# Zero Configuration Pixel Protocol v 0.1

## Change Log

* 1. – Minor documentation updates only

## Overview

Please refer to the header file here which has the definitive layout:

<https://github.com/smeighan/xLights/blob/ZCPP/xLights/outputs/ZCPP.h>

All packets are exchanged over port: 30005

UDP Unicast except where otherwise stated

When multicast (other than discovery) if the IP address of the controller is aa.bb.cc.dd then the multicast is to 224.0.31.dd). This limits multicast to 254 controllers.

Multibyte binary data is always transmitted MSB->LSB

## Discovery

Sent multicast to 224.0.30. 5

|  |  |  |
| --- | --- | --- |
| Token | 0-3 | “ZCPP” |
| Type | 4 | 0x00 |
| Protocol Version | 5 | 0x00 |
| Minimum Protocol Version | 6 | Minimum protocol version supported by the device sending the request – sending device must support at least this version |
| Maximum Protocol Version | 7 | Maximum protocol version supported by the device sending the request – sending device must support all versions up to and including this version |

Notes: Controllers should respond to this packet regardless of whether it is running the same protocol version or not.

## Discovery Response

Unicast to the requestor on the port the discovery packet arrived from

|  |  |  |
| --- | --- | --- |
| Token | 0-3 | “ZCPP” |
| Type | 4 | 0x01 |
| Protocol Version | 5 | 0x00 |
| Minimum Protocol Version | 6 | Minimum protocol version this controller understands |
| Maximum Protocol Version | 7 | Maximum protocol version this controller understands |
| Vendor Id | 8-9 | Number assigned to each vendor  Falcon – 0x0000  FPP – 0x0001  ESPixelStick – 0x0002 |
| Model Id | 10-11 | Unique id for each model of controller the vendor sells – vendor defined |
| Firmware Version | 12-23 | String representing the controllers firmware version. If less than 12 characters then it may be null terminated. |
| MAC Address | 24-29 | A unique constant Id for this controller |
| Unused | 30-31 |  |
| IP4 Address | 32-35 | IPv4 IP Address |
| IP4 Mask | 36-39 | IPv4 Subnet Mask |
| User Controller Id | 40-71 | A user set name for this controller |
| Maximum Channels | 72-75 | Maximum channels the controller can receive |
| Pixel Ports | 76 | Maximum pixel ports supported |
| RS Ports | 77 | Maximum RSxxx ports |
| Max Channels Per Pixel Port | 78-79 | Maximum channels each pixel port can support |
| Max Channels Per RS Port | 80-81 | Maximum channels each RSxxx port can support |
| Flags | 82-83 | 0x0002 – Controller prefers data as multicast  0x0004 – Controller does not want to receive configuration  0x0008 – Controller supports virtual strings  0x0010 – Controller supports smart remotes |
| Protocols Supported | 84-87 | 0x00000001 WS2811  0x00000002 GECE  0x00000004 DMX  0x00000008 LX1203  0x00000010 TLS3001  0x00000020 LPD6803  0x00000040 WS2801  0x00000080 SM16716  0x00000100 MB16020  0x00000200 MY9231  0x00000400 APA102  0x00000800 MY9221  0x00001000 SK6812  0x00002000 UCS1903  0x00004000 TM18XX  0x00008000 RENARD  0x00010000 LPD8806  0x00020000 DM412  0x00040000 P9813  0x00080000 LOR |

Notes: If the requestor must respect the protocol constraints in this response

A controller that wants t be discovered but doesn’t want ZCPP to overwrite its configuration should set the flag to contain 0x04. A controller may want to make that a user selectable option.

## Configuration Packet

Unicast/Multicast to the controller

Sent no more than once per frame (although there may be multiple if all data does not fit in one packet). Typically once every 10 seconds.

