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Embedded LNS Gateway Instruction

BSP 7.2.13

Contents

1. Introduction

TEKTELIC Embedded LNS Gateways simplify the integration of LoRaWAN devices with industrial protocols such as MQTT, BACnet IP, and Modbus TCP/IP.

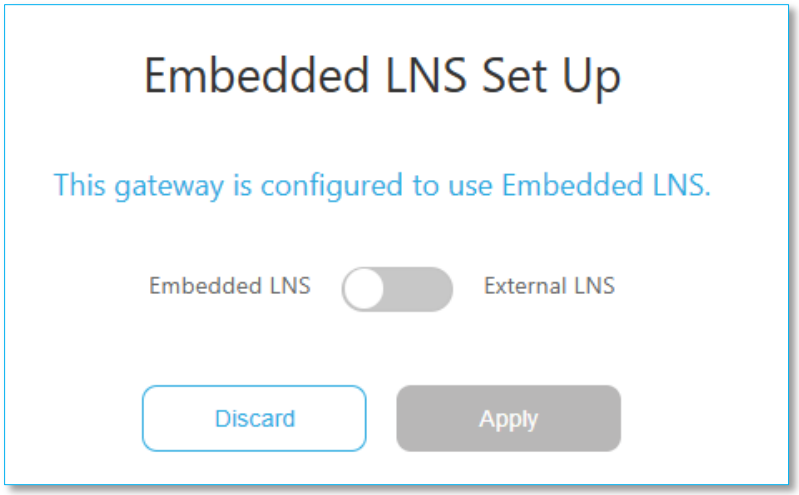
Depending on the intended use case, the configuration steps for these gateways may vary. To start, ensure that all components are correctly set up as follows:

1. Initial Setup:
   - Add LoRaWAN Device Profiles, and Devices using Kona Link. (Section 2 & 3)
2. Protocol-Specific Configuration: Configure and manage the supported protocols:
   - BACnet/IP: Refer to Section 4.1 for setup guidelines.
   - Modbus TCP/IP: Refer to Section 4.2 for detailed steps.
   - MQTT: Refer to Section 4.3 for configuration instructions.
3. Licensing process to retrieve fingerprint and to activate license (Section 5)

You can see some troubleshooting tips specific for the use cases in Section 6

NOTE: Important note for Users

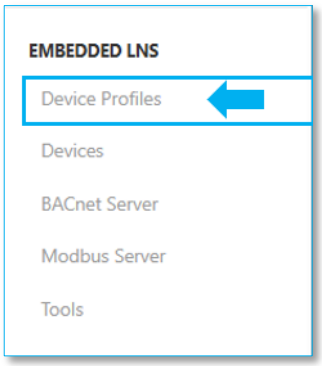
- The **Embedded LNS BSP version 7.2.13** now **requires a valid license**.
- Before proceeding, please ensure that you:
  - Have **obtained and activated** the **required license**.
  - Have **switched from External LNS to Embedded LNS** in your configuration, as shown below.



2. Manage Device Profiles

1. Login to Kona Link web page using “Host Name” or “IP Address”:
   - Using “Host Name”
     Host Name URL: https://kona-<GW variant>-<last 6 digit GW ID>.local/
     Eg: https://kona-micro-0011ab.local/
   - Using “IP Address”
     IP Address URL: https://<GW IP Address>/
     Eg: https://192.0.2.111/

2. Navigate to **Device Profile** section.



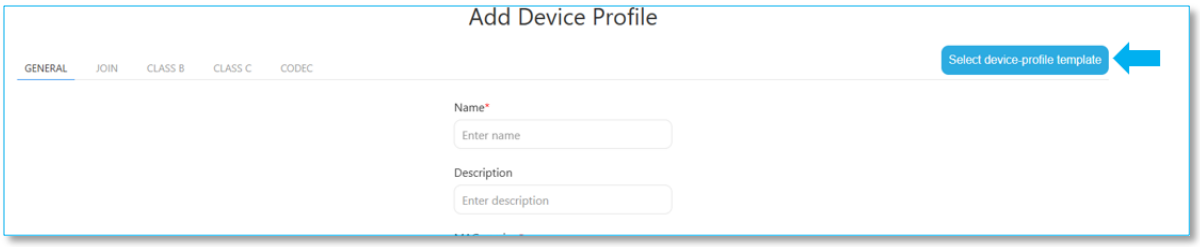
3. Click the **‘+’ icon** on the right side of the page to add a new Device Profile.

4. User has three options for Configuration of device profiles:
   - Select Device profile from existing list of Device profile template.
   - Configure Device profile Template using Vendor package
   - Add Device profile Manually.

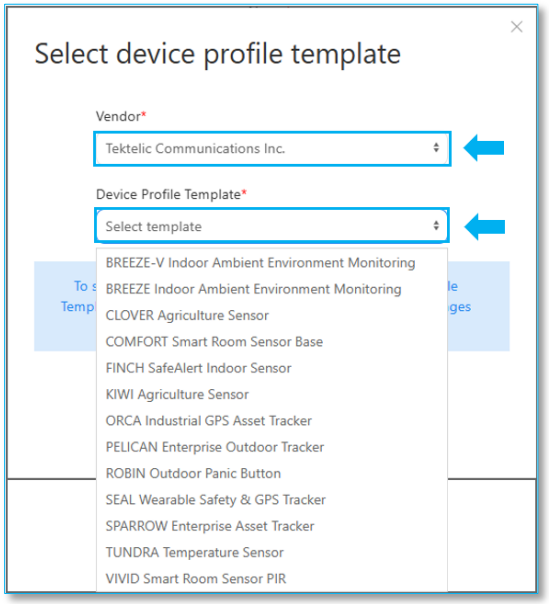
2.1 Pre-Configured Device Profile Template

To Select a Device Profile from the existing list of **Device profile Templates:**

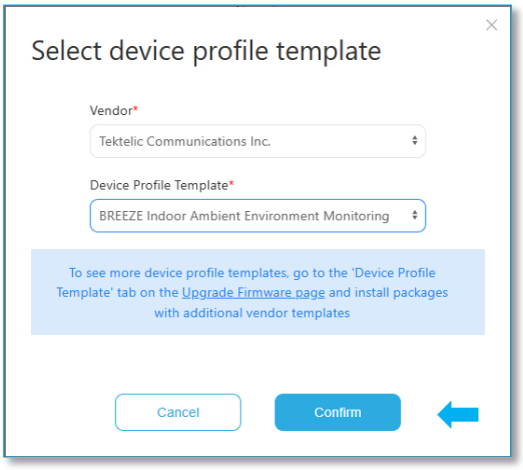
1. Click on **Select device-profile template**



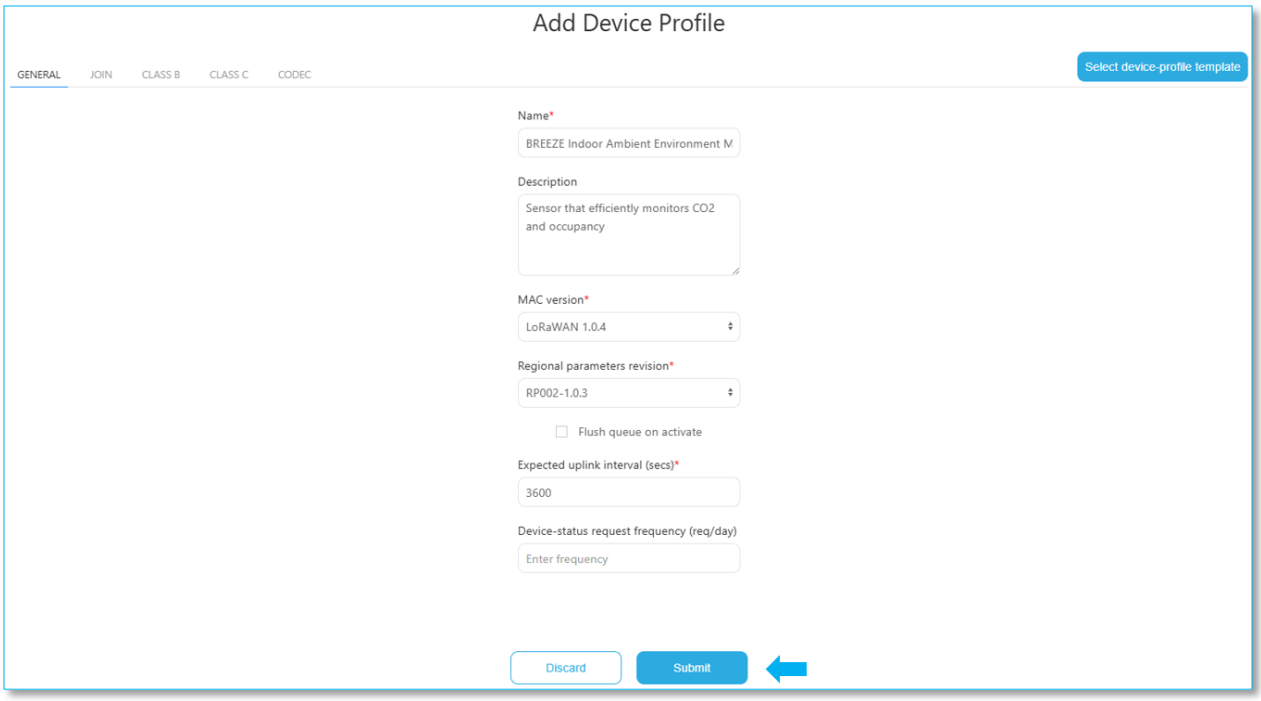
2. Select a **Vendor**.
3. Select from the **Device Profile Template**, from the dropdown menu



- Click on **Confirm**



4. Click on "**Submit**" to save the Device profile



2.2 Configure Vendor Device Profile Template

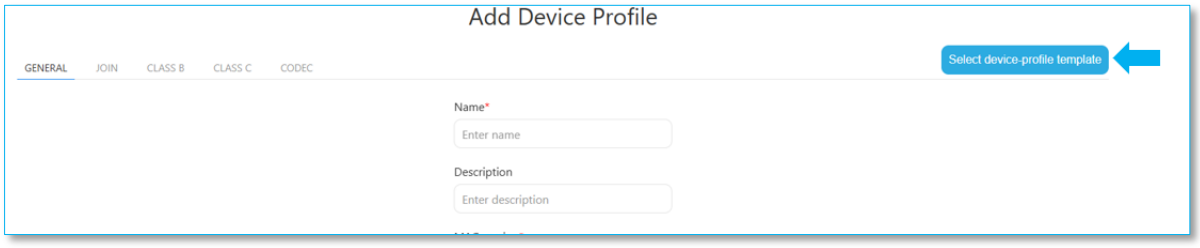
To Select a Device Profile from a different Vendor, add the corresponding package **Device profile Templates:**

Before we begin, the user has to

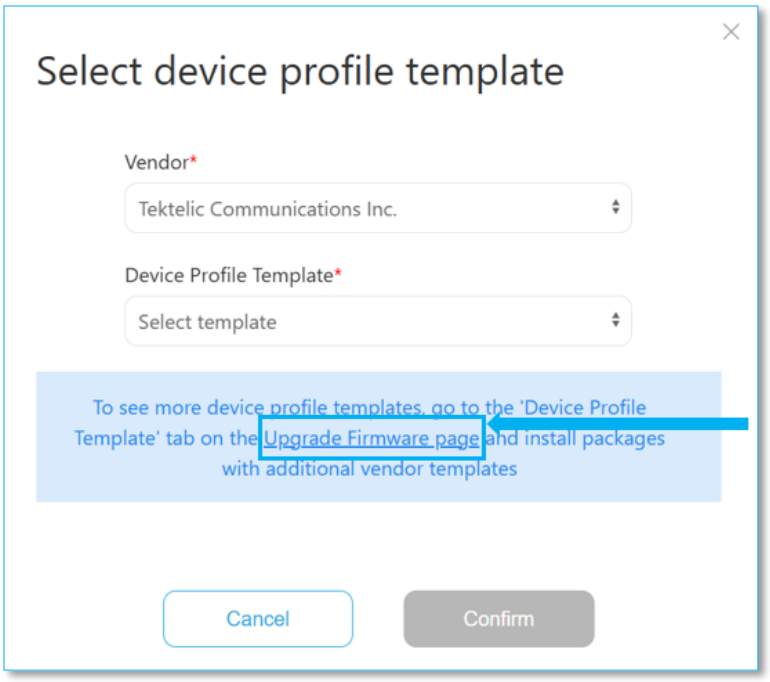
a) Install packages with additional vendor templates

b) And then Select the corresponding Vendor and Device profile Template.

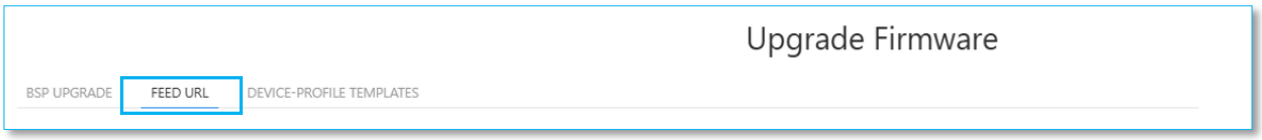
1. Click on **Select device-profile template**



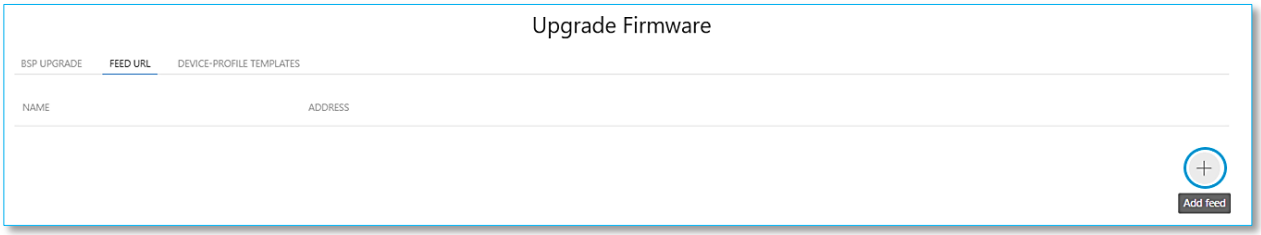
2. Click on "**Upgrade Firmware page**" hyperlink



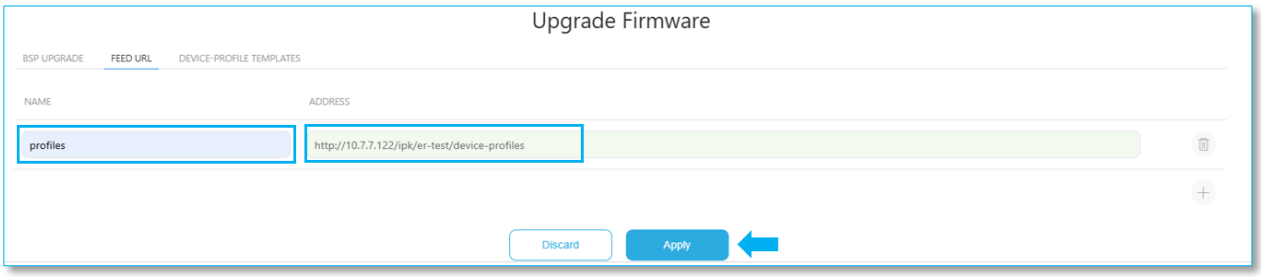
3. User is redirected to "**Upgrade Firmware**" page. Switch to "**FEED URL**" tab



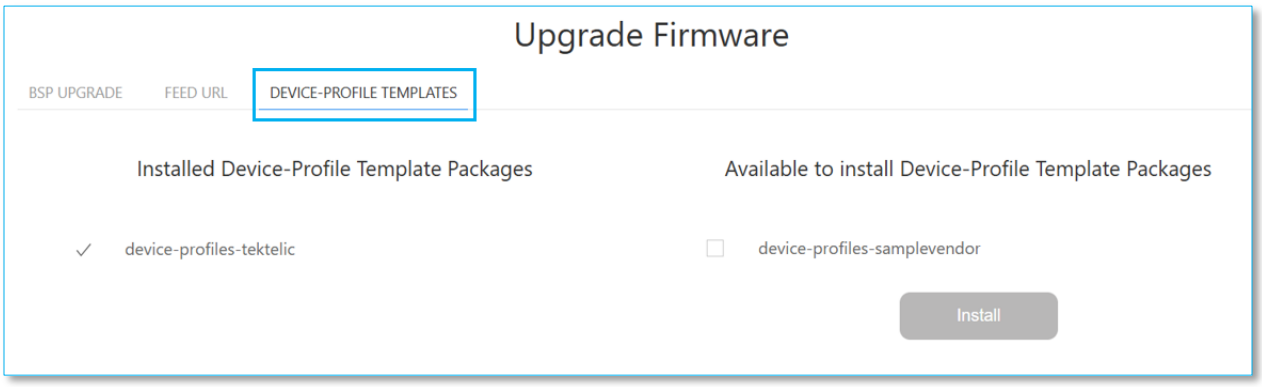
4. Click the **'+' icon** on the right side of the page to add a feed.



