

Kuando Busylight LoRa and The Things Network: Getting started

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The Things Network allows the addressing of the Busylight LoRa devices with https – requests.

We will describe how to send commands to your LoRa Busylight in various ways.

For demonstration, we will use "The Things Network Community Edition". Please note that the Community Edition may delay your Busylight control commands.

Create a TTN account and application

The first step is creating a user for TTN: Open a browser and go to https://www.thethingsnetwork.org/

In the right upper corner, you will find a Button "Sign Up".

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	THE DINGS				
	CREATE AN ACCOUNT Welcome aboard! Fill by your details to oranke an account on The Things Network and start exploring the work of CaRAVAN.				
	USERNAME Your public name.				
-	EMAIL ADDRESS Your email address stays privates. An activation email will be sent to you shortly (please direct your your bidor).				
	PASSWORD Use at least 6 characters.				
8	NEWSLETTER				
	Subscribe to the newsletter.				
	By registering an account you agree to our <u>Terms and Conditions</u> and <u>Ethacu Pulicu</u>				
	Air eady have an account ("Locin				
	You are the network, Let's build this thing topother, - $\underline{\mathrm{The Things, Network}}$				

After filling the form, there will be an email validation. After Validation, you are logged in.





Please click on "Console".

Now, please select the appropriate network cluster for you, typically the nearest.

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Australia 1							
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More information							

After selecting, you enter the TTN Console:

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	Walk right through to your applications and/or ga		
	Need help? Have a look at our 📓 Documentation 😂 or G	iet support 2.	
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	Go to applications	Go to gateways	

Now, klick on Applications – Add Application



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Please note the applicationid, you will need it later.

Registering you Gateway

Typically, the procedure to add a LoRa Gateway to TTN is very good described in the gateway documentation, and for the most common gateways as well in the TTN documentation.

You can find the TTN documentation here:

https://www.thethingsnetwork.org/docs/devices-and-gateways/adding-gateways/

Here, we show a simple gateway using the Semtech UDP Packet Forwarder.

To register the gateway, you need to know the gateway EUID.

In the TTN console, lick on Gateways, then klick Add gateway.



Add gateway - Console - The Thi x +	0	-	۵	3	×
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Public					
The location of this geteway may be visible to other users and on public gateway maps					
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Schedule downlink late 00					
Enable server-side buffer of downlink messages					
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Create gateway					
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Please select the appropriate values for Frequencies for your country.

In the gateway configuration, you need to enter the server address which is shown here in the registration form.

Example: For a Tektelic gateway, you need to enter the server FQDN in the file /etc/default/config.json.

The server address needs to be adjusted.

Here you see an example for the European TTN community cloud:



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General	Board Details	Utilities	Configuration Fir	ewall Wireless Modem HM Alar	m Log				
		Refresh files	/etc/default/config			✓ Read	Write	Delet	
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After changing and writing the content of the file, you need to restart the packet forwarder (or the gateway).

If everything is done correctly, you can see the gateway in status connected.

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ID \$	Name 🗢	Gateway EUI 🗢		Sta	atus
	Busylight Test Gateway	0.0000000000000000000000000000000000000		Connecte	d 🔹



Registering your Busylight

For registering your Busylight device, you need these information:

DeviceEUI	(8 Byte Hex)
AppEUI	(8 Byte Hex)
АррКеу	(16 Byte Hex)

If you have already created an application inside TTN, you can skip the next step.

If you do not have an application, please create one using the "+ Add Application Button."

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THE THEMOS STACK	M Overview	Applications	📫 Gateways	AL Organizations	C EUI C	community rt plan ①		
Add application								
Owner*								
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Application ID *								
testapplication								
Application name								
Application for testing								
Description								
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		one approxim						
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Please enter the application by clicking it.



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Please click "+ Add end device" now and click on "Manually".

