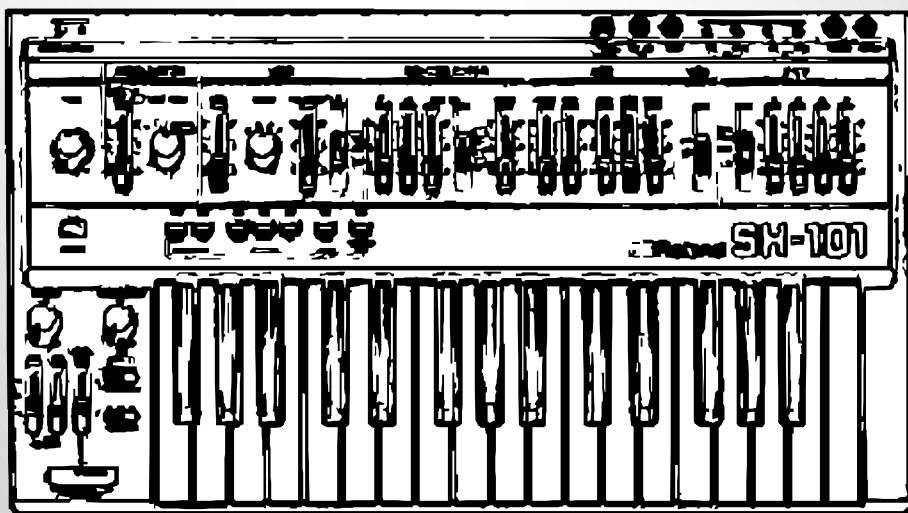


SH 101-M

MIDI Interface

for Roland SH-101

Model 8-438
ver. 1.0



SYSTEM EXCLUSIVE COMMUNICATION

Rev. 2





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1 SYSTEM EXCLUSIVE COMMUNICATION

SH101-M interface uses system of System Exclusive communication to receive and to transmit a SysEx Messages for the control of all parameters in memory banks of the interface. It is also possible to list an actual memory banks content. These data can be backed up in the PC for example.

Certain system and testing functions can be launched by SysEx commands as well.

2 SYSEX MESSAGES STRUCTURE

SH101-M receives / transmits own specific messages with the following structure:

[hex]	[bin]	byte
F0	11110000	Start SysEx
00	00000000	Manufacturer ID (always 3 byte)
20	00100000	
21	00100001	
ii	0iiiiiii	Device ID
5C	01011100	Model ID
cc	0ccccccc	Command
aa	0aaaaaaaa	Address
dd	0ddddddd	Datablock (0 ~ 14 byte in dependence on message type)
..	
dd	0ddddddd	
xx	0xxxxxxxx	Checksum
F7	11110111	End SysEx

2.1 "DEVICE ID" BYTE

The device ID byte identifies the MIDI device exactly. It is equal to a number of an active MIDI channel (00h for channel Nr. 1, 01h for channel Nr. 2 etc. up to 0Fh for channel Nr. 16). The next possible value of the Device ID is 7Fh – universal Device ID always accepted by the interface regardless on active MIDI channel number.

For all other values of the Device ID (from 10h to 7Eh) the message is considered to be invalid and it is ignored by the interface.

2.2 "COMMAND" BYTE

The command "cc" specifies the message type i.e. the interface function type.

2.3 "ADDRESS" BYTE

The address "aa" specifies the memory area or selects the system function accordingly to a type of the SysEx Msg – see below.

2.4 "DATA" BYTE(S)

The block of databytes "dd...dd" contains the values of a parameters or a functions defined by the SysEx Msg type. The number of bytes in the datablock "dd...dd" is a different accordingly to a type of the SysEx message. It can consists from 0 to 14 databytes.

