Solution Guide:

Wireless Monitoring & Control
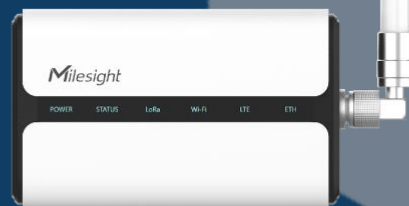
Table of Contents

Overview

What is the purpose of this document?

In this guide we will help you to choose wireless sensors and controllers, gateways and BEMS controllers from our product range for your wireless monitoring and/or control solution by

- Exploring the different wireless devices and BEMS controllers in our product range
  - o Describe and compare the main features
  - o Highlight pros and cons, capacity limits etc.
- Showing each product in a worked solution example with explanations of the choices made, looking at –
  - o **Internal Air Quality Sensing** – checking of the environment to ensure people are in a healthy work, study or living environment
  - o **Plant sensing and control** – interfacing with various plant to monitor and control using built in detectors or IO interfacing
  - o **Integration of wireless data into the BEMS** – gateway and MQTT broker devices to link the field devices to various types of BEMS controllers

The guide will also outline the engineering and commissioning activities to help you understand the time resources required to deliver each solution.

Who is this document for?

- **Technical Sales People** – the guide will help you build proposals by guiding you in selecting the right hardware to fulfil the required functionality, whilst being as competitive on pricing as possible, and to help estimate engineering and commissioning time
- **Project Engineers** – the guide will help you to select the right hardware to fulfil the required functionality of your design. The guide could also highlight opportunities to increase margin by value engineering your solution, e.g. maintaining functionality whilst selecting a less costly controller and IO module(s) than estimated for

Please note – this document is intended as a guide only and should always be read in conjunction with the latest technical documentation for any product.

LoRaWAN Transmitters/Receivers Options Matrix

Transmitter Sensors/Devices ▶ Receivers/Gateways ▼		Milesight	Enless	Others
Milesight UG65		✔️	✔️	❓ Testing required case-by-case, limited support
	BEMS Interface ▶	HTTPS / MQTT / BACnet IP	HTTPS / MQTT	❓ Testing required case-by-case, limited support
Enless RX-xxx-500		❌	✔️	❌
	BEMS Interface ▶		BACnet IP & MS/TP / Modbus TCP and RTU	
Other Public/Private Receivers/Gateways ❓		✔️ Limited support	✔️ Limited support	✔️ Limited support

Controller Comms Option Possibilities

JACE 8000	Edge 10	MAC36	AAC20
BACnet IP & MS/TP	BACnet IP & MS/TP	BACnet IP & MS/TP	BACnet IP & MS/TP
Modbus TCP and RTU	Modbus TCP and RTU	Modbus TCP and RTU	Modbus TCP and RTU
MQTT		MQTT	
HTTPS		HTTPS	

Application Example 1 – Office Space Monitoring

In this example we show how a new or existing JACE 8000 can work with the Milesight UG65 LoRaWAN gateway and the Innon HTTP and JSON Niagara 4 modules to monitor Milesight LoRaWAN sensors to provide valuable feedback on how an office space is being used and how effectively and efficiently the HVAC and lighting systems are maintaining conditions.

We also demonstrate that battery powered wireless sensors can be used for certain HVAC control functions, even if the transmission periods are relatively slow, e.g. 5 to 10 minutes.

