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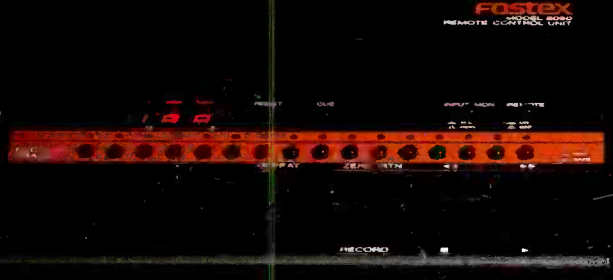
studio sound

AND BROADCAST ENGINEERING



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studio sound
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JULY 1983
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Cover: The Fostex *B-16* 16-track recorder, reviewed on page 104. Photo by Roger Phillips

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Editorial

Technology, technique and training

We live in a technological society, and the recording industry is one of the highest-technology industries around. Surrounded by technology in the studio, it is very easy to lose track of what we are trying to do—which is to express creative ideas through that technology, whether the end result is the sound at a live concert, a record, a video soundtrack or a commercial. From time to time, this fact is pointed out to us, an excellent example being the interview with Glyn Johns that we published a couple of years ago. Technology does not exist in a vacuum: with it comes a set of *techniques* which enable us to use the equipment. For most people, those techniques are operational ones: like the average car driver, we do not also need to be mechanics (although we do have to remember and know enough to look after the gear in a day-to-day fashion, whether it is remembering to fill the tank with petrol or lining up the tape machine for a different operating level). In many ways it makes sense to think of the technology as including both the hardware *and* the operational techniques that go with it.

Very often, the operational knowledge required for a piece of equipment—even very advanced gear, like a console automation system—is quite straightforward. We learn how to drive the gear by a combination of what we are given in the manual plus a good dose of experience—ours and that of other people, if we are working in a studio, or our experience alone in the case of, say, someone using a 'home recording' system outside the studio environment.

But however complex the equipment, and however simple (or otherwise) the operating knowledge, it is very tempting to regard the two as sufficient on their own to do a good job. This is, of course, not the case: there is another ingredient that is vital to the recording industry (and many other industries too, particularly in the entertainment sector) and that is creativity. Creativity is something that gives every indication of being an innate quality which, when added to our knowledge of how to drive the equipment, enables us to do something useful, something 'artistic', something more than the traditional job of the 'recording technician' (which was simply to get the music on to disc or tape).

Of course, there are those who believe that creative intervention by the recording engineer (or the producer, for that matter), beyond simply translating musical requirements into sound engineering practicalities and performing them is an anathema: that the job of the recording engineer *is* simply that of a technician, accurately capturing musical ideas. While there are no doubt producers and engineers who 'overproduce'—who transform an artist's work into something quite alien to the musicians concerned—I tend to feel that engineers and producers *do* have a creative role to play in all but the simplest (a stereo mic in front of a concert-hall orchestra) recording sessions. Surely, I would suggest, we must regard an album, say, as the end product of a studio team, one which is largely the band, but also includes influences and ideas from the engineer and the producer in a creative sense. Certainly there is an ethical question here concerning how far studio personnel *should* creatively influence an artist's music, but it is a question of degree rather than basic concept. We cannot, surely, necessarily expect the band to be expert at the possibilities of the modern studio, just as we cannot expect the lead guitarist to be an excellent keyboard player. As the musical abilities of individual band members are complemented by each other, should we not also allow the band to be complemented by the studio engineer and the producer? If so, then we must ask how the engineer develops such creative talents. Just as a musician, however creative and imaginative, does not become a virtuoso performer merely by reading the instruction manual supplied with a new instrument (or even by taking lessons on how to play), a recording engineer does not become a 'virtuoso performer' merely by learning how to do overdubs or drop-ins, or by studying mic technique.

This, of course, is where creativity comes in. An artist of any kind needs to have both a 'message' (whatever it may be) and the expertise—the command of relevant technique—to get that message across via the chosen medium. Creativity in our field might be described as the mixture of both—the message and the medium may be as close as McLuhan portrayed them in the sense that the message may well be 'arranged' for the medium, just as, for example, Mike Oldfield's *Tubular Bells* could not have have existed without the modern recording studio.

Unfortunately, the question 'What is creativity?', apart from being a difficult one, is impossible to take much further here. More relevant to today's studio people is, in fact, how expertise is developed. In Britain, and perhaps even in North America, the answer is 'with difficulty'. As the recession has hit the studios, they have tended to reduce staff, and with the benefits of modern technology, particularly the autolocator, studios have tended towards 'self-op' configurations in which the second engineer or tape-op is an unnecessary, expensive luxury. Although the major studios on both sides of the Atlantic still employ assistant engineers, they do not account for as great a percentage of recordings as they used to, and they alone provide only a very narrow and restricted avenue through which new recording engineers can enter the industry.

In smaller studios even this avenue does not exist. Many smaller facilities are operated by the people who own them; they are used by the owners or by engineers from elsewhere and they are often maintained simply by calling the manufacturer when things go wrong.

The industry therefore relies on the educational system to provide new 'talent', but here the situation is quite appalling. What is needed is an accredited 'entry level' course which will supply the people—on both the maintenance and the balance sides—which tomorrow's studios will need; this course almost certainly would need to be part of the national educational system. And with educational budgets cut on both sides of the Atlantic this seems a long way away. But without such a course, or courses, the recording industry will soon be in quite a state. On the balance side, the industry will have to rely on the training given by a few major studios to supply all its needs—this limits the potential size of the industry (perhaps it is all too realistic) but also puts a burden on the major studios to operate with higher staff overheads than their competitors. On the maintenance side the situation is even worse, as there is no course which will be able even to take engineers from other parts of the electronics industry and train them for the pro audio environment, let alone train audio technicians from scratch.

Overall, the future looks rather grim.

Richard Elen

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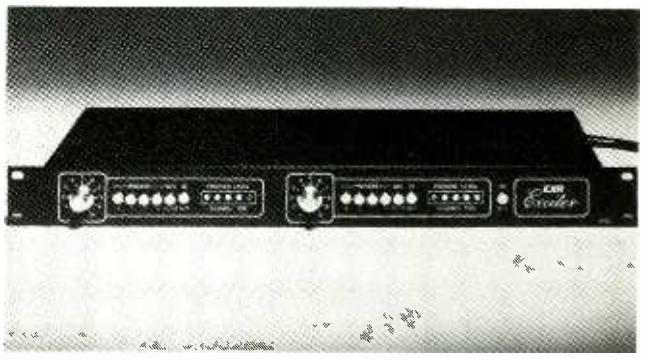

Excitement for Disbelievers Two new psychoacoustic processors from EXR. Success in both broadcast and recording studios, has resulted in development of specialist units to enhance sound using their patented process, yet offering a degree of control. **Stand 65/66**

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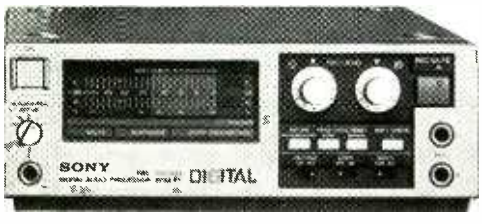

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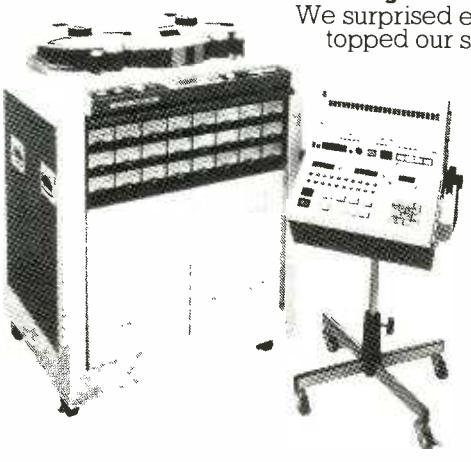

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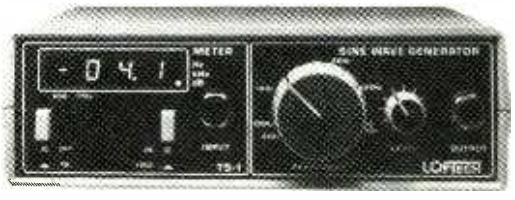

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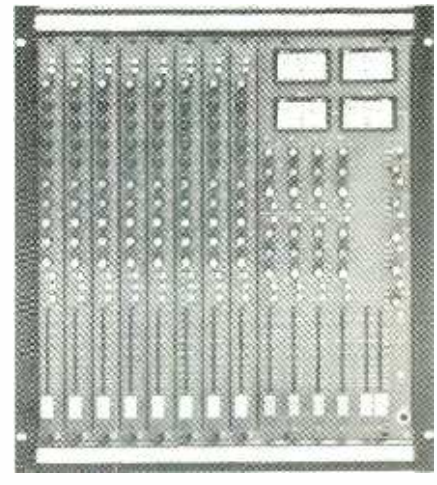

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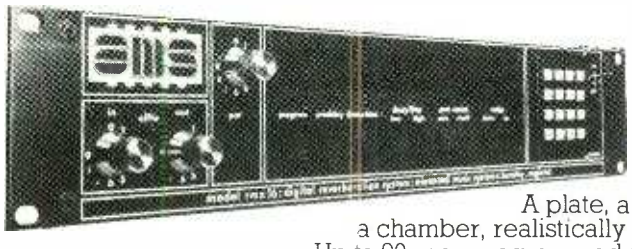

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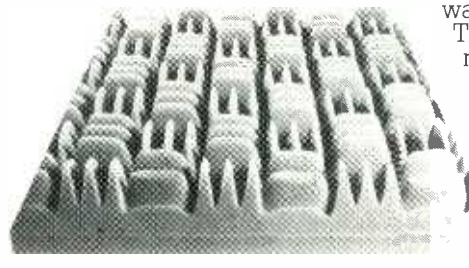

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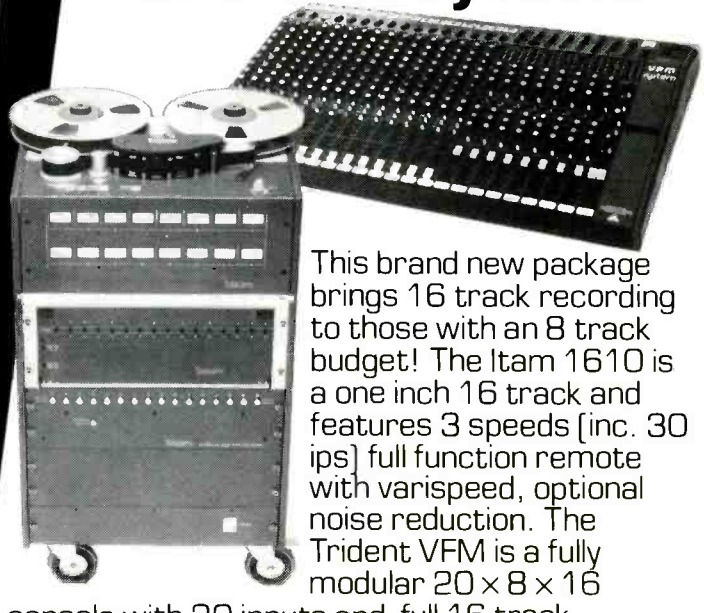

This brand new package brings 16 track recording to those with an 8 track budget! The Itam 1610 is a one inch 16 track and features 3 speeds (inc. 30 ips) full function remote with varispeed, optional noise reduction. The Trident VFM is a fully modular 20 × 8 × 16 console with 20 inputs and full 16 track monitoring. Special Offer (subject to stocks):

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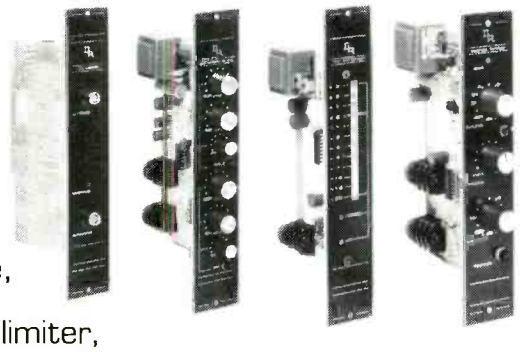

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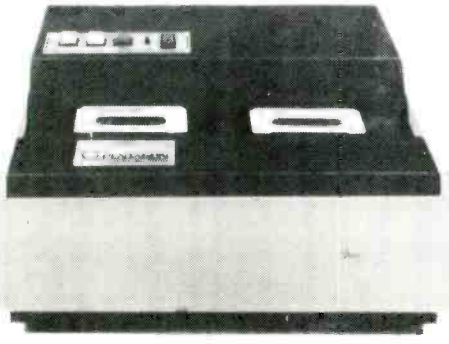

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407 ¼ 10½ NAB	11.95	11.45	10
456 7 inch	5.65	5.25	10
456 ¼ 10½ HUB Bulk pack	—	7.20	10
456 ¼ 10½ NAB spool	10.45	9.90	10
456 ½ 10½ NAB	18.95	18.00	7
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456 2 inch 10½ NAB	62.50	59.50	2
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457 7 inch (LP)	6.95	6.60	10
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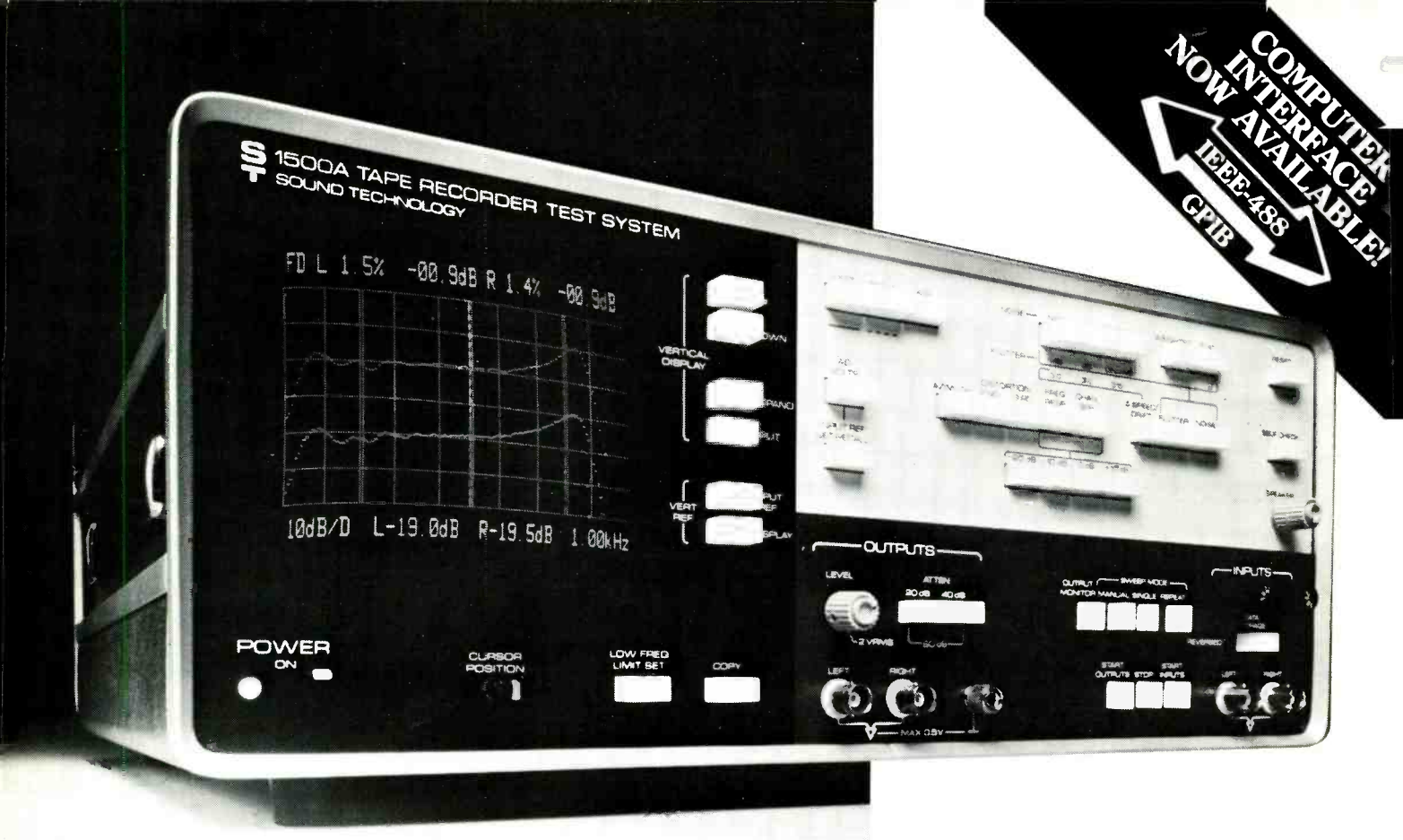

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Because of the modular plug-in design, the 1500A is designed to grow with you. Many accessories are now available which include a 1/3 octave spectrum analyzer card (noise: 20Hz-20kHz, Wow & Flutter, .5Hz-200Hz) that easily plugs into the mainframe; a hard copy printer; a comprehensive test record that lets you test cartridges, tonearms and turntables; a balancing system that will allow you to interface balanced I/O test applications; and a heavy-duty transport case. There's even a kit for rack mounting.

Add to the above the powerful new GPIB, IEEE interface for computers, and you have an extremely broad range of functions and applications that the advanced 1500A can tackle.

Who Can Use It?

Broadcaster. Recording studio. Film sound studio. Audio manufacturer. Audio dealer. Service technician. Researcher. Virtually anyone whose job requires accurate evaluation of audio equipment performance. Wherever you are in the audio spectrum, it can make life a whole lot easier.

Clean up your act with the 1500A. It's intelligent. And so is a phone call to Sound Technology. We'll be pleased to send full information on the 1500A and our other industry standard test equipment.

SOUND TECHNOLOGY

Precision Audio Marketing
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Virginia Water, Surrey, U.K.
Tel: Wentworth 4416

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Since 1950 Bauch has supplied the finest products and an unrivalled service to the professional sound recording and broadcast industries.

Today, with the inclusion of broadcast video and semi-professional sound divisions, Bauch is actively satisfying the requirements of the entire spectrum of communications industries.

Bauch offers a complete service for the design and installation of professional audio and broadcast video systems: an all inclusive service combining up-to-the-minute technology and skills with individual and personal attention.

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For permanent installations. All controls are behind the removable front cover for cost effective tamper-proof equalisation.

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STAND NO. 68

A.P.R.S. 22nd, 23rd, 24th JUNE 1983

TEL: 01-943 1368

THE MORE-AFFORDABLE 948.

From the makers of the world's finest broadcast turntables comes the EMT 948, a direct drive unit that embodies the proven circuitry and reliability of the EMT 950 in a compact format.

Featuring almost instant start (0.02 secs), stop and reverse cue; motor-driven tone-arm lift and integral amplifiers, the EMT 948 has a new shock-absorbing system and pick-up illumination.

Available for use with a standard 47k-ohm cartridge, the EMT 948 is an integrated system ready to drop straight into a desk-top. The EMT 948 brings excellence within greater affordability.

For further information contact F.W.O. Bauch Limited.

EMT FRANZ GmbH
Postfach 1520. D 7630 Lahr Tel 07825-1011. Telex 754319 Franz D.

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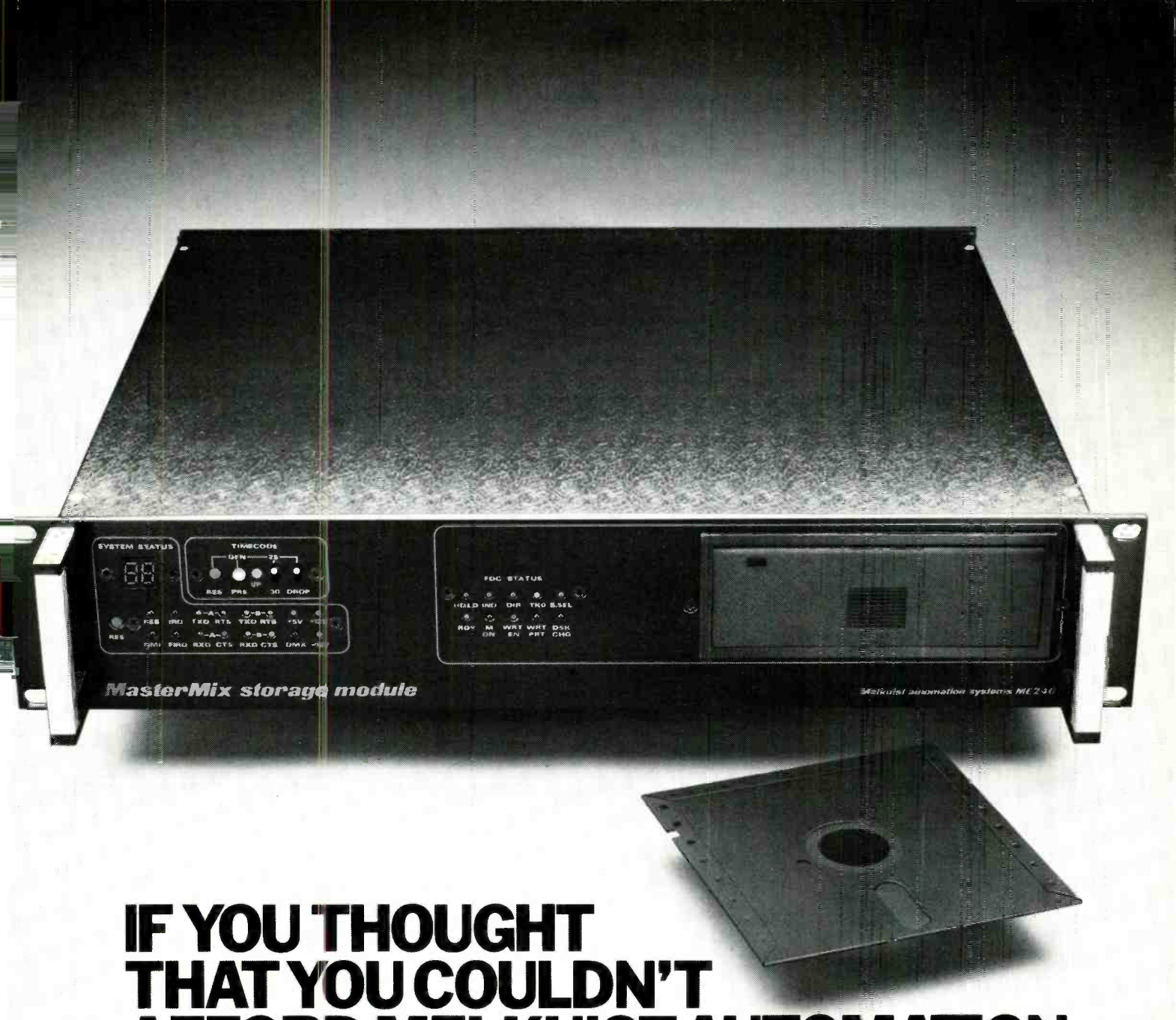

IF YOU THOUGHT THAT YOU COULDN'T AFFORD MELKUIST AUTOMATION, THINK AGAIN.

Practical, versatile and easy to operate, the new Melkuist Mastermix generation of automation systems reflect the Melkuist design philosophy of extending the power and performance of the engineers art.

The microprocessor based storage unit reproduces fader movements and mutes within single frame accuracy and features integral high density disk storage and a multi-standard SMPTE time code reader/generator system.

Melkuist Mastermix utilise the very latest developments in semi-conductor and floppy disk technology to provide high performance at low cost.

Complementary front-end modules have been custom-engineered for the full range of VCA fader types currently used in mixing consoles: not only the processor-based grouping systems of Harrison (Series 4), and MCI, but also the Melkuist and Fadex.

Designed by musicians for musicians, Melkuist Mastermix works quietly in the background, leaving the engineer free to concentrate on the mix.

Melkuist Mastermix. Combining versatility with high performance.

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Telephone: 0582 416028 Telex: 825828

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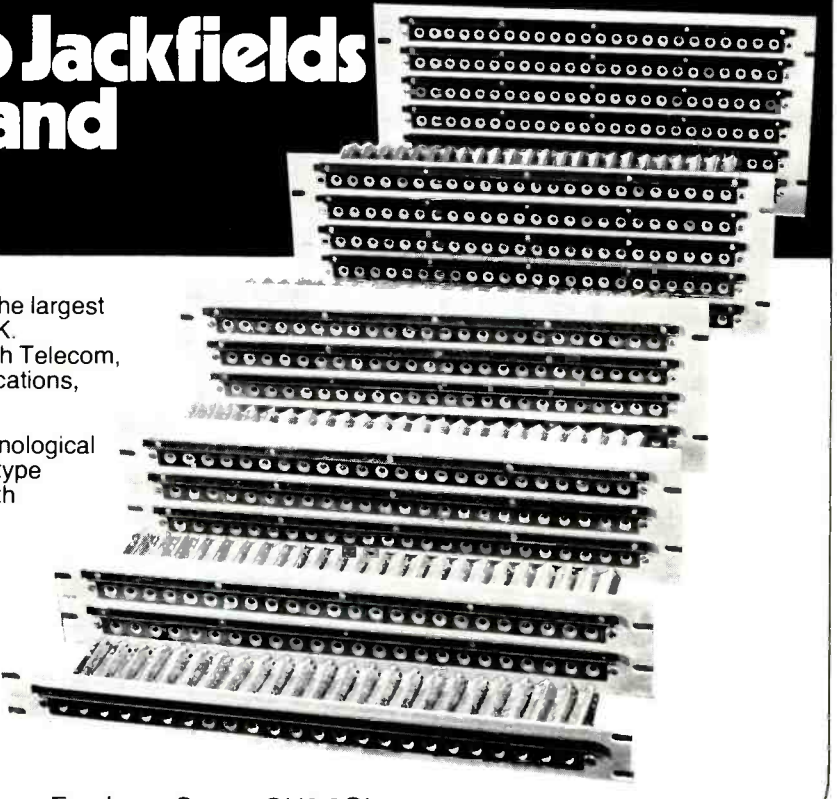
Audio & Video Jackfields for Recording and Broadcasting



Mosses and Mitchell are recognised as being the largest manufacturer of Jacks and Jackfields in the U.K.
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NEVE TODAY

Spring 1983

Welcome to the first issue of our news magazine. As designers and manufacturers of audio mixing, control and distribution systems since the early days of the industry, we have many installations throughout the world in quality radio, TV production, film and recording studios. Future issues will describe an interesting selection of such installations as well as report on the fast developing Digital audio scene.
This issue's publication is due to coincide with the TV Symposium at Montreux so its main coverage is on items of specific interest to Broadcasters. We hope that they will stimulate you to look for a Neve solution to your audio projects.

Laci Nester-Smith
Group Managing Director

Live Theatre Ancient and Modern

Between a Victorian public house and a disused cinema, facing the common in Shepherd's Bush, London, stands the BBC Television Theatre. Originally the Shepherd's Bush Empire built in 1903, this impressive red-brick building was acquired by the BBC in the early 1950's and converted into a "live" television studio specialising in light entertainment programmes.

Inside, much of the original fabric remains including most of the seating although, the stage, orchestra pit and all the stalls to the right-hand side of the centre gangway have been removed to make way for a modern TV studio facility.

Working together with their BBC colleagues, Neve's engineers had to find solutions to several problems. Firstly, one of the space and shape – the new sound mixing console had to fit the control room perfectly and yet be 'spot on' ergonomically. Secondly, difficult access meant the console was going to be fork-lifted through a specially created hole in the wall into the control room. This meant the console had to be capable of being dismantled into sections for installation. Thirdly, the variety of productions called for unique flexibility in arranging the physical position of the group faders.

There is always an enormous demand for tickets to the shows and waiting lists are usually quite long but, if you are interested in seeing what must be the only Theatre/TV Studio of its kind in the world, then the experience is worth waiting for. Information can be obtained from the BBC Ticket Unit.

Audio Control Room

BBC Television Theatre, Shepherds Bush

Neve Audio Systems

The name of Neve is known worldwide as the manufacturer of fine audio consoles but Neve has also become renowned for the supply of complete audio systems constructed to the same high standard as all the company's products.

OB Vehicles for NOS

Projects handled by the Systems Department cover the whole range of the broadcasting and music recording industries – from local radio stations to national broadcasting centres, from an OB Vehicle to a multi-studio recording complex.

1982 was an excellent year for the Systems Department. It saw the completion of the seven month installation programme of broadcasting equipment into the new Conference Palace in Baghdad. A consortium of three European suppliers – Neve, Bosch-Fernseh of West Germany and Sajkoltokheiden Oy of Finland – handled the installation of all audio, video and lighting equipment, with Neve taking care of the audio side, of course. The work was completed on time, despite the problems caused by the political tensions in that part of the world.

This contract was followed by a three-studio recording complex for Farian in West Germany, the re-equipping of five radio studios in Dubai and installations for the Arab Broadcast Union Training Centre in Damascus.

Nearer at home, was the supply and installation of all audio equipment for Britain's latest television company TV-AM.

TV-AM Studio A with Neve 5106/24

But Neve engineers do not restrict themselves only to fixed installations. During 1982 they were responsible for equipping the audio cubicles in two outside broadcast vans for Bosch-Fernseh and for the complete construction of three multi-track recording and broadcasting vans for NOS in Holland.

The systems section of the Neve organisation has been built-up over many years with experience gained from numerous contracts undertaken as far apart as Radio Stations in Papua New Guinea and TV studios for the BBC and ITN in London.

Just one of the hazards

1983 will be another record year for Neve systems. During 1983 installation teams will be working in Syria, Dubai, Holland, Egypt, Thailand and Northern Ireland. One of their largest assignments will be the complete audio package for the new studio complex for Central Television in Nottingham.

Neve is not just the manufacturer of the finest audio consoles in the world, it is also one of the foremost suppliers of complete audio systems.

News from North America

Neve's influence in North America can be seen from New York to Los Angeles, from Quebec to Florida. From the major networks of ABC, CBC, CBS, NBC and PBS, to local stations such as WFSB in Hartford, Connecticut, Neve has won respect in this very demanding market.

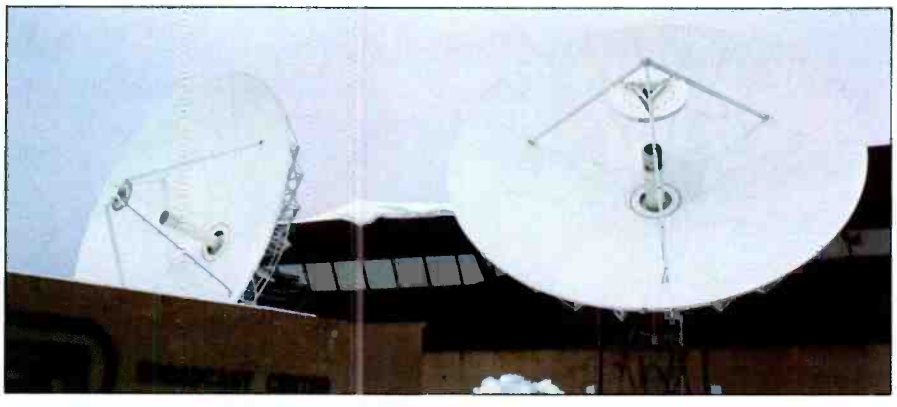
Rupert Neve Inc., Bethel, Connecticut

The needs of North American broadcasters are served by their own Neve company. Rupert Neve Incorporated is located in Bethel Connecticut with an office in the heart of the action on the West Coast in Hollywood and provides Sales and Service to the USA and Canada.

The Sound of Neve, via satellite

In the heart of New England lies one of the world's major satellite broadcasters, ESPN, beaming sports programming 24-hours a day across the United States. Neve recently bid, and won against intense international competition, a $350,000 contract, part of a general re-equipping program to replace existing audio consoles in ESPN's fleet of outside broadcast vehicles. Both companies' personnel worked closely together to ensure that installation and commissioning of consoles could take place on site as and when trucks were released from engagements.

All pre-wiring was done before delivery, minimising down-time and hence additional costs. The new consoles have helped ESPN maintain their leadership in sports broadcasting.



TELEVISION POST PRODUCTION

Neve is well known in film circles with such household names as Lucasfilm (of "Star Wars" fame) and in recent years has found equal success in television post production. With their 542 "one inch" audio consoles and the impressive 81 series NECAM computer-assisted mixing consoles, nearly 100 edit rooms now enjoy Neve audio.

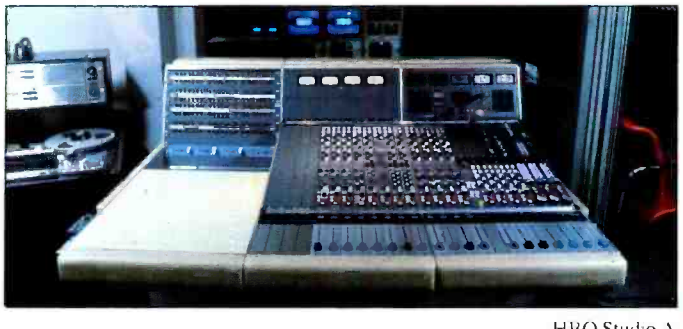
One such complex is the Skaggs Video Center in Salt Lake City. A Neve 8108/32 console fitted with NECAM II is linked to an AMPEX ATR124 and SONY BVU800 video tape machine.

Their NECAM II system is fully compatible with over 40 other NECAM systems in operation in North America, ensuring business from any areas. Skaggs also use Neve consoles in their main production area.

The great Neve movie

In the USA, on cable television, you can usually watch around 30 different channels of entertainment, the American way.

Home Box Office provide a complete programming schedule 24-hours a day to cable operators on two channels and three time zones. Neve have been chosen seven times as the major contractor for audio equipment. The latest is for 300 distribution amplifiers with associated dual power supplies worth over $100,000, to be installed at HBO's satellite transmission network. The new network will be fully stereo equipped and Neve have had to build and install all the equipment in just 6 weeks.



HBO Studio A

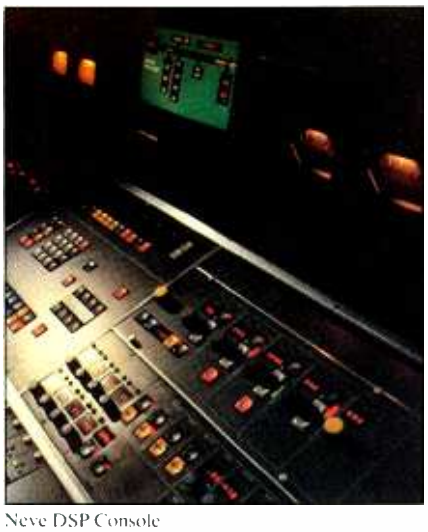
Neve Today Neve

Neve Leads in Digital Standards

Neve's development work on the FULLY DIGITAL Sound Mixing Console (DSP) is now coming to fruition with the first of the series being assembled for operational service.

The DSP console will lead to new heights in sound quality and automation. The quality degradation which would be caused by the multiple conversions and reconversions between analogue and digital will be avoided. This coupled with the complete assignability of the DSP represents a leapfrog in technology over any known form of analogue desk.

This ultimate in quality requires all the equipment to interface satisfactorily and this is where Neve has played an important role. Neve's Technical Director, Dr Martin Jones, together with colleagues of the Digital Standards Working Party agreed final recommendation for the details of interface specifications at the Audio Engineering Society's convention at Eindhoven. The 48kHz sampling rate is now formally agreed as the professional standard and the AES digital interface format is the *de facto* standard for interconnection.



Neve DSP Console

After the convention Dr Jones said: "This has been an historic occasion marking the European launch of the Digital Audio Compact Disc – the beginning of a new epoch in audio. The quality now available to the home listener is such a tremendous step forward that it is as good as a direct line to the studio mixing desk. It is fitting that the ALL DIGITAL SOUND Studio System should become a reality at the same time as the Compact Disc".

The new heights in listening quality brought by the CD, brings the focus on to quality of production in the studio; thanks to the standards agreement this, too, can now take a quantum leap forward with an ALL DIGITAL line.

Neve in Japan

The Neve Slogan "The Sound of Neve is Worldwide" is certainly borne out with over 40 installations in Radio and TV Broadcasting and Recording Studios in Tokyo and Osaka. One of the newest of Tokyo's music recording studios is the very beautiful studio of EMI Toshiba. This attractive studio has been designed to present a lively and bright atmosphere both from the viewpoint of appearance and the 'normal' mode of the variable acoustics. Centre piece of the control room is a new Neve custom built multitrack mixer which is the second comprehensive Neve mixer in the EMI Toshiba complex. Just a few of the organisations in Japan who have specified Neve are: NHK, CBS-Sony, Fuji TV Yamaha, TBS, Mainichi-Hoso, Asahi.

Neve are enthusiastically represented and supported in Japan by:

ゼネラル通商株式会社
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Marukoshi Building
2–19, Kanda Tsukasa-cho
Chiyoda-ku Tokyo 101 Japan.

Neve on show 1983

Because of the wide range of audio industries served by Neve (TV, radio, video, film and music) and the worldwide sales of its audio products, Neve is represented at most major professional Exhibitions and Conventions throughout the world.

MIDEM	– Cannes, France	– January
AES	– Eindhoven, Netherlands	– March
NAB	– Las Vegas, USA	– April
TV Montreux	– Switzerland	– May
APRS	– London, UK	– June
AES	– New York, USA	– October
Radio Show	– Birmingham, UK	– October
VIDCON	– Cannes, France	– October
Photokina	– Cologne, Germany	– October
Interbee	– Tokyo, Japan	– November
CTEAP	– Paris, France	– December

Visit us at these and also at our Headquarters in Melbourn, where we have a demonstration room with a fully-working Digital Audio System. We look forward to welcoming you.

CO DESIGN UK

Neve

Neve Electronics International Ltd. Melbourn, Royston, Herts, SG8 6AU, England Tel Royston (0763) 60776. Telex 81381. Cables Neve Cambridge

Rupert Neve Inc. Berkshire Industrial Park, Bethel, Connecticut 06801, USA. Tel (203) 744 6230. Telex 969638

Rupert Neve Inc. 7533 Sunset Boulevard, Hollywood, California 90046 USA. Tel. (213) 874-8124 Telex 194942

Rupert Neve GmbH 6100 Darmstadt Bismarckstrasse, 114 West Germany Telex (003) 419581

STUDER RE-STATES THE ART.

With the new A810, Studer makes a quantum leap forward in audio recorder technology. Quite simply, it re-states the art of analogue recording.

The STUDER A810 is a microprocessor controlled audio recorder which in addition to total microprocessor control of all transport functions and electronics switching, also offers a set of three "soft keys" which may be user programmed for a variety of functions. These can be selected from a library of: autolocate (up to four addresses), start locate, fader start, tape dump, remote ready, code channel ready, and a choice of two lifter defeat modes.

The A810 also provides programmable audio electronics, a revolutionary system which stores electronic alignment parameters (level, bias, equalization, and erase) for different tape formulations in memory for instant recall at the push of a button. Trimpots, normally used for this function, have been eliminated. The machine even lines itself up everytime it is switched on.

Other features standard on the A810 are quartz-referenced capstan speed control, zero locator, real time counter with +/– readout, four selectable tape spooling speeds, self-sync, meters switchable for VU or PPM indication, phase corrected record and reproduce amps, calibrate/uncalibrate buttons, and monitor speaker.

The A810 offers time-coincident SMPTE code on a centre track between both audio channels. Audio/code crosstalk rejection is better than 90 dB, while an internal digital delay automatically compensates for the time offset at all speeds.

Just write or 'phone for full details.

Studer A810. A quantum leap.

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CH-8105 Regensdorf Telephone (01) 840 29 60

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QUESTION:

Which range of studio monitors, apart from the new Tannoy SRM Series with SyncSource,™ provides a single point sound source for all monitoring applications?

