USER'S GUIDE for the

Buchla 218e-V3



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V5.0 5/5/24 (JD)

For 218e Software verion 36.2+

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Version comments:
Software version 36 Fixes: arpeggiation syncs with clock even when going in and out of arpeggiation mode.
Fixed pitch bend overflow at lowest octave.
Timing is improved with changes to MIDI handling.

New with software version 36?:
There is a new a latch function using pads 2&3
Arp Sync settings are rearranged.
We limited the MIDI channel range and CC to Channel 1-12 and CC 1-12 to allow for an expanded and playable octave (keys 13-25) in edit mode. (Key6 CC re-assignment = CC74)
It is more comprehensive as a MIDI controller: There is a MIDI note output for the strip pulse and the switches and all pots send MIDI CC messages.
Portamento setting is now more logarithmic
Mono vs poly changes the key pulse output mode when lifting a key while another is held.
Pitchbend and portamento are now sent over the internal bus. But to take advantage of that for the 208C you'll need to update your 208MIDI to the latest firmware.
MIDI CC 121 and 123 are sent going in and out of edit mode to control both transposition and stuck note possibilities on the 208C.

Manual/guide update: V4.9 adds notes on 200e breakout boards. V5.0 corrects the listed keys active in edit mode.

Introduction

The 218e is capacitive keyboard modeled after the original 218 built in 1973, but adding an arpeggiator, and MIDI capabilities.

If you have a 218e with a Music Easel or for using in a larger system, welcome to the 200e system! These notes will acquaint your 218e.

If you have a 218e-V3, then you have a more advanced version of the 218e. This is indicated by a "v3" in the upper right corner of the 218e, but also by the presence of a new strip and other features mentioned below. If you have the original 218e refer to the older 218e_FC_208CDblr_Guide_v2.0.PDF publication for features and settings specific to the earlier 218e.

What's new in "V3"?

1. There is an additional location sensitive ribbon-like "strip" for quick 0-10 volt output. This includes a pulse output and way to switch between modulation and pitchbend modes.
2. Arpeggiation can be triggered by a pulse input. (This can be changed back to have the rate to be controlled CV using a jumper or firmware change. See appendix for details.)
3. Preset pads have a pulse output
4. A new mode for preset pot 4 allows for a larger transpose range for both CV and the internal bus.
5. A reset button allows the 218e to reboot and recalibrate the keys without need to reboot power.
6. USB-MIDI input and output
7. The red keys (a piano's black keys) have been integrated into the main playing surface.
8. There is additional MIDI functionality including channel assignment to 1-12, controller output assignments, velocity, and more complete MIDI to CV conversion.
9. "Main" is now called "pitch" to refer more directly to the typical 208 connection and its expected use for pitch control.
10. MIDI output can be polyphonic and includes a calculated velocity

Important Safety Precautions

Do not disassemble this equipment. Refer all servicing to a qualified service engineer. But if you insist, be sure to follow the next advice.
When installing, removing, or exchanging a module, please be certain to turn off the power supply.
– power must be turned off before plugging in or unplugging modules.
Buchla power connections and cables are keyed to be used in one direction only! Reversing the connectors can cause significant system damage.

We are not liable for damage or injury due to lack of common sense:
Do not use the system near water; do not take it into your bath, sauna or hot tub. Take care not to spill liquids on or into the 200.
Exercise close supervision when using the instrument near children or when children are using it.
The 200's power supply is for indoor use only. Do not use a damaged or alternate supply.
Refer all servicing to qualified personnel. There are no user serviceable parts or adjustments inside the 200e.

COMMON BUCHLA SYSTEM STUFF

Before getting into the details of the 218e modules, lets pursue some items that all modern Buchla 200 modules share in common. First the connections: Like its predecessors--the 200, and 100--the 200e series differentiates between control voltages, signals, and pulses.

Control voltages (C.V.'s) are used to specify parameter levels, range from 0 to 10 volts, and are interconnected with banana jacks and cords.

Pulses are used for timing information and have two levels: 10 volt pulses transmit only transient information; while 5 volts indicates the sustain. Pulses, like C.V.'s, also employ banana interconnections.

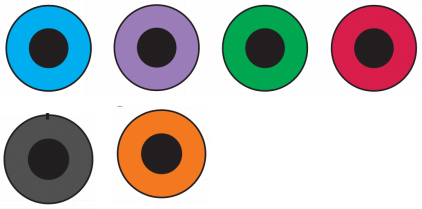
Fun fact: By contrast other modular synth systems often use two 3.5mm outputs/inputs to accomplish the same communication: one for "gates" and one for "triggers." But those typically 5v signals will not "trigger" most pulse inputs on a 200 system.)

Signals (audio signals) are the raw material of electronic music, Signals are connected via Tini-Jax connectors and shielded patchcords. The 218e has no audio output.

Color-coding of cables and Banana Jacks:

Note that both types of patchcords are color coded to indicate their length-- a handy feature in complex patches.

But more importantly, banana receptacles/jacks are color coded to indicate their function:
OUTPUTS: CV output are blue, sometimes violet, and occasionally green.
Pulse outputs are invariably red. (And in early 200 series pulse inputs were also red.)



INPUTS:
CV inputs are black (and sometimes grey.)
Pulse INPUTS are orange*.
(*The Music Easel/208 includes an exception to the color-coding standard, Orange is used as a CV output for its association with the 208 EG fader and switch covers.
Yellow is likewise used for the 208 Pulser output. Note that the 208/208C Pulser output is a sawtooth CV, not a pulse.)

Ground reference connection (VERY IMPORTANT):



On every Buchla boat/housing there is a black banana jack (sometimes labeled "gnd", often near the card slot or power supply. When interconnecting/patching between two synthesizer systems, it is important that the ground reference is shared between the systems--including between two Buchla systems. The ground is not just a reference, it completes the circuit. Without this shared connection, control voltages will have behave unpredictably. The connection is not necessary inside an isolated system, but it is very important between system and especially from a LEM218 to Easel Command or another 200 or 200e system.
Why isn't this true for other electronic music boxes? Audio cables carry the ground connection with them on their "sleeve"; the banana cables do not. The circuit is not complete until a ground banana cable is connected between two systems. (If you do connect the systems through an audio cable, that can sometimes be enough, but it's best to connect with the banana cable.

