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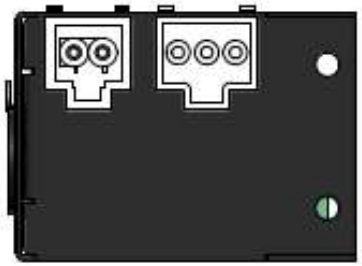
Sezione Connettori di alimentazione eBUS.

Power supply connectors and BUS.



OverledBUSpilot è un sistema di trasmissione DMX over power, si tratta di trasmissione del DMX sulla alimentazione a 12 o 24vdc, senza che sia necessario polarizzare i conduttori. Questo permette di semplificare il cablaggio e di rendere possibile la installazione in piscine o fontane data la alimentazione in bassa tensione di lampade. Il numero massimo di dispositivi slave collegabili è 32 per apparecchio,con massimo 8 byte di dati (in DMX 8 canali per lampada) per un carico totale massimo di 500Watt, questo modulo è interfacciabile con sistemi ART NET dove può essere utilizzato come nodo ad un universe DMX, oppure tramite DMX input, è anche utilizzabile come DMX recorder dotato di SD per memorizzare degli Show, la comunicazione sul bus è di tipo time slot dove OverledBUSpilot è il master con controllo di errore, quindi se l'informazione non arriva correttamente agli slave (driver or node) questa viene rinviata nuovamente al successivo slot temporale (entro 20-35msec).
OverledBUSpilot oltre a inviare uno show registrato sul BUS proprietario (OvelredBUS) invia anche sulla uscita DMX dati di altri canali non eventualmente utilizzati su OverledBUS, questo permette di sincronizzare altre apparecchiature non OverledBUS ma solo compatibili con DMX. Le lampade collegate al sistema OvrledBUS devono avere apposita elettronica di controllo e alimentazione, questi sono da installare nel corpo lampada e sono in grado di alimentare i led,questi moduli si chiamano OverledBUSdriver, sono di forma circolare a più livelli per le varie funzionalità, ogni livello a funzioni specifiche, ricezione DMX da OverledBUS, conversione in DMX, modulo Driver per led,se non integrato con i led.

OverledBUSpilot:

- RDM/DMX/ArtNet to OverLed Bus Network
- ArtNet to DMX
- DMX to ArtNet
- ArtNet Recorder
- DMX Recorder
- ArtNet + DMX Player

OverledBUSpilot it's a data over power system,the DMX signal or ART NET signal it is converted and transmitted over power. The power supply of this system can be 12VDC or 24VDC, the data trasmission over power is made on twisted wire cat 5, with correct section depending on the total power required from the fixture connected.The maximum number of the fixture are 32, the maximum DMX channel per fixture are 8, the maximum power possible is 500W, and 100mt cable.OverledBUSpilot it is also a DMX recorder and ART NET node for one Universe (512 DMX channel). OverledBUSpilot it is the MASTER of the entire system, where the data are transimitted in time slot, error free, if a data packet isn't received correctelely from the slave module (driver or node), this will be sent again in 20-35mSec. OverledBUSpilot, it is a poprietary Overled bus and send also DMX out on the connectorin the front panel, the available channels are from 256-up to 512. The OverledBUS system require Master (OverledBUSpilot) and Slave OverledBUSdriver or node, those board can drive LED or STRIP led with power top. The OverledBUSdriver can be integrated with the lamp, the OverledBUSnode it is native in a box, for external applications, with screw driver connectors for the Harness.

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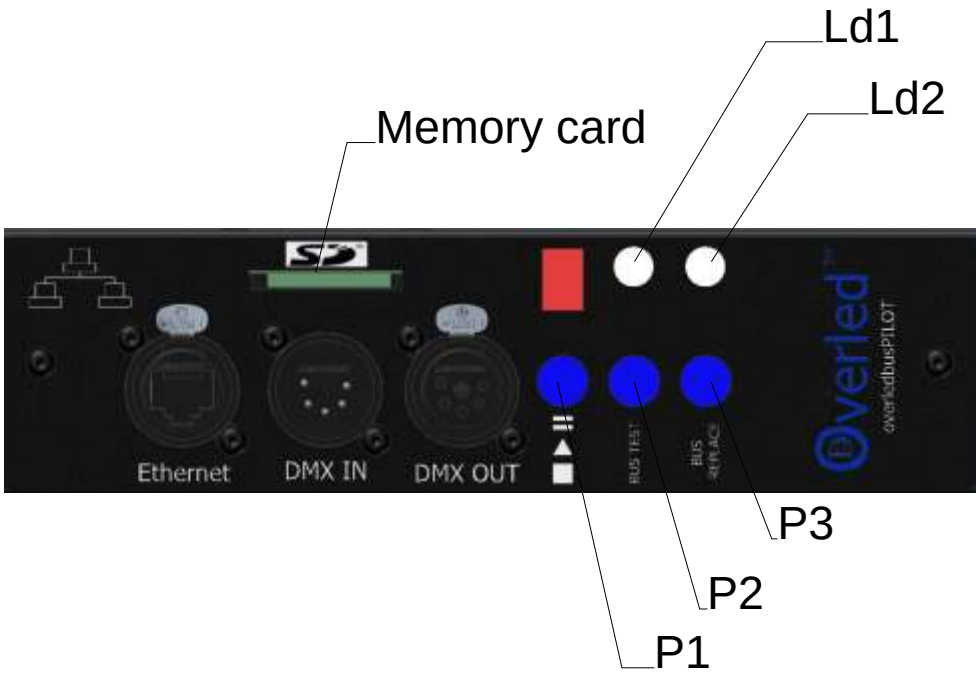

Connettori : Da sinistra a destra: Ethernet, DMX-IN, DMX-OUT
Connectors: From left to the right: Ethernet, DMX-IN, DMX-OUT
LD1 = DMX IN / DMX OUT / Play / Record
LD2 = Monitor DMX, OverLed Bus

P1 = Play / Record / Stop
P2 = OverLed Bus test / Select
P3 = OverLed Bus Replace

Ld1 status:
Blue = DMX IN mode. if blink = valid signal input
Blue = DMX OUT mode. if blink = Artnet --> DMX OUT valid.
Green = sd-card show in play.
Red blink = Recording on sd-card.
Red no blink = error.

