PX255

DMX/DALI/DMX

Interface

User manual

Table of Contents

Manufacturer reserves the right to make modifications in order to improve device operation.

1   Description

DMX/DALI/DMX Interface is a powerful device that allows to combine dynamic light system based on the DALI protocol and systems using DMX-512 signal. It allows to connect DMX-512 device in the DALI protocol, or to connect DALI device operating in the protocol DMX-512 standard. According to DALI specification, the PX255 can control up to 64 DALI devices (such as ballasts). A menu of the PX255 allows to address individual lamps or groups of devices, user can create up to 16 groups.

Additionally, for each of the lamp (ballast), it is possible to define a number of individual parameters such as minimum and maximum brightness of the lamp, the time at which the brightness of the lamp reaches its maximum value ("*fade time*"), the number of steps needed to achieve the maximum level of brightness ("*fade rate*") or determine the brightness of each lamp in the event of failure of the control system.

The device is powered from 24V DC and manufactured in a housing of six individual rail modules width adapted for mounting on 35mm wide DIN rails.

2 Safety conditions

DMX/DALI/DMX Interface is powered with safe voltage 24V DC; however, during its installation and use the following rules must be strictly observed:

1. The device may only be connected to 24V DC current (stabilized voltage) with current-carrying capacity compatible with technical data.
2. All the conductors should be protected against mechanical and thermal damage.
3. In the event of any conductor damaging, it should be replaced with the one of the same technical data.
4. Connection of DMX signal should be made with shielded conductor.
5. All repairs and connections of outputs or DMX signal can only be made with power off.
6. PX255 should be strictly protected against contact with water and other liquids.
7. All sudden shocks – particularly dropping – should be avoided.
8. The device cannot be turned on in places with humidity exceeding 90%.
9. The device cannot be used in places with temperature lower than +2°C or higher than +40°C.
10. For cleaning use only a damp cloth.

3   Connectors and control elements
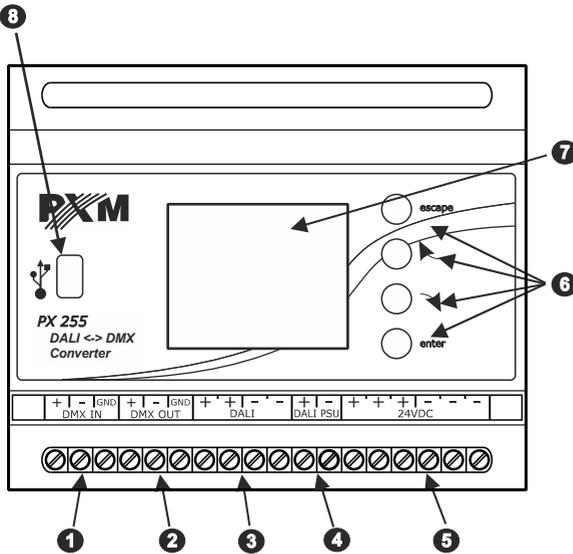
1. DMX-512 input
2. DMX-512 output
3. DALI input
4. DALI power supply
5. Power supply
6. Control buttons
7. Display
8. USB input

4   Navigating the menu

Navigating the menu of the device allow programmable buttons. Every button is described on the right side and their use is as follows:

escape – exits from the currently programmed parameter without saving the changes or goes to the higher level in the menu (pressing the *escape* button while being in main menu will cause to exit to the *summary screen*)

◤ – scrolls up the menu or left (horizontal menu)

◢ – scrolls down the menu or right (horizontal menu)

enter – allows to enter the selected option and approve the set value

To change the value of selected parameter, you must choose on the screen button "+" or "-" using the ↖ or ↘ key.

After that you need to save the settings before going level up, this will allow storing value in memory of the PX255. To do this, after moving to the screen button 💾 you need to push *enter* button.

5   Use of the device

After switching on the screen shows the main window menu, which summarizes the device status. It describes all of the input signals of the PX255.

