# MAX

# MIDIGUIDE

**MAX**
**MIDI VOICE EXPANDER/**
**COMPUTER PERIPHERAL**

**MIDIGUIDE**

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# MAX MIDIGUIDE

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## 1 OVERVIEW

MIDI (Musical Instrument Digital Interface) is a system which allows computer-controlled musical instruments to communicate with each other. Any two MIDI-equipped instruments may be connected together through standard 5-pin DIN jacks, allowing the instruments to work together both at a basic level and at more complex levels.

For example, MAX can be driven by another MIDI-equipped synthesizer with one cable in a "master/slave" set-up, so that playing the master's keyboard simultaneously plays MAX to make rich, ensemble effects. If the master is equipped with performance controls (such as wheels) these can remotely control MAX. Likewise, selecting a sound (program) on the master instantly selects a corresponding sound number on MAX.

In fact, MIDI can be used to control virtually all of MAX's features. Whether or not all of these MIDI features can actually be used depends on the specific design of the other MIDI equipment. Therefore to take full advantage of MAX's MIDI features, it is recommended that you review this MIDIGUIDE in some detail.

This MIDIGUIDE is divided into two sections. The first shows how MAX operates with other MIDI-equipped instruments. The second covers the creation of custom sounds for MAX.

"MIDI APPLICATIONS" provides instructions for connecting MAX to MIDI-equipped drum machines (such as the SCI Drumtraks) and three specific SCI instruments: another MAX, the Six-Trak, and the Prophet-T8. These examples introduce MAX's MIDI functions to demonstrate how MIDI can be used to control MAX (for example, as a velocity-sensitive MIDI voice expander). (Owners of instruments other than those listed above may find this section of interest, as it shows how MIDI implementations can vary.)

"PROGRAMMING MAX" describes MAX's synthesizer "voices" in detail, followed by recommended methods for creating new sounds for MAX using either a Six-Trak or MIDI-equipped computer. For programmers of MIDI-equipped computers, "MAX MIDI IMPLEMENTATION" provides the details on MAX's MIDI vocabulary.

Finally, the factory sound charts are provided for several of the applications listed above.

Note: MIDI is an evolving system. We encourage you to experiment with various instrument configurations and let us know what, if any, other control options would be useful to you.

## 2 MIDI APPLICATIONS

This section presents practical instructions on how to use MAX with other instruments. When power is switched on, MAX transmits and receives keyboard, wheel and sound selection information. However, other control options are available for more advanced applications. The following examples explain how to obtain the best results using these options. Three of the examples given deal only with Sequential Circuits instruments although MAX can be used with any MIDI-equipped instrument.

Each example begins by setting both instruments to their power-up conditions. This is mainly due to the operation of the other instruments used with MAX. For example, MAX has a "coded function" to enable MIDI sound changes, and another to disable them, while the Six-Trak has one coded function to alternately enable then disable MIDI program (sound) changes. Turning the Six-Trak off, then on again eliminates any doubt of the status of its MIDI functions. The same applies to instruments used in the other examples.

Following the connection and preparation instructions in each example, there are three subsections:

> BASIC MIDI OPERATION
> This describes how MAX operates with the other instrument when power is switched on but no other functions are activated. At this stage some functions do not work.

> DUMP OPERATIONS
> This explains how to send sound or song information between similar instruments (for example, between a Six-Trak and MAX), and does not apply to the Prophet-T8 or Drumtraks.

> CONTROL OPTIONS
> This explains how to enable available control options on both instruments in the example. The coded functions allow MAX to operate at a higher level with the other instrument in the example.

In some examples there are instructions to enable certain functions (for example, Double Mode) which may not be possible on other instruments. To avoid undesired results when using MAX as a "slave," owners of non-SCI instruments will find MIDI FUNCTIONS (see page 19) useful for disabling MIDI control inputs on MAX. If you are not sure whether or not your other instruments recognize MAX's coded functions, read MAX MIDI IMPLEMENTATION (page 35) to find out in greater detail how these commands work.


## 2.1    USING MAX WITH DRUM MACHINES

Recording songs with MAX's built-in recorder is covered in the operation manual. The following explains how to synchronize MAX's recorder to MIDI-equipped drum machines. Owners of drum machines not equipped with MIDI need to use a MIDI clock accessory device for the applications described below.

The SCI Drumtraks differs from other MIDI-equipped drum machines by sending MIDI information which prevents MAX's songs from going "out of sync" with the Drumtraks. To acheive the same result, other drum machines must be stopped, then restarted. Two methods are described below for each application. One method deals with the Drumtraks, the other method deals with other MIDI-equipped drum machines. Please note that in order for songs to be played back with a drum machine, they must also be recorded with a drum machine.

Connection:

Connect drum machine **MIDI OUT** to MAX **MIDI IN**.

Set MAX to its power-up conditions:

Either:    Switch MAX power off, then on.
           This erases sounds 80 - 99 and both songs.


Or:        Press **Erase**.

           Enter **20** on the **SOUND SELECT** keypad.

           Enter **03** on the **SOUND SELECT** keypad.

           Press **Erase**.

MAX is now set to Mode 1, with the Basic Channel set to 3.


Enable MIDI clock input on MAX.

           Hold **Record**.
                  It blinks.

           Press upper **Speed** switch.

           Release **Record**.
                  It still blinks.

           Press **Record**.
                  It stops blinking.


## SONG PLAYBACK

Select drum pattern on drum machine.
           For this example, select a 4/4 rhythm. If the drum pattern is
           playing, turn it off.


Prepare MAX for playback of Demo Song 1:

           Select **Song 1**.

           Press **Start**.
                  MAX waits for MIDI clocks from the drum box.


Start drum machine.
           Both the drum pattern and song play back. The drum machine
           controls the speed. (MAX's **Speed** switches do not operate.)

Stop drum machine.
           The song stops also.

Start drum machine.

Song playback resumes. If a Drumtraks is used, each time it is stopped, then started, MAX resumes playback from the beginning of the song.

Note: If a Drumtraks is used, it is possible to start the Drumtraks first, then start MAX's recorder (for example to have a drum introduction to a song):

Start Drumtraks.

Select desired song. (For this example, use **Song 1**.)

Hold **Stop**.

When ready, press **Start**.
When the drum pattern loops, or another pattern in the Drumtraks song starts, the MAX song starts.

Release both **Start** and **Stop**.

## SONG RECORDING WITH THE SCI DRUMTRAKS

Prepare Drumtraks.

On the Drumtraks select a suitable pattern for recording the song.

Prepare MAX to record the Basic Track(s).

Select either **Song 1** or **Song 2**.

Press **Erase**.

Press the selected **Song** switch.
This erases the demo (or previous) song.

Select the desired sound for the Basic Track(s).

Press **Record**.
It blinks. **Track 1** blinks.
If more than one track is needed, switch on other tracks.

Press **Start**.
**Record** stops blinking. If you want notes to be recorded exactly on the down-beat of the drum pattern, hold the desired keys. (At this point, any keys held are not played by MAX.)

Start recording the Basic Track.

Start Drumtraks.
As soon as the Drumtraks pattern loops, MAX is ready to record, and any keys held are heard.

End recording, and begin playback.

Press **Record.**

When the Drumtraks pattern loops, the song begins playback, and stays in sync with the Drumtraks.

Note: When using MAX with a drum machine, do not use **Stop** to end recording.

## AUTO-CORRECT

When used with a Drumtraks, MAX's recorder sets its song lengths to match the length of the Drumtraks pattern used during recording. If during recording, you press **Record** (to end recording) slightly too soon or too late, MAX determines when the song is supposed to end by looking for the next or most recent drum pattern ending, indicated by a MIDI Pattern Marker from the Drumtraks. (For more information, see MAX MIDI IMPLEMENTATION, page 40).

Once the length of a song is auto-corrected to match a Drumtraks pattern, it does not go out of sync. For this reason, be sure to record your songs with a Drumtraks pattern of the same time signature. Attempting to record a 3/4 song with a 4/4 pattern may produce a 4/4 song instead (depending on the song length). Once the song is recorded, it may be played back with a pattern in any time signature.

When **Record** is pressed to end recording, MAX waits for the current drum pattern to end before playback begins so the basic track remains in sync with the Drumtraks. However, if **Record** is pressed less than a quarter note after the end of a Drumtraks pattern, MAX assumes you intended to press it earlier, and goes immediately into playback.

Note: Auto-correct does not affect the notes of a song, only the song length.

## SONG RECORDING WITH OTHER MIDI-EQUIPPED DRUM MACHINES

As explained on the previous page, auto-correcting the length of MAX's songs keeps them from going out of sync with the Drumtraks pattern by using a MIDI pattern marker. Although many drum machines are equipped with MIDI, they may not be equipped with a pattern marker feature. In these cases, attempts to stop recording by pressing **Record** produce unsatisfactory results, such as the song going out of sync with the drum machine after a few repetitions (due the song length not being an exact multiple of the drum pattern length).

It is still possible to set the lenth of MAX's songs to prevent them from going out of sync, but the drum machine in use must be able to stop playing exactly at the end of a pattern. The best method is to record the basic track(s) on MAX while your drum machine plays a single-play (non-repeating) song.

Create a song on your drum machine of the same length as the song you wish to record.
It does not have to be the same drum song you intend to playback with MAX when you are finished. For recording you may want to use a simple bass drum pattern. For example, make a simple one-measure drum pattern. Then create a drum "song" on your drum machine which consists of four repitions of the simple pattern. (Most drum machines allow you to create songs which stop playing rather than loop endlessly.) This allows you to create a four-measure song on MAX.

