



SOLARIS

User & Installation Guide





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Solaris RTU PLC

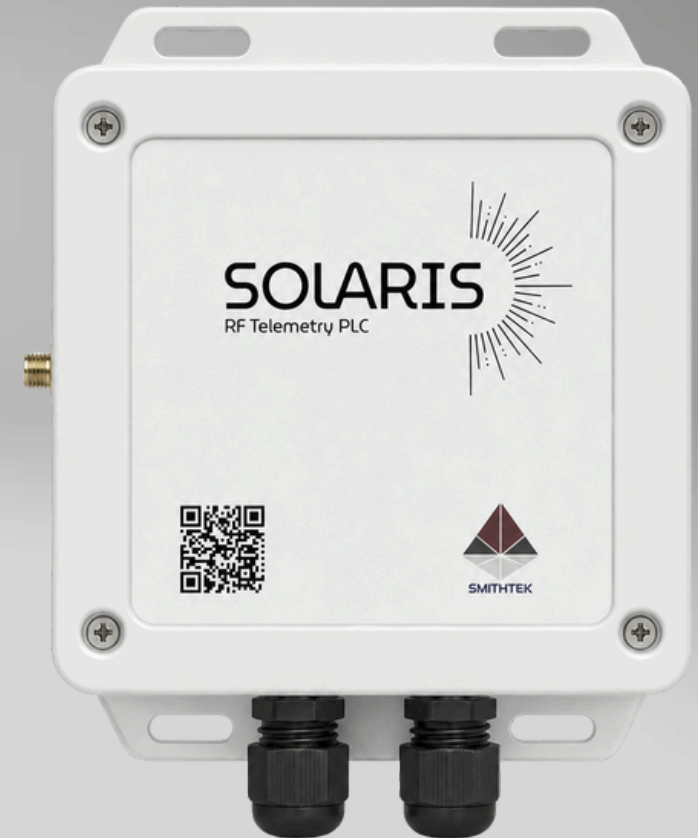
The **Solaris RTU PLC** is a compact, weatherproof telemetry and control unit designed for remote monitoring and automation applications. Based on the proven Mako PLC platform, Solaris delivers essential PLC and telemetry functionality in a simplified, low-power package, making it ideal for remote sites where reliability, ease of deployment, and energy efficiency are critical.

Supplied as a **complete solar-powered telemetry station**, each Solaris unit combines the **RTU PLC, solar charge controller, battery system, antenna**, and **solar panel** into a single purpose-built enclosure. The system has been specifically designed for rapid installation, typically requiring only bandit straps or simple mounting hardware to secure it to a pole, fence, tank stand, or existing structure. This minimises installation time and reduces the need for complex site works.

Solaris is suitable for a wide range of applications including **water tanks, pump stations, bore fields, irrigation systems, environmental monitoring, wastewater infrastructure, generators**, and other **remote assets**. The unit can monitor digital and analogue inputs, control outputs, log operational data, and communicate with remote monitoring platforms.

The **Solaris RTU PLC** integrates directly with **Smithtek's Cloud SCADA**, providing real-time monitoring, alarm notifications, historical data logging, reporting, and asset visualisation from a central dashboard. Operators can remotely monitor site performance and receive alerts on critical events, helping reduce unnecessary travel and improve operational awareness.

Control strategies and automation logic can be developed using **Smithtek's V-NET** programming environment, providing a flexible graphical platform for creating custom telemetry and control applications. Configurable reporting intervals from 1 to 5 minutes ensure timely updates on asset status, battery voltage, sensor readings, alarms, and overall system performance.



Specifications

PLC Specs

Voltage Supply: 12-24 VDC
Power Consumption: 0.65 W
Maximum Load: 1 A @ 12 VDC
Relay Maximum Load: 1A
Analog Input: 4-20 mA
ADC Resolution: 10-bit ADC
RF Frequency: 472.0625 MHz
RF Bandwidth: 125 kHz / 62.5 kHz
Maximum RF Range: Up to 15 km
Digital Inputs: PNP High-Side
Pulse Input: Assignable
RS485: Selectable 120 Ω Termination
Protection: Auto-Reset Fuse
IP Rating: IP65
Weight: < 400 g
Dimensions: 120 × 150 × 60 mm
Material: ABS

Power Station Specs

Model: S-3024 Solar Power Supply System
Solar Panel: 30 W monocrystalline
Panel Size: 420 mm × 390 mm × 20 mm
Panel Efficiency: 21.7%
Protection Rating: IP66
Battery Capacity: 8Ah / 88.8 Wh
Rated Voltage: DC 9 V to 12.6 V
Maximum Charge Current: 7 A
Maximum Output Current: 5 A
Operating Temperature: -30°C to 85°C
Mounting Angle: Adjustable, 0° to 45°
System Weight: 4.4 kg
DC Output Cable: 1 m, 2 × 0.75 mm² copper



Application Use



- Water storage tank level monitoring
- Bore and pump control systems
- Irrigation monitoring and automation
- Stock water and livestock watering points
- Dam and reservoir level monitoring
- Environmental monitoring stations
- Weather and rainfall monitoring systems
- Wastewater pump stations and wet wells
- Reverse osmosis (RO) and water treatment plants
- Generator and power system monitoring
- Fuel tank level and consumption monitoring
- Remote valve control and status monitoring
- Solar-powered telemetry installations
- Remote community infrastructure monitoring
- Mining and dewatering applications
- Equipment fault and alarm reporting
- Remote site security and intrusion monitoring
- Utility and infrastructure asset monitoring
- Temporary construction and hire equipment telemetry
- Any remote asset requiring monitoring, control, data logging, or alarm notification

Solaris Layout

Access Screws

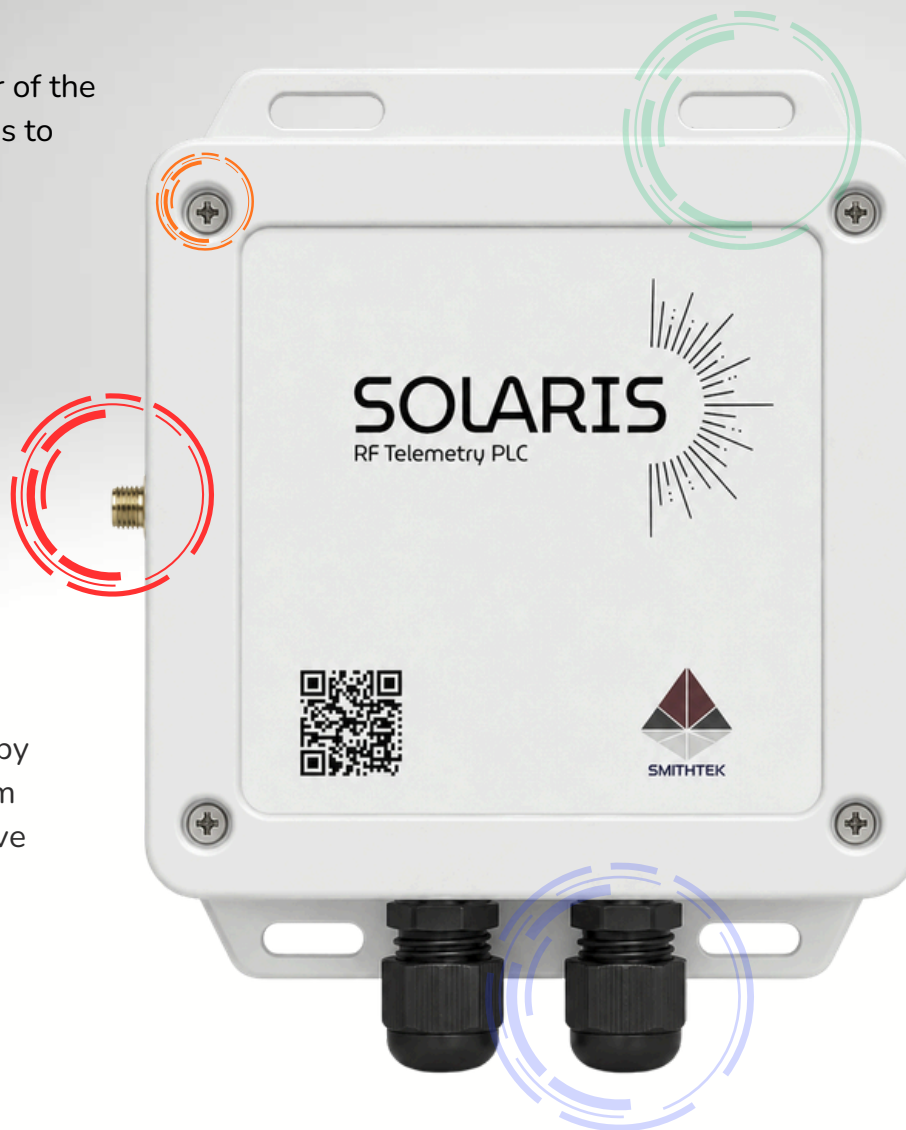
There are 4 screws in each corner of the PLC. Unscrew them to gain access to the wiring terminals.

SMA Antenna

A Single SMA brass Antenna connection is on the LHS of the module. Screw the provided antenna hand tight.

Over tightening can shear or thread the SMA.

Antenna selection is determined by the installer. Assets far away from the PassPort Gateway should have larger gain antennas.



Mounting Wings

There are 2 mounting wings top and bottom of the module. Screw size max 5mm holes. The Base unit can be mounted to any flat surface direct. Or you can use the 2 pole mounted brackets.

Try to avoid direct sunlight and hide the base unit behind a structure or the solar panel so it is in the shade.

Cable Glands

There are 2* 16mm compression glands. External wires and/or cables to be fed through the glands and the glands must be tightened to ensure they are water tight.

Lid Rubber Sealant Strip

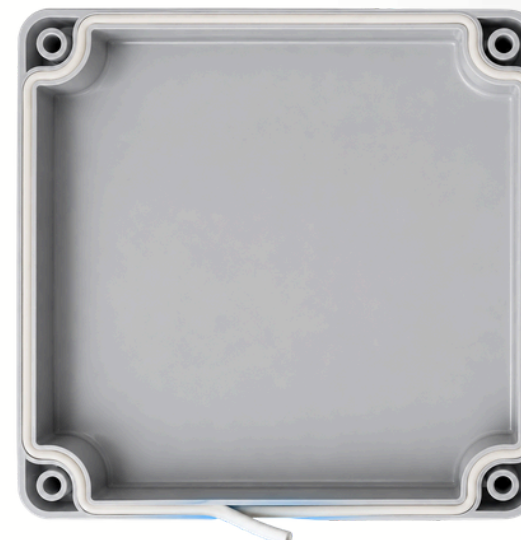
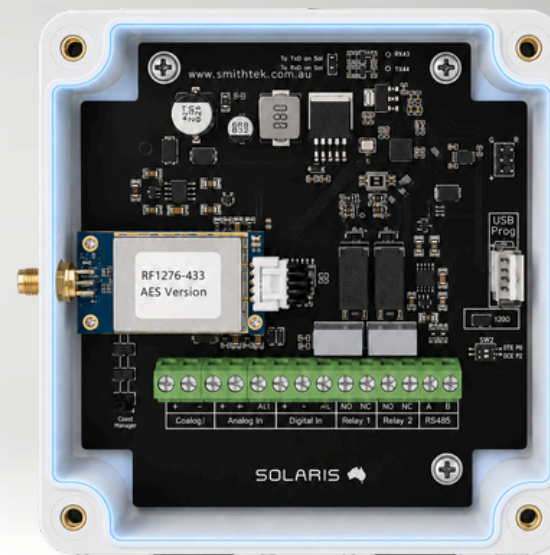
A white rubber sealant strip must be correctly fitted inside the lid to ensure the Solaris enclosure remains waterproof. The sealant strip must be laid neatly around the full lid channel before the lid is installed. Both ends of the sealant strip must meet when laid into position. Allow the ends to overlap by approximately 1–2 mm. When the lid is pressed down and tightened, the overlapping ends will compress together and form a continuous seal.

Ensure the sealant strip is:

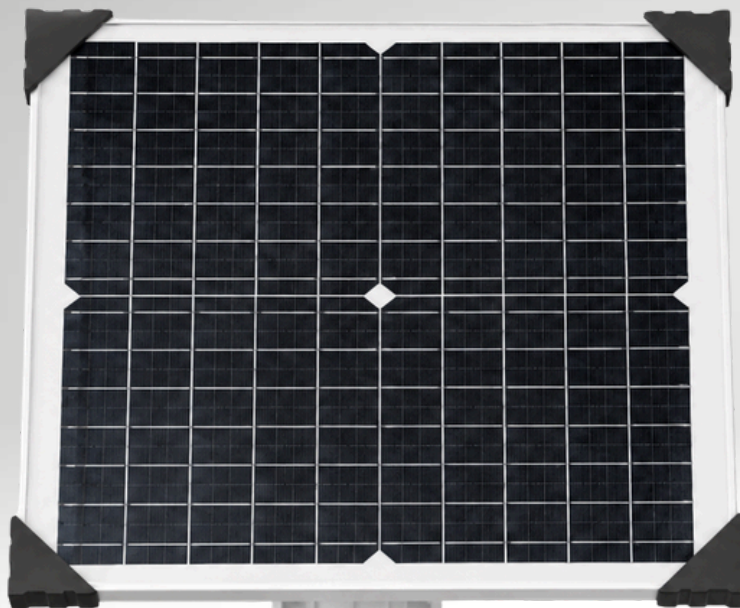
- Fully seated inside the lid channel
- Not twisted
- Not stretched
- Not damaged
- Joined correctly at both ends

Without the rubber sealant strip fitted correctly, the enclosure may allow water ingress during heavy rain, washdown, or water jets. If the rubber seal comes out of the lid, carefully push it back into the seal groove before fitting the lid.

Make sure the seal is seated evenly all the way around the lid and is not twisted, stretched, pinched, or damaged. The join in the rubber seal should be positioned at the bottom of the lid. This helps reduce the chance of water entering from the top of the enclosure if moisture or drips run down the lid. Do not refit the lid until the seal is correctly seated in the groove.



Power Station Layout



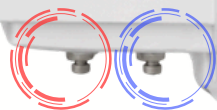
Swivel mount

The Solaris Power Station includes an underside swivel mount option. The kit contains a mounting plate that screws to the underside of the Power Station. This mounting plate is designed for fitting external sensors below the unit, allowing the sensor position and angle to be adjusted during installation.



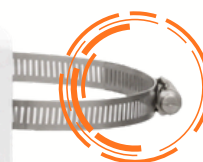
Solar Plug

The plug furthest away from the mounting arm is for the solar panel, it is a 2 PIN plug.



Band Straps

There are two slotted holes on the rear mounting plate. These slots are designed to accept band straps up to 15 mm wide, allowing the Solaris Power Station to be securely mounted to a pole. Alternatively, the Solaris Power Station can be bolted directly through the mounting holes and fixed vertically to a suitable flat surface. The solar panel is fitted with an adjustable swivel bracket. This allows the panel pitch and rotation to be adjusted for the best solar position during installation.



Solaris Power Station Connection

The plug closest to the mounting arm is the power connector for the Solaris PLC. This is a 4-pin plug used to supply power from the Solaris Power Station to the Solaris PLC.

Wire colours:

Green = +12VDC

Blue = 0VDC



Pole Mount Brackets

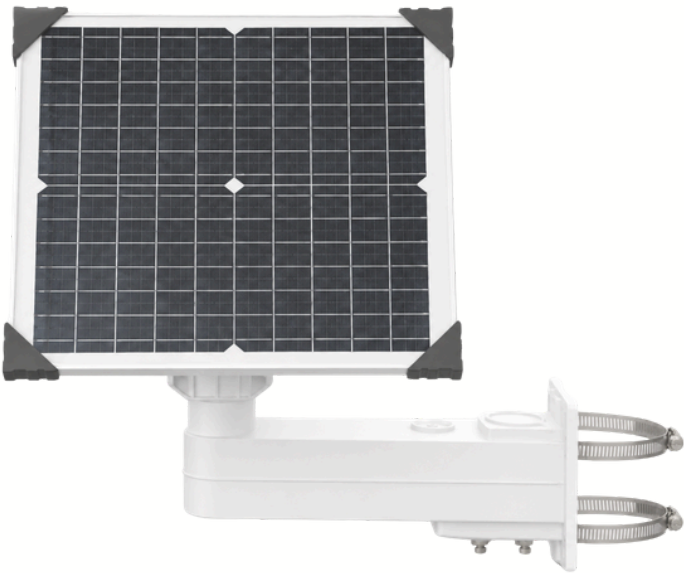
Mounting Compatibility

Before installation, ensure your mounting pole meets the minimum structural diameter (Nominal Diameter) required for each unit:

Equipment	Minimum Pole Size	Mounting Hardware Required
Solaris Power Station	>DN50	Heavy-duty pole mounting straps
Solaris PLC	>DN20	Solaris aluminium brackets, mounting screws, and straps

Solaris Power Station Installation

- 1. Position the Unit:** Hold the Solaris Power Station against the pole at the desired installation height.
- 2. Thread the Straps:** Thread the pole mounting straps directly through the built-in strap holes located at the base of the unit's mounting arm.
- 3. Secure to Pole:** Wrap the straps firmly around the pole and tension them securely to lock the unit in place.



Solaris PLC Installation

- 1. Attach the Brackets:** Secure the auxiliary aluminium pole mounting brackets to the integrated mounting wings on the Solaris PLC using the provided screws.
- 2. Thread the Straps:** Pass the pole mounting straps through the designated slots on the newly attached aluminium brackets.
- 3. Secure to Pole:** Position the PLC assembly against the pole, wrap the straps around the circumference, and tighten securely.

