DE2 AND ED2 QUICK OPERATION

DE2 SETUP

The DE2 sends DMX A input levels over an Ethernet network as Art-Net DMX packets encoded with the "A" Universe/Group thumbwheel setting, while DMX B input levels are sent encoded with the "B" Universe/Group setting:

➢ **Plug the DE2 into mains power, plug one or two DMX cables from the output of your control panel into the DMX inputs of the DE2. The DMX LEDs show the presence of any DMX signals.**

➢ **Plug a flexible RJ45 "straight through" Ethernet cable into the RJ45 connector on the DE2. Plug the other end of the cable into a 10BASE-T Ethernet hub. Use the sockets labelled X on the hub.**

➢ **To set the normal "No Merge" mode at standard refresh rate, set the central Mode thumbwheel to 0.**

➢ **To send DMX A levels as Packets A encoded as Universe 0, Group 0, set thumbwheel 1 to 0, and thumbwheel 2 to 0. LED A will be on to show packets are being sent.**

➢ **To send DMX B levels as Packets B encoded as Universe 1, Group 0, set thumbwheel 4 to 1, and thumbwheel 5 to 0. LED B will be on to show packets are being sent.**

▪ For other DE2 options such as HTP, LTP modes etc see pages 9 and 10.

▪ The term "Group" used here corresponds to the term "Sub-Net" used by Art-Net.

ED2 SETUP

The ED2 receives Art-Net DMX over Ethernet packets from an Art-Net compatible control panel (or one or more DE2s). DMX over Ethernet Packets matching the "A" Universe/Group thumbwheel setting are output as DMX A levels, and packets matching the "B" Universe/Group setting are output as DMX B levels:

➢ **Plug the ED2 into mains power, plug one or two DMX cables into the DMX outputs to drive your DMX dimmers or luminaires. The DMX LEDs show the ED2 is transmitting DMX.**

➢ **Plug a flexible RJ45 "straight through" Ethernet cable into the RJ45 connector on the ED2. Plug the other end of the cable into the 10BASE-T Ethernet hub (see above). Use the sockets labelled X on the hub. The E LED will be on if any packets are found on the network.**

➢ **To set "No Merge" mode, A and B channels to receive Art-Net, set the central Mode thumbwheel to 0.**

➢ **Set the A and B Universe and Group thumbwheels to match the Universe and Group settings on the control panel (or DE2). If any packets on the network match the ED2's A/B Universe/Group settings, the A/B LEDs will be on, and the levels output at the DMX A/B sockets.**

▪ For other ED2 options such as HTP, LTP modes etc see pages 15 to 18.

PID II TABLE OF CONTENTS

DE2 AND ED2 INTRODUCTION

The Theatrelight DE2 and ED2 provide a reliable and cost effective method of distributing multiple DMX universes throughout a Theatre or Studio without the expense involved in installing and terminating RS-485 cables necessary for each DMX universe. The DE2 (**D**mx to **E**thernet) sends DMX as data packets over a 10BASE-T Ethernet cable system, while the matching ED2 (**E**thernet **to D**mx) converts the DMX data packets back to DMX. Both models have a built in mains power supply available in 220-240 and 100-120 vac versions. The following provides an overview of the features of the Theatrelight DE2 and ED2 units.

DE2 Features

- Two DMX 512-A inputs, each independently isolated to 500vdc
- 10BASE-T Ethernet port independently isolated to 500vdc
- DE2 sends Art-Net compatible data packets over a 10BASE-T Ethernet network
- Setup by thumbwheels for Universe (0-9) and Group (0-9) for each DMX channel for a total of 100 universes
- Setup by thumbwheel for No Merge, HTP merge (Highest Takes Precedence) or LTP merge (Latest Takes Precedence)
- Setup by thumbwheel for fast or standard refresh rate

ED2 Features

- Two DMX 512-A outputs, each independently isolated to 500vdc
- 10BASE-T Ethernet port independently isolated to 500vdc
- ED2 receives Art-Net, Streaming ACN, or ShowNet data packets from a 10BASE-T Ethernet network
- Setup by thumbwheels for Universe (0-9) and Group (0-9) for each DMX channel for a total of 100 universes
- Setup by thumbwheel for No Merge, HTP merge (Highest Takes Precedence) or LTP merge (Latest Takes Precedence)
- Setup by thumbwheel for both channels to receive Art-Net, Streaming ACN, or ShowNet

"Art-Net" is a trademark of Artistic License UK, who have published the "Art-Net" protocol to the public realm. "Streaming ACN" (sACN) is ESTA/PLASA standard E1.31. "ShowNet" is a trademark (and proprietary protocol) of Philips Strand Electric.

DE2 AND ED2 FRONT PANEL LEGEND
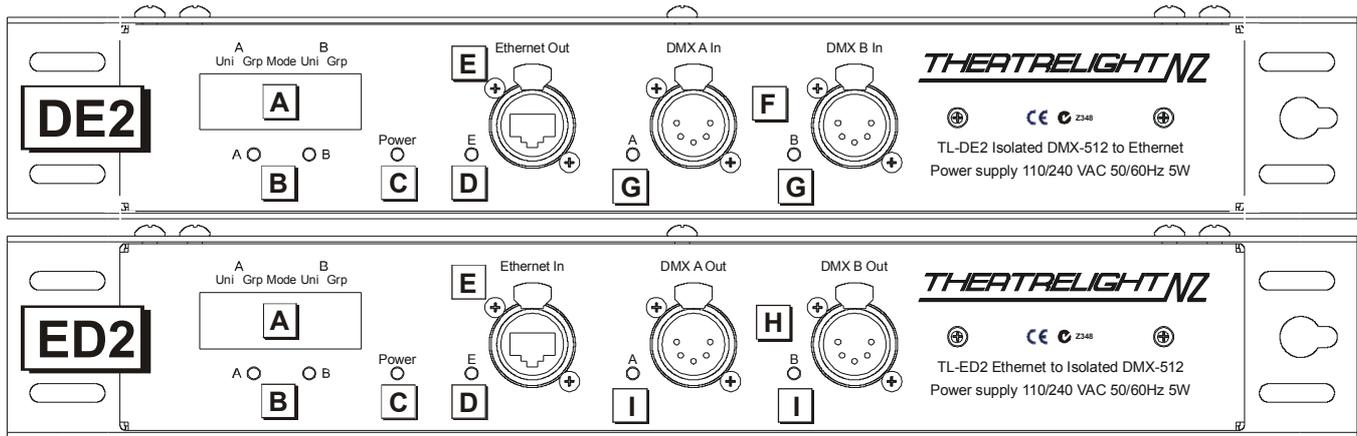
A   Thumbwheel switches 1-5 for setting Universe A (thumbwheel 1), Group/Subnet A (thumbwheel 2), Mode (thumbwheel 3), Universe B (thumbwheel 4), Group/Subnet B (thumbwheel 5)

