

MODEL D

Authentic Analog Synthesizer with 3 VCOs,
Ladder Filter, LFO and Eurorack Format



User Support Bulletin

Introduction

The unit is carefully calibrated at the factory. The performance may change over time or due to environmental changes, and the following recalibration procedures will help bring it back to its factory settings. If you do not feel comfortable doing these calibrations, then we recommend they are done by an experienced audio service technician. This is especially true for those units that need to be opened to gain access to voltage test points and calibration potentiometers.

CAUTION: Incorrect calibration or damage to the delicate adjustment potentiometers may lead to the unit becoming inoperable.

Note: Although re-calibration will not invalidate the warranty, any damage caused during re-calibration may invalidate the warranty.

Equipment required

1. Small insulated trimpot screwdriver
2. Small Phillips screwdriver
3. A flat sheet of cardboard or other insulator as wide as the MODEL D. (This will help prevent damage to the top panel when it is inverted and resting on the bottom chassis)

The following equipment is required for the Oscillator adjustment and Octave Range adjustment:

1. An external MIDI keyboard of at least 3 octaves including A2 and C6
2. MIDI cable
3. Pair of headphones or a sound system to monitor the main output

The following equipment is required for the Pitch CV adjustment:

1. Digital DC Voltmeter with a scale that can display accurately to 0.001 V
2. Laptop or desktop computer previously loaded with and running a MIDI utility that can send SysEx commands to the MODEL D
3. USB type A to USB type B connection cable

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A-440 Reference

The MODEL D A-440 pitch is generated and regulated by the MCU and there is no adjustment required. This set frequency is used as a reference in the following procedure to calibrate OSC1.

Important Note about Reset

If you have previously adjusted the MIDI IN Transpose or MIDI Note Zero Volts, you **MUST** reset the MODEL D to its factory settings before doing the following procedures.

Preparation



Before doing the PITCH CV calibrations, become familiar with, and practice the procedures for sending SysEx commands to the MODEL D. In this way, you will spend less time with the calibrations.

Calibration Procedure

The main printed circuit board (PCB) of the MODEL D has various test points and miniature potentiometers (trimpots) that allow the various calibration and adjustment procedures to be carried out. This involves lifting up the front panel to allow access to the bottom side of the PCB.

Three main calibrations can be carried out:

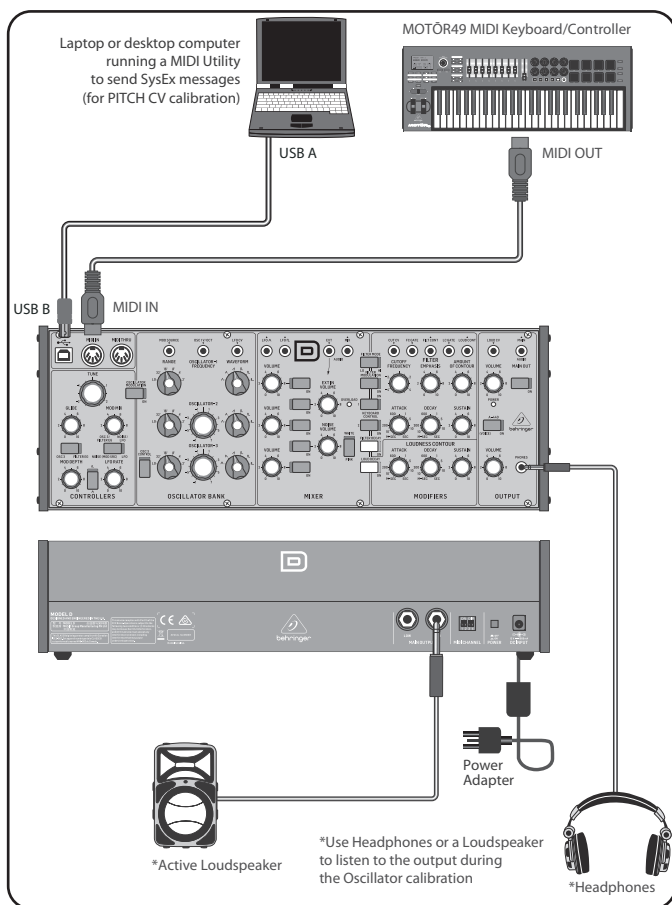
1. The PITCH CV can be calibrated using a computer to send a SysEx command, an external keyboard, and a digital DC voltmeter. See PITCH CV Calibration.
2. The oscillators can be calibrated using a guitar tuner or the internally-generated A-440 concert pitch, and an external keyboard. See Oscillator Calibration.
3. The Octave RANGE can be calibrated using an external keyboard. See Octave Range Calibration.

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Preliminary Procedure

Follow all steps in the order in which they are presented.

The diagram below shows the typical connections for this procedure.



Connections

- STEP 1** Connect the external power supply adapter to the rear power input of the MODEL D.
- STEP 2** Connect the MIDI output of an external keyboard to the MIDI IN connector of the MODEL D.
- STEP 3** Connect a laptop or desktop computer to the MODEL D USB input. (This is only required if you are doing the PITCH CV calibration, or doing a Reset.)

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- STEP 4** Turn down the MODEL D headphone volume knob, and connect your headphones to the MODEL D headphones output connector. Alternatively, you can monitor the MODEL D output using the main outputs and a suitable sound system and speakers.
- STEP 5** Turn on the MODEL D rear panel power switch and check that its Power LED comes on.
- STEP 6** Important: Leave the MODEL D turned on for approximately 30 minutes. This will allow the circuits time to warm up and the components and performance to stabilise with temperature. Without this warm-up time, the calibrations will be inaccurate.
- STEP 7** Set the MODEL D controls as shown below.

