



# IRIV IO Controller

## IR4.0 Industrial I/O Controller



## Datasheet

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## 1. Features

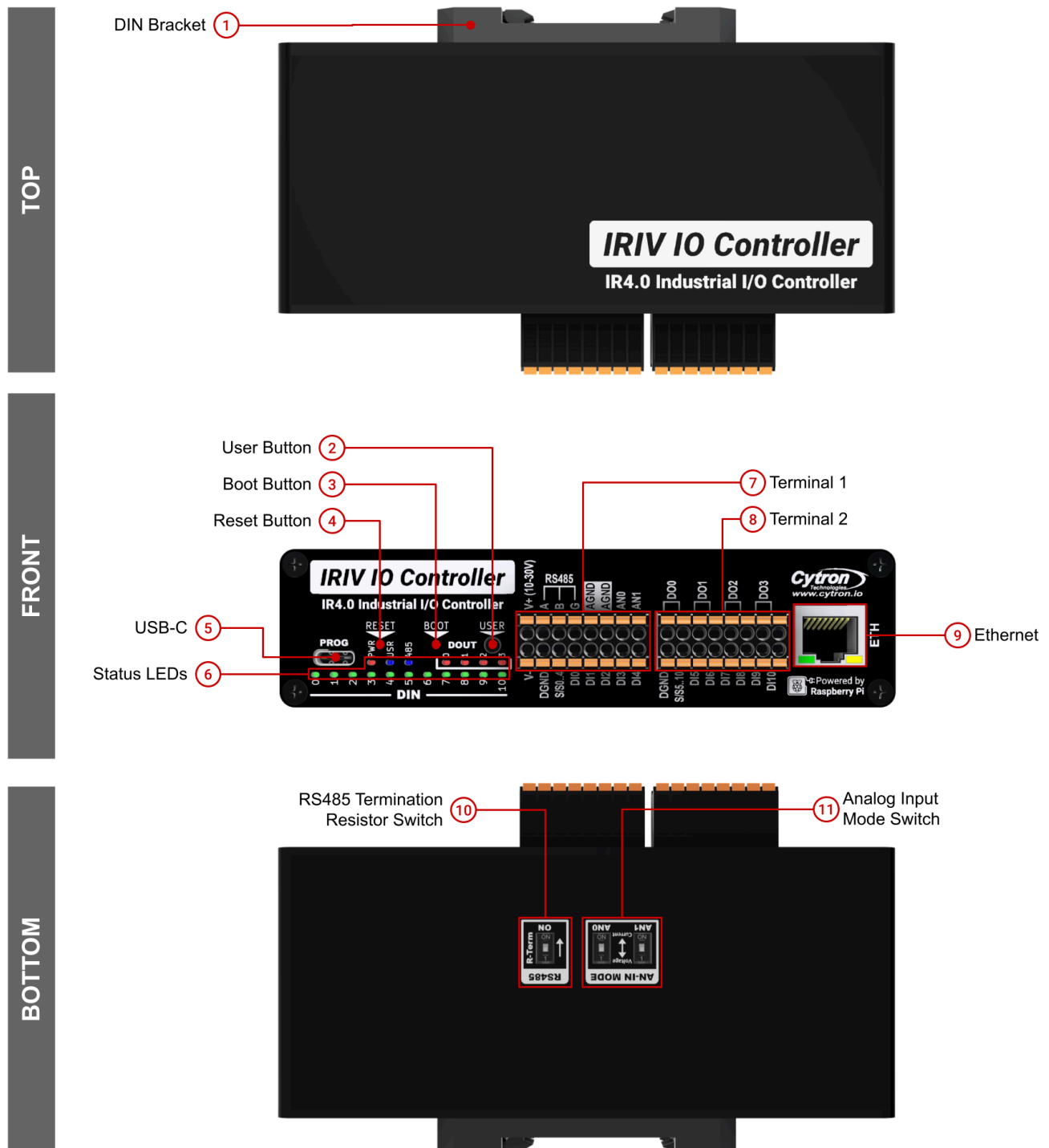
Features	Description
Microcontroller	Raspberry Pi RP2350A, Dual Cortex-M33 @ 150MHz
RAM	520KB on chip SRAM
Storage	2MB flash memory
Interfaces	1x USB-C (For programming and configuration)
	1x RJ45 Ethernet (via W5500 Ethernet controller)
	1x isolated RS485
	11x isolated digital input (up to 50V)
	4x isolated digital output (up to 50V)
	2x 12-bit analog input (0 - 10.56V / 0 - 42.58mA)
Power Supply	DC 10-30V surge protected
Additional Features	PCF85063A Real Time Clock
	1x reset button 1x boot button & 1x programmable button
	1x programmable LED
	Status LED for Power, RS485, DIN & DOUT
	1x passive buzzer
Enclosure	Metal enclosure, fanless design, DIN rail mountable
Dimension	(L)140mm x (W)60mm x (H)36mm (metal enclosure only, excluding 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	4.9	5.2	VDC
2	Power Consumption	-	0.7	W	
3	Isolated Digital Input	Low Level ( $V_{IL}$ )	-	$\pm 0.8$	V
		High Level ( $V_{IH}$ )	$\pm 3$	$\pm 50$	V
		Maximum Pulse Frequency (50% Duty Cycle)	-	5000	Hz
		Isolation Voltage	3750		Vrms
4	Analog Input	Resolution	12		bit
		Voltage Mode	0	10.56	V
		Current Mode	0	42.58	mA
		Input Impedance (Voltage Mode)	32K		$\Omega$
		Input Impedance (Current Mode)	248		$\Omega$
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	Operating Temperature	-20	70	$^{\circ}\text{C}$	

