DEBIX Model A User Manual

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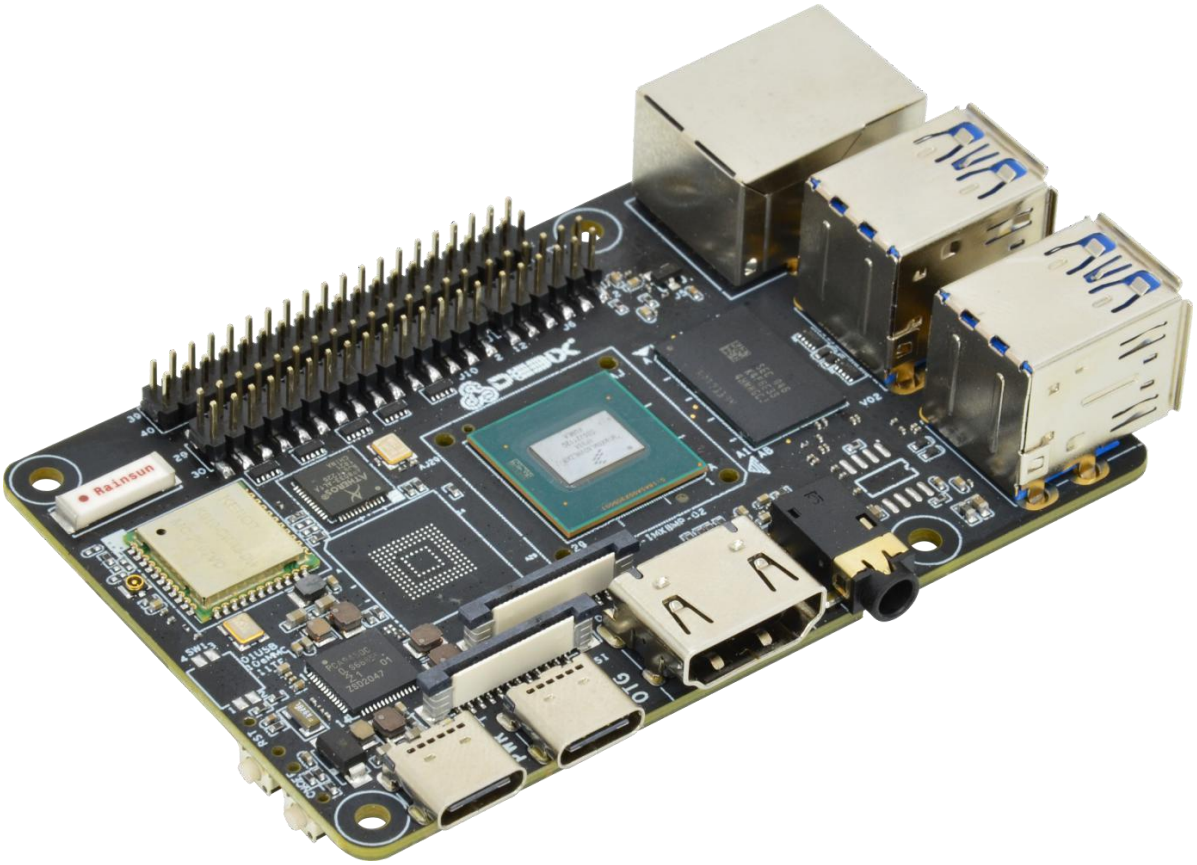
Editor: Polyhex Technology Company Limited（http://www.polyhex.net/）

In recent years, with the ever-increasing product demand in fields of application such as smart home, smart security, video surveillance and industrial automation, AI chips capable of resolving problems in these fields have also emerged. Polyhex Technology has responded to this demand with the launch of DEBIX Model A, a development board based on NXP NPU processor i.MX 8M Plus. It focuses on machine learning, vision processing, and industrial IoTs, meeting the application needs of commercial and industrial fields such as education, security monitoring, industrial automation, smart homes and smart cities.



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Chapter 1 About DEBIX

DEBIX is essentially a versatile single board computer, which can be widely applied in artificial intelligence, machine learning and industry 4.0 applications.

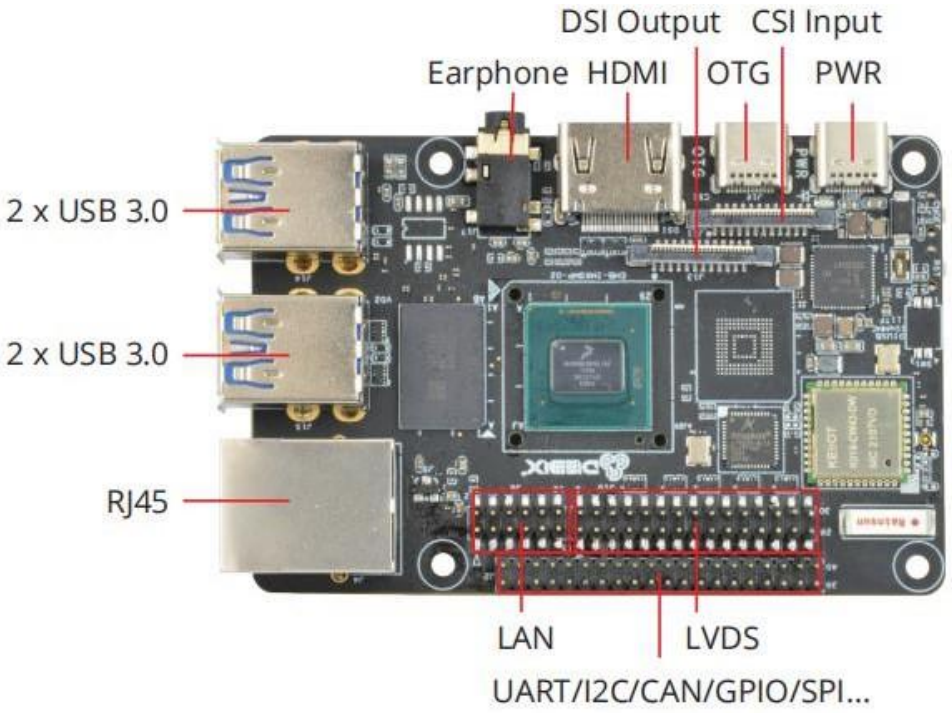
The following are some of the powerful features of DEBIX:

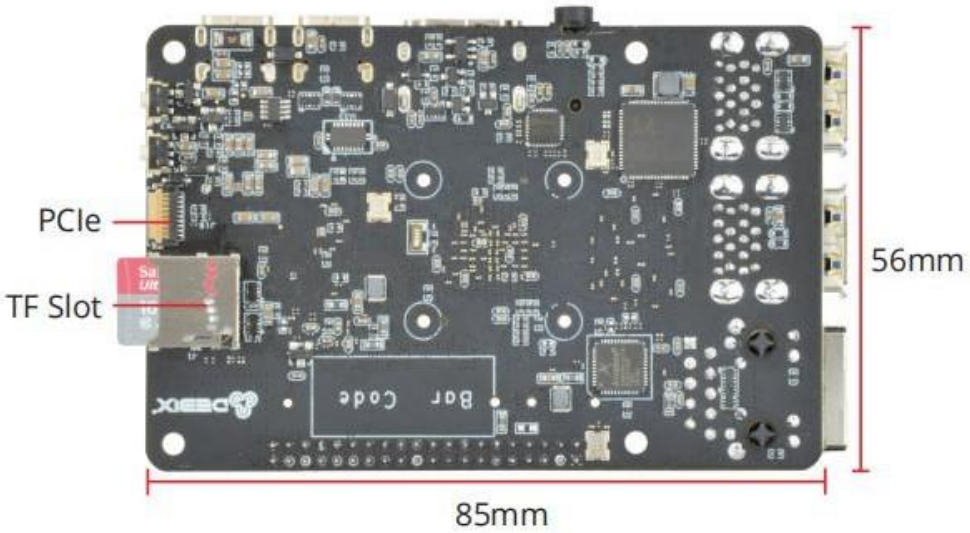
- Powerful Quad Core Arm ® Cortex ® -A53 CPU with a Neural Processing Unit (NPU) operating at up to 2.3 TOPS.
- The multimedia capabilities include video encode (including h.265) and decode, 3D/2D graphic acceleration, and multiple audio and voice functionalities.
- Real-time control with Cortex-M7. Robust control networks supported by dual CAN FD and dual Gigabit Ethernet with Time Sensitive Networking (TSN).
- High industrial reliability with DRAM inline ECC.
- Designed for severe environmental conditions and industrial grade temperature requirements. The wide CPU temperature range of -40°C to 105°C makes it suitable for extreme operation environments like public transportation and industrial control etc.
- The credit card form factor board contains 40 GPIO ports. This allows DEBIX to give full processor performance while being free from application restrictions in physical space.
- Support mainstream operating systems including Android, Ubuntu and Yocto.

