

Audiolino Brick Firmware Specification v1.0.0

New in this release

This is the first Audiolino Brick firmware release.

Introduction

Audiolino Brick embeds a library of ready to use audio algorithms that can be recalled and configured by the user. After configuration the settings can be stored into the board for standalone operation in up to 32 internal program locations. Everything can be controlled via MIDI protocol using standard and SYSEX messages. To simplify operation you can download Audiolino Brick Editor from www.audiolino.com but you can also implement the MIDI communication protocol yourself to drive everything from an external microcontroller or UI. Audiolino MIDI SYSEX interface is powerful. It allows a complete control of the device and supports bidirectional communication to have feedback on command execution. Bidirectional MIDI communication is recommended and it allows you to avoid software delays in host code.

Setups

Audiolino Brick embeds a certain number of setups. Setups are containers for DSP processing blocks, like effects and equalizers. At the end of this document a detailed description of setups and related parameters is given.

Internal programs

Audiolino Brick has 32 internal programs. Internal programs may be recalled by MIDI program change or by LOAD_PROGRAM SYSEX. The first 4 programs can also be selected using POT4 after configuring it in *Program select* mode.

Controllers

Audiolino Brick has up to 8 controllers that can be set via MIDI control changes. Controllers are mapped to parameters in a predefined way that depends on particular setup. The first 4 controllers can also be changed locally using POT1, POT2, POT3 and POT4.

Audiolino MIDI implementation chart

Function	Transmitted	Recognized	Remarks
Basic channel	1-16	1-16	Selected via dip-switch
Mode	4	4	OMNI OFF, MONO
Note on/off	X	X	
After touch	X	X	
Pitch bend	X	X	
Control change	16 to 19	16 to 23	
Program change	0 to 31	0 to 31	
System exclusive	O	O	
System common	X	X	
System realtime	X	X	

Legend

O = Supported X = Not supported

Control changes

Controller	Control number	Source
1	16	POT1
2	17	POT2
3	18	POT3
4	19	POT4 (when in pot. mode)
5	20	-
6	21	-
7	22	-
8	23	-

Note

When Audiolino Brick devices operate in chain mode some MIDI data forwarding and filtering rules apply. A special SYSEX message (*CHAIN_INTERNAL*) is used to forward MIDI data to other Brick Devices. Details of Audiolino Brick MIDI operation in chain mode is out of the scope of this document.

Audiolino Brick SYSEX addendum

Audiolino devices share a common SYSEX implementation. In this section only details regarding Audiolino Brick will be given. For detailed operation of SYSEX messages please refer to Audiolino Brick SYSEX Specification document.

SYSEX format

General form of Audiolino Brick SYSEX is:

Byte	Name	Description
1	BOS	Begin of SYSEX (0xF0)
2	MID0	Manufacturer ID0 (0x00)
3	MID1	Manufacturer ID1 (0x21)
4	MID2	Manufacturer ID2 (0x44)
5	DID	Device ID (0x01 - Brick)
6	CH	Channel (0x00 to 0x0F)
7	STA	Status
8	CMD	Command
...		Optional payload
N-1	CKS	Checksum
N	EOS	End of SYSEX (0xF7)

SYSEX example The following is an example of a valid SYSEX message to request ID to an Audiolino Brick device configured on channel MIDI 16 (all DIP switches set to ON position):

F0 00 21 44 **01 0F** 11 00 7A F7

01 - DID (Audiolino Brick) **0F** - CH (16)

Commands

The following table summarizes commands recognized by Audiolino Brick devices.

Command value	Mnemonic	Supported-by
0x00	ID	APP, BL
0x01	RESET	APP, BL
0x02	WHO	APP, BL
0x03	SERIAL	APP, BL
0x04	SUPPORTED_CMD	APP, BL
0x05	VER	APP, BL
0x06	DISCOVERY	APP
0x07	FACTORY_RESET	APP
0x08	STORE_DEV_PARAMS	APP
0x09	LOAD_PROGRAM	APP
0x0A	STORE_PROGRAM	APP
0x0B	DEV_PARAM_GET	APP
0x0C	DEV_PARAM_SET	APP
0x0D	EDIT_PARAM_GET	APP
0x0E	EDIT_PARAM_SET	APP
0x0F	ALG_PARAM_GET	APP
0x10	ALG_PARAM_SET	APP
0x16	DUMP_INFO	APP
0x17	DUMP_ERASE	APP
0x18	DUMP_WRITE	APP
0x19	DUMP_READ	APP
0x1A	DUMP_CRC	APP
0x1B	FW_UPGRADE_ERASE	APP
0x1C	FW_UPGRADE_WRITE	APP

