

Dragino I/O Relay LT-22222-L Walkthrough

for US/AU915mhz

For remote power cycle of 1 or 2 devices and
voltage/current monitoring over LoRaWAN

by @tanny7241

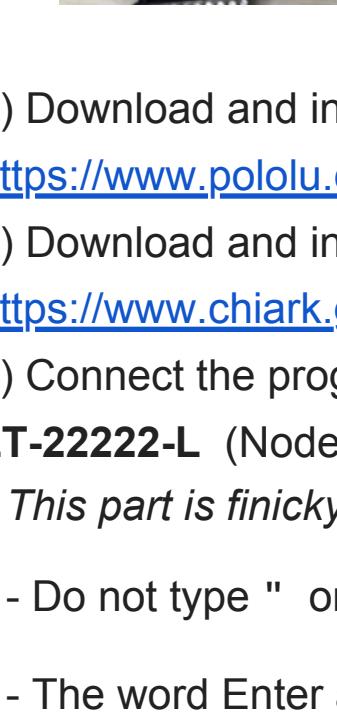
with special thanks to @tteague#3838

(Updated April 5, 2022)

The Dragino LT-22222-L ships as a Class C device. For Helium, we need to change that to Class A. In addition, the default settings for US/AU915mhz, as well as for CN470, are to lazily scan all 72 potential channels in your region's band, when most LoRaWAN gateways only use 8. When the device joins, the server will issue a downlink telling the device how to behave. I've included links to the, USB converter, driver and application you'll need in this walkthrough to make your life a little easier.

End Goals:

- 1) Set the device from Class C to Class A so it can work with Helium
- 2) Configure the end node to work in sub-band 2
- 3) Join the Helium Network
- 4) Control the relay on Datacake
- 5) Wire the node for power relay and voltage/current monitoring



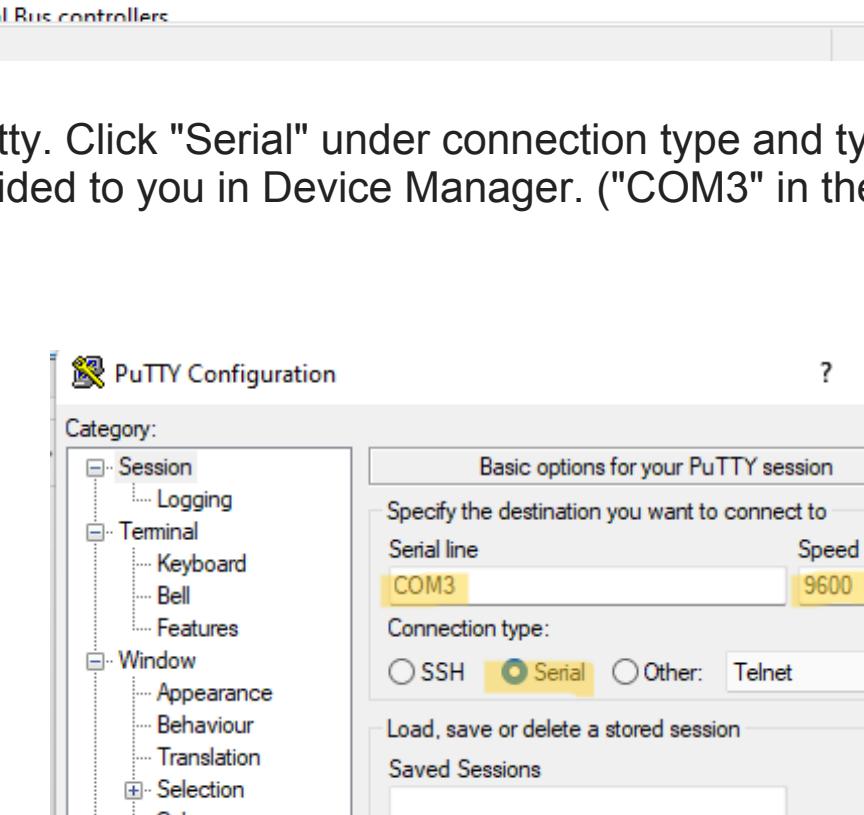
ALWAYS USE CAUTION WHEN WORKING WITH ELECTRICITY. NEVER PLUG WIRES DIRECTLY INTO A SOCKET, ALWAYS USE A DC ADAPTER RATED FOR YOUR DEVICE.

