



enLink Status-L

USER GUIDE

LoRaWAN Wireless Water Leakage Sensor



Contents

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1. Introduction	4
2. Configuration	4
3. Join enLink devices to the LoRaWAN network	5
4. Setting / Changing the enLink LoRaWAN Keys	6
5. Setting / changing the transmit interval	9
6. Setting / Changing the Leak Detection Threshold	10
7. Water Leak Cable Connections	12
8. System Testing	13
9. Battery Installation / Replacement	14
10. LoRaWAN Payload Decoder	15
11. Technical Support	15

1. Introduction

enLink Status-L Water Leak Sensor helps protect your critical infrastructure from water related damage which could be caused by issues like faulty HVAC systems, leaks in pipes and adverse weather conditions.

The unit detects the presence of water using a special conductive water detection cable. The leak detection sampling interval and detection thresholds can be user configured for the application. Adaptive LoRaWAN transmission interval immediately notifies a detection event together with regular "heartbeat" status messages for assurance that the system is operating correctly.

2. Configuration

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

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 / JoinEUI*: Application Identifier. Used to identify the end application.
- AppKey: Application key. Used to create the session keys.

**Note: In LoRaWAN 1.1, AppEUI was renamed to JoinEUI.*

For many applications Synetica can supply enLink Status-L units with the above parameters pre-configured, so providing the LoRa gateway has the matching keys the join process will happen automatically once the enLink Status-L 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.

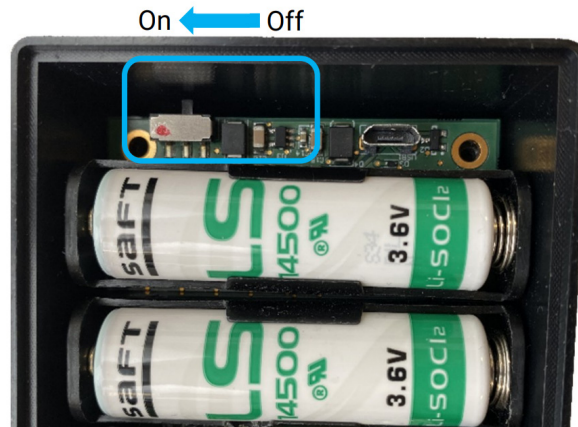
3. Join enLink devices to the LoRaWAN network

enLink 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.

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

To power the device ON, remove the cover of the enLink Status by unscrewing the two screws on the cover.

Locate the power switch and using small screwdriver gently slide the power switch towards the ON position as shown.



Switch to the On Position

Once powered ON, the enLink device will send a Join request message to the LoRaWAN network server. 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 to Join

When the device has successfully joined the network the Mode LED will blink GREEN five times 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

4. Setting / Changing the enLink LoRaWAN Keys

For many applications, Synetica can supply enLink units with the LoRaWAN AppEUI and AppKey parameters pre-configured to your requirements, whereby if the LoRa gateway has matching keys the join process will happen automatically once the unit is in wireless range and switched on.

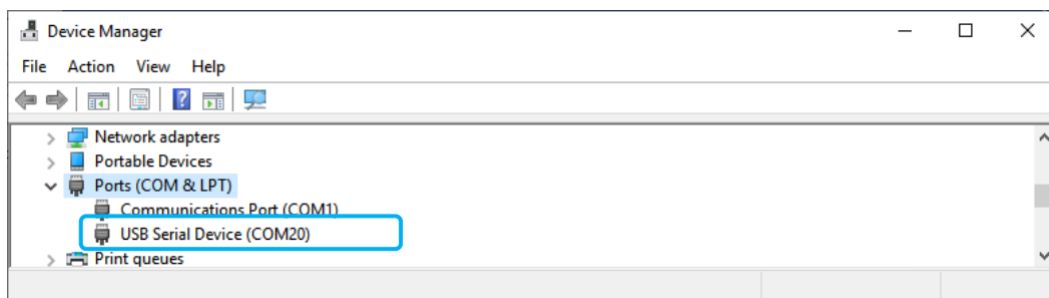
The DevEUI is always set at device manufacture and is unique. The device AppEUI and AppKey can easily be set via the USB connection as detailed below.

Connect a micro USB cable to the enLink unit. The device will attach to a COM port on your PC.

Using a terminal program (e.g. Tera Term <https://github.com/TeraTermProject/teraterm/releases>) connect to the COM port used by the enLink device.

See Synetica document “Configuring enLink Devices Using Serial Terminal Applications” for more details including using PuTTY and serial applications that will operate on Apple and Linux computers.

