



# THEREMINI

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V1.1 FIRMWARE ADDENDUM

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This document describes the changes and new features in Theremini Firmware series 1.1, as compared to Firmware series 1.0. For aspects of the Theremini which have not changed, see the users manual.

The term “Firmware 1.1” in this document refers to all versions in Firmware series 1.1, which include 1.1.0, 1.1.1, etc.

- | Theremin Mode has been added.
- | A new source for the control voltage output has been added, called NOTE.
- | Control voltage output offset and scaling can be adjusted.
- | MIDI continuous controllers are now “throttled”, and the channels can be selected independently.
- | The pitch antenna response speed can be changed.
- | The Advanced Menu has been moved to the end of the Setup Menu.

*These and other changes are described in detail in the sections that follow.*

## **1. NEW SETTINGS IN FIRMWARE V1.1**

### **1.1. SHORTCUTS**

The Theremini provides a few navigation shortcuts which can make operation much faster.

#### **QUICK MENU NAVIGATION**

When the PRESETS knob is turned while SETUP is held down, the Theremini steps through menus and fields. You can use this feature to step backward or forward through a menu. This is the only way to move backward one step in a menu.

#### **EXIT FROM A MENU**

To exit from a menu, hold SETUP and press EFFECT. If you are in a submenu, this combination will return you to the previous menu. In the Setup menu, SETUP + EFFECT returns you to the tuner screen.

#### **SKIP CALIBRATION STEPS**

Pressing SETUP while in calibration mode skips to the next step. You can use this to perform only one part of the calibration. You can always exit calibration using SETUP + EFFECT.

#### **QUICKLY SET SCALE AND ROOT**

On the tuner screen, holding SCALE and turning PRESETS scrolls through the scale options. Similarly, holding ROOT and turning the PRESETS knob scrolls through the root notes.

### **1.2. TUNER SCREEN**

The tuner in Firmware 1.1 displays the actual pitch being produced by the synthesizer. In Firmware 1.0, the tuner displayed the pitch being generated by the antenna; it did not include transposition.

In Firmware 1.1, the Note Range display also changes with transposition. The note range settings still determine the notes produced by the pitch antenna, but they are shown in terms of the notes being produced by the synthesizer. For example, the Note Range parameters will be shown one octave lower for a preset with transposition of -12 semitones than for a preset with transposition of 0 semitones. This affects the display only; the same value is set internally.

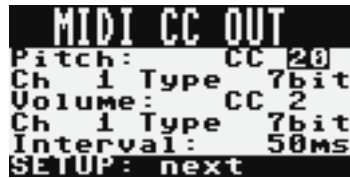
There are two transposition settings which affect the Tuner and Note Range displays: the preset transposition, and the playback transposition set in Theremin Mode.

### 1.3. MIDI CV SETUP MENU

The MIDI CV Setup menu is in the same location in the Setup menu as in Firmware 1.0.

Several new settings have been added in Firmware 1.1.

#### 1.3.1. PAGE 1: CONTINUOUS CONTROLLER SETTINGS



```
MIDI CC OUT
Pitch: CC 20
Ch 1 Type 7bit
Volume: CC 2
Ch 1 Type 7bit
Interval: 50ms
SETUP: next
```

This screen controls the continuous controllers transmitted for the Pitch and Volume antennas.

##### PITCH CC NUMBER

Sets the continuous controller number for the Pitch CC.

##### PITCH CC CH

The “Ch” option sets the MIDI channel for the Pitch CC.

##### PITCH CC TYPE

Chooses between 7-bit, 14-bit, and none (same as Firmware 1.0).

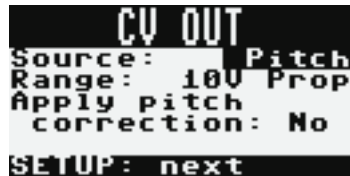
##### VOLUME CC NUMBER, CH, TYPE

Same as the Pitch options, but for the Volume CC.

##### INTERVAL

Sets the throttling interval in milliseconds. See “CC throttling” below.

#### 1.3.2. PAGE 2: CV OUT SETTINGS



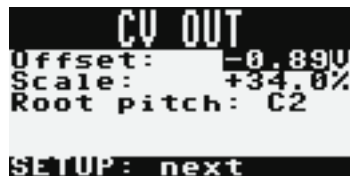
```
CV OUT
Source: Pitch
Range: 10V Prop
Apply pitch
correction: No
SETUP: next
```

The settings on this screen are the same as in Firmware 1.0, except **Source**:

| A new source, Note, is now available. It sends a 1V/oct control voltage for controlling analog synthesizers. See “Control voltage output” (*page 10*) for details.

| The order of the source selections is now Note, Pitch, Volume.

