

Modbus User Guide

RF-LW-MODB

LoRaWAN Wireless Modbus Bridge

- LoRaWAN long range wireless
- Externally powered 12-24V
- Modbus RTU RS485



Modbus



LoRaWAN Wireless



EasySetup

Modbus instantly converts wired Modbus devices such as meters, PLC's and sensors to LoRa long range wireless. Any instrument, device or sensor with a wired Modbus RS485 interface can be read and converted to a wireless device. Modbus register values are transmitted to the cloud using long range LoRa wireless where the device data can be displayed and analysed. A built in USB port allows all parameters including Modbus parameters, wireless signal strength and wireless network configuration to be viewed and set using simple menus via any USB enabled host such as a PC or Mac.

Features

- Up to 32 Modbus registers per Modbus unit
- Modbus RTU RS485
- LoRa long range wireless
- Frequency Range 863-870MHz*
- Frequency Range 902-928MHz*
- Up to +18dBm Tx Power
- Built in USB port for power and configuration
- Mains powered
- CE compliant
- RoHS compliant
- Made in the UK

*Model dependent, see Selection Guide section

- Up to 32 Modbus registers per Modbus unit
- 2-part Screw terminals, 2 x RS485 connectors

1. Introduction

LoRa devices can be configured using OTAA (Over-the-Air-Activation) or ABP (Activation-byPersonalisation).

OTAA is the most secure way to connect a device to the LoRa network. In OTAA, the device performs a Join procedure with the network, during which a dynamic DevAddr (device address) is assigned and security keys are negotiated with the device.

ABP allows you to set the DevAddr as well as the security keys in the module. This is simpler than OTAA as there is no Join procedure, however, it is less secure than OTAA.

This guide will illustrate using OTAA as it is the most secure and flexible method.

The OTAA configuration requires the following parameters to be correctly set:

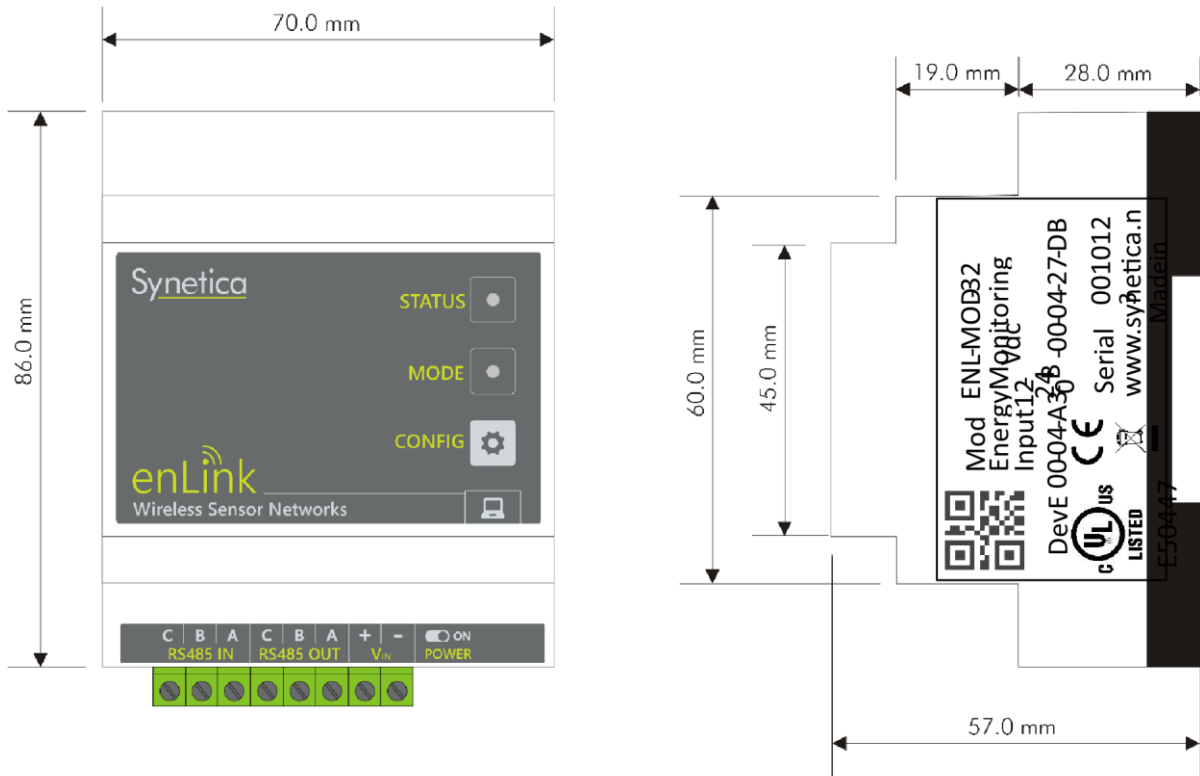
- DevEUI: End-device Identifier. It is unique for every device and is set at device manufacture.
- AppEUI: Application Identifier. Used to identify the end application.
- AppKey: Application key. Used to create the session keys.