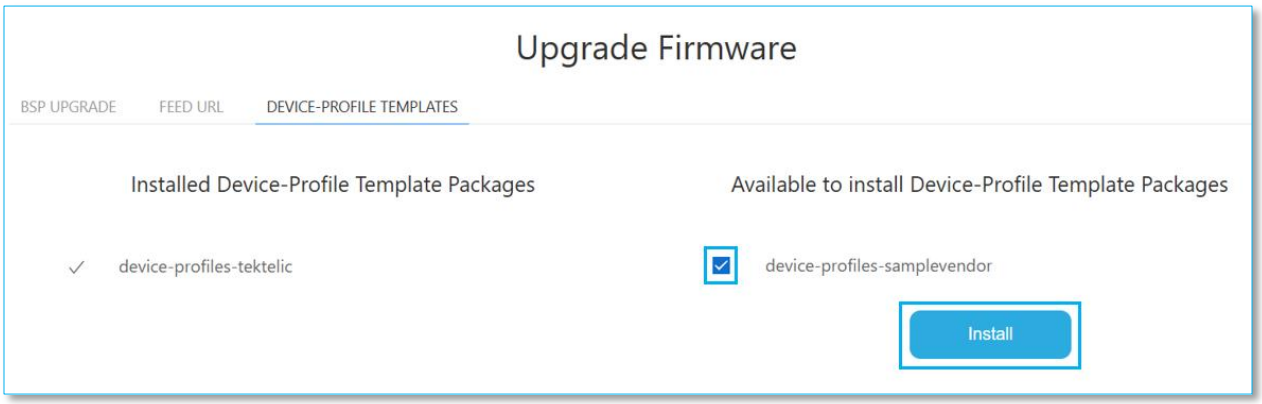
5. Enter the **Name** and **Address**, then Click **Apply** to save the changes



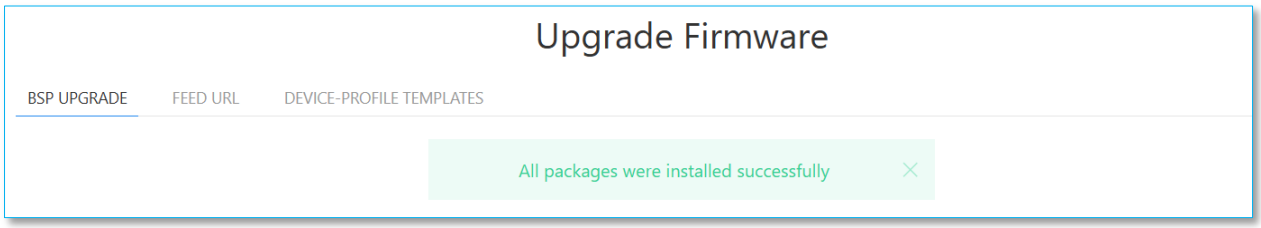
6. Once the URL is applied, switch to "**DEVICE PROFILE TEMPLATES**" tab to view the available packages to install.



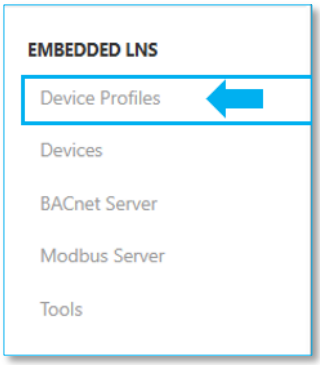
7. Select the **checkbox** for the applicable package and click "**Install**" to complete the installation of the Device-Profile Template package.



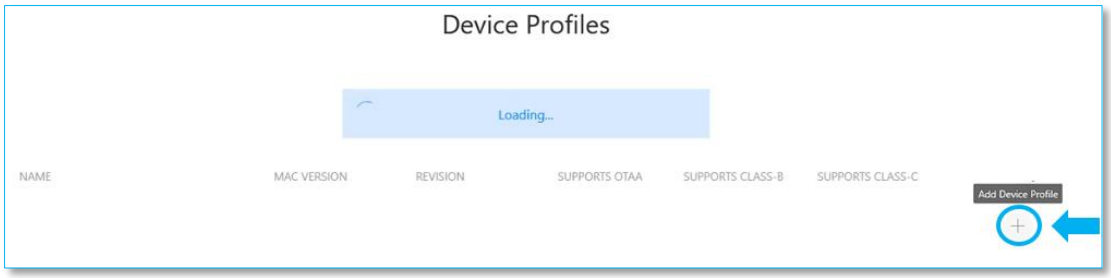
8. After the installation success message appears, proceed to the next step



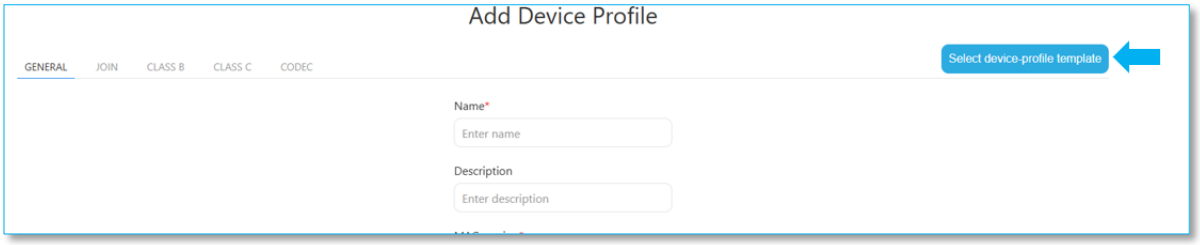
9. Navigate to **Device Profile** section



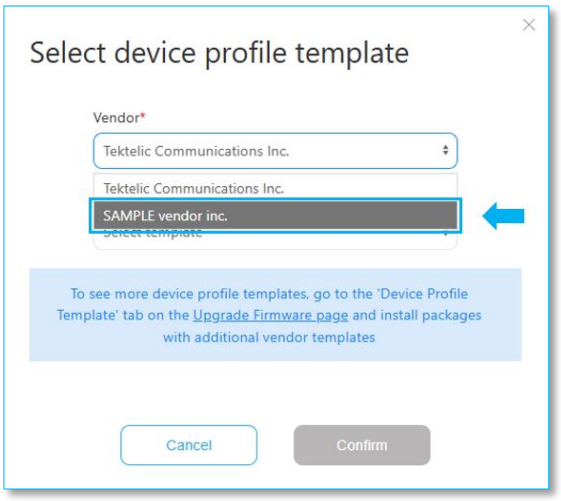
10. Click the **'+' icon** on the right side of the page to add a new Device Profile.



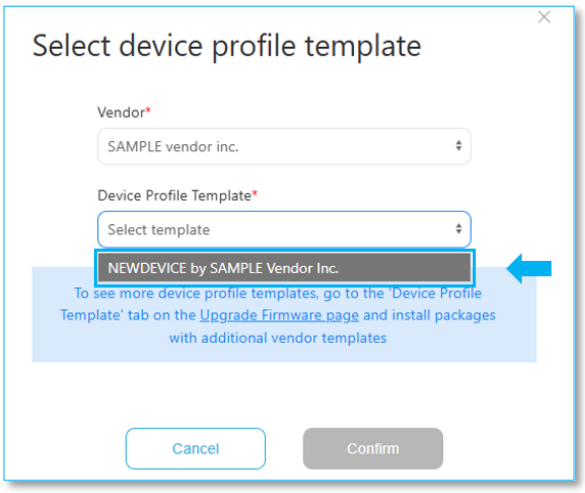
11. Click on **Select device profile template**



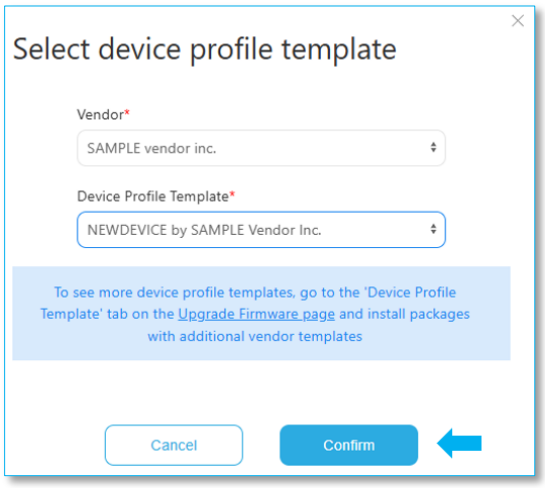
12. Select a **Vendor**.



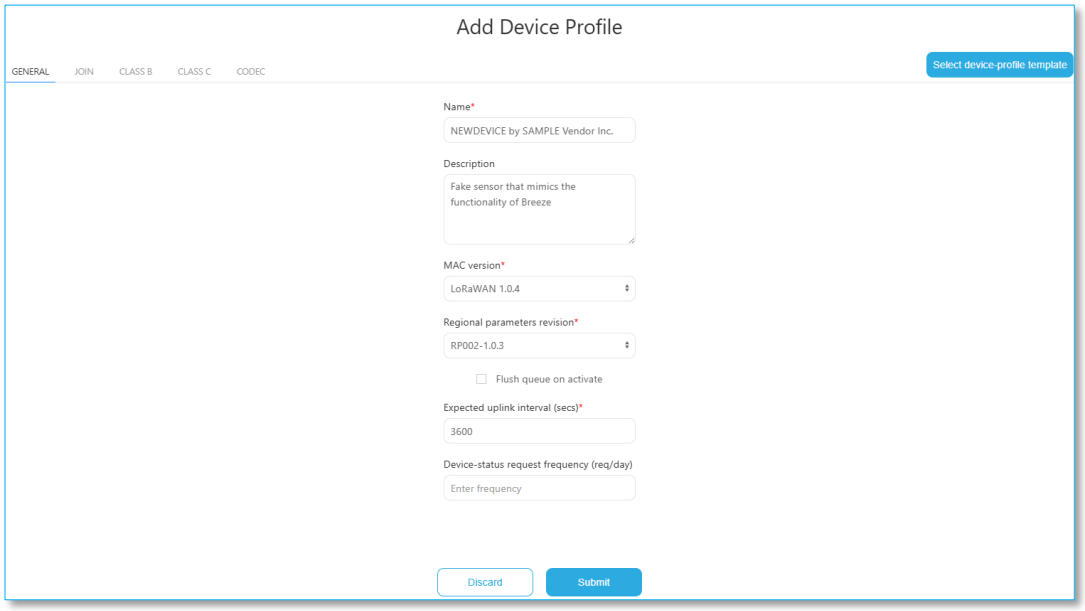
13. Select from the **Device Profile Template**, from the dropdown menu



14. Click on **Confirm**

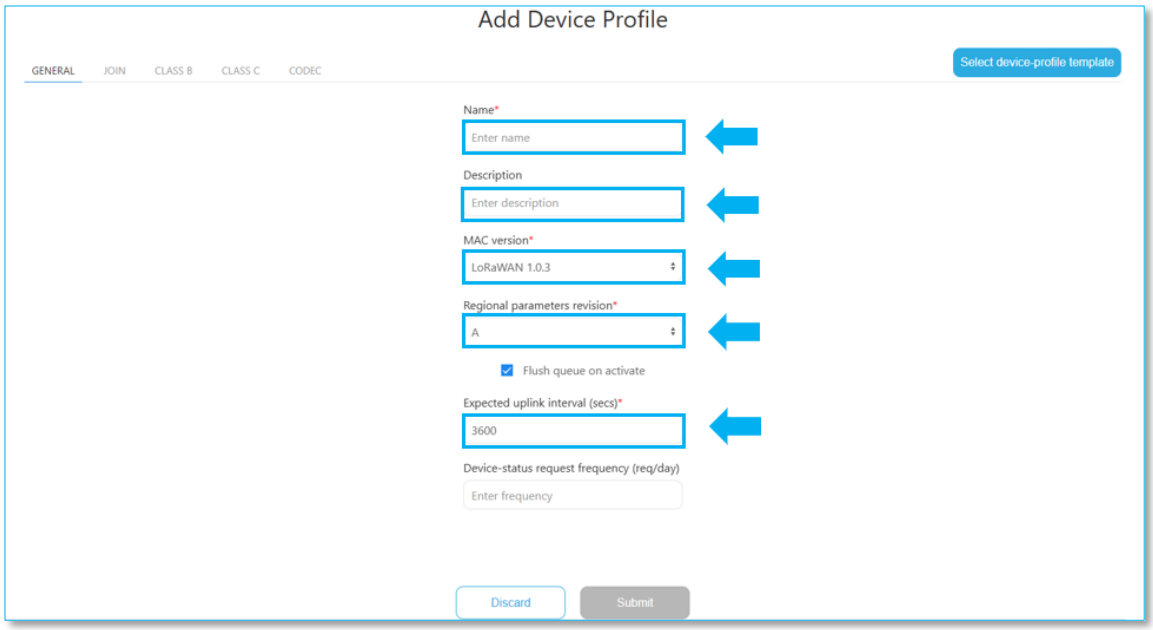


15. Click on "**Submit**" to save the Device profile

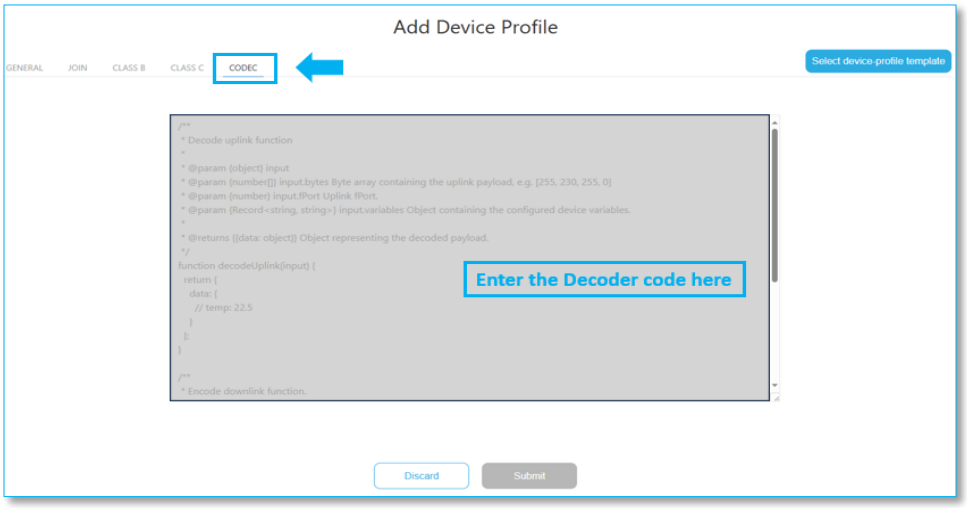


2.3 Adding Device Profile Manually

1. Configure device profile based on the **documentation from your device vendor**:
    ii. Assign a name for the device
    iii. Enter the Description
    iv. Enter MAC version and regional parameters revision appropriate for your device. Default MAC version is LoRaWAN 1.0.2 and Regional parameters revision as RP002-1.0.2.
    v. Enter the Expected uplink interval in seconds

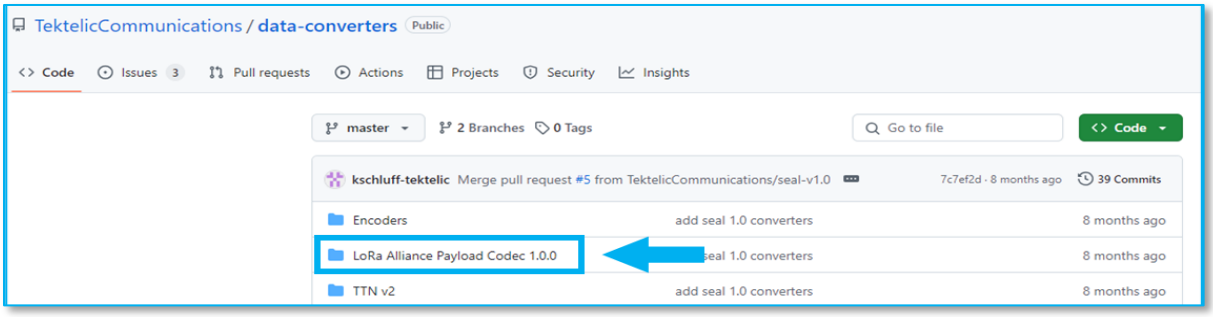


2. Select **CODEC** tab, and enter the Decoder code here.



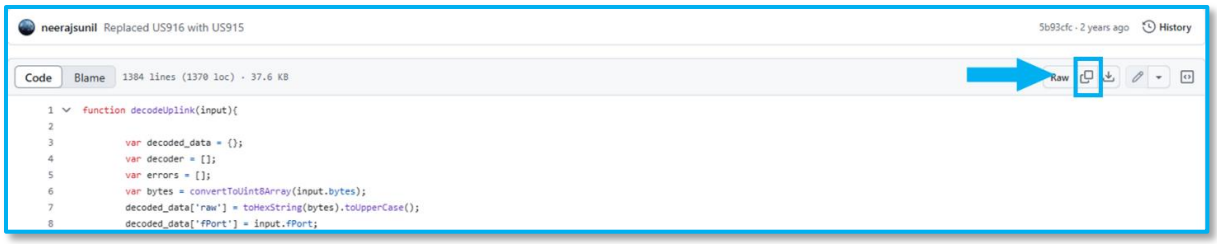
Please note, use the exact CODEC for your device model, if you are unsure which CODEC to use, contact your device vendor to obtain the decoder script.