You will need:

- 1) The Dragino LT-22222-L, in your region's band, antenna attached
- 2) The 1/8" programming plug it comes with
- 3) 12v power supply, wired Hot to VIN, Neutral to GND.

Which wire is positive on 12v adapter?

If the multi-colored wire is black and red, the black wire is the negative wire, while the red one is positive. If both wires are black but one has a white stripe, the positive wire should be the one with the white stripe, and the negative wire should be black. RECOMMENDED: TEST WITH VOLTMETER



Don't plug in the CP2102 before you install the drivers.

Typically the Rx from one device goes to the Tx of the other, and vice versa. This diagram does the swap for you, and the quick connector Dragino sends with the node should line up perfectly with GND/RX/TX on the CP2102

- 4) A USB to TTL Converter, use a CP2102 if you want to match the walkthrough:

https://www.amazon.com/IZOKEE-CP2102-Converter-Adapter-Downloader/dp/B07D6LLX19/ref=sr_1_3?keywords=usb+to+ttl+adapter&qid=1647726342&sr=8-3

- 5) Download and install the USB drivers for the CP2102

<https://www.pololu.com/docs/0J7/all>

- 6) Download and install Putty

<https://www.chiark.greenend.org.uk/~sgtatham/putty/latest.html>

- 7) Connect the programming cable to USB adapter, plug in and power the LT-22222-L (Node <- headphone w/ quick connect <-> CP-2102-> PC)

This part is finicky, follow these guidelines:

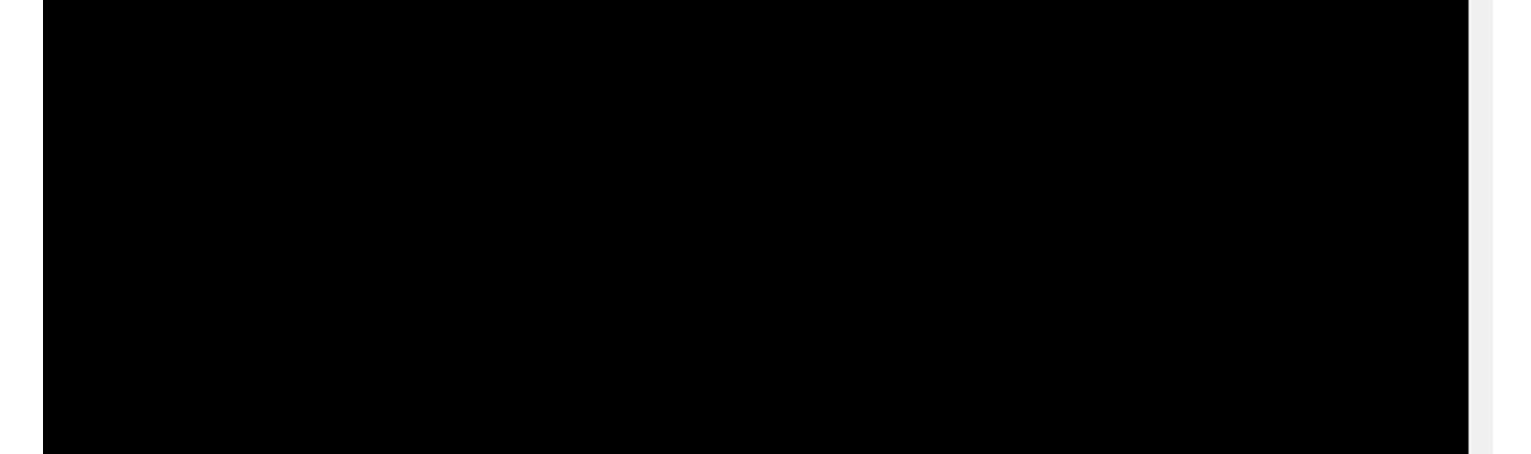
- Do not type " " or < and > into the console.

