



# DESIGNER INSTALLATION GUIDE & HARDWARE REFERENCE

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## SECTION 1 - WELCOME

Thank you for purchasing a Pharos Architectural Controls Limited product, we hope that it fulfils your expectations and provides a lifetime of reliable service.

If you have any questions or require technical support please contact:

Email: support@pharoscontrols.com

Telephone: +44-(0)20-7471-9449

Web: pharoscontrols.com

Installation instructions for hardware not included in this document, and technical specifications of this and other Pharos products can be found on our website.

### 1.1 - OVERVIEW

The Pharos control solution has two complementary parts: the installed Controllers and Remote Devices, and the Designer software which runs on any personal computer and is only required when creating or modifying the presentation.

This guide is primarily intended as a reference for the Pharos hardware installation. For Designer software help please refer to the on-line documentation (once installed, see below) .

### 1.2 - SOFTWARE INSTALLATION

- Microsoft Windows (see the website for supported OS):

Download the appropriate installer from pharoscontrols.com and run the Installer.

- Apple Macintosh (see the website for supported OS):

Download the appropriate installer from pharoscontrols.com and run the Installer.

## SECTION 2 - LPC

### 2.1 - LPC INSTALLATION

The Lighting Playback Controller (LPC) is 100% solid state and has been qualified to operate in a dry environment:

- Temperature range 0°C to 50°C (32°F to 122°F)
- Humidity 10-50% relative, non-condensing
- Ingress IP40

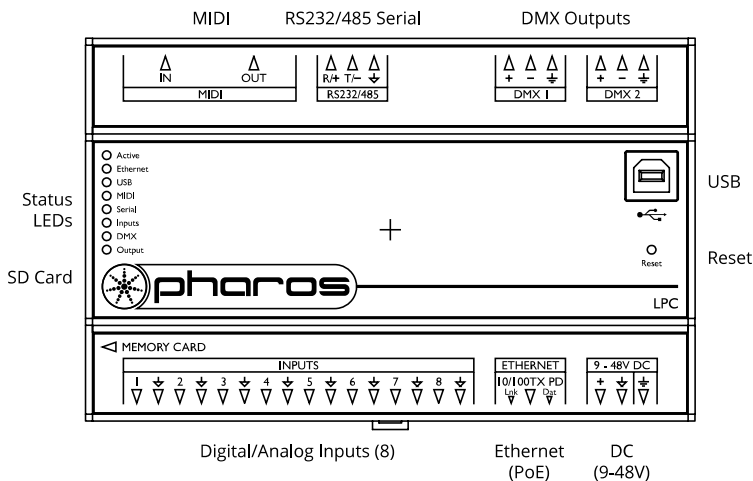
Sealed IP65 rated consumer units are available for outdoor use, please consult your Pharos distributor or representative.

Since the units require no user intervention once installed they are suitable for remote installation with all configuration and management taking place over an Ethernet network. However it is recommended that access can be gained in the unlikely event of a hardware failure.

**NOTE:** This equipment is not suitable for use in locations where children are likely to be present.

### 2.2 - LPC LAYOUT

The following drawing illustrates the layout of the LPC, refer to the following sections for details:





## 2.3 - LPC VERSIONS

There are three versions of the LPC available: LPC 1, LPC 2 and LPC 4. The LPC 1 supports 512 DMX channels, the LPC 2 supports 1024 channels and the LPC 4 supports 2048 channels (of which 1024 channels are eDMX only). All can be used as a stand-alone controller or co-operatively, via an Ethernet network, to form a scalable system.

## 2.4 - POWER SUPPLY

The LPC can be powered in two different ways:

- DC power (9 to 48V)

A limited power source approved to UL60950-1 2nd Edition, CAN/CSA C22.2 No. 60950-1.07 2nd Edition MUST be used, with an output voltage of 9 to 48V DC.

Such a power supply can be connected directly to the LPC using the DC Input connector. The pins on this connector are marked:

- + Positive input (9 to 48V DC)
- ⚡ Signal ground (0V)
- ⏏ Chassis ground (earth)

The power supply should be connected to the Positive and Signal ground inputs, ensuring the polarity is correct. Where possible, use a 12V (minimum) supply in preference to a 9V supply to ensure some headroom.

The LPC will typically consume 4W.

- Power-over-Ethernet (PoE)

A standard (802.3af) Power-over-Ethernet switch may be used to provide both power and a network connection to the LPC using a single cable.

The LPC operates as a PoE Class 2 device (3.84-6.49W) and will typically consume 4W.

**NOTE:** Power should only be applied using one of the above methods. Redundant operation using both sources is not supported.

**NOTE:** Power must not be disconnected when uploading project data nor during bootloader/firmware updates to the LPC as corruption of the data or software may occur, perhaps even rendering the unit inoperable.

### 2.5 - GROUNDING

The LPC is designed to be mounted on a grounded (earthed) DIN-rail and a dedicated Chassis ground (earth) terminal is also provided which should be connected to a suitable earth.

Additionally, the Signal ground can be tied to Chassis ground to provide a suitable reference but this is not generally recommended.

If in any doubt at all, or if you have unusual power supply or grounding/earthing requirements, then please consult Pharos Support.

### 2.6 - REALTIME CLOCK BATTERY

The LPC's internal realtime clock is battery-backed to ensure operation when the unit is not powered. The battery should last for at least 10 years and is easily replaced when necessary, replacement battery: Renata CR2032 Lithium Button Cell.

**CAUTION:** Risk of explosion if battery replaced by incorrect type. Dispose of used batteries according to the manufacturer's instructions.

**ATTENTION:** Il y a un danger d'explosion s'il y a un remplacement incorrect de batterie. Mettre au rebut les batteries usages conformément aux instructions du fabricant.

### 2.7 - MEMORY CARD

The LPC is shipped with an 8GB SD Memory Card which should be sufficient for most projects since the LPC's data storage is extremely efficient, even with a multitude of imported media files. However, a larger capacity card could of course be fitted if required.

As only the project's programming data resides on the card, the card is also a convenient way to backup data for archiving; the Designer project file for example. Furthermore, in the event of LPC hardware failure, simply moving the card into a replacement unit with identical or more recent firmware is sufficient to get the project up and running again.

### 2.8 - STATUS LEDS

The Pharos logo will illuminate when power is applied to the LPC. The red LEDs on the front of the LPC indicate the unit's current status.

Active:	The Active LED illuminates once the boot up procedure has completed and is indicative of a fully functional unit.
Ethernet:	The Ethernet LED indicates Pharos-related network activity (not network link, see Ethernet port later).
USB:	The USB LED indicates communication on the USB port.
MIDI:	The MIDI LED indicates MIDI command/timecode activity on the MIDI port.
Serial:	The Serial LED indicates RS232 or RS485 activity on the Serial port.
Inputs:	The Inputs LED indicates digital, analog or contact closure activity on the Input ports.
DMX:	The DMX LED indicates that valid DMX512 data is being output from the DMX ports.
Output:	The Output LED indicates that a valid project file has been loaded from the memory card and that playback and data output has started.

## 2.9 - ERROR CODES

Additionally, the red status LEDs are used to indicate any boot failures of the LPC that prevent the unit from going active.

Error codes are indicated by double flashing the Ethernet, USB, and MIDI LEDs, followed by a 1 second pause. The Active LED will also be off.

The next three LEDs indicate the error.

Serial:	Memory card missing (insert or replace memory card).
Inputs:	Memory card corrupt (format or replace memory card).
Serial + Input:	Unable to communicate with front panel (contact our support).
Serial + DMX:	Hardware failure (contact our support).

### 2.10 - RESET SWITCH

The LPC may be reset by inserting a small blunt object into the reset hole on the front of the LPC to depress the reset switch. The switch should be held for at least one second.

**NOTE:** The reset must not be operated when uploading project data nor during bootloader/firmware updates to the LPC as corruption of the data or software may occur, perhaps even rendering the unit inoperable.

### 2.11 - WATCHDOG

The internal “watchdog” is enabled by default to reset automatically the LPC in case of a software crash as a result of either a coding error (“bug”) or a random electromagnetic event such as a power brown-out or spike, nearby lightning strike or static discharge. Please refer to the Designer Help to learn how to disable this feature (not recommended).

### 2.12 - PORTS

- RS232/RS485 Serial Port

The serial port's protocol (RS232 or RS485), data rate and format settings (baud, parity, stop bits, etc.) are configured using Designer.

In RS232 mode, the port operates in full duplex with the following pinout:

R/+ Receive

T/- Transmit

⌵ Signal ground

In RS485 (and DMX In) mode, the port operates in half duplex with the following pinout:

R/+ Data +

T/- Data -

⌵ Signal Ground


The serial port is not isolated from the LPC's power supply. If isolation is required, it must either be provided by the connected device or a separate isolator should be used.

- MIDI Input and Output


The MIDI input and output connectors are standard 5 pin DIN connections. They may be connected directly to any standard MIDI device.

- DMX Outputs

Two DMX outputs are provided. An LPC 1 will output on both the same DMX universe data, an LPC 2 and LPC 4 will output a separate universe on each. The pins on these connectors are marked:

- + Data + ('Hot' or 'True')
- Data - ('Cold' or 'Complement')
-  Chassis ground (shield)

To make up a cable to a 5 pin XLR the following connections should be made:

	LPC:	5 pin XLR:
Data +	+	3
Data -	-	2
Shield		1

The DMX ports are by default not isolated from the LPC's ground connection which is the recommended configuration for driving isolated inputs - the majority of DMX receivers.

If required this may be changed by removing the top cover of the LPC and removing the jumper marked 'JP1', located to the right of the DMX ports. The two DMX ports will then be optically isolated from the LPC's internal circuitry although not from each other.

- Digital/Analog Inputs

The LPC features 8 digital/analog inputs on one 16 way connector. To connect an input signal to the LPC one connection should be made to the desired input pin, marked '1' to '8', and the other should be made to the adjacent signal ground pin.

The inputs can be individually configured via Designer to operate in one of three modes:

**Contact closure:** An external volt-free switch may be connected between the input pin and the signal ground pin.

In this mode, the input pin is internally pulled-up to 5V via a 2.2Kohm resistor, so the switch only needs to be rated at 5V, 2.5mA or greater.

**Digital input:** An external voltage source (such as a 12VDC trigger output) may be connected between the input pin and the signal ground pin.

In this mode, the input pin is internally pulled down to 0V via a 202.1Kohm resistor and the maximum input voltage supported is 24VDC.

The LPC may be configured to specify what the 'high' and 'low' threshold voltages are. This facility can be used to provide 'Schmitt trigger' action.

**Analog input:** An external voltage source (such as a 0-10V analog signal) may be connected between the input pin and the signal ground pin.

In this mode, the input pin is internally pulled down to 0V via a 202.1Kohm resistor and the maximum input voltage supported is 24VDC.

The LPC may be configured to specify what the input voltage range is. Voltages inside this range are reported as 0% to 100%.

In all modes, the maximum rated input voltage is 24VDC. The inputs should never be driven with a higher voltage nor negative voltage or damage may occur.

In all modes, all signal ground pins are connected together internally. The digital/analog inputs are not isolated from each other nor the LPC's power supply. If isolation is required, it must either be provided by the connected device or a separate isolator should be used.

- Ethernet

A standard 10/100TX Ethernet connection may be made to the LPC. As the LPC supports Power-over-Ethernet (PoE), a PoE switch or midspan injector can be used. The LEDs on the RJ45 jack itself are useful for debugging the Ethernet installation:

The Lnk LED will illuminate when an Ethernet link has been established.

The Dat LED will illuminate to indicate Ethernet traffic (not just Pharos-relevant).

- USB

The USB port may be used to connect the LPC to a PC to upload project data and update the LPC's internal operating software.

**NOTE:** Ports and third party equipment can be damaged when plugging or unplugging an energised system (hot-plugging). It is therefore advisable to remove power before making or breaking port connections.

### SECTION 3 - TPC

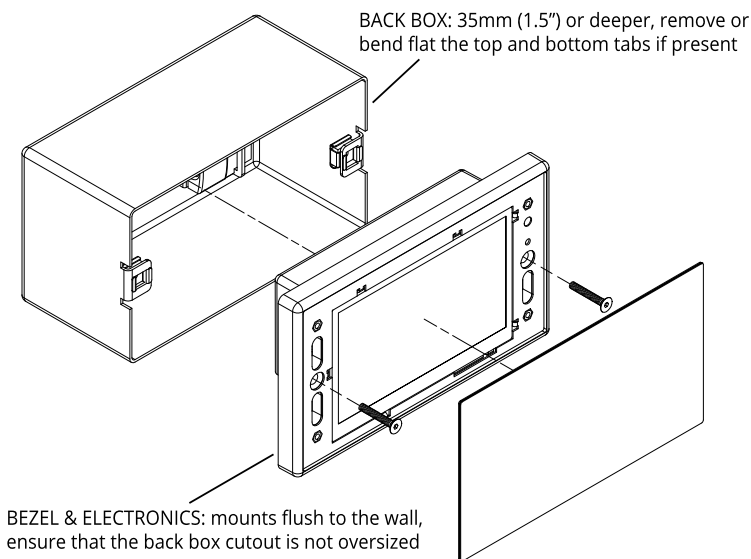
#### 3.1 - TPC INSTALLATION

The Touch Panel Controller (TPC) is a fully fledged Controller in its own right with an integrated touch screen user interface. It can also share its user interface with other Pharos Controllers when operating as part of a system across an Ethernet network.

