

## Industrial Wi-Fi, LoRa RF, Modbus PLC





# Mako V2

Industrial Wi-Fi, LoRa RF, Modbus PLC

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## QUICK START

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← Point of Interest

# Mako V2

Industrial Wi-Fi, LoRa RF, Modbus PLC

## Mako V2 Description

Smithtek's **Mako V2 PLC** is built around three core principles:

- **Reliability**
- **Simplicity**
- **Future proof**

Combining an ultra-fast PLC with full IoT capability, its versatile design allows it to operate as either a master or slave controller. With embedded LoRa RF, Wi-Fi, GPS, and a compact footprint, it's ideal for remote applications. Its built-in IoT connectors enable direct integration with internet-based control and monitoring services.

**V-NET configuration software** uses an intuitive drag-and-drop interface, making it accessible to all skill levels. Equipped with modern communications protocols, IoT connectors, and classic PLC tools, it gives users flexibility and creative control like never before.

The Mako V2 breaks traditional barriers as it steps into the future of control.

### Application Use:

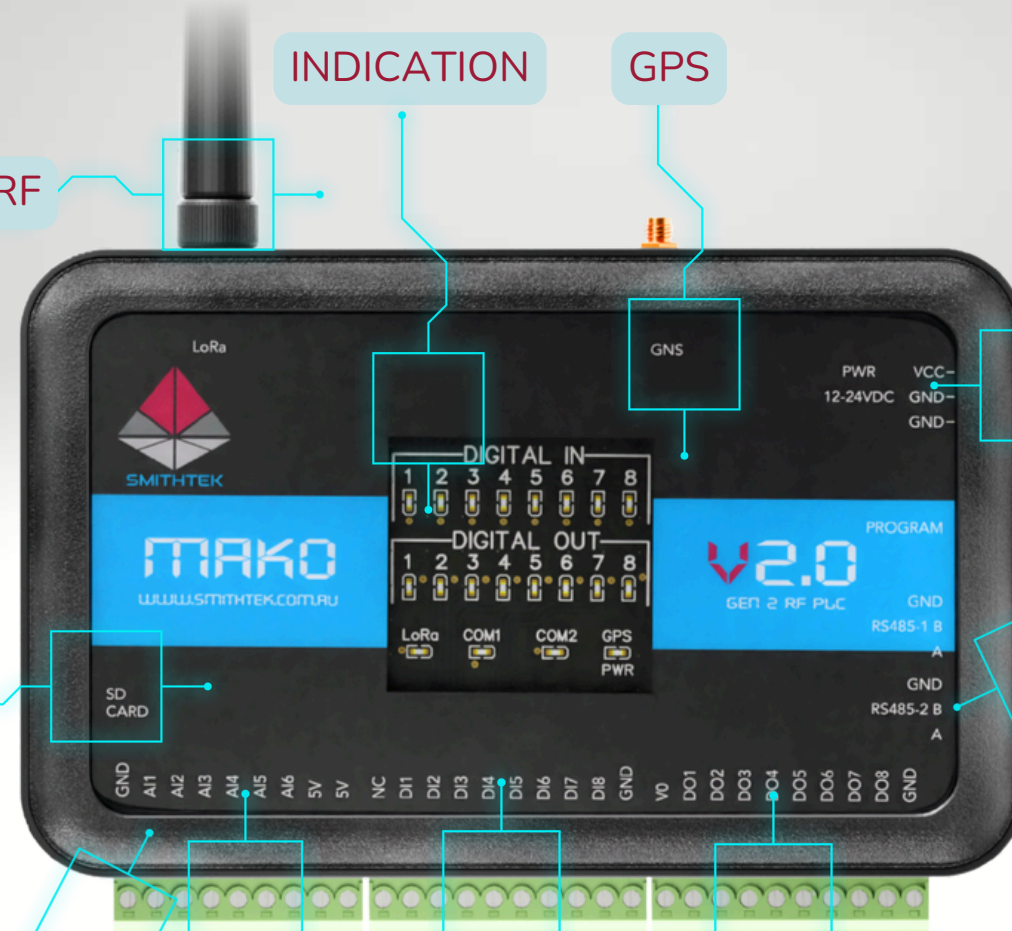
- Remote control & monitoring of assets.
- Agriculture, farming.
- Mining, resources sector.
- Pump control, irrigation control., bore control.
- Remote communities.
- Water treatment, UV disinfection, flow meters.
- Tank monitoring and control.
- Survey-data logging, environmental sensors.
- Generators, remote control and monitoring.
- Power stations, remote control and monitoring
- Parks and public areas.
- Mobile plant machines and skids.



# Mako V2

Industrial Wi-Fi, LoRa RF, Modbus PLC

## Device Layout



LoRa RF

INDICATION

GPS

10.5-28VDC

2 x RS485

SD STORAGE

2 x 0-5V AI

4 x 4 20mA AI

8 x DI

8 x DO

- 10.5-28VDC supply
- 4 x 4-20mA analog inputs
- 2 x 0-5VDC analog inputs
- 8 Digital inputs / pulse inputs 1khz
- 8 x Digital outputs, transistor NPN
- 5 x 3A relay **MV2-R version only**
- 2 x RS485 serial ports
- 1 x Micro SD slot
- 1 x GNS- GPS/GLONASS/GALILEO
- 1 x LoRa SX 1278 private LoRa coms
- LED Coms indication
- Internal battery supply sensor

### Indicator LED's

- All indicator LED's will activate when they receive a signal (RX) only
- The GPS indicator will flash at 1hz when it has a satellite lock
- Com 1 LED will be constant when uploading a program

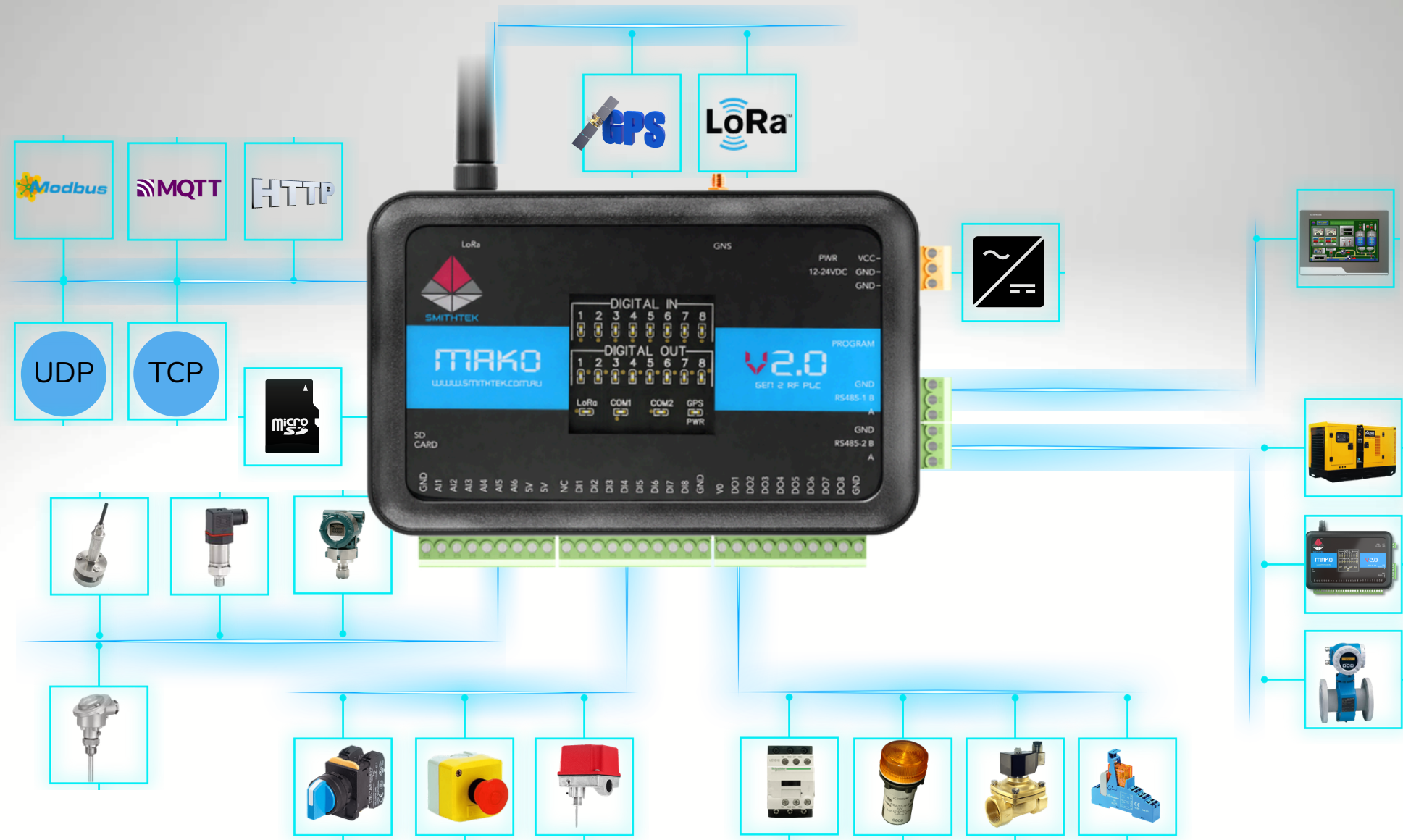


COM1 = RS485-1  
COM2 = RS485-2

# Mako V2

Industrial Wi-Fi, LoRa RF, Modbus PLC

Connection Topology





# Mako V2

## Industrial Wi-Fi, LoRa RF, Modbus PLC

## Device Features

- 240MHz, Dual-core Xtensa® 32-bit LX6 MCU
- Multi communication ability, LoRa, Wi-Fi, RS485
- High precision 4 20mA analog inputs.
- Low power mode
- LoRa RF, 300 to 1000Mhz range
- 15KM LOS RF communications over LoRa
- **Single** device mode, **mesh** mode, **master** slave mode
- Micro SD storage for data logging.
- GNS (GPS, GLONASS, Galileo)
- 8 Digital inputs all assignable to pulse inputs 1 to 1Khz
- 8 Digital outputs NPN transistor type
- 3A Relay version available **5 outputs**
- Wi-Fi- IEEE 802.11, WPA2- AES
- Modbus RTU/TCP, 2 channels can act as slave or master independently
- Internal power supply sensing assignable on the V-NET software
- HTTP and HTTPS SSL security
- MQTT. 3.1 secure
- Advanced data type tools, Json, binary, packets, ASCII, base 64
- V-NET programmer IDE, simple, packed with tools to assist simplify programming functions
- Super small size, tough robust with hardened 35mm din-rail connectors



# Mako V2

## Industrial Wi-Fi, LoRa RF, Modbus PLC

## Device Specification

|              |                                     |                                          |
|--------------|-------------------------------------|------------------------------------------|
| Device Specs | Voltage Supply                      | 9-28VDC                                  |
|              | Power Max                           | 2.16 Watts                               |
|              | Load Idle                           | 90mA                                     |
|              | Load Each Relay                     | 23mA(Relay Version)                      |
|              | Operating Temperatures              | 40 to +85C                               |
|              | Operating Humidity                  | 0 – 95% RH (NC)                          |
|              | Dimensions                          | 160/98/34 mm                             |
|              | Dimensions with Terminals Connected | 178/117.5/39.5 mm                        |
|              | Enclosure Material                  | ABS (ROHS)                               |
|              | Programming Communication Method    | USB Type A                               |
|              | Terminals                           | 2.54mm socket connectors WIRE SIZE 2.5MM |
|              | Mounting Option 1                   | Spring load (35mm Din-rail clips)        |
| LoRa Radio   | RF Type                             | LoRa Modulation                          |
|              | RF BW                               | 62.5-500kHz                              |
|              | RF Frequency                        | 169-915MHz                               |
|              | TX Power                            | 0-20dBm max 100mW                        |
|              | Encryption                          | 128bit AES                               |
|              | Antenna Type                        | SMA Female                               |
|              | TX Load                             | 18.75mA at 24VDC 0.45W                   |
|              | RX Load                             | 4mA at 24VDC 0.095W                      |
| Wi-Fi        | Radio RF                            | 2.4GHz                                   |
|              | Security                            | WPA, WPA2, WPA3 , AES                    |
|              | Standards                           | 802.11 b/g/n                             |
|              | TX Power                            | 0 - 20.5dBm                              |
|              | TX Load                             | 54mA ave at 24VDC                        |
|              | Rx Load                             | 18.75mA ave at 24VDC                     |

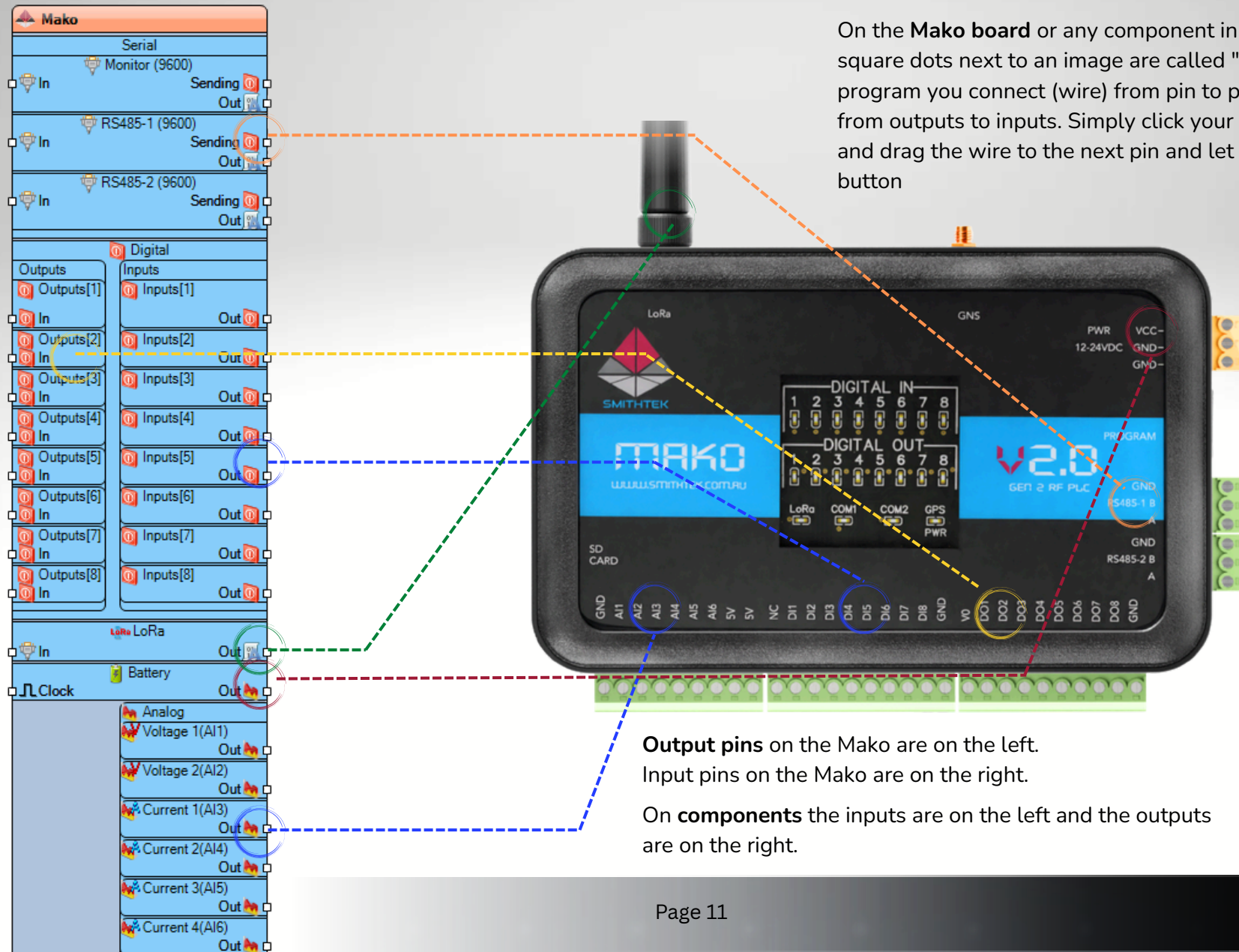
|     |                              |                                                                                            |
|-----|------------------------------|--------------------------------------------------------------------------------------------|
| IO  | Digital Input                | PNP open collector<br>>10.5VDC <b>True</b><br><6VDC <b>False</b>                           |
|     | Digital Input                | Pulse input 0.1hz to 1kHz<br>Program debounce 0 to >99999mS                                |
|     | Digital output Relay         | 3A max 150VDC                                                                              |
|     | Digital output Transistor    | Transistor NPN Max 200mA per output                                                        |
|     | 4 20mA Analog Input          | Single ended 16bit ADC                                                                     |
|     | 0-5VDC Analog Input          | Single ended 12bit ADC                                                                     |
|     | RS485-1                      | TVS protected with built in 120Ω Terminator                                                |
|     | RS485-2                      | TVS protected with built in 120Ω Terminator                                                |
| GNS | Update frequency             | 1Hz                                                                                        |
|     | Tracking channels            | 32                                                                                         |
|     | Positioning Precision        | 2.5M                                                                                       |
|     | Cold start                   | 32 seconds first fix                                                                       |
|     | Hot start                    | < 3 seconds from power-up                                                                  |
|     | System Features              | Reads up to six satellite navigation systems and implements joint positioning, navigation. |
|     | Navigation Satellite Systems | BeiDou ,GPS,GLONASS,Galileo                                                                |
|     | Latitude                     | (DD) decimal degrees -7 decimal places                                                     |
|     | Logtitude                    | (DD) decimal degrees -7 decimal places                                                     |
|     | Course                       | 0-360 degrees                                                                              |
|     | Speed                        | Feet per second                                                                            |
|     | RX load                      | 4.8mA at 24VDC , 0.115W                                                                    |



# Mako V2

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## V-NET Editor, Physical Device Terminal Mapping



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V-NET Interface

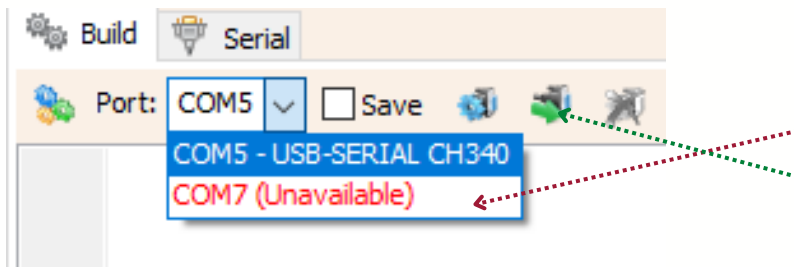


To Program the Mako you need to use the supplied USB-A to USB-A. The Mako is a USB client device.

