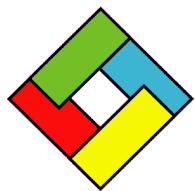


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BLUEAUDIO2
USER MANUAL

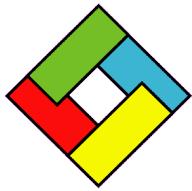
Authors:

A. Colognese

Date:

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Revision List

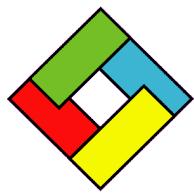
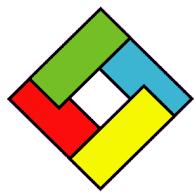


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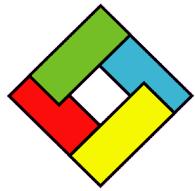


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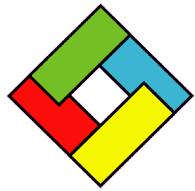
1 Introduction

This document describes main characteristics and features of **BlueAudio2** devices for intercom or mobile applications.

Conventions

In the document following conventions are assumed:

- **HU**: **BlueAudio2** or **BlueAudio** device.
- **CU**: Mobile cellular phone with Bluetooth support.

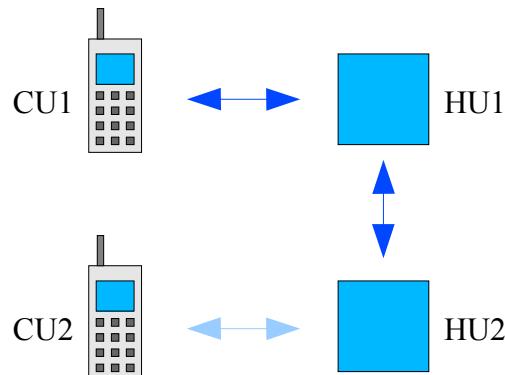


2 BlueAudio2 system

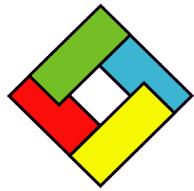
2.1 System Description

BlueAudio2 is a wireless device that allows hands-free use of any mobile phone supporting Bluetooth Headset or Hands-free profiles, but also provides capability for easy wireless audio communication with another BlueAudio2 device, or a BlueAudio one. Its main application could be a Bluetooth Helmet. All functions are implemented with a user-friendly interface based on a multifunctional button located on the helmet, an external led and audio messages sent to hi-fidelity acoustic speakers.

User will be able to talk with a passenger and in case of a incoming call from a paired cellular phone, he will be able to answer. The connection with the paired device is automatically set-up and it can be dropped by each user.



In the previous figure, a blue arrow indicates the possibility to establish an audio link between two devices. Two devices can establish an audio link only if they were previously paired. This



connections can be dropped if there is an incoming call from a paired cellular phone, if affiliated. **HU** devices use a dedicated protocol of communication between them. This protocol guarantees that two devices can be paired and connected only if they are produced by the same producer. To be paired with a cellular phone, the device is delivered with a password which must be typed during the pairing procedure.

Audio volume can be selected among 5 levels.

The application is supplied with an internal rechargeable battery pack and significant efforts have been devoted to reduce power consumption to provide users with a full day of usage on a single charge. Standby current consumption was designed to be lower than $5 \mu\text{A}$. In addition **BlueAudio2** offers superior noise reduction.

2.2 Hardware Description

BlueAudio2 is a Bluetooth device for wireless audio communications.

In Fig. 2.2 you can see the block diagram of the system.