ANSWER:

The New SRM Series with SyncSource.™ A range of time compensated single point sound source monitors from:

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Bringing Music Back to Life

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and in the **USA & Canada: Tannoy Crown,**
97 Victoria Street N, Kitchener, Ontario, Canada
N2H 5C1. Telephone (519) 745 1158 Telex 069 55328

THE CASSETTE DECK FROM STUDER. NEED WE SAY MORE?

Only now, years after the original launch of the Compact Cassette, have Studer put their name to a cassette deck – the Studer A710.

Its everything you would expect from Studer. Impeccable performance. Precision engineering. Die-cast Aluminium construction. In-built longevity. In short, Studer quality, flexibility and reliability.

Its features include:

- ☐ Balanced line in and out on XLR connectors
- ☐ Separate input and output controls with calibration button
- ☐ Full remote control, including fader start
- ☐ Four motors: two spooling and two capstan
- ☐ Three head design for maximum precision with separately adjustable azimuth
- ☐ Suitable for rack mounting

The new A710. The Studer name says it all.

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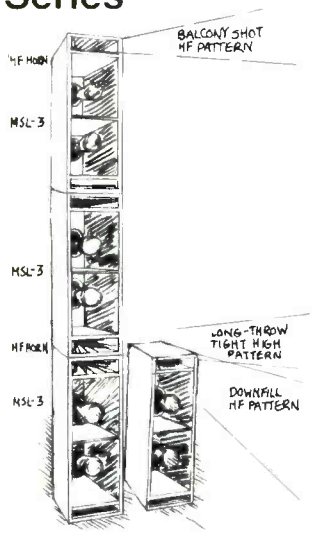
Technical Information Series



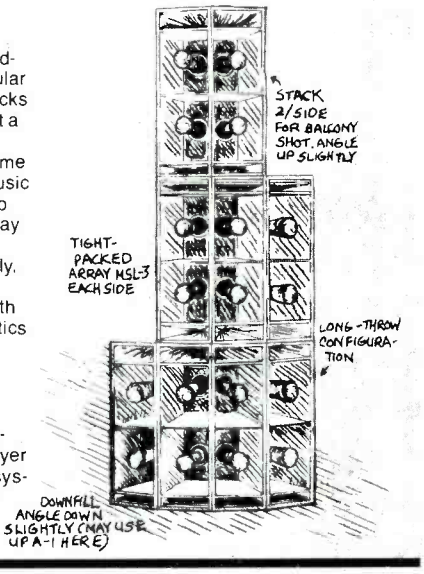
Topic 1
Loudspeaker Arraying

At Meyer Sound, we've applied over a decade of research and field experience to the production of a growing line of reinforcement loudspeaker systems optimized for arraying, and we've developed sets of simple, clear guidelines for applying these systems. For the professional user, calculation and experimentation are replaced by a body of dependable techniques offering the means to make arrays which afford consistent, exceptional performance.

Polar Control
An important key to this performance is careful control of polar response. Meyer Sound reinforcement systems are designed to be coherent not only in terms of phase, but also in terms of propagation. For this reason, the crossover transition in Meyer systems is smooth and seamless, and frequency response remains consistent over long throws. In arrays, propagation coherence means smooth addition between adjacent units, minimizing lobing and producing a coherent image of the source behind the array. In practical terms, this means even, controlled coverage, greatly enhanced clarity, and little or no need for room EQ.

Modular Design
Meyer Sound reinforcement loudspeakers are designed as modular systems: full-range building blocks which offer the flexibility to meet a wide variety of demands. This means, for example, that the same product which serves for live music reinforcement in a 500-seat club can be used to make a large array for voice reinforcement in a 15,000-seat sports arena. Finally, since the array retains the performance of the modular unit with which it is made, its characteristics are predictable.

User Orientation
For the professional in the field, dependable real-world performance is the ultimate goal. At Meyer Sound, we direct our efforts in system design and documentation toward making that goal more achievable. If you would like more information on the theory behind our arrayable systems, and how these systems can be made to work for you, call or write us today.



Meyer Sound

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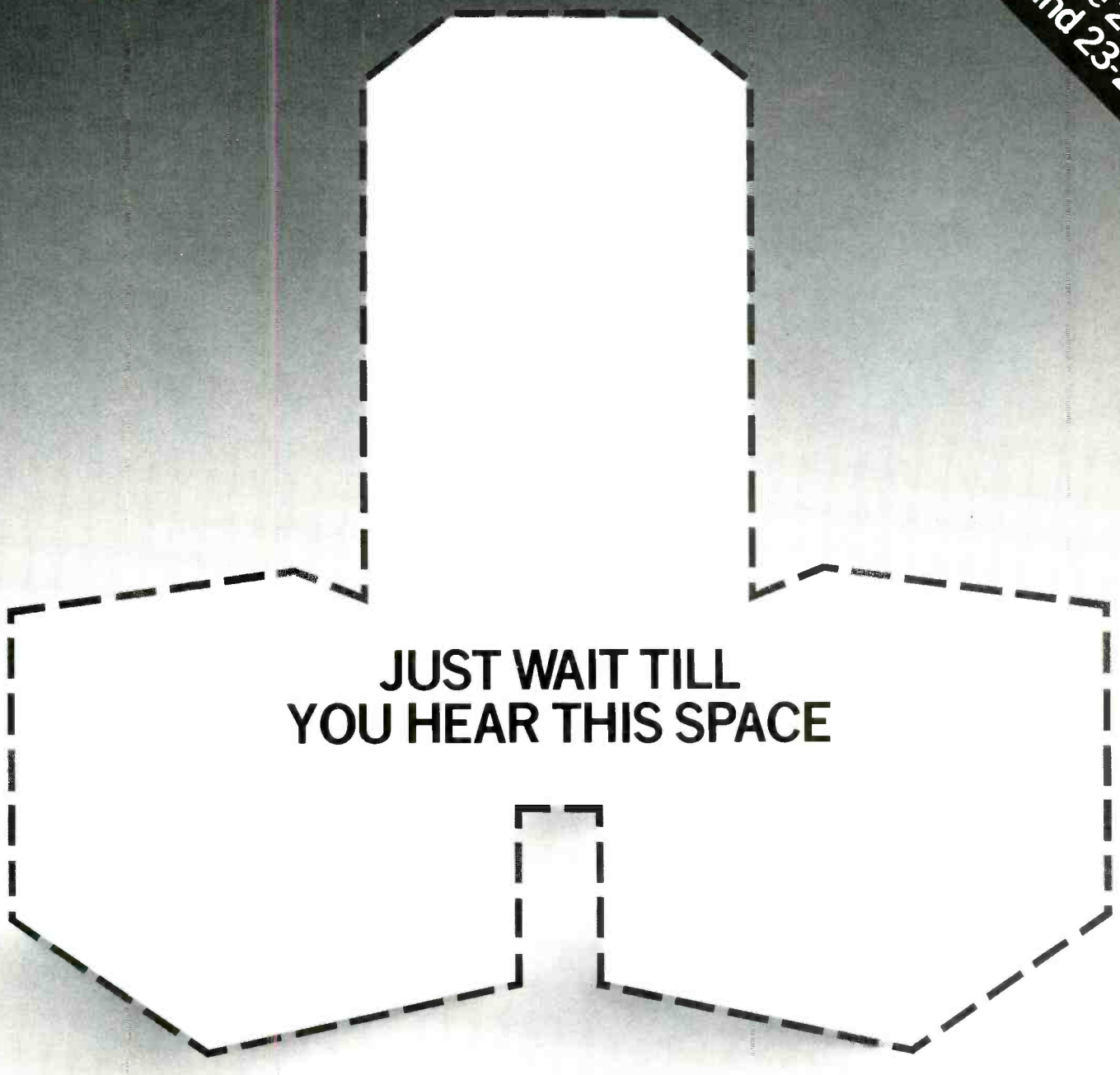
First showing at APRS, June 22-24 see it on stand 23-29.



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TELEX the name for performance

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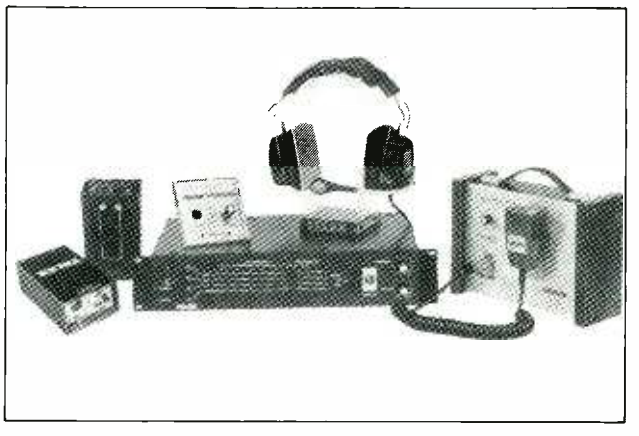
TELEX AUDIOCOM—A heavy-duty, wired intercom system for professionals, designed for fixed installations or portable use. Available with 'belt-packs' or speaker stations, the Audiocom can accommodate up to 30 stations per line and each line can be up to 5 miles long.



TELEX WIRELESS MICROPHONES—Powerful, clean signals from the pocket transmitter WT-100, hand-held microphone transmitters WHM-300 and music performers WHM400 (guitar pick-up options available). The microphone system incorporates a unique compressor expander which increases the dynamic range and improves the signal to noise and ratio. With the patented dual antenna diversity system 'drop-outs' are effectively eliminated.

For more technical information please contact the UK distributors:

AVCOM SYSTEMS LTD
Stanlake Mews
London W12 7HS

Tel no: 01-740 0051
Telex: 892513

Individually, they're amazing. Together, they're unbeatable.

Recording studios, radio and television production suites, video and A/V facilities and serious musician/composers have discovered that Valley People equipment improves productivity, offers ease of operation, requires little or no maintenance and provides excellent signal quality. Standing alone they offer unrivalled processing power and versatility: used together by the creative engineer/producer, they increase variety and control dramatically.

QHZ Quad Preamp

Provides all the equipment below with instant access to the full range of high impedance sources, such as electronic musical instruments, microphones and even hi-fi kit. The clarity of audio is unsurpassed.

QLZ Quad Mic Preamp

The low impedance unit for transparent, distortion-free recording as well as on-the-air or live performances. Each of the four inputs is adjustable from 20dB to 60dB of gain.

Maxi-Q Equaliser

Provides maximum flexibility: the seven octave range on each of the three frequency bands gives a six octave overlap. Ideally suited to pre-conditioning of signals when used in-line with the Kepex II and Gain Brain II.

Kepex II Expander/Gate

Spectacular performance in noise gating, reduction and elimination is complemented by its creative value in 'loosening' drum effects, removing excess cymbal ring or performing electronic musical effects.

Gain Brain II

Widely adjustable limiter/compressor and ducker, specially designed for production work. Major advantages include 'natural' quality of sound, flatness of VU and improved low frequency performance.

Five superior products. Each amazing. All unbeatable.

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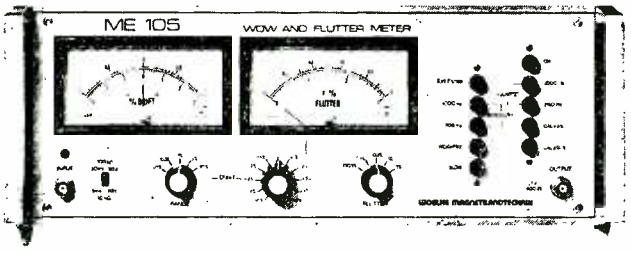

The well-known Wow and Flutter Meters, ME105 (illus.), ME106, ME108, ME110.
Also ME201 Flutter Classification Unit, ME401 Automatic Distortion Unit and ME302 (Wave Analyser).
And now also an ever-increasing range of Tapeheads for Professional/Studio applications including Time Codes Heads.
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FOSTEX: B-16 16-track ½" new recorder: London main agents
FOSTEX: A-8, A-2, 250, X-15 recorders plus all rack units
MXR: Graphics, digital delays, dual limiter, drum Computer (June)
ROLAND: Dimension D, digital delay, power amps, tape echoes, guitar synthesisers, keyboard synthesisers, amps, microcomposers, studio synth (100M)...if they make it we sell it!
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KORG SDD-3000 Programmable Digital Delay 9 memories, 10 Hz-17 kHz delay freq., 1.023 ms. delay, 4 modes of modulation, hold facility, 4 way low and high filters built in, stereo outputs with phase inversion.
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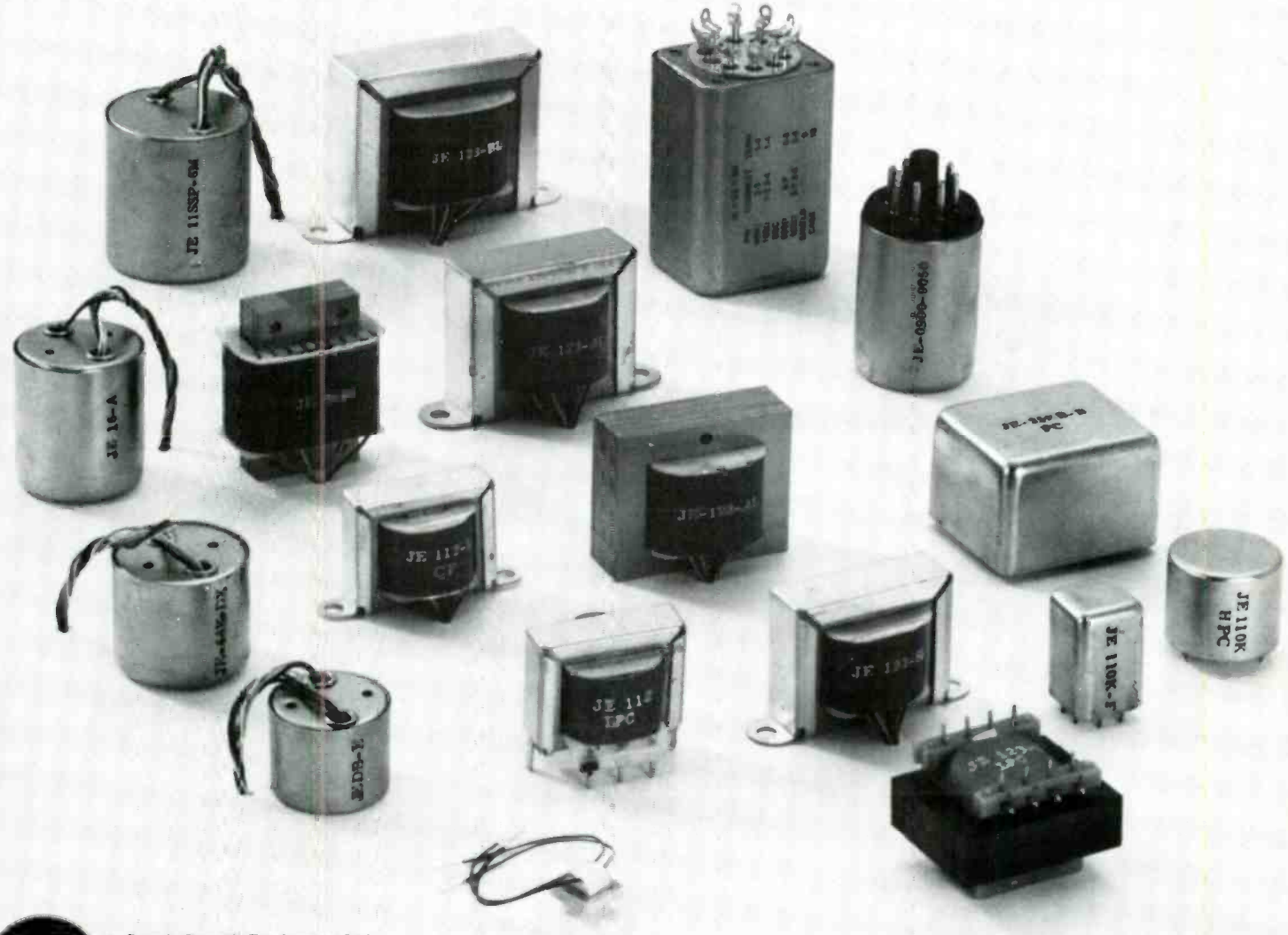

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Telephone: 01-734 2812/3/4/5
Telex: 27 939 SCENIC G

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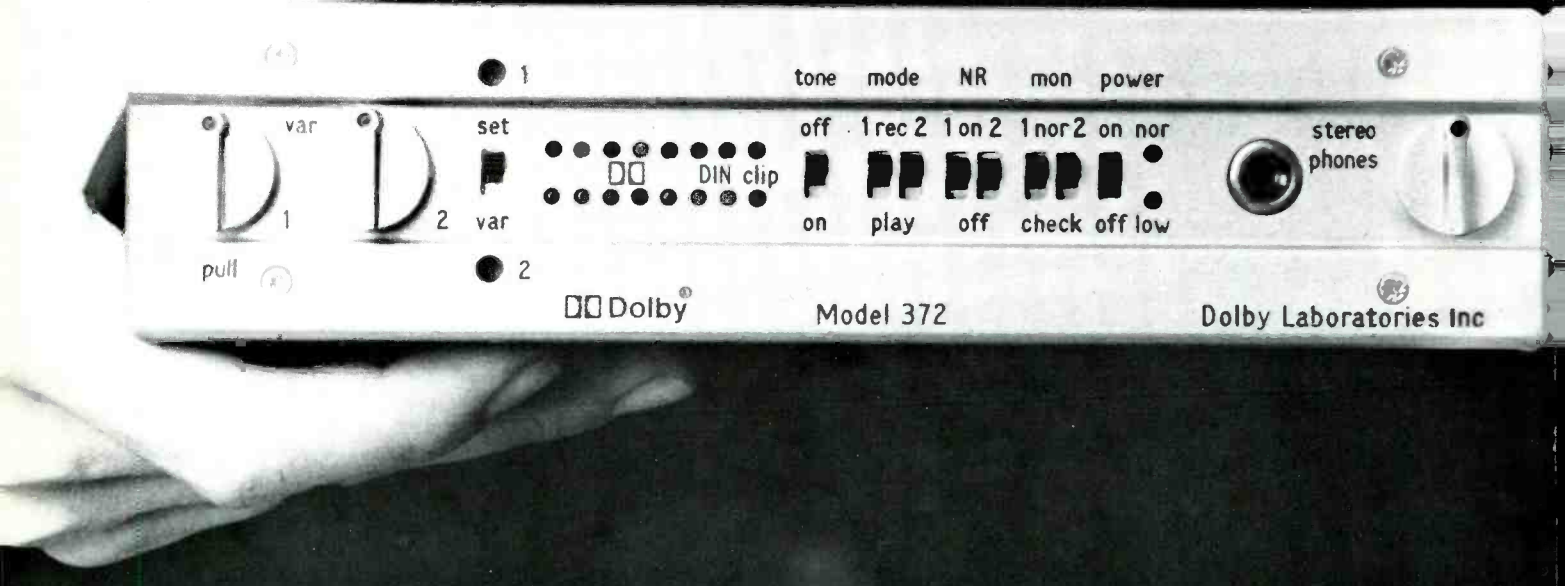
Dolby Model 372

A portable 2 channel professional A-Type noise reduction unit



FEATURES

*Compact Construction .
220mm × 184mm × 44mm; weight, 1.3kg.

*Independence from mains supplies.

*Input level controls either for record level setting before encoding or for rapid 'Dolby Level' calibration in play (decode), with accurate LED display for each channel.

*Stereo headphone monitor with level control independent from 'line-out' level.

*Differential inputs with wide sensitivity range, minimum −10dBv (245mV) for Dolby Level.

APPLICATIONS

*Video Tape Recorders — where noise reduction modules cannot be installed directly in machines, e.g. portable 1", U-matic, etc.

*Mobile Recording — giving portability and flexibility.

*Radio and Television Outside Broadcasts — keeping the noise low from the first generation, so that modern production techniques, with noise reduction, can be used to the best advantage.

Dolby A-type noise reduction is well proven throughout the world in professional sound recording, with over 70,000 channels in use. Applications include master recording, multi-track, film sound production, and 1" VTR soundtracks. Adding to the range of existing products, the Model 372 increases the versatility of Dolby noise reduction due to its compact size and independence from mains supplies.

DOLBY LABORATORIES, INC., 731 Sansome Street, San Francisco CA 94111. Phone (415) 392-0300. Telex 34409 • 346 Clapham Road, London SW9. Phone 01-720 1111. Telex 919109.

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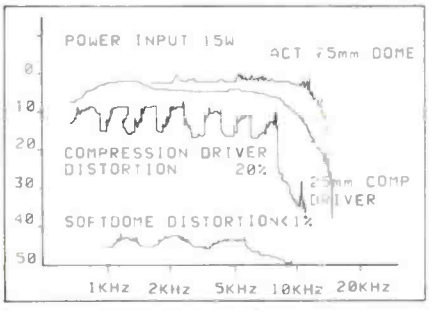
This is the most powerful mid range driver of its type in current production.

Powerful but clean.



Soft dome design produces less than one tenth the amount of distortion of the conventional compression types.

At levels up to a shattering 128dB peak spl, the harmonic content is minimal. None of the inherent harshness, or distortion, which characterises typical horn loaded monitor systems.

You hear dirty sounds, only if they are recorded that way.

T Series Monitors from Turnkey Two incorporate these drivers. They are the first high level monitors to employ this soft dome technology.

As a result, they are smoother, more accurate, and less tiring to listen to.

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The systems are acclaimed as setting a new standard for faithful reproduction of sound.

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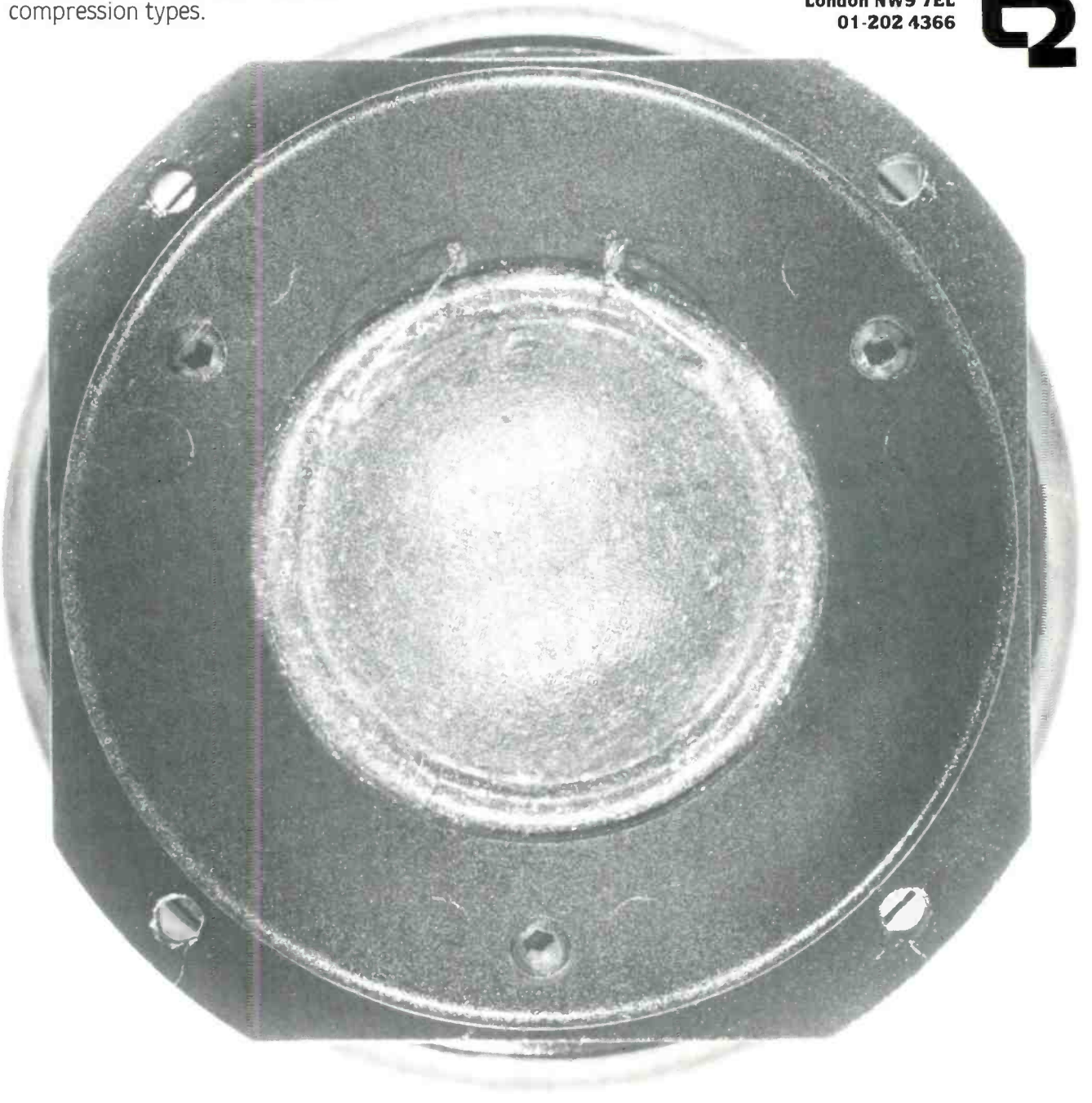

diary

DMM for EMI

After accepting CD, EMI have taken a signficant step forward in conventional record production by adopting the Teldec DMM system under licence. Several of the production problems associated with conventional vinyl discs—especially those associated with surface noise and clicks—are the result of using lacquer blanks. Lacquer is a good surface for cutting but has rather unstable characteristics which vary with time and climate (particularly temperature). Audible results include pre- and post-echo effects caused by adjacent grooves influencing each other. There are also problems with the next stage in the manufacturing process—nickel plating the master lacquer, including purity and metallic structure of the coating.

The DMM process avoids many of the problems of conventional cutting, and in addition enables the production of stampers direct from the master disc, reducing the production time and cost by a large proportion (not that the consumer will ever see any of that reduced cost, of course). The system was first suggested almost a century ago but was not technically capable of perfection until recently, when it was revived by RCA a couple of years ago for their capacitance video disc system, about which very little has been heard outside the United States—laser technology strikes again.

The process involves depositing a copper surface on to a steel disc, and cutting this in more or less the normal fashion—with the exception that a number of changes are made to the cutting stylus, including a lack of burnishing facets and a face angle of greater than 90°. In addition, the cutter stylus is vibrated ultrasonically, the vibration amplitude being proportional to groove depth (and thus cutting resistance), the result being a very smooth groove structure and a limitation of the cutter head mechanical loading. The master may be used to produce stampers directly, exhibiting 10 dB or better reduction in surface noise, and virtually no clicks and pops. If records are made carefully, these advantages will be present on the final product, though of course average levels of quality control, regurgitated vinyl, and an inability to aim straight at the factory will quickly dispose of all but the money-saving advantages.

The elimination of pre- and post-echo also allows the groove spacing to be reduced on the cut: computer-controlled lathes like the *VMS-80* can achieve 10-15% more playing time per side by making full use of groove-nesting and other varigroove techniques. In addition, the stability of the master during and after cutting preserves transient information. Finally, the reduction in processes (one in DMM as opposed to three—master stamper, mother and stamper—from the master lacquer in conventional disc manufacture) greatly improves reliability. Fewer recuts are required because of processing or other problems.

EMI will be introducing the DMM system into their Cologne plant in the next few months, and other major EMI pressing operations will have the system installed early next year—Teldec will press DMM releases (which will have a special logo) for EMI until then. We currently have no information on the availability of blanks or cutter heads (the Neumann *SX80CM*) for independent cutting rooms who want to offer the system.

First European Sony digital multitrack

Wisseloord Studios, Hilversum in the Netherlands has become the first European studio to take delivery of a Sony *3324* digital multitrack recorder on a permanent basis. Wisseloord is part of the PolyGram group of companies of which Philips is a joint owner with Siemens. As developers of the *Compact Disc* with Sony, Philips have a vested interest in improving the standard of recordings for *CD* release to show off the capabilities of their hardware. The installation of a *3324* in a leading European studio is therefore a step in the right direction. It only leaves the question — did they actually get their order in first?

CBS/Sony new CD plant

CBS Inc and the Sony Corporation have announced that a new subsidiary of CBS/Sony Inc will purchase CBS' tape duplication and injection molding facilities at Terre Haute, Indiana and convert them to the manufacture of *Compact Discs*. The deal is still dependent upon the Japanese government agreeing the purchase but as long as that is decided soon, the plant will be pressing *CD*s by late 1984 and will offer services to CBS and other record companies. At present CBS/Sony manufacture *CD* in Japan and export them to the US and this would continue until the new facility is operational. The investment in the proposed facility is expected to be about $21 million.

Sony read/write laser disc

Sony have recently developed a prototype laser disc which can be written to as well as read, and may be used for both digital and analogue data. The prototype disc is 300 mm in diameter and is capable of recording 15 Gbits per side. The only serious problem at present is that of erasure, but it is still likely that the disc will be useful for archiving purposes, in view of its very high recording density.

Each surface of the disc has two layers deposited on it. The outer recording layer consists of an antimony-selenium compound metal. When heated to 170° by a 7 mW laser during recording, this substance changes from an amorphous to a crystalline state, the crystalline form having three times the reflectivity of the amorphous form. Information is thus stored on the disc by creating appropriate reflective areas, being read with a laser in the same way as a conventional optical disc. The second, inner layer on the disc surface consists of a heat-absorbing bismuth-telluride compound which increases the definition of the boundaries between the recorded reflective areas and the amorphous ones, making possible the recording of reflective areas of defined length, thus permitting analogue information storage. The inner layer also increases the reflectivity of the laser-crystallised regions.

APRS bar shock

Despite the recession, APRS '83 will be bigger than ever, with 17 new exhibitors. In order to accommodate them, the bar area has had to be reduced severely. The original plan was for 93 exhibitors: the additional stands will no doubt make for an even more lively and interesting show this year.

APRS will be held at the Kensington Exhibition Centre from June 22-24 1983.

Correcting an omission

In the January 1983 issue we published a feature entitled Bandpass Filter Design by Dennis A Bohn. Unfortunately we omitted to mention the company affiliation of the author. This should have been Rane Corporation which is a relatively new US-based designer and manufacturer of professional audio products.

Rane Corporation, 6510 216th SW, Mountlake Terrace, WA98043, USA.

Address changes

Recording Studio Services have moved to new premises at 1145 Brookdale Avenue, Bay Shore, NY 11706. Tel: (516) 667-6737. This address replaces the one listed under Studio Designers and Consultants in the April service guide.

Queens Award

Audio Kinetics (UK) Ltd has been awarded the Queen's Award for Export Achievement. Although initially founded to produce acoustic screens, their main products are now autolocators and the *Q.LOCK* synchroniser system of which about 80% are exported.

Agencies

● Otari UK have appointed Turnkey as dealers for the full range of Otari products. They wish to make it clear that this does not affect the existing dealership held by Industrial Tape Applications who also handle the full range.

Industrial Tape Applications, 1/7 Harewood Avenue, London NW1. Phone: 01-724 2497. Telex: 21879. Turnkey, 8 East Barnet Road, New Barnet, Herts. Phone: 01-440 9221. Telex: 25769.

● Tannoy have announced that the products of Tannoy and Tresham Tannoy will now be distributed in North America by the Canadian company Crown. All enquiries should be addressed to Tannoy Crown, 97 Victoria Street North, Kitchener, Ontario, Canada N2H 5C1.

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new products

Ecoplate III

New from Studio Technologies is a modestly priced plate reverberation system in a fairly compact unit. The *Ecoplate III* apparently retains most of the features of the other *Ecoplate* models. It has a pre-tuned plate with a new shock resistant plate suspension system that will, it is claimed, eliminate tuning problems. The reverb time is variable from ½ to 5 secs with a signal-to-noise ratio of 65 dB and frequency response of the reverb signal is 80 Hz to 20 kHz. The input requirements are −10 or +4 dBm, 10k Ω unbalanced with stereo outputs at +4 dBm (24 dBm max) unbalanced. Both high and low EQ is variable.

The *Ecoplate III* has dimensions of 55 × 37 × 9 in and weighs 98 lbs.

Studio Technologies Inc, 6666 North Lincoln Avenue, Lincolnwood, IL 60645, USA. Tel: (312) 679-9400.

Canford speaker mounts

Canford Audio has released a new range of mounting brackets for loudspeakers and TV monitors. Called the *Omnimount* range, the systems are based around ball and socket clamps offering precise angle adjustment. Two styles are available, one featuring rear supports which make it suitable for speaker mounting, and the other providing 'stand on' mounting for such items as video monitors. There are also three methods of mounting: wall mounts, ceiling plates and a threaded rod system for mounting through false ceilings.

The brackets also feature anti-vandal protection—preset angles can only be altered with a socket spanner, and wiring can be threaded through the central tube. Advantages of the system include good acoustic decoupling and easier installation than conventional systems.

Canford Audio, Stargate Works, Ryton, Tyne and Wear NE40 3EX. Tel: (091) 413 7171.

Harrison Series 4

Released for the first time at AES Anaheim was a new range of consoles from Harrison, the *Series 4*. There are two basic configurations: the *MR-4* 24-track recording console and the *TV-4* stereo teleproduction console. A number of options are available including choice of metering.

The consoles have been designed from the ground up and represent a significant advance in facilities and cost-effectiveness, brought about in part by the application of new circuit technology and manufacturing techniques.

Harrison Systems Inc, PO Box 22964, Nashville, TN 37202. Phone: (615) 834-1184.

UK: FWO Bauch, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ. Tel: 01-953 0091.

In brief

● Quad/Eight Electronics have a new model of the *System 5* digital reverb processor. This is designated *System 5-LC,* LC referring to local control. This unit has all the features of the full *System 5* but without the remote control unit. All the controls are mounted on the front panel of the mainframe rack mounting processor section, which results in a fairly substantial reduction in cost with the possibility of adding remote facilities at a later date.

Quad/Eight Electronics, 11929 Vose Street, North Hollywood, CA 91605, USA. Tel: (213) 764-1516. Telex: 662446.

● Agfa-Gevaert have announced that their new digital audio tape, *PEM 297D* is now available in the UK. *PEM 297D* is a ¼ in reel to reel tape that will be supplied in 4,600 ft lengths on 10 in NAB reels.

Agfa-Gevaert Ltd, 27 Great West Road, Brentford, Middlesex TW8 9AX. Tel: 01-560 2131.

Formula Sound system equaliser

The *SE1* is a new 2-channel ½-octave system equaliser from Formula Sound. The basic unit is a standard 19 in rack mount design with 1¾ in height. Each channel operates independently, both having 19 screwdriver rotary controls for frequency bands with centres from 31 Hz to 16 kHz. All these controls including the EQ in/out and LED power indicator are situated behind a removable front panel with only the LED being visible.

The filter type is a simulated inductor and gives equal Q in both cut and boost. With all the controls set flat the unit has unity gain with EQ in or out. With EQ in but flat it has a frequency response of 10 Hz to 30 kHz ± ½ dB.

In the event of the mains power failing, the *SE1* is equipped with relays that bypass all the electronics. These same relays also provide a delayed turn on for protection from transients, when the power is applied.

All connections are 3-pin XLR type. The front panel is finished in black anodised aluminium while the casing is black plastic coated steel.

Formula Sound Ltd, 3 Waterloo Road, Stockport SK1 3BD, UK. Tel: 061-480 3781.

Pro phono preamp with CX

Advancing Technology Corporation have announced the availability of their new phono preamp with switchable CX decode capability. The unit has a distortion of 0.002%, noise is given as −90 dB/10 mV input, with the frequency response specified as per RIAA ±0.05 dB. The output level is adjustable to +24 dB at 600 Ω.

CBS will no doubt be pleased that one of their licensees has produced a professional decode preamp, and the unit will find obvious broadcast applications. CBS may be less pleased, however, to read the first paragraph of the press release, which includes the words 'CX . . . compresses the audio on the disc . . . Therefore, encoded discs cannot be played without serious side effects.' Unless, of course, you have a decoder, where the ATC preamp would be an obvious choice. So much for 'Compatible Expansion . . .'.

Advancing Technology Corporation, 27106 46th Avenue South, Kent, WA 98032. Phone: (206) 854-1004.

ADA Digital delay

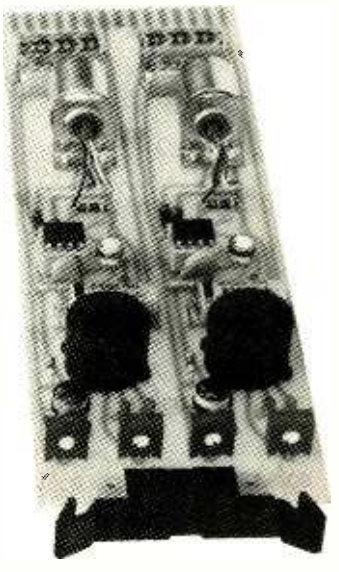
The ADA *D1280* DDL is a new delay processor from ADA Signal Processors of California. The unit features delay times from 0.156 ms to 1280 ms all at 15 kHz bandwidth. Seven delay range pushbuttons and a multiplier control allow rapid access to any desired setting. A novel feature of the unit is an LED whose flashing rate is related to the delay time such that the unit may be adjusted visually so that repeats fall on the beat. The unit also incorporates regeneration, repeat hold and modulation features and a LPF allows HF rolloff in the regeneration path. The modulation depth control has a 4:1 delay sweep range while the speed control varies the modulation rate between 0.1 and 25 s per sweep cycle. A 4-step LED headroom indicator is included, and options available include a footswitch for effect and repeat hold switching, and a 240 V AC version.

ADA Signal Processors, 2316 Fourth Street, Berkeley, CA 74710. Tel: (415) 548-1311.

New ProTech items

ProTech Audio has introduced a new power amplifier to its product line, the model *872*. The output is 70 W continuous into 8 Ω and is also available with 70.7 V transformer isolated line output. The amplifier incorporates speaker protection overload and short circuit protection circuitry. The power switch incorporates a magnetic circuit breaker giving fuse protection of the AC lines. Both rails of the bipolar DC power supply are also fused. The volume control is rear mounted to prevent unauthorised use.

Another item recently introduced by ProTech is the model *72509* 2-channel mic preamplifier with compression and limiting facilities. Each channel incorporates mic input transformers, adjustable gain and threshold settings and offset trim. The unit is designed to mount in any of four different *Integra III* enclosures. Frequency response is ± 0.2 dB 20 Hz to 20 kHz with a gain of 55 dB, maximum output +20 dBm with compression and limiting ratios of 2.5:1 and 40:1 respectively.



ProTech Audio Corporation, Flowerfield Building 1, St James, NY 11780, USA.

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The LinnDrum Syndrome...

With the emergence of a number of 'alternative' drum machines, Linn Electronics, the inventors of the digital drum machine, feel that you may be slightly confused as to why professional musicians, producers and studios still insist on a LinnDrum as their drum machine.

We don't think that it's only because of the longer, crisper sounds or the flexibility and ease of operation; and it isn't merely the large library of user-changeable plug-in drum sounds or the custom sound chip service that lets you put your favourite kit sounds in the LinnDrum; nor is it the sixteen drum sounds each with its own output, volume fader and pan control or even the 2600 event memory with its 98 patterns and 49 songs and programmable dynamics; and it isn't simply the five trigger inputs with which you can trigger all the drum sounds from drum synthesiser pads, tape tracks or any audio source or the programmable trigger output that allows the rhythmic programming of external synthesiser sounds; nor is it the unique tempo display in beats-per-minute or frames-per-beat or the adjustable hi-hat decay.

But it is the combination of these features and many more that makes professionals choose the LinnDrum. But don't take our word for it – come and hear it. Then decide.

SYCO SYS Linn

20 Conduit Place, London W2 Tel 01-724 2451 for appointment

Now Available from Stock

new products

Teac digital recorder

New from Teac is the *FXZ-100* fixed-head PCM recorder. The machine features 2-channel PCM recording with 48 kHz sampling rate and 16-bit linear quantisation; 130 min recording time per 10½ in reel of *200* tape; 4-, 8-, or 16-track upgrade possibilities with the same tape format; full error correction; and a thin-film digital recording head. The tape speed is 7½ in/s, the record density being 17.64 Kbits/in, and the minimum recording wavelength 4.32 μm. The machine measures 25¾ × 41 × 25 ins (whd approx. Technical specifications are the usual for PCM systems.