|  |  |  |
| --- | --- | --- |
| Token | 0-3 | “ZCPP” |
| Type | 4 | 0x0A |
| Protocol Version | 5 | 0x00 |
| Configuration Sequence Number | 6-7 | A number that increments each time the configuration changes. It always starts at zero and never exceeds 32000. It will be the same on all packets if multiple packets are required to transmit all the extra configuration |
| User Controller Id | 8-39 | A user set name for this controller |
| Flags | 40 | 0x10 Controller should respond to this packet with a Query Configuration Response Packet  0x20 Extra data packets will immediately follow the config packets  0x40 This is the first configuration packet being sent  0x80 This is the last configuration packet being sent |
| Priority | 41 | Priority of this source |
| Filler | 42 |  |
| Ports | 43 | A value which is the number of ports/port-virtual strings in this configuration frame |
| The following fields appear 0-90 times depending on the ports value |  |  |
| Port | 44\* | Port number – High bit of port number is 1 if it is a Serial/RS port.  0->n |
| Smart Remote | 45\* Bits 6 & 7 | 0x00 – No smart remote  0x40 – Smart remote A  0x80 – Smart remote B  0xC0 – Smart remote C |
| PortString | 45\* Bits 0-5 | Virtual string within port  0->n |
| Protocol | 46\* | A coded byte for the protocol to be used on that port. Protocols are  0x00 WS2811  0x01 GECE  0x02 DMX  0x03 LX1203  0x04 TLS3001  0x05 LPD6803  0x06 WS2801  0x07 SM16716  0x08 MB16020  0x09 MY92131  0x0A APA102  0x0B MY9221  0x0C SK6812  0x0D UCS1903  0x0E TM18XX  0x0F RENARD  0x10 LPD8806  0x11 DM412  0x12 P9813  0x13 LOR |
| Grouping | 47\* | How many pixels to group as one pixel. Default 1 |
| Start Channel | 48-51\* | Zero based offset to the first byte of data to be sent out a port |
| Channels | 52-55\* | Minimum channels to send out this port |
| Direction | 56\* – Bit 7 | 0x00 – Forward – Default  0x80 – Reversed |
| Colour Order | 56\* – Bits 0-3 | 0x00 – RGB – Default  0x01 – RBG  0x02 – GRB  0x03 – GBR  0x04 – BRG  0x05 – BGR |
| Null Pixels | 57\* | How many null pixels to precede the model with – Default 0 |
| Brightness | 58\* | Brightness % - Default 100 |
| Gamma | 59\* | Gamma \* 10 – Default 10 |

Strings will always be sent with string ports first in order. If there are multiple strings these will be sent in order as well. Eg:

Pixel port 0/String 0

Pixel port 0/String 1

Pixel port 1/String 0

Serial port 1

Serial port 2

Each frame can support up to 85 strings

## Extra Configuration Information

Sent no more than once per frame (although there may be multiple if all data does not fit in one packet). Typically once every 60 seconds.

Unicast/Multicast to the controller

|  |  |  |
| --- | --- | --- |
| Token | 0-3 | “ZCPP” |
| Type | 4 | 0x0B |
| Protocol Version | 5 | 0x00 |
| Configuration Sequence Number | 6-7 | A number that increments each time the configuration changes. It always starts at zero and never exceeds 32000. It will be the same on all packets if multiple packets are required to transmit all the extra configuration |
| Flags | 8 | 0x40 – first packet flag  0x80 – last packet flag to say this is the last in a series of config packets |
| Priority | 9 | Priority of this source |
| Filler | 10 |  |
| Ports | 11 | A value which is the number of ports/port-virtual strings in this configuration frame |
| The following fields appear 0-n times depending on the ports value |  |  |
| Port | 12\* | Port number – High bit of port number is 1 if it is a Serial/RS port.  0->n |
| Smart Remote | 13\* Bits 6 & 7 | 0x00 – No smart remote  0x40 – Smart remote A  0x80 – Smart remote B  0xC0 – Smart remote C |
| PortString | 13\* Bits 0-5 | Virtual string within port  0->n |
| Description Length | 14\* | Bytes required for the description. There is no terminating null character. |
| Description | 15+\* | Description for this port. |

Note: Descriptions will never span a packet.

