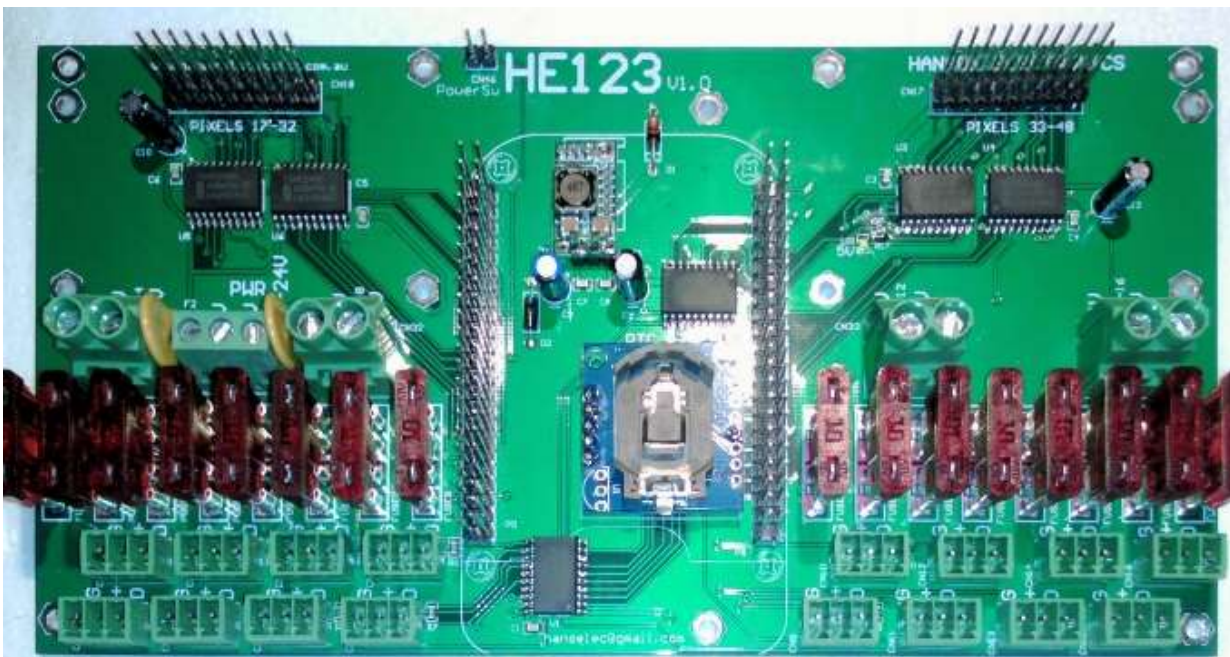


# HANSON ELECTRONICS

## HE123 BeagleboneBlack 48 output pixel controller User Manual



The HE123 is a pixel controller board operated via a BeagleBone Black (BBB) single board computer. It uses design elements of the RGB123 48 output pixel board and can be controlled with Falcon Player (FPP). The HE123 is the motherboard that the BBB plugs onto. Up to 2 optional daughter boards (of 3 types) can plug onto it as well. The 48 outputs are for 2811 and compatible pixels.

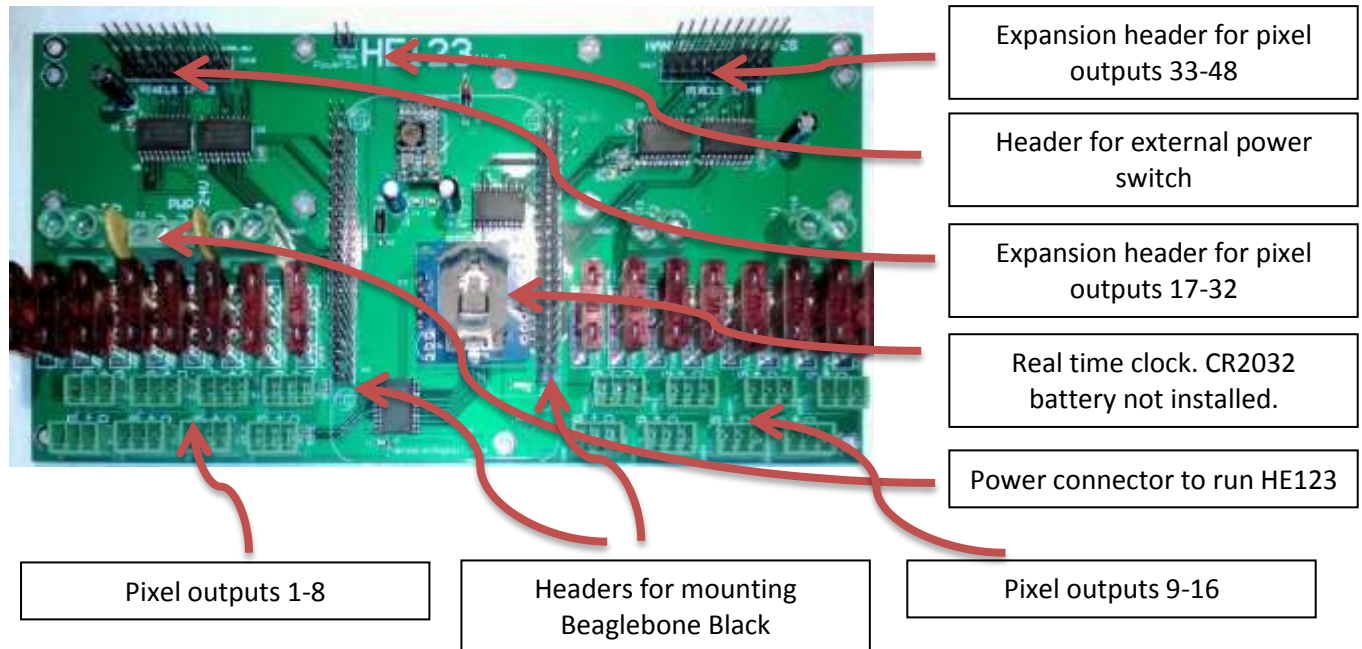
Dimensions and user manuals are available on website where applicable.

Revision 1.2  
22-May-2018

<http://www.hansonelectronics.com.au>

## HE123 motherboard

- 16 fused pixel outputs with 4 outputs per power input
- 2 expansion headers of 16 pixel outputs each
- inbuilt real time clock
- connects to HE123RJ, HE123TX, HE123PX
- header to take the Beaglebone Black power switch to the outside of an enclosure. A normally open switch can be connected to this header for powering off the BBB.
- can be powered by 5V or 12-24V



The HE123 is a motherboard designed to be run off a Beaglebone Black (BBB) single board computer and is compatible with the RGB123 48 output cape that it is designed around.

