digiLED ZEUS™

User Manual

Version 1.91

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NOTE: Technical images are blurred. For more information please email: hellozeus@digiled.com

Introduction

digiLED ZEUS™ is an Eco Power Management System plus plus[1] for giant LED screens or similar equipment. Using patented British technology, for the first time it enables Screen owners to easily and safely power-up their LED screens without concerns about overload and in-rush.

ZEUS™ systems are made up of two types of device:

- The ZEUS™ Cards (or Nodes) that are local to the LED screen panels.
- The ZEUS™ Head End that controls all the Nodes.

ZEUS™ Cards are a small credit card sized PCB that are installed either inside the LED panel or in a small external package, local to the outside of every panel. The ZEUS™ Cards are then networked together with Cat5e cable and connected in a daisy chain to the Head End in the control rack.

Figure 1 - Crew installing a digiTHIN HD Screen with ZEUS™

The Head End component of the patented digiLED ZEUS™ System is the gateway between IP/LAN control and the hardware installed in the LED screen itself. digiLED offer solutions that are custom built by digiLED or alternatively, if clients choose, they can use off the shelf Power Over Ethernet equipment to operate ZEUS™.

This document describes the processes to install, commission, program and use the ZEUS system.

[1] There are many more features to ZEUS than just Power Management – Please see Appendix 2

Copyright and Legal

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Registered in England & Wales 4969679

Safety Considerations

digiLED equipment should only be used by competent and qualified personnel.

Screen construction activities should only be undertaken by competent technicians with screen rigging experience. Screen cabling activities should only be undertaken by technicians with suitable electrical and wiring experience.

All personnel involved in the screen installation process must be of sound health and drug and alcohol free.

If in doubt about any part of the screen cabling or construction, work should be stopped.

Advice should be sought until the query has been resolved as per digiLED technical advice and support.

Installation Warning

CAUTION [2]

Never install a ZEUS Head End unit with its ac power connected to an Uninterruptable Power Supply (UPS) [2]

2

Electrical Safety

Please note that a screen with a digiLED ZEUS™ system will have 2 types of AC power feed.

- The AC power to the LED screen panels.
- The AC power to the ZEUS™ Head End device.

Take care when following instructions about the switching of AC power circuits that the operator is aware of the two different types. **In particular, the operator should be aware and understand that just because a ZEUS™ system is powered down, this does not mean that there is no high voltage AC power present in the LED panel.**

[2] Why? See Appendix 3

It is for this reason that digiLED must reinforce the importance of ZEUS™ equipment only being installed and operated by competent and qualified personnel.

Screen owners and operators should conduct their own risk assessment around the nature of remotely operated electrical equipment.

In some locations it may be preferable to include a warning sign close to the LED screen that reads similarly to this example:

> **This equipment is remotely controlled and may start without warning.**
>
> **No personnel should work on this equipment without understanding and isolating the systems that trigger this remote function.**

How ZEUS™ is Used

Example 1

A screen installed in the foyer of an office is intended to switch off at 8pm and remain off until the next morning at 6am.

In this scenario, ZEUS™ would be schedule-programmed to automatically execute this off / on cycle for every day of the year required. Weekends use different operational hours, but this too can be programmed in using different schedules for certain days of the week.

The programming of this example is detailed later in this document.

Example 2

A screen installed at a cricket club is only required to work when matches are taking place in the stadium.

In this scenario, the event staff for the match-day AV would use the ZEUS™ App on their PCs, iPADs or mobile phones to manually operate the remotely networked ZEUS™ equipment to turn on the screen well in advance of the match starting. Once the event is finished, the same staff would power-down the LED screen as part of their wrap-up activities at the end of the day.

Example 3
An LED billboard operator has a planning restriction placed on their screen that specifies a screen black-out between the hours of midnight and 6am.

In this scenario, ZEUS™ would be schedule programmed to power-down the screen at 1 minute past midnight (the media player would have started playing black at midnight exactly).

The following morning, ZEUS™ would power-up the LED at 05.55am.

Because the media player is playing black video until 6am, this power-up would be invisible to the viewer but the screen operator would have saved thousands of pounds of electricity in the year, simply by removing wasteful overnight power-draw from the screen.

Components & Parts Description

Overview

Two main components exist within a ZEUS system

- The Head End
- The ZEUS Nodes

The Head End is the controlling device that receives the ON / OFF commands over a network connection and communicates this to the Nodes.

The Nodes are typically installed inside the screen cabinets and are wired in a daisy-chain style, all fed by the Head End.

At present, there are 3 versions of Head End available and 4 versions of Node.

Head End – 4 Port, Rack Mount Z20.01.A

The standard[3] Head End (model Z20.01.A) is a 2u 19-inch rack mount device.

When installed in a rack it will occupy 2u of rack heigh (88.9mm) and require a depth of 307mm.

The Head End contains a web-relay that is controlled over IP or similar. The web-relay in turn activates the output feeds to the ZEUS™ circuits – a Cat5[4] transported high-gain variant of PoE.

The front and rear panel features are detailed below:

[3] Larger devices can be commissioned if required when screens are ordered.
[4] Or better Cat type cable system.

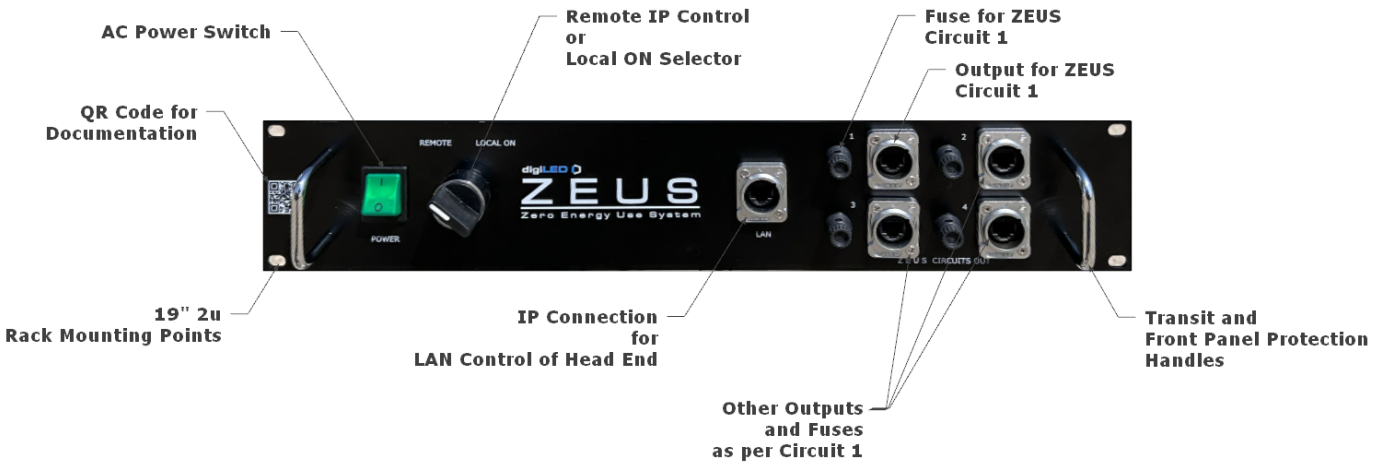


Figure 2 - ZEUS™ Head End Front Panel

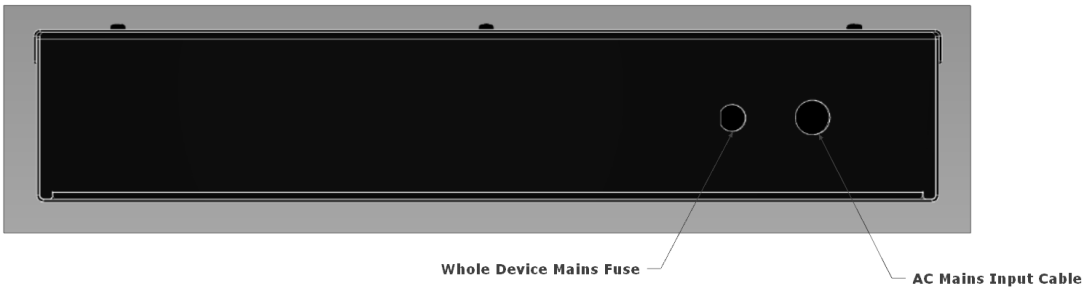


Figure 3 - Rear Panel

Version B

From Spring 2024, digiLED is shipping a reduced depth case for the 2u Head End. The Z20.01.B Head End now has a rack depth of 265mm. Please note however that the Neutrik True1 Power Cable that connects to the rear panel means an overall rack depth of XXXX is still required to accommodate the cable.

Figure 4 – Z20.01.B 2u, 4 Port Head End

Head End – 8 Port, Rack Mount Z21.01.A

The Z21 Head End is the same physical size and function as the Z20 unit with the addition of 4 further ZEUS ports on the front panel.

Designed to operate larger screens with more ZEUS circuits, the Z21 Head End can be used to provide 8 individual ZEUS circuits or 4 ZEUS circuits with hot backup.

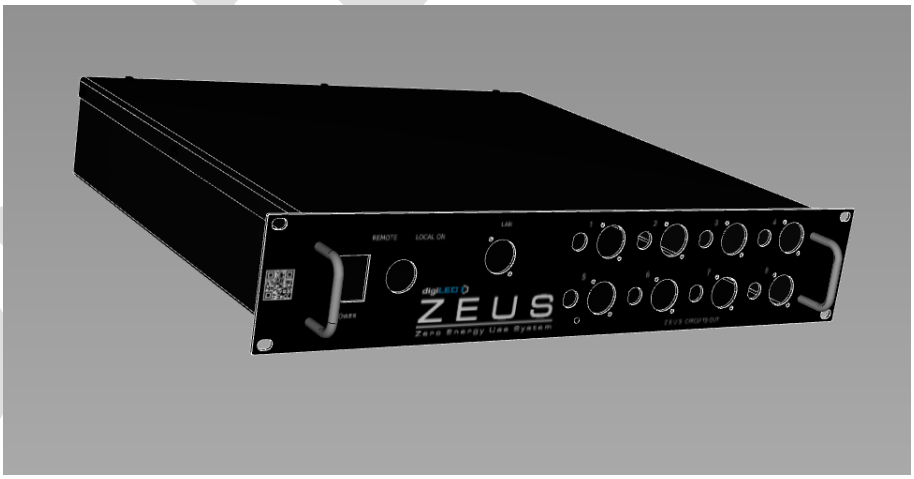


Figure 5 - Z21.01.A 2u, 8 Port Head End

Head End – 1 Port, 1u Rack Size Z22.01.A

For screens that don't require 4 ports of ZEUS connectivity, a smaller Head End is available.

Figure 6 1u Head End (Single Port)

The Z22.01.A unit has a height of 1 rack unit and is capable of powering ~ 100 nodes.

Connection to the control LAN is via the blue RJ45 port while ZEUS nodes are connected to the red RJ45 port.

Head End - 1Port, IP Rated Z23.01.A

For applications that require a weatherproof Head End and only a single ZEUS output port, the Z23.01.A Head End is suggested.

Figure 7 - Z23.01.A Outdoor Rated Head End

This Head End features waterproof Neutrik TrueOne Ac power connectors and a weatherproof RJ45 connector for both IP data and ZEUS data.

As with other Head Ends, the RJ45 connection to the ZEUS nodes is red coloured.

Blue is used to denote the RJ45 connection for the control LAN.

Fuses and Safety

On the rear panel of the 2u Head End is a single fuse holder. This contains an AC rated fuse that protects the entire device from overload conditions. This fuse is of a 5x20mm glass type rated at 4A.

Every output channel from a digiLED ZEUS™ Head End is protected by an over-current fuse. These are a 5x20mm type glass fuse rated at 4A.

In normal operation these should never fail or need replacing.

If any fuses do blow, this indicates a critical cable fault on the channel which will need thorough investigation before recommissioning.

Only replace blown fuses with the same type and rating.

A link to a UK supplier for replacement fuses can be found here:
https://cpc.farnell.com/multicomp/mc000891/fuse-5x20mm-glass-quick-blow-4a/dp/FF03077

Wired LAN Connections

The LAN connection hardware inside a ZEUS Head End uses 100BASE-TX twisted pair for its Ethernet connection.

The vast majority of modern Ethernet equipment and switches default to Gigabit (1000BASE T) comms however.

Normally, with auto-negotiation this is no issue. A network switch will simply handshake with the Head End and negotiate a 100BASE TX comms line.

In rare occasions, you may find some obscure Ethernet hardware will provide ONLY Gigabit data. In this case, this hardware would be incompatible with the Head End comms.

Only use Ethernet and IP hardware that has auto-negotiation enabled.

ZUES Nodes

Internal ZEUS™ Cards

When installed inside an LED panel such as the digiTHIN HD series of LED panels, the ZEUS™ card is described as 'internal'. In this form, the circuit is integrated into the operation of the LED panel.

Figure 8 - A Set of Internal ZEUS™ Cards before installation into digiTHIN Chassis

Typically, ZEUS™ Nodes' controls are daisy-chained from Node-to-Node, Panel to Panel to create a network that can be activated by the Head End.