2.5 "CHECKSUM" BYTE

The checksum byte "**xx**" confirms the validity of System Exclusive message. It must be calculated as 7-bit complement of the sum of bytes from 'Model ID' to 'Data' (by other words, seven-bit sum of bytes from the "Model ID" to "Checksum" must be equal to zero). If the checksum byte is invalid, the whole message is invalid too and it is ignored by the interface.

3 COMMAND TYPES OVERVIEW

The command "**cc**" defines the interface activity after the whole message is received. The valid values of "**cc**" are:

- "**cc**"=10h → **Bulk Dump Data Request** – request for a content of user memory bank in the internal interface's memory.
- "**cc**"=20h → **Bulk Dump Data Save / Load** – response to the "Bulk Dump Data Request" or the change of a content of user memory bank in the internal interface's memory.
- "**cc**"=30h → **System Functions** – launches a system function, exact procedure is specified by the values of the "Address" and "Data" bytes.
- "**cc**"=40h → **Service** – launches the testing functions for the interface's hardware checking.

3.1 "BULK DUMP DATA REQUEST" COMMAND

The "Bulk Dump Data Request" command launches the listing of the data from the preset or system memory banks stored in user memory.

If the address "**aa**" is from 00h to 1Fh, the message is an request for a content of the preset memory bank. It corresponds to the number from 1 to 32 of a requested preset in that case. If the address "**aa**" is 20h, the message is a request for a content of the system memory bank. For the address "**aa**" in range from 21h to 7Fh, the message is evaluated as invalid and it is ignored by the interface. Databytes "**dd**" are not used in this type of the SysEx message.

Immediately after the "Bulk Dump Data Request" message reception the interface sends the "Bulk Dump Data Save / Load" message (see below) as a reply. All parameters data of requested memory bank are included in this message.

Form of the message:

[hex]	[bin]	byte
F0	11110000	Start SysEx
00	00000000	Manufacturer ID (3 byte)
20	00100000	
21	00100001	
ii	0iiiiiii	Device ID
5C	01011100	Model ID
10	00010000	Command (Data Request)
aa	00aaaaaa	Address (00h ~ 1Fh : preset banks / 20h : system bank)
xx	0xxxxxxx	Checksum
F7	11110111	End SysEx

3.2 "BULK DUMP DATA SAVE / LOAD" COMMAND

Transmitting the "Bulk Dump Data Save / Load" message to SH101-M, changes the content of a memory bank saved in the user interface's memory. This SysEx Msg message is also sent from the SH101-M as reply to the "Bulk Dump Data Request" message (see above).



If the address "aa" is from 00h to 1Fh, the content of a preset memory bank (values of parameters) is included in the message. The address "aa" corresponds to the number from 1 to 32 of requested preset in such case. If the address "aa" is 20h, the message includes the content of the system memory bank (values of a system parameters). For the address "aa" in range from 21h to 7Fh, the message is considered to be invalid and it is ignored by the interface.

The datablock "dd ... dd" contains 6 bytes for the system memory bank or 14 bytes for a preset memory bank

3.2.1 "BULK DUMP DATA SAVE / LOAD" FOR SYSTEM MEMORY BANK

Form of the message:

[hex]	[bin]	byte
F0	11110000	Start SysEx
00	00000000	Manufacturer ID (3 byte)
20	00100000	
21	00100001	
ii	0iiiiiii	Device ID
5C	01011100	Model ID
20	00100000	Command (Data Save / Load)
20	00100000	Address
d1	0ddddddd	Datablock (6 byte)
..	
d6	0ddddddd	
xx	0xxxxxxx	Checksum
F7	11110111	End SysEx

The datablock "d1...d6" of the system parameters always contains 6 bytes with the following content:

- 1st byte: **MIDI CHANNEL**, valid range is from 00h to 0Fh
- 2nd byte: **AUTO LOCAT**, valid range is from 00h to 01h
- 3rd byte: **START SYNC**, valid range is from 00h to 01h
- 4th byte: **AUTO RESET**, valid range is from 00h to 01h
- 5th byte: **MOD THRESHOLD**, valid range is from 00h to 7Fh
- 6th byte: **CLK PULSE LENGTH**, valid range is from 00h to 78h

For detailed description of the system parameters see the user manual.

