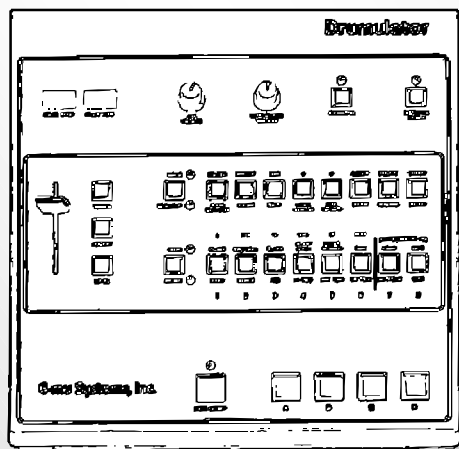


EDRM-M

MIDI interface for EMU Drumulator

Model 8-450
ver. 1.0



MIDI SYSTEM EXCLUSIVE COMMUNICATION



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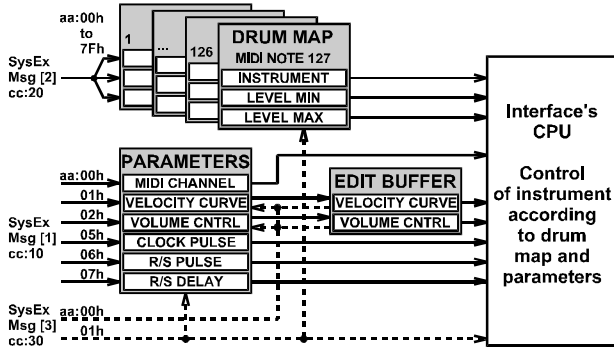
This manual in PDF form is available on supplemental CD-ROM or on manufacturer's web-pages.

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1. SYSTEM EXCLUSIVE COMMUNICATION

EDRM-M interface disposes of a system of System Exclusive communication which enables to program all parameters and instrument map in internal memory of the interface. Some system and testing functions can be launched via SysEx commands too. Block diagram on pic. 1 shows system of SysEx communication.

Pic. 1 – Block diagram of SysEx communication



2. SYSEX MESSAGES STRUCTURE

EDRM-M receives own specific messages with this structure:

F0h	Start SysEx
00h 20h 21h	Manufacturer ID
ii	Device ID
67h	Model ID
cc	Command
aa	Address
dd...dd	Data bytes
xx	Checksum
F7h	End SysEx

2.1. "DEVICE ID" BYTE

The device ID byte identifies the MIDI device exactly.

It must be equal to a number of just an active MIDI channel (00h for channel Nr. 1, 01h for channel Nr. 2 etc. up to 0Fh for channel Nr. 16). If the device is set to OMNI mode, it reacts to all Device ID in range from 00h to 0Fh.

Next possible value of the Device ID is 7Fh – this is the universal Device ID always accepted by the interface regardless on which MIDI channel number is just active.

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

2.2. "COMMAND" BYTE

The command "cc" specifies the interface function type after the whole SysEx Msg is received.



2.3. "ADDRESS" BYTE

The Address "aa" specifies the memory area or selects the system function in dependence on a type of the SysEx Msg – see below.

2.4. "DATA" BYTE

The block of databytes "dd...dd" contains the values of a parameters or functions given by the SysEx Msg. The number of bytes in datablock "dd...dd" is a different in dependence on a type of the SysEx message. There can be 1 or 3 databytes.

2.5. "CHECKSUM" BYTE

The checksum byte "xx" confirms the validity of System Exclusive message. It must be calculated so that seven-bit sum of bytes from the "Model ID" to "Checksum" is equal to zero (i.e. "xx" is seven-bit complement of the sum of bytes from "Model ID" to "Data"). 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" gives the interface activity after the whole message is received. The valid values of "cc" are:

- "cc"=10h - **Change Parameter** – change of values of system parameters in the interface's memory (see [1] on pic. 1).
- "cc"=20h - **Change Note Assignment (Instrument Map)** - change of a content of drum map in the interface's memory (see [2] on pic. 1).
- "cc"=30h - **Direct Control** - system functions for direct control of the interface's hardware (see [3] on pic. 1).
- "cc"=40h - **Testing Procedures** - testing functions for the interface's hardware checking.

For all other values of the "cc", the message is evaluated as invalid and it is ignored by the interface.