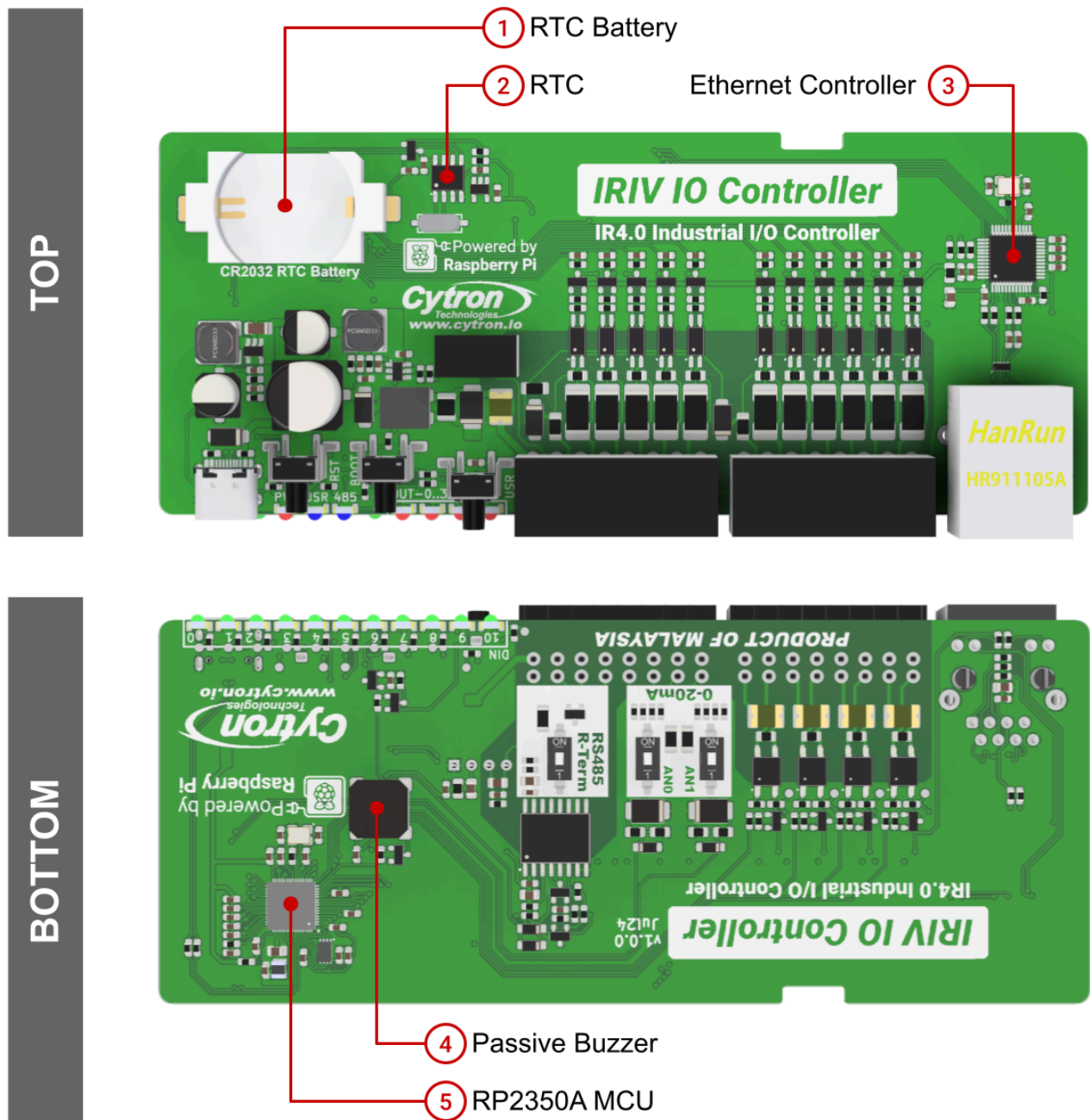
## 3. Layout

### 3.1 External Layout



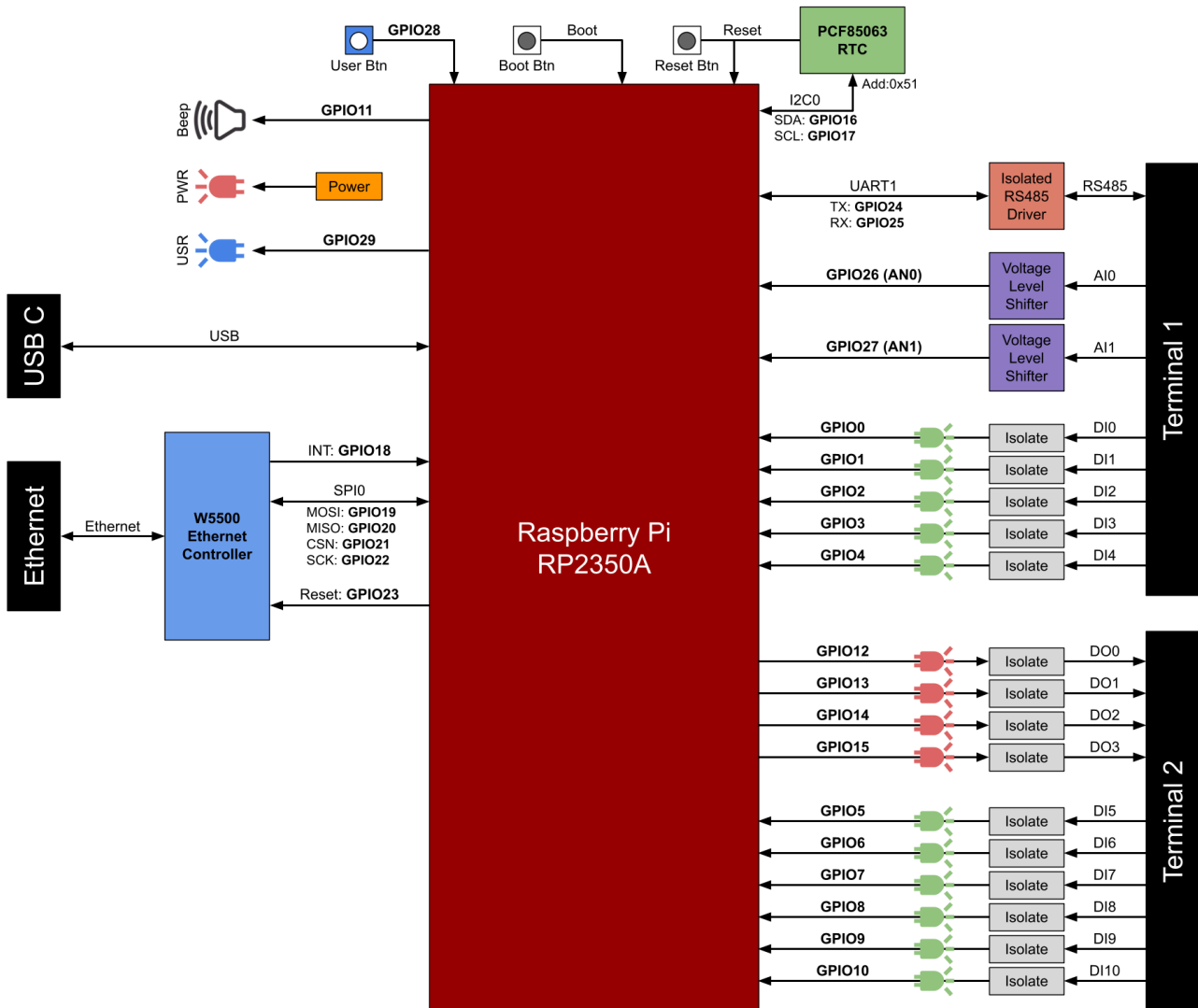
No.	Function	Description
1	<b>DIN Bracket</b>	For mounting on DIN rail.
2	<b>User Button</b>	User programmable button. Connected to <b>GPIO28</b> (active low).
3	<b>Boot Button</b>	Press and hold this button while resetting the RP2350A will enter the bootloader mode. Used to upload the programs. <i>* This is a pinhole button and can be pressed with a paperclip.</i>
4	<b>Reset Button</b>	Press to reset the RP2350A. <i>* This is a pinhole button and can be pressed with a paperclip.</i>
5	<b>USB-C</b>	Used to upload the program. Can be used to power up the IRIV IO Controller too.
6	<b>Status LEDs</b>	<b>PWR</b> - Turn on when powered up. <b>USR</b> - User programmable LED. Controlled by <b>GPIO29</b> . <b>485</b> - Turn on when there is activity on the RS485. <b>DOUT 0-3</b> - Turn on when the output is activated. <b>DIN 0-10</b> - Turn on when the input is triggered.
7	<b>Terminal 1</b>	Pluggable terminal 1. See <a href="#">here</a> for more details.
8	<b>Terminal 2</b>	Pluggable terminal 2. See <a href="#">here</a> for more details.
9	<b>Ethernet</b>	Ethernet port driven by Wiznet W5500 Ethernet Controller.
10	<b>RS485 Termination Resistor Switch</b>	Turn on to connect the RS485 120 Ohm termination resistor. This is only needed for the first & last device in the RS485 chain.
11	<b>Analog Input Mode Switch</b>	Configure the analog inputs to measure voltage (0-10V) or current (0-40mA).

