MSX 4

Active Microphone Splitter

Dynamic Microphone behaviour

Everyday dynamic microphones are broadly assumed to have an impedance around 250 ohms. In reality, the impedance of many widely used microphones fluctuates widely at resonant points across their frequency range, up to 2500 ohms (over 10 times higher) and down to 50 ohms*, or one fifth of the nominal. These impedance fluctuations aren't a problem when microphones are plugged into a single mixer, presenting a load that's close to the 1200 ohms specified for most microphones.

The trouble starts when more than one mixer needs to be connected across each microphone. As soon as a monitoring console is added across the F.O.H. mixer, microphone loading drops to 600 ohms (fig.1). When additional mixers are added for recording and / or broadcasting, the loading falls further, down to 300 ohms when 4 mixers' inputs are connected. The load impedance seen by microphones is often even lower at high frequencies, above 5kHz, due to the capacitance of many metres of multicore cable, and also the RF filtering capacitors inside each console

*eg. some models by AKG, EV, Shure and Sennheiser.

How excess loading affects Microphones.

The extra loading of multiple mixers has two effects: First, it reduces the microphone's output level by

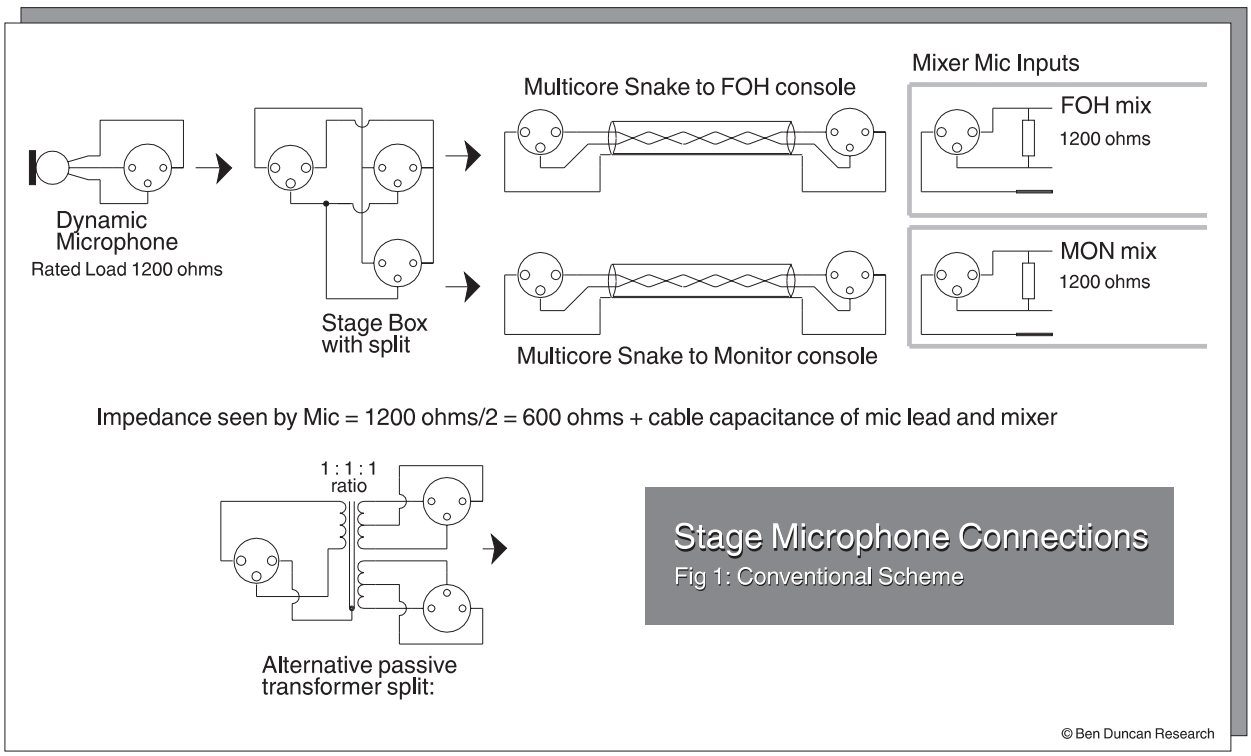


FIG.1: As soon as a monitor console is added, the microphone's loading impedance is halved.

between 3 and 6dB. This isn't much of a problem by itself, but if any of the mixers is for some reason unplugged or switched from 'Microphone' (1200 ohms input impedance) to 'Line' (10k bridging impedance), this sudden change in microphone level can trigger feedback / howlround in the PA system, requiring some frenzied adjustments.

Second, and more important perhaps, the microphone's frequency response is changed. At the microphone's resonant points, the response (with loads below the rated 1200 ohms) may dip or peak by several extra dB, causing a substantial change in the way the microphone sounds. This upsets the engineer's judgement as to which microphone to use, and requires extra EQ'ing effort in an attempt to recover the intended sonic characteristics.

Because the response changes can involve changes in quite sharp dips and peaks, not many console EQ sections will be capable of fully or satisfactorily compensating the results of the microphone's excess loading. Again, if the 'Microphone / Line' settings of any of the 2,3 or 4 mixers across the microphone are subsequently changed, the frequency response will be upset, possibly causing howlround, and certainly causing the microphone's sound to change again, requiring further EQ'ing. Even without Microphone / Line switching, level and tonal changes can occur when pad switches are operated, as in some consoles their setting significantly alters the input load impedance.

Overall, as the PA crew have little control over what broadcasting and recording engineers do with the consoles in their trucks, this explains why broadcast and recording link-ups are regarded with some trepidation...

Why Microphone Splitter Transformers don't help.

Microphone 'splitter' transformers are commonly employed when microphones are connected to more than one or two mixers. They usually have 1:1 ratios, eg. 1:1:1:1 for a three-way split. It's a common belief that they alleviate the mixers' loading effects. This however is wrong, unless the transformer is combined with active electronics.

Usually for reasons of cost, splitter transformers are stand-alone, passive devices. If so, they can only apportion the microphone's impedance equally between the mixers, ***exactly as would happen without the transformer!*** Splitter transformers are still useful, as they galvanically isolate the grounds breaking potential loops, and also restricting the potential for damage and death if any circuits are accidentally connected to the mains power. However, Ground isolation can be achieved more cheaply by breaking shield connections with switches, or using low value resistors for a "soft float".

Since good transformers are highly expensive, and more affordable transformers will always add significant frequency response, phase and distortion aberrations of their own, it's really best to avoid them unless galvanic isolation is essential for safety, for example, in outdoor events where wet weather is possible, or where insurance requires it.

Benefits of an Active Split

Because an Active Microphone Splitter makes each feed immune to changes caused by the loading presented by additional mixer connections, one of its psychological high notes is that harassed live sound en-

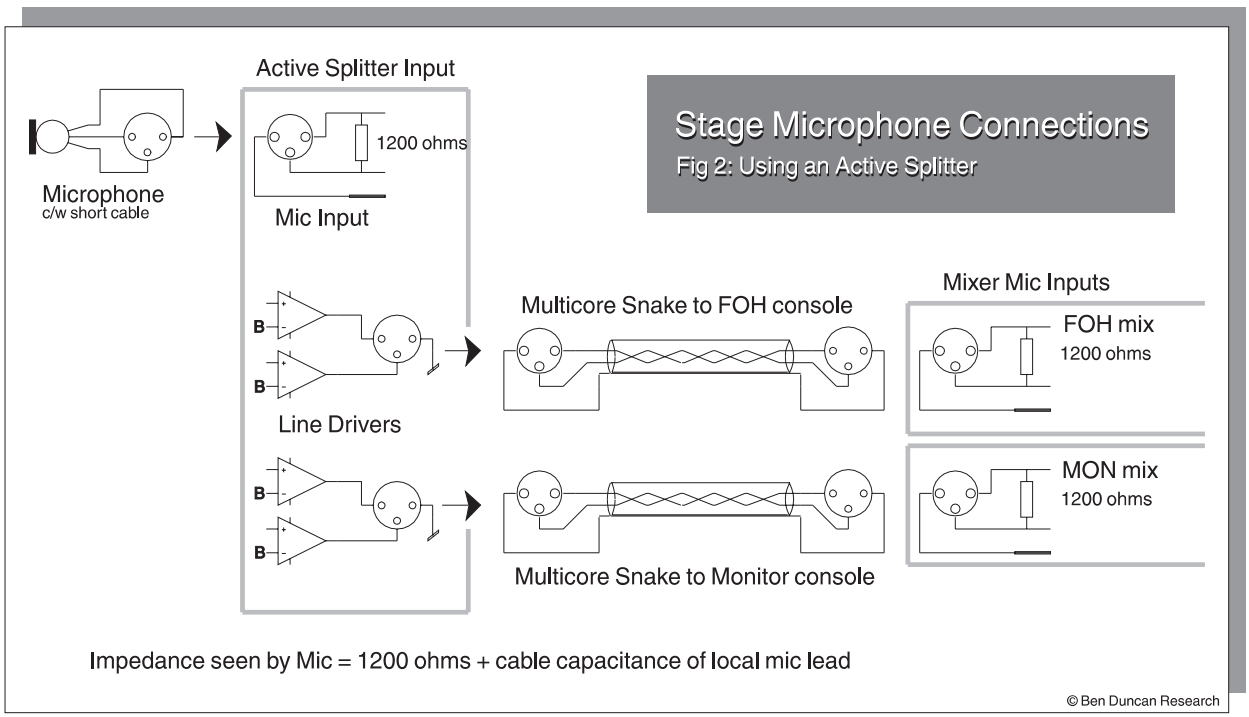


FIG.2: An Active Microphone Splitter allows several consoles to be used without affecting microphone loading.

gineers can quit worrying about the mobile truck !

Use of an Active Microphone Splitter close to the microphones also improves sound quality - on at least 3 counts:

First, each microphone's signal level is brought up to line level ***before*** it has travelled away from the stage, so the signal level rides 10-20dB higher above hum, RF hash and signal breakthrough that gets picked up along the main body of multicore cabling.

Meanwhile, the noise level (or S / N ratio) of the microphone splitter is as good as the best console microphone inputs.

Second, pickup in the multicore is typically reduced, particulary at RF, as the Active Microphone Splitter's output impedance is much lower (at 50 ohms) at all audio frequencies and up to 1 MHz and above, and is more consistent than any dynamic microphone.

Third, by avoiding the complex loading effects of multiple consoles, each microphone's frequency response and sonics are improved - back to what the maker intended - and less EQ'ing will be required.

Finally, passing microphone signals through transformers (with their well known transient, phase, amplitude and distortion aberrations) can be avoided in most cases.

It's not a complete 'win-win' situation, though, and a possible downside of Active microphone splitting, compared to Passive splitter boxes, is a higher risk of unreliability, since a mains power supply, and also more parts, are required.

But, by using ***two*** Power Supplies in tandem we have effectively a second, 'redundant' power supply which will cut-in instantaneously if the first supply goes down. This successfully overcomes the first objection. Meanwhile, the extra parts are all low power, small-signal, high quality electronics, certainly no less reliable than the microphone amplification in premium mixing consoles.

Inside the ARX MSX4.

The ARX MSX 4 microphone splitter contains high quality components in a carefully considered signal path. This provides Dynamic microphones with a constant, ideal 1200 ohm load, irrespective of whether the pad switch is in or out.