3.1. "CHANGE PARAMETER" COMMAND

Form: **F0 00 20 21 ii 67 10 aa dd xx F7 [hex]**

(where "ii" = Device ID, "aa" = Address, "dd" = databyte, "xx" = Checksum)

With a help of the "Change Parameter" command ("cc"=10h), it is allowed to change default values of system parameters stored in the interface's user memory (see [1] on pic. 1).

Valid values of Address "aa" byte are from 00h to 07h. Address "aa" then defines requested parameter. For addresses "aa" = 08h to 7Fh the SysEx Msg is evaluated as invalid and it is ignored by the device. Addresses 03h and 04h are not used in version 1 – they are reserved for next versions. Changes of parameter values on these addresses have no influence to the interface.

The only one databyte "dd" contents value of requested parameter which will be stored in the interface's memory. Value of the "dd" databyte must be in valid range – valid range for individual parameters are:

- "aa" = 00h / MIDI Channel : "dd" = 00h až 11h

Parameter chooses receiving MIDI channel.

- Values of "dd" from 00h to 0Fh conform to fix setting of MIDI channel number from 1 to 16 (00h for channel 1, 01h for channel 2, etc. up to 0Fh for channel 16). In this setting, the interface will



react only to acceptable MIDI command sent on channel chosen by this way. DIL switch on the interface boards is ignored.

- Value 10h chooses OMNI mode. In that case, the interface will react to acceptable MIDI command sent on any of sixteen channels. DIL switch on the interface boards is ignored.
 - Value 11h **assigns**, that the number of MIDI channel is given by setting of DIL switch on the interface board – see user manual of the interface.
 - For all other values of the databyte (i.e. 12h to 7Fh), the message is evaluated as invalid and it is ignored by the interface.
- **"aa" = 01h / Velocity Curve : "dd" = 00h to 04h**
The parameter selects conversion curve for conversion of Velocity values to level of drum instruments. "dd" is 00h for "Lin", 01h for "Exp1", 02h for "Exp2", 03h for "Log1" and 04h for "Log2" – see user manual of the interface. For all other values of the databyte (i.e. 05h to 7Fh), the message is evaluated as invalid and it is ignored by the interface.
 - **"aa" = 02h / Volume Control Mode : "dd" = 00h to 03h**
The parameter selects MIDI controllers for volume of the instrument control (CC7 – Volume and CC11 - Expression). "dd" is 00h for "None", 01h for "Volume", 02h for "Expression" and 03h for "Both" – see user manual of the interface. For all other values of the databyte (i.e. 04h to 7Fh), the message is evaluated as invalid and it is ignored by the interface.
 - **"aa" = 03h / reserve**
This address is reserved for future version of operational system.
 - **"aa" = 04h / reserve**
This address is reserved for future version of operational system.
 - **"aa" = 05h / Clock Pulse Duration : "dd" = 00h až 7Fh**
The parameter sets **the** duration of analogue clock pulse generated by the interface (in "Clock" working mode) for control of tempo of the instrument's sequencer. The databyte can be in range from 00h to 7Fh. Duration of the pulse is given by equation:
CLOCK = 0,104167 * (dd + 5) [ms]
So possible range is ca 0,52 to 13,75 ms.
 - **"aa" = 06h / Run/Stop Pulse Duration : "dd" = 00h až 7Fh**
The parameter sets **the** duration of Run/Stop pulse generated by the interface (in "Clock" working mode) for control of start and stop of the instrument's sequencer. The databyte can be in range from 00h to 7Fh. Duration of the pulse is given by equation:
RUN/STOP = 0,625 * (dd + 3) [ms]
So possible range is ca 1,88 to 81,25 ms.
 - **"aa" = 07h / LED Delay : "dd" = 00h až 7Fh**
The parameter sets safe delay of the interface (in "Clock" working mode) for evaluation of RUN/STOP status of the instrument. The databyte can be in range from 00h to 7Fh. Duration of the pulse is given by equation:
DELAY = 10 * (dd + 5) [ms]
The possible range is 50 to 1320 ms.

3.2. "CHANGE NOTE ASSIGNMENT (INSTRUMENT MAP)" COMMAND

Form: **F0 00 20 21 ii 67 20 aa d1 d2 d3 xx F7 [hex]**

(where "ii" = Device ID, "aa" = Address, "dx" = databyte, "xx" = Checksum)

By transmitting of the "Change Note Assignment" message to the interface, it is allowed to define assigning of any MIDI note to sound generators of the instrument. By other words, it is allowed to create own map of drum instrument in the user interface's memory (see [2] on pic. 1).