B   A and B LEDs show DMX A and B packets being sent (DE2) and matching packets received (ED2)

C   Power LED shows the main CPU and Ethernet circuitry is powered

D   E (Ethernet) LED shows packets being sent (DE2), or (ED2) packets received - both matching and non-matching

E   Neutrik "Ethercon" RJ45 connector for connection to an Ethernet Hub (or DE2 to ED2 using a "crossover" cable)

F   Neutrik 5 pin DMX connectors for input of two DMX universes from a control panel with DMX output (DE2)

G   DMX A and B LEDs show presence of DMX signals on the DMX input connectors (DE2)

H   Neutrik 5 pin DMX connectors for output of two DMX universes from DMX over Ethernet packets (ED2)

I   DMX A and B LEDs show presence of DMX signals on the DMX output connectors (ED2)

DE2 AND ED2 FRONT PANEL

The DE2 and ED2 are housed in sturdy steel cases designed for mounting on lighting bars, on a wall or inside an equipment cabinet. The case matches that used for the Theatrelight SP4, the DMX isolator/splitter. Each unit has its own mains power supply for simple installation. The following description refers to the labels in the front panel picture opposite:

A   Thumbwheels Thumbwheel switches allow fast setup of the Universe and Group A and B numbers. Each can be set in the range 0-9 permitting the encoding or decoding of up to 100 DMX universes, The centre Mode thumbwheel selects LTP and HTP merge modes, Fast or Standard refresh rate (DE2), or Art-Net or ShowNet packet type (ED2)

B   A and B LEDs In the DE2 these show that DMX A and B packets are being sent. In the ED2, these LEDs indicate that a packet *matching* the thumbwheel setting for Universe, Group and Art-Net/sACN/ShowNet type is being received and output to the DMX connector. DMX over Ethernet packets must be received at least one per second.

C   Power LED The Power LED shows that the internal CPU and Ethernet circuitry is correctly powered.

D   Ethernet LED In the DE2, the Ethernet LED shows packets being sent. In the ED2, if this LED is lit, packets are present on the network *whether or not they match* the thumbwheel settings for Universe, Group and Type (Art-Net/sACN/ShowNet).

E   Ethernet connector Both the DE2 and ED2 use the Neutrik "Ethercon" RJ45 connector for connection to an Ethernet Hub. A (single) DE2 may also be connected directly to a (single) ED2 using a "crossover" cable without using a hub.

F   DMX Inputs The DE2 uses Neutrik 5 pin DMX connectors for input of two DMX universes from a control panel. Each DMX input is isolated from the other DMX input, from the internal electronics, and the Ethernet line.

G   DMX LEDs On the DE2, these LEDs show active DMX signals are present on the DMX input connectors. The DE2's LEDs show only the presence of an DMX signal, and do not display any DMX errors if present.

H   DMX Outputs The ED2 uses Neutrik 5 pin DMX connectors for output of two DMX universes from Art-Net, sACN, or ShowNet DMX over Ethernet packets. If no packets are being received, the DMX signals are maintained with all channels set at level zero. Each DMX output is isolated from the other DMX output, from the internal electronics, and the Ethernet line.

I   DMX LEDs On the ED2, these LEDs show active DMX signals are present on the DMX output connectors. The LEDs show only the presence of an DMX signal. Even if no valid data packets are being received, the ED2's DMX LEDs stay on showing DMX levels are being continually transmitted, but with all levels at zero.

▪ DMX plug and socket pinout is: pin 1 = screen, pin 2 = data -, pin 3 = data +. For RJ45 pinout see page 22.

ETHERNET COMMUNICATIONS

The DE2 transmits Art-Net DMX Ethernet data packets over a 10BASE-T Ethernet local area network, The ED2 receives the packet and converts them back to DMX. In addition to Art-Net, the ED2 can also receive Streaming ACN (release 3), and a subset of ShowNet. Data is sent via 8 pin "RJ45" connectors over a cable made of 4 twisted pairs (Cat 5 or Cat5e cable), to an Ethernet hub (switcher) wired "Star" fashion, The 10BASE-T standard uses a data rate of 10 Megabits per second, about 40 times faster than the DMX standard of 250 Kilobits per second.

Each Ethernet device (such as a DE2 or ED2 or PC) when connected to a network hub uses just 4 wires of the 8 in the Cat 5 cable- one pair of wires is used only for transmitting data, and the other pair only for receiving data. The data is sent through small pulse transformers which naturally provide voltage isolation and immunity to earth loop problems which are so common in many DMX installations. Additionally problems of data integrity common with DMX installations are minimised with DMX over Ethernet as each data packet carries a checksum (there is no such check in the DMX standard). Due to the high frequency used (10Megahertz), the data weakens with increasing length of cable, and so the distance between any transmitter and receiver is normally limited to 100 meters, although 150 meters or more is possible by using high quality cable and good installation. The distance can be extended by adding Ethernet hubs at ~100m intervals.

For Ethernet devices to talk together, the transmit pair of wires of any device must always be connected to the receive pair of any other device and vice-versa (as no data will get far if a transmit pair is connected to another transmit pair). The normal wiring of devices (or "nodes") such as PCs (and the DE2 and ED2 as well) is termed the **MD1** connection- the transmit or Tx pair uses pins 1 and 2 of the RJ45 connector, and the receive or Rx pair use pins 3 and 6. These are connected to a hub using the normal "straight-through" cable where pin 1 is wired to pin1 etc. Common 4 port Ethernet hubs have 4 sockets for accepting 4 of these MD1 nodes- and since a Transmit pair must always be connected to a Receive pair, pins 1 and 2 on the hub therefore have a receive function, while pins 3 and 6 are the transmit pair. Such a crossed over connection on the hub is termed the **MD1-X** connection, and often the normal WLAN inputs on a hub are labelled 1X, 2X 3X etc to denote they are MD1-X, the opposite to the MD1 nodes on a PC. The socket labelled "Uplink" on the hub is an MD1 type- and this of course can only be connected to an MD1-X device such the input to another hub, and not to a PC, DE2, or ED2. Automatic MDI/MDI-X hubs can sense TX and RX lines and switch their internal electronics to provide the proper function.

Two MD1 devices can be connected directly to each other *without a hub* by the use of a "crossover cable", a cable in which the Tx pair and the Rx pair are crossed over so the Tx pair (pins 1 and 2) at one end are wired to the Rx pair (pins 3 and 6) at the other end (and vice versa). However as any one Ethernet device has the power to drive only one other device, this form of connection is limited to connecting just two Ethernet devices together: a single DE2 connected to a single ED2 in this manner gives increased reliability by omitting the extra connectors and electronics in the hub.

