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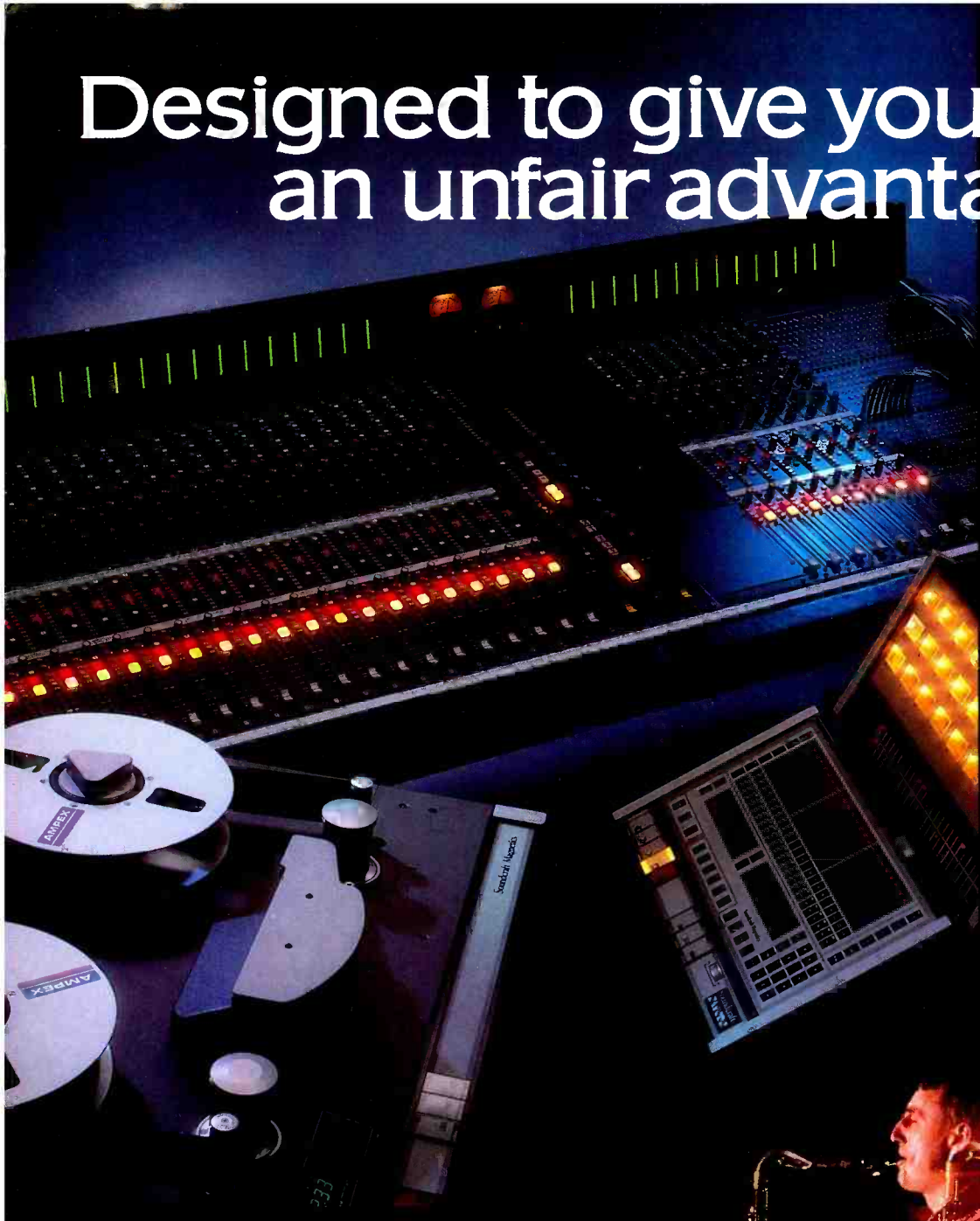

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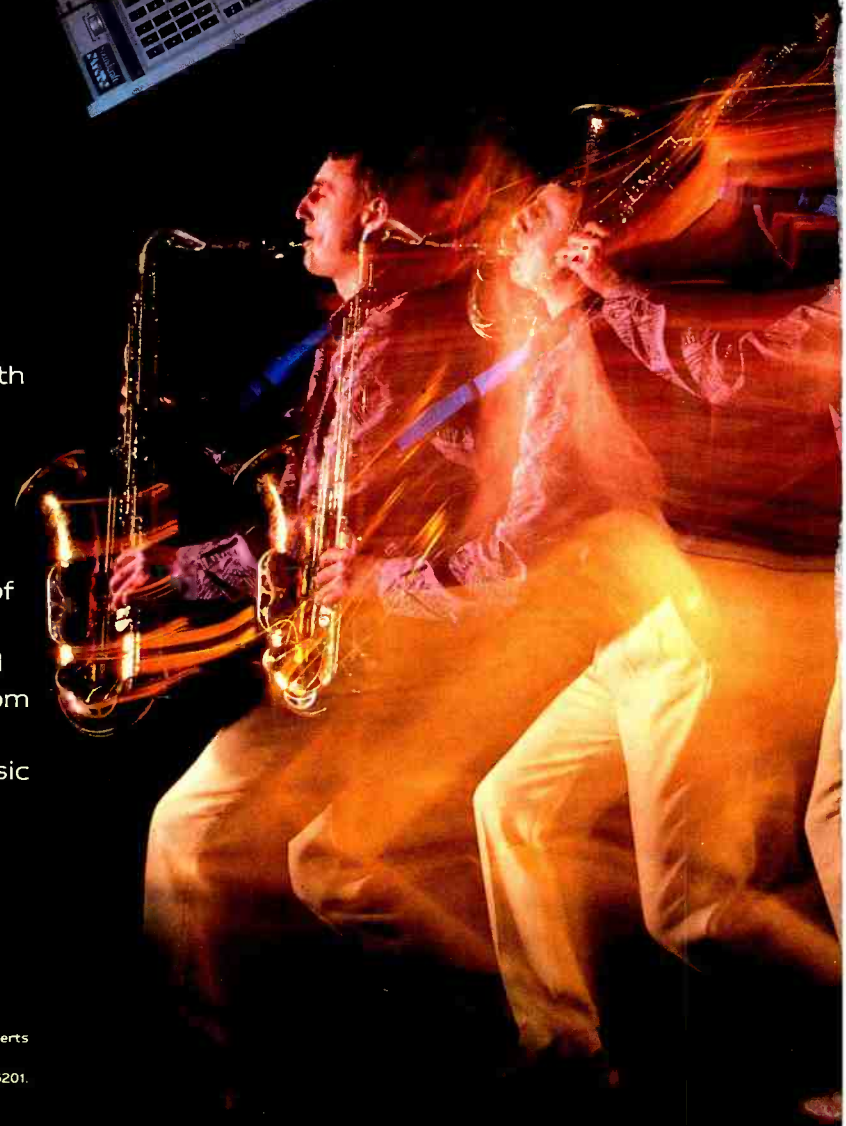

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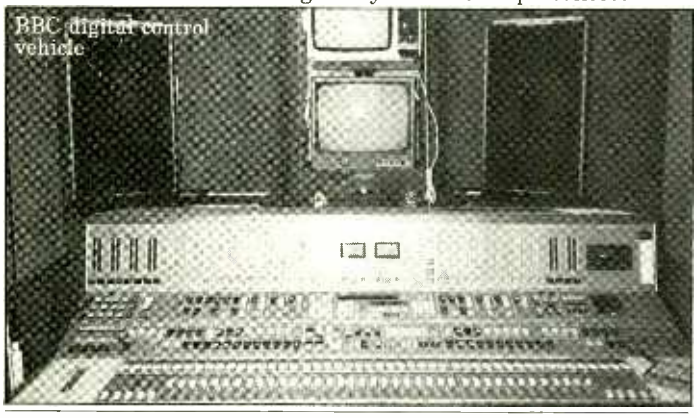

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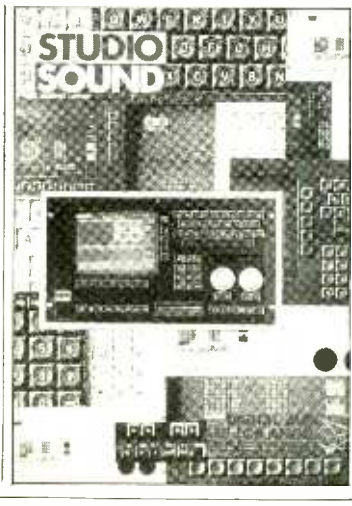

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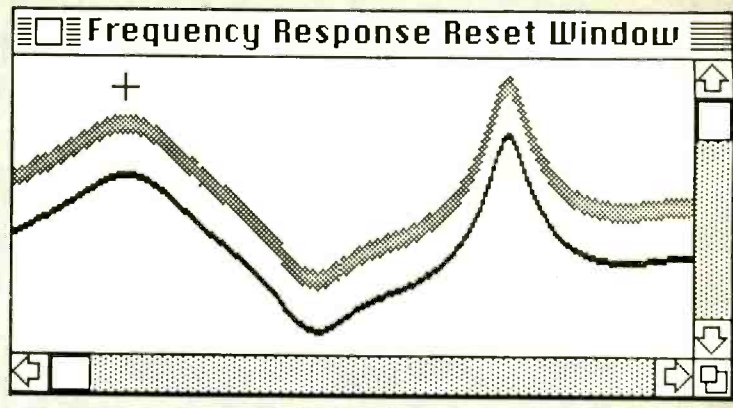

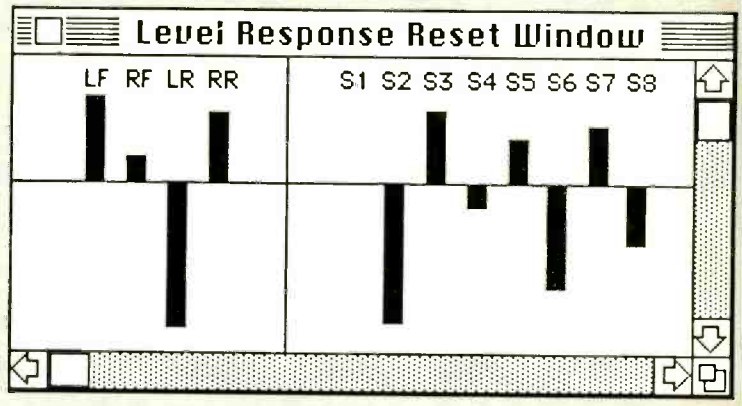

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EDITORIAL

EDITORIAL

This month's comment from Keith Spencer-Allen

Give a little bit

Two years ago we decided not to try to isolate digital audio as a separate topic away from our other coverage. After all, at that time we were seeing the installation of the first of the multitrack digital consoles; digital reverbs and other processors were standard units for the job; digital mastering on *1610/F1* and other formats was well established; and digital multitracks were gradually becoming more widely used. We felt it would be a mistake still to try to look at digital audio as something for the future when it was quite clearly here now. Our attitude was that we would cover new products and techniques and it would be more-or-less independent of their being analogue or digital.

One year ago we changed our minds again. Not really because we were wrong (we weren't) but because we could suddenly see a lot of interest in new storage and signal manipulation techniques. These were made available through the use of digital audio and as such many of these techniques just would not have been possible with analogue signal.

So here we are now, one year later looking at digital audio as a separate topic—not so much at the digits themselves but at the techniques that are now possible.

Disk based recording has been the major introduction over the last 18 months with the *Synclavier* hard disk recorder and the AMS *AudioFile* being sold, installed and earning their keep. They were not the first—the honour for the first commercially available system probably goes to Denon for a disk based editing system. These two products are, however, a reality and you can buy them. These are just the start—shortly we will see systems from Lexicon, Droid Works, Fogerolle, For. A and a whole host more. The easy bit is getting the audio on to the disk and retrieving it. The difficult part is what do you do to it before, after and during to make a useful system.

These systems will require a new approach and a different technique. It is a mistake to look upon them as a replacement for any existing item of studio equipment because in reality they really don't replace anything. The current units are a little bit mastering machine, a little bit multitrack machine, a little bit automation system, a little bit mixing console, a little bit digital editor, a little bit sampler, a little bit this and a little bit that. They are also capable of working techniques that are not possible in any other practical way. In short we have a new category of studio equipment—an addition to our cupboard of techniques and not a better mousetrap.

I would not like to hazard a guess as to when the recording medium—at present the hard disk—will be vast enough to allow long multitrack recording times without large numbers of cascading disk units. Even if we were able to develop a medium that would record long programme material in multiple tracks there would still be the problem of what to do with the data once you have finished working on the track. The data would have to be dumped to another storage medium and this is where the current problem lies. At the moment we would still have to turn to some form of tape based system and the problems that these entail. This may be where R-DAT comes into its own but for that we will have to wait and see. We are not going to become part of the ridiculous amount of speculation on R-DAT, about what it can and cannot do, and will or will not mean commercially. Panic and misinformation are rife.

The advent of disk based systems is something to be welcomed but on their own terms as they do not really replace any single item completely. We hope to be following developments in this area very closely starting with an initial look at the facilities of the AMS *AudioFile* in this issue. Over the next few months we will aim to treat all the systems in a similar manner and hopefully convey why it is also very difficult to compare existing systems directly as they all have their strong points and their weaknesses, be they technical or financial and seem to strongly reflect the technical background of their manufacturers.

The continuing merger of electronically produced music and the recording process is a further complication of what used to be the nice clear dividing line between the musician and the recording engineer—the one who created the sound and the one who preserved that moment. So may I suggest that while we are purging our pigeon holes of prejudices about what disk based recording systems are, should and/or might be, we also try to contemplate that we may have to lose this musician/engineer approach and view the creation of sound as the important thing, by whatever means it is generated. With this change of emphasis we find ourselves in the situation where it becomes difficult to separate the technical from the artistic and neither end is fully served. The dilemma grows and unfortunately it is here to stay. Or is it?

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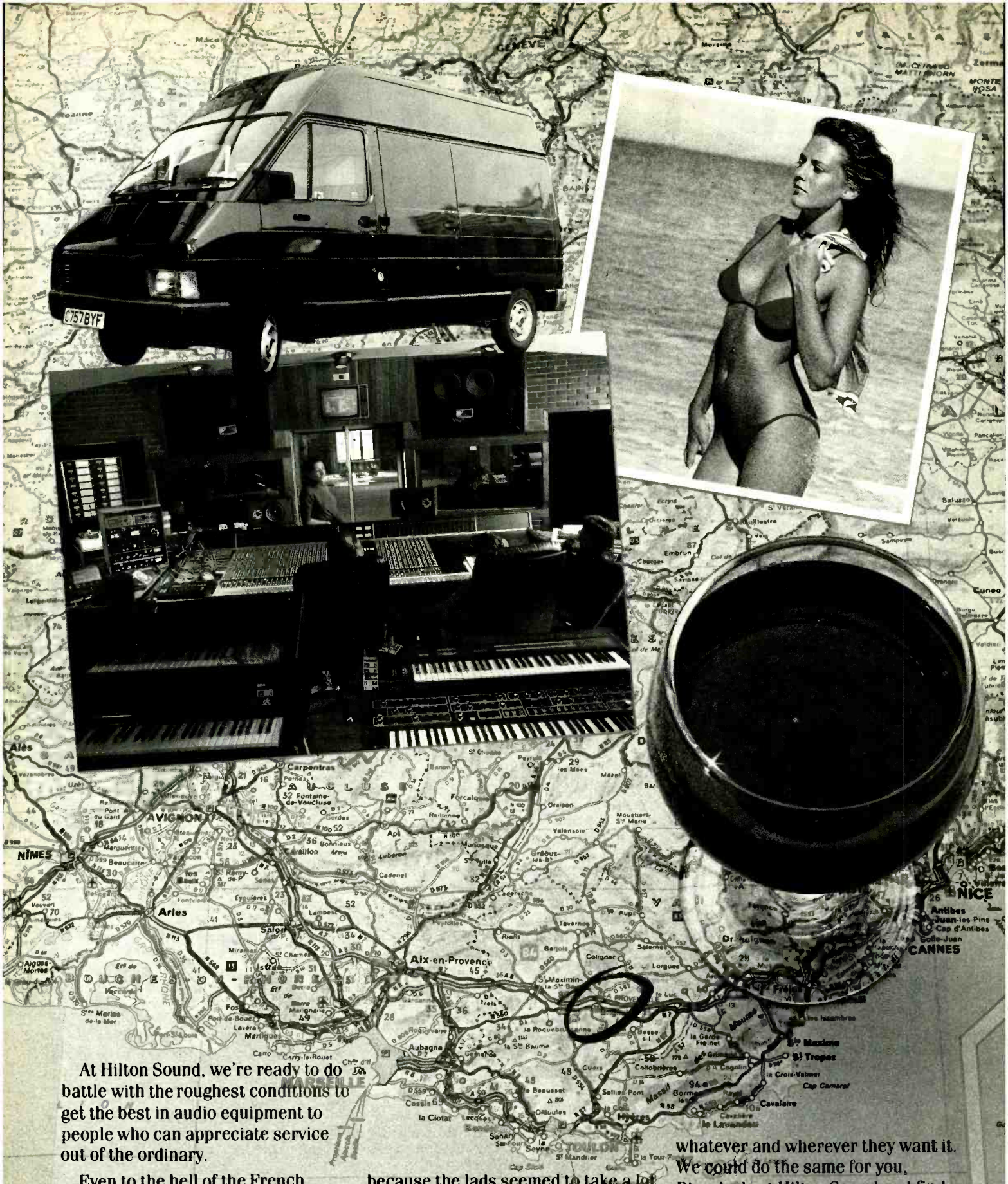

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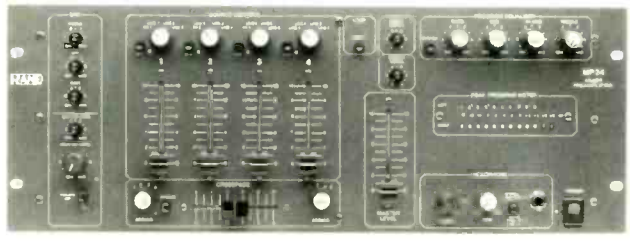

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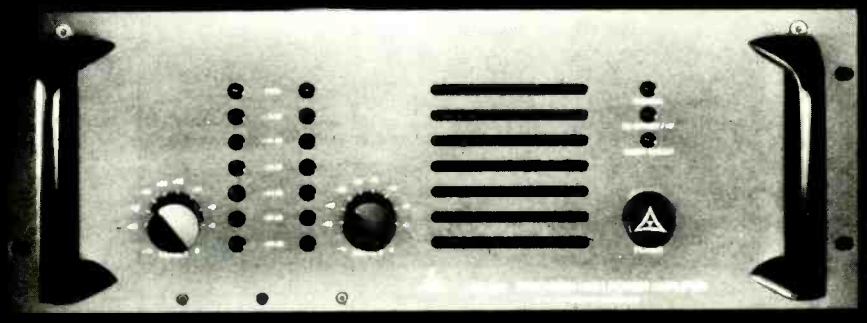

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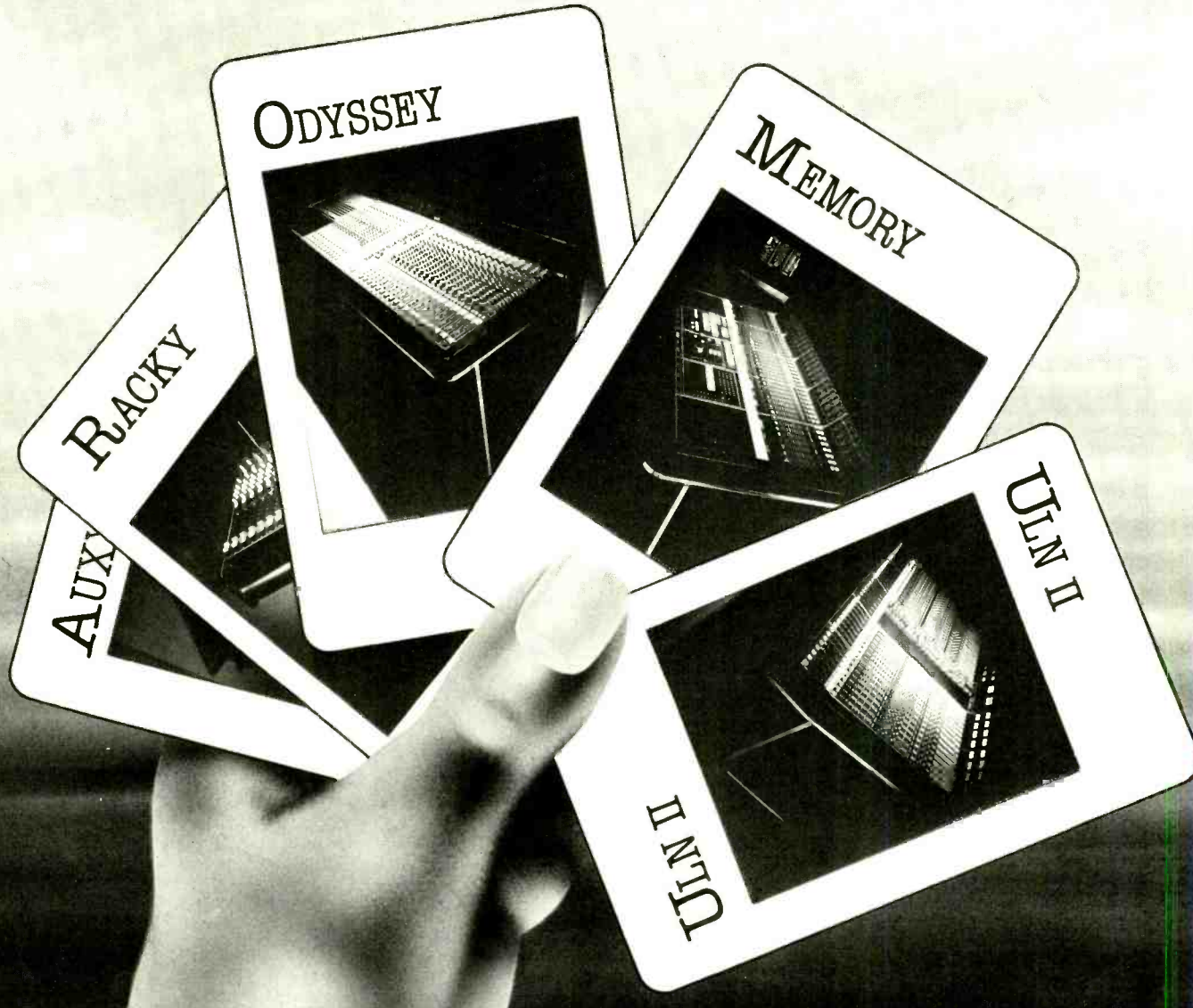

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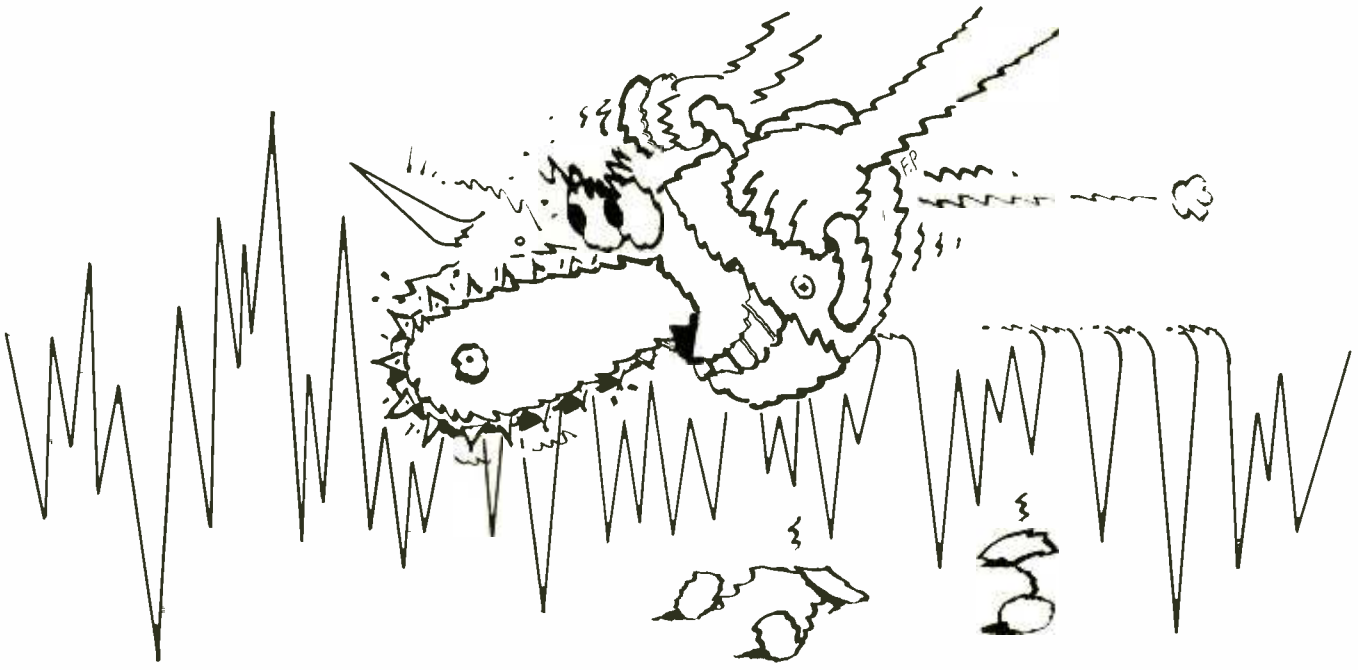

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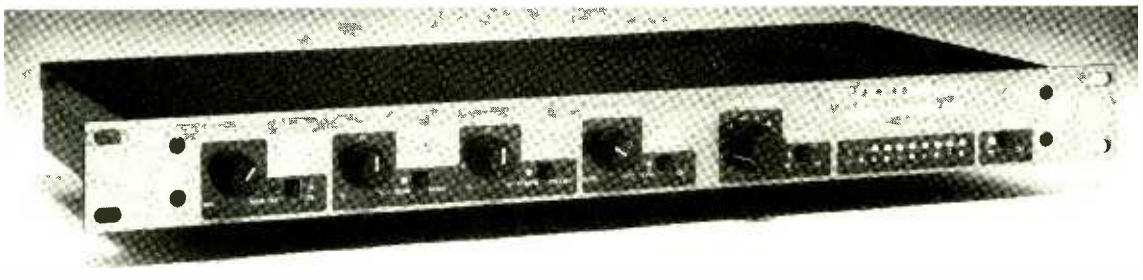

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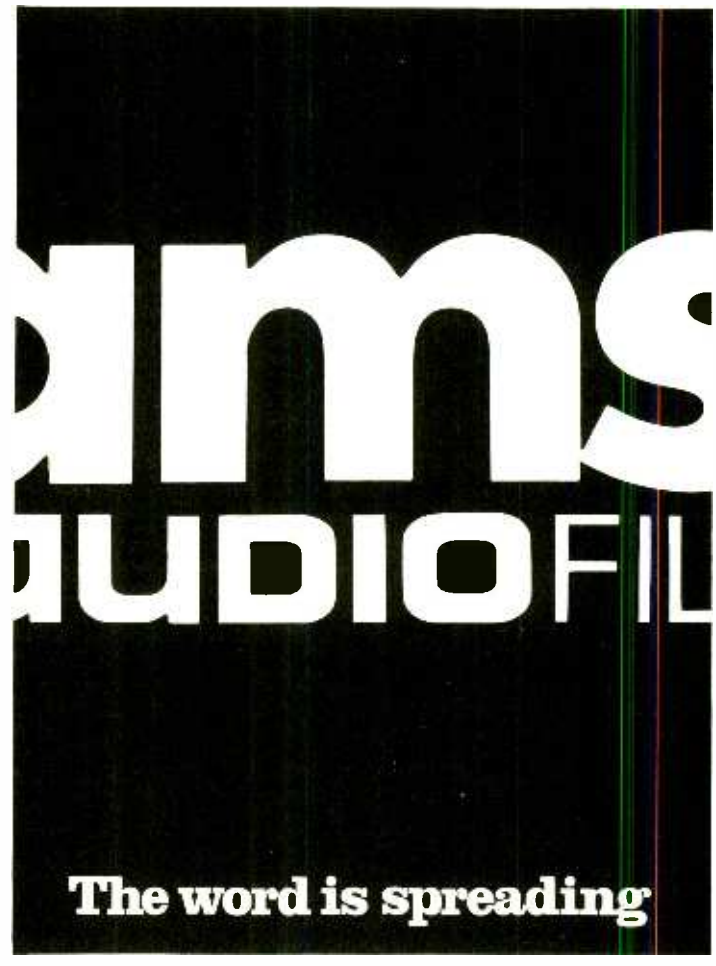

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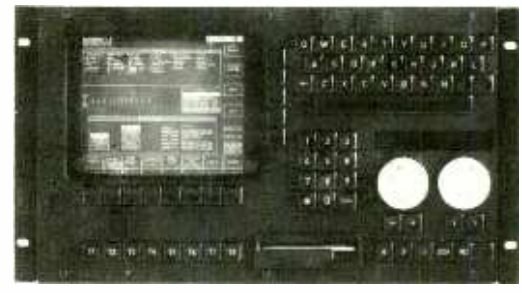

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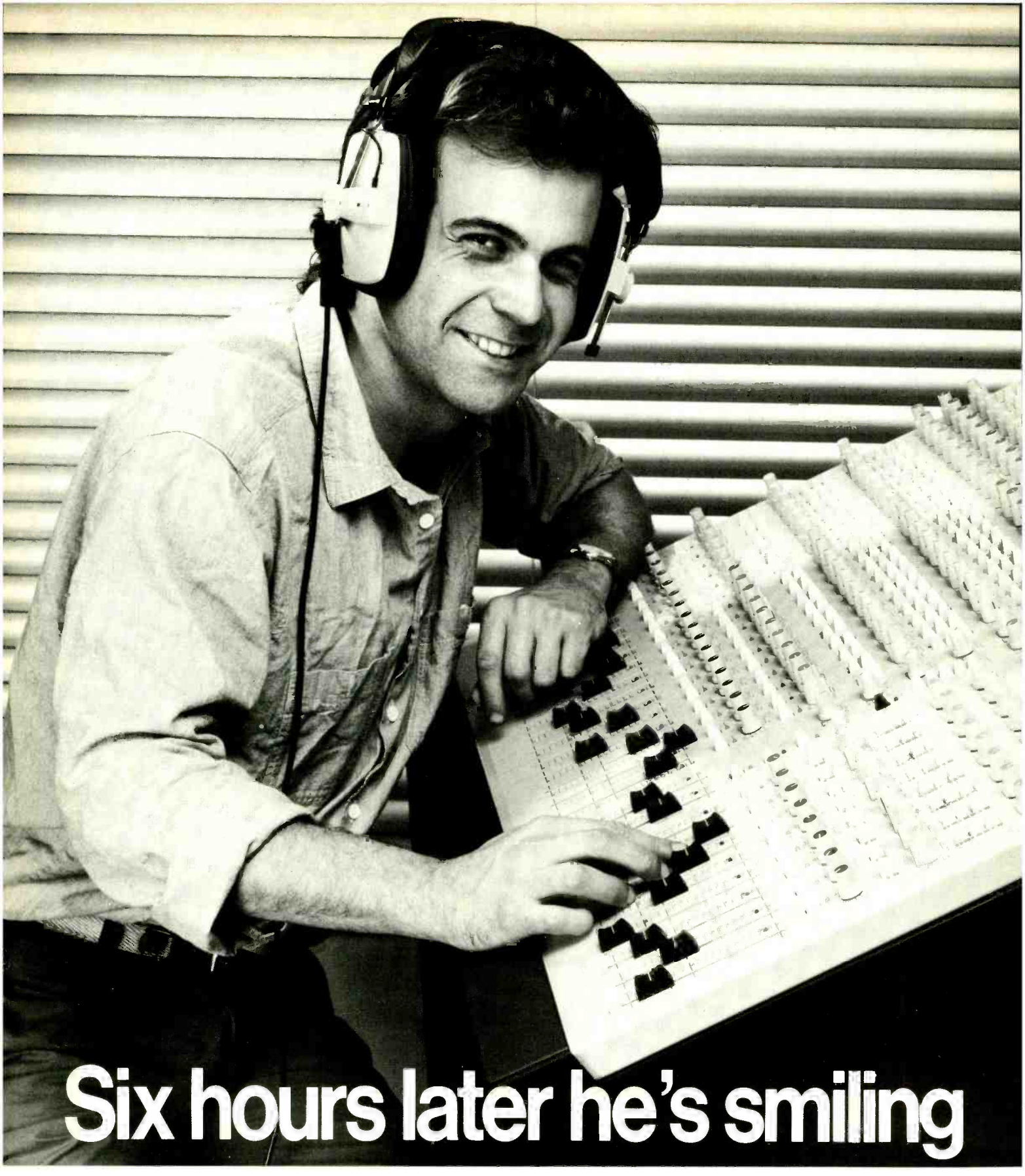

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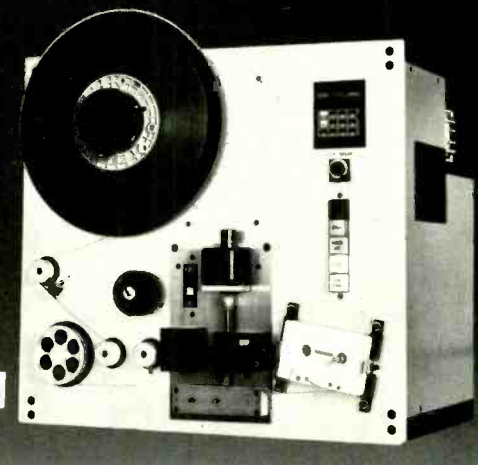

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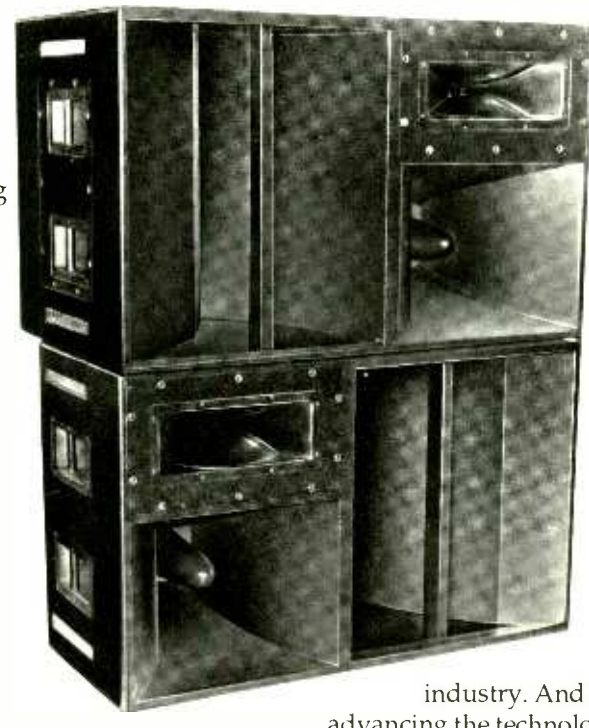

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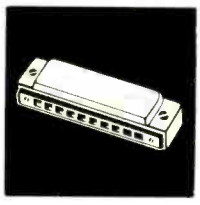

SHURE SM98
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The SM98 utilizes a high performance, low noise, low distortion preamp, allowing it to be used for close miking of drums, brass instruments, and other high SPL sources without danger of overload problems. Extremely smooth frequency response for accurate, faithful reproduction of acoustic instruments and near perfect cardioid polar pattern at all frequencies for superior source isolation.

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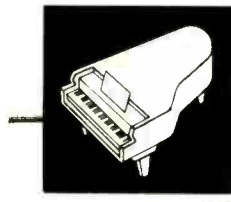
The hands-free operation drummers and keyboard players demand. The noise-reducing cartridge in the SM10A, SM12A and SM14A gives you high output for punch in live vocal situations, and a crisp, clean, balanced midrange. In addition, these microphones reject background noise and minimise leakage from other sound sources on stage. The microphone in each model is unidirectional and close talking.

SHURE SM94
GENERAL INSTRUMENTS

The SM94 is an excellent instrumentalist's microphone with performance that compares favourably to many more expensive studio units. Flat frequency response with no troublesome "spikes" or "icicles", very uniform cardioid pattern does not "collapse" at high frequencies for highly controlled off-axis performance, internal battery takes over if Simplex power fails, low handling noise.

SHURE SM91
BOUNDARY EFFECTS

The SM91 is a surface-mounted permanently biased condenser microphone with a half-cardioid directional pattern. Because of this unidirectional pattern, the SM91 discriminates against sounds originating from the rear and permits the microphone to operate with much less reverberant pickup and muddiness than omnidirectional models. Applications include piano, stage work and conferencing.



SHURE SM57
GENERAL INSTRUMENTS

Offering wide range reproduction of music and voice, this dynamic microphone features an exceptionally uniform and effective unidirectional pickup pattern. The performance characteristics and unique construction make it ideal for both studio and remote use. The SM57's mid-range presence peak and good low-frequency response make it an ideal microphone for use with a wide variety of instruments.

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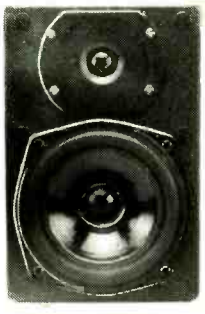

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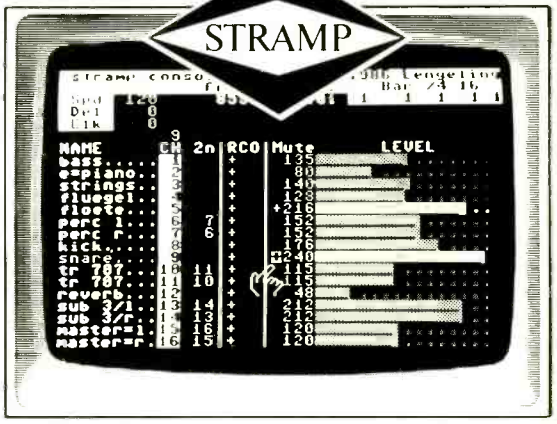

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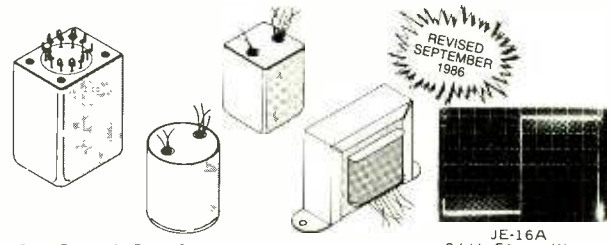

JE-16A
2 kHz Square Wave

INPUT TRANSFORMERS AND SPECIAL TYPES

Model	Application	Impedance Ratio Pri-Sec	Turns Ratio Pri:Sec	20Hz Max Input Level[1]	Typical THD Below Saturation (%) 20 Hz / 1 kHz	Frequency Response (dB ref. 1 kHz) 20 Hz / 20 kHz	Band-Width[2] –3 dB @(kHz)	20 kHz Phase Response (degrees)	Over-Shoot (%)	Noise Figure (dB)	Magnetic Shield[4] (dB)	Number of Faraday[4] Shields	Package[5]	PRICES 1-19	100-249	1000
MICROPHONE INPUT																
JE-16-A JE-16-B	Mic in for 990 opamp	150-600	1:2	+8	0.036/0.003	−0.08/−0.05	230	−8	<1	1.7	−30	1	A=1 B=2	75.42 82.89	49.87 54.81	34.40 37.81
JE-13K7-A JE-13K7-B	Mic in for 990 or I.C.	150-3750	1:5	+8	0.036/0.003	−0.09/−0.21	85	−19	<2	2.3	−30	1	A=1 B=2	75.42 82.89	49.87 54.81	34.40 37.81
* JE-115K-E	Mic in for I.C. opamp	150-15K	1:10	−6	0.170/0.010	−0.50/+0.10	100	−16	<7	1.5	−30	1	3	54.81	36.24	28.39
LINE INPUT																
JE-11P-9	Line in	15K-15K	1:1	+26	0.025/0.003	−0.03/−0.30	52	−28	<3		−30	1	1	122.22	80.82	55.75
JE-11P-1	Line in	15K-15K	1:1	+17	0.045/0.003	−0.03/−0.25	85	−23	<1		−30	1	3	52.32	34.59	27.10
JE-6110K-B JE-6110K-BB	Line in bridging	36K-2200 (10K-600)	4:1	+24	0.005/0.002	−0.02/−0.09	125	−12	<1		−30	1	B=1 BB=2	73.95 85.59	48.90 56.59	35.88 39.04
JE-10KB-C	Line in bridging	30K-1800 (10K-600)	4:1	+19	0.033/0.003	−0.11/−0.08	160	−9	<2		−30	1	3	53.17	35.16	24.53
JE-11SSP-8M	Line in/ repeat coil	600/150-600/150	1:1 split	+22	0.035/0.003	−0.03/−0.00	120	−9	<3.5		−30	1	4	194.63	128.69	88.78
JE-11SSP-6M	Line in/ repeat coil	600/150-600/150	1:1 split	+17	0.035/0.003	−0.25/−0.00	160	−5	<3		−30	1	5	98.39	65.06	44.88
SPECIAL TYPES																
JE-MB-C	2-way[3] mic split	150-150	1:1	+1	0.050/0.003	−0.16/−0.13	100	−12	<1		−30	2	3	44.85	29.65	23.24
JE-MB-D	3-way[3] mic split	150-150-150	1:1:1	+2	0.044/0.003	−0.14/−0.16	100	−12	<1		−30	3	3	76.19	50.37	39.42
JE-MB-E	4-way[3] mic split	150-150-150-150	1:1:1:1	+10	0.050/0.002	−0.10/−1.00	40	−18	<1		−30	4	1	114.40	75.64	52.18
JE-DB-E	Direct box for guitar	20K-150	12:1	+19	0.096/0.005	−0.20/−0.20	80	−18	<1		−30	2	6	54.56	36.07	28.23

1. (dBu) Max input level = 1% THD; dBu = dBv ref. 0.775 V
2. With recommended secondary termination
3. Specifications shown are for max. number of secondaries terminated in 1000 ohm (typical mic preamp)
4. Separate lead supplied for case and for each faraday shield
5. Except as noted, above transformers are cased in 80% nickel mu-metal cans with wire leads.

PACKAGE DIMENSIONS:

	W	L	H
1 =	1 5/16" Diam.	×	1 9/16"
2 =	1 3/16" ×	1 3/16" ×	1 5/8"
3 =	1 1/8" Diam.	×	1 1/16"
4 =	1 1/2" ×	1 3/4"	2 1/2" w/solder terminals
5 =	1 5/8" Diam.	×	1 3/4"
6 =	1 1/8" Diam.	×	1 5/16"

NICKEL CORE OUTPUT TRANSFORMERS[6]

Model	Construction	Nominal Impedance Ratio Pri-Sec	Turns Ratio Pri:Sec	20 Hz Max Output Level[7] (dBu)	across (n) windings	600Ω Load Loss (dB)	DC Resistance per Winding	Typical THD Below Saturation (%) 20 Hz / 1 kHz	Frequency Response (dB ref. 1 kHz) 20 Hz / 20 kHz	Band-Width –3 dB @ (kHz)	20 kHz Phase Response (degrees)	Over-Shoot (%)	Package	PRICES 1-19	100-249	1000
JE-11-BMCF	Bifilar 80% nickel	600-600	1:1	+26	1	−1.1	40Ω	0.002/0.002	−0.02/−0.00	>10MHz	−0.0	<1[9]	7	81.55	53.92	37.76
JE-11-DMCF	Bifilar 80% nickel	600-600	1:1	+21	1	−1.0	38Ω	0.004/0.002	−0.02/−0.00	>10MHz	−0.0	<1[9]	8	56.32	37.24	25.69
JE-123-BLCF	Quadfilar	600-600 150-600	1:1 1:2	+32	2	−1.1	20Ω	0.041/0.003	−0.02/−0.01	>450 170	−1.9 −4.0	<1[8]	7	73.85	43.14	29.76
JE-11SS-DLCF	Bifilar split/split	600-600 150-600	1:1 1:2	+27	2	−1.0	19Ω	0.065/0.003	−0.02/−0.01	>10MHz 245	−0.0 −2.5	<1[8]	8	53.62	35.45	24.46
JE-11-ELCF	Bifilar	600-600	1:1	+23.5	1	−1.1	40Ω	0.088/0.003	−0.03/−0.00	>10MHz	−0.0	<1[9]	9	36.36	24.04	16.59
JE-11-FLCF	Bifilar	600-600	1:1	+20.4	1	−1.6	58Ω	0.114/0.003	−0.03/−0.00	>10MHz	−0.0	<1[9]	10	27.36	18.09	12.48
JE-112-LCF	Quadfilar	600-600 150-600	1:1 1:2	+20.4	2	−1.6	29Ω	0.114/0.003	−0.03/−0.01	>450 205	−1.2 −3.2	<1[8]	10	32.80	21.69	14.96
JE-123-ALCF	Quadfilar	66.7-600	1:3	+26.5	3	−1.3	8Ω	0.125/0.003	−0.04/+0.06	190	−4.6	<6[8]	8	50.96	33.69	23.24
JE-11S-LCF	Bifilar w/ split pri.	600-600 150-600	1:1 1:2	+30	1 (sec)	−1.7	63Ω	0.058/0.002	−0.02/+0.01 −0.02/−0.05	>10MHz 155	+1.1 −4.1	<1[8]	8	50.96	33.69	23.24

6. Multifilar construction has no faraday shield: cannot be used as input transformer. All specifications are for 0Ω source, 600Ω load.
7. Max output level = 1% THD; dBu = dBv ref. 0.775 V
8. Source amplifier −3 dB @ 100 kHz
9. Source amplifier −3 dB @ 200 kHz
10. Output transformers are horizontal channel frame type with wire leads, vertical channel frames available. PC types available.

PACKAGE DIMENSIONS:

	W	L	H	Mounting Centers
7 =	1 1/2" ×	2 5/16" ×	1 15/16"	2 13/16"
8 =	1 5/16" ×	1 15/16" ×	1 5/8"	2 3/8"
9 =	1 1/8" ×	1 11/16" ×	1 3/8"	2"
10 =	1 1/16" ×	1 7/16" ×	1 3/16"	1 3/4"

* IMPROVED PERFORMANCE

Prices shown are effective 9/15/86 and are subject to change without notice. Packing, shipping, and applicable sales taxes additional.

These charts include the most popular types which are usually available from stock. Many other types are available from stock or custom designs for OEM orders of 100 pieces or more can be made to order. Certified computer testing is available for OEM orders. Call or write for applications assistance and/or detailed data sheets on individual models.

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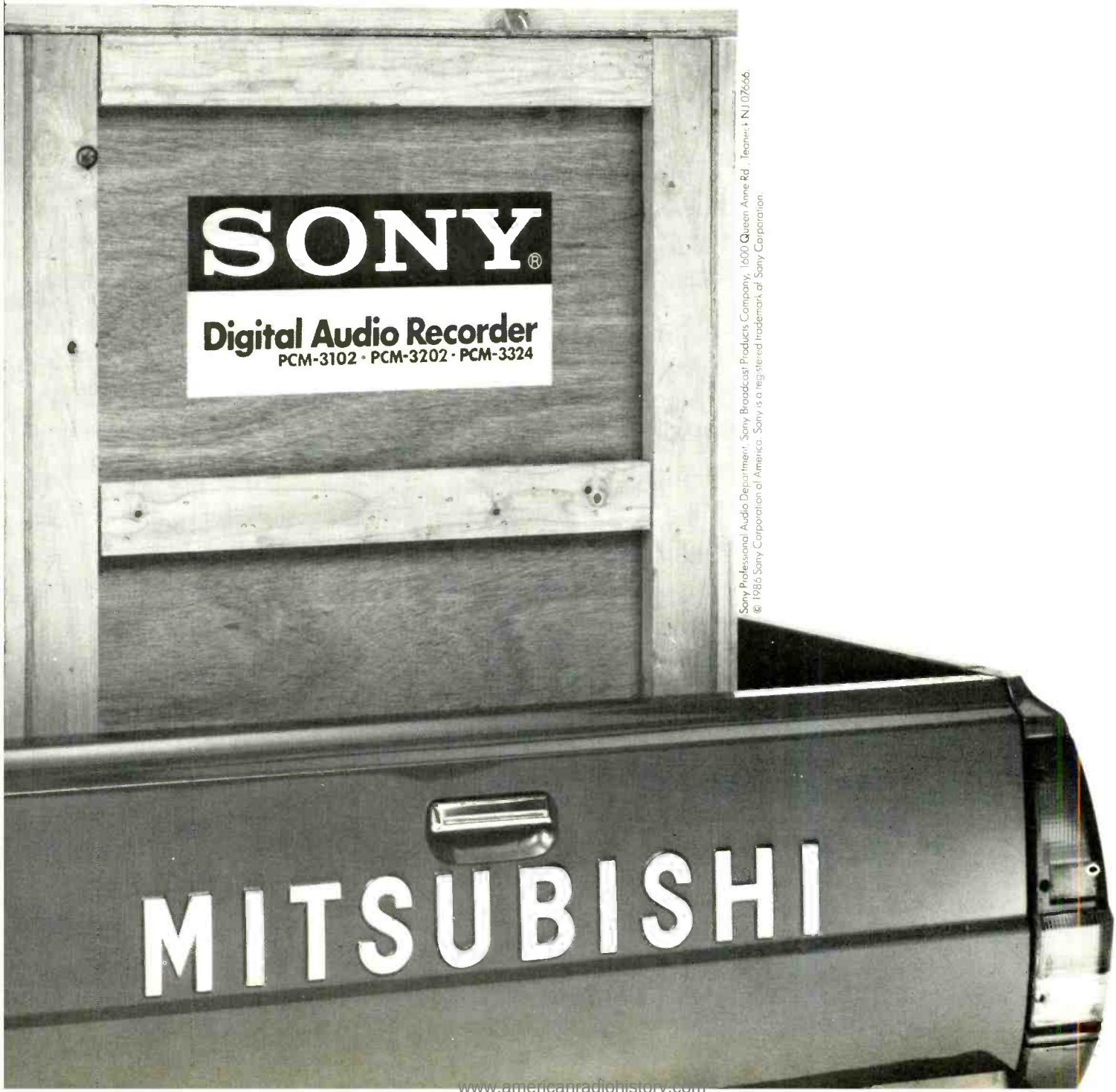

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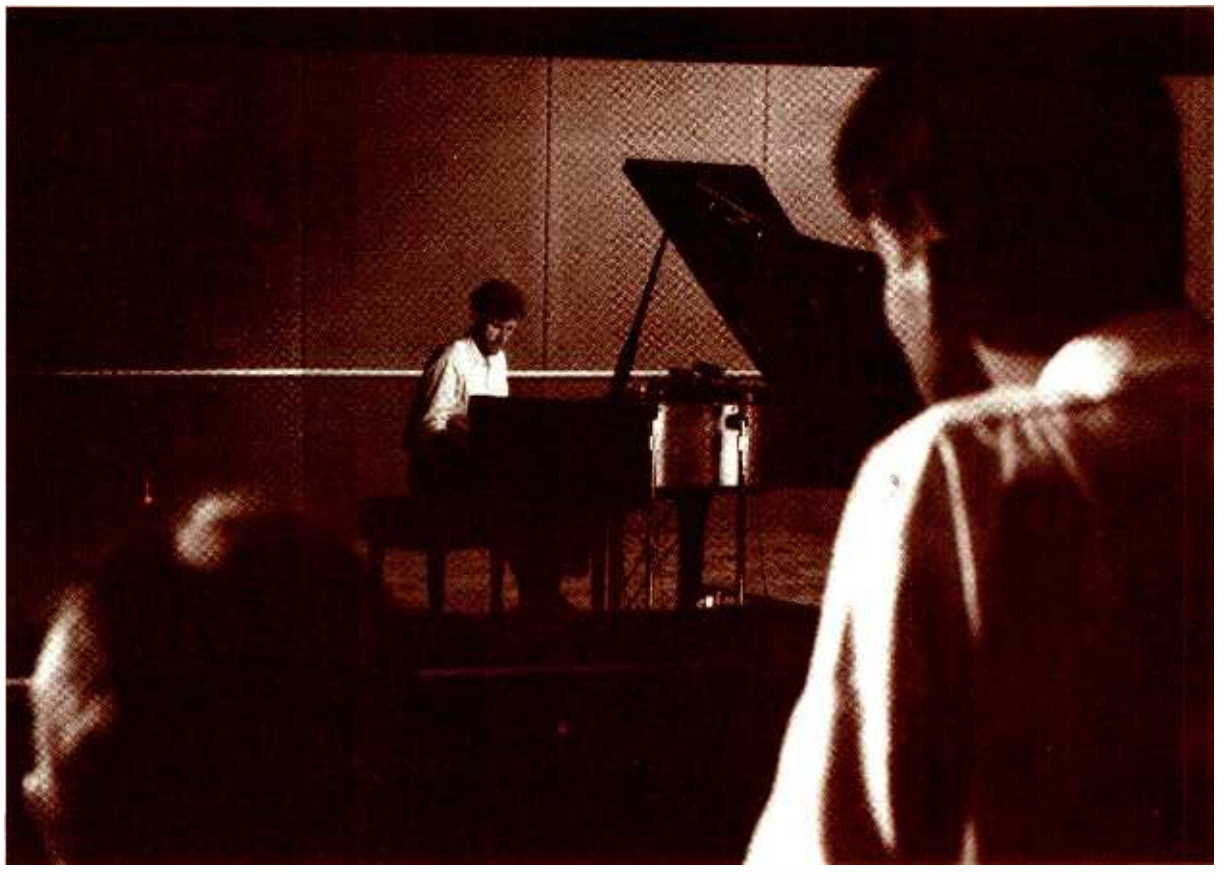

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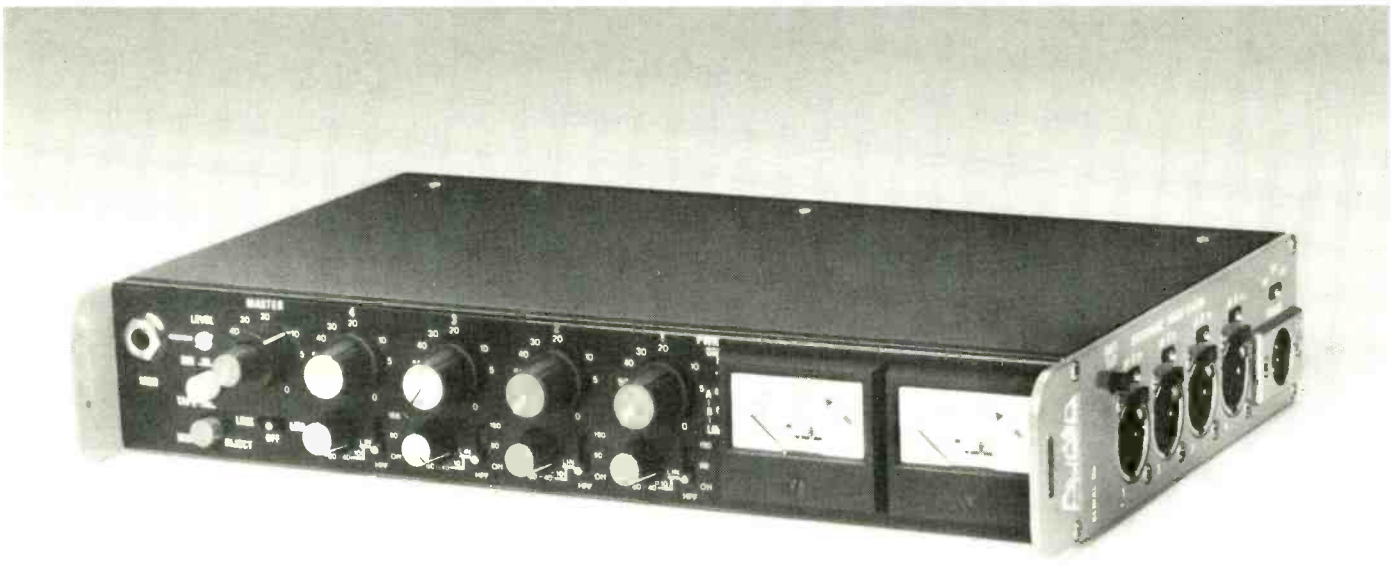

