Calrec Model 3A an operational assessment

THE *Mark 3A* microphone differs slightly from the newer *Mark 3B* described by Hugh Ford; in general terms, the *Mark 3B* has improved performance and includes a useful LED feature in the microphone itself. The electrical differences between the two would probably not be noticed on a subjective basis.

Many examples are available of the Ambisonic recording capabilities of the *Soundfield* microphone, issued as consumer-format 2-channel UHJ discs and tape cassettes. I was more interested in seeing how the microphone performed in perhaps more subtle ways when used ambisonically, in exploring the post-production facilities of the soundfield controls, and in a general assessment as a conventional mono/stereo microphone.

Tests and monitoring

The control unit was set up to drive four identical power amps and four phase-matched 2-way loudspeakers of around 6 litre capacity. This system was used to monitor the output of the microphone ambisonically, and to replay B-format test recordings taken from the mic or synthesised by other means. B-format recordings were taken from the microphone and made to include Z-channel (height) information; although no use is made of this in horizontal-surround decoding, it was felt prudent to make some recordings including height information against the day a professional 'with height' decoder arrives.

In exploring mono and stereo use of the microphone, various arrangements were synthesised using the soundfield controls and recordings made on a conventional stereo machine. The majority of stereo monitoring was carried out using a pair of Mission *730 Mk I* loudspeakers rather than the much smaller enclosures used for ambisonics, to take advantage of the greater power handling and low frequency extension. The same arrangement was used in post-production stereo synthesis of material already recorded in B-format.

The microphone was set up in rooms of various sizes to record ambience, speech and other sounds at various distances. It was also set up outdoors, on a rooftop 65ft above ground to record the dawn chorus of birds very early on a June morning, and in a garden at ground level to capture the rustic sounds of a summer evening: bees buzzing, birds fluttering, leaves whispering, jet aircraft roaring overhead and railway trains clattering past. Several thunderstorms were also recorded outdoors, the microphone being mounted vertically beneath a large golfing umbrella, or more securely inside the house to take a 'window' perspective on the thunder and rain. Murphy's Law arranged that at no time did any storm (some of which were severe) pass directly overhead; nevertheless, the 'brooding' quality of outdoor ambience, with mutterings of storms and thunder rolling around the skies as the edges of storms passed by, made excellent test material.

For direct stereo recording, cardioids or figure-of-eights were synthesised, and set at various angles, mostly between 90° and 120°. Quad pairs were also synthesised, and various angles and patterns tried, such as back-to-back cardioids crossed at 90°. The same patterns were synthesised from B-format recordings, and the various possibilities listened to in conventional stereo. Use was also made of the stereo headphone facility of the control unit, the 'out of head' images made possible by some of the synthesised patterns being compared to those obtained by traditional binaural arrangements using miniature omnidirectional electrets mounted on dummy heads or separated by a vertical plate.

The B-format decoder of the control unit was also compared subjectively to the Abacoid *Professional Ambisonic Decoder, PAD 9211,* using B-format material derived from the *Soundfield* microphone.

Ambisonic performance

I have never before heard indoor or outdoor ambience captured and reproduced with such stunning reality. In the case of outdoor recordings, one of the promises of this technology—that of 'transparent walls'—was met. Distant sounds were reproduced far beyond the walls of the listening room, correct in all perspective. Birdsong and all the various minute sounds near and far were effortlessly recreated, and at times it was hard to believe that the loudspeakers in the room had anything to do with the soundfield. Sounds were so natural and convincing that it was often impossible to differentiate those recorded and those audible in the room from outside, particularly if windows were open. This led to amusing incidents like stopping the tape to listen to a bird apparently singing outside, only to discover that the particular bird was not 'live' but BASF!

