

## Firmware User Guide

### kcAudioGateway v6.7 Build 4

### Introduction

Our kcAudioGateway firmware is an audio source/transmitter system that operates in one of two modes, which now combines the functionality offered in our previously separate kcAudioAdapter and kcAudioGateway editions. There are no UART commands or SPP data service currently available. All user functions are currently implemented with PIO pins. There are minimal output messages via UART in this edition.

### AGHFP mode

AGHFP mode is the default mode, implementing Bluetooth AGHFP profile which is intended to connect to a standard Bluetooth cell phone mono headset. The audio is sampled at 8kHz, and operates two-way communications. The kcAudioGateway does not implement “phone calls” like a phone gateway would, but rather opens the bi-directional audio channel automatically, without the call answer or hang up states.

### A2DP mode

A2DP mode implements Bluetooth A2DP Source profile which is intended to connect to standard Bluetooth stereo headsets or speakers. The audio is sampled at 44.1kHz, and transmits stereo audio.

### Firmware Editions

Our default kcAudioGateway is released in two editions: our class 1 KC5012 edition, and our class 2 KC6012 edition (also intended for KC6112 modules).

### Supported Bluetooth Profiles

Profile	Name	Version	Configured
AGHFP	Audio Gateway Hands Free Profile	1.5	Enabled
A2DP	Advanced Audio Distribution Profile – Source Edition	1.2	Enabled
AVRCP	Audio Video Remote Control Profile – Target Edition	1.0	Not Implemented

### Audio Codec Options

AGHFP mode supports the Bluetooth standard CVSD, aLAW, and uLaw codec formats.

A2DP mode supports the Bluetooth standard SBC (Sub-Band Coding) codec format, and a low latency optional codec, FastStream. FastStream is automatically selected whenever the receiver device supports it.

### Firmware Change Log

Changes from kcAudioGW v6.7.3 include:

- Added AVRCP output messages, when controls commands are received (Rewind, FastForward, Play, Pause).

Changes from kcAudioGW v6.7.2 include:

- Fixed LEDs blink pattern when connected.
- Startup Uart message indicates A2DP Mode or HFP Mode.

Changes from kcAudioGW v6.5.1 include:

- Combines the functions of kcAudioGateway and kcAudioAdapter.
- Provides both power switch and power button operations. See the Multifunctional ENABLE/BTB for description.
- Startup tones indicate Gateway or Adapter modes.
- Added Test Mode to set device to Gateway or Adapter mode.

Changes from kcAudioGW v6.5.0 include:

- PIO assignment of Streaming indicator was changed from PIO 7 to PIO 10. Our BlueDemo Audio Evaluation Boards utilizes PIO 10 for amplifier enable, which corresponds to the Streaming indicator.

### Multifunctional ENABLE / BTB

The BTB – Bluetooth button is a multi-featured input button. Most of the features are activated differently based on the current operating mode of the device.

The ENABLE pin is a dual purpose pin, and kcAudioGateway firmware can operate both power switch and power button modes.

First, power button mode is supported, where the ENABLE pin is tied to a momentary button (typically supplied directly from a li-ion battery). In this usage model, the ENABLE pin is used as the BTB. A long press of ENABLE will power up the device, and a subsequent very long press will power off the device. When the device is on, this ENABLE pin will provide the same features as the BTB.

Secondly, power switch mode is supported, where an external system power switch is used, typically to supply a DC power source. In this mode the ENABLE pin will be tied to this switched power source, and will simply turn on/off the device. In this mode, since the ENABLE pin is held HIGH when powered on, then BTB features must be operated using the BTB assigned Pio 4.

The device provides both power switch and power button operations by latching the system ENABLE internally, thus allowing the ENABLE pin to turn on/off the device with simple button presses, and additionally triggering all the features of the BTB when subsequently pressed. However, if the system is powered up, and the ENABLE pin remains HIGH for over 10 seconds, then the ENABLE button disables the internal power latch, which will allow the device to power off immediately upon release of the ENABLE pin (LOW).

### Push-To-Talk

A special Push-To-Talk feature has been added (since kcAudioGW v6.5.0) that receives a standard Bluetooth cell phone headset button press to toggle the PTT feature in our firmware. This is typically a Voice Activation feature where a phone would open an audio channel in order to receive voice commands. When PTT is toggled OFF, the PTT indicator goes low, and the microphone channel is muted. When toggled ON, the PTT indicator goes HIGH, and the mic channel is unmuted.