3. For Example: For Tektelic devices, official payload decoders are available on TEKTELIC's GitHub.
    a. Go to LoRa Alliance Payload Codec 1.0.0 folder in Tektelic GitHub (LoRa Alliance format).



b. Choose the folder named according to your device type

c. **Copy** the code and **insert** into, Add Device Profile **"Codec"** tab

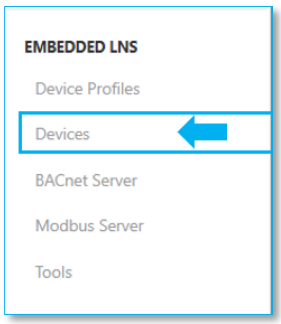


4. After successfully entering the CODEC, click on "**Submit**" to save the Device profile

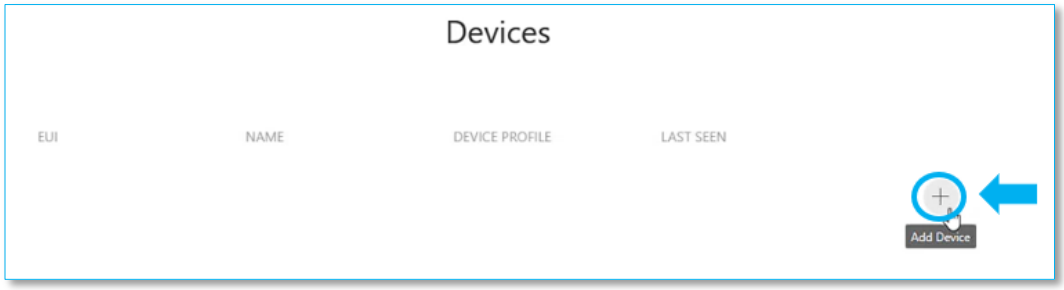
3. Manage LoRaWAN Devices

1. Login to Kona Link web page using “Host Name” or “IP Address”:
    - Using “Host Name”
      Host Name URL: https://kona-<GW variant>-<last 6 digit GW ID>.local/
      Eg: https://kona-micro-0011ab.local/
    - Using “IP Address”
      IP Address URL: https://<GW IP Address>/
      Eg: https://192.0.2.111/

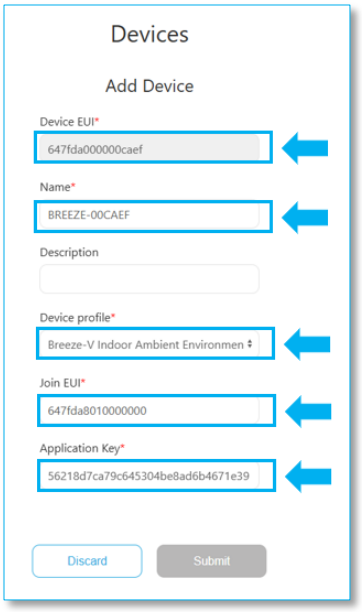
2. Navigate to Devices section.



3. Click the **‘+’ icon** on the right side of the page to add a new Device.

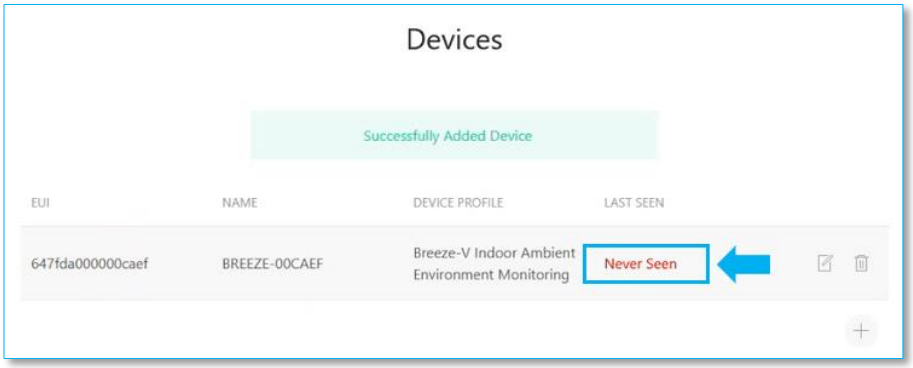


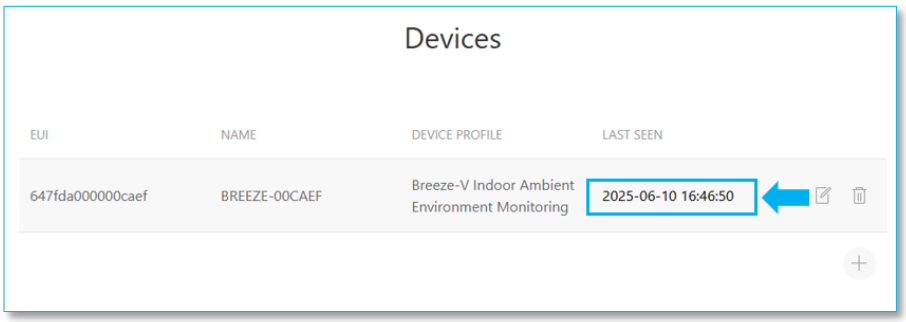
4. Configure device parameters:
    - DevEUI (Device Unique Identifier)
    - Name
    - Device profile (chose existing from the dropdown list)
    - JoinEUI (Join Server Identifier)
    - Application Key (on submit)



5. Click on **Submit**.

6. When first added, the device shows **"Never Seen."** To update this, either **rejoin the device to the network** or **wait for the next uplink** to occur automatically.





NOTE: After creating the device profiles and adding devices, the **Last Seen** field will update to confirm the devices are online. If the devices are not online, refer to the **Troubleshooting** section.

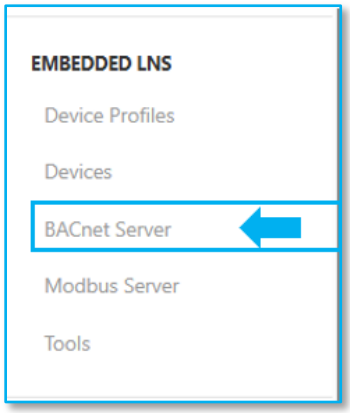
4. Application Specific Configurations

4.1 Connecting to BACnet IP

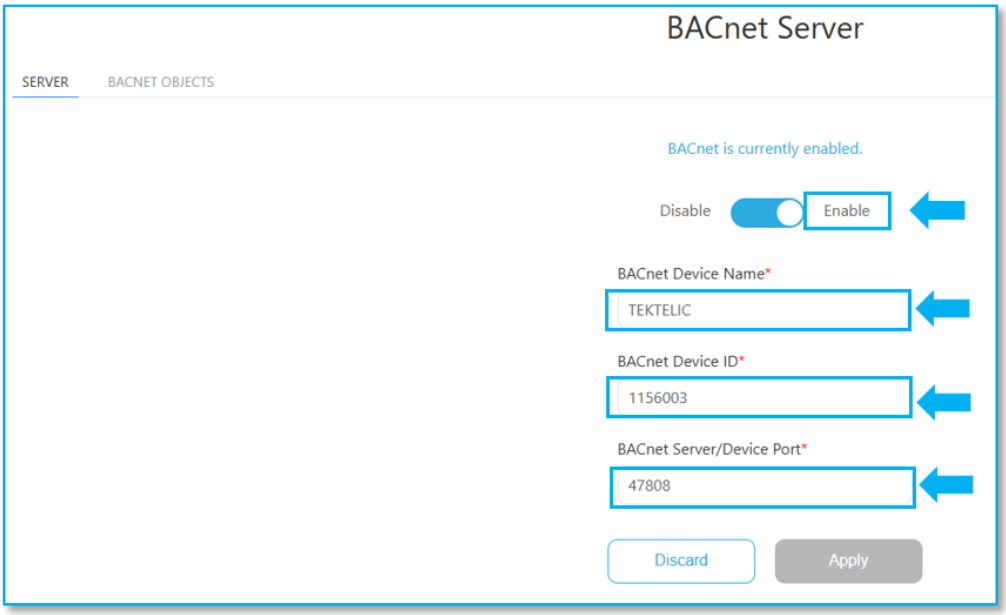
1. Login to Kona Link web page using “Host Name” or “IP Address”:
   - Using “Host Name”

   Host Name URL: https://kona-<GW variant>-<last 6 digit GW ID>.local/
   Eg: https://kona-micro-0011ab.local/
   - Using “IP Address”

   IP Address URL: https://<GW IP Address>/
   Eg: https://192.0.2.111/
2. Navigate to **BACnet Server**



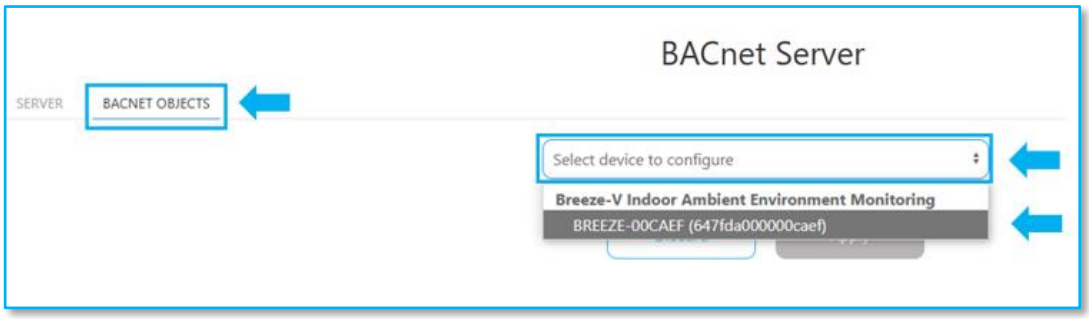
3. “**Enable**” the BACnet server, the default setting is “Disable”
4. Enter the details in Name, Device Id and Device Port fields



5. Switch to "**BACnet Objects**" tab to configure BACnet objects.
6. Select from the devices already configured. (Please note the devices are organized by Device Type)
7. Device Selection and BACnet Object Configuration:

BACnet Object Configuration for TEKTELIC Devices

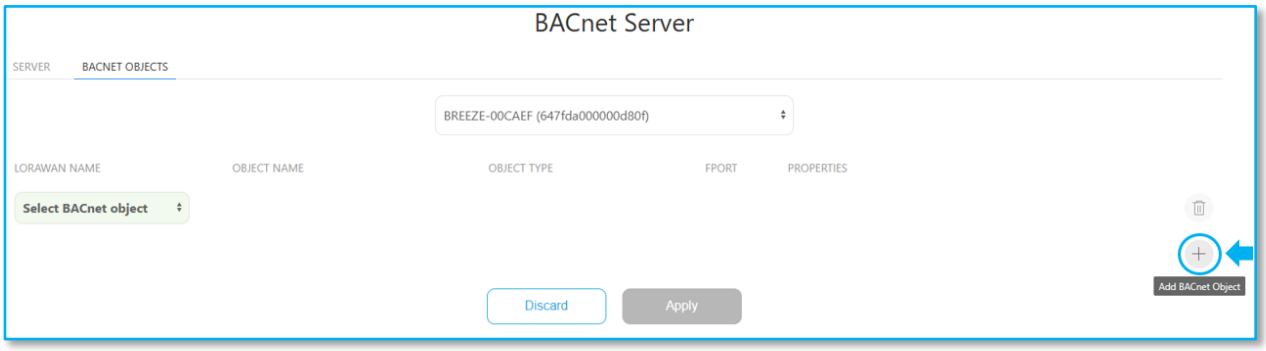
1) Click on "**Select device to configure**" and choose the Device.



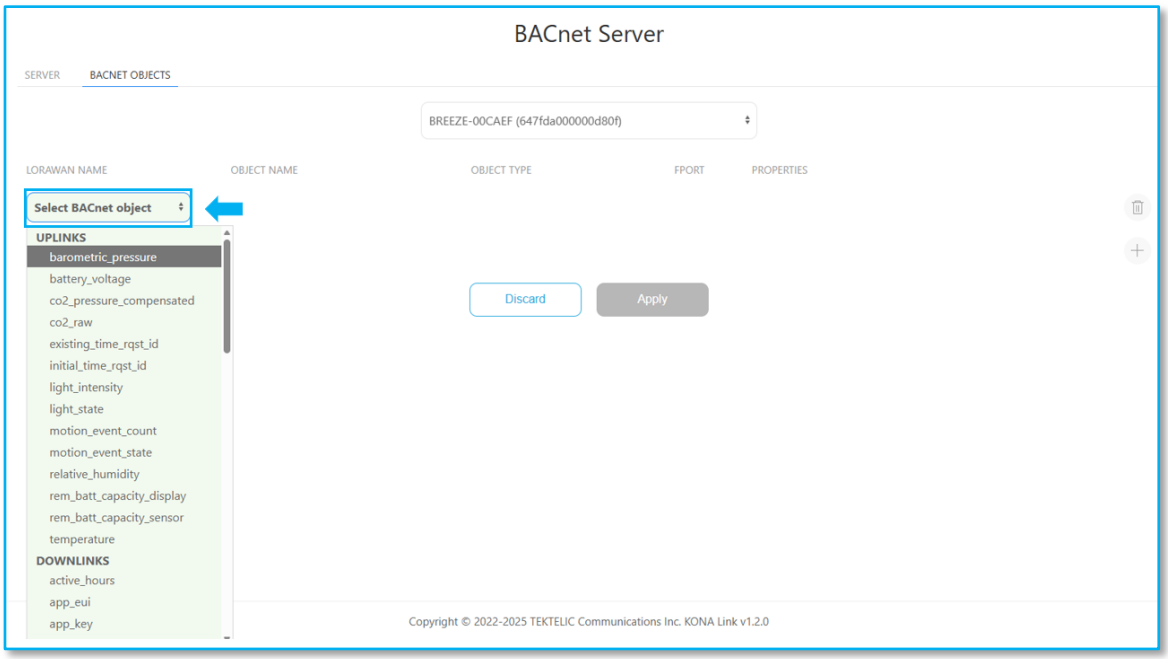
NOTE: BACnet objects are automatically be created upon receiving an LoRaWAN Uplink. Alternately, users may follow "Manual configuration of BACnet Objects" steps to setup BACnet objects.

NOTE: Only "Uplink" objects are created automatically, BACnet objects used to send LoRaWAN Downlinks must be configured manually by the user following the steps for

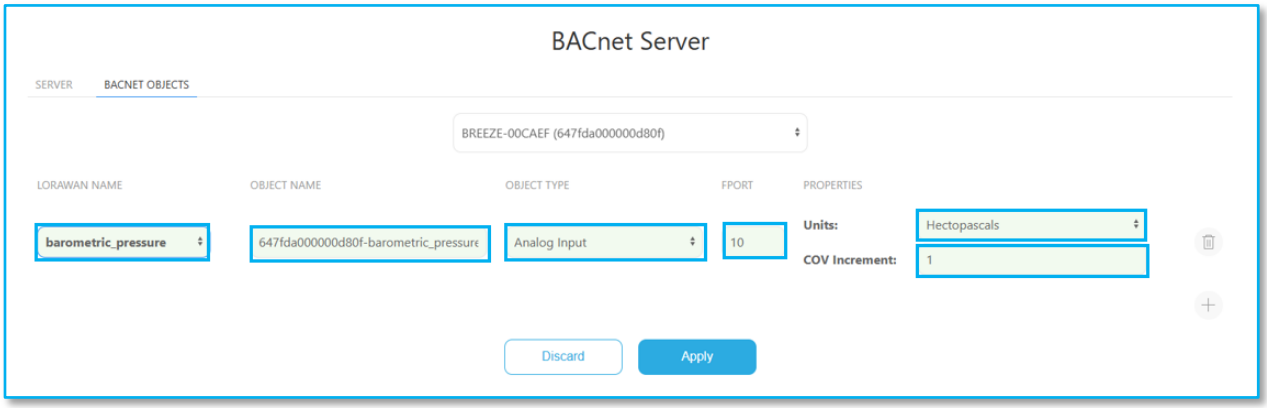
2) Click the **'+' icon** on the right side of the page to add a BACnet object.



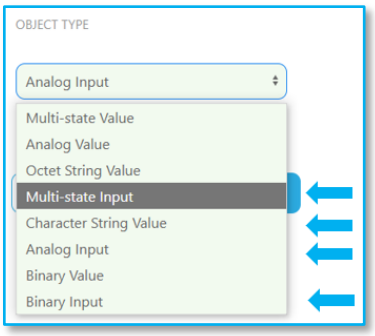
3) Select the **BACnet object**, i.e. the LoRaWAN parameter name from the drop down for an **Uplink**.



- The Object Name, Object Type, FPort and Properties (units and COV Increments) are populated automatically. User may modify these fields as needed.

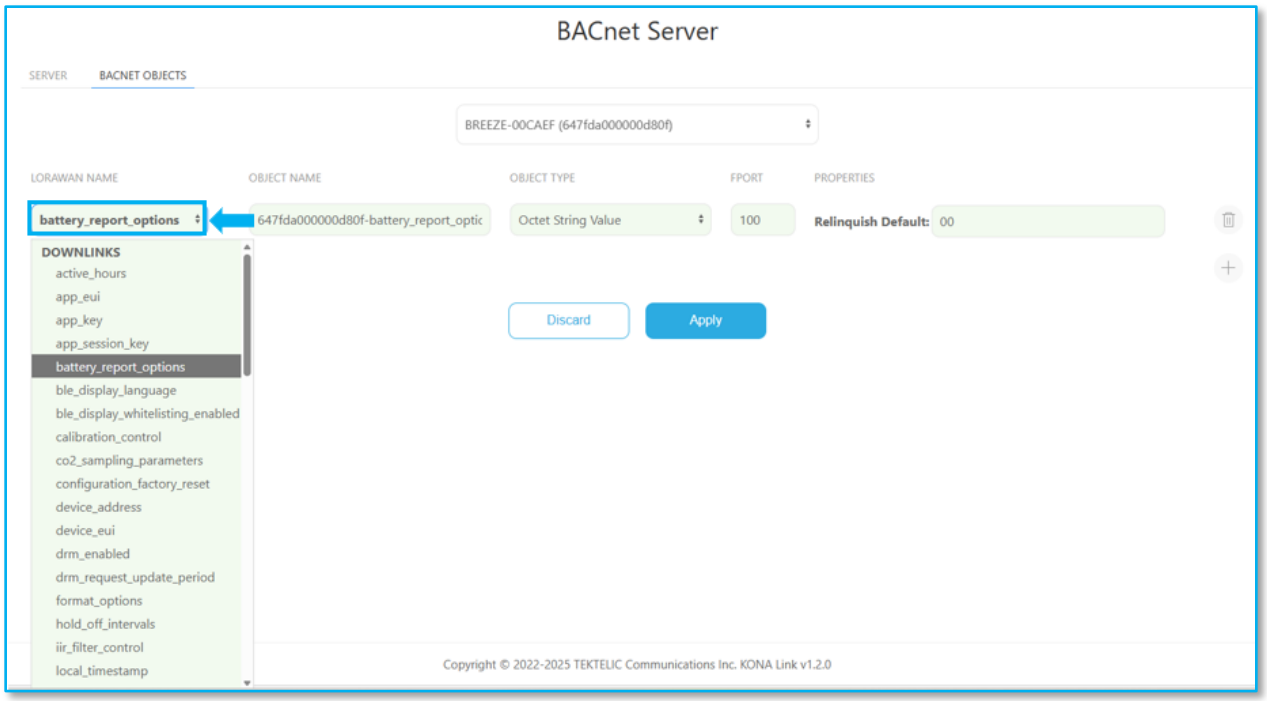


- The Object Type for Uplinks are typically Multi-state Input, Character string value, Analog Input, or Binary Input.