Prepare MAX for recording:

Select either **Song 1** or **Song 2.**

Press **Erase.**

Press the selected **Song** switch.
This erases the demo song.

Select desired sound for the basic track(s).

Switch MAX **Record** on.
**Track 1** blinks.
If more than one track is needed, switch on other tracks.

Press **Start.**
No sound is heard when the keyboard is played. If notes are desired on the down-beat of the drum pattern, hold them now.

To start recording:

Start drum machine.
Recording starts immediately. If you wait before playing any notes, your pause is recorded into the song.

Play basic track(s) on MAX.

When the drum song stops, MAX stops recording. The basic track is now the same length as the drum song you recorded with.

## SONG OVERDUBBING

There are two methods for overdubbing notes on MAX's recorder. One method starts with the drum machine and MAX's recorder stopped, the other method allows overdubbing without stopping playback.

If both MAX's recorder and the drum machine are playing back:

Select desired sound for overdub.

Press **Record.**
It blinks. MAX produces no sound until **Record** stays lit (see below).

Select desired tracks for the overdub.
> If you want notes to be overdubbed on the down-beat of the drum pattern, hold the desired keys before the song loops (while **Record** blinks).

When the song loops and **Record** stays lit, play overdub on MAX.
> Overdubbing stops when the song loops.

### If both MAX's recorder and the drum machine are stopped:

Select desired sound for overdub.

Press **Record**.
> It blinks. MAX produces no sound until **Record** stays lit (see below). Any previously recorded tracks light up.

Select desired track(s) for the overdub.
> The selected tracks blink.

Press **Start**.
> If you want notes to be overdubbed on the down-beat of the drum pattern, hold the desired keys.

Start Drumtraks.
> Overdubbing begins immediately. The previously recorded tracks and the keys held are played.

Note: Overdubbing does not require using unused tracks. If you wish to add to an existing track care must be taken not to overdub too many notes as this results in "lost" notes.

## 2.2    USING TWO MAXS

Connection:

> Connect **MIDI OUT** of master unit to **MIDI IN** of the slave.

Set both MAXs to its power-up conditions:

Either:    Switch MAX power off, then on.
> This erases sounds 80 - 99 and both songs.

Or:    Press **Erase**.

Enter **20** on the **SOUND SELECT** keypad.

Enter **03** on the **SOUND SELECT** keypad.

Press **Erase**.

MAX is now set to Mode 1, with the Basic Channel set to 3.

## BASIC MIDI OPERATION

Keyboard playing on the master is duplicated by the slave.
> As you play on the master, the same notes are played on the slave.

Sound changes on the master are duplicated by the slave.
> Any sound number selected on the master is also selected on the slave. Both displays show the same sound number.

When the master's recorder is on, the slave does not play the master's recorded song.
> However, while the recorder is running, the slave does play any notes that you play on the master or slave keyboard or both.

## DUMP OPERATIONS

To load both songs from the master to the slave:

> Press **Erase** on the master.
> > **Erase** starts blinking.

> Enter **30** on the master's **SOUND SELECT** keypad.
> > **Erase** stops blinking momentarily.

> Wait for **Erase** to resume blinking.

> Press **Erase.**
> > **Erase** stops blinking. The master's songs are now copied into the slave.

## CONTROL OPTIONS

To select Double Mode:

> Press **Erase** on the master.

> Enter **23** on the **SOUND SELECT** keypad.

> Press **Erase** again.
> > Anything played from the master's keyboard or recorder is duplicated on the slave, including the sound numbers used in the master's songs.

Selecting Double Mode selects Mode 4 and enables sound and external wheel changes over MIDI.

Note: In Double Mode, the slave does not display any sound changes sent from the master, although the sounds change on both MAXs.

To disable MIDI sound changes on the slave:

> Press **Erase** on the slave.

> Enter **24** on the **SOUND SELECT** keypad.

> Press **Erase** on the slave.
> > Selecting a sound on the master no longer selects the same sound on the slave.

To enable MIDI sound changes on the slave:
> This action is only necessary if MIDI sound changes have been disabled.
> Sound changes are enabled on MAX on power-up.

Press **Erase** on the slave.

Enter **25** on the slave's **SOUND SELECT** keypad.

Press **Erase** on the slave.
> Selecting a sound on the master selects the same sound on the slave.


To synchronise two MAXs to one Drumtraks:

Connect MAX #1 **MIDI OUT** to MAX #2 **MIDI IN.**
> Songs may then be recorded on either MAX in sync with the Drumtraks.


## 2.3 USING MAX WITH A SIX-TRAK

The following example uses the Six-Trak as the master, and MAX as the slave (current Six-Trak software version: TRAK0_9).

Connection:

Connect Six-Trak **MIDI OUT** to MAX **MIDI IN.**


Set MAX to its power-up conditions:

Either: Switch MAX power off, then on.
> This erases sounds 80 - 99 and both songs.

Or: Press **Erase.**

Enter **20** on the **SOUND SELECT** keypad.

Enter **03** on the **SOUND SELECT** keypad.

Press **Erase.**

MAX is now set to Mode 1, with the Basic Channel set to 3.


To prepare the Six-Trak:
The following procedure sets the Six-Trak's mode and channel number to match the MAX's.

Hold **TRACK RECORD.**

Press **SELECT 1.**
> This selects Omni mode.

Release **TRACK RECORD.**

Press **PARAMETER.**

Enter **36** on the **SELECT** keypad.

Press **VALUE.**

Adjust **VALUE** to **03.**
    This sets the Basic Channel to 3.

Press **PROGRAM.**

## BASIC MIDI OPERATION

Keyboard playing on the Six-Trak is duplicated by MAX.
    As you play on the Six-Trak, the same notes are played on MAX.

Selecting a program on the Six-Trak does not select the same sound number on MAX.
    The Six-Trak does not send program changes over MIDI on power-up.

When the Six-Trak's sequencer is playing, the slave does not play the recorded notes.
    However, MAX plays any notes that you play on the Six-Trak keyboard
    while the Six-Trak sequencer is running.

## DUMP OPERATIONS

To send one program from the Six-Trak to the MAX:

    Select a program between 80 and 99 on the Six-Trak. For this example, enter
    87.
        If the desired Six-Trak program is not numbered 80-99, move it to one of
        these locations.

    Hold **CONTROL RECORD** on the Six-Trak.

    Press **SELECT 2** on the Six-Trak.

    Release **CONTROL RECORD** on Six-Trak.

    Enter **87** on MAX's **SOUND SELECT** keypad.
        Sound #87 on MAX now contains the same sound as program #87 on the
        Six-Trak.

To send 20 programs from the Six-Trak to MAX:
Note: This records over any sounds currently in 80 - 99.

    Hold **TRACK RECORD** on the Six-Trak.

    Press **SELECT 9** on the Six-Trak.
        **TRACK RECORD** lights for a few seconds while 100 programs are sent
        to MAX. Only sounds #80-99 of MAX are now the same as programs #80-
        99 on the Six-Trak (assuming programs #00 - 79 were different before
        the dump).

## CONTROL OPTIONS

<u>To enable MIDI program selections from the Six-Trak:</u>
<u>Note:</u> If program selections have previously been enabled, this procedure disables them.
(On power-up, Six-Trak program selections over MIDI are disabled.)

Hold **CONTROL RECORD** on Six-Trak.

Press **SELECT 1** on Six-Trak.

Release **CONTROL RECORD.**
Any program number selected on the Six-Trak is also selected on MAX.
If MAX does not contain any sounds in locations 80-99, selecting any of
these program numbers on the Six-Trak has no effect on MAX.

<u>To disable MIDI sound selections on MAX:</u>

Press **Erase** on MAX.

Enter **24** on MAX's **SOUND SELECT** keypad.

Press **Erase** on MAX.
Selecting any program numbers on the Six-Trak has no effect on MAX's
current sound.

<u>To enable MIDI sound selections on MAX:</u>

Press **Erase** on MAX.

Enter **25** on the **SOUND SELECT** keypad.

Press **Erase** on MAX.

<u>Note:</u> If MAX contains no sounds in locations #80 - 99, selecting Six-Trak programs
#80-99 has no effect on MAX.

<u>To enable the Six-Trak's wheels over MIDI:</u>

Hold **CONTROL RECORD** on the Six-Trak.

Press **SELECT 4** on the Six-Trak.

Release **CONTROL RECORD.**
MAX responds to the Six-Trak's PITCH and MOD wheels.

<u>To disable external wheels on MAX:</u>

Press **Erase** on MAX.

Enter **26** on the **SOUND SELECT** keypad.

Press **Erase** on MAX.
> MAX does not respond to the Six-Trak's wheels, even if they are enabled on the Six-Trak itself.


To enable external wheels on MAX:

Press **Erase** on MAX.

Enter **27** on the **SOUND SELECT** keypad.

Press **Erase** on MAX.
> MAX responds to the Six-Trak's PITCH and MOD wheels if they have been enabled on the Six-Trak itself.


To select Double Mode on both instruments:

Hold **TRACK RECORD** on the Six-Trak.

Press **SELECT 2** on the Six-Trak.

Release **TRACK RECORD** on the Six-Trak.
> Anything played from the Six-Trak keyboard or sequencer is played on MAX (including all sound numbers used in the Six-Trak sequences or selected from the Six-Trak's front panel). PITCH and MOD wheel movements are also duplicated on MAX.