DEBIX has a clear edge in the area of facial and object recognition applications which combine machine learning and visual processing. Take facial recognition as an example: DEBIX can simultaneously detect and identify the body frames and facial features of multiple people. It can also be used in traffic control to identify vehicle types and information of drivers. Using NPU to perform recognition operations not only increases the recognition speed, but also sees a noticeable reduction to the burden on the CPU. DEBIX's TSN technology makes it essential for Industrial 4.0 applications, as it meets the needs of industrial enterprises with precision oriented production time control, thus increasing the interconnection speed of the IoT.

DEBIX Structure Overview

DEBIX's interface features a compact arrangement, the interface components are visible at a glance. Let's learn more about DEBIX's interface through the following pictures/





DEBIX uses NXP i.MX 8M Plus based SOC, it has 2GB/4GB/6GB memory, supports Gigabit Ethernet, dual-band wireless network and Bluetooth 5.0. The data specifications are as follows:

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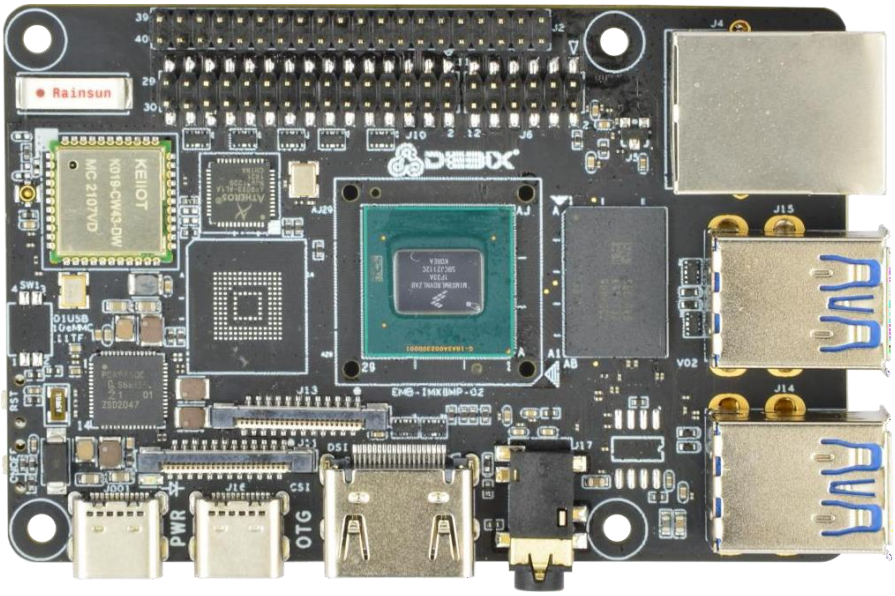
System	
CPU	NXP i.MX 8M Plus (default), 4 x Cortex-A53, comes with an integrated neural processing unit (NPU) that delivers up to 2.3 TOPS. Industrial grade CPU runs at 1.6GHz, and commercial grade CPU runs at up to 1.8GHz. (i.MX 8M Plus series CPU optional)
Memory	2GB LPDDR4 (4GB/6GB optional)
Storage	Default: TF card (Onboard 8GB-128GB eMMC optional)
Operating System	Android 11, Yocto, Ubuntu
I/O Interfaces	
Gigabit Network	10/100/1000M LAN 1 x RJ45 with POE power supply (need POE power supply module） 1 x pin header (without network transformer)
WIFI & BT	2.4G & 5G dual-frequency WIFI, BT5.0
USB	4 x USB 3.0 Host Type-A, 1 x USB 2.0 OTG Type-C
Audio	1 x Earphone L & R OUT，1 x Earphone Mic IN
HDMI	1 x HDMI OUT
Expansion	
40-Pin Double-Row Headers	(1) 3 x UART, 2 x SPI, 2 x I2C, 2 x CAN, 1 x PWM, 2 x GPIO, dedicated interfaces can be reused as GPIO ports (2) 1 x SPDIF digital audio input/output (3) 5V power supply, system reset, ON/OFF
LVDS	1 x LVDS, single & dual channel 8bit, double-row pin headers
MIPI CSI	1 x MIPI CSI, support 4Lane FPC socket
MIPI DSI	1 x MIPI DSI, support 4Lane FPC socket
PCIe	1 x PCIe, support PCIe x1 FPC socket
Power Supply	
Power Supply	DC 5V/3A Type-C
Mechanical & Environmental	
Size	85.0 x 56.0mm
CPU Temperature	-40℃ to 105℃

DEBIX Tech Specs



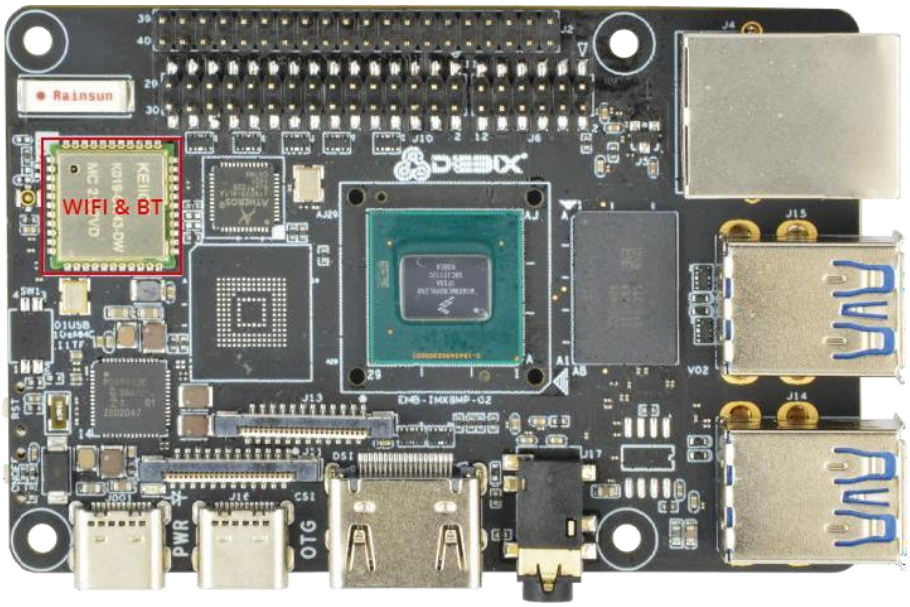
Like an ordinary computer, DEBIX consists of a range of different computer components. The most important component is the "brain" of the computer, the system-on-chip/SoC in the center at the front of the motherboard.

The SoC contains most of the components of the computer, usually including the central processing unit (CPU) and the graphics processing unit (GPU). And next to the SoC you will find another larger chip, the random access memory (RAM/memory).

CPU & GPU

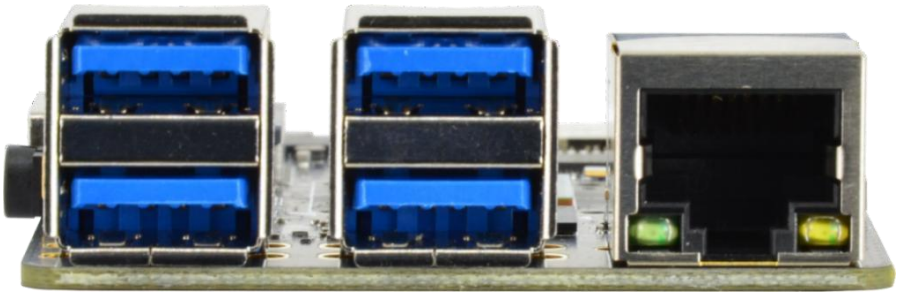
RAM

There is a component with a metal cover in the upper left corner of the motherboard, it contains the wireless communication module which contains the wireless network card and Bluetooth components.

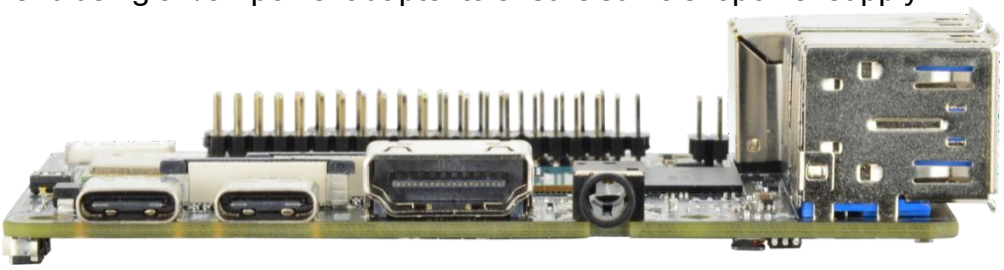


DEBIX I/O Interfaces

DEBIX has 4 USB 3.0 ports. The right side of the USB 3.0 is an Ethernet port, it connects DEBIX to the network through a cable with an RJ45 connector. There are two status indicators below the Ethernet port to show the signal upstream or downstream status.



There is a 3.5mm headphone interface with audio output function on the side of the board. Next to the headphone interface, there is a full-size HDMI connector for connecting a display device, TV or projector. On the left side, there is a multi-function OTG port for programing, system updating, or USB drive & hard disk connecting etc. Next to the OTG interface is the USB Type-C power port for DEBIX power supply. We recommend using 5V/3A power adapter to ensure sufficient power supply.



