ANDREW RUSSELL

DUAL CV SOURCE

DIGITAL CV SOURCE AND METER • THE ULTIMATE CV MULTI-TOOL

Version 1.0.1 • Copyright 2020 • Compatible with Reason 9.2 and later

USE DUAL CV SOURCE AS A...

- Static CV source
- Digital CV meter and note display
- Attenuverter
- VCA
- Polyphonic MIDI-to-CV converter
- Performance-to-CV converter (Pitch Bend, Modulation, etc.)
- Sample-and-Hold / Track-and-Hold
- Quantizer
- Logic and Maths unit
- Random number generator
- Up to 12-output CV splitter

FEATURES

- 2 channels
- 4 outputs per channel + an inverse output per channel
- 4 configurable auxiliary outputs
- Two 5-digit interactive digital displays
- Two high-speed graph displays
- Two secondary displays on the back panel
- Digital note display
- Full range CV support
- CV Multiply inputs
- Automatable value controls
- Configurable MIDI-to-CV conversion with retrigger and sustain
- 4-note polyphony
- Support for all six performance controllers (Pitch Bend, Modulation, Sustain, Expression, Breath, and Aftertouch)
- Channel Multiplication and Addition
- Logic and Maths outputs for: inverse (negation), reciprocal (division), Boolean (“on”/”off”), min, max, and, or, xor, sign, clamp
- Latch (sample-and-hold) with: 4 modes, CV and MIDI trigger, latch state output
- Key Snap (quantize) with configurable scale and 21 built-in scale presets
- Random number generator with reproducible output

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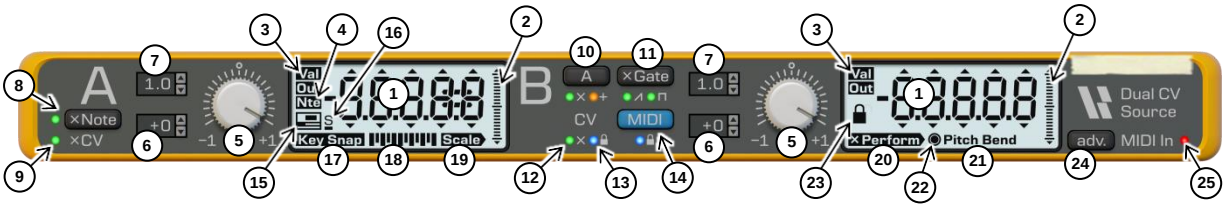
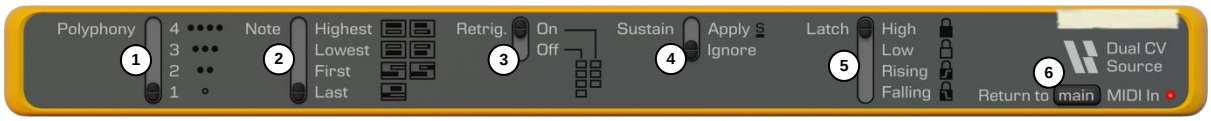
USER INTERFACE

FRONT PANEL



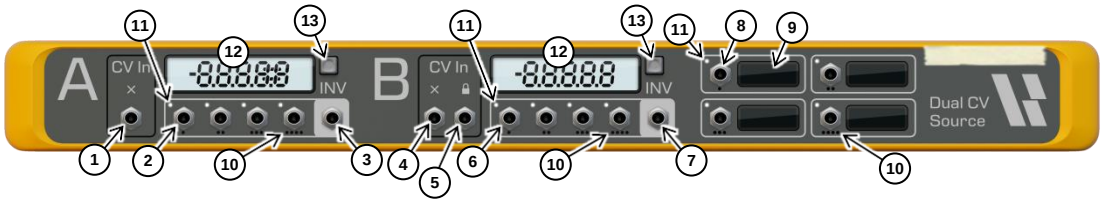
1) Digital displays A and B
2) Bipolar 1-unit graphs A and B
3) **Display Mode** A and B (value mode and output mode)
4) **Display Note** (channel A only)
5) Channel A and B Value **Fine** control
6) Channel A and B Value **Offset** control
7) Channel A and B Value **Magnitude** control
8) Channel **A Multiply MIDI: Note** button and indicator
9) Channel **A Multiply CV In** indicator
10) Channel **B Multiply/Add A** button and indicators
11) Channel **B Multiply MIDI: Velocity/Gate** button and indicators
12) Channel **B Multiply CV In** indicator
13) Channel **B CV Latch** indicator
14) Channel **B MIDI Latch** button and indicator
15) **Note Mode** indicator
16) **Apply Sustain** indicator (“S”) and **Sustain** indicator (“_”)
17) Channel **A Key Snap** button
18) **Key Snap Notes** control
19) **Key Snap Scale** menu
20) Channel **B Multiply Performance** menu
21) Channel **B Multiply Performance** selection display
22) **Performance Activity** indicator
23) Channel **B Latch Indicator**
24) **Advanced** panel toggle button
25) **MIDI In** indicator