The main elements of the solution are –

- JACE 8000
  - HTTPS server function for UG65 to send sensor data to
  - BEMS logging, alarming and graphical user interface of floor occupancy levels and conditions
- Milesight UG65 Gateway
  - LoRaWAN receiver for LoRaWAN sensor data
  - Sends JSON data using HTTPS POST method to JACE's HTTPS server
- Milesight AM307 Internal Air Quality Sensors
  - Sensing of space temperature, humidity CO_2 level, light level, pressure, TVOC, motion for floor
- Milesight W202 PIR and Light Sensors
  - Detects movement/occupancy of people and light level in various zones
- Milesight VS121 AI Workplace Sensor
  - Counts people coming in and out of the floor area
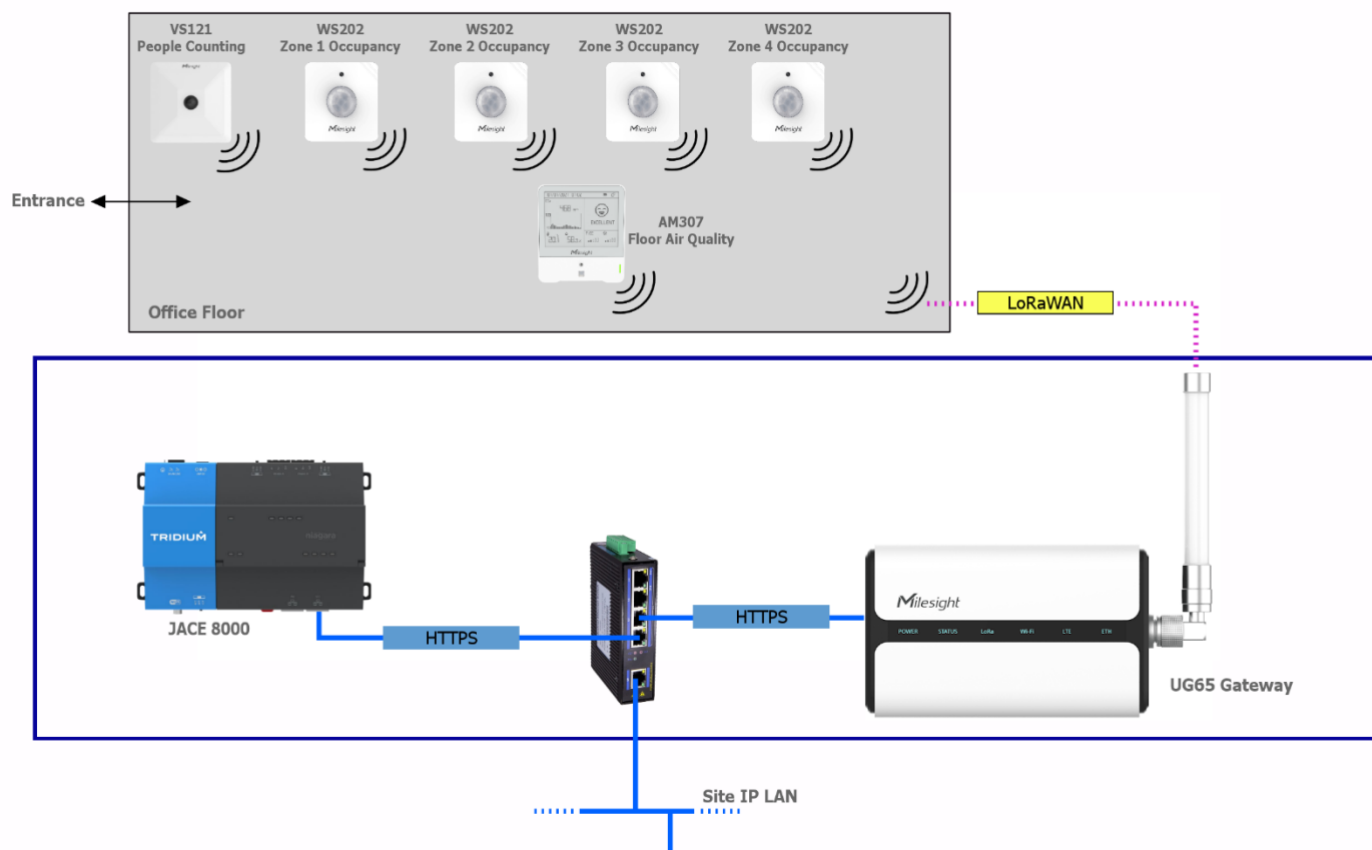
Hardware Functions and Reasons for Selection

JACE 8000

Main Functions

- Provides interface with UG65 LoRaWAN gateway via its HTTP server
  - Wire sheet with Innon API and JSON components
    - HTTP POST receipt from UG65
    - JSON payload decoding
      - Identifies each LoRaWAN sensor payload
      - Writes to dedicated N4 component slots
- History data recording of sensor data as required

  !
  - 5000 histories MAX
  - Configuration of history collection and archiving may need careful consideration to avoid over-filling RAM

- Provides alarms as required, e.g. temperature, humidity, CO2 levels, TVOC levels not meeting SLAs or at uncomfortable or unhealthy levels
- Shares LoRaWAN data with Niagara 4 BEMS, e.g. –
  - CO2 for ventilation control of fans and dampers
    - Does not require fast control so 5 – 10 minute battery saving transmission period is acceptable
  - Space temperature for HVAC terminal unit optimum start/stop routine
    - Does not require fast control so 5 – 10 minute battery saving transmission period is acceptable
  - If faster update periods are required, mains adapter powered AM307 is available

  !
  - Battery powered wireless sensors are generally not suited to fast control or critical control applications

- Connected to site BEMS IP network for remote web station supervision
  - Graphical user interface
  - Dashboard views
  - Alarm management
  - History viewing, export and archiving
  - Analytical processing of data to give better insights

Reasons for Selection

- Quick and simple integration with UG65 using Innon API and JSON N4 modules
  - httpServlet component consumes NO proxy points – using alternative BACnet integration method would require approximately 60 proxy points
  - No limit to amount of LoRaWAN sensors or devices being read
- Dedicated panel for LoRaWAN integration so no hard IO required, better fit, slightly less expensive than MAC36