Teac FXZ-100

Oberheim digital drum machine

Oberheim Electronics have announced a new digital drum machine to be known as the *DX*. It uses recordings of real drums retained in the memory and allows programmability of rhythms, time signatures, sequence length and tempo in both real time and single step modes. There are seven voices with the bass drum, snare and high hat adjustable to three further settings for dynamics in the case of the drums, and open, closed and accented for the high hat. There are separate outputs for each voice as well as mixing facilities.

The *DX* has 100 sequences and 50 songs with a memory capacity of 2,000 notes. Other features include the ability to sync with other equipment, accept external trigger inputs, cassette interface for storage of sequences and back up battery for memory retention.

Oberheim Electronics Inc, 2250 South Barrington Avenue, Los Angeles, CA 90064. Tel: (213) 473-6574.

Toa microphones

The *RD series* is a range of eight microphones recently introduced by Toa. Primarily designed for live work, the range includes many different types with some models being described as having studio applications. Models *RD-10/12/13/14* are basically handheld vocal mics, all being unidirectional dynamics with integral large windshields.

Models RD-15C/16/17E are described as mics for instrumental pickup and are phantom-powered condensor, dynamic and electret-condensor respectively. All three are unidirectional although the response of the *RD-15C* is further described as cardioid. The *RD-18* is an omnidirectional dynamic mic that is actually recommended for recording use.

Toa Electric Co Ltd, Kobe, Japan.
UK: Toa Electric Co Ltd, PO Box 82 Castle Street, Ongar, Essex. Tel: 0277 364333. Telex: 995554.
USA: Toa Electronics Inc, 1023 Grandview Drive, San Francisco, CA 94080. Tel: (415) 588-2583. Telex: 331332.

Fostex new products

Three new products have been launched by Fostex and they will all have a fairly large impact on different areas of the recording market.

Firstly comes the *B16,* 16-track on ½ in tape machine which is featured on the cover of this issue and also reviewed on page 104. At present this machine is only a prototype although it will apparently only change in minor ways before full production commences shortly. The impact that this machine will have is difficult to predict although it appeared quite impressive during the short time it was available for the photo session before being sent for review. It will officially be shown at the APRS and until then precise information is rather limited.

The second new item is the *X-15 Tracker,* a 4-channel, 4-track recorder/mixer that runs on an external AC adaptor or from a clip-on battery pack. Its dimensions are 3 × 11½ × 7¾ in without the battery pack and this only adds 1¼ in to the depth. Features include Dolby B, 1⅞ in/s tape speed, 3-position input selectors, varispeed and remote punch in facilities. Two tracks may be recorded at any one time and the levels are set by the two faders with LED indicators running alongside them. These faders are switched between pairs of tracks and these signals may be equalised with the simple treble and bass controls on the record channels. There is a 4-channel monitor mixer with pan control on each channel. For mixdown these balance the level on each track and the mix is then routed through the faders and may also be equalised. The price is also attractive at about just over half that of the *Multitracker 250.*

The final item is a new version of the *A-8* 8-track on ¼ in tape machine. Designated the *A-8LR,* it has the ability to record all eight tracks at once and not just the four of the standard *A-8* which will continue to be available.

Fostex Corp, 512 Miyazawacho, Akishima, Tokyo, 196, Japan.
UK: Bandive Ltd, Brent View Road, London NW9 7EL. Tel: 01-202 4366.
USA: Fostex Corp of America, 15431 Blackburn Avenue, Norwalk, CA 90650.

High power Genelec monitor

Genelec demonstrated a new high power monitor system, the *1025A* at the recent Eindhoven AES. The design criterion was natural reproduction at high levels in large control rooms. Designed for flush mounting, the cabinet is a 450 litre dual chamber, bass reflex enclosure with a 19 in rack mounted 3-channel power amplifier/active crossover unit. The system is equipped with full logic circuitry to sense the condition of the drivers and to self-check the amplifiers themselves.

Quoted specifications include a frequency response of ±2 dB from 28 Hz to 20 kHz, power amplifier ratings of 750 W 'continuous' and 1 kW 'music power' and an SPL of 122 dB per pair in a normally damped 100 m^3 control room.

Genelec OY, Satamakatu 7, SF-74100 Iisalmi, Finland. Tel: (77) 24. 942. Telex: 4404.
UK: Future Film Developments, 36/38 Lexington Street, London W1R 3HR. Tel: 01-437 1892. Telex: 21624.

Boundary recording news

It seems that at the present time almost all of the major microphone manufacturers have something new to offer for boundary recording. The company with the largest product line of this type of mic is Crown/Amcron and their newest model is the *PZM^R 2.5.* This is the unit that combines a pressure capsule with a corner boundary constructed of a perspex-type material that is clear, giving the mic a very low profile appearance. This design gives greater directionality to the mic response and is designed to be placed on a surface such as a floor or table and aimed at the sound source. The frequency response is apparently specifically tailored for speech and hence applications such as theatre sound.

The *PZM^R 2.5* plugs directly into a 12 to 48V phantom power supply and includes a transformer balanced, low impedance output with a permanently attached 15ft cable.

Sennheiser have announced an Acoustical Boundary Microphone, the *MKE212.* They have decided to take a slightly different approach to Crown and have decided to mount the capsule within the boundary plate rather than pointing at the plate from another housing. They claim that reduces even the reflections and disturbances that such small protrusions cause. The capsule they use is the *KE4,* a 4.75mm condenser-type positioned so that the sound inlet hole is flush with the plate surface. The inlet hole is only 0.5mm in diameter and this further minimises cancellation problems. The *MKE 212* is designed to point directly at the sound source. The sound inlet is protected by a plastic cover and a windscreen insert is also available. There are two versions and they differ in powering requirements. Sennheiser claim that they can be used to achieve stereo results and are similar to dummy head stereo but are actually loudspeaker compatible.

Crown, 1718 West Mishawaka Road, Elkhart, IN. 46514.
UK: HHB Hire and Sales, Unit F, New Crescent Works, London NW10. Tel: 01-961 3295. Telex: 923393.
Sennheiser Electronic, D-3002 Wedemark 2, West Germany.
UK: Hayden Laboratories Ltd, Hayden House, Chiltern Hill, Chalfort St Peter, Bucks SL9 9UG. Tel: 02813 89221. Telex: 849469.
USA: Sennheiser Electronic Corp, 10 W 37th Street, New York, NY 10018. Tel: (212) 239-0190. Telex: 421608. ■

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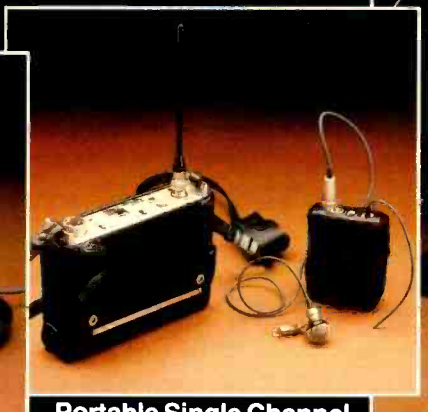

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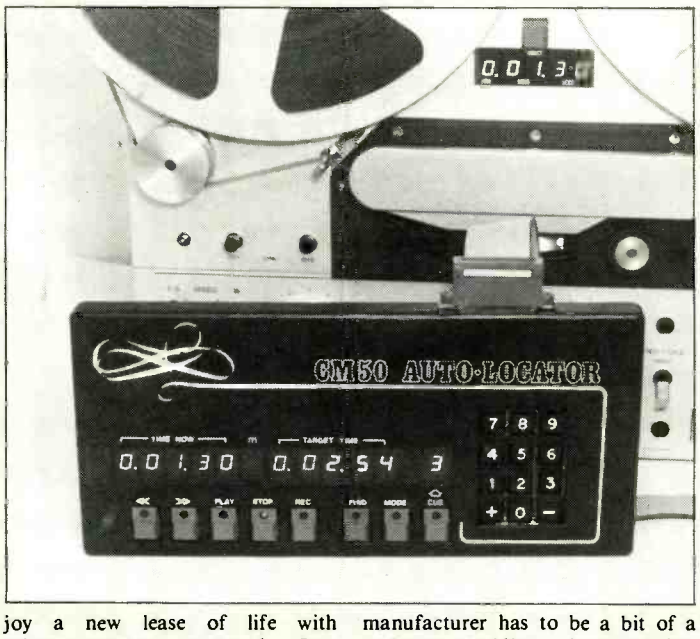
Autolocator

Autolocators are a vital part of the modern cost-effective self-operated recording facility, and even if there are assistant engineers available, many engineers find it difficult to believe that they could ever have managed without one. Autolocator design is a fascinating example of the use of microprocessors to control 'real' systems, and in this article Steve Brown discusses the basic design criteria for autolocation systems, with examples taken from his own company's range of products.

I SUPPOSE one could split writing programs for microprocessors or computers into two categories. One, the computer would be a 'black box' which could be on a different continent for all the difference it makes. The input and output from that computer would be a visual display unit and printer. The program would probably involve a great deal of mathematics and logic but all operations would happen inside the computer. My second category is the one that has something attached to it that is controlled by the microprocessor. The programming has to take into account the characteristic of whatever (or whoever) is connected to it. In the latter case the aspects of design are far more interesting— which is how I come to be writing about autolocators.

Most tape transports now are controlled by a microprocessor, a job to which it is very well suited. Unlike digital audio projects it has plenty of time in which to think. A microprocessor can only do one thing at a time. In a complex operation, it's surprising how all the microseconds add up. However, in tape transport control, the microprocessor has the luxury of milliseconds in which to carry out its various tasks. Many tape machine manufacturers, although using microprocessors in their decks, don't take the additional step of providing an integral autolocator. In many cases they provide one as an extra either under their own label or manufactured by a separate company but customised to their own machine. The Audio Kinetics *XT24* has a stable of several machines to which it will attach. Also, controlled return to zero is now common on several decks such as the Tascam *52* and *58*, and in the case of the *A810* and *ATR800* a limited number of stored cues is provided. However, there are still a large number of current tape machines that can benefit from an autolocator and, of course, many older machines—some even with mechanical counters—can enjoy a new lease of life with microprocessor control. One wonders, then, why autolocators don't feature as a commonly-used accessory in the same way as digital echo, signal processing and noise reduction. In these days of timecode, is it enough to be able to locate a section of tape to the nearest second or two? Well, autolocators don't really have to compete with synchronisers. Although there are some cases where they may form an integral part of a synchroniser by spooling a tape to a 2- or 3-second window from which it will pull into sync, their own applications are as much needed now as they ever were. Also, there's no reason why prices for autolocators shouldn't fall to anything between £200 and £750 depending on facilities offered. At the moment the market is relatively limited and therefore prices reflect that. But in many ways, the need for a cheap and simple autolocator is greater now. Many smaller multitrack users are one-man bands; the balance engineer is the tape jockey and also probably the producer. That's understating it; he's probably the musician as well!

What facilities is he going to need and how much is he prepared to pay? He probably won't want to pay much more than 25% of the original cost of the tape machine whether it be a 2-track ¼ in machine costing around £800 for a top-of-the-range multitrack. So, the autolocator manufacturer has to be a bit of a sculptor; providing a cheap and simple autolocator for the personal multitrack market and a product of impeccable finish and loads of special features to make it worthy of the top-of-the-range machine it's being connected to.



What facilities are required? All autolocators have the same basic set of instructions. A number of stored cues (normally nine or 10) may be updated either via a numeric keypad or by transferring the time on tape—even if in fast wind—into the cue memory by a single key operation. Apart from the normal deck controls (fast re-wind, fast forward, play, record and stop) the autolocator will feature a search function, cue select and the facility to shuttle between two cue locations for repeated playback of the same section of tape. It must display time on tape and also the target time which may be a stored cue (in which case the cue number may also be displayed). The target time may also be updated directly from the key pad. Numerals would shift left in the same way as a calculator, and an entry would be terminated by pressing ENTER. The autolocator should take account of an illegal entry such as 90 s, converting it to 1 minute 30 seconds. These basic facilities may be expanded to provide, for example, a string of events instead of a single fixed shuttle:

01 PLAY CUE 1 TILL CUE 2
02 PLAY CUE 4 TILL CUE 5
03 PLAY CUE 7 TILL CUE 8
04 JUMP BACK TO LINE 01
(Or stop)

This string of events may be stored in a battery-protected memory together with the cue times, and each line shows on the LED display in an abbreviated form. Designed primarily for audio-visual work, it does enable the operator to have a greater control over how his autolocator performs; after all it is supposed to be an extension of his own arm. He can always settle for a conventional shuttle:

01 PLAY CUE 1 TILL CUE 2
02 JUMP BACK TO LINE 01

Another expansion for an autolocator is to provide a greater degree of information on cue times. I remember one studio where I turned up wearing my salesman's hat and nearly blew a take because the control room was occupied by the engineer and musicians with the drummer looking very lonely in the studio. I had to stand rigid between the vocalist and his guitarist clutching my case until the take was finished, feeling a real charlie. I mention this because when I finally got to speak to the engineer he was not working by cue numbers and timings; time meant nothing to him. He didn't actually have an autolocator which is why I was there; so if he recognises himself in this article, perhaps he'd still like one! He wanted to be able to shuttle back to 'chorus 1' or 'middle 8'. (It does help if an engineer such as myself can learn such musical terms!). So an autolocator could really become a useful tool! I feel strongly that a great deal of

design

Steve Brown
(Applied Microsystems)

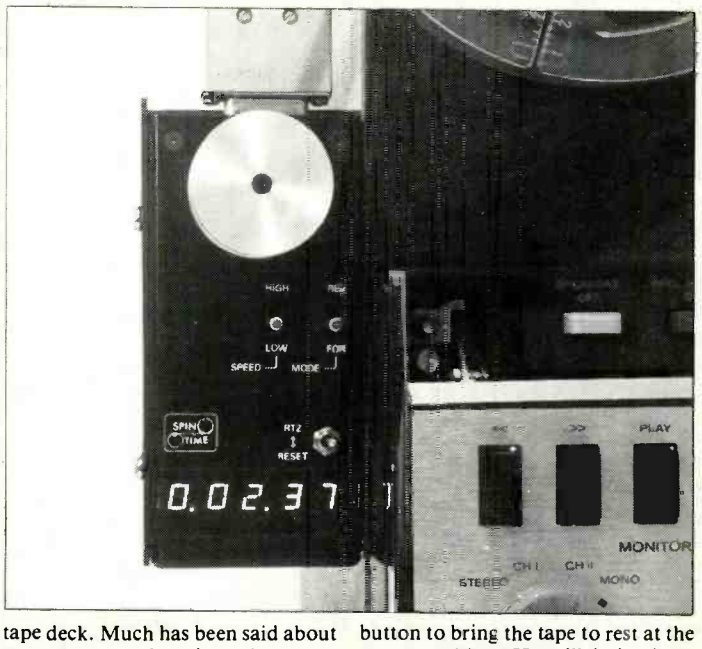
technology is designed for its own sake without enough regard for the poor operator and I know, I've done it! Music is an art, and what makes this business so fascinating for me is the marrying of electronics and music (or speech). That's really why I mentioned the conventional computer programming in the first paragraph. Electronics and computing really come alive when the application has something really tangible. But I digress. The autolocator could give the operator recognisable information rather than a row of numbers.

What is needed is a cathode ray tube (CRT) display with such information as artist, title, and take number, rather like an electronic scratch-pad. The operator could use a kind of shorthand: instead of giving him a full alphanumeric key board, we would have 'CHORUS' or 'MIDDLE' on a single key. In some applications a printer could be attached to give a complete log of events.

What I have been describing is a couple of autolocator products from my company. The *CM50* is a fairly straightforward autolocator, but with battery protected memory and serial interface for connection to an external computer. The *CM55* expands these themes by providing a CRT with descriptions of takes in addition to actual timings. Also, it will control and synchronise two machines. This brings to mind one interesting application where two tape decks could be controlled as a pair, one playing a cue while the other searched for its next cue using the string facility. The pair could be playing commercials on a radio station and the system would automatically do an off-air check and print out the commercial title timing and off-air conformation. A traffic officer could set up his day's commercials on the system using ¼ in tape rather than have to transfer to cart. The *CM55* autolocator provides these facilities; alternatively, one could hook up a microcomputer to a *CM50* autolocator via its serial interface and write one's own programs. So, the basic operation of an autolocator is fairly simple. Then why aren't autolocators being boxed in their hundreds to be shipped around the world?

The answer is probably that it isn't quite that simple. It's probably one reason that digital signal processing is such a booming business. The ins and outs are zero level audio which is standard the world over, and yet its designers have all the flexibility of a microprocessor to play with.

It is one thing to design an autolocator for one specific tape machine, but if an autolocator is to be interfaced with a number of different tape machines then a great deal more design work has to be done. Having covered the basic functions of a 'typical' autolocator which most people are familiar with, let's look at how it connects to the



tape deck. Much has been said about auto locators learning about the mechanics of the tape machine that they are connected to. The Audio Kinetics *XT24* learns and permanently memorises a machine and the tape on it in time sectors so that, rather than measure the performance momentarily, it knows by the time on the counter what performance is going to result from an operation before it actually happens. In fact in most cases 'learning' is probably the wrong word as it suggests long-term learning, whereas an autolocator can normally get away with monitoring the deck performance in the short-term. The braking performance will always be different for the middle of a spool compared with the end and the autolocator will always check back what it is doing. An autolocator can't ever be set up for one model of machine as the braking performance will vary from one machine to the other.

This is probably the most interesting part of designing an autolocator; one has to consider how a human operator would carry out the same task. Consider an example: The tape is 30 min away from its target time. The gap is large enough for the deck to reach its maximum spooling speed. The human operator will have learned through experience how late he can leave pressing the stop button or (more normally) the reverse wind button to bring the tape to rest at the target position. He will judge it so that one operation will bring the tape to rest within about 10 to 20 s (how good are you?) and, by repeatedly reversing the fast wind, inch the tape to its exact target. Often operating STOP and WIND results in a clattering of relays, whereas flipping from one fast wind to the other gives very smooth results. The former gives more control for a human operator, the latter is normally used by an autolocator.

For an autolocator, the first braking operation from fast wind may be set permanently in memory for the particular machine it's attached to at that time (typically 40 s of tape at full spooling speed, assuming 15 in/s selected). In fact it's a very easy design. If then a different machine of the same model is substituted, the autolocator can look really very dumb, either leaving the braking too late and going way past the target time and out the other side like a misjudged re-entry from space, or brake far too early and approach with the caution of a learner driver in the centre of London. One trick to work out this initial braking is as follows: the auto locator with all its intelligence should be able to brake the deck almost imperceptibly well before it needs to, just long enough to measure the braking ability of the deck at that one particular position of the tape. From the information that it has collected about the deck (this is all the learning it needs to do) it should be able to bring the deck to a stop at exactly the correct location. In practice, it leaves a little bit of tape in hand to do a gently controlled approach.

An autolocator has an additional kind of search of operation to the full speed spooling situation above. If it is only about 30 s from its cue point it has a slightly different calculation to make. It might of course take the easy way out and inch up to its target time, but this is often slow and laborious. What it should do is go directly to fast wind and operate reverse braking only when necessary to prevent an overshoot. The calculations are a little more complex as the deck is accelerating at the time and the amount of acceleration must be taken into account. With careful design of this part of the program, the autolocator manufacturer should be able to interface with any tape deck. So in order for the manufacturer to provide as near as possible a universal autolocator, he has to make his deck control software adapt to the deck in a very flexible way so that it does not need to be changed from one machine to another.

The main area of difficulty in providing a universal autolocator is in the time information that the system needs from the tape deck. Tape machines without electronic time counters—such as early Otari *5050*s and the Revox series— cannot, in their basic form, drive an autolocator but there are add-on timers available which either hook on to the side of the deck or form an integral part of the tape machine. The name of this tape timing family is *Spin-Time*. The simplest version consists of a small self-contained

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Autolocator design

unit with an LED display in minutes and seconds coupled to an idler wheel as would be found on a studio tape machine. The tape is laced around the idler wheel and instantly gives the facility to time an item on tape in fast wind instead of having to time with a stop watch at normal replay speed. Power is taken from the remote socket on the Revox series while special versions fit inside such machines as the *PR99* and Otari *5050*. The idler wheel used by *Spin Time* may then be used as the basis of an autolocator for early tape transports. Another problem with adding an autolocator is that some machines have electronic counters but still can't drive an autolocator without modification. There are several 4- and 8-track machines such as the Fostex *A8* which could benefit from an autolocator, so we mustn't let these problems stand in the way.

Once the physical problems of bringing the tape motion information out into a separate unit are overcome, it's interesting to see how much is common to a wide variety of decks. To go right back to basics, the tape movement is measured by wrapping it around an idler wheel of a circumference which relates to the tape speed; for example a wheel of circumference 3¾ in has an approximate diameter of 1.1 in, which fits neatly on most tape decks; similarly, a 5 in circumference gives a diameter of about 1.6 in. A photo-electric sensor is arranged to detect holes or slots in a disc attached to the idler wheel. A popular combination is a 3¾ in circumference wheel with 4 slots giving, for example, 16 pulses per second at 15 in/s. A single sensor will detect the movement and speed of the tape but, like viewing the world through one eye, leaves a missing dimension, in this case the direction of the tape. The answer to this is, as far as I know, universal. A second sensor is set at a specific angle to the first so that it gets a different view of the slots. **Fig 1** shows how the information is decoded by a microprocessor; there are also several different methods using conventional logic.

The electronic signal is used by the autolocator for two purposes. One is to keep track of the time on tape; the second is as a measure of deck speed. Some tape decks even provide a higher resolution pulse signal which is used only as a measure of tape speed. This can be an advantage to the autolocator as it enables the speed of a deck to be measured more rapidly, especially important at low speed. Later versions of the *A80* and the Tascam *58* series are examples here.

The whole accuracy of the system depends totally on the accuracy of the wheel diameter and the amount of tape slip, and the better the tape the greater amount of tape slip! So anything that depends on this as a time reference is bound to be imperfect although there are ways of overcoming this (see later). At least, the current use of electronic sensing is a great improvement over previous mechanical tape counters due to the fact that there is very little additional friction which could contribute to tape slip.

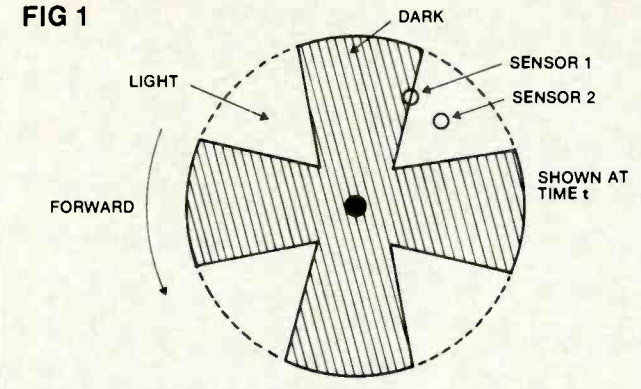
If a section of tape is spooled backwards and forwards repeatedly, even with a good quality deck, the slip errors will accumulate and the time display could very soon read 2 s error. One interesting answer to this problem is to update the time display. The best way to illustrate it is by a strange verbal dialogue! Spool back to cue 5, the time shows cue 5 stored time but because of tape slip, when replay is operated, the deck is already 1½ s into the cue. Spool back to cue 5, find the start on tape and tell the autolocator 'This is really cue 5'. The autolocator will then shift its zero reference and all stored cues will be adjusted by the same amount. If you think about it, there are a few pitfalls here, but it's better than nothing.

If you are using a multitrack, then the chances are you'll have a spare track. This can be used for timecode—not SMPTE (which is expensive and would eclipse the cost of the autolocator in many cases) but a 10 s code identifying frames or 25 ths of a second (make it 30 for the USA) in a 10 s cycle. The autolocator can be guaranteed to find the right section of tape to within 2 to 3 s, let alone 10. The timecode (call it 'micro timecode') can be recorded on to a spare track and will remain there for the lifetime of the tape. The frequency would be low because less information has to be recorded per frame than with SMPTE (18 bits against 80) so crosstalk would be proportionally less.

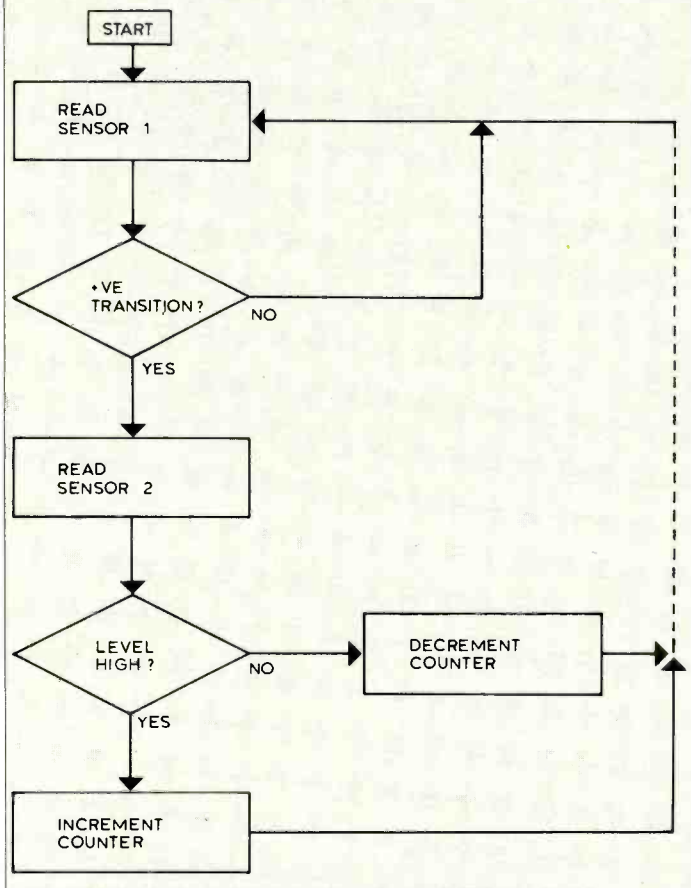
The autolocator would continually correct itself between the time that it reads off the idler wheel (which could be wrong) and the 'micro timecode' it reads off the control track assuming that it has already stored in its memory the timecode for each cue. The autolocator would store against each cue its time in minutes and seconds as normal but in addition would store the timecode number which would be 1 to 249 representing a maximum of 25 frames over 10 seconds. This code can form the basis for a simple synchroniser: by interlacing hours, minutes and seconds into the basic 10 s code, a complete (but non-standard) frame-defined timecode can be devised, far simpler than SMPTE but yet—because it is also frame-defined—it may be 'standards-converted' into SMPTE. Even without the hours and minutes it will still lock two machines providing they are both started within the same 10 s window.

When I first viewed the prospect of writing about autolocators, I felt rather like a student having to write about the Napoleonic Wars or something similar! It's a subject on which one could write a paragraph or write for ever. I've covered the subject as broadly as I can. ■

FIG 1



TYPICAL IDLER WHEL (UNDERSIDE)



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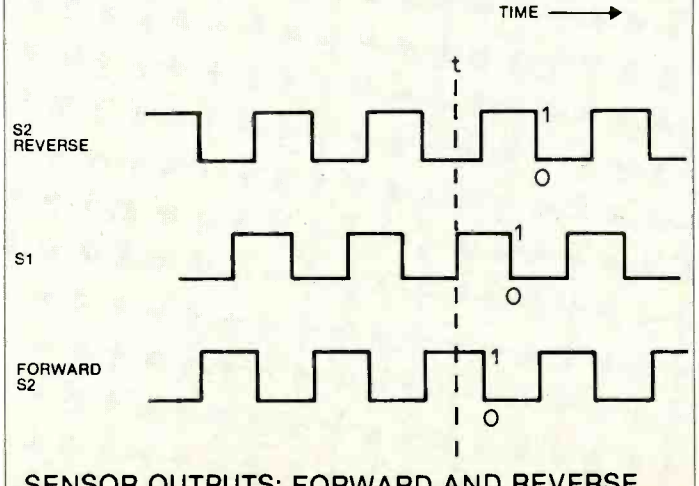

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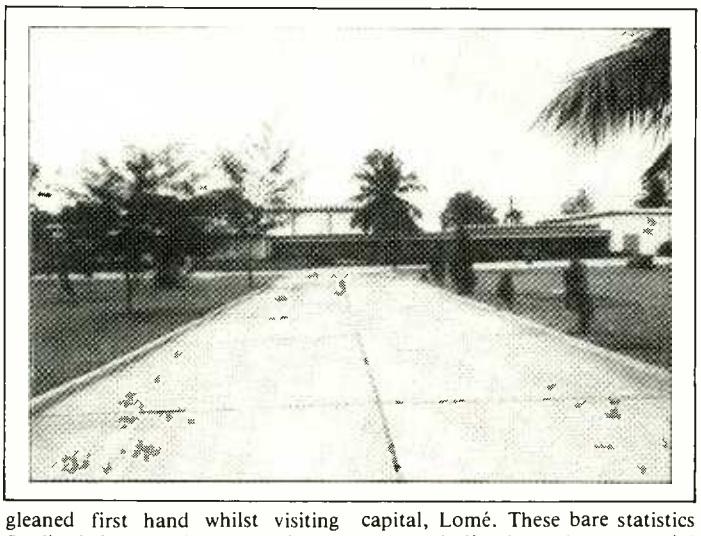
SSE

New ways in West Africa

NOEL BELL

TOGO, for those readers not in 'the know', is a West African Republic situated on the 'Slave Coast' of the Gulf of Guinea. The country, which is a former French colony, forms a narrow corridor of land some 75 miles wide and some 350 miles in length situated between Ghana to the West and Benin and Nigeria to the East. Unlike some of its neighbours, Togo is one of the most politically and economically stable parts of West Africa —something which is reflected in its choice as a regular venue as host to Organisation of African Unity conferences—and Togo has in fact been termed 'the Switzerland of Africa' a phrase which does give the 'flavour' of the country. A somewhat unlikely place to find a complete record pressing, disc cutting and recording complex, you might think, but not so!



Situated some five miles inland from Togo's seashore capital Lomé, in a sparkling new purpose-built structure, is Studio de la Nouvelle Marche, Office Togolaise du Disque. This rather grand sounding name, and the excellently equipped and constructed complex, is the end result of a major decision by the Togolaise government to invest in recording technology. The complex which is semi-autonomous, comes under the aegis of the Togolaise Ministry of Information, which decided to finance the venture in 1978. For a country of only limited resources, but with a healthy economy, such a project was not to be undertaken lightly. However, West Africa, and in particular Nigeria, is an expanding market for records and even now there are still few facilities available for the recording and pressing of music by African artists. Despite high initial investment, the project can be seen as a viable proposition that has foreign currency-earning potential with the opportunity to attract outside artists and export pressings. In addition, of course, it has a considerable prestige value for such a small country.

Prior to detailing the construction and facilities of the Togolaise complex, it is perhaps worth giving some background information on the music and recorded music scene in West Africa, and on the area itself. This information, which was largely gleaned first hand whilst visiting Studio de la Nouvelle Marche in the company of David Hawkins of Eastlake Audio, is to say the least interesting.

The countries surrounding Togo—Benin, Ghana, Ivory Coast, Nigeria and Upper Volta—form a vast potential consumer market of some 110 million people. Nigeria with an estimated population of some 77 million is by far the predominant influence economically. Despite a collapse in its oil revenues with the fall in the price of oil, and the pressures of feeding such a large population, Nigeria is still the richest country in the area. Whilst its economy has been dislocated by the effects of world economic recession Nigeria still has a considerable influence in the consumer, ie record buying, market. Next in rank after Nigeria is Ghana with a population of some 13 million. Under normal circumstances Ghana would also be a significant economic influence, however, Ghana's economy is currently in a sorry state. Following a military coup which overturned the previous civilian spendthrift government, Ghana is now under military rule with curfews, strict money control, petrol rationing, and much reduced scope for consumer spending. Continuing with the league table, next come Ivory Coast (7½ million), Upper Volta (6½ million), and Benin (3½ million).

Togo by comparison has a population of a mere 2½ million with some 135,000 people in the capital, Lomé. These bare statistics whilst indicating the potential market to be served by Studio de la Nouvelle Marche also indicate the relatively small economic 'home base' upon which the complex depends. An additional factor which needs to be taken into account is that the majority of the aforementioned populations are primarily agrarian based, with little access or money to pay for the consumer goodies we take for granted. Accordingly, in purely economic terms the number of potential users or consumers of the finished recorded products from the Togolaise complex is relatively small, probably in the order of some 500,000 people. Reducing this figure to take account of imported material and the output of other—mainly Nigerian—pressing plants and recording facilities, and one has a potential buying market of perhaps some 200,000 people. Sufficient to justify the Togolaise government's decision to embark on its complex, but indicating that a cautious approach was necessary.

Obviating the limited record buying potential of West Africa is a curious, but I suppose logical consumer practice. I suppose it could be called semi-legalised record taping, but it fulfils two criteria. It solves the problem of limited supplies of singles and it meets consumer demand. The practice in question takes the form of a member of the public going to his local record store and having the proprietor record the singles or LP tracks required on to cassette, the record store owner charging for this service. The cassette which is recorded can be either a virgin item sold by the record store owner, or one the customer brings with him/her for over-recording. Since the supply of blank cassette tapes in West Africa is by no means constant, whilst record store owners seldom have more than five copies of even the most popular single records in stock, this practice seems to meet a consumer need. Quite what the world's major record companies would make of this is another matter!

Whilst live music is a major cultural and artistic activity in West Africa, I was somewhat surprised at how often workers would stride out from semi-dense greenery along the roads clutching portable radios or portable radio cassette recorders. What sources of music these workers were listening to I have no means of knowing, but the aforementioned practice plus conventional taping from a friend or a radio programme seem the most obvious means. One thing is for sure, as in much of the Third World, the people who manufacture and sell batteries aren't likely to go out of business.

Another interesting aspect of the West African recorded music market is the prevalence of pirated recordings on cassette tape. Because of the limited supply of the real item it seems only natural. However, seeing street stalls selling pre-recorded albums or 'selections' (complete with appropriate facsimile cassette liners) in the heat of the midday sun doesn't exactly augur well for the 'baked' quality of the pirate merchandise. Add to this the fact that these copies were probably made in a back room with fairly limited equipment and one doesn't need too much of an effort to keep walking. Whether these street vendors are mainly after unknowing tourist trade is difficult to say, but pirating is a problem which the Togolaise authorities seem to condone as a necessary evil rather than encourage. Now that the government has a stake in producing records it may take a less charitable view, though.

Finally, in this overview of the West African recording scene, a few

words about the music. As one would suspect the colonial hangover from French or British rule has had some effect. Certainly at a Lomé night club it seemed odd to hear Dire Strait's *Sultans of Swing* booming out of the loudspeakers, whereas other French or French influenced artists seemed more in place. However, the range of home grown West African music, both instrumental and vocal, was wide. This ranged from fairly 'raw' chants with drum or percussion accompaniment, through to bands producing the equal of anything that for example West Indian influenced bands are producing in Europe. Another interesting factor was that although distinct tribal influences could be heard in many items, because many West Africans are multilingual and because much of the music is rhythm dominated there is a universal market for the majority of recorded home grown music. Overall there was certainly evidence of a healthy local West African music scene which should point to a busy future for Studio de la Nouvelle Marche.

Following authorisation of the record pressing, disc cutting and recording complex by the Togolaise Ministry of Information in 1978, the first task was to appoint a contractor to design, build and equip the project. Because Togo is a French speaking country, and a former French colony, it was therefore only natural that a French company used to carrying out such work in the Third World should be appointed. The choice in this instance was 3M France who have carried out similar projects elsewhere in Africa. After visits to the proposed site for the complex, 3M France engineers drew up complete construction plans and arranged provision of a complete turnkey package. As part of this process 3M France, who act as agents for Eastlake Audio in French speaking areas, also appointed Eastlake Audio as subcontractors for the acoustic treatment of the relevant areas of the complex.

From the initial stages of the project it was decided that it should be constructed in three phases. This was partially done to spread the cost of the project thereby easing the drain on this small country's resources, whilst also having the advantage that as phases were completed they could begin contributing revenue. Phase 1 comprised the construction of a 24-track recording studio; Phase 2 which followed shortly after involved the construction of a disc pressing facility with a capacity of 3,000 discs per day; while Phase 3 saw the construction of a disc cutting room. Other conveniences which were provided included maintenance facilities, offices, and —most important—a bar!

Construction of Phase 1 of the project commenced in late 1979, with the recording studio being completed in November 1980, the complete project being finished in November 1981. Inauguration of the operational life of the complex took place on January 11, 1981 even though the disc cutting room was still under construction.

Recording studio control room

Cutting room

Five miles from central Lomé and adjacent to a main highway, the complex is on land purchased by the Togolaise Ministry of Information from local farmers, so it is in peaceful rural surroundings away from the hubbub of the capital. The building housing the complex is constructed from concrete and is split into two halves with a corridor linking the multitrack studio/cutting room section with the electroplating/pressing departments. The studio/cutting room is built on floating slabs as per normal practice. The choice of concrete as the main construction material was for purely practical reasons as the climate in West Africa with torrential rain bursts followed by blistering sun is highly conducive to destroying and rotting other materials. In addition the local wildlife species which include lizards and termites of all varieties have a certain predilection for making their homes or alternatively living off other materials. These problems posed particular headaches for Dave Hawkins as acoustic treatment and the Eastlake philosophy make much use of the wood and other materials which have a natural attraction to bugs. As Dave puts it "West Africa produces some excellent native hardwoods, but none of the structural grade long span softwoods which we typically use for studio and control room construction. Moreover, it is difficult to obtain locally grown and prepared timber of consistent nominal size," therefore it was decided that all timber to be used by Eastlake's construction crew would be imported from Europe. The timber used was kiln dried and treated with preservative insecticide and shipped out to Togo by container, hence minimising potential problems. Certainly when I visited the complex in 1982 no visible signs of decay were evident and coupled to Togolaise pride in the care of their facilities it seems that the extra trouble involved has been worthwhile.

Tour

The tour of Studio de la Nouvelle Marche, which literally translated means Studio of the New Way, commences with the multitrack studio. This is laid out as a basic rectangular shape with a bright live area with a ceramic tiled floor at one end, which can be shut off from the rest of the studio by two sets of sliding glass doors, and with the control room at the opposite end. Access to the control room from the studio is via double sliding glass doors with a small area in between which may be used as a live isolation booth if necessary. To the immediate left of the control room end of the studio is a drum booth. The overall size of the studio is some 1,500 ft^2 with the partitioned live area having an area of some 375 ft^2. The finish of the studio is to the usual Eastlake style with wood panelling in the live area, the side walls of the drum booth and on a couple of sections of the irregular walls of the studio. Other sections are finished with cork bark and carpeting, while in addition sliding wall drapes are fitted along the righthand wall of the studio. Considering that the studio had been in constant use for some two years it was surprising that it appeared to be in 'as new' condition. It would appear therefore that the studio staff treat it with much tender loving care.

Loitering within the studio is a fine range of musical instruments, particularly including a Ludwig drum kit, Fender guitars and amplifiers, a Martin acoustic guitar, a Hammond *B 3000* organ, Fender Rhodes electric piano, Elka string synthesiser, *Polymoog* synthesiser, ARP *Odyssey* synthesiser, Hohner *Clavinet* and a Yamaha grand piano. The reason for this wide plethora of instruments is quite simple; since this is West Africa you can't just order up extra instruments from the hire company down the road at a few hours notice. Accordingly if artists want anything unusual the onus is on them to provide it. However, the studio's selection is certainly more than adequate for most purposes.

