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Catena 4801 Assembly Instructions and Test Procedure

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1 Introduction

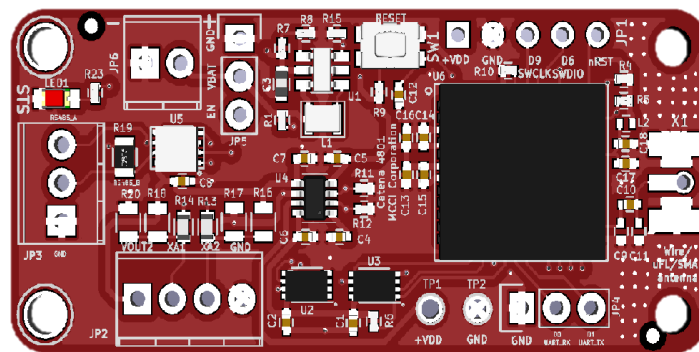
This document outlines the Catena 4801 board description and also about the assembly and test procedure instructions.

2 Catena 4801 Assembly Requirements

2.1 Catena 4801

Catena 4801 (123001401) has Murata LoRa Module IC (CMWX1ZZABZ-078), FRAM (MB85RC64TA), Flash IC (MX25V8035FZUI), RS485 Transceiver IC (SN65HVD75DR), Boost Regulator (MCP16252), High Side Switch (TPS22960).

Figure 1 Catena 4801



2.2 1x03 Screw Terminals

1X03 screw terminal (123001438) is to connect the board with RS485 module.

Figure 2 1X03 Screw Terminal



2.3 1x02 Screw Terminals

1X02 screw Terminal(123001439) is to connect the battery to the board to provide Power.

Figure 3 1X02 Screw Terminal



2.4 1X05 Pin Header

1X05 pin header (123001440) is used to program the board using ST Link

Figure 4 1X05 Pin Header



2.5 1X03 Pin Header

1X03 Pin header(123001441) is used for Serial communication

Figure 5 1X03 Pin Header



2.6 Power Source

Any power source which provide 3.3V can be used to power Catena-4801.

Figure 6 Battery

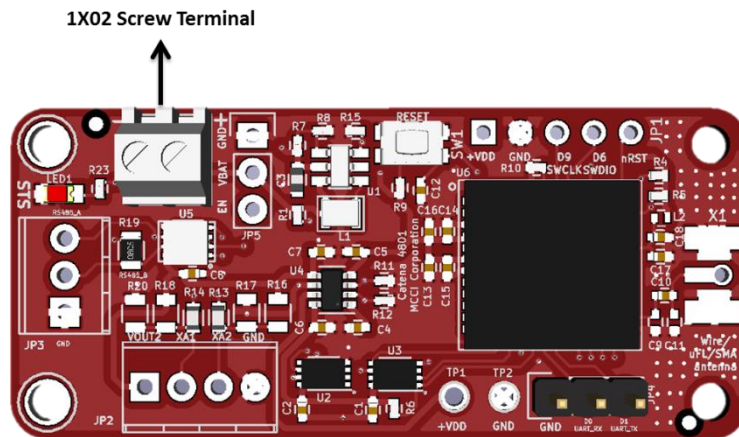


3 Catena 4801 Assembly Instructions

3.1 Install The Screw Terminals

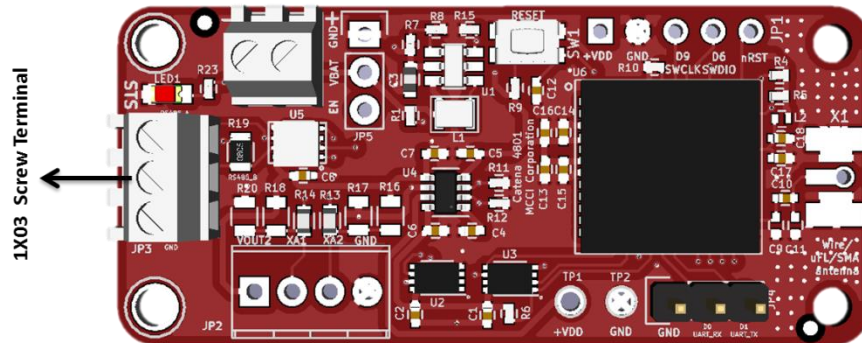
1. Attach the 1X02 Screw Terminal on JP6
 - I. Solder one post
 - II. Adjust for proper alignments and good cosmetics
 - III. Solder the remaining posts

Figure 7 Catena 4801 with 1x02 Screw Terminal



2. Attach the 1X03 Screw Terminal on JP3
 - I. Solder one post
 - II. Adjust for proper alignments and good cosmetics.
 - III. Solder the remaining posts

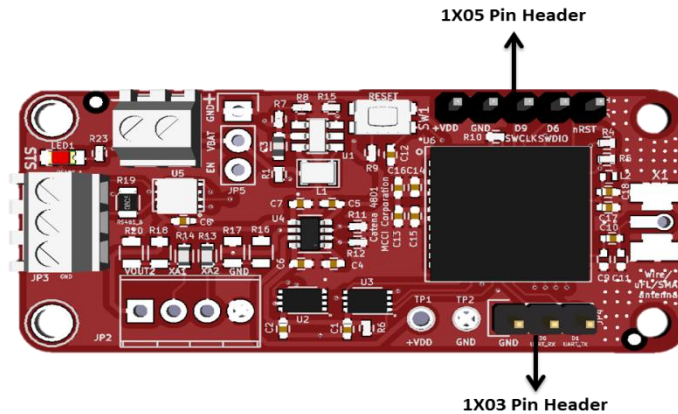
Figure 8 Catena 4801 with 1x03 Screw Terminal



3.2 Install the Pin Headers

1. Attach the 1X05 Pin Header and 1X03 Pin Header on JP1 and JP4 respectively.
 - I. Solder one or two posts on each strip, to tack the header in place
 - II. Adjust the vertical and horizontal alignment
 - III. Solder the remaining posts for reliable electrical contact.

