White paper:
Integration of fixed white OneSpace panels with DALI controls

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1   Introduction

The ColorKinetics OneSpace portfolio consists out of 2 product ranges:

- ColorKinetics OneSpace Luminous Ceiling (OS LC)
- ColorKinetics OneSpace Prefab (OSP)

The differences between these 2 portfolios are mainly defined by the dimensions.
OneSpace Prefab comes in ready to mount panels with dimensions from 900mm x 900mm up to 1800mm x 3000m.
OneSpace Luminous Ceiling is available in bigger sizes, up to 3000mm x 9900mm.
Because OneSpace Luminous Ceiling is too big to be delivered, ready to mount, in a box, the panel is divided in smaller modules that are installed as one panel on location.

With respect to controls and system integration the general control architecture is the same for both product ranges. The key difference is the total amount of drivers that are used in the panels. The total number of drivers is depending on the dimension of the panel.

OneSpace panels can be controlled via DALI or 0-10V control systems. The Tunable White panels are only available with DALI interface. 0-!0V is only available for the fixed white versions and only for the US region.

White papers, similar as this one, are available for following topics:
- Integration of fixed white OneSpace panels with DALI controls
- Integration of fixed white OneSpace panels with 0-10V controls
- Integration of OneSpace TW panels with DALI controls
- Integration of OneSpace panels - occupancy / daylight harvesting
- Integration of OneSpace TW panels - circadian rhythm control
- OneSpace - Enabling internal DALI power supply of Philips Xitanium SR driver

For more information please contact your ColorKinetics representative.

www.colorkinetics.com

2 Control interface OneSpace

2.1 DALI interface explanation

OneSpace modules/panels are controllable via a DALI 207 interface (digital addressable lighting interface). DALI is a two-way communication protocol that permits devices to be individually addressed and it also allows multiple devices to be addressed simultaneously via multicast or broadcast messages.

Each device is assigned a unique static short address in the numeric range 0 to 63. Which makes it possible to have maximum 64 devices on one DALI network. More devices can be controlled if a broadcast signal is used with a limit that the DALI bus current does not exceed 250mA.
Data is transferred between controller and devices via an asynchronous, half-duplex, serial protocol at a data rate of 1200 bit/s.

A two-pair wire cable is used for the DALI network. The network can be arranged in a bus or star topology, or a combination of these. DALI is not classified as SELV (Separated Extra Low Voltage) and therefore its wiring may be run next to mains cables or within a multi-core cable that includes mains power.

DALI wires can be connected to a device without regard for polarity with a maximum length of 300 meters.

2.1.1 DALI specifications OneSpace

DALI specifications Philips Xitanium drivers:

- Philips Xitanium 75W 0.7-2.0A 54V SR 230V
    o 12nc: 9290.015.05006
    o CE and CCC
- Philips Xitanium 75W 2.0A 54V SR 120-277V
    o 12nc: 9290.007.27513
    o UL
- DALI power consumption per driver: 2mA max.

Factory default settings:

1. Power on setting: DALI 254
   - When power is applied to the OneSpace panel, the luminaire fully lights up to its maximum setting.
2. System failure setting: DALI 254
   - When the DALI signal is lost the OneSpace panel goes to its maximum state.
3. Maximum: DALI 254
   - This is the maximum dimming level, so 254 means that max DALI output is Max power setting.
4. Minimum: DALI 169
   - This is the minimum dimming level, so 169 means that the OneSpace panel is dimmable to 10%.
5. E-box: Group address 0

2.2   Hardware explanation OneSpace

OneSpace has two major components
1.   light panel (or module)
2.   E-box that is connected to the light panel.

The E-box consists out of Philips Xitanium constant current drivers together with a terminal block for connecting mains and control interface.

Figure 1: Inside look of an E-box with the maximum quantity of drivers

The number of drivers inside an E-box vary with the size of the panel. Below table describes the number of drivers inside the E-box. In case of multiple OneSpace Prefab panels or in case of a OneSpace Luminous Ceiling panel which consists out of multiple modules, multiple E-boxes must be connected to the same control interface. Always check the maximum number of drivers that can be connected to the used control system. Contact your control system representative for more information.

