ATX LED Consultants Inc
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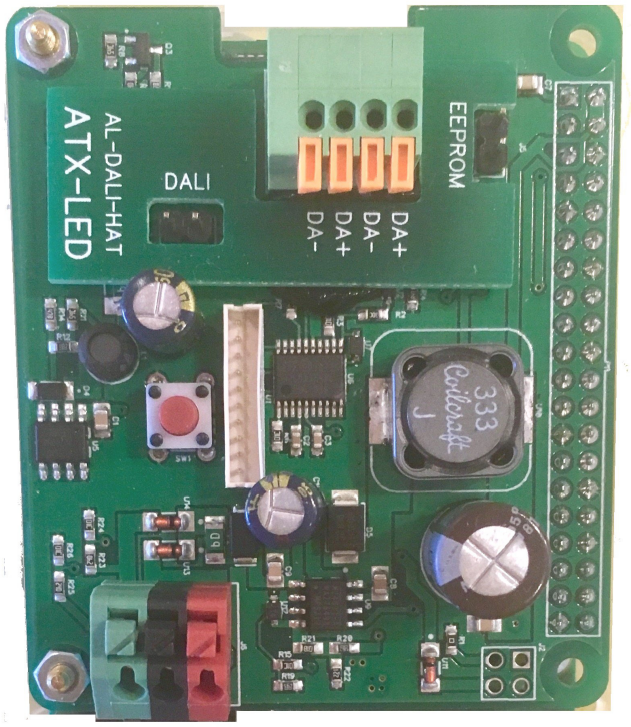
AL-DALI-HAT-V1

Raspberry Pi to DALI Co-Processor

with

DALI power supply 16 volts
Raspberry Power 5 volts
Passive PoE (option)



Product Description - AL-DALI-HAT

This device interconnects a Raspberry Pi with a DALI bus. Using your own software or our ZWD application (not included) – you can now control up to 64 addressable light fixtures from a Raspberry Pi.

Included in the AL-DALI-HAT are the following key functions

- DALI hardware interface
- DALI power supply (16v, 65 mA) current limited
- 5V power supply for the Pi with 10 watts
- Real Time co-processor to offload the DALI bus hardware interface
- 44 to 56 volt input range, redundant inputs
- Optional PoE input
- Serial port to the Raspberry Pi
- Power supply monitoring via GPIO to the Pi

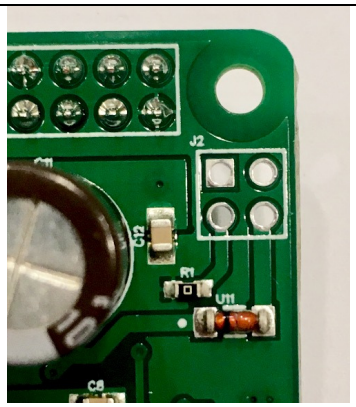
Overview

The Raspberry Pi uses the on-board serial port to communicate at 19200 baud to the DALI HAT, this rate is 16 times faster than the DALI bus – the hardware on the HAT adapts the UART serial data stream into DALI encoding. The Pi can read and write the DALI bus at it's leisure, the co-processor on the HAT handles all real-time functions.

Wiring Connections

Power for the AL-DALI-HAT

Apply power to the HAT and thru that to the Raspberry PI using the Red/Black/Green DC connector. The device uses 44 to 56 volts and 12 watts max. The Red and Green positions are power input – the Black is the ground line. Two inputs allow redundant supplies to be used

	The device can be powered from the Raspberry Pi 3B+ PoE pins. Only a passive PoE injector, like the WS-POE-1 should be used, or a Mikrotik or Ubiquiti PoE switch can be used. This is mode B compatible, so pins 4,5 are+ and 7,8 are - 44v to 48v is recommended. Ask us for delivery of the device with the female header installed.

Power Monitoring and Failover

The 2 power inputs are designed for redundancy – the board will operate with either connected, and will signal to the Pi if one of the two inputs has no power. The Pi can monitor each input from GPIO pins 29 (GPIO5) and 31 (GPIO6)

DALI bus connection

Connect a pair of DA pins to your DALI bus. You can use an external DALI power supply, or the internal one. The DALI bus must have a current limit (typically 260 mA and 16 volt max) for normal operation. The 2 pairs of connections are pass thru – there is just one bus. Observe the + and – if an external supply is used.

DALI bus power

The HAT has an on-board DALI power supply with 65 mA. If you elect to connect multiple power supplies in parallel – then please observe the + and – power pins. The Jumper (Red in photo) can be inserted to activate the on-board power supply. Future versions will allow readback of the DALI voltage.