Next to the OTG port is the CSI connector for camera module connection. There is also a DSI connector for touch screen connection.

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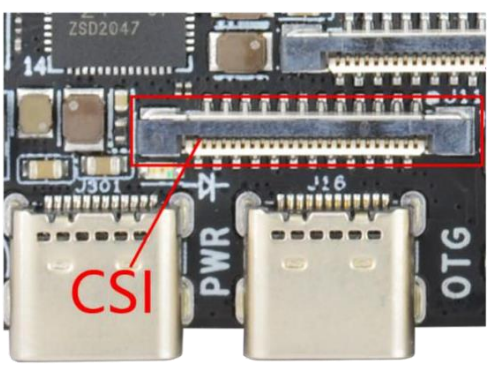
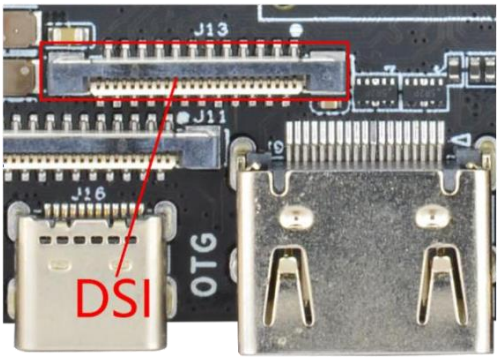
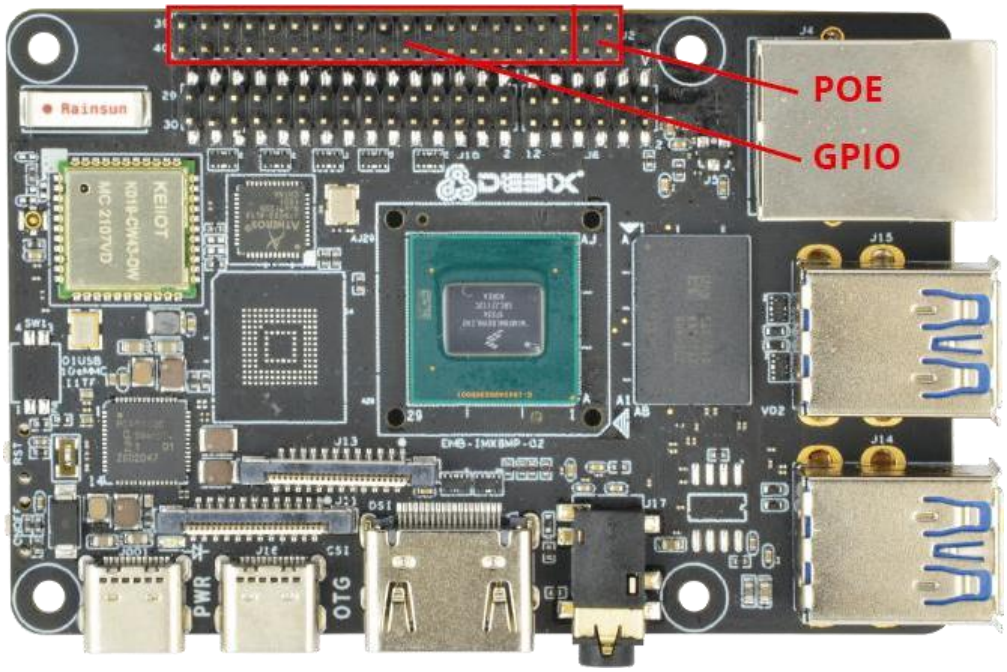
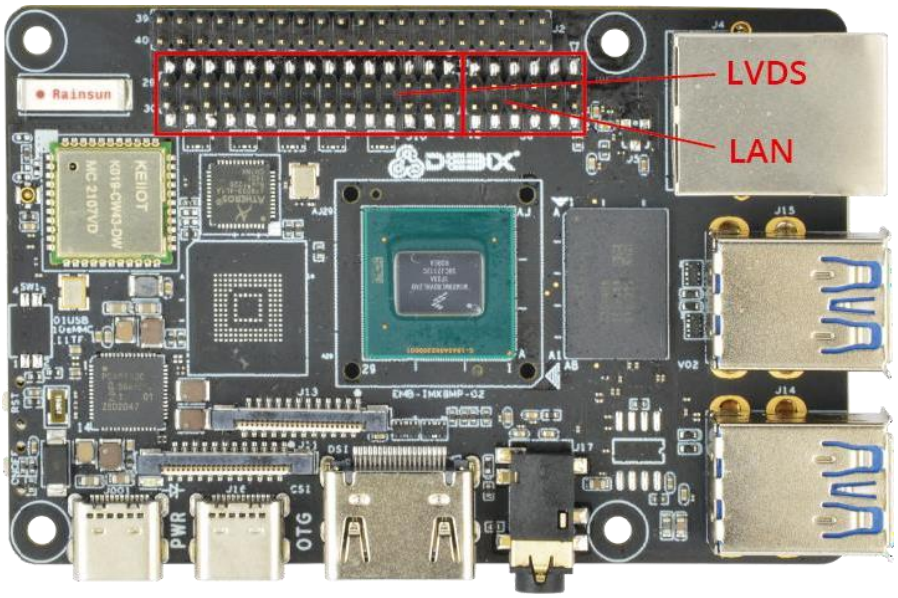




The 40-pin GPIO connectors on one side of DEBIX are for external hardware connection such as LEDs, buttons, sensors, and functional modules. The 4-pin smaller connector next to it is the POE HAT for the Power Over Ethernet connection.



On the inside of the GPIO pins, there is a 42-pinhead connector, of which the 12 pins on the right are for LAN connection, while the 30 pins on the left are for the LVDS screen connection.



The Micro SD slot is on the back of the motherboard. Insert the Micro SD card with the installed system in the slot, and then power to start. Next to the TF card slot is the PCIe port for the connection of independent accessories such as sound cards etc.

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Chapter 2 DEBIX Installation Guide

DEBIX is designed to maximize the ease of use and convenience for users, as much as possible, while making sure it still works like a standard computer.

You will need to prepare the following peripherals to make it work:

Power adapter - 5V power adapter, at least 3A rated current, equipped with USB Type-C Output.

Micro SD card - Used to install the DEBIX operating system on it, the minimum capacity requirement is 8GB, although 16GB or larger capacity is recommended.

USB keyboard and mouse - Any standard computer keyboard and mouse will do. They can be directly connected through DEBIX's USB ports.

HDMI Cable - Both ends need to be full-size HDMI ports, used to connect to a TV, projector, or display device that supports HDMI input. If your display device only supports VGA or DVI input, you will also need an adapter. Users can choose to replace HDMI with the LVDS interface when connecting LVDS screen.

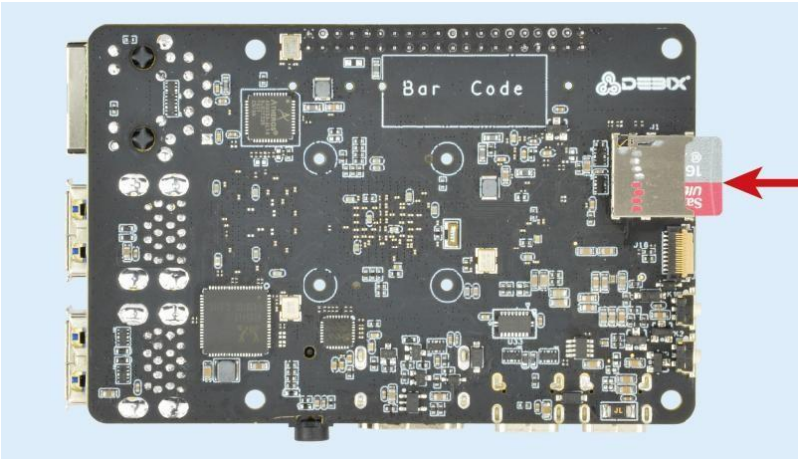
Notice: We recommended to install a case for DEBIX before assembling the hardware, which can effectively avoid the short circuit of the motherboard components caused by accidental touch.

Hardware Installation

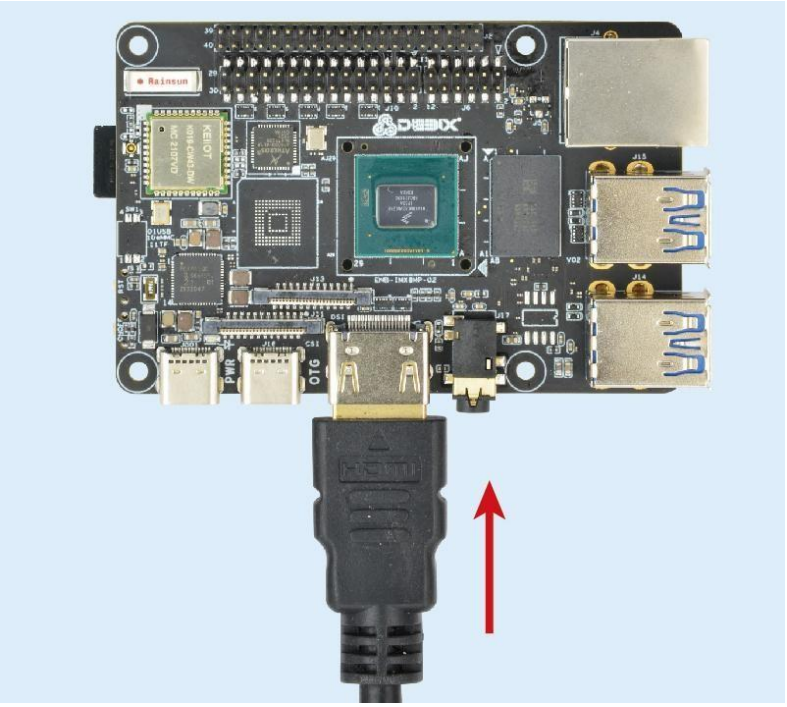
Before we start to install the hardware, please make sure that previous contents about DEBIX interface have been fully understood.