Use of some of the *Soundfield* controls destroyed the sense of reality with the outdoor recordings. Azimuth rotated the field, elevation up or down changed the angle of 'view', but the soundfield remained stable and even. Changes in dominance crumpled perspective; they made the soundfield 'lumpy' and immediately made the listener aware of the artificial nature of the soundfield. This is perhaps to be expected; such a control and effect is a new experience in audio terms and no doubt in time listeners will adapt to such effects on outdoor recordings. I would liken the effect to the flattened and distorted perspectives obtained photographically by the use of a lens of extended focal length; we have all seen the effects so often that they are accepted by the eye and the brain does not protest. The dominance controls did not appear to have this effect on recordings made indoors however and I shall deal with this below.

The thunderstorms recorded outdoors were impressively captured, as was the distinct 'pressure wedge' of being outdoors under a large umbrella in the rain. But here the soundfield tended to form an annular ring about the listener at full centre, raindrops hitting the umbrella above or adjacent to the microphone being reproduced about 5ft away; that is to say, on the circle passing through the four monitoring loudspeakers. Sounds farther from the microphone were reproduced in correct perspective, rain hitting bushes and trees and thunder rolling at a distance were all 'out-of-room' and very realistic.

Indoor recordings recreated the ambience and acoustics of different sized rooms very accurately. Using the microphone in a rather confined space (much smaller than the physical dimensions of the listening area) produced a rather unnerving and claustrophobic effect, reflected sounds appearing to originate uncomfortably close to the listener, with an amount of mental confusion caused by the eye telling the brain that the walls of the (real) room were so far away and the ear perceiving reflections in the soundfield indicating 'phantom walls' much closer. There are intriguing possibilities to be explored here: use of the *Soundfield* mic in drama, for instance, as well as special effects in conjunction with a synthesised soundfield when working from multitrack as source material.

The dominance controls were found to be most useful on indoor recordings: artificially changing the mic's position in the room, the acoustic view of the room changes but the phantom physical confines of the (recorded) room remaining largely constant. This effect seems to hold good regardless of the size of the original room, which implies that the crumpled perspectives noted on outdoor ambience do not occur when the *Soundfield* mic is used to capture a soundfield physically limited and confined by reflecting surfaces. Thus, dominance controls are useful in overcoming any compromises in microphone positioning which may have to be

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made in certain venues, yet do not distort the soundfield or introduce an obvious element of artificiality in the reproduced effect. The effectiveness of dominance and elevation controls was demonstrated when recording a thunderstorm from within a room with the mic positioned close to an open window leaning outwards at around 75°. Use of these controls on the resulting B-format recording allowed useful changes in perspective, increasing or decreasing the acoustic influences of the room and rain on surfaces outside and below the mic. The stability of the window image was remarkable, as was the ability to 'zoom' to and from the window. Probably because of the brain's acceptance of windows admitting outside sounds, distortions in perspective were not found disturbing or unduly artificial.

Tests using voice or other sounds very close to the mic indoors indicate that localisation in the reproduced soundfield became vague and blurred. Since the microphone represents the head of the listener in the soundfield, sounds originating 4in away would have to be reproduced 'in the head' of a listener positioned at full centre. However, my tests seem to indicate that there extends a zone of about 2ft around the mic where the reproduced image refuses to localise. This cannot be wholly attributed to deficiencies in decoder or speaker arrangements, nor to interference fringes from the physical presence of the listener in the soundfield, as experiments—with soundfields synthesised from discrete sources using elementary localisation controls—show it is possible to vector phantom images very close indeed to the listener, to at least halve the 'no admittance' zone around the listener.

At distances of about 2ft localisation is fairly good, although I have doubts about the perspective. Beyond 5 to 6ft, the soundfield falls happily and naturally into place.

Stereo performance

Whilst I remain doubtful about some aspects of the *Soundfield* mic's ambisonic performance, it is a very different story when various arrays are synthesised and the mic used for conventional stereo, or mono, recording. There are no doubts at all about localisation in a stereo image of sounds originating just a few inches from the mic —images are stable and as convincing as stereo can ever be.

The mic is without doubt the most 'transparent' type I have ever heard, and I am unable to pinpoint any tell-tale colorations, only those produced by synthesising various polar patterns; for example, the typical bass-humping of cardioids on closely-miked speech.

