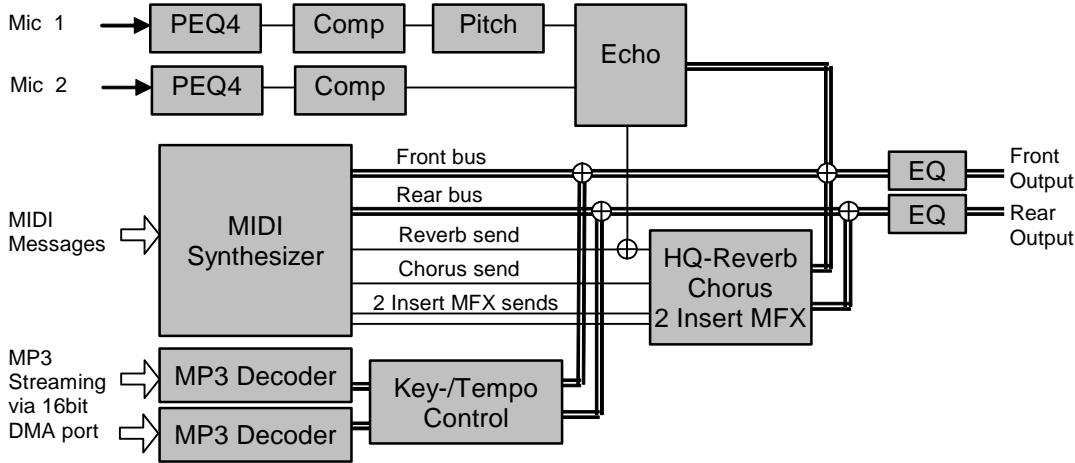


Signal Processing Synoptic



Features of MIDI Synthesizer

- typically hardware configuration : SAM3816 + Flash + 64kx16 SRAM + stereo DAC
- 48Khz sampling rate (12.288Mhz quartz)
- full GM/™ implementation, 32 MIDI channels
- up to 126 voice polyphony
- ™ compatible Reverb, Chorus
- 2 individual Insert Multi-Effects (MFX) with Delay, Distortion, Rotary etc.
- 4 speaker output, individual 4-bands on Front and Rear outputs and 3D-Spatializer
- USB MIDI supported (USB AudioClass 1.0 compliant, 2 MIDI devices for 32 MIDI channel access)
- available Wave-ROM: CleanWave16® (16Mbit, 128 GM instruments + 159 variations, 9 drumsets) and CleanWave32® (32Mbit, 128 GM instruments + 195 variations, 9 drumsets + 1 SFX-set), others on request.

Features of Microphone Input & Effects

- 2 Microphone inputs with individual gain control
- Low-Cut Filter in input, Noise Gate, Compressor / Compander / Limiter
- Tone control: 4 bands parametric Equalizer (+/- 15dB at ~0.23dB steps)
- Pitch Shifter: up to +/- 1 octave (Feedback Cancelling, Voice Doubling, funny Effects, like Mickey Mouse)
- Stereo Multi-Tap Delay / Echo

Features of MP3 Player (optionally)

- 2 independent MP3 decoders supports MPEG-1 Layer 3 (ISO/IEC 11172), streaming through 16bit parallel port
- High quality Key- /Tempo control

Available Reference Design: 3816-EK (stand alone evaluation)



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MPEG Layer-3 audio coding technology licensed from Fraunhofer IIS and Thomson Licensing.

HOST Interface

The slave 8-bit / 16bit parallel interface of SAM3816 is used to connect the chip to a Host processor for transfer of MIDI and MP3 data and control. The 16bit parallel I/O interface of SAM3816 can be used for high speed DMA data transfer. The 8bit parallel I/O interface is composed of two byte registers and one IRQ.

Pin description

Pin name	Pin#	Direction	Data Type
A0	17	In	Slave 8bit interface address. Indicates type of transfer data: A0 = low, WR/ = low;: write Data (MIDI messages) A0 = low, RD/ = low: read Data Register (e.g. Acknowledge byte) A0 = high, WR/ = low: write Control Message (e.g. MP3 Control) A0 = high, RD/ = low: read I/O Status Register (see below) (A1 must be 0 for 8bit interface access)
A1	30 (or 22)	In	Address line for DMA 16bit parallel interface (0=8bit, 1=16bit DMA)
CS/	20	In	Slave 8bit interface chip select, active low
WR/	18	In	Slave 8bit interface write, active low. D7-D0 data is sampled by chip on WR/ rising edge if CS/ is low.
RD/	19	In	Slave 8bit interface read, active low. D7-D0 data is output when RD/ goes low and CS/ is low.
D7-D0	6-13	In/Out	Function of these pins depends on level of A1 pin: A1 = 0: Slave 8bit interface data. Output if CS/ and RD/ are low (read from chip), input if CS/ and WR/ are low (write to chip). Type of data defined by A0 input. A1 = 1: Slave DMA 16bit data. Output if CS/ and RD/ are low (read from chip), input if CS/ and WR/ are low (write to chip). A0 input is "don't care".
D15-D8	140-144, 1-3	In/Out	Slave DMA 16bit data when A1 = 1
IRQ / DMA_READY	14	Out	Function of this pin depends on level of A1 pin: A1 = 0: Slave 8bit interface interrupt request. High when data is ready to be transferred from chip to host. Reset by a read from Host (CS/=0 and RD/=0). A1 = 1: this pin is reflecting status of current DMA read/write. Before beginning next read/write, host has to check DMA_RDY is 1.

I/O Status Register

The status register shows availability of the 8bit interface:

TE	RF	X	X	X	X	X	X
----	----	---	---	---	---	---	---

Status register is read when A0 = 1, A1 = 0, RD/ = 0, CS/ = 0

TE: Transmit empty. If "0", 8bit data from SAM3816 to host is pending and IRQ is high.
Reading the data at A0=low will set TE to 1 and clear IRQ.

RF: Receiver full. If "0" then SAM3816 is ready to accept 8bit data from host.
See notes about RF bit in SAM3816.pdf page 21.

Control Messages and MP3 Streaming (optionally)

Host can send Control Messages through 8bit parallel interface. All messages include 1 command byte (MSB=1) followed by 0 or 1 data bytes (MSB=0). The command byte and data byte must be sent with pin A0=1, A1=0. Acknowledge bytes from SAM3816 can be read by Host on 8bit parallel interface with A0=0, A1=0. MP3 streaming data is send via DMA 16bit interface with A1=1.

Multiple streaming MP3 is provided through 16bit (DMA) Host port with individual commands for each track.

System Control Messages

Host -> SAM3816

Command	Data	Description	
FEh	-	Xfer End command	-
FFh	-	Reset all (restart firmware from power-up point)	-

SAM3816 -> Host

Command	Data	Description	
ACh	-	Acknowledge	-

MP3 Control Messages

Host -> SAM3816

Command	Data	Description	Power-up default
8nh	-	Reset MP3 streaming buffer SAM3816 send acknowledge (Fnh = request first MP3 data block) when streaming buffer reset is finished.	-
9nh	-	Stop / Pause MP3 playing	-
Anh	-	Start / Continue MP3 playing	-
Bnh	Volume	MP3 Volume (0 to 7Fh)	7Fh
Cnh	Pan	MP3 stereo balance: 0=left...40h=center...7Fh=right	40h
Fnh	data	If data = 1, select MP3 streaming buffer to prepare DMA transfer If data = 0, select MP3 track to stop automatically, when end of MP3 reached (in this case no further MP3 data demand). SAM3816 send acknowledge (ACh) when streaming buffer or End-Of-MP3 command is set.	-
A5h	-	Start / Continue MP3 Track#1 and Track#2 (at same time)	-

SAM3816 -> Host

Command	Data	Description	
Fnh	-	request MP3 data, half buffer is free for receiving next data <i>(buffer size is 800h bytes = 1024 words in current firmware)</i>	

“n” is MP3 track, 0 or 1

MP3 Streaming Protocol

In order to have synchronized start-up of all MP3 tracks, the Host should prepare all buffers for all tracks before sending MP3 start command "Anh".

MP3 Streaming start-up example for 2 MP3 tracks:

Prepare track 1 buffer:

- Host send "80h" to reset MP3 streaming buffer
- Host wait for SAM3816 send "F0h" = request first MP3 data on track 1
- Host send F0h 01h to select MP3 streaming buffer track 1
- Host wait for acknowledge "ACh"
- Host send max half buffer (= 512 word) MP3 data via DMA 16bit
- Host send "FEh" (end of xfer)

Prepare track 2 buffer:

- Host send "81h" to reset MP3 streaming buffer
- Host wait for SAM3816 send "F1h" = request first MP3 data on track 2
- Host send F1h 01h to select MP3 streaming buffer track 2
- Host wait for acknowledge "ACh"
- Host send max half buffer (= 512 word) MP3 data via DMA 16bit
- Host send "FEh" (end of xfer)

Start MP3 tracks:

- Host send "A0h" to start MP3 decoder track 1
 - Host send "A1h" to start MP3 decoder track 2
- or
- Host send "A5h" to start MP3 decoder track 1 & 2 (at same time)

MP3 Streaming example for multiple MP3 tracks ("n" is MP3 track, 0 or 1):

- Host wait for SAM3816 send "Fnh" = request next MP3 data on track "n"
- Host send Fn timer to select MP3 streaming buffer track "n"
- Host wait for acknowledge "ACh"
- Host send max half buffer (= 512 word) MP3 data via DMA 16bit
- Host send "FEh" (end of xfer)
- Repeat steps during play (with switching between MP3 buffers for multiple tracks)

End of MP3:

- Host wait for SAM3816 send "Fnh" = request next MP3 data on track "n"
- Host send Fn timer 00h to select MP3 track to stop automatically (track "n")
- SAM3816 stops automatically the MP3 decoder when all has MP3 data has been consumed and played

During the DMA transfer, Host can also at any time send some new commands/data in 8bit mode by setting A1 pin back to 0. This simultaneously use of 8bit mode together with DMA 16bit mode is typically corresponding to case of sending control messages (A1=0) while doing MP3 streaming (A1=1).

