



TECHNICAL DATA SHEET

NBL-3

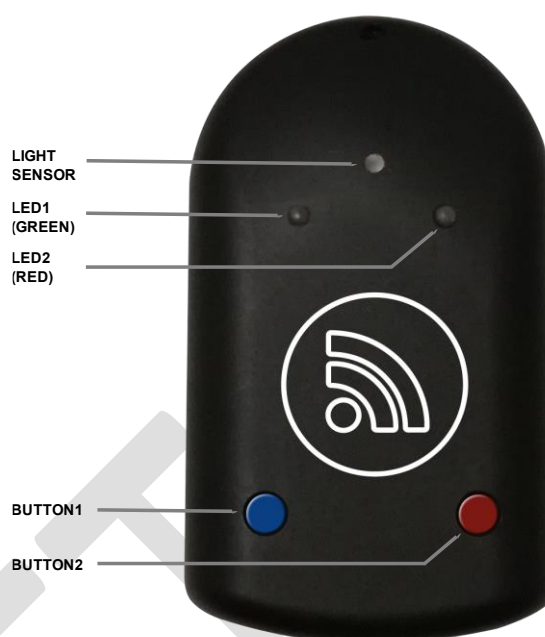


Contents:

1	Features	3
2	Functionality.....	3
3	Dimensions.....	4
4	Broadcasting packet structure	5
5	GATT server functionality	5
5.1	<i>Device Information Service.....</i>	6
5.2	<i>Characteristic</i>	6
5.3	<i>Status/Operation Service.....</i>	6
5.3.1	<i>Command Control Characteristic</i>	6
5.3.1.1	<i>KeepAlive command.....</i>	6
5.3.1.2	<i>Reset command.....</i>	6
5.3.1.3	<i>ConfigReset command</i>	6
5.3.1.4	<i>SetPIN command.....</i>	7
5.3.1.5	<i>LED command.....</i>	7
5.3.1	<i>Reset Characteristic.....</i>	7
5.3.2	<i>Device Status0 Characteristic</i>	7
5.3.1	<i>Device Status1 Characteristic</i>	8
5.4	<i>General Configuration Service.....</i>	8
5.4.1	<i>Periods Characteristic.....</i>	8
5.4.2	<i>Advertising time Characteristic</i>	9
5.4.3	<i>Advertising payload Characteristic.....</i>	9
5.4.4	<i>Active sensor Characteristic</i>	9
5.4.5	<i>Light sensor configuration Characteristic.....</i>	9
5.4.6	<i>Temperature sensor configuration Characteristic</i>	10
5.4.7	<i>Humidity sensor configuration Characteristic.....</i>	10
5.4.8	<i>Led/button Configuration Characteristic</i>	11
5.5	<i>Configuration of card reading mode Service</i>	11
5.5.1	<i>Card Config0 Characteristic</i>	11
5.5.2	<i>Card Config1 Characteristic</i>	11
5.5.3	<i>Card Config2 Characteristic</i>	11
6	Sensor work mode.....	12
6.1	<i>Delta</i>	12
6.2	<i>Margin.....</i>	12
7	Button work mode	12
7.1	<i>Normal.....</i>	12
7.2	<i>Toggle.....</i>	13
8	Power Off / Reset to default settings.....	13
9	Power On.....	13
10	Paring	13
11	Firmware update functionality	15
11.1	<i>Firmware update using the NBL Tool application</i>	15
11.2	<i>Firmware upgrade algorithm</i>	16
12	Battery Replacement	17
13	LED	17
13.1	<i>MSG_START.....</i>	17
13.2	<i>MSG_ADV.....</i>	17
13.3	<i>MSG_CONN</i>	17
13.4	<i>MSG_WAK_UP</i>	17

1 FEATURES

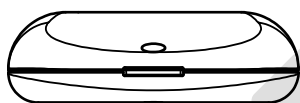
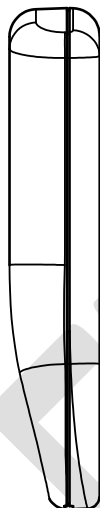
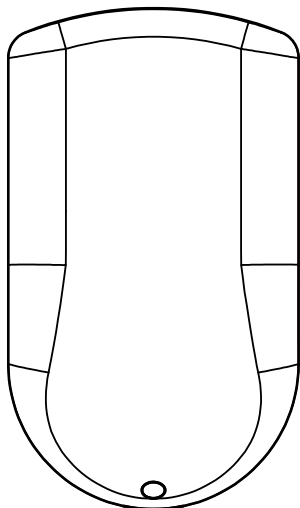
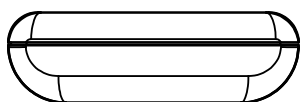
- Mifare® Classic, Desfire card supports
- Bluetooth low energy module
- Two AAA battery supply
- Up to 3 years battery operation
- Built-in two LED indicators
- Built-in two buttons
- UID and card DATA available
- Configure via BL link
- Firmware update via Bluetooth
- Operating temperature -40°C to +85°C
- Enclosure size: 100x58x18
- Additional sensors in NBL-3:
 - Temperature
 - Humidity
 - Magnetic field
 - Light