Table 1: number of drivers vs panel (or module) size

Number of 75W drivers vs panel (or module) size		Width (mm)				
		600/ 2	**900/ 3**	**1200/ 4**	**1500/ 5**	**1800/ 6**
Length (mm and ft)	**900/ 3**	1 driver	1 driver			
	1200/ 4	1 driver	1 driver	1 driver		
	1500/ 5	1 driver	1 driver	1 driver	2 drivers	
	1800/ 6	1 driver	1 driver	2 drivers	2 drivers	3 drivers
	2100/ 7	1 driver	2 drivers	2 drivers	3 drivers	3 drivers
	2400/ 8	1 driver	2 drivers	2 drivers	3 drivers	3 drivers
	2700/ 9	1 driver	2 drivers	2 drivers	3 drivers	3 drivers
	3000/ 10	1 driver	2 drivers	2 drivers	3 drivers	3 drivers

Table 2: DALI current consumption per E-box

E-box type	DALI current consumptions
E-box 1 driver	2mA max
E-box 2 drivers	4mA max
E-box 3 drivers	6mA max

When setting up the DALI network it is important that the number of drivers in the project is known. If the maximum number of 64 devices in a DALI network is exceeded, a second DALI network is needed.

The number of drivers in the network also define the needed DALI power supply (together with all other DALI devices in the network). Be aware that the number of drivers can be higher than the number of E-boxes.

2.2.1   Example: 40 panels (or modules) - size 1200mm x 2700mm

Below example describes a project with 40 panels of the size 1200mm x 2700mm.

Each panel (or module) has 1 E-box with 2 drivers inside. So, we need 40 x 2 = 80 DALI addresses. This is not possible within 1 DALI network, so we must use 2 networks if we want to control all the panels (or modules) separately by an BMS.

For group control you can also use a broadcast signal.
A simple dimmer that sends a broadcast signal can control hundreds of panels if we make sure that we use the right hardware (DALI repeaters and DALI power supplies).
Each driver consumes 2mA on the DALI network, so in this example this would be 160mA (without taking into account the control devices in the network).

2.3 Inrush currents CE & CCC E-box

When using a lot of panels, care must be taken that the inrush currents are still within limits of the used circuit breaker. The following specification are valid for the Philips Xitanium 75W CE/CCC drivers that are inside the E-box.

Table 3: Inrush current – CE & CCC

Specification	Value	Unit	Condition
Inrush current Ipeak	24.9	A	Input voltage 230V
Inrush current Twidth	215	µs	Input voltage 230V, measured at 50% Ipeak
Drivers / MCB 16A type B	≤ 24	pcs	
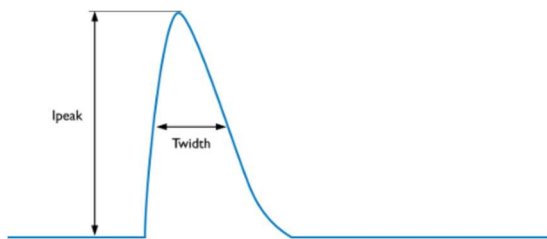
Figure 2: Inrush Current CE & CCC – info

Below table shows the number of drivers that can be connected to different types of circuit breaker with.

Table 4: Number of drivers per MCB type

MCB	Rating	Number of drivers
B	10A	15
B	13A	19
B	**16A**	**24 (default in datasheet)**
B	20A	30
B	25A	37
C	10A	24
C	13A	32
C	16A	40
C	20A	49
C	25A	62

So, for a panel with 3 drivers, maximum 8 panels can be connected to a MCB 16A type B.

2.4   Inrush currents UL E-box

Table 5: Inrush current - UL

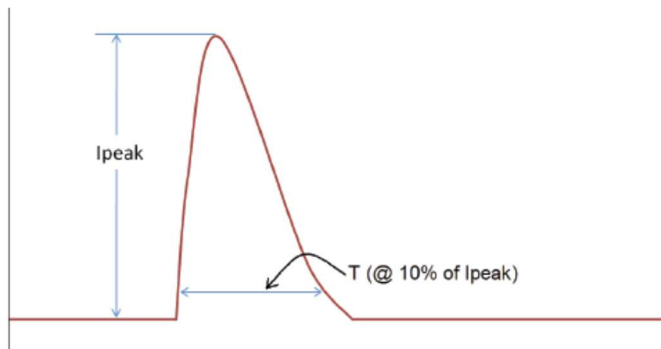| Specification	Value	Unit	Condition
Inrush current Ipeak	24	A	Input voltage 120Vrms
Inrush current Twidth	369	µs	Input voltage 120Vrms, measured at 10% Ipeak
Inrush current Ipeak	57	A	Input voltage 277Vrms
Inrush current Twidth	348	µs	Input voltage 277Vrms, measured at 10% Ipeak

Figure 3: Inrush Current UL – info

3   DALI controls

A OneSpace panel can easily be controlled via a DALI control system. This can be a simple DALI broadcast rotary dimmer, group control (via DALI group address 0) or a complex BMS for broadcast/group or addressable control.