Figure 9 Catena 4801 with 1x05 and 1x03 Pin Header



3.3 Catena 4801 setup with Test Clip

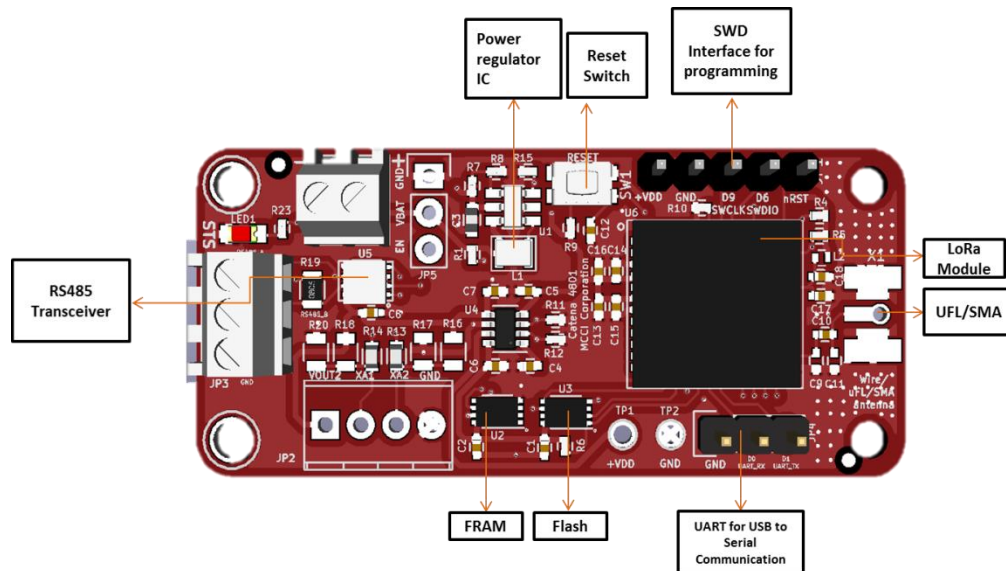
JP3, JP1 and JP4 can be replaced with **Error! Reference source not found.** instead of Pin Headers for easy assembling and testing.

Figure 10 Catena 4801 with test clip assembly



4 Board Description

Figure 11 Catena 4801 Description



5 Software Requirements

To proceed with Catena 4801 setup and test procedure, the below software tools are required.

- **Arduino IDE** for windows can be downloaded from below link:
 - <https://www.arduino.cc/en/Main/Software>
- **ST-Link Debugger driver** for windows can be downloaded from the link below:
 - <https://www.st.com/en/development-tools/stsw-link009.html>
- **pyModSlave** (234001161) is a free python-based implementation of a ModBus slave application for simulation purposes. The slave application can be downloaded from the link below:
 - <https://sourceforge.net/projects/pymodslave/>
- **FT232RL VCP Drivers** for Windows can be downloaded from below link:
 - <https://www.ftdichip.com/Drivers/CDM/CDM%20v2.12.28%20WHQL%20Certified.zip>
- **USB to Serial converter** for windows

6 Test Setup

6.1 Catena 4801 Test Setup Requirement

6.1.1 ST-LINK/V2 in-circuit debugger/programmer

The ST-LINK/V2 (123001120) is an in-circuit debugger and programmer for the STM8 and STM32 microcontroller families. The single wire interface module (SWIM) and JTAG/serial wire debugging (SWD) interfaces are used to communicate with any STM8 or STM32 microcontroller located on an application board.

Figure 12 ST Link Programmer



6.1.2 RS485 Module

This breakout board (123001443) pairs an SP3485 RS-485 transceiver with an FT232RL USB UART IC to convert a USB stream to RS-485. The SP3485 is a half-duplex transceiver, so it can only communicate one way at a time, but it can reach transmission speeds of up to 10Mbps. The RTS pin of the FT232RL is connected to transmit and receive enable inputs of the SP3485, this line is used to control the transmission mode of the RS-485 transceiver. With the proper drivers installed, the FT232RL will enumerate as a virtual COM port; the drivers are available for Windows, Mac and Linux.

Figure 13 USB to RS-485 Converter



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6.1.3 USB to Serial Cable

USB to Serial Cable (123001121) is used for Configuring the device with TTN and also for monitoring the device performance on the Serial Monitor.