The HE123 has 16 fused pixel outputs and 2 expansion headers to allow for the addition of an additional 32 outputs. The additional outputs can be facilitated by the HE123-RJ, the HE123-TX or HE123-PX. The HE123 can be run off either Falcon Player (FPP <http://falconchristmas.com/forum/index.php?board=8.0>) or the Ledscape library (<https://github.com/Yona-Appletree/LEDscape>). As Falcon Player is the most common control method and uses parts of the LEDscape library it will be the only method discussed.

The HE123 is supplied with no output fuses and without a Beaglebone Black (unless ordered with 1). It can be powered from either 5V or 12V. The 5V supply should be stable and vary no more than +/- 0.1V. The 12V supply can actually be anywhere in the range of 8-24V but 12V is the nominal voltage. Reversing the power or connecting up to both the 5V and 12V inputs at the same time may damage components on the board or the BBB. The BBB is powered from the same power source as the HE123.

There is a real time clock (RTC) that can be used for scheduling a show. It uses a CR2032 battery which isn't supplied. The RTC doesn't need to be used if the HE123 will have a connection through a network to the internet and thus have access to a time server.

Care should be taken when plugging the BBB on top of the HE123 to ensure that no pins are bent and that there is no mis-alignment of the header pins. The Ethernet connector comes out the same end as the pixel connectors (see above picture).

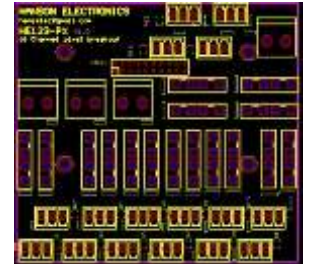
BeagleBone Black (BBB) is used for running Falcon Player and operating the HE123 pixel controller. It can also be used for other lighting control gear. The BBB is the brains that controls the HE123 and provides storage for sequences and Ethernet access. The BBB is not supplied with the HE123.  
<http://www.hansonelectronics.com.au/product/beaglebone-black/>



## ***Daughterboards***

### **HE123-PX powered pixel expansion daughterboard**

- 16 outputs. 4 power inputs. 4 fuses per output
- maximum of 30A per power input and 10A per pixel output
- plugs on top of HE123 to give an additional 16 fused 2811 outputs



### **HE123-RJ pixel breakout daughterboard**

- 16 outputs. no electronics. pixel outputs match standard RJ45 pairs
- plugs on top of HE123 to give an additional 16 unfused 2811 outputs on 4 RJ45 connectors
- mates with 4 HE123-EX
- up to several metres between HE123-RJ and HE123-EX

<http://www.hansonelectronics.com.au/product/he123-rj/>



### **HE123-TX pixel differential expansion daughterboard**

- 16 RS422 balanced pair outputs for long range tx
- 16 outputs. pixel outputs on standard RJ45 pairs
- mates with 4 HE123-RX
- up to several hundred metres between HE123-TX and HE123-RX

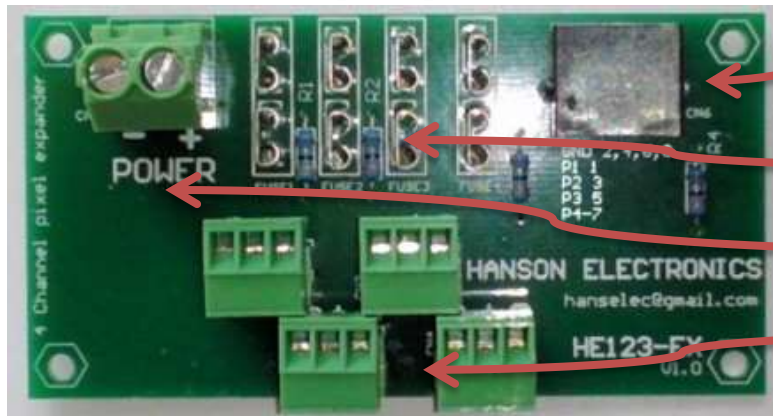
<http://www.hansonelectronics.com.au/product/he123-tx/>





## Receivers

### HE123-EX 4 channel pixel power breakout



RJ45 connector for pixel input to board

Fuses for pixel outputs

Input power connector

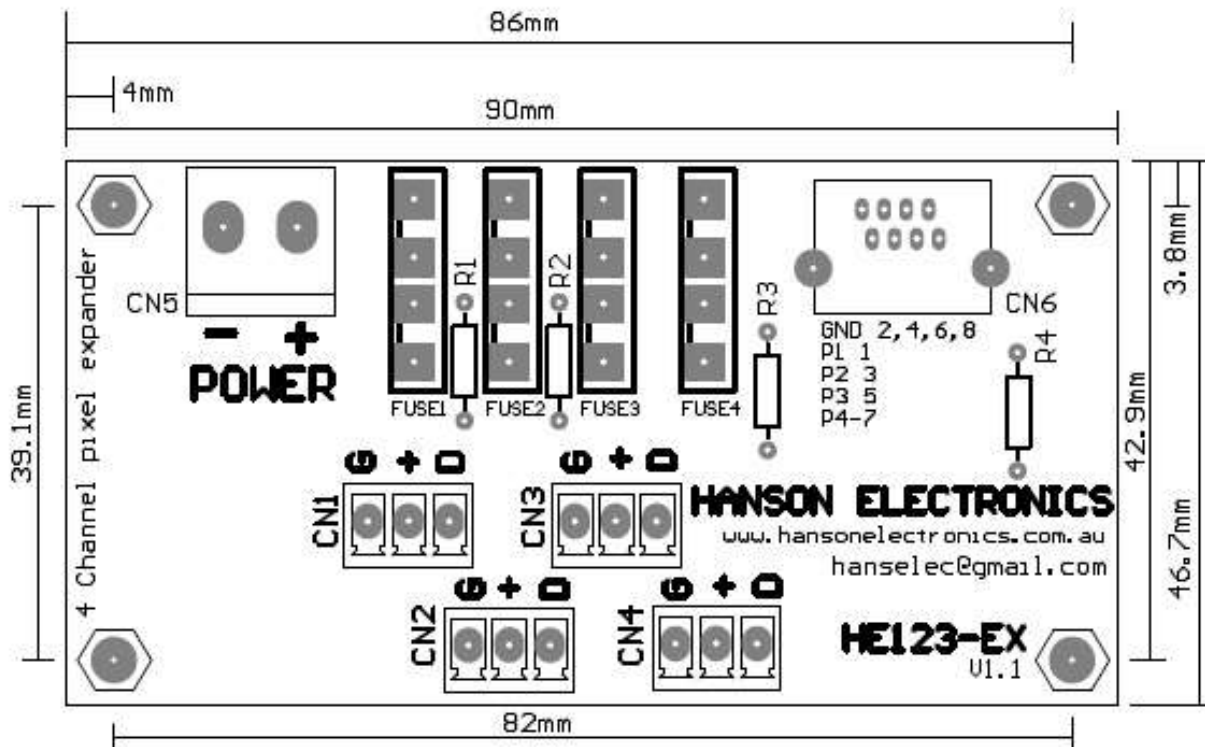
Pixel output connectors

- RJ45 connector to 4 channels fused pixel outputs
- mates with HE123RJ via RJ45 connector. Can be connected to other pixel boards to provide output fusing.
- can be used as a breakout to power unfused pixel outputs like on rPi-28D or J1Sys P2
- maximum of 30A input to pcb via power connector
- maximum of 10A fuse to any pixel output. ATO fuses are used.
- up to several metres between pixel controller and HE123-EX. The distance depends on cable, the actual pixel controller and also distance between HE123-EX and pixels.