Microphone Effect Controls

The Microphone effects are controlled through MIDI NRPN messages (on serial MIDI IN, or 8bit Host port A0=0). MIDI channel is "don't care" for all these NRPNs.

NRPN sending method:

CTRL#99=high byte, CTRL#98=low byte, CTRL#6=vv

Example:

NRPN Microphone 1 Level 3724H = 40H

- Send MIDI CTRL#99 with value 56 (37h), MIDI code: 0B0h 063h 037h
- Send MIDI CTRL#98 with value 64 (24h), MIDI code: 0B0h 062h 024h
- Send MIDI CTRL#6 with value 64 (40h), MIDI code: 0B0h 006h 040h

MIDI Synthesizer Front/Rear Level NRPN controls (38xxH) and MIDI Equalizer NRPN controls (39xxH) are described in detailed MIDI implementation chart on page 14.

Microphone 1 & 2 Input Controls		
3720h	Microphone 1 Low Cut Filter Frequency: 0 = off, 1 = ~20Hz...7Fh = ~200Hz	0
3721h	Microphone 2 Low Cut Filter Frequency: 0 = off, 1 = ~20Hz...7Fh = ~200Hz	0
3722h	Microphone 1 Noise Gate Threshold level: 0 = off, 1 = -66dB ... 7Fh = -24dB	0
3723h	Microphone 2 Noise Gate Threshold level: 0 = off, 1 = -66dB ... 7Fh = -24dB	0
3724h	Microphone 1 Level (0..7Fh)	64
3725h	Microphone 2 Level (0..7Fh)	0
3726h	Microphone 1 Pan (0..40h..7Fh = left..center..right)	64
3727h	Microphone 2 Pan (0..40h..7Fh = left..center..right)	64
3736h	Microphone 1 to Reverb send (0..7Fh)	64
3737h	Microphone 2 to Reverb send (0..7Fh)	64
3738h	Microphone 1 to Echo send (0..7Fh)	64
3739h	Microphone 2 to Echo send (0..7Fh)	64
Microphone 1 Pitch Shifter Controls		
373Ah	Pitch Shifter Preset (see Pitch Shifter Preset table)	0 (OFF)
373Bh	Mix value: 0=only direct signal, 7Fh=only pitched signal	127
373Ch	Pitch Shift Amount: 0=one octave down, 64=original, 127=one octave up	64
373Dh	Post Low Pass Filter Frequency (0..7Fh, 0=Filter closed)	127
373Eh	Post Low Pass Filter Resonance (0..7Fh, 0=no Resonance)	0
373Fh	Pitch Shifter ON/OFF: =0 OFF, else ON	0 (OFF)
Microphone 1 Compressor/Compressor/Limiter Controls		
3740h	Compressor Preset (see Compressor Preset table)	0 (OFF)
3741h	Compressor ON/OFF: =0 OFF, else ON	OFF
3742h	Attack time: 0=fast attack (0.1ms), ... 60=1ms, ... 100=10ms, till 127=slow attack (100ms), exp. Curve	64
3743h	Release time: 0=fast release (10ms), ... 60=100ms, ... 100=1s, till 127=slow release (~5s), exp. Curve	64
3744h	Threshold: 127=0dB, 64=-6dB, 32=-12dB, 16=-18dB, 8=-24dB, 4=-30dB, 2=-36dB 0=-Inf	127
3745h	Ratio: 127=1/128, 126=2/128 (1/64), 125=3/128, ... 64=64/128 (1/2), ... 0=1/1	0
3746h	Threshold2: 127=0dB, 64=-6dB, 32=-12dB, 16=-18dB, 8=-24dB, 4=-30dB, 2=-36dB 0=-Inf	0
3747h	Ratio2: 127=1/128, 126=2/128 (1/64), 125=3/128, ... 64=64/128 (1/2), ... 0=1/1	0
Microphone 2 Compressor/Compressor/Limiter Controls		
3748h	Compressor Preset (see Compressor Preset table)	0 (OFF)
3749h	Compressor ON/OFF: =0 OFF, else ON	OFF
374Ah	Attack time: 0=fast attack (0.1ms), ... 60=1ms, ... 100=10ms, till 127=slow attack (100ms), exp. Curve	64
374Bh	Release time: 0=fast release (10ms), ... 60=100ms, ... 100=1s, till 127=slow release (~5s), exp. Curve	64
374Ch	Threshold: 127=0dB, 64=-6dB, 32=-12dB, 16=-18dB, 8=-24dB, 4=-30dB, 2=-36dB 0=-Inf	127
374Dh	Ratio: 127=1/128, 126=2/128 (1/64), 125=3/128, ... 64=64/128 (1/2), ... 0=1/1	0
374Eh	Threshold2: 127=0dB, 64=-6dB, 32=-12dB, 16=-18dB, 8=-24dB, 4=-30dB, 2=-36dB 0=-Inf	0
374Fh	Ratio2: 127=1/128, 126=2/128 (1/64), 125=3/128, ... 64=64/128 (1/2), ... 0=1/1	0

Microphone 1 Parametric Equalizer		
3760h	Equalizer ON/OFF: = 0 OFF, else ON	OFF
3761h	Low Band Gain (0..7Fh), 0=-12dB...64=0dB...127=+12dB	64
3762h	Low_Mid Band Gain (0..7Fh), 0=-15dB...64=0dB...127=+15dB	64
3763h	High_Mid Band Gain (0..7Fh), 0=-15dB...64=0dB...127=+15dB	64
3764h	High Band Gain (0..7Fh), 0=-12dB...64=0dB...127=+12dB	64
3765h	Low Band Freq: 0=-80Hz...64=900Hz...127=2KHz	10 (~100Hz)
3766h	Low_Mid Band Freq: 0=-60Hz...64=~1.4KHz...127=~3KHz	6 (~500Hz)
3767h	High_Mid Band Freq: 0=-60Hz...64=~5.1KHz...127=~10.3KHz	104 (~8KHz)
3768h	High Band Freq: 0=-500Hz...64=-5KHz...127=~15KHz	127
3769h	Low_Mid Band Q-Factor: 0:Q=1, 127:Q=20	64 (Q=2)
376Ah	High_Mid Band Q-Factor: 0:Q=1, 127:Q=20	64 (Q=2)
Microphone 2 Parametric Equalizer		
3770h	Equalizer ON/OFF: = 0 OFF, else ON	OFF
3771h	Low Band Gain (0..7Fh), 0=-12dB...64=0dB...127=+12dB	64
3772h	Low_Mid Band Gain (0..7Fh), 0=-15dB...64=0dB...127=+15dB	64
3773h	High_Mid Band Gain (0..7Fh), 0=-15dB...64=0dB...127=+15dB	64
3774h	High Band Gain (0..7Fh), 0=-12dB...64=0dB...127=+12dB	64
3775h	Low Band Freq: 0=-80Hz...64=900Hz...127=2KHz	10 (~100Hz)
3776h	Low_Mid Band Freq: 0=-60Hz...64=~1.4KHz...127=~3KHz	6 (~500Hz)
3777h	High_Mid Band Freq: 0=-60Hz...64=~5.1KHz...127=~10.3KHz	104 (~8KHz)
3778h	High Band Freq: 0=-500Hz...64=-5KHz...127=~15KHz	127
3779h	Low_Mid Band Q-Factor: 0:Q=1, 127:Q=20	64 (Q=2)
377Ah	High_Mid Band Q-Factor: 0:Q=1, 127:Q=20	64 (Q=2)
Microphone Echo Controls		
3730h	Echo Preset (0 to 4): 0=OFF 1=mono echo, 2=Stereo echo, 3=Triplet echo, 4=Multi Tap	1
3731h	Echo Pre High Pass Filter (0..7Fh, 0=no Filter)	0
3732h	Echo Pre High Shelf Filter Gain (0=-12dB to 7Fh=+12dB, 64=0dB)	64
3728h	Echo Level (0..7Fh)	64
3729h	Echo Delay Time (0..7Fh = 0..1365ms)	32
372Ah	Echo Feedback (0..7Fh)	64
3733h	Echo HDamp Filter (0..7Fh)	64
3734h	Echo Input Level (0..7Fh)	64
3735h	Echo to Reverb send (0..7Fh)	64

Microphone Echo Presets

Preset is selected by using midi NRPN 3730h:

B0h 63h 37h B0h 62h 30h B0h 06h NN (NN is preset number, from 0 to 4, see list below).

ECHO PRESETS

Nb	Name	Preset Default Values			
		Level	Delay Time	Feedback	Hdamp
0	OFF	0	/	/	/
1	Delay 1: Mono	64	30	64	0
2	Delay 2: Stereo	64	30	64	0
3	Delay 3: Stereo Triplet	64	30	64	0
4	Delay 4: Multi-Tap	64	30	64	0

Microphone Pitch Shift Presets

Preset is selected by using MIDI NRPN command 373Ah:

B0h 63h 37h B0h 62h 3Ah B0h 06h NN (NN is preset number, from 0 to 9, see list below).

PITCH SHIFT PRESETS

Nb	Name	Preset Default values				
		Coarse Tune	Fine Tune	Filter Cut Frequency	Filter Resonance	Pitch shifted signal Mix
VOCAL PITCH SHIFT						
1	Male Voice	61	0	127	0	127
2	Robot Voice	58	0	96	120	127
3	Dark Voice 1	55	0	64	64	127
4	Dark Voice 2	52	0	32	110	127
5	Female Voice	67	0	127	0	127
6	Duck Voice	70	0	64	110	127
7	Mouse Voice 1	73	0	64	0	127
8	Mouse Voice 2	76	0	64	0	127
9	Choir (Doubling)	64	12	127	0	64

Note:

Some Pitch Shift Presets are using an additional 12dB low pass filter with Resonance for doing special sound effects (e.g. in "Dark Voice" or "Robot Voice").

