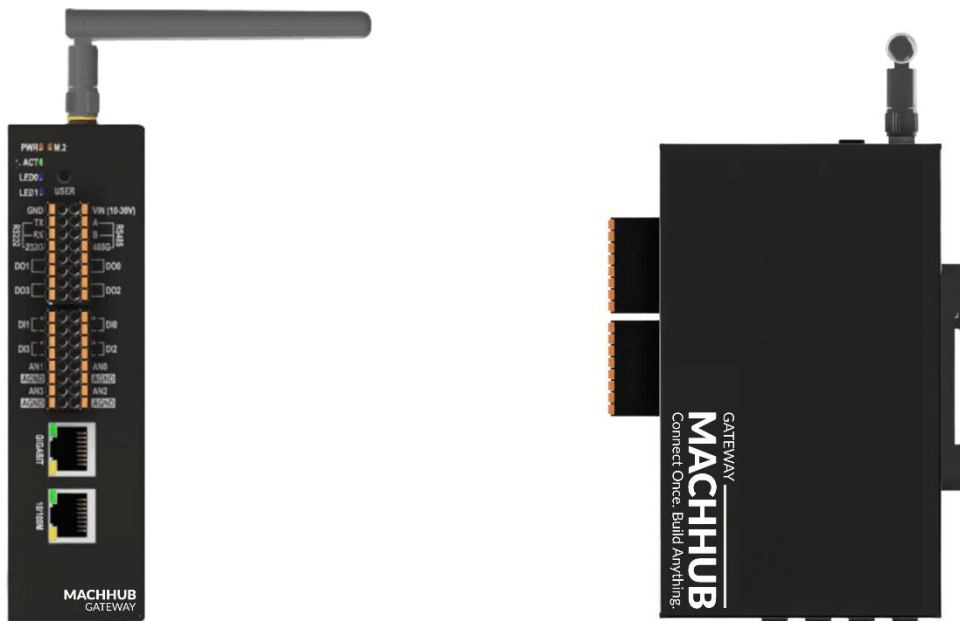




MACHHUB A5

IR4.0 CM5 Industrial Controller



User Manual

Rev 1.0
August 2026

Information in this publication regarding device applications and the like is intended through suggestion only and may be superseded by updates. It is your responsibility to ensure that your application meets with your specifications. No representation or warranty is given and no liability is assumed by Intellogic Technology Incorporated with respect to the accuracy or use of such information or infringement of patents or other intellectual property rights arising from such use or otherwise. Use of Intellogic Technology's products as critical components in life support systems is not authorized except with express written approval by Intellogic Technology. No licenses are conveyed, implicitly or otherwise, under any intellectual property rights.

Contents

1. Features.....	3
2. Specifications	4
3. Layout.....	6
3.1 External Layout	6
3.2 Internal Board Layout	8
4. Block Diagram	9
5. Interfaces and Functions	10
5.1 Terminal 1	10
5.1.1 Power Supply Input	10
5.1.2 Isolated RS485	10
5.1.3 Isolated RS232	11
5.1.4 Isolated Digital Output	11
5.2 Terminal 2	12
5.2.1 Isolated Digital Input	12
5.2.2 Isolated Analog Input	12
6.1 Without DIN Rail Socket	14
6.2 DIN Rail Mount Position 1 (Default)	14
6.3 DIN Rail Mount Position 2	15
6.4 DIN Rail Mount Position 3	15

1. Features

Features	Description
Compute Module	Raspberry Pi CM5
CPU	Broadcom BCM2712 quad-core 64-bit Cortex-A76 (ARM v8) SoC @ 2.4GHz
Variants	MACHHUB A5 Wireless 4GB/32GB MACHHUB A5 Wireless 8GB/32GB MACHHUB A5 Wireless 16GB/64GB
RAM	4GB/8GB/16GB LPDDR4-4267
Storage	32GB/64GB eMMC, expandable via M.2 NVMe SSD
Wireless (optional)	2.4GHz / 5.0GHz IEEE 802.11 b/g/n/ac WiFi, Bluetooth 5.0, BLE
Interfaces	1x Full-size HDMI 2.0 (up to 4K@60Hz)
	2x USB 2.0 port
	1x USB-C (for boot and debug)
	2x RJ45 Ethernet Port: 1 x 10/100/1000M (Gigabit) + 1x 10/100M
	4x Isolated digital input (up to 50V)
	4x Isolated digital output (up to 50V)
	4x Isolated analog input (0-5V / 0-10V / 0-20mA, Common GND)
	1x Isolated RS232
	1x Isolated RS485
	1x M.2 Key-M socket for NVMe SSD
	1x mini PCIe socket (Only USB2.0 & SPI signals are connected to this port. PCIe signal is not available).
Power Supply	DC 10-30V surge-protected
Additional Features	PCF85063A Real Time Clock
	ATECC608B Crypto Authentication
	SSD1306 0.96" OLED Display
	1x Reset button & 1x Programmable button
	1x Active buzzer & 2x Programmable LED
Enclosure	Metal enclosure, fanless design, DIN rail mountable
IP Rating	IP20
Dimension	141.2mm x 83.5mm x 39.5mm (metal enclosure only, excl. antenna, DIN socket & connectors)