The connections used on the RJ45 connector for the 4 pixel connections are marked on the pcb.

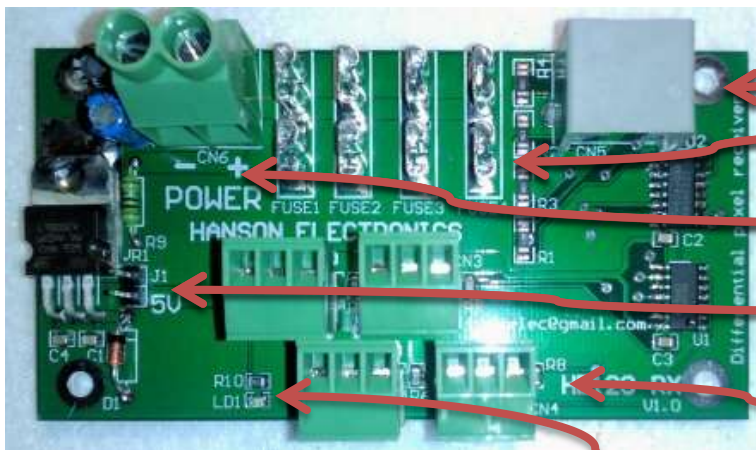
GND	-Pins 2,4,6,8
Pixel 1 data	-Pin 1
Pixel 2 data	-Pin 3
Pixel 3 data	-Pin 5
Pixel 4 data	-Pin 6

<http://www.hansonelectronics.com.au/product/he123-ex/>



HE123-EX Drilling/mounting template (not to scale)