If the device receives the DMX signal it displays a green message *DMX signal OK*. If DMX signal is not detected at the input the device on the screen is displayed *No DMX Signal*. Similarly, during correct operation of the DALI bus a *DALI BUS OK* message is displayed and when there is no connection or something is wrong *DALI BUS Error*.
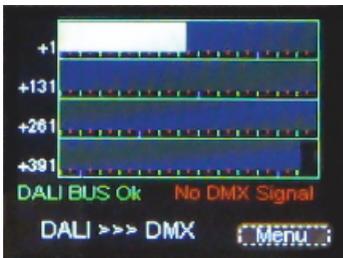
Description of information showed on *Summary screen* window:

- view of a display on the left side (DALI to DMX mode): white bars correspond to the values of virtual ballast brightness transmitted onto the DMX-512 protocol. Height of bars represents the value of the DMX signal on each channel (full height is 255, no bar means 0). The display above shows the maximum value of 64 transmitting DMX channels.
- view of a display on the right side (DMX to DALI mode): red boxes show the present value of the converted from DMX signal and sent to a specific address of DALI ballast. This address can be read from a visualization on the screen. It is the sum of the visible at the beginning of each row and column.

Red bars indicates no conversion of DMX signal to individual control onto precise address. Green fields describe converted values of DMX signal send to chosen group (between 1 – 16), blue fields shows value send to all ballasts.

Description of other messages displayed on the *Summary screen*:

- **001 – 512** – the present starting channel of the DMX-512 protocol, in which the device operates (this function is parameterized in the *DALI<<<DMX Patching* menu)
- **DMX >>> DALI** – information about the mode in which the device operates in a given moment e.g. signal processing such as DMX-512 DALI protocol.

- **DALI >>> DMX** – device work in the signal processing from the DALI to DMX-512 protocol mode

When the PX255 is working in mode DALI to DMX-512 signal conversion it simulates the work of ballast (virtual ballast) allowing to any DALI controller identification of devices on the DALI line, thus sending messages to the busbar.

In the case of working mode DMX-512 to DALI the PX255 transmits the processed DMX signal directly to the DALI protocol.

6   Main menu

At the bottom of the *Summary screen* a menu screen button is placed. Once approved, with the enter button, the user is transferred to the Main menu screen. This menu allows to configure all of devices' parameters according to user needs. The following picture shows the list of available options.

To select one of them use ↖ or ↘ buttons and then choose an option and confirm the selection by pressing enter.
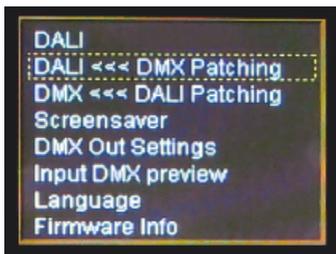

NOTE! The conversion, for example, from DMX to DALI is written as **DALI <<< DMX Patch.**

7 Programming device settings

7.1 DALI

After selecting *DALI* sub-menu a user will see another window. Available options allow to menage all the options associated with the DALI protocol. The picture below shows the list of available options. To choose one of them you need to select appropriate option with ↖ or ↘ buttons and confirm the selection by pressing *enter* button.
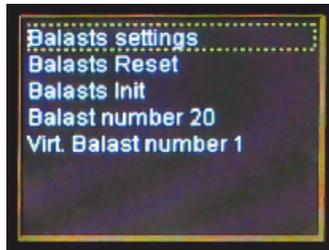
Remarks:

Ballast – is a device plugged in to the DALI bus. Typically, this is part of the lamp, but it may also be other DALI device.

DALI interface protocol is relatively slow compared to the DMX protocol, because of that in large installations to optimize it is recommended:

- limit number of ballast (7.1.4 point) to the actual number of lamps in the system
- group ballasts delete redundant address groups

7.1.1 Ballasts settings

The *Ballast settings* menu is the first available option. It allows to change all the major features for available ballasts. When selected, and after pressing *enter* button, the device checks the communication with DALI ballasts visible on the protocol and reads the available ballasts information.

In the vent of lack of power supply on the DALI line on the screen appears *Bus Error* message.
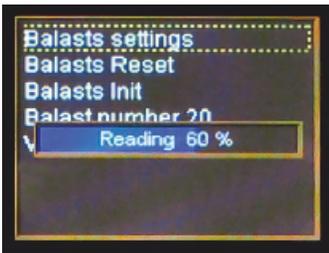
After reading the parameters on the screen is show picture visible above.

All ballasts option allows to change the settings for all devices visible on the DALI line.

Consecutive found ballasts are marked with lighting bulbs symbols that are visible next to the number of ballast. The ballast marked with with a question mark sign are not found by the PX255. The device supports up to 64 ballasts (according to DALI protocol specification). Only in recognized ballasts user can change parameters. To do this, select the ballast using ↖ or ↘ buttons, then confirm choice by pressing *enter*.

