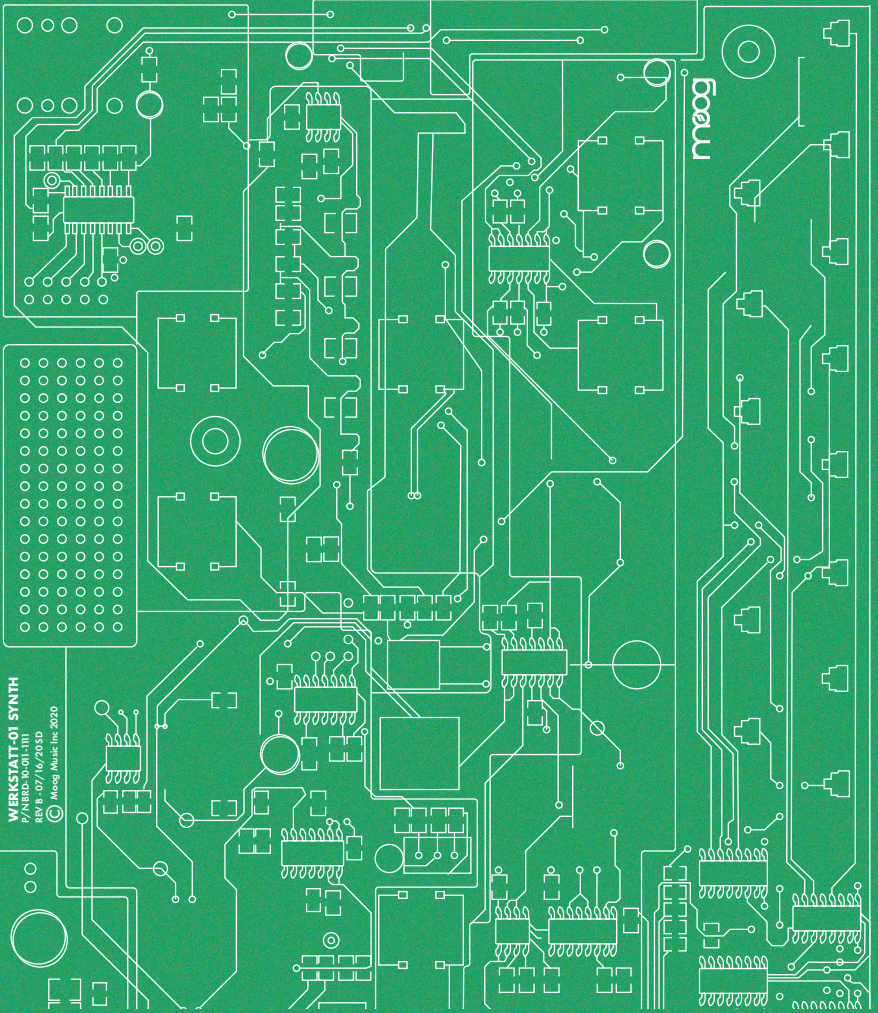


# WERKSTATT-01

## Modification Handbook



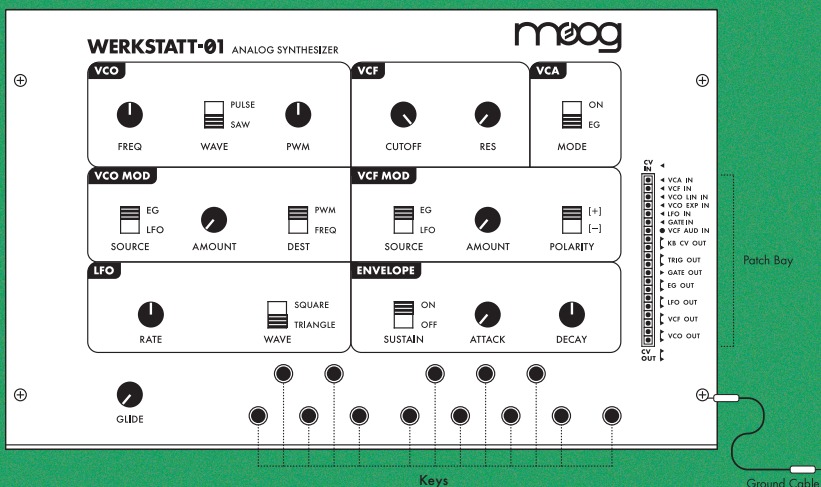
WERKSTATT-01 SYNTH  
P/NBRD-10-01-1111  
REV B - 07/16/2015  
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# Modification Handbook