Ld2 status:
Se DMX o ArtNet in entrata visualizza i colori dei primi 3 canali DMX.
If DMX or ArtNet input display the first 3channels colours.

In assenza di dispositivi OverLed Bus fa due brevi lampeggi bianchi ogni 10 secondi.
If no OverledBUS Slave devices (driver or node) connected short blink every 10 seconds.

Altri colori = usati per modalita' di sostituzione OverLed Bus slave00 (pulsanti P2, P3).

Other colours used for overledBUS slave module replacement.

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Funzioni OverLed Bus:

OverledBUSpilot (master) e puo' gestire fino a 32 “Slave”.
La filosofia OverLed Bus e' basata su uno schema master/slave (un master, tanti slave). Uno slave viene denominato “OverledBUS driver o node e puo' essere un faretto o qualsiasi altro dispositivo dotato di un certo numero di canali, equivalenti in funzionalita' al concetto dei canali DMX.
Ogni slave ha un codice univoco impostato in fabbrica non modificabile che serve ad identificarlo sul BUS.
Quando uno slave viene connesso in rete, questo codice viene confrontato con un database interno a OverledBUSpilot, se e' uno slave conosciuto (precedentemente memorizzato) l'indirizzo DMX a lui associato viene letto dal database e l'unita' inizia subito a funzionare come programmato. In caso contrario, verra' assegnato un indirizzo DMX = 1 per default. Inviando dati DMX o ArtNet sui canali corrispondenti, gli slave reagiranno di conseguenza.
Il DMX Patch dei OverledBUS driver o node e' come segue:

CH1 = Shutter (255 = sempre aperto)
CH2 = Dimmer
CH3 = R
CH4 = G
CH5 = B
CH6 = Color Temperature control
CH7 = Macro
Ch8 = Color Mode

OverLed Bus:

OverLed Bus Pilot (master) can manage up to 32 slave on the bus.
OverLedBUS architecture is master/slave based,the overledBUS slave can be Driver for internal fixture application or node for external fixture application those electronics have inside constant current driver for led power supply or PWM voltage output for powertop strip led.
Each slave have factory ID that can’t be changed, this default data it is used for network identification.
In the overledBUS architecture, as soon a slave is connected, it’s ID is checked with internal (OverledBUSpilot) database list if this not recognized, not memorized before,a new DMX addres on the BUS it is assigned =1 as default, if this units is recognized (found it’s ID in database) start to run on the BUS.

Salve module DMX Patching:

CH1 = Shutter (255 =open)
CH2 = Dimmer
CH3 = R
CH4 = G
CH5 = B
CH6 = Color Temperature control
CH7 = Macro
CH8 = Color Mode

Overled OverledBUSpilot

Memorizzazione di un nuovo Slave:

La memorizzazione di un nuovo slave (node o driver) consiste nell'attribuzione di un OverLed Bus driver ID (fra 1e 32, che e' il numero massimo di dispositivi collegabili ad una rete) e dell'indirizzo DMX di base.Lo slave id viene assegnato arbitrariamente da OverledBUSpilot ogni volta che uno slave sconosciuto si presenta in rete. Il pilot evita di assegnare ID gia' in uso da parte di eventuali slave gia' presenti, anche se momentaneamente non connessi nel BUS.

Una volta memorizzato, lo slave otterra' sempre lo stesso ID ad ogni successiva accensione e a questa potra' essere associata una serie di impostazioni, fra cui l'indirizzo DMX di base.

La memorizzazione puo' essere effettuata in due modi:

Pulsante presente sullo slave: inviare un segnale DMX al OverledBUSpilot con un solo canale a 255, che sara' il numero del canale DMX assegnato. Tenere premuto il pulsante sullo slave fino a notare una breve interruzione nel lampeggio del led rosso (a bordo del point). Il point viene memorizzato nell'OverledBUSpilot con l'indirizzo desiderato. Ogni volta che lo slave verra' rilevato in rete, gli sara' assegnato quell'indirizzo.

Comandi RDM: E' necessario disporre del software ed interfaccia RDM ECCO. Dopo aver effettuato un DISCOVERY (OverledBUSpilot deve comparire nell'elenco dei dispositivi RDM con il codice OL 01000000) procedere ad identificare lo slave desiderato impostando via via numeri diversi nella casella "SUB DEVICE" (fra 1 e 32) e premendo il tasto IDENTIFY. La casella SUB DEVICE altro non e' che il OverLed Bus ID (fra 1 e 32) univoco con il quale e' possibile interagire con ciascuno slave.

Se lo slave non e' mai stato memorizzato (quindi il suo ID e' temporaneo e potrebbe cambiare alla prossima accensione), esso lampeggerà in BIANCO per qualche istante.

Se invece si tratta di uno slave gia' noto, si accederà in BIANCO FISSO per qualche istante. E' possibile allora scrivere l'indirizzo DMX desiderato nella casella DMX ADDRESS.

New slave module setting:

Setting a new slave module on OverledBUS is performed assigning ID of overledBUS from 1 to 32 (32 it is a maximum ID available on the OverledBUS) with DMX address position.

The Slave module ID it's arbitrary assigned mode from the OverledBUSpilot if this is not registred, avoiding to use same ID already in use for other salve, if they in use or in memory only.