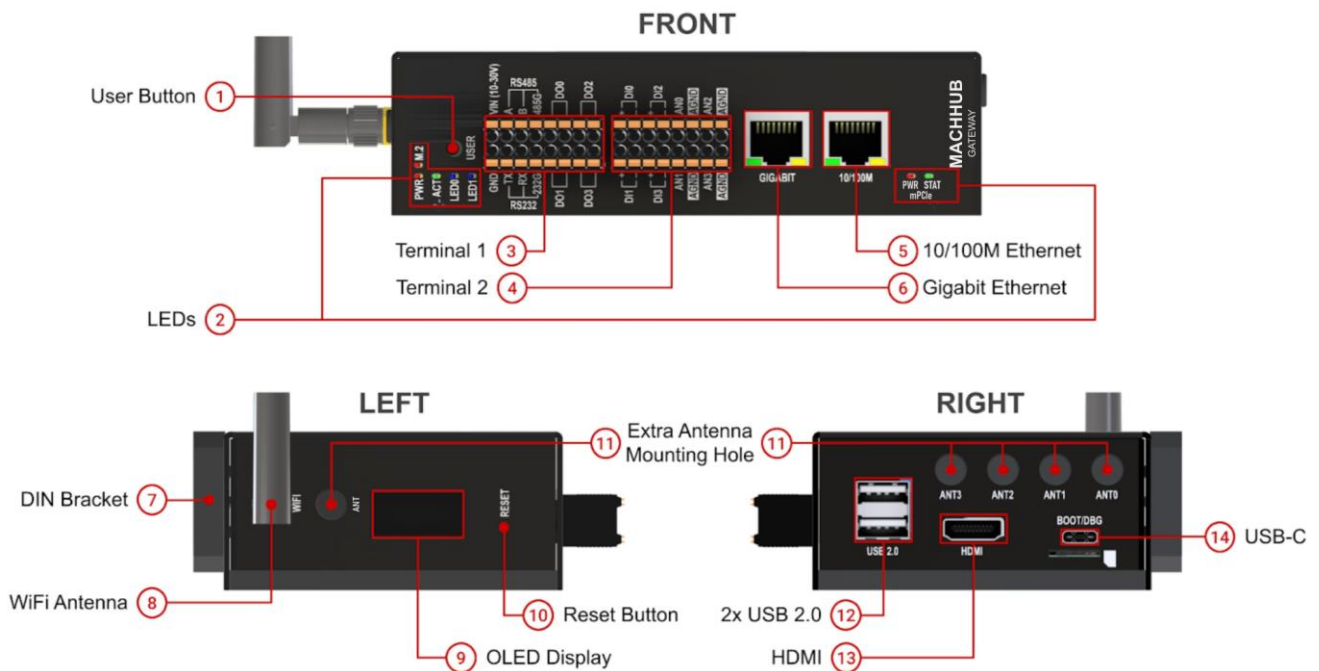
2. Specifications

No.	Parameters		Min	Max	Unit
1	Power Input Voltage	Terminal 1 (Surge Protected up to 60V 20ms)	10	30	VDC
		USB-C (3 Amp)	4.9	5.2	VDC
2	Power Consumption * When running stress test command "stress-ng --cpu 4 --cpu-method fft" * USB load not included.	MACHHUB A5	-	10.5	W
3	Isolated Digital Input	Low Level (V _{IL})	-50	0.8	V
		High Level (V _{IH})	3	50	V
		Isolation Voltage	3750		Vrms
4	Isolated Analog Input	Voltage Mode	0	10	V
		Current Mode	0	20	mA
		Input Impedance (Voltage Mode)	25		kΩ
		Input Impedance (Current Mode)	250		Ω
		Isolation Voltage	3000		Vrms
5	Isolated Digital Output	Voltage	-	50	V
		Current	-	500	mA
		Isolation Voltage	1500		Vrms
6	Isolated RS485	Maximum Baud Rate	500		kbps
		Isolation Voltage	5000		Vrms
7	Isolated RS232	Maximum Baud Rate	120		kbps
		Isolation Voltage	3000		Vrms

