SKYLAB

FUTURE TECHNOLOGY, SOLUTIONS & SERVICE

LoRa Edge

Manual

Content

Version	Changes
1.0	First release.
1.2	Support for more configuration via downlink, sensor integration in Wi-Fi payload and radio beacon.
1.3	Changed downlink for software version 1.3

1. Hardware pinout

How the microcontroller (ATSAMD21G18) pins are connected on the board is displayed in Table 1: Pinout Skylab board. This table also displays the name in the Arduino IDE.

Table 1: Pinout Skylab board

uC pin	Board pin	Name in Arduino IDE
PA02	A0	A0, DAC0
PA03	-	-
PA04	-	-
PA05	AIN5 (battery)	AIN5
PA06	D0	D0
PA07	D8	D8
PA08	D3	D3
PA09	D4	D4
PA10	Busy (LR1110)	BUSY
PA11	Event (LR1110)	EVENT
PA12	-	-
PA13	-	-
PA14	NRESET (LR1110)	NRESET
PA15	LED Red	LEDR
PA16	MOSI	MOSI
PA17	SCK	SCK
PA18	NSS (LR1110)	NSS
PA19	MISO	MISO
PA20	INT2 (LSM303AGR)	INT2
PA21	INT1 (LSM303AGR)	INT1
PA22	SDA	SDA
PA23	SCL	SCL
PA24	D- (usb)	PIN_USB_DM
PA25	D+ (usb)	PIN_USB_DP
PA27	PA27 (pad)	PA27
PA28	PA28 (pad)	PA28
PA30	SWDCLK/TCK (debug pins)	-
PA31	SWDIO/TMS (debug pins)	-
PB02	PB02 (pad)	PB02
PB03	PB03 (pad)	PB03
PB08	LNA (GNSS)	LNA
PB09	INT3 (LSM303AGR)	INT3
PB10	LED Green	LEDG
PB11	LED Blue	LEDB
PB22	TX	PIN_SERIAL_TX
PB23	RX	PIN_SERIAL_RX

2. Charging

How to connect the battery and the solar panel is showed in Figure 1: How to connect the battery and solar panel.

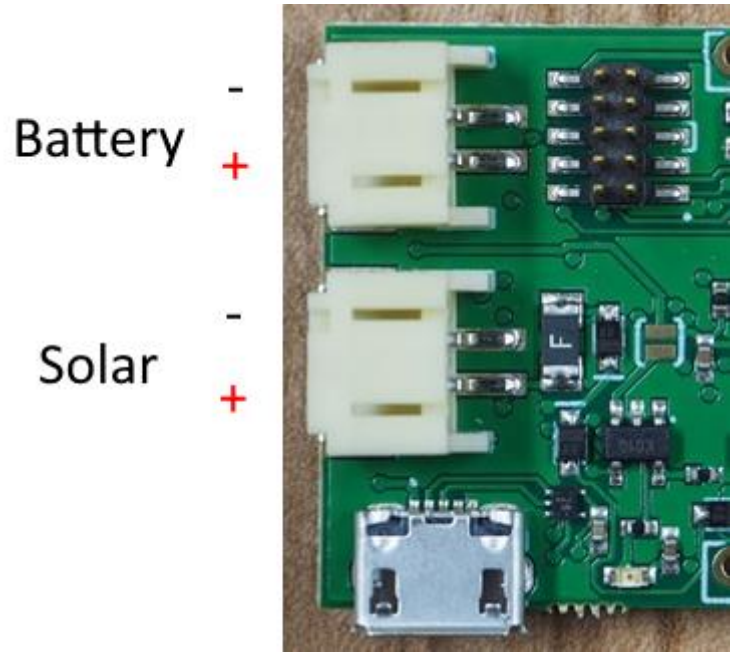

Figure 1: How to connect the battery and solar panel

Charging a lithium ion battery can be done by the USB port or by the solar connector (solar connector can be used with a solar panel or a direct DC power supply). The voltage must be a maximum of 5.5 volt. The meaning of the battery LED is explained in Table 2: Charge controller states.

Table 2: Charge controller states

Charge controller state	**LED**
No battery	OFF
Charging	ON
Charge complete	OFF
Shutdown	OFF

The battery jumper must be connected when using the charge controller (see Figure 2: Battery jumper).

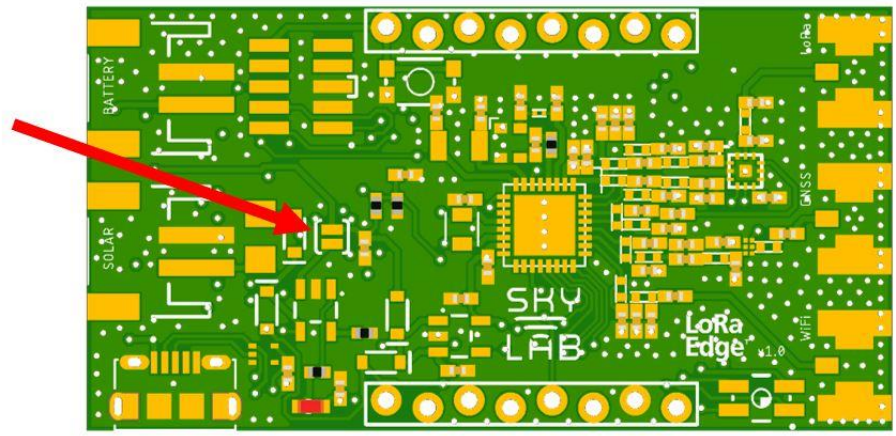

Figure 2: Battery jumper

3. Configure Arduino IDE

The Arduino IDE can be used for uploading software via the micro USB port. Before it can be used the IDE must be configured.