Below a couple of broadcast only controls examples.

3.1   Broadcast only examples

3.1.1   1 OSP panel project with a rotary dimmer

- 1x rotary DALI 207 dimmer with integrated DALI PSU 52mA
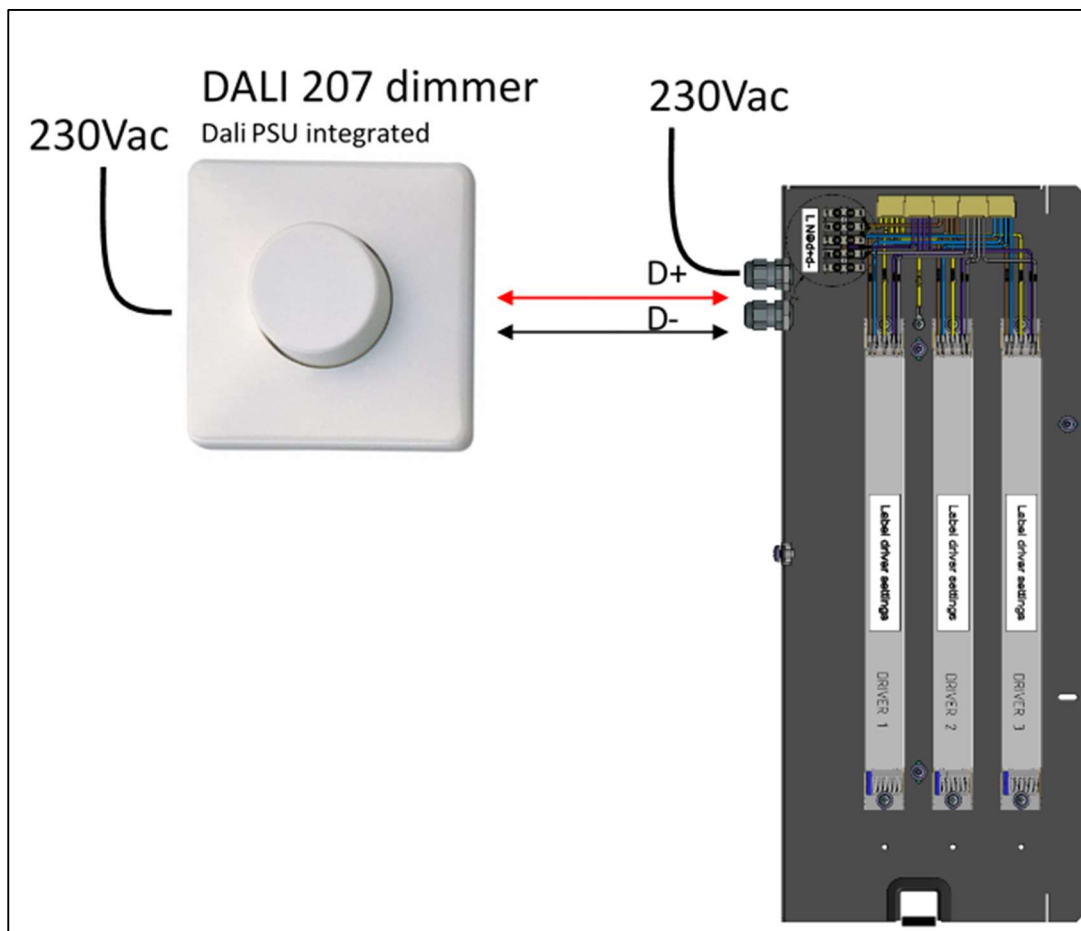- 1x OneSpace E-box with 3 drivers