The units are designed to be permanently installed into UK double-gang or custom back boxes (supplied separately). The units are 100% solid state and have been qualified to operate in a dry environment:

- Temperature range 0°C to 50°C (32°F to 122°F)
- Humidity 10-50% relative, non-condensing
- Ingress IP40

The following diagram illustrates a typical installation:

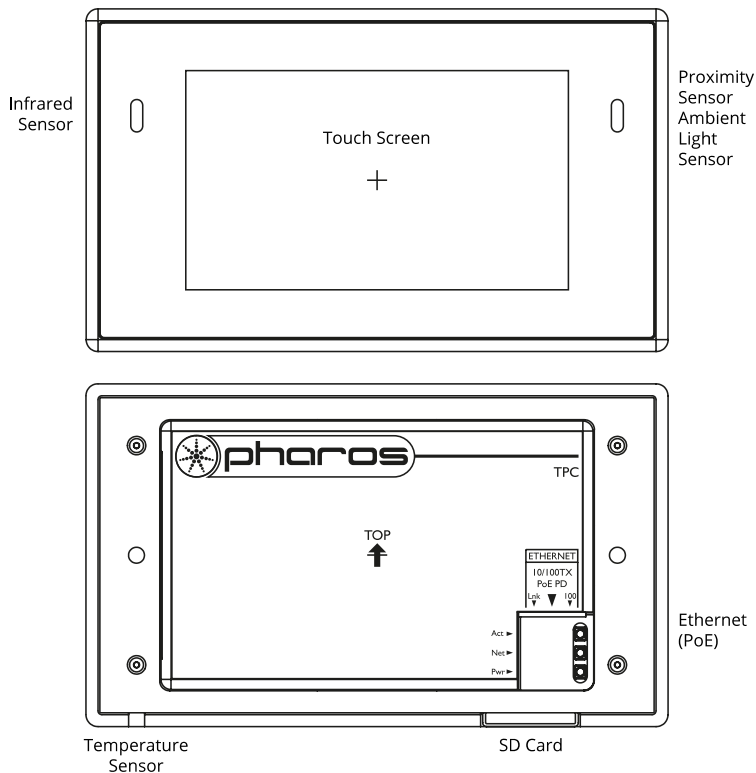


Carefully remove the protective films from the front of the liquid crystal display and the magnetic overlay before final assembly.



### 3.2 - TPC LAYOUT

The following drawing illustrates the layout of a TPC, refer to the following sections for details:



### 3.3 - POWER SUPPLY

- Power-over-Ethernet (PoE)

A standard (802.3af) Power-over-Ethernet switch should be used to provide both power and a network connection to the TPC using a single cable. Alternatively, if a PoE switch is not available, a PoE midspan injector could be used.

Alternatively, the EXT can be used to provide power and a data connection to the TPC.

A limited power source approved to UL60950-1 2nd Edition, CAN/CSA C22.2 No. 60950- 1.07 2nd Edition MUST be used, with an SELV output voltage.

The TPC operates as a PoE Class 2 device (3.84-6.49W) and will typically consume 4W.

**NOTE:** Power must not be disconnected during firmware updates to the TPC as corruption of the software may occur, perhaps even rendering the unit inoperable.

**3.4 - REALTIME CLOCK BATTERY**

The TPC's internal realtime clock is battery-backed to ensure operation when the unit is not powered. The battery should last for at least 10 years and is easily replaced when necessary, replacement battery: Renata CR2032 Lithium Button Cell.

**CAUTION:** Risk of explosion if battery replaced by incorrect type. Dispose of used batteries according to the manufacturer's instructions.

**ATTENTION:** Il y a un danger d'explosion s'il y a un remplacement incorrect de batterie. Mettre au rebut les batteries usages conformément aux instructions du fabricant.

**3.5 - MEMORY CARD**

The TPC is shipped with a 2GB SD Memory Card which should be sufficient for most projects since the TPC's data storage is extremely efficient, even with a multitude of imported media files. However, a larger capacity card could of course be fitted if required.

As only the project's programming data resides on the card, the card is also a convenient way to backup data for archiving; the Designer project file for example. Furthermore, in the event of TPC hardware failure, simply moving the card into a replacement unit with identical or more recent firmware is sufficient to get the project up and running again.

### 3.6 - STATUS LEDS

The LEDs on the rear of the unit provide the following status information:

Pwr:	Power - illuminates when the unit is correctly powered.
Act:	Active - illuminates once the boot up procedure has completed and is indicative of a fully functional unit.
Net:	Network - illuminates when the unit is sending or receiving Pharos-related data.
Lnk:	Link - illuminates once the unit has established an Ethernet link.
100:	100BASE-TX - illuminates when the Ethernet link is operating at 100Mbit/s.

The LEDs on the front of the unit (under the overlay) provide the following status information:

Pwr:	Power - illuminates when the unit is correctly powered.
Act:	Active - illuminates once the boot up procedure has completed and is indicative of a fully functional unit.
Eth:	Ethernet - illuminates when the unit is sending or receiving Pharos-related data.
Out:	Output - indicates that a valid project file has been loaded from the memory card and that playback and data output has started.

### 3.7 - ERROR CODES

Additionally, the red status LEDs are used to indicate any boot failures of the TPC that prevent the unit from going active. These codes are outlined below, and in all cases, Power LED will remain on, but the Active LED will be off.

Ethernet + Output double flashing:	Memory card missing (insert or replace card).
Ethernet + Output triple flashing:	Internal flash error (contact our support).

### 3.8 - RESET SWITCH

The TPC may be reset by removing the magnetic overlay and pressing the reset switch. The switch should be held for at least one second.

**NOTE:** The reset must not be operated during firmware updates to the TPC as corruption of the software may occur, perhaps even rendering the unit inoperable.

### 3.9 - CONFIG SWITCH

The TPC may be placed in a configuration mode by removing the magnetic overlay and pressing the config switch, refer to Designer Help for instructions.

### 3.10 - WATCHDOG

An internal "watchdog" will automatically reset the TPC in case of a software crash as a result of either a coding error ("bug") or a random electromagnetic event such as a power brown-out or spike, nearby lightning strike or static discharge.

### 3.11 - LEARNING IR RECEIVER

The TPC may be taught to recognise different IR codes from a standard infra red remote control, refer to Designer Help for instructions.

### 3.12 - TEMPERATURE SENSOR

The Temperature Sensor can be used to measure the ambient temperature around the TPC.

**NOTE:** The Temperature Sensor cutout is not a release catch and attempting to use it as such will result in damage to the unit, perhaps even rendering the unit inoperable.

## SECTION 4 - EXT

### 4.1 - EXT INSTALLATION

The EXT is designed to be permanently installed in a central control room/cupboard or DIN consumer unit for remote deployment. The enclosure and mounting complies with DIN43880 and EN60715 (35/7.5 rail) respectively.

The units are 100% solid state and have been qualified to operate in a dry environment:

- Temperature range 0°C to 50°C (32°F to 122°F)
- Humidity 10-50% relative, non-condensing
- Ingress IP40

Sealed IP65 rated consumer units are available for outdoor use, please consult your Pharos distributor or representative.

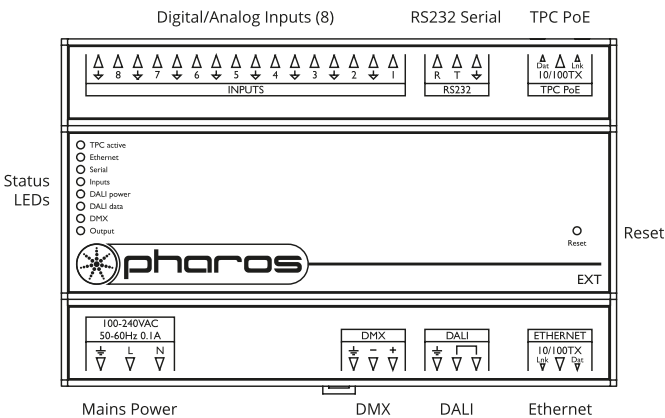
Since the units require no user intervention once installed they are suitable for remote installation with all configuration and management taking place over an Ethernet network. However it is recommended that access can be gained in the unlikely event of a hardware failure.

**NOTE:** The EXT should be installed within a fire enclosure. Any SELV parts or wires inside the cabinet should not touch the mains connector of the EXT.

**NOTE:** This equipment is not suitable for use in locations where children are likely to be present.

### 4.2 - EXT LAYOUT

The following drawing illustrates the layout of an EXT, refer to the following sections for details:



4.3 - POWER SUPPLY

The EXT is mains powered via a 100-240V fused switch mode power supply unit compatible with all worldwide mains supply standards; 100-240VAC 50/60Hz. The EXT will typically consume a maximum of 10W.

**NOTE:** Power must not be disconnected when uploading project data nor during bootloader/firmware updates to the EXT or TPC as corruption of the data or software may occur, perhaps even rendering the unit inoperable.

**CAUTION:** The EXT is a permanently connected device. A readily accessible two-pole disconnect device with at least 3mm contact separation shall be incorporated in the building installation wiring.

**ATTENTION:** L' EXT est un équipement connecté en permanence. Un dispositif de déconnexion à deux pôles facilement accessible avec au moins une séparation de contact de 3mm doit être incorporé au câblage d'installation du bâtiment.

4.4 - GROUNDING

The EXT must be correctly grounded to electrical safety earth at all times.

4.5 - STATUS LEDS

The Pharos logo will illuminate when power is applied to the EXT. The red LEDs on the front of the EXT indicate the unit's current status.

TPC active:	The TPC active LED will light continuously once the EXT has connected to a project running on a TPC.
Ethernet:	The Ethernet LED indicates Pharos-related network activity (not network link, see Ethernet port later).
Serial:	The Serial LED indicates RS232 activity on the Serial port.
Inputs:	The Inputs LED indicates digital, analog or contact closure activity on the Input ports.
DALI power:	The DALI power LED indicates that a DALI power supply has been detected on the bus. EXT does not provide DALI power.
DALI data:	The DALI data LED indicates DALI data activity on the DALI port.
DMX:	The DMX LED indicates that valid DMX512 data is being output from the DMX port.
Output:	The Output LED indicates that a valid project file has been loaded from the memory card on the connected TPC and that playback and data output has started.

## 4.6 - ERROR CODES

Additionally, the red status LEDs are used to indicate any boot failures to the EXT that prevent the unit from going active. Error codes are displayed by a repeating pattern of flashing all four LEDs a number of times in succession, followed by a 1 second pause:

1 flash:	Invalid firmware version (reload firmware from Designer)
2 flashes:	Invalid device type or serial number
3 flashes:	Internal memory test error
4 flashes:	Unable to perform factory restore due to corrupt factory firmware
5 flashes:	Current firmware is corrupt, no valid firmware versions available to restore

6 flashes:                Restored firmware is corrupt

Codes 2 through 6 indicate a hardware error; please consult your distributor, representative or Pharos Support for assistance.

### 4.7 - RESET SWITCH

The EXT may be reset by inserting a small blunt object into the reset hole on the front of the EXT to depress the reset switch. The switch should be held for at least one second. This will not reset the connected TPC.

**NOTE:** The reset must not be operated when uploading project data nor during bootloader/firmware updates to the EXT or TPC as corruption of the data or software may occur, perhaps even rendering the unit inoperable.

### 4.8 - PORTS

- RS232 Serial Port

The serial port's data rate and format settings (baud, parity, stop bits, etc.) are configured using Designer.

The port operates in full duplex with the following pinout:

R/+ Receive

T/- Transmit

⏚ Signal ground

The serial port is not isolated from the EXT's power supply. If isolation is required, it must either be provided by the connected device or a separate isolator should be used.

- DMX Output

The pins on this connector are marked:

+ Data + ('Hot' or 'True')


- Data - ('Cold' or 'Complement')

⏚ Chassis ground (shield)

To make up a cable to a 5 pin XLR the following connections should be made:



EXT: 5 pin XLR:

Data +	+	3
Data -	-	2
Shield		1

The DMX port is isolated from the EXT's ground connection.

- Digital/Analog Inputs

The EXT features 8 digital/analog inputs on one 16 way connector. To connect an input signal to the EXT, one connection should be made to the desired input pin, marked '1' to '8', and the other should be made to the adjacent signal ground pin.

The inputs can be individually configured via Designer to operate in one of three modes:

**Contact closure:** An external volt-free switch may be connected between the input pin and the signal ground pin.

In this mode, the input pin is internally pulled-up to 5V via a 2.2Kohm resistor, so the switch only needs to be rated at 5V, 2.5mA or greater.

**Digital input:** An external voltage source (such as a 12VDC trigger output) may be connected between the input pin and the signal ground pin.

In this mode, the input pin is internally pulled down to 0V via a 2Mohm resistor and the maximum input voltage supported is 24VDC.

The EXT may be configured to specify what the 'high' and 'low' threshold voltages are. This facility can be used to provide 'Schmitt trigger' action.

**Analog input:** An external voltage source (such as a 0-10VDC analog signal) may be connected between the input pin and the signal ground pin.

In this mode, the input pin is internally pulled down to 0V via a 2Mohm resistor and the maximum input voltage supported is 24VDC.