- The word Enter always means the button.

- Do not hit backspace in the terminal: If you have a typo, close and start over.

- Use ALL caps

First, navigate to your Device Manager to find the COM port for your device, it should be **COM3**



Open Putty. Click "Serial" under connection type and type in the COM port provided to you in Device Manager. ("COM3" in the example)

Click "Terminal" under "Category" and select Local Echo: "Force On"

Below is a preview of the AT terminal. Fun fact, AT commands are called that because ATtention.

Click "Open"

Baud Rate :9600

Data Bits: 8

Stop Bits: 1

Parity: None

Flow Control: XON/XOFF

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Stop Bits: 1

Parity: None

Flow Control: XON/XOFF

Click "Open"

Baud Rate :9600

Data Bits: 8

Stop Bits: 1

Parity: None

Flow Control: XON/XOFF

Click "Open"

Baud Rate :9600

Data Bits: 8

Stop Bits: 1

Parity: None

Flow Control: XON/XOFF

Click "Open"

Baud Rate :9600

Data Bits: 8

Stop Bits: 1

Parity: None

Flow Control: XON/XOFF

Click "Open"

Baud Rate :9600

Data Bits: 8

Stop Bits: 1

Parity: None

Flow Control: XON/XOFF

Click "Open"

Baud Rate :9600

Data Bits: 8

Stop Bits: 1

Parity: None

Flow Control: XON/XOFF

Click "Open"

Baud Rate :9600

Data Bits: 8

Stop Bits: 1

Parity: None

Flow Control: XON/XOFF

Click "Open"

Baud Rate :9600

Data Bits: 8

Stop Bits: 1

Parity: None

Flow Control: XON/XOFF

Click "Open"

Baud Rate :9600

Data Bits: 8

Stop Bits: 1

Parity: None

Flow Control: XON/XOFF

Click "Open"

Baud Rate :9600

Data Bits: 8

Stop Bits: 1

Parity: None

Flow Control: XON/XOFF

Click "Open"

Baud Rate :9600

Data Bits: 8

Stop Bits: 1

Parity: None

Flow Control: XON/XOFF

Click "Open"

Baud Rate :9600

Data Bits: 8

Stop Bits: 1

Parity: None

Flow Control: XON/XOFF

Click "Open"

Baud Rate :9600

Data Bits: 8

Stop Bits: 1

Parity: None

Flow Control: XON/XOFF

Click "Open"

Baud Rate :9600

Data Bits: 8

Stop Bits: 1

Parity: None

Flow Control: XON/XOFF

Click "Open"

Baud Rate :9600

Data Bits: 8

Stop Bits: 1

Parity: None

Flow Control: XON/XOFF

Click "Open"

</div

[The default password is "123456", when <Incorrect Password> appears, just type 123456 and hit enter.]

Follow this dialogue carefully, "" indicate a command, <> indicate a response. If you get an error message, enter the command again. If it interrupts your commands with a Tx/Rx feed while you're typing, wait for it to stop, and enter the command again:

Enter the default password:

"123456" Enter

<Correct Password>

"ATZ" Enter

<DRAGINO XX Device

Image Version: XXX...

Frequency Band: XXX...<-(Make sure the band reflects your region's)