ADVANCED PANEL



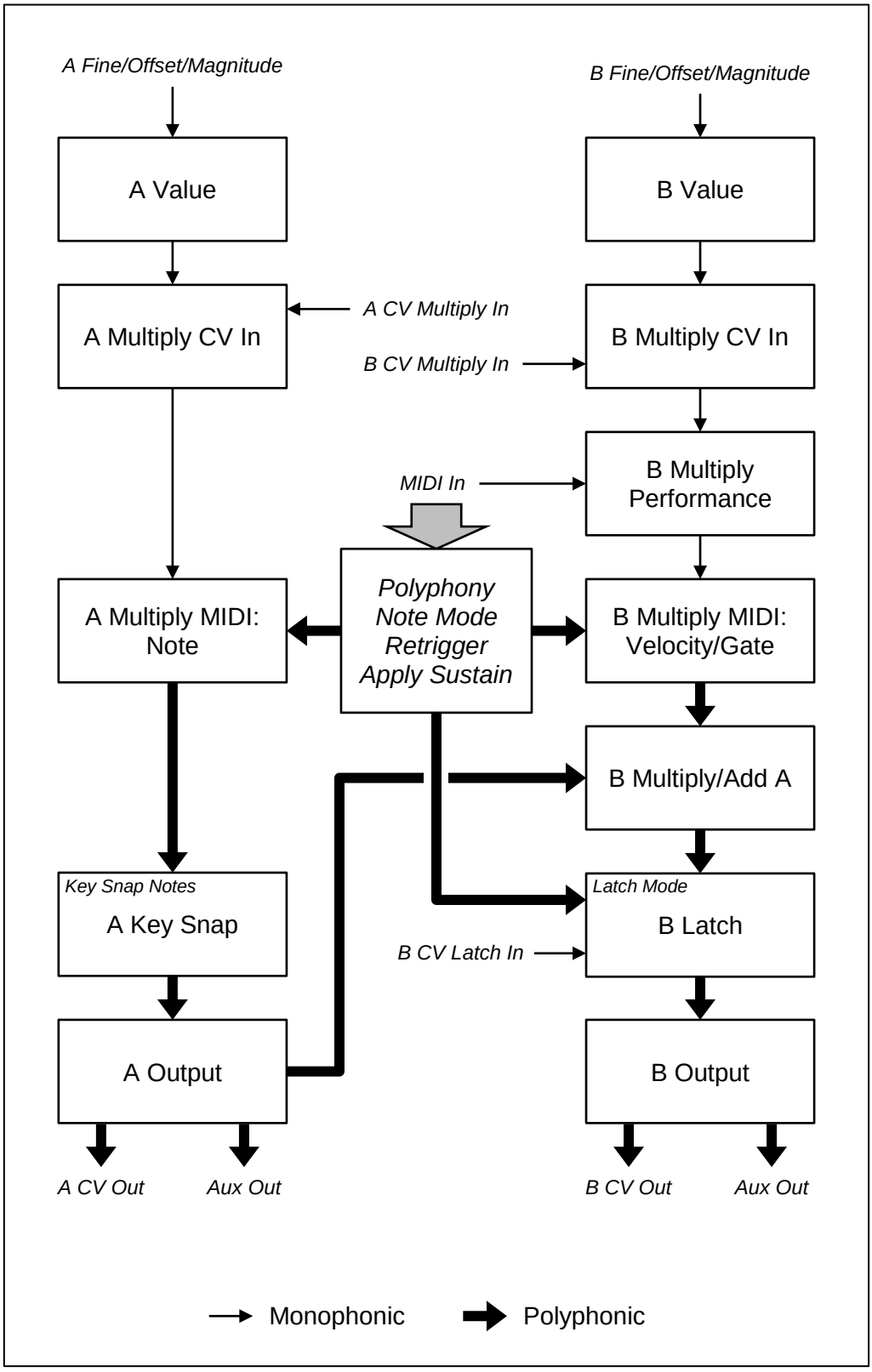
1) **Polyphony** selector
2) **Note Mode** selector
3) **Retrigger** selector
4) **Apply Sustain** selector
5) **Latch Mode** selector
6) Return to **Main** panel

