SW User Guide

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TELIT
TECHNICAL
DOCUMENTATION

Stollmann is a Telit brand.

BlueEva+S/ADC

Evaluation Kit User Guide

Release r03

Table of Contents

1 Introduction

This documentation describes the usage of the evaluation board for the Bluetooth module BlueMod+S/ADC.

The evaluation board is not a finished product and is intended for development and evaluation purposes in a laboratory environment only.

2 Package Content

The BlueEva+S/ADC package contains the following components:

- 1 x BlueEva+S Board
- 1 x USB cable
- 1 x Battery CR2032
- 1 x ADC Extension Board
- 1 x Printed card with download instructions

3 Version Information

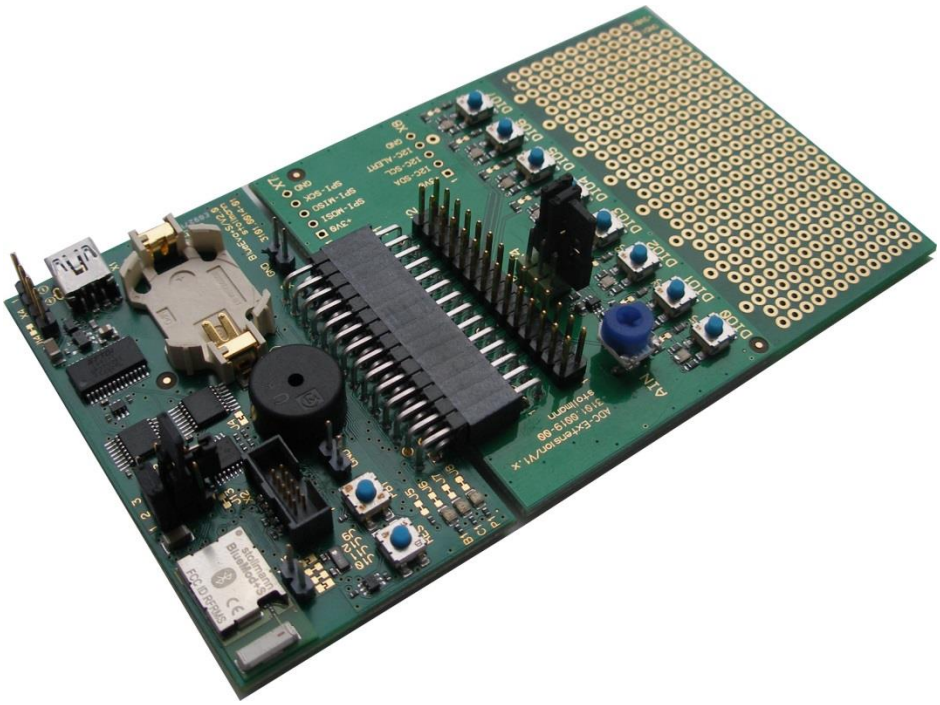


Figure 1: BlueEva+S board V2.1 + ADC extension board V1

4 Hardware

4.1 BlueEva+S

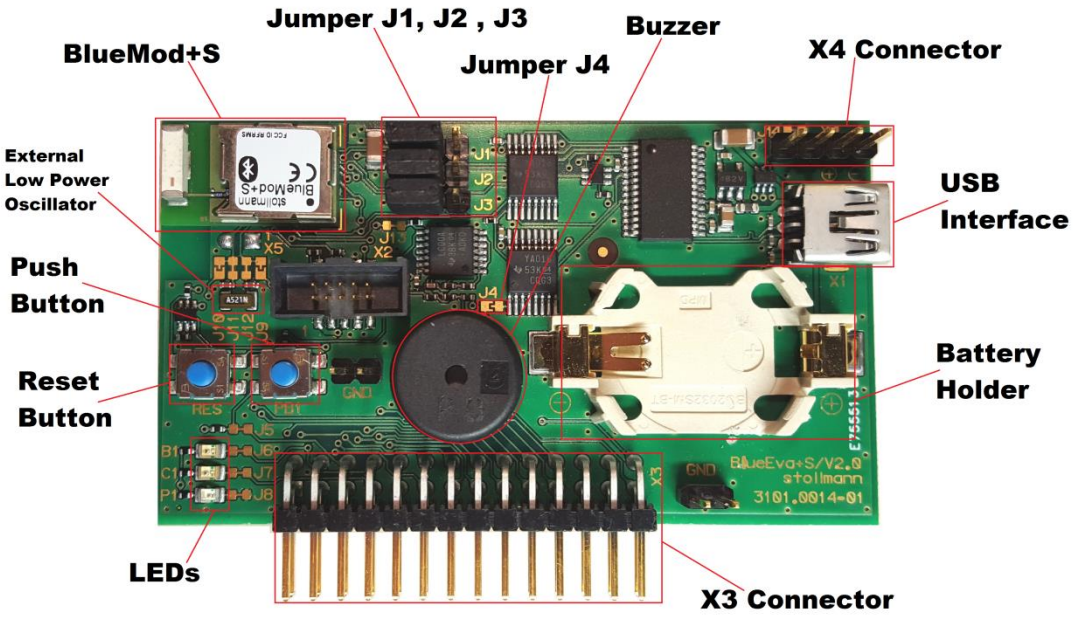


Figure 2: BlueEva+S

4.1.1 BlueMod+S

The BlueEva+S is equipped with a BlueMod+S Bluetooth module.

4.1.2 Reset

The BlueEva+S is equipped with a reset button. Pressing the reset button will trigger the BlueMod+S module to perform a reset. The USB port is not influenced by the reset.

4.1.3 USB Interface

The BlueEva+S provides an USB interface which is used to connect the evaluation board to the host and as power supply.

The USB interface is equipped with an FTDI USB to serial bridge, interfacing the serial port of the BlueMod+S.

The serial port is a high-speed UART interface at CMOS levels and supports the following features:

- Transmission speed: 9,600 – 921,600 bps (asynchronous)
- Character representation: 8 bit, no parity, 1 stop bit (8N1)
- Hardware flow-control with RTS/CTS (active low)

For details please refer to the *BlueMod+S Hardware Reference*.

4.1.4 LEDs

The BlueEva+S provides several LEDs for functional indication.

Interface	Position	Function
LEDs	P1	Indicates the presence of power supply voltage
	B1	Connected to GPIO[3] (1)
	C1	Connected to GPIO[2] (1)

(1) Function depending on firmware support

4.1.5 External Low Power Oscillator

The BlueEva+S provides an external low power crystal. This is connected to the BlueMod+S by default. For using alternatively low power oscillator sources refer to the schematics and the *BlueMod+S Hardware Reference*.

4.1.6 Connectors / Jumpers

4.1.7 Jumper J2

Jumper J2 provides the possibility to invoke the bootloader at start-up. This is required for firmware update.

Jumper Number	Position	Function
J2	1-2	Normal operation mode at start-up
J2	2-3	Invoke bootloader at start-up (BOOT0)

4.1.8 Jumper J3

Jumper J3 is used for either hangup or UICP functionality.

In hangup mode DTR# is connected to GPIO[4]. An existing connection is terminated by DTR drop (high signal on DTR#).

In UICP mode DTR# is used as IUR-IN# signal. UICP is an advanced power management protocol. For further information about UICP please refer to the *UICP UART Interface Control Protocol Specification*.

Jumper Number	Position	Function
J3	1-2	DTR# connected to IUR-IN# for using UICP
J3	2-3	DTR# connected to GPIO[4]

4.1.9 Jumper J4

Jumper J4 provides the possibility to disable (by closing it with a soldering point) the USB to serial bridge. With a closed jumper J4, the in- and outputs of the FTDI chip are disconnected. Therefore the modules serial port can be controlled via Connector X3 (see chapter 0).

When using BlueEva+S V2.1, be sure to connect a serial interface via connector X3 only when jumper J4 is closed. Otherwise the serial interface and the USB to serial bridge will collide.

4.1.10 Connector X3

Connector X3 is a 28 pin extension header exposing all module signals.

