Touch Keyboard Requirements

The following requirements are in Gherkin format.

What happens when a key is pressed and released

- Given my finger is over **C1** key
- When I touch the key without releasing
    - Then I get **MIDI Control Change** message on **Channel 1**
        - And *Controller* is **4AH** (74 decimal) labeled "Brightness" in MIDI manual
        - And *Control Value* is between **0** and **127** depending the closest electrode to my fingertip when the key is touched (see Mapping below)
    - Then I get **MIDI Note On** message on **Channel 1**
        - And *Pitch* is **C1**
        - And *Velocity* is always **127** (maximum velocity)

- When I slide my finger along **C1** key without releasing
    - Then I get **MIDI Control Change** message on **Channel 1**
        - And *Controller* is **4AH** (74 decimal) labeled "Brightness" in MIDI manual
        - And *Control Value* is between **0** and **127** depending on the closest electrode to my fingertip as my finger is moving (see Mapping below)

- When I release the key
    - Then I get **MIDI Control Change** message on **Channel 1**
        - And *Controller* is **4AH** (74 decimal) labeled "Brightness" in MIDI manual
        - And *Control Value* is between **0** and **127** depending the closest electrode to my fingertip when the key is touched (see Mapping below)
    - Then I get **MIDI Note Off** message on **Channel 1**
        - And *Pitch* is **C1**
        - And *Velocity* is always **0** (minimum velocity)

What happens when a second key is pressed while the first is still held down

The keyboard should maintain *monophonic* behavior: only one key can be registered as pressed at the same time. If a second key is pressed while the first is still held down, Note Off is sent for the first key and Note On for the second key. This is described by the following requirement:

- Given my finger is over C1 key
- When I touch any of the electrodes within this key
    - Then I get **MIDI Control Change** message on **Channel 1**
        - And *Controller* is **4AH** (74 decimal) labeled "Brightness" in MIDI manual
        - And *Control Value* is between **0** and **127** depending the closest electrode to my fingertip when the key is touched (see Mapping below)

    - Then I get **MIDI Note On** message on **Channel 1**
        - And *Pitch* is **C1**
        - And *Velocity* is always **127** (maximum velocity)
- When I touch any of the electrodes within C2 key while still holding down C1 key
    - Then I get **MIDI Control Change** message on **Channel 1**
        - And *Controller* is **4AH** (74 decimal) labeled "Brightness" in MIDI manual
        - And *Control Value* is between **0** and **127** depending the closest electrode to my fingertip when the key is touched (see Mapping below)
    - Then I get **MIDI Note Off** message on **Channel 1**
        - And *Pitch* is **C1**
        - And *Velocity* is always **0** (minimum velocity)
    - Then I get **MIDI Note On** message on **Channel 1**
        - And *Pitch* is **C2**
        - And *Velocity* is always **127** (maximum velocity)
- When I release the key
    - Then I get **MIDI Control Change** message on **Channel 1**
        - And *Controller* is **4AH** (74 decimal) labeled "Brightness" in MIDI manual
        - And *Control Value* is between **0** and **127** depending the closest electrode to my fingertip when the key is touched (see Mapping below)
    - Then I get **MIDI Note Off** message on **Channel 1**
        - And *Pitch* is **C2**
        - And *Velocity* is always **0** (minimum velocity)

Control Change Controller

The following excerpt from The Complete MIDI 1.0 Detailed Specification lists value 74 for the Control Change controller called “Brightness”:

SOUND CONTROLLERS

Controllers 46H through 4FH are defined as “Sound Controllers.” Manufacturers and users may map any functions they desire to these ten controllers. However, to further aid standardization and easy set-up for users, the MMA and JMSC may determine “default” assignments for these controllers. A manufacturer may independently assign other functions to these controllers, but it should be understood that the MMA and JMSC may later assign different defaults to them.