Microphone Compressor/Compander/Limiter Presets

Preset is selected by using MIDI NRPN command 3740h for Microphone1, resp. 3748h for Microphone2.

Preset number can be in range 0 to 9 (see list below).

COMPRESSOR/COMPANDER/LIMITER PRESETS

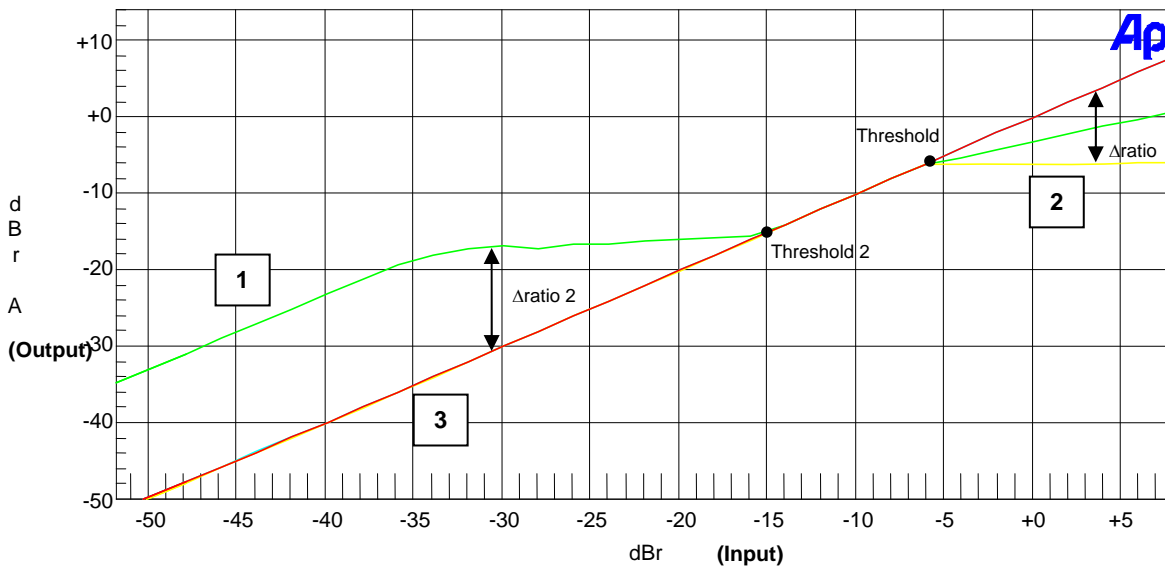
Nb	Name	Preset Default values					
		Attack	Release	Threshold	Ratio	Threshold2	Ratio2
0	NO COMPRESSION	64	0	127	0	0	0
COMPRESSOR / COMPANDER							
1	COMPRESSOR 1: -18dB 2:1	64	0	16	64	0	0
2	COMPRESSOR 2: -15dB 3:1	64	0	22	84	0	0
3	COMPRESSOR 3: -21dB 7:1	64	0	11	110	0	0
4	COMPRESSOR 4: -24dB 12:1	64	0	8	117	0	0
5	COMPRESSOR 5: -18dB 5:1 COMPANDER -24dB 2:1	64	0	16	100	8	64
6	COMPRESSOR 6: -6dB 12:1 COMPANDER -24dB 12:1	64	0	64	117	8	117
LIMITER / LIMANDER							
7	LIMITER 1: -6dB	0	64	64	127	0	0
8	LIMITER 2: -18dB	0	64	16	127	0	0
9	LIMITER 3: -12dB LIMANDER: -24dB	0	64	32	127	8	127

Microphone Comander function description

Comander function is useful for voice processing. Dynamic process is delimited by 2 inflections point (threshold, and threshold2), between these 2 points, signal is unchanged (unity gain).

Compressing signal below Threshold2 is possible by adjusting ratio2 parameter. Higher the parameter ratio2 is, higher the signal below threshold2 will be amplified (useful for example for small voice, Maximum amplification is 18dB).

Compressing signal above Threshold is possible by adjusting ratio parameter. Higher the parameter ratio is, higher the signal will be limited (yellow curve).



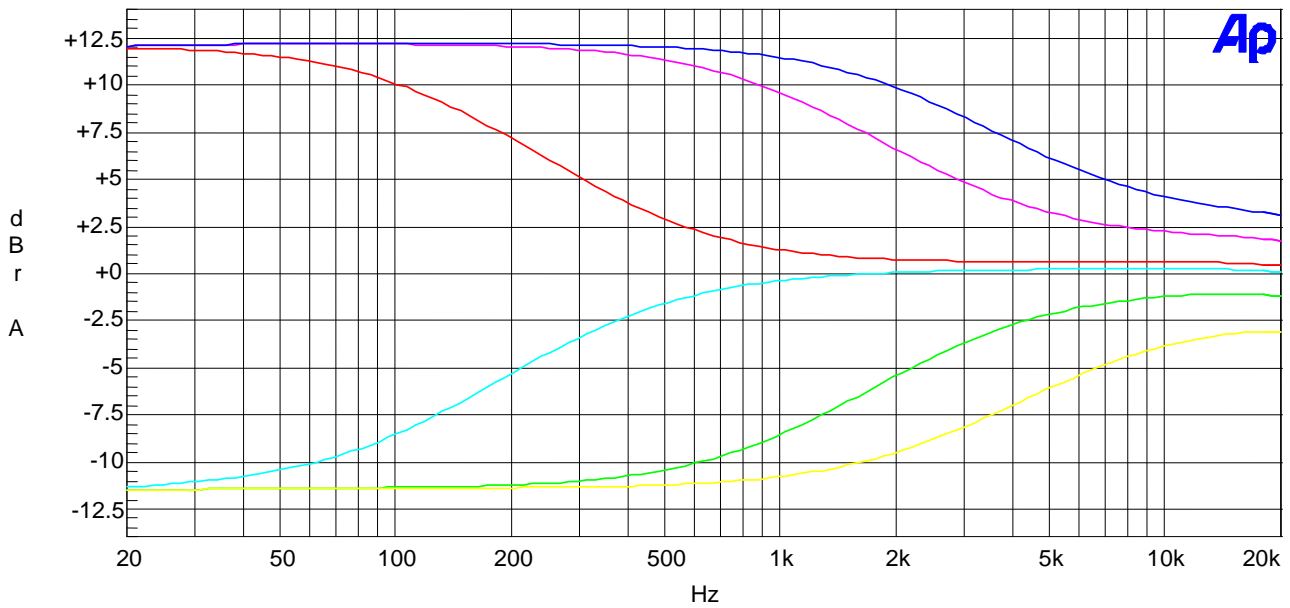
Sweep	Color	Comment
1	Green	Thershold2=7(-15dB), Ratio2=127, Threshold=20(-6dB), Ratio=64
2	Yellow	Limiter, Thershold2=0, Ratio2=0, Threshold=20(-6dB), Ratio=127
3	Red	Unity gain, Thershold2=0, Ratio2=0, Threshold=127, Ratio=0 (OFF)

Microphone Parametric Equalizer

Parametric Equalizer is a 4 band equalizer, a low shelf filter, 2 parametric mid bands, and a high shelf filter. For low and high shelf filters the gain can be set from -12dB to $+12\text{ dB}$, for the 2 middle bands the gain can be set from -15dB to $+15\text{ dB}$, Q factor can be set from 1 to 20.

Low pass Shelf filter

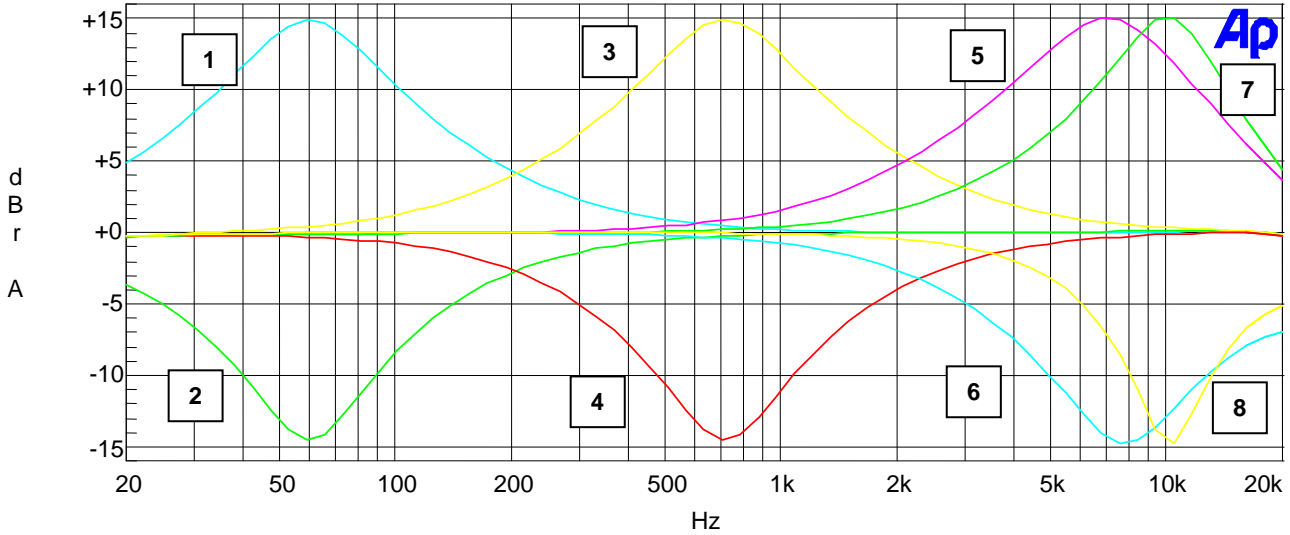
The low pass Shelf Filter frequency range is from 80 Hz to 1 kHz. The following diagram shows the behavior of low pass filter at different frequencies:



Red and cyan: frequency control value is 0 (80Hz) at $+12$ and -12 dB
 Magenta and green: frequency control value is 64 (900Hz) at $+12$ and -12 dB
 Blue and yellow: when frequency control value is 127 (2KHz) at $+12$ and -12 dB

