Panoramic Power

Modbus Programmer's Guide

Gen 4/4+ Bridge

Firmware v476 & v676.12.7 / April 2025

centrica Business Solutions | Panoramic Power

Contents

Figure List

Version Tracker

Date	Bridge Firmware Version Number	Changes Made to Guide
12-Sept-2023	v676.10	- Modbus RTU Baud Rate - Fix documentation error for Pulse Register Values - Updated the support links for the Manuals
13-Feb-2024	N/A	- Corrected Modbus Parameter definition to "Little endian BYTE SWAP"
16-Oct-2024	N/A	- Removed the PowerRadar term (except for Bridge Configuration Tool references)
25-April-2025	v676.12	- New formatting

Introduction and overview

This document covers the operation and interface definition of the Panoramic Power Bridge when working in the stand-alone mode. In this mode, the Bridge implements a Modbus TCP/RTU protocol which sends sensor's current readings to a local server. The local server acts as a Modbus master server and the Bridge acts as a Modbus TCP/RTU slave.

This guide focuses on the new Bridge stand-alone (Modbus TCP/RTU) operational mode. It is supplementary to the Gen 4+ Bridge Manual which covers basic Bridge operations and should be reviewed prior to using this guide. Version 476 adds support for PAN-42 sensors (up to 3) and for Modbus RTU (RS485) connection.

The image below depicts a typical network diagram for a Bridge operating in the stand-alone mode:

- Sensors transmit readings once every 10 seconds to the Bridge via proprietary wireless communications.
- For each configured sensor, the Bridge stores the last received measurement in memory. It will be stored until overridden by a new measurement from the same sensor or until the Bridge resets.
- A Modbus TCP/RTU master device (typically a computer or PLC) connects to the Bridge via local area network (LAN) or RS485 cable and polls the Bridges for sensor data.
- The Modbus master device can connect to multiple Bridges, each of them receiving multiple sensors.
- Bridge configuration is done via the Bridge's built in web server, using the web browser of a laptop connected in the LAN.

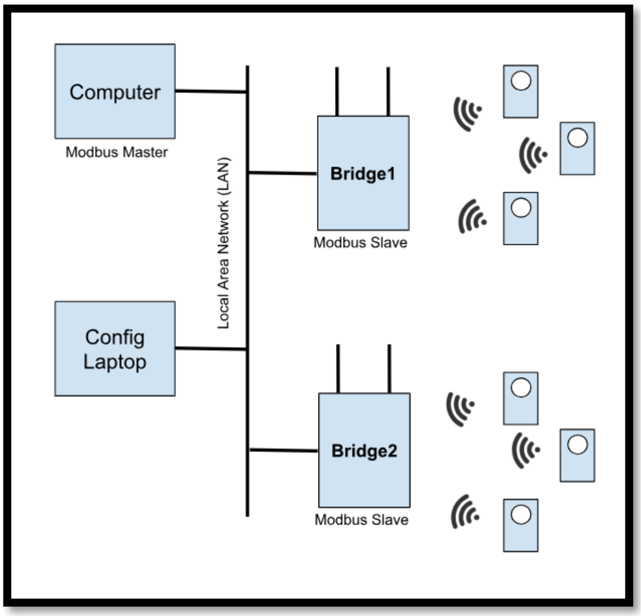

Figure 1: Network diagram

Hardware & Networking requirements

Supported Hardware

- Sensors: PAN-10, PAN-12, PAN-14 and PAN-42.
- The Modbus interface also supports reading the Bridge's pulse inputs (Gen4 and above)
- The Modbus TCP solution is supported by Gen3 and above and requires firmware v470 or higher. To support PAN-42 sensors, and/or RTU interface, firmware v476 is needed.
- In stand-alone mode, each Bridge supports up to 32 data points (A single phase sensor or a phase in a 3-phase sensor).

Supported LAN networks

To work in the Modbus TCP mode, the Bridge must be set-up for Ethernet connectivity. A Bridge configured for cellular network connectivity supports Modbus RTU but does not support Modbus TCP.

Assigning a fixed Bridge IP address

For Modbus TCP to operate properly, the Modbus master must be able to repeatedly reach a specific Bridge via its IP address or DNS name. The solution requires a fixed static IP address assigned to the Bridge. This can be done by selecting 'fixed IP' in the Bridge network settings, or alternatively using DHCP but ensuring that the DHCP server always assigns the same IP address to the specific Bridge.

> Please refer to the Gen 4+ Bridge Manual for more information about configuring the Bridge networking.

Assigning a Slave address

For Modbus RTU to operate properly, the Bridge is assigned a Base (slave) Address and the Modbus master must have a list of all the monitored Bridges and their Base Addresses (in the range of 1 to 247).

Bridge configuration

Bridge configuration is done from a laptop's web browser using the Bridge built-in web server.

Initial Bridge configuration, including setting up a fixed IP address to be used later, is done via a directly connected laptop. Please see '*Accessing the Bridge web interface'* section in the Gen 4+ Bridge Manual.

Once a fixed IP has been assigned to the Bridge and the **Bridge Admin UI Availability** in the **Bridge Configuration** screen is set to **Always**, further configuration can be done by navigating to the Bridge IP address from a web browser. The laptop used for such configuration must have HTTP route to the Bridge.

NTP requirements

To operate properly, the Bridge needs to get the real time clock (RTC). Since the Bridge has no battery-powered hardware RTC, it gets the time using a standard NTP server.

The Bridge gets the NTP time, as part of the boot process, using the following process:

1. If a dedicated NTP server IP is defined, it will try to get the time from that server
2. Alternatively, it will try to get the time from a list of well-known public NTP servers
3. If both options above fail, it will get the time from the cloud-based server.

Option 3 above only works in ‘Connect to PowerRadar mode’ or ‘combined mode’ (See ‘Connection Setup’ section below). Therefore, when working in ‘Stand-Alone Modbus TCP’ mode an NTP server must be defined in the LAN or alternatively, NTP outbound access to public servers must be implemented in the firewall.

Another option is to set the real-time clock via the Modbus Interface (by writing to registers 1-2. see Table 1). This will override any time retrieved during the boot process.

Modbus parameters

These parameters are needed when setting up the connection from the Modbus Master:

- The Bridge Modbus TCP interface is enabled via **TCP port 502**
- Recommended timeout value for the Master is **5 seconds**.
- **Little endian Byte swap** word order is used
- For **Modbus RTU** mode an RS485 interface set to **38400 Baud, 8 data bits, No parity, one Stop bit** and **no handshake** (No DSR, CTS, DTR, RTS). Request messages can get Responses of up to 125 data registers. See the Gen 4+ Bridge Manual for details of the Bridge Modbus (RS485) connector. Note: A USB to RS485 can be used for the RS485 interface.

