# Installation & User Manual
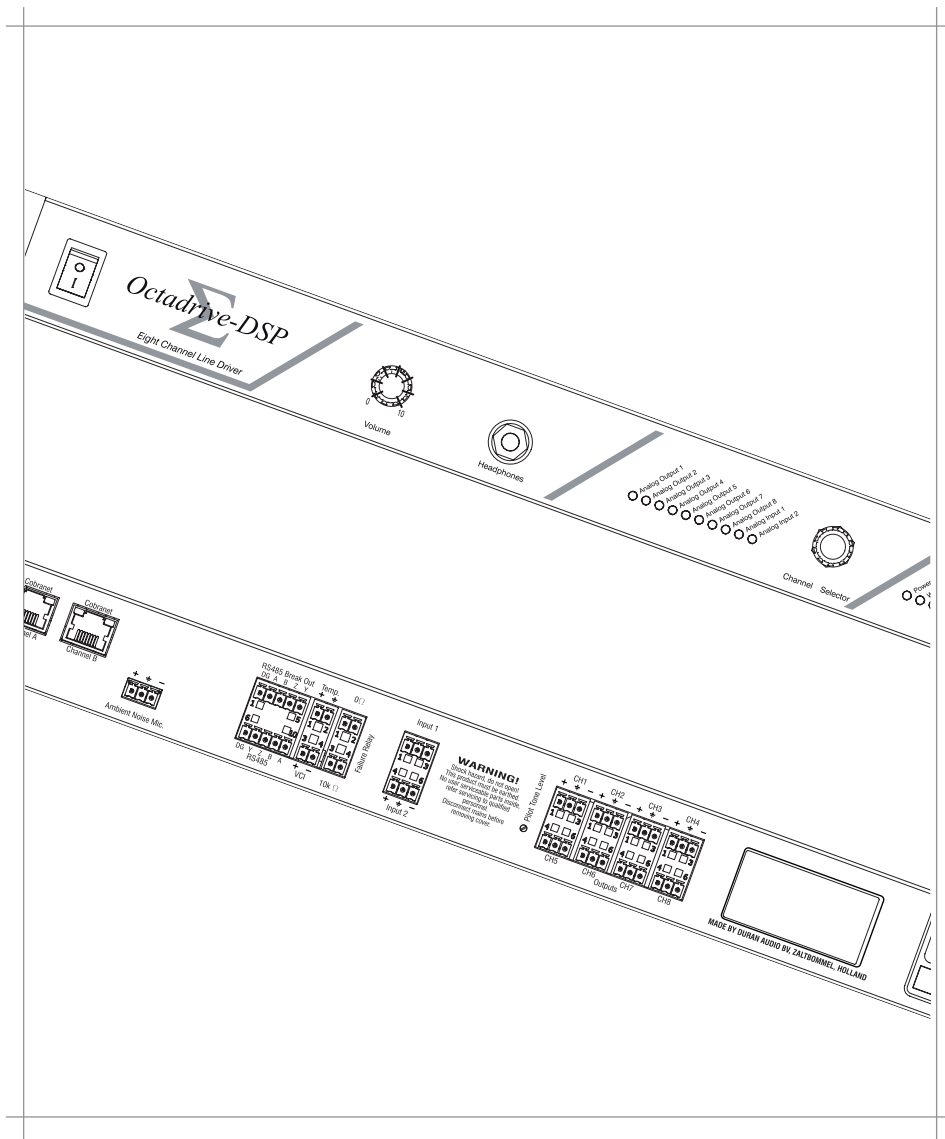
## AXYS® Octadrive DSP-CN

8-channel line driver

(Part No. 391030)



Shaping the future of sound reinforcement

AXYS®
TUNNEL
by HARMAN

# REFERENCE TO EC STATEMENT OF CONFORMITY

This document confirms that products manufactured by Duran Audio bearing the CE label meet all the requirements in the EMC directive 2004/108/EC and LV directive 2006/95/EC laid down by the Member States Council for adjustment of legal requirements. Furthermore the products comply with the rules and regulations from 30 August 1995 referring to the electromagnetic compatibility of devices. Duran Audio products bearing the CE label comply with the following harmonised or national standards:

**EMC:**
EN 55103-1; E1, E2, E3
EN 55103-2; E1, E2, E3
EN 50130-4
EN 50121-4

**Safety:**
IEC 60065: 2001 (ed7); A1: 2007, A2: 2010

**Mains Harmonics:**
EN 61000-3-2: 2001

**Insulation:**
Class1

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Zaltbommel, June 2012

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# IMPORTANT SAFETY INSTRUCTIONS

This symbol is intended to alert you to the presence of uninsulated dangerous voltages within the product's enclosure that may be of sufficient magnitude to constitute a risk of electric shock.

This symbol is used throughout this manual and is intended to alert you to the presence of important instructions.

1. Read these instructions.

2. Keep these instructions.

3. Heed all warnings.

4. Follow all instructions.

5. Do not use this apparatus near water.

6. Clean only with dry cloth.

7. Do not block any ventilation openings. Install in accordance with the manufacturer's instructions.

8. Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat.

9. Do not defeat the safety purpose of the polarised or grounding-type plug. A grounding type plug has two blades and a third grounding prong. The wide blade or the third prong is provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.

10. Protect the power cord from being walked on or pinched particularly at plugs, convenience receptacles, and the point where they exit from the apparatus.

11. Only use attachments/accessories specified by the manufacturer.

12. Unplug this apparatus during lightning storms or when unused for long periods of time.

13. Refer servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.

**Warning** - To reduce the risk of fire or electric shock, do not expose this apparatus to rain or moisture and objects filled with liquids, such as vases, should not be placed on this apparatus.

**Warning** - To disconnect this apparatus from the mains power supply, turn off the power at the red rocker switch at the extreme left of the front panel and remove the connector from the mains input socket labelled Mains on the rear panel.

**Warning** - This apparatus is a Class I device and must be connected to a mains socket outlet that provides a safety ground connection.

# INTRODUCTION

Thank you for purchasing this AXYS® Octadrive DSP-CN unit.

In order to get the best out of your Octadrive DSP-CN, please take the time to read through this manual before you install and use it for the first time.

## OVERVIEW

The AXYS Octadrive DSP-CN is essentially a special-purpose eight channel audio distribution amplifier. It is primarily intended for use in a life-safety audio system in conjunction with other AXYS audio products, where AXYS WinControl software is used to provide configuration, control, and monitoring of the system components.

The Octadrive DSP-CN has been specifically designed as a line driver, to allow high quality analogue audio to be sent over long cable runs. As well as analogue audio inputs and outputs, it has a CobraNet® interface, permitting it to be used with high-quality digital audio distributed via a dedicated network using conventional Ethernet hardware. The core of the unit is its DSP (Digital Signal Processing) block, which allows comprehensive adjustment to the audio signals being fed to each output.