## HE123-RX 4 channel Balanced long range pixel receiver



RJ45 connector for balanced pixel input to board

Fuses for pixel outputs

Input power connector

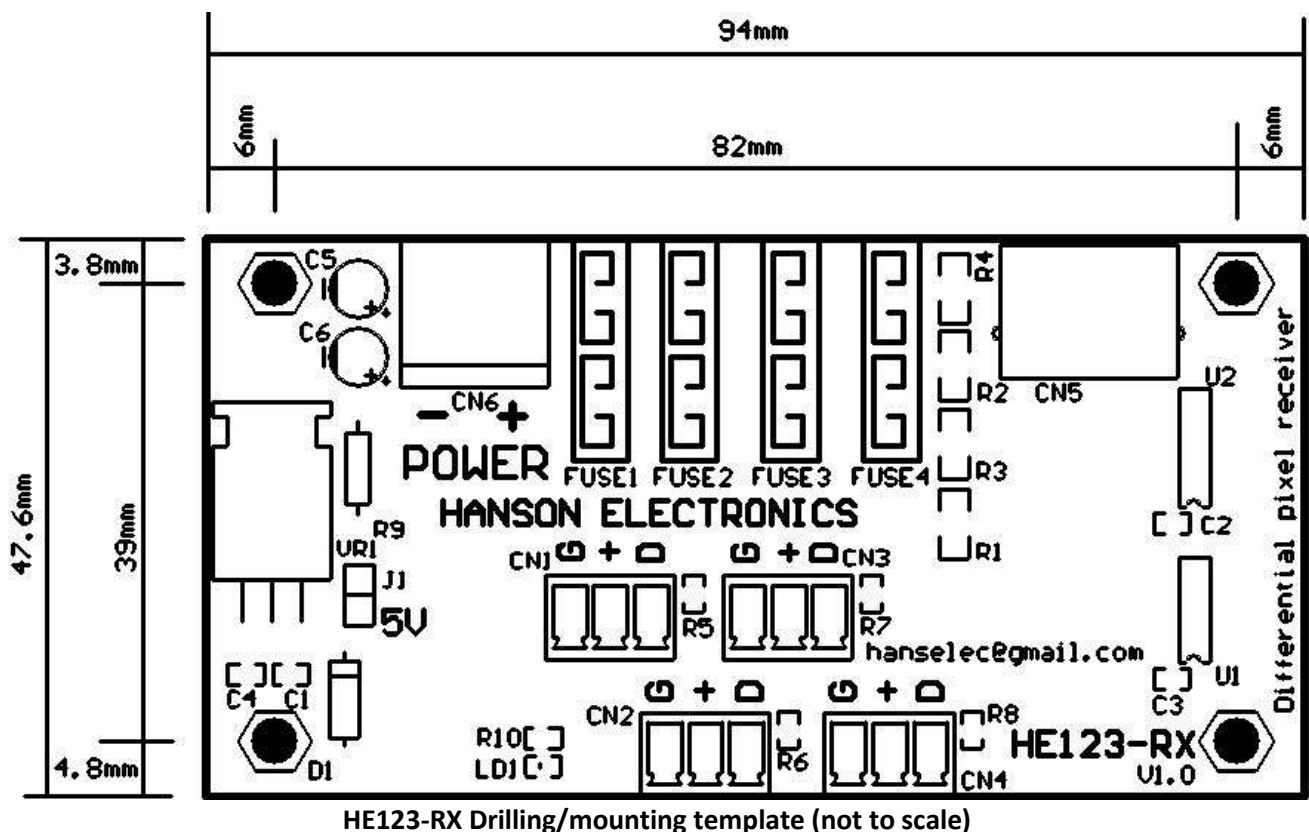
Jumper for running board off 5V

Pixel output connectors

Power LED

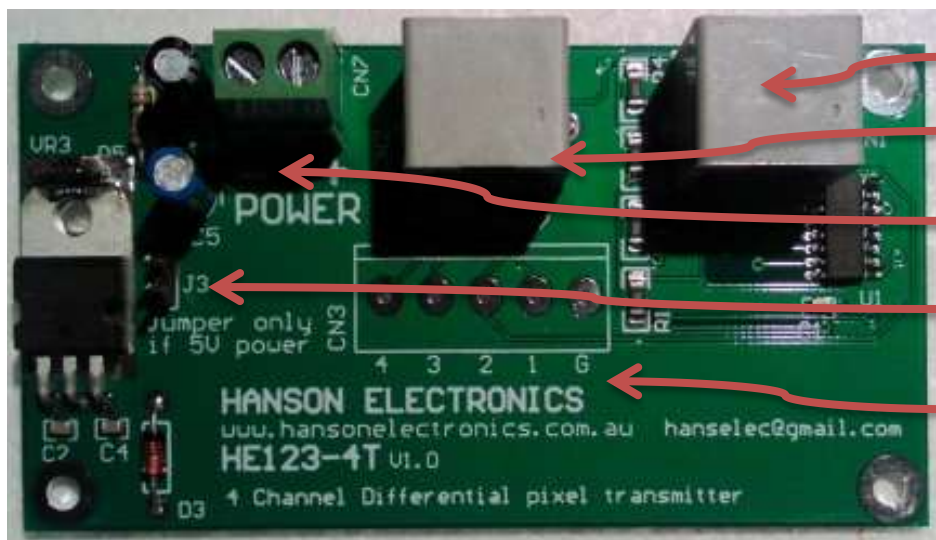
- RJ45 connector to 4 channels powered, buffered pixel outputs
- mates with HE123-TX or HE123-4T
- can be powered from 5V or 12-24V (whichever the pixel voltage is)
- jumper to select 5V input power. Powering the board with more than 5.1V while the 5V jumper is installed will damage the board.
- maximum of 30A input to pcb
- maximum of 10A fuse to any pixel output
- up to several hundred metres between HE123-TX (or HE123-4T) and HE123-RX

<http://www.hansonelectronics.com.au/product/he123-rx/>



## Standalone transmitter

### HE123-4T 4 channel pixel to 4 balanced long range pixel transmitter



RJ45 connector for balanced pixel output from board

RJ45 connector for pixel input to board

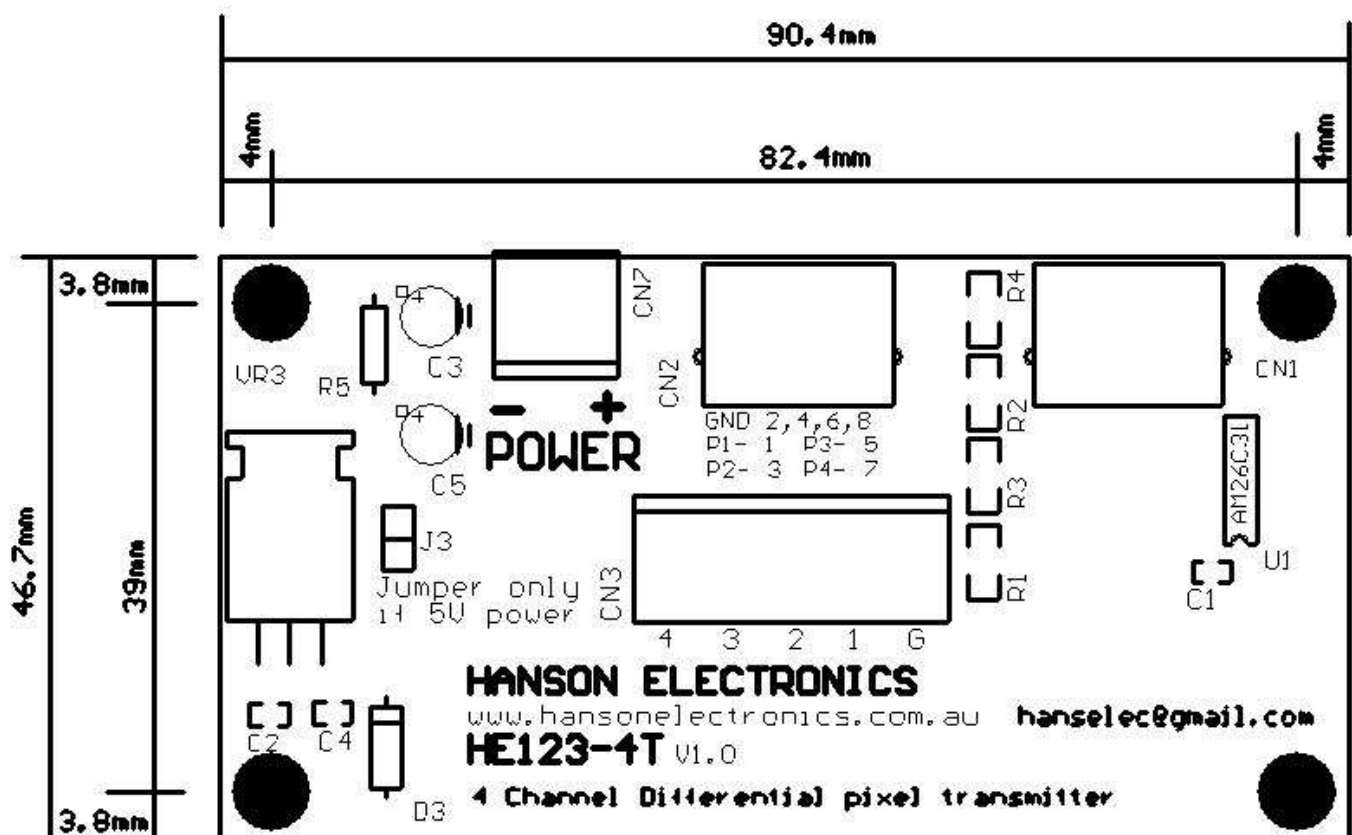
Input power connector

Jumper for running board from 5V

Mounting holes for 5mm terminal as alternative pixel input to board

- balanced pair outputs for long range transmission
- connects to any 281x pixel board to allow long range transmission
- mates with 1 HE123-RX
- connects via RJ45 to HE123-RX or other pixel board. Pads are supplied to allow fitting of a 5 way 5mm terminal block.
- powered from 5V or 12-24V

<http://www.hansonelectronics.com.au/product/he123-4t/>



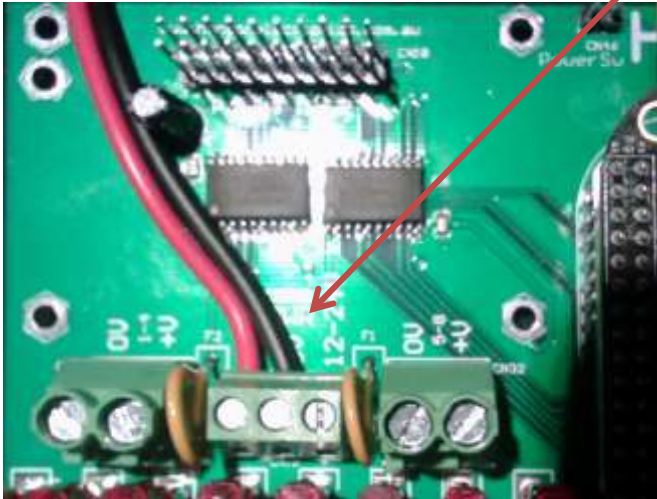
HE123-4T Mounting/drilling template (not to scale)