Figure 14 USB to Serial Cable

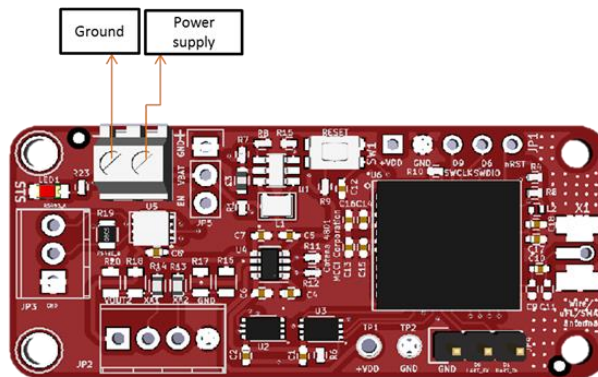


Note : The Serial cable configurations are mentioned in the Table 2

6.2 Catena 4801 Configuration

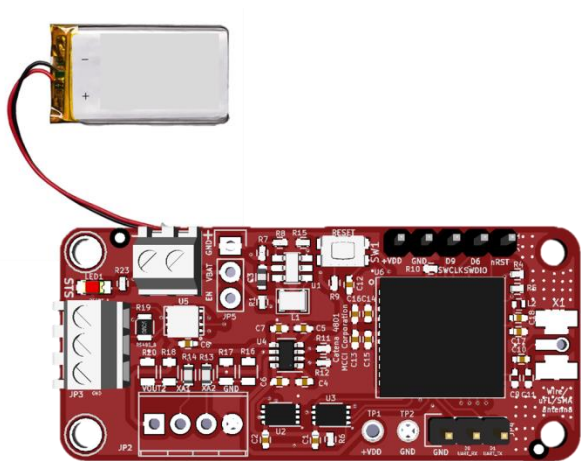
Catena 4801 configurations are described below.

Figure 15 Catena 4801 Battery Configuration



1. Connect the Battery or any power source to the JP6 of the board.

Figure 16 Catena 4801 with Battery



2. Catena 4801 with USB to RS-485 Converter

Figure 17 Catena 4801 with RS485

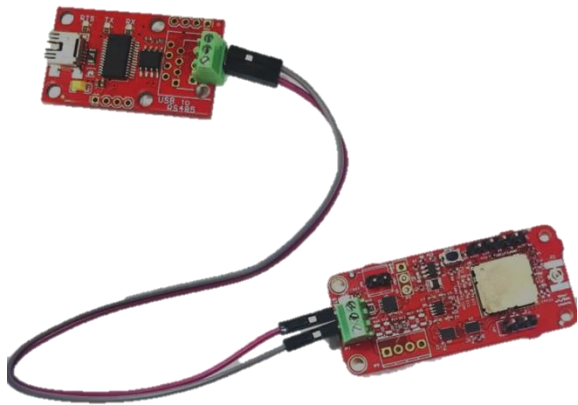


Table 1 Catena4801 to RS485 Connection

RS485 connection	
Catena4801	RS-485 module
Terminal A	Terminal A
Terminal B	Terminal B

3. Catena 4801 Serial connection – USB to Serial Cable TTL-232R-RPI has been used for Serial monitor.

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Figure 18 Catena 4801 Serial Configuration

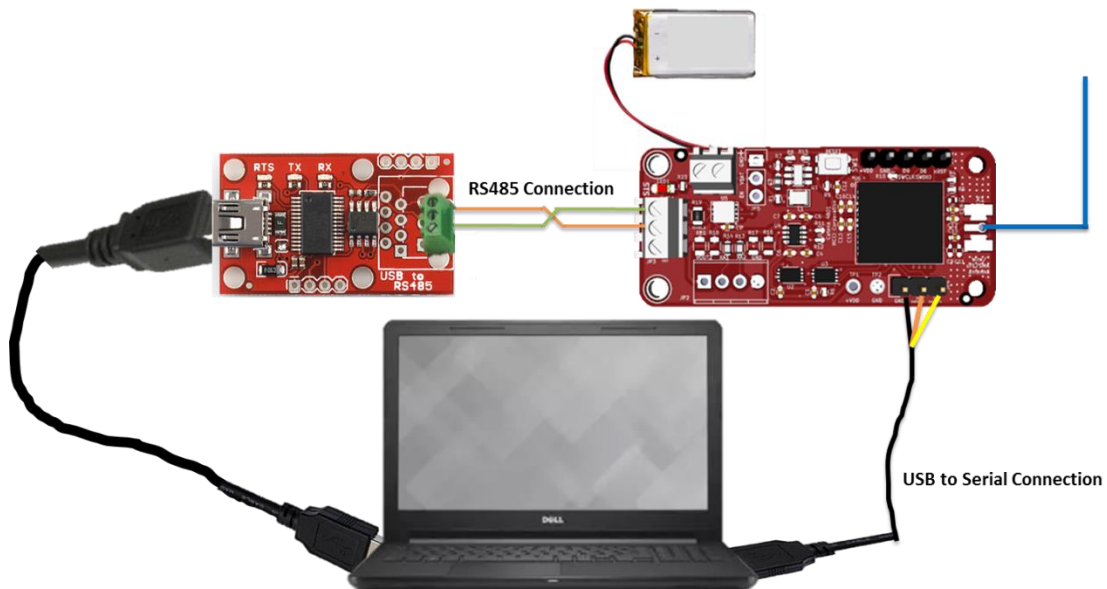


Table 2 USB to Serial Connection

Catena4801 (JP4)	USB - Serial cable (color)
GND	Black
D1_UART_RX	Orange
D0_UART_TX	Yellow