Note: When in Double Mode, if a program is selected on the Six-Trak, MAX selects the same sound number (not necessarily the same sound) but does not display any sound change on the front panel.


## 2.4    USING MAX WITH A PROPHET-T8

Note: The Prophet-T8's MIDI operation is detailed in the Prophet-T8 MIDIGUIDE (MG1008).


Connection:

Connect Prophet-T8 **MIDI OUT** to MAX **MIDI IN**.


Set MAX to its power-up conditions:

Either: Switch MAX power off, then on.
> This erases sounds 80 - 99 and both songs.


Or:    Press **Erase**.

Enter **20** on the **SOUND SELECT** keypad.

Enter **03** on the **SOUND SELECT** keypad.

Press **Erase**.

MAX is now set to Mode 1, with the Basic Channel set to 3.

## BASIC MIDI OPERATION

Keyboard playing on the Prophet-T8 is duplicated by MAX.
MAX is controlled by the lower five octaves ($B_0$-$C_5$) of the -T8's keyboard, including the sequencer. This is regardless of keyboard mode (**SINGLE, SPLIT, DOUBLE**). Playing notes above $C_5$ produces the same note one octave lower.

As you play the Prophet-T8, the same notes are played on MAX. When the -T8 keyboard mode is set to **SINGLE**, it plays a maximum of eight notes, but MAX plays only the last six notes played, so occasionally not all the notes played on the -T8 will be heard from MAX.

On the other hand, if the -T8 keyboard mode is set to **DOUBLE**, it plays a maximum of four notes, so ocasionally MAX plays more notes than the -T8.

MAX does not respond to the -T8's keyboard velocity.
Keyboard velocity must be enabled on MAX (see page 18).

MAX does not respond to the Prophet-T8 PITCH and MOD wheels.
The Prophet-T8's wheels are not enabled over MIDI on power-up. To enable -T8 wheels over MIDI see CONTROL OPTIONS on page 18.

Program changes on the Prophet-T8 have no effect on MAX.
Program (sound) changes made on the Prophet-T8 are not enabled over MIDI on power-up. For instructions to enable -T8 program changes over MIDI see CONTROL OPTIONS on page 17.

When the Prophet-T8's sequencer is running, MAX plays the sequenced notes.

## VELOCITY

Although MAX is not a velocity-sensitive keyboard by itself, it can be dynamically controlled by a velocity-sensitive keyboard (such as the Prophet-T8) through MIDI.

Each of MAX's sounds has a programmed volume so that when sounds are selected, MASTER VOLUME need not be adjusted to compensate. There are sixteen possible programmed volume levels. Similarly, MAX accepts sixteen levels of key velocity information with each note received through MIDI (see MAX MIDI IMPLEMENTATION, page 36). Increasing the key velocity of notes played on the velocity-sensitive "master" increases the resulting voice volumes on MAX, but only up to the programmed voume level. For example, if MAX's current sound has a programmed volume of 14, sending a velocity of 9 produces a note volume of 9. If a key velocity of 15 is sent, the note produced is at a volume of 14, the programmed volume level.

Non-velocity-sensitive keyboards send notes over MIDI with a velocity of 40H (half the full range). If MAX is used as a slave to such an instrument, notes are played at half the full range. To avoid volume differences when playing both the master keyboard and MAX's, velocity is disabled on MAX on power-up. Velocity can be enabled with a MIDI function (see page 18).

## CONTROL OPTIONS

To enable -T8 program changes to control MAX:

Hold **RECORD** on the -T8.

Press **PROG/SEQ 1** on the -T8.

Release **RECORD.**

If a program is selected on the -T8, a corresponding sound is selected on MAX. 100 of the -T8's left and right programs correspond to MAX's sound numbers, as shown by the following abbreviated table:

| -T8 | MAX | -T8 | MAX |
|-----|-----|-----|-----|
| L11 | 00 | R11 | 64 |
| L12 | 01 | R12 | 65 |
| L21 | 08 | R21 | 72 |
| L31 | 16 | R31 | 80 |
| L41 | 24 | R41 | 88 |
| L51 | 32 | R51 | 96 |
| L61 | 40 | R54 | 99 |
| L71 | 48 | R55 and up | not recognized |
| L81 | 56 | | |
| L88 | 63 | | |

Note: Selecting -T8 programs R31-99 has no effect on MAX unless sounds #80-99 have been loaded into MAX's memory from a Six-Trak (see page 13) or MIDI-equipped computer (see page 33).

To disable MIDI sound changes on MAX:

Press **Erase** on MAX.

Enter **24** on MAX's **SOUND SELECT** keypad.

Press **Erase** on MAX.

Any sound numbers selected on the -T8 have no effect on MAX's current sound.

To enable MIDI sound changes on MAX:

Press **Erase** on MAX.

Enter **25** on the **SOUND SELECT** keypad.

Press **Erase** on MAX.
    If MIDI sound selections are enabled on the -T8, any sound number
    selected on the -T8 is also selected on MAX. If MAX does not contain
    any sounds in locations 80-99, selecting one of these sound numbers on
    the -T8 has no effect on MAX.

## To enable the -T8 wheels to control MAX:

Hold **RECORD** on the Prophet-T8.

Press **PROG/SEQ 4** on the -T8.

Release **RECORD.**
    MAX responds to the -T8 wheels if, on the -T8, **ENABLE WHEELS** is on.

## To disable external wheels on MAX:

Press **Erase** on MAX.

Enter **26** on the **SOUND SELECT** keypad.

Press **Erase** on MAX.
    Now MAX does not respond to the -T8's wheels, even if they are enabled
    on the -T8 itself.

## To enable external wheels on MAX:

Press **Erase** on MAX.

Enter **27** on the **SOUND SELECT** keypad.

Press **Erase** on MAX.
    Now MAX responds to the -T8's PITCH and MOD wheels if they have
    been enabled on the -T8 itself.

## To disable external keyboard velocity on MAX:

Press **Erase** on MAX.

Enter **35** on the **SOUND SELECT** keypad.

Press **Erase** on MAX.

## To enable external keyboard velocity on MAX:
    (Disabled on power-up.)

Press **Erase** on MAX.

Enter **36** on the **SOUND SELECT** keypad.

Press **Erase** on MAX.

> MAX responds to the -T8's keyboard velocity. When the -T8 keys are played slowly, MAX plays at a low volume. As the -T8 keys are played harder (faster), MAX's volume increases.

## 2.5    MIDI FUNCTIONS

On power-up, MAX sends and receives Note On/Off, external wheel, and sound selection data. This section explains how to disable or enable these and other functions to optimize MAX's operation with other MIDI equipment (for sound storage, song editing, and music print-out).

Although MIDI can enhance an instrument's performance, it does not change an instrument's sound-producing capabilties. Similarly, MIDI applications with a home computer are determined by the computer's capabilities, but allow instruments such as MAX to offer more performance features than previously possible.

To select the coded functions which follow in this section:

Press **Erase**.
> It blinks.

Enter the appropriate two-digit code on the **SOUND SELECT** keypad.
> **Erase** still blinks.

If any other functions are to be selected, enter the appropriate code now, while **Erase** is blinking.

Press **Erase**.
> It stops blinking. Normal operation is resumed.

The exception to this general procedure is the MIDI clock input, which is enabled using **Record** (see **CLOCK INPUT,** page 22).

### MODES

MIDI includes control modes which make it easy to connect several instruments. Information sent by one keyboard instrument, sequencer or computer may be sent to several receiving instruments with little interfacing hardware, by using MIDI channels to distribute MIDI information to any of sixteen destinations.

Therefore, depending on the application, it may be desired to have instruments interpret MIDI information in subtly different ways. For example, one instrument in a chain of "slave" synthesizers may be set to receive notes played only in channel 7, while another instrument may be set to play notes received from any of the sixteen MIDI channels. The first "slave" operates in "Mode 3," which allows it to select one MIDI channel through which it receives information. The latter instrument operates in "Mode 1," receiving information on all MIDI channels, and assigning the received notes to its available "voices." (Modes 1 and 3 are most commonly used, but there are two remaining modes.)

The following information explains how the modes affect MAX's behavior, and how they are used for special applications.

### Mode 1 (Omni On/Mono Off)
**Erase, SOUND SELECT 20**

In Mode 1, data is sent on the Basic Channel and received from all channels. On power-up, Mode 1 (Omni On/ Mono Off) is selected and the Basic Channel number is set to 3.

### Mode 2 (Omni On/Mono On)

Mode 2 can not be selected with a coded function. Mode 2 assigns all MIDI information to one voice of an instrument, for monophonic performance. If a Mode 2 command is received through MIDI, Mode 1 is selected.

### Mode 3 (Omni Off/Mono Off)
**Erase, SOUND SELECT 21**

When Mode 3 is selected, messages without the Basic Channel number are ignored. Only messages in the Basic Channel are recognized.

### Mode 4 (Omni Off/Mono On)
**Erase, SOUND SELECT 22**

When Mode 4 is selected, MAX assigns each of its six voices to channels N to N+5, where N is the current Basic Channel number. This normally means channels 3 - 8 (N=3). Note that the Basic Channel must not be set above 11, to allow room for six voices. If the Basic Channel is set above 11 when Mode 4 is selected, the Basic Channel is automatically set to 11.

### Change Channel Number
**Erase, SOUND SELECT 01 - 16**

Note that in Mode 4, channel 11 is the maximum usable channel. The Basic Channel number can also be changed remotely by a Select Double Mode command over MIDI.

