Rubix IO-24 - Statement of Work - Stage 1

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1 Product Design Specification

1.1 Communication Protocols

1.1.1 RIO-24

Ethernet	RS485	LoRa
BACnet IP	Modbus	Device can be added to a lora gateway (as a slave)
MQTT	BACnet MSTP	Device can also be set up as a limited lora gateway for up to 10 Nube iO sensors (Droplets, Micro-edges).

1.1.2 RIO-10

RS485	LoRa
Modbus	Device can be added to a lora gateway (as a slave)
BACnet MSTP	Device can also be set up as a limited lora gateway for up to 10 Nube iO sensors (Droplets, Micro-edges).

1.2 IO specification

IO type selection will be done with header pins and jumpers.

1.2.1 RIO-24

Types	Count	IO max count	Up to
Universal input type 1	8	0-10VDC outputs	10
Universal input type 2	4	Relay outputs	6
Universal output	4	0-10VDC inputs	8
Digital input/output	2	4-20mA inputs	4
Digital input/analog output	6	Thermistor inputs	8
Total IO	**24**	PT100 inputs	8
		Digital inputs	20
		Pulse inputs	4
		Total options	**68**

1.2.2 RIO-10

Types	Count	IO max count	Up to
Universal input type 1	2	0-10VDC outputs	4
Universal input type 3	4	Relay outputs	2
Universal output	2	0-10VDC inputs	6
Digital input/analog output	2	4-20mA inputs	4
Total IO	**10**	Thermistor inputs	6
		PT100 inputs	6
		Digital inputs	8
		Pulse inputs	4
		Total options	**40**

1.2.3 Inputs

1.2.3.1 Universal input type 1

- Digital IN (on/off)
  - 10VDC switching voltage
- 0 - 10VDC
  - 24 bit ADC
  - ±0.06% accuracy
  - 0.01V resolution
- Thermistor 10K and 20K
  - 10VDC reference voltage
  - ±0.1% reference voltage accuracy
  - 10K Ω divider resistor
  - ±0.05% resistor accuracy
  - 24 bit ADC
  - ±0.06% ADC accuracy
  - 0.01°C resolution
- PT100
  - 10VDC reference voltage
  - ±0.1% reference voltage accuracy
  - 50 Ω divider resistor
  - ±0.05% resistor accuracy
  - 24 bit ADC
  - ±0.06% ADC accuracy
  - 0.01°C resolution

1.2.3.2 Universal input type 2

- Digital input (on/off)
  - 24VDC switching voltage
- 0-20mA
  - 24 bit ADC
  - 60 Ω impedance
  - ±0.08% accuracy
  - 0.01mA resolution
- Pulse/Counter
  - 24VDC switching voltage
  - 20 hertz max input rate

1.2.3.3 Universal input type 3

- 0 - 10VDC
  - 24 bit ADC
  - ±0.06% accuracy
  - 0.01V resolution
- Thermistor 10K and 20K
  - 10VDC reference voltage
  - ±0.1% reference voltage accuracy
  - 10K Ω divider resistor
  - ±0.05% resistor accuracy
  - 24 bit ADC
  - ±0.06% ADC accuracy
  - 0.01°C resolution
- PT100
  - 10VDC reference voltage
  - ±0.1% reference voltage accuracy
  - 50 Ω divider resistor
  - ±0.05% resistor accuracy
  - 24 bit ADC
  - ±0.06% ADC accuracy
  - 0.01°C resolution
- Digital input (on/off)
  - 10VDC switching voltage
- 0-20mA
  - 24 bit ADC
  - 60 Ω impedance
  - ±0.08% accuracy
  - 0.01mA resolution
- Pulse/Counter
  - 10VDC switching voltage
  - 20 hertz max input rate

1.2.4 Outputs

1.2.4.1 Universal output

- 0-10VDC
  - DAC 12 Bit
  - ±0.5% accuracy
  - 0.01V resolution
- Relay
  - Up to 5A @48VAC
  - Up to 3A @30VDC
  - Min. 5×10E6 ope. (at 180 times/min)

1.2.5 Mixed

1.2.5.1 Digital input/output

- Digital input (on/off)
  - 24VDC switching voltage
- Relay output
  - Up to 5A @48VAC
  - Up to 3A @30VDC
  - Min. 5×10E6 ope. (at 180 times/min)

1.2.5.2 Digital input/Analog output

- Digital input (on/off)
  - 24VDC switching voltage
- 0-10VDC
  - DAC 12 Bit
  - ±0.5% accuracy
  - 0.01V resolution

1.3 Power

The controller will feature a built-in isolator, enabling compatibility with both full-wave and half-wave systems.

