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**SPRINGCARD TWIST'N'BLUE**

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**Hardware Integration Guide**

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## 1. INTRODUCTION

### 1.1. ABSTRACT

**SpringCard Twist'N'Blue** is an OEM BLE-to-PC interface board. It has been created to prototype, experiment and benchmark **Bluetooth Low Energy (BLE)** applications.

This document provides all necessary information to perform the physical integration of the **Twist'N'Blue** OEM board in your system.

Be aware that, as a versatile development board, the **Twist'N'Blue** may run a significant number of different firmwares, each of them leading to a different software integration. Therefore, the software integration as well as the configuration of the device, are out of the scope of this document, and are covered by a specific integration manual accompanying every firmware.

### 1.2. PRODUCT IDENTIFICATION

Firmware	Product	Order code	Description
K663/BLE	Twist'N'Blue TTL <i>BLUE</i>	SC16236	OEM BLE-to-PC interface board with SpringBlue Firmware
	Twist'N'Blue 232 <i>BLUE</i>	SC16237	
	Twist'N'Blue 485 <i>BLUE</i>	SC17050	
	Twist'N'Blue TTL <i>ORANGE</i>	SC17051	OEM BLE-to-PC interface board with Orange Firmware
	Twist'N'Blue 232 <i>ORANGE</i>	SC17052	
	Twist'N'Blue 485 <i>ORANGE</i>	SC17053	
	Twist'N'Blue TTL <i>SPY</i>	SC17054	OEM BLE-to-PC interface board with BLE SPY Firmware
	Twist'N'Blue 232 <i>SPY</i>	SC17055	
	Twist'N'Blue 485 <i>SPY</i>	SC17056	

Table 1: List of Twist'N'Blue products

### 1.3. RELATED DOCUMENTS

EDITOR	DOCUMENT #	TITLE / VERSION
SpringCard	PMD17049	Smart Readers with SpringBlue Configuration and Software Guide

Table 2: List of related documents

## 1.4. AUDIENCE

This manual is designed for use by electronic hardware integrators. It assumes that the reader has expert knowledge of digital electronics.

## 1.5. DISCLAIMERS

- **The SpringCard Twist'N'Blue has not been certified by Bluetooth SIG, and has not endorsed CE nor FCC certification. This product shall be used for evaluation purposes only.**
- As an evaluation-only product, the purchase of this product carries with it no warranties, either expressed or implied.
- While every care has been taken to provide a quality product, we cannot guarantee that this product will function correctly together with all Bluetooth Low Energy devices; the product may not operate or may operate improperly with some Bluetooth Low Energy devices.
- **SpringCard** does not take any responsibility for leakage of information during Bluetooth Low Energy communication.

## 1.6. IMPORTANT – PRECAUTION ON 2.4 GHz RADIO COMMUNICATION

- Bluetooth wireless technology operates within a range of about 10 meters. Maximum communication range may vary depending on obstacles (person, metal, wall, etc.) or electromagnetic environment,
- No assertion could be made on the operating distance that could actually be obtained in-the-field,
- Observe the location of the product's Bluetooth antenna in 2.2. There should be no metal (including another PCB or any conductive material), in any direction, at less than 15 mm of the antenna.
- The operation of the product may be perturbed by any other device using 2.4 GHz frequency, such as an other Bluetooth devices, wireless LAN devices (WiFi), mesh network devices (Zigbee, Thread, IEEE 802.15.4), cordless telephone, or microwave oven.
- The product shall not be used in an area where wireless waves are prohibited, such as in an air plane, a hospital or near electronic medical devices.
- The product shall not be used in an area where inflammable gas is present, such as in a petrol station, airport, hospital.
- We do not take any responsibility for leakage of information during Bluetooth communication.

## 1.7. SUPPORT AND UPDATES

Related documentation (e.g. product datasheets, application notes, sample software, HOWTOs and FAQs...) is available at SpringCard's web site:

[www.springcard.com](http://www.springcard.com)

Updated versions of this document and others are posted on this web site as soon as they are available.

