

# Slate Digital Virtual Microphone System

Microphone,  
Preamp &  
Modelling  
Software

Can this unique combination of software and hardware really recreate the sound of some of the most revered microphones in the world? We put it up against the originals to find out!



NEIL ROGERS

Most hardware components of the traditional recording studio are now available in digitally modelled or 'virtual' plug-in software versions. Pretty much every classic compressor, EQ, analogue tape recorder or effects unit in the history of recorded music is now seemingly available to use in our DAWs with the minimum of fuss. Even a studio's live room can be recreated to some extent, thanks to increasingly advanced room-modelling software and convolution-based reverb. Microphones, however, have been among the toughest nuts to crack. It has generally been considered extremely difficult, if not impossible, to truly model how different microphones respond to any given source, from any angle, in any space.

It's perhaps not surprising, then, that the release of the Slate Digital Virtual Microphone System — or VMS for short — has created something of a stir in the industry. Slate Digital's CEO Steven Slate has helped generate some of the hype, of course, and his highly personalised, ultra-confident marketing style has made him something of a polarising figure in the world of pro audio. Look beyond the hype, however, and you'll see that many people, including me, are regular and enthusiastic users of his ever-expanding range of mix processing tools. Slate are also a manufacturer who aspire to innovate: they were one of the first plug-in companies to embrace an affordable pay-monthly system for their entire suite of plug-ins, and their Raven touchscreen DAW controllers offer a new way of working with our

## Slate Digital VMS £999

### PROS

- Creates believable emulations of some of the classic tube microphone models.
- Relatively affordable package.
- The included microphone sounds good on its own.
- Good-quality case and shockmount.
- Ability to change the microphone model after the recording session.

### CONS

- Ability to change the microphone model after the recording session!
- System is dependent on a decent, low-latency recording setup to work in real time.
- Some minor sibilance issues on some singers.

### SUMMARY

The VMS is a bold new product that can deliver on its promise to recreate the sound of some of the classic microphone models — at a fraction of the price. Whilst not always being completely indistinguishable, the results were always to a good and usable standard. Perhaps of more interest, though, is its potential to change the traditional workflow of the recording process, in ways which could be both good and bad!

computer-based setups.

The Slate Digital Virtual Microphone System claims to precisely model many of the classic large-diaphragm valve capacitor microphones, and some well-know preamps, of the last 70 years. Is the VMS a new frontier for pro audio, then? Or does it represent a step too far for today's digital modelling technology?



When you consider the fact that the whole system comes in at less than £1000, and that some of the microphones in question will set you back more than £10,000 each on the second-hand market, it is certainly not only an intriguing proposition but a bold one.

### Overview

The Slate VMS comes as a package of both hardware and software. Included is a large-diaphragm capacitor microphone, a stand-alone hardware preamp, and the all-important modelling software, which is downloaded from the Slate Digital web site. The software functions as part of their Mix Rack package and allows you to audition the different microphone and

preamp models, both in real time and, significantly, post recording.

The microphone and the preamp are designed to provide a relatively characterless, transparent signal, which the software can then process to add the character of the microphones. This included hardware is key as, unlike a purely software-based system — such as the old Antares mic modelling plug-in — the hardware ensures a known neutral source characteristic with which the software can react.

With crude but obvious pseudonyms for the mics in question, the software is available initially with three microphone options: the FG-47 (Neumann U47), the FG-251 (Telefunken ELA M251) and the

FG-800 (Sony C800g). Slate have since released an additional expansion pack, which adds a number of additional tube-mic options including the Neumann U67 and the AKG C12. Once you have auditioned and selected your mic of choice, you have the option of increasing the 'intensity' of a particular model's character: the software slider ranges from 100 to 150 percent, where 100 percent is the closest emulation, and higher values increase the level of modelled harmonics and valve saturation.

Also included within the software are two virtual preamp options, emulating the Neve 1073 and the Telefunken V76. As well as using these along with the microphone models, you can also record direct into the line input on the Slate preamp, to use these preamp models for a keyboard or direct bass recording, for example.