Voltage : isolated 12-24V AC/DC,

Current : 0.5A at 24V

1.4 Functionality

1.4.1 Existing (R-IO-16)

Comms:

- USB
- Modbus
- LoRaRAW IO + Passthrough
- LoRaWAN IO + Passthrough

Other:

- OEM Apps
- RIOT Engine (bms flow programming runtime, like a honeywell spyder)

1.4.2 New Components

Comms:

- BACnet IP
- BACnet MS/TP
- MQTT (sparkplug?)
- NFC for tech and oem commissioning

NFC

The use case for the NFC is to allow the user to do the following

- Set comms settings, like IP, port and BACnet ID
- Read and write to IO values
- Can also be used for OEM to allow them for example to make it easy for their users to commission the OEM application

1.5 Physical Attributes

1.5.1 Temperature range

In accordance with prevalent industrial standards, the controller is designed to maintain optimal performance within a wide temperature range of -20°C to +80°C, ensuring reliable operation under varying conditions.

1.5.2 Approximate dimensions

1.5.2.1 RIO-24

- L: 155 mm
- H: 64 mm
- W : 112 mm

This compact controller design accommodates approximately 25 screw terminals (5.08 mm) on each side. Compared to the Rubix Compute this controller would be 43mm longer.

1.5.2.2 RIO-10

- L: 65 mm
- H: 64 mm
- W : 112 mm

This compact controller design accommodates approximately 9 screw terminals (5.08 mm) on each side. This would be the same size as the current RIO-16.

1.6 Additional features

1.6.1 Ethernet Switch

The RIO-24 controller incorporates a built-in switch, connecting two Ethernet ports internally, effectively eliminating the need for an external switch and streamlining connectivity.

1.6.2 Near field communication (NFC)

Both controllers offer NFC integration, allowing users to connect with a mobile app for real-time data visualization and convenient configuration adjustments.

1.6.3 LoRa Module

Both controllers will provide comprehensive support for LoRaWAN and LoRa RAW protocols, functioning as both a device and a dedicated LoRa RAW receiver.

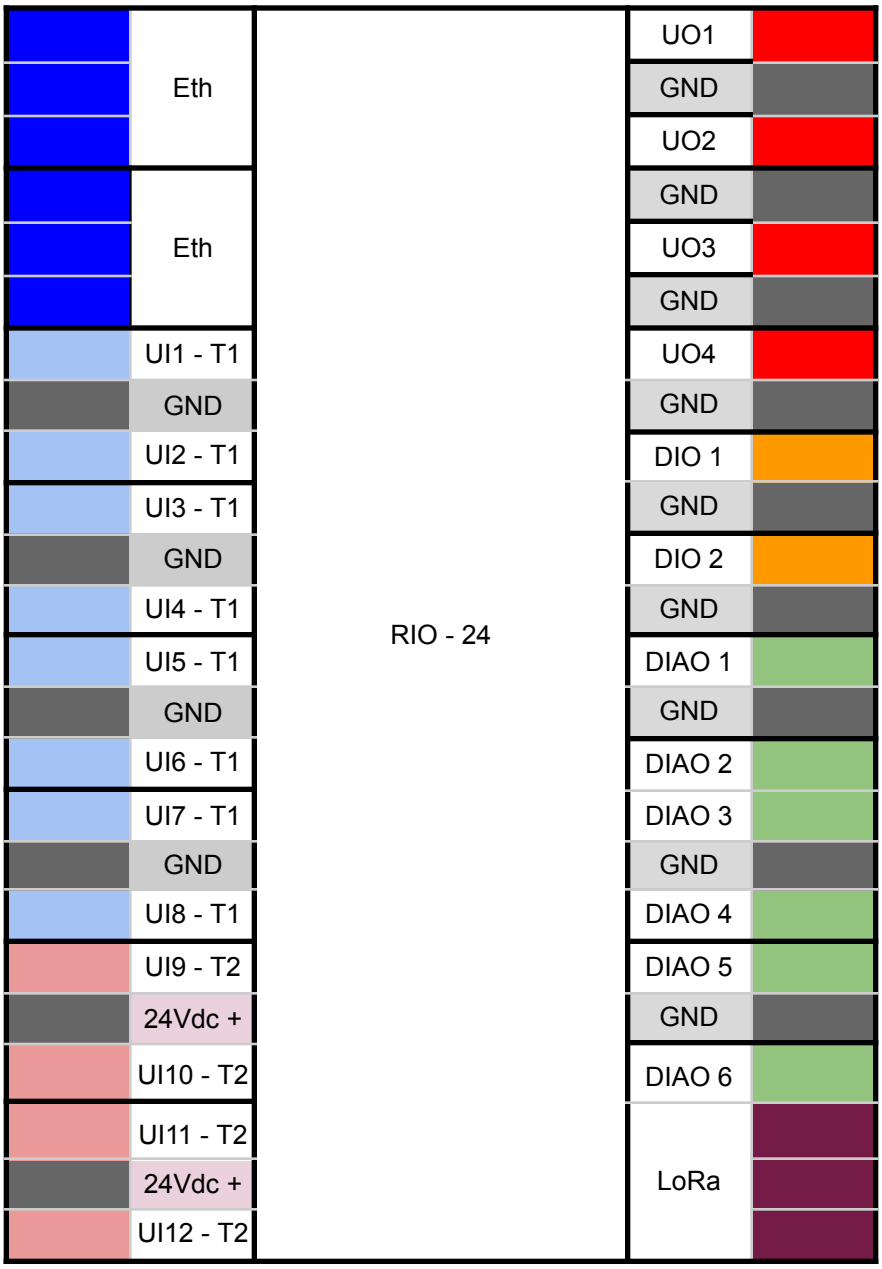
The LoRa RAW receiver enables direct connectivity for a select number of devices to the controller, bypassing the need for a separate gateway and simplifying the setup process.