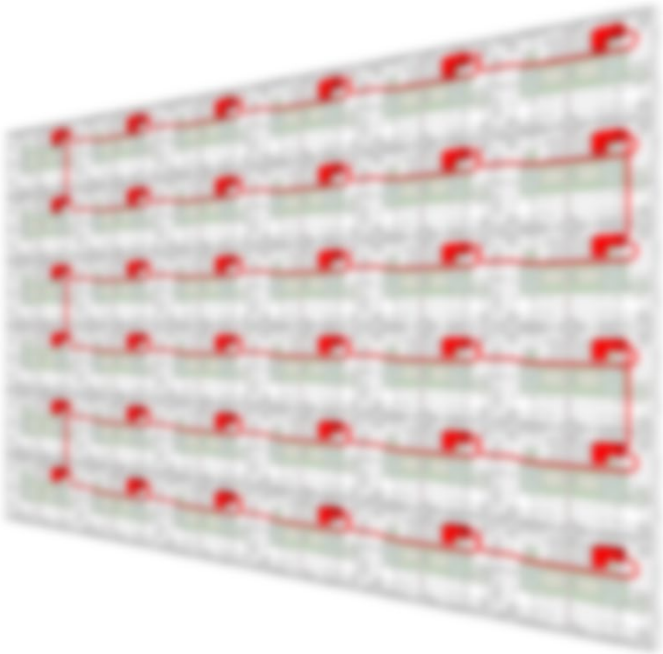


Figure 9 - ZEUS™ Nodes Daisy-Chained inside digiTHIN Panels

Please refer to the documentation specific to your project for both the topology and the number of links in the daisy-chain used in your screen. This is normally provided at the point of commissioning by digiLED technical staff.

Internal Card Type Z03.01.A

Card type Z03.01.A is typically installed in the digiLED digiTHIN range of LED panels.

Features of node are the RJ45 control IN and OUT connections and the indicator LED to show when ZEUS™ has activated.

Figure 10 Internal Card Z03.01.A

Also note the use of a clear plastic cover to isolate parts of the PCB where high voltage AC may be present. Always ensure this cover is in place and is not in any way damaged before powering up or working on a screen.

Internal M to F Node type Z04.01.A

The Z04.01.A Node is a ZEUS node intended for fitting into THIN type LED panels without using the PCB form factor of the Z03.

Typically, these will be cable tied or clipped into the inner structure of wall-mounted COB or SMD screens, often in a retro-fit operation.

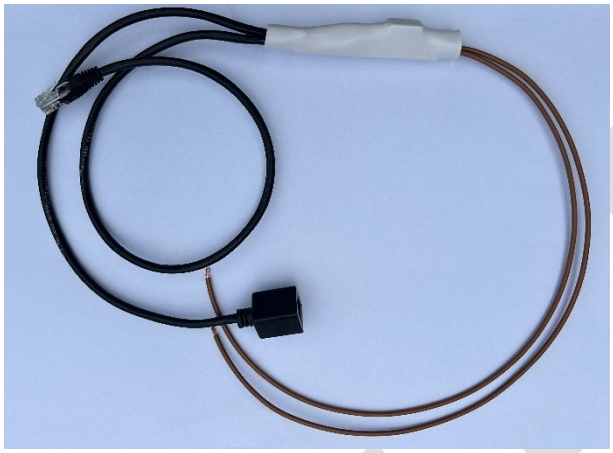


Figure 11 - M to F Z04.01.A

Internal M to M Node type Z04.01.M

The Z04.01.M Node is a ZEUS node intended for fitting into VISION type LED panels without using the PCB form factor of the Z03.

Typically, these will be cable tied or clipped into the PDP of the LED panel and used to switch the ac power to the PSU / PSUs of the PDP.

Figure 12 - M to M Z04.01.M

External ZEUS™ Nodes

External ZEUS™ nodes are installed in close proximity to the rear of screen equipment where the architecture of the cabinet did not permit internal nodes to be factory-fitted.

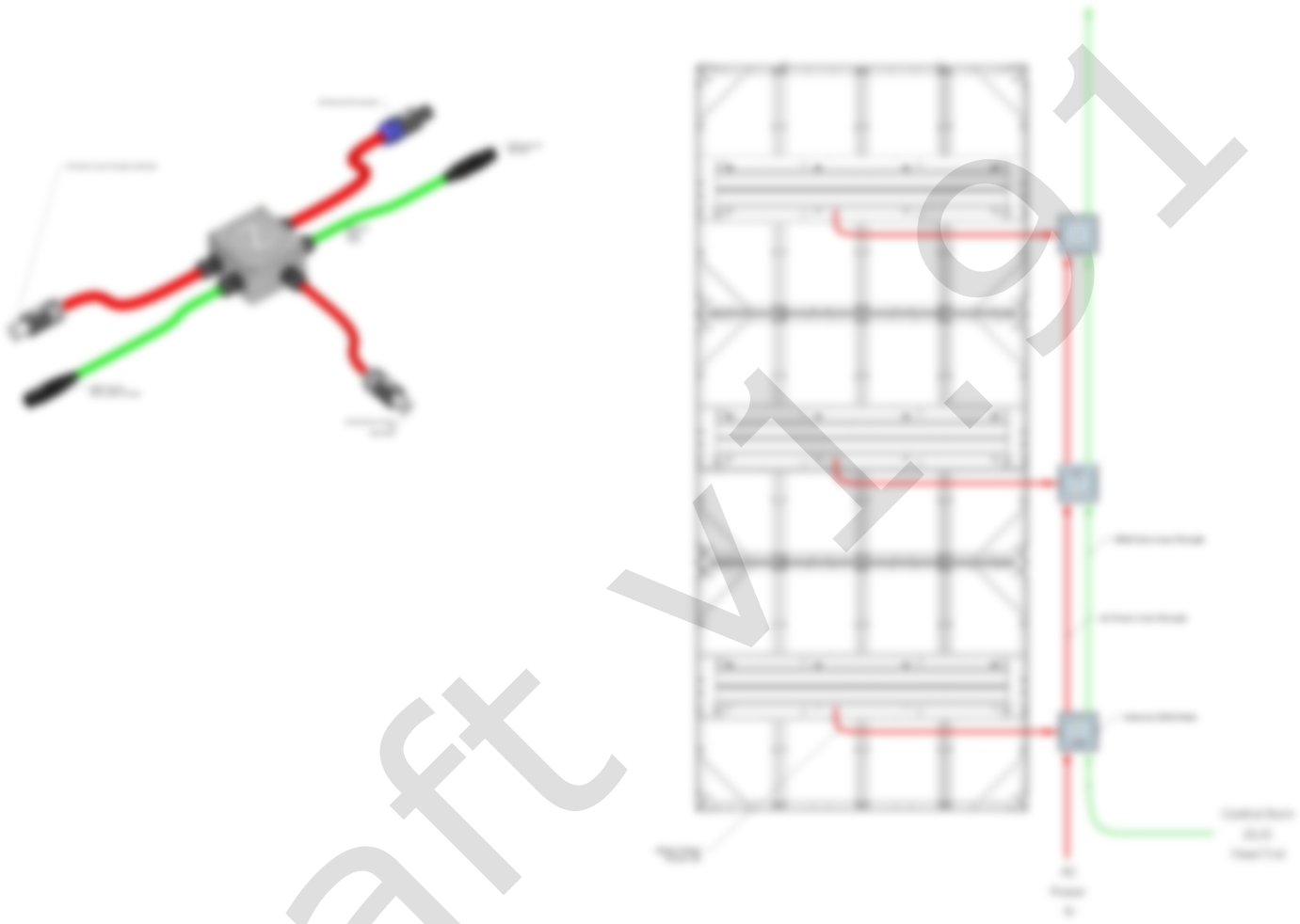


Figure 13 – An External ZEUS™ Node w Example on Vision A Panels

The nodes are daisy-chained together with both power and data connections that allows ZEUS™ to energise[5] a small spur cable that forks off each node to individual LED panels.

Typically, the power daisy-chain (red) will consist of some 3 to 10[6] nodes whereas the data daisy-chain (green) can be up to 64 nodes on one circuit.

[5] Based on the ZEUS™ randomization startup algorithm.
[6] Qty depends on LED panel type.

Installation Instructions

Cabling a ZEUS™ System.

Typically, digiLED will provide instructions as to the cabling system of ZEUS™ on a new digiLED screen. Please only use the cabling plan provided by digiLED.

This will have been designed to daisy-chain a suitable number of Nodes together without overloading either the Head End or the interconnectors.

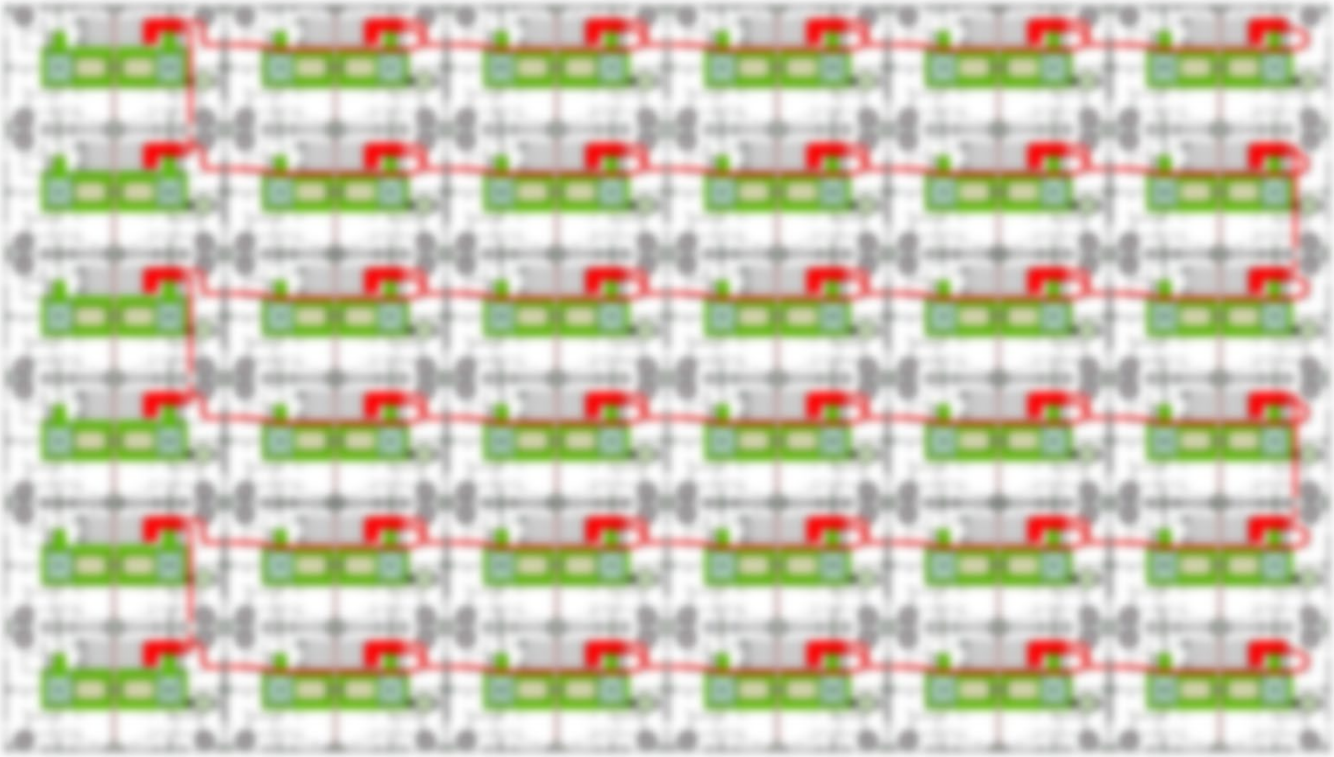


Figure 14 - ZEUS™ Nodes (red) Daisy-Chained in a Screen

Maximum Nodes in a Chain

Typically, digiLED recommend a maximum of no more than 75 nodes[7] in any given daisy-chain.

Please consult with digiLED if your project has a requirement to exceed 75 nodes.

[7] Depending on Node model or revision, in some circumstances this number may be higher

Maximum Cable Lengths

The longest cables in a ZEUS™ system are likely to be the "feeder cables" which connect from the Head End to Node 1 in the screen.

While these can be up to 120m in length, a derating is applied to the maximum number of nodes that can be daisy-chained on long feeder cables. Please see the below table when considering how the system is to be cabled.

0 – 75m	75 nodes
75 – 86m	67 nodes
86 – 98m	60 nodes
98 – 108m	55 nodes
108 - 120m	50 nodes

Hot Backup – Single Head End

For added system resilience, a loop-back connection can be made on the ZEUS cable runs so that both the start and finish of the ZEUS cables terminate at a Head End.

The first way to do this is with a single Head End where one output port is used as the Primary and a second port is used as the Backup.

When cabled like this, a Node or cable can break anywhere within the screen without video playback on the screen being affected.

Failure of a Head End will however cause an interruption to normal screen operation.