Once the slave module is already in the memory of the OverledBUSpilot it will use same ID every time and this can be linked to DMX address thru RDM system.

ID setting for the slave can be made in two ways, using a pushbutton on the salve module or using RDM system, by the pushbutton it is necessary send DMX data signal value at 255 in the channel you want to be associated to the address, for example, sending 255 on the channel 9 and pressing the push button on the slave channel 9 it is assumed on this slave as first DMX address, the slave on board led blink shortelely to indicate ID assigned on the slave, at every power on this ID will be linked to the DMX address assigned.

RDM ID assignement:

Ecco RDM software and hardware it is necessary, use ECCO software to perform Discovery (refer to it's user manual), after this a list of device found will appear on the left of screen,the overledBUSpilot appear with the code OL 01000000 (OL is Overled device), then proceede to identify the SUBdevice, the slave on overledBUS are seen as sub device on RDM, now set the ID from 1-32 and assign the DMX value on the DMX address windows.

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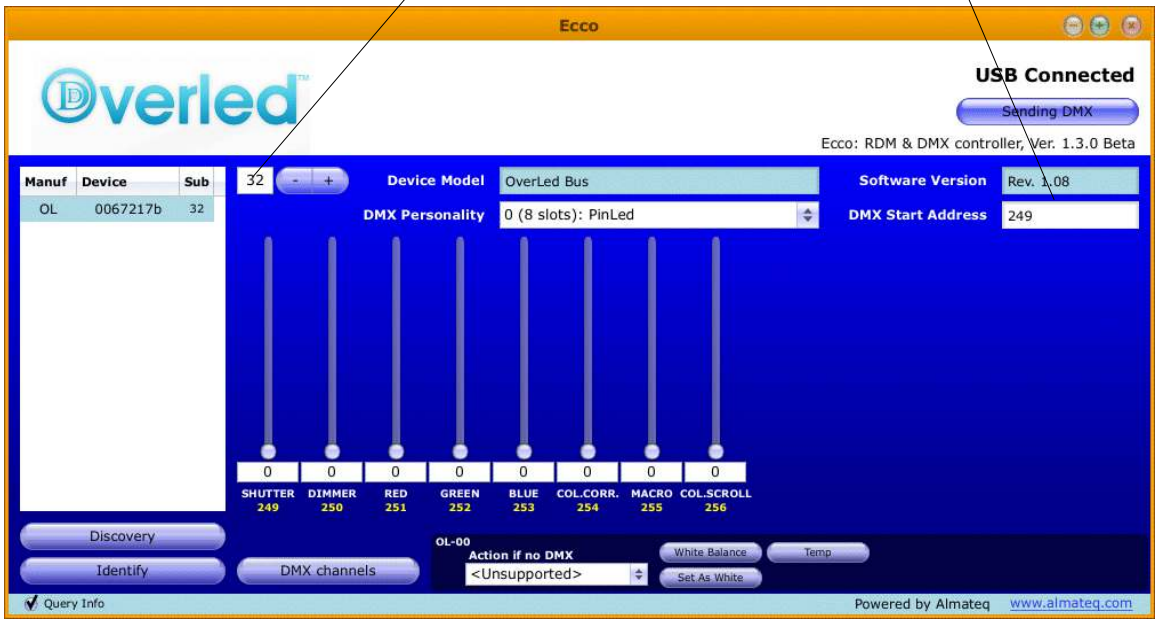
RDM Setting Screen shot

Slave Discovery

Slave identification on bus

Sub Net device

DMX address



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Sostituzione di uno slave:

La sostituzione di uno slave ha lo scopo di assegnare il suo ID (fra 1 e 32) ad un nuovo slave, facendo ereditare a quest'ultimo tutte le impostazioni compreso l'indirizzo DMX di base.

Tutte le operazioni si effettuano mediante i tasti P2, P3 ed il led LD2.

Prima di procedere, collegare UN nuovo slave in sostituzione. NOTA: non collegare piu' di un nuovo slave per volta.

Su OverledBUSpilot Premere il tasto P2: se il led LD2 lampeggia verde, tutti gli slave registrati sono in salute. Se lampeggia rosso, uno o piu' di loro non si sono presentati all'OverledBUSpilot. In questo caso (durata lampeggio = 5 sec) premere di nuovo P2: se non ci sono nuovi slave (sostitutivi) la procedura termina immeditatamente.

Altrimenti il primo slave trovato (scansione slot a partire dal primo) viene usato come target; e' bene installare un solo nuovo slave per volta in modo da sapere a priori quale sarà il target. Il led LD2 lampeggia fra blu e magenta (come prima ma con blu fisso). Il timeout e' ora 15 secondi. Ad ogni pressione di P2 verra' associato al nuovo slave l'indirizzo DMX di uno degli slave trovati non funzinanti sul bus (se e' uno solo, la pressione non avra' alcun effetto).

Quando (e se) l'indirizzo DMX corrisponde (il nuovo slave si comporta come quello che deve sostituire) premere P3: il vecchio slave verra' eliminato dal database e sovra scritto in EEprom con l'UID di quello sostitutivo. Anche il numero di RDM_SUBDEVICE viene ereditato.

Procedere eventualmente a collegare un nuovo point per sostituirne un altro.

Slave Replacement:

Slave replacement target is to assign new ID from1 to 32, assuming to this slave connected all features that replaced has.

The replacement procedures are made using P2,P3 and led Ld2. Before to start with this procedure, replace the salve desired with a new one. Note: do not replace more then one slave at the same time.

Pressing pushbutton P2 if Ld2 green blink all slave are registred and they are healty, if Ld2 red blink mean, one or more slave it is not in the bus.