This booklet contains a series of self-guided modification tutorials for the Moog Werkstatt-01 Analog Synthesizer. Immerse yourself in the world of sonic discovery and joyous experimentation that awaits you inside.

## START WITH A BASIC PATCH:

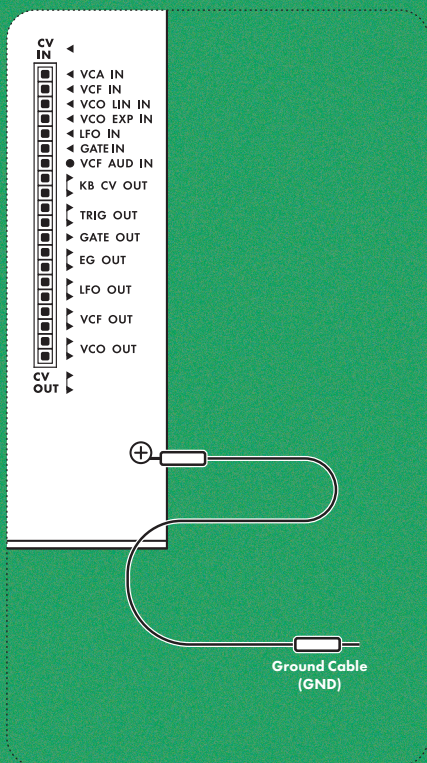
Match all knobs and switches to the graphic below.



Press the keys to hear the synthesizer's sound in the headphones. Notice the sonic qualities of our basic patch. This initial sound will be our starting point as we perform circuit modifications to expand our electronic capabilities.

**NOTE:** This handbook includes projects that require different electrical parts and sensors. We made a wishlist on [SPARKFUN.COM](https://www.sparkfun.com) with everything you will need – [CLICK HERE TO SEE THE WISHLIST.](#)

# BEFORE YOU BEGIN, YOU MUST CORRECTLY GROUND YOUR WERKSTATT-01!



## HOW TO GROUND YOUR WERKSTATT-01:

1. Unscrew the bottom right screw on the front panel of your Werkstatt-01 slightly, but do not remove it completely.

2. Insert one end of a jumper cable underneath the screw head and tighten the screw back down until it is snug and the jumper cable is securely fixed in place.

**NOTE:** This jumper cable is now acting as the ground (GND) cable for your Werkstatt-01.

3. Follow the instructions in modification lessons 2-6 to find where the other end of the ground cable should run.

AFTER GROUNDING YOUR WERKSTATT-01, YOU ARE READY TO SAFELY PROCEED WITH THE FOLLOWING MODIFICATION LESSONS. HAVE FUN!

# Low Frequency Oscillator (LFO) Mod

1

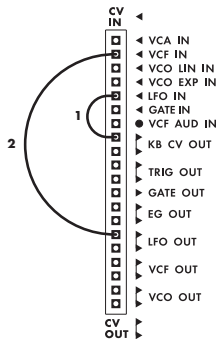
## Materials:

Jumper Cables (M/M)

2x 

## Instructions:

1. Run a jumper from **KB CV OUT** to **LFO IN**. <sup>(1)</sup>
2. Run a jumper from **LFO OUT** to **VCF IN**. <sup>(2)</sup>

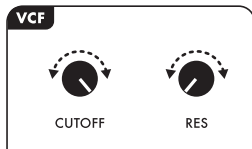


*(1) This sends a keyboard control voltage based on the note you are currently holding to manipulate the LFO RATE.*

*(2) This sends a control voltage based on the oscillation of the LFO output to the VCF cutoff.*

Press the keys to hear the “wobbling” effect of our first modification. As you move from left to right on the keyboard, take note of the wobble’s increasing speed.