Insert Micro SD card

Prepare the Micro SD card with the operating system installed, and insert it into the card slot on the back of DEBIX. If you need to remove it, just pull out the card gently after the power is off.



Connect the display device



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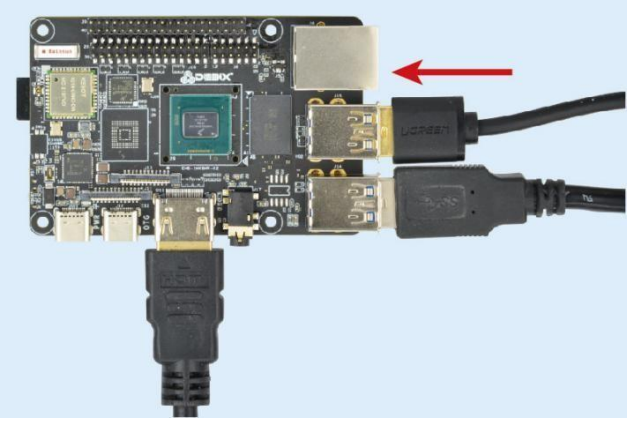
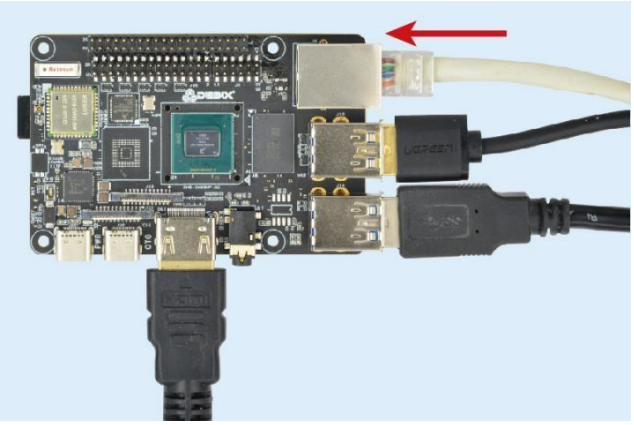
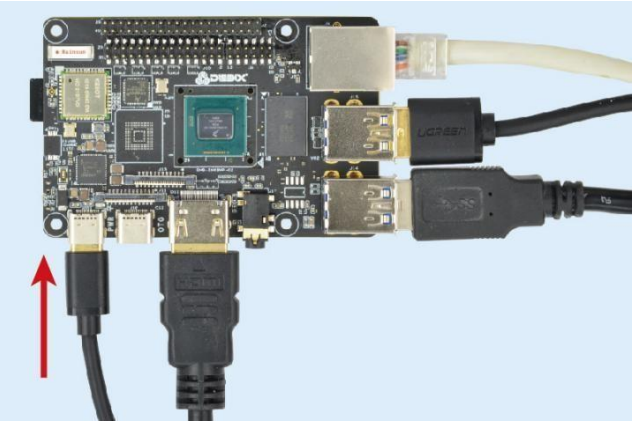
Connect the keyboard and mouse



Connect the network cable



Connect the power adapter



Plug in the power to boot up.

Congratulation! You have completed the installation of DEBIX hardware.

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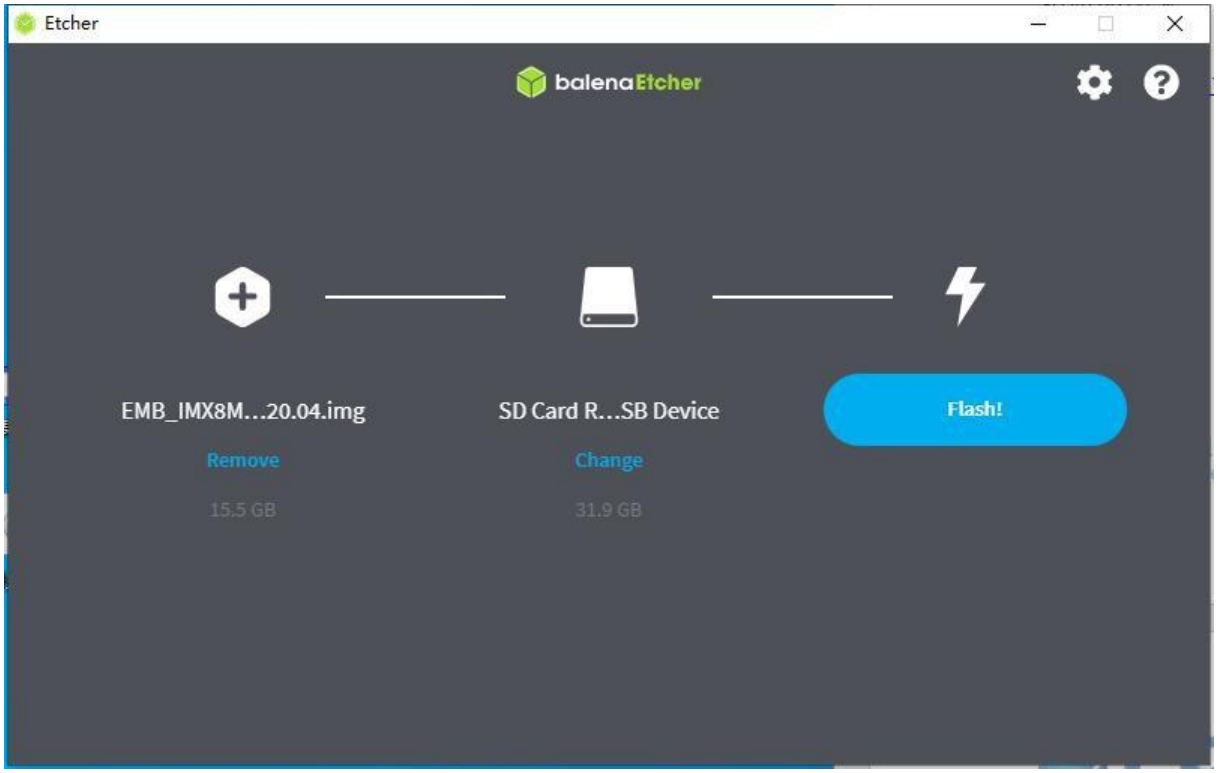
Software Installation

After downloading the latest system image file we provided to DEBIX, you can use the tool called Etcher to write the system image to the Micro SD card. Etcher supports Windows system, you also can find the corresponding version for Linux system under macOS. We have simplified the DEBIX software installation process with only the following three steps:

Download link：https://www.balena.io/etcher/

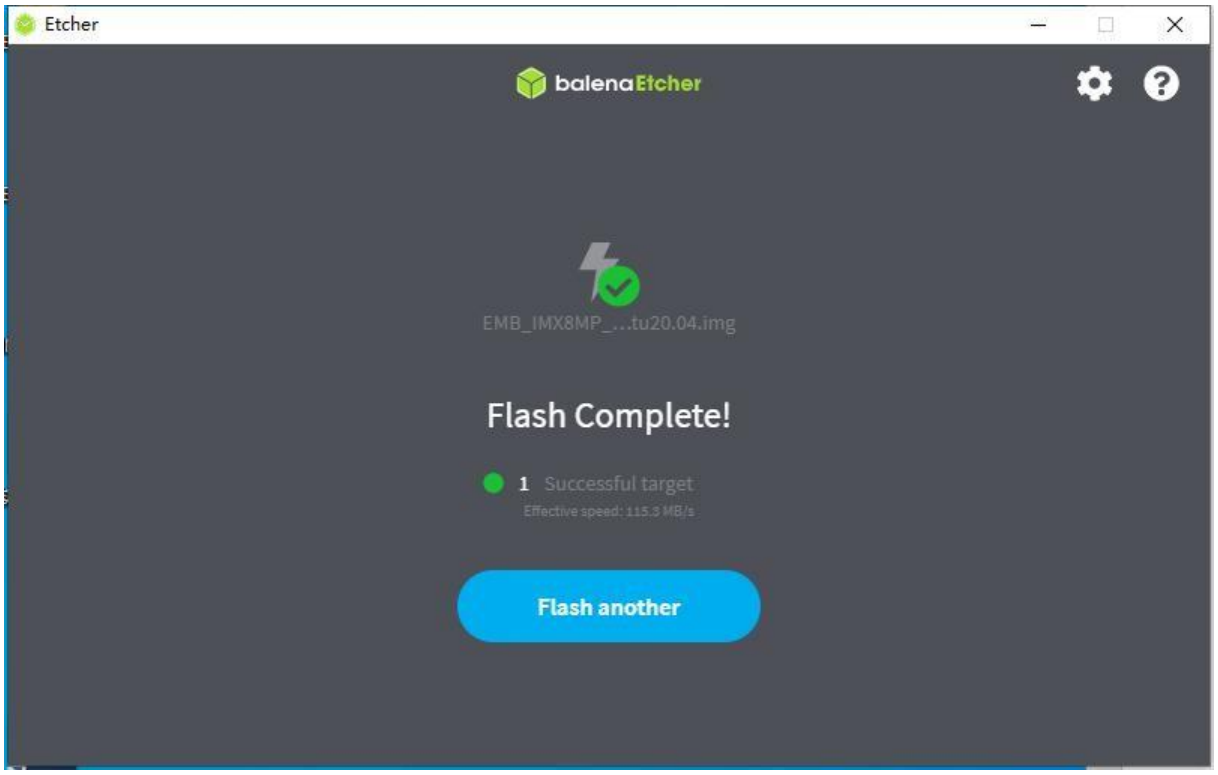
After installation, start Etcher, insert the SD card, select the img file to be installed and the disk partition corresponding to the SD card.