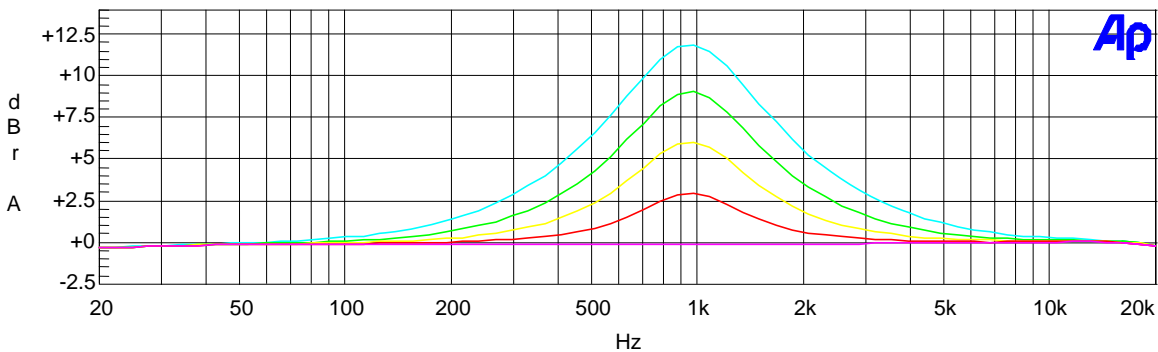
Middle BandPass/BandStop filter

Frequency control value are between 0 and 127, (respectively from 60Hz to 10,3 kHz). Measurements are done at -15dB and +15dB, and Q of 1.0



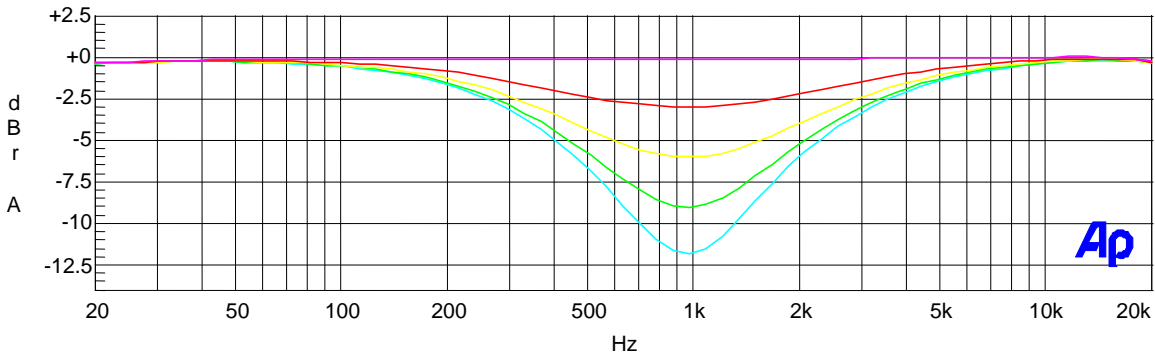
Sweep	Color	Comment		
1	Cyan	Gain=127(+15dB)	Fc=0(60Hz)	Q=0 (1)
2	Green	Gain=0(-15dB)	Fc=0(60Hz)	Q=0 (1)
3	Yellow	Gain=127(+15dB)	Fc=9(700Hz)	Q=0 (1)
4	Red	Gain=0(-15dB)	Fc=9(700Hz)	Q=0 (1)
5	Magenta	Gain=127(+15dB)	Fc=88(7kHz)	Q=0 (1)
6	Cyan	Gain=0(-15dB)	Fc=88(7kHz)	Q=30
7	Green	Gain=127(+15dB)	Fc=127(10,3kHz)	Q=41
8	Yellow	Gain=5(-15dB)	Fc=127(10,3kHz)	Q = 72

For Boost, Cut and Q, measurements are done at 1kHz, boost gain control value are from 64 to 127, (respectively from 0dB to +15dB):



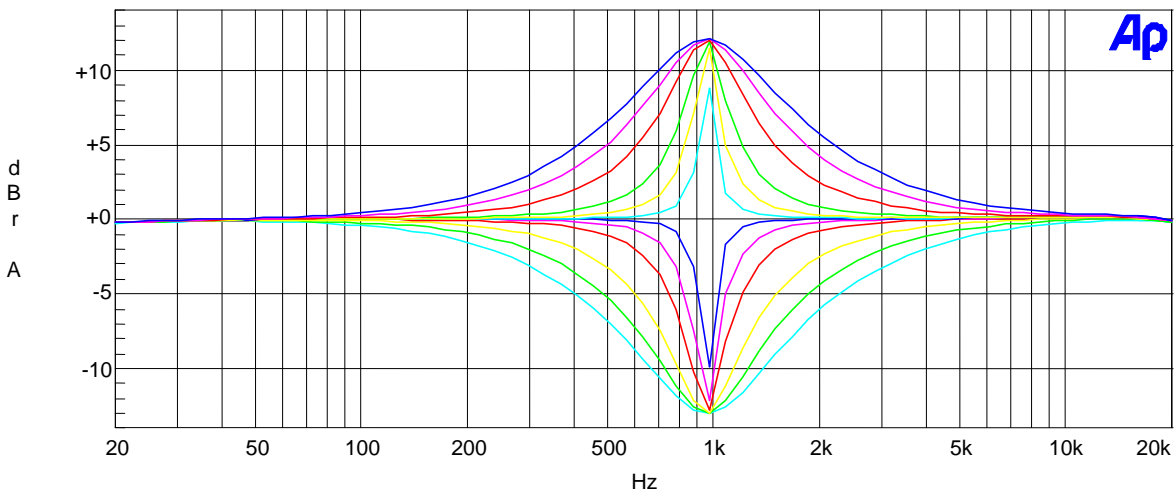
Sweep	Trace	Color	Comment
1	1	Cyan	Gain=120(+12dB)
2	1	Green	Gain=100(+9dB)
3	1	Yellow	Gain=82(+6dB)
4	1	Red	Gain=69(+3dB)
5	1	Magenta	Gain=64(0dB)

Cut gain control value are from 0 to 64, (respectively from -15dB to 0dB):



Sweep	Trace	Color	Comment
1	1	Cyan	Gain=4 (-12dB)
2	1	Green	Gain=12 (-9dB)
3	1	Yellow	Gain=24 (-6dB)
4	1	Red	Gain=41 (-3dB)
5	1	Magenta	Gain=64(0dB)

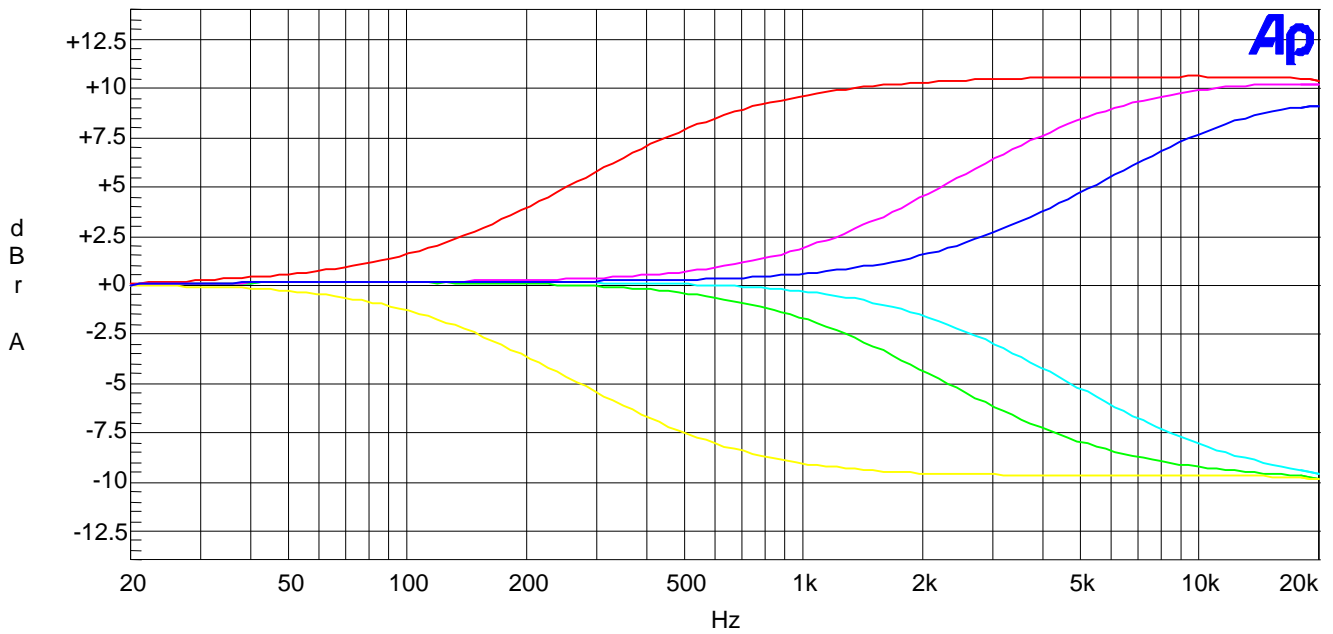
Q factor control value is between 0 and 127, (respectively Q from 1 to 20):



Sweep	Trace	Color	Comment
1	1	Cyan	Q=0 (1) (BandStop)
2	1	Green	Q=32 (BandStop)
3	1	Yellow	Q=64 (BandStop)
4	1	Red	Q=96 (BandStop)
5	1	Magenta	Q=110 (BandStop)
6	1	Blue	Q=127 (BandStop)

High pass Shelf filter

The high pass filter frequency range is variable from 180 Hz to 3kHz. (at -3dB from 0dB).



Red and yellow: when frequency control value is 0 (500Hz) at + 12 and -12 dB
 Magenta and green: when frequency control value is 64 (5KHz) at + 12 and -12 dB
 Blue and cyan: when frequency control value is 127 (15KHz) at + 12 and -12 dB

DREAM Special MIDI Synthesizer NRPN Controls

MIDI channel must be 0 for all these NRPNs.