For technical support enquiries, please refer to SpringCard support page, on the web at

[www.springcard.com/support](http://www.springcard.com/support)



## 2. HARDWARE OVERVIEW & DIMENSIONS

### 2.1. TOP VIEW

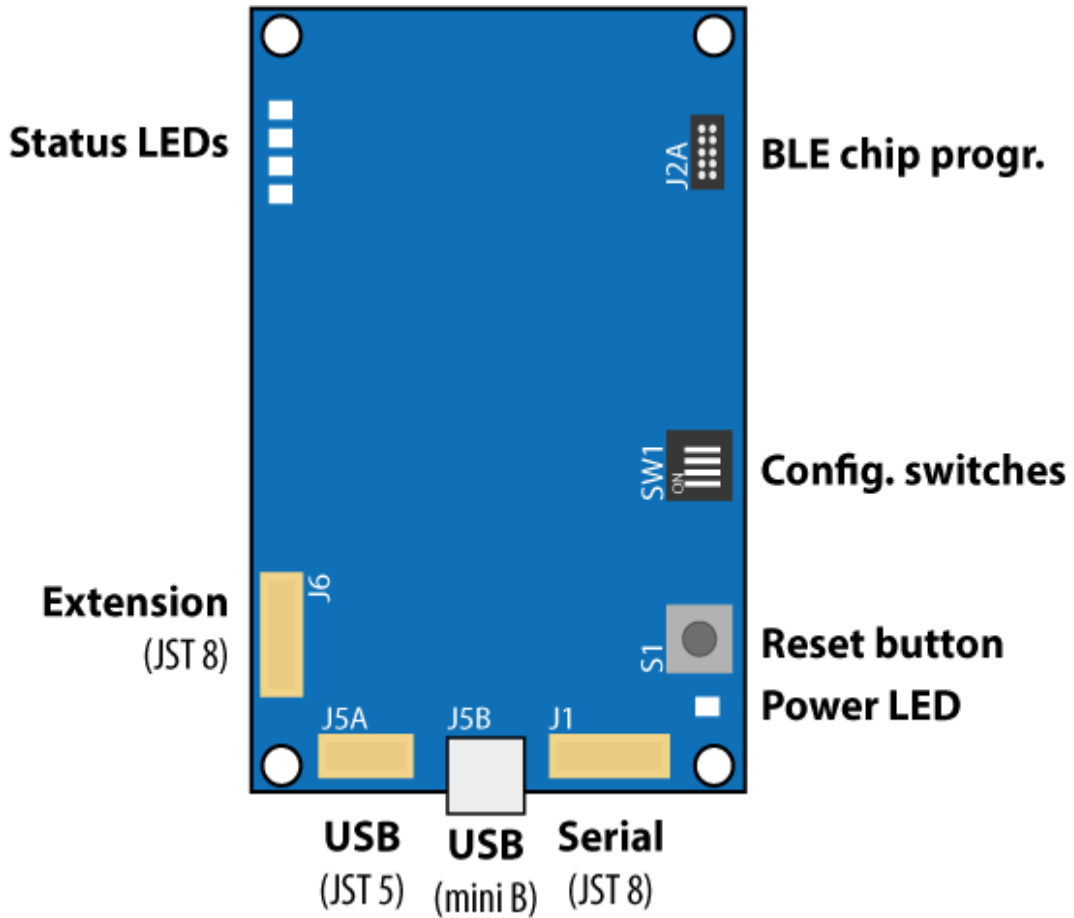


Illustration 1: The Twist'N'Blue PCB (top view)

**Note:** The illustration shows the PCB fully populated, with all possible connectors. Some connectors may remain unmounted on some hardware version.

## 2.2. BOTTOM VIEW

**Bluetooth  
antenna**

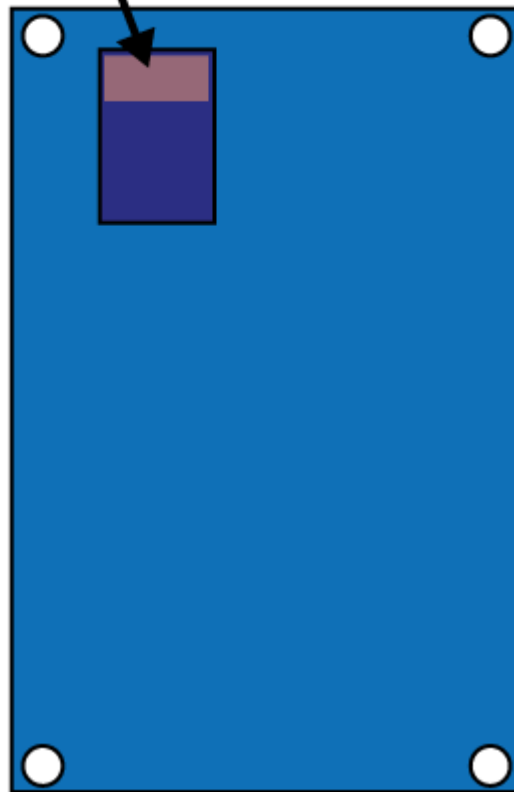


Illustration 2: The Twist'N'Blue PCB (bottom view)