Milesight UG65 LoRaWAN Gateway

Main Functions

- Receives LoRaWAN transmissions from registered Milesight sensors and devices
  - ⚠ o 2000 sensors/devices MAX
- Encodes data into JSON payloads
- Sends HTTP POST to JACE every time a new LoRaWAN transmission is received

Reasons for Selection

- Easy web page-based configuration and set-up/commissioning
  - Ready made LoRaWAN to JSON encoders available for each Milesight sensor/device on Innon support website
  - Innon API and JSON modules easily decode above JSON payloads in N4

Milesight AM307 LoRaWAN Internal Air Quality Sensor

Main Functions

- Detects air quality
  - Temperature – shared with BEMS optimum start/stop control
  - Humidity
  - CO_2 – shared with BEMS ventilation control
  - TVOC (total volatile compounds)
  - Pressure
  - Light level
  - Movement
  - PM2.5/10
  - Formaldehyde
  - Ozone
- Shows above data to space occupants
  - Readings shown in real time (users can select what is shown)
  - Graph of CO_2
  - Emoticon changes if air quality changes
  - Traffic light system to show good or poor air quality
  - Buzzer alarm option
- Transmits data to UG65 (for forwarding to JACE)
  - Usually every 5-10 minutes to conserve battery

Reasons for Selection

- Attractive device to mount in office space
- Gives occupants local feedback of space conditions
- Long battery life (3 years with 10 minute Tx interval)
  - Battery is user replaceable to give sensor long serviceable life
- Easy configuration and commissioning with smartphone app using NFC
- Good wireless penetration through building fabric
- Long range wireless capability

Milesight W202 PIR and Light Sensor

Main Functions
- Detects motion and light level in floor space zone
    - Provides feedback on floor zone usage profile
    - Can be cross-referenced with light levels to determine if they are at correct level for occupied and unoccupied status
- Transmits data to UG65 (for forwarding to JACE)
    - Usually every 5-10 minutes to conserve battery OR
    - Immediately when motion is detected

Reasons for Selection
- Attractive device to mount on office ceiling
- Wide PIR sensing angle range
- Long battery life (4 years with 30 triggers per day)
    - Battery is user replaceable to give sensor long serviceable life
- Easy configuration and commissioning with smartphone app using NFC
- Good penetration through building fabric
- Long range capability

Milesight VS121 Workplace People Counting Sensor

Main Functions
- Counts people entering and leaving floor
    - Number of entries, exits to give total occupancy
    - Provides general usage profile for floor as a whole
- Transmits data to UG65 (for forwarding to JACE)

Reasons for Selection
- Attractive device to mount on office ceiling
- Wide PIR sensing angle range
- Easy configuration and commissioning using web interface via WiFi
- Intelligence to get 98% accuracy, e.g. U-turn detection
- GDPR compliant – anonymous detection to provide privacy for occupants
- Good penetration through building fabric
- Long range capability

Engineering and Commissioning Procedure Overview

- Configure each LoRaWAN sensor
    - o Set transmission times
    - o Set-up people counting routine
    - o Set display to required view
    - o Take note of device EUI number and record in schedule
- Configure UG65
    - o Set-up IP, security, wireless settings
    - o Set-up sensor device profiles and applications then add devices
- JACE 8000
    - o Commission and license
    - o Engineer station which would include
        - ▪ Configure httpServlet and JSON wire sheets to decode UG65 payloads
        - ▪ Configure histories and alarms
- Pre-commission all wireless sensors
- Commission system as a whole checking each monitoring function behaves as per description of operation

Application Example 2 – Remote Metering & Control

In this example we show how a new or existing MAC36 can work with the Milesight UG65 LoRaWAN gateway and an MQTT broker to monitor a remote building's electricity sub-meters wirelessly.

We also show how the MAC36 can send messages to the meters using downlinks to reset energy and maximum data and how LoRaWAN devices can communicate directly using D2D (device-to-device).