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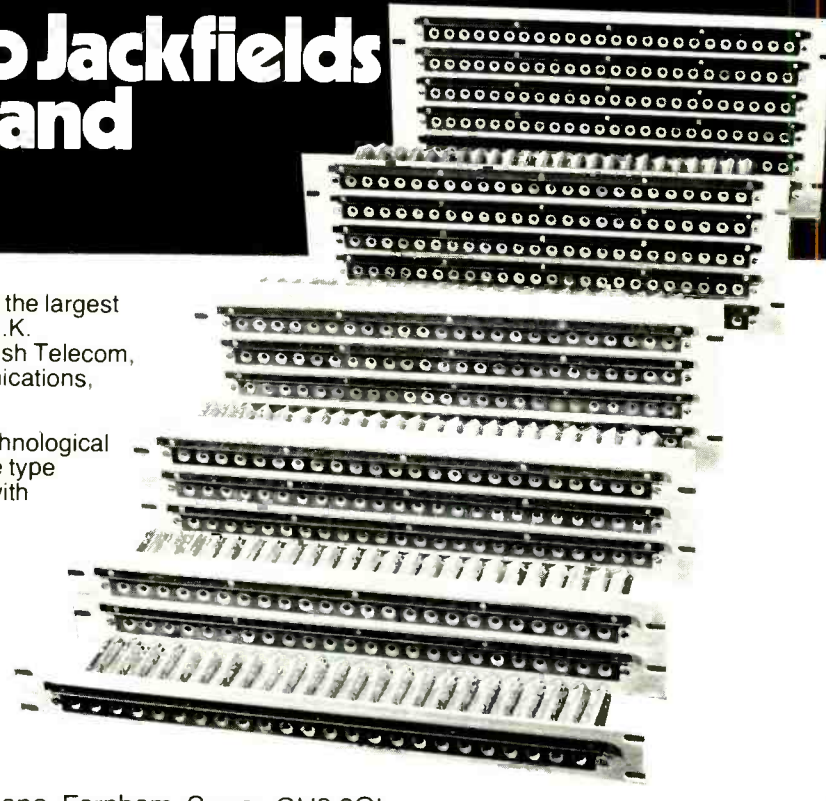

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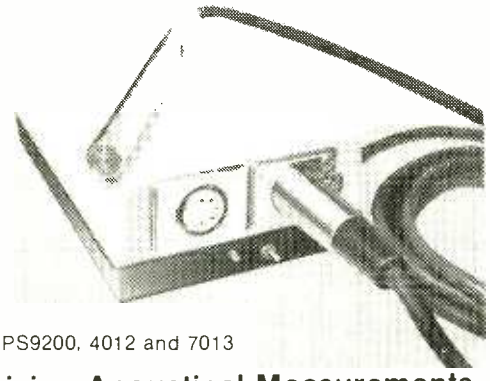

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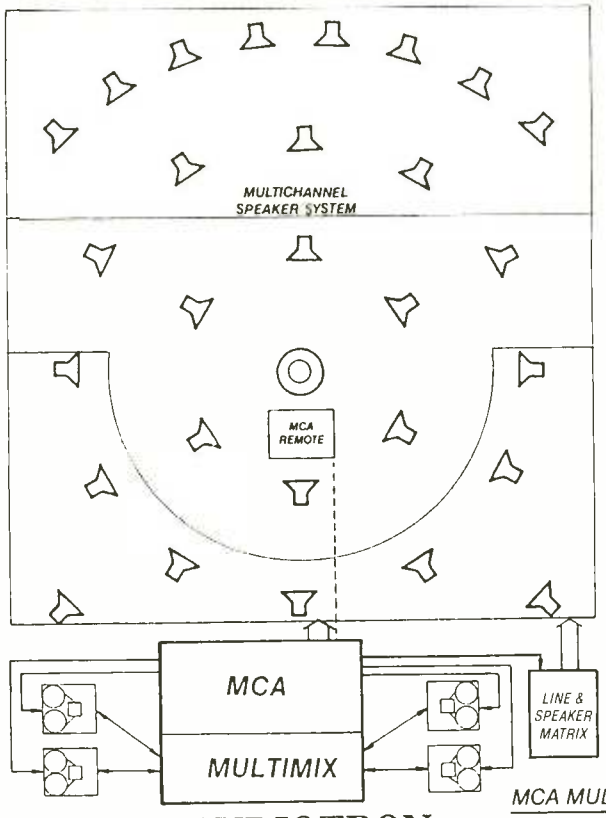

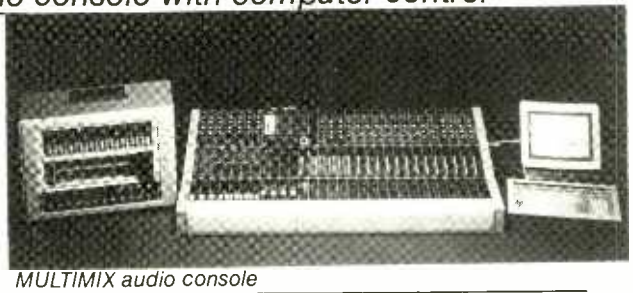

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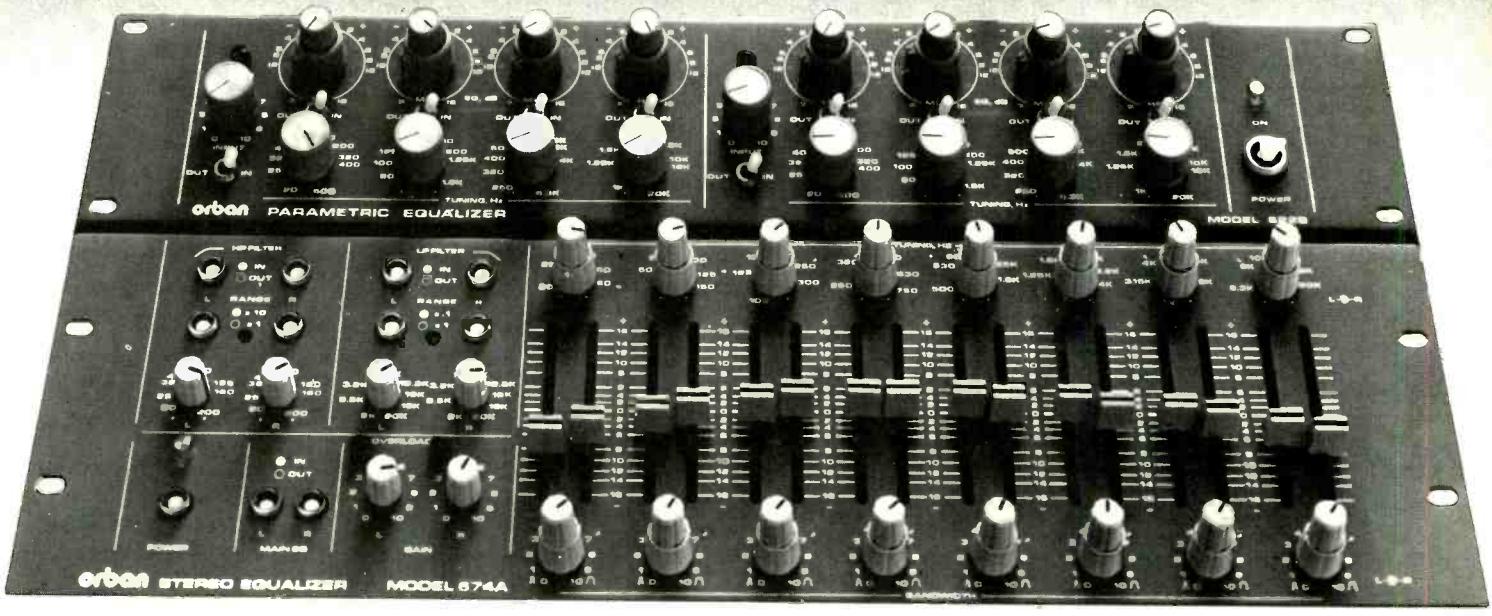

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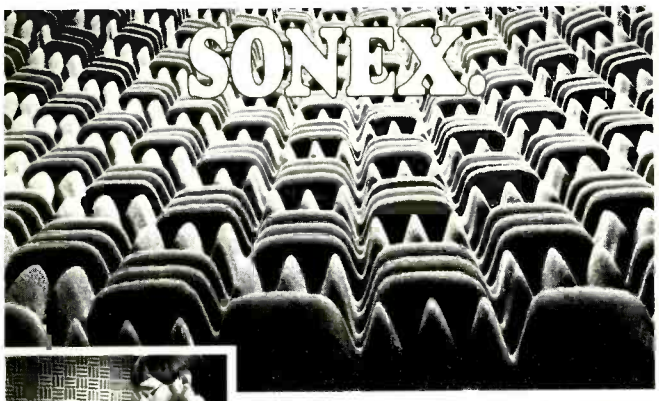

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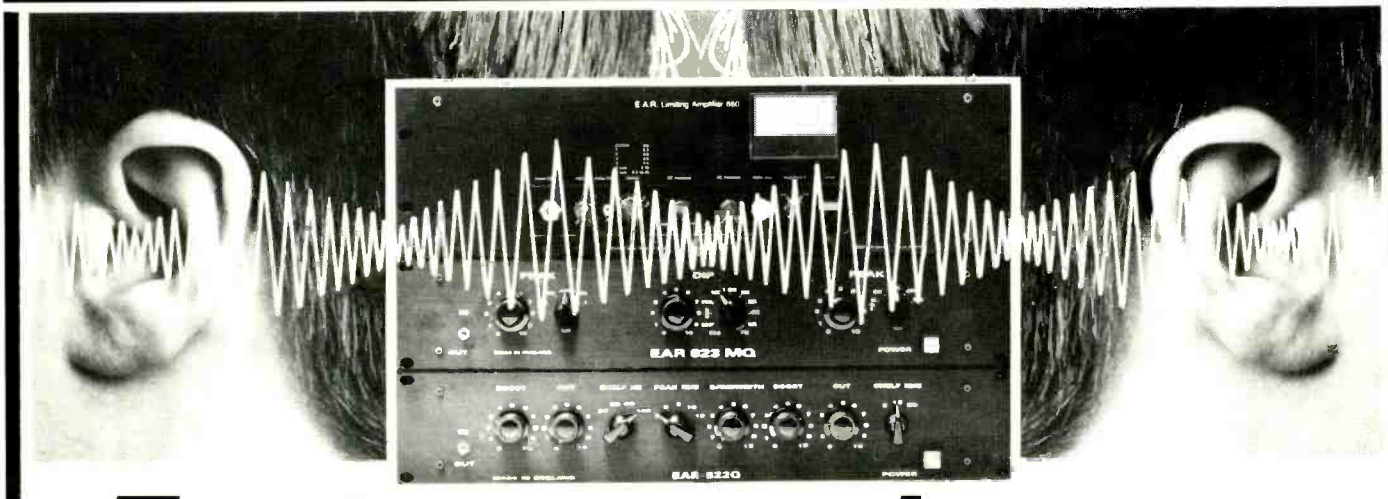

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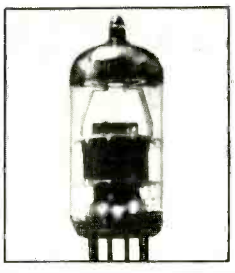

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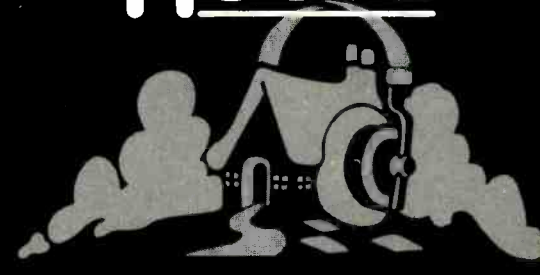

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BBC Digital Control Vehicle 12 months on

It was last September that the BBC Digital Control Vehicle was officially handed over to Radio Outside Broadcasts and became operational. The DCV was quite a unique project that was the result of many years' commitment by the BBC to digital audio R&D. Basically the DCV was an OB trailer unit equipped with a Neve *DSP* digital console, digital recording facilities and special acoustic treatments that included expanding side walls to enlarge the control room when on location. The details of the installation were covered in the December 1985 issue.

The unit was designed to be able to feed signals for live broadcast or as a recording unit. At 15 m with the tractor unit the DCV is the largest of the BBC OB vehicles and is internally divided into four areas—the computer room at the head of the unit, followed by the control room with console across the width of the trailer, the tape machine area, and at the rear the communication areas.

At the launch, the DCV was described as experimental—not that the unit was an experiment itself but that the BBC wished to learn about the practical aspects of digital audio operations and gain as much feedback from all types of users as possible to help in future planning. It was decided therefore that the *DSP* console which they had developed in conjunction with Neve, should be fitted in a mobile, as this was more flexible than a fixed installation. This, together with the other facilities of the DCV, has resulted in one of, if not the most technically advanced mobile anywhere.

For the trial period there has been a team of four operator/engineers with the DCV. It was decided fairly early on that there was little point in making it a general vehicle and expect to get any meaningful information feedback although this doesn't preclude users outside this team.

Senior sound supervisor Alan Wilson: "We have found the console to be a very friendly beast. It is quite easy to give an operator some multitrack experience one day and he is off the next day as long as there is somebody around literate in the console to guide him a bit."

So far the DCV has done 25 live shows and many more recorded productions. As part of the efforts to gain feedback, the unit was taken round the BBC regions with the intention of completing a show in each area, although this was not always possible. Most of the work so far has been classical music with some Radio 2-type as well; there has not been a great deal of rock or drama use as yet.

Alan Wilson: "Some BBC operators, particularly from the rock area, have had some reservations about its use as a live broadcast tool. They tend to have an inherent prejudice against assignability for a start. They like to see everything happening at the same time and with some justification—they often use a lot of dynamics (compression/limiting/gating) and need the information from the displays to set them up properly, eg checking the gates on a drum kit are all releasing correctly. On the *DSP* as it stands now, in its simplest form you only get a display for the source that you have accessed. You can use other desk meters to simulate other dynamics displays but this is not always convenient."

The DCV went back to Neve during May and June to allow some of the operator feedback to be incorporated into the *DSP* software—some of these changes were things that the BBC engineers had specified in the first place and now wanted changed and others were new aspects. There were no hardware changes.

One area where the DCV *DSP* differs from the more widely known system at CTS studios is that there is no dedicated separate monitoring mix system. The DCV unit has a switched mode that allows the complete desk to become a monitor mixer—an action completed within a few seconds. In assignability design concept this is no different to the CTS approach except that the CTS desk has a separate set of controls permanently selected to this function from choice. Such a facility also takes up a lot of room not available in the DCV but the shows completed so far have not revealed any operational problem in this changeover system.

Computers are notorious for not liking to be moved so how reliable has the *DSP* been in the unit?

Alan Wilson: "The console has proved to be reliable and has completed every live show that we have asked of it. We have, however, had our problems—I suspect probably about the same that you would with an analogue desk of equal complexity. When we first started moving the DCV we used an available BBC tractor unit that was very hard sprung to such a degree that it would vibrate you out of your seat if your feet weren't touching the floor. This did the computer no good as all the cards were vibrating out. We now have a committed tractor with air springing and this has improved things a lot."

The other potential problem areas of temperature and suitable mains power have not materialised. During the very coldest weather an air conditioner unit seized up and stopped proceedings but not during any live programme. As for the mains power the console has proved to be very good at what it will take. The DCV team has become used to looking at power requirements similar to the TV mobiles rather than the normal OB 13 A socket. In Alan Wilson's words, "It takes 40 A to heat up the chips in the computer and 30 A to cool them down; a further 30 A is used for the air conditioning in the other areas and the digital multitrack draws about another 10 A. We have had to get used to running off a generator which it does quite happily despite the 'drunken sugar-loaf' waveform."

The A/D converters were arranged in the form of stage boxes that are wheeled into the vicinity of the stage. These boxes are then connected to the main desk by fibre optic links. These work very well

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and you can run the fibre optic cable in places you would not dream of running standard cables. Alan Wilson also considers that the earth isolation of the systems has often got them out of trouble in instances where they would normally expect difficulties.

On the recording side a Sony *PCM-3324* has just become the permanent multitrack following a period of hiring machines. The other machines currently in the unit are a pair of Telefunken *MX-80* digital 2-tracks and a pair of Studer *B67*s. Although the desk has been able to communicate digitally with the digital 2-tracks via BBC designed and built converters it was only recently that they took delivery of a digital interface for the Sony *PCM-3324*. This is only the third Sony Digital Interface Kit *K1111* delivered as yet and is a modular rack mount system with each of the modules handling two channels.

Apparently the unit was delivered and worked straight off which is quite a tribute to someone bearing in mind the uniqueness of itself and the console it talks to. It converts AES/EBU digital output from the *DSP* to a form that the *3324* requires and vice versa. It is also possible to switch emphasis on and off on individual channels. Prior to this box arriving the *3324* was fed via its analogue inputs which was felt to offer superior noise figures to an analogue multitrack and was therefore warranted. They are hoping for a further improvement from an all digital signal chain and tests carried out so far appear to indicate that this will be the case.

Machine area with Sony PCM-3324

Even before this interface and the possible sonic improvements, had there been any other observations of quality from the system?

Alan Wilson: "There has been a general consensus that there is improved clarity—not just in the sound from one mic but in terms of panning and the multi mic balance—the panning is more accurate." Some of that clarity is definitely down to the listening conditions which are far better than in any other BBC OB vehicle. The digital signal path and the improved acoustics has led to situations where techniques have had to change. Alan for instance once used ribbon mics, particularly for one of his speciality areas: choral evensong. However, the low output and the need for a high gain has meant that these mics are not used now due to the noise increase. Higher output condensers are now being used. A combination of the improved acoustics and the console has brought to light a problem that was being masked by an analogue signal chain with acoustics which were not so good.

Some of the producers using the DCV have yet to be convinced that this monitored/recorded sound is an improvement. They had been in the unique position of having both digital and analogue mixes going at the same time using mic splits to another OB vehicle on certain occasions and there have been some requests to muddy up the digital chain to make it sound more similar to the analogue. In some cases, after complaints they have checked out the signal chains and found that something has drifted or is not quite right, although in most cases of comment it appears to be just what people are used to listening to.

As yet there has not been a great deal of mixdown work nor overdubbing completed in the DCV although this is really just how the work has gone so far rather than intention. It is then that the expanding sides of the unit will come into their own. Although the room response is equalised for sides out, it is still pretty good with them in if slightly claustrophobic. On a personal level with the sides out it is the least mobile feeling mobile I've been in.

Alan Wilson admitted that even after six months they are still only scratching the surface of what the DCV is probably capable of. The week following this interview the DCV will be handling the last week of the Henry Wood Promenade concerts at the Royal Albert Hall, broadcasting live. The Proms set-up will consist of a small remote digital mixer (BBC designs dept) that will take the announcer's voice and add the output of the *DSP* (the music balance) for the complete feed. This signal will then be AES/EBU converted to NICAM within the DCV then fed to a radio link on the top of the Albert Hall to Broadcasting House for broadcasting. At present the final stages of this link at Broadcasting House are analogue but there are future plans.

When NICAM is not practicable Sony *PCM-F1* encoded signals have been transferred down video links with great success even when the link is not particularly good and/or a stereo link is not available.

The OB use of a digital audio signal chain has become a reality and the BBC is in a unique position being able to experiment in a way that no commercial organisation could. There is still a great deal of experimenting to be done and hopefully the BBC will continue to be as helpful and open over their future practical experience with the DCV as they have been over the past six months' findings.

Keith Spencer-Allen

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SSL joins the UEI group

SSL has joined UEI plc one of Britain's most successful high technology groups. The move brings SSL together with Quantel, the largest member of the UEI group and the market leader in digital television and video post production graphics, special effects, frame store and animation systems. At the present share price, the combined group will have a market capitalisation in excess of £180 million.

Founder and chairman Colin Sanders explained that as was the tradition in the group, SSL would continue to operate in a largely autonomous manner. He said, however, "We all recognise that the advanced needs of our clients will best be served by the development of integrated systems running compatible software, all designed to allow efficient coupling between every aspect of production and post production.

"In joining forces, Solid State Logic, Quantel and the rest of the UEI group are acting to ensure a smooth transition and the most stunning creative gains for both the artists and the engineers who will pilot these future systems."

With the traditional distinctions between audio recording studios, video production houses and broadcast facilities starting to fade each industry has begun to 'borrow' the techniques and the technology developed by the other sectors. As a result a much larger and broader service industry is emerging. This 'communications production industry', as SSL describes it, embraces all aspects of sound and vision, whether for entertainment or information and whether the final consumer format is vinyl records, audio cassettes, compact discs, video cassettes, video discs, broadcast radio, broadcast television, high-definition television, multichannel television cablecast or satellite.

Re-organisation of BBC engineering departments

Several BBC engineering departments have recently been re-organised. Studio planning and installation, previously carried out by the Studio Capital Projects Department (SCPD), has been devolved from Engineering Division into the BBC Radio, Television and External Service Directorates.

Radio Projects and Radio Group (SPCD) become Radio Capital Projects Department (RCPD), headed by George Crowe, with Assistant Head, Roy Newrick. RCPD is located at 'Woodlands', London W12.

Television Projects have combined with the television sections of SCPD to become Planning and Installation Department, Television (PID (Tel)), headed by Ken Ackerman, with Deputy Head, Mike Stickler, and Assistant Head, Dave Bevan. PID (Tel) is also located at 'Woodlands', London W12.

Engineering Projects and Planning Department, External Services, has been enlarged by the transfer of staff from SCPD. The department, which continues to be headed by Les Richardson, is located at Bush House, London WC2.

Designs Department and Equipment Department combined to become Design and Equipment Department, headed by Bert Neale. The new department has two groups: Design Group headed by David Kitson and Support Group headed by David Walker. Design Group, currently located at Western House, London W1 will eventually move to join the rest of the Department, who are already located at Avenue House, London W4.

A new section of Engineering Division has been created to be responsible for the planning, acquisition, and commissioning of computer installations for the Engineering, Finance, Personnel and Public Affairs Directorates. Based at Woodlands, London W12, the Information Technology Engineering section will be headed by Paul Jarrett, with deputy head Roger Powell.

Conservation manager for National Sound Archive

The National Sound Archive has appointed Peter Copeland as conservation manager. He will head the Technical Services section and one of his first duties will be the establishment of a commercial Search and Copy Service to promote wider media use of non-BBC NSA material. He will also assist in the refurbishment of the NSA public listening facilities which are due to be re-opened at the end of the year.

Apart from spending some time at the Egton House Gramophone Library where he developed specialised systems for disc-to-tape transfer of old and valuable recordings, Peter Copeland has been with the BBC since 1960. During the last 15 years he was a senior sound supervisor at the BBC TV centre in Bristol.

Contracts

- Neve has won a contract to supply a *V* series console with *Necam 96* to the Bee Gees' Middle Ear Studio in Miami, Florida.
- The BBC has ordered 19 Klark-Teknik *DN780* digital reverb/processors with the new *Version 2.0* software which will be distributed amongst the various departments of BBC Radio in London.
- Mitsubishi has supplied two *X-850* 32-track recorders and two *X-86* digital mastering machines to George Martin's Air Montserrat studio. This represents the largest single order received by the Mitsubishi Pro Audio Group.

Other recent sales have included an *X-850* to Ardent Recording Studios and to Soundworks and *X-80* 2-track recorders to the Readers Digest Association and Digital Music Products.

- PR Records Ltd in London has signed a contract with Teldec in Berlin for DMM metal processing and mastering. This is the second pressing plant in the UK to handle DMM masters—EMI being the first.
- Harrison has shipped the first four of its advanced totally automated series *10* audio console systems. The first was an 80-input system to Denny Jaeger Productions in Oakland, California, the other three to Mike Oldfield Music, England; Marquee Studios, London and Westlake Audio in Hollywood.
- Recent sales of Soundtracs products include *M* series consoles to Expo '86 in Canada in the Pavilion of Promise and to the main Aztec Stadium in Mexico for the World Cup. Roy Haye of Culture Club purchased a *CM4400/CMS2* package for their private studio; Seaworld in Florida installed a *CM4400* for video post production and Eric Stewart has also placed an order for a *CM4400/CMS2* package.
- Recent *Eclipse* systems installed and commissioned by Audio Kinetics in the UK have included Lansdowne Studios, Molinare, Scottish Television and Fountain TV. Six systems have also been installed in Switzerland, including Swiss Television.
- The Mitsubishi Pro Audio Group is to supply $1.25M worth of equipment to Cannon Films Inc including Westrex magnetic film recorders and reproducers and a custom built film re-recording console with *Compumix IV* automation and Intelligent Digital Faders. The Cannon Films facility is probably the largest film post production installation that LA has seen for years and will be located in Hollywood. The complex will encompass the entire feature film life cycle, from conception to distribution, under one roof.
- London Weekend Television has placed a firm order for a second custom console from Neve. This is to comprise a 48-channel *V* series console plus a grams mixer based on the *51* series and an audience sub-mixer. All the equipment will be installed in Studio Two which is due to open autumn 1987. The refurbishment of Studio One recently completed, included a customised 48-channel *V* series with *Necam 96* plus a grams and 12-channel audience mixer.

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We're on the move

We've all come a long way in ten years.... And while many of you have enjoyed successful projects and opened up bigger and better studios, we've had an increasing struggle against decreasing space, landlords, motor traders, rag traders and so forth in our delightful premises in New Crescent Works.

At last we've found a new home – not half a mile down the road from where we are now, but infinitely more salubrious and easier to find.

From **3rd November 1986** we shall be trading from our new headquarters in Scrubs Lane offering expanded facilities for both demonstrations and servicing, a much larger digital editing suite, as well as far greater levels of comfort for staff and visitors alike.

Our enormous new showroom will allow us to demonstrate complete 24 track studio systems, 16 track audio-visual packages and the very latest in digital recording technology. Additionally we will have our usual permanent demonstrations of the very best in home studio recording systems, video equipment, amplifiers, CD players, signal processors, mics, monitors – in fact everything you might need.

So to make sure you don't lose us and we don't lose you, please make a note of **our new address and telephone number.**

Here's to the next ten....

HHB Hire & Sales,
73-75 Scrubs Lane, London NW10 6QU
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DIARY

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People, events, services

Forthcoming events

October 28 11th Sound Broadcasting Equipment Show, Albany Hotel, Birmingham, UK.
November 6 to 9 Institute of Acoustics 2nd Annual Conference: Reproduced Sound, Hydro Hotel, Windermere, UK.
November 12 to 16 81st AES Convention, Los Angeles, USA.
November 19 to 22 14th Tonmeistertagung Munchen 86, Deutsche Museum, Munich, West Germany.
1987
March 28 to April 1 NAB Convention, Dallas, Texas.

Contracts

● Hollywood Studios has become the world's largest user of the Harrison automated *PP-1* audio post production console having taken delivery of its third system. The new console provides 72 inputs and has 24 submaster modules. With the integral 24-input pre-dub submixer total input capacity is 96 dub channels. This brings the studio's investment in the *PP-1* to well over $1 million. The new console will be installed in Studio D, replacing a smaller *PP-1* which is to be moved to Studio C.

Other Harrison sales include two *MR-4* 24-track consoles to the Music Business Institute in Atlanta, Georgia; a series *10* to Soundfirm in Melbourne, Australia; a 36-input *MR-4* and a *PRO-7* to Australian Broadcasting in Brisbane; a *TV-4* stereo teleproduction console to BCNZ in New Zealand and the first order for the *AIR-7* on-air radio console in China. Harrison has also recently sold its 12th *MR-3* to the PRC.

● Soundtracs has won a number of contracts in the Far East. These include a *CM4400* 24/8/16 console for post production at Shenzhen TV in China; a *CM4400* and two *MR* 24/8/16 consoles to Mun Hwa TV and Broadcast Corporation, Seoul, Korea for the '86 Seoul International Song Festival; an *M32-8* to Atlantis World Entertainment in Singapore and a *T-32-8* for the *Police & Friends* telecast. Soundtracs has also supplied an *M24-8* to the Hong Kong Academic Community Hall for its sound reinforcement system.

● Unique Recording Studios in New York has updated its facilities with the addition of four new Studer *A800 Mk III* master recorders and three ½ in *A820* 2-tracks. Extensive renovations to the control room in Studio B have now been completed with the installation of UREI *813*s and the complete acoustical redesign of walls, floor and ceiling.

● Soundcraft Canada has supplied RCA with 23 consoles for use at Expo '86 in Vancouver, Canada. The package included four series *800B*s and *400B*s, a series *500* and 14 series *200*s. In Australia, PA company Revolver has recently purchased two series *800B*s—a 40-channel front-of-house console and a 32-channel monitor desk. The Adelaide Festival Theatre has purchased a series *800B* for the Australian production of *Cats*. The console is currently at the Theatre Royal in Sydney. In the UK Soundcraft recently supplied TFA with two series *4* consoles (one house, one monitor version).

● Coach Audio Sales in Germany has recently installed a Cadac console at the CBS Studios in Frankfurt.

● Amek has supplied BBC Television Centre with two post production consoles based on the *BCII* but tailored to meet BBC requirements. Other BBC contracts include a special transportable verion of the *BCII* for BBC Radio Outside Broadcasts and a console for an advanced digital and analogue film studio in Bristol. Greene Street Recording has placed an order for the *APC1000* assignable production console. The console will be fitted with GML fader automation and has 80 inputs, 48 buses and full Amek Active Recall on all control functions.

● Stevie Wonder has purchased three Meyer Sound Laboratories *833* monitor systems, one for use at home and two for Wonderland, his personal-use studio in Los Angeles.

Agencies

● FWO Bauch Ltd has been appointed exclusive UK distributor for the Lexicon *RD-1 (Opus)* hard disk audio production system. The system will perform multitrack digital recording, editing, time alignment, mixing, signal processing and overdubbing.

● Coach Audio Sales is now exclusive agent in Germany for Bel, Electrospace and Sanken. Coach Audio Sales, Gunther Kutsch und Stefan Mayer, GbR, Wendalinusstrasse 3, D-6690 St Wendel, West Germany. Tel: 06851/70141.

● Sonosax SA, the Swiss manufacturer of professional sound products has appointed Professional Sound Corporation, 5707 Cahuenga Boulevard, North Hollywood, CA. Tel: (818) 760-6544 as its exclusive importer and US distributor.

● Dod Electronics has been granted exclusive US marketing and distribution rights for the IVL *64*, *4000*, *5000* and *MIDI Master II* pitch recognition units. In addition to these models Dod will be exclusively marketing the *7000* in South America, Africa, the Middle East and Europe. These products are now to become the *MIDI Master* series and will be marketed in the UK under the Dod name.

● Elliot Bros has been appointed distributor of the *Middle Monitor* by Wellard Research.

● Turnkey has recently signed an exclusive microphone dealership agreement with Bruel & Kjaer.

● Audio Music Manufacturing has appointed Fender as its USA and Canada distributor. Ram and Dynamix mixers will form a major part of Fender's new Special Products operation.

In the UK Ram and Dynamix will be distributed by J & I Arbiter Ltd which has also taken on the UK distribution for *Vesta Fire*.

Digital Information Exchange

The second Digital Information Exchange is to be held at the Private Members' Suite at London Zoo on November 25th, 26th and 27th. A number of new and important developments will be demonstrated and explained including R-DAT, the AMS *AudioFile*, digital VTR, the all-digital studio and some broader aspects of compact disc. There will also be news from the US digital recording scene and a user's guide to digital multitrack recording. Hands on sessions are scheduled for all three days.

The seminar, which is sponsored by Sony Broadcast and HHB Hire & Sales in association with *Studio Sound* and *Pro Sound News*, will involve a large number of leading industry names with presentations planned from AMS, EMI, SSL, HMV, Trilion, Philips Interactive Media Systems, Editel, Audio FX, the Alvey Project, Alan Parsons, Silver Platter, Sony and HHB.

Day One (Nov 25th) will deal mainly with digital audio in the broadcast environment, Day Two (Nov 26th) is aimed at recording engineers and record company production managers and Day Three (Nov 27th) will be looking at applications of digital audio in scientific research and data storage.

Charges have been geared to cover the cost of staging the event and providing refreshments and a buffet lunch. The cost of each daily session is £50.00 plus VAT or £120 plus VAT for all three days.

Technical Projects bought

In a joint operation, Canford Audio and Neutrik have bought Technical Projects from the company's receiver. Of interest to Canford Audio are the DI boxes and intercom systems and to Neutrik, the *MJS* test sets which it sees as an interesting complement to its *Audiograph* measuring system.

According to Bernhard Weingartner of Neutrik and Iain Elliott of Canford Audio the intention is to restart production as soon as possible. Most Isle of Wight production staff will be retained. ▷

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Low-cost digital audio comes of age.

The Sony PCM series has now been available for several years. In this time recording and broadcast organisations, government, educational and industrial establishments, as well as individual users have all acknowledged the unique value of these units, and made them a new standard. It is the superlative quality of Sony PCM digital, coupled with extremely low cost that has brought about this professional acceptance of the range. This is borne out by the number of new ancilliary products from other manufacturers, that have further increased the flexibility and versatility of the range. Examples of these products are the 'CLUE' logging and editing system from HHB, as well as various interfaces which allow digital communication with the PCM 1610.

Sony has acknowledged that this acceptance by professional users necessitates a change of policy towards these products. Accordingly they have upgraded them from the domestic catalogue, and, realising the need for professional support and all that that entails, have appointed HHB as specialist dealers to represent them in the pro-audio market.

We are proud to announce this appointment, and happy to assure our customers of continued availability of the PCM range. The re-instatement of the PCM production line has been very largely due to pressure from end-users, who are after all the motivating force in the audio world. So if you are involved with audio recording and are still unfamiliar with Sony digital, then you owe it to yourself to call HHB – the No. 1 name in Digital Audio.

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THE SONY PCMF1 AND PCM701ES DIGITAL AUDIO PROCESSORS.

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People, events, services

- Following a weekend seminar held by the Institute of Broadcast Sound entitled The Digital Future, IBS are producing a booklet comprising many aspects of digital development which will be sold as a training aid. Enquiries should be addressed to the editor Roger Derry at 94 Oakdale Road, Leytonstone, London E11 4DL. Tel: 01-556 9620.
- The latest 1986/87 Measuring Instrument Catalogue from Precision Instrument Laboratories (PIL). Contained within the 100 pages are over 400 outline specifications of all types of electrical and electronic test and measuring instruments manufactured by 60 companies worldwide. Fibreoptic equipment is included for the first time.
- BPI Yearbook—annual report on the British record industry. Containing 36 sections which have all been updated by BPI general manager Peter Scaping as editor and BPI researcher Christine Manley. New additions include a chart analysis from national pop chart compilers Gallup; A guide to music industry organisations; and a general guide to the making and exploitation of sound recordings. It also contains a wide range of industry statistics and analyses covering trade delivery figures for all types of discs and cassettes, manufacturing, import and export, costs, employment, distribution, retailing, charts, certified awards and market shares.
- Vermason Ltd, UK specialists in static protection, have brought out a new 44 page catalogue. It covers their complete range of products, materials and equipment and includes an introduction which deals with the causes and detrimental effects of static.

Literature received

- AES has published Stereophonic Techniques: An Anthology of Reprinted Articles of Stereophonic Technique. It is a compilation of 67 documents, articles and papers published in the AES Journal, Audio Engineering (now Audio), Electrical Engineering, IRE Transactions on Audio, Journal of the Acoustical Society of America, Journal of the SMPTE and From Tin Foil to Stereo by Oliver Reed and Walter L Welch. The background and history is covered from the historic Paris Opera broadcast in 1881 to contemporary methods and equipment.
- Imhof-Bedco Standard Products Ltd has published its latest edition of the Express Service catalogue containing 130 pages of electronics packaging products ranging from complete racks, sub-racks and cases through to ancillary equipment.
- Published in association with Kodak Ltd, the third edition of Electro 86/87 is now available. The directory provides details of film, television and audio facilities including recent developments in cable and satellite. Also included is the Kodak commissioned Film Production Directory which was previously published by the Motion Picture & Television Sales division. The book is available in two versions, a paperback edition and a spiral-bound 'professional' alternative.
- The Performing Right Society has recently published its 1986-87 yearbook which in addition to the reference section includes a review of 1985 and a special section on copyright. The 124-page yearbook and the Directors' Report & Accounts are available from The Performing Right Society Ltd, 29/33 Berners Street, London W1P 4AA, UK. Tel: 01-580 5544.

CLEAR REASON

For the music studio owner, no decision is more critical than choosing a console. Both financially and creatively, the success of your operation may well depend on the capabilities and quality of the system you select, and the company that supports it. Clear reason, we suggest, to consider the SL 4000 E Series Master Studio System from Solid State Logic. But certainly not the only reason.

Consider, for instance, that only SSL has built-in track remotes on every channel, integrated with the industry's most versatile monitor fader and foldback facilities. Or that SSL alone provides pushbutton signal processor routing for each channel's noise gate and expander, compressor/limiter, high and low pass filters, and parametric equaliser — plus switchable phantom power, patchfree audio subgrouping, AFL and PFL monitoring, fader start for external devices, and stereo modules with balance and Image Width controls.

Consider that SSL makes the industry's only comprehensive studio control system — with integral synchronisation of up to five audio/video machines, concise English commands, tape location by timecode, foot/frames, cue numbers or key words, and complete session list management. And that SSL alone offers extensive fader, group and mute automation and mix manipulation *plus* optional programmable parametric equalisation and panning, multi-repeatable Events Control, and Automatic Dialogue Replacement.

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DIARY

People

● Dan Garrigan, previously western regional sales manager for ROH has been appointed national sales manager for the ROH division of Anchor Audio who recently purchased the ROH product line.

● Michael Sherman has been appointed international sales director at the new London offices of Swiss company Sondor.

● Amek has recently appointed Steve Landin as head of test. Previously Landin worked for the BBC's capital projects department testing and accepting consoles and installing and commissioning radio stations.

● FWO Bauch has appointed Dave Wood to head its Revox hi-fi division. He will be responsible for Revox sales and service in the UK.

● Altec Lansing has announced the appointment of Clark D Nail as manager, Production Design Engineering.

● Peirce-Phelps audio systems division has added three people to their staff: Thomas W Knauss, sales engineer; James Ritz, senior audio engineer; and Jerry Williamson, sales representative.

● Former director of marketing for Renkus-Heinz Inc, Jason Larson has left to develop an international network of professional live sound Smart System contractors. The Network will have offices in California, Texas, New Jersey and England and will utilise identical flying arena Smart Systems capable of supporting any artist in any venue unassisted.

● Mark Goodman has joined Apple Sound Services to represent its sound hire services and facilities within the UK.

Address changes

● Ensoniq Europe has restructured its European distribution arrangements. The head office has been moved from Brussels to Ensoniq Europe BV, Domplein 1, 3512 JC Utrecht, Holland. Tel: 31-30-314 225. Telex: 40541. The Brussels office is to become a regional sales office for Belgium and will be renamed Ensoniq Belgium BVBA. A German regional office (Ensoniq Germany GmbH) is to be opened shortly in Moers.

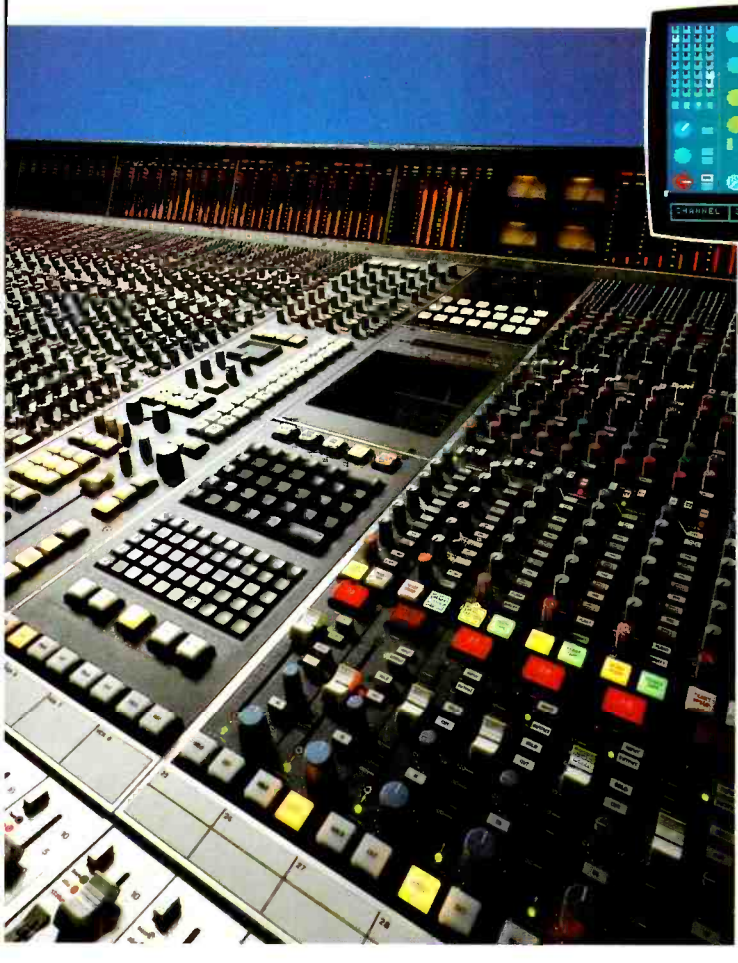
● Electro-Voice SA has moved to Mark IV Industries, Keltenstrasse 5, CH-2563 Ipsach, Switzerland. There is also a new telex number: 934045.

● The ROH product line has been purchased by Anchor Audio and the entire ROH operation has been moved from Atlanta. Anchor Audio Inc, 913W 223rd St, Torrance, CA 90502, USA. Tel: (213) 533-5984.

● Sondor of Switzerland has created a new company in the UK. Sondor of Switzerland Ltd, 107 Swains Lane, Highgate Village, London N6 6PJ. Tel: 01-341 9181.

Synthesiser tape contest

The 1986 Synthesizer Tape Contest is now underway, the deadline for entries being October 31st, 1986. All entries should be on cassette and must be 5 min or less. Tapes should be recorded using multitrack or sound on sound techniques and produced entirely or mainly with synth/computer instruments. Further details: Synsound (Dept STC), The Sound House, PO Box 37b, East Molesey, Surrey KT8 9JB, UK. Tel: 01-577 5818 or 01-979 9997.



Then consider that SSL's Studio Computer alone goes beyond mixing automation to provide Total Recall™ — a unique system, completely independent of the audio path, which stores all I/O module settings after each session. The new TR AutoScan function makes it faster than ever to recreate headphone and monitor mixes, equalisation, or entire console setups with quarter dB accuracy and rapid verification. And SSL alone offers data-compatibility with more than 300 installations — in over 80 cities around the world.

Finally, consider a company whose record of practical innovation, ongoing development and in-depth technical support has earned repeat orders from many of the world's toughest customers — a company that other manufacturers use as a standard for comparison. We join them in urging you to compare. Our 40 page colour brochure on the SL 4000 E Series is a good place to start. It's yours for the asking, and it just might make your difficult decision a whole lot easier. Clear reason, may we suggest, to write or call us today.

Solid State Logic

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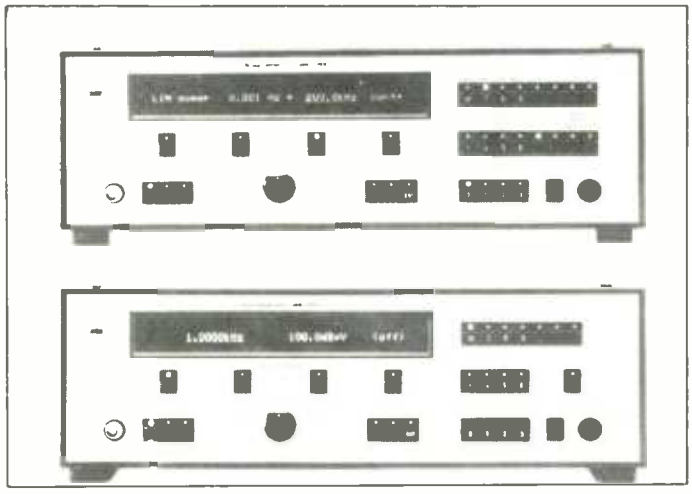
Alpha Audio Sonex 1

Sonex 1 is a flame resistant version of the already popular Sonex acoustic material. The new version is a porous acoustic melamine material. According to independent tests the new uncoated material meets US Class 1 requirements for both flame spread and smoke density, thus making it suitable for a wide range of applications such as public buildings, theatres, schools, hallways and meeting rooms.

The material, which is 2 in thick, will be available in 4×2 ft panels. Packaging will be four panels to a box. The material is available uncoated in white or in a variety of additional colours. A washable black or light-grey Hypalon finish is also available which enables the panels to repel oil, acid or solvents.

Alpha Audio, 2049 West Broad Street, Richmond, VA 23220, USA. Tel: (804) 358-3852.



Bruel & Kjaer 1051 & 1049 test equipment

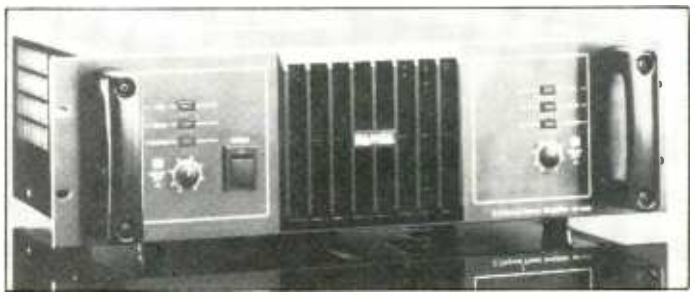
Bruel & Kjaer has introduced the *1051* sine generator and *1049* sine/noise generator for use with automatic testing and quality control systems. Both instruments have linear and log sweep ranges with user preset frequency limits from 0.2 Hz to 200 kHz and extended linear frequency sweeps from 0.001 Hz to 200 kHz with 1 MHz resolution.

Both single and repetitive sweep modes with accurate 4-digit sweep rate selection permit synchronous operations with graphic recording and oscilloscope monitoring equipment. Output levels from 100 μV to 5 VRMS are selectable with an attenuator accuracy of 0.03 dB. The amplitude is flat within 0.05 dB over the AF range. Output distortion is better than −96 dB and typically −110 dB at 1 kHz.

Both generators have an IEC/IEEE interface enabling them to be used for automated test systems. For regular tests nine completely different sets of control panel settings can be stored in the memory section. In addition a 1024 point user defined amplitude weighted frequency sweep can be stored when any form of 'constant output' test measurements need relating to frequency.

Identical in every way to the *1049*, the *1051* also features narrow band random white and pink noise outputs for electro-acoustic measurements in addition to a log amplitude sweep and a compressor providing 126 dB amplitude regulation.

Bruel & Kjaer A/S, DK-2850, Denmark.
UK: Bruel & Kjaer (UK) Ltd, 92 Uxbridge Road, Harrow, Middlesex HA3 6BZ. Tel: 01-954 2366.
USA: Bruel & Kjaer Instruments Inc, 185 Forest Street, Marlborough, MA 01752. Tel: (617) 481-7000.



Ramsa power amplifiers

Ramsa has announced two new professional power amplifiers offering similar features. The *WP-9110* and *WP-9220* are rated at 100 WRMS and 200 WRMS/channel into 8 Ω resp. In the bridged mono mode, outputs are roughly trebled to 300 W and 600 W.

The amplifiers have been subjected to extensive performance tests and are claimed to be capable of withstanding excessively high input levels outside the audio spectrum without loss of sound quality or transistor damage. The amplifiers feature two-stage, temperature-controlled cooling fans.

UK: Ramsa, Panasonic UK Ltd, 300 Bath Road, Slough, Berks SL1 6JB. Tel: 0753 34522.
USA: Panasonic Professional Audio Division, Matsushita Electric Corp of America, 1 Panasonic Way, Secaucus, NJ 07094. Tel: (201) 348-7000.

JBL 2123H transducer

JBL has developed a new midrange drive unit with a 3 in (76 mm) voice coil for sound reinforcement and custom monitor systems required to operate at high sound pressure levels. According to the manufacturers the *2123H* has the highest power handling of any JBL 10 in midrange transducer (250 W continuous pink noise) and provides a sensitivity of 101 dB at 1 m with 1 W.

To reduce distortion and ensure a smoother frequency response the unit features a curvilinear cone, double half-roll surround and overhanging aluminium ribbon voice coil. The claimed frequency response is 200 Hz to 5 kHz ±2 dB. Unwanted second harmonic distortion is reduced with JBL's patented Symmetrical Field Geometry magnetic structure.

The *2123H* features a die-cast aluminium frame manufactured to very tight tolerances. The truncated frame style allows tight packing of the drive unit in multiple transducer arrays.

JBL Professional, 8500 Balboa Boulevard, Northridge, CA 91329, USA. Tel: (213) 893-8411.
UK: Harman (Audio) UK Ltd, Mill Street, Slough SL2 5DD. Tel: 0753 76911.

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AMEK OTARI

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THE WINNING COMBINATION

If you're putting together a new multitrack studio, or upgrading an existing one, the combination of an Otari multitrack and an Amek Angela has probably already occurred to you.

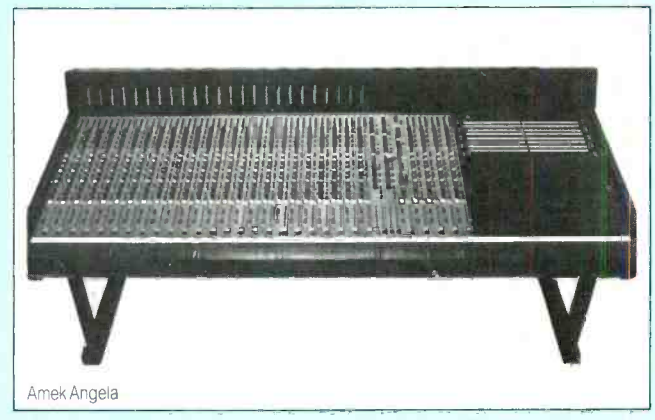
It's a combination that over the last two years has proved the most successful we've handled in our 14 years.

Otari MTR 90

Otari MX 70

The MTR90, as the world's best-selling multitrack recorder, needs little introduction. Suffice to say the MTR90 is now the first choice of many of the world's leading producers and engineers.

The new Otari MX70 is a state-of-the-art 1" 8- or 16-track drawing on the advanced design ideas of the MTR90. The MX70 makes Otari performance and features available at a much lower price.



Amek Angela

The Amek Angela must be now nearly as well known as the MTR90. The attributes of the Angela are many and varied, but those most commonly-quoted are the highly musical eq section and general transparency of sound, the incredible flexibility of operation and the very high standard of mechanical construction.

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Only ITA can offer the experience of having already installed many Otari/Amek systems, for a variety of different applications, from private studios to video post-production facilities.

We don't stop with Otari and Amek; our product range is about the largest of any UK supplier, and the ITA service includes studio design and building as well as full installation and back-up.

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NEW PRODUCTS

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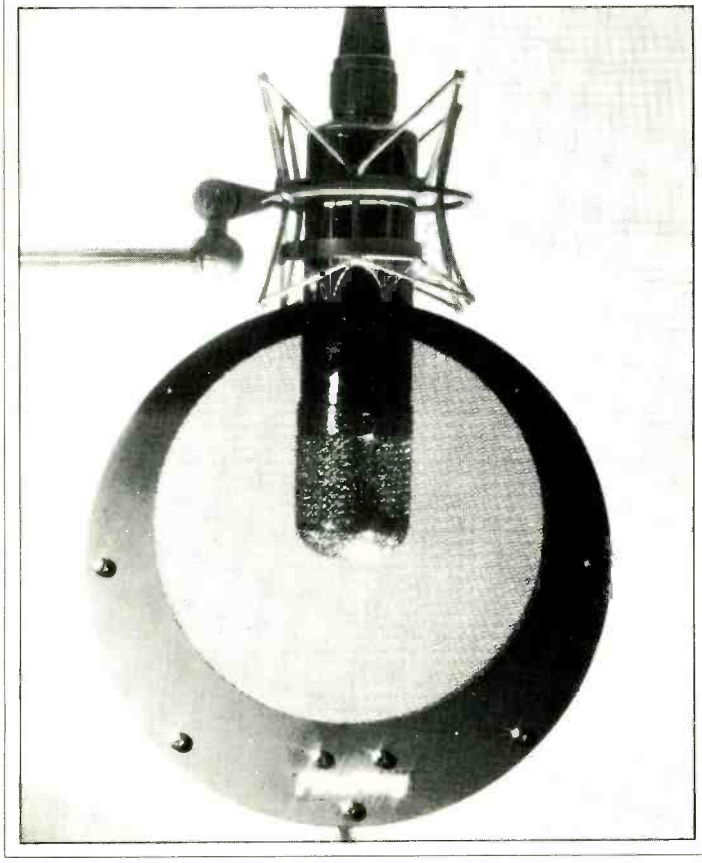
Miller Audio NS-TENuator and FilteRing

Designed to replace the infamous 'stocking on a coat hanger' pop filter, the *FilteRing* uses a standard microphone stand mount and has a steel frame that securely holds replaceable nylon filters. Two filters (made from the same material as nylon stockings) are supplied with each frame but it is also possible to use custom filters which can easily be made to fit the *FilteRing*. Replacement takes less than 2 min.

Requiring only a screwdriver the *NS-TENuator* can easily be installed (or removed) in 5 min. Designed specifically for the Yamaha *NS-10M* loudspeaker, the unit neatly holds tissue paper or any other filter material against the tweeter. Using Yamaha's existing mounting holes the *NS-TENuator* is made from steel and is finished in jet black to match the cabinet.

Miller Audio Services/ Accessories, 4928 Maytime Lane, Culver City, CA 90230-5055, USA. Tel: (213) 836-4524.



Clarity MIDI/XLV controller

The Clarity *MIDI/XLV* is an automation system for the Lexicon *224XL* digital reverberator. With no modifications to the *224XL* the *MIDI/XLV* provides both program change and continuous control of all *LARC* parameters from a MIDI synthesiser or sequencer.

The unit enables the *LARC* faders to be controlled from any MIDI source (any MIDI controller to any combination of control parameters) and a bypass mode returns full control to the *LARC*. The Clarity *MIDI/XLV* provides factory presets for ease of use in addition to numerous user definable presets. The unit will receive on any MIDI channel and has eight voltage outputs to retrofit to existing processors and synths to enable MIDI control.

Full positive and negative scaling of the control input is provided as is full MIDI implementation including last or average key number, velocity and pressure.