Pin Number	Signal	Type	Description
1	+3V0	PWR	Supply voltage output
2	+3V0	PWR	Supply voltage output
3	GND	PWR	Ground
4	GND	PWR	Ground
5	GPIO[0]	I	GPIO
6	GPIO[1]	I	GPIO
7	GPIO[2]	I/O	LED C1, user IO
8	GPIO[3]	I/O	LED B1, user IO
9	GPIO[4]	I-PD	HANGUP
10	GPIO[5]	I/O	IOD, user IO
11	GPIO[6]	I-DIS	GPIO
12	GPIO[7]	I-DIS	GPIO
13	GPIO[8]	I/O	IOA, user IO
14	GPIO[9]	I-DIS	Leave open (1)
15	GPIO[10]	I-DIS	Leave open (1)
16	GPIO[11]	I-DIS	Leave open (1)
17	GPIO[12]	I-DIS	Leave open (1)
18	GPIO[13]	I-DIS	Leave open (1)
19	GPIO[14]	I-DIS	Leave open (1)
20	PO26_AIN0		See schematic (1)
21	PO27_AIN1		See schematic (1)
22	EXT-RES#	I-PU	User reset
23	UART-TXD(2)	O-PP	IUR data OUT
24	UART-RXD(2)	I	IUR data IN
25	UART-CTS#(2)	I	Flow control / IUC
26	UART-RTS#(2)	O-PP	Flow control / IUC
27	IUR-IN#(2)	I	UICP control
28	IUR-OUT#(2)	O-PP	UICP control

PU = PullUp, PD = PullDown, PP = PushPull, I-DIS = InputBufferDisconnected

(1) Function depending on firmware support

(2) BlueEva+S V1.0: Disconnected from module, when jumper J4 is open

4.1.11 Connector X4

Connector X4 provides the possibility to measure the supply current of the BlueMod+S and to power the evaluation board with an external power supply.

Pin Number	Signal
1	GND
2	ext. PWR
3	+3V0
4	+3V0-BT

4.1.12 Buzzer

The Buzzer can be used to generate alarm and other audible signals.

4.1.13 Push Button

The Push Button can be used as input for human interaction.

4.2 Current Measurement

Current measurement can be performed by opening (cut off) jumper J14 and measuring the current drawn by BlueMod+S between pin 3 and 4 of connector X4. The currents drawn by other peripherals on BlueEva+S are not included in this measurement.

For measuring the minimum current, the serial interface must be disconnected from the module. This can be achieved by disconnecting the USB plug and powering the board via external or battery supply or by closing solder jumper J4.

4.3 Power Supply

The three power sources are decoupled from each other by diodes connected in series. The presence of the supply voltage is indicated by LED P1.

4.3.1 USB Power Supply

V_{BUS} of the USB connector X1 directly powers the USB to serial converter and via a voltage regulator the rest of the circuitry.

4.3.2 External Power Supply

Pin 1 and 2 of connector X4 provides the possibility to connect an external power supply (see *BlueMod+S Hardware Reference*).

4.3.3 Battery Holder

The battery holder provides the possibility to run the BlueEva+S without external power (via USB or external power supply) by using a 3V coin cell battery CR2032. Opening jumper J8 will disconnect the power LED P1 and thus save 1.8mA of battery current. For safety reasons there should be permanently connected no other power supply, when a battery is inserted.

4.4 How To Interface the UART Lines on TTL level

If you want to access the UART lines directly it is important to disable the onboard USB to serial bridge by closing jumper J4 with a soldering point.

All UART signals are available at connector X3 and can be connected to your application.

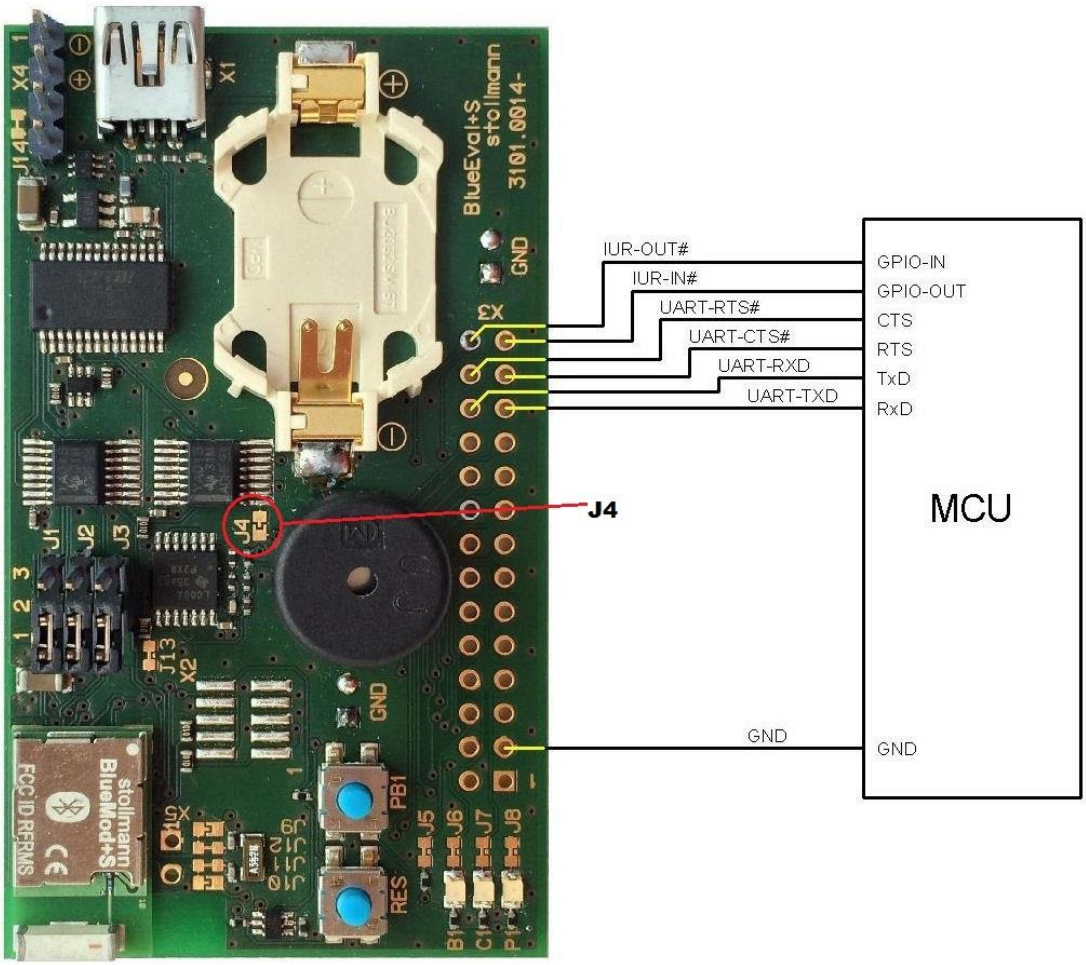


Figure 3: MCU connected to UART lines

4.5 Default Configuration

The BlueEva+S is preconfigured as described below:

Jumper Number	Position	Function
J1	1-2	Normal operation mode at start-up
J2	1-2	Normal operation mode at start-up
J3	1-2	DTR# connected to IUR-IN# for using UICP