### AudioLink

The AudioLink feature is similar to Push-To-Talk, but toggles ON/OFF the entire bi-directional audio channel. This feature can provide significant power savings, as the processor can sleep when the audio channel is not operating. The connection remains open in standby mode when the audio channel is closed. When AudioLink toggled OFF, the STREAMING indicator goes low, and the audio channel is dropped completely. When toggled ON, the STREAMING indicator goes HIGH, and the audio channel is opened.

### AVRCP Messages

The following messages are output via Uart when Avrcp control signals are received from a remote device:

-> Avrcp RR Press	-> Avrcp RR Release	-> Avrcp FF Press	-> Avrcp FF Release
-> Avrcp Skip Backward	-> Avrcp Skip Forward	-> Avrcp Play	-> Avrcp Pause
-> Avrcp Stop			

## Automatic Features

Feature
Reconnect on startup (with previously paired devices)
Search for new headset on startup (if no paired devices)
Reconnect on link loss
Idle shutdown after 30 minutes

## Feature Activation

PIO pins are used to activate firmware features. PIO default state is LOW (0V), and activates the assigned feature with a HIGH (3.3V) signal press, and LOW (0V) signal release. The “button presses” are debounced by 4 readings within 15ms. The following timings are configured for a “button press” to activate an assigned feature.

Press	Activation Time
Short	< 1.0 second
Double	Within 0.5 seconds
Long	1.0+ second

Press	Activation Time
Very Long	2.5+ seconds
Very Very Long	5.0+ seconds
Hold	Repeat every 0.25 sec

## PIO Assignments

PIN Function	Name	I/O	Feature
ENABLE		Input	Press or Hold Continuously for power up
PIO 2	PTT	Output	HIGH when mic channel is ON
PIO 3			Unused
PIO 4	BTB	Input	Bluetooth Button: Multifunctional See Below
PIO 5	VOLUP	Input	Press: Volume Up; Double: Input Gain Up
PIO 6	VOLDN	Input	Press: Volume Down; Double: Input Gain Down
PIO 7			unused
PIO 8	AUDIOLINK	Input	Press: Toggle audio streaming on/off
PIO 9	CONNECTED	Output	HIGH when connected
PIO 10	STREAMING	Output	HIGH when audio is streaming

## Button Features

Feature	Button	Press	Condition
System On	ENABLE	Very Long	Only when (firmware) system off
System On	BTB	Very Long	Only when (firmware) system off
System Off	BTB	Very Long	Any
Reconnect	BTB	Short	Only when not connected
Search	BTB	Long	Only when not connected
Volume Up	VOLUP	Short	Any
Volume Down	VOLDN	Short	Any
Input Gain Up	VOLUP	Double	Any
Input Gain Down	VOLDN	Double	Any
Reset Pairing	VOLUP + VOLDN	Very Long	Any
Enter DFU Mode	PIO 2	HIGH	Only during power up
Test Mode	RR + AUDIOLINK	Very Long	Toggle test mode on/off
Set AGHFP mode	VOLUP	Short	Only in test mode
Set A2DP mode	VOLDN	Short	Only in test mode
Audio Loopback	RR	Short	Only in test mode

## LED Event and State Indicators

When battery is low, the Red led blinks instead of the Blue led.

When the battery is charging, both Blue and Red blink together.

Event	LED Action	Timing
System On	Blue Flash	1s on
System Off	Red Flash	1s on
Reset Pairing List	Blue+Red Triple Flash	100ms on/off/on/off/on/off
Enter DFU Mode	Blue+Red Triple Flash	100ms on/off/on/off/on/off

State	LED Action	Timing
Connectable	Blue Blinking	100ms on, 2500ms off
Connected, No Audio	Blue Double Blinking	100ms on/off/on, 1500ms off
Connected, Audio Streaming	Blue Double Blinking	100ms on/off/on, 1500ms off
Searching	Red/Blue Alternate Fast Blinking	100ms on/off
Reconnecting	Blue Fast Blinking	100ms on/off

## Output Volume

Default output volume for new connections is Level 14 = 0 dB.

<b>Level</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>
<b>Gain</b>	-45.0 dB	-39.0 dB	-35.5 dB	-33.0 dB	-29.5 dB	-27.0 dB	-23.5 dB	-21.0 dB

<b>Level</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>
<b>Gain</b>	-18.0 dB	-15.0 dB	-12.0 dB	-9.0 dB	-6.0 dB	-3.0 dB	0 dB	+3.5 dB

## Input Volume

Default input gain is 0 dB.



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