MODEL D Control Settings for Calibration

CONTROLLERS		OSCILLATOR BANK		MIXER		MODIFIERS		OUTPUT	
KNOBS		KNOBS		KNOBS		KNOBS		KNOBS	
TUNE	0	OSC1 RANGE	8'	OSC1 VOLUME	10	CUTOFF FREQ	5	MAIN VOLUME	*
GLIDE	0	OSC2 RANGE	8'	OSC2 VOLUME	10	FILTER EMPHASIS	0	PHONES VOLUME	*
MOD MIX	*	OSC3 RANGE	8'	OSC3 VOLUME	10	AMOUNT OF CONTOUR	0		
MOD DEPTH	0	OSC1 WAVEFORM	SAWTOOTH	EXT IN VOLUME	0	FILTER ATTACK	0	SWITCHES	
LFO RATE	0	OSC2 WAVEFORM	SAWTOOTH	NOISE VOLUME	0	FILTER DECAY	0	MAIN OUT	*
		OSC3 WAVEFORM	SAWTOOTH	OSC1 SELECT	ON	FILTER SUSTAIN	0	A-440	ON
SWITCHES		OSC2 TUNE	0	OSC2 SELECT	OFF	LOUDNESS ATTACK	0		
OSC3/FILTER EG	*	OSC3 TUNE	0	OSC3 SELECT	OFF	LOUDNESS DECAY	SEC		
NOISE/LFO	*			EXT IN SELECT	OFF	LOUDNESS SUSTAIN	10		
SQR/TRNG	*	SWITCHES		NOISE SELECT	OFF				
		OSCILLATOR MOD	OFF						
		OSC3 CONTROL	ON	SWITCHES					
				WHITE/PINK	*				
						EXTERNAL KEYBOARD			
						MOD WHEEL	DOWN		
						PITCH WHEEL	CENTERED		

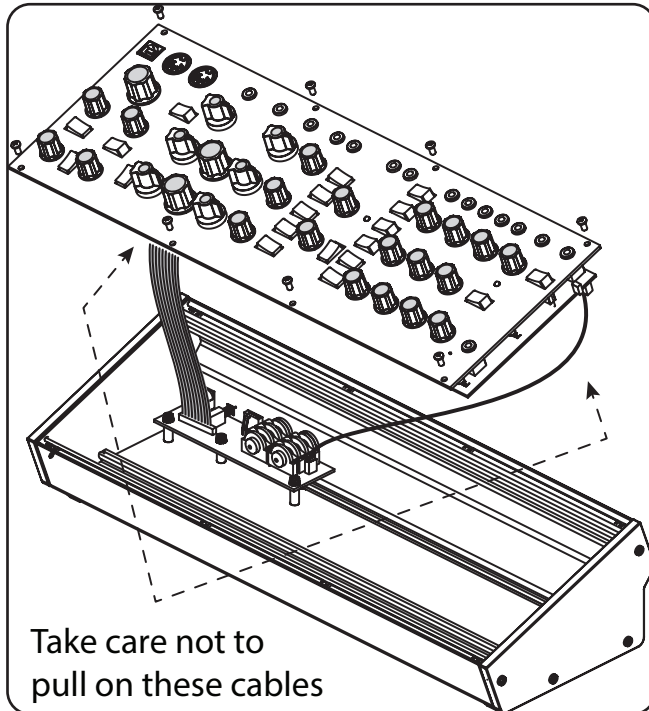
Lifting off the top panel

- STEP 8** Turn off the MODEL D power.
- STEP 9** Try and do the following steps quickly and carefully to keep any cooling down to a minimum.

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**STEP
10**

Carefully undo the 8 screws on the top panel as shown. There is no need to undo any other screws.

**STEP
11**

Carefully lift the top panel assembly and turn it over so the PCB is facing upwards. Be careful not to pull on the two cables from the lower side of the main PCB. As your connections to other equipment are still in place, take care not to pull out any cables or damage them.

**STEP
12**

Place a piece of cardboard or similar insulator between the controls and the main chassis. This will help prevent damage to the controls as you lay the top assembly onto the main chassis. To protect the wooden side panels from being scratched, you can add some protective tape over the top edge of each side panel.

**STEP
13**

Make sure that the top panel is in a secure position and that it is not liable to be dropped or damaged, or become disconnected with its internal cables or the MIDI cables or headphone cable.

**STEP
14**

Double check that the MODEL D controls are still as shown on the previous page, in case they were moved during the top panel removal.

**STEP
15**

Because the main PCB is exposed, make sure you are not touching it, and that it is not touching any metal work that may cause a short-circuit.

**STEP
16**

Turn on the MODEL D rear panel power switch and check that its Power LED comes on.

**STEP
17**

Do not turn off the MODEL D or let it cool down, until all the calibrations are completed.

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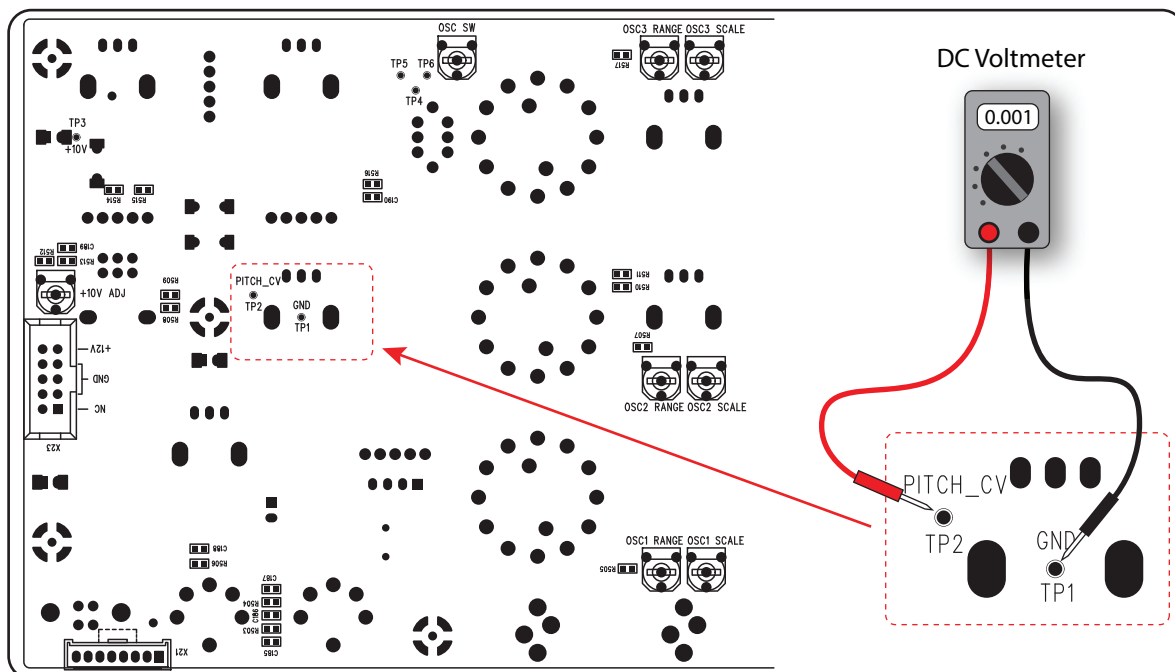
**STEP
18**

If the A-440 switch is in the ON position, you should hear the tone in your headphones or main system if you carefully bring the headphone volume or main volume up.