The interface with WinControl may be via RS-485 or CobraNet®. The unit also incorporates a number of fail-safe features, making it very reliable and suitable for use in critical situations.

## FEATURES

- Eight independent, low impedance transformer-balanced analogue outputs

- +19 dBV drive capability

- Two transformer-balanced analogue inputs

- Eight-channel bi-directional CobraNet® digital audio interface

- On-board DSP, providing control of level, EQ, delay, etc. on all inputs and outputs

- Full configuration, control and monitoring with AXYS WinControl software

- Control interface via RS-485 or CobraNet®

- RS-485 breakout connection

- Pilot tone detection on analogue and digital inputs

- Internal pilot tone generator, routed to outputs

- ANS (Ambient Noise Sensing) mic input

- Ambient temperature sensor input

- Dual-contact surveillance/failure relay, suitable for volt-free or impedance-sensing monitoring

- External DC control voltage input

- Headphone monitoring of all analogue inputs and outputs

- DSP bypass function

- Fail-safe hardware bypass function

- Universal power supply (100-240 VAC)

## WHAT'S IN THE PACKAGING

In addition to the Octadrive DSP-CN itself, each unit is shipped with the following items:

- Installation and User Manual (this document)

- AC power cable (2 m), fitted with an IEC connector and a European-style mains plug

- Full set of mating screw-terminal connectors

# GENERAL DESCRIPTION
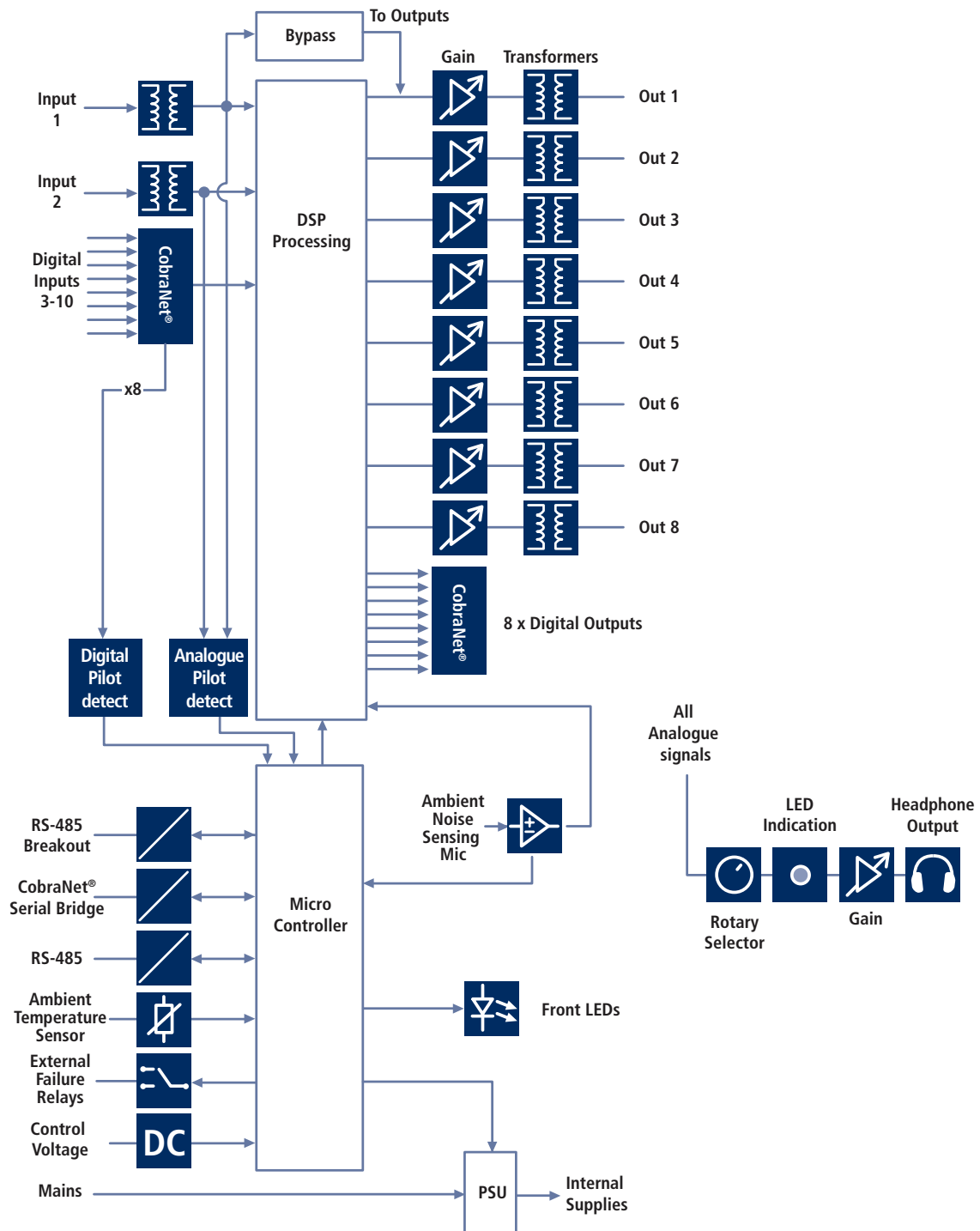
## BLOCK DIAGRAM AND SYSTEM DESCRIPTION

fig.1: Block Diagram

The simplified block diagram above shows the unit's internal signal routing.

The unit has two analogue inputs, making it suitable for connection to primary and secondary audio sources in life-safety applications. The inputs are transformer-balanced and offer low noise and very high CMRR (Common-Mode Rejection Ratio). The input stage gain is controlled in the digital domain, and is user-adjustable over a range of 80 dB. When enabled, both inputs are routed to all eight outputs, via the DSP core.

The audio transformers fitted to the main inputs and all outputs are of professional grade and provide full galvanic isolation from source and destination equipment, eliminating the potential for ground loops to occur between items of equipment which may be running on very different AC supplies. The analogue input and A-D converter stages accept a peak signal level of +21 dBV without clipping.

The eight outputs are also transformer-balanced, and have very low output impedance enabling high-capacitance loads (i.e., long cables) to be driven without perceptible signal degradation of any kind.

The analogue inputs are fed to a pilot tone detector so that continuous monitoring of the input connections may be made. The detector will, if enabled to do so, switch from Input 1 to Input 2 if pilot tone on Input 1 is lost.

The CobraNet® interface is bi-directional, and can receive and transmit eight channels of digital audio. The inputs are routed to the DSP core along with the analogue inputs, and are also continuously monitored for pilot-tone, with the same auto-switching arrangement as the analogue inputs. All active inputs (as enabled via WinControl), both analogue and digital, are routed to all eight output channels.

