

## TC-Helicon VoiceWorks MIDI System Exclusive

### Version 1.4

*Note: All numerical values will appear in HEXADECIMAL notation unless otherwise indicated:*

*0xF0 = F0h = F0 – The latter value is the expression of the hex numeral used.*

*Decimal equivalents will appear in brackets after their hex counterparts:*

*0xF0 = F0h = F0 = (240)*

*0x64 = 64h = 64 = (100)*

### General message format:

F0	MIDI System exclusive message start
00	3 byte manufacturers ID for TC-Helicon
01	...
38	...
<Device ID>	System exclusive device ID (user parameter)
4C	VoiceWorks model ID
<Message ID>	VoiceWorks message type identifier (see table below)
<Data>	Data – depends on message type (see format description. below)
...	
...	
F7	MIDI System exclusive message terminator

### Preset numbers

Preset numbers are represented in the SysEx messages as 2 bytes (14 bit value). The first byte is the 7 least significant bits and the second is the 7 most significant bits. The preset numbers are mapped as follows:

Preset number zero is the currently edited preset.

#### **Examples:**

*Factory preset number 67 (decimal) would be translated into bytes 43 (67 in decimal - LSB) and 00 (MSB).*

*User preset number 48 (decimal) would be translated into number 148 (decimal) = 1x128+20 (decimal) and would thus be represented as bytes 14 (LSB - 20 in decimal) and 01 (MSB).*

## Data Packing (24-bit words to 4x7-bit bytes)

The idea of packing data is to take a 24-bit value (the normal width of parameters in VoiceWorks) and represent it as 4 bytes of 7 bits each. This is done because SYSEX data can only be 7 bits in size. The first three bytes hold (in sequence) bits 0-6, 7-13 and 14-20 of the 24-bit value. The fourth byte hold bits 21-23 of the 24-bit value as LSB's with zeros in the remaining bits.

Example:

If the value of a 24 bit parameter is 0x266, it would look like "66 04 00 00" in a SYSEX package.

This is decoded as follows:

SYSEX Data:

```
Byte1 66 hex = X1100110 (abcdefg)
Byte2 04 hex = X0000100 (hijklmn)
Byte3 0  hex = X0000000 (opqrstu)
Byte4 0  hex = X0000000 (****vwx)
```

Final 24Bit Value:

```
          vw xopqrs tuhijklm nabcdefg
Total = 00000000 00000010 01100110
      =      0x0      0x2      0x66
      = 0x000266
```

## Message data format

The format of the data used/needed in the different SysEx messages depends on the type of message. Below are descriptions for each message type explaining data formatting.

SysEx message type	Identifier
VoiceWorks Request Preset	45
VoiceWorks Request Parameter	47
VoiceWorks Preset Data	20
VoiceWorks Parameter Data	22
VoiceWorks Request Shift Map	51
VoiceWorks Shift Map Data	31
VoiceWorks Request Song	14
VoiceWorks Request Setup	15
VoiceWorks Song Data	12
VoiceWorks Setup Data	13
VoiceWorks Preset Received Notification	34

## VoiceWorks Data Request messages

### Preset Request - 45:

<Data> is 2 bytes representing the number of the preset requested. See above for description of preset number representation. The data transmitted by VoiceWorks upon receiving this message will be formatted as a **Preset Data** message (see below for complete description)

**Parameter Request - 47:**

<Data> is 2 bytes. The first byte defines the group to which the parameter belongs and the second byte identifies the parameter within the group. See below for a complete listing of parameters and grouping. The data transmitted by VoiceWorks upon receiving this message will be formatted as a **Param Data** message (see below for complete description)

**Shift Map Request - 51:**

<Data> is 1 byte. The value of this byte is ignored. The data transmitted by VoiceWorks upon receiving this message will be formatted as a **Shift Map Data** message (see below for complete description)

**Song Request - 14:**

<Data> is 1 byte. The byte specifies the song number (0 is the first song). The data transmitted by VoiceWorks upon receiving this message will be formatted as a **Song Data** message (see below for complete description)

**Setup Map Request - 15:**

<Data> is 1 byte. The value of this byte is ignored. The data transmitted by VoiceWorks upon receiving this message will be formatted as a **Setup Data** message (see below for complete description)

**VoiceWorks Data messages****Preset Receive Notification - 34:**

<Data> is 1 byte. 1 means success, 0 means fail.

Sometimes VoiceWorks needs to reorganize its internal preset bank after receiving a SYSEX preset. While this is happening, VoiceWorks has to ignore incoming preset SYSEX packages. If this happens while you are dumping several presets to the unit, you can lose a preset without realizing it. This situation can be avoided by waiting for VoiceWorks to send this message indicating that the preset was successfully stored.