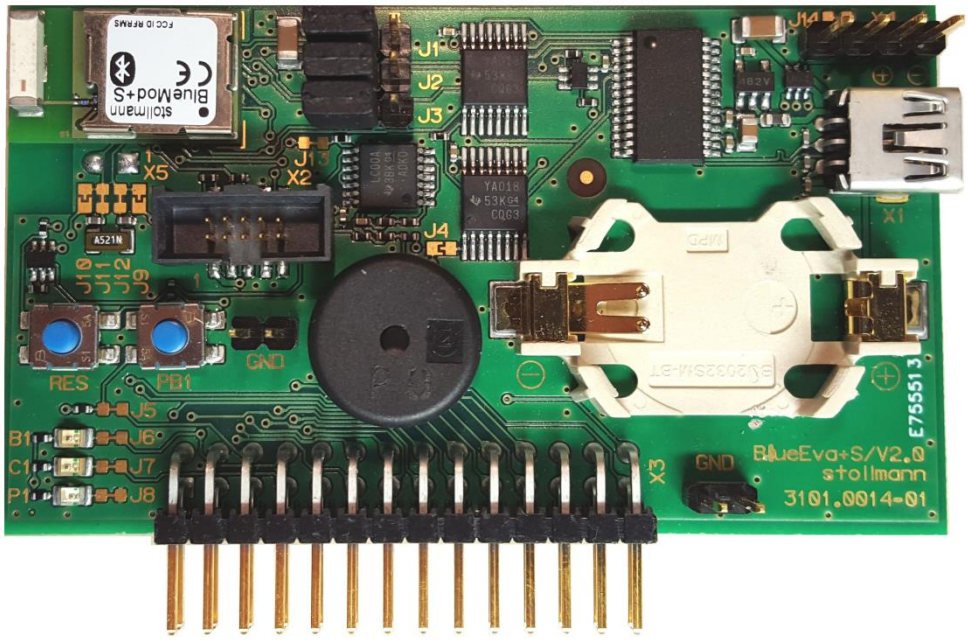
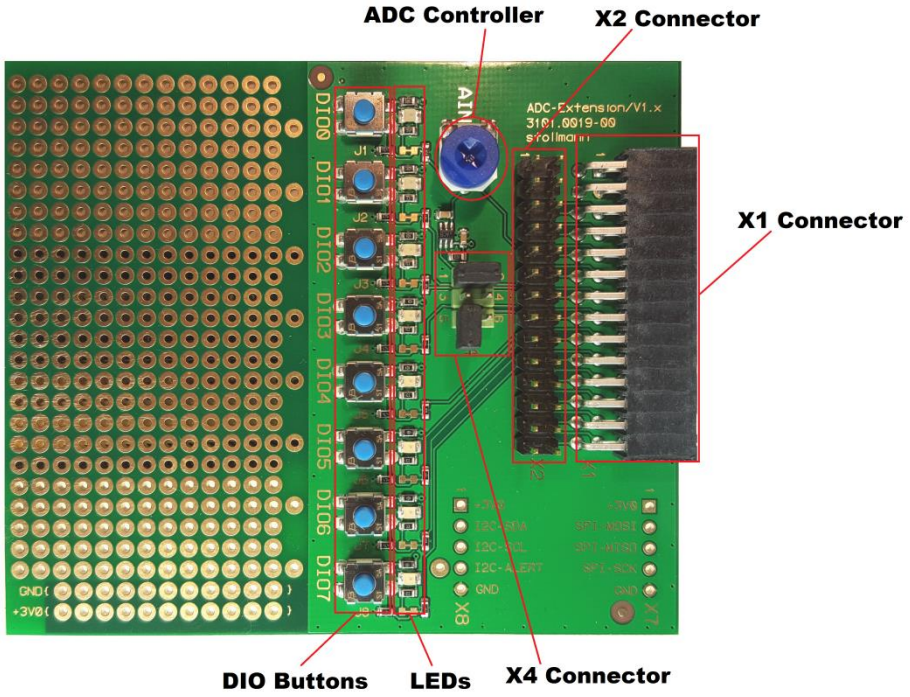


Figure 4: BlueEva+S default configuration

4.6 ADC Extension Board



4.6.1 Connector X1

Connector X1 is the counterpart to the connector X3 (see also chapter 4.1.10) from the BlueEva+S board.

4.6.2 Connector X2

With the help of this connector it is possible to apply DIO/ADC signals.
This connector is connected in parallel to the X1 connector.

4.6.3 DIO Buttons

The DIO buttons can be used on condition that the GPIOs are configured as input.

4.6.4 ADC Controller

The ADC controller can be used on condition that the pins 1-2 of interface X4 are bridged. The ADC controller allows generating a voltage in the range of about 0V – 3V for the ADC analog Input on the Module.

4.6.5 Connector X4

Pin Number	Signal	Description
1-2	ADC analog input	If these pins are bridged (e.g. with a jumper) this will enable the signal input from the ADC controller.
3-4	CNF_RES#	If the CNF_RES# signal is active (pins 3-4 are bridged for at least 1000ms) some parameter of the BlueEva+S/ADC will be set to default to ensure that the BlueMod+S/ADC is reachable/connectable again in case of misconfiguration.
5-6	OTA-CMD-EN#	If these pins are bridged (e.g. with a jumper) this will enable the SCIS mode (in this case the UART mode is disabled). If these pins are not bridged this will enable the UART mode (in this case the SCIS mode is disabled). *Note: A hardware reset is necessary after changing the SCIS/UART mode.*

4.6.6 LEDs

If some of the GPIO signals from the BlueEva+S/ADC are configured as output then the corresponding LEDs can be used to monitor the output DIO signals.

If some of the GPIO signals from the BlueEva+S/ADC are configured as input then the corresponding LED will shine as long as the button is pressed.

5 Setup

5.1 System Requirements

- PC with Windows® XP or higher
- 1 free USB port
- Adobe Acrobat® Reader for reading the documentation

5.2 Startup

To install the BlueEva+S/ADC on a PC please connect the mini USB connector to the BlueEva+S/ADC hardware and the USB-A connector to a free USB port on the PC.

5.3 Installation of the BlueEva+S/ADC USB Driver

Connect the BlueEva+S/ADC to a free USB port of a PC and install the USB device drivers by following the instructions of the Windows® Hardware Wizard using the downloaded FTDI VCP USB to UART driver.

If required download the latest FTDI VCP USB to UART driver from:
http://www.ftdichip.com/Drivers/VCP.htm

The USB connection is used for power supply and for UART communication to a PC over a virtual COM port. This lets you use a terminal emulation program to perform the configuration or to control the Bluetooth connection.

You may download the TeraTerm terminal program from our web site:
http://www.stollmann.de/en/support/downloads/tools.html

6 ADC Utility PC Client / ADC Utility iOS Client

Telit provides two software clients to be able to connect and configure the BlueEva+S/ADC. Both versions are made for test purposes and have the same look and feel and the same feature set.

6.1 ADC Utility iOS Client

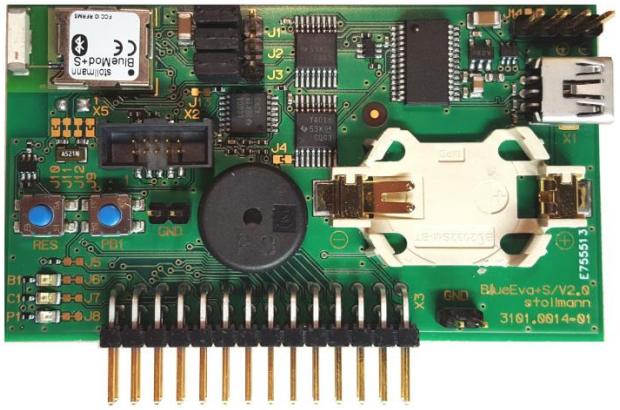
The ADC Utility iOS client is an iOS based software client and can be downloaded from the App Store for free:

https://itunes.apple.com/us/app/adc-utility/id1068531858?mt=8

The ADC Utility iOS client uses the Bluetooth stack from the iPhone and is after the software is successfully installed therefore ready to use.

6.2 ADC Utility PC Client

The ADC Utility PC Client is a free Windows based software client which needs additionally a BlueEva+S/Central device to connect to the BlueEva+S/ADC device. The BlueEva+S/Central device is not part of this package and must be purchased additionally. Please contact us on how to purchase the BlueEva+S/Central (Part number: 53231-24) including the ADC Utility PC Client Software:
e-mail: ts-srd@telit.com



BlueEva+S/Central

6.2.1 Installation of the BlueEva+S/Central USB Driver

The ADC Utility PC Client needs a BlueEva+S/Central (see chapter 6.2).

Connect the BlueEva+S/Central to a free USB port of a PC and install the USB device drivers by following the instructions of the Windows® Hardware Wizard using the downloaded FTDI VCP USB to UART driver.

