MIDI TO CV CONVERTER

MIDI-4CV_ MIVCV

GROOVE (viii-c) 1989

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1. INTRODUCTION

Congratulations you are now the proud owner of a marvel of modern technology.....the **GROOVE MIDI-4CV** converter. It will enable you to use those wonderful old monosynths, with their warm and often unpredictable tonal qualities to bring new life into your music.

The Groove M4CV provides a control voltage suitable for driving monosynths which use the 1V/Oct scaling system, this system is used by the majority of synths. There is an option to provide a linear control voltage output, which is the other system used by analogue synths for external pitch control, so the M4CV is capable of controlling just about every type of synth.

The MIDI-4CV_ will control four synths, either independently or in POLY mode, providing Control Voltage, Trigger, and VCA/VCF Level as its outputs. In addition pitch-bend (+/- Oct.) is added to the CV output, the amount being variable from 0 to +/-1 Oct. The VCA/VCF Level output may be assigned to key-velocity, modulation-wheel, after-touch, breath-controller,.....The Trigger output may be set to cover most eventualities, including S-trigger. A 'Coarse Tune' trimmer is provided to adjust the Control Voltage by +/-2 Octaves but since the trimmer is of the multi-turn variety it can also be used for fine tuning!

There are four such synth control channels, each having three control outputs associated with it. In addition a DIN-SYNC output is also provided, this allows older Roland equipment (TB-303, TR-808, TR-606) to be synchronised to the MIDI clock. There is also an ARP-CLK output, this provides a pulse output that is locked to the MIDI clock and may be used to drive older drum machines and sequencers (pre-MIDI) that have an EXT-CLK input, it may also be used to drive arpeggiators on synths.

As well as being used to control synths, the control outputs of the M4CV may be connected to 'simmons' type drum modules, with SIMMs mode selected on the M4CV the control outputs then output a trigger voltage proportional to velocity. So 'simmons' type drum modules can be triggered over MIDI, the channel can be selected as can the group of trigger notes, 12 outputs are provided for this.

2. PRINCIPLES OF OPERATION

Before describing how to use the Groove M4CV we present here an introduction to the control voltage system used on older synths, for the benefit of those of you who are not familiar with it.

In the days before MIDI sockets, to provide for external control of synths it was necessary to provide separate control inputs for the various elements of the sound that must be controlled. So some means of controlling the pitch of the sound was required as was control over the duration of the sound ie. a gate signal. These two signals were the two basic control inputs provided on most synths in addition some means of controlling the filter cut-off was often provided. Unfortunately in the days before MIDI there was no standardisation of synth control and so several types of trigger (gate) signal and two forms of pitch control signal were adopted by the various manufacturers.

The two types of pitch control signal employ different scaling, and it is only possible to cater for one type of scaling*. The '1Volt-per-Octave' (1V/Oct) scaling, so called because for each Volt increase the pitch increases by one octave, is used in the Groove M4CV as this is the most commonly found scaling. The other type of scaling is known as 'Hertz-per-Volt' (Hz/V), actually it is kiloHertz per Volt, and for each Volt increase the pitch increases by 1 kiloHertz. The Hz/V system was used extensively by Yamaha on their monosynths, so sadly these will not track the pitch control signal produced by the M4CV. Fortunately most of the better known monosynths employ the V/Oct scaling and will work with the M4CV.

There are basically four types of trigger signal all of which the M4CV can be set to produce. The odd one out of the four is the so called S-trigger, the 'S' stands for 'short', this system uses a relay to make a contact when a trigger is required, the M4CV has one S-trigger output. The other three trigger types use a voltage level to determine trigger on/off these trigger systems are:

1. POSITIVE GOING (+VE) TRIGGER : output normally sits at 0V and goes to a positive voltage for the length of the gate period.
2. GROUND TRIGGER (GND) : output normally sits at a positive voltage and goes to 0V for the gate.
3. NEGATIVE GOING (-VE) TRIGGER : output normally sits at 0V and goes to a negative voltage for the gate.

As mentioned all of these three trigger systems are available on the M4CV as standard so there should be no problems in triggering any monosynth.