3.2.2 "BULK DUMP DATA SAVE / LOAD" FOR PRESET MEMORY BANK

Form of the message:

[hex]	[bin]	byte
F0	11110000	Start SysEx
00	00000000	Manufacturer ID (3 byte)
20	00100000	
21	00100001	
ii	0iiiiiii	Device ID
5C	01011100	Model ID
20	00100000	Command (Data Save / Load)
aa	000aaaaa	Address (00h ~ 1Fh)
d1	0ddddddd	Datablock (14 byte)
..	
d14	0ddddddd	
xx	0xxxxxxx	Checksum
F7	11110111	End SysEx



The datablock "d1...d14" of the system parameters always contains 14 bytes with this content:

- 1st byte: **VCO - KEY SHIFT**, valid range is from 00h to 43h
- 2nd byte: **VCO - AFTERTOUCH BEND**, valid range is from 00h to 7Fh
- 3rd byte: **VCF - FREQUENCY**, valid range is from 00h to 7Fh
- 4th byte: **VCF - KEY FOLLOW**, valid range is from 00h to 7Fh
- 5th byte: **VCF - VELOCITY AMOUNT**, valid range is from 00h to 7Fh
- 6th byte: **VCF - AFTERTOUCH AMOUNT**, valid range is from 00h to 7Fh
- 7th byte: **VCA - KEY FOLLOW**, valid range is from 00h to 7Fh
- 8th byte: **VCA - VELOCITY AMOUNT**, valid range is from 00h to 7Fh
- 9th byte: **VCA - AFTERTOUCH AMOUNT**, valid range is from 00h to 7Fh
- 10th byte: **CTRL - VOLUME MODE**, valid range is from 00h to 03h
- 11th byte: **CTRL - BENDER MODE**, valid range is from 00h to 01h
- 12th byte: **CTRL - CLOCK MODE**, valid range is from 00h to 03h
- 13th byte: **CTRL - CLOCK RATE**, valid range is from 00h to 7Fh
- 14th byte: **CTRL - INDICATOR MODE**, valid range is from 00h to 03h

For detailed description of the preset parameters see the user manual.

3.3 "SYSTEM FUNCTION" COMMANDS

The "System Function" commands ("cc"=30h) are direct commands for the execution of system function. The type of the function is defined by the address "aa".

The datablock "dd" always contains only one databyte which specifies an activity of a system function.

- "aa"=00h → **Preset Change / Request** - change of actual preset or request for the actual preset.
- "aa"=01h → **Save Edit Buffer To Memory Bank** - saving of edit buffer content to a memory bank.
- "aa"=02h → **Interface Reset** – execution of hardware reset or factory reset of the interface.
- "aa"=03h → **SW Version Request** – request for version of installed software.
- "aa"=04h → **Internal Memory Test** – execution of functionality test of interface’s user memory.

3.3.1 PRESET CHANGE / REQUEST

Form of the message:

[hex]	[bin]	byte
F0	11110000	Start SysEx
00	00000000	Manufacturer ID (3 byte)
20	00100000	
21	00100001	
ii	0iiiiiii	Device ID
5C	01011100	Model ID
30	00110000	Command (System Function)
00	00000000	Address (Preset Change / Request)
dd	0ddddd	Databyte (00h ~ 1Fh : change / 20h ~ 7Fh : request)
xx	0xxxxxxx	Checksum
F7	11110111	End SysEx

If the address "aa" is equal to 00h, the SysEx Msg is a command for the preset change or it is a request for the number of actual preset. The value of databyte "dd" can be from 00h to 7Fh.

