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› Waveshare PCIe to M.2 E Key HAT+ for Raspberry Pi 5 User Manual

waveshare PCIe TO M.2 E KEY HAT+

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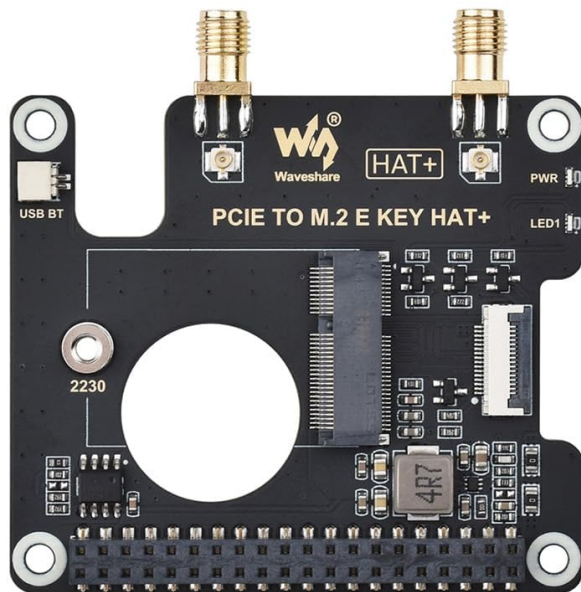
Model: PCIe TO M.2 E KEY HAT+

1. INTRODUCTION AND OVERVIEW

The Waveshare PCIe to M.2 E Key HAT+ is an expansion board designed specifically for the Raspberry Pi 5. It enables the integration of various NGFF (M.2 E Key) wireless network interface cards (NICs), enhancing the Raspberry Pi 5's wireless capabilities. This HAT+ supports USB Bluetooth connections and adheres to the new HAT+ standard, ensuring compatibility and ease of use with Raspberry Pi 5 software and firmware.

Package Content

PCIE TO M.2 E KEY HAT+ x1



2*20 Pin header x1



IPEX 1 to IPEX 4 adapter cable
~6cm (2pcs) x1



Type-A to SH1.0 2Pin cable x1



16P-Cable-40mm x1



Screws pack x1



Image 1.1: Waveshare PCIe to M.2 E Key HAT+ Overview

This image displays the Waveshare PCIe to M.2 E Key HAT+ board, highlighting its design for the Raspberry Pi 5 and its compatibility with various NGFF (M.2 E Key) wireless NICs.

2. PACKAGE CONTENTS

Please verify that all items listed below are included in your package. If any components are missing or damaged, please contact customer support.

- PCIE TO M.2 E KEY HAT+ x1
- 2*20 Pin header x1
- IPEX 1 to IPEX 4 adapter cable ~6cm (2pcs) x1
- Type-A to SH1.0 2Pin cable x1
- 16P-Cable-40mm x1
- Screws pack x1

PCIe To M.2 E KEY HAT

Designed for Raspberry Pi 5

Compatible With Various NGFF (M.2 E Key) Wireless NIC

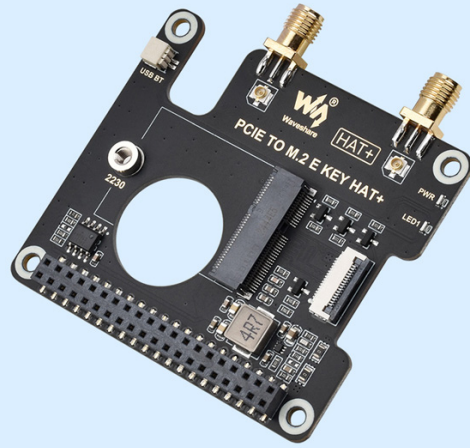


Image 2.1: Package Contents

This image illustrates all components included in the Waveshare PCIe to M.2 E Key HAT+ package, such as the HAT board, cables, headers, and mounting hardware.

3. SETUP AND INSTALLATION

Follow these steps to properly install your Waveshare PCIe to M.2 E Key HAT+ onto your Raspberry Pi 5.

3.1 General Installation Overview

The HAT+ mounts directly onto your Raspberry Pi 5. Ensure the Raspberry Pi is powered off and disconnected from all power sources before beginning installation.