Clarity, Nelson Lane, Garrison NY 10524, USA. UK: Scenic Sounds Equipment Ltd, Unit 2, 12 William Road, London NW1 3EN. Tel: 01-387 1262.

ASC timecode adaptor

The Otari *5050* Mk 111-2 is now available with a retrofit ASC centre track timecode track option. This consists of a headblock modification which replaces the normally unused quarter-track head with a combined erase/read-write CTTC head and a 1U unit fitted to the top of the *5050* which contains the timecode electronics.

The unit provides a large timecode display and caters for 24, 25, 29.94 and 30-frame codes automatically. Code type and valid code and record LEDs are provided.

UK distribution: ITA, 1 Felgate Mews, Studland Street, London W6 9JT. Tel: 01-748 9009.

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AMEK's APC1000 offers, first and foremost, the ultimate standard of equalization and sonic performance that producers and engineers worldwide know AMEK alone delivers. The demand to put the AMEK performance standard within the framework of an advanced automation system has been great. So to handle the growing need for a very large number of inputs whilst retaining operational speed and simplicity, we've recreated the concepts behind the multitrack console by taking automation to the limits possible under current technology without compromising the signal path.

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The Soundcraft SCM762 Mk III recorder comes complete with remote control, varispeed, zero locate and cycle functions. It will run at 15 or 30 ips and is widely used by many professionals in master recording and video post-production work.

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Soundtracs CMS2 – automation system.
Soundcraft SCM762 Mk III 24 track recorder.
Commodore PC and disk drive.
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NEW PRODUCTS

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Stramp CP-1 automation

The Stramp *CP-1* automated mixdown system consists of four basic elements: the *REALCON* software package (for the Commodore *64*); a *CP-1A* 8-channel hardware module; Sync and MIDI interface units and the *CP-1A-1* remote-control device.

The system controls, via the software, up to 64 audio channels and provides mute/de-mute and 256 discrete level steps. It can be operated from the computer keyboard or via MIDI and the monitor displays 16 channels at a time.

The hardware module is a 19 in 2U high unit containing eight voltage-controlled amplifiers. Input sensitivity can be set internally to −10 dB or +4 dB and a Reference Level Adj trim pot is provided. A Test switch sets all the VCAs to their 100% value and can either be used for alignment or to set the *CP-1A* in the bypass position.

The MIDI interface provides for one MIDI input and either three MIDI-out or three MIDI-Thru connections. The Sync interface enables clock write (sync to tape) or read (tape to sync) and includes level adjustment and optimum level indicator.

The remote control unit provides dynamic control of all 64 channels via a 100 mm P&G fader.

Audio-Vertrieb, Peter Strüven GmbH, Am Mulenberg 26, D-2085 Quickborn, West Germany. Tel: 04106/6 99 99.

AKG C414B-ULS microphone

The AKG *C414B-ULS* mic is specifically designed for digital recording. It features a 1 in gold-sputtered foil diaphragm with special Teflon coated lead out wires for use in high humidity environments. Considerable attention has been paid to reducing stray capacitance, RF interference, noise and distortion within the preamplifier stage and the microphone is claimed to offer a completely linear transfer characteristic of all transmission parameters.

The mic provides four switchable polar patterns, a 12 dB/octave bass cut filter at 75 and 150 Hz and switchable −10 or −20 dB attenuation. Standard accessories include foam-type windshield and stand adaptor.

Manufacturer's specification claims a minimum dynamic range of 126 dB, frequency response of 20 Hz to 20 kHz, S/N ratio of 80 dB and a maximum SPL for 0.5% THD of 140/150/160 dB SPL (0/−10/−20 attenuation). For high level low distortion transmission of the very low frequencies a special transformerless version *(C414B-TL)* is available.

AKG Akustische U Kino-Gerate GmbH, Brunhildengasse 1, A-1150 Wien, Austria. Tel: (43222) 9565 17-0.

UK: AKG Acoustics Ltd, Catteshall Wharf, Catteshall Lane, Godalming, Surrey GU7 1JG. Tel: 444868 25702.

USA: AKG Acoustics Inc, 77 Selleck Street, Stamford, CT 06902. Tel: (203) 348-2121.

Adcola 777 rework station

Suitable for the maintenance department that is constantly repairing circuit boards and electronic equipment is the portable Adcola *777* rework station. The unit incorporates its own internal vacuum source and requires a 220/240 V, 100 W, 50 Hz supply. Both the desoldering and soldering tools are thermostatically controlled with the desoldering tool on a Set/Read circuit coupled to a LED display.

A range of four desoldering tips is supplied with the unit and replaceable throw away tips can be ordered. Twenty-three soldering tips are also available. The *777* also features a hot air blow facility and comes complete with full operating instructions and a comprehensive spares and tool kit.

Adcola Products Ltd, Adcola House, Gauden Road, London SW4 6LH, UK. Tel: 01-622 0291. ▷

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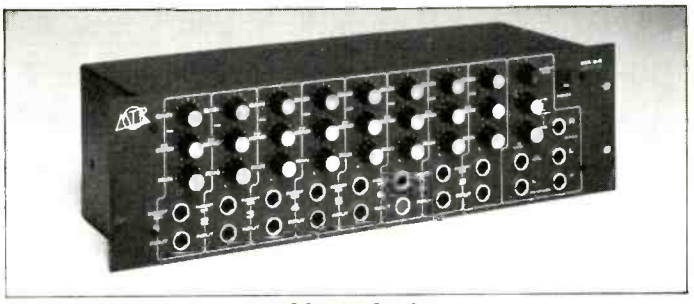
NEW PRODUCTS

NEW PRODUCTS

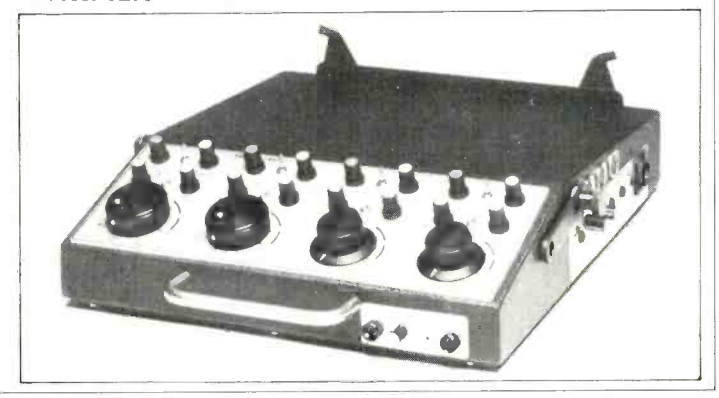
Equipment, modifications, options, software

In brief

Agfa-Gevaert Ltd has introduced a new VHS cassette for professional users. Available in E-30, E-60, E-90, E-120 and E-180 lengths the tape is claimed to have a very low dropout count (less than 20 per min). UK: Agfa-Gevaert Ltd, 27 Great West Road, Brentford, Middx TW8 9AX. . . **MTR** has introduced the *SLM 82*, an 8-channel stereo line level mixer in a 3U, 19 in rack mount format. It has been specifically designed for mixing drum machine outputs, synth and keyboard setups or effects. All connections are on the front panel and the unit includes gain, pan, aux post fade channel, stereo master volume, stereo aux return and pan. . . **Tascam** has introduced two rack-mountable cassette recorders, the *112* and the *112R* auto reverse version. The recorders feature Dolby *B*, *C* and *HX-Pro*. The *112R* also features a remote socket in order to 'chain' several units together either for extended playing times or in a master/slave configuration for duplication use. With the new remote system computer controlled tape systems with a broad variety of applications can be created. . . **EMO Systems** has unveiled *The Switcher*, a device which enables non-technical personnel to initiate or switch off electronic equipment in the correct sequence. A coded keypad is used so there are no lost keys and unauthorised use is prevented. EMO Systems Ltd, Durham Road, Ushaw Moor, Durham City DH7 7LF, UK. Tel: 0385 730787. . . **Publison** is now able to supply function 5, which was first shown at the Montreux AES, to users of the *Infernal Machine 90*. . . **Circuit Research Labs** is now manufacturing the *SSM 2200*



△ MTR SLM 82 mixer ▽ASC-MX4S MkII



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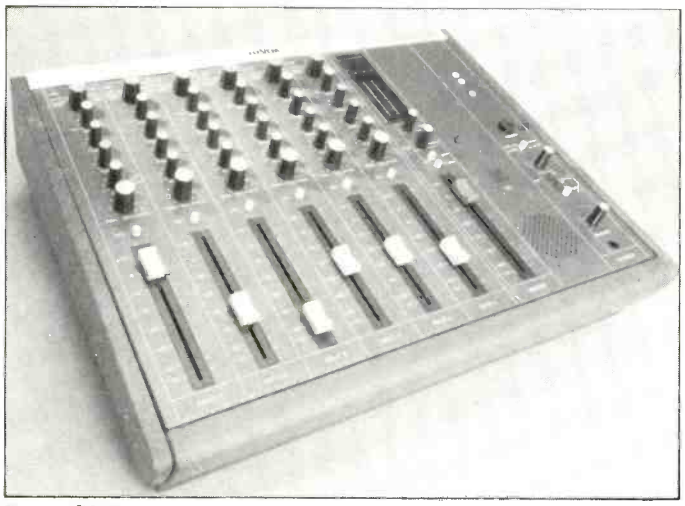
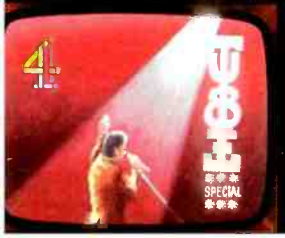


Revox C279

noise reduction chip under its new number *CRL 2200*. The chip is a single channel, single-ended noise reduction system (Dynafex) requiring few external components. . . **Tanrak** has a new digital sampler/delay. The device offers a 15 kHz bandwidth up to 1.5 s (8 s at reduced bandwidth), 87 dB dynamic range, auto or manual triggering, full sample edit, single or loop play, velocity sensitive dynamics, modulation, decay and overdubbing. Connections include Input, Output, Gate In (positive going), CV IN (1V/oct) and Modulation In. Tantek, Business & Technology Centre, Bessemer Drive, Stevenage, Herts SG1 2DX, UK. Tel: 0438 310120. . . **Audio Services Corporation** has announced a new version of the *ASC-MX4S* mixer. The Mk 2 version includes RF filtering, 4-step input pads, internal battery powering, 8 dB increase in headroom, 10 dB more dynamic range at channel fader and faster turn on. New options include adjustable output limiter, transformer input/outputs, mid EQ and stereo headphone monitoring. Audio Services Corp, 4210 Lankershim Boulevard, North Hollywood CA 91602, USA. Tel: (818) 980-9891. . . **Revox** has introduced for the first time ever an audio mixer. The *C279* has six unbalanced stereo or six balanced mono inputs. The stereo master provides for two balanced and two unbalanced outputs. The mixer uses VCA technology and long stroke faders and among the options are integrated dbx noise reduction and fader start facilities. UK: FWO Bauch Ltd, 49 Theobald Street, Borehamwood, Herts WD6 4RZ. Tel: 01-953 0091. . . **RPG Diffusor Systems** has introduced the *Abffusor*, an absorptive/diffusive Class A fire-rated panel with absorption coefficients of 1.04, 1.05, 1.04, 1.07, 0.09 and 0.82 at octave centres from 4000-125 Hz. The panels are 4×2 ft with an average depth of 2 in. RPG Diffusor Systems Inc, 12003 Wimbleton St, Largo MD 20772, USA. **UK:** RPG Europe, Unit 15, Northfield Ind Est, Beresford Ave, Wembley HA0 1YB□

nologyis in your interest.



Although artificial reverberation is often used as a special effect in the recording process it is naturally all around us. We associate it with realism and it allows us to define space. It is therefore an essential ingredient in the making of soundtracks.

The Klark-Teknik Digital Reverberation System brings to your working environment an extremely versatile reverberation processor which gives you instant access to Hall, Chamber, Room and Plate reverb simulations of outstanding audio quality.

There is that rich reverberation sound that makes musical instruments sound transparent and alive, and gives sonic stature to vocals, brilliant percussive plate sound, highly convincing reverberant room ambience and a selection of super-effective Non-Lin and Reverse gated sounds frequently used in contemporary music production.

As a bonus, there are a number of useful digital versions of special effects devices, and a fully functional remote control included at no extra cost.

The Klark-Teknik Reverberation System is based upon a high speed Digital Signal Processor and is claimed to be one of the leading digital systems currently available. Moreover, with the additional benefits of progressive hardware architecture and comprehensive world-wide software update service, it represents unsurpassed value for money when it comes to competitive price/performance ratio.

DN780 Features

- 16 bit linear conversion system with 32 bit arithmetic processing essential for state of the art reverb.
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NEW PRODU
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Equipment, modifications, options, software

Trident Di-An console

The Trident *Di-An* is a fairly major departure in console design for Trident incorporating a design approach that has so far really only been implemented in fully digital consoles. The *Di-An* is a digitally controlled system with an analogue signal path and uses a system of central assignment for EQ, routing, panning, aux sends and channel input functions. Each channel still has a dedicated fader for that channel together with muting, solo, AFL and PFL selection above it. In addition to the scribble strip there is a 4-character alpha-numeric display that allows entry of a channel ident that may be stored along with other console information. The Access button grouped with these controls selects all the centrally grouped console functions to that channel. The central panels are virtually all knobless layouts using pushbuttons for up and down control, LED readout for frequency and LED ladders for level. The equaliser consists of a 4-band type each with 16 frequencies and variable Q in addition to separate high and low pass filters. Aside from central console memory, each EQ setting has four EQ memories which can be accessed from the panel.

The advantages of this type of system are that important controls are nearer to the operator on large consoles and that each panel allows more detail display than a system where the controls are on individual channels.

There are a number of quite unique features on the mic/line input fascia including a high impedance mode for a mic input and an auto-gain key to set input gain automatically.

The *Di-An* has the ability to store and recall up to 128 complete console settings providing a complete reset of console status. These can be triggered against SMPTE code from a multitrack taking 20 ms to change between events. Console data can be stored on floppy disk and a drive is an integral part of the console.

Various fader automation systems will be available from VCA-based systems to a moving fader system with independent disk storage. Trident claims that as the console uses very few rotary controls and only a relatively small number of switches reliability will be much increased over a conventional console and further, as no audio travels through front panel controls switch problems are greatly reduced anyway.

Other facilities include the provision of 24 aux sends per input which can also be ganged as stereo pairs, 100-segment bargraph meter displays switchable VU or PPM with peak hold and spectrum analysis facilities.

The analogue circuitry of the equaliser is basically the same design that Trident have used in their more standard consoles although they have stated that the console is also capable of having its audio signal path replaced with digital path should this be required in the future.

For a fuller description of this console we would refer you to the June 1986 issue.

Trident has reported considerable interest and several international sales already, based upon advanced information.

Trident Audio Developments Ltd, Trident House, Rodd Industrial Estate, Govett Avenue, Shepperton, Middx TW17 8AQ, UK. Tel: 0932 224665.
USA: Trident USA Inc, 308 N Stanley Avenue, Los Angeles, CA 90036. Tel: (213) 933-7555.

Trident Di-An

Stepp DG1 digital guitar

The *DG1* (Digital Guitar One) is the first musical instrument introduced by Stepp and is the result of four years research and development costing £1.5 million. It is claimed to be the world's first totally electronic guitar with an integral dedicated sound generation source.

The *DG1* consists of the guitar itself and an LSU (Life Support Unit) which contains the synth voice boards, power supply and communications interface. All the LSU functions are contained within the *DG1* guitar stand.

The guitar uses SCI (Semi-Conductor Intelligent) electronic facsimile frets. No metal frets are required for harmonic pitch information because the Stepp strings never need to be tuned in the conventional manner: a non-interrupt autotune and calibration facility is included which constantly checks tuning at 1 s intervals. Eight octaves are available and tunings can be stored and recalled from any of the 100 memories. Chords can be played, stored and strummed without using the left hand and according to the manufacturer the *DG1* will produce a sound when a string is plucked faster than a traditional electric guitar with conventional pickups.

Because of the fully programmable architecture of the guitar the dedicated synthesiser can produce an extremely varied collection of electric and acoustic guitar sounds in addition to piano, brass and violin sounds. Also

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with modulated, sync and routing options totally new 'guitar' sounds can be created.

The guitar has balanced (*XLR*-type) and unbalanced (jack) outputs; a cassette interface (mic or line, in and out) and MIDI (in, out and thru). MIDI can be polymode (one channel for all strings) or split (six MIDI channels for strings 1-6). With the *DG1* connected to a MIDI sequencer it is possible to play a bass part, assign it to one of the MIDI channels (one string) and whilst it is playing back add rhythm and then whilst both parts are playing back add a solo line.

Other features include 1-16 channel number; 0-99 program number; program change on/off; tuning up or down two octaves; bar, fret and stum assign to MIDI parameters such as touch, pitchband, etc, and dump single Stepp programs, splits or all. One fret is scanned every ½ ms and strum information to the voice processor takes less than 1 ms.

Stepp, 3 Primrose Mews, Sharpleshall Street, London NW1 8YL, UK. Tel: 01-722 5448.

Stepp DG1

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MUSIC PAGE

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Mark Jenkins on synthesis for the studio

Simmons SDS 1000

The latest Simmons electronic drum kit aims to offer the classic Simmons sound plus several alternatives at a budget price. As before it is in two parts—the pads and the brain—and in this case the brain does not have MIDI inputs although these can be added with the *TMI* or *MTM* interfaces.

An analogue tom sound and a computer-generated bass drum sound are matched with four digitally sampled snares including high and low acoustic plus gated and electronic sounds.

The drums are grouped into five factory and five user-programmable kits and pad trigger controls, audio output volume levels for the five drums, and stereo and master volumes are all easily accessible. The programming section is simplified as compared to the earlier *SDS9* kit but includes a second skin facility, copying the effect of double heads on the toms. Stands are not included but the pads are of the latest design.

Simmons Electronics, Unit 11, Alban Park, Hatfield Road, St Albans, Herts AL4 0JH, UK. Tel: 0727 36191.
USA: Simmons Group Center Inc, 23917 Crastsman Road, Calabasas, CA 91302. Tel: (818) 884-2653.

Ensoniq ESQ-1

The *ESQ-1* is an 8-note polyphonic, three oscillator per voice, velocity sensitive multitimbral synthesiser with sequencer. Sounds are built on combinations of 32 alternative waveforms, some sampled, some digitally synthesised and harmonically filtered.

The *ESQ-1*'s 5-octave keyboard has a slightly weighted action and there is a single data entry slider and an 80-character fluorescent display, highly visible under all lighting conditions, which names 10 of the 40 onboard sounds at a time. Thirty Sequence numbers (in 10s) and 10 Song names can also be called up, and a cartridge allows a further 80 sounds to be accessed.

Split, Layer and Split/Layer playing modes with different pairs of sounds on each keyboard half combine with multitimbral playing using the inbuilt 8-track polyphonic sequencer which also interfaces to external instruments.

Programming buttons around the display take on different roles according to the present function and each facility—envelope, filter, amplifier and so on—has its own set of parameters available for editing. Global parameters such as Tuning and Pitch Bend range are also programmable but not for each voice independently.

The sequencer has a capacity of 2,400 notes expandable to 10,000 notes; sounds, performance parameters, pan positions, tempo and all other data is stored to tape or (via an Ensoniq *Mirage*) to disk.

The sequencer offers autolocate, autocorrect and punch-in functions, and has several control and sync inputs on the rear panel, which lacks only MIDI Thru and headphone outputs. Audio outputs are stereo jacks.

Assessment

The *ESQ-1* is the most impressive budget keyboard launched for some years. The design is outstandingly clear, the voicing and sequencer facilities incredibly versatile, and the range of sounds—from sampled to digital to analogue—unmatched.

Ensoniq Corp, 263 Great Valley Parkway, Malvern, PA 19355, USA.
UK: Ensoniq, 14 Back Lane, London NW3 1HL. Tel: 01-435 2434.

Akai

The *S900* sampler is already selling well but a simpler *S700* model is to be introduced to replace the *S612* later this year. Before that it will be possible to see the *MG1214*, an improved version of the *MG1212* mixer/recorder with smoother faders, SMPTE facilities and cosmetics. There's also a new 'portastudio' design, the *MG614*, with a fifth sync track and autolocate facilities.

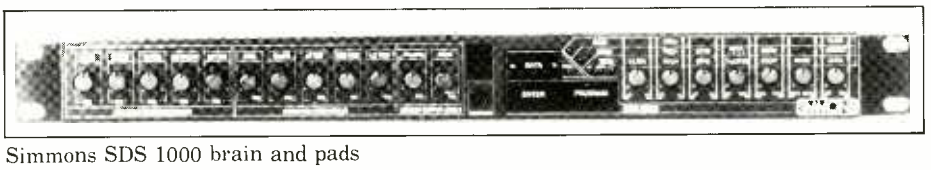
The 19 in *ME25S* Note Splitter allows up to 64 4-way splits to be programmed to convert a MIDI keyboard such as the Yamaha *DX7* into a powerful master keyboard. Patch changes, octave shifts and pitch wheel response can all be programmed as part of each patch. *ME30P* is a 4-8 programmable MIDI matrix which allows 15 complete patches to be set up and recalled instantly to interface synthesisers to sequencers, computers and MIDI effects.

UK: Akai (UK) Ltd, 12 Silver Jubilee Way, Haslemere Heathrow Estate, Hounslow, Middx TW4 6NF. Tel: 01-897 6388.
USA: Akai Professional Products, PO Box 2344, Fort Worth, TX 76113. Tel: (817) 336 5114.

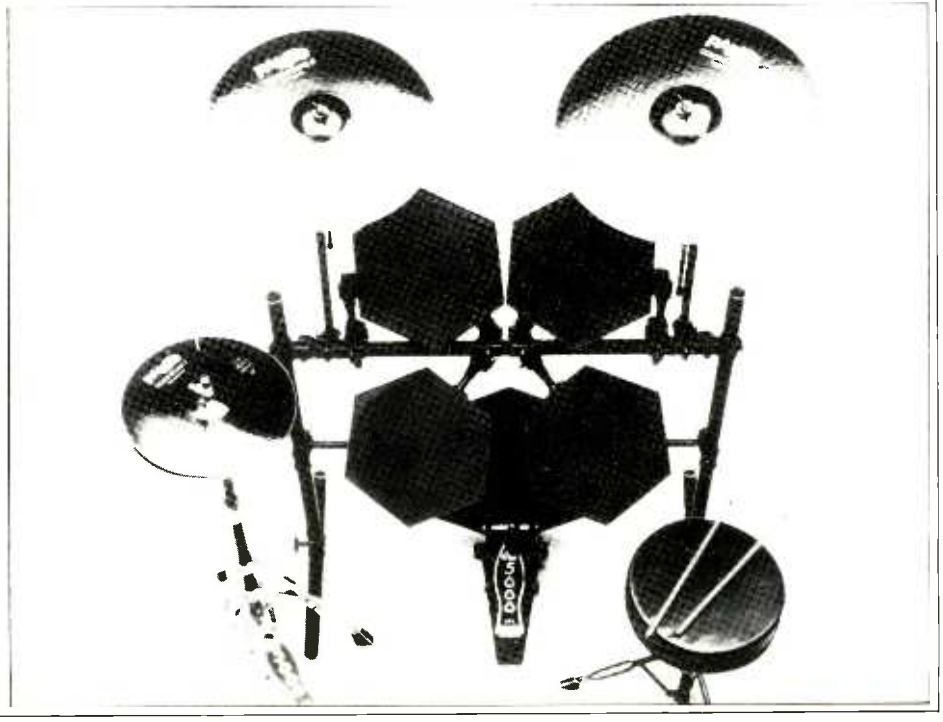
Korg DD-1

The *DD-1* is a new sampling drum machine with touch sensitive programming keys, programmable pitch, decay and output level per sound, 18 sounds plus ROM card loading, auto rolls and flams, MIDI, 100 pattern/10×9999 bar song memory, tape and RAM dump plus MIDI dump to an *SQD-1* or other sequencer, tap tempo facility and audio trigger.

UK: Korg, 32-34 Gordon House Road, London NW5 1NE. Tel: 01-267 5151.
USA: Korg USA Inc, 89 Frost Street, Westbury, NY 11590. Tel: (516) 333-9100.



Simmons SDS 1000 brain and pads



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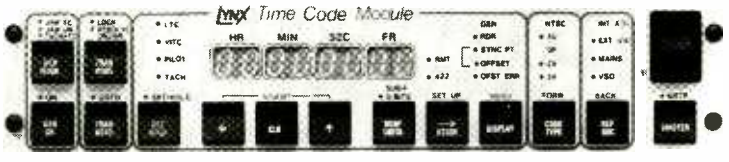

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EXHIBITION PREVIEW

AES 81ST CONVENTION PREVIEW LOS ANGELES

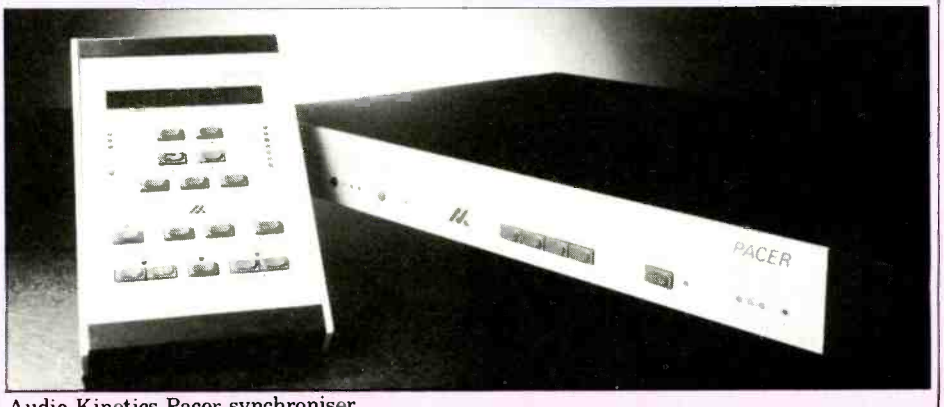
A guide to exhibitors and products on show

The 81st Convention of the Audio Engineering Society will be held at the Los Angeles Convention Center from November 12 to 16. As usual the convention will consist of a wide variety of papers, workshops and associated events and of course the exhibition. The exhibition starts one day after the opening of the convention on the 13th. In this preview we have concentrated on new items at the exhibition compiled from information available to us at the time of writing.

A

● **ACO Pacific:** will be demonstrating the new *ACM48UE ENG* microphone system designed for mounting on cameras for stereo or mono applications where the the 12 VDC 2mA requirements are met by camera supplies. Additionally on demonstration will be the *ACM48UP* in a stereo application, the *Ghost* portable 48 VDC phantom power supply, and the *Acoustical Interface* integrated *Type 1* mic system for measurement and precision recording. Several other new products will also be introduced. ● **Acoustic Sciences:** range of acoustic treatment systems including tube traps designed for control of sound within a space on a temporary or installation basis being particularly effective at low frequencies. ● **Adams-Smith:** will introduce *Zeta Three* tape synchroniser, timecode and MIDI generator and reader for the musician, featuring computer, transport and remote control ports. Latest version of *2600* A/V editor for audio for video track building/sound sweetening giving video style audio editing, industry standard edit decision list input and $\frac{1}{100}$ frame audio punch-in/out. There will be a working demonstration of audio for video editing with the *Compact Controller*. ● **AEG Corp:** has a range of analogue professional recorders, high speed duplication equipment and cassette tape loaders. ● **Agfa Gevaert:** two new products—*Magnetite 62*, a cassette for IEC Bias I 120 μs equalisation, and PE 649 iron oxide, high output, low noise cassette duplication tape. Also on show will be cassette tapes *PE 627/827, PE 619/819/1219*; studio tapes *PEM 469/468/297D* and the range of professional video products. ● **AKG Acoustics:** new products including mics *CK-8X* short shotgun, *C-522* stereo ENG, *C-562* boundary layer, *C-410* headset type, *D-112* dynamic cardioid, *D-130NR* dynamic omni, *D-310NR* dynamic cardioid, *D-330NR* dynamic hypercardioid, the *C414B/ULS* and the *C-414B/TL*; the *Q-15* communications headset; the *ADR-68K* digital reverb/effects processor; and the *MSP-126* stereo processor. ● **ALD Laboratory:** no information received. ● **Alesis:** reverb based signal processing equipment including the pre-programmed *Midiverb* and *Midifex*. ● **Allen & Heath Brenell USA:** several products new to the US. Featured will be the 24 bus *Sigma* series of consoles intended for multitrack or live use dependent upon modules selected. All feature 4-band sweepable EQ, HPF, six aux sends and two cue circuits. Local muting and microprocessor muting available. Also being introduced to the US will be the 32-input *SP432* sound reinforcement console and *Studio 12* production console along with a new software package for *CMC* based on SMPTE. ● **Alpha Audio:** range of acoustic treatment products including the new Class 1 fire rated *Sonex 1* acoustic panels. Also on display will be the *BOSS* automation/editing system. ● **Altec Lansing:** wide range of live sound products. ● **Amek/TAC Consoles:** full range of mixing consoles including several new models: Amek *BC11* 4-bus console system with many module and chassis options for various broadcast applications; *Classic*—the latest in the range of broadcast consoles but with applications in other areas of sound recording; a production model *APC1000* (Assignable Production Console) featuring central assignment of all channel switch functions; and Amek *G2520*, which has been developed from and replaces the *M2500*. From TAC there are further new products: *SR9000* sound reinforcement console for use by large touring sound reinforcement companies and in-theatre installations. New options for the *Scorpion* series include eight (instead of four) auxiliary sends per input module, and a stereo input module, a third chassis option accommodating up to 53 modules which may be configured in studio or sound reinforcement formats. ● **America Multimedia/Concept Design:** range of high speed duplicating equipment and accessories. ● **American Recorder Technologies:** no information available. ● **Ampex**: wide range of analogue and digital mastering tapes, multitrack tapes and video cassettes. ● **AMS Industries:** the latest version of the *AudioFile*, the hard disk based linear 16 bit recording and playback system. Also on demonstration will be the complete range of digital audio processing systems including the *RMX 16* reverberation system, *Timeflex*, the *DMX 15.80s* now with MIDI control and dual channel sampling with reverse playback and the *DMX 15.80 SB* broadcast delay unit. ● **Anchor Audio:** range of portable sound systems, cabled intercoms, audio cables and microphones. ● **ANT Telecommunications:** the full range of *telcom 64* companders for noise reduction applications in audio, video and broadcast. ● **Anvil Cases:** a wide range of professional flight cases for the film, recording and entertainment industries. ● **Apex Machine:** hand and semi-automated cassette label printers. ● **APG Ingeniere**: loudspeaker systems for PA and sound reinforcement applications. ● **Aphex Systems:** full range of Aphex products including the *Aural Exciters*, the *Dominator*, and the *Compellor*. Also on show will be the upgraded version of the professional *Type*

Adams-Smith 2600 A/V audio editor



Audio Kinetics Pacer synchroniser

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II Exciter and the latest version of the *Type C*. ● **API Audio Products:** new and retrofit modules for API consoles, fader automation system and details on full console systems. ● **Apogee Electronics:** no information received. ● **Apogee Sound:** no information received. ● **Applied Research & Technology:** range of signal processing units including the *171, 172, 173* and *174* equalisers; *190* digital delay; *DR1* and *DR2a* digital reverbs and the *PD3* pro delay system. ART will also be introducing a completely new range of moderately priced signal processing devices. ● **ATB:** at a US AES convention for the first time ATB will be showing audio and VHS video cassette components that are particularly designed to meet automatic assembling requirements and meet all latest standard specifications. ATB already have significant US presence and in 1985 produced components for one billion audio cassettes. ● **Audioco:** audio and video duplicating equipment including winders, loaders, labels and accessories. ● **Audioanalyse:** no information received. ● **Audiocast Conseil:** no information received. ● **Audio/Digital Inc:** wide range of digital delay units for applications including reverb pre-delay, multiple tape for reinforcement installations and general applications. ● **Audio Kinetics:** complete range of synchronisers to cover all areas of machine control. New will be the *Pacer* low cost two machine synchroniser which combines twin timecode readers, serial interface, slave interface and resolver facility within the same module. Also on show will be the *Eclipse* audio editor, the *Q.Lock 4.10, MasterMix* console automation system and the *Timelink Electronic Gearbox*. ● **Audio Media Research:** wide range of products including speaker systems. ● **Audio Precision:** new switcher modules for the *System One* audio test system, plus new wow and flutter capability including scrape flutter. A new software version will also be demonstrated which permits running swept tests while holding constant some measured parameter of the device under test. ● **Audio-Technica US:** range of recording, broadcast and entertainment microphones, cartridges, headsets and accessories. ● **Audio Video Consultants:** audio and video duplication systems, tape loaders, insertion and labelling products. ● **Kenneth A Bacon Associates:** flexible real time tape duplication systems.

B

● **Barcus-Berry Electronics:** the *BBE 202* differential load reactance compensator—a multiband programme controlled signal processor designed to improve sonic clarity. ● **BASF Corp Info Systems:** a full range of audio and video tapes on display including bulk duplicating tapes, new bulk video pancakes, *Loopmaster 920* and a complete line of studio and cassette calibration tapes. The company will also feature the first showing of a new tool for determining correct azimuth. ● **B&B Systems:** no information received. ● **BC:** no information received. ● **Beyer Dynamic:** range of headphones, wireless, dynamic and condensor mics and microphone accessories. Products making their first appearance include the *M700* super cardioid dynamic mic, *MCE 80* cardioid condenser, *MCE 10* miniature cardioid condenser, *M422* miniature hypercardioid dynamic and the *DT 770 DT 990* headsets. ● **BGW Systems:** in addition to the current range of power amplifiers the company will be previewing the *SPA-1* and *SPA-3*, a new range of signal processing power amplifiers. ● **Biamp Systems:** will debut DJ mixers: *DJ3001, DJ4001* and *DJ5001*. New power amps will also be shown including *XA100, XA300, XA600, XA1000, T500* and *T1000*. *Rackmax* rack mount high performance mixer will be introduced. Biamp's established range of mixing consoles for recording and live applications, signal processing and power amps will also be there. ● **Boulder Amplifier/Silver Lake Research:** no information received. ● **Brooke Siren Systems:** in addition to the comprehensive display of existing BSS products the new active microphone splitting system will be on display. The system provides a 4-channel splitter with each channel having four isolated outputs and can provide individual, remotely changeable, channel gain and headroom from the master mixing console. A new stereo noise gate *(DPR412)* with optional auto drift threshold, auto envelope and average and peak display system will also be on the stand. ● **Bruel & Kjaer Instruments:** precision studio microphones, including its new stereo matched sets of microphones. Also on display will be the line of electro-acoustic test equipment including loudspeaker test system, time delay spectrometry unit, wow and flutter meters, etc. ● **Bryston:** range of pre and power amplifiers with various customer options available according to applications.

C

● **CAE:** connectors, jacks, jackfields and related communication equipment. ● **Cal Switch:** electronic component products. ● **Canare Cable:** introducing *MR202-AT* series multichannel microphone cable—2-conductor individually insulated twisted pairs with aluminium tape shield and captive drain wire—for fixed installations: *D202* series multichannel data cable for digital data transmission. *VBC-FB* pre-assembled *BNC/BNC* cables for patchbay and other video interfacing situations; and *4S6* and *4S11* quad conductor speaker cable for demanding amplifier/speaker hookups. ● **Dwight Cavendish Co:** no information available. ● **Cerwin-Vega:** loudspeaker components and enclosures for music and sound reinforcement applications. ● **Cetec Gauss:** loudspeaker drive units for recording studios and sound reinforcement systems and high speed audio duplicating equipment. ● **Cetec Ivie:** range of audio spectrum analysers and associated room analysis equipment. Also on display will be the *5000* series modular sound system. ● **Cetec Vega:** complete line of professional wireless mics including the model *66B* portable receiver. Designed around a GAASFET front end for high sensivity the *66B* incorporates *Dynex 11*, Cetec Vega's audio processor which provides a wide dynamic range and high signal to noise ratio. The battery powered receiver is designed for on location film and TV production and ▷

Community Light & Sound CS70

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other portable wireless applications. ● **Cipher Digital:** complete range of timecode products for the audio, film and video industries. Including editing, synchronising and machine control systems. Featured new products include series *4800 Shadow II* synchroniser, *Softpac* softkey memory expansion system, *CDI-750* timecode reader/generator/event controller. ● **CMX:** will be showing the latest developments on the *Cass 1* (Computer Aided Sound Sweetening) system. ● **Community Light & Sound:** new *CS* series loudspeaker systems will be launched. *CS70* designed to be 'affordable', features four custom designed 12 in low frequency drivers, a pair of midrange drivers with 2 in throats and a Focused Array high frequency section. *CS45* is a 2-way ported unit with high sensitivity and low distortion. *CS38M* is a floor monitor version of *CS35*. *CS50B* is a sub-woofer built around an 18 in low frequency driver. ● **Connectrics:** range of *Seck* portable mixing consoles. Featured will be the *1282* 12-input 8-bus portable mixer. ● **JL Cooper Electronics:** new products will include additions to *MidiMation* series including *SAM Disk* intelligent disk storage device for *SAM; MAGI*, the Mixer Automation Gain Interface low cost fader automation system; and *ARNI* Automated Routing Network Interface automated patchbay. Existing products include the *Midi Mute* 8-channel automated audio mute; and *SAM* SMPTE Automation Manager that reads SMPTE and stores moves made with *MidiMation* devices. ● **Countryman Associates:** will be featuring the Isomax range of precision electret mics. ● **Crest Audio:** a new range of power amplifiers incorporating features designed specifically for recording studios and fixed installations. All convection cooled, the new models are available in 50, 100 and 200 W into 8 Ω/channel. The new power amplifiers also feature full function limiters on each channel. Crest will also be showing its existing range of amplifiers ranging from 40 to 1800 W. ● **Crown International:** full range of Crown products including power amplifiers, boundary type microphones and the Techron audio measuring system. ● **CST Sales:** no information received.

D

● **db Magazine:** sound recording magazine and audio publications. ● **dbx:** the full dbx pro product line including the noise reduction systems, digital recording system, devices for PA systems, signal processing units, OEM VCAs, etc. ● **DCS Audio Products:** demonstrating its *DAP-1* multichannel digital effects processor which allows user-programmed effects to be run on up to four independent input and output channels. Basic effects include a variety of reverbs, loop editing, simple and complex delays, band filters and other programs. The effects can be concatenated to perform several effects in series on each channel. Memory is expandable to 40 s at full bandwith. ● **Design Direct Sound:** loudspeaker systems and components for sound reinforcement applications. ● **Dialight:** no information received. ● **Digital Creations:** no information received. ● **Digital Despatch:** no information received. ● **DOD Electronics:** range of signal processing equipment including digital delays, reverb units, compressor/limiters, graphic equalisers, crossovers and ancillary units. ● **Dolby Laboratories:** Dolby *SR* for the first time at a US AES. The spectral recording process provides analogue tape with improved clarity and dynamic range and *SR* modules can be used in existing Dolby *A* frames. Also on show will be the model *390* encode/decode Dolby *C* noise reduction unit for ¾ in professional VCRs. This will give older video machines audio quality comparable with the new Sony *SP* series U-matic which has built in Dolby *C*. Other units to be featured include the *cat 280* and *431* Dolby *SR* modules, the model *380i A*-type NR unit for 1 in VTRs and the *CP55* and *CP200* cinema processors. ● **Dorrough Electronics:** Loudness Meter which simultaneously displays peak and average information on one scale enabling uniform loudness from various source material. ● **D&R Electronics:** complete range of mixing consoles and a wide range of signal processing equipment. All D&R consoles have been cosmetically updated and new items include revised *300, 700, 4000* and *8000* consoles; the new *Dayner* modular console; *Multigate* noise gate; a de-esser with a new subtraction principle and a 2-channel mic amp with extremely low noise figures. The *SCORE* fader automation system is now available with motorised faders.

E

● **Educational Electronics Corporation:** no information received. ● **Electronic Systems Laboratories:** no information received. ● **Electro Sound:** will display the *ES8000* and *ES5000* high speed tape duplicators. Also on display will be the new *ES4800* digital slave and the series *4300* automated quality control system including test signal generator, signal analyser and precision slave calibrator. ● **ElectroSpace Developments:** signal processing equipment including the *Spanner, Gate,* the *Strate Gate* and a new variable knee compressor/limiter. ● **Electro-Voice:** full range of E-V products including microphones, drive units monitor systems and live sound mixing consoles. Featured will be three-2-way speaker systems for permanent sound reinforcement applications. ● **Elison:** no information received. ● **E-Mu Systems:** a variety of keyboard, synth and software options including the *Emulator II* with hard disk and CD-ROM, the *SP-12, Emax* and *Emax Rack*, the latter being the first sampling expander offered by E-Mu. ● **Eventide** A new 2-channel broadcast delay, *BD980*, will be introduced ▷

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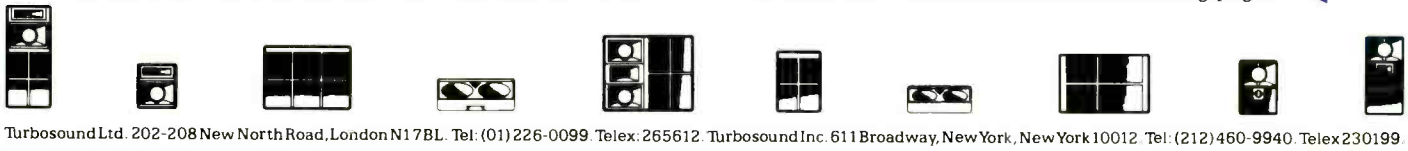

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featuring *Timesqueeze* time compression up to 10 s, stereo talk show delay with up to 10 s stereo delay. Enhanced catch up is provided by 'ramp to zero mode' which lets you out of delays while the 'wait and exit' feature plays out delay and dumps to real time. Eventide will also introduce MIDI implementation for the *SP2016* special effects processor/reverb, which is also available as a retrofit option. ● **Everything Audio:** will be providing information and details of the wide range of professional audio products stocked by the company.

F

● **Fairlight Instruments:** Fairlight series *III CMI* with full SMPTE chase/lock implementation; the *Voicetracker VT-5* programmable pitch to MIDI converter and the *CVI Computer Video Instrument.* ● **Fender Musical Instruments:** range of guitars including the new *Vintage Replica* series, amplifiers and musical instrument accessories. ● **Fife-Pearce Electric:** no information received. ● **FM Acoustics:** full range of precision power amplifiers along with *Forcelines* new high energy transfer cables and, latest FM product, the *FM236/4* linear-phase electronic crossover available either as 3-way or 4-way monophonic unit with or without precision limiters. ● **Focusrite:** various console and outboard modules for professional recording use. ● **Fostex Corp Of America:** range of multitrack and mastering machines including the new *E* series. ● **Full Sail—Center For The Recording Arts:** details of audio training.

G

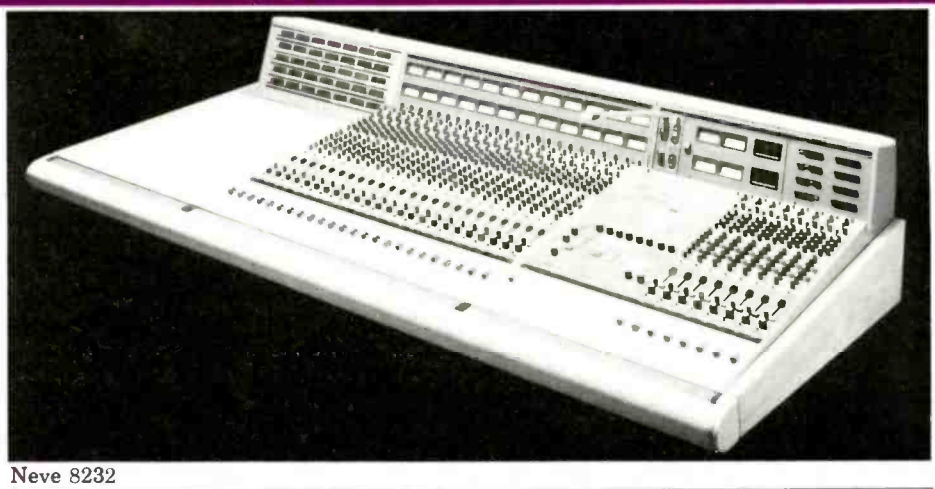
● **Gold Line:** demonstrations of low cost test equipment and measurement systems. ● **Gotham Audio Corporation:** full range of professional products from Teldec, Neumann, Harmonia Mundi, EMT, NTP, K&H and Studer. New products will include the latest developments by Teldec and Neumann for DDM CD processing; new RSM stereo condenser microphone from Neumann; from Harmonia Mundi Acustica, the *BW 102/21* digital domain equaliser which, together with the already available HMA modules, enables complete signal processing in the digital domain between all tape formats.

H

● **David Hafler Co:** range of professional power amplifiers including the *P500, P505, P220* and *P225*. ● **Harrison Systems:** featured will be the fully automated series *10* console in production form. ● **HM Electronics:** will be exhibiting products from their range of wireless microphones, and wireless and cabled intercom systems.

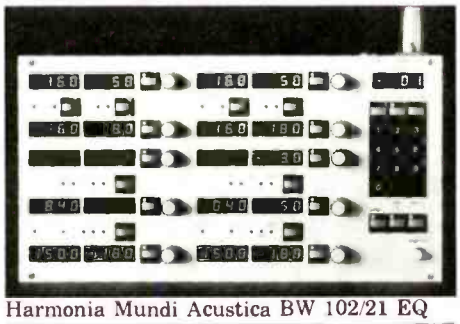
I

● **Ibanez:** featured will be the Ibanez *SDR1000* stereo reverb. ● **Heino Ilsemann:** audio duplicating ancillary equipment including cassette manufacturing equipment, box and foil wrapping and cassette sorter. ● **Industry West Electronics:** no information received. ● **Innovative Electronic design:** computer-based digital audio control systems. ● **Inovonics:** will demonstrate its line of audio recording, signal processing and instrumentation equipment for studio and broadcast use. Debuting will be a new insert magnetic film recording electronics and a redesigned high speed tape duplicating amplifier—both incorporating HFE program-controlled bias system. Other new products include a PWM tri-band broadcast processor and FM stereo generator which will be shown alongside the established replacement studio recorder electronics, compressor/limiters and the TVU on-screen audio level display for teleproduction. ● **Institute Of Audio/Video Engineering:** no information received. ● **International Music Co/Akai Digital:** full range of Akai professional products. Featured will be the new *S900* digital sampler with the ASK90 audio trigger interface board. ● **IPS:** no information received. ● **IQS:** a range of products for automated signal analysis and control system *416-2a.* Operations cover full audio bandwidths with simultaneous data capture on each channel.



Neve 8232

Automated signal analysis and control from IQS



Harmonia Mundi Acustica BW 102/21 EQ

J

● **JBL Professional:** new products will include the JBL/UREI model *7922* digital audio delay featuring linear phase filters for flat phase and amplitude to 20 kHz and 10 μs resolution for loudspeaker alignment use. Other products will include the model *6215* 1U amplifier JBL concert series speakers and the JBL *4400* series studio monitors featuring titanium dome tweeters. ● **JVC:** the new *VP-900* digital audio processor together with the *AE900V* editor, *CR850U* U-matic video recorders, *FC900* and *FC901* format converters.

K

● **Kenwood USA:** no information received. ● **King Instrument:** model *793* dual tape supply cassette loader and the new fully automatic model *2500* dual

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supply video loader. ● **Klark-Teknik:** complete range of *DN300* series equalisers, the *DN780* reverb and the *DM60/* RT60 analyser system. New products will include the *DN305* noise masking processor, *DN716* digital delay, *Jade 1* acoustic monitor, and the *PMC402* ENG/location mixer. Also on display will be the complete range of DDA products. ● **Thomas Klotz Muikelektronik:** 19 in rack mic, line and DI box modular interface system and cable products. ● **Korg USA:** full range of Korg electronic music and signal processing products. ● **Kurzweil Music Systems:** will be showing the *250* with the latest software implementations. ● **Kyric:** no information received.

L

● **Lexicon:** will be showing for the first time at AES model *480L* Digital Effects System and *2400* Stereo Audio Time Compressor/Expander. *480L* functions as two independent machines which can be configured in mono split, stereo split or stereo cascade and has various hardware and software options. *2400* utilises SMPTE for closed loop machine control with accuracy within 2 frames/hr. The Random Access Recorder Editor Processor hard disk digital recorder/ editor will be demonstrated. ● **LTM Sound Dept:** range of ENG mixers, mic poles and windshields suspensions.

M

● **Magnefax International:** tape duplicating equipment including loopbin and slave systems and duplicating accessories. ● **Marshall Electronics:** complete range of signal processing devices including *Time Modulator, Tape Eliminator* and the *AES 357* ambience effects system. ● **Martin Audio:** range of sound reinforcement loudspeakers, systems and components. ● **Meyer Sound:** latest *MS1000* amplifier rated at 1,200 W continuous total sinewave power short term, and 800 W continuous long term with loads down to 2 Ω. ● **Milab International:** full range of microphone products with featured product being the *VIP50* line output condenser mic. ● **Mitsubishi Pro-Audio Group:** products making a first appearance include the Mitsubishi *X-400* 16-channel digital multitrack, the *X-86* 2-channel mastering machine, and the quad Eight 'New Look' *Westar* mixing console with *Compumix* hard disk automation. Other products on show will be the *X-850* 32-channel digital multitrack, Westrex *ST-6000* and *ST-12000* mag film recorders and reproducers and the Westrex digital master motion controller. ● **Mix Magazine:** sound recording magazine and audio publication. ● **Monster Cable:** specialist cable and connectors for audio and video applications: ● **Mosses & Mitchell:** range of jack and jackfields for audio and video use.

N

● **Nagra Magnetic Recorders:** will be ▷

SCHOEPS
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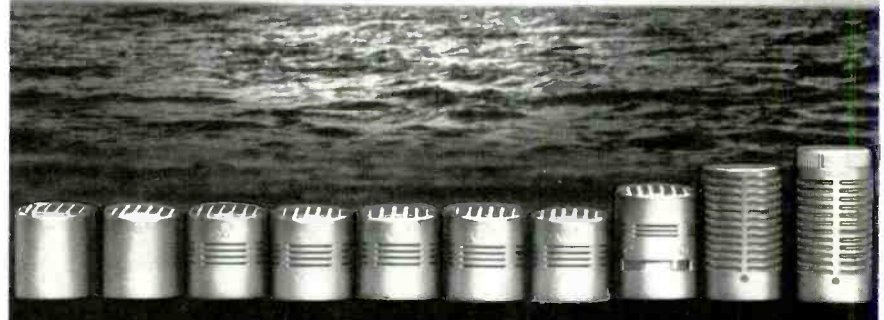
CONDENSER
MICROPHONES

Professional Boundary Layer Microphone ...



an addition to our Colette-family

— Contact —

AUS	Klarion Enterprises Pty. Ltd. P.O. Box 379, South Melbourne, Victoria, 3205. Tel.: (03) 613541
A	Studer Revox Wien Ges. m. b. H., Ludwiggasse 4, 1180 Wien, Tel.: (02 22) 47 33 09
B	Heynen B.V.,Bedrijfstraat 2, 3500 Hasselt, Tel.: 011-21 00 06
BR	Centelec Equipamentos e Sistemas Electrónicos Ltda., 20561 Rio de Janeiro/R. J., Tel.: (021) 268-79 48
CDN	Studer Revox Canada Ltd. 14 Banigan Drive, Toronto, Ontario, M4H 1E9, Tel.: 416-423-2831
SF	Lounamaa Electronics Oy, Uimarinpolku 27 A, 00330 Helsinki 33, Tel.: 90-488 566
F	ELNO S. A., 18-20, rue du Val Notre-Dame, 95100 Argenteuil, Tel.: (1) 39.82.29.73
HK	Audio Consultants Co., Ltd., 58 Pak Tai Street, Tokwawan, Kowloon, Hong Kong B.C.C., Tel.: 3-712525 1
I	TDS - Tecniche del Suono S.r.l., Piazza Crivellone, 5, 20148 Milano, Tel.: 46.96.105
IL	Kolinor Ltd., 18 Ha'arba'a Street, Tel-Aviv, Tel.: 03-263298
J	Imai & Company Ltd., 1-6 Tomihisacho, Shinjuku Tokyo, Tel. (03) 357-0401
NL	Heynen B.V., P.O. Box 10, 6590 AA Gennep, Tel.: 08851-96111
N	Siv. Ing. Benum A/S, Boks 145 Vinderen, Oslo 3, Tel.: (02) 145460
P	G. E. R. Av. Estados Unidos da América, 51-5°, Dto. 1700 Lisboa, Tel.: 88 40 21
E	Singleton Productions, Via Augusta, 59 Desp. 804 - Edif. Mercurio, Barcelona-6, Tel.: 237 70 60
S	NATAB Akustik AB, P.O. Box 6016, 55006 Jönköping, Tel.: 036-14 24 80
CH	PAJAC - Jaques Zeller, Morges 12, 1111 Echichens, Tel.: 021-72 24 21
GB	Scenic Sounds Equipment Marketing Ltd., 10 William Road, London NW 1, Tel.: 01-387 1262
USA	Posthorn Recordings, 142 West - 26th Street, 10th Floor, New York City, N.Y. 10001, Tel.: (212) 242-3737

Schalltechnik Dr.-Ing. Schoeps GmbH,
Postbox 410970 D-7500 Karlsruhe, Telex 7826902, Tel. (0721) 42016/42011

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displaying the full range of Nagra portable tape machines. ● **Nakamichi USA Corp:** professional and domestic cassette recorders and accessories. Featured new product is the *MR-2* 2-head professional cassette deck. ● **Neotek:** examples from their range of audio mixing consoles. ● **Rupert Neve:** will introduce and demonstrate their first standard production digital audio console, *DTC-1* based on a 2-channel digital console built for Tape One Studios in London. Also on demonstration will be the new *8232* 32-channel production console and the recently introduced *V* series master recording console with *NECAM 96* moving fader automation. ● **New England Digital:** will demonstrate the *Synclavier* digital audio system and new options which enables stand alone tapeless direct-to-disk recording. Features include MIDI, SMPTE, guitar interface, stereo sampling capability at 100 kHz/channel and engraving quality music printing.

O

● **Orban Associates:** will introduce two new products. The *Co-operator* is a combined gated compressor/leveller and high frequency limiter for non-technical operators in recording, video post production and broadcast. The *Programmable Mike Processor* is a compressor/limiter, 3-band parametric equaliser, noise gate/compressor gate and de-esser in one rack unit, designed to allow storage of complex processing functions on voice which can then be instantly recalled. ● **Otari:** full line of multitrack and mastering tape machines and cassette duplication products. New products will include the *DTR-900* 32-channel digital multitrack; *MX-80* 32-track analogue multitrack; the *EC-201* portable SMPTE/EBU timecode reader and the *CTM-10* cartridge recorder/reproducer. ● **Oxmoor:** no information received.