Please fill the form like this, using the appropriate frequency plan for your location:



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	Europe 863-870 MHz (SF12 for RX2)					
General settings	Show advanced activation, LoRaWAN class and cluster settings ^					
	Activation mode ⑦ *					
	Over the air activation (OTAA)					
	Activation by personalization (ABP)					
	O Define multicast group (ABP & Multicast)					
	Additional LoRaWAN class capabilities ⑦					
	Class C (Continuous)					
	Network defaults ⑦					
	✓ Use network's default MAC settings					
	Cluster settings ⑦					
	Use external LoRaWAN backend servers					
	DevEUI ⑦*					
	AppEUI ③* Fill with zeros					
	AppKey ⑦ *					
	Generate					
	End device ID ⑦*					
	eui-2(
	This value is automatically prefilled using the DevEUI					
	After registration					
	View registered end device					
	Register another end device of this type					
< Hide sidebar	Register end device					
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After registering and everything OK, the device will be shown as connected:



End devices - Application for test	+					•	
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Testing the Busylight

You can test your connected Busylight by sending the downlink payload from the TTN console. To do that, please open the device details page.

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11 Ov	trview		00004137568602				
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<> Paj	load formatters v	General information	1		Live data		See all activit
犬 Inb	egrations ~	End device ID	eu1-300004175-000		↑ 13:46:59 Forward	i uplink data message end device	
🚉 Col	laborators	Description	This end device has no de	scription	@ 12:31:32 Create		
Ov API	keys	Created at	Oct 5, 2021 12:31:31		© 12:31:32 Create		
to Ge	neral settings	Activation informati	ion		12:31:32 Create 12:31:31 Create		
	and according to	AppEUI	2010/00/00 00 00 00/00/00	0	12131131 LTeate	end device	
		DevEUI	Desire data da 11 meteoria	0	Location	Change	e location setting
		Root key ID	n/a				
		АррКеу		••••••			
		NwkKey	n/a				
		Session information					
		Device address	10.00.00	o 🖺	NOT	ocation information available	
		NwkSKey		🐐 🛛			
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	AppSKey		•••••				
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Here, please klick on Messaging – Downlink:



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Application for testing				eu anna anna anna					
Overview 0		000041371	60682						
🙏 End devices	Last seen 8 min	utes ago 1 🔨 🔨	b 9				Created 2 hours ago		
IL Live data	Overview L	ive data Messagi	ng Location	Payload formatters	Claiming	General settings			
<> Payload formatters ↓ ↑ Integrations ↓	Uplink	Downlink							
Collaborators	Schedule dov	vnlink							
Ov API keys	Insert Mode								
General settings	Replace downlink queue Push to downlink queue (append)								
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	15								
	Payload								
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The Fport needs to be set to 15. They Payload needs to be specified in Hex notation. Please have a look to the chaper about the hardware payload format.

In this case, the Busylight will be solid white.

TTN Payload formatter for the Busylight

A Payload formatter gives you the ability to send human-readable json strings to control the Busylight instead of the raw hardware bytes as described in the Busylight LoRa Hardware Payload format chapter.

To insert Payload formatter, open the application and klick on the "Payload Formatter – Downlink" menu.

Please select "Javascript" as the Formatter Type and enter the source into the Formatter parameter field.



Default downlink payload format ×	+	•	
← → C 🔒 eu1.cloud.thething	s.network/console/applications/busylighttestapplication/payload-formatters/downlink	Q 🕁 🕈	• 🕑
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11 Application for testing	Applications > Application for testing > Payload formatters > Downlink		
Cverview	Default downlink payload formatter		
🙏 End devices	You can use the "Payload formatter" tab of individual end devices to test downlink payload formatter payload formatter settings per end device.	rs and to define in	dividual
1. Live data	,,		
Payload formatters	Setup		
↑ Uplink	Formatter type *		
🕹 Downlink	Javascript		
 Integrations ↓ Collaborators API keys General settings 	<pre>function encodeDoumlink(input) { return { bytes:((input.data.sed & douber), (input.data.blue & douber), (input.data bytes:(input.data.set & douber)), featt is, encode doublink(input) { if if if</pre>	a.green & GxG	0FF), (
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Here is the complete formatter:

```
function encodeDownlink(input) {
   return {
      bytes:[(input.data.red & 0x00FF), (input.data.blue & 0x00FF), (input.data.green
& 0x00FF), (input.data.ontime & 0x00FF),
      (input.data.offtime & 0x00FF),
      fPort: 15,
      warnings: [],
      errors: []
   };
}
function decodeDownlink(input) {
   return {
      data: {
        red: input.bytes[0],
        green: input.bytes[2],
        blue: input.bytes[3],
        offtime: input.bytes[4]
      },
      warnings: [],
      errors: []
   }
}
```