Figure 4: Broadcast - 1 E-box

3.1.2   Multiple E-boxes project with a rotary dimmer

- 1x rotary DALI 207 dimmer with integrated DALI PSU 52mA
- Maximum number of OneSpace E-boxes with 3 drivers
    - 3 drivers per E-Box → 3x 2mA = 6mA per E-Box
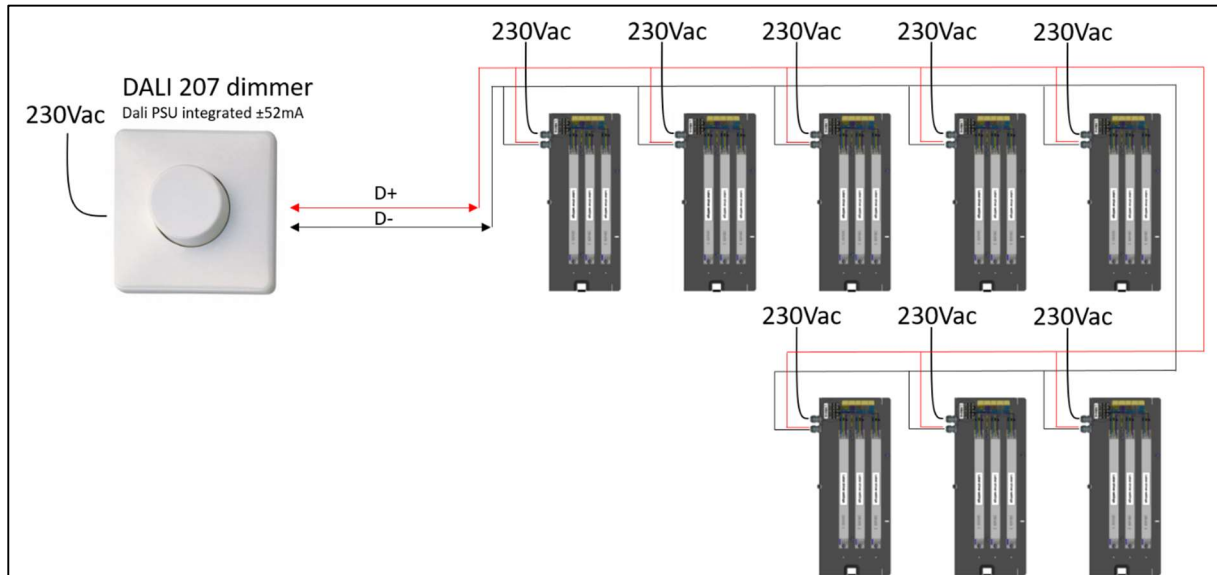   - 52 / 6mA = 8 E-boxes.

Figure 5: Broadcast - Multiple E-boxes

3.1.3   100+ panels project with a rotary dimmer

- 1x rotary DALI 207 dimmer with integrated DALI PSU 52mA
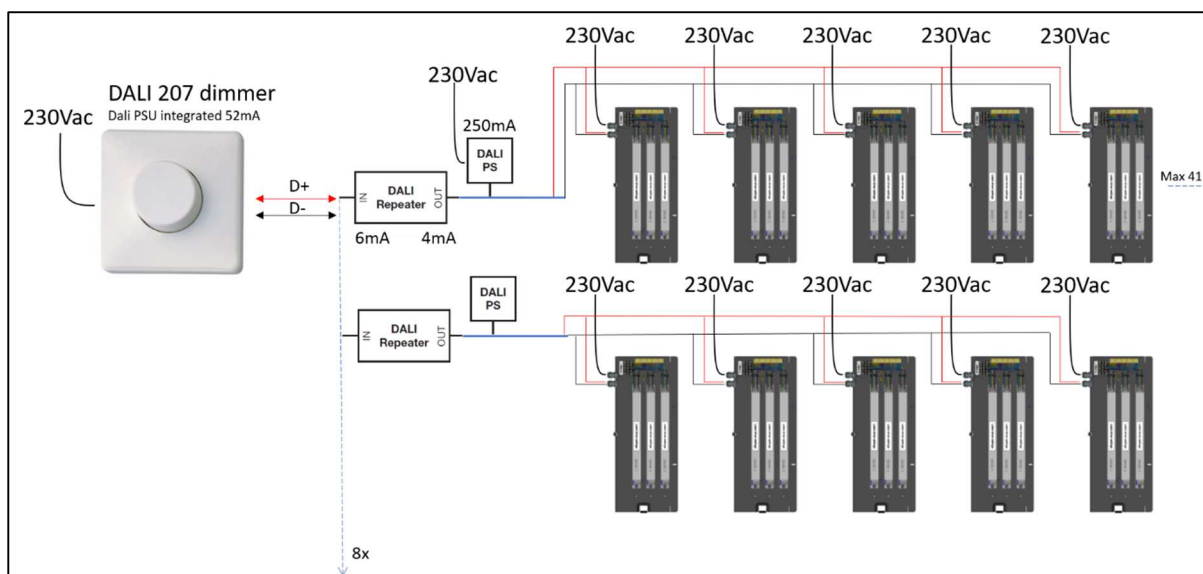- Max 8x DALI repeater
- Max 8x DALI PSU