Command value	Mnemonic	Supported-by
0x71	CHAIN_INTERNAL	APP
0x72	LOOPBACK	APP
0x7F	STATUS	APP

Supported-by

- APP: Application
- BL: Bootloader

APP ID

Command 0x05 (VER) is used to get firmware version. Audiolino Brick production firmware has *App ID0* = 1 and *App ID1* = 1.

Device parameters

To read device parameters use command 0x0B (DEV_PARAM_GET). To write device parameters use command 0x0C (DEV_PARAM_SET). Note that parameters are written to RAM only. To store them in flash memory use command 0x08 (STORE_DEV_PARAMS). This will store all the parameters with a single command.

The following table summarizes Audiolino Brick device parameters:

Address	Name	Min	Max	Default	Access
0	STARTUP_PROGRAM	0	31	0	RW
1	POT1_POLARITY	0	1	0	RW
2	POT2_POLARITY	0	1	0	RW
3	POT3_POLARITY	0	1	0	RW
4	POT4_POLARITY	0	1	0	RW
5	POT4_MODE	0	31	0	RW

STARTUP_PROGRAM

This is the startup program to be recalled at boot.

POTx_POLARITY

This is the polarity selected for potentiometer X:

- 0: normal
- 1: reverse

POT4_MODE

With this parameter you can set the POT4 operating mode:

- 0: potentiometer
- 1: program select

Edit parameters

The following table summarizes Audiolino Brick edit parameters. Audiolino Brick edit parameters are stored with program data. Each program has its own copy of this data and replaces existing values when it is recalled (via *PROGRAM CHANGE* or via *LOAD_PROGRAM SYSEX* message).

To read edit parameters use command 0x0D (*EDIT_PARAM_GET*). To write device parameters use command 0x0E (*EDIT_PARAM_SET*). Note that parameters are written to RAM only. To store them in flash memory use command 0x0A (*STORE_PROGRAM*). Please note that when a program is stored all the actual algorithm parameters values are also stored. Algorithms parameters can be set via command 0x0F (*ALG_PARAM_GET*) and command 0x10 (*ALG_PARAM_SET*).

Address	Name	Min	Max	Default	Access
0	SETUP	0	N-1	0	RW
1	CTL1_CC	0	127	16	RW
2	CTL2_CC	0	127	17	RW
3	CTL3_CC	0	127	18	RW
4	CTL4_CC	0	127	19	RW
5	CTL5_CC	0	127	20	RW
6	CTL6_CC	0	127	21	RW
7	CTL7_CC	0	127	22	RW
8	CTL8_CC	0	127	23	RW

SETUP

This is the number of the setup the program is using.

CTLx_CC

This is the MIDI controller number related to controller X. It is recommended to leave parameters 1 to 8 to their default values.

Status

Command 0x7F (*STATUS*) is used to get device status. The following tables summarizes Audiolino Brick *STATUS* payloads.

TX payload

none

RX payload

Byte	Name	Description
1	PGM	Current program number
2	SETUP	Active setup index
3	CTL1_CC	Controller 1 current value
4	CTL2_CC	Controller 2 current value
5	CTL3_CC	Controller 3 current value
6	CTL4_CC	Controller 4 current value

Byte	Name	Description
7	CTL5_CC	Controller 5 current value
8	CTL6_CC	Controller 6 current value
9	CTL7_CC	Controller 7 current value
10	CTL8_CC	Controller 8 current value
11	CTL1_CC	Controller 1 number
12	CTL2_CC	Controller 2 number
13	CTL3_CC	Controller 3 number
14	CTL4_CC	Controller 4 number
15	CTL5_CC	Controller 5 number
16	CTL6_CC	Controller 6 number
17	CTL7_CC	Controller 7 number
18	CTL8_CC	Controller 8 number

Setups (internal library)

Internal Audiolino Brick setups can be loaded with LOAD_SETUP SYSEX command. Once a setup is loaded, all parameters are set to default values and can be read or written via ALG_PARAM_SET and ALG_PARAM_GET SYSEX commands. In the next sections a detailed view of each setup is given.

