KRM MUSIC SYSTEMS

[KRM-100]
MIDI-CV-Arpeggiator

2016-12-02
Manual v1.7
Hardware v1.1
Firmware v1.08

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Thank You

Thank you for purchasing the [KRM-100] MIDI-CV-Arpeggiator.

If you have any questions or comments, please visit my website for contact information.

www.krmmusicsystems.com

-Keith Robert Murray

1 Quick Setup Instructions

- Connect the standard Eurorack 16-pin power connector to the back of the [KRM-100]. Be careful to orient the cable correctly, with the -12 volt pins towards the bottom of the module, where it is marked "Red Stripe" on the board.
- Adjust the contrast control (small trimmer on the left side edge of the module) for the best display output.
- The pitch CV appears on the CV jack (defaults to 1 V/octave).
- The gate signal appears on the GATE jack (defaults to 5 V V-trig).
- The aux CV (controlled by MIDI CC 74) appears on the AUX jack.
- The arpeggiator output is echoed on the MIDI out jack, in addition to the CV and GATE jacks.

1.1 MIDI Controllable Features

The various features of the [KRM-100] are controlled with the following MIDI control messages (knobs and buttons).

Feature	MIDI Control	Notes
Arpeggiator On/Off	CC 85 (Toggle Button)	Start or stop the arpeggiator.
Arpeggiator Latch On/Off	CC 64 (Sustain Pedal)	Notes played while the sustain pedal is depressed will latch into the arpeggiator.
Arpeggiator Pattern	Program Change	Select Program Change (patch change) numbers to select the arpeggiator pattern.
Arpeggiator Clock Source (Internal / MIDI)	CC 83 (Toggle Button)	Choose internal clock, or MIDI sync.
Arpeggiator Speed / Quantization	CC 19 (Rotary)	Change the arpeggiator speed, or beat quantization for MIDI sync.
Arpeggiator Gate Width	CC 72 (Rotary)	Change the gate width (note length).

Mini Sequencer Record Start / Stop	CC 86 (Toggle Button)	Start or stop recording on the mini sequencer.
Aux CV	CC 74 (Rotary)	Adjust the aux CV output (typically the filter).
Pitch Wheel Range	CC 15 (Rotary)	Change the maximum range of the pitch wheel (1 to 12 semitones in both directions).
LFO Speed / Quantization	CC 16 (Rotary)	Change the speed of the built-in LFO, or beat quantization for MIDI sync.
LFO Waveshape	CC 17 (Rotary)	Change the waveshape of the built-in LFO.
LFO Phase	CC 18 (Rotary)	Change the phase (start point) of the built-in LFO.
LFO Key Sync On/Off	CC 81 (Toggle Button)	Restart the LFO waveshape on every key press.
LFO clock source (Internal / MIDI)	CC 82 or 83 (Toggle Button)	Select internal clock, or MIDI sync.
Mod Control	CC 1 (Modulation Wheel)	Modulation wheel.
Mod Range	CC 15 (Rotary)	Change the maximum range of the modulation depth (1 to 12 semitones).
Mod Mapping (pitch, aux CV)	CC 80 (Toggle Button)	Select pitch modulation, or aux CV modulation (typically the filter).
Portamento Speed	CC 5 (Rotary)	Change the portamento speed.
Portamento Mode	CC 84 (Toggle Button)	Choose constant rate, or constant speed portamento.
Portamento On/Off	CC 65 or 5 (Toggle Button)	Turn portamento on or off.

1.2 Arpeggiator, Mini Sequencer, and LFO MIDI Sync

When synced to MIDI beat clock, the speed control for the arpeggiator and mini sequencer (MIDI CC 19), and LFO (MIDI CC 16), select from the following quantizations:

MIDI Beat Clock Sync	
4 Whole Notes	3 Whole Notes
2 Whole Notes	Whole Note
Half Note	Half Note Triplet
Quarter Note	Quarter Note Triplet
Eighth Note	Eighth Note Triplet
Sixteenth Note	Sixteenth Note Triplet
Thirty-second Note	Thirty-second Note Triplet

1.3 LFO Waveshapes

The LFO waveshape control (MIDI CC 17) selects from the following:

LFO Waveshapes	
Triangle	
Sawtooth	Inverted Sawtooth
Square (50% Pulse)	40% Pulse
30% Pulse	20% Pulse
10% Pulse	Random

1.4 Using The Arpeggiator

- Start the arpeggiator (MIDI toggle button CC 85).
- Play a chord, and keep the notes depressed.
- Change the arpeggiator pattern with MIDI Program Change messages (patch change messages). The Up and Down buttons on the module will also cycle through the arpeggiator patterns and octave repeats, respectively.
- The sustain pedal (CC 64) will latch the notes into the arpeggiator, which will keep playing even if you release all notes on the keyboard.
- Stop the arpeggiator (MIDI toggle button CC 85) to return to normal playing. The red Config button on the module will also stop the arpeggiator.

The first number in the Program Change message selects the arpeggiator pattern from the following list:

Arpeggiator Patterns	
1. Up (UP)	2. Down (DN)
3. Up-Down (UD)	4. Down-Up (DU)
5. Up-Down with Repeated Note (UDR)	6. Down-Up with Repeated Note (DUR)
7. Random (RND)	8. Mini Sequencer (Custom Patt.) (SEQ)

The second number in the program change message selects the number of octaves to repeat with the pattern (from 1 to 5).