Click“Flash!“ Wait patiently, the program will write the system to your Micro SD card. When "Flash Complete" appears, it means that the system has been successfully programmed into the Micro SD card.

Notice: The system may prompt you that the disk is unavailable and needs to be formatted, please ignore it, it is not an error!

Insert the Micro SD card into DEBIX, connect the display device and power on, then you



can see the splash screen.

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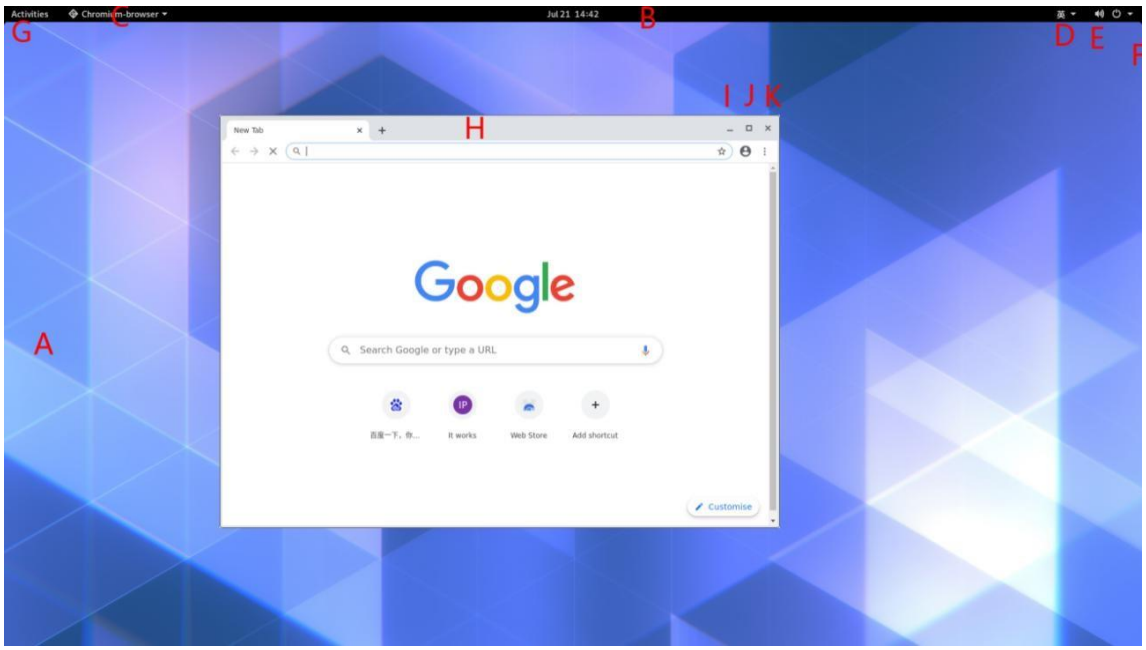
Chapter 3 Using DEBIX

During the first boot, you will first enter the login interface. At this time, enter the default username “debix” and password "debix" to enter the desktop.

Desktop Introduction

The default system we provide is the system with Desktop. Here is a brief exhibition.



[A]Wallpaper	[B]Taskbar	[C]Task
[D]Language Switch Button	[E]Sound Volume Icon	[F]Power Button
[G]Activity Button	[H]Window Title Bar	[I]Minimize Button
[J]Maximum Button	[K]Close Button	

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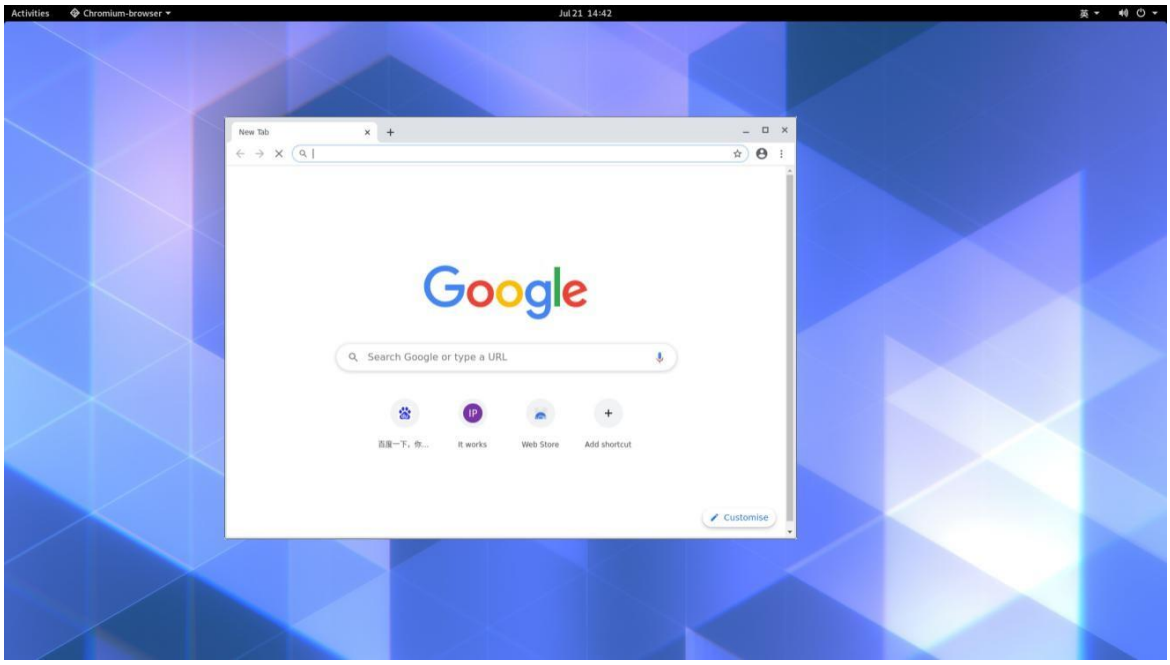
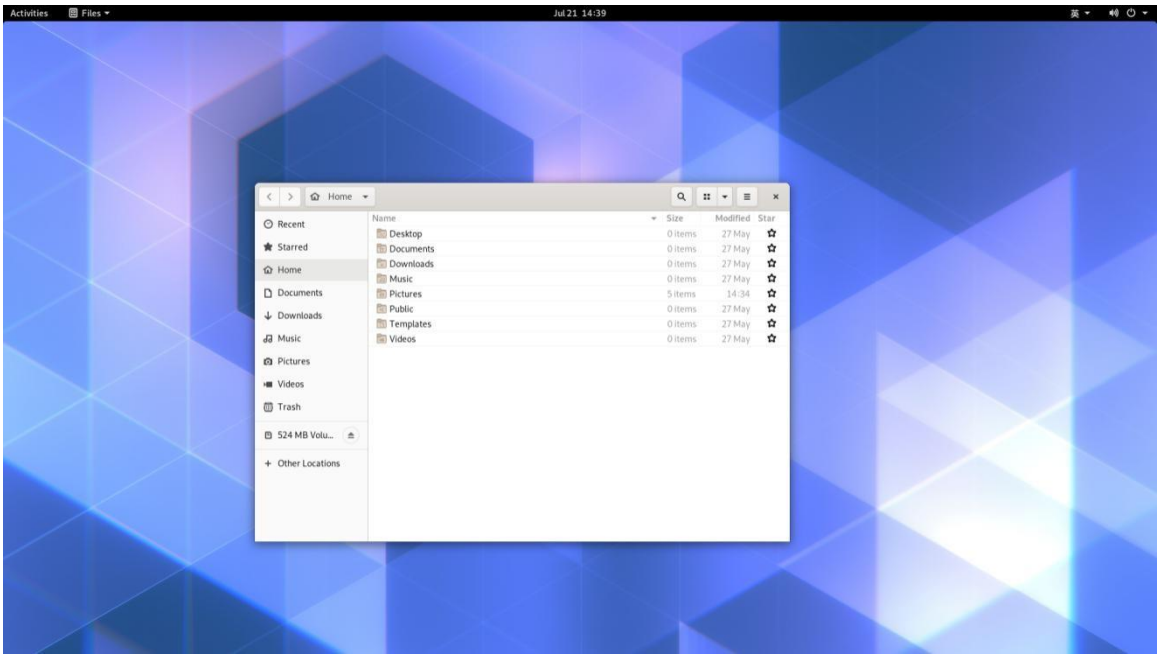
System Browser

DEBIX's desktop system pre-installed the Chromium browser. If you have used Google Chrome, you will be familiar with it.