2.3. DIMENSIONS

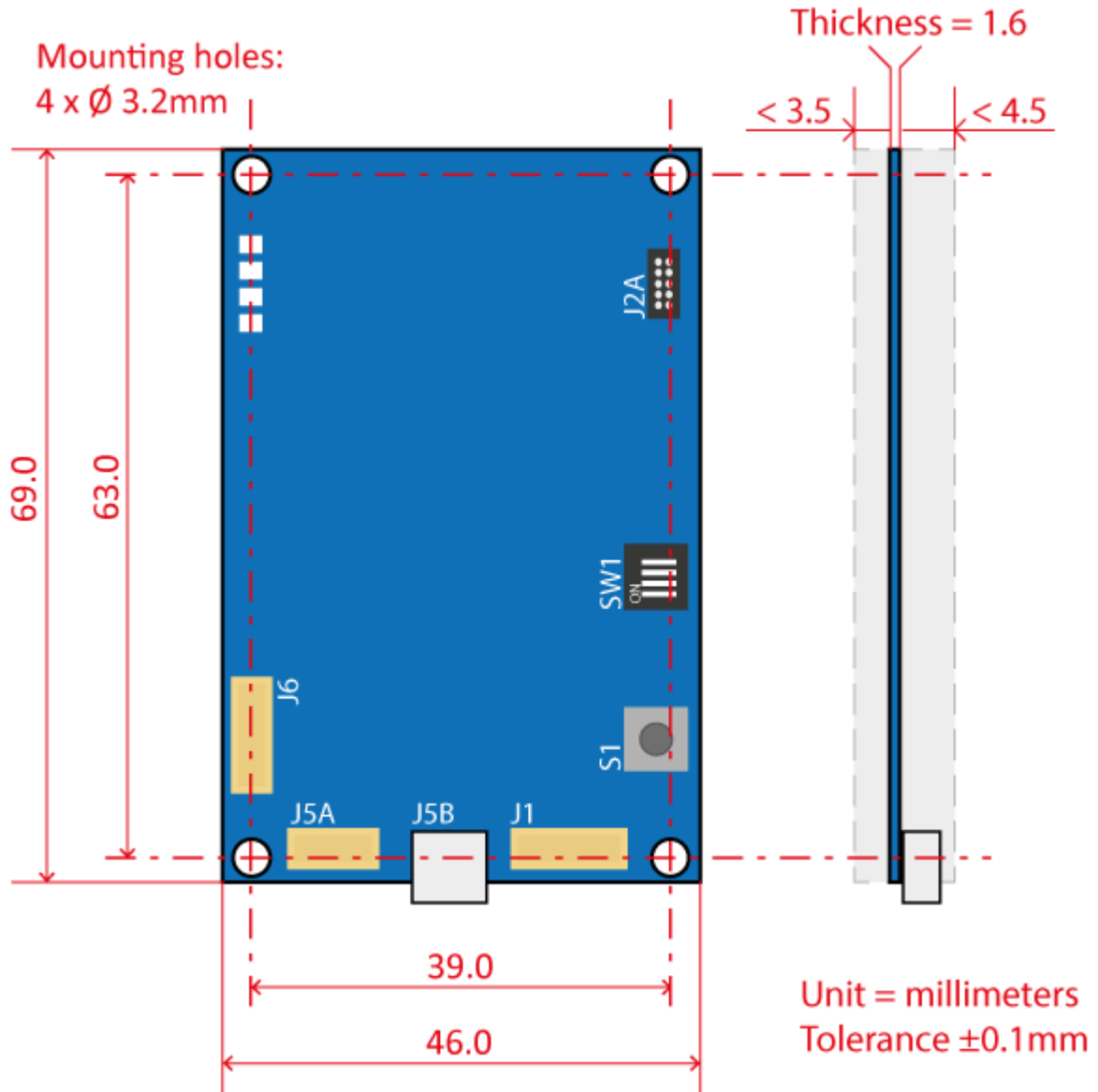


Illustration 3: Dimensions of the Twist'N'Blue

### 3. CONNECTORS AND PINOUT

#### 3.1. SERIAL (J1)

J1 is a connector hosting the primary Serial communication interface of the product.

