TEKTELIC Communications Inc.
7657 10th Street NE Calgary, Alberta
Canada, T2E 8X2

Embedded LNS Gateway Instruction

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:

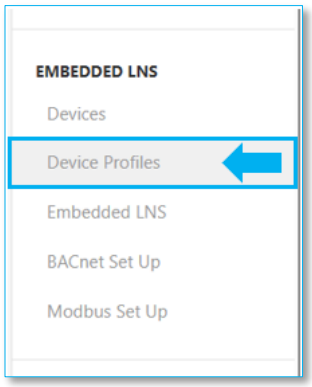
1. Initial Setup:
   - Add LoRaWAN Devices, and Device Profiles using Kona Link. (Section 2)
2. Protocol-Specific Configuration: Use Node-RED to configure and manage the supported protocols:
   - BACnet/IP: Refer to Section 3.1 for setup guidelines.
   - Modbus TCP/IP: Refer to Section 3.2 for detailed steps.
   - MQTT: Refer to Section 3.3 for configuration instructions.

You can see some troubleshooting tips specific for the use cases in Section 4

2. 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 **Device Profile** section.

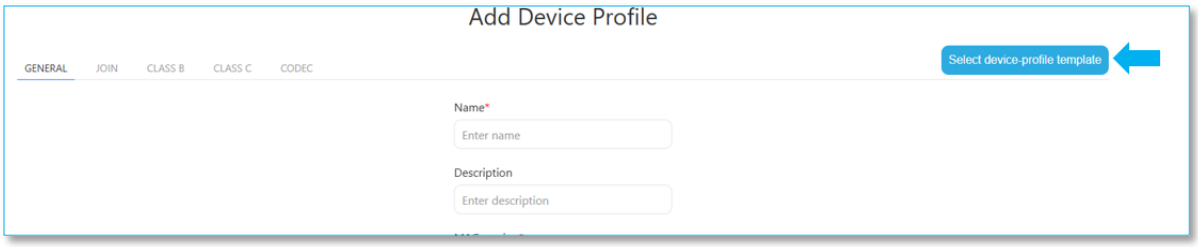


3. Click on **Add Device Profile**.

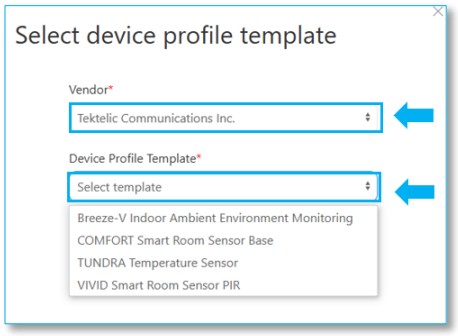
4. User has two options for Configuration of device profiles:

7.1. Select a Device Profile from the existing list of **Device profile Templates**

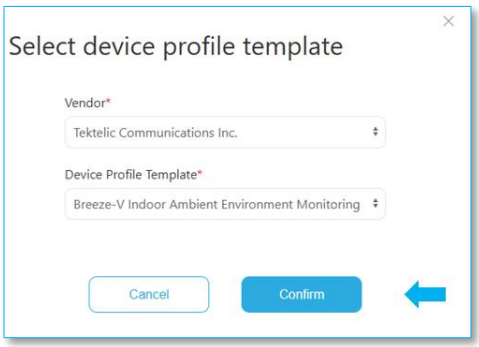
- Click on **Select device-profile template**



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



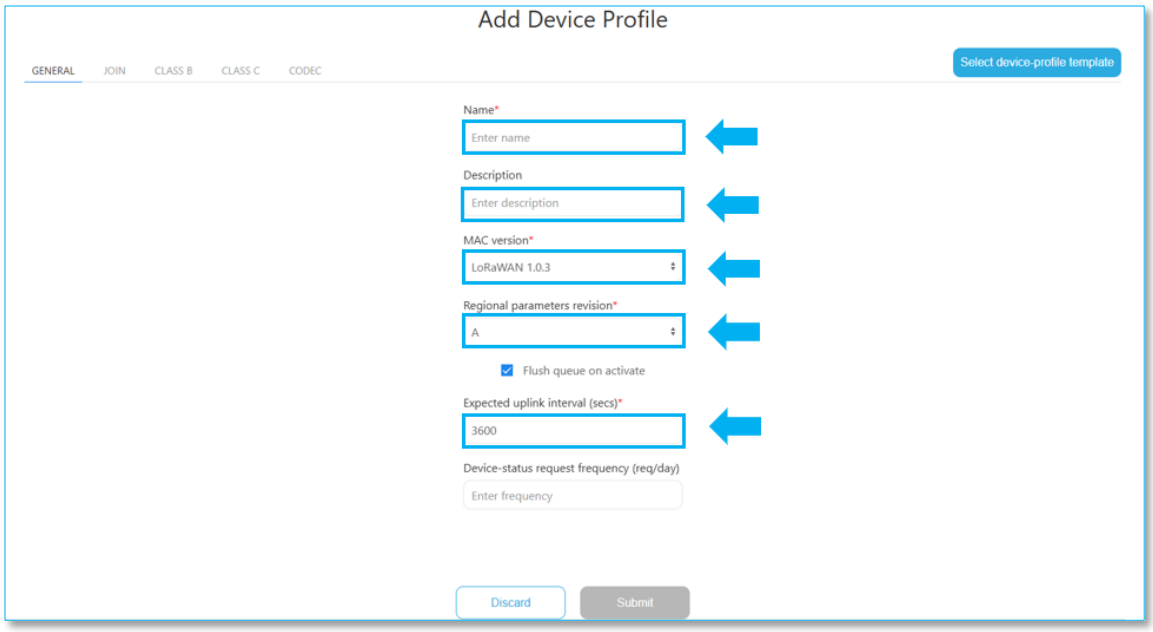
- Click on **Confirm**



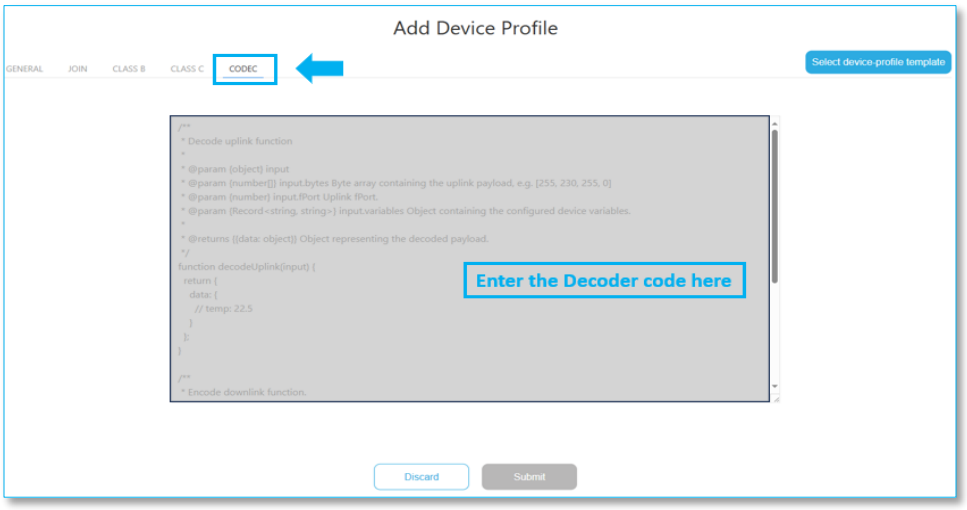
- Click on "**Submit**" to save the Device profile

7.2. Add Device Profile Manually

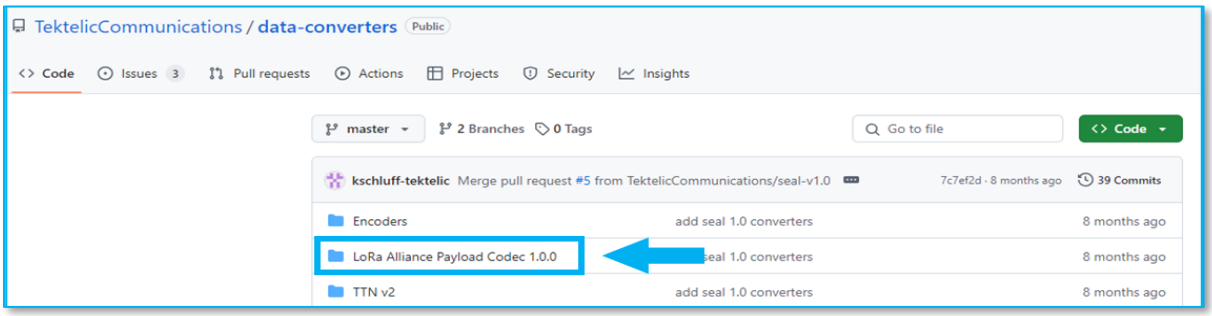
- Configure device profile based on the documentation from your device vendor:
    i. Assign a name for the device
    ii. Enter the Description
    iii. Enter MAC version and regional parameters revision appropriate for your device. Default MAC version is LoRaWAN 1.0.2 and Regional parameters revision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



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

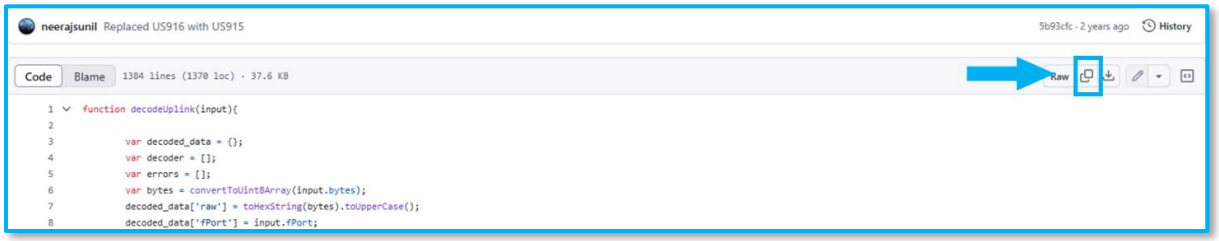


- Contact your device vendor to obtain the decoder script.
  For Example: For Tektelic devices, go to [LoRa Alliance Payload Codec 1.0.0] folder in [Tektelic GitHub] (LoRa Alliance format).