Capacitive keyboard grounding considerations:

It is important to **use a 3-prong AC adapter** – like the one provided with all Buchla systems— plugged into a properly grounded outlet. And the DC ground barrel must be connected to AC ground; not all AC Adapters are. This 3rd pin, the AC "earth ground" connection has the best signal connection to your body.
When in doubt, use the provided AC adapter.

If this is not an option for you, accessorize with a fashionable grounding strap tight around your wrist. You will also establish a great connection to your capacitive keyboard with a Buchla **ground strap** connected to the black "ground"/"gnd" banana, especially if you have a power connection that is not connected to earth ground. In a pinch, pinch/hold the metal end of a banana cable that is plugged into this same ground banana. *Warning: if you are going to ground yourself with a strap, don't wear it during a lightning storm.*

This same ground can also be found on the front panels of a 208C or other modules and rims of some cases it you want to simply touch those things while you play. The little lines on keys 1-29 of the 218e-V3 are also ground and can provide a minimal amount of ground connection in the absence of a good earth ground connection.

It is also true that moisture can improve your grounding and will affect the detection of your finger. Experiment with touching ground. Moisturizing can help but could also result in false finger detection if the moisture remains on a key. None of these procedures should be necessary in a typical environment, but the 218e is not a typical keyboard.

Before you start: About auto-calibration
Keep your hands away on boot up and reset and count to 4:

Every time you boot up the 218e or 218e-V3, the keyboard auto-calibrates to its environment. This is indicated by the 4 pad LEDs lighting up. It takes a few seconds. That means that if a finger is near a key when you turn it on or touch it too soon, that key will be desensitized to your finger. For instance, if you are holding on the keyboard area when you turn on or hit the "reset" button, several keys may fail to function at all.



Recalibrating/Resetting during performance?: **A reset button was added to 218e-V3** because we encourage you to recalibrate the keys just before playing the instrument just as you would re-tune up an acoustic guitar after it has adjusted to the stage environment. Resetting will ensure more consistent reading of the capacitive surface without having to reboot your whole system.

Tactile keyboard Surface

The surface consists of 29 individual keys comprising 2-1/3 octaves. Each touch of the keyboard generates a pulse, a pressure CV, and pitch CV. These outputs are placed in the upper left of the 218, expecting to be plugged directly into the nearby the pulse, pressure, and pitch CV inputs of a 208.



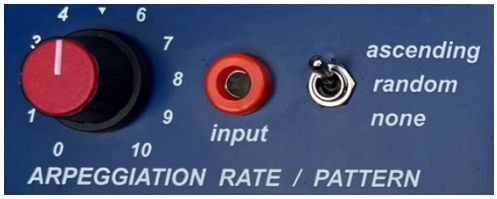
The **pulse** output is red banana on the upper left. A red LED will indicate every pulse output. The **pressure CV** output correlates to the detected amount of finger contact on the current/last single key touched. The blue LEDs next to the pressure output will get brighter as the voltage gets higher.

The "**pitch**" output corresponds to the 1.2v/octave pitch of the key.

At the Buchla standard of 1.2v/per octave, that means that the pitch C will be 0v,1.2v, 2.4v, 4.8v or 6.0v depending on the octave being played. (Notice how conveniently that relates the MIDI "C" notes 0, 12, 24, 48 and 60.) Every ½ step higher will be .1v higher.



To the right of these outputs is **Portamento** control. Adding portamento will make the pitches slide from one to the next like a violinist sliding a finger to the next pitch. It is an endearing musical affect. To control the speed of the slide, turn the knob higher. At 0, it does not slide; At 10 it may take several seconds to reach the next pitch. The input banana is another way to control this parameter with a CV. The CV input will add to the portamento time set by the knob.



To the right of portamento is the **Arpeggiator**. The 218 will arpeggiate based on the keys that are sustained with the fingers or sustain pedal. The switch determines the **PATTERN**: whether the arpeggiation is active or whether it plays an ascending or a random pattern. *(For more random options, see the appendix for information on how set and play with "directed random").*

Velocity output for all keys corresponds to the velocity of the last key played, allowing the user to dynamically play the pattern. As on the 2013 218e, a small random velocity variation also keeps the pattern from being static. (Minimum velocity range for the arpeggiator is set in edit mode.)

The **ARPEGGIATION RATE,** is controlled by the knob. At knob position "0" the arpeggiator stops and only a pulse input will advance it. Turning the knob will increase the steady rate of arpeggiation. (The rate changes on the next event.) The Arpeggiation rate can also be controlled by MIDI when it is synced to a clock. **See the Appendix for more information MIDI clock setup and response.**

"input": As per a traditional late-200/200e system, this orange banana indicates that it is a pulse input. New to the 218e-V3 is the change from CV control of the rate to advancing the arpeggiator using pulse inputs. Even while the rate is set higher than 0, pulse inputs can also advance it so you can create interlocking rhythms between pulse inputs and the automatic advances.
(See the Appendix for a way to change that orange banana input from pulse to CV rate control with hardware modification, or how to change the portamento CV input into a rate control with software.)

Note that the pulser CV out of the 208C yellow jack is a sawtooth envelope, not a pulse, so if you use it for the arp pulse input, the response may be a little unpredictable. Use a CV to pulse converter to fix that.

Also note that the V3 version of the 218e starts its arpeggiation as soon as the key is touched, like normal key performance. Remember to make sure you switch to "none" for basic keyboard performance, because the instance arpeggiator response can fool you.

Welcome to the strip!



New to the 218e is the additional of a strip. Many historic Buchla capacitive keyboards included a strip or two and so why shouldn't this one! And its got a pulse!

Try it out! The blue banana output is a 0-10v output range. Two blue LEDs at the ends help to indicate when the voltage approaches 0v or 10v, and the middle LED indicates the overall voltage level. The LEDs are directly controlled by the CV output.

There are two modes to the strip: absolute mode and relative pitchbend mode.

How to Switch between absolute mode and relative pitchbend mode:
Touch and hold the top and bottom segment on the strip for 2 seconds. The red pulse strip LED will flash when it changes modes. This works without going into edit mode.

