

What the fields mean

The specifications

One of the central tenets of this CD-ROM is the presentation of manufacturer's data in a common format to allow valid comparisons. For dimensions and many other specification categories this is quite straightforward but for those such as Noise and Max SPL (Sound Pressure Level) some caution is necessary. There are several august bodies who have set out ideals of measurement and layout of data to simplify this but unfortunately commercial companies tend not to adhere to these and we have to work within those constraints. It is certainly possible to reach useful conclusions from the published data in this CD-ROM but readers must not relinquish their critical faculties – it is equally possible to be misled.

For the trickier data categories the method of preparing the specification, the philosophy behind the method, the accuracy of any measurements, and the tolerance with which the results are stated, are crucial. If a serious and detailed comparison between products is required it cannot be overemphasised that the reader *must* check the original sources and discover how the manufacturers derived their figures. They should also check the specific definition of terms such as Signal-to-Noise Ratio and Dynamic Range which are by no means consistent between companies or even products.

Frequency response

The Frequency Response field is designed to allow the manufacturer to show the range over which the microphone is intended to be used. It should be noted that not all microphones are intended to have a flat response. Pressure gradient microphones for close use may have heavily tilted response curves to compensate for expected proximity effects, just as others for general speech and vocal use may have intentionally peaked mid/high frequency curves.

There is an (optional) tolerance figure that should be read in conjunction with the frequency response graph. Very good devices may be specified to have a deviation from the published curve of only ± 1 or 2dB, some may have a looser figure. Where no tolerance is given there may be an implied ± 3 dB, or it may indicate rather more erratic behaviour that a manufacturer would prefer not to declare. A device with an unambitious declared response of 40Hz - 16kHz but specifying a tight tolerance of ± 2 dB may well be superior to one with a vaguer claim of 20Hz to 25kHz. Pairs of microphones for stereo use should be selected to have close tolerances – and ideally track each other to better than 2dB.

Output sensitivity

Output Sensitivity indicates the voltage level delivered at the output of the microphone with a sound pressure level of 1 Pascal (Pa). This is the equivalent to 94dB SPL, 10 μ bars or 10dynes/cm². The figure is a theoretical one which assumes no significant electrical load and so under practical conditions the output will be slightly lower.

The dynamic range of a microphone is logically the difference between the loudest sound the microphone can handle without distorting significantly (<1%) and the level of noise that inevitably contaminates the signal path even when no sound is present. For dynamic microphones this noise is very largely generated by whatever microphone amplifier the user chooses to connect and so a useful figure rarely appears in the specification.

Self noise

With capacitor microphones the significant Self Noise may originate both in the capsule and in the internal preamplifier or impedance converter. A few highly respected manufacturers measure their microphones acoustically to include the cap-

sule within the measurement path. This is an exemplary technique but it is both difficult to accomplish and can give somewhat conservative figures so many others prefer to use a dummy capsule input and measure the electrical path only. Thus not all noise measurements are truly equivalent. Moreover in an attempt to relate the noise figures to what the ear might hear various equalisation curves are used (itself a somewhat debated issue). The common ones met are CCIR 468-1 (or 468-3) – also termed DIN 45405 – and quoted in dB, or DIN 45412/IEC 651 or IEC 179 quoted in dB-A. The dB-A rating is preferred by manufacturers since it is the most optimistic.

Max SPL

As you increase the acoustic sound level into a microphone a point will be reached where the output starts to distort, at first in a minor way and eventually as severe clipping. Most manufacturers list a Max SPL with a THD (Total Harmonic Distortion) figure which links the acoustic input level to a specific amount of distortion. They may choose any level – 0.25%, 0.5% or 1% can often be found. For a typical microphone the relationship between each of these is approximately 6dB so a Max SPL figure of 126dB at 1% THD can be translated with some confidence as 120dB at 0.5% THD. However the reverse may well not apply – a quoted 120dB figure at 0.5% might mean >5% distortion at 121dB if the microphone is on the verge of clipping at this point.

An SPL figure with no THD should be assumed to be a level at which gross distortion – clipping – is about to occur. With many microphones (and techniques of measurement) this point will be quite close to the 1% figure but for some designs a large (>10dB) and valuable headroom may exist which will markedly affect the way the microphone can be used.

Pad

In capacitor microphones Max SPL is usually limited by the electronics rather than the capsule so a pre-attenuator or pad may be fitted to increase the range. A 10dB pad will improve a Max SPL of

130dB to 140dB but will decrease sensitivity correspondingly by 10dB. The figures given in the text are for the pad switched to zero.