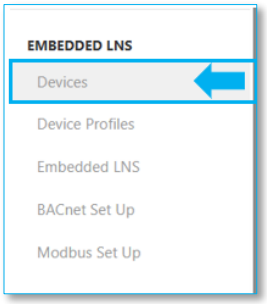
- Choose the folder named according to your device type

- Copy the code and insert it into Device Profile Codec tab

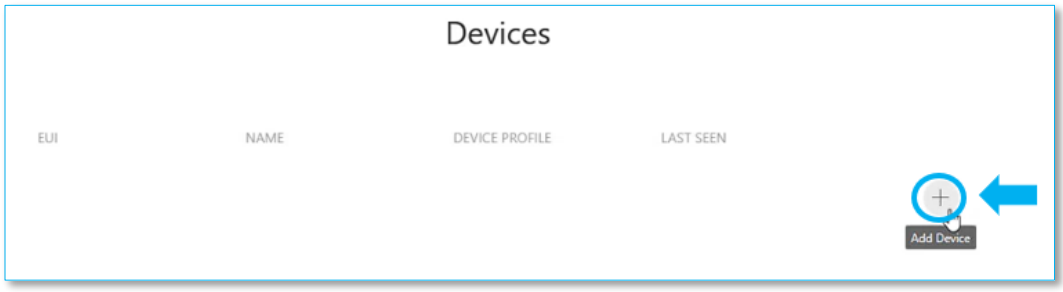


- Click on "**Submit**" to save the Device profile

5. Navigate to **Devices** section.

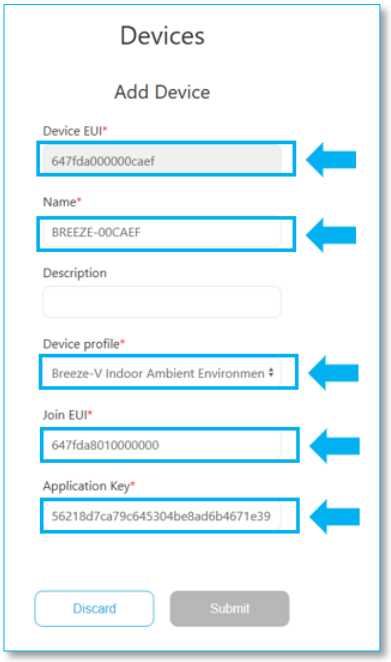


6. Click on **Add Device**



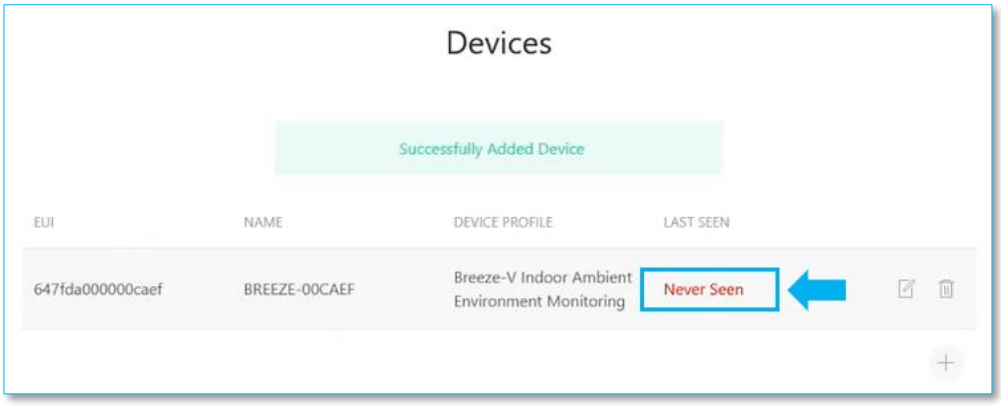
7. Configure device parameters:

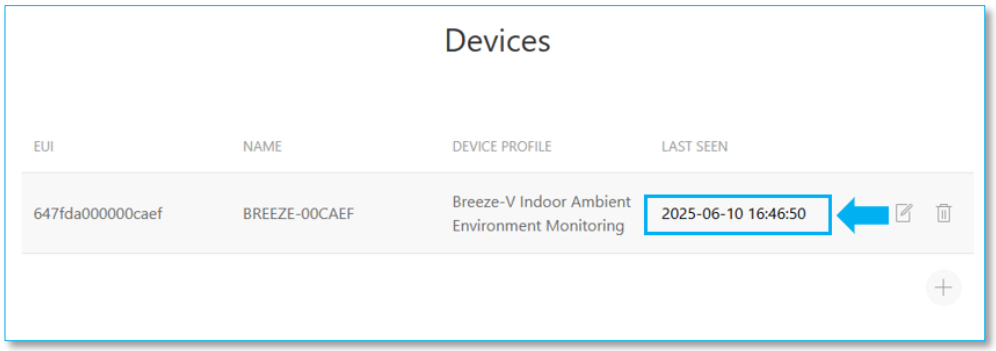
    - DevEUI (Device Unique Identifier)
    - Name
    - Device profile (chose existing from the dropdown list)
    - JoinEUI (Join Server Identifier)
    - Application Key (on submit)



8. Click on **Submit**.

9. When first added, the device is marked as **'Never seen**'. You can either force the device to rejoin the network or wait for the next uplink, which will automatically update the **'Last Seen**' status.





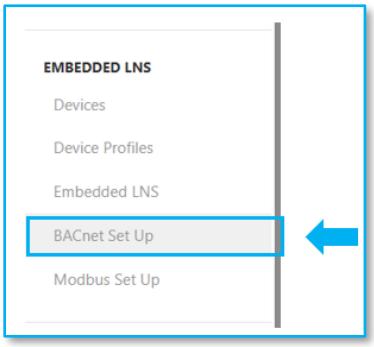
3. Application Specific Configurations

3.1 Connecting to BACnet IP

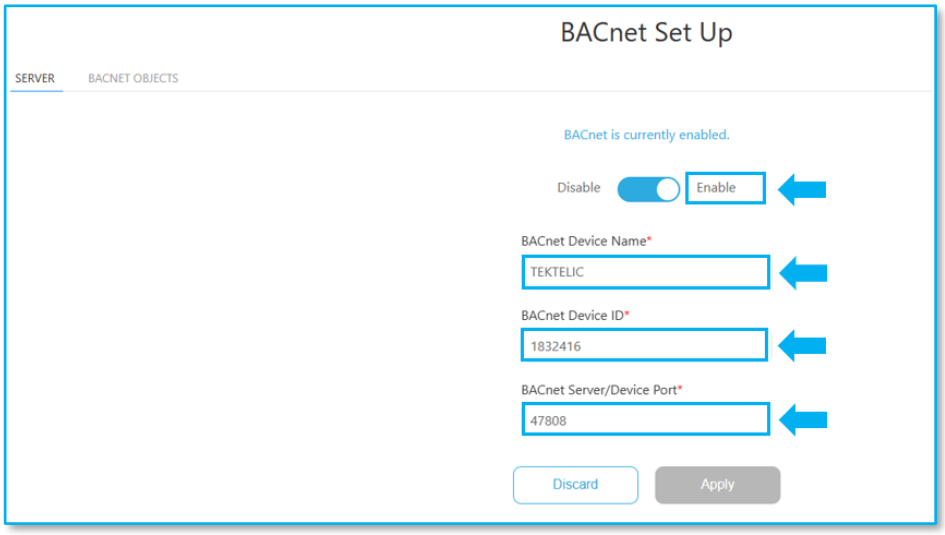
1. Login to Kona Link web page using “Host Name” or “IP Address”:
   - Using “Host Name”

   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 Set Up**



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

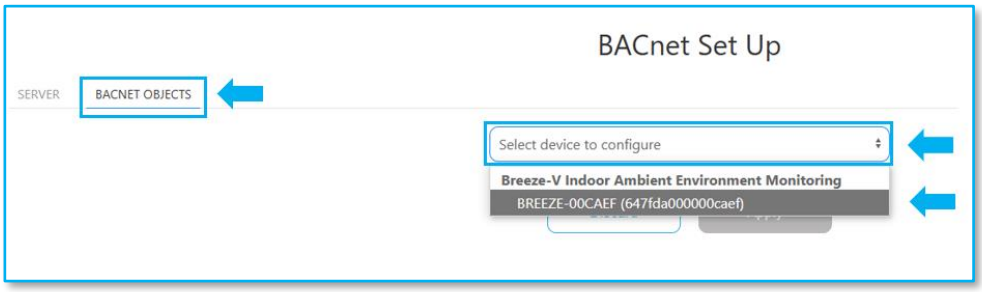


5. Switch to “**BACnet Objects**” tab to configure BACnet objects.
6. Select from the devices already configured. (Please note the devices are organized by Device Type)

7. Device Selection and BACnet Object Configuration:

7.1. BACnet Object Configuration for TEKTELIC Devices

- Click on Select device-profile template

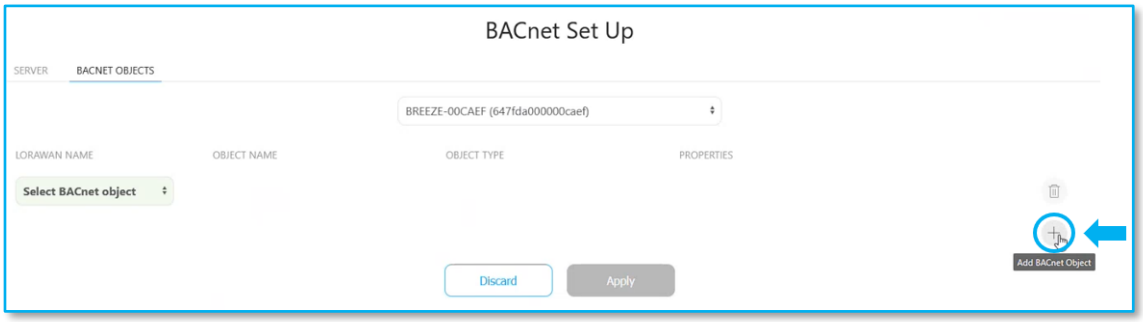


NOTE: BACnet objects are automatically be created upon receiving an LoRaWAN Uplink. Alternately, users may follow "Manual configuration of BACnet Objects" steps to setup BACnet objects.