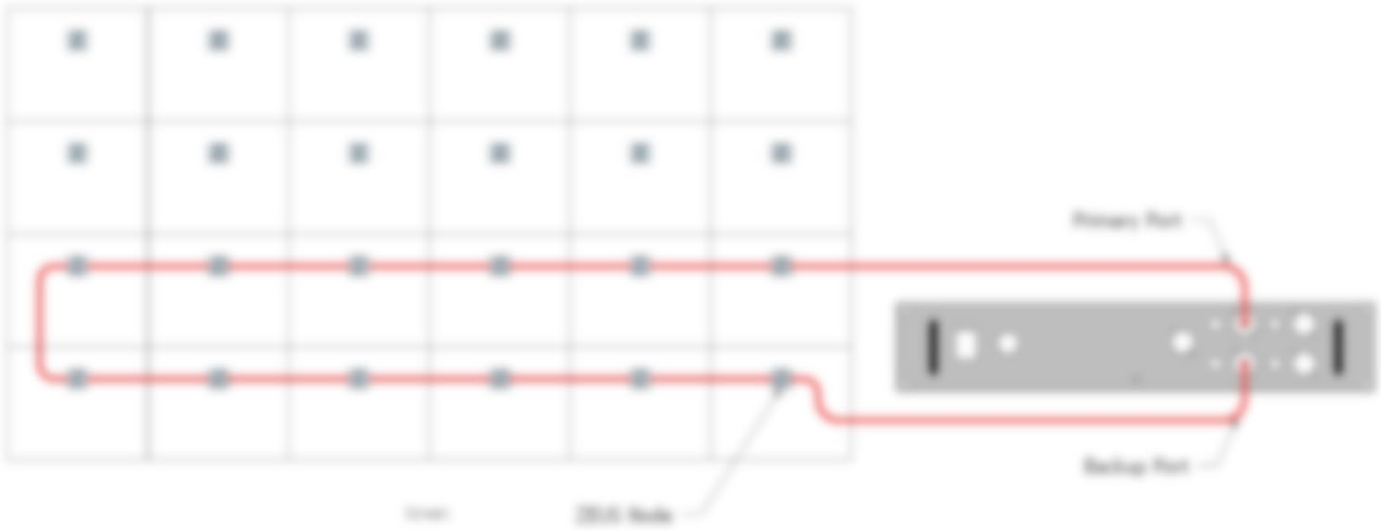


Figure 15 - Hot Backup with Single Head End

Hot Backup – Dual Head End

The second was to build a resilient system is to use 2 Head Ends.

In this wiring method, a complete second Head End can act as the backup device for a Primary Head End.

With this wiring system, a Node or cable can break anywhere within the screen without video playback on the screen being affected.

Even the failure of one Head End will not cause an interruption to normal screen operation.

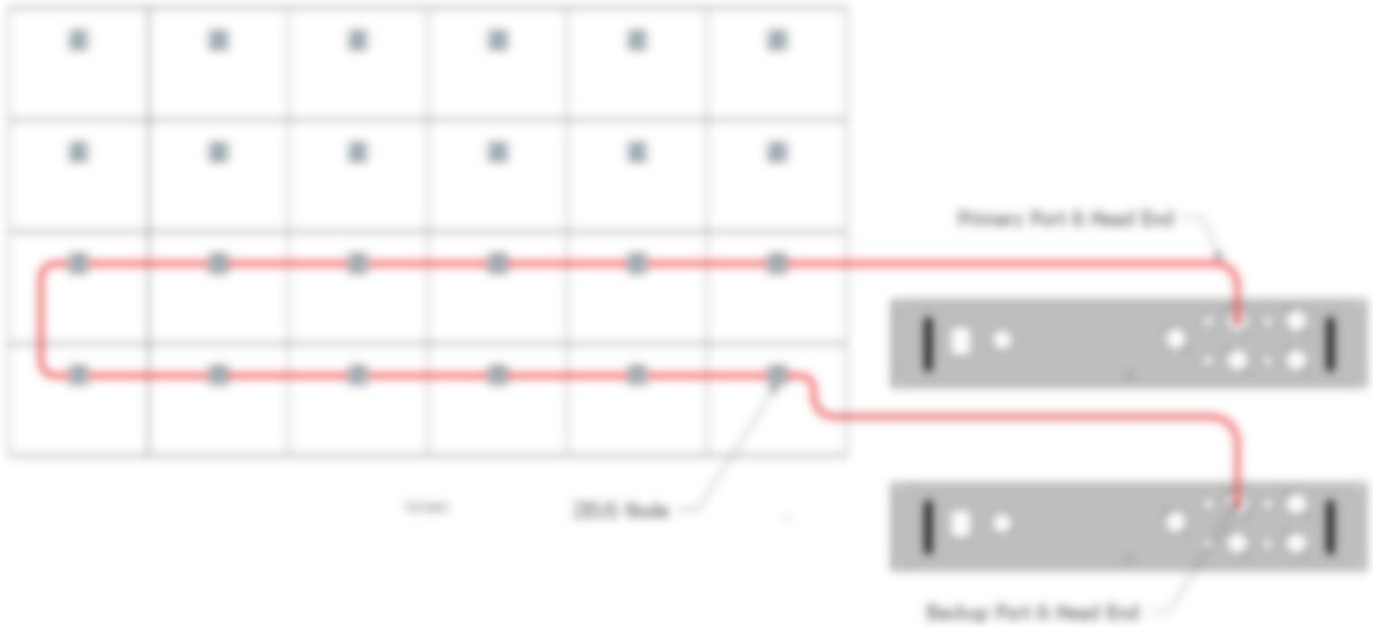


Figure 16 - Dual Head End Hot Backup

Note – Additional programming is required to the web switching device to activate Dual Head Ends in this fashion. Please see the later chapter XXX for further details.

First Run and Commissioning

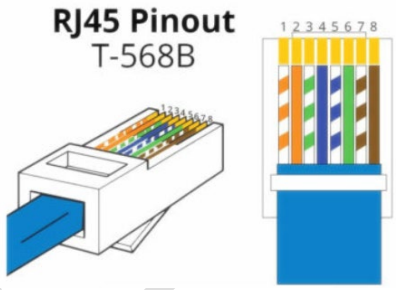
Cable Checks

If any cables for the ZEUS™ system have been handmade/terminated by the installation crew, digiLED recommend a Cat5 cable tester is used before the system is energised.

The tester should be able to identify both end-to-end continuity on all 8 conductors and be able to show if any wire colours have been swapped over.

The standard RJ45 T568B cable colour map of

1. Orange/White
2. Orange
3. Green/White
4. Blue
5. Blue/White
6. Green
7. Brown/White
8. Brown



should be used for all RJ45 terminations and crimps.

If wiring and continuity checks are passed, the commissioning technician should move on to the next step:

Single Feed Verification

Note – the following should ideally be done with the Screen power off. i.e. AC power feeds to the LED panels switched off.

When a ZEUS™ Head End and Node system is first connected, digiLED recommends connecting only 1 feeder cable[8] at a time during the initial power-up.

To do this, set the selector switch to **LOCAL ON** and leave the AC power switch OFF.

Now plug in the first feed cable leaving all others unplugged.

Switch on the AC power to the Head End and ask an observer to check that all the ZEUS™ nodes in that particular section of screen energise correctly. This is normally indicated by a green or white LED on the ZEUS™ node PCB coming live after 10 to 15 seconds.

[8] "Feeder Cable" in this context is the name given to the long Cat6 cable that runs between the ZEUS Head End and the 1st node in the screen.

REMEMBER – Each and every ZEUS™ Node has an in-built random switch on period of between 10 to 20 seconds. Be patient. Do not expect to see any ZEUS™ nodes switching on during the first 10 seconds the Head End is powered.

If the cable and screen section under test passes the power-up test detailed above, switch off the AC power to the Head End, unplug the cable in question and mark it with tape or similar as "tested & OK".

Now move on to the second feeder cable from the ZEUS™ Head End.

Repeat the above process and verify that feeder cable 2 is operating as expected.

Continue to repeat the process until all feeder cables to the screen have been solo-tested and verified.

Now, with the AC power to the Head End switched off, plug in all verified feed cables to the Head End.

The AC power can now be switched ON and the Selector Switch operated as required to manually power the screen.

Please note, the ON / OFF State of the internal Web Relay cannot be verified until correctly programmed.

This means the function of the REMOTE selection of the Selector Switch may operate in either fully ON or OFF until the unit is programmed.

Power Down Behaviour

Please note, a Head End with only one Node connected may exhibit slow / sluggish power-down behaviour.

With a Head End running just one node, it may take up to 30 seconds for a node to power down after the LOCAL ON switch has been switched off.

This behaviour is unique to systems with one or two Nodes.

A typical 36 Node screen (for example) should power down in less than a second when commanded to do so.

Head End Operation and Programming

Manual Operation / Local ON

The simplest way to operate digiLED ZEUS™ is with manual user input. To do this ensure that the Head End is switched on. Now move the selector switch to the LOCAL ON position. This will transmit the command to all the ZEUS™ Nodes to activate. After 10 to 15 seconds the ZEUS™ nodes will trigger, and the screen will power up.

To power down the screen manually return the selector switch from LOCAL ON to REMOTE control. Ensure that the Shelly functions are also commanding the screen to power down.

Alternatively, switching off the AC power to the ZEUS™ Head End will also deactivate all the ZEUS™ nodes in the LED screen.

Auto & Remote Operation

If using the Alterco Robotics / Shelly type Head End, remote operation is done via either a direct LAN connection to the device or via the Shelly Cloud service.

Of these, the Shelly Cloud service is by far the most user friendly and versatile.

digiLED recommends that the Shelly Cloud service is the preferred way to interact with the ZEUS Head End.

The Shelly Cloud Environment

Complimentary with the purchase of a ZEUS Head End (Alterco Robotics Version) is a free online service called the Shelly Cloud.

This has the advantage of making the device control available to anybody, anywhere with internet access and a password.

You could literally be on a beach, in Jamaica with your mobile phone and the Shelly Cloud would allow you to control the screens at Arsenal Emirates Football Club (if you had the password).

To start using the Shelly Cloud service, please go to https://control.shelly.cloud

Tools needed

To use the Shelly Cloud environment, you will need an iPhone or Android device capable of downloading and running Apps with access to the Bluetooth pairing function.

In addition, a laptop PC with internet connection may be helpful (but not critical)

Pre-Registered?

For some screens & sites, digiLED may have already registered a customer account on Shelly Cloud. Please check with your digiLED technical representative if an account has been pre-registered on your behalf.

Registering

To start using the Shelly Cloud environment you first have to register for a new account. This is done by opening a web browser (on laptop or phone) and going to https://control.shelly.cloud - following the prompts to create a new user and account.

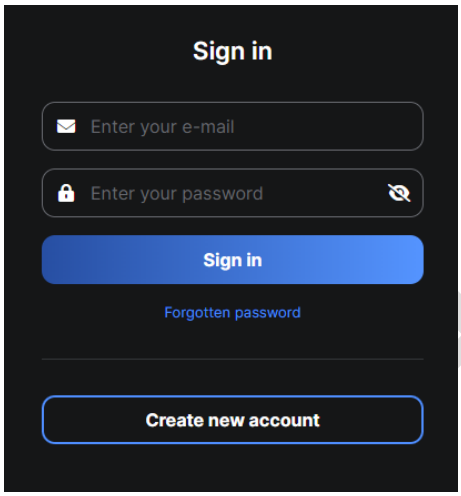


Figure 17 - Create New Account (Shelly Cloud)

The prompt will ask you for a username in the form of an e-mail and will ask you to create a password. As with all these things, please ensure the username and password are safely written down as you will need these for future logins. Please click the tick boxes as appropriate to enable the sign up to complete.

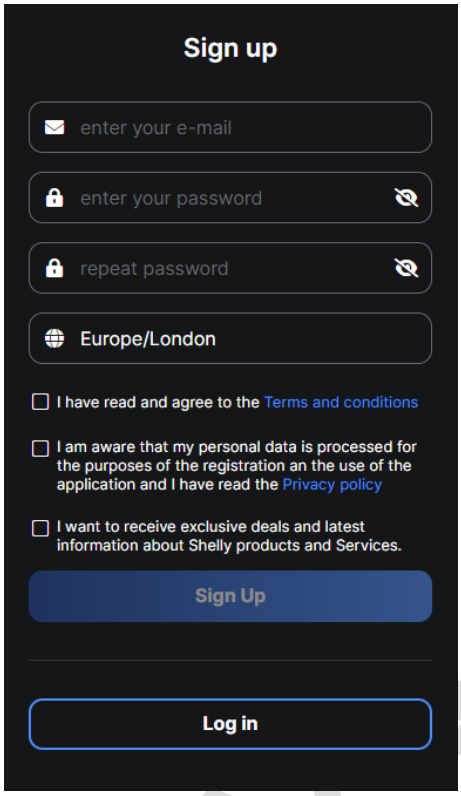


Figure 18 - Signup Form

Once an account is created. A verification e-mail will be sent. Which you will need to click on in order to fully activate the Shelly Cloud[9].

After completion, the above web address will display a brand new Shelly Cloud dashboard but without any devices on boarded. Please follow the next steps to onboard your first device.

[9] At the time of writing, a know bug is that verification emails may be delayed for up to 24 hours. While this halts features such as email reporting, it does not stop the onboarding of the ZEUS Head End as the SKIP button can be clicked and email verification postponed for a day.

Adding Devices

The onboarding of new devices to the Shelly Cloud must be done using a mobile phone. Please use the following link to install the Shelly app. for both Android and iPhone.

