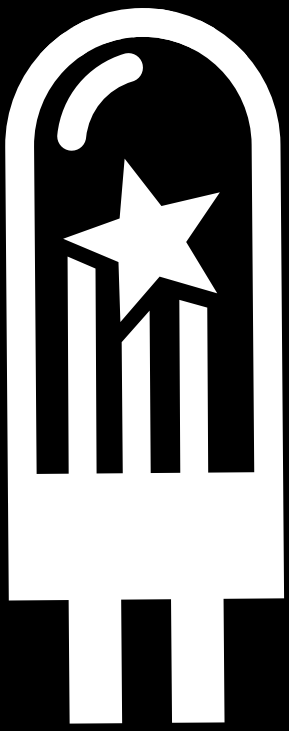
M-AUDIO

SPUTNIK

Tube Microphone



User Guide

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Introduction

Congratulations on your purchase of M-Audio's Sputnik multi-pattern vacuum tube large-diaphragm condenser microphone. Studio artists around the world rely on M-Audio microphones to capture acoustic performances with clarity and accurate tonal balance. The Sputnik tube microphone from M-Audio improves upon that reputation as a top-of-the-line solution for applications requiring the smoothest, world-class sound. Engineered to the highest sonic standards, the Sputnik addresses the needs of the most critical professional users.

The Sputnik microphone represents the culmination of over a year of design and development. Based on a classic vacuum tube design and manufactured in modern facilities to exacting standards, this multi-pattern, dual-sided large-diaphragm studio condenser mic delivers the lush, classic sound normally associated with rare and expensive vintage mics like the Neumann U47 and AKG C12. In fact, its rich low-mid and smooth upper-mid response makes it a good bridge between these two venerable mics.

The Sputnik's combination of military-grade vacuum tube, ultra-sensitive gold evaporated Mylar diaphragm, solid brass construction, and multiple polar patterns makes it ideal for a wide variety of voices, instruments, and applications—especially putting that signature sound in the spotlight. Engineered from scratch, we designed Sputnik with input from some of L.A.'s top recording engineers and producers—and it's an instant classic in their hands. We are pleased to present what we believe to be the most versatile and natural-sounding microphone solution for professional and high-end applications.

What's in the box?

Your Sputnik tube mic box contains:

- Sputnik microphone
- power supply
- 7-pin cable
- grounded IEC power cable
- flight case
- shock mount
- soft cloth bag
- this owner's manual

Using the Sputnik Microphone

Standard Operation

Even if you're a seasoned expert in microphone use and placement, we recommend you read the following instructions when setting up the Sputnik for the first time.

BEFORE YOU GET STARTED...

The Sputnik power supply comes factory programmed for 100V~50/60Hz, 120V~50/60Hz, or 240V~50/60Hz operation. The label on the bottom face of the power supply indicates the AC mains voltage operation. The only way to change it is by altering the internal circuitry, but you (the customer) cannot do that without voiding your warranty. Before using the mic, please check the label on the bottom of the power supply unit to make sure it is set up to accept the AC line voltage in your location. (This should not be a problem if you bought it in the country in which you are using it.)

However, if you need to use it in another location with a different AC mains voltage, we recommend you use a high-quality general-purpose step-up or step-down transformer, rather than one of those inexpensive voltage converters suitable for an electric razor. If you use the latter, rather than the former, the voltage output may be a square wave (rather than a sine wave)—which will probably result in noisy operation and will eventually cook the mic!

Please note that the mains fuse is user replaceable. If you need to change it, please follow the table on the bottom of the power supply in order to select an appropriate fuse with the proper current rating.

Now that you've ensured that the power supply is set to the correct voltage, you can begin to set up the Sputnik mic.

1) First, make sure the power supply is turned off (and preferably, unplugged from the wall).
2) Take the Sputnik 7-pin cable and connect it to the female socket on the back of the power supply. (Facing the arrow indentation on the male plug upward will help you align the pins correctly.)

3) Screw the M-Audio shock mount onto a sturdy mic stand and then place the Sputnik mic into the shock mount. The threaded mounting ring at the bottom of the shock mount screws into the bottom of the Sputnik microphone, securing it in place. We recommend that you always use the shock mount with the Sputnik mic as it provides a safe and stable structure and it greatly reduces vibrations coupling to the mic stand from the floor.