Providing the LoRa gateway has the matching keys the join process will happen automatically once the Modbus unit is in wireless range and switched on.

The DevEUI is always set at device manufacture and is unique. The device AppEUI and AppKey can easily be set via the USB connection if required and the process is detailed later in this document.

2. Join devices to the LoRaWAN network

Devices in wireless range and with the correct AppEUI and AppKey settings set will automatically join the LoRaWAN network when they are first powered up.



Modbus Unit and Label

The unique **DevEUI** is printed on all devices and is also present in the QR code. The **DevEUI** can be used to identify the device once joined to the network.

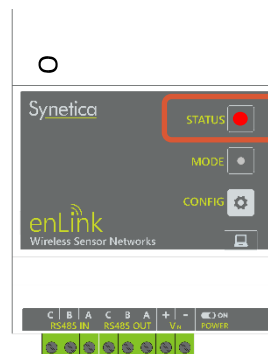
Apply input power to the unit by connecting a 12 to 24V power source to the Vin terminals.

To power the device ON, slide the **POWER** switch to the right to the **ON** position as shown below.



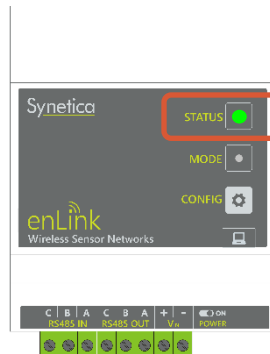
Switch to the ON position

Once powered ON, the device will send a Join request message to the Conduit. The Status LED will blink RED as shown below whilst the Join process is taking place. Depending on factors such as signal strength, RF interference etc the Join process may take several seconds to complete.



Blinking Red LED – Attempting Join

When the device has successfully joined the network the Status LED will blink GREEN for several seconds to show that the Join has been completed. The LED's will then switch off to conserve the batteries.



Blinking Green LED – Device Successfully Joined

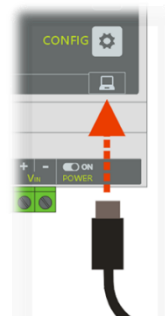
3. Setting / changing the LoRa keys

If the LoRa gateway has matching keys the join process will happen automatically once the Modbus unit is in wireless range and switched on.

The DevEUI is always set at device manufacture and is unique. The device **AppEUI** and **AppKey** can easily be set via the USB connection as detailed below.

Connect a micro USB cable to the unit.

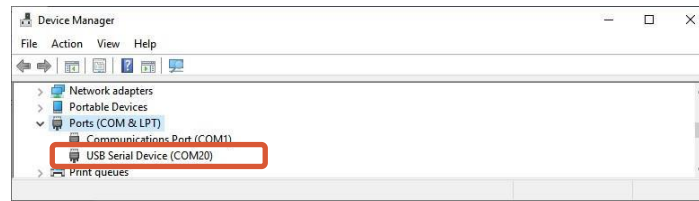
When the USB is connected, the unit does not use the voltage from the host PC to power itself, so requires external power.