If required download the latest FTDI VCP USB to UART driver from:
http://www.ftdichip.com/Drivers/VCP.htm

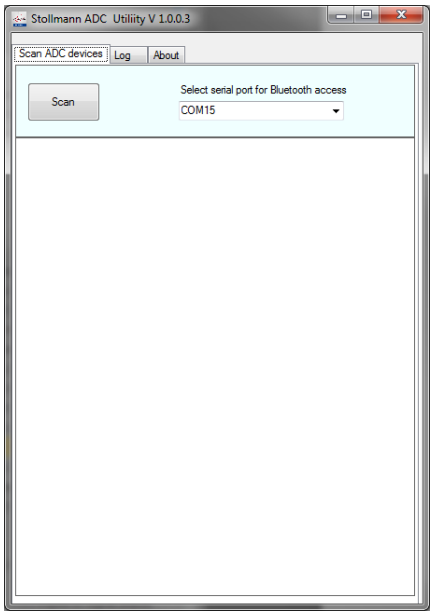
The USB connection is used for power supply and for UART communication to a PC over a virtual COM port.

Note: Please refer to the device manager to figure out which virtual COM port is used for the BlueEva+S/Central hardware.

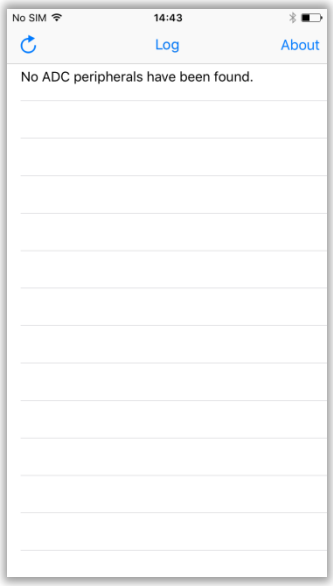
6.3 ADC Utility Client: Starting the ADC Utility Client

The ADC iOS Client can be download and installed from App Store whereas the ADC PC Client must be copied respectively unzipped to a directory of your choice on your PC. Execute “adcUI.exe” while the BlueEva+S/Central is connected to your PC.

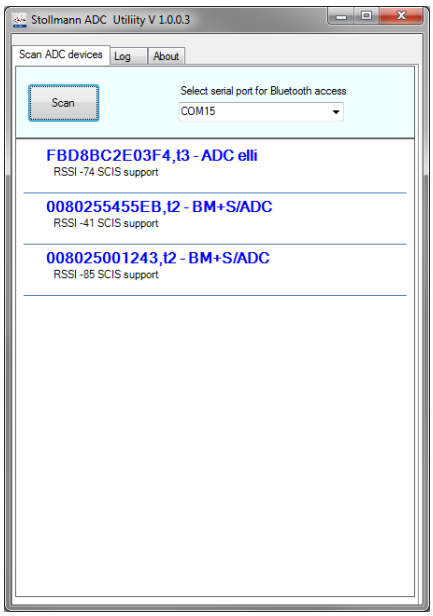
Regarding ADC PC Client: After application starts choose the COM port where the BlueEva+S/Central is connected to. The “Scan” button should be now selectable and a scan can be initiated. If the proper COM port could not be open then an error message will appear (e.g. “Adapter plugged in on COMxx does not response”).



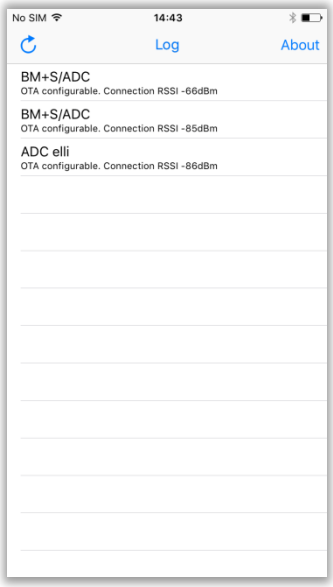
PC Client: Application start



iOS Client: Application start



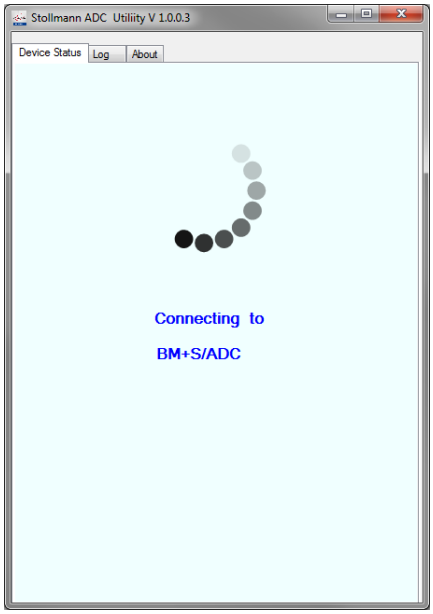
PC Client: Scan results



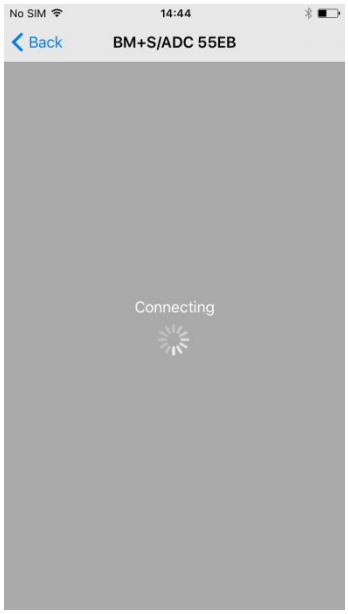
iOS Client: Scan results

6.4 ADC Utility Client: Connect to a ADC Device

Double click (PC Client) or touch (iOS Client) on an ADC device will initiate a connection. If the ADC device is configured with security (please refer to the ADC AT commands “AT+SECAIOS” / “AT+SECSCIS”) it may happen that a security message appears during the connection setup or configure device screen access.

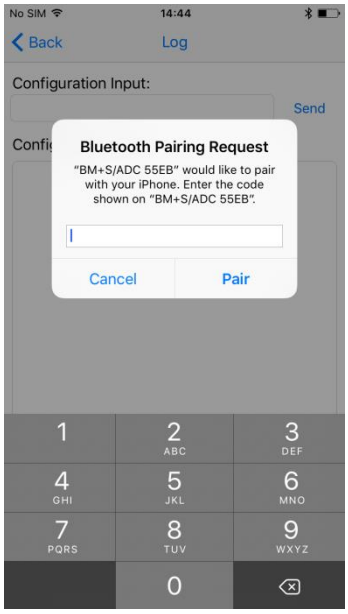


PC Client:
Connecting to a ADC device



iOS Client:
Connecting to a ADC device

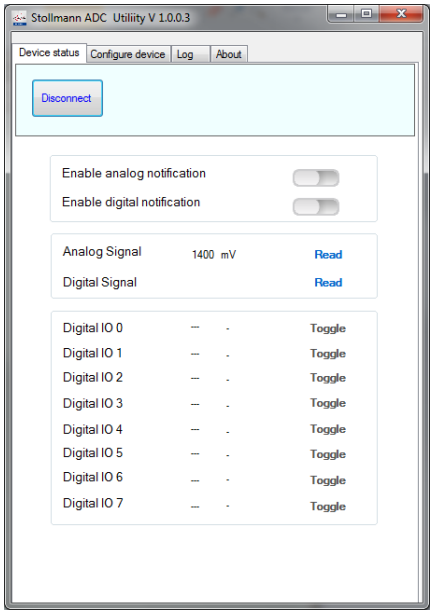
PC Client:
Security / PIN request



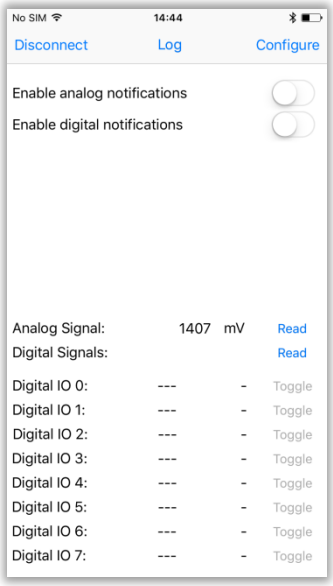
iOS Client:
Security / PIN request

6.5 ADC Utility Client: Signal Status Screen / Configure Device Screen

After successful connection the device status will be shown. The device status shows the states regarding the digital IO and analogue signals. Reading a digital or analogue state can be executed manually. Furthermore the digital and/or analogue notifications can be enabled or disabled.