The user may use the following editable parameters:

- **Fade rate** – range 1 – 15;

  The number of steps needed to achieve the maximum level of brightness

- **Fade time** – range 0 – 15;

  The transition time between the levels of brightness:

  - 0 – immediate transition between brightness levels
  - 1 – 15 time of transition

- **Power On level** – range 0 – 254;

  The brightness of the lamp after switching on:

  - 0 – light is off
  - 254 – full brightness (100%)

- **System error level** – range 0 – 254;

  The brightness level of the lamp when on the control bus there is an error:

  - 0 – light is off
  - 254 – full brightness (100%)

- **Minimal level** – range 0 – 254;

  The lowest level of the brightness of the lamp:

  - 0 – light is off
  - 254 – full brightness (100%)

    When this parameter is set to a relatively high level, the DMX control will respond during reducing of the modulation only to this value. After crossing of minimal level the further reduction will not affect the behavior of the lamp.

If DMX signal would be set to 0 lamp would turn off every time, no matter how high the level of the minimum brightness of the lamp will be set.

- **Maximal level** – range 0 – 254;

  The highest level of brightness of the lamp:
  - 0 – light is off
  - 254 – full brightness (100%)

- **Group 1 – 16** – range 0 – 1;

  Allocation of the ballast to a specific group:
  - 0 – indicates no assignment
  - 1 – selected ballast belongs to the group

- **Scene 1 – 16** – range 0 – 255;

  The change of the brightness of the lamp for the specified scene: 0 – 254 – the brightness level of the scene, 255 – the scene is not set. Scenes are parameterized for each ballast separately by DALI controller. PX255 allows to make changes in the brightness of the scene set in the ballast. You can not select which scene will be switched on by the controller.

In addition, each ballast is described with information parameters (they do not allow to make changes in their value). Below it list of those parameters:

- **Status** – range 0 – 255;

  Displays a decimal value of the status

- **Ballast communication** – values: Yes / No;

  This indicates that the lamp responds to messages

- **Ballast fail** – values: Yes / No;

  This indicates that the lamp responds an error

- **Power On Event** – values: Yes / No;

  Displays the lamp reports that it has been switched on

- **Limit error** – values: Yes / No;

  Displays info about the state when brightness level limits has been exceeded

- **Reset state** – values: Yes / No;

  This indicates that the lamp has been reset

- **Unknown address** – values: Yes / No;

  This indicates that the lamp has lost its address
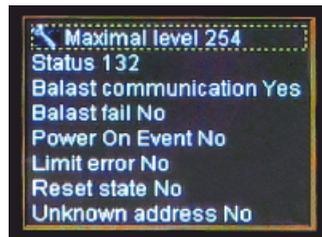
7.1.2 Ballasts reset

Ballast reset allows to restore the default settings for all ballast and each individual. To reset all ballasts at the same time, select the *All ballasts* option. After confirm with the *enter* button, a message about the execution of the operation: *Ballast Reset OK* will be showed.

When a single ballast reset is needed you need to select desired ballast and then proceed as in the case of all ballast reset. If you try to reset the ballast is not found by the device there will be an error message displayed *Reset ERR*.

7.1.3 Ballasts initialization

This is important menu because of the possibility of assigning individual addresses to selected ballasts in the chosen by the user order. Such operation allows the menu labeled as *Manual*. To assign individual ballasts according to needs the user should select the screen-button *Manual* and confirm with *enter* button. After this select using ⬉ or ⬊ button change number of ballast (in range Adr.00 to Adr.63). The device is finding ballasts separately, and each should be addressed individual.

In case you choosing *Auto* option, the PX255 automatically assigns the next found ballasts addresses (00 to 63).
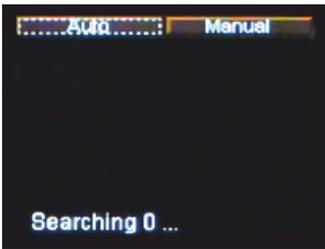
7.1.4 Number of ballasts

The maximum amount of ballast supported with DALI protocol is limited to 64, but to make it easier to program and optimize the performance we recommend to set only the required amount of ballast available in the DALI system.

To change the amount of ballast after entering to Number of ballasts you need to select the "+" or "-" screen-button using ⬉ or ⬊ buttons. Then press *enter* to set the reference value.