Figure 19 - https://www.shelly.com/app_download/

Once installed, the app has a blue plus icon at the bottom right-hand corner for adding new devices to the Shelly Cloud. Please follow the instructions in the app to complete the onboarding process.

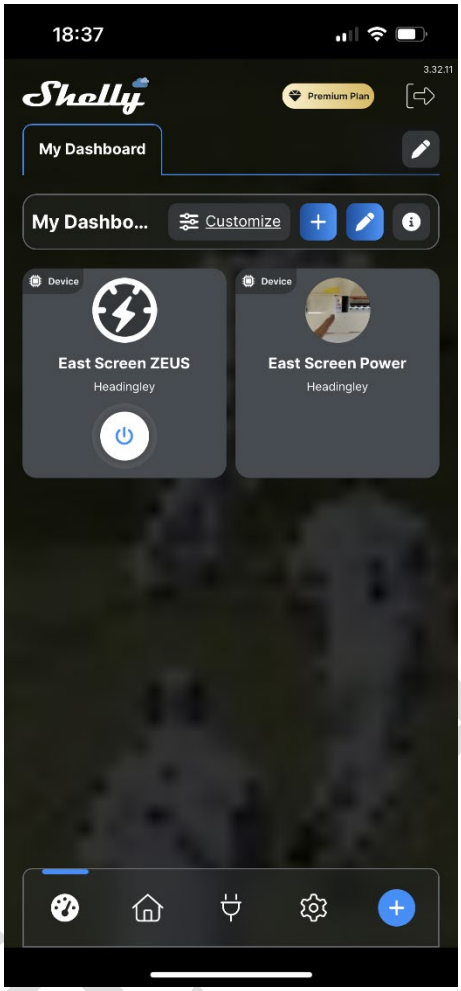


Figure 20 - Blue PLUS Icon at Bottom Right of App

Bluetooth vs Access Point On-Boarding

Initial on-boarding / pairing of a ZEUS Head End (Alterco Robotics Shelly type) is done by either a mobile phone Bluetooth pairing operation or via the mobile phone locking on to a WiFi access point created by the Head End.

Note that both operations are handled from inside the Shelly App and do not require the user to change the phone's native Bluetooth or WiFi settings.

digiLED recommends that the primary on-boarding method is Bluetooth.

Bluetooth On-Boarding

To add a device via Bluetooth, click the blue + icon at the bottom right of the Shelly App on a mobile phone. Now select Add via Bluetooth.

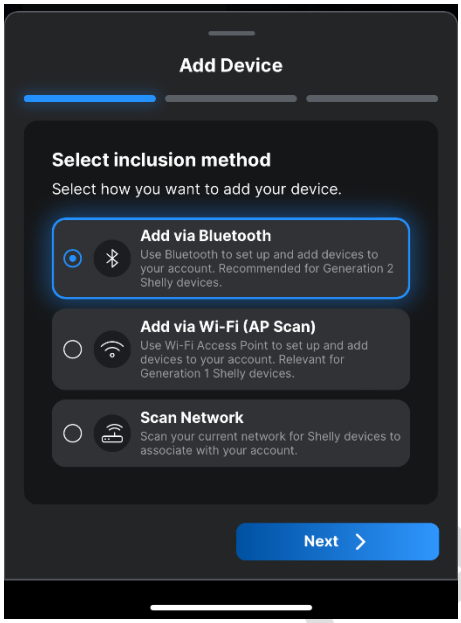


Figure 21 - Add Device via Bluetooth

After a short scan of the local Bluetooth devices, if the ZEUS Head End is in range, it will return the following prompt.

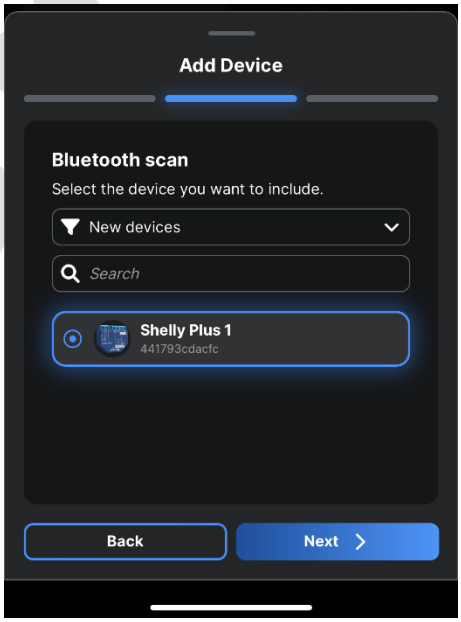


Figure 22 – Radio Button Clicked (blue)

Click the left-hand radio button by the discovered device and click NEXT.

The next page allows the configuration of permanent WiFi connectivity (if needed).

If the Head End is to be controlled over WiFi, click the EDIT button to enter the SSID and Password of the network the device should use.

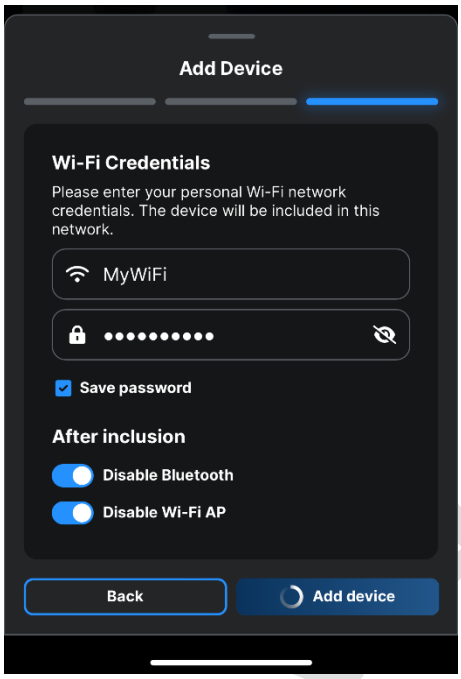


Figure 23 - Adding SSID and Password Info for WiFi use (if required)

Ensure that the **Save Password** tick box is selected.

Optionally, users can choose to the Disable Bluetooth and Disable WiFi Access Point at this stage.

digiLED recommends these options are deselected as this action can be performed later on and would otherwise hinder a failed WiFi login.

An example of why this may be critical would be if a typo was made in the SSID or password that prevented correct WiFi connection.

WiFi On-Boarding

Dashboard Environment

Rooms

Login Sharing

Once a Shelly Cloud environment has been registered and initialised, it can be shared with multiple users. These users can be on the same LAN or external to the organisation. The only thing they need is a web browser and Internet access.

To share the Shelly Cloud. Please give them you user the web address control.shelly.cloud And instruct them to log in with the same username and password that you used to create the account.

Please bear in mind by sharing this way, the new user will have full access to all devices in your cloud, including the ability to switch ZEUS on and off.

Programming without Shelly Cloud

Inside every ZEUS™ Head End is a switching device that responds to IP / LAN / WiFi commands to activate or deactivate the ZEUS™ system.

digiLED manufacture a number of variants of the Head End system so please ensure you are reading the instructions appropriate to the variant installed.

Alterco Robotics Version

The following instructions relate to the Allterco Robotics' Shelly Pro series of IP control devices. Please consult digiLED for alternative instructions if your Head End is not of this type.

To program the device when first delivered, a Windows, Linux or mac Laptop must be used with a static IP address on a wired point-to-point network.

The factory default IP address of the Head End is 192.168.1.30

To communicate with this address, set a static IP on the laptop that is in the same subnet/range i.e. 192.168.1.31

Control and programming of the Alterco Robotics device can now be undertaken using a web browser such as Firefox, Chrome or similar.

Type the address 192.168.1.30 into the address bar of the browser, hit Enter on the keyboard and the following landing page will load:

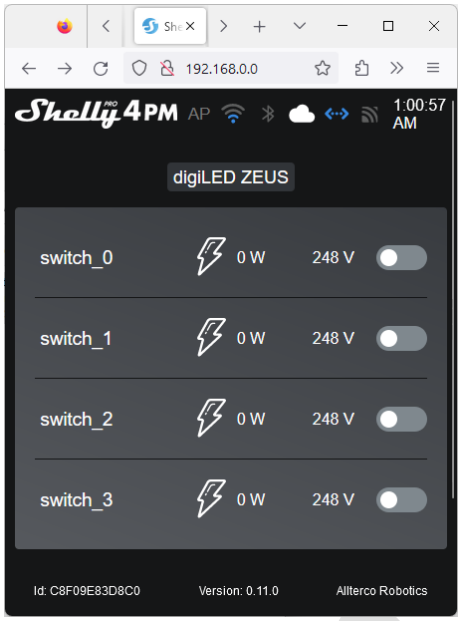


Figure 24 - Alterco Robotics Landing Page

Changing the Default IP

While 192.168.1.30 is the default address of the ZEUS Head End, it is likely that users will want to program their own IP address.

To do this, browse to the landing page of the Alterco Robotics Shelly as described in the previous chapter.

Scroll down until the NETWORKs icon is visible at the bottom of the page:

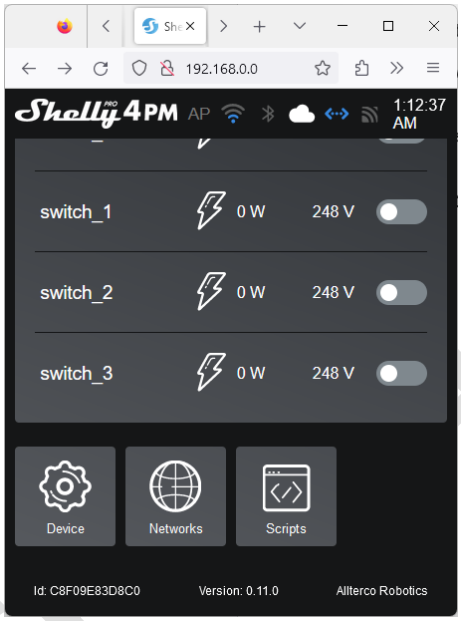


Figure 25 - Networks Button after Scroll Down

After clicking this button, expand to the section marked “Ethernet”.

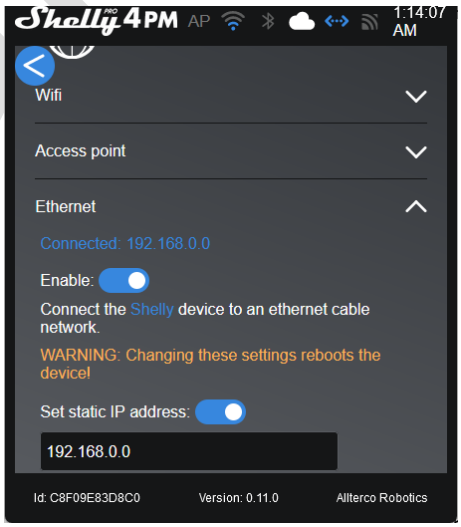


Figure 26 - Ethernet Menu

A new preferred static IP address can now be typed into the entry box at the bottom of the screen.

CAUTION - digiLED strongly recommends that the new IP address is both written down AND photographed before proceeding.

Lost address devices need to be hard reset – a process which is best avoided by recording the new IP address NOW.

Once the new IP address is entered, scroll down to the Apply button.

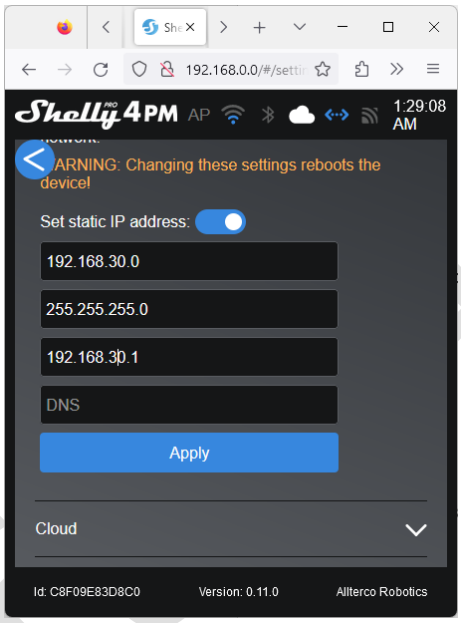


Figure 27 - Static IP Settings

Once clicked, the device will ask for confirmation before rebooting.

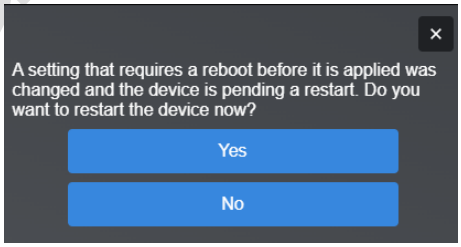


Figure 28 - Wired Connection Verification pending Reboot

As soon as the system reboots, you will lose the network connection with the device. Your laptop or control PC will need to have its static IP address changed in order for it to communicate once more with the new address range that has been set on Head End.

Disabling Unused Networks

Changing the Device Name

In locations where multiple Head Ends are installed, users may wish to change the name of the Alterco Robotics Shelly Device.

To do this, first use as browser (as above) to navigate to the Landing Page.

Scroll down until the Device icon can be seen.