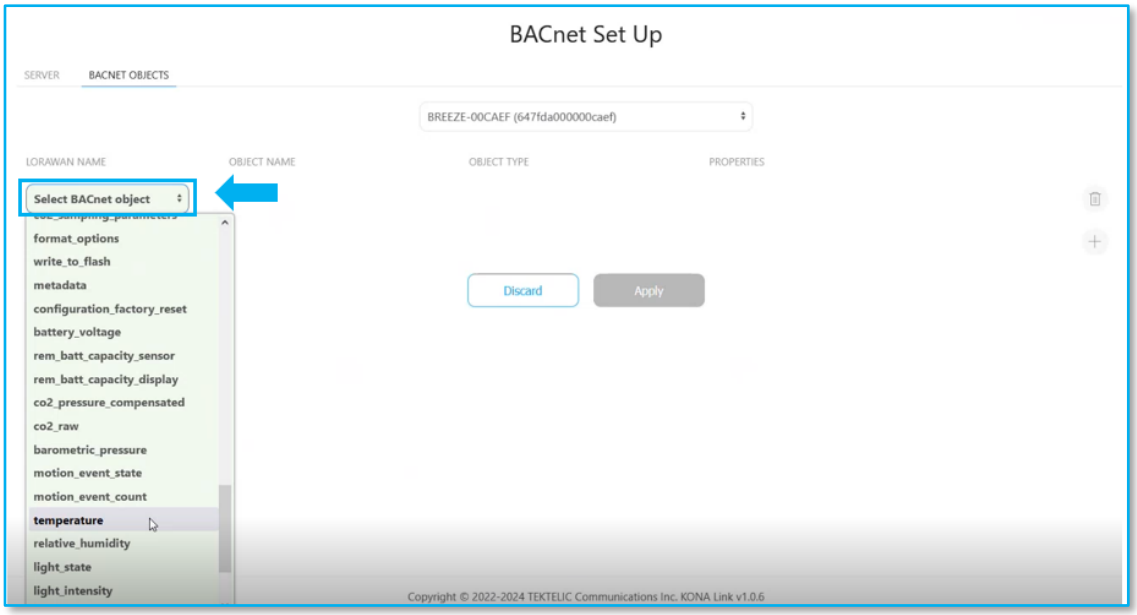
NOTE: Only "Uplink" objects are created automatically, BACnet objects used to send LoRaWAN Downlinks must be configured manually by the user following the steps for "Manual configuration of BACnet Objects".

- Steps for Manual Configuration of BACnet Objects

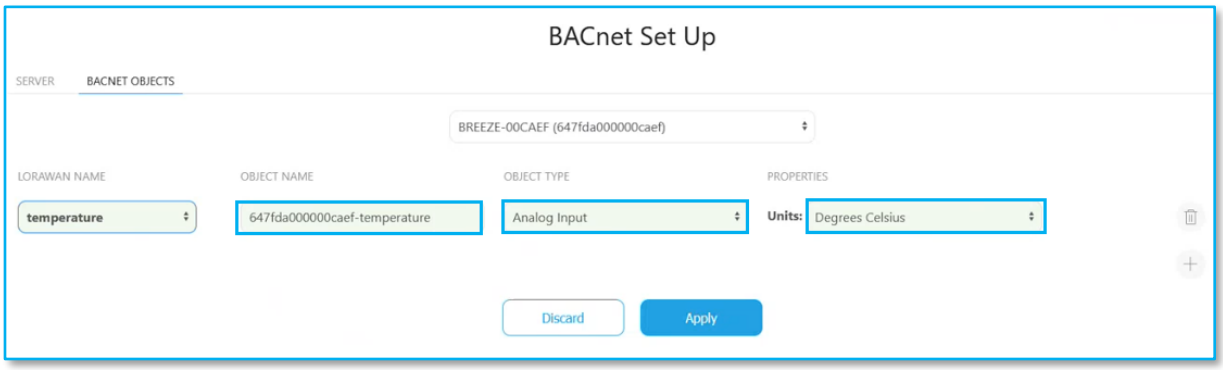
a. Click on "**Add"** BACnet Objects



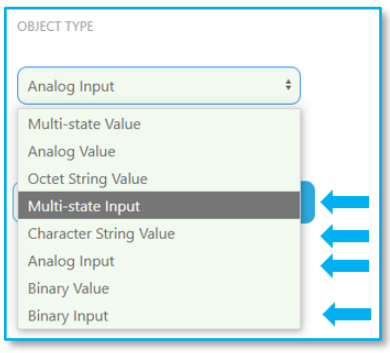
b. **Select the BACnet object**, i;e the LoRaWAN parameter name from the drop down.



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

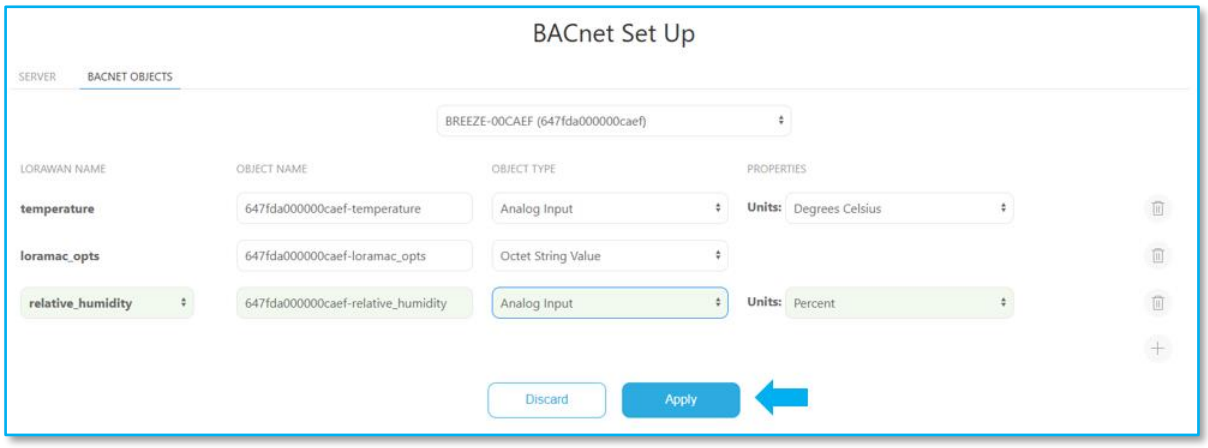


d. The Object Type for an Uplinks are typically Multi-state Input, Character string value, Analog Input, or Binary Input. Object types used for downlinks are typically Analog Value, Binary Value, Character String Value, or Octet String Value.



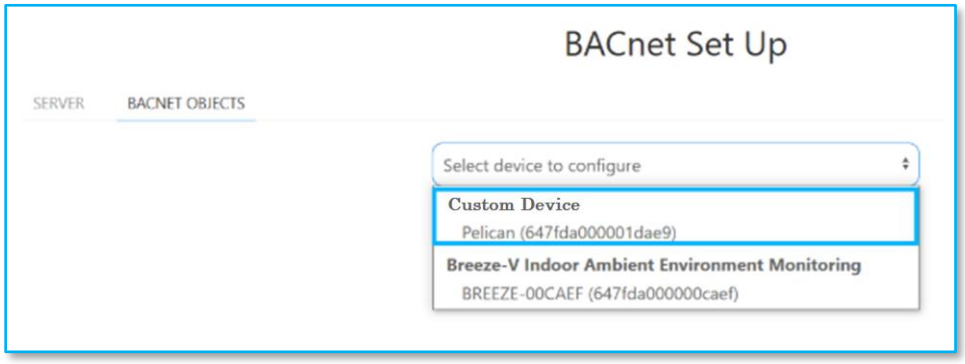
e. Repeat the steps above to add all required BACnet uplink and downlink objects.

f. Click on "**Apply**"