For example, sending program change **13** will select the **Up** pattern, repeated over **3 octaves**. This will be shown on the display as 3UP.

If you are using a Roland MIDI controller with '88' style number buttons, or an older MIDI controller that starts the program change numbering at 1 instead of 0 (some Yamaha keyboards), then see the PC TYPE parameter in section **3 Changing The Default Configuration**.

1.5 Recording With The Mini Sequencer

There is a mini sequencer inside of the arpeggiator, that can store up to 32 notes or rests (including velocity or the Aux CC channel).

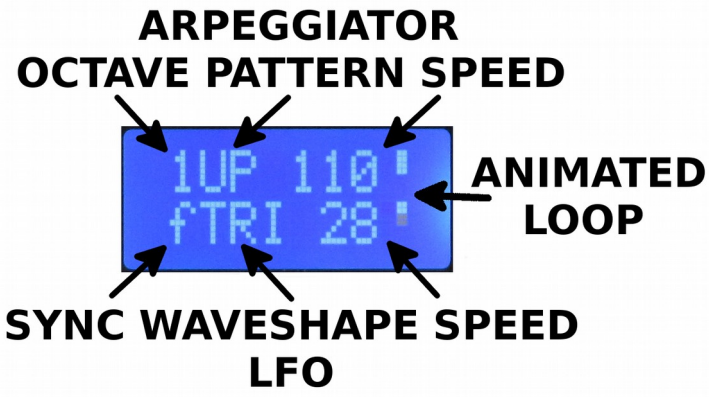
- Start the arpeggiator (MIDI toggle button CC 85).
- Enable mini sequencer recording (MIDI toggle button CC 86).
- Play notes one at a time, step-sequencer fashion. Press the sustain pedal to insert a rest. The Down button on the module will also insert a rest. The display will show how many notes and rests have been entered.
- Disable mini sequencer recording (MIDI toggle button CC 86).
- Press a single note, and your sequence will play back. It will be transposed by the note you are playing, relative to middle C.
- Stop the arpeggiator (MIDI toggle button CC 85) to return to normal playing. The red Config button on the module will also stop the arpeggiator.

To play back a previously recorded sequence, select pattern 8 (SEQ) in the arpeggiator. It is also possible to repeat the sequence over multiple octaves, just like any other arpeggiator pattern.

The last sequence recorded is saved in non-volatile memory, and is retained when power to the [KRM-100] is removed.

2 Real Time Display

During normal operation, the display will show the current status of the arpeggiator and LFO.



2.1 Arpeggiator and LFO Speed Display

When the arpeggiator or LFO is under MIDI sync, the speed will be shown as a subdivision of the beat. For example, one step of the arpeggiator could occur on every 8th note, and this will be displayed as 8. The display values are:

MIDI Beat Clock Speed Display	
W4 - 4 Whole Notes	W3 - 3 Whole Notes
W2 - 2 Whole Notes	W1 - Whole Note
2 - Half Note	2T - Half Note Triplet
4 - Quarter Note	4T - Quarter Note Triplet
8 - Eighth Note	8T - Eighth Note Triplet
16 - Sixteenth Note	16T - Sixteenth Note Triplet
32 - Thirty-second Note	32T - Thirty-second Note Triplet

The speed of the arpeggiator and LFO are also shown as an animated loop.

The downbeat of the arpeggiator will be shown as 1 in the animated loop, when it is under MIDI sync. Under very fast speeds, the downbeat occurs very quickly, and may not be visible on the display. The animated loop of the LFO will be shown as + at speeds above about 25 Hz.

2.2 LFO Sync Display

The LFO sync display values are:

LFO Sync Display
f - Free Run
k - Restart On Key Down
m - MIDI Sync

2.3 Other Display Messages

Many other display messages will appear temporarily, as you control other features of the [KRM-100].

Temporary Display Messages
LFO PHAS – LFO phase in degrees.
MOD MAP – Modulation mapping to PTCH CV (pitch) or AUX CV.
ARP GATE – Arpeggiator gate time as a percent.
ARP LTCH – Arpeggiator note latch ON or OFF.
SUSTAIN – Sustain pedal ON or OFF.
PORTMNTO – Portamento time, and type (constant RATE or constant TIME).
MOD RNG SEMI – Maximum modulation range, in semitones.
PW RNG SEMI – Maximum pitch wheel range, in semitones.
SEQ REC NOTE – Indicates the current step number, for the mini sequencer.
SEQ FULL – Indicates that the mini sequencer is full.
SYSEX – Incoming SysEx message has been received.
SYSEX ERROR – There is an error in the incoming SysEx message.

3 Changing the Default Configuration

The default configuration of the [KRM-100] assumes the most common setup:

- 1 V/octave response.
- 5 volt V-trig gate.
- Lowest key on the MIDI controller corresponds to low C (MIDI note 36)
- Listen on MIDI channel 1.
- Portamento speed and on/off control are both set to MIDI CC 5.
- Sustain pedal controls traditional sustain, and also latches notes into the arpeggiator.
- No scale or range tuning compensation.