The device will attach to a COM port on your PC.

Using a terminal program (e.g. Teraterm <https://tssh2.osdn.jp/>) connect to the COM port used by the device.

To verify which COM port is being used, check the Windows™ Device Manager (In Windows - Click the **Start** button, type **device manager** into the search box and tap **Device Manager** on the menu.) Expand the **Ports (Com & LPT)** menu as shown below.

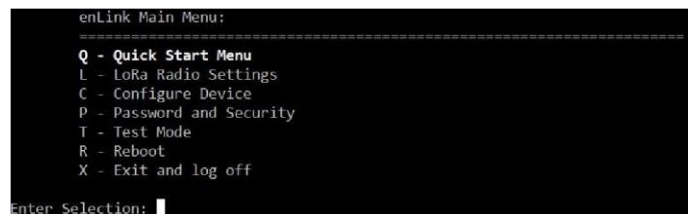


In your terminal program press the **Enter** key. A summary screen will appear as shown below. The default password is the last four digits of the displayed **DevEUI**, in the screen below this is 83ed.



logon screen

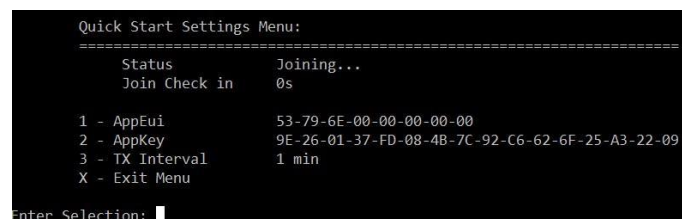
The screen below will show with the Main Menu options. Enter **Q** to enter the **Quick Start Menu**.



Main Menu

The **Quick Start Menu** contains only the parameters that normally need to be configured to setup the device and join the LoRa network.

From the **Quick Start Menu** you can change the **AppEUI** and **AppKey**.



Quick Start Settings Menu

From the **Quick Start Settings Menu**, access the **AppEUI** setting by entering **1**. Enter the 16 character **AppEUI** using numbers and letters a to f. Do not include spaces or any other characters. Pressing **S**

will enter the default **AppEUI** which you can then edit. Press **Enter** when the key is correctly entered to return to the **Quick Start Settings Menu**.

```
Enter Selection: 9
Current Setting: AppEui = 53-79-6E-00-00-00-00-00
Enter a new 16 character EUI using only numbers and the letters A to F (no separators)
Hit <S> to enter the default value: 53-79-6E-00-00-00-00-00
-----
New EUI: 53796E0000000000
```

AppEUI setting

From the **Quick Start Settings Menu** access the **AppKey** setting by entering **2**. Enter the 32 character **Appkey** using numbers and letters a to f. Do not include spaces or any other characters. Pressing **S** will enter the default **AppKey** which you can then edit. Press **Enter** when the key is correctly entered to return to the **Quick Start Settings Menu**.

```
Enter Selection: 10
Current Setting: AppKey = 9E-26-01-37-FD-08-4B-7C-92-C6-62-6F-25-A3-22-09
Enter a new 32 character EUI using only numbers and the letters A to F (no separators)
Hit <S> to enter the default value: 9E-26-01-37-FD-08-4B-7C-92-C6-62-6F-25-A3-22-09
-----
New EUI: 9E260137FD084B7C92C6626F25A32209
```

AppKey setting

Press **X** from the **Quick Start Settings Menu** to return to the Main menu.

The header will show **** Reboot Required **** as shown below. The new key settings will not take effect until the device is restarted. Enter **R** to reboot followed by **OK**. The device will restart with the entered **AppEUI** and **AppKey** and attempt to join the LoRa network.

```
enLink Main Menu: ** Reboot Required **
-----
Q - Quick Start Menu
L - LoRa Radio Settings
C - Configure Device
P - Password and Security
T - Test Mode
R - Reboot
X - Exit and log off
Enter Selection: |
```

Reboot Required notification

Check your LoRaWAN network server to verify that the device has joined successfully.