Bypass

Description

Bypass

Setup ID: 0

Parameters

None

CHO-X

Description

Stereo chorus effect with 4 taps delay line

Setup ID: 1

Parameters

Id	Name	Unit	Step	Min	Max	Default	Controller
0	Mute	-	1	0	1	0	-
1	Bypass	-	1	0	1	0	3
2	DryWet	%	0.1	0	100	50	4
3	Mod.Depth	%	0.1	0	100	50	1
4	Mod.Speed	Hz	0.01	0.01	5	1	2
5	LRPhase	degree	1	0	180	90	7
6	Predelay	ms	0.01	0	20	0	5
7	Feedback	%	0.1	-100	100	0	6

Id	Name	Unit	Step	Min	Max	Default	Controller
8	Mod1.Depth	%	0.1	0	100	50	-
9	Mod2.Depth	%	0.1	0	100	50	-
10	Mod3.Depth	%	0.1	0	100	50	-
11	Mod4.Depth	%	0.1	0	100	50	-
12	Mod1.Phase	degree	1	0	360	0	-
13	Mod2.Phase	degree	1	0	360	45	-
14	Mod3.Phase	degree	1	0	360	90	-
15	Mod4.Phase	degree	1	0	360	135	-
16	Mod1.Gain	-	0.01	-1	1	0.25	-
17	Mod2.Gain	-	0.01	-1	1	0.25	-
18	Mod3.Gain	-	0.01	-1	1	0.25	-
19	Mod4.Gain	-	0.01	-1	1	0.25	-

TRE

Description

Stereo tremolo effect

Setup ID: 2

Parameters

Id	Name	Unit	Step	Min	Max	Default	Controller
0	Mute	-	1	0	1	0	-
1	Bypass	-	1	0	1	0	3
2	DryWet	%	0.1	0	100	80	4
3	Frequency	Hz	0.01	0.01	10	1	1
4	LRPhase	degree	1	0	180	0	2
5	Shape	-	1	0	1	0	5

PHA-4

Description

Stereo 4 stages phaser effect

Setup ID: 3

Parameters

Id	Name	Unit	Step	Min	Max	Default	Controller
0	Mute	-	1	0	1	0	-
1	Bypass	-	1	0	1	0	3
2	DryWet	%	0.1	0	100	100	4
3	EffDepth	%	0.1	0	100	50	1
4	Feedback	%	0.1	0	100	50	5
5	Mod.Depth	cents	1	0	4800	2400	-
6	Mod.Speed	Hz	0.01	0.01	5	1	2

Id	Name	Unit	Step	Min	Max	Default	Controller
7	Mod.LRPhase	degree	0.01	0	180	0	6
8	AllPass.Cutoff1	Hz	1	20	20000	800	-
9	AllPass.Cutoff2	Hz	1	20	20000	800	-
10	AllPass.Cutoff3	Hz	1	20	20000	800	-
11	AllPass.Cutoff4	Hz	1	20	20000	800	-

DEL

Description

Stereo delay effect

Setup ID: 4

Parameters

Id	Name	Unit	Step	Min	Max	Default	Controller
0	Mute	-	1	0	1	0	-
1	Bypass	-	1	0	1	0	3
2	DryWet	%	0.1	0	100	80	4
3	Delay	%	0.1	0	100	50	1
4	Feedback	%	0.1	0	100	0	2
5	Damp	%	0.1	0	100	0	5
6	DelayL	ms	0.1	0	600	300	6
7	DelayR	ms	0.1	0	600	300	7

REV

Description

Basic reverb effect

Setup ID: 5

Parameters

Id	Name	Unit	Step	Min	Max	Default	Controller
0	Mute	-	1	0	1	0	-
1	Bypass	-	1	0	1	0	3
2	DryWet	%	0.1	0	100	80	4
3	Decay	ms	1	500	8000	1000	1
4	Damp	%	0.1	0	100	50	2
5	Spread	%	0.1	0	100	50	5