Remember to save values using floppy disc button 💾 and confirm with *enter*

7.1.5 Number of virtual ballasts

This menu is responsible for the amount of simulated virtual ballast by PX255. This parameter is important for devices operating in DALI to DMX-512 protocol conversion mode. According DALI protocol the maximum number of ballasts is limited to 64. The user in this menu can further reduce the number of such ballast to zero.

To change the parameters, proceed similarly as in the previous paragraph.

7.2   DALI <<< DMX (DMX to DALI) patching

This option allows you to set the parameters of conversion of DMX-512 signal to the DALI protocol. First of all, you can choose DMX channel which is responsible for the specified number DALI ballast. The option DMX address 001 is responsible for determining the DMX start address, according to which are automatically assigned consecutive DMX channels to all the ballast. It is

also possible to allocate one group to selected one DMX channel. In addition, the last option on the menu list i.e. *All ballasts < DMX---* allows to set all DALI ballasts to one selected DMX channel.

To change the default values follow these steps: select a specific ballast using ➘ or ➴ buttons and confirm by pressing *enter* button. Then the selected option is highlighted in blue, and using ➘ or ➴ buttons you can change the DMX channel values corresponding to a specific ballast. The selected value must be confirmed by pressing the *enter* button.

NOTE! Patching from DMX signal to DALI, e.g. channel 1 to ballast 0 is shown as **Ballast 00 < DMX 001**.

Remarks:

Number of visible ballasts available for lamps depends on the number of units declared by the user during the selection of the amount of ballast on the menu *DALI → Ballast number*. The default values is 12 ballasts. In such cases where the installation supports a smaller number of ballast it is advisable to limit the value of the real quantity.

When the user wants to increase reduced number of ballasts it again, there is a possibility that the device will assign automatically next available

DMX channels to ballasts. To do so the user should select the option *DMX address 001* and change its value by one (increasing or decreasing). This will quickly assign successive DMX addresses of all the ballasts.

7.3 DMX <<< DALI (DALI to DMX) patching

This option allows to enter the converted brightness value of the virtual ballast onto a given DMX channel. First of all, you can change the virtual DALI ballast address with the specified number, which is assigned to the selected channel DMX. It is also possible to send a zero value to a specified DMX-512 channel (it has to be set to zero – the screen visible below on the right).

To change the default values you need to carry on as follows: select a specific ballast using the keys ↖ or ↘ and confirm by pressing *enter*. Then the selected option is highlighted in blue, and the using buttons ↖ or ↘ you can change the value of the DALI ballast virtual number assigned to a specific DMX channel or a zero value (when to the channel DMX-512 is not sent any value). The selected value has to be confirmed by pressing the *enter* button.

NOTE! Patching from DALI signal to DMX, e.g. virtual ballast 0 to DMX address 1 is shown as **DMX 001 <<< Virtual Ballast 00**.

Notes:

Number of visible virtual ballast depends on the amount of equipment declared by the user when selecting the menu number DALI ballast *DALI →Virtual ballasts*.

The default value is the maximum number of 64 virtual ballast, but when it is necessary it can be reduced.

We use the name "*virtual ballast*" due to the need of simulations by the PX255 the real ballasts. This allows the correct operation of the protocol conversion mode from DALI to DMX-512.

7.4   Screensaver

In this menu it is possible to activate the screensaver mode after a time period of inactivity (not pressing any of programming button in PX255). To activate this feature you need to select the *Screensaver Off* button and press *enter*. After this the box next to the text *Screensaver On* will be filled in. To deactivate press one more time *enter* button.
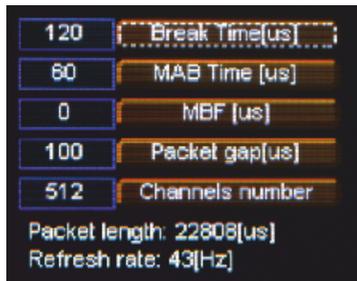
When you select *Screensaver On* you can also set the time after which the back-light of the screen is turned off. To do this, select the *Set* button and confirm with *enter*. Then there will a new screen show up where you can select the screensaver parameters. To adjust the time gap select "+" or "-" buttons and press the *enter* button.
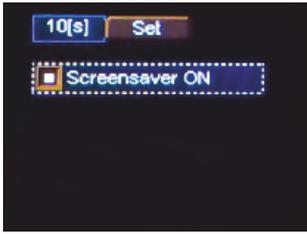
Remember to save values using floppy disc button 💾 and confirm with *enter*

7.5   DMX Out settings

After selecting a sub-menu *DMX Out Settings* on the screen will show up the currently set parameters of DMX signal. This menu allow to replace the parameters of the DMX-512 signal sent from a device. Default in the PX255 are set values visible below.