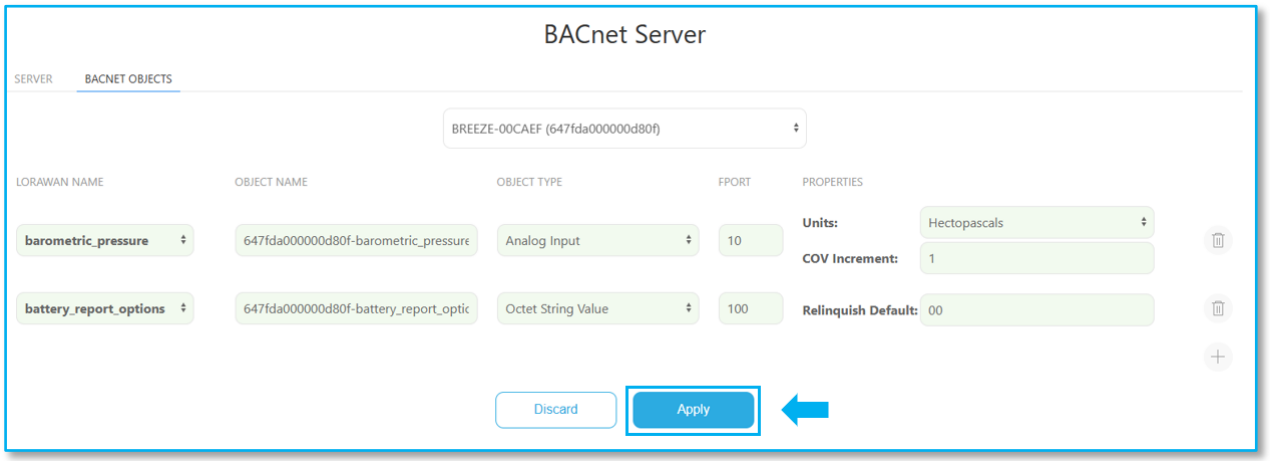
- When the user selects “Multi-state Input” from the Object Type dropdown menu, they can then proceed to specify the number of states.

4) Select the **BACnet object**, i.e. the LoRaWAN parameter name from the drop down for a **Downlink**.
   - Object types used for downlinks are typically Analog Value, Binary Value, Character String Value, or Octet String Value.



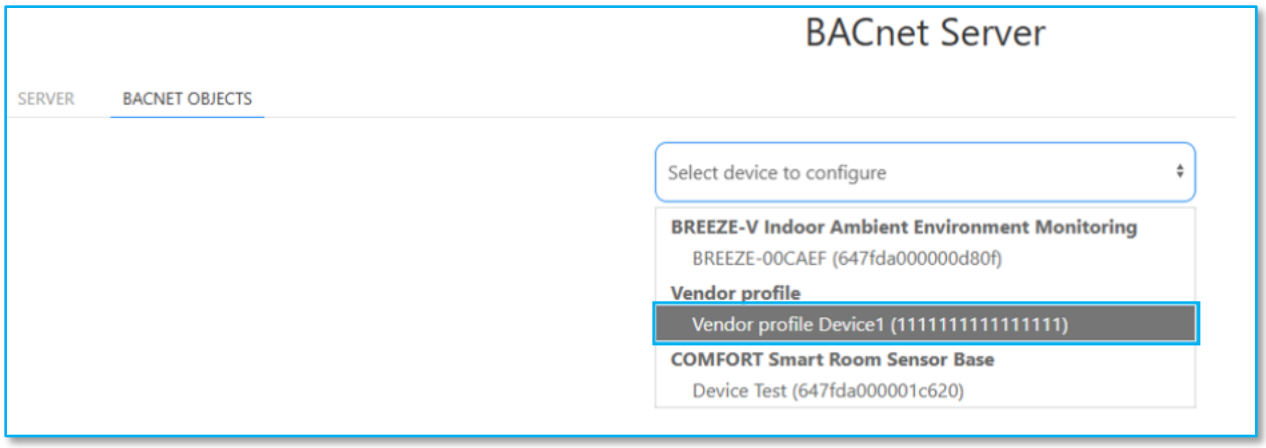
5) Repeat the steps above to add all required BACnet uplink and downlink objects.

6) Click on "**Apply**"

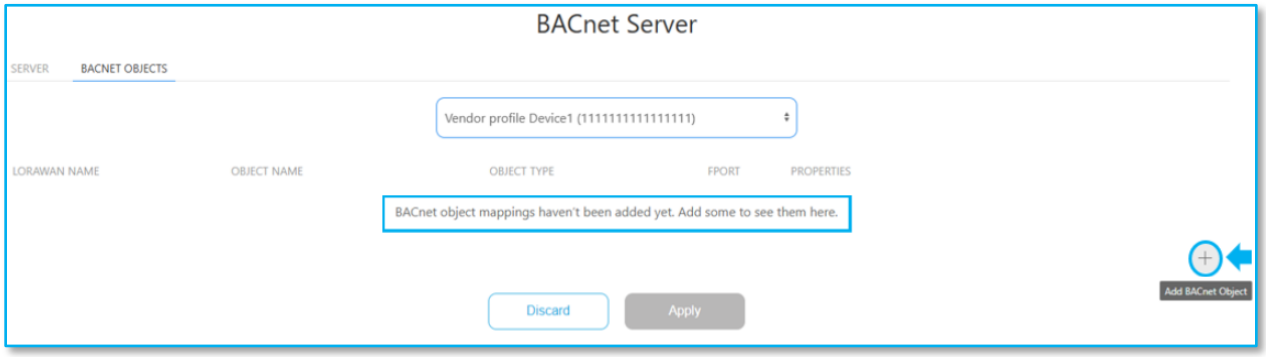


Steps for Manual Configuration of BACnet Objects

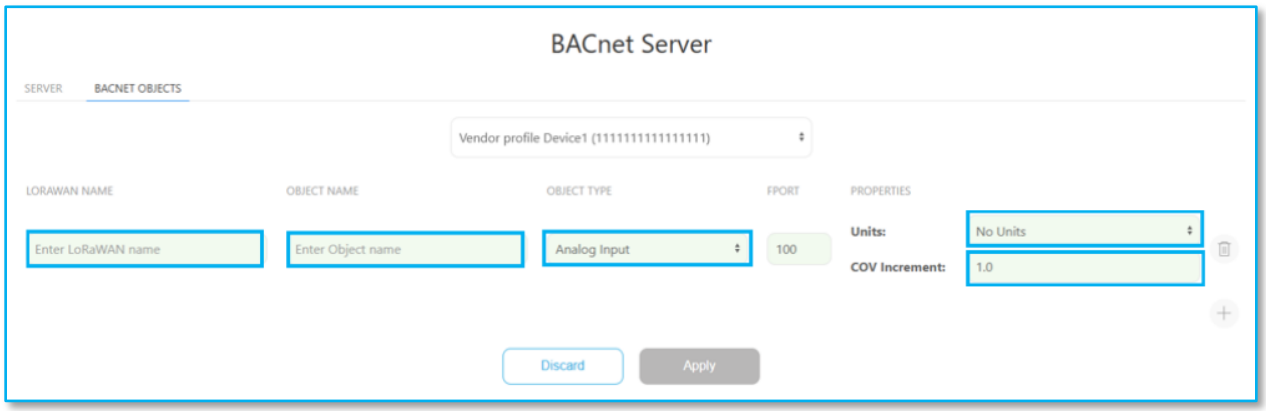
1) Click on "**Select device to configure**" and choose the Custom Device.



2) Click the **'+' icon** on the right side of the page to add a new BACnet object.

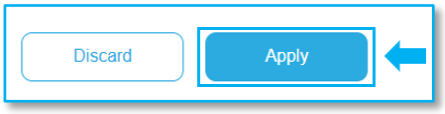


3) User can enter the LoRaWAN Name (ensuring it matches the parameter name used in the **LoRaWAN decoder**), along with the Object Name, Object Type, and Properties (units and COV Increment).



4) Repeat the steps above to add all required BACnet uplink and downlink objects.

5) Click on “**Apply**”



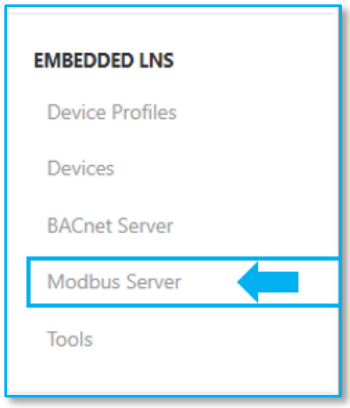
4.2 Connecting to Modbus TCP/IP

1. Login to Kona Link web page using “Host Name” or “IP Address”:
   - Using “Host Name”

   Host Name URL: https://kona-<GW variant>-<last 6 digit GW ID>.local/
   Eg: https://kona-micro-0011ab.local/
   - Using “IP Address”

   IP Address URL: https://<GW IP Address>/
   Eg: https://192.0.2.111/

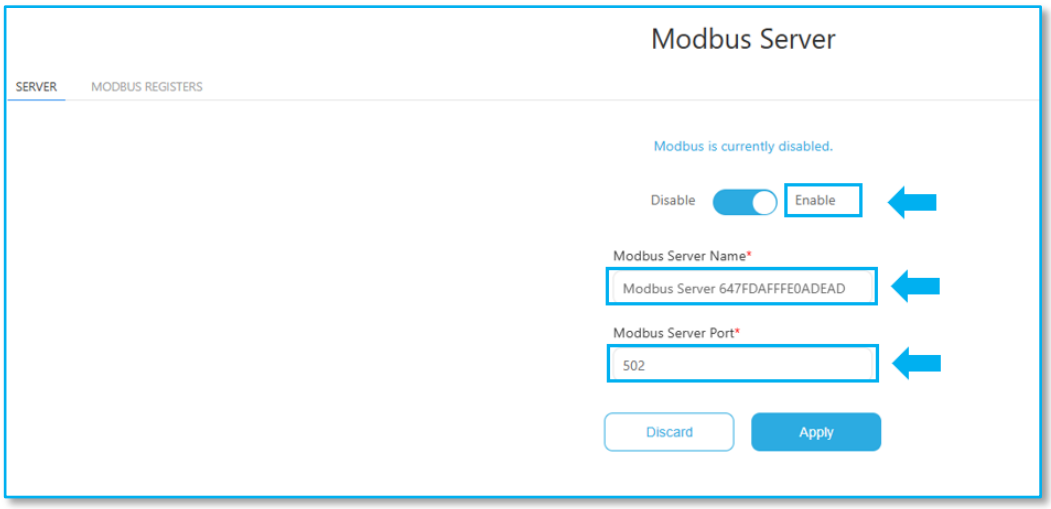
2. Navigate to **Modbus Server**



3. “**Enable**” the Modbus Server, the default setting is “Disable”

4. Enter the details in **Modbus Server Name**, and **Modbus Server Port** fields and then click “**Apply**”.

   Please note, the default port is **502**, but any port number **greater than or equal to 500** may be used.

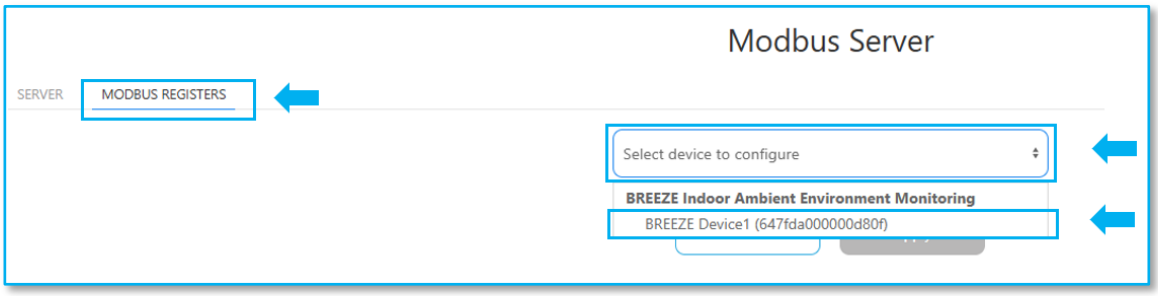


5. Switch to "**MODBUS REGISTERS**" tab to configure registers.

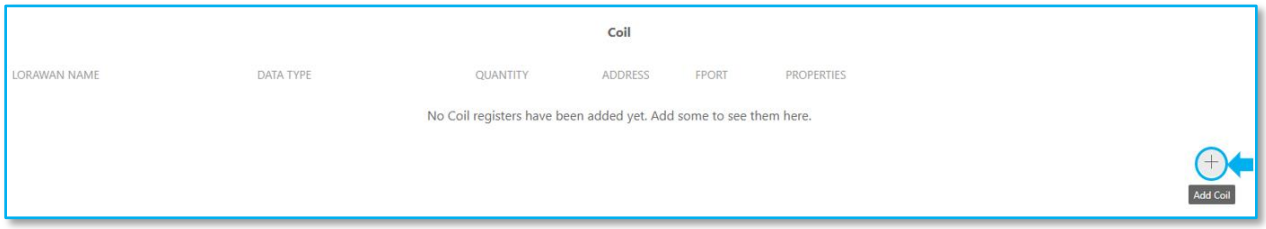
6. Device Selection and Modbus Registers Configuration:

   MODBUS Register Configuration for TEKTELIC Devices

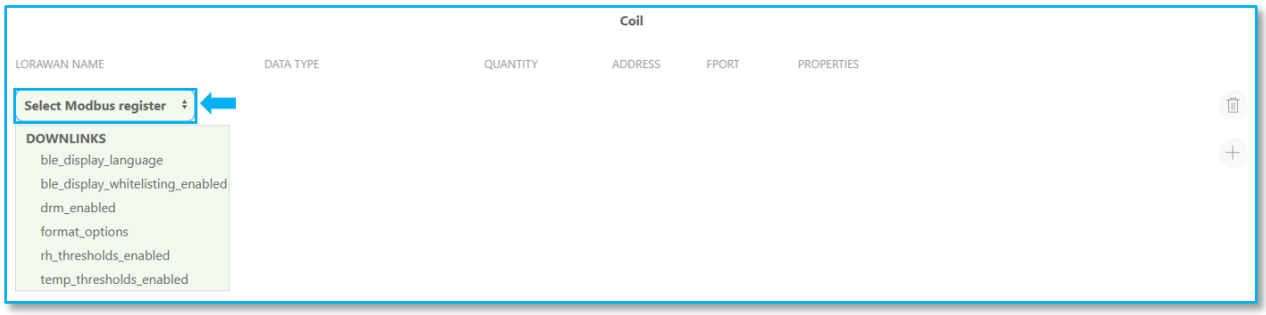
   1) **Select the Device** for Modbus Register Configuration
      - Select from the devices already configured. (Please note the devices are organized by Device Type)
      - Click on Select device-profile template



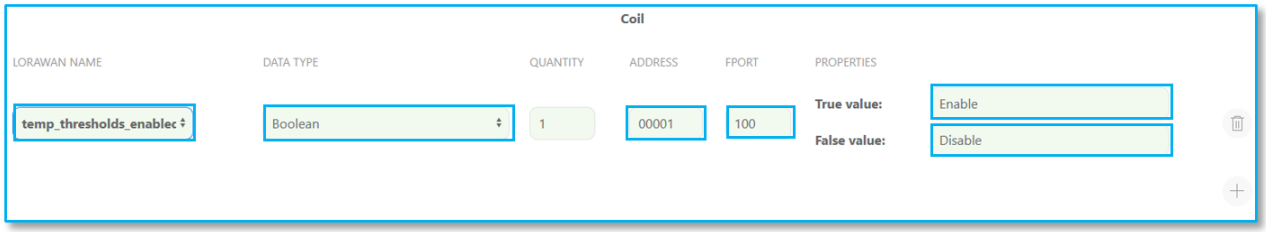
   2) Configure **Downlinks** using "**Coil**" Register
      - Click the **'+' icon** on the right side of the page to add a Coil.



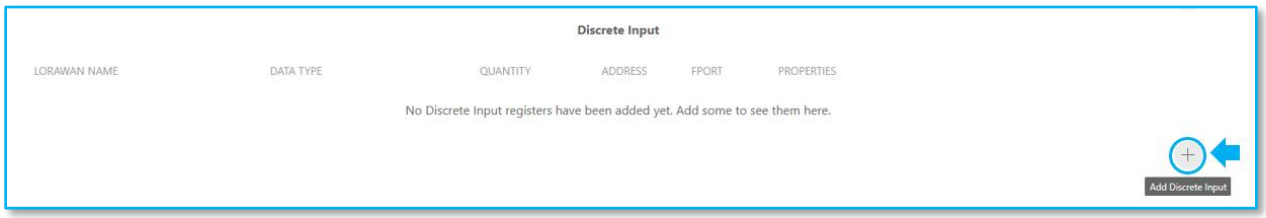
- Select the **Modbus register**, i.e. the LoRaWAN parameter name from the drop down.



- The Register Name, Data Type, Address, FPort and Properties (True value, False value) are populated automatically. User may modify these fields as needed.