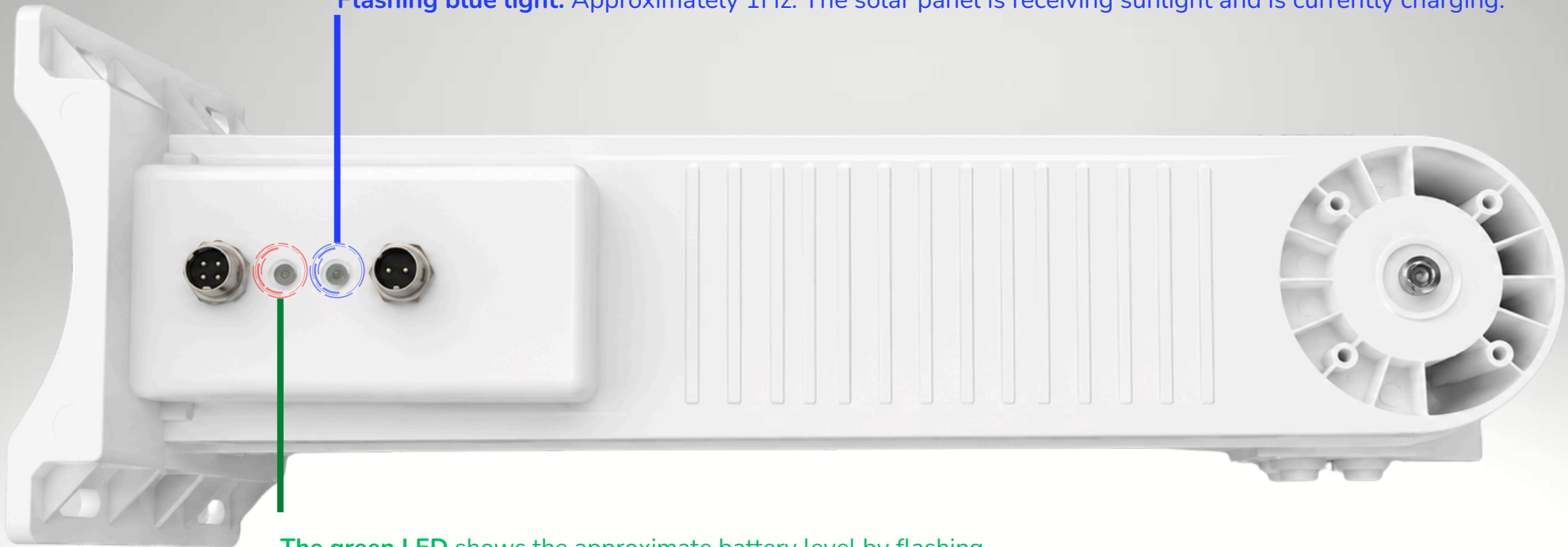


Power Station Indicator LED

Blue LED this is the solar PV LED

Constant blue light: No sun detected. The solar panel is not currently charging.

Flashing blue light: Approximately 1Hz. The solar panel is receiving sunlight and is currently charging.



The green LED shows the approximate battery level by flashing.
Each flash represents approximately 10% battery level.

For example:

- 1 flash:** Approximately 10% battery
- 2 flashes:** Approximately 20% battery
- 5 flashes:** Approximately 50% battery
- 10 flashes:** Approximately 100% battery

After showing the battery level, the green LED will wait approximately 60 seconds before repeating the flash sequence.

Power Station Installation

Install the Solaris solar panel in a clear outdoor location with good exposure to direct sunlight. The solar panel should face north where possible, as this will normally provide the best sunlight exposure throughout the day in Australia.

Mount the panel at an angle of approximately 30 to 45 degrees. Avoid installing the panel flat, as this can reduce solar performance and allow dirt, dust, or water to sit on the panel surface.

Choose a location that is free from shade. Do not install the panel where sunlight may be blocked by trees, leaves, buildings, roofs, poles, tanks, walls, or other equipment.

Check the area across the full day where possible, as shade may move across the panel during morning, midday, or afternoon sunlight. Make sure the solar panel is mounted securely and positioned so the front face of the panel has a clear view of the sky.

Before final installation, confirm the panel is clean and not covered by packaging, protective material, dirt, dust, leaves, or bird droppings. Poor solar panel placement can reduce charging performance and may prevent the Solaris from maintaining battery charge correctly.

Maintenance

Regularly check the Solaris solar panel to make sure it is clean, secure, and free from obstructions.

Remove any leaves, dirt, dust, bird droppings, or other material that may block sunlight from reaching the panel. Check that the mounting bracket, bolts, and fixing points remain secure, especially after strong wind, heavy rain, storms, or other extreme weather.

Inspect the cable and connection points for signs of damage, wear, corrosion, or loose fittings. Do not clean or inspect the solar panel in unsafe wet or slippery conditions. If the panel, bracket, cable, or connection point appears damaged, arrange for it to be inspected or repaired before returning the system to normal service.



External SMA Protection

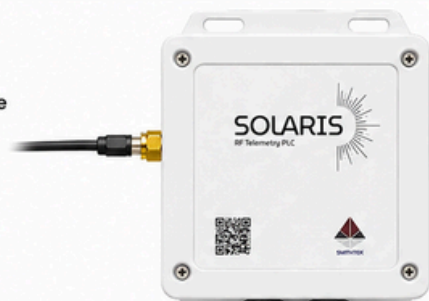
The **SMA antenna** connection should be **protected from moisture** once the antenna cable has been fitted.

After **tightening** the SMA connector, apply suitable protection around the connection point to help prevent water ingress.

This can be done using **adhesive-lined heat shrink** over the SMA joint, or by applying a neat bead of neutral cure silicone around the SMA base and connector joint. Make sure the seal covers the exposed connection area but does not place strain on the cable or connector. Check the SMA connection during routine maintenance and after heavy rain, washing, or extreme weather.

Option 1: Heat Shrink

- 1 Connect SMA cable



- 2 Slide adhesive heat shrink over joint

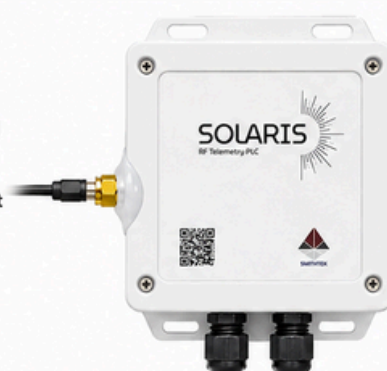


- 3 Shrink to seal

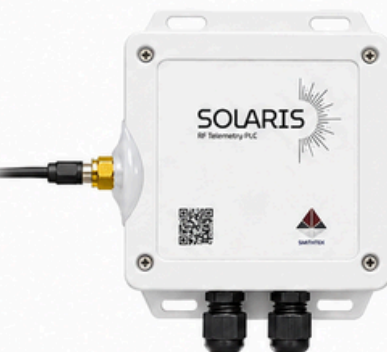


Option 2: Silicone Seal

- 1 Apply neutral cure silicone around SMA base and joint

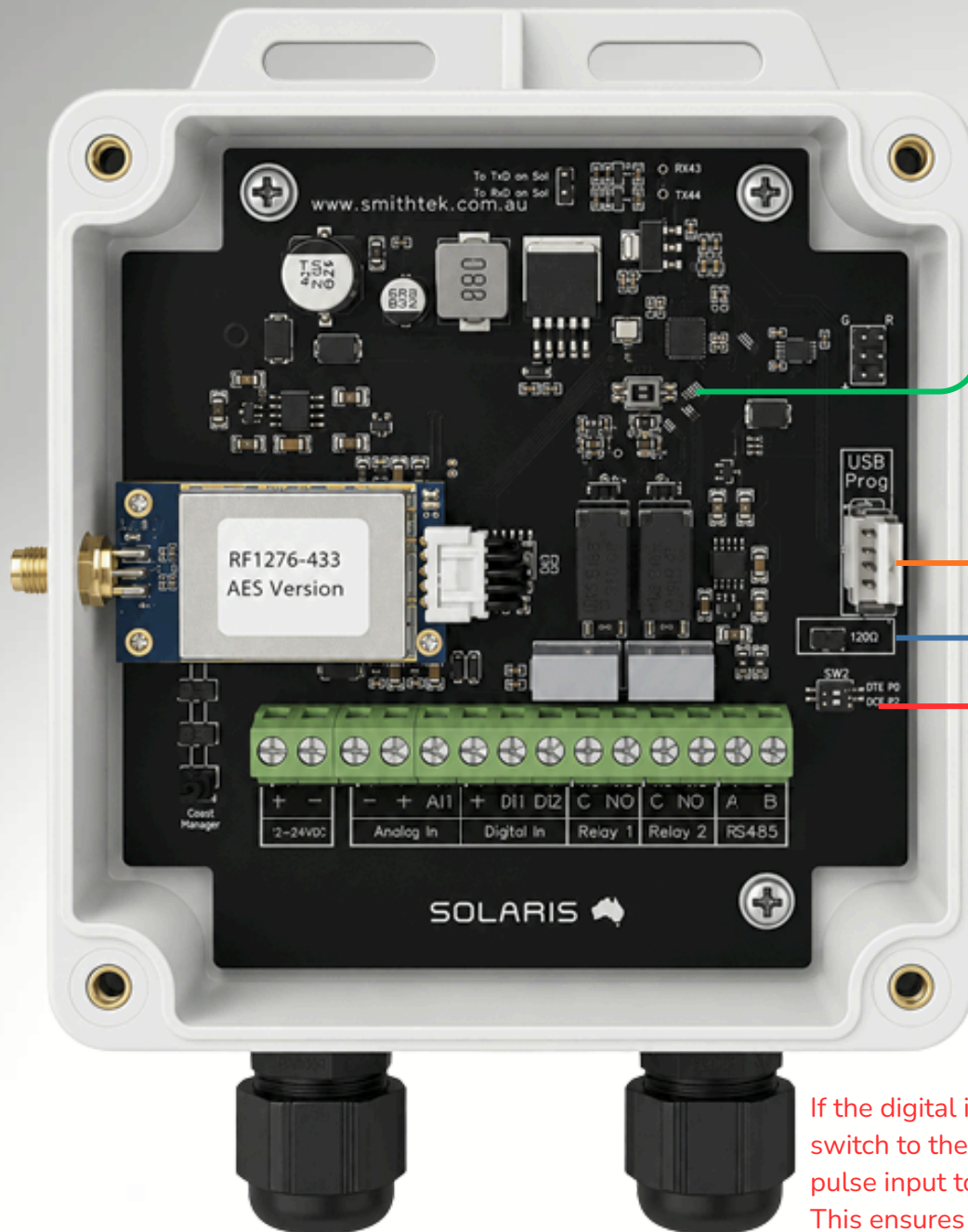


- 2 Seal against moisture



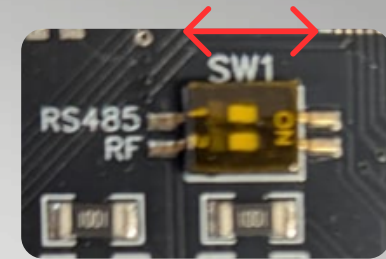
Protect the SMA connection from water ingress

Solaris Wiring Overview



RS485 & RF Activation Switches

RS485 - Left: Off
 RS485 - Right: On
 RF - Left: OFF
 RF - Right: On



When programming the Solaris, the RS485 must be left (Off)
 The programming port shares the RS485 with the programming chip. If it is right it will not allow you to upload a program

USB A Programming Port

The USB PROG is for programming the Solaris PLC using V-NET programming software. connect the USB A to USB A to your computer and the Solaris

120 Ω Termination Resistor

Jumper on will activate the 120Ω termination resistor. You can store the jumper on the "coat hanger" on the left side of the circuit board if not used.

Digital Pullup

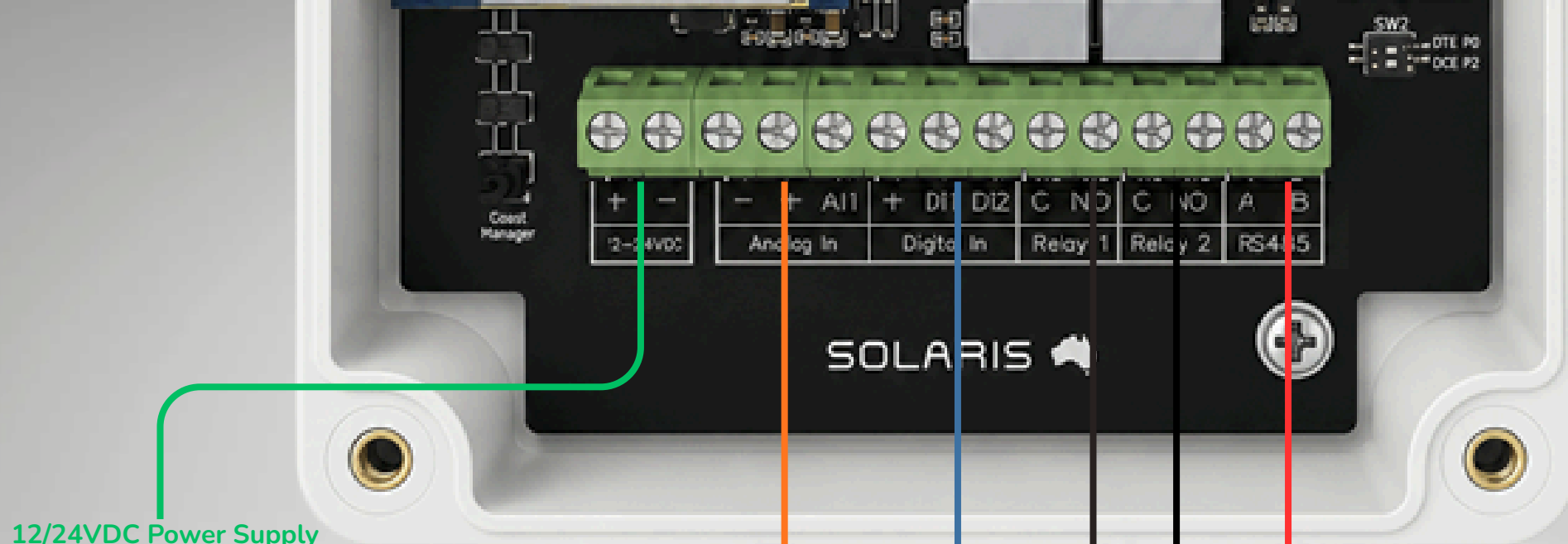
The 120 ohm termination resistor is to be used if cable lengths are longer than 20 meters, rs485 cables must be shielded, twisted-pair configuration with a characteristic impedance of 120 Ω

DI1 PU left: Pull up on
 DI1 PU Right: No pull up
 DI2 PU left: Pull up on
 DI2 PU Right: No pull up

The digital input pull-up resistors are 2.2 kΩ and are used for NPN-type pulse outputs, commonly found on pulse transmitters.



If the digital input is being used with an NPN pulse output, slide the pull-up switch to the right. This applies +VE through the pull-up resistor, allowing the pulse input to switch correctly between high and low states. This ensures the digital input can reliably detect pulses from a transmitter.



12/24VDC Power Supply Minimum 100mA

- + = External power voltage
- - = External power ground

4 20mA Passive Analog input

- + = internal voltage
- - = internal ground
- AI1 = 4 20mA sensor signal

2* Digital Inputs PNP Configurable to Pulse Input 500hz

- + = internal voltage
- DI1 = digital input 1
- DI2 = digital input 2

2*Relay outputs 100VDC - 1A

- C = common wire
- NO = Normally open wire

RS485 Modbus Open Source Serial Coms

- A = A differential line
- B = B differential line

Before Wiring the Solaris PLC



Pre-Wiring & Enclosure Handling

1. Environmental Requirements

Wire the Solaris PLC in a clean, dry environment isolated from:

- Wind-blown dust and rain.
- Water spray or washdown areas.
- Debris from grinding, drilling, or cutting.

CRITICAL: Never leave the enclosure open during rain, high wind, or dusty conditions.

2. Circuit Board Protection

Removing the lid exposes the internal circuit board. While protected by a conformal coating, it is not immune to damage from poor installation practices. You must prevent the entry of:

- Water or moisture.
- Dust, dirt, or insects.
- Metal filings or stray cable strands.

3. Handling Checklist

Complete these steps before handling the enclosure or starting any wiring:

- Isolate power to the system completely.
- Wash and dry your hands thoroughly.
- Avoid direct contact with circuit board components.
- Keep the lid and rubber sealant strip pristine.
- Contain debris by keeping loose wire strands away from the board.

4. Cleaning the Enclosure

Inspect the inside of the enclosure carefully before closing the lid. All dust, wire clippings, and particles must be removed.