**STEP
19**

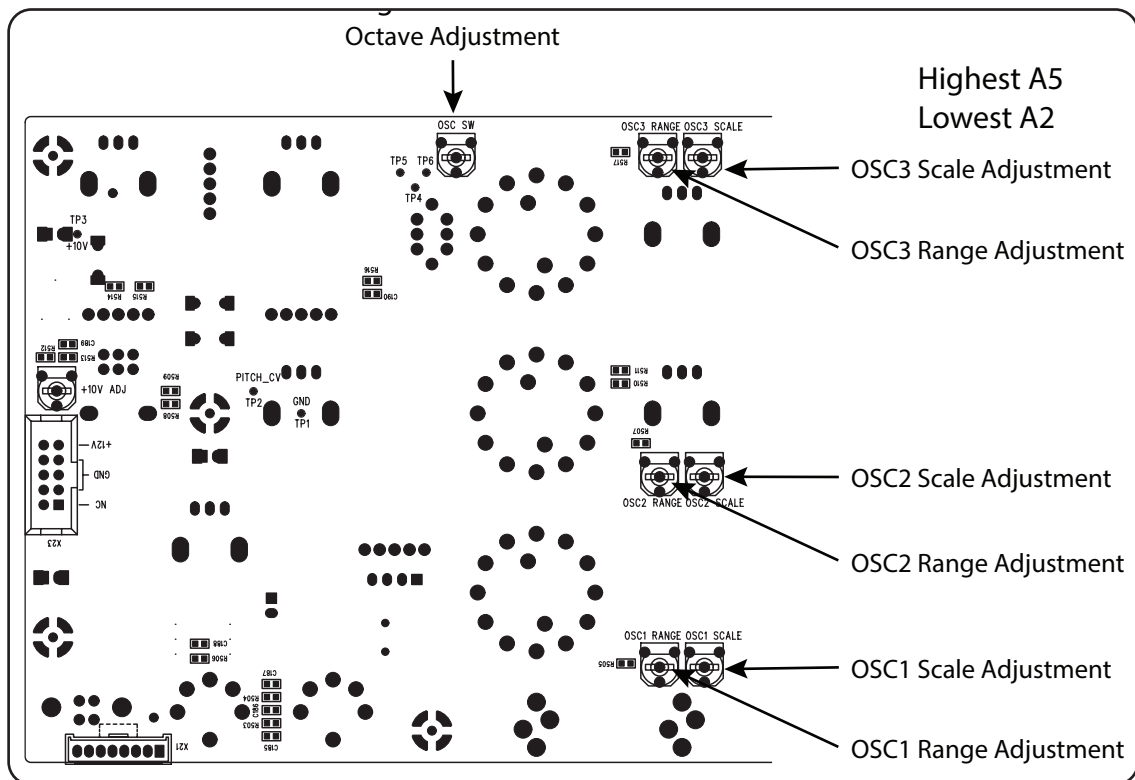
Now that everything is ready, inspect the bottom surface of the PCB as shown on the next page.

The diagram below shows the Test Points TP1 and TP2 used in the PITCH/CV calibration. Take a look at the PCB and locate these two test points.



The diagram below shows the adjustment trimpots that are used in the Oscillator and Octave range calibration procedures. Take a look at your PCB and locate these various trimpots. (The later version of the PCB uses different multi-turn trimpots.)

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PITCH CV Calibration

The PITCH CV calibration procedure uses a computer MIDI utility to send a SysEx command to the MODEL D to put it into calibration mode.

Once in calibration mode, a digital DC Voltmeter is used to measure the voltage at a test point while test notes are played using the external keyboard.

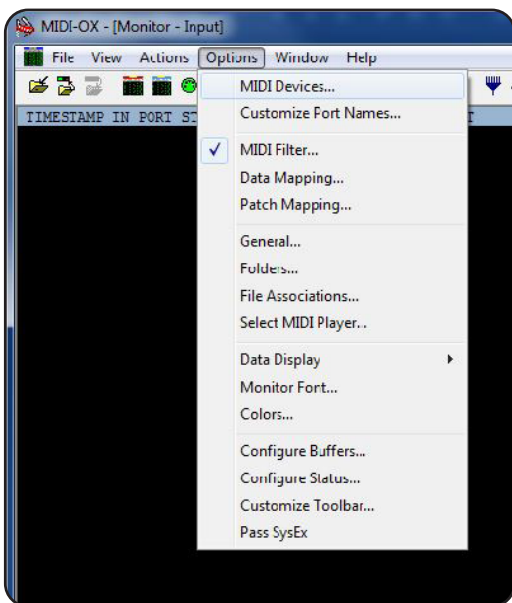
The meter should have a resolution of 3 or more decimal places, for example 0.001 V.

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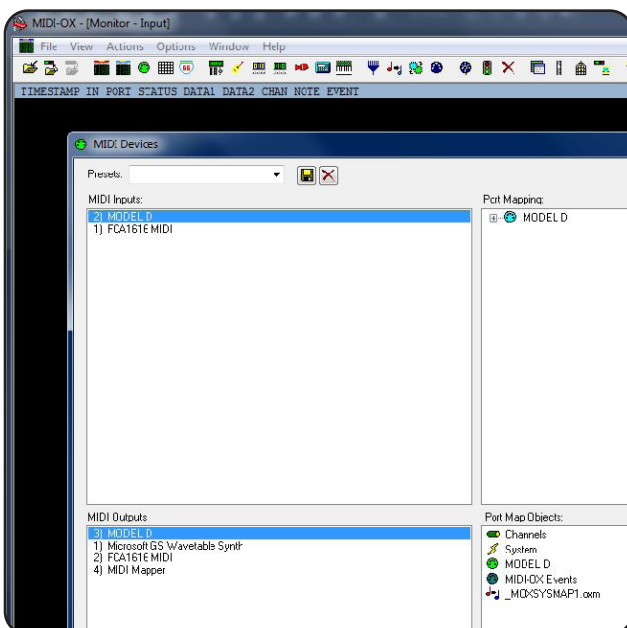
Putting the MODEL D into Pitch CV Calibration Mode

The following example shows the use of the popular MIDI Utility “MIDI OX” to send a SysEx message from your computer to the MODEL D to put it into PITCH CV Calibration mode. (This same procedure can be used to send any SysEx message to the MODEL D.)