## Model Behaviour

If the VMS does, or even comes pretty close to doing what it claims to do, then the system could represent excellent value for money, and would bring the sonic characteristics of many of the most coveted microphones in recording history to a whole new group of users. Perhaps most intriguingly, it also has the potential to remove a layer of decision-making in the recording process and potentially add a brand-new one to the post-production or mixing stage. Deciding which microphone to use in a given situation is a big part of a recording session, and the ability to audition microphones after the event has many implications — both good and bad.

Could this kind of technology be another nail in the coffin for the conventional recording studio? Most of



us take advantage of numerous kinds of digital modelling software these days, and whilst many users acknowledge that they perhaps still don't sound quite the same as the real thing, they're content that it's close enough, or sounds good in its own right, and happily embrace the convenience and affordability that software emulations give them.

## Methodology

Rather than just trying it out on a few sessions at my studio, the team at *SOS* decided that this review would be a great excuse to let a group of us out into the wider world and pitch the VMS against some of the actual microphones that it claims to model. With help from the fantastic team at FX Rentals in London, we were able to get access to four of the classic mics that the VMS attempts to model: the Neumann U47 and U67, the AKG C12 and the Sony C800g. I agreed to host the session at my Cambridge-based Half-ton Studios, and in addition to my own ears, those of *SOS* editors Hugh Robjohns, Sam Inglis and Chris Korff were present, as well as regular *SOS* author Mike Senior.

While it's difficult to get too scientific about these things, we came up with a simple system by which we felt we could consistently audition the

respective microphones against their emulations. As different mics could be changed in the software on the Slate VMS, we knew we could keep the Slate microphone in a fixed position in the live room. We would then position each of the vintage mics, in turn, with the capsules as close as practically possible to the Slate's, and record a short vocal performance. We decided we needed to test both a male and female vocal and, while soundchecking the mic with some spoken word, we decided that an additional voiceover-style recording would be a worthwhile addition. We decided to focus the review very much on the microphone side of things, but since I have a Neve 1073 preamp at my studio, we used that for all of the 'real' microphone recordings, and applied the Slate 1073 emulation to all the modelled mic recordings.

## In The Box

Before beginning the session proper, we all had a good look at and feel of what's included in the hardware side of the system. The microphone itself is called the ML-1; it has a good feeling of weight and quality to it, and whilst the all-black styling won't appeal to everyone, it does give it a neutral feel that is not trying to look like any other well-known microphone. Without knowing any details of the ML-1's manufacturing, it looks to me very much like a generic large-diaphragm mic that you would perhaps expect to cost around £300 to £400. The included shockmount feels solid and was easy to use, and the fact it comes with a decent quality hard case is a plus.

## Hear For Yourself!

All the audio files captured in this session have been made available on the *SOS* web site, so you can compare the original microphones with the VMS models. To download the files, head to <http://sosm.ag/nov16media>.



The included preamp, the VMS-One, was OK in terms of build quality, and I found it pleasant enough to work with during the session. Designed to sit on a desktop, the VMS-One has all the basic controls you might expect from a stand-alone preamp: phantom power, input pad, polarity switching, mic/line selection and a large gain control knob.

The system setup is designed so that you route the ML-1 microphone into the VMS-One preamp in a conventional manner. Your signal would then go in to a line-level input on your mixer or interface and then on to your DAW of choice. Reading, and watching, the promotional material for the system, it seems very much intended that you perform 'through' the software and use the emulations in real time. This concerned me ever so slightly, as while the software itself doesn't produce any

latency, you are at the mercy of the limitations of your particular system. In my experience, even small amounts of audible delay can be very distracting to performers, and while there are many setups these days that are capable of operating at very low latency, I suspect there will be some users who will struggle to be able to use the VMS in real time without issues.