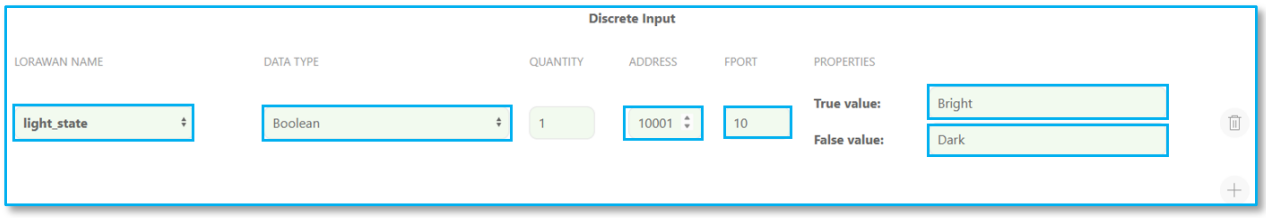


3) Configure **Uplinks** using "**Discrete Input**" Register
   - Click the **'+' icon** on the right side of the page to add a Discrete Input.

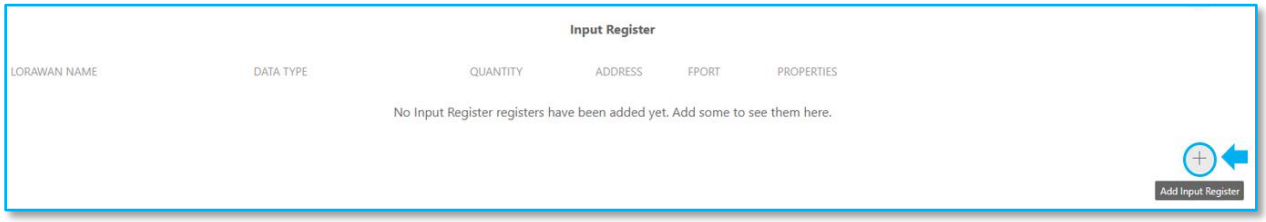


   - Select the **Modbus register**, i.e. the LoRaWAN parameter name from the drop down.

   - The Register Name, Data Type, Address, FPort and Properties (True value, False value) are populated automatically. User may modify these fields as needed.



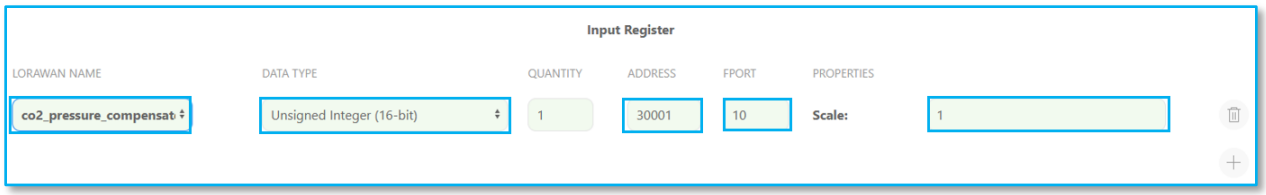
4) Configure **Uplinks** using "**Input Register**"
   - Click the **'+' icon** on the right side of the page to add an Input Register.



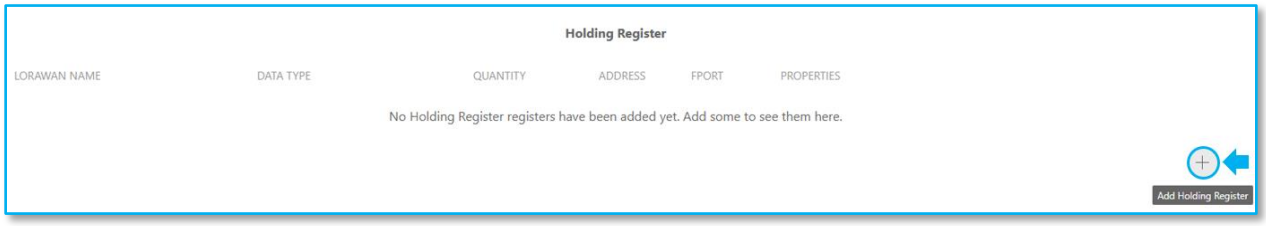
   - Select the **Modbus register**, i.e. the LoRaWAN parameter name from the drop down.

   - The Register Name, Data Type, Address, FPort and Properties (Scale) are populated automatically. User may modify these fields as needed.

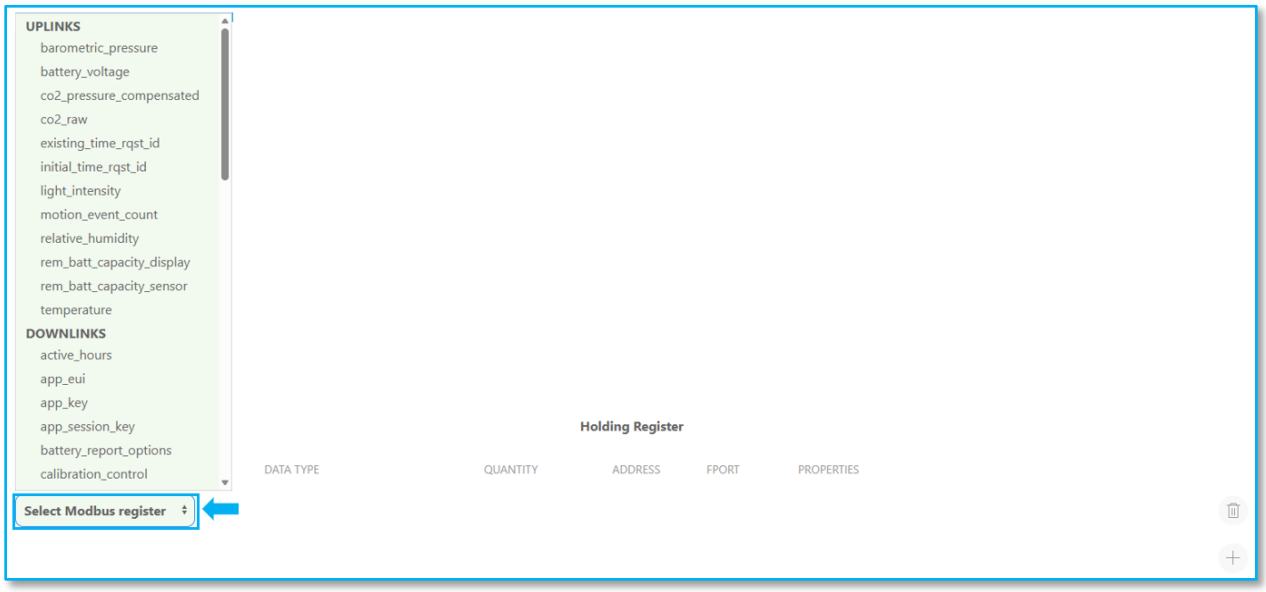
     Please note, for certain registers, the **Properties** field may not be populated. The **Scale** value represents a multiplier applied to the received register data. It is often used to convert between integer and floating-point values. For example, applying a scale factor of **0.1** to a received value of **101** results in **10.0**.



5) Configure **Uplinks and Downlinks** using "**Holding Register**"
   - Click the **'+' icon** on the right side of the page to add a Holding Register.

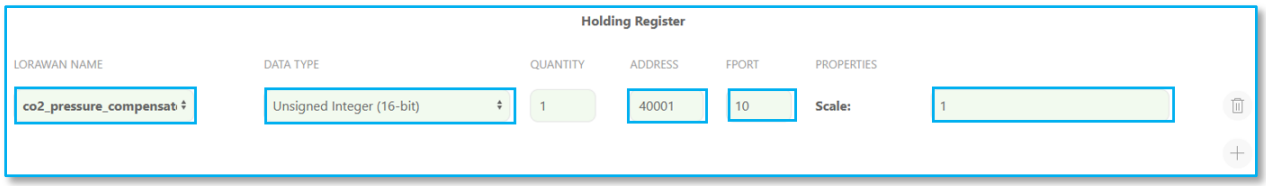


   - Select the **Modbus register**, i.e. the LoRaWAN parameter name from the drop down.



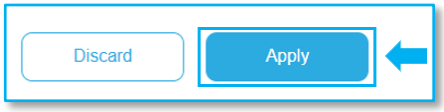
   - The Object Name, Object Type and Properties (units) are populated automatically. User may modify these fields as needed.

     Please note, for certain registers, the **"Properties"** field may not be populated



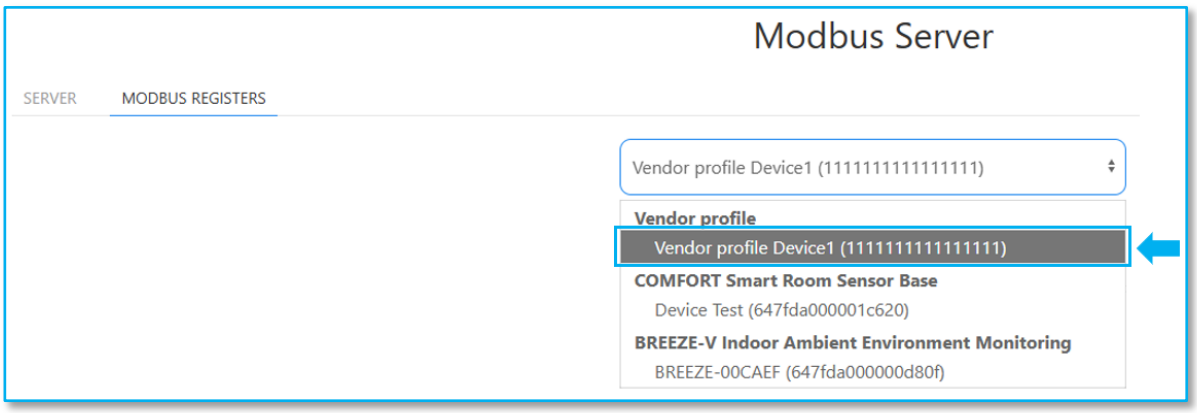
6) **Repeat** the steps above to add all required Modbus uplink and downlink registers.

7) Click on "**Apply**"

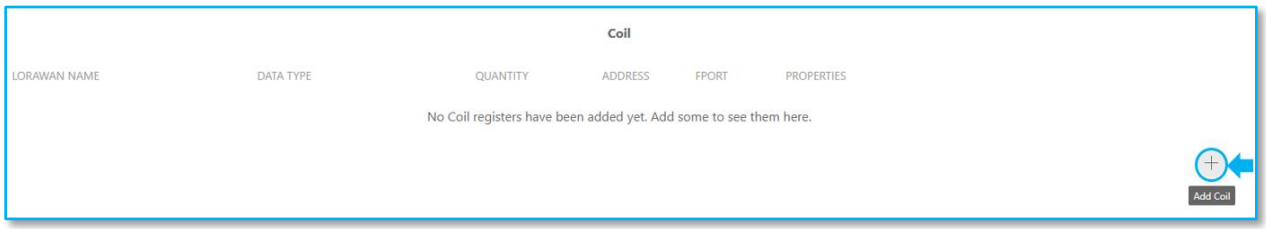


MODBUS Register Configuration for CUSTOM Devices

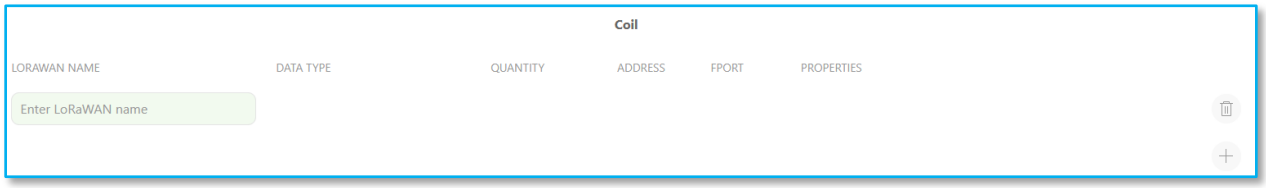
1) **Select the Custom Device** for Modbus Register Configuration
2) Click on "Select device to configure" and choose the Custom Device.
   - Select from the devices already configured. (Please note the devices are organized by Device Type)



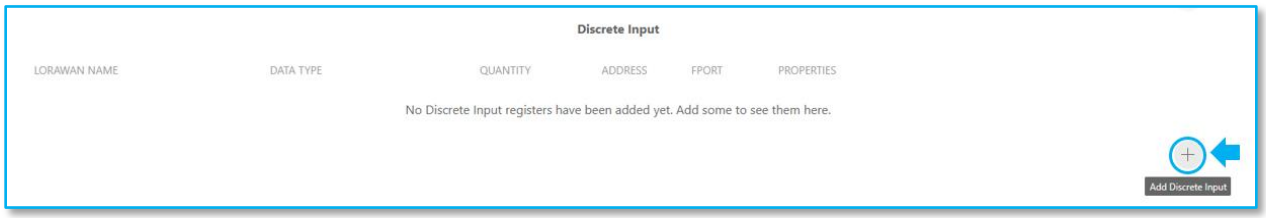
3) Configure **Downlinks** using "Coil" Register
   - Click the **'+' icon** on the right side of the page to add a Coil.



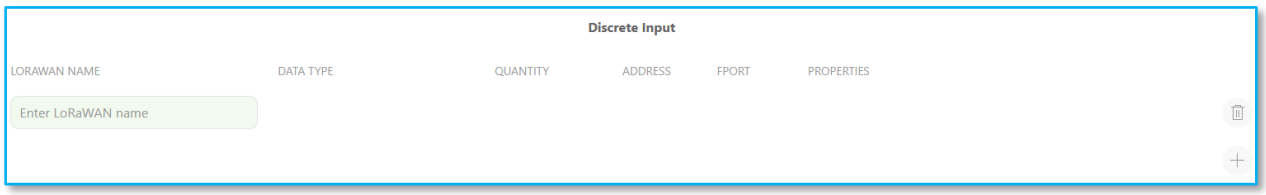
- User can enter the Register Name, Data Type, Address, Fport and Properties, ensuring it matches the parameter name used in the **LoRaWAN decoder**.



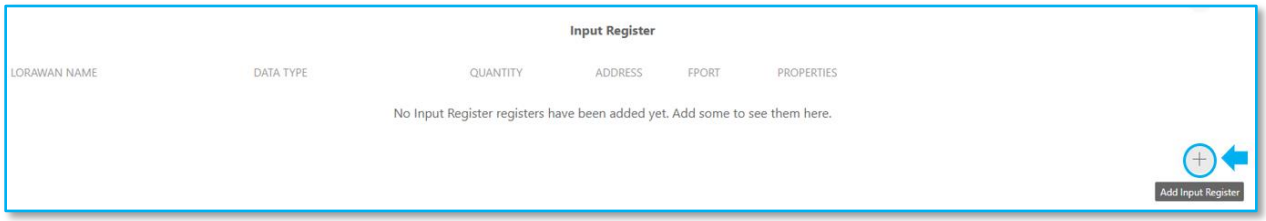
4) **Configure Uplinks** using “Discrete Input” Register
   - Click the **‘+’ icon** on the right side of the page to add a Discrete Input.



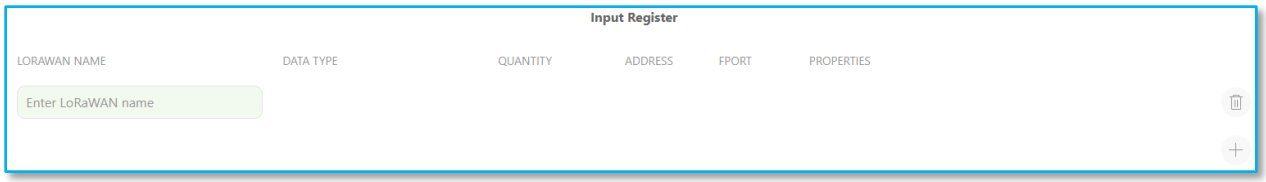
   - User can enter the Register Name, Data Type, Address, Fport and Properties, ensuring it matches the parameter name used in the **LoRaWAN decoder**.



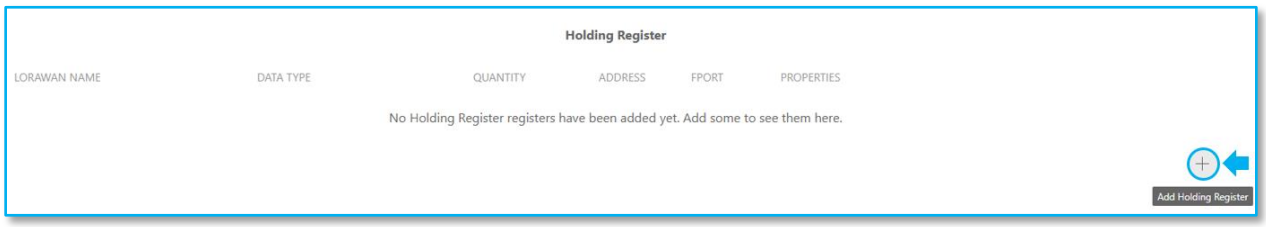
5) **Configure Uplinks** using “Input Register”
   - Click the **‘+’ icon** on the right side of the page to add an Input Register.



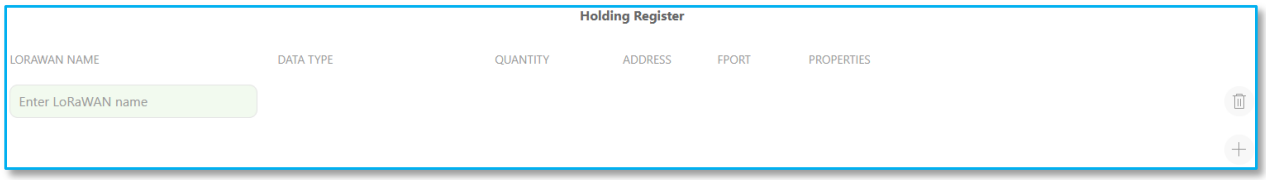
   - User can enter the Register Name, Data Type, Address, Fport and Properties, ensuring it matches the parameter name used in the **LoRaWAN decoder**.