NRPN sending method:

CTRL#99=high byte, CTRL#98=low byte, CTRL#6=vv

Example:

In order to set General Master Volume (NRPN 3707h) to value 64 (40h), send

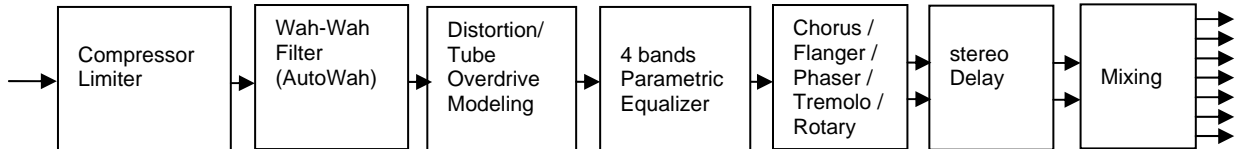
- CTRL#99=56 (37h) (MIDI code: 0B0h 063h 037h)
- CTRL#98=07 (07h) (MIDI code: 0B0h 062h 007h)
- CTRL#6 =64 (40h) (MIDI code: 0B0h 006h 040h)

NRPN # (High Low)	Description	Power-up default
General		
3707h	Master volume	0 (mute) to 7Fh (max)
3755h	Equalizer / 3D Spatializer ON/OFF (bit 2: 3D, bit1: Front EQ, bit 0: Rear EQ)	EQ on, 3D off
Front Output 4-bands Equalizer		
3708h	Equalizer Low Band Gain	0=-12dB, 40h=0dB, 7Fh=+12dB
3709h	Equalizer Low Mid Band Gain	0=-12dB, 40h=0dB, 7Fh=+12dB
370Ah	Equalizer High Mid Band Gain	0=-12dB, 40h=0dB, 7Fh=+12dB
370Bh	Equalizer High Band Gain	0=-12dB, 40h=0dB, 7Fh=+12dB
370Ch	Equalizer Low Band Freq	0=0Hz, 64=400Hz, 127=800Hz
370Dh	Equalizer Low Mid Band Freq	0=0Hz, 64=1.28KHz, 127=2.5kHz
370Eh	Equalizer High Mid Band Freq	0=60Hz, 64=5.1KHz, 127=10.7kHz
370Fh	Equalizer High Band Freq	0=1kHz, 64=3.4KHz, 127=5.8kHz
3701h	Equalizer Low Mid Band Q	0:Q=1, 40h:Q=2, 7Fh:Q=20
3702h	Equalizer High Mid Band Q	0:Q=1, 40h:Q=2, 7Fh:Q=20
Rear Output 4-bands Equalizer		
3718h	Equalizer Low Band Gain	0=-12dB, 40h=0dB, 7Fh=+12dB
3719h	Equalizer Low Mid Band Gain	0=-12dB, 40h=0dB, 7Fh=+12dB
371Ah	Equalizer High Mid Band Gain	0=-12dB, 40h=0dB, 7Fh=+12dB
371Bh	Equalizer High Band Gain	0=-12dB, 40h=0dB, 7Fh=+12dB
371Ch	Equalizer Low Band Freq	0=0Hz, 64=400Hz, 127=800Hz
371Dh	Equalizer Low Mid Band Freq	0=0Hz, 64=1.28KHz, 127=2.5kHz
371Eh	Equalizer High Mid Band Freq	0=60Hz, 64=5.1KHz, 127=10.7kHz
371Fh	Equalizer High Band Freq	0=1kHz, 64=3.4KHz, 127=5.8kHz
3711h	Equalizer Low Mid Band Q	0:Q=1, 40h:Q=2, 7Fh:Q=20
3712h	Equalizer High Mid Band Q	0:Q=1, 40h:Q=2, 7Fh:Q=20
Spatializer 3D Effect		
3714h	Spatializer effect volume	0=no effect, till 7Fh=maximum effect
3715h	Spatializer effect delay time	0=0ms, till 7Fh=max delay time
3716h	Spatializer effect input mode	0=stereo, else mono
3717h	Spatializer effect output mode	0=2 speaker, else 4 speaker
Front/Rear Mix		
3758h	Reverb Front level (0 to 7Fh)	7Fh
3759h	Reverb Rear level (0 to 7Fh)	0
375Ah	Chorus Front level (0 to 7Fh)	7Fh
375Bh	Chorus Rear level (0 to 7Fh)	0
375Eh	Output Front level (0 to 7Fh, 0=mute, 40h=0dB, 7Fh=+6dB)	40h
375Fh	Output Rear level (0 to 7Fh, 0=mute, 40h=0dB, 7Fh=+6dB)	40h
38xxh	Front/Rear mix of MIDI channel xxh xxh=0 to 0Fh if port 1, xxh=10h to 1Fh if port 2 value = 0 to 7Fh: 0=all Front, 40h=center, 7Fh=all Rear	0

Insert Effects NRPN Controls

Using an Insert Effect means that a single MIDI part (or also several) can be switched to “Insert FX ON”. In this case these MIDI parts are going through the insert effect block first (e.g. Guitar Multi-Effects) and after into mixing (Front L/R, Rear L/R, Reverb, Chorus and Delay send).

This Multi-Effect configuration is running in one DSP:



Be aware that also single effects or combinations of only some of these effects are possible by switching OFF the other effects in the signal processing path.

Sysex message to switch Insert Effect ON: F0H 41H 00H 42H 12H 40H 4pH 22H nn xx F7H (xx = don't care) with 'p'=MIDI track, 'nn': 0 = track in normal mode, 1 = send to MFX1, 2 = send to MFX2, 3 = send to both MFX

NRPN messages for Insert MFX1 must be sent with NRPN High byte = 0x3A.

NRPN messages for Insert MFX2 must be sent with NRPN High byte = 0x3B.

NRPN messages for Insert MFX1&MFX2 (stereo) must be sent with NRPN High byte = 0x3C.

NRPN High	NRPN Low	Description
Insert MFX Mix Controls		
3xh	21h	Input gain, 0 to 7Fh
3xh	22h	Lo-cut filter frequency: 0 = OFF, till 7FFFh = ~300Hz
3xh	23h	Hi-cut filter frequency: 0 = ~1.5KHz,... 100=~6KHz, till 7FFFh = OFF
3xh	2Ah	Output level, 0 to 7Fh
3xh	2Bh	Output panning, 0 to 7Fh (main output left/right mix, 0=left, till 7Fh=right)
3xh	2Ch	Output Front/Rear Mix, 0 to 7Fh (0 = only Front, 40h = both, till 7Fh = only Rear)
3xh	2Dh	Send to Global Reverb: 0=~ -∞, 1=~ -42dB, 127=~ 0dB
3xh	2Eh	Send to Global Chorus: 0=~ -∞, 1=~ -42dB, 127=~ 0dB
Insert MFX Compressor/Limiter Controls		
3xh	40h	Compressor Preset (see below)
3xh	41h	Compressor ON/OFF: =0 OFF, else ON
3xh	42h	Attack time: 0=fast attack (0.1ms), ... 60=1ms, ... 100=10ms, till 127=slow attack (100ms), exp. curve
3xh	43h	Release time: 0=fast release (10ms), ... 60=100ms, ... 100=1s, till 127=slow release (~5s), exp. curve
3xh	44h	Threshold: 0=-42.3, 1=-42dB, 2=-41.66dB, 7Eh=-0.33dB, 7Fh=0dB
3xh	45h	Ratio: 127=1:128, 126=2:128 (1:64), 125=3:128, ... 64=64:128 (1:2), ... 0=1:1
3xh	46h	Boost (applied on signal after compression): 127= x8 ... 64=x4 ... 32=x2 ... 0 = x1
3xh	47h	Knee: 0=Hard Knee else Soft Knee
Insert MFX Wah-Wah Controls		
3xh	50h	Wah-Wah Preset (see below)
3xh	51h	Wah-Wah Filter type: 0 = low pass filter, 1 = band pass filter
3xh	52h	Wah-Wah Filter frequency / Pedal Position: 0 = closed 0Hz , till 127 = open 8kHz
3xh	53h	Wah-Wah Filter resonance: 0 = no resonance, till 127 = max resonance
3xh	54h	Auto-Wah Sensitivity: 0=OFF, till 127=100%
Insert MFX Distortion Controls		
3xh	60h	Distortion Preset (see below)
3xh	61h	Distortion ON/OFF: =0 OFF, else ON
3xh	62h	Pre Gain: 0=OFF, 1 = -42dB till 127 = 0dB
3xh	63h	Type: 0=Tube, 1=asymmetric parabolic1, 2=asymmetric parabolic2
3xh	64h	Low Pass Filter frequency: 0 = closed 0Hz , till 127 = open 8kHz
3xh	65h	Low Pass Filter resonance: 0 = no resonance, till 127 = max resonance
3xh	66h	Post Gain: 0=OFF, 1 = -42dB till 127 = 0dB
3xh	67h	Drive: 0 till 7 (0 to +42dB)