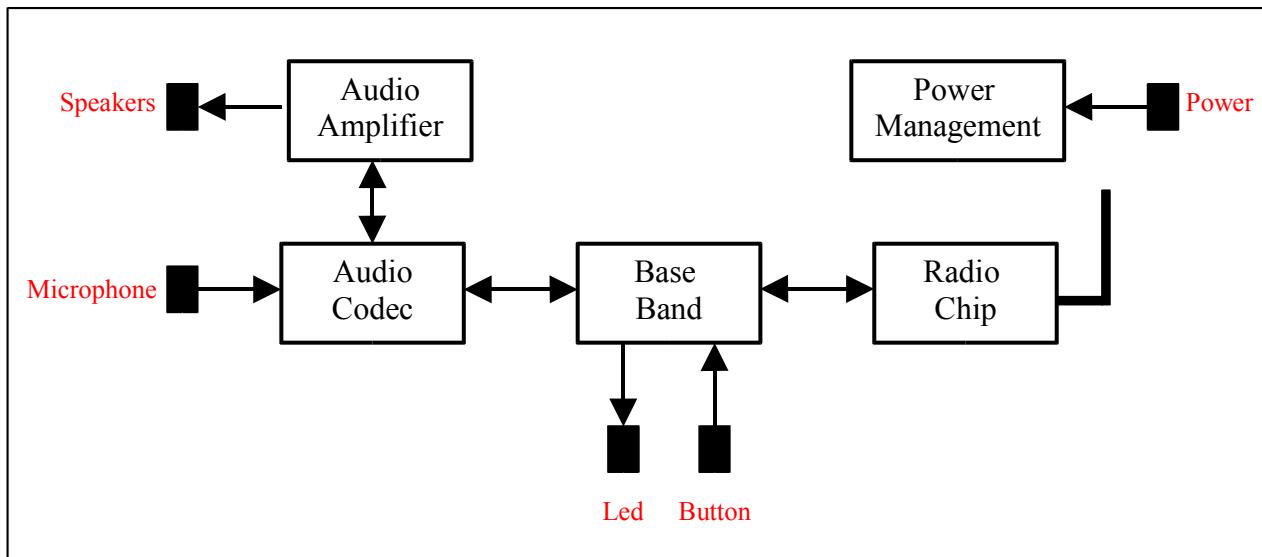
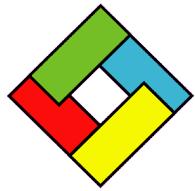


Fig 2: Block Diagram

The Bluetooth chipset is based on a STMicroelectronic solution. An Audio codec chip performs the digital/analog and analog/digital conversion. The output audio is amplified by a 1.25W amplifier



with volume control. The antenna is integrated on the PCB.

The power management block perform two main task:

- voltage regulation
- low power switch off

For more details, please refer to Appendix A.

2.3 Electrical specifications

2.3.1 Maximum ratings

Parameter	min	Typ	Max	Unit
DC Power Supply	3.3	3.6	6	V
Power Consumption	5 μ	60m	100m	A
Operating Temperature	-20	27	70	°C
Storage Temperature	-40	27	100	°C
Relative Humidity ¹	10%	-	90%	-

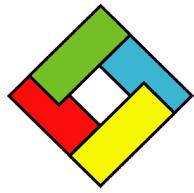
WARNING

Stressing the device beyond the Maximum Ratings may cause permanent damage. These are stress rating only. Operation beyond Operating Conditions is not recommended and extended exposure beyond Operating Condition may affect reliability.

2.3.2 Mechanical specifications

The device cannot be used without packaging or external shielding. Users cannot reach electronic parts, connectors and cables.

¹Non condensing

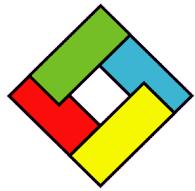


Parameter	min	Typ	Max	Unit
Width	-	47	-	mm
Lenght	-	47	-	mm
High	-	-	7	mm

2.3.3 Bluetooth Specifications

The **BlueAudio2** is a Bluetooth device certified for audio wireless audio by Bluetooth Qualification Body (BQB). It is compliant to Bluetooth Protocol V1.1b and it supports the following profiles:

- HSP: HeadSet Profile
- HFP: Hands-Free Profile
- ICP: Intercomm Profile (not qualified, modified and proprietary).



3 Features

3.1 Power Supply

BlueAudio2 devices can be powered by 3.6V by means of Li-Ion battery with a capability of 650mA/h. This solution allows an autonomy of approximately 8-10 hours in continuous operation. When off, the system has a power consumption lower than 5µA.

3.2 User Interface

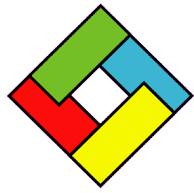
The user interface is based on:

- a push-button
- a LED
- audio messages (i.e. tones)

This interface allows the user to control the state of the device and to send it appropriate commands.