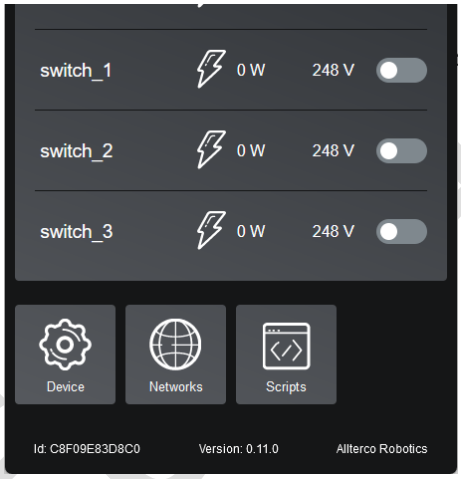


Figure 29 - Landing Page

After clicking on the Device menu, expand the Device Name menu.

A new device name can now be entered into this field.

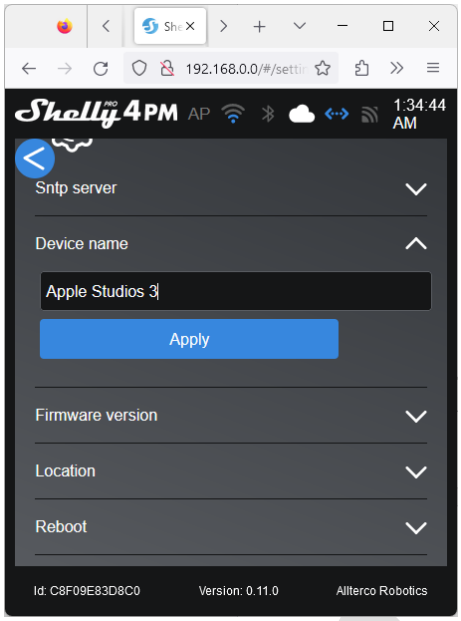


Figure 30 - Entering a new Device Name

Click the Apply button to save the changes.

Interface Security

Connection to the Alterco Robotics Shelly user interface can be protected with a user programmed PIN or password. It is critical that the person setting the PIN writes down and stores the PIN. If the PIN is lost, the Shelly device and Head End will need a factory reset to return the device to its default condition.

To set the PIN, scroll down the landing page until the Device icon is visible.

Click on Device and navigate to the Authentication menu.

Toggle the switch to enable Authentication, then enter a password or PIN of choice.

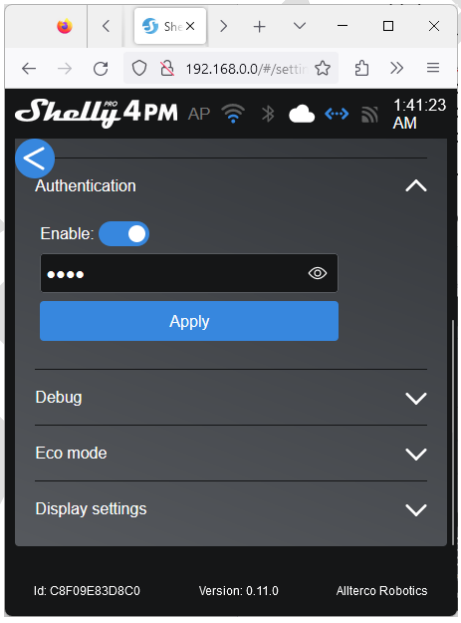


Figure 31 - New PIN entered

Day to Day Operation

Dos and Don’ts

- Don’t panic in the first 20 seconds after activating a screen with ZEUS. There is a randomised time delay of 10 to 20 seconds before the screen will have booted up.
- If working on the Power Box / Electrical Distribution, do not re-power the screen using the breakers while ZEUS remains in the ON setting. Always re-power the screen via breakers / fuses with the ZEUS Head End in the OFF setting and flip ZEUS to ON after the Power Box feeds have been made live.

Remote Control Operation

Remote operation of the ZEUS™ Head End is achieved by 3 common methods.

- Web Interface Direct Operation
- Cloud Interface Remote Operation
- IP Command Strings

Web Interface Direct Operation

Direct operation of the Shelly device can be done using any common web browser (on the same network as the Head End) such as Firefox, Chrome, Safari etc.

To access the Direct Web Interface, type the IP address of the shelly device into the address bar of the browser and hit Enter.

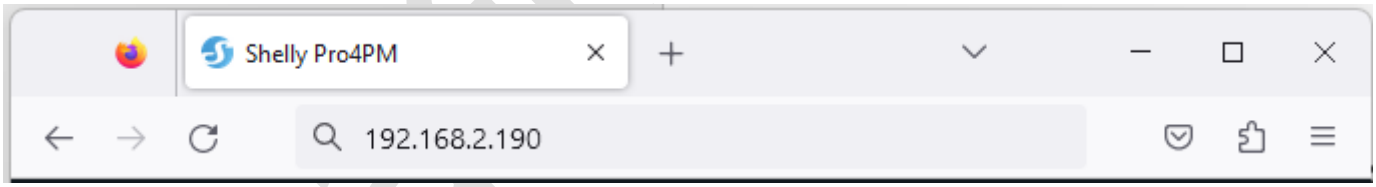


Figure 32 - Typing the IP address into Firefox Browser

If the Shelly user interface has been protected with a pin, enter the saved pin to access the Shelly user interface page.

Once connected to the Shelly user interface, ZEUS™ can be powered up by activating the switch for channel 0 of the Shelly device. Note that it may take 10 to 15 seconds for the LED panels to boot.

Powering down the screen from the Shelly user interface is as simple as clicking the Channel 0 switch to the off position. Unlike the startup, the LED screen will respond instantly to this and will be powered down within a second.

Cloud Interface Remote Operation

Arguably the most extensive way to interface with the Alterco Robotic brain inside the Head End is to onboard it with the free Shelly Cloud platform.

Please see the detailed chapter below about programming and using the Cloud features.

API and 3rd Party Equipment Control

Providing that the IP address of the Head End is known, a number of functions can be controlled using ASCII command strings directed at the IP address. This enables systems such as AMX, Extron or Crestron to remote control the Head End device.

CAUTION – This is a complex subject with many options regarding the commands available to a programmer. A small sample of the possible commands is described below. Please speak to digiLED technical support for further info beyond this manual.

Enabling IP Command Strings – (Web Interface)

If using a 3rd party control system such as Extron, Crestron or AMX, programmers may wish to switch the head end via an ascii string send.

To enable this feature, the Alterco Robotics Shelly controller must first have this feature activated.

This is done by logging in, either via the cloud or the direct web interface and navigating to the SETTINGS section of the interface.

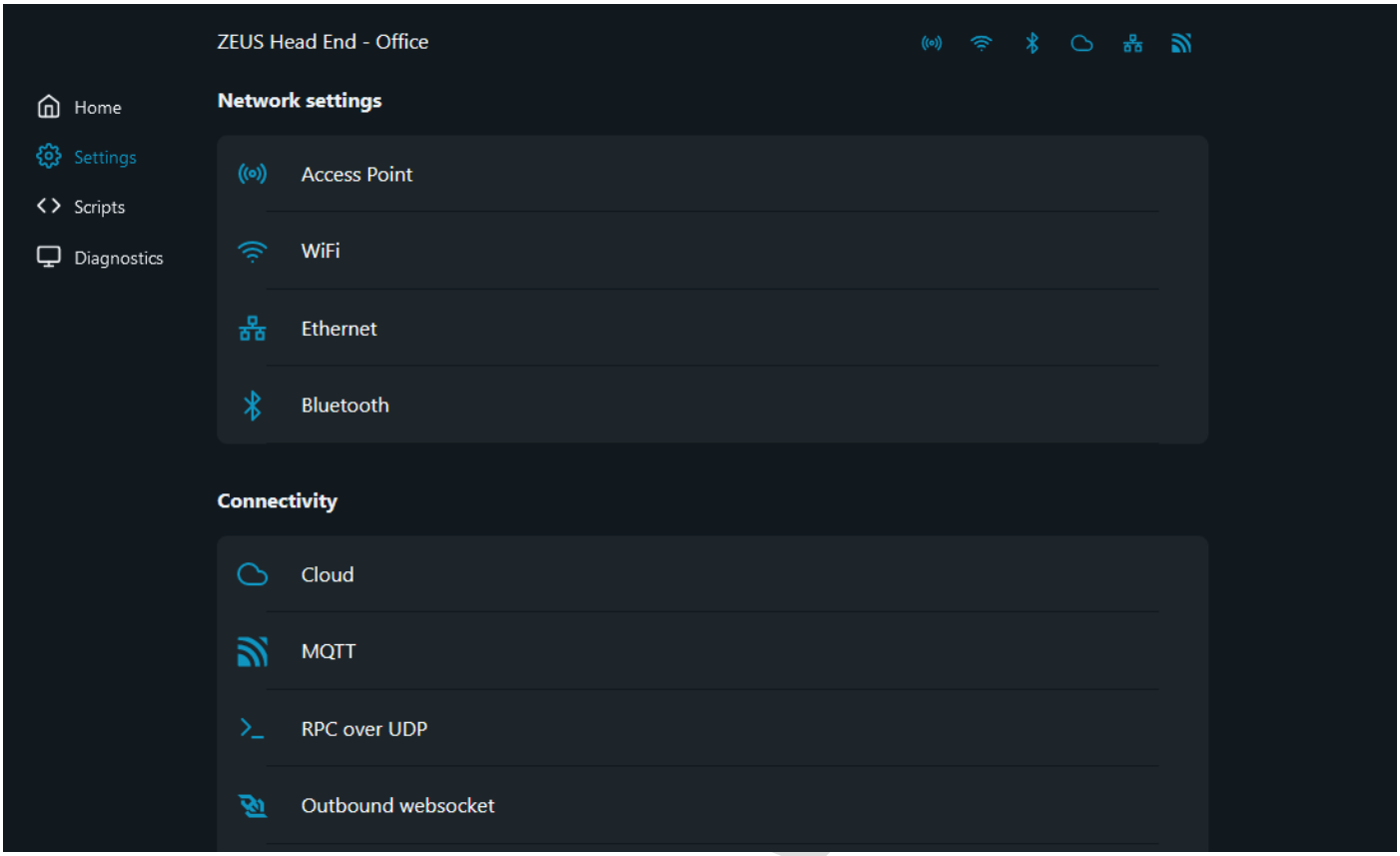


Figure 33 - Settings Menu

Click on the RPC over UDP menu and add data for the Listening Port and Destination Address.

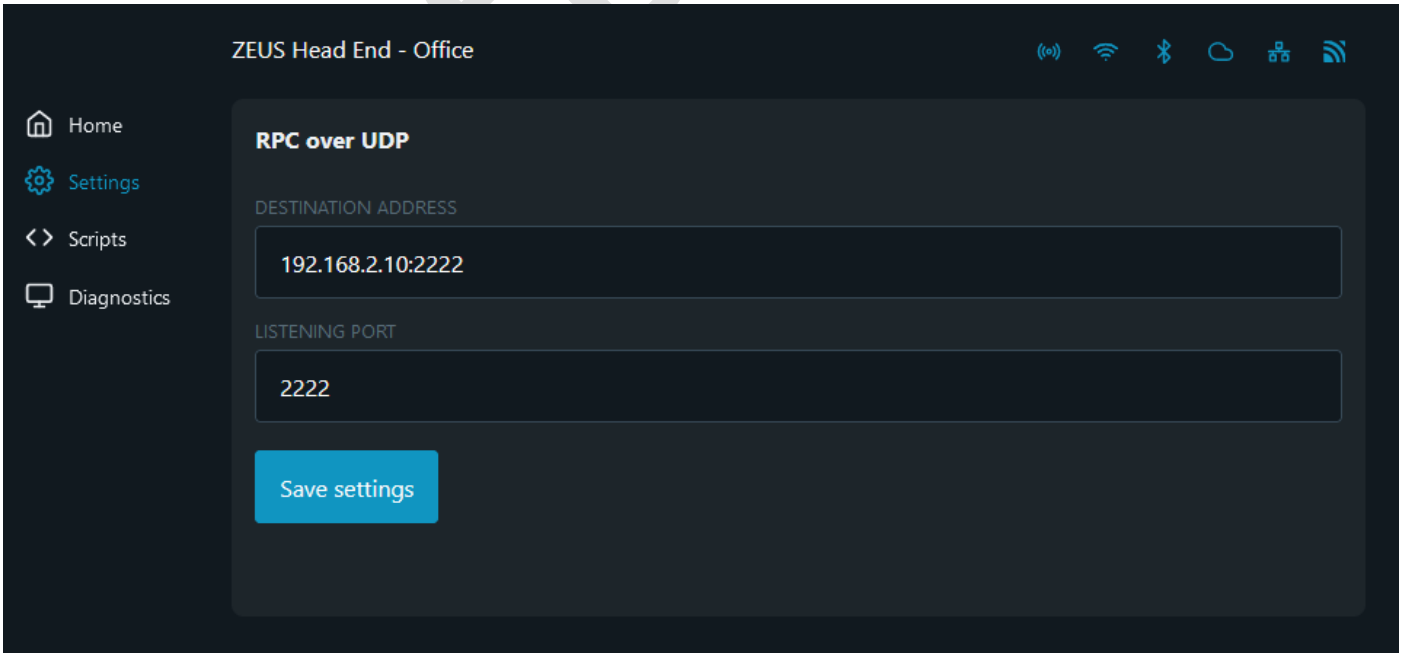


Figure 34 - RPC over UDP Settings

The Listening Port can be any legitimate IP Port on the Local Area Network (2222 in the above example)

The Destination Address is the (optional) IP address for any computer that (optionally) may be used to receive confirmation that the command was successful (not necessarily required for basic remote operation)

Once the data has been entered, click the SAVE SETTINGS button.