## DUMPS

### Dump Current Sound
**Erase, SOUND SELECT 28**

This sends the 16 bytes of parameter data for the sound currently displayed. (For details on parameters, see PROGRAMMING MAX, page 23.)

### Dump 100 Sounds
**Erase, SOUND SELECT 29**

### Dump Songs
**Erase, SOUND SELECT 30**

## CONTROL OPTIONS

### Select Double Mode
**Erase, SOUND SELECT 23**

For MAX/MAX or Six-Trak/MAX. In the master instrument, enables wheel changes, voice-to-voice (or voice-to-track) sound (or program) changes and note information (Mode 4). Selects Channel 11 if set to higher. Sends SYS EX 7B Double Mode Command, to cause similar changes in the slave.

### Disable Sound Change
**Erase, SOUND SELECT 24**
This disables sound changes over MIDI. On power-up, sound changes are enabled.

### Enable Sound Change
**Erase, SOUND SELECT 25**
Only necessary if sound changes are intentionally disabled.

### Disable Wheel Changes
**Erase, SOUND SELECT 26**
This disables PITCH and MOD wheel received over MIDI. On power-up, enabled.

### Enable Wheels Changes
**Erase, SOUND SELECT 27**
Only necessary if disabled intentionally.

### Local On
**Erase, SOUND SELECT 31**
Enables the MAX's keyboard and switches. Enabled on power-up.

### Local Off
**Erase, SOUND SELECT 32**
Disconnects the keyboard and switches from the sound-generating circuitry. Keyboard information is sent over MIDI, but only received MIDI Note On/Off data plays the MAX. (In other words, the keyboard and recorder do not work.) This code will be ignored when the recorder is on.

### Disable Parameter Changes
**Erase, SOUND SELECT 33**
This prevents the current sound from being altered by MIDI parameter changes. Parameter changes are disabled on power-up on MAX.

### Enable Parameter Changes
**Erase, SOUND SELECT 34**
This enables MIDI parameter changes. (For applications of this function, see CREATING NEW SOUNDS FOR MAX, page 33).

### Disable External Keyboard Velocity
**Erase, SOUND SELECT 35**

### Enable External Keyboard Velocity
**Erase, SOUND SELECT 36**
This allows MIDI-equipped velocity-sensitive keyboards to control MAX's voice volumes. Disabled on power-up.

Select Basic Sound #1
**Erase, SOUND SELECT 37**
Selects a basic sound consisting of an un-filtered sawtooth waveform with a simple
"on/off" envelope. Used for functional testing of MAX's synthsizer voices.


Select Basic Sound #2
**Erase, SOUND SELECT 38**
Selects same sound as #1, but has a pulse waveform instead of a sawtooth.


Note: Codes 39 - 99 are either inactive or for service use only. Some of the functions
enabled with these codes can only be disabled by turning **Power** off, (which erases both
songs and any sounds in locations 80-99).


## CLOCK INPUT

To enable MIDI clock input:

> Hold **Record**.
>> It blinks.

> Press upper **Speed** switch.
>> The display reads "00".

> Release **Record**.

> Press **Record**.
>> It stops blinking.

When MIDI clock input is enabled, MAX's recorder does not record or playback songs
until a MIDI clock byte is received. On power-up, disabled.

To disable MIDI clock input:

> Hold **Record**.
>> It blinks.

> Press lower **Speed** switch.
>> The display shows the last **Speed** value set before the MIDI clock input
>> was enabled.

> Release **Record**.

> Press **Record**.
>> It stops blinking.

# 3    PROGRAMMING MAX

Basic operation with the factory sounds has already been covered in MIDI APPLICATIONS. You can use the MAX soley with the factory sounds. However, as good as they are, the musician is bound to feel that some are more useful than others in specific musical contexts. This is why you want to be able to create your own custom sounds.

New sounds must be developed on an external MIDI-equipped instrument or computer in order to be stored in MAX's memory. New sounds may be loaded into MAX's memory locations 80-99 using the MIDI functions covered in MIDI APPLICATIONS.

In USING MAX WITH A SIX-TRAK, methods were described for loading sounds into MAX from a Six-Trak. Before new sounds are developed for MAX, it is important to understand MAX's sound producing capabilities and how they differ from a Six-Trak's capabilities. SYNTHESIZER PARAMETERS describes MAX's synthesizer "voices" as a first step toward understanding how to create new sounds. CREATING NEW SOUNDS FOR MAX explains how a Six-Trak may be used in this application, and how similar methods may be applied to MIDI-equipped computers.

The parameter values of MAX's factory sounds are listed towards the end of the manual, and may be used for guidelines when creating new sounds.

It may be desired to control MAX with a computer for applications other than new sound development. Some other applications for a computer are:

Store sounds and songs from MAX.

Use as a multi-timbal sequencer.

Print music played on MAX.

Applications are, of course, determined by the capabilities of the MIDI-equipped computer and the abilities of the programmer. MAX MIDI IMPLEMENTATION contains the details a programmer requires to write software for computer applications with MAX. For details on MIDI in general, see THE COMPLETE SCI MIDI (Document Number: MIDI-3).

## 3.1    SYNTHESIZER PARAMETERS

This section describes MAX's programmable voice parameters.
MAX actually contains six synthesizers, termed "voices." Figure 3.1 diagrams one of these voices at a very general level. The MAX fits into the tradition of voltage-controlled analog synthesizers. To understand these instruments it has proven useful to identify three basic functions: controllers, audio sources, and modifiers (filters and amplifiers). Each voice contains several of each type of function, which are represented on the block diagram, Figure 3.2.

Basically, controllers provide the control voltages (CVs) which determine the pitch of the audio sources, or the filtering or attenuation effects of the modifiers. Controllers can be mechanical devices such as keyboards and wheels. For example, as the CV from the keyboard to the oscillator (audio source) is increased, the oscillator frequency increases. Or controllers can be electronic, such as the LFO or the three envelope
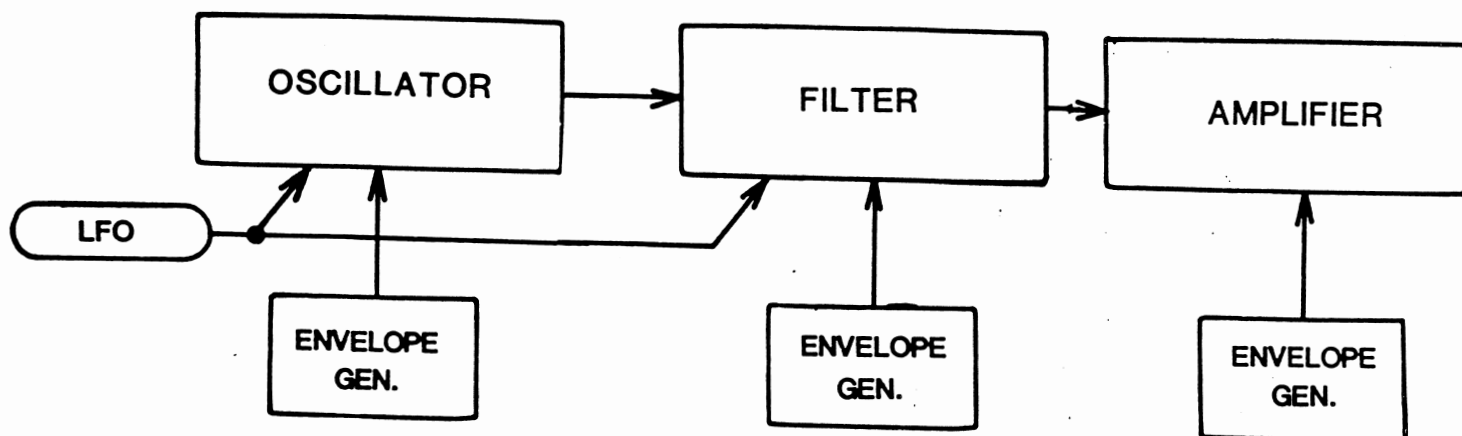
```
                                    ┌──────────────┐
   ┌────────────────┐      ┌───────────┐      │              │
   │                │      │           │      │              │
   │   OSCILLATOR   │─────▶│   FILTER  │─────▶│  AMPLIFIER   │
   │                │      │           │      │              │
   └────────────────┘      └───────────┘      └──────────────┘
```

Figure 3.1
MAX GENERAL VOICE DIAGRAM

generators. For example, as a rapidly-decreasing CV from an envelope generator sweeps down the the filter cutoff frequency, it imparts a "pluck" to the voice.

There are three audio sources: the oscillator, the noise source, and the filter, if it is adjusted for self-resonance.

The mixer, filter (when not in self-resonance), and amplifier are modifiers.

A more detailed examination of the voice parameters follows. Parameter numbers are indicated by a "#," and are used when transmitting individual parameter changes to MAX over MIDI (see MAX MIDI IMPLEMENTATION, page 37).


## OSCILLATOR

The oscillator is an audio-frequency source always under control of COARSE and FINE FREQUENCY, the keyboard, external PITCH wheel (if MAX is slaved to a PITCH wheel-equipped instrument and wheel changes are enabled on both instruments), and MASTER TUNE. Oscillator frequency can be modulated by the LFO and by the envelope generator. PULSE-WIDTH (PW) can also be modulated by the LFO.

If no waveshape parameter is on, the oscillator has no audio output. If two or three waveshapes are on, they are mixed at full level and supplied as the oscillator's output to the MIXER.