If this happen, Ld2 blink for 5 seconds, then press P2 again on the OverledBUSpilot, if no new slave connected the procedure end immediatelely.

If first new slave found this it will be used as target; this is the reason why the best is to install one slave at the time, to know excatelely wich one is the replaced on the BUS.

Ld2 blink between magenta and blue, at every P2 pression a new device is associated at new DMX address, if non working salve found nothing will happen.

When new salve it is associated with DMX, it will work as the previous replaced, pressing P3 the old slave it will be deleted from OverledBUSpilot database, also sub device RDM will assume this as new one.Repeat for every device replaced this procedure.

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Funzioni ArtNet:
La gestione delle funzioni ArtNet avviene per mezzo del programma JartNet403, che deve essere lanciato su un computer dotato di Java Runtime.
Il computer ed il dispositivo devono essereinterconnessi in rete Ethernet. Nel caso piu' semplice,collegarli direttamente mediante un cavo cross. Alimentare il dispositivo.
Premere il tasto “Board Manager” presente nella finestra principale del programma: si aprira' una seconda finestra che serve per la gestione del nodo.
Nella nuova finestra (Board Manager) premere il tasto “Discover Nodes”: se correttamente connesso, il nodo comparira' nella sezione a sinistra della finestra stessa.
Dopo averlo selezionato (cliccando col tasto sinistro sulla riga che lo identifica) sara' possibile utilizzare tutte le funzioni operative e di impostazione descritte di seguito.
Se l'indirizzo IP di default (che viene indicato sulla riga con tutti i dati) non cade all'interno della sottorete locale (ad esempio 10.0.0.x) occorre modificarlo mediante l'apposito pulsante.

ArtNet to DMX:
Premere il tasto “Enable DMX Out”: il led LD1 diventera' BLU ed iniziera' a lampeggiare in presenza di pacchetti ArtNet diretti all'IP specificato nelle impostazioni. Tali pacchetti saranno disponibili in formato DMX sulconnettore XLR. (Nota: per inviare pacchetti ArtNet tornare alla finestra principale, impostare l'indirizzo IP del nodo nella casella in alto a sinistra e premere il grande bottone a destra).
NOTA: per utilizzare segnali DMX esterni sara' prima necessario disabilitare la modalita' DMX Out, condizione indicata dal colore azzurro di Ld1.

ArtNet Recording:
Dopo aver abilitato il DMX Out (vedi sopra) avviare la registrazione dello show ArtNet premendo il tasto “Rec” (quello con il tondo rosso). E' possibile scegliere il numero dello show mediante l'apposita casella, consentendo la registrazione di piu' show sulla stessa sd-card.
Alternativa:
tenere premuto P1 per piu' di due secondi.
Per terminare la registrazione premere il tasto “Stop” (tasto con quadrato azzurro).

ArtNet node mode:

Art net ,use the java run time software JartNet403 Overled software, before to install check if your computer have Java Runtime.OverledBUSpilot must be connected thru ethernet HUB to PC or by cross ethernet cable.
To find the overledBUSpilot Art net node mode, use Board Manager from JartNet403, select the Ip of Art net node, you want to use, set the ip in the software, and start the operation with DMX consolle, recording show or making effect. Art Net node mode is compatible with all kind of device compliant with this standard,please refer to ArtNet device to understand how to connect OverledBUSpilot.

ArtNet to DMX: Press “Enable DMX Out”: LD1 switch on Blue and start to blink if ArtNet packed are for the IP specified in setting of overledBUSpilot. The Art net data stream it is available in DMX format on the XLR DMX connector for the entire 512 DMX universe. For Ip setting use JartNet403 and follow the instruction for IP settings in ArtNet Node, don’t forget to open DMX out in this software.

ArtNet Recording:
Once sete DMX Out start Recording pressing on JartNet403 software “Rec”,.It is possible to select show number up to 99, with same software JartNet403, all programmed shows are stored in same SD card.
Start Recording by P1 pushButton, for more then 2 seconds, to stop recording Press P1 again.

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ArtNet / DMX PlayBack:
Per effettuare il PlayBack dello show premere “Play” (il tasto con il triangolo azzurro). Lo show verra' riprodotto simultaneamente su ArtNet e su DMX. Il Play e' prioritario su eventuali pacchetti ArtNet in arrivo, che verranno ignorati.
Se lo show selezionato non dovesse essere presente sulla sd-card, il led si illuminera' in ROSSO per circa 3 secondi dopodiche' il dispositivo tornera' nelle condizioni precedenti.
Alternativa: e' possibile attivare il PLAY premendo brevemente il tasto P1. In questo caso, il numero dello show in riproduzione sara' l'ultimo utilizzato nel Board Manager.
Per tornare in modalita' DMX IN (ovvero disabilitare 'ArtNet to DMX) premere il pulsante “Disable DMX Out” oppure premere brevemente P1.

DMX Record:
Accertarsi che il nodo non sia in modalita' DMX Out (vedi paragrafo precedente), ossia che il led sia di colore azzurro. Fornire un segnale dmx al connettore DMX IN: se riconosciuto, il led lampeggia.
Tenere premuto il pulsante P1 per piu' di 2 secondi: il led iniziera' a lampeggiare in ROSSO, per indicare che la registrazione e' in corso. In caso di errore (ad esempio sd-card non inserita) il led diventera' rosso fisso per circa 3 secondi, dopodiche' il dispositivo tornera' a riposo (led di colore azzurro, lampeggiante se il segnale DMX e' presente).
Per terminare la registrazione premere brevemente il pulsante.

ArtNet / DMX PlayBack:
To playBack press Play (p1) or use play on the JartNet403, show will run on ArtNet and DMX out connector, also on OverledBUS, during play operation no ArtNet node packed are consider.
If no show recorded on SD memory Red Led stay on for 3 second, and OverledBUSpilot return in IDLE state.Starting play from P1 the last selected show on SD will run, this operation of setting number of show it must be done by JartNet403as explained before in Board Manager settings.
To go back in ArtNet to DMX out press P1 again to switch on this modality.

