

SH 2/9-M

MIDI Interface for Roland SH-2 / SH-09

Model 8-437
ver. 1.0



OWNER'S MANUAL





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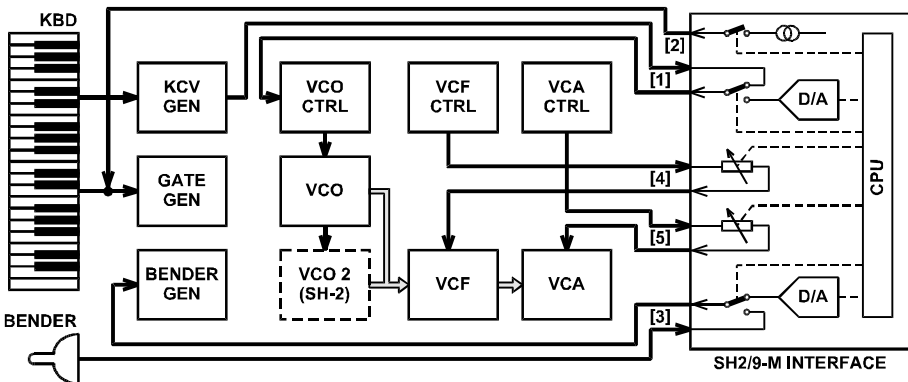
1. DEVICE DESCRIPTION

SH2/9-M is a MIDI retrofit for Roland SH-2 and SH-09 synthesizers. The device enables the instrument to be controlled via MIDI as a MIDI expander. SH2/9-M enables to control instrument's BENDER, VCO, VCF, VCA and ENV via MIDI commands. More over, the device includes software LFO that can be used as alternative source for instrument's VCO modulation

1.1. FUNCTION OF INTERFACE

Functional block schematics of the interface is on pic. 1. The interface controls instrument's VCO via CV generated by 16-bit DAC (it replaces instrument's KCV) [1] and it switches GATE generator for launching of ENV too [2]. Manual controller BENDER on instrument's panel can be disconnected and replaced with DAC of the interface [3]. Interface's voltage regulator is inserted between VCF and control circuits of VCF [4]. Interface's voltage regulator is inserted between VCA and control circuits of VCA too [5]. It allows additional changes of output level of VCA.

Pic. 1 – Functional block schematics



2. CONNECTION TO MIDI SYSTEM

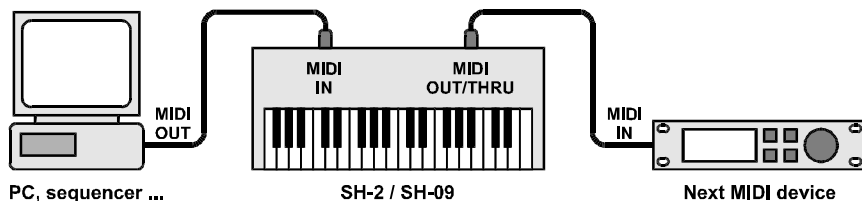
The interface has connectors for both MIDI data input and output. Standard MIDI cables with DIN 41524 connector (5 pins / 180°) is used for interconnection with other MIDI devices.

2.1. CONNECTION FOR STANDARD WORKING MODE

Data from host MIDI system (PC, sequencer, master keyboard etc.) for control of SH-2 / SH-09 instrument are incoming to MIDI-IN input of the interface.

All MIDI data incoming to MIDI input of the interface are transferred to MIDI-THRU/OUT output of the interface without any changes (THRU function). It enables connection of next MIDI devices to host system without an additional Thru-Box etc. MIDI input of next MIDI device will be simply interconnected with MIDI-THRU/OUT output of the interface (see pic. 2).

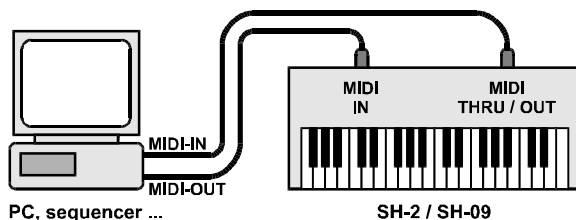
If there are no other devices controlled from the MIDI host system, only MIDI-IN cable is necessary (from host system to MIDI-IN input of the interface). MIDI-THRU/OUT output of the interface stays unconnected.

Pic. 2 – Connection to MIDI system for standard working mode

2.2. CONNECTION FOR MEMORY CONTENT TRANSFER

Except data from input MIDI-IN, own interface's System Exclusive messages are transmitted to output MIDI-THRU/OUT. These messages are transmitted as response of the interface to requests for memory banks content listing from host system.

If that function is used, MIDI output MIDI-THRU/OUT of the interface must be connected to MIDI input of host system (PC, sequencer...) in which data from interface's memory will be archived (see pic. 3).

Pic. 3 – Connection to MIDI system for memory content transfer

Attention! If this way of connection is used, function named MIDI ECHO, THRU etc. must be disabled in sequencer. In other case, communication loop can occur and whole MIDI system "freezes"!

3. INTERFACE OPERATION

The interface has only one manual control element – tumbler switch – which switches the interface on (activation of the interface) or off (deactivation of the interface). Working statuses and functions of the interface are indicated with help of two-color (red / green) LED.

Remark: Switch and indication LED need not to be installed unconditionally. The interface can be switched on and off remotely – with help of MIDI commands. Details are described in Appendix D.

3.1. INITIALIZATION SEQUENCE

Always when SH-2 / SH-09 instrument is switched on, reset sequence of interface's CPU is executed automatically. During this sequence, system parameters are read from memory (see chapter 4.1) and default values of preset parameters are stored into edit buffer (see table 2). This causes that the interface is set to initial non-active mode and it has no influence to the instrument. After that, status of tumbler switch is watched and in dependence on it, all next activity of the interface unwinds.



3.2. INSTRUMENT OPERATION

If the interface is switched off, it has no influence to the instrument and SH-2 / SH-09 instrument can be controlled by the same way like no MIDI interface is installed. In off status of the interface, all MIDI communication is disabled too – on both MIDI input and output of the interface. Also, indication LED doesn't light at all.

After switching on (by manual switch), the interface stays still inactive (it has still no influence to the instrument) and indication LED doesn't still light. But MIDI communication is now enabled and the interface is prepared to take control over the instrument's circuits.

This occurs automatically after first MIDI command is received. Activation of the interface is indicated with LED – it lights red. Immediately after that, instrument's keyboard is disconnected and the interface takes control over instrument's VCO. Since this time, own instrument's keyboard can't be used yet. However, all other control elements on SH-2 / SH-09 instrument's panel stay fully functional except Bender – its function depends on setting of CONTROL - Bender Mode preset parameter (see chapter 4.2.16).

3.3. INDICATION OF WORKING STATUS

The user is informed about the actual interface's status by the dual color indication LED installed on instrument's panel.

If the interface is inactive, the LED does not light at all.

Active status of the interface is indicated by red light of the indication LED.