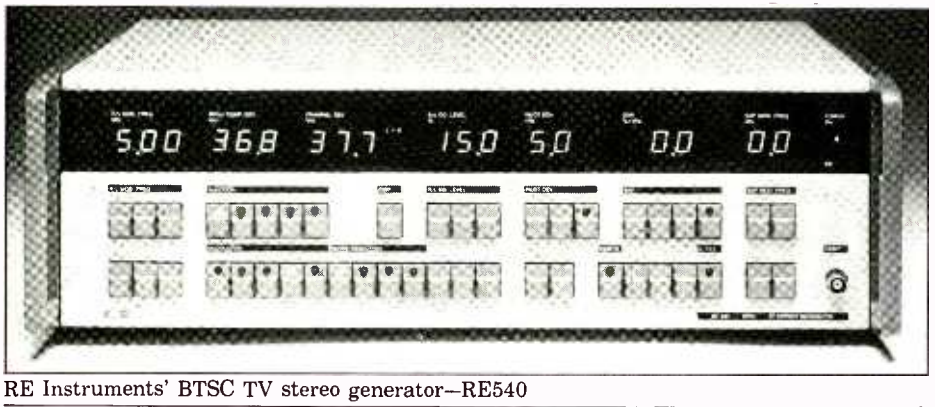
Sennheiser MKH20 P48 omni condenser

P

● **Pacifica Radio Electronics:** no information received. ● **Paktec Automation:** no information received. ● **Panasonic Industrial/RAMSA:** a variety of products for the recording and entertainment industry including mics, mixing consoles, loudspeakers and a new range of professional amplifiers. ● **Peavey Electronics:** will be showing products from its wide range of sound reinforcement equipment. ● **Penn Fabrication:** a complete range of custom loudspeaker and flight case accessories. ● **Penny & Giles:** full range of studio faders and servo controlled audio faders including the quadrant and T quadrant. ● **Pro Co Sound:** a new 19 in rack mounting TT (Bantam) patchbay system for 8-, 16-, 24-, 32-track recording applications, providing full patching facilities for up to 32 inputs/groups/tape tracks, left to right stereo masters, up to three stereo tape machines and auxiliary sends and returns, etc. ● **Professional Audio Services & Supply:** a wide range of professional products from various manufacturers. On display will be the Amek *BC-II* broadcast console, TAC *Scorpion* consoles, Tannoy monitors and Drawmer *201* noise gates. ● **Professional Audio Systems:** products for the PA and sound reinforcement industry. ● **Professional Sound Corp:** no information received. ● **Publison America:** will be showing the *Infernal Machine 90* including the latest software updates. ● **Pyral:** range of magnetic tape products for the film, recording and broadcast industries.

R

● **RE/P & SVC:** recording and audio/video contracting magazines. ● **RE Instruments:** *RE201* dual channel audio analyser and the new *RE540* BTSC TV stereo generator. *RE21* will be demonstrated in both tape recorder and transmission link test applications. *RE540* is designed for use in testing the audio circuits of stereo television sets conforming to the BTSC multichannel sound recommendation. ● **Renkus-Heinz:** will be showing its most powerful *Smart* system to date. The model *MR-1/LR-2M* features a combination of a hi/mid cabinet with two subwoofer enclosures. The *MR-1* integrates two HF and a single mid driver into a trapezoidal enclosure. For very high outputs the *MR-1* is designed to couple with two *LR-2M* bass enclosures. Also on show will be specially designed power amp racks optimised for use with *Smart* speaker systems. ● **Rent Music International:** no information received. ● **Research Technology International:** the TapeChek *VT-3100* ¾ in U-matic videotape evaluator/cleanser. Featured new product will be the *DV-5* drop-out analyser/timecode generator which combine two necessary functions for CD premastering. ● **Roland:** range of synchronisers, effects units and musical instruments including the new *JX-10* analogue synthesiser. ● **RPG Diffusor Systems:** full range of reflection phase grating sound diffusors including the new *RQD-734* and *734S* low cost diffusors which may also be supplied in almost any finish. Also featuring new *Abffusor* absorptive/diffusive class A fire-rated panel, and the *Ensemble* acoustical shell. ● **RTS Systems:** a full range of products including the intercom system, dedicated amplifier range and mini mixers.



RE Instruments' BTSC TV stereo generator—RE540

S

● **Saki Magnetics:** the complete line of long life ferrite replacement heads for tape recorders by Ampex, MCI, Mincom, Otari, Scully and Studer and 24-track metal replacement heads for recorders manufactured by Mincon and MCI. New products will be 24-track 2 in metal heads for Ampex *MM1200*, Otari *MTR90*, Studer *A800* and 16-track 1 in heads for Teac *8516*. ● **Samson Products:** range of diversity wireless microphones along with various accessories including mic stands and belt packs. ● **Sanken:** *CU-41, CMS-2. CU-31* and *32* condenser mics. New to the show will be the *CMS-7* and *CMS-7HC* microphones. These are lightweight stereo condenser microphones for indoor and outdoor TV, film and broadcast use. The *CMS-7* provides an M-S cardioid pattern and the *CMS-7HC* is a hypercardioid version. Both mics have stereo width control and are designed for maximum immunity to noise interference in difficult environments where wind, microphone and cable handling noises can be a problem. ● **Schoeps/Posthorn Recordings:** will be showing and demonstrating the full line of Schoeps professional condenser microphones. A limited edition *M221B* tube mic will be available for audition. Sonotrim miniature lavalier mics and frogpole mic booms will also be on display. ● **SVC Audio:** range of signal processing devices and professional recording accessories. ● **Selco/Sifam:** large range of panel meters, knobs and accessories. ● **Sennheiser Electronics:** will introduce the *MKH20 P48* omnidirectional studio condenser ▷

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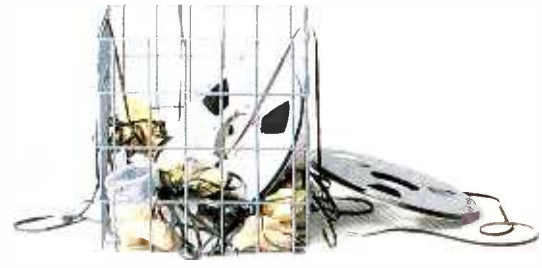

TRUTH... OR CONSEQUENCES.

If you haven't heard JBL's new generation of Studio Monitors, you haven't heard the "truth" about your sound.

TRUTH: A lot of monitors "color" their sound. They don't deliver truly flat response. Their technology is full of compromises. Their components are from a variety of sources, and not designed to precisely integrate with each other.
CONSEQUENCES: Bad mixes. Re-mixes. Having to "trash" an entire session. Or worst of all, no mixes because clients simply don't come back.

TRUTH: JBL eliminates these consequences by achieving a new "truth" in sound: JBL's remarkable new 4400 Series. The design, size, and materials have been specifically tailored to each monitor's function. For example, the 2-way 4406 6" Monitor is ideally designed for console or close-in listening. While the 2-way 8" 4408 is ideal for broadcast applications. The 3-way 10" 4410 Monitor captures maximum spatial detail at greater listening distances. And the 3-way 12" 4412 Monitor is mounted with a tight-cluster arrangement for close-in monitoring.
CONSEQUENCES: "Universal" monitors, those not specifically designed for a precise application or environment, invariably compromise technology, with inferior sound the result.

TRUTH: JBL's 4400 Series Studio Monitors achieve a new "truth" in sound with an extended high frequency response that remains effortlessly smooth through the critical 3,000 to 20,000 Hz range. And even extends beyond audibility to 27 kHz, reducing phase shift within the audible band for a more open and natural sound. The 4400 Series' incomparable high end clarity is the result of JBL's use of pure titanium for its unique ribbed-dome tweeter and diamond surround, capable of withstanding forces surpassing a phenomenal 1000 G's.
CONSEQUENCES: When pushed hard, most tweeters simply fail. Transient detail blurs, and the material itself deforms and breaks down. Other materials can't take the stress, and crack under pressure.

TRUTH: The Frequency Dividing Network in each 4400 Series monitor allows optimum transitions between drivers in both amplitude and phase. The precisely calibrated reference controls let you adjust for personal preferences, room variations, and specific equalization.
CONSEQUENCES: When the interaction between drivers is not carefully orchestrated, the results can be edgy, indistinctive, or simply "false" sound.

TRUTH: All 4400 Studio Monitors feature JBL's exclusive Symmetrical Field Geometry magnetic structure, which dramatically reduces second harmonic distortion, and is key in producing the 4400's deep, powerful, clean bass.
CONSEQUENCES: Conventional magnetic structures utilize non-symmetrical magnetic fields, which add significantly to distortion due to a nonlinear pull on the voice coil.

TRUTH: 4400 Series monitors also feature special low diffraction grill frame designs, which reduce time delay distortion. Extra-large voice coils and ultra-rigid cast frames result in both mechanical and thermal stability under heavy professional use.
CONSEQUENCES: For reasons of economics, monitors will often use stamped rather than cast frames, resulting in both mechanical distortion and power compression.

TRUTH: The JBL 4400 Studio Monitor Series captures the full dynamic range, extended high frequency, and precise character of your sound as no other monitors in the business. Experience the 4400 Series Studio Monitors at your JBL dealer's today.
CONSEQUENCES: You'll never know the "truth" until you do.

JBL

JBL Professional
8500 Balboa Boulevard
Northridge, CA 91329

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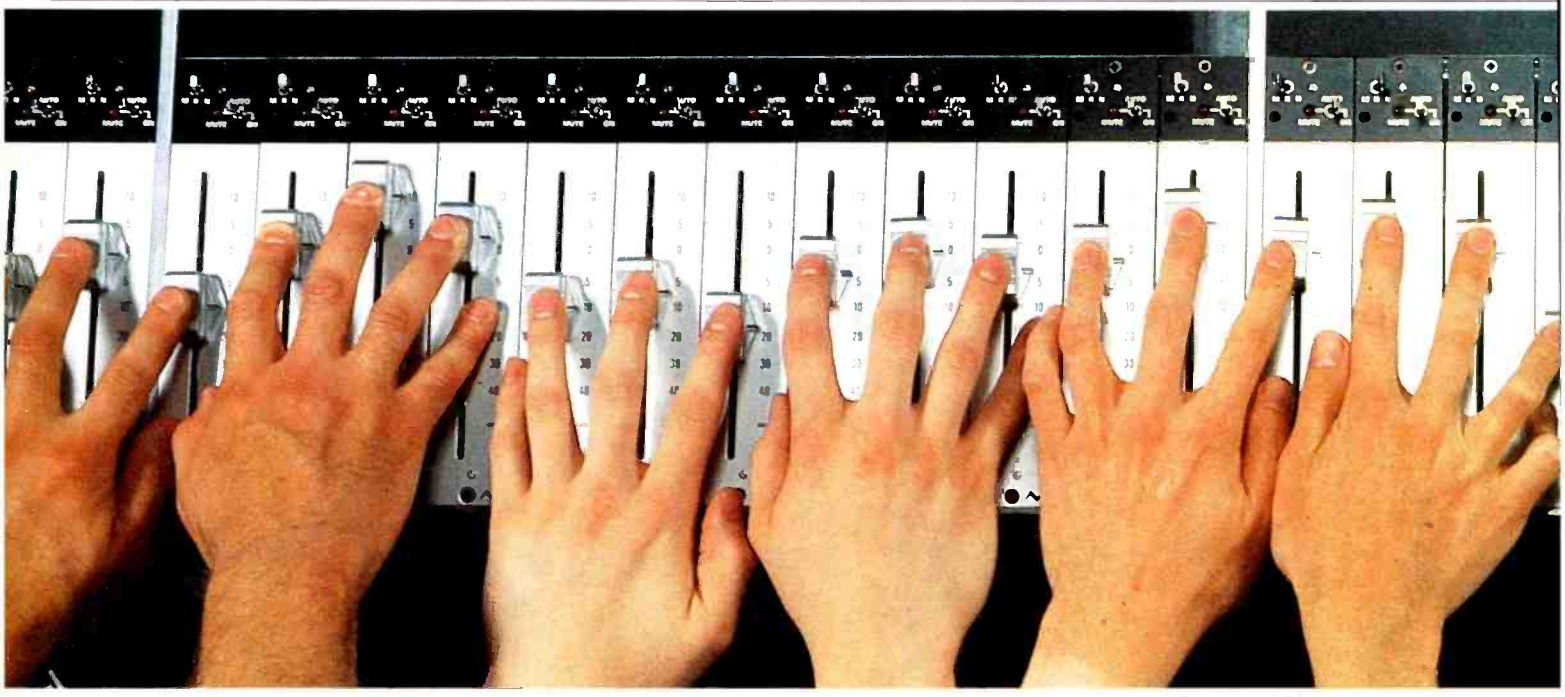
EXHIBITION PREVIEW

microphone which utilises the same symmetrical capsule as the cardioid *MKH40*. Optimal resistive loading of the diaphragm gives highly linear frequency responses and inherent low noise levels. ● **Shure Brothers:** will display the latest *SM89* shotgun microphone and *A89SM* shock mount along with the complete line of professional microphones and circuitry products, professional phono cartridges, Automatic Microphone System, the *Field production* and the *M* series microphone mixers. The new line of broadcast and studio cartridges will also be shown. ● **Sierra Audio Acoustics:** variable acoustic systems and phase coherent studio designs. ● **Skotel:** range of timecode readers, generators, inserters and data interfaces for the film, broadcast and recording industries. ● **Solid State Logic:** will be demonstrating their complete range of audio consoles, studio computer systems and machine controls systems including the *SL 5000 M* series audio production system, the *SL 6000 E* series stereo video system, the *SL 4000 E* studio master system. New products on display will include the *Advanced Total Recall* and *AutoScan* refinements to the SSL computer systems, the liquid crystal bargraph metering system and additional audio and control cassettes for the *SL 5000 M* console. ● **Sontec Electronics:** no information received. ● **Sony Broadcast Products:** full range of audio products including the *PCM-3324* digital multitrack, *RM-3310* remote control, *APR* series of analogue tape machines, the *MX300* and *2000* mixing consoles, the CD mastering systems and the *PCM-1630* digital processor and *DAE1100* editing systems and other digital products. Also on display will be the full range of other Sony products including mics and wireless products. ● **Sound Engineer & Producer:** sound recording magazine. ● **Sound Ideas:** extensive range of sound effects specially selected for use in recording, film, broadcast and media

Stanton 310 stereo phono preamp

Shure SM89 shotgun condenser mic



Looks like it's

Getting the producer, the manager, the roadie and the tape op. to help is one solution - but their hands aren't the same as your hands, and the final mix won't be your mix.

Necam gives you as many extra pairs of hands as you need, whenever you need them - and they're all yours!

No juggling with fader bars and cursors on VDUs or trying to null LED indicators in time to switch to 'write'. No noise and distortion from VCAs. Just real faders moving in real time, reproducing your previous best mix precisely as you did it and instantly - instinctively - updating it however and whenever you choose.

NEVE ELECTRONICS INTERNATIONAL LIMITED, CAMBRIDGE HOUSE, MELBOURN, ROYSTON,

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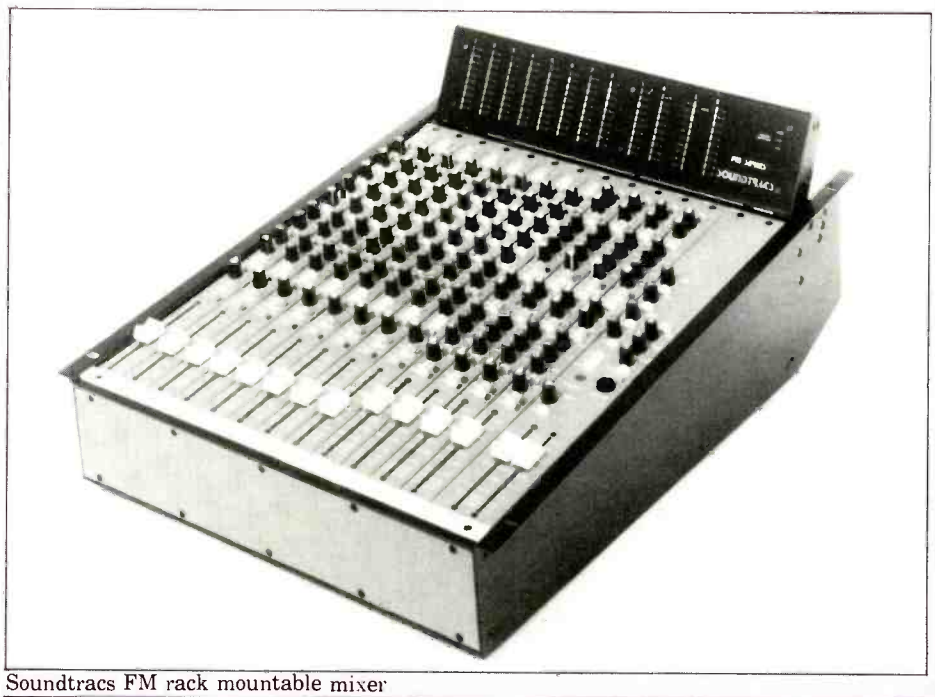
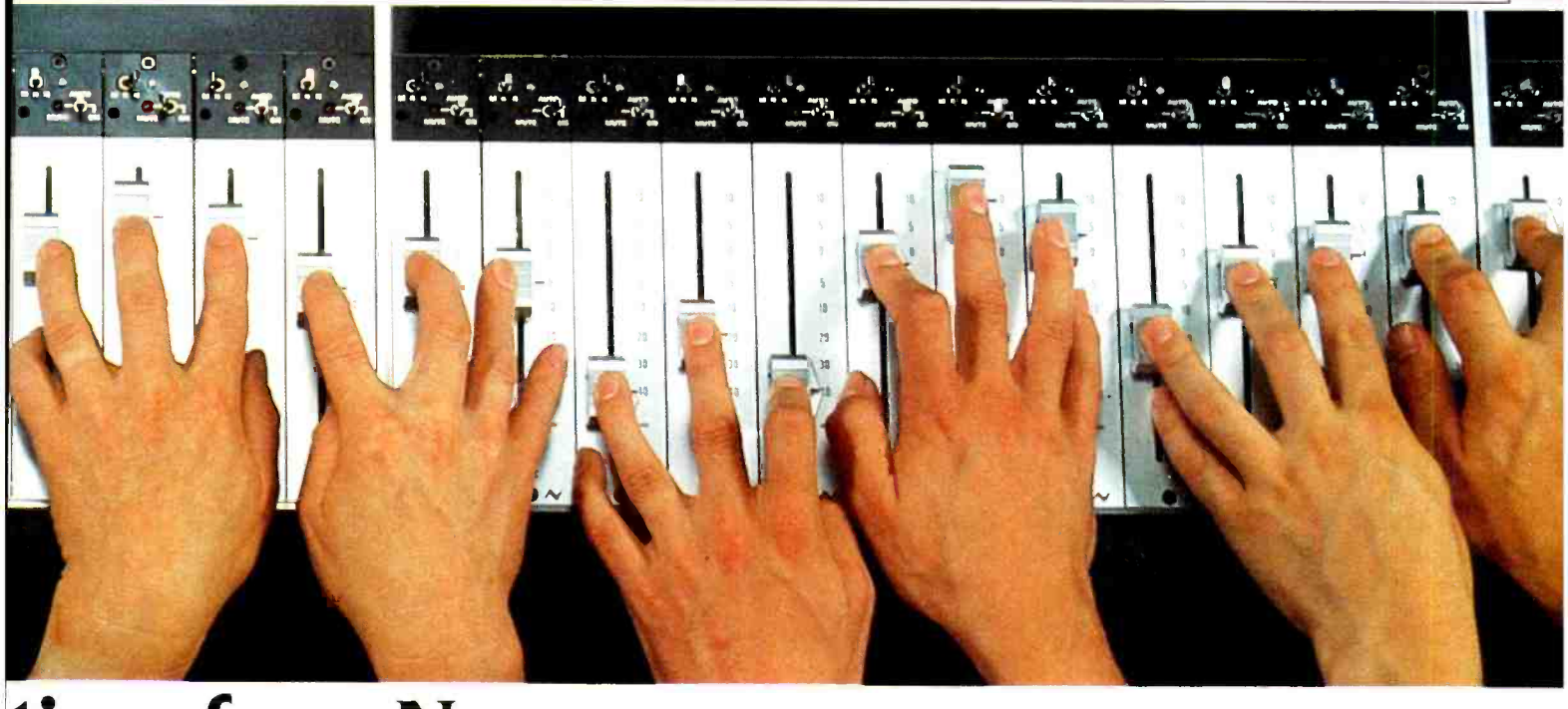
EXHIBITION PREVIEW

applications. ● **Soundmaster International:** will be showing the *Soundmaster* integrated editing system which incorporates *Syncro* totally programmable machine synchroniser. ● **Sound Technology Inc:** will be demonstrating the *MSAT* multichannel switching system for audio test applications and automatic signal routing and the *Quicktest* audio testing software used for automated testing in conjunction with the *ST 1510A* and an IBM compatible computer. Also on show will be the *1510A* tape recorder/audio test system, *3000A* automated audio test system, *3100A* programmable audio function generator, *1710A* professional distortion analyser, model *170* precision filter set and assorted test records and tapes. ● **Soundtracs:** full range of recording and reinforcement mixing consoles including *T* series, *M* series and *MR* series. New consoles will be the *MC* series monitor desk and a range of 19 in rack mounting modular mixers for applications including 4- and 8-track recording, broadcast, stage monitoring, keyboard mixing and video post production. A 'working studio' will be featured on the stand based around the new *CP6800* 24-track console introduced at the APRS with on board computer system automating routing and patching, plus events controller for external effects. The *Midi* console will be introduced designed to be interfaced with MIDI controlled equipment. ● **Sound & Vision:** no information received. ● **Stanton Magnetics:** will feature *981HZ mkIIs, 981LZ mkIIs, 881 mkIIs* and *681EEE mkIIs* cartridges. Also being introduced is *310B* stereo professional phono preamplifier designed to correctly interface all Stanton and selected magnetic phono cartridges for optimum playback of disk records and calibration of audio systems. ● **Star Case Manufacturing Co:** no information received. ● **Steinway & Sons:** will be showing examples of their range of pianos. ● **Studer Revox America:** will introduce its *A812* professional recorder for broadcast, video post production and ▷



Soundtracs FM rack mountable mixer



time for a Necam.

You can group together as many faders as you like and have as many different groups as you need.

You can set up muting groups, take up to 999 snapshots of fader and mute settings, use up to 128 event switches, merge different mixes into each other or into snapshot set-ups.

Necam gives you all this, plus precise machine control and replay accuracy to ¼ SMPTE frame.

There's nothing like having Necam at your fingertips, so call John Andrews and book the Neve demo studio for your first experience.

We know you'll like the look of what you see.

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CAPTURING SOUND AT ITS PUREST

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recording studio applications, featuring total microprocessor control of all transport and audio electronic parameters; *A807* microprocessor controlled compact professional recorder; *SC4008* and *SC4016* system controllers which both work in conjunction with Studer *TLS4000* bus-compatible synchronisers; and Studer *963* mixing console offering the features of a full size production console in a smaller frame. The full range of existing products will also be shown. ● **Studio Master Systems:** will show *Studio Master Plus* with CCL (console control logging)—a software and hardware package for the Apple *MacIntosh* computer for logging all knobs and fader positions on computer disk, with no modification to your console. New software being introduced includes *Studio Master*, *Track Master* and *Outboard Master*. ● **Studio Technologies:** will introduce a new self-powered dual microphone preamplifier—transformerless, balanced, in and out preamp designed to give optimum interface between analogue microphones and digital recorders. *AN-2* mono compatible stereo simulator for MTS broadcasting will be demonstrated. ● **Sunkyong International:** will be showing its audio and video magnetic tape products. ● **Swintek Enterprises:** the Mark *200D/C* wireless headset interconnect for use with the RTS or Clear-Com hard wired intercoms; the *PRO Audio* TRF switching diversity receivers and hand-held *PL-80* mics and the studio quality mark *QDC-50A* video camera wireless microphone system.

T

● **Tannoy North America:** new *Super Gold* monitors (*SGM* series) studio monitors, developed from the original *Super Red* monitors and including *SGM12B, SGM12X, SGM1000* and *SGM3000*. Other products being shown are the range of high current MOSFET *SR840* amplification, *NFM8* nearfield and *FSM* twin 15 in studio monitors. ● **Tape Automation:** loopbins, high speed slaves and fully automatic cassette winders in addition to their fully automatic video cassette loading system. ● **Tascam/Teac Corp Of America:** examples from the wide range of tape machine, mixing consoles and associated products. ● **Technics:** no information received. ● **Telex Communications:** high speed duplicating equipment, wireless mics and associated broadcast equipment. ● **3M Magnetic Media Division:** range of professional audio and video tape products. ● **360 Systems:** launching its *MI* products range featuring *MIDIbass, MIDI Patcher* and the new *MIDImerge*—a multipurpose rack mounting unit which can merge two incoming MIDI signals along with selectively filtering performance information. ● **Timeline:** the Lynx timecode module and the new *LTC-422 Lynx* Timeline controller. ● **Times One Technology:** no information received. ● **Trident USA:** will be exhibiting models from its range of mixing consoles. Featured console will be the *Di-An* digitally controlled analogue system. ● **TTL USA:** will be showing products designed for the tape duplicating industry. ● **Turbosound:** three new developments—the *TSE* Installation System, the *V-2* high frequency coupling device and the 24 in *LS-2403* low frequency woofer with a 6 in voiced coil. This latter unit will be available in the established *TSW-124* enclosure. Also on show will be the *TMS* enclosures, the *TMW* low profile monitors, the *TPC-1151* phase checker system and the *TSE* series separate enclosures. ● **27th Dimention:** no information received.

V

● **Valley People:** full range with new products including the models *815* and *415* dynamic sibilance processors, the model *400* mic processor; and from USAudio the *Leveller*. ● **VCL Audio:** no information received. ● **Versadyne International:** high speed duplication equipment and accessories.

W

● **Westlake Audio:** new *BBSM-8* monitor designed as a high accuracy portable reference. Other applications include small control room monitoring, mobile recording, broadcast on-air or production work, quality control stations, editing suites, and producer or auditioning offices. ● **Whirlwind Music Distrib:** audio cables and multicore leads for recording, broadcast and entertainment. ● **Wireworks:** multicore and cable products for professional applications.

Y

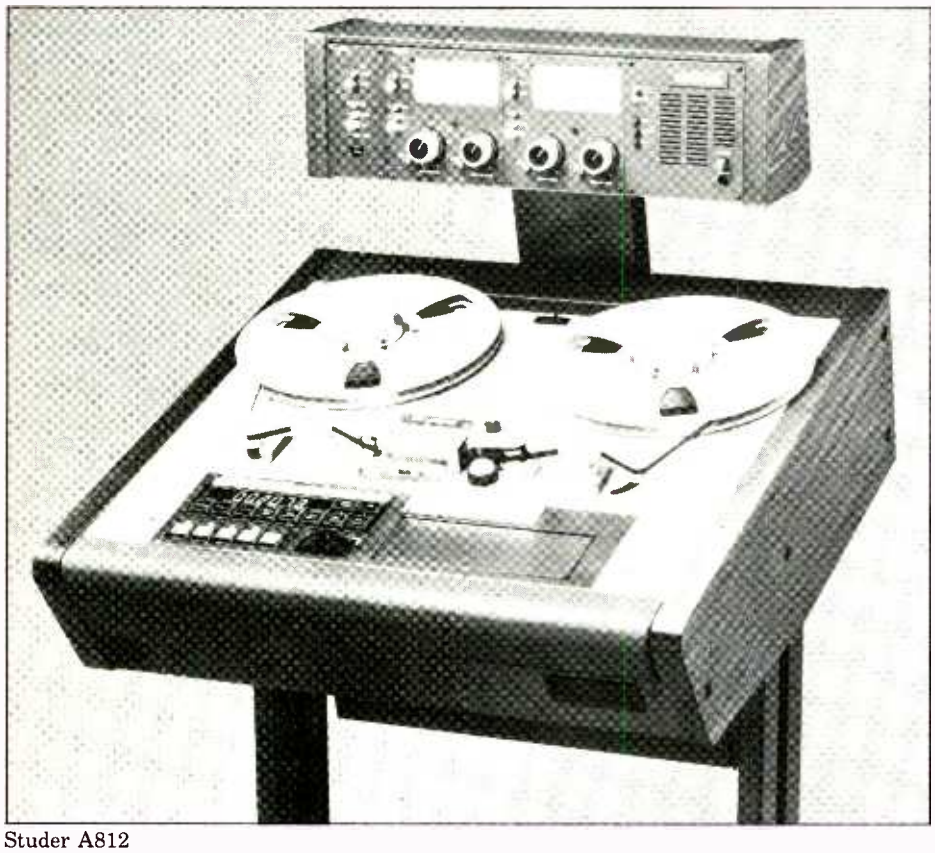
● **Yamaha International:** examples from the very wide range of pro audio products including the *SPX90* digital multi-effect processor, the *MZ* series mics, the *P2075* power amplifier, *S300* compact speaker system, etc.

Z

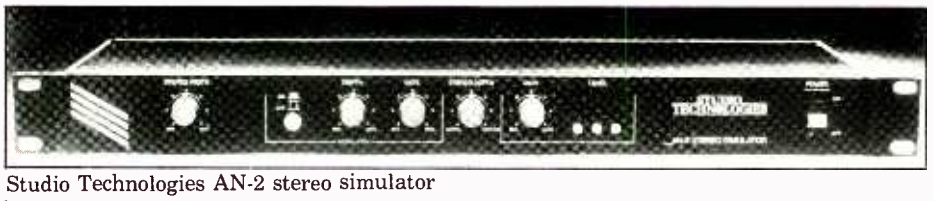
● **Zonal:** full range of professional products including *MSR* film, audio tape and cassette tape.

●

● **Studio Sound:** we will be exhibiting out latest issue together with copies of our sister publications *Broadcast Systems Engineering* and *One to One*. Both editorial and advertising staff will be in attendance at the booth or around the exhibition and we look forward to meeting anyone who wishes to drop by for a chat.□



Studer A812



Studio Technologies AN-2 stereo simulator

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Covering the Monitoring Spectrum.

The Tannoy FSM studio monitor loudspeaker and the DTM-8 reference monitors cover the complete professional spectrum.

The new FSM inherits all the traditions of the widely-acclaimed SRM series. However, the crossover network is all 'hard-wired' and the frequency response adjustment in the crossover employs gold plated links between robust terminals. The result is increased reliability and superior aural properties when compared to wafer switches.

The unique 'LF Window' enables the high pass filter feeding the dual concentric unit to be bypassed. Both units then operate in parallel, with a 3dB subsequent increase in low frequency energy. This facility is of particular value in matching the FSM to different room acoustics with difficult bass characteristics.

Compact desktop units

The new compact DTM-8 meets the need for phase-coherent point source desktop monitoring. It uses a state-of-the-art 8" dual concentric drive unit, which offers all the features of stable stereo images, axially aligned acoustic source, phase coherence, smooth frequency characteristics and low colouration.

For full details on both ends of the spectrum, just contact F.W.O. Bauch Limited.

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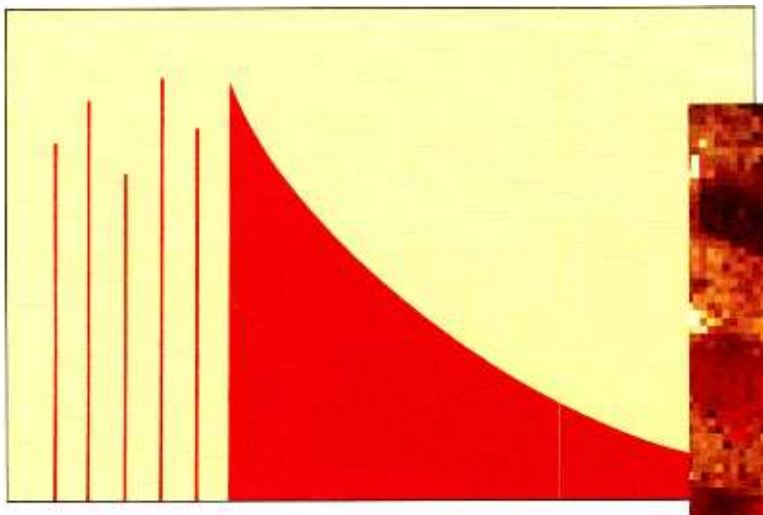
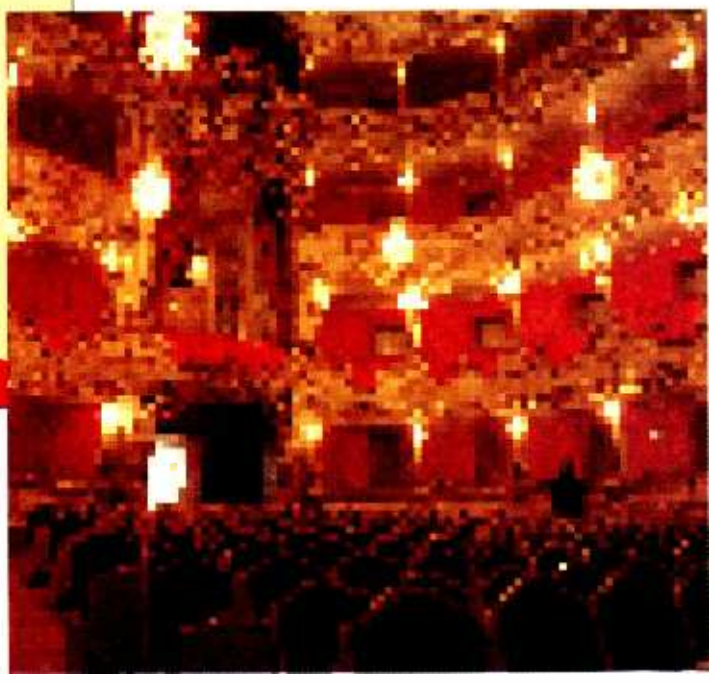
New sounds only change what we hear.





Digital reverb sounded like this.
First generation digital reverb offers control over a few discrete pre-echos These are followed by the exponentially decaying reverb envelope typical of plates or small chambers

New approaches to ambience, imaging and sampling

The new 480L digital effects system from Lexicon was created to produce more accurate room simulations. However, within its innovative software and hardware are possibilities that extend far beyond the limits of realism: combinations of plate, gated and ambient reverbs, unique cascaded time-based effects, sampling. Personal settings can be stored and transported on RAM cartridges.

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Moving forward by looking back

The 480L is a generation beyond other digital processors in both hardware and software. Yet many of its advances were conceived in centuries-old concert halls. Close analysis uncovered basic flaws in the usual digital techniques of ambient simulation.

In real halls, the rate of the first 15 dB of decay is crucial to the perception of spaciousness and ambience. For many listening positions, this initial decay is longer than the measurement of total reverb time would suggest. To emulate these fine old halls, it is necessary to control the initial decay independently of the overall reverb time.

Hall programs of unprecedented realism

The initial reverb envelope defines apparent room size and ambience to the ear. In real spaces, this buildup and decay is gradual, with a complex, non-exponential profile. The use of digital pre-delays does increase apparent room size, but adds unnaturally defined attacks that make the sound artificial. The 480L's SHAPE and SPREAD parameters emulate the complex profile of natural reverb. SHAPE affects the contour of the reverb envelope, while SPREAD controls the time factor for that contour. When balanced with SIZE (reverb density) and RT60 MID, SHAPE and SPREAD create deep, warm, spacious ambience without excessive decay times.

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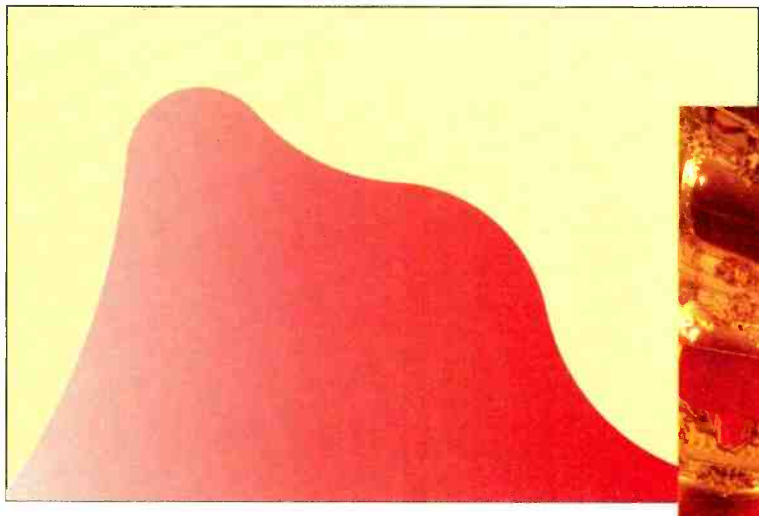

Now we have a clearer picture.
The 480L's innovative SHAPE and SPREAD controls continuously adjust the diffused reverb profile to match the ideal ambience characteristics of a real hall — with uniquely natural pre-delay.

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The 480L is engineered for the unforgiving all-digital audio environment, with its higher standards of accuracy and dynamic range. The PCM 1610/1630 compatible *digital I/O interface* lets you add true stereo ambience and sampling, *all in the digital domain*. 18 bit linear internal architecture and converters produce a wet signal dynamic range of 98 dB. Now you can add reverb without adding noise — even on a digital master.

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THE DIRECTION OF MIDI

Mark Jenkins traces the development of MIDI and speculates on its future

The MIDI standard for communication between digital musical instruments has been established for around four years now and has become phenomenally successful when compared to the previously slow acceptance of standards in the fields of computing and music. There are now over 300 readily available MIDI instruments including keyboards, synthesisers, drum machines, sequencers, computers, guitar synthesisers, synchronisers and effects.

Allowing instruments to communicate with each other has created far more new designs and techniques than anyone could have imagined. The basic application of MIDI—connecting a sequencer to a single keyboard or connecting two keyboards together to play in unison—has been left far behind, although of course these techniques are still in use every day.

It's now worth taking some time to investigate the nature of the MIDI standard, the reasons for its popularity and the techniques it helps to make possible. MIDI is flexible and we will take a look at the ways in which it may develop in the near future.

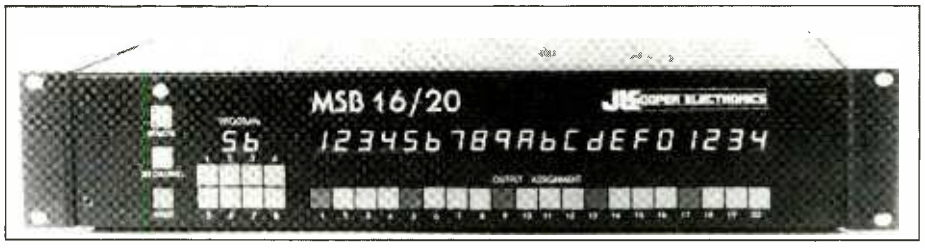
History

MIDI began life as USI, the Universal Synthesiser Interface proposed by Dave Smith of Sequential to solve problems such as those found in interfacing his Sequential *Polysequencer* to the *Prophet 5* synth. The Japanese manufacturers, Yamaha, Roland *et al*, suggested the addition of many information codes beyond simple note on and note off—Roland, for instance, were already sending patch (memory) changes along their Digital Communication Bus (DCB).

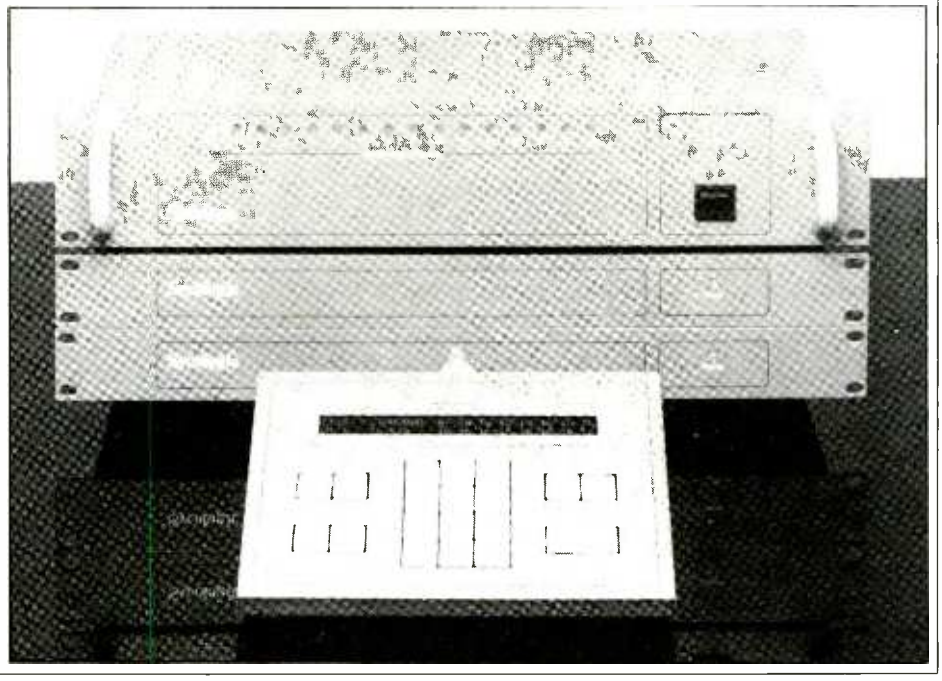
The DCB was a parallel interface but was expensive to implement due to the complex multipin computer connectors needed. MIDI was proposed as a serial interface which required a lot of work on the arrangement of information transmission but which benefited from much cheaper connecting hardware in the form of a simple 5-pin DIN socket.

Since the introduction of MIDI only one major revision has been needed although there are now several more in the air. Most objections to MIDI still refer to its speed—when many instruments are playing complex parts, delays due to the serial nature of the standard can become quite audible. However, most MIDI software now makes compensating delays available (on the Steinberg *Pro 16* and *C-Lab* composition packages for the Commodore *64* computer, for instance) and some software even manages to exceed the 16-channel capability of the standard (on the Steinberg *Pro 24* package for the Atari ▷

MSB 16/20 from JL Cooper Electronics



Sycologic M16 with two M16X expanders



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THE DIRECTION OF MIDI

520ST computer and on the Linn sequencers).

Modes

MIDI transmissions are tagged with a channel number from 1 to 16—instruments responding to all 16 are said to be in Omni Mode, instruments responding to just one of these are in Poly Mode, and instruments responding to more than one channel simultaneously are in Mono Mode.

Few instruments have only Omni Mode now, and several new modes have been invented as options. Sequential invented the Overflow Mode, in which all notes played beyond the capability of one synth are passed on to another to create one 16-voice instrument from two 8-voice instruments, for instance; while Ensoniq's Multi Mode allows all eight voices on their *ESQ-1* synth to transmit and receive on different MIDI channels simultaneously.

Relatively few instruments capable of playing in Mono Mode exist—the *ESQ-1*, Oberheim *Xpander*, Casio *CZ* series and SCI *MultiTrak* are exceptions—but this facility is obviously becoming more popular as musicians use sequencers or computers to create complete pieces on synthesisers and require many different sounds simultaneously to do so.

The Midi Mode in use is defined by the transmission of one of a set of codes, the meanings of which have changed slightly since the standard was created. See **Table 1. Table 2** summarises the changes.

Original MIDI products manufactured in the first 18 months or so of the standard, such as the Sequential *Prophet 600*, Roland JX3-P and early Yamaha *DX7*s, will ignore the codes 122, 123 and 124, and this could lead to problems unless the instruments are updated with an EPROM change. The new Mode commands represent a slight simplification of the system and allow the Local Keyboard On/Off feature to be introduced. This stops MIDI information from a synthesiser's keyboard reaching its voice generators and means that a synthesiser could be played from a sequencer while its keyboard was used to control another synth or program another sequence line.

Changes have also been made to the System Real Time or clock codes which we will look at later.

Categories

MIDI information is transmitted in five categories: these are Channel, System Common, System Exclusive, System Reset and System Real Time codes.

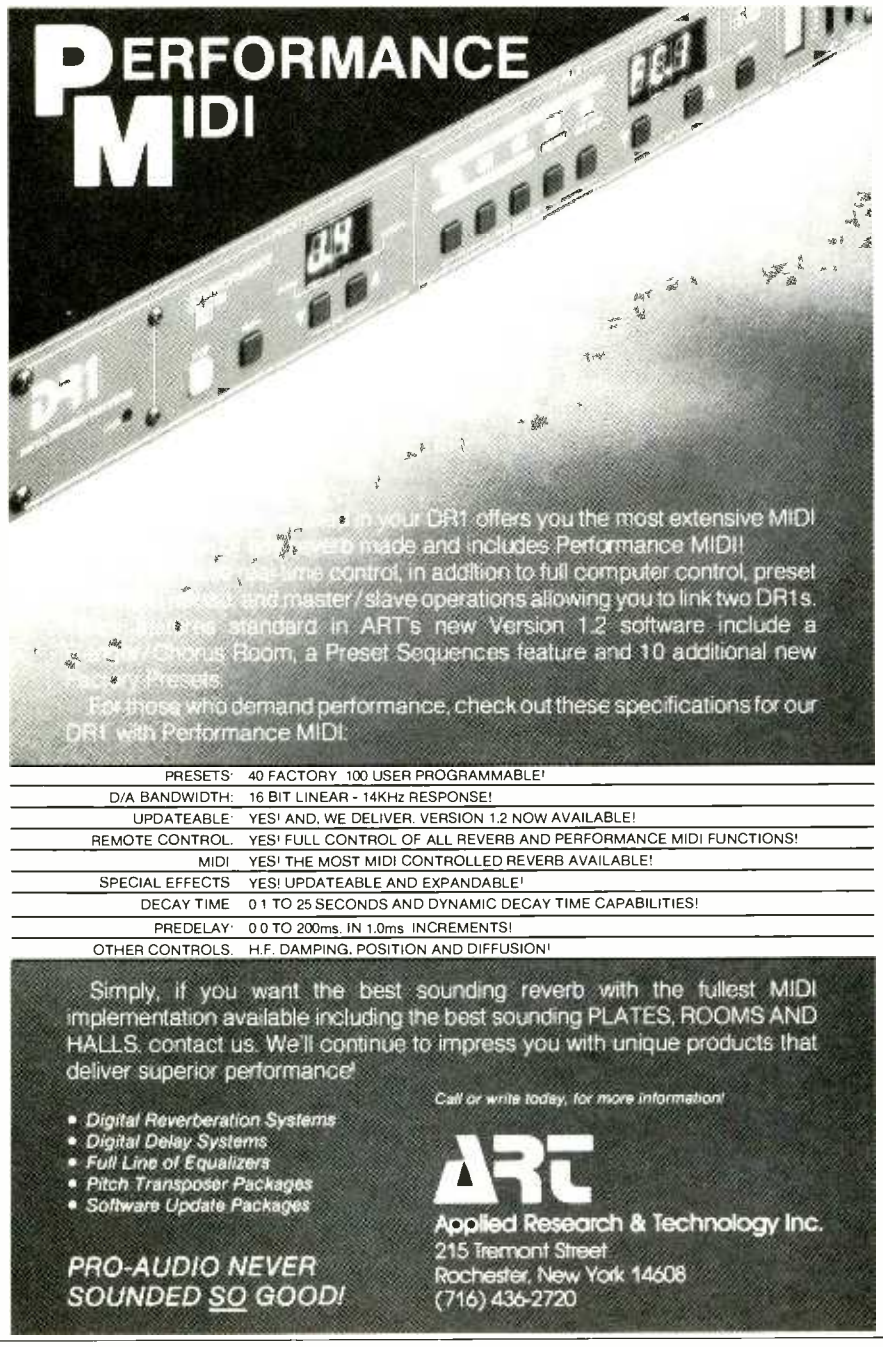
System Reset comprises only one command: a code to set all connected units back to their power-up condition, while System Exclusive is used by each manufacturer for its own purposes. Most information is channel information which can be tagged with a number from 1-16 so as to affect only Poly Mode instruments set to the correct channel.

Channel Codes include Note On, which for instance is identified by a binary 'status byte' of 9 (1001). All Status bytes start with a 1, while Data Bytes, used to actually transmit a new value, start with a 0.

In fact a Note On event consists of three codes in the form 1001/aaaa, 0bbb/bbbb, 0ccc/cccc which represents Note On plus Channel No, Key No from 0-127 and Key On Velocity from 0-127. Note On codes must be followed at some point by Note Off codes with a status byte of 8 (1000) or notes will sound indefinitely.

From the complexity of a Note On command it is easy to see why delays may be caused if up to 16 instruments have to be controlled. Pitch Bend and Velocity Data causes particular problems here. Other channel codes include: Polyphonic Key Pressure, Channel Pressure, Control Change, Program Change, Pitch Wheel.

Polyphonic Key Pressure affects all voices of a synthesiser if any keys are pressed, while Channel Pressure only affects the individual keys pressed. Channel Pressure response is very rare, virtually confined to the Yamaha *DX-1* in practice, and it has only been in the last few months that polyphonic pressure and velocity response have become common other than on the Yamaha *DX7*. This is a good example of the expense of mechanical considerations—such as velocity and pressure sensing



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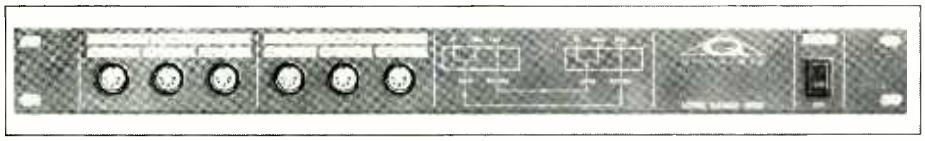

Long Range MIDI from Quark

keyboards—limiting the number of MIDI options which can be implemented. As the synthesiser circuitry itself is reduced towards a single chip (as on the Ensoniq Mirage), more investment will be possible for these facilities.

Control Change codes are left open to the individual manufacturer in recognition of the fact that every instrument will have its own control layout; 128 codes are available, of which only one—the Pitch Bender—is specifically defined, as address 0. In most cases this is more than sufficient, although on the Yamaha *DX7* 147 parameters are needed to define a sound.

Similarly, the channel code for Program Change has only 128 memories available, which limits the number it is worth providing on an instrument. In fact few instruments in common usage have even this number of memories—the Yamaha *DX7* fitted with a Syco Logic *MX-1* memory expansion, which responds reliably to MIDI patch transmissions for all 128 memories, is an exception.

System Common codes include several transmissions intended for all connected instruments. These are ignored if the instrument is not capable of responding. See **Table 3.**

Their main purpose is to set sequencers and other units to the correct Measure and Song number, to put analogue synthesisers into their tuning routine and to signal the termination of a System Exclusive transmission.

The transmission of Measure and Song number information is becoming increasingly important as cheap SMPTE/MIDI units become available to tie MIDI sequencers and computers to tape. In fact a combined standard called MSMPTE is in the offing.

System Exclusive Codes are used as desired by each manufacturer and have so far been quite imaginatively applied. The assignment of ID codes (01 for Sequential, 42 for Roland, 43 for Yamaha and so on) makes sure that instruments from other manufacturers cannot be confused by transmissions not intended for them.

Most manufacturers use System Exclusive codes to data dump sounds from their instruments to another instrument, although Roland use them to control their synthesisers from a programmer unit, and Hybrid Arts in the US have developed a System Exclusive based MIDI protein analyser(!) Uses are limited only by the imagination of the manufacturer and academic users are even exploiting Sys Ex to overcome what they see as the harmonic limitations of MIDI, which always plays in a tempered scale!

System Real Time codes allow MIDI instruments which are performing real time tasks—such as playing a sequence or drum pattern—to synchronise together. Converters from clock pulses, DIN sync, SMPTE and other sync systems to and from MIDI clocks are now widely available and the use of MIDI Song Pointers derived from SMPTE codes is becoming more widespread.

As mentioned above, the Real Time section of MIDI has been changed since its inception as **Table** 4 shows.

The latest MIDI (version 1.0) simplifies the system by throwing out Clock In Play, Clock In Stop and Clock Plus Measure End in favour of just Clock and Stop. Active Sensing is a new function which isn't always implemented—codes are transmitted every 300 ms or so and if not received the slave instrument goes to All Notes Off. Therefore if the MIDI input cable is accidentally pulled out, any notes which have not been switched off will rapidly be silenced instead of droning on endlessly.

A full list of MIDI specifications is available in the public domain document No MIDI 1.0 5/8/83 from Sequential Circuits Inc. 3051 North 1st Street, San Jose, CA 95134, USA.

Problems and solutions

The changes mentioned in the MIDI specification answered specific problems but more remain. Enthusiasts claim that these are unimportant or even non-existent (one recent article argued that MIDI delays are less significant than the delays caused by the speed of sound when members of an audience are not equidistant from stereo PA speakers) but many companies such as NED and Fender opposed MIDI quite vehemently in its early days.

The hardware of the MIDI system is well defined; information is transmitted from the instrument's processor via a ▷

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THE DIRECTION OF MIDI

UART (Universal Asynchronous Receive/Transmit) circuit and information received also goes through an Opto-Isolator which uses an LED facing a light sensitive surface to transmit information while protecting the instrument from direct exposure to high electrical charges.

The standard demands a rise and fall time of less than 2 μs in the Opto and MIDI has been set to work at 31.25 kBaud (31.25 kbit/s). Transmissions are organised in packages of 10 bits—a Start Bit, eight Data Bits and a Stop Bit, which will take 320 μs to transmit.

If we have 10 synthesisers responding to 3-byte Note On transmissions, each taking 3×320=960 μs (around $\frac{1}{1000}$ s), the delay for the synth on the end of the line can be 10 times this long. One hundredth of a second delays are obviously very audible, and cramming the information through any faster can lead to buffer overload in the receiving processor. In fact, several of the latest Sequential instruments have the option of operating their MIDI at twice the normal pace if connected to similarly equipped instruments.

Speeding up the MIDI standard is then one of the most obvious developments for the future. Another is the improvement of MIDI facilities on effects units—at present, reverbs such as the Alesis *Midiverb*, Yamaha *REV-7* and Roland *SRV2000* simply respond to patch changes, which is quite useful for automation but not highly imaginative.

Lexicon's *PCM 70* shows the way ahead with 'performance MIDI' which allows effects parameters to be varied by MIDI data transmitted from the instrument which is being processed. Pressure sensitive chorus depth is one useful example.

Another improvement would be to standardise the System Exclusive data which at the moment is the exact opposite of the standard. This is probably impractical for analogue and digital synthesisers (it's hard to see how the 30 or so controls of an analogue Roland *Juno 106* could be made to relate to the 147 of an FM Yamaha *DX7*) but the situation is more hopeful for sampling keyboards. Sequential and Ensoniq have both implemented a Wave Data Dump for their sampled sounds and Digidesign's *Sound Designer* software is capable of transforming E-Mu *Emulator II* files stored to disk into Sequential *Prophet 2000* files—with some experimentation. In two years it will almost certainly be possible to transfer sample files from any MIDI instrument to any other, with a computer such as the Atari *5060* (the forthcoming 5 Mbyte version of the *520ST*) automatically compensating for differing maximum sample times, frequency response and so on.

The use of MIDI computers is another exciting field—the Atari models are the first to have built-in MIDI although it's still useful to add an interface to provide additional inputs and outputs, clock inputs, footswitch inputs and so on. Despite the introduction of Roland's inexpensive *MC500* MIDI *MicroComposer* home computers still offer the best value for money as MIDI controllers. An Atari *1040ST* running Steinberg's *Pro 24* package provides 200,000 note capacity and a vastly informative screen display.