## 3.2 Internal Board Layout



No.	Function	Description
1	RTC Battery	Insert a CR2032 coin cell to keep the RTC running when the system is powered off.
2	RTC	PCF85063A Real Time Clock (I2C Slave Address = 0x51).
3	Ethernet Controller	Wiznet W5500 Ethernet Controller.
4	Passive Buzzer	Passive buzzer which is able to play variable frequency tone or melody. Controlled by <b>GPIO11</b> .
5	RP2350A	Raspberry Pi RP2350A Microcontroller.

## 4. Block Diagram





## 5. Interfaces and Functions

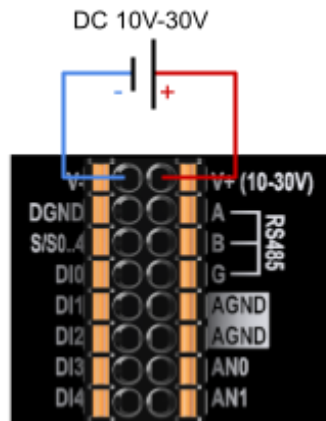
### 5.1 Pin Mapping

Functions	RP2350A		
Digital Input	DI0	GPIO	GP0
	DI1		GP1
	DI2		GP2
	DI3		GP3
	DI4		GP4
	DI5		GP5
	DI6		GP6
	DI7		GP7
	DI8		GP8
	DI9		GP9
	DI10		GP10
Analog Input	AN0	ADC	GP26
	AN1		GP27
Digital Output	DO0	GPIO	GP12
	DO1		GP13
	DO2		GP14
	DO3		GP15
RS485	TX	UART1	GP24
	RX		GP25
Ethernet (W5500)	INT	GPIO	GP18
	RESET		GP23
	CSn		GP21
	MOSI	SPI0	GP19
	MISO		GP20
	SCK		GP22
Real Time Clock (PCF85063)	SDA	I2C0	GP16
	SCL		GP17
User Programmable Button		GPIO	GP28
User Programmable LED		GPIO	GP29
Passive Buzzer		GPIO/PWM	GP11

## 5.2 Terminal Block

### 5.2.1 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.

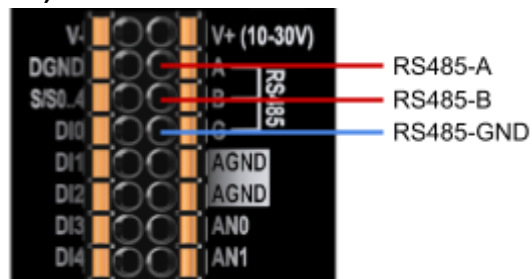


The power supply input is protected with a 500mA PTC. The PTC might open in the event of surge or overcurrent. If the device is unable to power up, wait for the PTC to cool down and it might be functioning again. Else, please contact the [support team](#) for further assistance.