- Packets on the network can be checked using a PC running a network analyser such as "WireShark" (www.wireshark.org). Networks carrying DMX data should not have access to the internet.

DE2 AND ED2 INSTALLATION

The DMX512 communication system has no built error checking, whereas DMX over Ethernet data is protected by checksum, resulting in increased data integrity. For both DMX and Ethernet installation, the following guidelines should be followed:

DMX

➢ **Use shielded twisted pair cable suitable for DMX512/RS485 communications to standard ANSI E1.11-2004**
➢ **Use good quality 5 pin XLR connectors.**
➢ **Do not connect the shield (pin 1) to earth or the XLR metal body.**
➢ **Do not disconnect the shield wire at one or both ends of a DMX512 cable.**
➢ **DMX512 wiring must be a daisy chain, starting at the control console and looping from device to device. The signal should not have any splits or T connections, except by using an electronic splitter.**
➢ **Keep cables at least 600mm away from parallel power cables - cross power cables at right angles.**
➢ **For lowest interference install DMX512 cabling in its own earthed steel (*not plastic*) conduit or trucking.**
➢ **The DMX512/RS485 standard allows up to 32 devices on a line - keep the number low to ensure reliability.**
➢ **A DMX line should be terminated with a 120 ohm resistor sited at the farthest point from the control panel.**
➢ **ED2 DMX inputs are fitted with internal 120 ohm resistors, as the ED2 is normally at the end of a DMX line.**
➢ **The use of isolated DMX512 splitters is recommended. These allow the signal to split into several legs, making cabling simpler and ensuring that failure of one device or cable does not fail the whole system.**
➢ **After any installation, all DMX wiring should be tested with an oscilloscope or DMX diagnostic tool to check adequate signal levels with minimum distortion, noise and reflections.**

Ethernet:
➢ **Use good quality cable to standard ANSI/TIA/EIA-568-A, preferably Cat5e.**
➢ **For improved communication reliability in noisy situations use Cat 6 or Cat 6a shielded cable.**
➢ **Use solid core cable for permanent wiring, stranded flexible cable only for non-permanent connection.**
➢ **Use good quality 8P8C "RJ45" connectors. For mechanical security use Neutrik Ethercon connectors.**
➢ **Cables must be properly installed and terminated to specification.**
➢ **Keep cables at least 600mm away from parallel power cables - cross power cables at right angles.**
➢ **Any bends in the cable must be greater than 4 times the cable outer diameter.**
➢ **Limit length between any two devices to 100 metres (including the flexible cables each end).**
➢ **If runs longer than 100 metres are required, use an Ethernet hub.**
➢ **Use a high quality hub for long-term reliability.**

DE2 OPERATION

Setup of the DE2 is simple and takes only a few minutes.

DE2 CONNECTION

➢ **Plug the DE2 into mains power. The Power LED shows power is on the main electronics. The A, B and Enet LEDs stay on for one second after power on.**
➢ **Plug one or two DMX cables from the output of your control panel into the DMX inputs of the DE2. The DMX LEDs show the presence of any DMX signals.**
➢ **Plug a flexible RJ45 "straight through" Ethernet cable into the RJ45 connector on the DE2. Plug the other end of the cable into a 10BASE-T Ethernet hub using the sockets labelled X to ensure the transmit data pair of the DE2 connect to a receive pair on the hub.**

▪ Do not use the "Uplink" socket on non-auto sensing hubs as this would connect the transmit data pair of the DE2 to a transmit data pair on the hub meaning the hub will not see the DE2 data.

DE2 SETTING UNIVERSE/GROUP CODES

The DE2 sends broadcast packets compatible with the Art-Net standard, encoded with the Universe and Group numbers on the front panel thumbwheels. Art-Net packets with DMX A data are encoded with thumbwheels 1 and 2- the A Universe/Group, and Art-Net packets with DMX B data are encoded with thumbwheels 4 and 5- the B Universe/Group. The Mode thumbwheel (thumbwheel 3) sets merge modes and the packet refresh rate.

➢ **To encode DMX A packets for example as Universe 0, Group 0, set thumbwheel 1 to 0, and thumbwheel 2 to 0. DMX A packets will be sent encoded as Universe 0, Group 0.**
➢ **To encode DMX B packets for example as Universe 1, Group 0, set thumbwheel 4 to 1, and thumbwheel 5 to 0. DMX B packets will be sent encoded as Universe 1, Group 0.**

▪ The term "Group" corresponds to "Sub-Net" in the Art-Net specification - Theatrelight uses the term "Group" to reduce confusion with other usages of Subnet".

▪ Do not set the A and B Universe/Group selection the same. If you do, LEDs A and B will blink alternately to indicate an error, and no packets will be sent (E LED Off). This prevents dimmers or moving lights behaving in an erratic fashion by trying to follow the differing levels received with every data packet.

DE2 SETTING NO MERGE

This is the normal mode to use when the DE2 is used to transmit two DMX universes from a control panel to dimmers or luminaires: one universe - DMX A, is sent as packets A, and a second universe- DMX B, is sent independently as packets B. Art-Net packets can be sent at a packet refresh rate of 20 msec (standard - mode 0) between packets or 10msecs between packets (fast - mode 3).

For example to send Art-Net data packets, No Merge mode, at standard refresh rate:

➢ **Set the central mode thumbwheel (thumbwheel 3) to 0.**

Then if the DE2 has signal on both DMX inputs, Art-Net Packets A are sent with DMX A input levels (encoded with the "A" Universe/Group selection), and Packets B are sent with DMX B input levels (encoded with the "B" Universe/Group selection). The A and B LEDs show that the A and B packets are being transmitted.

DE2 SETTING HTP MERGE

This mode allows seamless transfer of control from a main control panel to a backup panel just by moving the grand masters of the panels: the highest level of each channel of DMX A and DMX B is sent as *both packets A and packets B*. The packet refresh rate can be set to 20 msec between packets (standard - mode 1) or 10msecs between packets (fast - mode 4).

To set Highest takes Precedence mode, at standard refresh rate:

➢ **Set the central mode thumbwheel (thumbwheel 3) to 1.**

The A and B LEDs show that the A and B packets are being transmitted.

DE2 SETTING LTP MERGE

This mode is of use where control needs to be switched from one area to another as for example moving from a studio or rehearsal control panel to the main panel in the control room. When the new panel is switched on, its DMX signal becomes the Latest On, and the new levels are sent to *both packets A and packets B*. The packet refresh rate can be set to 20 msec between packets (standard - mode 2) or 10msecs between packets (fast - mode 5).