2 FUNCTIONALITY

- Unpaired reader (state after default reset) is waiting for button only
- Reader scans for transponder detect or button press all time when is paired
- In case above event occurs, reader sends advertising packet for T_a time in period T_b . Defaults: $T_a=50\text{sec}$, $T_b=100\text{ms}$
- During advertising green led is flashing slowly. Reader stops blinking and advertising after disconnection.
- Depending on configuration, read card ID can be present on advertising packet or/and on characteristic
- Reader close connection and goes into low power 60 seconds after last data exchange.
- Each LED can be controlled on GATT services
- Reader can be on/off by long button press
- Reader perform sensor measurement in period which is configurable
- Button and magnetic field sensor reacts immediately
- If any sensor value is out of margin, reader wakes up and sends advertising packet
- Sensors configuration is set by GATT services.

3 DIMENSIONS



4 BROADCASTING PACKET STRUCTURE

EIR Type	Description / Value	LEN
Flags – 0x01	0x06 GeneralDiscoverable, BrEdrNotSupported	3B
Complete name – 0x09	‘NBL-3’	7B
Service data – 0x16	Data format:	21B

BYTE:	0..1	2	3	4..5	6..7	8	9	10..18
Field:	UUID	Status	Batt	Temp	Humi	Light	CID_Len	CID

Field	Description								
UUID	'NX'								
Status	Data format: MSB LSB <table><tr><td>Prox</td><td>Temp</td><td>Humi</td><td>Light</td><td>Card</td><td>0</td><td>B1</td><td>B2</td></tr></table> • Prox – state of magnetic field sensor • Temp – if 1, the measured temperature is outside the defined values • Humi – if 1, the measured humidity is outside the defined range • Light – if 1, the measured light is outside the defined range • Card – if 1, the ID is read • Btn1 – state of button 1 • Btn2 – state of button 2	Prox	Temp	Humi	Light	Card	0	B1	B2
Prox	Temp	Humi	Light	Card	0	B1	B2		
Batt	Battery level in %.								
Temp	Temperature								
Humi	Humidity								
Light	Light (8 oldest bits)								
CID_Len	ID length.								
CID	ID card number.								

Total packet length: 31B

5 GATT SERVER FUNCTIONALITY

GATT Structure:

- [Device Information Service](#)
 - Manufacturer Name Characteristic
 - Model Number Characteristic
 - Serial Number Characteristic
 - Hardware Revision Characteristic
 - Firmware Revision Characteristic
 - System ID Characteristic
- [Device Status/Operation Service](#)
 - [Led Control Characteristic](#)
 - [Reset Characteristic](#)
 - [Device Status0 Characteristic](#)
 - [Device Status1 Characteristic](#)
- [General Configuration Service](#)
 - [Periods Characteristic](#)
 - [Advertising time Characteristic](#)
 - [Advertising payload Characteristic](#)
 - [Active sensor Characteristic](#)

- [Light sensor configuration Characteristic](#)
- [Temperature sensor configuration Characteristic](#)
- [Humidity sensor configuration Characteristic](#)
- [Led/button configuration Characteristic](#)
- [Configuration of Card Reading Mode Service](#)
 - [Card Config0 Characteristic](#)
 - [Card Config1 Characteristic](#)
 - [Card Config2 Characteristic](#)

5.1 DEVICE INFORMATION SERVICE

UUID 0x180A

DESCRIPTION

5.2 CHARACTERISTIC

Characteristic	UUID	Type	Sample Value
Manufacturer Name	2A29	Read	Netronix
Model Number	2A24	Read	NBL-3
Serial Number	2A25	Read	0000
Hardware Revision	2A27	Read	0x00800102 (for NBL-V3)
Firmware Revision	2A26	Read	X.Y
System ID	2A23	Read	t.b.d.