Depending on the components mounted on the PCB, this Serial communication interface could provide and accommodate either

- TTL (0/5V) or CMOS (0/3.3V) RX/TX signals → see § 3.1.1 for RS-TTL version (products with “TTL” in the name),
- RS-232 (-6V/+6V) RX/TX signals → see § 3.1.2 for RS-232 version (products with “232” in the name),
- RS-485 Bus A/Bus B signals → see § 3.1.3 for RS-485 version (products with “485” in the name),

*There's no visible difference between a RS-TTL, RS-232 and RS-485 version. Please verify carefully the product's label to identify which of the 3 Serial versions is actually mounted.*

*DO NOT connect anything to the Serial interface (J1) when the USB interface (J5A or J5B) is in use.*

#### Reference

JST SHR-8

#### Pinout diagram

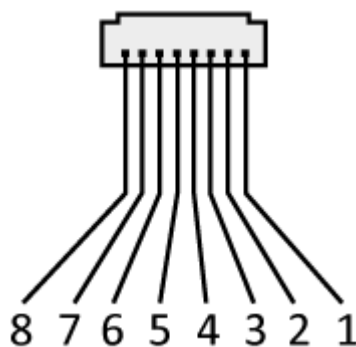


Illustration 4: Pinout diagram for J1

### 3.1.1. RS-TTL version

PIN	NAME	Type	Description
1	RFU	Not wired	Must be left unconnected
2	/FLASH	IN	May be left unconnected if /FLASH is not driven by external interface
3	GND	Ground	
4	/RESET	IN	May be left unconnected if /RESET is not driven by external interface
5	VCC	Power	Power supply (5V)
6	RX_TTL	IN	Serial line at TTL/CMOS level – Host to Twist'N'Blue
7	TX_TTL	OUT	Serial line at TTL/CMOS level – Twist'N'Blue to Host
8	GND	Ground	

**Table 3: Pinout detail for J1, RS-TTL version**

### 3.1.2. RS-232 version

PIN	NAME	Type	Description
1	RFU	Not wired	Must be left unconnected
2	/FLASH	IN	May be left unconnected if /FLASH is not driven by external interface
3	GND	Ground	
4	/RESET	IN	May be left unconnected if /RESET is not driven by external interface
5	VCC	Power	Power supply (5V)
6	RX_232	IN	Serial line at RS-232 level – Host to Twist'N'Blue
7	TX_232	OUT	Serial line at RS-232 level – Twist'N'Blue to Host
8	GND	Ground	

**Table 4: Pinout detail for J1, RS-232 version**

### 3.1.3. RS-485 version

PIN	NAME	Type	Description
1	RFU	Not wired	Must be left unconnected
2	/FLASH	IN	May be left unconnected if /FLASH is not driven by external interface
3	GND	Ground	
4	/RESET	IN	May be left unconnected if /RESET is not driven by external interface
5	VCC	Power	Power supply (5V)
6	BUS_B	Bus	Serial line at RS-485 level – Bus B signal
7	BUS_A	Bus	Serial line at RS-485 level – Bus A Signal
8	GND	Ground	

**Table 5: Pinout detail for J1, RS-485 version**

### 3.2. USB (J5A AND J5B)

The **Twist'N'Blue** features 2 USB connectors, that could be used indifferently to connect the product to a host computer.

USB driver installation is documented in chapter 6.

*DO NOT connect both USB connectors (J5A and J5B) at the same time.*

*DO NOT connect anything to the Serial interface (J1) when the USB interface (J5A or J5B) is in use.*

#### 3.2.1. USB 5-pin connector (J5A)

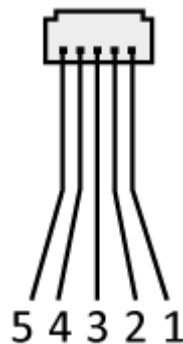
Use this connector to connect the **Twist'N'Blue** to a computer's USB port.

A ready-to-use cable is available at **SpringCard's**. Please contact [sales@springcard.com](mailto:sales@springcard.com).

#### Reference

JST SHR-5

#### Pinout diagram



**Illustration 5:**  
Pinout diagram  
for J5A



## Pinout details

PIN	NAME	Type	Description
1	VBUS	Power	USB power supply (5V)
2	DM	IN/OUT	USB D-
3	DP	IN/OUT	USB D+
4	GND	Ground	Ground wire
5	SHIELD	Ground	Cord's shielding

**Table 6: Pinout details for J5A**

### 3.2.2. USB mini B connector (J5B)

Use this connector to connect the **Twist'N'Blue** to a computer's USB port, using a standard USB mini B to host cable. Standard pinout applies.