Bridge Modbus Software Model

Modbus Register Map

This section is for use by the Modbus Host programmer. The table below shows the Bridge register map as reflected to the Modbus Master:

Type	Functional Code	Register # (Dec)	Description	Size (16 bit words)	Format	Comments
Bridge Date/Time						
R/W	Read=3 Write=16	0001-0002	Bridge date and time (UNIX Epoch time)	2	UINT32	Set through Modbus or by NTP A UNIX Epoch time is the number of seconds that have elapsed since 00:00:00 Thursday, 1 January 1970, Coordinated Universal Time (UTC), minus leap seconds. The consensus is for Epoch time to be signed, and this is the usual practice. Nevertheless, it can be used as a 31-bit unsigned number.
1. **Bridge Information, 10 words (registers)**						
R	4	0001	Bridge model	1	UINT16	0 - GEN3, 1 - GEN4, 2 - GEN4+, 3 - GEN5, 4 - GEN4+ NW
R	4	0002 - 0003	Bridge serial number	2	UINT32	
R	4	0004	Bridge mode	1	UINT16	0 – Connect to PowerRadar, 1 - Standalone, 2 - Combined
R	4	0005	Bridge HW version	1	UINT16	
R	4	0006	Bridge FW ver. - Major	1	UINT16	
R	4	0007	Bridge FW ver. - Minor	1	UINT16	
R	4	0008	Bridge Noise Floor [dBm]	1	INT16	
R	4	0009-0010	Assigned slots	2	UINT32	Bit field format. One bit per slot. 1st slot in LSBit. 1 – assigned slot, 0 - unassigned
2. Sensor Readings - Array of 32 slots, 20 words (registers) each. The first 9 are common for all sensors. N = Slot No. 0-31						
R	4	2001+20N	Sensor status	1	UINT16	0- Slot Empty 1- No message RX 2- Message RX (RX = received) 3- Message RX, No RTC 4- No Messages RX over 1 minute 5- No Messages RX over 5 minutes See Table 2.
R	4	2002+20N 2003+20N	Sensor S/N (0: unassigned slot)	2	UINT32	
R	4	2004+20N	Sensor Type and Phase Number (PAN42)	1	UINT16	In LSByte: Sensor Type 10=PAN10, 12=PAN12, 14=PAN14 For PAN42: MSByte = Phase No., LSByte = 42 Phase 1: 1, 42 = 298 Phase 2: 2, 42 = 554 Phase 3: 3, 42 = 810

Type	Functional Code	Register # (Dec)	Description	Size (16 bit words)	Format	Comments
R	4	2005+20N 2006+20N	Unix Epoch Timestamp (0: RTC not set)	2	UINT32	Timestamp – a UNIX Epoch timestamp of the latest message received from the sensor. It is the number of seconds that have elapsed since 00:00:00 Thursday, 1 January 1970, Coordinated Universal Time (UTC), minus leap seconds. The consensus is for Epoch time to be signed, and this is the usual practice. Nevertheless, it can be used as a 31-bit unsigned number.
R	4	2007+20N 2008+20N	Current Reading [A]	2	FLOAT32	
R	4	2009+20N	Reading RSSI [dBm]	1	INT16	
R	4	2010+20N	Sensor HW version	1	UINT16	
R	4	2011+20N	Sensor FW ver. - Major	1	UINT16	
R	4	2012+20N	Sensor FW ver. - Minor	1	UINT16	
Next 8 registers are for PAN42 sensors. N = Slot No. 0-31						
R	4	2013+20N - 2014+20N	Vs-rms [V]	2	FLOAT32	
R	4	2015+20N – 2016+20N	Active Power [Watt]	2	FLOAT32	
R	4	2017+20N – 2018+20N	Reactive Power [VAR]	2	FLOAT32	
R	4	2019+20N – 2020+20N	Power Factor	2	FLOAT32	
3. **Extended parameters - Array of 32 slots x 4 registers each. N = Slot No. 0-31**						
R	4	3001+4N	additional_idx	1	UINT16	Only for Pan42. Entry index number +1 of additional Pan42 data in the **Additional parameters** table (next table). Range: 1 – 9. For other sensors = 0.
R	4	3002+4N - 3003+4N	Line frequency [Hz]	2	FLOAT32	For PAN42
R	4	3004+4N	PAN42 Error Report	1	UINT16	PAN42 errors: (see note below) 1 = EEPROPM read error 2 = EEPROPM write error 3 = Energy counter rollover 4 = Energy counter manual reset
4. Additional parameters – Array of 9 slots x 18 registers each (up to 3 PAN42). n= additional_idx-1 of Slot N (N= Slot No. 0-31)						
R	4	3501+18n	Report flags	1	UINT16	For future use
R	4	3502+18n	spare	1	UINT16	For future use
R	4	3503+18n - 3504+18n	Active Energy – Phase #X [Watt-hr]	2	FLOAT32	Phase Consumed Active Energy
R	4	3505+18n - 3506+18n	Exported active energy – Phase #X [Watt-hr]	2	FLOAT32	Phase Exported Active Energy
R	4	3507+18n - 3508+18n	V_THD – Phase #X [%]	2	FLOAT32	Phase Voltage THD
R	4	3509+18n - 3510+18n	I_THD – Phase #X [%]	2	FLOAT32	Phase Current THD
R	4	3511+18n	SAG condition – Phase #X	1	UINT16	Phase SAG events count in last minute
R	4	3512+18n	SAG duration - Phase #X	1	UINT16	Phase SAG events duration (msec) in last minute