BACK PANEL



1) Channel **A CV Multiply In**
2) Channel **A CV Out** sockets 1-4
3) Channel **A CV Out Inverse** socket
4) Channel **B CV Multiply In**
5) Channel **B CV Latch In**
6) Channel **B CV Out** sockets 1-4
7) Channel **B CV Out Inverse** socket
8) **Aux CV Out** sockets 1-4
9) **Aux Source Selection** menus 1-4
10) Polyphonic channel labels (polyphonic mode only)
11) **Polyphonic Activity** indicators (polyphonic mode only)
12) Digital / Graph mini-displays A and B
13) Mini-display mode toggles A and B

SIGNAL PATH


A Fine/Offset/Magnitude
B Fine/Offset/Magnitude
A Value
B Value
A Multiply CV In
A CV Multiply In
B CV Multiply In
B Multiply CV In
B Multiply Performance
MIDI In
Polyphony
Note Mode
Retrigger
Apply Sustain
A Multiply MIDI: Note
B Multiply MIDI: Velocity/Gate
B Multiply/Add A
Key Snap Notes
A Key Snap
Latch Mode
B Latch
B CV Latch In
A Output
B Output
A CV Out
Aux Out
B CV Out
Aux Out
Monophonic
Polyphonic

VALUE CONTROLS

Channel A and B each have **Fine**, **Offset**, and **Magnitude** controls that allow you to set the input Value for each channel. These controls can be automated. The Value for each channel is calculated using the following formula:

$$Value = Magnitude \times (Fine + Offset)$$

Each Value is clamped to the range [-10000, 10000].

With no other features in use, a channel's Value will be that channel's Output.

CHANNEL CV OUTPUT

The Output of a channel is output from the channel's **CV Out sockets** on the back of the device. The negation of the Output will be output from the channel's **CV Out Inverse** socket.

See the "Polyphony" section for more details about polyphonic output.

See the "Auxiliary Outputs" section for more details about the auxiliary outputs.

DIGITAL DISPLAYS

Channel A and B each have an associated 5-digit display. The mode of each display can be changed by toggling the **Display Mode** control.

Channel A can also display in note mode, which is available for both output and value modes.

OUTPUT MODE (DEFAULT)

In output mode, the display shows the Output for that channel.

If the Output exceeds the range of the display, then "RANGE" is shown in the display. The range of the display is determined by the **Magnitude** control and the **Offset** control (offsets of ±9 and ±10 expand the range of the display to the next magnitude).

> 💡 To expand the range without altering the Value, hold Shift and then click and drag the digital display to the right (see below).

If the Output is polyphonic, then "POLY" is shown in the display.

In output mode, clicking to edit the Value in the display will temporary change the display to value mode.

VALUE MODE

In value mode, the display shows the Value for that channel.

Each digit can be modified individually by clicking and dragging that digit, or by clicking the arrows above and below each digit (arrows are unavailable in output mode).

The Value can be reset to 1.0 by holding Control and clicking anywhere in the digit display (Command on Mac).

The Value can be negated by holding Control and Shift and clicking anywhere in the digit display (Command and Shift on Mac).

The Value can be truncated at a chosen digit by holding Control and Alt and clicking that digit in the display (Command and Alt on Mac).

The Value can be multiplied or divided by 10 by holding Alt and dragging the digits in the display left or right respectively. Note that the Value is rounded to the displayed digits.

The **Magnitude** can be changed, without altering the Value, by holding Shift and dragging digits in the display left or right. Note that the Value is rounded to the displayed digits.

