ATX LED Consultants Inc
Merged IoT and Power Solutions
LED Drivers Room quality sensors

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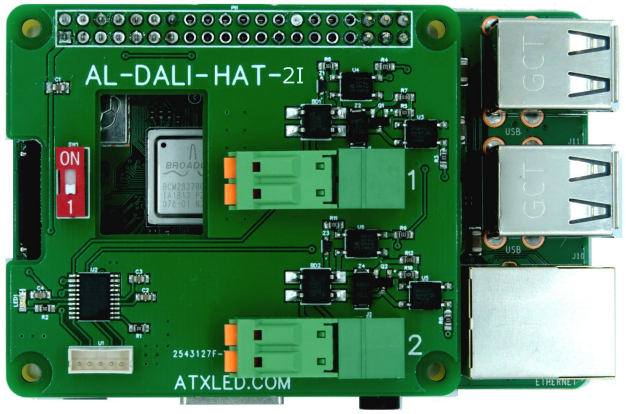


AL-DALI-HAT-I

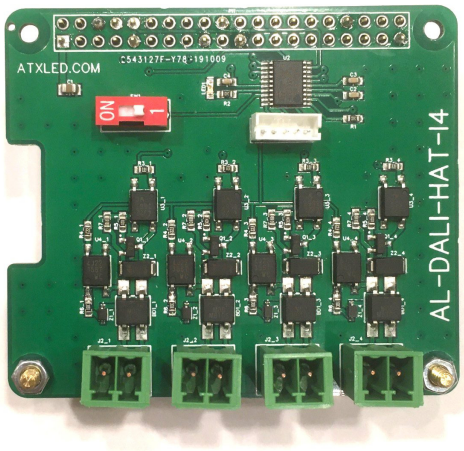
Raspberry Pi to DALI Co-Processor

with either:

2 Isolated Busses

or

4 Isolated Busses



Product Description - AL-DALI-HAT-I2 or I4

This device interconnects a Raspberry Pi with 2 (or 4) DALI busses. Using your own software or our ZWD application (not included) – you can now control up to 256 addressable light fixtures from a Raspberry Pi.

Included in the AL-DALI-HAT-I2 (I4) are the following key functions

- DALI hardware interface
- Real Time co-processor to offload the DALI bus hardware interface
- Serial port to the Raspberry Pi
- DALI bus status reporting

Overview

The Raspberry Pi uses the on-board serial port to communicate at 19200 baud to the DALI HAT-I, this rate is 16 times faster than the DALI bus – the hardware on the HAT-I2 (I4) 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-I2 (I4) handles all real-time functions.

Wiring Connections

Power for the AL-DALI-HAT-I

Connect the AL-DALI-HAT-I2 or AL-DALI-HAT-I4 to the Raspberry PI. Apply power to the Raspberry Pi.

DALI bus connection

Connect a pair of DA pins to your DALI bus. You will need an external DALI power supply. The DALI bus must have a current limit (typically 260 mA and 16 volt max) for normal operation. The 2 (4) busses are opto isolated from the DALI Pi itself.

Specifications

Name	Function	Description
	Internal Power consumption	50 milliwatt (plus the Pi)
DA	DALI Bus	2 (or 4) DALI Busses, opto isolated,
Power	Interface to Pi	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)
	Operating Temperature	0°C ~ 50°C
	Size	75 mm x 55 mm x 27 mm
Option Switch	Software defined	You can read the switch position using the 'P' command

DALI monitoring – packets to the Pi

At all times – the AL-DALI-HAT-I2 (I4) 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

- 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
- M means 25 bit DALI command, 8 Hex characters follow
- D means DALI bus power supply change
- X means bus collision on Receive– normal in most cases
- Z means bus collision on Transmit– normal in most cases
- N means no response received – normal in most cases
- V means version info
- P is for other status info
- Q is for DALI Bus Quality info (HAT type 1 only)
- S is a response to a query command “s” below, 30 characters follow
- T is the extension of S – up to 60 characters can be stored using the S command

The DALI Bus voltage status is encoded as a 3 characters: Dxc – sent proactively by the HAT to the Pi on any change in the bus status, or in response to a ‘d’ query

- x = 0: no power on DALI
- x = 1: Bus current too high – cannot drive to zero
- x = 2: DALI bus OK
- c = 1: (or none) 1 Channel board
- c = 2: 2 Channel board
- c = 4: 4 Channel board