Type	Functional Code	Register # (Dec)	Description	Size (16 bit words)	Format	Comments
R	4	3513+18n - 3514+18n	Phase Balance [degrees]	2	FLOAT32	in Ph1: Ph1-Ph3; in Ph2: Ph2-Ph1; in Ph3: Ph3-Ph2
R	4	3515+18n	SWELL condition - Phase #X	1	UINT16	Phase SWELL events count in last minute
R	4	3516+18n	SWELL duration - Phase #X	1	UINT16	Phase SWELL events duration (msec) in last minute
R	4	3517+18n - 3518+18n	Unix Epoch SAG / SWELL Event Timestamp (0: There was no event or RTC not set)	2	UINT32	Event Timestamp – Timestamp of the latest SAG / SWELL event message received from the sensor. A UNIX Epoch time is the number of seconds that have elapsed since 00:00:00 Thursday, 1 January 1970, Coordinated Universal Time (UTC), minus leap seconds. The consensus is for Epoch time to be signed, and this is the usual practice. Nevertheless, it can be used as a 31-bit unsigned number.
5. Pulse Counter #1 Readings						
R	4	5001	Status	1	UINT16	0- Disabled 1- No pulse received since last read or reboot 2- Pulse received, No RTC 3- Pulse received, RTC is set
R	4	5002-5003	Unix Epoch Timestamp of Modbus status read	2	UINT32	(0: RTC not set)
R	4	5004-5005	Count (Pulse #1)	2	UINT32	Accumulated count during the lifetime of the Bridge. Note: the bridge counts both rising and falling edges of the pulses.
6. Pulse Counter #2 Readings						
R	4	5006	Status	1	UINT16	0- Disabled 1- No pulse received since last read or reboot 2- Pulse received, No RTC 3- Pulse received, RTC is set
R	4	5007-5008	Unix Epoch Timestamp of Modbus status read	2	UINT32	(0: RTC not set)
R	4	5009-5010	Count (Pulse #2)	2	UINT32	Accumulated count during the lifetime of the Bridge. Note: the bridge counts both rising and falling edges of the pulses.

Table 1: Bridge Register Map

Note: When reading or writing 32-bit elements (UINT32 or FLOAT32), it is required to access them in a single Modbus commend (with size =2). Accessing them via two separate commands (size=1) may create abnormal results. **Little endian Byte swap** word order is used.

The map contains 4 main areas:

- **Bridge date/time settings** – Holding registers 1-2 - This is where the Modbus host can set or read the **R**eal-**T**ime **C**lock of the Bridge. It can be used if there is no RTC server reachable by the Bridge.
- **Bridge information** – Input registers 1-12 - Table 1.1 - Various Bridge status data
- **Sensor readings** – This is where the sensor readings are retrieved.

  There are 3 tables with sensor readings: (N = slot number 0 to 31)

  a. Table 1.2 – Input registers 2001-2010 +20N – **Sensor main readings** – An array of 32 slots x 20.

  b. Table 1.3 - Input registers 3001-3004 +4N – **Extended parameters** - Array of 32 slots x 4 registers each

  c. Table 1.4 - Input registers 3501-3518 +18n – **Additional parameters** – Array of 9 slots x 18 registers each (for up to 3 PAN42 sensors). Here n = 0-8 (additional_idx–1 from table 1.3)

  NOTE: For the additional parameters of a PAN42 sensor, use the additional_idx from table 1.3 to get the associated entry in table 1.4.
  Additional parameters: Table 1.4(n), where n = Table 1.3(additional_idx – 1) (range 0-8)

- **Pulse Counter #1 and #2 Readings** – These holds the counters for the two pulse inputs of the Bridge. Tables 1.5 and 1.6 – Input registers 5001-5005 for Pulse counter #1, Input registers 5006-5010 for Pulse counter #2.
  Note: the bridge counts both rising and falling edges of the pulses. It means that for a device with a KY output, the count should be divided by 2.
- **PAN42 EEPOROM error reports** – The PAN42 uses an EEPROM to save the energy counters. It saves the counters every 20 seconds. In case of power shortage, when the power is back, the last saved values are restored. If the reading from the EEPROM or writing to EEPROM fails, the PAN42 sends an error report (error 1 or 2). The energy counters roll over when the value exceeds the 32-bits size (0xFFFFFFFF to 0). In this case it sends an error report 3. The user can reset the counters by pressing an internal pushbutton (see the PAN-42 User Manual). This action sends the error report 4.

Sensor slot allocation example

The following image depicts an example of how the sensor software model works:

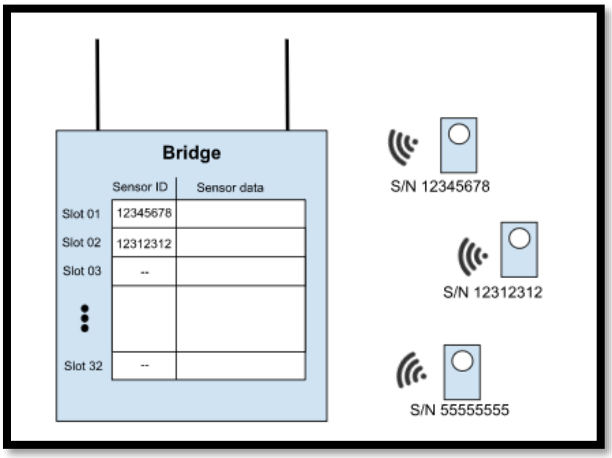

Figure 2: Software model example

In the example above:

- Only two of the 32 Bridge slots have been assigned to sensors.
- Slot #1 has been assigned to sensor S/N 12345678
- Slot #2 has been assigned to sensor S/N 12312312
- Slots #3-#32 have not been assigned with any sensors and remain empty.
- Whenever a sensor message from one of the two sensors (12345678 or 12312312) is received, the sensor-data section of the table will be updated. The update will override the previous data.
- We can also see another sensor (S/N 55555555) which is received by the Bridge but has not been allocated to any slot. This sensor data will be ignored when the Bridge is in Modbus TCP mode.
  In '*Connect to PowerRadar mode'* or '*combined mode'* all sensor data is simultaneously sent to the cloud-based server regardless of the assignment.

Sensor Readings

As seen in Figure 2 above, each sensor slot contains sensor data. This section will review and explain the sensor data stored for each slot.