Insert MFX Parametric Equalizer Controls		
3xh	70h	Equalizer Preset (see below)
3xh	71h	Parametric Equalizer: ON/OFF : 0=OFF, else ON
3xh	72h	Low band gain: 0=-12dB, 64=0dB, 127=+12dB
3xh	73h	Low-Mid band gain: 0=-12dB, 64=0dB, 127=+12dB
3xh	74h	High-Mid band gain: 0=-12dB, 64=0dB, 127=+12dB
3xh	75h	High band gain: 0=-12dB, 64=0dB, 127=+12dB
3xh	76h	Low band frequency: 0=40Hz, till 127=1.5KHz
3xh	77h	Low-Mid band frequency: 0=40Hz, till 127=2,5KHz
3xh	78h	High-Mid band frequency: 0=40Hz, till 127=10KHz
3xh	79h	High band frequency: 0=500Hz, till 127=2KHz
3xh	7Ah	Low-Mid band Q: 0=1.0 ... 64=2.0... 127=20.0
3xh	7Bh	High-Mid band Q: 0=1.0 ... 64=2.0... 127=20.0
Insert MFX Amp Model Control		
3xh	20h	Amp Model Preset (see below)
Insert MFX Chorus/Flanger/Phaser/Tremolo/Rotary Controls		
3xh	30h	Chorus/Flanger/Phaser/Tremolo/Rotary Preset (see below)
3xh	31h	Effect Level, 0 to 7Fh
3xh	32h	Chorus/Flanging delay time: 0 = 1ms, till 127 = 30ms
3xh	33h	Chorus/Flanging feedback, 0 to 7Fh
3xh	34h	Chorus/Flanging/Short-Delay high pass filter on input: 0 = no filter to 1.2 kHz
3xh	35h	HDAMP: high frequency filter on delay feedback, , 0 to 7Fh = 0 to 100 %
3xh	36h	Modulation rate: 0 = ~0,023 Hz, ...64=~0,89Hz, till 127 = ~5,8 Hz (~1Hz to ~20Hz for Tremolo)
3xh	37h	Modulation depth, 0 to 7Fh
3xh	38h	Tremolo modulation shape: 0 = triangle, till 127 = square
3xh	39h	Rotary speed control: 0=slow, 1=fast (only for Rotary preset # 23)
3xh	3Ah	Rotary fast speed rate (only for Rotary preset # 23)
3xh	3Bh	Rotary slow to fast speed acceleration time (only for Rotary preset # 23)
3xh	3Ch	Rotary fast to slow speed de-acceleration time (only for Rotary preset # 23)
3xh	3Fh	Effect ON/OFF, 0 = OFF, else ON
Insert MFX Delay Controls		
3xh	58h	Delay Preset, 0..4 (off, mono1, mono2, stereo1, stereo2)
3xh	59h	Delay ON/OFF, 0 = OFF, else ON
3xh	5Ah	Delay Mode, 0=mono, 1=stereo
3xh	5Bh	Delay PreLP, 0 to 7Fh
3xh	5Ch	Delay Level, 0 to 7Fh
3xh	5Dh	Delay Time, 0 to 7Fh = 0 to 640ms
3xh	5Eh	Delay Feedback, 0 to 7Fh
3xh	5Fh	HDAMP: high frequency filter on delay feedback, , 0 to 7Fh = 0 to 100 %
Insert MFX Reset All		
3xh	7Fh	Reset All: all Effects OFF, LoCut/HiCut OFF, only Front, Pan center, Reverb/Chorus = 0 For NRPN 3C7Fh (stereo IMFX Reset) set IMFX1 Pan to Left, IMFX2 Pan to Right

Insert MFX Compressor/Limiter Presets

Preset is selected by using MIDI NRPN 3x40h, with value = preset number, from 0 to 8

Nb	Name	Preset Default values				
		Attack	Release	Threshold	Ratio	Boost
0	NO COMPRESSION	64	0	127	0	0
1	COMPR 1: -18dB 2:1	64	0	73	64	24
2	COMPR 2: -15dB 3:1	64	0	82	84	32
3	COMPR 3: -18dB 5:1	64	0	73	100	48
4	COMPR 4: -21dB 7:1	64	0	64	110	48
5	COMPR 5: -24dB 12:1	64	0	55	117	64
6	LIMITER 1: -6dB	64	0	109	127	0
7	LIMITER 2: -12dB	64	0	91	127	0
8	LIMITER 3: -18dB	64	0	73	127	0

Note: Preset value for Compressor Knee value is always 0 (Hard Knee).

Insert MFX Wah-Wah Presets

Preset is selected by using MIDI NRPN 3x50h, with value = preset number, from 0 to 7

Nb	Name	Preset Default values			
		Filter Type	Frequency	Resonance	Auto-Wah Sens
0	Off	0	127	0	0
1	Auto-Wah 1	0	67	107	127
2	Auto-Wah 2	0	50	75	127
3	Auto-Wah 3	1	70	100	100
4	Wah-Wah 1	0	127	80	0
5	Wah-Wah 2	1	64	80	0

Note:

If Auto-Wah is set ON (Auto-Wah sensitivity > 0), the Wah-Wah Filter Frequency (= Wah-Wah Pedal Position) will be modulated by the current value of the channel level detect. The parameters for setting up the level detector (attack and release) are taken from Compressor settings.

Insert MFX Distortion Presets

Preset is selected by using MIDI NRPN 3x60h, with value = preset number, from 0 to 13

Nb	Name	Preset Default values						
		Drive	Type	Hi-Cut Filter Frequency	Post Gain	Pre Gain	RC LP Filter	Low Lev Cut
OFF								
0	OFF	0	0	127	127	127	127	0
TUBE DISTORTION								
1	TUBE DIST Low 1	3	1	100	60	64	127	1
2	TUBE DIST Low 2	4	2	80	50	64	127	2
3	TUBE DIST Medium 1	5	1	70	40	64	127	2
4	TUBE DIST Medium 2	5	2	70	40	64	127	3
5	TUBE DIST High 1	6	1	60	40	64	127	3
6	TUBE DIST High 2	6	2	60	40	64	127	3
SPECIAL DISTORTION								
7	SMOOTH OD	6	6	50	30	64	80	3
8	DISTORTION	7	1	40	30	64	127	3
9	CRUNCH	5	5	60	40	64	80	3
10	FUZZ	6	7	80	40	64	127	3
11	GRUNGE	5	4	110	40	64	127	2
12	METAL	8	3	40	40	64	127	4
13	MESS	10	0	80	30	64	127	4

Notes:

Preset value for Hi-Cut Filter Q is always 0.

Insert MFX Parametric Equalizer Presets

Presets are selected by using MIDI 3x70h, with value = preset number, from 0 to 13

Nb	Name	Preset Default Values									
		Gain Low	Gain Low Mid	Gain High Mid	Gain High	Freq Low	Freq Low Mid	Freq High Mid	Freq High	Quality Low Mid	Quality High Mid
0	Flat	64	64	64	64	40	24	64	127	0	64
1	JC Clean	80	30	90	64	40	20	50	60	0	80
2	Acoustic	90	20	110	64	40	26	113	50	30	100
3	Black Panel	80	40	90	64	40	28	30	40	0	40
4	Brit Combo	60	80	80	64	100	64	7	127	0	30
5	Tweed	64	30	80	64	50	42	28	60	100	20
6	Stack Classic	64	20	85	64	80	40	30	40	20	40
7	Metal	64	50	100	64	80	50	35	127	0	70
8	R-Fier	64	20	70	64	80	30	30	80	30	50
9	Dyna Amp	64	20	75	64	40	32	25	127	64	50
10	Crunch	64	75	30	64	40	10	8	127	20	70
11	VO Drive	64	64	90	64	40	20	30	127	64	60
12	BG Lead	64	64	70	64	40	20	64	127	64	64
13	MS HiGain	64	80	50	64	40	10	6	127	80	70

Insert MFX AMP-Model Presets

Preset is selected by using MIDI 3x20h, with value = preset number, from 0 to 13

Nb	Name	Preset Default Values						
		Input Gain	Lo-Cut Filter Frq	Hi-Cut Filter Frq	Compr Preset	Distortion Preset	Wah-Wah Preset	PEQ Preset
0	OFF	90	0	127	0	0	0	0
1	JC Clean	90	25	90	0	0	0	1
2	Acoustic	90	40	127	0	1	0	2
3	Black Panel	90	25	90	0	2	0	3
4	Brit Combo	90	40	70	0	9	0	4
5	Tweed	90	30	80	0	8	0	5
6	Stack Classic	90	40	80	0	7	0	6
7	Metal	90	30	70	0	12	0	7
8	R-Fier	90	30	70	0	13	0	8
9	Dyna Amp	90	30	70	1	12	0	9
10	Crunch	90	20	80	0	7	0	10
11	VO Drive	90	20	80	0	7	0	11
12	BG Lead	90	20	80	0	8	0	12
13	MS Hgain	90	20	80	0	9	0	13

Insert MFX Chorus/Flanger/Phaser/Tremolo/Rotary Presets

Preset is selected by using MIDI NRPN 3x30h, with value = preset number, from 0 to 23

Nb	Name	Preset Default Values					
		Volume	Delay	Feedback	Hdamp	Chorus Rate	Chorus Depth
0	OFF	0	/	/	/	/	/
1	Chorus Light 1	56	20	0	0	40	30
2	Chorus Light 2	56	40	0	0	30	30
3	Chorus Medium 1	64	26	0	0	45	40
4	Chorus Medium 2	64	60	0	0	35	50
5	Chorus Deep 1	64	64	0	0	40	70
6	Chorus Deep 2	64	80	0	0	45	90
7	Chorus Fast 1	64	30	0	0	70	10
8	Chorus Fast 2	64	60	0	0	60	20
9	Resonant Chorus	64	30	80	0	40	20
10	Long Time Chorus	64	100	0	0	20	20
11	Flange Light	64	8	32	0	30	30
12	Flange Medium	72	13	72	0	40	80
13	Flange Slow Deep	72	2	50	0	20	90
14	Flange Deep	72	6	100	0	50	100
15	Phaser Light	64	0	80	0	50	50
16	Phaser Medium	64	0	90	0	60	80
17	Phaser Slow Deep	64	0	100	0	20	110
18	Phaser Fast	64	0	40	0	120	60
19	Tremolo Slow	64	0	0	0	20	60
20	Tremolo Medium 1	64	0	0	20	40	70
21	Tremolo Medium 2	64	0	0	40	60	90
22	Tremolo Fast	64	0	0	60	100	110
23	Rotary Slow	90	30	0	0	50	20

Note:

Preset value for Pre-High-pass-Filter is always 0 (off).

Detailed MIDI Implementation

2 ports of 16 channels are provided for a total of 32 channels. MIDI Message "F5 nn" is used to switch between the two ports (nn=1 or 2).