Other equipment includes a useful selection of microphones—AKG *C414EB, D224, C451E, D12;* Neumann *U87* and *U47;* and Shure *SM7.* Other items included a pair of JBL *4311s* and Pioneer headphones for foldback driven by Crown *D75s.*

The control room looks directly on to the studio with the console centrally placed opposite the sliding glass doors. To aid observation there are also two windows each side of the doors, one looking directly into the studio and the other looking into the drum booth. Above these two windows are placed two Eastlake *TM1* monitors flush mounted on sloping wood panelling. These monitors are two of four monitor housings provided, but the two housings on the rear wall of the control room (2 to accommodate quadraphonic monitoring and mixdown) are driverless. The Eastlake monitors are driven by HH *S500D* power amps and the control room is equalised with White *4001* ⅓-octave equalisers with a plug in 18 dB/octave crossover at 80 Hz. The Eastlake monitors are fitted with Gauss LF and MF drivers and Emilar tweeters.

The console in the control room is a 32/24/32 Audio Help *CS2405* modular console provided on an OEM basis to 3M France. This console with 32 inputs and outputs has parametric equalisation, four subgroups and eight echo sends. At the right of the desk is a sloping patchbay while to the left is a section of 19in racking flush with the console fascia. This contains an Aphex *602B Aural Exciter,* UREI

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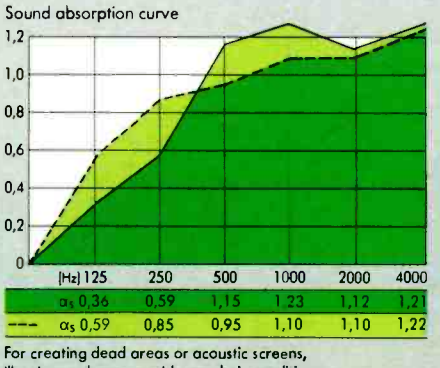

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New ways in West Africa

527A graphic equaliser, Eventide *H910 Harmonizer,* Eventide *FL201 Instant Flanger,* a dbx *162* stereo comp/limiter, and an Audio and Design *F-760X-RS Compex* limiter. The console also includes two inbuilt Audio Kinetics *XT-24* autolocators, plus tape remotes for two Revoxes situated above the subgroup master faders. Metering on the desk is of the conventional VU type and includes a phase meter. Located above the meter penthouse are a pair of the ubiquitous Auratones.

Situated in two alcoves at the rear of the control room are the tape machines and a free standing 19 in auxiliary equipment rack. The tape machines and a free standing 19 in auxilliary equipment rack. The tape machines comprise a 3M *M79* 24-track, a 3M *M79* 2-track master recorder, and a pair of Revox *A77*s. To accompany the tape machines the studio has Dolby noise reduction while the tape used is 3M *250* and *256.* The free standing rack accommodates the Dolby *M52H* noise reduction cards and PSU, plus a pair of MicMix *Master-Room* 2-channel reverbs and a Kenwood Dolby stereo cassette deck. Lurking elsewhere there was also a JVC record turntable. The studio is excellently equipped with facilities that would be the envy of some European studios. Not only does it look good, it is well maintained and it sounds good.

Next on the itinerary is the cutting room. This exactly mimics the layout of the studio's control room even to the extent of fitting glass fronted cupboards for tape storage in the same relative positions as the observation windows and sliding doors of the control room. Accordingly, since the Eastlake monitoring arrangements are identical to the studio control room, a producer/artist can check each phase of the recording to disc cutting process under optimum conditions. A most useful feature and a good example of the care which has gone into the design and implementation of this project.

The console in the disc cutting room is again an Audio Help desk supplied on an OEM basis to 3M France. Yet again this includes Auratones mounted on the top fascia, plus an Audio Kinetics *XT-24* autolocator, and a 2-track tape remote. The console also includes pre-listening and programme monitoring facilities, parametric ±15 dB equalisation, and inset in the facia are two Dolby *361* noise reduction units, two dbx *162* stereo comp/limiters, and a small patchbay. The console's centrally placed meter hood has two L and R VU meters, a phase meter, and two NTP bargraph meters for monitoring A and B signals plus L + R phase. The tape machines in the cutting room are a pair of 3M *M79* 2-track preview machines which have interchangeable 4-track ½ in heads. Situated in the righthand rear alcove is a Neumann *VMS70* disc cutting lathe with an *SX74* stereo cutterhead. These are fed and driven from a Neumann *VG74B* rack. The lacquers in use here are from Pyral and Audiodisc.

Both the studio and the cutting room are completely air conditioned with a highly efficient system of silencers and ducts in fibreglass to keep the noise level of the system at a minimum. Another useful precaution was the provision of an electronic tension regulator to ensure a smooth electrical supply to the studio and cutting room.

Moving along the linking corridor to the pressing facility, this comprises an electroplating department and record pressing plant. The electroplating section is equipped with 3M France supplied units comprising an electroplating tank with two separate cathodes, silver plating by pistol process, polishing, preforming, and a centering and trimming machine. Highlighting the quality approach to the whole complex, a de-ionising water processing plant is also included.

The pressing plant has two 3M France supplied record presses (complete with extruders), one for 7 in singles and one for LPs. These presses are semi-automatic thereby providing higher quality pressings and the potential for producing picture records. The presses take up only half the available space in their designated section of the building allowing extra presses to be added as required. In addition to the above facilities the presses are supplied with hydraulic power, steam, refrigerated water and compressed air by means of a hydraulic plant, boiler, cooling tower (complete with closed circuit water system and pumps) and an air compressor all supplied by 3M France. The pressing plant also has a quality control cabin with a record player for checking finished pressings.

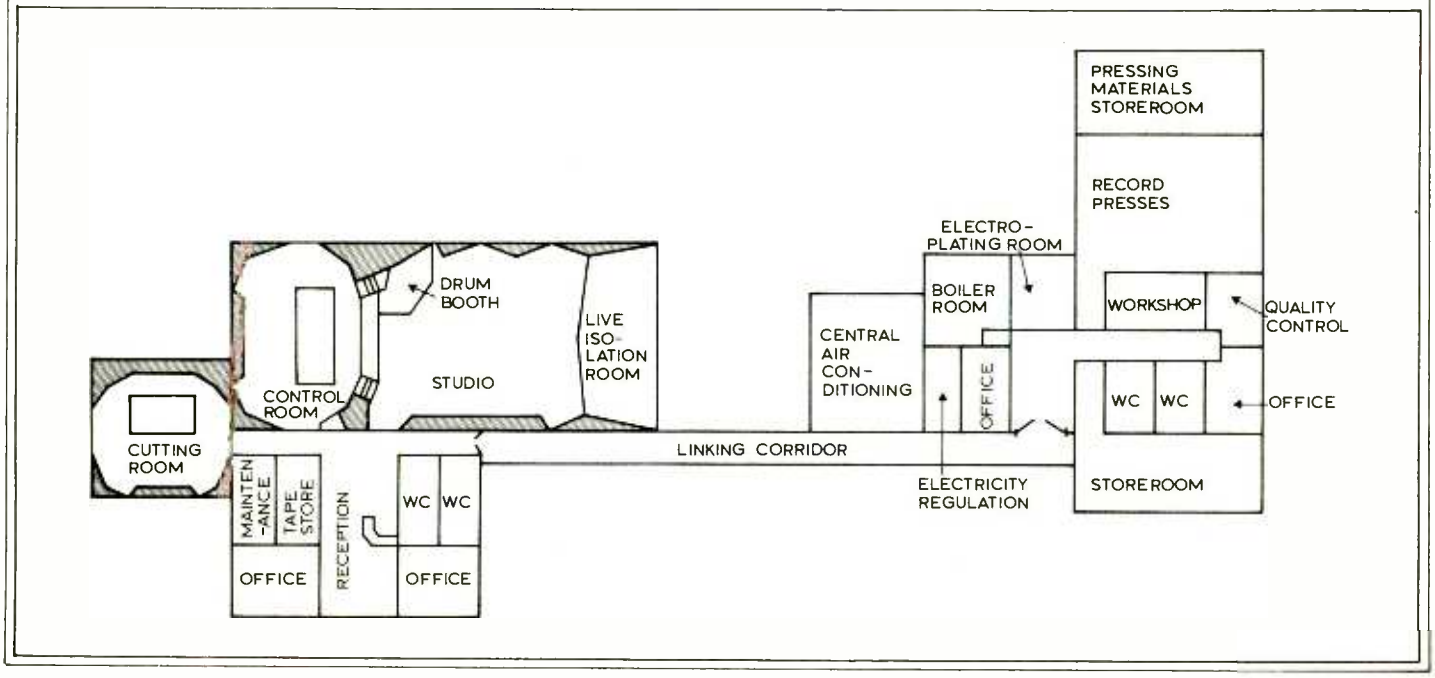
As the studio is situated in West Africa the complex also has a fully equipped maintenance department, for fairly obvious reasons. This is fitted with a wide range of test equipment including an oscilloscope, multimeters, etc, all manufactured by Hewlett Packard.

The Togolaise complex is staffed exclusively by Togolaise nationals. Overall a total of 23 staff are employed directly by the studio, but of these the 'nitty gritty' personnel around which everything revolves number six. These are the commercial director Amabley Kokouw, artistic director Tassane Ouyi, maintenance/cutting engineer Assih Patanahni, and the three balance engineers Woamekpo Koffi, Anifrani Ekpi and Kagnassim Kalentena. All these crucial personnel were extremely competent and well-trained, complementing the high technical standards of the complex. The studio has recently recorded a wide range of artists including bands from Togo, Ghana, Nigeria, the Ivory Coast, Upper Volta and—interestingly—American Tamla Motown artists. Whilst the first group of nationalities are only to be expected it is interesting to see that without any substantial promotion as it were, mainstream recording artists were availing themselves of the complex's excellent facilities. Hopefully this initial 'toe in the water' exercise will bear fruit and other North American and European artists will follow in the Tamla footsteps. Certainly the commercial director hopes they will and at a very competitive studio rate for top quality facilities it is one of the few places where you can go from recording to finished pressings. They deserve to succeed in this aim.

To sum up, Studio de la Nouvelle Marche offers prestigious facilities in an unusual part of the world. Togo is a very friendly part of the world and the weather and relaxed atmosphere are extremely conducive to non-pressurised recording. Lomé has a number of top quality hotels which already cater for tourism, while for long term stay bands arrangements can be made for the rental of villas. Communication is also no problem as Lomé airport has international connections to Paris, Zurich, Amsterdam and Rome, plus other African connections. ■

Studio de la Nouvelle Marche, BP 1244, Lomé, Togo. Tel: Togo 21-67-73 or 21-68-62. Telex: 5294 MINFO TO marked for the attention of Tassane Ouyi.

I would like to record my thanks for assistance to David Hawkins of Eastlake Audio, Guy Berriot and Bertrand Lablancherie of 3M France, and Assih Patanahni, Tassane Ouyi and Amabley Kokouw at Studio de la Nouvelle Marche.



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APRS preview

The APRS exhibition will be held at the Kensington Exhibition Centre, Derry Street (just off Kensington High Street), Kensington, London, between June 22nd and 24th inclusive from 10.00 to 18.00 hours except for the last day when the exhibition closes at 17.00 hours. Entrance is by business card.

A

● **AC Electronic Services:** wide range of power amplifiers, crossovers and accessories. Featured items include 24-channel *ML24/24* in-line console, *TR16* and *TR24* 16- and 24-track machines in a new modular format, the first showing of the *TR2* ½ in 2-track tape machine and a low cost simultaneous encode/decode noise reduction system. The latter item will hold 16 channels in a 19 in rack and has a claimed noise reduction factor of 50dB. ● **Advanced Music Systems (AMS):** full range of products with featured items—*DMX15-80S* stereo digital delay line pitch changer with new de-glitch module and audio triggerable loop editing software; the *RMX 16* digital reverb with the first demo of the optional bar code reader addition and two new programs; the *A/V SYNC* 3-channel digital delay for use with video synchronisers. ● **AKG:** full range of mics, headphones, reverb systems and delays and other audio components. Featured items will include *The Tube* valve microphone, mini monitors and the Aphex range of equipment with the new Aphex *Type B* aural exciter. ● **Agfa-Gevaert:** full range of audio and video tapes. On show for the first time is *PEM 297D*, a ¼ in digital tape in 4,600ft lengths on 10 in NAB reels. Other tapes on show will be *PEM 428* long play, *PEM 468, PEM 369, PEM 269, PE 39, PE 49,* duplicating tapes *PE 619* and *PE 819, PER 368* for use with Nagra recorders and a new range of audio cassettes. ● **Allen & Heath Brenell:** a *Syncon B* console running with a *M24* 24-track tape machine, a selection of other mixers including units from the *System 8* and *21 Series* ranges. ● **Ampex:** the full range of products with featured items being *ATR800* tape machine available in a variety of formats and with intertrack time code, the other tape machines in the ATR range and the full range of tapes and cassettes. ● **Applied Microsystems:** *Spin-Time* real time tape timer, *CM50* and *CM55* autolocators, and a new development in basic synchronisers. ● **Atlantex Music:** the full range of MXR and Ashly products and the other lines that they handle. New items include the MXR *Pitch Shifter*, two MXR digital delay lines with 320 ms and 1 s max delays, the Ashly *SC 33* stereo noise gate and a revised model of *The Kit* known as the *MPC 2*. ● **Audio & Design (Recording):** the full range of Audio & Design products including two new Scamp modules, the *S30* expander/gate and the *S31* compressor/limiter. Also on show will be the full range of 'little boxes' including the *ProPak* audio interface, the *AmPak* monitor amp and a new time code reader. Other equipment on show will include Eela Audio *3000 Series* in-line console, *S200* broadcast console and the economic *S100* console with a full range of Eela accessories; Calrec microphones including the *Mk IV Soundfield* mic and the Ambisonics Mastering System including a *Transcoder* and a *Pan/Rotate Unit*; Telefunken *Telcom* noise reduction; the Neutrik *Audiograph 3300* and the Meridian interactive speakers in a professional format. ● **Audio Developments:** full range of products including the *AD049, AD060, AD045* and *AD062* sound mixers. ● **Audio Kinetics:** the *Q.LOCK 3.10C* time code synchroniser will be demonstrated in a audio/video post production set-up with a video master linked to a multitrack recorder and a mastering machine. Also incorporated will be new software programs, Automatic Dialogue Replacement *Q.SOFT-ADR* and Sound Effects Assembly *Q.SOFT-SFX*. ● **Audio Services:** details of the new and secondhand equipment available. ● **Audio Systems Components (ASC):** modified *PR99* for broadcast use. ● **Audio Visual Marketing:** full range of Milab microphones, and products from NEAL and Ferrograph. ● **Audix:** products designed for the broadcast industry. Demonstrated will be the *MXT1200* console designed for broadcast and OB use, the *3B06* modular distribution amplifier, and the featured item will be the *Assignable* console. ● **Alice:** featured item will be the *SILK* series of mixers, the first of which has just been installed. It is a multitrack digitally controlled 24/6/2 console for music recording and video post production. Capable of simultaneous stereo and 24/26-track working using an external events controller with digital interface which can assign up to 24 separate functions on each channel. The console can be placed under computer control. ● **Autograph:** will feature the Meyer *833* studio monitor and information on other Meyer products, together with a number of other lines.

B

● **BASF:** full range of tape for recording and duplication including test tapes and audio cassettes etc. ● **FWO Bauch:** will feature a wide range of products from Studer, Revox, Neumann, EMT, Albrecht, Klein + Hummel, Harrison, ITC, Melkuist, UREI, Lexicon, Valley People, MRL, Switchcraft, Gotham, Ivie, Transco and Europa Film. Recently introduced products which will be on demonstration include the Studer *A810* ¼ in mono/stereo tape machine with timecode facilities; the Studer *A710* professional cassette recorder; the Studer *TLS 4000* SMPTE synchroniser; a Studer *900B Series* mixing console; the Neumann *TLM 170* microphone; the EMT *938* record turntable; Lexicon *PCM 42* digital sound processors and the *PrimeTime II* digital delay processor; Harrison *MR-4* mixing console and the *TV-3* and *TV-4* television sound consoles; the Valley People *610* dual comp/limiter; the first European showing of the new ITC *Delta Series* of cartridge machines; and the first public showing of the new Melkuist *Master-Mix* mixing console automation systems.

● **Beyer:** range of dynamic and condenser mics, headphones and radio mic systems. ● **Bruel & Kjaer:** comprehensive range of test equipment and showing for the first time, the range of music recording microphones Types *4003, 4006, 4004* and *4007* with power supplies.

C

● **Cetec International:** high speed cassette duplication systems. ● **Clyde Electronics:** range of broadcast orientated electronic equipment including the *Alpha Series* mixing consoles that have an 8-track capability. ● **Cunnings Recording Associates:** Ferrograph *Studio 8* tape machines, pilot tone synchroniser, pulse rate converter, details of their tape and cassette duplication facilities, cassette materials supplies and products for which they are dealers. ● **Crow of Reading:** Enertec tape machines featuring the *F500,* and details of the other products and services offered. ● **Citec:** range of high quality studio faders. ● **Canford Audio:** a selection from their large range of studio and broadcast sundry equipment and supplies. New products will include the Citec range of conductive plastic faders and Niverco cassette to cassette duplicators. Also on display will be Illsonic acoustic tiles and other studio furnishings. ● **Clive Green:** Cadac multitrack in-line consoles available with modules suitable for broadcast or recording applications.

D

● **Dolby:** the full range of noise reduction units including the *SP Series*. New items include the 2-channel *M372* portable noise reduction unit and a range of noise reduction cards for video recorder use — including *cat 226* for Ampex *VPR2B* and Marconi *MR2B,* and *cat 234* for the Sony *BVH 2000*.

56 ▶

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APRS preview

E

● **Ernest Turner Instruments:** comprehensive range of VU and PPM meters including bargraph display units. ● **Elliott Brothers:** details of the reconing, installation and design services offered as well as a selection of Tannoy products. ● **Eardley Electronics:** the full range of Neutrik connectors and the Neutrik *Audiograph 3300,* a modular audio measuring system. ● **EMO Systems:** range of products manufactured including DI boxes, mic splitter, 19 in rackmount power distribution unit and an RIAA disc preamp.

F

● **Film Tech Electronics:** range of compact portable mixers for ENG use. ● **Formula Sound:** details of design, manufacture and installation services. Products on display include *S19GA* 19-band graphic equaliser/analyser, *QUE-4* studio foldback system and *PM-80* production mixer. Also on show will be new room equaliser units. ● **Feldon Audio:** products featured will include RTW digital/analogue interface for the Sony *PCM-F1*; Digital Systems *DPU 1610* analogue/digital disc cutting delay unit; Auditronics *PPEQ-1* programmable parametric equaliser; Eventide *SP2016* digital signal processor plus the full product range; Sony digital recording systems, mics' high speed cassette duplicators, headphones; and products from Marshall Electronics, Ursa Major, Ortofon, Inovonics, Commodore *PET* computer systems, Synton and Pulse Designs. ● **Fraser-Peacock Associates:** details of their audio visual production, audio and video cassette duplication. They will also be demonstrating the improved version of the Sony *CCP 13B* cassette to cassette copier. Demonstration copies of visitors material will also be made. ● **Future Film Developments:** selections from the large range of connectors, cables, patchfields etc that they handle as well as products from Stellavox RTS and Genelec.

H

● **Hill Audio:** new items will be the *DX2000* 1,000 W/channel stereo power amplifier, the *J Series 3* sound reinforcement and multitrack console available in any format from 16/4/2 to 48/16/2; *Series 3* monitor console, the latest version of the *B Series* budget modular mixers and the *DX* range of amplifiers. ● **H/H Electronic:** the *MosFet* range of power amplifiers, *TPA* series and *S500D* amplifiers, the range of drive units and details of their other PA products. ● **HHB:** full range of **Amcron** power amplifiers and *PZM* mics with several new models; selection of **Gauss** speakers; Sony products including *PCM 1610* and *DAE 1100* editor, *PCM F1* and *Compact Disc* players; selection of signal processing equipment from their hire stock plus several new products as yet unconfirmed. ● **Harman Audio:** will be showing the Tascam *50 Series* tape machines with a *58* running in sync with video units, the *Tascam M50* mixing console, the Tascam 16-track, the *Enhancement Series* of processing units and the *JBL 4612* mini PA sound system. ● **Hayden Labs:** wide range of products from Nagra, Sennheiser and Telefunken.

I

● **International Musician:** musician orientated magazines and publications. ● **Industrial Tape Applications:** the complete line of Otari equipment, details of the ITA hire business—mics to multitracks, the Itam *Sigma* console, the smaller Itam consoles and the compact *1610* 16-track on 1 in tape machine. ● **Industrial Acoustics:** full range of acoustic control materials.

J

● **John Hornby Skewes:** will be showing the complete range of Audio-Technica microphones for stage and studio applications. Four models are now available with phantom power option. ● **James Yorke:** details of the company's cassette duplication, production and packaging services; its tape coating and slitting operation and micro computer program duplication service.

K

● **Klark-Teknik:** the full range of products will be on display including graphic equalisers, digital delays, reverb system and audio measurement equipment. New items will include the *DN 360,* a 2-channel ⅓ octave graphic equaliser with 30 bands at ISO frequencies using thick-film filters; the *DN 300* single channel version of the *DN 360* with tunable HF and LF filters; *DN 301* ⅓ octave attentuating graphic equaliser; *DN 332* 2-channel ⅓ octave graphic equaliser; *DN 700* low cost digital delay with 3 outputs and 434 ms max delay. ● **Kelsey Acoustics:** wide range of connectors, transformers, mic stands DI boxes, the *NG4 MK1* 4-channel noise gate, stage boxes, Audicom intercom systems, the Yamaha Professional range of power amplifiers and accessories. ● **Keith Monks:** a wide range of equipment including record cleaning machines, mic stands, cable drums and other accessory products. New items include the *MSF3* folding leg stand, a carbon fibre fish pole, and a new mic splitter box. ● **King Instruments:** self feed cassette loaders and various video tape loaders.

L

● **Leevers-Rich:** *Proline* series of ¼ in tape machines, Garner bulk erasers, Tomcat cart machines and BMX broadcast consoles. ● **Leeholme Audio Services:** details of the company's cassette duplication and cassette supply services. ● **Lennard Developments:** range of test equipment from Woelke Magnetband Technik together with the range of professional recording tape heads.

M

● **Music Laboratories:** PSE range of equipment and selections from the range of products that they carry as dealers. ● **Mike Fraser Film Services:** demonstration of the *CAT* automatic tape splicer and other tape editing products. ● **Magnetic Tapes:** the *Chilton* range of mixing consoles for recording, PA and broadcast use. ● **Mosses & Mitchell:** full range of audio jacks and jackfields. ● **Midas:** *PR System* consoles for sound reinforcement applications: *TR System* modular theatre consoles; and *Auditorium* console system.

N

● **NEAL:** models from the full range of NEAL recording and broadcast cassette recorders. Latest addition to the range to be shown is the *600 Series* dual deck recorders. Facilities offered within this format will allow versions for logging, copying, or dual recording of up to four channels. ● **Neve:** a selection of consoles for recording, broadcasting and film use. Featured will be a *51 Series* console, the new *8128* console available in formats up to 56 channels, the latest fully working version of *NECAM* for post-production dubbing work. Information on the Neve Digital Audio Console will also be available.

O

● **Otari:** full range of tape machines including the *MTR10* in 2-track ¼ in and ½ in formats, the *MTR-12* available in the same formats as the *MTR-10*, the *MTR90* 24-track also available in 16- and 8-track versions, and the *MX5050* series of tape machines.

P

● **Pilkington Fibreoptic Technologies:** details of fibreoptic products and multiplexing systems. ● **Precision Audio Marketing:** the full range of Sound Technology test equipment featuring the new *Model 1510A* microprocessor controlled tape recorder/audio test system. ● **Philip Drake:** products from their range of talkback/intercom, audio distribution and theatre systems. ● **Penny & Giles:** the range of conductive plastic faders featuring the *3000 Series* faders as well as the full range of other faders and rotary pots.

R

● **RE Instruments (Danbridge):** will feature the *RE201* dual channel audio analyser and a sample of other products from their range. ● **Rebis:** full range of modular and rack mounting effects and signal processing units. ● **Raindirk:** examples of the ranges of broadcast and recording consoles together with various periphery equipment. ● **Roland:** wide range of products including the Roland Rack system, the *SDE-2000* digital delay line, the *MC4B* Microcomposer, a range of mixers and power PA units, synthesisers and drum machines.

S

● **Solid State Logic:** the established *4000* series with *Total Recall* and the new *SSL 6000E* series consoles and computer systems. The *6000* is designed for live teleproduction, outside broadcasts and video post production. ● **Sountracs:** featured will be a modular mixer system available from 16/4/2 to 32/12/2 with 24-track monitoring, using a microprocessor for routing and memory allowing full write, store and recall routing externally via a keyboard on one of the modules. The established range of 4-, 8- and 16-track mixers will also be displayed together with a new 26/26/8/2 console. ● **Sifam:** wide range of VU and PPM meters, control knobs, switches and transformers. ● **Swisstone Electronics:** full range of Rogers monitoring systems. ● **Sony Broadcast:** *PCM 1610* PCM processor with U-matic based digital recording systems, *3324* digital multitrack with new autolocator/remote control unit, *Compact Disc* players and professional version, mics, radio mics, ancillary digital units. In addition there will be mixing consoles and tape machines from MCI. ● **Surrey Electronics:** the full range of products for metering, disc preamps, frequency shifters, distribution amps etc. New items include *Stereo Disc Amplifier 4* to accept cartridge outputs and deliver balanced lines, *PPM5* 20 pin dual in-line hybrid, stereo microphone amplifier and a stereo version of the *Stabilizer/Frequency Shifter.* ● **Sonifex:** range of NAB cart machines and small mixers. ● **Scenic Sounds:** will be exhibiting items from the wide range of products that they handle. Items shown for the first time include the Lexicon *200* reverb system, 360 Systems digital keyboard, Deltalab *Effectron* delay lines, btx *Cypher* SMPTE time code generator with video character insertor, jam sync and other options; *Shadow* control unit, dbx *700* digital system, Schoeps capsule *BLM 3* for the Colette range using boundary techniques, Orban *424A* and *422A,* and the Countryman range of miniature mics. Also featured on the stand will be the Amek range of consoles with the centre of attention being the *Angela* in-line console. Modules from the other consoles in the Amek range will also be shown. ● **SRT:** details of the company's disc cutting and disc pressing

facilities. ● **Stanley Productions:** a range of products from Zonal and Magna Tontraeger, including audio cassette materials for duplication, both tape and casings etc and ¼ in *Generation I* high level, low noise, reel to reel tape. ● **Shuttlesound:** selection of items from the Electro-Voice and Tapco ranges. ● **Syco Systems:** as UK agents for a wide number of digital synthesisers, there will be information available on products from Fairlight, PPG, Digital Keyboards, E-mu Systems, Linn, RSF as well as the Quantec *Room Simulator*. ● **Soundcraft:** featured will be the new *TS24*, an in-line console with a design that is claimed to reduce the confusion that can sometimes occur in consoles of this type. Also on show will be a *Series 2400* with automation, consoles from the *Series 1600* range, live consoles *800B, 400B* and *Series 200,* and the range of Soundcraft multitrack tape machines with the recent addition of the *SCM 2000* 2-track machines available in ¼ in stereo, 2-track and a ½ in version all with centre timecode option. ● **Shure (HW International):** full range of Shure mics together with other selected items. Featured items will include the Shure *AMS 8000* directional mic/automatic mixer system, the Alpage range of cassette decks with the *AL90* and the possibility of some new models. ● **Samcine:** wide range of custom flight and transit cases.

T

● **Turnkey:** selections from their product range. Featured items will be the Synclavier with recent options, the Turnkey monitors, Illsonic acoustic foam and EXR signal processors. Studio design and construction services from Turnkey 2 will be shown. Associated company Bandive will be showing the Seck mixer range and from Fostex, the new *X15 Tracker* and the *B16* ½ in 16-track. ● **Tannoy:** range of professional studio monitors from small to very high power units with several new models. Also Tannoy Tresham power amplifiers. ● **Technical Projects:** new products on display will include *MJS 401D* audio measuring system in working prototype form, *ART*—automatic reverb timer which includes a detailed 60dB decay curve video display, *IQS Model 401* FFT spectrum analyser, HME *System 85* radio mic system, an intercom range comprising *LS300* Series loudspeaker stations, *LS200, 400* and *600* Series listen only loudspeaker stations, *DMH 200* Series headsets, *HS121* headset station and *AD903* 2 wire to 4 wire intercom unit. **Thorn EMI:** will be showing the full range of products from Capitol Magnetics. These include the new Apollo lacquer master which they describe as the ultimate lacquer master for analogue applications, cassette tape and *Audiopak* NAB cartridge. EMI Tape will also show their range of audio cassettes and accessories. ● **Trad:** a selection of new and secondhand equipment and details of services. ● **Tweed Audio:** Wide range of sound recording and broadcast consoles. Details of custom design and building services. ● **Trident Audio:** featured items will be the new *80B* and *Series 70* consoles. The *Series 80B* is a development of the *80* and uses a hard wired patch bay and a differing construction but with the same facilities and a reduced price. The *Series 70* is a console derived from the *Trimix*. Also displayed will be the redesigned *VFM* Series consoles. ● **TAM Studio:** a working lathe cutting on the stand as last year with details of their cutting and duplication services. Further information will be available on their new disc cutting sales and services together with new items they will manufacture as well as products from Ortofon who they now represent professionally. ● **Tracktech:** the *BMB Series* of mixing consoles will be shown for the first time in the UK. Models include 18/18/16 and 26/26/24 and both are in-line types. CMOS switching is used in the routing. Each channel has four modes—on (for recording), over-dub, track bounce and mix. These may be set on the channels or by master status controls. VU meters are standard with LED bargraphs optional, as are several other options. ● **Tandberg:** full range of tape machines and cassette recorders. Shown for the first time will be the *TCCR 530* computer controlled cassette recorder, the *TCR522* mono 1 or 2 track cassette machines, and the *TCD 3014* microprocessor controlled 4-motor cassette recorder.

V

● **Vitavox:** range of loudspeakers and mic equipment as well as D&R Electronica consoles.

● As last year, Don Larking Audio Sales are organising an 'Over The Road Show' at the Kensington Town Hall on the same days as the APRS with opening times of 10.00 hours til late. The show will comprise operational recording set-ups based around the Trident *Series 70*, Teac and Fostex systems. Other items on display will be the Bel product line, Cutec portable cassette studio, and the Movement Drum Computer.

● Editorial and advertising staff from *Studio Sound* and sister publication, *Broadcast Sound* will be attending the exhibition based either at our stand or around the exhibition itself. Copies of the magazine will also be available from our stand. ■

letters

Training course report

Dear Sir, I recently attended a course advertised in Studio Sound *for studio engineering and thought you might be interested in a review of my experience.*

The course is run by JSO Studios. They offer weekend, one week and 24-track courses for people considering studio engineering as a profession, or just plain interested. I attended the one-week course (five days). I was attracted to the course by the wording of the advert and JSO's letter following my enquiry, indicating small numbers for low teacher/student ratio and tutoring "to a person's own level and with regard to their own particular interest".

I run a small studio at Bristol Polytechnic which is used for teaching and radio production work. All my experience has been in speech and effects and mixing programme material for radio. What I wanted from the course was to find out about, and have experience in, multi-track music recording and stereophony with a view to expanding my work into that area.

The cost of the course was £220 for the five days, inclusive of hotel for four nights. On top of this was travel and subsistence.

During the five days' course members could ask questions at any time, but only on the first two days and morning of the third was there any form of structured instruction.

Before being critical I think everyone who attended the course went away having learned something that was beneficial. But to most of us a studio session with the band was not something we were seeing for the first time. For a novice I have no doubt the week would have been extremely enlightening, but having talked to most of the course members what everyone wanted was practical supervised experience on the mixing desk, problem solving, and technical information. In the event what most of us got practically was between 30 and 60 min on the last day.

The reason for this is clear. The engineer had a divided loyalty (not his fault) between the course members and the band who were paying for and expected finished demos of three songs by the end of the week. The engineer was consequently under pressure.

It was fortunate and by chance that on the second day one of the course members volunteered to play the studio drum kit and piano for us to practise setting up microphones and getting a balance. This exercise demonstrated a phasing problem which otherwise would not have occurred. There was no time for us to experiment in this way with the band as there should have been, due to the time restriction imposed by the number of songs to record. We simply had to watch the engineer do his job.

It is sound well proven educational practice that a person learns and understands most from doing, not from watching.

For a satisfactory outcome there should have been fewer people on the course. JSO advertised a norm of six or seven. There were eight (nine if you include their own staff member who was obviously along for the ride). Five would have been realistic. It is impossible for one person to "tutor" eight people "to their own level with regard to their own particular interest" in a week let alone a weekend in the way they had it organised.

With one exception everyone on the course had some professional experience. This is not surprising as it was advertised in a professional magazine, Studio Sound. *I would suggest that this led many of us to have certain expectations.*

Overall I was disappointed. The engineer was very good and under the circumstances did a good job, but he was unfairly compromised by having a responsibility to both the band and the course.

To be constructive. It would have been better with fewer course members, a band to record one *song so everyone can mic-up, record and mix under supervision then the final mix to be done by the engineer after course members have finished. Better still would be to hire three musicians (piano, bass and drums) who can double on guitar and vocal. The drummer could be brought in first as the drums take the longest to set up and mic. All three for the next session to record the backing track then two for the last session for vocals and overdubs. Three 3 hr sessions to do one song leaving more time for the essential tasks of the course.*

We would like to express our thanks to Mike, the engineer.

Yours faithfully, Dave Griffiths, Bristol Polytechnic, St Matthias Site, Oldbury Court Road, Fishponds, Bristol BS16 2JJ.

A pat on the back

Dear Sir, Congratulations on the 'look' of the May issue. I have been a reader of Studio Sound *almost since it was called* Tape Recorder, *and it has been my 'bible' ever since I was a tape-op. While the quality of articles has always been very high, it has tended to look a bit conservative and staid as times have changed. After all, you are not the* AES Journal *and I suspect you don't want to be! The May issue changed all that, though, and looked really 'state of the art', in keeping with your articles. I was particularly impressed by the contents page, which looked very good. I am also glad to see that you now have more room for editorials, which I always read, even though I don't always agree with what you say, particularly about digital recording and home taping. I also like the colour in your articles, which as well as looking good, often makes things clearer. Keep up the good work!*

Yours faithfully, R. Sturgeon, Chief Engineer, Sound Production Associates, 41/42 Wychtree Street, Morriston, Swansea SA6 8EX.

Interfacing

Dear Sir, In the January 1983 issue, page 3, Richard Elen referred to "rumours abounding that it is possible to interface the . . . PCM-F1 *Sony digital processor . . . with a 16-bit PCM editing system".*

In fact, direct interfacing, ie without extra interfacing circuitry, is impossible, as the PCM-F1 *encoding format differs from that used in the 16-bit professional processors. Some basic information about this format business can be found in the paper of T. Doi & al, 'On Several Standards for Converting PCM Signals into Video Signals',* JAES *Vol. 26 September 1978, pp. 641-649.*

A direct digital transfer of recordings made with the PCM-F1 *is possible only by using a 14-bit professional processor, eg the* PCM 100 *(Sony), but in this case you can forget the 16-bit resolution.*

For a direct transfer of the 16-bit PCM-F1 *recordings on a 16-bit professional equipment an extra interface circuit is needed. This circuit can be based:*

(a) on the formatting of the digital signals 'collected' inside the PCM-F1 *(prior to video encoding);*

(b) on the decoding and formatting of the video output of the PCM-F1.

The solution (a) is less complicated as circuitry but needs some modification of the PCM-F1, *while the solution (b) uses the normal inputs/outputs of the processor but is more complex.*

Our lab developed such an interface (patent applied for), which was already used successfully for the direct digital transfer of several albums of different record companies and studios who asked for this service.

We should also like to inform interested readers that PCM-F1 *processors accept for digital* replay *either NTSC or PAL video-recorders. If you, for example, own a NTSC system and a colleague sends you a cassette recorded on a PAL system, you can replay the cassette using a PAL video-recorder and even copy it on your NTSC video-recorder. The only problem is that the pitch will be slightly changed (by 1/1000): in most cases this is acceptable.*

Yours faithfully, Dr Benjamin Bernfeld, Harmonia Mundi Acustica, In den Sigristmatten 6, D-7800 Freiburg, West Germany.

Richard Elen replies:

In my January editorial, I was indeed referring to interfacing the *PCM-F1* in 16-bit mode via an internal modification to the *PCM-F1* itself. We investigated the possibility of publishing an article on the subject of modifications to the unit for this and other purposes, but eventually decided that such modifications were inadvisable. Instead, the article—*Inside the PCM-F1*, by Tony Faulkner, which appeared in the March issue—concentrates on how the unit operates, and only two minor internal modifications or adjustments are suggested: one to make the unit switchable for NTSC/PAL, and the other to optimise performance in other areas.

Tron

Dear Sir, Completely misleading is the best way to describe Bob Anthony's Tron article (Nov '82). Contrary to what the article implies, Frank Serafine and Gordon Ecker were part of a large team responsible for creating and editing Tron's sound effects.

Wendy Carlos, who scored the film, contributed many sound effects as well as the fascinating 'orchestral textures' incorrectly labelled as layers of sound effects in the article.

While the new SMPTE technology is exciting and has many applications, cutting good old 35 mm mag film proved faster and easier for about half the effects, and I suggest doing some careful research before utilizing one technique over the other.

Finally, my role in all of this is made out to have been the hiring of Serafine and Ecker. In fact, the overall concept of the sound design—the interplay of music and sound effects—and many specific effects, were conceived by me. I thought you should know.

Yours faithfully, Michael Fremer, Music and Sound Design Supervisor, Tron, 2308 Pisani Pl, Venice, California 90291, USA.

The funny-looking mike that's taken very seriously.

The PZM with its flat back plate, is as unconventional as it looks. Its revolutionary design eliminates phase-induced interference and provides a significant improvement in signal quality.

Indeed the PZM represents the most important advance in microphone technology of the last fifty years.

But why take our word for it? The PZM has won the utmost respect from sound engineers all over the world.

In a recent issue, Studio Sound examined the applications of the PZM in contemporary recording, and its conclusions are a glowing endorsement of all we've claimed for this remarkable microphone.

Top engineers were interviewed and confirmed that the PZM provided an undistorted output, free from comb-filtering.

They found that it gave a 180° pick-up with no off-axis problems and that it was ideal for reproducing anything from ambience to a grand piano.

They spoke of its extraordinary reach and clarity, of the way in which it simplified the business of miking-up and how its low profile made it ideal in hidden applications such as theatre and television.

All in all, the experts are deeply impressed by the PZM and already regard it as an indispensable tool in the creation of a transparently natural sound, free from non-linear characteristics, both on stage and in the studio.

For details of available models, including the new 3LV tie clip microphone, prices and suggestions for further applications of the PZM microphone, just telephone Mike Silverston on 01-961 3295.

PZM
FROM
HHB

HHB Hire and Sales, Unit F, New Crescent Works, Nicoll Rd, London NW10 9AX. Tel: 01-961 3295. Telex: 923393.

AUSTRIA: HI-FI STEREO CENTER KAIN SALZBURG 37701
BELGIUM/FRANCE: GENERAL TRADING LUXEMBOURG 471548.
DENMARK: TEAM SOUND APS GRAESTED 02-292522.
GERMANY: AUDIO VERTRIEB PETER STRUVEN GmbH HAMBURG 5245151.
FINLAND: STUDIOTEC KY HELSINKI 80-556252.
HOLLAND: IEMKE ROOS IMPORT BV AMSTERDAM 972121.
ITALY: AUDIST SRL MILANO 8394728.
SPAIN: MABEL SDAD. ANMA. BARCELONA 3517011.
SWEDEN: ELA-LJUD AB SUNDBYBERG 08-984422.
SWITZERLAND: MUSICA AG ZURICH 2524952.

Solid State Logic

In the Foreground of Television Audio

Audio for video is on a lot of minds these days. Advanced video formats and transmission methods make dramatic improvement possible. Producers' concerns over the initial impact and residual value of their programmes make it desirable. EFP, new competitive arenas and increased consumer awareness make it necessary. And now, the SSL Stereo Video System makes it practical.