8	Operating Temperature	-20	60	°C
---	-----------------------	-----	----	----

3. Layout

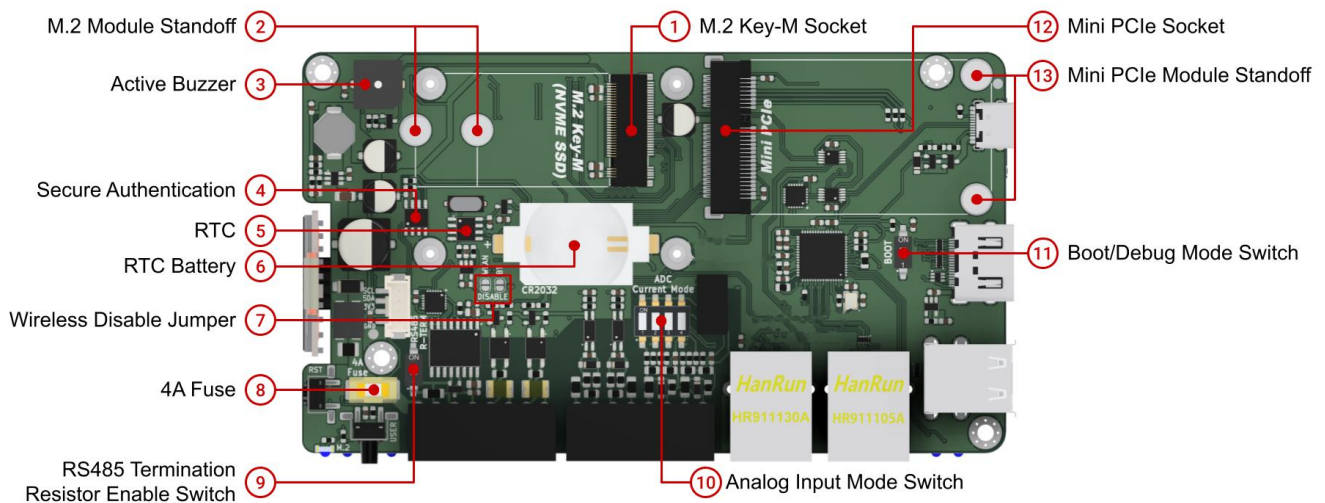
3.1 External Layout



No.	Function	Description
1	User Button	User programmable button. Connected to GPIO4. Can be programmed to be a safe shutdown button.
2	LEDs	PWR - CM5 power. Same as the red LED on Pi 4. ACT - CM5 activity. Same as the green LED on Pi 4. LED0 - User-programmable LED 0. Controlled by GPIO20. LED1 - User programmable LED 1. Controlled by GPIO21. M.2 - NVME SSD activity.
3	Terminal 1	Pluggable terminal 1. See here for more details.
4	Terminal 2	Pluggable terminal 2. See here for more details.
5	10/100M Ethernet	The 10/100M Ethernet is extended via a USB ethernet controller. Mapped to eth1 in Raspberry Pi OS.
6	Gigabit Ethernet	This is the default 10/100/1000M Gigabit Ethernet of CM5. Mapped to eth0 in Raspberry Pi OS.
7	DIN Bracket	For mounting on DIN rail. Can be moved to the bottom of the MACHHUB as well.
8	WiFi Antenna (optional)	Antenna for CM5 WiFi and Bluetooth.
9	OLED Display	0.96" SSD1306 OLED display (I2C Slave Address = 0x3C).

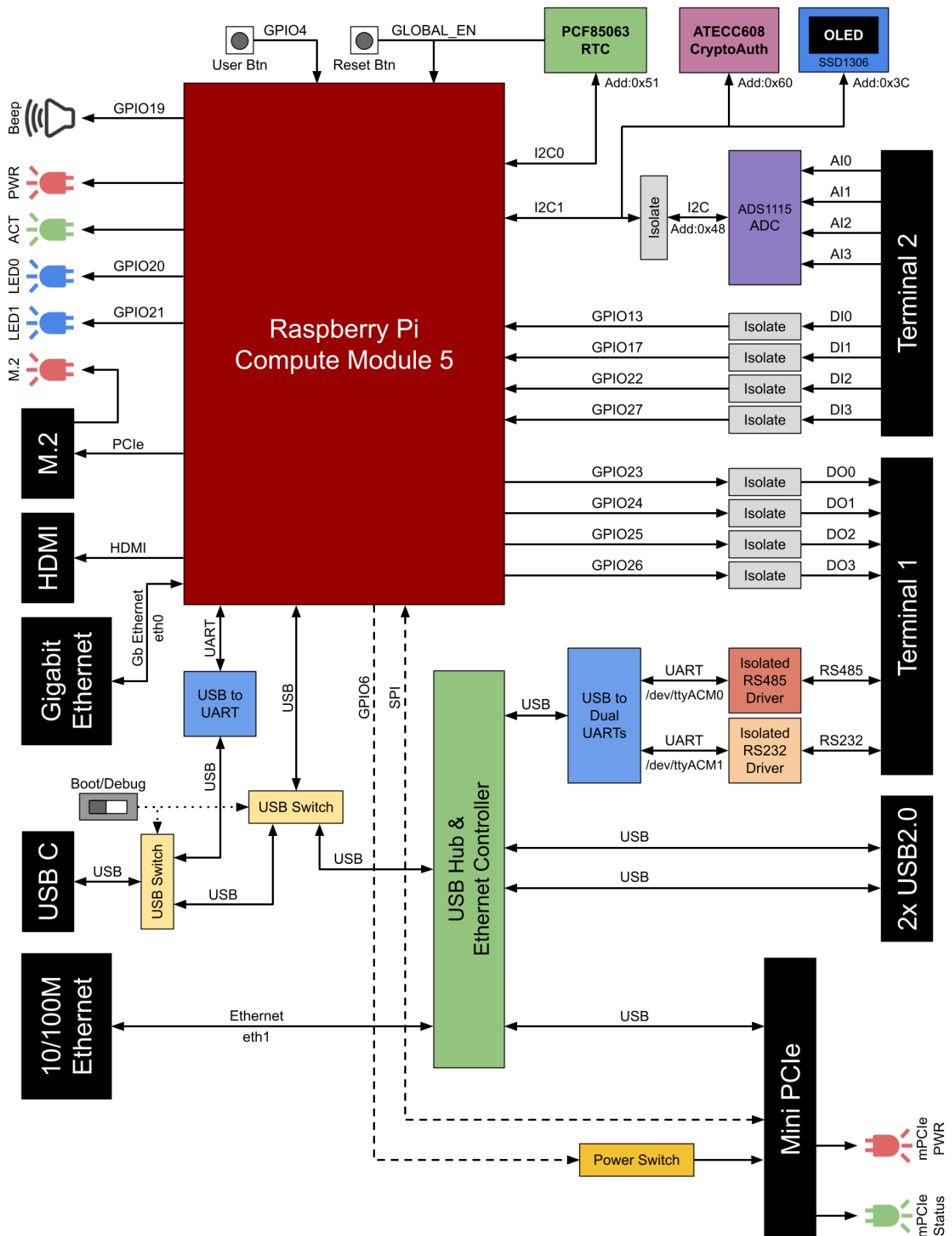
10	Reset Button	Hard reset the Raspberry Pi CM5. Can also be used to wake up the CM5 after shutting down.
11	Extra Antenna Mounting Hole	Extra mounting holes for the antennas.
12	USB 2.0 Ports	2x USB 2.0 host capable of running at 480Mbps. The maximum current for both ports is 1000mA.
13	HDMI	Full-size Type-A HDMI for external display. Up to 4K resolutions.
14	USB-C	This port is dual-function and selectable via the onboard boot/debug switch. Boot - Used to load the OS image into the eMMC of CM5. Debug - Connected to the UART port of the CM5 via a USB-UART chip. Can be used to show the console of the CM5. This port can be used to power up the MACHHUB too.