Image 3.1: How To Install

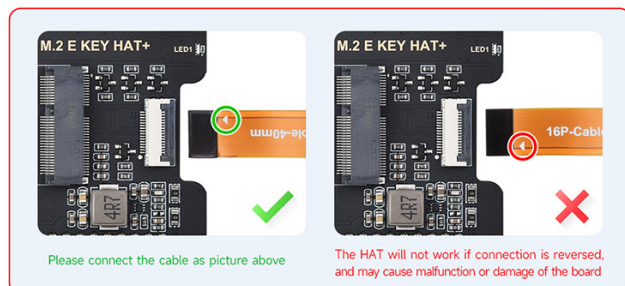
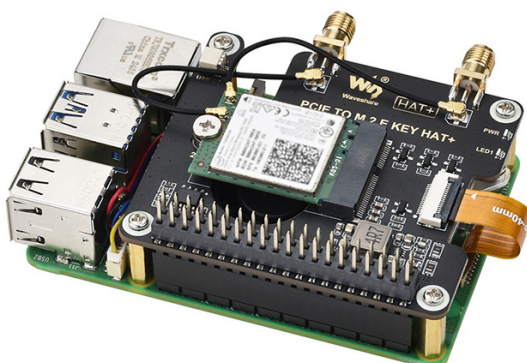
This exploded view diagram shows the step-by-step assembly of the HAT+ onto the Raspberry Pi 5, including the placement of standoffs and screws.

3.2 Connecting to Raspberry Pi 5 via 16PIN Cable

Connect the provided 16-pin PCIe cable between the HAT+ and the Raspberry Pi 5. Ensure the cable is connected in the correct orientation to prevent damage to the board or improper function. Refer to the diagram below for the correct connection.

Connecting To PI5 Via 16PIN Cable

Based On 16PIN PCIe Interface Of Raspberry Pi 5



* for reference only, please refer to the Package Content for detailed part list

Image 3.2: 16PIN Cable Connection

This diagram illustrates the correct and incorrect ways to connect the 16-pin PCIe cable between the HAT+ and the Raspberry

Pi 5. Always ensure the cable is connected as pictured in the 'correct' example.

3.3 Installing M.2 E Key Wireless NIC

The HAT+ is compatible with various NGFF (M.2 E Key) wireless NICs. Identify the correct key type for your module (A/E Key or E Key) and carefully insert it into the M.2 slot on the HAT+. Secure the module with the provided screw.



Image 3.3: Compatible Wireless NIC Types

This image helps identify the two common M.2 E Key slot types (A/E Key and E Key) to ensure proper installation of your wireless NIC module.

3.4 Connecting External Antennas

Attach your external antennas to the onboard SMA female antenna connectors. Ensure they are securely fastened but do not overtighten.

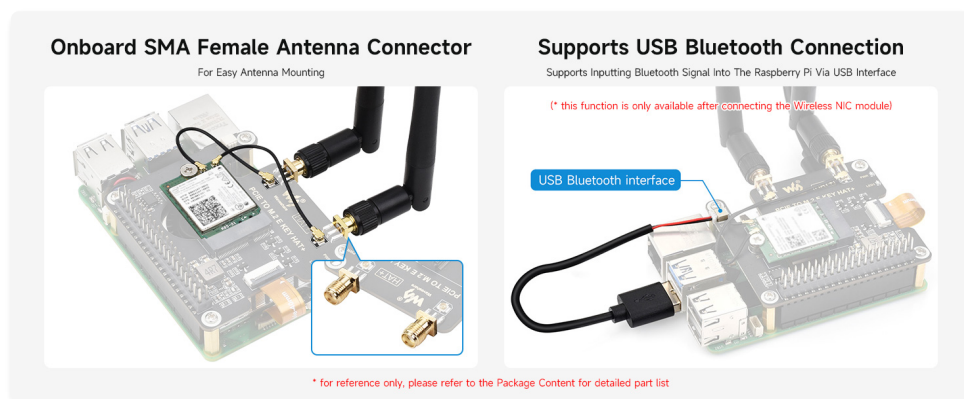


Image 3.4: Onboard SMA Female Antenna Connector

This image provides a close-up view of the SMA female antenna connectors on the HAT+, demonstrating where and how to attach external antennas.

3.5 USB Bluetooth Connection

If your wireless NIC module supports Bluetooth via USB, connect the provided Type-A to SH1.0 2Pin cable from the HAT+ to an available USB port on your Raspberry Pi 5. This function is only available after connecting a compatible wireless NIC module.

Various Wireless NIC Support											
Supports The Following Modules, With More Compatible Modules Coming Soon											
MODEL											
	RTL8822CE		AX200		AX210		BE200				
WI-FI VERSION	Wi-Fi 5		Wi-Fi 6		Wi-Fi 6E		Wi-Fi 7				
WI-FI BAND	2.4GHz	5GHz	2.4GHz	5GHz	2.4GHz	5GHz	6GHz	2.4GHz	5GHz	6GHz	
WI-FI RATE	300Mbps	867Mbps	574Mbps	2400Mbps	574Mbps	2400Mbps	2400Mbps	574Mbps	2400Mbps	5800Mbps	
INTERFACE	NGFF (M.2 A/E Key)										
BLUETOOTH VERSION	5.0		5.2		5.3		5.4				
TECHNICAL SUPPORT	MU-MIMO										
ANTENNA CONNECTOR	IPEX 4 Connector										
SYSTEM SUPPORT	Linux, Windows 10 / 11										
DIMENSIONS	22.0 × 30.0 × 2.4mm										

Image 3.5: USB Bluetooth Interface Connection

This illustration demonstrates how to connect the USB Bluetooth interface cable from the HAT+ to the Raspberry Pi 5, enabling Bluetooth functionality through the USB interface.