To set Latest takes Precedence mode, at standard refresh rate:

➢ **Set the central mode thumbwheel (thumbwheel 3) to 2.**

If either the A or B LED is on, then the control panel connected to that input was the latest controller to be turned on. The other LED flashes to show the previous latest on control panel has been superseded as the active controller.

DE2 MODE OPTIONS

The following sections provide a more detailed description of the DE2 Merge and Refresh modes, together with DMX Fail and LED behaviour.

The DE2 mode options include No merge, HTP merge (Highest Takes Precedence), and LTP merge (Latest Takes Precedence). These modes can be selected with a choice of two packet refresh rates, Standard or Fast.

The mode switch (thumbwheel 3) options are:

Mode	Merge Mode	Refresh	Merge Description
Mode 0:	No merge	20msec	DMX A levels sent as Packets A, DMX B levels sent as Packets B
Mode 1:	HTP merge	20msec	DMX A and B merged on HTP basis, sent as both Packets A and B
Mode 2:	LTP merge	20msec	The latest On of either DMX A or B is sent as both Packets A and B
Mode 3:	No merge	10msec	DMX A levels sent as Packets A, DMX B levels sent as Packets B
Mode 4:	HTP merge	10msec	DMX A and B merged on HTP basis, sent as both Packets A and B
Mode 5:	LTP merge	10msec	The latest On of either DMX A or B is sent as both Packets A and B
Modes 6-9:	No merge	20msec	These selections default to mode 0

- Note that Packets A are always encoded with the Group/Universe codes set on Thumbwheels A, and Packets B are always encoded with the Group/Universe codes set Thumbwheels B.

- If you want to HTP or LTP merge the DMX output of 2 control panels in a system where a DE2 is connected to an ED2, you should set *either* the DE2 to HTP/LTP *or* the ED2 to HTP/LTP merge mode - **not both**. The opposite end should be set to No Merge mode.to ensure the expected merge behaviour

A detailed description of these modes follows.

DE2 STANDARD REFRESH MODE

A DMX control panel sends 512 levels every 23 msec, if working at the maximum speed allowed under DMX 512-1990: about 44 frames of 512 levels every second. The DE2 in standard speed mode (modes 0, 1, 2) sends a DMX data packet every 20 msec, or 50 frames of data per second, close to the DMX standard and fast enough for most lighting purposes. In cases where a delay may be noticeable such as LED lighting, the DE2 has a faster rate available (modes 4, 5, 6) - 10msec between frames or 100 frames a second, more than twice as fast as normal DMX.

When the mode thumbwheel is set in the range 0 to 2, the DE2 sends packets at 20msec or 50 frames a second for DMX A, and 20 msec or 50 frames a second for DMX B. The A and B packets are interleaved at 10 msec intervals.

- In systems using a number of DE2 units to send multiple universes over the same network, two or more DE2s may send packets at the same instant - a "packet collision" - which results in both packets being unreadable, or if readable, may have checksum errors. In order to reduce such collisions, each DE2 send its packets with a small time difference between packets. This timing is randomly varied over a range of 3% every 100msecs, so any DE2 has little chance of synchronising its packet send time with any other DE2 in a multiple universe system.

DE2 FAST REFRESH MODE

When the mode thumbwheel is set in the range 3 to 5, the DE2 sends packets at 10msec or 100 frames a second for DMX A, and 10msec or 100 frames a second for DMX B. The A and B packets are interleaved at 5 msec intervals. The interleaved timing of 5msec is randomly modified by +/-3% every 100 msecs.

- Some Ethernet hubs intended for the domestic market may drop packets at these higher data rates. If you experience regular drop-out problems, check if this is due to the choice of hub.

DE2 NO MERGE MODE

The following details the DE2 No Merge mode behaviour (Mode selections 0, 3):

If DMX A is on and DMX B is off: the DE2 sends only Packets A with DMX A levels. The A LED will be on.

If DMX B is on and DMX A is off: the DE2 sends only Packets B with DMX B levels. The B LED will be on.

If both DMX A and DMX B are on: the DE2 sends Packets A with DMX A levels and Packets B with DMX B levels.

Both A and B LEDs will be on.

If either or both DMX A or B go off: packet sending stops within 1 second of DMX off. Both A and B LEDs will be off.

DE2 HTP MODE

The following details the DE2 HTP merge mode behaviour (Mode selections 1, 4):

If DMX A is on and DMX B is off: the DE2 sends both Packets A and B with DMX A levels. The A LED will be on, the B LED will flash.

If DMX B is on and DMX A is off: the DE2 sends both Packets A and B with DMX B levels. The B LED will be on, the A LED will flash.

If both DMX A and DMX B are on: the DE2 sends Packets A and B with HTP merged levels. Both A and B LEDs will be on.

If both DMX A and DMX B are off: no packets are sent- packet sending stops within 1 second of both DMX off. Both A and B LEDs will be off.

▪ The same HTP merged levels are sent as both Packets A and B - to two differently coded destinations

DE2 LTP MODE

The following details the DE2 LTP merge mode behaviour (Mode selections 2, 5):

If DMX A is the latest DMX channel on and DMX B was on or off: the DE2 makes DMX A active and sends DMX A levels to both Packets A and B. The A LED will be on, the B LED will flash.

If DMX B is the latest DMX channel on and DMX A was on or off: the DE2 makes DMX B active and sends DMX B levels to both Packets A and B. The B LED will be on, the A LED will flash.

If DMX A was active and goes off:

> *if DMX B was on but inactive:* the DE2 sends both Packets A and B with DMX B levels (DMX B is re-activated)

> *if DMX B was off:* packet send stops within 1 second of DMX A off. Both A and B LEDs will be off.

If DMX B was active and goes off:

> *if DMX A was on but inactive:* the DE2 sends both Packets A and B with DMX A levels (DMX A is re-activated)

> *if DMX A was off:* packet send stops within 1 second of DMX B off. Both A and B LEDs will be off.