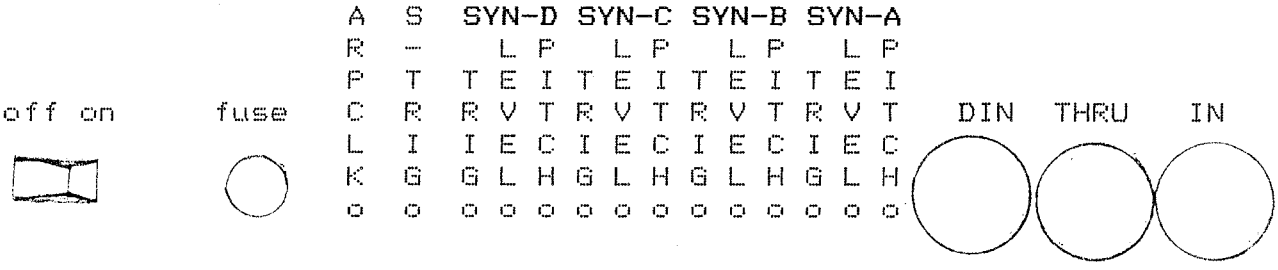
The third control output provided by the Groove M4CV is intended for controlling the filter cut-off frequency of the synth. Control of this synth parameter, by external means, is not so common and so there is no predetermined format for this signal. So the M4CV provides a control signal in the range 0 to +8V and this may be controlled by MIDI velocity, mod-wheel, after-touch or breath controller data. If your synth does not have a control input for VCF cut-off then we can probably provide it with one to ensure you get the full benefit of this useful control output.

*an option is available that provides a 'Hertz per Volt' scale.

3. CONNECTIONS

This section describes the connections to the M4CV and how to link up your synth to the M4CV.

The diagram below illustrates the rear panel of the M4CV, it has three 5-pin DIN sockets for MIDI IN and THRU, and DIN-SYNC, four--teen 3.5mm jack sockets provide the control output signals. Viewed from behind the rear panel is laid out as shown below;



The three synth control outputs are PITCH, LEVEL and TRIG, there are four sets, for synth A, B, C and D. These three outputs should be linked as follows;

PITCH: This is the pitch control output and should be linked to the pitch control input on your synth, this should be marked 'CV IN' however there are other possibilities, if in doubt consult your synth manual.

LEVEL: This is the VCF cut-off control output and should be linked to the FILTER control input on your synth.

TRIG : This is the trigger output and should be linked to the trigger input on your synth, generally labelled TRIGGER or GATE IN.

The other two outputs available are S-TRIG and ARP-CLK these are;

S-TRIG: This is the S-trigger control output as previously described, it should be connected to the synth trigger input in place of the TRIG output above. The S-trigger is only available for one of the synths the M4CV is controlling, this is synth A.

ARP-CLK: This is the Arpeggiator Clock output and provides a 0<->10V clock signal derived from the MIDI clock and would typically be used for syncing an arpeggiator or sequencer to the MIDI clock. So this output should be linked to an input marked 'EXT CLOCK' or similar. For more details about this output see section 5.2.2

The other output on the rear of the M4CV unit is the **DIN-SYNC**, it is a 5-pin DIN socket that looks like a MIDI socket (but it isn't) and should be linked to DIN-SYNC IN of the unit you wish to sync to MIDI.

4. SETTING UP

Having linked your synth up to the M4CV it will be necessary to callibrate the scaling of PITCH output from the M4CV. This should only need to be done once for any given synth, depending on how stable the voltage-to-pitch converter within the synth is. Allow the synth and M4CV to warm up for 10 minutes before attempting to callibrate the V/Oct scaling.

As you look at the M4CV from the front there are 12 small holes on the right side of the front panel, as shown below;

SYN-A			SYN-B			SYN-C			SYN-D		
Tune	Bend	V/Oct	Tune	Bend	V/Oct	Tune	Bend	V/Oct	Tune	Bend	V/Oct

You will need a small screwdriver (or tweeker) to adjust these trimpots, there are three trimpots per synth control channel and these function as follows;

V/Oct : This is the most critical of the three as this sets the pitch scaling of the M4CV and if this is not right at the start the synth will only stay in tune over a small range of the keyboard. This is a multiturn pot to allow the V/Oct to be set accurately, it provides about +/-20% variation so the V/Oct may be set between 0.8 and 1.2 V/Oct. This range is necessary since the scaling within the synth itself will drift over the years.