The Mako does not need mains DC power supply in order for it to be programmed. However, some features like the battery sense and relays on the (Relay) version may not operate correctly.

To program the Mako.

- Insert the USB to the host computer and the Mako
- **Select the correct COMS port on V-NET IDE.**
- **Press the upload button.**
- Wait for a minute for it to upload.
- Repeat as many times as you wish.

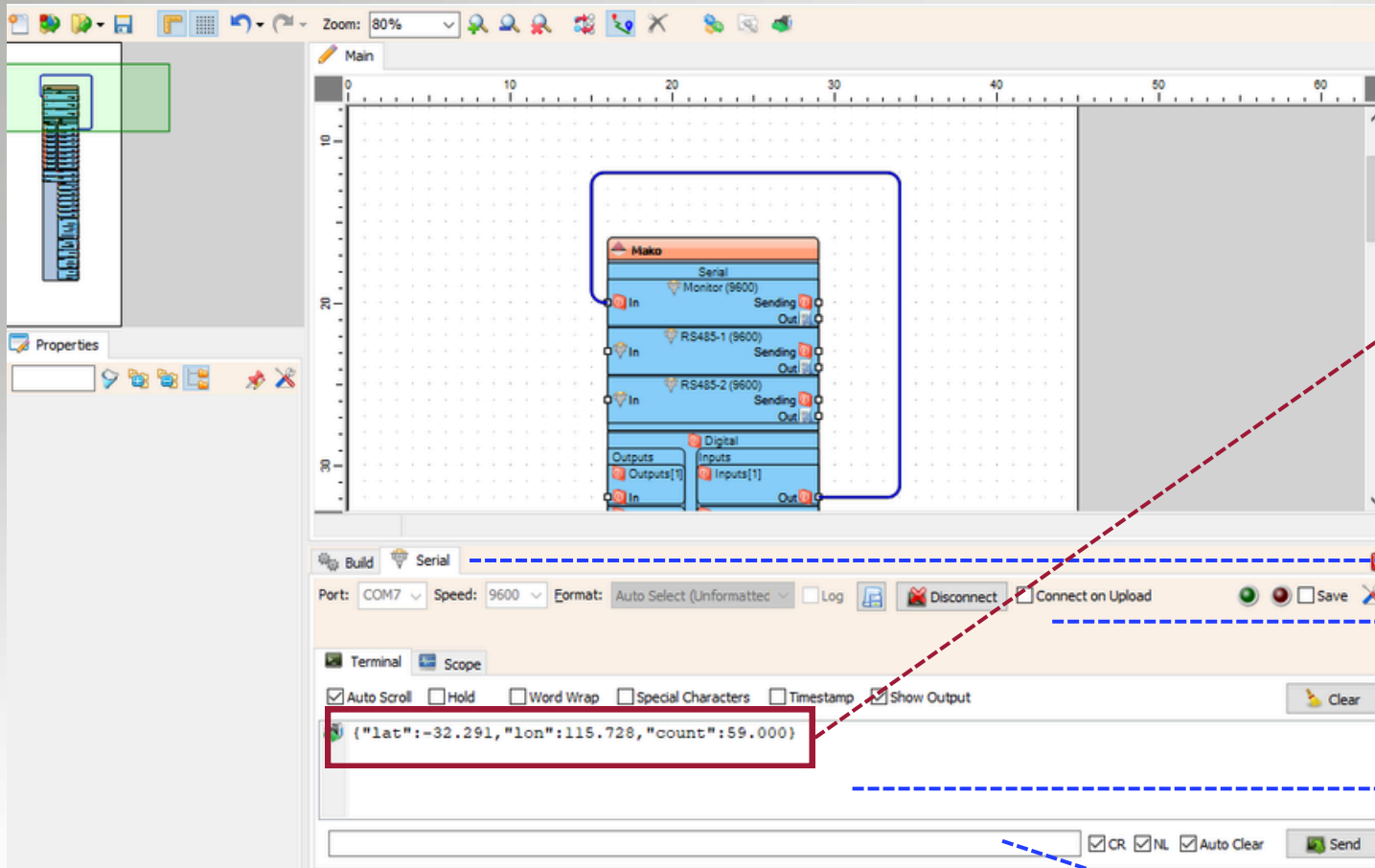




# Mako V2

Industrial Wi-Fi, LoRa RF, Modbus PLC

## V-NET Serial Monitor



The serial monitor window is showing GPS data that has been wired to the serial input pin.

Serial monitor

Connect / disconnect

Serial monitor display

Serial monitor Send

Serial monitor send commands

When programming the Mako using V-NET, there is a serial monitor feature that you can use.

It is a very powerful tool that will not only allow you to monitor your progress but give you an understanding on how each of the components work. To use the serial monitor you simply wire from any Mako pin or component pin to the serial input pin, respectively you can wire from the serial output pin to the Mako and/or components, and send serial data back from the keyboard, like text, numbers, bool ETC. The above example shows a digital input wired to the serial monitor input pin. When the digital input changes state the serial monitor window will display 'true' or 'false'.

# Mako V2

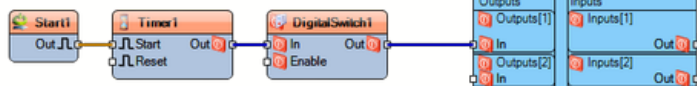
Industrial Wi-Fi, LoRa RF, Modbus PLC

## Wiring Examples - Relay Output

### Relay Output

DO1,DO2,DO3,DO4,DO5  
DO6-Not used LED Only  
DO7-Not used LED Only  
DO8-Not used LED Only

10.5-28VDC >500mA



# Mako V2

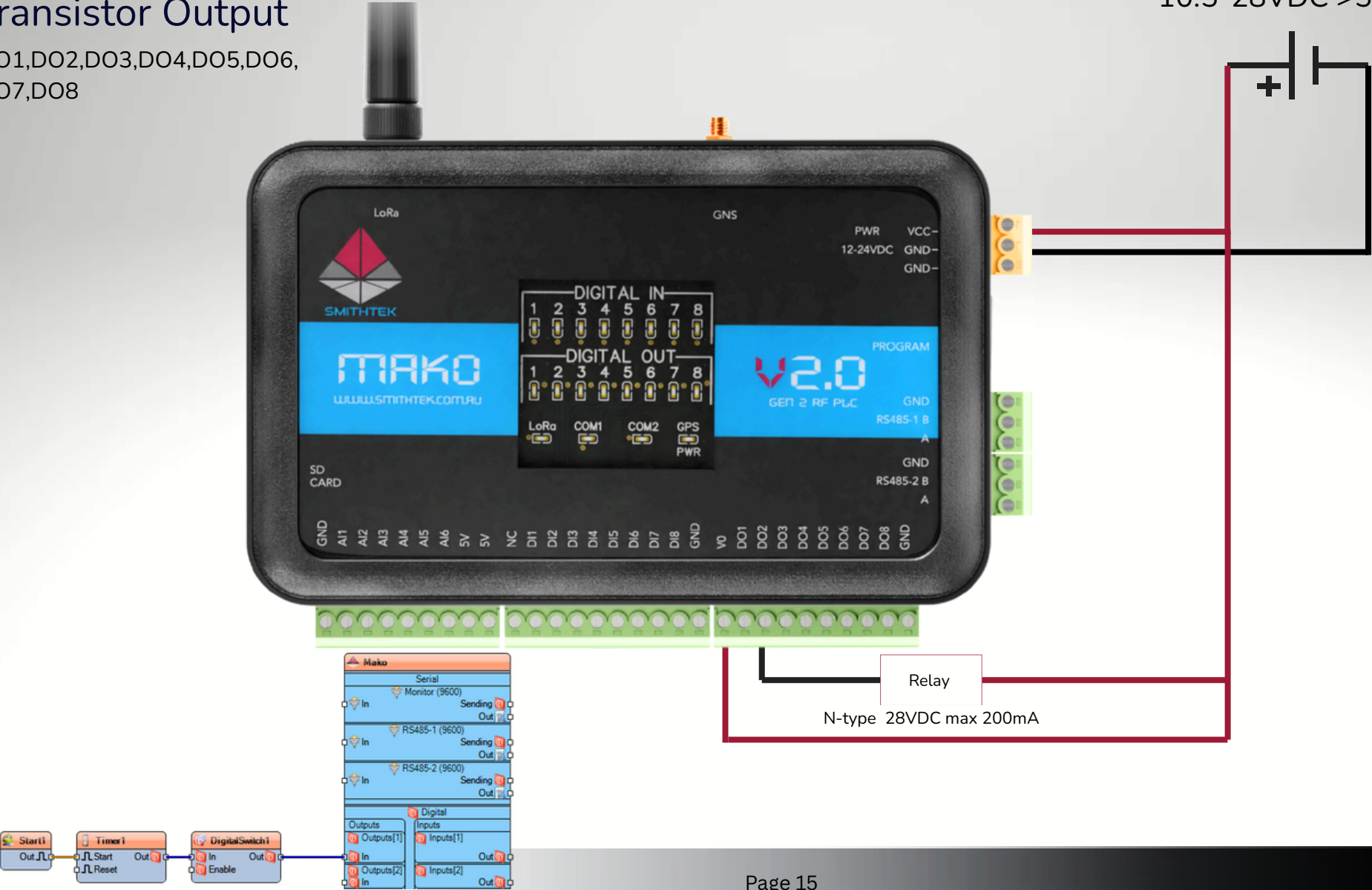
Industrial Wi-Fi, LoRa RF, Modbus PLC

Wiring Examples - Transistor Output

## Transistor Output

DO1,DO2,DO3,DO4,DO5,DO6,  
DO7,DO8

10.5-28VDC >500mA



# Mako V2

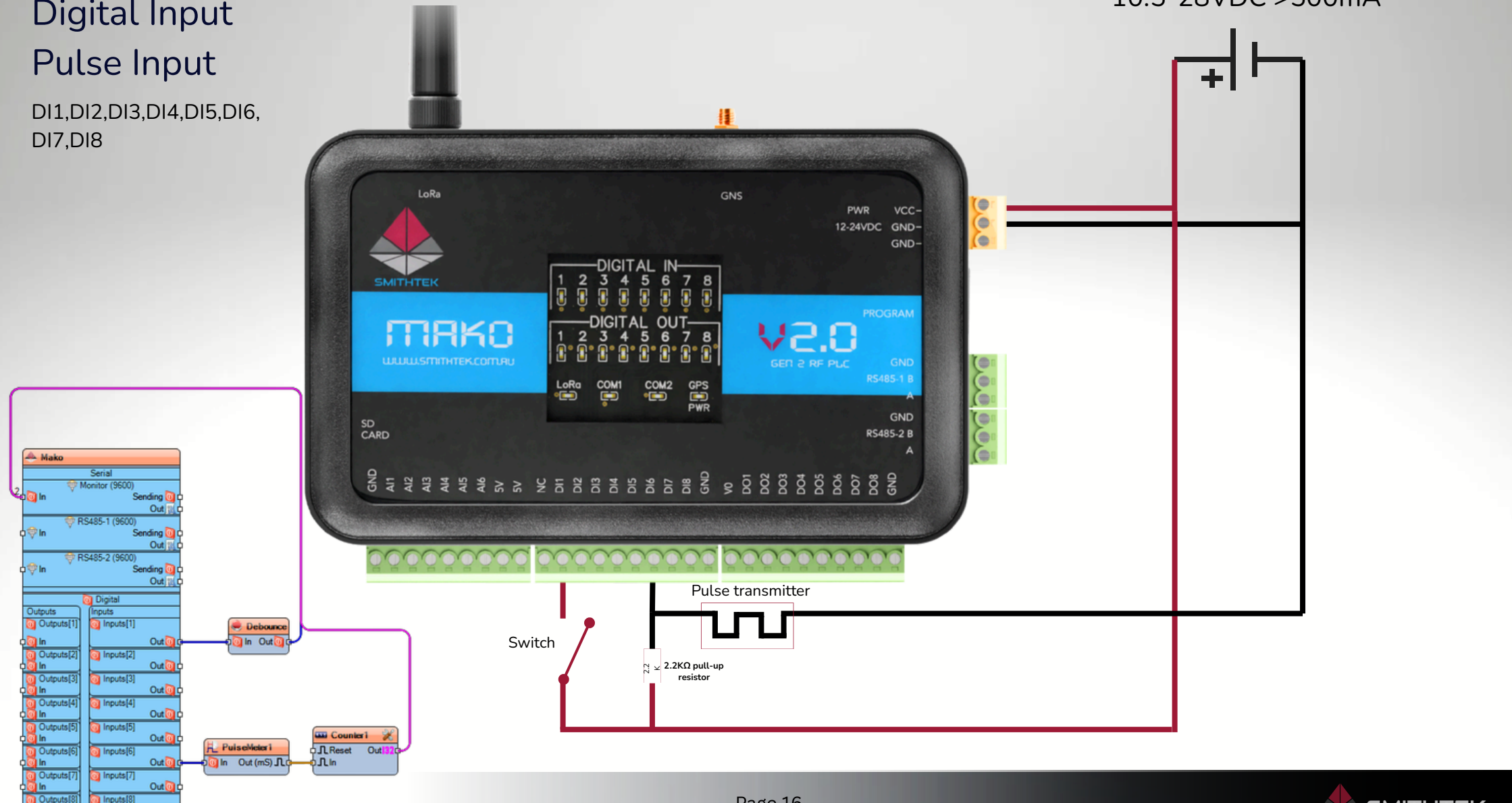
Industrial Wi-Fi, LoRa RF, Modbus PLC

## Wiring Examples Digital Input / Pulse Input

### Digital Input Pulse Input

DI1,DI2,DI3,DI4,DI5,DI6,  
DI7,DI8

10.5-28VDC >500mA





# Mako V2

Industrial Wi-Fi, LoRa RF, Modbus PLC

## Wiring Examples 4 20mA Analog Input

### 4 20mA Input

AI3,AI4,AI5,AI6

10.5-28VDC >500mA



If the power supply to the Mako is different to the sensor, make sure the ground is common on this port.