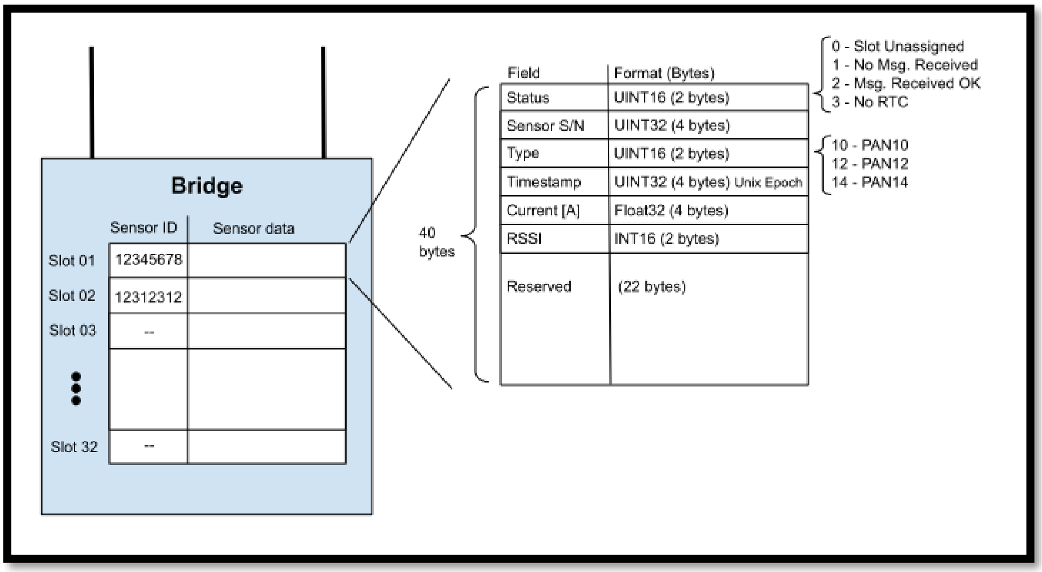

Figure 3: Sensor data storage

As seen in the image, each sensor slot reserve 40 bytes of memory and store the following values:

- **Status –** Indicating the status of the reading of the specific slot.
- **Sensor S/N** – This is the serial number of the sensor associated with this slot
- **Timestamp** – A UNIX Epoch timestamp of the latest message received from the sensor. It is the number of seconds that have elapsed since 00:00:00 Thursday, 1 January 1970, Coordinated Universal Time (UTC), minus leap seconds.
- **Current [A]** – The calibrated current (in A) measured in the last sensor message received.
- **RSSI** – an indication of the RSSI (signal strength) of the last measurement in dBm.

Note: When reading a specific sensor slot data, it is recommended to read the entire 20-word (40 bytes) slot data using a single Modbus commend (with size =20), then parse the data in the Modbus master. The maximum number of registers that can be read in one request is 125 (250 Bytes). It means that it is possible to read data of some sensors in one request.

When reading the data, the status register should be analyzed first. Based on its content the other registers should be processed as shown in the table:

Status	Code	Meaning
0	Slot Unassigned	This slot has no sensor S/N allocation. All other registers in this slot can be ignored.
1	No message was Received	A sensor S/N has been assigned to this slot, but no sensor message has been received since the last Bridge reset. This can be because the sensor is not yet installed, is not in the Bridge RF coverage area, or because the device monitored by the sensor is off. All other registers in this slot can be ignored.
2	Message has been Received OK	A sensor S/N has been assigned to this slot, and a reading has been received. The reading timestamp, Current value and RSSI can be processed.
3	NO RTC	A sensor S/N has been assigned to this slot, and a reading has been received. However, since the Bridge has no real-time-clock (RTC) the timestamp value is 0. In this case, the Bridge RTC clock should be set via the Bridge Date/Time settings register.
4	No message has been received for over 1 minute	A sensor S/N has been assigned to this slot, and a reading has been received. No message has been received for over 1 minute. The reading timestamp, Current value and RSSI are of the last received message.
5	No message has been received for over 5 minutes	A sensor S/N has been assigned to this slot, and a reading has been received. No message has been received for over 5 minutes. The reading timestamp, Current value and RSSI are of the last received message. The status will change upon receiving a message or a Bridge reset (after resetting it will be 1 = No Msg Received).

Table 2: Sensor Status

Pulse counter registers

Gen 4 Bridges (and above) support two pulse inputs. The Bridge counts the pulses on each of the inputs and provides this data in the registers.

> Note: The Bridge counts both rising and falling edges of the pulse. These registers store the total count. This value is persistent even after a Bridge reset.

Sensor Calibration keys (not PAN42)

Each Panoramic sensor is calibrated during manufacturing and a unique calibration key is generated for every sensor. This key is used to calibrate the sensor raw measurements to achieve optimal accuracy.

When working in Connected to PowerRadar mode, raw measurements are calibrated in the cloud. In stand-alone mode, however, the calibration is done on the Bridge itself, utilizing a unique calibration key.

The calibration key is a sensor specific, 15 alpha-numeric string (e.g. ACD43-XU3V5-Z7RF3), which must be provided when allocating a sensor to be used in stand-alone mode and dual mode.

To get a calibration key for a specific sensor use one of the flowing options:

- **Automatically calibration key retrieval** - if the laptop used to configure the Bridge has Internet access, a calibration key can be automatically retrieved when defining the sensor in the Bridge. This is the easiest and most efficient way to get the calibration key. Internet access is only required for the laptop used to set the Bridge and only during the configuration.
- **Manual calibration key retrieval** – In the rare case where internet access is not available during Bridge configuration, please contact Support by opening a ticket at www.powerradar.energy/support and provide the serial numbers of sensors needed. A file containing the respective calibration keys will be provided to be manually entered into the Bridge.

Bridge Configuration for stand-alone mode

To work in the stand alone-mode the Bridge must be configured via the built-in web interface. This is explained in detail in the Gen 4+ Bridge Manual.

Connect to the Bridge web interface

Initial Bridge configuration is done by forcing the Bridge into configuration mode and directly connecting a laptop with point-to-point ethernet cable.

The full process is defined in the '*Accessing the Bridge web interface*' section in the Gen 4+ Bridge Manual.

Set networking mode

1. Navigate to the '*Network Setup'* tab and set the Bridge networking mode
2. Note that only 'Ethernet' networks support the stand-alone Modbus TCP mode. Stand-alone Modbus RTU mode can work alongside any network mode.
3. Set the IP configuration for the Bridge. A static IP (or DHCP with fixed IP guarantee) must be used in stand-alone mode to allow the master Modbus TCP to repeatedly address this Bridge.