Tune : This is another multiturn pot which provides a total tune range of +/-2 Octaves but is sufficiently fine to allow for fine tuning as well.

Bend : This is a normal, single turn pot and is used to set the amount of pitch-bend which may be applied to the pitch output. Pitch-bend may be set from 0 to +/-1 Oct.

4.1 Callibrating V/Oct :

In order to perform this callibration it will be necessary to connect a MIDI keyboard to the MIDI IN on the M4CV, you may also have to proceed to the next section, Editing Parameters, first to set which MIDI channel synth A/B/C/D responds on. Assuming that your synth is responding to the MIDI keyboard proceed as follows;

1. Set the synth and MIDI keyboard to produce a sine wave or similar pure tone that is suitable for tuning. It will be necessary to hear both synth and MIDI keyboard as you will be tuning the synth to the MIDI keyboard.
2. Centre any tune controls on the synth and MIDI keyboard.
3. Play Middle C (MIDI note# 60) on the MIDI keyboard.
4. Adjust 'Tune' trimpot on the M4CV until both keyboards are in tune.
5. Play a note 3-4 octaves up (C6-C7) on the MIDI keyboard.
6. Adjust 'V/Oct' trimpot on the M4CV until both keyboards are in tune.

The M4CV unit should reliably produce an accurate pitch control voltage over a range of 6 or 7 octaves. Now in order to produce this range it is necessary to use a bipolar control voltage, so with the M4CV Tune in the centre, middle C = 0V, any notes above this produce positive voltages whereas notes below middle C will produce negative voltages. Typically the control range is -3V to +4V (ie. 7 Octaves) with M4CV Tune in the centre, the Tune control will add +/- 2V to this, making a total control range of -5V to +6V. Some synths don't like negative control voltages and so will not track very far below middle C, bear this in mind when you are callibrating V/Oct and can't get the synth in tune an octave below middle C.

4.2 Tune and Transpose :

With the tune control set in the centre of its travel and no transpose applied then MIDI note #60 (mid. C) should give 0V at the pitch control output. The M4CV provides for +/- 3 octaves of pitch control voltage (ie. +/-3V) around note #60, thus the M4CV will respond to MIDI from note #24 to #96. Now the tune control provides a means of altering the pitch of the Synth, relative to the MIDI note #, by upto +/- 2 octaves. This control is continuously variable between these limits and should be more than sufficient for all tuning needs. However the situation may arise where you wish the synth to respond over a different range of MIDI note numbers, so a software transpose function is provided for this (see section 5.2.1). This transpose function simply moves the 6 octave range of the M4CV around the 10.5 octave range that MIDI allows for, thus it is possible to transpose the synth response range up or down three octaves. This will also help to get round problems you may have if your synth doesn't respond to a negative pitch control voltage.

4.3 PITCHBEND :

The M4CV generates a pitchbend voltage from MIDI pitchbend data, this voltage passes through the BEND pot. and is then added to the pitch control voltage. Thus it is possible to vary the amount of pitchbend applied to the synth by means of the BEND control. The BEND control can set pitchbend amount from 0 to +/- 1 octave, to assist in setting the pitchbend there is a routine in software (see section 5.3.4). This pitchbend setup routine allows you to specify the pitchbend amount in semitone steps, the M4CV then sends the appropriate signals to the synth and you simply adjust the BEND control until the desired range is acheived.

5. EDITING PARAMETERS

The Groove MIDI-4CV has been designed with maximum flexibility in mind, as a consequence of this there are many parameters which may be edited. This section provides a detailed description of all the parameters which may be edited.

The display consists of eight LEDs which are used to indicate the parameter you are editing and its value. These LEDs may be in one of four conditions; off, on, slow-flashing, fast-flashing, for the purpose of this description these conditions will be indicated by the following symbols;

1. OFF =0
2. ON =1
3. SLOW-FLASH=+
4. FAST-FLASH=*

UNKNOWN =x

The last entry above, 'UNKNOWN', refers to LEDs whose status depends on the value they are displaying, hence these LEDs will be either ON or OFF.

Thus the condition of the LED display will be indicated by the following notation: LED{+OO*xxxx}, the eight LEDs are depicted left to right as they are on the front panel, corresponding to the eight switches A-H.

There are an additional four LEDs to the right of the main display, these are used when editing to indicate which of the four SYNTHs you are currently editing.