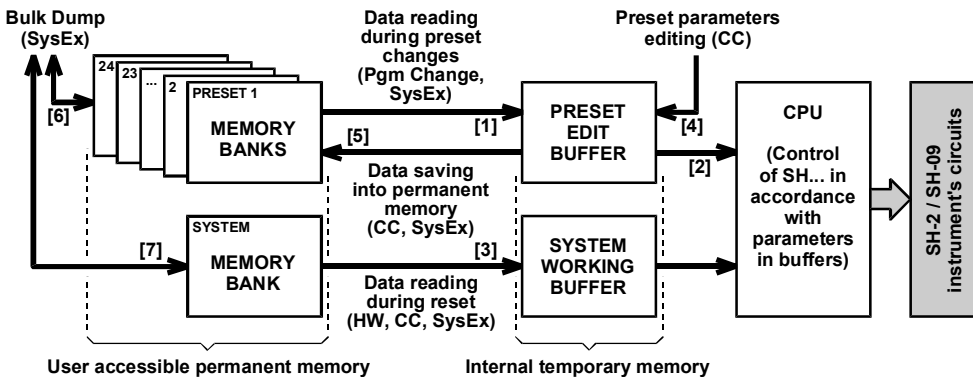
If indication of some function of the interface is allowed by CONTROL - Indicator Mode preset parameter (see chapter 4.2.17), selected function is indicated by green light or blink of the indication LED.

If there is an error occurred in interface's function, the indication LED starts to blink – see Appendix B.

4. PARAMETERS

Settings of parameters affects significantly operation of the interface during incoming MIDI commands processing and during control of instrument's circuits. The parameters are divided in two basic groups – system parameters and preset parameters – see pic. 4.

Pic. 4 – Structure of internal interface's memory





All parameters are stored in memory banks in internal memory of the interface. There is one memory bank for system parameters and 24 memory banks for preset parameters. Content of all memory banks can be read or changed with help of Bulk Dump SysEx Messages [6] and [7] (see description of System Exclusive communication).

Content of system memory bank is read into working buffer and then to CPU always only during interface's reset [3].

Choice of requested preset can be done with help of standard MIDI command Program Change or with help of SysEx command (see description of System Exclusive communication). Always when preset is changed, content of selected preset memory bank is transferred to edit buffer [1] and from here, operation of interface's CPU is driven.

Preset parameters in edit buffer can be changed during the device operation with help of MIDI Control Changes [4]. Made changes then can be stored back to some of preset memory banks [5] (with help of SysEx command – see description of System Exclusive communication).

4.1. SYSTEM PARAMETERS

The system parameters control the basic function of the interface. System parameters are always valid independently on the actual preset settings – the change of the system parameters take effect the same way in all user presets.

System parameters can be changed only by Bulk Dump SysEx Messages (see description of System Exclusive communication). However, executed changes approve oneself till after interface's reset – when the instrument will be switched on next time!

The values of system parameters that are saved in factory or if "Factory Reset" is executed (see description of System Exclusive communication) shows table 1.

Table 1 – Range of valid values and a default values of system parameters

Parameter name	Valid values		Default values (Factory Reset)	
	[dec]	[hex]	[dec]	[hex]
MIDI Channel	0 ~ 15	00 ~ 0F	0	00
ENV Break Pulse Duration	0 ~ 116	00 ~ 74	12	0C

4.1.1. MIDI CHANNEL

Parameter selects MIDI channel for the communication of the interface with MIDI system. It is possible to choose any of the 1-16 channels.

Parameter values are 0 - 15. Value 0 is for MIDI channel Nr.1, value 1 selects Nr. 2 etc. up to value 15 which selects MIDI channel Nr. 16

4.1.2. ENV BREAK PULSE DURATION

Parameter sets the duration of break impulses for the instrument's ENV circuits if the interface works in Legato mode (see description of MIDI controller Nr. 68 – chapter 5.1.2.1). Length of the break impulses is defined by the following formula:

$$\text{ENV_BREAK_PULSE} = (\text{PARAMETER_VALUE} + 4) / 4 \text{ [in milliseconds]}$$

Parameter values range is 0 - 116, corresponding to the length of the break impulses 1 ms - 30 ms. Default value is 12 (e.g. impulse with the length of approx. 4 ms). It is suitable for the most situations, only in the exceptional situations the value of the parameter can be adjusted to provide reliable reaction of the ENV circuits.



4.2. PRESET PARAMETERS

The preset parameters set functions of the interface whose influence sound of SH-2 / SH-09 instrument. The preset parameters sets, which and how MIDI commands are going to control BENDER, VCO, VCF, VCA and ENV circuits of the instrument.

Values of the preset parameters in edit buffer (see pic. 4) are set by the MIDI controllers (Control Changes) - it is possible to change them during the playing the instrument thus. Default values of the preset parameters stored in the edit buffer after reset are shown in table 2. These default values are also stored in all interface preset memory banks after "Factory Reset" procedure (see manual for SysEx communication).

Table 2 – Range of valid values and a default values of preset parameters

Parameter name	Range of valid values		Default values		Setting with help of MIDI CC Nr.	
	[dec]	[hex]	[dec]	[hex]	[dec]	[hex]
VCO - Pitch - Key Shift	0 ~ 79	00 ~ 4F	48	30	40	28
VCO - Pitch - Aftertouch Bend	0 ~ 127	00 ~ 7F	64	40	41	29
VCO - Modulation – Wave	0 ~ 3	00 ~ 03	1	01	42	2A
VCO - Modulation – Polarity	0 ~ 3	00 ~ 03	0	00	43	2B
VCO - Modulation – Rate	0 ~ 127	00 ~ 7F	64	40	44	2C
VCO - Modulation - Wheel Amount	0 ~ 127	00 ~ 7F	0	00	45	2D
VCO - Modulation - Aftertouch Amount	0 ~ 127	00 ~ 7F	0	00	46	2E
VCO - Modulation - Retrigger	0 ~ 2	00 ~ 02	2	02	47	2F
VCF - Cutoff – Frequency	0 ~ 127	00 ~ 7F	127	7F	48	30
VCF - Cutoff - Key Follow	0 ~ 127	00 ~ 7F	64	40	49	31
VCF - Cutoff - Velocity Amount	0 ~ 127	00 ~ 7F	0	00	50	32
VCF - Cutoff - Aftertouch Amount	0 ~ 127	00 ~ 7F	0	00	51	33
VCA - Level - Key Follow	0 ~ 127	00 ~ 7F	64	40	52	34
VCA - Level - Velocity Amount	0 ~ 127	00 ~ 7F	0	00	53	35
VCA - Level - Aftertouch Amount	0 ~ 127	00 ~ 7F	0	00	54	36
VCA - Level - Volume Mode	0 ~ 3	00 ~ 03	0	00	55	37
CONTROL - Bender Mode	0 ~ 1	00 ~ 01	1	01	56	38
CONTROL - Indicator Mode	0 ~ 3	00 ~ 03	0	00	57	39