DevEui= XX XX XX XX XX XX XX XX

Enter Password to Active AT Commands

followed by the Tx and Rx information>

"AT+CLASS?" Enter

<AT+CLASS: Get or Set the Device Class>

"AT+CLASS=A" Enter

<OK>

"AT+CHE?" Enter

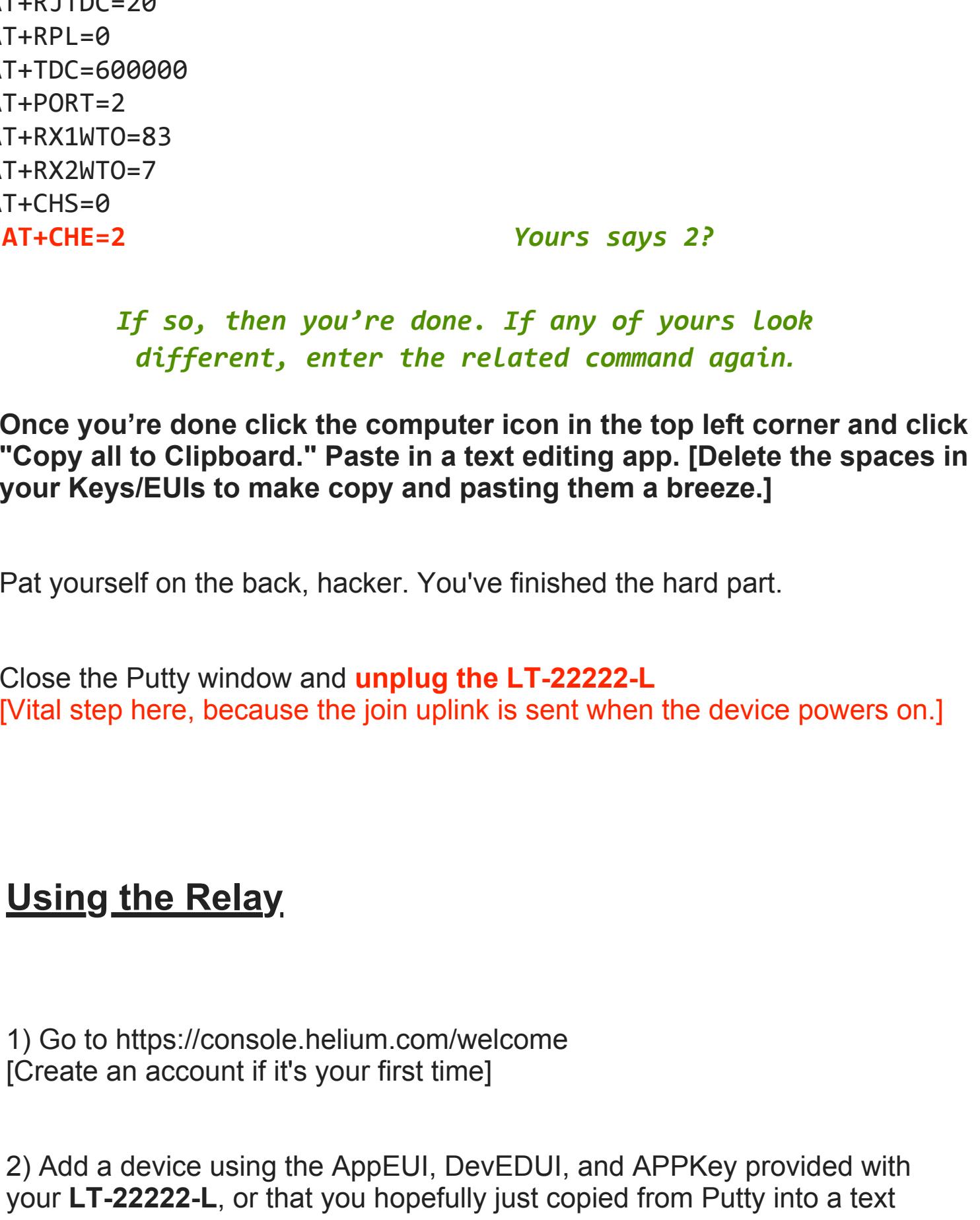
<AT+CHE: Get or Set eight channels mode, Only for US915,AU915,CM470'>

"AT+CHE=2" Enter

<OK> (Or After reset of the MCU)

"ATZ?" Enter [This resets the MCU]

<OK>



```
AT
OK
ATZ
DRAGINO LT-22222-L Device
Image Version: v1.5.6
LoRaWan Stack: DR-IWS-005
Frequency Band: US915
DevEui= A8 40 41 8F 81 83 94 8D

JoinRequest NbTrials= 72

Please use AT+DEBUG to see debug info

***** UpLinkCounter= 0 *****
TX on freq 902.700 MHz at DR 0
txDone
RX on freq 924.500 MHz at DR 10
rxTimeOut
RX on freq 923.300 MHz at DR 8
rxTimeOut
```

Enter this last command, and check the lines indented in bold:

"AT+CFG" Enter

<Stop Tx events, Please wait for all configurations to print

AT+DEUI=1234567890123...

