

## **A Review of Lighting Control Protocols**

The lighting industry uses a remarkably diverse range of lighting control protocols. The reasons for this vary. In some instances, choice of protocol is cost driven, in others it is simply advancement in technology. Added to this equation is the inevitable group of manufacturers who attempt to foist proprietary control onto their customers in the hope of locking them into a specific product range.

In this article, I will attempt to describe the most significant protocols and discuss some of the benefits and drawbacks.

### Analogue Control.

Analogue control simply involves using a single wire for each control circuit. The voltage on the wire varies (usually between 0 to 10V) and the voltage at any given time sets the intensity of the dimmer. This is the oldest form of control. It is still in regular use today, primarily due to its simplicity. Any fault can be easily diagnosed with a voltmeter. The main drawback is that today's lighting systems use many channels, ranging from hundreds to tens of thousands. At this level, analogue becomes very cumbersome and expensive. It is worth noting that the analogue control protocol has just recently become an ANSI (American National Standards Institute) standard (ANSI E1.3 2001).

### Early Multiplex.

The limitations of analogue control led manufacturers to investigate methods of sending multiple control channels over a single wire. The generic term for this is multiplex. Two different types exist: Analogue Multiplex and Digital Multiplex.

Early developers of Analogue Multiplex include Strand Lighting with their D54 protocol and ADB with S20. These protocols are still in use today, although rarely used for new installations. Analogue Multiplex solved the problem of transmitting many channels over one wire. Unfortunately, these protocols are prone to problems such as interference, which is visible as flickering lights.

The next round of developments came with Digital Multiplex. The concept is similar, but the multiple control channels are transmitted over a single cable using digital information. Early developers include Avab and Colortran with similarly named protocols. The only drawback with this type of protocol is the fact that they are proprietary systems. This made it very difficult to interconnect equipment from differing manufacturers. Conversion products, called protocol converters were developed by companies such as Artistic Licence, ADB and Grey Interfaces, but these were relatively expensive ways of solving a problem that should not have existed. The problem was solved in 1988...

### DMX512

DMX512 was the first standard method of digital multiplex. It was invented by the USITT (United States Institute of Theatre Technology) in 1988. Adoption of the standard by manufacturers was exponential.

As the name suggests, DMX512 allows 512 channels to be Digitally MultipleXed on a single cable. It employs an electrical standard called RS485, this is a method of transmitting data over a pair of wires that are twisted together. The result is very high immunity from electrical interference.

In 1990, the standard underwent some improvements. That is why the term DMX512 (1990) is often seen on equipment marking.

In the decade to follow, DMX512 became the defacto standard and proved remarkably resilient. One potential drawback was the complexity of diagnosing faults on a digital system. This was quickly overcome as manufacturers developed sophisticated test tools such as the Goddard Design 'Lil DMXter' and the Artistic Licence 'Micro-Scope'.

DMX512 has just undergone a series of upgrades and a new standard 'DMX512-A' now exists. Happily, this is completely compatible with the earlier version. DMX512-A addressed a number of minor limitations in the original standard, along with adding a range of new functionality.

### Talking Back.

By the early 2000s, one of the biggest problems was the fact that DMX512 only 'talked' in one direction. That is from the control system to the dimmers or moving lights. There was no way to retrieve information such as status and temperature from the lights. More importantly, the DMX512 address of each light needed to be set manually, often using fiddly 'DIP Switches'. As channel counts rose into the tens of thousands, the need for a solution became urgent....

### RDM.

RDM stands for Remote Device Management and is a new standard in development at ESTA (Entertainment Services & Technology Association). It operates on the same cable as DMX512 or DMX512-A and allows bi-directional communication.

This provides numerous benefits, key amongst them is the ability to remotely set the DMX512 start address. In large installations, this allows the task of 'patching' the lights to be totally automated.

RDM also allows diagnostics data to be retrieved from the lamps and dimmers. The range of information is wide and varied. It can include feedback such as operating temperature, moisture sensors, lamp hours and fault information.

Whilst RDM is not yet a standard, a number of manufacturers are shipping products that are compatible with version one of the draft. These include Artistic Licence, Wybron and EDI with major players such as High End and Vari\*Lite set to join soon. The first fully integrated RDM control system; Colour-Tramp was launched by Artistic Licence in 2003. By extensive use of RDM, it operates as both the lighting controller and also as a diagnostics and management system. Information retrieved from the lamps using RDM can be displayed on a PC screen or even emailed for evaluation and maintenance control.

## The Ether

DMX512-A and RDM provide a solid workhorse that will be with us for the foreseeable future. There is only one limitation: Only a short time ago, 512 channels seemed sufficient. That is no longer the case. We now regularly talk about the number of Universes of DMX512 not the number of channels (Universe is the term used to describe a group of 512 channels or one 'cable' of DMX512).

Just as rising channel counts spurred the change from Analogue to Multiplex, a way to multiplex DMX512 Universes over the same cable was sought.

Most manufacturers agreed that Ethernet is the interface to use. The majority of implementations effectively multiplex multiple universes of DMX512 over the Ethernet cable. The first manufacturers to offer solutions were proprietary. Strand released ShowNet, ETC released EtcNet II & Artistic Licence released Art-Net.

ESTA started a programme called ACN (Advanced Control Network). Unfortunately and almost ten years on, the standard is still in development. The concept is laudable; to invent an Ethernet control protocol that will provide a standard method of control for everything from lights to sound, video and even stage mechanics. In recent years, the programme has come under new stewardship, has goals that are more realistic and may soon see the light of day.

In an attempt to break the deadlock, Artistic Licence released Art-Net into the public domain and then included a range of free development tools and software. The concept seems to have worked. With over forty manufacturers now supporting Art-Net, it is becoming the defacto standard.

Ethernet protocols such as Art-Net do not replace DMX512 and RDM, they all work together. The Ethernet part is used to distribute many universes of data around a building, converting locally to DMX512/RDM for local distribution to lights and dimmers.

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