PEQ-8

Description

Stereo 8 bands parametric equalizer

Setup ID: 6
Parameters

Id	Name	Unit	Step	Min	Max	Default	Controller
0	Mute	-	1	0	1	0	-
1	Bypass	-	1	0	1	0	-
2	Band0.freq	Hz	1	50	20000	100	-
3	Band0.gain	dB	0.1	-12	6	0	1
4	Band0.q	-	0.01	0.5	8	4	-
5	Band1.freq	Hz	1	50	20000	200	-
6	Band1.gain	dB	0.1	-12	6	0	2
7	Band1.q	-	0.01	0.5	8	4	-
8	Band2.freq	Hz	1	50	20000	400	-
9	Band2.gain	dB	0.1	-12	6	0	3
10	Band2.q	-	0.01	0.5	8	4	-
11	Band3.freq	Hz	1	50	20000	800	-
12	Band3.gain	dB	0.1	-12	6	0	4
13	Band3.q	-	0.01	0.5	8	4	-
14	Band4.freq	Hz	1	50	20000	1600	-
15	Band4.gain	dB	0.1	-12	6	0	5
16	Band4.q	-	0.01	0.5	8	4	-
17	Band5.freq	Hz	1	50	20000	3200	-
18	Band5.gain	dB	0.1	-12	6	0	6
19	Band5.q	-	0.01	0.5	8	4	-
20	Band7.freq	Hz	1	50	20000	6400	-
21	Band7.gain	dB	0.1	-12	6	0	7
22	Band7.q	-	0.01	0.5	8	4	-
23	Band8.freq	Hz	1	50	20000	12800	-
24	Band8.gain	dB	0.1	-12	6	0	8
25	Band8.q	-	0.01	0.5	8	4	-

MSEQ-8
Description

Mid/Side 8 bands parametric equalizer

Setup ID: 7
Parameters

Id	Name	Unit	Step	Min	Max	Default	Controller
0	Mute	-	1	0	1	0	-
1	MLevel	-	0.1	0	100	100	1
2	SLevel	-	0.1	0	100	100	2
3	Band1.freq	Hz	1	50	20000	100	-
4	Band1.gain	dB	0.1	-12	6	0	-
5	Band1.q	-	0.01	0.5	8	4	-
6	Band2.freq	Hz	1	50	20000	200	-

Id	Name	Unit	Step	Min	Max	Default	Controller
7	Band2.gain	dB	0.1	-12	6	0	-
8	Band2.q	-	0.01	0.5	8	4	-
9	Band3.freq	Hz	1	50	20000	400	-
10	Band3.gain	dB	0.1	-12	6	0	-
11	Band3.q	-	0.01	0.5	8	4	-
12	Band4.freq	Hz	1	50	20000	800	-
13	Band4.gain	dB	0.1	-12	6	0	-
14	Band4.q	-	0.01	0.5	8	4	-
15	Band5.freq	Hz	1	50	20000	1600	-
16	Band5.gain	dB	0.1	-12	6	0	-
17	Band5.q	-	0.01	0.5	8	4	-
18	Band6.freq	Hz	1	50	20000	3200	-
19	Band6.gain	dB	0.1	-12	6	0	-
20	Band6.q	-	0.01	0.5	8	4	-
21	Band7.freq	Hz	1	50	20000	6400	-
22	Band7.gain	dB	0.1	-12	6	0	-
23	Band7.q	-	0.01	0.5	8	4	-
24	Band8.freq	Hz	1	50	20000	12800	-
25	Band8.gain	dB	0.1	-12	6	0	-
26	Band8.q	-	0.01	0.5	8	4	-
27	Band1.freq	Hz	1	50	20000	100	-
28	Band1.gain	dB	0.1	-12	6	0	-
29	Band1.q	-	0.01	0.5	8	4	-
30	Band2.freq	Hz	1	50	20000	200	-
31	Band2.gain	dB	0.1	-12	6	0	-
32	Band2.q	-	0.01	0.5	8	4	-
33	Band3.freq	Hz	1	50	20000	400	-
34	Band3.gain	dB	0.1	-12	6	0	-
35	Band3.q	-	0.01	0.5	8	4	-
36	Band4.freq	Hz	1	50	20000	800	-
37	Band4.gain	dB	0.1	-12	6	0	-
38	Band4.q	-	0.01	0.5	8	4	-
39	Band5.freq	Hz	1	50	20000	1600	-
40	Band5.gain	dB	0.1	-12	6	0	-
41	Band5.q	-	0.01	0.5	8	4	-
42	Band6.freq	Hz	1	50	20000	3200	-
43	Band6.gain	dB	0.1	-12	6	0	-
44	Band6.q	-	0.01	0.5	8	4	-
45	Band7.freq	Hz	1	50	20000	6400	-
46	Band7.gain	dB	0.1	-12	6	0	-
47	Band7.q	-	0.01	0.5	8	4	-
48	Band8.freq	Hz	1	50	20000	12800	-
49	Band8.gain	dB	0.1	-12	6	0	-
50	Band8.q	-	0.01	0.5	8	4	-

