Integration into a LoRa Network



Wireless Ultrasonic Sensor WILSEN.sonic.level

WS-UCC*-F406-B15-B41-01-02



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Purpose of the Documentation

This manual describes the integration of a WILSEN.sonic.level wireless ultrasonic sensor into a LoRa network using the example of the onboarding process to "The Things Network" (TTN) v3.

The example integration consists of the following steps:

- 1. Creating a customer account with TTN
- 2. Creating a new application
- 3. Creating a new device
- 4. Transmitting sensor data
- 5. Payload decoder
- 6. Software applications for processing the sensor data

1. Creating a Customer Account with TTN

1. Type "The Things Network" in the search window of your web browser or follow the link: https://www.thethingsnetwork.org/



- 2. Click on "Sign Up" to create your own customer account.
- 3. Follow the further instructions in the dialog menu.

- 4. After successfully creating a customer account, select the "Console" area.
- 5. Then select your TTN cluster from the drop-down list on the left side of the screen, e.g. "Europe 1 (eu1)".
- Here you have the possibility to register a new application (for example a WILSEN sensor) or a new LoRa gateway to the network.

Note

Make sure that the sensor is located in the radio range of at least one LoRa gateway at its later place of use. If you have not yet installed your own gateway, you can use a LoRa network tester to find out whether TTN network coverage is already available at this location. To do this, register a network tester as a new device in your TTN account. You will find instructions on how to proceed in the accompanying documentation of the respective network tester.

If TTN coverage is not yet available, you can install your own LoRa gateway. To do this, follow the instructions in the accompanying documentation from the gateway manufacturer.

If there is already an active TTN network at the sensor's place of use, you can register and operate the WILSEN.sonic.level there.

2. Creating a New Application

1. In your account, click the "Go to applications" link in the "Overview" view or select "Applications" directly in the header.



- 2. Select "add application" in the upper right corner of the dialog box.
- 3. Next, complete the required entries "Application ID" and "Description".

Note

For more detailed information on the entries, see the relevant accompanying documentation in the portal.

THE THINGS NETWORK	THE THINGS STACK Community Edition	Overview	Applications 🗃 Gateways 👫 Organizations
			Add application
			Owner*
			Application ID*
			wilsen-test-at-ttn
			Application name
			My WILSEN test application
			Description
			Description for my new application
			M Optional application description; can also be used to save notes about the application
			Create application

4. Confirm the entries by clicking on the "Create application" button.

3. Creating a New Device

- 1. Select the "Applications" tab and choose the application to which you want to add a device.
- 2. Then click on the "Add end device" button.

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				End devices (0)			Q Search by ID = Import end devices	+ Add end device
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- 3. In the "Register end device" dialog, first select "Manually". Make sure that "Over the air activation (OTAA)" is selected as "Activation mode". In the following, select "MAC V1.0.3" as "LoRaWAN version".
- 4. Click on the "Start" button.

THE THINGS STACK THE THINGS STACK Community Edition	Overview Applications	Gateways 🕹 Organizations
My WILSEN test application		Applications > My WILSEN test application > End devices > Register manually
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Overview		Register end device
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u Live data		Preparation
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1 Integrations		Over the air activation (OTAA)
Collaborators		Activation by personalization (ABP)
		O Multicast
OT API keys		O Do not configure activation
🕸 General settings		LoRaWAN version ⑦*
		MAC V1.0.3
		Network Server address
		eu1.cloud.thethings.network
		Application Server address
		eu1.cloud.thethings.network
		External Join Server ${}^{\odot}$
		Enabled
		Join Server address
		eu1.cloud.thethings.network
< Hide sidebar		Start

- 5. Follow the dialog for creating a new device and assign an "End Device ID" as device name. Please note that the form editor only accepts lowercase letters and no spaces!
- 6. In the "AppEUI" field, enter either the "AppEUI" assigned as factory default by the device manufacturer or assign any 16-digit "AppEUI" in hexadecimal format for your application yourself.

Note

You can find the factory assigned AppEUI by connecting to the device using the WILSEN app. The AppEUI is displayed in the "LoRaWAN configuration" menu of the mobile app.

In case you assign your own AppEUI, the AppEUI must be changed and saved via the mobile app in the sensor settings.

7. Enter the "DevEUI (Device EUI)" next. This is a device-specific, unique identification number that each LoRaWAN device owns.