3.2.1 Button functions

There are more kinds of pressure detected and handled by BlueAudio2 devices: some of them can be used only in special situations, while during normal behaviour only two of them are commonly used. The various pressure types are distinguished by their duration and the user is helped by the system with audio and/or visual feedback as soon as it recognize the particular pressure being effected. Actions are effectively taken only when the button is released, in order to avoid multiple

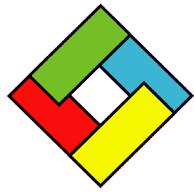


and undesired commands.

Type	Length (s)	Applicable when	Effect	Notification
Turn on	$4 \leq t < 9$	BlueAudio2 is off	Turns device on	Tone, LED steady on
HS pairing	$9 \leq t < 14$	BlueAudio2 is off	Turns device on and enters HS pairing mode	Tone, LED blinking fast
HF pairing	$t \geq 14$	BlueAudio2 is off	Turns device on and enters HF pairing mode	Tone, LED blinking fast
Short	$0.2 \leq t < 2$	BlueAudio2 is on	Depends on device status	Nothing
Long	$2 \leq t < 5$	BlueAudio2 is on	Depends on device status	Tone
Turn off	$t \geq 5$	BlueAudio2 is on	Turns device off	Tone, LED steady on

The following table describes the operations associated to short and long button pressures in the various states the device can be in. Call related actions are only performed if a paired device is available for that kind of call.

Mode	State	Short pressure	Long pressure
-	Off	-	-
HS	Pairing	Start inquiry and enters master pairing	Delete stored pairing informations
	Master pairing	Start inquiry if not already pending	-
	Idle	Initiate HS outgoing call	Initiate intercom call if device is master
	Outgoing call	-	-
	Incoming call	Accept call	-
	Call	Adjust volume	Close call



Mode	State	Short pressure	Long pressure
HF	Idle	Connect cellular phone	Initiate intercom call if device is master
	HF service	Activate voice recognition	Close service connection
	Outgoing call	Adjust volume (if audio is present)	Close call
	Incoming call	Accept call	Refuse call
	Call	Adjust volume	Close call
	Voice recognition	-	Terminate voice recognition
HF/HS	Intercom call	Adjust volume	Close call

3.2.2 Led Messages

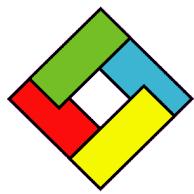
The led it has the function to transmit a visual message on the state of the device. The following table is looked at.

Status	Led
Off	Off
On	Very slow blinking
Pairing	Fast blinking
Connected	Slow blinking

3.2.3 Audio messages - Tones

Tones are played from the speakers to indicate an event or the confirmation of a command. The following table lists all the tones used by the application and the events they are associated to.

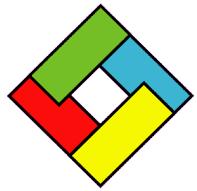
Name	Tone	Action/Event
turn_on	1 kHz, 300ms	Device turning on
turn_off	600 Hz, 450ms	Device turning off
pairing_mode_hs	1.4 kHz, 350ms	Start of HS pairing mode
pairing_mode_hf	1.4 kHz, 250ms 60 ms mute 1.4 kHz, 250ms	Start of HF pairing mode
pairing_success	1.4 kHz, 450ms	Pairing successfully completed