### 5.2.2 Isolated RS485

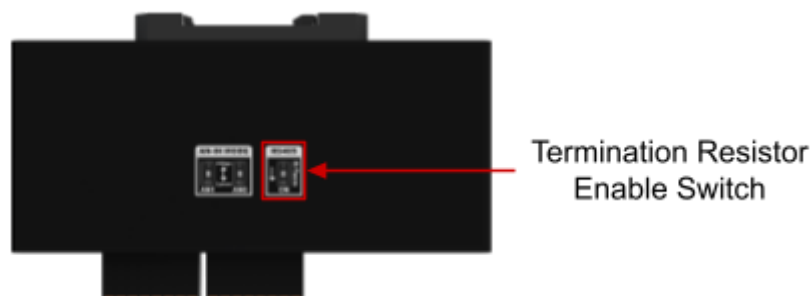
The RS485 interface is isolated from the system and other interfaces.

It has a maximum baud rate of 500kbps, automatic direction control and it's mapped to the **UART1 (Tx: GPIO24, Rx: GPIO25)** of RP2350A MCU.



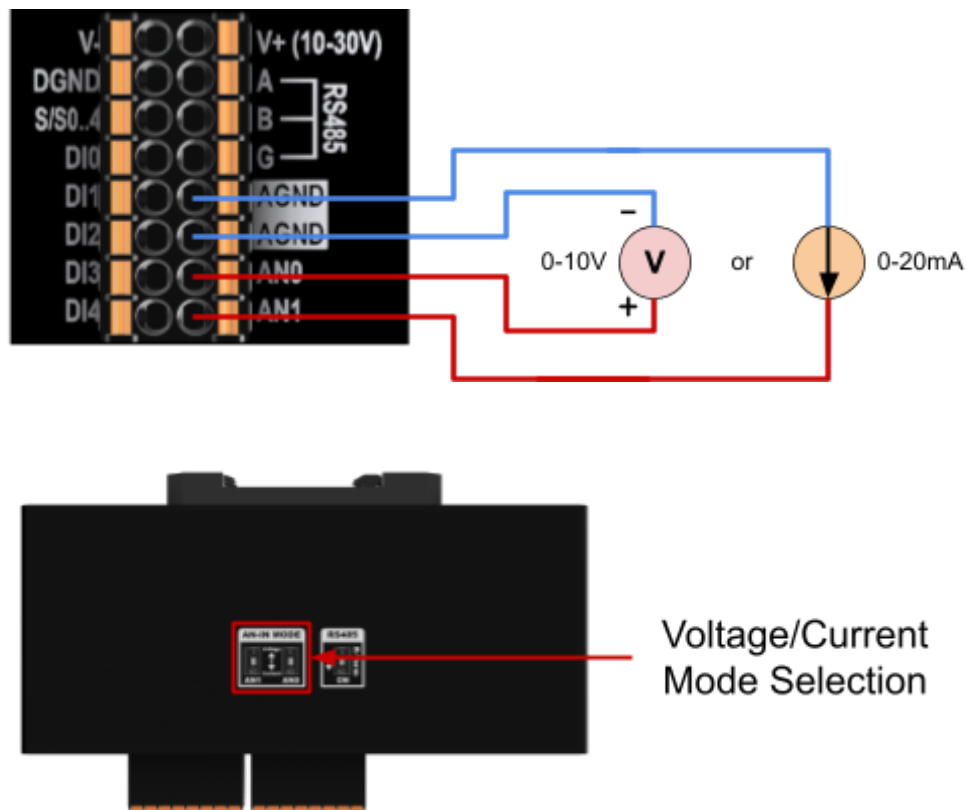
RS485 usually works by only connecting the A-B signal. However, we do also recommend connecting the GND too for better noise immunity.

The RS485 also comes with a 120Ω termination resistor which can be switched on/off via a switch at the bottom of the IRIV IO Controller.