6) **Configure Uplinks and Downlinks** using “Holding Register”
   - Click the **‘+’ icon** on the right side of the page to add a Holding Register.

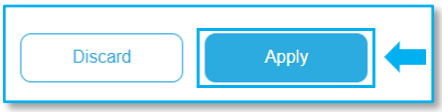


   - User can enter the Register Name, Data Type, Address, Fport and Properties, ensuring it matches the parameter name used in the **LoRaWAN decoder**.



7) **Repeat** the steps above to add all required Modbus uplink and downlink registers.

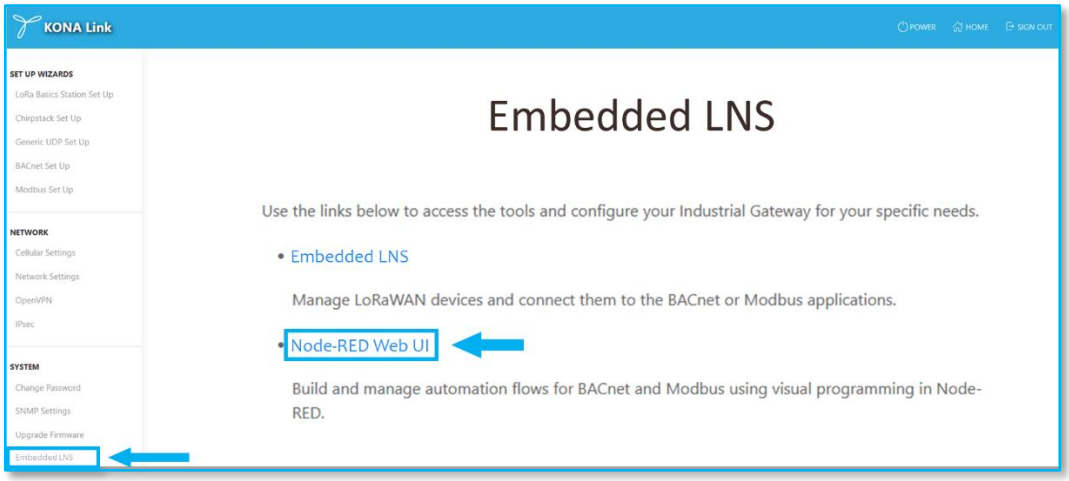
8) Click on “**Apply**”



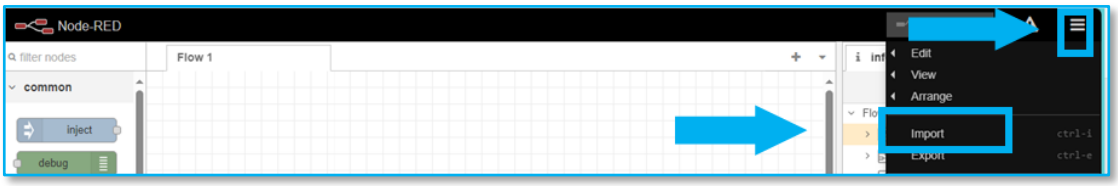
4.3 Send Decoded Uplink to External MQTT Broker

1. Login to Kona Link web page using “Host Name” or “IP Address”:
   - Using “Host Name”
     Host Name URL: https://kona-<GW variant>-<last 6 digit GW ID>.local/
     Eg: https://kona-micro-0011ab.local/
   - Using “IP Address”
     IP Address URL: https://<GW IP Address>/
     Eg: https://192.0.2.111/

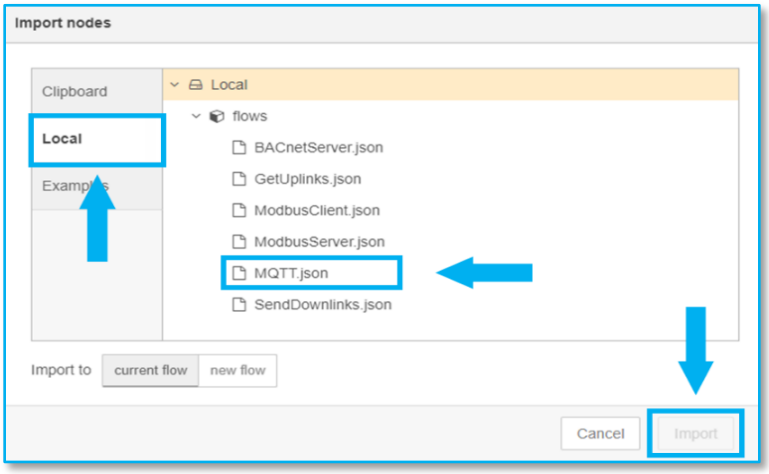
2. Follow the **Node-RED Web UI** link in Embedded LNS subsection in Kona Link



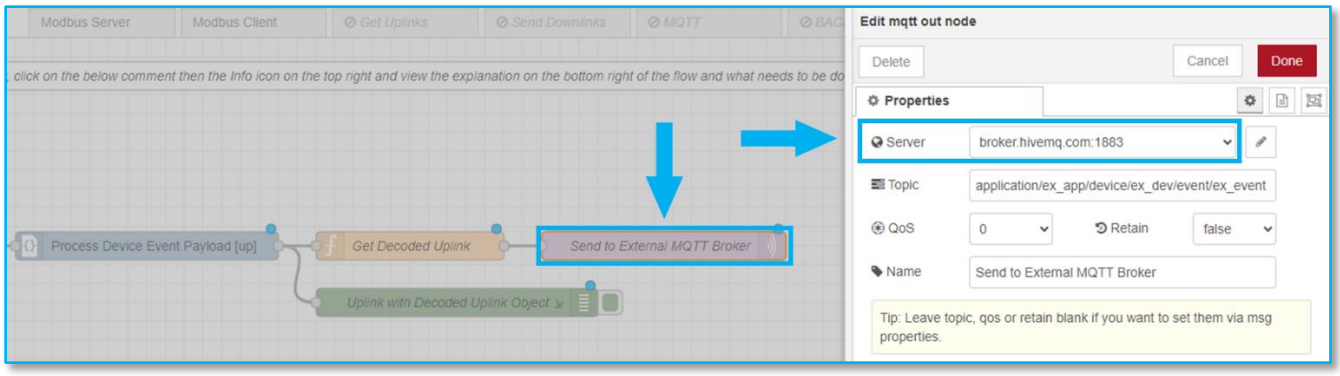
3. In a new flow go to menu and select **Import**



4. Go to section Local and select **MQTT.json** flow for your application:



5. In **Send External MQTT Broker** node in Server field enter the address of the MQTT broker you wish to use



6. Deploy the flow.

4.4 Get Decoded Uplinks from Chirpstack LNS to Node Red

1. Login to Kona Link web page using “Host Name” or “IP Address”:

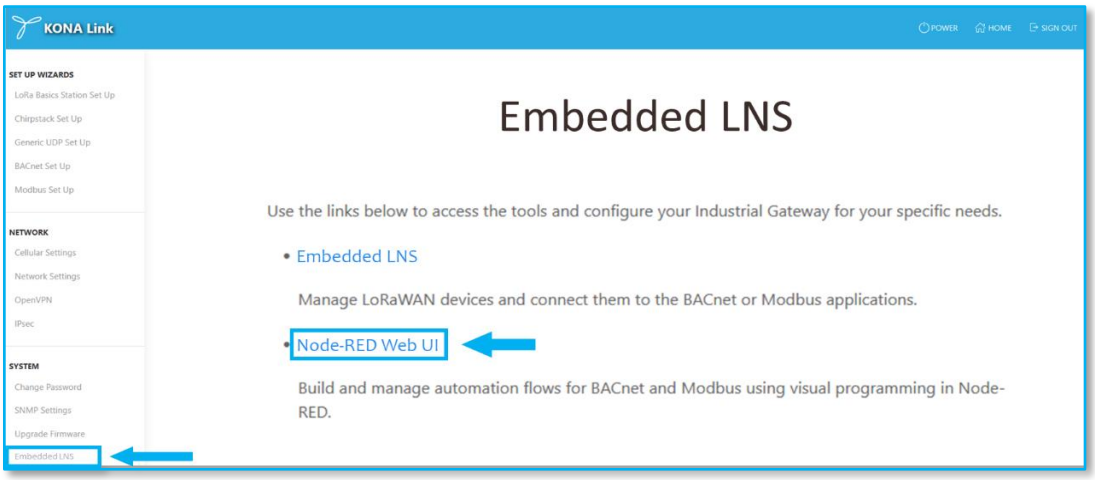
   - Using “Host Name”

   Host Name URL: https://kona-<GW variant>-<last 6 digit GW ID>.local/
   Eg: https://kona-micro-0011ab.local/

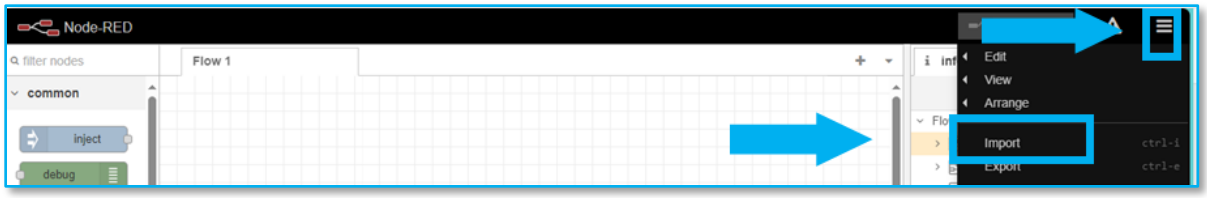
   - Using “IP Address”

   IP Address URL: https://<GW IP Address>/
   Eg: https://192.0.2.111/

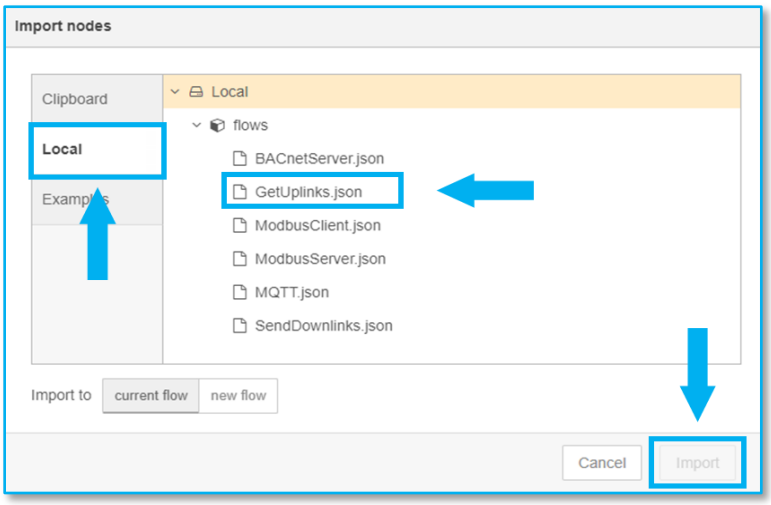
2. Follow the **Node-RED Web UI** link in Embedded LNS subsection in Kona Link



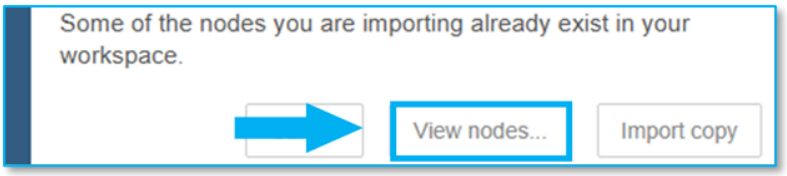
3. In a new flow go to menu and select **Import**



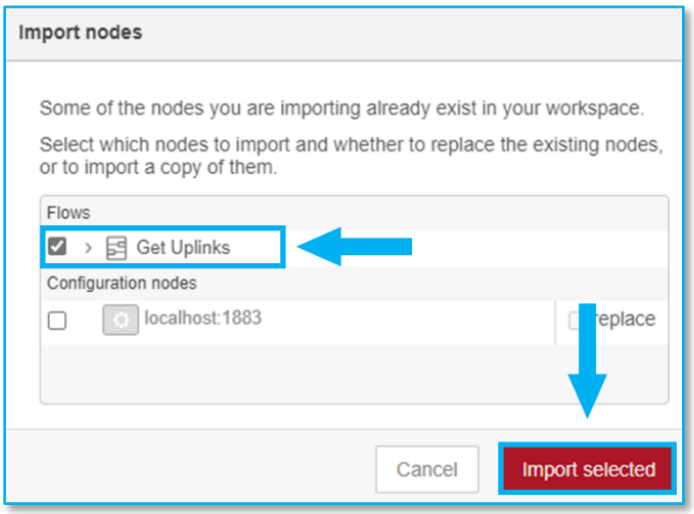
4. Go to section Local and select **GetUplinks** flow for your application:



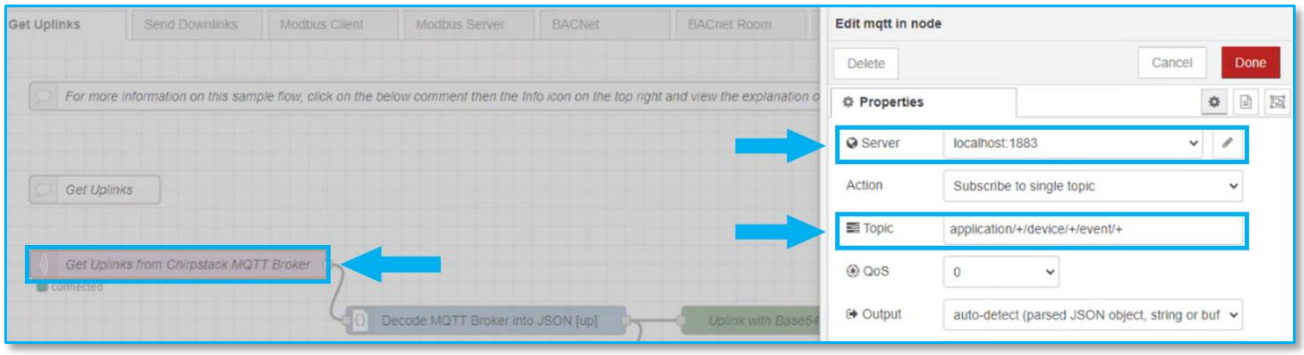
5. On the incoming warning message, click on **View nodes**.



6. On the Import nodes window, ensure that only Get Uplinks is checked, then click on **Import selected**.



7. In GetUplinks flow configure Get Uplinks from Embedded LNS MQTT Server input node:
    7.1. Server: localhost:1883 for Embedded LNS
    7.2. Topic: Set the subscription topic to match the topic of your LoRaWAN device (e.g., device uplink).



8. Once you receive the uplink data, use a function node to process it. You may need to decode the payload using a data converter if Embedded LNS is set up with the correct profiles.
9. After decoding the data, you can use it to trigger other actions, such as sending data to a database, displaying it on a dashboard, or forwarding it to other systems.
10. Deploy the flow.

5. Licensing Process

Gateways operating with Embedded LNS require a valid license. Each license is uniquely generated based on the gateway's fingerprint and **cannot be reused** on any other device.

To obtain this license, the gateway's **fingerprint** must first be retrieved and submitted to **TEKTELIC**. TEKTELIC will then generate and return a valid license file. Once received, the license must be **installed** on the gateway.

This section provides a detailed explanation of both steps:

1. **Retrieving the gateway fingerprint**
2. **Installing the license**

Please note, Licensing is supported only on **BSP version 7.2.13 and later**.

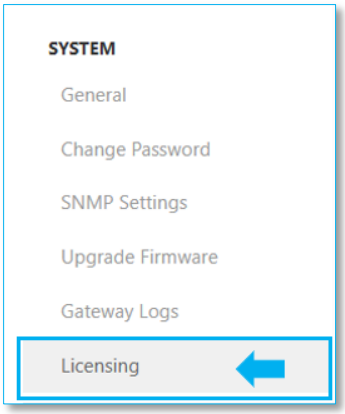
5.1 Retrieving the Gateway Fingerprint

A gateway fingerprint is required before TEKTELIC an generate a license.

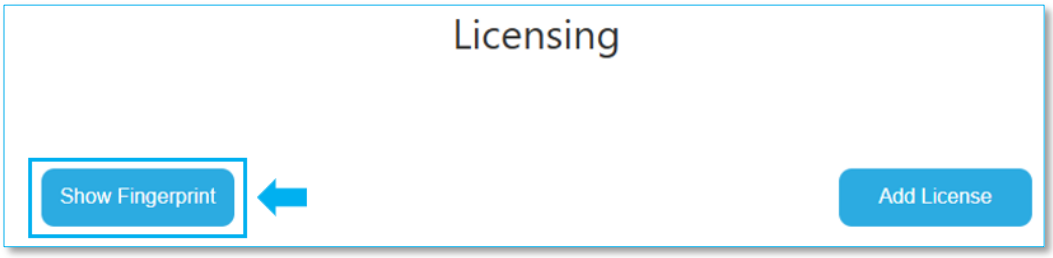
Steps to Retrieve Fingerprint in KONA Link:

1. Login to Kona Link web page using "Host Name" or "IP Address":
   - Using "Host Name"
     Host Name URL: https://kona-<GW variant>-<last 6 digit GW ID>.local/
     Eg: https://kona-micro-0011ab.local/
   - Using "IP Address"
     IP Address URL: https://<GW IP Address>/
     Eg: https://192.0.2.111/

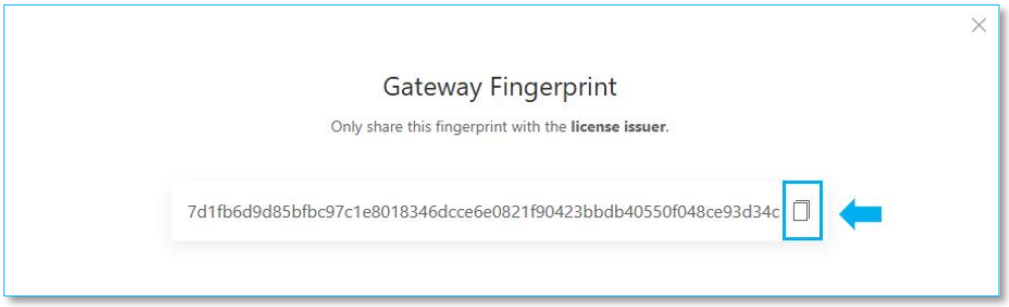
2. Navigate to "**Licensing**" under **System** section.