The main elements of the solution are –

- MAC36
  - Reads and writes data from/to meters
- Milesight UG65 Gateway
  - LoRaWAN receiver for LoRaWAN sensor data
  - Gateway to BEMS via MQTT
- Raspeberry Pi
  - Hosting MQTT broker software
- Milesight UC300 LoRaWAN controller
  - Reads sub-meters using RS485 port using Modbus protocol
  - Switches lights according to occupancy
- Milesight VS121
  - Determines if people are in the room
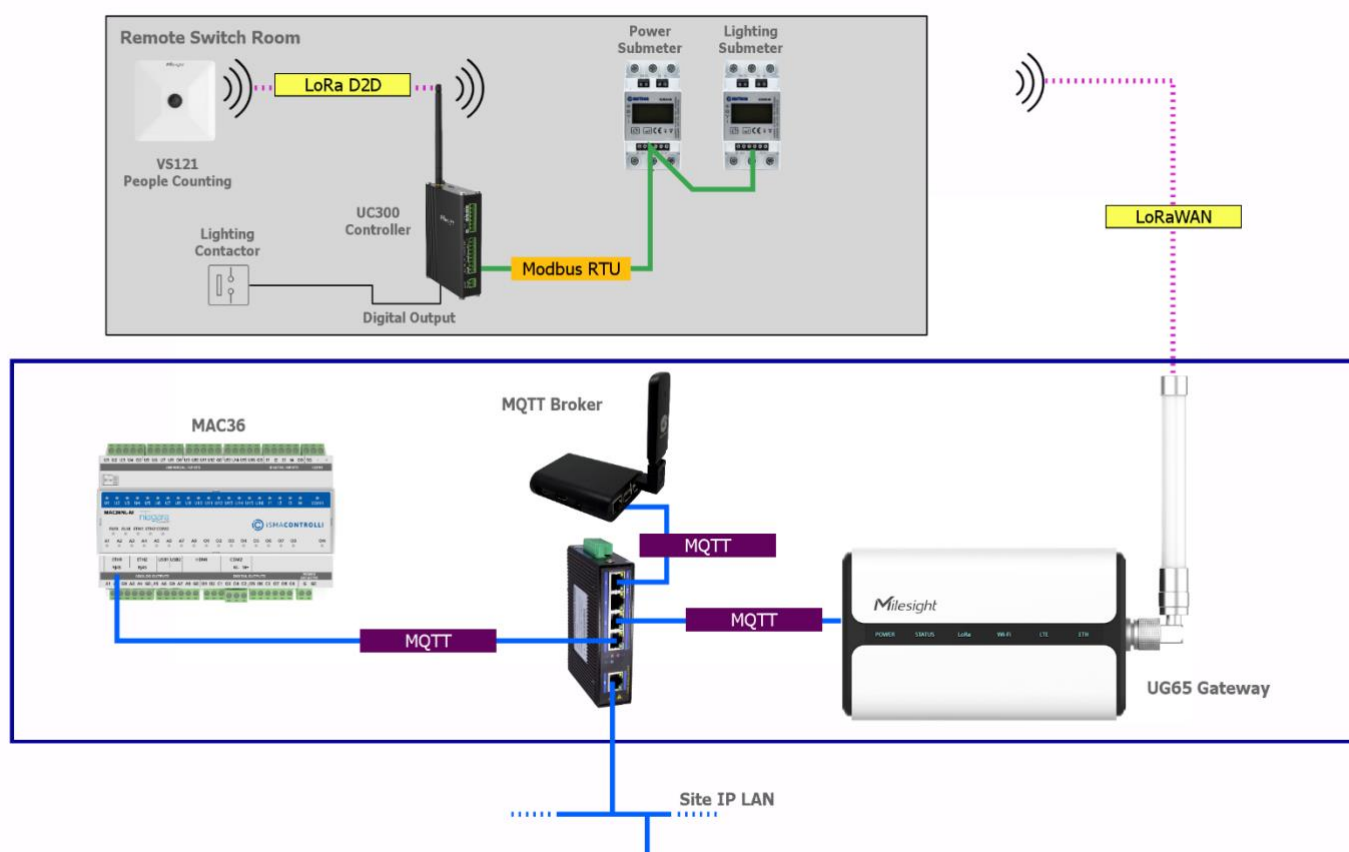
Hardware Functions and Reasons for Selection

MAC36

Main Functions

- History data recording of submeters
    - Subscribes to meter data topics using MQTT driver being published to Raspberry Pi by UG65 when meter data is transmitted from UC300
    - **!** ○ 5000 histories MAX
    - Configuration of history collection and archiving may need careful consideration to avoid over-filling RAM

- Resets meter energy and maximum data
    - Publishes to meter reset request topics using MQTT via Raspberry Pi, UG65 and UC300
- Connected to site BEMS IP network for remote web station supervision
    - Graphical user interface
    - Dashboard views
    - Alarm management
    - History viewing, export and archiving
    - Analytical and aM&T processing of data to give better insights

Reasons for Selection

- Part of main motor control centre in main building that requires some hard-wired control functions – better fit than JACE 8000 and more cost effective

Milesight UG65 LoRaWAN Gateway

Main Functions
- Receives LoRaWAN transmissions from UC300 for sensor data

- **!** ○ 2000 sensors/devices MAX

- Encodes data into JSON payloads
- Publishes MQTT to topics in Raspberry Pi every time a new LoRaWAN transmission is received
- Subscribes to meter data reset topics in Raspberry Pi broker being published to by MAC36, sends downlink to UC300 when reset occurs

Reasons for Selection
- Easy web page-based configuration and set-up/commissioning
    - Ready made LoRaWAN to JSON encoders available for each Milesight sensor/device on Innon support website
    - Innon API and JSON modules easily decode above JSON payloads in N4