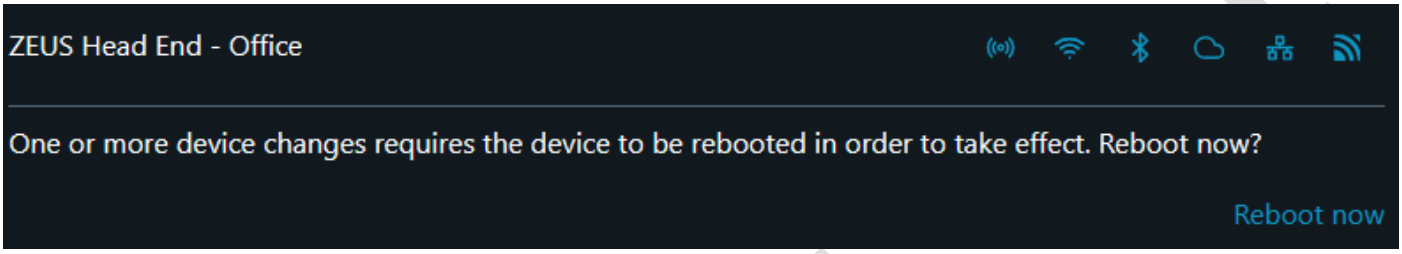


Figure 35 - Reboot Confirmation

A dialogue box will appear at the top of the screen prompting you to reboot the device to apply the changes. Click REBOOT NOW to execute the reboot.

The Alterco Robotics Shelly device is now ready for remote control over IP via data strings.

Enabling IP Command Strings – (Push Command)

GetConfig
In a web browser such as Firefox or Google Chrome, in the URL bar, enter

http://192.168.0.2/rpc/Sys.GetConfig (assuming the Head End is on address 192.168.0.2)

The web browser will return config status of the Alterco Robotics Shelly device.

{"device":{"name":"Shelly2","mac":"30C6F78A66F4","fw_id":"20220512-131933/0.10.2-beta1-gd0e2a8c","eco_mode":false},"location":{"tz":"Europe/London","lat":50.9384,"lon":-0.4731},"debug":{"mqtt":{"enable":false},"websocket":{"enable":false},"udp":{"addr":null}},"ui_data":{},"rpc_udp":{"dst_addr":"192.168.0.2:224","listen_port":226},"sntp":{"server":"time.google.com"},"cfg_rev":44}

The section highlighted in yellow will confirm whether the device is ready to be remote controlled over UDP.

In the above example, the device IS ready and will listen on port 224 for UDP controls.

If you see NULL anywhere in this return, the device is not yet configured.

If your GetConfig result is different or needs changing, the config can be set with the following commands.

SetConfig – Listen Port
The Listen Port is the port that ZEUS will listen to for commands over UDP from your PC/Crestron/Extron device. It can be set using the following command:

http://192.168.0.2/rpc/Sys.SetConfig?config={"rpc_udp":{"listen_port":223}}

The Listen Port must be an INTEGER (number)

In the browser window, these commands will return...

{"restart_required":true}

Reboot Command
Following any changes to the Alterco Robotics Shelly IP settings, a reboot is generally needed to apply the changes. This can be done by typing the following into your web browser:

http://192.168.0.2/rpc/Shelly.Reboot (assuming your Head End is on IP address 192.168.0.2)

SetConfig – Destination Address
The destination address is the address where ZEUS must send response data to (i.e. PC/Crestron/Extron device etc)

Destination Address must be a "STRING" and be IP:PORT -

In your browser URL, enter:

http://192.168.0.2/rpc/Sys.SetConfig?config={"rpc_udp":{"dst_addr":"192.168.0.10:222","listen_port":223}}

OR

http://192.168.0.2/rpc/Sys.SetConfig?config={"rpc_udp":{"dst_addr":"192.168.0.10:222"}}

(assumes the Crestron device is on 192.168.0.10)

IMPORTANT – Following the SetConfig command above, please execute a Reboot Command as detailed above.

GetConfig – Again
Remember that after any changes have been made, the GetConfig command (as detailed above) can be used to verify the commands have been applied.

Example ON Command
To turn on the ZEUS Head End, open a new browser window in Chrome, Firefox or similar. (Ensure the Browser is running on the same network as the Head End).

Copy paste the following text into the address bar:

http://192.168.0.2/rpc/Switch.Set?id=0&on=true

The webpage will load a basic JSON response with text along the lines of:

response {"was_on":false}

Example OFF Command
To turn on the ZEUS Head End, open a new browser window in Chrome, Firefox or similar. (Ensure the Browser is running on the same network as the Head End).

Copy paste the following text into the address bar:

http://192.168.0.2/rpc/Switch.Set?id=0&on=false

The webpage will load a basic JSON response with text along the lines of:

response {"was_on":true}

The JSON Response
In the above examples, responses replate to the previous state of the device before the command was received. For example, response {"was_on":false} means that the previous state of the Head End was "Off" (i.e. a false report that it "was on")

Similarly, the response {"was_on":true} means that the previous state of the Head End was "On" .

These data strings are for information only and do not affect the operation of IP command string sending.

Terminal Commands

GetStatus
The GetStatus command allows 3rd party equipment to poll the Head End and establish whether it is in the OFF or ON state.

Using a terminal such as "Hercules" , send the following string

{"id": 2,"src":"user_1","method":"Switch.GetStatus","params": {"id":0}}

- the device will return

{"id":2,"src":"shellypro2-30c6f78a66f4","dst":"user_1","result":{"id":0, "source":"UDP_in", "output":true,"temperature":{"tC":30.4, "tF":86.7}}}

The text highlighted in yellow defines the ZEUS status (ON=TRUE, OFF=FALSE)

Example ON Command (via terminal)

{"id": 2,"src":"user_1","method":"Switch.Set","params": {"id":0,"on":true}}

Example OFF Command (via Terminal)

{"id": 2,"src":"user_1","method":"Switch.Set","params": {"id":0,"on":false}}

Common Features – Web Interface Direct

Using the Alterco Robotics Shelly a number of options exist for the automatic operation of ZEUS.

Time Triggers

The Shelly device can be triggered to execute a power up at any given time of the day. This is done by XXXXXXXXX

Similarly, Power-down triggers can be set to run at a given time. This is done by XXXXXX

The Shelly also includes the option to execute multiple time-triggers throughout the 24 hours clock if this option is desired.

Calendar Triggers

Environment Triggers

Fire Alarm & Building Alert Triggers

Emergency Stop Triggers

Safety and Operational Do's and Don'ts

Do take the time to program the Head End and its functions to gain the maximum power and Carbon saving for your screen.

ZEUS™ is a tool that offers both financial and environmental benefits to screen owners. The gains can only be realised however if all relevant users of the screen have an understanding of how to operate and manage the ZEUS™ controller.

Don't (if possible) unplug and re-plug the RJ45 connections of a ZEUS™ control system while the Head End is commanding the Nodes to switch ON. If connections need to be altered or re-plugged, try to do this with the Head End powered down. While plugging an RJ45 that is active should not cause excessive damage to the plug or socket, it still remains good practice to do this with the Head End powered down.

Post Power Cut

In the event that the AC feed to a screen has been disrupted, but, though a quirk of wiring, the ac feed to the head end has not, there is a reasonable chance of breakers tripping.

If breakers do trip, this is normal and safe, but it will require resetting by a competent person once the Head End has been switched off.

Broadly speaking, if the breakers feeding power to the LED screen are to be operated, the ZEUS™ system should be switched off before this happens.

Advanced Operation – Overwintering Screens

The Scheduling feature of the ZEUS™ Head End enables the periodic turning on and "wake up" of screens that may be out of use during the winter period.

When combined with Novastar's built in bitmap feature for Receiving Cards[10], this creates an environment where moisture build-up can be very gently driven out of the SMDs of a screen during the winter months.

For this system to operate, 3 things are required:

- The ZEUS™ Head End should be programmed with a schedule that wakes the screen approximately every ten days.
- The Novastar Receiving Cards in the screen should be programmed with a Prestore Picture of a low-level grey.
- The Novastar Sender or control equipment should remain switched off during the winter period.

Programming for Winter

Testing Winter Operation

To test the Prestore Picture has loaded and saved correctly, exit Nova LCT Mars and turn off the power to the Sender. If the process has correctly completed, the LED screen will at this point show the grey bitmap image on each and every panel of the screen.

Scheduling Winter Cycles

digiLED recommends that the winter cycles are set to run approximately every 10 days. The duration of the power-up should be approximately 4 hours and it may be good practise to schedule the power-up of the screen to occur around midday.

Safety Considerations

It is good practise for electrical equipment that is remotely controlled and may start without user intervention to be labelled with a warning notice that reads[11]:

This equipment is remotely controlled and may start without warning.

Do not work on this equipment without understanding and isolating the equipment which triggers this remote function.

[10] Commonly referred to as a Prestore Picture
[11] (or similar)

Customers may choose to undertake their own risk assessment and produce a method statement appropriate to electrical equipment that will start without human intervention under control of a schedule.

Cancelling the Winter Cycle
To cancel the automatic winter cycle:

1. the Nova sender should be powered up. Once powered up Nova LCT Mars software should be used to return to the prestore picture menu. Once in this menu the correct selection should be made to cancel the prestore picture and return the screen to displaying black when it receives no signal or a fault condition.
2. In addition the Shelly controller inside the Head End should be programmed to disable the automatic startup schedule that was put in place at the start of the winter. For information on how to do this please refer to the chapter above on programming the Shelley control unit.

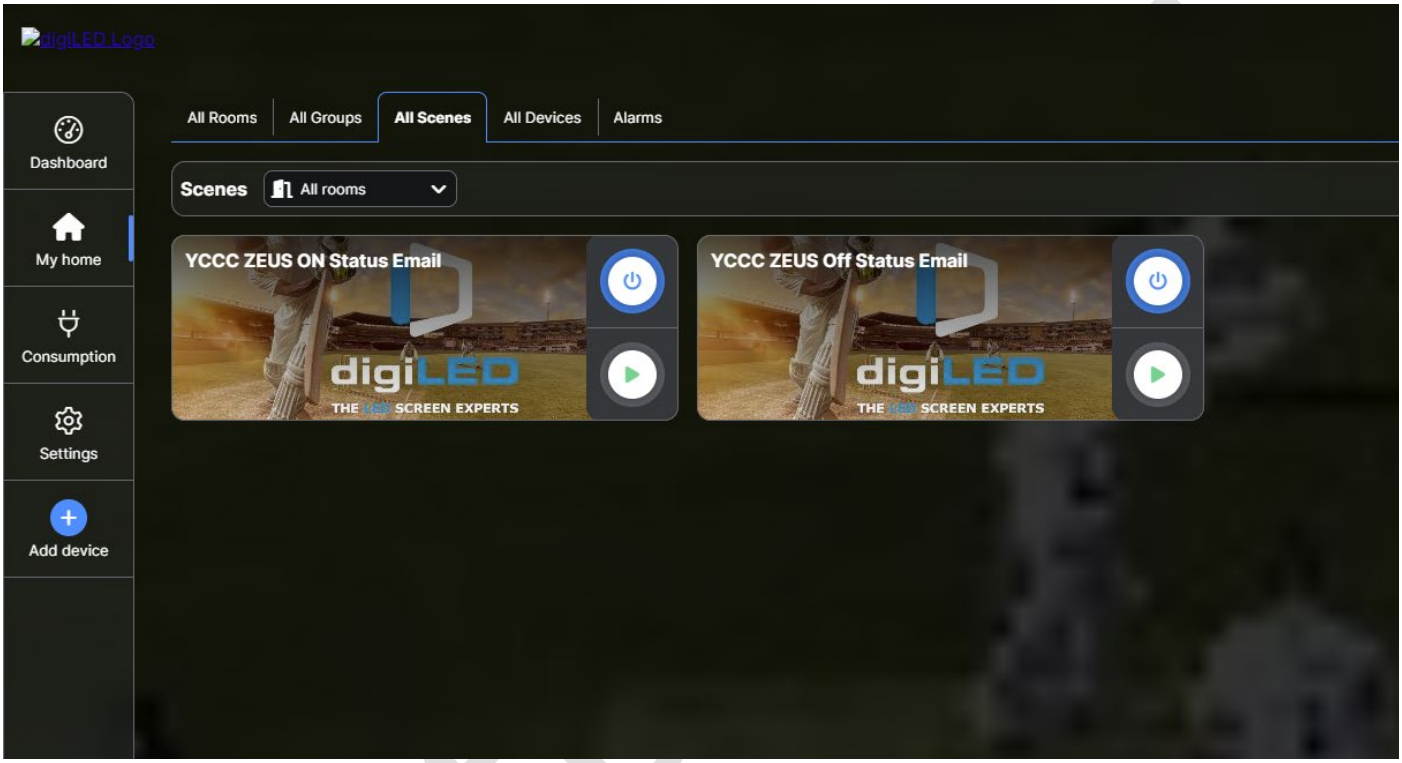
The screen can now be returned to normal operation. digiLED strongly recommends however that the brightness is not raised too quickly from the 10% value to 100%. digiLED recommends the brightness is ramped up over a period of 24 hours so as to not shock the SMD LEDs.

