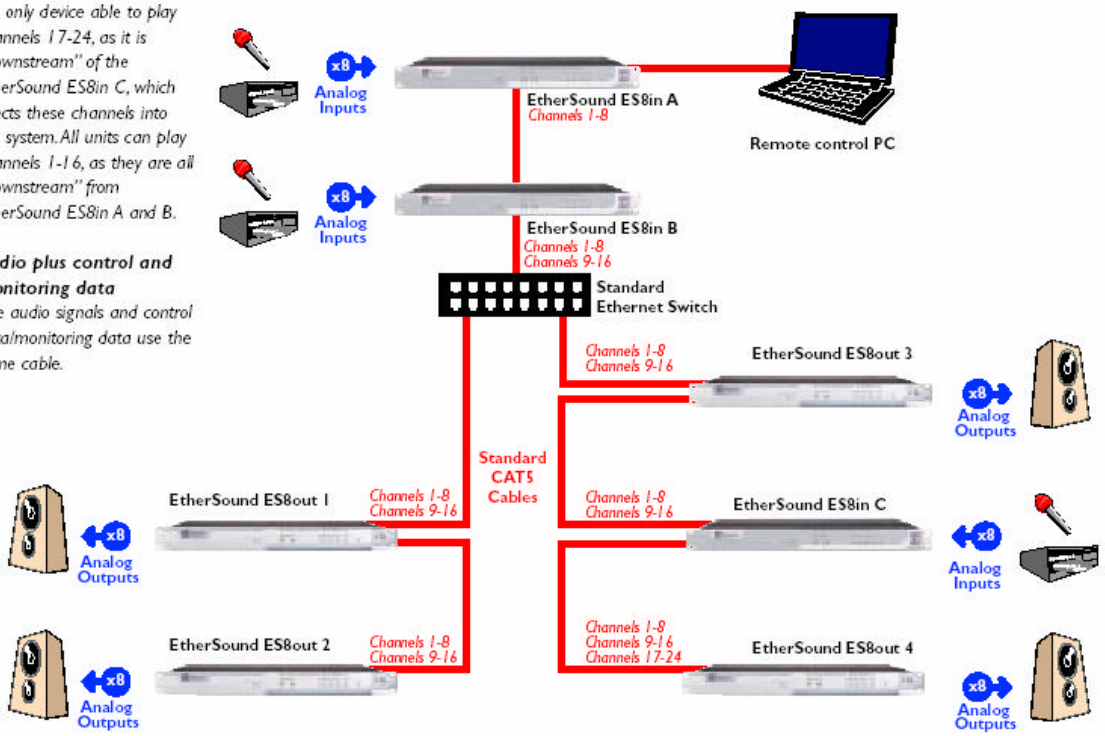
EXAMPLE OF AN ETHERSOUND NETWORK ARCHITECTURE

Concept of "downstream" distribution

EtherSound ES8out No. 4 is the only device able to play channels 17-24, as it is "downstream" of the EtherSound ES8in C, which injects these channels into the system. All units can play channels 1-16, as they are all "downstream" from EtherSound ES8in A and B.

Audio plus control and monitoring data

The audio signals and control data/monitoring data use the same cable.



Bi-directional control data on the same cable

By transporting bi-directional control data signals on the same cable as the digital audio, EtherSound eliminates the need for separate cables for the control and monitoring of equipment such as amplifiers, lighting, keyboards, automation, etc. Eight GPIO ports (four optocoupled inputs and four relay outputs) and one RS232 port can be managed by a remote computer.

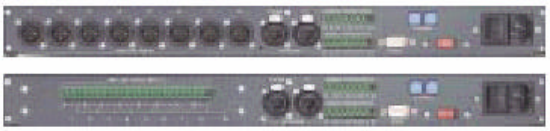
Low latency to meet the requirements of studio, stage, and broadcast

Minimal latency was one of Digigram's key design requirements for EtherSound. No other technology offers such high audio quality with such low latency. Furthermore, EtherSound is fully deterministic, making it possible to calculate the exact delay between any two devices in an EtherSound network.

The point-to-point transmission time between an audio input and an audio output in an EtherSound network is six samples (125 µs at 48 kHz). Each slave module in a daisy chain adds only 1.22 µs to this time. Latency is independent of the number of channels transmitted.

Connectivity

The connectivity of EtherSound ES8in/8out assures easy integration into a large number of audio systems.



- Analog audio: Eight inputs (EtherSound ES8in) or eight outputs (EtherSound ES8out), available as either eight XLR connectors or one 24-point terminal block
- EtherSound:
  - Two ruggedized EtherCon RJ45 for "FROM" and "TO" ports
- Control and monitoring:
  - Four/four inputs/outputs GPIO on two 8-point terminal blocks
  - RS232 serial port on 9-pin Sub-D
- Rear panel:
  - Two rotary switches for local selection of audio channels
  - AC main switch (100-240 VAC; 47-63 Hz).