▪ The same LTP merged levels are sent as both Packets A and B - to two differently coded destinations

DE2 LED BEHAVIOUR

The following details the behaviour of the Ethernet LED (E LED) and the A and B channel LEDs

Enet LED: All merge modes: On if Packets A or B are being sent, Off if no packets are being sent

LEDs A/B, All merge modes

LED A/B alternate flash: Error - the Universe/Group A selection is the same as the Universe/Group B selection.
This would result in a conflict where different data is sent to the same address. (flash rate is 5 per sec)

LEDs A/B, No merge mode

LED A On: DMX A is on, and Packets A are sent with DMX A levels

LED A Off: DMX A is off or invalid, and no Packets A are sent

LED B On: DMX B is on, and Packets B are sent with DMX B levels

LED B Off: DMX B is off or invalid, and no Packets B are sent

LEDs A/B, HTP merge mode:

LED A and B On: Packets A and B are sent with HTP levels of DMX A and B (both DMX A and DMX B on)

LED A On, B flashing: Packets A and B are sent with DMX A levels (DMX A on, DMX B off/invalid). (flash rate is 1 per sec)

LED A flashing, B On: Packets A and B are sent with DMX B levels (DMX A off/invalid, DMX B on). (flash rate is 1 per sec)

LED A and B Off: No Packets A or B are sent (both DMX A/B off/invalid)

LEDs A/B, LTP merge mode:

LED A On, B Flashing: Packets A and B are sent with DMX A levels (DMX A active, DMX B on/inactive or off
(flash rate is 1 per sec)

LED A flashing, On: Packets A and B are sent with DMX B levels (DMX A on/inactive or off, DMX B active).
(flash rate is 1 per sec)

LED A and B Off: No Packets A or B are sent (both DMX A/B off/invalid)

ED2 OPERATION

Setup of the ED2 is simple and takes only a few minutes.

ED2 CONNECTION

➢ **Plug the ED2 into mains power. The Power LED shows power is on the main electronics. The A, B and Enet LEDs stay on for one second after power on.**
➢ **Plug a flexible RJ45 "straight through" Ethernet cable into the RJ45 connector on the ED2. Plug the other end of the cable into a 10BASE-T Ethernet hub using the sockets labelled X to ensure the receive pair of the ED2 connects to a transmit pair on the hub. The Ethernet LED will be on if any packets are found on the network.**
➢ **Plug one or two DMX cables into the DMX outputs to drive your DMX dimmers or luminaires. The DMX LEDs show the ED2 is transmitting DMX.**

▪ Do not use the "Uplink" connection on the hub as this would connect the receive data pair of the ED2 to a receive data pair on the hub meaning the ED2 will not see data from the hub.

ED2 SETTING THE ART-NET UNIVERSE

The ED2 receives Art-Net packets on channels A and B using thumbwheels to select the Universe and Group. The Mode thumbwheel sets merge mode, and also the Art-Net/sACN/ShowNet packet type. Art-Net has adopted a convention of labelling the first Universe (levels 1-512) as Universe 0 (not 1). The first Subnet is also labelled 0. Theatrelight uses the "Group" for Art-Net's "Sub-Net" to reduce confusion with other uses of "Subnet" (and also for use with sACN and ShowNet data). The Group setting only needs to moved off the 0 setting if using more than 10 universes (5120 levels). To receive data from an Art-Net control panel (or DE2) sending two Universes, Universe 0 (the first Universe) and 1, both encoded as SubNet 0:

➢ **Set the Mode thumbwheel (thumbwheel 3) to 0: both A and B channels receive Art-Net packets, No Merge.**
➢ **Set thumbwheel 1 to 0, thumbwheel 2 to 0: (Universe 0, SubNet/Group 0). If matching Art-Net packets are on the network, the A LED will be on, and the levels will be output as DMX A levels.**
➢ **Set thumbwheel 4 to 1, thumbwheel 5 to 0: (Universe 1, SubNet/Group 0). If matching Art-Net packets are on the network, the B LED will be on, and the levels will be output as DMX B levels.**

▪ In No Merge mode, the A and B Universe/Group/ selection may be set the same: if so both LEDs A and B will blink at a one second rate, and the same data from the Universe/Group matching packet will be output to both DMX A and DMX B. This allows the ED2 to be used as a DMX spliiter - driving two DMX lines with the same data.

▪ The ED2 receives UDP Art-Net packets from source IP addresses 2.*.*.* or 10.*.*.* (and 192.168.*.*), with the Art-Net Universe matching the ED2 Universe thumbwheel, and the Art-Net SubNet matching the ED2 Group thumbwheel (if needed). An Art- Net control system should have the Universe count limited to 9, and the SubNet number limited to 9.

ED2 SETTING THE STREAMING ACN UNIVERSE

The ED2 can be set to receive Streaming ACN (release 3) DMX over Ethernet packets. Streaming ACN (sACN) is similar to Art-Net in that it continually sends ("streams") a single DMX Universe of 512 levels with an encoded Universe number over an Ethernet connection. Instead of the Art-Net convention of starting its first Universe from 0, the sACN Universe count starts from 1. When used in sACN mode, the ED2's Group thumbwheel switch is programmed to count tens of Universes if needed for systems over 5120 channels, allowing the ED2 to select sACN Universes in the range 1 to 99. Universe 0 in the sACN standard is not a valid selection, so this thumbwheel choice (Group 0, Universe 0) results in an error flash of the A and B LEDs.

To receive Streaming ACN data from a control panel sending two Universes. Universe 1 (the first Universe) and 2:

➢ **Set the Mode thumbwheel (thumbwheel 3) to 1: both A and B channels receive sACN packets, No Merge.**
➢ **Set thumbwheel 1 to 1, thumbwheel 2 to 0: (Universe 1, Group 0 = sACN Universe 1). If matching sACN Universe 1 DMX data packets are on the network, the A LED will be on, and the levels will be output as DMX A levels.**
➢ **Set thumbwheel 4 to 2, thumbwheel 5 to 0: (Universe 2, Group 0 = sACN Universe 2). If matching sACN Universe 2 DMX data packets are on the network, the B LED will be on, and the levels will be output as DMX B levels.**

▪ In No Merge mode, the A and B Universe/Group/Type selection may be set the same: if so both LEDs A and B will blink at a one second rate, and both DMX A and B connectors will output the same levels. This facility allows the ED2 to function as a two output DMX splitter, driving two separate isolated DMX cables with the same data.

▪ The ED2 receives UDP Streaming ACN (release 3) packets only from source IP addresses 192.168.*.* (and 2.*.*.* or 10.*.*.*) with sACN Universe *ones* matching the ED2 Universe thumbwheel, and sACN Universe *tens* set by the ED2 Group thumbwheel (if needed). An sACN control system should be set up to match these IP address requirements, with the sACN Universe count limited to 99, and DMX Start Code = 0.

ED2 SETTING THE SHOWNET UNIVERSE

The ED2 can be set to receive ShowNet packets. Art-Net uses a "Universe" count of 16 (each Universe of 512 lighting levels) and an additional count "Subnet" (Group) of 16 - a total possible count of 16 x 16 Universes, or 131,072 levels. However ShowNet uses a different system - ShowNet "Netslot" is the start address of a set of levels, and "Netsize" determines the number of levels after that start address. With just two thumbwheels per channel, the ED2 cannot select every "Netslot" start address- but it can receive any two universes if the ShowNet system is set up to send them as integral universes of 512 channels. ShowNet systems are commonly set up to send integral universes anyway, as the levels almost always end up as one or more DMX lines - each a single universe of 512 levels.