3.2 Internal Board Layout



No.	Function	Description
1	M.2 Key-M Socket	M.2 Key-M Socket for PCIe module (Gen 2* 1-lane PCIe). Support NVME SSD size 2230 & 2242 (Bootable). * <i>M.2 SATA SSD is not supported.</i> * <i>CM5's PCIe can be enabled to be Gen 3 (not certified)</i>
2	M.2 Module Standoff	Standoff for mounting the 2230 or 2242 M.2 PCIE module.
3	Active Buzzer	User-programmable active piezo buzzer. Controlled by GPIO19. Beep when output is high.
4	Secure Authentication	ATECC608B Secure Authentication (I2C Slave Address = 0x60).
5	RTC	PCF85063A Real Time Clock (I2C Slave Address = 0x51).
6	RTC Battery	Insert a CR2032 coin cell to keep the RTC running when the system is powered off.
7	Wireless Disable Jumper	Solder and short the jumper together to disable WiFi or Bluetooth (BT).
8	4A Fuse	4 Amp replaceable fuse for the power input.
9	RS485 Termination Resistor Enable Switch	Connect/disconnect the 120 Ohm termination resistor for RS485.
10	Analog Input Mode Switch	Configure the analog inputs to measure voltage (0-10V) or current (0-20mA).
11	Boot/Debug Mode Switch	Select whether to use the USB-C for boot or debug mode.
12	Mini PCIe Socket	Mini PCIe Socket. Only USB 2.0 and SPI are available. There is no PCIe connection. Power to the Mini PCIe socket can be turned on/off via GPIO6 .
13	Mini PCIe Module Standoff	Standoff for mounting the mini PCIe module.

4. Block Diagram

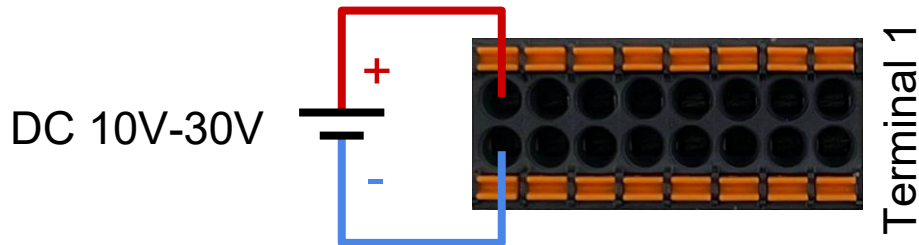


5. Interfaces and Functions

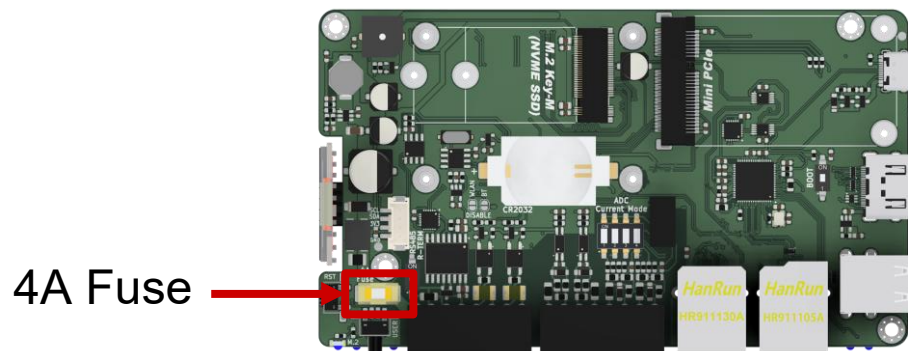
5.1 Terminal 1

5.1.1 Power Supply Input

The power supply input is compatible with DC voltage from 10V to 30V. Diagram below shows the connection to the power supply. No earth connection is required for this device.

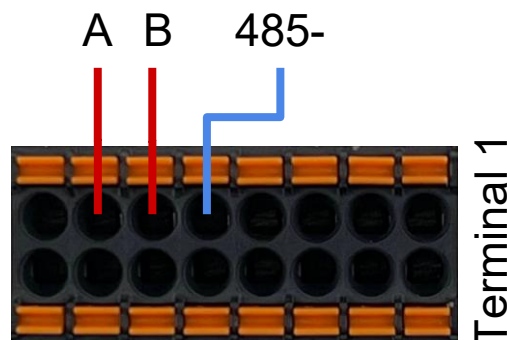


The power supply input is fuse-protected. The fuse might break in the event of a surge or overcurrent. If the device is unable to power up, check the 4 Amp fuse and replace it if needed.



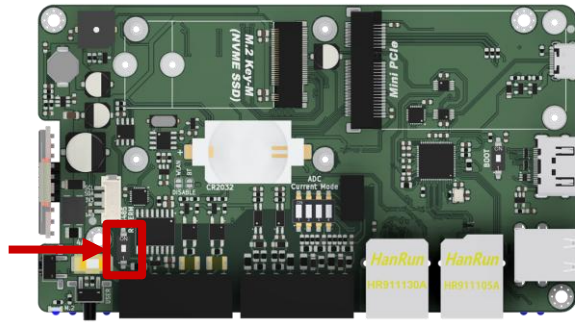
5.1.2 Isolated RS485

The RS485 interface is isolated from the system and other interfaces. It has a maximum baud rate of 500kbps, automatic direction control and it's mapped to `/dev/ttyACM0` in the Raspberry Pi.



