

Communication Protocols

As described previously in the [control systems](#) section, there are several ways in which control data can be sent from one device to another. The most fundamental attributes are whether the signal is analogue or digital, and whether it is multiplexed.

Control Protocols

The following are protocols that are most likely to be found today. There is wide variation in their capabilities and use.

[Advanced Control Network - ACN](#)

ACN (or the ANSI BSR E1.17 standard) is the next generation control protocol which is under development by ESTA (Entertainment Services and Technology Association). It will operate using an [Ethernet network](#) and is intended partly to address the limitations of DMX512.

The [design goals of ACN](#), as specified by ESTA, are available for reference.

[Advanced Dimmer Network - ADN](#)

A proprietary protocol from ADB. ADN allows bi-directional networking (control and reporting) of a complete ADB dimmer system, without the need for additional wiring. It is based on the same underlying protocol of DMX512, and utilises the second data pair of a standard DMX control cable.

ADB62.5

An old digital protocol developed by ADB. Still in use although not on new products. Uses a [5-pin XLR](#), so care must be taken not to confuse it with DMX512.

AMX192

An old *analogue* protocol specified by USITT which is now hardly used. It suffers from all problems inherent in an analogue protocol, such as noise and ground loops. This protocol can control a maximum of 192/384 channels using a TDM (Time Division Multiplex) format. Uses a [4-pin XLR](#) connector.

[Art-Net](#)

Technically, not a lighting protocol as such, but a transmission method for [DMX512](#) lighting data. Art-Net translates DMX data into packets that can be sent and received over a standard [Ethernet](#) network. Art-Net was invented by Artistic Licence and is now public domain, meaning that a large number of manufacturers support this Ethernet 'language'. The alternative is a proprietary Ethernet transmission system, such as ShowNet (Strand) or ETC-Net2 (ETC). Ethernet systems generally use the [RJ45](#) connector.

Avab

A digital protocol developed by Avab. It is not as fast as DMX512 but is still widely used. The protocol controls a maximum of 256 channels. Connectors vary, and the [5-pin XLR](#) is often used.

C105

Developed by Compulite, C105 was an early digital protocol, and had the advantage of an opto-isolator board in the output stage of the control desk which was powered from the demultiplexer, thus reducing noise problems.

CMX (Colortran)

A digital protocol developed by Colortran, controlling 512 channels. It is not as fast as DMX512 but is still widely used, especially in America. DMX was largely based on this protocol, and CMX equipment can usually be easily modified for DMX operation.

CMX (Compulite)

This is based on DMX, but uses the second data pair for return of status information from certain digital dimming systems. Original versions were not compatible with DMX, but all systems from mid-1998 onwards produced a CMX output which was fully DMX compliant.

D54

An old *analogue* TDM (Time Division Multiplex) protocol developed by Strand, still very widely used. It is prone to ground loop problems, which cause erratic behaviour. Problems can usually be solved by ensuring the lighting desk, monitor and demux unit are all at the same ground potential. D54 can control up to 384 channels using a multiplex format signal. Uses a [3-pin XLR](#), although a [4-pin](#) is sometimes used when compatibility with AMX192 is needed.

DMX512

This is a digital protocol used to carry lighting control data between the lighting desk and the dimmers or intelligent units, originally designed in 1986. DMX512 can control up to 512 channels using a multiplexed signal. It should be connected by a [5-pin XLR](#) connector, although many moving light manufacturers use the [3-pin XLR](#). The wiring for the first three pins is the same in both cases:

- ? Pin 1 Ground (*connects to the cable screen*);
- ? Pin 2 Data minus (*connects to one wire of the twisted pair*);
- ? Pin 3 Data plus (*connects to the other wire of the twisted pair*).

It may be best to leave pins 4 & 5 unconnected as there are compatibility problems between different manufacturers. The control desk has the female output connector.

DMX512 (1990)

The protocol was changed slightly in 1990. The Mark after Break value was increased to 8uS. In reality, this is seldom an issue.

[DMX512-A](#)

This is currently a draft standard, designed to improve on some of the limitations of DMX512(1990). The key feature of DMX512-A is that it is backwards compatible. Other improvements include bi-directional communication facilities, and error reporting. [More details](#) are available for reference.

[Ethernet Systems](#)

An Ethernet network is system used for communication between computer equipment. Ethernet systems come in a number of flavours, all of which contain the word 'Base' - for example 10BaseT. The different flavours use different connectors and work at different data rates.

Ethernet systems are starting to be used in the Entertainment Technology Industry for sending large amounts of control data when DMX512 is too slow (for example using the [Art-Net](#) 'language'). The most important flavour is 10BaseT which uses the [RJ45](#) (telephone handset) connector.

Ethernet systems are currently being used to distribute [DMX512](#) data over a lighting system network, although a new protocol - [ACN](#) - is being developed as the next generation control system protocol.

[MIDI](#)

MIDI is an acronym for Musical Instrument Digital Interface, and is a digital protocol designed to allow musical instruments to communicate. It is used frequently in lighting control for remote control. It connects via a [5-pin DIN](#) connector. There are many different types of information transmitted on MIDI, so it should not be assumed that two pieces of equipment can talk just because they both have MIDI connectors.

MIDI equipment is usually supplied with an 'implementation sheet' which will show whether two pieces of equipment are compatible.

Midi Show Control (MSC)

Utilising the MIDI language, MSC provides show control functions, such as synchronising sound and lighting with pyrotechnica. It is widely used in the theme park industry.

PMX

A digital multiplex control system (developed by Pulsar), based on the EIA-232 specification. Uses a [5-pin XLR](#) connector. No further details available.

[Remote Device Management - RDM](#)

Remote Device Management (or RDM) is the colloquial name for the ANSI E1.20 standard in development at ESTA.

RDM is intended to allow bi-directional communication over the DMX512 cable. This will occur on the standard twisted pair connected to pins 2 and 3. This same pair of wires is used to transmit data from the console to the dimmers or moving lamps.

[More information](#) on RDM is available for reference.

S20

An old *analogue* protocol developed by ADB, for the control of up to 480 channels. Still in use, although not on new products. Uses a [5-pin DIN](#), so care must be taken not to confuse it with MIDI.

SMX

A digital multiplex control system (developed by Rank Strand). SMX was designed to provide fault reporting and other nice features, unfortunately it is so complex that it is seldom seen in practice. Normally uses a [5-pin XLR](#) connector.

Timecode

Timecode is the general name given to sending time information between equipment so that they can synchronise together. There are many different types:

VI

T Vertical Interval TimeCode is incorporated into a video signal;

C

LT

C Longitudinal TimeCode can be recorded on audio tape or CD, or transmitted as an audio signal. It comes in four flavours of its own:

Film

operates at 24fps and is used by the film industry;

EBU

operates at 25fps, the European video standard;

SMPTE (Society of Motion Picture & Television Engineers)

universal standard operates at 30fps, one of the US video formats;

DF (Drop Frame)

operates at 29.97fps, the other US video standard;

M

T

C

MIDI TimeCode operates at any one of the frame rates above and is transmitted over a MIDI cable. It is the MIDI equivalent of SMPTE.