STEP 1 Run MIDI OX on your computer, and go to OPTIONS/MIDI DEVICES.



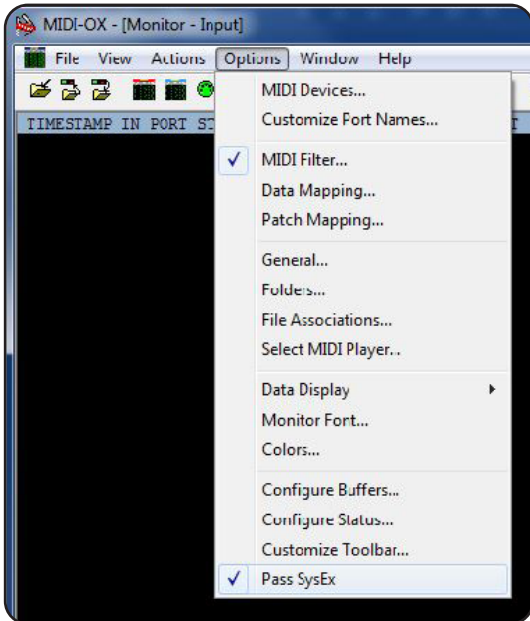
STEP 2 Select the MODEL D as the MIDI IN and MIDI OUT.



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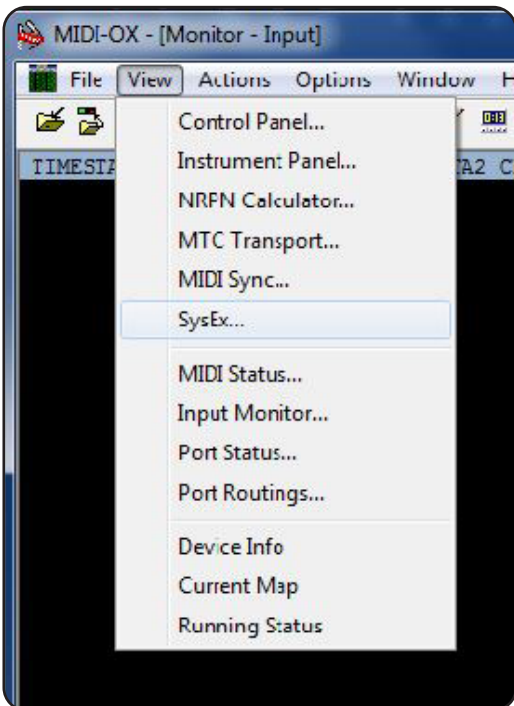
STEP 3

Select "Pass SysEx" at the bottom of the Options pull down menu. (It might already be ticked, which is fine.)



STEP 4

In the VIEW Menu, select SysEx..

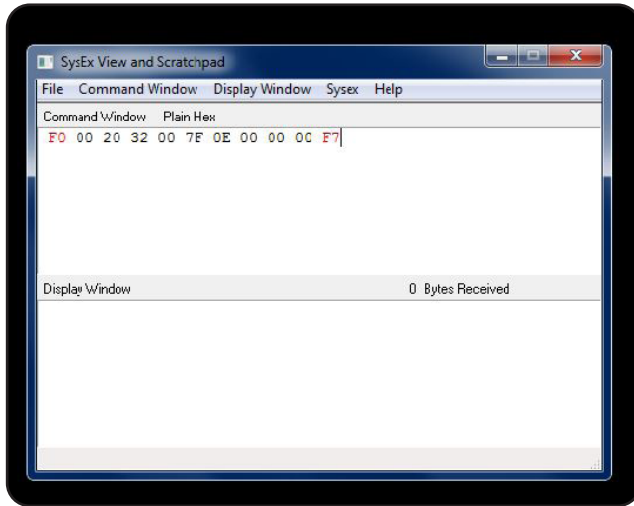


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STEP 5

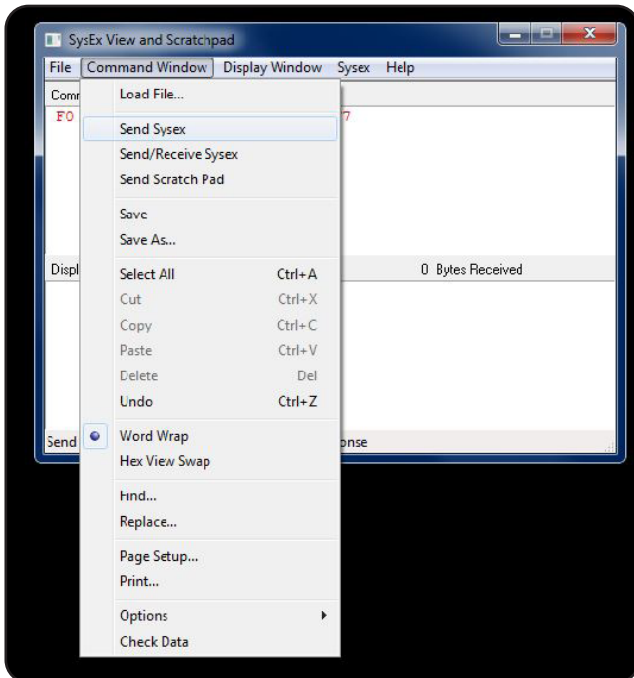
In the Command Window, enter the SysEx command to be sent to the MODEL D. For PITCH Calibration, the command is:

F0 00 20 32 00 7F 0E 00 00 00 F7



STEP 6

In the Command Window drop-down menu, select Send SysEx.



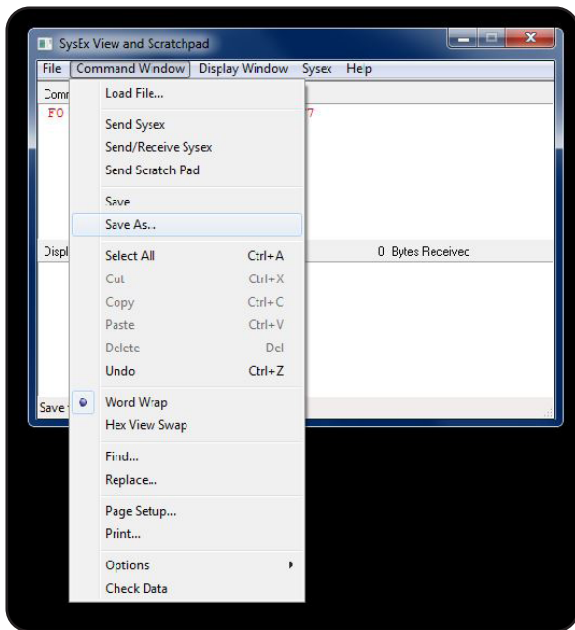
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STEP 7

The SysEx message will be sent to the MODEL D, and it will then be in its PITCH Calibration mode.