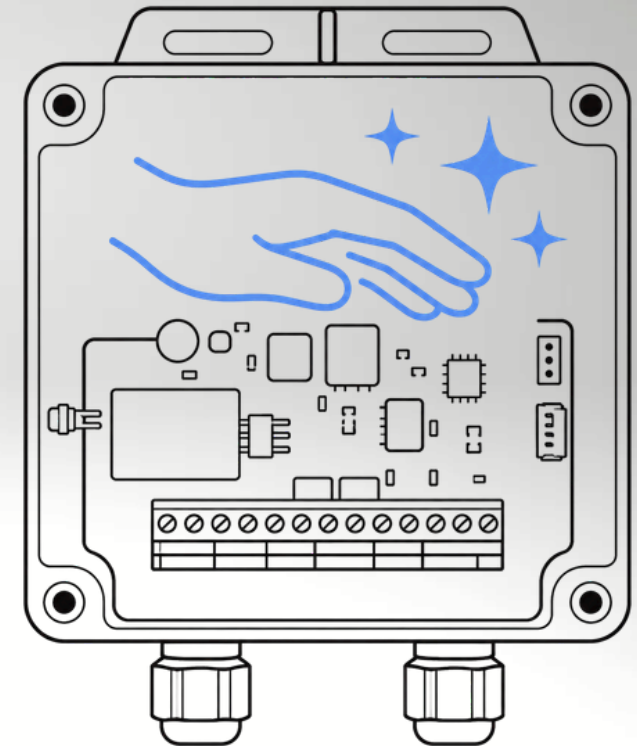
Approved Cleaning Methods:

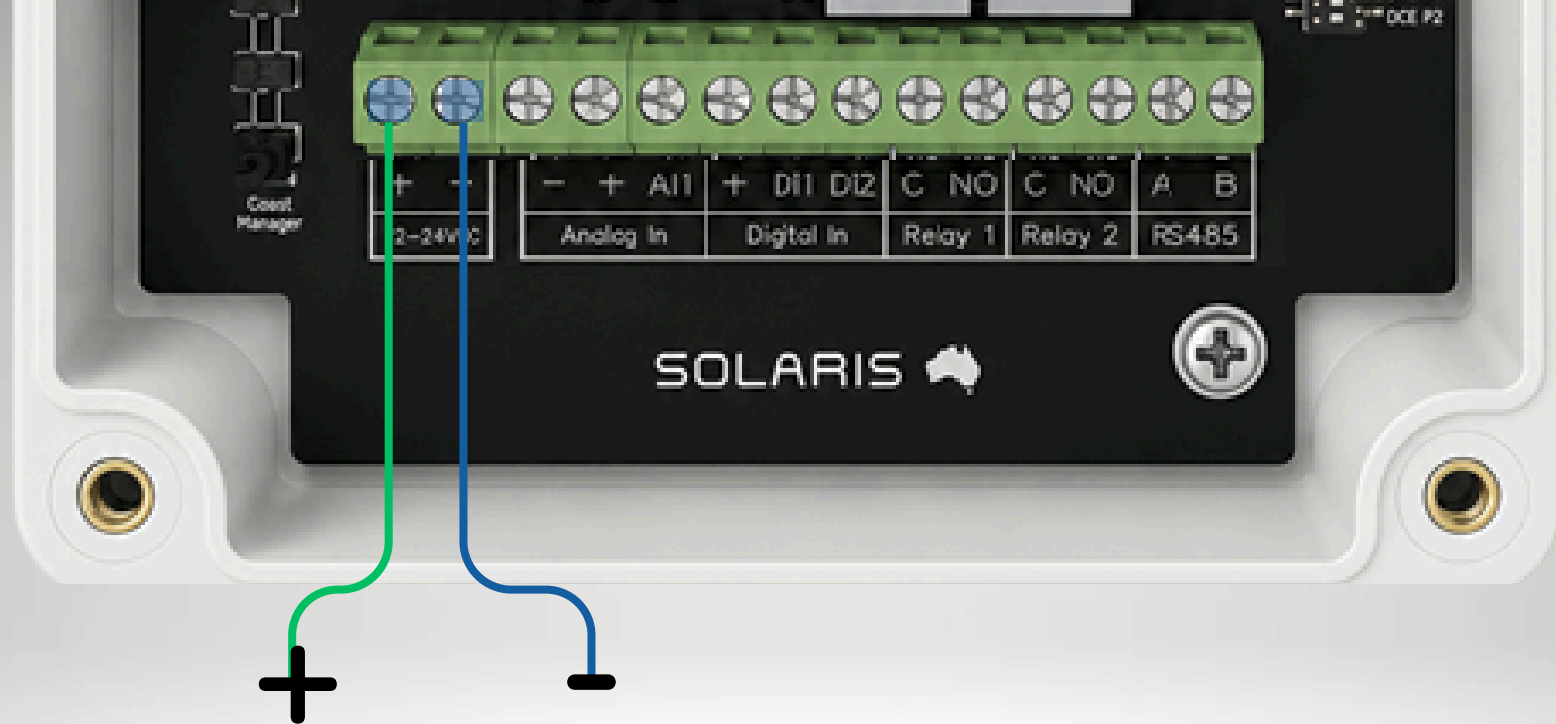
- Clean, dry, lint-free cloth.
- Soft anti-static brush.
- ESD-safe vacuum cleaner.

Prohibited Cleaning Methods

- Do not use water, solvents, wet cloths, or general cleaners.
- Do not use household vacuums, as static electricity will damage electronics.

WARNING: *The enclosure must be completely clean and dry before tightening the lid. Failure to comply may cause water ingress, corrosion, electrical faults, or total system failure.*





Connecting DC Power Supply

Solaris Power Station Connection

The Solaris Power Station is supplied with a pre-moulded power cable for connection to the Solaris PLC.

Wire colours are as follows:

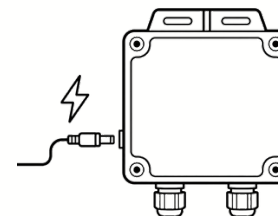
Green: + DC Positive

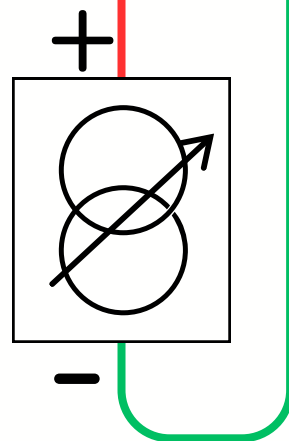
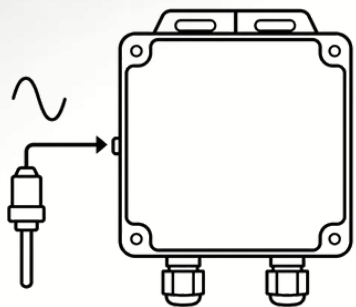
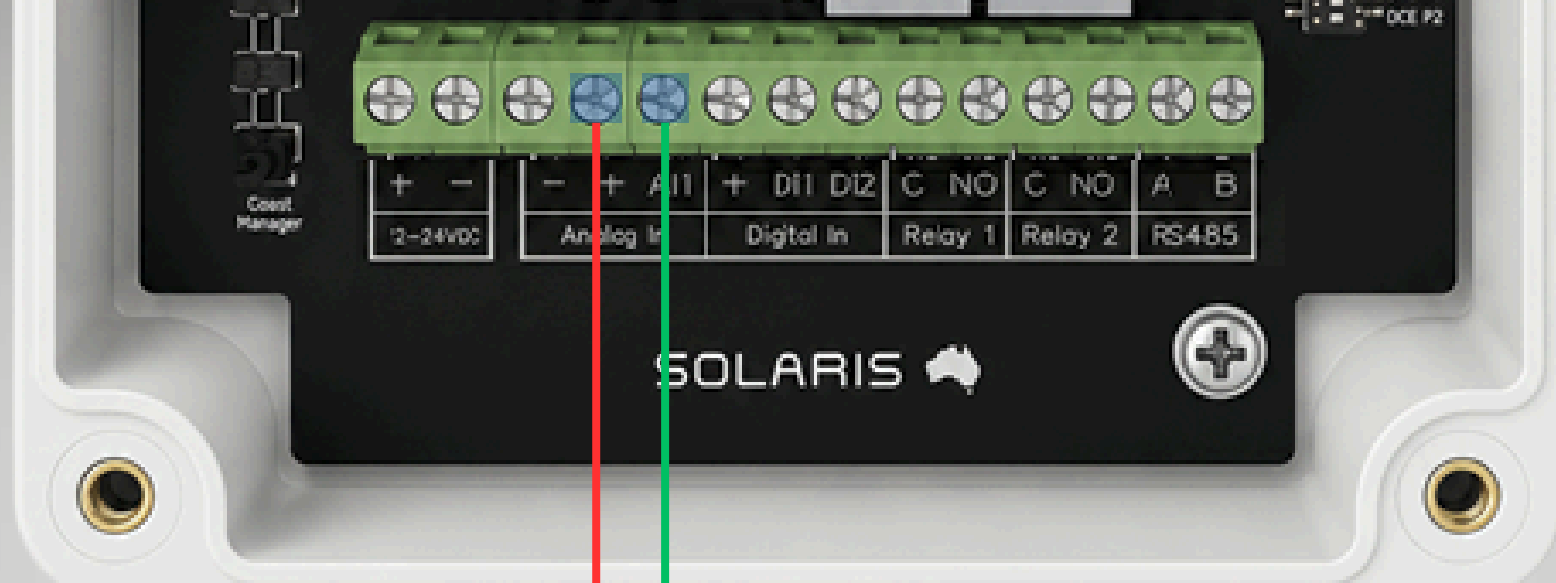
Blue: -DC Negative

Before powering the Solaris PLC, ensure the polarity is correct. Incorrect polarity may damage connected equipment. The Power Station provides the required DC supply for the Solaris PLC, connected sensors, and relay operation.

External DC Power Supply

The Solaris PLC is compatible with 12/24 VDC power supplies and can accept a stable DC voltage from external sources other than the Solaris Power Station. When using an external power supply, it must provide a stable, low-ripple DC output capable of supplying at least 500 mA. This ensures the Solaris PLC, connected sensors, and any energised relays can operate reliably.



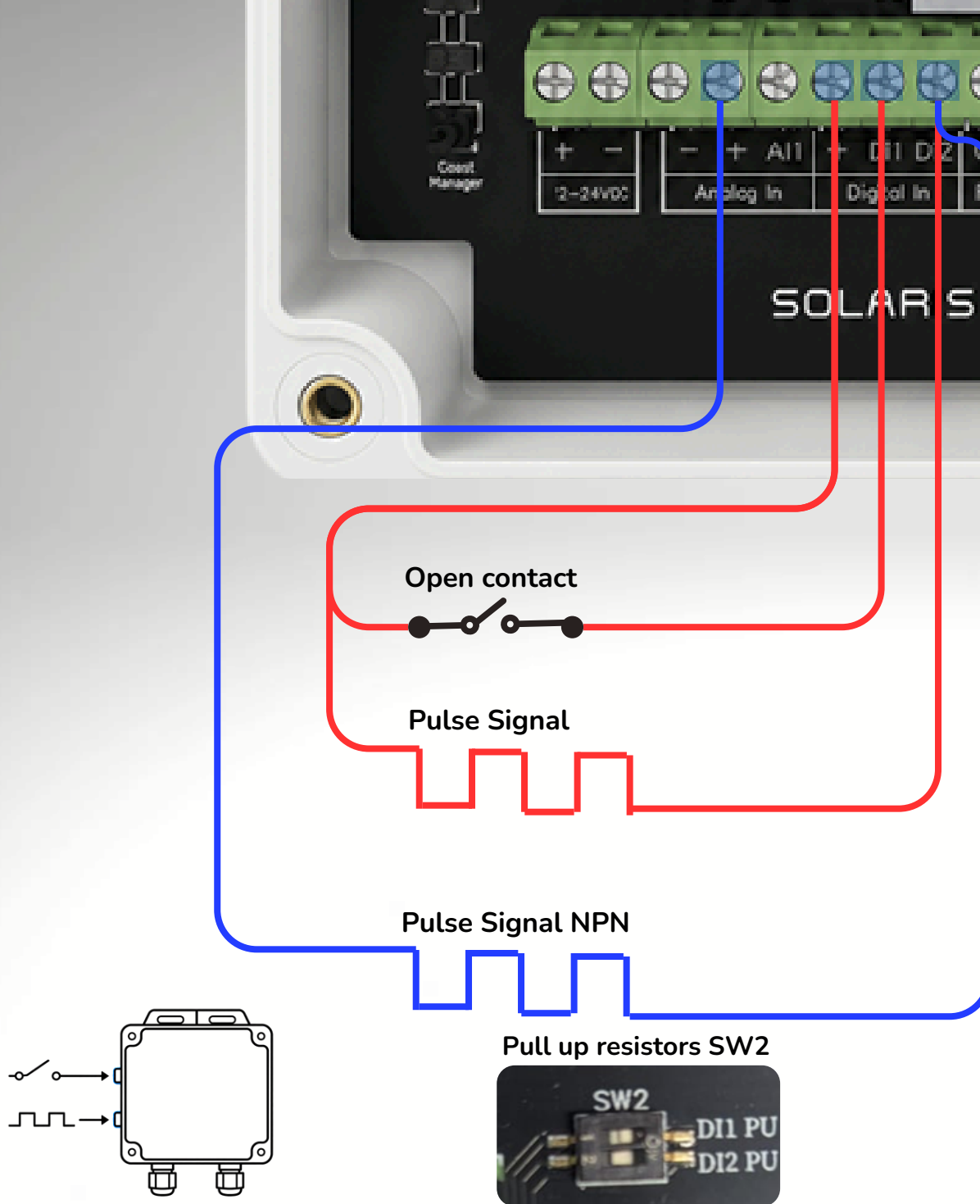


Connecting a 4–20 mA Sensor

The Solaris PLC includes 1 × analogue input for connecting a 4–20 mA sensor, such as a pressure, level, flow, or other industrial transmitter. Connect the sensor signal output to the AI1 analogue input and ensure the sensor sensor power is the same as the Solaris, especially the ground wire.

The analogue input is read using a 10-bit ADC, giving a raw value range of 0 to 1023 counts. The input value is automatically scaled to a human readable 4–20mA signal. The user only needs to convert this scale to a usable value that matches the connected sensor range

For best results, use a stable DC supply and shielded cable where the sensor cable run is long or installed near pumps, motors, or other electrical noise sources.



Digital Inputs

The Solaris PLC features two PNP-type digital inputs that require a positive DC voltage signal to trigger a TRUE state.

Input Voltage Thresholds:

- 10 VDC to 29 VDC: TRUE (On)
- Below 1 VDC: FALSE (Off)

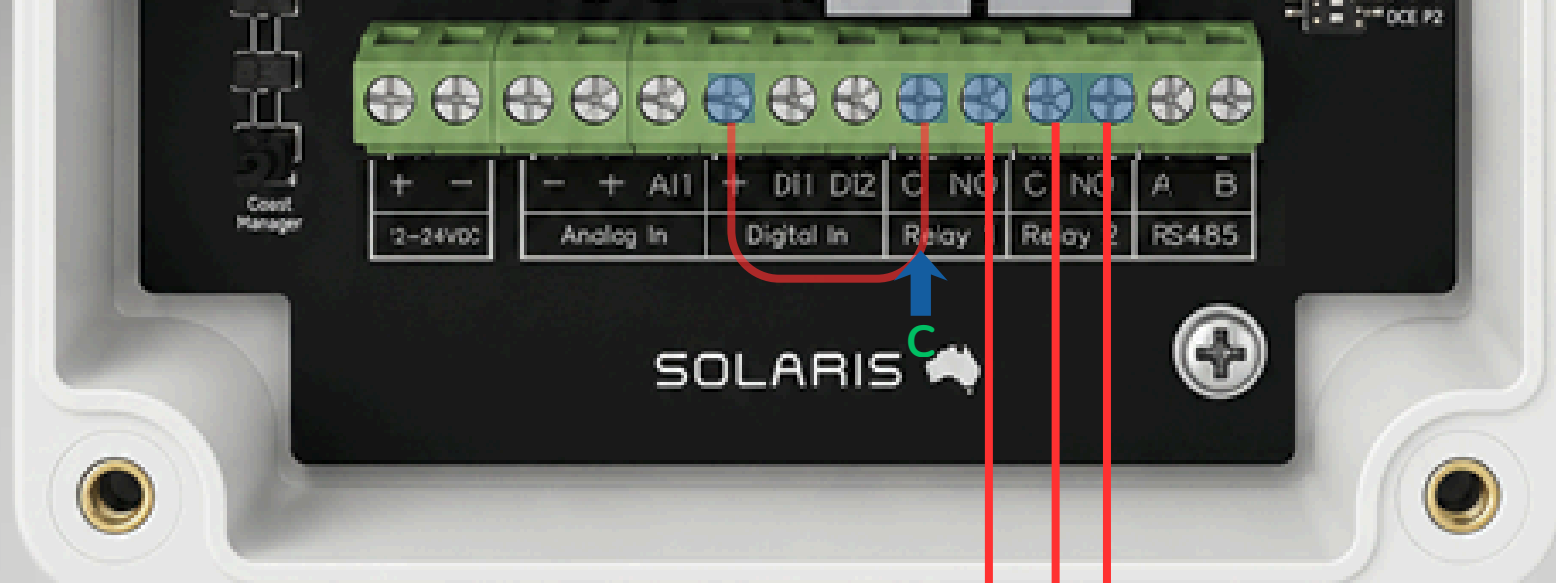
Pulse Input Mode:

Each input can be configured as a pulse input via V-NET, supporting a maximum pulse frequency of 500 Hz.

NPN Sensors & Pull-Up Resistors:

For sensors or flow meters using an NPN-type pulse output, the Solaris PLC features an internal 2.2 kΩ weak pull-up resistor.

- **Activation:** Enable the resistor using the SW2 DIP switches.
- **Rule:** Only activate the pull-up resistor if explicitly required by your connected NPN device.



Relay Output

The Solaris PLC includes 2 × relay outputs.

Each relay output provides a dry contact suitable for switching external circuits, such as:

- **Contactor coils**
- **External relay coils**
- **Solenoids**
- **External sensor power supplies**
- **Low-current DC loads**

For general use, each relay output should be treated as suitable for switching loads up to approximately:

Relay Output Rating Recommended:

1A at 30 VDC Resistive DC loads

0.35 A at 125 VAC Resistive AC loads

Each relay output has 2 terminals:

C = Common relay contact

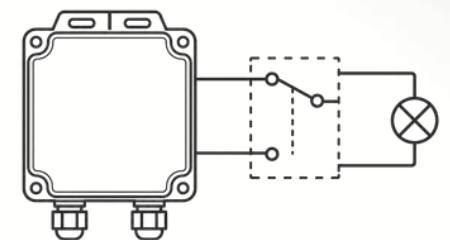
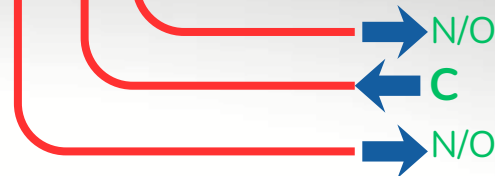
NO = Normally open relay contact

There is no normally closed contact available on the Solaris PLC relay outputs.

When the relay is off, the C and NO terminals are open. When the relay is energised, the C and NO terminals close, allowing the external circuit to switch on. The relay outputs are suitable for control switching, not for directly switching large motors, pumps, or high-current loads.

For pump control, the relay output should be used to switch a suitable external contactor or interposing relay.

When switching inductive loads such as relay coils, contactors, or solenoids, suitable suppression should be used where required.





RS485

The Solaris PLC includes one RS485 communication port for expansion and device connectivity.

Terminal Layout:

- A: RS485 A (+)
- B: RS485 B (-)

Network Capabilities:

- Device Limit: Supports up to 32 devices on a single bus.
- Roles: Functions as a Master or Slave device (Modbus RTU or other serial protocols).
- Integration: Connects to other PLCs, HMIs, SCADA platforms, and industrial sensors. Configuration is managed via V-NET software, which supports standard serial settings (baud rate, parity, stop bits, and device addressing).

Wiring Topology:

- Approved: Wire devices using a drop bus or daisy-chain topology.
- Prohibited: Avoid star wiring configurations, as they cause data corruption and communication issues.