Raspberry Pi power

The HAT delivers 5 volts 10 watts to the PI. Please do not use the Micro USB connectors on the Pi module to provide power to the Pi.

Specifications

Name	Function	Description
DC/Gnd	Power source	Dual Spring terminal, primary and secondary with failover - 44 to 57 volts (V1) or 24-57volts (V2)
	Internal Power consumption	100 milliwatt plus the Pi Peak power during DALI scan – 500 mW
DA	DALI Bus	DALI in and out – wired together Multi Master collision detect on xmit and receive
Power	Interface to Pi	5 Volts to the Pi (pins 2 and 4) Ground (pins 6, 9, 14, 20, 25, 30, 34, 39) 3.3 Volts from the Pi (20 mA) (pin 1)
Serial IP	Interface to Pi	Serial Tx and Rx (pins 8, 10)
EEprom	HAT ID	An EEprom 24C32 is provided for ID purposes (pins 27, 28)
GPIO	Power Monitoring	Pins 29, 31 are each connected to a 20:1 divider from 48v Use the Pi GPIO to detect if power is present
Programming	STM32	The onboard processor is programmed by a 5 pin ZHR connector
	Operating Temperature	0°C ~ 50°C
	Size	75 mm x 55 mm x 27 mm

DALI monitoring to the Pi

At all times – the AL-DALI-HAT is listening to the DALI bus. Any commands on the bus will be forwarded to the Pi for recording the state of the DALI bus.

The packets sent to the Pi are either:

- H means 16 bit DALI command, 4 Hex characters follow
- J means 8 bit DALI command, 2 Hex characters follow
- L means 24 bit DALI command, 6 Hex characters follow
- D means DALI bus power supply failure
- X means bus collision on Receive– normal in most cases
- N means no response received – normal in most cases
- V means version info

The DALI power supply failure is encoded as (Dx) – sent proactively by the HAT to the Pi

- x = 0: no power on DALI
- x = 1: Bus current too high – cannot drive to zero
- x = 2: DALI bus OK

The HAT version status info is encoded as (Vxxyy) where

- xx = Hardware Version
- yy = Firmware Version

DALI Command Structure

DALI commands for simple applications are 2 byte commands with either a 1 byte response or no response. The Wikipedia article offers a good explanation.

The 2 bytes of each basic command can be of these these types

A) Simple Direct Light Level commands
B) Complex commands for immediate action
C) Complex commands requiring the command to be repeated once in 100 ms for action
D) Complex commands using previously stored information

There are 3 types of addressing methods for these commands

1) Broadcast – all device receive the same information
2) Unicast – only one device receives the information
3) Group – only the devices in that group receive the information.

There are 64 individual addresses, 16 group addresses, one broadcast. The individual and group addresses are shift one bit left for transmission.

The AL-DALI-HAT accepts Hex commands to pass thru to the DALI bus. So Hex 2 is address one. The commands listed in the AL-WS-DR2, AL-WS-010v, and PWS-POE-DALI are listed in Decimal – please convert to hex. In Hex – the format is

Target	Direct Light Control	Complex Commands
Broadcast	FExx where xx is the light level	FFxx where xx is the command 0 thru 255
Individual	00 thru 7E (address times 2)	yyxx where yy is 01 thru 7F (addr x 2 + 1) xx is a command from 0 thru 255
Group	80 thru 9E (group times 2 + 128)	yyxx where yy is 81 thru 9F (group x 2 + 1) xx is a command from 0 thru 255
Broadcast		A1xx thru BFxx – commands 256 thru 271 xx is the data to the device
Broadcast		C1xx thru DFxx – commands 272 thru 287 xx is the data to the device

The DALI devices have up to 3 internal registers called DTR, DTR1 and DTR2.

Many complex commands require that the DTR register be written first, then the command is given. For example – setting the Maximum dimming level requires first a number be stored in DTR, then the DTR is stored into the device. AL-DALI-HAT accepts Hex commands to pass thru to the DALI bus. For example, setting device 5 to max level 240 (the range is 0 thru 254) the commands are

a) A3F0 – save 240 into the DTR in all devices (broadcast)
b) 0B2A – save DTR as max value only to device address 5 (times 2 plus 1 == B)

So Hex 0A is address five direct control and 0B is address five complex commands. The commands listed in the AL-WS-DR2, AL-WS-010v, and PWS-POE-DALI are listed in decimal – please convert to hex.