In absolute mode the strip acts like traditional mod wheel and stays at the value when you remove your finger.
In relative pitchbend mode the strip acts more like a traditional pitch wheel that snaps back to the center position. It's "relative" to the starting position because it always starts with a centered value no matter where you start your gesture. This is not unlike a traditional pitch wheel without a center indentation to grab.



If you want to bend the full range up, it's best to start the gesture left of center. When you go past the range of the pitchbend, reversing the direction of your gesture will pick up where you left off.
If you want to add vibrato like a violin, simply put your finger down and wiggle it back and forth.

TO CONFIGURE MIDI OUTPUT and CV behavior, first learn how to get into edit mode.

MIDI output of the strip in absolute mode: Default MIDI output is CC1/Mod Wheel, but can be changed to any controller number 1-12* (*Key 6 assigns to CC74 instead of CC6) To set the CC# assigned to the strip, go into edit configuration mode and then touch and hold the strip while also touching one of the keys 1-12 for two seconds until you see the pulse LED flash. The CC assignment will change to the key number selected.

A note about CC# reassignments. For 208C users, this is a way to reassign it from the automatic connection of timbre control over MIDI. For a 208C user, using a banana cable to make your own connection might make more sense.
It is best to know what CC#s are assigned to the Easel Command — the 208MIDI daughtercard in the 208C — so you either use them or avoid them.
Here is a quick overview of the Easel Command's assignments:
CC1, timbre; CC2, modulation amount; CC3, pressure slew rate; CC5, portamento rate; CC9, pitchbend depth.

For standalone MIDI users, you might want to consider CC#s that typically control software — for instance CC7 for volume or CC10 for panning. For other parameters use your instrument to reassign control to CC1 to CC12.

How to set the range in relative pitchbend mode (in edit mode): *Hold strip and turn ARP knob.* The strip CV range is always 0-10v and the strip CV will always snap back to 5 volts but the pitch banana CV will also be affected per the range of control over the pitchbend as set in edit/configuration mode. Go to edit mode, then touch and hold a finger on the strip while turning the arpeggiation knob: Full (default) octave range (+/-1.2 volts) is set at 10; for only a whole step (+/-.2v), set it at 2. At a setting of 0 the strip position will not affect the pitch output. (See below.)





A snap back relative mode for modulation and CV: At the 0 setting of the knob, the pitchbend range=0=off. Then the MIDI function will switch back to the assigned CC for a relative CC function.

How to set the strip slew rate: (This affects both modes**)**: Go to edit mode, then touch and hold a finger on the strip while turning the portamento knob. Setting it with some slew is recommended.

Next is the **PRESET VOLTAGE SOURCE**



Only one “preset voltage source” can be selected at a time as indicated by the LEDs. The knob above each pad sets the output CV from 0-10v. The corresponding voltage will appear at the blue **“output” banana** when that knob/source is selected.

A MIDI CC will be output that follows the CV output. The MIDI CC# default to CC2, but can be changed while in edit mode to any CC# 1-12* by holding a finger on pad1 while then holding a key number for 2 seconds.* (*Key 6 assigns to CC74 instead of CC6) (This is same technique for CC assignment as for the strip CC#.)

With V3 a pulse output has been added to the preset voltage section to allow triggering events simultaneous with the output. For example, you may stack this pulse output with the main keyboard pulse output to hear the octave events when ADD TO PITCH is set to octave.
Or for 200e users, this pulse output is especially useful when you also send the preset CV output to selection inputs--orange and black banana jack pairs--on a 252e, 225e, 272e, or 266e.

TRANSPOSITION: the ADD TO PITCH switch



Octave Transposition with pads: use the "**octaves**" switch setting for instant transposition of the pitch output using just pads 1 to 4.

In monophonic mode the transposition will imitate the instant transposition of the pitch CV output and – if you are holding a key with a finger or sustain pedal – will play a new MIDI note when you touch the pad.

In Poly mode the held MIDI notes will not shift up immediately when you touch the pads to ADD "octaves" TO PITCH, but the next played key will be in the new octave. This allows you to hold a played low bass note with a sustain pedal touch a higher octave pad and then play chord on a higher octave. The transposition only affects the keys played after the octave is set even while the previous octave's keys still sound.

Non-traditonal transpositions using the knobs and pads: The "**preset**" switch setting will add the CV—as set by the pad selected knob—to the pitch output. This is not quantized to ½ steps. You could set it to non-tempered transpositions or set the knobs very carefully to do transpositions of traditional intervals to modulate the key.

No pad effect on pitch: In the **"none**" switch setting, the pads and knobs will not set the transposition and it will default set to the 2nd octave. This frees up the pads and knobs to be independent of transposition. The setting also turns on NoteOn output for the pads on MIDI channel 16 which can be used for MIDI triggering.

For example, if the octaves setting is used in combination with the "output" CV or MIDI CC, the user might use the preset output settings from the knobs to automatically change a parameter of a sound based on the octave being played. But if you want that control to be independent the only way to avoid associating the octave with the "output" CV or MIDI CC is to set it to "none."

Transposition can still be accomplished with a new Knob 4 feature per below regardless.

NEW: Knob 4 TRANSPOSITION



When the yellow LED next to “trn” is lit under Preset Voltage Source knob 4 —the rightmost knob— the position of this knob will determine octave transposition of the “**pitch**” CV, the internal bus and MIDI outputs.
To enable this mode, go into edit mode and touch key 27 to toggle on or off. *(See how to get into EDIT MODE in the next section.)*

Try it! The yellow LED will flash with every octave shift and you should hear the results.
(CV changes out the “pitch” banana don’t occur until position 3.6. See the chart below.)

Not only is this a unique way to quickly shift octaves, this feature accomplishes two other things:
#1. This frees up using pads 1-3 for other functions while still having independent transpose control.
#2. The knob’s 0-2.4 range allows users of 261e, 259e and AuxCard to control i2c messages for octaves lower than the 208C can go, and allows this mere 29 note keyboard to play a full 0-127 range for MIDI notes.