NOTE MODE (CHANNEL A ONLY)

Clicking **Display Note** will enable note mode for the Channel A display. Note mode can be selected independently of output and value mode.

In note mode, channel A will show the Value or Output as a note in the form of "*octave*. *note*" between "-2. C" and "8. G". The note will be followed by an accidental when required. The conversion from a value to a note matches the Reason specification for CV Note signals.

Both the octave and note can be modified by clicking and dragging either the octave or note up or down, or by clicking the arrows above and below either the octave or note (arrows are unavailable in output mode).

The displayed accidental can be toggled between sharp and flat by clicking on the display region where the accidental appears.

The Value can be reset to 1.0 by holding Control and clicking anywhere in the digit display (Command on Mac). 1.0 will be displayed as "8. G" in note mode.

GRAPH DISPLAYS

Both channels A and B provide a graph display of their Output. The graph display updates faster than the digital display, allowing visualisation of high-frequency signals.

The graph shows values in the range of [-1, 1]. If values exceed this range, then an arrow is shown in the direction the range is exceeded.

BACK PANEL DISPLAYS

Both channels A and B provide a mini-display on the back of the device. These displays can show either: the Output value of the channel, or a graph of the Output in the range [-1, 1]. The mode of each mini-display can be toggled using the small button to the right of the display.

MEASURING AND MULTIPLYING CV (ATTENUVERTER, CV SPLITTER)

An external CV signal can be connected to **A Multiply CV In** or **B Multiply CV In** on the back of the device. Connecting to this input will turn on that channel's **Multiply CV In** indicator on the front of the device.

With the default Value of 1.0, and no other features in use, the Output of the channel will be equal to the input CV value. The value can be viewed in the digital display in Output mode, and also in the graph display. By using multiple output sockets the channel can be used as a CV splitter.

Setting the Value to something other than 1.0 will cause that channel to act as an attenuverter, multiplying the CV signal before outputting it.

MIDI TO CV

> 💡 To send MIDI data to a Dual CV Source device in Reason, select the device in the Rack then click the MIDI focus indicator to the left of the device. This will create a track for the device if one does not already exist.
>
> 💡 When used in a Combinator, you must manually enable "Receive Notes" and "Performance Controllers" to receive MIDI data from the Combinator. Reason does not enable these by default for Utility devices.
>
> These settings can be found by clicking "Show Programmer" on the Combinator and selecting the Dual CV Source device in the Combinator's programmer section.

By enabling **A Multiply MIDI: Note**, the value of Channel A will be multiplied by the CV Note value of incoming MIDI data ($1/127^{th}$ per MIDI note number). This value is held after the note is released.

By enabling **B Multiply MIDI: Velocity**, the value of channel B will be multiplied by the velocity of incoming MIDI notes. This value is *not* held after the note is released. Enable **B Multiply MIDI: Gate** to multiply by a value of 1.0 when a note is held, and by 0.0 otherwise.

> 💡 To hold a velocity value after the note is released, use channel B's latching feature, or the "velocity hold" auxiliary output.

By setting both Values to 1.0 and enabling both **A Multiply MIDI** and **B Multiply MIDI**, the device can be used as a MIDI to CV converter. Take the CV Note output from channel A and the CV Gate output from channel B.

ADVANCED MIDI SETTINGS

The advanced MIDI settings are available in the **Advanced** panel, and control how the device responds to incoming MIDI events.

By selecting a **Polyphony** value greater than 1, enabling **A Multiply MIDI** or **B Multiply MIDI** or **B MIDI Latch** will cause the respective channel to become polyphonic. See the "Polyphony" section for more detail. **Polyphony** determines the number of polyphony slots (1 for monophonic).

Note Mode determines whether the First (oldest), Last (newest), Highest, or Lowest note takes priority when available polyphony slots have been exhausted, or when selecting a note to retrigger.

Retrigger determines whether a held note, that is not already playing, will be played when a polyphony slot becomes available.

An icon indicating the currently selected combination of **Note Mode** and **Retrigger** is displayed in the **Note Mode** indicator on the front panel ("Last + Retrigger", the default, is blank).

Apply Sustain causes notes to continue playing while the Sustain/Damper peddle is held (MIDI CC 64), irrespective of note-up events. **Apply Sustain** is indicated with an "S" on the front panel, while the state of the Sustain peddle is indicated by an underbar below the "S".