DALI commands from the Pi

The AL-DALI-HAT receives serial port strings from Pi and forwards them to the DALI bus. The packet is 2, 4, or 6 bytes long and begins with one of these characters.
:

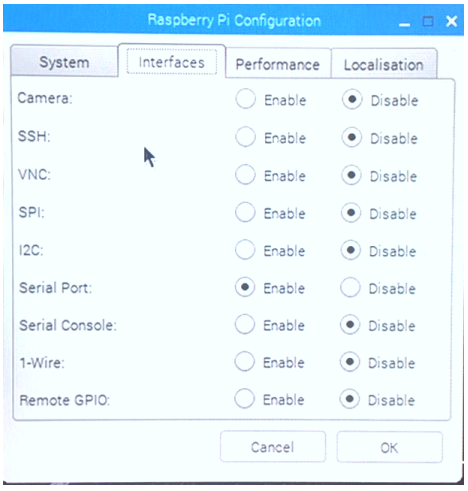
Start	Length	Command type
h	4	16 bit DALI
t	4	16 bit DALI – sent twice
j	2	8 bit DALI
l	6	24 bit DALI
d	-	Query DALI bus info
v	-	Query Version

On receipt, the AL-DALI-HAT will wait for the DALI bus to be non busy, then will transmit the command. In the case of the t command – it will send the data twice within 100 ms.

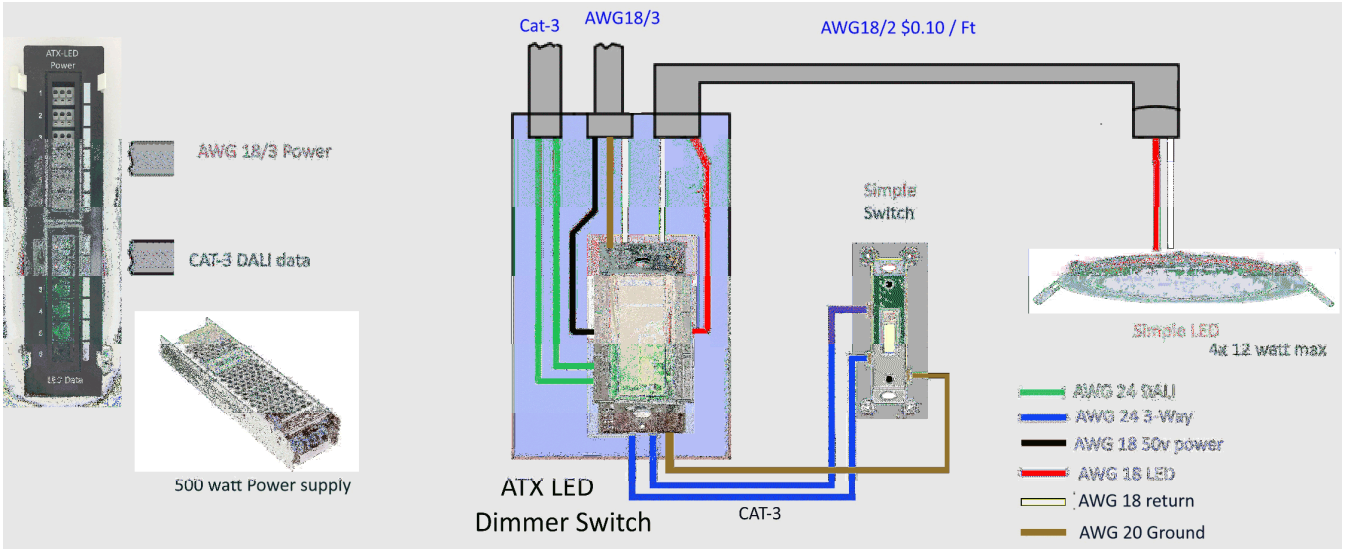
See https://atxled.com/Pi for python code samples. Some DALI lighting control examples from Pi to Pi Hat to DALI bus are shown here

Function 00	Decimal command	Send to HAT	Response
All lights on full	254 254	hFEFE	None
All lights off	254 0	hFE00	None
Initialize	165 0	tA500	None
Query status of #4	9 144	h0990	6
Set #5 to 200	10 200	H0AC8	None

See https://atxled.com/pdf/AL-WS-DR2.pdf for a list of commands, see the wikipedia article on DALI lighting for the addressing format for DALI. Configure the Pi serial port as shown below



DALI bus products from ATX LED Consultants



Low Voltage house lighting product line