In describing the switch pushes required the following notation will be used [A], [B],.....,[H], where [A] refers to switch A !

There are four basic pages of operation;

1. MODE SELECT; MONO/POLY SIMM
2. SYNTH SELECT GROUP 1
3. EDIT MODE GROUP 2
4. MEMORY STORE/RECALL

These four pages differ depending on which mode the M4CV is in.

To step from one page to the next use key [A], after page 4 the system returns to page 1. At power-on the M4CV enters page 4 and recalls the memory which was active prior to power-off. Press KEY [A] to move to page 1, the MODE select page.

EXAMPLE: power has just been applied, now step through the pages.

```
power-on -> LED {*10011101}    :RECALL MODE, mem. #13
KEY [A]  -> LED {00100000}     :MODE SELECT, mono mode
KEY [A]  -> LED {10010001}     :SYNTH SELECT = SYNTH A
KEY [A]  -> LED {+0000000}     :EDIT MODE
KEY [A]  -> LED {*0001101}     :MEMORY STORE/RECALL mem.#13
KEY [A]  -> LED {00100000}     :MODE SELECT, mono mode
```

So the pattern continues, stepping through the four modes.

In general the editing process uses the keys/leds as follows;

KEY/LED A steps between modes of operation.
KEY/LED B,C,D selects parameter to edit.
KEY/LED E,F,G,H alters parameter value.

Parameter values will be in one of two forms;

(i) Binary Values

In many cases the parameter value will be a number in the range of 0 to 15 and in order to display this on LEDs the binary number system is used;

LED E	F	G	H	VALUE
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	10
1	0	1	1	11
1	1	0	0	12
1	1	0	1	13
1	1	1	0	14
1	1	1	1	15

To alter the value of the parameter simply press one of the keys [E]-[H] and the value of that particular 'bit' will flip between one and zero. This form of representation is used for setting the MIDI channel, for instance, where a value from 1 to 16 is needed.

(ii) Flag Values

For many parameters it is only necessary to select one (or more) of several options, in this case each of the keys [E]-[H] is used to choose one of the options. In some cases the options are mutually exclusive, for instance it is only possible to select one type of trigger output from the three available. On the other hand it is possible to select any combination of four sources of MIDI data to control the LEVEL output.

5.1 MODE SELECT

MODE SELECT is used to select which mode the M4CV will operate in the mode that is selected will affect the rest of the editing functions detailed in this section. The three modes are selected with KEYs [B],[C] and [D] as follows;

```
KEY [B]   ->   LED {01000000}---{1001}  :SIMM MODE
KEY [C]   ->   LED {00100000}---{1111}  :POLY MODE
KEY [D]   ->   LED {00010000}---{xxxx}  :MONO MODE
```

In MONO MODE the four LEDs to the right of the main display indicate which SYNTH is currently selected for editing purposes, so only one LED will be lit at a time.

5.1.1 SIMM MODE: LED {01000000}---{1001}

This mode turns the M4CV into a trigger unit for 'simmons' type drum modules, it provides 12 outputs which are arranged in two groups of six. Each group may then be set to respond on its own MIDI channel to six consecutive KEYs, see section 6 for more details of this mode, and in particular details of editing SIMM parameters.

5.1.2 POLY MODE: LED {00100000}---{1111}

This mode provides polyphonic assignment of the incoming MIDI data to the four synth control channels. Whereas in MONO mode each synth channel has its own set of parameters, in POLY mode there is one set of parameters that applies to all the synth channels. So, although you edit the same parameters in POLY as you do in MONO, in the case of POLY there is only one set of parameters, thus in SYNTH SELECT mode it is only possible to select SYNTH A. Section 5.2, 5.3 and 5.4 cover the editing of SYNTH parameters, this process is practically the same for both POLY and MONO mode, any differences will be pointed out where they occur.

5.1.3 MONO MODE: LED {00010000}----{xxxx}

This mode provides four independent synth control channels from the M4CV. Each has its own set of parameters as detailed in sections 5.2, 5.3 and 5.4.

5.2 SYNTH SELECT

This mode is not only used to select one of the four synth channels for editing, but also to transpose the key range over which a synth channel responds and to set the ARP CLK parameters.