Various key signals are assigned to the eight CobraNet® outputs for remote monitoring purposes. See "fig.10: DSP Block Diagram" on page 16. The assignments are as follows:

| COBRANET OUTPUT | ASSIGNMENT |
|---|---|
| 1 | Analogue output 1 or ANS mic (selected via WinControl) |
| 2 | Analogue output 2 or ANS mic (selected via WinControl) |
| 3 | Analogue output 3 |
| 4 | Analogue output 4 |
| 5 | Analogue input 1 |
| 6 | Analogue input 2 |
| 7 | Analogue input 1, post-channel DSP |
| 8 | Analogue input 2, post-channel DSP |

The Octadrive DSP-CN incorporates a surveillance function which activates an externally-accessible relay in the event of various definable fault conditions, such as a PSU malfunction or a loss of pilot tone at either of the main inputs. The fault conditions for relay activation are defined in WinControl.

The Octadrive DSP-CN also includes a low noise pilot tone generator, which routes to all outputs. The level is user-adjustable.

The power supply is conservatively-rated and operates on any AC supply voltage from 100 V to 240 V.
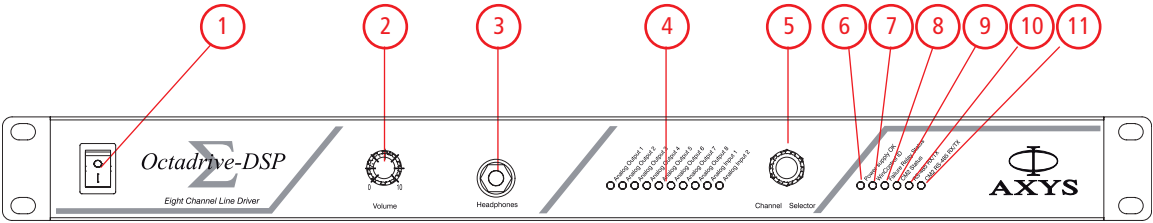
## FRONT PANEL



*fig.2: Front panel view*

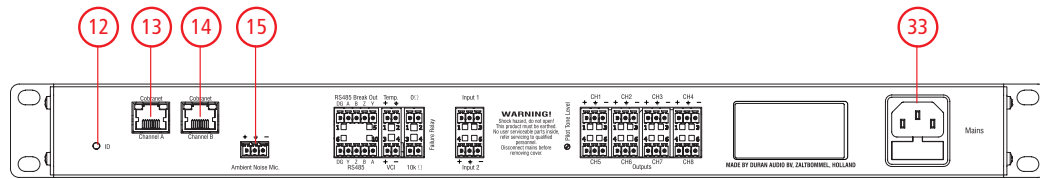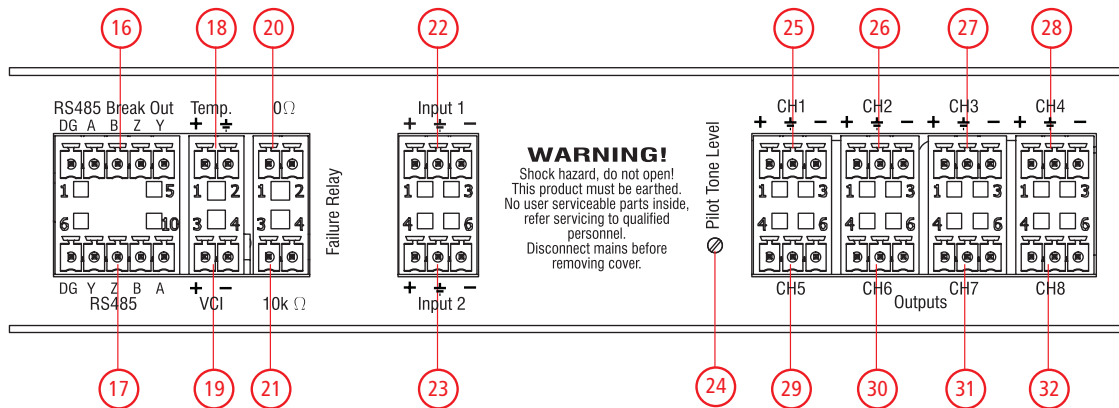| REF. | PANEL LEGEND | ITEM |
|------|--------------|------|
| 1 | | Power switch with internal neon indicator (red) |
| 2 | Volume | Headphones level control |
| 3 | Headphones | Socket for local monitoring |
| 4 | | Monitoring source indicator LEDs (green) |
| 5 | Channel Selector | Selects local monitoring source |
| 6 | Power supply OK | PSU status LED (green) |
| 7 | WinControl ID | Unit identification LED (green) |
| 8 | Failure Relay Status | Bi-colour LED (green/red), indicates failure state |
| 9 | CM2 Status | Bi-colour LED (green/red), indicates status of CobraNet® board |
| 10 | RS-485 RX/TX | Tri-colour (green/orange/red) LED indicates comms activity at RS485 port |
| 11 | CM2 RS-485 RX/TX | Tri-colour (green/orange/red) LED indicates comms activity at RS485 break-out port |

# REAR PANEL



*fig.3:  Rear panel view*



*fig.4:  Rear panel Detail view*

| REF. | PANEL LEGEND | ITEM |
|---|---|---|
| 12 | ID | Duplicates front panel WinControl ID LED |
| 13 | CobraNet® Channel A | CobraNet® port A |
| 14 | CobraNet® Channel B | CobraNet® port B |
| 15 | Ambient Noise Mic | ANS mic input |
| 16 | RS485 Break Out | RS-485 breakout for further equipment |
| 17 | RS485 | RS-485 comms port |
| 18 | Temp | Ambient temperature sensor input |
| 19 | VCI | External control voltage input |
| 20 | 0 Ω | Failure relay contacts 1 |
| 21 | 10k Ω | Failure relay contacts 2 |
| 22 | Input 1 | Input 1 |
| 23 | Input 2 | Input 2 |
| 24 | Pilot Tone Level | Pilot tone generator level adjustment |
| 25 | CH1 | Output 1 |
| 26 | CH2 | Output 2 |
| 27 | CH3 | Output 3 |
| 28 | CH4 | Output 4 |
| 29 | CH5 | Output 5 |
| 30 | CH6 | Output 6 |
| 31 | CH7 | Output 7 |
| 32 | CH8 | Output 8 |
| 33 | Mains | IEC mains connector with integral fuseholder |

Wiring details for all the rear connectors can be found in subsequent sections of the manual.

# INSTALLATION AND OPERATION

## MECHANICAL INSTALLATION

The Octadrive DSP-CN is designed to be mounted in a standard 19″ equipment rack. The front panel is fitted with rackmount ears for this purpose. The Octadrive DSP-CN occupies 1U of vertical rack space.