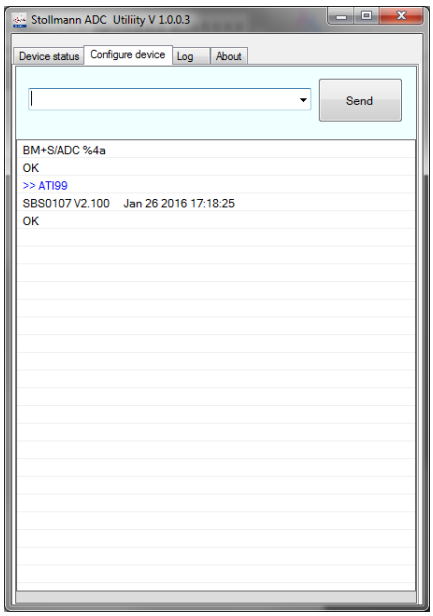


PC Client: Device status

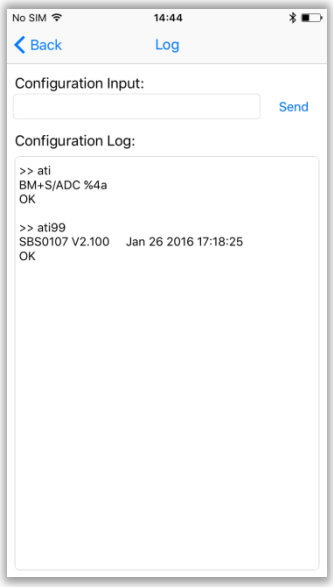


iOS Client: Device status

If the SCIS mode is enabled on the BlueEva+S/ADC device it is possible to send AT commands to the BlueMod+S/ADC via SCIS interface (via air). The SCIS interface allows to configure the BlueMod+S/ADC module over the air without access to the BlueMod+S/ADC UART.



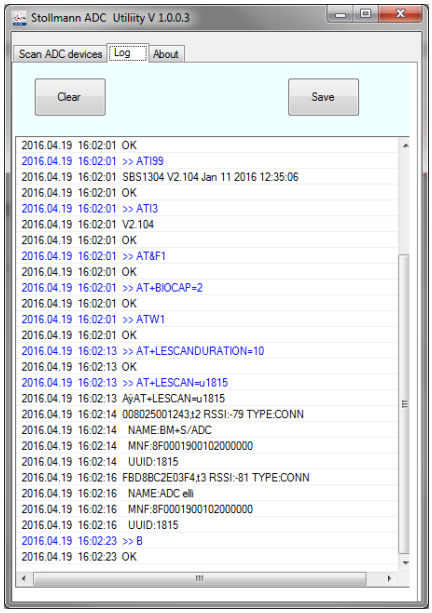
PC Client: Configure device



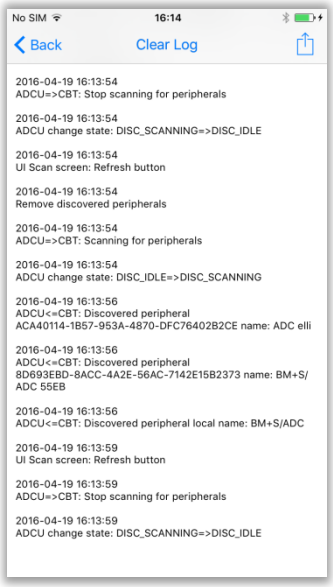
iOS Client: Configure device

6.6 ADC Utility Client: Logging Screen

The PC Client logging screen displays AT commands related information for communication with the BlueEva+S/Central connected to the local UART while the iOS Client displays sent or received related iOS events.
The logging screen can be cleared by using the button “Clear” (PC Client) respectively “Clear log” (iOS Client).



PC Client: Logging screen



iOS Client: Logging screen

6.7 ADC Utility Client: Hands on - Alarm System Examples

6.7.1.1 Configure State Control

- Configure DIO4 as output to signal App Monitor state
  ➔ **AT+GPIO=4,dir=o,fbv=0n**
  DIO4 is an output, the initial default signal level is low, the actual signal level will be reset to default in case of an disconnect
- Configure DIO6 as output to control alarm system state
  ➔ **AT+GPIO=6,dir=o,fbv=0p**
  DIO6 is an output, the initial default signal level is low, the actual signal level will preserved in case of an disconnect
- Configure DIO7 as input to monitor alarm system state
  ➔ **AT+GPIO=7,dir=i,pull=n**
  DIO7 is an input, the pull resistors are disabled

Now the alarm system can be armed and its actual state can be read. Alarm system gets App State update in case of disconnect.

6.7.1.2 Configure Battery Monitoring

- Define alarm conditions for analog notifications
  ➔ **AT+ADCTHLD=1000,edge=f**
  Alarm will be triggered if input voltage falls below 1000mV threshold

  ➔ **AT+ADCSR=100**
  Alarm condition will be checked every 100ms (ADC Sample Rate)
- Enabled analog signal notifications
  ➔ Switch corresponding application slider to “ON”
  The corresponding GATT CCCD attribute of the AIOS will be set by the Application

Now the alarm system can trigger an low power Application alarm any time when connected

7 Usage of the BlueEva+S/ADC

7.1 Configuration of the BlueEva+S/ADC

7.1.1 UART Mode

Note: Verify that the UART mode is enabled (see also chapter "4.6.5 Connector X4")

If the BlueEva+S/ADC is correctly connected to the PC, a terminal emulation program can be used to read and modify the configuration settings.

For a more detailed description of the AT commands used for this purpose, please consult our *BlueMod+S/ADC AT Command Reference*.

As shipped by the factory, the BlueEva+S/ADC works at 115,200 bps, using the 8N1 data format (8 data bits, no parity, 1 stop bit). Please configure your terminal emulation program accordingly. Select the COM port the BlueEva+S/ADC is connected to (COM22 in the example below).

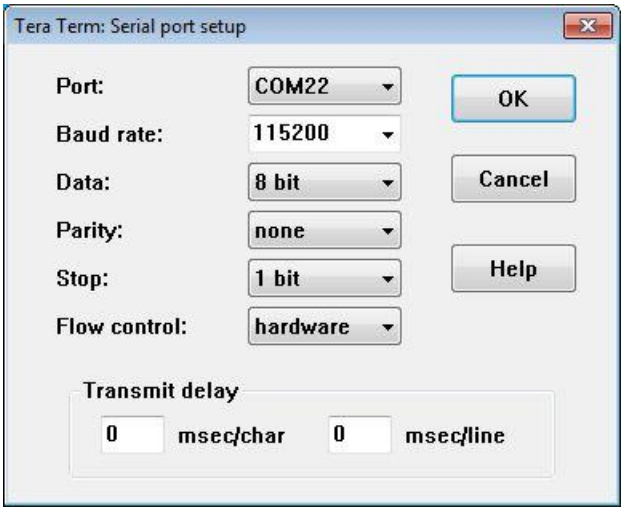


Figure 5: COM port configuration with TeraTerm

Once you have successfully configured the terminal emulation program, issuing the "AT" command without parameters should prompt the BlueEva+S/ADC to return OK.

Now you can readout information about the type of the connected device using the "ATI" command.

In the next step, you should issue the "ATI99" command to determine the firmware version installed and check to see whether that is the most recent version.

Finally, you should use the "AT+BOAD" command to determine the Bluetooth address of the BlueEva+S/ADC. The Bluetooth address is unique, letting you identify the correct device for each Bluetooth address.