See the below chart to see how these transpositions affect the outputs

Knob4	pitch CV	i2c	MIDI (decimal)
0	0-2.8v	*0-28	0 to 28
1.2	0-2.8v	12 to 40	12 to 40
2.4	0-2.8v	24 to 52	24 to 52
3.6	1.2-4.0v	36 to 64	36 to 64
4.8	2.4-5.2v	48 to 76	48 to 76
6	3.6-6.4v	60 to 88	60 to 88
7.2	4.8-7.6v	72 to 100	72 to 100
8.4	6.0-8.8v	84 to 112	84 to 112
9.6	7.2-10.0v	96 to 124	96 to 124

You might notice that the knob position has a relationship with 0-10 volts and with MIDI note numbers. But to really understand it, just use your ears!

The chart above assumes you are playing in the “none” switch setting. When the ADD TO PITCH switch is set to **“octaves”,** you can simultaneously and use the preset voltage source pads 1-4 for additional octave control. They work together

If engaged, the transposition knob will be active in edit mode too to allow you to test different octaves when playing keys 13-25. *(only keys 17-25 in earlier software.)*

ALTERNATE USES OF THE Preset Voltage Source “pads”

Normally you should only play one pad at a time, otherwise. . .
You can also change the functionality of the keyboard by holding certain pad combinations:

Hold Pads 1&2 for getting into and out of edit mode:

More on that in the next section.

The other pad combinations below are features to be used during performance; features that work outside of edit mode.

NEW: Hold Pads 2&3 for LATCH

When you hold pads 2&3 simultaneously for 3 seconds, then the keys you are holding and the keys you play – while still holding pads 2 & 3 – will latch exactly as if you are playing a sustain pedal. To turn off the latch, lift your fingers off of pad 2&3 and play any key 1-29. This allows you to set up a drone or keep an arpeggiation going while not touching the keyboard or using the sustain pedal.

You can still use the strip or knobs or play the pads to change octaves without turning off the latch if you carefully stay away from keys 1-29.

Unlike the sustain pedal, this latch mode does not work while playing in edit mode.

Hold Pads 3&4 to toggle Polyphonic and Mono modes:

The LED next to “pm” is lit in poly mode.

In monophonic mode if two keys are held and one is lifted, the note will return to the pitch the held key and send a pulse and a MIDI note.

In polyphonic mode the CV and bus output will still be monophonic, but the MIDI output will be polyphonic.
Pitch CV will not jump back to a previously held key in software version 36.2+. The two different monophonic modes of output give you options for CV performance and also to more closely imitate the MIDI output for those who might double MIDI output with CV outputs, especially when in a transient mode on the 208.

Internal bus messages are monophonic and work just like the CV output.

The poly/mono mode shortcut is to be used outside of edit mode. In edit mode, key 29 toggles the feature.

That is all you need to know to start playing. But if you want to change the response settings on your 218e-V3, or turn on and off various features, or take advantage of some of the MIDI output options, here’s how. . .

EDIT MODE: Configure your preferred settings.



To enter edit mode, **hold the preset pads 1 and 2** until they flash quickly.
The LEDs will then flash slowly to indicate it is in this edit configuration mode.

On the 218e-V3 those pads have 2 lines on them. Hold the two pads with the two lines for two seconds.

Once in this mode, touch keys and move pots to configure per the descriptions below.

Keys 1-12: Assign the MIDI output channel 1-12
New to the 218e-V3 is channel output assignment. In edit mode, touch and hold keys 1-12 for a second until you see the pulse LED flash and that will reassign MIDI output to the respective MIDI channel
MIDI channel settings are saved.

Keys 13-25 remain playable in edit mode with no consequences and are a good way to test your changes. The MIDI channel limit allows for a full octave of active keyboard while in edit mode.

Key 26: Toggle on and off “directed random”. This affects the random arpeggiation. The preset LED will indicate status while in edit mode. See Appendix 1 for a description.

Key 27: Toggle on and off knob 4’s TRANSPOSE mode. See “Knob4 transposition” section above for a description. (Transposing with knob 4 is active in edit mode too!)

Key 28: Toggle on and off remote enable.
On the 218e-V3 there is an LED status indicator for remote enable. See REMOTE ENABLE description in the following input and output connections section.

Key 29: Toggle on and off Polyphonic MIDI Mode. “pm” is its LED status indicator. Your MIDI output is now polyphonic! Toggle it off it you want the MIDI to work monophonically like the monophonic CV output. *A quicker alternative method to toggle MIDI polyphony without going into edit mode, press and hold preset pads 3 & 4 until they flash.*

Strip plus Portamento knob: Strip Portamento speed/slew





Touch and hold the strip while setting the portamento knob to change the amount of portamento for the strip. The higher the knob value, the slower the CV will change its voltage. This is also known as “slew” and is a nice way to smooth out the slides or create delayed changes.
Likewise you can set the pitchbend range for the pitch CV by turning the Arpeggiator knob. *To make it less likely that you set that accidentally, we require that you touch the strip while you turn the knob. And in this way you can also instantly test the results.*

More configuration control comes from the Preset Voltage Source knobs (numbering 1 to 4; left to right)



Pressure sensitivity | Velocity sensitivity | Minimum velocity value | 200e Bus assignment (if touching pad 4)

Knob 1: Pressure sensitivity
If the pressure does not respond to your liking, move the knob and adjust the “pressure” sensitivity. 10 is the most sensitive setting and the output will jump to 10v with just your finger tips. *Tip: use keys 13-25 to test in real-time. (only keys 17-25 in earlier software.)*

Pads 2&3 + Knob 1: Key threshold/sensitivity: Holding down pads 2 and 3 while turning knob 1 changes the setting for the touch threshold for notes. Be careful with this. This setting should NOT be changed often, and extreme settings may make the keyboard seem unusable. The most usable sensitivity settings are between knob positions 4 and 6. The default/typical setting is set in the middle (5). This is independent of pressure sensitivity.

Knob 2: Velocity sensitivity (for internal bus and MIDI output)
In configuration mode, knob 2 adjusts the velocity sensitivity. Note that the higher the sensitivity may lower your velocity output as you increase the range of the velocity. Velocity sensitivity of 0 will play one velocity and 10 will require very fast strikes to get higher velocities. (*Tip: Use keys 13-25 to test velocity. If knob 4 is transposing, that is also active.)*

Knob 3: Minimum keyboard velocity (for internal bus and MIDI output only)
In configuration mode, preset knob 3 adjusts the lowest velocity value for keyboard performance. At value 0, you will allow the full range, but that could result in very quiet notes. Working in tandem with velocity sensitivity, adjust the value to your taste. Be sure the PATTERN switch is set to none.