MIDI delays have been a source of problems on guitar synthesisers and other unusual control systems but this problem has recently been solved in two ways. The Stepp guitar synthesiser has its own built-in voice circuits which communicate with the playing strings using an interface much faster than MIDI, while having a MIDI output available for external instruments. And Roland's new *GX* guitar pickup fits on a conventional guitar but does not need more than two cycles of a note to sound

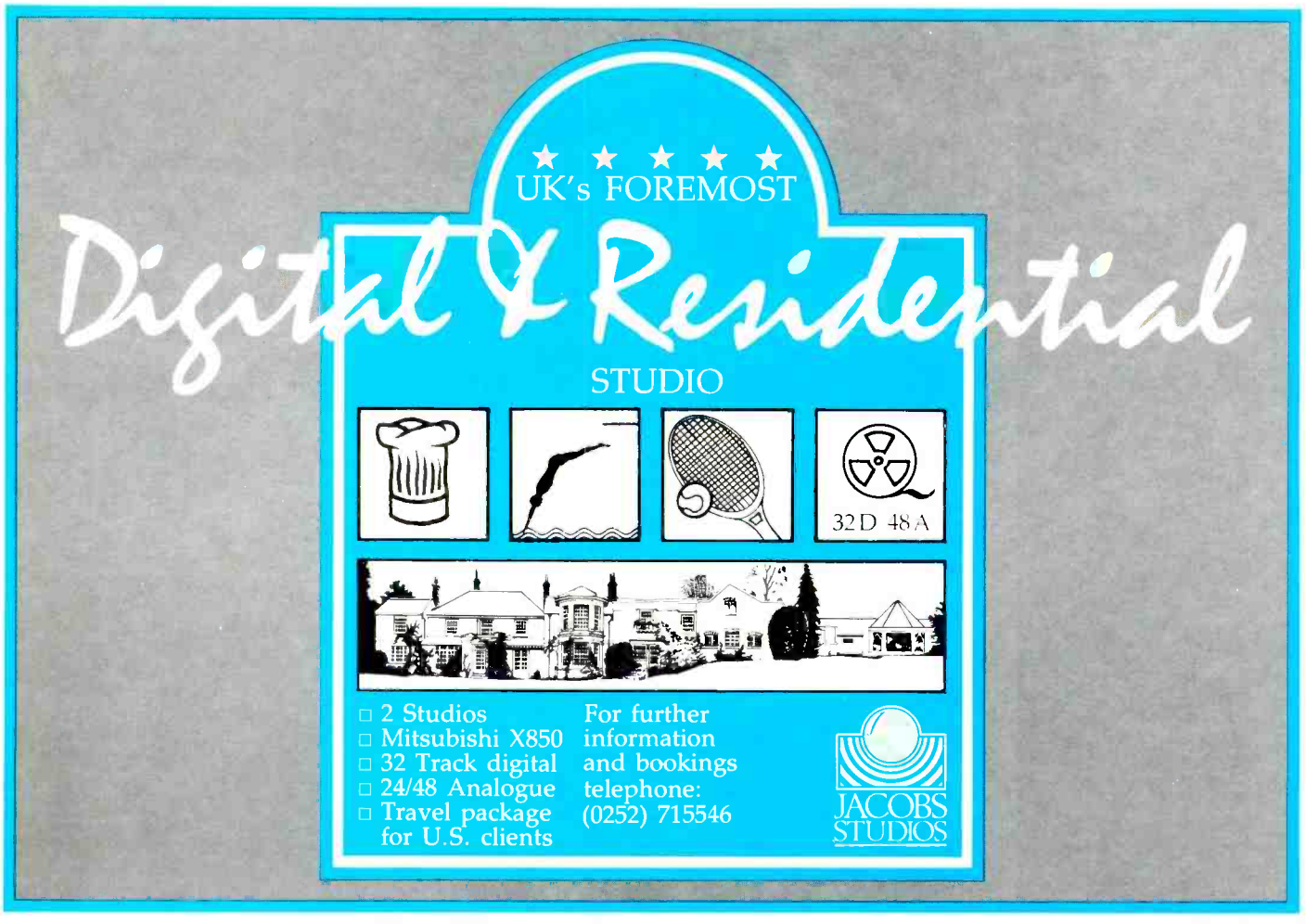

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TABLE 1

bbb/bbbb	Original MIDI	MIDI 1.0
122	undefined	Local keyboard on/off; ccc/cccc=0; Off ccc/cccc=127; On
123	undefined	All Notes Off ccc/cccc=0
124	undefined	Omni Off+All Notes Off ccc/cccc=0
125	Omni+All Notes Off ccc/cccc=0	Omni On+All Notes Off ccc/cccc=0
126	Mono+All Notes Off ccc/cccc=0	Mono+All Notes Off ccc/cccc=M (M=MIDI Ch 1-16)
127	Poly+All Notes Off ccc/cccc=0	Poly+All Notes Off ccc/cccc=0

TABLE 2

bbb/bbbb		Functions		
Original MIDI	Description	Omni	Mono	Poly
125	Omni	On	Off	Off
126	Mono	Off	On	Off
127	Poly	Off	Off	On
MIDI 1.0				
124	Omni Off	Off	—	—
125	Omni On	On	—	—
126	Mono	—	On	Off
127	Poly	—	Off	On

TABLE 3

Hexadecimal value	Meaning
241	Undefined
242	Measure (three bytes)
243	Song (two bytes)
244	Undefined
245	Undefined
246	Tune (initiates synth tune routine duplicating front panel control)
247	End of System Exclusive

TABLE 4

Value	Original MIDI	MIDI 1.0
248	Clock in Play (sent at 24ppqn while transmitter is in Play mode)	Clock
249	Measure End (sent at end of each measure instead of F8)	Unused
250	Start From 1st Measure (sent when Play is hit on master—F8 should follow within 5 ms)	Start
251	Continue Start (restarts from point when last F8 was sent)	Continue
252	Clock in Stop (sent in Stop to synchronise a phase locked loop for interpolating the timing clock)	Stop
253	Unused	Unused
254	Unused	Active Sensing

before calculating its pitch, as did previous models, allowing MIDI conversion to begin much more quickly.

Apart from speeding up the baud rate of MIDI there are two new interfaces in the offing. SCSI, the Small Computer Interface, is implemented on Sequential's *Studio 440* sampling drum machine/sequencer and is intended to be used for sample patch dumps for editing by computer and MSMPTE, which transmits SMPTE codes via MIDI and reconverts them for the use of sequencers and drum machines, is to be launched in earnest in 1987.

The future

In some ways it seems a shame that any changes have to be made to the standard since this will inevitably lead to incompatibility; however, if changes are made thoughtfully, upward compatibility will always be possible and over the last couple of years an active market in converters and enhancers to make up for MIDI deficiencies has sprung up. Companies such as JL Cooper in the US, Quark and Syco Logic in the UK are solving the problems of MIDI virtually as they arise.

In the future, the MIDI mixing desk is a likely development. Akai, RSD and Allen and Heath already have models ranging from 8-input mixdown desks to 32-input recording desks with MIDI-operated mute and route patch selection but as yet there is no MIDI-operated 'total recall'-type system with automated fader changes. Possibly operation at double baud rate will be necessary to achieve this on a large desk but as we have seen, this needn't cause problems.

Certainly MIDI will be around for at least 10 years. When it is superseded, it will probably be by its own high speed offspring—which may well be called Super MSMPTE—rather than by a completely new system. With the exception of the mixing facilities and some of the performance aspects of effects control, the totally MIDI-operated studio is now a reality. Perhaps rather than struggling to afford digital recording, some studios ought to be looking at digital performance via MIDI, and the complete abandonment of multitrack tape recording as it is now.□

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THE PD FORMAT

The tape format for the Mitsubishi (PD format) digital tape machine is designed on the basis of a compromise between the physical constraints of the recording media and the functions of the recorder. In this article Kunimaro Tanaka* describes the characteristics of errors occurring in the recording channels and the philosophy behind development of the tape format

*Kunimaro Tanaka is chief design engineer at the products development laboratory of Mitsubishi Electric Corporation

In order to improve the quality and fidelity of reproduced music, various types of digital audio tape recorders have been developed. Digitisation of the entire professional audio system is needed in the near future in order to provide source material for compact disc, digital audio satellite broadcasting and DAT (compact cassette-type consumer digital tape recorder).

Although the digital audio recorder is similar to the computer data recorder, it should be designed to meet the requirements of professional audio use, therefore the recorder should be developed according to the following criteria.

- In order to reduce tape consumption, the recording density is usually very high. Consequently the error rate in the reproduced data is also very high.
- The reliability of the recorder should be very high because of its professional applications.
- The redundancy of the recorded audio data helps in the concealment of the data error(s). First order interpolation is a very useful method of error concealment.
- Features such as punch-in/punch-out and electronic/splice editing, as well as others, are necessary for a professional recorder.

This article details a brief explanation on the coding theory, the characteristics of the errors occurring on the recording channel(s), the actual type format and a completely digitised professional entertainment system.

Errors in the recording channel

Fig 1 shows a type of error in the recording channel. The horizontal axis denotes the number of tracks where errors occur simultaneously and the vertical axis denotes the number of errors occurring, which corresponds to error probability. The data was obtained at the following parameters: linear recording density is 20 kbit/in, the track width is 305 μm. From this figure it can be said that the occurrence of a 2-track simultaneous error is of the order of 1/10,000th of the occurrence of a 1-track error, and that errors involving three or more tracks simultaneously are very rare.

Fig 2 illustrates the error run length versus the probability of errors occurring. Here 1-frame errors occur most often.

Fig 3 illustrates the variations in the error rate from track to track when the recorder is slightly misadjusted. The horizontal axis shows the measured time, while the horizontal lines correspond to each track. A circle whose diameter is proportional to the error rate is written when there is an error in some track. When the heads are mounted on the recorder correctly, the error rate is low and almost identical at each track. On the other hand when the heads are poorly mounted, the error rate in a few particular weak tracks tend to be very high (rather than the error rate of each track becoming high simultaneously).

Coding theory

Burst errors occur in the direction that tape is running (ie longitudinally) while random errors occur in a transverse direction at the recording channel, as described above. Therefore rectangular arrays of the digits whose sides correspond to the direction that tape is running and the transverse direction are effective for error correction coding.

By combining 1-dimensional codes, rectangular arrays of digits are

TABLE 1 Types of tape format

	Stereo Tape Recorder	Multichannel recorder							Digital Cassette Recorder
Tape width (in)	¼	¼			½	1			Cassette
Number of channels	2	4	8	16	16	32	64		2 4
Number of external data channels	1	1		2	3	3	4		1
Number of auxiliary analogue channels	1	1			2	2			1
Number of tracks per channel	8/2	10/4		10/8	10/4	10/8			
Number of tracks	10	12		23	45	45	86		
Tape speed (in/s)	7½ 15	15		30	15	30			4¾
Modulation method	MFM	4/6M							
Error correction code	RSC Code								
Sampling rate	48 kHz								
Quantisation	16 bit								

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constructed. It is well known that there are some classes of codes, ie product codes, concatenated codes, which have rectangular arrays of digits. Product codes have the advantage of simple implementation. On the other hand, concatenated codes are more efficient because the maximum distance separable code (MDS) can be employed as one of a combined two 1-dimensional codes. MDS codes are most efficient to a given redundancy. The Generalised Product Code (GPC) is therefore introduced as an intermediate between product codes and concatenated codes. The GPC is realisable by using the MDS code as in the case of the concatenated code; however, the encoding and decoding of the GPC requires less hardware than that of the concatenated code, because the MDS used in the GPC consists of but a small segment of MDS. Signal processing of the short symbol of code requires less hardware than that of a longer one. We shall call this a sub-class of GPC, which is the combination of the Reed-Solomon Code (RSC) and the Cyclic Redundancy Check Code (CRCC). Reed-Solomon Codes are applied in the cross-track direction and CRCC in the longitudinal direction. The code is applied to the digital audio recorder.

Tape format

Table 1 shows the types of tape format. Broadly, 'tape format' can be classified as the tape format for the multichannel recorder, that of the 2-channel master recorder, or that of the cassette type recorder.

The multichannel format is developed on the basis that each audio channel is recorded on a separate track to allow punch-in/out and a 2-dimensional error correcting code is used for reliability.

When the tape transport is improperly adjusted (ie when the recorder is field-adjusted) large amounts of error tend to occur in a few weak tracks, as described earlier. This means that when a tape is recorded in a studio where the deck is slightly misadjusted and played back, on a well adjusted deck there is a chance that some tracks will not replay well. For this reason a 2-dimensional error correcting format code (using RSC) is used. The codeword is shown in **Fig 4.** Here there are 10 tracks used for eight audio channels and each horizontal line corresponds to a recording track (channel 1 is recorded on track 1, channel 2 on track 2, etc). Two extra tracks are provided to record check bits of the RSC. The sync pattern, which indicates the beginning of the block, is recorded at the ▷

FIG. 1
PROBABILITY VS NUMBER OF ERRONEOUS TRACK

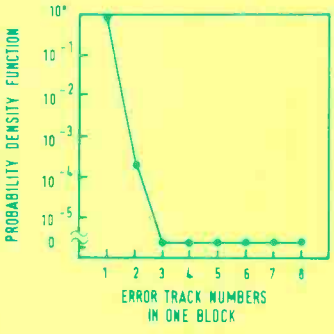


FIG. 2
ERROR RUN-LENGTH VS OCCURRENCE PROBABILITY

FIG. 3
MAP OF ERROR PATTERN

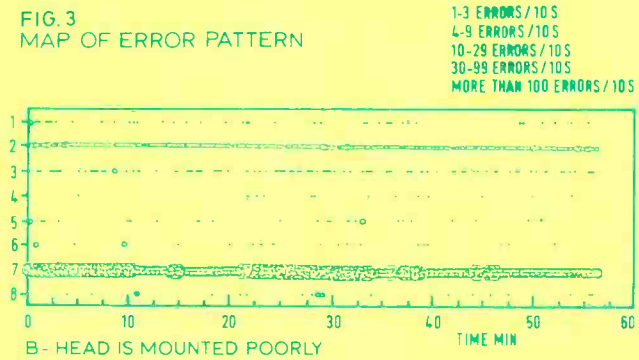
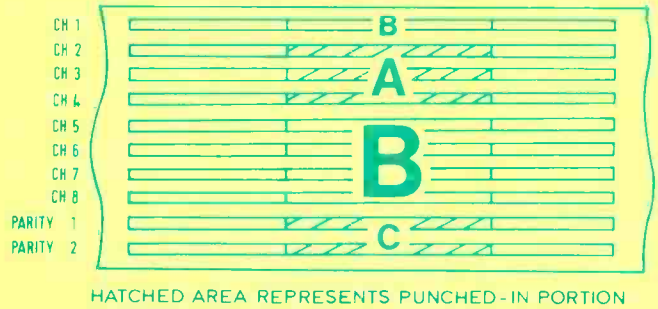


FIG. 4
CODE FORMAT OF MULTI-CHANNEL RECORDER

SAMPLE

CH 1	SYNC	1-1	1-2	1-3	1-4	1-5	1-6	1-7	1-8	1-9	1-10	1-11	1-12	CRC
CH 2	SYNC	2-1	2-2	2-3	2-4									CRC
CH 3	SYNC	3-1	3-2											CRC
CH 4	SYNC	4-1											4-12	CRC
CH 5	SYNC	5-1											5-12	CRC
CH 6	SYNC											6-11	6-12	CRC
CH 7	SYNC										7-10	7-11	7-12	CRC
CH 8	SYNC								8-8	8-9	8-10	8-11	8-12	CRC
PARITY 1	SYNC	$\Sigma a_i \alpha^i$												CRC
PARITY 2	SYNC	Σa_i												CRC

FIG. 5
PUNCH-IN, PUNCH-OUT AT MULTI-CHANNEL RECORDER



HATCHED AREA REPRESENTS PUNCHED-IN PORTION
B-REPRESENTS NON-PUNCHED-IN PORTION

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FIG. 6
DIFFICULTY OF RECONSTRUCTION OF CODE FORMAT AT PUNCH-IN AND PUNCH-OUT

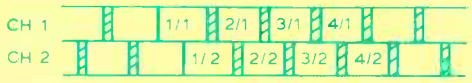
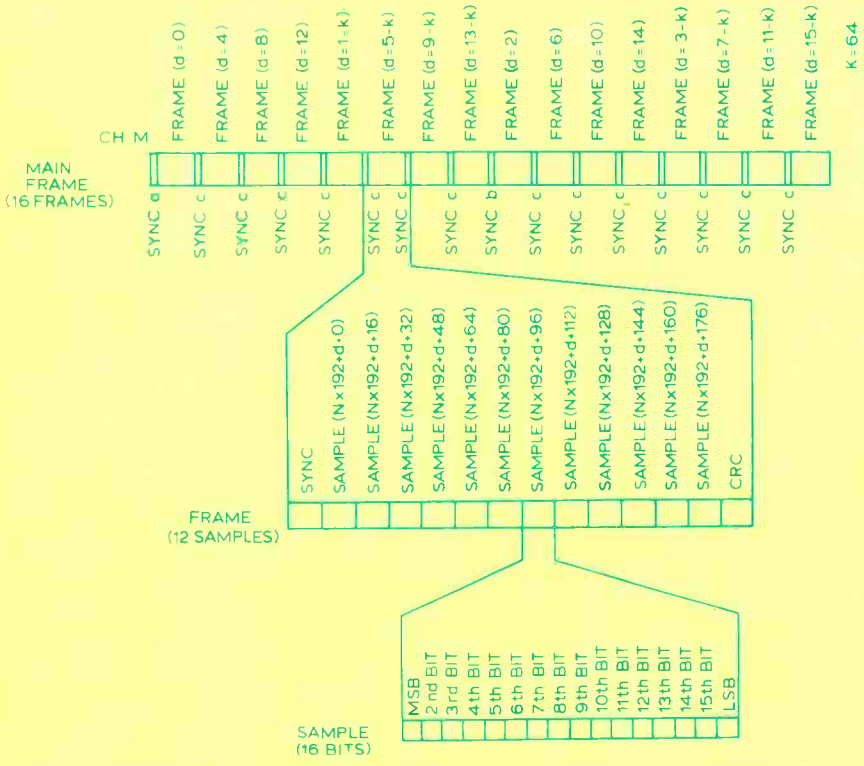


FIG. 7
SYNCHRONOUS PATTERN FOR MAIN-BLOCK SUB-BLOCK SYSTEM



beginning of each frame (one track portion of one block). CRCC is recorded at the end of each frame and allows the detection of errors.

When channels 2, 3 and 4 are punched-in and punched-out, the corresponding check bits are renewed, as shown in **Fig 5**. Inaccuracies in the mounting of the heads and in the tape speed make reconstruction of the code-block difficult. **Fig 6** shows in closer detail the punch-in portions of tracks 1 and 2. '1/1' represents the first frame of channel 1, and so on. Although '1/1' and '1/2' should be coupled for decoding, '2/1' and '1/2' might be coupled erroneously. To solve this dilemma, a main-block and sub-block system is employed. **Fig 7** shows the structure of the main block and the sub-block. There are 16 sub-blocks in one main-block. Sync A is used at the first sub-block of the main block, sync B is used at the ninth sub-block of the main block, the rest of the sub-blocks use sync C. The main block is first reconstructed without error (as shown in **Fig 8**) and then the sub-blocks can be coupled correctly for decoding in the punch-in and punch-out modes.

RSC has the ability to correct a 2-track error, ie when the signal from one track is lost, burst errors occurring in another track can be corrected. **Fig 9** documents the results of numerical calculations as to the error correcting ability of this code. The model of the error is assumed to be the Gilbert model, which is a model of burst error. When the bit error rate is 10^{-4} (which is of a typical magnitude) the mean time between error concealment is slightly less than 24 hrs. This is of a ▷

FIG. 9
ERROR CORRECTING ABILITY OF RSC CODE

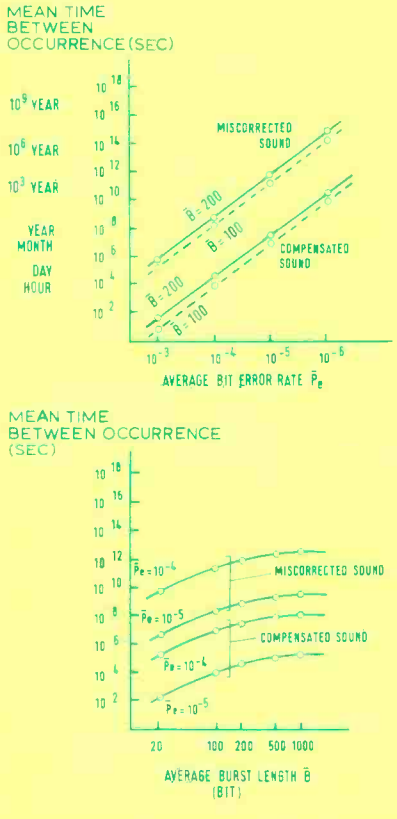


FIG. 8
RECONSTRUCTION OF CODE FORMAT AT PUNCH-IN AND PUNCH-OUT WHEN MAIN-BLOCK SUB-BLOCK SYSTEM IS EMPLOYED

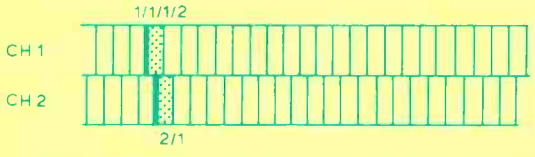
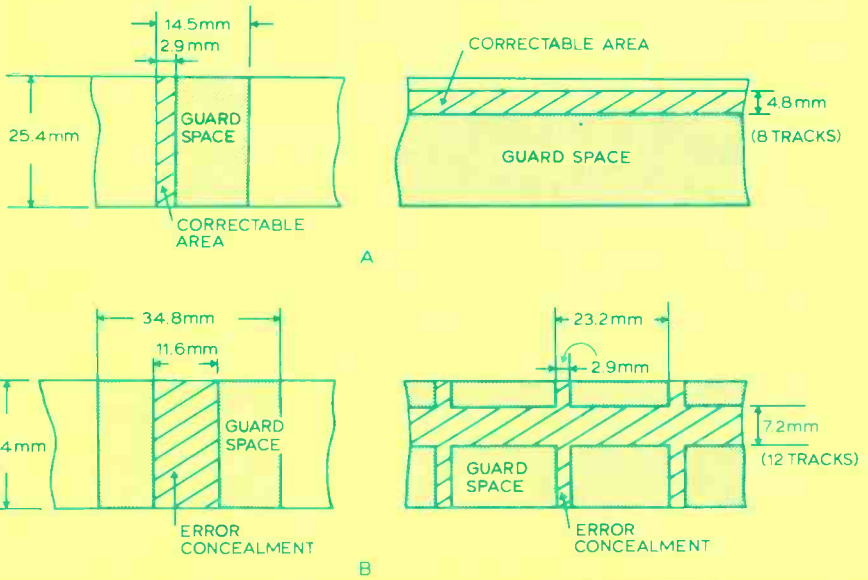


FIG. 10
THE LARGEST SIZE OF ERROR WHICH CAN BE ERROR CORRECTED OR ERROR CONCEALED



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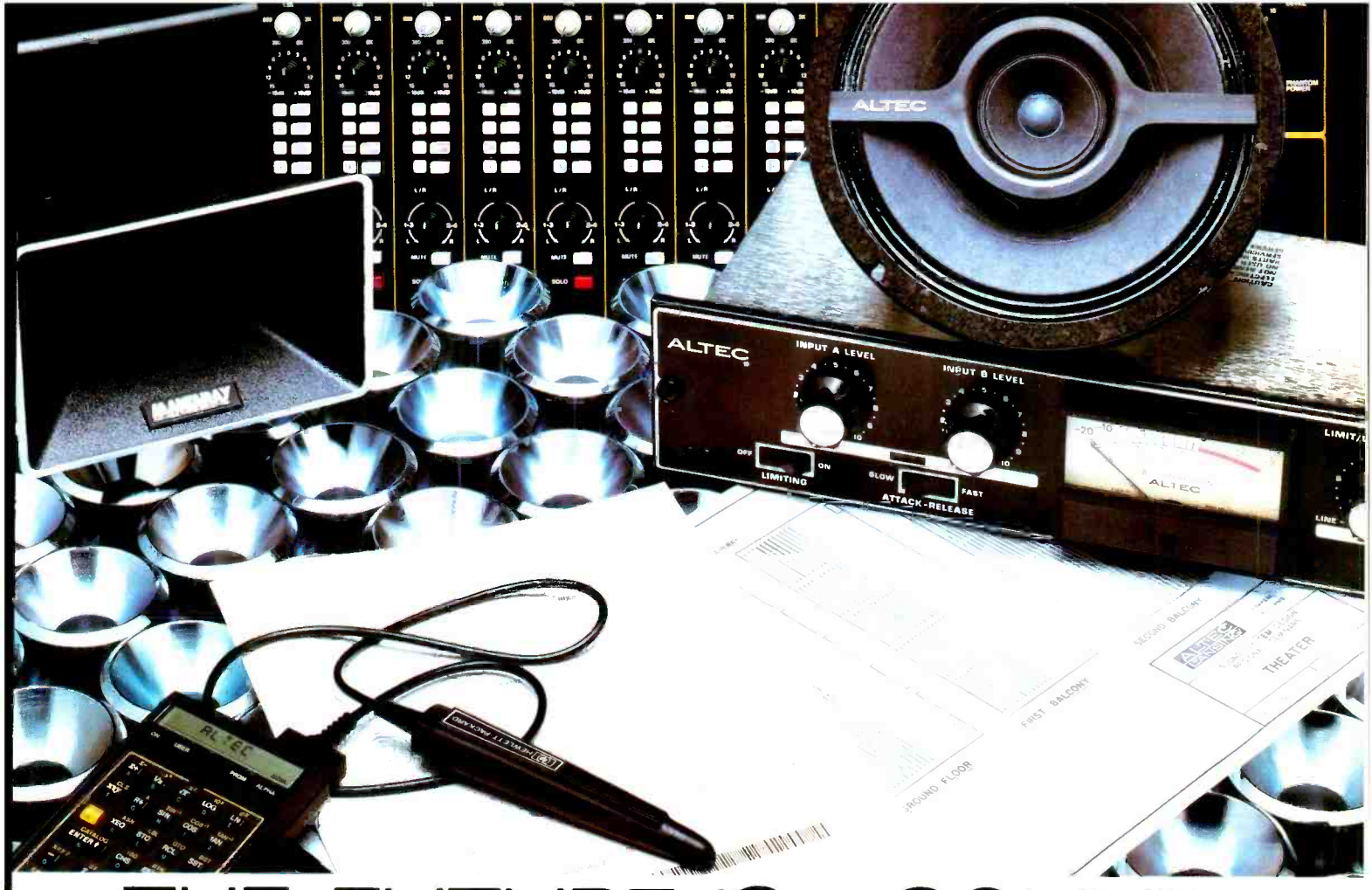

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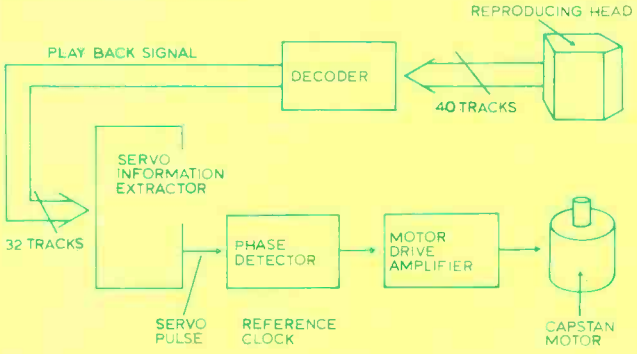
very practical value. The code is then interleaved in a very complicated manner during recording. As a result a large-sized error as shown in **Fig 10(a)** can be corrected, when there are no other errors in the vicinity. The error, however, depicted in **Fig 10(b)** can be detected but not corrected.

A phase-locked loop capstan servo mechanism is required for driving the

THE PD FORMAT

tape of a digital audio recorder (necessary for the removal of wow and flutter components). If there were to be a separate clock signal track (control track) and the operation of the recorder depended heavily on extracting the clock signals from that clock track for control, the reliability of the recorder would be restricted to the operation of the clock signal track. In other words, when the playback signal from the clock track is in a poor condition, ie during headclog, severe headwear, etc, the operation of all the tracks of the recorder deteriorate. In order to prevent this problem, a separate clock signal track is not provided. Here, the clock signal necessary for the demodulation of the playback signal is generated from the playback signal itself. A 'self-clocking' type of modulation code is therefore employed. The servo pulses required for accurate servo control are extracted from any of the 32-channel playback signals, therefore the servo system fails only when every track fails (audio playback signals are not available during this most serious condition). **Fig 11** shows how the capstan servo system is employed.

FIG 11
SERVO PULSE EXTRACTOR



Two-channel format

Development of the format for the 2-channel recorder is based on the following criteria: neither the track density nor the linear packing density should be too high to prohibit splice editing. Both the left and right channels are recorded over eight tracks (six tracks for digital audio data and two for check bits) and as a result, error concealment is still possible when errors are noted in a large number of tracks simultaneously.

Compared with an analogue recorder, the recorded wave length and the track width of the digital recorder is very short. In order to make splice editing possible, the number of tracks should be chosen to be the minimum, yet satisfying the requirement of the recorder. The parameters chosen are: track width 305 μm, track pitch 625 μm, as shown in **Fig 12**. There are 10 tracks across the tape: eight for digital audio data and check bits, one for analogue audio (cue) and one for timecode data.

The audio data is interleaved during recording. The audio data of the left and right channels is therefore mixed and recorded on six (of the eight) data tracks, as shown in **Fig 13**. The purpose of this arrangement is to increase the maximum number of erroneous tracks tolerable to ▷

FIG 14
CODE FORMAT FOR 2-CHANNEL RECORDER

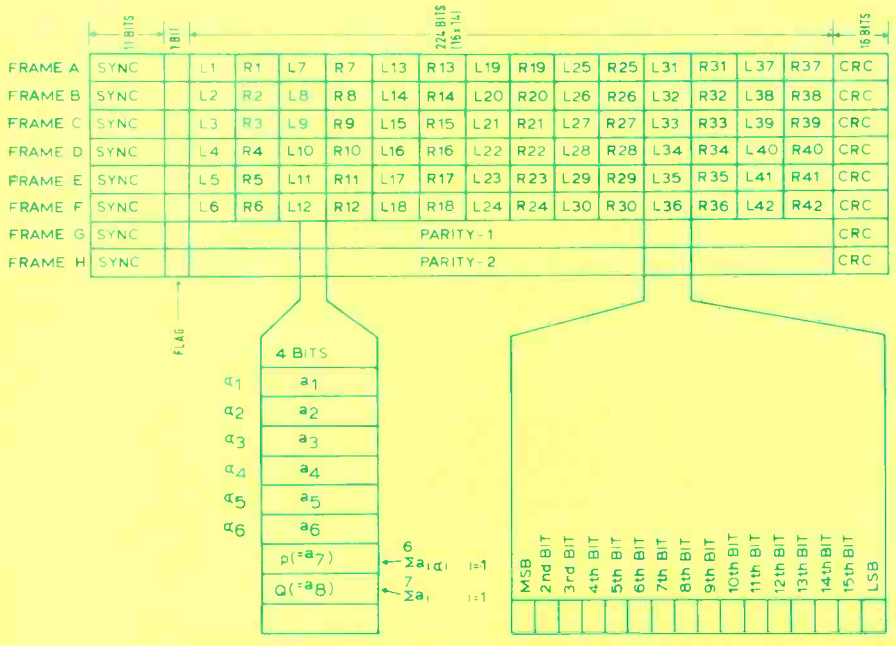


FIG 12
PHYSICAL GEOMETRY OF TAPE FORMAT FOR 2-CHANNEL RECORDER

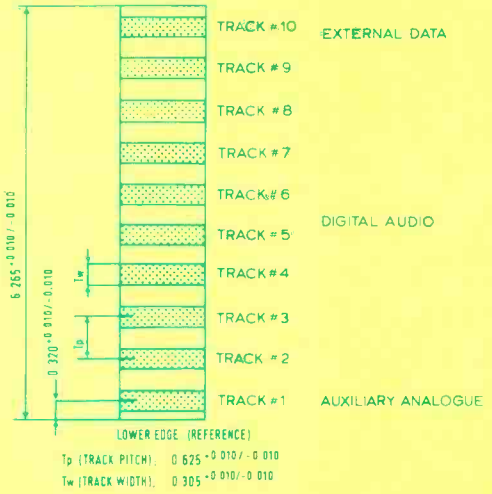
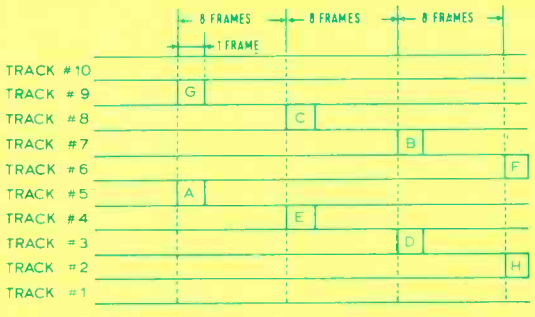


FIG 13
INTERLEAVE EMPLOYED FOR 2-CHANNEL RECORDER



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maintain a certain quality of error concealment. When the playback signal from seven (of the 10 total) tracks is lost, every erroneous sample is succeeded by the correct sample. The use of First-Order Interpolation is therefore employed for error concealment. The error correcting code employed in the 2-channel recorder is similar to the one used in the multichannel recorder and the code format for this recorder is shown in **Fig 14.**

The clock system and servo-system employed in the 2-channel recorder are also similar to the ones used in the multichannel recorder. Again, a separate clock track is not used. The servo information is extracted from the playback signals of the channels.

The format of the cassette type digital tape recorder is yet to be decided. In order to reduce the cost of this recorder, LSIs developed for other consumer products should be employed because the sound quality of the proposed digital

consumer recorder should be the same as that of a professional one, although the reliability of a professional recorder must be higher than that of a consumer recorder. The reliability of the LSIs are high enough for professional use. When the standard tape format for a consumer cassette type digital recorder has been decided, the LSIs will be introduced into professional recording systems.

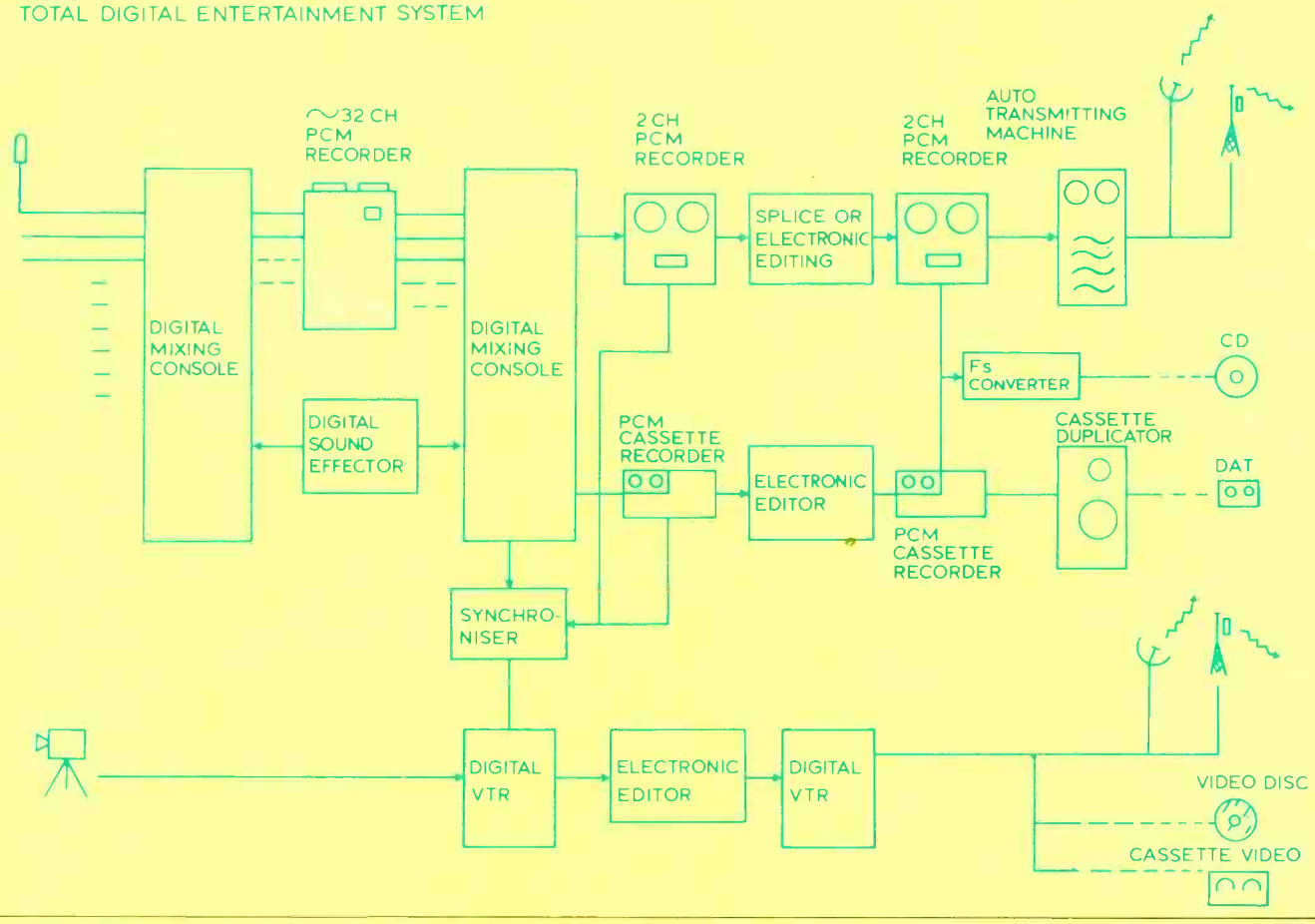
Total digital entertainment system

Fig 15 shows a simple block diagram of the totally digitised entertainment system of the future. Mitsubishi is confident that the entire entertainment business will be digitised in the near future and the advent of compact disc and other developing technologies support this conclusion. The company's basic philosophy in developing professional audio equipment is to support this digitisation by supplying this equipment for now.

Conclusion

The tape formats for the 2-channel and the multichannel digital audio recorders of Mitsubishi Electric, Otari and AEG-Telefunken, have been in production for sometime. The basic premise in developing the format was one of high reliability. The number of tracks employed is more than that of their analogue counterparts and even though the possibility that some track has a poor condition might be high, it is still believed sound of an acceptable quality should be maintained. This is why there is a 2-dimensional error correcting code. Many recorders of this type have already been used for professional applications and field experience demonstrates that the tape format described above is quite practical in actual use. □

FIG.15
TOTAL DIGITAL ENTERTAINMENT SYSTEM



Maximum Distance Separable Code (MDS)

When the binary code of b bit length is considered, there can be 2^b kinds of different code. When the check bits of k bit are attached during the encoding procedure of the error correcting code there are $2^{(k+b)}$ types of binary code whose length is (k+b) bit. The encoding of the error correcting code assigns b types of binary code on to (k+b) types of binary code of a (k+b) bit length.

When one symbol of binary code of b bit length is changed, the revised new code (which is a different code) is also assigned; however, when one symbol of (k+b) bit binary code is changed, the new code might be one which was not assigned. This means that the code is erroneous because it had not been originally recorded and the reproduced code is one that was not assigned. This character is used for error detection or error correction.

Suppose there are two binary codes of a bit length of (k+b). Some of the symbols are different and some the same. The number of different symbols is referred to as the Hamming Distance. For example, the distance between the word 10111000 and 10101001 is 2. When 2^b kinds of information are assigned on to $2^{(k+b)}$ kinds of code, the minimum distance between the assigned codes is important because that minimum distance is directly related to the error detecting and correcting capability. The method of assigning codes which make the minimum distance the maximum is the best method of assignation from the standpoint of efficiency. This type of error correcting code is called Maximum Distance Separable Code (MDS).

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STUDIOFILE

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Eel Pie Studios, Twickenham

Hanging on the wall of Eel Pie's reception in Twickenham is a picture of Victorian England at its best: the rolling green acres of an unspoilt country estate viewed from its Thames-side boathouse—the same boathouse that is now the site of Pete Townshend's multitrack studio and video production complex. Pete bought the place in its water-logged state back in 1975 and its first subsequent incarnation was as a film/video workshop centring mainly around the collection and production of films on the life and teachings of the Indian spiritual leader, Meha Baba, with whom Pete was deeply involved. Facilities included 16 mm dubbing, basic 8-track sound recording and a 16 mm projection suite looking out over a large auditorium/studio floor area at the other end of which was a stage and retractable projection screen.

Pete also used the place as a multitrack demo studio, and a Studiofile in the May 1982 edition of this magazine tells how in spring 1981 it was decided to dispense with most of the picture equipment and 'go commercial' with the installation of an upmarket 24-track music facility involving an SSL 40/32 with *Total Recall* (it's now been updated to 48-channel), a pair of Studer *A800* multitracks and Ampex *ATR 100* stereo machines. The control room was completely redesigned as a room-within-a-room by Keith Slaughter (who also redesigned the Broadwick Street Eel Pie in 1982) although the studio floor area was left in its original very live state with only a set of adjustable curtains running around its plastered walls for acoustic treatment. The stage also remained, with it in mind to offer the space for video promo shoots, though still the main focus was on music recording. It was a perfect time to buy SSL and with little promotion the studio operated very successfully.

A couple of years later it was apparent that there was still a lot of space in the building which was not being properly used. A second SSL multitrack studio was considered and they even went as far as having plans drawn up for it but the current state of 'SSL saturation' was apparent even then and the idea was scrapped. The final decision brought the changes full circle when in February 1984 Townshend re-entered the picture business and work commenced restructuring the rest of the building to include a relatively sophisticated video production facility. He made all the decisions about layout and the way the different parts of the studio would interrelate and Keith Slaughter was called in again to put it to plan and co-ordinate the building work. Townshend's lack of fondness for the 'gold fish bowl' effect of having the control room looking out directly over the studio floor coupled with his desire to leave the main studio area as large as possible meant that the control room was built in a different area separated from the main room by a corridor. Communication is via closed circuit TV involving a six camera rig. The original multitrack studio design included a large overdub booth directly in front of the control room, and so in the new scheme of things the multitrack studio and the video production facility can be used at the same time for separate productions without interference. Alternatively, the main room can still be used exclusively for multitrack music recording, or for a combination of simultaneous music and video production. This physical separation was also a great asset in that it made it possible to continue running the multitrack studio for mixing and overdubbing throughout most of the construction period.

Video control room

The video control room has been built behind the overdub booth and measures approximately 16×16 ft. The machines are housed in a separate adjacent machine room. The suite is equipped with a Cox *T-16* plus vision mixer, a Fairlight *CVI* digital video processor, *BVU* high band U-matics, a Sony 1 in VTR, a number of VHS and Betamax VCRs and two Sony *DCM-3* cameras with remote controls. Though the Cox can handle quite complex on-line mixing, currently only simple three-to-one high band editing is possible although 1 in facilities are being considered for the future. There's also a Rank Tempus lighting controller, an Amek 12/4 audio mixer plus a 24/2 rack mounted Neve mixer allowing 24-track monitoring/mixing, an Otari *MTR-90* 24-track and an Adams-Smith *2600* synchroniser. Upstairs there's a dressing room, a make-up room and kitchen facilities.

One of the main problems facing Keith Slaughter in the main room was limited ceiling height and the fact that, though some form of room-within-a-room construction was necessary for isolation, Pete was very keen to keep the space as large as possible and of course for video work height is very important. The final dimensions turned out to be approximately 50×25×13 ft. The lack of height does somewhat limit the type of production that can be handled but it was decided at an early stage that the cost of raising the roof was prohibitive. Before construction began the walls and ceiling were stripped back to the bare reinforced concrete. The walls were then clad with a sandwich of plaster board and *Revac* then a gap and finally a second plasterboard/*Revac* sandwich resting on Neoprene pads for isolation. The size of the gap was dictated by the route of the air conditioning ducts and is anywhere between just a few inches and about 18 in. *Metsec* metal section girders run across the width of the room resting on stanchions running down between the two walls, which in turn rest on Neoprene pads thereby isolating the entire structure from the floor. These girders take the weight of the false ceiling and the lighting rig. It was decided to completely rip out the old lighting system and put in a new 50 kW rig, purpose-built for video. This rendered the old air conditioning system totally inadequate to deal with the huge resultant heat output, and the plant house for the final system actually takes up almost as much room as the main studio itself.

Construction was completed in October 1984. Townshend himself is consistently involved with film and TV projects and so the video studio has been used in that way right from day one. Such work includes all the dubbing to both video and 35 mm on the *White City* film project which Eel Pie co-produced and for which Pete helped write the script, wrote the music and recorded the album with producer Chris Thomas. Pete is also keen on archiving his own activities in the studio so that the material is there for future documentaries that are almost bound to be done on someone with his standing. He explained: "It was Paul McCartney who first made me aware of the importance of archiving. Every time I went to see him or work with him there'd be a camera crew hanging round our necks. I thought it was terrible but he said he was going to film everything he did, knowing ▷

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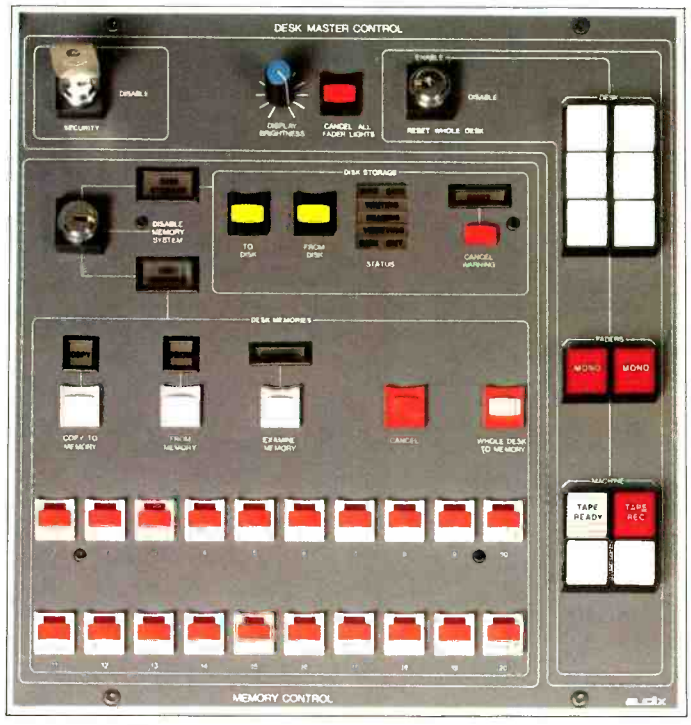
Thanks for the memory.



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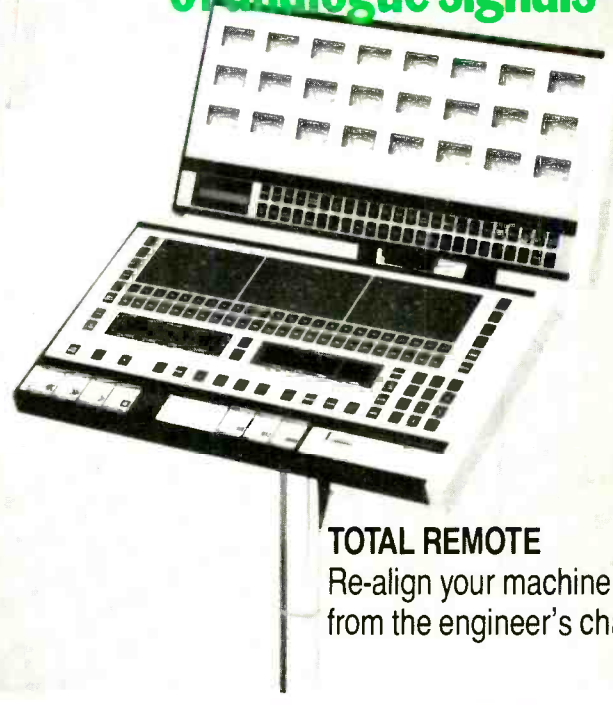

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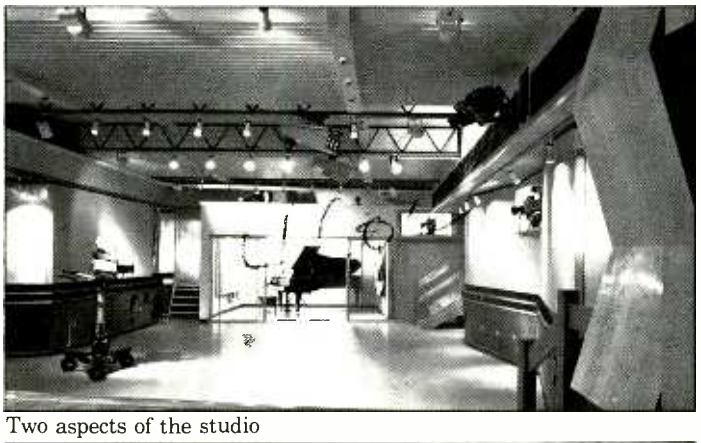
that at some time in the future it would be valuable. Phil Collins also does a lot of that although it's only on a domestic format."

So the video facility had been used but was the project a commercial success? I asked studio manager, Russ Schlagbaum, "What we were attempting to do was to offer creative artists the opportunity to get hands-on experience of working with television, as Pete says to 'demystify' TV. We could see that the two areas of audio and video were merging and so we made the choice—and possibly it could have been a mistake—for an audio studio to commit to video; and we felt that that would happen more and more, that more audio studios would start working with video but in fact it was the other way round. What happened is that video studios made what was to them a relatively small investment to move into audio, and so you got a number of places putting in SSL studios. The difference between them and us is that we have the experience in audio, we have the music recording background. At present we're offering the video side as a facility without operational staff, we have a technical engineer to make sure that everything works but the client has to bring in their own lighting cameramen and editor, etc."

Basically, with the exception of a couple of days here and there, there has been very little outside commercial interest despite a £12,000 full colour brochure that went out with *Music Week*. To get the ball rolling they offered to do a complete promo production for a Siren Records' artist, shot on high band and edited to 1 in to ACTT standards, free of charge, on the understanding that if they liked the product and wanted to repeat the exercise with other artists, they would pay the going rate. The project was successfully completed, and artist and record company seemed delighted, but unfortunately failed to return for more on a commercial basis. Russ worked out that it cost them around £3,000 to do and thus figured that they could offer such a package commercially at £5,000.

Eel Pie, continued



Two aspects of the studio

As August was a quiet month, and in order to get the idea moving, they decided to offer the service at half price for the four weekends in August only, and took out a full page advert in *Music Week* inviting record companies to come forward. The next week they followed that up with a similar half-page ad, and then sent a copy of the promotion out to a long list of record companies. After all that they received only one call which was from Arista, and even they finally cancelled. It seems that the package fell between two stools; too expensive for a demo and not expensive enough to make record company executives consider it worthy of a major artist doing a full production intended for broadcast. At the moment, though, there is no doubt that they are very serious about what they're doing. Eel Pie doesn't have a very definite commercial stance in video.

Pete is involved in actually training his staff and experimenting with what and how they're going to slot into the video market. Where they're aiming the facility now is less clear. "You've actually caught us with the 'cards in the air'," Pete said. "We're not too sure which way it's going to go at the moment. In VAPP, what we're confident we can do is to serve any outside client whatever their needs. We're very good at that. When it comes to in-house video productions, or things I might dream up, or packages we might offer just to bring the place to life and get our staff properly trained, that's a greyer area.

"We've got an enormous sound effects library which I've been building up since *Quadraphenia* back in 1972, and we're currently looking at some way to commit it to a format that can be used for track laying. At the moment I like the idea of a *Synclavier*, although I'm going to look at the *AudioFile* or maybe Dave Woolley's (Trilion's chief sound engineer) method of synchronising VCRs with Sony *PCM-701*s."

At the moment, if they want to do a VAPP session they have to tie up their main audio suite, and so they're in the process of constructing a separate control room upstairs to be equipped with a Neve *8078* console and the Otari *MTR-90*. It'll be linked with the rooms downstairs via the CCTV and will be going out at around £50/hr for the basic facility, plus extra for VTRs, etc. Pete: "I'd like it to be related to a synthesiser composition/track laying facility. Right now though, we don't offer that as our main service because we don't have a sound supervisor here, and we can't afford the kind of money that somebody would require, especially if they're just going to sit around waiting for work."

What about the huge extra capital investment involved in creating a video facility? Is that always going to be a problem for the aspiring audio studio that's been used to smaller figures? Pete: "There are a lot of words bandied about over the higher capital investment but if you're thinking about setting up a state-of-the-art audio studio with a digital Neve console and a couple of digital multitracks, you are talking about £1½ million; I think audio has caught up with video to some extent. The investment in this video facility is about £¾ million; I would have spent at least that if I'd built another audio suite, particularly if I'd gone digital. Where audio people really run into difficulties with video suites is that they don't understand the change in the client/studio relationship. The fact that the client expects far more per minute in services, attention, chasing and follow-up than they do in audio. Audio is a bit like Hertz Rent-A-Car, you just hire them the room and they use it. In video, time is much more valuable and there has to be a much higher level of efficiency and service. Often when an artist comes in here to record we might have a cup of coffee and chat for a couple of hours before they start working, it's all very laid back because they can afford the £80/hr and they're the only people who's time they're taking up. It's also very related to the stupidly low rates charged by ▷

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STUDIOFILE

multitrack studios; as soon as there's a big orchestra involved suddenly things speed up. We're quite capable of working efficiently in the audio industry when necessary."

Pete went on to explain how he considered budgets of around £150,000 for an album to be too much, and that it was necessary to make more efficient use of studio time if the industry was to survive without long casualty lists. "If you could make the money spent more effective, perhaps studios could put their rates up. Because if they don't put the rates up the current glut of studios will turn into a famine, because they're going to start to drop like flies. I've made an enormous amount of money in my life, and even I'm feeling the pinch asking the kind of rates we're asking."

Townshend is looking to the future where he sees that it will be more common for

Eel Pie, continued

artists to get audio/video deals with record companies, rather than making records and then tacking on a video afterwards. At present record companies see money for a video as part of the promotion budget as opposed to the creative budget and he sees this as being something that needs to change for certain types of artist. In this new mode of working he sees that there needs to be a new integrated production facility and a method that combines all aspects of aural and visual creation and manipulation in one easily controlled suite. The current facility at Eel Pie is a basis for Pete's experiment and research to train the next generation of staff in the new working methods—once he's discovered more precisely what these methods are to look like. At the moment they're coming up against the television industry's well-known complete lack of faith in the audio industry's competence with pictures.

There can be little doubt that they're going to stay in the picture industry in some way and indeed they already have a room upstairs ready plumbed-in for a full production 1 in on-line edit suite just waiting for the decision to invest in the hardware. Coupled with the mooted *Synclavier* based music synthesis/track laying studio, and the possibility of updating the multitrack console, they're talking about a huge investment. Much will depend on the outcome of a market research project that they are having carried out at the moment.

Pete is undoubtedly strongly committed and read out an extract from a very interesting letter he had received from a friend in a video production company called Video Design, in Helsinki: 'By the end of the decade European nations will be broadcasting 300 hours a day and the total appetite for films, series, documentaries and entertainment will be around 500,000 hours a year. Even assuming American and other imports, repeats and so on, it still leaves approximately 100,000 hours a year to be produced. At the moment Britain, France, Germany and Italy combined only produce 5,000 hours.'

Pete seemed to have some faith in the credibility of his friend's research. You have to admire the man's pioneering spirit, and it will be interesting to return for another look at the Twickenham facility in 1990.