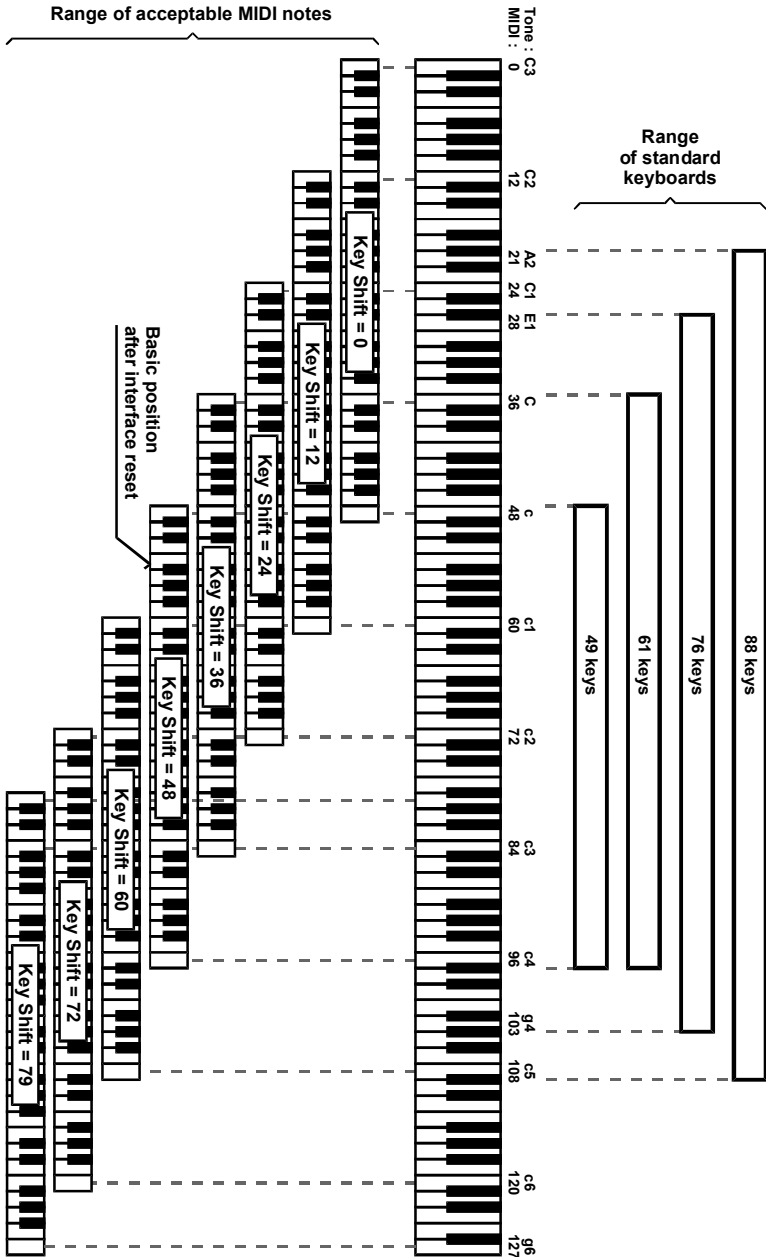
Edited values of the parameters are stored in the edit buffer only. The content of the buffer is saved temporarily only (see pic. 4), till the preset change or instrument switch off or hardware reset. To save the edited parameters permanently, it is necessary to save them into a preset memory bank. There are 24 available spaces for user settings. Saving the values in a preset memory bank is done by the MIDI System Exclusive command (see manual for SysEx communication). With help of SysEx commands, it is also possible to change complete content of any preset memory bank.

4.2.1. VCO PITCH - KEY SHIFT

SH2/9-M interface accepts 49 MIDI notes – range of virtual keyboard is four octaves thus. Range of acceptable notes can be shifted with help of VCO PITCH - Key Shift parameter in whole scale of MIDI notes. Step is one semitone. Valid range of shift is from 0 to +79 semitones – value of the parameter can be from 0 to 79 thus.



Pic. 5 – Influence of “VCO Pitch - Key Shift” parameter



If no shift is chosen (i.e. parameter value is equal to 0), lowest key of virtual keyboard corresponds to MIDI note Nr. 0 and highest key corresponds to MIDI note Nr. 48. If shift is +1 semitone (parameter value is equal to 1), lowest key of corresponds to MIDI note Nr. 1 and highest key corresponds to MIDI note Nr. 49. And so on up to shift is +79 semitones (parameter value is equal to 79) when lowest key of virtual keyboard corresponds to MIDI note Nr. 79 and highest key corresponds to MIDI note Nr. 127. By other words, value of the parameter is equal to number of lowest acceptable MIDI note. Influence of parameter value shows pic. 5.

The parameter value in edit buffer can be set during operation with help of MIDI controller (Control Changes) Nr. 40 – see chapter 5.1.2.2.

4.2.2. VCO PITCH – AFTERTOUCH BEND

Frequency of instrument's VCO can be shifted ("bended") via MIDI command Channel Afterouch. The parameter sets level of influence of Channel Afterouch command to VCO frequency. Maximal possible VCO frequency shift is up to ± 4 semitones.

Value of the parameter can be from 0 to 127. If value is equal to 64, MIDI command Channel Afterouch doesn't affect instrument's VCO frequency at all. For parameter values from 65 to 127, VCO frequency is increased directly proportional to value of Channel Aftertouch command (frequency is increased in +4 semitones for value 127 and Channel Aftertouch = 127). For parameter values from 63 to 0, VCO frequency is decreased directly proportional to value of Channel Aftertouch command (frequency is decreased in -4 semitones for value 0 and Channel Aftertouch = 127).

The parameter value in edit buffer can be set during operation with help of MIDI controller (Control Changes) Nr. 41 – see chapter 5.1.2.2.

4.2.3. VCO MOD - WAVE

SH2/9-M interface includes internal software LFO, which can modulate (sweep) frequency of instrument's VCO. Parameter VCO MOD - Wave selects one from 4 possible waveforms of modulation signal (see pic. 6). Value of the parameter can be from 0 to 3. These values correspond to waveforms: "Square" (parameter value 0), "Triangle" (parameter value 1), "Saw-Fall" (parameter value 2) and "Saw-Rise" (parameter value 3).

The parameter value in edit buffer can be set during operation with help of MIDI controller (Control Changes) Nr. 42 – see chapter 5.1.2.2.

4.2.4. VCO MOD - POLARITY

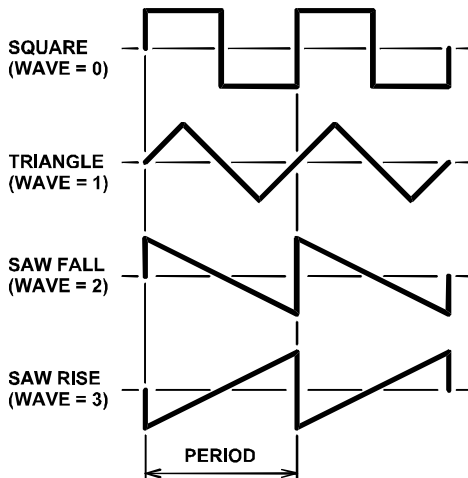
The parameter chooses sweeping polarity (orientation) of instrument's VCO by internal interface's LFO. Value of the parameter can be from 0 to 3. These values set four polarities: "Center-1" (parameter value 0), "Center-2" (parameter value 1), "Up" (parameter value 2) and "Down" (parameter value 3) – see pic. 7.

The parameter value in edit buffer can be set during operation with help of MIDI controller (Control Changes) Nr. 43 – see chapter 5.1.2.2.

Polarity "Center 1 - 0"

Frequency of VCO is swept symmetrically around basic frequency.

Pic. 6 – Modulation signal waveform





Polarity "Center 2 - 180°"

Same as previously, Frequency of VCO is swept symmetrically around basic frequency, but phase shift of modulation signal is 180°.