To receive integral universes from ShowNet data packets, the ED2 uses its Universe 0 setting to receive Netslot start address 1 (the first universe - the same numbering from zero used by Art-Net). If the ShowNet Netsize for this slot is set at 512 levels, the ED2 will receive the first 512 levels (levels 1-512) from the ShowNet controller - equating to Art-Net Universe 0 and sACN Universe 1. Similarly the ED2 Universe 1 setting receives Netslot start address 513 for the next 512 levels, the ED2 Universe setting 2 will receive Netslot start address 1025 for 512 levels, and so on. In addition the ED2 Group setting can be used to offset these Netslot start addresses by 10 universes (5120 levels) if needed for systems over 5120 levels.

For example if the ShowNet controller has been set up to send 1024 levels, one packet starting at Netslot 1, with Netsize 512 (i.e. ShowNet Universe 0, the first universe) and a second packet starting at Netslot 513, Netsize 512 (i.e. ShowNet Universe 1, the second universe) then to receive these packets as DMX A and B levels:

> **Set the Mode thumbwheel (thumbwheel 3) to 2: both A and B channels receive ShowNet packets, no merge.**
> **Set thumbwheel 1 to 0, thumbwheel 2 to 0: (Universe 0, Group 0). If matching ShowNet packets are on the network, the A LED will be on, and ShowNet levels 1-512 will be output as DMX A levels.**
> **Set thumbwheel 4 to 1, thumbwheel 5 to 0: (Universe 1, Group 0). If matching ShowNet packets are on the network, the B LED will be on, and ShowNet levels 513-1024 will be output as DMX B levels.**

▪ In No Merge mode, the A and B Universe/Group selection may be set the same: if so both LEDs A and B will blink at a one second rate, and both DMX A and B connectors will output the same levels. This facility allows the ED2 to function as a two output DMX splitter, driving two separate isolated DMX cables with the same data.

▪ The ED2 receives UDP ShowNet DMX packets only from source IP addresses 192.168.*.* (and 2.*.*.* or 10.*.*.*) with ShowNet Netslot addresses (NetSlot-1)/512 matching the ED2 Universe thumbwheel, and (NetSlot-1)/5120 set by the ED2 Group thumbwheel (if needed). A ShowNet control system should be set up to match these IP address and NetSlot and NetSize requirements, and with a maximum NetSlot value of 51,200 (100 Universes each of 512 levels).

ED2 SETTING NO MERGE

This is the normal mode to use when the ED2 is used to receive two separate DMX universes from one or more control panels (or one or more DE2s). Packets on the network matching the A Universe/Group/Type are output to DMX A, and packets matching the B Universe/Group/Type are output separately to DMX B:

- ➢ **Set the Mode thumbwheel (thumbwheel 3) to 0 to receive Art-Net packets on both A and B channels**
- ➢ **Set the Mode thumbwheel to 1 to receive sACN packets on both A and B channels**
- ➢ **Set the Mode thumbwheel to 2 to receive ShowNet packets on both A and B channels**

The A and B LEDs show if matching A and B packets are being received.

ED2 SETTING HTP MERGE

HTP means Highest takes Precedence. This mode allows seamless transfer of control from a main control panels to a backup panel just by moving the grand masters of the control panels: the *Highest* level of each channel of packets A and packets B is output to *both DMX connectors A and B:*

- ➢ **Set the Mode thumbwheel (thumbwheel 3) to 3 to HTP merge Art-Net packets on both A and B channels**
- ➢ **Set the Mode thumbwheel to 4 to HTP merge sACN packets on both A and B channels**
- ➢ **Set the Mode thumbwheel to 5 to HTP merge ShowNet packets on both A and B channels**

Both the A and B LEDs will be on if both control panels are on- but if one control panel fails, its corresponding LED will flash, but both the DMX A and B will output the data received from the remaining on control panel.

ED2 SETTING LTP MERGE

LTP means Latest takes Precedence. This mode is useful if control needs to be switched from say the studio or rehearsal panel to the panel in the control room. When the new panel is switched on, it becomes the *Latest* control panel to send DMX packets, and the new levels are output to *both DMX connectors A and B:*

- ➢ **Set the Mode thumbwheel (thumbwheel 3) to 6 to LTP merge Art-Net packets on both A and B channels**
- ➢ **Set the Mode thumbwheel to 7 to LTP merge sACN packets on both A and B channels**
- ➢ **Set the Mode thumbwheel to 8 to LTP merge ShowNet packets on both A and B channels**

If the A LED is on, and the B LED flashing, then the panel sending packets A is the latest on (and vice versa).

ED2 MODE OPTIONS

The ED2 mode options include No merge, HTP mode (Highest Takes Precedence), and LTP mode (Latest Takes Precedence) and a choice of receiving Art-Net, Streaming ACN, or ShowNet packets.

The mode switch (thumbwheel 3) options are:

Mode	A Packet	B Packet	Merge	Merge Description
0	Art-Net	Art-Net	No merge	Packets A output to DMX A, Packets B output to DMX B
1	sACN	sACN	No merge	Packets A output to DMX A, Packets B output to DMX B
2	ShowNet	ShowNet	No merge	Packets A output to DMX A, Packets B output to DMX B
3	Art-Net	Art-Net	HTP	Packets A and B HTP merged, output to both DMX A and B
4	sACN	sACN	HTP	Packets A and B HTP merged, output to both DMX A and B
5	ShowNet	ShowNet	HTP	Packets A and B HTP merged, output to both DMX A and B
6	Art-Net	Art-Net	LTP	Latest On of either Packets A or B output to both DMX A and B
7	sACN	sACN	LTP	Latest On of either Packets A or B output to both DMX A and B
8	ShowNet	ShowNet	LTP	Latest On of either Packets A or B output to both DMX A and B

A detailed description of the Merge modes and their associated Packet Fail and LED behaviour follows:

ED2 NO MERGE MODE

The following details the ED2 No Merge mode behaviour:

Any packets matching the A selection (Universe/Group/Type), are output to the DMX A connector, and any packets matching the B selection of Universe and Group and Type (Art-Net, sACN or ShowNet), are output to the DMX B connector :

 If a packet matches the A Universe and Group A selection and is of the same type:

      the A LED will be on and the packet levels will be output on DMX connector A

If a packet matches the B Universe and Group B selection and is of the same type:

      the B LED will be on and the packet levels will be output on DMX connector B

if either Packets A or B were being received, then stop:

> after a 1 second delay that control panel is assumed to have to have been turned off - the A or B LED goes off, the DMX levels are kept for 1 minute, then faded to black over 2 minutes