The first thing is to install the board via board manager.

Go to File → Preferences. Add the following link to Additional Boards Manager URLs:

https://github.com/SkyLabIoT/LoRaEdge_BasicTracking/raw/master/package_skylab_index.json

The board package can be downloaded via Tools → Board → Boards Manager… by searching for SkyLab.

Select the board via Tools → Board → SkyLab Boards → SkyLab LoRa Edge.

The example sketch can be loaded via File → Examples → SkyLab LoRa Edge → BasicLoRaA.

4. Example mode A device (BasicLoRaA)

How to use the mode A example sketch.

4.1. Joining network

After uploading the mode A example sketch the serial monitor can be opened on a 9600 baud rate. The system starts with displaying the configured join_eui, dev_eui and app_key. The join_eui is requested from the LR1110 chip and is unique to that specific chip. This key should be used in the console of the used network. The dev_eui and app_key are configured in the code and should be changed for the correct keys, given by the used network console. If configured correctly the device automatically joins.

4.2. Configure via downlink

Downlinks should be send on port 2.
The downlink format should be as follows:

0	1-2	3	4	5
LED	Interval	Beacon	Wi-Fi	GNSS

Byte 0: LED
This byte configures the status LED
0 = OFF
1 = ON (during Wi-Fi scan (blue), GNSS scan (red) and radio beacon (green))
Others = keep current setting

Byte 1 and 2: Interval
These 2 bytes configure the standard interval time between messages
Time is in minutes. Interval set to 0 will keep current setting and will not set an new interval time. Maximum time is 65535 minutes.

Byte 3: Beacon
This byte configure the time that de beacon is turned on. Time is in minutes. Maximum time is 255 minutes.
When set to 0 the beacon will not be turned on.

Byte 4: Wi-Fi
This byte turns the Wi-Fi payload on or off.
0 = OFF
1 = ON
Others = keep current setting

Byte 5: GNSS
This byte turns the GNSS payload on or off.
0 = OFF
1 = ON
Others = keep current setting

Downlink examples:

LED on, interval on 5 minutes, no beacon, Wi-Fi and GNSS payload on:
01 00 05 00 00 00 01 01

LED off, interval 600 minutes, no beacon, Wi-Fi payload on, GNSS payload off:
00 15 36 00 00 00 01 00

Keep current LED and interval setting, no beacon, Wi-Fi payload off, GNSS payload on:
02 00 00 00 00 00 00 01

Turn beacon on for 5 minutes, keep all other current settings:
02 00 00 01 00 05 02 02

4.3. Uplink format

The mode A example sketch can send 4 types of payload. These payloads types are identifiable by the port number used.

On port 1:

The LR1110 sends an automated message when joining and every 24 hours after that. This message can be ignored.

On port 2:
This is the Wi-Fi and sensor payload. This payload has the information of 3 Wi-Fi points and the sensor data. The format is as follows:

0	1-6	7	8-13	14	15-20
RSSI 1	MAC 1	RSSI 2	MAC 2	RSSI 3	MAC 3

21	22-23	24-25	26
Battery voltage	Temperature	Pressure	Humidity

Byte 0, 7 and 14:
These bytes have the RSSI / signal strength of the scanned Wi-Fi points. These values must be interpreted as signed integers.

Byte 1 to 6, 8 to 13 and 15 to 20:
These bytes have the MAC addresses of the scanned Wi-Fi points.

Byte 21: Battery voltage
This byte has the raw battery voltage value. The exact voltage can be calculated with:
Voltage = (float)((3.3 / 255) * ((4.7 + 10) / 10) * (Battery voltage));

Byte 22 to 23: Temperature
These bytes have the temperature value. The exact temperature in degree Celsius (◦C) can be calculated with:
Temperature = (float)(Temperature / 100);

Byte 24 to 25: Pressure
These bytes have the air pressure value. The exact pressure in degree hector Pascal (hPa) can be calculated with:
Air pressure = (float)(Pressure / 10);

Byte 26: Humidity
This byte has the humidity value in %.

On port 3:
This is the GNSS payload. This payload only has the raw GNSS data and is variable in size.

On port 10:
This payload is used as a “I am awake” message. By default it is set to every 24 hours. This can be changed by changing the value “controlTime”. The format is as follows:

0
Battery voltage

Byte 0: Battery voltage
This byte has the raw battery voltage value. The exact voltage can be calculated with:
Voltage = (float)((3.3 / 255) * ((4.7 + 10) / 10) * (Battery voltage));

4.4. Beacon

When the beacon setting is set to 1 the beacon will be activated. The device will leave the network and sends a random LoRa payload every second on the 869800000 Hz frequency (outside the official LoRa frequency). The green LED will turn on if the LED activation is set to 1. The beacon will stop when the set time is reached. The system will rejoin the network and operate as before.