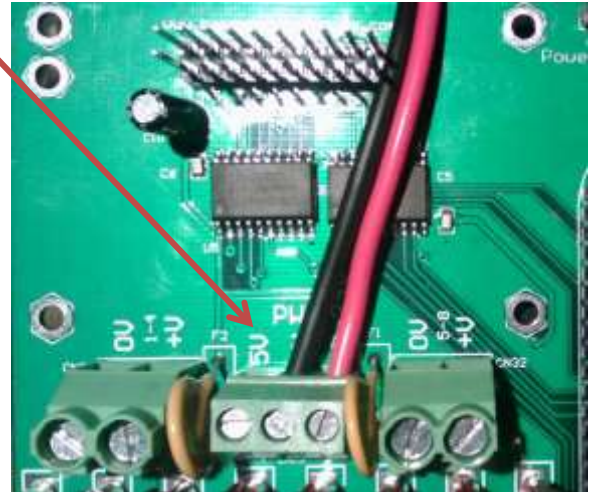
# Connection Examples

## HE123 Power

HE123 power connector (between pixel power connectors 1-4 and 5-8)



HE123 powered from 5V



HE123 powered from 12V

The Beaglebone Black (BBB) is powered from the HE123. The board and BBB are powered via the 3 way terminal located between the power connectors for pixel outputs 1-4 and 5-8. Depending on the voltage that the board is to be powered from it would be connected to either the 0V and 5V terminals or 0V and 12-24V terminals.

Connecting higher than 5.1V to the 5V input of the HE123 will likely damage the BBB immediately.

There is a 5V power led to the right of the BBB socket (below where the pixel outputs 33-48 daughterboard mounts) There is a header terminal for a power switch mounted to the top left of the BBB location. This switch works in parallel with the power switch on the BBB.

The HE123 has 4 power connectors for the 16 direct pixel outputs. These 4 connectors share a common ground but the +ve inputs are isolated. Each of the 4 inputs powers 4 pixel outputs. The maximum current that the power connector can carry is 30A and the 4 output connectors are rated to a maximum of 10A each.

## Pixel connectors



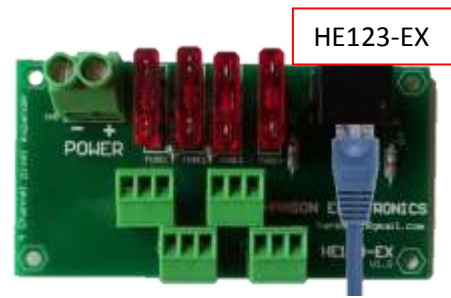
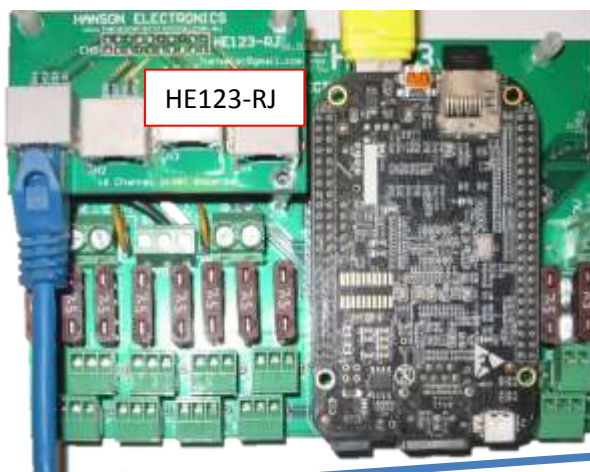
Pixel connection labels  
G, +, D

Pixel output connectors.  
(plugs removed)

All of the pixel connectors on all HE123 series boards use 3 pin pluggable terminals rated to a maximum of 10A. Each connector has its connections labelled with a G, + and D. These are Ground or 0V, +Ve power which can be 5V, 12V or 24V and Data.

**Take note of the position of connections as what is used on HE123 series may vary compared to other pixel controllers.**

## HE123-RJ connected to HE123-EX



Linked by up to 10m of Cat5/Cat6 cable

The HE123RJ provides 4 RJ45 outputs each with 4 281x pixel outputs on a “pair” of connections. The board allows the fusing and distribution of outputs to occur up to several metres away from the HE123. The total distance from the HE123-RJ to HE123-EX and to the 1<sup>st</sup> pixel should typically be under 10m total. It “may” be possible to go further depending on the choice of cable and environmental noise.

Only 1 of the 4 outputs of HE123-RJ is shown connected

Power to HE123-EX not shown

The HE123-EX is purely a power distribution board and there is no electronics on the board.

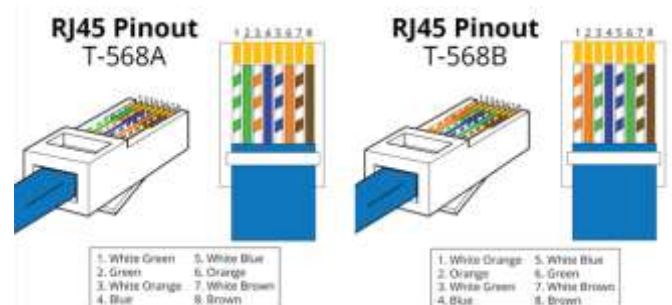
The HE123-EX can be used with any pixel voltage.

The 4 outputs of the HE123-EX are powered from the 1 30A rated power input and each output is rated to a maximum of 10A.

The HE123-EX can be used to provide fused output power to virtually any other WS281x compatible source. If doing this then use a standard Cat5 patch cable with 1 end stripped.

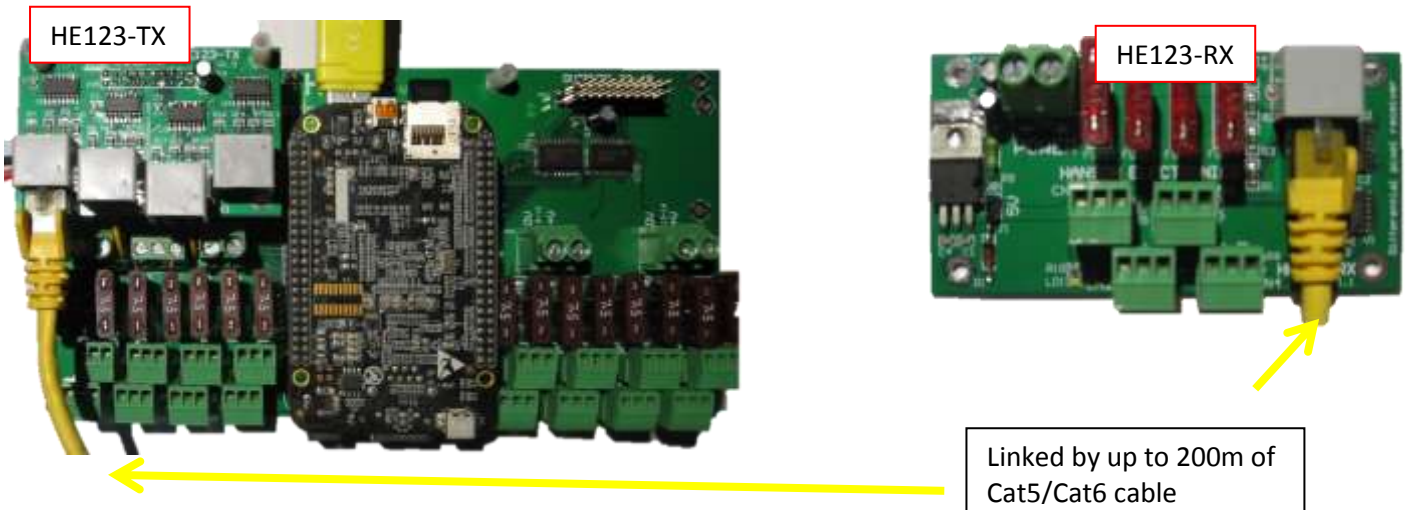
The input RJ45 connector uses the following