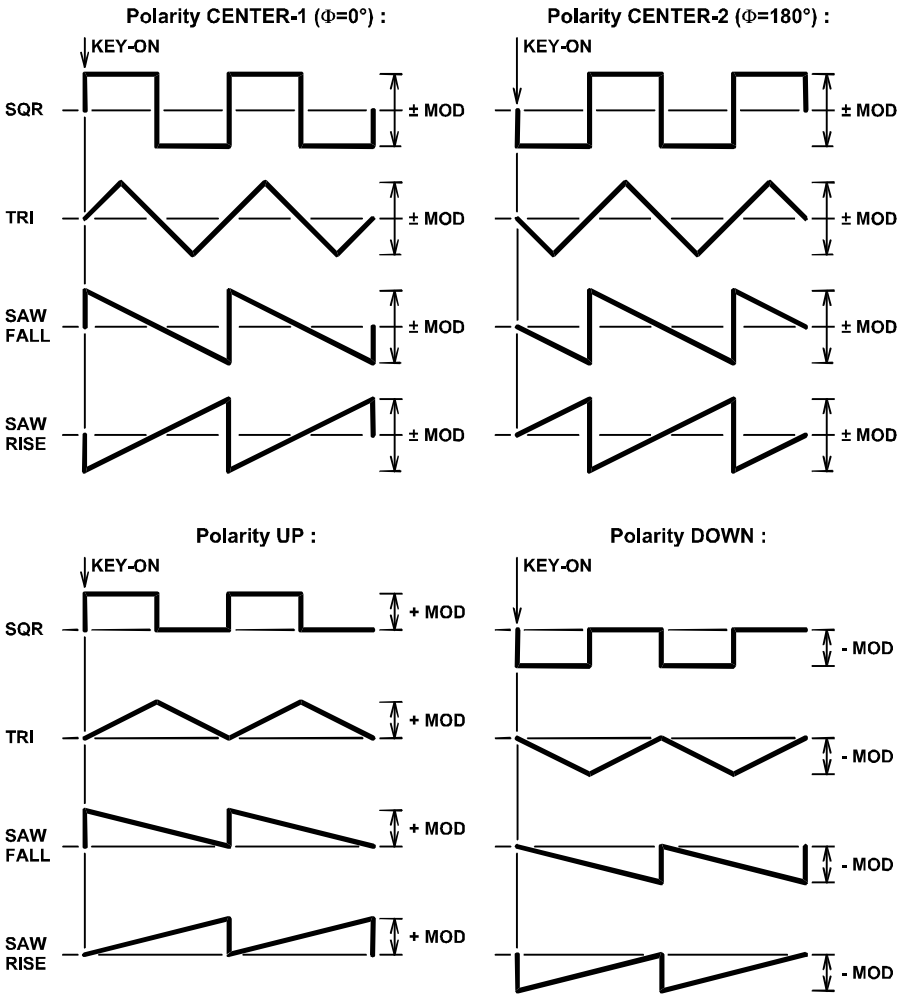
Polarity "Up"

Frequency of VCO is swept only up from basic frequency (i.e. VCO frequency is only increased by modulation).

Polarity "Down"

Frequency of VCO is swept only down from basic frequency (i.e. VCO frequency is only decreased by modulation).

Pic. 7 – Modulation signal polarity



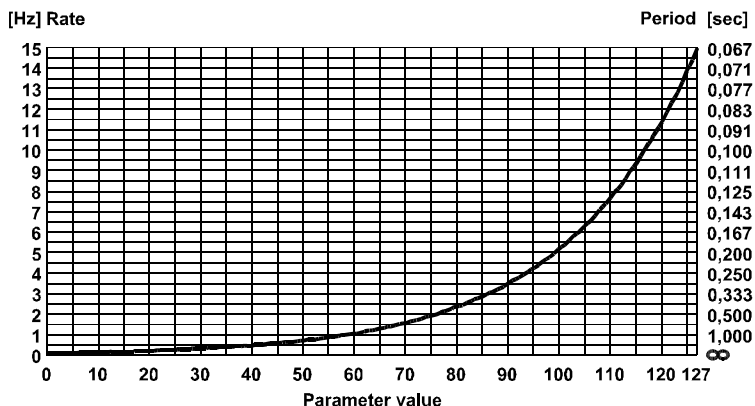
**4.2.5. VCO MOD - RATE**

The parameter sets rate of interface's internal software LFO. Duration of period and frequency respectively of internal LFO correspond to parameter value from 0 to 127 shows table 3 and pic. 8.

The parameter value in edit buffer can be set during operation with help of MIDI controller (Control Changes) Nr. 44 – see chapter 5.1.2.2.

Table 3 - Period duration / frequency of internal LFO

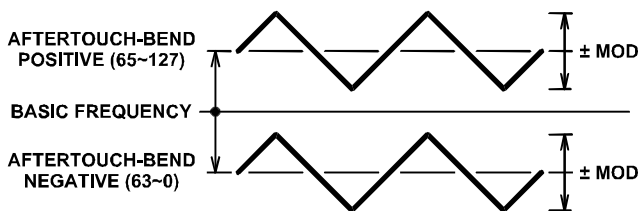
Param.	Mod- Rate		Param.	Mod - Rate		Param.	Mod - Rate		Param.	Mod - Rate	
	Period	Freq.		Period	Freq.		Period	Freq.		Period	Freq.
[dec]	[sec]	[Hz]	[dec]	[sec]	[Hz]	[dec]	[sec]	[Hz]	[dec]	[sec]	[Hz]
0	10,000	0,100	32	2,829	0,353	64	0,801	1,249	96	0,227	4,415
1	9,613	0,104	33	2,720	0,368	65	0,770	1,299	97	0,218	4,593
2	9,241	0,108	34	2,615	0,382	66	0,740	1,352	98	0,209	4,777
3	8,884	0,113	35	2,514	0,398	67	0,711	1,406	99	0,201	4,970
4	8,540	0,117	36	2,416	0,414	68	0,684	1,463	100	0,193	5,170
5	8,210	0,122	37	2,323	0,431	69	0,657	1,522	101	0,186	5,378
6	7,892	0,127	38	2,233	0,448	70	0,632	1,583	102	0,179	5,594
7	7,587	0,132	39	2,147	0,466	71	0,607	1,646	103	0,172	5,819
8	7,293	0,137	40	2,064	0,485	72	0,584	1,713	104	0,165	6,053
9	7,011	0,143	41	1,984	0,504	73	0,561	1,782	107	0,159	6,297
10	6,740	0,148	42	1,907	0,524	74	0,540	1,853	106	0,153	6,550
11	6,479	0,154	43	1,833	0,545	75	0,519	1,928	107	0,147	6,814
12	6,229	0,161	44	1,762	0,567	76	0,499	2,006	108	0,141	7,088
13	5,988	0,167	45	1,694	0,590	77	0,479	2,086	109	0,136	7,373
14	5,756	0,174	46	1,629	0,614	78	0,461	2,170	110	0,130	7,670
15	5,533	0,181	47	1,566	0,639	79	0,443	2,258	111	0,125	7,979
16	5,319	0,188	48	1,505	0,664	80	0,426	2,348	112	0,120	8,300
17	5,113	0,196	49	1,447	0,691	81	0,409	2,443	113	0,116	8,634
18	4,916	0,203	50	1,391	0,719	82	0,394	2,541	114	0,111	8,981
19	4,725	0,212	51	1,337	0,748	83	0,378	2,643	118	0,107	9,343
20	4,543	0,220	52	1,285	0,778	84	0,364	2,750	116	0,103	9,719
21	4,367	0,229	53	1,236	0,809	58	0,350	2,860	117	0,099	10,110
22	4,198	0,238	54	1,188	0,842	86	0,336	2,976	118	0,095	10,517
23	4,036	0,248	55	1,142	0,876	87	0,323	3,095	119	0,091	10,940
24	3,879	0,258	56	1,098	0,911	88	0,311	3,220	120	0,088	11,380
25	3,729	0,268	57	1,055	0,948	89	0,299	3,349	121	0,084	11,838
26	3,585	0,279	58	1,014	0,986	90	0,287	3,484	122	0,081	12,315
27	3,446	0,290	59	0,975	1,026	91	0,276	3,624	123	0,078	12,810
28	3,313	0,302	60	0,937	1,067	92	0,265	3,770	124	0,075	13,326
29	3,185	0,314	61	0,901	1,110	93	0,255	3,922	125	0,072	13,862
30	3,062	0,327	62	0,866	1,154	94	0,245	4,080	126	0,069	14,420
31	2,943	0,340	63	0,833	1,201	95	0,236	4,244	127	0,067	15,000

Pic. 8 – Rate of internal modulation signal


4.2.6. VCO MOD - MODULATION WHEEL AMOUNT

Parameter sets maximal possible depth of instrument's VCO modulation allowed for MIDI controller Modulation (CC1). Value of the parameter can be from 0 to 127. If parameter value is equal to 0, MIDI controller Modulation (CC1) doesn't affect instrument's VCO modulation at all. For parameter values from 1 to 127 is maximal modulation depth increased directly proportional to value of the parameter (maximal depth of instrument's VCO modulation is ± 4 semitones for value equal to 127 and CC1 = 127). VCO frequency is swept around frequency given by sum of basic VCO frequency and shift of Channel Aftertouch in dependence on VCO PITCH - Aftertouch Bend parameter (see pic. 9).