The EXT may be configured to specify what the input voltage range is. Voltages inside this range are reported as 0% to 100%.

In all modes, the maximum rated input voltage is 24VDC. The inputs should never be driven with a higher voltage nor negative voltage or damage may occur.

In all modes, all signal ground pins are connected together internally. The digital/analog inputs are not isolated from each other nor the EXT's power supply. If isolation is required, it must either be provided by the connected device or a separate isolator should be used.

- DALI

A DALI bus interface is provided on a 3 way connector:

- ┌ DALI bus (polarity insensitive)
- └ DALI bus (polarity insensitive)
- ⏏ Chassis ground (for optional shield)

The DALI data LED will indicate valid data on the bus.

**NOTE:** DALI bus requires a dedicated DALI bus power supply to function, the DALI power LED will illuminate solidly to indicate suitable (9-26V) power. The LED will be off for no power or flash to indicate out of range power.

- TPC PoE

Specifically designed to provide power and data to a connected TPC. The LEDs on the RJ45 jack itself are useful for debugging the connection between the EXT and a TPC:

The Lnk LED will illuminate when an Ethernet link has been established.

The Dat LED will illuminate to indicate Ethernet traffic between the EXT and a TPC.

**NOTE:** TPC PoE port is designed to work with the TPC alone. Connecting any other Pharos or third party devices to this port could damage the device and/or the EXT.

- Ethernet

A standard 10/100TX Ethernet connection may be made to the EXT. The LEDs on the RJ45 jack itself are useful for debugging the Ethernet installation:

The Lnk LED will illuminate when an Ethernet link has been established.

The Dat LED will illuminate to indicate Ethernet traffic (not just Pharos-relevant).

**NOTE:** Ports and third party equipment can be damaged when plugging or unplugging an energised system (hot-plugging). It is therefore advisable to remove power before making or breaking port connections.

## SECTION 5 - LPC X

### 5.1 - LPC X REV2 INSTALLATION

The Lighting Playback Controller X (LPC X) is designed to be rack mounted in a central control room for fixed installations or flight cased for touring applications. The 1U enclosure and 19" rack mounting complies with IEC 60297.

The unit is largely solid state and has been qualified to operate in a dry environment:

- Temperature range 0°C to 50°C (32°F to 122°F)
- Humidity 10-50% relative, non-condensing
- Ingress IP20

**NOTE:** Particular attention must be paid to cooling; under no circumstances should the airflow to the heat sinks be restricted and a rack fan cooling unit should be considered when multiple units are stacked together to maintain the correct ambient temperature.

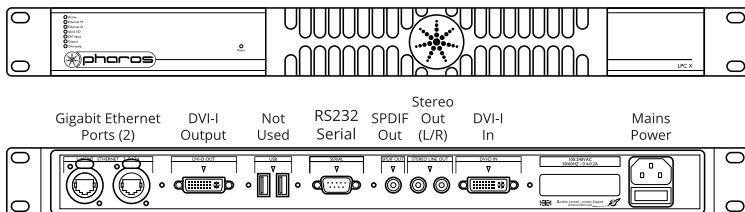
**NOTE:** This equipment is not suitable for use in locations where children are likely to be present.

Since the unit requires no user intervention once installed it is suitable for remote installation with all configuration and management taking place over an Ethernet network. However it is recommended that access can be gained in the unlikely event of a hardware failure.

The LPC X is fitted with fan filters mounted on the front panel of the product. Should the filters become clogged, they need to be replaced. Please contact Pharos Support for further information.

### 5.2 - LPC X LAYOUT

The following drawings illustrate the layout of the LPC X, refer to the following sections for details:



### 5.3 - LPC X VERSIONS

There are multiple versions of the LPC X that differ only in the maximum number of control channels that can be accommodated. For example, the LPC 20 can control 20 DMX universes (10,240 channels) while the LPC 100 can control 100 DMX universes (51200 channels).

The LPC X can be used as a stand-alone controller or co-operatively with other Pharos Controllers and Remote Devices, via an Ethernet network, to form a scalable system.

### 5.4 - POWER SUPPLY

The LPC X is mains powered via a fused, universal input power supply unit (PSU) compatible with all worldwide mains supply standards; 100-250V 50/60Hz.

The LPC X will consume 40W typical (50W maximum).

**NOTE:** Power must not be disconnected when uploading project data nor during bootloader/firmware updates to the LPC X as corruption of the data or software may occur, perhaps even rendering the unit inoperable.

**CAUTION:** For pluggable equipment, the socket outlet shall be installed near the equipment and shall be easily accessible.

**ATTENTION:** En cas d'équipement enfichable, la prise doit être montée près de l'équipement et doit offrir un accès facile.

### 5.5 - GROUNDING

The LPC X must be correctly grounded to electrical safety earth at all times.

### 5.6 - REALTIME CLOCK BATTERIES

The LPC X's internal realtime clock is battery-backed to ensure operation when the unit is not powered. The batteries should last for at least 10 years and are easily replaced when necessary, replacement battery: Renata CR2032 Lithium Button Cell.

**CAUTION:** Risk of explosion if battery replaced by incorrect type. Dispose of used batteries according to the manufacturer's instructions.

**ATTENTION:** Il y a un danger d'explosion s'il y a un remplacement incorrect de batterie. Mettre au rebut les batteries usages conformément aux instructions du fabricant.

**5.7 - MEMORY STORAGE**

The LPC X is shipped with a 128GB SSD which should be sufficient for most projects since the LPC X's data storage is extremely efficient, even with a multitude of imported media files.

As only the project's programming data resides on the card, the card is also a convenient way to backup data for archiving; the Designer project file for example. Furthermore, in the event of LPC X hardware failure, simply moving the card into a replacement unit is sufficient to get the project up and running again.

**5.8 - STATUS LEDS**

The Pharos logo will illuminate when power is applied to the LPC X. The red LEDs above indicate the unit's current status.

Active:	The Active LED flashes throughout the boot up procedure and lights solidly once this has been completed and is indicative of a fully functional unit.
Ethernet M:	The Ethernet M LED indicates Pharos-related network activity (not network link) on the MGMT (Management) port.
Ethernet D:	The Ethernet D LED indicates Pharos-related network activity (not network link) on the DATA port.
Serial I/O:	The Serial I/O LED indicates RS232 activity on the Serial port.
DVI Input:	The DVI Input LED indicates capture card activity on the DVI-I port .
Output:	The Output LED indicates that a valid project file has been loaded from the memory card and that playback and data output (eDMX and DVI) has started.
Overtemp:	The Overtemp LED will illuminate if the processor core(s) reaches 95°C (203°F) indicating a fault in the system's cooling, typically caused by raised ambient temperatures. Consult the web interface's home page to monitor the system temperatures and take remedial action.

## 5.9 - ERROR CODES

Error codes are indicated by double flashing of the Ethernet M, Ethernet D, and Serial I/O LEDs, followed by a 1 second pause. The Active LED will also be off.

The bottom three LEDs indicate the error:

DVI Input:	Memory card missing (insert or replace memory card).
Output:	Memory card corrupt (format or replace memory card).
DVI Input + Output:	Unable to communicate with front panel (contact our support).
DVI Input + Overtemp:	Hardware failure (contact our support)

Main board errors can usually be resolved by running the LPC X Recovery Tool on a PC. This may format the SSD and reinstall the firmware. In such a case all project data will be erased and so an upload will be required to restore programming.

## 5.10 - RESET SWITCH

The LPC X may be reset by inserting a small blunt object into the reset hole on the front panel to depress the reset switch. The switch should be held for at least one second.

**NOTE:** The reset must not be operated when uploading project data nor during bootloader/firmware updates to the LPC X as corruption of the data or software may occur, perhaps even rendering the unit inoperable.

## 5.11 - WATCHDOG

The internal “watchdog” is enabled by default to reset automatically the LPC X in case of a software crash as a result of either a coding error (“bug”) or a random electromagnetic event such as a power brown-out or spike, nearby lightning strike or static discharge. Please refer to the Designer Help to learn how to disable this feature (not recommended).

## 5.12 - PORTS

- Ethernet 1 - MGMT

A standard 10/100/1000BASE-T Ethernet connection may be made to this port for management and networking to other Pharos Controllers and Remote Devices.

- Ethernet 2 - DATA

A standard 10/100/1000BASE-T Ethernet connection may be made to this port to output data to lighting fixtures using Ethernet protocols (eDMX) such as sACN, ArtNet and KiNET.

- DVI-I Output

A standard DVI connection may be made to this port to route output data to the lighting fixtures using the Digital Video Interface.

- RS232 Serial Port

The serial ports may be connected directly to a PC using a null modem cable. Other devices may require different cables depending on their pinout. The serial port is a 9 pin male D connector with the following pinout:

1: DCD

2: Receive data (RXD)

3: Transmit data (TXD)

4: DTR

5: Signal ground

6: DSR

7: RTS

8: CTS

9: RI

The serial port is not isolated from the LPC X's power supply. If isolation is required, it must either be provided by the connected device or a separate isolator should be used.

- DVI-I Input

A standard DVI connection may be made to this port to route video data to a Live Video Preset within the project. Requires the Controller to be the DVI variant.

- USB

This port is not supported at the time of writing (refer to the current Designer Help).



- SPDIF Out

A standard RCA coaxial cable may be connected for digital audio output from the Controller. 2-channel PCM audio is supported.

- Stereo Line Out

Two RCA connectors are provided for analog stereo audio output.

**NOTE:** Ports and third party equipment can be damaged when plugging or unplugging an energised system (hot-plugging). It is therefore advisable to remove power before making or breaking port connections.

SECTION 6 - VLC

6.1 - VLC INSTALLATION

The Video Lighting Controller (VLC) is designed to be rack mounted in a central control room for fixed installations or flight cased for touring applications. The 1U enclosure and 19" rack mounting complies with IEC 60297.

The unit is largely solid state and has been qualified to operate in a dry environment:

- Temperature range 0°C to 50°C (32°F to 122°F)
- Humidity 10-50% relative, non-condensing
- Ingress IP20

**NOTE:** Particular attention must be paid to cooling; under no circumstances should the airflow to the heat sinks be restricted and rack fan cooling unit should be considered when multiple units are stacked together to maintain the correct ambient temperature.

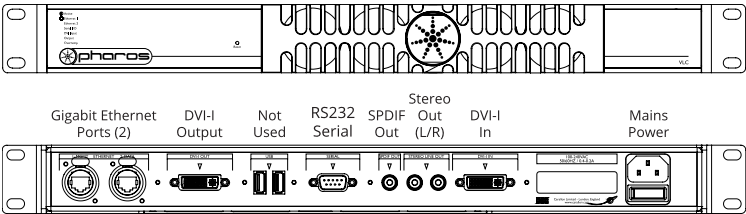
**NOTE:** This equipment is not suitable for use in locations where children are likely to be present.

Since the unit requires no user intervention once installed it is suitable for remote installation with all configuration and management taking place over an Ethernet network. However it is recommended that access can be gained in the unlikely event of a hardware failure.

The VLC is fitted with fan filters mounted on the front panel of the product. Should the filters become clogged, they need to be replaced. Please contact Pharos Support for further information.

6.2 - VLC LAYOUT

The following drawings illustrate the layout of the VLC, refer to the following sections for details:



### 6.3 - VLC VERSIONS

There are multiple versions of the VLC that differ only in the maximum number of control channels that can be accommodated. For example, the VLC 50 can control 50 DMX universes (25,600 channels) while the VLC 1500 can control 1500 DMX universes (768,000 channels).

The VLC can be used as a stand-alone controller or co-operatively with other Pharos Controllers and Remote Devices, via an Ethernet network, to form a scalable system.

### 6.4 - POWER SUPPLY

The VLC is mains powered via an internally fused, universal input power supply unit (PSU) compatible with all worldwide mains supply standards; 100-240V 50/60Hz. The VLC will consume 40W typical (50W maximum).

**NOTE:** Power must not be disconnected when uploading project data nor during firmware updates to the VLC as corruption of the data or software may occur, perhaps even rendering the unit inoperable.

**CAUTION:** For pluggable equipment, the socket outlet shall be installed near the equipment and shall be easily accessible.

**ATTENTION:** En cas d'équipement enfichable, la prise doit être montée près de l'équipement et doit offrir un accès facile.

### 6.5 - GROUNDING

The VLC must be correctly grounded to electrical safety earth at all times.

### 6.6 - REALTIME CLOCK BATTERIES

The VLC's internal realtime clock is battery-backed to ensure operation when the unit is not powered. The batteries should last for at least 10 years and are easily replaced when necessary, replacement battery: Renata CR2032 Lithium Button Cell.

**CAUTION:** Risk of explosion if battery replaced by incorrect type. Dispose of used batteries according to the manufacturer's instructions.

**ATTENTION:** Il y a un danger d'explosion s'il y a un remplacement incorrect de batterie. Mettre au rebut les batteries usages conformément aux instructions du fabricant.

**6.7 - MEMORY STORAGE**

The VLC is shipped with a 128GB SSD which should be sufficient for most projects since the VLC’s data storage is extremely efficient, even with a multitude of imported media files.

**6.8 - STATUS LEDS**

The Pharos logo will illuminate when power is applied to the VLC. The red LEDs above indicate the unit’s current status.