Figure 6: Max 328 OneSpace E-boxes with 3 drivers

3.1.4   Max 96 E-Boxes project 12 broadcast channels with Dynalite DDBC-1200

- 1x Dynalite DDBC-1200
- 1x Antumbra display
- 96x OneSpace E-boxes (with 3 drivers)
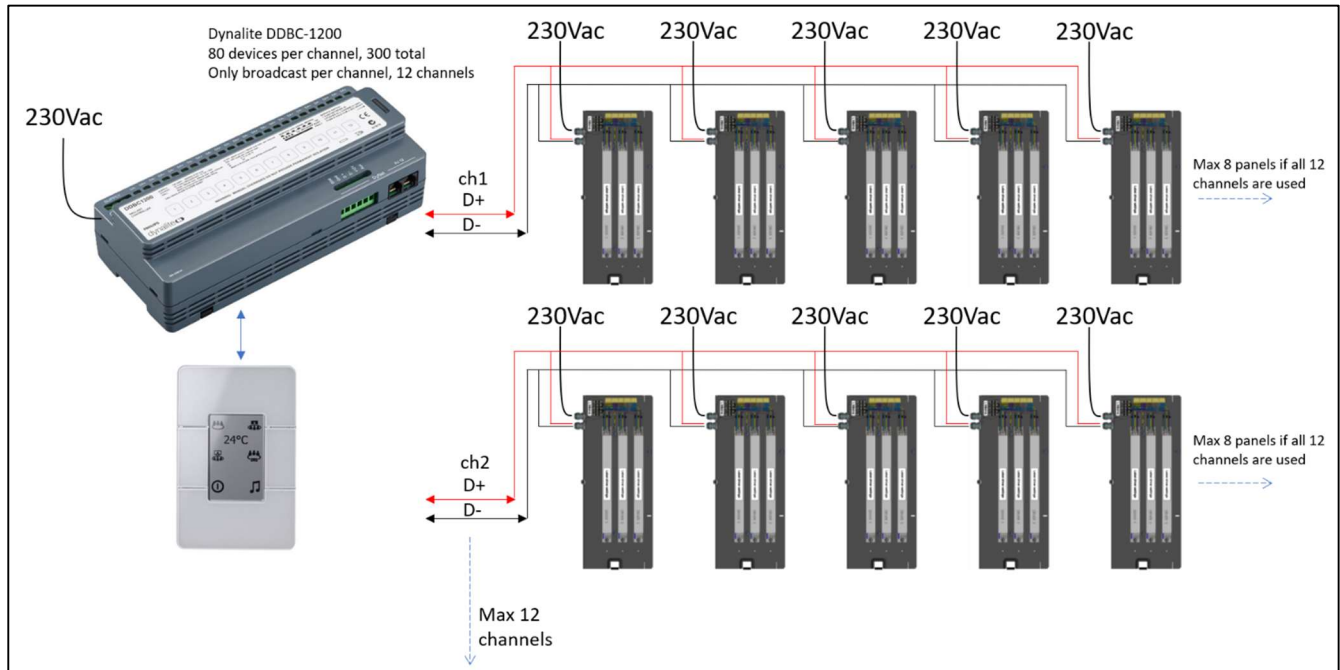- 12 broadcast channels -> 12 "groups"

Figure 7: Multiple broadcast channels with Dynalite DDBC-1200

3.2   Fully addressable examples

3.2.1   21 E-Boxes project with Dynalite DDBC-120 (each E-Box fully addressable)