#### 1.3.3. PAGE 3: CV OUT OFFSET AND SCALE



```
CV OUT
Offset: -0.89V
Scale: +34.8%
Root pitch: C2
SETUP: next
```

These settings are new to Firmware 1.1. See “Control voltage output” (*page 10*) for detailed information on these settings.

##### OFFSET

This adds the given voltage to the CV output.

##### SCALE

This multiplies the CV out by a constant.

##### ROOT PITCH

This sets the pitch corresponding to the lowest CV for the Note source. This setting has no effect on the other sources.

## 1.4. ADVANCED MENU

In Firmware 1.1, the Advanced menu is available at the end of the Setup menu. In Firmware 1.0, the Advanced menu could only be reached through a special key sequence. The first page of the Advanced menu is new in Firmware 1.1.

### 1.4.1. PAGE 1: RESPONSE, CALIBRATION TIME, THEREMIN MODE

```
ADVANCED SETUP
Response.... MED
Calibration
wait time.. 3s
Theremin
mode.....OFF
SETUP: next
```

These settings are new to Firmware 1.1.

#### RESPONSE

Sets the response speed for the pitch and volume antennas. See “Response speed” (page 13)

#### CALIBRATION WAIT TIME

The amount of time which will be spent counting down during the calibration steps. This can be adjusted from 1s - 10s. Many users will want to set this to 1s, to make the calibration process faster.

#### THEREMIN MODE

Activates Theremin Mode. See “Theremin Mode” below for details.

### 1.4.2. PAGES 2 AND 3: PRESET LOADING PREFERENCES, DISPLAY CONTRAST

```
ADVANCED SETUP
Load from preset
-Correction
amount.....YES
-Scale/root..YES
-Effect mix..YES
SETUP: next
```

These pages and settings operate the same as their counterparts in Firmware 1.0.

```
ADVANCED SETUP

Contrast.... 72%

SETUP: exit
```

## 2. THEREMIN MODE

Theremini Firmware version 1.1 introduces a new mode of operation called Theremin Mode. In Theremin Mode, the Theremini behaves similarly to a traditional analogue theremin. The original mode is now called Normal Mode, and operates much as the Theremini did in version 1.0.

It is very important to remember that Theremin Mode is not intended to replace calibration. Even an analogue theremin often requires readjustment when moved to a different location. It is this kind of adjustment which is automatically performed during the calibration process on the Theremini. If the response of the Theremini is unsatisfactory even after adjusting the Pitch knob, you should run calibration.

Despite this, in many situations, adjusting the Pitch knob can bring the instrument to a satisfactory response, so that a calibration is not required. This can be very useful for live performance.

## 2.1. USING THEREMIN MODE

To activate Theremin Mode, go to the Advanced Menu, locate the Theremin Mode option, and change its value to 'ON' (*page 5*). The setting is retained after power-off.

Theremin Mode differs from Normal Mode in the following ways:

- | The pitch is not constrained to the interval between Low Note and High Note. It is allowed to vary as much as the pitch antenna signal does.
- | Pressing the Setup button toggles between the Quantizer Screen and the Adjustment Screen. In the adjustment screen, the Pitch and Amount knobs operate similarly to the Pitch and Volume knobs on a traditional theremin, and the Scale and Root buttons adjust note range and transposition. The quantizer screen is the same as the main screen in Normal Mode.

*NOTE: Automute is enabled by default. You may want to turn it off when using Theremin Mode.*

## 2.2. QUANTIZER SCREEN



The quantizer screen looks and behaves the same as it does in Normal Mode, except for the behavior of the Setup button. The Pitch Correction and Amount knobs retain their usual functions, and the Scale and Root adjust the quantizer's scale and root note as usual.

## 2.3. ADJUSTMENT SCREEN



In the Adjustment Screen, the controls resemble those of a traditional theremin:

- | The Pitch Correction knob modifies the pitch antenna response in a similar way to the pitch knob on an analogue theremin. See “Pitch adjustment control” (*page 7*) for details.
- | The Amount knob controls Master Volume.
- | Pressing SCALE sets Note Range. This causes the High Note setting to be offset from the Low Note by the given number of octaves, changing the basic range of the instrument. (If 5 High Note is not an exact number of octaves away from Low Note, the nearest number of octaves is shown.) See “Note Range” (*page 9*) for details about Note Range in Theremin Mode.
- | Pressing ROOT adjusts playback transposition. This allows you to quickly transpose the instrument one octave up or down.