Because certain of the *Soundfield* controls remain operative when a conventional stereo signal is taken from the control unit, these can be used to clean up or sharpen the pickup of the mic and discriminate against unwanted sound splash. Unless the mic is being used in a live broadcast situation, where the stereo output could be mixed with other conventional or synthesised microphones, it may be wise to record the mic output as a B-format signal and take advantage of the post-production possibilities and re-takes so that the best compromise can be found.

In short, the *Soundfield* is a superb stereo microphone, with many exciting possibilities as a result of the ambisonic technology, and must be assured of a future even if the full production techniques of ambisonics are never employed.

Ergonomics

The relative complexity of the microphone makes a dedicated multiway connecting lead necessary, and the MIL *C-26482* 19-pin multipole connectors used are not readily available as line-mounting mating pairs. Normally, 160 yards of lead restricts SPL handling at high frequencies, but the manufacturer quotes 138dB SPL at 1kHz, 134dB SPL at 10kHz under such circumstances, so long leads are not a problem. In a studio situation, it may not be convenient to operate with a 1-piece lead and cable drum, so that dedicated sectional leads may have to be made up, perhaps using some other type of multipole connectors, such as the circular *QM*-type.

The connector at the mic-end of the lead supplied was threaded to accept the ⅜in Whitworth thread of standard mic stands and booms, allowing it to be mounted readily in a vertical position on a stand. The microphone is light enough to be suspended by its lead without much fear of excessive strain, although the angle of cable entry into the connector/mounting boss causes a slight sideways tilt (nothing the *Soundfield*'s controls can't correct if required). The *Mark 3A* was found to be sensitive to mild physical shock and care should be taken not to tap the mic stand or allow the cable to flap against it, otherwise disturbing low-frequency thumps and rumbles result.

The *Mark 3B*, I understand, is fitted with an LED indicator, visible from below when the mic is suspended. Not only does this LED indicate power-on, it also serves to indicate the relative ambisonic 'north' or 0° azimuth. Very useful, and a feature missing from the earlier *3A*.

The controls of the various modules comprising the control unit are straightforward for the most part, provided that time is taken to sit down with the manual to work through them and become familiar with the various functions and options. Discard or ignore the operating manual at your peril! A useful adjunct to the Calrec manual is a shortform guide entitled *The XWYZ of the Soundfield Microphone* prepared by Mike Skeet of Whitetower Records.

I found the output level control to mistrack noticeably over the lower part of its range, and as this was used to set the monitor level, it was rather a nuisance. I eventually solved this by arranging L-pad attenuators in the output of the tape recorder, fixing its own output level controls with small blobs of *Plasticine* after checking for identical levels in each of the B-format channels using a millivoltmeter. This allowed the output level control on the Calrec control unit to be used over the central portions of its range, where

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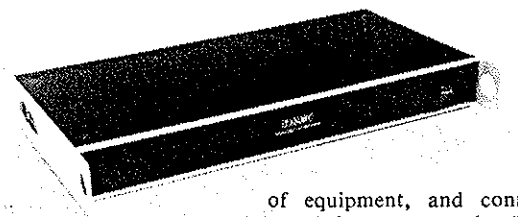
UHJ Encoder



A 19in rack-mount unit, 1U high, the Calrec UHJ encoder may be used to produce consumer-format 2-channel UHJ software from professional B-format ambisonic masters. Compared to the complexity of the *Soundfield* Mic control unit module rack, the encoder is rather boring to look at, but is a vital link in providing end-user ambisonic software.

The front panel carries the only control—the mains power switch. The encoder operates on 110/240V AC mains, voltage selection effected by a screw on the rear panel which engages an internal switch. The rear panel is furnished with a 3-pole IEC mains input socket, mains fuseholder, voltage selector screw and input and output signal sockets.

B-format input signals X, W and Y only—Z (height) information is not used in the encoding process—are input via 3-pin *XLR* sockets, female contact, wired to BS/IEC standard. UHJ 2-channel signals are output via 3-pin *XLR* sockets, male contact, wired to the same standard.