Termination Resistor:

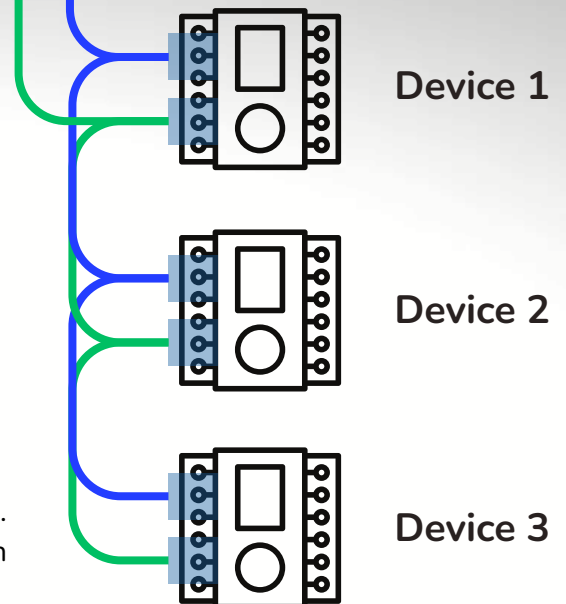
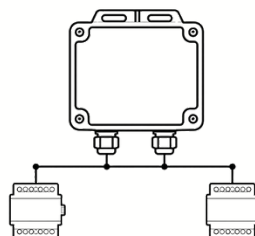
- Hardware: An integrated 120 Ω termination resistor jumper is located to the right of the RS485 terminals.
- Rule: Enable this jumper only if the Solaris PLC sits at the final, physical end of the RS485 communication line

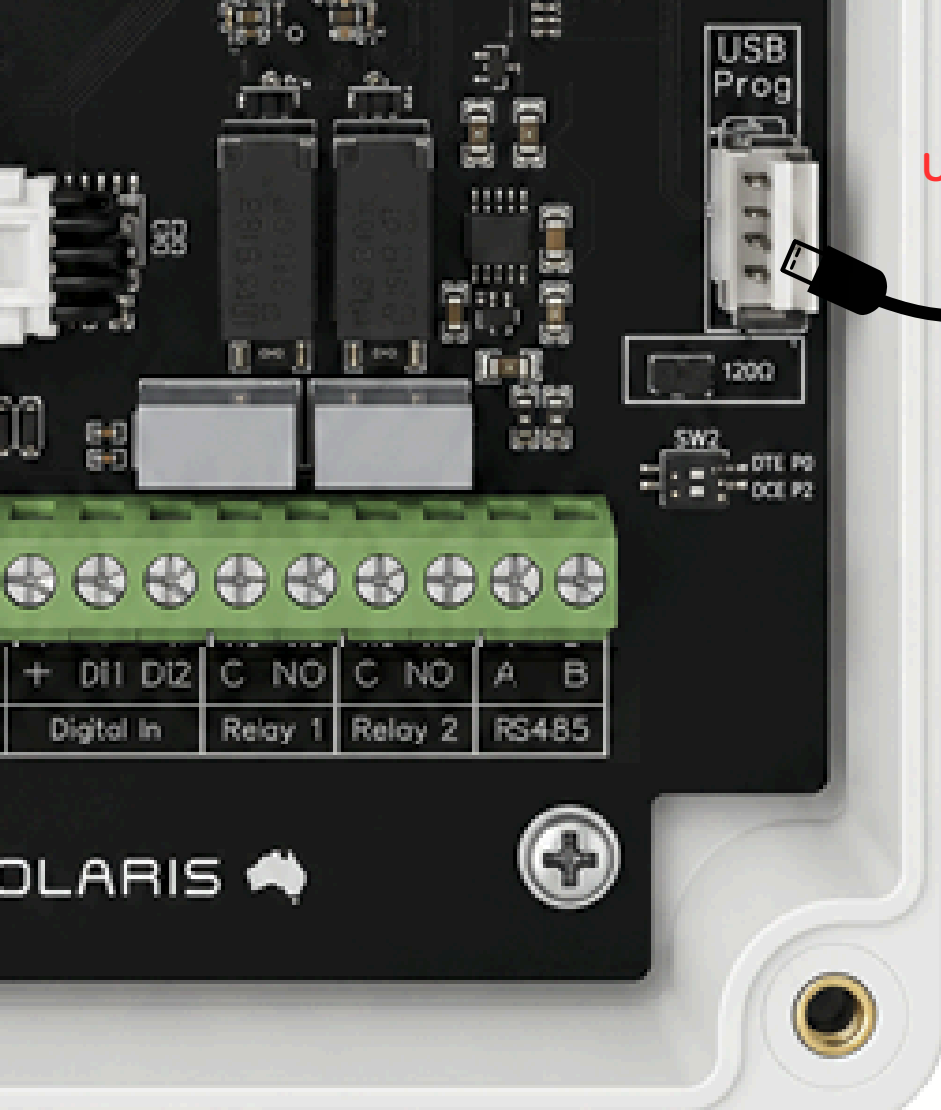


120 ohm Termination Resistor



Termination resistor
jumper lives on the
coat hanger





USB-A to USB-A



USB Program Upload

To upload a sketch from V-NET to the Solaris PLC, the RS485 DIP switch on SW1 must be slid to the left position, OFF.

This is required because the RS485 port and the programming chip share the same serial port.

If the RS485 DIP switch is not switched OFF, the Solaris PLC will not accept the program upload.

Upload Procedure:

1. Slide the RS485 DIP switch on SW1 to the left / OFF position.
2. Connect the supplied USB A to USB A programming lead between the computer and the Solaris PLC.
3. Open V-NET.
4. Create or open the required Solaris program.
5. Select the correct serial port.
6. Upload the program to the Solaris PLC.

During the upload process, the 2 × serial LEDs will flash to indicate communication activity. Once programming is complete, the RS485 DIP switch can be returned to the required operating position if RS485 communication is being used.

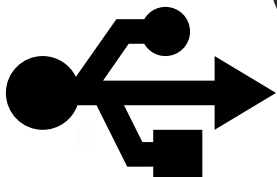
NOTE!

The Lead required to program the Solaris is a USB-A to USB-A
Contact Smithtek support for replacement if lost

info@smithtek.com.au



SW1



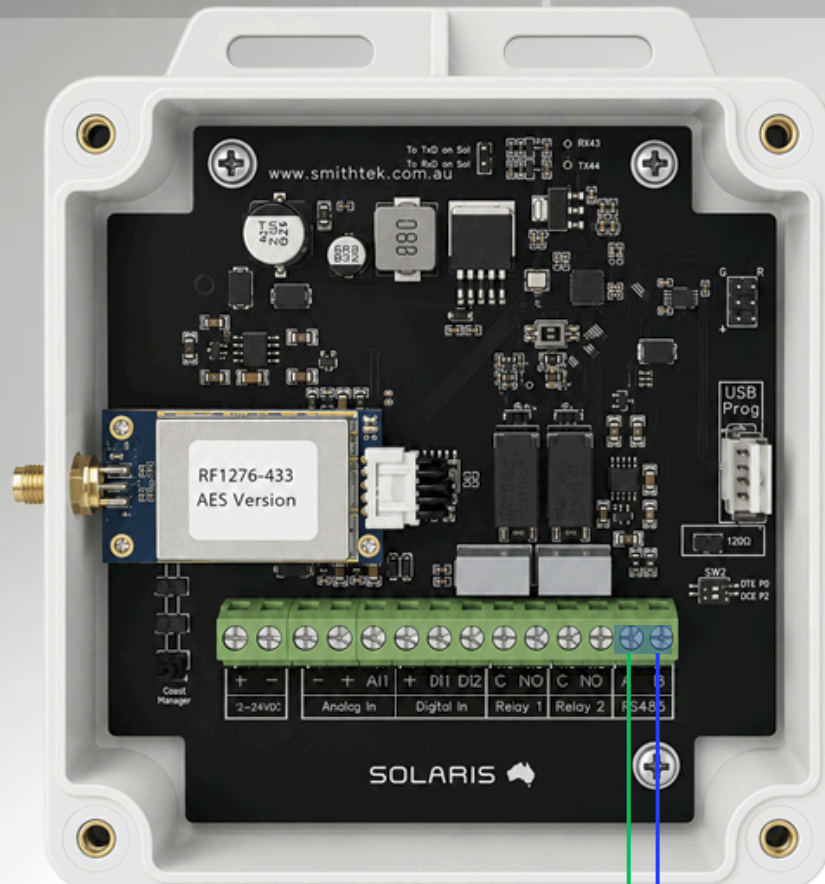
RF Antenna and Communications

The **Solaris PLC** includes an **SMA antenna** connection for **RF** communications.

The RF module can achieve communication ranges of up to 15 km, depending on installation conditions, antenna placement, terrain, and line of sight. A line-of-sight survey should be completed before installation to ensure the best possible RF link quality.

The Solaris PLC is compatible with the Smithtek PassPort Gateway as standard and can also communicate with Mako PLCs, making it part of the wider Smithtek RF telemetry topology. RF communication settings can be configured in V-NET. The supplied antenna uses an SMA connection and must be connected to the Solaris SMA antenna port. The antenna should be hand-tightened only. Do not overtighten, as this may damage the SMA connector.





HMI Screen Integration

The Solaris PLC RS485 port can communicate with most HMI screens using the Modbus RTU protocol.

This allows the Solaris PLC to be controlled locally through a modern touchscreen interface, providing a simple way to view system status, adjust settings, and operate connected equipment.

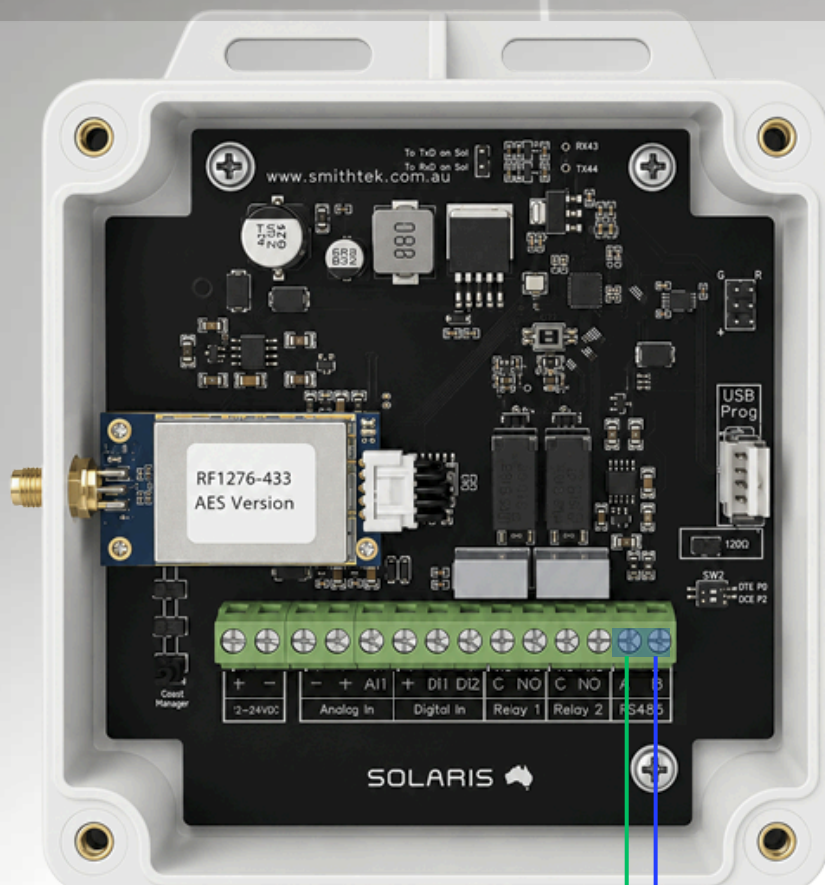
The RF communications can operate at the same time as the local HMI connection, allowing the Solaris PLC to provide both:

- **Local control using an HMI screen**
- **Remote control using Smithtek RF telemetry**

Using an HMI screen can reduce the need for traditional panel-mounted pilot lamps, switches, and selector switches.

This provides a cleaner control panel layout while still allowing operators to monitor and control the system locally.

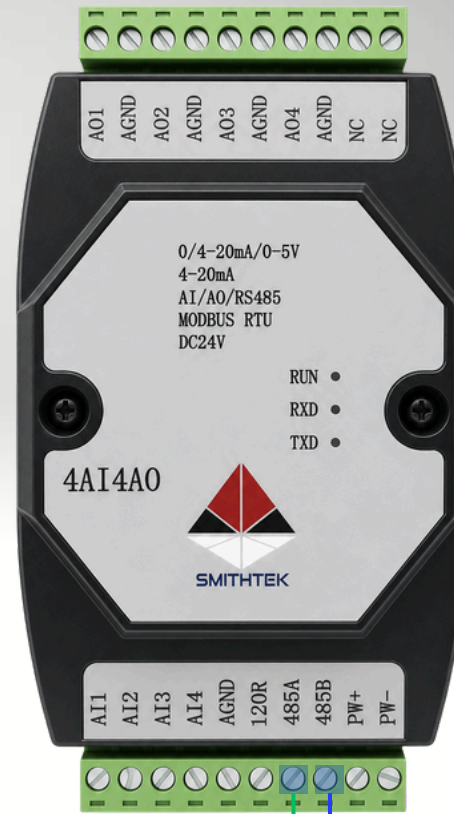
Expansion



Digital IO Module



Analog IO Module



Modbus I/O Expansion Modules

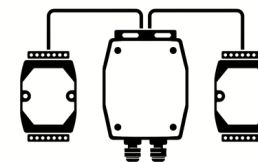
The Solaris PLC can expand its input and output capabilities using Smithtek RS485 Modbus extension modules for larger, more complex control applications.

Available Modules

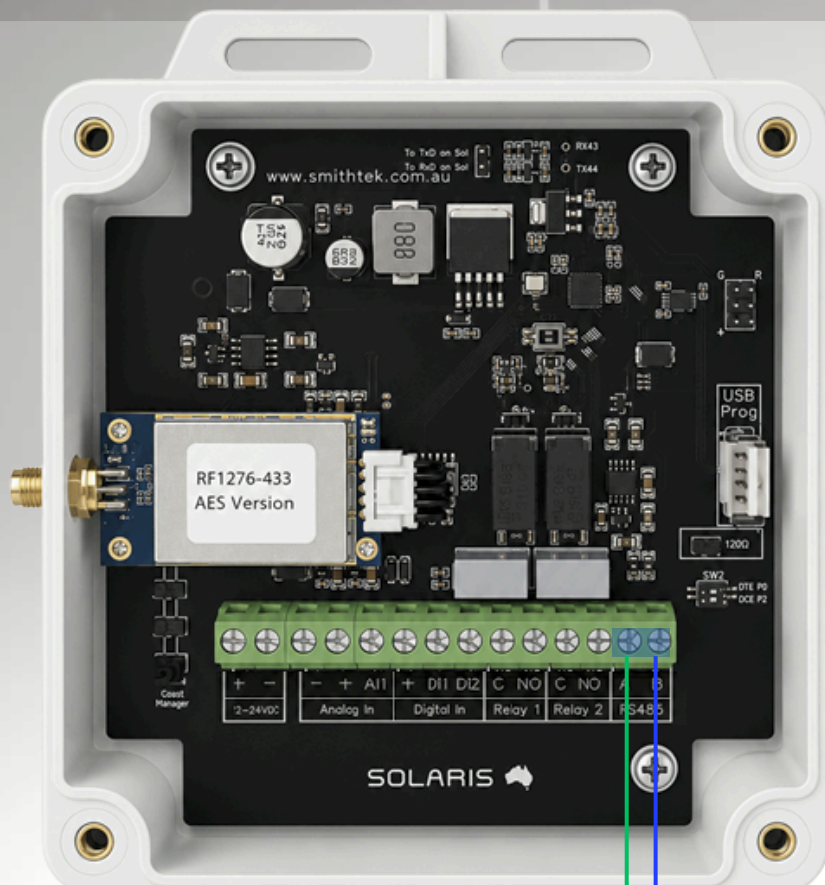
- Analog 4I4O Module: Adds 4 × Analogue Inputs and 4 × Analogue Outputs (selectable 4–20 mA or 0–5 V).
- DO8DI8 Module: Adds 8 × Digital Inputs and 8 × Digital Outputs.

Integration & Configuration

- Connection: Connect expansion modules directly to the main Solaris RS485 Modbus port.
- Control: Configure the modules within V-NET software to read and write data seamlessly as part of your control program.
- Benefit: Provides a highly flexible, high-density I/O footprint while keeping the physical system footprint compact.



Weather Stations



Supported Measurements:

- Wind Speed
- Wind Direction
- Temperature
- Humidity
- Rainfall
- Additional weather parameters supported by the connected device

Typical Applications:

- Irrigation Shutdown
- Pump Protection
- Environmental Monitoring
- Remote Site Telemetry
- Weather-Based Automation Systems

The **Solaris PLC** supports a wide range of weather stations using **Modbus RS485** communication. Weather data can be read directly into the PLC and utilised for monitoring, alarming, automation and remote reporting applications.

Smithtek has extensive experience integrating **Gill Instruments** weather stations. Gill offers a wide range of weather monitoring solutions, including models capable of measuring wind speeds up to 60 m/s.

Weather station values are imported into the Solaris PLC using V-NET and can be used throughout the control program for logic, calculations, alarming and telemetry reporting.



Smithtek RF Network Compatibility

The Solaris PLC is a Smithtek product and is designed to operate as part of the Smithtek RF telemetry system. By design, the Solaris PLC is compatible with the Mako PLC and the PassPort Gateway using the Smithtek RF module.

The Solaris PLC can be:

- Added to an existing Mako and PassPort RF network
- Used as part of a new Smithtek RF network
- Interchanged with Mako PLCs and PassPort Gateways where suitable
- Configured as part of a distributed RF telemetry system

Using the Modbus over RF protocol, the system designer only needs to assign a unique device ID to each node on the network.

This allows Solaris PLCs, Mako PLCs, and PassPort Gateways to communicate across the same RF network when correctly configured. All RF settings must match across the network to ensure reliable communication between nodes. These settings include items such as RF frequency, network configuration, addressing, and any other RF communication settings configured in V-NET. If the RF settings do not match, the devices may not communicate correctly.

V-NET Programmer Installation Guide

Follow these steps to install the V-NET Programmer V8 on your Windows computer. For the Solaris your V-NET Version must be greater than **Version 8.0.0.156**

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
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.