You can also hold SCALE or ROOT and turn the PRESETS knob for a quick adjustment of the Note Range and Transpose settings, just as in the Quantizer screen.

The quantizer and adjustment screens differ only in the functions of the panel controls. The behavior of the pitch and volume antennas is the same in both screens.

## 2.4. PITCH ADJUSTMENT CONTROL

The pitch adjustment control in the Adjustment Screen modifies the pitch antenna response in a similar way to the pitch knob on an analogue theremin.

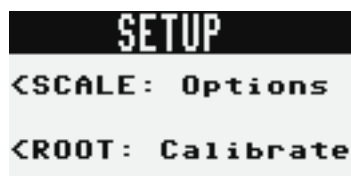
When the knob is set to the center position (twelve o'clock), no adjustment is applied; the pitch antenna response is the same as in Normal Mode. Turning the knob to the left (counter-clockwise) tends to raise the pitch of a given position, and turning it to the right (clockwise) tends to lower the pitch. Moving the knob away from the center also changes the range of the instrument.

If the pitch adjustment does not behave as you expect, try performing a calibration.

Keep in mind that the pitch adjustment is not a replacement for the calibration procedure. The pitch adjustment has a limited range, and does not work in the same way as calibration. It is intended for making small adjustments which bring the playing response to a satisfactory state. It cannot compensate for calibration settings which are completely incorrect.

The adjustment is applied only in Theremin Mode. If you switch back to Normal Mode, the adjustment is not applied.

## 2.5. JUMP SCREEN



In Theremin Mode, holding down the Setup button for a short time reveals the Jump Screen. From this screen, you can quickly “jump” to either the Setup menu or calibration. To do this, keep holding SETUP, and press:

### **SCALE**

to go to the Setup menu

### **ROOT**

to jump to calibration

## 2.6. CONTROL DIFFERENCES

The differences between the controls in Theremin Mode and Normal Mode are summarized in the following table.

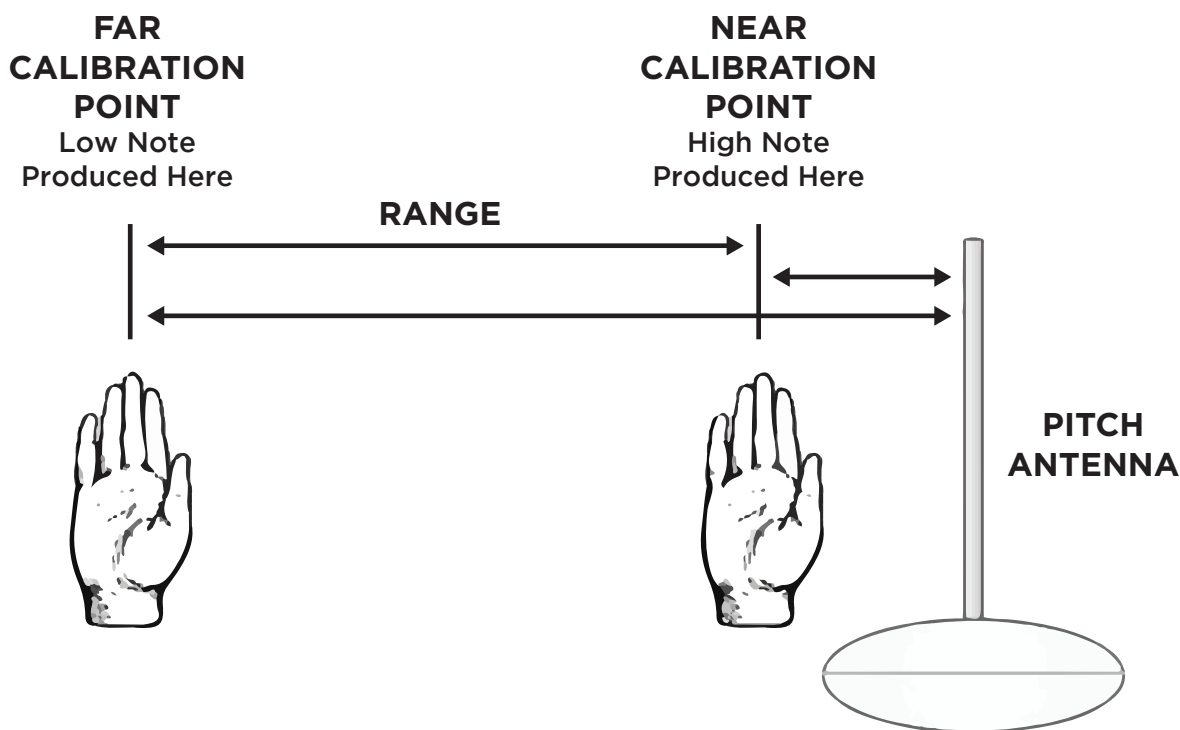
CONTROL	NORMAL MODE	THEREMIN MODE, QUANTIZER SCREEN	THEREMIN MODE, ADJUSTMENT SCREEN
Pitch antenna	Controls pitch, Constrained	Controls pitch, Unconstrained	Controls pitch, Unconstrained
Setup button (press once)	Enter setup menu	Toggles to Adjustment Screen	Toggles to Quantizer Screen
Setup button (hold for 2sec)	Enter calibration mode	Nothing	Nothing
Setup button (hold for 0.2sec)	Nothing	Display help	Display help
Setup button (hold for 5sec)	Nothing	Enter calibration mode	Enter calibration mode
Pitch Correction	Pitch Correction	Pitch Correction	Pitch response
Amount	Effect amount	Effect amount	Master volume
Scale button	Select next scale	Select next scale	Select next range
Setup + Root	Enter calibration mode	Enter calibration mode	Enter calibration mode
Setup + Scale	Enter setup menu	Enter setup menu	Enter setup menu