4) Plug the female end of the 7-pin cable into the bottom of the mic. To help align the pins, make sure the clip on the female plug faces the same direction as the front of the mic. (The front of the mic is the side with "Sputnik" engraved.)

5) Connect a balanced XLR microphone cable between the power supply and your mic preamp. We recommend you use the highest quality cable possible. Generally speaking, the shorter the cable, the better. (Remember: because the Sputnik power supply unit provides the voltages needed to power the Sputnik mic, you shouldn't use the +48V phantom power function on your preamp.)

6) Connect the grounded AC power cable from the power supply mains feed to the wall power socket.

7) Turn your mic preamp gain level all the way down. You'll gradually turn the level up once the Sputnik is up and running.

8) Now you can turn on the power switch on the power supply. It takes about 15 seconds for the red power LED to illuminate fully and ideally you should wait a few minutes for the Sputnik to "warm up" and for the operating voltages to stabilize before you begin recording. (We designed the slow "warm up" circuit in this way in order to extend the life of the vacuum tube.)

9) Select the polar pattern and attenuation level appropriate to your recording setup by using the switches on the body of the Sputnik mic.

10) Now you can adjust your mic preamp gain level, phase, etc. as appropriate.

11) When shutting down the mic, you should always turn off the power supply first and wait for the red LED to go out completely before removing the cables.

Recommendations

1) **Preamplifiers**:
for best results, use the best mic preamp you can. This may seem like an obvious statement, but all too often we find artists skimping on their mic preamp after they've invested in a top-quality microphone. Indeed, although the Sputnik mic itself outputs a clean, true representation of the captured sound, you'll lose some of the benefits if your preamp colors the sound in any way. There are many good preamps on the market, but we can recommend some that work great with any mic: M-Audio's Tampa, Octane, and DMP3. These are all very "neutral" sounding devices that amplify your mic signal without changing timbre or dynamics, and they won't adversely affect the depth and energy of your audio signal. (In case you missed it before: don't engage the +48V phantom power function on your preamp when using the Sputnik mic; the Sputnik power supply handles that function itself.)

2) **Pop filter**:
we recommend you always use a "pop filter" when recording vocals. It's a sonically transparent mesh or metal grill placed between the mic and the singer that filters out "plosive" sounds (consonants like "p," "t," and "b") that can cause transient distortion in the capsule from short bursts of energy exciting the diaphragm. The pop filter will also help keep moisture away from the capsule when the singer breathes out into the mic. (Accumulations of moisture can be detrimental to the life of the capsule.)

3) **Storage**:
we recommend you store the mic and power supply in the flight case when you're not using them. Alternatively, if you want to keep the Sputnik mounted on a stand within its shock mount when you're not using it, please make sure you cover it using the soft cloth bag included in the flight case. This will help keep dust and other particulate matter from contaminating the capsule over time, extending the Sputnik's life.

4) **Temperature, humidity, and other environmental conditions**:
while the Sputnik may work in outer space, it's been optimized for terrestrial use. If at all possible, keep the Sputnik mic and power supply in a stable (cool and dry) environment, and never let them get wet. In other words, avoid using the Sputnik outdoors, and don't drop it in a swimming pool.

Sputnik Features

Capsule

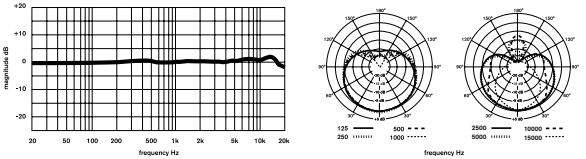
The Sputnik's custom double-sided capsule is the heart of the Sputnik mic and it's the element primarily responsible for the mic's sensitivity and transparent sound characteristics. The capsule consists of two 1-inch circular Mylar diaphragms, which we've manufactured to a precise thickness of 3 microns (or 1.18 x 10^{-4} inches). The diaphragms are clamped down along their circumference, conforming to a tightly regulated tension spec, allowing their centers to vibrate responsively (but with precise damping) when acted upon by sound waves. Spaced precisely 47 microns behind the diaphragms are the backplates, which we machined from solid brass and which contain an elaborately configured hole arrangement for a smooth frequency response over multiple pickup patterns. The diaphragms each contain a layer of 24-karat gold, distributed uniformly on their Mylar surface using advanced evaporation techniques. All of this is accomplished using computer-controlled manufacturing processes in a state-of-the-art facility to ensure exceptional consistency of quality.