Pad 3 + Knob 3: Minimum arpeggiation velocity
Touch pad 3 first then turning preset knob 3 will change the minimum velocity value for arpeggiation. You may want a higher minimum velocity for arpeggiation than your normal keyboard performance. You can test this in edit mode if a pattern is selected.

Pad 4 + Knob 4: Assign (or disable) internal bus note output
Touch pad 4 first and then turn knob 4 and the static illumination of the four preset pads indicates the internal bus assignment. The internal bus, especially useful on a 200e system, can be used to control select modules (such as the 259e, 261, 281e and 292e and more) without the use of bananas cables.
Assign the internal bus output by turning preset knob 4 through selections: none; A, B, C, D; A+B; C+D; A+B+C+D. If you don’t use the internal bus and are only using the banana connections or MIDI output, disable the bus by turning the knob to 0.

What connects to the internal bus? *The 208C "keyboard" inputs for pulse and pitch respond to notes on internal bus A when the 208C is in remote or both mode. But that is only if you have the 208MIDI daughterboard installed. ("Easel Commands" have with the 208MIDI board installed.) The AuxCard oscillator listens to internal bus C. (If you have an LEM218 you could connect to the bus through the 10-pin 2mm power connector on the right.)*
Other Buchla modules that can respond to the internal MIDI bus include 261e, 259e, 281e/h, and 292e/h. Similar to MIDI, NoteOn messages (pitch/bus assignment/velocity) messages are sent; Unlike MIDI, the CC messages can NOT be over the internal bus.

Pad 1,2,3,4: Factory reset: Hold all four pads while in edit mode until flashes to reset all configuration back to default values.



Exit edit mode the same way you entered the mode:
hold preset pads 1 and 2 until they flash quickly again.
Upon exiting the edit mode, the settings are saved.

THE INS & THE OUTS: Ways to connect to your sound world

MIDI Output: Notes, pressure and Continuous Controller's

Channel assignable output:
In addition to pressure (channel aftertouch), and new to the 218e-V3, the strip puts on *CC1/Mod wheel by default on the assigned channel. Preset Voltage Source puts out *CC2/Breath by default and the Portamento knob puts out CC5 (portamento) on the assigned channel. *CC#s can be reassigned in edit mode.

See edit mode to make changes to MIDI channel assignment and velocity settings.

Fixed channel output:
Strip trigger note: touching the strip puts out MIDI note 4 on channel 16.
Pad trigger notes: If set to "none" on the ADD TO PITCH switch, touching pads 1-4 will put out the four lowest MIDI notes (0-3) on channel 16 to allow MIDI note triggering of 4 sequences or scenes.
Arpeggiation knob: CC16 on channel 16
Pattern switch: CC17, values 0, 64,127 on channel 16
Add to Pitch switch: CC18, values 0, 64,127 on channel 16

MIDI Input: Use of the 218e-V3 for MIDI to CV conversion:

The 218e-V3 converts incoming MIDI signals ***on the selected MIDI channel*** (as set in edit mode) from the MIDI input just as if you were playing the 218e keyboard. MIDI notes become pulses and pitch CV outputs. With the V3 updates channel pressure messages CC messages get sent from 0-127 get sent out the related output as 0-10v. And with the latest software, Notes 1-5 on channel 16 come out as pulses on the PVS and strip pulse bananas regardless of the selected MIDI channel.

This allows you to record a 218e-V3 performance and then play it back through the 218e. In fact, the controls of portamento, arpeggiation, and preset voltage source selection will still apply when using this MIDI input.

For even more interaction the octave setting will transpose the MIDI input just as it would when you play the 218e keyboard. Use the lowest octave setting when switched to "octaves" or switch to "none" if you want to get the non-transposed input. C0 or [MIDI note 24] will equal 0 volts in this setting and is the lowest note the 218e; the highest is note F7 [MIDI note113] 8.9v.)

MIDI input to the 218e will be especially useful for 208 users *who don't have a 208C*. That's because there are fewer ways of controlling a 208C from the 218e-V3 than the 208C's internal 208MIDI card. For most new Easel systems with a 208C, the 3.5mm MIDI in jack will be connected to the 208C directly.*

For new Easel users, consult with the EMBIO guide on how to directly the MIDI Input to the 218e instead of the default 208C.

For older Easel cases, a 6-pin header and cable can be soldered to the 218e-V3 to make it compatible with the older BEMI 2013-2020 case. See Appendix VI

You can also use the internal bus A to get pitch CV's out the pitch banana if you have remote enabled your 218e. See below.

REMOTE ENABLE the 218e to put MIDI note input onto the 200e internal bus or enable internal bus A output to the 218e's pitch and pulse jacks:

When you have remote enabled your 218e, internal bus A will get sent out the CV pitch outputs, but also MIDI input on channels 1-4 will be turned into internal bus messages on bus channels A-D, respectively. For instance, to send a MIDI message to the AuxCard on bus C, you can send a MIDI message on channel 3.

Remote enabling the 218e may be most useful for 200e users.

On the 218e-V3 the "rem en" LED will indicate on status.

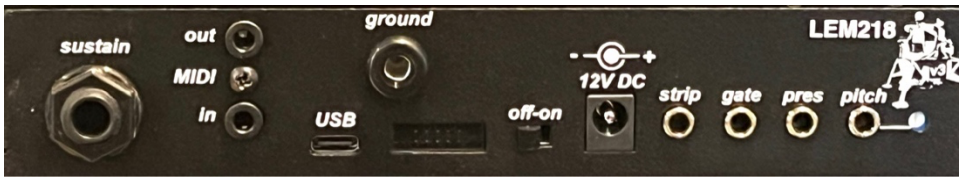
The 218e will not be remote enabled upon boot up. This is a temporary un-saved setting.

218e-v3 Input and output jacks:

IO connections can come from any **LEM218v3 or Easel power panel including EMBIO**.
(For 5XIO connections, request one made specifically for the 218e-V3 or modify per instructions. *)

The 10-pin cable connection includes the USB, sustain pedal and standard MIDI connections all in one cable. Be sure to plug it in the correct header.
The older 218e or older IO interfaces use a 6pin cable. See Appendix V for information on that.