5.3 STATUS/OPERATION SERVICE

UUID 4d696372-6f63-6869-702d-524e00000001

DESCRIPTION

5.3.1 COMMAND CONTROL CHARACTERISTIC

UUID BF3FBD80063F11E59E00000000000001

TYPE Read/Write

LENGHT 20

DESCRIPTION Data format:

BYTE 0	BYTE[1..19]
CMD	Param

5.3.1.1 KEEPALIVE COMMAND

The KeepAlive command prevents the device from going to sleep mode.

Format:

Byte	Field	Value	Description
BYTE 0	CMD	0x00	-

5.3.1.2 RESET COMMAND

The Reset command restarts the device. After reboot, the device will be in bootloader mode for 10 seconds.

Format:

Byte	Field	Value	Description
BYTE 0	CMD	0xD0	-
BYTE[1..4]	PARAM	0x01, 0x02, 0x03, 0x04	-

5.3.1.3 CONFIGRESET COMMAND

ConfigReset command returns to factory settings.

Format:

Byte	Field	Value	Description
BYTE 0	CMD	0xD4	-
BYTE[1..4]	PARAM	0x55, 0xAA, 0xA5, 0x5A	-

5.3.1.4 SETPIN COMMAND

The SetPIN command allows you to:

- enable / disable PIN code during pairing
- PIN code setting

Format:

Byte	Field	Value	Description
BYTE 0	CMD	0x20	-
BYTE[1]	PIN_EN	0x00 lub 0x01	0 – PIN disabled 1 – PIN enabled
BYTE[2..7]	PIN[6]		6 byte PIN code, each byte must be in the range 0-9.

5.3.1.5 LED COMMAND

The command allows you to control the LEDs

Format:

Byte	Field	Value	Description
BYTE 0	CMD	0x10	-
BYTE[1]	RedLedActivity	0x00..0x03, 0x0F	0x00 – turn off red LED 0x01 – turn on red LED for defined time 0x02 – blink slow red LED for defined time 0x03 – blink fast red LED for defined time 0x0F – do not change red LED state
BYTE[2]	RedLedTime	0x00..0xFF	Time in 100ms (0-25sec.)
BYTE[3]	GreenLedActivity	0x00..0x03, 0x0F	0x00 – turn off red LED 0x01 – turn on red LED for defined time 0x02 – blink slow red LED for defined time 0x03 – blink fast red LED for defined time 0x0F – do not change red LED state
BYTE[4]	GreenLedTime	0x00..0xFF	Time in 100ms (0-25sec.)

5.3.1 RESET CHARACTERISTIC

UUID	BF3FBD80063F11E59E00000000000002
TYPE	Read/Write
LENGHT	???
DESCRIPTION	???

5.3.2 DEVICE STATUS0 CHARACTERISTIC

UUID	BF3FBD80063F11E59E00000000000003					
TYPE	Read					
LENGHT	9					
DESCRIPTION	Data format:					
	BYTE 0	BYTE[1..2]	BYTE[3..4]	BYTE[5..6]	BYTE 7	BYTE 8
	State	Temperature	Humidity	Light	Battery	IO

Field	Description								
State	Button and sensor status. MSB LSB <table><tr><td>Prox</td><td>Temp</td><td>Humi</td><td>Light</td><td>Card</td><td>0</td><td>B1</td><td>B2</td></tr></table> • Prox – state of magnetic field sensor • Temp – 1 – temperature outside specified margins • Humi – 1 – humidity outside specified margins • Light – 1 – light outside specified margins • Card – XXX • Btn1 – state of button 1 • Btn2 – state of button 2	Prox	Temp	Humi	Light	Card	0	B1	B2
Prox	Temp	Humi	Light	Card	0	B1	B2		
Temperature	Measured temperature. To obtain value in Celsius degree use formula: $Temp = \frac{165(T_H * 256 + T_L)}{65535} - 40$								
Humidity	Measured humidity. To obtain value in RH% use formula: $H = \frac{(H_H * 256 + H_L)}{65535}$								
Light	Measured light.								
Battery	Battery level in %.								
IO	0x00								

5.3.1 DEVICE STATUS1 CHARACTERISTIC

UUID	BF3FBD80063F11E59E00000000000004										
TYPE	Read										
LENGHT	17										
DESCRIPTION	Data format: <table border="1" style="width: 100%; text-align: center;"> <tr> <th>BYTE 0</th><th>BYTE[1..16]</th></tr> <tr> <td>CardID_Len</td><td>CardID</td></tr> </table> <table border="1" style="width: 100%;"> <tr> <th>Field</th><th>Description</th></tr> <tr> <td>CardID_Len</td><td>ID length.</td></tr> <tr> <td>CardID</td><td>ID card number, padded with 0</td></tr> </table>	BYTE 0	BYTE[1..16]	CardID_Len	CardID	Field	Description	CardID_Len	ID length.	CardID	ID card number, padded with 0
BYTE 0	BYTE[1..16]										
CardID_Len	CardID										
Field	Description										
CardID_Len	ID length.										
CardID	ID card number, padded with 0										