# Mako V2

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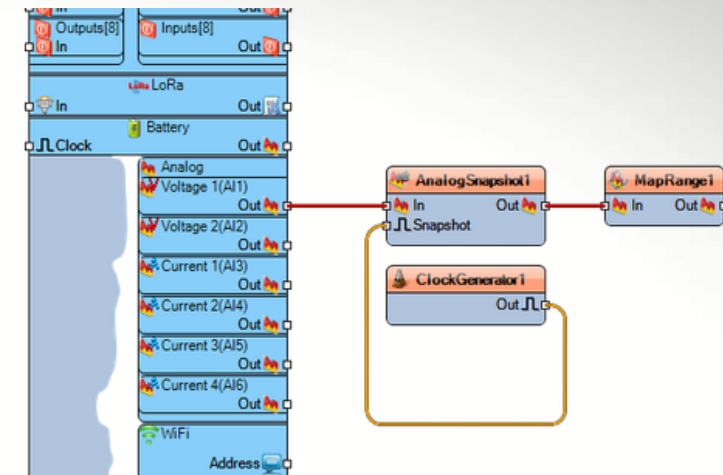
## Wiring Examples 0-5V Analog Input

### 0-5VDC Input

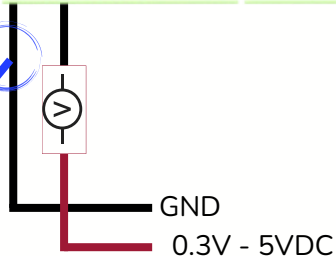
AI1 & AI2



10.5-28VDC >500mA



Optional



If the power supply to the Mako is different to the sensor make sure the ground is common on this port

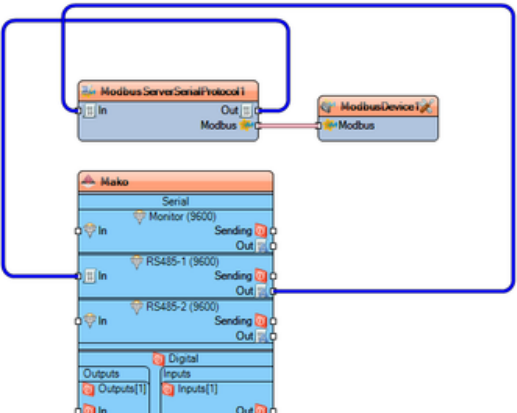
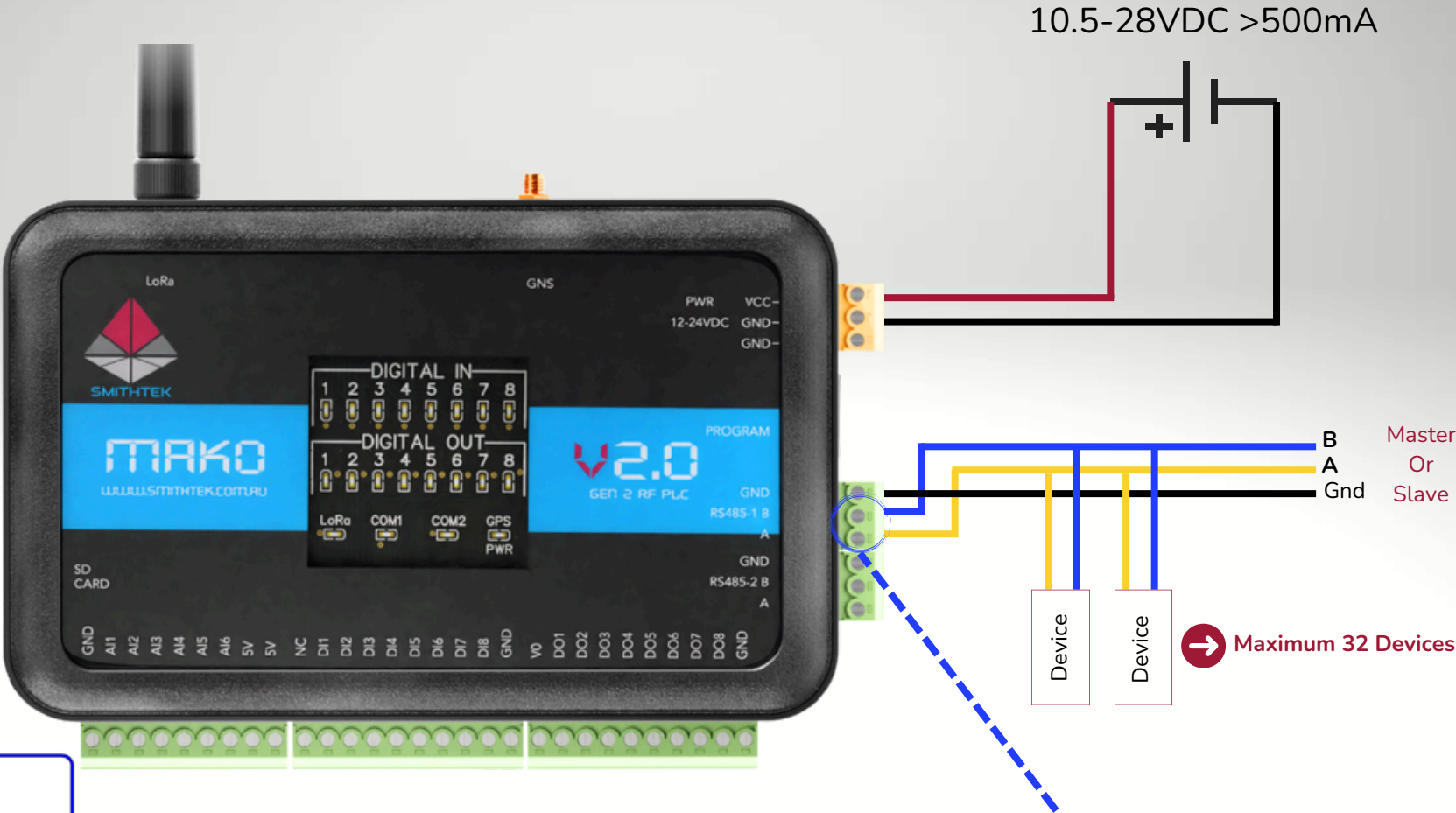
# Mako V2

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## Wiring Examples RS485 Interface

### RS485

RS485-1  
RS485-2



Both RS485 ports have built in 120Ω termination resistors. Depending on the serial protocol used both ports can act as either a **slave** or **master** device

### V-NET Programmer V8 Installation Guide

Follow these steps to install the V-NET Programmer V8 on your Windows computer.

#### System Requirements:

Before you begin the installation process, please ensure your computer meets the following minimum system requirements:

- **Operating system:** Windows 7 with SP1 (Windows 10 recommended)
- **Processor:** Intel or AMD processor with 32-bit, 64-bit support (1.2 GHz or faster recommended)
- **GPU or video memory:** 2GB
- **System memory (RAM):** 4GB
- **Free storage space:** 4 GB
- **Installation size:** 1.3GB

#### Installation Process:

1. Download the installation package from the following link: [https://www.smithtek.com.au/\\_files/archives/6ba956\\_11b6010da19048098addfea6b54d73a0.zip](https://www.smithtek.com.au/_files/archives/6ba956_11b6010da19048098addfea6b54d73a0.zip)
2. Extract the contents of the .zip file to a folder on your computer.
3. Inside the extracted folder, you will find the following files:
  - V-NET Programmer installation file (.EXE)
  - V-NET USB drivers
  - README file with installation instructions
4. Open the README file and review the installation instructions.
5. Double-click the V-NET Programmer installation file (.EXE) to start the installation process.
6. Follow the on-screen prompts to complete the installation.
7. Once the V-NET Programmer is installed, locate and install the V-NET USB drivers.
8. After installing the USB drivers, restart your computer to complete the installation process.

You have now successfully installed the V-NET Programmer V8 on your Windows computer.

**Enjoy using the software!**



# Mako V2

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## V-NET Configuration Software Design Area

The screenshot shows the V-Net Programmer 8.0.0.84 software interface. The interface is divided into several main sections:

- Program Tools:** Located at the top, containing a menu bar (File, Project, Edit, Search, View, Help) and a toolbar with various icons for file operations, editing, and viewing. A zoom level of 90% is displayed.
- Design Map:** Located on the left side, showing a vertical representation of the project structure. It includes a 'Mako' board icon and a list of components like Serial Monitor, RS485-1, RS485-2, Digital Inputs/Outputs, LoRa, Battery, Analog, and WiFi.
- Mako & Components Properties:** Located below the Design Map, showing a list of properties for the selected component (Mako Device). Properties include Analog (6 Items), Battery (Enabled=True), Digital (Outputs=8 Items), EEPROM (Elements=0 Items), GPS (BaseYear=2000), LoRa (Bandwidth=125, Elements=0 Items), Micro SD (Operations=0 Items), Processor (3 Items), Serial (AccessPoint=Ch...), and WiFi (AccessPoint=Ch...).
- Design Area:** The central workspace where the program is built. It shows a vertical stack of components connected by lines. Components include Serial Monitor, RS485-1, RS485-2, Digital Inputs/Outputs, LoRa, Battery, Analog, and WiFi. The components are connected in a way that suggests a data flow or signal path.
- Components:** Located on the right side, showing a list of available components. The list includes Gates, Input/Output, Digital, Date/Time, Unsigned, Flip-Flops, Modbus, Quaternion, Memory, Integer, Generators, Binary, Data Sources, Communication, AutoText, Analog, Converters, Data Sinks, Complex, Math, Measurement, Synchronization, and Filters. The list is scrollable, and a scroll bar is visible on the right.
- Compile and Monitor:** Located at the bottom, containing buttons for 'Build' and 'Serial'.

Annotations with red arrows point to specific features:

- Change list appearance:** Points to the 'Change list appearance' icon in the Components panel toolbar.
- Auto hide list:** Points to the 'Auto hide list' icon in the Components panel toolbar.
- Expand all:** Points to the 'Expand all' icon in the Components panel toolbar.
- Collapse search:** Points to the 'Collapse search' icon in the Components panel toolbar.
- Search Component:** Points to the search bar in the Components panel.
- Scroll Bar:** Points to the vertical scroll bar in the Components panel.
- Open program compile and serial scope windows:** Points to the 'Build' and 'Serial' buttons in the Compile and Monitor section.

### Program Tools

This is the basic tools  
Save files, load files ,  
create subflows

### Design Map

The design map allows  
you too see the whole  
project area

### Compile and Monitor

Tools for compiling your program,  
Using the serial monitor debug tool  
Or the serial monitor scope tool. **USB**  
port for uploading is chosen in this section

### Components

This is the library of instruction sets to build  
your program. **They drag and drop into the**  
**design area, or you can click once on the**  
**component, then click again in the design area**

### Mako & Components Properties

The Mako board properties can be edited in this section.  
Wi-Fi settings, LoRa settings, Analog settings, EEPROM settings, SD  
card setting and more. The same area also allows you to edit the  
properties for every component used in the program. **just click once**  
**and it will display the properties**

# Mako V2

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## V-NET Configuration Software Data Types

### V-NET supports the following data types.

- **Digital:** (bool) Represents true or false values, typically used for decision-making or conditional operations.
- **Analog:** (Floating point) on some components there are options to change byte order from LSB to MSB
- **Integer:** 8,16,32,64 bit represents whole numbers, either positive or negative. Integers do not store decimal values.
- **Unsigned:** 8,16,32,64 bit (positive number)
- **Text:** (String) A sequence of characters, representing text or other human-readable data.
- **Binary:** Represents data in the binary format, which is a sequence of bits (0s and 1s).  
Binary data types are often used for low-level operations, such as bit-wise manipulation or communication with hardware devices.
- **Quaternion**
- **Clock:** Pulse signal
- **Char:** Represents a single character or symbol, such as a letter, number, or punctuation mark.
- **Complex:**
- **Array:** A collection of elements, all of the same data type, stored in a contiguous block of memory.  
Arrays can be used to store multiple values of the same type in a single variable.
- **Date/Time:** Represents date and time values, allowing for the storage and manipulation of calendar dates and times.  
Date and time formats can be represented in various ways, such as Unix timestamps  
(the number of seconds since January 1, 1970), or more human-readable formats like "YYYY-MM-DD HH:MM:SS."

Each data type has a unique symbol next to the wiring (PIN) captured in the image below



The screenshot shows a wiring diagram on the left and a data type list on the right. The wiring diagram includes components like Digital, Serial, Clock, LoRa, Battery, Analog (Voltage and Current), WiFi, and Char. The data type list is a scrollable menu with various options, each accompanied by a unique symbol. A red dotted box highlights the data type list, and a red arrow points from the text above to it. A red dotted line also connects the 'Integer' data type in the list to the 'Integer' data type in the text above.

Data types can be interchanged or converted in the program. If you can convert the data the program will allow you to wire between the pins

Most data types can trigger the clock pins.  
This is useful for triggering events whilst reading sensor input data at the same time.

# Mako V2

Industrial Wi-Fi, LoRa RF, Modbus PLC

## V-NET Configuration Software Sink Pins

### Sink Pins (Set-Points)

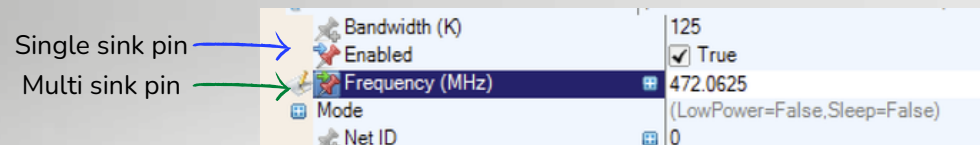
V-NET has a feature that allows you to dynamically change values within your code by the means of sink pins, AKA set-points.

If a component supports sink pins you will identify this by the thumb tac at the side of the pin. click on this tac and you will have options.

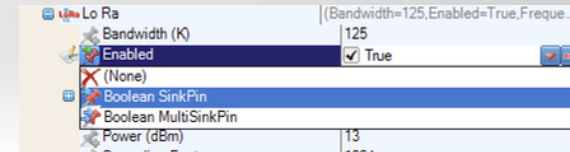
**None, Sink Pin, Multi Sink Pin.** the options will be prefixed with the data type, so the example below shows for a digital sink pin (Boolean)

The **single sink pin** has a **blue arrow** associated with its symbol, the **multi sink pin** has a **green arrow**

Sink Pin Types



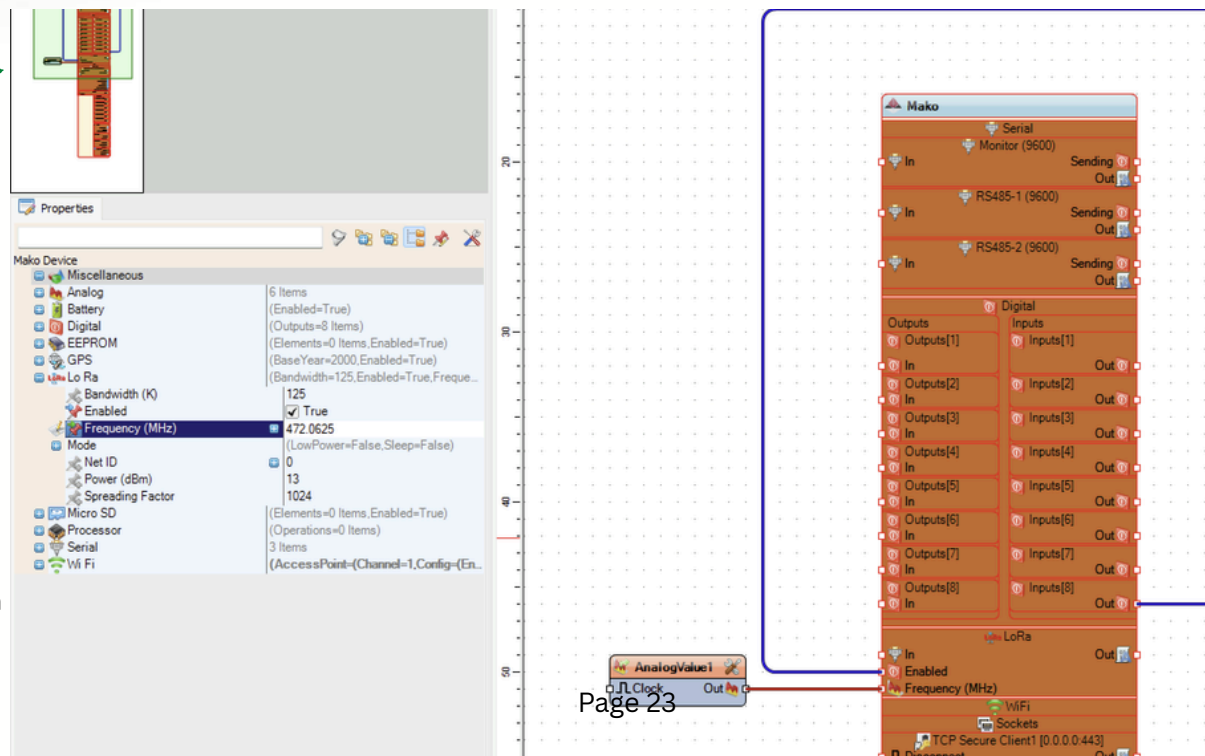
Sink Pin Options



### Example

On the example to the right, we are wiring digital input 8 to turn on /off the LoRa module by means of its enable sink pin. We are also injecting a simulated analog value to the 'Frequency' band sink pin of the LoRa RF module.

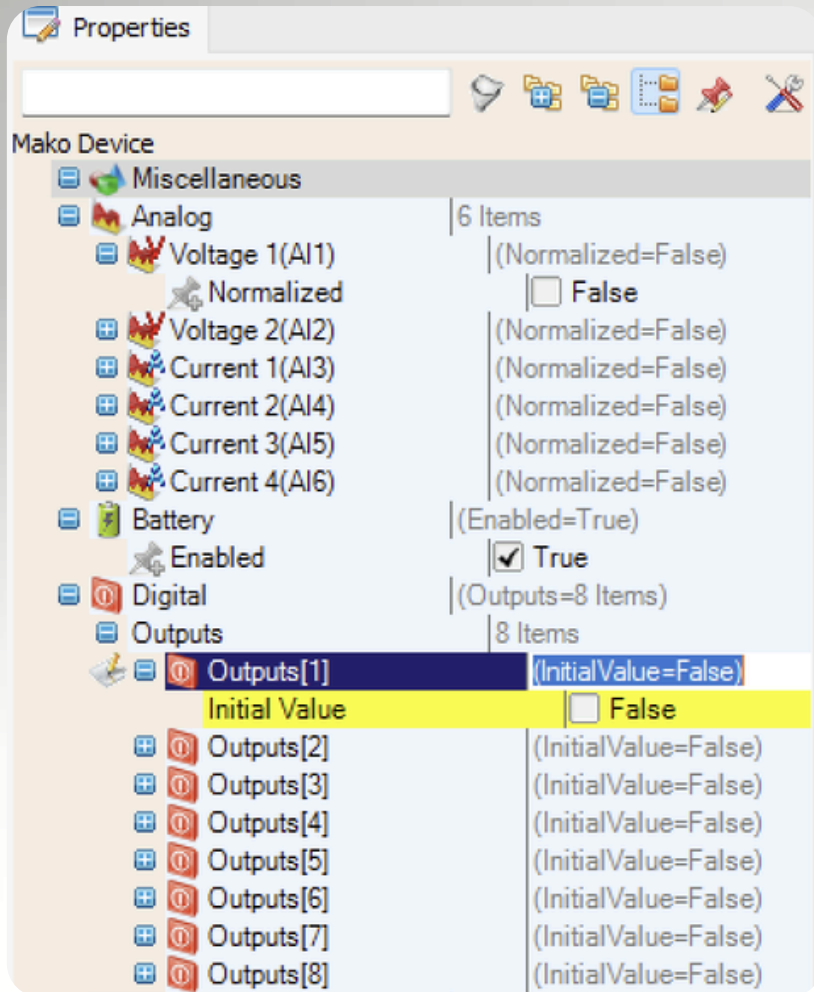
This example shows how we can dynamically change the RF frequency and turn on/off LoRa module dynamically. Sink pins are very useful for automation processes where the operators is required to update settings without having to re-program the PLC.