← LoRaWAN	Config. APPLY			
Device EUI	9C:65:F9:FF:FE:45:66:8C			
Application EUI	00:00:00:00:00:00:00:00:0 1			
Application Key	E0:85:88:AB:24:99:40: 64:B5:16:46:DF:8F:5F: 5A:B0			

For WILSEN devices, the 16-digit number in hexadecimal format can be found by connecting to the device using the WILSEN app. The device-specific **Device EUI** is displayed in the "LoRaWAN configuration" menu of the app. Alternatively, the Device EUI can also be found on the type plate and the packaging label of the device. 8. The "End device name" and "End device description" labels can be optionally assigned. Click the "Network layer settings" button to access the further settings.

Applications > My WILSEN test application > End devices > Register manually > Basic settings From The LoRaWAN Device Repository Manually		
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9. Select "Europe 863-870 MHz (SF9 for RX2 - recommended)" as "Frequency plan". Then click on the "Join settings" button.

Applications > My WILSEN test application > End	devices 🗲 Register manually	> Network layer settings
Register end device		
From The LoRaWAN Device Repository Manual	lly	
Basic settings 2 End device ID's, Name and Description	Network layer settings Frequency plan, regional parameters, end device class and session keys.	3 Join settings Root keys, NetID and kek labels.
Frequency plan ⑦*		
Europe 863-870 MHz (SF9 for RX2 - recommended)		
LoRaWAN version ⑦*		
MAC V1.0.3	\sim	
Regional Parameters version ⑦*		
PHY V1.0.3 REV A		
LoRaWAN class capabilities 🔊		
Supports class B		
Supports class C		
Advanced settings 🗸 🗸		
< Basic settings		Join settings >

10. Enter the 32-digit AppKey in hexadecimal format required for encrypting the transmission data and click on the "Add end device" button.

Applications > My WILSEN test application >	End devices > Register manually > Join sett	ings
Register end device		
From The LoRaWAN Device Repository	anually	
Basic settings End device ID's, Name and Description	Network layer settings Frequency plan, regional parameters, end device class and session keys.	3 Join settings Root keys, NetID and kek labels.
Root keys		
АррКеу ⑦*		
E0 85 88 AB 24 99 40 64 B5 16 4	6 DF 8F 5F 5A BØ	
Advanced settings 🗸 🗸		
< Network layer settings		Add end device

Note

As AppKey, the factory-assigned value from Pepperl+Fuchs can be used. You can find this by connecting to the device using the WILSEN app. The **Application Key** is displayed in the "LoRaWAN configuration" menu of the app.

Alternatively, you can also use a 32-digit hexadecimal value provided by the TTN network server or a 32-digit hexadecimal value that you have created yourself. It is only important that the same AppKey is entered both in the device and at TTN. In case the AppKey stored in the device should be customized, change it using the WILSEN app and save the new LoRaWAN settings in the device by pressing the "Apply" button.

The new device is now added to the selected application and also appears in the application-specific list of "End devices".

Applications > My WILSEN test application > End devices > my-new-wilsen									
ip: my-new-wilsen ID: my-new-wilsen • Last seen info unavailable ↑ n/a ↓ n/a Created 34 minutes ago Overview Live data Messaging Location Payload formatters Claiming General settings									
General information		Live data See all activity →							
End device ID	my-new-wilsen	14:01:39 Create end device							
Description	This end device has no description	14:01:39 Create end device							
		14:01:39 Create end device							
Created at	Jun 30, 2021 14:01:39	• 14:01:39 Create end device							
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АррЕОГ	00 00 00 00 00 00 01 <> 1								
DevEUI	9C 65 F9 FF FE 45 66 8C <>	Location Change location settings \rightarrow							
Root key ID	n/a								
АррКеу	••••••								
NwkKey	n/a								
Session information									
No data available		No location mormation available							

Note

If the sensor is in the detection range of a LoRaWAN gateway registered with TTN, the connection establishment starts after the time set in the WILSEN app in the menu "LoRaWAN configuration" under item "Next transmission" has elapsed. You can recognize a successful connection establishment in the TTN by the fact that the status indicator of your device changes from yellow to blue.

After completing the sensor configuration, disconnect the Bluetooth connection between the WILSEN app and the device by first switching back to the "Device discovery" overview in the WILSEN app and then closing the app.

4. Transmitting Sensor Data

- 1. Select the "Applications" tab and choose the application you created.
- 2. Then click on "See all activity" in the "Live data" area on the right side of the screen.

An overview appears showing all incoming and outgoing telemetry data exchanged between LoRa network and the devices.

At the first connection between sensor and network, the device is logged into the network (a join process is performed).

After network login, telemetry data transfer between sensor and network starts. Data uploads from the sensor to the network are marked with a small arrow pointing upwards. Downloads from the network to the sensor are marked with a small arrow pointing down.

5. Payload Decoder

A payload decoder is used to interpret the payload string.