After any change sending the extra data will always occur after the model data is sent

Descriptions will always be sent with string ports first in order. If there are multiple strings these will be sent in order as well. Eg:

Pixel port 0/String 0

Pixel port 0/String 1

Pixel port 1/String 0

Serial port 1

Serial port 2

## Configuration Query

Unicast/Multicast to the controller

|  |  |  |
| --- | --- | --- |
| Token | 0-3 | “ZCPP” |
| Type | 4 | 0x0C |
| Protocol Version | 5 | 0x00 |

## Configuration Query Response

Unicast to the requestor on the port the discovery packet arrived from

|  |  |  |
| --- | --- | --- |
| Token | 0-3 | “ZCPP” |
| Type | 4 | 0x0C |
| Protocol Version | 5 | 0x00 |
| Configuration Sequence Number | 6-7 | The last configuration sequence number we received |
| User Controller Id | 8-39 | A user set name for this controller |
| Filler | 40-41 | Need to ensure alignment |
| Flags | 42 | 0x40 This is the first configuration query response packet being sent  0x80 This is the last configuration query response packet being sent |
| Ports | 43 | A value which is the number of ports/port-virtual strings in this configuration query response frame |
| The following fields appear 0-115 times depending on the ports value |  |  |
| Port | 44\* | Port number – High bit of port number is 1 if it is a Serial/RS port.  0->n |
| Smart Remote | 45\* Bits 6 & 7 | 0x00 – No smart remote  0x40 – Smart remote A  0x80 – Smart remote B  0xC0 – Smart remote C |
| PortString | 45\* Bits 0-5 | Virtual string within port  0->n |
| Protocol | 46\* | A coded byte for the protocol to be used on that port. Protocols are  0x00 WS2811  0x01 GECE  0x02 DMX  0x03 LX1203  0x04 TLS3001  0x05 LPD6803  0x06 WS2801  0x07 SM16716  0x08 MB16020  0x09 MY92131  0x0A APA102  0x0B MY9221  0x0C SK6812  0x0D UCS1903  0x0E TM18XX  0x0F RENARD  0x10 LOR |
| Grouping | 47\* | How many pixels to group as one pixel. Default 1 |
| Start Channel | 48-51\* | Zero based offset to the first byte of data to be sent out a port |
| Channels | 52-55\* | Minimum channels to send out this port |
| Direction | 56\* – Bit 7 | 0x00 – Forward – Default  0x80 – Reversed |
| Colour Order | 56\* – Bits 0-3 | 0x00 – RGB – Default  0x01 – RBG  0x02 – GRB  0x03 – GBR  0x04 – BRG  0x05 – BGR |
| Null Pixels | 57\* | How many null pixels to precede the model with – Default 0 |
| Brightness | 58\* | Brightness % - Default 100 |
| Gamma | 59\* | Gamma \* 10 – Default 10 |

## Data Packet

Unicast/Multicast to the controller

As many will be sent as necessary to send a full frame of data

|  |  |  |
| --- | --- | --- |
| Token | 0-3 | “ZCPP” |
| Type | 4 | 0x14 |
| Version | 5 | 0x00 |
| Frame Sequence Number | 6 | Cycling value 0-255 that increments with every frame |
| Flags | 7 | 0x01 – Sync Will be sent  0x40 – This is the first packet in the frame  0x80 – This is the last packet in the frame  Both flags can be set |
| Frame address | 8-11 | The offset of the data in this packet within the frame |
| Packet Data Length | 12-13 | Amount of data in this packet after this header |
| Priority | 14 | Priority of this source |
| Packet Data | 15-1457 |  |

## Sync Packet

Optionally 1 sent per frame

Sent multicast to 224.0.30. 5

|  |  |  |
| --- | --- | --- |
| Token | 0-3 | “ZCPP” |
| Type | 4 | 0x15 |
| Version | 5 | 0x00 |
| Frame Sequence Number | 6 | Cycling value 0-255 that increments with every frame |

## ZCPP Configuration Packet File

The configuration packet and extra configuration packets will be stored in a file which can be used by players to send out the config … without them having to do all the work and have all the information required to create the config packets.

These files will be named xxx\_xxx\_xxx\_xxx.zcpp (case sensitive, no leading zeroes).

Each file will be formatted as follows

|  |  |  |
| --- | --- | --- |
| Token | 0-3 | ZCPP |
| Type | 4 | Packet type that follows  0x00 – Configuration packet  0x01 – Extra Configuration Information |
| Size | 5-6 | Size of the packet |
| Packet | <see size> | Packet data |
| … | Repeat Type/Size/Packet |  |
| End | Last byte | 0xFF – No more packets |

There can be multiple of all packet types

Where multi byte numbers are sent/stored in files they are always MSB->LSB.