James Betteridge

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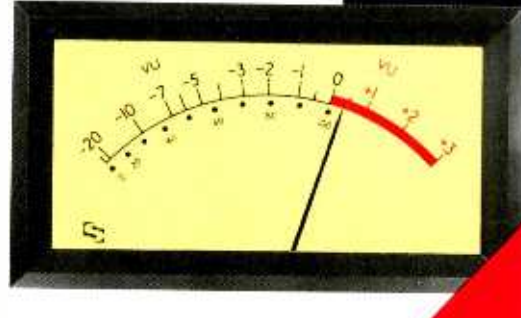

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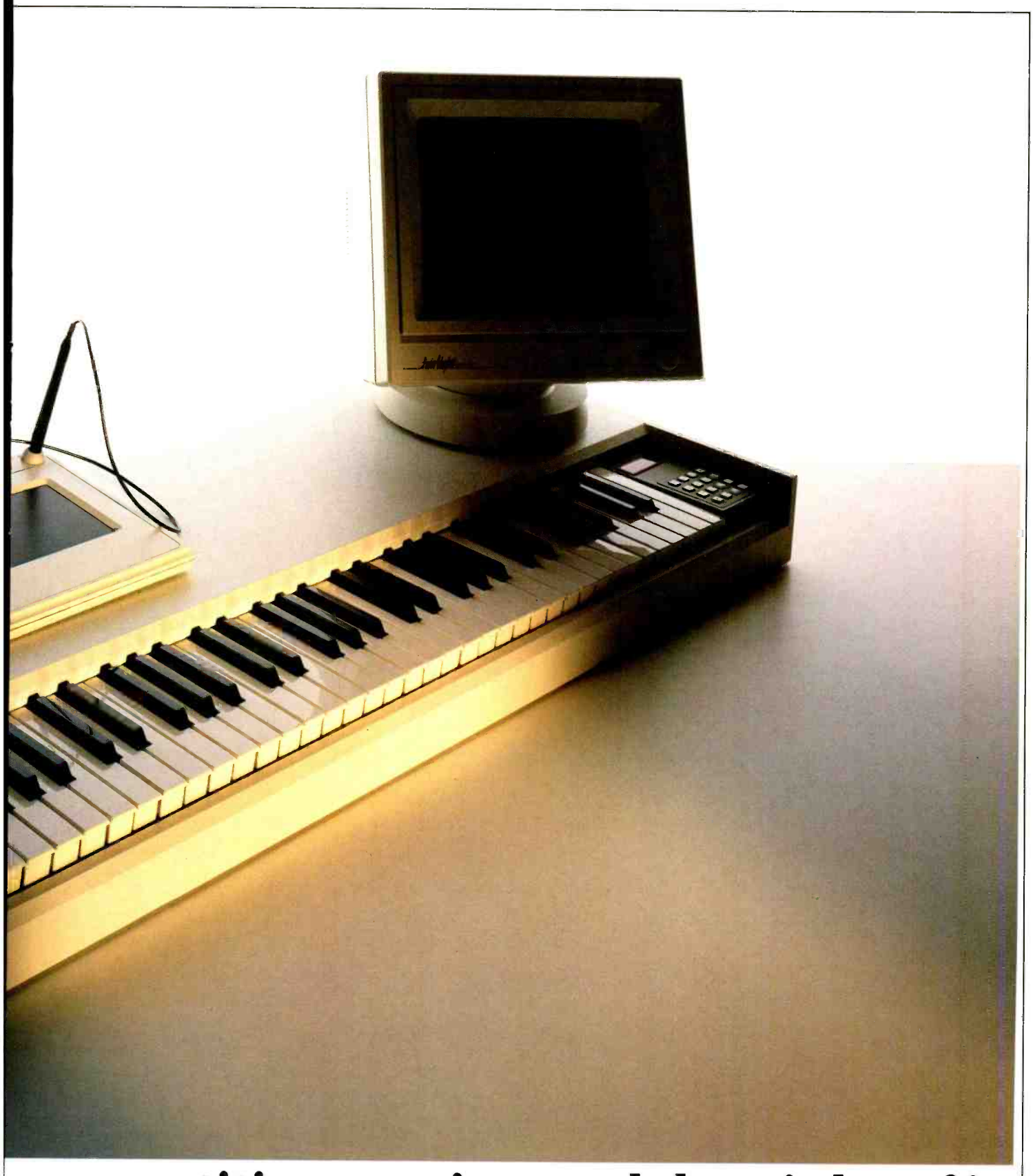

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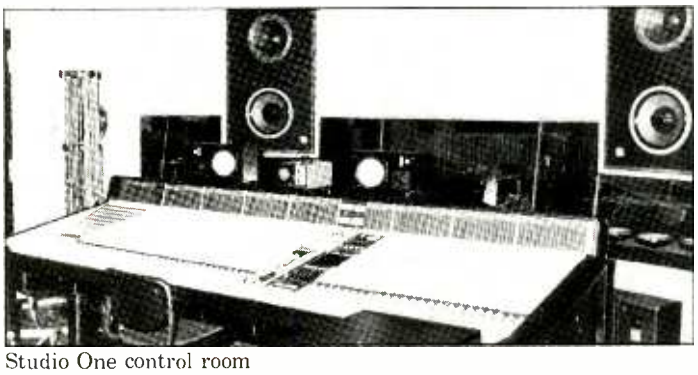
IN-HOUSE IN TOKYO

Carl Snape looks at the in-house recording facilities of two major Japanese record companies

Toshiba-EMI

Unlike EMI's Abbey Road Studios in London, Toshiba-EMI is an in-house operation serving, almost exclusively, the recording needs of Toshiba-EMI artists. The studios are located in central Tokyo, close to the government departments and diplomatic quarter in the Minato-ku district.

There are three main recording studios at the Tokyo headquarters of Toshiba-EMI. The original studios—One and Two—are located, along with the remix room, in a self-contained building directly behind, and across the street from, the main office block. Studio Three, the newest of the Toshiba-EMI rooms, is actually in the main office block up on the 7th floor. The front of the building faces a busy main road, whilst the rear view from the studio looks out across an untypically tranquil Tokyo. Visitors to Studio Three have the Prime Minister as their next door neighbour and the view includes part of his garden.



Studio One control room

Studio Three was opened fairly recently (August 1982) whilst the original studios (Studio One and Two) go back to November 1966. Over the years both these original studios have been extensively modified and updated.

The design work for the studios was done by Toshi'aki Shigeta, president and chief engineer of architecture at Nittohboh Acoustical Engineering, in conjunction with the studio's project team. Studio One is the second largest of the three rooms and is used mainly for pop, folk and Japanese traditional music. The total area occupied by Studio One is 167.5 m^2 which provides 117.5 m^2 on the main studio floor and space for three isolation booths which occupy a further 50 m^2. These isolation booths were not part of the original design but were added in 1979. Although occupying a slightly smaller floor area than Studio Three, Studio One in fact feels much bigger simply because of the very high ceiling and the more symmetrical arrangement of the walls.

In comparison with the studio, the control room in Studio One is quite compact with the 56-channel SSL *4000* console totally dominating the room. The SSL (with *Total Recall*) is a fairly recent addition having been installed in the spring of '85 at a time when the control room itself was receiving an acoustic facelift. Previously the studio had been using an API console that was originally installed in 1975. Studio manager Osamu Moriwaki basically had three reasons for choosing SSL: compact size for number of

CBS/Sony

CBS/Sony Studio is located in central Tokyo just to the north of Akasaka Park and west of the city centre. To reach the studio you take a turning off the crowded hustle and bustle of the main road down a narrow street into what is, to all intents and purposes, a residential area. There, amongst a densely-packed collection of houses, bungalows and miscellaneous paraphernalia of urban life stands the studio complex: purpose built and six storeys high. In a city where new roads tend to be built over houses rather than around them, having a massive studio complex tucked away in a tiny residential street probably doesn't seem all that extraordinary.

Once you enter the modern, tiled reception area the only clue to this being Japan (or a recording studio for that matter) is a colour TV showing (in Japanese) who is booked into which studio and at what time the respective sessions begin and end. Several of these monitors are dotted around the building which makes it easy to tell at a glance if a room is free or if a session is just starting or well under way. Given that there are 40 members of staff, twenty of whom are engineers, it helps keep things smooth running if everyone knows who is meant to be doing what and where.

The monitors also serve another useful purpose in that all studio fees are charged according to the data shown on the screen. Any queries about time spent on a session can be checked against the screen data and queried if there is a problem.

The studio itself is part of the CBS/Sony group which is a joint equal venture between the Sony Corporation and CBS Inc. In all there are nine affiliated companies in Japan including CBS/Sony Inc, CBS/Sony Records Inc, Epic/Sony Inc, April Music Inc and the CBS/Sony Family Club.

There are also two affiliated companies in the US one of which is a CD plant and the other a lemon farm! The CD plant has since become wholly owned by Sony; whether CBS/Sony California Inc are still growing lemons wasn't mentioned.

The studio was established eight years ago, in October 1978 (CBS/Sony was only created as recently as 1968 with the record division starting in 1974). The main studios are at Shinanomachi and are primarily for the use of CBS/Sony artists. A second facility (with two studios) is available for outside clients. This is in Roppongi, just to the south of Shinanomachi and one of Tokyo's main entertainment areas.

Studio One control room

The Shinanomachi complex houses three studios, two remix rooms, disc and digital mastering facilities, two rehearsal rooms, editing rooms, two maintenance areas, two studio lobbies (open plan areas where musicians can relax during sessions), tape library, showers, cafeteria, various offices and a room where engineers can catch up on a little sleep during hectic sessions.

Studio One is the main studio and will accommodate between 30 and 40 musicians. In common with the rest of the CBS/Sony complex, the studio and control room was designed by Tom Hidley although over the years the Eastlake rooms have been subjected to a number of modifications.

The main studio area is 180 m^2 and although it has a high ceiling the room is fairly dead with the floor covered in

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IN-HOUSE IN TOKYO

channels, functionality and economical price.

The control room is best described as functional with few if any frills to distract from the business of just getting on with the job. If the hectic session going on during our visit was anything to go by it seems unlikely that anyone would have time to notice their surroundings. Although it was only just after mid-day the monitoring was well up, the ashtrays were overflowing and the control room was a hive of activity.

Large Mastering Lab 3-way *Super Red* monitors (using Altec drive units) provide the main monitoring with Yamaha *NS10*s providing the nearfield requirements. The Yamahas are positioned conventionally on the meter bridge along with a phase meter which is located directly in front of the engineer. Amplification is via McIntosh *2500* (500 W/channel) power amplifiers.

Other equipment includes a Mitsubishi *X-800* digital multitrack machine, Studer *A800* multitrack and Studer *A80* for mastering. Outboard equipment includes AMS *RMX-16*, EMT *140* plate, Yamaha *REV-7*, Audio Kinetics *Q.Lock 3.10* synchroniser, Lexicon *Prime Time 93*, Roland *Dimension D* and *SDE 3000*, Korg *SDD 3000*, Kepex *804*, UREI *1176*, Orban *526A* and Dolby *361*s and *SP-24*.

Studio Two is the smallest room and mainly used for overdubbing vocals and solo instruments. The control room occupies 31.2 m² and the studio 45.1 m². The control room has a totally different feel to that in Studio One. The main visual difference is the wood cladding on the walls which introduces a touch of comfort to the surroundings. As with Studio One, *NS10*s and the phase meter are standard issue but the main monitors are the smaller Mastering Lab *Big Red* speakers. These use a 2-way Altec driver driven by the McIntosh *2500* power amplifier.

Chosen essentially for its sound quality is a Neve *8028* console. This was purchased in 1980 (replacing an MCI console bought in 1973) when a general remodelling of the room was under way. This followed an earlier update to the room in 1975. Interestingly, in addition to the large patchbay on the Neve, the rack includes a massive cross-point patching system some 16 U high.

Tape machines in Studio Two are Studer—a 24-track *A800* and an *A80*. Noise reduction is Dolby (*M-24* and *361*) and dbx (24-channel *261*). Apart from the AMS and Orban most of the remaining equipment in Studio Two is similar to Studio One.

Studio Three is Toshiba-EMI's newest and largest studio and therefore in many ways more ideally represents the studio's current ideas about recording design and practice—given of course the constraints of fitting everything into the confines of a modern office block.

You enter the studio through a large soundproof door. Once inside a couple of steps lead up ▷

Toshiba-EMI

Studio One

a thick dark brown carpet and most of the walls and doors faced with bark. At the rear of the studio is a large 'live' area structurally isolated from the main studio with a tiled marble floor and walls covered, floor to ceiling, with 15 mm thick black glass. Full length curtains on all four walls can be drawn to control acoustic reflections. Large glass sliding doors provide access from the main studio area thus enabling both engineer and producer to retain visual contact during the session. The studio also contains a separate drum booth and two other isolation booths. All the studios have fully floating floors with 3-point isolation through the doorways.

Down the hall is Studio Two. This is a smaller room

CBS/Sony

(100 m²) but is built along the same lines as Studio One with a similar live 'glass' area and three isolation booths. Acoustically this is the studio favoured by most rock bands and is therefore usually busier than Studio One. It is also cheaper to hire. Studio Three is the smallest of the studios (60 m²) and is mainly used for recording rhythm sections and small groups. In common with the other two studios it is carpeted in dark brown with bark and natural wood finishes on the walls and bark covered doors.

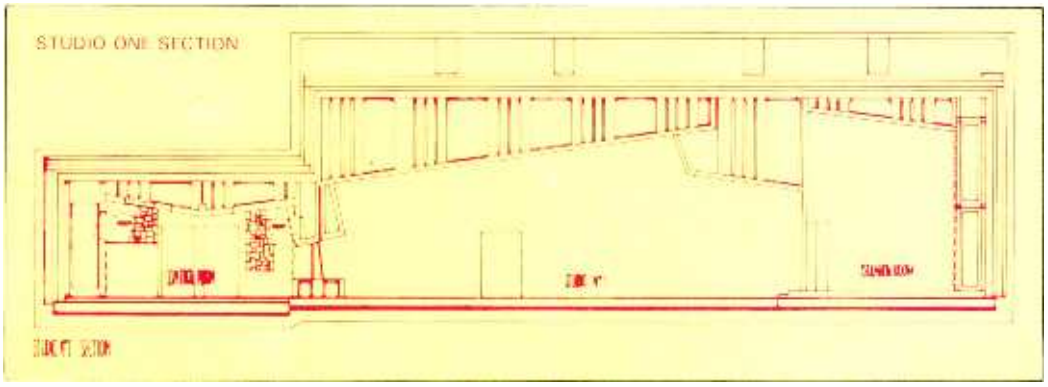
Control rooms

With the important requirement to provide consistent listening conditions throughout the complex all three control rooms are identical in size and are equipped with more or less the same equipment. The two remix rooms and the three control rooms still retain the original Neve consoles although these have been somewhat modified by the studio over the years. The air in central Tokyo is pretty polluted by any standards and the fitting of gold contacts throughout the consoles has been necessary in order to maintain signal quality. Also to this end the Neves (40 input, *8000* series) have been extensively rewired with LC-OFC (Linear Crystal Oxygen-Free Copper) cables. All the connections between studio and control room are also made via specially-made custom cables.

Studer *A800* 24-track tape machines are standard to all rooms although little analogue recording is done these days. According to Michio Sakamoto, the studio's chief engineer, at least 90% of all new recordings are digital. Shinanomachi has five Sony *PCM-3324*s and Roppongi another two. Ideally the studio would like more in order to do 48-track recordings without having to deprive one of the rooms of its *3324*. It's just a question of cost.

Standard mastering equipment in all five rooms is ½ in Ampex 2- and 4-channel *ATR 104*s, ¼ in Studer *A80*s, Sony *PCM-1610* and Sony *PCM-F1*s. Monitoring was originally done with Eastlake *TM3*s but now the studios are equipped with TAD monitors. Some fairly extensive work has been done on the monitoring and one of the most interesting modifications is the application of lead sheeting to the outer face of the speaker cabinets. This is to reduce resonances and vibration. Despite the tell-tale White graphics in the rack no EQ is used on the monitors in the control rooms.

Originally the studio had Auratones for nearfield monitoring but nowadays the ▷



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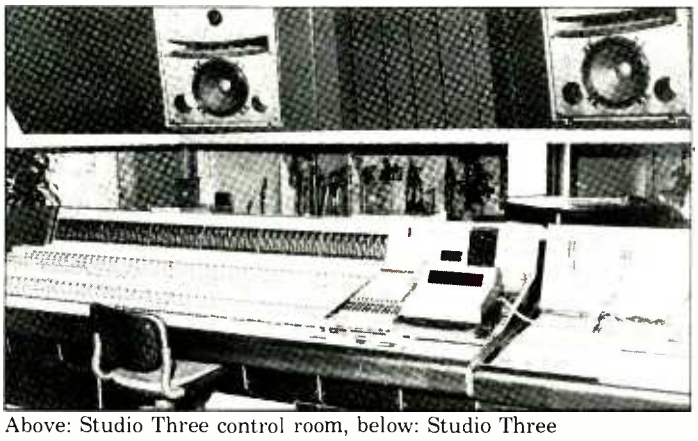
IN-HOUSE IN TOKYO

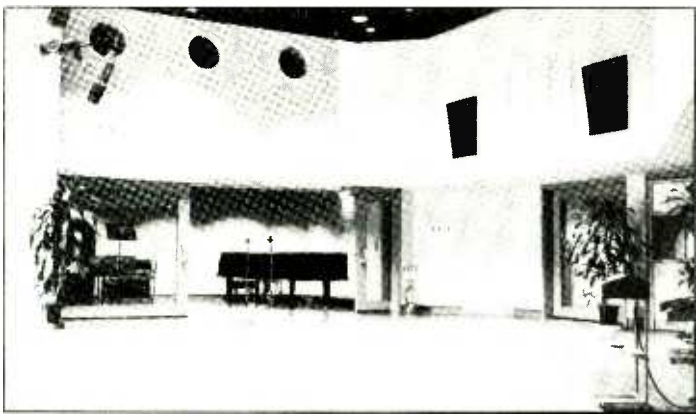
Toshiba-EMI

to the control room door and straight ahead is a second soundproof door leading to the studio. Initial impressions of the studio are of a surprisingly light and airy environment without it seeming cavernous. The total floor area is 230 m^2, which includes three isolation booths (52 m^2), the control room (50 m^2) and the studio (128 m^2). The studio area itself occupies two floors of the building in order to provide a larger volume of air space. The use of glass, light coloured walls and white brickwork against the natural colour of the wooden floor give the room its airiness: the dark-coloured ceiling prevents it from becoming too overpowering. The studio lighting can be adjusted from pitch darkness to extremely bright and clear, important when you are working with both classical musicians and rock and pop artists.

One not so obvious part of the lighting design is the arrangement of down lights. Although they look randomly distributed they are in fact arranged as star constellations which can be individually switched on or off according to how dark or bright you want



Above: Studio Three control room, below: Studio Three



the studio. During the day natural light is available through a single window at the back of the studio. The window also has another useful purpose. In the event of fire or other disaster on the floors below this is how the fire brigade gain access to the studio—which explains why the opening handle is on the outside!

The control room is equipped with a custom built Neve *8078* console and custom made *PHG-8000 MkII* monitor loudspeakers. These, along with a pair of *PHG-5000 MkIII* loudspeakers (used for foldback in the studio), use Gauss drive units and were designed by Akasaka Kohge'i. AB Systems *410 Cs* provide amplification.

Noise reduction is extensive with either 48 channels of Dolby (*SP-48*) or dbx (*K9* cards) available in addition to the Dolby *361*s. Tape machines include Mitsubishi digital 32-track *X-800*, Studer *A800* and Studer *A80* all housed in a separate machine room directly behind the control room.

Other equipment in Studio Three includes AMS (*RMX-16* and *DMX15.80*s), EMT (*140* and *251*), AKG *BX-20*, Sony *DRE-2000*, Eventide *H-949*,

engineers tend to favour Yamaha *NS10*s—without tissue paper. The Shinanomachi studio generally sticks to the same monitoring although over in Roppongi there's usually no problem if a producer brings in his own.

The microphone complement is very extensive and includes some interesting items such as the Sony *C-55AC* (only available in Japan), a selection of Neumann valve mics and the RCA *77DX*. All the microphones, including a wide selection of standard Neumann, Shure, Sennheiser, Schoeps, AKG, Sony, B&K, Electro-Voice, and Amcron *PZM* mics, are kept in a separate room in foam-lined compartments in what can only be described as a vast filing system.

Outboard equipment is again fairly standard to most of the rooms and is reasonably comprehensive. Unlike other CBS studios around the world CBS/Sony tend not to hire in equipment for sessions so what they have in-house covers most of their needs.

In addition to Valley People Kepex and Kepex II gates there are also UREI *1176, LA4, 1178;* Quad Eight *2B*; Orban *424A* and Fairchild

CBS/Sony

valve limiters and compressors. Delays include Roland *SDE 2000*; Lexicon *Prime Time 93* and Eventide *H949* with MXR phase shifters and Roland *SDD-320* chorus units. Equalisers, exciters, auto pan units and DI boxes are all made in house.

The choice of reverb includes AMS, AKG *BX20*, Sony *DRE-2000A*, Yamaha *REV-7* and EMT *140st*. In all there are eight EMT plates in addition to an echo chamber in the basement and some very lively stairwells and hallways all of which get used from time to time. For the really adventurous there is also a large open lift shaft that drops down to the lower carpark.

Other equipment includes Dolby *361*s; in house timecode generators and readers along with the Sony *BVG-1600* and *BVG-1500* equivalents; Audio Kinetics *Q.Lock*, Tektronix sync generators and Sony VTRs and monitors. Power amplifiers are domestic Sony *TA902*s with the maintenance department's modifications.

Remix rooms

There are two remix rooms both of which are based on similar lines to the control rooms. The remix rooms are slightly smaller (30 m^2 as opposed to 36 m^2) and contain small isolation booths for overdubbing vocals and other individual instruments. The major difference is the provision of Necam 96 on the 36-channel Neve. The two rooms otherwise contain identical recording and processing equipment.

Maintenance

The maintenance department is a real treasure house of manuals (21 ft of them, three shelves high), test equipment, components and prototypes. Upstairs, close to the studios, is a small day-to-day maintenance section and downstairs, in the basement, is the 'factory'. It is here that all the heavy maintenance and fabrication is done. Unable to find for example decent mic-stands, the maintenance department set about designing and making a few. Although many maintenance departments can put together a DI box and make a few modifications to the console or tape machine, few studios can claim to have their own custom-designed mic stands—especially when they extend up to 5 m and are air-damped.

The upstairs maintenance department appears to be well used. Lying on the service bench amongst a great pile of bits and pieces was a Sony *DAQ-999*—a never released prototype of the *DAQ-1000* cue editor used in CD mastering, a *Kepex* in for repair and a spare ¼ in headblock. The latter proved to be particularly interesting. All the Studer *A80*s in the studio are fitted with modified heads made by the Magnetic Division at Sony. This is where the *3324* heads are made and according to the studio the sound of the Studer machines is completely different with the Sony heads.

The electronics have also been improved, especially with respect to the power supplies. According to Mr Sakamoto power supplies can be extremely critical, "Efficiency of power requirement is very good outside Japan using balanced power systems at 220 V. Here in Japan we are using an unbalanced power circuit with 100 V, 50 Hz. The condition of the mains power is very bad. Fortunately this studio gets its electricity

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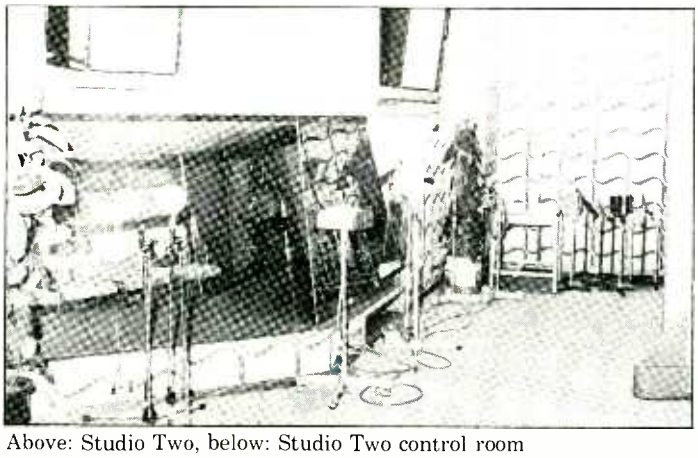
IN-HOUSE IN TOKYO

Lexicon *Prime Time 93*, Roland (*SDE-2000* and *SDE-3000*), Korg *SDD-3000*, Kepex (*804* and *805*), EXR *EX-3*, UREI (*1176* and *1178*), Orban *562 A* and Audio Kinetics *Q.Lock 3.10*. The usual complement of mics is available. Also available is the Neumann valve *49c* and *M-269c* (strings, vocals) and the AKG *Tube* (strings, piano or vocals). The studio has also designed some custom items including a cue system mixing console, indicator system and a drop-out checker for digital recording.

Overall the engineers felt that digital was the preferable recording medium though they did express doubts whether 16-bit/44.1 kHz accurately contained all the musical information. In this respect they looked forward to the introduction of higher density recording systems. For now the engineers felt that digital was still capable of high quality sound, that it was easy to handle the information and that the hardware was easy to control and maintenance free.

Throughout the studio special attention is given to

Toshiba-EMI



Above: Studio Two, below: Studio Two control room

controlling and/or minimising acoustic reflections in order to obtain the clearest sound quality of the original instruments. This is also followed through in the control rooms where high resolution loudspeakers and in-phase propagation over a wide listening area were among the major design criteria. Other facilities at Toshoba-EMI include a disc cutting room and remix facility (API desk).

As a general principle the studios are not available to outside users. The internal booking system may provide an interesting comparison for studios outside Japan.

Rates are based on three separate time zones. Japanese musicians who prefer playing during the 'dawn's early light' get the best deal of all! Hourly rates are nearly a third cheaper between midnight and 9am than during the hours between noon and midnight. This is the most expensive part of the day in which to book the studio. The rate in the third zone, between 9am and noon, varies—as with the other zones—according to the studio. Studio Three is the most ▷

directly from the power station and so the condition of the mains is good but over most of Japan the supply is not."

Most of the equipment in the studio was fitted with large gauge power cables and Mr Sakamoto was critical of many imported products that had mains cables with insufficient current carrying capacity for use in Japan.

Engineers at CBS/Sony enjoy a relatively unique position compared with their opposite numbers in the UK, in that not only do they get to test and evaluate the majority of Sony studio products they also get to see their ideas and recommendations incorporated in the equipment. It can sometimes be a heavy responsibility and there are occasions when not everyone sees eye-to-eye. The studio for example doesn't *have* to buy Sony equipment—although if they have had a hand in its design it must be difficult to decline. There are times, however, when for example the cost of a piece of equipment seems a little high that the studio decides to make its own.

During the development of products Sony employ a large number of engineers to work out the ideas and decide on

CBS/Sony

the facilities and function of the equipment. This is especially true with the range of digital equipment and it was the CBS/Sony Studios that provided the necessary 'user' input choosing recommended frequencies on the digital mixer for example and ensuring that the digital tape machines could be operated as conveniently as their analogue counterparts.

Disc cutting

CBS/Sony has three disc cutting rooms. One is at the main pressing plant in Shizuoka-ken and two are at the studios. They do all the cutting for CBS in Japan and they cut lacquers for Warner Bros, Pioneer, Tokuma, Canyon and many other smaller labels. The studio also does ½ speed mastering for the CBS Master Sound hi-fi series. Interestingly there has only been one occasion when the studio made any direct-to-disc recordings.

The disc cutting system is basically Neumann although the studio has incorporated a number of their own modifications. The lathe sits on a special heavy stone base 15 cm thick and is equipped with a Sony crystal-locked servo turntable and CBS groove-spacing computer. Despite all the technical modifications it was amusing to see a genuine 'Heath Robinson' arrangement of signal cables leading from the cutting amps to the cutter head. Rather than being neatly secured to the carriage they were dangling in mid air held aloft by half a dozen or so wires. It looked like a rickety fishing rod sticking out of the wall. I never did quite get to the bottom of what it did but I would imagine it was to prevent any drag being exerted on the cutterhead by the cables as the head travels across the lacquer.

The cutting console is computer operated and all EQ settings can be preset via the computer. It does one or two other things, one of which is a standing joke played on all new disc cutting engineers. At the end of every run out groove the computer triggers a recorded message which says, "Thank you very much for using this system." New recruits are left alone whilst experienced engineers wait for the nervous engineer concentrating intently on the job in hand to get caught out by the voice over the monitors. It seems engineers are much the same the world over.

The acoustics of the cutting rooms have been subjected to a number of changes including the fitting of anti-vibration mounting between wall and fabric finishes. The sound is very tight with improved stereo image and solidarity being the main benefits.

In the ceiling, above the cutting console is a hook. It is used for suspending a B&K calibration mic which is used for checking the room response. A one minute sample is integrated by the computer system to obtain an accurate frequency response. The data is then used to retune the room. Monthly checks are made and it was interesting to hear the engineers say that the sound character on the console has been slowly changing over the years to take account of changes both in the music and the room.

Digital mastering

There are four digital mastering suites in the complex all preparing tapes for compact disc production. ▷

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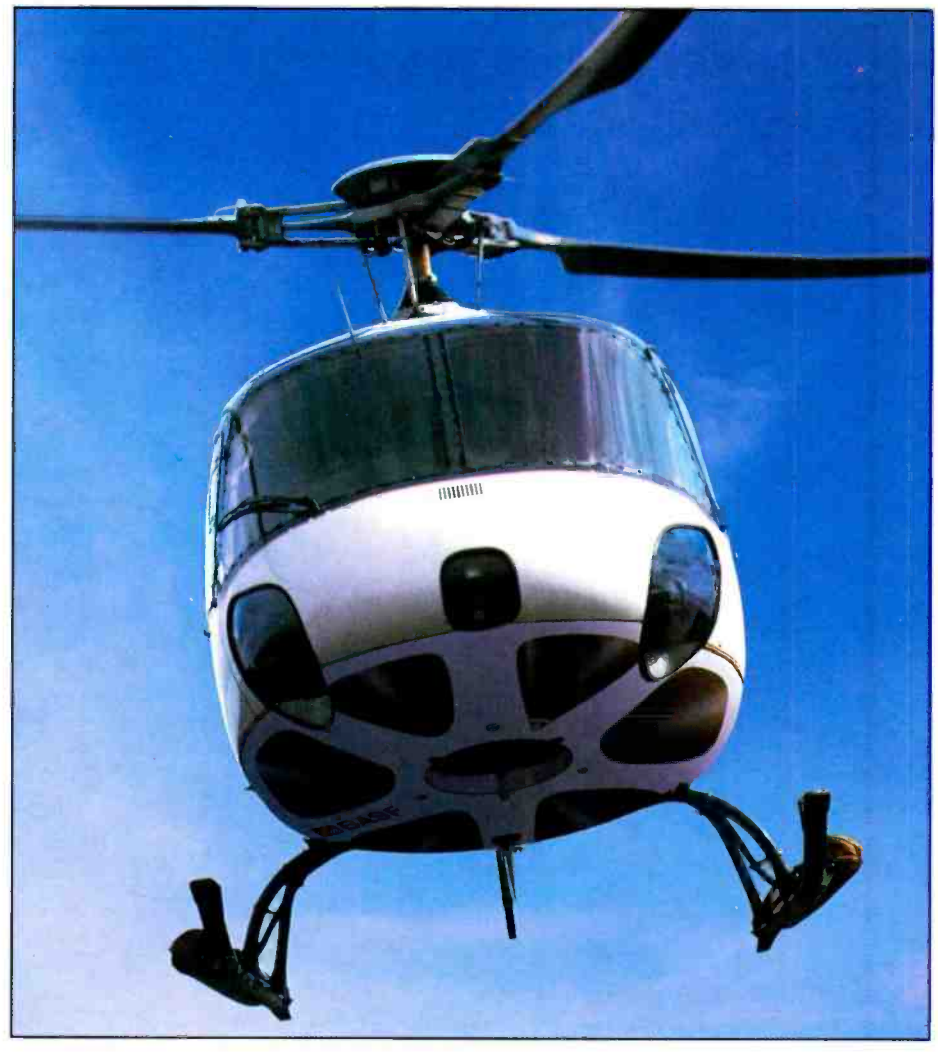

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IN-HOUSE IN TOKYO

expensive, followed by Studio One. Rates in Studio Two are comparatively inexpensive.

Using the current exchange rate of 226 Yen to the pound it costs approximately £190 an hour to use Studio Three between noon and midnight. This compares with £133 for Studio One and £80 for Studio Two. The lowest rates (after midnight) are £120 in Studio Three, £97 in Studio One and £57 in Studio Two. There are also extras to be taken into account (in-house studios need to make money too). Using the studio's Steinways would cost about £17 a session. Extra special effects units are typically £17 an hour to rent and of course you'll need a tape machine! These are extra. Currently the 32-track Mitsubishi costs £44 an hour and the Studer 24-track, £26.

Discounts do exist and these are on a fixed basis. The daily rate remains at 100% of the hourly rate but two days hire drops to 80%, three days 50% and four to seven days, 20%. Block bookings are a good investment and it pays to get everything done in one block session. A 'quick' two hour session in the afternoon with the Mitsubishi, a piano and an extra AMS could cost you nearly £450 in Studio Three!□

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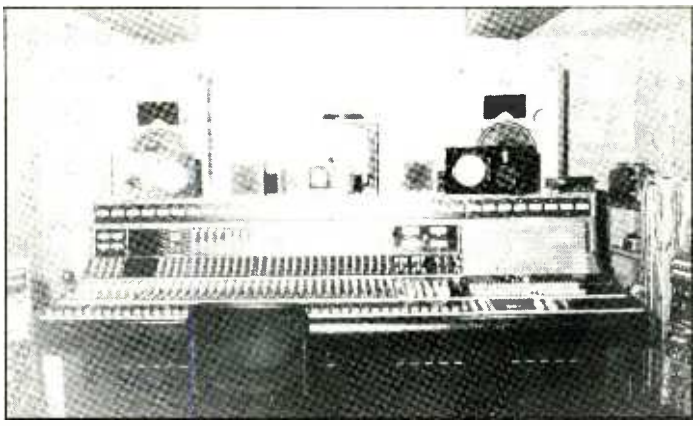
Mix-down room



Originally the rooms were fitted with JBL *4320*s but the horn units for example are no longer original and there have been a number of other smaller modifications. The editing rooms are not very large and there would be no room for instance to use the larger studio monitors to keep the continuity of sound.

Two dedicated mixing desks are used depending on the source material. An in-house analogue desk and the 8-channel Sony *K-1105* digital mixing system. This latter system providing a complete digital link, including equalisation, between the digital master and the digital CD production copy.

Printed readouts of error correction are possible using the *DAQ-1000* cue editor but according to the engineers there is not really enough information provided. To get round the problem the studio has devised their own system which is linked to a *DAE-1100* digital audio editor. With the output of the *DAE-1100* connected to an external computer comprehensive data can be printed out. The actual system was built by the studio when—as the studio put it—Sony asked them to pay for the modifications to be made to the existing equipment.

On the other hand there is some modified equipment floating around. Someone mentioned a special version of the Sony *DA-100* but they were not letting on just what the development was.

Tape library

Being linked to a major record company there is always a fortune in master tapes to be cared for and

CBS/Sony

upstairs in a high security area is the tape library. The doors automatically lock on leaving and all the tapes are kept in metal filing cabinets with individual sealed metal doors.

In order to reduce the fire risk the room has a separate air conditioning system thus preventing fire and smoke from a possible fire elsewhere in the building from affecting the tapes.

Both analogue and digital masters are kept in the library. The very first digital tape which was made 12 years ago on prototype *1610* equipment was at the factory. The records show however that it was made on 3M tape. Virtually all the other digital masters are Sony tapes. In addition to popular music there are a large number of classical tapes. These are usually recorded on location in familiar American and European venues and not in the Tokyo studio. In fact very little classical music is recorded at Shinanomachi.

Working in Japan

From the coolness of the tape library we moved to the cafeteria and a chance to find out a little more about what it was like to be a recording engineer in Japan.

After taking a college course in acoustic engineering Michio Sakamoto's first job was as an engineer at CBS/Sony Studios. This was about nine years ago and would appear to be a fairly conventional route into the recording world. Most engineers are apparently taken from technical institutes or other studios. The latter is a fairly recent situation and it may well prove to be on the increase.

Essentially the Japanese are traditionally very strict about the work ethic and will invariably stay with one company for many years. This is the Japanese custom and it used to apply to everyone, including recording studios. Times are changing however. One recording company for example recently created one almighty great stir by suggesting that engineers who join the company would be required to sign a contract that terminated their employment at the age of 35. This would be bad enough in the West but in Japan the idea has catastrophic implications.

Although the CBS/Sony studios are a relatively young company compared with other Japanese record companies and facilities they have nevertheless adopted a lot of very old Japanese customs. According to Sakamoto this is causing a certain amount of agitation among the younger engineers who are apparently planning to overthrow the 'old' ways. How far they will get remains to be seen but the thought of being out of work at 35 must be a sobering thought to the modernists.

Overall the general atmosphere between studios in Tokyo is very friendly and overrides any animosity there may be between companies at a consumer level. On the product side for example JVC and Sony are very competitive (an understatement if ever there was one) but as far as the studios are concerned they both get on very well. There is no problem for example about calling up their competitors and asking them to help out with a spare part or maybe offer advice or an opinion.

Things don't always go the way you expect them to however. Apparently the pro audio industry didn't do too well in Japan last year so the whole industry got together at the end of the year and threw a massive 'Forget this year' party. They obviously have a sense of humour but they also have the determination to get it right next time around.□

Remix room

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WHAM AT WEMBLEY

Terry Nelson reports on the PA rig which used up a major rental company's stock and was still hungry for more

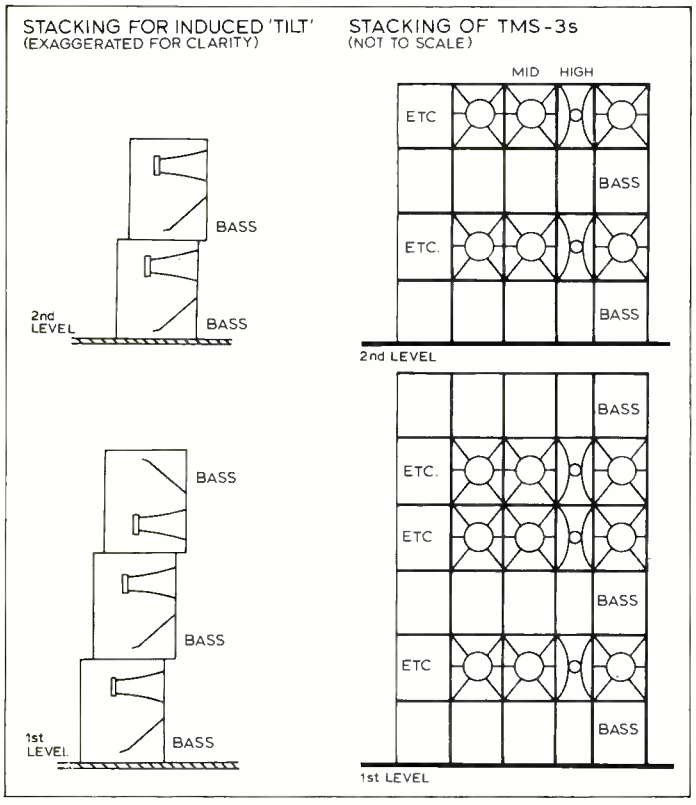
The larger-than-usual sound system supplied for the Wham! Final concert at Wembley football ground in June used up TFA Rentals' total stock of *TMS-3* cabinets and more had to be brought in from Iron Maiden's rig (now known as Total Productions). The sell-out concert required even coverage to the 80,000 plus audience to avoid boring holes in the heads of the front rows and leaving the back wondering what was going on. The other consideration, of course, was that it had to be powerful!

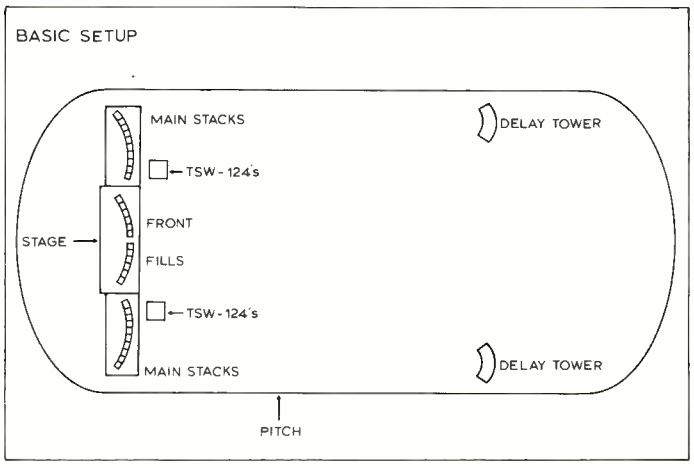
The configuration was left and right main stacks, central fill stacks, left and right subwoofer stacks and two delay towers that were placed approximately two thirds of the way down the pitch. The visual requirements of the stage meant that the main stacks were to be built quite high up from the ground. The constraints were because the main stage had to be seen by all the audience and there were two large walkways—or platforms—raised 4ft at each side of the stage running the width of the soundwings. A wall of *TMS-3*s would not be very welcome here.

The main stacks comprised 70 Turbosound *TMS-3* enclosures per soundwing plus 11 *TSW-124* subwoofers. The latter were installed directly on the ground in a square (with one corner missing) configuration thus avoiding any low frequency being applied directly to the stage. The *TMS-3*s were in a 5×14 arrangement that formed a gently curving array with the arc becoming more acute at the outer end. Because of the way the *TMS-3* enclosure is built, normal vertical stacking could have caused problems with beaming, the vertical coupling of the mid and high horns giving rise to a multiple line source effect where the listening area would be divided into 'NOW YOU HEAR IT—now you hear it' sections.

"In order to avoid this," said John Newsham (TFA/Turbosound), "we went for a more horizontal coverage. The cabinets were also turned through 90° to give a bass down, bass down, bass up configuration on the first level and bass down-bass down on the second level. This meant that the horns were working on their vertical axis and thus giving very precisely defined areas of coverage—by the time the sound got to the audience every part was covered, with no hot spots. In fact, the mids and highs were beautifully smooth right across the arena—no mean feat."

The height of the first level was further from the ground than TFA would have really liked but as John explained, "one always has to try and work within the confines of the situation. One of the problems when the system is high up is the sound has a tendency to stay 'over the heads' of the audience, especially within the confines of an arena, if the cabinets are stacked up perfectly vertical. We were able to induce a 'tilt' in the system by placing each cabinet slightly forward of the one underneath it thus aiming ▷





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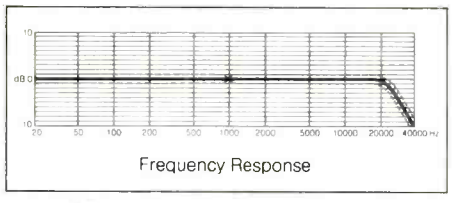

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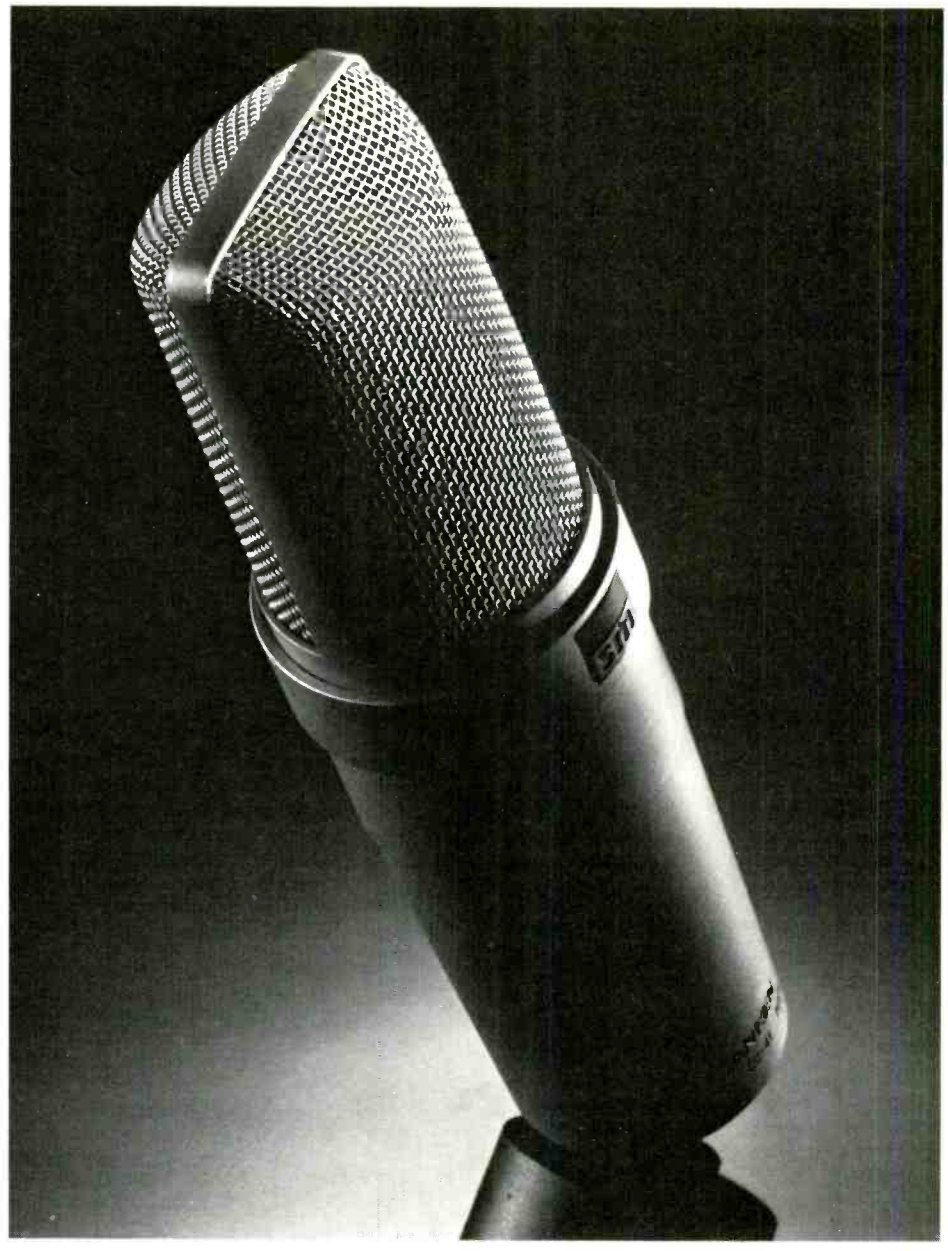

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WHAM AT WEMBLEY

the sound down into the audience."

The main system was reinforced by a centre fill arrangement of two groups of eight *TMS-3*s placed underneath the stage in two curving arrays of 1×8. Due to the distance between the main system and the centre fill it was necessary to delay the latter by 30 ms, for proper synchronisation thus avoiding the sound from the centre fill arriving 'in front' of the main signal.

The two delay systems, placed towards the other end of the pitch, were built up with components from the older Turbosound *Festival* system and formed compact curved arrays each side of the pitch. Delay time of the main system was 275 ms.

In discussions with the TFA crew during set up there was some doubt as to whether the delay towers would be really necessary as the mass of sound from the main system, "...would be quite considerable!" but on the day they proved their worth. They helped with the overall coverage in the arena and provided that extra bit of presence at the back.

In order to facilitate changeovers, two separate console/multicore systems were used throughout. Individual stageboxes fed the monitor and house consoles for Wham! and the support band so everything was set up and ready to go.

Monitoring was via a Soundcraft series *4* monitor console for Wham! and an *800B* for the second system. The main console provided 16 output mixes with 16 ⅓-octave graphics on insert. All wedges were biamped via BSS *320* and *340* electronic crossovers with each cabinet housing two Turbosound 15 in speakers and a radial horn with 2 in compression driver. Amplifiers were Carvers with Crest amplifiers powering the two pairs of Meyer *MSC3* sidefill systems.

The front-of-house system consisted of two series *4* consoles for Wham! and one series *4* for the support. Three system drive racks were employed—one for the main system, one for the front fill and one for the delay towers. Standard contents of these racks is a Klark-Teknik *DN60* spectrum analyser with two *DN 27* ⅓-octave graphic equalisers, BSS *MCS200* electronic crossover system with Turbosound phase correctable card, Sony *FX 1010* cassette deck and 96-way patchbay. For the occasion, however, Rack Two was minus the cassette and analyser and fitted with two Klark-Teknik *DN700* digital delay lines for the front fill and Rack Three found room for two more *DN700s* for the delay towers.

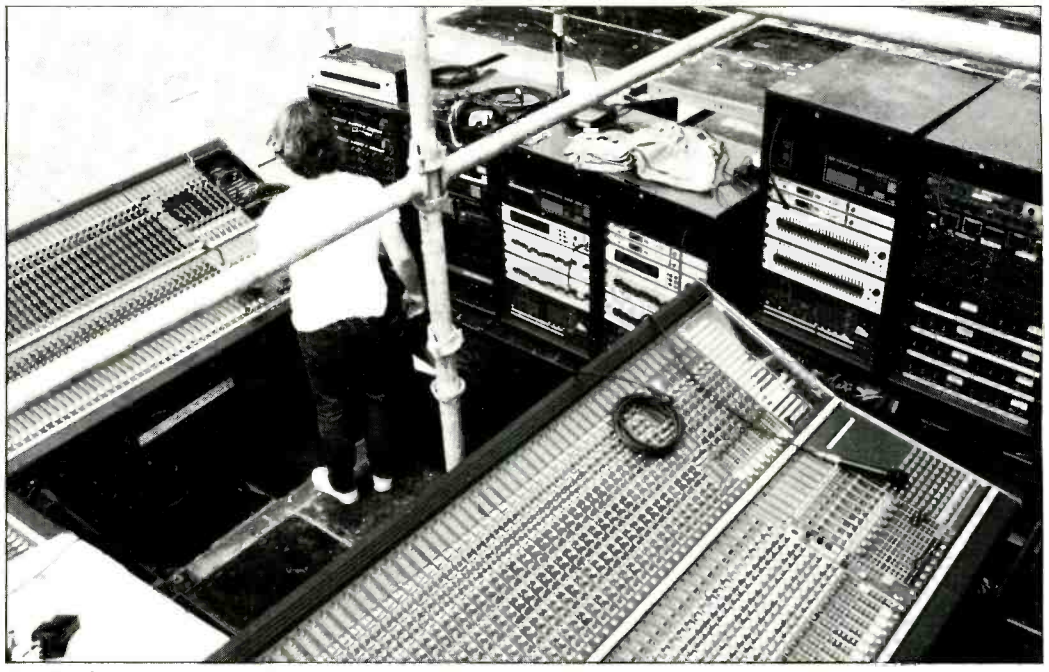
Effects were fairly standard: two racks for Wham! containing mainly compressors and gates (including a dbx *165A* for George Michael's vocal), digital reverberation and echo units and two Eventide *H949 Harmonizers*. A third similar rack was installed for the support console.

Power for the main system was provided by 12 TFA racks per side containing C-Audio amplifiers, with each rack driving six *TMS-3* cabinets. Power for the front fills was provided by special design Turbosound *TMA 23* stereo tri-amplifiers. Mains supply to all amplifiers was via 240 V 3-phase with power being evenly distributed throughout.

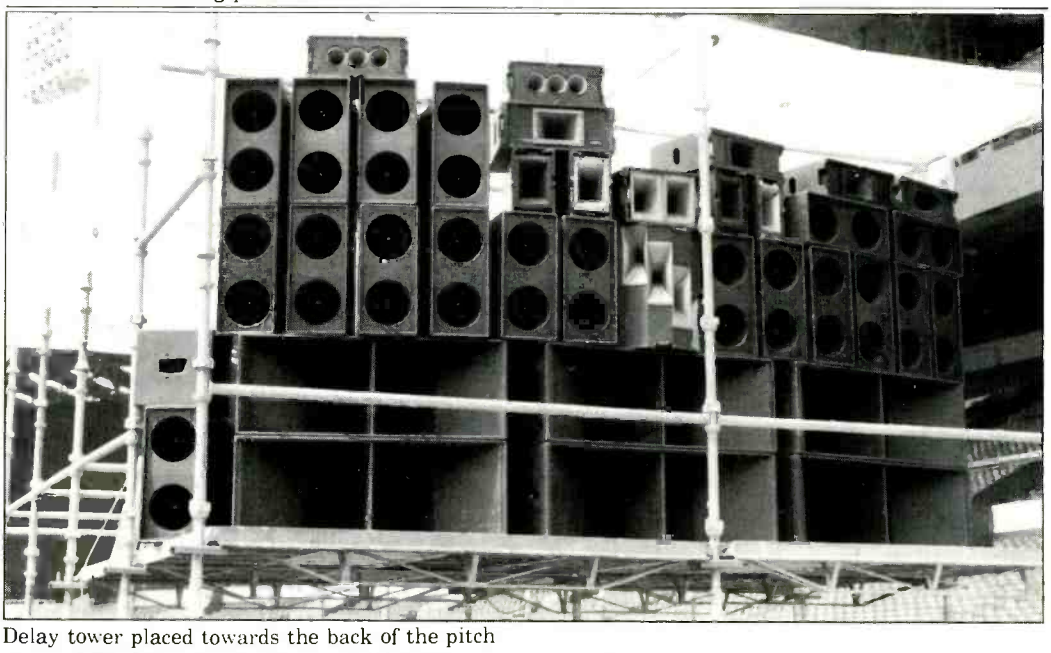
Had any problems been encountered at Wembley? "Yes," said John Newsham, "it was too hot! By the time we got a stable temperature it was towards the end of the evening and it was a shame that only the last hour of the concert really saw the system coming into its own."

Above all the obvious difficulties that can crop up in open air gigs atmospheric conditions are often a real headache. Wembley was no exception.