## 2.7. NOTE RANGE

In Normal Mode, the Low Note and High Note parameters determine the complete range of the instrument. The pitch is not allowed to go lower than Low Note, or higher than High Note.

In Theremin Mode, this limit is removed, but the Low Note and High Note parameters are still significant. To understand how they affect the pitch, consider how the Theremin translates the position of your hand into a pitch value.



When the Theremini is calibrated, two distances from the antenna are recorded: the Far calibration point, and the Near calibration point. These two points establish the way the antenna maps to pitch values: the Theremini pitch antenna is designed to produce the Low Note at the Far calibration point, and the High Note at the Near calibration point.

When you change the values for Low Note or High Note, the calibration points don't change; only the values of Low Note and High Note change. This changes the pitch of the instrument, and also the effective pitch range of the instrument.

Low Note and High Note work the same way in both Theremin Mode and Normal Mode. However, in Normal Mode, the pitch is not allowed to go lower than Low Note, or higher than High Note. Therefore, moving your hand outside of the calibration points results in a pitch which is "clamped" to the High Note or Low Note (assuming the Theremini has been calibrated correctly).

In Theremin Mode, this "clamping" is removed. When you move your hand beyond the Near calibration point, the pitch goes higher than High Note. When you move your hand beyond the Far calibration point, the pitch goes lower than Low Note. The actual pitches which will be played are determined by Low Note and High Note – the range inside the calibrated range is extrapolated beyond the calibration points.

## 2.8. THROUGH-ZERO

In Theremin Mode, as you move your hand away from the antenna, the pitch goes lower and lower, until the instrument becomes almost silent. Then, as you continue to move away from the antenna, the pitch actually begins to increase. This behavior is called through-zero, and it is normal for an analog theremin.

Some players use the through-zero phenomenon to set up the pitch field. They do this by holding their hand at a certain distance, and then adjusting the pitch knob until the instrument becomes silent. The through-zero point is then where the hand is held. This can be a quick way to establish a playing range.

## 3. CONTROL-VOLTAGE OUTPUT

The control-voltage output allows you to connect the Theremini to an effects device or synthesizer, and control a parameter, such as depth or pitch, from one of the antennas.

Theremini Firmware 1.1 adds a new CV source, NOTE, and the ability to adjust the scaling and offset of the CV output.

### 3.1. NOTE CV SOURCE

The NOTE CV source is designed for driving any analog synthesizer which accepts a volt-per-octave control voltage. Using this source, you can accurately control the pitch of a volt-per-octave analog synthesizer from the Theremini.

The NOTE source is not suitable for controlling the pitch of hertz-per-volt synthesizers (which were mainly manufactured during the 1970s). If your synthesizer does not seem to track the NOTE source at all, check whether your synthesizer has a hertz-per-volt response.