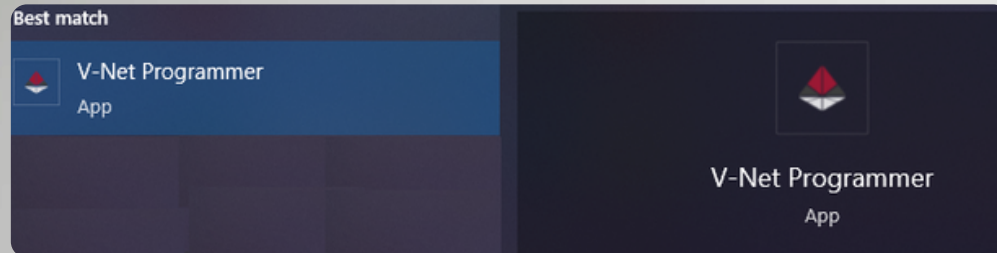
You have now successfully installed the V-NET Programmer on your Windows computer.

Enjoy using the software!

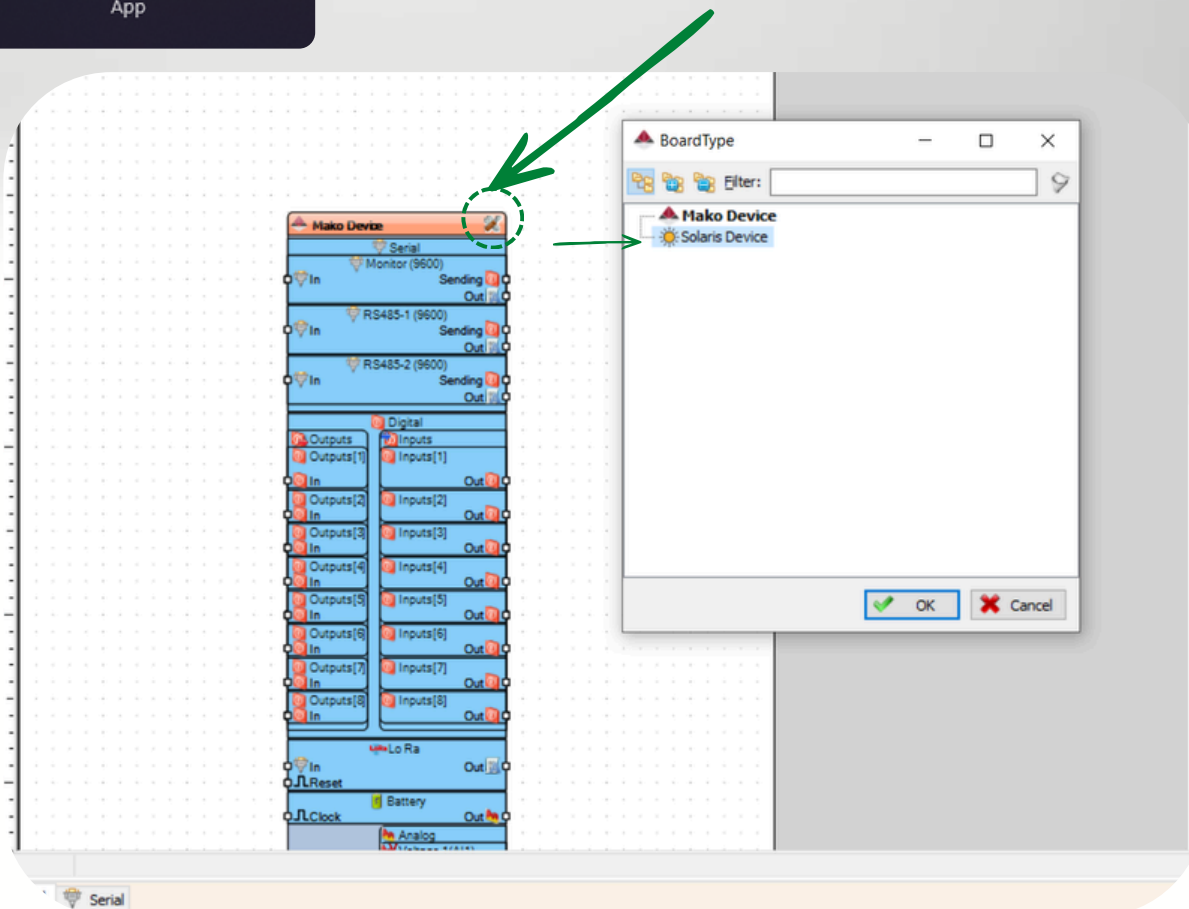
Opening V-NET



Once you have installed V-NET, there should be a V-NET logo on your desktop. Double click it to open the app, or search your apps using the windows search bar.

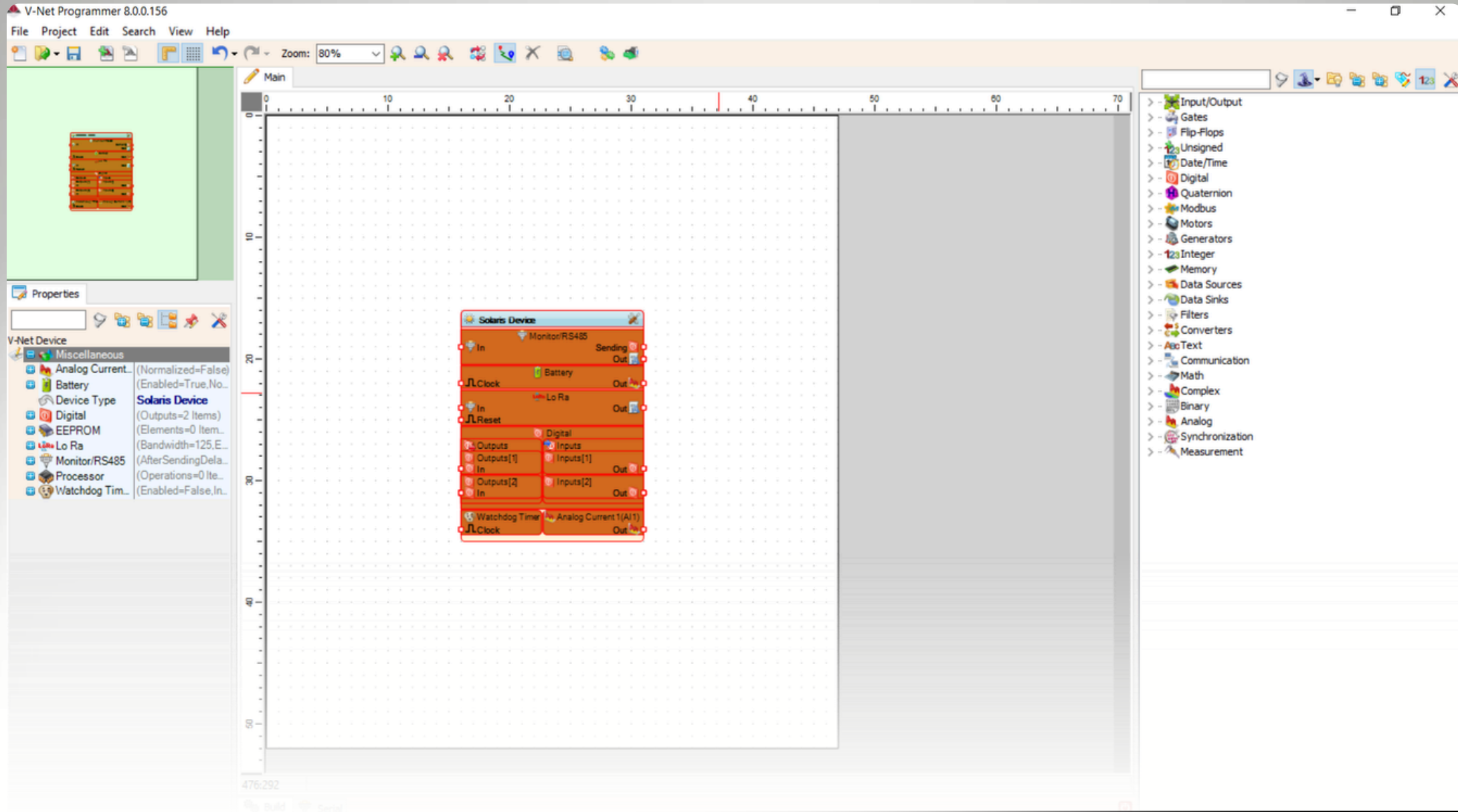


When V-NET Opens it defaults to the **Mako PLC**. Click the **tool icon** on the top right of the Mako board and select **Solaris Device** then press **OK**.

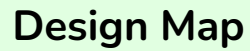


General Layout

When you have selected the Solaris board the layout will look like the below image:



Programme Tools



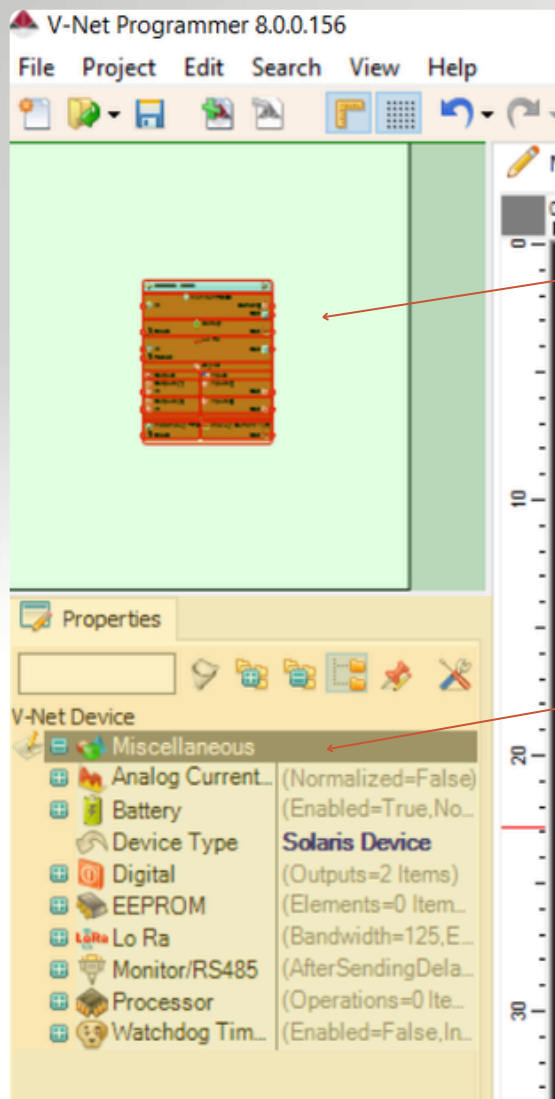
Design Area

Solaris & Components Properties

Components

Compile and Monitor

Design Map & Solaris Components Properties:



Design Map

The design map allows you to see the whole project area.

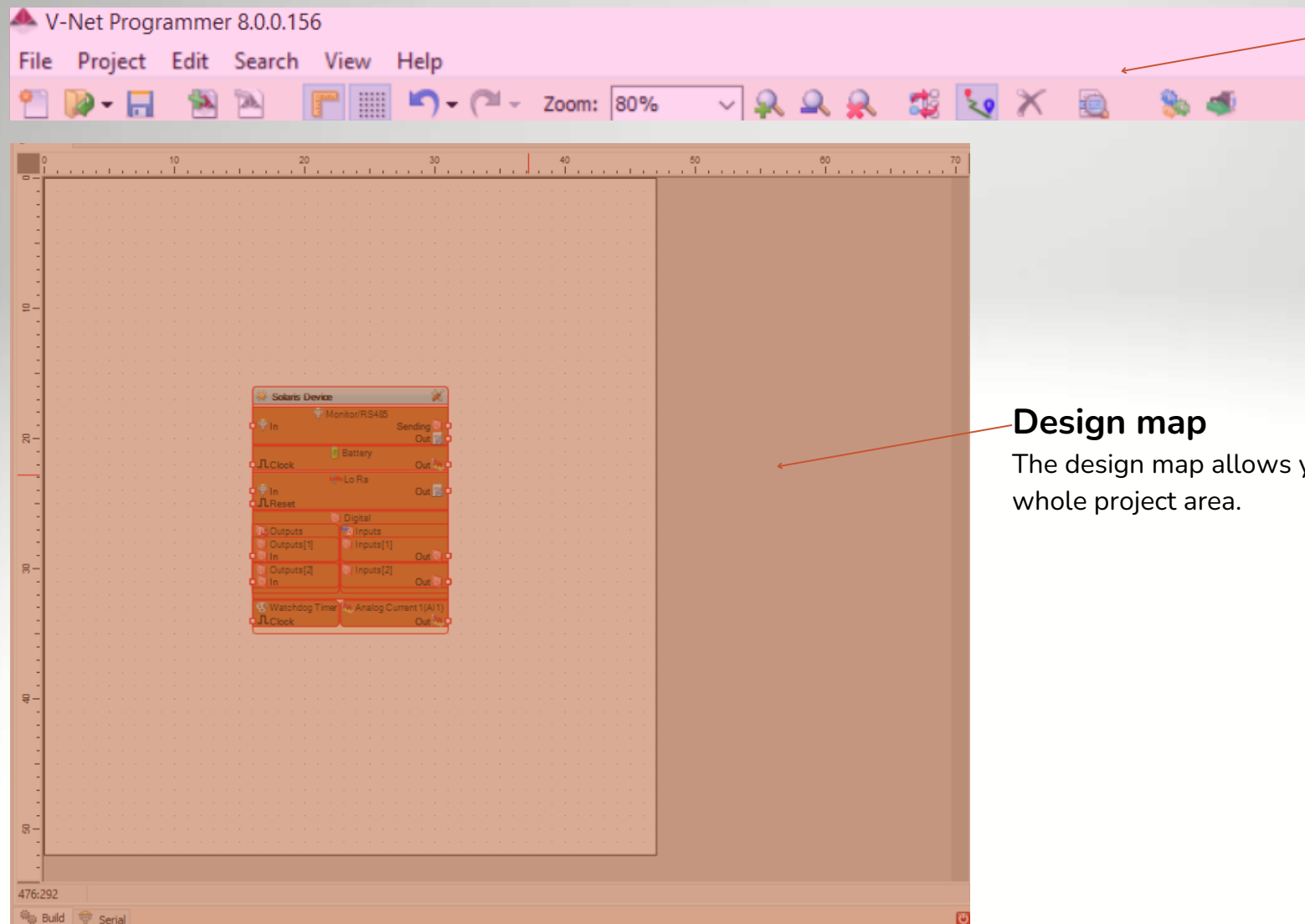
Solaris & Components properties

The Solaris 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.**



Layout Meanings

Programme Tools & Design Map:



Programme Tools

This is the basic tools, save files, load files, create sub diagrams.

Design map

The design map allows you to see the whole project area.

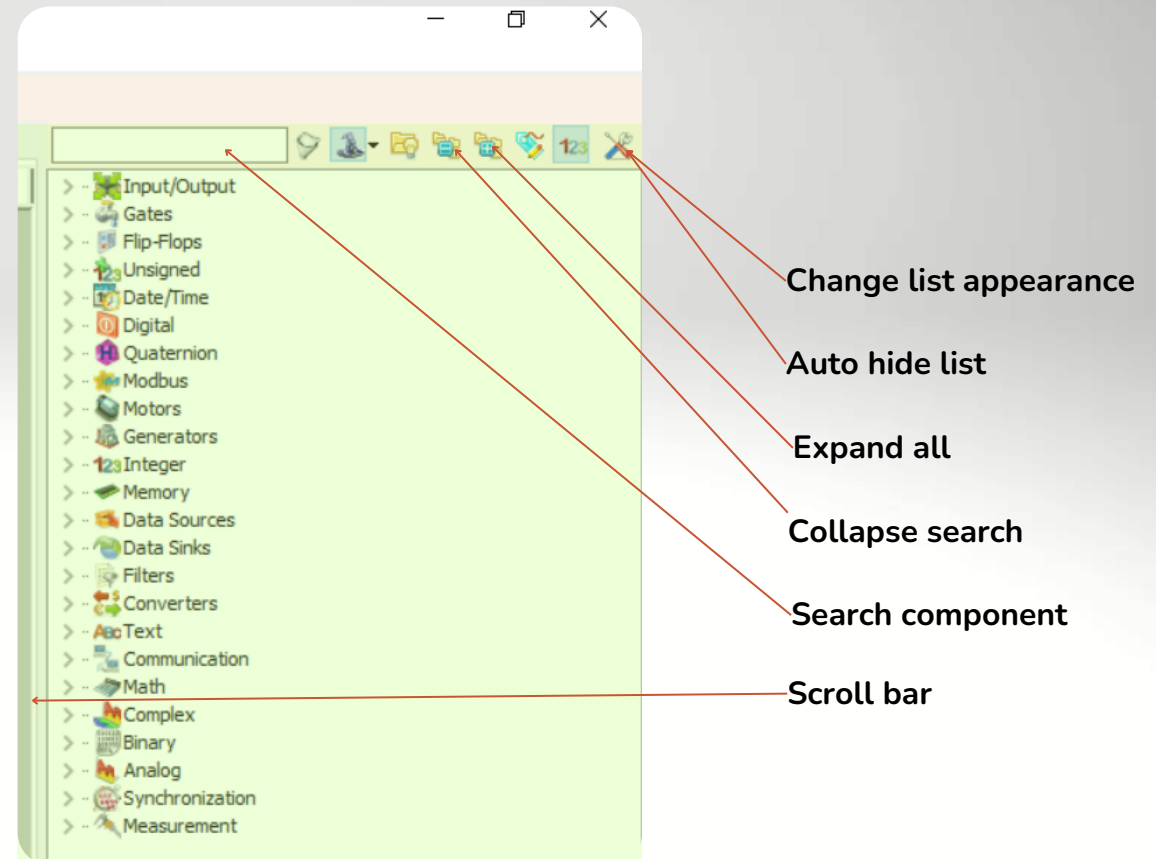


Layout Meanings

Compile and Monitor and Components:

Components

This is the library of instruction sets (Components) to use 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



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.

Open program compile and serial scope windows.

Mouse Control

The mouse is the main control method used throughout the V-NET programming environment.