Name	Tone	Action/Event
pairing_failure	600 Hz, 350ms	Pairing unsuccessfully completed
inquiry_failed	800 Hz, 150ms 600 Hz, 150ms	Master device inquiry failure
tick	1 kHz, 100ms	Long button pressure detected
warning	600 Hz, 250ms	<ul style="list-style-type: none"> • HFP/HSP light/medium errors • HFP/HSP outgoing connection timeout • No operations for short or long button pressures in current state • Operation not available
error	600 Hz, 250ms, 80 ms mute, 600 Hz, 250ms	Serious HFP/HSP errors
ic_connection	1.4 kHz, 200ms	Intercomm connection established
ic_disconnection	800 Hz, 300ms	Intercomm disconnection
ic_link_failure	800 Hz, 300ms, 50 ms mute, 600 Hz, 100 ms	Intercomm connection link timeout
hx_connection	1.4 kHz, 100ms, 50 ms mute, 1.4 kHz, 100ms	HFP/HSP connection established
hx_disconnection	800 Hz, 100ms, 50 ms mute, 800 Hz, 100ms	HFP/HSP disconnection
hx_link_failure	800 Hz, 100ms, 50 ms mute, 800 Hz, 100ms, 50 ms mute, 600 Hz, 100ms	HFP/HSP connection link timeout
ring	1.4 kHz, 200 ms, 100 ms mute, 1.4 kHz, 200 ms	Ring tone for incoming phone calls (played when inband-ringing is not supported by the cellular phone)
voice_rec_on	1.4 kHz, 50ms	HFP activation of voice recognition

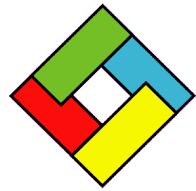
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Name	Tone	Action/Event
voice_rec_off	800 Hz, 50ms	HFP deactivation of voice recognition
volume_step	800 Hz, 100 ms	Audio volume increased/decreased of 1 step
volume_max	1 kHz, 100 ms	Audio volume reached maximum level
volume_min	600 Hz, 100 ms	Audio volume reached minimum level



4 Pairing

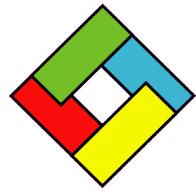
The pairing procedure is necessary in order to let two **HU** devices know each other and to allow the connection between them. This procedure must be executed at the first use of the system or every time you want to connect a new device. A **BlueAudio2** device can be paired at the same time to a cellular phone and to an other **HU**. If correctly performed, the pairing configuration is permanently stored and automatically reloaded during switch on.

Pairing mode can be entered only from a turned off **BlueAudio2** and requires special button pressures much longer than the those necessary to just turn on the device. **BlueAudio2** devices offer two pairing modes in order to give the user the chance to choose the profile to be used when pairing toward a mobile phone, a feature that is very useful when the latter supports both Headset and Hands-free profiles:

1. HS pairing mode, which allow pairing with cellular phones supporting Bluetooth Headset profile or with another **HU** device;
2. HF pairing mode, which allow pairing only with cellular phones supporting Bluetooth Hands-free profile.

4.1 HS pairing mode

This procedure allows the pairing of a **BlueAudio2** device with a cellular phone supporting Bluetooth Headset profile or with another **HU** device. It can be entered from a turned off **BlueAudio2** device by pressing its button and keeping it pressed until the device firstly plays a tone and turns its LED steady on as a confirmation that it is being turned on and secondly, after about 5 seconds, plays another tone and starts blinking its LED very fast. The button can now be released and the pairing procedure can be continued.



4.1.1 Pairing with a mobile supporting Headset profile

1. Enter the HS pairing mode of your [BlueAudio2](#) device;
2. Follow the instructions of your cellular phone in order to start its pairing procedures. It will look for other Bluetooth devices and present you a list where you should be able to see the [BlueAudio2](#) one, which is identified by the name "STILO HS" followed by some other informations, namely its firmware version and an identification code. Select the [BlueAudio2](#) device;
3. Once prompted for a PIN type the password "1111", without quotes.
4. If the procedure is correctly executed, the cellular phone will display a confirmation message and [BlueAudio2](#) will play a confirmation tone.

4.1.2 Pairing with a [HU](#) device

1. Enter the HS pairing mode of your [BlueAudio2](#) device;
2. Enter the other device pairing mode (HS pairing mode if it is a [BlueAudio2](#) one, normal pairing mode if it is a [BlueAudio](#) one);
3. Press shortly the button of the device you want to be the master, so to say the one that will connect the paired one, called the slave. The master will proceed to discover the other device and to try to pair it.
4. The success or failure of pairing will be confirmed by a tone and, in case of success, the master device will automatically establish an audio connection toward the slave.