For Mac-based recording systems, Slate Digital recommend using the VMS with a low-latency Thunderbolt interface running at 96kHz, with a buffer size around 64 samples, to achieve a latency lower than 2ms. For PC, they recommend a low-latency USB interface ("RME make the best, in our opinion"), or PCIe-based options such as those made by Lynx. In my own studio, I have a Lynx Aurora interface with a PC running Pro Tools 12, at a fairly low buffer size of 256 samples.

With conventional routing, I could still hear latency as I walked through to the live room and spoke into the mic with the headphones on. You could of course just monitor through the mic and then play with the software afterwards, but once you have found a model that suits your voice, this might become frustrating.

With a lot to get through on the day, we decided for the sake of our exercise to not monitor with the mic emulations in real time. We were, of course, fortunate enough to have the real microphones set up, to both monitor with, and to feed to the respective singers' headphones.

### **Neumann U47**

The first classic mic out of its flight case was the legendary Neumann U47. With

the microphone safely positioned next to the Slate ML-1, the first vocalist up was Jules Harding, who we had somehow convinced to be our voiceover artist. I always find spoken word to be an excellent illustration of a microphone's basic character — helped greatly of course by the fact that it stands alone, without any music to mask the subtle nuances.

I've used a U47 a few times before, and in its natural state it doesn't suit every voice, by any means. When it does, though, its rich bottom end, and general all-round smoothness, can be a dream to work with. Jules had a naturally deep and resonant voice anyhow, so it almost felt a bit too 'full' until we got him to back off the mic slightly to reduce some of the U47's generous proximity effect.



With a short 30-second piece captured — and with a gaggle of ever-so-slightly sceptical engineers hovering in the control room — we were able to make our first comparison with the Slate Digital VMS. I left the ‘intensity’ control flat for the moment and switched between the modelled mic and the real one. I would describe the first impressions as pleasantly surprised, rather than jaw-dropping, but it’s important to note that no two U47s (or any other mics of that age) are ever going to sound the same. The term ‘it’s in the ball-park’ was certainly appropriate, though, and the Virtual Microphone System was seemingly doing a pretty good job of capturing the right ‘flavour’. It’s notable that the emulated version was a little brighter than our U47, and this would prove to be a recurring theme.

Cranking up the intensity made things more ‘syrupy’, however, and it also helped fill out the bottom end to more closely match the real thing. It was quite obvious even at this early stage that there wasn’t a huge amount of difference between them, and that the VMS deserved to be taken seriously. Briefly flicking between the ‘flat’ mic and the emulations, it also seemed clear that the software was able to produce dramatically different sounds to the unprocessed ML-1 microphone, with barely any noticeable artifacts.

Moving onto our singers, our male example was *SOS*’s very own Sam Inglis. As Sam often records his voice in combination with him playing acoustic guitar, we decided that this could be a useful test of the system’s ability to model the off-axis sound of the microphones, as benign off-axis sound

is a much-appreciated feature of many high-end microphones. Listening to the real thing first, the U47 wasn’t necessarily a natural choice for Sam’s voice, as it sounded almost too rich and full. It did a great job of softening any harshness and sibilance issues, however, and I was keen to see if the VMS was able to do a similar job. It did, up to a point, and we were impressed with just how close it was coming to sounding like our particular vintage model. Again, playing with the intensity control in the software enabled us to bring the bottom end more in line with the real thing.

However, in the instrumental sections of Sam’s song where only the off-axis guitar sound was captured, there seemed much



more of a difference in tone between the two mics. This does not mean the off-axis sound was bad, just that it was further from the real thing than the on-axis sound.

For our female voice, Grace Kuhl had very kindly agreed to be our test subject for the afternoon and, importantly, she would be singing over a full-sounding pre-recorded backing track. Why is this important? Well, if the VMS can come reasonably close to accurately modelling these mics, then maybe any differences that might remain would be indistinguishable in the context of a full track.

