Operation Manual

Mopho

Operation Manual

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FC Tested To Comply
With FCC Standards
FOR OFFICE USE   C E

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Contents

Quick Start

Thanks for purchasing your Mopho synthesizer! Listen to the sounds, twiddle some knobs, have some fun!

Please Register!

Please go to www.davesmithinstruments.com and register your synth. If you purchased directly from us, there is no need to register—we already have your contact information.

Powering Up

So, plug in the power supply, connect (in stereo!!) to your mixer/sound system, and start playing!

You can use the PUSH IT switch to trigger sounds without a keyboard. If you're using a MIDI keyboard, try applying keyboard pressure (aftertouch) and the mod wheel. Many sounds are fairly simple at first, then come alive when you use the controllers. With other sounds, you may need to hold the notes a while to let the sound unfold. Playing in different ways has a big effect on the programs.

Selecting and Editing Programs and Global Settings

You can use the increment and decrement (+ and -) switches to step through the programs. Hold them down briefly to increment or decrement the bank. There are 3 banks of 128 programs.

If you want to edit a program, just turn any knob. The new value will be displayed in the bottom line of the LCD (the top line displays the programmed value for handy reference).

After turning knobs, just hit PROGRAM MODE so the LCD goes back to the program/bank screen, allowing you to change programs again.

Press and hold the PROGRAM MODE switch briefly to display the Global menu and change higher level parameters such as MIDI channel number, Transpose/Detune, and so on. The PROGRAM knob changes the displayed page and increment and decrement change the values. These settings are remembered when the synth is turned off.

Summary

You should be up and running now; for more operation information, read on. Or, just look up specific parameters for detailed notes. Pages 26 through 28 contain a handy reference for mod destinations and sources. At some point you should

read through the manual to discover all the little features that you might not notice at first.

Don't forget you get a free editor for Mac OS or Windows with your purchase. Download it from www.soundtower.com/mopho.

I should mention that this manual does not include explanations of basic analog synthesizer functions. It assumes you already know what an oscillator is, how a low-pass filter affects the sound, what an ADSR envelope looks like, and so on.

Fortunately, these days it is quite easy to find such resources on the Internet. If you want to learn the lingo and the basics, just try a search in Google (or the search engine of your choice), something like "analog synthesizer tutorial." You'll find plenty of good reading material.

Have fun!

Dave Smith

Special thanks to:

Jeff Koepper, Andrew McGowan, Dave Polich, and Stefan Trippler. Thanks also to the authors of the Prophet '08 programs, many of which are used in Mopho.

Getting Connected

Mopho has several inputs and outputs on its back panel.

Power Input — Connect the power supply included with your Mopho. The power supply comes with different AC adaptor prongs that enable it to work almost anywhere in the world. If for whatever reason you need to use a different supply, it must match the specifications printed on the front panel.

> **Note**: The power supply label says "Evolver" on it; we use the same supply for the mono Evolvers, the Prophets, and Tetra.

MIDI In — To receive MIDI data from another device, connect this to the other device's MIDI Out.

MIDI Out — To send MIDI data to another device, connect this to the other device's MIDI In. This output can also be configured as a MIDI Thru using the MIDI Out Select parameter in the Global menu.

Audio In — Mopho can be used as a signal processor. Audio is routed through the filter and envelopes and, when the signal level is high enough, a gate is generated. Audio can also be used to advance the sequencer when Seq Trigger is set to Audio In.

> **Note:** Though Mopho can process external audio, it does not have a pitch detector, so the oscillators do not track the pitch of the source audio.

Audio Out — Mopho's unbalanced, stereo outputs.

Phones — A 1/4 inch stereo headphone jack.

Front Panel Controls
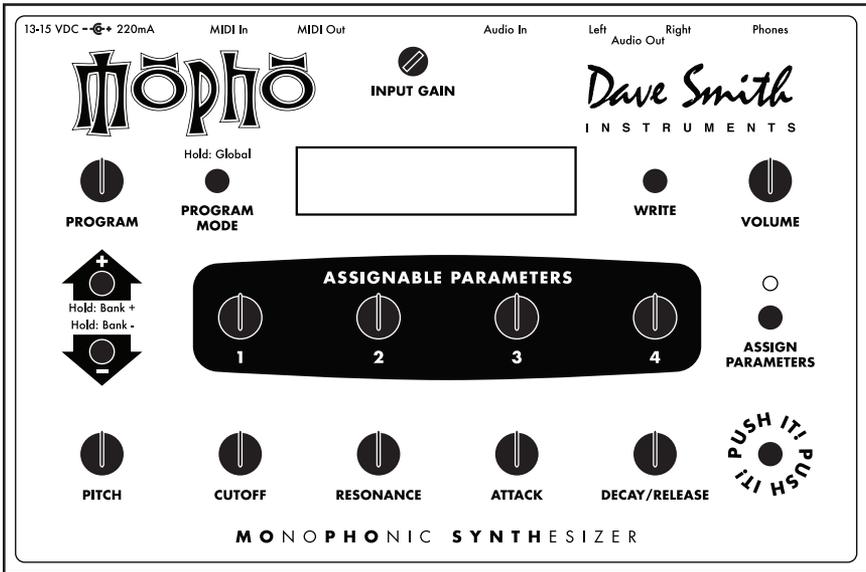
Input Gain — Used to adjust the gain of AUDIO IN. For more about using Mopho to process external audio, see page 11. For low-level sources (like guitars), INPUT GAIN should be turned up. For line-level sources, it will usually be turned down. Turning it down does not turn it off, it just decreases the gain. External Input Volume (see *Mixer Parameters* on page 17) controls the amount of signal that gets mixed into the filter and must be turned up for any audio— external or feedback—to be heard.

> **Note:** The factory programs use a naming convention where "FB" indicates a program is designed to take advantage of the feedback capability. When nothing is plugged into the Audio In jack, the left Audio Output is normalled to the input. This provides a feedback path that will create some unique, wild sounds. INPUT GAIN is not a programmable control, so its position will have an effect on those programs. For most FB sounds, the INPUT GAIN should be set to minimum, and will get out of control (often nicely!) when turned up.

Program — Use PROGRAM to change and scroll through the programs. Also used to select parameters in Global mode.

Program Mode — Mopho has three modes of operation: program, edit, and global. When in program mode, the display shows the name, number, and bank of the current program. Editing any of the parameters puts Mopho into edit

mode and displays the last parameter edited and its stored and edited values. See *Program Parameters* starting on page 15 for more information.

Global mode is accessed by briefly holding down the PROGRAM MODE button. The Global menu is displayed. Use PROGRAM to change global parameters and the increment and decrement (+ and -) buttons to change the settings. See *Global Parameters* on page 13 for more information.

To return to program mode from edit or global mode, simply press PROGRAM MODE.

Write — Use WRITE to save an edited program to any of Mopho's 384 memory locations. To execute the write operation, press the increment (+) button. To cancel a write, press WRITE, decrement (-), or PROGRAM MODE. WRITE is also used to execute certain operations in the Global menu.

> **Note:** You can store a program in a different location. After hitting the WRITE button, you can change the destination using the PROGRAM knob, and you can change banks by holding the increment (+) and decrement (-) buttons. Be careful changing the banks! If you hit the increment button quickly, it saves the program wherever you are at that point. If you want to change banks, just be sure to hold the button for a couple seconds.

Volume — Controls the volume of the left and right audio outputs and the headphone output.

Increment/Decrement — The increment and decrement (+ and -) controls are used to step through programs in program mode, to change values in the Global menu, and to confirm or cancel various operations. In edit mode they increase/decrease the parameter value. They are also used to select Mopho's three program banks. Hold increment briefly to switch to the next highest bank; hold decrement to switch to the next lowest bank.

Assignable Parameters 1-4 — Any of Mopho's program parameters can be edited from the front panel using the ASSIGNABLE PARAMETERS controls and the assignments for the controls are saved per program, to best suit that program. In other words, the assignments for the controls can be completely different from one program to another.

Assign Parameters — When the ASSIGN PARAMETERS LED is lit, turn any of the ASSIGNABLE PARAMETERS controls to select from the list of program parameters. Press ASSIGN PARAMETERS again (turn the LED off) to use the ASSIGNABLE PARAMETERS controls to edit the selected parameters. For a description of the parameters, see *Program Parameters* beginning on page 15. For a list of the parameters, see page 29.

Pitch — Controls the base frequency of the two oscillators. The relative interval between the two oscillators is maintained, even when the extremes are reached.

Cutoff — Controls the filter cutoff.

Resonance — Controls filter resonance.

> **Note:** The filter will only self oscillate when in 4-pole mode. See *Low-pass Filter Parameters* on page 17 for more information.