Raspberry Pi MQTT Broker

Main Functions
- Hosts MQTT broker application to allow MAC36 and UG65 to publish and subscribe to metering topics to retrieve meter data and reset energy and maximum data

Reasons for Selection
- Inexpensive SBC to perform simple single function
- Can be installed in panel to make solution self-contained
  - Easier for service engineers to locate and understand
  - Less prone to 3rd party disruption than hosting on shared PC or server

Milesight UC300 LoRaWAN Controller

Main Functions
- Polls Modbus meter data periodically

  ⚠ o 16 Modbus registers MAX (each register can be from any slave)

- Transmits data to UG65
- Receives meter reset downlinks from MAC36 via MQTT broker and UG65
  - Sends Modbus commands to meter reset registers
- Receives D2D messages from VS121 to determine occupancy to switch lights on and off via digital output

Reasons for Selection
- Remote building has no BEMS or IT network – low cost solution to metering requirement
- Has simple strategy to control lights according to occupancy detection

Milesight VS121 People Counting

Main Functions
- Detects number of people in room
- Transmits occupancy status directly to UC300 controller using LoRaWAN D2D messages

Engineering and Commissioning Procedure Overview

- Configure UC300
  - o Set up Modbus polling of meters
  - o Set-up Modbus reset command
  - o Set-up switching logic for lights
  - o Configure IO
  - o Take note of EUI
- Configure VS121
  - o Set-up D2D messaging of occupancy to UC300
  - o Take note of EUI
- Configure meters
  - o Set Modbus addresses
  - o Set any EOL resistors etc. as required
- Configure UG65
  - o Set-up IP, security, wireless settings
  - o Set-up UC300 device profile and application then add device
- MAC36
  - o Commission and license
  - o Engineer station which would include
    - ▪ Configure MQTT driver and JSON wire sheets to decode and encode MQTT topic payloads
    - ▪ Configure histories and alarms
- Pre-commission all meters and lighting system
- Commission system as a whole checking each monitoring and control function behaves as per description of operation

Application Example 3 – Pulse Meter Reading

In this example we show how a new or existing Edge 10 can work with an Enless BACnet gateway and Enless repeater to monitor pulse meters in a difficult to reach far off part of the building

The main elements of the solution are –

- Edge 10
    - o BEMS logging and graphical user interface of meters
- Enless RX BACNET 500-312 LoRa Gateway Receiver
    - o LoRa receiver for LoRa pulse counter device data
- Enless RX REPEATER 600-301
    - o Extends LoRa range to distant pulse reading devices
- Enless TX PULSE 600-036
    - o Counts pulses on water and gas meters
- Enless TX PULSE LED 600-038
    - o Counts LED pulses on electricity meter
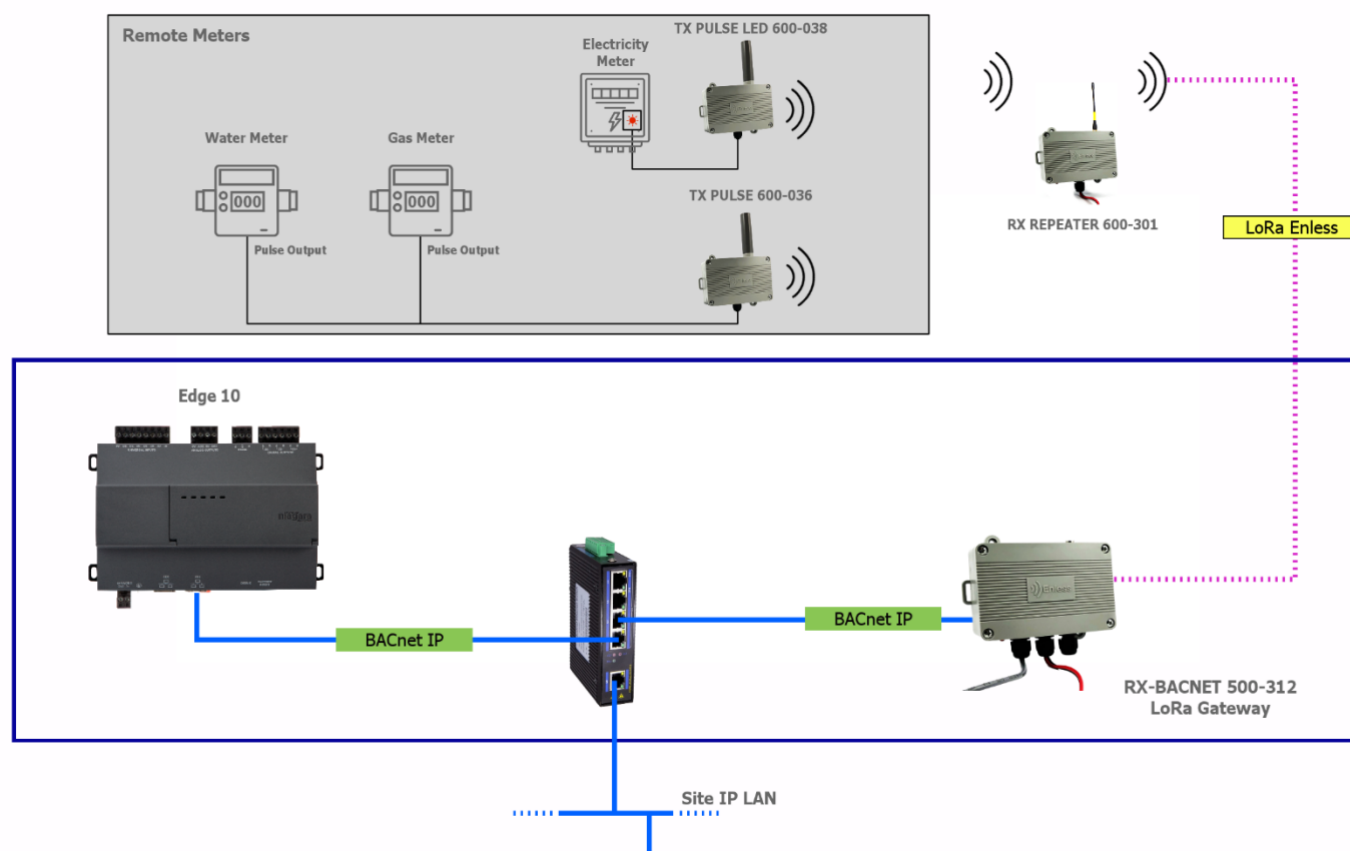
Hardware Functions and Reasons for Selection