RS485 can work by only connecting the A-B signal. However, we do also recommend connecting the GND too for better noise immunity. The RS485 also comes with a 120Ω termination resistor which can be switched on/off via a switch.

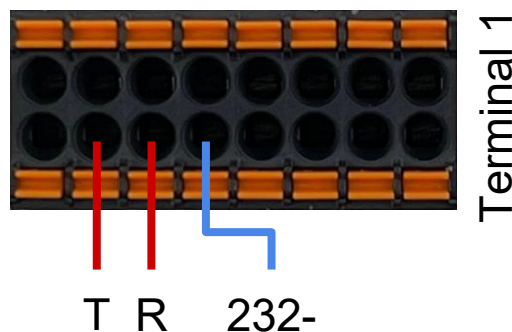
Termination Resistor Enable Switch



5.1.3 Isolated RS232

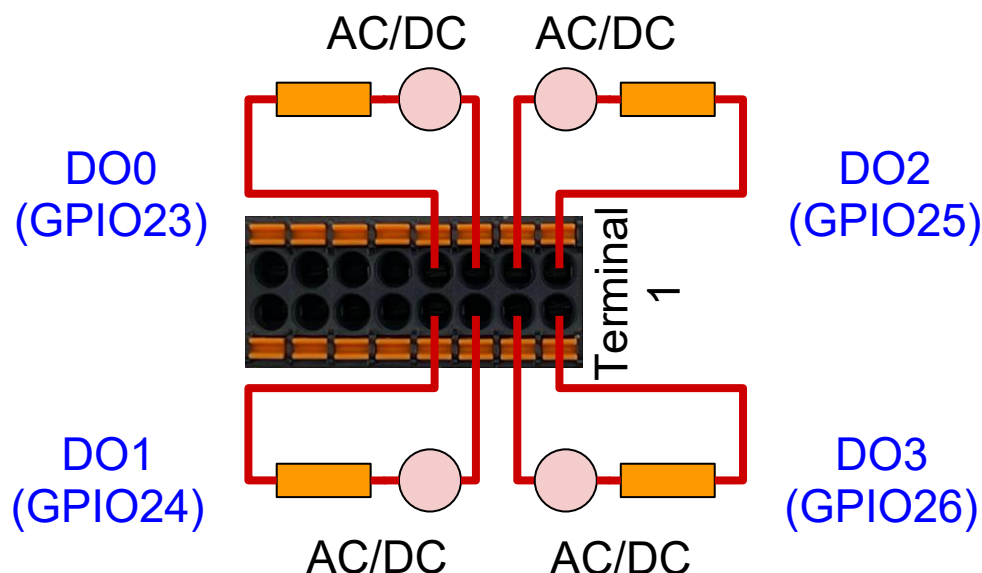
The RS232 interface is isolated from the system and other interfaces.

It has a maximum baud rate of 120kbps and it's mapped to `/dev/ttyACM1` in the Raspberry Pi.



5.1.4 Isolated Digital Output

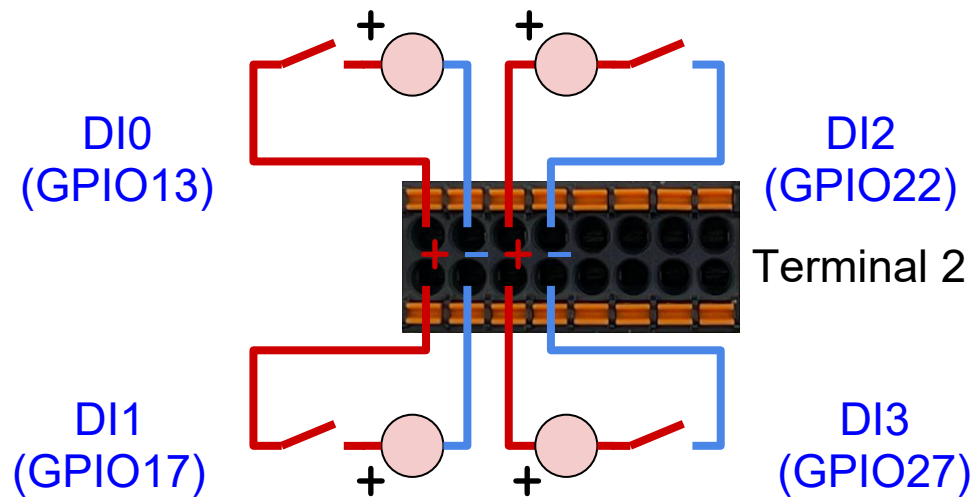
There are four digital outputs that are isolated from the system as well as among the different output channels. The outputs are active high and controlled directly from the Raspberry Pi GPIO. They are dry contact outputs driven by a solid state relay and able to handle DC or AC load at a maximum of 50V 500mA.