To select between the three sub-modes within the SYNTH SELECT mode use keys [B], [C] and [D] thus;

```
KEY [B] -> LED (1100xxxx)          :ARP CLK EDIT
KEY [C] -> LED (1010x0xx)          :KEY TRANSPOSE
KEY [D] -> LED (10010xxx)          :SYNTH SELECT
```

5.2.1 SYNTH SELECT : LED (1001xxxx) (xxxx=current SYNTH)

This mode is named SYNTH SELECT since it is used to select which of the four SYNTHs (Synth A/B/C/D) will have its parameters edited when in Edit Mode. The currently selected SYNTH will be displayed on the four LEDs to the right of the main block of eight LEDs (In POLY mode only SYNTH A may be selected).
The SYNTH is selected thus;

```
KEY [H] -> LED (10010001)---(1000) :Selects Synth A
KEY [G] -> LED (10010010)---(0100) :Selects Synth B
KEY [F] -> LED (10010100)---(0010) :Selects Synth C
KEY [E] -> LED (10011000)---(0001) :Selects Synth D
```

In POLY MODE only SYNTH A may be selected.

5.2.2 KEY TRANSPOSE : LED (1010x0xx) (x0xx=transpose value)

This function is used to move the 6 octave range of the M4CV around the MIDI range of 10.5 octaves. It is possible to 'transpose' the M4CV range by +/- 3 octaves in 1 octave steps and each of the four SYNTHs (Synth A/B/C/D) have their own transpose value. Thus the SYNTH is selected as in 5.2.1 above then the transpose value altered with keys [E], [G] and [H]. Key [E] selects whether the transpose is up or down and keys [G], [H] select the number of octaves (in binary) from 0 to 3.

EXAMPLE: here are some examples of transpose values;

DISPLAY	TRANSPOSE	KEY RANGE
LED (10100000) OR LED (10101000)	:no transpose	24 - 96
LED (10101010)	:down 2 oct.	48 -120
LED (10100001)	:up 1 oct.	12 - 84
LED (10100011)	:up 3 oct.	0 - 60
LED (10101001)	:down 1 oct.	36 -108

Note that in transposing upwards the M4CV range moves down the MIDI key range and vice-versa.

5.2.3 ARP CLK EDIT : LED {1100xxxx} (xxxx= arp. clk mode)

This mode is provided for editing the arpeggiator clock output, this would typically be used for synchronising an arpeggiator or sequencer to the MIDI clock, it supports MIDI START, STOP, CONTINUE and CLOCK data. There are two parameters to edit;

(i) **CLOCK RATE**, this is the number of MIDI clocks per Arp. Clock, ie. MIDI clock divide factor. There are eight values and these are selected with keys [F] to [H] in binary format as follows;

LED {F G H}	CLOCK DIVIDE
0 0 0	2
0 0 1	3 — * KR-55 (+ clock with start)
0 1 0	4
0 1 1	6
1 0 0	8
1 0 1	12
1 1 0	16
1 1 1	24

(ii) **CLOCK SENSE**, this determines which direction the Arp. Clock output goes for a clock event, it is altered with key [E] which selects between a HI->LO clock or a LO->HI clock. In both cases the Arp. clock output swings between 0<->+10V. In most cases a LO->HI clock will be used, the state of this parameter is shown on LED E as;

LED {11000xxx} :clock HI->LO
LED {11001xxx} :clock LO->HI

EXAMPLES: Here are some examples of Arp. Clock values;

LED {11001000} :LO->HI, 12 ppqn
LED {11001011} :LO->HI, 4 ppqn — 16th
LED {11000110} :HI->LO, 1.5 ppqn

5.3 EDIT MODE

This mode is used to edit the parameters of the SYNTH selected previously (sect.5.2). The parameter is selected with keys [B] to [D] and each key selects one of two parameters, by pressing a given key more than once editing will step between the two parameters, the LED for the given key flashes slow or fast depending on which parameter is selected.
The parameters are selected as follows;

```
KEY [B] -> LED {++OOxxxx}          :MIDI CHANNEL
     KEY [B] -> LED {+*OOxxxx}     :KEY PRIORITY
KEY [C] -> LED {+O+Oxxxx}          :TRIGGER TYPE
     KEY [C] -> LED {+O*Oxxxx}     :PITCHBEND SET-UP
KEY [D] -> LED {+OO+xxxx}          :LEVEL SOURCE
     KEY [D] -> LED {+OO*xxxx}     :LEVEL OFFSET
```

It is possible to move between the parameters in any order with the obvious constraint that the second functions on the keys can only be accessed after the first !!! At all times in EDIT mode the currently selected SYNTH will be shown on the four LEDs to the right of the eight main LEDs.