### 3.2. SCALE AND OFFSET

The Scale and Offset parameters allow you to calibrate the CV output. Although mainly intended for the NOTE source, the Scale and Offset parameters apply to all three sources. (The Root Note parameter applies only to the NOTE source.)

The Offset parameter adds the given voltage to the CV output. A negative value lowers the output voltage; a positive value raises the output voltage.

The Scale parameter scales (multiplies) the CV output voltage by the given amount. For example, when Scale is set to 101.5%, the output voltage is multiplied by 1.015.

The scale and offset parameters affect the output according to the formula

$$\text{base voltage} \times (\text{scale} / 100) + \text{offset}$$

The lowest voltage which the CV output can generate is approximately zero volts, and the highest is approximately 10 volts. Setting the offset voltage to a negative number will not make the output produce a negative voltage: the output will remain at zero volts.

The Scale parameter can be set to a negative value. For this to be useful, the Offset parameter should be set to a large positive value. This will invert the CV output.

### 3.3. ROOT NOTE SETTING

The Root Note setting determines what pitch will generate the lowest CV output voltage.

Root Note allows you to offset the CV out by semitones. This has several uses, including transposing the external synthesizer, or increasing the available range. The Root Note setting applies only to the NOTE source.

The Root Note setting has an apparent reverse effect on the CV out value: raising it actually lowers the CV out voltage. This behavior is correct: a higher Root Note value means that the control voltage range starts at a higher pitch; this lowers the voltage produced for a given pitch.

### 3.4. TUNING THE NOTE SOURCE

Some simple analog synthesizers do not have accessible tracking adjustments and are not calibrated. If the Theremini's CV out scale and offset parameters are set to their default values, these synthesizers may not track the Theremini correctly. You can bring them into unison with the Theremini by adjusting the scale and offset parameters on the Theremini. This is done using the following procedure:

1. On the Theremini, turn off Automute, and turn the quantizer up all the way. It may also be helpful to use a scale with large jumps, like Fifth, so that the pitch remains as static as possible.
2. Connect the Theremini's CV output to your synthesizer's pitch CV input. Set up the Theremini and your synthesizer so that you can hear them both together. Adjust your synthesizer so that its pitch is roughly in the same range as the Theremini.
3. On the Theremini, navigate to the second CV OUT page, which contains the Offset and Scale parameters.
4. Play a low pitch on the Theremini. Adjust the Offset parameter until the Theremini and the synthesizer are playing the same pitch.
5. Play a high pitch on the Theremini. Adjust the Scale parameter until the Theremini and the synthesizer are playing the same pitch.
6. Return to the low pitch on the Theremini. You may find that, even when playing the same pitch on the Theremini that you did in step 4, the Theremini and the synthesizer are no longer in tune. This is normal. Adjust the Offset parameter again until the instruments are once again in tune.
7. Return to the high pitch. Again, you may find that the two instruments have gone out of tune. Adjust the Scale parameter until they are playing the same pitch.

Repeat steps 6 and 7 until the two instruments track each other correctly over the full range. You should find that each time you repeat steps 6 and 7, the instruments track a little more closely. Eventually, they will play in unison.

### 3.5. ABOUT VOLTAGE RANGE

The voltage range setting applies in a slightly different way to the NOTE source than it does to the PITCH and VOLUME sources.

The PITCH and VOLUME sources are intended to cover the entire selected range. These sources communicate the magnitude of the signal coming from the pitch and volume antennas. For example, when the VOLUME source is selected, and the range is 10V, the CV out will vary from 0 to 10V as the volume antenna is manipulated, or twice as much as it does for the 5V range. In other words, the 10V range doubles the scaling of the CV out for the PITCH and VOLUME sources.

The NOTE source, by contrast, is not designed to cover the full voltage range: it is designed to communicate a pitch value. For the NOTE source, the voltage range setting functions as a limit, so that 5V-only synthesizers will not be damaged by a 10V signal. However, for the NOTE source, the voltage range setting does not affect the scaling of the output voltage. Pitches remain 1/12V apart for the NOTE source, whether the range is 5V or 10V.

## 4. OTHER NEW FEATURES

### 4.1. MIDI CC THROTTLING

The Theremini is capable of transmitting continuous controller messages very rapidly. However, some hosts and devices can become overwhelmed if messages are transmitted too quickly. To address this, Theremini Firmware 1.1 offers throttling, which limits the rate at which CC messages are transmitted.