120	Break Time[us]
60	MAB Time [us]
0	MBF [us]
100	Packet gap[us]
512	Channels number

Packet length: 22808[us]
Refresh rate: 43[Hz]

At the bottom of the screen is displayed the aggregate *Packet length* and *Refresh rate* for so configured parameters.

<u>DMX-512 protocol – useful information</u>

DMX-512 protocol describes exactly the way according to which data is sent. The basic element of each data transfer protocol is a low or high level of voltage on the line called a bit. Its duration in the DMX-512 is exactly 4 microseconds. The set of such a few bits determines transmission code. In

our case code length is 8 bits or a byte. This allows 256 different combinations, e.g. levels of brightness.

To a byte of data you need to add a few control bits to determine when a byte is starting, and when it ends. In the DMX-512 there is one start bit and two stop bits. In this way we obtain a sequence of 11 bit called a frame.
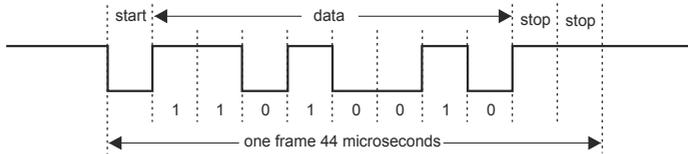

Because one frame contains full information about the DMX channel, to send all of 512 channels we need 512 frames. However, the receiver need to recognize when the entire transmission starts (i.e. which channel is first). That is way the transmission begins with the signal called BREAK. It have to last at least 88 microseconds. Another important signal is MARK AFTER BRAKE (MAB). Its length was in the original specification allocated to 4 microseconds. But it quickly became apparent that many of the devices manufactured at that time had big trouble with catching up to such a short pulse. That is why in 1990 the change of the MAB to 8 microseconds was introduced. After transferring the MAB a controller is obliged to send a START CODE byte.

The creators of the DMX protocol reserved this byte to the so-called "future applications". It was planned to mark with it sending of 512 bytes to control dimmers or other receivers. However, since the beginning it was not exactly clear what it will be those "other" device, it was assumed that at the moment its value will be zero – and it stayed so. The starting byte must be zero. If not, the receiver should ignore all the subsequent bytes.
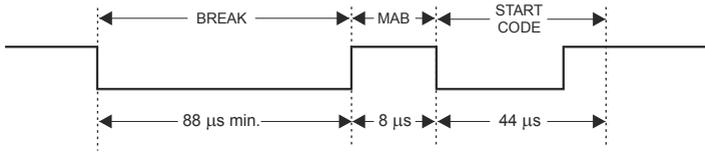
When you send a zero byte controller starts to send bytes with data, starting from the content of the first channel. The minimum number of channels permitted by the standard is 24 and a maximum 512.

This means that even if we have a simple 6-channel lam controller, the transmitter still have to send 24 DMX channels. The interval between each frame of data is marked as MARK BETWEEN FRAME (MBF) and can range from 0 to 1 second. Thus, a complete DMX package looks as below:
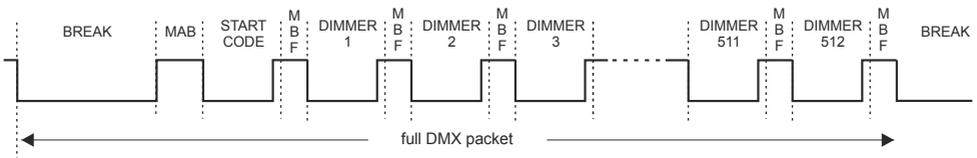
Obviously, sending time of one DMX data set depends on the number of channels. For a minimum of 24 channels it is 1196 microseconds, and for a maximum of 512 channels it is 22668 microseconds. Because of that, the maximum transmission change rate value is 836Hz (for 24 channels), and in the second case only 44hZ (for 512 channels). This is quite a serious limitation, whose effects can be observed during fast movement of e.g. a large number of scanning mirrors. Another quite important parameter is the minimum frequency of sending DMX packets. According to the standard the rate is 1Hz. This means that the interval longer then 1 second is considered as no DMX signal. Unfortunately, creators of this protocol did not defined what should do in this case the receiver. There are several possibilities:

- maintain of the recently received DMX value

- immediate shutdown of device (BLACKOUT)

- smooth device shutdown

- during the lack of DMX it sends a previously predetermined value

In the most applications a one of the first two solutions are used or the user is allowed to select the one of the options with appropriate software.