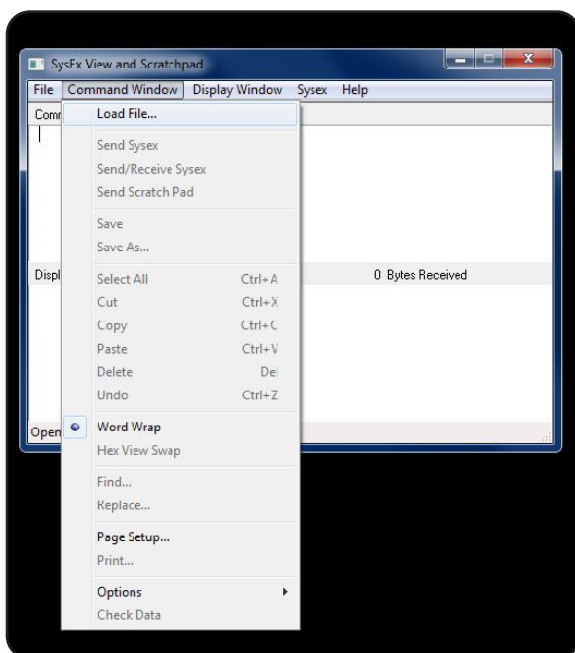
STEP 8

If you wanted, you can use the SAVE AS command in the Command Window drop down menu to save the SysEx message as a file on your computer for later use.



STEP 9

Then use the LOAD command in the Command Window drop down menu to recall the SysEx message from a file on your computer.



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Pitch CV Calibration continued

STEP
1

Follow the procedure on the previous page to put the MODEL D into PITCH Calibration mode using SysEx.

STEP
2

Make sure that the preliminary procedures shown in section 5.1 have been followed, and the MODEL D front panel controls and switches are set as directed.

STEP
3

Set the Digital Voltmeter to measure a range below 10 VDC.S

STEP
4

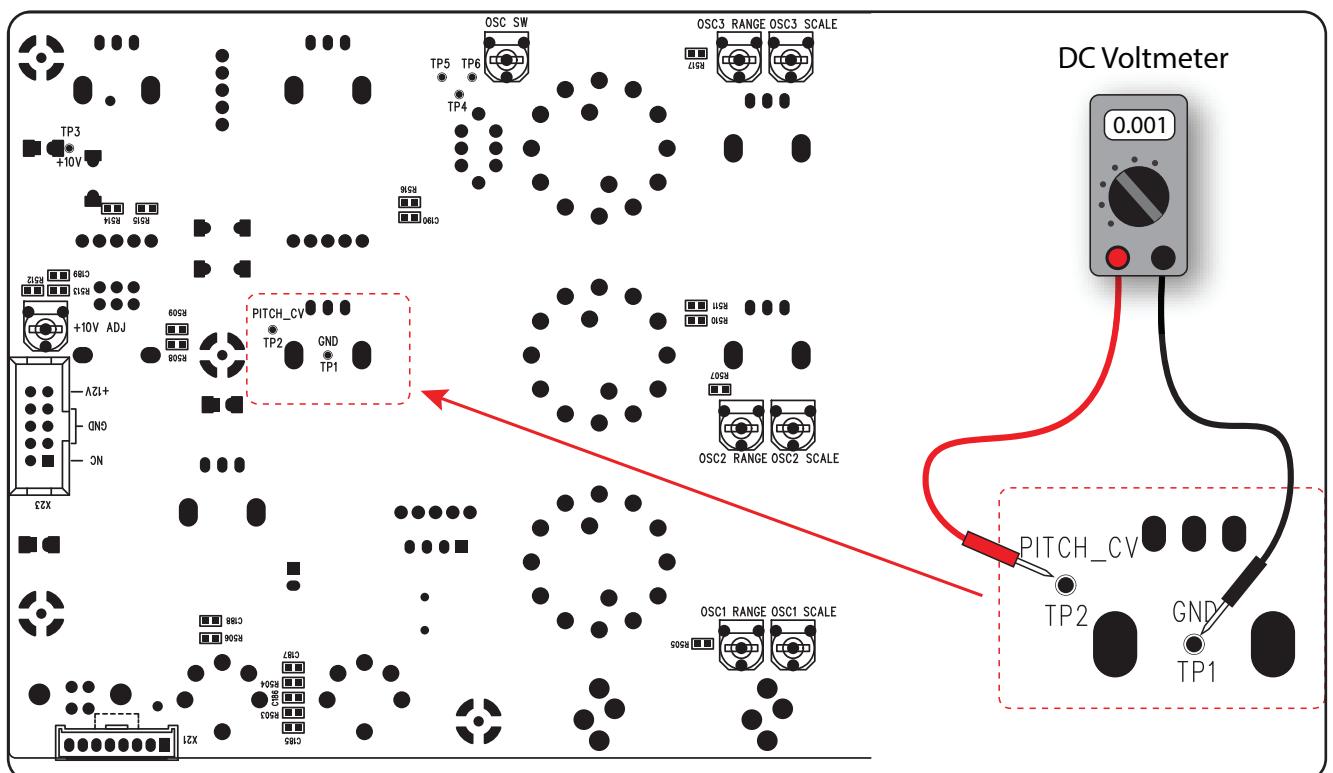
Locate the Test Points PITCH CV TP1 and TP2 on the bottom surface of the main PCB, as shown below.

STEP
5

Connect the positive probe of your Voltmeter to TP2.