3. Select **Show Fingerprint**



4. **Copy** the displayed fingerprint for submission to TEKTELIC sales



5. Share the "**Gateway Fingerprint**" with TEKTELIC Sales.

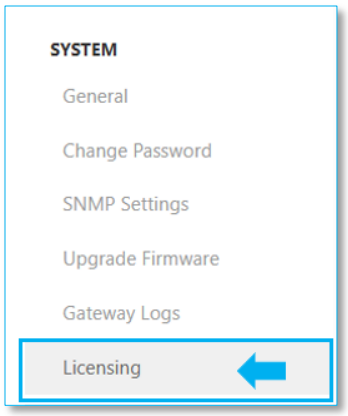
5.2 Activating the License

After receiving your license file from TEKTELIC:

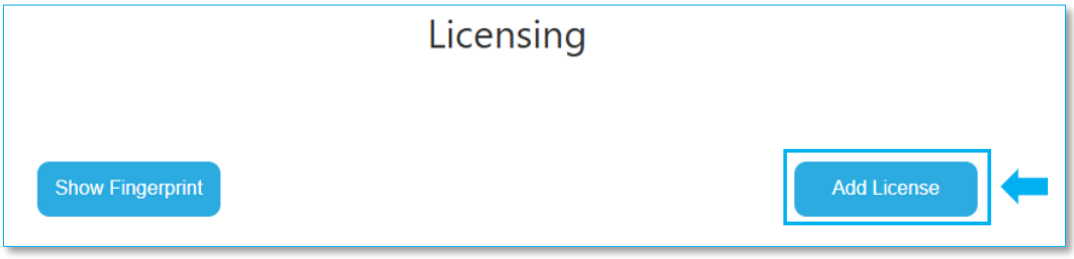
1. Login to Kona Link web page using "Host Name" or "IP Address":
   - Using "Host Name"

   Host Name URL: https://kona-<GW variant>-<last 6 digit GW ID>.local/
   Eg: https://kona-micro-0011ab.local/
   - Using "IP Address"

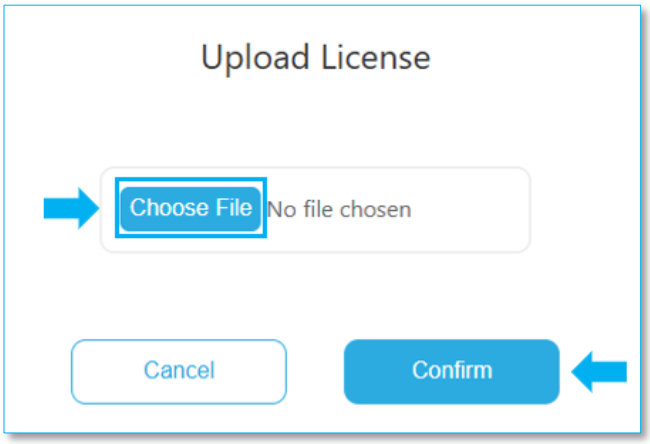
   IP Address URL: https://<GW IP Address>/
   Eg: https://192.0.2.111/
2. Navigate to "**Licensing**" under **System** section



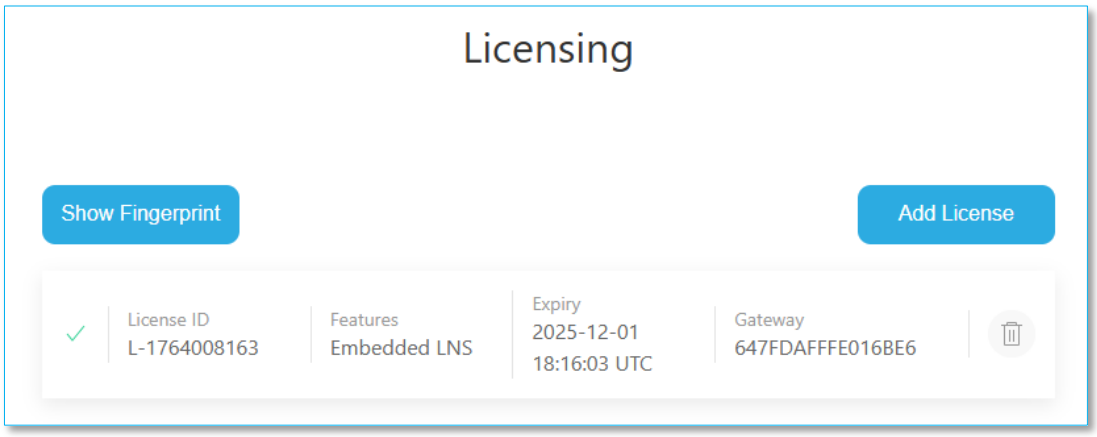
3. Select **Add License**



4. A pop-up window will appear prompting the user to **Choose File**. Select the license file provided by TEKTELIC, then click **Confirm** to save the changes.



5. The user should now be able to view the uploaded license, displaying the License ID, features, expiry date, and the associated Gateway ID.


Licensing
Show Fingerprint
Add License
License ID
L-1764008163
Features
Embedded LNS
Expiry
2025-12-01
18:16:03 UTC
Gateway
647FDAFFFE016BE6

6. Troubleshooting

6.1 Device Connectivity Issue - Check gateway Configuration

1. If the user has trouble connecting, check the gateway BSP version
2. If your Gateway was shipped with BSP version 7.2.13 or earlier, follow the below steps to check if the Gateway is listed.
    a. Login to Kona Link web page using “Host Name” or “IP Address”:
        - Using “Host Name”

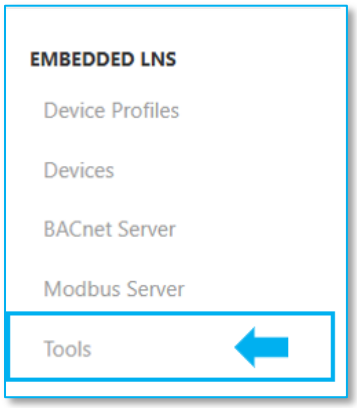
        Host Name URL: https://kona-<GW variant>-<last 6 digit GW ID>.local/

        Eg: https://kona-micro-0011ab.local/
        - Using “IP Address”

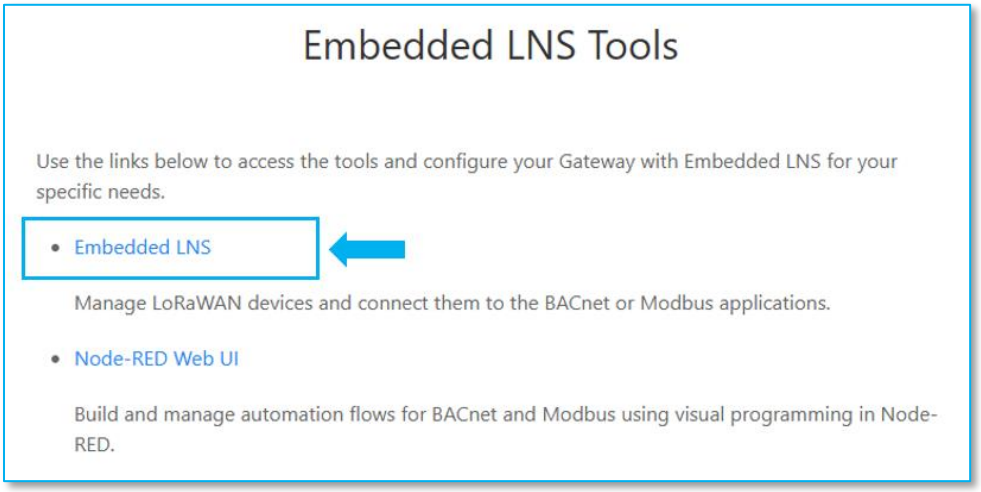
        IP Address URL: https://<GW IP Address>/

        Eg: https://192.0.2.111/

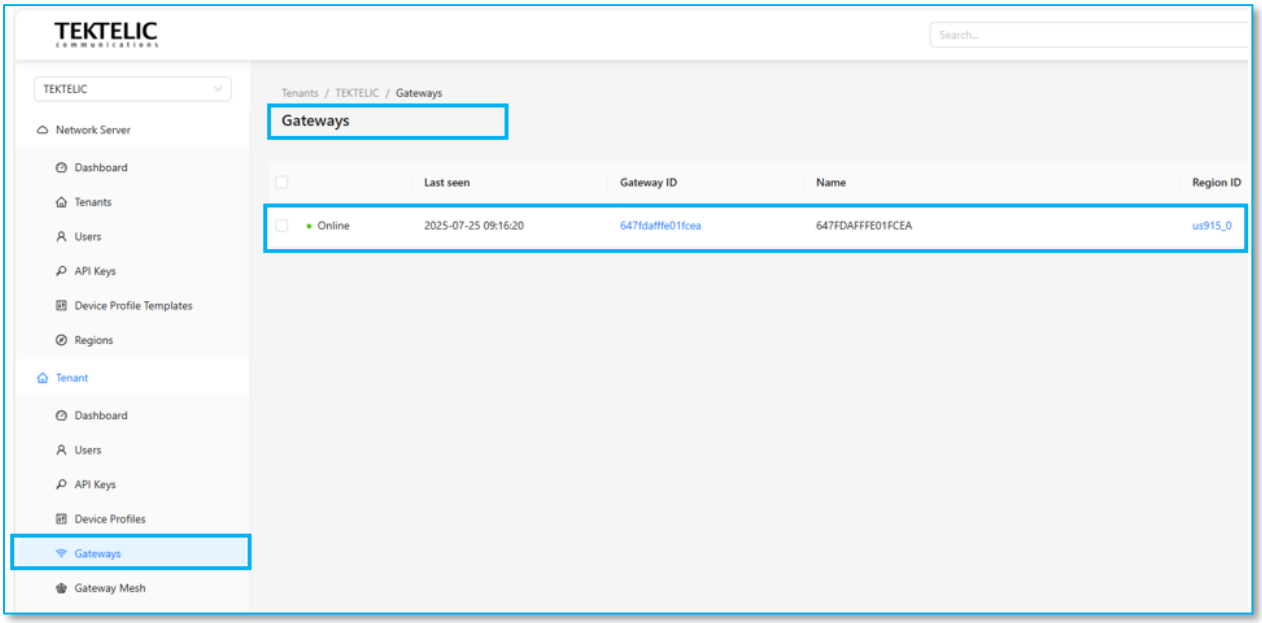
    b. Navigate to “**Tools**” under Embedded LNS



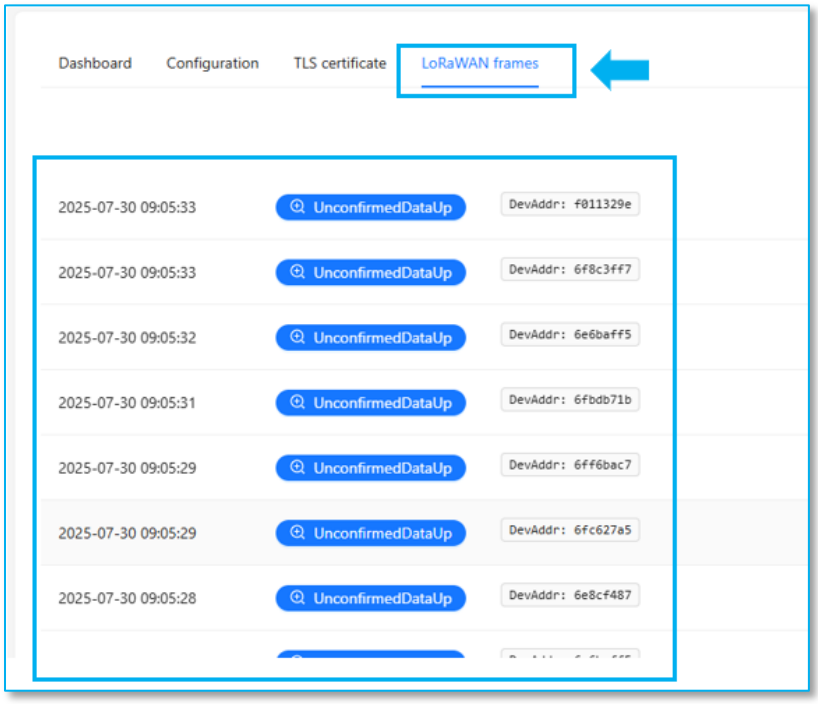
    c. Log into Embedded LNS Network Server by clicking on “**Embedded LNS**” link.



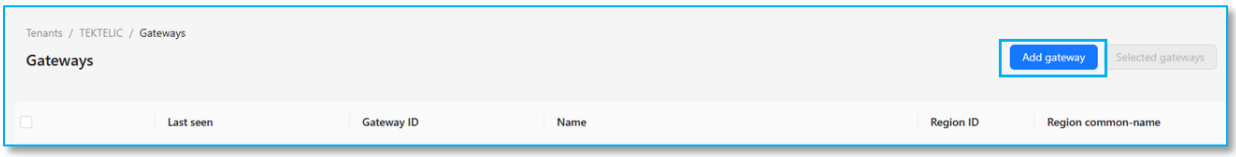
d. Navigate to Gateway section, and verify if a gateway is listed.



3. If the gateway is listed,
    a. Click on “Gateway ID”
    b. Select “LoRaWAN frames” tab
    c. Verify if the packets are being received



4. If the gateway is not listed,
    a. Click on “Add gateway”, using the Gateway ID shown on the KONA Link home page.



6.2 Managing Modbus Server after upgrading BSP

If you are upgrading from **Embedded LNS BSP version 7.1.16.3 to BSP version 7.2.13** and were previously using **Node-RED** for managing Modbus registers, please review the following:

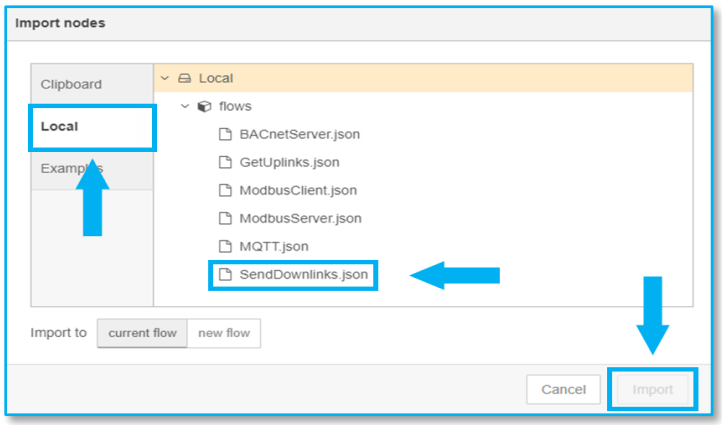
1. **For Existing Node-RED Modbus Users**
    b. You can **continue using your existing Modbus setup** in Node-RED after upgrading.
    c. However, **do NOT enable the new Modbus service** in **BSP version 7.2.13 while Node-RED Modbus is still active**.
    d. Running both simultaneously may **cause configuration conflicts** and **affect system stability**.

2. **Switching to the BSP version 7.2.13 Modbus**
    If you wish to adopt the **new Modbus functionality** included in **BSP version 7.2.13**:
    - **Disable** the existing Modbus configuration in **Node-RED** first.
    - Then **re-populate all Modbus registers** manually in the **BSP version 7.2.13 Modbus interface** using the steps listed in this section.
    - Verify that all registers and mappings are configured correctly before deployment.