# Mako V2

Industrial Wi-Fi, LoRa RF, Modbus PLC

## Mako Properties Analog, Battery, Digital Outputs



### Analog 4 20mA inputs

**Normalised:** Selecting false on this will produce a 4 20mA value on the analog pins. Selecting true on this will output a 4 20mA output scaled between 0-1 value 1 being the maximum 20mA, 0 being 4mA.

**NOTE:** The default value AI1,2,3,4 will output is 4.0000 to 20.0000, this is designed to mirror the actual current level of your sensors. The user can map this value using a 'Map Range Analog'

### Battery

**Enabled:** Turn on the feature to read the Mako device VCC DC input supply.

It will output a typical voltage between the range of 12VDC to 24VDC, depending on your application. The optimal voltage measuring range is 9VDC to 28VDC.

If the Mako device is only powered by the USB programming lead, the battery will output a voltage 0.6VDC. This is an internal reference voltage indicating the USB only is connected.

### Digital outputs

**Initial Value:** You can select if the digital output initialises (starts) with a **true value** or **false value**



# Mako V2

Industrial Wi-Fi, LoRa RF, Modbus PLC

## Mako Properties -EEPROM

### \*\*WARNING\*\*

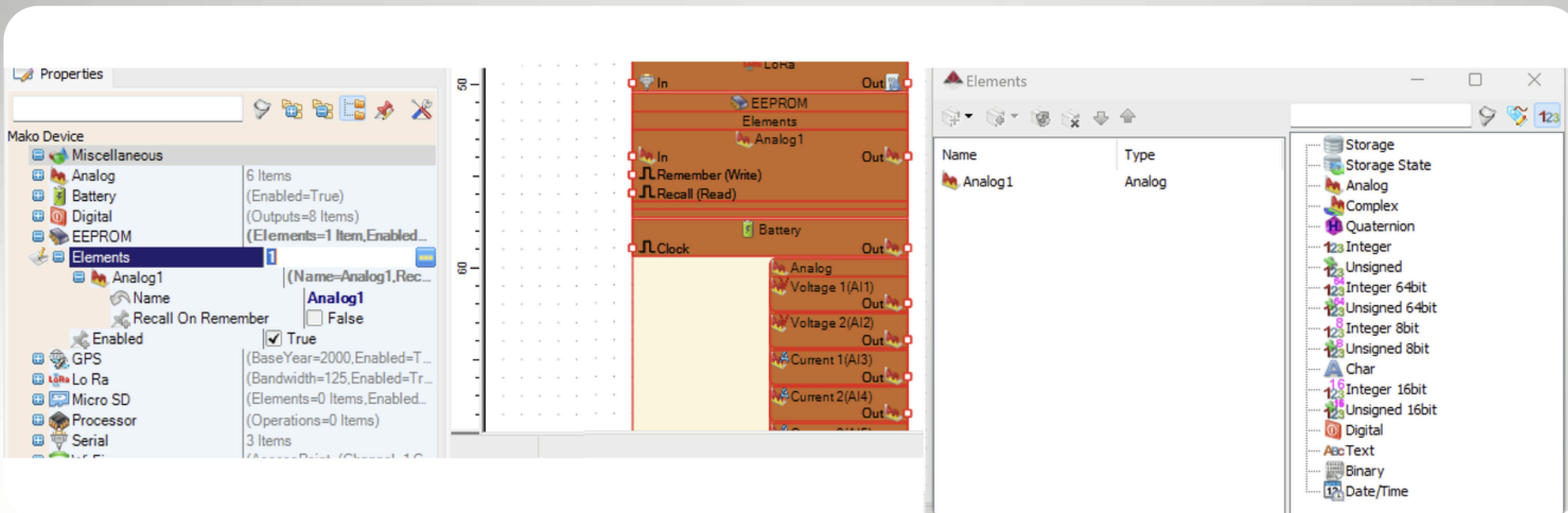
'The EEPROM maximum storage capacity is 512kb.'

'The maximum write cycles is 100K per life of the product'

### EEPROM

**Elements:** Open elements and add EEPROM data types. When added to the EEPROM elements table (below picture) the Mako board will change its shape and new pins will show. A new input pin in the selected data type, a new output pin with the same data type. Remember pin for (writing to EEPROM) recall pin for reading

**Recall on remember:** If you clock the remember pin it will automatically recall the stored data.



When data is connected to the **EEPROM** data pin, as shown in the example where it's an analog pin, the data continuously flows into the pin. As soon as the **"remember"** pin is triggered, the data present at that moment will be saved. For storing multiple data points, you can use a text element as storage and connect a JSON object to it. This approach allows you to store and retrieve batches of sensor data or set-point data simultaneously.

# Mako V2

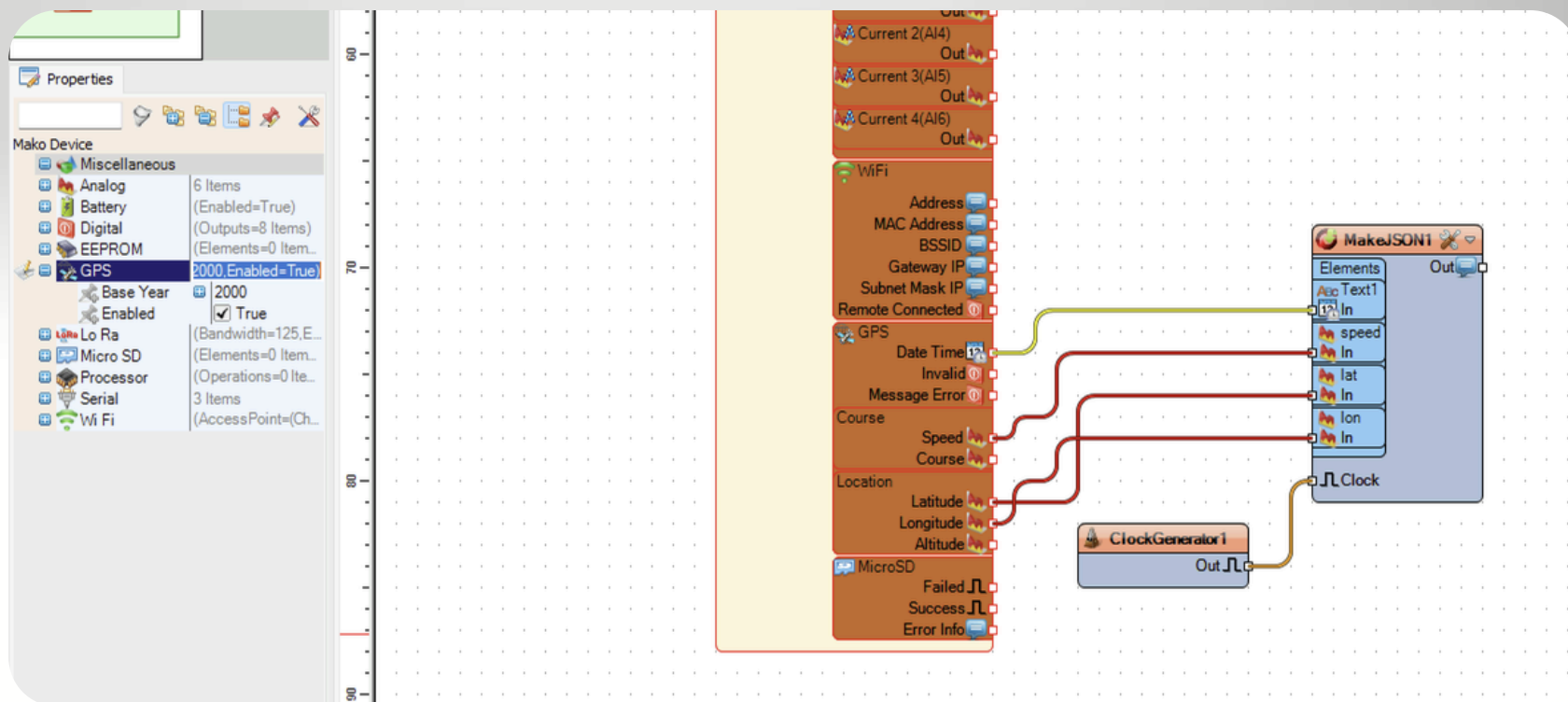
Industrial Wi-Fi, LoRa RF, Modbus PLC

## Mako Properties - GNS

### GNS

**Base Year:** Sets the base year of your GNS NMEA date/time output

**Enabled:** Turns the GNS data feed on/off



The GNS update is 1hz, (every second) the bottom right hand side of the Mako board has the GNS data pins, coordinates, speed, course, date/time. Each of these pins will output data at the 1hz at the same time. A useful way to use the GNS is to feed the data to a json object for further use in your program or you can wire each GNS pin directly to Modbus.

# Mako V2

Industrial Wi-Fi, LoRa RF, Modbus PLC

## Mako Properties - LoRa RF Introduction

### LoRa RF

The **Mako V2**, a versatile and powerful device equipped with the cutting-edge LoRa SX1276 module. This module enables long-range, low-power wireless communication, making it perfect for a wide range of IoT applications, including smart agriculture, smart city infrastructure, and industrial monitoring. Before you begin using your Mako V2, **it is essential to familiarise yourself with the local RF rules and regulations. Ensuring that your module adheres to these guidelines will help prevent any legal issues and potential interference with other wireless devices operating in your area.**

**To get started** with your Mako V2 and its LoRa SX1276 module, follow these simple steps:

1. Carefully read the device's documentation, paying close attention to the technical specifications and wiring instructions.
2. Properly connect the antenna and ensure that it is compatible with the communication system's frequency. The antenna plays a crucial role in the communication system, and selecting the right one is vital for optimal performance.
3. Configure the LoRa RF module to match your desired communication settings, such as the frequency band, spreading factor, and output power.
4. Test the communication range and signal quality between your Mako V2 and other LoRa devices, making any necessary adjustments to ensure reliable and efficient data transmission.

By following these guidelines and adhering to local RF rules and regulations, you'll be well on your way to harnessing the full potential of your Mako V2 and its RF. Enjoy exploring the many possibilities this powerful combination offers for your IoT projects!

#### **Constructing a Network (one point to multi-point):**

The RF1276 is a semi-duplex module capable of supporting point-to-point or one point to multi-point communication. In the one point to multi-point mode, you need to designate one module as the master and the others as slave modules. Each module must have a unique ID. The master module controls the communication coordination by sending data or commands with ID information. All slave modules receive the data packets and compare the received ID with their own. If there's a match, the module processes the data packet, otherwise discards it. To prevent interference, only one module should transmit data when the network is in operation. The RF1276 allows you to set multiple different frequencies, enabling several networks to function simultaneously in the same area. When setting up your network, keep in mind the following considerations due to the complexities of wireless communication and inherent characteristics of airborne data transfers.

# Mako V2

Industrial Wi-Fi, LoRa RF, Modbus PLC

## Mako Properties - LoRa RF Properties

### LoRa RF

**Bandwidth:** The RF bandwidth

**Enabled:** Turns the LoRa on/off

**Frequency:** Sets the communication frequency

**Mode:**

**Low Power:** LP mode for power saving

**Sleep:** Sets the LoRa to sleep

**Net ID:** Sets your unique communication ID key 0 to 256.

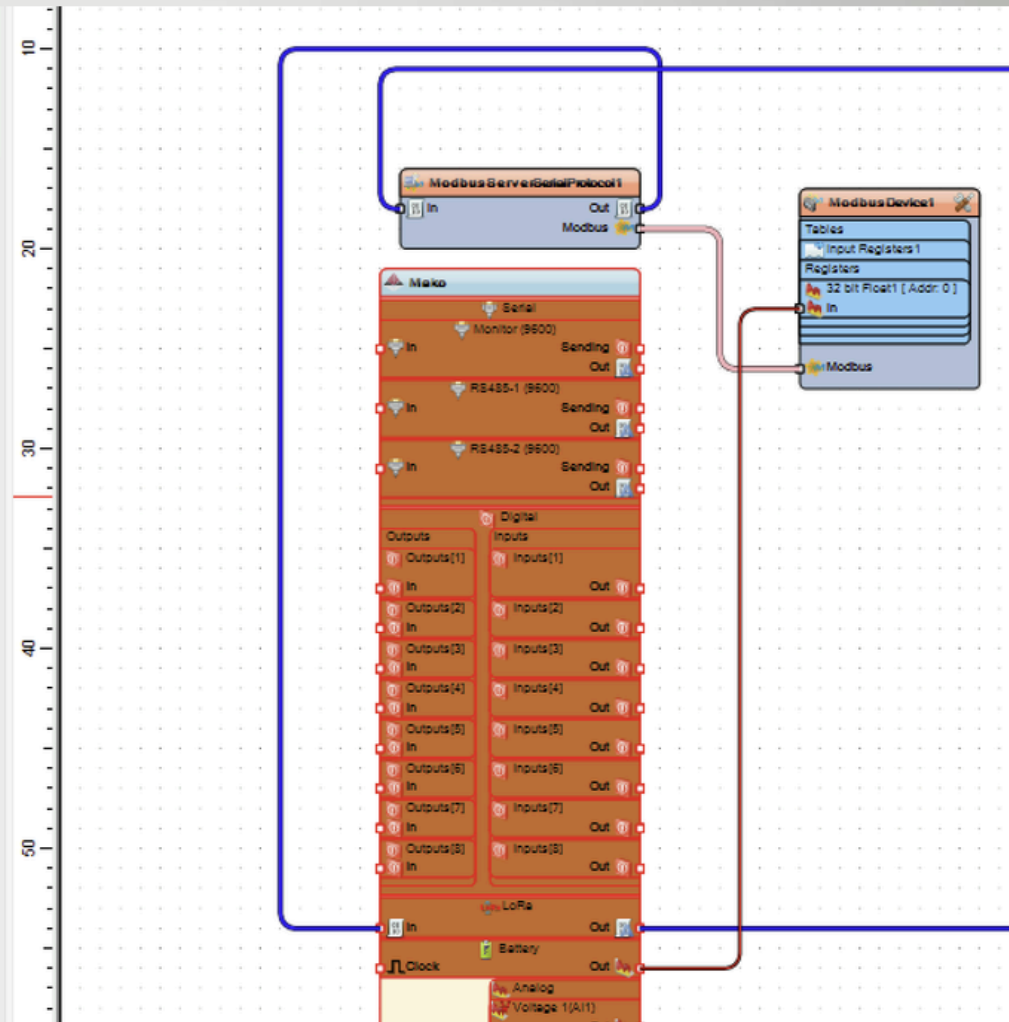
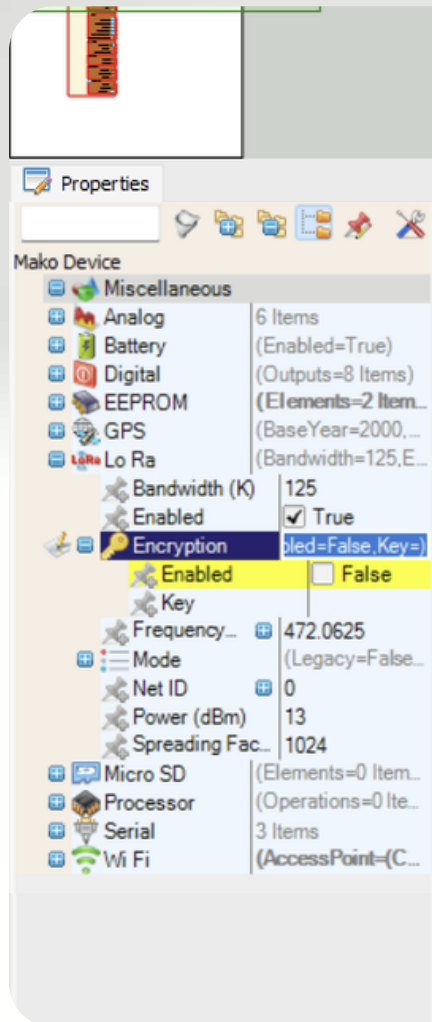
**Power:** Sets the RF output power

**Spreading Factor:** Sets the air data rate.

**Encryption Enabled :** Turns on 128AES message layer encryption.

**Key :** This is your encryption key, make sure it is at least 8 characters long. They key must match on all devices on your network, including the PassPort and Solaris products.

When sending data over the air, attention to these settings is important to ensure communications is tuned to be reliable and efficient. The Spreading factor is important. The lower the spreading factor the longer range you can send data packets.