## Ventilation

The Octadrive DSP-CN is cooled by natural convection. The unit should remain within its operational temperature range under most circumstances, but if it is to be installed in a location of high ambient temperature, and/or in a rack containing a significant quantity of heat-generating equipment (see below), consideration should be given to climate-controlling the room in which the equipment rack is situated.

⚠️ Installation of the Octadrive DSP-CN in a 19″ rack immediately above or below another item of equipment generating a significant amount of heat (e.g., a power amplifier) is not recommended. Plain or slotted 1U blank panels should be used as spacers.

## CONNECTOR AND WIRING DETAILS

### AC Mains

⚡ **Warning** - This apparatus is a Class I device and must be connected to a mains socket outlet that provides a safety ground connection.

⚡ AC power is via a rear panel IEC mains connector [33]*. An IEC mains cable (power cord) fitted with a European-style plug is supplied with the unit. If the standard AC outlets in the territory are of a different type, an IEC mains lead fitted with the correct style of plug should be sourced. Alternatively, fit the correct type of mains plug, carefully observing the following cable colour codes:

| PIN | CONNECT | COLOUR (EUROPE) | COLOUR (US) |
|-----|---------|-----------------|-------------|
| L | Live | Brown | Black |
| N | Neutral | Blue | White |
| E | Earth (Ground) | Green/Yellow | Green |

The Octadrive incorporates a "universal" PSU, and will operate on all AC mains voltages from 100 V to 240 V.

The connector assembly has an integral fuse holder. Note the fuse specifications below:

| | 230 V & 115 V |
|-----|---------------|
| Type | T3.15A (slo-blo) |
| Size | 20 x 5 mm |
| Rating | 3.15 A |

⚡ In the event of a blown fuse always first investigate why it blew. Only replace a fuse with one of the type and rating specified. The fuse holder has space for storage of a spare fuse. Never attempt to replace a fuse without first removing the IEC plug from the unit.

*Numbers in square brackets refer to the figs. 2,3 & 4 on pages 8 & 9.

## Analogue Audio Connections

All analogue audio connections are on 3-pin 3.81 mm-pitch screw-terminal connectors. Mating connectors are supplied with the unit. The connectors are grouped in pairs. All audio connections (both inputs and outputs) should be wired according to the diagram below:
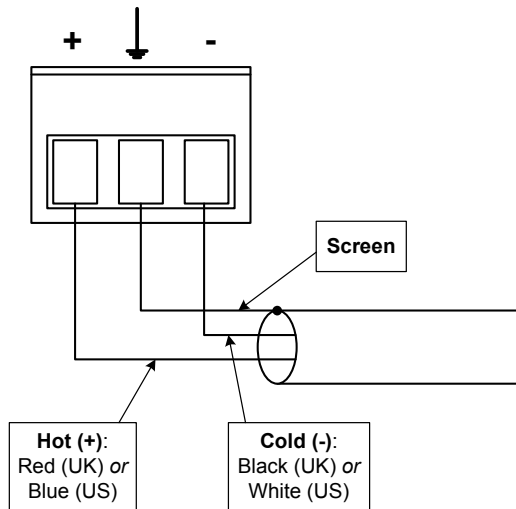


*fig.5:  Analogue Audio Connectors*

To minimise hum and noise pickup, balanced interconnections between audio sources and the Octadrive DSP-CN should always be used wherever possible. If driving from an unbalanced source, use the same wiring as shown above at the Octadrive DSP-CN end, but connect the 'hot' core to the signal output and the 'cold' core to the ground terminal of that output; the cable's own screen should be connected at the Octadrive DSP-CN end only.

⚠ Unbalanced connection to the Octadrive DSP-CN's outputs defeats the unit's primary purpose and should never be used.

### Main Inputs

The two transformer-balanced **Main Inputs** are on the connectors [22] and [23]. As with other AXYS products (e.g., Intellivox loudspeakers and Industry Amps), the normal routing of the input signals may be altered by enabling auto-input switching from WinControl.

In normal operation, both inputs route internally to all eight outputs. If auto-input switching is enabled, only Input 1 is used. If auto-input switching is then triggered - either by pilot-tone failure or low signal level - Input 2 is used instead. Note that input channel priorities are assignable in WinControl, and Input 2 may be used as the "normal" input instead if wished. See "Auto-input switching" on page 17 for more information on use of auto-input switching, and also the WinControl Help files.

The inputs can accept levels up to +21 dBV peak.

### Outputs

The transformer-balanced, low impedance **Outputs** are on connectors [25] to [32]. The output stages are capable of driving long cable runs with minimal signal degradation. However, it should be noted that with very long runs (e.g., >500 m), the cable properties become significant and high frequencies may be attenuated. This may be an issue if the system uses an HF pilot-tone for fault reporting, and the cable used should be a type with low series resistance and capacitance.

The outputs may be globally set to "high-gain" or "low-gain" mode from the unit's `Volume` tab in WinControl. `Analog output gain` has options of 0 dB (low-gain, the default value) or 14 dB (high-gain). The "high-gain" setting should be selected if the Octadrive DSP-CN is being used to drive very long lines where signal loss and potential interference is anticipated.

### Ambient Noise Microphone

The Octadrive DSP-CN's processor card includes an Autogain algorithm which adjusts the gain through the unit in response to ambient noise levels. To accomplish this, an external Ambient Noise Sensing (ANS) microphone* must be connected to the ANS mic input.

Connection is via a 3-pin 3.81 mm-pitch screw-terminal connector, with the same pinout as the analogue audio inputs.

The ANS signal may also be "re-broadcast" on two channels of the CobraNet® audio output to other CobraNet®-equipped units. This option may be set up in WinControl.

* A suitable AXYS® microphone (combined with a temperature sensor) is available – Part No. 97661101 Ambient Mic and Temperature sensor. Refer to "Ambient temperature sensor" on page 14.

# CobraNet® interface

Connections using the CobraNet® interface are made via RJ-45 connectors. Either Port A or Port B may be used; if a dual redundant network is employed in the installation, then use both ports, connecting each to independent Ethernet switches.

⚠️ **NOTE:** The two CobraNet® ports CANNOT be used to "daisy-chain" the Ethernet connection between multiple pieces of equipment.

⚠️ **NOTE:** The CobraNet® ports do not auto-select between "straight" and "crossed" cables. Standard "straight" cables should be used throughout an installation which include Ethernet switches, but if connecting the Octadrive DSP-CN directly to a PC (i.e., for configuration purposes), a "crossed" cable should be used.