SPECIFICATIONS

Configuration	EtherSound ES8in	EtherSound ES8out
Size	1U 19" rack mount unit: 43.9 x 482.6 x 297.1mm	
Power supply	100-240 VAC, 47-63 Hz	
Operating: temperature/humidity (non-condensing)	-5 °C-70 °C / 0% -95%	
Power consumption	<30 Watts	

Parameters

Selection of audio channels	Manually by rotary switches or by Windows 2000/XP compatible software
EtherSound System Configuration Software	Software application allowing the detection of the topology of an EtherSound network, the control of groups, remote channel assignment, control of GPIO inputs/outputs, and RS232 port.

Inputs/Outputs

Analog audio	8 mono balanced line inputs	8 mono balanced line outputs
Impedance	22.2 kΩ	<100 Ω
Nominal level	+4 dBu or -10 dBV with internal jumper	+4 dBu with output gain remote control from 0 to -72 dB
Maximum level	+22 dBu or +10 dBu with internal jumper	+22 dBu with output gain remote control from 0 to -72 dB

Connectivity

Analog audio	8 XLR female or one 24-point terminal block	8 XLR male or one 24-point terminal block
EtherSound	2 EtherCon female RJ45 compatible	2 EtherCon female RJ45 compatible
GPIO	4 optocoupled inputs and 4 relay outputs on two 8-point terminal blocks	4 optocoupled inputs and 4 relay outputs on two 8-point terminal blocks
Serial ports	1 RS232 on DB9	1 RS232 on DB9

Audio specifications

Sampling frequency	48 kHz or 44.1 kHz	48 kHz or 44.1 kHz
A/D and D/A converter resolution	24bits	24bits
Frequency response at 48 kHz	20 Hz – 20 kHz: ± 0.2 dB	20 Hz – 20 kHz: ± 0.2 dB
Dynamic range –60dBfs with Fs=48 kHz (20 Hz/20 kHz, unweighted)	>102 dB	>109 dB
Distortion and noise (THD+N) at 1 kHz	<-94 dB (0.002%)	<-93 dB (0.002%)
Phase difference between channels: 20 Hz/20 kHz	0.5°/2°	0.5°/2°
Crosstalk at 1 kHz	<-100 dB	<-100 dB

Synchronization

Clock source	Either internal (if first EtherSound device in a network) or external, locked on EtherSound upstream	External, locked on EtherSound upstream

Digigram

Networking Your Sound

Digigram (www.digigram.com) digital audio solutions are key to the success of public address and pro sound installations, as well as broadcast and media production companies worldwide. We develop innovative networked audio devices, computer sound cards, and audio management software.

Digigram Powered solutions are installed in thousands of radio and television stations; corporate and commercial sound installations; and audio recording and video post-production facilities around the globe.

Customers are served from four regional business units: Digigram Europe (Digigram Headquarters, Montbonnot, France), Digigram Inc. (Arlington, VA USA), Digigram Asia (Singapore), and Digigram América Latina (Cuernavaca, Mexico). Digigram is publicly traded on the Paris stock exchange (Euroclear: 3578).

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1.2. Related Submittal(s) / Grant(s)

All host equipment used in the test configuration are FCC granted, when relevant.

1.3. Tested System Details

The FCC IDs for all equipment, plus description of all cables used in the tested system are :

Trade Mark – Model Number (Serial number)	FCC ID	Description	Cable description
DIGIGRAM ES8 OUT * (sn: 0051) **DIGIGRAM ES8 IN * (sn: 0051)** ***XLR and terminals block models***	**IGTES8**	**Ethernet Audio bridges**	Standard power cable unshielded, Ethernet FTP cables RS232 shielded cable Analog audio IN/OUT lines, shielded. GPIO cables, unshielded
DIGIGRAM (sn: none)	None	I/O Load box	Standard power cable (only for earth connection)

* : Equipment under test

1.4. Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4-1992, FCC Part 15 Subpart B.
Radiated testing was performed at an antenna to EUT distance of 10 meters. During testing, all equipment's and cables were moved relative to each other in order to identify the worst case set-up.

1.5. Test facility

Tests have been performed on April 18th and 23rd, 2003.

The test facility used to collect all the test data is the SMEE *Actions Mesures* facility, located ZI des Blanchisseries, 38500 VOIRON, France.
This test facility has been fully described in a report and accepted by FCC as compliant with the radiated and AC line conducted test site criteria in ANSI C63.4-2000 in a letter dated July 19, 2002 (registration number 94821).
This test facility has also been accredited by COFRAC (French accreditation authority for European union test lab accreditation organization) according to NF EN ISO/IEC 17025, accreditation number 1-0844 as compliant with test site criteria and competence in 47 CFR Part 15/ANSI C63.4 and EN55022/CISPR22 norms for 89/336/EEC European EMC Directive application. All pertinent data for this test facility remains unchanged.