Due to the lack of compliance with the DMX-512 standard, many devices available on the market may have problems with reading DMX packets. In case of any problems, it is recommended to use longer times of Break length (Break), break after break (MAB), channel and packet spacing (MBF). The above options allow you to select the appropriate parameters of the output signal.

1. **Break Time** allows to change the length of the interval between successive DMX packets. Break signal may take longer, but can not be less than 88 microseconds.
Usually it lasts about 120 – 140 microseconds.

At the top of the screen next to the option name are visible important information that simplify setting an appropriate value.

Break Length Time
Minimum 88μs

120

Remember to save values using floppy disc button 🖫 and confirm with *enter*

2. **MAB Time** (Mark After Break) is the interval time that occurs in each package according to the standard DMX-512. The minimum value is 16 microseconds.
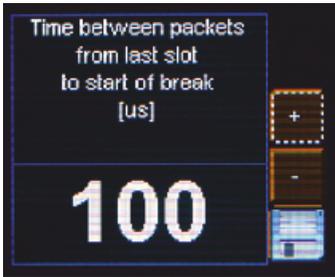

Remember to save values using floppy disc button 💾 and confirm with *enter*

3. **MBF** (Mark Between Frame) – the amount of time (if any) between the end of one frame (end of the 2nd stop bit) and the start of the next – Mark Time Between Frames (MTBF) is the full name. Its length can range from 0 to 1000 microseconds, the shorter the better.

Remember to save values using floppy disc button 💾 and confirm with *enter*

4. Packet gap – the amount of time between packets (from last slot to start of the break). Its length can range from 16 to 5000 microseconds.

Remember to save values using floppy disc button ![floppy] and confirm with *enter*

5. Channels number – using this feature, you can limit the number of channels sent from PX255. The minimum value is 24 channels and the maximum is 512 (default).

7.6   Input DMX preview

This menu allows to check the current DMX signal received by the PX255.

<u>The presentation of DMX signal:</u>

The value of DMX signal on a given channel is presented in the form white bar, the height of which varies proportionally according to the relation: the greatest height – DMX value is 255, no bar – DMX value is 0.

DMX channels are described on the left side, respectively *1, 129, 257, 385* for subsequent lines. In addition, each line is divided by dots, where red means another ten channels, and green additional 100 channels bigger value.

7.7 Language

Language settings allows to change the menu language. To do this select appropriate language using ➘ or ➘ buttons and press *enter*.
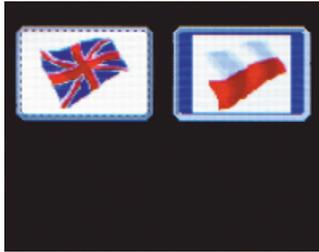
7.8 Firmware version

This option allows to check the firmware and bootloader version and serial number. Additionally, you can restore the default settings.