### #02 COARSE FREQUENCY
Value Range: 00-48
- 00= lowest octave
- 12= one octave up
- 24= two octaves (middle C)
- 36= three octaves
- 48= four octaves

Adjusts oscillator pitch in semitones, over a four-octave range. To this is added the four-octave keyboard, for a total range of eight octaves. Exact oscillator pitch should be fine-tuned with the MASTER TUNE (see Operation Manual), with #03 FINE at a value of 0.

Note that to keep sounds in tune, this parameter should normally be adjusted to the octaves (00, 12, 24...).

### #03 FINE FREQUENCY
Value Range: 00-31
- 32= one semitone

Normally this parameter is set to 0, while oscillator pitch is adjusted with MASTER TUNE. This parameter adjusts oscillator frequency by up to just less than a semitone, allowing detuning the oscillator for complex effects.

### #04 GLIDE RATE
Value Range: 00-15
- 0= no glide
- 15= maximum glide (four octaves in approximately ten seconds)

When set to 0, the keyboard CV which controls the oscillator pitch, instantly steps between notes. As GLIDE is raised, the CV does not step between the notes, but begins to slide. This introduces "portamento" between notes. Polyphonic use of glide is difficult to predict--but can produce interesting effects.

### #05 LFO FREQUENCY MODULATION
Value Range: 00/01
- 00= Off
- 01= On

This enables LFO modulation of the oscillator frequency, according to the level set by #18 LFO AMOUNT. This produces a vibrato or trill, according to the value of #19 LFO SHAPE.

### #06 OSCILLATOR ENVELOPE AMOUNT
Value Range: 00-15

This parameter controls the depth of oscillator envelope modulation.

Each voice contains three independent ADSR envelope generators: one controls oscillator frequency; one controls filter cutoff frequency; and one controls the

amplifier gain. The following comments on the ADSR envelope generators are valid for all three.

An "envelope" changes value over time at a rate adjusted by the ATTACK, DECAY, and RELEASE parameters. As the envelopes are generated with each keystroke, they "contour" the voice intonation, timbre, and dynamics, animating the otherwise raw waveshapes which come from the mixer.

The contour pattern is initiated when a key is struck. This "triggers" the envelope generator(s) to proceed through their attack and decay periods. These periods can each range from zero to about 11 seconds. The envelope voltage rises to its full value, then falls (decays) to the level set by the sustain parameter, where it remains until the key is released. When the key is released, the gate goes off and the envelope voltage drops to zero at a rate set by the release parameter.

### #07 INVERT
Value Range: 00/01
        00=Normal
        01=Invert

This turns the oscillator envelope upside down. When normal, the envelope will drive the oscillator sharp. If inverted, the oscillator is driven flat.

### #08 ATTACK
Value Range: 00-15
        8= 1 second
        15= 11 seconds

Adjusts the length of time for the envelope to go from zero level (when key is initially pressed) to maximum level.

### #09 DECAY
Value Range: 00-15
        8= 1 second
        15= 11 seconds

Adjusts the length of time for the envelope to go from maximum level to sustain level. If sustain is set at maximum then the decay parameter value is irrelevant, because the level is already maximum.

### #10 SUSTAIN
Value Range: 00-15

Adjusts the sustain level from zero to maximum. This is a level control, not a time control. Sustain <u>time</u> is the period between the end of the decay period and the beginning of the release period. This is the length of time the key is held after the attack and decay stages.

## #11 RELEASE
Value Range: 00-15

Adjusts the length of time for the envelope to go from sustain level to zero. If the key is released before the attack or decay periods have elapsed, release controls the time taken for the envelope to drop to zero from whatever its level when the key was released. If the attack and decay periods have elapsed and sustain is set to 0, then the release value is irrelevant, because the level is already minimum.

## #12 SAWTOOTH WAVE
Value Range: 00/01
       00= Off
       01= On

Enables full-level waveshape containing all harmonics. This basic shape is often described as "brassy."

## #13 TRIANGLE WAVE
Value Range: 00/01
       00= Off
       01= On

Enables full-level triangle wave, containing little harmonic energy, thus having a dull tone.

## #14 PULSE WAVE
Value Range: 00/01
       00= Off
       01= On

Enables full-level waveshape whose harmonic content, thus timbre, depends on the value of #15 PULSE WIDTH and #16 LFO modulation. If switching this on produces no sound, try adjusting #15 PULSE WIDTH to a value between 2 and 60.

Note: If all three waveshapes are on and the filter is well open, some distortion may occur when several keys are played simultaneously. If this occurs, compensate by simply reducing #36 VOICE VOLUME.

## #15 PULSE WIDTH
Value Range: 00-63
       01= 1%
       15= 25%
       31= square wave
       47= 75%
       63= 99%

Adjusts the harmonic content of the pulse wave by varying its duty cycle from approximately 1 to 99%. At the extreme parameter values (00-02 and 60-63) the pulses may be barely audible. A 50% duty-cycle pulse (having only odd harmonics), also called a square wave, can be selected (approximately value 31).

This parameter is only effective if #14 PULSE WAVE is on. This parameter has no effect on the sawtooth or triangle waves.

## #16 PULSE-WIDTH LFO-MODULATION
Value Range: 00/01
        00= Off
        01= On

Applies LFO-modulation to oscillator pulse width.

## LFO

"Modulation" refers to a periodic or consistent (as opposed to accidental) aural change which is interesting or musically useful. Modulation is created by electronic controllers when it is not possible to adjust a mechanical controller with the required speed or precision. Modulation systems thus free the hands for playing the keyboard.

Modulation involves a signal-generating source and a modulated destination. MAX contains two modulation systems in each voice: LFO-MOD and FREQUENCY-MOD. FREQ-MOD has one source, the oscillator, and one destination, the filter. For more information see #31 OSC TRIANGLE MODULATION AMOUNT.

LFO-MOD has a low-frequency oscillator (LFO) as a source, but has three selectable destinations. The LFO is controlled by the FREQUENCY, PROGRAMMED AMOUNT, AND TRIANGLE/SQUARE WAVE parameters. To this modulation level is added any contribution of the external MOD wheel, if MAX is driven by a MOD wheel-equipped instrument and wheel changes are enabled over MIDI on both instruments. Total modulation is applied by LFO switches to the OSCILLATOR FREQUENCY, PULSE WIDTH and FILTER destinations.

## #17 FREQUENCY
Value Range: 00-15

Adjusts LFO frequency from about ¼ to 20 Hz.

## #18 PROGRAMMED AMOUNT
Value Range: 00-31

Programs modulation depth independently from the MOD wheel.

## #19 TRIANGLE/SQUARE WAVE
Value Range: 00/01
        00=Triangle
        01=Square

Selects a triangle wave for vibrato, or a square wave for trills.

# FILTER

The FILTER section contains parameters of the filter itself and of its ADSR envelope generator. The envelope generator is identical to the oscillator envelope generator, discussed above (see page 26).

## #20 OSC/NOISE MIXER
Value Range: 00-31
        00= maximum oscillator level
        15= even mixture
        31= maximum noise level

Adjusts the ratio of the oscillator and noise source input to the filter.

## #21 CUTOFF FREQUENCY
Value Range: 00-127
        (The "hundreds" digit is not displayed. For example, value 127 is displayed as 27.)

Adjusts cutoff frequency of the 24 dB/octave (4-pole) low-pass filter. This parameter is rather like a tone control. "Cutoff" is the frequency below which all elements of the mixer's output signal are let through. The higher-frequency components of the input signal (that is, all those above the cutoff frequency) are suppressed. The higher the parameter value, the higher the frequencies are which pass through the filter. Thus, the "brighter" the sound.

In addition to this parameter, overall cutoff frequency is the result of all the filter modulation parameters.

## #22 RESONANCE
Value Range: 00-63
        43= approximate oscillation point (may vary by voice)

Adjusts the amount of filter resonance. As the value is increased from 0, the amount of resonance ("emphasis," "regeneration," or "Q") applied to those signal components at the cutoff frequency increases. As resonance increases, frequencies lower than the cutoff becomes decreasingly audible in comparison with those nearer the cutoff. As the parameter value is further increased, the filter breaks into oscillation, acting like a sine-wave audio source whose pitch is determined by #21 CUTOFF FREQUENCY and the various filter modulation sources.

## #23 ENVELOPE AMOUNT
Value Range: 00-15
        00= no envelope modulation

The filter cutoff may be varied over time by the filter envelope generator. This parameter adjusts the depth of filter envelope modulation (similar to #06 OSCILLATOR ENVELOPE AMOUNT).

## #24 INVERT
Value Range: 00/01
   00=Normal
   01=Invert

When normal, the envelope drives the filter cutoff positively. If inverted, the filter cutoff contour is reversed.


## #25 ATTACK
Value Range: 00-15

Same as ATTACK in OSCILLATOR section.


## #26 DECAY
Value Range: 00-15

Same as DECAY in OSCILLATOR section.


## #27 SUSTAIN
Value Range: 00-15

Same as SUSTAIN in OSCILLATOR section.


## #28 RELEASE
Value Range: 00-15

Same as RELEASE in OSCILLATOR section.

If filter release produces no effect, check that AMPLIFIER RELEASE is set to approximately the same value.


## #29 LFO
Value Range: 00/01
   00= Off
   01= On

This parameter switches LFO-modulation to the filter, which typically produces a vibrato effect.


## #30 KEYBOARD
Value Range: 00-02
   00= Off
   01= Half
   02= Full

When full, the KEYBOARD control voltage (CV) is applied to the filter's cutoff frequency just as it is normally applied to the oscillator. With the filter thus "tracking" the keyboard, cutoff frequency is maintained at a constant point relative to the notes being played. This results in a consistency of timbre over the whole keyboard range.