The overall test Setup for Catena 4801 is shown Figure 19

Figure 19 Catena 4801 Overall Test Setup



7 Test Procedure

7.1 Library Packages

Catena 4801 testing requires the following libraries:

- Catena-Arduino-Platform
- Catena-mcciadk
- arduino-lorawan
- arduino-lmic
- Modbus-for-Arduino
- Adafruit_FRAM_I2C

The above libraries can be cloned from <https://github.com/mcci-catena>

7.2 Programming Catena4801 Using STLink

7.2.1 ST Link Configuration

STLink Configuration is shown in the below table

Table 3 Catena4801 to STLink connection

ST-Link connection	
Catena4801	ST-Link
GND	Pin 3
NRST	Pin 15
3.3V	Pin 1
SWCLK	Pin 9
SWDIO	Pin 7

Figure 20 STLink



Pin configurations of the ST-Link debugger with Catena 4801 as mentioned in Table 3. The Catena 4801 connection with PC using STLink Debugger is shown in the Figure 21.

Figure 21 Upload setup using STLink debugger

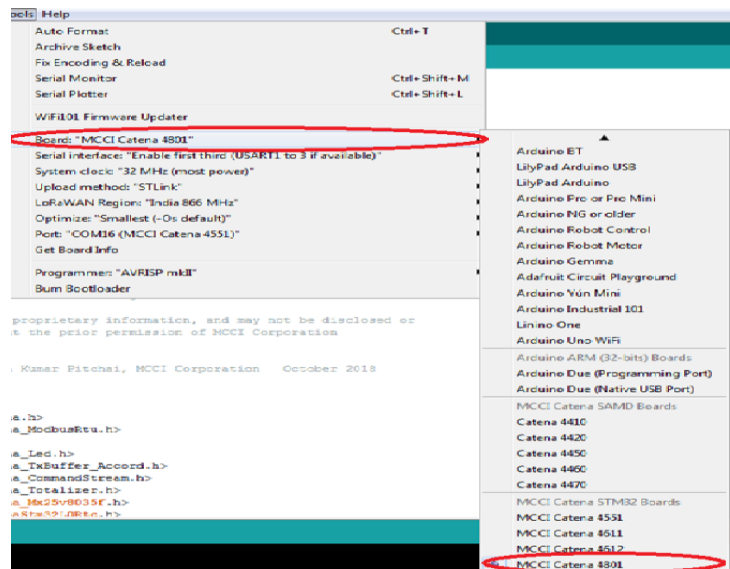


For debugging, the STLink debugger is to be connected with PC, install the STLink debugger driver which is mentioned Section 5.

After the installation of STLink driver and the upload setup, clone the [Modbus-for-Arduino](#) under the branch **catena4801_host** and open the example sketch **catena_modbus_simple_host**. Now follow the below steps to upload the test sketch using Arduino IDE:

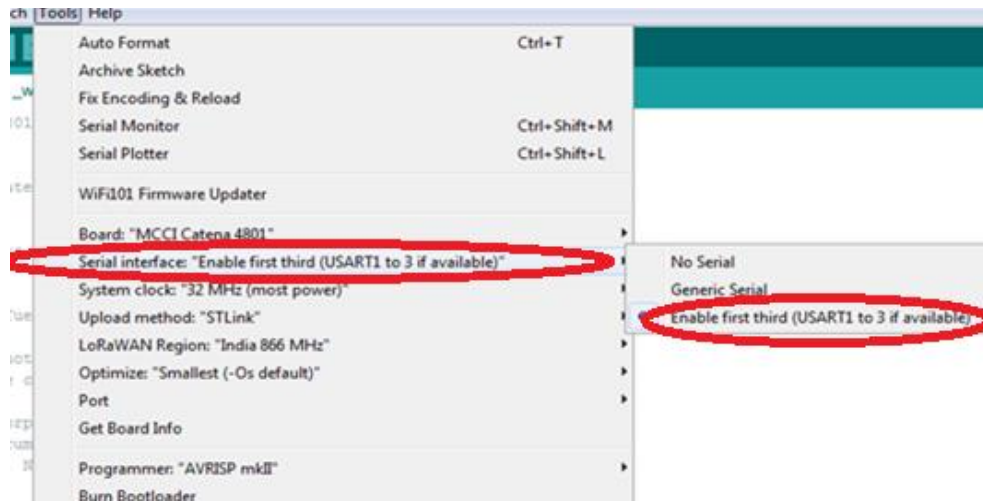
1. Install the latest BSP for MCCI Catena STM32-v2.0.0 to add support for Catena 4801 in Arduino IDE.
2. **MCCI Catena STM32 Boards** should be installed from the Boards Manager.
3. Once the board has been installed, **Catena 4801** board has to be selected under **MCCI Catena STM32 Boards**.

Figure 22 Selection of board



4. **Enable first third in the serial interface menu** is selected from the **Tools** tab.

