Intellivox

Delivering Ultimate Intelligibility

STEERING INTO THE FUTURE
Brief History

In the early 1990’s Duran Audio recognised that the speech intelligibility of PA systems in many large public buildings had not improved since the early 1970’s. In many ways it was, and still is, becoming increasingly difficult to design intelligible sound systems. Several factors contribute to this:

- There has been an increasing trend to use historic buildings as multipurpose venues.
- The trend amongst architects for public buildings and transport hubs has moved towards very large open spaces with clean finishes and high light levels. This results in spaces with hard surfaces and long reverberation times.
- There has been little improvement in loudspeaker technology in this market area.

Having identified the problem Duran Audio set about seeking the solution. The ideal solution appeared to be a single source that would have a very high directivity whilst at the same time being able to provide an even SPL coverage. With digital signal processing becoming more affordable this near perfect solution soon became a reality in the form of the AXYS® Octarray and Octavox systems which were the first DDC (Digital Directivity Control) systems.

Introduction

Product development continued at pace after the introduction of these first DDC products and they were rapidly replaced with the AXYS® Intellivox range. During the development of the Intellivox range Duran Audio’s R&D team: miniaturised the electronics, extensively improved the available DSP power and defined a networking protocol that enabled remote control and surveillance capabilities. This meant that for the first time all the necessary electronics could be fully integrated into the same enclosure as the loudspeaker array. 1996 saw the introduction of the AXYS® Intellivox-2c, the world’s first commercially available digitally controlled loudspeaker array.

Hardware development was only half the challenge. A demanding software development program was initiated to ensure that users would be able to easily configure and monitor Intellivox systems. This development program resulted in our WinControl software which offers full control over a network of Intellivox units. Duran Audio also identified the requirement for a prediction package to assist electro-acoustic consultants. DDA (Digital Directivity Analysis) enables system designers to rapidly visualize their design within a 3D room model and then export the results into third party ray tracing prediction software for further calculation and analysis.

Since the introduction of the AXYS® Intellivox range, our digitally controlled loudspeaker arrays have been specified to achieve ultimate speech intelligibility in large highly reverberant spaces all over the world. A variety of array lengths are available, which means that there is an Intellivox to suit every application. Arrays range from the Intellivox-1b, which is under 70 cm, to the Intellivox-6c, which at almost 5 m is the longest array in the range. The longer arrays not only offer greater throw, but also greater control of the directivity at low frequencies.

Applications

Intellivox installations can now be found all over the world in a variety of applications including Transport Hubs, Places of Worship, Parliaments, Theatres, Conference Facilities, Atriums and Museums. They not only offer excellent intelligibility but are often more sensitive to the architecture of the space than conventional systems. When the architect, electro-acoustic consultant and installer work closely together the ultimate intelligibility and stunning visuals can be achieved simultaneously. In more innovative designs Intellivox units have been recessed into walls, placed inside custom built enclosures, housed within customer information displays, incorporated into theatrical scenery and in some cases been hand painted by a scenic designer to perfectly match the surface on which they are being mounted. The Intellivox can be ordered in any colour and can even be coloured matched to a paint sample.

References include:

- Grand Central Terminal, New York, US
- The Louvre, Paris, France
- British Museum, UK
- Milan Dom, Milan, Italy
- Dubai Airport, UAE
- JFK Airport, New York, US
- Parliament, Copenhagen, Denmark
- WTC Dubai, UAE
- Ahmanson Theatre, Los Angeles, US
**DDC**

DDC stands for Digital Directivity Control. DDC represents a multi-channel loudspeaker array technology where the single loudspeaker elements are positioned in space according to a patented algorithm. Each loudspeaker channel has its own dedicated audio path through the DSP and amplification which means that each loudspeaker can have its own unique set of filters. This technology enables users to electronically manipulate the vertical dispersion of an Intellivox array.

In the case of the Intellivox-6c the beam can be steered +/- 16 deg from the acoustic centre, the opening angle can be adjusted between 4 and 10 deg and the focus distance can also be controlled.

**What does DDC have to offer?**

The beam steering capability of the Intellivox means that even coverage can be maintained across the listening plane whilst steering the beam away from surfaces that may cause unwanted reflections. This results in a very high direct to reverberant sound ratio which is essential for achieving acceptable levels of speech intelligibility within reverberant spaces.

**Predicting the performance**

Our DDA, Digital Directivity Analysis software can be used for predicting the performance of a DDC controlled array. DDA allows the user to visualise and predict the direct SPL distribution from an array. For more detailed analysis users can transfer the directivity, calculated in DDA, to CATT-Acoustic or EASE4.0.

One way to visualise the dispersion is to imagine a disc of sound coming from the array, by adjusting the elevation angle this disc can aimed up or down. This technique also means that, unlike mechanically aimed passive arrays, the back radiated energy is also controlled. This control means that electronically aimed Intellivox arrays add far less energy to the reverberant field compared to conventional systems.

However, this is not the only benefit of the technology. DDC can also offer even SPL distribution over large distances. Well designed DDC installations can offer very little variation in direct SPL across the listening area. And for outdoor applications DDC technology can also offer some solutions to problems with environmental noise pollution.
WinControl

Intellivox products are configured using the proprietary WinControl software, communication between the PC and the Intellivox is via a RS-485 network. WinControl allows users to manipulate the critical beam steering parameters (opening angle, elevation angle and focus distance) that define the vertical dispersion of the array. In addition to this users can control the other functions that are included within the Intellivox DSP software. These include:

- Volume Control
- Four Band Parametric EQ
- Delay, up to 335ms
- AVC (Automatic Volume Control)

Once the units have been configured the PC can be removed from the network as the settings are stored in non volatile memory.

Apart from the DSP, Intellivox products are equipped with a RISC processor that takes care of all the surveillance routines, which are performed every 20 ms. In addition to this the RISC is monitored by a watchdog, which in the event of a failure will reset the RISC. Surveillance functions include, but are not limited to:

- Pilot Tone Detection
- Amplifier Load Surveillance
- Ambient Noise Sensing Microphone Surveillance
- Amplifier Surveillance
- Temperature Surveillance
- DSP Functionality

All relevant status parameters and temperatures can be monitored via the RS-485 network. Failures can be reported by the on board failure relay or via one of the many features offered by WinControl.

WinControl screen dump examples.