AT+DADDR=123456789012...

AT+APPKEY=12345678901...

AT+NWKSKY=1234567890...

AT+APPSKEY=1234567890...

AT+APPEUI=12345678901...

AT+ADR=1

AT+TXP=0

AT+DR=4

AT+DCS=0

AT+PNM=1

AT+RX2FQ=923300000

AT+RX2DR=8

AT+RX1DL=1000

AT+RX2DL=2000

AT+JN1DL=5000

AT+JN2DL=6000

AT+NJM=1

AT+NWKID=00 00 00 00

AT+FCU=0

AT+FCD=0

AT+CLASS=A

Yours says CLASS A?

AT+NJS=0

AT+RECVB=0:

AT+RECV=0:

AT+VER=v1.5.6 US915

Yours says US915?

AT+CFM=0

AT+CFS=0

AT+SNR=0

AT+RSSI=0

AT+RJTDC=20

AT+RPL=0

AT+TDC=60000

AT+PORT=2

AT+RX1WTO=83

AT+RX2WTO=7

AT+CHS=0

AT+CHE=2

Yours says 2?

If so, then you're done. If any of yours Look different, enter the related command again.

Once you're done click the computer icon in the top left corner and click "Copy all to Clipboard." Paste in a text editing app. [Delete the spaces in your Keys/EUIs to make copy and pasting them a breeze.]

Pat yourself on the back, hacker. You've finished the hard part.

Close the Putty window and **unplug the LT-22222-L**

[Vital step here, because the join uplink is sent when the device powers on.]

Using the Relay

1) Go to <https://console.helium.com/welcome> [Create an account if it's your first time]

2) Add a device using the AppEUI, DevEUI, and APPKey provided with your **LT-22222-L**, or that you hopefully just copied from Putty into a text app.

Don't forget to delete all spaces in your Keys/EUIs. There is a pending state when adding the device and you will not see any data flow/joins/etc during this period

3) **Power on the device** and scroll to the device Event Log at the bottom of the device's page to confirm you got the Uplink, it should be nearly simultaneous with a downlink.

Welcome to the Helium network! You did it :)

Navigate to your Datacake dashboard <https://app.datacake.de/> and add the device: Select "LoRaWAN" / "Helium"

Select the **Dragino LT-22222-L**

Now navigate back over to your Helium Console and click "Integrations" > "Add Integration" > "Datacake HTTP"

Navigate back to your Datacake dashboard and click your user name in the top left corner > click "Edit Profile" > "API" > "Show Token" > Now copy that token to your clipboard.

and paste it to the “ENDPOINT DETAILS” in your Helium Integration

STEP 1 – CHOOSE AN INTEGRATION TYPE
Datacake
This Integration simplifies sending data to the Datacake IoT platform. Tell me more about setting up this Integration. Change
STEP 2 - ENDPOINT DETAILS
Enter Datacake Token: [redacted]

Navigate back over to Datacake and click “Configuration” > Scroll down to “Network Server” and click “Change” > Scroll down to your “Uplink URL” and copy it to your clipboard.

LORIOT
kerlink Kerlink Wanesy
Showing 1 to 5 of 8 results Previous Next
Uplink URL https://api.datacake.co/integrations/lorawan/helium/ Copy
Configure your LoRa Network Server to send data to this URL
Populate credentials from upstream message Product-wide setting
Helium includes the downlink configuration in uplink messages. If enabled, the system will use this data.
Helium Device ID
Helium Integration Id Product-wide setting

Navigate back over to Helium Console and click “Integrations” > Select your LT-22222-L > Scroll down to “Endpoint URL” and paste the “Uplink URL” you just copied from Datacake and click “Update Details”

Flows
NODES
Devices
Functions
Integrations
CONFIGS
Alerts
Profiles
Multiple Packets
ADMIN
Coverage
Organizations
Data Credits
Users v2.2.4
Flows
NODES
dragino 1 Device
Relay 1 Device
Autosaving Changes
UPDATE YOUR CONNECTION DETAILS
POST GET PUT PATCH
Endpoint URL (Required) https://api.datacake.co/integrations/lorawan/helium/
HTTP Headers (Optional)
Key Authentication
Value Token
+ Add Header
URL Params (Optional usage for payload interpolation)
+ Add Param

Click “Flows” > “+ Nodes” > Drag your device out of that menu and it’ll stick to the background.