Use the front panel buttons to change the configuration:

- Press the Config button.
- Scroll through the list of parameters with the Up and Down buttons. The > character will appear, indicating the value stored in memory.
- To edit a parameter, hold the Config button down for 2 seconds. The < character will appear, indicating the Edit mode.
- Scroll through the list of values with the Up and Down buttons. Alternatively, turn or press MIDI controls, and the [KRM-100] will automatically detect the correct MIDI CC for knobs, faders, etc.
- Press the Config button to save the value, and exit the Edit mode.
- Press the Config button again to exit.

All configuration changes are saved in non-volatile memory, and are retained when power is removed from the [KRM-100].

The following is a full list of configuration parameters:

Configuration Parameters
MIDI CH – MIDI Channel.
AUX CV CC – MIDI CC for aux CV.
ARP ENBL CC – MIDI CC toggle button for arpeggiator on/off.
ARP SPED CC – MIDI CC for arpeggiator speed or MIDI beat quantization.
ARP GATE CC – MIDI CC for arpeggiator gate percent.
ARP LTCH CC – MIDI CC toggle button for arpeggiator latch (typically the sustain pedal, or CC 64).

ARP SYNC CC – MIDI CC toggle button for arpeggiator free run / MIDI sync.
SEQ REC CC – MIDI CC toggle button for mini sequencer record start/stop.
SEQ REC AUX – Aux CC recording enabled for the mini sequencer (YES or NO).
LFO WAVE CC – MIDI CC for LFO waveshape select.
LFO SPED CC – MIDI CC for LFO speed or MIDI beat quantization.
LFO KEY – Default value for LFO FREERUN or RETRIG on key down.
LFO KEY CC – MIDI CC toggle button for LFO key down control.
LFO PHAS CC – MIDI CC for LFO phase in degrees.
LFO SYNC CC – MIDI CC toggle button for LFO free run / MIDI sync.
MOD WHEL CC – MIDI CC for modulation control (typically CC 1).
MOD MAP – Default value for modulation mapping to PTCH CV (pitch) or AUX CV.
MOD MAP CC – MIDI CC toggle button to select the modulation mapping.
MOD RNGE SEMI – Default value for modulation range in semitones.
MOD RNGE CC – MIDI CC for modulation range in semitones.
PW RANGE SEMI – Default value for pitch wheel range in semitones.
PW RANGE CC – MIDI CC for pitch wheel range in semitones.
PORT ENB CC – MIDI CC toggle button for portamento On/Off.
PORT SPD CC – MIDI CC for portamento speed.
PORT TYP – Default value for portamento type constant RATE or constant TIME.
PORT TYP CC – MIDI CC toggle button for portamento type.
VOLT OUT – Voltage output of 1V/OCT, 1.2V/OC, 0.32V/OC, or Hz/V.
TUNE SCAL – Tuning offset for scale (factory calibrated to 0).
TUNE RNGE – Tuning offset for range (factory calibrated to 0).
ALT TUNE – Enable the alternate tuning mode, and set it to an Equal Divisions of the Octave scale (EDO) or edit individual semitones of the custom tuning table (USR mode).
GATE – Select gate type of V-TRIG or S-TRIG.
MULT TRG – Multi-trig delay value in milliseconds (0 indicates no multi-trig).
KEY MODE – Key priority of LOW PRI (low note), HIGHPRI (high note), or

LASTPRI (last note).
MIDI OUT PW – MIDI pitch wheel output YES or NO.
MIDI OUT MOD – MIDI modulation wheel output YES or NO.
MIDI OUT VEL – MIDI key velocity output YES or NO.
MIDI VEL DFLT – Default value for MIDI key velocity output, if MIDI velocity has been disabled.
ACTV SEN – MIDI Active Sense message detection ENABLE or DISABLE.
SND OFF – MIDI All Sound Off message detection ENABLE or DISABLE.
NOTESOFF – MIDI All Notes Off message detection ENABLE or DISABLE.
RSET CON – MIDI Reset All Controllers message detection ENABLE or DISABLE.
PC TYPE – Program Change (patch change) type of START@0 (most keyboards), START@1 (older Yamaha keyboards), or 88 (Roland “88” keyboards).
BTN TYPE – Select TOGGLE for newer MIDI controllers, or NON-TGL for older controllers that do not support toggle buttons.
MIDI LOW NOTE – MIDI note number corresponding to 0 volts pitch CV output.

3.1 Assigning Aftertouch, Channel Pressure, Velocity, and Pitch Wheel As MIDI CC Parameters

The MOD WHEL CC and AUX CV CC parameters are normally assigned to standard MIDI CC controls (like knobs, wheels, or faders). However, they can also be assigned to the pitch wheel, channel pressure, aftertouch, and key velocity. In the parameter list, these values can be found after CC number 119, and are shown as PW, PRS, AFT, and VEL, respectively.

When in the Edit mode, you can press any MIDI key to automatically select VEL, or move the pitch wheel to select PW.

4 Configuration Tips

If your MIDI controller has a minimal number of knobs, faders, and buttons, the following tips may help you conserve their use.