**Preset Data - 20:**

<Data> is 388 bytes organized as follows (in sequence):

2 bytes	Preset number (see above)
12 bytes	Preset name (as ASCII characters)
1 byte	Number of notes in custom scale
16 bytes ( <b>cs</b> )	Custom correction scale (uses data packing)
64 bytes ( <b>cs</b> )	Custom shift map for each voice (uses data packing)
292 bytes ( <b>cs</b> )	73x24-bit values for each parameter in the preset (uses data packing)
1 byte	Checksum of the data marked <b>cs</b> (see below for description)

Notes:

*Custom Correction Scale:*

A correction scale is represented internally as 12 x 8 bit values packed into 4 x 24 bit words (see the VoiceWorks manual for a detailed description).

Example: Major Scale

Chromatic semitones present: 0, 2, 4, 5, 7, 9, 11 (note count = 7)

12 x 8 bit values: 0, 2, 4, 5, 7, 9, 11, 0, 0, 0, 0, 0 (appended with zeros)

At this point an offset of 0x32 is applied to each value for internal purposes.

(0x32, 0x34, 0x36) (0x37, 0x39, 0x3B) (0x43, 0x00, 0x00) (0x00, 0x00, 0x00)

4 x 24 bit words:

word1: 00110010 00110100 00110110 = 0x323436

word2: 00110111 00111001 00111011 = 0x37393B

word3: 10000011 00000000 00000000 = 0x430000

word4: 00000000 00000000 00000000 = 0x000000

Finally, the SYSEX data is created by packing each word into 4 x 7 bit values as described above in the **data packing** description. (This system is used so that in the future software updates, it might be possible to specify scales with more than 16 pitch divisions per octave).

#### *Custom Shift maps:*

Shift maps are represented internally as 4 sets of 12 values (see the VoiceWorks manual for detailed description). Each value specifies the shift amount for its position in the chromatic scale. For example, a shift map causing an upward major 3<sup>rd</sup> interval for all chromatic input notes would be 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3. A unison map would be 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0. Shift entries can also be negative for downward shifts.

For the purpose of storing and dumping, the 12 bytes are packed into 4 x 24-bit values each holding 3 bytes. An offset of (0x32) is applied to each value before packing them into the 4 x 24 bit words. The SYSEX data within a preset dump is finally created by packing these 24-bit words into 7 bit bytes using the **data packing** scheme. Since there are 4 voices on the VoiceWorks, there are 4 custom shift maps making for 4x16 bytes of SYSEX data.

**Checksum:** The checksum is 1 byte holding the 7 least significant bits of the sum of all bytes contributing to the checksum. In this case the contributing data is the data sections marked by **cs** in the table above.

*Example: The byte values 1,2,3,...,126 would result in the following checksum.  $1+2+3+...+126 = 8001$ . To get the 7 least significant bits divide by 128 and then multiply the remainder by 128. In this example it would be 65.*

#### **Parameter data - 22:**

<Data> is 4 bytes. The first two bytes identify the parameter as described above under **Parameter Request**. The last two bytes determine the value of the parameter represented as a 14 bit 2's complement signed value. If a value exceeds the limits of the parameter the value will be limited.

#### *Examples:*

*The value 169 (decimal) =  $1 \times 128 + 41$  would be represented as bytes 01 (MSB) and 29 (LSB)*

*The value -43 ~ 16384-43 (decimal) =  $16341 = 127 \times 128 + 85$  would be bytes 7F (MSB) and 55 (LSB)*

Example – Control Voice #4 bypass state (observe the LED on the fourth Voice Key)

F0 00 01 38 00 4C 22 00 44 00 00 F7

F0 = SysEx start.

00 = Byte 1 of 3 byte manufacturer's ID for TC-Helicon.

01 = Byte 2 of 3 byte manufacturer's ID for TC-Helicon.

38 = Byte 3 of 3 byte manufacturer's ID for TC-Helicon.

00 = Sysex Device ID (default value of 0).

4C = VoiceWorks model ID.

22 = VoiceWorks Message Type Identifier (Parameter Data Identifier)

00 = Parameter Group ID.

44 = Parameter ID for Voice #4 bypass state

00 = Parameter Data MSB (Most significant bit).

00 = Parameter Data LSB (Least significant bit). Value, 0 decimal.

F7 = SysEx message end.

### Shift Map Data - 31:

(Note: Shift Map data is represented differently than when it is a part of a preset dump)

<Data> is 48 bytes. Each byte represents the shift mapping for the respective note in the chromatic scale. A value of 0 is equivalent to -24 semitones (down two octaves), 1A (26 in decimal) is equivalent to +2 semitones (up two semitones), 30 (48 in decimal) is equivalent to +24 semitones (up two octaves), and 36 (54 in decimal) is equivalent to N/C (no change). Consult the VoiceWorks manual for a complete description of the Shift Map user parameter. If any entry in the shift map is beyond the limits the message will be ignored. (This data differs from the when included in a preset dump because it's not packed the same way and does not have the 0x32 offset applied. It's easier to read and manipulate in this format).

### Song Data - 12:

<Data> is 138 bytes. The first byte specifies the song number (from 0 to 49). The next 16 bytes specify the 16 character song name. The next 120 bytes represent the song data. Each step of the song is represented by a 24-bit word that is packed into 4 7-bit bytes as described in the **data packing** section. 30 steps multiplied by 4 bytes per step gives 120 bytes total. The final byte is a checksum that is calculated from the 120 bytes of song data.