DMX Record:
Check the OverledBUSpilot is on the DMX out mode, Ld2 blue send DMX data on the DMX IN connector if ok LED blink, press P1 more then 2 second the led switcho on red blinking to indicate Recording in progress.If error happen RED led stop blink and stay on for 3 second, returning OverledBUSpilot in Idle state, or in ArtNEt to DMX mode blue led blink.In case the recording is correct to stop this mode press P1 shortelely.

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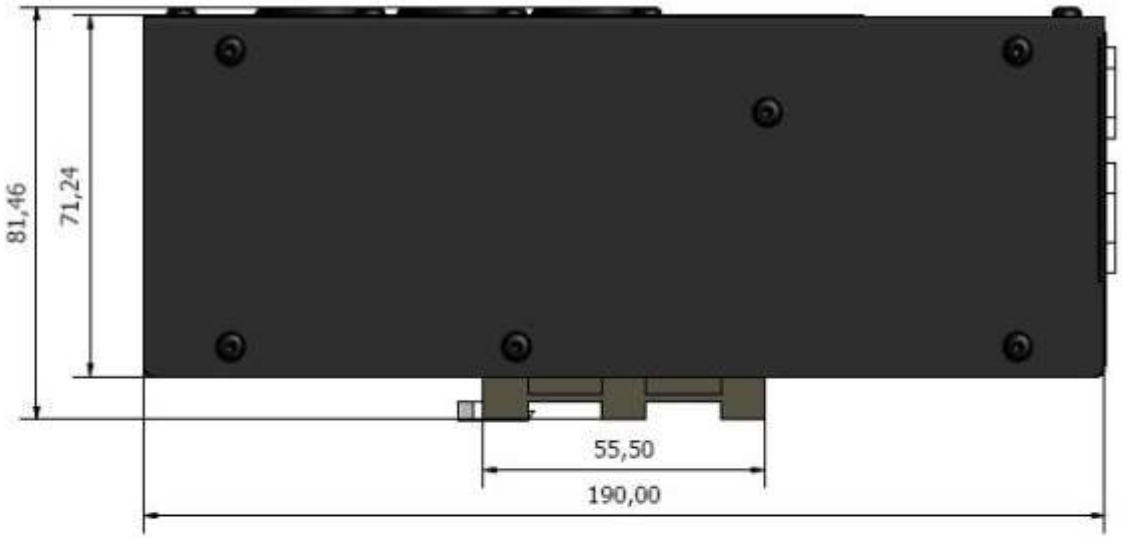

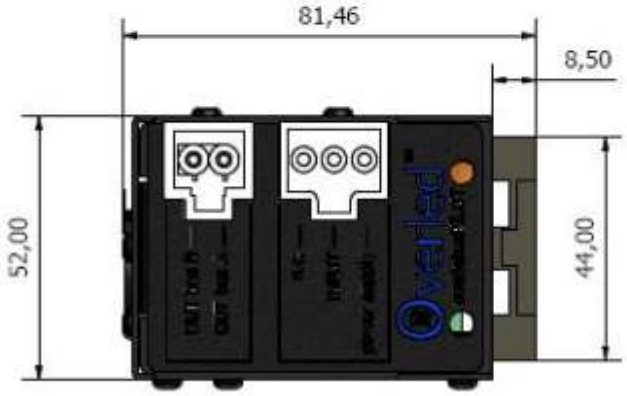

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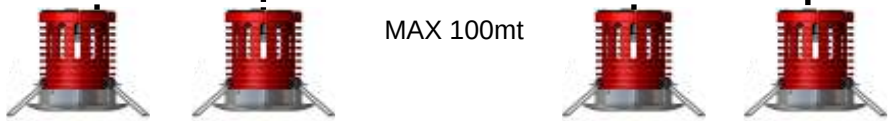
Cablaggio:

Twisted cat5 Pair not polarized with correct size on load

cavo 2 poli non polarizzato twistato cat 5 con sezione appropriata



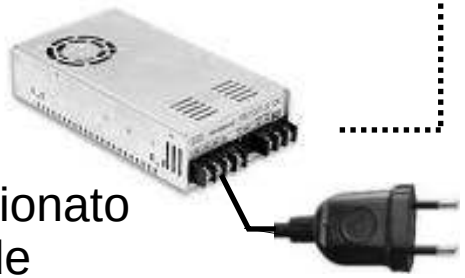
MAX 100mt

Lampada led con OverledBUSdriver installato all'interno

Led fixture with embedded OvrledBUSdriver embedded

modulo #1 .... #32

module #1 .... #32



Alimentatore
12 o 24Vdc dimensionato
per il carico lampade

110/220VAC

External switching power supply 12/24VDC out with correct power for the load.