To restore default setting press *enter* button, then select the *Yes* button and again approve with *enter*. In the case of incorrect choosing option, you can go back by selecting *No*, or go directly level up in menu by pressing *escape.*
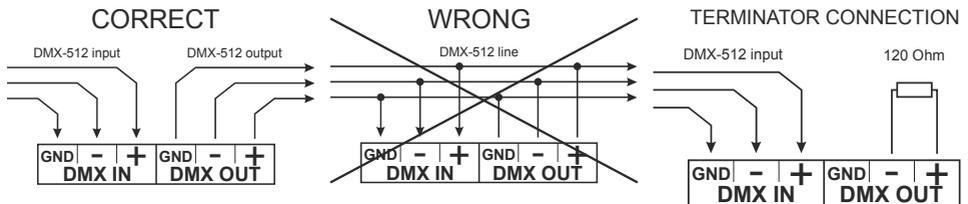
You need to remember that using *Set default settings* option will erase set by the user configuration
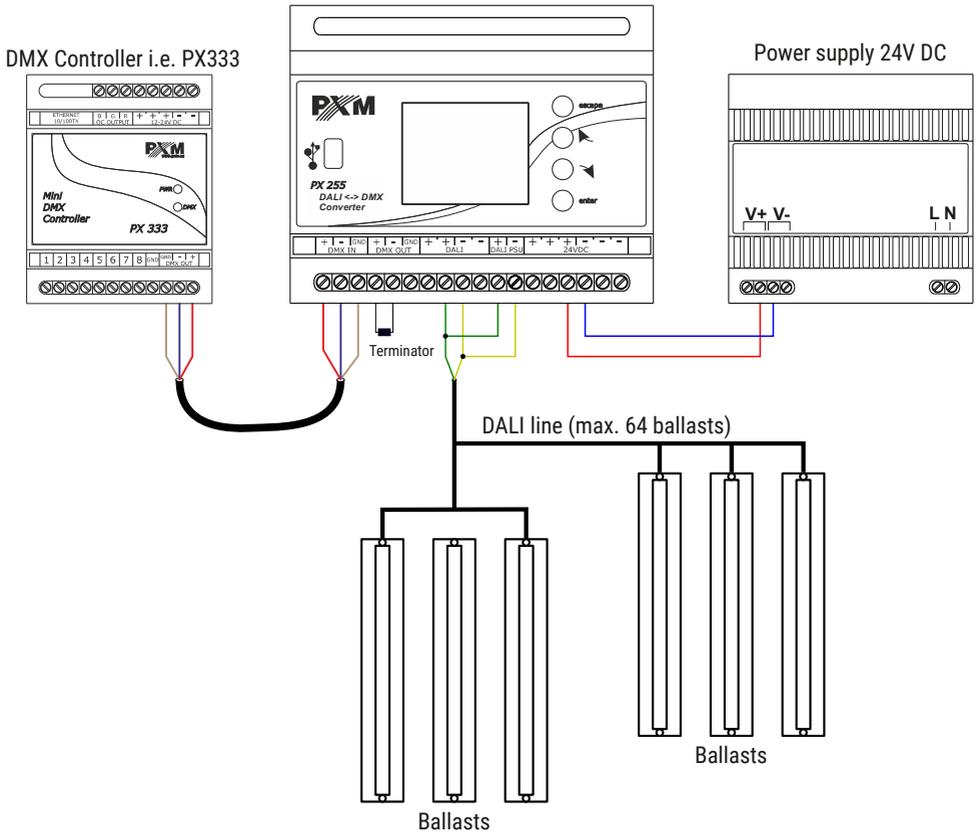
8 DMX signal connection

PX255 have to be connected to DMX line in serial mode, with no branches on DMX control cable. That means that DMX line, from the signal source, must be connected to **DMX IN** pins of PX255 and later, directly from **DMX OUT** pins to the next device in DMX chain.

If the PX255 is the last DMX chain receiver there should be terminator (resistor 120 Ohm) mounted between "**DMX+**" and "**DMX-**" pins of **DMX OUT** section.
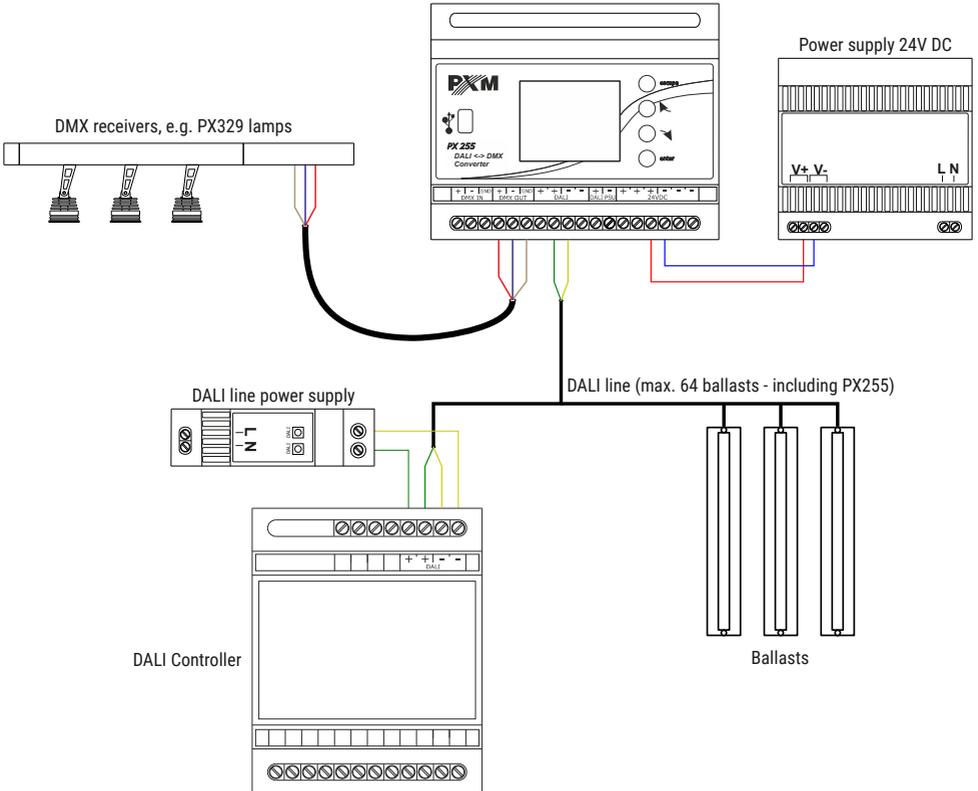
9 Connection scheme