- Don't try to assign every parameter to a MIDI knob, fader, or button. If you don't need to control a parameter in real-time (like the portamento type), assign the default value in the Configuration menu, and ignore any MIDI control.
- Assign the arpeggiator and LFO MIDI sync control to the same button. In most situations, you will want to enable or disable MIDI sync on the arpeggiator and LFO at the same time. This is the factory default setting of the [KRM-100].
- Assign the portamento On/Off and speed control to the same knob. In this case, the [KRM-100] will automatically turn the portamento off, if the speed control is set to 0 (the lowest setting). This is the factory default setting of the [KRM-100].
- Assign the pitch wheel and MOD pitch range control to the same knob. In most cases, if you are limiting the pitch wheel range, you also want to limit the MOD pitch range by the same amount.
- Remember that the Sustain pedal (and other pedals, if you have them), act as on/off toggle switches. The factory setting of the [KRM-100] uses the sustain pedal as both traditional sustain, and for the latch control on the arpeggiator.

5 Range and Scale Tuning Adjustment

The [KRM-100] has a built-in voltage reference, and is tuned digitally. There are no potentiometers or trimmers. It has been factory calibrated to the 1 volt/octave standard.

If it should become necessary to adjust the tuning, this can be done in the Configuration menu, using the TUNE RANG (range) and TUNE SCAL (scale) parameters. The value of each parameter can be varied between -64 and 63, with a value of 0 corresponding to the factory calibration. Each step corresponds to a pitch change of approximately 2 cents.

6 Alternate Tuning Mode

The [KRM-100] can be configured to 3 different tuning modes.

6.1 12-Tone Equal Temperament

- In the Configuration menu, select the ALT TUNE parameter, and set it to a value of OFF 0. This is the default mode.

6.2 Any Equal Division of the Octave (from 2-EDO to 60-EDO)

- In the Configuration menu, select the ALT TUNE parameter, and set it to a value of EDO 2, through to EDO 60. The EDO modes can not be used if the CV pitch output is configured for Hz/V.

6.3 User Defined Tuning Table (Any Arbitrary Scale)

- In the Configuration menu, select the ALT TUNE parameter, and set it to USR 1. Keep the menu in the Edit state (with the < character showing).
- Press any MIDI key, and keep it pressed.
- Adjust the coarse tuning of this key by tuning the MIDI knob associated with the arpeggiator speed (CC 19).
- Adjust the fine tuning of this key by turning the MIDI knob associated with the LFO speed (CC 16).
- Continue for every key that you want to adjust.
- Exit the Edit state, and then exit the Configuration menu.

To make tuning easier, connect a MIDI synthesizer or sound module to the MIDI output jack. Monitor the output of the MIDI synthesizer, and use it as a pitch reference for each key.

7 Resetting the KRM-100 to the Factory Defaults

To reset the [KRM-100] back to the factory defaults, power off the module, hold down the Config button, and then power the module back on. A message of DEFAULTS LOADED will appear on the display.

8 Setting The Gate Output To 12 Volts

The [KRM-100] can be used to drive an external analog synthesizer, outside of the Eurorack system it is installed in. Some synthesizers (like the Arp Odyssey) require a higher gate voltage than the Eurorack 5 volt standard.

The gate output of the [KRM-100] can be set to 12 volts via a jumper on the right side edge of the module.

WARNING: Ensure that the synthesizer or modules receiving the 12 volt gate signal are compatible with this higher voltage.

Appendix A – Technical Specifications

[KRM-100] MIDI-CV-Arpeggiator Module

- Eurorack format 14HP.
- +12 V (45 mA), and -12 V (10 mA).
- 5-pin DIN MIDI input and output.
- 0 to 5 V output for pitch and aux CV.
- 16-bit DAC.
- 1 V/oct, 1.2 V/oct, 0.32 V/oct, or Hz/V pitch CV response.
- S-Trig or V-Trig gate.
- 5 V or 12 V gate output.

Appendix B – Configuration Update Via SysEx

All configuration settings on the [KRM-100] can be changed by using SysEx messages. It is also possible to request a configuration dump over SysEx. This can be used to restore the [KRM-100] back to a known configuration state, or to clone one module from another.

Any changes made to the configuration are immediately stored in non-volatile memory, and are retained when the [KRM-100] is turned off.

The SysEx format for all configuration changes is shown below. The SysEx start and end bytes (F0h and F7h) are typically added in by SysEx librarian software, and do not need to be included.

F0 00 02 0C 01 01 <Device ID> <ACTION> <PARAMETER> <DATA> F7

If more than one [KRM-100] is used in a single chain of MIDI devices, each one should be given a unique **Device ID** (see parameter **3Eh** in the **Parameter Descriptions** table below). This will allow SysEx messages to be read by one [KRM-100], but ignored by others. By default, this ID is set to 00h. Sending an ID of 7Fh will be recognized by all boards, regardless of their actual Device ID.

The **ACTION** byte determines whether the SysEx message is a configuration update (writing to the [KRM-100]), a request for a configuration dump, or some other action. The ACTION byte must be one of the following:

01h - Request a configuration dump.
41h - Write a new configuration value to the board.
61h - Factory reset.
62h - Copy the current tuning table to the custom tuning table memory.

Some actions may also require a PARAMETER byte, and DATA bytes.

The **PARAMETER** byte determines which parameter settings will be updated, or returned in a configuration dump. A single parameter can be chosen (from the **Parameter Descriptions** table below), or a group of parameters can be selected from the following values:

40h - The full main configuration, excluding the custom arpeggiator pattern, and tuning table (64 bytes of data).
41h - The custom arpeggiator pattern (64 bytes of data).
44h – The custom tuning table, MSB (61 bytes of data).
45h – The custom tuning table, LSB (61 bytes of data).