Address "aa" defines the number of requested MIDI note. Valid values of Address "aa" byte are from 00h to 7Fh – a sound generator can be assigned to each of MIDI notes.

Datablock always includes three databytes "d1 d2 d3". Their meaning is as below:

- **d1**: Defines sound generator of the instrument which will be launched by given MIDI note. Allowed values of "d1" databyte are from 00h to 0Dh – it corresponds to these sound generators:

▪ 00h = None Generator (Silence)	▪ 07h = Cow Bell (CB)
▪ 01h = Bass Drum (BD)	▪ 08h = Closed High Hat (CH)
▪ 02h = Snare Drum (SD)	▪ 09h = Open High Hat (OH)
▪ 03h = Rim Shot (RS)	▪ 0Ah = Cymbal (CY)
▪ 04h = Low Tom (LT)	▪ 0Bh = Claves (CL)
▪ 05h = Mid Tom (MT)	▪ 0Ch = Hand Clap (CP)
▪ 06h = High Tom (HT)	▪ 0Dh = Metronome Click (MC)

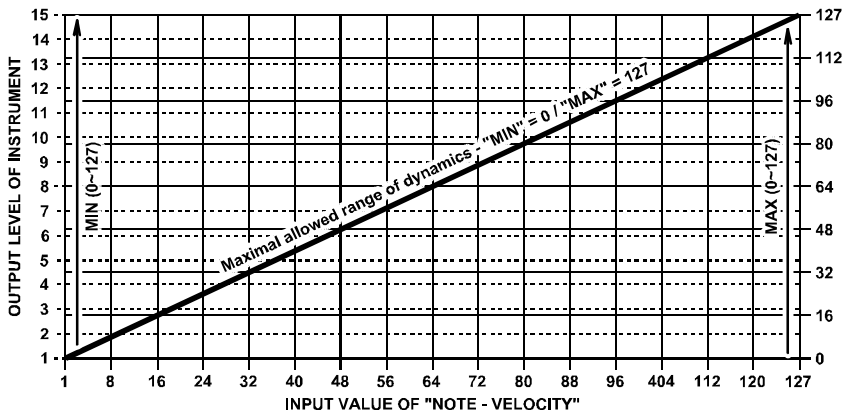
If value of first databyte "d1" is out of valid range (i.e. 0Eh to 7Fh), the whole message is evaluated as invalid and it is ignored.

- **d2**: Defines minimum of enabled dynamic range of assigned sound generator, i.e. if velocity of the MIDI note is equal to 1 (see pic. 2). Higher minimal level of acoustic signal corresponds to higher value of the databyte. Value of "d2" databyte can be from 00h to 7Fh.
- **d3**: Defines maximum of enabled dynamic range of assigned sound generator, i.e. if velocity of the MIDI note is equal to 127 (see pic. 2). Higher maximal level of acoustic signal corresponds to higher value of the databyte. Value of "d3" databyte can be from 00h to 7Fh.

Remark: However, there is a condition that value of "d3" databyte (maximal level of acoustic signal) must not be lower than value of "d2" databyte (minimal level of acoustic signal). If the interface receives SysEx Msg with disallowed value of the second databyte "d2" (i.e. if "d2" > "d3"), value of "d2" databyte is automatically modified so that the condition is accomplished (i.e. "d2" = "d3").

Each of SysEx Msg defines just one MIDI note. Definitions of all other notes stay without changes. If there is a request for rewriting of more notes definition, corresponding number of SysEx messages must be transmitted to the interface. But these messages **must not** be transmitted consecutive. **Time delay 50 ms at least** must be inserted before every particular message in order to store previous value into interface's memory safely. If a lot of SysEx messages are transmitted to the interface consecutive, input buffer overflows and error can occur. The error then disallows correct operating of the interface.

Pic. 2 – Definition of dynamic range of sound generator





3.3. "DIRECT CONTROL" COMMANDS

Form : **F0 00 20 21 ii 67 30 aa dd xx F7 [hex]**

(where "ii" = Device ID, "aa" = Address, "dd" = databyte, "xx" = Checksum)

The "Direct Control" commands ("cc"=30h) are direct commands for the execution of a system function which controls the interface's hardware directly (see [3] on pic. 1).

The type of function is given by the address "aa":

- 00h = Save Edit Buffer – saving of parameters values from edit buffer to permanent memory.
- 01h = Reset – hardware reset or renewal of factory setting of all parameters and MIDI notes assignment (instrument map).