## Data Transmitting Table

The table below outlines various parameters for the RF1276 module, including the RF\_Factor (Chips), RF\_BW (kHz), equivalent air data rate (Kbps), and sensitivity (dBm). The default setting is highlighted for your reference:

| RF_Factor (Chips) | RF_BW (kHz) | Equivalent Air Data Rate (Kbps) | Sensitivity (dBm) |
|-------------------|-------------|---------------------------------|-------------------|
| 128               | 125         | 5.47                            | -123              |
| 256               | 125         | 3.125                           | -126              |
| 512               | 125         | 1.758                           | -129              |
| 1024              | 125         | 0.977                           | -132              |
| 2048 (Default)    | 125         | 0.537                           | -135              |
| 4096              | 125         | 0.293                           | -138              |

This table provides a useful reference for understanding the trade-offs between various settings, such as higher data rates and lower sensitivity or vice versa. By selecting the appropriate configuration, you can optimise your network's performance based on your specific requirements and use case.

### LoRa RF

Here's a brief explanation of each column:

- RF\_Factor (Chips):** This is the spreading factor of the LoRa modulation, which affects the data rate and sensitivity. Higher RF\_Factors result in a lower data rate but better sensitivity and range.
- RF\_BW (kHz):** This is the bandwidth of the LoRa signal. In this table, all settings use a **bandwidth of 125 kHz**.
- Equivalent Air Data Rate (Kbps):** This is the effective data rate that can be achieved with the given RF\_Factor and RF\_BW. Higher data rates allow for faster data transmission but may have reduced range and sensitivity.
- Sensitivity (dBm):** This is the sensitivity of the receiver for the given configuration. Higher sensitivity values indicate a better ability to receive weak signals, which can increase the range.
- Best for Long Range:** This column indicates the best configuration for achieving long-range communication. In this case, an RF\_Factor of 4096 is optimal.
- Best for Large Data:** This column indicates the best configuration for transmitting large amounts of data quickly. In this case, an RF\_Factor of 128 is optimal.
- Time for 256-byte Packet (ms):** This column shows the approximate time it takes to send a 256-byte data packet using each configuration. The times are calculated based on the air data rate and do not account for protocol overhead or other factors that could affect the actual transmission time. These values give a rough idea of how different settings impact the time it takes to send a fixed-size packet.

*\*Recommended settings in the 125kHz bandwidth\**

| RF_Factor (Chips) | RF_BW (kHz) | Equivalent Air Data Rate (Kbps) | Sensitivity (dBm) | Best for Long Range | Best for Large Data | Time for 256-byte Packet (ms) |
|-------------------|-------------|---------------------------------|-------------------|---------------------|---------------------|-------------------------------|
| 128               | 125         | 5.47                            | -123              |                     | ✓                   | 37.5                          |
| 256               | 125         | 3.125                           | -126              |                     |                     | 65.5                          |
| 512               | 125         | 1.758                           | -129              |                     |                     | 116.5                         |
| 1024              | 125         | 0.977                           | -132              |                     |                     | 209.7                         |
| 2048 (Default)    | 125         | 0.537                           | -135              |                     |                     | 381.0                         |
| 4096              | 125         | 0.293                           | -138              | ✓                   |                     | 697.2                         |

The table provides an overview of different LoRa configurations with their respective RF\_Factor, RF\_BW, equivalent air data rate, and sensitivity.

It also highlights the best settings for long-range communication and large data transmission.

Lastly, it shows the approximate time it takes to send a 256-byte data packet for each configuration.

# Mako V2

Industrial Wi-Fi, LoRa RF, Modbus PLC

## Mako Properties - SD Card

### **\*\*WARNING\*\***

'Always power off the Mako during insert and eject of the SD card'

'Not doing so may result in corrupt data or damage to the SD card'

### SD CARD

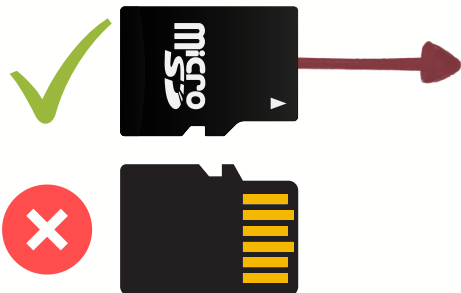
The Mako V2 is equipped with a microSD card slot on the left-hand side, which supports up to 32GB of storage. This feature allows you to expand the PLC's memory capacity for data logging, program storage, or other purposes.

To make use of this feature, follow these steps:

1. Purchase a compatible microSD card with a capacity of up to 32GB.
2. Power off the Mako V2 PLC to ensure safe handling and prevent any damage to the device or the microSD card.
3. Locate the microSD card slot on the left-hand side of the Mako V2 PLC. You will find a small slot, which may be labeled as 'microSD' or 'SD.'
4. Insert the microSD card into the slot, making sure to align it with the slot's shape and orientation. Gently push the card until it clicks into place.
5. Power on the Mako V2 PLC, and follow the manufacturer's instructions for configuring the device to use the microSD card for your desired purpose (e.g., data logging, program storage).

By using a 32GB microSD card with your Mako V2 PLC, you'll have ample storage space to handle various applications and store essential data, enabling you to take full advantage of your PLC's capabilities.

When inserting the SD card, make sure the connection pads on the SD card are facing down and the card artwork is facing up.



# Mako V2

Industrial Wi-Fi, LoRa RF, Modbus PLC

## Mako Properties - SD Card

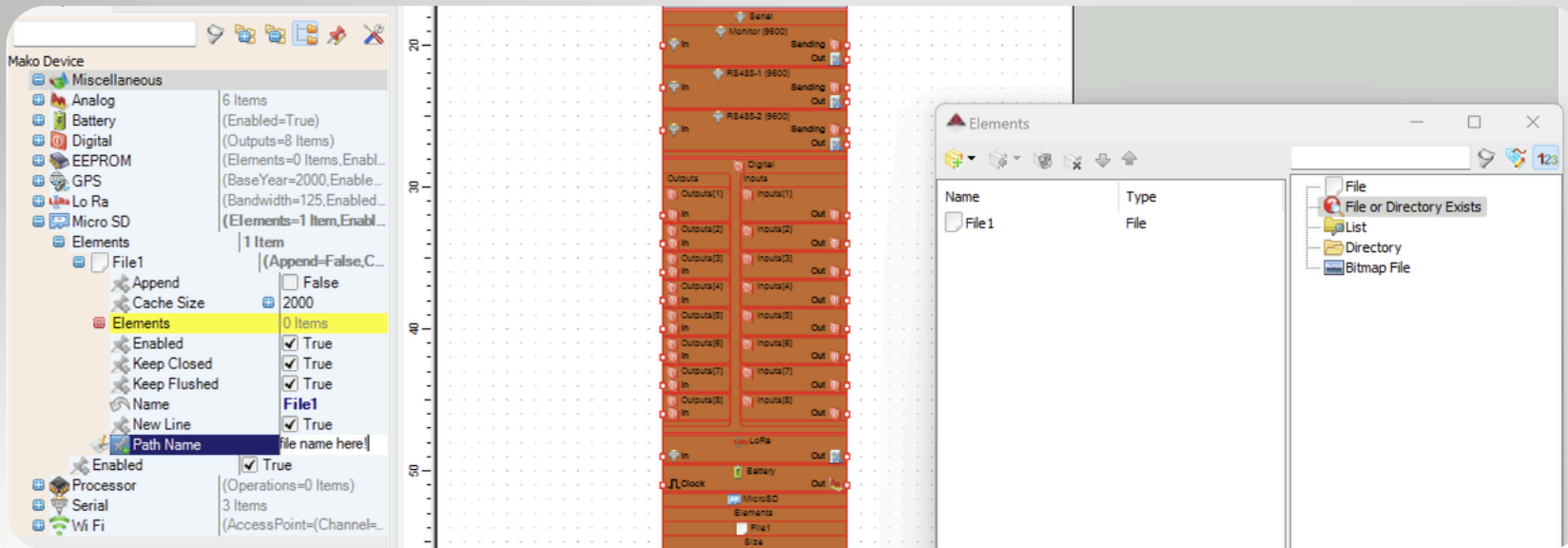
### SD CARD

**Elements:** Add a SD card function. For a simple data logging file or storage file insert a text element.

**Append:** Turn on to write new lines after the last or turn off to overwrite the file every time. For data logging you would turn on 'true'.

**Enabled:** Turns the SD card on /off.

**Cache Size:** Size in bytes you can cache before writing to SD card. *The flush pin will clear the cache if clocked.*



### Default Settings

**Keep Closed:** Keeps the write session closed, continuous operation.

**keep Flushed:** Automatically flushes the cache when full and after transfer to SD card.

**Name:** This is the name for your **element**. It is **not** the file name!

**New Line:** Automatically starts the new line for the next write session.

**Path Name:** this is the filename, pathname and file type. For example: MyNewFile.txt, or /mylocation/MyNewFile.txt, or CSV.

*If you use a file edtension like .CSV, you must ensure your data is stored in .CSV format, or the file will not read properly.*



# Mako V2

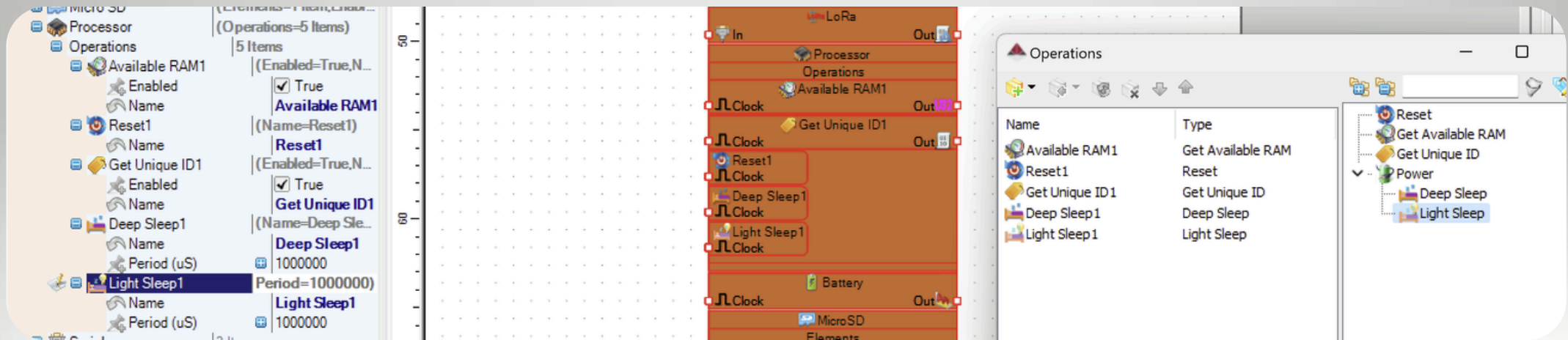
Industrial Wi-Fi, LoRa RF, Modbus PLC

## Mako Properties - Processor

### Processor:

**Operations:** Select processor operations. See the image below for available operations.

**Enabled:** Turns the processor functions on/off



### Operations

**Reset:** This will add a reset pin to the Mako board. clock this pin to reset the device at any time during its operation.

This is useful for watchdog processes.

**Get Available RAM:** A new 32uid pin will appear on the Mako board, wire this pin to serial or other components to utilise your Mako available RAM for logic.

**Get Unique ID:** A new binary pin will appear on the Mako board, wire this pin to the serial or other components to utilise your ID.

**Deep Sleep:** Clock the deep sleep pin and the Mako processor will sleep for a period you set in microseconds uS.

**Light Sleep:** Clock the light sleep pin and the Mako processor will sleep for a period you set in microseconds uS.

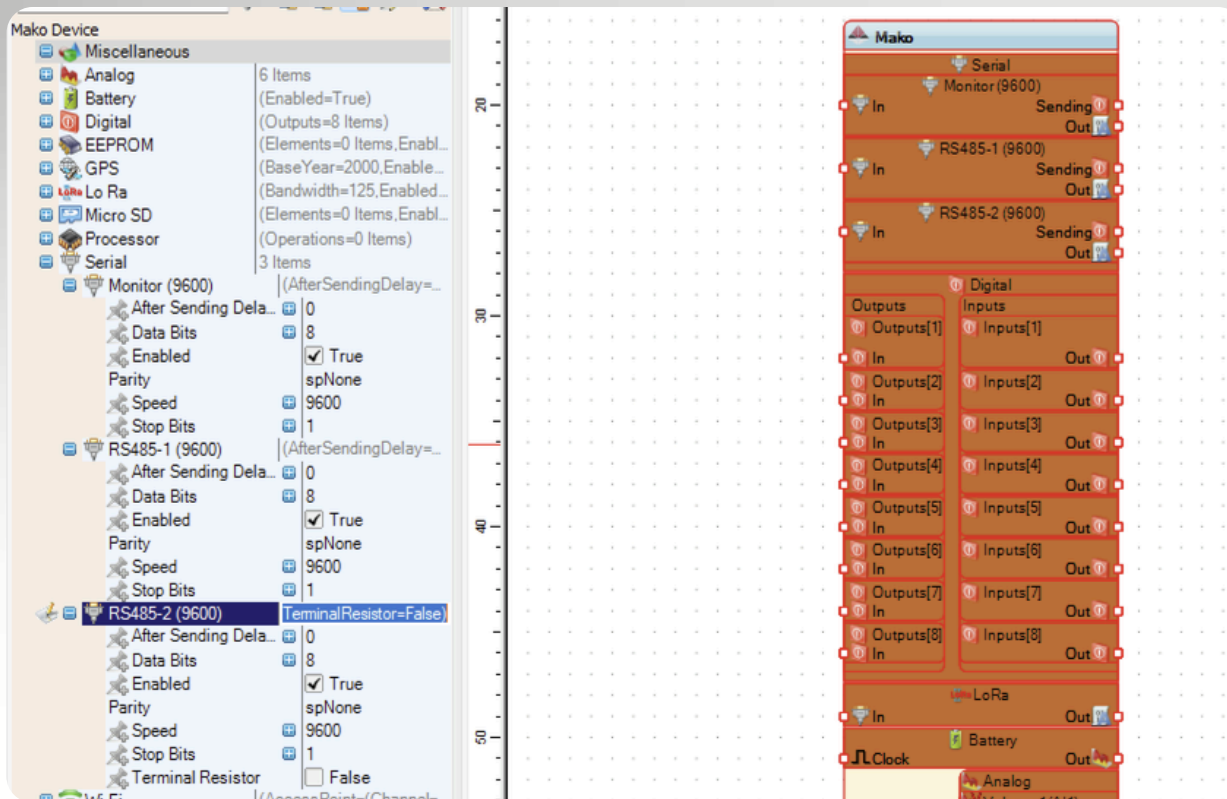
# Mako V2

Industrial Wi-Fi, LoRa RF, Modbus PLC

## Mako Properties - Serial Port

### Serial Ports:

The Mako has 3 serial ports at the top of the board in the V-NET software. The first '**Serial Monitor**' is the USB interface between your host programming device (computer) and your Mako device. It is also the serial channel you would use to directly wire components to or Mako IO for instant data viewing. The serial port is useful for debugging or testing components during program development, the 2 x RS485 sections connect to the physical RS485 on the right hand side of the Mako.



### Serial Properties:

**After Sending Delay:** Sets a delay before the Mako will send another packet. Delay time is in microseconds uS.

**Data Bits:** Sets the serial data bits.

**Enabled:** Turns the serial on/off.

**Parity:** Configures your serial connection parity.

**Speed:** Your baud rate speed, default 9600.

**Stop Bits:** Select your stop bit for the data end transmission.

# Mako V2

Industrial Wi-Fi, LoRa RF, Modbus PLC

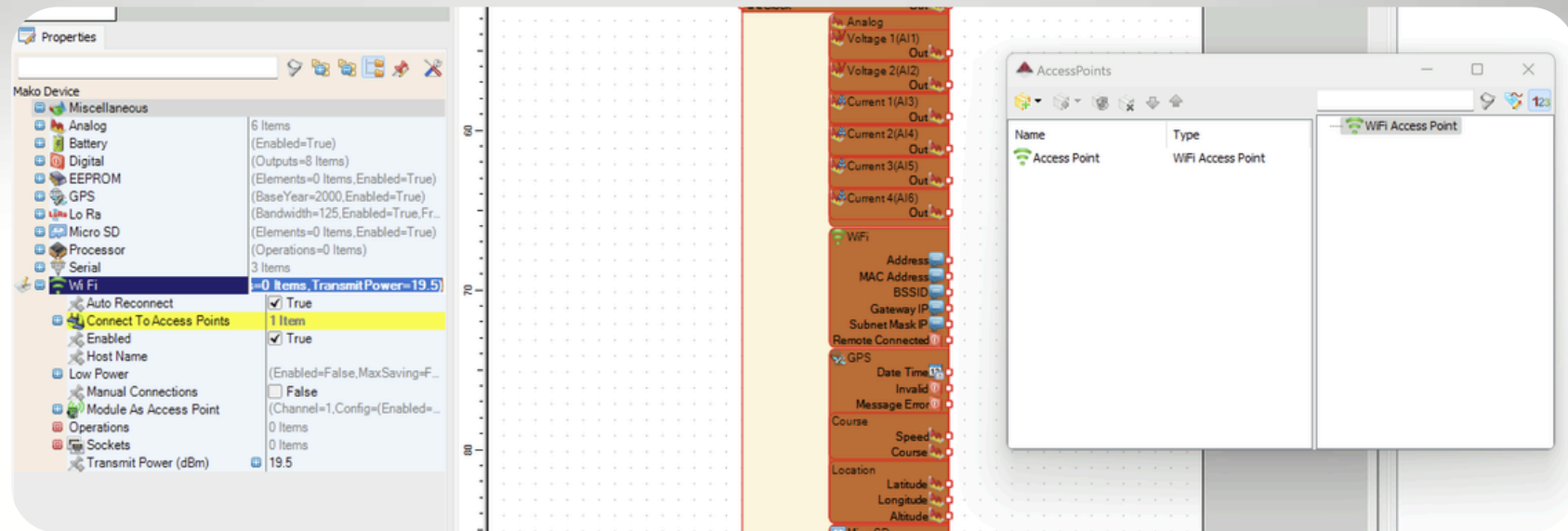
## V-NET Configuration Wi-Fi - Introduction

### Wi-Fi - Introduction

The Mako has a powerful embedded Wi-Fi chip that allows it to transform into an IoT device or an advanced IP PLC. It supports many features, some outlined on [page 9](#). The Mako can be a client or host device, it can connect to other Wi-Fi hot-spots, or it can become a Wi-Fi hot-spot. This is ideal for custom TCP, [UDP](#) protocols. The Wi-Fi range is up to 25 meters, longer with boosted LAN networks. V-NET allows for multiple Wi-Fi connections at the same time. When a Wi-Fi connection is configured, it is then possible to configure sockets, TCP, UDP, these will ultimately give you access to things like Modbus TCP, Mqtt, HTTP.