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Cable shielding Ethernet:

Main article: Electromagnetic shielding
STP cable format

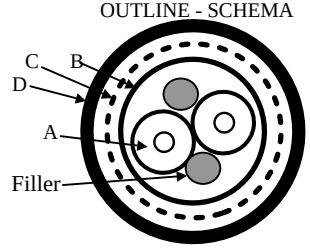
Twisted pair cables are often shielded in attempt to prevent electromagnetic interference. Because the shielding is made of metal, it may also serve as a ground. However, usually a shielded or a screened twisted pair cable has a special grounding wire added called a drain wire. This shielding can be applied to individual pairs, or to the collection of pairs. When shielding is applied to the collection of pairs, this is referred to as screening. The shielding must be grounded for the shielding to work.Shielded twisted pair (STP or STP-A) STP cabling includes metal shielding over each individual pair of copper wires. This type of shielding protects cable from external EMI (electromagnetic interferences). e.g. the 150 ohm shielded twisted pair cables defined by the IBM Cabling System specifications and used with token ring networks.Screened unshielded twisted pair (S/UTP) Also known as Foiled Twisted Pair (FTP), is a screened UTP cable (ScTP).
Screened shielded twisted pair (S/STP or S/FTP) S/STP cabling, also known as Screened Fully shielded Twisted Pair (S/FTP), is both individually shielded (like STP cabling) and also has an outer metal shielding covering the entire group of shielded copper pairs (like S/UTP).This type of cabling offers the best protection from interference from external sources, and also eliminates alien crosstalk.
Note that different vendors and authors use different terminology (i.e. STP has been used to denote both STP-A, S/STP, and S/UTP) .

DMX cable specification

DESCRIPTION: Round Cable Sec. 2x0.25 mm² d.5.50 mm
DESCRIZIONE: Cavo tondo sez. 2x0.25 mm² d.5.50 mm

FLAMAR COD: -
CUSTOMER CODE: -

OUTLINE - SCHEMA



A

Conductor Conduttore

Material	Materiale	Bare Copper	
Conductor nr.	N.dei conduttori	2	
Stranding	Trefolatura	14x0.15	mm
Section nom	Sezione nominale	0.25	mm²
Electric resistance	Resistenza elettrica	<77.5 (IEC 344)	? /km
Insulation material	Materiale di isolam.	PE	
Color ins.	Colore isolamento	Red-Blue	
Hardness ins.	Durezza isolamento	55	Shore D
Diameter	Diametro	1.75+/-0.10	

1th Shielding 1° Schermo B

Material	Materiale	Tape Al-Pet (Al outside)	

2nd Shielding 2° Schermo C

Material	Materiale	Tin Copper	
Avg. coverage	Copertura media	95	%
Electric resistance	Resistenza elettrica	<35	? /km

Protectiv Cover Guaina D

Material	Materiale	PVC	
Color	Colore	Black	
Hardness	Durezza	76	Shore A
Diameter	Diametro	5.50+/-0.20	mm

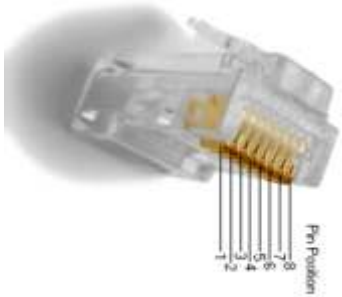
Marcatura a ink-jet da definire

Temperature Rating:	-20°C to +70°C
Voltage Rating:	30V (Only Electronic use, not for Power)
Dielectric Strength	2000Vx1’
Capacità nominale c/c	64 pF/m
Impedenza nominale	120 Ohm

Cable conforming to: Standard 2002/95/CE (RoHS)
Packaging Confezionamento Bobina d.230

Overled OverledBUSpilot

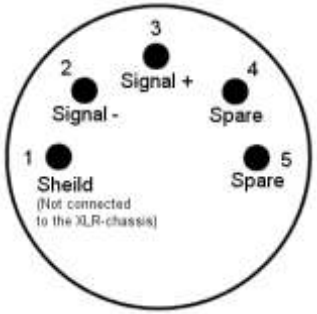
Ethernet connectors



TIA/EIA-568-B T568A Wiring Pin	Pair	Wire	Color
1	3	tip	Pair 3 Wire 1 white/green
2	3	ring	Pair 3 Wire 2 green

Pin	Pair	Wire	Color
1	2	tip	Pair 2 Wire 1 white/orange
2	2	ring	Pair 2 Wire 2 orange
3	3	tip	Pair 3 Wire

DMX connector



Pin 1 = signal reference = cable shield
Pin 2 = signal inversion = ' - ' or B, blue
Pin 3 = signal = ' + ' or A, red
Pin 4 = not used
Pin 5 = not used

Overled OverledBUSpilot

Overled is a brand of DDS Elettronica S.r.l. - Via Nicolò Biondo 171 - 41100 Modena Italy - www.overled.com
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DMX512

Developed by the Engineering Commission of United States Institute for Theatre Technology (USITT), the standard was created in 1986, with subsequent revisions in 1990 leading to USITT DMX512/1990.DMX512-A In 1998 the Entertainment Services and Technology Association (ESTA) began a revision process to develop the standard as an ANSI standard. The resulting revised standard, known officially as "Entertainment Technology — USITT DMX512-A — Asynchronous Serial Digital Data Transmission Standard for Controlling Lighting Equipment and Accessories", was approved by the American National Standards Institute (ANSI) in November 2004. This current standard is also known as "E1.11, USITT DMX512-A", or just "DMX512-A", and is maintained by ESTA.

Network topology

A DMX512 network employs a multi-drop bus topology with nodes strung together in what is commonly called a daisy chain. A network consists of a single DMX512 controller — which is the sole master of the network — and one or more slave devices. For example, a lighting console is frequently employed as the controller for a network of slave devices such as dimmers, fog machines and intelligent moving lights.
Each slave device has a DMX512 "IN" connector and, in many case, a DMX512 "OUT" connector (sometimes marked "THRU") as well. The controller, which has only an OUT connector, is connected via a DMX512 cable to the IN connector of the first slave. A second cable then links the OUT or THRU connector of the first slave to the IN connector of the next slave in the chain, and so on. The final, empty, OUT or THRU connector of the last slave on the daisy chain should have a terminator plugged into it. A terminator is a stand-alone male connector with a built-in resistor. The resistor — typically 120 O to match the cable characteristic impedance, is connected across the primary data signal pair. If a secondary data pair is used, then another termination resistor is connected across it as well. Although simple systems, i.e., systems having few devices and short cable runs, may work reliably without a terminator, it is considered good practice always to use a terminator at the end of the daisy chain. Some DMX devices have built-in terminators that can be manually activated with a mechanical switch or by software, or by automatically sensing the absence of a connected cable.
Each DMX network is called a "DMX universe". Large control desks (operator consoles) may have the capacity to control multiple universes, with an OUT connector provided for each universe.