Figure 23 Selecting the Serial Interface



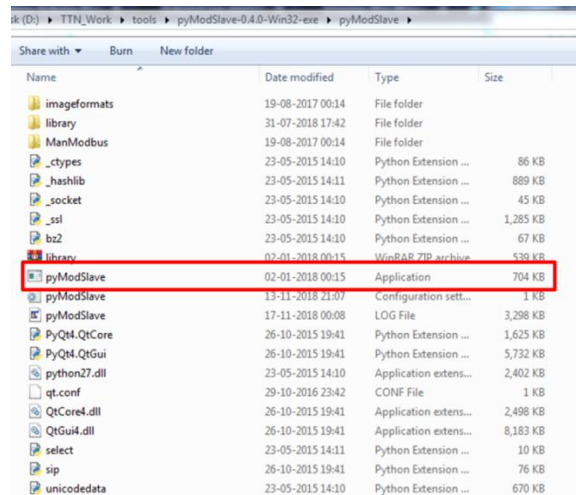
7.3 Configuring RS-485 module

RS485 module has to be configured as a slave device. Download and install the FT232RL VCP Drivers which is mentioned in mentioned in the Section 5. Download the pyMod Slave application which is mentioned in the Section 5.

The steps which is mentioned below should be followed once it is downloaded

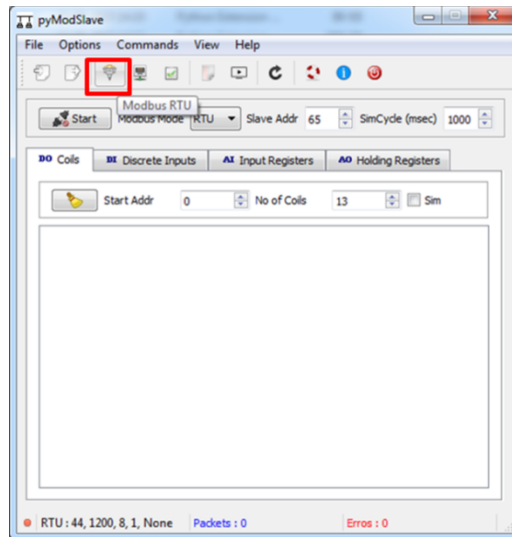
1. Extract the package and Run the pyModSlave application.

Figure 24 Execution of pyModSlave application



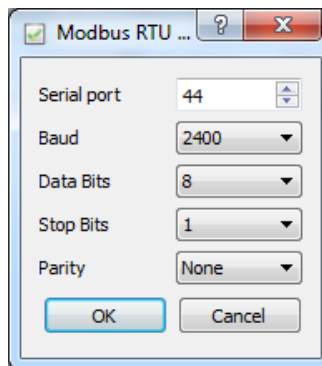
2. Click the Modbus RTU icon. In the dialog box, enter the serial port number.

Figure 25 Setting up Modbus RTU mode



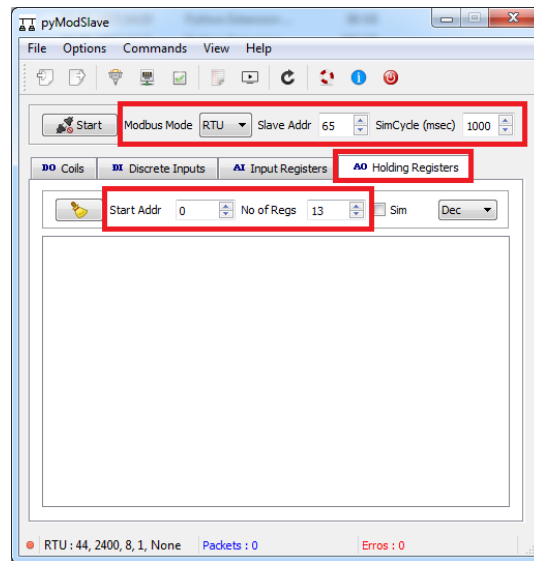
3. Select the port number from the **Serial Port** and set the available baud rate from the **Baud** as 2400(or supporting any other baud rate). Click ok.

Figure 26 Modbus RTU settings dialog box



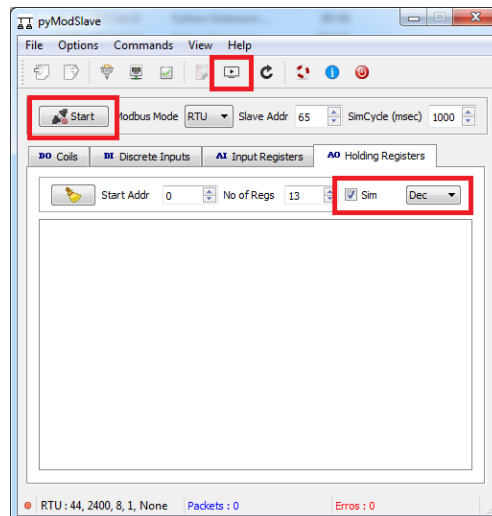
4. Set the Modbus mode to **RTU**. Select the tab **Holding Registers**. Enter the **Slave address** as 65, **SimCycle** as 1000, **Start address** as 0 and **No. of coils** as 13.