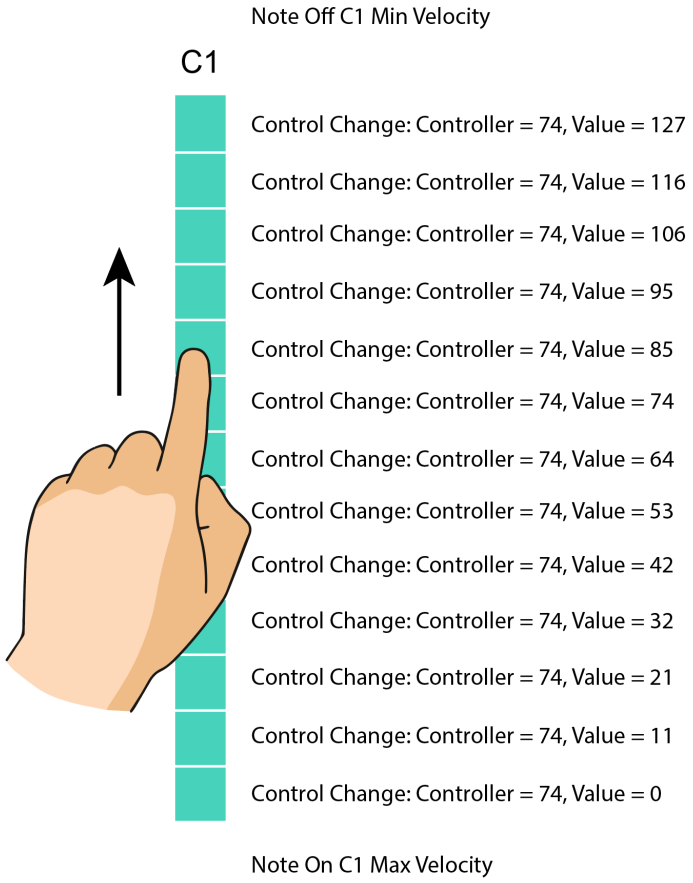
Five Sound Controller defaults have currently been defined by the MMA and JMSC:

Number	Name	Instruments
46H (70)	Sound Controller #1	Sound Variation
47H (71)	Sound Controller #2	Timber/Harmonic Intensity
48H (72)	Sound Controller #3	Release Time
49H (73)	Sound Controller #4	Attack Time
4AH (74)	Sound Controller #5	Brightness

Control Change Mapping

Each key has **13 electrodes**, indexed from **0** to **12** (counting from bottom to top).
Electrode 0 (*bottom*) generates *MIDI Control Change Value* **0**.
Electrode 12 (top) generates MIDI Control Change Value **127**.
Electrodes **in between** generate respective values according to this formula:

CC Value = Round(Index / 12 * 127)
CC Controller is constant (always 74) which maps to “Brightness” sound controller.



Summary:

- Electrode 0: CC Value 0
- Electrode 1: CC Value 11
- Electrode 2: CC Value 21
- Electrode 3: CC Value 32
- Electrode 4: CC Value 42
- Electrode 5: CC Value 53
- Electrode 6: CC Value 64

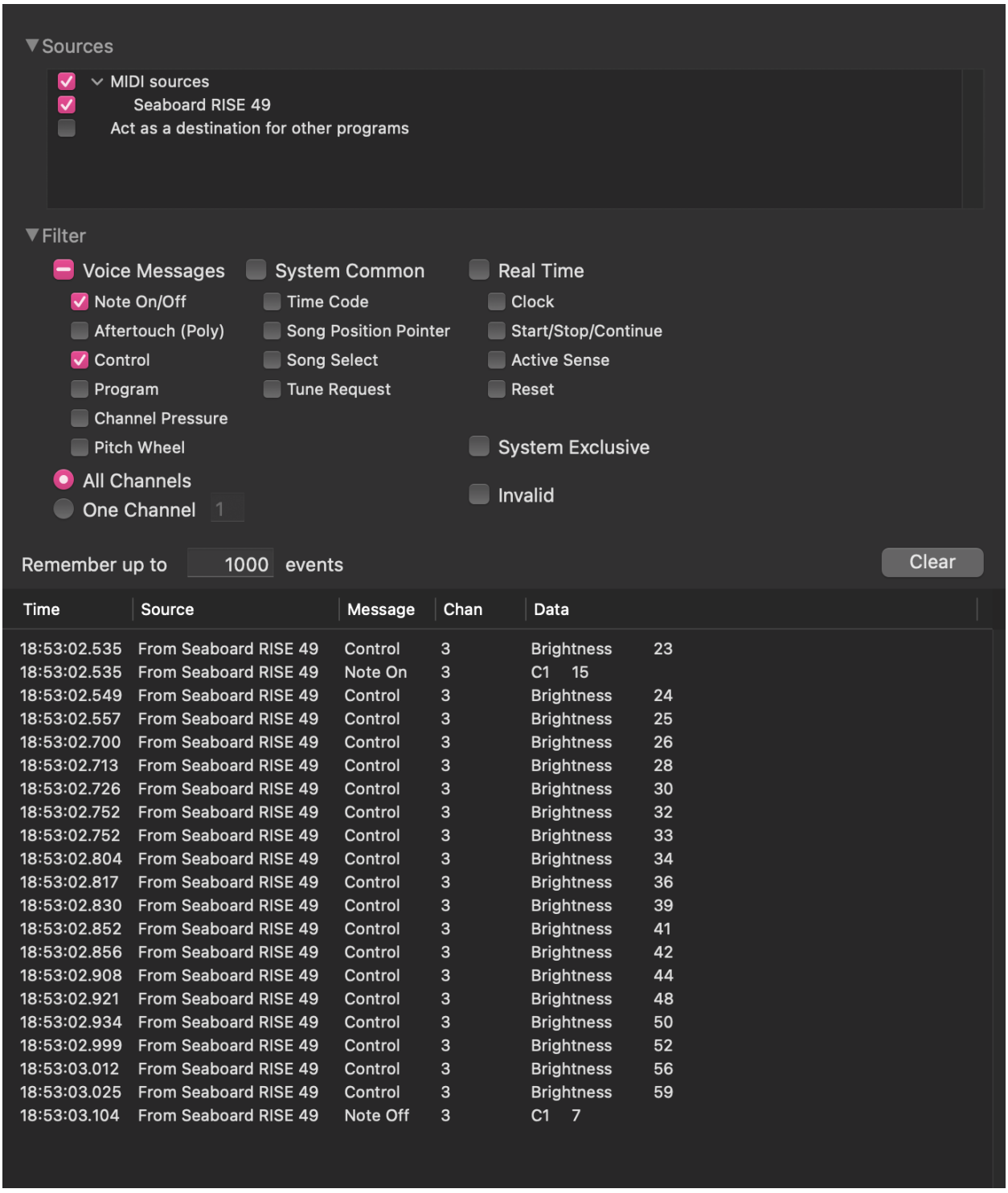
- Electrode 7: CC Value 74
- Electrode 8: CC Value 85
- Electrode 9: CC Value 95
- Electrode 10: CC Value 106
- Electrode 11: CC Value 116
- Electrode 12: CC Value 127