When KEYBOARD is off, notes played higher on the keyboard have a duller timbre. Obviously, the 1/2 value selects the midrange between these two effects.

If FILTER RESONANCE is set for self-oscillation, setting KEYBOARD on Full allows the filter to be played from the keyboard. However, since the filters in resonance are not precisely tuned, there is considerable error from the normal keyboard scale. (Unless a complex effect is desired, #23 ENVELOPE AMOUNT will in this case normally be set to 0, to maintain a steady frequency from voice to voice).

If the KEYBOARD parameter is toggled while holding keys down, the effect will not be heard until the key is restruck.

### #31 OSC TRIANGLE MOD AMOUNT
Value Range: 00-63

This parameter controls FREQ-MOD. Increasing this parameter applies the oscillator triangle waveform as a control voltage to the filter cutoff frequency. This high-frequency modulation is used to create "ring" modulation and bell effects.

This parameter operates regardless of whether #13 OSCILLATOR TRIANGLE is switched on.

### AMPLIFIER

The sole amplifier controls are the envelope generator attack, decay, sustain, and release parameters, which shape the envelope applied to the VCA. These parameters control the note dynamics.

### #32 ATTACK
Value Range: 00-15

Same as ATTACK in OSCILLATOR section.

### #33 DECAY
Value Range: 00-15

Same as DECAY in OSCILLATOR section.

### #34 SUSTAIN
Value Range: 00-15

Same as SUSTAIN in OSCILLATOR section. Unless this parameter is turned up slightly, nothing will be heard after the attack and decay periods have elapsed.

### #35 RELEASE
Value Range: 00-15

Same as RELEASE in OSCILLATOR section.

**#36 VOICE VOLUME**
Value Range: 00-15
      15= maximum signal-to-noise ratio

Programmable voice volume is a convenient way to balance the loudness of sounds so you aren't always fiddling with MASTER VOLUME. Use it after the sound is basically recorded.

In MAX, a sound's VOICE VOLUME parameter value becomes the track's initial Track Volume value when using MAX's recorder.


## 3.2    CREATING NEW SOUNDS FOR MAX

Methods for loading MAX's memory from a Six-Trak are described in MIDI APPLICATIONS. MAX's synthesizer voices have been described in the previous section. The following section presents some advanced MIDI applications for MAX.


### USING A SIX-TRAK

MAX's synthesizer voices are the same as the Six-Trak's, allowing programs developed on the Six-Trak to be dumped to MAX. Methods for programming the Six-Trak are explained in the Six-Trak operation manual (CM610). Methods for dumping programs from the Six-Trak to MAX are covered in USING MAX WITH A SIX-TRAK (see page 13).

If you wish to alter one of MAX's factory sounds, it must first be loaded into the Six-Trak where the sound's parameters may be adjusted. The altered sound can then be dumped back into one of MAX's sound locations 80 - 99. It is important to note that although MAX can receive program dumps from a Six-Trak, a Six-Trak does not accept sound (or song) dumps from a MAX. (This means that MAX's factory sounds must be loaded into the Six-Trak manually.)

The one difference between MAX's and the Six-Trak's synthesizer is that the Six-Trak has a UNISON feature which allows all six of the Six-Trak's voices to play one note, producing a very "fat" monophonic sound. If a Six-Trak program using UNISON is dumped to MAX, UNISON is ignored, and the sound can be played polyphonically. (Table 1, on page 41 shows how data is stored in MAX's memory. Note that bit Z5 (used for UNISON in the Six-Trak - see CM610) is not listed in the switch bit list on page 41.)


### USING A COMPUTER

Now that more MIDIs (such as the SCI Model 64) are available for low-cost computers, you may be interested in writing programs which control MAX, perhaps to play longer songs (sequences) or simply for creating new sounds and loading them into MAX's memory.

MAX MIDI IMPLEMENTATION lists all of MAX's "transmitted" and "receive" data. One received byte of interest is Parameter Change (page 37). This command from an external device allows one of the current sound's parameters to be changed via MIDI, so MAX's sounds can be modified as you play it.

When the current sound is selected, it is placed in MAX's Scratchpad memory, no matter whether it is normally stored permanently stored in ROM as one of the factory sounds or in RAM after a computer load. When a sound is in Scratchpad, the Parameter Change command becomes very useful.

For example, to change the current sound without losing the original, select one of MAX's factory sounds, then transmit the Parameter Change MIDI code from the computer, specifying the parameter number and corresponding value. For example, if the filter cutoff of sound #24 is altered using the Parameter Change command, the new sound differs from the original, but if #24 is selected again, the edited version is lost.

Note: To use the MIDI Parameter Change command, parameter changes must be enabled either on MAX (see MIDI FUNCTIONS, page 19), or by sending the Enable All MIDI command (see MAX MIDI IMPLEMENTATION, page 40) to MAX.

If, after altering one of MAX's sounds, it is desired to store the new sound in one of MAX's sound locations 80 - 99, the computer in use must format the sound's parameters as shown in Table 1 (see page 41), then dump them into MAX using the MAX Sound Dump Receive MIDI command (see MAX MIDI IMPLEMENTATION, page 39).

For computer-controlled edits, it is recommended that you keep a computer file of the factory sounds, even though they are permanently recorded in MAX's ROM. Having the factory sounds in the computer's memory allows you to alter factory sounds on MAX, using the Parameter Change command, and later dump the altered version of the factory sound from the computer to MAX's "top" 20 locations, after applying the parameter changes to the computer's record of the original sound. Note that a MIDI-equipped computer can be programmed to accept sound and song dumps from MAX, so no manual loading is necessary.

Table 1 (page 41) shows the compacted form in which sound data is transmitted and stored in memory. This format is used only when a complete sound is sent over MIDI. When using the parameter change command, the format shown in Table 2 (MAX Parameter Table, page 42) is used. Note that in Table 2, byte #0 is not used, and that byte #1 is the MOD WHEEL.

Parameter changes are sent to MAX through MIDI as "continuous controllers." After enabling parameter changes on MAX, be sure to disable them before using MAX with another MIDI-eqipped keyboard, since some instruments use MIDI "continuous controller" commands to alter other controls.

For more information on use of continuous controllers, see the MIDI 1.0 specification (available in THE COMPLETE SCI MIDI (Document Number: MIDI-3).

## THE BASIC SOUND

When creating progams it is often convenient to begin with a basic sound instead of just editing an existing sound. Starting over from a basic patch can also free you from your existing sounds to find new ones.

Rather than having to manually check and edit all of a sound's parameters, a function is available which clears all parameters to 0, except for the minimum needed to produce a basic sound.

To select the basic sound, use **Erase / SOUND SELECT 37.** This sets all parameters to 0, except:

| | |
|---|---|
| #12 SAWTOOTH | 1 (on) |
| #21 CUTOFF | 127 |
| #30 FILTER KEYBOARD | 2 (full) |
| #34 AMP SUSTAIN | 15 |
| #36 VOICE VOLUME | 15 |

The keyboard now plays with this basic sound.

If rather than 37, 38 is entered on the **SOUND SELECT** keypad, #14 OSC PULSE WAVE is set to 1 (on) (instead of #12 OSC SAWTOOTH WAVE), and #15 PULSE WIDTH is set to 31. All other parameters are the same.

An alternative to selecting the basic sound on MAX is to have the basic sound stored in the computer and dumped to MAX in locations 80 - 99. The basic sound can then be edited like any other sound in MAX's memory.


## 3.3     MAX MIDI IMPLEMENTATION


Unless otherwise specified, status/data bytes are given in "hex" and binary, while numbers in descriptions are in decimal.

**TRANSMITTED DATA**

| Status | Second | Third/Other |
|---|---|---|

ROUTINE

**Note On.**

| | | |
|---|---|---|
| 9NH | K | 40H |
| 1001 nnnn | 0kkk kkkk | 0100 0000 |
| | K = 36(C0) - 84(C4) | |


**Note Off.**

| | | |
|---|---|---|
| 9NH | K | 00H |
| 1001 nnnn | 0kkk kkkk | 0000 0000 |

Same as **Note On,** but velocity = 0.


**Timing Clock.**
F8H
1111 1000
Sent whenever a timing clock status byte (F8H) is received.


**Stop Song**
FCH
1111 1100
Sent whenever a Stop Song status byte (FCH) is received.

## TRANSMITTED DATA

Status   Second   Third/Other

<u>Status</u>   <u>Second</u>   <u>Third/Other</u>

## CONTROL

**Sound Change.**
```
CNH        P
1100 nnnn  0ppp pppp
           P = 00 - 99
```
From front panel. Only sent if enabled (see page 21).

## SYSTEM EXCLUSIVE

**Sound Data.**
```
F0H        01H        08H        P         D     F7H
1111 0000  0000 0001  0000 1000  0ppp pppp data 1111 0111
(SYS EX    SCI ID     MAX ID     Sound #         EOX)
                                 (00-99)
```
If P=127, **Song 1** and **Song 2** are transmitted.
Sent by request only. Data is 16 bytes of sound data, sent as 32 four-bit nibbles, right justified, LS nibble sent first. For bit packing positions, see Table 1 on page 41.

**Double Mode** (for use with a Six-Trak or another MAX).
```
F0H        01H        7BH        0NH       F7H
1111 0000  0000 0001  0111 1011  0000 nnnn 1111 0111
(SYS EX    SCI ID     SEL CH     channel#  EOX)
```
Sets Basic Channel to new channel N (nnnn). Also enables wheels, sound change, and parameter change send/receives and selects Mode 4 (Onmi Off/Mono On).