DMX to DALI signal conversion (*DALI <<< DMX*)

DMX Controller i.e. PX333

Power supply 24V DC

Terminator

DALI line (max. 64 ballasts)

Ballasts

Ballasts

NOTE! The PX255 device has a built-in DALI line power supply (*DALI PSU*), which can be used instead of an external line power supply.

DALI to DMX signal conversion (*DMX <<< DALI*)

Power supply 24V DC

DMX receivers, e.g. PX329 lamps

PX 255
DALI <-> DMX
Converter

V+ V-   L N

DALI line power supply

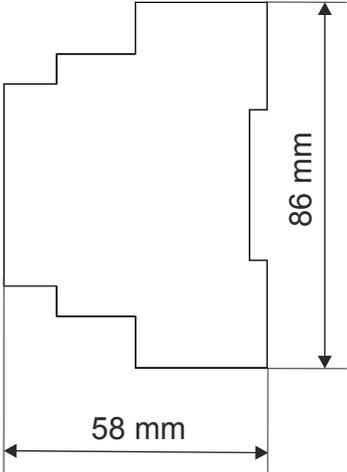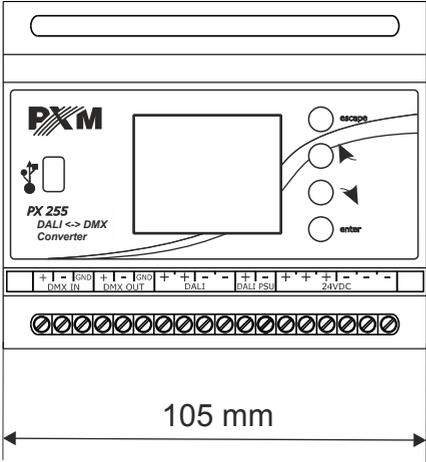DALI line (max. 64 ballasts - including PX255)

DALI Controller

Ballasts

NOTE! The PX255 device has a built-in DALI line power supply (*DALI PSU*), which can be used instead of an external line power supply. In the example above, an external DALI power supply was used.

10 Dimensions

11 Technical data

type	PX255
power supply	24V DC
DMX input	1 (512 channels)
DMX output	1 (512 channels)
DALI channels	64
virtual DALI ballasts	64
number of device groups	16
power consumption	max. 7W
10V output	0,1mA
output connections	terminal blocks, USB
weight	0.2kg
dimensions	width: 105mm (6-modules) height: 86mm depth: 60mm

Podłęże, 23.05.2019

DECLARATION OF CONFORMITY

PXM Marek Żupnik spółka komandytowa
Podłęże 654, 32-003 Podłęże

we declare that our product:

Product name: DMX/DALI/DMX Interface

Product code: PX255

meets the requirements of the following standards, as well as harmonised standards:

PN-EN IEC 63000:2019-01   EN IEC 63000:2018
PN-EN 60065:2015-08   EN 60065:2014
PN-EN 61000-4-2:2011   EN 61000-4-2:2009
PN-EN IEC 61000-6-1:2019-03   EN IEC 61000-6-1:2019
PN-EN 61000-6-3:2008   EN 61000-6-3:2007

and meets the essential requirements of the following directives:

2011/65/UE **DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL** of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment
Text with EEA relevance.

2014/30/UE **DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL** of 26 February 2014 on the harmonisation of the laws of the Member States relating to electromagnetic compatibility (recast)
Text with EEA relevance.

2014/35/UE **DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL** of 26 February 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits

PXM
Marek Żupnik spółka komandytowa
32-003 Podłęże, Podłęże 654
NIP 677-002-54-53

mgr inż. Marek Żupnik.