Attack — Simultaneously adjusts the attack portion of all envelope generators: filter, amplifier, and Envelope 3.

Decay/Release — Simultaneously adjusts the decay and release portions of all envelope generators: filter, amplifier, and Envelope 3.

Push It! — The PUSH IT button is a manual trigger to play Mopho. It can trigger a specific note (at a specific velocity) or a gated sequence, latch notes or sequences on and off, and manually step through a sequence. For more information, see *Program Parameters*, beginning on page 15.

Basic Operation

In designing Mopho, the goal was to make a great sounding analog mono synth that was also affordable. Toward that end, we wanted to give players enough control over parameters to make it useful for performance, so we came up with a combination of "hard-wired" commonly used controls and user-assignable controls. Any of Mopho's parameters can be edited in real time from the front panel controls. But we also recognize that may not be the quickest or easiest way to program sounds from scratch. A free editor is available for Mac OS and Windows that gives you access to all of Mopho's program parameters simultaneously. Download it here: www.soundtower.com/mopho. Also, an advanced version of the editor with more features can be purchased from our Web site.

> **Note:** Most of the Prophet '08's controls map directly to Mopho's controls, so if you have a Prophet '08, you can use it as a MIDI control surface for Mopho.

When Mopho first powers up, it is in Program mode. The top line of the LCD shows the Program (1…128) and Bank (1…3) number of the currently selected program, and the bottom line shows the 16-character name of the program. The PROGRAM knob changes the program. The program can also be changed by pressing the increment (+) or decrement (-) switches, respectively. To increment to the next bank, hold the increment switch briefly; to decrement to the previous bank, hold the decrement switch.

To edit a program, simply turn any knob. The ASSIGNABLE PARAMETERS knobs have been preset to useful parameters for the factory programs. To change a knob's assignment, press ASSIGN PARAMETERS to light the LED. Turning any of the ASSIGNABLE PARAMETERS knobs now will scroll through the list of available parameters. Choose one or more parameters to edit and then press ASSIGN PARAMETERS again to exit the assignment mode (ASSIGN PARAMETERS LED should now be off). See *Program Parameters* on page 15 for a detailed list of all parameters and their functions. After editing parameters, press the PROGRAM MODE switch to exit edit mode and return to program mode.

Feedback

As you can see from the illustration on the following page, the left Audio Output is normalled to the Audio In. (This connection is broken when a plug is inserted in the Audio In.) Turning up the external input volume (ExtIn Vol parameter) will cause varying amounts of the audio output to be mixed back in pre-filter. For most purposes, small amounts of feedback are most useful and the resulting effect is similar to an overdrive distortion. Higher levels of feedback can get very squirrelly and rude (which may be exactly the effect you're looking for).
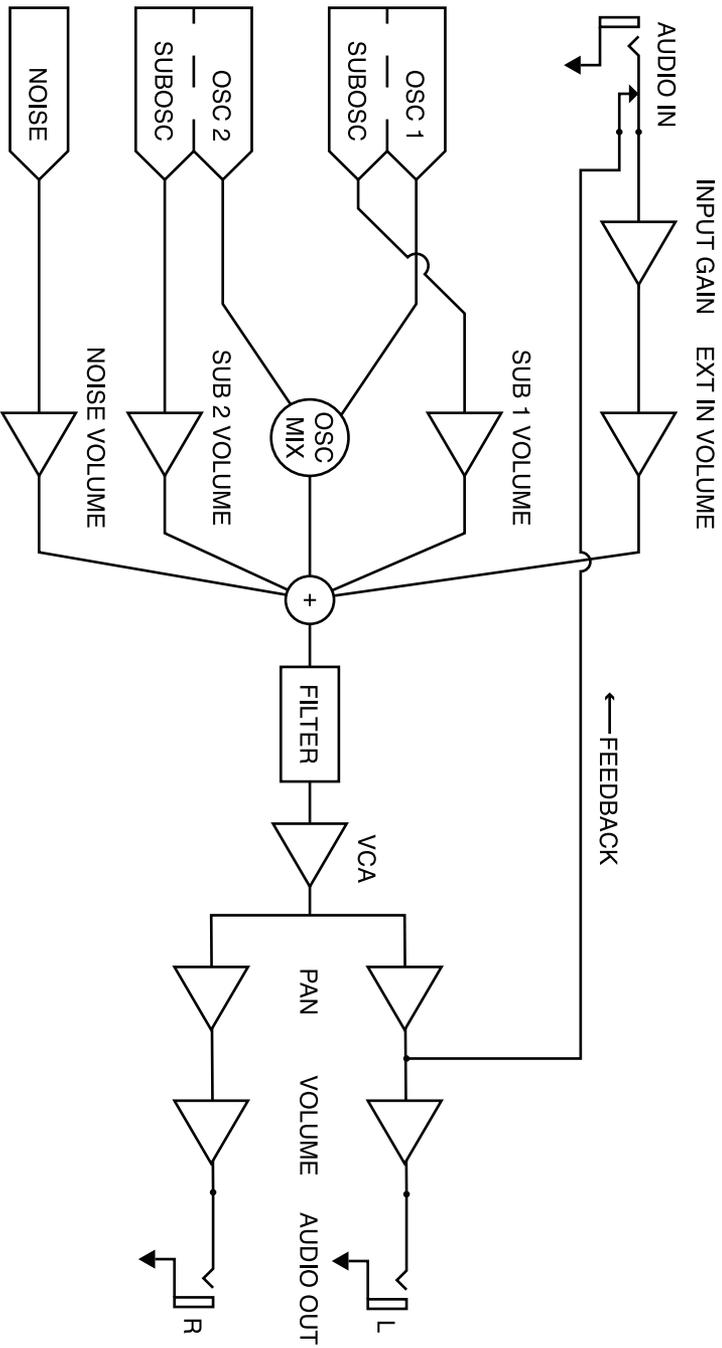
MOPHO SIGNAL FLOW DIAGRAM
(Modulation routing omitted for clarity)

INPUT GAIN also affects the level of the feedback signal, so you'll typically want to start with INPUT GAIN turned down.

Several of the factory programs already have some level of feedback programmed in, as indicated by the letters "FB" following the name. To hear the effect of ExtIn Vol and INPUT GAIN, call up one of those programs and vary those parameters.

Audio In

Audio In can also be used to process an external audio source, to get access to the analog filter as a sound processor. In general, when using a line-level input, you will want the INPUT GAIN control set to minimum. When using a low-level source, such as an electric guitar, you'll need to turn up the INPUT GAIN to get sufficient signal level.

When processing external audio, you will first need to turn up the ExtIn Vol level in the Mixer. Otherwise no signal gets to the filter. Also note that the VCA needs to be open to hear the input. This can be done a number of ways:

1. Just turn up the VCA Level if you want the signal to go through continuously

2. Manually trigger the VCA envelope with the PUSH IT button or a MIDI keyboard

3. Select AudioIn as the mode in the PushItSw parameter, which automatically gates the VCA envelope with an input signal greater than a fixed threshold

There are also numerous other ways of opening the VCA using modulation.

Saving a Program

To save a Program, press the WRITE switch and the following screen appears:

```
Write? P:xxx B:x
Hit:  Inc if Yes
```

Press the increment (+) switch to save the current program, or decrement (-) to cancel (or press the WRITE switch again). To store in a different location, use PROGRAM to select a new destination, and hold the increment or decrement switch to choose a different bank.

Global Parameters

Mopho's Global parameters affect all programs globally. Examples include MIDI channel and fine tune. To edit the Global parameters, hold down the PROGRAM MODE switch until Global Parameter is displayed. The PROGRAM knob changes the global parameter and the increment and decrement buttons change the value.

Transpose: -12…+12 — Master Transpose control, 0 is centered. Steps in semitones.

Fine Tune: -50…+50 — Master Fine Tune control; 0 centered. Steps in cents (50 cents = 1/2 semitone).

MIDI Channel: ALL, 1…16 — Selects which MIDI channel to send and receive data, 1 to 16. All receives on all 16 channels.

Clock: see table — Selects the MIDI clock status.

Display	MIDI Clock Setting
Internal	MIDI clock is neither sent nor received
MIDI Out	MIDI clock is sent
MIDI In	MIDI clock is received
Midi In/Out	MIDI clock is received and transmitted

MIDI Parameter Send: NRPN, CC, Off — Changes to the values of Mopho's front panel controls are transmitted via MIDI as Non-registered Parameter Number (NRPN) controllers or as Continuous Controllers (CC). Transmission of parameters can also be turned off. See *MIDI Implementation* on page 30 for details.

> **Note:** NRPNs are the preferred method of parameter transmission, since they cover the complete range of all parameters, while CCs only handle the main parameters.