For addresses "aa" = 02h to 7Fh, the SysEx message is evaluated as invalid and it is ignored.

The only one databyte "dd" specifies an activity of a system function exactly.

3.3.1. "SAVE EDIT BUFFER"

Form : **F0 00 20 21 ii 67 30 00 7F 4C F7 [hex]**

If the address "aa" is equal to 00h, the SysEx Msg is the command for the saving of actual temporary data from edit buffer to permanent memory of the interface.

Value of databyte "dd" must be always 7Fh. For all other values, the message is evaluated as invalid and it is ignored by the interface.

Immediately after valid message receiving, actual values of "Velocity Curve" and "Volume Control Mode" parameters are stored to permanent memory and they will be taken as default values after next startup of the instrument

3.3.2. "RESET"

Form : **F0 00 20 21 ii 67 30 01 dd xx F7 [hex]**

If the address "aa" is equal to 01h, the SysEx Msg is the command for execution of reset of the interface. The value of databyte "dd" can be only 00h or 7Fh. For all other values the message is evaluated as invalid and it is ignored by the interface.

If the value of "dd" databyte is 00h, the hardware reset of the interface is executed. The interface is set to the same status after the instrument is switched on..

If the value of "dd" databyte 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 during the command of execution.**

After successful execution of "Factory Reset", red LED in interface's board blinks 5 times with period about 0,4 sec.

"Factory Reset" values of system parameters			
Nr.	Parameter name	Parameter setting	Parameter value [hex]
00h	MIDI Channel	MIDI channel given by DIL switch	11h
01h	Velocity Curve	Linear	00h
02h	Volume Control Mode	CC7 – Volume	01h
05h	Clock Pulse Duration	2 ms	0Eh
06h	Run/Stop Pulse Duration	20 ms	1Dh
07h	Run/Stop Delay	150 ms	0Fh



"Factory Reset" drum instrument map									
Note Nr.	Assigned sound generator				Note Nr.	Assigned sound generator			
	Nr.	Instrument name	Dynamics			Nr.	Instrument name	Dynamics	
			Min.	Max.				Min.	Max.
15h	0Dh	MC - Metronome Click	00h	7Fh	2Eh	09h	OH - Open Hi Hat	00h	7Fh
21h	01h	BD - Bass Drum	00h	7Fh	2Fh	05h	MT - Mid Tom	00h	7Fh
22h	03h	RS - Rim Shot	00h	7Fh	30h	06h	HT - High Tom	00h	7Fh
23h	01h	BD - Bass Drum	00h	7Fh	31h	0Ah	CY - Cymbal	00h	7Fh
24h	01h	BD - Bass Drum	00h	7Fh	32h	06h	HT - High Tom	00h	7Fh
25h	03h	RS - Rim Shot	00h	7Fh	33h	0Ah	CY - Cymbal	00h	7Fh
26h	02h	SD - Snare Drum	00h	7Fh	34h	0Ah	CY - Cymbal	00h	7Fh
27h	0Ch	CP - Hand Clap	00h	7Fh	35h	09h	OH - Open Hi Hat	00h	7Fh
28h	02h	SD - Snare Drum	00h	7Fh	37h	0Ah	CY - Cymbal	00h	7Fh
29h	04h	LT - Low Tom	00h	7Fh	38h	07h	CB - Cow Bell	00h	7Fh
2Ah	08h	CH - Closed Hi Hat	00h	7Fh	39h	0Ah	CY - Cymbal	00h	7Fh
2Bh	04h	LT - Low Tom	00h	7Fh	3Bh	0Ah	CY - Cymbal	00h	7Fh
2Ch	08h	CH - Closed Hi Hat	00h	7Fh	4Bh	0Bh	CL - Claves	00h	7Fh
2Dh	05h	MT - Mid Tom	00h	7Fh	All other notes undefined (Silence)				

3.4. "TESTING PROCEDURES" COMMANDS

Form: **F0 00 20 21 ii 67 40 aa dd xx F7 [hex]**

(where "ii" = Device ID, "aa" = Address, "dd" = databyte, "xx" = Checksum)

The "Test" commands ("cc"=40h) are assigned only for the debugging in production and for the service procedures of the interface. Their usage is not assumed in normal usage.

**4. EXAMPLES OF SYSEX MESSAGE CREATION***Task 1:*

Set receiving MIDI channel to channel Nr. 16.