Flows
NODES
dragino 1 Device
Relay 1 Device
Autosaving Changes

Click “+ Nodes” > Drag your Datacake Integration onto your Flows board as well.

Now connect the dots! Click to draw a line connecting the two. It should appear dotted indicating data flow. This is how your Flows board will work for all integrations. It’s sexy, isn’t it?

Navigate back over to your Datacake dashboard and click “Downlinks” and click “Switch on all Relays”. You should receive a message that says “Downlink sent to the LNS successfully”

DATACAKE
Fleet > It-22222-l
lt-22222-l
Serial Number Last update Tags
Dashboard Legacy Dashboard History Downlinks Configuration Debug Rules Permissions
Downlinks + Add Downlink
Name Description
Reset Device Sends a Reset Request to the Device
Switch off all Relays Switches off all Relays on Module.
Switch On all relays Switches on all relays
Set Relay Sets relay based on R01_CONTROL and R02_CONTROL
Send Downlink More
Send Downlink More
Send Downlink More
Configure and send Downlink More

Go over to Helium Console, click “Devices” > LT-22222-L > and scroll down to your “Event Log” and make sure you see a red Downlink Queued.

Event Log Expand All Filter Events w/ Commands Show Dropped Uplinks: Late Inactive Device Export JSON
+ 1 Downlink Queued Type: Downlink Queued No. of Hotspots: 1 Time: Mar 24, 2022 6:42:18 300 AM
+ 1 Uplink Type: Uplink No. of Hotspots: 1 Time: Mar 24, 2022 6:39:31.326 AM
+ 128 Uplink Type: Uplink No. of Hotspots: 1 Time: Mar 24, 2022 6:29:31.359 AM
+ 127 Uplink Type: Uplink No. of Hotspots: 1 Time: Mar 24, 2022 6:19:31.402 AM
+ 126 Uplink Type: Uplink No. of Hotspots: 1 Time: Mar 24, 2022 6:09:31.387 AM

It could take around 10 minutes for you to see the RO1 and RO2 lights on your LT-22222-L illuminate. If they do, you’re all done!

If you are not getting the downlinks, the easiest thing to do will be to remove the device from Helium console, and start over. You’ve got this!

Relay Wiring Configuration-

Note the use of a socket in this diagram is for illustrative purposes only. USE CAUTION WHEN WORKING WITH ELECTRICITY. DO NOT PLUG WIRES DIRECTLY INTO A SOCKET, ALWAYS USE A DC ADAPTER RATED FOR YOUR DEVICE.

-Run only the hot wires (+) into RO1-1 / RO1-2 and RO2-1 / RO2-2

The steps below apply specifically to the off-grid configuration provided in an <https://www.iotoffgrid.com/solar-enclosure-kit>. The LT-22222-L can be powered directly by a 7-24v DC adapter for on-the-grid indoor and enclosure applications.

The black wires don't need to be cut. If they are, splice/crimp carefully.

1) Power off
2) Daisy chain batteries together with charging splitter (if >1) [img next page]
3 Connect 1 battery lead to solar controller

4) Connect opposite battery lead to LT-22222-2 (+VIN,-GND)

5) Connect appliance lead from controller to regulator

6) Run the (+) miner wire into RO1-1 and out RO1-2 to miner

7) Run the (-) miner wire from controller to miner

8) Run the (+) router wire from regulator to RO2-1 and out RO2-2 to router

9) Run the (-) router wire from regulator to router

10) *OPTIONAL: analog voltage monitoring (battery voltage) <12"~14-16 AWG wire from (+) battery input of controller to AVI1

11) **OPTIONAL: analog current monitoring (solar) <12"~14-16 AWG wire from (+) solar input of controller to ACI-1