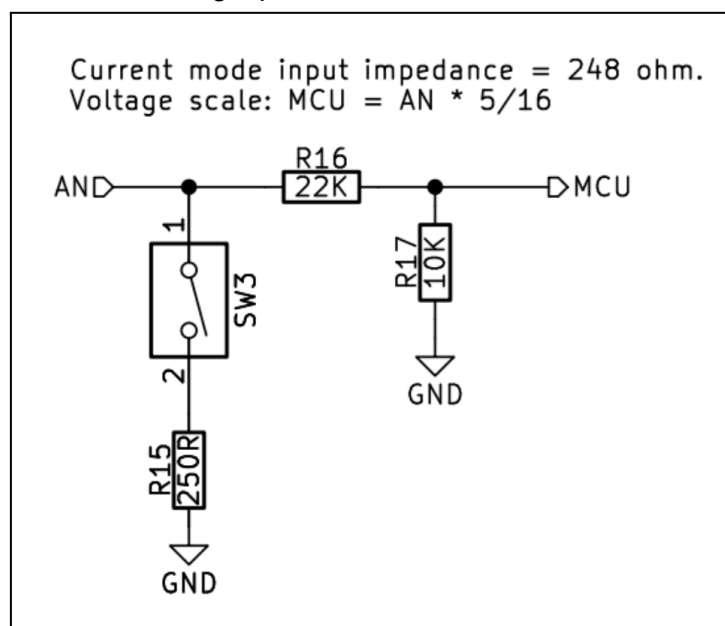
### 5.2.3 Analog Input

There are 2 analog inputs (non-isolated, AGND is shared with system GND) connected to the **AN0 (GPIO26) & AN1 (GPIO27)** of the RP2350A MCU. They can be configured to measure voltage or current with a DIP switch at the bottom of the IRIV IO Controller.



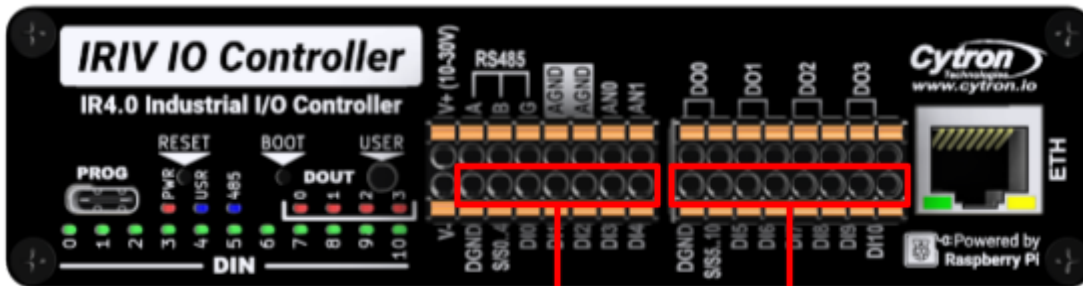
The ADC has 12-bit resolution with full scale of 10.56V or 42.58mA.  
The input impedance is 32k $\Omega$  for voltage mode and 248 $\Omega$  for current mode.

This is the simplified schematic of analog inputs.



## 5.2.4 Isolated Digital Input

There are 11 isolated digital inputs (active high) divided into two groups, with independent common S/S (Sink/Source) for each group. This design provides the flexibility to connect to both PNP and NPN sensors at the same time. Besides that, there is also a built in isolated power source for dry contact inputs without any external power supply.



DIN Group 1 (DI 0-4)

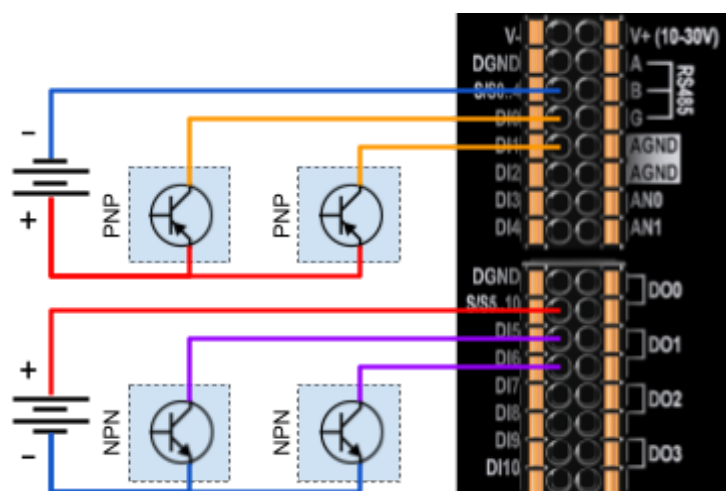
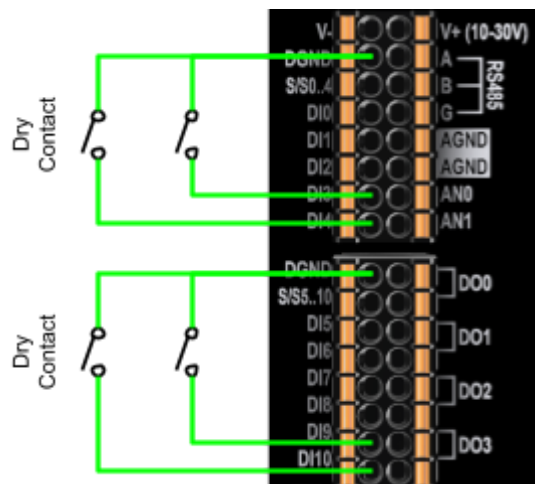
DIN Group 2 (DI 5-10)