PERFORMANCE CONTROLLERS

Use the **B Multiply Performance** menu to select a combination of any of the six performance parameters (Pitch Bend, Modulation, Sustain, Expression, Breath, Aftertouch) to multiply channel B. Activity on any of the selected parameters will be indicated by the **Performance Activity** indicator.

> 💡 Performance parameters are also available as auxiliary outputs, allowing them to be used independently of each other, and without requiring the use of channel B.

KEY SNAP (QUANTIZER)

When channel **A Key Snap** is enabled, the Output of channel A is snapped to the selected **Key Snap Notes**.

Individual notes can be turned on or off by clicking on them in the **Key Snap Notes** control. The active notes can be transposed up and down by holding down Alt and clicking and dragging left and right in the control. If no notes are active, key snap assumes a chromatic scale.

Scales can be selected from the **Key Snap Scales** menu. The selected scale will replace the current **Key Snap Notes**. The following scales are available (with intervals indicated in semitones, S=semitone, T=tone).

- Major (T-T-S-T-T-T-S)
- Natural Minor (T-S-T-T-S-T-T)
- Harmonic Minor (T-S-T-T-S-3-S)
- Melodic Minor (T-S-T-T-T-T-S)
- Major Pentatonic (T-T-3-T-3)
- Minor Pentatonic (3-T-T-3-T)
- Hemi Pentatonic (S-4-T-S-4)
- Dorian (T-S-T-T-T-S-T)
- Phrygian (S-T-T-T-S-T-T)
- Lydian (T-T-T-S-T-T-S)
- Mixolydian (T-T-S-T-T-S-T)
- Aeolian (T-S-T-T-S-T-T)
- Locrian (S-T-T-S-T-T-T)
- Diminished Whole-Half (T-S-T-S-T-S-T-S)
- Diminished Half-Whole (S-T-S-T-S-T-S-T)
- Whole Tone (T-T-T-T-T-T)
- Minor Tetratonic (3-3-3-3)
- Major Tritonic (4-4-4)
- Augmented Diatonic (6-6)
- Perfect Diatonic (7-5)
- Blues (3-T-S-S-3-T)
- Spanish (S-3-S-T-S-T-T)

CHANNEL ADDITION AND MULTIPLICATION (VCA, PRECISION ADDER, CV MERGER)

By enabling **B Multiply/Add A: Multiply A**, channel B will be multiplied by the output of channel A.

By enabling **B Multiply/Add A: Add A**, the output of channel A will be added to channel B. This addition occurs after any multiplication on channel B.

If channel A is polyphonic, then enabling **B Multiply/Add A** will cause channel B to become polyphonic.

LATCH (SAMPLE AND HOLD/TRACK AND HOLD)

The Output of channel B will remain unchanging (latched) when latching is enabled and the state of the latch is Closed.

Latching can be enabled by plugging a signal into **B CV Latch In**, or by enabling **B MIDI Latch**, or both. The latch state is then controlled by CV or MIDI or both respectively.

> 💡 To perform latching based on automation, Remote override, keyboard control, or mouse input: toggle the **B MIDI Latch** button while **Latch Mode** is set to High. You can also control the button using MIDI CC 69 (“Hold 2”).

The behaviour of the latch depends on the **Latch Mode** as follows:

- High (default): The latch is normally Closed. The latch is Open while any notes are playing, or while the CV value is greater than zero.
- Low: The latch is normally Open. The latch is Closed while any notes are playing, or while the CV value is greater than zero.
- Rising: The latch is normally Closed. The latch will Open instantaneously if a note starts playing, or if the CV note value changes (except if the CV value changes to “off”).
- Falling: The latch is normally Closed. The latch will Open instantaneously if a note stops playing, or if the CV note value changes (except if the CV value changes from “off”).

The **Latch Mode** is displayed in the **B Latch Indicator** on the front panel. If the latch is Open in High or Low mode, then the indicator shows that the latch is Open. Rising and Falling modes do not show an Open indicator, as they only ever open instantaneously.

The latch state is polyphonic, and each latch state only considers notes playing on its polyphony slot when controlled by MIDI.

LATCH TIMING

In High, Low, and Rising modes, the latched value is the Output value at the time that the latch state changed.