- 1x Dynalite DDBC-120
- 1x Antumbra display
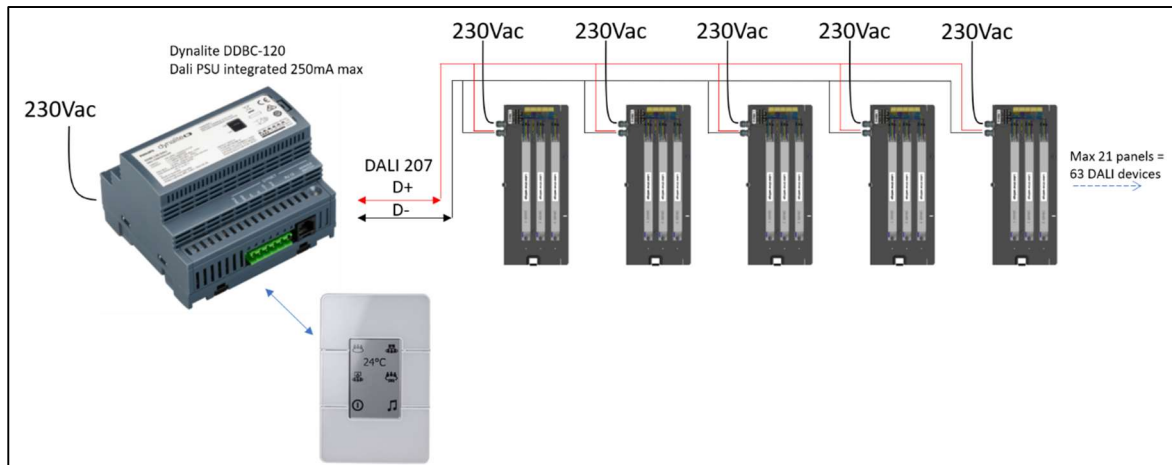- 21x OneSpace E-Boxes (with 3 drivers)

Figure 8: Maximum 21 E-Boxes with Dynalite DDBC-120

3.2.2   100+ E-Box project with Dynalite DDBC-120 (each E-Box fully addressable)

- 5x Dynalite DDBC-120
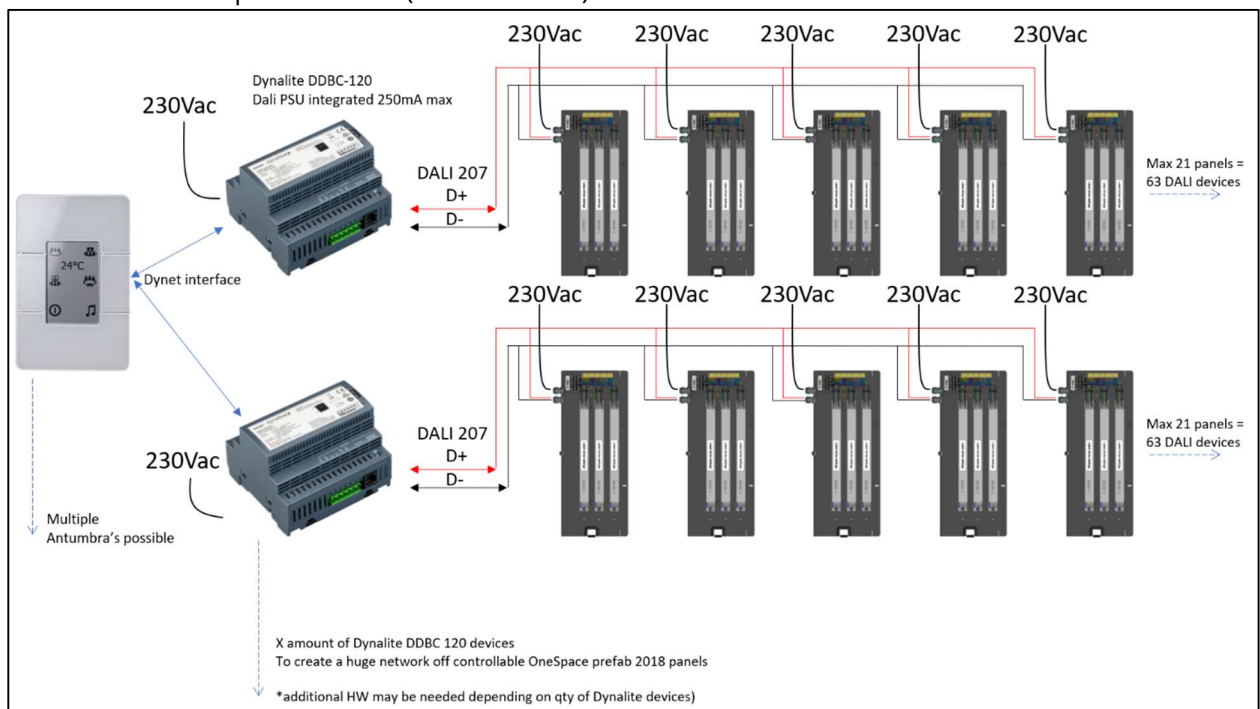- 1x Antumbra display
- 105x OneSpace E-Boxes (with 3 drivers)

Figure 9: 100+ E-Box project with Dynalite DDBC-120