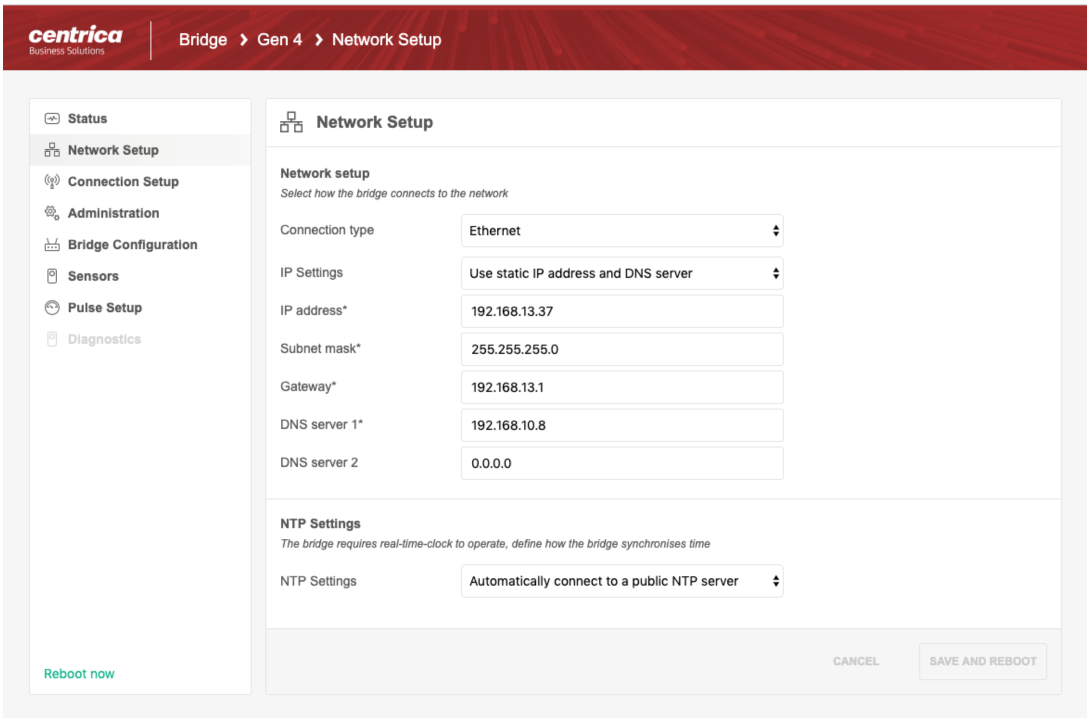

Figure 4: The Network Setup Screen

Set Connection mode

1. Navigate to the '*Connection Setup'* tab to set the Bridge connection preferences.
2. By default, the Bridge is configured to "Connect to PowerRadar"
3. Check '*Enable Stand Alone Modbus mode'* to enable the Modbus mode option.
4. Check '*Modbus TCP'* to enable the Modbus TCP option, or '*Modbus RTU'* to enable the Modbus RTU option.
5. For the Modbus RTU option, enter the '*Modbus Base Address*' (1 to 247).
6. Set the RTU port speed (bps) from the dropdown menu.
7. Note that it is possible to set both 'PowerRadar' and '*Modbus'* modes concurrently. In this case:
    a. The Bridge will send sensor data to the cloud-based server (all received sensors).
    b. In parallel, it will make sensor data available for Modbus (allocated sensors only).

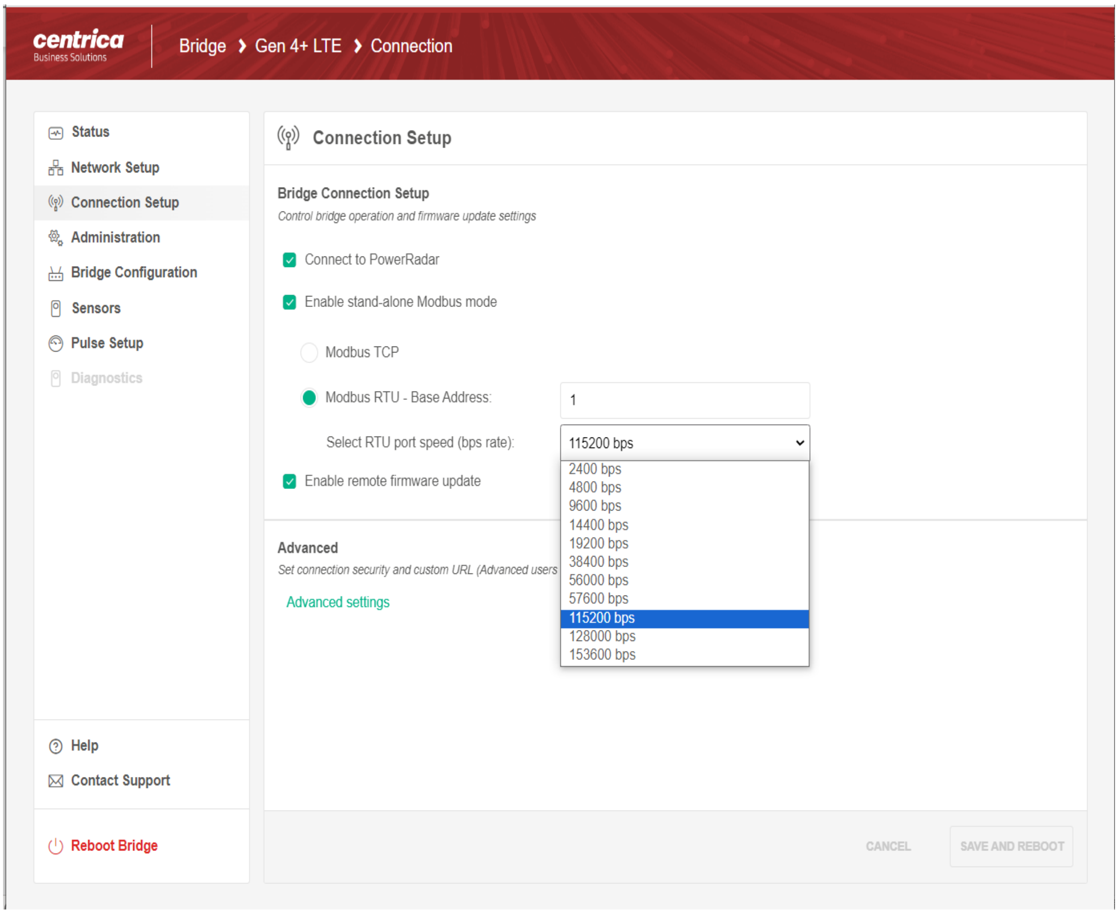

Figure 5: The Connection Setup Screen

Define Bridge UI accessibility

For enhanced security, the Bridge UI is accessible by default only during configuration mode, using a wired-connected laptop.

It is possible to change that configuration, making the UI accessible from any laptop in the same LAN as the Bridge. While less secure, this mode can be useful during testing and sensor setup when multiple frequent changes are made to the Bridge UI. Setting up a unique administrator password is strongly recommended.