4. OPERATING INSTRUCTIONS

Once the Waveshare PCIe to M.2 E Key HAT+ is physically installed, you will need to configure your Raspberry Pi 5's operating system to recognize and utilize the installed wireless NIC.

4.1 Software Configuration

- Power On:** Connect power to your Raspberry Pi 5.
- Operating System:** Ensure your Raspberry Pi 5 is running a compatible operating system (e.g., Raspberry Pi OS, Ubuntu).
- Driver Installation:** Depending on your chosen M.2 E Key wireless NIC, you may need to install specific drivers. Refer to the documentation provided with your wireless NIC or the Waveshare Wiki for detailed instructions.
- Network Configuration:** Configure your wireless network settings through your operating system's network manager.
- Bluetooth Configuration:** If using the USB Bluetooth connection, ensure Bluetooth services are enabled and configured in your operating system.

4.2 HAT+ Standard Features

The HAT+ standard provides several benefits for Raspberry Pi 5 users:

- Automatic Detection:** Supports automatic detection by Raspberry Pi software/firmware.
- EEPROM Integration:** Integrates an EEPROM chip for automatic board configuration loading, simplifying the development process.
- Standardized Dimensions:** Features standardized dimensions for a perfect fit with Raspberry Pi.
- Power Supply:** Supports power supply through the Raspberry Pi 40PIN GPIO.

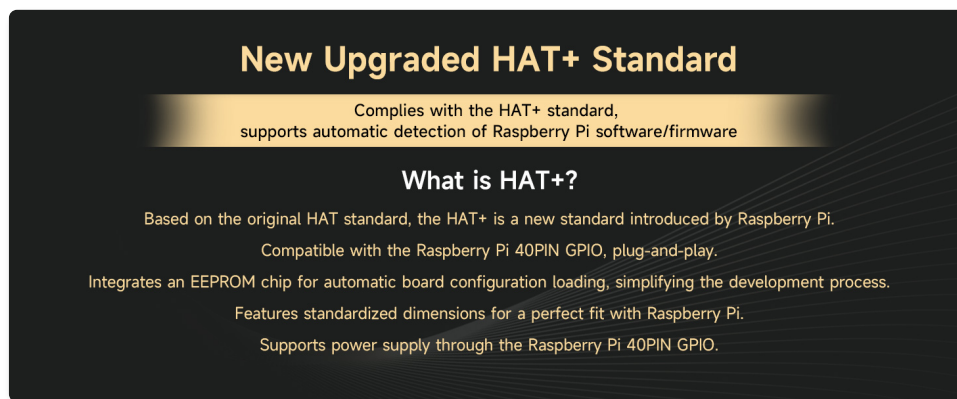


Image 4.1: New Upgraded HAT+ Standard

This image provides details on the new HAT+ standard, including its features like automatic detection, EEPROM integration, standardized dimensions, and power supply capabilities.

5. MAINTENANCE

To ensure the longevity and optimal performance of your Waveshare PCIe to M.2 E Key HAT+:

- **Keep Clean:** Regularly clean the board with a soft, dry brush or compressed air to remove dust and debris. Avoid using liquids.
- **Handle with Care:** Always handle the board by its edges to avoid touching components, which can cause electrostatic discharge damage.
- **Storage:** When not in use, store the HAT+ in an anti-static bag in a cool, dry environment.
- **Firmware Updates:** Keep your Raspberry Pi 5's firmware and operating system updated to ensure compatibility and access to the latest features and bug fixes.

6. TROUBLESHOOTING

If you encounter issues with your Waveshare PCIe to M.2 E Key HAT+, consider the following troubleshooting steps:

- **No Detection of Wireless NIC:**
 - Ensure the 16-pin PCIe cable is correctly and securely connected to both the HAT+ and the Raspberry Pi 5. Refer to Image 3.2.
 - Verify that the M.2 E Key wireless NIC is properly seated in its slot and secured.
 - Check if the wireless NIC requires specific drivers and if they are installed correctly on your Raspberry Pi OS.
 - Confirm that your wireless NIC is compatible with the HAT+. Refer to the specifications or Waveshare Wiki.
- **Bluetooth Not Working:**
 - Ensure the USB Bluetooth cable is connected from the HAT+ to a USB port on the Raspberry Pi 5. Refer to Image 3.5.
 - Verify that your wireless NIC module supports Bluetooth via USB.
 - Check your operating system's Bluetooth settings and ensure Bluetooth services are enabled.
- **Physical Damage / Loose Parts:**
 - When handling connectors, especially the PCIe cable clip, exercise extreme care. These small

components can be fragile. If a clip is lost or damaged, contact Waveshare support for potential replacement options.