Use the mouse to:

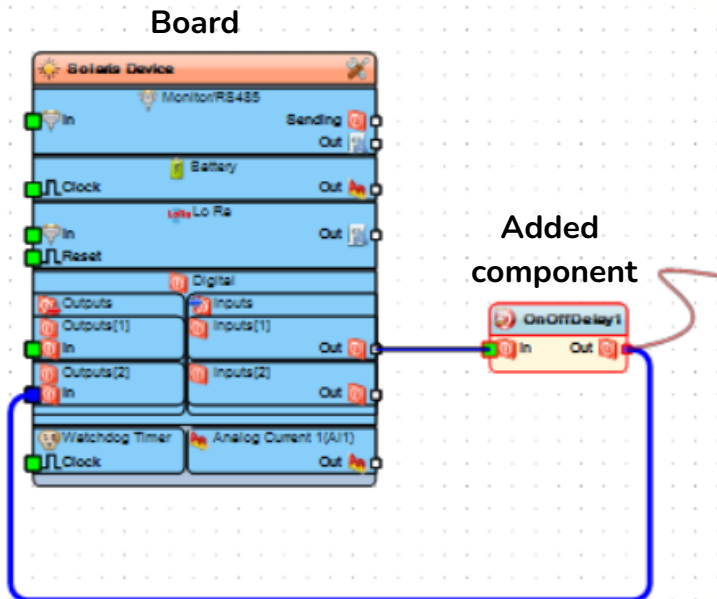
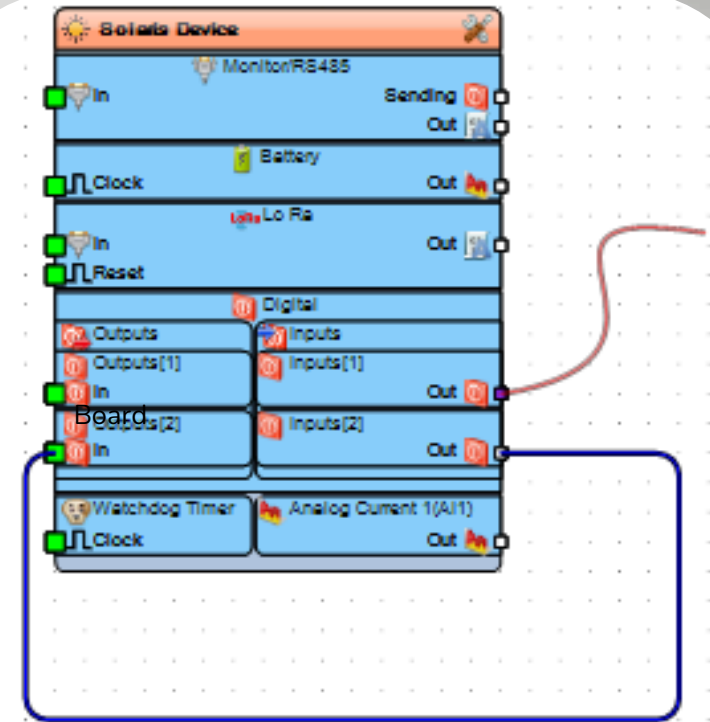
- Place components onto the workspace
- Select and move items
- Create wires between components
- Connect board pins to logic blocks

Wires act as the signal pathways within the PLC program. They transfer signals from one component, input or board pin to another.

Basic Example:

A digital input can be wired directly to a digital output.

If Digital Input 2 is triggered, the signal is passed through the wire to Digital Output 2. The output will then turn on or off depending on the input state.



Within V-NET, the Solaris or Mako PLC is referred to as a Board. A Component is a functional block that can be added to your program from the Component Library located in the top-right corner of the screen.

Components can be wired:

- To and from the PLC board
- Between other components
- Into larger control and automation sequences

Adding Components:

1. Search for the required function or instruction in the Component Library.
2. Double-click the component, or drag and drop it into the design area.
3. Create wires between components to build your program logic.

Components form the building blocks of your PLC application and are used to create control, monitoring and automation functions.

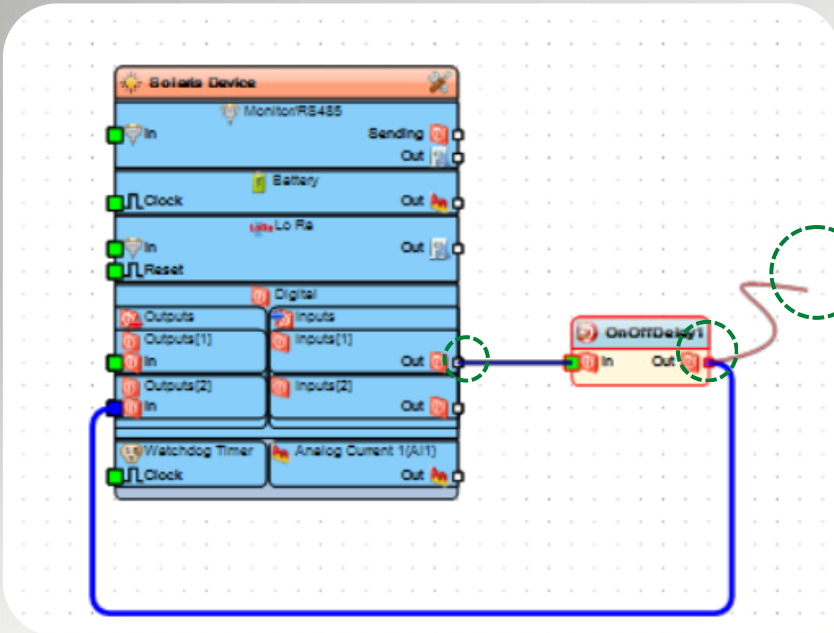


Mouse Control

Left / Right Click

To create a wire, left-click and hold the mouse button on any available pin on the board or component. You can cross-wire between different data types where supported. Pins will only be available if they can be connected. If a pin cannot be connected, it will turn light grey.

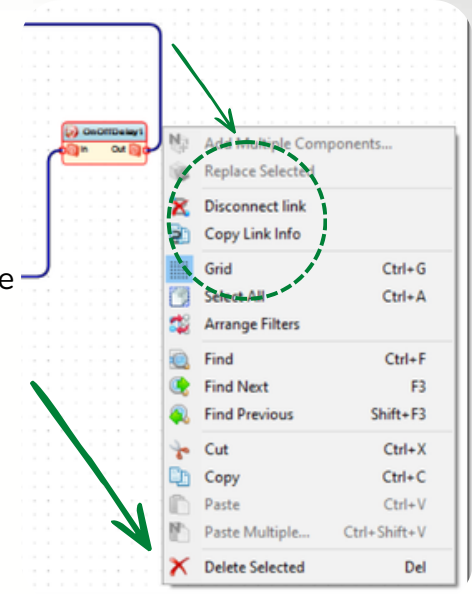
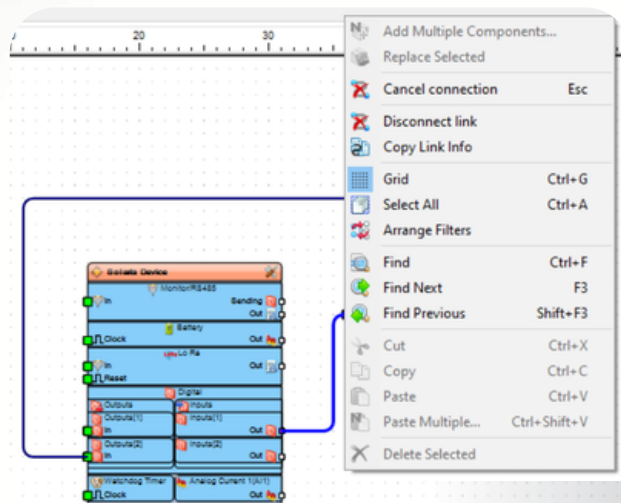
While holding the left mouse button, move your mouse pointer from the starting pin to the next pin. When the wire reaches a valid destination pin, the arrival pin will turn red. Release the left mouse button to create the wire.



To remove a wire, right-click on the wire and select Disconnect Link.

To delete a component, right-click on the component and select Delete Selected.

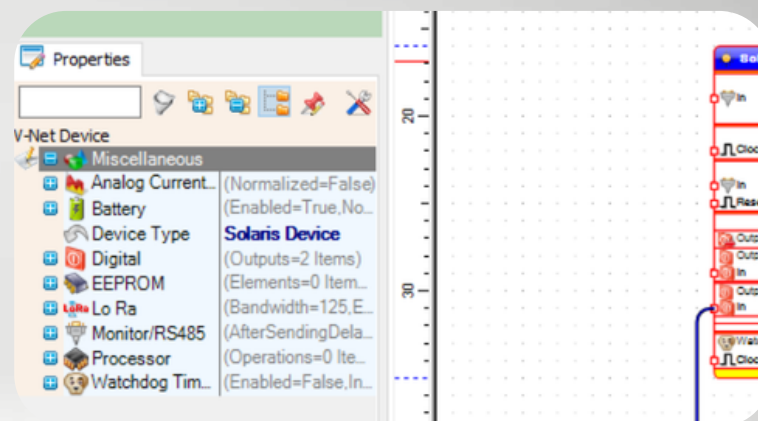
To cancel wiring while halfway through creating a connection, right-click at any time and select Cancel Connection.





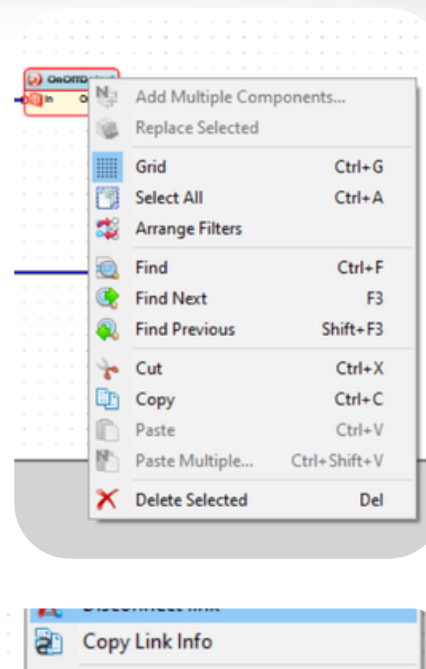
Additional Mouse Features

Left clicking on the Solaris board or component will bring up the properties. This is where you configure it.



Right-clicking on a component opens a menu with additional design and editing tools.

1. **Grid:** Turns the design area grid on or off.
2. **Select All:** Selects everything currently shown in the design area.
3. **Arrange Filters:** Automatically arranges the placement of components in the design area.
4. **Warning:** This function can use a large amount of processing memory, especially on larger projects.
5. **Find Next / Find Previous:** Searches through components and pins in the design area.
6. **Cut, Copy and Paste:** General editing tools used to move, copy, and paste components. Standard Windows shortcuts such as Ctrl+C and Ctrl+V can also be used.
7. **Left-clicking** on a wire will show an additional property called Copy Link Info. This copies the link information for the selected wire net.

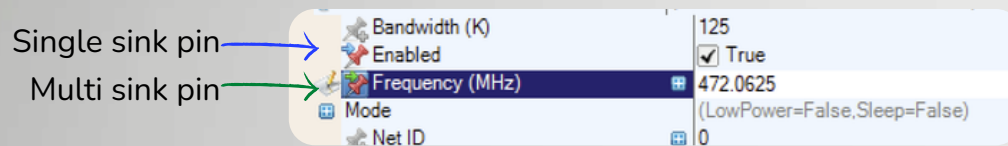




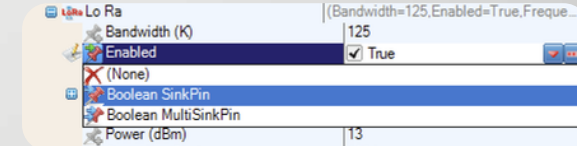
Sink Pins (Setpoints)

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



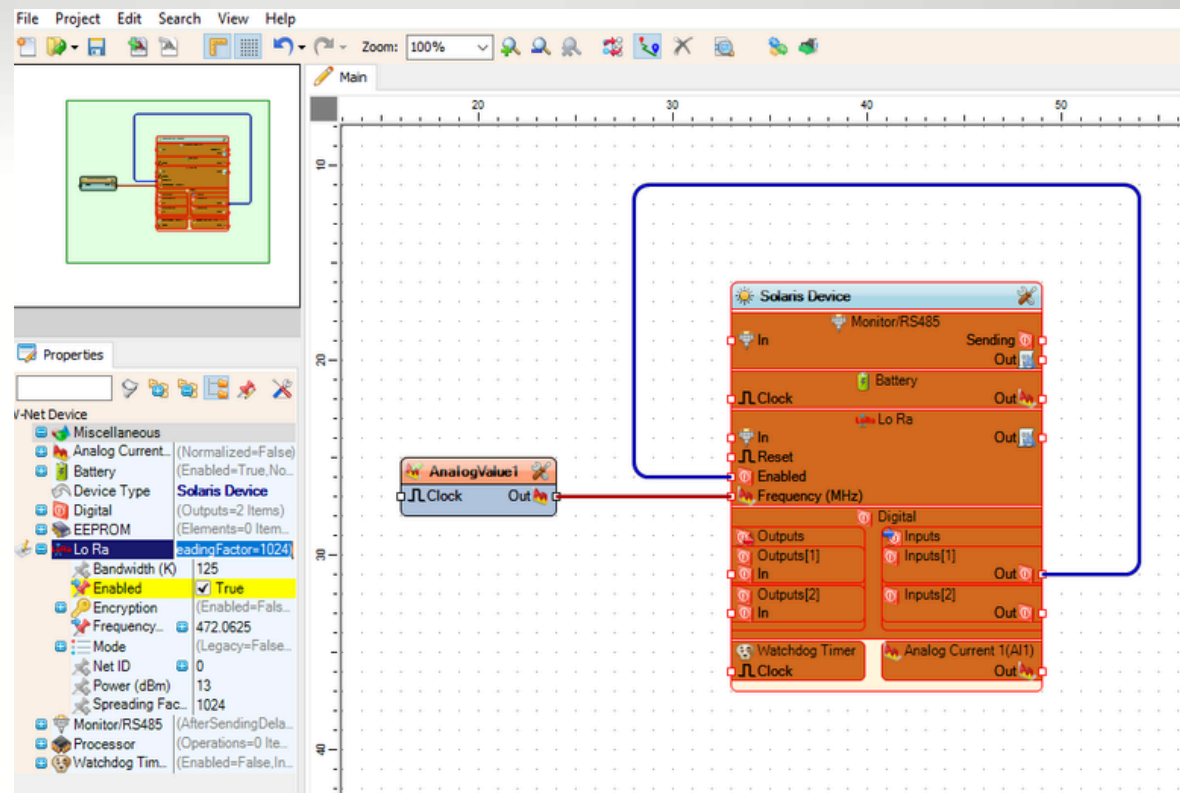
Sink Pin Options



Example

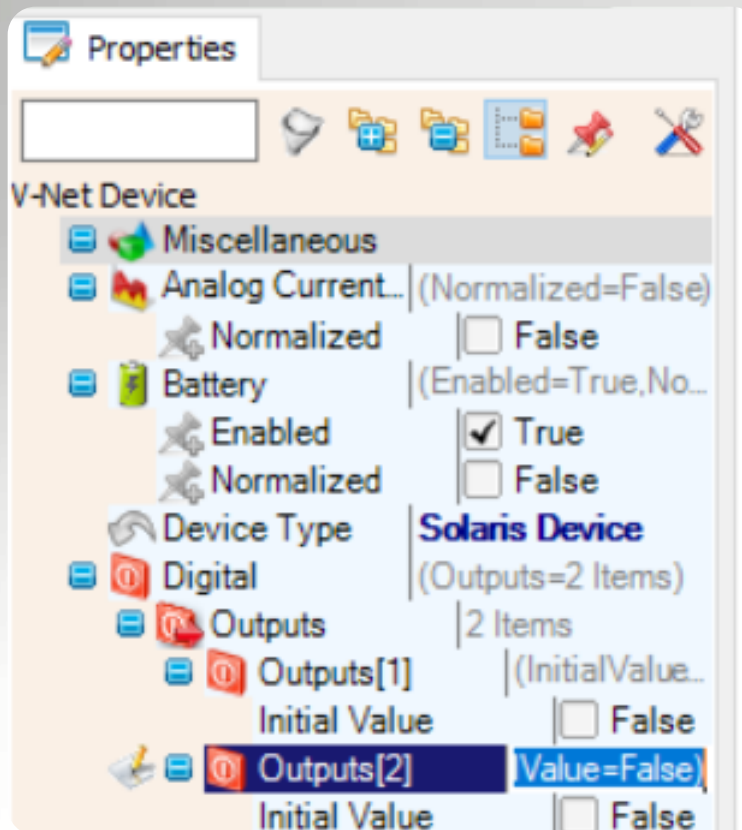
On the example to the right, we are wiring digital input 1 to turn on /off the LoRa module by means of its enable sink pin. We are also injecting a simulated analog value to the 'Frequency' band sink pin of the LoRa RF module.

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.





Inputs and Outputs



Analog 4 20mA Inputs

Normalized: 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

Battery

Enabled: Turn on the feature to read the Solaris device VCC DC input supply. It will output a typical voltage between the range of 12VDC to 24VDC, depending on your application. The maximum voltage detecting range is 1VDC to 28VDC. If the Solaris 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 (Relay Control)

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

EEPROM

WARNING

'The EEPROM maximum storage capacity is 512kb.'
'The maximum write cycles is 100K per life of the product'



Elements: Opens the EEPROM Elements table, where you can add EEPROM data types to your Solaris programme.