File Management

Like other systems, DEBIX uses file manager as the desktop file management tool.



The files downloaded through browser are stored in the Downloads directory under the user's Home directory. The desktop files are stored in the Desktop directory. For removable disks, the disk name will be displayed in the file manager when inserted,

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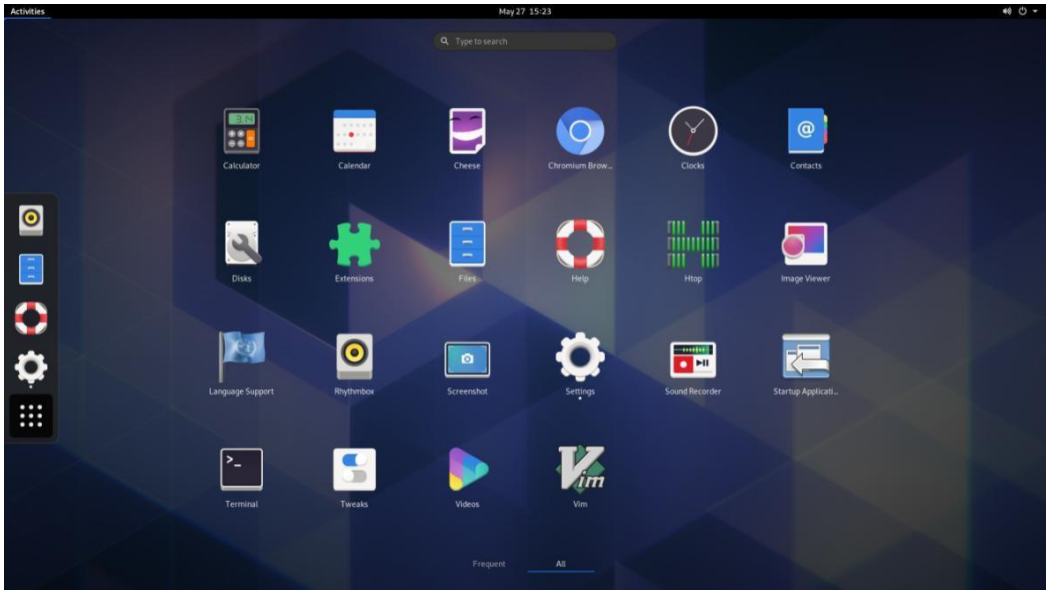
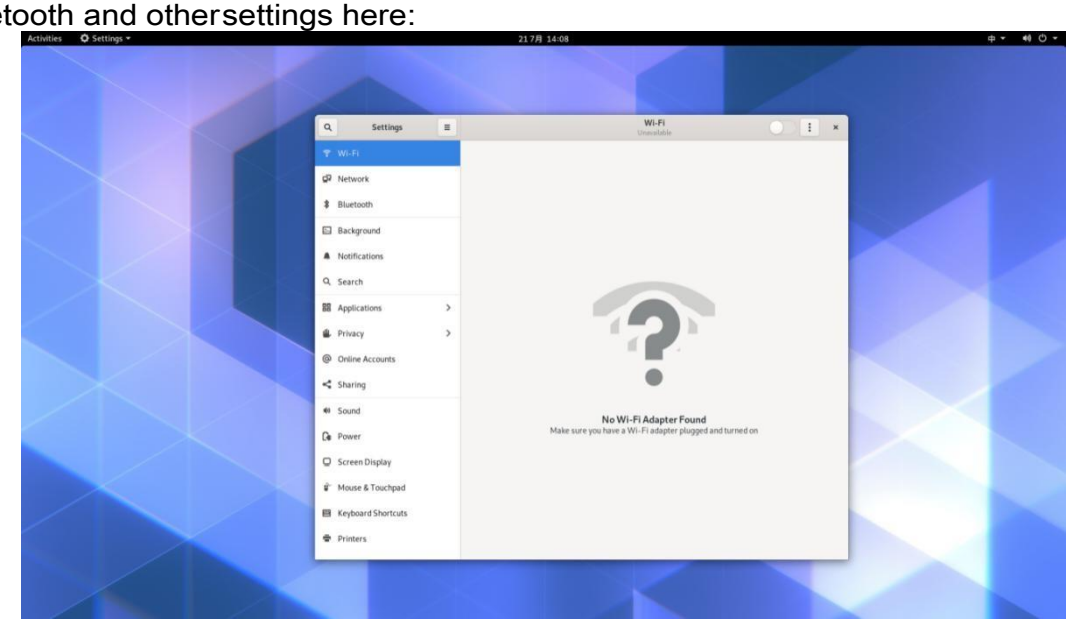
users can click to view them.

First Time Using

Click “Activities” in the upper left corner to open application interface. There are some pre-installed applications.

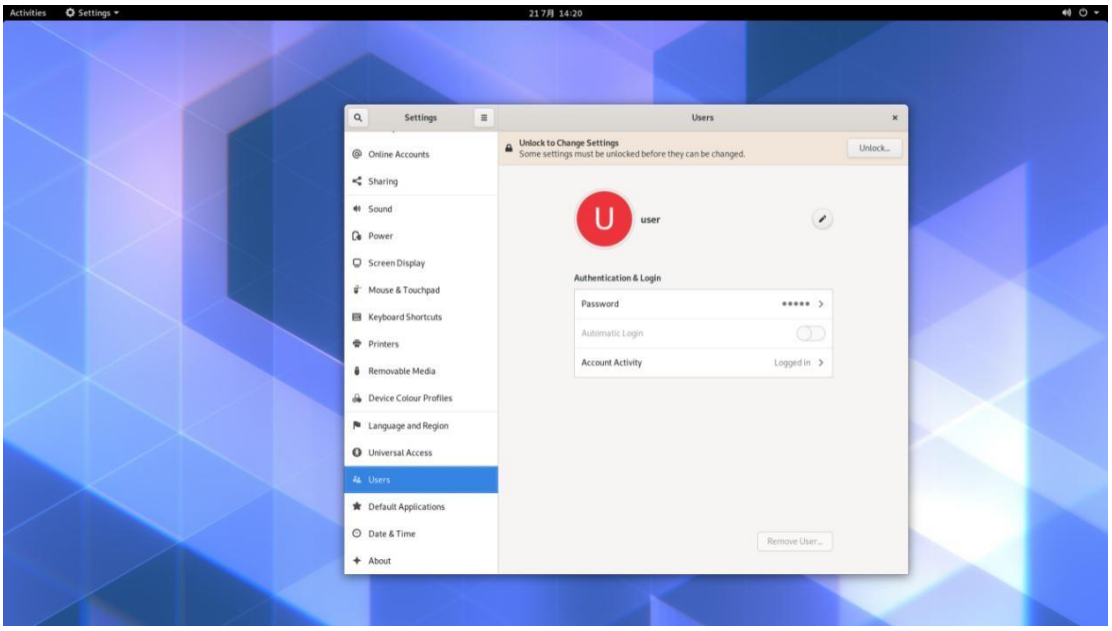


Open Setting, you will see some personal settings about the system, you can set up Wi-Fi, Bluetooth and other settings here:



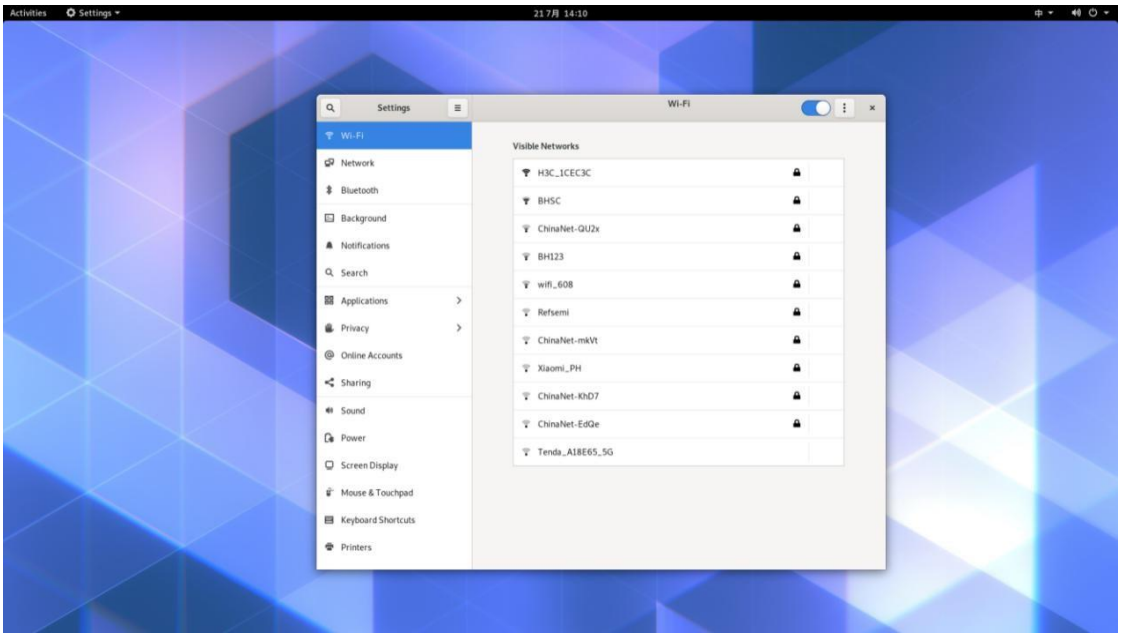
Change User Password

First open the Users tab, where your username and password are displayed, click “Unlock” in the upper right corner to enter the default user password, and then click “password” to set a new user id and password:



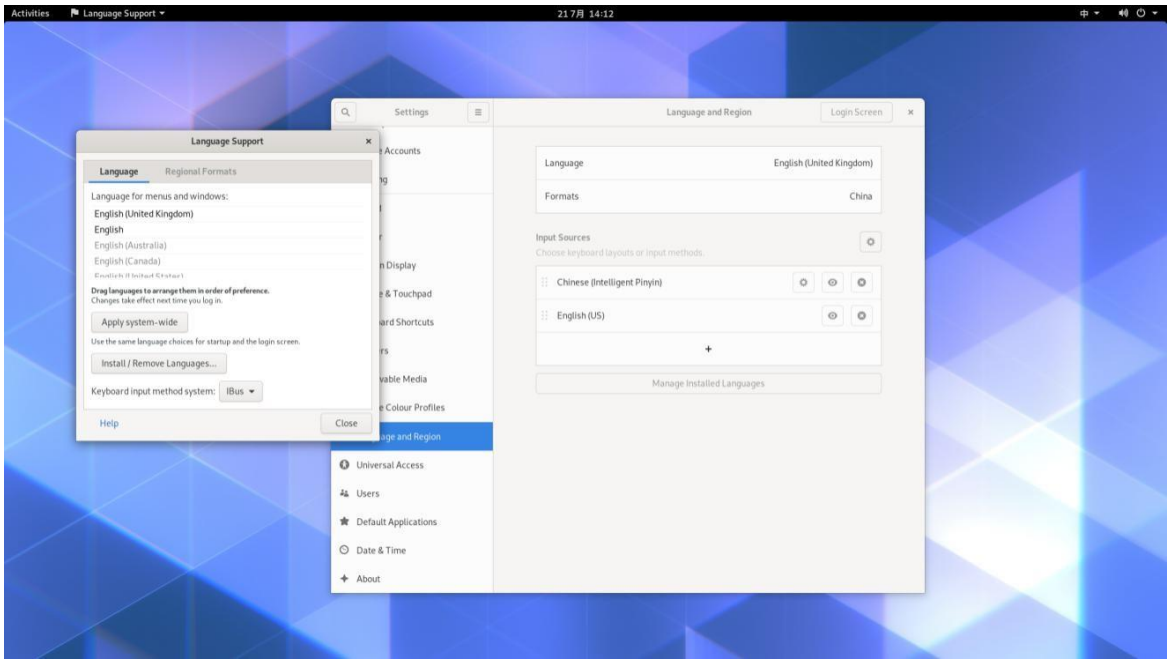
Wi-Fi Connection

Click the Wi-Fi tab, open the switch in the upper right corner of the window, then select your Wi-Fi and enter the password to connect to the network;

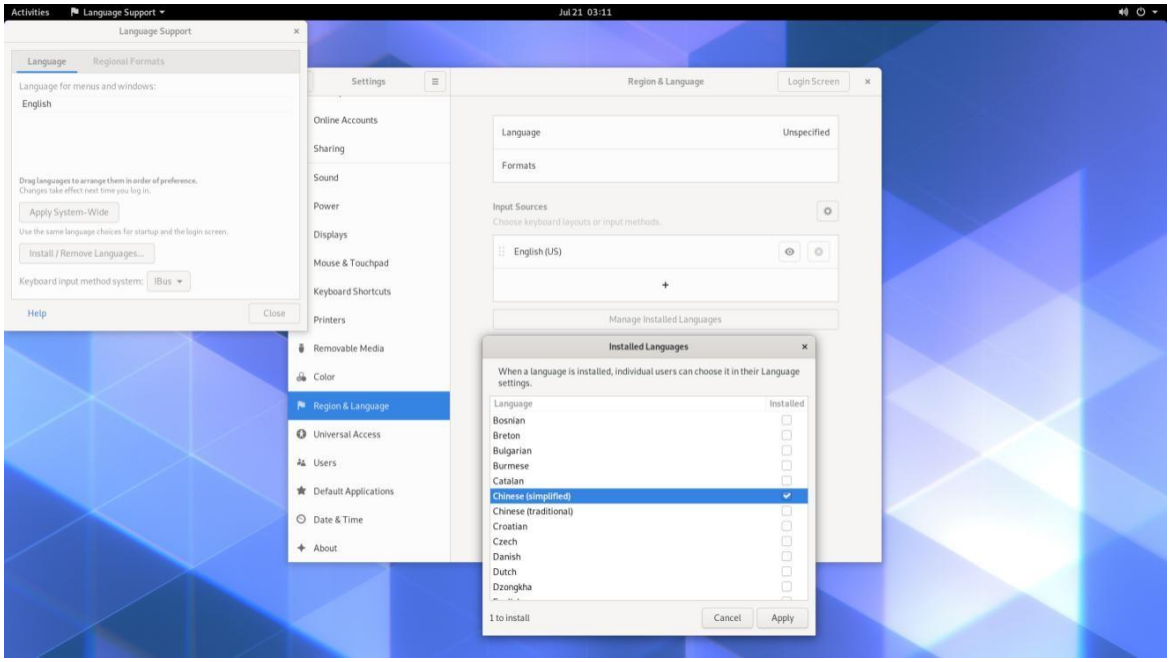


Change Language

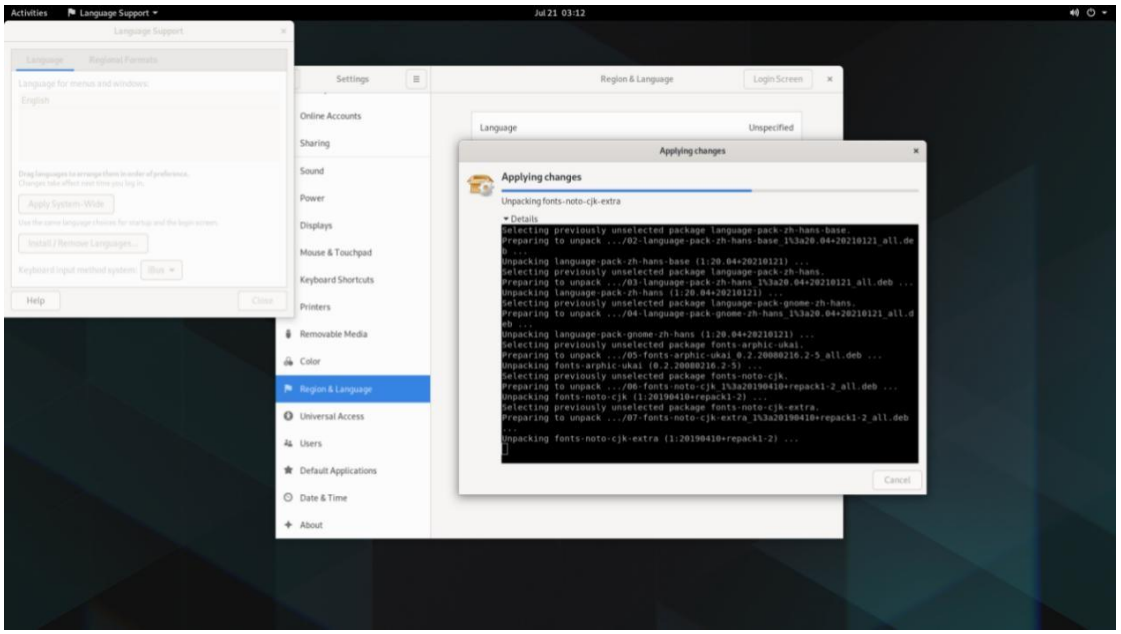
If you want to change the language, select Language and Region, then open “Manage Installed Languages”:



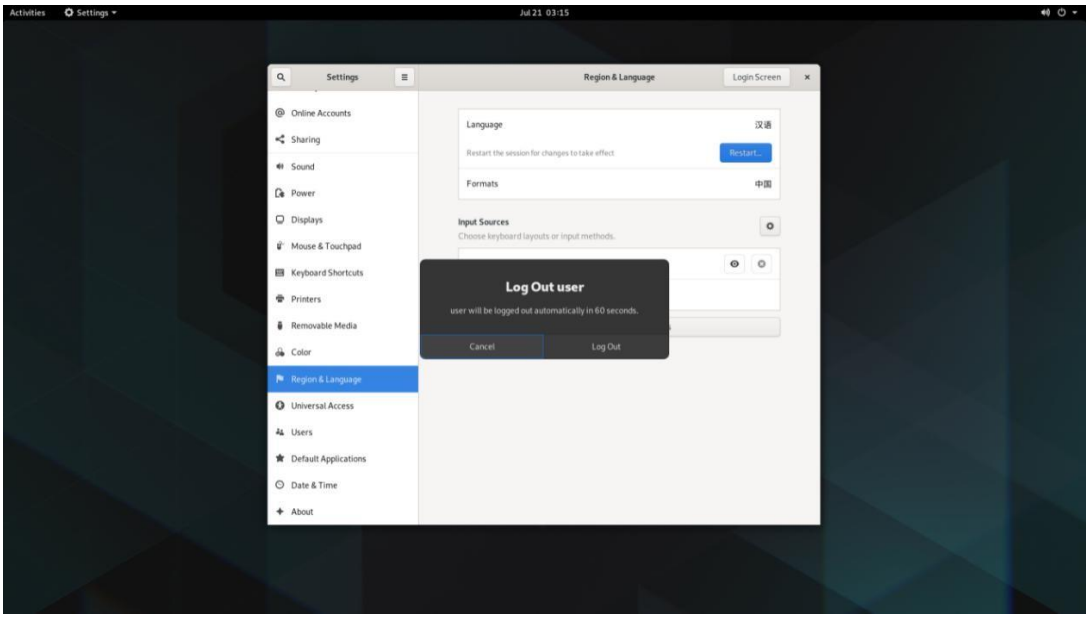
Then click ”Install/Remove Languages“ in the newly appeared window:



Open Installed Languages, check the language you want, click “Apply”, the system will automatically download the language pack, you may need to enter the user password before download:

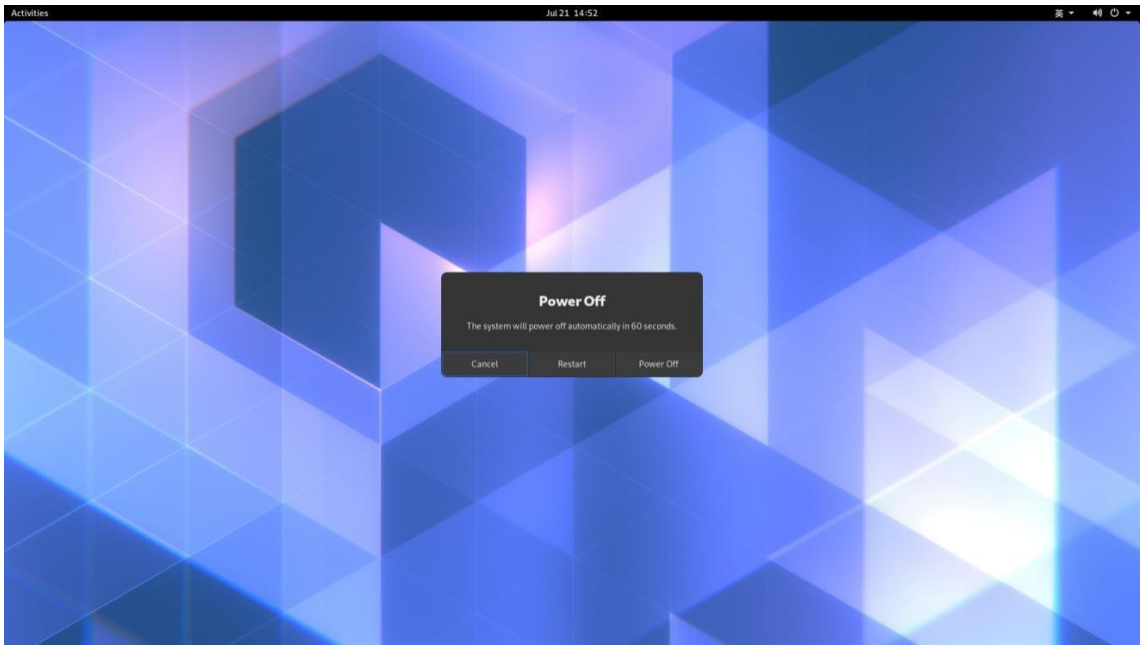


After the installation, click “Apply System-Wide”, then go back to the Language and Region tab, click “Language” at the top, select the language you want, and then click “restart”:



Shut Down

The power tab will show up when users click the Power Button in the upper right corner of the system. You can choose to log off, restart or Power Off to shut down. Wait until the display turns black and the status indicator (red) on the motherboard is completely off, then disconnect the power supply.



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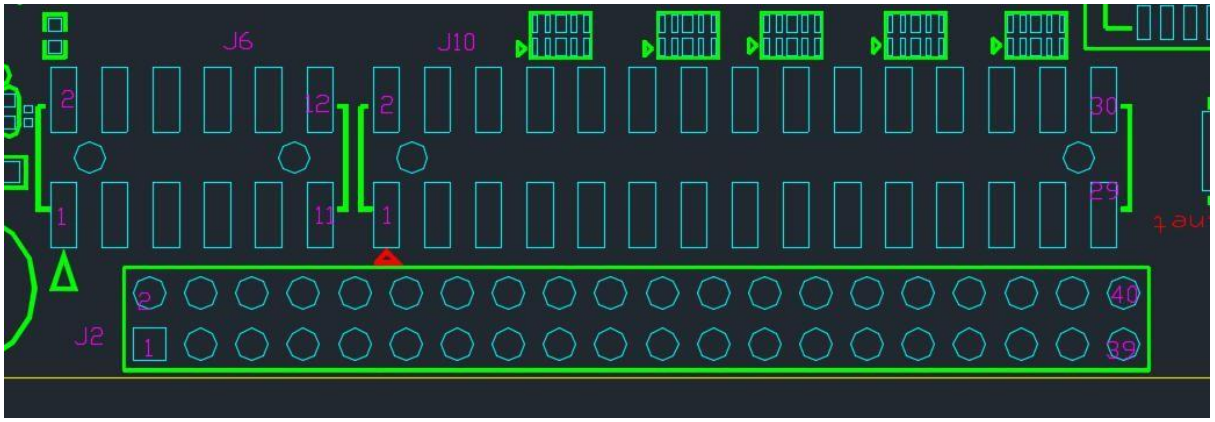
Chapter 4 Introduction of Hardware Programming

When it comes to programming, software usually appears first to the mind, while In fact, programming can be applied far beyond the scope of software. The field of hardware programming that has tangible effects in the real world is called physical computing.
Physical computing methods are widely adopted in the facilities all around you. You can find traces of hardware programming when you set the timers for washing machines, set traffic lights for intersections, and configure a constant room temperature level with your air conditioner, these are all examples of hardware programming around us.

DEBIX is designed with a set of general-purpose input/output interfaces (GPIO), which makes it an unparalleled tool for you to discover and learn about physical computing!

GPIO Introduction

The GPIO connector is on the top edge of the DEBIX presented in the form of two long rows of metal pins (20Pin x 2). You can connect hardware such as light-emitting diodes (LED), and control their switches through DEBIX.
The GPIO pins have different applications including physical computing, power supply, and communicating with expansion boards such as SenseHAT.
The following picture shows the detailed function definition of DEBIX GPIO pins:



40 Pin double-row pin headers（J2）

I2C electrical level 3.3V

pin	definition	pin	definition
1	GND	2	VDD_5V
3	GND	4	VDD_5V
5	UART2_RXD	6	ONOFF
7	UART2_TXD	8	SYS_nRST

9	UART3_RXD	10	ECSPI1_SS0
11	UART3_TXD	12	ECSPI1_MOSI
13	UART4_RXD	14	ECSPI1_MISO
15	UART4_TXD	16	ECSPI1_SCLK
17	GND	18	GND
19	I2C4_SCL	20	ECSPI2_SS0
21	I2C4_SDA	22	ECSPI2_MOSI
23	I2C6_SCL	24	ECSPI2_MISO
25	I2C6_SDA	26	ECSPI2_SCLK
27	GND	28	GND
29	GPIO1_IO11	30	GPIO1_IO12
31	CAN1_TXD	32	GPIO1_IO13
33	CAN1_RXD	34	SPDIF_TX
35	CAN2_TXD	36	SPDIF_RX
37	CAN2_RXD	38	SPDIF_EXT_CLK
39	GND	40	GND

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
-- Reorient or relocate the receiving antenna.
-- Increase the separation between the equipment and receiver.
-- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
-- Consult the dealer or an experienced radio/TV technician for help.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

The distance between user and device should be no less than 20cm.