5.2 Terminal 2

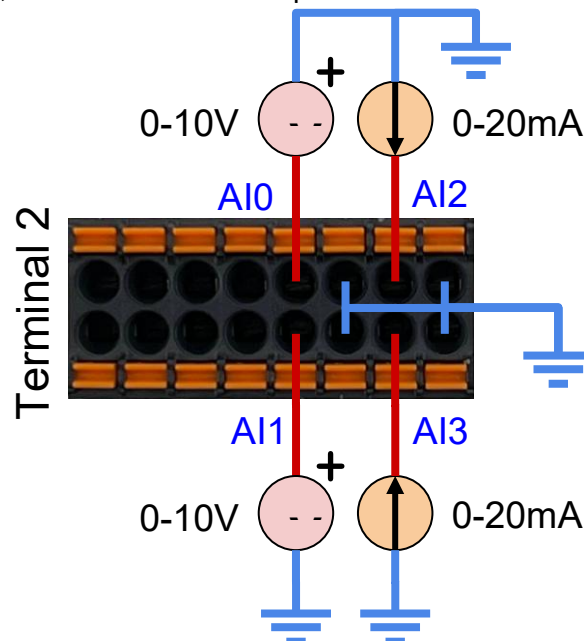
5.2.1 Isolated Digital Input

There are four digital inputs that are isolated from the system as well as among the different input channels. The inputs are active high and accessible directly from the Raspberry Pi GPIOs. They are only compatible with **wet contacts** and require a minimum of DC 3.0V 0.2mA to turn on. The maximum input voltage is DC 50V.



5.2.2 Isolated Analog Input

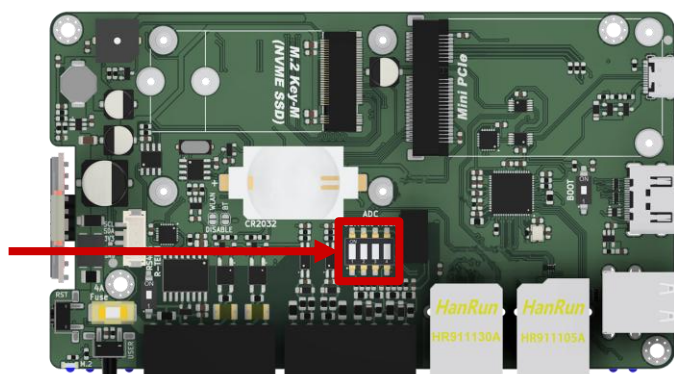
MACHHUB has a built-in **ADS1115** I2C ADC (Address = 0x48). There are four isolated analog inputs that are compatible with 0-5V, 0-10V and 0-20mA input.



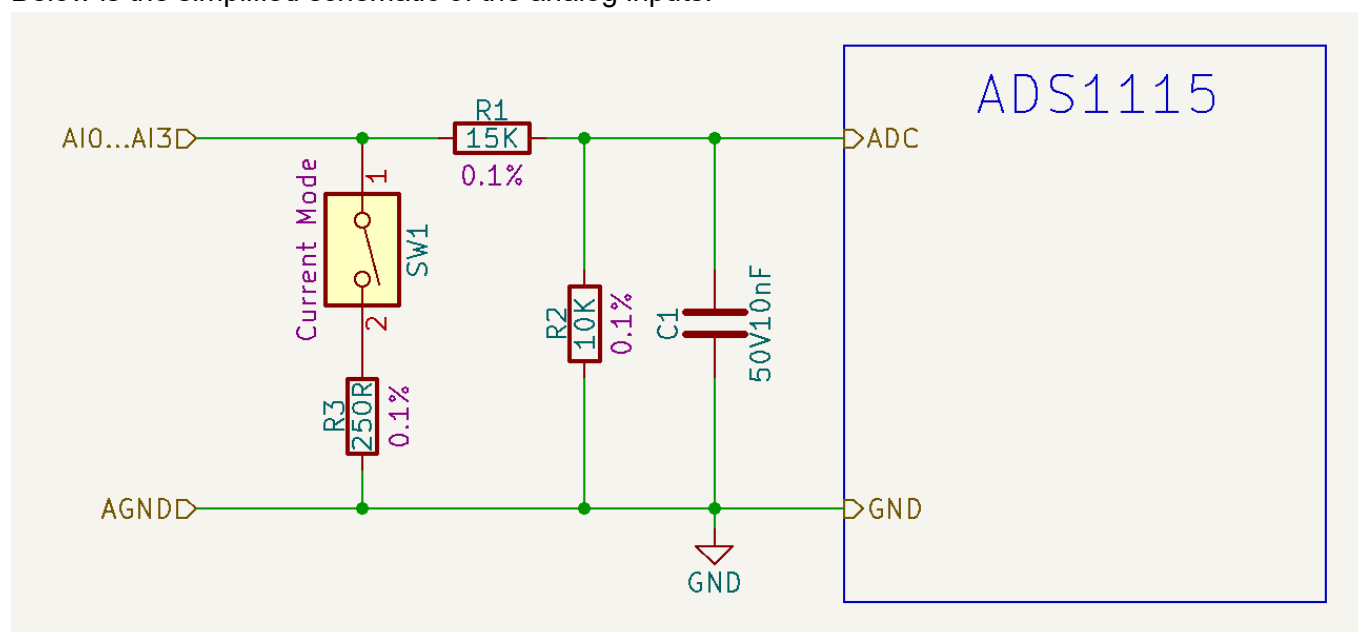
⚠ The AGND is isolated from the system ground, but it's common among all the analog input channels.

To measure the 0-20mA current input, the internal shunt resistor needs to be enabled.