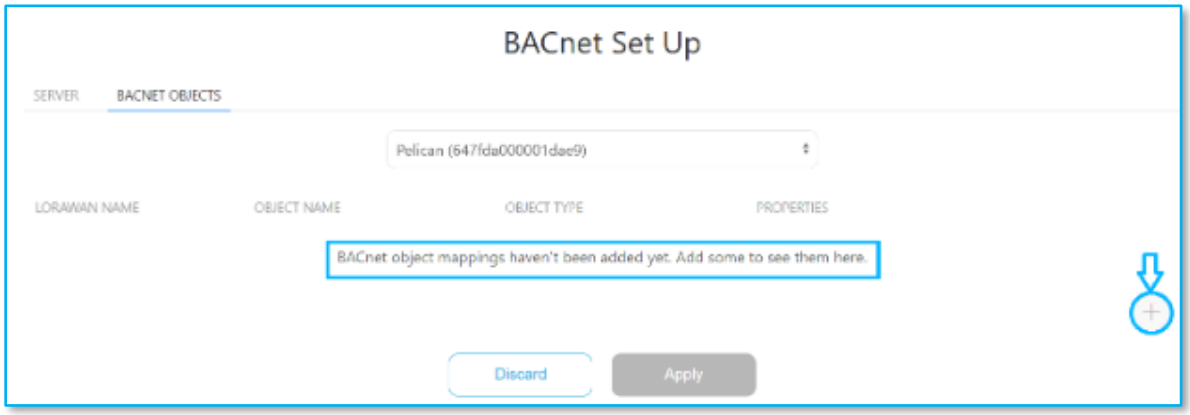


7.2. Manul Configuration of BACnet Objects

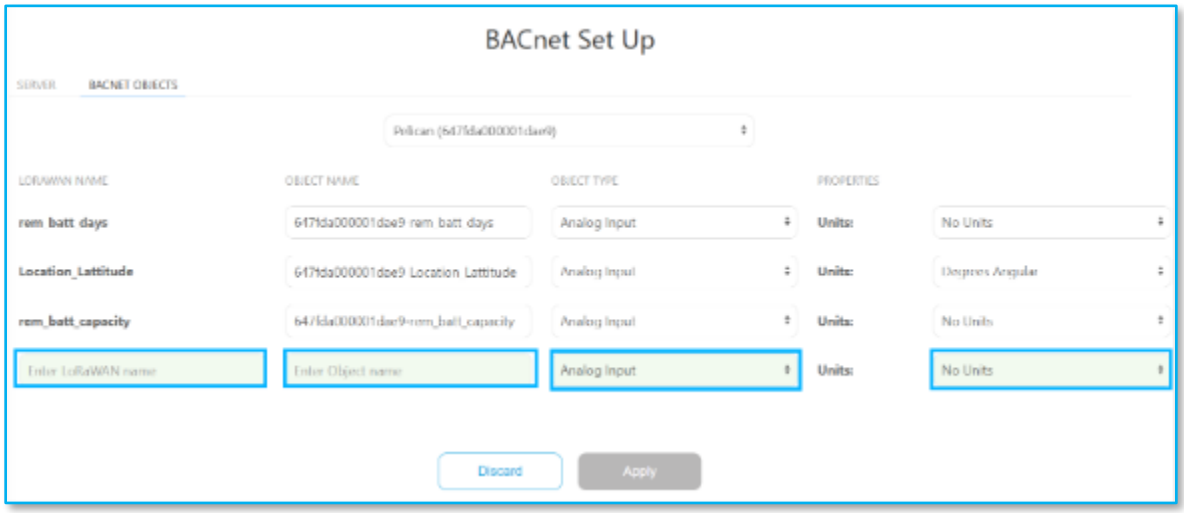
- Click on "Select device to configure" and choose the Custom Device.



- Steps for Manual Configuration of BACnet Objects
  a. Click on "**+**" to add a BACnet Object



b. 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** (such as units).



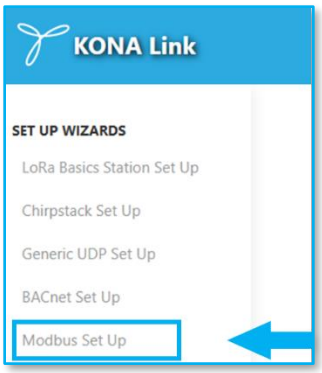
g. Repeat the steps above to add all required BACnet uplink and downlink objects.

h. Click on "**Apply**"

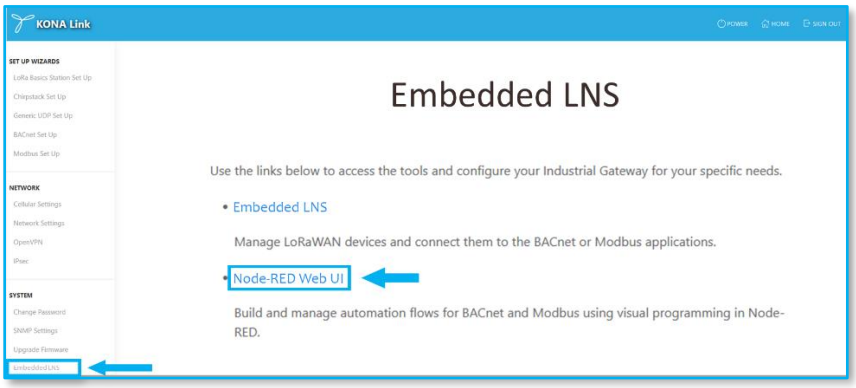
3.2 Connecting to Modbus TCP/IP

NOTE: Before moving on to Modbus Configurations in Node Red, Gateways, Devices and Codec should be registered and configured correctly. And Device should join and send uplinks successfully.

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. In SET UP WIZARDS section use Modbus Set Up to enable Modbus

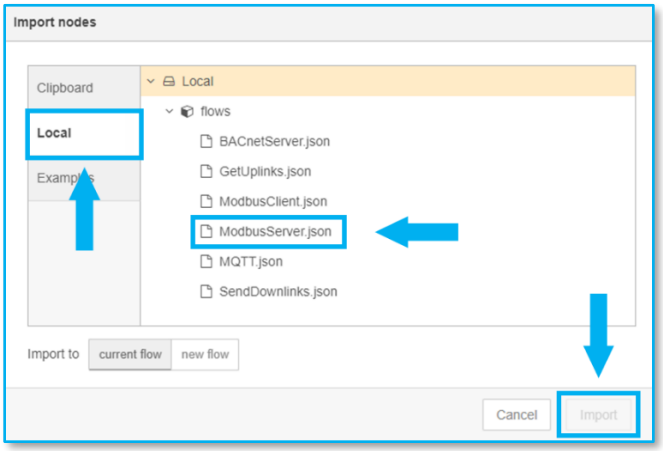


3. Follow the **Node-RED Web UI** link in Embedded LNS subsection in Kona Link

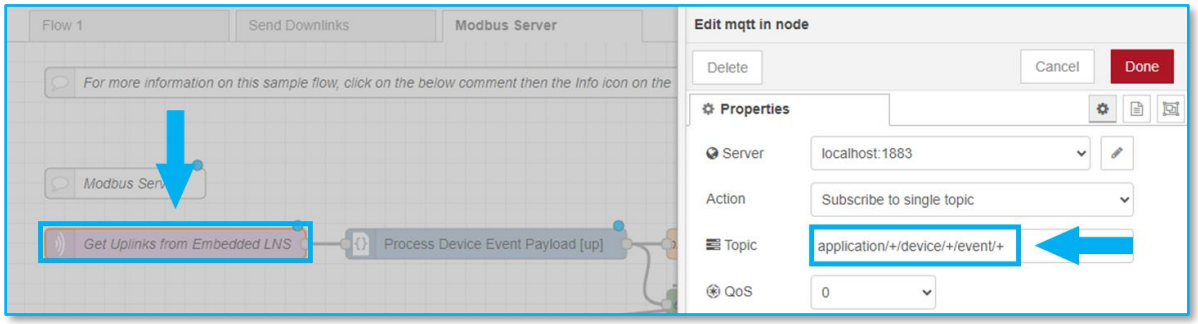


4. In a new flow go to menu and select **Import**

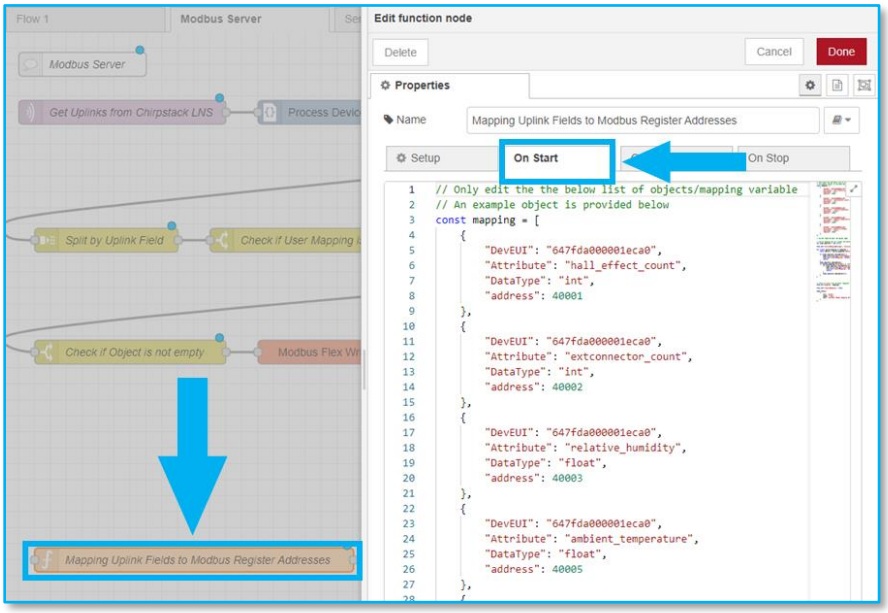
5. Go to section **Local** and select **Modbus Server** flow:



6. In the Modbus Server flow and in the **Get Uplinks from Embedded LNS** node, configure the following. Set the subscription topic to match the one being used by your LoRaWAN device (e.g., device uplinks) or leave default.



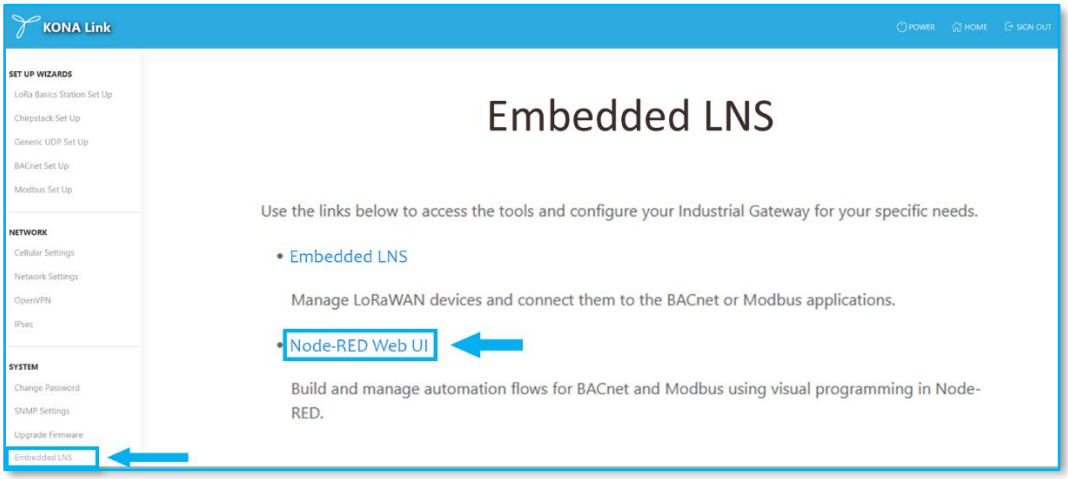
7. In **Mapping Uplink Fields to Modbus Register Addresses** node Open the **On Start** tab.