XCR-2

Description

Linkwitz–Riley crossover

Setup ID: 8

Parameters

Id	Name	Unit	Step	Min	Max	Default	Controller
0	Mute	-	1	0	1	0	-
1	Attenuation	dB	0.1	0	100	0	-
2	LowPass.Cutoff	Hz	1	50	20000	1000	-
3	LowPass.Gain	dB	0.1	0	20	0	-
4	LowPass.Delay	ms	0.01	0	42	0	-
5	HighPass.Cutoff	Hz	1	50	20000	1000	-
6	HighPass.Gain	dB	0.1	0	20	0	-
7	HighPass.Delay	ms	0.01	0	42	0	-

SVF

Description

Stereo state variable filter

Setup ID: 9

Parameters

Id	Name	Unit	Step	Min	Max	Default	Controller
0	Mute	-	1	0	1	0	-
1	Bypass	-	1	0	1	0	3
2	Cutoff	cents	1	0	10000	4800	1
3	Resonance	%	0.01	0	100	0	2
4	Type	-	1	0	2	0	4

FLA

Description

Stereo flanger effect

Setup ID: 10

Parameters

Id	Name	Unit	Step	Min	Max	Default	Controller
0	Mute	-	1	0	1	0	-
1	Bypass	-	1	0	1	0	3
2	DryWet	%	0.1	0	100	100	4
3	Mod.Depth	ms	0.01	0.05	10	1	1
4	Mod.Offset	ms	0.01	0	2	0	-
5	Mod.Speed	Hz	0.01	0.01	5	1	2
6	LRPhase	degree	1	0	180	0	-

Id	Name	Unit	Step	Min	Max	Default	Controller
7	Feedback	%	0.1	-100	100	0	-
8	GOut	-	0.01	0	1	0.7	-

VIB

Description

Stereo vibrato effect

Setup ID: 11

Parameters

Id	Name	Unit	Step	Min	Max	Default	Controller
0	Mute	-	1	0	1	0	-
1	Bypass	-	1	0	1	0	3
2	DryWet	%	0.1	0	100	100	4
3	Mod.Depth	ms	0.1	1	10	2	1
4	Mod.Speed	Hz	0.01	0.01	5	1	2
5	LRPhase	degree	1	0	180	0	-

CHO

Description

Stereo chorus effect

Setup ID: 12

Parameters

Id	Name	Unit	Step	Min	Max	Default	Controller
0	Mute	-	1	0	1	0	-
1	Bypass	-	1	0	1	0	3
2	DryWet	%	0.1	0	100	100	4
3	EffDepth	%	0.1	0	100	80	1
4	Mod.Depth	ms	0.1	2	20	5	-
5	Mod.Offset	ms	0.1	0	10	5	-
6	Mod.Speed	Hz	0.01	0.01	5	1	2
7	Mod1.PhaseL	degree	1	0	360	0	-
8	Mod1.PhaseR	degree	1	0	360	90	-
9	Mod2.PhaseL	degree	1	0	360	180	-
10	Mod2.PhaseR	degree	1	0	360	270	-
11	GOut	-	0.01	0	1	0.7	-