4. Import / Export Modbus Configuration

The Modbus menu allows you to save and set Modbus configuration data so it can be backed up and easily used on multiple Modbus units for rapid configuration.

5. Export Settings

To Export the settings, follow the steps below.

From the main menu enter **c** for Configure Device.

```
enLink Main Menu:
=====
Q - Quick Start Menu
L - LoRa Radio Settings
C - Configure Device
P - Password and Security
T - Test Mode
R - Reboot
Enter Selection: |
```

Main menu

```
Modbus Configuration Menu:
=====
B - Baud Rate          9600
D - Data Bits          8
P - Parity              None
S - Stop Bits          1
R - Retries            3
T - Timeout            2000 ms
I - Inter Message Delay 150 ms
-----
C - Configure Data Points 13/32
M - Import/Export
A - Read All Data Points 13/0 (OK/Exceptions)
L - Loop Read All (hit 'x' to exit)
-----
? - Show Exception Code Help
X - Exit Menu
Enter Selection: |
```

Modbus menu

Next select **m** for Import / Export followed by **e** for Export.

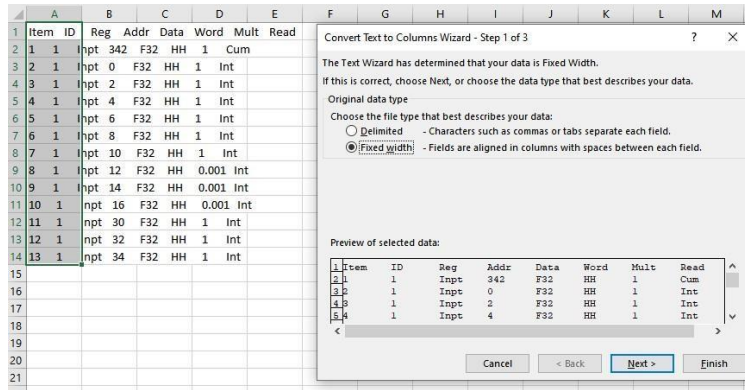
The current settings will appear as text in a table, an example is shown below:

```
Item  ID  Reg  Addr  Data  Word  Mult  Read
1     1   Inpt 342   F32   HH    1     Cum
2     1   Inpt 0     F32   HH    1     Int
3     1   Inpt 2     F32   HH    1     Int
4     1   Inpt 4     F32   HH    1     Int
5     1   Inpt 6     F32   HH    1     Int
6     1   Inpt 8     F32   HH    1     Int
7     1   Inpt 10    F32   HH    1     Int
8     1   Inpt 12    F32   HH    0.001 Int
9     1   Inpt 14    F32   HH    0.001 Int
10    1   Inpt 16    F32   HH    0.001 Int
11    1   Inpt 30    F32   HH    1     Int
12    1   Inpt 32    F32   HH    1     Int
13    1   Inpt 34    F32   HH    1     Int

Copy the table above and paste into a text or spreadsheet editor
Press a key to continue: |
```

Exported configuration settings

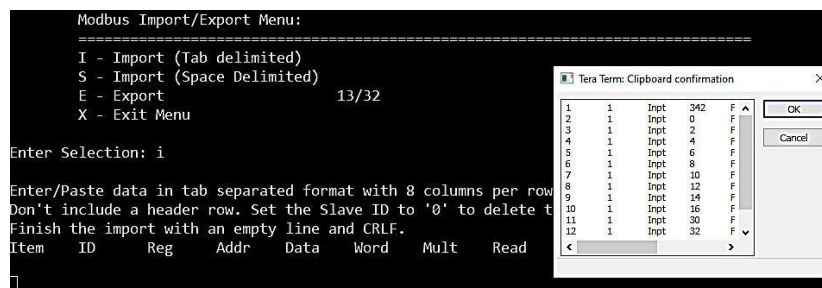
Copy the table by highlighting the table and then select Alt-C on the keyboard to copy the table to the clipboard. You can now paste this into a spreadsheet such as Excel. Convert the data to columns for easy editing by selecting Data tab and “Text to column” with fixed width as the data type as shown below.