In Falling mode, the latched value is the calculated Output value (not considering latching) from *before* the latch state changed. In other words: the value is latched at the end of the note, not at the start of the subsequent note or rest.

CV LATCH HYBRID NOTE/GATE INPUT

The **B CV Latch In** accepts a hybrid CV signal that is either a CV Note or CV Gate signal. A negative or zero signal is interpreted as “off”. A positive signal is interpreted as both “on” and as a CV Note.

For **Latch Modes** High and Low, a CV Gate signal is sufficient.

For **Latch Modes** Rising and Falling, a CV Gate or CV Note signal is often sufficient. More accurate behaviour is possible by multiplying a CV Note signal by a CV Gate signal first, where the CV Gate signal is strictly 0.0 or 1.0. The resulting signal is either 0.0 for note-up, or a CV Note value for note-down.

> 💡 To convert a CV Gate signal with velocity data to a purely on (1.0) or off (0.0) signal, use the “A On” or “B On” **Aux CV Out** of a Dual CV Source device.

> 💡 This scheme prevents the use of C-2 (note number 0) as a valid note. If C-2 is required, add a small positive offset (such as +0.0001) to the CV Note signal, before multiplying it by the CV Gate signal.

POLYPHONY

Dual CV Source supports up to 4-note polyphony. The **Polyphony** control on the **Advanced** panel selects the number of polyphony slots that are available. If **Polyphony** is set to 1, then the device is monophonic regardless of other settings.

MIDI notes are assigned to polyphony slots starting from the first slot when no other notes are playing. Subsequent notes are assigned to polyphony slots in a round-robin pattern, until all notes are up.

All device inputs other than MIDI notes are not polyphonic, and are applied to all polyphony slots.

Channel A is polyphonic when **A Multiply MIDI** is enabled and the device has more than one polyphony slot. The channel A digital display will show “POLY”.

Channel B is polyphonic when **B Multiply MIDI** or **B MIDI Latch** is enabled and the device has more than one polyphony slot, or when **B Multiply/Add A** is enabled and channel A is polyphonic. The channel B digital display will show “POLY”.

Individual **Aux CV Out** sockets are polyphonic when they are outputting data from: channel A if it is polyphonic, channel B if it polyphonic, both channel A and channel B if either are polyphonic, MIDI note data (Note, Gate, Velocity, Velocity Hold), the latch state if **B MIDI Latch** is enabled, or random values unless **B CV Latch** is enabled and **B MIDI Latch** is disabled.

When the device is polyphonic, the channel A and B graph display and the channel B latch state indicator show values from the polyphony slot that a note was most recently assigned to.

The **A CV Out**, **B CV Out** and **Aux CV Out** sockets are assigned to polyphony slots depending on the **Polyphony** setting of the device, with the following pattern:

Socket Number	1	2	3	4
Polyphony = 1	1	1	1	1
Polyphony = 2	1	2	1	2
Polyphony = 3	1	2	3	1
Polyphony = 4	1	2	3	4

The **A CV Out Inverse** and **B CV Out Inverse** sockets are always assigned to polyphony slot 1.

When Polyphony is set higher than one, 1-4 dots will appear below each socket to indicate the socket's polyphony slot assignment.

When Polyphony is set higher than one, a **Polyphonic Activity** indicator will appear at the top-left of each socket. The indicator will illuminate if the socket is receiving polyphonic data and there is currently a MIDI note down on the polyphony slot associated with that socket.

AUXILIARY OUTPUTS

There are four **Aux CV Out** sockets on the back panel that provide access to useful and convenient functions. The output of each socket can be selected using the associated **Aux Source Selection** menu.

The following auxiliary sources are available. Note that some outputs are polyphonic, as described in the "Polyphony" section, and will output data from their assigned polyphony slot.

Note

Outputs a CV Note signal for the most recently played MIDI note. This is equal to the MIDI note number divided by 127.

Velocity

Outputs a CV Gate signal for the currently playing MIDI note, in the range [0, 1].

Gate

Outputs 1.0 if there is a currently playing MIDI note, otherwise outputs 0.0.

Velocity Hold [Vel.Hold]

Outputs the velocity of the most recently played MIDI note, in the range [0, 1].