Edge 10

Main Functions

- BACnet driver reads BACnet objects in the Enless gateway updated by the LoRa pulse reader transmissions
- History data recording of meters
  - Converts pulse counts into consumption data and logs as required

  !   o   Configuration of history collection and archiving may need careful consideration to avoid over-filling RAM

- Connected to site BEMS IP network for remote web station supervision
  - Graphical user interface
  - Dashboard views
  - Alarm management
  - History viewing, export and archiving
  - Analytical and aM&T processing of data to give better insights

Reasons for Selection

- Application only requires small amount of BACnet proxy points, cost effective option compared to more powerful controllers such as JACE and MAC36

Enless RX BACNET 500-312 LoRa Gateway

Main Functions

- Receives LoRa transmissions from Enless pulse counter devices

  - 40 transmitter sensors/devices MAX

  !   o   Propriety LoRa Enless private protocol
    - Only works with Enless sensors

- Writes LoRa data to BACnet objects
- Serves BACnet objects to any BACnet client, e.g. Edge 10

Reasons for Selection

- Easy engineering and configuration process with Enless LoRa devices and Edge 10
  - Web based
  - Detailed instructions from manufacturer for both transmitters and receiver in one document
  - Simple BACnet discovery by Edge 10 of meter data

Enless RX REPEATER 600-301 LoRa Repeater

Main Functions
- Receives LoRa transmissions from Enless transmitters and re-transmits to other Enless receivers, e.g. RX BACNET
  - o No limit on transmitters
  - o Propriety LoRa Enless private protocol
    - ▪ Only works with Enless sensors and gateways

Reasons for Selection
- Application is with very remote pulse counters that cannot directly reach RX BACNET in wireless panel
- Easy engineering and configuration with other Enless products chosen as part of solution

Enless TX PULSE LED 600-038 LoRa Pulse Counter

Main Functions
- Counts LED pulses on electricity meter
- Transmits pulse data to BACnet receiver

Reasons for Selection
- Electricity meter has no contact or open collector pulse output to read
- Battery is user replaceable to give sensor long serviceable life

Enless TX PULSE 600-036 LoRa Pulse Counter

Main Functions
- Counts contact pulses on water meter
- Counts contact pulses on gas meter chatter box
- Transmits pulse data to BACnet receiver

Reasons for Selection
- Meters have contact pulse outputs to read
- Battery is user replaceable to give sensor long serviceable life

Engineering and Commissioning Procedure Overview

- Configure pulse counter transmitters
  - o Check LoRa link
  - o Connect battery
  - o Take note of EUI
- Turn on LoRa repeater
- Configure LoRa receiver
  - o Set-up IP and BACnet settings
  - o Discover transmitters and change settings if required, e.g. transmit period
- Edge 10
  - o Engineer station which would include
    - ▪ Configure BACnet driver, discover BACnet receiver and discover its points
    - ▪ Configure histories and alarms
- Pre-commission all meters
- Commission system as a whole checking each monitoring function behaves as per description of operation

Application Example 4 – Tank Level Monitoring

In this example we show how a new or existing iSMA AAC20 can work with an Enless Modbus gateway to monitor the level of a tank in an area of the building that would be difficult to install hardwired BEMS monitoring to.