Active:	The Active LED flashes throughout the boot up procedure and lights solidly once this has been completed and is indicative of a fully functional unit.
Ethernet M:	The Ethernet M LED indicates Pharos-related network activity (not network link) on the MGMT (Management) port.
Ethernet D:	The Ethernet D LED indicates Pharos-related network activity (not network link) on the DATA port.
Serial I/O:	The Serial I/O LED indicates RS232 activity on the Serial port.
DVI Input:	The DVI Input LED indicates capture card activity on the DVI-I port.
Output:	The Output LED indicates that a valid project file has been loaded from the memory card and that playback and data output (eDMX and DVI) has started.
Overtemp:	The Overtemp LED will illuminate if the processor core(s) reaches 95°C (203°F) indicating a fault in the system’s cooling, typically caused by raised ambient temperatures. Consult the web interface’s home page to monitor the system temperatures and take remedial action.

**6.9 - ERROR CODES**

Additionally, the red status LEDs are used to indicate any boot failures of the VLC that prevent the unit from going active. Error codes are indicated by double flashing the Ethernet M, Ethernet D and Serial I/O LEDs, followed by a 1 second pause. The bottom three LEDs indicate the error.

DVI Input:	Memory card missing (insert or replace memory card).
Output:	Memory card corrupt (format or replace memory card).
DVI Input + Output:	Unable to communicate with front panel (contact our support).
DVI Input + Overtemp:	Hardware failure (contact our support).

## 6.10 - RESET SWITCH

The VLC may be reset by inserting a small blunt object into the reset hole on the front panel to depress the reset switch. The switch should be held for at least one second.

**NOTE:** The reset must not be operated when uploading project data nor during bootloader/firmware updates to the VLC as corruption of the data or software may occur, perhaps even rendering the unit inoperable.

## 6.11 - WATCHDOG

The internal “watchdog” is enabled by default to reset automatically the VLC in case of a software crash as a result of either a coding error (“bug”) or a random electromagnetic event such as a power brown-out or spike, nearby lightning strike or static discharge. Please refer to the Designer Help to learn how to disable this feature (not recommended).

## 6.12 - PORTS

- Ethernet 1 - MGMT

A standard 10/100/1000BASE-T Ethernet connection may be made to this port for management and networking to other Pharos Controllers and Remote Devices.

- Ethernet 2 - DATA

A standard 10/100/1000BASE-T Ethernet connection may be made to this port to output data to lighting fixtures using Ethernet protocols (eDMX) such as sACN, ArtNet and KiNET.

- DVI-I Output

This port is not supported at the time of writing (refer to the current Designer Help).

- RS232 Serial Port

The serial ports may be connected directly to a PC using a null modem cable. Other devices may require different cables depending on their pinout. The serial port is a 9 pin male D connector with the following pinout:

1: DCD

2: Receive data (RXD)

3: Transmit data (TXD)

4: DTR

5: Signal ground

6: DSR

7: RTS

8: CTS

9: RI

The serial port is not isolated from the VLC's power supply. If isolation is required, it must either be provided by the connected device or a separate isolator should be used.

- DVI-I Input

A standard DVI connection may be made to this port to route video data to a Live Video Preset within the project.

- USB

This port is not supported at the time of writing (refer to the current Designer Help).

- SPDIF Out

A standard RCA coaxial cable may be connected for digital audio output from the Controller. 2-channel PCM audio is supported.

- Stereo Line Out

Two RCA connectors are provided for analog stereo audio output.

**NOTE:** Ports and third party equipment can be damaged when plugging or unplugging an energised system (hot-plugging). It is therefore advisable to remove power before making or breaking port connections.

### SECTION 7 - VLC+

#### 7.1 - VLC+ INSTALLATION

The Video Lighting Controller+ (VLC+) is designed to be rack mounted in a central control room for fixed installations or flight cased for touring applications. The 2U enclosure and 19" rack mounting complies with IEC 60297.

The unit is largely solid state and has been qualified to operate in a dry environment:

- Temperature range 0°C to 50°C (32°F to 122°F)
- Humidity 10-50% relative, non-condensing
- Ingress IP20

**CAUTION:** Particular attention must be paid to cooling; under no circumstances should the airflow to the heat sinks be restricted and rack fan cooling unit should be considered when multiple units are stacked together to maintain the correct ambient temperature.

**ATTENTION:** Une attention toute particulière doit être portée au refroidissement; en aucun cas, le flux d'aire vers les dissipateurs de chaleur ne doit être restreint et une unité de refroidissement du ventilateur en rack doit être envisagée lorsque plusieurs unités sont empilées ensemble pour maintenir la température ambiante correcte.

Since the unit requires no user intervention once installed it is suitable for remote installation with all configuration and management taking place over an Ethernet network. However it is recommended that access can be gained in the unlikely event of a hardware failure.

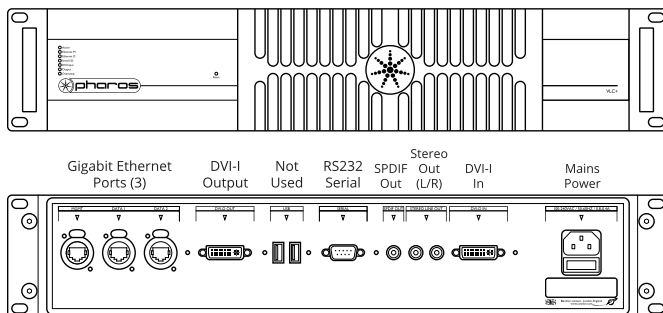
The VLC+ is fitted with fan filters mounted on the front panel of the product. Should the filters become clogged, they need to be replaced. Please contact Pharos Support for further information.

**NOTE:** This equipment is not suitable for use in locations where children are likely to be present.



## 7.2 - VLC+ LAYOUT

The following drawings illustrate the layout of the VLC+, refer to the following sections for details:



## 7.3 - VLC+ VERSIONS

There are multiple versions of the VLC+ that differ only in the maximum number of control channels that can be accommodated. For example, the VLC+ 50 can control 50 DMX universes (25,600 channels) while the VLC+ 3000 can control 3000 DMX universes (1,536,000 channels).

The VLC+ can be used as a stand-alone controller or co-operatively with other Pharos Controllers and Remote Devices, via an Ethernet network, to form a scalable system.

## 7.4 - POWER SUPPLY

The VLC+ is mains powered via an internally fused, universal input power supply unit (PSU) compatible with all worldwide mains supply standards; 100-240V 50/60Hz. The VLC+ will consume 40W typical (100W maximum).

**NOTE:** Power must not be disconnected when uploading project data nor during firmware updates to the VLC+ as corruption of the data or software may occur, perhaps even rendering the unit inoperable.

**CAUTION:** For pluggable equipment, the socket outlet shall be installed near the equipment and shall be easily accessible.

**ATTENTION:** En cas d'équipement enfichable, la prise doit être montée près de l'équipement et doit offrir un accès facile.

7.5 - GROUNDING

The VLC+ must be correctly grounded to electrical safety earth at all times.

7.6 - REALTIME CLOCK BATTERIES

The VLC+'s internal realtime clock is battery-backed to ensure operation when the unit is not powered. The batteries should last for at least 10 years and are easily replaced when necessary, replacement battery: Renata CR2032 Lithium Button Cell.

**CAUTION:** Risk of explosion if battery replaced by incorrect type. Dispose of used batteries according to the manufacturer's instructions.

**ATTENTION:** Il y a un danger d'explosion s'il y a un remplacement incorrect de batterie. Mettre au rebut les batteries usages conformément aux instructions du fabricant.

7.7 - MEMORY STORAGE

The VLC+ is shipped with a 128GB SSD which should be sufficient for most projects since the VLC+'s data storage is extremely efficient, even with a multitude of imported media files. However, a larger capacity drive could be fitted if required.

7.8 - STATUS LEDS

The Pharos logo will illuminate when power is applied to the VLC+. The red LEDs above indicate the unit's current status.

- |             |   |
|-------------|---|
| Active:     | The Active LED flashes throughout the boot up procedure and lights solidly once this has been completed and is indicative of a fully functional unit. |
| Ethernet M: | The Ethernet M LED indicates Pharos-related network activity (not network link) on the MGMT (Management) port.  |
| Ethernet D: | The Ethernet D LED indicates Pharos-related network activity (not network link) on the DATA port.   |
| Serial I/O: | The Serial I/O LED indicates RS232 activity on the Serial port.   |
| DVI Input:  | The DVI Input LED indicates capture card activity on the DVI-I port.  |
| Output:     | The Output LED indicates that a valid project file has been   |

loaded from the memory card and that playback and data output (eDMX and DVI) has started.

**Overtemp:** The Overtemp LED will illuminate if the processor core(s) reaches 95°C (203°F) indicating a fault in the system's cooling, typically caused by raised ambient temperatures. Consult the web interface's home page to monitor the system temperatures and take remedial action.

7.9 - ERROR CODES

Additionally, the red status LEDs are used to indicate any boot failures that prevent the unit from going active.

Error codes are indicated by double flashing the Ethernet M, Ethernet D and Serial I/O LEDs, followed by a 1 second pause. The bottom three LEDs indicate the error.

DVI Input:	Memory card missing (insert or replace memory card).
Output:	Memory card corrupt (format or replace memory card).
DVI Input + Output:	Unable to communicate with front panel (contact our support).
DVI Input + Overtemp:	Hardware failure (contact our support).

7.10 - RESET SWITCH

The VLC+ may be reset by inserting a small blunt object into the reset hole on the front panel to depress the reset switch. The switch should be held for at least one second.

**NOTE:** The reset must not be operated when uploading project data nor during bootloader/firmware updates to the VLC+ as corruption of the data or software may occur, perhaps even rendering the unit inoperable.

7.11 - WATCHDOG

The internal "watchdog" is enabled by default to reset automatically the VLC+ in case of a software crash as a result of either a coding error ("bug") or a random electromagnetic event such as a power brown-out or spike, nearby lightning strike or static discharge. Please refer to the Designer Help to learn how to disable this feature (not recommended).

### 7.12 - PORTS

- Ethernet 1 - Management

A standard 10/100/1000BASE-T Ethernet connection may be made to this port for management and networking to other Pharos Controllers and Remote Devices.

- Ethernet 2 - Data

A standard 10/100/1000BASE-T Ethernet connection may be made to this port to output data to lighting fixtures using Ethernet protocols (eDMX) such as sACN, ArtNet and KiNET.

- Ethernet 3 - Data

A standard 10/100/1000BASE-T Ethernet connection may be made to this port to output data to lighting fixtures using Ethernet protocols (eDMX) such as sACN, ArtNet and KiNET.

**NOTE:** The two data ports must not be connected to the same physical network.

- DVI-I Output

A standard DVI connection may be made to this port to route output data to the lighting fixtures using the Digital Video Interface.

- RS232 Serial Port

The serial ports may be connected directly to a PC using a null modem cable. Other devices may require different cables depending on their pinout. The serial port is a 9 pin male D connector with the following pinout:

1: DCD

2: Receive data (RXD)

3: Transmit data (TXD)

4: DTR

5: Signal ground

6: DSR

7: RTS

8: CTS

## 9: RI

The serial port is not isolated from the VLC+'s power supply. If isolation is required, it must either be provided by the connected device or a separate isolator should be used.

- DVI-I Input

A standard DVI connection may be made to this port to route video data to a Live Video Preset within the project.

- USB

This port is not supported at the time of writing (refer to the current Designer Help).

- SPDIF Out

A standard RCA coaxial cable may be connected for digital audio output from the Controller. 2-channel PCM audio is supported.

- Stereo Line Out

Two RCA connectors are provided for analog stereo audio output.

**CAUTION:** Ports and third party equipment can be damaged when plugging or unplugging an energised system (hot-plugging). Remove power before making or breaking port connections.

**ATTENTION:** Les ports et l'équipement d'un tiers peuvent être endommagés lors du branchement ou du débranchement d'un système sous tension (branchement à chaud). Enlever l'alimentation avant d'établir ou de rompre les connexions de port.

### SECTION 8 - RIO

#### 8.1 - RIO INSTALLATION

The Remote Input/Output Devices (RIO) are ancillary devices that provide additional input and output interfaces to a system. As such, they can not be used on their own but must have at least one Controller present on an Ethernet network to function.

The units are designed to be permanently installed in a control room/cupboard or DIN consumer unit. The enclosure and mounting complies with DIN43880 and EN60715 (35/7.5 rail) respectively.

The units are 100% solid state and have been qualified to operate in a dry environment:

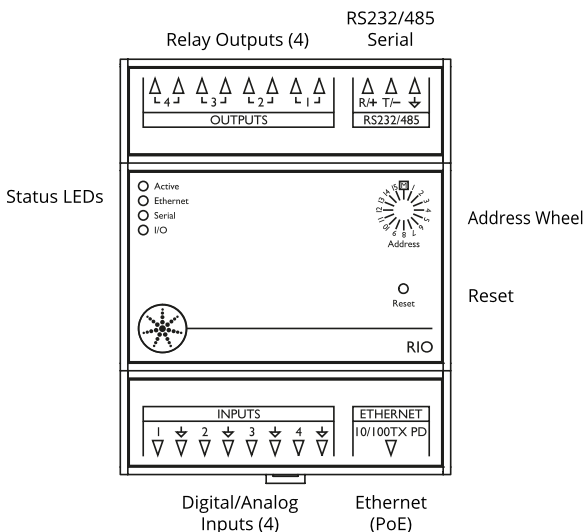
- Temperature range 0°C to 50°C (32°F to 122°F)
- Humidity 10-50% relative, non-condensing
- Ingress IP40

Sealed IP65 rated consumer units are available for outdoor use, please consult your Pharos distributor or representative.