Figure 27 Setting up Modbus mode and configuring slave



5. Click the Bus monitor icon and Simulation option. Then click Start.

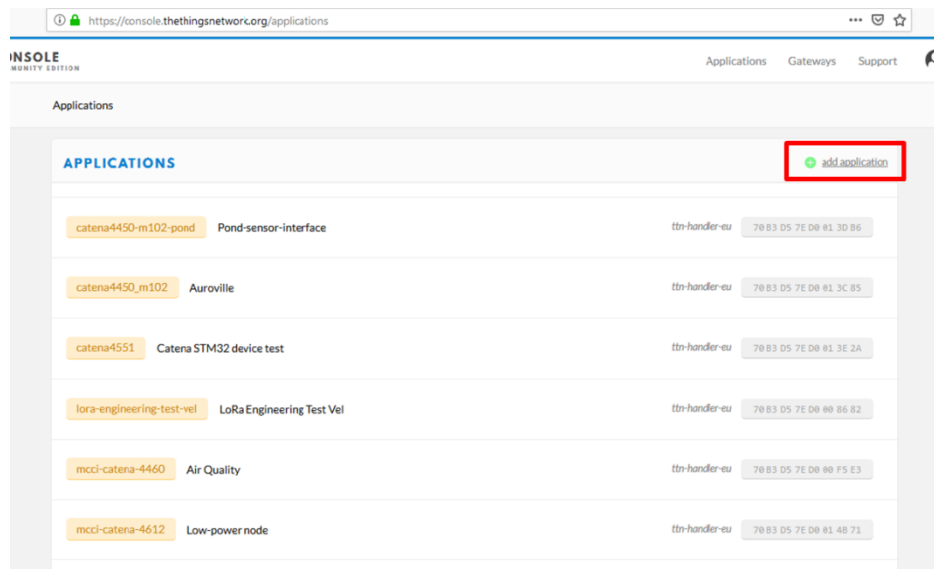
Figure 28 Selection of Bus Monitor and Starting the communication



7.4 Connecting to the network

1. The device can be connected to the Network using TTN Console.
<https://www.thethingsnetwork.org/>.
2. Add application is selected from the **Applications** Tab.

Figure 29 Creating Application



3. Enter the Application ID and Description under **Application** -> **Add Application**

Figure 30 Added Application

The screenshot shows the 'Add Application' form. It has four main sections: 'Application ID' with a text input field containing 'enter-application-id'; 'Description' with a text input field containing 'Eg. My sensor network application'; 'Application EUI' with a text input field containing 'EUI issued by The Things Network'; and 'Handler registration' with a dropdown menu showing 'ttn-handler-eu'. At the bottom right, there are 'Cancel' and 'Add application' buttons.

ADD APPLICATION

Application ID
The unique identifier of your application on the network
enter-application-id

Description
A human readable description of your new app
Eg. My sensor network application

Application EUI
An application EUI will be issued for The Things Network block for convenience, you can add your own in the application settings page.
EUI issued by The Things Network

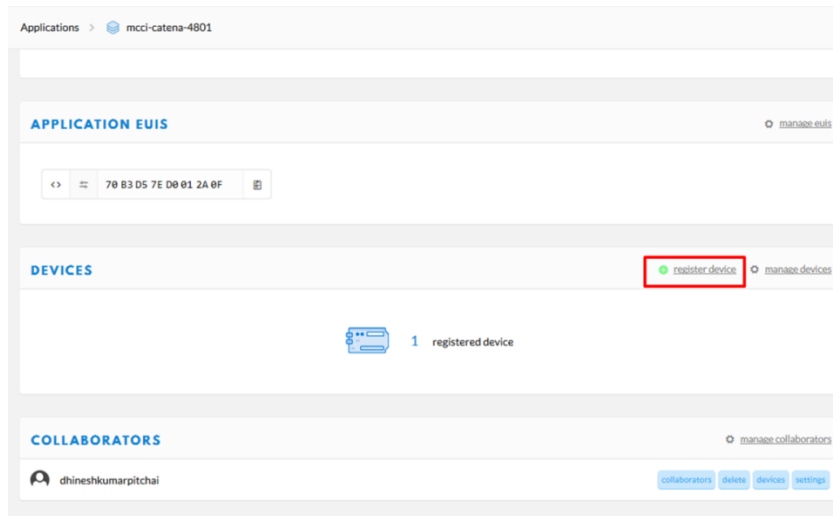
Handler registration
Select the handler you want to register this application to
ttn-handler-eu

Cancel Add application

7.4.1 Registering the device

1. After creating the application, the device is registered by selecting the **register device** option.

Figure 31 Registering the device



2. Enter the Device ID, which should be atleast of two characters.
3. Enter the Serial Number of the device under Device EUI tab.
4. Select on Register to complete the registration.

Figure 32 Registering the device with parameters

The 'REGISTER DEVICE' form contains the following fields:

- Device ID**: A text field with the value 'catena' and a green checkmark icon.
- Device EUI**: A text field with the value '00 00 00 00 00 00 01' and a green checkmark icon with '8 bytes' text.
- App Key**: A text field with the placeholder 'this field will be generated' and a green checkmark icon.
- App EUI**: A text field with the value '70 B3 D5 7E D0 01 3D B6' and a green checkmark icon.

At the bottom right, there are 'Cancel' and 'Register' buttons.