The parameter value in edit buffer can be set during operation with help of MIDI controller (Control Changes) Nr. 45 – see chapter 5.1.2.2.

Pic. 9 – Resulting VCO frequency


4.2.7. VCO MOD - AFTERTOUCH AMOUNT

Parameter sets maximal possible depth of instrument's VCO modulation allowed for MIDI command Channel Aftertouch. Value of the parameter can be from 0 to 127. If parameter value is equal to 0, Channel Aftertouch command doesn't affect instrument's VCO modulation at all. For parameter values from 1 to 127 is maximal modulation depth increased directly proportional to value of the parameter (maximal depth of instrument's VCO modulation is ± 4 semitones for value equal to 127 and Channel Aftertouch = 127). VCO frequency is swept around frequency given by sum of basic VCO frequency and shift of Channel Aftertouch in dependence on VCO PITCH - Aftertouch Bend parameter (see pic. 9).

The parameter value in edit buffer can be set during operation with help of MIDI controller (Control Changes) Nr. 46 – see chapter 5.1.2.2.

4.2.8. VCO MOD - RETRIG

The parameter disables or enables synchronization of start of internal modulation LFO period (repeated triggering) with receiving of Note-On MIDI commands. Parameter is of use only if more keys are pressed simultaneously.

Synchronization "Off"

Start of LFO period (LFO launching) is synchronized only with pressing of first key after previous releasing of all keys. Any next pressed key has no influence.

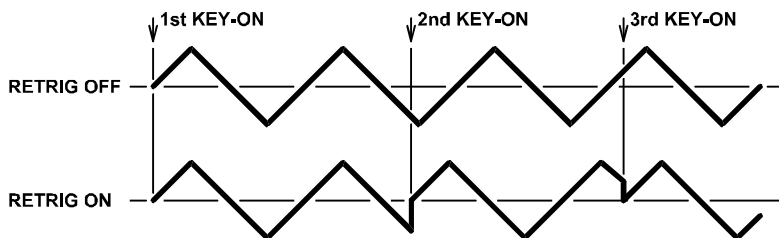
Synchronization "On"

Start of LFO period is always synchronized with pressing of any acceptable key (i.e. each time when acceptable Note-On command is received) - LFO is launched repeatedly and independently on previous releasing of all keys.

Synchronization "Legato"

Repeated launching of LFO is controlled by MIDI controller Legato (CC68). LFO synchronization is always "On" in Legato mode and it is always "Off" in Non-Legato mode - see above.

Pic. 10 – LFO synchronization in accordance with Retrig parameter



The parameter value in edit buffer can be set during operation with help of MIDI controller (Control Changes) Nr. 47 – see chapter 5.1.2.2.

4.2.9. VCF CUTOFF – FREQUENCY CONTROL

The parameter allows to decrease basic frequency of VCF set by potentiometer CUTOFF FREQUENCY on instrument's panel. Value of the parameter can be from 0 to 127. If parameter value is equal to 127, basic frequency of VCF set by potentiometer CUTOFF FREQUENCY isn't affected at all. When parameter value is decreased, cut-off frequency of VCF is decreased too, up to parameter value is equal to 0 when VCF is totally closed.

This parameter is useful for creation of atypical sound effects or frequency responses of VCF if the instrument is controlled via sequencer or PC.

The parameter value in edit buffer can be set during operation with help of MIDI controller (Control Changes) Nr. 48 – see chapter 5.1.2.2.

4.2.10. VCF CUTOFF - KEY FOLLOW

Parameter sets affecting level of instrument's VCF by position of key on the master keyboard (i.e. in dependence on tone height).



Value of the parameter can be from 0 to 127. If value is equal to 64, VCF isn't affected by key position at all. For parameter values from 65 to 127, VCF cut-off frequency is increased directly proportional to MIDI note number. For parameter values from 63 to 0, VCF cut-off frequency is decreased directly proportional to MIDI note number.

The parameter value in edit buffer can be set during operation with help of MIDI controller (Control Changes) Nr. 49 – see chapter 5.1.2.2.

4.2.11. VCF CUTOFF - VELOCITY AMOUNT

Parameter sets affecting level of instrument's VCF by velocity value of MIDI Note-On commands. Cut-off frequency of VCF can be increased directly proportional to velocity value. Value of the parameter can be from 0 to 127. For value equal to 0, VCF isn't affected by velocity at all. For parameter value equal to 127, maximal affecting is allowed.

The parameter value in edit buffer can be set during operation with help of MIDI controller (Control Changes) Nr. 50 – see chapter 5.1.2.2.

4.2.12. VCF CUTOFF - AFTERTOUCH AMOUNT

Parameter sets affecting level of instrument's VCF by value of last received Channel Aftertouch command. Cut-off frequency of VCF can be increased directly proportional to value of Channel Aftertouch. Value of the parameter can be from 0 to 127. For value equal to 0, VCF isn't affected by Channel Aftertouch at all. For parameter value equal to 127, maximal affecting is allowed.

The parameter value in edit buffer can be set during operation with help of MIDI controller (Control Changes) Nr. 51 – see chapter 5.1.2.2.

4.2.13. VCA LEVEL - KEY FOLLOW

Parameter sets affecting level of instrument's VCA by position of key on the master keyboard (i.e. in dependence on tone height). Value of the parameter can be from 0 to 127. If value is equal to 64, VCA isn't affected by key position at all. For parameter values from 65 to 127, VCA gain is increased directly proportional to MIDI note number. For parameter values from 63 to 0, VCA gain is decreased directly proportional to MIDI note number.

The parameter value in edit buffer can be set during operation with help of MIDI controller (Control Changes) Nr. 52 – see chapter 5.1.2.2.

4.2.14. VCA LEVEL - VELOCITY AMOUNT

Parameter sets affecting level of instrument's VCA by velocity value of MIDI Note-On commands. Gain of VCA can be increased directly proportional to velocity value. Value of the parameter can be from 0 to 127. For value equal to 0, VCA isn't affected by velocity at all. For parameter value equal to 127, maximal affecting is allowed.

The parameter value in edit buffer can be set during operation with help of MIDI controller (Control Changes) Nr. 53 – see chapter 5.1.2.2.

4.2.15. VCA LEVEL - AFTERTOUCH AMOUNT

Parameter sets affecting level of instrument's VCA by value of last received Channel Aftertouch command. Gain of VCA can be increased directly proportional to value of Channel Aftertouch. Value of the parameter can be from 0 to 127. For value equal to 0, VCA isn't affected by Channel Aftertouch at all. For parameter value equal to 127, maximal affecting is allowed.

The parameter value in edit buffer can be set during operation with help of MIDI controller (Control Changes) Nr. 54 – see chapter 5.1.2.2.