Each PARAMETER is associated with one or more **DATA** bytes. If a configuration dump is requested, then a single DATA byte is required, indicating the number of seconds to pause before sending the data dump. This will allow the SysEx librarian software enough time to get ready to capture the configuration dump.

When sending multiple SysEx configuration messages in a row, pause for a few seconds between them.

Example SysEx Messages

Factory Reset
F0 00 02 0C 01 01 00 **61** F7

Update the MIDI Listen Channel to 0Fh (16)
F0 00 02 0C 01 01 00 **41 00 0F** F7

Update the Arpeggiator Start Button CC to 04h (4)
F0 00 02 0C 01 01 00 **41 1E 04** F7

Update the Power-on Value for the Aux CV to 7Fh (127, fully on)
F0 00 02 0C 01 01 00 **41 06 7F** F7

Enable MIDI Active Sense
F0 00 02 0C 01 01 00 **41 31 01** F7

Enable MIDI All Notes Off
F0 00 02 0C 01 01 00 **41 33 01** F7

Disable Velocity on MIDI Out, and set the Default Velocity to 7Fh (127)
F0 00 02 0C 01 01 00 **41 29 00** F7
F0 00 02 0C 01 01 00 **41 2A 7F** F7

Request the Full Main Configuration, Waiting For 5 Seconds Before the Dump
F0 00 02 0C 01 01 00 **01 40 05** F7

The response from the above configuration request is this SysEx message:
F0 00 02 0C 01 01 00 **41 40 00 24 0F 02 03 47 3F 03 10 32 03 11 00 12 00 01 03 0F 02 50 ... 00 00 00 00 00 00 00 00** F7

PARAMETER Descriptions

Parameter 00h	MIDI Listen Channel	
	Default Value	00h (0, MIDI channel 1)
	MIDI listen channel. 00h represents MIDI channel 1. 0Fh represents MIDI channel 16.	

Parameter 01h	Lowest MIDI Note	
	Default Value	24h (32, Low C on most keyboards)
	MIDI note value that represents the lowest key on the host synthesizer.	

Parameter 02h	CC for Pitch Wheel Range	
	Default Value	0Fh (15)
	MIDI CC knob to control the pitch wheel range (the maximum bend up or down).	

Parameter 03h	Power-on Value for Pitch Wheel Range	
	Default Value	02h (2 semitones)
	Power-on value of maximum pitch wheel range (the maximum bend up or down), in semitones.	

Parameter 04h	Smoothing Factor for Pitch Wheel	
	Default Value	03h (3)
	Anti-zipper smoothing value for PW (0 = off, 5 = heavy smoothing)	

Parameter 05h	CC for Aux CV (typically the filter)	
	Default Value	47h (74)
	MIDI CC knob to control the Aux CV (typically the filter) in real time. In addition to any MIDI CC, the Aux CV can also be controlled by the Pitch Wheel (7Ch), Channel Pressure (7Dh), Aftertouch (7Eh), or Key Velocity (7Fh).	

Parameter 06h	Power-on Value for Aux CV	
	Default Value	3Fh (63)
	Power-on value for the aux CV output.	

Parameter 07h	Anti-zipper Smoothing Factor for Aux CV	
	Default Value	03h (3)
	Anti-zipper smoothing value for the aux CV (0 = off, 5 = heavy smoothing).	

Parameter 08h	CC for LFO Speed	
	Default Value	10h (16)
	MIDI CC knob to control LFO speed in real time.	

Parameter 09h	Power-on Value for LFO Speed	
	Default Value	55h (85)
	Power-on value for the LFO speed.	

Parameter 0Ah	Unused	
	Default Value	00h (0)
	Unused.	

Parameter 0Bh	CC for LFO Shape	
	Default Value	11h (17)
	MIDI CC knob to control the LFO shape in real time.	

Parameter 0Ch	Power-on Value for LFO Shape	
	Default Value	00h (0, triangle)
	Power-on value for the LFO shape.	

Parameter 0Dh	CC for LFO Phase (Wave Start)	
	Default Value	12h (18)
	MIDI CC knob to control the LFO phase in real time.	
Parameter	Power-on Value for LFO Phase	

0Eh	Default Value	00h (0)
	Power-on value for the LFO phase.	

Parameter 0Fh	CC for Modulation Control (Mod Wheel)	
	Default Value	01h (1)
	MIDI CC knob to control modulation (typically the Mod Wheel). In addition to any MIDI CC, the Modulation Control can also be controlled by the Pitch Wheel (7Ch), Channel Pressure (7Dh), Aftertouch (7Eh), or Key Velocity (7Fh).	

Parameter 10h	Anti-zipper Smoothing Factor For Modulation Control	
	Default Value	03h (3)
	Anti-zipper smoothing value for modulation control (0 = off, 5 = heavy smoothing).	

Parameter 11h	CC for Modulation Pitch Range	
	Default Value	0Fh (15)
	MIDI CC to control the modulation pitch range in real time.	

Parameter 12h	Power-on Value for Modulation Pitch Range	
	Default Value	02h (2 semitones)
	Power-on value for the modulation pitch range. Note that if modulation is mapped to the Aux CV, and not pitch, then this value is ignored and the output will be the full 0 to 5 volt range.	

