



RF-LW-GP I USER GUIDE

LoRaWAN Gauge
Pressure Sensor

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RF-LW-GP1 User Guide

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RF-LW-GP1

LoRaWAN Gauge Pressure Sensor

RF-LW-GP1, LoRaWAN Pressure Sensor measures gauge pressure with industry leading accuracy ensuring managers are quickly alerted to system malfunctions.

The monitor is a vital tool in areas where the need to monitor liquid or gas pressure is paramount, such as medical gases, agri-tech facilities, laboratory, industry and pharmaceutical.

The one-piece 17-4ph stainless construction is suitable for difficult media such as contaminated water, steam, and mildly corrosive fluids.

The RF-LW-GP1 transmits data using long range LoRa wireless which easily integrates with cloud services or on-site systems via Modbus IP to ensure users are kept up to date with operational performance and to generate alerts when necessary.



Features

- Pressure Type: Gauge Pressure
- Ranges available: 0-7 bar, 0-10 bar, 0-350 bar
- Pressure accuracy: $\pm 0.25\%$ FSO (Combined linearity, hysteresis & repeatability)
- Zero offset: -0.5 to 0.5 % FS
- Operating temperature range: -40 – 125°C
- Temperature compensated (from -20 – 85°C)
- Pressure port fitting: $\frac{1}{4}$ " - 19 BSPT
- Wetted material: 17-4PH Stainless Steel
- Proof pressure: 2X Burst pressure: 5X
- Cable length : 1m
- LoRa data parameters: Pressure & Temperature
- Controller Dimensions: 129 x 67 x 41mm
- Sensor Dimensions: 22.25 x 22.25 x 53.34mm
- UKCA, CE, FCC compliant
- Enclosure IP rating: Standard IP40 / NEMA 1
- With optional gasket IP67 / NEMA 4
- Enclosure IP rating: Standard IP40 / NEMA 1
- With optional gasket IP67 / NEMA 4

RF-LW-GP1:

- Robust, one piece stainless sensor for liquid/gas pressure measurement
- Various pressure options available
 - Simple, quick installation
- Easy configuration via USB / downlink
 - LoRa™ wireless, up to 16km range
 - Battery life 3+ years*
 - Signal and battery indicator
 - Made in the UK

1. Introduction

RF-LW-GP1, LoRaWAN Pressure Sensor measures gauge pressure with industry-leading accuracy. It is a vital tool in areas where the need to monitor liquid or gas pressure is paramount, such as the aerospace industry, in laboratory and medical applications, for environmental tests or for a range of manufacturing and engineering processes.

The one-piece 17-4ph stainless-steel construction is suitable for use in environments where material corrosion may occur such as contaminated water, steam, and mildly corrosive fluids. The RF-LW-GP1 transmits data using long-range LoRa wireless which easily integrates with cloud services or on-site systems via Modbus IP to ensure users are kept up to date with operational performance and to generate alerts when necessary.

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 can supply RF-LW-GP1 units with the above parameters pre-configured, so providing the LoRa gateway has the matching keys the join process will happen automatically once the RF-LW-GP1 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. Powering the Unit

To power the device ON, remove the cover of the RF-LW-GP1 by unscrewing the two screws on the cover. Locate the power switch, shown below and using a small screwdriver gently slide the power

switch towards the OFF position.

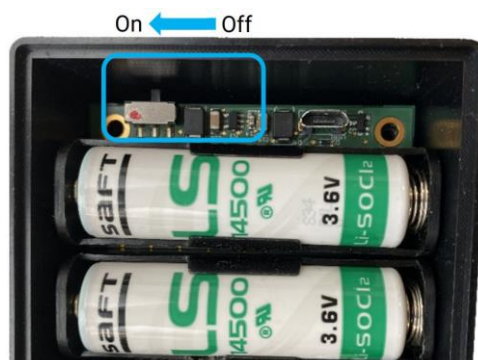
Insert the 2 x AA sized Lithium 3.6V batteries taking great care to insert them the correct way around. Locate the plus (+) and minus (-) signs on the battery and use the plus (+) and minus (-) guides on AA battery holders to insert the batteries in the proper direction. Both batteries face in the same direction.



Be sure to insert the minus (-) end first and remove the plus (+) end first when replacing the batteries.

Lithium batteries have very high energy capacity and a great degree of care should be exercised to ensure that all batteries are new, from the same manufacturer, installed the correct way around and are not in any way damaged. Refer to Section 12 for more details.

