MDK User Guide: HAT Adapter Board

Part number: SJYN1623A

Introduction

The Raspberry Pi ecosystem contains a wide variety of existing HATs (Hardware Attached on Top) that can be used to start your project, or maybe you have an existing Pi project to port to Moto Mods.

The Moto Mods HAT Adapter Board is Raspberry Pi HAT compatible and allows the use of commercially available HATs. It includes the 40-pin Header, Camera, and Display connectors in the proper locations.

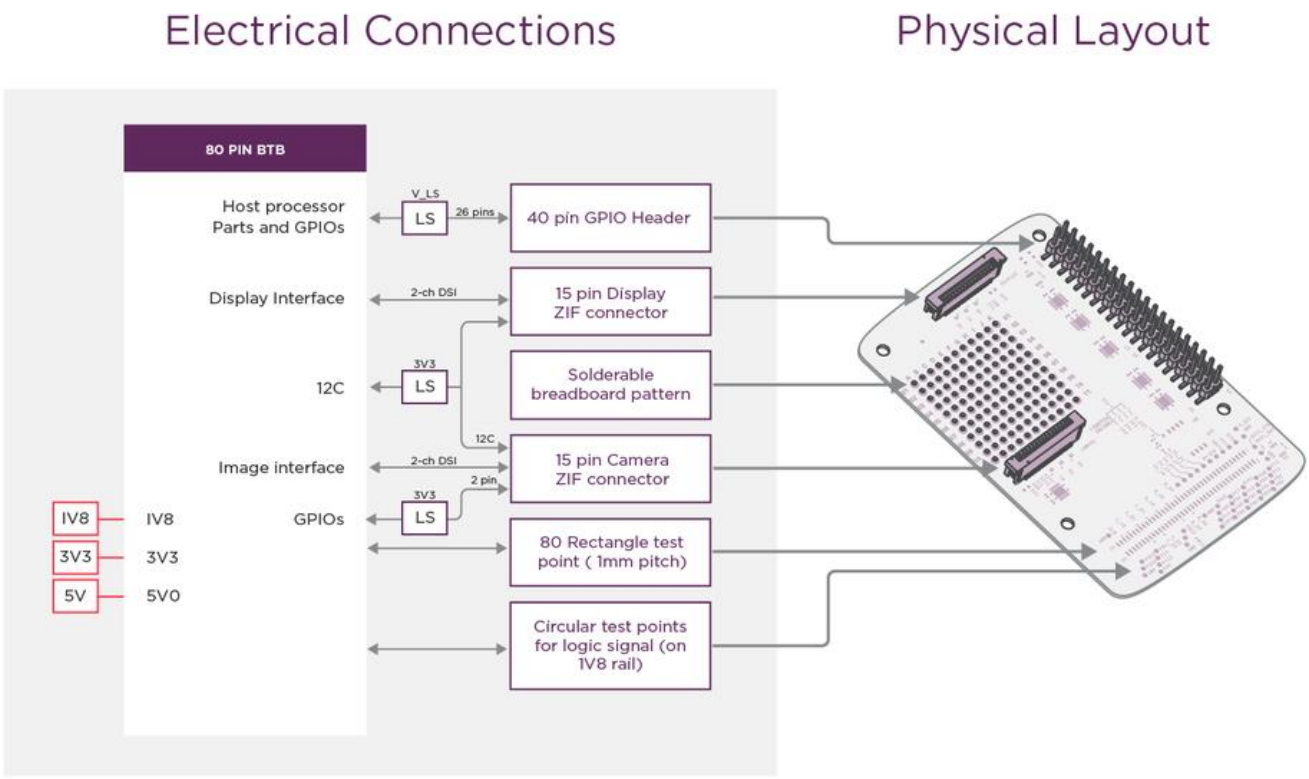
Software Considerations

When working with the Moto Mods HAT adapter board, existing Pi firmware must be ported to the MuC. For example, drivers written for the Raspian OS based on Debian Linux need to be ported to NuttX. In addition tasks and queues may require redesign to operate in the Moto Mods embedded environment.