**Pattern Marker.**
```
F0H        01H        7FH        F7H
1111 0000  0000 0001  0111 1111  1111 0111
```
Sent whenever a pattern marker is received.

## RECOGNIZED RECEIVE DATA

## ROUTINE

**Note Off.**
```
8NH        K          V
1000 nnnn  0kkk kkkk  0vvv vvvv
                      V is ignored
```
The status bytes need not be sent every event.

**Note On.**
```
9NH        K          V
1001 nnnn  0kkk kkkk  0vvv vxxx
```
If K is outside of the range 36-96, it will be transposed to the nearest octave inside this range.
     V ignored, unless enabled (see page 21). The 3 LSBs are ignored.
     V=0, Note Off

## RECOGNIZED RECEIVE DATA

| Status | Second | Third/Other |
|--------|--------|-------------|

**Sound Change** (if enabled).
CNH        P
1100 nnnn    0ppp pppp
              P = 0 - 99, sound number
              P = 0 - 79, if no computer load
If enabled and with Omni Mode On, changes all six voices to sound #P (ignore channel number).

**PITCH Wheel Change** (if enabled).
ENH          Vls        Vms
1110 nnnn    0vvv vvvv    0vvv vvvv
              V = LS byte
                          V = MS byte
                          For reference, a change of 10H in the MSB produces a one-semitone pitch change in the MAX.
Goes to all 6 voices. Successive PITCH wheel changes can be received without repeating the status byte.

**Timing Clock.**
F8H
1111 1000
Can be received at any time, including between any other messsage. Used to sync internal recorder to Model 400 Drumtraks.

Note: During record the MAX senses Timing Clocks from the 400 automatically, between the time RECORD is selected and when the first note is played.

**Stop Song**
FCH
1111 1100
If **Song 1** or **2** is active receiving this code will stop the song.

## CONTROL

**Parameter Change** (if enabled).
BNH          C          V
1011 nnnn    0ccc cccc    0vvv vvvv
              C = Parameter #
                          V = Parameter Value
For valid parameter numbers and values, see Table 2.

**External Modulation Amount** (if enabled).
BNH          01H        M
1011 nnnn    0000 0001    000m mmmm
Successive Mod Wheel changes can be received without repeating the Status byte. Goes to all six voices. This amount added to programmed initial modulation amount.

## RECOGNIZED RECEIVE DATA

| Status | Second | Third/Other |
|--------|--------|-------------|

**Select Local Control Off.**

| BNH | 7AH | 00H |
|-----|-----|-----|
| 1011 nnnn | 0111 1010 | 0000 0000 |

When Local Control is Off, the keyboard, wheel, and sound change information is only sent over MIDI and the six voices are only controlled by MIDI. This enables elaborate keyboard modes via external controllers. This should not be sent to the MAX when its recorder is on. It will be ignored.

**Select Local Control On.**

| BNH | 7AH | 7FH |
|-----|-----|-----|
| 1011 nnnn | 0111 1010 | 0111 1111 |

When Local Control is On (normal), the MAX's keyboard, and sound changes play and assign the six voices.

**All Notes Off.**

| BNH | 7BH | 00H |
|-----|-----|-----|
| 1011 nnnn | 0111 1011 | 0000 0000 |

**Omni Mode Off, All Notes Off.**

| BNH | 7CH | 00H |
|-----|-----|-----|
| 1011 nnnn | 0111 1100 | 0000 0000 |

**Omni Mode On, All Notes Off.**

| BNH | 7DH | 00H |
|-----|-----|-----|
| 1011 nnnn | 0111 1101 | 0000 0000 |

**Mono Mode On/Poly Mode Off, All Notes Off.**

| BNH | 7EH | 00H |
|-----|-----|-----|
| 1011 nnnn | 0111 1110 | 0000 0000 |

If MAX is in Mode 1 (Omni On/Mono Off) when this command is received, MAX remains in Mode 1 instead of changing to Mode 2.

**Poly Mode On/Mono Mode Off, All Notes Off.**

| BNH | 7FH | 00H |
|-----|-----|-----|
| 1011 nnnn | 0111 1111 | 0000 0000 |

## RECOGNIZED RECEIVE DATA

| Status | Second | Third/Other |
|--------|--------|-------------|

## SYSTEM EXCLUSIVE

**Sound Dump Request.**

| FOH | 01H | 00H | P | | F7H |
|-----|-----|-----|---|---|-----|
| 1111 0000 | 0000 0001 | 0000 0000 | 0ppp pppp | data | 1111 0111 |
| (SYS EX | SCI ID | REQUEST | Sound # | | EOX) |

        If ID wrong, message ignored.

                P = 0 - 99

                If P=127, Song 1 and Song 2.


**MAX Sound Dump Receive**

| FOH | 01H | 08H | P | | F7H |
|-----|-----|-----|---|---|-----|
| 1111 0000 | 0000 0001 | 0000 1000 | 0ppp pppp | data | 1111 0111 |
| (SYS EX | SCI ID | MAX ID | Sound # | | EOX) |
| | | | 80-99 | | |

        If either ID wrong, message ignored.

                If P=127, Song 1 and Song 2.

Data is 16 bytes of sound data, sent as 32 four-bit nibbles, right justified, LS nibble sent first. Sent by request only. For bit packing positions, see Table 1 (page 41).


**Six-Trak Sound Dump Receive**

| FOH | 01H | 05H | P | | F7H |
|-----|-----|-----|---|---|-----|
| 1111 0000 | 0000 0001 | 0000 0101 | 0ppp pppp | data | 1111 0111 |
| (SYS EX | SCI ID | Six-Trak | Sound # | | EOX) |
| | | ID | 80-99 | | |

                If P is greater than 99 (eg: when songs dumped from Six-Trak), data is ignored.

Same as MAX Sound Dump Receive. MAX accepts program dumps from a Six-Trak.


**Select Double Mode**

| FOH | 01H | 7BH | 0NH | F7H |
|-----|-----|-----|-----|-----|
| 1111 0000 | 0000 0001 | 0111 1011 | 0000 nnnn | 1111 0111 |
| (SYS EX | SCI ID | SEL CH | channel# | EOX) |

Set Basic Channel to new channel N (nnnn). Also enables wheels, sound change, and parameter change send/receives and selects Mode 4 (Onmi Off/Mono On).


<u>Wheel Enable</u>

| FOH | 01H | 7CH | 0NH | F7H |
|-----|-----|-----|-----|-----|
| 1111 0000 | 0000 0001 | 0111 1100 | 0000 nnnn | 1111 0111 |
| (SYS EX | SCI ID | ENABLE | voice# | EOX) |

If Mode 4, enables wheels on voice N (nnnn).


<u>Wheel Disable</u>

| FOH | 01H | 7DH | 0NH | F7H |
|-----|-----|-----|-----|-----|
| 1111 0000 | 0000 0001 | 0111 1101 | 0000 nnnn | 1111 0111 |
| (SYS EX | SCI ID | DISABLE | voice# | EOX) |

If Mode 4, disables wheels on voice N (nnnn).

## RECOGNIZED RECEIVE DATA

| Status | Second | Third/Other |
|--------|--------|-------------|

### Enable All MIDI Send/Receives

| | | | |
|---|---|---|---|
| F0H | 01H | 7EH | F7H |
| 1111 0000 | 0000 0001 | 0111 1110 | 1111 0111 |
| (SYS EX | SCI ID | ENABLE | EOX) |

This forces all send/receives to be enabled, including wheels, sound changes, and parameter changes.

### Pattern Marker.

| | | | |
|---|---|---|---|
| F0H | 01H | 7FH | F7H |
| 1111 0000 | 0000 0001 | 0111 1111 | 1111 0111 |
| (SYS EX | SCI ID | PM | EOX) |

Sent by Drumtraks before the first Timing Clock of each pattern, except at the start, when it is not sent. The MAX uses this marker during song recording to auto-correct the start and stop timing of the song.

## Table 1
## MAX SOUND BIT MAP

16 bytes of sound data

| BYTE | MS BIT | | | | | | LS BIT | |
|---|---|---|---|---|---|---|---|---|
| 0 | B1 | B0 | A5 | A4 | A3 | A2 | A1 | A0 |
| 1 | D0 | C3 | C2 | C1 | C0 | B4 | B3 | B2 |
| 2 | F0 | E3 | E2 | E1 | E0 | D3 | D2 | D1 |
| 3 | H0 | G3 | G2 | G1 | G0 | F3 | F2 | F1 |
| 4 | I4 | I3 | I2 | I1 | I0 | H3 | H2 | H1 |
| 5 | K2 | K1 | K0 | J3 | J2 | J1 | J0 | I5 |
| 6 | M0 | L4 | L3 | L2 | L1 | L0 | K4 | K3 |
| 7 | N1 | N0 | M6 | M5 | M4 | M3 | M2 | M1 |
| 8 | O3 | O2 | O1 | O0 | N5 | N4 | N3 | N2 |
| 9 | Q3 | Q2 | Q1 | Q0 | P3 | P2 | P1 | P0 |
| A | S3 | S2 | S1 | S0 | R3 | R2 | R1 | R0 |
| B | U1 | U0 | T5 | T4 | T3 | T2 | T1 | T0 |
| C | W1 | W0 | V3 | V2 | V1 | V0 | U3 | U2 |
| D | Y1 | Y0 | X3 | X2 | X1 | X0 | W3 | W2 |
| E | - | Z4 | Z3 | Z2 | Z1 | Z0 | Y3 | Y2 |
| F | - | - | ZB | ZA | Z9 | Z8 | Z7 | Z6 |