**S/S0..4** is the common sink/source for DIN Group 1 (DI0 - DI4)

**S/S5..10** is the common sink/source for DIN Group 2 (DI5-DI10)

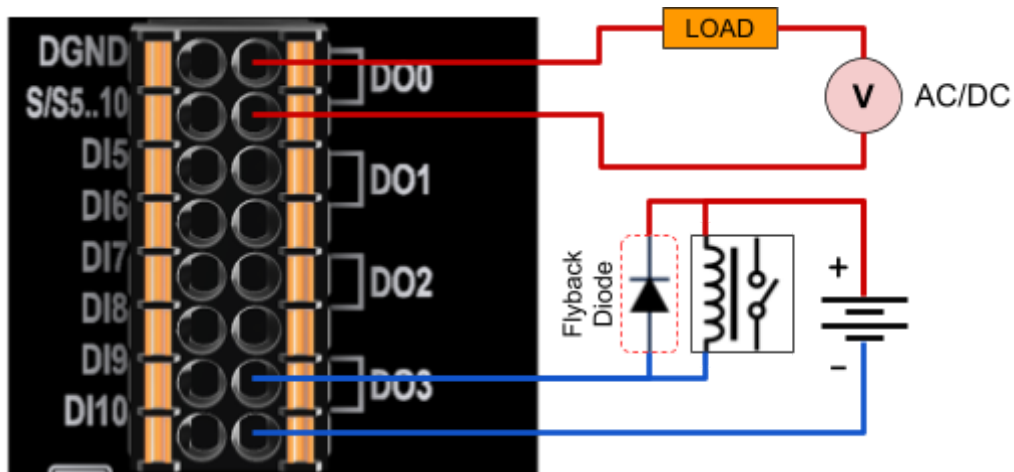
**DGND** is the common digital ground for dry contact input. This is shared between DIN Group 1 & 2.

Examples of connecting to dry contact, PNP & NPN Sensors:



## 5.2.5 Isolated Digital Output

There are four digital outputs which 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 maximum 50V 500mA.



*\* For inductive load such as relay, it's recommended to connect a **flyback diode** in parallel with the load. This helps to reduce the EMI from switching the inductive load; even though it's still safe to operate without the diode as the outputs have built-in surge protection.*

## 5.3 Ethernet

The ethernet is powered by the widely used Wiznet W5500 ethernet MAC and PHY. It communicates with the RP2350A MCU via SPI at maximum frequency up to 80MHz.