**NOTE:** This equipment is not suitable for use in locations where children are likely to be present.

#### 8.2 - RIO LAYOUT

The following drawing illustrates the layout of a Remote Input/Output Device, refer to the following sections for details:



### 8.3 - RIO VERSIONS

There are five versions of the RIO available:

- RIO 80: 8 digital/analog inputs & RS232/485/DMX serial port.
- RIO 44: 4 digital/analog inputs, 4 relay outputs & RS232/485/DMX serial port (shown above).
- RIO 08: 8 relay outputs & RS232/485/DMX serial port.
- RIO A: Balanced stereo audio/timecode input & MIDI input/output ports.
- RIO D: DALI bus interface.

### 8.4 - POWER SUPPLY

- Power-over-Ethernet (PoE)

A standard (802.3af) Power-over-Ethernet switch should be used to provide both power and a network connection to the RIO using a single cable. Alternatively, if a PoE switch is not available, a PoE midspan injector could be used.

The RIO operates as a PoE Class 1 device (0.44-3.84W) and will typically consume 1.5W .

**NOTE:** Power must not be disconnected during firmware updates to the RIO as corruption of the software may occur, perhaps even rendering the unit inoperable.

**8.5 - GROUNDING**

The RIO is designed to be mounted on a grounded (earthed) DIN-rail, no dedicated Chassis ground (earth) terminal is provided.

The PoE connection (power and data) is completely isolated from all the RIO's ports but the ports are not isolated from each other (except relay outputs, RIO 44 and RIO 08 only).

**8.6 - STATUS LEDS**

The Pharos logo will illuminate when power is applied to the RIO. The red LEDs on the front of the RIO indicate the unit's current status. RIO versions will have related Status LEDs.

- |              |  |
|--------------|--|
| Active:      | The Active LED flashes slowly once the boot up procedure has completed to indicate a fully functional unit. Once the RIO has connected to a project running on a Controller, the Active LED will light continuously. |
| Ethernet:    | The Ethernet LED indicates Pharos-related network activity (not network link, see Ethernet port later).  |
| Serial:      | The Serial LED indicates RS232 or RS485 activity on the Serial port, if configured for Serial.   |
| I/O:         | The I/O LED indicates digital, analog, contact closure or relay activity on the Input/Output ports.  |
| MIDI:        | The MIDI LED indicates MIDI command/timecode activity on the MIDI port, if configured for MIDI.  |
| Audio / LTC: | The Audio / LTC LED indicates Audio/LTC activity on the Audio Input ports.   |
| DALI power   | The DALI power LED indicates that a DALI power supply has been detected on the bus. RIO D does not provide   |



	DALI power.
DALI data	The DALI data LED indicates DALI data activity on the DALI port.
DMX:	The DMX LED indicates that valid DMX512 data is being output from the DMX port.
Output:	The Output LED indicates that a valid project file has been loaded from the memory card on the connected TPC and that playback and data output has started.

## 8.7 - ERROR CODES

Additionally, the red status LEDs are used to indicate any boot failures of the RIO that prevent the unit from operating. Error codes are displayed by a repeating pattern of flashing all four LEDs a number of times in succession, followed by a 1 second pause:

1 flash:	Invalid firmware version (reload firmware from Designer)
2 flashes:	Invalid device type or serial number
3 flashes:	Internal memory test error
4 flashes:	Unable to perform factory restore due to corrupt factory firmware
5 flashes:	Current firmware is corrupt, no valid firmware versions available to restore
6 flashes:	Restored firmware is corrupt

Codes 2 through 6 indicate a hardware error; please consult your distributor, representative or Pharos Support for assistance.

## 8.8 - ADDRESS WHEEL

Multiple RIOs may be used on a single network. Each RIO is uniquely identified by its type (80, 44, 08 or A) and an address setting.

Wheel settings '1' to '15' directly set the RIO's address to the corresponding number. Up to 15 of each type may be addressed in this way. For systems with more than 15 RIOs of a single type, the manual ('M') setting should be used to allow identification using the RIO's serial number rather than the address.

### 8.9 - RESET SWITCH

The RIO may be reset by inserting a small blunt object into the reset hole on the front of the RIO to depress the reset switch. The switch should be held for at least one second.

**NOTE:** The reset must not be operated during firmware updates to the RIO as corruption of the software may occur, perhaps even rendering the unit inoperable.

### 8.10 - WATCHDOG

An internal "watchdog" will automatically reset the RIO in case of a software crash as a result of either a coding error ("bug") or a random electromagnetic event such as a power brown-out or spike, nearby lightning strike or static discharge.

### 8.11 - PORTS

- Digital/Analog Inputs (RIO 80 and RIO 44 only)

The RIO features 8 (RIO 80) or 4 (RIO 44) digital/analog inputs on two (RIO 80) or one (RIO 44) 8 way connectors. To connect an input signal to the RIO, one connection should be made to the desired input pin, marked '1' to '8' (RIO 80) or '1' to '4' (RIO 44), and the other should be made to the adjacent common pin.

The RIO inputs can be individually configured to operate in one of three modes:

**Contact closure:** An external volt-free switch may be connected between the input pin and the signal ground pin.

In this mode, the input pin is internally pulled-up to 5V via a 2.2Kohm resistor, so the switch only needs to be rated at 5V , 2.5mA or greater.

**Digital input:** An external voltage source (such as a 12VDC trigger output) may be connected between the input pin and the signal ground pin.

In this mode, the input pin is internally pulled down to 0V via a 2Mohm resistor and the maximum input voltage supported is 24VDC .

The RIO may be configured using Designer to specify what the 'high' and 'low' threshold voltages are. This facility can be used to provide 'Schmitt trigger' action.

**Analog input:** An external voltage source (such as a 0-10VDC analog signal) may be connected between the input pin and the signal ground pin.

In this mode, the input pin is internally pulled down to 0V via a 2Mohm resistor and the maximum input voltage supported is 24VDC .

The RIO may be configured using Designer to specify what the input voltage range is. Voltages inside this range are reported as 0% to 100%.

In all modes, the maximum rated input voltage is 24VDC . The inputs should never be driven with a higher voltage nor negative voltage or damage may occur.

- Relay Outputs (RIO 08 and RIO 44 only)

The RIO features 8 (RIO 08) or 4 (RIO 44) relay outputs on two (RIO 08) or one (RIO 44) 8 way connectors.

The RIO relays are rated at 48V (AC or DC), 250mA. This comparatively low rating is due to the use of solid-state relays to ensure silent operation and long-term reliability.

All relay outputs are fully isolated from each other (1kV) and all other ports.

**NOTE:** An external power supply is required to power the relay outputs. An external PSU can be used to power one or more relay outputs.

- RS232/RS485/DMX Serial Port (RIO 80, RIO 44 and RIO 08 only)

The serial port's protocol (RS232 or RS485), data rate and format settings (baud, parity, stop bits, etc.) are configured using Designer. The port can additionally be configured to output 96 channels of DMX512 control data (RDM is not supported).

In RS232 mode, the port operates in full duplex with the following pinout:

R/+ Receive

T/- Transmit

⏚ Signal ground

In RS485 & DMX modes, the port operates in half duplex with the following pinout:

R/+ Data +

T/- Data -







⏚ Signal Ground

- MIDI Input and Output (RIO A only)

The MIDI input and output connectors are standard 5 pin DIN connections. They may be connected directly to any standard MIDI device.

- Analog Audio Input (RIO A only)




Balanced stereo audio input is provided @ 0dBV line level on a 6 way connector:

-  Balanced audio right channel +
-  Balanced audio right channel - (tie to ground for unbalanced)
-  Signal ground
-  Balanced audio left channel +
-  Balanced audio left channel - (tie to ground for unbalanced)
-  Signal ground

The audio input can also accept linear time code (LTC) such as SMPTE/EBU on either channel but not both, configured using Designer. The Audio / LTC LED will indicate peak for audio and valid for time code.

- DALI (RIO D only)

A DALI bus interface is provided on a 3 way connector:

-  DALI bus (polarity insensitive)
-  DALI bus (polarity insensitive)
-  Chassis ground (for optional shield)

The DALI data LED will indicate valid data on the bus.

**NOTE:** The DALI bus requires a dedicated DALI bus power supply to function, the DALI power LED will illuminate solidly to indicate suitable (9-26V) power. The LED will be off for no power or flash to indicate out of range power.

- Ethernet

A standard 10/100TX Ethernet connection must be made to the RIO. A Power-overEthernet (PoE) switch or midspan injector is required to operate the RIO.

The LEDs on the RJ45 jack are useful for debugging the Ethernet installation: The Lnk LED will illuminate when an Ethernet link has been established. The Dat LED will illuminate to indicate Ethernet traffic (not just Pharos-relevant).

**NOTE:** Ports and third party equipment can be damaged when plugging or unplugging an energised system (hot-plugging). It is therefore advisable to remove power before making or breaking port connections.

### SECTION 9 - BPS

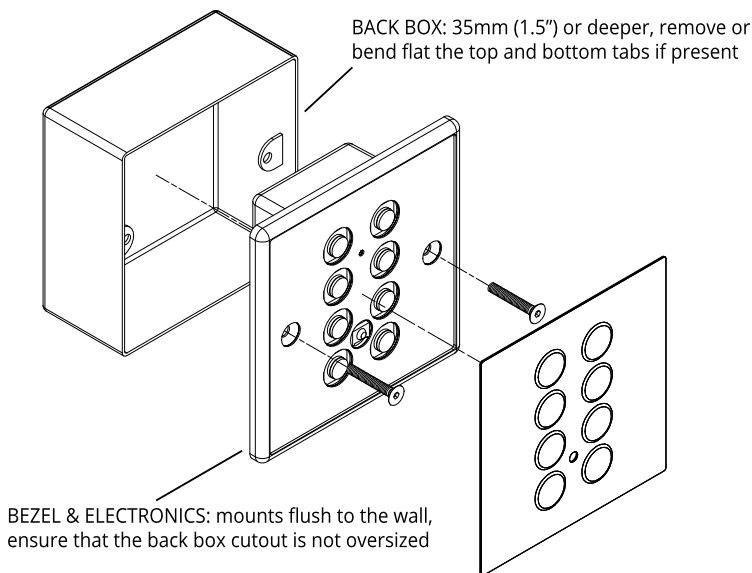
#### 9.1 - BPS INSTALLATION

The Button Panel Stations (BPS) are ancillary devices that provide user interfaces to a system. As such, they can not be used on their own but must have at least one Controller present on an Ethernet network to function.

The units are designed to be permanently installed into UK or US single-gang back boxes (supplied separately). The units are 100% solid state and have been qualified to operate in a dry environment:

- Temperature range 0°C to 50°C (32°F to 122°F)
- Humidity 10-50% relative, non-condensing
- Ingress IP40

The following drawing illustrates a typical installation (UK shown):



#### 9.2 - BPS VERSIONS

The BPS has a slimline bezel with magnetic overlay, in various bezel and overlay colours.

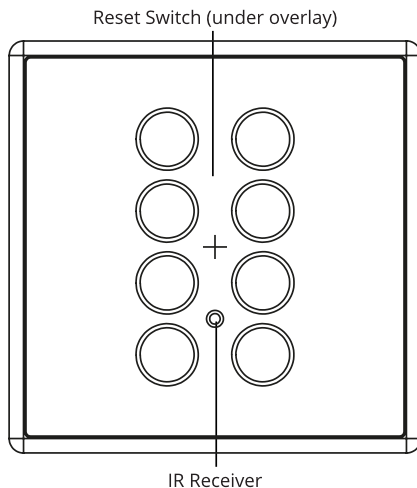
The BPS is available in two sizes:

UK - UK Single gang back box

US - US Single gang back box

### 9.3 - BPS LAYOUT

The following drawing illustrates the layout of a Pharos Button Panel Station (UK shown with overlay removed), refer to the following sections for details:



### 9.4 - POWER SUPPLY

- Power-over-Ethernet (PoE)

A standard (802.3af) Power-over-Ethernet switch should be used to provide both power and a network connection to the BPS using a single cable. Alternatively, if a PoE switch is not available, a PoE midspan injector could be used.

The BPS operates as a PoE Class 1 device (0.44-3.84W) and will typically consume 1.5W .

**NOTE:** Power must not be disconnected during firmware updates to the BPS as corruption of the software may occur, perhaps even rendering the unit inoperable.

### 9.5 - STATUS LEDS

The LEDs on the rear of the unit provide the following status information:

Pwr:	Power - illuminates when the unit is correctly powered.
Act:	Active - illuminates once the boot up procedure has completed and is indicative of a fully functional unit.
Net:	Network - illuminates when the unit is sending or receiving Pharos-related data.
Lnk:	Link - illuminates once the unit has established an Ethernet link.
100:	100BASE-TX - illuminates when the Ethernet link is operating at 100Mbit/s.