Check that the batteries are correctly inserted and then slide the power switch to ON.



Switch to the On Position

Once powered ON, the RF-LW-GP1 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 LoRaWAN Keys and Device Parameters

The unique **DevEUI** is printed on all RF-LW-GP1 devices and is also present in the QR code. The **DevEUI** can be used to identify the device once joined to the network.

For many applications, Synetica can supply RF-LW-GP1 units with the LoRaWAN AppEUI and AppKey parameters preconfigured 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.

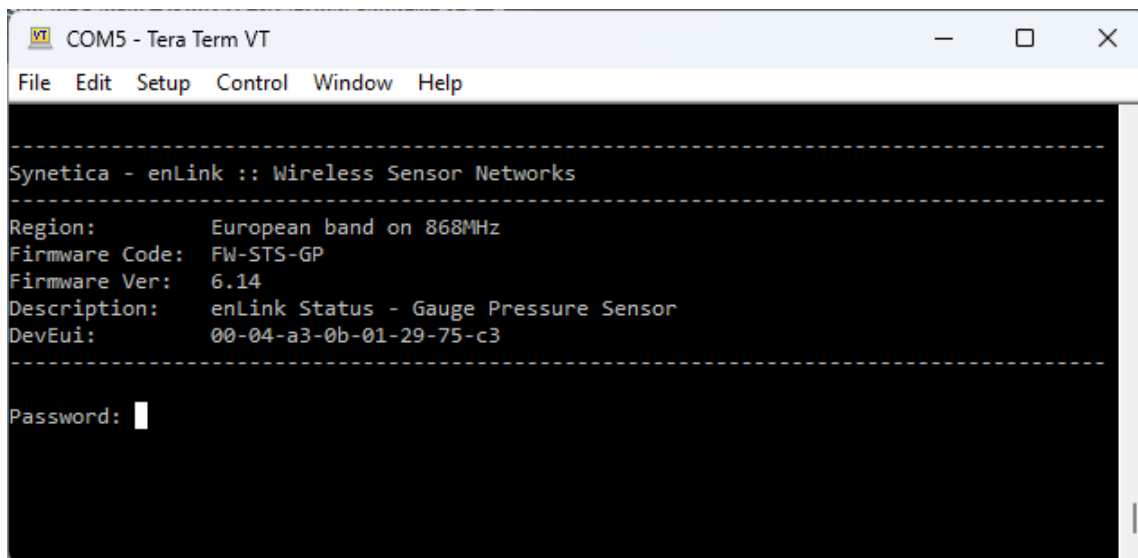
Connect a micro USB cable to the RF-LW-GP1 unit. The device will attach to a COM port on your PC.

Using a terminal program (e.g. Tera Term <https://github.com/TeraTermProject/teraterm/releases>) connect to the COM port used by the RF-LW-GP1 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.

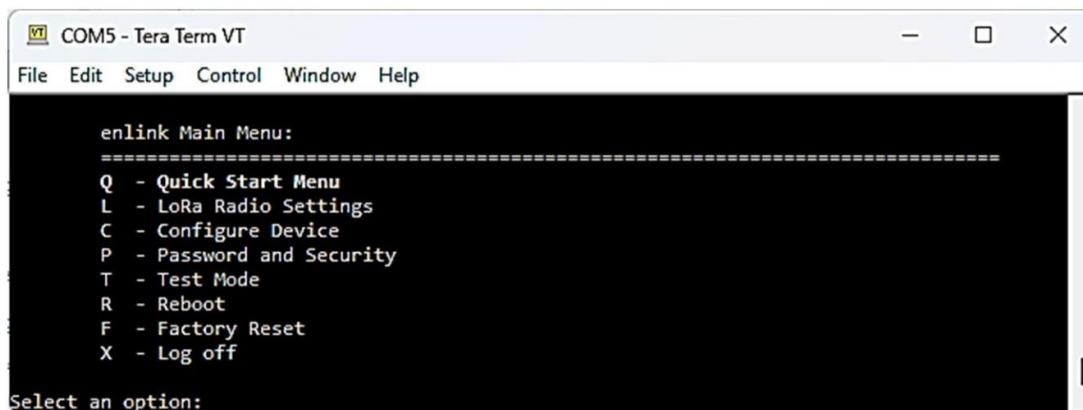


In your terminal program press the **Enter** key. An RF-LW-GP1 summary screen will appear as shown below. The default password is the last four digits of the displayed **DevEUI**, in the screen below this is 75c3.