"I think the biggest problem was the temperature inversion layer which just sat over the stadium. It was hot outside with no breeze and inside it was almost like a furnace! The differing air densities produce a lens effect where the wavefront is defracted upwards (similar to the optical defraction produced by a stick that is half in the water) and, of course, to make matters worse, different frequencies get refracted at different angles. The problem is, there is not much you can do about ▷



Front-of-house mixing position



Delay tower placed towards the back of the pitch

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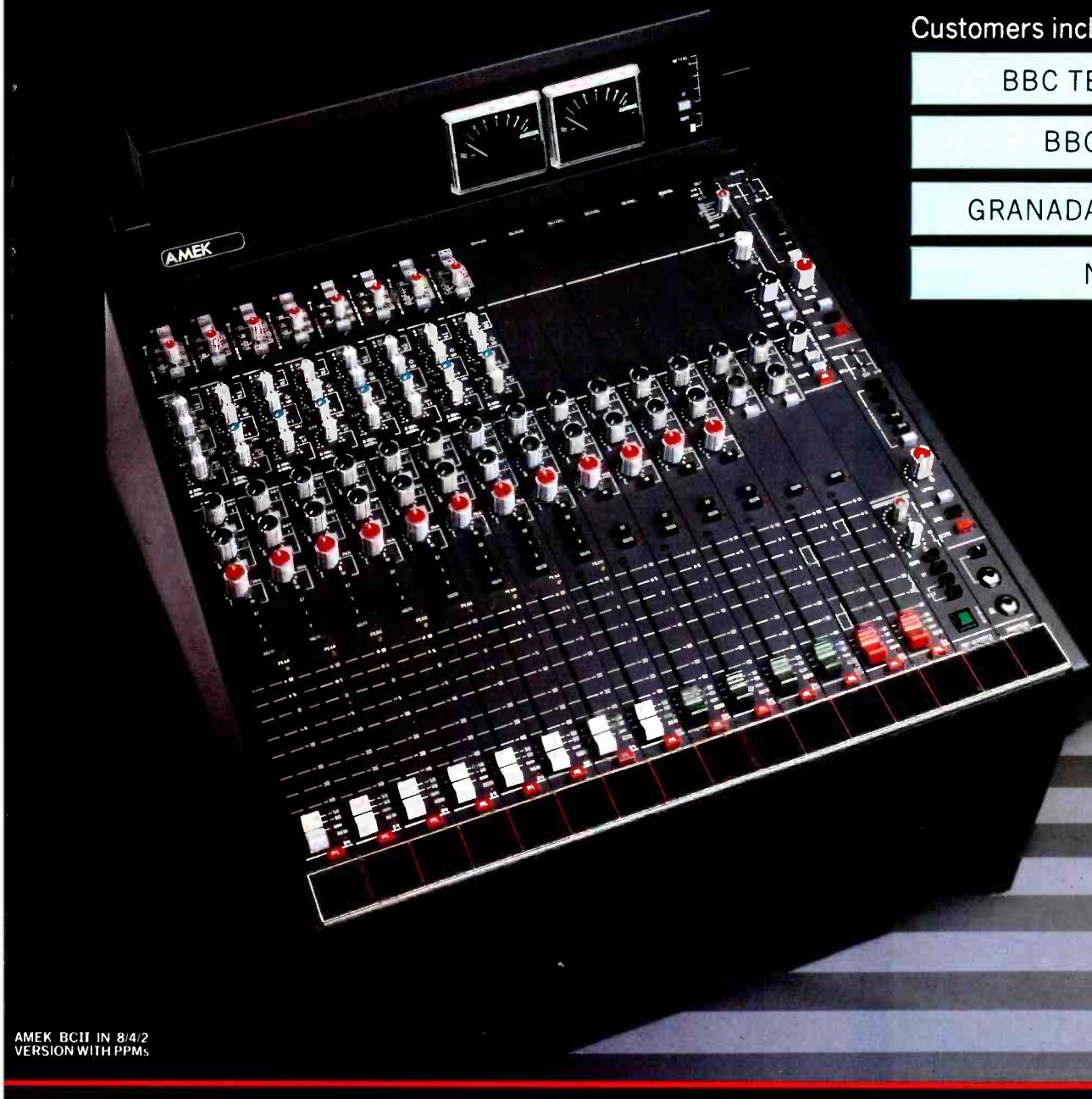
AMEK

B C I I



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Fax: 061-834 0593.

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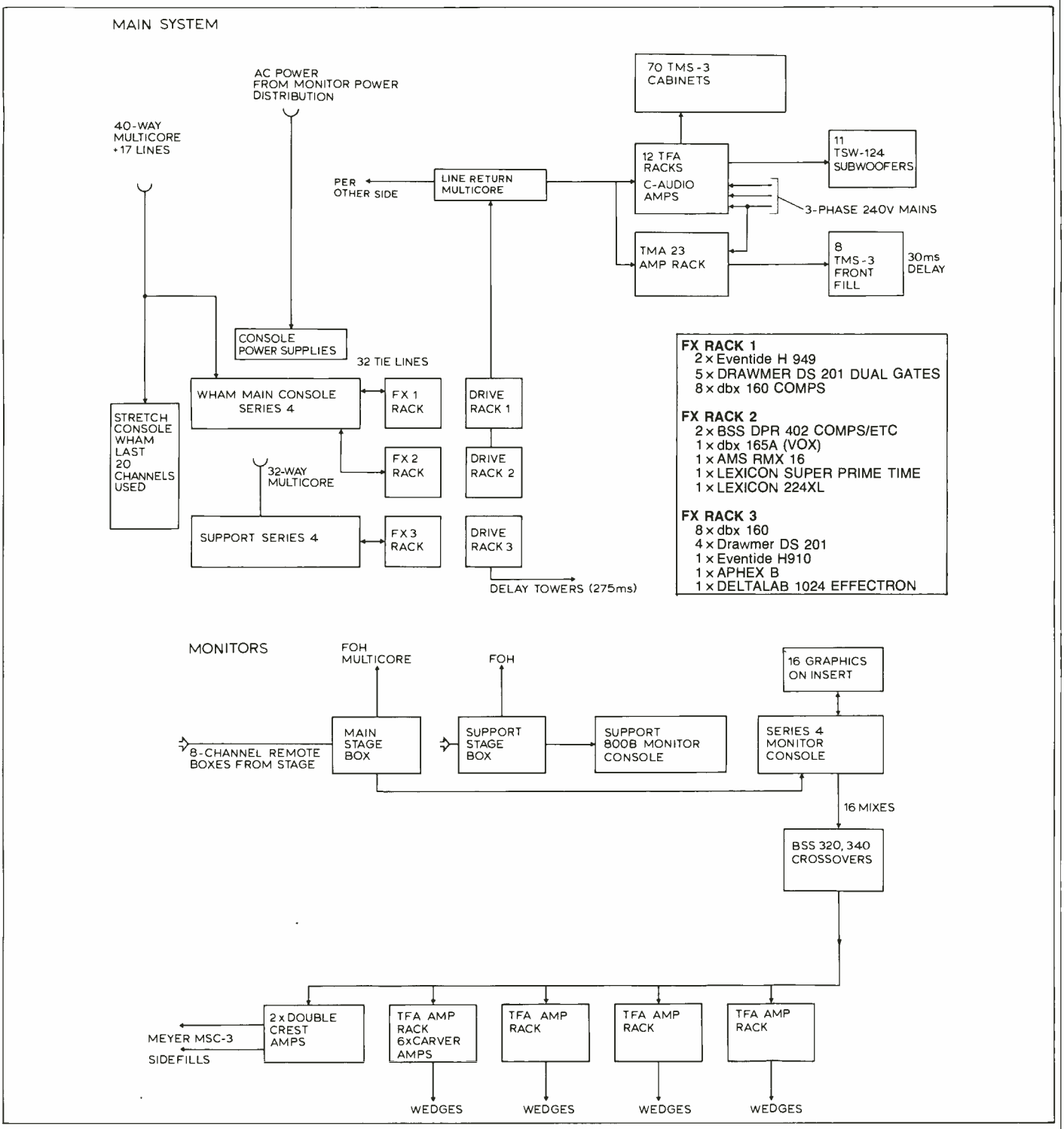
WHAM AT WEMBLEY



it, short of a nice breeze coming along and mixing the layers to produce an even temperature. We did think that this situation might arise, of course, and the built in 'tilt' to the system did at least help to counteract it by aiming the sound down.

"Stadiums (arenas) are not really the best places in the world to hold rock concerts though the sound is often improved quite a bit if the stage is placed along one of the sides rather than at an end. The other problem is that they are designed to amplify the cheers of the crowd during football matches and this is really the last thing you want in a concert sound situation—especially when the tiers are throwing the sound back at you and around the stadium!"

Although TFA's Nick Atkins was the official systems engineer, most of TFA's senior people were in attendance to help with sound adjustments throughout the stadium. One problem (caught early on) was that the front fills were too prominent and were being used for the basis of the house mix. A bit of judicious amplifier tweaking caused the level of the main system to be raised for better stadium coverage while the front fill was lowered to blend in with the overall sound.

No matter how many sound checks you have the performance is always different: musicians tend to play louder (usually by about 50%), the weather conditions may change, also you have an audience instead of an empty arena or field. The real soundcheck is the first number and it takes fast reactions to get everything together. It may sound great at the mix position but 20 yds to the right they may be wondering where the bass has gone or why there is too much. Poor sound on the day can sometimes be due to the fact that the band is not playing particularly well, and if it's not good to start with . . .

At the end of the day the principal thing is that it is a success and the Wham! Final lived up to its promise. □

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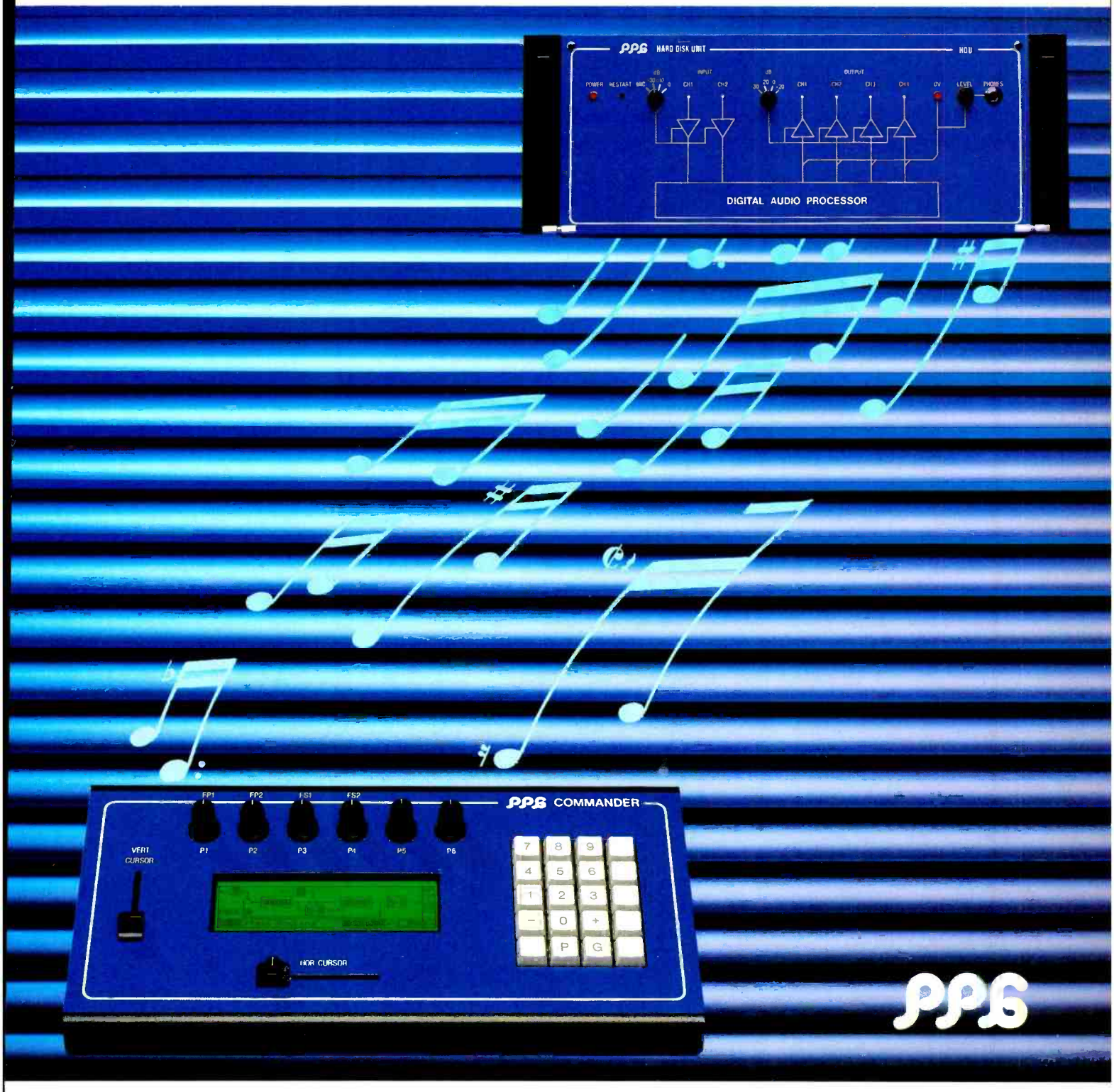
A Piece of Music Revolution



Realtime Audio Processing: The PPG 85 MByte Hard Disk Unit

With its Hard Disk Unit (HDU) PPG introduces a completely new and revolutionary concept in digital sound processing and music production. The field of application ranges from audio to film and video where the HDU represents the most innovative and versatile System capable of handling studio- and stage applications. Take the HDU as multitrack recorder and use it for the preproduction and modification of any vocal or instrumental music arrangement, use it as digital master and editing system, as effect unit, as digital filter with its 32 different parameters. The HDU opens up entirely new fields of audio processing and makes some of the old ones easier to handle.

- There are 12 minutes of recording and playback in 16 bit quality at 44.1 KHz, which can be split into 10 tracks and into 100 events.

- Time manipulation of playback is possible in stereo or mono and does not interfer with the pitch, and changing the pitch does not interfer with the desired speed of reproduction.

- The unique resampling feature can be used as often as required. Internal digital mixing and copying can be done directly and / or through the built-in effect programs like delay, echo, phasing, flanging, harmonizing etc. - without any noise ever.

- All parameters for a computer-mix or overdubbing can be controlled by using the remote control unit or via a MIDI sequenzer.

- The creation of complex distortion effects is possible by simulating an amplifier curve.

- Each parameter position of the HDU can be stored in one of the 1000 memory locations.

- The HDU can be integrated into any MIDI System.

There are a lot of possibilities where the HDU is the right answer and its field of application will be extended with new software products, PPG is constantly working on.

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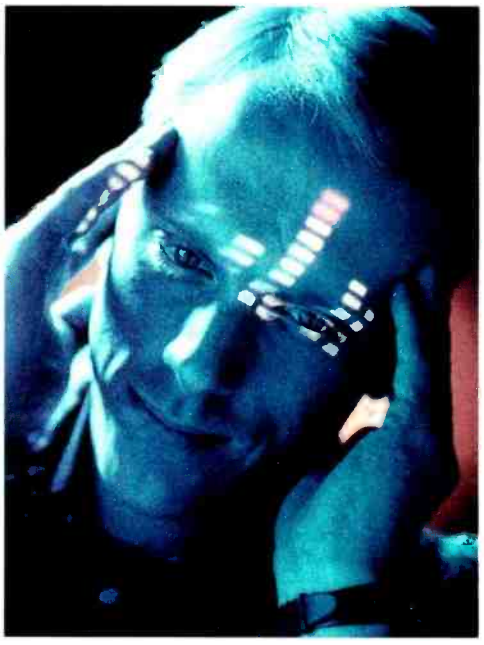

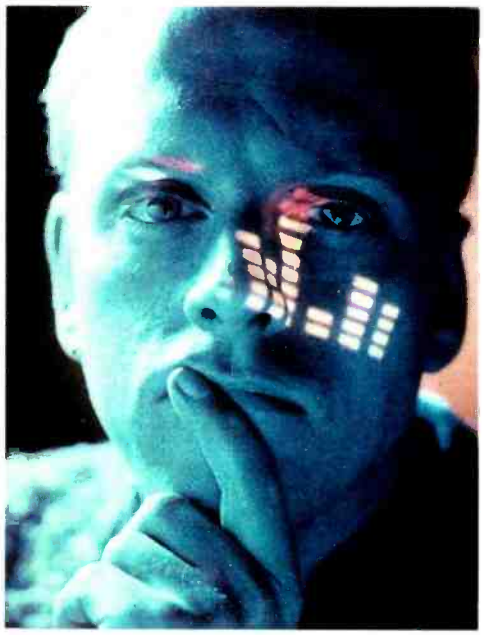

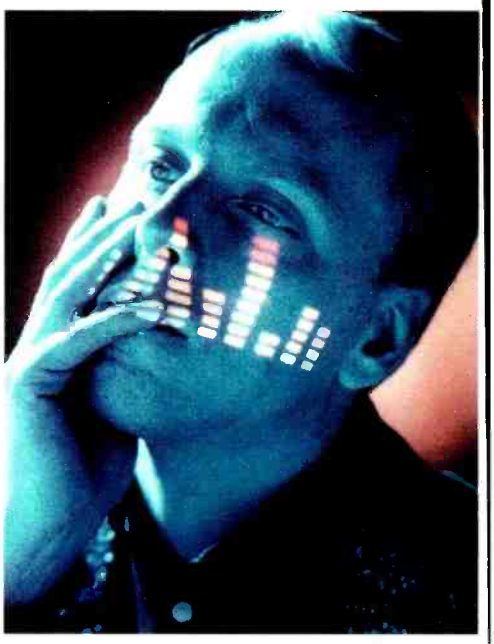

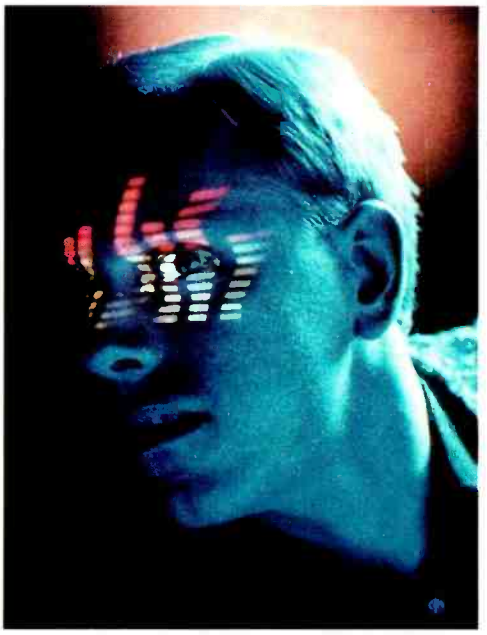

YAMAHA SOUNDS LIKE YOU MEAN IT.

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ADAM WILLIAMS

"In the future, the time it takes to record an album will be the time it takes to listen to it."

"Spontaneity produces the best records. The worst thing that can happen in a studio is when you get stuck in a rut," says Williams. On 'That Perfect Beat' he ended up using the backing track off the demo just to get back that fresh, original sound that seems to slide further and further away the longer a session wears on.

"Most control rooms are like Star Trek. The last thing they inspire is that feeling you get when a band walks on to the stage. It's not surprising there's a gulf between musicians and technology, like they're on different sides of the glass."

Williams, of course, has been on both sides. He used to play bass with The Selector. He turned producer out of sheer frustration with the studio system. As far as he's concerned, the producer should be just like one of the band. "Engineer, producer, musician, it's all the same to me."

Now, though, times are changing and Williams is optimistic. "Take Yamaha. They're coming at it from the musical side. Like when I went on an R&D visit to their silicon plant, the first thing they insisted on showing us was their grand piano factory."

"Yamaha have really pushed and established MIDI and made all their equipment MIDI-compatible. The point about MIDI, it's a direct connection between the performer and the hardware, so production becomes performance in itself. You see, there's not the leg-work of hooking up A to B. That's all gone – or going, anyway."

"On top of that, most of their hardware's within musician's budgets and when you own something, you really get to know it. That's exactly what musicians have to do."

He cites the Sweet Dreams tour as an example (Williams co-produced the album with Dave Stewart): "We toured the control room. We were all listening to the finished mix on stage which was fed directly to the PA. Actually, everyone in the audience thought we were miming – it sounded like a professional recording – but everything was totally live."

"You know, in the Fifties they used to just walk into the studio and do it. Completely off-the-cuff. The recording was as good as the performance and that was it. Well, we're moving back that way again."

"Sort of Fifties with knobs on."

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AUDIOFILE

The AudioFile is one of the first disk based recording/editing systems that is commercially available. Keith Spencer-Allen takes a look at the practical aspects of the system.

Although the AMS *AudioFile* is not the only hard disk based recording/editing system being developed, it is one of the first to be fully commercially available with over a dozen units currently in use. The purpose of this article is to outline the system and what it is capable of doing at the time of writing. As with all software based products, the manufacturers have a high degree of freedom to change facilities although in the case of the *AudioFile* development has reached the point where the 'basic' machine has been completed—this being the unit that incorporates all the major design features and provides the building block for what is an almost open-ended product.

The first prototype versions were shown at AES and NAB Conventions in 1985 as the result of over three years R&D by AMS into hard disk based digital audio recording. To fully understand the capabilities of *AudioFile* it is useful to consider some of the background to the development.

AMS have been manufacturing digital delay lines for many years which through software developments became capable of manipulating audio signals held in their memory. Apart from the simple triggering of samples held in memory, other facilities became possible such as the editing of samples which could then be triggered from a wide range of external controllers. The effects of this within popular music are widely known and some use has been made of triggered samples with film and video post production for sound effects particularly as it is relatively simple to trigger a solid state store to picture. Multiple sound effects, however, required the same multiple of sampling units—good for the manufacturers but expensive and less practical to control for the user.

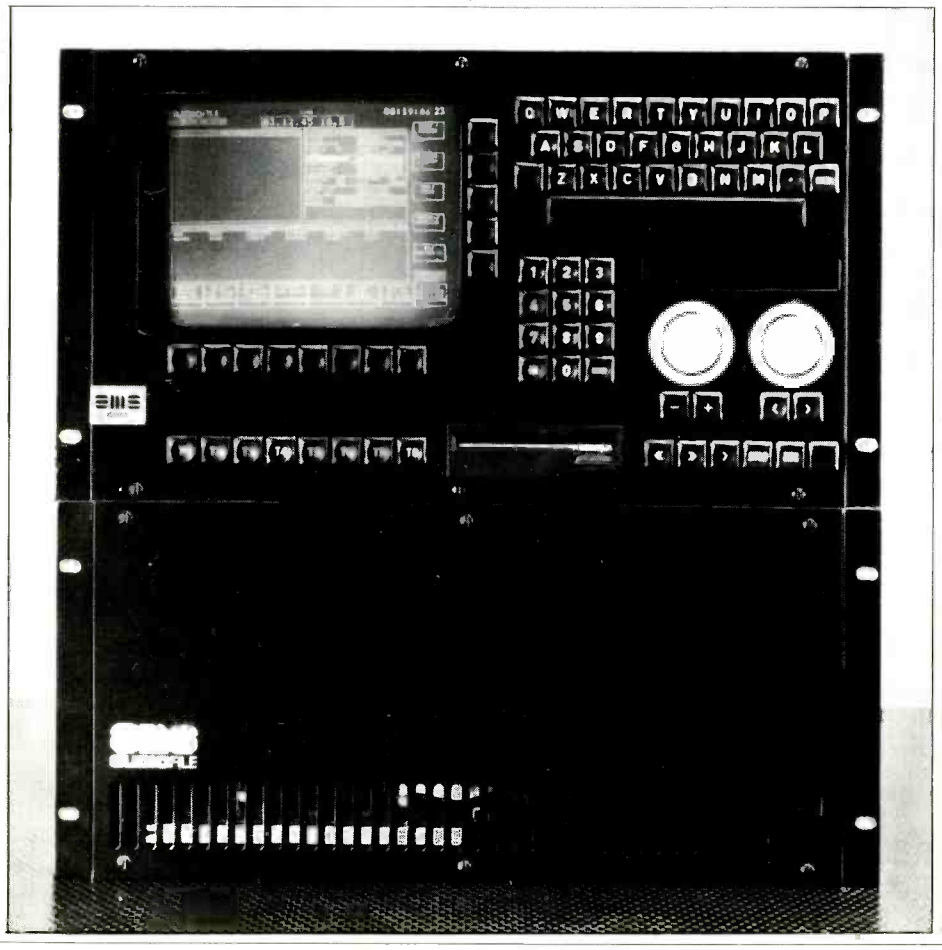
In late 1982 AMS completed development of the *DMX 16E* which was a digital preview editor with over 30 s audio storage capacity. It was intended to work with digital audio recorders where the audio would be recorded into the unit from the digital tape machines and trial edits could be performed with the ability to use variable speed, 'rocking & rolling' and programmable crossfades. Following the previously mentioned interest in multiple sampling applications, experimental work was done using the 30 s plus memory of the *DMX 16E* for multiple sampling storage and cataloguing. The following year a much modified *DMX 16E* was shown capable of recording, editing and triggering multiple samples and this in turn stimulated interest in a solid state digital recorder. The requirements being discussed were beyond the solid state capacities available at that time at reasonable cost and so another storage medium was needed. Enter the *AudioFile* with hard disk.

Basic capabilities

At one level the *AudioFile* could be looked at as a 'super sampler' but its real abilities lie in the manipulation of sound against time—something that is possible when you free yourself from the physical restrictions of magnetic tape. By offering longer recording times than solid state memory, the *AudioFile* also has straight recording applications although viewing its use just as a 'simple' digital recorder is perhaps missing the point.

The first applications of the system are in film and video post production where a lot of the push for development of the system came from. One of the earliest commercial users was TVS which was using the system for triggering sound effects for a TV game show that would normally have had to be laid on to the soundtrack in post production rather than live.

For the recording studio, *AudioFile* could be a mastering/editing medium particularly where you need to create completely new mixes from one already in existence such as with 12 in remixes, etc. The editing could be done on *AudioFile* with the original remaining intact and the different created mixes being copied to Sony *PCM-1610/30* for mastering. There are also, of course, multitrack applications either alone or, more usefully, running in sync with a standard multitrack and offering another eight tracks that are super flexible. Probably better would be to use six tracks and then mix down to the remaining pair so that the full editing capabilities could be used. With the time



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slip capabilities of the system the possibilities of time related effects, spinning in vocals, creating new sections, etc, and then editing the final mix are quite exciting.

There are also possibilities for use for mastering where crossfades, track order and between track timings can be played with infinite variety in assembling albums, etc. The PQ and other subcodes can be added during assembly, the complete album then being mastered to *1610/1630/F1/701*, etc, ready for CD mastering.

Hardware

There are three physical sections to *AudioFile*—the mainframe, a power supply for the mainframe and the control surface. The mainframe basically contains all the hardware including the hard disks, the A/D and D/A converters and the audio inputs/outputs. The control surface has very little hardware except for the main micro, a floppy disk driver and its own power supply. The control surface communicates with the mainframe by an RS422 interface and can separate by up to 250 m. Further, it is possible to remote the monitor running composite video to another monitor so that the system can be set up quite flexibly. It would make sense to keep the mainframe outside the monitoring environment, normally, as the hard disk drives would be a little too noisy for the digital control room.

Control surface

The control surface of the production units is slightly different from the units that have been used for demonstration at various exhibitions having incorporated user feedback. The main focus is the high resolution monitor which not only displays details of the work in hand but also the functions of the soft keys that are positioned eight below the screen and five up the right hand side. The displays are boxes of similar size to the keys and highlight when that key is selected. For those of you with a horror of multifunction keys, the *AudioFile* restricts itself to a single function per key on each display page.

The heart of the *AudioFile* lies in these software definable keys and the screen. All the other control surface features are mainly for information entry rather than system control. For instance the QWERTY keyboard has no control functions and is solely for title information and the numerics pad is purely for the entry of number values. In the lower right hand section of the panel is a pair of digipots—large continuously rotating pots whose function at any time is defined by the selected operational mode and is indicated in the LED window above them. The right hand digipot tends to be for cursor movement while the left is normally used for updating numerics. Below the digipots are pairs of buttons which allow step up or down in digipot values and are useful for occasions when the pot is too sensitive for small changes.

Below this lies a set of very standard looking tape-type transport controls together with a blank button whose function at present is to be part of the system reset. These controls can treat audio in the system as if it was recorded on tape. This layout keeps the computer aspects of the system to a minimum. As will be seen later there has been considerable effort to use tape machine analogies wherever possible to try to reduce the unfamiliarity of the system.

Only remaining on the control surface is a row of eight trigger keys and the 3.5 in Sony-type floppy disk drive which is used for loading all the operating system software and holds user programmed information. All software updates will be made in this form.

System

Powering up of the system is achieved by inserting the system floppy disk. First displayed on the screen is the version of the software being loaded. (At the time of writing this is 302B/25 frames. Parallel software is user produced for 30 frames although user selectable frame rates will be introduced soon.)

It is necessary at this point to introduce two critical *AudioFile* terms—Cues and Events. A cue is any piece of audio placed in the *AudioFile* whether it is a sound effect or a complete piece of music. When cues are strung together they form an events list.

Once the software is fully loaded the screen goes to the default menu. The softkey functions are indicated on the screen by the displayed boxes along the lower edge. These include record enable, events or cue page selection, erase audio, internal/external clock, assign triggers and record triggers. It is possible that the software release imminent shortly before publication of this article may change the precise details of these keys but they will be broadly similar.

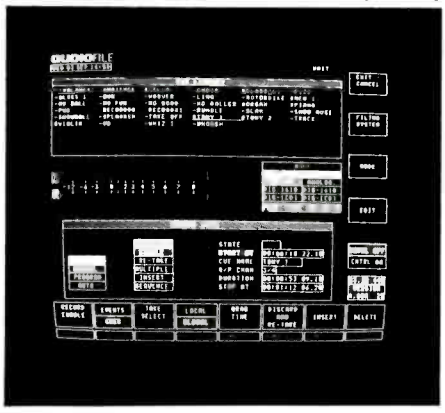
The middle section of the monitor displays the available cues which it is possible to scroll through. There is no real limit to how many cues can be stored but the maximum record time available with a single hard disk is approximately an hour of single-channel audio—each further drive added gives a further hour. When the cues are recorded into the *AudioFile* they may be titled using the keyboard; if they are not, the *AudioFile* assigns the timecode value from its own internal clock to the cue.

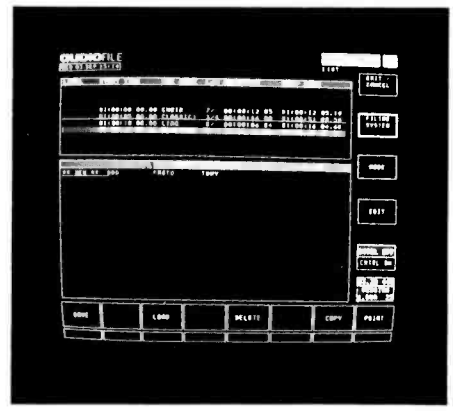
As most of the software available so far is aimed at the post production area it is easiest to explain the full operation in that context. The simplest function level is to send cues to the system outputs by assigning triggers. This is achieved by selecting the Assign Triggers softkey, moving the right hand digipot till the cursor is on the required cue in the library and then to touch the softkey representing that trigger. That cue can then be triggered just by pressing that trigger button and the audio cue will play through until the recorded cue reaches the end although it can be stopped and started by pressing the trigger again. Should you hold down the button longer, the cue will stop when you release the button. The system is full of features such as this allowing you to find a technique of working that suits.

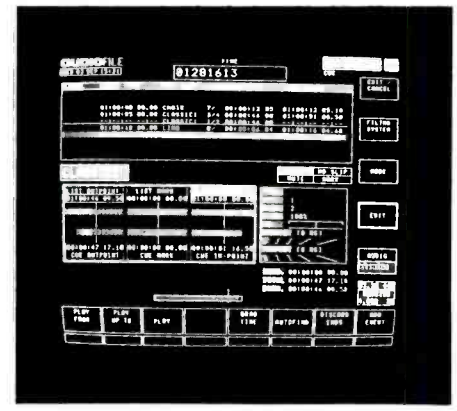
There are eight triggers and the experienced operator can assign them very quickly, the trigger key picking up the assigned cue title for clear operation use. Should you make a mistake or change your mind you just assign a new cue. Once in the trigger assign mode that is just what you do, there being no 'Computerese' such as Enter commands, etc. All the triggers are identical except when a stereo cue is selected which automatically adopts a pair of triggers. At this stage of operation the cues can be triggered manually or externally.

The next step would be to create an events list. The cues can be selected by moving the cursor through the cue library with the digipot and pressing the insert button on the required cue. The events list under assembly is displayed in the top half of the monitor showing labels for (facility for identing cues separate from their cue name) start time in timecode (which may not have yet been assigned if cue was not recorded against timecode), the output destination (L or R), duration of the cue and stop time. If there are no timecode values assigned for cues these need to be entered but from the events edit page. ▷

These screen displays are from the pending software release and therefore are not exactly as covered in text







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AUDIOFILE

Another method of creating an events list is to record triggers against timecode. This is very simple to do—just select External Timecode, eg from a U-matic, select Record Triggers mode and then every time you hit a trigger key, the trigger and the cue assigned to it will be placed on the events list. Returning to the events page and re-introducing the external timecode will cause the events list to play off as triggered. In this way it is possible to very quickly add audio cues to a timecoded picture, it is then possible to just move the cue starts fine tuning the start point.

Events page

On this page the monitor shows the events list we have created at the top of the screen but the cue library from the cue page has disappeared to be replaced by a graphic illustration of a piece of 8-track tape. Tape graphics are used on all displays of the *AudioFile* where editing or events are shown as it is what engineers are used to. Part of the graphic is a fixed point which is current time or, continuing the analogy, represents the tape head—the point at which audio is triggered. The 'tape' moves across the screen from left to right with timecode always displayed. The cues are shown as highlighted blocks on the tape with the cue title printed on the block if it is long enough. This is a very clear representation of what is happening and it also gives your post production engineer an idea of the approaching cue so if he has to change outboard EQ, etc, there is a visual guide.

Part of the *AudioFile* at present is a chase synchroniser that allows it to lock up to external timecode as mentioned. At present that takes about 2 s at which time the 'tape' and all other functions are updated and moving. If we wanted to update the cue triggers in the events list so they were closer than the existing timecode values or those entered manually by the trigger keys, either the burned in timecode value from a video screen, etc, can be entered via the numerics keypad, or by the digipots. For many uses, particularly where precise timecode values may not be available, the latter will be the easier. Just switch the *AudioFile* to internal timecode, the digipots become active with the right hand pot selecting the cues to be updated from the events list and the left hand pot adjusting the timecode of the cue start. The digipots are in direct contact with the system; there is no need for any system commands. A useful feature of the monitor display is the way the 'tape' always moves to the same point that the cursor is selecting on the events list itself so you are always sure of what is where.

Editing cues

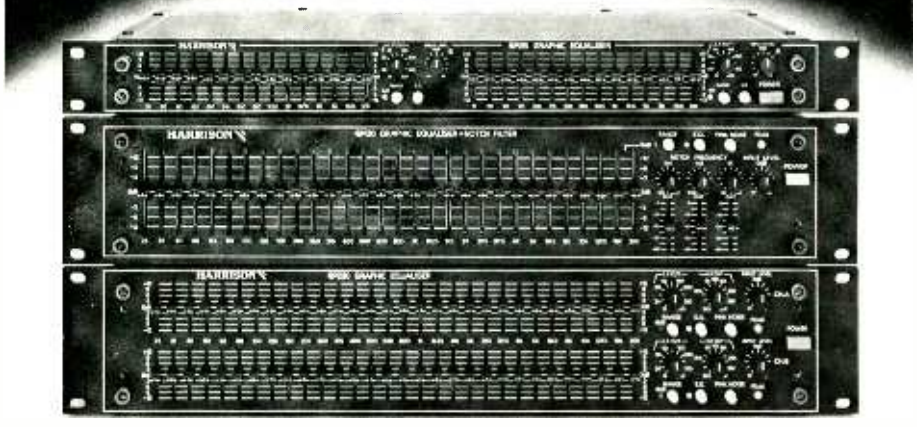
The display of the cue edit page has a number of differences to the events page. The events list is still there. The cue itself is represented by a single piece of 'tape' with the unedited areas of the cue being indicated by graphic marks, an unedited cue being solid graphic. The mode defaults to timing editing of the cue in point (cue beginning) although it is also possible to edit the cue out and the cue mark. (Cue mark is a way of indicating a specific point in a cue, for instance in a cue that starts with wind, then a door slams, leaving only wind to the end, it will be important that the door slam is exactly on time and so a cue mark would be assigned to this point and with the exact timecode value required. This would enable the complete cue to be moved around including the cue in and out points just by lining up the cue mark.) If you remove the beginning of a cue that is in the events list you have the choice of the cue 'moving up' to the old cue point or staying where it is.

The cue can be played whilst you are editing with the softkeys offering options such as Play From, Play Up To and Play and relate to whatever edit point is selected. A key labelled Grab Time allows editing on the fly. So to remove the start of a cue you just play the cue, hit grab time and at that point you have edited the cue start off. Playing the cue now plays the edited version. It is important to remember that when editing on *AudioFile* you are really just placing marker flags on the audio and nothing is discarded—it is just not played. There is some discussion at the moment as to whether a number of software options will be implemented in the next major release. One possibility is the Discard Tails option that would allow you to permanently discard tops and tails of edited cues and so conserve disk space.

At the time of writing (early September) the software in the demonstration machine did not support the audio editing functions also to be found on the cue edit page. Development work on the next release was in progress and it will include many of the aspects of possible *AudioFile* use that will have real interest to the recording studio/mastering facility. By the time of publication, facilities such as stereo editing, internal mixing and track bouncing will most likely be implemented. Selection of these facilities will be by the right hand digipot moving a cursor up a list of modes and the left hand digipot control detail. So, for ▷

HARRISON

GRAPHIC EQUALISERS-*PLUS*



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example on level control, the left pot will introduce attenuation in percentage steps from 100% being the level of the cue recorded into *AudioFile*. When internal bouncing is implemented this will allow level matching of cues—there being no plans for gain implementation. With Balance the left pot moves a small marker to left or right of centre position and on edit positions it controls the ramp in and out times which are selectable over a wide range from 50 ms upwards, possibly as much as 15 s, although this had not been decided at the time of writing. The edit information is displayed on a graphic illustration of an edit block below which the full timing information on the edit is displayed.

It is at this point in the system that the conventional tape transporter controls also come into use and can be used to play through the cue as if it were a piece of tape including fast wind and stop. The tape graphic illustration also moves fully indicating what the system is doing.

AUDIOFILE

Events editing

This is for editing the events list in a number of differing ways. There are a number of reasons why it might be necessary to change the events list. One might be that you simply wish to edit the cue in some way. It is quite possible that you may wish to use different parts of the same cue in different places on the events list. One example is a dog bark and a howl on the same cue. It would be possible on the cue edit page to prepare different versions of the same cue and then the events edit page, these could then carry the same title, eg Dog, but the label field would differentiate between the different versions, eg the bark and howl, just the bark and just the howl.

On this page it is possible to edit three aspects of the cue within the list—the list in, list mark and the list out points. The slip mode can also be engaged where the complete cue can be slipped in time against timecode. The graphic display on the monitor informs the operator of the implications to other parts of the cue caused by what is being altered. For instance, highlighting the graphic would show that if the list is moved back in time with no time slip the editing is occurring off the beginning of the cue thus drawing attention to potentially annoying mistakes that editing against time would allow you to make.

It is still possible to complete most of the cue editing functions on this page with the addition of being able to work with labels.

Other aspects

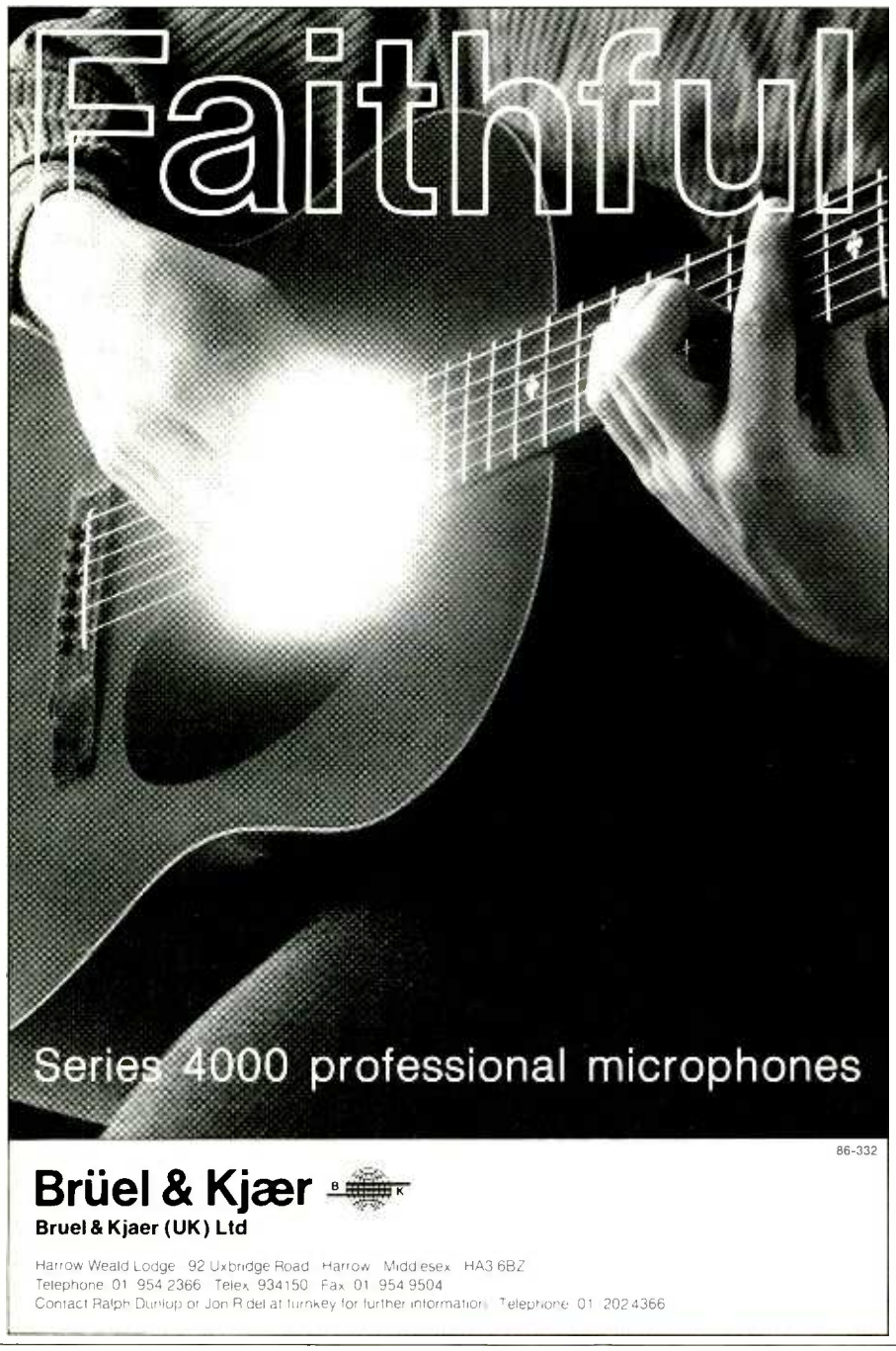
There is also a Filing System page that allows control of general system operations such as saving events lists, loading events lists, deleting, copying and printing (hard copy) data. At the present there are digital interfaces for *PCM-1610* and *1630*, *F1* and *701* for save and load operations. The *AudioFile* would make a good sound FX library manager interfaced with a digital recorder for its cue information. The only disadvantage of the system would be that for this and all other cue loading operations it currently has to be done in real time, ie loading 30 min of cues takes 30 min. This time is probably easily saved once the system is operational but AMS is keeping a close eye upon possible alternative loading and saving of digital audio systems that would run at faster rates. There are possibilities including running pairs of digital recorders and tape streamers but neither offer a totally superior solution.

Although at present the *AudioFile* uses hard disk there is provision within the system for that to change should a better and more suitable system be developed. For example, a read/write optical disk would be a useful improvement but such practical developments are a few years away as yet although *AudioFile* could interface with such a system.

Other points

I have tried to give some feel for the operation of the *AudioFile* system, a system that I must admit to being impressed with even though this article is really based around what will be the old software (hopefully) by the time you read this. With open ended products such as this it is never possible to be all-encompassing and practical use is the only proper way to evaluate such systems.

I understand that after the next software implementation and the *AudioFile* has reached what AMS describes as the basic building block status, there is a possibility that one of the next steps will be specialised applications software to suit some of the other uses mentioned in the article. Whatever happens it will be interesting to follow the future developments of the *AudioFile* and other disk based systems.□



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IN PERSPECTIVE

IN PERSPECTIVE

Comment from Martin Polon, our US columnist

Audio Student
1234 Anywhere Street
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Dear Mr or Ms Student,

I hope to provide some answers to many of the questions that are asked about careers in the business of audio. I know you need some information so you might make some positive career decisions. There are courses of study that can improve your chances of finding a job you will enjoy and grow in. There are numerous opportunities you can aspire to in audio. No one who applies themselves in an educational experience and is interested in working hard on the job should find their career in audio thwarted—but remember there are no guarantees in this life.

The question that so many young people ask is, 'How do I get to work with Prince or Sting or The Academy of St Martin-in-the-Fields' (or fill in the name of any other top group you choose). The number of jobs that exist in the recording field can be measured in thousands but recording is just a portion of the total number of jobs available in audio. A number of jobs working with top artists in the studio do exist but these generally require years of training and on-the-job

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experience. It is very important to remember that the audio business is a large one covering nearly 500,000 jobs worldwide that involve audio in some format. Many of these jobs in diverse fields such as radio and television broadcasting, audio/visual services—media, high-end audio retailing, military applications, medical research and sound reinforcement may seem neither connected nor glamorous but the opportunities to work with the best in music are more frequent than not and the compensation in most areas of audio work frequently eclipses that available in recording; at least initially.

As a long-time educator in audio, I must recommend to anyone I counsel the advantages of a college degree. The audio business is changing so fast as to provide no guidelines that will remain 'chiselled in stone' for any length of time. The audio business today is technology driven and the driving forces are digital electronics, the marriage of audio with video and computer technology. We are gradually digitising the entire recording process and the studio as well. Music is increasingly being made with electronics, especially in motion pictures and television. In a world increasingly conscious of degree preparation the presence of a diploma will increase the range of opportunities available. There is the added bonus of being able to alter course in the longer term and return to school for a Master's degree in Business or in Music/Audio if you want to be a manager or an educator.

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Obviously, there will be some situations where you will want the intensive hands-on experience of a specialised institution offering audio training in a shorter time frame. A number of these schools are considered absolutely superior for this kind of instruction. But, consider the option of transferring credits from these institutions to finish up a four year degree either during or after the time you attend the specialised training and/or try to take some college level classes at the same time. There is nothing that can replace your having a four-year college degree as we approach the 21st Century—the century of advanced technology.

It is impossible to give you a specific 'degree map' to success in the audio industry. The stories of those who have succeeded cover a range of degrees from Abnormal Psychology (some would say the field of choice for the recording industry) to Biology to Electronics to Music to Physics to Management to Theatre Arts. Obviously, you can find many success stories for those with degrees in Electrical Engineering; especially with a specialisation in audio. But, the current trend in the USA, Great Britain and Europe to tailor music curricula to audio education with special attention to technical courses as well, seems to me to be the best of both worlds—music and technology. Such programmes have taken to heart the influence of the best features of the Tonmeister concept and made adaptions to fit the needs of today's audio business.

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What I am saying is that having a degree in Electrical Engineering is not going to hinder you if audio engineering is what you want. It can only help if you desire to work in the design and manufacture of audio systems and equipment. It will also enable you to get an intensive background in computer technology.

Today the degree in engineering is not the only path to a career in audio as it was 20 years ago when I started out. The degree in music with an audio specialisation will sustain you in a very broad range of employment opportunities and provide a surprising amount of technical education as well. A degree in physics with a specialisation in acoustics will allow you to consult in the design of the architectural spaces where music is made, recorded and performed by artists and orchestras. A degree in psychology could lead to a career in analysis of the interaction between hearing and human socialisation. You may even want to tailor a special programme for yourself by combining course work from several disciplines, for example management courses with a music/audio programme.

If you are currently enrolled in an engineering or music or physics or business programme, I certainly would endorse your continuing with your present programme and talking with your music or physics or business or engineering department about taking some additional classes as a 'minor'. In this way, you could create your own 'Tonmeister' programme where you are now. You will find that many of these programmes will

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A natural phenomenon occuring when the moon passes between the earth and the sun, resulting in total darkness. This unique event is the result of a complex chain of events culminating in the perfect alignment of their orbital trajectories.
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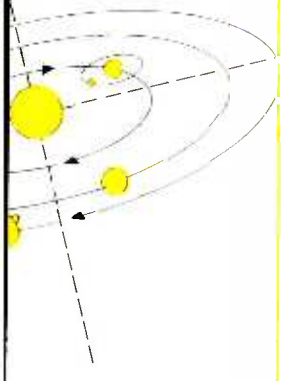
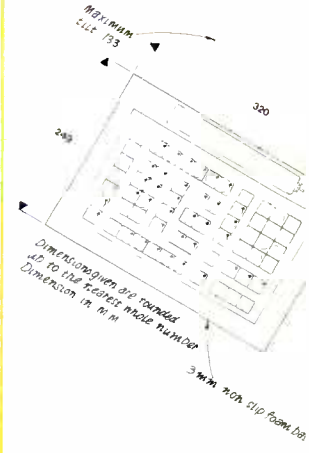
Many of The Eclipse's unique functions were beyond the wildest imagination of Audio engineers until Audio Kinetics applied their advanced research technology to create an electronic edit controller which will, when interfaced with Q-LOCK Synchronisers, add a little magic to modern post production facilities.





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IN PERSPECTIVE

IN PERSPECTIVE

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welcome your presence acting to cross-pollinate their programme with your love of music and audio. This may be a wiser option than changing schools altogether and losing many credits in the transfer process.

Perhaps the most important decision you must make at this time is which institution to attend; if you are not already in an established programme. There are several tasks to complete to find out if a programme of instruction in audio is right for you. You must ask these and other questions; no one will do it for you and you have the potential for improving the likelihood of finding a position in audio that you will both enjoy and prosper from.

- Use the AES Education Directory to select programmes.
- Visit the educational institution you have interest in.
- Talk to current attendeds and past graduates of the programme. Their comments are valuable because of their experience.
- Talk to the programme's faculty. You will have to learn from and work with these people for a number of years. Do not evaluate the faculty solely on what they have done, evaluate them on what they can teach you.
- Examine the institution's facilities. They will probably not include a digital multitrack or a 60-channel computer-driven mixing console. Evaluate the facilities only in terms of what you can learn. The critical issue is the mix of faculty skills, facilities and creative options.

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- Ask about internship opportunities. Ascertain the percentage of students placed and the number of options offered during your course of study.
- Find out about graduates currently employed in the industry. The critical issue is not a job placement service but that institution's job placement record.

Of course, much of the responsibility for success is yours. You should be reading as much of the available literature in the business of audio as you can. You should be reading important technical magazines like *Studio Sound*. You should read magazines about the business like *Pro Sound News*. You can get a broader grasp of the whole electronic entertainment community by reading *Billboard* and *Weekly Variety*. It may be impossible for you to get these and a score of other excellent publications regularly but you can buy them when you see them on a news stand. You can read many of them in your local library. The issues that do not reach your library or news stand will frequently be available from a local studio, broadcaster or production facility.

Get to know the staff and you will accomplish two things: you will probably get their discards of important publications and they will know about you and your interest in audio. More people have begun careers with summer jobs in this way than one would think. And don't forget to read the technical journals from prestigious societies like the Audio Engineering Society (AES) and the Society of Motion Picture and Television

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Engineers (SMPTE). These publications are not as much 'fun' as the others but they will tell you where technology is moving in the business you hope to be a part of. Libraries almost always have these publications. And if all this sounds like work—it is! It is a job; the first part of your becoming an audio professional.

If you are now in college or have not yet joined, the way you 'spend' your spare time can affect your future success in an audio career. Almost every educational institution in the world today has opportunities for voluntary and sometimes paid employment with audio and music. These opportunities are especially important if you have had to compromise with a programme that is academically sound but does not have a specific audio enrichment. Become a part of the student radio station—join the sound crew; volunteer for sound work in drama or theatrical arts; become involved with educational or instructional television; seek work in audio visual or instructional media units; etc. The same can be said for outside employment. Unfortunately, you may have to forgo some income you would otherwise have from afternoon, weekend or summer jobs. But you can turn that around. Maybe you do try to work in the mail room during the summer or after school at a local radio or TV station, recording studio, video production house, etc. You can always volunteer with public agencies many of whom have elaborate audio facilities. These opportunities do occur for those who persevere.

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It is so hard to say what you will actually be doing in 10 or 15 years. But if you have a love of audio and an academic degree, the range of jobs open to you is far greater than if you started in the recording business by 'sweeping the floor' as many studio engineers today frequently boast about having done. There are non-college alternatives to obtaining audio training. One could do worse than spending four years in the air force assigned to a forces broadcasting service or equivalent. Such duty would prepare one for all the options in broadcasting and satellites and offer college training options as well. But aside from the carefully chosen options available in military service, little else can match the long term value that a college education in audio can provide.

Lastly, you are eligible to be a student member of the AES at any time you have student status. If you write to the AES International Headquarters in New York City and ask them to send you an application for membership you will be well on your way.

Yours truly,

Martin Polon
Chairman
AES Education Committee

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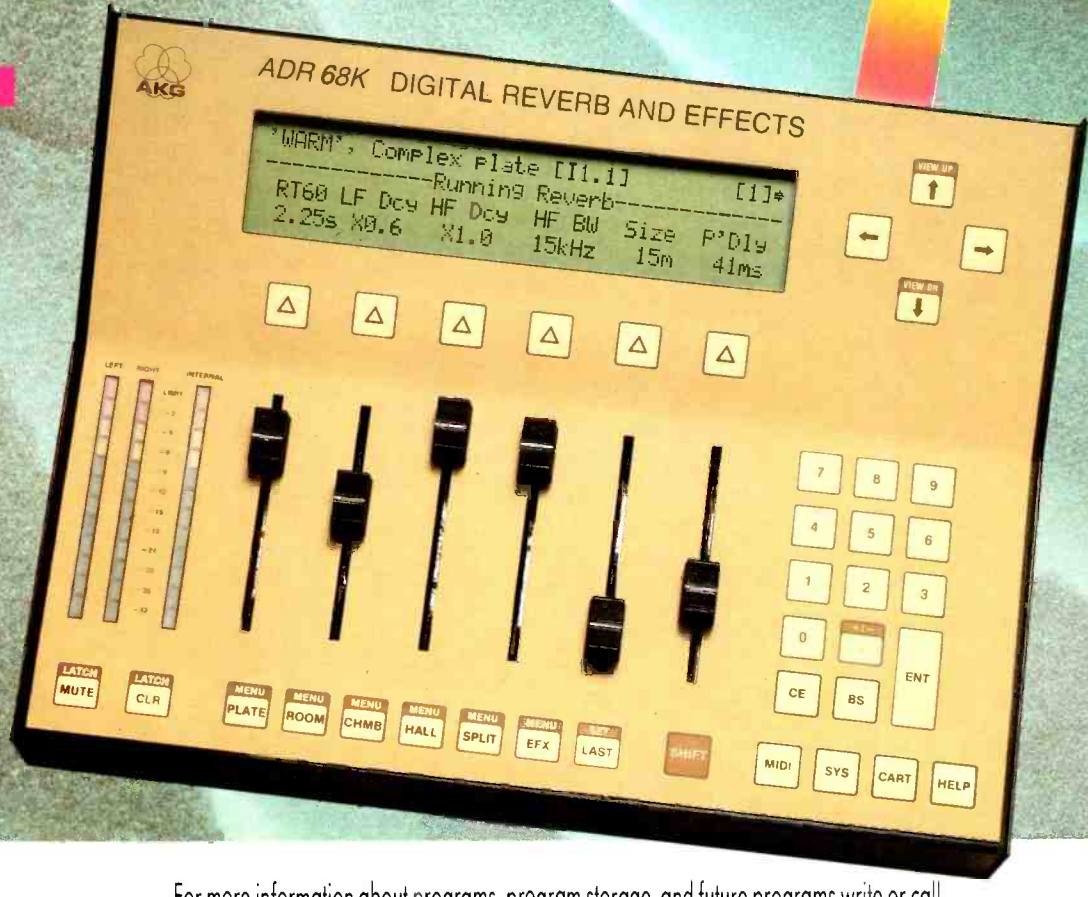

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BUSINESS BUSINESS

Barry Fox investigates the facts behind the industry news

Musical notes

Nice to know that there can still be something completely new in music. Whenever a radio station plays a record by US guitarist Stanley Jordan, the presenter feels obliged to explain that the sound isn't overdubbed. Stanley Jordan really does make one guitar sound like two or three, playing at the same time. And Jordan's appearance at a JVC-Capital concert at the Royal Festival Hall proved that there really is no electronic trick. It's a routine electric guitar and single jack.