The CC messages are throttled in two ways:

1. CCs are never transmitted more often than the throttling interval. For example, if “Interval” is set to 100ms, the CC messages from a given source will be separated by at least 100 milliseconds. (The different pitch and volume CCs may of course appear closer together than 100ms.)
2. A CC value is not transmitted twice. If the throttling interval passes, but the value of the source has not changed, the value will not be transmitted again. However, there is an exception to this: if a CC has not been transmitted for one second or longer, it is retransmitted, even if it has not changed.

These features are new to Firmware 1.1.

## 4.2. RESPONSE SPEED

The signals generated from the antennas are filtered before they are sent to the synthesizer. Without this filtering, the Theremini would sound “jittery”, “gurgly”, or “fluttery”, and would be difficult or impossible to play, especially at distances far from the antenna.

The causes of jitter and instability appearing on the antenna signals can be classified as internal sources – noise inherent in the Theremini’s internal circuitry – and external sources, such as radio interference, a poor-quality power supply, or even another theremin.

The internal sources of jitter remain at roughly the same level for each Theremini. However, the external causes vary depending on the Theremini’s location and environment. Some environments are very quiet; for these environments, filtering can be minimal. But very noisy environments may require much stronger filtering.

Unfortunately, stronger filtering causes, in general, a more sluggish playing response. It is therefore not possible to choose one filter strength which works equally well in all situations.

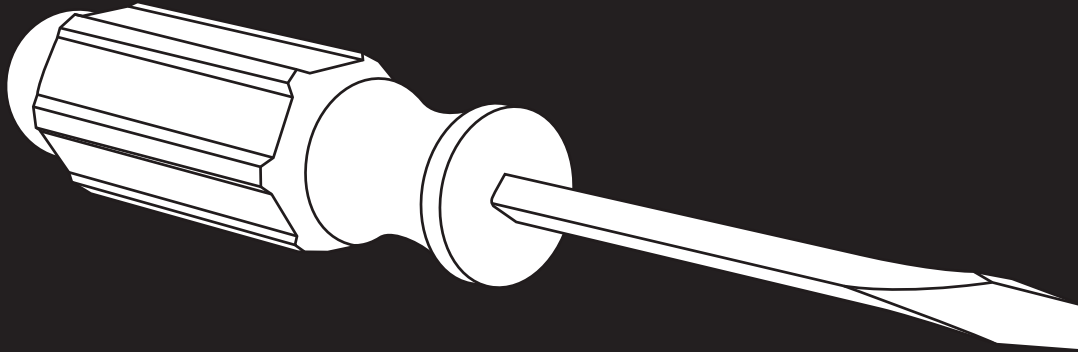
To address this, Theremini Firmware 1.1 introduces the Response setting, located on the first page of the Advanced menu. This has three selections: SLOW, MED, and FAST. SLOW represents the strongest filtering, MED is a medium setting, and FAST is a lighter filtering. The default setting is MED.

If the Theremini is “gurgling” or “jittering”, turning the Response to a slower setting can often eliminate the problem. If the playing response feels too slow, turning the Response to a faster setting may be desirable.

Some players will be more sensitive than others to jitter or gurgle. These players will likely prefer the SLOW or MED settings. For the pitch antenna, these effects greatly increase as the hand is moved farther from the antenna. Some players will require this region to be very stable, but others will not mind a little instability.

It is rare for the higher notes, played closer to the antenna, to be unstable at any setting, unless very strong sources of interference are present, so players who tend to remain in that region may prefer the faster settings.

Players who are using the quantizer, especially at very strong quantization levels, may find they can use the faster settings in any situation, due to the tendency of the quantizer to stabilize pitch.



## **WARRANTY AND SERVICE INFO**

### **LIMITED WARRANTY**

Moog Music warrants that its products will be free from defects in materials and workmanship, and shall conform to specifications current at the time of shipment, for a period of one year from date of purchase. During the one- year period, any defective products will be repaired or replaced, at Moog Music's option, on a return-to-factory basis. This Warranty covers defects that Moog Music determines are no fault of the user.

### **RETURNING YOUR THEREMINI FOR REPLACEMENT/REPAIR**

You must obtain prior approval and an RMA number from Moog Music before returning any product to us. Wrap your Theremini carefully and pack it with the power adapter in its original carton. The warranty will not be honored if the product is not properly packed. Send it to Moog Music with transportation and insurance charges paid. A reasonable cost for service, materials and return freight will be charged to replace materials defective through the fault of the user, or for which the one year warranty period has expired. Transportation and insurance charges from Moog Music to your United States address, of products repaired or replaced under warranty will be paid by Moog Music.

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