RF-LW-GP1 Logon Screen

The screen below will show with the RF-LW-GP1 Main Menu options. Enter **Q** to enter the **Quick Start Menu**.



RF-LW-GP1 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. 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. 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 **RF-LW-GP1 Main Menu**.

The header will show **** Reboot Required **** as shown below. The new key settings will not take effect until the RF-LW-GP1 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                    Joining...
Join Check in             0s

DevEui                    00-04-a3-0b-01-29-75-c3
E - AppEui                53-79-6e-00-00-00-00-01
K - AppKey                14-bd-b3-03-81-b9-ff-5f-ad-76-0a-7c-99-f1-d6-58
T - Transmit Interval     30 mins
X - Exit Menu
  
```

Reboot Required Notification

5. Setting / changing the transmit interval

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

```
Select an option: t
Current Setting: Transmit Interval = 30 mins
```

```
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
```

```
Enter Selection:
```

## Transmit Interval Settings

Select a fixed transmit interval from the menu options. 15 minutes or longer is recommended to extend battery life. Press Enter when the key is correctly entered to return to the Quick Start Settings Menu.

## 6. Setting / changing the pressure sensor parameters

The pressure sensor parameters can be offset to compensate for pipe lengths, environmental conditions and sensor drift. Where possible, the zeroing adjustment should be carried out when the sensor is in its measurement position and environment.

From the **Main Menu** access the configuration menu by entering **C**. This screen will display the current device temperature and pressure sensor values and also provide access to live readings.

```
Sensor Readings:
```

```
-- Gauge Pressure Sensor [M32]
```

```
Sensor Max Range 1000 kPa / 10000 mbar
Reading Offset 0.0 kPa / 0 mbar
Raw Reading -0.9 kPa / -9 mbar
Reading -0.9 kPa / -9 mbar
Sensor Temperature 20.3°C
```

```
Device Options:
```

- ```
-----
D - Live readings display
P - Gauge Pressure Sensor
X - Exit Menu
```

```
Select an option: █
```

Configuration Menu

Enter **P** to view the Pressure menu

```
Select an option: p

Gauge Pressure Sensor Options:
=====
R - Set Max Range           1000 kPa / 10000 mbar
O - Set Offset              0.0 kPa / 0 mbar
X - Exit Menu

Select an option: █
```

Enter **R** to change the maximum range of the pressure sensor. The default is 10000 mbar and can be changed between 1 and 60,000 mbar. (1kPa = 10 mbar).

Enter **O** to change the pressure sensor offset. The default is zero and can be changed to +/- 32767.

Enter **X** to return to the **Options** menu.

7. Live Display

From the **Main Menu** access the configuration menu by entering **C**. This screen will display the current device tem- perature, humidity, pressure sensor values and also provide access to live readings.

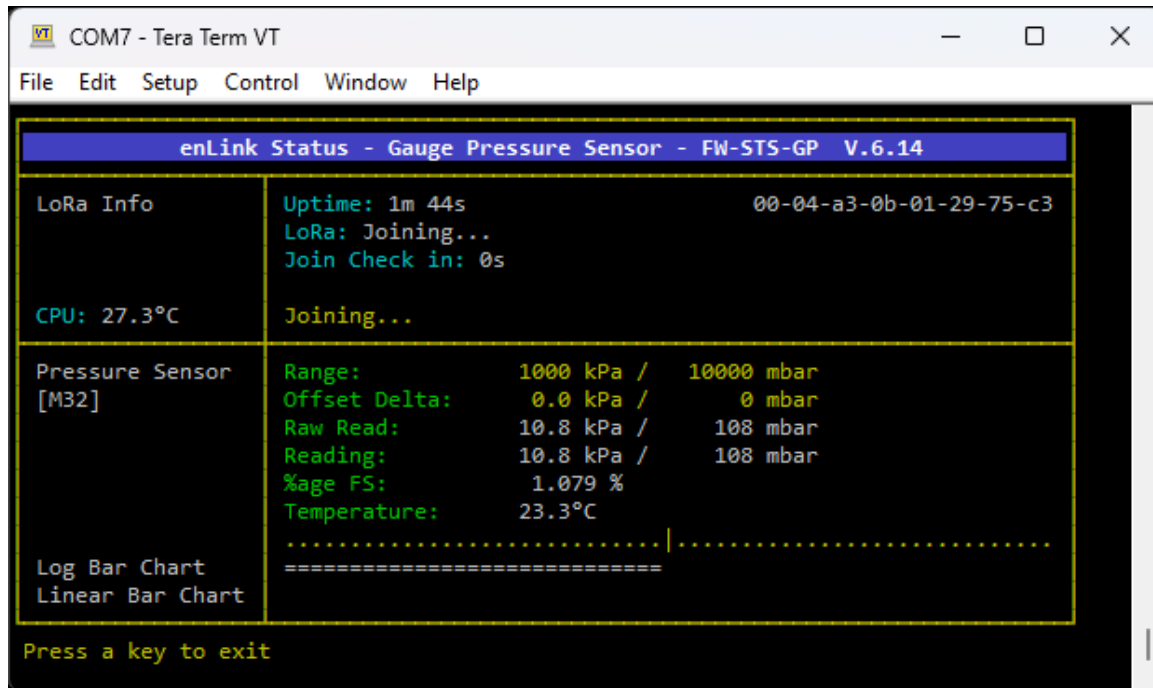
```
Sensor Readings:
-----
-- Gauge Pressure Sensor [M32]
   Sensor Max Range           1000 kPa / 10000 mbar
   Reading Offset             0.0 kPa / 0 mbar
   Raw Reading                -0.9 kPa / -9 mbar
   Reading                    -0.9 kPa / -9 mbar
   Sensor Temperature         25.9°C