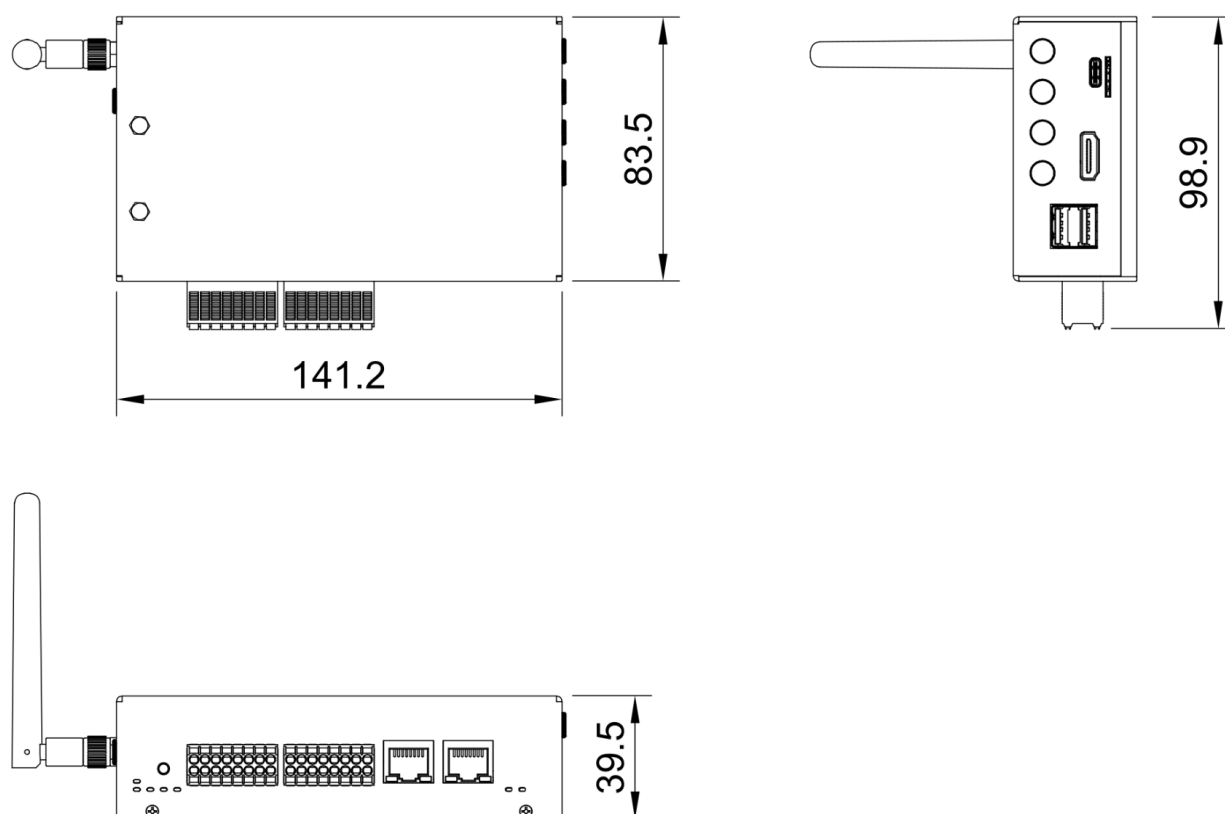
Turn on to
measure current



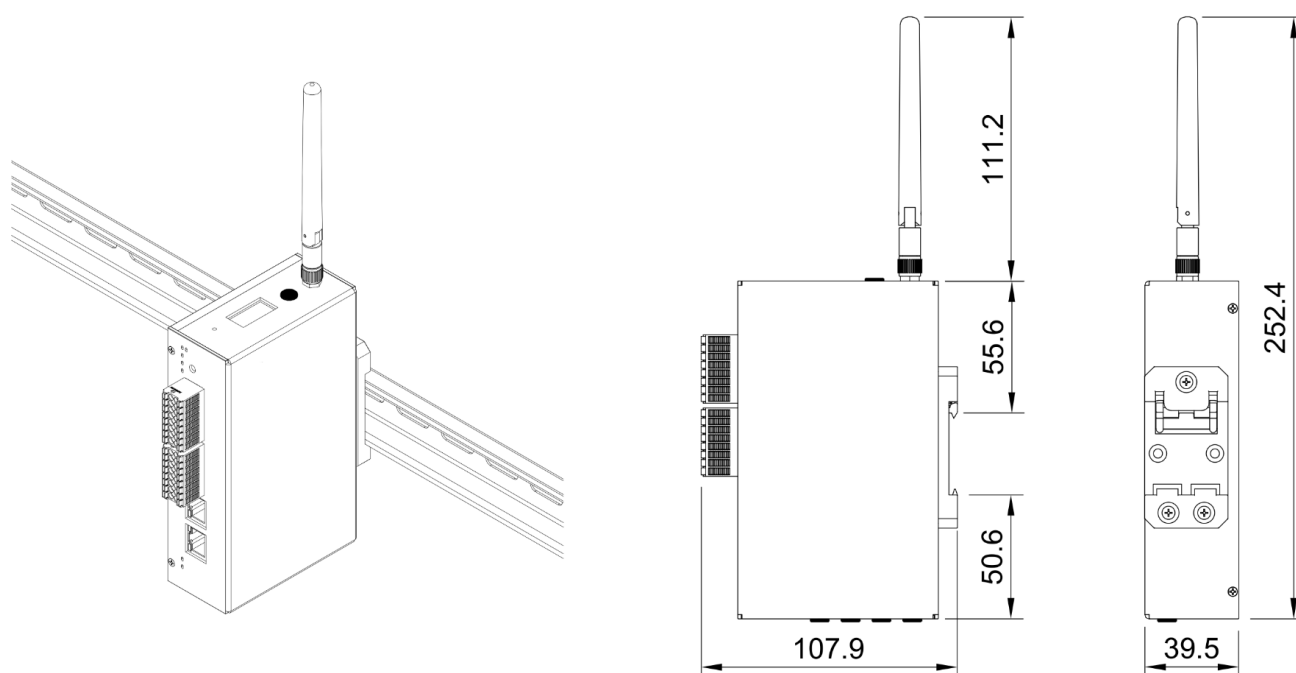
The input impedance is 25k Ω for voltage mode and 250 Ω for current mode.
Below is the simplified schematic of the analog inputs.