Standard pre-made CAT5 or CAT5-e network cables (see note below) may be used to connect an Octadrive DSP-CN to local Ethernet switch(es). However, in many installations, the network connection from within a rack to an Ethernet switch will be via structural cabling. In this case, wire mating RJ-45 plugs (not supplied) as shown below:



*fig.6:  CobraNet® Connectors*

| PIN | CAT5 CORE |
|-----|-----------|
| 1 | White + Orange |
| 2 | Orange |
| 3 | White + Green |
| 4 | Blue |
| 5 | White + Blue |
| 6 | Green |
| 7 | White + Brown |
| 8 | Brown |

The maximum cable run for reliable operation using CAT-5/CAT-5e cable is of the order of 100 m. If longer distances are involved, the use of multimode fibre-optic cable is recommended. This is generally satisfactory up to 2 km, but repeaters (or the use of single-mode fibre) can be used to increase the distance further. A third-party Ethernet-to-fibre interface will be required in these situations.

The CobraNet® interface gives the Octadrive DSP-CN digital audio I/O and an alternative control method (to RS-485). The interface is bi-directional, thus providing eight additional audio inputs and eight additional audio outputs, at a sampling rate of 48 kHz and bit depths of 16, 20 or 24 bits. Another CobraNet®-equipped product will be required elsewhere in the system to transmit and receive the data.  See "CobraNet® configuration" on page 19 for further details.

⚠️ **NOTE:** Unscreened CAT-5/CAT-5e UTP cable can be used, but note that the Octadrive DSP-CN may fail to preserve its high level of noise immunity and as a consequence, will no longer be compliant with the standards set out in the EC Statement of Conformity. CAT-5/CAT-5e twisted pair cable with an overall foil shield (referred to as FTP or F/UTP) is required for full compliance.

# Control connections

### RS-485 interface

The RS-485 network connection may be wired if remote monitoring and control are required. If CobraNet® is being employed in the installation, the RS-485 connection is optional as the CobraNet Serial Bridge feature makes it possible to control and monitor the Octadrive DSP-CN via EtherNet. However, such installations may still utilise the RS-485 interface as a secondary backup, or as the control protocol of choice. AXYS WinControl software can operate using either protocol, but control via the CobraNet Serial Bridge requires either Cirrus CobraNet Object Tools (COT) or CobraNet Application Development Tools to be installed on the computer running WinControl.

The network connection is a 5-pin 3.81 mm-pitch screw-terminal connector, and should be wired as shown in the diagram below:
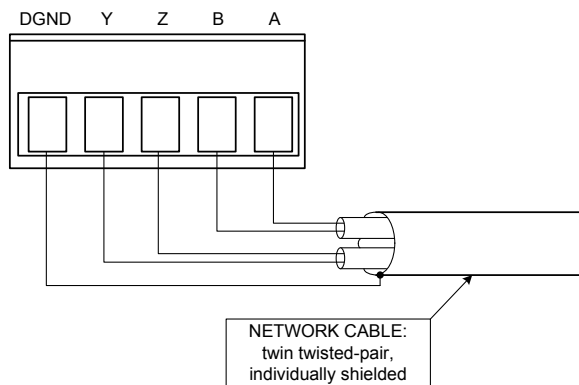
*fig.7:  RS-485 Connections*

Note that 2-pair cable, with each pair individually-screened, should be used for RS-485 connection. The transmit (Tx) and receive (Rx) balanced data lines must be wired via their own twisted pairs. CAT-5 type UTP or FTP cable is NOT suitable. Please refer to the Appendix section of the manual for cable specifications.

The RS-485 interface permits multiple devices to be "daisy-chained" in parallel (see diagram below), so that all units are controlled by the same PC. In such a system, each amplifier must have its own unique network address; this is set up via WinControl.
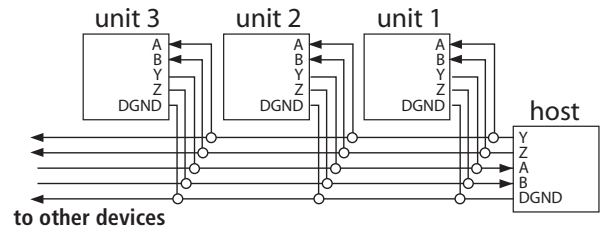
*fig.8:  RS-485 Network*

The maximum cable length over which the network connection will operate reliably depends on the cable type and the baud rate used. With good quality cable, a safe maximum figure (at 19.2 kbaud) is 2000 m. If the distance is significantly longer than this, a network repeater will be required.

⚠️ Before connecting multiple devices to the same network subnet, ensure that their network addresses do not overlap. Each device should be set to a unique network address (determined via WinControl).

⚠️ In some installations, it is normal practice to disconnect the RS-485 network from the USB-to-RS-485 converter at the host (computer) during normal operation. This removes the possibility of extraneous data being inadvertently transmitted over the network. In such a situation, the converter is only reconnected when system maintenance or checks are required. Disconnecting from the convertor in this way leaves the Rx lines of the devices unterminated. In most situations this does not present any problems, but with a large network in a hostile EMC environment, it is recommended that the host Y and Z lines (host Tx/device Rx) are terminated in a 100 ohm resistor for normal operation. This can be easily achieved by plugging the XLR5 F connector into a spare male connector with the resistor on the appropriate pins. This termination can then be removed and the convertor reconnected when necessary. (If there is any doubt about which pins should be terminated, shorting all five pins will generally be equally effective.)

### RS-485 Break-out connector

This connector can be used when the Octadrive DSP-CN is being controlled via Ethernet using the CobraNet Serial Bridge facility, and there is further local AXYS equipment which needs to be controlled and/or monitored, but which lacks Ethernet capability. The RS-485 Break-out port can be used as a bi-directional local RS-485 interface. Note that the Break-out port is not suitable for use with third-party equipment.

### Failure relay

The Octadrive DSP-CN includes a two-pole changeover relay whose contacts are accessible on two 2-pole 3.81 mm-pitch screw-terminal connectors. The conditions under which the relay operates are defined as part of the unit configuration in WinControl.

One pole of the relay provides volt-free contacts (Contacts 1, [20]), the other (Contacts 2, [21]) has internal resistors to allow the Octadrive DSP-CN to be connected directly to impedance-sensing line monitoring equipment such as the AXYS Cerberus.

On Connector [20], the pins of Contacts 1 are short-circuit in normal operation, and become open-circuit when a failure condition arises.
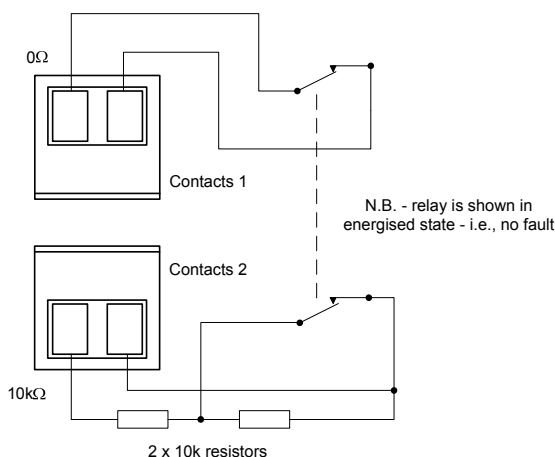


*fig.9: Failure relay*

On Connector [21], the pins of Contacts 2 present an impedance of 10k Ω in normal operation. When a fault condition occurs, it rises to 20k Ω.