The LEM218v3** is a standalone version of the 218e-v3 and has additional connections as described below:
(The v3 version of the LEM218 is not compatible with the older 218e. See Appendix V for details.)



Sustain: The Easel comes with a ¼" connection labeled "sus" or "sustain." The keyboard will hold one pitch or latch arpeggiated pitches while holding down sustain. In Polyphonic MIDI mode it will transmit MIDI CC64 unless it is in an arpeggiation setting. The pedal holds notes in mono mode, but does not send MIDI CC64. You can use either normally-open or normally-closed pedals. The polarity of your sustain pedal will be sensed on power up or during a reset button press.

3.5mm MIDI outputs and inputs.

These use traditional MIDI signals and can be adapted to DIN cables. See the included cable adapter for a 3.5mm to 5pin DIN connection. (More available from Buchla USA.)

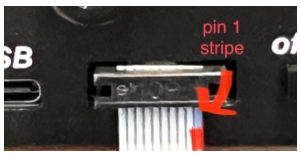
USB: With the 218e-V3, USB-MIDI has been added and functions the same as the DIN/3.5mm MIDI in and out. Either the USB-C connection on the LEM218 or Music Easel can be used or the USB-B connection on the 5XIO. (See below for more 5XIO information.)

Ground: essential to use for a common ground connection to other Buchla systems such as a 208C. The CV connections will be unstable and uneven without a return signal path.
Power: 12volt DC power input.
A 3-prong grounded connector with AC ground connected to the DC ground barrel end of the AC adapter is essential for good operation. The full 3 Amp power supply that can be swapped with Easel Command is provided and is a good choice.
Compatible Specification: 10.8-13.2 volt, center positive, 2.5mm barrel, 500mA minimum.
(It is not USB powered.)

pitch, pres, gate, strip 3.5mm jack outputs include a 1v/octave pitch output, a 0-8volt pressure CV, 0-8v strip CV, and a gate output for use with Eurorack equipment. *(To get the 0-10v Preset Voltage outputs you would need to adapt the banana outputs to 3.5mm cables)*

v/oct pitch trimpot: The LEM218's 1v/octave trimpot can be adjusted to maintain 1 volt per octave at the 3.5mm pitch output.

optional h-Power input: Power can come from a Buchla boat that has an accessible h-power outlet/connection. Use this 2mm 10-pin optional power to connect all the power needed including ground and the internal MIDI bus through an h-series power cable.
When using h-power, don't connect the AC adapter.



Be sure pin1 stripe is on the right side (by "off"). 2mm IDC headers can be shoved in reversed if forced and will have catastrophic consequences if powered that way! Please double check pin1 located as pictured here.
Tip: Don't make the h-power cable too long. (You could exchange the long internal h-power cable with a shorter h-power cable in order to get a longer external connection while minimizing the overall cable length from the boat power.)
And hopefully it's on a quiet PSU board. The keyboard is sensitive to ground noise.

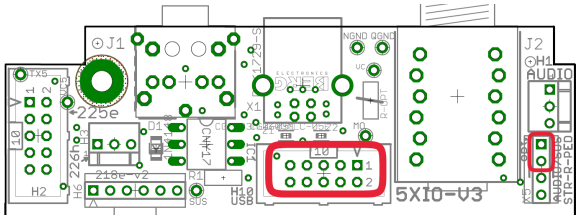
** In a nod to the earliest names used in NASA's Apollo missions and the space travel possibilities that made their way into everyone's imaginations in the early 1970's, the LEM is named after the "Lunar Excursion Module," the original name for the Lunar Module. It pairs with the "Easel Command" [Service Module]. Let your sonic imaginations take off to the moon and beyond!

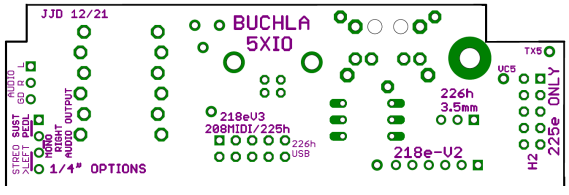
200e boat I/O connections:

200e boat breakout board for rectangular slots: ("218eV3 bust out" or **"**V3IO") This includes a 3.5mm sustain pedal input (with cable adapter to ¼") and a USB-C connection for both USB-MIDI in and out and the ability to make firmware updates over USB.
(If requested, the V3IO board can be modified to accept 3.5mm MIDI input instead of sustain.)

200e boat 5XIO for larger IO ports:
If in an older bottom 200e boat you'll need to direct the cable out a hole up to a boat with an IO panel. The provided 10pin cable should be long enough.
Use the middle 10pin connection H10.
Consult with Buchla USA to get a 5XIO specifically modified for use with the 218e-V3
(OR see below)

<u>*5XIO Modifications needed (if not factory provided):</u>
1) jumper the R jack for use as a sustain pedal. The bottom the 5XIO also has text to confirm your setting is right.
2) If there is no audio connected, then you also need NGND and QNGD shorted together for sustain to work.
3) For MIDI DIN/3.5mm input to work, there is a resistor modification to pull up the signal harder. Consult with Buchla USA. This modification is exclusive for 218e-V3 use only.





<u>Alternate sustain pedal only boat hack:</u>
Warranty-not-guaranteed-hack: If you don't use MIDI at all but want a sustain pedal input in a different housing, you can find or drill a hole in that housing for a ¼" jack and then connect the signal/tip to pin1 and ground to pin2 using just a 2-pin header in to the 6pin H1 header on the 218e where "SUS" is pointing to.



Appendix I: Arpeggiation

MIDI Sync The 218e Arpeggiator

You can send MIDI Sync to the LEM 218 to synchronize your arpeggiator with your computer. Below as descriptions of a preferences settings for several DAWs. The below examples assume you are using the USB MIDI connection. If you are using a DIN connection, then you will select the MIDI port as configured by your MIDI interface, rather than “218e.”
Consult the MIDI Clock and LEM 218 document for screenshots of the settings below.

Apple Logic

In Logic, you’ll go to Preferences, then go to the MIDI Sync Project Settings and click the MIDI tab. Select the 218e from the menu and select Clock to set up your sync.

Bitwig Studio

Go to the preferences window and select the Synchronization tab and under Settings select the clock symbol.