Multiple Polar Pattern Selection

For maximum versatility, we designed the Sputnik capsule to be double-sided (dual diaphragms with back-to-back dual backplates), so you can use cardioid, omnidirectional, and figure-8 pickup patterns at will.

Cardioid: this is the most widely used pattern and it's considered unidirectional because the mic picks up signal primarily from its front side. The backplate hole pattern is such that some sound leaks carefully from the front to the back of the capsule causing a precise "null" in the pickup response of the back. This is a popular pattern because it allows you to isolate the sound you are trying to record as it minimizes the intrusion of room reflections (or other nearby unwanted sounds). Importantly, in this mode the Sputnik will exhibit a slight *proximity effect,* which is a boost in the low-mid frequency response as the sound you are capturing gets close to the mic—i.e., within a couple of inches of the capsule. (This characteristic, present in almost every microphone with a unidirectional pickup pattern, has been exploited successfully by many singers and voice artists wanting to sound "bigger" or "deeper" than they really are.)

Cardioid



Omni-Directional

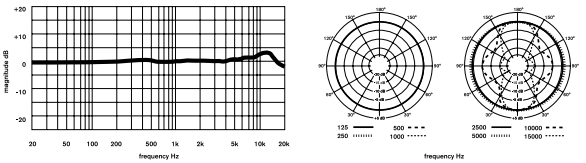
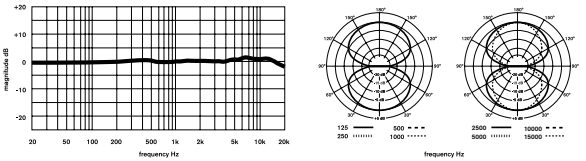


Figure-Eight



Omnidirectional: as the name suggests, the Sputnik picks up sound equally in all directions when using this pattern. It's great when you want to collect room ambience along with the source. The Sputnik utilizes the dual-diaphragm design to capture two cardioid patterns (one from each side) and it sums them electrically in carefully configured phase and level combinations to create a smooth, even response all the way around. This pattern does not exhibit the proximity effect.

Figure-8: this pattern allows you to capture sound bidirectionally—in other words, on the Sputnik's two opposing faces; but it has very strong rejection of sound sources located 90 degrees off-axis (i.e., on the sides). This pattern doesn't exhibit any proximity effect—indeed it has a very even frequency response overall. You can use this pattern to capture, for example, the sounds of two

performers singing toward each other. The strong off-axis rejection (roughly 40dB of attenuation) can make it useful for, say, mic'ing a drum kit if you want to isolate individual drums or cymbals. Moreover, the Sputnik's figure-8 pattern is *very symmetrical,* which make it a perfect candidate for use in mid-side ("M/S") recording—a technique used to capture very accurately a stereo image with excellent mono downmix compatibility.

Attenuation and Filter Controls

The Sputnik contains a switchable 10dB attenuation pad, useful for situations where the sound you are capturing is sufficiently loud that it may overdrive some part of the audio signal chain.

Additionally, there is a switchable 80-Hz 2nd-order high-pass rolloff filter (12dB/octave) for filtering out such annoyances as low-frequency rumble from traffic noise outside your studio, or vibrations transmitted up the mic stand from a player tapping his or her foot. We advise you to use this function judiciously since you may be capturing a sound source with valuable information below 80Hz; furthermore, please remember that the less circuitry you introduce into the signal path, the cleaner your output signal will be—so you should consider switching in the high-pass filter as a "last resort" problem-solving tactic. For many applications, the M-Audio shock mount will successfully reduce the noise from low-frequency vibrations.