4.2.16. VCA LEVEL - VOLUME MODE

The parameter allows to choose method of instrument's global loudness control via standard MIDI controllers Volume (CC7) and Expression (CC11). One of four methods can be chosen: **"Off"** (parameter value 0), **"Volume"** (parameter value 1), **"Expression"** (parameter value 2) and **"Volume + Expression"** (parameter value 3). In all cases, manual controller VOLUME on instrument's panel stays fully functional.

Mode **"Off"**

Control of instrument's global loudness via MIDI controllers Volume (CC7) and Expression (CC11) is disabled. Both controllers are ignored.

Mode **"Volume"**

Only MIDI controller Volume (CC7) is used for control of instrument's global loudness. Controller Expression (CC11) is ignored.

Mode **"Expression"**

Only MIDI controller Expression (CC11) is used for control of instrument's global loudness. Controller Volume (CC7) is ignored.

Mode **"Volume + Expression"**

Both MIDI controllers Volume (CC7) and Expression (CC11) are used for control of instrument's global loudness.

The parameter value in edit buffer can be set during operation with help of MIDI controller (Control Changes) Nr. 55 – see chapter 5.1.2.2.

4.2.17. CONTROL - BENDER MODE

The parameter allows to choose method for control of instrument's bender. One of two modes can be chosen: **„MIDI“** (parameter value 0) or **„Instrument“** (parameter value 1).

Mode **"MIDI"**

Manual controller (lever) BENDER on instrument's panel is disconnected and MIDI command Pitch Bend (Pitch Wheel) takes control over the bender.

Mode **"Instrument"**

Manual controller (lever) BENDER on instrument's panel works normally and MIDI command Pitch Bend (Pitch Wheel) is ignored.

The parameter value in edit buffer can be set during operation with help of MIDI controller (Control Changes) Nr. 56 – see chapter 5.1.2.2.

4.2.18. CONTROL - INDICATOR MODE

The parameter allows to choose function of interface's LED indicator. One of four functions can be chosen: **"Off"** (parameter value 0), **"Gate"** (parameter value 1), **"MIDI-Msg"** (parameter value 2) and **"Mod-Rate"** (parameter value 3). LED indicator works only if the interface is active (i.e. the instrument is switched to MIDI mode – see chapter 3.2). If the interface is inactive, LED indicator doesn't light at all.

Mode **"Off"**

LED indicator is turned off in this mode – it light in red continuously.

Mode **"Gate"**

In this mode, LED indicator is copying status of envelope generator (ENV) - signal GATE. Indication LED lights in red in quiescent status and it lights in green if GATE signal is active.

**Mode "MIDI-Msg"**

In this mode, LED indicator indicates incoming MIDI commands which are acceptable for control of the interface. Only transferred MIDI data (THRU function) are not indicated - LED indicator lights in red. Always when acceptable MIDI data are received, the LED blinks in green.. If acceptable data flow is continuous, green LED lights seemingly constantly.

Mode "Mod-Rate"

In this mode, LED indicator indicates rate of interface's internal software LFO. LED indicator lights in red or in green alternatively (ratio 1:1) in dependence on internal LFO frequency.

The parameter value in edit buffer can be set during operation with help of MIDI controller (Control Changes) Nr. 56 – see chapter 5.1.2.2.

5. MIDI IMPLEMENTATION

SH2/9-M interface can communicate by all available methods – it recognizes MIDI channel commands, common system commands as well as SysEx MIDI commands.

5.1. CHANNEL COMMANDS

Interface recognizes channel MIDI commands "Note-Off", "Note-On", "Control Changes", "Channel Aftertouch", "Pitch Bend" and "Program Change". So-called Running Status mode of MIDI communication is fully kept. The commands are received on the channel defined by the system parameter MIDI Channel.

5.1.1. NOTE ON/OFF

Interface accepts Note-On and Note-Off commands in the range of max. 49 notes. Accepted note numbers are defined by VCO PITCH - Key Shift parameter (see chapter 4.2.1).

Although SH-2 a SH-09 are monophonic instruments, the interface remembers last six active Note-On commands. This is important if more keys are pressed on master keyboard in sequence and the last is released. In this case, the interface switches back to the previous pressed note (key). If there are six MIDI notes received yet, next received note replaces the first received note (last received note has the highest priority).

5.1.2. CONTROL CHANGES

The interface recognizes standard controllers Nr. 1, 7, 11, 64, 68, 120, 121, 123. Some other controllers are used for temporary setting of parameters values in edit buffer (CC Nr. from 40 to 58) and for control of interface's functions (CC Nr. 119).

5.1.2.1. STANDARD CONTROLLERS**CC 1 – Modulation Wheel**

The controller enables modulation of instrument's VCO by signal of internal software LFO of the interface. Maximal depth of modulation is given by preset parameter VCO MOD - Wheel Amount. It can be up to ± 4 semitones.

The interface accepts whole range of controller values from 0 to 127.

CC 7 – Volume

The controller enables to control instrument's loudness (it control instrument's VCA). It assert only if preset parameter VCA LEVEL - Volume Control is set to value 1 or 3.

The interface accepts whole range of controller values from 0 to 127.

**CC 11 – Expression**

The controller enables to control instrument's loudness (it control instrument's VCA). It assert only if preset parameter VCA LEVEL - Volume Control is set to value 2 or 3.

The interface accepts whole range of controller values from 0 to 127.

CC 64 – Hold

The controller works standard way: holds tone generator of the instrument playing (active) during the time when the Hold command is active (hold pedal pressed). Values from 64 to 127 are recognized as on-status, values from 0 to 63 as off-status.

CC 68 – Legato

The controller enables (values from 64 to 127) or disables (values from 0 to 63) Legato mode of playing, i.e. repeated start of the instrument's envelope generator (ENV) while receiving more MIDI Note-On commands simultaneously. The controller affects repeated start of internal interface's LFO too in dependence on setting of preset parameter VCO MOD - Retrig.

If the Legato mode is off, envelope generator (ENV) starts always repeatedly when any key is pressed (i.e. if acceptable Note-On command is received) independently on previous releasing of all keys.

If the Legato mode is on, envelope generator (ENV) starts only if first key is pressed after previous releasing of all keys. If any next key is pressed, the new key only changes the control voltage for VCO and the ENV remains unaffected.

CC 120 – All Sound Off

The VCO is muted and ENV generator is switched off immediately after receiving of this controller – independently on MIDI commands Note-On received previously.

CC 121 – Reset All Controllers

Immediately after receiving of this controller, some CC and other controls are set to their initial status:

CC1 Modulation → minimum (0)

CC7 Volume → maximum (127)

CC11 Expression → maximum (127)

CC48 Own controller VCF CUTOFF - Frequency → maximum (127)

CC64 Hold → off (0)

CC68 Legato → off (0)

Pitch Bend (Wheel) → middle position (4096)

CC 123 – All Notes Off

Same as with All Sound Off, the VCO is muted and ENV generator is switched off immediately after receiving of this controller – independently on MIDI commands Note-On received previously.

5.1.2.2. OWN CONTROLLERS FOR PRESET PARAMETERS SETTING**CC 40 – Own controller : VCO PITCH - Key Shift**

Received value of the controller is converted to the value of VCO PITCH - Key Shift parameter (see chapter 4.2.1). Values of the controller from 0 to 79 correspond to the parameter value directly. Values of the controller from 80 to 127 are converted to closest valid value (i.e. 79). Value of the parameter is set temporarily in edit buffer only (see pic. 4) – it is valid till the next change of the controller or till reset of the device.

**CC 41 – Own controller : VCO PITCH - Aftertouch Bend**

Received value of the controller from 0 to 127 corresponds to value of VCO PITCH - Aftertouch Bend parameter directly (see chapter 4.2.2). Value of the parameter is set temporarily in edit buffer only (see pic. 4) – it is valid till the next change of the controller or till reset of the device.