Like many female singers, Grace has a voice that suits a bit of 'airiness', and I didn't think our real U47 sounded all that great on her voice, producing a tone that was a bit dull. This could easily be solved with a little EQ, of course, but in this context I preferred the slight extra brightness of the VMS version. Listening on a pair of headphones, I could detect a few small issues with the lower mid-range balance on the VMS version, and when I added some high-frequency shelving EQ — as I might in a mix — the real U47 opened up in a beautiful way that I felt left the modelled version slightly behind. We are talking small differences

## Special FX

We'd like to thank the excellent pro-audio hire company FX Rentals for the use of their classic microphones, without which we wouldn't have been able to perform this unique experiment.

**W** [www.fxgroup.net](http://www.fxgroup.net)

here, though, and the results with the Slate model were still impressive.

## AKG C12

Next up was the AKG C12, another legendary valve heavyweight and a beautiful mic to see and use first hand. *[It should be noted that the C12 that FX Rentals provided us with had been fitted with a nylon-rimmed capsule, rather than the original brass-ringed type. These do have significant sonic differences, but since for many years AKG themselves fitted C12s with the nylon variant when carrying out repairs, the microphone we used for the test is still arguably an 'authentic' C12 — Ed.]*

Listening to our female vocalist Grace first this time, there seemed much more of a difference to me with this model, in that the VMS felt slightly 'wispy'-sounding, lacking in body and prone to some slight sibilance issues. The real mic, however, sounded balanced and bright, without any harshness, and a couple of members of the SOS team were raving about the 'smooth' top end.

On Sam's vocal, the VMS did a much better job, and, whilst not sounding exactly the same, I would quite happily have used either. The VMS seemed brighter than our C12, which seemed to suit Sam's voice more in this context.

With our voiceover sample, there wasn't a huge amount of difference, with the VMS doing a good job of presenting Jules' voice, with perhaps just a whisper more sibilance than on the real thing.

## Neumann U67

Turning next to the Neumann U67, it's worth starting off by saying just how

much we all liked the sound of the original that FX Rentals had lent us. The main word I can think of to describe the sound is 'balanced'. The way this mic softens the top end of a source is a lovely, lovely thing, and you could dial in plenty of high-frequency EQ before things started getting harsh. Could the VMS get us there at a fraction of the price? Well, although it provided very useable results, I felt that on this particular microphone the differences were greater than with all the others. On Grace, in particular, the VMS 67 sounded more 'tizzy' and sibilant, while on Sam the real mic sounded smoother and more 'whole' in the mid-range area. It's important to note, though, that we were actively looking for these differences, as we were comparing it directly to a seriously good-sounding — and seriously expensive — vintage microphone.

### **Sony C800g**

The last microphone we auditioned was one that I'd never had the pleasure of using before. The Sony C800g is certainly a distinctive-looking beast, with its large fin-like heat-sink protruding from the mic body. Taking in the sound of the real microphone first, we all liked its ability to push the top end of a vocal without getting harsh. It surprised us especially with its ability to offer a different perspective on a performance, and Mike Senior, in particular, was very taken with how it was able to seemingly change the feel of a song.

Superlatives abound, then, but how did the VMS compare? On our voiceover artist, Jules, it did a pretty good job: there was a difference in the lower-mid

region, but with the intensity increased in the software, the difference was reduced. The brightness and general characteristic were close though. On Sam's vocal, we felt that the VMS was doing a pretty decent job of capturing the feel of the mic, although that top-end boost almost felt a bit 'forced' at times. For what it's worth, there was a noticeable difference in the sound of the guitar spill on this recording — again, not good or bad, just different. For Grace's voice, however, the VMS was a little wide of the mark for me. As with the C12 model, the VMS seemed a little hollow-sounding, and that distinctive top end was just not the same, with a small but clear increase in sibilance issues and general harshness.

### **General Observations**

Judging two sounds that are similar can be a highly subjective thing, of course, and it would certainly be interesting to compare some of the models in more of a 'blind' setting. Human nature being what it is, it's also true that if we look hard enough for a problem, we can usually find one. We also all have different things we look for in a microphone, with my ears seemingly being particularly sensitive around the sibilant 4-7 kHz region. It's also worth making the point that in all the recordings we did, the VMS gave results that, at the very least, we felt we could work with.