For decoding the uplink messages, you can use this uplink decoder:

```
function decodeUplink(input) {
    if (input.bytes.length == 24)
    {

    ireturn {
    data: {
        RSSI: byteArrayToLong(input.bytes, 0),
        SNR: byteArrayToLong(input.bytes, 4),
        messages_received: byteArrayToLong(input.bytes, 8),
        receases_cond: byteArrayToLong(input.bytes, 12),
              messages_send: byteArrayToLong(input.bytes,
lastcolor_red: input.bytes[16],
lastcolor_blue: input.bytes[17],
lastcolor_green: input.bytes[18],
lastcolor_ontime: input.bytes[19],
lastcolor_offtime: input.bytes[20],
              sw_rev: input.bytes[21],
hw_rev: input.bytes[22],
              adr_state: input.bytes[23]
          },
         warnings: [],
errors: []
    };
}_
     else
     {
         return {data: {
    bytes: input.bytes,
         },
         warnings: [],
errors: []
     }
}
}
byteArrayToLong = function(/*byte[]*/byteArray, /*int*/from) {
    return byteArray[from] | (byteArray[from+1] << 8) | (byteArray[from+2] << 16) |</pre>
(byteArray[from+3] << 24);
};
```



Controlling the Busylight with http Requests

If you plan to control the Busylight with http/https requests, you need to create an API Key.

To create a key, open the application and click on "API Keys".

API keys - Application for tes	ting × +					0	-		×
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	y Edition	Applications	🛋 Gateways	2 Organizations		EU1 Community No support plan (*)			•
Application for testing	Applications >	Application for testing	> API keys						
	API keys (0)							+ Add API	key
Overview	Key ID		Name					Granted R	Sghts
🙏 End devices									
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2 Collaborators									
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© 2021 The Things Stack by The Thin	ngs Network and The Things In	dustries			🕀 EN	v3.15.1 Documer	itation	③ Get si	upport

Then klick on "+ Add API Key".





Give a reasonable name and grant the right to write downlink traffic.

After saving, you need to copy the key for your application. Please be aware that you cannot access it a second time!!



You are now ready to write control your Busylight with a HTML request. Please change the yellow text parts to your needs.

You need to send a POST request to this URI:

```
https://<mark>your_ttn_server</mark>/api/v3/as/applications/<mark>your_application_id</mark>/devices/<mark>your_dev</mark>
ice_id/down/push
```

You send this Body:

```
{
    "downlinks": [{
    "decoded_payload": {
        "red": 0,
        "green": 0,
        "blue": 255,
        "ontime": 255,
        "offtime": 0
    },
    "f_port": 15
    }]
}
```

And you need to send these Headers:

```
Authorization: Bearer <mark>your_api_key</mark>
Content-Type: application/json
User-Agent: busylight/v1
```



Here is a PowerShell example that switches a Busylight to solid blue:



Busylight LoRa Hardware Payload format

The Busylight expects a 5-byte binary payload for switching the colors.

Byte 0: Red Color intensity (0..255) Byte 1: Blue Color intensity (0..255) Byte 2: Green Color intensity (0..255) Byte 3: On Steps (0..255) Byte 4: Off Steps (0..255)

Example for blue static light:

Byte[0]=0 Byte[1]=255 Byte[2]=0 Byte[3]=255 Byte[4]=0

The Hex form will be: 00FF00FF00

For TTN https operating, if using the frm_payload to specify the payload for the end device, the byte array needs to be send as a base64 encoded string.

When using the payload formatter, you can specify the values using a json string:

```
{
    "downlinks": [{
    "decoded_payload": {
        "red": 0,
        "green": 0,
        "blue": 255,
        "ontime": 255,
        "offtime": 0
    },
    "f_port": 15
    }]
}
```