Electrical

DMX512 data are sent using EIA-485 voltage levels. However, quoting from E1.11, "The electrical specifications of this Standard are those of EIA-485-A, except where specifically stated in this document. Where a conflict between EIA-485-A and this document exists, this document is controlling as far as this Standard is concerned."

DMX512 is a bus network no more than 1200 meters long, with not more than 32 devices on a single bus. If more than 32 devices need to communicate, the network can be expanded across parallel buses using DMX splitters. Network wiring consists of a shielded twisted pair, with a characteristic impedance of 120 Ohms, with a termination resistor at the end of the cable furthest from the controller to absorb signal reflections.

Connectors

DMX512 1990 specifies that where connectors are used, the data link shall use five-pin XLR style electrical connectors (XLR-5), with female connectors used on transmitting (OUT) ports and male connectors on receiving ports. DMX512-A (E1.11) requires the use of an XLR-5 connector, unless there is insufficient physical space on the device, in which case an XLR-5 adapter shall be supplied. DMX512-A (E1.11-2008) allows the use of eight-pin modular (RJ-45) connectors for fixed installations where regular plugging and unplugging of equipment is not required.Some DMX512 equipment manufacturers employ non-compliant connectors and pinouts; the most common of these is the three-pin XLR connector, since the electrical specification currently only defines a purpose for a single wire pair. There is risk of equipment damage if a novice unfamiliar with lighting technology accidentally plugs XLR 3-pin DMX into an audio device, since the DMX signal voltages are much higher than what audio equipment normally uses.Also, devices are sometimes fitted with four-pin connectors when both communications and power are sent through a common cable.

XLR-5 pinout

1. Signal Common
2. Data 1- (Primary Data Link)
3. Data 1+ (Primary Data Link)
4. Data 2- (Optional Secondary Data Link)
5. Data 2+ (Optional Secondary Data Link)

RJ-45 pinout

1. Data 1+
2. Data 1-
3. Data 2+
4. Not Assigned
5. Not Assigned
6. Data 2-
7. Signal Common (0 V) for Data 1
8. Signal Common (0 V) for Data 2

The RJ-45 connector pinout matches the conductor pairing scheme used by Category 5 (Cat5) twisted pair patch cables. The avoidance of pins 4 and 5 helps to prevent equipment damage, if the cabling is accidentally plugged into a single-line public switched telephone network phone jack.
Cabling for DMX512 was removed from the standard and a separate cabling standards project was started in 2004. Two cabling standards have been developed, one for portable DMX512 cables (ANSI E1.27-1 - 2006) and one for permanent installations (draft standard BSR E1.27-2). This resolved issues arising from the differences in requirements for cables used in touring shows versus those used for permanent infrastructure.
The electrical characteristics of DMX512 cable are specified in terms of impedance and capacitance, although there are often mechanical and other considerations that must be considered as well. Cable types that are appropriate for DMX512 usage will have a nominal characteristic impedance of 120 ohms. Cat5 cable, commonly used for networking and telecommunications, has been tested by ESTA for use with DMX512A. Also, cables designed for EIA485 typically meet the DMX512 electrical specifications. Conversely, microphone and line level audio cables lack the requisite electrical characteristics and thus are not suitable for DMX512 cabling. The significantly lower impedance and higher capacitance of these cables distort the DMX512 digital waveforms, which in turn can cause irregular operation or intermittent errors that are difficult to identify and correct.

RDM Physical layer

The RDM protocol and the RDM physical layer were designed to be compatible with legacy equipment. All compliant legacy DMX512 receivers should be usable in mixed systems with an RDM controller (console) and RDM responders (receivers). DMX receivers and RDM responders can be used with a legacy DMX console to form a DMX512 only system. From a user's point of view the system layout is very similar to a DMX system. The controller is placed at one end of the main cable segment. The cable is run receiver to receiver in a daisy-chain fashion. RDM enabled splitters are used the same way DMX splitters would be. The far end (the non console or splitter end) of a cable segment should be terminated.RDM requires two significant topology changes compared to DMX. However, these changes are generally internal to equipment and therefore not seen by the user.First, a controller's (console's) output is terminated. Second, this termination must provide a bias to keep the line in the 'marking state' when no driver is enabled.The reason for the additional termination is that a network segment will be driven at many points along its length. Hence, either end of the segment, if unterminated, will cause reflections.A DMX console's output drivers are always enabled. The RDM protocol is designed so that except during discovery, there should never be data collisions. To assure this lack of collisions, while making possible implementation on different platforms, there are times when all line drivers are required to be disabled. If nothing more than the termination was done, the line would float to some unknown level. In that case one or more random changes might be read on the line. These random changes greatly decrease system accuracy. So the biasing of the line is requiredTo assure this, section 2.4.1 (Line Bias Networks) of the standard says; "The command port shall provide a means to bias the termination of the data link to a value of at least 245 mV and verified by using the test circuit described in Appendix F."The standard further states that, the biasing mean "shall be polarized such that Data+ of the data link is positive with respect to Data- the data link. The Line Biasing network shall maintain this bias when the data link is loaded with the equivalent of 32 unit loads and common mode voltage is varied over the range of +7 volts to -7 voltThe standard does not require any particular circuit for providing the basis and termination; however, the simplest method is often a passive pull apart network.Whatever method is used must be tested with the chosen driver chip to see that the design combination still meets the requirement of E1.20. Tests are given in Appendix F of the standard. These tests are for design verification and are not required as production testing. Experience has shown many EIA485 drivers designed for 5 volt operation will pass the required tests. It is not so clear that all 3.3 volt parts will pass. In either case this performance must be verified. Details of the pull apart network and the tests can be found in ANSI E1.20 - 2006.