Output impedance and recommended load

At one time microphones were matched to their electrical loads but this technique is no longer used. Instead designers now try to give a microphone as low an output impedance as possible and stipulate a recommended load which will be significantly higher. Loads (impedances) numerically greater than this will cause no problems, but lower ones will result in excessive loss of signal output, degraded frequency response and a lower threshold for distortion. For a few microphones the recommended load for best performance may be rather higher than some typical preamplifier input impedances.

Powering

The categories for powering are limited to a handful of options which cover the main possibilities. Phantom 48v implies the usual $\pm 4v$ tolerance of supplies with a positive voltage on both signal conductors relative to the screen. Phantom 12-48v covers all other phantom power microphones, some of which can operate across 9-52v while a few may prefer a minimum of 24v. The full specifications for many microphones often indicate that performance (sensitivity and particularly Max SPL) may be restricted at lower operating voltages – and even more so where optional battery powering is offered.

Tonader (T12) powering assumes +12v on XLR Pin 2 relative to Pin 3 unless otherwise stated. Most valve (tube) and high-voltage microphones require special proprietary power supplies while the FET circuitry of many electrets can be powered by an internal battery. Some microphones (most obviously lavaliers) for use with radio transmitters are available in a special version to accommodate the range of AB powering common on these units – listed as other. The supply current indicates the typical value for primary powering method.

Type

The division of microphones into “dynamic” or “capacitor” is rather too broad for the purposes of this CD-ROM so six narrower classifications (shown as icons at the head of the page) have been made to distinguish each microphone’s operating principles.

Dynamic is restricted to moving coil devices since ribbon microphones have fundamentally different characteristics. Early electret microphones gained an unfortunate reputation for the lack of permanence of their electric fields and their elevated noise levels. However they have long since outgrown such slurs and are now represented amongst the best reference microphones. Some of these pre-polarised designs may have advantages under certain environmental conditions or where powering current is restricted so they are distinguished from the classic DC-biased or RF capacitor microphones. There is a category for digital capacitor – designs where the analogue output of the capsule is converted to an AES/EBU digital signal within the microphone body itself. And finally there is a category for tube (valve) designs since these are intended to give a specific character to the sound.

Polar pattern and use

For the most part polar pattern descriptions are self-evident and require little extra explanation. They may not be quite as well distinguished in practice: wide cardioids, for instance, may merge into sub-cardioids (and even be termed hypocardioids). Highly directional microphones often rely on interference tube techniques but the manufacturers may describe them in terms of their transducer pattern as well - for instance “hypercardioid /line gradient”. These are all categorised here as short or long rifles .

Boundary layer microphones typically have a hemispherical response and are classed as such even if the actual response has been “bent” to give some increased directionality in one or more planes.

A number of different schemes have been adopted to generate 2 and 3-dimensional soundscapes using discs, spheres, dummy heads or even real

heads to produce timing and level differences between more than one transducer. Microphone arrays or assemblies using any of these techniques are classed as Ear/sphere/ dummy head.

Lavalier microphones were originally hung around the neck but have long since shrunk to something tiny that is pinned on the lapel, hidden in the hair or disguised amongst clothing. The versions that are mounted on a variety of frames as “headworn” microphones and any other “personal” microphones are also lumped under this heading.

Physical characteristics

Weight and length are given in both Imperial (sometimes archaically known as English) and metric units with an approximated conversion. Depth is only used for microphones that are not essentially cylindrical.

Graphs

Finally graphs for frequency response and polar diagram are included. Necessarily they are limited in size and resolution but provide a useful overview of the typical on-axis response and the approximate degree to which this changes with rotation. They are not meant as a substitute for the far greater detail and accuracy that should be available from the manufacturer’s original calibration laboratory source data.

A dashed frequency curve indicates a switched option (such as a high pass filter) or a diffuse field HF response unless otherwise labelled. The polar pattern key is consistent but the precise frequencies are whatever the manufacturer has chosen.

Accessories

The “included” and “optional” accessories are a selection of the main ones offered by the manufacturer. The list is not exhaustive and reference should always be made to current sales brochures and catalogues.

Rycote accessories are shown for those microphones that commonly use them. The most usual

options are listed but there may be alternative arrangements for specific requirements. Where microphones are normally used within protected environments they will have no listing but Rycote accessories may still be available to fit them.

Price

The price of a microphone is as variable as the price of any other commercial item - and this CD is not particularly concerned with such matters. However the small picture and limited description (<100 words) can benefit from a little amplification if they are to give a fair impression of a microphone. To that extent a guide is given with three break-points (in \$ US) to suggest inexpensive, moderately expensive or very expensive microphones.

An article by Michael Williams on the Interpretation of Data Sheets is available on this CD-ROM. It expands considerably upon the information given here and is recommended reading.

Rycote

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