Excel File

6. Import Settings

To import a saved configuration file, select **m** (for Import / Export) from the Modbus menu and then **i** to Import (Tab delimited). Copy the configuration table from your spreadsheet file onto the clipboard and then in TeraTerm right click in the window and a pop-up dialogue with the pasted clipboard information will show. See below. Select OK from the dialogue and the configuration table will import. Press return to complete the process.



Paste configuration table into TeraTerm

```

Enter/Paste data in tab separated format with 8 columns per row.
Don't include a header row. Set the Slave ID to '0' to delete the configuration item.
Finish the import with an empty line and CRLF.
Item  ID    Reg  Addr  Data  Word  Mult  Read
1      1     Inpt  342   F32   HH     1     Cum ... imported OK
2      1     Inpt   0     F32   HH     1     Int ... imported OK
3      1     Inpt   2     F32   HH     1     Int ... imported OK
4      1     Inpt   4     F32   HH     1     Int ... imported OK
5      1     Inpt   6     F32   HH     1     Int ... imported OK
6      1     Inpt   8     F32   HH     1     Int ... imported OK
7      1     Inpt  10     F32   HH     1     Int ... imported OK
8      1     Inpt  12     F32   HH     0.001 Int ... imported OK
9      1     Inpt  14     F32   HH     0.001 Int ... imported OK
10     1     Inpt  16     F32   HH     0.001 Int ... imported OK
11     1     Inpt  30     F32   HH     1     Int ... imported OK
12     1     Inpt  32     F32   HH     1     Int ... imported OK
13     1     Inpt  34     F32   HH     1     Int ... imported OK

Import Finished. Results:
Item  ID    Reg  Addr  Data  Word  Mult  Read
1      1     Inpt  342   F32   HH     1     Cum
2      1     Inpt   0     F32   HH     1     Int
3      1     Inpt   2     F32   HH     1     Int
4      1     Inpt   4     F32   HH     1     Int
5      1     Inpt   6     F32   HH     1     Int
6      1     Inpt   8     F32   HH     1     Int
7      1     Inpt  10     F32   HH     1     Int
8      1     Inpt  12     F32   HH     0.001 Int
9      1     Inpt  14     F32   HH     0.001 Int
10     1     Inpt  16     F32   HH     0.001 Int
11     1     Inpt  30     F32   HH     1     Int
12     1     Inpt  32     F32   HH     1     Int
13     1     Inpt  34     F32   HH     1     Int

Press a key to continue: █
  
```

Successfully imported configuration table.

Test your settings by selecting a from the Modbus menu to read all data points as shown below.

```
For the following, you can press <Return> to select the
default value in brackets [], or you can enter a new value.

Read All Data Points Options:
=====
N - Normal <==
D - Detailed

Enter Selection [Normal]:

--- Modbus RTU Initialised: 9600 8 None 1
--- Retries: 3 Timeout: 2000 ms IMD: 150 ms
-----
--- [ 1] Reading: 71.901711
-----
--- [ 2] Reading: 236.480103
-----
--- [ 3] Reading: 0
-----
--- [ 4] Reading: 0
-----
--- [ 5] Reading: 0.031823732
-----
--- [ 6] Reading: 0
-----
--- [ 7] Reading: 0.142522
-----
--- [ 8] Reading: 0.0033794984
-----
--- [ 9] Reading: 0
-----
--- [10] Reading: 0
-----
--- [11] Reading: 0.470523
-----
--- [12] Reading: 1
-----
--- [13] Reading: -1
-----

Modbus read completed
Press a key to continue: █
```

Read Modbus registers