MIDI Message	HEX Code	Description	Compatibility
NOTE ON	9nH kk vv	Midi channel n(0-15) note ON #kk(1-127), velocity vv(1-127). vv=0 means NOTE OFF	MIDI
NOTE OFF	8nH kk vv	Midi channel n(0-15) note OFF #kk(1-127), vv is don't care.	MIDI
PITCH BEND	EnH bl bh	Pitch bend as specified by bh bl (14 bits) Maximum swing is +/- 1 tone (power-up). Can be changed using « pitch bend sensitivity ». Center position is 00H 40H.	GM
PROGRAM CHANGE	CnH pp	Program (patch) change. Specific action on channel 10 (n=9) : select drumset. Refer to sounds / drumset list. Drumsets can be assigned to other channels (see SYSEX MIDI channel to part assign and part to rhythm allocation)	GM/GS
CHANNEL AFTERTOUCH	DnH vv	vv pressure value. Effect set using Sys. Ex. 40H 2pH 20H-26H	MIDI
CTRL 00	BnH 00H cc	Bank select : Refer to sounds list. No action on drumset	GS/DREAM
CTRL 01	BnH 01H cc	Modulation wheel. Rate and maximum depth can be set using SYSEX	MIDI
CTRL 05	BnH 05H cc	Portamento time.	MIDI
CTRL 06	BnH 06H cc	Data entry : provides data to RPN and NRPN	MIDI
CTRL 07	BnH 07H cc	Volume (default=100)	MIDI
CTRL 10	BnH 0AH cc	Pan (default=64 center)	MIDI
CTRL 11	BnH 0BH cc	Expression (default=127)	MIDI/GM
CTRL 64	BnH 40H cc	Sustain (damper) pedal	MIDI
CTRL 65	BnH 41H cc	Portamento ON/OFF	MIDI
CTRL 66	BnH 42H cc	Sostenuto pedal	MIDI
CTRL 67	BnH 43H cc	Soft pedal	MIDI
CTRL 71	BnH 47H cc	TVF Resonance modify (same as nrpn 0121h)	GM/GS
CTRL 72	BnH 48H cc	Env release time modify (same as nrpn 0166h)	GM/GS
CTRL 73	BnH 49H cc	Env attack time modify (same as nrpn 0163h)	GM/GS
CTRL 74	BnH 4AH cc	TVF cutoff freq modify (same as nrpn 0120h)	GM/GS
CTRL 75	BnH 4BH cc	Env decay time modify (same as nrpn 0164h)	GM/GS
CTRL 76	BnH 4CH cc	Vibrato rate modify (same as nrpn 0108h)	GM/GS
CTRL 77	BnH 4DH cc	Vibrato depth modify (same as nrpn 0109h)	GM/GS
CTRL 78	BnH 4EH cc	Vibrato delay modify (same as nrpn 010Ah)	GM/GS
CTRL 84	BnH 54H vv	Portamento control	GS
CTRL 91	BnH 5BH vv	Reverb send level vv=00H to 7FH	GS
CTRL 93	BnH 5DH vv	Chorus send level vv=00H to 7FH	GS
CTRL 98	BnH 62H vv	NRPN low	MIDI
CTRL 99	BnH 63H vv	NRPN high	MIDI
CTRL 100	BnH 64H vv	RPN low	MIDI
CTRL 101	BnH 65H vv	RPN high	MIDI
CTRL 120	BnH 78H 00H	All sound off (abrupt stop of sound on channel n)	MIDI
CTRL 121	BnH 79H 00H	Reset all controllers	MIDI
CTRL 123	BnH 7BH 00H	All notes off	MIDI
CTRL 126	BnH 7EH 00H	Mono on	MIDI
CTRL 127	BnH 7FH 00H	Poly on (default power-up)	MIDI
CTRL CC1	BnH ccH vvH	Assignable Controller 1. cc=Controller number (0-5Fh), vv=Control value (0-7Fh). Control number (ccH) can be set on CC1 CONTROLLER NUMBER (Sys. Ex 40 1x 1F). The resulting effect is determined by CC1 controller function (Sys.Ex. 40 2p 40-4A)	GS
CTRL CC2	BnH ccH vvH	Assignable Controller 2. cc=Controller number (00h-5Fh), vv=control value (0-7Fh). Control number can be set on CC2 CONTROLLER NUMBER (Sys.Ex. 40 1x 20). The resulting effect is determined by CC2 controller function (Sys.Ex.40 2p 50-5A).	GS
RPN 0000H	BnH 65H 00H 64H 00H 06H vv	Pitch bend sensitivity in semitones (default=2)	MIDI/GM
RPN 0001H	BnH 65H 00H 64H 01H 06H vv	Fine tuning in cents (vv=00 -100, vv=40H 0, vv=7FH +100)	MIDI
RPN 0002H	BnH 65H 00H 64H 02H 06H vv	Coarse tuning in half-tones (vv=00 -64, vv=40H 0, vv=7FH +64)	MIDI
NRPN 0108H	BnH 63H 01H 62H 08H 06H vv	Vibrate rate modify (vv=40H -> no modif)	GS
NRPN 0109H	BnH 63H 01H 62H 09H 06H vv	Vibrate depth modify (vv=40H -> no modif)	GS
NRPN 010AH	BnH 63H 01H 62H 0AH 06H vv	Vibrate delay modify (vv=40H -> no modif)	GS
NRPN 0120H	BnH 63H 01H 62H 20H 06H vv	TVF cutoff freq modify(vv=40H -> no modif)	GS
NRPN 0121H	BnH 63H 01H 62H 21H 06H vv	TVF resonance modify (vv=40H -> no modif)	GS

NRPN 0163H	BnH 63H 01H 62H 63H 06H vv	Env. attack time modify(vv=40H ->no modif)	GS
NRPN 0164H	BnH 63H 01H 62H 64H 06H vv	Env. decay time modify(vv=40H -> no modif)	GS
NRPN 0166H	BnH 63H 01H 62H 66H 06H vv	Env. release time modif(vv=40H ->no modif)	GS
NRPN 18rrH	BnH 63H 18H 62H rr 06H vv	Pitch coarse of drum instr. note rr in semitones (vv=40H -> no modif) (note 6)	GS
NRPN 1ArrH	BnH 63H 1AH 62H rr 06H vv	Level of drum instrument note rr (vv=00 to 7FH) (note 6)	GS
NRPN 1BrrH	BnH 63H 1BH 62H rr 06H vv	Front/Rear mix of drum instrument note rr (vv=00 to 7FH) (note 6)	DREAM
NRPN 1CrrH	BnH 63H 1CH 62H rr 06H vv	Pan of drum instrument note rr (40H = middle) (note 6)	GS
NRPN 1DrrH	BnH 63H 1DH 62H rr 06H vv	Reverb send level of drum instrument note rr (vv=00 to 7FH) (note 6)	GS
NRPN 1ErrH	BnH 63H 1EH 62H rr 06H vv	Chorus send level of drum instrument note rr (vv=00 to 7FH) (note 6)	GS
Standard Sysex	F0H 7EH 7FH 09H 01H F7H	General MIDI reset (note 4)	GM
Standard Sysex	F0H 7FH 7FH 04H 01H 00H ll F7H	Master volume (ll=0 to 127, default 127) (note 4). Not reset by GS reset	GM
SYSEX	F0H 41H 00H 42H 12H 40H 00H 00H dd dd dd dd xx F7H	Master tune (default dd= 00H 04H 00H 00H) -100.0 to +100.0 cents. Nibblized data should be used (always four bytes). For example, to tune to +100.0 cents, sent data should be 00H 07H 0EH 08H (note 4)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 00H 04H vv xx F7H	Master volume (default vv=7FH) (note 4) Not reset by GS reset.	GS
SYSEX	F0H 41H 00H 42H 12H 40H 00H 05H vv xx F7H	Master key-shift (default vv=40H, no transpose) (note 4)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 00H 06H vv xx F7H	Master pan (default vv=40H, center) (note 4)	
SYSEX	F0H 41H 00H 42H 12H 40H 00H 7FH 00H xx F7H	GS reset (note 4)	GS
SYSEX	F0H 41H 00H 42H 12H 40 01H 10H vv1 vv2 vv3 vv4 vv5 vv6 vv7 vv8 vv9 vv10 vv11 vv12 vv13 vv14 vv15 vv16 xx F7h	Voice reserve : vv1= Part 10 (Default vv=2) vv2 to vv10 = Part 1 to 9 (Default vv=2) vv11 to vv16= Part 11 to 16 (Default vv=0) (note 4)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 01H 30H vv xx F7H	Reverb type (vv=0 to 7), default = 04H 00H : Room1 01H : Room2 02H : Room3 03H : Hall1 04H : Hall2 05H : Plate 06H : Delay 07H : Pan delay (note 5)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 01H 31H vv xx F7H	Reverb character, default 04H (note 5)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 01H 32H vv xx F7H	Reverb Pre-LPF, 0 to 7, default 0 (note 5)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 01H 33H vv xx F7H	Reverb master level, default = 64 (note 5)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 01H 34H vv xx F7H	Reverb time (note 5)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 01H 35H vv xx F7H	Reverb delay feedback. Only if reverb number=6 or 7 (delays) (note 5)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 01H 37H vv xx F7H	Reverb pre delay time (vv=0 to 7Fh = 0ms to 127ms). Only if reverb number=0 to 5 (reverbs)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 01H 38H vv xx F7H	Chorus type (vv=0 to 7), default = 02H 00H : Chorus1 01H : Chorus2 02H : Chorus3 03H : Chorus4 04H : Feedback 05H : Flanger 06H : Short delay 07H : FB delay (note 5)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 01H 39H vv xx F7H	Chorus Pre-LPF, 0 to 7, default = 0 (note 5)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 01H 3AH vv xx F7H	Chorus master level, default = 64 (note 5)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 01H 3BH vv xx F7H	Chorus feedback (note 5)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 01H 3CH vv xx F7H	Chorus delay (note 5)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 01H 3DH vv xx F7H	Chorus rate (note 5)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 01H 3EH vv xx F7H	Chorus depth (note 5)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 01H 3FH vv xx F7H	Chorus send level to reverb, default=0 (note 5)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 02H 00H vv xx F7H	EQ Low Freq, vv: 0=200Hz, 1=400Hz, default 0	GS