The SL 6000 E Series places all of the signal processing, switching and machine control required for live and post-production stereo audio under the control of a single engineer. Fully distributed master logic and extensive local switching accomodate the immediacy of broadcast requirements with the versatility of multi-track technology. Exclusive SSL software and a unique mix bus system combine the creative flexibility of film sound technique with the efficiency and economy of electronic production.

The SL 6000 E Series lets you specify a system which will meet your current needs exactly. As those needs grow and change, SSL fills them with additional hardware and software modules which retrofit in the field. The Stereo Video System is designed and built to last. Your investment is further protected by performance specifications which exceed the challenge of the best 16 bit digital recorders.

And of course, the Solid State Logic Stereo Video System provides you with the ergonomic and sonic attributes which have made our companion SL 4000 E Series the leading choice of the world's great music studios.

Format Flexibility

The Stereo Video System's six bus mix matrix accomodates all audio-for-video formats. Along with standard mono, stereo and multi-track operations, each input may be panned between one of three stereo mix buses. This allows the engineer to freely divide the console into dialogue, music and effects sections as each project requires.

The Dialogue, Music and Effects mixes may be recorded in mono on a 3 stripe or 4 track, or in stereo on an 8 track or the multi-track master. Composite stereo and mono mixes of all 6 buses are derived from the master mix matrix for monitoring, transmission and/or simultaneous (first generation!) layback to the stereo video recorder. Alternatively, the six buses may be used for stereo mix and mix minus feeds during live coverage.

Comprehensive Signal Processing

Each I/O module contains an expander/gate, compressor/limiter, high and low pass filters, four band parametric equalisation, six cue/aux sends and tape electronics remotes. Master logic, pushbutton signal processor routing, patchfree audio subgrouping, and 8 VCA Group Masters ease complex productions, and always provide the minimum signal path.

Total Recall

Complete details of all I/O module control settings are stored on floppy disc by SSL's Total Recall System, enabling console setups to be restored within .25dB accuracy. Not only does Total Recall save time on each production, it allows greater scheduling flexibility with fewer headaches than ever before possible.

Computer Assistance. Live And In Post.

The SSL Primary Studio Computer is instructed with simple phrases entered via dedicated command keys and an alphanumeric keyboard at the console centre. A small video display advises the engineer of all activity. Above this display, controls for the SSL Video Switcher enable the mixer to call programme, preview or computer displays to the main video monitor.

The computer accepts entries in all timecode and foot/frames standards, and provides complete cue, edit, punch-in and mix list management. In post-production, it links multiple ATRs, VTRs or film chains with the Dynamic Mixing functions, providing fast and familiar rollback and pick-up recording, with every move automatically updated in the computer!

In live production, the SSL Real Time System enables complex sequences of all channel and group fades and cuts to be pre-programmed, and then manually executed with a single set of controls.

The SSL Events Controller provides up to 16 multi-repeatable contact closures under computer control. The SSL Effects Controller adds 40 A/D ports to link the computer with external signal processors.

The Solid State Logic Stereo Video System is available in studio and Outside Broadcast versions from 16 to 56 I/O modules, with up to 112 line and microphone inputs plus four stereo effects returns. Please call or write on your letterhead for complete details and prices.

Solid State Logic
Churchfields, Stonesfield
Oxford, England OX7 2PQ
Telephone (099 389) 8282
Telex 837400 SSL OX

Solid State Logic
Stereo Video Systems

Solid State Logic
2633 Fifteenth Street, N.W.
Washington, D.C. 20009 USA
Telephone (202) 333-1500
Telex 440519 SSL DC

product guide
Tape Recorders 16 track +

This product guide contains details of analogue multitrack tape recorders with more than eight tracks. Machines of 8-track and under were covered in the June issue. Digital multitrack machines will be surveyed in a forthcoming guide.

ABE (West Germany)
ABE Becker GmbH & Co, Mainaustrasse 5, D-7750 Konstanz. Tel: 07531 21536.

MTR Series: 16-, 24- and 32-track on 2 in; 7½/15 in/s.

ACCURATE SOUND (USA)
Accurate Sound Corp, 114 5th Avenue, Redwood City, CA 94063. Tel: (415) 365-2843. Telex: 348327.

Model 2600 Transport: 24- or 16-track on 2 in, 16-track on 1 in; 3¾ to 30 in/s; remote control and DC servo option; Inovonics or ASCO electronics.

ACES (UK)
AC Electronic Services, Broad Oak, Albrighton, Near Shrewsbury, Shropshire SY4 3AG. Tel: 0939 290574.
USA: ACES (USA), 244 Lyell Avenue, Rochester, NY. Tel: (716) 458-5610.

TR Series: 16- and 24-track on 2 in; 15 in/s.

ALLEN AND HEATH (UK)
Allen and Heath/Brenell Ltd, Pembroke House, Campsbourne Road, London N8. Tel: 01-340 3291. Telex: 267727.
USA: Audio Marketing Ltd, 652 Glenbrook Road, Stamford, CT 06906. Tel: (203) 359-2312.

Syncon M16/M24: 16- or 24-track on 2 in; 15/30 in/s; varispeed – 50 to + 100%.

AMPEX (USA)
Ampex Corporation, 401 Broadway, Redwood City, CA 94063. Tel: (415) 367-2011. Telex: 348464.
UK: Ampex Great Britain Ltd, Acre Road, Reading RG2 0QR. Tel: 0734 875200. Telex: 848346.

MM1200: 16- or 24-track on 2 in; 7½/15 in/s or 15/30 in/s.
ATR-124/116: 24- and 16-track on 2 in; 7½/15/30 in/s; varispeed – 50 to + 200%; accepts up to 16 in reels.

FOSTEX (Japan)
Fostex Corp, 512 Miyazawacho, Akishima, Tokyo. Tel: 0425-45-6111. Telex: 2842-203.
USA: Fostex Corporation of America, 15431 Blackburn Avenue, Norwalk, CA 90650. Tel: (213) 921-1112.
UK: Bandive Ltd, Brent View Road, London NW9 7EL. Tel: 01-202 4366.

B16: 16-track on ½ in; 10½ reel capacity; built-in Dolby C, varispeed.

IEM (USA)
International Electro-Magnetics Inc, Eric Drive and Cornell Avenue, Palatine, IL 60067. Tel: (312) 358-4622.

1000 Series: 16- or 24-track on 2 in; 7½/15/30 in/s; varispeed 7½ to 30 in/s; accepts 14 in reels.

ITAM (UK)
Industrial Tape Application Ltd, 1-7 Harewood Avenue, Marylebone Road, London NW1. Tel: 01-724 2497/7368. Telex: 21879.

1610: 16-track on 1 in; 7½/15/30 in/s; ±50% varispeed; optional dbx.

LYREC (Denmark)
Lyrec Manufacturing A/S, Hollandsvej 12, DK-2800 Lyngby. Tel: 02 87.63.22. Telex: 37568.
UK: Lyrec (UK) Ltd, c/o Feldon Audio, 126 Great Portland Street, London W1N 5PM. Tel: 01-580 4314. Telex: 28668.
USA: Rupert Neve Inc, Berkshire Industrial Park, Bethel, CT 06801. Tel: (203) 744-6230. Telex: 969638.

TR532: 16- or 24-track on 2 in; 15/30 in/s.

MCI (USA)
MCI Inc. A Division of the Sony Corporation of ▶

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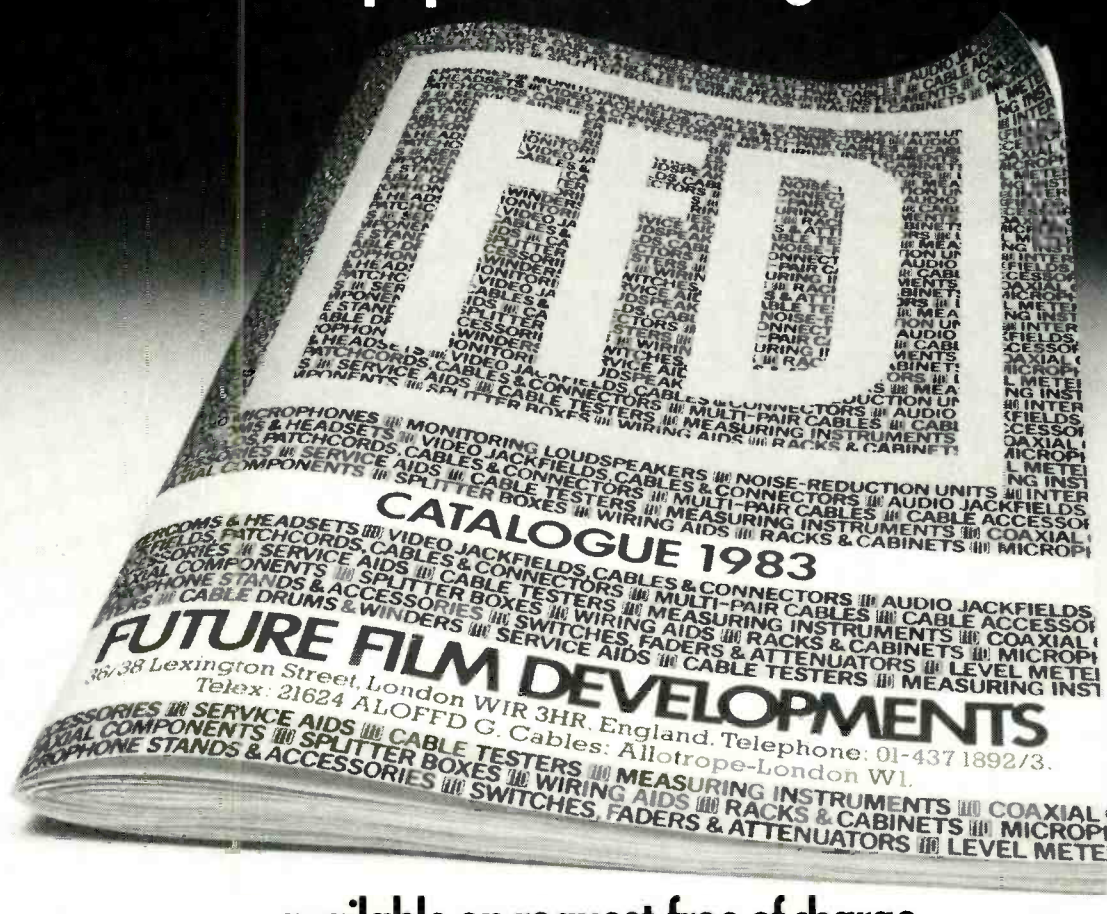

available on request, free of charge.

Those who are involved in cabling and interconnection of audio, video, data and instrumentation signals will find this catalogue an invaluable tool. The experience of over a decade in this field has been applied to the selection of a range of components and equipment – many of which are now exclusive to FFD.

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36/38 Lexington Street, London WIR 3HR, England. Telephone: 01-437 1892/3.
Telex: 21624 ALOFFD G. Cables: Allotrope-London W1.

product guide
Tape Recorders 16 track +

America, 1400 W Commercial Blvd, Fort Lauderdale, FL 33309. Tel: (305) 491-0825. Telex: 514362.
UK: Sony Broadcast Ltd, City Wall House, Basing View, Basingstoke, Hampshire RG21 2LA.

JH-24: 16- or 24-track on 2 in; 15/30 in/s; accepts 14 in reels; NAB/CCIR/AES selectable EQ.

3M (USA)
3M Company, 3M Centre, St Paul, MN 55101. Tel: (612) 736-9567. Telex: 297434.
UK: 3M (UK) Ltd, PO Box 1, Bracknell, Berks RG12 1JU. Tel: 0344 26726. Telex: 849371.

M79: 16- or 24-track on 2 in; 7½/15 in/s or 15/30 in/s.

OTARI (Japan)
Otari Electric Co, Otari Building, 4-29-18 Minami, Ogikubo, Suginamiku, Tokyo. Tel: 03 333-9631. Telex: 26604.
USA: Otari Corp, 2 Davis Drive, Belmont, CA 94002. Tel: (415) 592-8311.
UK: Otari Electric (UK) Ltd, Herschel Industrial Centre, 22 Church Street, Slough SL1 1TP. Tel: 0753 38261.

MTR-90: 16- or 24-track on 2 in; 15/30 in/s; varispeed.

SOUNDCRAFT (UK)
Soundcraft Magnetics Ltd, 5-8 Great Sutton Street, London EC1V 0BX. Tel: 01-253 9878. Telex: 21198.
USA: Soundcraft USA, 20610 Manhattan Place, Suite 120, Torrance, CA 90501. Tel: (213) 328-2595.

SCM 381-16: 16-track on 1 in; 15 in/s; varispeed +15 to −50%.
SCM 762-16/SCM 762-24: 16- or 24-track on 2 in; 15/30 in/s; varispeed +15 to −50%.

STEPHENS (USA)
Stephens Electronics Inc, 3513 Pacific Avenue, Burbank, CA 91505. Tel: (213) 842-5116.

Capstanless Multitrack: 16-, 24-, 32- or 40-track on 2 in; 15/30 in/s, plus 60 in/s scan.

STUDER (Switerland)
Studer International AG, Althardstrasse 150, CH-8105 Regensdorf. Tel: 01 840.29.60. Telex: 58489.
UK: FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ. Tel: 01-953 0091. Telex: 27502.
USA: Studer Revox America Inc, 1425 Elm Hill Pike, Nashville, TN 37210. Tel: (615) 254-5651. Telex: 554453.

A80/VU MkIII: 16- or 24-track on 2 in; 7½/15 in/s or 15/30 in/s; CCIR or NAB EQ.
A800: 16- or 24-track on 2 in; 7½/15 in/s or 15/30 in/s; varispeed.

TEAC (Japan)
Teac Corp, 3-7-3 Naka-cho, Musashino, Tokyo. Tel: 0422 53-1111. Telex: 2822551.
UK: Harman (Audio) UK Ltd, Mill Street, Slough SL2 5DD. Tel: 0753 76911. Telex: 849069.
USA: Teac Corp of America, 7733 Telegraph Road, Montebello, CA 90640. Tel: (213) 726-0303. Telex: 677014.

Tascam Series 85-16: 16-track on 1 in; 15 in/s; ±10% varispeed.

TELEFUNKEN (West Germany)
AEG-Telefunken, Postfach 2154, D-7750 Konstanz. Tel: 07531 862460. Telex: 733233.
UK: Hayden Laboratories Ltd, Hayden House, Chiltern Hill, Chalfont St Peter, Bucks SL9 9UG. Tel: 0753 888447. Telex: 849469.
USA: Gotham Audio Corp, 741 Washington Street, New York, NY 10014. Tel: (212) 741-7411.

M15A: 16-, 24- or 32-track on 2 in; 7½/15 in/s or 15/30 in/s; NAB/CCIR/AES switchable EQ; ±50% varispeed.

TRIDENT (UK)
Trident Audio Developments Ltd, PO Box 38, Studios Road, Shepperton, Middx TW17 0QD. Tel: 09328 60241. Telex: 8813982.
USA: Trident (USA) Inc, 652 Glenbrook Road, Stamford, CT 06906. Tel: (203) 357-8337.

TSR Series: 16- or 24-track on 2 in; 15/30 in/s; varispeed 6 to 38 in/s; accepts 14 in reels. ■

SCM 381-16

"Untwisting all the chains that tie the hidden soul of harmony." Milton, 1608-167

Knowledge is the key to unequalled audio equalisation — and Klark-Teknik's DN60 Audio Spectrum Analyser is a rack-mounted, laboratory standard instrument that provides instantly usable information for an enormous range of applications. With continuous measurement and display of signal levels at 30 points across a broad audio spectrum from 25Hz to 20KHz, this cost-effective microprocessor-based analyser adds new standards of accuracy to the audio professional's vocabulary.

For easy equalisation, the 30 measurement frequencies of the DN60 exactly match the control frequencies of our latest two-channel DN30/30 equaliser. Add the inexpensive RT60 Reverberation Analyser to untangle structural reflections. Result: exact knowledge permits exact adjustment of response levels for total control of sound consistency. DN60 has got the features you need, because it is:

The most powerful audio-analyser on the market today — and because it is microprocessor-based, not only accurately monitoring the full audio band from 25Hz to 20KHz but also offering three memories plus a peak hold memory.

Options include X/Y plotter, dot matrix printer, the matched RT60 Reverberation Decay Analyser and a calibrated measuring microphone.

It is a tough but compact rack-mounted instrument with easy operation and superb 'lights-out' readability, and it is tested rigorously to Klark-Teknik's usual high standards, with a long burn-in period to ensure maximum reliability on the road and in the studio.

ALL THESE USES!

- Tape recorder alignment
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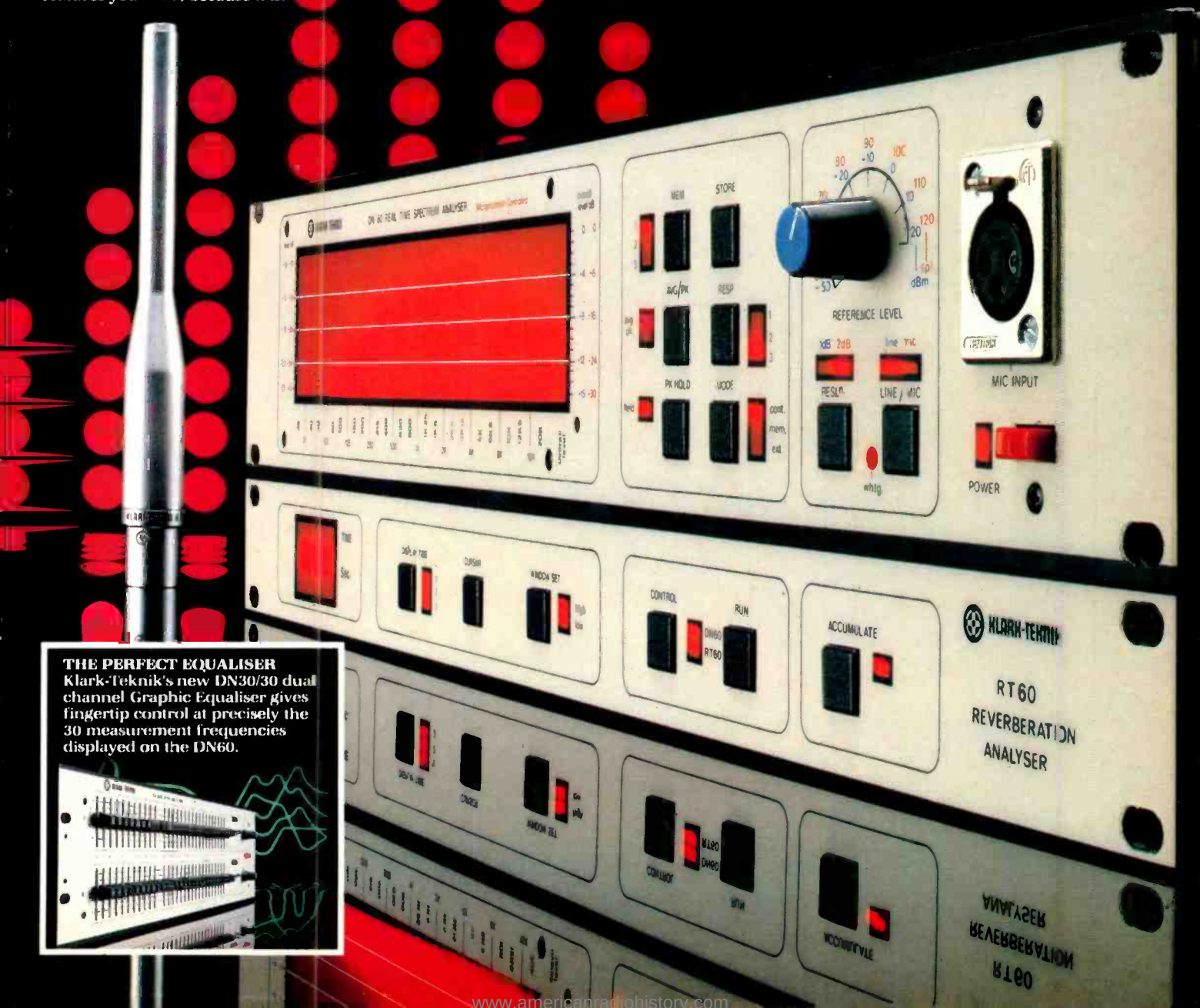
- Fast semi-automatic production testing
- Selective noise level checks and environmental analysis
- Quality assurance for VTR audio channels
- Broadcast programme quality monitoring
- Music content analysis and level monitoring
- Level optimisation in disc cutting

For technical details ask for:
Our DN60/RT60 Data Sheet
Our DN30/30 Data Sheet.

KLARK TEKNIK
sound science

Klark-Teknik Research Limited
Coppice Trading Estate, Kidderminster, DY11 7HJ, England
Telephone: (0562) 741515 Telex: 33982

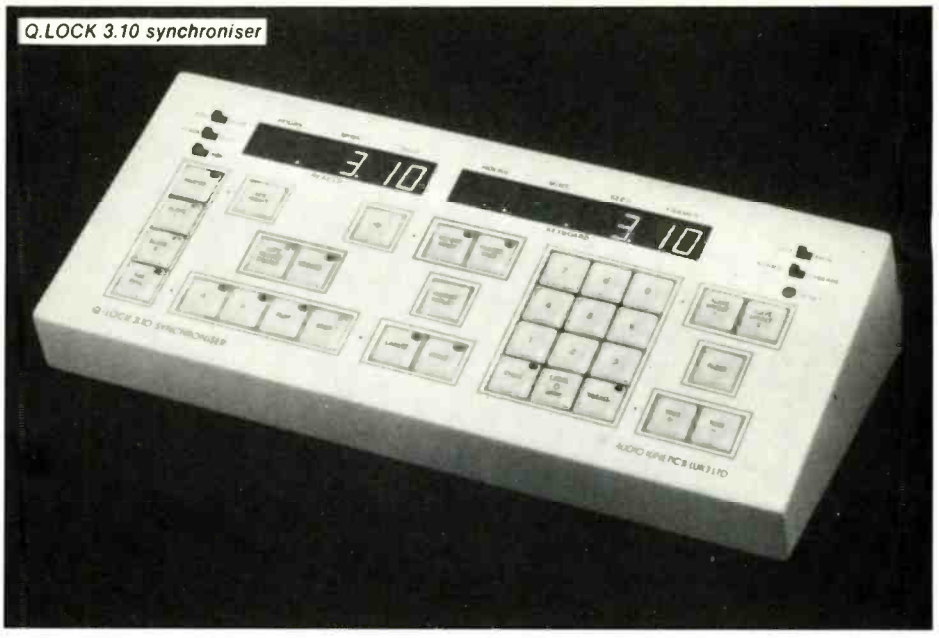
Klark-Teknik Electronics Inc
262a Eastern Parkway, Farmingdale, NY 11735, USA
Telephone: (516) 249-3660



THE PERFECT EQUALISER
Klark-Teknik's new DN30/30 dual channel Graphic Equaliser gives fingertip control at precisely the 30 measurement frequencies displayed on the DN60.

product Autolocators guide

This product guide excludes autolocator and synchroniser systems where these form part of a dedicated control system such as SSL and Neve products.



ADAMS-SMITH (USA)

Adams-Smith Inc, PO Box 130, 34 Tower Street, Hudson, MA 01749. Tel: (617) 562-3801. Telex: 710-347-6698.
UK: Pye TVT Ltd, PO Box 41, Coldhams Lane, Cambridge CB1 3JU. Tel: 0223 45115. Telex: 81103.
USA: Philips Broadcast Equipment Inc, 91 McKee Drive, Mahwah, NJ 07430. Tel: (201) 529-3800.

Model 605: synchroniser for master transport with two slaves (video or audio) using SMPTE/EBU timecode. Operates over 1,000:1 speed range with an accuracy to 1/100 of a TV frame (333 μs USA, 100 μs Europe); operates with inconsistent and mixed timecodes; provides programmable stop and automatic roll-back; independent rapid cueing of transports. Slaves follow master wind and stop functions; 15 stores available for timecode comparisons. Servo outputs available as either bipolar DC signals with adjustable offset or as 9.6 kHz FM signals. Interfaces are available for Ampex *MM1100/1200, ATR100, VPR1, VPR2, VR2000*, Ferrograph *Studio 8*, Bosch *BCN50*, JVC *CR8300*, Sony *VO2850* (modified), Studer *A80*, 3M *M79* and Philips *PVR2*. Does not include timecode generator.
Model TS-1605: system controller with extended editing memory for television audio post-production; utilises VTR for master; accepts up to two audio slave transports; and includes facility to control auxillary equipment such as cartridge transports. Also has facility to sync telecine sound follower equipment with a film chain and facility to sync audio tapes to film projection equipment interlocked to a magnetic film transport. Unit uses SMPTE/EBU timecode; can accept 50/60 Hz sinewave pilot tone signals; operates over ¼ to 100x speed range with an accuracy of 1/100 of a TV frame (333 μs NTSC, 400 μs PAL); operates with inconsistent and mixed timecodes; provides fast or slow dynamic phase adjustment; provides programmable stop and automatic cycling; independent rapid cueing of transports. Slaves follow master wind and stop functions; scratch pad memory with 100 10-digit registers for storing edit and cue points and offsets. Servo outputs available as either bipolar DC signals with adjustable offset, or as 9.6 kHz FM signals. No external interface boxes nor specific transport-related internal interface modules required. Does not include timecode generator.
Series 2600: modular SMPTE/EBU synchronising system for video tape editing utilising VITC (vertical interval timecode) thus freeing an audio track by eliminating the need for longitudinal timecode on helical scan VTRs. System accepts PAL/SECAM, NTSC and 24-frame film standards. Includes a tape synchroniser module for slaving an audio tape recorder to a master which can be a video recorder or a second audio machine. No specific interfaces required.

APPLIED MICROSYSTEMS (UK)

Applied Microsystems Ltd, 60 Baker Street, Weybridge, Surrey KT13 8AL. Tel: 0932 54778. Telex: 8952022.

CM50: microprocessor controlled autolocator working in real time from tachometer pulses. Uses two separate LED displays for 'Time Now' and 'Target Time'; nine memory locations; numeric keypad entry of cue points, or by single keystroke on-the-fly. Single cycle or continuous cycle facility, plus relative time location.

AUDIO KINETICS (UK)

Audio Kinetics (UK) Ltd, Kinetic Centre, Theobald Street, Boreham Wood, Herts WD6 4PJ. Tel: 01-953 8118. Telex: 299951.
USA: Audio Kinetics Inc, 4721 Laurel Canyon Blvd, Suite 209, North Hollywood, CA 91607. Tel: (213) 980-5717. Telex: 194781.

Q.LOCK 310: multi-microprocessor SMPTE/EBU generator/synchroniser able to locate and lock three audio/video tape transports; SMPTE single frame accuracy; five additional event operations for autorecord drop in/out memories or additional machines start/stop; built-in SMPTE/EBU skip/SMPTE non-skip generator with jam sync; offset memory with calculation facility, 10 memory locate points; record/offset/locate memory frame trim facility; user definable preroll and instant replay; full transport remote controls; high speed tachometer processing eliminates need for tape-to-head contact in wind; *Q-Link* feature allows linkage of two more *Q.LOCK* systems for control of five machines or control by external computer command source—many interfaces available.
Q-Soft: range of specialist software packages for the *Q.Lock* synchroniser including an automated record entry and exit package with five timecode programmable events for multitrack studio audio sweetening; an automatic dialogue replacement package for film and video post-production; a telecine mastering package where automated assemble editing with separate audio is required; a sound effects package for specialised film and video post-production; and on request special software to user requirements.

XT-24 Intelocator: intelligent autolocator that has the capacity to learn a particular tape plus transport behaviour pattern and subsequently optimise the locate sequence. Uses two separate counters for master and interlocate; four memories; in/s readout for varispeed; full transport remotes; leverwheel numerics for fast entry of locations; ±2 s accuracy over 30 min of tape at 15 in/s; auto compensations for high and low speed. Various interfaces are available for many machines.

btx (USA)

The btx Corporation, 12 Huron Drive, Natick, MA 01760. Tel: (617) 653-6811.
UK: Scenic Sounds Equipment Ltd, 97-99 Dean Street, London W1V 5RA. Tel: 01-734 2812. Telex: 27939.

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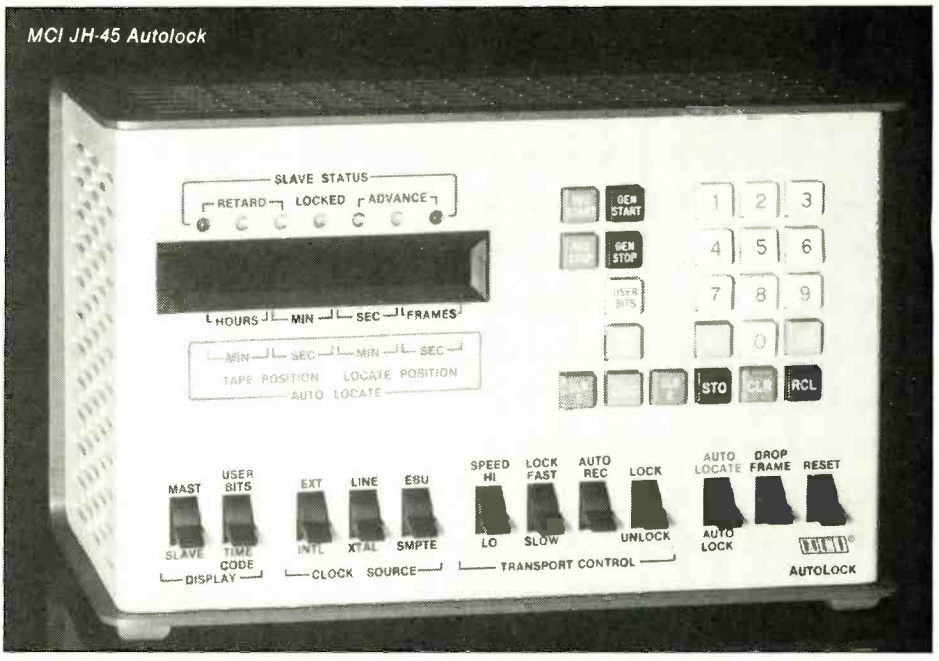
product guide
Autolocators



Shadow System: microprocessor, software-based, synchroniser and tape controller with intelligent interface to audio and video tape machines. Comprises two units, the *Shadow* and *Shadow Control* command console. Basic *Shadow* is a chase synchroniser with a standardised *RS232C* interface for remote computer control. Optional *Shadow Control* command console provides full autolocate and control facilities with 34 dedicated key commands, LED data display and nine memory registers. System operates with SMPTE/EBU timecode, 24-frame film timecode, or 60 Hz tachometer pulses. System will sync to 1/100-frame in play mode; has 24-hour offset capability; will sync three or more transports. Does not include timecode generator.

EECO (USA)
EECO Inc, 1601 East Chestnut Avenue, Santa Ana, CA 92701. Tel: (714) 835-6000. Telex: 678420.
UK: Ampex International, Acre Road, Reading RG2 1QR. Tel: 0734 875200. Telex: 847611.
USA: Ampex Corp, 401 Broadway, Redwood City, CA 94063. Tel: (415) 367-2011. Telex: 348464.

MQS-100: provides synchronisation for three machines, video or audio, using SMPTE/EBU timecode. Features include roll back, cue, store direct, chase, offset adjustments, machine status, mixed transports, mixed timecodes (unrestricted offsets, drop or non-drop frame), remote operation. Timecode may be transferred from any machine readout to any cue or register storage; machines enabled or disabled during system operation to reduce mode changing; three internal event commands for staggered starting; six scratch pad memories; freeze store of running code. Resync time is slow or fast, accuracy is ±100 μs. Various interfaces available.
MQS-100A: similar to *MQS-100* with extra features including timecode transfer from any machine to any cue or event register; variable preroll; event offset capability; and the ability to make mode changes 'on-the-run'.

ELECTOR (Canada)
Electro & Optical Systems Ltd, 31 Progress Court, Scarborough, Ontario M1G 3V5. Tel: (416) 439-9333. Telex: 065-25431.
USA: E & O Systems Ltd, 2998 Scott Blvd, Santa Clara, CA 95050. Tel: (408) 727-1506. Telex: 171200.

MkII Time Code Series: variety of synchronising units comprising *TCR/VCG/D-2* reader, *TCG/D-2* generator, a range of timecode distribution amps and a wideband amp. Readout via NTSC, PAL or monochrome video; LED timecode display; speed x0.1 to x60 with extended speed option; SMPTE or EBU timecodes.

GIESE (West Germany)
Giese Electronic KG, Klaus-Groth-Strasse 84/86, D-2000 Hamburg 26. Tel: (040) 250 31.13. Telex: 211853.

Lock-System 3: modular synchronising system for audio/video/film. Comprises main control unit with numeric keypad, LED timecode display and SMPTE/EBU timecode generator/reader; plus interface modules for master and slaves.
Taker A/B: SMPTE/EBU timecode based autolocator/synchroniser for audio and video tape machines where the master is a video machine. Also available in a version for film projectors.

GTC (West Germany)
GTC Film-und Fernseh-Studiotechnik GmbH, Wöhrendamm 29, D-2070 Grosshansdorf. Tel: (04102) 62062. Telex: 20189854.
UK: GTC Ltd, Stonefield Way, Ruislip, Middlesex HA4 0YL. Tel: 01-864 1601.

Edition: video/audio interlock system using VITC (vertical interval timecode) and/or longitudinal SMPTE/EBU timecode. System is accurate to half a frame at all speeds and usually only requires the use of two control buttons, one defining the sync point and the other for activating the lock. Interlock tasks include synchronised sound transfer from video to audio machines or vice versa; synchronisation of mag film on an editing table to a video image for track laying; motion control of a VTR as a slave to mag/mag film drives in dubbing; and interlock of mag tape or mag film units to video machines for parallel sound editing. Sync interlock, including still, is achieved by the use of VITC recorded on two picture lines and read by the revolving head drum of the video recorder. Other features include automatic changeover to phase locked sync at sound speed and use of CTL pulse from the VTR control track to ensure interlock in the event of poor timecode reading. Interfaces available for JVC and Sony *U-matics* and many tape machines.

MAGLINK (UK)
Maglink Audio Products Ltd, 17 Erncroft Way, Twickenham, Middlesex TW1 1DA. Tel: 01-891 2770/0895. Telex: 8954029.

Maglink Multi-Machine System: expandable synchronising system using Maglink timecode; basic system operates with one master and one slave, but additional slave cards may be added, up to a maximum of four; interfaces to audio, video and film machines. Features include: location display, switchable display format for various video or film formats, display hold, system status display, machine select and keyboard for entries, offset, searching, programme cue, advance or retard to speed up or slow down machines, repeat function, and cue recall. Various interfaces available; built-in timecode generator.
Maglink II Synchronising System: basically similar to the Maglink *Multi-Machine Synchroniser* but simplified to only operate with one slave.

MAGNA-TECH (USA)
Magna-Tech Electronic Co Inc, 630 Ninth Avenue, New York, NY 10036. Tel: (212) 586-7240. Telex: 126191.
UK: Branch & Appleby Ltd, Stonefield Way, Ruislip, Middlesex HA4 0YL. Tel: 01-864 1577.

Multi-Lok II; film-to-video interlock system providing synchronisation of MTE electronic drive high speed mag film recorders and reproducers

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Eventide Clockworks

The Eventide SP 2016 programmable effects processor:

The most versatile audio processing instrument ever developed is now available: EVENTIDE, with over a decade of leadership in digital audio effects again advances the state-of-the-art with the SP2016 Programmable Effects Processor. In a single 3½" rack mounted device, EVENTIDE has engineered the most powerfully versatile digital processing system ever employed in an audio component.

FEATURES OF THE SP2016:

REVERB
At your fingertips is a wide variety of reverb programs with operator control of all parameters plus superb audio spec. performance and reverb quality. The SP2016 accepts EVENTIDE's new software "Reverb Library" Roms, a growing collection of plug-in programs.

DIGIPLEX® ECHO
The SP2016 provides EVENTIDE's Digiplex echo, our digital version of multiple-head tape echo. Exclusive features include incredibly stable operation, giving literally hours of decay time with no noise build-up.

CHORUS EFFECTS AS YOU'VE NEVER HEARD THEM BEFORE
ADT takes on a whole new meaning. "D" can now stand for dozens, not just double! Each voice can vary randomly in time, amplitude and space.

FULL BANDWIDTH DELAY
16kHz: 0 to 1.6 sec. delay in 25 microsecond steps.
8kHz: 0 to 3.2 sec. delay in 30 microsecond steps.

SELECTIVE BAND DELAY
The first in a series of dramatic new effects exclusive to the SP2016. You can separate the signal into a number of frequency bands and independently delay each band up to 3.2 seconds.

FLANGING AND PHASING
Quality and control features far surpassing existing devices.

CLASSICAL DIGITAL LINEAR PHASE FILTERS
For PA, crossovers and EQ. Design filters to your specifications using the IEEE-compatible remote controller.

FULL STEREO OPERATION
2 in, 2 out.

PROGRAM SOFTWARE SUBSCRIPTION SERVICE
The SP2016's digital circuitry is so powerful, we've yet barely tapped the ultimate capabilities inherant in the Programmable Effects Processor. EVENTIDE continues to develop new and exclusive effects for the SP2016. Not just updated and refined reverb programs (although we will offer these, too) but totally new and unique effects. Because the SP2016 is a fully programmable system, we can supply these new effects (as well as revisions) as they are developed via convenient plug-in modules. They will be available individually or through our program software subscription service. The SP2016 is obsolescence proof.

SELF-TEST FEATURE
The most extensive self-test capabilities of any pro-audio product ever! Should a problem develop, the SP2016 will spot it and even pinpoint the part number of the suspect I.C.

U.K. Distributors

FELDON AUDIO

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product Autolocators guide

(single or multiple units) with a video tape recorder and/or audio tape recorders. Sync accuracy is within 5/100 of a frame and the sprocketed machine may be the master or slave. System operates with SMPTE/EBU timecode and at either 24/25/30/30 drop frame rates. Record-On, Record-Off, Stop and Mute are pre-settable and there is a programmable variable offset facility. Other features include variable advance/retard, slow-lock, and operation as either code-only master or sync-only master.

MCI (USA)

MCI Division, Sony Corporation of America, 1400 W Commercial Blvd, Fort Lauderdale, FL 33309. Tel: (305) 491-0825. Telex: 514362.
UK: Sony Broadcast Ltd, City Wall House, Basing View, Basingstoke, Hants RG21 2LA. Tel: 0256 55011. Telex: 858424.

JH-45 Autolock: self-contained synchroniser with built-in SMPTE/EBU timecode generator, readers, synchronisers and autolocator; slaves any MCI transport to any audio/video/film transport replaying timecode, with a typical accuracy of ±50 μs; generates timecode synchronised to external power frequency; permits use of user bits in timecode; reads either tacho pulses or high speed timecode in spooling mode; advance/retard at rate of three frame/s; code display shows absolute difference between master and slave; adjusted timecode display subtracts the offset to absolute timecode difference; park slave allows machine to stop within a frame of timecodce display; punch in/out record at selected programmable sequence; 10 scratch pad memories; autolocator mode with realtime display; auto read/write of tape position counter on to tape itself with 10 memory positions; shuffle function.
Autolocator III: microprocessor-based autolocator for MCI transports; 10 memories; repeat function; tape velocity indicator showing both in/s and pitch shift; 35ft connection cable; fast windback time for 30 in/s of about 15 s per 100 ft of tape by measuring inertia of tape spools.
RTZ III: microprocessor-based autolocator for the *JH-110 Series* tape machines; return-to-zero function; four memory locations; presettable up/down real-time counter; tape speed indicator capable of locating from the positive or negative domain.

MELKUIST (UK)

Melkuist Ltd, 35a Guildford Street, Luton LU1 2NQ. Tel: 0582 416028.
UK: FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ. Tel: 01-953 0091. Telex: 27502.

Event Selector: SMPTE/EBU timecode-based programmable event selector capable of programming up to 250 cue points. External units are 'fired' by 32 changeover relays.

OMNI Q (Canada)

Commercial Electronics Ltd, 1335 Burrard Street, Vancouver, British Columbia, V6Z 1Z7. Tel: (604) 669-5525. Telex: 0454470.
USA: Omni Q Inc, 8-12th Street, Blaine, WA 98230.

Omni Q TL Series: synchroniser/effects module system comprising the *TL1* synchroniser/effects unit, *TL2* expansion module, and *TL3* remote control. *TL1* generates a 40 bit timecode (incorporating parity check) modulated on a 21 kHz carrier allowing limited audio use of timecode channels. Other features include external sync from pulses within a 20 to 80 Hz range; video sync mode from a 12 kHz timecode carrier; fast and slow slewing modes; servo control of slave machine ±50 μs; and phase control facility allowing manual offseting of ±30 ms for phasing and flanging effects. *TL2* adds the following features: LCD time display; phase meter; master/slave remote transport controls; and dual master/slave autolocate. The *TL3* remote control unit for the *TL2* features a remote display; remote transport controls; and keypad entry of autolocate times with 10 memory locations and automated punch-in/punch-out facility.

SONDOR (Switzerland)

Sondor Export AG, Dachlerenstrasse 11, CH-8702 Zollikon-Zürich. Tel: 01-65.80.90. Telex: 55670.
UK: Preview Two (Sound) Ltd, 37-39 Oxford Street, London W1R 1RE. Tel: 01-437 1441.

EPS8000: system allowing synchronising of any number of Sondor magnetic film transports from timecode supplied by an audio/video/film master transport. The system will operate by: using timecode on slave, as a timing reference for synchronous operation with actual synchronism achieved by using start marks, or timecode; using timecode on slave to achieve precise synchronism comparing frame numbers but with possible offset; and finally, not using slave timecode but taking timing information from transport itself with synchronism manually achieved on start mark. Allows electronic looping (rock'n'roll) within the Sondor system; provides reading at ¼ to 50x play speed and display of SMPTE/EBU timecode but no built-in generator; synchronising input from slave is either timecode or 2-phase signal, output to slave is 2-phase signal.

STUDER (Switzerland)

Studer International AG, Althardstrasse 150, CH-8105 Regensdorf. Tel: 01-840.29.60. Telex: 58489.
UK: FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ. Tel: 01-953 0091. Telex: 27502.
USA: Studer Revox America Inc, 1425 Elm Hill Pike, Nashville, TN 37210. Tel: (615) 254-5651. Telex: 554453.

Tapelock System 2000 Mk II: system to operate with *A80/VU* or *A800* as slave, accepts most machines as masters. Synchronisation accuracy 30 μs. Principal features are lock where the slave searches for the master address and synchronises immediately; offset up to 24 hours with display of actual offset; pilot which uses pilot tone as reference after synchronising achieved for transfers back to film; edit mode for programmable drop-in and drop-out to 1 ms accuracy and with 8 s preroll facility, and with rehearse facility (*A800* only); address start and stop for up to four playback machines (cart machines); SMPTE/EBU timecode generator built-in with any address start; hold to capture a time in the memories; store offset which allows discontinuous timecode to be read back, offset being changed when necessary; wow and flutter compensation; operates at 24/25/29.97 or 30 frames/s; lock-up time 3 s; auto muting of all playback amps during lock-up; ±5 ms (±1 ms with repark command) accurate parking allows manual editing; built-in calculator for address manipulation; built-in varispeed control ±15/8 tones; presettable address limits to stop tape winding out. Parallel/serial converter rack allows the programmer to locate several hundred metres away from the synchroniser. Main programmer is available for *A800, A80* master control or *A80* locator. Various interfaces available.
TLS 4000: compact synchroniser capable of automatically handling timecode, pilot signals and tachometer pulses. All functions may be remoted via a serial data buss.
ECS 6000: programmable event controller system capable of storing up to 1,520 events and handling up to 24 slave units. Two SMPTE/EBU timecodes can be used alternatively and interfacing to computer terminal is via standard RS-232C serial data buss.
Autolocator: available to operate with *A800* and *A80* models, no interfacing required. Microprocessor controlled; separate displays for actual tape position and locate position; 20 memories to store addresses; cue store for auto storage of cue points on the fly (10 memories); roll back to defined time; loop operation; two additional working memories; offsetting of tape position using keyboard; optimisation of search and park for fastest response.

TELEFUNKEN (West Germany)

AEG-Telefunken, Postfach 2154, D-7750 Konstanz, West Germany. Tel: 07531 862460. Telex: 733233.
UK: Hayden Laboratories Ltd, Hayden House, Chiltern Hill, Chalfont St Peter, Bucks SL9 9UG. Tel: 0753 888447. Telex: 849469.
USA: Gotham Audio Corp, 741 Washington Street, New York, NY 10014. Tel: (212) 741-7411. Telex: 129269.

MTS15A-1 Synchronising System: multi-machine synchronising system using one or two Telefunken *M15A* transports and slaves, and most video/audio transports as masters. Operates using EBU timecode; three built-in readers but no generator; fast synchronising time; timecode offset for record/replay head preparation; timecode display for each transport; operation with non-continuous timecode; external indication of parking and synchronisation; accuracy to one frame (40 ms); stability 0.5 ms; slave *M15A* transports require timecode amplifier and synchroniser adaptor; interfaces for Bosch *BCN*, Sony *2850*, JVC *8300*. ■

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studiofile

Eel Pie, London

Pete Townshend took over the lease of Eel Pie's Broadwick Street property from the video facilities company Molinare back in 1979. There was already a 24-track studio in existence in the upper half of the building, and after a little tidying up, Pete opened it as a commercial concern. However, the construction of the studio and the fact that it was on the first floor with no service lift led to the decision to construct a purpose-built facility on the ground floor and move the operation down.

If you thought that Eel Pie Studio was situated down by a river in Twickenham, you were right: there are two of them. The Twickenham place opened for business around September 1981, and without the aid of any kind of advertising, has been doing tolerably well ever since. Most of the second half of last year was taken up with recording and mixing an album for Thin Lizzy, whilst January of this year has already seen the likes of Elvis Costello, Duran Duran and Wah! booking time there.

The Twickenham control room was designed by the very experienced Keith Slaughter, working with the partnership of Bill Mackey and Phil Fox who handled all the physical construction work. The results were very good (see Studiofile, May 1982) and it was the same team who tackled the Broadwick Street project. In fact, even as the final stages of Twickenham studio were being completed work was started on the West End building.

The downstairs area was more or less an empty shell, and so the proportions and layout of the various rooms was limited only by the overall size of the building. The control room measures 12×19 ft, and is a mechanically isolated structure with a 6 in cast reinforced concrete floor resting on Teco pads. These pads consist of a layer of rubber sandwiched between two layers of cork. To maintain the optimum ratio of compliance against load bearing ability, a certain number of holes are cut in the rubber layer according to the load to which it is to be submitted. A medium pile carpet was layed directly on to the concrete.

The control room window measures approximately 6×4 ft, and is triple-glazed with ½ in toughened plate glass. It is mounted in a double skin brick wall with a 2 ft cavity, forming one of the sides of the room.

The end wall supporting the monitor housing is also of brick whilst the remaining side and end walls are of a 4×2 in stud construction resting on neoprene pads for isolation. The lower 3 ft of these walls has been designed as a low frequency absorber using low density Rockwool, Fibreglass and 6 mm plywood with a covering of carpet. The upper part provides wide band absorption by means of medium density, tissue-faced Rockwool with a hessian covering. In addition, there is a large active bass trap running along the top of the rear wall which also houses the air conditioning trunking.

The monitor housing is based on a 4 in reinforced concrete slab running the complete width of the room. Either side, separate compartments have been constructed for each speaker from a plasterboard, Revac, plasterboard sandwich on stud work, whilst the space remaining between them, though usable for anything, is ideal for supporting a video monitor and has been wired for that purpose. The standard house monitors are UREI *813*s, although Tannoy *Super Reds* are available and the housings will accept any medium-sized monitor, although the JBL *4350*s are just a little too large. The UREIs are driven by a Studer *A68* with no equalisation whilst secondary monitoring is available via JBL *4311*s, David *6000*s or, of course, a pair of Auratone cubes, powered by a Quad *405*.

The false ceiling is a 6×2 in framework which, acoustically, has been split into two such that the front half, constructed from plasterboard, Revac, Fibreglass and chipboard, all with a final finish of Brazilian mahogany boarding, is generally bright and reflective, whilst the rear half offers broadband absorption from a more open structure of Rockwool and Fibreglass with a covering of hessian, and spaced mahogany boarding.

The main studio floor area is about 200 ft² with an extra 120 ft² being offered by an isolation booth separated by a standard, double-glazed sliding glass door. Parquet flooring, hessian-covered plaster walls and large expanses of glass (patio doors and control room window), make the room very bright and live. The second patio door is the entrance to the main studio from the corridor leading from the control room and the only broadband absorption provided in the main room is on the wall opposite this entrance. Most of this wall is covered with a modular treatment, whilst the false ceiling of Rockwool-backed acoustic tiles was most efficient at higher frequencies. Optional extra absorptive treatment is planned for clients wishing to work with a more controlled acoustic although the present situation apparently yields an excellent live drum sound.

The main equipment includes a modified Neve 32/24 model *8058*, a 3M *M79* with an 8-, 16- or 24-track headblock option, a pair of Studer *B62*s, an Ampex *ATR100* with ½ in headblock option, and a good assortment of processing equipment. This included an EMT *140* plate; UREI, *Scamp* and A&D compressor/limiters; *Scamp* and Drawmer gates; an Eventide *1745A* DDL and *H910 Harmonizer* plus various other effects units by MXR and Bel. There will soon be available a Lexicon *224* and an AMS *DDL* with pitch change facilities. Dolby-A is used throughout.

The only instrument included in the hourly rate is a Yamaha 5 ft 6 in grand, and a Roland *JC120* is the only amplification.

A good selection of professional mics is available including Neumann, *PZM*, AKG, Sennheiser and most other standard models. Multitrack lock to picture is available on request from the Twickenham studio.

A recreation room was being completed at the time of our visit. It measures approximately 21 ft×10 ft, and although it won't include any real cooking facilities, it will have one of those horrendous space-based games, which may put you off your food anyway.

James Francis

Eel Pie Studio, 45 Broadwick Street, London W1. Tel: 01-434 3953.

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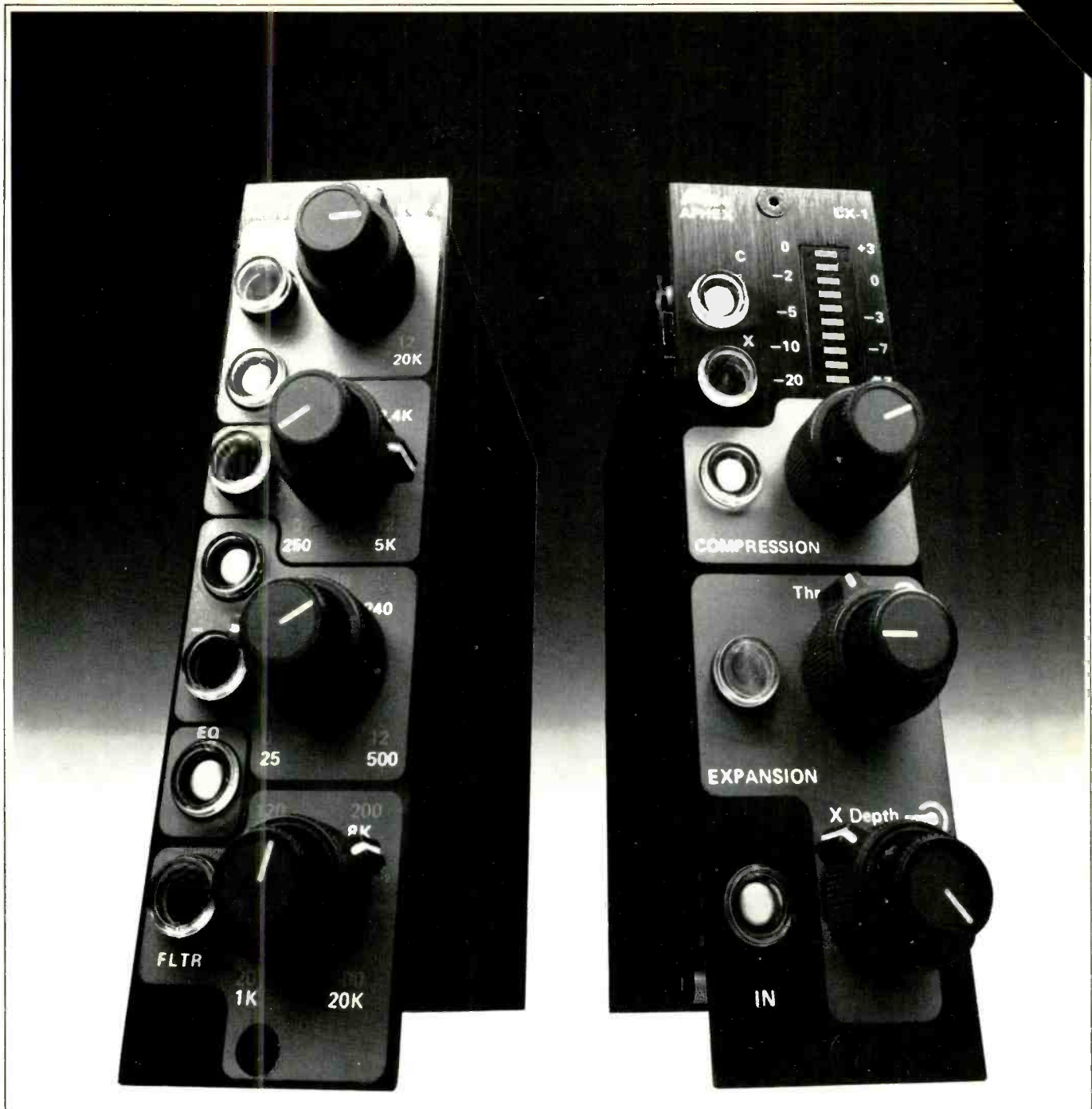

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Sear Sound, New York

When it comes to recording studios in New York City, to borrow a phrase from Arlo Guthrie, you can get anything you want. There are so many facilities, from $10-an-hour basement 8-tracks to automated 32-track digitals with video lockup and multiple soundstages, that it might seem like going out on a limb to call any one place 'unique'. But for a variety of reasons, Sear Sound is such a place.

On the surface, Sear Sound appears to be a well-equipped, modestly-priced, somewhat traditional 16-track house in midtown Manhattan, with a solid, wide-ranging clientele. A little digging, however, reveals several important deviations from the norm: the unusual history of the studio and of the people who run it, the scope of operations that go on within its walls, and the fact that Sear Sound is passionately devoted to the technology of vacuum tubes.

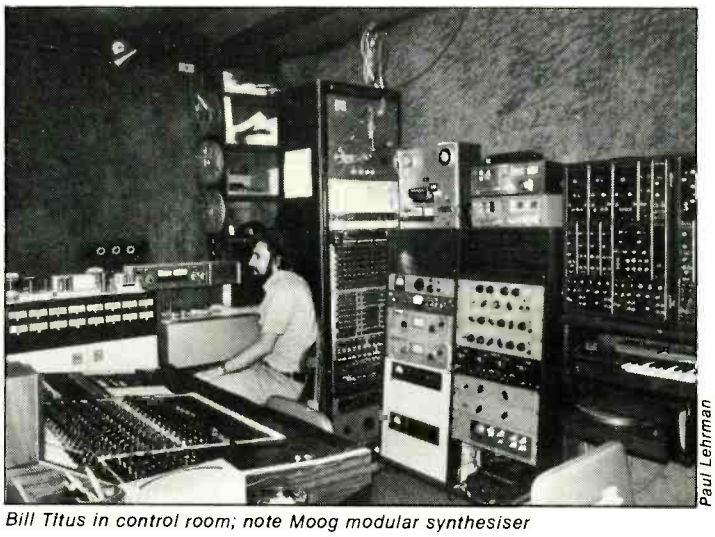
This is not just referring to a few vintage Neumann mics, Fairchild limiters or McIntosh power amps, although all of these are here. I'm talking about almost the entire audio chain, including console and tape recorders, using no solid-state devices.

Before we get down to details, a little background is in order. Walter Sear, the owner of Sear Sound, started his professional career as a tuba player, performing with such august groups as the Philadelphia Orchestra and the Radio City Music Hall orchestra. In the mid '50s, he got involved with one Robert Moog. The two of them had a wild idea about making cheap transistorised guitar amps, but given the technology of the time, they couldn't get them to sound very good. So instead, they made Theremins, and from there moved into synthesisers. These early devices were all modular, patch-cord-controlled contraptions. It was Sear, apparently, who suggested putting a keyboard on the thing, and the rest, as they say, is history. Sear helped to design the *Minimoog* and the *Electrocomp* line of synths, and started to create electronic music for a variety of projects, including records, commercials and film scores like *Midnight Cowboy*. To facilitate his work, he rented a studio at Fine Recording, then one of New York's most respected studios, where he also contributed his services as an engineer.

The story goes that Sear also designed the first VCA console: one day he installed three Moog VCA's in Fine's board. The late Bob Fine, the studio owner, took one look at it and said: "Sure it works, but no self-respecting engineer would ever use it." When the studio went out of business, a victim of the recession of the late '60s, Sear bought some of its equipment, and set up shop in the mezzanine of the Paramount Hotel, in what was to become the heart of New York's studio district.

Paul Lehrman

Chief engineer Bill Titus shows module from custom vacuum-tube console



Paul Lehrman

Bill Titus in control room; note Moog modular synthesiser

Along with Russ Hamm (now with Gotham Audio), he designed and built the console. According to current chief engineer Bill Titus: "They didn't start out to build a tube console, but they had worked at Fine when the first transistorised boards came in, and they all thought they sounded like the speakers had blown. They did some research, and concluded that you can't build a transistor console that sounds like a tube one."

The 16-by-16 console, which after ten years remains almost totally unmodified, uses 3-stage Class-A triode circuitry for the mic preamps and output amps—nothing fancy, just "standard textbook tube technology". The equalisers are passive, with a tube-stage follower, and they can be cut completely out of the signal path. 'The fewer components in the way, the cleaner the sound," says Titus.

"Nuvistors are the trick," he explains. "They are non-microphonic, and have a high signal-to-noise ratio. The faders appear to be linear tracking, but actually they are mechanically coupled to rotary pots sealed inside the board. It's a lot of metal, but in ten years, there's never been a crackle."

To extend tube life, the console filaments are turned on slowly with a manual variac before the HT goes on. The power supply is government surplus—it originally powered radar equipment on the DEW (Distant Early Warning) Line anti-ballistic missile system. Heat from the tubes hasn't been too much of a problem, but Titus does admit to occasionally running the air-conditioner in January.

Like his boss, Titus came to the studio business via the classical-music world. He was a tuba student of Sear's at New York's Mannes College, and built a recording facility there after his graduation. Following a change in the school's administration, he went out into the real world, landing a job as a maintenance engineer at A&R Studios. For two and a half years, he held down the evening and graveyard shifts, working with producers like Phil Ramone, and putting out fires at 3 am. "Many's the night I would have killed for the Neve rep's home phone number," he laughs. Early in 1981, after a few months of 80 hr weeks, he decided his health might be better served were he to work elsewhere, and he went to his old teacher to ask him advice on where to go. Sear hired him as chief engineer and studio manager.

Besides the console, tube equipment at Sear Sound includes microphones (AKG *C12* and *C28*, Sony *C37A*, and Neumann *U47*, *U67* and *KM56*—along with *KM84* and *U87*, "for people who have to have transistors," according to Titus), instrument amps (Ampeg and Traynor), equalisers (Pultec), limiters (*LA-2A* and Fairchild), power amps (a pair of McIntosh *M175*s—"it's plenty of power; tubes don't clup"), reverb (EMT mono), and the master 2-track and mono tape decks (Ampex *300*s with *351* electronics). The most fascinating piece of outboard gear is a Pultec (tube, of course) line amplifier, which has been modified for use as an optical peak limiter. "You can't hear it at all," says Titus, "even on film dialogue."

Of course, not everything can use tubes, and there are goodies like a UREI notch filter, an Orban stereo synthesiser ("It follows the plate—it's great because there's no cancellation in mono"), an Eventiude *949 Harmonizer*, and a DeltaLab delay.

There are non-tube mics as well: RCA *44* and *77*, Electro-Voice *666*, Altec 'lipstick', and a host of less esoteric units. "This studio is set up for keyboard players," says Titus, and sure enough, there's an 1894 Steinway 7 ft 5 in grand, a Baldwin electronic harpsichord, a *Rhodes 88*, a Hammond *C3*, a celeste, an RMI *Rocksichord*, a 1930s-vintage *Novachord*, Electrocomp and Moog synthesisers, and some weird old stuff even Titus can't describe. There's also a hybrid drum kit, timpani, orchestra bells, bell tree, and a well-stocked percussion toy box.

Control room monitoring is handled by UREI *811A*s and Auratones ("which are going as soon as Radio Shack has another sale on its *Minimus-7*s") as well as three JBL *Aquarius I*s—hi-fi speakers that the manufacturer discontinued ten years ago, but that Sear claims are the best-sounding speakers ever made.

Multitrack work is handled by an Ampex *MM-1200* (solid state, alas), and besides the Ampex ¼ in decks, there is a Studer *B67* ("I can't hear the difference") and a Pioneer ¼-track. Titus explains that the studio prefers the 16-track format because of its improved noise figure over 24-track, and it refuses to put in noise reduction, "because it kills all the transients, and that's what tubes are all about."

Sear and Hamm built an additional 16 modules at the time the console was constructed, with the idea of eventually expanding the board to 32 tracks, and bringing in a second 16-track tape machine. Professional ¾ in VTRs, along with video editing and monitoring facilities, are already in house, so improving post-production capabilities is the next step. 76 ▶

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In the back of the complex is a film mixing theatre, which features a completely passive 20-track Westrex mixing console. The board was built originally for MGM, then bought by Fine, and eventually by Sear. 'We're real auction freaks,' says Titus. 'Ten years ago Walter was buying old tube mics for $100 to $200 each, and people were laughing at him.' The only active audio gear ever used here are three more of the Pultec line amp/limiters.

Also back here, mostly resulting from Sear's activities composing scores for film and A/V clients, are complete editing facilities for both 16 mm and 35 mm film, including two flatbed film editors and three upright *Moviolas*. Sear's idea is to provide complete vertical structure to the film maker, under one roof. Here the sound can be recorded, the music composed, transfers done to mag film, sound effects from an extensive library added, and the final track mixed and edited. One film that had just been completed when we visited, an 'adult fantasy', included a rather steamy scene shot in the recording studio. Titus himself had a non-speaking part as a tape op.

Paul Lehrman

Film mixing room with passive Westrex console

Besides film tracks, the studio covers the entire spectrum of music recording, from rock and rockabilly to classical, MOR, and country. Clients have included the mammoth advertising agency BBD&O, Columbia Records, PBS-TV, and theatrical productions like *Oh! Calcutta!*, as well as independent engineers like Bill Fischer and Chuck Irwin.

And at $80 an hour, the clients keep coming in a steady stream. That is due in large part because, despite their fascination with old technology, the people at Sear Sound are well-steeped in the business realities of today. Given the tough shape the recording-studio business is in at present, Titus is confident that his studio, with its 'mid-line' status, can do well. 'The $200 studio is becoming more and more irrelevant,' he opines. 'Here, we have the sound, but not the price.' His biggest worries lie elsewhere—like in the fact that RCA has stopped making nuvistors. There are other manufacturers, but it's hard to say how long they will continue in the business. Of course, that's the price a traditionalist has to pay in an innovation-hungry industry. To borrow another phrase, you gotta get 'em while they're hot!

Paul D Lehrman

Sear Sound, Paramount Hotel, 235 West 46th Street, New York, NY 10036, USA. Tel: (212) 582-5380.

Quattro, Rome

Possibly due to its geographical location—surrounded by hills—Rome is one of those cities where one can get away from it fast into the surrounding country and still be 15-20 minutes from the city centre, especially if you have an Italian driver! Looking for all the world like a farm left over from the days of Imperial Rome is Quattro 1 (or Quattro Uno) recording studio, and, judging from the stream of clients that come in, the quiet of the countryside would appear to have its assets.

Access is by one of the main roads out of Rome leading to the Naples autostrada, meaning that it is easy to get there from whichever direction you are coming from. A turnoff on to a small road, that was designed for Land-Rovers more than anything else, and after a few hundred yards of bumping, there you are at Quattro 1. Load-in is easy as everything is ground floor so there are no steps to contend with. The building itself resembles a long, low barn, at once giving an atmosphere of down-to-basics and no frills. Once through the front door one is immediately in the waiting room/foyer which has a good selection of sofas and armchairs, plus a few games and the indispensable drinks machine! Simple meals can also be prepared at the studio but with an abundance of local restaurants nearby, who wants to stay at work all the time? Leading off from the foyer is a corridor leading to the control room—turn left—and studio, straight on.

The control room is more or less square and is attractively finished with a mixture of wood panelling, drapes across the rear shelves where tapes are kept, and moquette. Seating for musicians and visitors is provided in front of the control room window so that the engineer doesn't have them breathing down his neck—in Quatro 1's case, owner/producer/engineer, Luciano Tarani—and almost providing a sort of mobile acoustic treatment. Recording and mixing centres around an MCI package comprising a *500 series* console with 42 i/o channels and 8 VCA groups, 24-track recorder and two mastering machines, the console being complete with automation and all recorder channels having Dolby. Monitoring is a choice between two systems plus the inevitable desk-mounted *Auratones*. For Tannoy enthusiasts, there is a pair of pedestal-mounted Buckinghams driven by a McIntosh amplifier on either side of the window and for JBL fans a pair of *4330*'s mounted on a shelf over the window and driven by an SAE amplifier. Both power amps are on the shelf as well so that you can see how hard you are driving them. It also keeps speaker leads short which is always a good idea. As well as being used separately, the monitors are often used together, which makes for a very 'present' sound, to say the least. The monitor chain is equalised by a pair of UREI *536* ⅓-octave graphics having some rather steep curves in places. When I discussed this with Luciano he told me that he wasn't too happy with the acoustics of the control room and that a rebuild was on the cards for the near future. In common with a growing number of engineers and producers today, he is more concerned with hearing what is going on on the other side of the glass than with the 'sound' of the control room, and thus be able to work more creatively. However, on hearing some of the masters done recently at the studio there is no doubt that Quattro 1 gets down good results, all with a clear, tight sound. The signal processing racks are neatly mounted into the walls and contain enough to keep most people happy. Gain reduction is available via UREI *1176* and *LA-3A* limiters as well as an A&D *Vocal Stressor*. In addition, channels can be kept clean with 12 channels of the Italian-made EFT noise gates. (I have already commented upon the efficiency of these gates in reports on other Rome studios.) For those cases requiring some special EQ, two UREI *545* parametrics are at the ready. Time domain effects are well catered for with an Eventide *Harmonizer* plus keyboard and *Instant Flanger*, Dynacord *TAM 19* digital echo, Lexicon *Prime Time*, EMT *251* and straight reverb from AKG *BX15* and *BX10*. Cassette copies are not forgotten either, and these are taken care of by Teac and Sansui quality decks.

The studio is in a large rectangular room, rather like a small hall, with an airy, spacious feel about it. Again, acoustic treatment is fairly simple but effective with moquette on the floor and walls, some spaced wooden panelling and a dropped and angled ceiling covered with acoustic tiles. In the interests of separation, various large screens are available in order to make up booths for drums, percussion, etc, though for general working the studio is left open-plan apart from the drums. The sound of the studio is quite crisp and free of troublesome resonances, as a quick tinkle on the piano illustrated. Apart from the Bosendorfer grand, other instruments include a Hammond *B3* with *760* Leslie, Yamaha *CP30* electric and Gretsch drums. Various amplifiers are also available as is a selection of little boxes for distortion, chorus, phasing and other goodies. Foldback for the studio is the usual cans and a pair of wall-mounted JBL *4320* monitors. Microphones consist of a fairly representative collection from Neumann, Sennheiser, AKG and the like.

As well as the usual 'mood lighting' available from a combination of spots, both studio and control room (plus the foyer) enjoy full daylight. However, there are shutters available for those people who are bent on keeping their studio tans. Since I was visiting between sessions, I was able to talk to the musicians working there (always interesting) and gathered that they liked working in Quattro 1 very much, the atmosphere being a lot less hectic than the in-town studios. The added attraction of daylight is also well appreciated, so studio designers take note! Asking about the Italian music scene, while they agreed that things were quite healthy, there was a general wish that the music be a bit more progressive at times and not quite so hit-parade-oriented, my question about the Italian rock scene being met with polite amusement! However, having seen singer Gianna Nannini with her band on the Rockpalast, I don't think they need to be too pessimistic. That the studio produces hit records is evidenced by the record sleeves in the foyer and includes such notables as Riccardo Fogli, Eduardo de Crescenzo, Viola Valentino, Mimmo Locasciulli and others.

Luciano was going to rush off for a quick bite in what was left of the lunch hour and it was time for us to be moving on as well to our next appointment, so it was thanks all round to all at Quattro 1 for an interesting visit.

Quattro 1 recording studio, Via Nomentana 1111, 00137 Rome, Italy. Phone: (06) 827 52 66 or 827 83 05.

Terry Nelson ■

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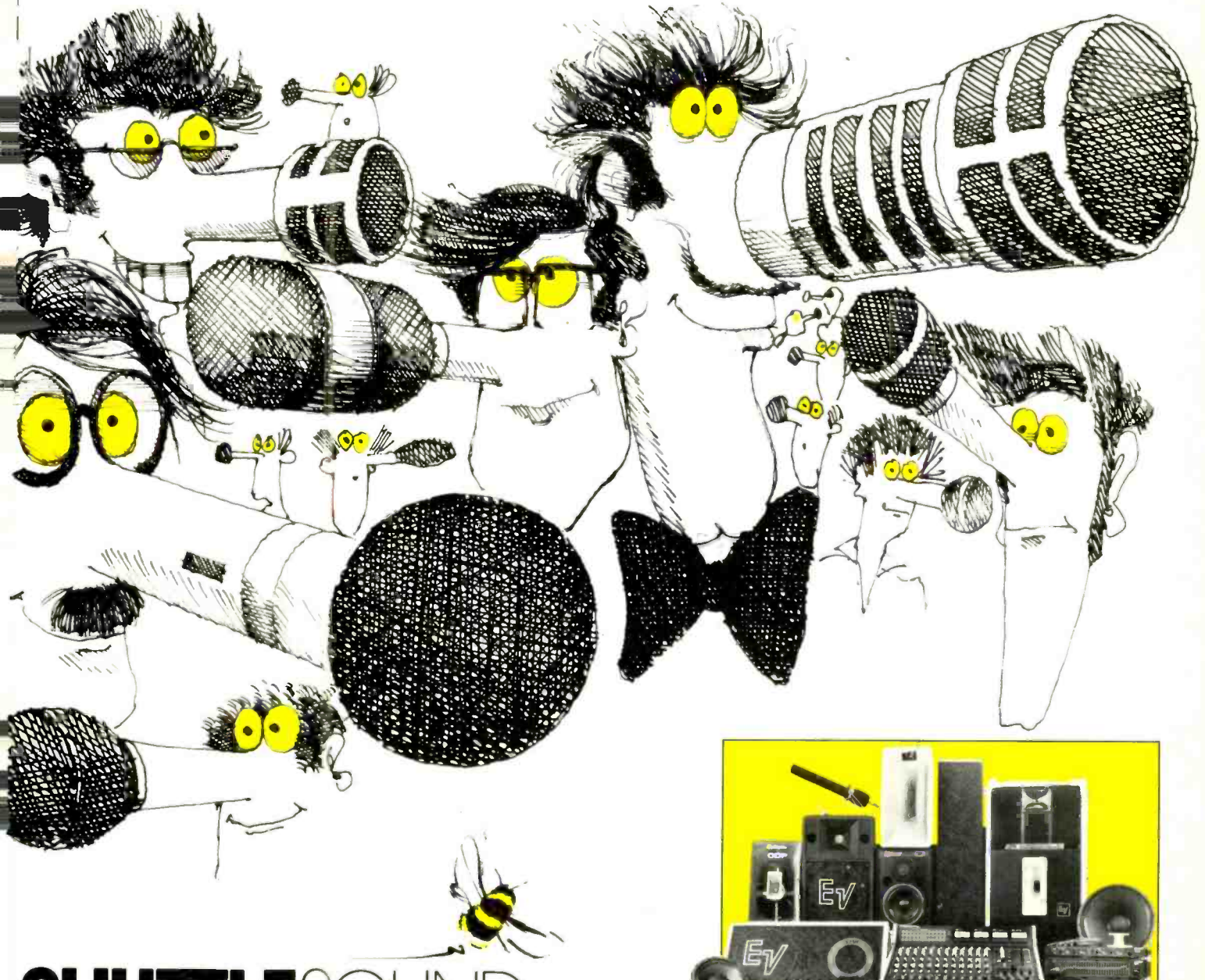

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COMPACT disc DIGITAL AUDIO

Inside the Compact Disc

Rod Duggan (Sony)

The success of this new system, launched in Japan last October and more recently in Europe and Britain, has brought digital sound reproduction to the consumer market. The quality of sound available is capable of revealing hitherto unnoticed faults in professional recording equipment and recording techniques. Hence there is a great deal of interest in both the Sony *CDP-101* (Domestic), and Sony *CDP-5000* (Professional) disc players from all parts of the recording and broadcast industry. This article describes the basic structure of the discs and players.

ASSEMBLED programme data from a *PCM-1610* processor is etched by laser on to the photo-resistive surface of a glass master disc. After developing, silver plating enables a metal master to be taken and a stamper is produced—nothing too unusual here. Individual discs are pressed out of clear plastic and the pitted disc thus produced is coated with aluminium to provide the reflective surface needed for the playback laser. The aluminised side is then coated with a protective film and printed with a label, the data thus appears as a spiral of bumps to be read out from the other side.

These data bumps are read by a laser beam, focused through the clear plastic to the reflective surface. At the disc surface, the beam is about 500 times larger than at the data surface, so that small marks accumulated on the disc surface in everyday use have little effect on the relatively large beam of light, and no effect on the final sound output.

As well as the two (or four) channels of audio, the digital track on the disc contains information for maintaining a constant speed of the disc (sync), error correction capability, and eight 98-bit control words for time display, titles, indexes and random access capability. Of these eight words, only two are used at present for indicating track number and location, time into track, and total time of disc. The six remaining words will be used in future for more advanced information such as a video display, or similar.

The disc spins at a constant linear velocity, of between 1.2 and 1.4 m/s, depending on each individual disc. The angular velocity or RPM will change as the radius of the track changes, so at the start (innermost track) the disc spins at about 500 RPM, and at the end (outermost track) it slows to about 200 RPM. This constant linear velocity is maintained by decoding the sync information off disc and feeding it into the disc motor servo.

To aid error correction, adjacent data is scattered around the circumference of the track in a predetermined order, so that if there is damage to one place on the disc, the error would appear as many small errors in the re-assembled data, and the error correction code could then easily correct these. Most small blemishes on the surface of the disc do not cause errors as the laser beam is out of focus on the surface, and covers a relatively large area.

Table 1 shows a comparison between the conventional 'vinyl and cardboard' LP and the *Compact Disc*. These figures are all fairly approximate, and vary slightly between different discs due to programme content but it shows how the performance of *CD* exceeds the LP.

Players

Discs are placed in the players, label uppermost, and the laser tracks from underneath. In the *CDP-101*, the sliding drawer shuts on a play command, the disc is optically sensed and the laser focus lens moves up and down to detect a focus point (if no focus is found after three attempts, the disc is ejected and the operator usually finds the disc was put in upside down). If a focus point is detected, the focus servo is turned on and fine focus is performed, the disc spins, and the first tracks are read out. These are the table of contents. The disc stops and awaits operator commands.

Tracking, focus, and data reading are all sensed by the single laser unit. **Fig 1** shows the optical pick-up unit. The laser diode emits one narrow beam of red light, at a power of nearly 0.4 mW, through a diffraction grating where, by interference, side beams are produced. The first side beams appear as side spots to the main beam on the disc and enable tracking to be performed, as there is no wall of vinyl to push the pick-up sideways as in conventional discs.

The polarising prism allows the light from the grating through to the collimating lens to produce parallel light ready to be focused on to the disc by what goes under the name of 'a 2-axis device'. This is really a lens that is eccentrically mounted in a drum that can both turn and move up and down, to perform fine tracking and focus respectively.

Just before the 2-axis device is a plate that rotates the polarisation of the light by 45° each time it passes through, so by the time the reflected light from the disc reaches the prism, the plane of polarisation has been altered by a total of 90°. This change is detected in the prism and the light is reflected sideways out to the photo-detectors.

On leaving the prism the light is converging to a spot focus, but on passing through the cylindrical lens, its horizontal convergence only is altered. This has the effect of producing a spot that is an ellipse when the disc is out of focus, and a circle when the disc is in focus. The ellipse is rotated 90° between too near and too far out of focus due to natural image inversion.