Pitch Bend [P.Bend]

Outputs the value of the pitch bend performance controller, in the range [-1, 1].

Modulation Wheel [Mod.W.]

Outputs the value of the modulation wheel performance controller, in the range [0, 1].

Sustain

Outputs the value of the sustain performance controller, in the range [0, 1].

Expression [Expres.]

Outputs the value of the expression performance controller, in the range [0, 1].

Breath

Outputs the value of the breath performance controller, in the range [0, 1].

Aftertouch [A.Touch]

Outputs the value of the aftertouch performance controller, in the range [0, 1].

Key Count [K.Count]

Outputs the number of MIDI notes currently being held down, in the range [0, 127].

> 💡 When the device is in polyphonic mode, you can use this as a monophonic gate signal to determine if any notes are down across all polyphony slots.

Latch

Outputs 1.0 when the latch is Open and 0.0 when the latch is Closed. Outputs 1.0 if the latch is disabled.

> 💡 This output can be used for chaining the latch state to the **B CV Latch In** input of additional Dual CV Source devices, if those devices have **Latch Mode** set to High.
>
> Note that the backwards-looking behaviour of the Falling edge latch cannot be chained. See the “Latch Timing” section for details.

Random (latch)

Outputs a random value in the range [-1, 1], that changes when the state of the latch changes to Open (and in other cases).

For a full description, see the section “Latched Random Values”.

A

Outputs the Output of channel A.

-A

Outputs the negative Output of channel A.

1/A

Outputs the reciprocal of the Output of channel A, clamped to the range [-10000, 10000]. Division by zero results in an output of 10000.

A On

Outputs 1.0 if the Output of channel A is greater than zero, otherwise outputs 0.0.

> 💡 This can be used to convert a continuous signal to a Boolean “on” / “off” signal.

min A,B (and)

Outputs the minimum of the Output of channel A and the Output of channel B.

> 💡 When used to combine two Boolean signals, the result is a logical AND.

max A,B (or)

Outputs the maximum of the Output of channel A and the Output of channel B.

> 💡 When used to combine two Boolean signals, the result is a logical OR.

xor A,B

If either of the Output of channel A or the Output of channel B is zero, outputs the Output of the other channel. If both are zero, the output will be 0.0.

If neither of the Output of channel A or the Output of channel B is zero, outputs 0.0.

> When used to combine two Boolean signals, the result is a logical XOR (exclusive-or).

B

Outputs the Output of channel B.

-B

Outputs the negative Output of channel B.

1/B

Outputs the reciprocal of the Output of channel B, clamped to the range [-10000, 10000]. Division by zero results in an output of 10000.

B On

Outputs 1.0 if the Output of channel B is greater than zero, otherwise outputs 0.0.

> This can be used to convert a continuous signal to a Boolean “on” / “off” signal.

B Sign

Outputs 1.0 if the Output of channel B is greater than zero, and -1.0 if the Output of channel B is less than zero, otherwise outputs 0.0.

> This can be used to convert a continuous signal to a ±gate signal.

B Clamp

Outputs the Output of channel B, clamped to the range [-1, 1].

LATCHED RANDOM VALUES

Random numbers can be generated by using the “Random (latch)” **Aux CV Out** outputs.

Random numbers are generated in the range [-1, 1], and change when the state of the latch changes to Open (based on the **Latch Mode** as described in the “Latch” section). When neither **B CV Latch In** nor **B MIDI Latch** is enabled, random numbers are generated as if **B MIDI Latch** is enabled.

All random numbers are regenerated when playback starts. All random numbers are also regenerated when **B MIDI Latch** becomes enabled.

> 💡 Similarly to latching, as discussed in the “Latch” section, you can use this feature to generate random numbers from automation, Remote override, keyboard control, mouse input, or MIDI CC 69 (“Hold 2”).

Random numbers are polyphonic and are generated per polyphony slot. If a polyphony slot is assigned to two or more output sockets, each socket receives a different random number.

The random number generator is seeded from the values of **Fine**, **Offset** and **Magnitude** for both channels A and B. If any of the seed parameters are being automated, the random number generator will delay reseeding until all seed parameters have stopped changing.

RANDOM NUMBER REPRODUCIBILTY

The generation of random numbers is designed to be reproducible between different playbacks, providing the events generating random numbers meet certain requirements described below.