24 bit Word Step Format

aaaaaaaa.dddd.bbbb.eecccccc

a=preset number, b=root, c=type (chord or scale number, see VoiceWorks Manual for details),  
d=mode (scale=0, chord=1, shift=2, notes=3), e=status \*

\* status: A song starts with the first step and ends with the first step that has 0x0 for its status. All active song steps must have 0x2 for their status, all unused steps must have 0x0 for their status.

### Setup Data - 13:

<Data> is 197 bytes. All 49 x 24bit setup parameters are sent packed into 196 7-bit bytes as described in the **data packing** section. A checksum calculated from all 49 parameters makes up the last byte.

## Parameter Grouping and Listing

Group name	Group ID
Preset Parameters	0
System Parameters	1

(The following numbers are in Decimal notation)

### Preset Parameters (Group 0)

Parameter Name	ID	Min	Max
voic level1	0	0	31
voic voicing1	1	0	*depends on harmony mode
voic gender1	2	-50	50
voic vibsty1	3	0	11
voic vibamt1	4	0	100
voic pan1	5	0	200
voic level2	6	0	31
voic voicing2	7	0	*depends on harmony mode
voic gender2	8	-50	50
voic vibsty2	9	0	11
voic vibamt2	10	0	100
voic pan2	11	0	200
voic level3	12	0	31
voic voicing3	13	0	*depends on harmony mode
voic gender3	14	-50	50
voic vibsty3	15	0	11
voic vibamt3	16	0	100
voic pan3	17	0	200
voic level4	18	0	31
voic voicing4	19	0	*depends on harmony mode
voic gender4	20	-50	50
voic vibsty4	21	0	11
voic vibamt4	22	0	100
voic pan4	23	0	200
harm mode	24	0	3
harm root	25	0	11
harm type	26	0	*depends on harmony mode
harm level	27	0	31
harm smooth	28	0	100
harm lead	29	0	1
harm style	30	0	7
harm sty amt	31	0	10
harm tuning	32	0	2
harm bend	33	0	1
harm porta	34	0	200

harm latch	35	0	1
harm notesatt	36	0	100
harm notesrel	37	0	100
thic level	38	0	31
thic detune	39	0	25
thic spread	40	0	100
effe level	41	0	31
effe revdlymix	42	0	100
effe leadrevsend	43	-20	31
effe harmrevsend	44	-20	31
effe auxrevsend	45	-20	31
effe leaddlysend	46	-20	31
effe harmdlysend	47	-20	31
effe auxdlysend	48	-20	31
effe dly2revsend	49	-20	31
effe revtype	50	0	13
effe revpredlylev	51	0	100
effe revdecaytime	52	0	200
effe revcolorl	53	0	6
effe revcolorh	54	0	6
effe dlytype	55	0	2
effe dlytime	56	0	1800
effe dlytempo	57	-21	1
effe dlyfeedback	58	0	99
effe dlyhfdamp	59	10	23
cor root	60	0	11
cor scale	61	0	5
cor win	62	0	200
cor att	63	0	99
cor amt	64	0	99
voice1 bypass	65	0	1
voice2 bypass	66	0	1
voice3 bypass	67	0	1
voice4 bypass	68	0	1
harm bypass	69	0	1
thic bypass	70	0	1
effe bypass	71	0	1
cor bypass	72	0	1

\* For Harmony Mode dependant parameters, see the VoiceWorks Manual for details.

### Setup Parameters (Group 1)

Parameter Name	ID	Min	Max
dryllevel	0	-1	31
leadpan	1	0	200
lowcut	2	0	3
dynamics	3	0	3

compthresh	4	-60	0
compratio	5	0	13
gate	6	-71	0
eqroute	7	0	3
lsfreq	8	0	22
lcboost	9	-12	12
hsfreq	10	0	22
hcboost	11	-12	12
midfreq	12	0	22
mcboost	13	-12	12
eq_q	14	0	16
outlevel	15	-100	0
output	16	0	1
samplerate	17	0	2
input	18	0	1
globaleff	19	0	100
tuning	20	0	80
midichan	21	0	16
midifilt	22	0	3
CC-Ctrl Mode	23	0	2
Global Chord	24	0	1
keysplit	25	24	127
keydir	26	0	1
vibctrl	27	0	1
notestrans	28	-4	4
bendrange	29	0	12
notes4chan	30	0	1
fs1	31	0	9
fs2	32	0	9
fs3	33	0	9
mididump	34	0	152
erasesong	35	0	50
restore	36	0	100
viewangle	37	0	6
delaycomp	38	0	1
micsense	39	0	1
sysexid	40	0	127
current_preset	41	1	100
taptempo	42	0	1800
preset_edited	43	0	1
bypass_all	44	0	1
mic_in	45	0	1
48v	46	0	1
20db	47	0	1
Bypass Mode	48	0	1