5.3.1 MIDI CHANNEL : **LED {++OOxxxx}** (xxxx= MIDI channel)
This is the MIDI channel on which the SYNTH will receive data, it is set in binary format with keys [E]-[H], now as binary format only allows for the numbers 0 to 15 it is necessary for you to add 1 to the value when interpreting the display or to subtract 1 when entering a value. So 0000 = chan.1, 0001 = chan.2, 0010 = chan.3,....., 1111 = chan.16, there is NO OMNI mode.
EXAMPLES: here are some typical displays;

```
LED {++OO1OO1}                :MIDI CHANNEL 10
LED {++OOOOOO}                :MIDI CHANNEL  1
LED {++OO11O1}                :MIDI CHANNEL 14
```

5.3.2 KEY PRIORITY : **LED {+*OOXxxx}** (xxx=priority, X=start)
This selects one of three key priorities for the SYNTH, it also selects if there is a clock with start for the Arp Clock or Din-Sync modes. The key priorities are Flag values and are selected with keys [F]-[H], only one priority may be active at a time, selection is as follows;

```
KEY [H] -> LED {+*OOxOO1}     :NEW  PRIORITY
KEY [G] -> LED {+*OOxO1O}     :LOW  PRIORITY
KEY [F] -> LED {+*OOx1OO}     :HIGH PRIORITY
```

NEW PRIORITY: The M4CV will assign the most recent NOTE-ON.
LOW PRIORITY: The M4CV will assign the lowest NOTE-ON.
HIGH PRIORITY:The M4CV will assign the highest NOTE-ON.

Thus LOW priority would be used to make the synth follow the bass line of a polyphonic part and HIGH priority for the lead line. New priority should generally be used for monophonic parts.

NOTE: KEY PRIORITY DOESN'T APPLY IN POLY MODE.

CLOCK WITH START : This mysterious parameter has been put in here as there was nowhere else to put it ! It is used to get around the problem that occurs with the MIDI START command, some systems interpret the START as the first CLOCK of the sequence, whereas other systems will send a CLOCK with the START. This parameter enables you to select whether there is a clock with start or not and adjusts the Arp. Clock output accordingly. Key [E] alters this parameter as follows;

```
KEY [E] -> LED {+*000xxx}          :NO CLOCK WITH START
KEY [E] -> LED {+*001xxx}          :CLOCK WITH START
```

This parameter is altered by key [E] regardless of which SYNTH is currently selected.

5.3.3 TRIGGER TYPE : LED {+0+0Xxxx} (X=Multi/Single, xxx=trig)

This parameter selects one of three trigger types for the TRIG output and whether notes will be retriggered (multi.) if a new note on is received before the last note was released. The three trigger types were described in section 2, selection is;

```
KEY [F] -> LED {+0+0X100}          :-VE TRIGGER
KEY [G] -> LED {+0+0X010}          :GND TRIGGER
KEY [H] -> LED {+0+0X001}          :+VE TRIGGER
```

If you have the S-TRIG option fitted then the +VE trigger should be selected to drive the S-TRIG output correctly.
To select multi/single trigger use key [E], with single trigger the synth will only be triggered if a new note is played and there are no notes currently sounding, select thus;

```
KEY [E] -> LED {+0+00xxx}          :SINGLE TRIGGER
KEY [E] -> LED {+0+01xxx}          :MULTI  TRIGGER
```

5.3.4 PITCHBEND SET-UP : LED {+0*0xxxx} (xxxx= bend amount)

This is a utility rather than a parameter, it enables pitchbend amount to be set-up in semitone steps. The bend amount is set in binary format on keys [E] to [H], the amount may vary between 0 semitones -> LED {+0*00000}
and +/- 1 Oct. -> LED {+0*01100}
In order to set-up the pitchbend amount, set the desired amount on keys [E] to [H] in binary format. The SYNTH you are working on will be continuously triggering, every 400ms or so, if you notice a difference in pitch between adjacent triggers then BEND amount requires adjustment. Adjust the relevant BEND trimmer (see section 4) until the adjacent triggers are at the same pitch.