This 24 hour brightness ramp can be programmed and run automatically from the brightness scheduling table built into Nova LCT Mars and software. The video source should be set to pure white video while the brightness ramp is used.

Reporting, Fault Finding and Diagnostics

Email Reporting

Using the Shelly Cloud environment, email reporting can be activated using the SCENES menu of the main Cloud webpage.



In the example above, two scenes are created, one to email a "Zeus has been switched ON" message and one for an equivalent "OFF" email.

Please note. Scene creation is only possible AFTER the onboarding of new Shelly devices and the allocation of "rooms" to the device.

Scene Summary

A pop-up Wizard is used to help users through a step-by-step process of creating Scenes.

Scenes are created using a logic flow of

- Selected Room and Device
- When
- Do
- Active Times
- More

Each of these headings has sub-features which the wizard prompts you to complete in order to create a functioning scene.

Scene Creation Example

Click on the MY HOME button on the left-hand bar of the Shelly Cloud webpage. In the top bar, click on the ALL SCENES tab.

On the right-hand side, a blue PLUS icon can be seen. Click this to create a new scene.

An ADD SCENE Wizard pops up.

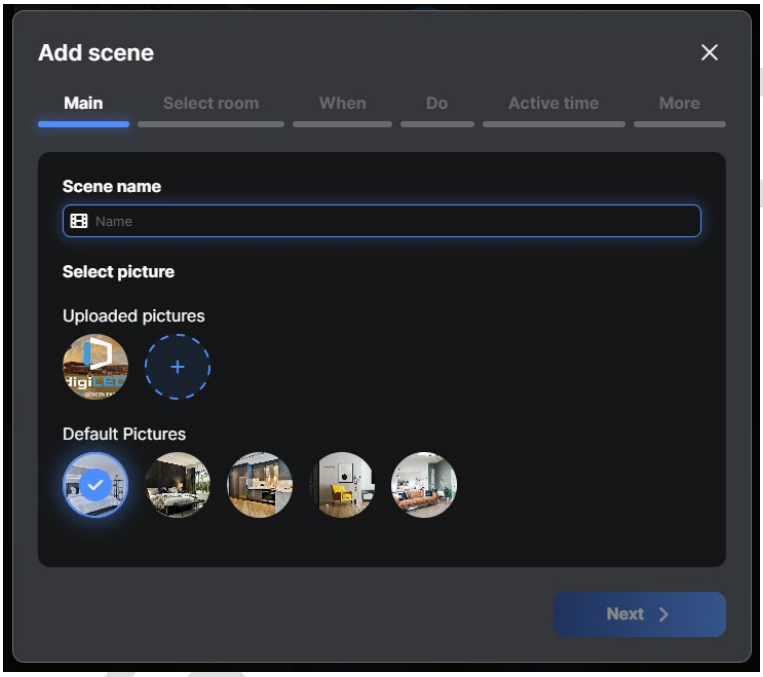


Figure 36 - Add Scene Wizard Window

Give your new scene a relevant name such as East Screen ZEUS On and if desired, select a suitable picture icon to help make scene operation clear to all users.

Click NEXT to select which "room" and which "device" the scene will apply to.

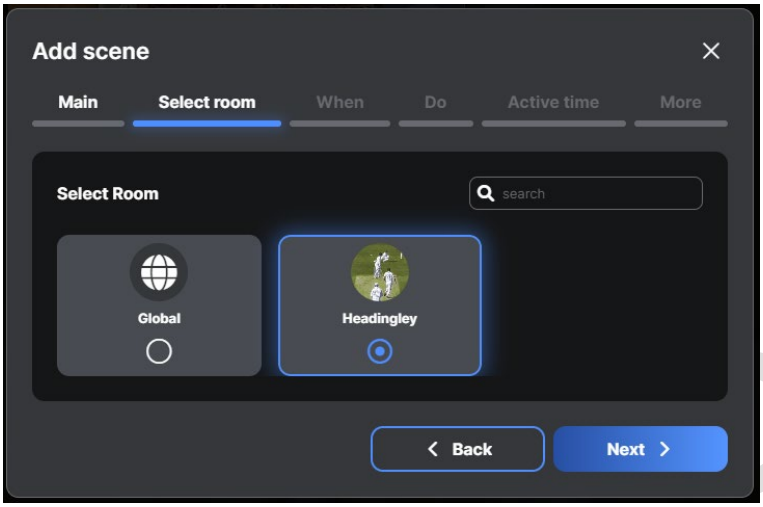


Figure 37 - "Room" Selection in Wizard

Click NEXT to move to the WHEN option.

Now click ADD CONDITION

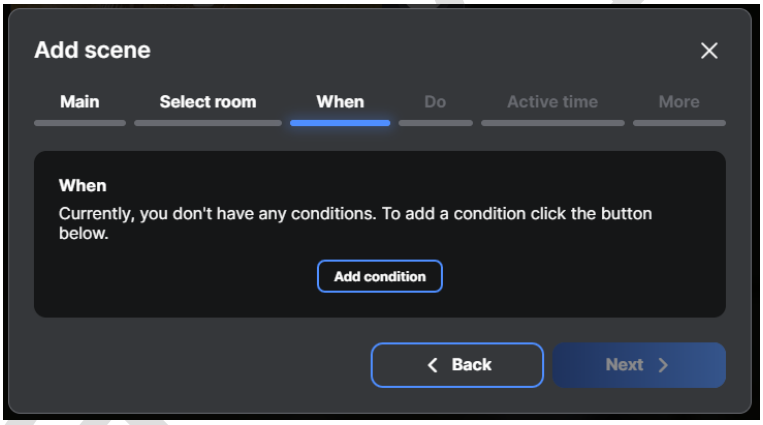


Figure 38 - Add Condition

In the following window, the CONDITION is programmed:

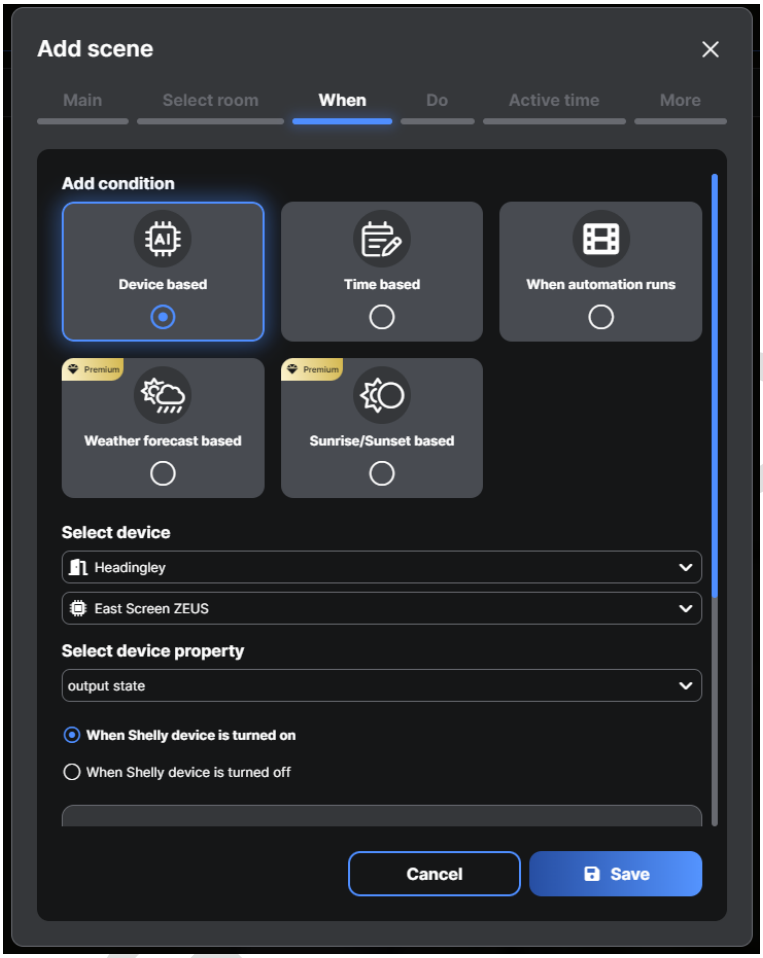


Figure 39 - Condition parameters in Scene

In the above example, a Device Based condition has been created, namely:

- In the room "Headingley"
- The device East Screen ZEUS,
- Has its output state monitored,
- For a change to an ON state.

The window will now need to be scrolled down to see the final part of these settings:

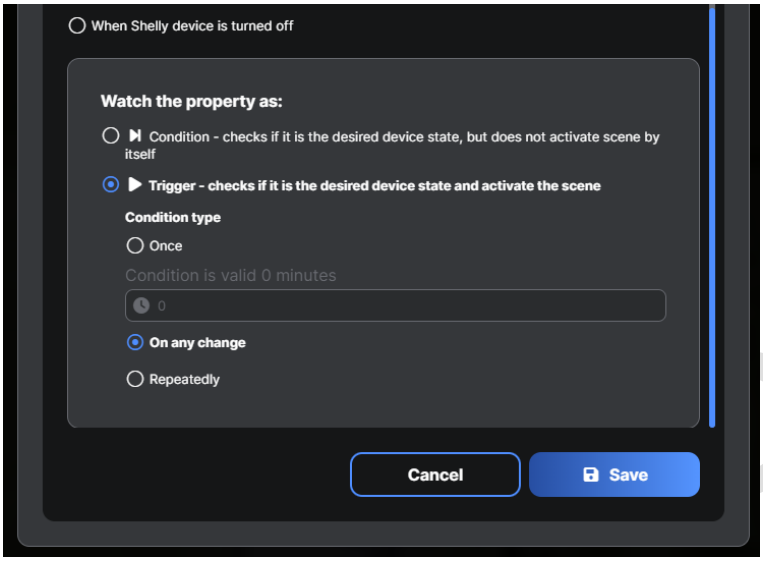


Figure 40 - Lower Window of Conditions

In the above window, the WATCH THE PROPERTY AS… selection has been set as TRIGGER, ON ANY CHANGE.

Click SAVE to continue.

As this is the only CONDITION to program, click the NEXT button to continue

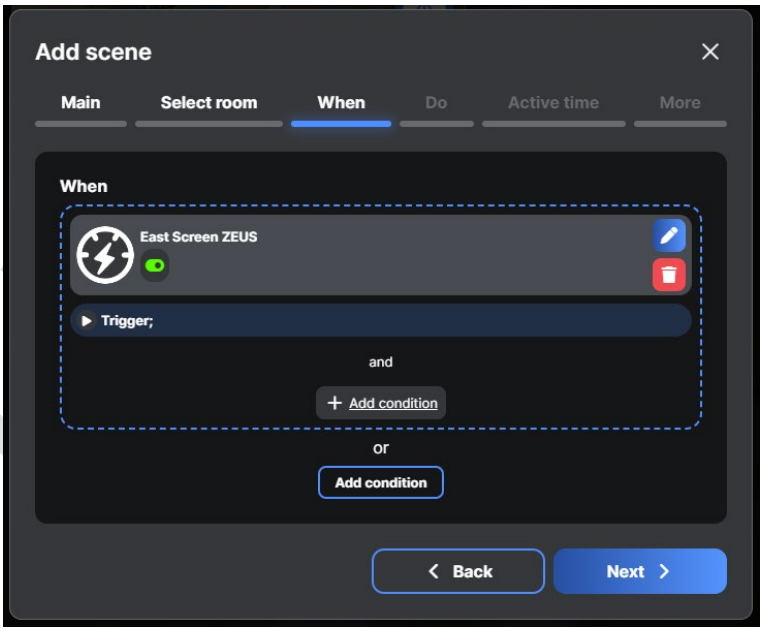
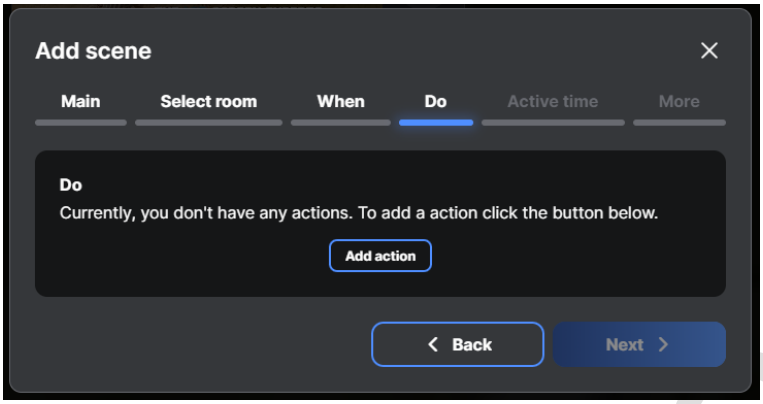


Figure 41 - Click NEXT to complete WHEN programming

The wizard now guides you through the DO section with the following window:



Click ADD ACTION to setup the email alert. The Action type selected should be NOTIFY ACTION and the SELECT NOTIFICATION TYPE should be set to EMAIL NOTIFICATION.