SYSEX	F0H 41H 00H 42H 12H 40H 02H 01H vv xx F7H	EQ Low Gain, vv: 0=-12dB, 40h=0dB, to7Fh=+12dB, default 60h=+6dB	GS								
SYSEX	F0H 41H 00H 42H 12H 40H 02H 02H vv xx F7H	EQ High Freq, vv: 0=3KHz, 1=6KHz, default 0	GS								
SYSEX	F0H 41H 00H 42H 12H 40H 02H 03H vv xx F7H	EQ High Gain, vv: 0=-12dB, 40h=0dB, to7Fh=+12dB, default 60h=+6dB	GS								
SYSEX	F0H 41H 00H 42H 12H 40H 1pH 02H nn xx F7H	MIDI channel to part assign, p is part (0 to 15), nn is MIDI channel (0 to 15, 16=OFF). This SYSEX allows to assign several parts to a single MIDI channel or to mute a part. (note 3) Default assignment : <table border="0"> <tr> <td><u>part</u></td> <td><u>MIDI channel</u></td> </tr> <tr> <td>0</td> <td>9 (DRUMS)</td> </tr> <tr> <td>1-9</td> <td>0-8</td> </tr> <tr> <td>10-15</td> <td>10-15</td> </tr> </table>	<u>part</u>	<u>MIDI channel</u>	0	9 (DRUMS)	1-9	0-8	10-15	10-15	GS
<u>part</u>	<u>MIDI channel</u>										
0	9 (DRUMS)										
1-9	0-8										
10-15	10-15										
SYSEX	F0H 41H 00H 42H 12H 40H 1pH 15H vv xx F7H	Part to rhythm allocation, p is part (0 to 15), vv is 00 (sound part) or 01 (rhythm part). This SYSEX allows a part to play sound or drumset. There is no limitation of the number of parts playing drumset. Default assignment : part 0 plays drums (default MIDI channel 9) all other parts play sound. (note 3)	GS								
SYSEX	F0H 41H 00H 42H 12H 40H 1pH 40H v1 v2 ... v12 xx F7H	Scale tuning, p is part (0 to 15), v1 to v12 are 12 semi-tones tuning values (C, C#, D, ... A#, B), in the range -64 (00H) 0 (40H) +63(7FH) cents. This SYSEX allows non chromatic tuning of the musical scale on a given part. Default v1, v2, ... ,v12 = 40H, 40H,...,40H (chromatic tuning). Scale tuning has no effect if the part is assigned to a rhythm channel or if the sound played is not of chromatic type. (note 3)	GS								
SYSEX	F0H 41H 00H 42H 12H 40H 1pH 1AH vv xx F7H	Velocity slope from 00H to 7FH (default = 40H) (note 3)	GS								
SYSEX	F0H 41H 00H 42H 12H 40H 1pH 1BH vv xx F7H	Velocity offset from 00H to 7FH (default = 40H) (note 3)	GS								
SYSEX	F0H 41H 00H 42H 12H 40H 1pH 1FH vv xx F7H	CC1 Controller number (00-5FH) (default = 10H) (note 3)	GS								
SYSEX	F0H 41H 00H 42H 12H 40H 1pH 20H vv xx F7H	CC2 Controller number (00-5FH) (default = 11H) (note 3)	GS								
SYSEX	F0H 41H 00H 42H 12H 40H 2pH 00H vv xx F7H	Mod pitch control (-24,+24 semitone) (default = 40H) (note 3)	GS								
SYSEX	F0H 41H 00H 42H 12H 40H 2pH 01H vv xx F7H	Mod tvf cutoff control (default = 40H) (note 3)	GS								
SYSEX	F0H 41H 00H 42H 12H 40H 2pH 02H vv xx F7H	Mod Amplitude control (-100%+100%) (default=40H) (note 3)	GS								
SYSEX	F0H 41H 00H 42H 12H 40H 2pH 03H vv xx F7H	Mod lfo1 rate control (default = 40H). n is don't care. Rate is common on all channels	GS								
SYSEX	F0H 41H 00H 42H 12H 40H 2pH 04H vv xx F7H	Mod lfo1 pitch depth (0-600 cents) (default=0AH) (note 3)	GS								
SYSEX	F0H 41H 00H 42H 12H 40H 2pH 05H vv xx F7H	Mod lfo1 tvf depth (default = 0H) (note 3)	GS								
SYSEX	F0H 41H 00H 42H 12H 40H 2pH 06H vv xx F7H	Mod lfo1 tva depth (0-100%) (default = 0H) (note 3)	GS								
SYSEX	F0H 41H 00H 42H 12H 40H 2pH 10H vv xx F7H	Bend pitch control (-24,+24 semitone) (default = 42H) (note 3)	GS								
SYSEX	F0H 41H 00H 42H 12H 40H 2pH 11H vv xx F7H	Bend tvf cutoff control (default = 40H) (note 3)	GS								
SYSEX	F0H 41H 00H 42H 12H 40H 2pH 12H vv xx F7H	Bend Amplitude control (-100%+100%) (default=40H) (note 3)	GS								
SYSEX	F0H 41H 00H 42H 12H 40H 2pH 14H vv xx F7H	Bend lfo1 pitch depth (0-600 cents) (default=00H) (note 3)	GS								
SYSEX	F0H 41H 00H 42H 12H 40H 2pH 15H vv xx F7H	Bend lfo1 tvf depth (default = 0H) (note 3)	GS								
SYSEX	F0H 41H 00H 42H 12H 40H 2pH 16H vv xx F7H	Bend lfo1 tva depth (0-100%) (default = 0H) (note 3)	GS								
SYSEX	F0H 41H 00H 42H 12H 40H 2pH 20H vv xx F7H	CAF pitch control (-24,+24 semitone) (default = 40H) (note 3)	GS								
SYSEX	F0H 41H 00H 42H 12H 40H 2pH 21H vv xx F7H	CAF tvf cutoff control (default = 40H) (note 3)	GS								
SYSEX	F0H 41H 00H 42H 12H 40H 2pH 22H vv xx F7H	CAF Amplitude control (-100%+100%) (default=40H) (note 3)	GS								
SYSEX	F0H 41H 00H 42H 12H 40H 2pH	CAF lfo1 pitch depth (0-600 cents) (default=00H) (note 3)	GS								

	24H vv xx F7H		
SYSEX	F0H 41H 00H 42H 12H 40H 2pH 25H vv xx F7H	CAF lfo1 tvf depth (default = 0H) (note 3)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 2pH 26H vv xx F7H	CAF lfo1 tva depth (0-100%) (default = 0H) (note 3)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 2pH 40H vv xx F7H	CC1 pitch control (-24,+24 semitone) (default = 40H) (note 3)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 2pH 41H vv xx F7H	CC1 tvf cutoff control (default = 40H) (note 3)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 2pH 42H vv xx F7H	CC1 Amplitude control (-100%+100%) (default=40H) (note 3)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 2pH 44H vv xx F7H	CC1 lfo1 pitch depth (0-600 cents) (default=00H) (note 3)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 2pH 45H vv xx F7H	CC1 lfo1 tvf depth (default = 0H) (note 3)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 2pH 46H vv xx F7H	CC1 lfo1 tva depth (0-100%) (default = 0H) (note 3)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 2pH 50H vv xx F7H	CC2 pitch control (-24,+24 semitone) (default = 40H) (note 3)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 2pH 51H vv xx F7H	CC2 tvf cutoff control (default = 40H) (note 3)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 2pH 52H vv xx F7H	CC2 Amplitude control (-100%+100%) (default=40H) (note 3)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 2pH 54H vv xx F7H	CC2 lfo1 pitch depth (0-600 cents) (default=00H) (note 3)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 2pH 55H vv xx F7H	CC2 lfo1 tvf depth (default = 0H) (note 3)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 2pH 56H vv xx F7H	CC2 lfo1 tva depth (0-100%) (default = 0H) (note 3)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 4pH 22H nn xx F7H	with 'p'=MIDI track, 'nn': 0 = track in normal mode, 1 = send to MFX1, 2 = send to MFX2, 3 = send to both MFX	GS / DREAM

- Notes :**
1. NRPN sending method : CTRL#99=high byte, CTRL#98=low byte, CTRL#6=vv. Example : NRPN 0108h = 40h -> CTRL#99=1, CTRL#98=8, CTRL#6=64.
 2. x or xx means « don't care »
 3. Cross system exclusive :
Address can be 040h xxh xxh or 050h xxh xxh
If adresse=040h xxh xxh : system exclusive applies to midi port 1 (midi channels 0-Fh) if received on midi port1 , applies to midi port 2 (midi channels 10-1Fh) if received on midi port 2.
If adresse=050h xxh xxh, cross system exclusive : applies to port 2 if received on port1, applies to port 1 if received on port2
 4. Non cross system exclusive applying only on receiving port :
System exclusive applies to midi port 1 (midi channels 0-Fh) if received on midi port1.
System exclusive applied to midi port 2 (midi channels 10-1Fh) if received on midi port2.
 5. Non cross system exclusive applying on both ports :
System exclusive will be applied to all midi channels (0-1Fh). Can be received on port 1 or port 2 indifferently.
This is the case for all system exclusive concerning reverb and chorus because reverb and chorus are the same for both ports 1 and 2.
 6. Drumset edit Nrpn : 4 different drumset edit tables are implemented :
 - 1 for midi port 1 channel 10
 - 1 for midi port 2 channel 10
 - 1 for midi port 1 channels 1-9 or 11-16 : for all these channels, edit table is the same
 - 1 for midi port 2 channels 1-9 or 11-16 : for all these channels, edit table is the same

Dream Contact

info@dream.fr

Website

<http://www.dream.fr>

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