1. Navigate to the '*Bridge Configuration*' tab
2. Choose Bridge UI accessibility:
    a. Choose '*Only in config mode*' for maximum security – In this mode the Bridge UI is only accessible from laptop with direct Ethernet connection and only when the Bridge is placed in Configuration mode.
    b. Choose '*Always*' for maximum flexibility – In this mode the Bridge UI is available from any device with Bridge network access. This mode is recommended only during setup period and after a unique administrator password is set.

Figure 6: Bridge Configuration

Assign sensors to slots

Any sensor to be used by the Modbus interface must first be allocated to specific location (slot) within the Bridge. Once allocated, this sensor readings are guaranteed to always be in a fixed register address.

Readings from sensors that were not assigned to a slot, will not be provided via the Modbus interface (but will continue to be sent to the cloud-based server if '*Connect to PowerRadar*' is set in the connection configuration page).

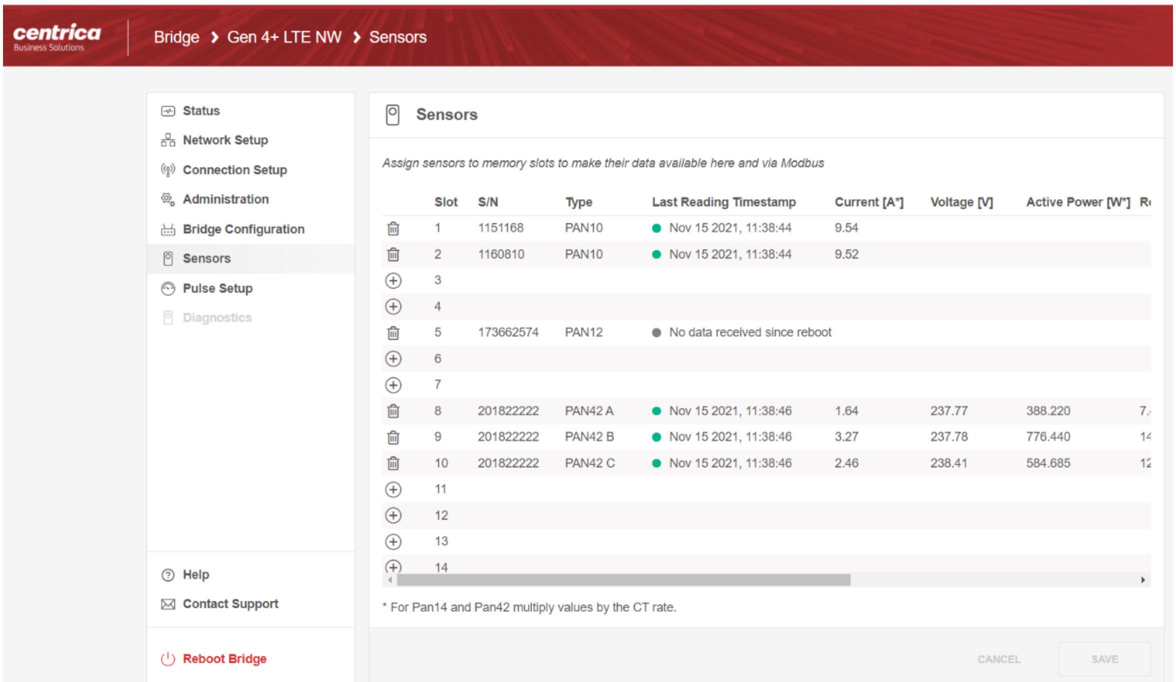

Figure 7: The Sensors Tab

<u>Assign a sensor to a slot</u>

1. Navigate to the '*Sensors' tab*
2. Choose an empty slot and press the '+' icon. For PAN42 sensor, make sure the following two slots are also available (PAN42 sensor requires 3 empty consecutive slots).
3. In the popup dialog choose the type of sensor:

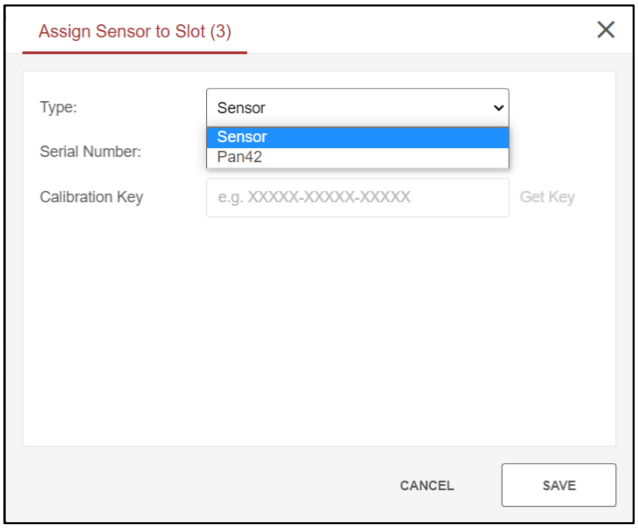

Figure 8: The Sensor type select menu

4. For PAN10, PAN12 and PAN14:

    a. Choose **Sensor**.

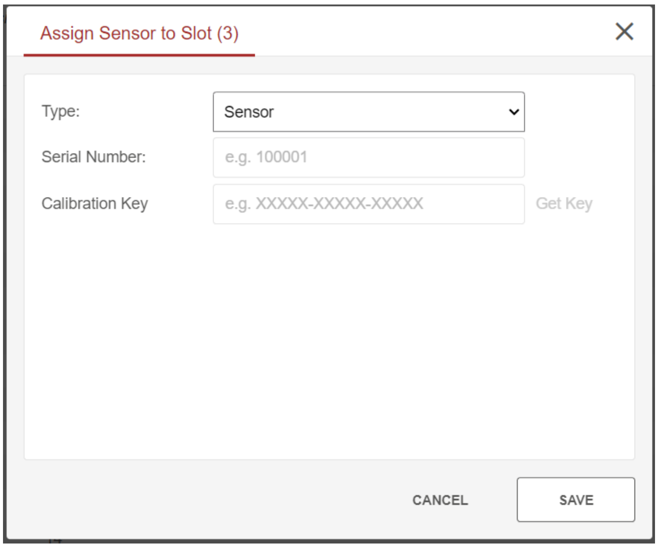

Figure 9: Add Sensor Pop-up

    b. Type the sensor's serial number.

    c. Type the calibration key if you have it or click '*Get calibration key'* to have it automatically retrieved and inserted (The web site must be reachable from the configuration laptop).

d. Press the **Save** button.