Monitoring MIDI Output

You can install MIDI Monitor by Snoize to check MIDI messages output from the device during development.

https://www.snoize.com/MIDIMonitor/

The following output has been captured from ROLI Seaboard, which fits the specification above (except for the Channel being 3 instead of 1, and different Velocities).


Sources
MIDI sources
Seaboard RISE 49
Act as a destination for other programs
Filter
Voice Messages
Note On/Off
Aftertouch (Poly)
Control
Program
Channel Pressure
Pitch Wheel
All Channels
One Channel 1
System Common
Time Code
Song Position Pointer
Song Select
Tune Request
Real Time
Clock
Start/Stop/Continue
Active Sense
Reset
System Exclusive
Invalid
Remember up to 1000 events
Clear
Time Source Message Chan Data
18:53:02.535 From Seaboard RISE 49 Control 3 Brightness 23
18:53:02.535 From Seaboard RISE 49 Note On 3 C1 15
18:53:02.549 From Seaboard RISE 49 Control 3 Brightness 24
18:53:02.557 From Seaboard RISE 49 Control 3 Brightness 25
18:53:02.700 From Seaboard RISE 49 Control 3 Brightness 26
18:53:02.713 From Seaboard RISE 49 Control 3 Brightness 28
18:53:02.726 From Seaboard RISE 49 Control 3 Brightness 30
18:53:02.752 From Seaboard RISE 49 Control 3 Brightness 32
18:53:02.752 From Seaboard RISE 49 Control 3 Brightness 33
18:53:02.804 From Seaboard RISE 49 Control 3 Brightness 34
18:53:02.817 From Seaboard RISE 49 Control 3 Brightness 36
18:53:02.830 From Seaboard RISE 49 Control 3 Brightness 39
18:53:02.852 From Seaboard RISE 49 Control 3 Brightness 41
18:53:02.856 From Seaboard RISE 49 Control 3 Brightness 42
18:53:02.908 From Seaboard RISE 49 Control 3 Brightness 44
18:53:02.921 From Seaboard RISE 49 Control 3 Brightness 48
18:53:02.934 From Seaboard RISE 49 Control 3 Brightness 50
18:53:02.999 From Seaboard RISE 49 Control 3 Brightness 52
18:53:03.012 From Seaboard RISE 49 Control 3 Brightness 56
18:53:03.025 From Seaboard RISE 49 Control 3 Brightness 59
18:53:03.104 From Seaboard RISE 49 Note Off 3 C1 7