STEP
6

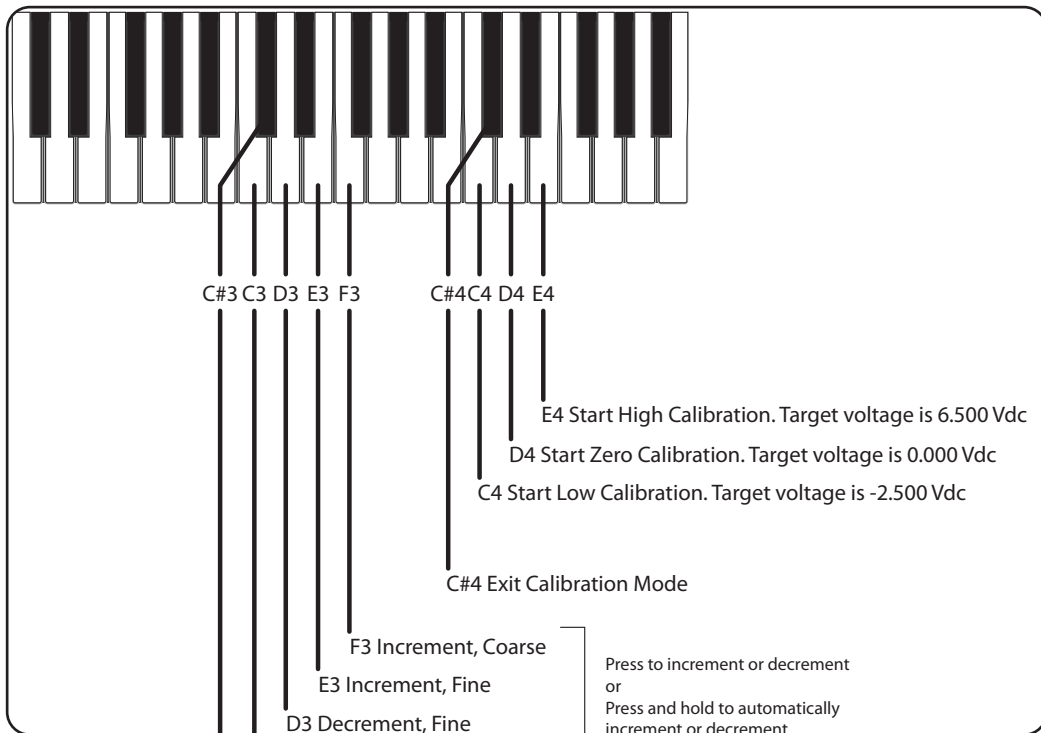
Connect the negative probe of your Voltmeter to TP1 (ground).



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STEP
7

Connect the positive probe of your Voltmeter to TP2.



Low Calibration Adjustment

STEP
8

Press C4 on the external keyboard to set the Low calibration value.

STEP
9

Measure the output voltage. It should read **-2.500 VDC**.

STEP
10

If required, the output voltage can be adjusted to this value by pressing the following keys. The Pitch/CV output adjustment resolution is about 2 mV

C3 = decrement coarse

D3 = decrement fine

E3 = increment fine

F3 = increment coarse

TIP: You can press and hold an increment or decrement key and (after a brief delay) the output adjustment will repeat automatically until the key is released.

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Zero Calibration Adjustment

STEP 11 Press D4 on the external keyboard to set the Zero calibration value.

STEP 12 Measure the output voltage. It should read **0.000 VDC**.

STEP 13 If required, the output voltage can be adjusted to this value by pressing the following keys. The Pitch/CV output adjustment resolution is about 2 mV

C3 = decrement coarse

D3 = decrement fine

E3 = increment fine

F3 = increment coarse

High Calibration Adjustment

STEP 14 Press E4 on the external keyboard to set the High calibration value.

STEP 15 Measure the output voltage. It should read **+6.500 VDC**.

STEP 16 If required, the output voltage can be adjusted to this value by pressing the following keys. The Pitch/CV output adjustment resolution is about 2 mV

C3 = decrement coarse

D3 = decrement fine

E3 = increment fine

F3 = increment coarse

Saving the PITCH CV Calibration Settings

STEP 17 When you are done, you must press C#3 to save your calibration settings.
NOTE: If you do not do this, your changes will not be saved.

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Exiting the PITCH CV Calibration Procedure

STEP 18

When you are finished, you must press C#4 to exit the Calibration Mode and return the MODEL D to normal operation.

STEP 19

If you want to do the other calibrations for the oscillators and octave range, follow the procedures shown on the next pages.

STEP 20

If you do not want to do any other calibrations, turn off the MODEL D, check the internal cables are securely connected, and secure its front panel assembly back onto the chassis using the 8 screws.

Exiting the PITCH CV Calibration Procedure

STEP 21

If you want to restore the Pitch CV calibration back to its factory settings, send the SysEx command shown below. (See the previous pages for details regarding the sending of SysEx messages.)

F0 00 20 32 00 7F 0F 00 00 00 F7

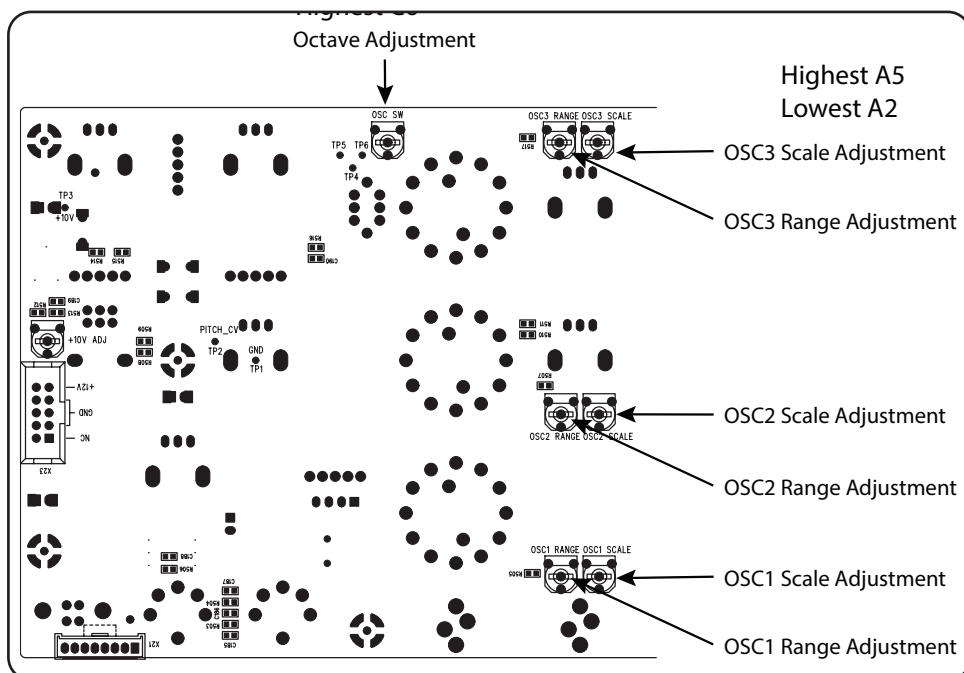
Oscillator Calibration

This calibration does not require the computer or SysEx, or the Voltmeter. An external keyboard is used, and adjustments are made to the various trimpots.