### 9.6 - ERROR CODES

Additionally, the red status LEDs are used to indicate any boot failures of the BPS that prevent the unit from operating. Error codes are displayed by a repeating pattern of flashing both LEDs a number of times in succession, followed by a 1 second pause:

1 flash:	Invalid firmware version (reload firmware from Designer)
2 flashes:	Invalid device type or serial number
3 flashes:	Internal memory test error
4 flashes:	Unable to perform factory restore due to corrupt factory firmware
5 flashes:	Current firmware is corrupt, no valid firmware versions available to restore
6 flashes:	Restored firmware is corrupt

Codes 2 through 6 indicate a hardware error; please consult your distributor, representative or Pharos Support for assistance.

### 9.7 - ADDRESS WHEEL

Multiple BPSs may be used on a single network. Each BPS is uniquely identified by its address setting.



Wheel settings '1' to '15' directly set the BPS's address to the corresponding number. Up to 15 BPSs may be addressed in this way. For systems with more, the manual ('M') setting should be used to allow identification using the BPS's serial number rather than the address.

## 9.8 - RESET SWITCH

The BPS may be reset by removing the magnetic overlay and inserting a small blunt object into the reset hole to depress the reset switch. The switch should be held for at least one second.

**NOTE:** The reset must not be operated during firmware updates to the BPS as corruption of the software may occur, perhaps even rendering the unit inoperable.

## 9.9 - WATCHDOG

An internal "watchdog" will automatically reset the BPS in case of a software crash as a result of either a coding error ("bug") or a random electromagnetic event such as a power brown-out or spike, nearby lightning strike or static discharge.

## 9.10 - LEARNING IR RECEIVER

The BPS may be taught to recognise up to 8 different IR codes from a standard infra red remote control. When a key on the remote control is pressed during normal operation, the BPS will react as though one of its 8 buttons has been pressed.

### 9.10.1 - TO ENTER LEARN MODE:

1. Enter by holding down the bottom two (or only two) buttons while pressing and releasing reset.
  - The buttons will display a clockwise chase sequence.
2. Release the two buttons.
  - Each button will flash quickly (4Hz) if an IR code has been learnt, or slowly (1Hz) if not.
  - No network communication will operate while in Learn Mode.
  - Learn Mode will automatically exit after 60 seconds of inactivity.

### 9.10.2 - TO LEARN AN IR CODE:

1. Briefly press and release a single button which should learn the IR code
  - The button will start flashing rapidly (8Hz) and the other buttons will extinguish.
2. Within ten seconds, point the IR remote at the BPS and press and hold the desired key.

- The buttons will display a clockwise chase sequence when the IR code has been learnt.
- 3. Release the key on the IR remote.
  - The button now will be flashing quickly (4Hz) to indicate that it has an IR code stored.

### **9.10.3 - TO ERASE AN IR CODE:**

1. Press and hold for three seconds the button which should erase its IR code.
  - The buttons will display a clockwise chase sequence when the IR code has been erased.
2. Release the button.
  - The button will now be flashing slowly (1Hz) to indicate that it has no IR code stored.

### **9.10.4 - TO TEST AN IR CODE:**

1. Point the IR remote at the BPS and press and hold the key to test.
  - The button(s) that has learnt this code will illuminate solidly, all others will extinguish.
2. Release the key and test the others.

### **9.10.5 - TO EXIT LEARN MODE:**

1. Press the reset button or wait for 60 seconds.
  - The buttons will now revert to normal operation.
  - Network communication will resume.

Note that the BPS does not have to be part of a networked Pharos system to learn IR codes, all that is required is PoE power and the donor IR remote control.

## SECTION 10 - TPS

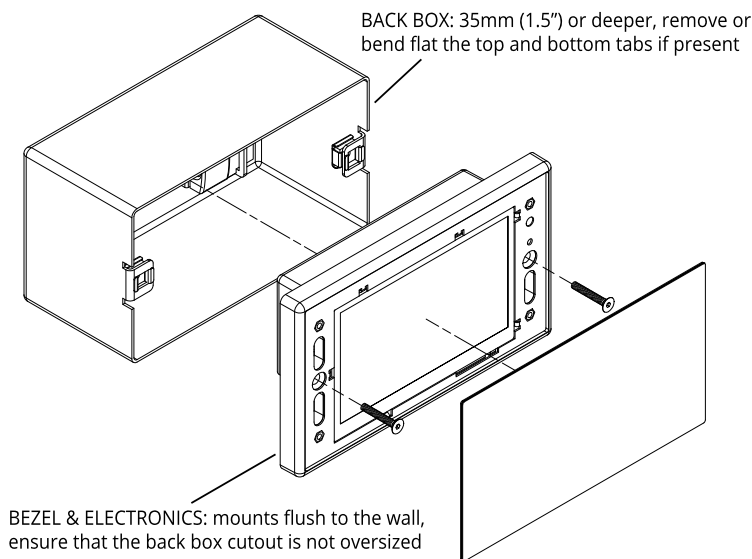
### 10.1 - TPS INSTALLATION

The Touch Panel Station (TPS) is an interface device with an integrated touch screen user interface. It is an ancillary device that provides a user interface to a system. As such, they can not be used on their own but must have at least one Controller present on an Ethernet network to function.

The units are designed to be permanently installed into UK double-gang or custom back boxes (supplied separately). The units are 100% solid state and have been qualified to operate in a dry environment:

- Temperature range 0°C to 50°C (32°F to 122°F)
- Humidity 10-50% relative, non-condensing
- Ingress IP40

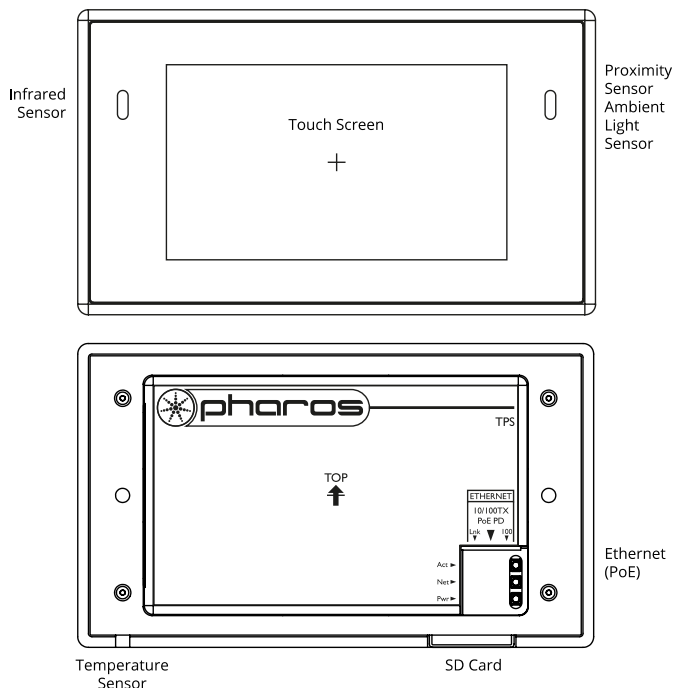
The following diagram illustrates a typical installation:



Carefully remove the protective films from the front of the liquid crystal display and the magnetic overlay before final assembly.

### 10.2 - TPS LAYOUT

The following drawing illustrates the layout of a Pharos Touch Panel Station, refer to the following sections for details:



### 10.3 - POWER SUPPLY

- Power-over-Ethernet (PoE)

A standard (802.3af) Power-over-Ethernet switch should be used to provide both power and a network connection to the TPS using a single cable. Alternatively, if a PoE switch is not available, a PoE midspan injector could be used.

A limited power source approved to UL60950-1 2nd Edition, CAN/CSA C22.2 No. 60950- 1.07 2nd Edition MUST be used, with an SELV output voltage. The TPS operates as a PoE Class 2 device (3.84-6.49W) and will typically consume 4W.

**NOTE:** Power must not be disconnected during firmware updates to the TPS as corruption of the software may occur, perhaps even rendering the unit inoperable.

#### 10.4 - REALTIME CLOCK BATTERY

The TPS's internal realtime clock is battery-backed to ensure operation when the unit is not powered. The battery should last for at least 10 years and is easily replaced when necessary, replacement battery: Renata CR2032 Lithium Button Cell.

**CAUTION:** Risk of explosion if battery replaced by incorrect type. Dispose of used batteries according to the manufacturer's instructions.

**ATTENTION:** Il y a un danger d'explosion s'il y a un remplacement incorrect de batterie. Mettre au rebut les batteries usages conformément aux instructions du fabricant.

#### 10.5 - MEMORY CARD

The TPS is shipped with a 2GB SD Memory Card. In the event of TPS hardware failure, simply moving the card into a replacement unit with identical or more recent firmware is sufficient to get the device up and running again.

#### 10.6 - STATUS LEDS

The LEDs on the rear of the unit provide the following status information:

Pwr:	Power - illuminates when the unit is correctly powered.
Act:	Active - illuminates once the boot up procedure has completed and is indicative of a fully functional unit.
Net:	Network - illuminates when the unit is sending or receiving Pharos-related data.
Lnk:	Link - illuminates once the unit has established an Ethernet link.
100:	100BASE-TX - illuminates when the Ethernet link is operating at 100Mbit/s.

The LEDs on the front of the unit (under the overlay) provide the following status information:

Pwr:	Power - illuminates when the unit is correctly powered.
------	---

- Act: Active - illuminates once the boot up procedure has completed and is indicative of a fully functional unit.
- Eth: Ethernet - illuminates when the unit is sending or receiving Pharos-related data.
- Out: Output - not currently used (except for error codes).

**10.7 - ERROR CODES**

Additionally, the red status LEDs are used to indicate any boot failures of the TPS that prevent the unit from going active. These codes are outlined below, and in all cases, the Power LED will remain on and the Active LED will be off.

- Ethernet + Output double flashing: Memory card missing (insert or replace card).
- Ethernet + Output triple flashing: Internal flash error (contact our support).

**10.8 - RESET SWITCH**

The TPS may be reset by removing the magnetic overlay and pressing the reset switch. The switch should be held for at least one second.

**NOTE:** The reset must not be operated during firmware updates to the TPS as corruption of the software may occur, perhaps even rendering the unit inoperable.

**10.9 - CONFIG SWITCH**

The TPS may be placed in a configuration mode by removing the magnetic overlay and pressing the config switch, refer to Designer Help for instructions.

**10.10 - WATCHDOG**

An internal "watchdog" will automatically reset the TPS in case of a software crash as a result of either a coding error ("bug") or a random electromagnetic event such as a power brown-out or spike, nearby lightning strike or static discharge.

**10.11 - LEARNING IR RECEIVER**

The TPS may be taught to recognise different IR codes from a standard infra red remote control, refer to Designer Help for instructions.

## 10.12 - TEMPERATURE SENSOR

The Temperature Sensor can be used to measure the ambient temperature around the TPS.

**NOTE:** The Temperature Sensor cutout is not a release catch and attempting to use it as such will result in damage to the unit, perhaps even rendering the unit inoperable.

### SECTION 11 - POE

#### 11.1 - POE INSTALLATION

The Pharos 2+4 port Power-over-Ethernet Switch (POE) is designed to be permanently installed in a central control room/cupboard or DIN consumer unit for remote deployment. The enclosure and mounting complies with DIN43880 and EN60715 (35/7.5 rail) respectively.

This guide relates to units with serial numbers greater than 021001. For a legacy POE with a lower serial number please refer to earlier versions of this installation guide.

The unit is 100% solid state and has been qualified to operate in a dry environment:

- Temperature range 0°C to 50°C (32°F to 122°F)
- Humidity 10-50% relative, non-condensing
- Ingress IP40

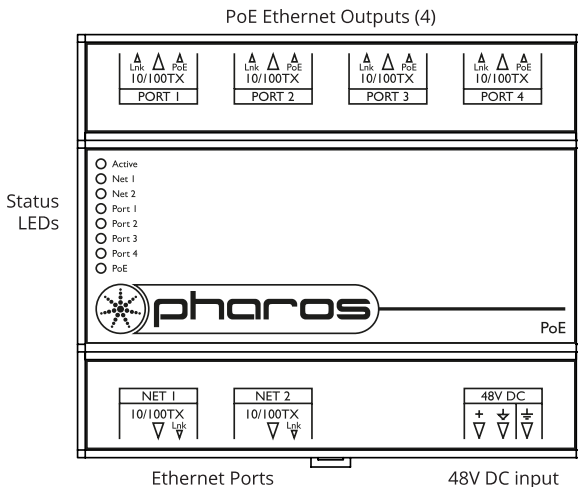
Sealed IP65 rated consumer units are available for outdoor use, please consult your Pharos distributor or representative.

**NOTE:** This equipment is not suitable for use in locations where children are likely to be present.

#### 11.2 - POE LAYOUT

The following drawing illustrates the layout of the POE, refer to the following sections for details:





### 11.3 - POWER SUPPLY

- DC power (48V)

A limited power source approved to UL60950-1 2 Edition, CAN/CSA C22.2 No. 60950nd1.07 2 Edition MUST be used, with an output voltage of 48V DC.

Such a power supply can be connected directly to the POE using the DC Input connector. The pins on this connector are marked:

- + Positive input (48V DC)
- ⚡ Signal ground (0V)
- ⚡ Chassis ground (earth)

The power supply should be connected to the Positive and Signal ground inputs, ensuring the polarity is correct.