CC 42 – Own controller : VCO MOD - Wave

Received value of the controller is converted to the value of VCO MOD – Wave parameter (see chapter 4.2.3). Values of the controller from 0 to 3 correspond to the parameter value directly. Values of the controller from 4 to 127 are converted to closest valid value (i.e. 3). Value of the parameter is set temporarily in edit buffer only (see pic. 4) – it is valid till the next change of the controller or till reset of the device.

CC 43 – Own controller : VCO MOD - Polarity

Received value of the controller is converted to the value of VCO MOD – Polarity parameter (see chapter 4.2.4). Values of the controller from 0 to 3 correspond to the parameter value directly. Values of the controller from 4 to 127 are converted to closest valid value (i.e. 3). Value of the parameter is set temporarily in edit buffer only (see pic. 4) – it is valid till the next change of the controller or till reset of the device.

CC 44 – Own controller : VCO MOD - Rate

Received value of the controller from 0 to 127 corresponds to value of VCO MOD – Rate parameter directly (see chapter 4.2.5). Value of the parameter is set temporarily in edit buffer only (see pic. 4) – it is valid till the next change of the controller or till reset of the device.

CC 45 – Own controller : VCO MOD - Modulation Wheel Amount

Received value of the controller from 0 to 127 corresponds to value of VCO MOD - Modulation Wheel Amount parameter directly (see chapter 4.2.6). Value of the parameter is set temporarily in edit buffer only (see pic. 4) – it is valid till the next change of the controller or till reset of the device.

CC 46 – Own controller : VCO MOD - Aftertouch Amount

Received value of the controller from 0 to 127 corresponds to value of VCO MOD - Aftertouch Amount parameter directly (see chapter 4.2.7). Value of the parameter is set temporarily in edit buffer only (see pic. 4) – it is valid till the next change of the controller or till reset of the device.

CC 47 – Own controller : VCO MOD - Retrigger

Received value of the controller is converted to the value of VCO MOD – Retrigger parameter (see chapter 4.2.8). Values of the controller 0 and 1 correspond to the parameter value directly. Values of the controller from 2 to 127 are converted to closest valid value (i.e. 1). Value of the parameter is set temporarily in edit buffer only (see pic. 4) – it is valid till the next change of the controller or till reset of the device.

CC 48 – Own controller : VCF CUTOFF - Frequency

Received value of the controller from 0 to 127 corresponds to value of VCF CUTOFF – Frequency parameter directly (see chapter 4.2.9). Value of the parameter is set temporarily in edit buffer only (see pic. 4) – it is valid till the next change of the controller or till reset of the device.

CC 49 – Own controller : VCF CUTOFF - Keyfollow

Received value of the controller from 0 to 127 corresponds to value of VCF CUTOFF – Keyfollow parameter directly (see chapter 4.2.10). Value of the parameter is set temporarily in edit buffer only (see pic. 4) – it is valid till the next change of the controller or till reset of the device.

**CC 50 – Own controller : VCF CUTOFF - Velocity Amount**

Received value of the controller from 0 to 127 corresponds to value of VCF CUTOFF – Velocity Amount parameter directly (see chapter 4.2.11). Value of the parameter is set temporarily in edit buffer only (see pic. 4) – it is valid till the next change of the controller or till reset of the device.

CC 51 – Own controller : VCF CUTOFF - Aftertouch Amount

Received value of the controller from 0 to 127 corresponds to value of VCF CUTOFF – Aftertouch Amount parameter directly (see chapter 4.2.12). Value of the parameter is set temporarily in edit buffer only (see pic. 4) – it is valid till the next change of the controller or till reset of the device.

CC 52 – Own controller : VCA LEVEL - Keyfollow

Received value of the controller from 0 to 127 corresponds to value of VCA LEVEL – Keyfollow parameter directly (see chapter 4.2.13). Value of the parameter is set temporarily in edit buffer only (see pic. 4) – it is valid till the next change of the controller or till reset of the device.

CC 53 – Own controller : VCA LEVEL - Velocity Amount

Received value of the controller from 0 to 127 corresponds to value of VCA LEVEL - Velocity Amount parameter directly (see chapter 4.2.14). Value of the parameter is set temporarily in edit buffer only (see pic. 4) – it is valid till the next change of the controller or till reset of the device.

CC 54 – Own controller : VCA LEVEL - Aftertouch Amount

Received value of the controller from 0 to 127 corresponds to value of VCA LEVEL - Aftertouch Amount parameter directly (see chapter 4.2.15). Value of the parameter is set temporarily in edit buffer only (see pic. 4) – it is valid till the next change of the controller or till reset of the device.

CC 55 – Own controller : VCA LEVEL - Volume Mode

Received value of the controller is converted to the value of VCA LEVEL - Volume Mode parameter (see chapter 4.2.16). Values of the controller from 0 to 3 correspond to the parameter value directly. Values of the controller from 4 to 127 are converted to closest valid value (i.e. 3). Value of the parameter is set temporarily in edit buffer only (see pic. 4) – it is valid till the next change of the controller or till reset of the device.

CC 56 – Own controller : CONTROL - Bender Mode

Received value of the controller is converted to the value of CONTROL - Bender Mode parameter (see chapter 4.2.17). Values of the controller 0 and 1 correspond to the parameter value directly (i.e. “MIDI” or “Instrument”). Values of the controller from 2 to 127 are converted to closest valid value (i.e. 1). Value of the parameter is set temporarily in edit buffer only (see pic. 4) – it is valid till the next change of the controller or till reset of the device.

CC 57 – Own controller : CONTROL - Indicator Mode

Received value of the controller is converted to the value of CONTROL - Indicator Mode parameter (see chapter 4.2.8). Values of the controller from 0 and correspond to the parameter value directly (i.e. “Off”, “Gate”, “MIDI-Msg” or “Mod-Rate”). Values of the controller from 4 to 127 are converted to closest valid value (i.e. 3). Value of the parameter is set temporarily in edit buffer only (see pic. 4) – it is valid till the next change of the controller or till reset of the device.



5.1.2.3. OWN CONTROLLER FOR INTERFACE'S FUNCTIONS CONTROL

CC 119 – Own controller : Reset

The controller allows to do hardware reset of the interface. Value of the controller must be always 0 – the controller is unacceptable and it is ignored in other cases.

The interface is deactivated immediately after this controller receiving. All circuits of the interface are set to default status as after the instrument is switched on. Interface doesn't affect the instrument and usage of instrument's keyboard is allowed. This controller is equivalent to common system command Reset (see chapter 5.2.1).

5.1.3. CHANNEL AFTERTOUCH

Channel Aftertouch command can affect instrument's VCO, VCF and VCA in dependence on setting of VCO - PITCH Aftertouch Bend, VCO - MOD Aftertouch Amount, VCF - CUTOFF Aftertouch Amount and VCA - LEVEL Aftertouch Amount preset parameters.

The interface accepts whole range of command's values from 0 to 127.

5.1.4. PITCH BEND (WHEEL)

Pitch Bend (Wheel) command can control instrument's bender in dependence on setting of CONTROL - Bender Mode preset parameter. In MIDI mode, frequencies of VCO and VCF can be "bended" according to positions of potentiometers on instrument's panel.

The interface accepts whole range of command's values from -8192 to +8191. However, only 12 bits of command's data are used.

5.1.5. PROGRAM CHANGE

Program Change command switches the user presets of the interface. Only program numbers from 0 to 23 are accepted and they correspond to presets numbers from 1 to 24. Program numbers from 24 to 127 are ignored.