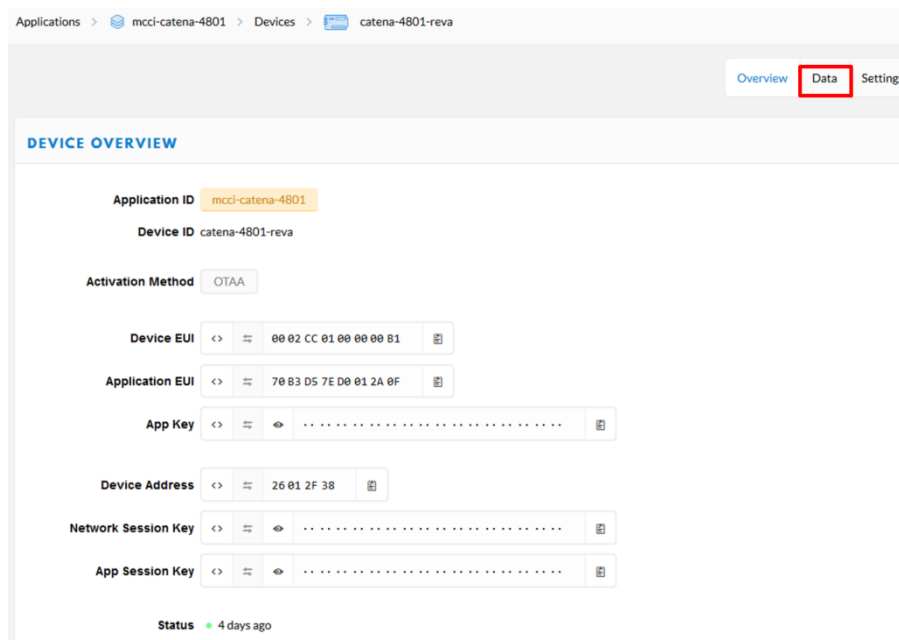
7.4.2 Configuration steps

The output data can be viewed through the serial terminal(TeraTerm/Serial monitor). To configure the device with TTN, the following commands should be entered in the serial terminal window.

- ***lorawan configure deveui***
(Replace deveui with the device eui number)
- ***lorawan configure appeui***
(Replace appeui with application eui generated. It can be taken from the device tab from the application)
- ***lorawan configure appkey***
(Replace the appkey with the appkey generated. It can be taken from the device tab from the application)
- ***lorawan configure join 1.***

Now the device will be connected with the network. The data can be viewed by selecting the Data tab in the TTN.

Figure 33 Device shown up with connection status and Data tab to view data



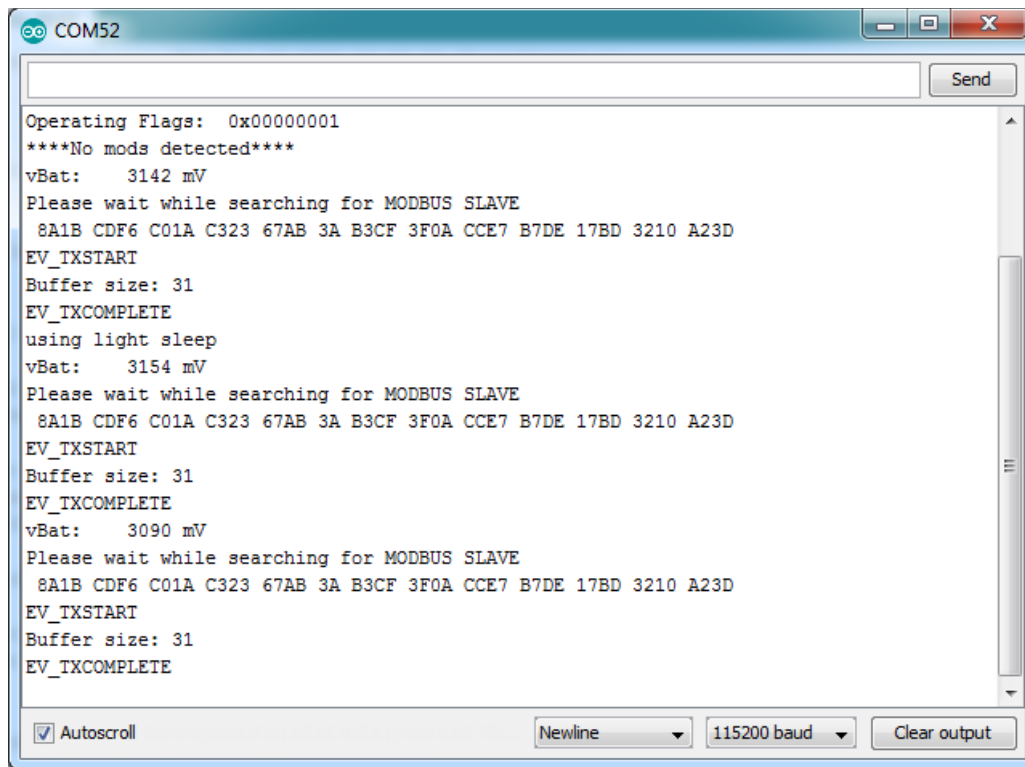
7.5 Test Results

Catena 4801 successfully communicates with RS485 module and sends the data to TTN and can be viewed in the TTN console. The results are shown below:

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Figure 34 Serial output of Catena 4801 in Arduino IDE