4.2 HF pairing mode

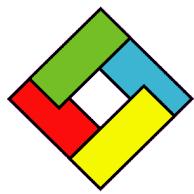
This procedure allows the pairing of a [BlueAudio2](#) device with a cellular phone supporting Bluetooth Hands-free profile. It can be entered from a turned off [BlueAudio2](#) device by pressing its button and keeping it pressed until the device firstly plays a tone and turns its LED steady on, as a confirmation that it is being turned on, secondly plays another tone and starts blinking its LED very fast to indicate the possibility of an HS pairing, and finally, after about 10 seconds from when it turned on, plays a third tone while the LED still blinks fast.

4.2.1 Pairing with a mobile supporting Headset profile

1. Enter the HS pairing mode of your [BlueAudio2](#) device;
5. Follow the instructions of your cellular phone in order to start its pairing procedures. It will look

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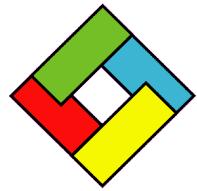
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for other Bluetooth devices and present you a list where you should be able to see the **BlueAudio2** one, which is identified by the name "STILO HF" followed by some other informations, namely its firmware version and an identification code. Select the **BlueAudio2** device;

6. Once prompted for a PIN type the password "1111", without quotes.
7. If the procedure is correctly executed, the cellular phone will display a confirmation message and **BlueAudio2** will play a confirmation tone.



5 Audio link set-up

The **BlueAudio2** system allows intercommunication with other **HU** devices and cellular phones equipped with Bluetooth technology and supporting Headset or Hands-free profiles.

5.1 HU ↔ HU

The connection **HU ↔ HU** permits to use **BlueAudio2** devices like an intercom. At startup the device paired as master automatically connects the slave one. If the latter is not reachable, the connection fails and the master remains in a idle state waiting for eventual incoming calls from cellular phone or for user commands.

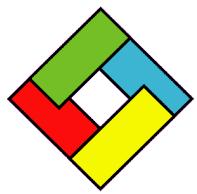
Once the intercomm connection is established the user can adjust the audio volume with short pressures of the button. The communication can be dropped voluntarily by the user of either master or slave devices with a long pressure of the button and is automatically dropped by the master device if it detects an incoming call from its paired phone. In this last case the master automatically tries to re-establish an intercom connection with the slave once disconnected from the cellular phone. Slave device cannot detect incoming connection if its already connected to another device.

5.2 CU ↔ HU

This mode allows the use of **BlueAudio2** like a standard Bluetooth Headset or Hands-free device. In particular it will be possible to accept an incoming call or to take advantage of the vocal synthesis (if present on telephone) in order to start an outgoing call. It is also possible to begin the call from

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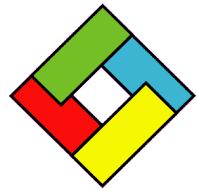
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the phone (by composing the number or by choosing it from the rubrica) and then switch the audio to **BlueAudio2** by pressing the button.

BlueAudio2 plays a ring tone when signaled by the cellular phone, unless an inband-ring tone is being played by the CU itself.



6 External connections

6.1 Power Supply Connector – JP3

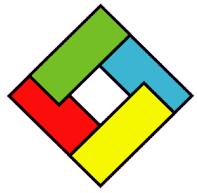
The power connector is a MOLEX 5264-02 2.50 mm pitch.

Pin	Function
1	VDD
2	GND

6.2 Speaker Connector – JP1

The speaker connector is a JST P/N PHR-04P 2mm pitch and the audio signal is balanced. The two speakers are in parallel.

Pin	Function
1	OUT+
2	OUT-
3	OUT+
4	OUT-



6.3 Microphone Connector – BFIN

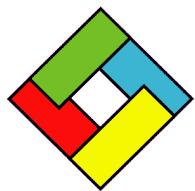
The microphone connector is a JST P/N PHR-03P 2mm pitch. The pin 1 supply the power for pre-amplified mic.

Pin	Function
1	IN+
2	GND
3	IN-

6.4 User Interface Connector – JP2

The User Interface connector is a JST P/N PHR-03P 2mm pitch.

Pin	Function
1	Button
2	Led
3	GND



7 BlueAudio2 Board View