Parameter 13h	CC for Modulation Destination Mapping (Pitch CV or Aux CV)	
	Default Value	50h (80)
	MIDI CC button to control the modulation destination mapping in real time (modulate pitch CV, or aux CV)	

Parameter 14h	Power-on Value for Modulation Destination Mapping	
	Default Value	00h (0, pitch CV)
	Power-on value for the modulation destination mapping. 00h (0) maps the modulation source to the pitch CV. 7Fh (127) maps the modulation source to the aux CV.	

Parameter 15h	CC for LFO Key-down Restart (Key Sync)	
	Default Value	51h (81)
	MIDI CC button to control the LFO key-down Restart mode (on/off) in real time.	

Parameter 16h	Power-on Value for LFO Key-down Restart (Key Sync)	
	Default Value	00h (0, looping LFO)
	Power-on value for the LFO key-down restart mode. 00h (0) will cause the LFO to loop continuously. 7Fh (127) will cause the LFO to restart on every key press.	

Parameter 17h	CC for LFO MIDI Sync (Internal / MIDI Clock)	
	Default Value	52h (82)
	MIDI CC button to control the LFO MIDI sync mode in real time, between the internal clock, and MIDI clock.	

Parameter 18h	Power-on Value for LFO MIDI Sync (Internal Clock / MIDI Clock)	
	Default Value	00h (0, internal clock)
	Power-on value for the LFO MIDI sync mode. 00h (0) will sync the LFO to the internal clock. 7Fh (127) will sync the LFO to MIDI clock.	

Parameter 19h	CC for Portamento Rate	
	Default Value	05h (5)
	MIDI CC knob to control the portamento rate in real time.	

Parameter 1Ah	Power-on Value for Portamento Rate	
	Default Value	40h (64)
	Power-on value for portamento rate.	

Parameter 1Bh	CC for Portamento Mode (Constant Rate / Constant Time)	
	Default Value	54h (84)
	MIDI CC button to control the portamento mode in real time.	

Parameter 1Ch	Power-on Value for Portamento Mode (Constant Rate / Constant Time)	
	Default Value	00h (0, constant rate)
	Power-on value for the portamento mode. 00h (0) sets the portamento mode to constant rate (traditional portamento). 7Fh (127) sets the portamento mode to constant time between any two notes.	

Parameter 1Dh	CC for Portamento (On / Off)	
	Default Value	41h (65)
	MIDI CC button to control turning portamento on and off in real time.	

Parameter 1Eh	CC for Arpeggiator (On / Off)	
	Default Value	55h (85)
	MIDI CC button to control turning the arpeggiator on and off in real time.	

Parameter 1Fh	CC for Arpeggiator Latch (On / Off)	
	Default Value	40h (64, sustain pedal)
	MIDI CC button to control turning the arpeggiator latch mode on and off in real time. The default is the sustain pedal.	

Parameter 20h	CC for Arpeggiator Speed	
	Default Value	13h (19)
	MIDI CC knob to control the arpeggiator speed in real time. If the arpeggiator is synced to MIDI clock, then this will control the note quantization for each arpeggiator step.	

Parameter 21h	CC for Arpeggiator Sync Source (Internal / MIDI)	
	Default Value	53h (83)
	MIDI CC button to control the arpeggiator MIDI sync source in real time, between the internal clock or MIDI clock.	

Parameter 22h	Power-on value for Arpeggiator Sync Source (Internal / MIDI clock)	
	Default Value	00h (0, internal clock)
	Power-on value for the arpeggiator sync source. A value of 00h (0) synchronizes to the internal clock. A value of 7Fh (127) synchronizes to the MIDI clock.	

Parameter 23h	CC for Arpeggiator Gate Width	
	Default Value	48h (72)
	MIDI CC knob to control the arpeggiator gate width in real time.	

Parameter 24h	MIDI Program Change Type	
	Default Value	00h (0, buttons start at 0)
	Power-on value for the MIDI program change type. 0 represents program change button numbers that start at 0. 1 represents program change button numbers that start at 1 (typically older Yamaha controllers). 3 represents Roland style 'two rows of 8' buttons.	

Parameter 25h	MIDI Button Toggle Type	
	Default Value	00h (0, toggle type buttons)
	Power-on value for the MIDI button toggle type. 00h (0) represents MIDI controller buttons that toggle between on (127) and off (0) automatically. 01h (1) represents older style MIDI controller buttons that do not automatically toggle. This can be used for older MIDI workstations without hardware toggle built into them.	

Parameter 26h	MIDI Output Enable	
	Default Value	01h (1, enable MIDI out)
	Power-on value to enable MIDI output of the arpeggiator (and notes played live). Set this parameter to 01h (1) to enable, and 00h (0) to disable. To set other MIDI output options (pitch wheel, modulation wheel, key velocity), see parameters 27h to 2Ah.	

Parameter 27h	MIDI Out For Pitch Wheel	
	Default Value	01h (1, enable PW out)
	Power-on value to enable MIDI output of the pitch wheel. Set this parameter to 01h (1) to enable, and 00h (0) to disable. The MIDI Output Enable option (parameter 26h) must also be enabled, for this to take effect.	

Parameter 28h	MIDI Out For Modulation Wheel	
	Default Value	01h (1, enable MOD wheel out)
	Power-on value to enable MIDI output of the modulation wheel. Set this parameter to 01h (1) to enable, and 00h (0) to disable. The MIDI Output Enable option (parameter 26h) must also be enabled, for this to take effect.	