Experiment further by turning the **CUTOFF** and **RES** knobs of the VCF.



Remove all patch cables and reset all knobs and switches to the basic patch before moving on to the next mod.

# Potentiometer Mod

2

## Materials:

1. Jumper Cables (M/M)

2. Breadboard

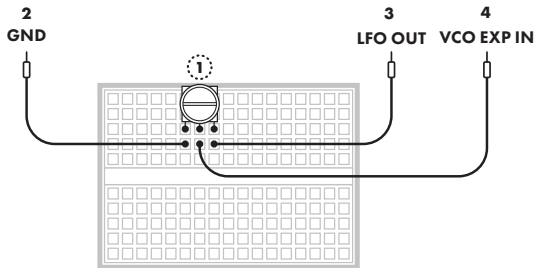
3. 10k Potentiometer

2x 




## Instructions:

1. Connect your potentiometer into the breadboard.
2. Run ground into one far lead of the potentiometer.
3. On the opposite leg, run a jumper to whatever signal you want to attenuate; for this example let's use **LFO OUT**.
4. Now run a jumper from the middle leg to any input you want to manipulate; for this example let's use **VCO EXP IN**.



Our second modification connects the “wobble” of the LFO to the pitch of the Oscillator and adds a “control knob” in between.

Hold down a key while turning the potentiometer  to hear how the modified circuit allows us to control the amount of the wobble.

*Clear the breadboard, reset the synthesizer to the basic patch, and move on to the next mod.*

# Photocell Mod

3

## Materials:

1. Jumper Cables (M/M)

2. Breadboard

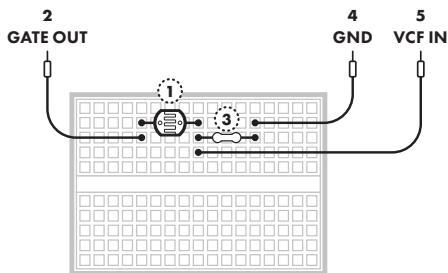
3. 10k Resistor

4. Photocell



## Instructions:

1. Connect the photocell into the breadboard.
2. Run one lead of the photocell to **GATE OUT**.<sup>(1)</sup>
3. Connect the opposite lead of photocell to a 10k resistor.<sup>(2)</sup>
4. Run ground into the other leg of the resistor.
5. Now at the junction of the resistor and the photocell run a jumper to **VCF IN**.



(1) **GATE OUT** Sends 5V+ when a note is pressed.

(2) The 10k resistor will create a voltage divider with a variable resistor.

We have just modified our synthesizer to include a motion-sensing controller. While pressing the keys, cup your hand over the photocell to reduce the amount of light it receives. Move your hand in and out of the sensor's range to experience hands-free control of our basic patch. Manipulate the VCF's **CUTOFF** and **RES** knobs to fine-tune your sound.

Clear the breadboard, reset the synthesizer to the basic patch, and move on to the next mod.

# Force Sensitive Resistor Mod

4

## Materials:

1. Jumper Cables (M/M)

2. Breadboard

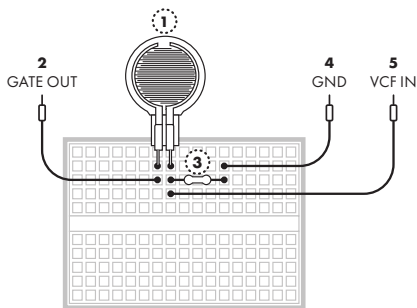
3. 10k Resistor


4. Force Sensitive Resistor



## Instructions:

1. Connect the Force Sensitive Resistor (FSR) into the breadboard.
2. Run a jumper from **GATE OUT** to one lead of the FSR.
3. Connect a 10k resistor to the breadboard from the other lead of the FSR.
4. Run ground into the opposite leg of the 10k resistor.
5. Run a jumper from the junction of the FSR lead and 10k resistor and run to **VCF IN**.