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

- xx = Hardware Version
- yy = Firmware Version
- zz = Hardware Type
  - none = Original HAT
  - 1 = HAT with Voltage reporting and management
  - 2 = HAT with 2 channels, no voltage reporting
  - 4 = HAT with 4 channels, no voltage reporting

The HAT status info is encoded as (Pxxxyyyz) and is sent when a change is detected or on ‘p’ query

- xxx = 000 (always 0 on these models)
- yyy = 000
- z = 0 or 1 for the Switch On/Off status

Bus Selection

The Pi to Hat commands are simple strings. For example HFEFE is all lights on (see DALI specs). To handle 2 or 4 busses – a prefix is applied.

Bus number	DALI all On command	DALI response
1	HFEFE	N
2	1HFEFE	1N
3	2HFEFE	2N
4	3HFEFE	3N

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 the 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-I2 (I4) 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-I2 (I4) 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 to the HAT

The AL-DALI-HAT-I2 (I4) 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. We send lower case, and receive upper case: Length is the number of characters after the command

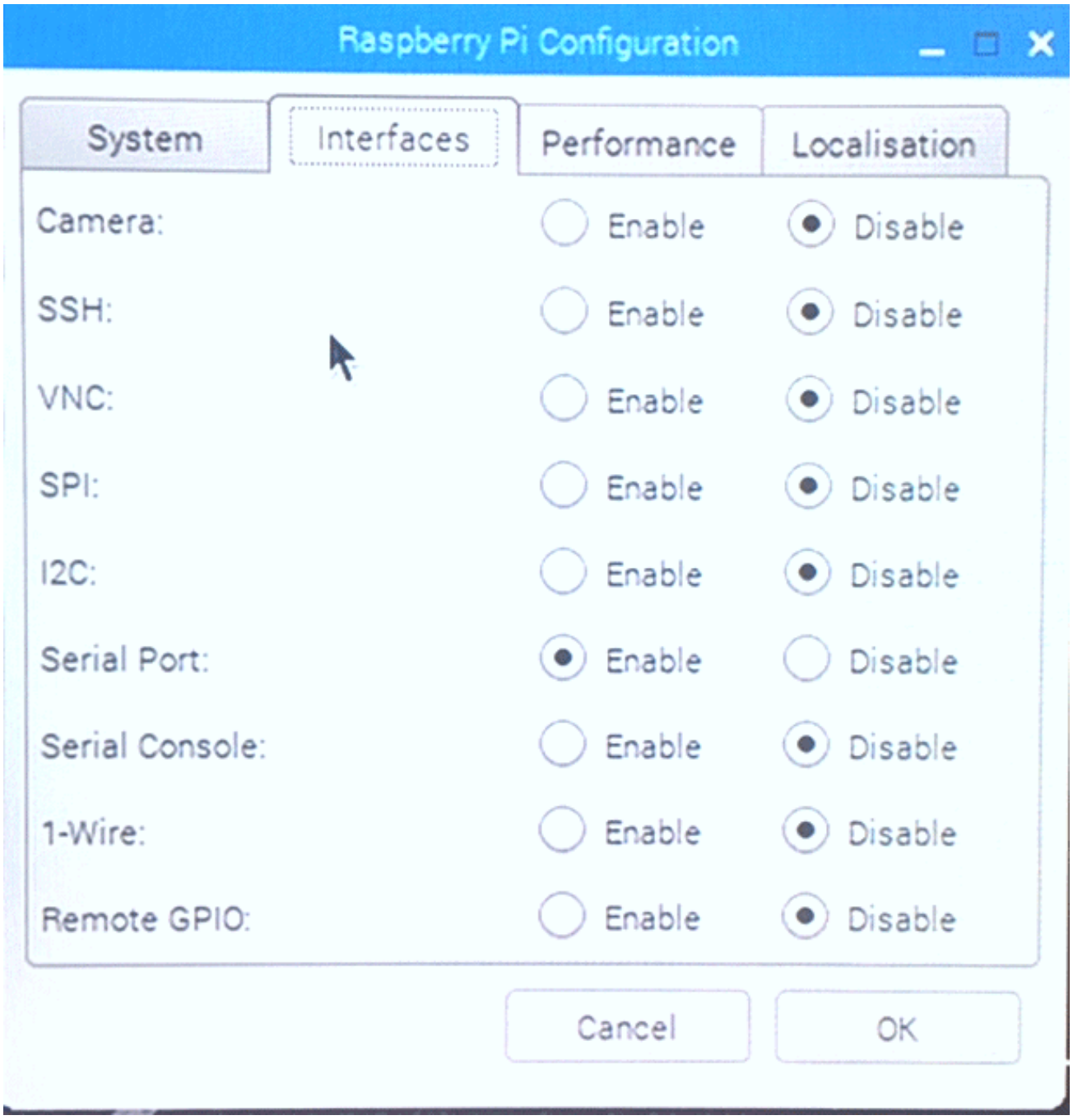
Command	Length	Command type
h	4	16 bit DALI
t	4	16 bit DALI – sent twice
j	2	8 bit DALI
l	6	24 bit DALI
d	0	Query DALI bus
p	0	Query power and switch Info
v	0	Query Version
s	0	Query String
	< 59	Store up to 59 characters