It supports network features such as:

- Configuring gateway IP
- Configuring static IP
- Configuring subnet mask
- Custom MAC address
- Configuring DNS1 & DNS2
- Configuring Wi-Fi channel



### Setting Up:

Under the Wi-Fi properties tab in the properties window, it will show the following:

**Connect To Access Points:** This connects your Mako to a Wi-Fi hot-spot, **ST Mode**

**Module As Access Point:** The Mako then becomes a Wi-Fi hot-spot, **AP Mode**

The Mako can operate in dual mode, allowing you to have both AP & ST at the same time.

*There is a limit of 5 connections. The Mako stability cannot be guaranteed going over this limit!*

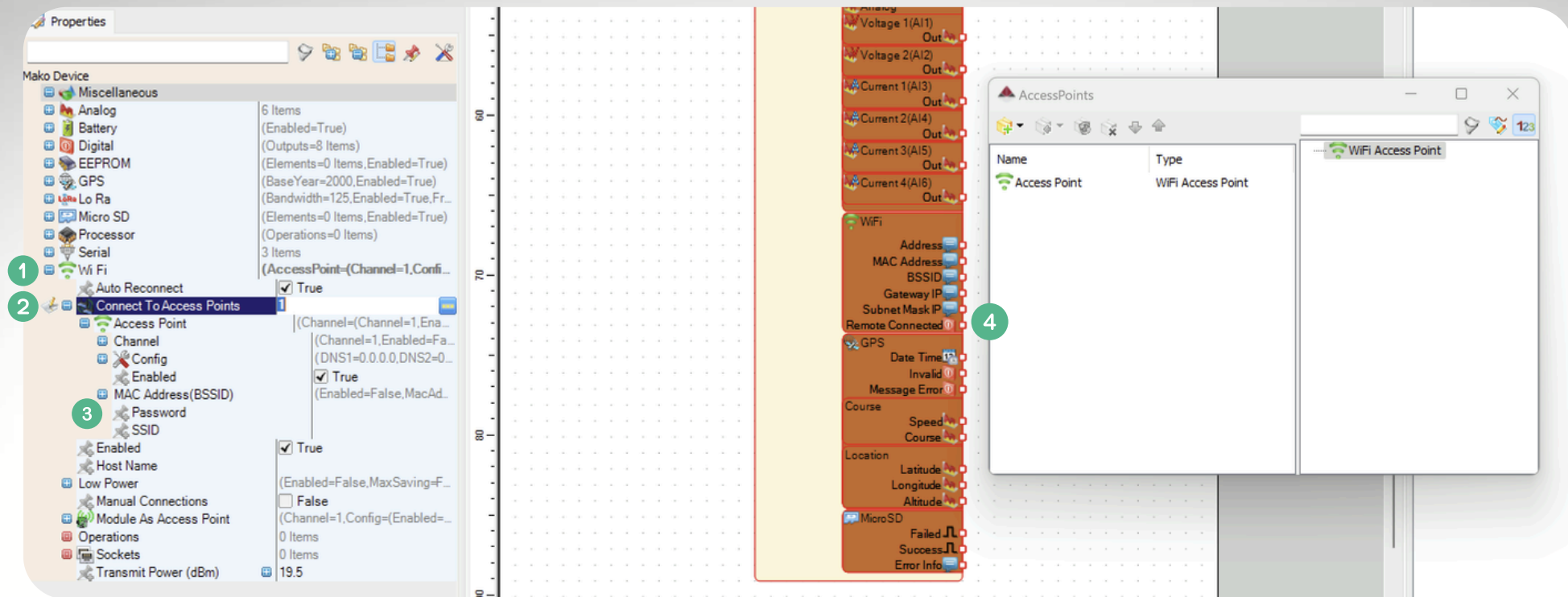
# Mako V2

Industrial Wi-Fi, LoRa RF, Modbus PLC

## V-NET Configuration Wi-Fi - Getting Started

### Wi-Fi - Getting Started

1. Open the Mako properties, click on 'Wi-Fi'
2. Add an access point by clicking the "Connect to Access Points". In the access point window add a new access point.
3. Fill out the access point **SSID & PASSWORD**
4. A remote connected pin will show on the Mako board in the Wi-Fi section. **\*\*Tip\*\*** connect the remote connected to a digital output pin. When the Mako has a Wi-Fi connection the digital output LED will turn on and if the connection drops, it will turn off.





# Mako V2

Industrial Wi-Fi, LoRa RF, Modbus PLC

## V-NET Configuration Wi-Fi - Connect to Access Point

### Wi-Fi - Connect to Access Point

The Wi-Fi property settings for AP mode and ST mode are the same. Some modes may have different settings applicable to its function.

**Channel:** Sets the Wi-Fi network channel

**Enabled:** Turns the Wi-Fi on/off

**DNS1:** Sets the DNS1 IP address

**DNS2:** Sets the DNS2 IP address

**Enabled:** This second enable sets the device to static IP mode (If selected you have to fill these fields out)

**Gateway:** Sets the Static gateway ID of your router, modem or network connection

**IP:** Sets your unique IP address in static mode

**Subnet:** Sets your subnet mask in static mode

**Enabled:** The 3rd enable allows you to customise your Mako MAC address, (this is useful for network identity schemes)

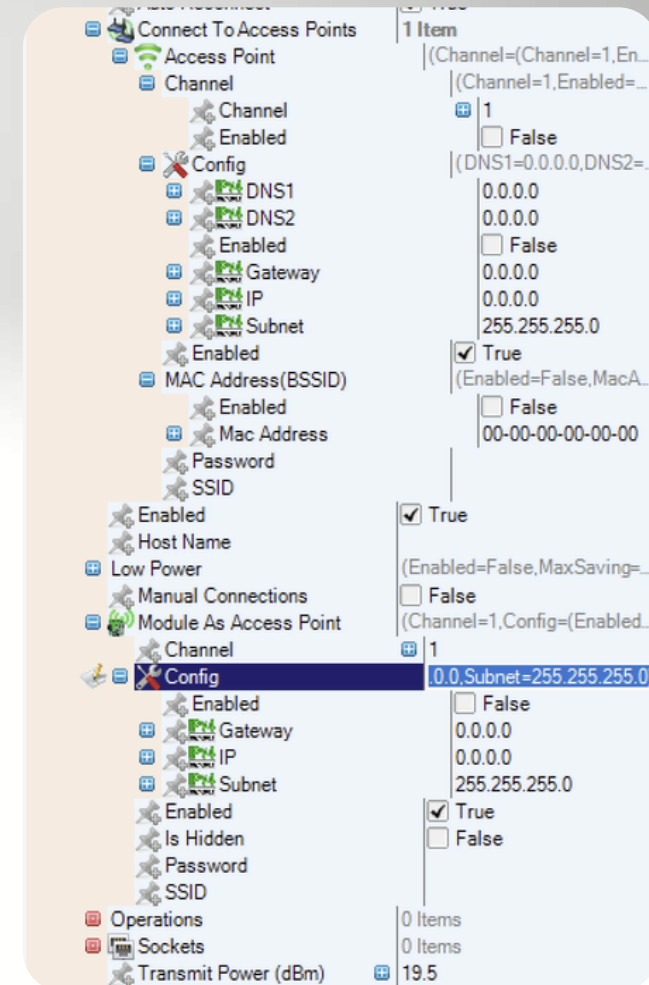
**Password:** Sets the Password for your hot-spot connection

**SSID:** Sets the Wi-Fi hot-spot broadcast name

**Host Name:** Sets the personal host name of your Mako device. If your network supports host name, your Mako can be discoverable by its host name.

**Low Power:** Enabled turns on/off low power mode, Max saving will reduce the Wi-Fi power draw by 40%

**Manual Connections:** NOT IN USE



# Mako V2

Industrial Wi-Fi, LoRa RF, Modbus PLC

## V-NET Configuration Wi-Fi - Module as Access Point

### Wi-Fi - Module as Access Point

The Wi-Fi property settings for AP mode and ST mode are the same. Some modes may have different settings applicable to its function.

**Channel:** Sets the Wi-Fi network channel

**Enabled:** This first enable sets the device to static IP mode (if selected, you must fill these fields out)

**Gateway:** Sets the static gateway ID of your router, modem or network connection

**IP:** Sets your unique IP address in static mode

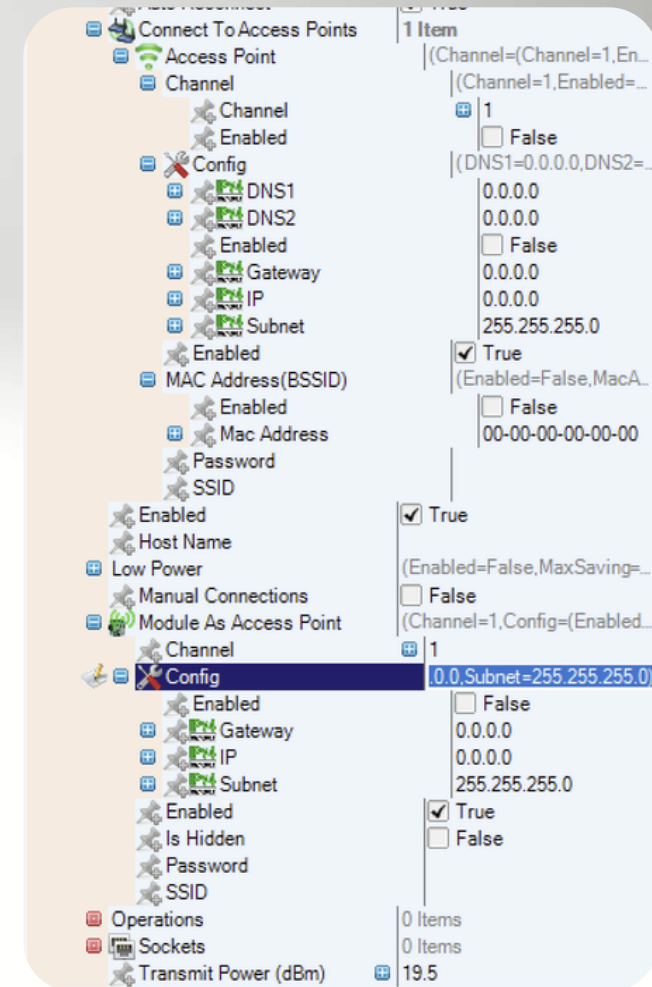
**Subnet:** Sets your subnet mask in static mode

**Enabled:** This second enable turns on /off the AP mode (Module as Access Point)

**Is hidden:** This will hide your AP mode from Wi-Fi scanning. If turned on, your device will be invisible from hot-spot scans and users will be unable to connect.

**Password:** Sets the Password for your hot-spot connection

**SSID:** Sets the Wi-Fi hot-spot broadcast name



# Mako V2

Industrial Wi-Fi, LoRa RF, Modbus PLC

## V-NET Configuration Wi-Fi - Operations

### Wi-Fi - Operations

The Mako has the following Wi-Fi operations. In the properties section under Wi-Fi, click the operations tab and in the new window add the operations on the right side you wish to use for the left side. When you add the operations, the Mako board will change shape and the new features will appear with pins to connect to.

**Get Host IP:** This will retrieve the gateway IP your Mako is connected to, for example if your router gateway is 192.168.1.1. This value will be available on the new pin created under 'Get Host IP'

**Scan Networks:** This will scan Wi-Fi networks and output them in text from the new pin created.

**Signal Strength:** This will output your Wi-Fi connection signal strength from the new created pin in 16bit Int.

**Reconnect:** This will create a new pin you can clock to force the Mako to reconnect.

**Program Over The Air:** This has multiple properties that allow you to set the MaKo to be programmed from V-NET over Wi-Fi and not require a USB.

The screenshot displays the Mako V2 configuration interface, specifically the Wi-Fi operations section. On the left, a tree view shows the configuration hierarchy: Host Name, Low Power, Manual Connections, Module As Access Point, Operations, Get Host IP, Host Name, Scan Networks, Channel, Max Timr Per Channel (mS), Passive, Show Hidden, Program Over WiFi, Enabled, Hostname, Mdns Enabled, Password, Port, Reboot On Success, and Sockets. The 'Program Over WiFi' section is expanded, showing properties like 'Enabled' (checked), 'Hostname', 'Mdns Enabled' (checked), 'Password', 'Port' (3232), and 'Reboot On Success' (checked). The 'Operations' tab is selected, showing a list of operations: Get Host IP, Scan Networks, SignalStrength, Reconnect, and Program Over WiFi. The 'Scan Networks' operation is expanded, showing properties like 'Found Network', 'Channel', 'Encryption', 'MACAddress(BSSID)', 'SSID', 'Signal Strength', 'Count', 'Failed', and 'Scanning'. The 'SignalStrength' operation is also expanded, showing properties like 'SignalStrength' and 'Signal Strength'. The 'Reconnect' operation is expanded, showing properties like 'Reconnect' and 'Clock'. The 'Program Over WiFi' operation is expanded, showing properties like 'Program Over WiFi', 'Error', 'Progress', and 'Uploading'. On the right, a window titled 'Operations' displays a table of operations:

| Name                 | Type                 |
|----------------------|----------------------|
| Get Host IP          | Get Host IP          |
| Scan WiFi Networks   | Scan WiFi Networks   |
| WiFi Signal Strength | WiFi Signal Strength |
| WiFi Reconnect       | WiFi Reconnect       |
| Program Over WiFi    | Program Over WiFi    |

# Mako V2

Industrial Wi-Fi, LoRa RF, Modbus PLC

## V-NET Configuration Wi-Fi - Operations Explained

### Wi-Fi - Operations: Explained

#### Operations: Get Host IP

This operation scans for a known host name and gets the IP address

**Enable:** Turns the scanner on/off

**Host Name:** Type the name of the host you wish to scan here

#### Operations: Scan Networks

This operation scans for Wi-Fi hot-spots

**Enable:** Turns the scanner on/off

**Channel:** Select the Wi-Fi channel you want to scan, leave at default 0 for all channels

**Max Time per Channel:** The time allocated to scan the channels in ms

**Passive:** Scans passive Wi-Fi networks

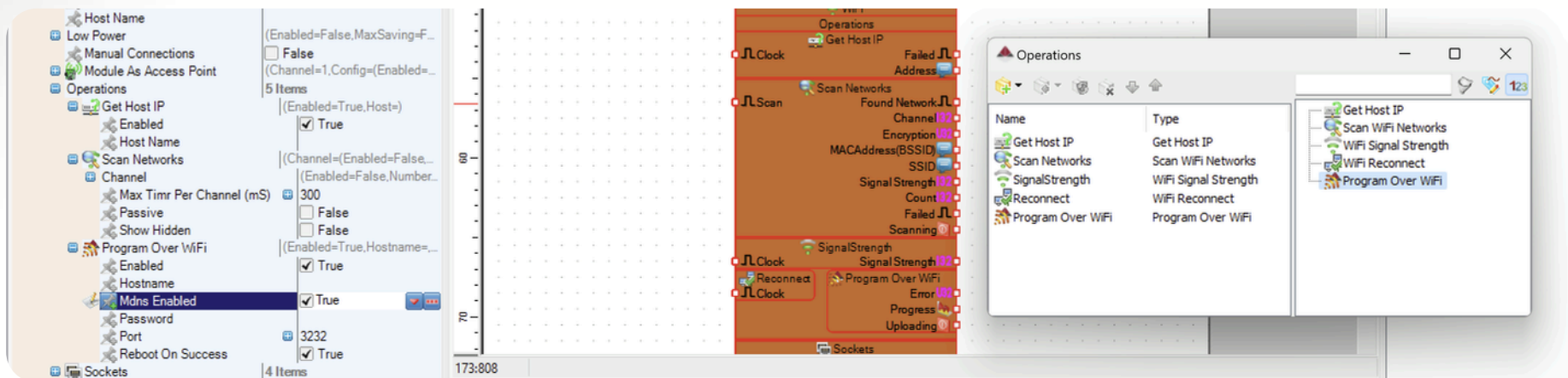
**Show Hidden:** Attempts to show hidden Wi-Fi networks

#### Operations: Signal Strength

This operation will create a new pin on the Mako board and if clocked will output the signal strength of the connected Wi-Fi network.

#### Operations: Reconnect

This operation will create a new pin on the Mako board and if clocked will force a reconnect to the configured Wi-Fi hot-spot.