For me, the U47 was the most accurately modelled, and I felt it did a great job on all of the performances, but the C12 was also very well represented. Across all the models, it was only on Grace's female voice that I felt the VMS was often a little off the mark — especially on the

Neumann U67 and Sony C800g. The intensity control on the VMS software was useful, though, and there was more than one occasion when this enabled a nice amount of control over the emulations' 'body' or 'fullness'.

We were concerned about the system's ability to model a mic's off-axis response, but whilst there were certainly differences in both tone and level with all the mics, it didn't necessarily seem like it would cause any problems in a mix. Listening closely on headphones, there was also a small difference in the amount of recorded

room sound on some of the models, which again points to differences in the off-axis response.

### Virtual Reality?

If you're a microphone enthusiast like me, then I'm sure you'll appreciate what a pleasure it is to get your hands on some of these classic microphones. Everything about them, from the large external power supplies and quirky cabling, to having to let the tubes warm up, gives a sense of gravitas to a session. Part of this, of course, is the visual impact they

## The Sony C800g

The extremely distinctive Sony C800g valve capacitor mic was introduced 1992 and is still in production today, costing around £7600. The design aim was to create 'the definitive vocal mic' with the highest possible sound quality, and it does have something of a unique sonic character which is extremely open and airy, without sounding harsh or emphasising sibilance. The polar pattern can be selected between omni and cardioid via a switch on the mic body.

The impedance conversion circuitry is built around a 6AU6A pentode valve, and the C800g is unique in featuring a built-in thermoelectric cooling system, which accounts for the large rearward projection and heatsink! Based on the Peltier principle, this cooling system has no moving parts or liquid. Instead, a semiconductor material is sandwiched between two metal plates and, when a DC voltage is applied across the material, a temperature differential builds up between the two metal plates. One plate is connected to the external



heatsink and remains at ambient room temperature, forcing the other plate to get cooler, helping to reduce the thermal noise of the electronic circuitry. A two-part aluminium body is designed to minimise mechanical noise conduction to the capsule. *Hugh Robjohns*

have in a live room and, with the older mics in particular, there is a reassuring sense of heritage combined with a curiosity with what that particular mic might have seen and heard during its lifetime. It feels good, even inspiring, and so long as they're well serviced and fully operational, they sound fantastic. If the VMS allows a whole new group of engineers to get close to the sound of these vintage classics, however, then many artists — and the listener, of course — won't care how nice it was for those involved during the recording session! You do, of course, also have to consider the ever-rising cost of these classic mics. At least a couple of the models we tested have gone way beyond the realms of being practically obtainable unless you have plenty of disposable income, or are looking at an investment or collector's item.

So does the Slate VMS system break down some walls for analogue modelling? For a couple of the examples from our recording session I felt that the differences were reasonably significant, with the VMS versions of the Neumann U67 and the Sony C800g being the ones that I felt were a little lacking. There also seemed to be an inherent 'modern' characteristic that remained from the source microphone; whilst certainly not unpleasant, this resulted in a brighter sound that could become sibilant. In the vast majority of our examples, however, the VMS did offer a very believable flavour of the mic in question and, more importantly, I felt I could always happily work with what it was capturing. The fact that six engineers sat debating some of the nuances of the various models after

the session was a testament to just how close these comparisons became!

Stepping back for a moment, though, I've always felt that whilst it is a real treat to use some of the classic mics, the increase in perceived 'quality' is a textbook example of diminishing returns. Once you get past a certain level of microphone, the differences become much more subtle and subjective. In my own engineering work, for example, whilst I can hear, and certainly appreciate, the subtle difference between my own old Neumann U87 and a borrowed U67, I've never once felt like it was holding back a particular recording. However, even the U87 is pretty expensive in its own right now, so the biggest question should perhaps be how the Slate VMS compares against microphones occupying a similar price point. If you're looking to make your first serious mic purchase, or to start expanding your mic options, then it could be a very tempting proposition. Indeed, Mike Senior made a compelling argument when we were discussing this issue, pointing out that for a voiceover studio or small vocal production setup, the VMS could remove the need to have multiple mics for different voices, and would therefore represent excellent value for money.