An AXYS® Cerberus or other impedance-sensing fault monitoring equipment may be connected to Contacts 2. The contact wiring arrangement is shown in the diagram.

The relay contacts have maximum current and voltage ratings of 100 mA and 24 V respectively.

### Ambient temperature sensor

The Octadrive DSP-CN is equipped with a loudspeaker frost protection system which activates the internally-generated low-level pilot tone if the ambient temperature drops below a pre-determined threshold. This is passed to the system's power amplifiers and produces current in the loudspeaker voice coils, warming the drivers slightly. The function may be enabled via WinControl.

This feature is also provided in certain other AXYS products: in particular, Intellivox loudspeakers and IndustryAmp power amplifiers. If the Octadrive DSP-CN is being used with third-party amplifiers, or with loudspeakers from the AXYS Sound Reinforcement range (which do not have this feature), we recommend that frost protection is enabled if the loudspeakers are in a location where low ambient temperatures are possible.

The pilot tone has a frequency of 27.5 kHz and is adjustable in level from -3 dBV down to -90 dBV. The level is set at the rear panel with the preset control [24]; carefully use a trimming tool to adjust this through the access hole. Do NOT force a screwdriver into the hole. Note that the actual pilot tone level will be affected by the 'high/low output gain mode' setting.

If this function is required, an external ambient temperature sensor (available as an option – see below) should be wired to the 2-pin 3.81 mm-pitch screw-terminal 'Temp' connector [18] using screened two-core cable. Connect the '+' terminal of the sensor to the '+' pin of the Temp connector, and both the '-' terminal of the sensor and the screen of the cable to the pin of the Temp connector marked with an earth (ground) symbol ⏚.

A suitable AXYS temperature sensor (combined with an ANS microphone) is available (Part No. 97661101 Ambient Mic and Temperature sensor). This should be wired using twin twisted-pair cable with an overall screen. Use one pair for the microphone and the other for the temperature sensor. Connect 'ntc' on the sensor to '+' on the Temp connector and 'AGND' on the sensor to the Temp connector pin marked with an earth (ground) symbol ⏚ . Connect the microphone pair to the '+' and '-' pins of the Ambient Microphone input. The cable's overall screen should be connected to the pin of the Ambient Microphone input marked with an earth (ground) symbol ⏚ .

**External control voltage input**

The Octadrive DSP-CN is fitted with an external control port [19] (marked 'VCI' on the rear panel), which can be used to load an internal "emergency" configuration in the form of a preset from memory in the event of, e.g., network failure.

The unit's internal memory has provision for an "emergency" configuration preset to be stored, and automatically recalled and loaded under certain programmable conditions. This preset is defined and configured in WinControl. This is a useful facility where the audio system is to be used for emergency evacuation messages. (See "Presets" on page 18 and the WinControl Help files for more information on Presets.) The emergency preset may also be recalled by an external DC voltage at the VCI input. This input is isolated by an opto-coupler. The emergency preset will be loaded either on a logic high (5 - 24 VDC) or a logic low (0 - 2 VDC) at the input (programmable in WinControl).

The connector is a 2-pole 3.81 mm-pitch screw-terminal type. Be careful to observe the '+' and '-' symbols on this connector when wiring to external equipment.

# DSP SECTION OVERVIEW

The Octadrive DSP-CN incorporates a 32-bit floating point Digital Signal Processor (DSP) in conjunction with 24-bit 128x-oversampling A-D and D-A conversion. This permits a very extensive range of system parameters to be controlled remotely and for internal storage of unit configuration.
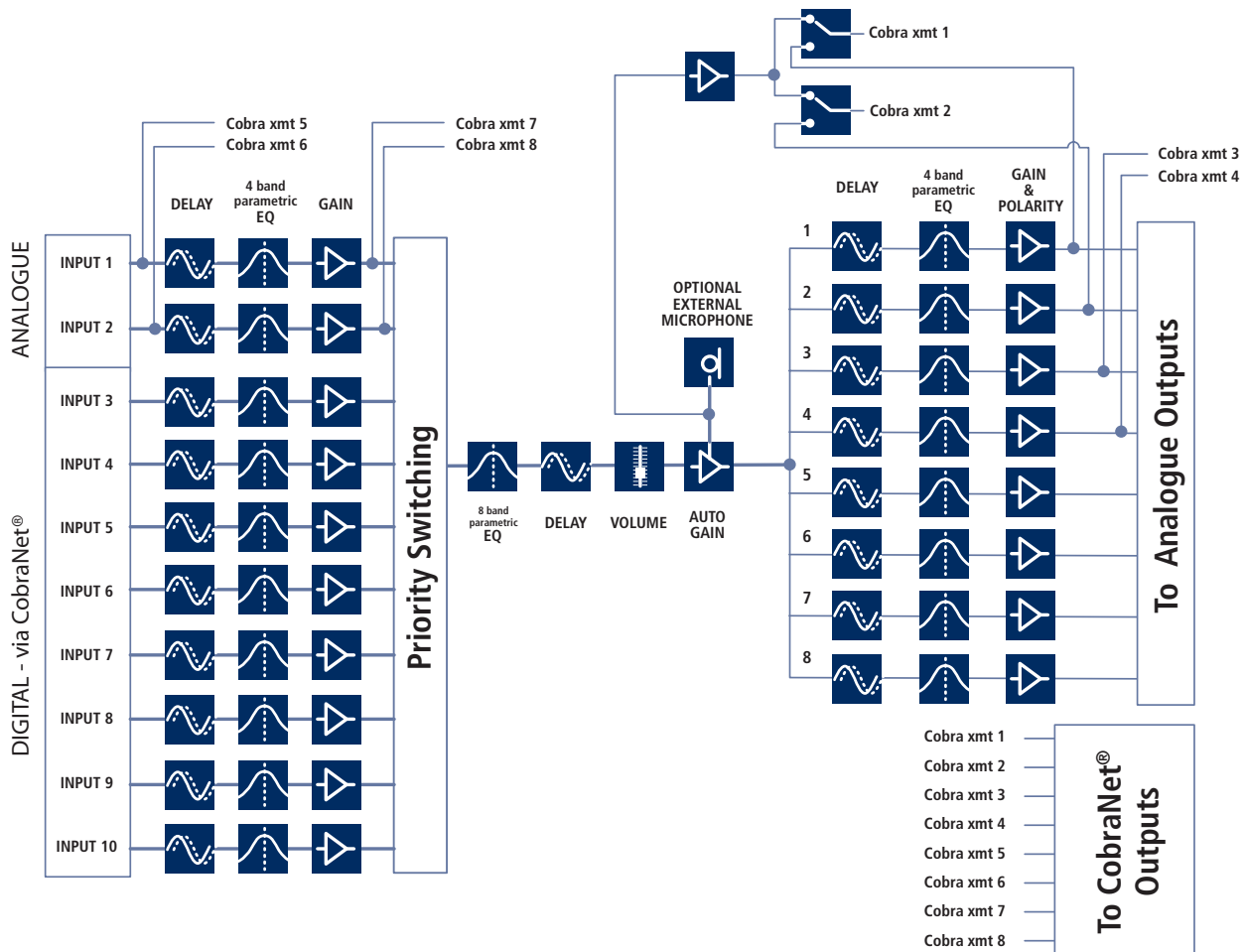