Parameter 29h	MIDI Out For Key Velocity	
	Default Value	01h (1, enable key velocity)
	Power-on value to enable MIDI output of key velocity. Set this parameter to 01h to enable, and 00h (0) to disable. The MIDI Output Enable option (parameter 26h) must also be enabled, for this to take effect.	

Parameter 2Ah	MIDI Out Default Key Velocity	
	Default Value	40h (64)
	Power-on value for the default MIDI out key velocity. If the MIDI output for key velocity is disabled (see parameter 29h), then this value will be used for all key velocities. The MIDI Output Enable option (parameter 26h) must also be enabled, for this to take effect.	

Parameter 2Bh	Gate Type	
	Default Value	00h (0, V-trig)
	Power-on value for the gate type. 0 represents V-trig. 1 represents S-trig.	

Parameter 2Ch	Pitch CV Type	
	Default Value	00h (0, 1 V/octave)
	Power-on value for the pitch CV type. 0 represents 1 V/octave, 1 represents 1.2 V/octave (EML and Buchla), 2 represents 0.32 V/octave (EMS), and 3 represents Hz/volt (early Korg and Yamaha).	

Parameter 2Dh	Unused	
	Default Value	00h (0)
	Unused	

Parameter 2Eh	Key Tracking Mode	
	Default Value	00h (0, low note priority)
	Power-on value for the key tracking mode. 0 represents low note priority (traditional mode). 1 represents high note priority. 2 represents last note priority (for complex trills or very fast articulation).	

Parameter 2Fh	Scale Tuning	
	Default Value	00h (0)
	Power-on value for the scale tuning. 0 represents no scale change. Values from 01h to 3Fh (1 to 63) represent an upward scale stretch (sharp), incrementing by 2 cents each value, for a maximum of 126 cents. Values from 7Fh to 40h (127 to 64) represent a downward scale stretch (flat), decrementing by 2 cents each value, for a minimum of 128 cents. Note that the [KRM-100] has a highly accurate internal voltage reference for tuning, and is factory calibrated. No tuning compensation should be necessary.	

Parameter 30h	Range Offset	
	Default Value	00h (0)
	Power-on value for the range offset. 0 represents no range offset. Values from 01h to 3Fh (1 to 63) represent an upward shift (sharp), incrementing 2 cents each value, for a maximum of 126 cents. Values from 7Fh to 40h (127 to 64) represent a downward shift (flat), incrementing 2 cents each value, for a maximum of 128 cents. It is not possible to set the range offset to cause a negative pitch CV output.	

Parameter 31h	MIDI Active Sense Enable / Disable	
	Default Value	00h (0, disable Active Sense)
	Power-on value for MIDI active sense enabled (01h or 1), or disabled (00h or 0).	

Parameter 32h	MIDI All Sound Off Enable / Disable	
	Default Value	00h (0, disable All Sound Off)
	Power-on value for MIDI All Sound Off enabled (01h or 1), or disabled (00h or 0).	

Parameter 33h	MIDI All Notes Off Enable / Disable	
	Default Value	00h (0, disable All Notes Off)
	Power-on value for MIDI All Notes Off enabled (01h or 1), or disabled (00h or 0).	

Parameter 34h	MIDI Reset All Controllers Enable / Disable	
	Default Value	00h (0, disable Reset All Controllers)
	Power-on value for MIDI Reset All Controllers enabled (01h or 1), or disabled (00h or 0).	

Parameter 35h	Alternate Tuning	
	Default Value	00h (0, 12-Tone Equal Temperament)
	A value of 0 (the default) configures the tuning to 12-Tone Equal Temperament. A value of 1 enables the user defined tuning table (any arbitrary scale). Values from 2 through 60 configure the tuning to Equal Divisions Of The Octave (from 2-EDO through 60-EDO).	

Parameter 36h	Invert Aux CV Output	
	Default Value	00h (0, do not invert Aux CV)
	Invert the Aux CV output. A value of 1 enables Aux CV inversion.	

Parameter 37h	Enable Multi-trig on Gate Output	
	Default Value	00h (0, multi-trig off)
	Enable multi-trig on gate output. This will re-trigger the gate on every key press, even if played legato (not releasing any keys). The value corresponds to the gate re-trigger time in milliseconds, from 1 to 20 ms. A value of 5 ms gives the best feel for most synthesizers.	

Parameter 38h	CC for Mini Sequencer Record (Enable/Disable)	
	Default Value	56h (86)
	MIDI CC button to enable or disable the mini sequencer recording function.	

Parameter 39h	Mini Sequencer Aux CC Channel Record (Enable/Disable)	
	Default Value	01h (1)
	A value of 1 enables recording of the Aux CC, and a value of 0 disables recording of the Aux CC. If Aux CC recording is disabled, key velocity will be recorded, even if key velocity is not mapped to any parameter.	

Parameter 3Ah	Unused	
	Default Value	00h (0)
	Unused	

Parameter 3Bh	Unused	
	Default Value	00h (0)
	Unused	

Parameter 3Ch	Unused	
	Default Value	00h (0)
	Unused	

Parameter 3Dh	Unused	
	Default Value	00h (0)
	Unused	

Parameter 3Eh	Device ID	
	Default Value	00h (0)
	If more that one [KRM-100] module is in the same chain of MIDI devices, give each of them a unique device ID.	