5.4 GENERAL CONFIGURATION SERVICE

UUID	4d696372-6f63-6869-702d-524e00000002
DESCRIPTION	to read / write configuration

5.4.1 PERIODS CHARACTERISTIC

UUID	bf3fbd80-063f-11e5-9e00-000000000011			
TYPE	Read/Write			
LENGHT	4			
DESCRIPTION	Data format:			
	BYTE 0	BYTE 1	BYTE 2	BYTE 3
	Scan sensor period		Current state advertising period	
	SSP H	SSP L	CSAP H	CSAP L

- Scan sensor period** – the period of time that data is read from temperature, humidity and light sensor.

$$Period[s] = (SSP_H * 255 + SSP_L)$$

Range: 0x0000 – 0xFFFF

Default: 0x0004 (4s)

- Current state advertising period** – the time after which the device will start sending a broadcast packet, even if no data has changed.

$$Period[s] = (CSAP_H * 255 + CSAP_L)$$

Range: 0x0000 – 0xFFFF**Default:** 0x1770 (6000s)**5.4.2 ADVERTISING TIME CHARACTERISTIC**

UUID	bf3fbd80-063f-11e5-9e00-000000000012
TYPE	Read/Write
LENGHT	1
DESCRIPTION	Advertising time in seconds. Range: 1-255 Default: 50

5.4.3 ADVERTISING PAYLOAD CHARACTERISTIC

UUID	bf3fbd80-063f-11e5-9e00-000000000013
TYPE	Read/Write
LENGHT	1
DESCRIPTION	0 – card ID is not present on Advertising packet. 1 – card ID is present on Advertising packet Default: 1

5.4.4 ACTIVE SENSOR CHARACTERISTIC

UUID	bf3fbd80-063f-11e5-9e00-000000000014									
TYPE	Read/Write									
LENGHT	1									
DESCRIPTION	Data format:									
	BYTE 0									
	ActiveSensor									

Field	Description							
ActiveSensor	MSB LSB							
	0	0	0	Card ID	Humidity	Temperature	Light	Magnetic
	Bit set to 1 means that the sensor is active							
	Default: 0x1F							

5.4.5 LIGHT SENSOR CONFIGURATION CHARACTERISTIC

UUID	bf3fbd80-063f-11e5-9e00-000000000015				
TYPE	Read/Write				
LENGHT	5				
DESCRIPTION	Data format:				
	BYTE 0	BYTE 1	BYTE 2	BYTE 3	BYTE4
	WorkMode	Light0		Light1	
	WM	L0_H	L0_L	L1_H	L1_L

Field	Description
WorkMode	Sensor work mode: - WM=0 – Delta - WM=1 – Margin Range: 0-1 Default: 0
Light0 Light1	For WM=0 (Delta): Light0 – base temperature Light1 – maximum allowable temperature change relative to base temperature For WM=1 :

- **Light0** – bottom margin
- **Light1** – top margin

Range: 0x0000-0xFFFF

Default: Light0 = 0x8000 (XXX), Light1 = 0x0300 (XXX)

Default: LightLow = 0x0000, LightHigh = 0xFFFF

5.4.6 TEMPERATURE SENSOR CONFIGURATION CHARACTERISTIC

UUID bf3fbd80-063f-11e5-9e00-000000000016

TYPE Read/Write

LENGHT 5

DESCRIPTION Data format:

BYTE 0	BYTE 1	BYTE 2	BYTE 3	BYTE4
WorkMode	Temp0		Temp1	
WM	T0_H	T0_L	T1_H	T1_L

$$Tx_{HL} = \frac{(Temp + 40) * 65535}{165}$$

$$Tx_{HL} = Tx_H * 256 + Tx_L$$

Field	Description
WorkMode	Sensor work mode: • WM=0 – Delta • WM=1 – Margin Range: 0-1 Default: 0
Temp0 Temp1	For WM=0 (Delta): • Temp0 – base temperature • Temp1 – maximum allowable temperature change relative to base temperature For WM=1 : • Temp0 – bottom margin • Temp1 – top margin Range: 0x0000-0xFFFF Default: Temp0 = 0x5D17 (20°C), Temp1 = 0x018E (1°C)

5.4.7 HUMIDITY SENSOR CONFIGURATION CHARACTERISTIC

UUID bf3fbd80-063f-11e5-9e00-000000000017

TYPE Read/Write

LENGHT 5

DESCRIPTION Data format:

BYTE 0	BYTE 1	BYTE 2	BYTE 3	BYTE4
WorkMode	Humi0		Humi1	
WM	H0_H	H0_L	H1_H	H1_L

$$Hx_{HL} = \frac{Humidity * 65535}{100}$$

$$Hx_{HL} = Hx_H * 256 + Hx_L$$

Field	Description
WorkMode	Sensor work mode: • WM=0 – Delta

	WM=1 – Margin Range: 0-1 Default: 0
Humi0 Humi1	For WM=0 (Delta): Humi0 – base humidity Humi1 – maximum allowable humidity change relative to base humidity For WM=1: Humi0 – bottom margin Humi1 – top margin Range: 0x0000-0xFFFF Default: Humi0 = 0x4CCC (30%), Humi1 = 0x051F (2%)

5.4.8 LED/BUTTON CONFIGURATION CHARACTERISTIC

UUID	bf3fbd80-063f-11e5-9e00-000000000018		
TYPE	Read/Write		
LENGHT	3		
DESCRIPTION	Data format:		
	BYTE 0	BYTE1	BYTE2
	LedMode	Btn1_WorkMode	Btn2_WorkMode

Field	Description
LedMode	0 – disable internal LED messages 1 – internal LED messages priority is higher than user LED messages 2 – internal LED messages priority is lower than user LED messages Default: 1
Btn1_WorkMode Btn2_WorkMode	Button operation mode. 0 – normal 1 – toggle Default: 0

5.5 CONFIGURATION OF CARD READING MODE SERVICE

UUID	4d696372-6f63-6869-702d-524e00000003
DESCRIPTION	to write configuration

5.5.1 CARD CONFIG0 CHARACTERISTIC

UUID	bf3fbd80-063f-11e5-9e00-000000000021
TYPE	Write
LENGHT	20
DESCRIPTION	Description is in document ND135 (NBL-X-MAN-EN Annex A)

5.5.2 CARD CONFIG1 CHARACTERISTIC

UUID	bf3fbd80-063f-11e5-9e00-000000000022
TYPE	Write
LENGHT	20
DESCRIPTION	Description is in document ND135 (NBL-X-MAN-EN Annex A)

5.5.3 CARD CONFIG2 CHARACTERISTIC

UUID	bf3fbd80-063f-11e5-9e00-000000000023
TYPE	Write
LENGHT	20
DESCRIPTION	Description is in document ND135 (NBL-X-MAN-EN Annex A)

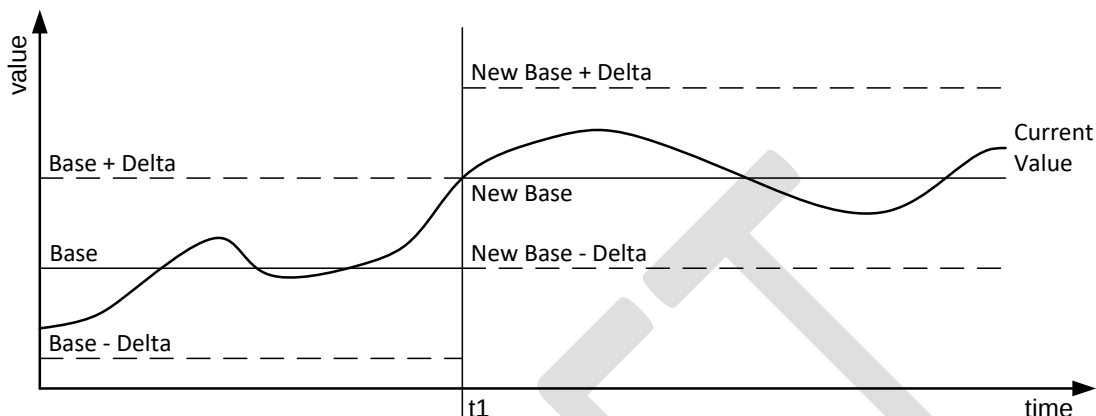
6 SENSOR WORK MODE

Work modes apply to temperature, humidity and light sensor.