Device Options:
-----
D - Live readings display
P - Gauge Pressure Sensor
X - Exit Menu

Select an option: █
```

Configuration Menu

The **D** option displays live readings, which can be used to verify the readings before deployment.



Live Readings Display

8. Battery Installation / Replacement

RF-LW-GP1 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 ER 14505 Lithium-thionyl chloride AA battery 3.6 volt, or direct equivalent.

SAFE DISPOSAL



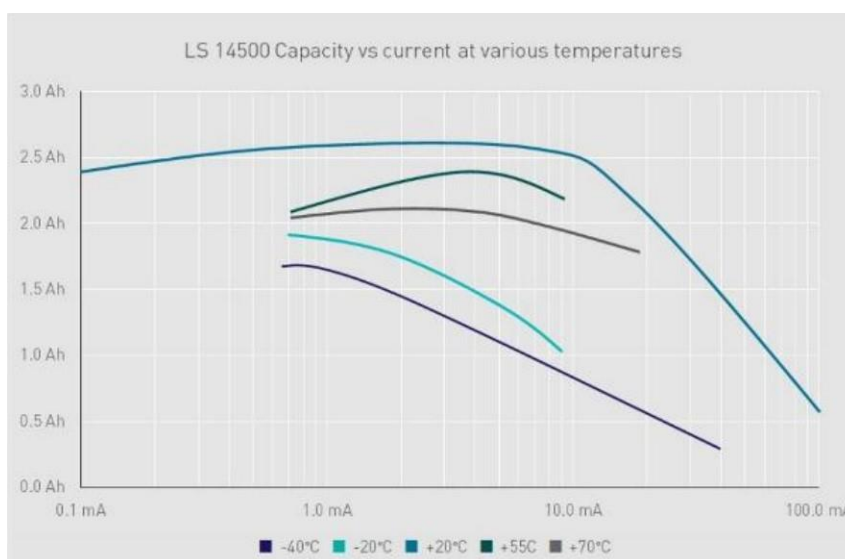
- Please recycle responsibly, a wide range of schemes are available.
- Do not dispose of in normal waste or in a fire.

9. Power Considerations

The device is powered with 2 x 3.6V Lithium-Thionyl chloride (Li-SOCl₂) AA sized batteries.

The pressure sensor consumes additional power while actively sensing and therefore, to prolong battery life, the sampling interval should be set to the longest period practical for the application. Sampling / transmission intervals of less than 15 minutes place strain on the batteries, limiting their capacity and should be avoided if possible.

Battery capacity is dependent on ambient temperatures, and this should be considered when estimating battery life. Low temperatures slow down electrochemical reactions significantly and increase the internal resistance of batteries. High temperature increase the battery self-discharge. The chart below illustrates the effect of temperature on the available battery capacity.



Battery Capacity vs Current at Various Temperatures for SAFT LS14500 Batteries

Battery life is also highly dependent on the LoRa spreading factor used. Higher spreading factors result in longer active times for the radio transceivers and shorter battery life. Positioning devices in closer proximity to a gateway will generally result in lower spreading factors, shorter time on air and much lower transmit power.

10. Technical Support

For technical assistance, please visit our website at www.sontay.com