The VMS sounds good in its own right. So what is of real interest with this new technology is not so much how accurate it is in modelling a particular microphone, but rather how it might change how we work. Whilst it can be a drag auditioning microphones sometimes, it is a big part of the craft of studio engineering. Do you really want to have the ability to change the microphone during the mixing stage?

We have so much choice now with mixing software that maybe one more option might not make that much difference, and it could even become a much more creative part of the process. It could also make our lives easier regarding accurately matching a mic to a voice, meaning the need for less consequent mix processing.

### Conclusions

I suspect for many engineers, particularly those who own some nice microphones already, a 'virtual microphone' will be perceived as a step too far. Looking at the package as a whole, though, you are getting a good-sounding large-diaphragm capacitor microphone and preamp for your money as well as the software, and Slate Digital have obviously been careful to make sure the capsule and associated electronics are of a certain standard, or the system just wouldn't come close to working.

I would describe the preamp component of the system as functional, while the all-important modelling software really is quite good. It's not always indistinguishable from the real thing, but at times it gets you frighteningly close, and in the context of a mix, or on less than stellar monitoring, you'd be hard

pushed to tell the difference. In my own studio, I can imagine using the VMS in a complementary fashion, alongside my other microphones, and it could open up some creative post-production options with backing vocals and the like. For some projects, you could perhaps also use the VMS as a mic-matching tool at the pre-production or demo stage, with a view to possibly hiring the real thing for a few days of key vocal tracking.

These are interesting times we live in, and the VMS certainly sounds good enough that I'd be very surprised if there wasn't more to come from this type of technology over the next few years. Whether this idea is exciting or horrific to you — delete as appropriate — it's going to be fascinating to see how things develop, and whether serious numbers of people embrace this new way of recording and mixing. All the audio files from our session are available on the *SOS* web site, so why not have a listen for yourself and see if you can hear the difference?

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## The Neumann U47

The U47 was the first capacitor microphone to be launched by Neumann following the company's relocation to Berlin after the Second World War in 1947. As with many other Neumann microphones, its model number derives from the year of its conception, although it wasn't officially launched until 1949. Today, good-condition U47s can change

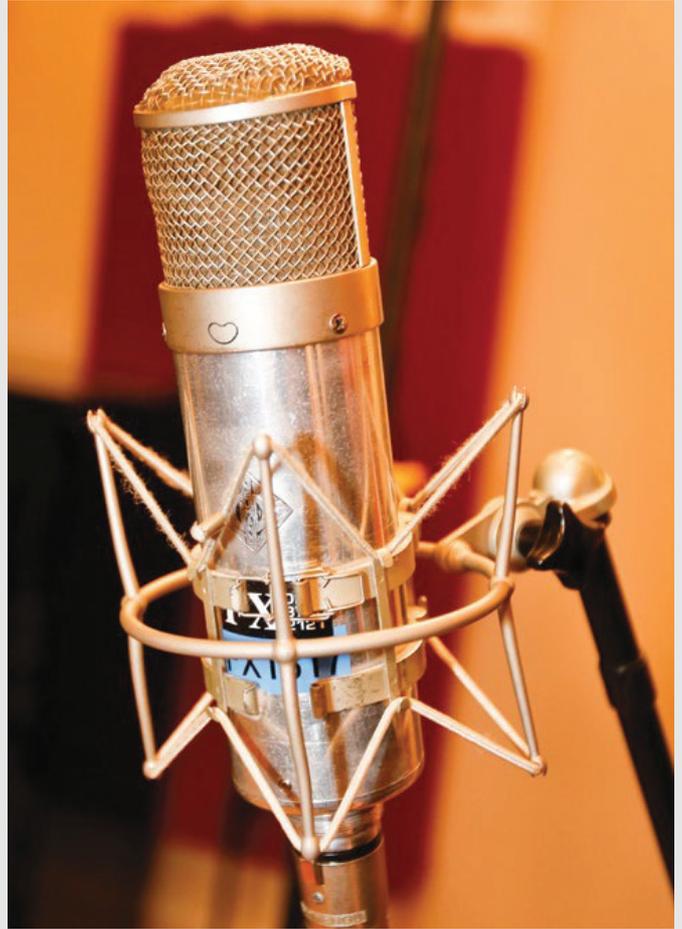
hands for in excess of £10,000.