Parameter 3Fh	Unused	
	Default Value	00h (0)
	Unused	

Appendix C – Mini Sequencer Recording Via SysEx

The easiest way to program a custom arpeggiator or mini sequencer pattern is by following the procedure in section **1.5 Recording With The Mini Sequencer**, playing it directly from a MIDI keyboard. However, it is also possibly to write a custom pattern via SysEx, or to read the current pattern via a SysEx data dump.

To program a pattern using SysEx, follow the procedure shown in **Appendix B - Configuration Update Via SysEx**, for parameter 41h.

The data format for the custom pattern is a series of 64 bytes. The first 32 bytes define the MIDI note numbers in the pattern, and the second 32 bytes define the MIDI note velocities.

To define a rest, use a MIDI note number of 7Eh and velocity of 00h (or an Aux CC Channel value between 00h and 7Fh)

All 64 bytes of the custom pattern must be defined, even if the length of the pattern is less than 32 notes.

If the custom pattern is less than 32 notes long, pad the unused note values and velocities with a value of 7Fh.

Appendix D – Custom Tuning Table Via SysEx

In addition to the standard tuning table which gives a voltage curve of V/octave or Hz/volt, a custom tuning table can be defined to give any CV response. This may be useful for VCOs that don't adhere to a traditional curve over their full range, or for DIY VCOs. It is also possible to define other scales or microtonal tunings.

If you have a reference keyboard or other instrument, it is often easier to program the custom tuning table by ear. See section **6 Alternate Tuning Mode**.

If you are calculating the tuning table directly, continue with the process described below.

The standard tuning table, and all pitch modulation, is calculated to a resolution of 16 bits. However, the custom tuning table has a resolution of 14 bits.

The custom tuning table is defined as two banks of values (the MSB 7 bits, and LSB 7 bits). There is a 14-bit value for every semitone from C to C, over 5 octaves (61 semitones in total). The values range from 0 (corresponding to 0 volts output), to 16383 (corresponding to 5 volts output).

To program a custom tuning table, follow the procedure shown in **Appendix B - Configuration Update Via SysEx**, for parameters 44h (tuning table MSB), and 45h (tuning table LSB). After uploading the tuning data, enable the custom tuning table by setting SysEx parameter 35h to 1.

When the custom tuning table is enabled, pitch bend is approximated to either the V/octave curve, or Hz/volt curve. Set SysEx parameter 2Ch accordingly.

One of the SysEx configuration actions (62h) allows you to copy the currently used tuning table into the custom tuning table memory. This can be useful to create a starting point for custom tuning.

Appendix E – MIDI Control Change Information

MIDI Control Change messages (CC), are used to control MIDI beat clock synchronization, the range of pitch bend/modulation, and LFO shapes.

CC Value	MIDI Clock Synchronization (CC 19 for Arpeggiator, CC 16 for LFO)
0 - 9	4 whole notes
10 - 18	3 whole notes
19 - 27	2 whole notes
28 - 36	whole note
37 - 45	half note
46 - 54	half note triplet
55 - 63	quarter note
64 - 72	quarter note triplet
73 - 81	eighth note
82 - 90	eighth note triplet
91 - 99	sixteenth note
100 - 108	sixteenth note triplet
109 - 117	thrity-second note
118 - 127	thirty-second note triplet

CC Value	Pitch Bend/Modulation Range (CC 15 for Pitch Wheel or MOD Wheel Range)
0 - 11	1 semitone
12 - 22	2 semitones
23 - 33	3 semitones
34 - 44	4 semitones
45 - 55	5 semitones
56 - 66	6 semitones
67 - 77	7 semitones
78 - 88	8 semitones
89 - 99	9 semitones
100 - 110	10 semitones
111 - 121	11 semitones
122 - 127	1 octave

CC Value	LFO Shape (CC 17 to select the shape)
0 - 13	Triangle
14 - 27	Sawtooth
28 - 41	Inverted Sawtooth
42 - 55	Square
56 - 69	40% Pulse
70 - 83	30% Pulse
84 - 97	20% Pulse
98 - 111	10% Pulse
111 - 127	Random

Appendix F – MIDI Implementation Chart

Model: [KRM-100] MIDI-CV-Arpeggiator

Function		Transmitted	Received	Notes
Basic Channel		1 - 16	1 - 16	Programmable *1
Mode		4 Omni Off, Mono	3 Omni Off, Poly	MIDI input is Poly, MIDI output is Mono
Note Number		0 - 127	0 - 127	Programmable
Velocity	Note On Note Off	O Fixed at 0	O O	Programmable
Aftertouch	Key (Poly) Channel (Mono)	X X	O O	
Pitch Bender		O	O	
Control Change	1 - 119	O	O	Programmable
Program Change		X	O	
System Exclusive		O	O	
System Common	SPP	X	O	*2
System Realtime	Beat Clock Clock Start Clock Continue Clock Stop	X X X X	O O O O	
Aux Messages	Local On/Off All Notes Off All Sound Off Reset Controllers Active Sense	X X X X X	O O O O O	*3 *3 *3 *3 *3

*1 The transmit and receive channels must be the same.

*2 Song Position Pointer messages will reset the arpeggiator, mini sequencer, and LFO to the nearest bar, if they are under MIDI beat clock control.

*3 These aux messages are disabled by default. They must be enabled via the front panel menu, or SysEx messages.