Protocol

RDM packets are inserted in-between the existing DMX data packets being used to control the lighting data. The DMX 512 specification always requires that DMX packets begin with the start code. The default Start Code is 0x00(also known as the Null Start Code). By using the start code 0xCC, RDM packets can be safely inserted between DMX data packets without older non-RDM aware devices attempting to read them.The DMX 512 specification required DMX connectors to be a 5-pin XLR type, with only the first 3 pins being used (pins 4 and 5 were reserved for "future use"). Unfortunately, various manufacturers started using the final two pins for various, proprietary purposes, such as low-voltage power or proprietary talk-back protocols. As a result, the decision was made to have all RDM communication on pins 2 and 3. This raises data collision concerns.The RDM standard addresses this problem by ensuring that in all cases (except discovery) only one device is authorized to be transmitting at any given time (somewhat similar to the token passing approach). Only the controller (of which there can be only one) can start an RDM exchange. Responders can speak only if spoken to. The controller will always initiate all RDM communication.

All RDM devices have a unique identifier (UID) that consists of a manufacturer ID and serial number.Protocol

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Art-Net is an Ethernet protocol based on the TCP/IP protocol suite. Its purpose is to allow transferof large amounts of DMX512 data over a wide area using standard networking technology.The latest revision of the protocol implements a number of new features and also simplifies thedata transfer mechanism. The hanges are all based on feed back from manufacturers who are usingthe protocol.

Limitations:
A theoretical limit of 255 universes of DMX512 exists in this specification. However a simplistic data rate comparison (DMX runs at 250KBaud, 10BaseT at 10MBaud) suggests a maximum of 40 universes of DMX is the limit. Art-Net uses a simple delta transmission compression technique that will provide about 40 universes. If an installation of more than say 30 universes is contemplated, then it is necessary to use the unicast features of Art-Net II and 100BaseT or better physical layer. If this is done the number of universes limit becomes purely related to the network bandwidth.

Credits:
Artistic Licence require that companies who implement Art-Net in their products include a user guide credit of: "Art-Net™ Designed by and Copyright Artistic Licence (UK) Ltd".

Terminology:
• Node: A device that translates DMX512 to or from Art-Net is referred to as a Node.
• Universe: A single DMX512 frame of 512 channels is referred to as a Universe.
• Sub-Net: A group of 16 consecutive universes is referred to as a sub-net. (Not to be confused with the subnet mask).
• A central controller or monitoring device (lighting console) is referred to as a Server.
• IP: The IP is the Internet protocol address. It is expressed in either a long word format (0x12345678) or dot format (2.255.255.255). Convention is that the former is hexadecimal and the latter is decimal. The IP uniquely identifies any Nodes or Servers on a network.
• Subnet Mask: Defines which part of the IP represents the Network address and which part represents the Node address. All Art-Net implementations require a Sub-Net mask of 255.0.0.0. This means that the first byte of the IP is the network address and the remaining three bytes are the Node address.
• Port: Actual data transmission on Art-Net uses the UDP protocol that operates 'on top of' the TCP/IP protocol. UDP data transfer operates by transferring data from a specific IP:Port address on a Node or Server to a second specific IP:Port address on a second Node or Server. Art-Net uses only one port address of 0x1936.
• Limited Broadcast: When a network first connects, the Server does not know the number of Nodes on the network, nor does it know their IP addresses. The Limited broadcast address allows the Server to send an ArtPoll to all Nodes on the network.
• Server: A generic term describing an Art-Net device with the primary task of generating control data. For example, a lighting console.
• Node: A generic term describing an Art-Net device with the primary task of receiving control data. For example, a dimmer or an Ethernet to DMX gateway.
• Media Server: A generic term describing an Art-Net device capable of generating control data based on the 'mx' Media Extensions to Art-Net.

Protocol Operation:

A Node operates in one mode, each Node having a unique IP address derived from its Ethernet MAC address. The UDP port used as sources and destinations is 0x1936.

IP address configuration
The Art-Net protocol can operate on either a DHCP managed address scheme or using static addresses. By default an Art-Net product will factory start using a Class A IP address scheme. This allows Art-Net products to communicate directly and without the need for a DHCP server to be connected to the network.IP address configuration - DHCPNodes report whether they are DHCP capable in the ArtPollReply packet. This document details packets on the assumption that static addressing is used. When DHCP is used, the addressing and subnet masks will be modified as dictated by the DHCP server.IP address configuration – Static AddressingThe use of Class A addressing is allowed within a closed network. It is important to ensure that Art-Net data is not routed onto the Internet.Products implementing Art-Net should default to the Primary IP address of 2.?.?.?.The IP address consists of a 32 bit number designated as A.B.C.D. The lower the bytes B.C.D is calculated from the MAC address. The high byte 'A' is set to one of two values as shown in the following table.The MAC address is a 48 bit number designated u:v:w:x:y:z. This is a globally unique number. The upper three bytes 'u.v.w' are registered to a specific organisation. The lower three bytes 'x.y.z' are assigned by that organisation. In order to ensure that there is minimal possibility of IP address conflicts between different manufacturers supporting Art-Net, the product OEM code is added to the MAC address.
The 'B' field of the IP address is calculated by adding the high byte of the OEM code with the low byte of the OEM code and the 'x' field of the MAC address.On power up, the Node checks its configuration for IP addressing mode. If it has been programmed to use a custom IP address, the following procedure is not used.