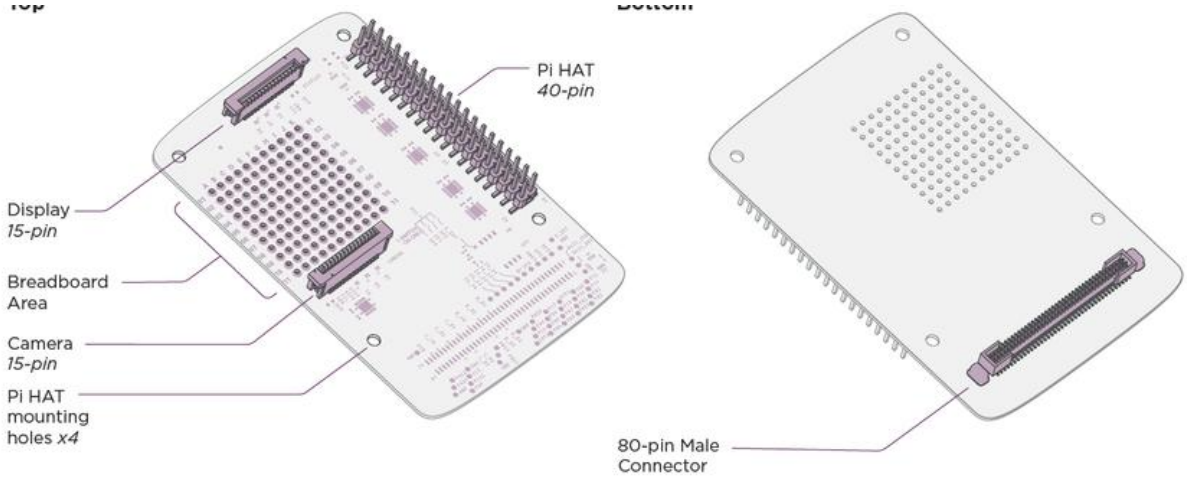
Electrical Details

Overview

This section covers:



Raspberry Pi HAT-compliant 40-pin Header



Raspberry Pi HAT 40-pin Connector Signal Cross-Reference

MotoMods HAT Adaptor 40-pin Name		Raspberry Pi 40-pin Name	
Pin #	Signal (LS: Level Shifted)	Pin #	rPi Equivalent function
2	VIO (Refer to Dip switch position) - off : 3P3 (Default) - on : 1P8	1	3V3 Power

MotoMods HAT Adaptor 40-pin Name		Raspberry Pi 40-pin Name	
Pin #	Signal (LS: Level Shifted)	Pin #	rPi Equivalent function
1	5P0	2	5V Power
4	PB11_LS	3	GPIO2 (SDA1)
3	5P0	4	5V Power
6	PB10_LS	5	GPIO3 (SCL1)
5	GND	6	Ground
8	PB2_LS	7	GPIO4 (GPIO_GCLK)
7	PA2_LS	8	GPIO14 (TXD0)
10	GND	9	Ground
9	PA3_LS	10	GPIO15 (RXD0)
12	PA0_LS	11	GPIO17 (GPIO_GEN0)
11	PC14_LS	12	GPIO18 (GPIO_GEN1/PCM_CLK)
14	PA10_LS	13	GPIO27 (GPIO_GEN2)
13	GND	14	Ground
16	PC12_LS	15	GPIO22 (GPIO_GEN3)
15	PC7_LS	16	GPIO23 (GPIO_GEN4)
18	VIO (Refer to Dip switch position) - off : 3P3 (Default) - on : 1P8	17	3V3 Power
17	PC8_LS	18	GPIO24 (GPIO_GEN5)