There are two methods of oscillator calibration as shown on the next page.

The PCB and the location of the trimpots is shown below.

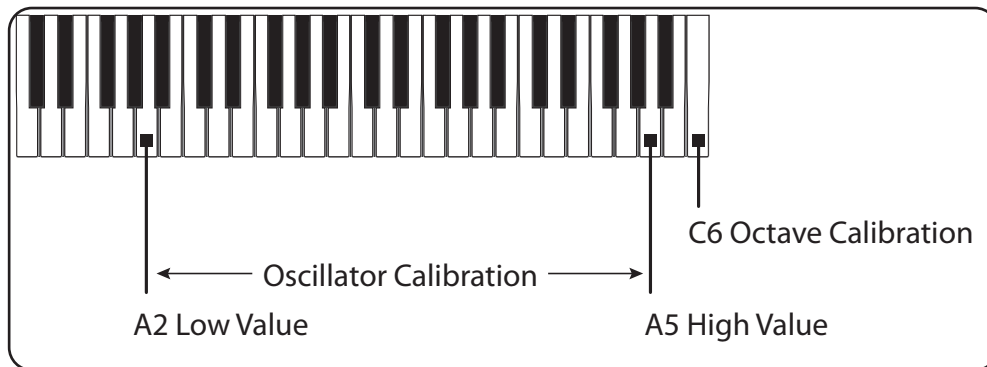
Note that the earlier version of the PCB has one-turn trim pots as shown, and the newer version uses multi-turn pots that require a small flat-headed screwdriver to adjust them



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The diagram below shows the keyboard notes that are used in the calibrations. Only A2 and A5 are used in the Oscillator calibration, and C6 is used in the Octave calibration.

Alternatively, notes may be played using a DAW with a MIDI interface connected to the MIDI IN on the MODEL D.



Calibration Procedure using a guitar tuner

This procedure is shown in a video made by our engineers, and we highly recommend that you take a look at the following link:

<https://www.youtube.com/watch?v=-PwSISQrQEM&feature=youtu.be>

STEP 1 Make sure that the preliminary procedures starting on page 3 above, have been followed, and the MODEL D front panel controls and switches are set as directed. Except: turn the A-440 switch OFF.

STEP 2 Connect a guitar tuner to the rear panel main 1/4" output.

OSC1 Range and Scale Calibration

STEP 3 On the PCB, locate the OSC1 RANGE and OSC1 SCALE trimpots. (See PCB drawing on the previous page.)

STEP 4 Turn ON the OSC1 switch.

STEP 5 On your external keyboard, press and hold the A5 key and adjust the OSC1 RANGE trimpot on the PCB while observing the tuner display.

STEP 6 On your external keyboard, press and hold the A2 key and adjust the OSC1 SCALE trimpot while observing the tuner display.

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STEP 7 Repeat steps 5 and 6 above until both notes are correct in the display. This may need to be repeated several times to get right.

STEP 8 Turn OFF the OSC1 switch.

OSC 2 Scale and Range Calibration

STEP 9 On the PCB, locate the OSC2 RANGE and OSC2 SCALE pots.

STEP 10 Turn ON the OSC2 switch.

STEP 11 On your external keyboard, press and hold the A5 key and adjust the OSC2 RANGE trimpot on the PCB while observing the tuner display.

STEP 12 On your external keyboard, press and hold the A2 key and adjust the OSC2 SCALE trimpot while observing the tuner display.

STEP 13 Repeat steps 11 and 12 above until both notes are correct in the display. This may need to be repeated several times to get right.

STEP 14 Turn OFF the OSC2 switch.

OSC 3 Scale and Range Calibration

STEP 15 Measure the output voltage. It sh On the PCB, locate the OSC3 RANGE and OSC3 SCALE pots

STEP 16 Turn ON the OSC3 switch.

STEP 17 On your external keyboard, press and hold the A5 key and adjust the OSC3 RANGE trimpot on the PCB while observing the tuner display.

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- STEP 18** On your external keyboard, press and hold the A2 key and adjust the OSC3 SCALE trimpot on the PCB while observing the tuner display.
- STEP 19** Repeat steps 17 and 18 above until both notes are correct in the display. This may need to be repeated several times to get right.
- STEP 20** Turn OFF the OSC3 switch.
- STEP 21** This completes the Oscillator Range and Scale Calibration.
- STEP 22** If you want to do the other calibrations for the octave range, follow the procedures shown on the next pages.
- STEP 23** If you do not want to do any other calibrations, turn off the MODEL D, check the internal cables are securely connected, and secure its front panel assembly back onto the chassis using the 8 screws.

Calibration Procedure using A-440

- STEP 1** Make sure that the preliminary procedures starting on page 3 above, have been followed, and the MODEL D front panel controls and switches are set as directed.

OSC1 Range and Scale Calibration

- STEP 2** On the PCB, locate the OSC1 RANGE and OSC1 SCALE trimpots. (See PCB drawing on the previous page.)
- STEP 3** As set up in the preliminary procedure, make sure the A-440 switch is ON. The A-440 test tone should be playing in your system.
- STEP 4** On your external keyboard, press and hold the A5 key. Listen carefully, and adjust the OSC1 RANGE trimpot on the PCB for zero beats
- STEP 5** On your external keyboard, press and hold the A2 key. Listen carefully, and adjust the OSC1 SCALE trimpot on the PCB for zero beats.
- STEP 6** Repeat steps 4 and 5 above until there are zero beats for either note. This may need to be repeated several times to get this right.

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STEP 7 Turn OFF the A-440 switch.

STEP 8 Make sure the OSC1 switch is left ON for the next calibration.

OSC 2 Scale and Range Calibration

STEP 9 On the PCB, locate the OSC2 RANGE and OSC2 SCALE pots.

STEP 10 As set up in the previous procedure, the A-440 test tone should be off, and the OSC1 switch should be set on. Turn on the OSC2 switch.

STEP 11 On your external keyboard, press and hold the A5 key. Listen carefully to the combination of OSC1 and OSC2, and adjust the OSC 2 RANGE trimpot on the PCB for zero beats between them.