6.1 DELTA

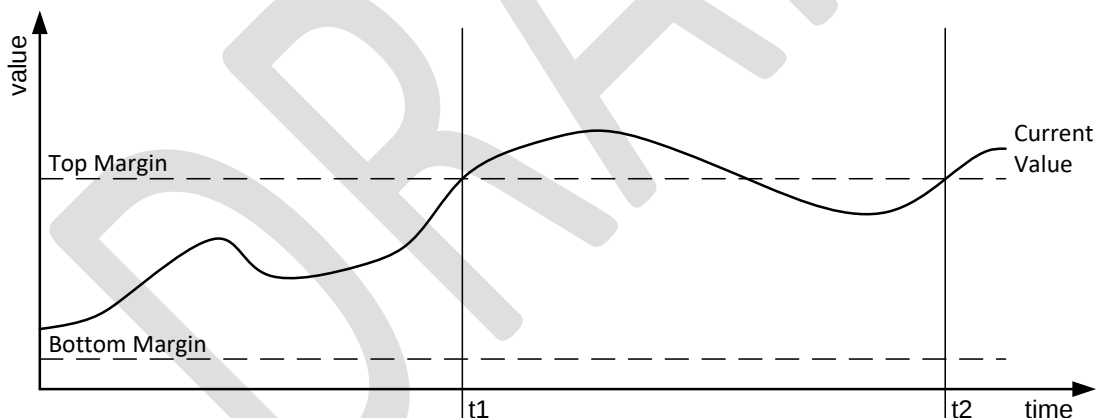
In Delta mode, the user can specify the base value and the maximum difference (delta) from the base value. If the measured value goes out of range (base value $\pm$ delta) then:

- the device starts sending advertising packages
- the base value will be replaced by the current value of the measured parameter.



6.2 MARGIN

In Margin mode, the user can specify the upper and lower value of the measured parameter. If the monitored parameter leaves the defined range, the device will start sending the advertising package (time t1 and t2 in the figure below).



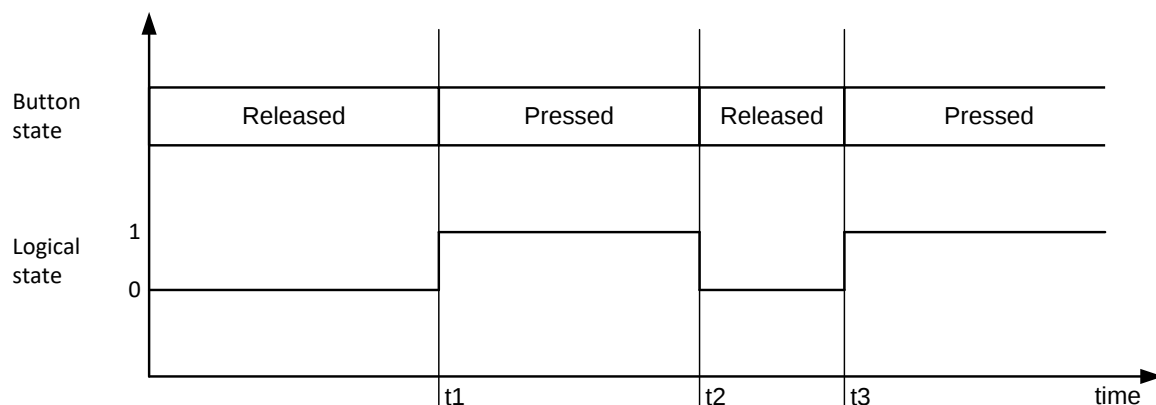
7 BUTTON WORK MODE

Each of the buttons can work in one of 2 modes:

- Normal
- toggle

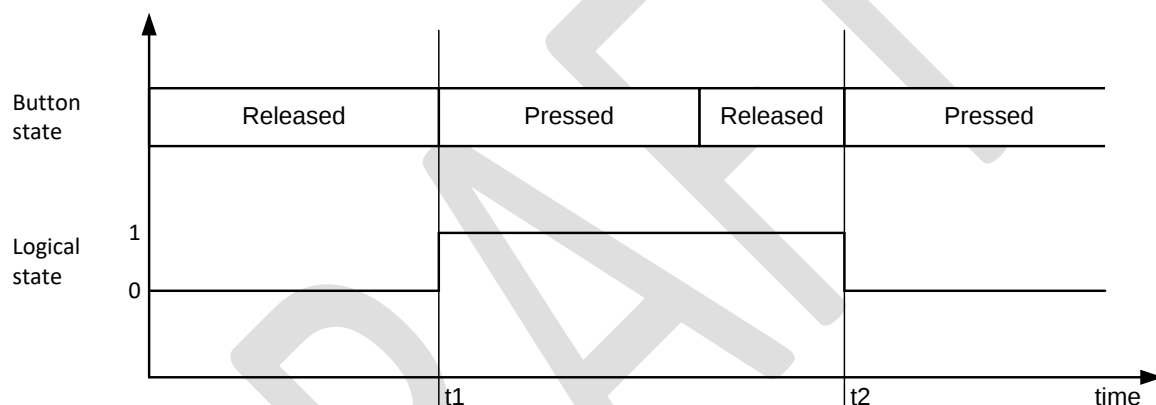
7.1 NORMAL

In Normal mode, the logical state directly reflects the physical state of the button. Each change of the button state causes the start sending of the advertising package / update of the data in the advertising package (time t1, t2 and t3 in the figure below).