MIDI Parameter Receive: All, NRPN, CC, Off — Sets the method by which Mopho receives parameter changes via MIDI. As with transmission, NRPNs are the preferred method, though some controllers may only be able to send CCs.

MIDI Control: Off, On — When On, the synth will respond to MIDI controllers, including Pitch Wheel, Mod Wheel, Pedal, Breath, Volume, and Expression.

MIDI SysEx: Off, On — When On, the synth will respond to received MIDI SysEx messages, and will transmit them, when prompted, to the MIDI Out. See *Sysex Messages* on page 41 for details.

Audio Out: Stereo, Mono — Mopho defaults to stereo operation. When set to Mono, this parameter defeats all pan settings and modulation, effectively making each of the outputs a mono output.

MIDI Out Select: Out, Thru — MIDI Out can be switched to MIDI Thru to daisychain multiple MIDI devices.

Basic Patch — Press the WRITE button to load a basic patch into the edit buffer. (The patch will not actually be written to the current program location unless intentionally written to memory in program mode using the WRITE button.)

Reset Globals — Mopho does not have a full hardware reset, but select this parameter and press WRITE to reset the global parameters to their factory defaults.

MIDI SysEx Dump: see table — Allows dumping of Programs in SysEx format via MIDI.

Display	MIDI Transmit Operation
Current Program	Dump current program
Current Bank	Dump all 128 programs in current bank
All Banks	Dump all programs in all 3 banks

Press the WRITE switch to start transmission. This feature is handy for saving Programs on a computer in SysEx format, or for sending them to another Mopho via a direct MIDI connection. The dumps include Program and Bank numbers, so when received, the programs will be stored in the same location.

Program Parameters

All Program parameters can be edited using any of the ASSIGNABLE PARAMETERS controls. To assign a parameter to a control, press the ASSIGN PARAMETERS button to light the LED, and then turn any of the knobs (1 through 4) to select a parameter. A full list of the parameters can be found on page 29. The selected parameter and value appear in the LCD display. The top line of the LCD displays the programmed value for reference; the bottom line displays the edited value.

To then change the value of the parameter you selected, hit the ASSIGN PARAMETERS button again, and the same knob will now change the value. You can also use the increment and decrement switches to adjust parameter values. Press both switches at the same time to set the parameter to zero.

> **Note**: Once you are done editing a program, before you save it, you should consider what parameters you want to access when playing the new program. Generally, when making a program, we try to assign each of the 4 knobs to a different parameter that makes sense for that particular program, providing extra live control.

Though it is certainly possible to perform detailed program generation and editing using these controls, it is usually much faster to use the free editor available for Mac OS or Windows. The minimal front panel of the Mopho is designed for fast, real-time changes in live performance.

Following are descriptions of each Mopho Program parameter.

Oscillator Parameters

Mopho has two analog oscillators. The basic controls for each oscillator are the same.

> **Note**: There are additional modulation controls that can affect the pitch of Oscillators 1 and 2. These are covered in other sections of the Parameter definitions.

Osc Freq: C 0…C 10 — Sets the base oscillator frequency over a 10 octave range, from 8 Hz to 8KHz, stepping in semitones. C3 is middle C, the first octave is 0 (C0, C#0, etc.), the second octave is 1 (C1, C#1, etc.), and so on.

Fine Freq: -50…+50 — Fine Tune control; 0 centered. Steps in cents (50 cents = 1/2 semitone).

Shape: see table — Selects the oscillator waveshape as follows:

Display	Waveshape
Osc Off	No output
Sawtooth	Sawtooth
Triangle	Triangle
Saw—Tri	Sawtooth — Triangle mix
Pulse xx	Pulse Wave, with pulse width ranging from minimum (0) to maximum (99). The pulse width will turn off at the two extremes — this allows some interesting modulation possibilities. A square wave will be at Pulse 50.

Glide: 0…127 — Sets the oscillator glide (portamento) rate. Glide can be set independently for each oscillator. Low values are faster. See "Glide Mode" below in *Miscellaneous Oscillator Parameters* for additional Glide settings.

Keyboard: On, Off — Turns keyboard tracking for the oscillator on and off.

Sub Osc 1: 1...127 — Sub-oscillator 1 generates a square wave pitched one octave below oscillator 1. This parameter controls the level.

Sub Osc 2: 1...127 — Sub-oscillator 2 generates a square wave pitched two octaves below oscillator 2. This parameter controls the level.

Miscellaneous Oscillator Parameters

Sync 2-> 1: Off, On — Turns oscillator hard sync on. With sync on, whenever oscillator 2 resets, it will force oscillator 1 to reset for the classic hard sync sound.

Glide Mode: see table — Sets the way the oscillators respond to Glide settings.

Display	Glide mode
FixRate	The Glide rate is fixed. The time to transition from one note to another varies depending upon the interval between the notes.
FixRate A	The same, but Glide is only applied when played legato; that is, when a new note is hit while another note is held.
FixTime	The Glide time is fixed. The time to transition from one note to another is the same, regardless of the interval.
FixTime A	The same, but Glide only is applied when played legato; that is, when a new note is hit while another note is held.

Osc Slop: 0…5 — The amount of random oscillator frequency slop. The analog oscillators in Mopho are very accurate, and will not drift. This works great for accurate sounds, and allows precise de-tuning. The Oscillator Slop parameter

allows subtle amounts of frequency drift. For larger amounts, use a random LFO or white noise mod.

Pitch Wheel Range: 0…12 — Sets the bend range, in semitones, of the pitch wheel. The setting is the range in the positive or negative direction. For example, a setting of 7 lets you bend a note up or down by a fifth.

Key Assign: see table — Determines how Mopho responds to keyed notes.

Display	Key mode
Low Note	Low note priority
LowRetrig	Low note priority, re-trigger envelopes
HighNote	High note priority
HighRetrg	High note priority, re-trigger envelopes
LastNote	Last note hit priority
LastRetrg	Last note hit priority, re-trigger envelopes

Mixer Parameters

Osc Mix: 0...127 — Enables the outputs of Oscillators 1 and 2 to be mixed in varying amounts. A setting of 0 is equivalent to 100% Oscillator 1 and 0% Oscillator 2. A setting of 127 is just the opposite. A setting of 64 is essentially a 50-50 mix of both oscillators.

Noise Level: 0…127 — Controls the volume of white noise mixed into the filter.

Ext In Volume: 0...127 — Controls the level of external audio input mixed into the filter. This is used for processing other audio sources (guitars, recordings, etc.) through Mopho's analog electronics. This works in conjunction with the front panel's INPUT GAIN control.

Also, since the left channel of AUDIO OUT is normalled to AUDIO IN, this control sets the amount of Mopho's audio output returned to the audio input. Use this for crazy feedback sounds.

Low-pass Filter Parameters

Mopho utilizes a switchable, 2- or 4-pole analog low-pass filter coupled with a 4-stage (plus delay) ADSR envelope generator.

Frequency: 0…164 — Sets the base filter cutoff frequency over more than 13 octaves. This control steps in semitones.

Resonance: 0…127 — Sets the Resonance level of the filter. At high settings the filter will self-oscillate in 4-pole mode. If the filter does not oscillate, switch to 4-pole mode.

Keyboard Amount: 0…127 — Sets the amount of keyboard (MIDI note) to the filter cutoff. A setting of 64 will step the filter one semitone for each note, 32 would be half-semitones, and so on.

Audio Mod: 0...127 — Controls the amount of audio from Oscillator 1 used to modulate the filter cutoff frequency. For filter-only audio, set OSCILLATOR MIX to 127, OSCILLATOR 2 SHAPE to Off, and OSCILLATOR 1 SHAPE to the desired waveshape. This is useful for bell-like FM sounds. A wide range of sounds can also be made using AUDIO MOD with the oscillators routed normally through the filter.

Config: 2 Pole, 4 Pole — Selects either 2- or 4-pole operation for the filter.

Envelope Amount: -127…+127 — Sets the amount of filter envelope routed to the cutoff frequency. This can be positive or negative, allowing inverted envelope control of the filter.

Envelope Velocity: 0…127 — Amount of key velocity controlling the level of the filter envelope.

Delay: 0...127 — Sets a delay between the time the filter envelope is triggered and when the Attack portion actually begins.

Attack: 0…127 — Sets the Attack time of the filter ADSR envelope generator.

Decay: 0…127 — Sets the Decay time.

Sustain: 0…127 — Sets the Sustain level.

Release: 0…127 — Sets the Release time.

VCA Parameters

VCA Level: 0…127 — Sets a base level for the VCA (Voltage Controlled Amplifier). This allows the VCA to be essentially bypassed, which is necessary for Programs that drone.