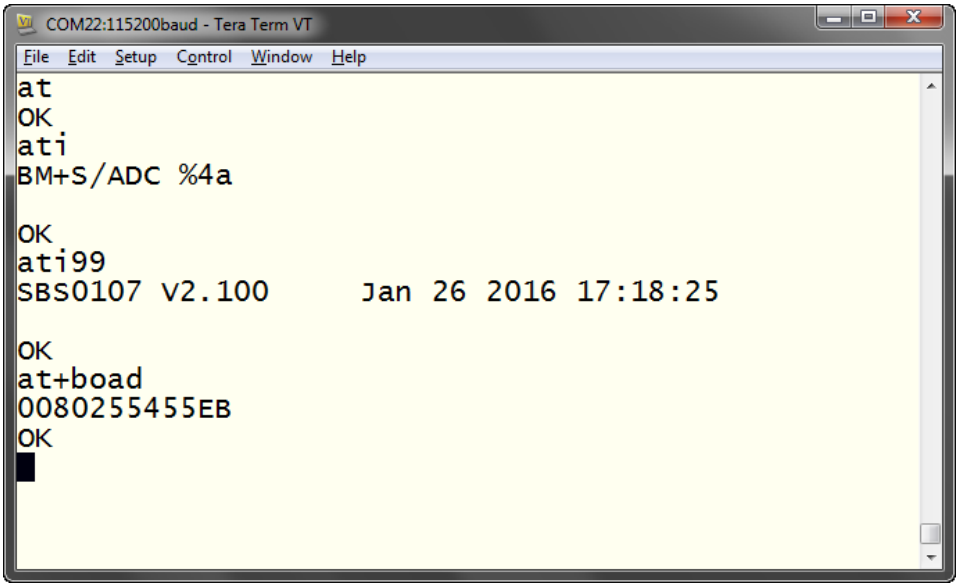


Figure 6: Reading some BlueEva+S/ADC settings with TeraTerm

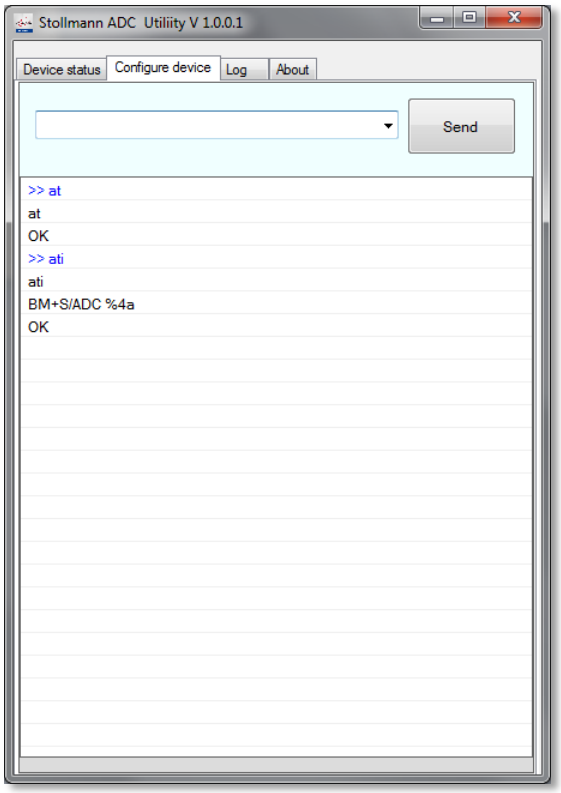
7.1.2 SCIS Mode

Note: Verify that the SCIS mode is enabled (see also chapter "4.6.5 Connector X4")

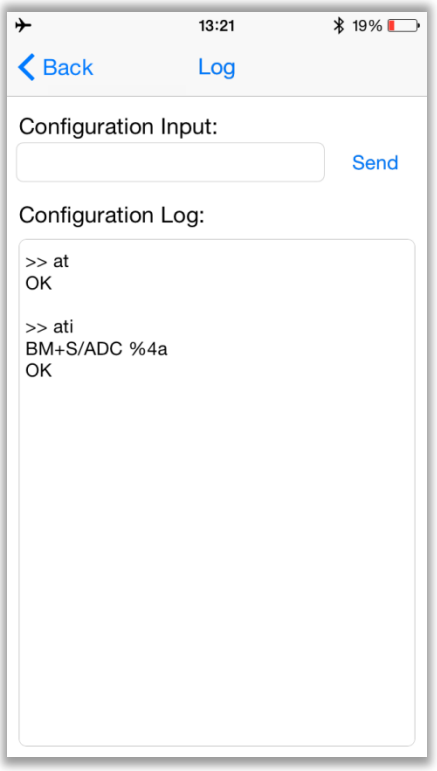
If the SCIS mode is enabled the AT commands can be exchanged over this interface.

Once you have successfully established a connection to the BlueEva+S/ADC device (hereinafter described on the basis of the PC client and iOS client) issuing the "AT" command without parameters via SCIS interface should prompt the BlueEva+S/ADC to return OK.

For a more detailed description of the AT commands used for this purpose, please consult our *BlueMod+S/ADC AT Command Reference.*



Send AT command (PC client)



Send AT command (iOS client)

7.2 Examples to Use Digital and Analogue Signals

With AT commands (see also chapter 7.1 and the document *BlueMod+S/ADC AT Command Reference*) it is possible to set different modes of input and/or output signals.

Note: The AT command can be entered either via UART or via SCIS interface. This makes no differences. Use AT&W to save the parameter persistently.

7.2.1 Digital IO Signal (Output)

Output Example 1:

The following example uses the AT command: **AT+GPIO=0,dir=o,fbv=1n**

GPIO=0 = *Logical number of GPIO*
dir=o = *Direction of GPIO is output*
fbv=1n = *[1] Output signal is high, [n] fallback to high if connection is shutdown*

Once the AT command has been send successfully the LED on the extension board for DIO0 switches to ON. The signal for the LED can be toggled with the PC client/iOS client (device status) depending on which client is connected. The device status of the PC client/iOS client shows additionally the corresponding signal level regarding DIO0 (Out = 0/1). If the toggle status is 0 and the connection will be disconnected or gets lost for any reason then the LED will become status 1 again because of the setting fbv=1n (fallback to high if the connection is shutdown).

Output Example 2:

The following example uses the AT command: **AT+GPIO=1,dir=o,fbv=0n**

GPIO=1 = *Logical number of GPIO*
dir=o = *Direction of GPIO is output*
fbv=0n = *[0] Output signal is low, [n] fallback to low if connection is shutdown*

Once the AT command has been send successfully the LED on the extension board for DIO1 switches or stays OFF. The signal for the LED can be toggled with the PC client/iOS Client (device status) depending on which client is connected. The device status of the PC client/iOS client shows additionally the corresponding signal level regarding DIO1 (Out = 0/1). If the toggle status is 1 and the connection will be disconnected or gets lost for any reason then the LED will become status 0 again because of the setting fbv=0n (fallback to low if the connection is shutdown).