STEP 12 On your external keyboard, press and hold the A2 key. Listen carefully to the combination of OSC1 and OSC2, and adjust the OSC2 SCALE trimpot on the PCB for zero beats between them.

STEP 13 Repeat steps 11 and 12 above until there are zero beats for either note. This may need to be repeated several times to get this right.

STEP 14 Turn OFF the OSC2 switch.

STEP 15 Make sure the OSC1 switch is left on, for the next calibration.

OSC 3 Scale and Range Calibration

STEP 16 On the PCB, locate the OSC3 RANGE and OSC3 SCALE pots.

STEP 17 As set up in the previous procedure, the A-440 test tone should be off, and the OSC1 switch should be set on. Turn on the OSC3 switch.

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- STEP 18** On your external keyboard, press and hold the A5 key. Listen carefully to the combination of OSC1 and OSC3, and adjust the OSC3 RANGE trimpot on the PCB for zero beats between them.
- STEP 19** On your external keyboard, press and hold the A2 key. Listen carefully to the combination of OSC1 and OSC3, and adjust the OSC3 SCALE trimpot on the PCB for zero beats between them.
- STEP 20** Repeat steps 18 and 19 above until there are zero beats for either note. This may need to be repeated several times to get this right.
- STEP 21** Turn OFF the OSC3 switch.
- STEP 22** This completes the Oscillator Range and Scale Calibration.
- STEP 23** If you want to do the other calibrations for the octave range, follow the procedures shown on the next pages.
- STEP 24** If you do not want to do any other calibrations, turn off the MODEL D, check the internal cables are securely connected, and secure its front panel assembly back onto the chassis using the 8 screws.

Octave Range Calibration

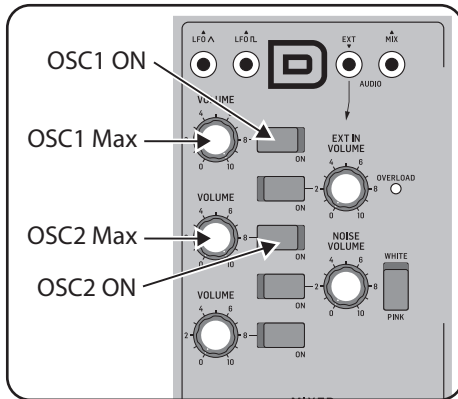
The octave calibration ensures that the OSC1 and OSC2 Octave RANGE knobs are in tune with each other. This calibration is done after the oscillator calibration.

- STEP 1** Make sure that the preliminary procedures shown in section 5.1 have been followed, and the MODEL D front panel controls and switches are set as directed.
- STEP 2** Turn OFF the A-440 switch, and keep the OSC1 VOLUME switch ON.

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STEP 5

Turn on the front panel OSC2 VOLUME switch in the MIXER section. (OSC1 is already on, OSC1 and 2 Volumes are up).

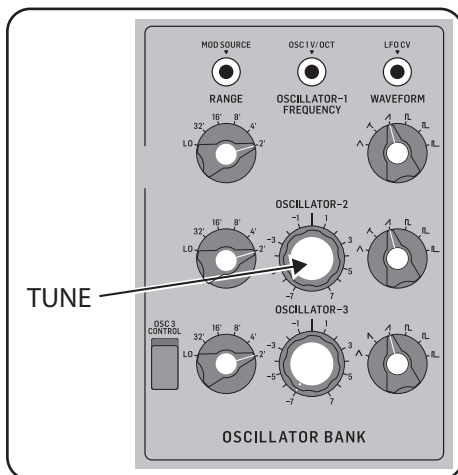


STEP 6

On your external keyboard, press and hold the C6 key. You should hear both OSC1 and OSC2. Adjust the headphone volume or main volume as required.

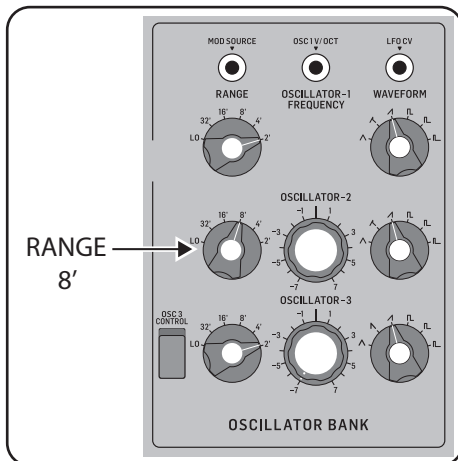
STEP 7

Listen carefully, and adjust the front panel OSCILLATOR-2 Tune knob until there are zero beats between OSC1 and OSC2.

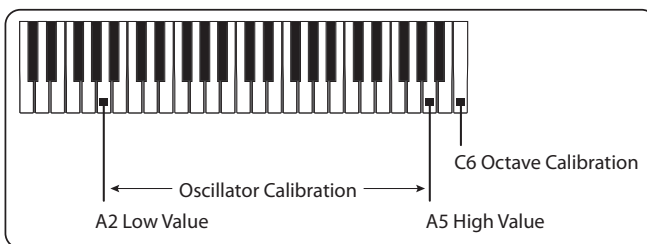


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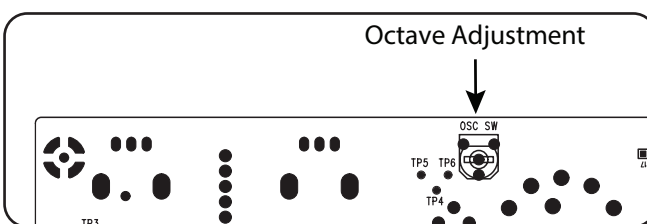
STEP 8 Turn the front panel OSC2 Octave RANGE knob to the 8' position.



STEP 9 On the PCB, locate the OSC2 RANGE and OSC2 SCALE pots.



STEP 10 Listen carefully, and adjust the OSC SW trimpot on the PCB, for zero beats between OSC1 (Range=2') and OSC2 (Range=8').



STEP 11 Repeat step 8 with different settings of the RANGE knob, and repeat steps 9 and 10 until both oscillators are in tune with each other at all settings of the Octave RANGE knob.

STEP 12 This completes the Octave Range Calibration.

STEP 13 If you do not want to do any other calibrations, turn off the MODEL D, check the internal cables are securely connected, and secure its front panel assembly back onto the chassis using the 8 screws.