> **Note:** If VCA LEVEL is on full, Envelope Amount has no effect. You normally want VCA LEVEL set to zero. For droning sounds, or using the Mopho to process external audio, you will probably turn the VCA Level up.

Env Amount: 0…127 — Sets the amount of VCA envelope to the VCA level.

Env Velocity: 0…127 — Sets the amount of keyboard velocity controlling the level of the VCA envelope.

Delay: 0...127 — Sets a delay between the time the amplifier envelope is triggered and when the Attack portion actually begins.

Attack: 0…127 — Sets the Attack time of the VCA ADSR envelope generator.

Decay: 0…127 — Sets the Decay time.

Sustain: 0…127 — Sets the Sustain level.

Release: 0…127 — Sets the Release time.

Program Volume: 0…127 — Sets the volume of the current program to match volumes between programs.

> **Note:** There is enough gain in the synth voice that with some settings, some mild clipping distortion may be heard. If this happens, try lowering the VOICE VOLUME, and/or the VCA ENVELOPE AMOUNT (or VCA VELOCITY AMOUNT).

LFO Parameters

Mopho has four Low Frequency Oscillators (LFOs). The same parameters are available for each.

Frequency: 0…150, sync — Sets the LFO frequency. Range 0-150 for un-synced LFO; speed ranges from slow (30 seconds) to very fast — at 90 (8 HZ, C-2) and above the speed steps in semitones, up to 150 (261 Hz, middle C).

> **Note**: Some of the analog functions may not respond well to the fastest LFO speeds, due to speed limitations of the control voltages; but they will certainly generate some interesting sounds.

Above 150, the sync speeds are as follows:

Display	Timing Sync
32 Steps	Sequence speed divided by 32; i.e. one LFO cycle takes 32 steps
16 Steps	Sequence speed divided by 16
8 Steps	Sequence speed divided by 8
6 Steps	Sequence speed divided by 6
4 Steps	Sequence speed divided by 4

3 Steps	Sequence speed divided by 3
2 Steps	Sequence speed divided by 2
1.5 Step	Sequence speed divided by 1.5
1 Step	One cycle per step
2/3 Step	Two cycles every three steps
1/2 Step	Two cycles per step
1/3 Step	Three cycles per step
1/4 Step	Four cycles per step
1/6 Step	Six cycles per step
1/8 Step	Eight cycles per step
1/16Step	Sixteen cycles per step

Shape: see table — Selects the LFO waveshape:

Display	LFO Shape
Triangle	Triangle
Rev Saw	Reverse Sawtooth
Sawtooth	Sawtooth
Square	Square Wave
Random	Random — changes once per cycle for sample-and-hold effects

Amount: 0…100 — Sets the amount of LFO routed to the destination.

Key Sync: Off, On — When on, the LFO is re-started each time a new note is played. Key Sync is set independently on each LFO.

Destination — See *Modulation Destinations* on page 26 for a list of possible destinations.

Envelope 3 Parameters

Envelope 3 is an auxiliary envelope for modulating various destinations. It can even be used as a sort of LFO using the Repeat parameter, which is unique to Envelope 3.

Destination — Sets the Envelope 3 destination. See *Modulation Destinations* on page 26 for a list of possible destinations.

Amount: -127…+127 — Sets the amount of Envelope 3.

Env Velocity: 0…127 — Sets the amount of key velocity controlling the level of envelope 3.

Env Delay: 0…127 — Sets a delay between the time Envelope 3 is triggered and when the Attack portion actually begins.

Env Attack: 0…127 — Sets the Attack time of Envelope 3.

Env Decay: 0…127 — Sets the Decay time.

Env Sustain: 0…127 — Sets the Sustain level.

Env Release: 0…127 — Sets the Release time.

Repeat: Off, On — When on, causes the delay, attack, decay, and sustain portions of Envelope 3 to loop for as long as the envelope is gated on.

Modulation Parameters

The Modulation Parameters let you configure the modulation routing and amount for Mopho's four general-purpose modulation slots as well as for MIDI controllers (Mod Wheel, Key Pressure, Breath Control, Velocity, and Foot Controller).

Since each Mopho mod source has a single destination, the four general purpose Mods provide a way to send a mod source (such as a sequence or LFO) to additional destinations, with a different amount. There are also additional mod sources available here, such as Noise, allowing a wide variety of possibilities.

To configure a general-purpose modulation slot, select the appropriate modulator (Mod 1, Mod 2, Mod 3, or Mod 4), and use the Source, Destination, and Amount parameters to route the modulation as desired.

To configure modulation for a standard MIDI controller, select the desired controller and amount, and then set the destination.

Source — Selects a modulation source. See *Modulation Sources* on page 28 for possible sources.

Amount: -127…+127 — Sets the amount of modulation.

Destination — Selects a modulation destination. See *Modulation Destinations* on page 26 for a list of possible destinations.

Mod Wheel Amount: -127…+127 — Sets the maximum amount of modulation that can be applied from MIDI Continuous Controller 1 (mod wheel).

Mod Wheel Destination — Selects the destination to which the mod wheel is routed. See *Modulation Destinations* on page 26 for a list of possible destinations.

Press Amount: -127…+127 **—** Sets the maximum amount of modulation that can be applied from MIDI Channel Pressure (aftertouch).

Press Destination — Selects the destination to which the Channel Pressure is routed. See *Modulation Destinations* on page 26 for a list of possible destinations.

Breath Amount: -127…+127 **—** Sets the maximum amount of modulation that can be applied from MIDI Continuous Controller 2 (breath controller).

Breath Destination — Selects the destination to which the breath control is routed. See *Modulation Destinations* on page 26 for a list of possible destinations.

Veloc Amount: -127…+127 **—** Sets the maximum amount of modulation that can be applied from MIDI note-on velocity.

Veloc Destination — Selects the destination to which the note-on velocity is routed. See *Modulation Destinations* on page 26 for a list of possible destinations.

Foot Amount: -127…+127 **—** Sets the maximum amount of modulation that can be applied from MIDI Continuous Controller 4 (foot controller).

Foot Destination — Selects the destination to which the foot control is routed. See *Modulation Destinations* on page 26 for a list of possible destinations.

Push It Switch Parameters

These parameters determine the behavior of the PUSH IT switch, Mopho's manual trigger.

Note: C0…C10 **—** Sets the note that plays when PUSH IT is pressed.

Velocity: 0…127 **—** Sets the MIDI note-on velocity.

Mode: Normal, Toggle, Audio In **—** When set to Normal, PUSH IT responds like a key: press it and a note plays, release it and the note ends. But when set to Toggle, PUSH IT turns the note on with one press and off with a second press. This is handy for making a note drone or for latching a gated sequence on.

Somewhat related, the Audio In setting will generate a gate from the Audio Input. When the signal gets above a certain level, the gate will go on. When it drops below that level, the gate will go off.

Clock Parameters

The sequencer and arpeggiator share the BPM and CLOCK DIVIDE settings.

BPM: 30…250 — Sets the programmed tempo for the sequencer in BPM (beats per minute).

Clock Divide: see table — Sets the note value for each sequence step relative to the BPM.

Display	Tempo	Timing Division
Half	BPM/2	Half note
Quartr	BPM	Quarter note
Eighth	BPM x 2	Eighth note
8 half	BPM x 2	Eighth note, half swing timing
8swing	BPM x 2	Eighth note, full swing timing
8 trip	BPM x 3	Eighth note triplets
16th	BPM x 4	Sixteenth note
16half	BPM x 4	Sixteenth note, half swing timing
16swng	BPM x 4	Sixteenth note, full swing timing
16trip	BPM x 6	Sixteenth note triplets
32nd	BPM x 8	Thirty-second note
32trip	BPM x 12	Thirty-second note triplets
64trip	BPM x 24	Sixty-fourth note triplets

Arpeggiator Parameters

Mopho's arpeggiator has four different operating modes and can be synced to a MIDI clock source.

Note: If the arpeggiator does not seem to be working, check the GLOBAL parameters to make sure Clock is set to Internal. If Clock is set to use an external clock source, Mopho must be receiving MIDI clock messages in order for the arpeggiator to run.

The tempo and note value are determined by the Clock Parameters.

Mode: see table **—** Sets the order in which the arpeggiator plays notes.

Display	Arpeggiator mode
Up	Arpeggiated notes play in ascending order.
Down	Arpeggiated notes play in descending order.
Up Down	Arpeggiated notes play in alternately ascending and descending order.
Assign	Arpeggiated notes play in the order in which they were struck.

On/Off: Off, On **—** Turns the arpeggiator on and off. Turning it on will turn off the Sequencer if it is on.