- **Poor Wireless Performance:**
 - Ensure external antennas are securely connected to the SMA connectors.
 - Check for environmental interference or obstructions.
 - Verify the quality and specifications of your chosen wireless NIC and antennas.

7. SPECIFICATIONS

Below are the technical specifications for the Waveshare PCIe to M.2 E Key HAT+.

Feature	Description
Compatible Devices	Raspberry Pi 5
Interface	PCIe to M.2 E Key
Standard	HAT+ Standard
Bluetooth Support	Via USB interface (requires compatible Wireless NIC module)
Antenna Connector	SMA Female
Model Number	PCIE TO M.2 E KEY HAT+
Manufacturer	Waveshare
UPC	788046389586

Various Wireless NIC Support

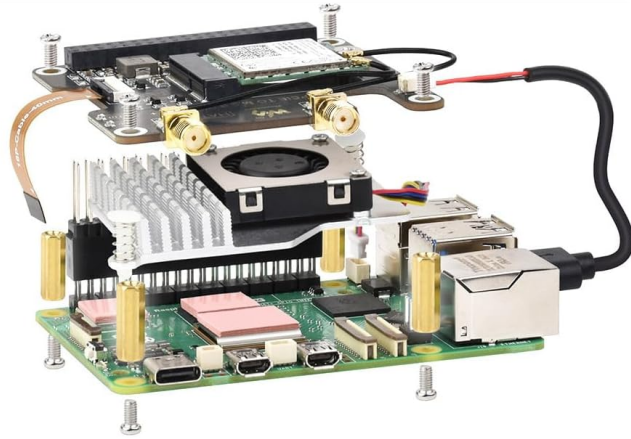
Supports The Following Modules, With More Compatible Modules Coming Soon

MODEL	 RTL8822CEAX200AX210BE200									
WI-FI VERSION	Wi-Fi 5Wi-Fi 6Wi-Fi 6EWi-Fi 7									
WI-FI BAND	2.4GHz	5GHz	2.4GHz	5GHz	2.4GHz	5GHz	6GHz	2.4GHz	5GHz	6GHz
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BLUETOOTH VERSION	5.0		5.2		5.3			5.4		
TECHNICAL SUPPORT	MU-MIMO									
ANTENNA CONNECTOR	IPEX 4 Connector									
SYSTEM SUPPORT	Linux, Windows 10 / 11									
DIMENSIONS	22.0 × 30.0 × 2.4mm									

Image 7.1: Various Wireless NIC Support

This table provides a comparison of various compatible wireless NIC modules, detailing their Wi-Fi versions, bands, rates, interfaces, Bluetooth versions, technical support, antenna connectors, system support, and dimensions.

How To Install



* for reference only, please refer to the Package Content for detailed part list

Outline Dimensions

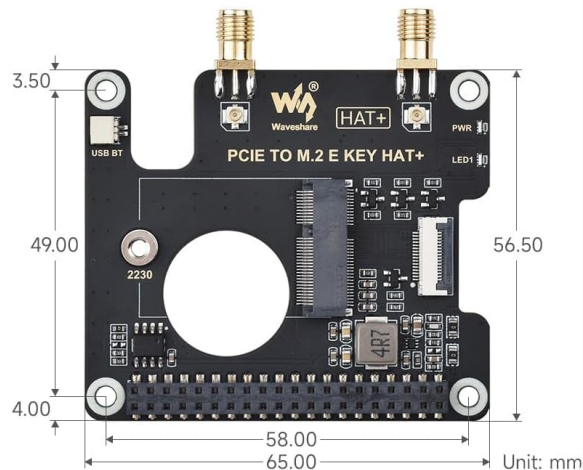


Image 7.2: Outline Dimensions

This technical drawing illustrates the precise outline dimensions of the WaveShare PCIe to M.2 E Key HAT+ in millimeters.

8. WARRANTY AND SUPPORT

8.1 Warranty Information

The WaveShare PCIe to M.2 E Key HAT+ comes with a **1-year warranty** from the date of purchase. This warranty covers manufacturing defects under normal use. It does not cover damage caused by misuse, accident, modification, or improper installation.

8.2 Technical Support

For technical assistance, detailed guides, and additional resources, please visit the official WaveShare Wiki. The Wiki provides comprehensive information, drivers, and tutorials to help you with your product. You can typically find a link to the Wiki on the WaveShare product page or by searching for "WaveShare Wiki" online. For further inquiries or warranty claims, please contact WaveShare customer support through their official website or the platform where you purchased the product.