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. An enLink 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 ea1f.

```

COM4 - Tera Term VT
File Edit Setup Control Window Help
-----
Synetica - enLink :: Wireless Sensor Networks
-----
Region:      European band on 868MHz
Firmware Code: FW-ST5-L-400
Firmware Ver: 6.14
Description: enLink Status - Leak Detector
DevEui:      00-04-a3-0b-01-2d-ea-1f
-----
Password: █
  
```

enLink Logon Screen

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

```

COM5 - Tera Term VT
File Edit Setup Control Window Help

enlink Main Menu:
=====
Q - Quick Start Menu
L - LoRa Radio Settings
C - Configure Device
P - Password and Security
T - Test Mode
R - Reboot
F - Factory Reset
X - Log off

Select an option:
  
```

enLink 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**.

```

COM5 - Tera Term VT
File Edit Setup Control Window Help

enlink Quick Start Menu:
=====
Status                Joining...
Join Check in         0s

DevEui                00-04-a3-0b-00-08-2f-a5
E - AppEui            53-79-6e-00-00-00-00-00
K - AppKey            08-34-5e-d2-a4-a1-5a-1e-00-cd-16-2a-1b-b9-91-f7
T - Transmit Interval 30 mins
X - Exit Menu

Select an option:
  
```

Quick Start Settings Menu

From the **Quick Start Settings Menu**, access the **AppEUI** setting by entering **E**. 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. R will set a random AppEUI. Press **Enter** when the key is correctly entered to return to the **Quick Start Settings Menu**.

```

E - AppEui            53-79-6e-00-00-00-00-00
K - AppKey            e6-ba-6c-c9-61-87-47-75-9d-13-e4-e0-9a-5f-40-0d
T - Transmit Interval 15 mins
X - Exit Menu

Select an option: e

Enter a new 16 character AppEUI using only numbers and the letters A to F (no separators)
Hit <S> to enter the default value or <R> for a random value

Current Setting: AppEUI = 53-79-6e-00-00-00-00-00

-----
New AppEUI: 53796e0000000000
  
```

AppEUI Setting

From the **Quick Start Settings Menu** access the AppKey setting by entering **K**. 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. R will set a random AppKey. Press **Enter** when the key is correctly entered to return to the **Quick Start Settings Menu**.

```

E - AppEui          53-79-6e-00-00-00-00-00
K - AppKey          e6-ba-6c-c9-61-87-47-75-9d-13-e4-e0-9a-5f-40-0d
T - Transmit Interval 15 mins
X - Exit Menu

Select an option: k

Enter a new 32 character AppKey using only numbers and the letters A to F (no separators)
Hit <S> to enter the default value or <R> for a random value

Current Setting: AppKey = e6-ba-6c-c9-61-87-47-75-9d-13-e4-e0-9a-5f-40-0d

-----
New AppKey: █

```

AppKey Setting

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

The header will show **** Reboot Required **** as shown below. The new key settings will not take effect until the enLink 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 Quick Start Menu:  ** Reboot Required **
-----
      Status          Joined 9s ago
      Join Check in   9m 5s

      DevEui          00-04-a3-0b-01-2e-08-72
E - AppEui          53-79-6e-00-00-00-00-00
K - AppKey          08-34-5d-d3-a4-a1-59-1e-ff-cc-15-2a-1b-b9-91-f6
T - Transmit Interval 30 mins
X - Exit Menu

Select an option:

```

Reboot Required Notification

5. Setting / changing the transmit interval

Access the Transmit Interval setting by entering T from the quick start menu.

```
Transmit Interval:
=====
1 - 30 s
2 - 1 min
3 - 2 mins
4 - 5 mins
5 - 10 mins
6 - 15 mins <==
7 - 20 mins
8 - 30 mins
9 - 60 mins
10 - 2 hours
11 - 3 hours
A - Adaptive
I - Adaptive Min interval: 5 mins
M - Adaptive Max interval: 60 mins
X - Exit Menu