Sequence Parameters

Mopho features a 4 x 16 "analog-style" step sequencer that can generate four separate sequence tracks of up to 16 steps each. Individual sequencer tracks can be routed to any standard modulation destination (see the table on page 26). Using VCA Envelope as a destination, for example, varies the volume of each step; a destination of Filter or Filter Envelope Amount will produce different filter settings per step. Typically, however, at least one sequence is routed to an oscillator to control pitch.

The sequencer is a "gated" sequencer. That is, a note must be played, either from the PUSH IT switch or via MIDI, in order for the sequence to be heard and it will continue to play as long as the note is held (gated) .

   Note: The PUSH IT switch's Toggle parameter enables notes (and, therefore, sequences) to be latched on for sustained playback.

The Clock Parameters determine the note value/tempo of the sequencer. The actual gate duration for each step is fixed at half the step time. Use the envelopes to generate notes of longer or shorter duration.

One very useful way to modulate a parameter in sync with a sequence is using LFOs with sync; LFO frequency runs from 0 to 150, after which you can select the sync settings. A setting of 16 Steps for LFO Frequency with a Triangle wave selected and routed to the filter will provide a clean filter sweep over a 16 step sequence, perfectly in sync! This is much easier (and smoother) than programming a filter sweep using sequence steps.

   Note: If the sequencer does not seem to be working, check the GLOBAL settings to make sure Clock is set to Internal. If Clock is set to use an external clock source, Mopho must be receiving MIDI clock messages in order for the sequencer to run.

Seq Trigger: see table — Sets the triggering mode for the Gated Sequencer.

Display	Trigger mode
Normal	Sequence plays from the first step when a key is held, and resets to step 1 each time a new note is played. Each sequence step retriggers the envelopes.
No Reset	The same, but does not reset to step 1 on every note.
No Gate	The keyboard triggers the envelopes; the sequence steps do not.
NoGateNR	Same, but does not reset with subsequent notes.
Key Step	Striking a key advances the sequencer one step.
Audio In	Steps the sequencer whenever the external audio input gets over a certain level.

On/Off: Off, On — Turns the sequencer on and off.

Seq 1, 2, 3, or 4 Destinations — Sets the destination for each of the four sequence tracks. For a complete list, see *Modulation Destinations* on page 26.

Seq 1, 2, 3, or 4 Steps: C0…D5+ or 0…125, Reset, Rest — Sets each step value for each of the four sequence tracks. The values are displayed as both relative note values and as simple numerical values. Note values are displayed in quarter tones with a plus sign (+) indicating that the pitch is a quarter tone higher than the displayed note number. The two highest values are Reset and Rest. Reset causes the sequence to reset to the first step, enabling sequences of fewer than 16 steps or even sequences in which the tracks are different lengths. Rest inserts a rest on the selected step.

Name Parameter

Edit Name — The lower LCD line displays the name of the Program with the active character blinking. When ASSIGN PARAMETERS is lit, the parameter control changes the position of the active character. When ASSIGN PARAMETERS is not lit, the parameter control steps through all the available characters for the active character. The increment and decrement buttons also change the character.

Modulation Destinations

Display	Destination
Off	No destination selected
Osc 1 Freq	Oscillator 1 Frequency
Osc 2 Freq	Oscillator 2 Frequency
OscAllFreq	Oscillator 1 and 2 Frequency
Osc Mix	Oscillator Mix
NoiseLevel	Noise Level
Osc1 PulsW	Oscillator 1 Pulse Width
Osc2 PulsW	Oscillator 2 Pulse Width
Osc All PW	All Oscillators Pulse Width
Low Pass	Lowpass Filter Frequency
Resonance	Resonance
Audio Mod	Audio Mod Amount
VCA Level	VCA Amount
Output Pan	Stereo Pan Position
LFO 1 Freq	LFO 1 Frequency
LFO 2 Freq	LFO 2 Frequency
LFO 3 Freq	LFO 3 Frequency
LFO 4 Freq	LFO 4 Frequency
LFOAllFreq	All LFO Frequencies
LFO 1 Amt	LFO 1 Amount
LFO 2 Amt	LFO 2 Amount
LFO 3 Amt	LFO 3 Amount
LFO 4 Amt	LFO 4 Amount
LFOAll Amt	All LFO Amounts
Env 1 Amt	Envelope 1 Amount (Level)
Env 2 Amt	Envelope 2 Amount (Level)
Env 3 Amt	Envelope 3 Amount (Level)
EnvAll Amt	All Envelope Amounts (Levels)
Env1Attack	Envelope 1 Attack Rate
Env2Attack	Envelope 2 Attack Rate
Env3Attack	Envelope 3 Attack Rate
EnvAll Att	All Envelope Attack Rates
Env1 Decay	Envelope 1 Decay Rate
Env2 Decay	Envelope 2 Decay Rate
Env3 Decay	Envelope 3 Decay Rate
EnvAll Dec	All Envelope Decay Rates
Env1Releas	Envelope 1 Release Rate
Env2Releas	Envelope 2 Release Rate

Env3Releas	Envelope 3 Release Rate
EnvAll Rel	All Envelope Release Rates
Mod 1 Amt	Modulator 1 Amount
Mod 2 Amt	Modulator 2 Amount
Mod 3 Amt	Modulator 3 Amount
Mod 4 Amt	Modulator 4 Amount
AudioInVol	Mixer Audio In Volume
Sub Osc 1	Sub Oscillator 1 Level
Sub Osc 2	Sub Oscillator 2 Level

Modulation Sources

Display	Source
Off	No source selected
Sequence1	Sequence 1
Sequence2	Sequence 2
Sequence3	Sequence 3
Sequence4	Sequence 4
LFO 1	LFO 1
LFO 2	LFO 2
LFO 3	LFO 3
LFO 4	LFO 4
Filt Env1	Filter Envelope
VCA Env 2	Amp (VCA) Envelope
Envelope3	Envelope 3
PitchBend	Pitch Bend
Mod Wheel	Mod Wheel
Pressure	Pressure (Aftertouch)
MidBreath	MIDI — Breath Controller
Midi Foot	MIDI — Foot Controller
Midi Exp	MIDI — Expression
Velocity	Keyboard Note Velocity
KeyNumber	Keyboard Note Number
Noise	Noise
EnvFollow	Audio In Envelope Follower
Peak Hold	Audio In Peak Hold

Parameter List

Osc 1 Frequency
Osc 1 Fine Freq
Oscillator 1 Shape
Oscillator 1 Glide
Osc 1 Key Track
Sub Osc 1 Level
Osc 2 Frequency
Osc 2 Fine Freq
Oscillator 2 Shape
Oscillator 2 Glide
Osc 2 Key Track
Sub Osc 2 Level
Osc Hard Sync
Glide Mode
Oscillator Slop
Pitch Wheel Range
Key Assign
Oscillator Mix
Noise Level
Ext In Volume
Filter Cutoff Freq
Filter Resonance
Filter Keyboard Amt
Filter Audio Mod
Filter Config/Mode
Filter Env Amount
Filter Env Velocity
Filter Env Delay
Filter Env Attack
Filter Env Decay
Filter Env Sustain
Filter Env Release
VCA Level
VCA Env Amount
VCA Env Velocity
VCA Env Delay
VCA Env Attack

VCA Env Decay
VCA Env Sustain
VCA Env Release
Program Volume
LFO 1 Frequency
LFO 1 Shape
LFO 1 Amount
LFO 1 Destination
LFO 1 Key Sync
LFO 2 Frequency
LFO 2 Shape
LFO 2 Amount
LFO 2 Destination
LFO 2 Key Sync
LFO 3 Frequency
LFO 3 Shape
LFO 3 Amount
LFO 3 Destination
LFO 3 Key Sync
LFO 4 Frequency
LFO 4 Shape
LFO 4 Amount
LFO 4 Destination
LFO 4 Key Sync
Env 3 Desination
Envelope 3 Amount
Envelope 3 Velocity
Envelope 3 Delay
Envelope 3 Attack
Envelope 3 Decay
Envelope 3 Sustain
Envelope 3 Release
Envelope 3 Repeat
Mod 1 Source
Mod 1 Amount
Mod 1 Destination
Mod 2 Source

Mod 2 Amount
Mod 2 Destination
Mod 3 Source
Mod 3 Amount
Mod 3 Destination
Mod 4 Source
Mod 4 Amount
Mod 4 Destination
Mod Wheel Amount
Mod Wheel Dest
Pressure Amount
Pressure Destination
Breath Amount
Breath Destination
Velocity Amount
Velocity Destination
Foot Control Amt
Foot Control Dest
Push It Note
Push It Velocity
Push It Mode
Clock BPM
Clock Divide
Arpeggiator Mode
Arpeggiator On/Off
Sequence Trigger
Sequencer On/Off
Seq 1 Destination
Seq 2 Destination
Seq 3 Destination
Seq 4 Destination
Seq 1 Steps 1 - 16
Seq 2 Steps 1 - 16
Seq 3 Steps 1 - 16
Seq 4 Steps 1 - 16
Edit Name

MIDI Implementation

Mopho receives MIDI data according to the mode controls under GLOBAL. In addition, there is interaction between some of the Program parameters that determine the overall response of Mopho to MIDI data.