Vacuum Tube Amplifier

In addition to the capsule, the Sputnik's Class-A head amplifier is a key element in the microphone's vintage sound. It picks the audio signal off the capsule and conditions it so that it can be sent out the microphone cable to an appropriate mic preamp. Its main ingredient is a low-current hand-selected military-grade 6205M vacuum tube—a diminutive pentode wired as a triode. What's notable about this amplifier circuit is that it's an all-discrete transconductance design based on thermionic studies by researchers at Harvard University and the American Institute of Physics. The amplifier uses a classic cascode circuit to increase the gain-bandwidth product and eliminate the effects of parasitic capacitances (the "Miller Effect")—giving the system a very wide frequency response. There are lots of benefits to this circuit for a microphone because it yields a high output impedance which makes the mic very tolerant of load conditions. (The output impedance of the Sputnik's cascode circuit is in the mega-ohms—dominated by the plate resistor—so it behaves like a perfect current source.)

Also noteworthy about the Sputnik's head amp is that the cascode topology uses both the aforementioned vacuum tube and an n-channel depletion-mode JFET. The 6205M tube is on the top (with the JFET at the cathode) so the amp exploits the best properties of each device. In terms of voltage, the tube is actually doing all of the heavy lifting and it allows the overall circuit to maximize headroom and give the widest possible bandwidth. Furthermore, the JFET biasing ensures that you don't get all the nasty artifacts from the tube that you might otherwise get—like microphonics, hum, crackle, etc. (The fact that it's a subminiature military-grade tube—hand-selected, tested, and burned for a week to ensure top performance—also minimizes these undesirable artifacts.)

The amp output feeds a custom-wound nickel-core output transformer, magnetically shielded to eliminate RF interference. The transformer's high relative permeability (μ_r) contributes to the Sputnik's low distortion characteristics and notable dynamic range, and it provides a comfortable 200Ω output impedance.

In essence, the Sputnik's vacuum tube circuitry delivers ultra-smooth harmonic detail and can respond very quickly to signals with fast rise/fall times coming off the capsule (thereby eliminating transient problems). The amp is quite linear and features graceful overload characteristics and an enormous dynamic range due to its high voltage operation. You can't achieve these results with a standard transistor amplifier or one of the more common Class-A vacuum tube designs.

Power Supply

The Sputnik power supply features a sophisticated circuit designed to ensure optimal performance of the Sputnik mic and audio signal path. The power supply charges the parallel-plate capacitor formed by the diaphragm and backplate of the capsule. The power supply also provides the operating voltages needed for the head amp. It starts up slowly by heating the tube's cathode (filament) first and then it ramps up the voltage on the anode (plate)—which is why the power supply's LED indicator lights up gradually, over a 15-second period, to indicate when the Sputnik is "ready for launch."

Additionally, the power supply has an automatic load-sensing circuit that compensates for varying transmission line impedances—so you can run cables as long as 200 feet.

M-Audio Shock Mount

The Sputnik's capsule is rubber-mounted internally, but you should still be careful to protect it from physical shocks and abuse. Always use the Sputnik with the included M-Audio shock mount on a sturdy mic stand. It's a comfortable, stable structure in which to seat the mic and it aids considerably in reducing unwanted low-frequency vibrations from your recording setup that can transduce into the audio path.

Solid Brass Construction

Machined from solid brass, the Sputnik's non-resonant body is glass-bead blasted and coated in nickel and hand polished. The capsule's protective grill has a >90% opening with radiused edges resulting in virtually no edge diffraction and a superior off-axis response.

Close Tolerance for Matched Sets

Many professional recording techniques require the use of two mics with identical (or near-identical) frequency and polar response. Every Sputnik mic is manufactured to be within 1dB of the published specifications. This means you can consider any two or more Sputnik mics you buy to qualify as a matched set for stereo or multiple-mic recording.

Flight Case and Mic Bag

To aid in transportation and storage, the Sputnik mic comes in a silver "wise-guy"-style flight case worthy of Agent Maxwell Smart. The case houses your cables, power supply, shock mount, and the mic itself. The only thing we didn't include is the shoe phone and a pair of handcuffs.

Additionally, you'll find a soft protective bag in the flight case. You can use this to cover the Sputnik when it's on the stand but not in use; it'll help keep particulate matter such as dust away from the mic. (Dust can degrade the performance of the diaphragm over time.)