MotoMods HAT Adaptor 40-pin Name		Raspberry Pi 40-pin Name	
Pin #	Signal (LS: Level Shifted)	Pin #	rPi Equivalent function
20	PA7_LS	19	GPIO10 (SPI_MOSI)
19	GND	20	Ground
22	PA6_LS	21	GPIO9 (SPI_MISO)
21	PD6_LS	22	GPIO25 (GPIO_GEN6)
24	PA5_LS	23	GPIO11 (SPI_SCLK)
23	PA4_LS	24	GPIO8 (SPI_CE0_N)
26	GND	20	Ground
25	PA15_LS	26	GPIO7 (SPI_CE1_N)
28	PC1_LS (reserved for I2C)	27	GPIO0 (ID_SD)
27	PC0_LS (reserved for I2C)	28	GPIO1 (ID_SC)
30	PG9_LS	29	GPIO5
29	GND	30	Ground
32	PG10_LS	31	GPIO6
31	PG12_LS	32	GPIO12
34	PH0_LS	33	GPIO13
33	GND	34	Ground
36	PC15_LS	35	GPIO19 (PCM_FS)
35	PA1_LS	36	GPIO16

MotoMods HAT Adaptor 40-pin Name		Raspberry Pi 40-pin Name	
Pin #	Signal (LS: Level Shifted)	Pin #	rPi Equivalent function
38	PC3_LS	37	GPIO26
37	PE7_LS	38	GPIO20 (PCM_DIN)
40	GND	34	Ground
39	PD7_LS	40	GPIO21 (PCM_DOUT)

Camera Connector

Camera Connector Signal Cross-Reference

MotoMods HAT Adaptor Camera Connector		Raspberry Pi Camera Connector	
Pin #	Signal	Pin #	rPi Equivalent function
15	GND	1	Ground
14	C_CSI1_D0N	2	CAM1_DN0
13	C_CSI1_D0P	3	CAM1_DP0
12	GND	4	Ground
11	C_CSI1_D1N	5	CAM1_DN1
10	C_CSI1_D1P	6	CAM1_DP1
9	GND	7	Ground
8	C_CSI1_CN	8	CAM1_CN
7	C_CSI1_CP	9	CAM1_CP

MotoMods HAT Adaptor Camera Connector		Raspberry Pi Camera Connector	
Pin #	Signal	Pin #	rPi Equivalent function
6	GND	10	Ground
5	PC9_3P3	11	CAM_GPIO0
4	PA9_3P3	12	CAM_GPIO1
3	PC0_LS (reserved for I2C)	13	SCL0
2	PC1_LS (reserved for I2C)	14	SDA0
1	3P3	15	3V3

Display Connector

Display Connector Signal Cross-Reference

MotoMods HAT Adaptor Display Connector		Raspberry Pi Display Connector	
Pin #	Signal	Pin #	rPi Equivalent function
15	GND	1	Ground
14	C_DSI1_D1N	2	DSI1_DN1
13	C_DSI1_D1P	3	DSI1_DP1
12	GND	4	Ground
11	C_DSI1_CN	5	DSI1_CN
10	C_DSI1_CP	6	DSI1_CP
9	GND	7	Ground

MotoMods HAT Adaptor Display Connector		Raspberry Pi Display Connector	
Pin #	Signal	Pin #	rPi Equivalent function
8	C_DSI1_D0N	8	DSI1_DN0
7	C_DSI1_D0P	9	DSI1_DP0
6	GND	10	Ground
5	PC0_LS (reserved for I2C)	11	SCL0
4	PC1_LS (reserved for I2C)	12	SDA0
3	GND	13	Ground
2	3P3	14	3V3
1	3P3	15	3V3

Configurable Logic Levels

The Raspberry Pi HAT Adapter Board contains level shifters to handle logic voltage levels at the 40-pin header. The DIP switch allows you to configure the level shifters for either a 1.8-volt or 3.3-volt interface at the 40-pin header. The MuC in the Reference Moto Mod uses 1.8-volt logic. Therefore, when using an existing Pi HAT set DIP switch to shift voltage levels to/from the Pi standard 3.3 volts.