# Mako V2

Industrial Wi-Fi, LoRa RF, Modbus PLC

## V-NET Configuration Wi-Fi - OTA

### Wi-Fi - Operations: Over The Air

A future feature of the Mako V2 features a program over the air (OTA) capability, which allows you to update your device's firmware remotely over Wi-Fi networks

**OTA is a future feature.**

# Mako V2

## Industrial Wi-Fi, LoRa RF, Modbus PLC

## V-NET Configuration

### Wi-Fi - Sockets

### Wi-Fi - Operations: Sockets

Sockets are used in internet connections to allow communication between different devices over a network. When the Mako establishes a Wi-Fi connection, the user can add TCP and UDP sockets to enable communication with other devices or servers. These sockets act as endpoints for data transmission, allowing the Mako to send and receive data packets over the network. By utilising TCP and UDP sockets, the Mako can establish reliable and efficient communication with other devices in the network.

To add a socket, open the Mako properties, scroll down to the bottom and click 'sockets'. The sockets window will open. Add sockets to the right side of the window. The Mako board will change shape, and new pins will appear.

**TCP Client:** The Mako can connect to servers and share data

**TCP Secure Client:** The Mako can connect to secure servers using TLS and share data

**TCP Server:** The Mako becomes a server and other devices can connect to the Mako and share data. This mode is required for Modbus TCP Server

**UDP Socket:** The Mako can communicate with UDP servers and share data.

The screenshot displays the Mako V2 configuration interface. On the left, a tree view shows the configuration hierarchy: GPS, Lo Ra, Micro SD, Processor, Serial, Wi Fi, Auto Reconnect, Connect To Access Points, Host Name, Low Power, Manual Connections, Module As Access Point, Operations, Sockets, TCP Client1, TCP Secure Client1, CACert, Certificate, Enabled, Host, Insecure, IP Address, Name, Port, Private Key, Reconnect Delay (mS), TCP Server1, UDP Socket1, and Transmit Power (dBm). The 'Sockets' window is open, showing a list of configured sockets:

| Name                             | Type                     |
|----------------------------------|--------------------------|
| TCP Client1 [0.0.0.0:80]         | TCP/IP Client            |
| TCP Secure Client1 [0.0.0.0:443] | TCP/IP Secure Client ... |
| TCP Server1 [80]                 | TCP/IP Server            |
| UDP Socket1 [80/0.0.0.0:80]      | UDP Socket               |

The main configuration panel on the right shows the 'Sockets' section with the following settings:

- (BaseYear=2000, Enabled=True)
- (Bandwidth=125, Enabled=True, Freque...)
- (Elements=0 Items, Enabled=True)
- (Operations=0 Items)
- 3 Items
- (AccessPoint=(Channel=1, Config=(En...))
- ☒ True
- 0 Items
- ☒ True
- (Enabled=False, MaxSaving=False)
- ☐ False
- (Channel=1, Config=(Enabled=False...))
- 0 Items
- 4 Items
- (Enabled=True, Host=, IPAdress...)
- (CACert=, Certificate=, Enabled=...)
- ☒ True
- ☐ False
- 0.0.0.0
- TCP Secure Client1
- 443
- 60000
- (Enabled=True, Name=TCP Ser...)
- (Enabled=True, Name=UDP So...)
- 19.5

# Mako V2

Industrial Wi-Fi, LoRa RF, Modbus PLC

## V-NET Configuration Wi-Fi - TCP Client

### Wi-Fi - Operations: Sockets TCP Client

A web socket TCP client is a type of client software that establishes a web socket connection with a web socket server using the 'Transmission Control Protocol' (TCP). Web sockets are a bi-directional communication protocol that allows real-time communication between a web server and a web client over a single, long-lived connection. The web socket TCP client establishes a connection to a web socket server and can send and receive data in real-time. The web socket server can push data to the client as soon as it becomes available, without the client having to constantly poll the server for new data. Web socket TCP clients are commonly used in applications where real-time communication is critical, such as MQTT, Modbus TCP, HTTP.

**Enabled:** Turns the TCP socket off/on

**Host:** Configure the host name of the server, example www.google.com

**IP Address:** Configure the IP address of your host example 8.8.8.8

**Port:** Configure the port of your host address example port 80

**Reconnect Delay:** Configure the time the Mako reconnects after it is disconnected in ms, default is 6000ms 6 seconds.

The image displays three screenshots related to the Mako V2 configuration interface for the Wi-Fi TCP Client.

- Left Screenshot:** Shows the 'Sockets' configuration panel. The 'TCP Client1' is selected. The 'Enabled' checkbox is checked. The 'Host' is set to '0.0.0.0', the 'Port' is '80', and the 'Reconnect Delay (mS)' is '60000'. The 'Transmit Power (dBm)' is set to '19.5'.
- Middle Screenshot:** Shows the 'Sockets' panel with 'TCP Client1' selected. The 'Enabled' checkbox is checked. The 'Reconnect Delay' is set to '60000'.
- Right Screenshot:** Shows the 'Sockets' panel with 'TCP Client1' selected. The 'Enabled' checkbox is checked. The 'Reconnect Delay' is set to '60000'.

## Wi-Fi - Operations: Sockets TCP Secure Client

A TLS (SSL) client socket securely connects to a WebSocket server using TCP and the TLS protocol, ensuring encrypted, tamper-proof communication. WebSockets enable real-time, two-way data exchange over a single persistent connection, allowing the server to push updates instantly without polling. TLS WebSocket clients are used in security-sensitive, real-time applications like IoT systems, home automation, and industrial monitoring.

**CA CERT:** This is your CA certificate. Open the window and copy & paste your CA cert

**Certificate:** This is your client certificate.

**Enabled:** Turns the TCP socket off/on

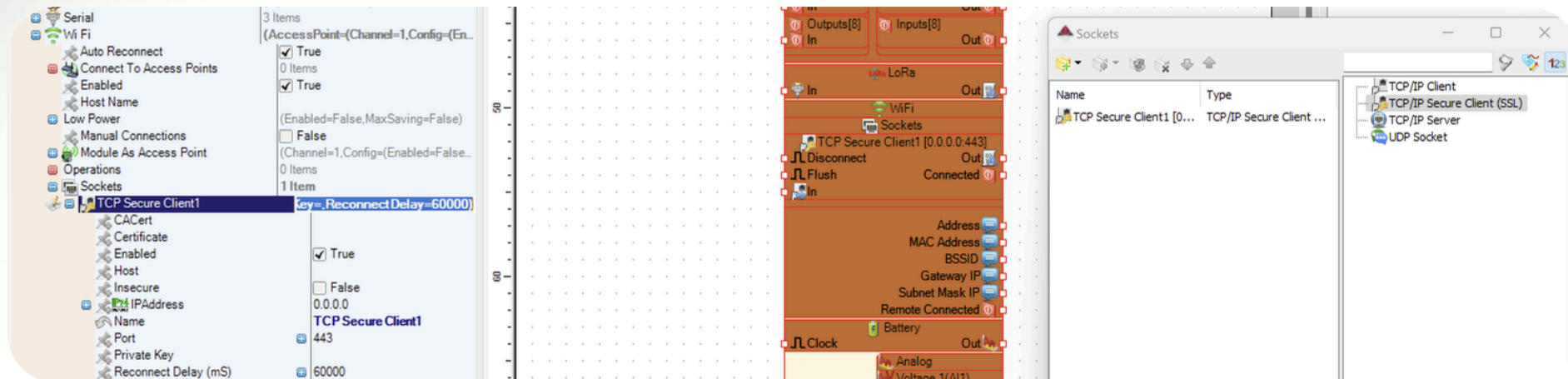
**Host:** Configure the host name of the server, example www.google.com

**IP Address:** Configure the IP address of your host example 8.8.8.8

**Port:** Configure the port of your host address example port 80

**Private Key:** This is your TLS/SSL private key, a secret cryptographic key used to decrypt TLS encrypted data. Open the window and copy & paste your private key.

**Reconnect Delay:** Configure the time the Mako reconnects after it is disconnected in ms, default is 6000ms 6 seconds.





# Mako V2

Industrial Wi-Fi, LoRa RF, Modbus PLC

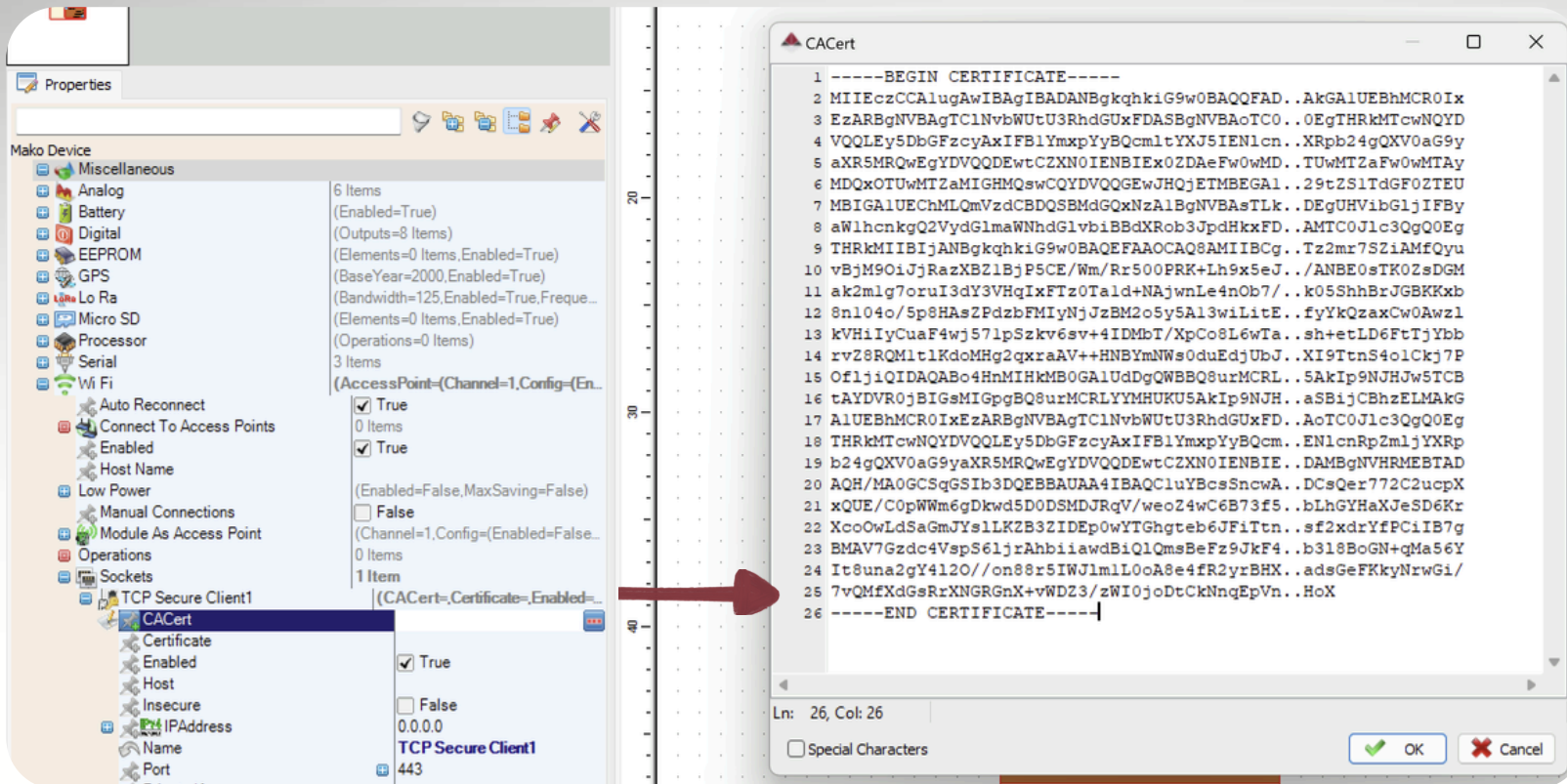
## V-NET Configuration Wi-Fi - TCP Secure CA Certificate

### Wi-Fi - Operations: TCP Secure CA Certificate

To properly use the TLS SSL TCP sockets, you must first create or retrieve the appropriate valid certificates and keys. The keys need to be copied into V-NET. In the Mako properties, open the sockets section, go to your secure client socket and click on the 'add certificate' tab next to each certificate property. Copy the PEM formatted certificate into the certificate window and press OK. The certificates and keys will be uploaded with the rest of the program when finished

#### Certificate format

CA: x.509 PEM encoded



# Mako V2

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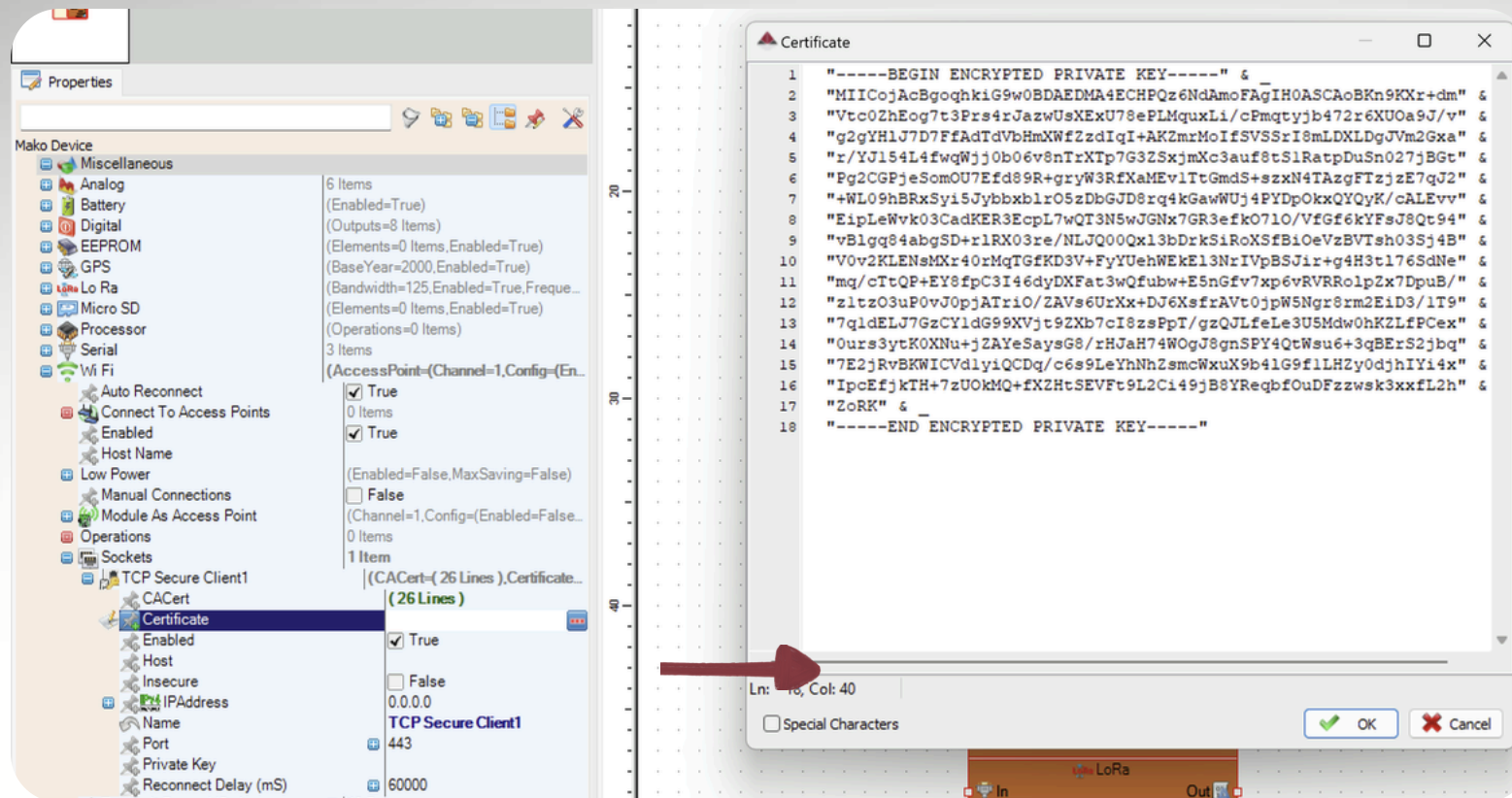
## V-NET Configuration Wi-Fi - TCP Secure Certificate

### Wi-Fi - Operations: TCP Secure Certificate

To properly use the TLS SSL TCP sockets, you must first create or retrieve the appropriate valid certificates and keys. The keys need to be copied into V-NET. In the Mako properties, open the sockets section, go to your secure client socket and click on the add certificate tab next to each certificate property. Copy the PEM formatted certificate into the certificate window and press OK. The certificates and keys will be uploaded with the rest of the program when finished