As the world's first commercially-available, switchable-pattern capacitor mic, the U47 was a ground-breaking product. Although it originally used the same M7 capsule that was developed for Neumann's pre-war CMV3 microphone — a twin-diaphragm, centre-terminated

design with PVC diaphragms — it used the capsule in a revolutionary new way. Whereas the rear diaphragm was left disconnected in the CMV3, bestowing a fixed cardioid polar pattern, a switch just below the grille of the U47 allowed the rear diaphragm to be polarised as well, enabling the user to switch between a cardioid or omnidirectional polar pattern.

From 1956 the capsule was redesigned to use more stable polyester diaphragms and was consequently re-named the K47/49, but it was still fundamentally very similar to the original M7 capsule. Specifically, it was a one-piece design with a shared middle electrode — an approach which made it difficult to match the tension of the front and back diaphragms, and thus made the omni pattern rather variable between production models. A sister microphone called the U48 was launched in the mid 1950s, offering the user a different choice of polar patterns switching between cardioid or figure-of-eight, the latter achieved by subtracting the output of the rear diaphragm from that of the front.

The microphone's impedance converter was built around a Telefunken VF14 pentode valve operated as a triode, but by the late 1950s Neumann were the only remaining customers for this particular design and so Telefunken ceased its production. Naturally, Neumann searched for a suitable replacement valve and released the U47N model in 1962, with a Nuistor valve, but the sound character was not the same and the U47 was finally withdrawn in 1965 — officially replaced by the U67 model.



Throughout the 1950s the worldwide distribution of Neumann mics was handled by Telefunken. The company were also allowed to rebrand the mic in the USA as the 'Tele 47', and it was in this form that the U47 quickly usurped RCA's ribbon microphones as the studio standard. This is why one of the best-known vocal artists of the period, Frank Sinatra, often referred to singing into his 'Telly' mic — meaning the rebadged Neumann U47.

A solid-state version of the U47, using exactly the same K47/49 capsule, was introduced in 1969, called the U47 FET, but while it had many excellent qualities and has gone on to become an iconic microphone in its own right, it had a different sound character to the original valve U47. *Hugh Robjohns*

## The AKG C12

One of the most highly regarded microphones from Austrian manufacturers AKG is the original C12, introduced in 1953 and remaining in production for a decade until 1963. Its CK12 edge-terminated twin-diaphragm capsule is often claimed to be the finest capacitor microphone capsule ever designed, and it actually operates in a fundamentally different way to the Neumann M7-based design (the AKG system relying on a resonator design while Neumann capsules employ an 'aperiodic' concept). In fact, the CK12 capsule evolved quite a lot over the years, with different diaphragm materials

(styroflex or mylar) and thicknesses (10, 9 or 6 microns), and changing dimensions of the back-plate chamber (in an effort to increase sensitivity, but with the side-effect of an increased HF response which became a key characteristic of the C12 sound).

The microphone itself was also constructed with different output transformers over the years, too, although it always employed a 6072 double-triode valve as the impedance converter. Consequently, there are probably more variations of AKG C12 than any other vintage production microphone.

Nevertheless, the CK12 capsule went on to form the basis of the classic C414 microphone and it has inspired the design of many of AKG's large-diaphragm capacitor capsules ever since. An original C12 microphone in good condition today can cost around £12,000.