The Philosophy Behind a World-Class Tube Microphone

The purpose of any microphone is to capture a living sound. The mic does this by converting the acoustic energy of the source into its exact electrical equivalent, which you can then record. The accuracy of this conversion is the main criteria we use to determine the quality of a studio microphone. Ultimately, the best tool we have to assess this accuracy is our own ear-brain mechanism. So we at M-Audio spent countless hours in some of Los Angeles' top recording facilities—recording and listening back to human voices and other instruments with some of our favorite studio engineers—to develop and refine a design that would yield the highest level of audible accuracy from input to output. (This was, of course, in addition to our standard empirical methods of taking detailed measurements and gathering technical data.)

Our decision to use a vacuum tube head amp circuit played an integral part in achieving the accurate, smooth response we were going after. But some people may wonder why we elected to employ a vacuum tube amplifier rather than a transistor-based integrated circuit device. Conventional wisdom dictates that tubes necessarily "warm up" an audio signal path by coloring the sound in particular ways. So doesn't this coloration taint the accuracy of the transduced signal in a microphone? In other words, if we're trying to capture an acoustic sound as honestly and accurately as possible, why use a vacuum tube?

This line of thinking is based on most people's association with the common use of vacuum tubes in guitar amps. Indeed, in the context of guitar amps, vacuum tube circuits do serve to *alter* the sound by "fattening up" guitar-note sustain because of the specific way they distort when handling overload conditions. However, a well-designed vacuum tube circuit can have distinct advantages over transistor designs (even FET-based designs) for a condenser microphone whose aim is to remain absolutely clean and sonically transparent.

One advantage is that the extremely high input impedance of a tube doesn't load down the microphone capsule output in any significant way. Also, there are some major differences in the inherent physical properties of the devices and with the circuit topologies and components used with each type of device. Linear vacuum tubes have lower overall distortion than bipolar transistors or FETs, and the distortion products are primarily lower-order—and therefore, more "musical" sounding. While the clipping characteristic of tubes is actually not much softer than that of transistors, the negative feedback networks necessary to achieve proper solid-state operation tend to "square-up" the clipping, resulting in higher- and odd-order harmonics. So the heavy feedback in most solid-state designs actually gives them worse overload performance and can cause transient intermodulation (TIM) distortion due to clipping or slew-rate limiting within the feedback loop. (When transistors overload—in a discrete circuit or in an op amp—the dominant distortion products are the third and fifth harmonics. These harmonics produce a sound many musicians refer to as "stopped" or "covered"; basically, not pleasant. On the other hand, with tubes the dominant distortion product is the second harmonic, with the fourth and sixth appearing with smaller amplitudes. Musically, the second harmonic is an octave above the fundamental and you can hardly hear it—but it adds body to the sound, making it appear "fuller." The other higher even-order harmonics result in a "singing" or "choral" sound.) Since vacuum tubes tend to be highly linear, with little or no negative feedback, you can drive them harder without hearing distortion. In other words, the tube's soft clipping also can increase the apparent dynamic range of the microphone—which is particularly useful when you're recording a singer whose voice can get really loud or really soft.

Coming back to the issue of microphone accuracy: our cascode tube circuit (described in the Features section) utilizes all of these desirable tube properties in order to allow you to record sounds more faithfully and realistically than with an "equivalent" transistor design. The tube circuit's higher dynamic range (due to higher operating voltages); greater tolerance for voltage spikes and graceful overload characteristics; and wider frequency response (due to a larger gain-bandwidth product) make it ideal for use in a world-class studio microphone. It's the sound you've heard on so many classic and clean-sounding recordings—and it's the sound you'll hear with the Sputnik mic.

What's in a Name?

"Sputnik" is a funny thing to call a microphone, but we thought it was oddly appropriate. As you may know, in the 1950s the former Soviet Union launched its Sputnik Program for unmanned space missions—and Sputnik 1, launched 4 October 1957, was the world's first artificial satellite. The success of the first Sputnik satellite did yield some positive long-term effects; among them, it motivated U.S. government officials to increase public spending on scientific research and education. Not coincidentally, the late 1950s also marked the time vacuum tubes started giving way to new transistor-based technology in consumer products (thanks in part to the pioneering efforts of engineers at Bell Labs). So the Sputnik satellite launch effectively coincided with the pinnacle of vacuum tube popularity before its decline. In other words, our microphone name is an oblique allusion to the era in which its core technology saw its peak.