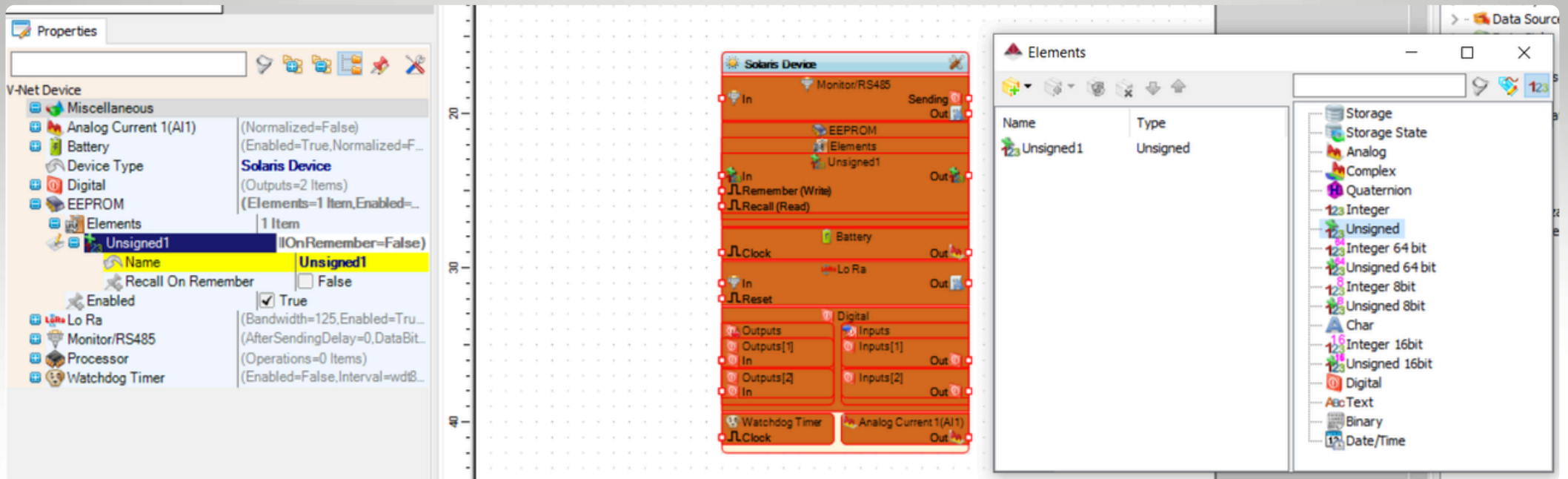
Data Type: When a data type is added to the EEPROM Elements table, the Solaris board component will change shape and new pins will appear. For each EEPROM element, a new input pin and output pin will be added using the selected data type.

Input Pin: The input pin is used with the Remember function to write data to EEPROM. The output pin is used with the Recall function to read the stored data back from EEPROM.

Remember: Writes the selected value to EEPROM.

Recall: Reads the stored value from EEPROM.

Recall on Remember: When enabled, clocking the Remember pin will automatically recall the stored data after it has been written.



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 setpoint data simultaneously.



RF (LoRa)



The Solaris PLC incorporates a LoRa SX1276 RF module, providing long-range, low-power wireless communication for applications such as agriculture, water management, remote infrastructure, industrial monitoring and telemetry.

Before You Begin:

- Ensure all RF settings comply with local regulations.
- Read the device specifications and wiring information before configuration.
- Verify the antenna is correctly installed and matched to the selected RF frequency.
- Configure the required RF parameters, including frequency, bandwidth, spreading factor, network ID and output power.
- Test signal quality and communication range before commissioning the system.

RF Network Types:

- Point-to-Point
- One Point-to-Multi-Point

Network Operation:

In a one point-to-multi-point network, one device is typically configured as the Master and all remaining devices as Slaves. The Master initiates communication by transmitting data packets containing a destination ID. All Slave devices receive the packet and compare the received ID with their own. If the ID matches, the packet is processed. If not, the packet is ignored.

Network Rules:

- Each device must have a unique ID if using Modbus over RF (**Note this does not refer to the RF Network ID settings**).
- All devices must use compatible RF settings.
- Master and Slave devices must use the same frequency, bandwidth, spreading factor and network ID.
- Only one device should transmit at a time to prevent RF packet collisions.



RF (LoRa)

Installation Considerations:

Communication performance is affected by:

- Antenna type
- Antenna height
- Cable length
- Mounting location
- Buildings and terrain
- Metal structures
- Vegetation
- Electrical noise sources

Multiple RF Networks:

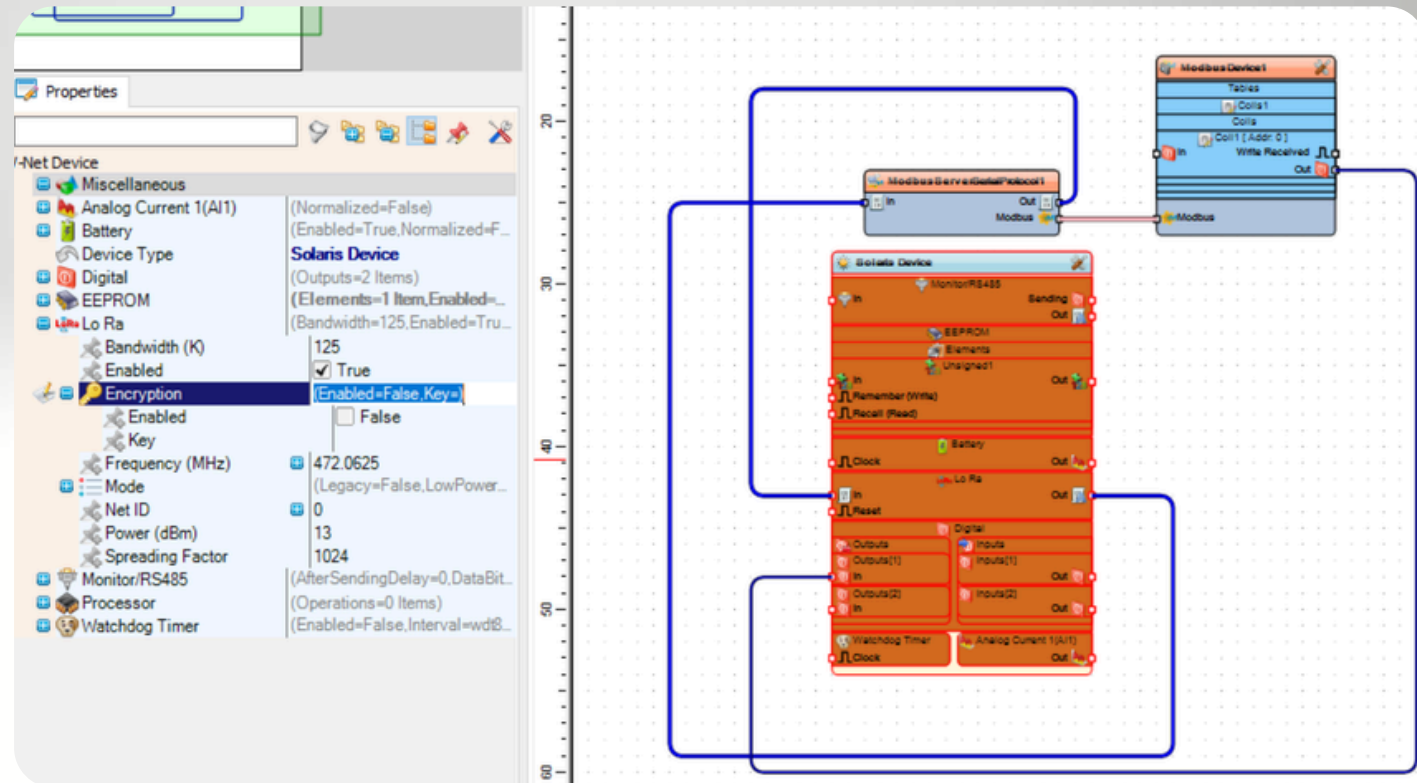
Multiple RF networks can operate within the same area by using different frequencies and ensuring compliance with local RF regulations.

Commissioning:

Always perform on-site communication testing before final commissioning. Adjust RF settings, antenna position or installation location as required to achieve reliable operation. When correctly configured, the Solaris RF system provides reliable long-range wireless communication for remote monitoring, control and automation applications.

RF (LoRa)

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 254
Power: sets the RF output power in dBm
Spreading factor: sets the air data rate.



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 higher the spreading factor the longer range you can send data packets. See the next page for details on these settings.



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.



RF (LoRa)

Here's a brief explanation of each column:

- 1. **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.
- 2. **RF_BW (kHz):** This is the bandwidth of the LoRa signal. In this table, all settings use a **bandwidth of 125 kHz**.
- 3. **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.
- 4. **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.
- 5. **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.
- 6. **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.
- 7. **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

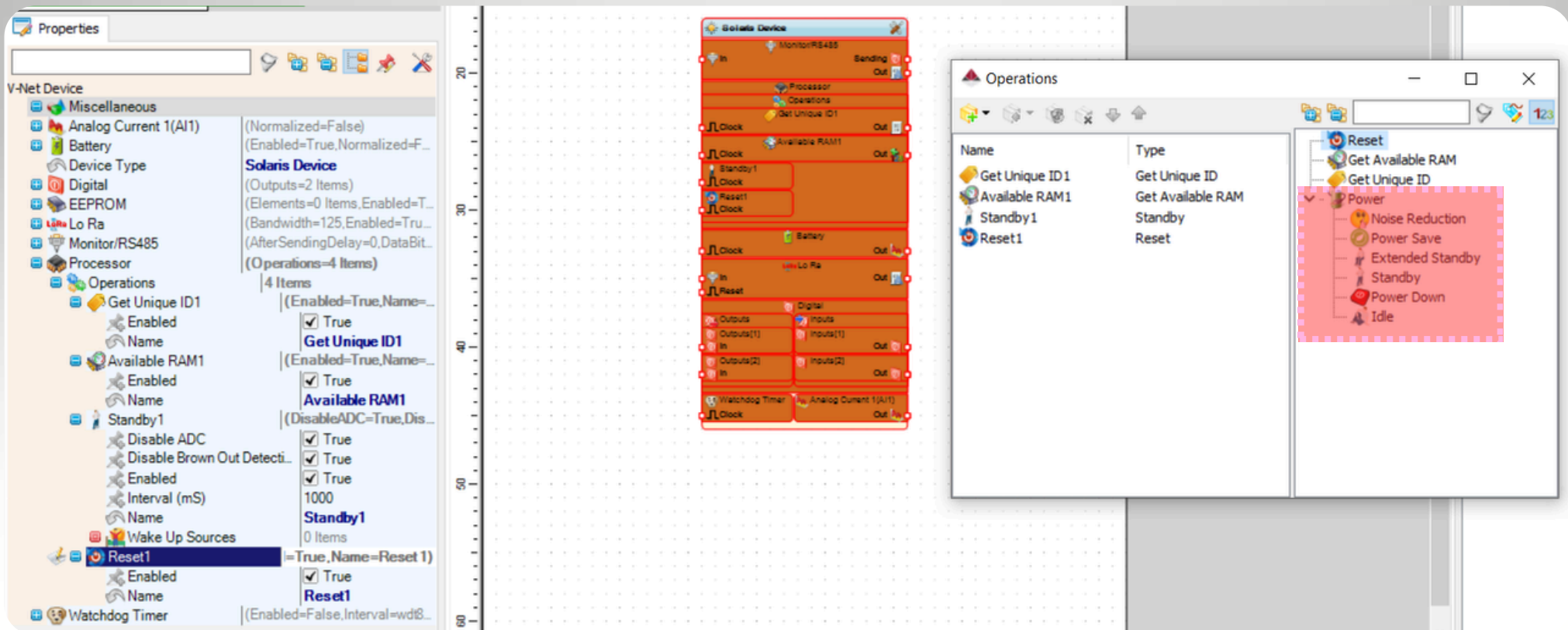
The table provides an overview of different LoRa configurations with their respective RF_Factor, RF_BW, equivalent air data rate, and sensitivity.

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.

Processor:

The following processor properties under **“Power”** are for future use and not available on the Solaris board on Version 8.0.0.156



The screenshot displays the V-Net software interface with three main components:

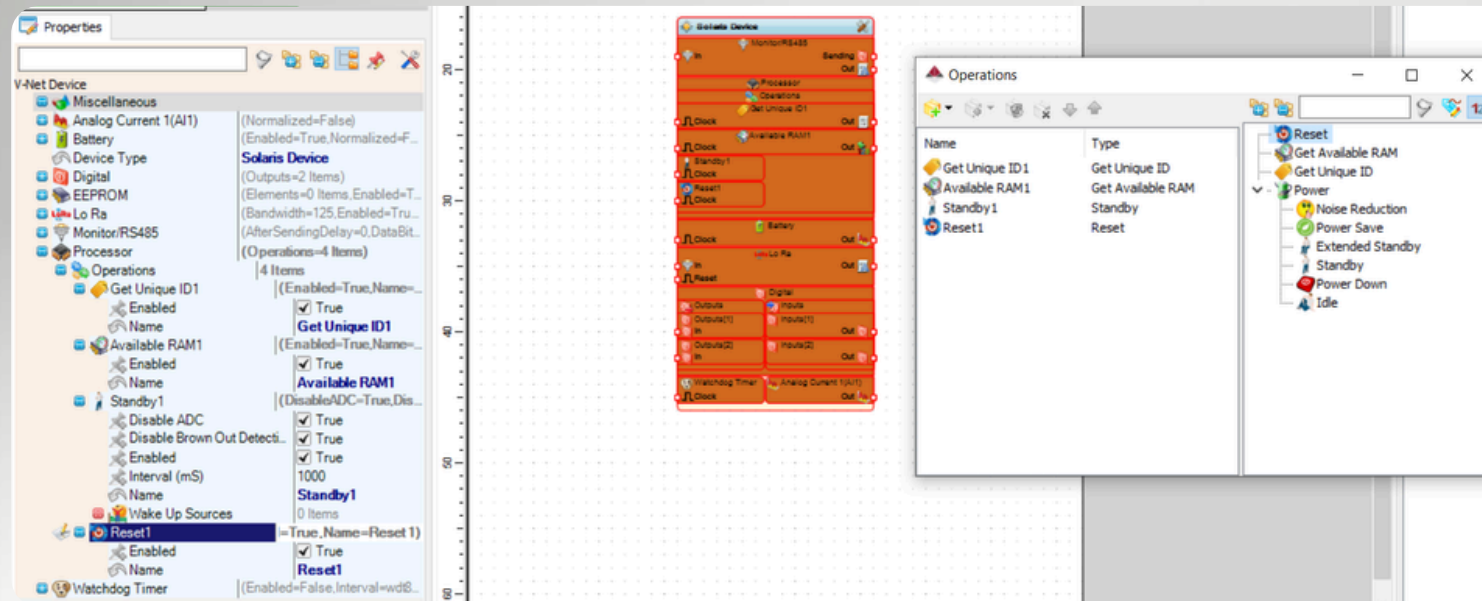
- Properties Window (Left):** Shows the configuration for the **Processor** device. The **Operations** list includes:
 - Get Unique ID1**: Enabled, Name = **Get Unique ID1**
 - Available RAM1**: Enabled, Name = **Available RAM1**
 - Standby1**: Disabled ADC, Disabled Brown Out Detecti..., Enabled, Interval (mS) = 1000, Name = **Standby1**
 - Reset1**: Enabled, Name = **Reset1**
 - Watchdog Timer**: Enabled=False, Interval=wdt...
- Ladder Logic Diagram (Center):** A schematic diagram showing the **Solaris Device** with various inputs and outputs. The **Processor** block is highlighted in red, showing its internal logic and connections to other components like **Monitor/RS485**, **Available RAM1**, **Battery**, **Lo Ra**, **Digital**, **Watchdog Timer**, and **Analog Current 1(AI1)**.
- Operations Window (Right):** A table listing the operations available for the **Processor** device. The **Power** section is highlighted in pink, showing the following operations:

Name	Type
Get Unique ID1	Get Unique ID
Available RAM1	Get Available RAM
Standby1	Standby
Reset1	Reset

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 Solaris 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 Solaris board, wire this pin to serial or other components to utilise your Solaris available RAM for logic.

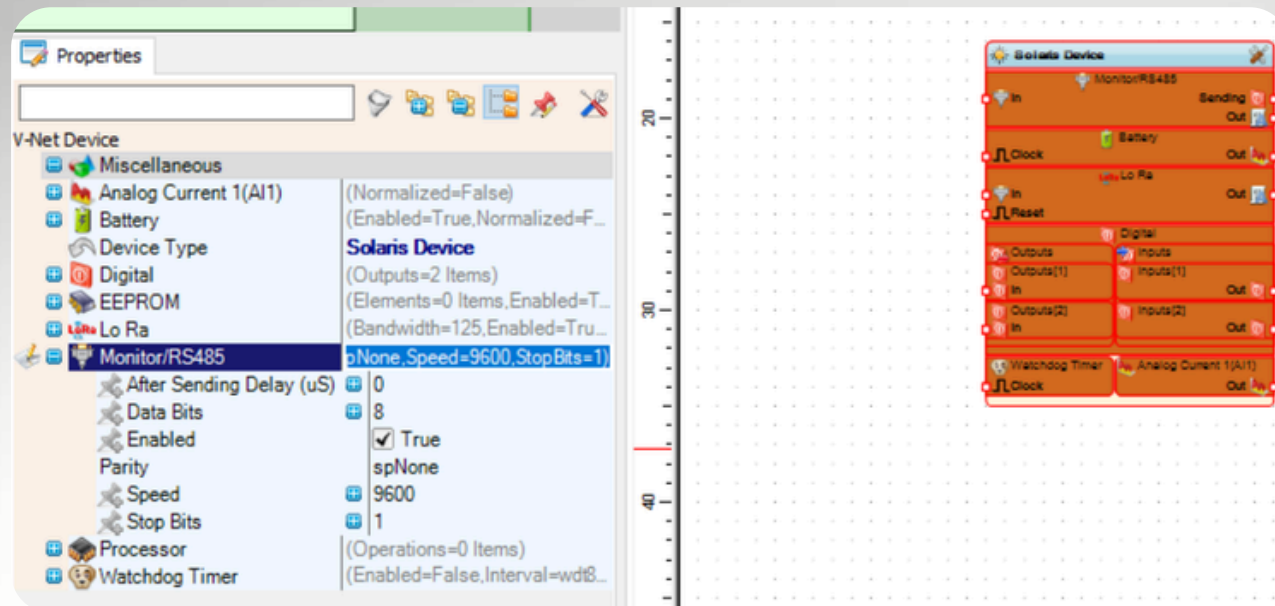
Get Unique ID: A new binary pin will appear on the Solaris board, wire this pin to the serial or other components to utilise your ID.