If the value of databyte "dd" is from 00h to 1Fh, the actual preset is changed after the reception of the command. The databyte "dd" specifies the number of newly selected preset (1 to 32). This command is an equivalent for the standard channel MIDI command "Program Change".



If the value of databyte "**dd**" is from 20h to 7Fh, the message is a request for the number of actual preset. In such case, the preset is not changed and the interface only transmits the information about the actual preset number to the MIDI output. The form of transmitted SysEx message is following:

F0 00 20 21 ii 5C 30 00 dd xx F7 [hex],

where the databyte "**dd**" is the number from 00h to 1Fh which defines the number of the actual preset number (1 to 32).

3.3.2 SAVE EDIT BUFFER TO MEMORY BANK

Form of the message:

[hex]	[bin]	byte
F0	11110000	Start SysEx
00	00000000	Manufacturer ID (3 byte)
20	00100000	
21	00100001	
ii	0iiiiiii	Device ID
5C	01011100	Model ID
30	00110000	Command (System Function)
01	00000001	Address (Save Edit Buffer)
dd	000ddddd	Databyte (00h ~ 1Fh)
xx	0xxxxxxxxx	Checksum
F7	11110111	End SysEx

If the address "**aa**" is equal to 01h, the SysEx Msg is a command for saving of the data from preset edit buffer to a preset memory bank in the user memory.

The value of databyte "**dd**" can be from 00h to 1Fh. This value specifies the number of a preset bank (1 to 32) to which the data will be stored.

For "**dd**" from 20h to 7Fh, the message is considered to be invalid and it is ignored by the interface.

3.3.3 INTERFACE RESET

Form of the message:

[hex]	[bin]	byte
F0	11110000	Start SysEx
00	00000000	Manufacturer ID (3 byte)
20	00100000	
21	00100001	
ii	0iiiiiii	Device ID
5C	01011100	Model ID
30	00110000	Command (System Function)
02	00000010	Address (Reset)
dd	0ddddd	Databyte (00h : HW reset / 7Fh : factory reset)
xx	0xxxxxxxxx	Checksum
F7	11110111	End SysEx

If the address "**aa**" is equal to 02h, the SysEx Msg is the command for execution of the interface reset. The value of databyte "**dd**" can only be 00h or 7Fh. For all other values the message is considered to be invalid and it is ignored by the interface.

If the value of databyte "**dd**" is 00h, the "warm hardware reset" of the interface is executed. The interface is set to the same status (stand-by) as if the instrument is switched on.



If the value of databyte "dd" is 7Fh, the complete "Factory Reset" is executed. The interface is initialized to the factory status (all parameters are set to the default values). **WARNING - All data stored by user in the internal memory are fully erased after the execution of this command.** It is recommended to make a back up of all user data by the "BULK DUMP DATA REQUEST" and "BULK DUMP DATA SAVE / LOAD" messages before the "Factory Reset".

3.3.4 SW VERSION REQUEST

Form of the message:

[hex]	[bin]	byte
F0	11110000	Start SysEx
00	00000000	Manufacturer ID (3 byte)
20	00100000	
21	00100001	
ii	0iiiiiii	Device ID
5C	01011100	Model ID
30	00110000	Command (System Function)
03	00000011	Address (SW Version Request)
00	00000000	Databyte
71	01110001	Checksum
F7	11110111	End SysEx

If the address "aa" is equal to 03h, the SysEx Msg is a request for the version number of the installed operation system. The value of databyte "dd" can only be 00h. For all other values the message is considered to be invalid and it is ignored by the interface.

Immediately after the request reception, the interface transmits the SysEx message:

F0 00 20 21 ii 5C 30 03 dd xx F7 [hex],

where nibbles of the databyte "dd" are identifying installed SW version. For example - byte 10h (nibbles 01h, 00h) means the version 1.0.