NOTE:
DIP switch settings have no effect on voltages at the display or camera connectors.

Mechanical Details

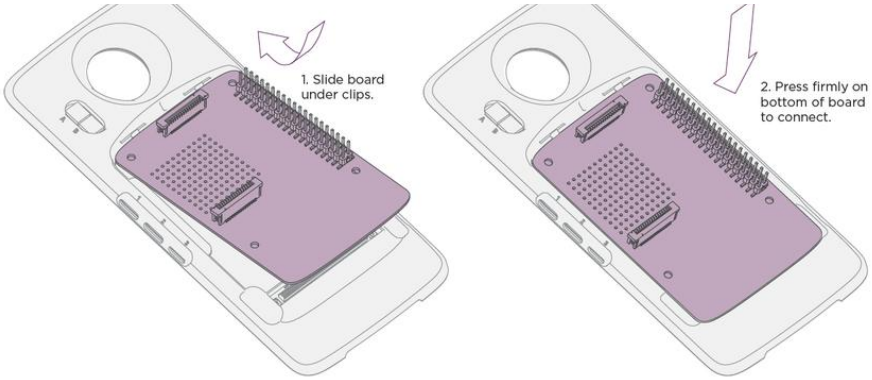
Inserting and Removing Raspberry Pi HAT Adapter Board

The physical dimensions and location of the 40-pin header on the Raspberry Pi HAT Adapter Board match the Raspberry Pi 2 Model B.

NOTE:
You must insert and remove the Raspberry Pi HAT Adapter Board by performing the following steps, in order to prevent damage from occurring.

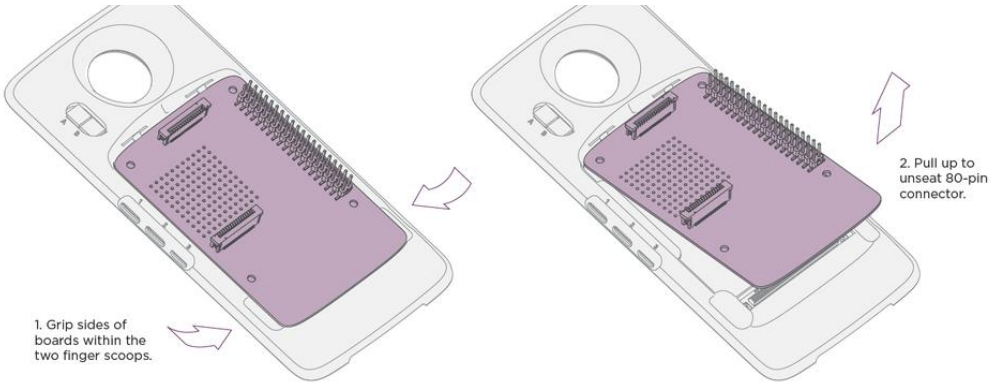
Inserting Raspberry Pi HAT Adapter Board Into Reference Moto Mod

- **Step 1:** Toe-in top edge of board under housing tabs.
- **Step 2:** Press board down to seat the 80 pin connector.



Removing Raspberry Pi HAT Adapter Board from Reference Moto Mod

- **Step 1:** Grip sides of board within two finger scoops.
- **Step 2:** Pull up to unseat the 80 pin connector.



Securing a Pi HAT to the Raspberry Pi HAT Adapter Board

Mounting hardware can be used to physically secure a Pi HAT to the Raspberry Pi HAT Adapter Board. However, fasteners used to secure the Pi HAT to the Raspberry Pi HAT Adapter Board **must be 2mm tall or less**. Fasteners over 2mm tall will interfere with the Reference Moto Mod during assembly, and **may cause damage**.

This diagram shows where the mounting hardware is placed within the Raspberry Pi HAT Adapter Board: