FEL MICBOOSTERS

Low levels from your microphones? Perhaps they could do with a little help. Chris Woolf MIBS reviews the phantom-powered FEL MicBoosters.

Ask half a dozen people in our line of business about 'Line level' and the answers will probably include 0dBu, PPM4, +4dBu, -18dB FS and a few other magic numbers. They may not be wholly accurate but they won't be too far adrift in terms of the analogue voltages they normally match up to. Ask about 'Microphone level' and you can expect a much, much wider range of answers.

Microphones are typified by the level in millivolts that they generate in response to a sound pressure of 1 Pascal (mv/Pa), which equates to 94dB SPL – a loud shout very close to you. Old-fashioned dynamic mics may well have a sensitivity of no more than 1mV/Pa (sometimes less), which puts 'Mic Level' at around -58dBu. A Sennheiser MKH416 (25mV/Pa) subjected to the same acoustic sound level would generate something nearer to -30dBu.

Of course this is merely a useful reference level. With normal speech at perhaps 60dB SPL the MKH416 would only produce -64dBu (0.5mV), and the dynamic one will be down at -92dBu and struggling to produce 20µV. At the opposite end of the scale, say 120dB SPL (the Threshold of Pain but by no means the loudest sounds we meet in recording situations), the dynamic is generating a healthy 20mV (-32dBu) while the MKH416 is trying to fry the preamplifier input with -4dBu (nearly half a volt), which we might deem to be more akin to 'line level.' So typical microphone levels are … just not typical. They can vary over an enormous range.

Toothpaste

Volts are not the only consideration: impedance also plays a significant role. The music world more often interprets this term as a knob on an amp that makes the mic sound different. The broadcast world is still convinced that it is something you 'match' to make the mic sound better. Both are nonsense – impedance is the hole in the end of the toothpaste tube that governs how hard it is to squeeze the stripy stuff out.

Being able to squeeze plenty of current out is a good thing for a source of electrical energy or signals – low impedance. By contrast making it difficult to squeeze much current *in* to an input (high impedance) and therefore being able to develop a moderate voltage across its terminals (as Ohm's Law dictates) is a good thing for the destination (load) impedance of, say, a microphone amplifier. And if the difference between the two is substantial then the effect of any cabling in between is minimised.

The other source of electrical energy that is relevant to this review is phantom power. Batteries, nuclear power stations and phantom supplies all have source impedance too, and Georg Ohm's Law (formulated to deal with the flow of electricity rather than toothpaste) applies just as much to them as it does to microphones. For P48 phantom power the source impedance is moderately high (a pair of 6.8kΩ resistors in parallel) so only a limited current can be squeezed out. The maximum allowed is just 10mA and for maximum *power* (V x mA) you can work out that it reduces to just 7mA. This is because for every mA drawn the voltage at the output terminals of the supply goes down.

FEL MicBoosters

The relevance of this brisk physics lesson will become clearer when we take a closer look at the FEL Communications MicBoosters. FEL makes use of the services of Nick Roast and Laurie Taylor – both IBS members and BBC sound supervisors – who have been marketing a range of related products for some while. Close communication with FEL proved useful for sorting out some measurement quirks and confusions, and I suspect that ordinary customers would get similar prompt and helpful service. But lest anyone think the relationship between FEL and the reviewer might be too cosy let me declare that I asked to look at these devices because I was not entirely convinced that good performance could come at so little power cost. As always, I treated the devices

entirely fairly but with the eye of a sceptic rather than a believer. *[We would expect nothing less of our Line Up reviewers – Ed]*

There are two basic versions of MicBooster; a Mini which is a minimalist square-section XLR-barrel (there is also a long-nosed variation to allow direct plugging into a mic), and the MB-1 which sits inside a chunky extruded aluminium box. The Mini is electronically interfaced and has a fixed gain of 20dB: the MB-1 uses transformers back and front, and is switchable between 20, 30 and 40dB gain. The Mini offers no opportunity for remote meddling at all because there are no controls. The MB-1 offers more gain options, a phantom-present LED, and the benefits (and defects) of transformers, but at the cost of a lot more bulk. The construction of both is to a high standard. The housings are solid enough to survive several years of rugged OB use intact, if not unscarred. The PCBs and internal construction are excellent; the connectors are Neutrik and the MB-1's transformers are made by Sowter. The MicBoosters are as robust and stolid as many of their potential users, but the interesting thing about both is the powering from the P48 phantom input that they plug into.

The great advantage of this is simplicity and reliability: if the mic input is connected so too is the power supply. There are no batteries to fuss about and no risk of an external supply being switched off. The disadvantage is that, as indicated above, a phantom supply is far from generous and low noise, high headroom and good bandwidth do not come easily with minimal power. FEL is very aware of this dilemma, and their instructions and spec sheets make the limitations perfectly clear. The maximum specified signal *output* for the electronically balanced Mini is -10dBu, and for the transformer-coupled MB-1 it is 0dBu. At the other end of the range is noise.

Sshh!

Noise in mic amps is measured as Equivalent Input Noise or EIN – the level of hiss and burble that you get out of the amp with its input terminated in a stated resistor when added to the gain of the amp. A perfect amplifier sees only the thermal noise associated with the resistor, a real one always adds some of its own; and because most of the noise happens in the earliest stages the EIN figure for low gain amplifiers tends to be poorer than it is for high gain ones. Some 60dB mic amps boast a figure close to -129dBu (arguably the maximum theoretically possible) but the low gain, low current Mini only claims -115dBu and the MB-1 -120dBu (at 20dB gain).

This, then, sets the context in which these amplifiers can be used successfully. For the Mini the signal needs to be within the range of -115 and -30dBu, giving a dynamic range of 85dB. For the MB-1 it needs to be between -120 and -20, -30 or -40dBu (depending on the gain setting). With 20dB of gain, that gives a dynamic range of 100dB while for 40dB gain the dynamic range reduces to only 80dB. Remember these figures are noise floor to signal peak, where a typical microphone might give nearer to 120dB dynamic range. So the MicBoosters are not intended for use on every occasion or for lifting a mic to line level. What they *are* good at is boosting the output of a mic sitting at the end of a long (and far from noise-free) OB cable. Or for lifting the level of a low-output mic into a mixer or recorder that has inadequate gain – some so-called mic inputs barely manage 40dB. The intention is that the booster is placed at the distant end to lift the low level signal above any (elevated) noise floor. For this they are undoubtedly successful – the proof being that there are a goodly number already in professional use.

The output impedance of the MB1 is an excellently low 30Ω and the Mini is a perfectly acceptable 150Ω. This is particularly good news since nominal gain can be 'helped' by increasing output impedance but at the cost of being unable to squeeze useful current through a long length of cable. Both devices should be able to drive several hundred metres of balanced cable and, together with any normal microphone preamplifier input impedance, the effect of the intervening cable should be negligible.

When thinking of likely applications for the FEL preamps, sports effects mics and wildlife recording scenarios will spring to everyone's mind, and in general these situations do not

Test Measurements

The measurements below apply to individual samples and are probably typical. The frequency response specification of the MicBoosters is given as 20Hz to 20kHz, but the plots are extended to 16Hz and 25kHz to show the shape of the slopes.

Noise – EIN

	MB-1 +20dB	MB-1 +30dB	MB-1 +40dB	Mini	3.5mm Series
RMS	-121dBu	-125dBu	-128dBu	-116dBu	-108.5dBu
CCIR unwt	-117dBu	-122dBu	-128dBu	-108dBu	-105dBu
CCIR wt	-110dBu	-115.5dBu	-119dBu	-104.5dBu	-107dBu

Conditions for the MB-1 and Mini are with phantom power measured as 47.74V (from IEC 61839 compliant source), load impedance >5KΩ, and no phantom load. For 3.5 Series the plug-in power supply is 5V via a 2.2kΩ source resistance.

demand vast dynamic range. With electrodynamic microphones there is little risk of overloading the boosters, but since these units pass on phantom power they can also be used with electrostatic mics too. Here more care does need to be taken. Max SPLs of 90 to 100dB (not unduly loud as a peak) are enough to overload the Boosters with averagely sensitive capacitor microphones. Of course, under these conditions there would probably be no need for a booster anyway, so this is more a case of wise application than a product warning.

The Phantom of the Operator

Being both phantom powered and able to pass on phantom power to the microphone (a selectable option on the MB-1 which is useful when working with ribbon microphones) is a clever trick but, again, not without a few limitations. The MB-1 necessarily draws a current and therefore the nominal 48V at the mixer XLR is dragged down to about 42.5V in normal use. But add a phantom powered mic and the volts drop considerably more – typical phantom current is usually within the range of 2-4mA nowadays. With a 3.5mA load (a Røde NTG1) it can be about 32V and the performance of the amp can suffer a little in terms of peak level as a result. The exact figures depend to an extent on individual component variation, but with what seems to be a representative sample, the limit (no additional phantom load providing 42.5V to the FEL preamp) was actually nearly 9dBu (better than spec) before significant distortion set in. If a phantom powered mic was attached, dragging the supply rail down to 32.5V, the peak level was barely -3dBu.

The performance of the FEL Mini is slightly different since it employs a technique of automatically adjusting its current demand, but the results are broadly similar.

One important caveat is that many capacitor microphones used with the FEL preamps will be working outside their theoretical specification. The DIN 45 596 standard quoted in the manual is extremely old and allowed a maximum of just 2mA. The current standard is IEC 61938 and allows up to 10mA – but with a specified tolerance of 4V for P48. This means that the phantom output available from the FEL units will always be technically undervoltage for P48 mics (though not P12-48 versions). In practical terms this is unlikely to be a problem with fully-compliant phantom supplies but the phantom supply quality and the likely current draw of a mic will need to be checked rather than taken on trust. Some mixers and recorders in professional use are known to have problems supplying rated current to a full house of hungry microphones.

Mint Flavour?

So do the MicBoosters perform? Yes, it seems so. Even under some firm squeezing (from the bottom of the tube, of course) they squeaked pretty sweetly. The actual test results are shown in the sidebar but they come satisfactorily close to the written spec. The frequency response of the MB-1 is slightly hampered by having transformers, but not to an extent that should be of any concern. The Mini's trace resembles a steamrollered toothpaste tube! These tests intentionally included some out-of-band frequencies to show any problematic behaviour, but there was nothing unexpected. Noise and overload points were close to those predicted in the specifications. Noise measured with a quasi-peak rectifier inevitably gives less attractive numbers but also shows nothing untoward that might have been hidden by the RMS readings. Distortion was extremely low (<0.1%) for all levels until close to the onset of clipping, when it rapidly increases. All told, the Boosters have a good, strong mint flavour.

The MicBoosters are not a panacea, and do not pretend to be. Both can solve some typical problems met in broadcasting and other situations where inadequate gain or excessive noise may present problems with using microphones. They need to be used intelligently with due regard for the restrictions in terms of actual mic levels and likely dynamic range, and with the likely power budget for the P48 lines. But given all that, this sceptic is convinced – they are undoubtedly useful tools that deliver more than one might reasonably expect.

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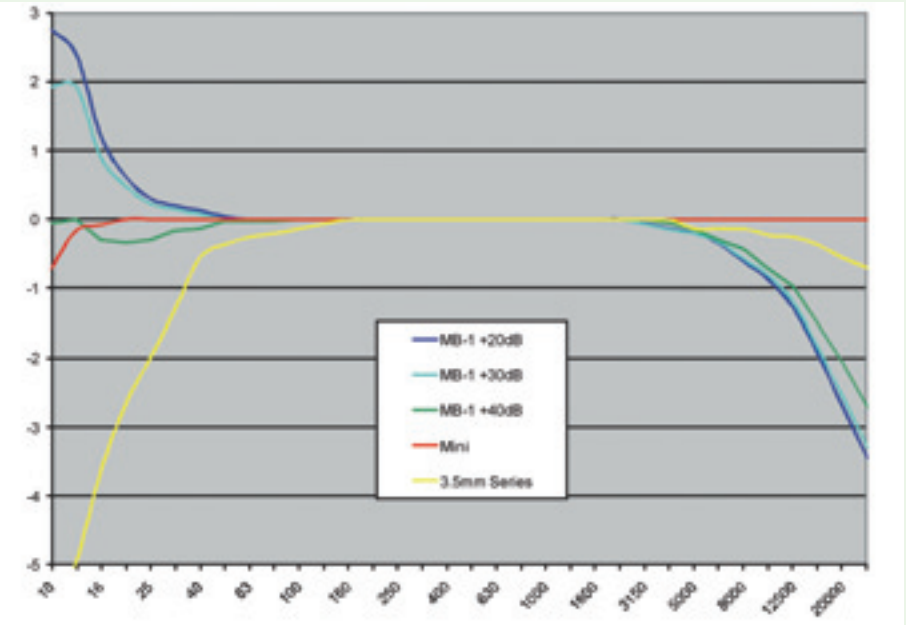

3.5 Series Plug-In Power

FEL's range also includes microphone amplifiers for use with consumer recorders that provide plug-in power. These obviously will not work with phantom powered capacitor mics but can allow the use of low-output dynamics with simple recorders that provide only limited (and possibly noisy) mic amp gain.

A mono version comes housed in a standard Neutrik XLR with a 3.5mm jack plug on a short tail. Plug-in power is even more limited than P48 so the actual performance of the (unbalanced) 3.5 Series Booster is extremely creditable. Results are shown in the sidebar. Other versions include boosters for 3.5mm stereo electret mics, and for stereo dynamic or self-powered mics.

Contacts

FEL Communications
www.micbooster.com

MB-1	£179 (mono)
MB-1s	£359 (stereo)
Mini	£ 99 (mono)
3.5mm Series	£76 to £142 depending on model

All prices exclude VAT