The random number generated depends on the time of the triggering event, as well as the note number of the triggering event, except that only the event time is used when both **B CV Latch In** and **B MIDI Latch** are enabled.

Due to timing uncertainty introduced when events are assigned to audio frames, the consistency of random numbers is only guaranteed for audio rates of 44100Hz and higher, for events that conform to the following requirements:

- At up to 280 BPM, Dual CV Source will generate *consistent* and *distinct* random numbers for events aligned to 1/64 or 1/32T boundaries (60 or 80 units apart in the sequencer, where each quarter note is broken up into 240 units).
- At up to 280 BPM, Dual CV Source will generate *consistent* (but potentially identical) random numbers for events aligned to 20-unit boundaries.
- At up to 140 BPM, Dual CV Source will generate *consistent* (but potentially identical) random numbers for events aligned to 10-unit boundaries.

Due to the way event timing interacts with looped audio, events that occur immediately at the start of a loop can be assigned a time from either the start or the end of the loop, once playback loops around.

Note that if the playback start position, audio rate, BPM, note times, and note numbers do not change, then random values should always be consistent between different playbacks, irrespective of note time alignment.

TIPS AND TRICKS

The instructions for these setups assume that the Dual CV Source devices are initialized to their default state.

BIPOLAR TO UNIPOLAR

Converts a signal in the range [-1, 1] to a signal in the range [0, 1].

1. Plug the input signal into **B CV Multiply In** of a Dual CV Source device
2. Set the Value of channel A to 0.5
3. Set the Value of channel B to 0.5
4. Enable **B Multiply/Add A: Add A**
5. Take the output signal from **B CV Out**

UNIPOLAR TO BIPOLAR

Converts a signal in the range [0, 1] to a signal in the range [-1, 1].

1. Plug the input signal into **B CV Multiply In** of a Dual CV Source device
2. Set the Value of channel A to -1.0
3. Set the Value of channel B to 2.0
4. Enable **B Multiply/Add A: Add A**
5. Take the output signal from **B CV Out**

ABSOLUTE VALUE

Calculates the absolute value of a signal (the absolute value changes a negative number into the equivalent positive number).

1. Plug the input signal into **B CV Multiply In** of the first Dual CV Source device
2. Take the **B CV Out** of the first device and plug it into **A CV Multiply In** of a second Dual CV Source device
3. Take an **Aux CV Out** from the first device, set to “B Sign”, and plug it into **B CV Multiply In** of the second device
4. Enable **B Multiply/Add A: Multiply A** on the second device
5. Take the output from **B CV Out** of the second device

TRANSPOSE NOTES BY SEMITONES (WITH OPTIONAL QUANTIZE)

This allows you to transpose notes by whole semitones.

1. Calculate the value of 1/127: Create a Dual CV Source device; set channel B's Value to 127; take the **Aux CV Out** of this device, set to "1/B", and plug it into the **B CV Multiply In** of a second Dual CV Source device
2. Plug the input CV Note signal into **A CV Multiply In** of the second device
3. (Optional) Enable **A Key Snap** on the second device
4. Set channel B's Value on the second device to the whole number of semitones to transpose by
5. Enable **B Multiply/Add A: Add A** on the second device
6. Take the output signal from **B CV Out** of the second device

LOGICAL NOT

Given a Boolean signal, generates the logical-not of that signal. 1.0 becomes 0.0, and 0.0 becomes 1.0.

1. Plug the input signal into **B CV Multiply In** of a Dual CV Source device
2. Set the Value of channel A to 1.0
3. Set the Value of channel B to -1.0
4. Enable **B Multiply/Add A: Add A**
5. Take the output signal from **B CV Out**

MIDI CC ASSIGNMENTS AND REMOTE

The following table shows the MIDI CC numbers assigned to automatable controls.

Parameter	MIDI CC
A Fine	14
A Offset	15
A Magnitude	16
B Fine	17
B Offset	18
B Magnitude	19
A Multiply MIDI	20
B Multiply/Add A	21
B Multiply MIDI	22
A Key Snap	23
B MIDI Latch	69 (“Hold 2”)

A table of Remote info can be exported from Reason. Select a Dual CV Source device and then select “Export Device Remote info” in the File menu.