3.3.5 INTERNAL MEMORY TEST

Form of the message:

[hex]	[bin]	byte
F0	11110000	Start SysEx
00	00000000	Manufacturer ID (3 byte)
20	00100000	
21	00100001	
ii	0iiiiiii	Device ID
5C	01011100	Model ID
30	00110000	Command (System Function)
04	00000100	Address (Memory Test)
00	00000000	Databyte
70	01110000	Checksum
F7	11110111	End SysEx

If the address "aa" is equal to 04h, the SysEx Msg is the command for execution of the complete test of functionality of the internal interface's memory.

The value of databyte "dd" must be always 00h. For all other values the message is considered to be invalid and it is ignored by the interface.



The test of the memory is executed immediately after the message is received. The test takes about 3 seconds. After the end of the test, the interface transmits SysEx message with the info about the result of the test:

F0 00 20 21 ii 5C 30 04 7F 71 F7 [hex] – if the memory works correctly

F0 00 20 21 ii 5C 30 04 01 6F F7 [hex] – if any malfunction was detected during the test

3.3.6 CV CALIBRATION

Form of the message:

[hex]	[bin]	byte
F0	11110000	Start SysEx
00	00000000	Manufacturer ID (3 byte)
20	00100000	
21	00100001	
ii	0iiiiiii	Device ID
5C	01011100	Model ID
30	00110000	Command (System Function)
05	00000100	Address (CV Calibration)
dd	0ddddddd	Databyte (Calibration constant)
xx	0xxxxxxx	Checksum
F7	11110111	End SysEx

If the address "aa" is equal to 05h, the SysEx Msg is the command for setting of the calibration constant for the control voltage (CV) DAC.

The value of databyte "dd" can be from 00h to 7Fh. Values 00h to 3Fh decrements the CV, value 40h leaves the CV unchanged and values 41h to 7Fh increment the CV.

3.4 "SERVICE" COMMANDS

The "Service" commands ("cc"=40h) are used only for the debugging of the firmware and for the service procedures of the interface. They are not expected to be used during regular operation.

4 EXAMPLES OF SYSEX MESSAGE CREATION

4.1 EXAMPLE 1

Task:

Set the system parameters of the interface to these values:

- MIDI CHANNEL: 0Fh (i.e. channel Nr. 16)
- AUTO LOCAL: 01h (i.e. ON)
- START SYNC: 01h (i.e. ON)
- AUTO RESET: 01h (i.e. ON)
- MOD THRESHOLD: 40h (i.e. middle position of CC#1)
- CLK PULSE LENGTH: 2Dh (i.e. 10 ms)

Solution:

- I don't know what number of the MIDI channel is actually active so the universal Device ID (**7Fh**) will be used.
- The command to be used is the "Bulk Dump Data Save / Load", the command byte will be **20h**.
- Data will be stored to a system memory bank, the address byte will be **20h**.

Start of SysEx Msg will be then:

Start SysEx : **F0h**



Mfr ID : **00h 20h 21h**
 Device ID : **7Fh**
 Model ID : **5Ch**
 Command : **20h**
 Address : **20h**

- All six bytes of the datablock are given by the task. Whole datablock will be:
0Fh 01h 01h 01h 40h 2Dh
- Now, the checksum must be calculated as 7-bit complement of the sum of bytes from 'Model ID' to 'Data', i.e.:
00h – (5Ch + 20h + 1Eh + 0Fh + 01h + 01h + 01h + 00h + 2Dh) = 27h
- The form of the whole required System Exclusive message is after the checksum and End SysEx byte refilling:
F0h 00h 20h 21h 7Fh 5Ch 20h 1Eh 0Fh 01h 01h 01h 00h 2Dh 27h F7h

When the message is received, the values of all system parameters in a system memory bank will be set accordingly to the SysEx message data. Note that to use the newly stored data the interface needs to be reset.