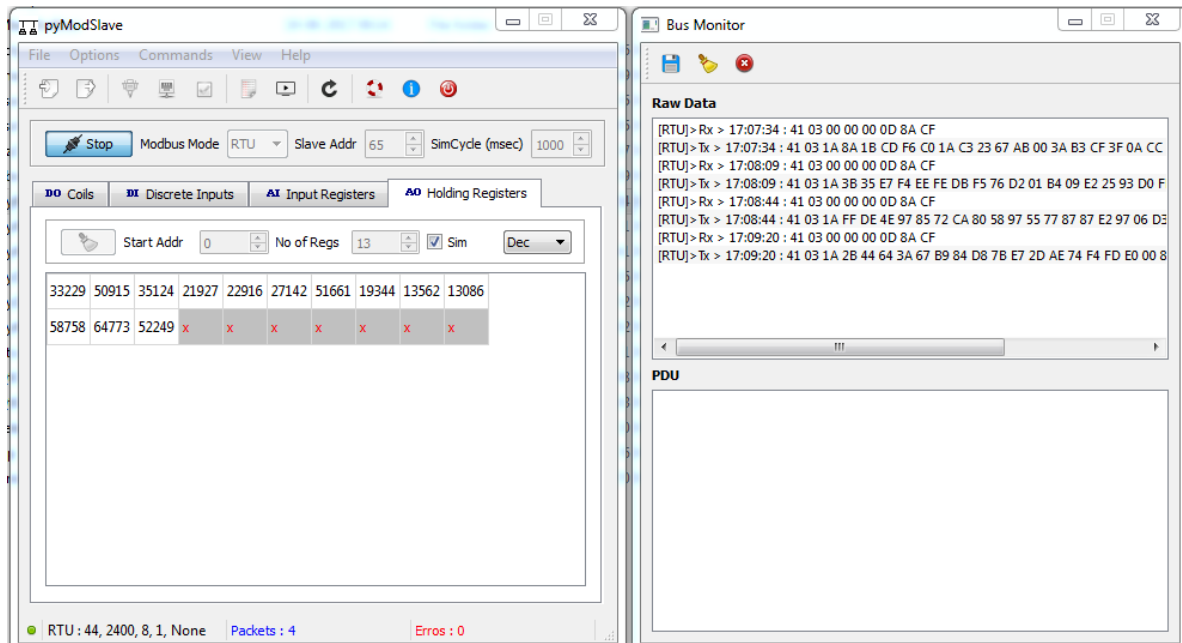


The screenshot shows the Arduino IDE serial monitor window titled 'COM52'. The output text is as follows:

```
Operating Flags: 0x00000001
****No mods detected****
vBat: 3142 mV
Please wait while searching for MODBUS SLAVE
8A1B CDF6 C01A C323 67AB 3A B3CF 3F0A CCE7 B7DE 17BD 3210 A23D
EV_TXSTART
Buffer size: 31
EV_TXCOMPLETE
using light sleep
vBat: 3154 mV
Please wait while searching for MODBUS SLAVE
8A1B CDF6 C01A C323 67AB 3A B3CF 3F0A CCE7 B7DE 17BD 3210 A23D
EV_TXSTART
Buffer size: 31
EV_TXCOMPLETE
vBat: 3090 mV
Please wait while searching for MODBUS SLAVE
8A1B CDF6 C01A C323 67AB 3A B3CF 3F0A CCE7 B7DE 17BD 3210 A23D
EV_TXSTART
Buffer size: 31
EV_TXCOMPLETE
```

At the bottom of the window, there are controls for 'Autoscroll' (checked), 'Newline' (dropdown), '115200 baud' (dropdown), and 'Clear output' (button).

Figure 35 Bus Monitor using pyModSlave



The screenshot displays two windows side-by-side. The left window is 'pyModSlave' and the right is 'Bus Monitor'.

pyModSlave Window:

- Menu: File, Options, Commands, View, Help
- Buttons: Stop, Modbus Mode, RTU, Slave Addr: 65, SimCycle (msec): 1000
- Tabs: DO Coils, DI Discrete Inputs, AI Input Registers, AO Holding Registers
- Fields: Start Addr: 0, No of Regs: 13, Sim (checked), Dec (dropdown)
- Table:

33229	50915	35124	21927	22916	27142	51661	19344	13562	13086
58758	64773	52249	X	X	X	X	X	X	X

Status bar: RTU : 44, 2400, 8, 1, None | Packets : 4 | Erros : 0

Bus Monitor Window:

- Buttons: Save, Load, Stop
- Section: Raw Data
- Log:

```
[RTU]> Rx > 17:07:34 : 41 03 00 00 00 0D 8A CF
[RTU]> Tx > 17:07:34 : 41 03 1A 8A 1B CD F6 C0 1A C3 23 67 AB 00 3A B3 CF 3F 0A CC
[RTU]> Rx > 17:08:09 : 41 03 00 00 00 0D 8A CF
[RTU]> Tx > 17:08:09 : 41 03 1A 3B 35 E7 F4 EE FE DB F5 76 D2 01 B4 09 E2 25 93 D0 F
[RTU]> Rx > 17:08:44 : 41 03 00 00 00 0D 8A CF
[RTU]> Tx > 17:08:44 : 41 03 1A FF DE 4E 97 85 72 CA 80 58 97 55 77 87 87 E2 97 06 D5
[RTU]> Rx > 17:09:20 : 41 03 00 00 00 0D 8A CF
[RTU]> Tx > 17:09:20 : 41 03 1A 2B 44 64 3A 67 B9 84 D8 7B E7 2D AE 74 F4 FD E0 00 8
```

Section: PDU

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Figure 36 Data in TTN Console