7.2.2 Digital IO Signal (Input)

The following example uses the AT command: **AT+GPIO=2,dir=i,pull=n**

GPIO=2 = *Logical number of GPIO*
dir=i = *Direction of GPIO is input*
pull=n = *GPIO has no pull resistor applied (default)*

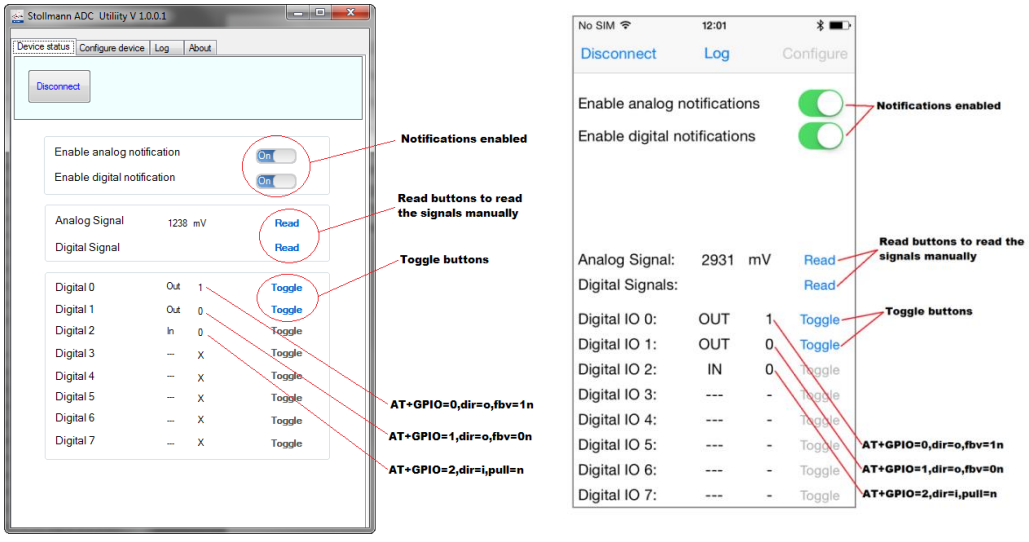
Once the AT command has been send successfully the DIO2 is ready to receive signal changes from the extension board. Press the DIO2 button to toggle between state 0 and 1. The input signal can be displayed with the PC client/iOS client (In = 0/1) by pressing the digital “Read” button manually or alternatively by enabling the digital notifications (DIO2 state will be automatically updated).

7.2.3 Analogue Signal (Input)

The following example uses the AT command: **AT+ADCSR=1000**

This command sets the ADC sample rate to 1000 (1000 = 1 sample per second).

Once the AT command has been send successfully the FW is generating analogue to digital (ADC) signals coming from the extension board (ADC controller) on condition that the pins 1-2 on the interface X4 are bridged. The analogue input signal can be displayed with the PC Client/iOS Client by pressing the analogue “Read” button manually or alternatively by enabling the analogue notifications (analogue value will be automatically updated each second).



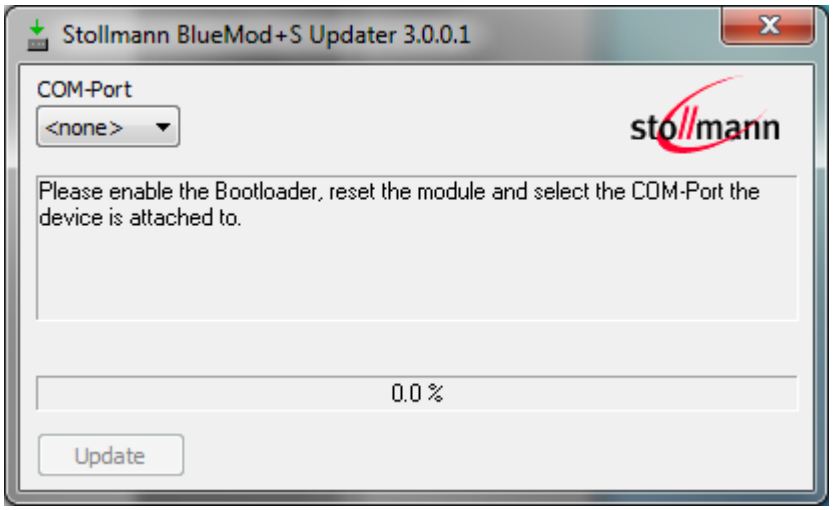
8 Firmware Update

8.1 Serial Firmware Upgrade (UART)

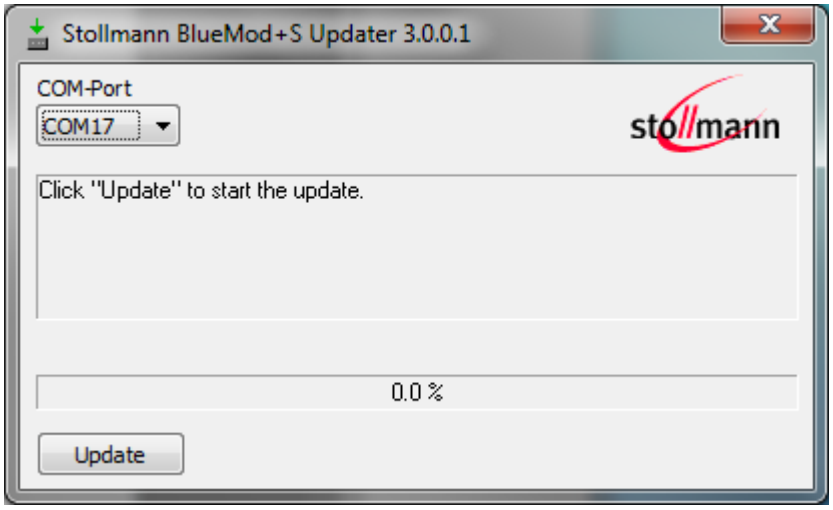
The firmware of the BlueEva+S/ADC can be updated by using the BlueMod+S Updater. The file name of the executable program consists of version and patch information.

Please follow the instructions below for updating the firmware:

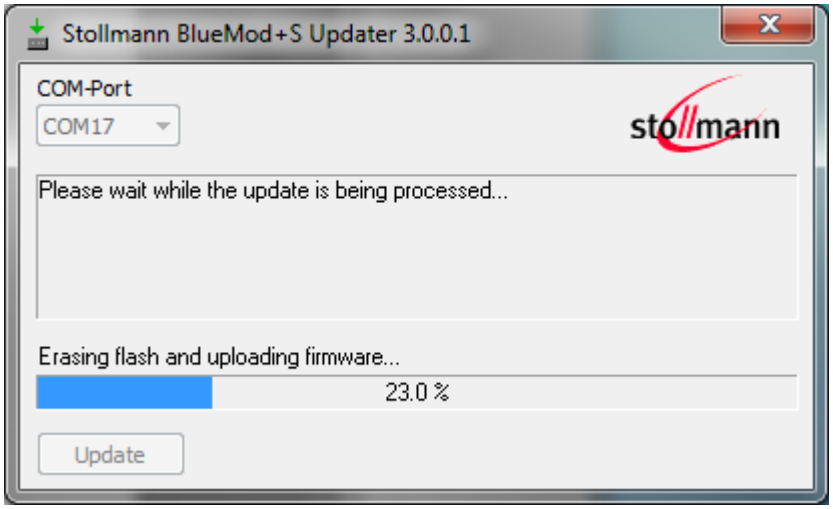
- Configure jumper J2 to position 2-3 to activate the bootloader at start-up.
- Connect the BlueEva+S/ADC to the USB port of a PC (make sure the FTDI VCP USB to UART driver is already installed). If the BlueEva+S/ADC is already connected to the PC perform a reset using the reset button.
- Start the *BM+S-ADC_v2_xxx_FWupdate.exe* program.



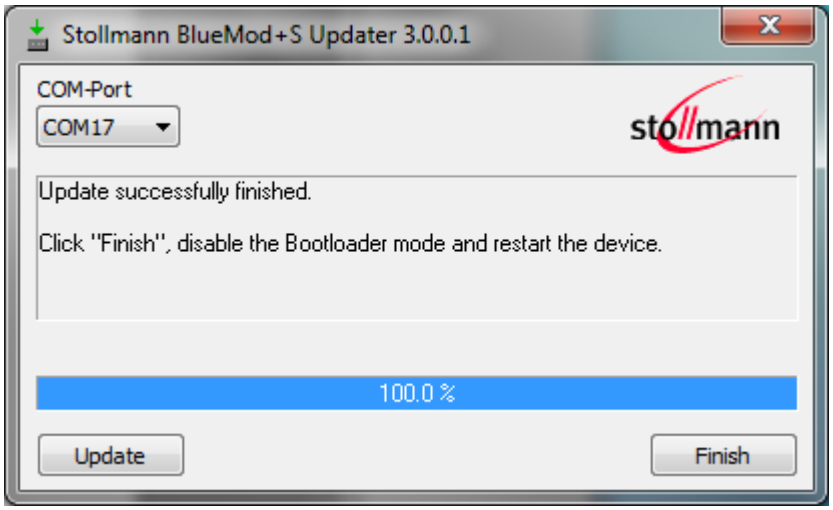
- Select the COM port the BlueEva+S/ADC is connected to and press the “Update” button.