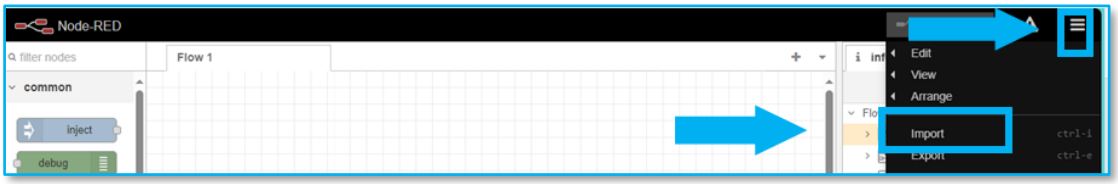
8. Add a mapping object for all possible uplink fields for each and every device you would like. The four attributes required for each mapping object are as follows:
   - DEVEUI: The device EUI for a given device
   - Attribute: The uplink field name exactly as it is written in the decoded uplink object.
   - DataType: Choose between float (decimal number), int (16-bit unsigned integer) and int32 (32-bit signed integer). Please note that floats and int32 require 2 contiguous registers. So, for example, if you have an uplink field that is a float assigned to register 40001, then both 40001 and 40002 register addresses are unavailable.
   - address: The Modbus register address that you would like the above specified attribute to write to.
9. Deploy the changes. The data from the uplink should now be available in Modbus format.

3.3 Send Decoded Uplink to External MQTT Broker

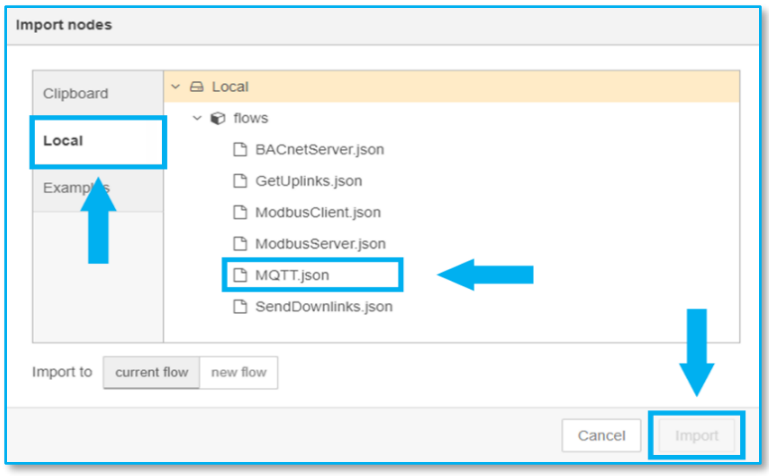
1. Login to Kona Link web page using “Host Name” or “IP Address”:
   - Using “Host Name”
     Host Name URL: https://kona-<GW variant>-<last 6 digit GW ID>.local/
     Eg: https://kona-micro-0011ab.local/
   - Using “IP Address”
     IP Address URL: https://<GW IP Address>/
     Eg: https://192.0.2.111/
2. Follow the **Node-RED Web UI** link in Embedded LNS subsection in Kona Link



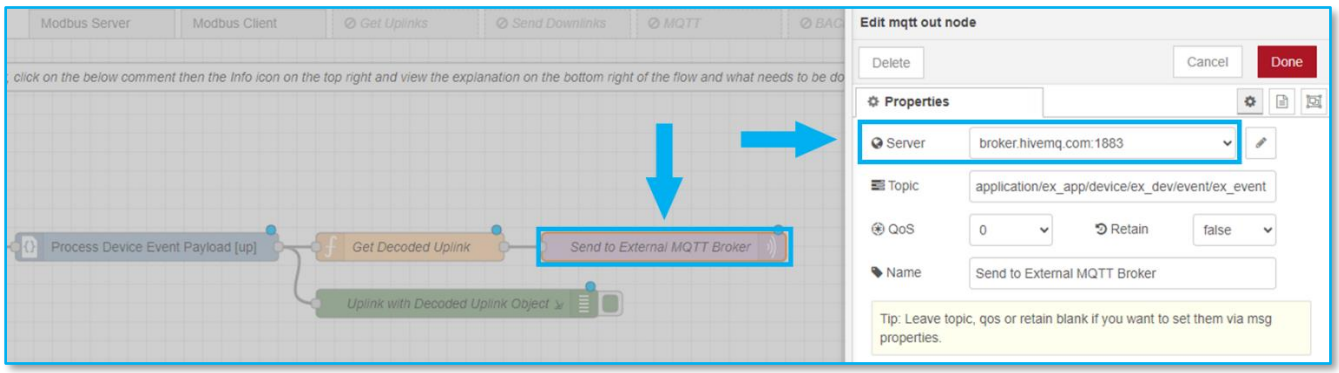
3. In a new flow go to menu and select **Import**



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



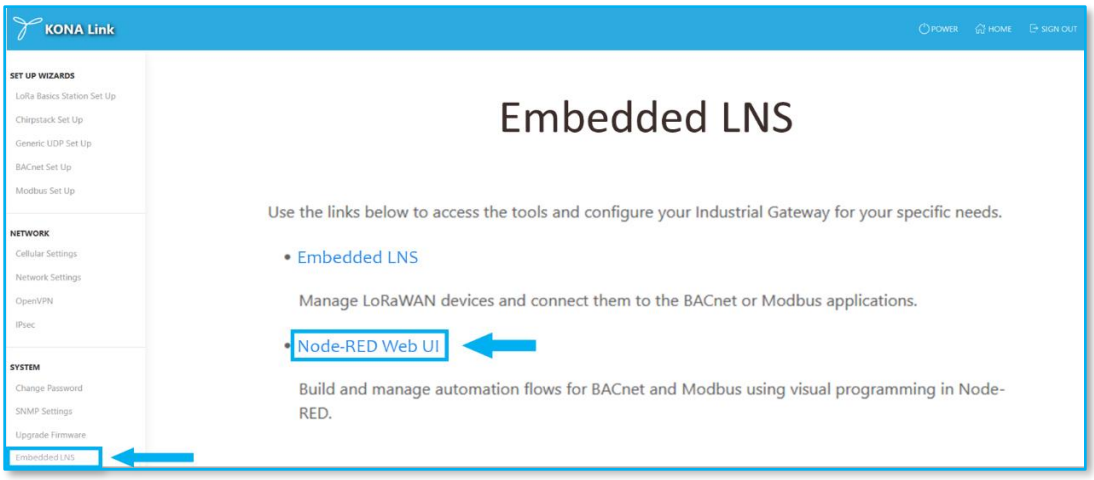
6. Deploy the flow.

3.4 Get Decoded Uplinks from Chirpstack LNS to Node Red

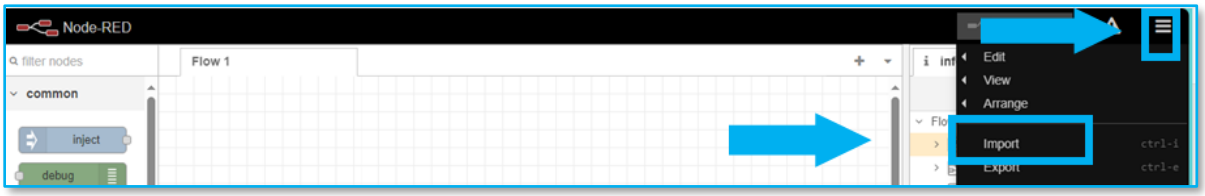
1. Login to Kona Link web page using “Host Name” or “IP Address”:
   - Using “Host Name”

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

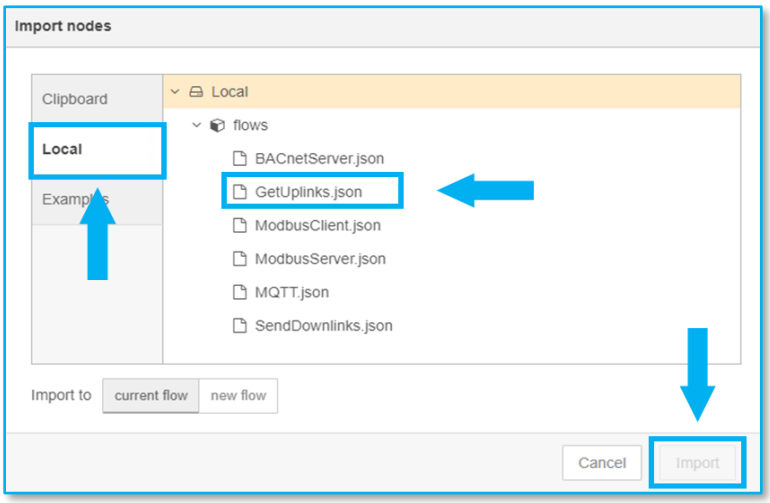
   IP Address URL: https://<GW IP Address>/
   Eg: https://192.0.2.111/
2. Follow the **Node-RED Web UI** link in Embedded LNS subsection in Kona Link