### 11.4 - POWER SUPPLY CHOICE & POE LOADING

The choice of power supply, in terms of its power rating, depends on the intended loading of the four PoE ports.

If the intention is to supply four Class 1 devices (for example RIO or BPS) then a 24W (48V @ 0.5A) supply will suffice.

If, however, the intention is to supply four Class 2 devices (for example LPC) then a 48W (48V @ 1A) supply will be required.

SECTION 11 - POE

The power supply must provide 48V, with an appropriate current and power rating for the devices.

The POE is capable of powering up to four IEEE 802.3af Class 1,2 and 3 and IEEE 802.3at Class 4 (Type 2) devices, the power supply required can be calculated using the table below:

Class	Example Pharos Devices	Maximum PSU Power Consumption
1	RIOs, BPS	4W
2	LPC, TPC, TPS	7W
3	None	15.4W
4	None	30W

E.g. to power 1 LPC, 1 TPC and 2 RIOs, the minimum required power would be:

$7+7+(2*4) = 22\text{ W}$

PoE Ports include overcurrent protection for the detected PoE class

Multiple POEs may be powered by a single power supply provided its rating is increased accordingly.

11.5 - GROUNDING

The POE is designed to be mounted on a grounded (earthed) DIN-rail and a dedicated Chassis ground (earth) terminal is also provided which should be connected to a suitable earth.

11.6 - STATUS LEDS

The Pharos logo will illuminate when power is applied to the POE. The red LEDs on the top of the POE indicate the unit's status:

- Active: Indicates that the unit is functional.
- Net 1-2: Illuminates when the Ethernet link has been established and toggles off to indicate data.
- Port 1-4: Illuminates when the link has been established and toggles off to indicate data.
- PoE: Indicates any activity on PoE Ports.

11.7 - PORTS

- Ethernet and PoE Ports

The POE includes 2 standard 10/100TX ports for communication with non-PoE devices, and 4 PoE capable 10/100TX ports to provide power and communication to PoE powered devices. The LEDs on the RJ45 port itself are useful for debugging the Ethernet installation:

Green (solid for link, flash for data)

Yellow (solid for PoE, slow flash for PoE detect error, fast flash for current error)

SECTION 12 - EDN

12.1 - EDN INSTALLATION

The Ethernet Data Node (EDN) is an ancillary device that provided additional DMX/RDM Output ports to a system. As such, it can not be used on their own but must have at least one Controller present on an Ethernet network to function.

The unit is designed to be rack mounted in a central control room for fixed installations. The 1U enclosure and 19" rack mounting comply with IEC 60297.

The unit is 100% solid state and has been qualified to operate in a dry environment:

- Temperature range 0°C to 50°C (32°F to 122°F)
- Humidity 10-50% relative, non-condensing
- Ingress IP20

**NOTE:** This equipment is not suitable for use in locations where children are likely to be present.

12.2 - POWER SUPPLY

The EDN is mains powered via an internally fused, universal input power supply unit (PSU) compatible with all worldwide mains supply standards; 100-240V (AC) 50/60Hz. The EDN typically consumes 25W with maximum 30W.

**CAUTION:** For pluggable equipment, the socket outlet shall be installed near the equipment and shall be easily accessible.

Use only recognized / certified jacketed cord of types:

UK: BS 1363, IEC 60320/C13 (IEC/C13), 250V, 5A

US: NEMA 5-15P, IEC 60320/C13 (IEC/C13), 125V, 10A

EU: CEE 7/7, IEC 60320/C13 (IEC/C13), 250V, 16A

**ATTENTION:** En cas d'équipement enfichable, la prise doit être montée près de l'équipement et doit offrir un accès facile.

Utilisez uniquement les types de cordon gainé reconnus / certifiés de:

UK: BS 1363, IEC 60320/C13 (IEC/C13), 250V, 5A

US: NEMA 5-15P, IEC 60320/C13 (IEC/C13), 125V, 10A

EU: CEE 7/7, IEC 60320/C13 (IEC/C13), 250V, 16A

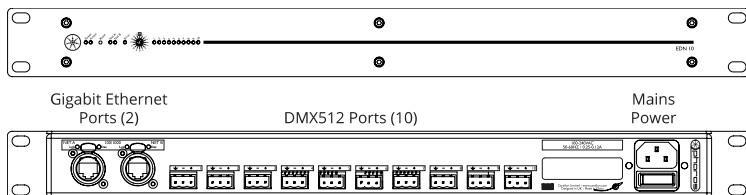
## 12.3 - GROUNDING

The EDN must be correctly grounded to electrical safety earth at all times.

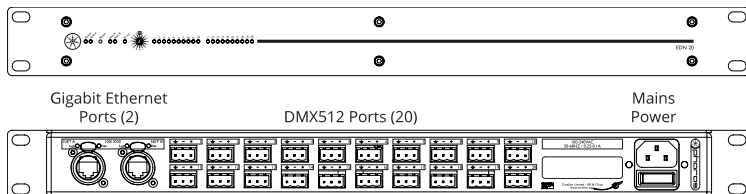
## 12.4 - EDN LAYOUT

The following drawings illustrate the layout of the EDN 10 and EDN 20, refer to the following sections for details:

### 12.4.1 - EDN 10



### 12.4.2 - EDN 20



## 12.5 - STATUS LEDs

Power:	Indicates the EDN is receiving power.
Active:	Indicates the EDN has booted and has the firmware up and running.
Net A:	Indicates activity on the Net A connection.
Net B:	Indicates activity on the Net B connection.
Error:	Indicates an error in the EDN. If flashing it indicates an Ethernet error (check connection).
1-10/20:	Indicates output on the corresponding data port.

**12.6 - ERROR CODES**

Additionally, the red status LEDs are used to indicate any boot failures of the EDN that prevent the unit from operating. Error codes are displayed by a repeating pattern of flashing all four LEDs a number of times in succession, followed by a 1 second pause:

1 flash:	Invalid firmware version (reset to factory default required)
2 flashes:	Invalid device type or serial number
3 flashes:	Hardware fault with mezzanine card

The second error code indicates a hardware error; please consult your distributor, representative, or Pharos Support for assistance.

**12.7 - ADDRESS WHEEL**

Multiple EDNs may be used on a single network. Each EDN is uniquely identified by its address setting.

Wheel settings '1' to '15' directly set the EDN's address to the corresponding number. Up to 15 EDNs may be addressed in this way. For systems with more than 15 EDNs, the manual ('M') setting should be used to allow identification using the EDN's serial number rather than the address.

**12.8 - RESET SWITCH**

The EDN may be reset by inserting a small blunt object into the reset hole on the front of the EDN to depress the reset switch. The switch should be held for at least one second.

The reset must not be operated during firmware updates to the EDN as corruption of the software may occur, perhaps even rendering the unit inoperable.

**12.9 - PORTS**

- Net A

A standard 100/1000BASE-T Ethernet connection may be made to this port for connecting to the wider Pharos system and receiving the lighting data.

- Net B

A standard 100/1000BASE-T Ethernet connection may be made to this secondary port, which allows additional EDN units to be daisy-chained onto

the same network for convenience. We recommend a limit of 8 daisy-chained EDNs to maintain high-performance playback.

This should **NOT** be connected to the same switch/network as Net A, as will create a network loop.

- 1-10/20 data ports.

Ten (EDN 10) or Twenty (EDN 20) DMX outputs are provided. The pins on these connectors are marked:

- + Data + ('Hot' or 'True')
- Data - ('Cold' or 'Complement')

⇓ Shield

To make up a cable to a 5 pin XLR the following connections should be made:

EDN: 5 pin XLR:

Data +	+	3
Data -	-	2
Shield	⇓	1

The data ports are fully isolated from the EDN's ground connection and each other.

## 12.10 - DMX & RDM GUIDELINES

The EDN is compatible with the DMX512, DMX512(1990), and DMX512-A standards and care should be taken to ensure that your cabling, wiring topology and termination also complies with these standards.

Such compliance is beyond the scope of this document but a good resource is "Recommended Practice in DMX 512" by Adam Bennette which is available through PLASA and USITT.

### SECTION 13 - SDI

#### 13.1 - SDI INSTALLATION

The Serial Data Interface (SDI) is an ancillary device that provides serial output to a system. As such, it cannot be used on its own but must have at least one Controller and one EDN (Ethernet Data Node) present in order to function.

The SDI is designed to be installed close to the desired LED fixtures, connected to the EDN via an RS485 connection at lengths determined by the output protocol type (see SDI Topology). The unit is designed to be DIN mounted. The enclosure and mounting complies with DIN43880 and EN60715 (35/7.5 rail) respectively, with an additional keyhole hook on the back for easy mounting next to fixtures.

The unit has been qualified to operate in a dry environment:

- Temperature range 0°C to 50°C (32°F to 122°F)
- Humidity 10-50% relative, non-condensing
- Ingress IP40

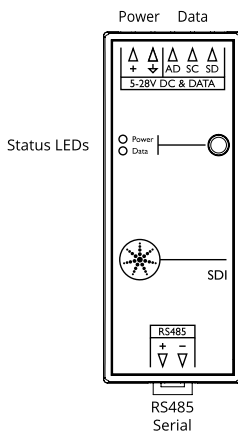
Since the units do not require user intervention once installed, they are suitable for remote installation. However, it is recommended that access can be gained in the unlikely event of a hardware failure.

**NOTE:** This equipment is not suitable for use in locations where children are likely to be present.

#### 13.2 - SDI LAYOUT

The following drawing illustrates the layout of an SDI, refer to the following sections for details:





### 13.3 - POWER SUPPLY

The units are shipped without external power supply.

The unit can be powered by DC power (5 to 28V).

Limited power source approved to:

- UL60950-1 2nd Edition, CAN/CSA C22.2 No. 60950-1.07 2nd Edition or
- UL 62368-1, CAN/CSA C22.2 No. 62368-1 or
- EN 60950-1, EN 62368-1

MUST be used, with an output voltage of 5 to 28V DC. The unit will typically consume 0.6W and an appropriate power supply must be used.

+ Positive input (5 to 28V DC)

↓ Signal ground (0V)

The power supply should be connected to the Positive and Signal ground inputs, ensuring the polarity is correct.

### 13.4 - GROUNDING

The incoming RS485 data signal is fully isolated and does not need a ground reference.

### 13.5 - STATUS LEDs

The status LEDs of the SDI will default to off to remain unobtrusive but can be turned on momentarily by pressing the button on the device to display current

status. All information below assumes the button is being pressed.

Power:	The Power LED will illuminate when power is applied to the EDN.
Data:	The Data LED indicates the EDN is receiving data from the EDN.

### 13.6 - PORTS

- RS485 Serial Port

This port requires a direct connection to the EDN and cannot be used for daisy-chaining multiple SDIs off the same EDN output.

The port operates in full duplex with the following pinout:

R/+ Receive

T/- Transmit

- Data Ports

The pins on this connector are marked:

AD: Asynchronous Data

SD: Synchronous Data

SC: Synchronous Clock

If the desired protocol is Asynchronous, only AD needs to be connected. If the protocol is Synchronous (SPI), both SD and SC need to be connected. AD and SD/SC should not be connected at the same time.

### 13.7 - SDI TOPOLOGY

Depending on the protocol used, the SDI must be connected to the EDN via a cable below a certain length:

- The protocol is synchronous (SPI), the cable must be no longer than 40m.
- If the protocol is asynchronous, the cable must be no longer than 200m.

Connecting the SDI to the first LED or IC of your fixtures must not exceed the length of 2m.

## SECTION 14 - RDM

### 14.1 - RDM INSTALLATION

The Pharos 1+4 port DMX512 Repeater (RDM) is designed to be permanently installed in a central control room/cupboard or DIN consumer unit for remote deployment. The enclosure and mounting complies with DIN43880 and EN60715 (35/7.5 rail) respectively.

The unit is 100% solid state and has been qualified to operate in a dry environment:

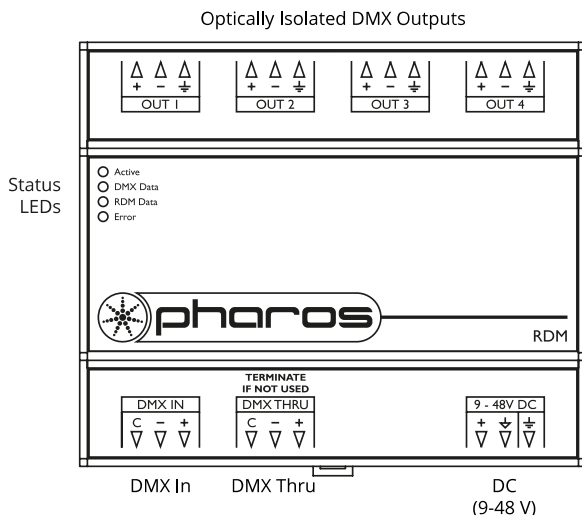
- Temperature range 0°C to 50°C (32°F to 122°F)
- Humidity 10-50% relative, non-condensing
- Ingress IP40

Sealed IP65 rated consumer units are available for outdoor use, please consult your Pharos distributor or representative.

**NOTE:** This equipment is not suitable for use in locations where children are likely to be present.

### 14.2 - RDM LAYOUT

The following drawing illustrates the layout of the RDM, refer to the following sections for details:



### 14.3 - POWER SUPPLY

- DC power (9 to 48V)

A limited power source approved to UL60950-1 2 Edition, CAN/CSA C22.2 No. 60950nd1.07 2 Edition MUST be used, with an output voltage of 9 to 48V DC.