The trick is musical—to play a walking bass line with the left hand, by picking and stopping the strings with different fingers, while picking other notes with the other hand. Like the four minute mile, no-one has ever done it before. But doubtless now it will become a guitarist's trick; like the circulating sax trick pioneered by Roland Kirk.

He could breathe air in through the nose while blowing out through the mouth to create the impression of playing without ever taking a breath. Once Kirk had shown the way, others followed. Some of them have found there is a bonus. When stopped by the police and breathalysed, they can blow fresh air into the bag instead of alcohol fumes.

Drummer Buddy Rich played the night after Stanley Jordan. He too had a new trick. It's not so nice. When the band came on stage, trumpet player Dana Watson was standing alongside a mixing desk. In between playing trumpet, Watson fiddled with the gain settings and as he fiddled, the band's brass section sounded more or less smeared. It never sounded live and crisp, even though there was only a touch of lift from the hall PA. I found out afterwards what had happened.

For Heaven knows what reason the Rich band now insists on doing its own on-stage monitor mix, from the stage. The job is done by the fourth trumpet player. How anyone can hope to set the monitor mix from the end of a trumpet section at the back of a screaming band is beyond me. But that's what the Rich band is trying to do.

Clearly the system doesn't work. There was so much level going into the front-firing monitor speakers behind Buddy Rich's drums, that the audience was hearing a mix of on-stage monitoring and live sound. But anyone who knows Buddy Rich, knows that he is one man you don't argue with. If that's what he wants, that's what he gets. He's welcome to it. God forbid it should start a trend.

Amazing journey

No amount of overdubbing on the Live Aid multitrack tapes can fill in the five minute gap during The Who's set which was caused by catastrophic power failure. Although the BBC was, rightly, very proud of getting the power back on again from a stand-by generator, it's worth bearing in mind why the mains failed.

First important point to note is that the TV mono sound was a straight mono sum of the radio stereo mix. It is normal practice in Europe for TV sound to travel with the picture as sound in sync. The mono TV sound is digitised, split into packets and these are slotted into the gaps in the video waveform created by synchronisation pulses. This is the 'sound-in-sync' system.

Second important point to note is that when Malcolm Hill's sound crew checked the Wembley mains before rigging their system, they found the two phases were of uneven voltage and the neutral line was 9 V above earth. We are not using it, they said, and called in a generator. The lighting crew also used a diesel. The BBC brought in a back-up but used the mains.

When The Who came on stage for their long awaited and much publicised reunion, the power failed. Although the stadium sound and lights stayed on the TV image froze into a digital skeleton on screen and the TV and radio sound died. Five minutes later, when the BBC's back-up generator cut in and sound and pictures came back, something impossible happened.

Anyone watching the pictures from Wembley on television, and listening in simulcast stereo from FM radio, saw pictures and sound almost a second out of sync. Anyone video taping TV pictures and stereo sound inadvertently captured this effect. As both pictures and sound were originating live, this should have been impossible. And it didn't happen for people watching or taping television with TV mono sound.

Here's what happened. The pictures frozen on screen were the images locked in the various digital frame stores routinely used along the transmission route to synchronise sources and add effects. When the power was restored stereo radio sound went out again along exactly the same route as before. But in the panic that ensued, the TV pictures, and with them the TV mono sound-in-sync, went to Philadelphia and back again, by double satellite hop. The double return journey into space delayed the pictures and sound by around 1 s. So the simulcast sound arrived direct from the BBC ahead of the pictures.

Quite quickly, the vision feed was switched back to direct transmission and the problem cured. It should be an easy job to pull the two together again for future re-transmission or issue from audio and video tapes. But nothing can repair the damage done by that 5 min shut down. Ironically it would have been better if the Wembley crews had *not* been so well prepared. If the stadium power supply had failed as well as the TV and radio power, The Who would have just cursed and started 5 min later.

NED

"We knew we couldn't beat IBM in the computer business," says Brad Naples, President of New England Digital which sells the *Synclavier* hard disk recording system, "so we decided to become the IBM of the recording industry."

Disk is ideal for pop work. Dump the rhythm tracks on to disk and there is no degradation or drop-out from tape wear even after days of overdubbing. A Winchester head doesn't touch the disk, it floats on air just above it. Film and TV producers also like the *Synclavier* because it lets them re-shape and mould the tempo and pitch of music, speech and effects recordings to fit the pictures. Rapid access is the key. It takes ms to take it from the top as the magnetic head just skips across the disk surface.

Synchronisation with pictures on screen is accurate to $\frac{1}{80}$ of a TV frame, ie one bit of SMPTE code. Fine editing of sound, by displaying the audio waveform on screen as a trace is accurate to $\frac{1}{50\,000}$ or or 0.00002 s. A 1 ms passage (0.001 s) can be excised between edit points. Parts of a recording can be extracted, cloned and copied elsewhere into the recording. NED likens this to word processing where paragraphs of text can be moved.

Firmware neatly solves a problem which has become the bane of the TV and video industry. Thanks to a quirk of TV engineering history, US and Japanese NTSC colour TV and video pictures run at 29.97 Hz frame/s instead of the 30 Hz used for black and white signals. The processor will 'drop' an awkward 108 frame/hr and so keep sound recordings perfectly in step with NTSC TV pictures. (Simple when you know why: NTSC frame rate is 29.97 Hz so difference between this and true 30 Hz is 0.03 frame/s. So in 1hr there are $60\times60\times0.03=108$ frames to be lost.)

For 16 bit code sample at 50 kHz, 1 Mbyte of Winchester storage is needed for every 10 s of sound. NED offers up to 140 Mbyte per disk, the processor can handle up to 32 channels of sound simultaneously. Eventually there will be a 32-track system recording for up to 30 min. This will be cost effective only for the largest TV studios, who need to handle up to half an hour of unbroken recording time, because it will require nearly 6 Gbyte (6,000 Mbyte) of disk capacity. A Mbyte of solid state RAM is used as a buffer in each channel to bridge the gaps between chunks of data handled by the disk; the data comes on and off disk in blocks of 256 K 16 bit words, ie 512 byte blocks.

Most studios will record on to tape first and then transfer short passages to *Synclavier* disk for editing and overdubbing. An 8-track system, equivalent to an 8-track studio tape recorder, capable of storing 15 min of sound will have 720 Mbyte of disk capacity and cost $135,000.

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REVIEW

REVIEW

A technical report by Hugh Ford

BENCHMARK MIA-4

The Benchmark *MIA-4* is primarily intended as a very low noise microphone preamplifier but may well find other applications where a very low noise amplifier capable of line level outputs is needed.

Mounted on a small good quality printed circuit board the amplifier has three controls, a rotary gain potentiometer and two locking pushbutton switches. One with a red knob switches phantom powering, the second with a grey knob inserting a nominally 20 dB pad at the input.

Naturally the powering is external requiring between ±15 VDC and ±22 VDC for the amplifier, and +48 VDC when phantom powering is used. The balanced input is fed from the decoupled phantom powering via the standard 6,810 Ω resistors in each leg. Sensibly the phantom power on/off switch not only has a series resistor at the +48 V input to reduce switching surges but it also discharges the decoupling capacitor when the phantom powering is switched off.

Following this there is the 20 dB pad and series decoupling capacitor consisting of aluminium electrolytics in parallel with film capacitors to reduce noise from the electrolytics. There follows a common mode choke for radio frequency rejection and back-to-back zener diodes for protection against excessive input voltages.

The first amplifier stage is a differential amplifier comprising two very low noise transistors into the bases of which the input is fed directly. The transistors are configured in an emitter feedback mode in conjunction with an NE5532N operational amplifier. Within this stage the gain control is between the two emitters and thus controls the amount of feedback.

The differential output from this stage is AC coupled, again with paralleled aluminium electrolytics and film capacitors, to the differential inputs of one half of a further NE5523N operational amplifier. One leg of the input to this stage, which has 6 dB gain, includes a gain trim and a capacitor for optimising common mode rejection. The output from this stage in series with paralleled capacitors and a 30.1 Ω resistor form one output leg with the other using the second half of the NE5532N as a phase inverter with a similar termination. Both the differential outputs are then decoupled to ground via 100 kΩ resistors to remove any charge in the output series capacitors.

A further output identified as Mix Out is taken from the inverting output via a 10 kΩ resistor with a link at the input to this stage allowing it to be used as a separate non-inverting amplifier.

Input and output configurations

The input impedance depends upon the use of the nominal 20 dB pad, being 4.03 kΩ in either leg or 8.07 kΩ in parallel with 780 pF balanced without the pad or 1.47 kΩ in parallel with 25 pF with the pad in circuit. If phantom powering is not required the removal of these components will increase the input impedance to around 20 kΩ.

Common mode rejection varied with the gain setting, a factor which is not surprising where the common mode rejection compensation is after the variable gain stage. Thus the common ▷

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Gain range: continuously adjustable from +18 to +73 dB. With use of the 20 dB pad the overall gain range is −2 to +73 dB.
Frequency response: high frequency response, for any gain: −3 dB >200 kHz; low frequency response, dependent upon gain: worst case at A=73 dB the −3 dB point is 26 Hz, at A=40 dB the −3 dB point is 0.85 Hz.
Total harmonic distortion: at a gain of 40 dB, the THD at 2 kHz is 0.0014% and at 20 kHz is 0.003%. All electrolytics are paralleled with large film capacitors.
Noise floor: for all gains up to 36 dB the output noise is −93 dBV. Above that a 1 dB noise figure applies, ie for a gain of 60 dB the output noise would be approximately −69.5 dBV, referenced to 150 Ω over a 20 kHz bandwidth.
Maximum output level: balanced out with ±15 V supplies =+27 dB; balanced out with ±20 V supplies =+30 dBV into 2 kΩ or greater; unbalanced outputs −6 dB from the above figures.
Input impedance: 20 kΩ, 1500 Ω when pad is inserted (balanced).
RF protection: the MIA-4 uses a 2-mode common mode filter that limits common mode bandwidth to 26 kHz, with no degradation in noise performance. As a result, RF is down 60 dB at 1 MHz, while allowing the differential bandwidth to be greater than 200 kHz.
Power requirements: voltages of ±15 to ±20 V for the circuit supply at approximately 25 mA; +48 V at a maximum of 10 mA is required for the phantom power.
Physical: the *MIA-4* is constructed on a printed circuit board that measures 2½ in wide by 4 in long by 1 in high.
Manufacturer: Benchmark Media Systems Inc, 3817 Brewerton Road, N Syracuse, NY 13202, USA.

FIG. 1 BENCHMARK MIA-4
COMMON MODE REJECTION WITH 50Ω SOURCE

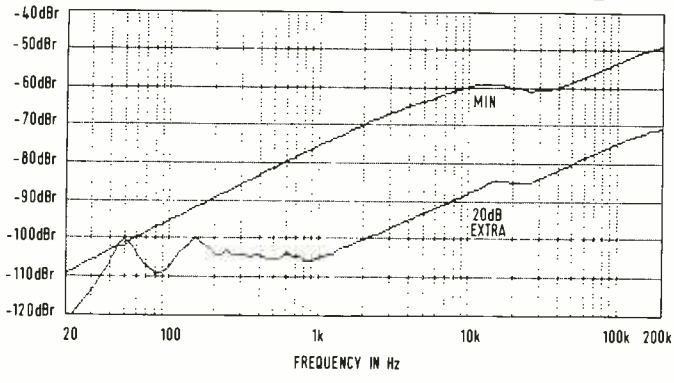

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FIG. 2 BENCHMARK MIA-4
FREQUENCY RESPONSE AT 1dB INTERVALS BELOW +27 dB OUT AT MAXIMUM GAIN

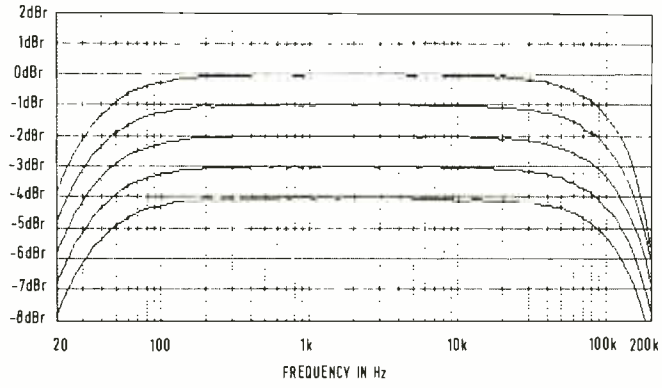
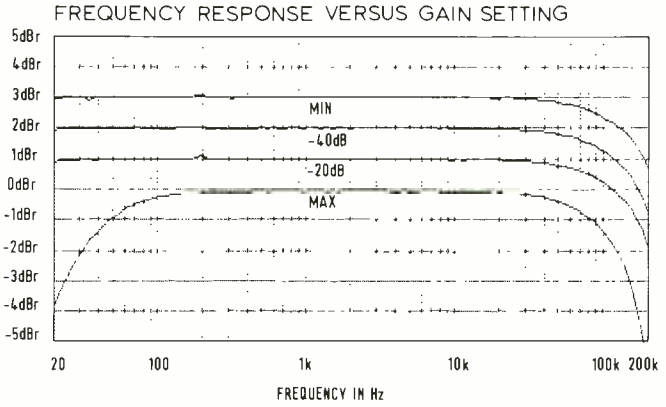


FIG. 3 BENCHMARK MIA-4
FREQUENCY RESPONSE VERSUS GAIN SETTING



mode rejection must be optimised for any particular gain. Reference to **Fig 1** shows the CMRR at minimum gain which was near the worst case and at 20 dB further gain which is around the best case.

The application of common mode radio frequency inputs had no undesirable effects and even 3 V of RF up to 3 MHz did not produce any audible effect at the output.

Overall gain at 1 KHz without the pad in circuit could be varied between 75.05 dB and 17.02 dB with the gain control. The precise attenuation of the pad depends upon the source impedance of the input; the theoretical attenuation is 20.83 dB with zero source impedance and the practical attenuation 21.14 dB with a 50 Ω source.

The maximum input level for 0.1% total harmonic distortion using ±15 VDC supplies was 2.78 VRMS (+11.1 dB.7V) without the pad increasing to over 27 VRMS (+30.8 dB.7V) with the pad in circuit.

Again using ±15 VDC supplies the maximum available output for 0.1% total harmonic distortion at 1 kHz was 19.00 VRMS (+27.8 dB.7V) differential from a source impedance of 62.7 Ω. Single ended the output level and impedance are halved with the balance between the outputs being a 0.01 dB difference in level.

Generally the impedances and gain are well matched for any type of microphone input including capacitor and dynamic types with an impedance of 200 Ω or less. The use of the 20 dB pad is unnecessary for most applications in view of the good signal handling capabilities.

Frequency response

The frequency response at maximum gain is shown in **Fig 2** where the input level has been stepped in 1 dB intervals below that required for the rated output of +27 dB.7V. It is clear from that plot that the frequency response is independent of output level.

Plotting the frequency responses versus the gain setting confirmed the manufacturer's statement that gain has little effect at high frequencies but modifies the low frequency response. In **Fig 3** the bottom trace is at maximum gain where the low frequency response drops to −1 dB at 50 Hz and at 80 kHz.

At 20 dB and 40 dB less gain shown in the next two traces, the −1 dB points are below 20 Hz and at over 100 kHz remain stable up to minimum gain. At these lower gains the −1 dB point was in fact below 2 Hz which is undesirably low for microphone inputs in some circumstances.

TABLE 1

Measurement method	Noise reference 0.7746 VRMS Maximum gain	Minimum gain
20 kHz effective noise bandwidth	−128.7 dB	−111.9 dB
22 Hz to 22 kHz RMS (18 dB/octave)	−127.7 dB	−110.9 dB
A-weighted RMS	−131.6 dB	−113.2 dB
CCIR-weighted RMS	−122.5 dB	−104.0 dB
CCIR-weighted quasi-peak	−118.6 dB	−100.1 dB
CCIR/ARM ref 2 kHz	−128.2 dB	−110.6 dB

Noise

Noise in the output was referred to the input (input shunted with 200 Ω) at maximum gain and at minimum gain. The excellent results are shown in **Table 1.**

At maximum gain the noise is within 1 dB of the theoretical minimum, being −129.6 dB for a 200 Ω resistor at room temperature over a 20 kHz bandwidth — an excellent performance.

As gain is reduced the noise becomes limited by the noise of the output stages which is 17 dB above the noise quoted in the right hand column in **Table 1**. Thus the 22 Hz to 22 kHz output noise is at −93.9 dB.7V and the available output with ±15 VDC supplies is +27.8 dB.7V leading to a potential dynamic range of 121.7 dB.

Rejection of ripple in the DC supplies was good with 50 Hz or 100 Hz components being reduced by at least 40 dB. Supply ripple or noise at high frequencies, however, is not rejected and caution in use is needed to avoid noise from the DC supplies entering the output.

Distortion

Harmonic distortion was at too low a level to measure individual harmonics ▷

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REVIEW

TABLE 2

Gain	22 kHz bandwidth	80 kHz bandwidth
20 dB	<0.001%	<0.001%
40 dB	0.0006%	0.001%
60 dB	0.0023%	0.0042%

TABLE 3

Frequency	Measured result	Specification	Instrument residual
2 kHz	0.00055%	0.0014%	0.00042%
20 kHz	0.00088%	0.0013%	0.00066%

FIG. 4 BENCHMARK MIA-4
TOTAL HARMONIC DISTORTION AND NOISE OVER 500 kHz BANDWIDTH AT +27dB OUT

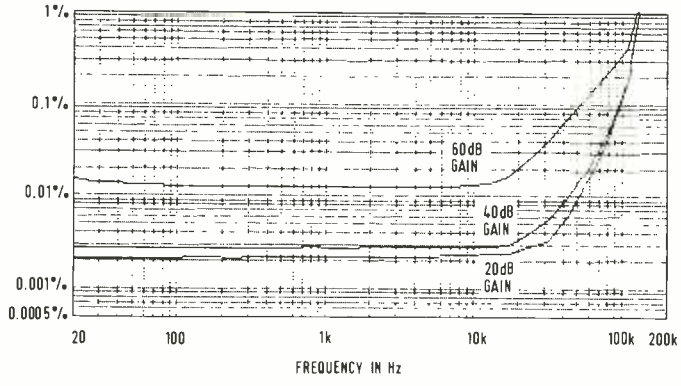


FIG. 5 BENCHMARK MIA-4
TOTAL HARMONIC DISTORTION AND NOISE OVER 500 kHz BANDWIDTH AT 100 kHz
REFERENCE +27dB OUT ON X AXIS

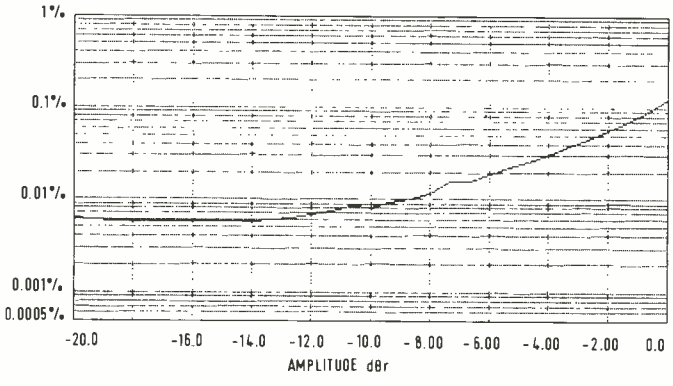


FIG. 6 BENCHMARK MIA-4
CCIF INTERMODULATION DISTORTION AT 40dB GAIN
EVEN ORDER PRODUCTS

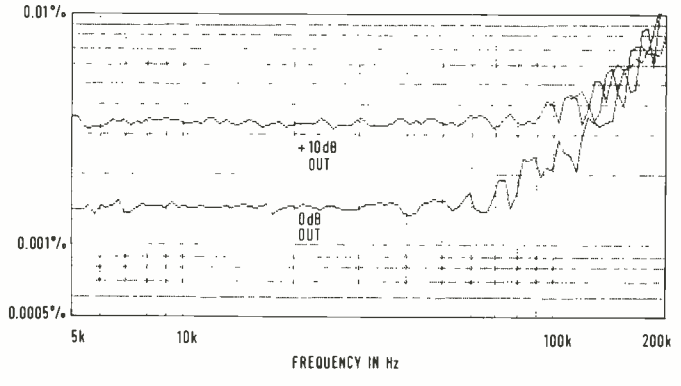
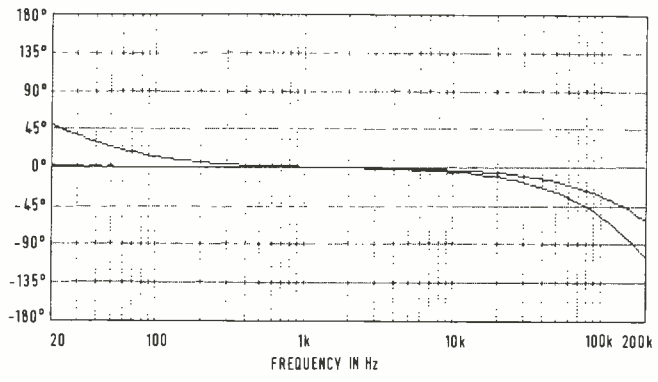


FIG. 7 BENCHMARK MIA-4
PHASE SHIFT AT MINIMUM AND MAXIMUM GAIN
MAXIMUM DEVIATIONS ARE AT MAXIMUM GAIN



without considerable complication. Therefore the total harmonic distortion plus noise was measured at 20 dB, 40 dB and 60 dB gain at +27 dB.7V output.

The input frequency was swept from 20 Hz to 20kHz and distortion measured over bandwidths up to 22 kHz and 80 kHz. The measured results were largely noise rather than harmonics with the results, as shown in **Table 2**, being fairly constant versus frequency.

Spot measurements at 2 kHz and 20 kHz at 40 dB gain to confirm the manufacturer's specification for +27 dB out, showed the amplifier to be substantially better than specification as shown in **Table 3.**

The distortion at higher frequencies versus frequency is shown in **Fig 4** with gain as a parameter for +27 dB output where there is significant increase in distortion above 20 kHz. This is sensitive to output level. The distortion versus output level at 100 kHz is shown in **Fig 5** for 20 dB gain. A 10 dB drop in output level offers a 20 dB decrease in distortion.

Intermodulation distortion to the CCIF twin tone method using tones separated by 120 Hz was good as shown in **Fig 6** where the even order products are shown at 0 dB and +10 dB output for 40 dB gain.

Transient intermodulation distortion to the DIM30 or DIM100 methods, using a 3.15 kHz square wave band limited to 30 kHz or 100 kHz mixed 4:1 with a 15 kHz sinewave, was remarkably low.

At 40 dB gain both recorded <0.003% with noise limiting the results at high gains.

Other matters

Phase shift was measured at minimum and maximum gain with, as might be predicted from the frequency response, maximum phase shift occurring at maximum gain, as shown in **Fig 7**, with minimal deviations in the audio frequency band.

Current drain from the DC supplies was 18 mA when operating on ±15 V rails with both rails requiring the same current which was constant with signal conditions. Current drain from the phantom power supply depends entirely upon the type of microphone in use with the amplifier module not draining any current from this supply.

Summary

The only criticism I have is the variation of frequency response and common mode rejection with gain. The former only applies at very high gains where the low frequency response falls off rather rapidly.

Noise performance was excellent with all forms of distortion also being at very low levels. All measurements were done with the module fully contained in a diecast alloy box and in order to attain the optimum performance in use suitable screening must be used. □

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REVIEW

REVIEW

A user report by Mark Jenkins

STEINBERG PRO 24

This is a software package for the Atari *520ST* and *1040ST* microcomputers manufactured by the German company Steinberg. It is a development of the *Pro 16* package which runs on the Commodore *64* micro but operates in a largely different manner and is in many ways much more powerful.

Pro 24 is programmed by, and controls, MIDI synthesisers and other instruments. The Atari computers need no special interface to connect to such instruments since they are equipped with standard MIDI In and Out ports, the first microcomputers to be so equipped. (Sinclair's *Spectrum Plus* uses unconventional MIDI implementation and non-standard connectors.)

Pro 24 runs on either the *520ST* or the *1040ST* model; the *1040ST* gives greater note capacity and is more likely to support forthcoming sampling and other devices such as the Hybrid Arts *ADAP* system. Each computer is available with a black and white (monochrome) high resolution monitor, or with a medium resolution colour monitor. Early versions of the *Pro 24* software work only with the monochrome monitor due to the amount of information which has to be shown on-screen. One pin in the computer's monitor port detects the presence of a high resolution model and the program will actually crash if a colour monitor is used. Later versions of *Pro 24* are adapted for colour with a slightly simplified display; in theory a high resolution monitor is still needed but in practice the standard medium resolution model gives a very clear display.

Setting up involves connecting the monitor, disk drive and synthesisers to the computer (the *1040*'s disk drive is built-in) inserting a printed circuit key into a left hand port (this is a security device to prevent unauthorised copying of the floppy disk) and loading the software disk. Steinberg prides itself on needing only one main display for most *Pro 24* operations although like all Atari software, the program is operated by a mouse-and-menu system and much more additional information can be pulled down from option boxes at the top of the screen. Most operations can also be carried out from the computer keyboard but the mouse is useful for those who prefer not to type.

The computer has a standard typewriter keyboard plus a numeric keypad to the right and uses 3.5 in disks familiar from the Prophet *2000* and Akai *S900* samplers. *Pro 24* acts as a 24-track polyphonic MIDI recorder, of course, only the standard 16 MIDI channels are available but the extra eight tracks are useful for keeping several alternative takes of a melody separately or for recording the left and right hand parts of a complex keyboard piece separately.

Most computer composition packages, including Steinberg's *Pro 16*, operate using the repetition (with suitable muting and transposition) of relatively short sections of music, largely in order to save memory space. *Pro 24* having much more memory to play with, though, acts more like a real tape machine, with the same copying and editing facilities but with a memory large enough to be treated as 'one long piece of tape'. Total capacity depends very much on how the memory is used but it is in the tens of thousands of notes.

Operation

Each of the 24 tracks is marked with a square at the top of the main screen and each can be put into record mode or set to play or to remain silent. The mouse selects Record status from a tape recorder-like control panel and notes are played from the synthesiser chosen as the master keyboard after a variable count-in; performances can be played back in real time or with various quantisation values.

SPECIFICATION

24 tracks
5,000 patterns
200,000 events
Quantise 4/6/8/12/16/24/32/48/64/384 (real time)
Real time/step time record
Note on quantise/note off quantise
Note and event editor
Insert/delete/cut/shift/lengthen/append
Reverse/double speed/repeat/extend/create
Data copy/pattern copy/track copy/multi copy
Track list/track erase/transpose/MIDI delay
Velocity edit and display/solo/mute/drop in-out
Fast forward/fast rewind/auto record and locate
Programmable tempo and time signature per pattern/per song
Split points/dump/MIDI input-output filter
MIDI clock with delay/MIDI song pointers
Pattern and song load and save to disk
Steinberg Research, Billwerder Neuer Deich 228, 2000 Hamburg 28, West Germany. Tel: 040 7898516/66.
UK: Steinberg Research, The Spendlove Centre, Charlbury, Oxford OX7 3PQ. Tel: 0608 811325.
(Thanks to Chromatix, Oak Road, Ealing Broadway Centre, London W5. (Tel: 01-567 3623) for providing demo facilities.)

Tempo is completely variable as is time signature and of course all the recorded tracks will play back as further ones are added. Less commonly, it's possible to make a change to a track and regain the original if you're not happy with the alternative version. It is also possible to assign two MIDI channels to a single track to cope with split keyboard instruments.

A large amount of information is permanently visible on the main *Pro 24* screen; Tempo, Beep (metronome) status, Master Tempo Track on/off (this is an optional invisible control track used to insert tempo changes), Synchronisation Status, Memory Remaining, Recording Start and End Point, Channel and Pattern number, Bar and Beat number are all visible. It is also possible to enter a name for each pattern and song (for instance, Bass 1, Bass 2, Melody 1, 'Song 1'), the name of each synthesiser connected, the MIDI mode and type of MIDI 'note off' code needed for each synthesiser.

Usefully, all this information can be saved to disk when a song is saved if desired so if the studio MIDI set up is fixed, with each keyboard on a known channel, an enormous amount of setting up time can be saved. Multitimbral synthesisers such as the Casio *CZ-101*, Oberheim *Xpander* and SCI *Six-Trax* can be set to mono mode if desired and, of course, patch changes can be recorded as part of a song so the correct patches for each keyboard could be chosen to appear in a blank measure before the music starts.

Recording and overdubbing on the 24 available tracks is straightforward enough. Alternative menus pulled down from the top of the screen include the following:

Desktop: to show the contents of the computer's operating disk.
File: for saving and loading song and pattern information.
Pattern: to display more comprehensive set up information (resolution, length, etc) on one specific pattern.
Track: to display comprehensive information on a complete track.
MIDI: for creating the basic MIDI set up, including Mode and Note Off code for each instrument, saved as part of a song.
Edit: accesses the Edit page.
Fast Access: accesses the most frequently used functions.

The Edit page, the only major alternative display needed when using *Pro 24*, consists of a grid which indicates

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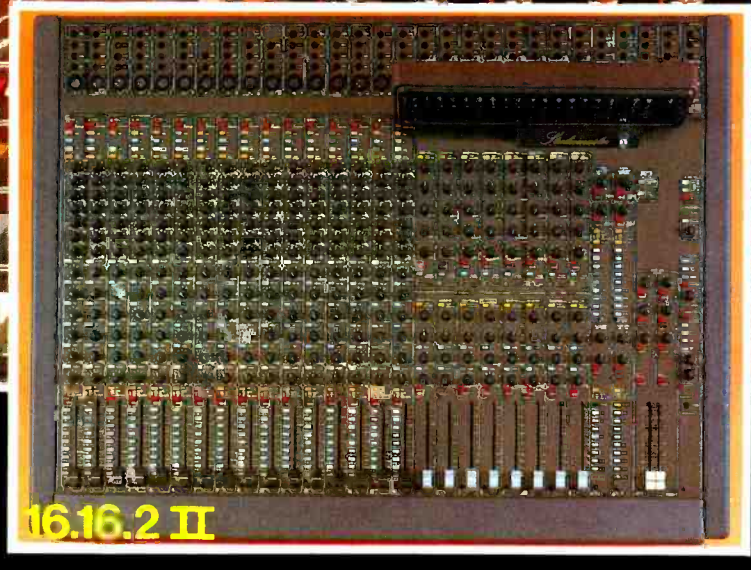
STUDIOMASTER

SERIES II



SPECIFICATIONS

FREQUENCY RESPONSE: 14Hz to 19kHz ± 1dB **T.H.D.:** < 0.02% @1kHz **C.M.R.R.:** –79dB@1kHz **EQUIVALENT INPUT NOISE:** –128dB **CROSSTALK:** –62dB channel to channel @ 10kHz **MAXIMUM VOLTAGE GAIN:** 82dB **DIMENSIONS (L x H x D):** 1016 x 245 x 718 mm (16.8.2 & 16.16.2) 888 x 245 x 718 mm (16.4.2). Input expander 268 x 140 x 718 mm. Tape monitor expander 76 x 140 x 718 mm. **ACCESSORIES:** ALL SERIES II mixers are supplied with an external power supply as standard. Flight cases are available for any SERIES II at extra cost.

THE STUDIOMASTER SERIES II MIXING CONSOLES

For many years now, Studiomaster have been producing high quality mixing consoles which with each phase of development have brought improved standards of mixing within the reach of more people.

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Six auxiliary busses with push-button return routing and a wide range of insert points cater to the growing demand for effects. 4-band input equalisation offers supreme sound control. Other useful features new to this mixer range include push-button output level selection (+4dBm/–10dBv), tape remix function, separate control room and studio cue mixes.

Perhaps the most outstanding feature of the SERIES II is the MIDI controlled muting of auxiliary returns and input channels. "Patches" are set up on a computer screen, then during mixdown or remix, sets of channels and auxiliaries are sequentially muted or switched on leaving you free to adjust fader levels and effects etc. while the computer actually performs the mixdown.

At Studiomaster we perfected the audio aspect of the mixer to give superb sound control and flexibility. THEN added the computer assistance in a clever way which adds very little cost to the desk, and leaves the desk fully operational when the MIDI is not required. All too often, mixers are built with "gimmick" computer features which are in practical terms useless as they create extra work, or their inclusion means sacrificing audio facilities.

The specification of these mixing consoles is superb, which means you can be sure that the mixer quality matches your multi-track machine for first class recordings that can go on to be mastered perfectly.

As always with Studiomaster, your mixer will grow with your demands: after purchasing your mixer and acquainting yourself with it, you can explore the MIDI capability, you can expand your input channels up to 32 (with 8-channel expanders that require NO soldering) and even expand your multi-track tape monitoring up to 16- or 24-track (on the 16.8.2 and 16.16.2 respectively) with an all new retro-fit add-on.

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every MIDI event which has been recorded over the number of bars and beats indicated. The number of bars accommodated by the display varies; the limitation is always the amount of MIDI information present so a single large chord with pitch bend would fill the display while several bars may fit in if they contain only simple repeated notes.

The Edit Page allows the user to enter notes in Step Time (although the quantisation functions on the normal Real Time page are quite comprehensive) and to carry out very fine editing such as altering the velocity of a note, changing its length or reversing a pattern of notes.

Using the main screen and the Edit page a number of patterns can be recorded and tidied up. Overdubbing to change some of the patterns is possible using full drop-in and drop-out functions; the left and right 'Locator Boxes' define the exact passage to be worked on and the count-in to the drop-in point is programmable. The 'Track Information' box shows whether the velocity of recorded notes has been altered and whether the track has been set to record one, or two different MIDI channels, for example when dealing with both halves of a split keyboard sound.

On velocity sensitive synthesisers such as the Yamaha *DX7* the playback volume can be altered for a rudimentary mixing function in addition to the selectable Mute function; this function uses MIDI velocity information and so is not applicable to non-velocity synths even if they respond to MIDI master volume codes.

Whole tracks, or sections of tracks, can be copied and appended to by name, and error messages indicate if you are trying to record over an existing track or recall a non-existent track. The system combines the advantages of earlier software—the ability to copy and edit sections with various changes rather than having to record them again—with the more 'natural' approach of the 24-track tape machine.

Pro 24 leaves options open to the last possible stage and includes a multi-copy function which allows any number of tracks to be merged together once you're certain that none of the component pieces will need to be changed. A simple bass phrase can be repeated many times and a melody or chord line recorded over the result—this is impossible on earlier packages such as *Pro 16* and *C-Lab* which only record over one section at a time. You can experiment with various mute patterns, introducing them at any stage of the composition, and on *Pro 24* there is no distinction between a Song Mode and a Pattern Mode—the Song is simply one very long pattern which can be dealt with in its entirety or in any sections desired by the user.

Synchronisation

While the Commodore *64* and other micros need dedicated MIDI interfaces which can be equipped with various synchronisation facilities, the Atari computers have built-in MIDI and so provide no opportunity to add tape synchronisation, footswitch or DIN synchronisation facilities. Initially the only solution was to use a Roland *SBX-80* which would generate and sync to SMPTE code and produce MIDI clocks and Song Pointers which the *Pro 24* can interpret. This solution has the advantage of allowing *Pro 24* to synchronise to the middle of a song; also available is the Hi-Tec synchroniser which uses its own non-SMPTE 'intelligent' code with MIDI Song Pointers, and Steinberg's MIDI merger which allows you to enter patterns from the master keyboard while *Pro 24* is receiving clocks or Song Pointers from such an external unit.

Pro 24 will also be able to read SMPTE directly, after its first update (see updating notes below), and Steinberg is about to market an interface which offers MIDI, footswitch, tape and other sync facilities but which ironically bypasses the Atari's MIDI socket and uses the RS232 socket instead.

The simplest non-SMPTE tape sync option is to run a MIDI drum machine from tape and use a switch box to decide whether *Pro 24* is being programmed from the mother keyboard or clocked from this external source.

Patch storage

Pro 24 has advanced functions for storing sounds from the Yamaha *DX7* and Roland *JX8-P* synthesisers, the SCI *Drumtraks* drum machine and several other MIDI instruments. An example bank of *DX7* sounds is provided and the synthesiser's memory can be emptied or filled via MIDI in a matter of seconds. This is a useful function particularly when dealing with the *TX816* and larger Yamaha systems since to some extent it makes it possible to save all the correct sounds with each song.

Assessment

The *Pro 24* system is quite imposing at first simply because it is so powerful and offers so many options.

Its operation is not particularly similar to that of *Pro 16*, *C-Lab* or other popular software packages and requires less of a 'modular' form of composition. Having virtually no restriction on memory (particularly on the *1040ST* model) is of course attractive (undoubtedly someone will manage to fill the computer up before long though) and the mouse based operating system (like that on the Southworth *Total Music* system and other Apple *MacIntosh* based programs) is a boon to those who are still a little intimidated by the computer keyboard.

It is possible to get a little lost amongst all the options available but since the memory capacity is there, it would have been foolish not to have given the program all the possible functions. Certainly for the price, the system is much more comprehensive and approachable than a dedicated hardware sequencer with no screen display such as the Linn *9000* and Yamaha *QX1*. The system is not well suited to live performance due to the delicacy of the computer but it would be easy to dump its contents into a dedicated sequencer.

The disk saving system is fast and reliable and the computer itself has a reputation for being well constructed. A large number of software packages in the business and graphics fields are easily available for the machine.

Experienced users report that *Pro 24* is speedy in operation and highly user friendly. Overall the package represents an excellent investment particularly considering the update service. In the UK, purchasers are entitled to 12 months' updates for a single subscription of £34.50. The first updates include the colour monitor option and SMPTE reading.□

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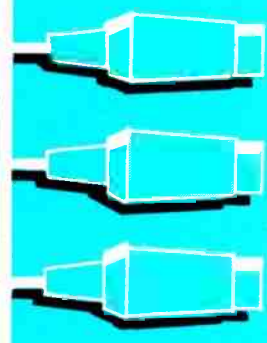

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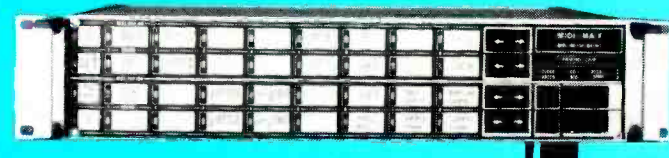

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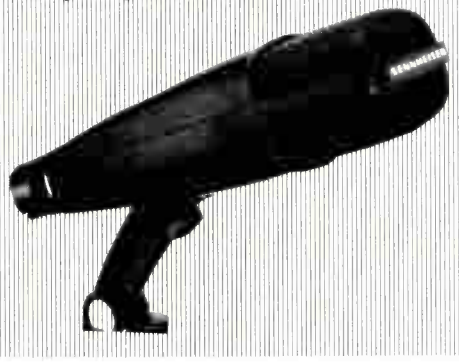

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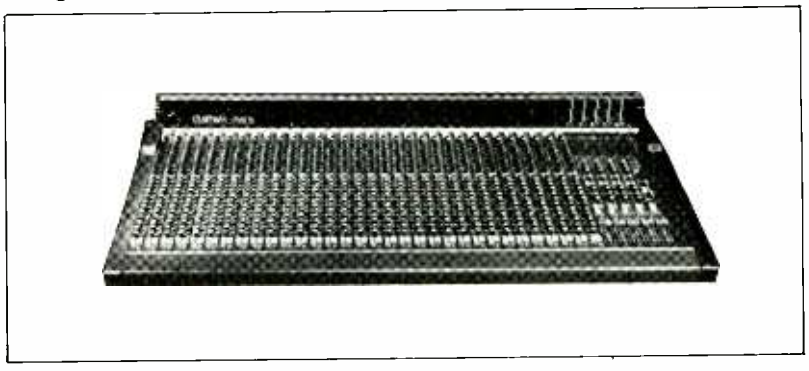

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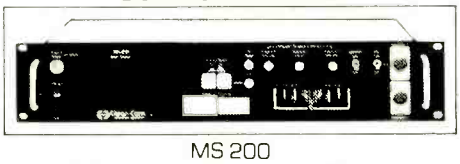

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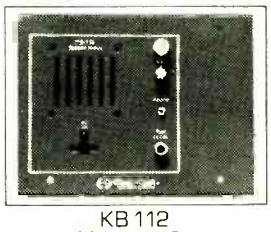

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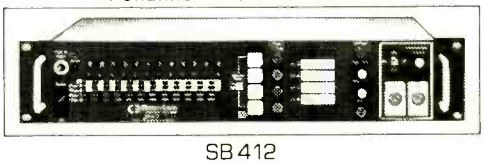

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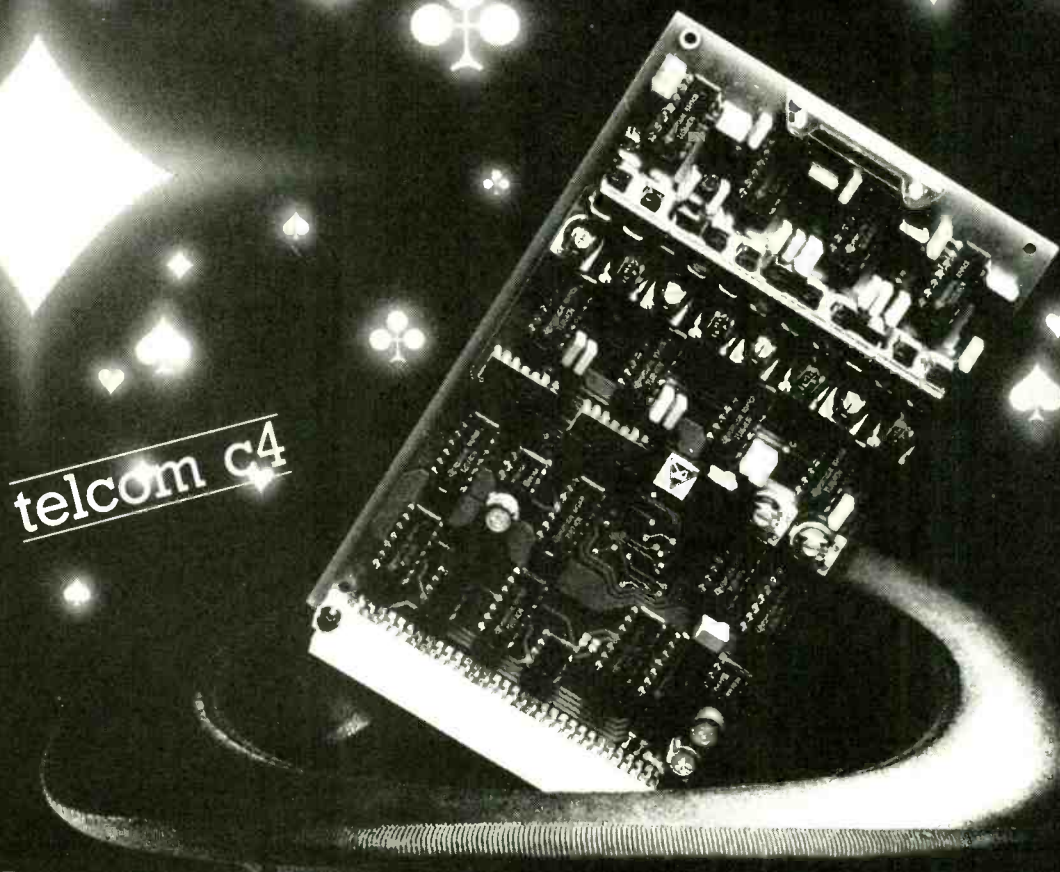

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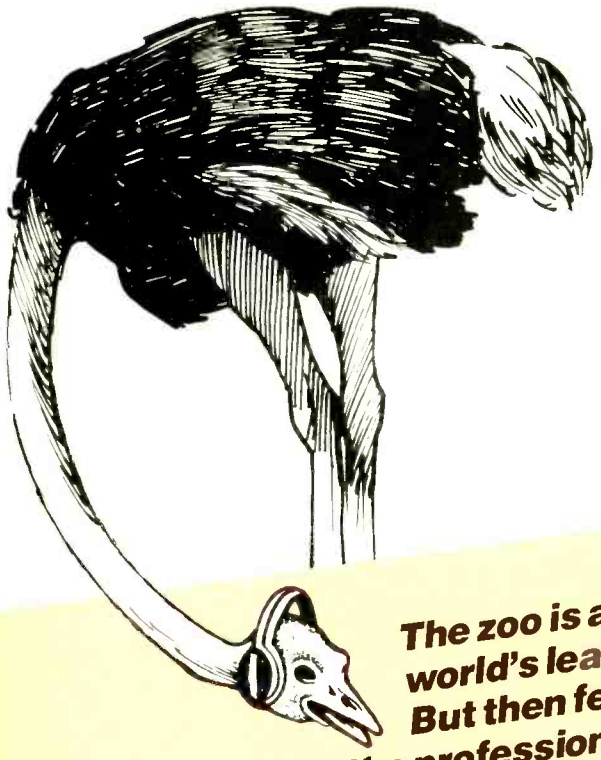

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DAY 2 Wednesday 26 November
DIGITAL RECORDING & COMPACT DISC

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- Audiofile: Music Recording & Editing with Hard Disk
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- Compact Disc Market Update
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DAY 3 Thursday 27 November
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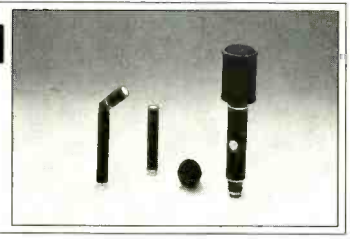

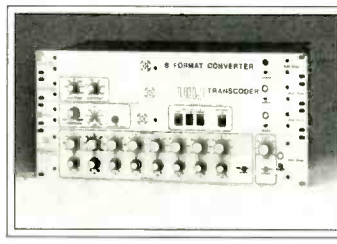

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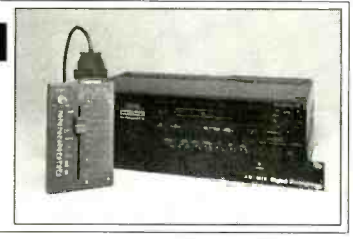

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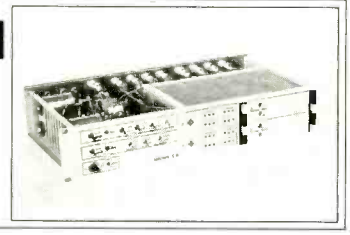

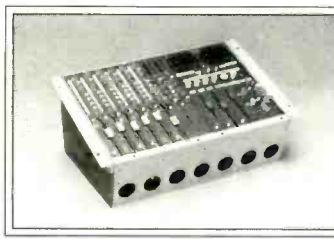

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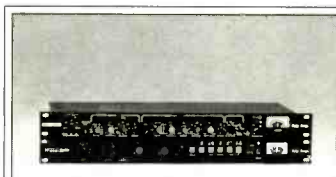

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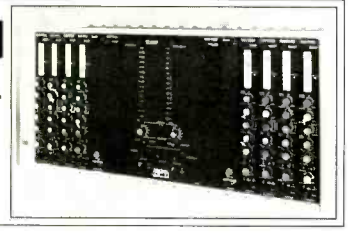

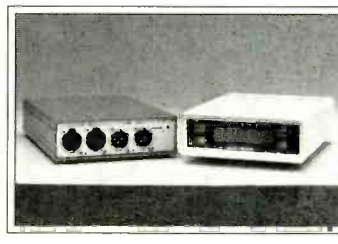

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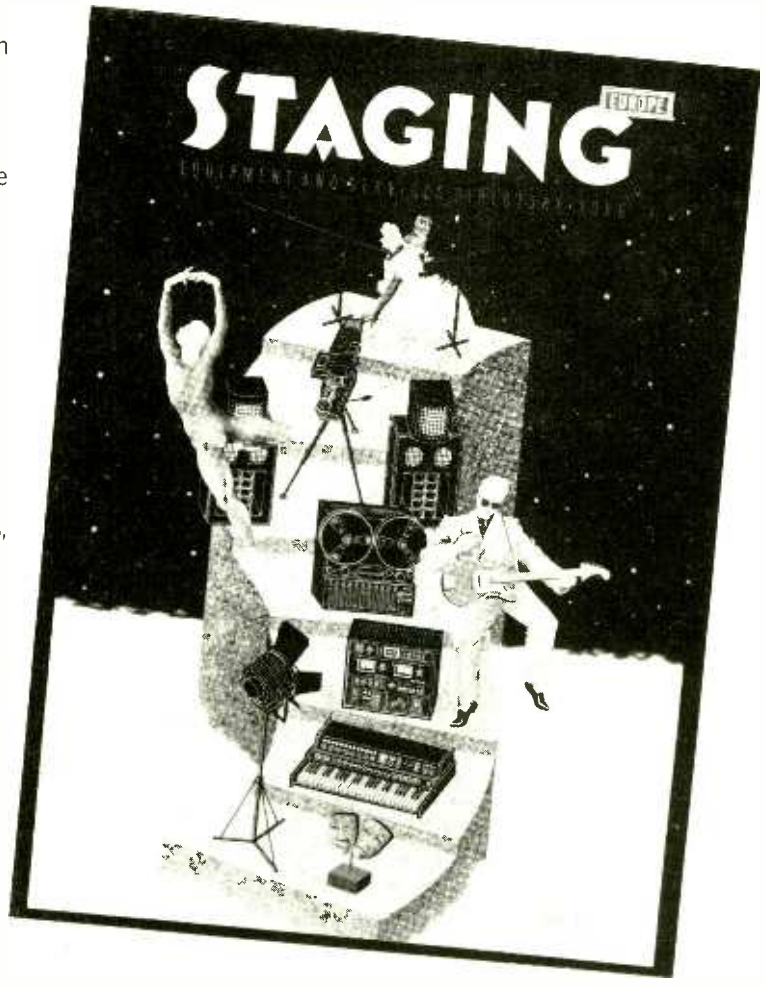

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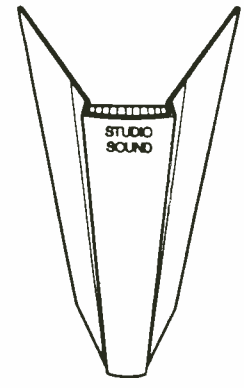

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STUDIO SOUND'S

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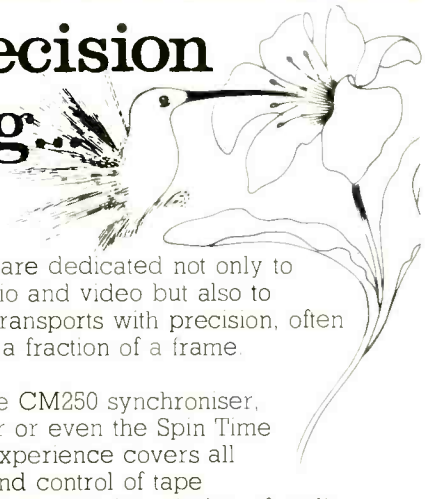

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Harrison 32/32 32 fitted with Alison automation, 65K programmer, usual bits, very nice console (we are not certain of the age of this console at the time of printing, please phone for details)	P.O.A.
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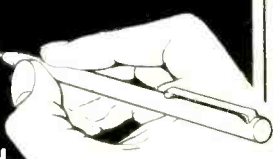
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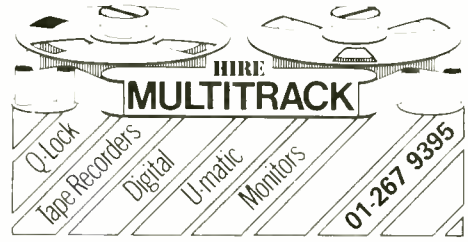

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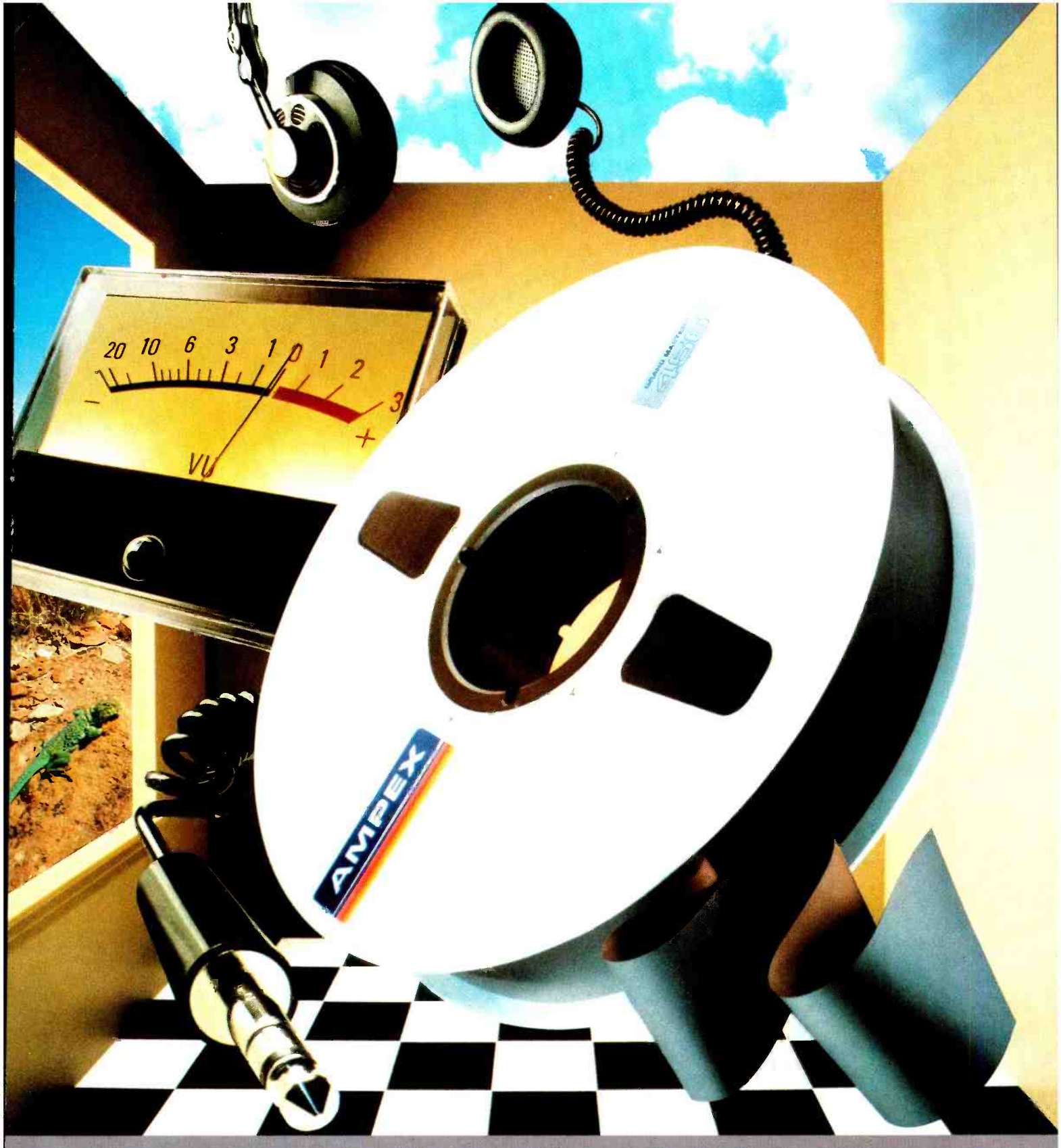

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