Enter Selection: █
```

Transmit Interval Settings

The transmit interval can be at fixed interval, or “adaptive”. Adaptive is recommended as when a leak event is detected a LoRaWAN message can be sent immediately, rather than waiting for the scheduled time.

If a fixed transmit interval is used, 15 minutes or longer is recommended to extend battery life.

To select **Adaptive Transmit Interval** select the **A** option and then change the settings for the **Adaptive Min Interval** and **Adaptive Max Interval** as required.

With adaptive transmit interval set, when a change of alarm state occurs a wireless message is sent immediately, however messages will not be sent more frequently than the **Adaptive Min Interval**. The **Adaptive Max Interval** acts like a heartbeat, so if no change of alarm state occurs then a message is sent at the **Adaptive Max Interval**.

Press **Enter** when the key is correctly entered to return to the **Quick Start Settings Menu**.

The Transmission Interval may also be changed using a LoRaWAN downlink message. See “<https://github.com/synetica/enlink-decoder?tab=readme-ov-file#downlink-message-index-tables>” for more details and example downlink messages.

6. Setting / Changing the Leak Detection Threshold

The leak detection threshold can be changed to adjust the sensitivity to water.

From the **Main Menu** access the configuration menu by entering **C**. This screen will display the current device temperature, humidity and Leak Detect parameters including the rope resistance and leak detection status.

```

COM20 - Tera Term VT
File Edit Setup Control Window Help

Sensor Readings:
-----
  Temperature/Humidity          25.8°C / 53%
-- ADC - Leak Sensor
  Reading                       0.40 kOhms
  Leak status                   LEAK DETECTED
  ADC raw reading/input voltage 5 / 4 mV
  Alarm Mode                    Low threshold alarm
  Leak detection Alarm Options   Below 400.0 ±100.0 kOhms
  Sample interval               30s

Device Options:
-----
D - Live readings display
A - ADC - Leak Sensor
X - Exit Menu

Select an option: █

```

Enter **A** to view the **ADC menu**.

```

Select an option: a

ADC - Leak Sensor:
=====
M - Select Alarm Mode          Low threshold alarm
O - Leak detection Alarm Options Below 1000.0 ±100.0 kOhms
S - Set sample interval        10s
T - Set test duration          5 minutes
X - Exit Menu

Enter Selection: █

```

The **M** option allows the alarm mode to be set. This should be set to Low threshold alarm.

```

Leak Detection Alarm Mode:
=====
N - No threshold alarm
H - High threshold alarm
L - Low threshold alarm      <==
X - Exit Menu

Select an option: █

```

The **O** option allows the leak detection threshold to be set according to the required sensitivity. The defaults are:

- L - Lower bound alarm level 400.0 k Ohms
- Y - Lower bound hysteresis ±100.0 k Ohms

```
Options for leak detection rope - Mode: Low threshold alarm:
```

```
=====
L - Lower bound alarm level          400.0 kOhms
Y - Lower bound hysteresis          ±100.0 kOhms
X - Exit Menu
```

```
Enter Selection: █
```

The **S** option allows the sample interval to be set. This is the frequency that the leak rope is sampled to check if an alarm condition exists. The minimum sampling interval is 10 seconds. Sampling the leak detection rope more frequently will drain the batteries more quickly, so a balance between sampling interval and battery life should be considered.

```
Select an option: a
```

```
ADC - Leak Sensor:
```

```
=====
M - Select Alarm Mode                Low threshold alarm
O - Leak detection Alarm Options      Below 1000.0 ±100.0 kOhms
S - Set sample interval              10s
T - Set test duration                 5 minutes
X - Exit Menu
```

```
Enter Selection: █
```

The **T** option allows the test duration to be set.

Below is the description of how the test is done. The test will ensure that the sensor is working correctly without having to connect to a PC or laptop. The test duration goes from 1 minute, until 20 minutes, the frequently used test duration is 5 minutes.

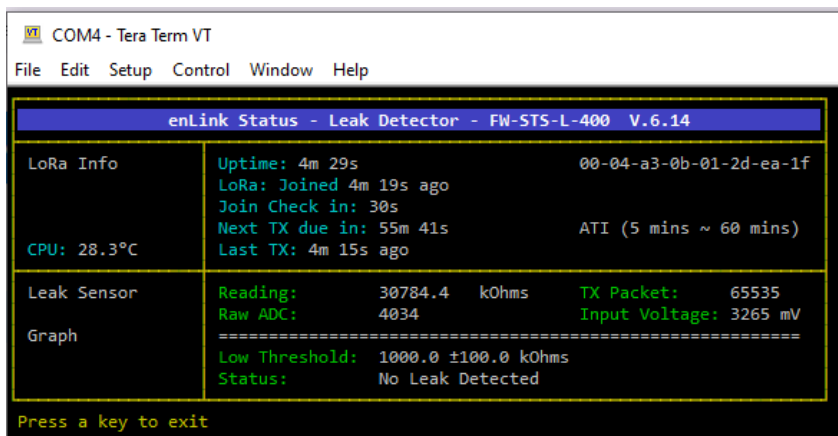
```
Enter Selection: t
```