Following are the Global parameters that affect response to MIDI:

MIDI Channel: ALL, 1…16 — Selects the MIDI channel to send and receive data, 1 to 16. All receives on any channel.

Clock: see table — Selects the MIDI clock status as follows:

Display	MIDI Clock Setting
Internal	MIDI clock is neither sent nor received
MIDI Out	MIDI clock is sent
MIDI In	MIDI clock is received
MIDIn/Out	MIDI clock is received and transmitted

MIDI Parameter Send: NRPN, CC, Off — Changes to the values of Mopho's front panel controls are transmitted via MIDI as Non-registered Parameter Number (NRPN) controllers or as Continuous Controllers (CC). Transmission of parameters can also be turned off.

MIDI Parameter Receive: All, NRPN, CC, Off — Sets the method by which Mopho receives parameter changes via MIDI. As with transmission, NRPNs are the preferred method, though some controllers may only be able to send CCs.

MIDI Control: Off, On — When On, the synth will respond to MIDI controllers, including Pitch Wheel, Mod Wheel, Pedal, Breath, Volume, and Expression.

MIDI SysEx: Off, On — When On, the synth will respond to received MIDI SysEx messages, and will transmit them, when prompted, to the MIDI Out.

MIDI Messages

System Real-time Messages

Status	Description
1111 1000	MIDI Timing Clock

Received Channel Messages

Status	Second	Third	Description
1000 nnnn	0kkkkkkk	0vvvvvvv	Note Off. Velocity is ignored
1001 nnnn	0kkkkkkk	0vvvvvvv	Note On. Note off if vvvvvvv = 0
1010 nnnn	0kkkkkkk	0vvvvvvv	Polyphonic Key Pressure
1011 nnnn	0vvvvvvv	0vvvvvvv	Control Change; see "Received Controller Messages" table following
1100 nnnn	0ppppppp		Program change, 0-127 for Programs 1-128 within current Bank
1101 nnnn	0vvvvvvv		Channel Pressure
1110 nnnn	0vvvvvvv	0vvvvvvv	Pitch Bend LS Byte then MS Byte

Notes:
0kkkkkkk	Note number 0 — 127
nnnn	Channel number 0 to 15 (MIDI channel 1-16). Ignored if MIDI channel set to ALL
0vvvvvvv	Value

Received Controller Messages

Status	Second	Third	Description
1011 nnnn	1	0vvvvvvv	Mod Wheel — directly assignable controller
1011 nnnn	2	0vvvvvvv	Breath Controller — directly assignable controller
1011 nnnn	4	0vvvvvvv	Foot Controller — directly assignable controller
1011 nnnn	7	0vvvvvvv	Volume — Combined with Master Volume and Voice Volume
1011 nnnn	74	0vvvvvvv	Brightness — Added to low-pass filter cutoff frequency
1011 nnnn	11	0vvvvvvv	Expression Controller — directly assignable controller
1011 nnnn	32	0vvvvvvv	Bank Select — 0 - 2 select banks 1 - 3; others ignored
1011 nnnn	64	0vvvvvvv	Damper pedal — holds envelopes in Sustain if 0100 0000 or higher
1011 nnnn	123	0vvvvvvv	All Notes Off — clear all MIDI notes
1011 nnnn	121	0vvvvvvv	Reset All Controllers — clears all MIDI controllers to 0, MIDI volume to maximum

See sections below for additional Continuous Controller (CC) and Non-registered Parameter Number (NRPN) messages received.

Transmitted Channel Messages

Status	Second	Third	Description
1100 nnnn	0ppppppp		Program change, 0 — 127 for Programs 1 — 128 within current Bank

Status	Second	Third	Description
1011 nnnn	0000 0111	0vvvvvvv	Volume knob
1011 nnnn	0010 0000	0vvvvvvv	Bank Select — 0 to 2

See sections below for additional Continuous Controller (CC) and Non-registered Parameter Number (NRPN) messages transmitted.

Additional Continuous Controllers (CCs) Transmitted/Received

The following table details how CCs are mapped onto Mopho's controls. They are transmitted when MIDI Parameter Send is set to CC in Global, and recognized when received when MIDI Parameter Receive is set to either CC or All in Global.

Parameter	CC#
Osc 1 Frequency	20
Osc 1 Freq Fine	21
Osc 1 Shape	22
Glide 1	23
Osc 2 Frequency	24
Osc 2 Freq Fine	25
Osc 2 Shape	26
Glide 2	27
Osc Mix	28
Noise Level	29
Sub Oscillator 1	30
Sub Oscillator 2	31
Filter Frequency	102
Resonance	103
Filter Key Amt	104
Filter Audio Mod	105
Filter Env Amt	106
Filter Env Vel Amt	107
Filter Delay	108
Filter Attack	109
Filter Decay	110
Filter Sustain	111

Parameter	CC#
Filter Release	112
VCA Level	113
Amp Env Amt	115
Amp Velocity Amt	116
Amp Delay	117
Amp Attack	118
Amp Decay	119
Amp Sustain	75
Amp Release	76
Env 3 Destination	85
Env 3 Amt	86
Env 3 Velocity Amt	87
Env 3 Delay	88
Env 3 Attack	89
Env 3 Decay	90
Env 3 Sustain	77
Env 3 Release	78
BPM	14
Clock Divide	15

NRPN Messages

The Non-Registered Parameter Number (NRPN) MIDI messages are used to transmit and receive both global and program parameters. They are transmitted when MIDI Parameter Send is set to NRPN in Global, and received when MIDI Parameter Receive is set to either NRPN or All in Global.

The messages are handled in standard MIDI format using the NRPN CC commands in running status byte format. Below is the format used for transmitting a NRPN parameter:

Transmitted NRPN Messages	
Status	**Description**
1011 nnnn	Control Change
0110 0011	NRPN parameter number MSB CC
0vvv vvvv	Parameter Number MSB
0110 0010	NRPN parameter number LSB CC
0vvv vvvv	Parameter Number LSB
0000 0110	NRPN parameter value MSB CC
0vvv vvvv	Parameter value MSB
0010 0110	NRPN parameter value LSB CC
0vvv vvvv	Parameter value LSB

The parameter number can be found in the two tables below, one for Global parameters, and the other for Program parameters. The parameter numbers and the parameter values are broken into two 7-bit bytes for MIDI transmission; the LSB has the seven least-significant bits, and the MSB has the seven most-significant bits, though in most cases the MSB will be zero or one, and never more than two.

When receiving an NRPN, all messages do not necessarily need to be transmitted, since the synth will track the most recent NRPN number, though it is usually good practice to send the entire message above.

Once an NRPN is selected, the synth will also respond to NRPN Data Increment and Decrement commands, which some controllers utilize. Finally, it responds to one RPN (Registered Parameter Number) command, the RPN/NRPN Reset command, which can be handy for resetting the currently selected parameter to a known state.

Status	Second	Third	Description
1011 nnnn	0110 0011	0vvvvvvv	NRPN parameter number MSB CC
1011 nnnn	0110 0010	0vvvvvvv	NRPN parameter number LSB CC
1011 nnnn	0000 0110	0vvvvvvv	NRPN parameter value MSB CC
1011 nnnn	0010 0110	0vvvvvvv	NRPN parameter value LSB CC
1011 nnnn	0110 0000	0xxxxxxx	NRPN parameter value Increment
1011 nnnn	0110 0001	0xxxxxxx	NRPN parameter value Decrement
1011 nnnn	0010 0101	0111111	RPN parameter number MSB CC — Reset NRPN parameter number (when both MSB and LSB received)
1011 nnnn	0010 0100	0111111	RPN parameter number LSB CC — Reset NRPN parameter number (when both MSB and LSB received)

Global Parameter Data

The following table shows the Global data that is sent and received on global parameter dumps, and the corresponding NRPN number when sent/received individually.