BARREL

BARREL

PLUG

PLUG

PLUG

PLUG

To Solar
Controller →

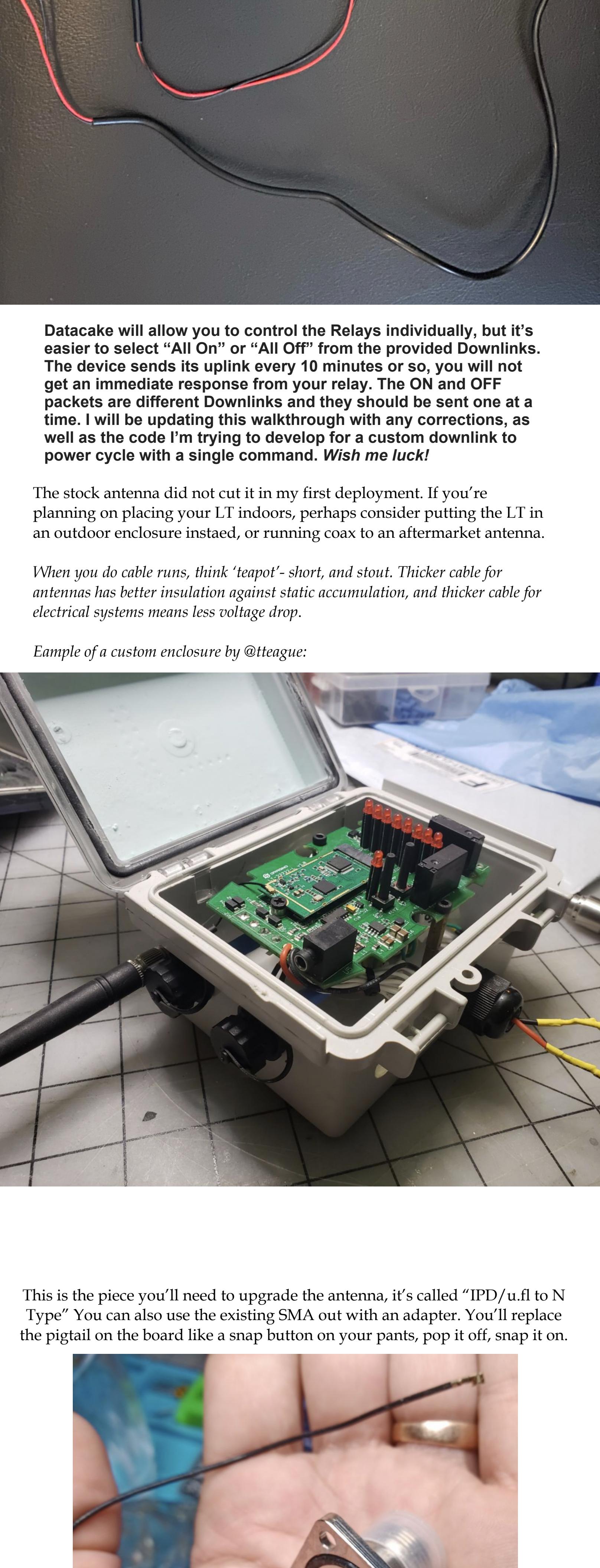
BARREL

To LT

SPLITTER

This is the recommended configuration provided by @Pirate_ProfTK#1062 for the 2 battery / splitter / controller / LT. Chances are you'll need to cut the plug off the lead to the LT and splice a <12" (+) and (-) wire to power the LT-22222-L

The image below illustrates how to wire the LT-22222-L on-the-grid with wall power supply for the node and miner. Repeat the process for the router.



Datacake will allow you to control the Relays individually, but it's easier to select "All On" or "All Off" from the provided Downlinks. The device sends its uplink every 10 minutes or so, you will not get an immediate response from your relay. The ON and OFF packets are different Downlinks and they should be sent one at a time. I will be updating this walkthrough with any corrections, as well as the code I'm trying to develop for a custom downlink to power cycle with a single command. Wish me luck!