```
The leak test is started with a 'long' button press of over 1 second.
You can stop the test with a short button press.
When running, both LEDs will flash quickly to show the test is active.
```

```
When a leak is detected, the RED Status LED will stay illuminated.
```

```
Enter the duration for the test in minutes (1 to 20, normally '5') [5 mins]: █
```

From the configuration menu, the **D** option displays live readings.



The **Live Display Menu** above can be used to verify the sensitivity settings before deployment.

7. Water Leak Cable Connections

enLink Status-L has an 8-way terminal block with screwless terminals for rapid connection of the leak cable. The cable is not polarity sensitive, so either cable can be attached in any order. Attach the leader cable to the terminals as shown below:

Terminal Number	Function
1	Leak Cable
2	Leak Cable
3	Not Used
4	Not Used
5	Not Used
6	Not Used
7	Not Used
8	Not Used

The connector is designed to accommodate the following cable sizes with a minimum of 10mm strip length.

- Connection capacity (single-wire): 0.2 – 0.5 mm²
- Connection capacity (single-wire): AWG 26 - 20

Water Detection Cable Characteristics

Designed specifically to detect water anywhere along its entire length, the water detection cable is constructed with individual spacer cables and two stainless steel sensor wires all welded together to form a single cable with an overall diameter of 3mm. The cable is flexible and can be wiped clean to remove contaminants or water.

Areas requiring monitoring for water leaks can be fitted with various lengths of water leak detection cable. The water detection cable will detect water anywhere along its length giving better coverage than conventional spot probes.

Cable Specification

- Overall diameter: 3mm
- Each Signal cable: 16/0.2mm (0.5mm) 3amp 110vac to IEC 189-3
- Sensor wires: Annelid 0.4mm diameter Stainless Steel
- Sensor resistance: 7 Ω per metre per sensor wire (14 Ω per cable metre)
- Sensor spacing: 9mm
- Maximum continuous Length: 100 metres

Positioning the Water Detection Cable

The detection cable is susceptible to damage and should not be fitted to areas where the cable is likely to be damaged or walked on. If fitting the cable around Air Conditioning Units with humidifiers, ensure that the cable is positioned at least one metre from the AC unit to help prevent intermittent alarms being generated from humidity or water droplets from the AHU.

Clean the area where the cable will be installed, to remove debris and sources of contamination.

Fit the leak detection cable using insulated 3.5mm cable clips or P-clips. Metal clips should not be used as they will conduct electricity causing false alarms. Clips should be fitted approximately every 1 to 1.5 metres apart. Ensure that the cable touches the floor between the clips, DO NOT tighten the cable so that the cable does not touch the floor. Do not allow the cable to twist or the exposed stainless conductors to touch together.

Tools or heavy objects can damage sensing cable. Avoid rolling, dropping, or setting heavy items on sensing cable.

Do not use adhesive tapes or clamping devices to secure the sensing cable.

8. System Testing