ED2 HTP MODE

The following details the ED2 HTP merge mode behaviour:

Any packets matching either the A or B selections (Universe/Group/Type), are combined on a Highest takes Precedence basis and the same levels output to both DMX A and B connectors:

If both Packets A and B were on then:

> *if Packet A fails:* after 1 second Packet B levels only are output to both DMX A and B connectors
>
> *if Packet B fails:* after 1 second Packet A levels only are output to both DMX A and B connectors

if only Packets A or B were being received, then stop:

> after a 1 second delay that control panel is assumed to have to have been turned off - the A or B LED goes off, the DMX levels are kept for 1 minute, then faded to black over 2 minutes

ED2 LTP MODE

The following details ED2 LTP merge mode behaviour:

The latest transmission of packets matching either the A or B selections (Universe/Group/Type), are output to both DMX A and B connectors:

If the control panel sending Packets A was the latest control panel to be turned on: A is set active (A LED on), and packet A
> levels are output to both the DMX A and B connectors. B LED is set flashing to denote it is inactive

If the control panel sending Packets B was the latest control panel to be turned on: B is set active (B LED on), and packet B
> levels are output to both the DMX A and B connectors. A LED is set flashing to denote it is inactive

if both Packets A and B were being received and the active channel stops: after a 1 second delay that control panel is
assumed to have been turned off- the other control panel is made active and its levels output to both the both DMX A
and B connectors.

if only Packets A or B were being received, then stop: after a 1 second delay that control panel is assumed to have
been turned off - the A or B LED goes off, the DMX levels are kept for 1 minute, then faded to black over 2 minutes

▪ In LTP mode the latest on state whether A and B is kept in flash memory through a power failure.

ED2 LED BEHAVIOUR

Enet LED Behaviour: All merge modes: On if *any* data packets are on the network, Off if no packets present.

LED A/B Behaviour, No merge mode

LED A On: Matching Packets A are being received, Packet A levels output to DMX A

LED A Off: No matching Packets A are being received, DMX A levels black (after any DMX Fail fade)

LED B On: Matching Packets B are being received, Packet B levels output to DMX A

LED B Off: No matching Packets B are being received, DMX B levels black (after any DMX Fail fade)

LED A/B 1 sec flash: (Universe/Group A = B) Matching Packet A levels output to both DMX A and DMX B

LED A/B Behaviour, HTP merge mode:

LED A and B On: Matching Packets A and B are being received, HTP levels to both DMX A and B

LED A On, LED B flashing: Matching Packets A (only) are being received, Packet A levels to both DMX A and B. The flash
                          rate is 1 flash per second.

LED A flashing, LED B On: Matching Packets B (only) are being received, Packet B levels to both DMX A and B. The flash
                          rate is 1 flash per second.

LED A/B Behaviour, LTP merge mode:

LED A On, B flashing: The control panel sending Packets A is the latest panel on: Packet A levels are being to both DMX
                           A and DMX B. The flash rate is 1 flash per second.

LED A flashing, B On: The control panel sending Packets B is the latest panel on: Packet B levels are being to both DMX
                           A and DMX B. The flash rate is 1 flash per second.

LED A and B Off: No matching Packets A or B are

LED A/B alternate flash: LTP mode: Error - the A and B selections (Universe/Group) are the same.
                           sACN mode; Error - a Universe/Group setting is 0/0 (not valid for sACN)

RJ45 CONNECTIONS

The RJ45 plug at each end of a Cat 5 cable may be wired to either of the T568A or T568B standards - which differ in the colour used for the Tx and Rx pairs only. T568A has Tx Green, Rx Orange, T568B has Tx Orange, Rx Green (the Tx/Rx pinout below is the MD1 connection):
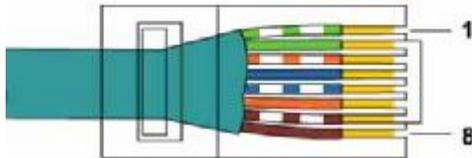
T568A standard

1	White/Green		Tx +
2	Green		Tx -
3	White/Orange		Rx
4	Blue		-
5	White/Blue		-
6	Orange		Rx-
7	White/Brown		-
-	–		

T568B standard

1	White/Orange		Tx +
2	Orange		Tx -
3	White/Green		Rx +
4	Blue		-
5	White/Blue		-
6	Green		Rx -
7	White/Brown		-
8	Brown		-
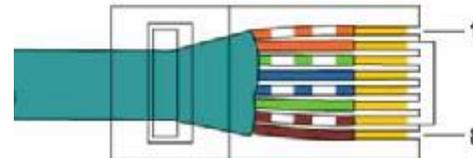
A "straight-through" cable may be made using either standard *so long as it has both ends wired to the same standard*.

A "crossover" cable for 10BASE-T is made by wiring one end to the T568A standard *and the other end to the T568B standard.*

- An easy way of making a crossover cable to connect a DE2 to an ED2 directly is to open the insulation of a common straight-through cable, cut the orange and green pairs (only), then resolder both pairs so the colours end up swapped.

SPECIFICATIONS

CONSTRUCTION Powder coated zinc plated steel. Legend silk-screened in solvent and abrasion resistant two pot epoxy ink.

ELECTRONICS 16 MIPS microprocessor with internal Flash memory.

ENVIRONMENTAL Ambient temperature 0 - 50° C, relative humidity 10 - 90%, non-condensing.

ETHERNET STANDARD 10BASE-T Ethernet. DE2 transmits Art-Net compatible DMX data packets, ED2 receives Art-Net DMX data packets and a subset of ShowNet DMX data packets.

DMX STANDARD USITT DMX-512-A, Start code 0. The DE2 expects to see the DMX Start Code = 0. The ED2 always transmits DMX with Start Code = 0 with DMX A and DMX B transmitted synchronously.

DMX TERMINATION Each ED2 DMX input is terminated with an internal 120 ohm resistor.

ISOLATION   Ethernet to all other Inputs/Outputs/Earth: 500vdc. Each DMX to all other Inputs/Outputs/Earth: 500vdc.

POWER ON TO PACKET SEND DELAY 1 second (DE2).

POWER ON TO PACKET RECEIVE DELAY 1 second (ED2).

PACKET REFRESH RATE 50 or 100 packets per second. DMX A and DMX B are transmitted synchronously (DE2).

RECEIVE LATENCY (delay from Ethernet packet data to DMX A/B output buffers): less than 2 msec (ED2).

DATA RETENTION In LTP mode the latest on state (A or B) is kept in flash memory through a power failure.

POWER SUPPLY 220-240 vac and 100-120vac models, single phase, power consumption less than 5 watts.

EXTERNAL CONNECTIONS

        Mains input: 3 core flexible cable.