5. For PAN42:

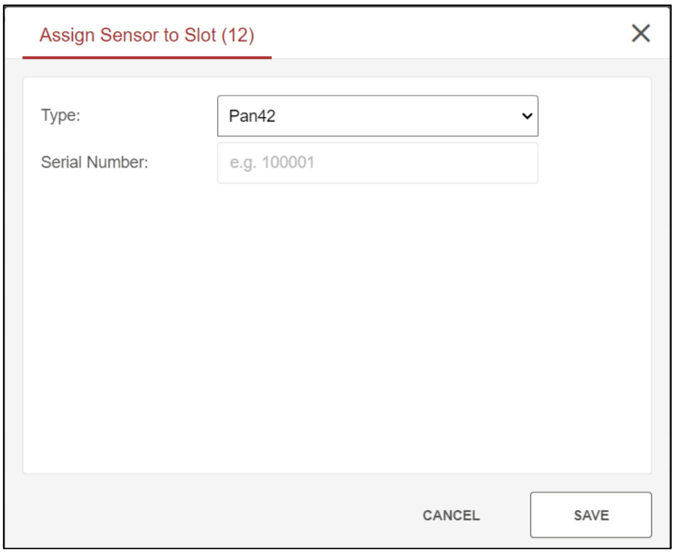

Figure 10: Add PAN42 Sensor Pop-up

a. Type the sensor's serial number. The sensor is registered in 3 slots (for 3 phases)

b. Press the **Save** button.

The sensor is now assigned to the slot. New readings will be shown in this screen and made available via the Modbus TCP/RTU interface.

Note 1: Stand-alone mode supports the following sensor types: PAN10, PAN12, PAN14 and up to 3 PAN42 sensors.

Note 2: The calibration key is a unique, per-sensor, value used by the Bridge to calibrate each reading for accuracy. It is a mandatory, sensor specific, value. PAN42 does not need calibration.

Note 3: When clicking 'Get Key, your browser communicates with the platform to get the calibration key. It is, therefore, essential that the laptop has Internet connectivity.

Note 4: If having issues retrieving the calibration key, please contact support who can provide an offline list of calibration keys to be entered manually.

Delete a sensor from the list

To delete a sensor from the list, press the Trash-Can icon at the beginning of the line. Confirm the delete.

You can delete a PAN-42 sensor by pressing the Trash-Can at any of the 3 sensor lines, all 3 lines will be deleted.

View Sensor Readings

Sensor readings are available in the 'Sensors Tab'. Each allocated sensor will display the last received reading. A new reading will override the previous reading.

1. Navigate to the '*Sensors'* tab. This Tab is accessible only when '*Connection Setup'* > '*Enable stand-alone Modbus mode'* is checked.
2. Allocated slots will show the following values for PAN10, PAN12, PAN14 and PAN42:
    a. **Sensor S/N**: The serial number of the allocated sensor
    b. **Current [A]**: The last calibrated measurement in Ampere.
    c. **RSSI [dBm]:** The received signal strength of the last measurement.
    d. **Timestamp**: the time of last measurement.

Note 1: The current readings shown here have already been individually calibrated by the Bridge for accuracy, using the calibration key.

Note 2: PAN10 and PAN12 current readings can be used as-is. For PAN14, these values should be multiplied by the CT-Rate of the CT used.

For PAN42 the table will show the following additional values:

e. **Voltage [V]**: The last measurement in Volts RMS

f. **Active Power [W]**: The last measurement in Watts

g. **Reactive Power [VAR]:** The last measurement in VARs

h. **Power Factor**: The last measurement power factor

i. **Frequency [Hz]**: The last measurement in Hertz

Note 3: For PAN42 the current, active power and reactive power reading values should be multiplied by the CT-Rate of the CT used.

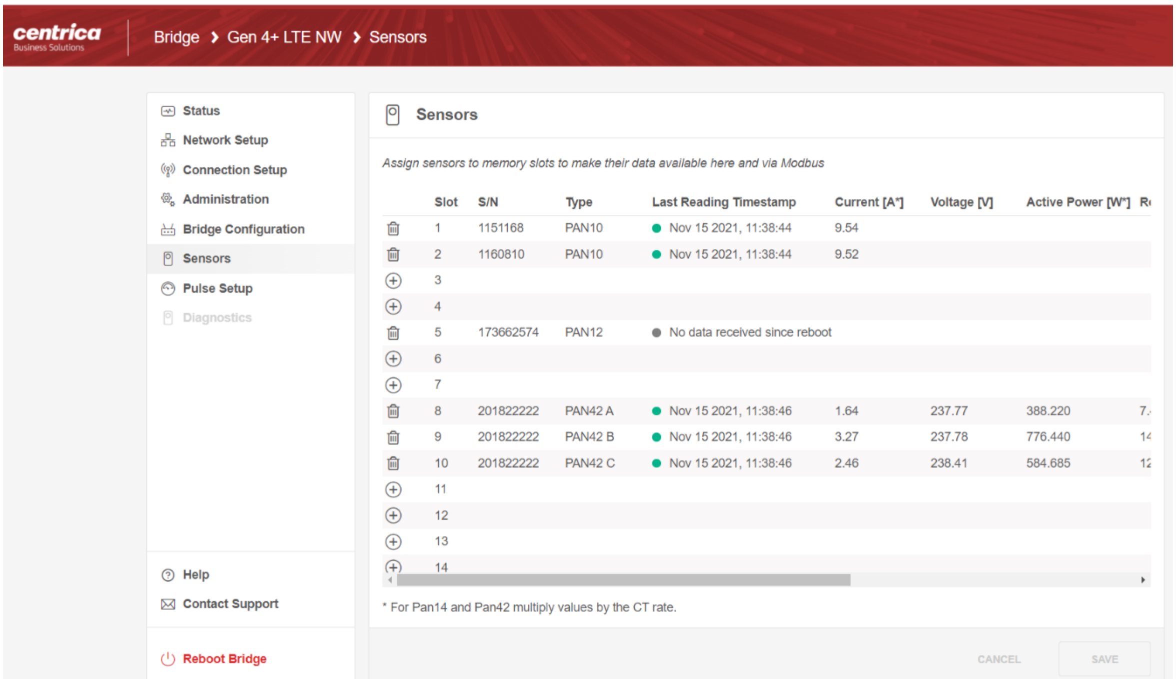

Figure 11: Sensor's list – Main values

Scroll Right for additonal readings:

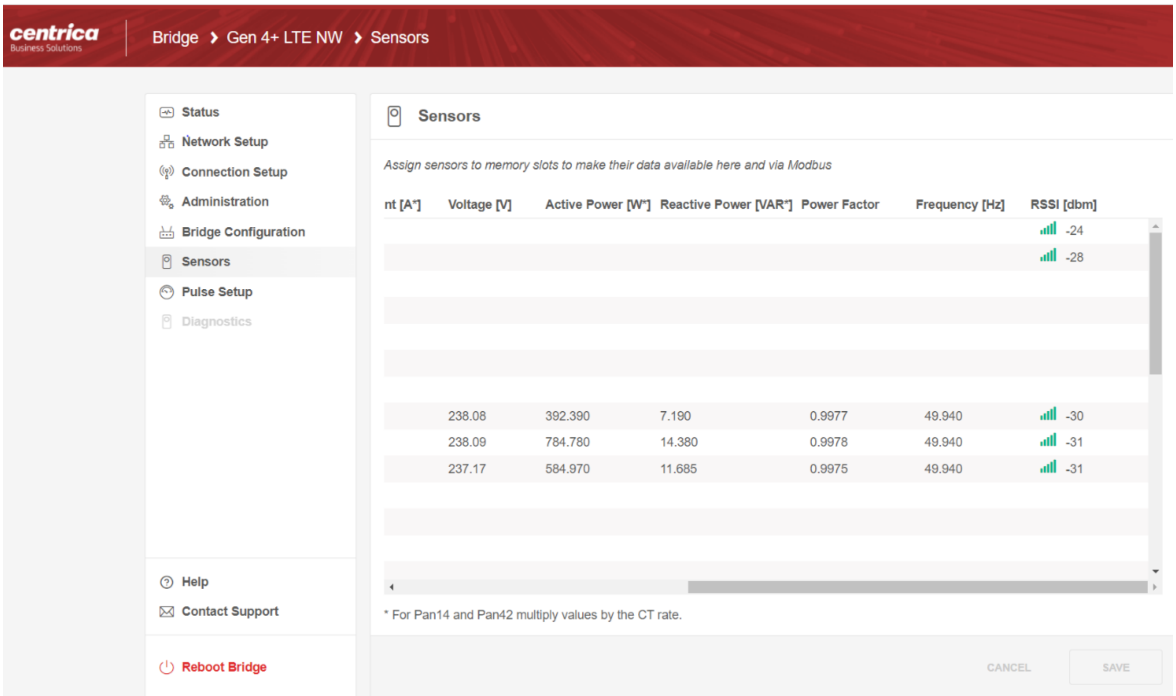

Figure 12: Sensor’s list – Additional readings

Configure the Bridge Pulse interface

1. Navigate to the 'Pulse Setup' *tab*
2. Enable pulse input 1, 2 or both
3. Enabled pulses are made available for Modbus TCP/RTU based on the '*Connection Setup*' > '*Enable stand-alone Modbus mode*' value and are sent to the cloud-based server based on the '*Connection Setup*' > '*Connect to PowerRadar*' value.
4. Pulse inputs are of type KY (2 terminals) but the counter counts both the Rising and Falling edges of the pulses. If the connected device is of type KY, you need to divide the reported counter value by 2. If the connected device is of type KYZ, connect either the K and Y terminals or the K and Z terminals. You do not need to divide the reported counter value by 2.

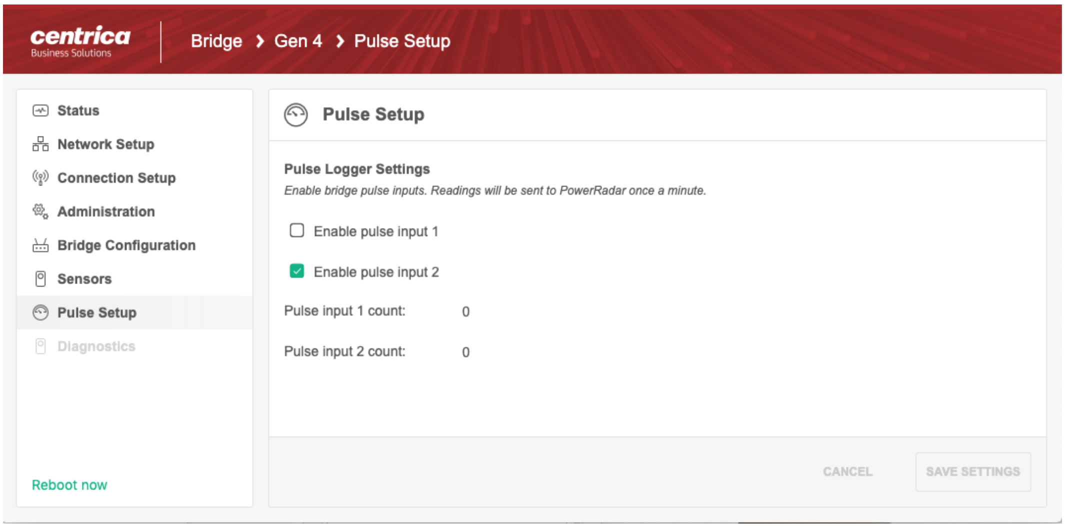

Figure 13: Pulse Setup Tab

Bridge LED configuration for stand-alone modes

The Bridge contains three hardware LED indicators that change based on Bridge operations.

For a full list of led indication states, please refer to the Gen 4+ Bridge Manual. The information below refers to changes in LED behavior in stand-alone mode.

In a '*Standalone mode'* the Bridge's middle LED (link state LED) supports the following behavior:

Modbus TCP mode:

- Slow **1-sec Yellow** blinking until local network connection is established (same as in '*Connect to PowerRadar'* mode). A solid Green when done.
- **Green**, faster **0.4-sec blink** if local network connection is established but no Modbus connection from a master device detected.
- **Solid green** when a Modbus master device connection is detected.

Modbus RTU mode:

- **Solid green** when a Modbus master device Request messages are detected.
- **Green**, faster **0.4-sec blink** after about 45 seconds of no Modbus master device requests.

In a '*Combined'* mode *(Cloud-based Server* and *Modbus)*

For communication with the network, there is no change in LED behavior when in '*Connect to PowerRadar'* or '*Combined'* modes. The Green LED shows the Communication with Modbus Master as described above, in parallel with the Network.