POLY PITCHBEND: In POLY MODE one ideally wants the same amount pitchbend applied to all channels. This would require all four pitchbend pots to be adjusted whenever you adjust the pitchbend amount. So to simplify things a switch is provided on the front panel which when in the POLY position will switch the synth channel A pitchbend voltage to all the other channels, so that it is now only necesary to adjust the channel A pitchbend pot.

5.3.5 LEVEL SOURCE : **LED {+00+xxxx}** (xxxx= source)

This parameter selects which sources of MIDI data have control over the LEVEL output, there are four to choose from as follows;

```
KEY [E] -> LED {+00+1xxx}        :BREATH CONTROLLER
KEY [F] -> LED {+00+x1xx}        :AFTER TOUCH
KEY [G] -> LED {+00+xx1x}        :MOD. WHEEL
KEY [H] -> LED {+00+xxx1}        :VELOCITY
```

Any combination of the above four may be selected to control the LEVEL output.

5.3.6 LEVEL OFFSET : **LED {+00*xxxx}** (xxxx= offset)

This parameter is used to set an offset voltage on the LEVEL output, this may be necessary if you are applying the LEVEL output to the filter cutoff on the synth and you want to raise the filter cut-off frequency. A typical situation where this would be required is for after-touch, where when you release all the keys the after-touch value will go to zero, this would normally close the filter right up but with offset you can control the close-up point. The offset value is entered in binary format using keys [E] to [H], the amount of offset ranges from 0 to a value just short of the maximum possible output on LEVEL;

```
LED {+00*0000}        :NO   OFFSET
     to
LED {+00*1111}        :MAX. OFFSET
```

5.4 MEMORY STORE/RECALL

There are 16 memory locations in which to store M4CV set-ups, each memory will store the parameters for each of the three modes of operation separately. So when you recall a memory the current mode of operation continues, with the new parameters. The ARP CLK parameter is also stored in each memory.

5.4.1 MEMORY RECALL : **LED {*100xxxx}** (xxxx=current mem. #)

At power-on the M4CV will recall the memory that was active before the M4CV was last turned off. This memory number is displayed on LEDs E-H in binary form, LED B will also be lit to indicate memory recall mode. So a typical display after power on is {*10011101} showing that memory number 13 has been recalled.

To recall another memory proceed thus:

1. select memory number with keys [E] to [H], setting the desired memory number 0-15 in binary. Note that when the mem. number displayed is not the same as that currently active then LED D will flash slowly.
2. having selected the desired mem. number press key [B], the new parameters are installed.

If LED D flashes rapidly then the mem. just recalled has invalid data in it, this may be the case when the unit has been just been purchased and the memories have not yet been filled with data.

Each memory stores data for the set-up of each synth control channel, also the ARP CLK parameters, and the SIMM parameters.

EXAMPLE: mem. #3 currently active and you want mem. #11.

```
LED (01000011)                      :mem. # 3 currently active
KEY [E] -> LED (010+1011)           :mem. #11 set
KEY [B] -> LED (01001011)           :mem. #11 recalled OK.
        -> LED (010*1011)           :mem. #11 data corrupted.
```

5.4.2 MEMORY STORE : LED (*010xxxx) (xxxx= mem. #)

Having edited the parameters for a particular synth setup, you may now wish to save this for future use, proceed as follows:

1. Select memory number from 0 to 15 with keys [E] to [H], if this is different from the current mem.# then LED D will slow-flash.
2. Press key [C], the data is now stored in the mem.# shown on LED E to H and will be retained after power down for future recall.

EXAMPLE: store edited data in mem.#14, not current mem.#.

```
KEY [E] TO [H]-> LED (*01+1110)     :SELECT MEM.#14
KEY [C]       -> LED (*01011110)    :DATA STORED
```

6. SIMM MODE

The SIMM mode is designed to trigger drum-synth modules that would normally be triggered by drum-pads or "bugs". It is possible to select the MIDI channel and half-octave where triggers will occur, independently for two groups of six control outputs. The level of the trigger is determined by the velocity of the triggering note (six consecutive notes determine triggering).

There are 12 control outputs, the PITCH, LEVEL and TRIG outputs for synth A/B/C/D. These outputs will produce trigger voltages in the range 0V to 4V depending on the velocity of the trigger note.