Param	NRPN	Range	Description
0	384	0 - 24	Master Transpose; 0 = -12 semitones (1 octave), 12 = 0 (no transpose), and 24 = +12 semitones.
1	385	0 - 100	Master Fine Tune; 0 = -50 cents, 50 = 0 (centered), 100 = + 50 cents
2	386	0 - 16	MIDI Channel; if = 0, data received on all MIDI channels. Otherwise = channel number 1 - 16.
3	388	0 - 3	MIDI clock select 0 Use Internal clock, don't send MIDI clock 1 Use Internal clock, send MIDI clock 2 Use MIDI clock In 3 Use MIDI clock In, and retransmit MIDI clock out
4	390	0 - 2	Parameter Send: 0 NRPN 1 CC 2 Off
5	391	0 - 3	Parameter Receive: 0 All 1 NRPN only 2 CC only 3 Off
6	394	0 - 1	MIDI Controller Send/Receive Off/On
7	395	0 - 1	MIDI Sysex Send/Receive Off/On

8	405	0 - 1	Audio Out: 0 Stereo 1 Mono
9	406	0 - 1	MIDI Out Select: 0 MIDI Out 1 MIDI Thru

Program Parameter Data

The following table lists Mopho's voice parameters. The parameter number in the program and edit buffer dumps are different than the NRPN numbers as seen; this was to maintain NRPN compatibility with the Prophet '08 as much as possible.

Param	NRPN	Range	Description
0	0	0 - 120	Oscillator 1 Frequency, 0 - 120 in semitones (10 octave range)
1	1	0 - 100	Oscillator 1 Fine Tune; 0 = -50 cents, 50 = 0 (centered), 100 = + 50 cents
2	2	0-103	Oscillator 1 Shape 0 Oscillator Off 1 Sawtooth 2 Triangle 3 Sawtooth/triangle mix 4 - 103 Pulse Wave, Pulse width 0 - 99
3	3	0 - 127	Oscillator 1 Glide
4	4	0 - 1	Oscillator 1 Keyboard Off/On
5	114	0 - 127	Sub Oscillator 1 Level
6	5	0 - 120	Oscillator 2 Frequency, 0 - 120 in semitones (10 octave range)
7	6	0 - 100	Oscillator 2 Fine Tune; 0 = -50 cents, 50 = 0 (centered), 100 = + 50 cents
8	7	0 - 103	Oscillator 2 Shape 0Oscillator Off 1 Sawtooth 2 Triangle 3 Sawtooth/triangle mix 4 - 103 Pulse Wave, Pulse width 0 - 99
9	8	0 - 127	Oscillator 2 Glide
10	9	0 - 1	Oscillator 2 Keyboard Off/On
11	115	0 - 127	Sub Oscillator 2 Level
12	10	0 - 1	Sync off/on
13	11	0 - 3	Glide Mode: 0 fixed rate 1 fixed rate auto 2 fixed time 3 fixed time auto
14	12	0 - 5	Oscillator Slop
15	93	0 - 12	Pitch Bend Range

16	96	0 - 5	Key Assign Mode: Low note priority Low note priority with re-trigger High note priority High note priority with re-trigger Last note hit priority Last note hit priority with re-trigger
17	13	0 - 127	Oscillator 1 - 2 Mix
18	14	0 - 127	Noise Level
19	116	0 - 127	External Audio Input Level
20	15	0 - 164	Filter Frequency, steps in semitones
21	16	0 - 127	Resonance
22	17	0 - 127	Filter Keyboard Amount
23	18	0 - 127	Filter Audio Modulation
24	19	0 - 1	Filter Poles 0: 2-pole; 1: 4-pole
25	20	0 - 254	Filter Envelope Amount; -127 to +127
26	21	0 - 127	Filter Envelope Velocity Amount
27	22	0 - 127	Filter Envelope Delay
28	23	0 - 127	Filter Envelope Attack
29	24	0 - 127	Filter Envelope Decay
30	25	0 - 127	Filter Envelope Sustain
31	26	0 - 127	Filter Envelope Release
32	27	0 - 127	VCA Initial Level
33	30	0 - 127	VCA Envelope Amount
34	31	0 - 127	VCA Envelope Velocity Amount
35	32	0 - 127	VCA Envelope Delay
36	33	0 - 127	VCA Envelope Attack
37	34	0 - 127	VCA Envelope Decay
38	35	0 - 127	VCA Envelope Sustain
39	36	0 - 127	VCA Envelope Release
40	29	0 - 127	Voice Volume
41	37	0 - 166	LFO 1 Frequency; 0 - 150 un-synced frequencies 151 Sequence speed divided by 32 152 Sequence speed divided by 16 153 Sequence speed divided by 8 154 Sequence speed divided by 6 155 Sequence speed divided by 4 156 Sequence speed divided by 3 157 Sequence speed divided by 2 158 Sequence speed divided by 1.5 159 One cycle per step 160 Two cycles per three steps 161 Two cycles per step 162 Three cycles per step 163 Four cycles per step 164 Six cycles per step

			165 Eight cycles per step 166 Sixteen cycles per step
42	38	0 - 4	LFO 1 Shape 0 Triangle 1 Reverse Sawtooth 2 Sawtooth 3 Pulse (square) 4 Random
43	39	0 - 127	LFO 1 Amount
44	40	0 - 46	LFO 1 Mod Destination; See Modulation Destination list below
45	41	0 - 1	LFO 1 Key Sync Off/On
46	42	0 - 166	LFO 2 Frequency; same as LFO 1
47	43	0 - 4	LFO 2 Shape; same as LFO 1
48	44	0 - 127	LFO 2 Amount
49	45	0 - 46	LFO 2 Mod Destination; See Modulation Destination list below
50	46	0 - 1	LFO 2 Key Sync Off/On
51	47	0 - 166	LFO 3 Frequency; same as LFO 1
52	48	0 - 4	LFO 3 Shape; same as LFO 1
53	49	0 - 127	LFO 3 Amount
54	50	0 - 46	LFO 3 Mod Destination; See Modulation Destination list below
55	51	0 - 1	LFO 3 Key Sync Off/On
56	52	0 - 166	LFO 4 Frequency; same as LFO 1
57	53	0 - 4	LFO 4 Shape; same as LFO 1
58	54	0 - 127	LFO 4 Amount
59	55	0 - 46	LFO 4 Mod Destination; See Modulation Destination list below
60	56	0 - 1	LFO 4 Key Sync Off/On
61	57	0 - 46	Envelope 3 Mod Destination; See Mod Destination list below
62	58	0 - 254	Envelope 3 Amount; -127 to +127
63	59	0 - 127	Envelope 3 Velocity Amount
64	60	0 - 127	Envelope 3 Delay
65	61	0 - 127	Envelope 3 Attack
66	62	0 - 127	Envelope 3 Decay
67	63	0 - 127	Envelope 3 Sustain
68	64	0 - 127	Envelope 3 Release
69	98	0 - 1	Envelope 3 Repeat Off/On
70	65	0 - 22	Mod 1 Source; See Modulation Source list below
71	66	0 - 254	Mod 1 Amount; -127 to +127
72	67	0 - 46	Mod 1 Destination; See Modulation Destination list below
73	68	0 - 22	Mod 2 Source; See Modulation Source list below
74	69	0 - 254	Mod 2 Amount; -127 to +127

75	70	0 - 46	Mod 2 Destination; See Modulation Destination list below
76	71	0 - 22	Mod 3 Source; See Modulation Source list below
77	72	0 - 254	Mod3 Amount; -127 to +127
78	73	0 - 46	Mod 3 Destination; See Modulation Destination list below
79	74	0 - 22	Mod 4 Source; See Modulation Source list below
80	75	0 - 254	Mod 4 Amount; -127 to +127
81	76	0 - 46	Mod 4 Destination; See Modulation Destination list below
82	81	0 - 254	Mod Wheel Amount; -127 to +127
83	82	0 - 46	Mod Wheel Destination; See ModDestination list below
84	83	0 - 254	Pressure Amount; -127 to +127
85	84	0 - 46	Pressure Destination; See ModDestination list below
86	85	0 - 254	Breath Amount; -127 to +127
87	86	0 - 46	Breath Destination; See ModDestination list below
88	87	0 - 254	Velocity Amount; -127 to +127
89	88	0 - 46	Velocity Destination; See ModDestination list below
90	89	0 - 254	Foot Control Amount; -127 to +127
91	90	0 - 46	Foot Control Destination; See ModDestination list below
92	111	0 - 120	Push It Switch Note Number
93	112	0 - 127	Push It Switch Velocity
94	113	0 - 2	Push It Switch Mode: 0 Normal 1 Toggle 2 Audio In
95	91	30 - 250	BPM tempo
96	92	0 - 12	Clock Divide: 0 Half Note 1 Quarter Note 2 Eighth Note 3 Eighth Note half swing 4 Eighth Note full swing 5 Eighth Note triplets 6 Sixteenth Note 7 Sixteenth Note half swing 8 Sixteenth Note full swing 9 Sixteenth Note triplets 10 Thirty-second Notes 11 Thirty-second Notes triplets 12 Sixty-Fourth note triplets