Pin	Pin Use	T568A colour	T568B colour
1	Pixel 1 data	White/Green	White/Orange
2	Ground (pixel 1)	Green	Orange
3	Pixel 2 data	White/Orange	White/Green
4	Ground (pixel 4)	Blue	Blue
5	Pixel 3 data	White/Blue	White/Blue
6	Ground (pixel 2)	Orange	Green
7	Pixel 4 data	White/Brown	White/Brown
8	Ground (pixel 4)	Brown	Brown





## HE123-TX connected to HE123-RX



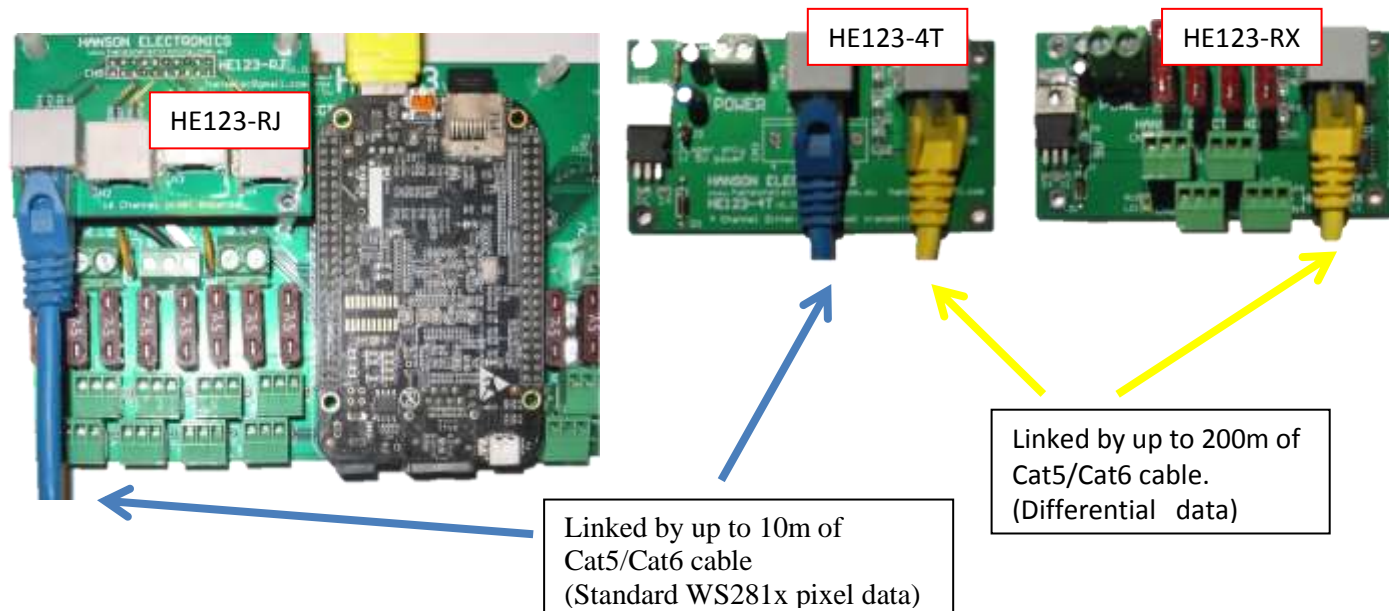
The power connection to the HE123-RX is not shown.

If the HE123-RX is to be ran off 5V the "5V" jumper should be installed. It should ONLY be installed if running off 5V

Only 1 of the 4 possible outputs of the HE123-TX is shown.

The maximum current capacity of the HE123-RX power input terminal is 30A. The maximum current on any of the 4 pixel output terminals is 10A.

## HE123-RJ connected to HE123-4T and then to HE123-RX

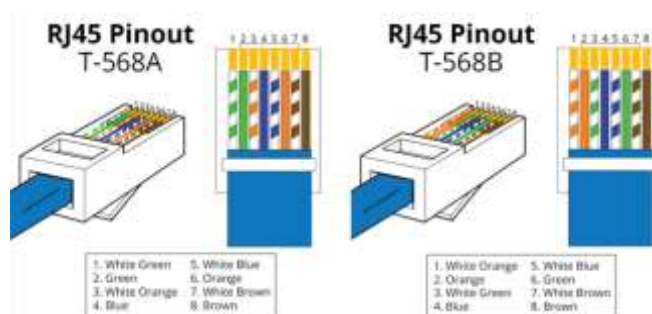


The HE123-RX can receive its differential RS422 data from either a HE123-TX or a HE123-4T. The above images show the connection required between a HE123-4T and a HE123-RX. The power connections for the HE123-4T and HE123-RX are not shown. The distance between the HE123-RJ and HE123-4T can typically be up to 10m. The environmental noise can reduce that distance. 1 of 4 possible connections from the HE123-RJ is shown. Any 1 of the 4 outputs (each with 4 pixel outputs) can be used.

If using the HE123-4T with an alternate pixel controller like 1 of the direct outputs of HE123, an F16, a Pixlite 16 or virtually any other WS281x compatible source then it's possible to use a standard Cat5 patch cable with 1 end stripped.