For this mod, we have installed a pressure-sensitive sensor into our synthesizer's Voltage Controlled Filter. Pinch the Force Sensitive Resistor  while pressing the keys and notice how our sound changes when you apply varied degrees of pressure. Dial in your signature sound using the **CUTOFF** and **RES** knobs of the synthesizer's VCF.

Clear the breadboard, reset the synthesizer to the basic patch, and move on to the next mod.

# Membrane Potentiometer Mod

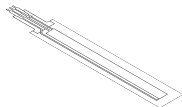
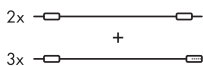
5

## Materials:

1. Jumper Cables (M/M) + (M/F)

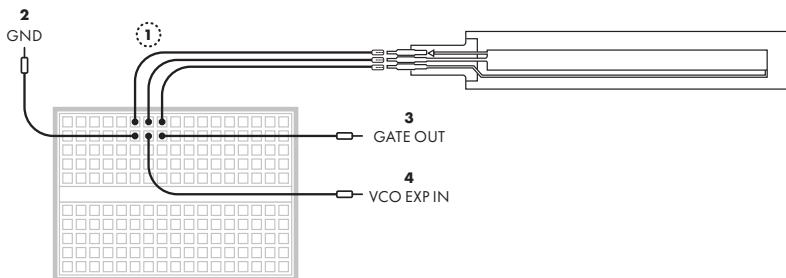
2. Breadboard

3. Membrane Potentiometer



## Instructions:

1. Extend membrane potentiometer off of the breadboard by using (3) M/F jumper cables.
2. Run ground to far lead of the potentiometer.
3. Run a jumper from the opposite leg of the potentiometer to **GATE OUT**.
4. Run a jumper from the middle lead of the potentiometer to **VCO EXP IN**.
5. Slowly press your finger on the membrane of the potentiometer as you hold a note.



By modifying the synthesizer's Oscillator to accept control from the Membrane Potentiometer, we have engineered our instrument to include an electronic ribbon controller. Hold any key, slide a finger up and down the Membrane Potentiometer, and do your best Keith Emerson impression.



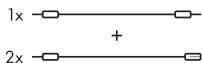
Clear the breadboard, reset the synthesizer to the basic patch, and move on to the next mod.

# Flex Sensor Mod

6

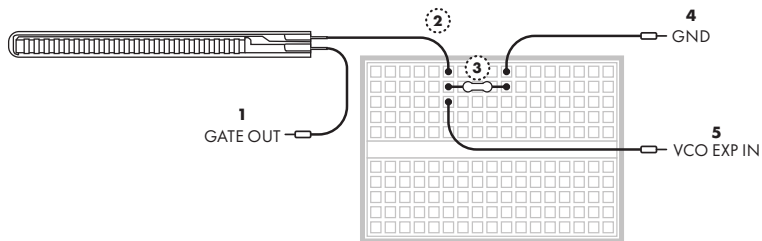
## Materials:

1. Jumper Cables (M/M) + (M/F)   2. Breadboard   3. 10k Resistor   4. Rubber Band   5. Flex Sensor



## Instructions:

1. Run a M/F jumper from **GATE OUT** to one lead of the flex sensor.
2. Run a M/F jumper from the other lead of the flex sensor to the breadboard.
3. Connect a 10k resistor onto the breadboard from the other lead.
4. Run ground to the other lead of the 10k resistor.
5. Run a jumper (M/M) from the junction of the flex sensor lead and 10k resistor to **VCO EXP IN**.
6. Take a rubber band and attach the flex sensor to your knuckle with metal pads facing up. Press a note and hear how the pitch changes as you bend your finger.



Welcome to the future. Our final modification blurs the lines between synthesizer and synthesist by outfitting you with a bio-mechanical flex sensor. Hold down a key and bend your finger to convert your brain waves into a control voltage.



# CONGRATULATIONS!

**You have completed the Werkstatt-01  
Modification Handbook.**

**Your synth-wizardry knows no limits  
as you finger-bend electronic sound  
to your will.**

Visit [WWW.MOOGMUSIC.COM/WERKSTATT](http://WWW.MOOGMUSIC.COM/WERKSTATT)  
to continue your exploration of Werkstatt-01  
through tips, tutorials, presets, and more.



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