The main elements of the solution are –

- iSMA AAC20
    - BEMS logging, alarming and graphical user interface of tank level
- Enless RX Modbus 500-302 LoRa Gateway Receiver
    - LoRa receiver for LoRa level signal data
- Enless TX 4-20mA 600-035
    - Reads tank level detector 4-20mA output and transmits to Modbus LoRa receiver
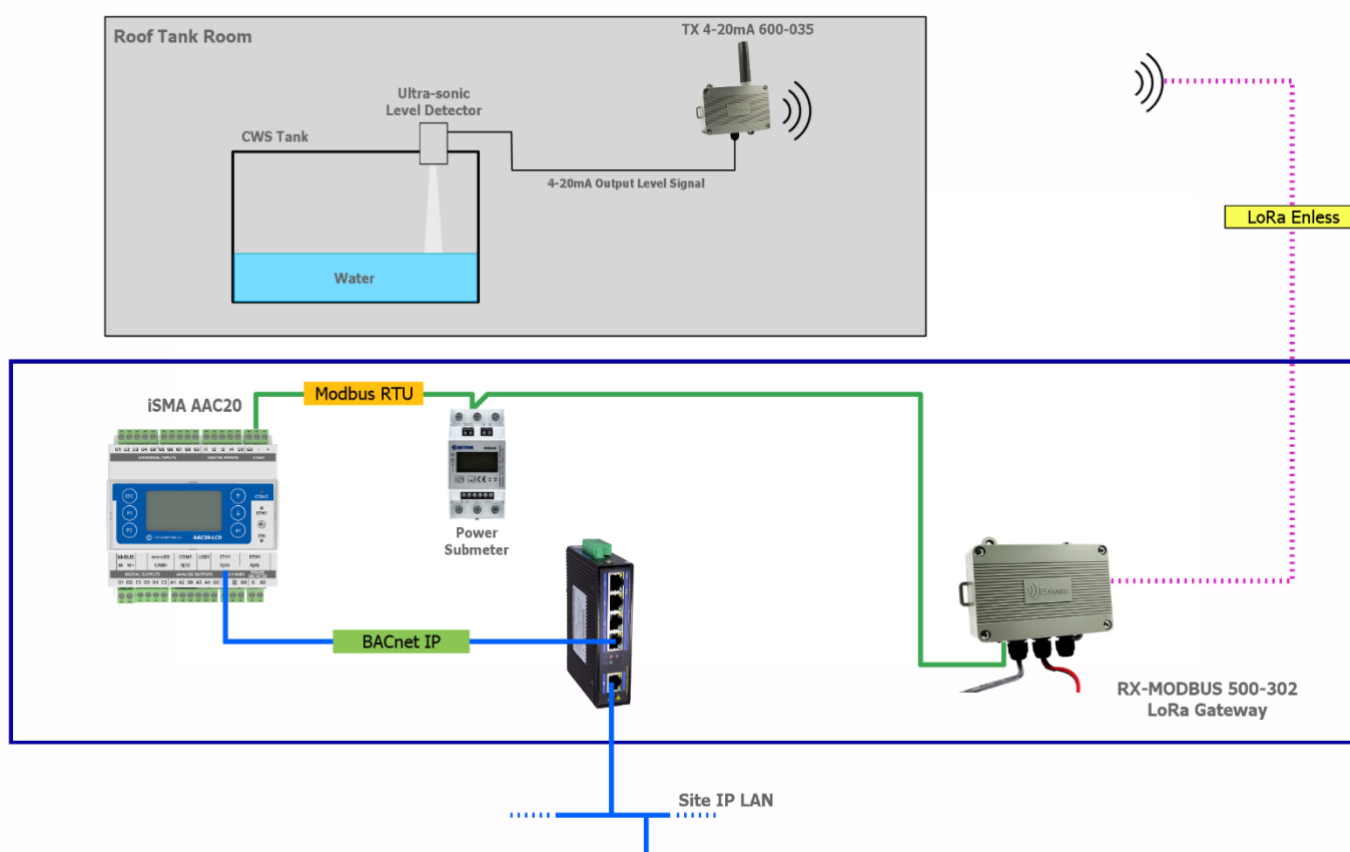
Hardware Functions and Reasons for Selection

iSMA AAC20

Main Functions

- Modbus driver reads Modbus registers in the Enless gateway updated by the LoRa 4-20mA reader transmissions
- Re-scaling of 0-20mA data into water level
- History data recording of water level

❗ o Configuration of history collection and archiving may need careful consideration to avoid over-filling SD card