On receipt, the AL-DALI-HAT-I2 (I4) 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-I2 (I4) to DALI bus are shown here

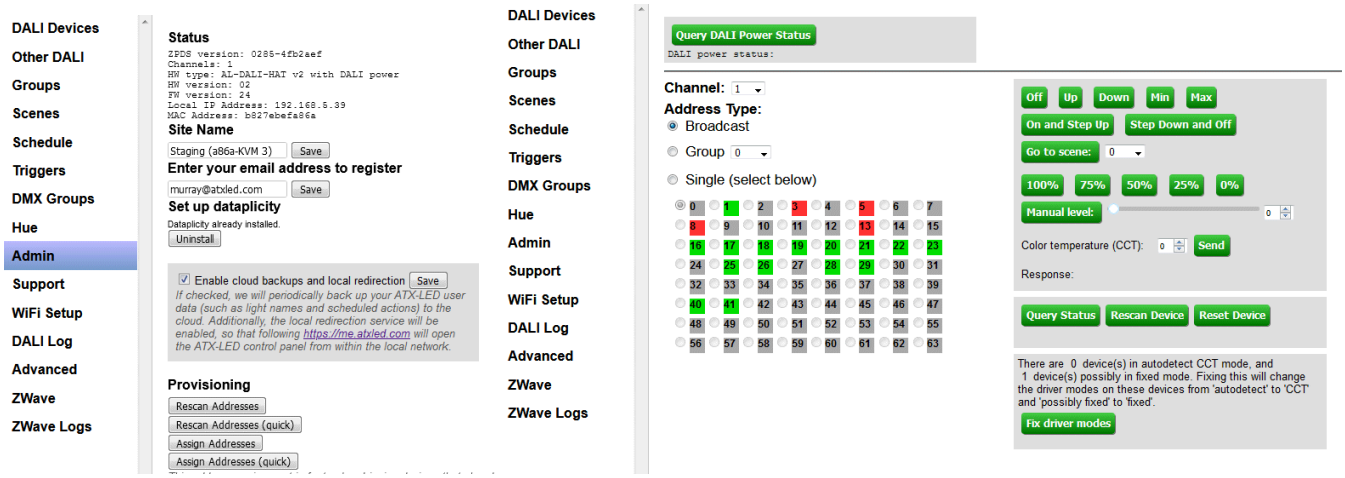
Function 00	Decimal command	Send to HAT-I2 (I4)	Response
All lights on full	254 254	hFEFE	None
All lights off	254 0	hFE00	None
Initialize	165 0	tA500	None
Query status of #4	9 144	h0990	6
Set #5 to 200	10 200	H0AC8	None