Each group of six control outputs are assigned to six consecutive MIDI notes. Note, it is important to set the coarse tune pot for synths A/B/C/D to the centre of its range, otherwise it will apply an offset voltage to the PITCH outputs, which may in turn cause false triggering to occur.

Note, when on page 1, the MODE select page LED A will flash in time to the received MIDI clock, provided a MIDI START command has been received. To avoid any confusion as to which mode you are in, the four LEDs to the right of the main display will indicate SIMM mode by (1001).

6.1 EDITING PARAMETERS:

There are two edit pages in SIMM MODE called GROUP 1 and GROUP 2, each page applies to a group of six outputs, GROUP 1 applies to SYNTH channels A and B, while GROUP 2 applies to SYNTH channels C and D. There are only two parameters to edit in each page, MIDI channel and trigger note block. First the GROUP 1 parameters are covered in detail (6.1.1 and 6.1.2), then the GROUP 2 parameters are covered briefly (6.1.3 and 6.1.4) as they are the same as the GROUP 1 parameters in principle.

6.1.1 MIDI CHANNEL: **LED {100+xxxx}**, xxxx=channel

This parameter is altered in the same way as the MIDI channel for synths., see section 5.3.1 of the M4CV manual. This sets which MIDI channel the GROUP 1 trigger outputs will be active on.

6.1.2 TRIGGER NOTES: **LED {10+0xxxx}**, xxxx=half octave block

This parameter allows you to assign which six notes of the MIDI key range will be assigned to the trigger outputs, for GROUP 1. The value is entered in binary format with a value of 0 to 15, to work out the base of the half octave simply multiply this value by 6 and add 12 (then subtract the number you first thought of.....), alternatively use the handy Groove half-octave look-up table;

LED xxxx	BASE NOTE	MIDI NOTE #
0000	-C1	12
0001	-F#1	18
0010	C0	24
0011	F#0	30
0100	C1	36
0101	F#1	42
0110	C2	48
0111	F#2	54
1000	C3	60
1001	F#3	66
1010	C4	72
1011	F#4	78
1100	C5	84
1101	F#5	90
1110	C6	96
1111	F#6	102

6.1.3 MIDI CHANNEL: **LED {+00+xxxx}**, xxxx=MIDI channel

This parameter is the same as that in 6.1.1 but applies to the GROUP 2 outputs.

6.1.4 TRIGGER NOTES: **LED {+0+0xxxx}**, xxxx=half octave block

This parameter is the same as that in 6.1.2 but applies to the GROUP 2 outputs.

6.2 MEMORY STORE/RECALL

The memory store/recall page is the same as that in MONO/POLY mode, so refer to sec. 5.4 for further details of this function.

7. REFERENCE

Here is a reference table to help in deciphereing operation and editing on the M4CV. The first table applies to MONO/POLY mode, while the second applies to SIMM mode.

POLY/MONO MODE REFERENCE:

KEY:A	B	C	D	E	F	G	H
MODE 0	SIMM 1	POLY 1	MONO 1				
SYNTH 1 SEL.	ARP CLK	TRANSP.	SYN-SEL	SENSE UP/DOWN SYN-D	<------CLK DIV------> XXX	<--OCT 0-3--> SYN-C	SYN-B	SYN-A
EDIT + (1st 1)	CHAN	TRIG	LEVEL	<----------CHAN 1-16----------> SIN/MUL BREATH CLK+STT	-VE AFTER HIGH	GND MOD LOW	+VE VEL NEW
EDIT + (2nd +)	PRITY	P/B AMT	OFFSET	<---------AMOUNT 1-12---------> <-----LEVEL OFFSET 1-16----->			
MEM *	RECALL	STORE		<----------MEM #1-16----------> <----------MEM #1-16---------->			

SIMM MODE REFERENCE:

KEY:A	B	C	D	E	F	G	H
MODE 0	SIMM 1	POLY 1	MONO 1				
GROUP 1 ONE		BLOCK	CHAN	<--------KEY BLOCK 1-16------> <----------CHAN 1-16---------->			
GROUP + TWO		BLOCK	CHAN	<--------KEY BLOCK 1-16------> <----------CHAN 1-16---------->			
MEM *	RECALL	STORE		<----------MEM #1-16----------> <----------MEM #1-16---------->			