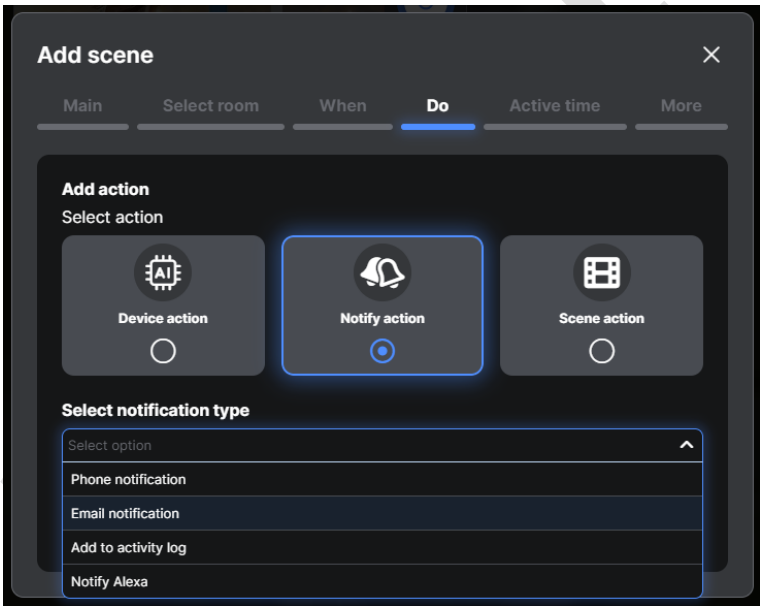


Figure 42 - Setting Email as Notification

In the box displaying the text "My Scene Triggered" edit the text to create your own unique message that will be embedded in your email alert.

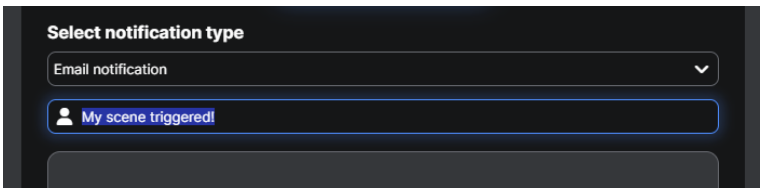


Figure 43 - Email Message Contents Text

Click the SAVE button to confirm the email programming. The DO section of the wizard is now complete.

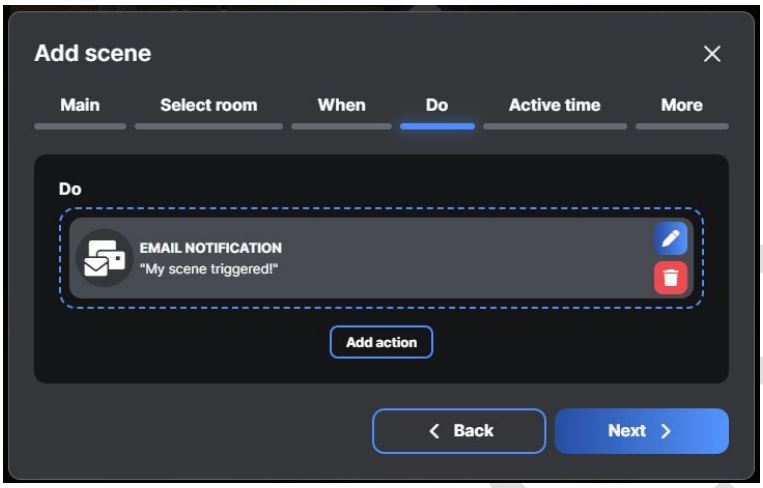


Figure 44 - Wizard DO programming complete.

Click the NEXT button to move to the ACTIVE TIME section of the programming.

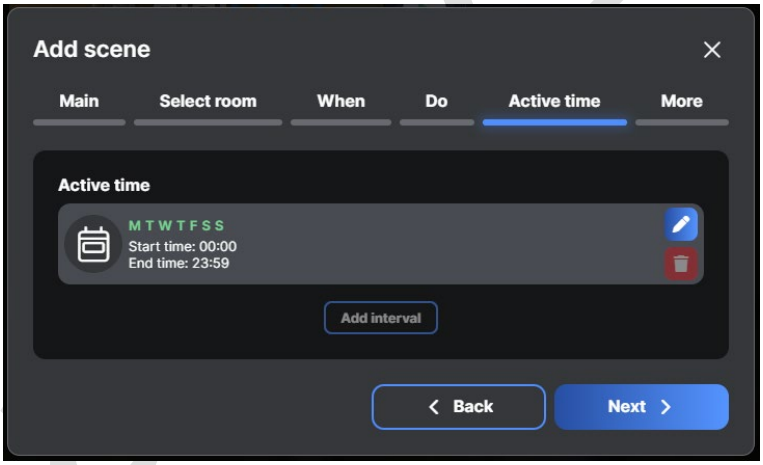


Figure 45 - Active Time Options

By default the wizard sets the active time to "all days of the week" and "all hours of the day". As this is appropriate for our email alert, don't change these settings. Just click NEXT complete the final step in the wizard.

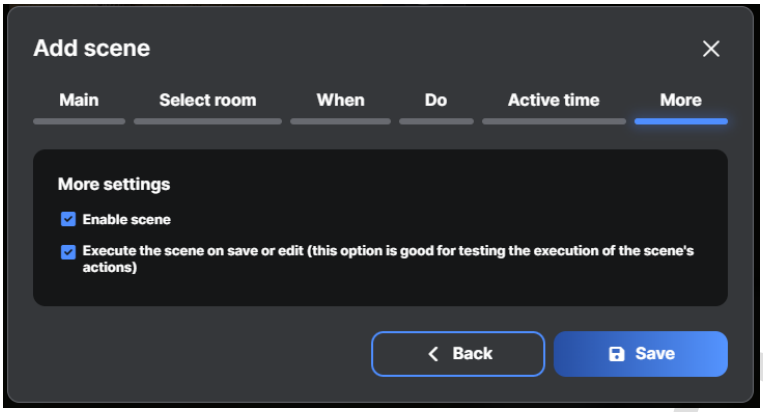


Figure 46 – Finalising the wizard process.

In this final step, leave both options ticked. As the boxes suggest this will both enable the scene in the Shelly Cloud and send a test email to verify it works.

Click SAVE to complete the process.

An email will then be sent from noreplyX@shelly.cloud to the email address used to register the Shelly Cloud account. (note, the X in the email sender will be a number from 0 to 9, selected at random by the cloud hardware)

Adding a Second Scene

In the above example, a Scene has been created that triggers an e-mail report when the Shelly device is switched on. If we also wish to receive an e-mail when the Shelly device is switched off, a new scene must be created.

This is done in exactly the same way as the instructions above, except the DEVICE ACTION must be DEVICE = OFF.

Complete and save the second scene in exactly the same way and once finished, both scenes will be visible in the scene section of the dashboard.

Email Forwarding

The report email is by default sense to one e-mail address only. If you have admin rights to your mail server or mail programme, you can set up your own e-mail forwarding rules. To trigger this notification, e-mail to go out to as many users as you choose. Please note however, this is done in your own e-mail environment and not in the Shelly Cloud environment.

Fault Finding

CAUTION - Any fault-finding of the ZEUS™ PCBs that are installed in the LED panels must be undertaken with extreme caution by suitably qualified professionals.

The ZEUS™ PCB, when installed in a panel, carries up to 240 volts ac on the board.

This represents a potential electric shock hazard to technicians working on the device who are not competent in high voltage electrical systems diagnosis.

If in doubt, stop work and seek help from a suitably qualified individual.

The most common type of faults likely to occur with a ZEUS™ system are cable faults from the Cat5 cables and their terminations.

If a Cat5 cable fault is suspected, the ZEUS™ Head End should be powered down and an appropriate cable tester used to verify that all 8 conductors in the cable are healthy and exhibit low impedance.

Any suspect Cat cables should be replaced as and when they are found.

A second useful diagnosis tool is to use a spare ZEUS™ PCB from the supplied spares kit with the screen.

In this limited case, it IS acceptable to fault-find with the Head End powered up.

The spare ZEUS™ PCB can be used to identify and troubleshoot how far the ZEUS™ control signal is travelling along the daisy-chain hops of the ZEUS™ nodes.

Note that when a hand-held (not installed in a panel) ZEUS™ PCB is used, the highest voltage present on the ZEUS™ system is 50 vdc. This is broadly considered safe to work with by competent persons.

Maintenance

As a fan-free, naturally cooled device, both ZEUS™ Nodes and the ZEUS™ Head End require little to no preventative maintenance.

Appendix

Appendix 1 FCC Part 15

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Appendix 2

Appendix 3 – Head End and UPS Warning

At the start of this document, a warning is shown instructing users to never install a Head End in a rack or system with a Uninterruptible Power Supply.

The following details the reason and an example of why this warning exists.

The reason a UPS system is forbidden is that a condition may arise where the screen is experiencing a power cut but, due to the UPS, the Head End doesn't.

Scenario

Imagine a screen and its equipment has a power cut.

When the power returns, so long as there is no UPS installed, ZEUS will hold the screen in a powered-off state.

This will ensure that no huge power spikes or inrush occurs at the moment when the power returns.

Contrast this with a scenario where during the power cut, ZEUS remains on and active due to a UPS running in the rack. In this scenario, when the power cut is restored, the screen is in a fully energised state and every single PSU in the screen will demand input power at the very millisecond that the power is restored.

This will most likely result in overloads and power spikes.

The "no UPS" warning in this document is to prevent this scenario.

Worst Case Scenario

If the instructions in this document were ignored and a UPS was installed with the ZEUS Head End, it is likely that MCBs and Breakers in the power distribution system for the screen would trip.

So long as the power distribution system is well designed and appropriately sized, this should be the extent of troubles if a UPS was used.

No consideration or guarantees are given for systems where the power distribution system is incorrectly designed, sized or connected.

Glossary

Allen Key	A type of hexagonal shaped screwdriver / tool.
AV	Audio Visual – A generic term for our industry that encompasses both Audio and Visual technical works.
Cabinet	See Panel
Chassis	The diecast aluminium back shell of a digiTHIN Panel
Feeder Cables	A generic name for the cables that connect a screen to its head end, control equipment or power source (sometimes caked Whips in the US)
Frame	See Chassis
Head End	The digiLED supplied rack mount device that controls and sends the signal to the network of ZEUS™ cards to power ON or power OFF depending on programming.
IP	Internet Protocol. A generic name for information that is sent over Ethernet connections.
L.E.D. / LED	Light Emitting Diode. The semiconductor device on the surface of the screen that produces Red, Green or Blue light.
LAN	Local Area Network. Refers to a data network (usually IP) that is in close physical or operational proximity to a connected device. i.e. all the computers in one office building may be connected to a LAN.
LED Tile	The Opto-electronic PCB mounted on the front of the digiTHIN that displays the video image.
LH	Left Hand
Newtons	A Scientific Standard Unit of Force
Node	A quick reference name for one single ZEUS™ PCB installed in a screen.
Nova LCT Mars	The control software written by Novastar Technologies for programming and managing the operation of the panels and receiving cards of an LED screen.
Panel	A complete assembly of digiTHIN Chassis and LED tiles
PCB	Printed Circuit Board
Prestore Picture	An image uploaded into Nova LCT Mars software that is then transmitted and stored on receiving cards. The image can be triggered to display on the LED in the event of signal failure or the boot up of the receiving card.
PSU	Power Supply Unit - A device to convert high voltage AC power to low voltage DC power for use inside electronic equipment.

R.M.A.	Returned Materials Authorisation
RCD	Residual Current Device - A trip or breaker that disconnects an electrical circuit when an earth fault condition is detected.
Receiving Card	The small PCB inside every digiTHIN that functions as the "brains" of the panel.
RH	Right Hand
RJ45	The correct technical name for the plug and socket system used with Cat5e cable. RJ45 plugs are normally found on the end of Cat5 cables. RJ45 sockets are normally found on devices such as the PDP.
S.M.D.	Surface Mount Device – The LED package containing both Red, Green and Blue LEDs. Found on the front face of the THIN soldered to the PCB in an array that creates the optical surface of the display.
Topology	(in this manual) the shape and connection direction of a daisy-chain of cables. Can be power or data.
WAN	Wide Area Network. Refers to a data network (usually IP) that is connected beyond the local of the connected device. i.e. a company's WAN might connect offices in two cities.
WEEE	Waste Electrical and Electronic Equipment Directive. A new European legal requirement covering the end of life treatment for all electronic goods.
X Axis / X Plane	When viewing the front of a screen, X Axis refers to a movement or line from left to right (or right to left)
Y Axis / Y Plane	When viewing the front of a screen, Y Axis refers to a movement or line from top to bottom (or bottom to top)
Z Axis / Z Plane	When viewing the front of a screen, Z Axis refers to the axis where THINs / Panels become more recessed or proud than the neighbouring screen surface i.e. perpendicular to the screen surface.
ZEUS	Zero Energy Use System. See this document.