POT BITS/RESOLUTION
A= OSC FREQ/6
B= FINE/5
C= GLIDE/4
D= OSC ENV AMOUNT/4
E= OSC ENV ATTACK/4
F= OSC ENV DECAY/4
G= OSC ENV SUSTAIN/4
H= OSC ENV RELEASE/4
I= PULSE WIDTH/6
J= LFO FREQ/4
K= LFO AMOUNT/5
L= MIXER/5
M= FILTER CUTOFF/7
N= RESONANCE/6
O= FIL ENV AMT/4
P= FIL ENV ATTACK/4
Q= FIL ENV DECAY/4
R= FIL ENV SUSTAIN/4
S= FIL ENV RELEASE/4
T= OSC TRI AMOUNT/6
U= VOICE VOLUME/4
V= AMP ENV ATTACK/4
W= AMP ENV DECAY/4
X= AMP ENV SUSTAIN/4
Y= AMP ENV RELEASE/4

SWITCH BITS
Z0    OSC SAW
Z1    OSC TRI
Z2    OSC PULSE
Z3    OSC ENV INVERT
Z4    FIL ENV INVERT
Z6    LFO SHAPE (1 = TRI)
Z7    LFO OSC
Z8    LFO PULSE
Z9    LFO FILTER
ZA    FIL HALF (Only one of
ZB    FIL FULL    these can be on.)

**Table 2**
**MAX PARAMETER TABLE**
(MS bytes only received)

| # | Function | # of Bits Resolution | Maximum Value | Format |
|---|----------|---------------------|---------------|--------|
| 1 | MOD WHEEL | 5 | 31 | 000m mmmm |

Mod Wheel data is right-justified in the least-significant five bits of a seven-bit number.

"x" indicates that it does not matter whether the bit is set to 1 or 0.

All remaining data is left-justified to the correct number of digits of a seven-bit number (value 0-127), as shown.

| # | Function | # of Bits Resolution | Maximum Value | Format |
|---|----------|---------------------|---------------|--------|
| 2 | OSC COARSE FREQUENCY | 6 | 48 | 0FFF FFFx |
| 3 | OSC FINE FREQUENCY | 5 | 31 | 0fff ffxx |
| 4 | OSC GLIDE RATE | 4 | 15 | 0ggg gxxx |
| 5 | OSC LFO | 1 (off/on) | 1 | 0Lxx xxxx |
| 6 | OSC ENVELOPE AMOUNT | 4 | 15 | 0aaa axxx |
| 7 | OSC ENV INVERT | 1 | 1 | 0ixx xxxx |
| 8 | OSC ENV ATTACK | 4 | 15 | 0aaa axxx |
| 9 | OSC ENV DECAY | 4 | 15 | 0ddd dxxx |
| 10 | OSC ENV SUSTAIN | 4 | 15 | 0sss sxxx |
| 11 | OSC ENV RELEASE | 4 | 15 | 0rrr rxxx |
| 12 | OSC SAWTOOTH WAVE | 1 | 1 | 0sxx xxxx |
| 13 | OSC TRIANGLE WAVE | 1 | 1 | 0txx xxxx |
| 14 | OSC PULSE WAVE | 1 | 1 | 0pxx xxxx |
| 15 | OSC PULSE WIDTH | 6 | 63 | 0ppp pppx |
| 16 | OSC PULSE LFO-MOD | 1 | 1 | 0Lxx xxxx |
| 17 | LFO FREQUENCY | 4 | 15 | 0FFF Fxxx |
| 18 | LFO PROG AMOUNT | 5 | 31 | 0aaa aaxx |
| 19 | LFO TRI/SQUARE WAVE | 1 | 1 | 0wxx xxxx |
| 20 | OSC/NOISE MIXER | 5 | 31 | 0mmm mmxx |
| 21 | FILT CUTOFF FREQUENCY | 7 | 127 | 0FFF FFFF |
| 22 | FILT RESONANCE | 6 | 63 | 0rrr rrrx |
| 23 | FILT ENVELOPE AMOUNT | 4 | 15 | 0aaa axxx |
| 24 | FILT ENV INVERT | 1 | 1 | 0ixx xxxx |
| 25 | FILT ENV ATTACK | 4 | 15 | 0aaa axxx |
| 26 | FILT ENV DECAY | 4 | 15 | 0ddd dxxx |
| 27 | FILT ENV SUSTAIN | 4 | 15 | 0sss sxxx |
| 28 | FILT ENV RELEASE | 4 | 15 | 0rrr rxxx |
| 29 | FILT LFO-MOD | 1 | 1 | 0Lxx xxxx |
| 30 | FILT KEYBOARD AMOUNT | 2 (off/half/on) | 2 | 0kkx xxxx |
| 31 | FILT-OSC TRI MOD AMT | 6 | 63 | 0rrr rrrx |
| 32 | AMP ATTACK | 4 | 15 | 0aaa axxx |
| 33 | AMP DECAY | 4 | 15 | 0ddd dxxx |
| 34 | AMP SUSTAIN | 4 | 15 | 0sss sxxx |
| 35 | AMP RELEASE | 4 | 15 | 0rrr rxxx |
| 36 | VOICE VOLUME | 4 | 15 | 0vvv vxxx |

# SCI MAX

PROGRAM NUMBER:                          PROGRAM NUMBER:

DESCRIPTION:                             DESCRIPTION:

NOTES:                                   NOTES:


| PARAMETERS | VALUE | | PARAMETERS | VALUE |
|---|---|---|---|---|
| **OSCILLATOR** | | | **OSCILLATOR** | |
| 02 OSC COARSE FREQUENCY | ___ | | 02 OSC COARSE FREQUENCY | ___ |
| 03 OSC FINE FREQUENCY | ___ | | 03 OSC FINE FREQUENCY | ___ |
| 04 OSC GLIDE RATE | ___ | | 04 OSC GLIDE RATE | ___ |
| 05 OSC LFO | ___ | | 05 OSC LFO | ___ |
| 06 OSC ENVELOPE AMOUNT | ___ | | 06 OSC ENVELOPE AMOUNT | ___ |
| 07 OSC ENV INVERT | ___ | | 07 OSC ENV INVERT | ___ |
| 08 OSC ENV ATTACK | ___ | | 08 OSC ENV ATTACK | ___ |
| 09 OSC ENV DECAY | ___ | | 09 OSC ENV DECAY | ___ |
| 10 OSC ENV SUSTAIN | ___ | | 10 OSC ENV SUSTAIN | ___ |
| 11 OSC ENV RELEASE | ___ | | 11 OSC ENV RELEASE | ___ |
| 12 OSC SAWTOOTH WAVE | ___ | | 12 OSC SAWTOOTH WAVE | ___ |
| 13 OSC TRIANGLE WAVE | ___ | | 13 OSC TRIANGLE WAVE | ___ |
| 14 OSC PULSE WAVE | ___ | | 14 OSC PULSE WAVE | ___ |
| 15 OSC PULSE WIDTH | ___ | | 15 OSC PULSE WIDTH | ___ |
| 16 OSC PULSE LFO-MOD | ___ | | 16 OSC PULSE LFO-MOD | ___ |
| **LFO** | | | **LFO** | |
| 17 LFO FREQUENCY | ___ | | 17 LFO FREQUENCY | ___ |
| 18 LFO PROG AMOUNT | ___ | | 18 LFO PROG AMOUNT | ___ |
| 19 LFO TRI/SQUARE WAVE | ___ | | 19 LFO TRI/SQUARE WAVE | ___ |
| **FILTER** | | | **FILTER** | |
| 20 OSC/NOISE MIXER | ___ | | 20 OSC/NOISE MIXER | ___ |
| 21 FILT CUTOFF FREQUENCY | ___ | | 21 FILT CUTOFF FREQUENCY | ___ |
| 22 FILT RESONANCE | ___ | | 22 FILT RESONANCE | ___ |
| 23 FILT ENVELOPE AMOUNT | ___ | | 23 FILT ENVELOPE AMOUNT | ___ |
| 24 FILT ENV INVERT | ___ | | 24 FILT ENV INVERT | ___ |
| 25 FILT ENV ATTACK | ___ | | 25 FILT ENV ATTACK | ___ |
| 26 FILT ENV DECAY | ___ | | 26 FILT ENV DECAY | ___ |
| 27 FILT ENV SUSTAIN | ___ | | 27 FILT ENV SUSTAIN | ___ |
| 28 FILT ENV RELEASE | ___ | | 28 FILT ENV RELEASE | ___ |
| 29 FILT LFO-MOD | ___ | | 29 FILT LFO-MOD | ___ |
| 30 FILT KEYBOARD AMOUNT | ___ | | 30 FILT KEYBOARD AMOUNT | ___ |
| 31 FILT-OSC TRI MOD AMT | ___ | | 31 FILT-OSC TRI MOD AMT | ___ |
| **AMPLIFIER** | | | **AMPLIFIER** | |
| 32 AMP ATTACK | ___ | | 32 AMP ATTACK | ___ |
| 33 AMP DECAY | ___ | | 33 AMP DECAY | ___ |
| 34 AMP SUSTAIN | ___ | | 34 AMP SUSTAIN | ___ |
| 35 AMP RELEASE | ___ | | 35 AMP RELEASE | ___ |
| 36 VOICE VOLUME | ___ | | 36 VOICE VOLUME | ___ |

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