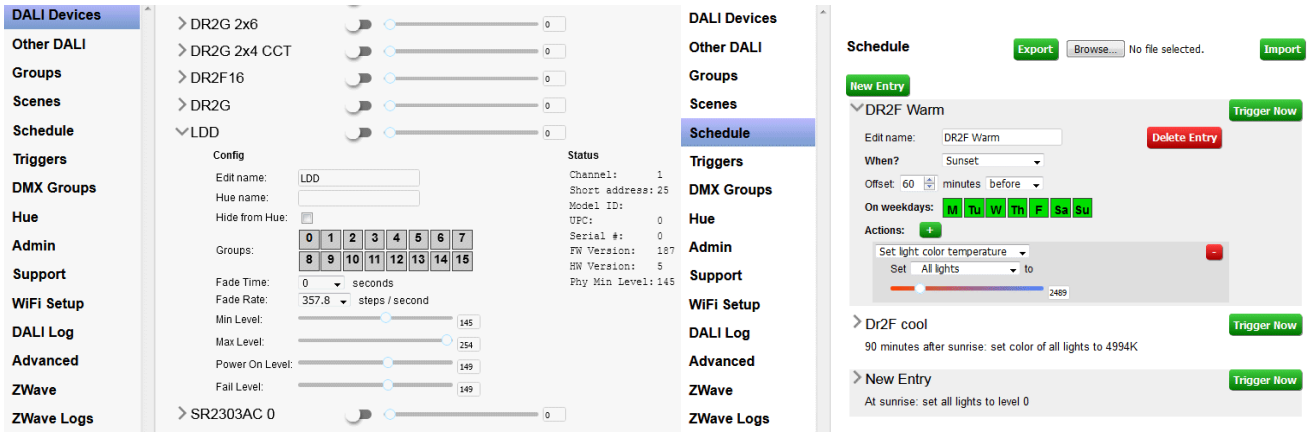
See https://atxled.com/pdf/AL-WS-DR2.pdf for a list of commands, see the wikipedia article on DALI lighting for the addressing format for DALI. Configure the Pi serial port as shown below


Raspberry Pi Configuration
System
Interfaces
Performance
Localisation
Camera:
Enable
Disable
SSH:
Enable
Disable
VNC:
Enable
Disable
SPI:
Enable
Disable
I2C:
Enable
Disable
Serial Port:
Enable
Disable
Serial Console:
Enable
Disable
1-Wire:
Enable
Disable
Remote GPIO:
Enable
Disable
Cancel
OK

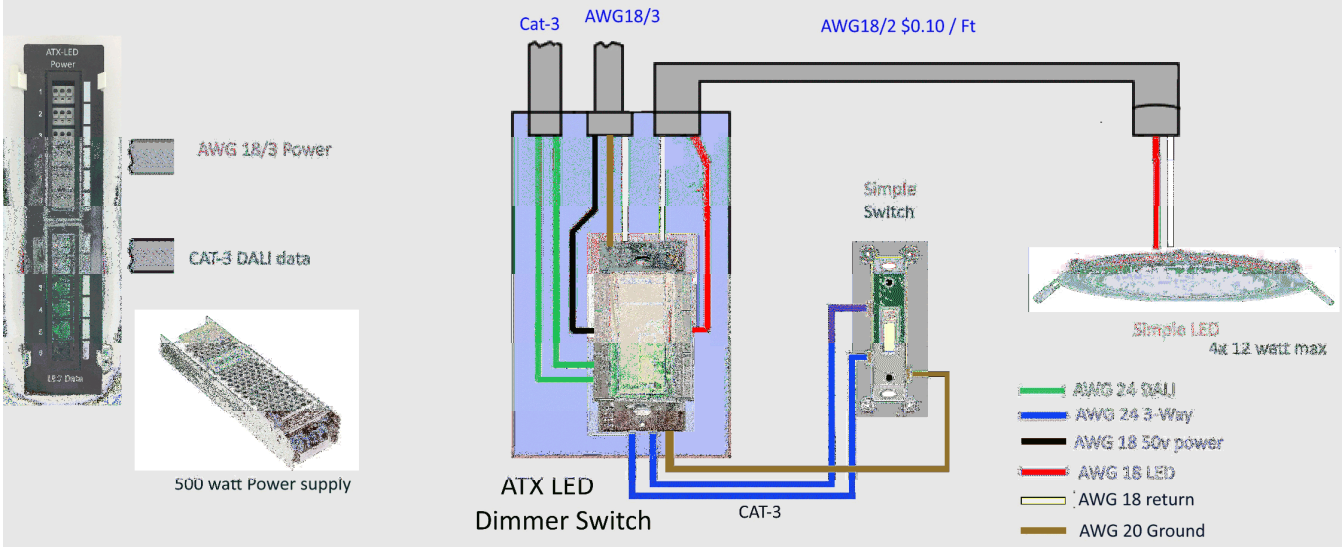
ATX LED ZWD Application

The ZWD package for the Raspberry Pi creates a complete DALI master with all features needed for configuration and management of a DALI system. It includes interfaces to Alexa, Google, Hue, Homebridge, Smartthings, Siri and so on.





DALI bus products from ATX LED Consultants



Low Voltage house lighting product line