### 3.3. EXTENSION (J6)

This connector is reserved for future use.

#### Reference

JST SHR-5

***J6 and J1 use the same JST SHR-8 connector. Be careful when connecting a cable!***

## 4. HARDWARE CONFIGURATION SWITCHES

The Twist'N'Blue features 4 configuration switches (SW1 block).

### 4.1. DEFINITION OF THE SWITCHES ON SW1

SW	NAME	Value	Description
1	MCU_BYPASS	OFF	J1 & USB are available for operation.
		ON	J1 & USB are bridged to either J6 or BLE chip (depending on SEL_BYPASS)
2	FLASH	OFF	The device starts in operation mode
		ON	The device starts in firmware upgrade mode (see chapter 7)
3	SEL_BYPASS	OFF	If MODE = ON: bridge J1 & USB $\leftrightarrow$ J6
		ON	If MODE = ON: bridge J1 & USB $\leftrightarrow$ BLE chip
4	USB_SPY	OFF	J1 & USB are available for operation.
		ON	Bridge USB $\leftrightarrow$ BLE chip (only J1 available for operation)

**Table 7: Definition on the switches on SW1**

## 4.2. NOMINAL POSITION OF THE SWITCHES FOR NORMAL OPERATION

For normal operation, the switches shall be positioned as defined in the table below.

*Using any other position of the switches is not supported.*

SW	NAME	Value	Description
1	MCU_BYPASS	OFF	J1 & USB are available for operation.
2	FLASH	OFF	The device starts in operation mode
3	SEL_BYPASS	OFF	<i>Default position</i>
4	USB_SPY	OFF	<i>Default position</i>

**Table 8: Default position of the switches**

## 5. ELECTRICAL CHARACTERISTICS

### 5.1. OPERATING CONDITION RANGE

SYMBOL	Parameter	Condition	Min	Typ	Max	Unit
T <sub>OPERATION</sub>	Operating temperature		-20	+25	+70	°C
VCC	Supply voltage	No USB	3.3	3.3 or 5.0	5.5	V
ICC	Power supply current	No USB, VCC=3.3V, radio OFF		TBD	TBD	mA
		No USB, VCC=3.3V, radio ON		36	40	
		No USB, VCC=5.0V, radio OFF		TBD	TBD	
		No USB, VCC=5.0V, radio ON		26	30	
VBUS	USB supply voltage	On USB	4.5	5.0	5.5	V
IUSB	USB power supply current	On USB, radio OFF		TBD	TBD	mA
		On USB, radio ON		36	40	

Table 9: Operating condition range

### 5.2. ABSOLUTE MAXIMUM RATINGS

Stresses beyond those listed under ‘Absolute Maximum Ratings’ may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these conditions is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

SYMBOL	Parameter	Min	Max	Unit
T <sub>STORAGE</sub>	Storage temperature	-20	+70	°C
VCC <sub>ABS</sub>	DC supply voltage with respect to ground	-0.3	6.0	V
V <sub>IN,ABS</sub>	Voltage to any pin with respect to ground (except RX_232, BUS_A and BUS_B)	-0.3	VCC + 0.3	V
V <sub>IN,232</sub>	Voltage to RX_232 with respect to ground	-25	25	V
V <sub>IN,485</sub>	Voltage to BUS_A or BUS_B with respect to ground	-9	14	V

Table 10: Absolute maximum ratings

### 5.3. INPUT PIN CHARACTERISTICS

SYMBOL	Parameter	Condition	Min	Max	Unit
$V_{IL}$	LOW-level going threshold pins: /FLASH, /RESET, RX_TTL			0.8	V
$V_{IH}$	HIGH-level going threshold pins: /FLASH, /RESET, RX_TTL	$VCC < 3.6V$	2.0		V
		$VCC > 4.5V$	$0.7 \times VCC$		
$I_{LEAK}$	Input leakage current pins: /FLASH, /RESET, RX_TTL			4	$\mu A$

Table 11: Input pin characteristics

### 5.4. OUTPUT PIN CHARACTERISTICS

SYMBOL	Parameter	Condition	Min	Max	Unit
$V_{OL}$	Output LOW-level pin: TX_TTL			0.4	V
$V_{OH}$	Output HIGH-level pin: TX_TTL	$VCC < 3.6V$	2.4		V
		$VCC > 4.5V$	3,8		
$I_O$	Output current source or sink pin: TX_TTL	$VCC < 3.6V$		16	mA
		$VCC > 4.5V$		32	