Ableton Live

In Preferences MIDI tab, select the “sync” column checkbox for the “Out: 218e” MIDI port.

Avid Pro Tools

From the Setup menu, select “MIDI” then “MIDI Beat Clock.”
Then, “Enable MIDI Beat Clock” for the 218e checkbox.

Start The Transport

However you do it, you won’t get the arpeggiator synchronized until you start the transport. Once you press play, the Arpreggiator will sync up, and the speed knob will discretely switch among different note divisions, as described below. Once you stop the transport of the host, the LEM 218 will revert to its internal timing.



Knob Value	0	1	2	3	4	5	6	7	8	9	10
Note Division	off	1/4	1/8	1/16	1/32	1/8 dot	1/16 dot	1/4 triplet	1/8 triplet	1/16 triplet	1/32 triplet

“Directed random” arpeggiation:

There is an optional arpeggiation setting called “directed random.” To give random arpeggiation a more dynamic character, **the direction of the random can be tied to the preset voltage source value**. As the Preset Voltage Source value increases, the random selections will increasingly ascend until the top value is the same as ascending; As the value goes low, the random variation favors descending until **it is fully descending at value 0**. At the center value/pot position, the arpeggiation will go up and down.
Being tied to the Preset Voltage Source means that this can be played dynamically by either turning the associated knob and by using the 4 pads to select the direction instantly This also gives users two more patterns (descending and up-down) to use without diverging from Don Buchla’s original design and while embracing the spirit of performance control over sources of uncertainty. I think you will enjoy the musical results.

To toggle this mode on and off, use key 26 while in edit mode.
The red preset voltage pulse LED will flash when in edit mode if this option is selected, but not on 218K+ versions

Appendix II: Troubleshooting/FAQs

Troubleshooting KEYS:

My keys are not responding or my connected instrument is not responding to the 218e.
First hit **"reset"** to recalibrate the keys. If the response is still not right consider resetting to the **factory default settings:**
In edit mode, hold down all four preset pads until the LEDs flash to reset the keyboard response and MIDI settings back to the factory defaults.

Pressure stopped working:
You may have accidentally set the pressure sensitivity to 0 in edit mode. Go back and edit the pressure sensitivity (See edit mode.) or factory reset per above.

When I play two keys the second one doesn't play or it plays late!:
Make sure you are not in Arpeggiation pattern is set to **"none".** Because arpeggiation starts with the key touch and the arpeggiation rate can be set to 0, it can be easy to not recognize this mistake.

Sometimes it misses pulses when I play a key twice:
Make sure the key is not still holding when you repeatedly hit a key that your finger fully leaves the sensitive area. Because there are no moving keys, it can be difficult to know when the key is no longer sensing the presence of your finger but the red pulse LED shows the sustain of a key.

The keys are holding too long!:
Wash your hands with soap so they are clean and dry and not sweaty. If moisture is on the keyboard, wipe it off with a towel and hit "reset" to recalibrate the keyboard. Consider an alcohol wipe (and wait for it to dry.) You can adjust the key on-off sensitivity lower in edit mode, but that doesn't directly fix a moisture issue.

Some keys seem less sensitive:
It is possible that some part of your body was close to the keyboard when it calibrated after a reset or reboot. Or too much time has passed since your last calibration and the environment has changed enough. Try pressing "reset," keep hands away and wait for it to finish calibrating.
(See this manual's sections on grounding and auto-calibration for more explanation.)

Sometimes the previous note plays when I lift my finger:
If you are still holding a key when you lift your finger, the CV jumps back to that held note. This is the way the pitch CV works in its mono mode. If you are not in Polyphonic MIDI mode ("pm"), the MIDI output will behave the same way.

Arpeggiation is uneven below 3:
Make sure you are connected to a clean power supply.

Troubleshooting VOLTAGES:

The transpose knob 4 doesn't do anything to the pitch CV until it gets to 3.6?:
Transpose IS working behind the scenes for internal and MIDI communication, but the CV output of the pitch will not change until the bottom most note matches its MIDI note equivalent. See the transpose section above. See the table in the section above called **Knob 4 TRANSPOSITION**

The Eurorack 1v/oct output is not playing in tune:
Use the trimpot next to the output to tune it up or down to the range you want.

The pitch LED is still on when I am not playing:

This is normal. The pitch LED indicates the control voltage out that banana jack. That voltage will remain where it was when the keyboard was last touched even if no notes are being output.

The knob/pot movement has no effect close to 0 and 10:
This is not unusual. Most potentiometers have a small area at the top and bottom of their movement where the resistance doesn't change even though the knob can turn a little. Annoying isn't it?

Troubleshooting MIDI:

MIDI output stopped working or did my 208C stop responding to MIDI?
Perhaps you accidentally changed MIDI channels while editing. Try setting the MIDI channel back to channel 1 by touching and holding key 1 in edit mode.

The 218e is not showing up on my USB port list.
Try hitting the reset button on the 218e and then check again.

My sustain pedal is working backwards!:
Reset/reboot with your pedal already inserted and foot off the pedal. The polarity of the pedal is sensed during power up and reset. Make sure you are not holding down the sustain pedal when you hit the reset button (unless you intend to reverse the function.)

My sustain pedal is not putting out sustain on MIDI:
Is the "pm" LED lit? The pedal will hold single notes in mono modes including during arpeggiation. It will only send CC64/sustain if you are both in poly mode and the arpeggiation switch is set to "none". When you are in that setting the "pm" LED is lit and not flashing.

208C/Easel Command troubleshooting:
My pitch is is too high and not being interpreted correctly!:
Of course you have to make sure you have set the fine tune knobs, but there are other inputs that can add offsets to the pitch, especially if you experimented with MIDI channels other than channel 1 or accidentally assigned the output to a different MIDI channel while editing the configuration. The oscillator pitch on the 208C is additive on all its inputs: Notes on channels 2 or 3 will push up the pitch up either of the oscillators and that pitch will remain offset until the lowest recognized pitch is sent on those other channels or the 208C is rebooted. Plugging in both MIDI and the pitch banana together can also drive up the pitch abnormally/additively.
Solution:
1) Reboot the 208C/Easel Command to reset the pitches and check again.
2) Unplug from the pitch banana CV input if you are using MIDI.
3) If you want to play on a different channel on your DAW while also plugged into MIDI input to the 208C, choose a channel 10 or above to be sure not to interfere with channel input assignments/oscillator pairings on the 208C.