Such a power supply can be connected directly to the RDM using the DC Input connector . The pins on this connector are marked:

- + Positive input (9 to 48V DC)
- ⚡ Signal ground (0V)
- ⏏ Chassis ground (earth)

The power supply should be connected to the Positive and Signal ground inputs, ensuring the polarity is correct.

The RDM will typically consume 4W with all ports fully loaded.

### 14.4 - GROUNDING

The RDM is designed to be mounted on a grounded (earthed) DIN-rail and a dedicated Chassis ground (earth) terminal is also provided which should be connected to a suitable earth.

### 14.5 - STATUS LEDS

The Pharos logo will illuminate when power is applied to the RDM. The red LEDs on the top of the RDM indicate the unit's status:

- |           |   |
|-----------|---|
| Active:   | Indicates that the unit is functional.                          |
| DMX data: | Illuminates when DMX data is being routed (input to all ports). |
| RDM data: | Illuminates when RDM data is being routed (a port to input).    |
| Error:    | Flashes to indicate an error condition.                         |

### 14.6 - PORTS

- DMX Inputs

One DMX In port is provided for the universe that is to be repeated.

The pins on these connectors are marked:

- + Data + ('Hot' or 'True')
- Data - ('Cold' or 'Complement')
- C Data Common (shield)

- DMX Thru

One DMX Thru port is provided to allow the universe to be passed on to further RDM units in a daisy-chain. Terminate if end of line.

The pins on these connectors are marked:

- + Data + ('Hot' or 'True')
- Data - ('Cold' or 'Complement')
- C Data Common (shield)

- DMX Outputs

Four DMX output ports are provided.

The pins on these connectors are marked:

- + Data + ('Hot' or 'True')
- Data - ('Cold' or 'Complement')
- ⏏ Chassis ground (shield)

To make up a cable to a 5 pin XLR the following connections should be made:

LPC: 5 pin XLR:

Data +	+	3
Data -	-	2
Shield	⏏	1

The DMX ports are by default not isolated from the RDM's ground connection which is the recommended configuration for driving isolated inputs - the majority of DMX receivers.

## 14.7 - DMX THRU TERMINATION

If the DMX Thru connection is not being used to daisy-chain to other DMX devices then the supplied termination resistor **MUST** be fitted to ensure data integrity.

### **14.8 - DMX & RDM GUIDELINES**

The RDM is compatible with the DMX512, DMX512(1990), DMX512-A and RDM 1.0 standards and care should be taken to ensure that your cabling, wiring topology and termination also complies with these standards.

Such compliance is beyond the scope of this document but a good resource is "Recommended Practice in DMX 512" by Adam Bennette which is available through PLASA and USITT .

## SECTION 15 - CXD

### 15.1 - CXD INSTALLATION

The Pharos LED Drivers (CxD) are ancillary devices that provide direct LED control. As such, they can not be used on their own but must have at least one Controller (LPC 1/2/4) or Remote Input/Output Device (RIO 80/44/08) present to provide the DMX control data.

The units are designed to be permanently installed in a central control room/cupboard or DIN consumer unit for remote deployment. The enclosure and mounting complies with DIN43880 and EN60715 (35/7.5 rail) respectively.

The units are 100% solid state and have been qualified to operate in a dry environment:

- Temperature range 0°C to 50°C (32°F to 122°F)
- Humidity 10-50% relative, non-condensing
- Ingress IP40

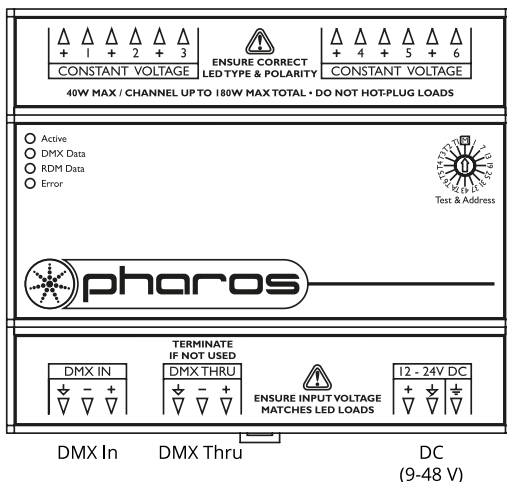
Sealed IP65 rated consumer units are available for outdoor use, please consult your Pharos distributor or representative.

**NOTE:** This equipment is not suitable for use in locations where children are likely to be present.

### 15.2 - CXD LAYOUT

The following drawing illustrates the layout of the CxD, refer to the following sections for details:

## LED Outputs

Status  
LEDs

## 15.3 - CXD VERSIONS

There are four versions of the CxD available:

- CVD: 6 channel constant voltage LED driver (shown above), 12-24V DC input.
- CCD 350: 6 channel constant 350mA current LED driver, 15-48V DC input.
- CCD 500: 6 channel constant 500mA current LED driver, 15-36V DC input.
- CCD 700: 6 channel constant 700mA current LED driver, 15-24V DC input.

## 15.4 - POWER SUPPLY

- DC power (12 to 48V dependant on version and LED loading)

A limited power source approved to UL60950-1 2 Edition, CAN/CSA C22.2 No. 60950nd1.07 2 Edition MUST be used, with an output voltage of 12 to 48V DC. Such a power supply can be connected directly to the CxD using the DC Input connector . The pins on this connector are marked:

- + Positive input (9 to 48V DC)
- ⬇ Signal ground (0V)
- ⬆ Chassis ground (earth)



The power supply should be connected to the Positive and Signal ground inputs, ensuring the polarity is correct.

The CxD will consume 200W maximum with all channels fully loaded at full intensity.

## 15.5 - GROUNDING

The CxD is designed to be mounted on a grounded (earthed) DIN-rail and a dedicated Chassis ground (earth) terminal is also provided which should be connected to a suitable earth.

## 15.6 - STATUS LEDS

The Pharos logo will illuminate when power is applied to the CxD. The red LEDs on the top of the CxD indicate the unit's status:

Active:	Indicates that the unit is functional.
DMX data:	Illuminates when DMX data is being received.
RDM data:	Illuminates when RDM data is being transmitted.
Error:	Flashes to indicate an error condition.

## 15.7 - DMX THRU TERMINATION

If the DMX Thru connection is not being used to daisy-chain to other DMX devices then the supplied termination resistor MUST be fitted to ensure data integrity.

## 15.8 - DMX & RDM GUIDELINES

The CxD is compatible with the DMX512, DMX512(1990), DMX512-A and RDM 1.0 standards and care should be taken to ensure that your cabling, wiring topology and termination also complies with these standards.

Such compliance is beyond the scope of this document but a good resource is "Recommended Practice in DMX 512" by Adam Bennette which is available through PLASA and USITT .

## 15.9 - TEST & ADDRESS WHEEL

Wheel settings '1' to '43' directly set the CxD's DMX start address to the corresponding channel number. Alternatively, use the managed ('M') setting to set the DMX start address via the RDM protocol (see Designer Help for details) in which case the CxD can be addressed to any DMX channel number.

Wheel settings 'T1' to 'T6' and 'TA' provide test facilities for the installer by bringing the corresponding channel or all channels to 25%. The DMX control data is ignored

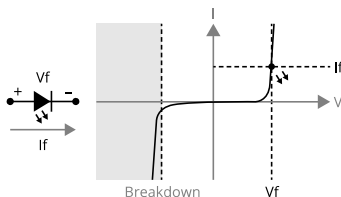
when testing channels in this way. Note that there is a small delay (0.5sec) in the response of the wheel to avoid intermediate settings taking effect.

### 15.10 - LED FIXTURE TYPES (LOW VOLTAGE ARCHITECTURAL ONLY)

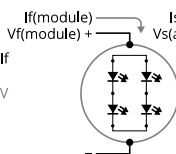
LED fixtures are totally unlike conventional lighting fixtures due to the behaviour of the semiconducting Light Emitting Diode (LED) itself:

- Correct polarity must be observed to avoid “breakdown”
- Specified forward voltage ( $V_f$ ) must at least be applied (the LED will “drop”  $V_f$ )
- Specified drive current ( $I_f$ ) must be carefully maintained
- Dimming is achieved by “chopping” the drive current, typically by PWM
- Thermal management is critical for long life and reliability, choose your fixtures well

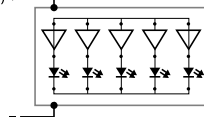
LED fixtures typically comprise either one or more LEDs in a module (“light engine”) or as an array on a substrate, commonly a flexible “tape” that can be cut to the desired length. This is the first important distinction to make since the former require a constant current driver (the fixture is just LEDs) and the latter a constant voltage driver (the fixture includes current control electronics):



LED Symbol & Voltage vs Current Graph



LED Module



LED Array

So before you can select the correct LED driver you must determine the fixture type and then gather the drive characteristics from the manufacturer:

#### LED MODULE - CONSTANT CURRENT DRIVE

- Module forward current  $I_f(\text{module})$  which is typically 350, 500 or 700mA
- Module forward voltage  $V_f(\text{module})$  which is module power divided by  $I_f(\text{module})$

#### LED ARRAY - CONSTANT VOLTAGE DRIVE

- Array supply voltage  $V_s(\text{array})$  which is typically 12 or 24V
- Array power dissipation  $P_s(\text{array})$  which is determined by its size/length (eg. Watt/metre)

Colour changing fixtures just have multiple instances of these LED arrangements, one for each colour, typically three (RGB) so requiring three driver/DMX channels to control. Note that with colour changing LED fixtures the anodes (+) are connected together and the cathodes (-) individually driven since LED current switching occurs on the negative side. Beware colour coded cables as there is no standard coding system.

### 15.11 - FIXTURE GANGING

It is often desirable to gang fixtures together onto one driver/DMX channel and here again the fixture type determines how this is done and what needs to be determined:

#### LED MODULE - GANG IN SERIES

- All modules must have the same forward current  $I_f(\text{module})$  to be ganged
- Determine the total forward voltage drop  $V_f(\text{total})$  by summing the  $V_f(\text{module})$ s
- It is helpful to end up with similar  $V_f(\text{total})$ s for each gang of arrays

#### LED ARRAY - GANG IN PARALLEL

- All arrays must have the same supply voltage  $V_s(\text{array})$  to be ganged
- Determine the total power load  $P_s(\text{total})$  by summing the  $P_s(\text{array})$ s
- It is helpful to end up with similar  $P_s(\text{total})$ s for each gang of arrays

### 15.12 - CXD VERSION & POWER SUPPLY SELECTION

Once you have determined the fixture types, drive characteristics and ganging requirements you can select the appropriate drivers & power supplies:

#### LED MODULE - GANG IN SERIES - CONSTANT CURRENT

- Use the CCD 350, 500 or 700 for 350, 500 or 700mA  $I_f(\text{module})$  drive respectively
- Choose a power supply such that  $V_{in}$  is slightly greater (2-3V) than the maximum  $V_f(\text{total})$
- The more that  $V_{in}$  exceeds  $V_f(\text{total})$  per channel then the worse the efficiency

#### LED ARRAY - GANG IN PARALLEL - CONSTANT VOLTAGE

- Use the CVD ensuring that each channel load is 40W maximum or 180W in total
- Choose a power supply such that  $V_{in}$  equals  $V_s(\text{array})$
- Choose a power supply capable of supplying the total load, sum of each  $P_s(\text{total})$

- Long cables decrease efficiency, split up large arrays to avoid visible drooping

That all being said, ganging is an iterative process based on zoning requirements and driver & power supply choices with the highest system efficiency and lowest cost being the overall target. It is often sensible to start with the constant voltage power supply requirement and use that for the constant current supply as well to standardise on a power supply but this is not a requirement. You should also not balk at selecting the LED fixtures themselves to fit into your overall system.

Further, consider distributing the LED drivers & power supplies to be close to the fixtures themselves to minimise cabling and cable losses (constant voltage) and maximise flexibility, particularly when it comes to refits. Finally it is advisable to use multiple low-power power supplies, perhaps one per 6 channel driver, rather than a centralised high-power approach.

## WARRANTY

Pharos Architectural Controls Limited (Pharos) products are warranted for a period of five (5) years from the original date of purchase against defective materials and workmanship.

This warranty is subject to the terms, conditions and exclusions available at [www.pharoscontrols.com/legal](http://www.pharoscontrols.com/legal)

## COMPLIANCE

The Pharos Architectural Controls Limited product range is manufactured to the highest quality in compliance with the following international standards:

## ENCLOSURE AND MOUNTING

- EN60715: Top hat section (TH) 35-7.5mm & 35-15mm DIN rail.
- DIN 43 880: Built-in equipment for electrical installations; Frame size 1.
- IEC 60297: 19" rack mounting enclosures.
- IP40 / IP20 rated.

## ELECTROMAGNETIC COMPATIBILITY

- 2014/30/EU (EMC)
- 2014/35/EU (LVD)

## SAFETY

- UL 62368-1 and CAN/CSA C22.2 No. 62368-1
- UL 60950-1 and CAN/CSA C22/2 No. 60950-1

## ENVIRONMENTAL

- 2011/65/EEC (RoHS)
- 2012/19/EU (WEEE)



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