To check that the unit is operating correctly, immerse a small area (50mm long) of the water detection cable into a vessel containing clean water and view the Leak Status on the Live Display screen. Verify that a LoRaWAN message is sent to the application.

The cable will need to be completely dry before the leak status returns to normal.

9. Battery Installation / Replacement

enLink devices use SAFT LS14500 or EVE ER14505 AA size 3.6 Volt Lithium Thionyl Chloride (Li-SOCl₂) batteries (non-rechargeable) or direct equivalent.

No other batteries are approved for use in the device.

Lithium Thionyl Chloride batteries have very high energy capacity and must be used and handled with care observing the guidance below.

WARNING! Risk of death or serious injury from explosion or fire



- Keep out of sight and reach of children.
- Fire, explosion and burn hazard - do not recharge, short circuit, crush, disassemble, incinerate.
- Due to the high terminal voltage (3.6V), they are not suitable as direct replacements for other battery technologies in the same can sizes.
- When not in use the Batteries must be stored in a non-hazardous area.
- Do not change batteries in an explosive gas atmosphere.
- When installing batteries, do not snag the battery terminal on the clip or the battery may be damaged. Do not apply excessive force.
- Do not drop. Dropping the battery may cause damage. If a battery is dropped, do not install the dropped battery into the unit
- Dispose of dropped battery promptly per local regulations or per the battery manufacturer's recommendations.

GUIDANCE

- Always install the batteries correctly as per instructions taking great care to observe the battery polarity.
- Ensure that the contact points are clean and conductive.
- All batteries must be the same model from the same manufacturer.
- Do not mix old and new batteries or batteries from different manufacturers.
- Do not heat or attempt to recharge the battery.
- Do not dispose of in a fire.
- Only install approved batteries: SAFT LS14500 or EVE ER14505 Lithium-thionyl chloride AA battery 3.6 volt, or direct equivalent.

SAFE DISPOSAL



- Please recycle responsibly, a wide range of schemes are available.
- Do not dispose of in normal waste or in a fire.

10. LoRaWAN Payload Decoder

The latest LoRaWAN payload decoders and guides are available on the Synetica GitHub repository:

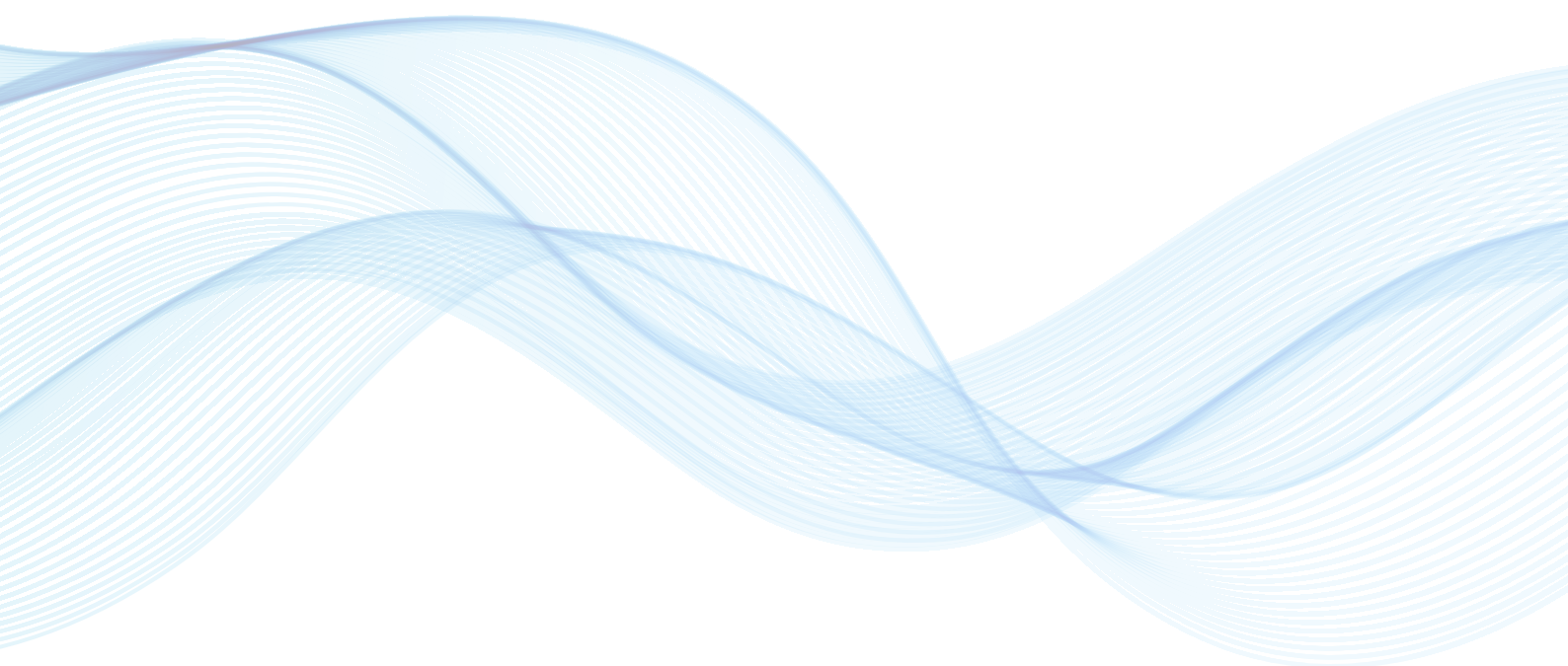
<https://github.com/synetica/enlink-decoder>

A live payload decoder which allows you to paste LoRa payloads in Hexadecimal or Base 64 and see the correctly decoded results can be found at the link below:

<https://synetica.github.io/enlink-decoder/>

11. Technical Support

For technical assistance, please visit the downloads section of our web site at www.synetica.net or email us at support@synetica.net



About us

Synetica was established in 2008 with the simple idea to revolutionise air quality monitoring, energy usage and remote asset monitoring. Our global customer base relies on our expertise to help them reduce emissions and clean up the air they breathe by allowing them to monitor their energy usage and key environmental parameters via the touch of a button.

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