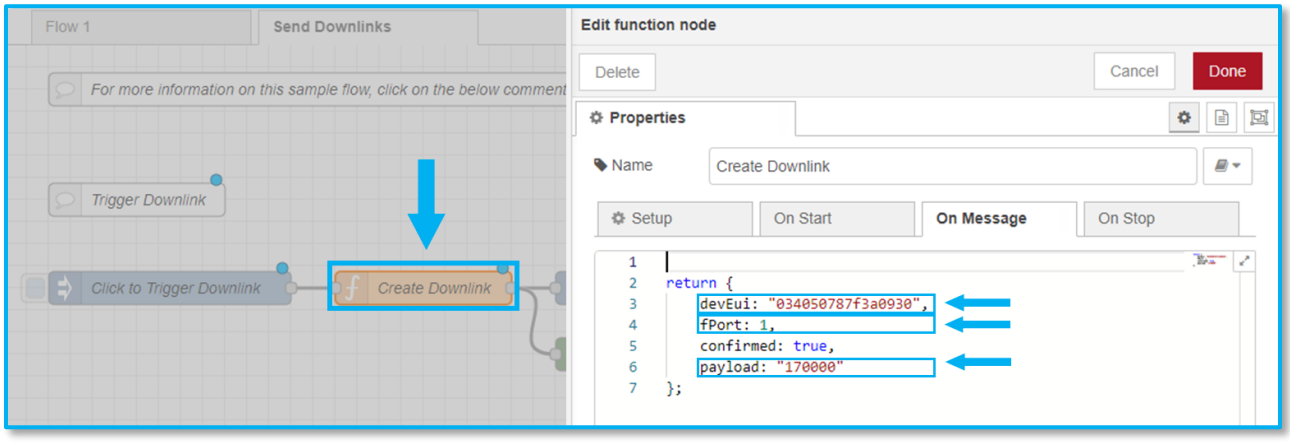
6.3 Sending Downlinks to Embedded LNS

1. In a new flow go to menu and select **Import**

2. Go to section Local and select SendDownlinks flow for your application:

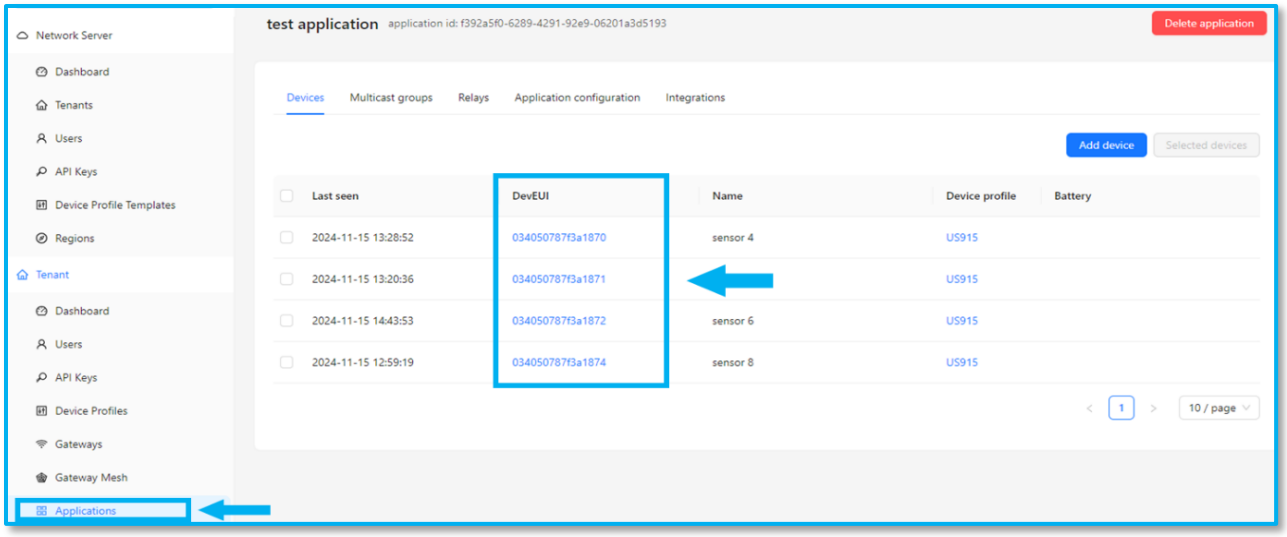


3. Click twice on **Send Downlink** and configure deveui, fPort and payload for your device according to the device documentation. For TEKTELIC devices, you can use the KONA Atlas tool to generate the payload.

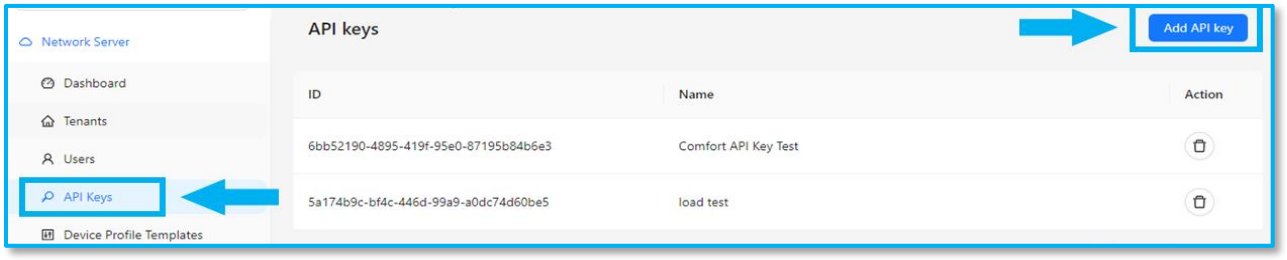


4. To get the DevEUI go to **Application** section in Embedded LNS and pick the application.

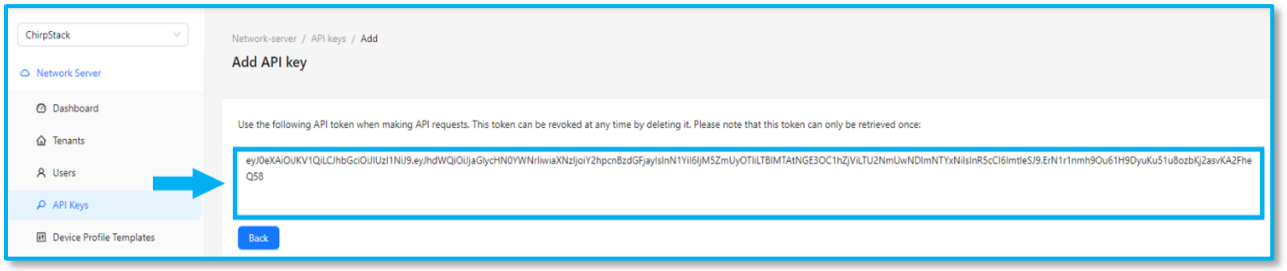
   In Devices section pick the **DevEUI** of the Device.



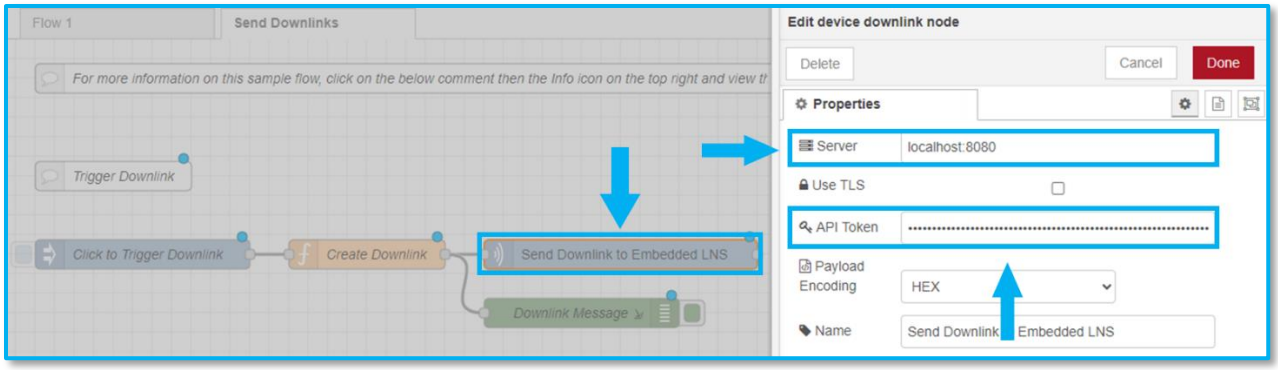
5. In Embedded LNS go to **API Keys** section and click on **Add API Key**



6. Record and copy the API key then click on "**Back**". It is critical that this key is recorded as it cannot be viewed again in the future. If the key is lost, you will need to generate a new one.

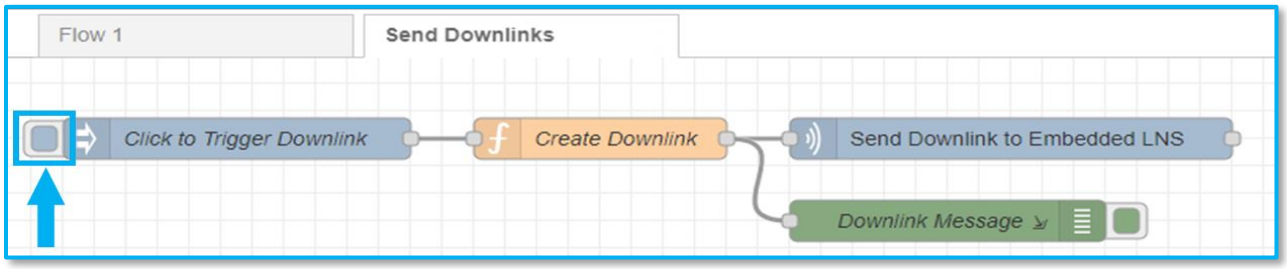


7. Back in NodeRED:
    - Double click on Send Downlink to Embedded LNS
    - make sure the Server is localhost:8080
    - insert API Token (Key) you got from Embedded LNS into API Token line
    - Click on "**Done**" and then after window closes click on "**Deploy**"



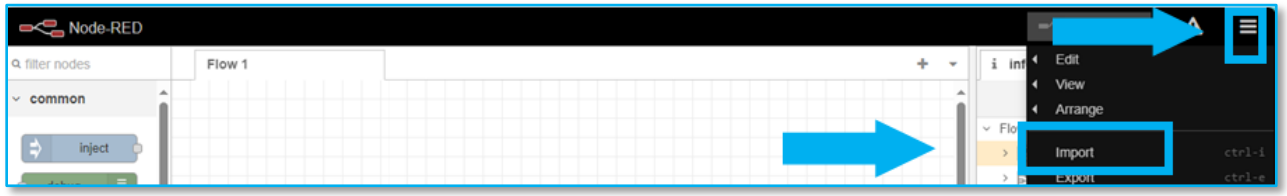
8. Click on "**Deploy**"

9. Trigger downlink by pushing the activating button

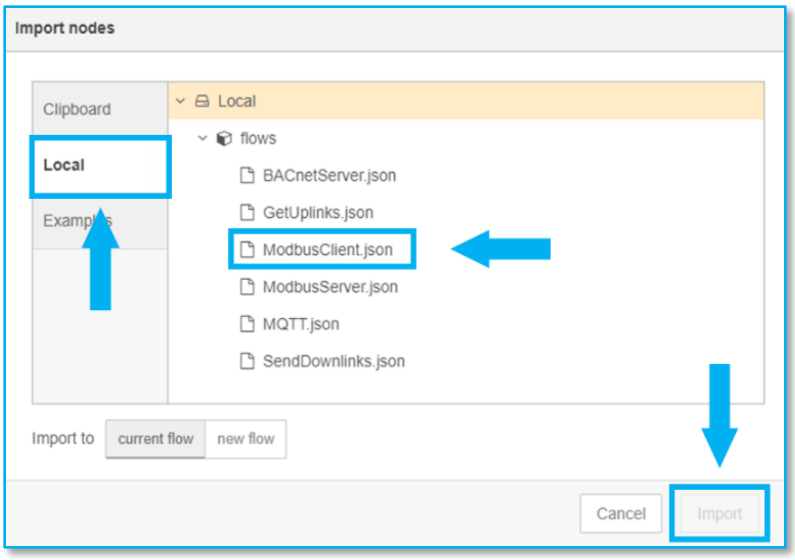


6.4 Configure a Modbus Client

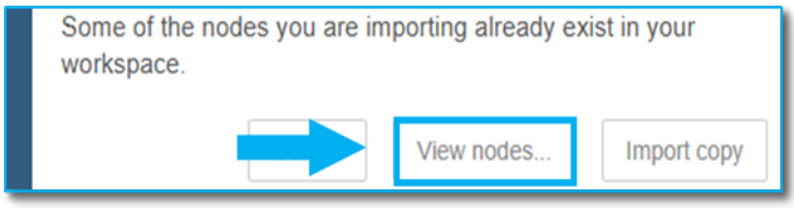
1. In a new flow go to menu and select **Import**



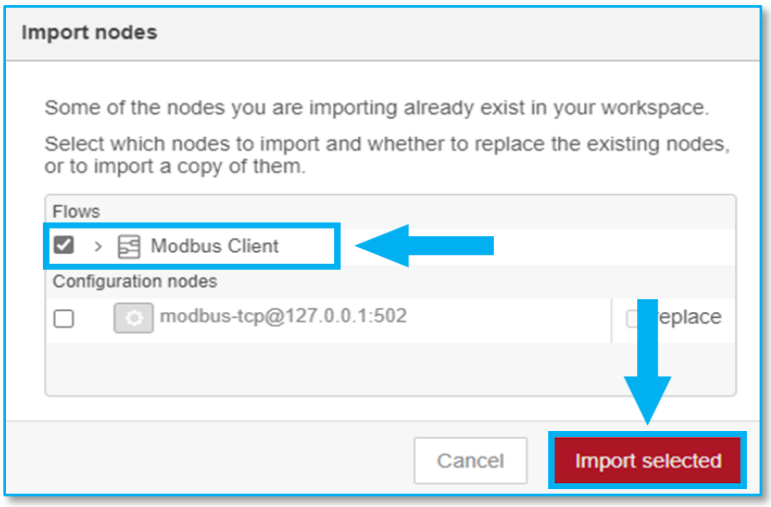
2. Go to section Local and select **Modbus Client** flow:



3. On the incoming warning message, click **View nodes**.

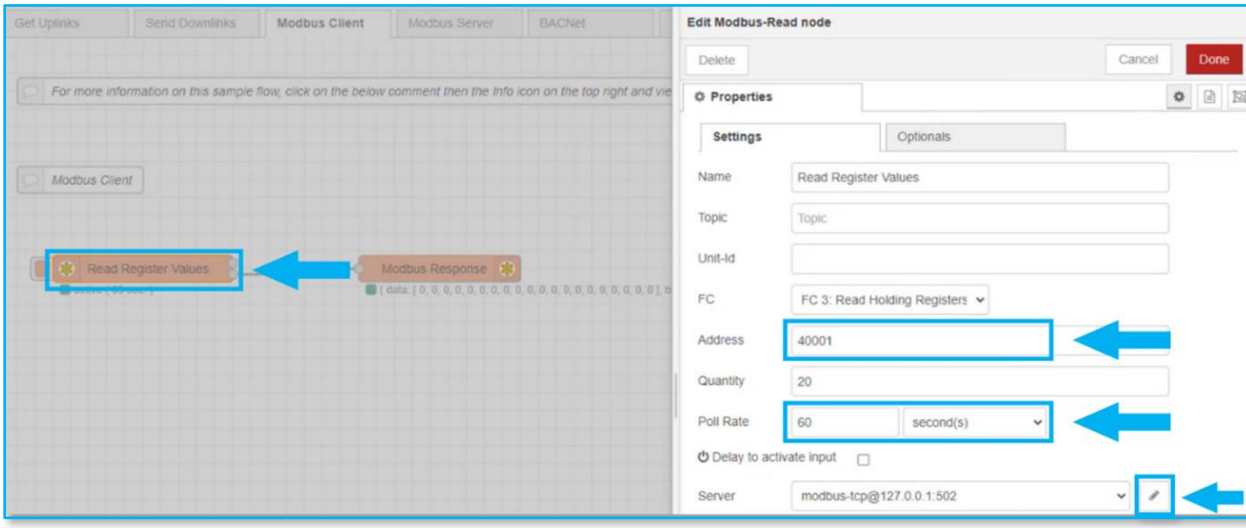


4. On the **Import nodes** window, ensure that only **Modbus Client** is checked, then click on "**Import selected**".



5. In Modbus Client flow in Read Register Values node:
    - Address: 40001
    - Quantity: 20 (means read 20 registers starting at the 40001 Modbus register address)

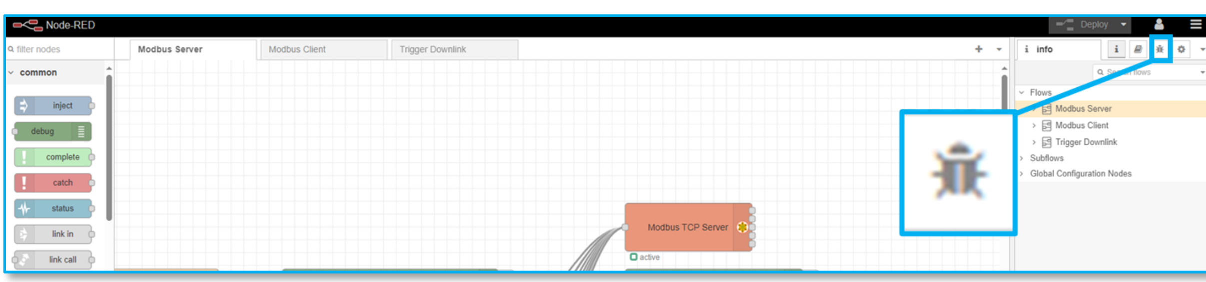
- Poll Rate: 60 seconds (value update time period)
- Update the server address



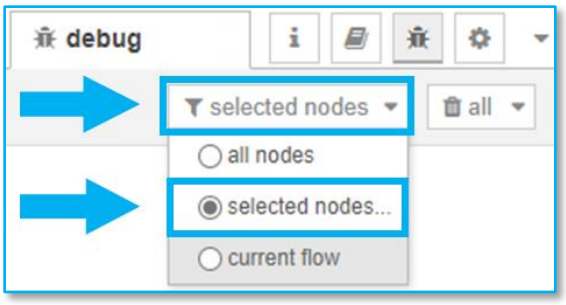
6. Deploy changes. After that you can activate push button to read the Modbus register values.

6.5 View Uplink Messages

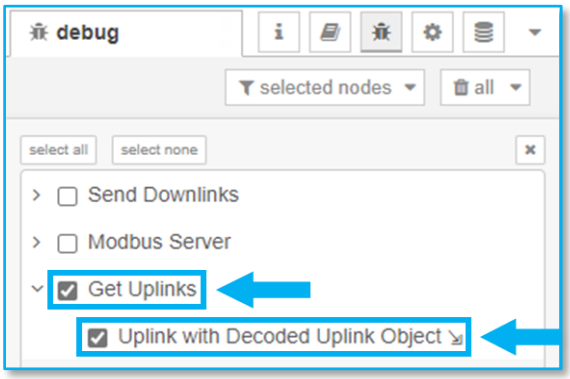
1. In a right panel select the debug icon represented by a bug.



2. In the nodes filter menu click on **selected nodes**



3. Select the flow you want to view uplinks for



4. You will be able to see decoded Uplink messages.