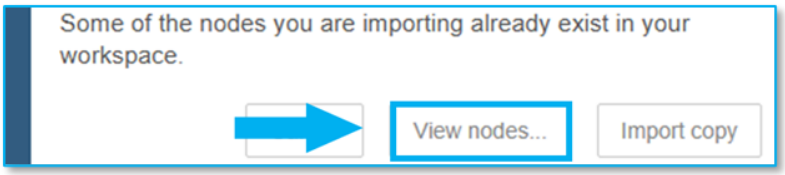
3. In a new flow go to menu and select **Import**



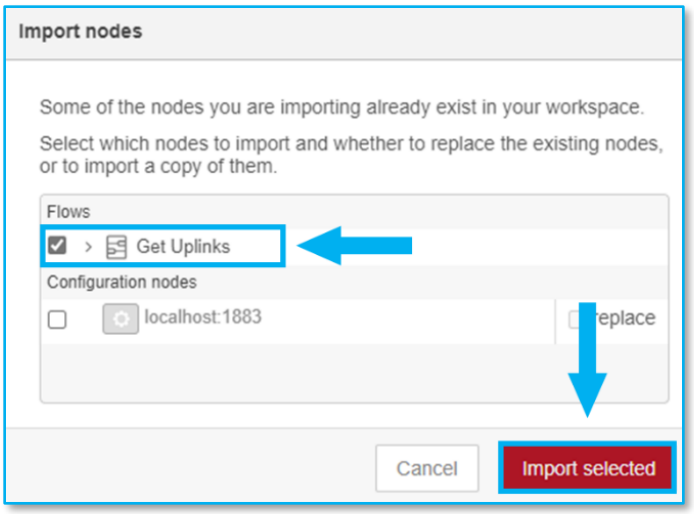
4. Go to section Local and select **GetUplinks** flow for your application:



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



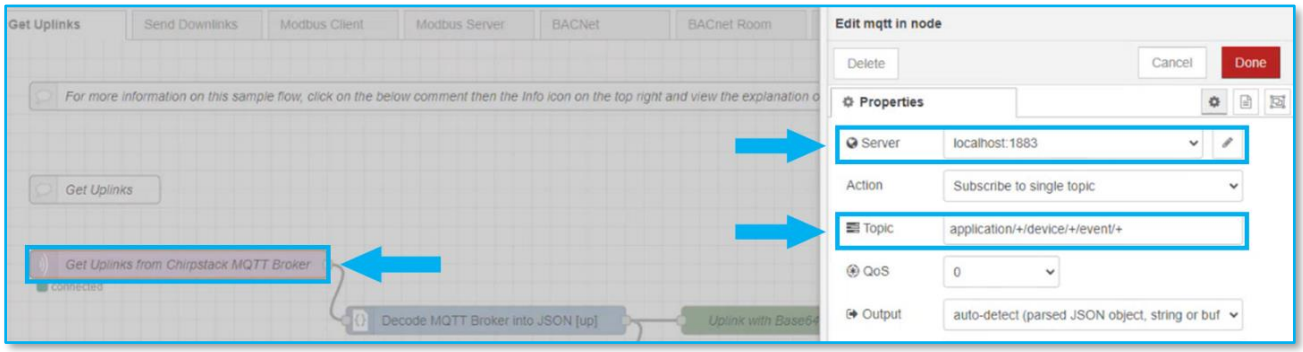
6. On the Import nodes window, ensure that only Get Uplinks is checked, then click on **Import selected**.



7. In GetUplinks flow configure Get Uplinks from Embedded LNS MQTT Server input node:

   1.1. Server: localhost:1883 for Embedded LNS

   1.2. Topic: Set the subscription topic to match the topic of your LoRaWAN device (e.g., device uplink).

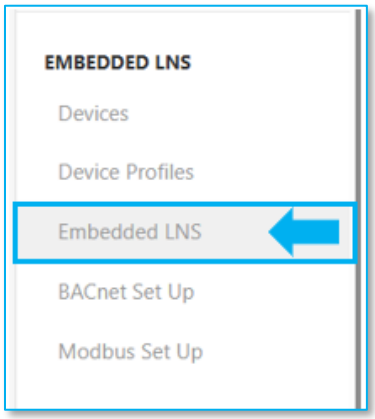


8. Once you receive the uplink data, use a function node to process it. You may need to decode the payload using a data converter if Embedded LNS is set up with the correct profiles.
9. After decoding the data, you can use it to trigger other actions, such as sending data to a database, displaying it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

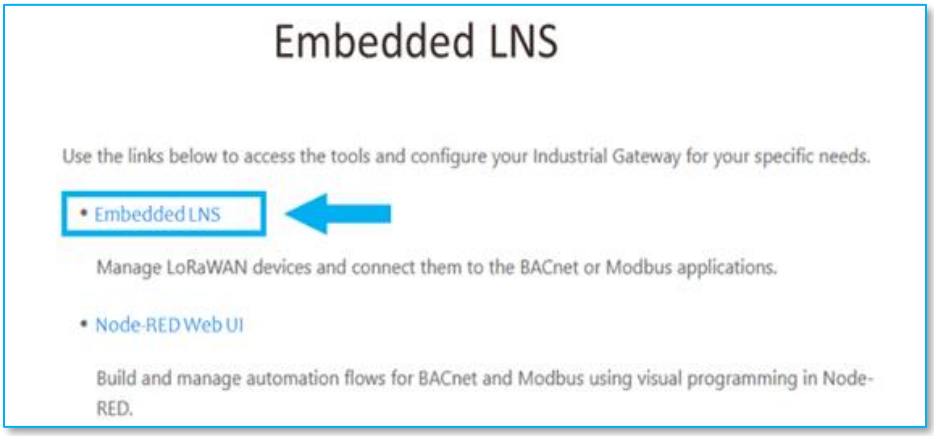
4. Troubleshooting

4.1 Check gateway Configuration

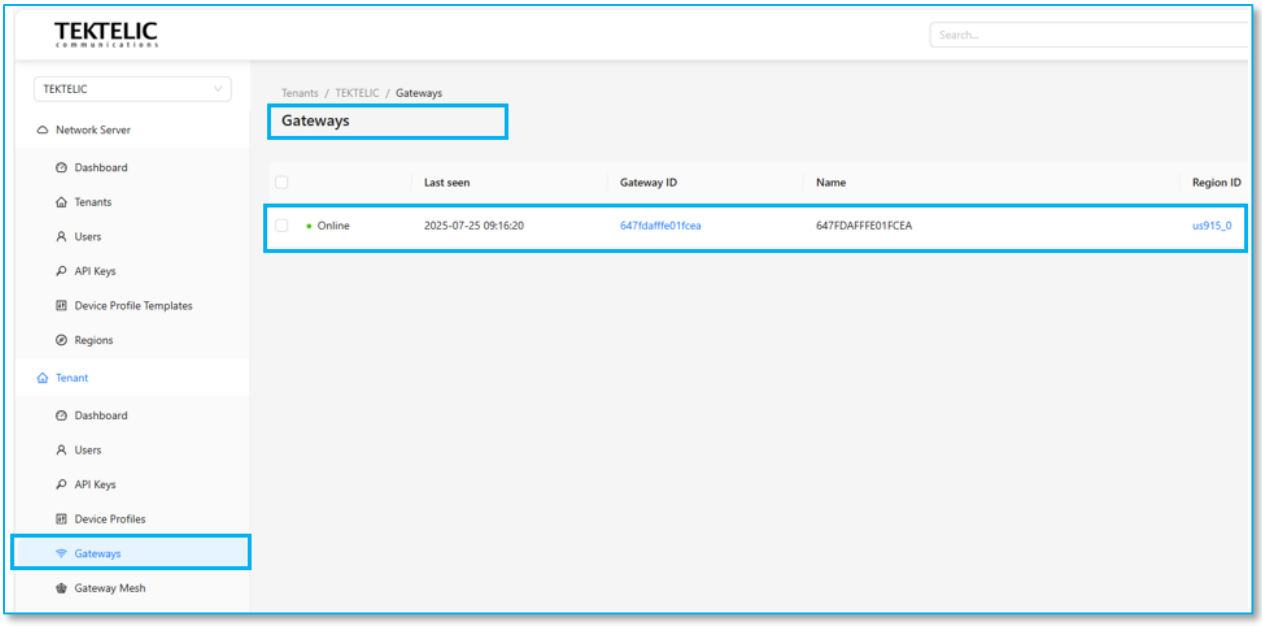
1. If the user has trouble connecting, check the gateway BSP version
2. If your Gateway was shipped with BSP version 7.10.12 or earlier, follow the below steps to check if the Gateway is listed.
    a. Login to Kona Link web page using “Host Name” or “IP Address”:
        - Using “Host Name”
          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 Embedded LNS



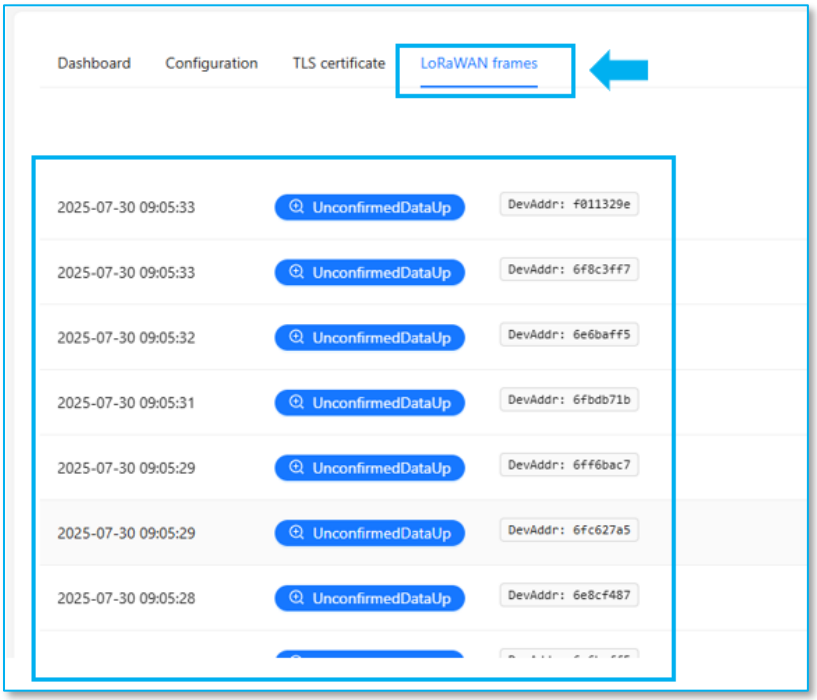
    c. Log into Embedded LNS Network Server by Embedded LNS link in Kona Link Embedded LNS link in Kona Link.