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

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

Serial Ports and RS485 Section - Modbus RTU

The Solaris has one serial communication channel in V-NET. This channel is shared between the Serial Monitor and the RS485 interface. The Serial Monitor is the USB interface between your programming computer and the Solaris device. It can be used for live data viewing, debugging, and testing components during program development. The RS485 section connects to the physical RS485 port on the Solaris device. Because the Serial Monitor and RS485 share the same serial channel, they should not be used for conflicting communication tasks at the same time. The RS485 port is commonly used for Modbus RTU communication with external devices such as sensors, meters, drives, and other compatible equipment. The RS485 dip switch on SW1, must slide left before you can connect the Computer, If you are using RS485, you cannot use the serial monitor



Serial Properties

After Sending Delay: Sets a delay before the Solaris sends another packet. Delay time is in microseconds (uS).

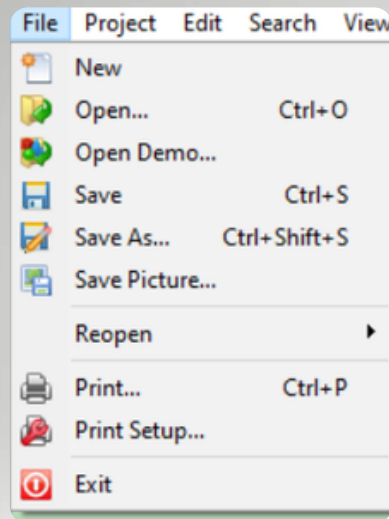
Data Bits: Sets the serial data bits.

Enabled: Turns the serial channel on or off.

Parity: Configures the serial connection parity.

Speed: Sets the baud rate speed. Default is 9600.

Stop Bits: Selects the stop bit used to mark the end of a serial transmission.



File

The File menu contains the primary options used to create, open, save and manage V-NET projects.

New: Creates a new V-NET project.

Open: Opens an existing project file.

Open Demo: Reserved for future use.

Save: Saves the current project.

Save As: Saves the current project using a new file name or location.

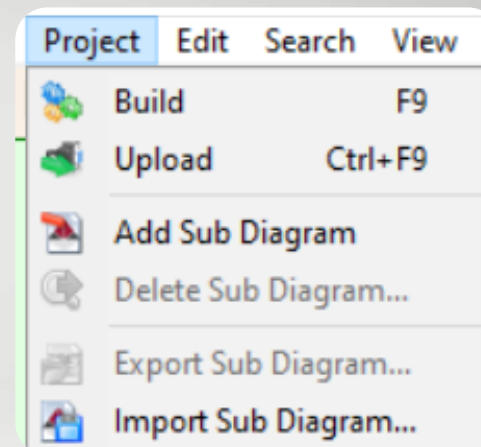
Save Picture: Exports an image of the current design area.

Reopen: Displays a list of recently opened projects.

Print: Prints the current design view.

Print Setup: Opens the printer configuration settings.

Exit: Closes the V-NET application.



Project

The Project menu contains the primary tools used to build, upload and manage your V-NET projects.

Build: Compiles the current project and checks for errors before upload.

Upload: Uploads the compiled program to the Solaris PLC.

Add Sub Diagram: Creates a new Sub Diagram page for organising program logic.

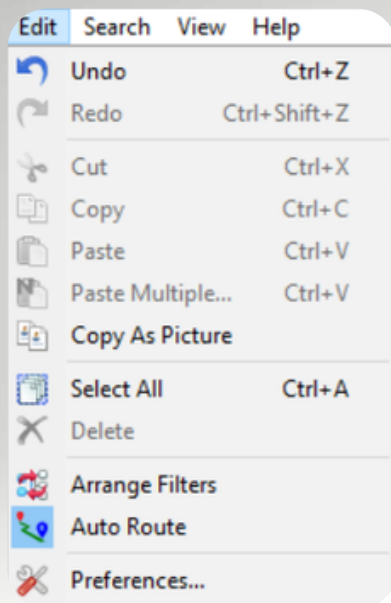
Delete Sub Diagram: Removes a selected Sub Diagram from the project.

Export Sub Diagram: Saves a Sub Diagram to a file for backup, reuse or sharing.

Import Sub Diagram: Loads a previously exported Sub Diagram into the current project.

Sub Diagrams

Sub Diagrams allow large programs to be organised across multiple pages. They can also be exported and imported between projects, making it easy to reuse common logic and standard program sections.



Edit

The Edit menu contains tools used to modify, copy, arrange and manage components within the V-NET design area.

Undo: Reverses the last action.

Redo: Restores the last action reversed using Undo.

Cut: Removes selected components and places them on the clipboard.

Copy: Copies selected components to the clipboard.

Paste: Pastes copied components into the design area.

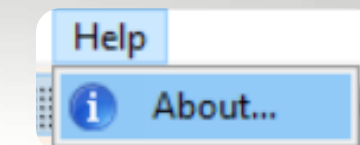
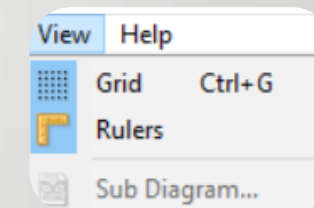
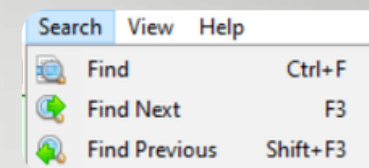
Paste Multiple: Pastes multiple copies of the selected component or selection.

Copy as Picture: Copies an image of the current design area for use in documents, manuals or image editing software.

Select All: Selects all components and wires in the current design area.

Auto Route: Automatically routes wires to improve diagram layout and readability.

Preferences: Opens the V-NET preferences window, including Auto Save settings.



Search, View, Help

The Search, View and Help menus contain the same tools available from the right-click menu within the V-NET design area.

Sub Diagram

A Sub Diagram allows you to create a separate workspace within your V-NET project for a specific section of logic. This helps keep the main Solaris board page clean and organised, particularly in larger projects containing multiple control sequences, calculations, communications or automation routines. Think of a Sub Diagram as a small program block that can be connected back into your main project.

Creating a Sub Diagram

1. Select Add Sub Diagram from the Project menu.
2. A new blank design page will be created.
3. Rename the Sub Diagram to describe its purpose.

Configuring Inputs and Outputs

1. Double-click the Sub Diagram component.
2. Add the required input and output pins.
3. Inputs pass signals into the Sub Diagram.
4. Outputs return processed signals back to the main program.

Using a Sub Diagram

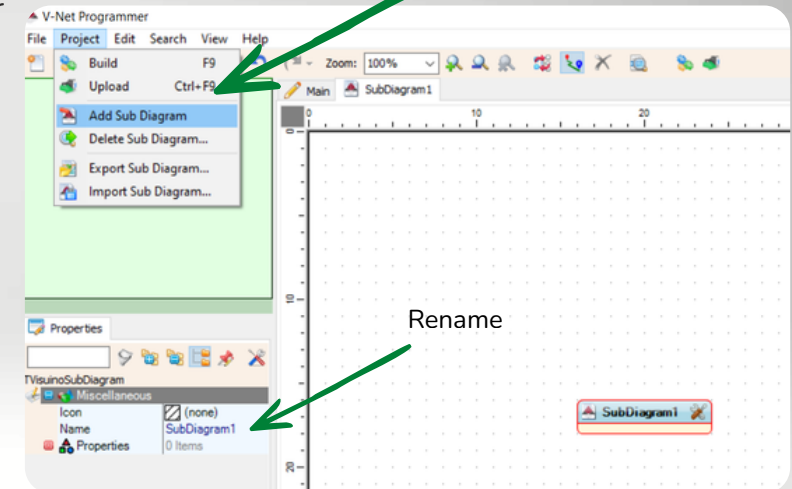
1. Return to the main Solaris board page.
2. Locate the new Sub Diagram component in the Component Library.
3. Drag the component into the design area.
4. Connect the required inputs and outputs.

Important

The order of the input and output pins must match between the Sub Diagram page and the Sub Diagram component on the main board page. This ensures signals are correctly transferred into and out of the Sub Diagram.

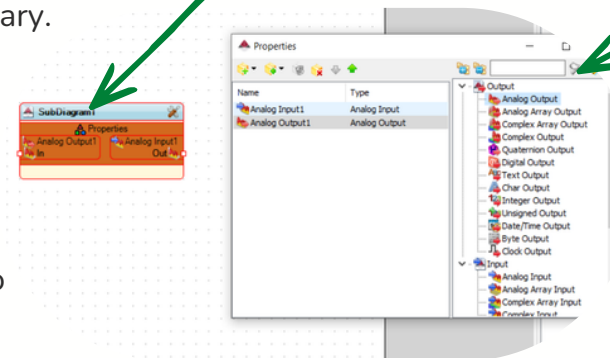
Benefits

Sub Diagrams make large projects easier to build, understand and troubleshoot by grouping related logic into dedicated workspaces.



Double click to add inputs and outputs

Add inputs/output data types here

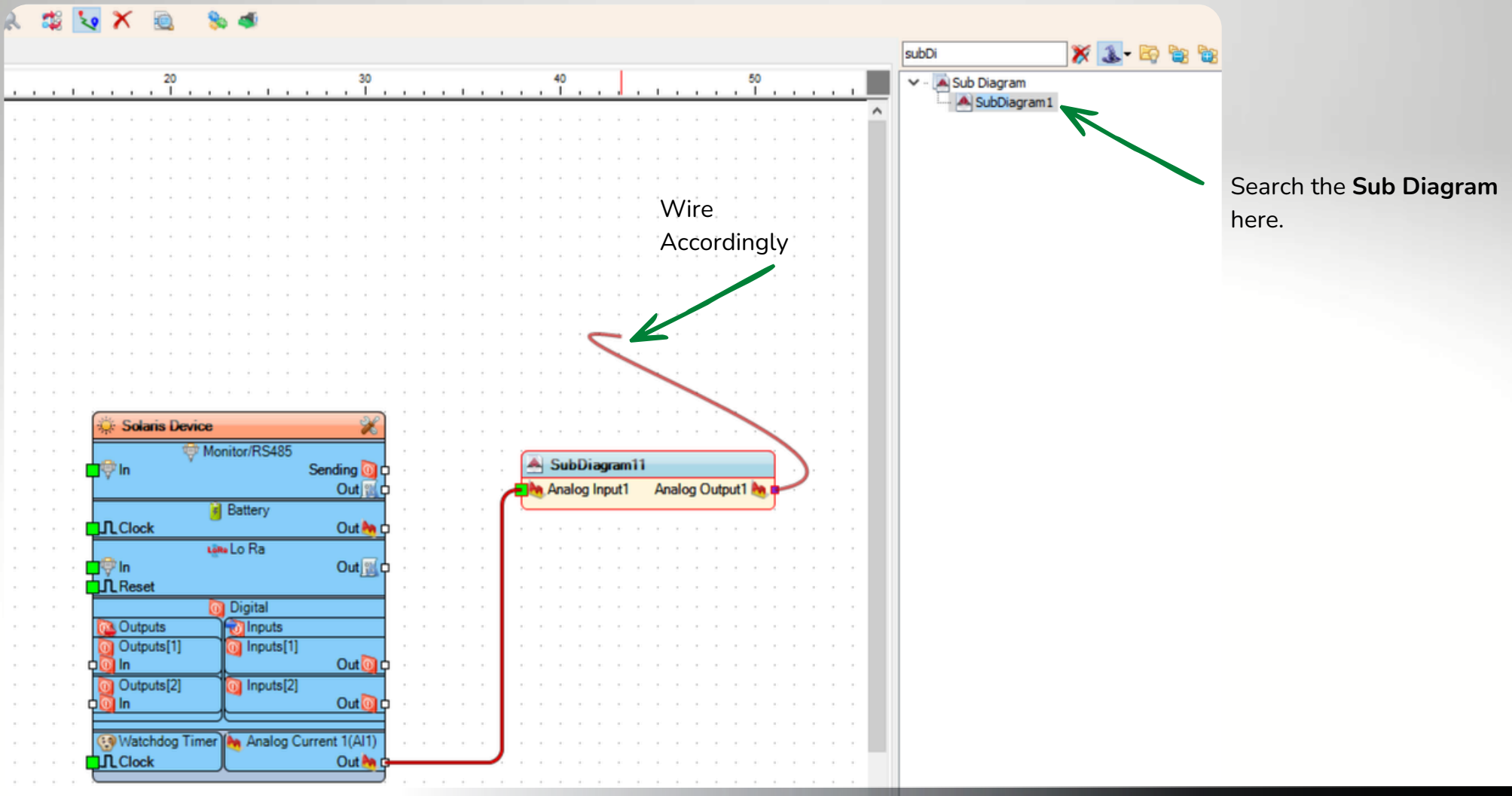


when you locate the Sub diagram on the Solaris board main page these IO pins will be available.

Sub Diagram

When you have finished building your **Sub Diagram page**, return to the main **Solaris board page**.

In the component library, search for the name of your Sub Diagram. Drag the Sub Diagram component into the main design area, then wire the inputs and outputs as required. Make sure the input and output order matches between the Sub Diagram page and the component on the main Solaris page. This ensures each signal is passed to the correct pin and the logic operates as intended.

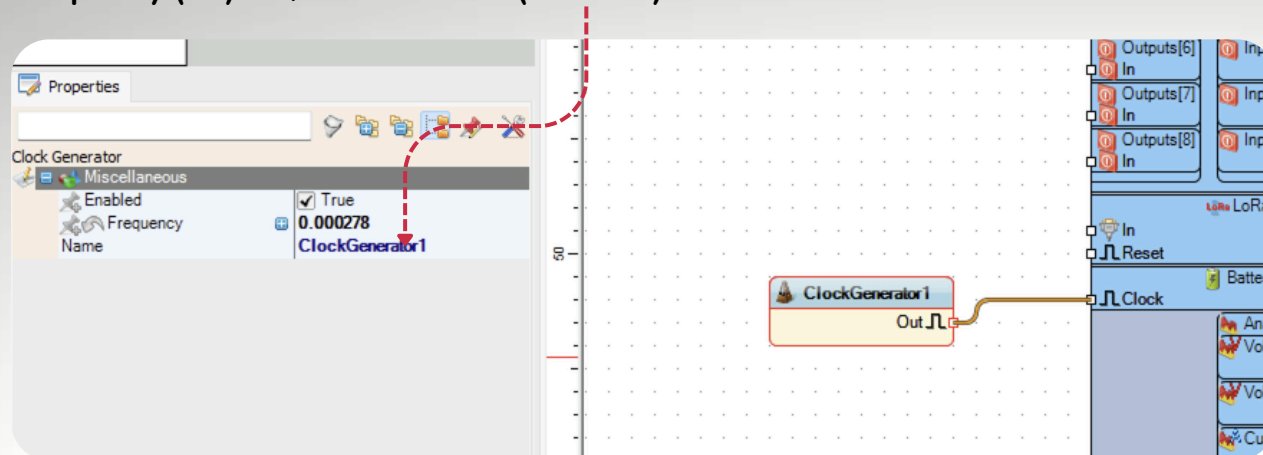


V-NET Configuration - Clock (HZ) Frequency Property

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	$1/15 \approx 0.0667$	240
20	0.05	180
25	$1/25 = 0.04$	144
30	$1/30 \approx 0.0333$	120
40	$1/40 = 0.025$	90
50	$1/50 = 0.02$	72
60	$1/60 \approx 0.0167$	60

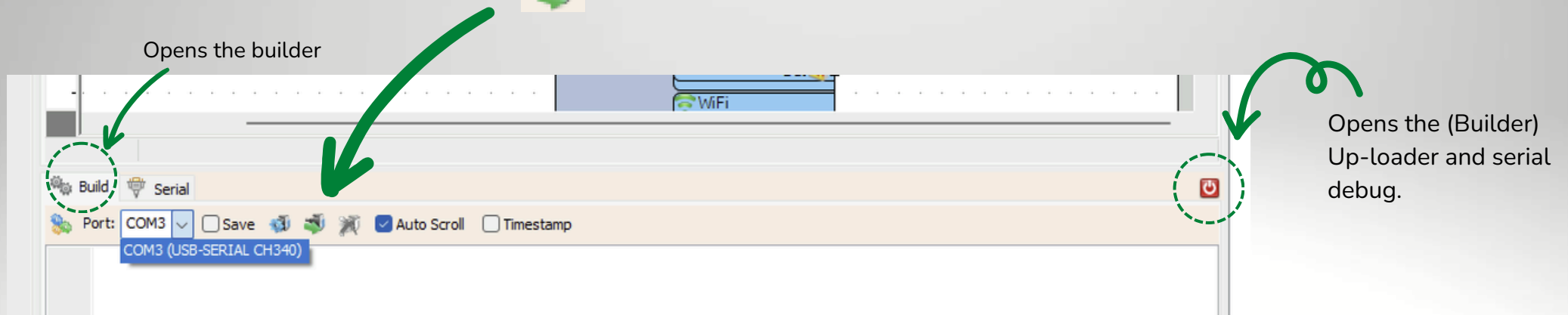
Program Upload

Uploading your first sketch

To upload your first sketch, make sure the USB cable is connected between your computer and the Solaris PLC.

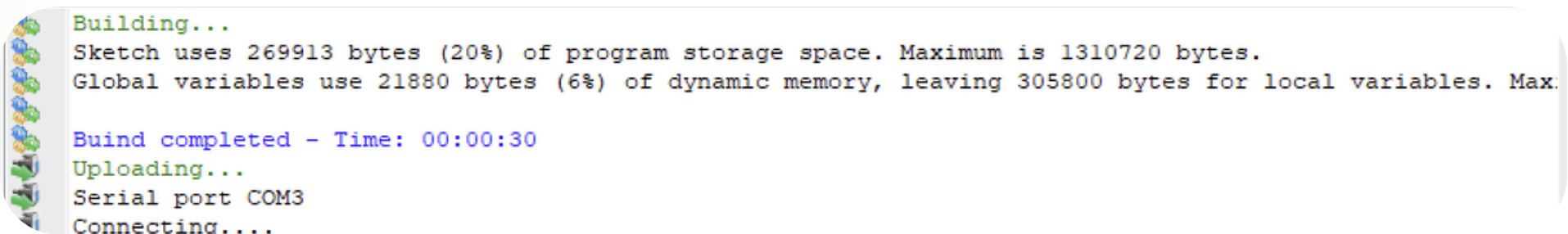
You do not need to connect a DC power supply when programming the Solaris. The USB cable provides enough power to run the device, allowing you to program and test on the fly without needing an industrial power supply connected.

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 below:



Program Upload



STAGE TWO: Looks like this and will say **"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
```



HANDY TIP

To cancel the upload at anytime hit the button below before or during the upload stages.



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. 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.



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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.