97	97	0 - 3	Arpeggiator Mode: 0 Up 1 Down 2 Up/Down 3 Assign
98	100	0 - 1	Arpeggiator; Off/On
99	94	0 - 5	Sequencer Trigger: 0 Normal 1 Normal, no reset 2 No gate 3 No gate/no reset 4 Key Step 5 Audio In
100	101	0 - 1	Gated Sequencer; Off/On
101	77	0 - 46	Sequence 1 Destination; See ModDestination list below
102	78	0 - 46	Sequence 2 Destination; See ModDestination list below
103	79	0 - 46	Sequence 3 Destination; See ModDestination list below
104	80	0 - 46	Sequence 4 Destination; See ModDestination list below
105	105	0 - 183	Assignable Parameter 1
106	106	0 - 183	Assignable Parameter 2
107	107	0 - 183	Assignable Parameter 3
108	108	0 - 183	Assignable Parameter 4
109 - 119			Unused
120 - 135	120 - 135	0 - 127	Sequence Track1, steps 1-16 0 to 125: Normal sequence step value 126 Reset 127 Rest
136 - 151	136 - 151	0 - 126	Sequence Track 2, steps 1-16 0 to 125: Normal sequence step value 126 Reset
152 - 167	152 - 167	0 - 126	Sequence Track 3, steps 1-16 0 to 125: Normal sequence step value 126 Reset
168 - 183	168 - 183	0 - 126	Sequence Track 4, steps 1-16 0 to 125: Normal sequence step value 126 Reset
184 - 199	184 - 199	32 - 127	Name characters 1-16, in ASCII format
200-255			unused

The following tables list the values used with the program parameters to specify modulation destinations and sources.

Mod Destinations	Value
Off	0
Osc 1 Freq	1
Osc 2 Freq	2
Osc 1 and 2 Freq	3
Osc Mix	4
Noise Level	5
Osc 1 Pulse Width	6
Osc 2 Pulse Width	7
Osc 1 and 2 Pulse Width	8
Filter Frequency	9
Resonance	10
Filter Audio Mod Amt	11
VCA Level	12
Pan Spread	13
LFO 1 Freq	14
LFO 2 Freq	15
LFO 3 Freq	16
LFO 4 Freq	17
All LFO Freq	18
LFO 1 Amt	19
LFO 2 Amt	20
LFO 3 Amt	21
LFO 3 Amt	22
All LFO Amt	23
Filter Env Amt	24
Amp Env Amt	25
Env 3 Amt	26
All Env Amounts	27
Env 1 Attack	28
Env 2 Attack	29
Env 3 Attack	30
All Env Attacks	31
Env 1 Decay	32
Env 2 Decay	33
Env 3 Decay	34
All Env Decays	35
Env 1 Release	36
Env 2 Release	37
Env 3 Release	38
All Env Releases	39

Mod 1 Amt	40
Mod 2 Amt	41
Mod 3 Amt	42
Mod 4 Amt	43
External Audio In Level	44
Sub Osc 1 Level	45
Sub Osc 2 Level	46

Mod Sources	Value
Off	0
Sequence Track 1	1
Sequence Track 2	2
Sequence Track 3	3
Sequence Track 4	4
LFO 1	5
LFO 2	6
LFO 3	7
LFO 4	8
Filter Envelope	9
Amp Envelope	10
Envelope 3	11
Pitch Bend	12
Mod Wheel	13
Pressure	14
MIDI Breath	15
MIDI Foot	16
MIDI Expression	17
Velocity	18
Note Number	19
Noise	20
Audio In Envelope Follower	21
Audio In Peak Hold	22

Sysex Messages

Universal System Exclusive Message (Device Inquiry)

Status	Description
1111 0000	System Exclusive (SysEx)
0111 1110	Non-realtime message
0vvv vvvv	If MIDI channel is set to 1 - 16, 0vvvvvvv must match (unless MIDI Channel = ALL); always responds if 0vvvvvvv = 0111 1111.
0000 0110	Inquiry Message
0000 0001	Inquiry Request
1111 0111	End of Exclusive (EOX)

Mopho responds with:

Status	Description
1111 0000	System Exclusive (SysEx)
0111 1110	Non-realtime message
0vvv vvvv	If MIDI Channel = ALL, 0vvvvvvv = 0111 1111. Otherwise 0vvvvvvv = Channel Number 0 - 15.
0000 0110	Inquiry Message
0000 0010	Inquiry Reply
0000 0001	DSI ID
0010 0101	Mopho ID (Family LS)
0000 0001	Family MS
0000 0000	Family Member LS
0000 0000	Family Member MS
0jjj nnnn	Main Software version: jjj - Minor rev; nnnn - Major rev
0000 0000	Zero Byte
0000 0000	Zero Byte
1111 0111	End of Exclusive (EOX)

Request Program Dump

Status	Description
1111 0000	System Exclusive (SysEx)
0000 0001	DSI ID
0010 0101	Mopho ID
0000 0101	Request Program Transmit
0000 00vv	Bank Number, 0 - 2
0vvv vvvv	Program Number, 0 - 127
1111 0111	End of Exclusive (EOX)

Mopho will respond by sending out the Program Data in the format described below in *Program Data Dump*.

Request Program Edit Buffer Dump

Status	Description
1111 0000	System Exclusive (SysEx)
0000 0001	DSI ID
0010 0101	Mopho ID
0000 0110	Request Program Edit Buffer Transmit
1111 0111	End of Exclusive (EOX)

Mopho will respond by sending out the current Program edit buffer in the format described below in *Program Edit Buffer Data Dump*.

Request Global Parameter Dump

Status	Description
1111 0000	System Exclusive (SysEx)
0000 0001	DSI ID
0010 0101	Mopho ID
0000 1110	Request Global Parameter Transmit
1111 0111	End of Exclusive (EOX)

Mopho will respond by sending out the current values of Global Parameters in the format described below in *Global Parameters Data Dump*.

Program Data Dump

Status	Description
1111 0000	System Exclusive (SysEx)
0000 0001	DSI ID
0010 0101	Mopho ID
0000 0010	Program Data
0000 00vv	Bank Number, 0 - 2
0vvv vvvv	Program Number, 0 - 127
0vvv vvvv	256 bytes expanded to 293 MIDI bytes in "packed MS bit" format (see page 44.)
1111 0111	End of Exclusive (EOX)

Program Edit Buffer Data Dump

Status	Description
1111 0000	System Exclusive (SysEx)
0000 0001	DSI ID
0010 0101	Mopho ID
0000 0011	Edit Buffer Data
0vvv vvvv	256 bytes expanded to 293 MIDI bytes in "packed MS bit" format (see page 44.)
1111 0111	End of Exclusive (EOX)

Status	Description
1111 0000	System Exclusive (SysEx)
0000 0001	DSI ID
0010 0101	Mopho ID
0000 1111	Main Parameter Data
0vvv vvvv	20 nibbles (LS then MS) for 10 Global parameters. Global Parameters are listed starting on page 34.
1111 0111	End of Exclusive (EOX)

Note: The Global Parameters Data Dump is not recognized when received; it is only transmitted when requested. NRPN messages are used to change Globals.

Packed Data Format

Data is packed in 8 byte "packets", with the MS bit stripped from 7 parameter bytes, and packed into an eighth byte, which is sent at the start of the 8 byte packet.

Example:

Input Data

```
1 A7 A6 A5 A4 A3 A2 A1 A0
2 B7 B6 B5 B4 B3 B2 B1 B0
3 C7 C6 C5 C4 C3 C2 C1 C0
4 D7 D6 D5 D4 D3 D2 D1 D0
5 E7 E6 E5 E4 E3 E2 E1 E0
6 F7 F6 F5 F4 F3 F2 F1 F0
7 G7 G6 G5 G4 G3 G2 G1 G0
```

Packed MIDI data

```
1   00 G7 F7 E7 D7 C7 B7 A7
2   00 A6 A5 A4 A3 A2 A1 A0
3   00 B6 B5 B4 B3 B2 B1 B0
4   00 C6 C5 C4 C3 C2 C1 C0
5   00 D6 D5 D4 D3 D2 D1 D0
6   00 E6 E5 E4 E3 E2 E1 E0
7   00 F6 F5 F4 F3 F2 F1 F0
8   00 G6 G5 G4 G3 G2 G1 G0
```

This explains why it takes 293 MIDI bytes to transmit 256 Program data bytes.

Hidden Functions

Hold the ASSIGN PARAMETER switch and hit the +/increment switch to calibrate the low-pass filter and analog oscillator waveshapes. This should not be necessary for normal operation.

Another (literally) hidden function: Carefully insert a small, standard screwdriver into the hole in the bottom panel to adjust the LCD contrast.