Fig 2 shows the array of detectors. The spots are always centred as shown, and changes in their areas cause different outputs from each cell. The sum of outputs A + B + C +

TABLE 1 COMPARISON OF SYSTEMS

	Vinyl LP	Compact Disc
Speed	33⅓ RPM	200 to 500 RPM
Max time per side	25 min	75 min
Groove length	400 m	over 5 km
Frequency response	30 Hz to 20 kHz,±3 dB	20 Hz to 20 kHz,± ½ dB
Pick-up life	500 hr	5,000 hr
Signal/noise ratio	60 dB (ignoring scratches)	90 dB
Distortion	2%	less than 0.01%

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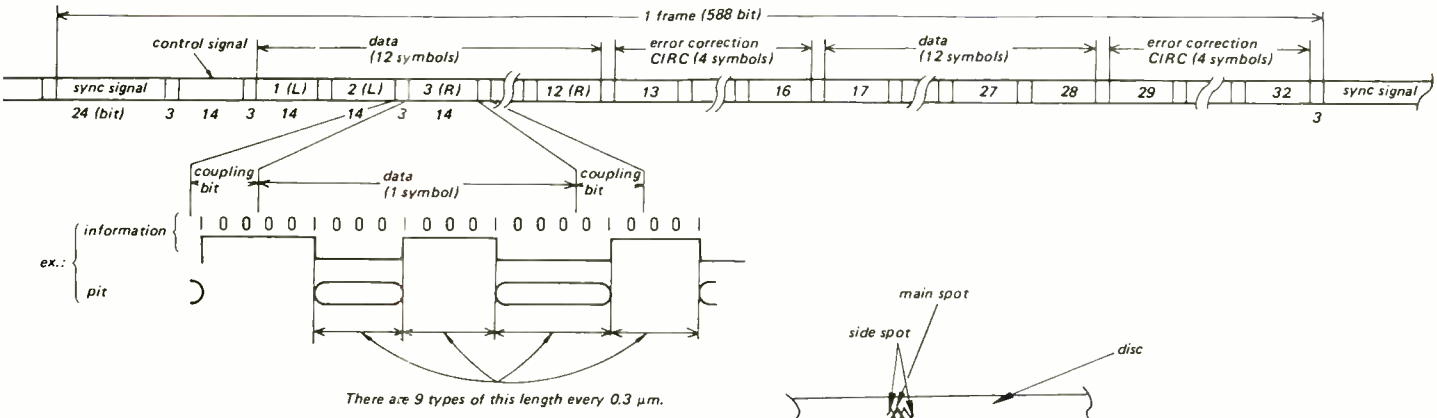
FIG. 3



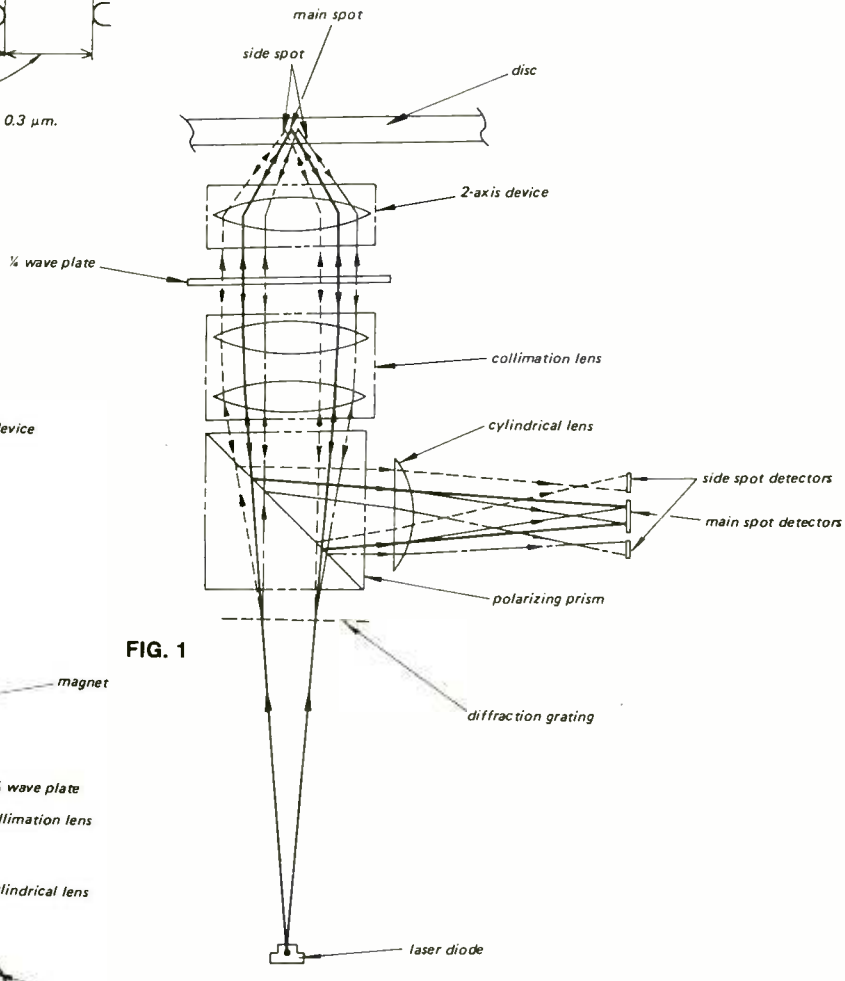
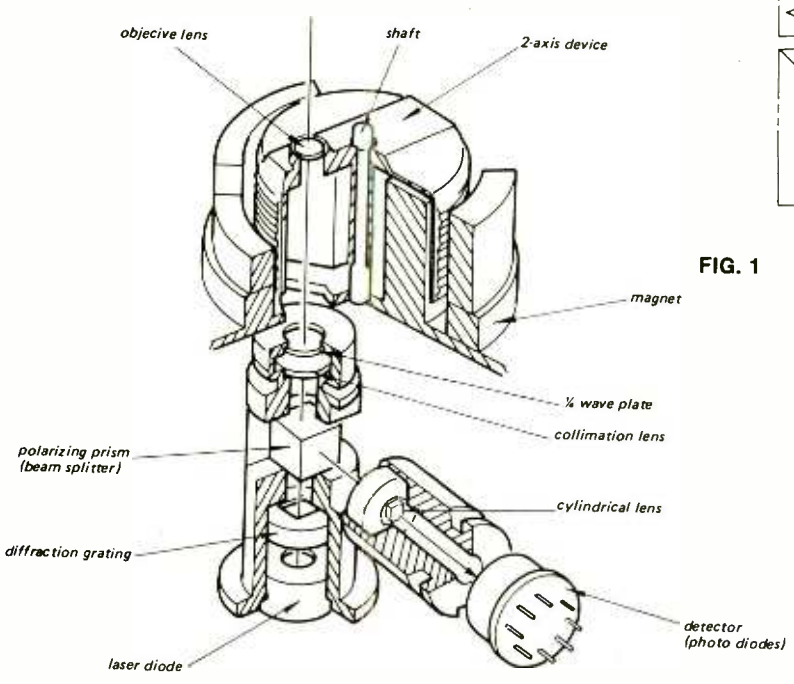


FIG. 1



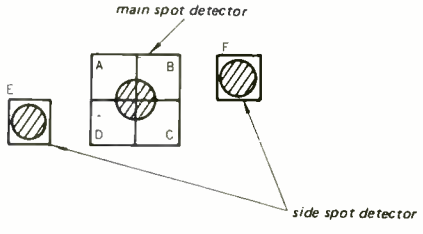


FIG. 2

D is data and is fed to the processing circuits. The difference (A + C) — (B + D) is positive for the disc too near, and negative for the disc too far away, and zero for correct focus. This is identified and fed to the focus servo. The side beams that were produced by the grating end up on detectors E and F, and are compared and fed to the tracking servo.

The data format is shown in **Fig 3.** One 16-bit word is split into two 8-bit words and encoded onto the disc as two 14-bit words (eight to 14 modulation). An 8-bit word can have 256 forms. A 14-bit word can have 16,384 forms. Of those, 256 are chosen that are very convenient for this system, hence the name or 'eight to 14 modulation'.

By now someone must have spotted that the control word is only 8 bits long (14 on disc due to EFM). This control word is stacked for 98 frames and read 'vertically' so there are now eight words of 98 bits each. Only two of these words are presently in use. One frame consists of 12 16-bit audio samples, four 28-bit error correction words, and 34 coupling, control and sync signal bits. The coupling bits are put in purely to help the transition between words on the disc.

The digital processing hardware in the units is greatly reduced due to mass production of three LSI (Large Scale Integration) chips, *CX-7933/34/35*. These three chips contain a total of 27,654 transistors, or the equivalent of 500 logic ICs. The *CX-7933* manages data demodulation, subcode demodulation and frame sync, the *CX-7934* manages RAM control, interpolation and interface for D/A converter, and the *CX-7935* is used solely for error detection and correction.

CDP-5000 processor and CDA-5000 analyser

The D/A converter used is a *CX-20017*, the same as the *CX-890* used in the *PCM-3324* and *PCM-F1*, but with some more integration of external circuitry. Full 16-bit resolution is achieved and assured with no need for adjustment.

There are three microcomputers in the *CDP-101*, one for the remote control (either infra-red or via the accessory port), one for the servo system control and subcode signal and one for master control keyboard control, display and laser switching control.

To cater for the professional market the *CDP-5000* has been developed, together with its partner, the *CDA-5000* disc analyser. The transport is totally different from the *CDP-101* in that the laser remains still while the disc moves for tracking, search and focus. This enables even faster access times than the *CDP-101* to be achieved.

The professional player has comprehensive timing and selection facilities, with instant start time of 300 ms maximum. A 2-speed cue dial enables any point in the disc to be found and starts practised on monitor playback before going out on line output, discs can then be started on any particular note in a disc. The Analyser system, *CDA-5000*, complements the professional player, and consists of a keyboard and video screen. With this, any *Compact Disc* can be played and all parameters checked, including error rates, timing accuracy of indexes, and coding errors. The whole information can be printed on paper for a permanent record of production quality.

The first generation of digital audio equipment is thus completed, incorporating several new concepts that are still to be refined, developed and accepted. The next few years are bound to see many changes in all industries related to audio products, and in particular recording studios and their work. ■

Note: UK users may be interested to note that Sony Broadcast will shortly be running a basic Digital Audio Concept course.

Compact Disc mastering

Chris Hollebone
(Sony Broadcast)

In this article Chris Hollebone attempts to explain some of the more important points of *Compact Disc* production in a non-technical manner. He will then suggest one or two areas where a little thought would go a long way towards improving some of the lamentable software that has accompanied the launch of the *CD* system.

EVERY advance in recording techniques is accompanied by its share of problems and pitfalls. The list of precedents is formidable; for instance, remember how long it took to overcome Dolby level compatability difficulties, not just internationally, but between adjacent studios. *Compact Disc* production is no exception. In fact the process involves many techniques that are alien to the analogue world in which we have grown up. This creates its own special aura of mystery. Indeed, the mythology and misunderstanding already prevalent would fill a book. The cause has not been helped by some particularly confusing, and sometimes conflicting, information that has been circulated by the major partners, Philips and Sony.

Many studios were circulated with a document entitled *Specifications of the ¾ in Cassette Type CD Master Tape*. This bewildered everybody by devoting half a page to the digital audio section and half to the timecode information and the following 10 pages to a very complex explanation of subcodes and PQ data. This was especially difficult to follow because the devices used in this process are only just appearing now. The general reaction from engineers was predictable and ranged from 'You must be joking' to 'You need a bloody degree to understand this'. Fair comment, but a future article may attempt to tackle this maze of maths. Suffice it to say, if you were fortunate enough to possess a *Cue Editor,* it would do the maths for you.

We shall deal with the first page of the specification which is absolutely fundamental to producing *Compact Discs* with the minimum fuss, delay, and most importantly, doing justice to the recorded material.

It's a Sony

One of the first nettles to grasp is that all masters must finish up on the Sony *PCM-1610/U-matic* system. Sorry chaps, but if you don't master on the Sony system, somebody else has to. If you are fortunate enough to have a *PCM-1610,* you have the opportunity to produce a master that will be faithfully reproduced on *CD*. There is no 'tweaking' in the cutting room, and no facilities exist in the factories for equalisation, level control or any other refinement. So the tape has to be perfect when it leaves you otherwise any mistakes are reproduced with frightening clarity.

Analogue masters

I will return to the problems of preparing your own *CD* masters later, but let's assume that the majority of tapes are analogue and you don't have access to a *PCM-1610*. Can you send these to be processed? Yes, but it will cost you more because somebody else has the job of copying the tapes, premastering and cue editing. Your tape should be the nearest to first generation that is usable. Do not follow the examples of those who have sent a production master specially equalised for analogue cutting. Please remove all leader tape and insert room tone or recorded blank tape. The sudden dropping in and out of tape hiss is disturbing on *CD*. You should make a timing list noting the beginning and ending of each title (see **Fig 1**). If there is a crossfade, note it on the list and list the time when the new title starts. Remember these cue points should start as cleanly as possible otherwise, when accessing on the player, you will never get a precise start. It is also recommended that you mark the start and finish points with splicing tape to give a visual indication. If you have sufficient time in the band you should set your cue point about 1½ s before the music starts. This lessens the chances of a few frames' miscue affecting the music and allows a comfortable start. If more than one tape is being sent, mark the reel numbers clearly. The *CD* is one sided so the label cannot be swapped. Remember to indicate the band timing between the original separate sides in order to keep the continuity.

Digital masters from analogue masters

So, you are the proud owner of a Sony *PCM-1610* system and you have a library of tapes to transfer. Great, you have control of your masters and only yourself to blame. For heaven's sake check the quality of the original tape. Don't use the first tape you can find without establishing its origin. If there are splices, check that they have not spread or become sticky. Many record companies do not have the original master but it is well worth trying to locate it. If you need to make a production master to iron out level problems or add more reverb or whatever, this is no problem. Copy it on to the digital machine and you enter the domain where copies no longer matter and your production master will be the same quality as the original.

It has to be said that in an ideal world with limitless resources, it would be preferable to remix many of the albums. Many analogue tapes are condemned to sounding awful on *CD* because when the original mix was done, it was with analogue disc cutting in mind. There were certain conventions that had to be observed otherwise it would be impossible to cut. If you do remix, the chances are that many will complain that the 'old sound' was better but consider what could have been done. No need to put the bass instruments in the stereo image centre. No need to compress it to death. No need to screw on extra HF boost to keep the transients. It's a new medium, so why not use its capabilities?

Digital masters

Mixing straight to digital will help to minimise these problems but ironically, you may find that you finish up with a master that cannot be used for analogue cutting—a dilemma! Obviously, to do two

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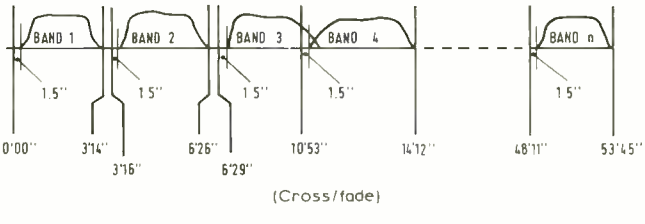
FIG 1a
TIMING LIST

TNO	Title	Beginning/ ending	Timing (Min Sec)
1.	XXXX	B	0 : 0
		E	3 : 14
2.	XXXX	B	3 : 16
		E	6 : 26
3.	XXXX	B	6 : 29
4.	XXXX	B	10 : 53 (Cross/fade)
		E	14 : 12
'	'	'	' '
'	'	'	' '
'	'	'	' '
n	XXXX	B	48 : 11
		E	53 : 45

FIG 1b
Order of bands in accordance with Fig 1a.



mixes of everything is not realistic, but surely it is easier and preferable to make an analogue production master from the *CD* mix rather than the other way round. You can take things away but once they are gone, you can't get them back.

So, what is the digital standard and how do we prepare the tape? We have already said that it must use the *PCM-1610* format and it must use *U-matic* cassette. *PCM-F1*, JVC/*U-matic*, dbx or any of the linear machines, 3M, Mitsubishi/Telefunken, or Soundstream, are not acceptable *(unless you don't mind transferring it to a 1610 via analogue—Ed)*. The sampling rate must be 44.1 kHz. Older tapes made on the *PCM-1600* or *1610* at 44.056 kHz must be transcoded. This can be done by direct digital dubbing through the *1610*. The incoming sampling rate is automatically detected and decoded and provided the internal sampling rate switch is selected to 44.1, the resulting copy will be at this rate. Anyone who has not switched to 44.1, please do so immediately. (If you have an unconverted *1600*, please contact your nearest Sony office.)

Now we have an interesting difference between the two majors. To emphasise or not to emphasise, that is the question. Polygram say no, CBS/Sony say yes and so do the other Japanese plants that are coming into production now. However, it matters not a lot. The emphasis is automatically detected by the receiving player, so no manual switching is necessary.

The timecode is not in dispute. It must be SMPTE 'non-drop frame' or, if you prefer the term, 'fully framed'. It must be synchronised to the video signal and not running wild. Before you ask, the internal timecode generator in the *PCM-1610* is switched to Non-Drop Frame when operating at 44.1 kHz, but check that the switch on the *DAE-1100* Editor is in the Non-Drop Frame position. (The switch is on the front of the TLC board.) Having got this together, it is vital that there is a minimum of 30 s uninterrupted timecode before the start of the music. On no account cross the 24 h barrier. Do not start the code at 23-59-30-00 and start the music at 00-00-00-00. It might have seemed a neat idea but it plays havoc with the system.

Tapes presented without timecode incur an extra pre-mastering charge and must be accompanied by the timing chart in **Fig 1**. Be warned that crossfades between tracks will not be welcome. Tapes with code are preferred and will cost less. These should be accompanied with the timing chart shown in **Fig 2**, again with crossfades, mark the time of the start of the new track. Exact frame accuracy is not required, and again a lead in of 1½ s is preferred, the absolute minimum being 10 frames.

There have been some misunderstandings over the recording level of the digital master. I have already said that the *PCM-1610* tape is transferred exactly one to one and this obviously applies to the level recorded on tape. Those familiar with the meter on the *1610* will know that the nominal zero appears half way up the scale of the meter, implying that there is a lot of headroom above this point. This is quite true and unless you are peaking well into this plus area you are not taking full advantage of the quantisation available on the processor. Recently it has emerged that it is recommended to make the peak level at +18 or +20 dB above the zero mark. Curiously, this crucial fact has never been mentioned in any of the written circulars, but emerged from the back

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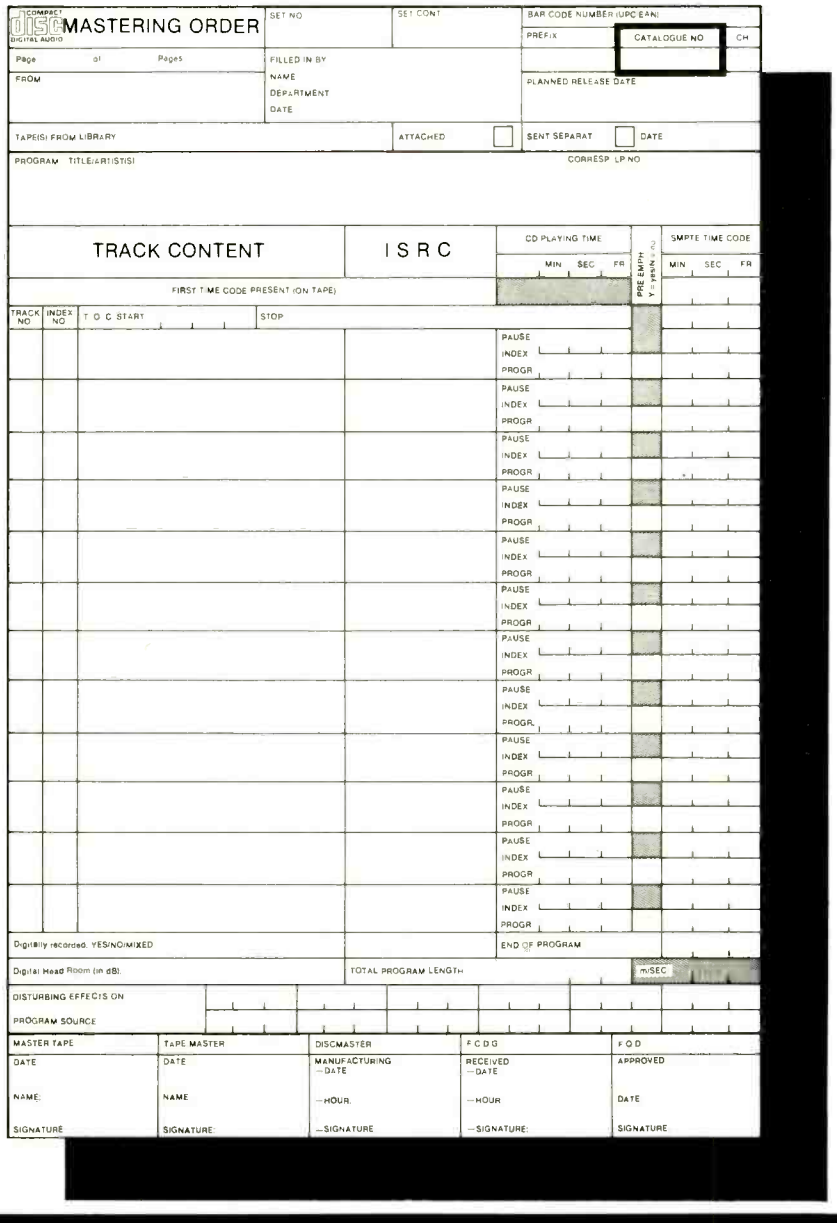
FIG 2

TNO	Title	Beginning/ ending	SMPTE Time-code[1] Hour	Min	Sec	Frame[2]
1	XXXX	B	00	00	30	00
		E	00	03	59	29
2	XXXX	B	00	04	03	21
		E	00	08	32	13
3	XXXX	B	00	08	36	14
4	XXXX	B	00	12	27	32 (Cross/fade)
'	'	'	'	'	'	'
'	'	'	'	'	'	'
'	'	'	'	'	'	'
n	XXXX	B	02	15	13	18
		E	02	19	21	23

Notes

[1] Encode the mastertape (on channel 2 of its analogue track) with the SMPTE code at least 30 s before the beginning of the first band. The SMPTE code must be synchronised with the video signal, fully framed and consecutive throughout the tape.

[2] If 'frame' cannot be read, chart without it is acceptable.



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door of both major companies. The logic behind this is that the optimum signal to noise and minimum distortion can occur at this point, but beware that not much head room remains. Exceed the end of the meter, and clipping and severe distortion may result. This does pose some problems because to load the tape to this extent plays havoc with the VU meters on your mixer. But in the words of the boffins "This emphasizes the fundamental incompatability of analogue and digital systems". There can be no solution to this until there are digital mixers in common use: in the meantime this remains a serious drawback. Those tapes previously recorded at too low a level can be copied through the *DAE-1100* with maximum gain offset, which raises the level by 6 dB per copy. The *PCM-1610* has some 6 dB gain increase available at the input preset. This additional 12 dB gain will assist in narrowing the discrepancy between the mixer output and the input level required for the *PCM-1610*. This does pose some problems because to load the tape fully plays havoc with the VU meters on your mixer but if you stay within these confines you will produce a very quiet *Compact Disc*. I fear that many will pursue the opposite course to attempt to produce the world's loudest *CD*, with all the signal compressed into the section between zero and the end of the scale. To do this is to make a mockery of the whole system and to perpetuate boring and lifeless music with absolutely no dynamics or colour. The *CD* system offers great opportunities to the composer who need no longer fear that his writing will be submerged by tape hiss and surface noise. As with all things, a good deal of common sense is required to get the best out of the system but no doubt we shall see a norm emerge for various types of music that will be acceptable to the listening public and the broadcasters.

Final processing

Now the tape is finished and has been sent for processing. What happens? The manufacturing process is discussed later, but you will see that it is not feasible to submit test pressings. Quality is carefully monitored at the factory, but as always, 'garbage in, garbage out' and some discs have appeared with bad cue editing. This is largely because comparatively crude editors have been used hitherto. The introduction of the Sony *DAQ-1000* will help to eliminate these problems and Philips are also developing a more sophisticated computer-based model. One precaution may pay off at this stage when sales are not so rapid. Only have a small production run and if these are good, ask for a repress. Minimum quantities are often as low as 500 with similar quantity re-orders.

The maximum recommended running time is 60 min but it is possible to cram more than this on a *CD*. The problem is that the longest *U-matic* cassettes are only 60 min long. Bearing in mind that most cassettes are slightly overlength, and deducting your initial 30 s for lead-in, you might get 65 min if very lucky. This will probably incur a small surcharge at the factory. If you need more than 65 min, please discuss this with the pressing plant concerned. The possibility of a longer cassette (say *KCA-75 BR)* is being studied at this moment, but there is no easy answer now.

Injection moulding under clean-air conditions at PolyGram's Langenhagen plant

What do you think of it so far?

When you consider that it was about a year between the appearance of the first prototype players and laboratory-assembled discs, and the introduction of reliable and sophisticated hardware and mass-produced software, I think one has to be impressed. Also impressive is the lack of faulty discs on the market. Contrary to the myth, the pressing yield rate for *CD* production is between 85 and 95% depending on plant and circumstance. Given the complex process and the very tight tolerances, this is very creditable. The audio industry is lucky to be riding on the back of *LaserVision* because, without a doubt, much was learned from the trials and tribulations of this system in its early development stages.

What of the comments so far on the quality of the software? There has always been a strong incentive to get discs out the door as fast as possible. All too often the record companies' attitude is 'Never mind the quality, so long as it sells'. I am afraid that this also applies to *CD* and most companies have played safe by issuing the old favourite best-sellers. Those companies playing so safe that they produce no *CD*s at all are fortunately dwindling. Most encouraging are the small and enterprising businesses in the UK that are showing the multi-nationals how to do it. I wish them well.

I make no apology for returning to a subject recently highlighted in a *Studio Sound* editorial. How many of the discs give the listener any clue as to their origin? Once again, the record companies' behaviour is thoroughly reprehensible. For the sake of one line of script on the accompanying literature, reviewers and enthusiasts alike are left to speculate as to how the recording arrived on this magical piece of plastic. Some have made the distinction between 'Digital recording' and 'Digital mastering'. The first is supposed to mean it was originally digitally recorded and the second means precisely nothing. Everything *has* to be digitally mastered to appear on *CD*. From *what* was it digitally mastered? Was it an analogue 2-track tape or Edison's phonograph? One simple line of text is all that is needed. For instance: 'Processed from an original analogue stereo master' or 'Processed from a digital master mixed down from analogue multi-track'. A bit of a mouthful maybe, but most buyers of *CD* will be interested in this sort of information.

One particularly famous label has re-issued one of the classic albums of the '60s, and much to their credit, on the reverse of the box, print the words 'Digitally mastered from an original analogue recording'. Open the box, and look at the disc and you will be surprised to read that it is 'An original digital recording'. Pretty remarkable for 1966 but pretty inexcusable on the part of the record company. Incidentally, on the same disc there is a false start on one title which was certainly not on the original and one of Britain's best known bass guitar players is playing the drums according to the sleeve notes. Enough said, but this sort of stupidity by the major companies is bound to impede the progress of a system which should significantly contribute to their own survival.

Sony's PCM 3324 24-track digital tape machine and PCM 1610 mastering system

Immediate future

The preceding paragraphs should have laid a few ghosts. Cue editing is still a mystery subject and I am sure it will have its share of problems which will emerge later this year. Those of you who have read the 'Specifications of CD' will have noticed that there are eight subcode channels on the disc but so far we have only used P and Q. Discussion documents will be circulated soon to try to establish the best use for R,S,T,U,V,W. I am also sure that this will generate its own unique set of problems to keep us on our toes. Never a dull moment! ■

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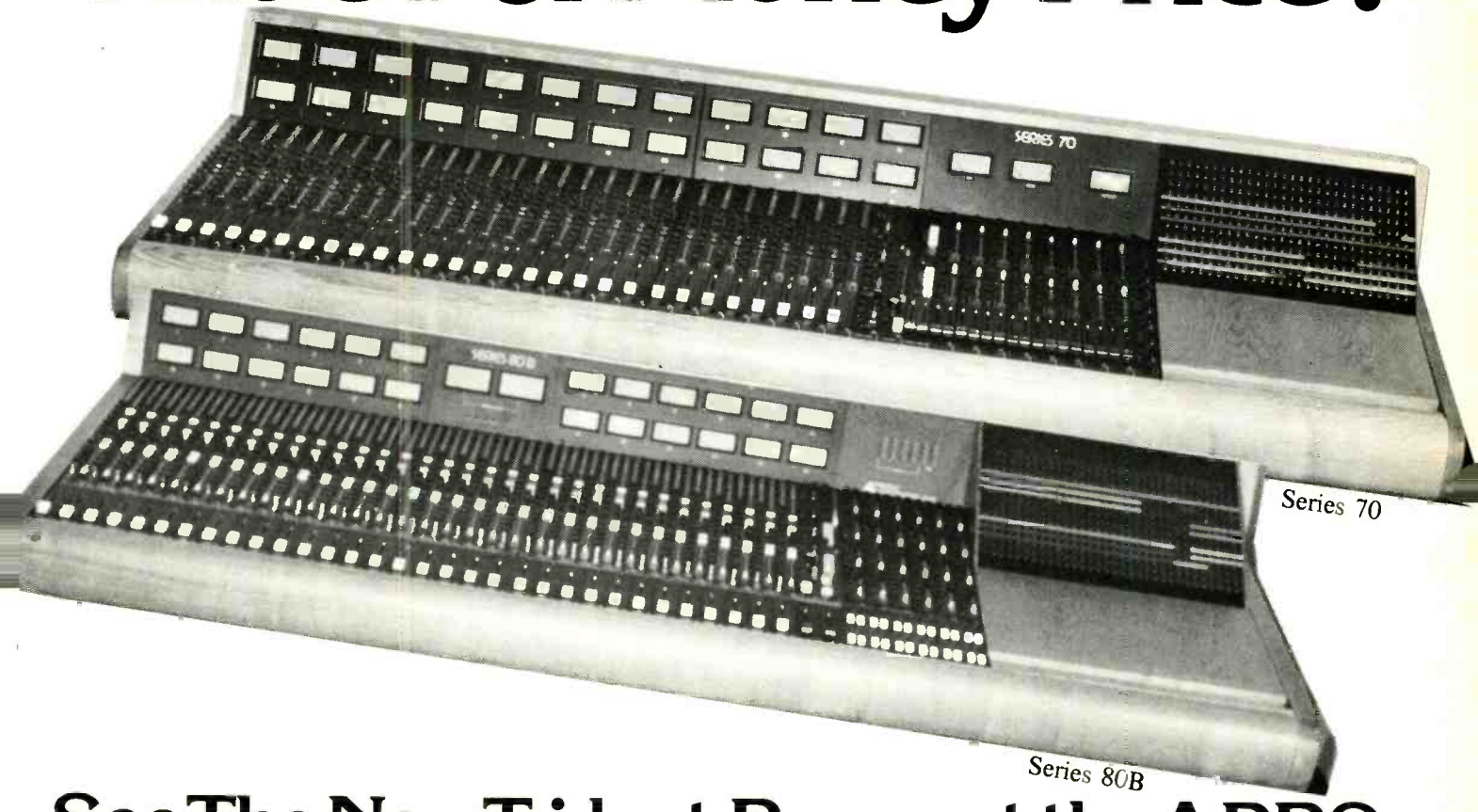

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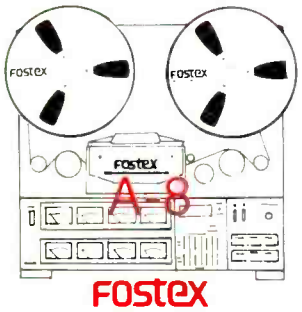

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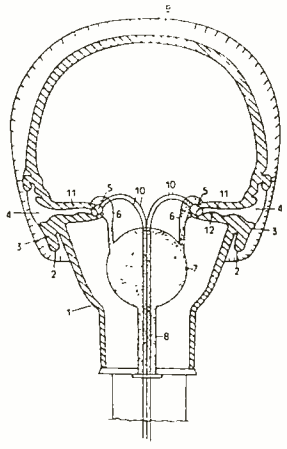

Hugo Zuccarelli's 'Holophonic' recording system has gained a good deal of publicity in the UK in recent months, but very few facts have emerged, either about Zuccarelli's claimed new theory of hearing, or about how Holophonics actually works, or is supposed to work. In this article, Barry Fox investigates the background to Holophony, and attempts to come to some conclusions. This turns out to be difficult.

Barry Fox

It would be very convenient if Hugo Zuccarelli's sound recording system, which he calls Holophonics, didn't work. Then there would be no need for this article. But Holophonics *does* work, up to a point, and as a result has generated a considerable amount of publicity. Normally level-headed journalists have gone overboard in print. The Southern ITV station TVS has devoted half an hour to the subject and pop group Pink Floyd is paying Zuccarelli a royalty for use of his system on their latest LP, *The Final Cut*.

So whatever the circumstances surrounding Holophonics, it seems encumbent on *Studio Sound* to report. This is far easier than it sounds. The Holophonics phenomenon is very long on colourful opinion and soft theory, but painfully short on hard fact. Preparing this report was like cataloguing cotton wool. If it weren't for the fact that Holophonics offers audibly interesting results I would have quit early. What follows is a sincere attempt at sifting fact from fantasy and confusion. Inevitably questions are raised. Hopefully they will prompt some hard fact answers.

First, it's useful to distinguish between discovery and invention. You *discover* a natural phenomenon, like gravity, which has always existed but never previously been recognised or explained. The established procedure in science circles is to publish a full description with back-up theory in one of the many specialist academic journals which are published by and for the scientific fraternity. These journals have a stringent vetting procedure. For a scientific paper to be published it must be written clearly, describe the discovery as fully as possible, expound any new theories in full and give source references for work that has gone before, often over hundreds of years. The stringent vetting is of course intended to save the publication from embarrassment by hoaxers, eccentrics and opportunists.

Publication usually stimulates debate and controversy. If the subject is of popular interest, it will be picked up and reported, in greatly condensed form, in more popular scientific magazines. These will give due credit to the original academic source. The next step is for the popular press to select and re-publish a few titbits. In this way the scientific discovery may eventually become an established part of text book theory, perhaps replacing a previous theory. This of course happened when the supposedly unsplittable atom was split. If the discovery is of monumental importance, the author of the original academic paper may receive recognition in the form of an award, the highest of which is the Nobel Prize.

Sometimes a published theory is publicly ridiculed. It is a risk any scientist must run in return for the chance of recognition. The Austrian monk Gregor Mendel bred peas in a monastery garden for seven years before publishing details of his work in 1866 in the *Proceedings of the Brunn Society for the Study of Natural Science*. It wasn't until after Mendel's death that scientists realised he had explained the basics of genetics, or why children take after their parents. Russian scientist Trofim Lysenko published a quite different theory, namely that children take after their environment rather than their parents. Under Stalin the Russians tried, but failed, to put Lysenko's theories into practice, to boost grain output. Now Lysenko's name is a bad joke in the scientific world.

An *invention* is quite different from a discovery. It involves the construction of equipment, or the design of a process, to produce a tangible, or at least saleable, end product. Since the 17th century the law has recognised that inventors are entitled to some reward for their work—without financial reward there is no incentive to invest time and money in research. This is why patents are granted for inventions. They give the inventor a monopoly on the achievement for up to 20 years. The exact period depends on the country. But the inventor must enter into a bargain with the State. In return for granting a monopoly the state demands that the inventor disclose full details of the innovation. This basic principle is embodied in the very word patent, which means to lay open.

The inventor's ideas are published in a patent so that they are added to the sum of human knowledge. Under modern law, patent applications are also published, a year or so after filing. While a patent is in force the public may read, write and talk about these ideas, but not put them into practice without permission from the inventor. Usually this involves payment, which is one way an inventor makes money. After the patent expires the published ideas become public property. If an invention is not new, then either the Patent Office will refuse the original application or, if a patent is granted, a third party will contest its validity in court. But once a patent application has been published it cannot then be unpublished. The only patent applications that remain secret are those which the Patent Office think represent a danger to national security, for instance a defence weapon. The decision not to publish on grounds of security is taken very promptly, within a few weeks of the original application reaching the Patent Office. Only once, in the case of some nerve gas patents, has the Patent Office in London taken something off the public library shelves.

Almost every patent application, in every country, is initially refused by the Patent Office. Sometimes the objections are purely formal and easily overcome, such as that the patent application covers more than one invention and should thus be trimmed or split into several separate cases. Other objections are more serious, for instance that the idea is old in the light of previous knowledge, for instance prior publications which are found by the Patent Office in the routine searches that are carried out on every new ap-

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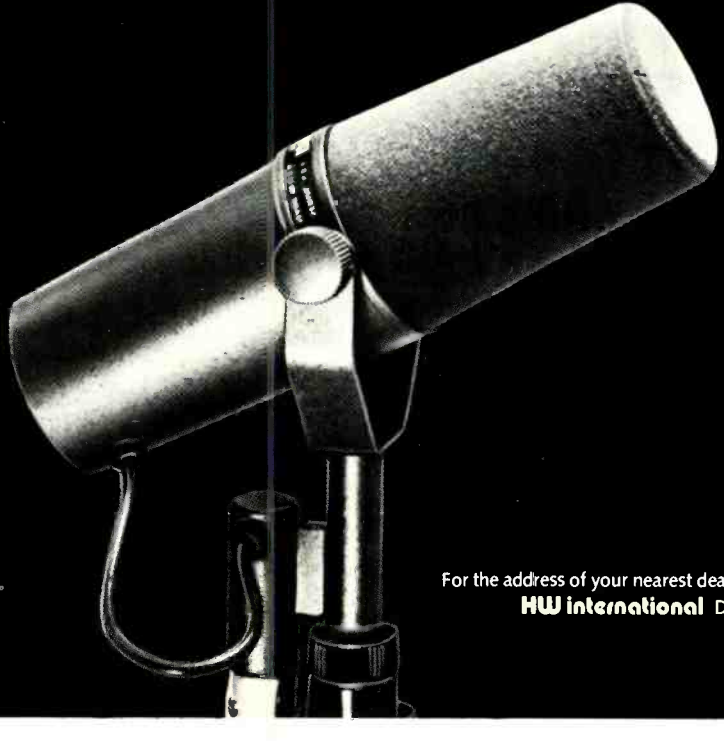
"We do use a lot of Shure mics... I think to great advantage. There are a lot of their mics I tend to use for fairly specific things. I've got good tom mics, good overhead mics. And there are certain Shure models–like the SM7–if we had only SM7 mics it wouldn't be the end of the world because you can actually use them on anything.... Actually, the SM7 is a great bass mic, that's the particular function I use it for."

From an interview with Mick McKenna – engineer with The Rolling Stones Mobile Studio. Reproduced by kind permission of 'Studio Sound'.



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an investigation

plication. Sometimes an application can be altered to meet these objections. On other occasions the patent application turns out to be irredeemably bad. It is refused and no patent granted. But the text remains published.

Not surprisingly, some inventors do not like that part of the bargain which requires them to publish full details of a new idea long before a patent is granted. This is why some inventors, and some firms, take a policy decision not to patent some ideas. They rely on secrecy. Obviously this is impractical if the product is to be sold, because immediately the secret becomes common knowledge. It's only practical to keep an invention secret if it is a process for making something that can be used behind closed doors, for instance a secret formula for magnetic tape, perfume, liqueur or cola drink.

Inventors have tried various ploys over the years to conceal the true significance of a patented innovation. Sometimes they will give the patent a confusing title to make it harder for searchers to locate. I've seen several patents entitled 'article and process of making it'! But the Patent Office usually insists on a sensible title which gives a fair clue to the invention. One inventor changed his name to Mr. X and gave his address as a post office box number. This was counter productive, because it simply drew attention to the patent as listed in the index!

Inventors often assign their rights to a company or business backer, who then files the patent. But the name of the inventor still appears on the patent and is indexed. There is no reason why an inventor should not file a patent in a completely false name, for instance inventor Smith of a London address could give his name as Jones, of the same address. This would confuse anyone searching for patents under the name of Smith. But it would present Mr. Smith with some tricky legal problems. How would Smith, for instance, draw up a contract to license the Jones patent to a third party and collect royalties? How would Smith sue in the courts on a patent in the name of Jones if someone infringed his rights? Apart from these obvious problems, the British Patent Office confirms that they would not look kindly on any inventor who used a false name with the intention of misrepresentation. So quite simply, an inventor who patents under a false name, to try and keep his ideas secret, could end up without any patent rights at all.

That's the general background, in brief. It sets the scene for the foreground specifics.

Hugo Zuccarelli, variously described as Italian or Argentinian, has formed a company called Zuccarelli Labs, with Mike King, previously with Advision and Feldon. According to Zuccarelli and King, they have not sought publicity for Zuccarelli's holophonic invention and it has been generated simply by the demonstrations which they have given. Like many others I've heard their demonstrations. What I've heard is a series of sound effects replayed from a Sony *F1* digital system through headphones. In many respects it was *déja vù*, a re-run of the first flush of surprise when I heard the first of two sound effects records made by Sennheiser of West Germany in 1973, using a dummy head designed at the Heinrich Hertz Research Institute in Berlin. This record was first demonstrated at the Berlin Radio Show that year and a few weeks later in London at the Olympia Audio Fair. It started the last of many crazes for dummy head stereo. Not only was it by far the best binaural recording then available to the public, it came at a time that was ripe for dummy head surround-sound.

In the mid-70's the audio industry was pushing quadraphonics but the public did not want to use

'After a quarter of an hour I found Zuccarelli's demonstration very boring'

a decoder, four channels of amplification and four loudspeakers. So headphones for listening from a stereo source seemed an attractive alternative. The BBC Research Department built a dummy head and Radio 4 broadcast some drama programmes and documentaries recorded using the technique. Several recordings were made and issued, but most were dreadful. Musicians and producers soon discovered the problems of binaural or dummy head recording. It works best for sound effects close to the dummy head or sounds moving past the head. The tape recorder must have good phase characteristics to preserve the inner-ear phase relationships i.e. to replicate the subtly different delays of different frequencies arriving at the two ears of a human head. The tape or disc recording medium must be free from background hiss and random snap, crackle and pop because this destroys the illusion.

Although the system works well when used to record one or two musical instruments close to the head, it falls flat when used for a band or orchestra which is of necessity recorded from a distance. In this case ambient noise clutters the recorded sound. In real life, humans are blessed with the 'cocktail party effect' which enables us to home in on one sound or conversation, to the exclusion of others which are equally loud or even louder. Microphones cannot work in the same way, so they simply pick up everything and the result is a jumble.