- Select the "Applications" tab and choose the application you created. Then click "< > Payload formatter" in the left menu section, and then click "Uplink".
- 2. Select Javascript as the formatter type.
- > In the "Formatter parameter" area, you can now paste the payload decoder as a JavaScript program.

Note

The payload description and the payload decoder for your WILSEN.sonic.level can be downloaded online from the product detail page for the respective WS-UCC*-F406-B15-B41-* wireless ultrasonic sensor at www.pepperl-fuchs.com. See the Documents and Software areas.

THE THINGS NETWORK	THE THINGS STACK Community Edition	Vverview	Applications	🖨 Gateways 🗮 Organizations	EU1 Community No SLA applicable
11 N	v WILSEN test application			Applications > My WILSEN test application > Payload formatters > Uplink	
	verview Id devices			Default uplink payload formatter	
II u	ve data			You can use the "Payload formatter" tab of individual end devices to test uplink payload formatters and to define individual payload formatter settings per end device. Set un	
<> Pa	yload formatters			Formatter type*	
1	Uplink			Javascript V	
\checkmark	Downlink			Formatter parameter *	
大 In	tegrations 🗸			1 "use strict"; 2 2 function decodellalar(input) i	^
** C	llaborators			var in; var si0;	
OT A	1 keys			<pre>o var obj = i; var hexStr = byte2HexString(input.bytes); var indicatorStr = ["FRESH", "FIT", "USABLE", "REPLACE", "FALSE DECODING"];</pre>	
\$ 6	neral settings			<pre>9</pre>	×

- 3. Copy the program code of the "Payload decoder for TTN V3" from the downloaded text file and replace with it possibly pre-entered code in the field "Formatter parameter".
- > After pasting the source code, you must save it to the application. To do this, click the *"Save changes"* button.

THE THINGS STACK	Overview Applications	🛁 Gateways 🛛 🎎 Organizations		EU1 Community No support plan ⑦				
My WILCEN test application		Applications > My WILSEN test application > Live data						
my witsen test application	Time Entity ID	Туре	Data preview	Verbose stream	Pause 📋 Clear			
Overview	↑ 12:39:37 my-new-wilsen	Forward uplink data message	<pre>Payload: { battery_vol: 3.6, fillinglvl: 97, payload: "0408010023030806610602014180999A03510124 </pre>	", proxx: 35, temp: "23.7" }	04 0B 01 00 23 03 0B 06			
🙏 End devices	↑ 12:09:38 my-new-wilsen	Forward uplink data message	Payload: { battery_vol: 3.6, fillinglvl: 97, payload: "040801002303080661060201415C000003510124 <	", proxx: 35, temp: "23.5" }	04 0B 01 00 23 03 0B 06			
Live data	↑ 11:09:38 my-new-wilsen	Forward uplink data message						
<> Payload formatters ~								
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OT API keys								
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From now on, all newly added telemetry data transmissions under "Live Data" will be decoded and the individual measured values/values and information contained in each payload will be displayed.

The incoming telemetry data from the LoRa sensors are stored in the TTN only within the active browser window. Thus, the data is lost by closing the browser window.

However, if the sensor data is to be stored for graphical display or later evaluation, it must be transferred from the TTN to a more advanced software application. The TTN already offers some integration possibilities as an example.

Select "Integrations" in the left menu area. In the opening list you can already see some possibilities. If you click on the option "Webhooks" and then on the button "+ Add webhook" in the upper right corner, you will get an overview of different integration options from various providers.

THE THINGS STACK Community Edition	Overview	Applications	🖨 Gateways 🛛 🏔 Organizations			EU1. Community Fair use policy applies ⑦
My WILSEN test application			Applications > My WILSEN test application >	Webhooks > Add		
Overview			Choose webhook templa	te		
End devices Live data S Payload formatters tintegrations			III Akenza	Cayenne	CLOUD. STUDIO	\square
MQTT			Akenza Core Integrate with Akenza Core	Cayenne Drag-and-Drop IoT Project Builder	Cloud Studio Integrate with Cloud Studio IoT platform	Datacake Send data to Datacake via TTI adapter
 Storage Integration AWS IOT LoRa Cloud Collaborators 				Homey Homey Integrate The Things Stack with your Homey	in a Box*	i Qubitro
 General settings 			deZem Integrate with the deZem data platform		IoTinaBox™ Plug-and-Play IoT Solutions	Qubitro Send your data to Qubitro
< Hide sidebar			Тадо	thethings 10	☐ ThingSpeak	

Among the integrations you will find:

- Databases for long-term storage of sensor data,
- IoT platforms for the graphical representation of sensor data,
- Applications for the logical processing of the data, for example, in which certain sensor values can trigger further actions.

To select a suitable integration, read the respective product description. Each integration provides specific documentation on how to integrate the sensor data from the TTN.