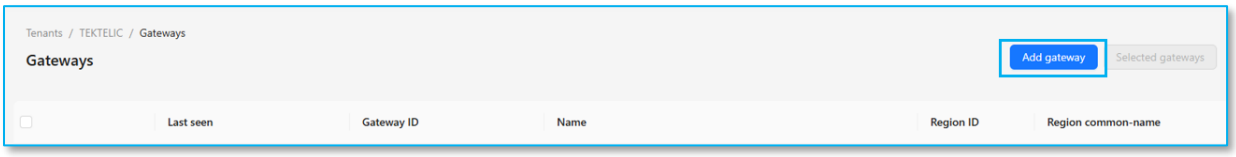
d. Navigate to Gateway section, and verify if a gateway is listed.



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



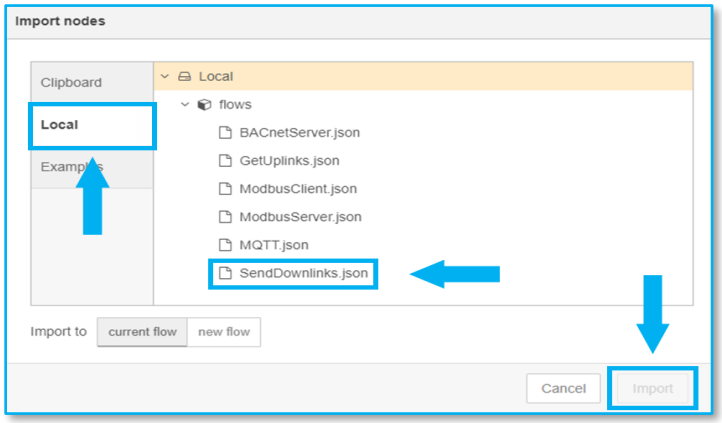
4. If the gateway is not listed,
    a. Click on “Add gateway”, using the Gateway ID shown on the KONA Link home page.



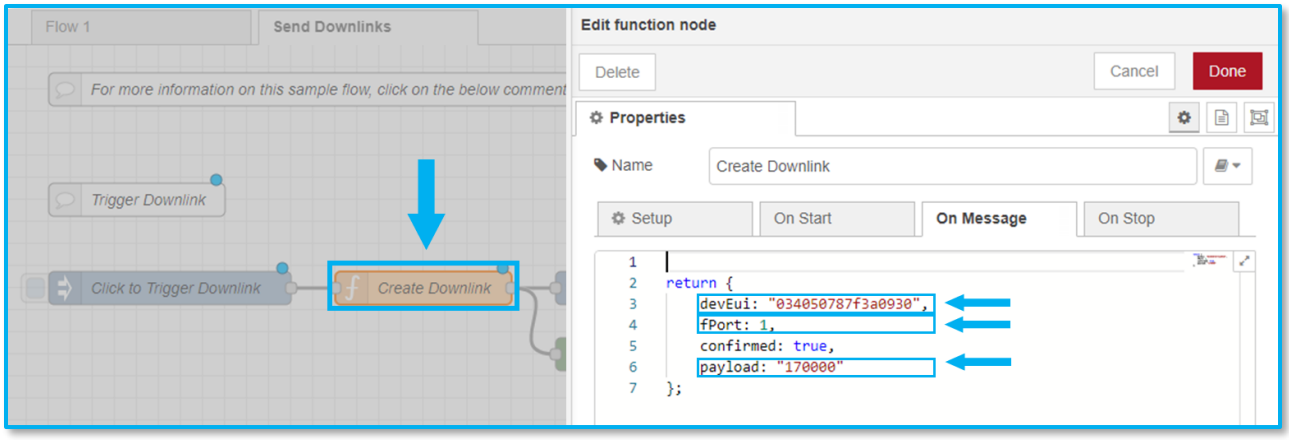
4.2 Sending Downlinks to Embedded LNS

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

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

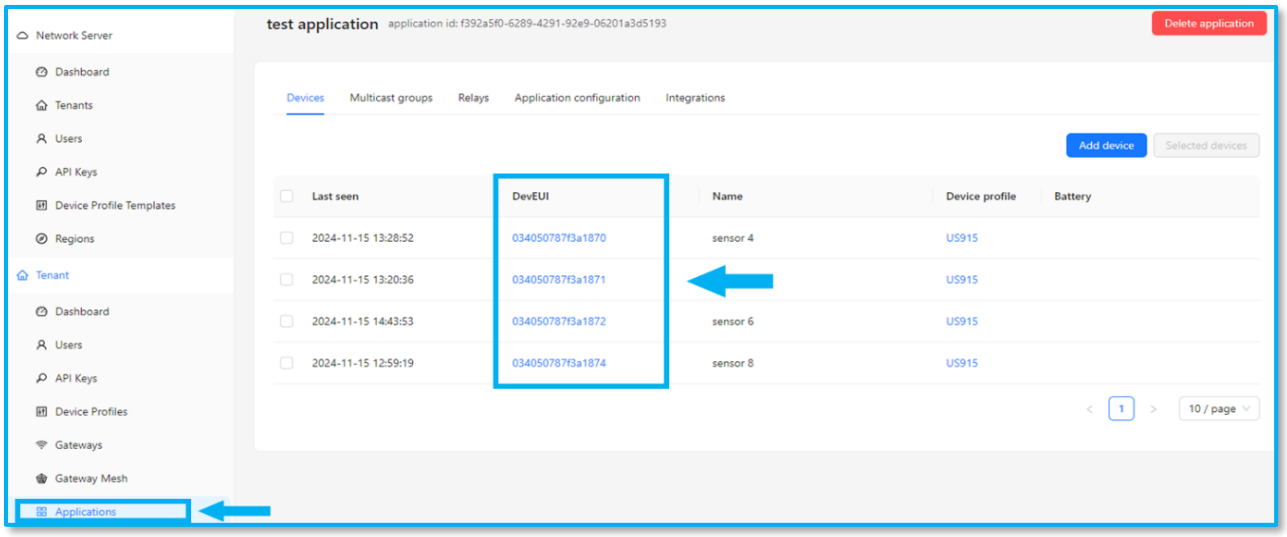


7. Click twice on **Send Downlink** and configure deveui, fPort and payload for your device according to the device documentation. For TEKTELIC devices, you can use the KONA Atlas tool to generate the payload.

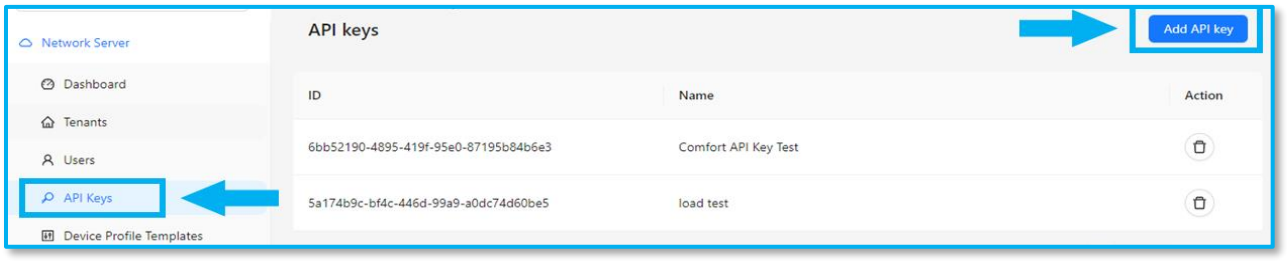


8. To get the DevEUI go to **Application** section in Embedded LNS and pick the application.

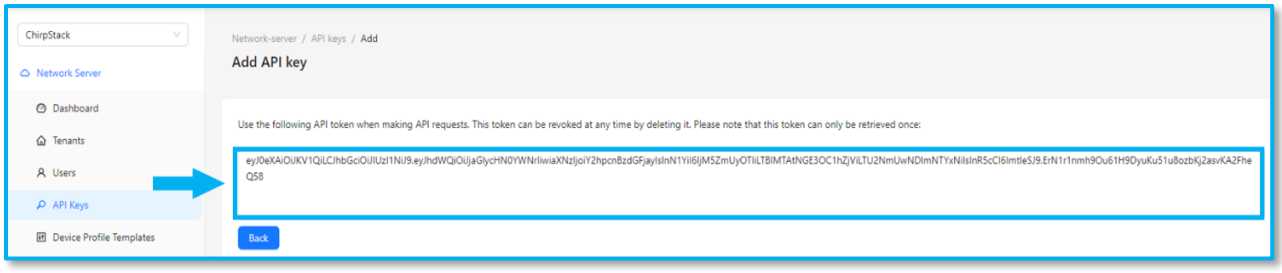
   In Devices section pick the **DevEUI** of the Device.



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



10. 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.