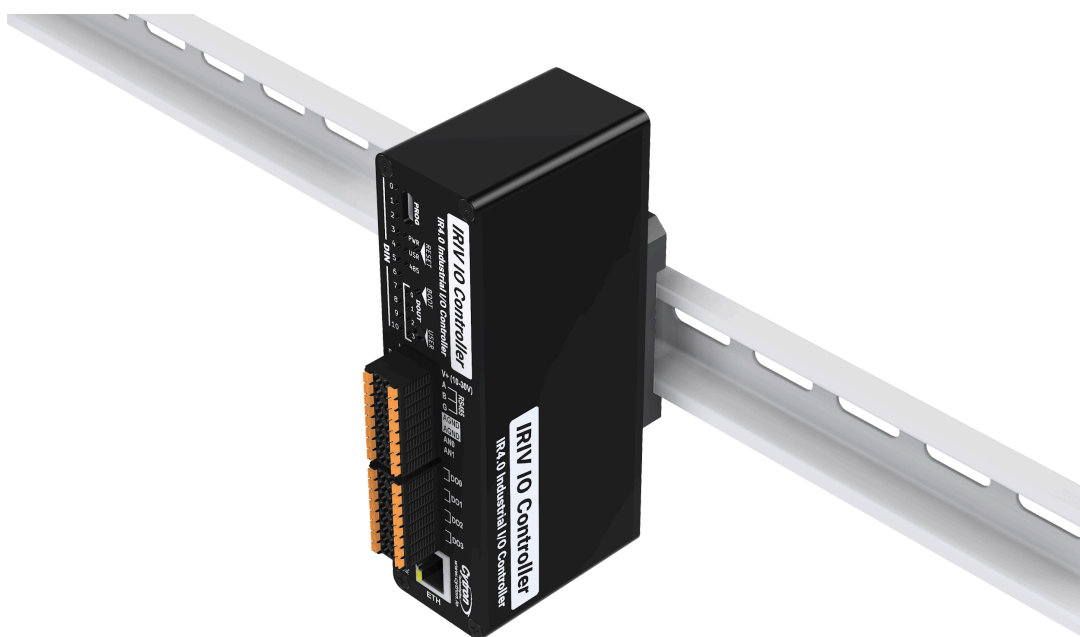
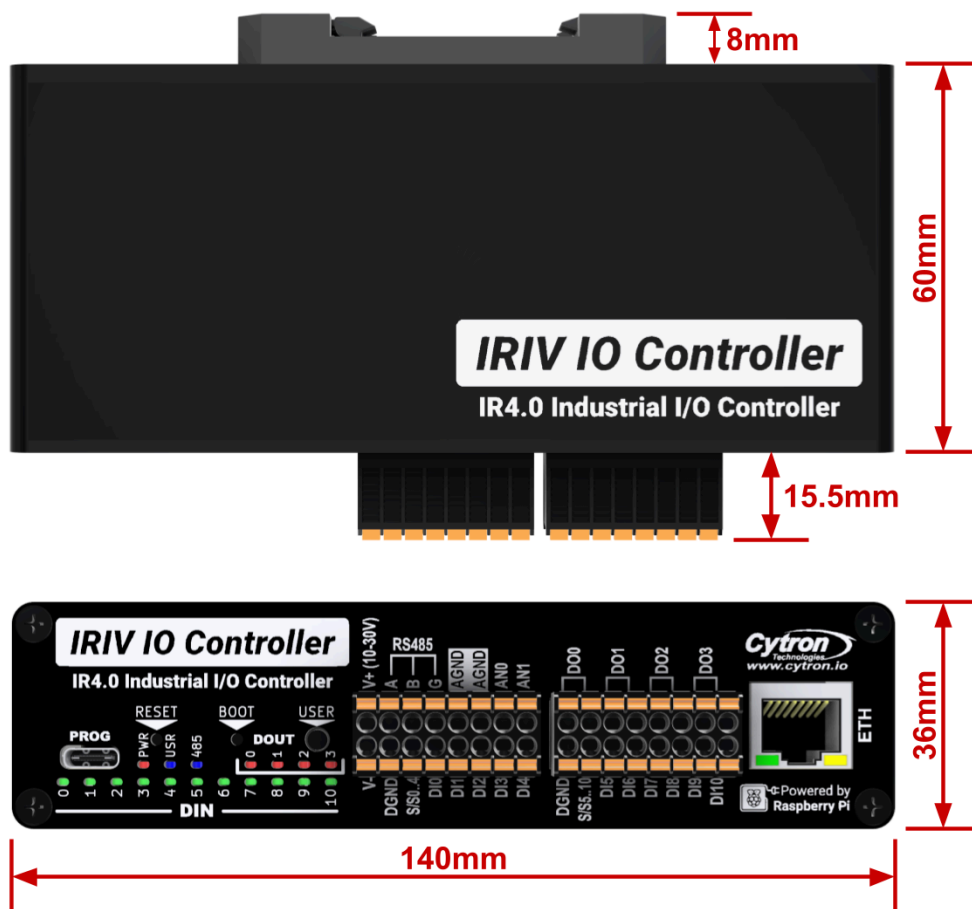
The W5500 has a built-in TCP/IP stack and supports both the OT (MODBUS TCP) and IT (MQTT/HTTP) communications.

### Features:

- Supports following Hardwired TCP/IP Protocols : TCP, UDP, ICMP, IPv4, ARP, IGMP, PPPoE
- Supports 8 independent sockets simultaneously
- Supports Power down mode
- Supports Wake on LAN over UDP
- Supports High Speed Serial Peripheral Interface(SPI MODE 0, 3)
- Internal 32Kbytes Memory for Tx/Rx Buffers
- 10BaseT/100BaseTX Ethernet PHY embedded
- Support Auto Negotiation (Full and half duplex, 10 and 100-based)

For more information, please refer to [Wiznet official website](#).

## 6. Dimension & DIN Rail Mounting



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