- Alarming of water level, low and high
- Connected to site BEMS IP network for remote web station supervision
  - Graphical user interface
  - Dashboard views
  - Alarm management
  - History viewing, export and archiving
  - Analytical processing of data to give better insights

Reasons for Selection

- Site has central supervisor so lack of proper graphics is not an issue
- Cost effective

Enless RX Modbus 500-302 LoRa Gateway

Main Functions

- Receives LoRa transmissions from Enless 4-20mA reader

❗ o 40 transmitter sensors/devices MAX
  o Propriety LoRa Enless private protocol
    ▪ Only works with Enless sensors

- Writes LoRa data to Modbus registers
- Registers can be read by any Modbus TCP or RTU master, e.g. AAC20

Reasons for Selection

- Easy engineering and configuration process with Enless LoRa devices and AAC20
  - Web based
  - Detailed instructions from manufacturer for both transmitters and receiver in one document
- RS485 comms option to fit in with incumbent metering network

Enless TX 4-20mA 600-035 Signal Reader

Main Functions
- Reads ultra-sonic water level detector 4-20mA output
- Transmits level data to Modbus receiver

Reasons for Selection
- Easy engineering and configuration process with Enless Modbus gateway receiver
- Battery is user replaceable to give sensor long serviceable life

Engineering and Commissioning Procedure Overview

- Configure 4-20mA reader transmitters
  - o Check LoRa link
  - o Connect battery
  - o Take note of EUI
- Configure LoRa Modbus receiver
  - o Set-up Modbus settings
  - o Discover transmitters and change settings if required, e.g. transmit period
- AAC20
  - o Engineer station which would include
    - ▪ Configure Modbus driver, add points
    - ▪ Configure histories and alarms
- Pre-commission 4-20mA reader
- Commission system as a whole checking each monitoring function behaves as per description of operation

Useful Resources

Knowledge Base

Knowledge Base is an extensive collection of articles designed to help you navigate your way through our range of products. We understand that starting out with new equipment can be daunting, which is why our team has created easy-to-follow articles that are tailored specifically to our customers' needs, so you can avoid common mistakes and pitfalls.

Our Knowledge Base is constantly growing with new articles added frequently, ensuring that you always have access to the latest and most up-to-date information.

http://know.innon.com

Documentation

If you've misplaced your manual, don't worry. Our online library has got all the latest software versions, datasheets, and manuals for all the products we distribute. Plus, we update our files daily, so you'll never have to worry about using outdated information. Our library is available 24/7, so you can access it whenever you need it. Just head to

http://support.innon.com

YouTube

Looking for more information on our products? Check out our friendly and informative YouTube channel! We've got everything from quick start videos to product walkthroughs and selection advice. Our team will guide you through our products, providing demonstrations and use cases to help you choose the right product for your needs.

https://www.youtube.com/channel/UCeM5DQ3Umugfm6pNLutR6dg

Niagara 4 Engineers Facebook Group

Join our Niagara 4 Engineers Facebook Group and connect with engineers from all over the world! With over 3000 members, this private group allows you to engage in conversations, ask questions, and offer peer support about products and technology. Please note that we have a strict no advertising or recruitment policy to protect the integrity of the group and keep the conversations Niagara focused.

https://www.facebook.com/groups/NiagaraEngineers

About our Solution Guide Range

We've developed our Solution Guide range to help clients select the best products to build their own solutions. They aren't glossy sales brochures or heavy datasheets; they're educational guides designed to provide you with the right balance of features and technical information to inform your decision-making process.

Each solution guide will give you a rounded sense of what the products can do, their features, limitations, and differences and, importantly, how to leverage them to your advantage. You'll see how the different elements come together to build each solution, and we even put forward engineering and commissioning exercises for effective time management.

About Innon Energy

Innon Energy was founded in 2008 by engineers husband and wife Radu and Turchian. Since then, we've focused on providing the best possible service to BMS companies. We're not just a product distribution company - we work closely with our clients to understand their specific needs and develop products that meet them.

At Innon, we believe that engineering is more than a job. We see it as an opportunity to solve problems that enhance the quality of life for everyone around us. Our sales team is made of BMS engineers passionate about finding innovative solutions to help other BMS engineers achieve their goals.

We also invest heavily in education and have a Learning Management System designed specifically so that BMS engineers can stay updated with the latest BMS and IoT technology. We take our core values seriously, and they guide everything we do. We believe that an engineer's role is to find solutions to problems. We are here to provide them with the right tools and education to achieve their goals.

We prioritize customer satisfaction above all else. We want our clients to feel confident and supported every step of the way. Our growth strategy for the future focuses on helping System Integrators and IoT companies win more projects and self-deliver them better. We never do projects ourselves.

Innon Energy is more than just a company - we're a community of engineers and problem-solvers who are committed to making a positive impact on the world. We're excited to partner with you and help you achieve your goals.

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CONTROL THINGS