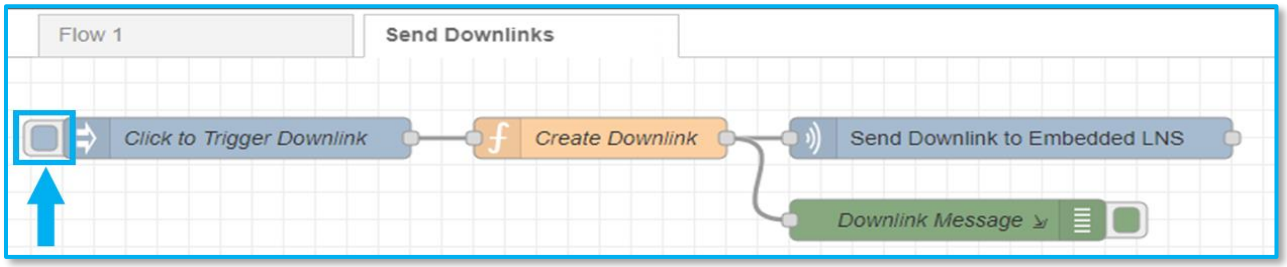


11. Back in NodeRED:

- 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**"

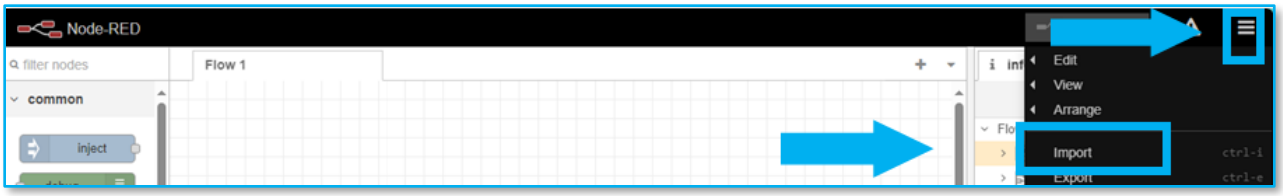
12. Click on "**Deploy**"

13. Trigger downlink by pushing the activating button

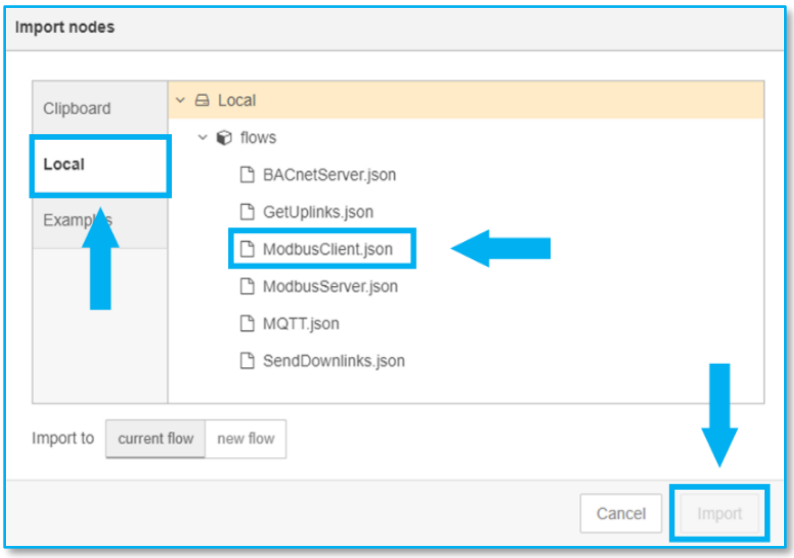


4.3 Configure a Modbus Client

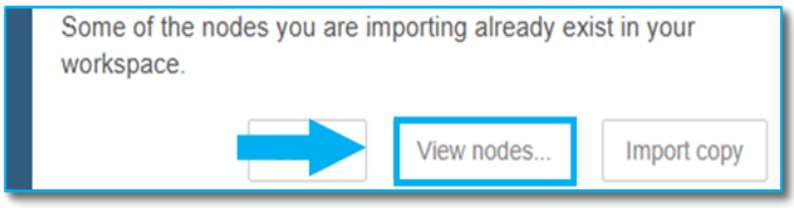
1. In a new flow go to menu and select **Import**



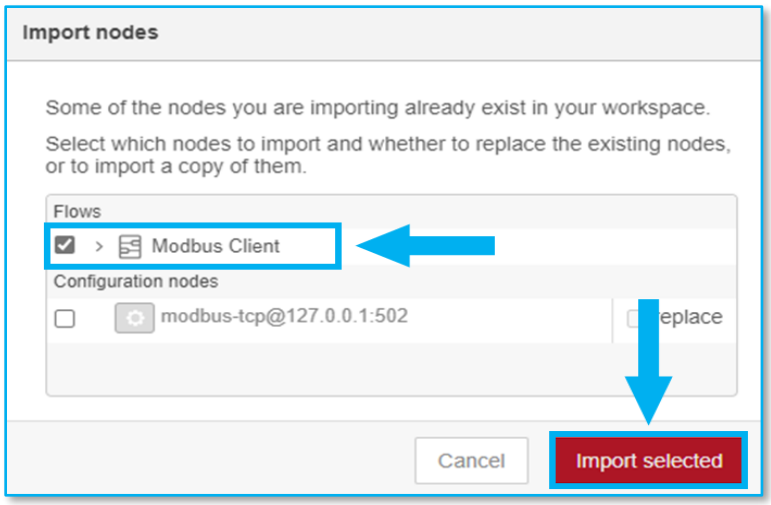
2. Go to section Local and select **Modbus Client** flow:



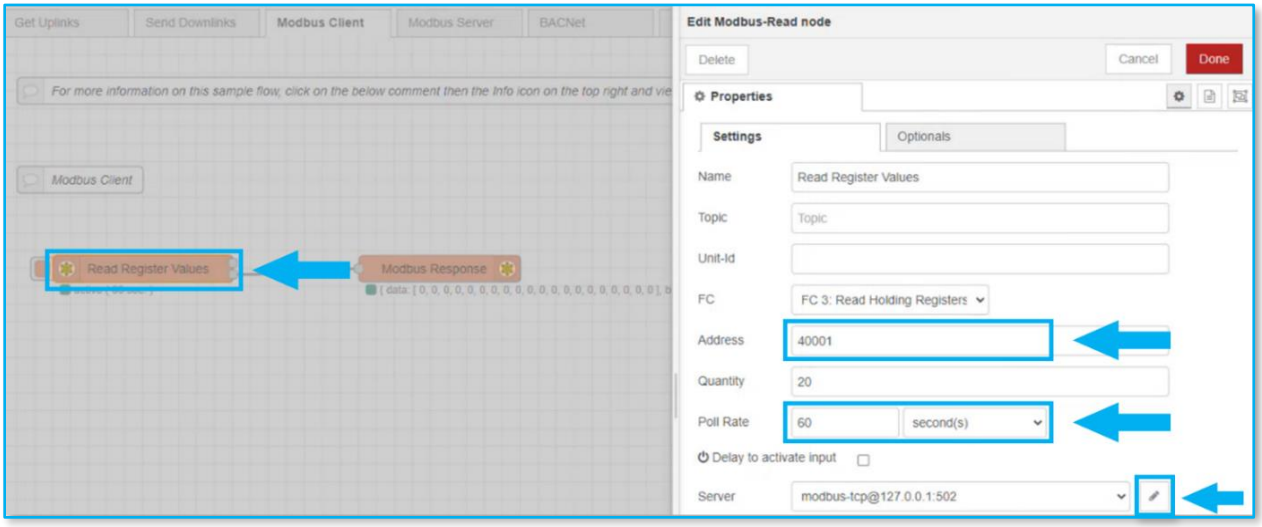
3. On the incoming warning message, click **View nodes**.



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



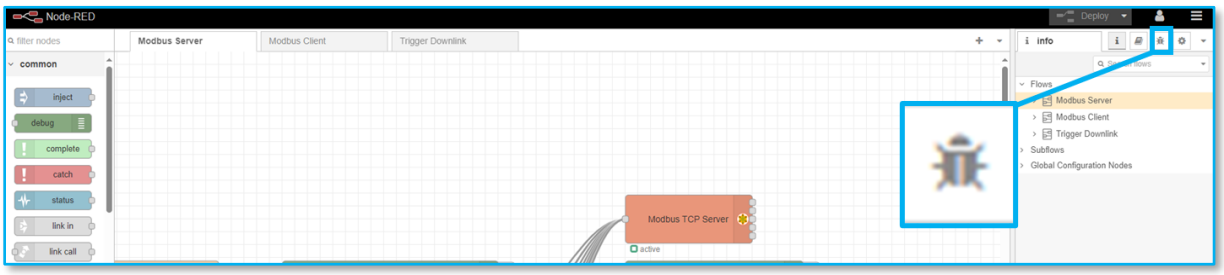
5. In Modbus Client flow in Read Register Values node:
   - Address: 40001
   - Quantity: 20 (means read 20 registers starting at the 40001 Modbus register address)
   - Poll Rate: 60 seconds (value update time period)
   - Update the server address



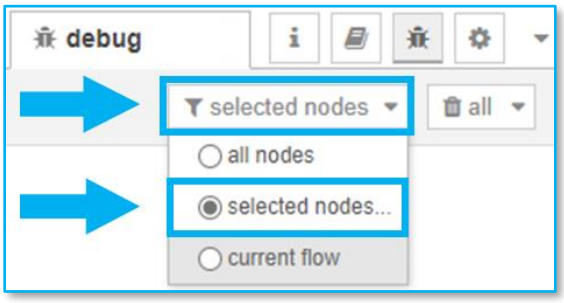
6. Deploy changes. After that you can activate push button to read the Modbus register values.

4.4 View Uplink Messages

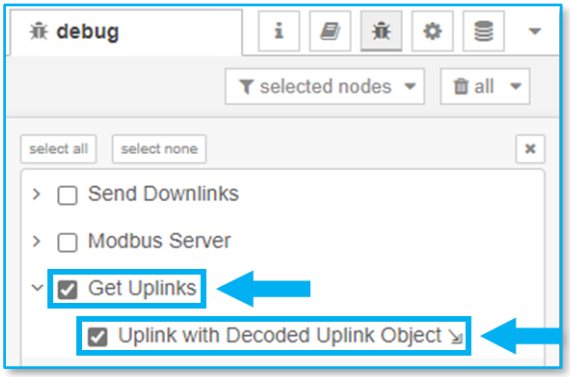
1. In a right panel select the debug icon represented by a bug.



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.