#### Certificate format

Client Certificate: X.509 PEM encoded



# Mako V2

Industrial Wi-Fi, LoRa RF, Modbus PLC

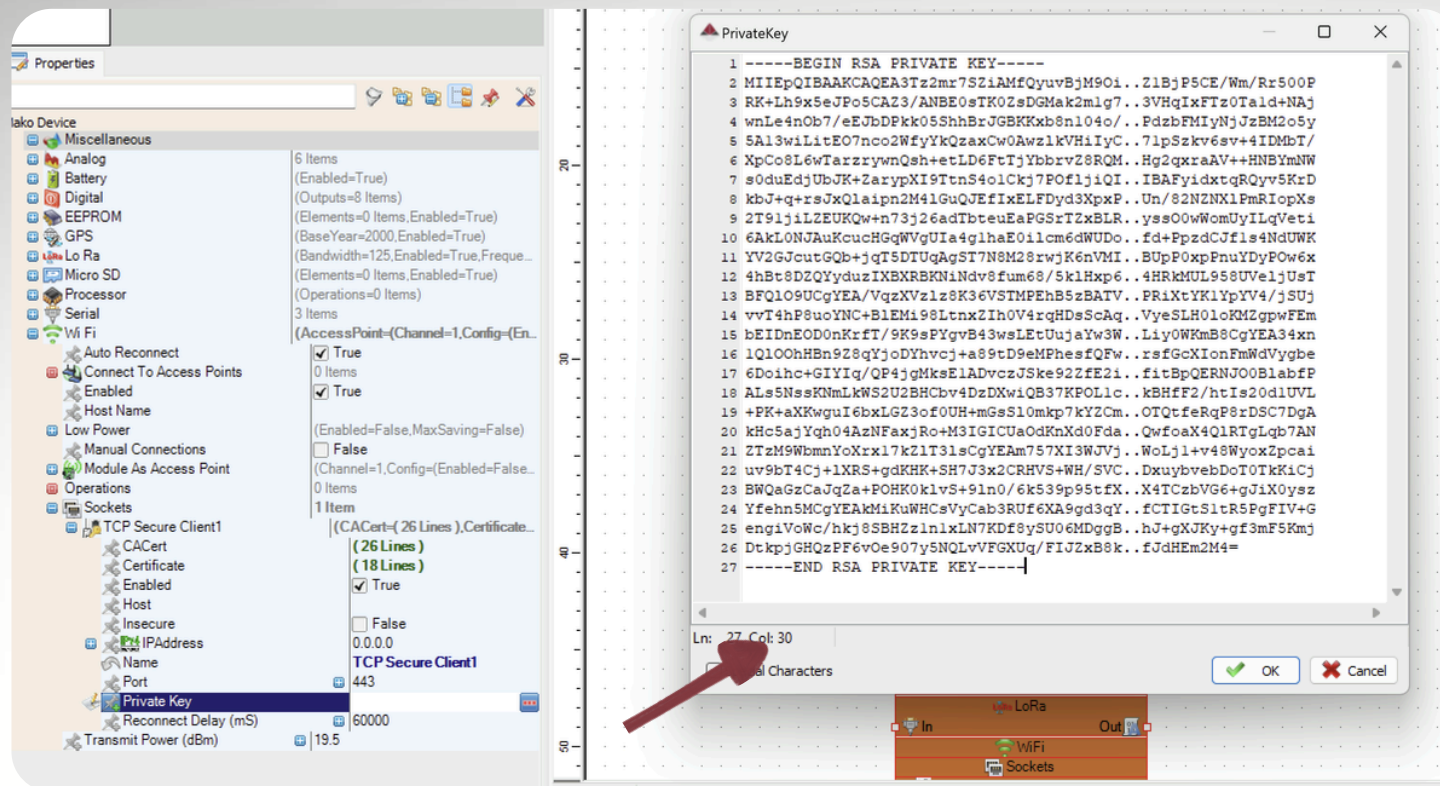
## V-NET Configuration Wi-Fi - TCP Secure Private Key

### Wi-Fi - Operations: TCP Secure Private Key

To properly use the TLS SSL TCP sockets you must first create or retrieve the appropriate valid certificates and keys. The keys need to be copied into V-NET. In the Mako properties, open the sockets section, go to your secure client socket and click on the add certificate tab next to each certificate property. Copy the PEM formatted certificate into the certificate window and press OK. The certificates and keys will be uploaded with the rest of the program when finished

#### Certificate format

Private Key: X.509 PEM encoded RSA





# Mako V2

Industrial Wi-Fi, LoRa RF, Modbus PLC

## V-NET Configuration Wi-Fi - TCP Server

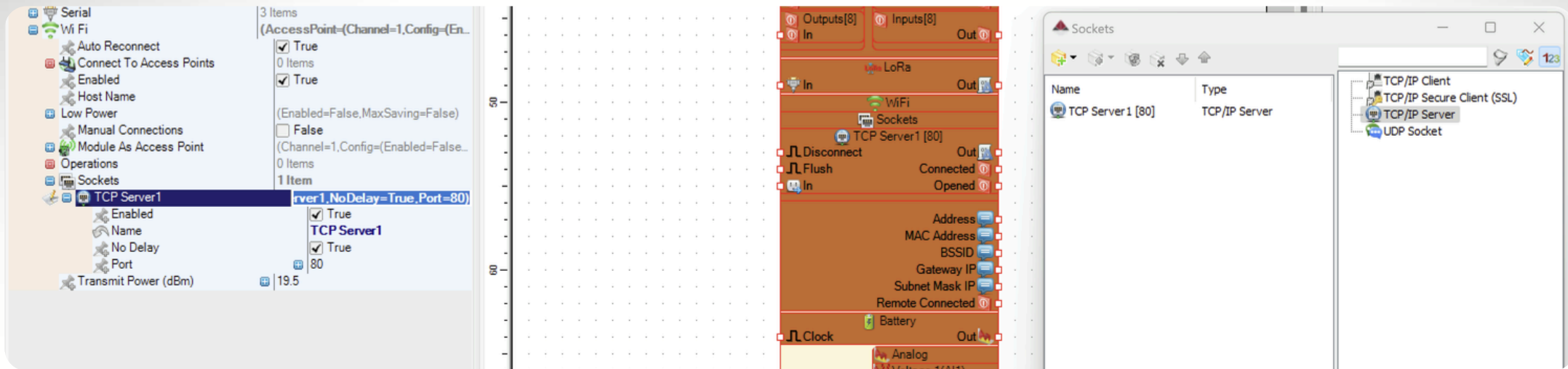
### Wi-Fi - Operations: Sockets - TCP Server

The Mako can generate a TCP Server. A TCP server is a type of server software that establishes a connection with a client using the 'Transmission Control Protocol' (TCP), allowing bidirectional communication between the server and the client. The TCP server IP address is taken from the IP settings you configure during the Wi-Fi setup or the settings your network assigns through DHCP protocol.

**Enable:** Turns the server on/off

**No Delay:** This turns on/off the no delay feature. Turned on it will prevent the Mako responding quicker than a web browser can process the data. This is only useful for programs that utilise web browser visualisation

**Port:** Sets the port your server is hosted on, for example port 80. If a remote client wants to connect, they should know the IP address of the device + the port of the device to make a successful connection.





# Mako V2

Industrial Wi-Fi, LoRa RF, Modbus PLC

## V-NET Configuration Wi-Fi - Sockets UDP

### Wi-Fi - Operations: Sockets UDP

A UDP socket is a type of endpoint for sending and receiving data over a network using the 'User Datagram Protocol' (UDP), a connectionless transport protocol that does not guarantee packet delivery, order, or integrity.

**Enable:** Turns the server on/off

**Port:** Sets the local UDP port, this is required for a remote device to send data back to the Mako

**Remote Host:** Configure here the name of your remote host device.

**Remote IP:** Configure here the IP address of your remote device

**Remote Port:** Configure here the port number of your remote device

*If the remote device was called Mako3 and it turned on a UDP socket on port 53 you would enter 'Mako3' in the 'Remote Host' and '80' in 'Remote Port'*

The image displays four screenshots from the Mako V2 software interface, illustrating the configuration of a UDP socket.

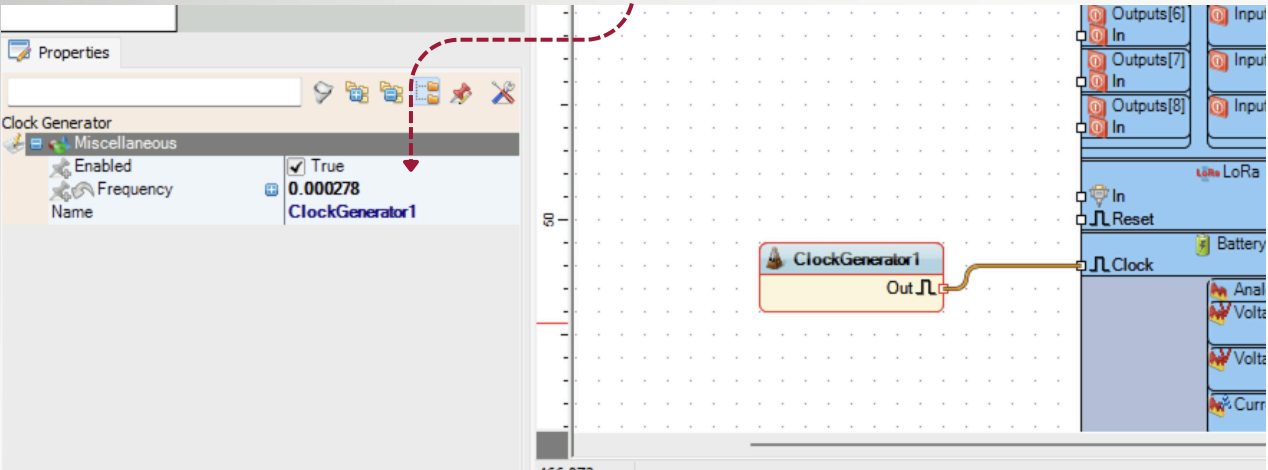
- Left Screenshot:** Shows the 'Sockets' configuration panel. The 'UDP Socket1' is selected. The 'Enabled' checkbox is checked. The 'Name' is 'UDP Socket1'. The 'Port' is set to 80. The 'Remote Host' is set to 0.0.0.0. The 'Remote Port' is set to 80. The 'Transmit Power (dBm)' is set to 19.5.
- Second Screenshot:** Shows a blank workspace with a grid.
- Third Screenshot:** Shows the 'Sockets' configuration panel with the 'UDP Socket1' selected. The 'Remote Port' is set to 80. The 'Remote Host' is set to 0.0.0.0. The 'Transmit Power (dBm)' is set to 19.5.
- Right Screenshot:** Shows the 'Sockets' configuration panel with the 'UDP Socket1' selected. The 'Remote Port' is set to 80. The 'Remote Host' is set to 0.0.0.0. The 'Transmit Power (dBm)' is set to 19.5.

### Clock (HZ) frequency property

Components within V-NET require setting the frequency property in Hertz (Hz). To configure a component to operate 5 times per second, simply enter '5' into the property. However, for operations that occur less frequently, such as every 5 seconds, a simple formula is used: **1 divided by the time in seconds**. Thus, for a 5-second interval, you would calculate 1/5, resulting in 0.2, which is the value to enter into the property.

For longer intervals, like 1 hour, first determine the number of seconds in an hour (1 hour = 3600 seconds). To set a component to operate once every hour, calculate 1/3600, yielding 0.000278 as the input for the frequency property.

Frequency (Hz)= 1 / Time Interval (Seconds)



### Examples:

| Time Interval (Seconds) | Frequency (Hz) | Frequency (Events per Hour) |
|-------------------------|----------------|-----------------------------|
| 5                       | 0.2            | 720                         |
| 10                      | 0.1            | 360                         |
| 15                      | 1/15 ≈ 0.0667  | 240                         |
| 20                      | 0.05           | 180                         |
| 25                      | 1/25 = 0.04    | 144                         |
| 30                      | 1/30 ≈ 0.0333  | 120                         |
| 40                      | 1/40 = 0.025   | 90                          |
| 50                      | 1/50 = 0.02    | 72                          |
| 60                      | 1/60 ≈ 0.0167  | 60                          |

# Mako V2

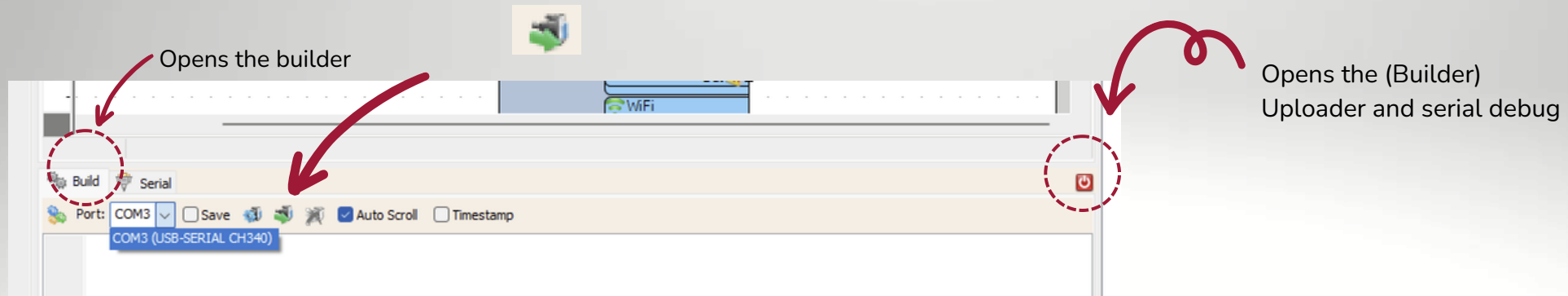
Industrial Wi-Fi, LoRa RF, Modbus PLC

## V-NET Configuration Uploading First Sketch

### First Sketch

To upload your first sketch you must ensure your USB is plugged into the computer and Mako PLC. Its worth noting you don't need a DC supply to program your Mako, the USB cable provides enough power to power the Mako, this allows you to program on the fly without having industrial power supply's connected.

To upload the sketch press this symbol >>>



There are 2 stages to the upload. The first stage is the compilation of your sketch. The second is the actual uploading. You must allow sufficient time and not stop or remove the USB during this period to avoid corrupting your program.

Stage one looks like this:

```
Building...
Sketch uses 269913 bytes (20%) of program storage space. Maximum is 1310720 bytes.
Global variables use 21880 bytes (6%) of dynamic memory, leaving 305800 bytes for local variables. Max.
Build completed - Time: 00:00:30
Uploading...
Serial port COM3
Connecting...
```

Stage two looks like this: 'SUCCESS - TIME: \*\*\*\*\*'

When it says this, it is safe to upload another program or remove the USB.

```
Leaving...
Hard resetting via RTS pin...
New upload port: COM3 (serial)
SUCCESS - Time: 00:00:17
```

### TIP

To cancel the upload at anytime hit this button



before or during the upload stages

# Mako V2

Industrial Wi-Fi, LoRa RF, Modbus PLC

## Warranty

Smithtek PTY LTD warrants to the original purchaser that this product will be free from defects in workmanship and materials, under normal use and conditions, for a period of one (1) year from the original invoice date. This warranty is non-transferable. During the warranty period, Smithtek PTY LTD will, at its sole discretion, repair, replace, or refund the purchase price of any defective product that is returned to us in accordance with our return policy. Smithtek PTY LTD may use new or refurbished parts or products to fulfill its warranty obligations. The customer is responsible for all shipping and handling fees associated with returning the defective product.

### This warranty does not cover:

- **Damage resulting from misuse, abuse, negligence, accidents, or improper use or installation**
- **Aesthetic damage such as scratches, dents, or stains**
- **Normal wear and tear**
- **Damage resulting from unauthorised repair or modification**
- **Dissatisfaction due to buyer's remorse**
- **Damage resulting from natural disasters, fire, theft, or acts of God**
- **Any condition resulting from incorrect or inadequate maintenance or care.**

This warranty is in lieu of all other warranties, express or implied, including any implied warranty of merchantability or fitness for a particular purpose. In no event shall Smithtek PTY LTD be liable for any indirect, special, incidental, or consequential damages arising from the use of this product.

To make a warranty claim, please contact our customer support team at [www.smithtek.com.au/support](http://www.smithtek.com.au/support). You may be asked to provide proof of purchase, including the model number and original dated sales receipt. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state or province to province.





# Mako V2

Industrial Wi-Fi, LoRa RF, Modbus PLC

## Returns Policy

At Smithtek PTY LTD, we want you to be completely satisfied with your purchase. If for any reason you are not satisfied, you may return your product within 30 days of delivery for a full refund of the purchase price (less shipping and handling charges).

To initiate a return, please contact our customer service department at [info@smithtek.com.au](mailto:info@smithtek.com.au).

Please have your order number and the reason for the return ready when you call. Our customer service representative will provide you with a Return Merchandise Authorisation (RMA) number, which must be included with your return. To qualify for a refund, the product must be in its original packaging and in resalable condition. Smithtek PTY LTD reserves the right to refuse a return or charge a restocking fee if the product is not returned in its original condition.

Smithtek PTY LTD will not be responsible for return shipping charges unless the product is being returned due to an error on our part. We recommend that you use a trackable shipping method and insure the package for the full value of the product. Smithtek PTY LTD will not be responsible for any lost or damaged packages.

Once we receive your return, we will process your refund within 5 business days. Refunds will be issued to the original payment method.

If you have any questions about our returns policy, please contact us at [info@smithtek.com.au](mailto:info@smithtek.com.au).



# Mako V2

Industrial Wi-Fi, LoRa RF, Modbus PLC



## Our Mission

At Smithtek, we are a proud family-run business dedicated to empowering industries, communities, and remote operators across Australia. Our mission is to deliver reliable, locally built telemetry and automation solutions that simplify how people monitor, control, and manage their assets, from water and energy to environmental systems.

Built on the values of trust, integrity, and innovation, we believe technology should be practical, transparent, and designed to last. Every product we create represents our family's commitment to quality, honesty, and hands-on support. By combining robust Australian hardware with intuitive cloud platforms, we help our clients gain real-time visibility, improve efficiency, and make confident decisions, wherever they are.

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