One of the unique aspects of the C12 at the time was its provision of nine switchable polar pattern options rather than just two or three! However, the



pattern couldn't be selected from the microphone itself; instead, the mic was connected to a bespoke power unit (called an N12), and another multicore cable ran out to a dedicated remote control box called the S12 which also provided the audio output connection. A huge rotary switch on the S12 box selected the desired polar pattern, allowing decisions to be made and auditioned from the control room for the first time.

AKG released a re-issue version of the C12 in 1994, called the C12VR. However, while this also employs a 6072 valve for the impedance converter, both the capsule construction and electronic circuitry are significantly different, and so too, therefore, is the sound character.

Bizarrely, there is a tenuous connection between the AKG C12 and the Neumann U47. In the late 1950s Neumann managed the worldwide distribution of their own microphones, leaving Telefunken

without the hugely successful U47 as their flagship studio capacitor mic. Consequently, Telefunken commissioned AKG to produce a bespoke version of the C12, but with a simplified polar pattern selector on the microphone itself.

The result was the Telefunken ELA M 250E, with cardioid and omni pattern options, and it was built into a slightly fatter body than the original C12 to accommodate the extra switching and circuitry. Inevitably, the new simplified circuitry, different internal construction, and different head grille shape and size contributed to a noticeably different sound character compared to an original C12, but it was a superb mic in its own right and a subsequent variant called the ELA M 251E, with a third figure-of-eight polar pattern option, became hugely popular and very well known in America. Siemens marketed OEM versions of the ELA M 250 and 251, called the SM203 and SM204, in Europe. *Hugh Robjohns*

## The Neumann U67

When warned of the impending obsolescence of the Telefunken VF14 valve, Neumann set about developing a new microphone to replace the U47 and, starting from a clean sheet of paper, the company's engineers took the opportunity to introduce several significant engineering improvements. The most obvious evolution was to the microphone's shape, introducing the iconic conical body and chisel-head grille to appeal to a far more style-conscious 1960s market.

One of the most important changes was to redesign the way the capsule was constructed, building it as two separate,

self-contained halves which could then be bolted back-to-back. This form of assembly was not only much simpler, but crucially it made it far easier to match precisely the diaphragm tensions across a batch of capsules. The resulting twin-diaphragm, centre-terminated capsule was christened the K870/67, using polyester foil diaphragms sputtered in gold. Apparently, this innovative design has become the most copied capsule in the world today!

The impedance conversion circuitry was also substantially more advanced than that of the U47. Based around a Telefunken EF86 pentode, wired

again as a triode, a tertiary winding on the output transformer provided negative feedback to improve distortion, and a steep roll-off below 30Hz was implemented in the grid circuit to help prevent low-frequency overloads due to wind, pops, vibration, and so on.

Also, instead of needing separate mics to obtain different polar patterns, the Neumann engineers built in the ability to select cardioid, omni, or fig-8 polar patterns via a switch just below the grille. Two more switches enabled a 10dB pad and a high-pass filter — options made necessary by the growing popularity of close-miking techniques, to prevent overloads and control the proximity effect.

Since this all-new microphone was designed and introduced in 1960, the first production batch was launched as the U60. However, Neumann's US distributors at this time, Gotham, persuaded Neumann to change the model name to the U67 to capitalise on the great success and popularity of its predecessor, the U47. The U67 microphone remained in production from 1960 through to 1971, and there was a limited-edition reissue in 1993. Original U67 mics in top condition can change hands today for as much as £12,000.

A solid-state replacement for the U67 was introduced in 1967 but, as the '67' model name was already taken, this new microphone was christened the U87 and has become arguably the best known of all Neumann mics. In fact, the U87 was amongst the first phantom-powered microphones introduced by Neumann, but the relatively low operating voltage this provided required a slightly different capsule construction, known as the K87



However, a sister microphone, introduced the following year and called the U77, operated on a 12V AB-power system and so needed a DC-DC converter to generate a sufficiently high capsule-biasing voltage, allowing use of the U67's original K870/67 capsule. When the U87 was re-engineered in 1986, the internal battery section of the original design was removed and a DC-DC converter incorporated, allowing the U87 Ai model to revert to using the K 870/67 capsule as well.  
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