*fig.10: DSP Block Diagram*

All DSP functions are adjusted using the WinControl software application. Detailed information on the use of WinControl is beyond the scope of this manual, and users should consult the WinControl Help files.

## Level controls

The gain of each analogue input and each digital input may be adjusted independently over the range -70 dB to +10 dB. Nominal input level with 0 dB gain is 0 dBV, and the maximum input level is +21 dBV (peak).

The level of each output channel can also be set independently, with a range of 80 dB.

Note that after the inputs have been summed, there is also a master level control (in the `Volume` tab of WinControl), which provides a single-point adjustment of the levels at all outputs, and a separate `Analog output gain` setting, which selects "low-gain" (0 dB) or "high-gain" (+14 dB) modes.

Polarity (phase) inversion is also available for each input and output.

## EQ adjustment

The DSP section provides very comprehensive signal equalisation for both inputs and outputs. Each analogue input, each digital input, and each amplifier channel has its own 4-band parametric equaliser. These provide up to 25 dB of cut or boost per band (depending on filter type selected) over the range 10 Hz to 24 kHz, with per-band selection of filter type.

Output equalisation can be used to construct crossover filtering to allow the Octadrive DSP-CN to drive multichannel (or individual) amplifiers in multi-way loudspeaker systems. Input equalisation permits tailoring of individual input signals for optimum clarity.

In addition to individual input and output equalisation, there is an overall 8-band parametric equaliser in the main volume control stage, which affects all inputs and outputs. Each band has the same characteristic as those of the input and output equalisers.

## Delay

Delay may be inserted in any or all of three locations in the audio signal chain. Each input may have up to 1.3 s of delay; each amplifier channel may have up to 43 s of delay, and an overall unit delay of up to 21 s may also be inserted at the main volume control stage. As the primary use of delay is time-alignment of loudspeakers in different locations, or of individual drivers within a single multi-way loudspeaker unit, the delay is also displayed by WinControl in terms of distance.

## Autogain

The DSP section includes an autogain algorithm which can be set to automatically adjust the overall volume level according to the ambient noise level detected by a microphone connected at the ANS mic input. The algorithm measures the ambient noise in gaps in the programme material being fed via the Octadrive DSP-CN. Once enabled, the amount of additional gain per dB of ambient noise increase can be controlled, as well as the threshold at which gain adaption begins.

## SURVEILLANCE FUNCTIONS

The Octadrive DSP-CN incorporates various surveillance features to ensure continuous operation in critical applications.

## Auto-input switching

All enabled inputs of the Octadrive DSP-CN (up to two analogue and eight digital) are summed by default, so that signals on all enabled inputs are always fed through the system. However, if wished, priorities may be assigned to individual inputs so that audio through the system is normally derived from one input only. The inputs are then monitored, either for presence of pilot tone, or for a continuous signal level above a pre-determined threshold. In the event of non-detection of the pilot tone or input signal, the signal source can be switched to that on an alternative input.

This arrangement is primarily intended to provide redundancy; by utilising more than one audio distribution path, a high degree of system of security can be gained.

The Input Mode setting in WinControl (at `Input > Common parameters`) allows selection of auto-switching mode. A brief description of each mode follows; see the WinControl Help files for full details.

### Normal mode

Auto-switching is disabled. All inputs are active, and summed. Use this mode if only one input is in use.

### Level-controlled priority switching

When enabled, the inputs will switch when the signal level at the detection point drops below -60 dBFS (default value), but this threshold may be set to any level between -80 dBFS and -20 dBFS. The detection point is post-processing, in order that filtering may be applied to remove specific frequencies or bands. When using analogue inputs, the relationship between dBFS and dBV's measured at the device's inputs should be taken into consideration; WinControl's Help files give full details.

It is also possible to set a Hold Time, so that unwanted switching does not occur between natural gaps in the programme.

### Pilot tone-controlled priority switching

It is common practice in critical audio systems to permanently route a low level, high-frequency tone through the system. The presence of this pilot tone can then be detected by various items of equipment to verify the continued operation of the audio paths. Set Input Mode to Pilot tone-controlled priority switching to enable this mode.

The Octadrive DSP-CN's pilot tone detector on the analogue inputs operates in the range 20 kHz to 30 kHz at a fixed threshold of -22 dBV. On the digital (CobraNet®) inputs, the frequency range is 19.2 kHz to 23.5 kHz and the threshold may be set between -10 dBFS and -60 dBFS.

The Octadrive DSP-CN's action on non-detection of a pilot tone can be configured via WinControl. A fault condition can be "flagged", and/or the input can be set auto-switch to that with the next priority.

⚠️ A notch filter should be inserted to suppress the pilot tone if its frequency is less than half the internal processor's sampling frequency (Fs/2, approximately 24 kHz). If the pilot tone is not sufficiently suppressed, signal detection (and other functions such as frost protection and Autogain) will not function properly. Further, this may result in excessive dissipation downstream, in the power amplifiers and/or connected loudspeakers. Pilot tone frequencies above Fs/2 are sufficiently suppressed by the anti-aliasing filter of the ADC. Note that any pilot tone frequency received via the digital inputs must always be < Fs/2.

## Failure relay

The two-pole changeover failure relay may be wired to a 'common fault' or other external fault monitoring system so that any fault condition detected by the Octadrive DSP-CN is immediately reported. The conditions which cause activation of the failure relay may be defined in WinControl, and may include, for example, DSP status failure, loss of firmware communication, pilot-tone loss, CobraNet® board failure, etc. See the WinControl Help files for full details.

If it is required to interface the Octadrive DSP-CN to impedance-sensing fault-monitoring equipment such as the AXYS® Cerberus, failure relay Contacts 2 should be used. See "Failure relay" on page 14 for connection details.