Appendix III: FIRMWARE UPDATES:

We like to get it right the first time, but if there are updated features or software fixes, downloadable firmware updates can be programmed via USB. There are a few steps to this. To find out how to update the 218e-V3 to the latest software, see the publication: ***How to do a 218e-V3 firmware update.pdf***

218e-V3 updates are not compatible with the older 218e.

You can know what Firmware you have if you have a 225e or 206e to read it:
To see the firmware version displayed by a preset manager, **hold presets pad 2, 3, & 4** until the message is displayed by the preset manager (after about 2 seconds).

Appendix IV: Arpeggiation CV input options:

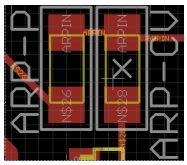


The user may make changes get CV control of the arpeggiation rate to get the same behavior as the 2013 218e.

Easiest: Keep the Arp pulse input and reassign the portamento CV input to the Arpeggiation rate with a firmware change: If you don't use the portamento CV input, you can reassign that hardware input to control the Arpeggiation Rate. Look on the website for the Firmware that is listed as with "Porta_CV_to_Arp_Rate" in the titled like 218eV3_v362_Porta_CV_to_Arp_Rate_DFU.hex and follow the firmware update instructions.

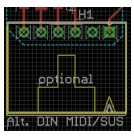
Fun tip: Pulse source for arp pulse in: the Easel Command gate in comes out the keyboard pulse input. Also the 208C sequencer could be used if the voltage is higher than 8v (8 fader) and alternate faders are low, then every other sequencer stage would trigger it. Pulser will work too if it's short, but if it in self mode or if long, the ramp down will make it not completely predictable.

More difficult: The user may change the pulse input to CV control of the arpeggiation:
This change requires a technician with basic soldering skills. By factory default there is a resistor at "ARP-P". "P" = pulse. Removing this resistor and then resoldering this same resistor on to the "ARP-CV" position changes the orange banana's input to control the arpeggiation rate with a control voltage. (This can be done with one soldering iron, but to do this even more easily may require 2 soldering irons.) Though the banana color should in theory change from orange to black, it is not required. But if you can make the resistor change, I'll be you can make the banana change to black to show that you did it.

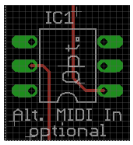


Most difficult: Reassign the portamento input to the Arpeggiation rate with hardware: If you can read this fine print, first question why you aren't doing this via the first/easiest software/firmware option. But know it is also possible to reassign the portamento banana jack input to control the speed of the arpeggiator instead while keeping the pulse input, but that modification was not considered in the original design, so the modification is slightly more involved: requiring a technician to remove R62 and jumping it's via to the "ARP" side the ARP-CV resistor. (No cuts needed). Contact customer support if you need that option and have access to a technician.

Appendix V. I/O options for 218e-V3 in older cases:



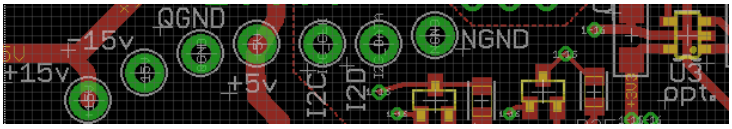
IO connections of a new 218^{e}-V3 to an old LEM218 or **older Easel suitcase** will require soldering of through-hole components. There is an unpopulated connector labeled H1. A connector can be added here to make the 218^{e}-V3 backward compatible with those older IO panels. Please contact Buchla USA for more information.



Additionally, IC1 would need to be populated to provide the MIDI Input when using the 6pin connector.

Backward power compatibility for the 218e-V3:
The simplest way to provide power to the 218e-V3 is through the h-power connector that was created for the h-series modules. If you do not have an h-series power connector on your system, there is « e2h adapter » board that can be purchased. The « e2h » board adapts the power and adds a 3.3v generator.

The 2nd method is much more involved and requires a qualified technician. That would be to wire up an old 200-series connector using the large pads. The holes are labeled.
In addition, U3 must be populated with a 3.3v generator and the h-power connector « H4 » removed. (Or optionally H4 can remain if the technician contacts Buchla USA for information on how to also cut the 3.3v line from the h-series power connector.)



<u>I/O connections for a v3 in an older 218e case: The 6-pin SIP header</u>.
Various older Easel cases include MIDI In and Sustain, and the LEM housing adds MIDI Out. The Buchla 218e can also be put in another housing and still retain those connections via the 6-pin SIP header. The old LEM218 pairs with the old 218e for power and I/O and includes this 6-pin connector.
This 6-pin connector (on the inside board on the right side) was designed to connect directly to panel jacks: The 2 MIDI In pins (pins1&2) can connected directly to a panel mounted 5-pin DIN jack (pins 4&5 respectively); MIDI Out (pins 3&4) connect to 5-pin DIN (pins 5&4 respectively); Ground (pin5) should connect to MIDI Out Din pin2 (and not to MIDI In) and also to Sustain pedal ground; and the Sustain switch signal (pin6) should connect to a sustain pedal input.

<u>For an old 218e (2013/version 2) inside a Modern Easel case.</u>
The EMBIO panel in a Modern 10-panel Easel case also includes the 6pin header so that older 218e's can plug use the MIDI and sustain jacks. A 6pin extension cable may be required.

<u>For an old 218e (2013/version 2) inside a 200e system</u>.
The simplest way to connect MIDI to a 218e is with the Buchla "5XIO" IO board header H6. This header connects MIDI In and MIDI Out 5-pin DIN connections (not USB) via the 6-pin connector from the 218e and a panel ¼" jack can be wired to pads on the left side for sustain. Or jumper the R jack for use as a sustain pedal. If there is no audio connected, then you also need NGND and QNGD shorted together for sustain to work using the R jack.

Afterword

As the director of the changes to Don Buchla's 218e and as the 218e's original and updated PCB layout artist, I hope you enjoy the updates! Special thanks to software developers Darren Gibbs and Dan McAnulty and the support of the whole Buchla USA team for making it possible! -Joel J Davel.