Solution:

- We don't know what number of the MIDI channel is an active so we choose universal Device ID **7Fh**
- The necessary command is the "**Change Parameter**", the command byte will be **10h**
- The value will be stored to the first position of memory bank so address byte will be **00h**
- MIDI channel Nr. 16 corresponds to parameter value 15 so databyte will be **0Fh**

Start of SysEx Msg will be then :

Start SysEx : **F0h**
 Mfr ID : **00h 20h 21h**
 Device ID : **7Fh**
 Model ID : **67h**
 Command : **10h**
 Address : **00h**
 Data : **0Fh**

- Now, the checksum must be calculated as 7-bit complement of the sum of bytes from Model ID to Data, i.e.:

$$00h - (67h + 10h + 00h + 0Fh) = 7Ah$$

- The form of the whole required System Exclusive message is after the checksum refilling:

F0h 00h 20h 21h 7Fh 67h 10h 00h 0Fh 7Ah F7h

Immediately after that message is received, default MIDI channel will be changed in permanent memory of the interface and the interface will receive only data on MIDI channel Nr. 16 since this time.

Similar method can be used for the creation of the SysEx Msg for drum map definition:

Task 2:

Assign **the** sound generator Cow Bell with dynamic range from 64 to 127 to MIDI note Nr. 0.

Solution:

- We don't know what number of the MIDI channel is an active so we choose universal Device ID **7Fh**
- The necessary command is the "**Change Note Assignment**", the Command byte will be **20h**
- Values for note Nr. 0 are changed so Address byte will be **00h**
- Requested sound generator is Cow Bell so **d1** databyte will be **07h**
- Requested minimum of dynamic range is 64 so **d2** databyte will be **40h**
- Requested maximum of dynamic range is 127 so **d3** databyte will be **7Fh**

Start of SysEx Msg will be then:

Start SysEx : **F0h**
 Mfr ID : **00h 20h 21h**
 Device ID : **7Fh**
 Model ID : **67h**
 Command : **20h**



Address : **00h**
 Data : **07h 40h 7Fh**

- Now, the checksum must be calculated as 7-bit complement of the sum of bytes from Model ID to Data, i.e.:

$$00h - (67h + 20h + 00h + 07h + 40h + 7Fh) = 33h$$

- The form of the whole required System Exclusive message is after the checksum refilling:

F0h 00h 20h 21h 7Fh 67h 20h 00h 07h 40h 7Fh 33h F7h

Immediately after that message is received, the definition of MIDI note Nr. 0 is changed in drum map memory and since this time, the interface will use Cow Bell drum instrument with dynamic range 64 to 127 for MIDI note Nr. 0.

Similar process is valid also for working with hardware of the interface:

Task 3:

Process "Factory Reset" of the interface.

Solution:

- We don't know what number of the MIDI channel is an active so we choose universal Device ID **7Fh**
- Necessary command is "Direct Control" so the Command byte will be **30h**
- Address reset processing is given resolutely so Address byte will be **01h**
- "Factory Reset" is requested so databyte will be **7Fh**

Start of SysEx Msg will be then:

Start SysEx : **F0h**
 Mfr ID : **00h 20h 21h**
 Device ID : **7Fh**
 Model ID : **67h**
 Command : **30h**
 Address : **01h**
 Data : **7Fh**

- Now, the checksum must be calculated as 7-bit complement of the sum of bytes from Model ID to Data, i.e.:

$$00h - (67h + 30h + 01h + 7Fh) = 69h$$

- The form of the whole required System Exclusive message is after the checksum refilling:

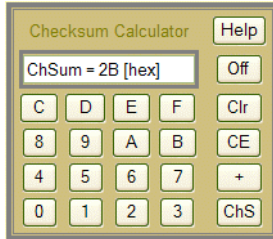
F0h 00h 20h 21h 7Fh 67h 30h 01h 7Fh 69h F7h

Immediately after that message is received, the factory setting values are written to the interface's memory and the interface will use them as default since this time.



5. SOFTWARE SUPPORT

For easier calculation of the checksum, a special software Checksum Calculator can be used. The calculator is based on Java script. The calculator is available on the supplemental CD-ROM:



Special software generator for the simple creation of the SysEx messages necessary for control and programming of EDRM-M interface is available on the supplemental CD-ROM. The generator is based on Java scripts. Any message for the interface setting described above can be created with a help of this generator.