        DMX Connector: Neutrik brand gold plated 5 Pin XLR.

        Ethernet Connector: Neutrik "Ethercon" heavy duty RJ45 connector

LISTINGS: CE, C-Tick.

Other firmware options and OEM versions - consult Theatrelight at <u>sales@theatrelight.co.nz</u>

The DE2 may be specified without DMX termination resistors at time of order.

MAINTENANCE

To keep the equipment working well take note of these points:

- Keep equipment in a clean air environment: dust is detrimental to electric connections and insulation.

- Use a damp cloth to keep the equipment clean. Do not use solvents.

- Take care that all connections are correctly made.

- Ensure all equipment is properly earthed to a low impedance earth system.

- Use DMX splitters/re-conditioners to ensure reliable DMX signals.

- Ensure the last unit in a DMX line is terminated with a 120 ohm resistor for reliable operation.

Theatrelight contact address:

THEATRELIGHT LTD

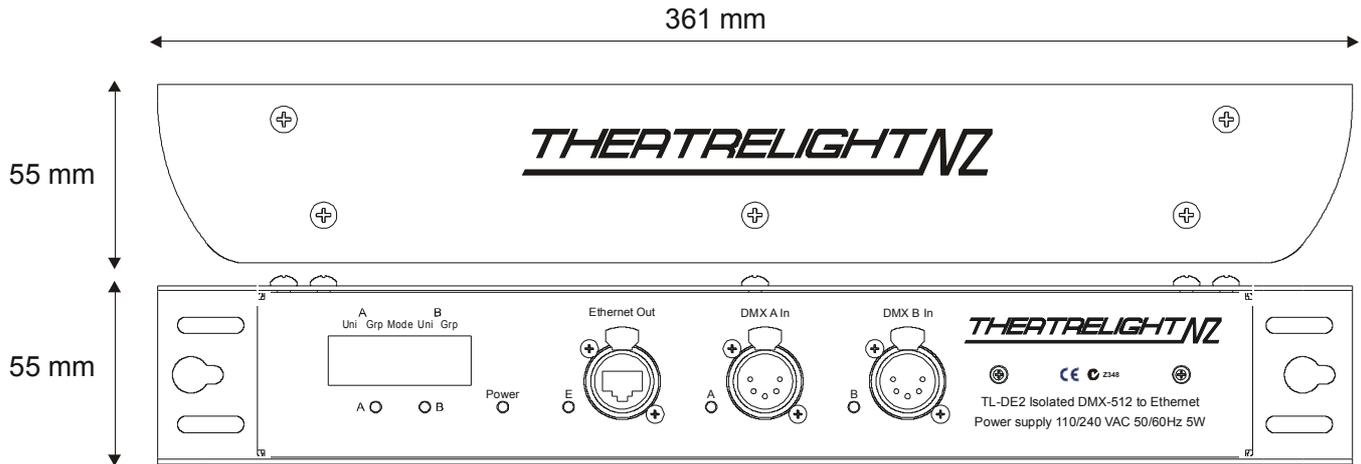PO BOX 13159 AUCKLAND, NEW ZEALAND

Phone 64-9-622-1187, 636-5805   Fax 64-9-636-5803

Web site: **www.theatrelight.co.nz**   E-mail: **sales@theatrelight.co.nz**

DE2/ED2 revision notes:

June 15A, 2011: Version J (firmware versions DE2: v1.2, ED2: v1.4)

.

DIMENSIONS

GLOSSARY

10BASE-T	10 Mbits/sec over twisted pair Ethernet standard
100BASE-T	100 Mbits/sec over twisted pair Ethernet standard
ADD MODE	Mode in which pressing a channel Flash key adds the channel to the other lighting
ANALOGUE	A smooth changing voltage (as opposed to digital)
ART-NET	A DMX over Ethernet protocol originated by Artistic License UK
BLACKOUT	All lights out on stage
BLIND	Not showing on stage
BO	Blackout; all lights out on stage
BPM	Beats per minute: applied to music rhythms
CHANNEL	One of the controlled output lines from a lighting desk; or a dimmer channel
CHASE	A repetitive pattern of lighting changes
CROSS-FADE	A smooth change from one lighting state to another
CUE	An action or time event which results in new lighting on stage; the lighting state following the cue
DBO	Dead Black-out: no light on stage
DIMMER	A power controller which changes the brilliance of lights connected to it
DIPLESS	Applied to a cross-fade where a dimmer up at the same level on both the new and the old lighting states does not change level during the cross-fade
DMX-512	A method of transmitting dimmer levels digitally over a two wire cable. (Digital MultipleX, 512 dimmers)
EMI	Electro-Magnetic Interference. Electrical noise
FADER	A slider control
FADE TIME	The time taken to complete a fade from full off to full on
FLASH KEY	Any key which flashes a channel or scene to Full. Also called Bump keys (USA)
GRAND MASTER	A master fader which controls the final output levels of a lighting desk

HTP	Highest Takes Precedence: the highest level is used as the controlling level
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LEVEL	The brightness of a dimmer as a number from 0 (off), to 10 (full on), or from 0% to 100%
LTP	Latest Takes Precedence: the latest command or level takes control
MASTER	A fader which has overall control of a number of levels or some other major function
MCB	Miniature Circuit Breaker- a re-settable current protection device
MD1	Medium Dependent Interface node uses Pin 1 and 2 to send, 3 and 6 to receive
MD1-X	Medium Dependent Interface node uses Pin 1 and 2 to receive transmit, 3 and 6 to send
MIMIC DISPLAY	A display often using Light Emitting Diodes (LEDs)
NON-DIM	A dimmer set to Non-dim acts like a switch: on or off
PRESET	A row of faders representing all the channels in a scene; to set up faders in advance of a cue
PREVIEW	To view a set of recorded levels without showing on stage
RJ-45	An 8 way connector (also called 8P8C) used to interconnect nodes on an Ethernet network
SCENE	A recording which stores a single set of all channel levels
SCR	Silicon Controlled Rectifier. A unidirectional power switch used in dimmers
SEQUENCE	A repetitive pattern of lighting changes
SHOW	A performance. In Theatrelight control panels, a Scenemaster which stores a sequence of cues
SHOWNET	A DMX over Ethernet protocol originated by Strand Electric
SOFTSTART	A minimum fade up time programmed into a dimmer to enhance lamp life
SOLO MODE	Another name for Kill mode
SNAP FADE	An instant change from one lighting state to another
STEP	To change from one scene or cue to another. Also, one scene of a Show or Chase
STREAMING ACN	(sACN) Another DMX over Ethernet protocol originated by ESTA (now joined with PLASA)
USITT	United States Institute of Theatre Technicians. Originators of the DMX-512 standard

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