7.2 TOGGLE

In toggle mode, the logic state changes to the opposite each time the button is pressed. Each change the logical state causes the start of sending the advertising package / data update in the advertising package (time t1 and t2 in the figure below).



8 POWER OFF / RESET TO DEFAULT SETTINGS

To set factory defaults and un-pairing both buttons must be pressed for 5 seconds additionally button 1 (blue) must be pressed first. It is also factory/transport configuration.

Procedure:

1. Press Button1 and hold
2. Press Button2 and hold
3. Keep the buttons pressed for 5 seconds.
4. The return to the factory settings will be signaled by flashing LED1 and LED2

9 POWER ON

Procedure:

1. Press Button2 and hold
2. Keep the button pressed for 5 seconds.
3. The PowerOn will be signaled by flashing LED1 and LED2

10 PARING

When device have defaults settings, reader waits for button then sends advertising packet for 60 seconds and blinks LEDs.

When the device is in the broadcast packet mode, it is possible to establish a connection via Bluetooth. If the connected device has not been paired before, NBL will initiate the pairing process. The pairing process with the device does not require a PIN code. After successful pairing, it is recommended to enter a PIN code. This can be done by writing an appropriate command to the CMD characteristics.

The NBL-3 can remember up to 8 pairing keys. Each subsequent pairing removes the earliest paired device from the list of paired devices.

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11 FIRMWARE UPDATE FUNCTIONALITY

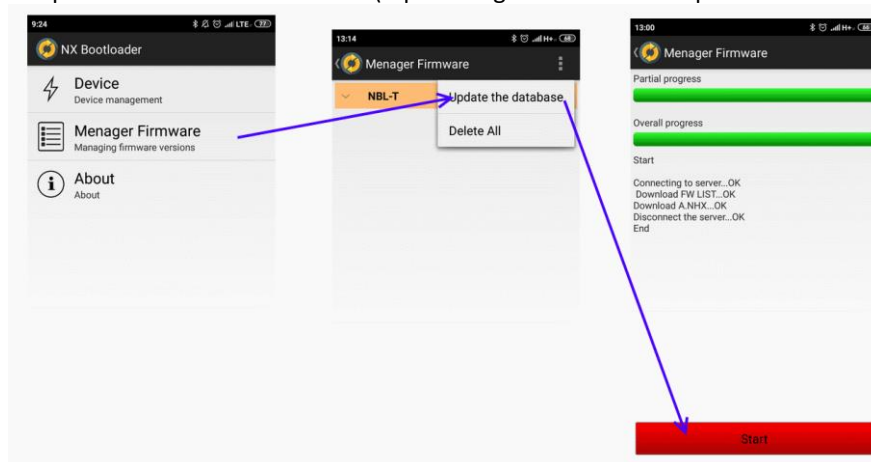
11.1 FIRMWARE UPDATE USING THE NBL TOOL APPLICATION

The firmware update is implemented using an application running on an android phone.

After the connection with the device, the application can start the bootloader mode. The bootloader mode can also be started by pressing the button 1 and the button 2 while switching on the power. The bootloader mode is signaled by a rapid blinking of the red LED.

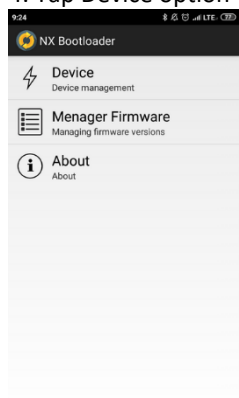
The firmware update procedure.