## PRESETS

In addition to retaining all current parameters and settings in non-volatile memory so that the amplifier resumes the same operational status after a power failure, the Octadrive DSP-CN also has seven further internal memories (Presets), each of which may contain an alternative unit

configuration. These Presets are normally accessed via WinControl, but any third-party control system capable of transmitting the correct commands via RS-485 (e.g. Crestron, AMX, etc.) may also be used.

One of the Presets may be assigned as an Emergency Preset, and automatically loaded in the event of loss of network communication. In life-safety systems using CobraNet® as the primary method of audio signal distribution, it is generally advisable to provide an analogue backup audio feed and configure the Octadrive DSP-CN to switch to a Preset including this in the event of a network failure. See the WinControl Help files for full details.

## COBRANET® CONFIGURATION

The CobraNet® interface in the Octadrive DSP-CN is self-organising and requires no adjustments. However, it is important that in systems with multiple CobraNet®-equipped units, each unit must have a unique CobraNet address. This, as well as the audio routing, is defined using Cirrus Logic's CobraNet Discovery software application. For systems that incorporate one or more AXYS WinControl Server PCs for system management, this application will be pre-installed on each computer.

This topic is beyond the scope of this manual, and further information can be found in the documentation covering WinControl Server configuration, which is available either with the WinControl Service Version installation set, or on the Service page (restricted access) of the AXYS website.

## DSP BYPASS

The Octadrive DSP-CN's processor board is continually monitored for correct operation, and in the event of failure, Analogue Input 1 is connected directly to the inputs of all eight output channels. This failsafe bypass ensures that the primary audio input always feeds the next stage of the system, even in the event of a major failure. The conditions for bypass are configurable from the Service version of WinControl. By default, a 'DSP not running' condition triggers the bypass action.

As with all other internally-monitored functions, a DSP failure is reported to the WinControl server via RS-485 or the CobraNet Serial Bridge, as well as triggering the external failure relay (if configured to do so).

## STATUS LEDS

The front panel carries a set of six LEDs showing the status of various unit functions. From left to right:

**Power supply OK** (green) [6]; illuminates when the Octadrive DSP-CN is switched on and the PSU is functioning normally.

**WinControl ID** (green) [7]; This LED can be illuminated temporarily ("pinged") from WinControl. This feature is provided so that in an installation using multiple AXYS units, each particular physical unit can be positively identified if necessary. Note that a second LED mimicking this functionality is fitted to the rear panel [12].

**Failure relay status** (bi-colour) [8]; normally green, indicating no fault state exists; turns red to indicate that a fault condition has de-energised the failure relay. The conditions defining a failure are set up via WinControl.

**CM2 status** (bi-colour) [9]; This LED will normally show green to confirm the presence and correct operation of the CobraNet® board. If a board failure occurs, the LED will turn red.

**RS-485 RX/TX** (tri-colour) [10]; indicates data at the RS-485 port; green indicates that data is being received, red that the Octadrive DSP-CN is transmitting data, and orange (normal state) if simultaneous data transmission and reception is occurring. Note that this LED does not operate when the Octadrive DSP-CN is being controlled via the CobraNet Serial Bridge.

**CM2 RS-485 RX/TX** (tri-colour) [11]; indicates data at the RS-485 Break-out port.

## LOCAL HEADPHONE MONITORING

The Octadrive DSP-CN is equipped with an internal headphone amplifier, the output being on a standard 3-pole ¼″ (6.35 mm) jack socket on the front panel [3]. Headphone monitoring is in mono. Headphones of between 32 and 600 ohms impedance are suitable.

The signal to be monitored in the headphones is selected by the Channel Selector control [5]. The choice is any of Analogue Outputs 1 to 8, or either of Analogue Inputs 1 or 2, and the source currently selected is confirmed by one of the ten green LEDs [4] being illuminated. The level in the headphones may be adjusted with the Volume control [2].

# APPENDIX

## TECHNICAL SPECIFICATIONS

Full technical specifications of the Octadrive DSP-CN are available at:

http://www.duran-audio.com

## MAINTENANCE AND WARRANTY INFORMATION

### Maintenance
Maintenance should only be performed by qualified service personnel. In case of doubt always contact your dealer. For cleaning, use non-abrasive and non-aggressive household cleaning agents only.

### Warranty Information
This Octadrive DSP-CN is covered by Duran Audio's standard product warranty, and is subject to the terms and conditions of the warranty. Please consult http://www.duran-audio.com for a full statement of warranty policy.

## COMMON ANALOGUE GROUNDING ISSUES

Correctly connecting the Octadrive DSP-CN to ground has several benefits. A full discussion of the issues involved can be found at http://www.duran-audio.com. Basic points to observe are:

**1. Safety.** The GND terminal of the mains connector provides a direct low impedance path from the metal parts of the chassis to ground. Always connect this terminal.

**2. Reduction of RF emission.** Although the Octadrive DSP-CN's electronics are well shielded and external connections are decoupled to prevent RF emission from the internal high speed digital circuits, this protection will not work properly if the chassis is not connected to ground.

**3. RF Immunity.** RF currents induced in the signal cables by external RF fields are effectively shorted to chassis ground, provided that the cable screen (shield) is of sufficiently low impedance.

In addition to the mains ground, Octadrive DSP-CN connectors have ground pins marked in different ways. Each serves a dedicated purpose and care should be taken that they are not interchanged or connected to each other.

- The pins with a "ground" symbol $\perp$ on the audio line input connectors and the ambient SPL mic/temperature sensor connector are connected internally directly to the chassis of the device. These pins are for connecting the screen (shield) of the audio and sensor cables.

- The RS-485 connectors have one pin marked DG and is intended as a terminal for the network cable screen (shield). Since the RS-485 interface is optically isolated (to prevent ground loops), DG has no relation to the chassis ground. DG should not be connected to any other ground pin on the chassis.

## SOFTWARE AND FIRMWARE UPDATES

The AXYS WinControl application is freely available and can be downloaded from the download area of our website; http://www.duran-audio.com. We advise installers, users and engineers to check our site regularly for updates. Firmware and DSP software upgrades will also be made available through the website. For further information about how to use WinControl please refer to the WinControl Help files.

## NETWORK CABLES

The type of cable necessary for correct operation of the RS-485 network is twin twisted pair with each pair individually shielded. Numerous cables of this type are readily available and cables broadly meeting the specifications of the example cable given below are likely to be suitable.

**Example of a preferred cable type:**

| Type | BELDEN 'Datalene' series No. 9729 2-pair |
|------|------------------------------------------|
| Characteristic impedance | 100 ohms |
| Capacitance (core to core) | 41 pF/m |
| Capacitance (core to screen) | 72.5 pF/m |
| DC resistance (core) | 78.7 ohms/km |
| DC resistance (screen) | 59.1 ohms/km |

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