Always when acceptable Program Change command is received, instrument's VCO is muted and envelope generator (ENV) is switched off. When the next MIDI Note-On command is received, the interface starts to work normally accordingly to the parameters of newly selected preset (program).

5.2. COMMON SYSTEM COMMANDS

5.2.1. RESET

When the Reset command is received, a complete hardware reset of the interface is executed – all interface's circuits are set to their default status (the same as after the instrument is switched on) and they don't affect the instrument at all.

5.3. SYSTEM EXCLUSIVE MESSAGES

The interface is equipped by the System Exclusive communication protocol, that enables bi-directional data flow of the memory bulk dumps and some system functions. Detailed description of the System Exclusive communication is in separate manual.

Attached CD-ROM contains software generator for creation of SysEx Messages for communication between the interface and MIDI host system. The software generator can create easily any kind of message necessary for control of the interface.



6. LIMITATION DURING THE INTERFACE USAGE AND RECOMMENDED SETTING

When the interface is active, it is impossible to use own instrument's keyboard. If a key on instrument's keyboard is pressed, instrument's VCO will not be affected (detuned) but undesirable launching of envelope generator will occur.

Also portamento circuit (PORTAMENTO slider) of the instrument is totally functionless after the interface activation! Unfortunately, instrument's hardware design don't allow usage of portamento if instrument's VCO is controlled by external voltage.

Function of BENDER controller on instrument's panel depends on setting of CONTROL - Bender Mode parameter – see chapter 4.2.17.

All other control elements on SH-2 / SH-09 instrument's panel stay fully functional although the instrument is driven via MIDI bus with help of SH2/9-M interface.

We recommend to disuse GATE+TRIG position of selector for choice of envelope generator (ENV) launching if the instrument is controlled via MIDI. In this mode, unwanted triggering of envelope can occur. It is caused by influence of frequency jumping if VCO is modulated by interface's internal software LFO.

7. TECHNICAL SPECIFICATION

MIDI bus :	fully according to MIDI Manufacturer Association standards
MIDI connectors :	2x DIN 41524 (5 pins / 180°)
Transit data delay MIDI IN → THRU :	max. 1 ms, typ. 0,32 ms
Electrical design :	under the regulations of the ČSN EN 60335-1+A55, ČSN EN 60335-2-45
EMC :	under the regulations of the ČSN EN 55014
Operating environment :	standard
Range of operating temperature :	+10 to +35 °C
Relative environmental humidity :	up to 85 %

8. WARRANTY CONDITIONS

The equipment is provided with **thirty-month warranty** starting from the date of the equipment take-over by the customer. This date must be specified on warranty list together with dealer's confirmation.

During this period of time, all defects of equipment or its accessories, caused by defective material or faulty manufacturing, will be removed free of charge.

Warranty repair is asserted by the customer against the dealer.

Warranty period is to be extended for the time period, during which the product was under the warranty repair.

The relevant legal regulations take effect in case of cancellation of purchase contract.

The customer will lose the right for free warranty repair, if he will not be able to submit properly filled out warranty list or if the defects of the product had been caused by:

- unavoidable event (natural disaster),
- connecting the device to the incorrect supply voltage,
- inputs or outputs overloading by connecting the signals source or load source with not-corresponding characteristics etc.,
- faulty equipment operation, which is at variance with the instructions referred-to in the operating manual,
- mechanical damage caused by consumer during transportation or usage of equipment,
- unprofessional interference with the equipment or by equipment modification without manufacturer's approval.

**APPENDIX A. - MIDI IMPLEMENTATION CHART****MIDI IMPLEMENTATION CHART**Device : **SH2/9-M**

Date : 10 / 2011

Model : **8-437**

Version : 1.0

Function		Transmission	Reception	Remarks
Basic	Default	X	1~16	¹⁾
Channel	Changed	X	1~16	¹⁾
Mode	Default	X	Mode 3	Not Altered ²⁾
	Messages	X	X	
Note Number		X	0~127	³⁾
Velocity	Note ON	X	O	
	Note OFF	X	X	
After	Key's	X	X	
Touch	Channel's	X	O	
Pitch Bender		X	O	
Control Changes	1	X	O	Modulation
	7	X	O	Volume
	11	X	O	Expression
	40 to 57	X	O	Own controllers – see description
	64	X	O	Hold
	68	X	O	Legato
	119	X	O	Own controller – see description
	120	X	O	All Sound Off
	121	X	O	Reset All Controllers
Program Change		X	O	Preset Change
System Exclusive		O	O	See description
System Common	Song Position	X	X	
	Song Select	X	X	
	Tune	X	X	
System Real Time	Clock Command	X	X	
Others	Local ON/OFF	X	X	
	All Notes Off	X	O	
	Active Sensing	X	X	
	Reset	X	O	
Notes : ¹⁾ Can be changed by user				
²⁾ Last six notes are stored in interface's buffer				
³⁾ Position of 49 acceptable notes depends on Key Shift setting				

Mode 1 : **OMNI ON, POLY**Mode 2 : **OMNI ON, MONO****O** : YesMode 3 : **OMNI OFF, POLY**Mode 4 : **OMNI OFF, MONO****X** : No



APPENDIX B. - ERROR STATUS INDICATION

If any fatal error occurs rarely during interface operation, the interface disconnects itself from instrument's circuits and it stops MIDI communication too. However, the instrument still can be controlled via its own keyboard and panel knobs.

User is informed about that situation by fast blinking of indication LED. LED indicator blinks in green if fatal error occurs in MIDI communication with host system (e.g. input MIDI data buffer overflows). Any error in communication between interface's CPU and memory is indicated by blinking of red LED indicator.

If a fatal error occurs, it is necessary to reset the interface totally for proper operation refresh - it is necessary turn the SH-2 / SH-09 instrument off and turn it on repeatedly after a moment.

APPENDIX C. – EMERGENCE OF LOOP IN MIDI COMMUNICATION

When SH2/9-M interface is controlled by a sequencer (HW or SW) and the devices are interconnected bidirectionally (with both MIDI cables) and the sequencer isn't set correctly, communication loop might occur and the entire MIDI system "freezes". It is caused due to the fact that all MIDI data incoming from sequencer to interface's input are transferred to interface's output (THRU function) and back to the sequencer thus. But the sequencer can also transfer MIDI data from input to its output in dependence on specific setting of the sequencer. This causes infinite cyclic transfer of the same MIDI data.

To avoid this situation, throughpass of MIDI data from input to output must be turned off in used sequencer. This function used to be name MIDI ECHO or MIDI THRU and the like in a sequencers.

APPENDIX D. – AUTOMATIC ACTIVATION OF INTERFACE

If manual switch of the interface is not installed and it is replaced by jumper (see installation manual for more info), the interface goes to active status immediately after initialization sequence (i.e. after the instrument is switched on – see chapter 3.1). MIDI communication is allowed but the interface still doesn't affect the instrument – it can be used by the same way as without installed interface.

The interface takes control over the instrument's circuits not until first MIDI command is incoming to interface's input MIDI-IN. Since this time, instrument's keyboard is disconnected and the interface takes control over instrument's VCO. However, all other controllers on instrument's panel stay fully functional.

The interface must be reset for return to status when the instrument isn't affected by the interface at all (i.e. instrument's keyboard can be used again). For reset of the interface, it is necessary turn the instrument off and then turn it on after a moment. Interface's reset can be invoked by software too – with help of common system MIDI command "Reset", with help of SysEx command "HW Reset" (see description of SysEx communication) or with help of MIDI controller (CC) Nr. 119 (see chapter 5.1.2.3).

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