The input RJ45 connector uses the following

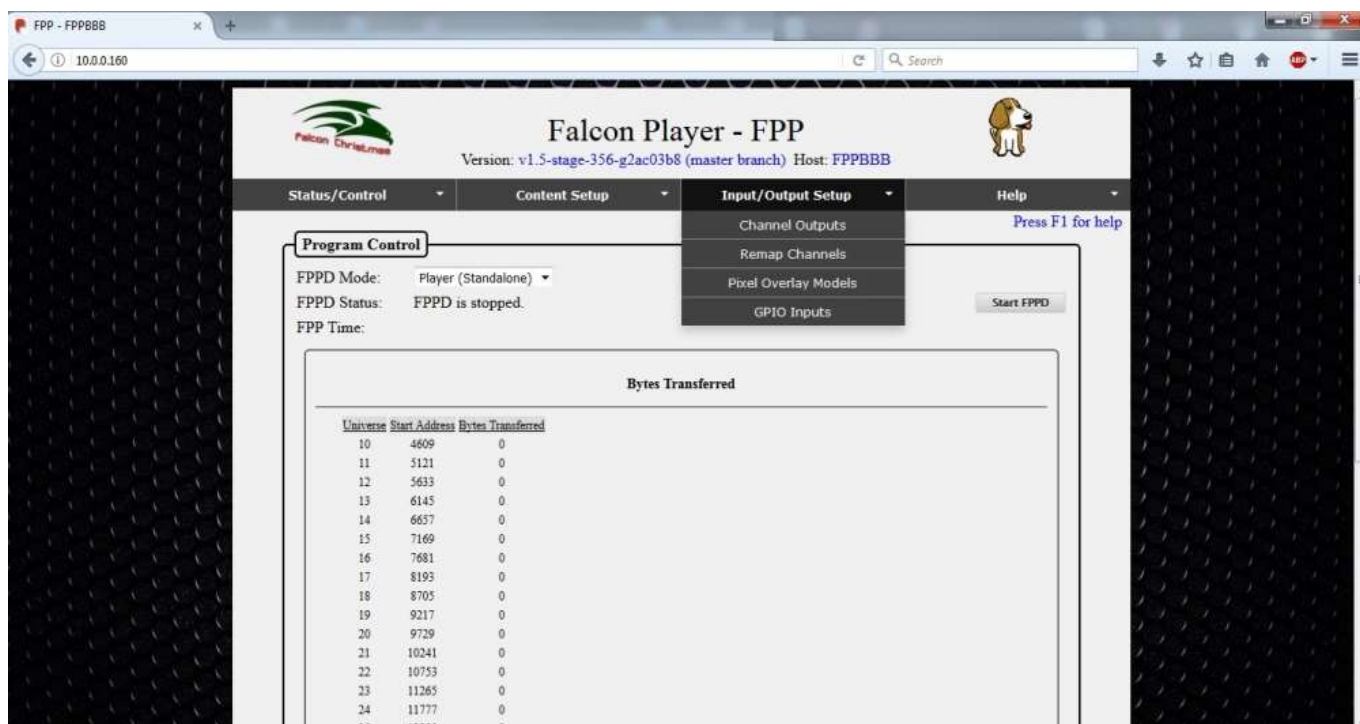
Pin	Pin Use	T568A colour	T568B colour
1	Pixel 1 data	White/Green	White/Orange
2	Ground (pixel 1)	Green	Orange
3	Pixel 2 data	White/Orange	White/Green
4	Ground (pixel 4)	Blue	Blue
5	Pixel 3 data	White/Blue	White/Blue
6	Ground (pixel 2)	Orange	Green
7	Pixel 4 data	White/Brown	White/Brown
8	Ground (pixel 4)	Brown	Brown



It is also possible to solder a 5 (actually a 2+3) way 5.0mm terminal block to the HE123-4T to allow screw connections for the incoming pixel data. These terminals are not supplied. If using this method the use of the 5 terminals is marked on the pcb.

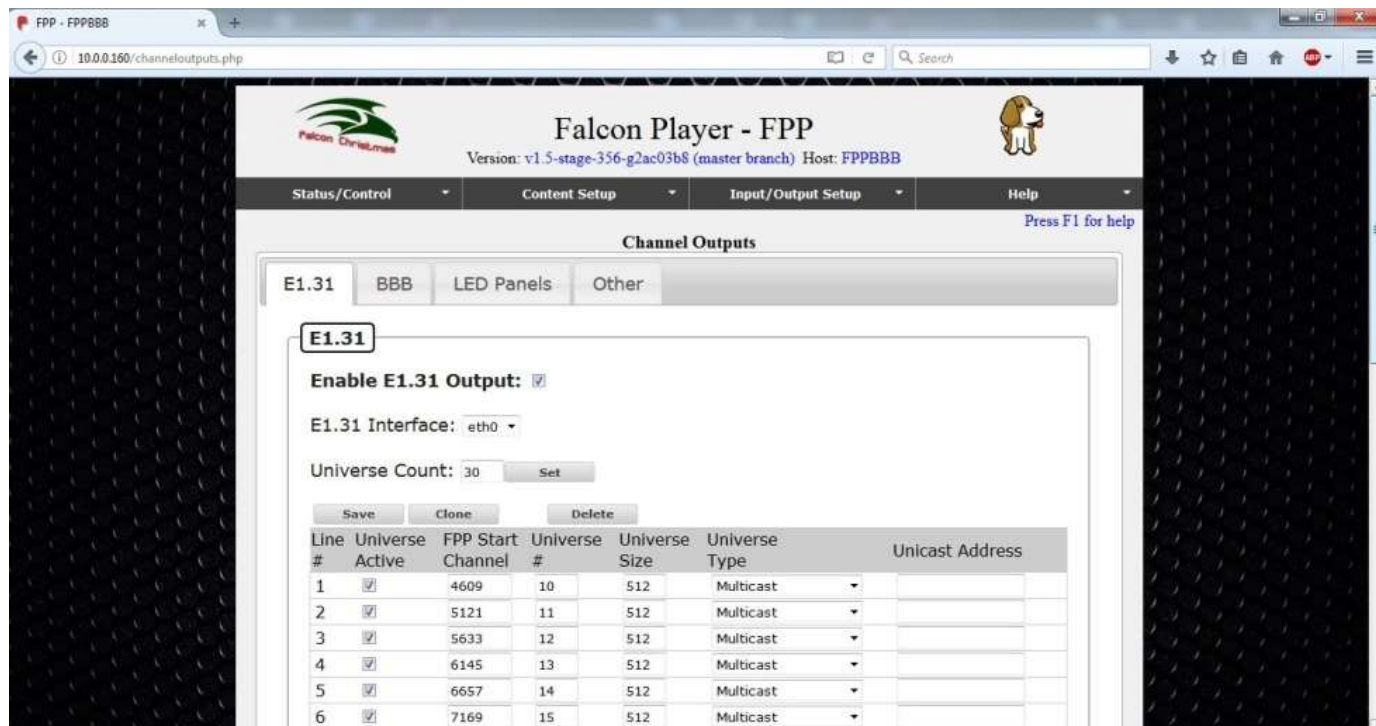
## Falcon Player (FPP) Configuration

The below screenshots show some of the configurations accessible via the FPP web interface required when setting up and using the HE123. The appearance and potentially placement of some configurations may change with different versions of Falcon Player.



The BBB the screenshots are of is configured with a static IP of 10.0.0.160 and was configured with a hostname of FPPBBB. The above screenshot is the Status display in Player (Standalone) mode.