4.2 EXAMPLE 2

Task:

Set the preset parameters of preset memory bank Nr. 1 to the following values:

- VCO - KEY SHIFT:	24h
- VCO - AFTERTOUCH BEND:	40h
- VCF – FREQUENCY:	7Fh
- VCF - KEY FOLLOW:	40h
- VCF - VELOCITY AMOUNT:	00h
- VCF - AFTERTOUCH AMOUNT:	00h
- VCA - KEY FOLLOW:	40h
- VCA - VELOCITY AMOUNT:	00h
- VCA - AFTERTOUCH AMOUNT:	00h
- CTRL - VOLUME MODE:	00h
- CTRL - BENDER MODE:	00h
- CTRL - CLOCK MODE:	00h
- CTRL - CLOCK RATE:	7Ah
- CTRL - INDICATOR MODE:	01h

Solution:

- I don't know what number of the MIDI channel is actually active so the universal Device ID (**7Fh**) will be used.
- The command to be used is the "**Bulk Dump Data Save / Load**", the command byte will be **20h**.
- Data will be stored to preset memory bank Nr. 1, the address byte will be **00h**.

Start of SysEx Msg will be then:

Start SysEx : **F0h**
 Mfr ID : **00h 20h 21h**
 Device ID : **7Fh**
 Model ID : **5Ch**
 Command : **20h**
 Address : **00h**

- All fourteen bytes of the datablock are given by the task. Whole datablock will be:
24h 40h 7Fh 40h 00h 00h 40h 00h 00h 00h 00h 00h 7Ah 01h

- Now, the checksum must be calculated as 7-bit complement of the sum of bytes from 'Model ID' to 'Data', i.e.:
 $00h - (5Ch + 20h + 00h + 24h + 40h + 7Fh + 40h + 00h + 00h + 40h + 00h + 00h + 00h + 00h + 7Ah + 01h) = 26h$
- The form of the whole required System Exclusive message is after the checksum and End SysEx byte refilling:
F0h 00h 20h 21h 7Fh 5Ch 20h 00h 24h 40h 7Fh 40h 00h 00h 40h 00h 00h 00h 00h 7Ah 01h 26h F7h

When the message is received, the values of all preset parameters in preset memory bank Nr. 1 will be set accordingly to the SysEx message data. If this preset number is set, the interface will start to work with the newly stored data.

4.3 EXAMPLE 3

Task:

Save data from preset edit buffer (set by CCs previously) to preset memory bank Nr. 1

Solution:

- I don't know what number of the MIDI channel is active so the universal Device ID (**7Fh**) will be used.
- The command to be used is the "**System Functions**", the command byte will be **30h**
- The function is "**Save Edit Buffer To Memory Bank**", the address byte will be **01h**

Start of SysEx Msg will be then:

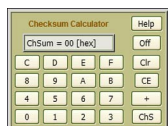
Start SysEx : **F0h**
Mfr ID : **00h 20h 21h**
Device ID : **7Fh**
Model ID : **5Ch**
Command : **30h**
Address : **01h**

- Databyte depends on number of required memory bank; for bank Nr. 1 it is 00h. Since datablock has only one byte, whole datablock will be then:
00h
- Now, the checksum must be calculated as 7-bit complement of the sum of bytes from 'Model ID' to 'Data', i.e.:
 $00h - (5Ch + 30h + 01h + 00h) = 73h$
- The form of the whole required System Exclusive message is after the checksum and End SysEx byte refilling:
F0h 00h 20h 21h 7Fh 5Ch 30h 01h 00h 73h F7h

When the message is received, the values of all parameters in preset edit buffer will be copied to preset memory bank Nr. 1.

5 SUPPORT SOFTWARE

Special software generator for an easy creation of any necessary SysEx messages for control and programming of the interface can be used (see Owner's Manual of the interface).



For easier calculation of the checksum, A special software calculator can be used.

Both these software tools are based on Java script so they can be launched under any operation system which includes a web browser. The Generator and the Calculator are available at manufacturer's web pages.