- The firmware will be uploaded.



- After the update is completed click the “Finish” button.



- To set back the BlueEva+S/ADC into normal operation mode, move jumper J2 to position 1-2 again and perform a reset.
- Send the AT&F command to set the factory default values.

Note:
Do not disconnect the device while the update is in progress, otherwise the update will fail and has to be repeated. In case it is not possible to update the module please contact the Telit support (e-mail: ts-srd@telit.com).

8.2 Firmware Update Over The Air (OTA)

The BlueMod+S/ADC supports firmware over the air update. The firmware update over the air can be performed by using the Nordic nRF ToolBox app available for iOS and Android or by using the Nordic Master Control Panel and the corresponding Nordic Bluetooth hardware.

The firmware over the air update in the BlueMod+S/ADC will be enabled with the AT commands below:

- AT+DFUMODE=2
- AT+DFUSTART

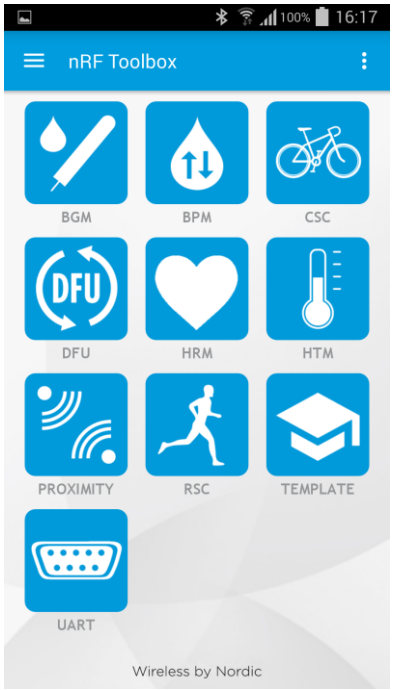
After sending the AT+DFUSTART command the BlueMod+S/ADC is visible in the air as “BM+S_DFU” (name configured with command AT+DFUNAME) for a time period of 2 minutes. If no firmware update is performed during this time the BlueMod+S/ADC will continue with normal operation.

The following chapter describes the firmware over the air update by using the Nordic nRF Toolbox app on Android.

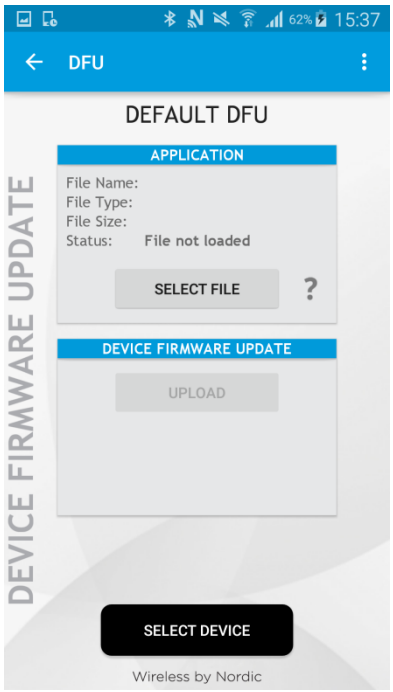
8.2.1 Firmware Update Over The Air using Nordic nRF Toolbox on Android

Make sure the BlueMod+S/ADC has already activated the firmware over the air update.

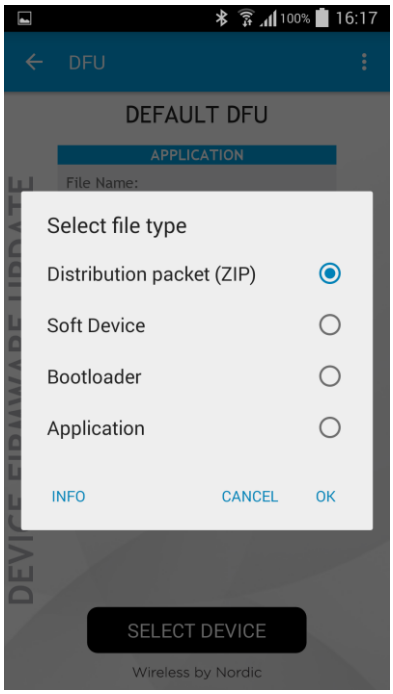
Open the nRF ToolBox app on the smartphone and choose “DFU“.



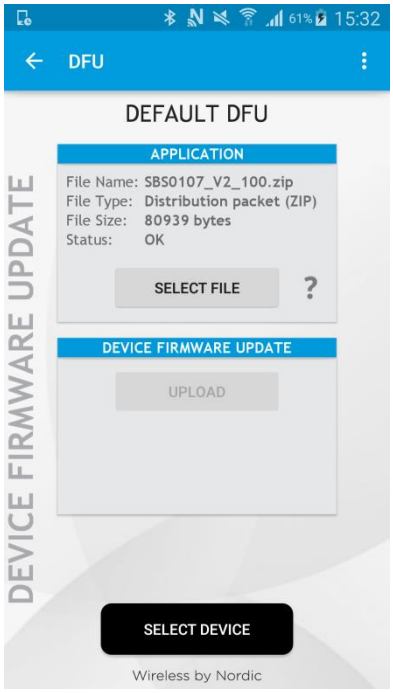
Press the button “SELECT FILE”:



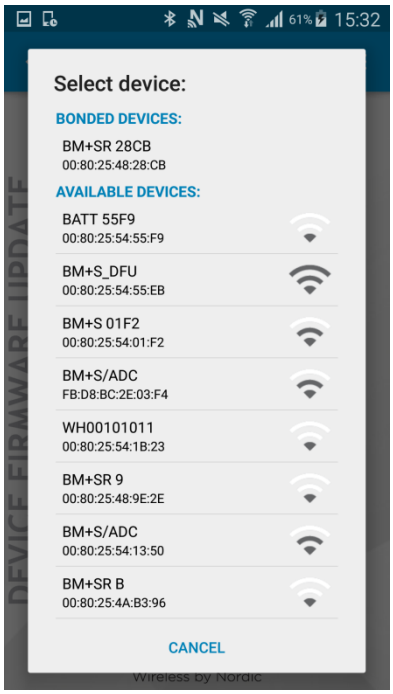
Select file type “Distribution packet (ZIP)”:



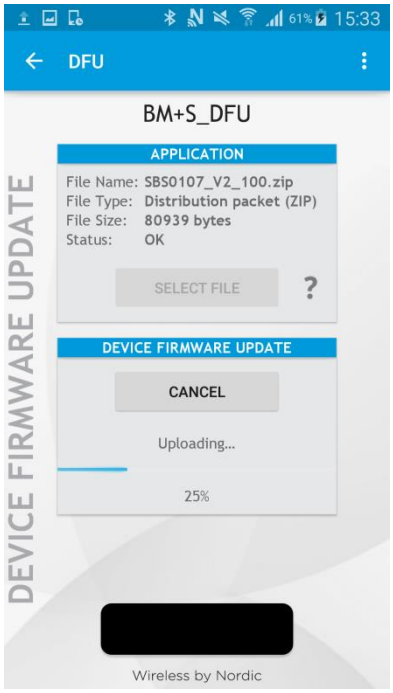
Search via file manager for the firmware package which was previously copied to the smartphone (e.g. SBS0107_V2_100.zip in the example below):



Press the button “SELECT DEVICE” and select the “BM+S_DFU” from the list of available devices:



Press the “UPLOAD” button to upload the firmware package over the air to the BlueMod+S/ADC:



After the file was uploaded successfully the BlueMod+S/ADC will start with the new firmware.

9 History

Version	Release Date	By	Change description
r01	22.03.2016	NH	Initial version
r02	18.04.2016	NH	Added additionally ADC Utility Client information
r03	24.05.2016	BG	Telit cover page added

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