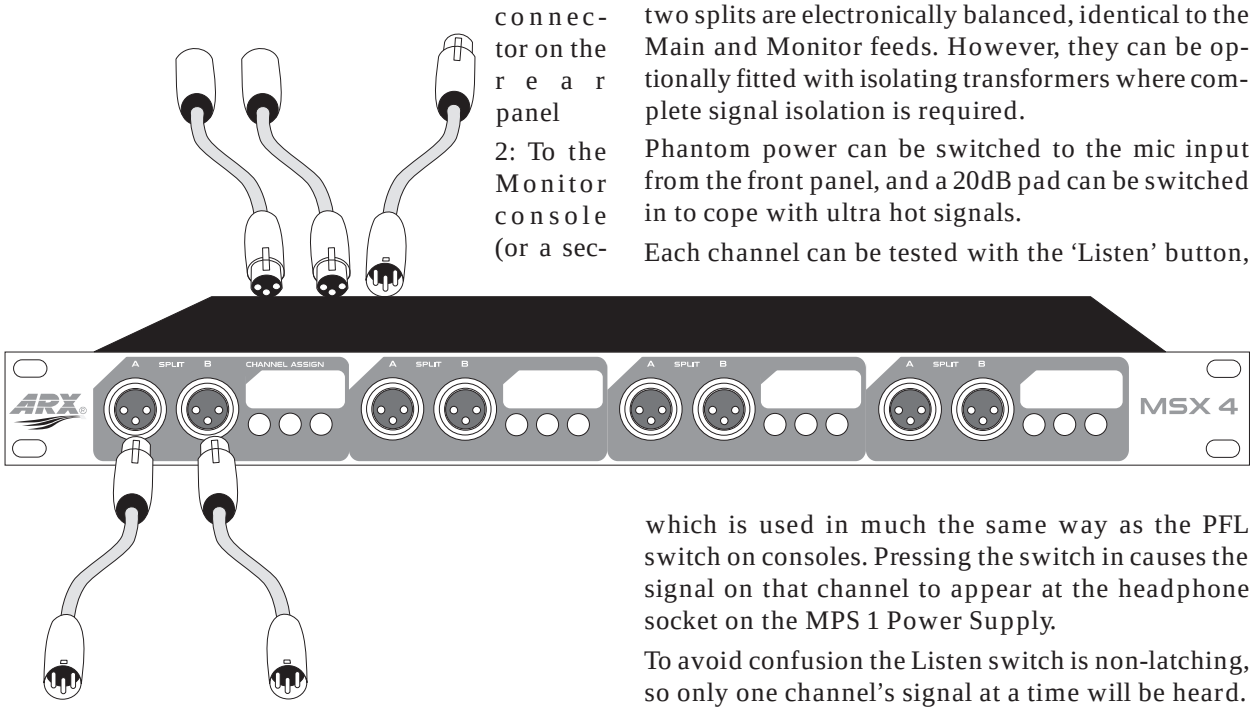
And, unlike many consoles, the switchable Phantom power is applied in a way that prevents speaker and nerve destroying bangs and clicks.

Powerful RF input filtering removes both common-mode and differential nasties at ultrasonic frequencies and above. High common-mode rejection at the input is achieved with precision fixed parts; there are no vulnerable trimpots. Similarly, independent differential outputs have been specified to avoid the need for fussy output CMR trimming, required in conventional, cross-coupled balanced drivers. Without the latter's feedback based topology, sonics are vastly improved.

Connecting the MSX 4

The original signal from the microphone is connected into the Input connector on the rear panelof the chosen channel. From there it can go any or all of four separate ways.

1: To the main Front of house console, out of the Main connector on the rear panel



2: To the Monitor console (or a second Main console) out of the Monitor connector on the rear panel

3: To either of the two front panel splits, for connection to remote trucks, OB vans, recording feeds, press feeds, etc. In normally supplied configuration these two splits are electronically balanced, identical to the Main and Monitor feeds. However, they can be optionally fitted with isolating transformers where complete signal isolation is required.

Phantom power can be switched to the mic input from the front panel, and a 20dB pad can be switched in to cope with ultra hot signals.

Each channel can be tested with the 'Listen' button, which is used in much the same way as the PFL switch on consoles. Pressing the switch in causes the signal on that channel to appear at the headphone socket on the MPS 1 Power Supply.

To avoid confusion the Listen switch is non-latching, so only one channel's signal at a time will be heard.

MSX 4 Options

The two front panel splits are available with isolating transformer balanced outputs if required. Ideally these should be installed at the time of ordering the unit(s), but they are available as a retrofittable kit. Contact ARX directly or the dealer at your point of sale for further information on obtaining a tranformer balancing kit. The kit has complete details on the installation, testing and ground lift wiring of the transformers.

Note: A reasonable amount of technical knowledge is required for this retrofitting, so we recommend that it be done by a qualified technician

The internal gain of the MSX 4 is set at +10dB. This is the optimum figure for obtaining the best signal to noise ratio. However, for applications that require the internal gain to be unity, contact ARX directly for the technical application notes.

Note: Once again, a reasonable amount of technical knowledge is required for this change, so we recommend that it be done by a qualified technician

Power Connections

The MSX 4 is designed to be used with the MPS 1 Dual Power Supply only. This unit has two completely independent power supplies inside, and both 6 pin connectors should be connected to the MSX 4 with the supplied leads.

If more than one MSX 4 is being used, then the MPS 1 should be connected as the following diagram shows.

IMPORTANT

Check that the AC Power at the wall is in the same voltage range as that printed on the fuse holder doors, before connecting the MPS 1 to the AC supply.

Application Notes by Colin Park and Ben Duncan