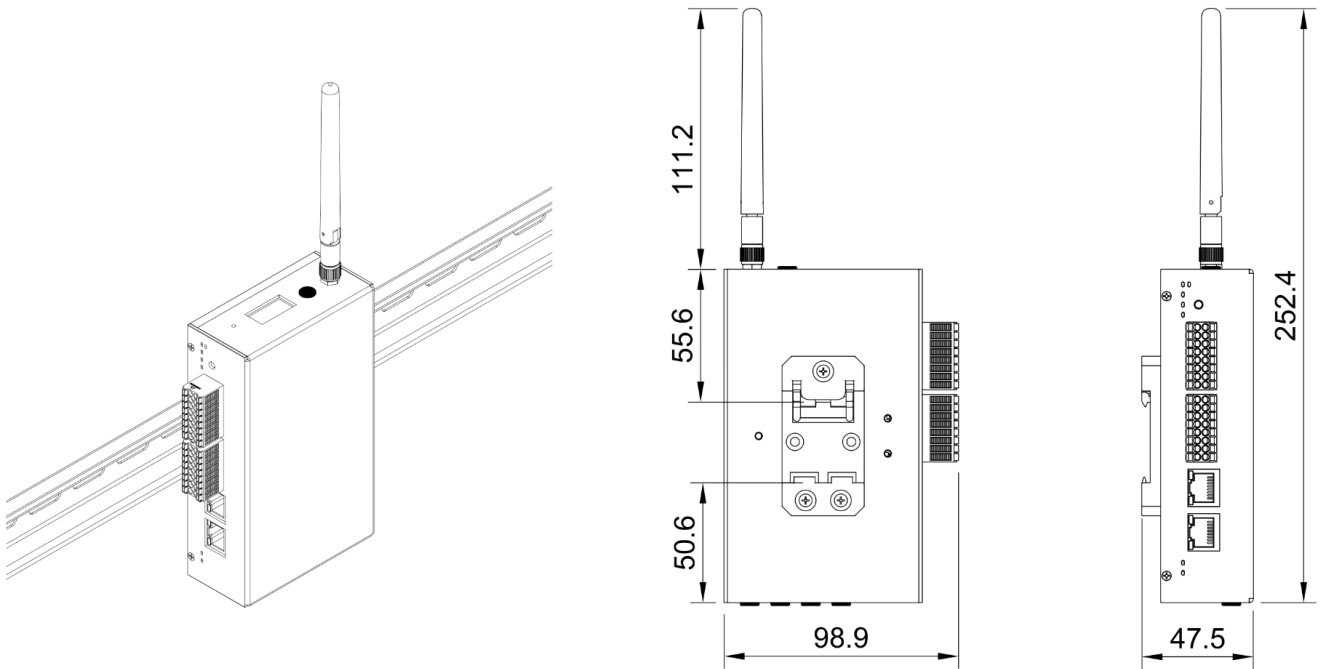
6.1 Without DIN Rail Socket



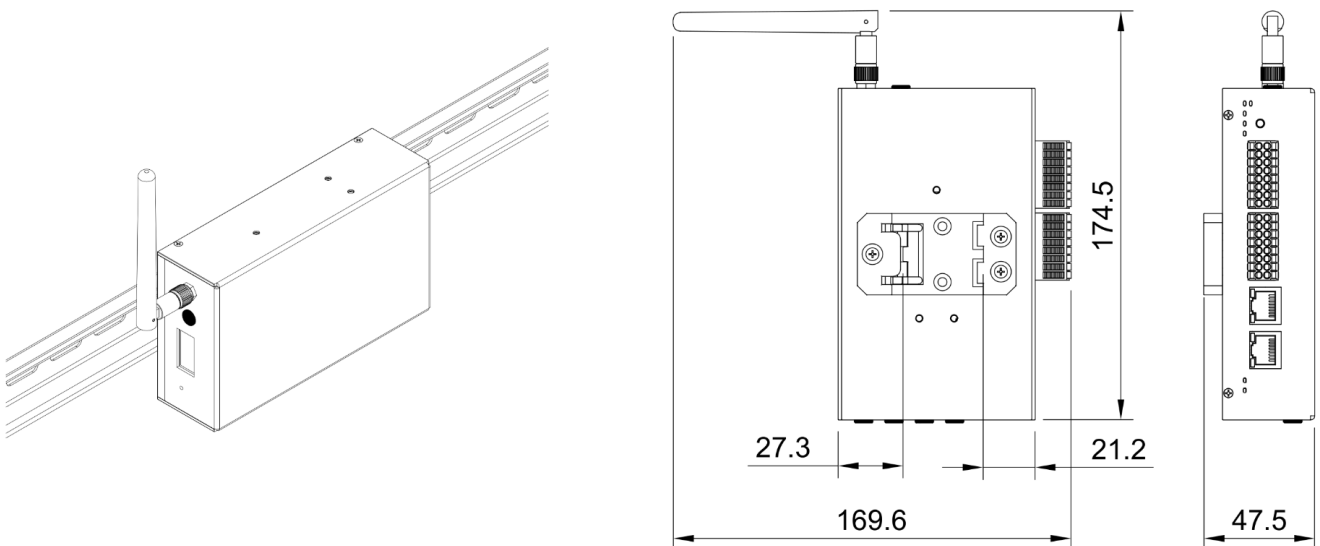
6.2 DIN Rail Mount Position 1 (Default)



6.3 DIN Rail Mount Position 2



6.4 DIN Rail Mount Position 3



Prepared by:

Intellogic Technology Sdn Bhd

www.machhub.dev