1. Run NX Bootloader application
2. Update the firmware database (tap: Menager Firmware -> Update the database -> Start)



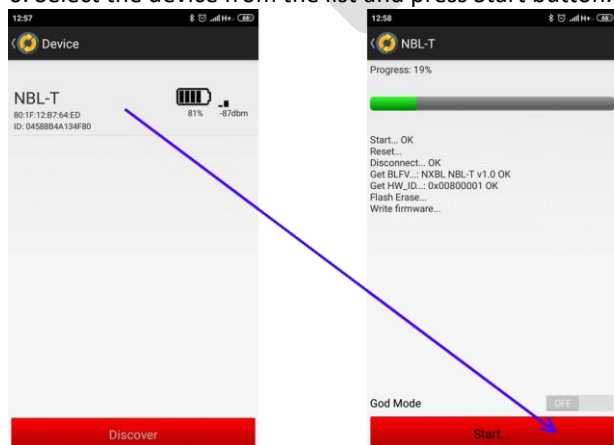
3. Back to main menu

4. Tap Device option

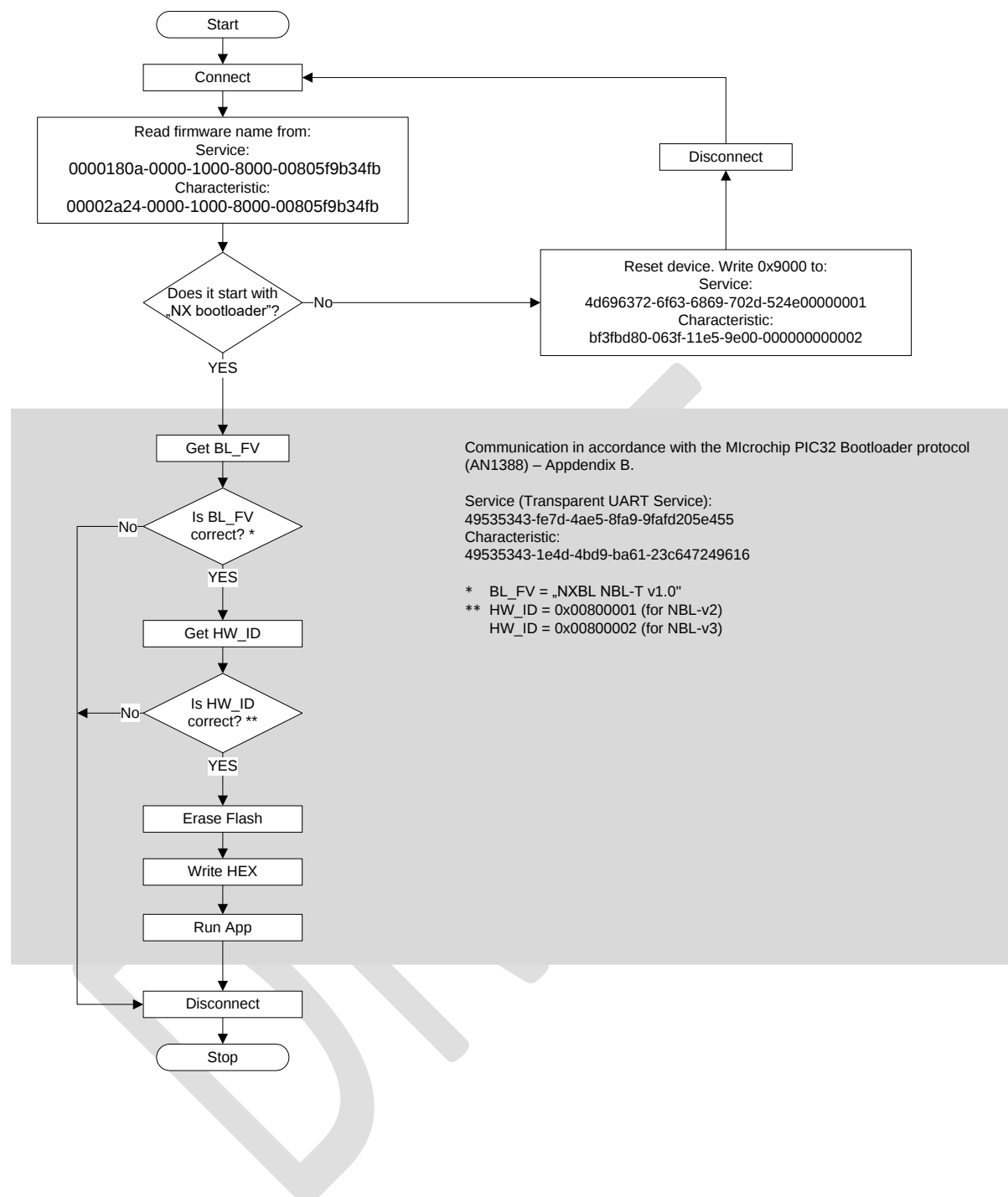


5. Wake up the device - eg by applying the card or entering it into the bootloader mode

6. Select the device from the list and press Start button.



11.2 FIRMWARE UPGRADE ALGORITHM



12 BATTERY REPLACEMENT

13 LED

13.1 MSG_START

13.2 MSG_ADV

13.3 MSG_CONN

13.4 MSG_WAK_UP

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