Tests were carried out using the encoder in conjunction with the Abacoid *Professional Ambisonic Decoder* and the same array of phase-matched speakers and monitor amps used in the subjective evaluation of other ambisonic hardware. By feeding B-format signals in parallel to the inputs of both pieces of equipment, and connecting the UHJ-encoded output to the UHJ input of the decoder, it was possible to make an A/B comparison of the directly decoded B-format signal and the UHJ encoded signal by moving the input selector switch on the decoder.

Such a direct comparison showed up some of the deficiencies of 2-channel UHJ. Generally speaking, the soundfield is not as well defined, images are 'fuzzier' and localisations at 90° and 270° azimuth (east and west positions) are much more unstable and uncertain. Overall, the UHJ soundfield is 'grainier' and details subtly veiled. I would stress that this is a direct A/B comparison, and that 2-channel UHJ is capable of impressive results when heard in isolation.

In terms of audio fidelity, the encoder appeared transparent and noise-free. It will no doubt become a basic but very necessary piece of equipment for any studio using ambisonic recording techniques and where consumer-format stereo-compatible copies are required from the more robust B-format professional masters. It will, of course, allow a client copy of completed or partially-completed work (rough mixes in the case of synthesised soundfields derived from multitrack) playable on domestic stereo equipment and producing an ambisonic soundfield if a domestic UHJ decoder and the necessary additional amps and speakers are used.

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tracking of the separate elements is much more acceptable.

This could well be a problem in a studio situation, where accurate channel gains are vital to the proper reproduction of an ambisonic soundfield and monitor levels are much more confortable at lower SPLs than is usual for stereo monitoring. Perhaps the manufacturer could offer the option of a module incorporating matched VCAs to ensure accuracy of gain setting.

The rear-mounted headphone sockets I found awkward, and if the control unit was rack-mounted, it would be difficult to reach them. I think that the two 6.3mm stereo jack sockets would be better mounted on the front of the headphone module.

Probably the biggest design defect lies in the function selector switch, which is co-axially mounted with the loudspeaker layout control. Misadjustment of the layout control is all too easy when the function selector is moved, and there seems no logic in combining the two controls in this manner. To make matters worse, the layout control is uncalibrated, so the whole process of setting up an accurate soundfield for monitor or replay purposes is rather hit and miss. I strongly advise that the layout control be separated from the function selector and provided with a better indication of the aspect ratios between the monitor speakers—some of the hazards of setting up and working with ambisonic soundfields have been described in *Circles of Confusion* (*Studio Sound*, August 1982). Ideally, the layout control should be accessible with a screwdriver.

Which decoder?

In assessing the soundfields captured by the *Soundfield* mic and the effects of the soundfield controls, it was felt that the performance of the Calrec decoder could be improved. Although not particularly obtrusive, there was a tendency for a 'noise node' to localise at 180° azimuth at a vector point approximately midway between full centre and the arc between the 'rear' speakers. Positioning oneself at this noise node, a degree of phasiness in the soundfield was perceptible. The noise node appeared to have no effect in terms of stability of images localised there, and did not seem to colour the sound of such images.

This effect has been noted before in earlier designs of B-format decoder, and appears common to domestic 2-channel UHJ decoders. Since the Abacoid *Professional Ambisonic Decoder* (reviewed *Studio Sound*, August 1982) was still on hand, subjective comparison was possible. The latter decoder tends to spread noise evenly over the soundfield with no obvious node and very little phasiness in the soundfield. In terms of image stability and localisation, there was nothing to choose between the decoders. However, I felt that the Calrec decoder had a slight 'veiling' effect which made it more fatiguing to listen to. I do not feel, though, that the performance of the decoder and the ergonomic problem of the layout control are in any way a real impediment in using the facilities of the *Soundfield* mic for ambisonic or conventional recording. Its advantages and performance far outweigh the niggles in the control unit.

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