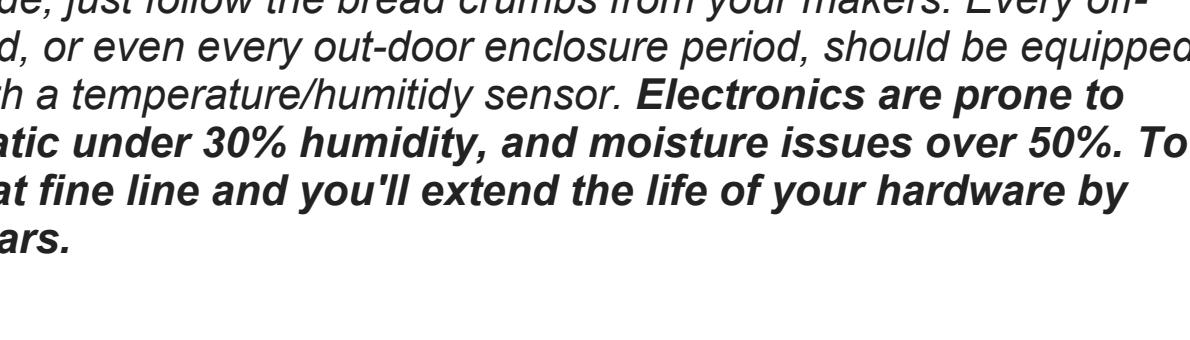
The stock antenna did not cut it in my first deployment. If you're planning on placing your LT indoors, perhaps consider putting the LT in an outdoor enclosure instead, or running coax to an aftermarket antenna.

When you do cable runs, think 'teapot'- short, and stout. Thicker cable for antennas has better insulation against static accumulation, and thicker cable for electrical systems means less voltage drop.

Example of a custom enclosure by @tteague:



This is the piece you'll need to upgrade the antenna, it's called "IPD/u.fl to N Type". You can also use the existing SMA out with an adapter. You'll replace the pigtail on the board like a snap button on your pants, pop it off, snap it on.



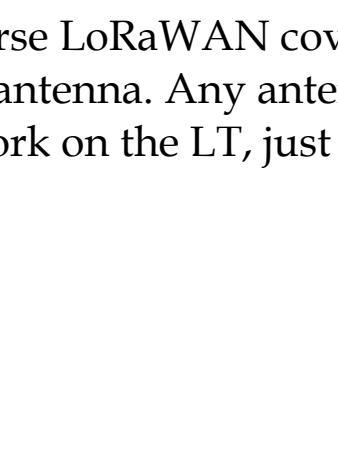
If your LT will be in sparse LoRaWAN coverage or indoors, highly consider running an aftermarket antenna. Any antenna that would work on your Helium miner would work on the LT, just be sure it's in your region's band.

Now you've got this incredible tool at your fingertips, create a folder on your phone with Helium Geek and a Safari bookmark to Datacake. Whenever you're ~500 blocks behind, start keeping an eye out. If your internet has been down and needs a reboot, your miner could probably benefit from a power cycle refreshing the snapshot. So if your router is offline and unresponsive, or if your miner gets stuck, and is behind **by 2000-2500 blocks** or so, cowboy boot those babies! Do not abuse the ability to power cycle your hardware, never do so more than once a day.

Thanks for sticking through this very complicated walkthrough. Hopefully it helps you, if you got stuck anywhere along the way or have any questions, I'm @tanny#7241 on Discord, and @iLoveSpectra on Twitter.

If you're feeling grateful, my HNT wallet address is provided below:

14fjXeSHN1t9f1TJLX5zWVC1P8iVPZ2M96Ke6iFDPwjxvK3fZq



Hopefully you've reached the end of this walkthrough for the first time without having even ordered your **LT-22222-L** yet. If you haven't used the Helium network by creating applications on Helium Console for LoRaWAN sensors, there's no need to start with this I/O Relay. There are countless sensors with limitless applications that allow you to nitpick every element of the physical environment, almost anywhere. The steps **Using the Relay** are the same for any node, just follow the bread crumbs from your makers. Every off-grid, or even every out-door enclosure period, should be equipped with a temperature/humidity sensor. **Electronics are prone to static under 30% humidity, and moisture issues over 50%. Tow that fine line and you'll extend the life of your hardware by years.**