It's important to note, however, that the Sputnik Program arguably sparked a turning point in the Cold War—one in which all the major world powers engaged in dubious maneuvering, economic terrorism, intimidation, propaganda, assassinations, and proxy wars. In short, the Sputnik Program ushered in an era of world-wide geostrategic shifts in public policy—and needless to say, they weren't pleasant. In essence, although we've named the mic "Sputnik," it should be clear that we are in no way endorsing the Cold-War manipulations escalated by any of the major world powers in the wake of the Sputnik Program. Put simply: *we just* like the name.

[Cold-War imagery aside, it's interesting to note that most high-quality vacuum tubes today are made in Russia; by contrast, the 6205M tube used in the Sputnik head amp is actually American-made. The tubes we use were made by Raytheon and Philips originally for use in RF (radio) applications for the US military. So our selection of the name "Sputnik" is further punctuated by this irony.]

Concluding Remarks

M-Audio is committed to developing studio microphones for those who demand the most accurate and true sound. We believe a well-designed mic should be clear and detailed, and should yield recordings that require little or no post processing in order to sound "correct"—which makes *your* job easier and more enjoyable. We encourage you to compare the Sputnik with any other mics on the market, and we trust you'll agree it's a microphone par excellence.

Appendix - Technical Specifications

Type	Large-Diaphragm Multi-Pattern Vacuum Tube Condenser
Capsule	3-micron thick Mylar diaphragm with evaporated gold, double sided; 1-inch diameter
Transconductance amplifier	6205M pentode vacuum tube, wired as a triode, military grade selected
Frequency Response	20Hz – 20kHz ±1dB
Sensitivity	30mV/Pa (-30.5dBV)
Max. SPL for 0.5% THD	132dB (or 142dB with 10dB pad)
Equivalent noise level	18dB (A-weighted)
Output impedance	200 Ω, transformer isolated
Recommended load impedance	> 1 kΩ
Connectors	7-pin male XLR for mic output to power supply; 3-pin male XLR for power supply output
Attenuation and rolloff	switchable 10dB pad; switchable 80-Hz 2nd-order (12dB/octave) rolloff
Polar patterns	cardioid, omni, figure-8
Size/weight	8-1/4" (h) x 3" (w) x 2" (d); 1.6 lbs.

** Above specifications subject to change without notice*

Warranty

Warranty Terms

M-Audio warrants products to be free from defects in materials and workmanship, under normal use and provided that the product is owned by the original, registered user. Visit www.m-audio.com/warranty for terms and limitations applying to your specific product.

Warranty Registration

Thank you for registering your new M-Audio product. Doing so immediately both entitles you to full warranty coverage and helps M-Audio develop and manufacture the finest quality products available. Register online at www.m-audio.com/register for the chance to win M-Audio giveaways.

Instructions for Use

The instructions contain the following:

- Protection against splashing of water / do not expose this appliance to rain or moisture
- Minimum distances to other objects (6")
- Cleaning instructions (wipe with damp cloth)
- Do not install near heat sources
- Do not defeat the safety purpose of the ground plug / proper grounding according to Article 820-22 of NEC
- Protection of the power cord / do not use polarized plug with extension cord, receptacle or other outlet unless the blades can be fully inserted
- Unplug during lightning storms
- Servicing by service personnel only/No user-serviceable parts inside
- Ventilation requirements/Keep unit at least 6" from nearest object
- Mounting requirements/Place on floor or mount securely on desk
- '...apparatus shall not be exposed to dripping or splashing and that no objects filled with liquids such as vases, shall be places on the apparatus...'
- the disconnect device (Plug)shall remain readily operable;
- An explanation and illustration of safety related graphical symbols used on the apparatus shall be included in the owner's instructions preceding any operating instructions

WARNING: This product contains chemicals, including lead, known to the State of California to cause cancer, and birth defects or other reproductive harm. ***Wash hands after handling.***

M-AUDIO Sputnik
FC Tested to comply with FCC standards
FOR HOME OR STUDIO USE

CE VCI N382

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