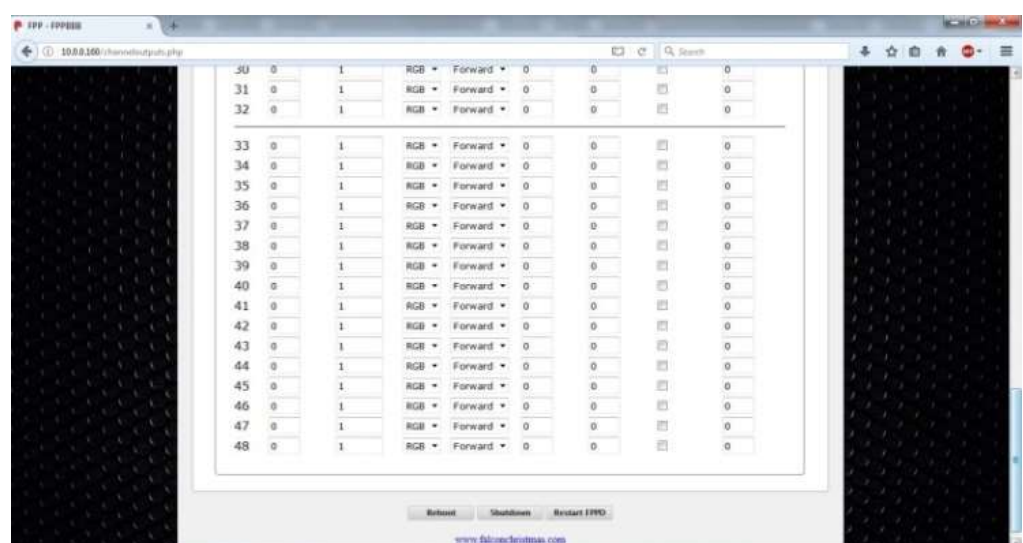
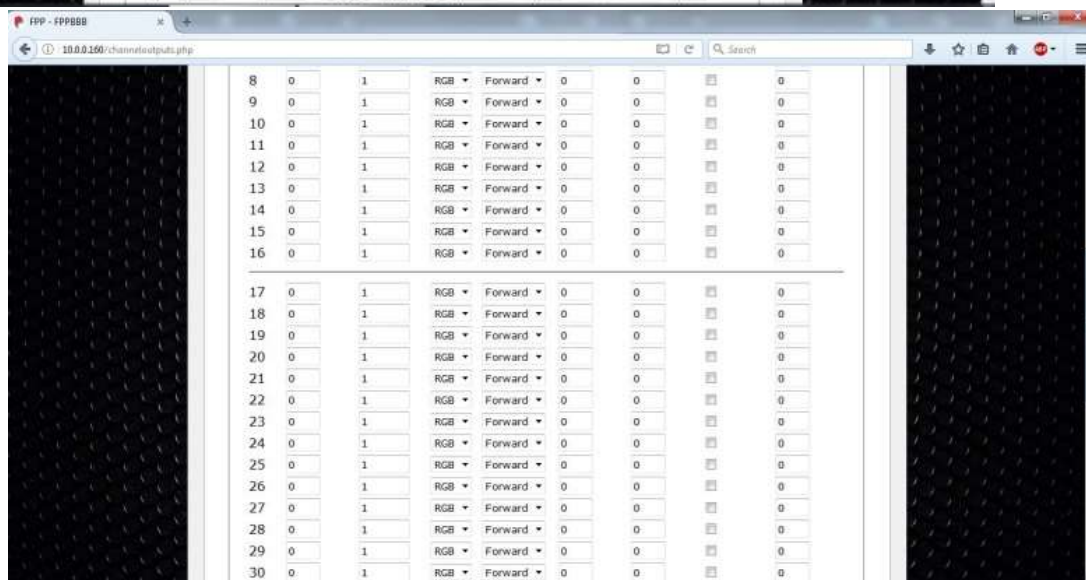
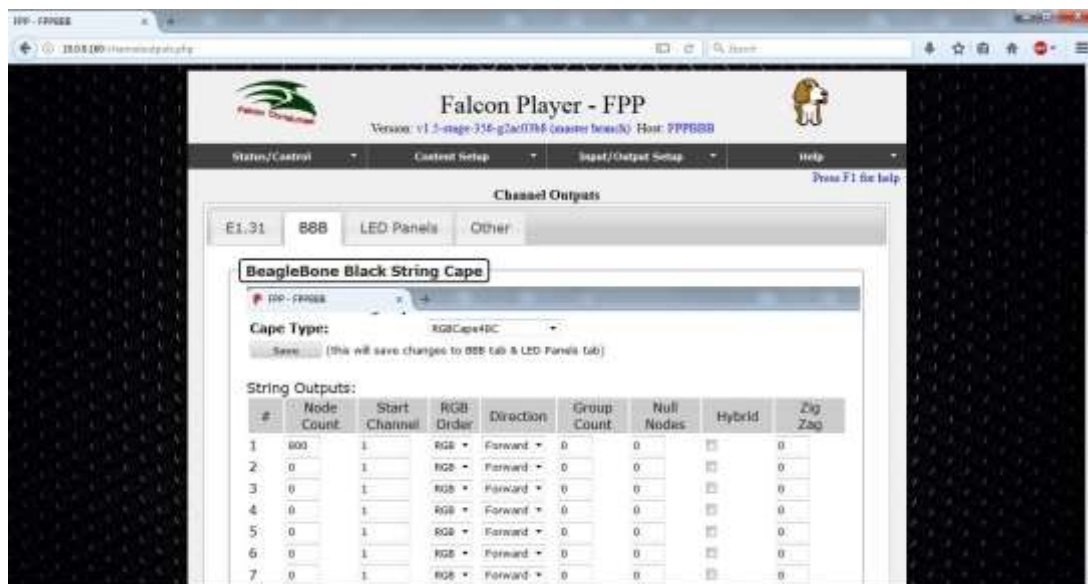
Falcon Player can be run in bridge mode if being used as an E1.31 pixel controller ran by Xlights or another BBB or Pi running FPP. The BBB can also be run as Standalone, Master or as a Slave. If running in Bridge mode then sequences, schedules and playlists don't need to be uploaded or configured.



See <http://falconchristmas.com/forum/index.php?board=8.0> for information on using and configuring Falcon Player. Channels that will be used for the pixel outputs need to be configured under Input/Output Setup -> Channel Outputs -> E1.31. If not using as Master then there is no need to tick the Enable E1.31 output but all of the required FPP channels, universes and universe sizes need to be configured. Once configured and saved, change to the BBB tab, select RGBCape48F as the cape type, configure whichever of the 48 outputs are used. The RGB Cape48C setting doesn't control all the outputs and changes the output order.



The 1<sup>st</sup> 16 outputs are on the HE123 motherboard and the other 2 groups of 16 are from the two optional daughterboards. Save after configuring. The FPPD will need restarting after changes.



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