1.6.4 Side connector

The slide connector enables attachment of expansion modules, eliminating the need for extra power and communication cabling. These expansion modules function as native I/O, fully integrating with the base controller for a streamlined experience.

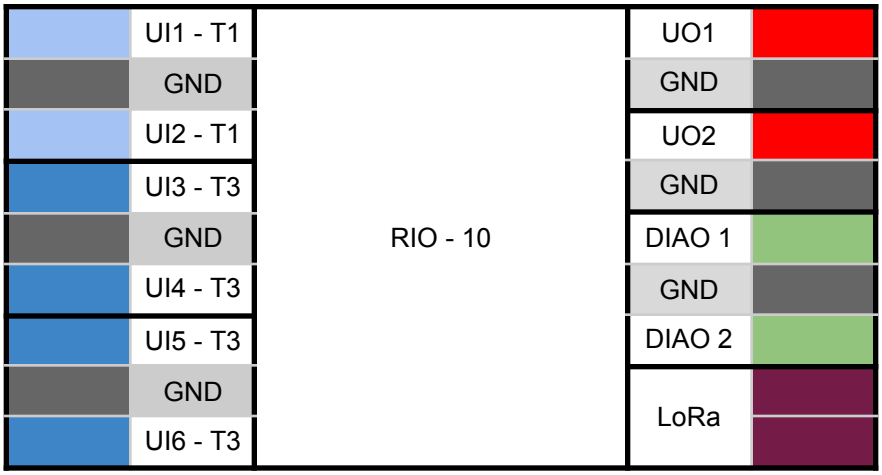
1.7 IO layout

1.7.1 RIO-24



Universal inputs Type 1 and Type 2 are designed with a 2-to-1 common terminal configuration. Type 1 includes a shared ground, and Type 2 has a shared 24VDC, allowing for the connection of two 4-20mA sensors using two core cables.
Universal outputs, digital inputs/outputs, and digital input/analog outputs employ a 1-to-1 ground terminal configuration.

1.7.2 RIO-10

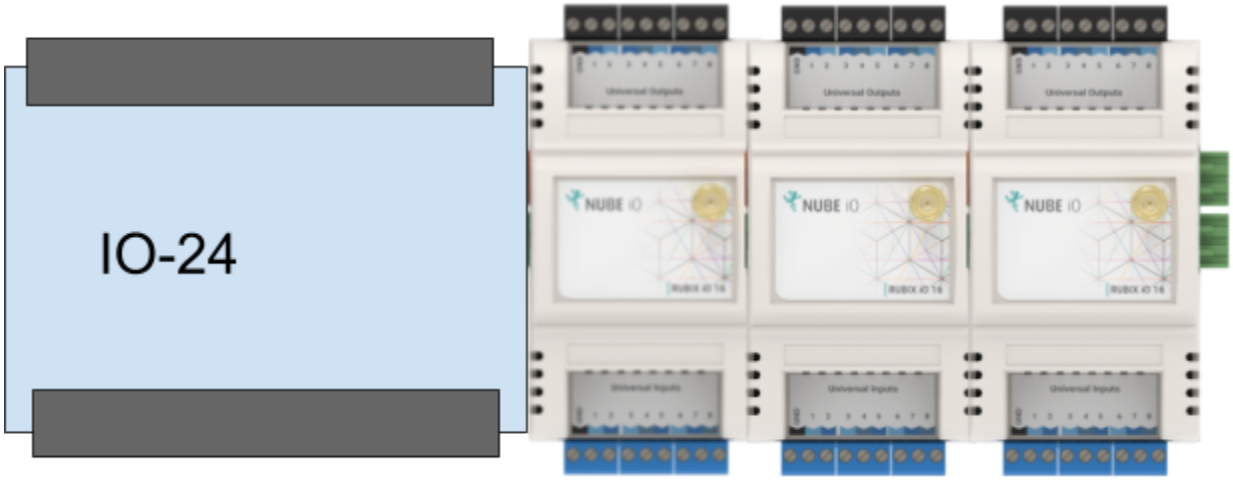


Universal inputs Type 3 and digital input/analog outputs have a 2-to-1 common terminal configuration with a shared ground.

Universal outputs have a 1-to-1 ground terminal configuration

1.8 IO expansion

We will allow for the IO-24 to take plugin IO modules



2 End user Programming (BMS)

The user will be able to program the device via the nube-io rubix-ce software