Table 12: Output pin characteristics

## 5.5. RS-232 INTERFACE

SYMBOL	Parameter	Min	Typ.	Max	Unit
$V_{IL,232}$	LOW-level going threshold pin: RX_232			-2.7	V
$V_{IH,232}$	HIGH-level going threshold pin: RX_232	2.7V			
$I_{LEAK,232}$	Input leakage current pin: RX_232	-0.01		0.01	$\mu$ A
$V_{OL,232}$	Output LOW-level pin: TX_232		-5.4	-5.0	V
$V_{OH,232}$	Output HIGH-level pin: TX_232	5.0	5.4		V

Table 13: Characteristics of the RS-232 interface

## 5.6. RS-485 INTERFACE

SYMBOL	Parameter	Min	Typ	Unit
$V_{OD,485}$	Differential output voltage between BUS_A & Bus_B at max load = 27 $\Omega$ ( <i>absolute value</i> )	1.5	5.0	V
$V_{th,485}$	Receiver differential threshold between BUS_A & Bus_B ( <i>absolute value</i> )	0.2		V

Table 14: Characteristics of the RS-485 interface

## 5.7. BLUETOOTH LOW ENERGY INTERFACE

SYMBOL	Parameter	Min	Typ.	Max	Unit
BLE_PWR	Transmit power		0	3	dBm
BLE_SENS	Receiver sensitivity		-91	-93	dBm
BLE_GAIN	Antenna peak gain			0.5	dBi
BLE_EFF	Antenna efficiency			30	%

## 6. USB INTERFACE AND DRIVER

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The **Twist'N'Blue's** USB interface is implemented through a USB-to-Serial bridge, part number **FTDI FT232RQ**.

Please go to <http://www.ftdichip.com/Drivers/VCP.htm> to download the latest driver for your operating system.

After installing the FTDI driver, the **Twist'N'Blue** is seen by the computer as a serial port (*COMxx* on Windows, */dev/usb/ttyXX* on Unix).



## 7. FIRMWARE UPGRADE

---

The firmware of the Twist'N'Blue's MCU could be upgraded in-the-field through either the Serial line (J1) or the USB interface (J5A / J5B).

The actual firmware upgrade is performed thanks to the **SpringCard Firmware Upgrade Utility (FUU)** running on a Windows computer.

**Twist'N'Blue** uses the same MCU as the K663 family (a Renesas RL78). Therefore, this procedure refers to K663-related information.

### 7.1. DOWNLOAD AND INSTALL FUU

Go to <http://tech.springcard.com/firmware-upgrade/k663-firmware-upgrade/>

Read the instructions and follow the link to download FUU installation package (SU13168):

<https://www.springcard.com/en/download/find/file/su13168>

### 7.2. OBTAIN THE FIRMWARE YOU WANT TO FLASH

Since the **Twist'N'Blue** is an evaluation-only product, neither of its firmware is publicly available. Please contact your interlocutor at SpringCard's to obtain the firmware you want to evaluate.

### 7.3. START THE DEVICE IN FIRMWARE UPGRADE MODE

#### 7.3.1. Using /FLASH pin

Set the /FLASH pin of J1 to a LOW level and reset the device to have the MCU start in firmware upgrade mode.

To reset the device, you may either:

- Set the /RESET pin to a LOW level for 10ms, and then release it to HIGH level (or floating),
- Press the RESET button (S1) for at least 10ms,
- Cycle the power,
- Send a reset command to the firmware, if it supports it.

Do not forget to set the /FLASH pin back to a HIGH level (or floating) once the upgrade has been performed.

### 7.3.2. Using the FLASH switch at SW1

Set switch 2 at SW1 to ON according to the table below and reset the device to have the MCU start in firmware upgrade mode.

SW	NAME	Value	Description
1	MCU_BYPASS	OFF	J1 & USB are available for operation.
2	FLASH	<b>ON</b>	The device starts in firmware upgrade mode
3	SEL_BYPASS	OFF	<i>Default position</i>
4	USB_SPY	OFF	<i>Default position</i>

Table 15: Position of the switches to upgrade the firmware

Do not forget to set the switch back to the default position for operation (§ 4.2) once the upgrade has been performed.

### 7.4. FLASH THE DEVICE

Follow the instructions at <http://tech.springcard.com/firmware-upgrade/k663-firmware-upgrade/> to flash the **Twist'N'Blue**.



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