Experimenters with dummy head stereo have also noted that the effect is more dramatic if the listener sits in a dark room, with eyes closed. This isn't a natural way for everyday listening. One inherent problem of binaural recording, the difficulty of distinguishing front sounds from rear sounds and sounds above from sounds below, was solved in a simple way. The recording gives the listener aural clues to the location of the sound, for instance a commentator says where he is standing or moving to give the listener a fix.

Although several pop groups flirted with binaural stereo in the 70's they soon abandoned the technique. Major groups, like The Who, rejected the idea out of hand. Apart from the technical problems there's little demand for a disc that only sounds right when heard through headphones. Remember this was all before the *Walkman* boom made headphone listening an everyday routine. Also with dummy head recording it's impossible to overdub or edit in the manner of conventional pan-potted multi-track stereo. Most musicians and producers don't like this restriction at all!

Several firms looked at the possibility of recreating the binaural effect with loudspeakers. The obvious way is to use one loudspeaker to each side of the ear so that the speakers function as giant headphones. A modification of this approach is to build a pair of loudspeakers into a cocoon-like affair. JVC adopted a different approach, with *Bi-phonics*. The left and right channel signals are electronically doctored so they can be replayed in a room through a pair of loudspeakers located for conventional stereo reproduction.

According to the conventional (Blumlein) approach to stereo reproduction, now standard for studio monitoring and domestic listening, the signals from the left and right loudspeakers mix in the room and reach both ears. For obvious reasons this destroys the effect of a binaural recording intended to be heard on headphones, where the left hand channel reaches only the left ear, and the right channel reaches only the right ear.

The JVC *Bi-phonics* system doctors the phase of the left and right channel signals so that they cancel where they mix. But *Bi-phonics* only works for a listener sitting in a tightly defined position in the room. Although Bi-phonics made news in 1977, when it was first demonstrated in Paris, London and Tokyo, it was soon forgotten. Sitting rigid and still on a carefully measured spot marked X is even more anti-social than headphone listening!

Meanwhile other Japanese manufacturers have pursued binaural headphone technology. Their main line of research has been to try and analyse what happens to sound as it passes through the natural canals of the human head. This is the essential starting point for any engineer trying to build a dummy head that replicates a human head, because a cleft stick problem faces all serious dummy head designers. If the microphones are located in the outer ears, they cannot "hear" the same sound as the human ear drum buried deep inside the head. But if the microphones are set deep inside the dummy head, then the sound which the listener eventually hears through headphones will have travelled through two sets of ear canal passages; once in the dummy head on the way to the microphones and once in the listener's head from headphones to eardrums. As the ear canals stamp a characteristic equalisation pattern on the sound passing through them, reverse equalisation must be applied to the dummy head signal recording. Hence the need to analyse the audio characteristic of the canals. Both Sony and Matsushita in Japan have worked on this problem, and filed patents on their ideas for a solution. British patents 1 520 318 and 1 520 319, from Sony, BP 1 517 938 from Matsushita and another patent 2 000 941, also from Matsushita, all discuss the transfer characteristic of the ear canals in human and dummy heads. I have personally seen engineers in Japan experimenting in an anechoic chamber with miniature microphones inserted by probe deep inside the canals of a human ear. The problem isn't new, nor is the solution. The problem for the Japanese is pragmatic. No-one has been sufficiently interested in dummy head recording to warrant the manufacture for sale of hardware to improve the technology.

By using the Sony F1 for his tapes, Zuccarelli has immediately ensured that his recordings are accurate in phase across the head, and do not

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There is a great deal to be said for Angela; so much, in fact, that there remains very little to say about the competition.

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suffer from the distractions of background hiss and analogue crackle. He demonstrates in the dark leaving the listener alone in the room. This is unsettling and heightens the subjective effect. The effects recorded are either close to the head or moving. In common with others who have listened, I found the recorded sounds coming more from the side and rear, than from the front. The only time I heard sounds obviously at the front, was when they were moving. All this ties in with the characteristics and deficiencies inherent in previous dummy head systems. But there was an impressive illusion of height, with sounds appearing to rise and fall in elevation.

After around quarter of an hour of different sound effects, I found the Zuccarelli demonstration very boring. I would like to have heard some music or some serious scientific tests, for instance the opportunity to identify the direction of sounds by ear and then check my conclusions for accuracy against a pre-printed sheet of directions. But no such scientific tests were available. For the record, I do *not* regard it as a scientific test when the listener is asked to point to a direction and the demonstrator simply says 'yes, that's right'. To be convincing the answers must be written up in advance.

At the end of the sound effects tape I was rewarded by a brief musical interlude. In fact it was a drum kit which sounded like a dummy head recording of a drum kit. It benefited from the transient peaks available from digital tape but was illogically behind my head. This demonstration was switched off half way through. Hugo Zuccarelli had come back into the room. He hadn't intended to play it, he told me. Next I was given a demonstration of Zuccarelli's Holophonic sound through loudspeakers, positioned on the floor one on each side of the listener and firing up to the ears in headphone fashion. The sound effects sounded much the same as on headphones, provided I sat with my head facing front so that each speaker could fire only direct into its intended ear. This is exactly as one would expect from a good dummy head recording reproduced through loudspeakers. The units were 8in coaxial drivers, which is again exactly what an engineer would routinely choose for the loudspeaker reproduction of binaural recordings. The desired effect is much more difficult to obtain with a multi-driver system and cross-over unit, which upsets phase relationships.

Next I finally got to hear some music. It was a short snatch of an unnamed orchestral work, apparently recorded at rehearsal. Afterwards Zuccarelli went through what seemed like a well established procedure of demonstrating to me that several other loudspeakers in the room weren't connected. I never for a moment thought they were. I got virtually no front image, just a rather muddled sound from the two loudspeakers at each side of my head. Incidentally I couldn't help feeling that the whole demonstration from Zuccarelli, was all a well-established routine. In nearly three hours I had difficulty asking any questions.

On this showing holophonics has for my money as much future for music as all the other previous binaural systems. This conclusion was borne out by another demonstration, this time by pop group Psychic TV. Amidst a blaze of rather silly publicity Psychic TV previewed their latest avant-garde recording. It is a mix of sound effects and music, recorded separately on multitrack digital tape and then combined by conventional mixing console.

The group claims it has recorded 'the first totally holophonic album in the world without using a single microphone' and says 'as well as the use of conventional electronics Zuccarelli also uses silicon and organic fluids, not employing the use of conventional audio signals.' You see what I mean about silly publicity. The sound effects are also rather silly, but impressive if you prefer your music to an accompaniment of odd sounds, like earth falling on the top of a coffin as it is buried.

As for the music, well a few sounds, like voice and marimba had obviously been recorded very close and sounded passable. Other music sounded flat and dead, with the image collapsing inside the listeners head. This does not bode well for holophonics as a musical medium. The Pink Floyd album *The Final Cut* could genuinely be said to benefit from the sound effects, simply because the Pink Floyd as a group have now espoused a musical style that naturally embraces sound effects. A record to be issued by CBS of Zuccarelli recordings will apparently be sound effects only. Doubtless this will excite some ears, but the record industry does not survive on sound effects records that only sound as intended when heard through headphones. CBS has had to delay release by at least a month because of the surely inevitable problem of cutting very wide dynamic range sound effects from digital tape on to analogue disc.

Probably as a result of all the publicity generated by Holophonics, someone somewhere is at this very moment recording a musical album, using hardware supplied by Zuccarelli Labs. We can only wait to hear how it sounds. There is also vague talk of adapting the system for use in cinemas. Zuccarelli says he has been in touch with Arthur C. Clarke, author of *2001,* and talked about future films. But will the cinema be equipped with phased arrays of loudspeakers all down each side? And how will the system cope with an audience that is randomly spaced different distances from the loudspeakers on each side? Will the cinema perhaps equip each chair with its own pair of loudspeakers? Don't laugh, this is just one of many ideas buried in the history of binaural sound. And this history bears a brief run through, even though Hugo Zuccarelli and Mike King refute the idea that holophonics is anything to do with binaural stereo.

In 1881 Clément Ader, a Frenchman fascinated by the aeronautics telephony, arranged a demonstration at the Paris Exhibition to put the then-new Bell telephone through its paces. As previously well-documented in *Studio Sound,* he arranged a row of 80 telephone mouthpieces or transmitters across the front of the Grand Opera stage in Paris and connected them by wire to 80 ear pieces. Visitors put a receiver to each ear. To quote a contemporary report, 'the sound took on a special character of relief and localization' because M. Ader had discovered 'a new acoustic effect'. It was the first demonstration of binaural stereo transmission and Ader filed patents. Throughout the last century that same new acoustic effect has repeatedly been discovered!

W. Bartlett Jones of Chicago was almost certainly the first to file a patent on binaural recording, in 1927. In his US patent number 1855 149 he envisaged a cinema, with each seat equipped with a pair of small speakers arranged as headphones one each side of the listener's head. The sound was to be recorded in the groove of a disc. In the 30's, the Chicago Museum of Science and Technology ran a permanent demonstration, sponsored by Bell Labs, of dummy head reproduction. The audience was equipped with headphones through which they heard an announcer in a transparent sound-proof booth talking into a dummy head microphone system. Even with the unrefined transducers then available, the results were impressive. Half way through the demonstration each visitor heard an unfamiliar voice whispering in their left ear. "Could you please move a little to the right, you're blocking my view", said the voice. Like a field of corn every visitor, imagining that they were blocking the view of the listener behind, moved to the right. So binaural stereo is hardly a new idea.

Now let's move up to date again. In February 1983, TVS the Southern ITV channel station, transmitted a *Real World* programme on Holophonics. It expounded Zuccarelli's theory, also repeated piecemeal to various journalists, including myself, that Edison got it wrong when he invented the phonograph. To cut a long confusing and highly questionable story short, Zuccarelli believes that the human hearing system is not simply a passive mechanism like a microphone. Instead it uses a reference signal, generated in some unspecified way, which mixes with the incoming sound to produce an interference pattern which is analogous to the interference pattern used in optical holography.

At the end of the programme TVS invited anyone interested to write in to the TV station, enclosing a stamped addressed envelope, for further information on Holography. Those who did so were sent a sketchy data sheet that reiterated points made in the programme, and suggested that anyone who wanted "further information" should now send another stamped addressed envelope, this time to the Holophony Information Service, 60, Hungerford Road, London N7 9LP. Those like me who followed through, were sent a single sheet of paper annoncing that a 'Zuccarelli holophonic demonstration record will be available in May on CBS label'. The sheet thanked correspondents for their interest and accompanied a bundle of photocopied cuttings from the press. These extolled the virtues of holophonics but gave no more hard facts.

At around the same time as I received this bundle of nothingness more articles appeared in print, all largely enthusiastic about holophonics, including two from sister publications of *Studio Sound, Hi-Fi News and Record Review* and *Professional Video.* Even Golden Ears of the audio business were impressed.

Almost no-one, it seemed, was expressing level-headed reservations. In some cases this was to be expected. Few people in the music and popular press have heard of dummy head or

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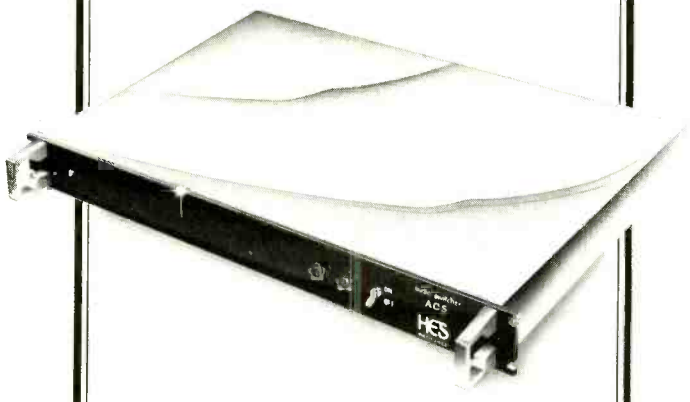

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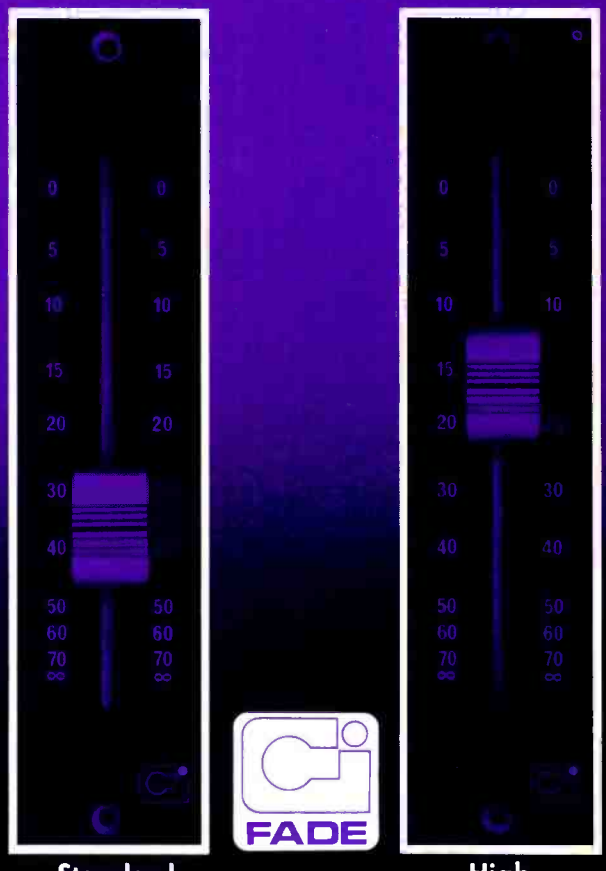

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an investigation

binaural stereo let alone heard it. Some specialist writers have heard only disappointing recordings, for instance made by cheap domestic systems sold by the hi fi trade. Others have forgotten the impact of those first demonstrations by Sennheiser. It was only after I'd written a less than 100% enthusiastic article on Holophonics that I received a 'phone call inviting me to visit Zuccarelli Labs and hear the 'official' demonstrations described above. Prior to that my 'phone calls had borne no fruit.

Certainly the demonstrations were interesting, but the discussions with Zuccarelli and King were very unrewarding. For the best part of three hours I was demonstrated to and lectured at. The few question I managed to get through the cracks were skilfully brushed aside for yet more lecturing and demonstrations. At the end of three hours hard listening I had accumulated around 20 pages of notes, which read like a stream of consciousness and boiled down to nothing new about the technology behind Holophonics. At one point Zuccarelli mentioned the possibility of a Nobel Prize! According to Zuccarelli everyone since Edison has been wrong in their approach to recording sound, and everyone has been wrongly describing Zuccarelli's own theory to replace Edison's. But he won't put the record straight until he has published his theory in some unspecified scientific magazine. So when will this be? For the answer Zuccarelli referred me to Dr. Martin Rosenberg, senior lecturer and neurophysiologist at Barts Hospital in London. According to Zuccarelli he and Rosenberg are cooperating to publish a full account of Zuccarelli's new theory on hearing.

I spoke then to Dr. Rosenberg. He wanted to make clear from the outset that he regarded Zuccarelli as a friend. 'I accept what he says until proved wrong', he told me. 'His sincerity has won me over. But he's got to publish formally in a learned journal and I am encouraging him to do so by finding someone to help him.'

Previously when pushed for more details, Zuccarelli and King had talked about an article to be published in the American part-science, part-sci-fi magazine *Omni*. But *Omni* the magazine subsequently confirmed to me that they had not yet taken a decision on when or even whether to publish an article on holophonics. In the meantime whether Zuccarelli Labs are seeking publicity or not, they are continuing to talk to the press, and demonstrate the system. They turned up one day at the National Sound Archive and offered a dem! The Pink Floyd record is in the shops, the CBS record is overdue for release and Psychic TV are using a PR agent to generate extravagant publicity for their own mix of Holophonic music and effects. Zuccarelli Labs are also talking to electronic firms about the manufacture of holophonics hardware. Zuccarelli himself continues to dismiss the existing theory of hearing as 'stupid'. Despite all his activity there is still no firm promise, let alone date, for publication of a clear and reasoned description of Zuccarelli's theory to replace text book theory. Dr. Rosenberg readily admits that he will be 'very upset' if his trust in Zuccarelli was unfounded.

For anyone looking for hard published fact I can offer only a few pointers. Frankly it's not worth bothering to read through the gaggle of articles that have been published on the subject, because none gives a useful explanation of Zuccarelli's theory and technology, and many are confused and contradictory. The idea of the ear acting as an active radiator could conceivably be true. There is well documented evidence that the ears of animals and humans will generate a sound, like an echo, when triggered with an input sound. There have been many reports over the years that the ears of cats, especially Siamese cats, will sometimes produce an audible whistle. Humans who suffer from the highly irritating problem of tinnitus, a popping, clicking, buzzing, roaring of sinewave tone heard inside the head, will sometimes emit the same sound from their ears so that it can be heard by others. Is this audible emission part of the active mechanism for hearing referred to by Zuccarelli? Or has Zuccarelli been sent off on a wild goose chase by observation of this effect, without realising that it is old and well documented? We'll know the answer only when he is prepared to discuss, or publish, a full account of his theory.

The one document worth reading is European patent application 0 050 100. It's available from most national Patent Offices, including the London Patent Office in Chancery Lane. This patent application was filed by Zuccarelli and dates back to 1980. It covers nine European countries and describes a carefully constructed dummy head, with brief reference to the kind of equalisation necessary to compensate for canal resonances. There's only passing and obscure reference to 'holographic' interference. The European Patent Office examiners have raised both formal and more substantial objections. The formal objections, that the patent claims don't relate to a single invention, will be easily overcome by Zuccarelli's patent agent. The more substantial objections, that what Zuccarelli claims as new isn't new in the light of prior publications, may well be much harder to refute. The basic concept of binaural stereo is of course as old as the hills. Only new, fine details, remain open for patenting. To be patentable those details must be both genuinely new, and genuinely inventive.

But Hugo Zuccarelli obviously has faith in his patent application. He has paid the £500 or so in official fees necessary to keep the application alive for a further stage of formal examination. If he succeeds in satisfying the examiners, and the patent is granted, the total bill including the obligatory translations, will be around £10,000. Under the circumstances it's hard to believe, as has been suggested, that Zuccarelli's patent application is a red herring. It's equally hard to believe, as has also been suggested, that there are other applications lurking in the patent files, under different names, which cover other pieces in the holophonic jigsaw. Such a ploy would be cripplingly expensive and legally dangerous.

In the absence of hard fact to the contrary from Zuccarelli, an observer is entitled to come to his own conclusions. For what they are worth mine are these. Zuccarelli's recording head, which he calls Ringo, is a carefully constructed dummy head with equally carefully designed electronic equalisation. The European patent application was an early attempt to cover the system, with details of the equalisation omitted, either because it wasn't ready in the interests of secrecy or because the circuits used are available as off-the-shelf hardware and thus not patentable.

The undeniably impressive results obtained are thanks to a combination of circumstances; good design of the head and sensible equalisation, the use of a digital tape system and demonstration of the system with carefully chosen sound effects under ideal conditions, that is to say with the listener alone in a darkened room. Clever publicity, including initial demonstrations to journalists most likely to write enthusiastically about the experience, have been another important ingredient.

But now crunch time is coming. The publicity generated and Zuccarelli's disparaging remarks about accepted hearing theory will oblige Zuccarelli to publish his theory on hearing. He has also whetted the record industry's appetite for Ringo-recorded music and its reproduction through loudspeakers, rather than headphones. They will now want to satisfy that appetite. Reputations, of technical journalists who have enthused over the system, and of experts like Dr. Martin Rosenberg who have publicly shown support, are on the line. We will return to Holophonics after a year and report again on what's happened. If you are interested in the subject, put this issue aside as a handy reference for twelve months' time. If my hunch is correct you'll need it because Holophonics will by then be a forgotten fad. But prove me wrong, Mr. Zuccarelli, and I'll gladly say so. ■

Readers may be interested to know that we first contacted Zuccarelli over a year ago, before he came to Britain, following reports on the system from a number of sources. At the time, Zuccarelli was working in Italy, sponsored by a group of musicians. Ultimately they fell out with each other and Zuccarelli came to England; the Italian group has now set up its own operation, and exhibited at the Eindhoven AES this year.

Soon after Zuccarelli's arrival in England, we heard the demonstrations and he agreed to write an article for us on the system: this never arrived. At Eindhoven, I asked Mike King about the European patent application, and was told that it was in fact a cover, and that the 'real' patents were filed under several different names and titles, allegedly to protect the 'invention' from rip-off. Zuccarelli approached several manufacturers at Eindhoven, and most of them, of course, asked to see the patents before taking it further. One American loudspeaker manufacturer was told that they would be in the mail the following week: at the time of writing, they still are. We, too, would like to see the patents, and that article we were promised. Until then we can only be sceptical, and wonder what Zuccarelli is hiding, and why. Is it a new recording system, based on an important discovery? Is it just binaural done properly for the first time commercially? Is it original? All these questions have been asked. What are the answers?

Richard Elen

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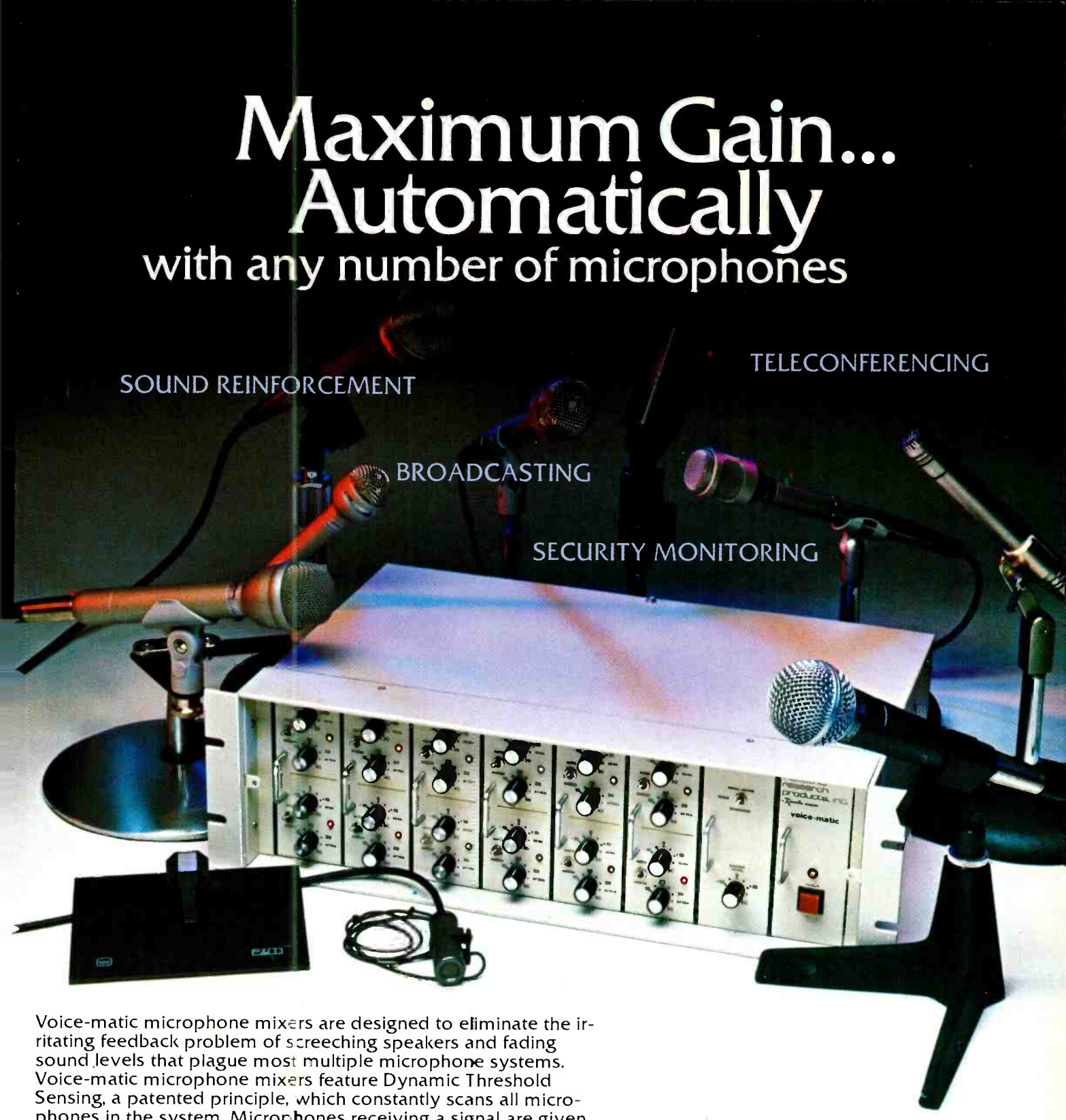

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AES ~ a report

Keith Spencer-Allen

The 73rd AES Convention was held at the POC Congress Centre, Eindhoven, the Netherlands. Aside from a wide range of demonstrations and other technical presentations, there was the usual wide range of technical papers presented—46 papers in total. As with all European AES conventions, the vast majority of papers were European in origin with the Netherlands being particularly well represented—which is not surprising considering that the Philips organisation has very close connections with the town of Eindhoven itself.

The papers presented were given under session topics and these included Psychoacoustics and Listening Tests, Digital Signal Processing and Interfaces, Musical Instruments, Transducers, Applications in Digital Audio, Sound Reinforcement and Room Acoustics, Measurement and Instrumentation.

In this report, a selection of the more relevant papers are covered and where available, the preprint number is given so that further information can be obtained if desired.

The subject matter of the first session was Psychoacoustics and Listening Tests. In a paper entitled 'Measurement and Prediction of the Timbre of Sound Reproduction', Henrik Staffeldt of the Danish Engineering Academy described how measurements of the ⅓-octave spectrum at the ear canal entrance can be used to calculate the subjective frequency response of a sound reproduction system. The subjective response to the perceived sound is determined by the loudness at specific critical bands. A model has been designed to aid prediction of tone timbre and helps to explain the role of head diffraction phenomena in creating this spectrum. (No preprint available.)

Paul M Boers in a paper under the title of 'The Influence of Anti-phase Crosstalk on the Localisation Cues in Stereo Signals', began by discussing the stereo widening facility that has become fairly common on some partable entertainment centres by the introduction of crosstalk between the channels in such a way that it is out of phase with the stereo signals. He detailed the current state of the practise and the acoustic phenomena associated with serious listening tests using such techniques. In the final part he went on to discuss the further effect of adding a slight delay to the anti-phase crosstalk signal and its result with relation to the stereo image. (Preprint 1967.)

'Modern Multitrack Recording Techniques' were covered in a paper from Andre Bourget of Studer International. The title is perhaps a misnomer as for a great deal the paper covered the deficiences of the recording process and the techniques required to overcome them, not all of which are limited to multitrack work. The preprint is available and should form an excellent introduction to the background of multitrack technique being very readable. (Preprint 1974).

Objective and subjective loudness comparisons between speech and music were the topics in 'Loudness Balance of Speech and Music in Radio Broadcasts' by Zorana Hrasovec Caric and Blazo Guzina of Radio Beograd. This is a tricky area particularly for those engineers who do not have to mix speech and music together on a regular basis. The paper detailed objective measurement techniques experimented with as well as subjective listening tests with a range of music and speech types. Further experiments with limiting, EQ and filtering on meter circuits were described and the results were discussed. (Preprint 1965.)

The many facets of Digital Signal processing and interfaces were covered in the second technical session. Messrs Sakamoto, Kogure, Shimbo and Komae from Matsushita described a signal processing system they have developed for a compact cassette digital recorder. The system is based around a metal evaporated tape development known as *Digital Angrom* tape. This is used in *Compact Cassette* format and the recorder employs a stationary head, high density ferrite recording head having 12 tracks at one recording side of 120 μm track width. This required a new modulation system to be developed referred to as *FEM-4*. Using the Digital Audio Tape-recorder (DAT) 60 mins of playing time is achieved with a compact cassette of DA tape—stereo in both directions, using a tape speed of 3¾ in/s. Sampling frequency is specified as 44.1 kHz and quantisation as 16-bit linear. They additionally proposed as standard for the development of a similar system using the DA tape in a Micro cassette format. (Preprint 1960.)

Oliver F Bodenmann of the Swiss Federal Institute of Technology presented a paper covering 'Easy Active Filter Design: A Personal Calculator'. In this paper he outlined computer programs that enable the user to design low-pass, high-pass or band-pass active filters with Chebyshev and Butterworth approximations up to 16th order. (Preprint 1979.)

In a paper titled 'Recent Developments in Digital Audio Techniques', K J Grundy, D P Robinson and C C Todd of Dolby Labs presented the Dolby approach to companded delta modulation. They detailed the background to their approach and went on to describe a practical system including encoder and decoder details. We hope to cover this subject in more detail in a future issue. (Preprint 1956.)

The last paper in this session was 'Design and Structure of a Digital Sound Mixing Desk' by V Aubrun and A Debayle of Enertec. In this paper they outlined the changing role of the console within an all, and partly digital, studio and the design criteria to be covered when designing a console capable of handling the requirements for the future. (Preprint 1981.)

The third technical session under the title of Musical Instruments consisted of just one paper—'Acoustics Within and Around the Grand Pianoforte' by Prof Dr Jan J Geluk, a Dutch consultant. He covered the basic acoustic production, development and transmission within the instrument and the resultant soundfield of the instrument. He also adds that the pianoforte took nearly 200 years to develop to a form similar to today using the ear as the principle research instrument. He poses the interesting question as to what shape the piano would have if it had developed using modern measurement and design techniques particularly the use of electronics. He also presented an electrical analogue of the pianoforte. (Preprint 1982.)

Transducers were the topic of the next session. Stephan Peus and Otmar Kern of Neumann gave details of the development of the new TLM 170 microphone in 'Transformerless Studio Condensor Microphones'. This mic has an

impedance convertor fed from a pulse width controlled DC convertor. This results in transformerless matching of the mic output to its load and capsule polarising voltages for five polar characteristics. (Preprint 1986 in German only.)

Ilpo Martikainen and Ari Varla of Genelec and Matti Otala of the Technical Research Centre of Finland presented a paper on 'Input Current Requirements of High-Quality Loudspeaker Systems'. They set out the way that amplifiers are generally designed and suggested that perhaps the concept of the loudspeaker system generally employed for design purposes is often inaccurate in the light of research. They draw a number of conclusions, the most important being that the output current demanded from an amplifier may grossly exceed the rated output current under conditions where the loudspeaker is carrying certain amplitude and band limited signals. From this they suggest that new ways of rating and measuring amplifiers are needed and that certain other points may now have to be considered. (Preprint 1987.)

The first paper in the Applications in Digital Audio was on the subject of 'Compact Disc Subcode Origination and Processing' by Messrs Wesdorp, Brands and van Dijk of Philips ELA. Information covering the origination and processing of the subcode information as well as possible future use of the subcode channels in professional applications was presented. Unfortunately no preprint is available. Also on the subject of the *Compact Disc*, Kees Schouhamer Immink and Jozef Braat of Philips gave detals of experiments leading to the development of an erasable *Compact Disc* system. (Preprint 1970.)

Paul Skritek, Ernst Parth and Robert Polleros from the Institute for Telecommunications Technical University, Vienna gave a paper detailing an approach to digital audio mixers based on 'low-cost' expandable design. They give details of a system with channel features such as level control, three equalisers, two shelving filters, pan pots and variable delay. (Preprint 1962.)

Robert Adams of dbx presented a paper covering 'Companded Predictive Delta Modulation: a Low-Cost Conversion Technique for Digital Recording.' This was covered in the February issue of *Studio Sound* although there have been some further developments that are covered in this paper. (Preprint 1978).

The papers in the Sound Reinforcement and Room Acoustics session were predominantly concerned with the acoustics and sound reinforcement of large stadiums and halls. Ernst-Jo Volker from the Institut Fur Akustik und Bauphysik gave a paper entitled 'Control Room for Music Monitoring' that was particularly interesting. It gave the subjective results achieved when you take 90 varied pro-audio people and replay a wide selection of music in four different control room designs. All criteria apart from the acoustics of the rooms were kept as constant as possible and the reactions of the subjects were recorded. Dummy head recordings were also made within the control rooms and these are also contrasted with the test results. From the results certain conclusions are drawn with perhaps the overriding point being that different designs were preferred for different types of music and perhaps there is no such item as a control room ideal for all music types with all designs being a compromise for certain music types. (Preprint 1958.)

Stephen Julestrom and Thomas Tichy of Shure Brothers gave details of the Shure *AMS8000* in a paper called 'Direction-Sensitive Gating: A New Approach to Automatic Mixing'. This involves the use of dedicated mics and circuitry with the system as a whole providing direction-sensitive gating on each mic. The mics have a gate each as with normal automatic mixing systems but the acceptance angle of incoming sounds is restricted to the front area of the mic. Quite loud sounds originating from the rear and sides, well above the gating threshold, are ignored while front signals operate as normal. This is achieved in simple terms by the use of two capsules within the mic and the outputs compared by the control electronics deciding when to open the gate. (Preprint 1976.)

The final session was entitled Measurement and Instrumentation. Eduard Stikvoort from Philips Research Labs presented a paper describing a digital distortion analyser for testing A/D conversion, sampling rate convertors etc. In operation it resembles its analogue equivalent, removing the test sine wave between 500 Hz and 20 kHz from the input signal and puts the amplified THD plus noise in the monitor DAC. This unit will reduce the influence of the DAC in the test chain by 40 dB enabling 16-bit A/D circuitry to be tested more easily. (Preprint 1972.)

In a paper 'Dynamic Distortion Measurements in Broadcasting and Mixing Consoles', Prof. Matti Otala of the Technical Research Centre of Finland and Sulo Hamalainen and Kalevi Rantala of the Finnish Broadcasting Company covered a measurement technique for IMD that resembles real-life signals rather than conventional static measurements and gives rather higher distortion levels as a result. It further explains why certain distortions may well be audible under certain conditions previously thought not relevant (Preprint not available.) ■

business

Barry Fox

CD—Pressing matters

Amidst all the soft puff about *Compact Disc* here are some hard facts. The system went on sale in Japan in October and in Britain, France, Germany and Holland in March. Belgium, Sweden, Switzerland and Singapore followed in April and Italy, Denmark, Spain, Finland, Austria, Norway and Australia in May. The US market opens out some time this summer. Everywhere the same pattern is repeating. Dealers can't get enough players so there are waiting lists. In Britain, Sony sold 3,500 players in the first six weeks, Philips sold 1,200 and Marantz sold 1,100. Despite much promising, other manufacturers were slow to get their players on to the market. Hitachi hit technical problems and had to modify its players after a lambasting by reviewers.

The discs on sale, around 200 titles and rising, came from PolyGram in Hannover and CBS/Sony in Japan. The only other two pressing plants in the world, Nippon-Columbia and Technics in Japan, have so far been producing relatively small quantities for the Japanese market. Next year CBS/Sony will press in the USA, Sonapress will join PolyGram in Germany and Nimbus and Forward Technology will press in the UK. Nimbus is of course already well known for its analogue pressing work. Forward Technology is owned by the same company that runs Orlake, a custom pressing plant. Both Nimbus and Forward Technology will start pressing from masters cut by Philips in Eindhoven but both plan eventually to do their own mastering. Nimbus is building its own mastering system and Forward Technology has commissioned the Engineering Department of Cambridge University to do the work. Neither Nimbus nor Forward Technology will be pressing in bulk before 1984.

PolyGram in Hannover has 24 presses running 24 hours a day and originally aimed at 4 million discs a year. This has now been upped to 5.6 million thanks to an extension of the factory which should be ready in June. But this may prove an optimistic estimate. PolyGram made only one million discs in the nine months after Hannover started production. The system launch was supported by discs stockpiled prior to the launch. Although PolyGram won't talk about the yield from Hannover, the company hasn't denied German reports that it is only 50 per cent, ie one disc junked for every two pressed.

Sony predicts that between 35,000 and 40,000 players of all makes will be sold in Britain this year. In Japan this number had been sold in the first three months. Some people with players have bought every single disc that's available. But the average is around 10 or 12 discs per player in the first month of ownership. In Japan 0.3 million discs were sold with the first 35,000 players. If this pattern repeats itself around the world then there must be a shortage of discs later this year. As soon as the trade smells the risk of a shortage, it will become a reality. People who have ordered players will buy discs in advance. This is already happening in Japan.

Philips could press discs at its LaserVision videodisc pressing plant in Blackburn, where poor sales of the system have meant redundancies for the workforce. But conversion to *Compact Disc* would be expensive and Philips still has hopes that LaserVision will take off, if only for the industrial market. Thorn-EMI could press discs at its Swindon factory, built to manufacture VHD/AHD discs and now mothballed. But again, conversion work would be expensive and there is pressure from video divisions in the company to hold fire until the dust has settled over the April launch of VHD in Japan. Also, Thorn-EMI still objects to the idea of paying a 3 US cent royalty to Philips for every disc pressed. That's just for a patent licence and technical specification. The pressing plant has to pay extra for mastering and pressing equipment and know-how on how to use it. That's why, for the time being at least, Thorn-EMI is releasing EMI music titles on discs custom pressed by PolyGram. Some people in PolyGram are now wondering how it can possibly cope with 200 extra titles to press.

Technically, most people seem satisfied with *Compact Disc*. But the honeymoon may not last. Already there are signs that Japanese pressings have fewer faults than European pressings. Most discs leaving the PolyGram factory are acceptable, that is to say that the error correction and interpolation circuits in domestic players can cope. PolyGram says the return rate of defective discs is 0.3 per cent. But what will happen when the public starts to recognise the fluttery sound of interpolation? And as discs in homes and broadcast stations get scratched through use and digital errors inherent in the pressed disc add to the number of digital errors caused by scratching, they may tip the player over the edge from correction into interpolation, or even muting. Also, there are advance signs of a very naughty practice in the making. One firm is suspected of copying its analogue master tapes on to digital tape so that it can claim to be issuing *Compact Discs* from digital masters!

Compact Disc could make an ideal archive medium. Carefully pressed and carefully handled it can last for ever. Engineers are puzzled why Philips hasn't yet agreed a standard for mono coding on a *Compact Disc*. Bits in the data stream have been assigned to switch the player between decoding and cueing the serial stream into 1 hr of 2-channel stereo or ½ hr of 4-channel surround sound. But no assignment has yet been made for mono or 3-channel surround sound.

Acting on video

Earlier this year the BBC announced a long-awaited deal with the Musicians Union and Equity to allow the release of old television programmes, like Hancock, *Fawlty Towers* and Last Night of the Proms, on home video tape or disc. The announcement was made over a weekend when there was no-one available to comment. The BBC planned a weekday press conference, but cancelled it when they realised that journalists would ask questions they didn't want to answer. And when the press 'phoned the BBC Video Division, their official spokesman wouldn't talk about the deal.

What we all wanted to know was how much the BBC had agreed to pay the unions. In fact, after several days of hard digging, I was able to winkle out the story from unofficial sources. To cut it short, the BBC had buckled to the unions' demands and agreed to pay actors and musicians money in advance of video release. For years they had been refusing to do this offering only to pay royalties on cassettes and discs actually sold. This is the deal which the ITV companies had with the unions, and which cleared the video release of productions like *Upstairs, Downstairs*.

The BBC had also buckled under over another sticking point. They agreed to pay money upfront to walk-on parts, like third spear carrier from the left, and extras in crowd scenes, as well as featured performers. Apart from the cost, think of the work involved. The BBC must contact every single person involved in a production and get their signature (or, if dead, the signature of their estate), before the release can go ahead. Effectively it means the BBC will only be able to release sure-fire winners that are guaranteed to sell enough cassettes or discs to pay for the advances. They will also have to release mainly programmes with a small cast.

The sting, for me, was in the tail. After laboriously finding all this out, I published the facts in several magazines. The same BBC spokesperson who had refused to give me any facts, then 'phoned and wrote to the editor of one magazine complaining that I had not made some subtle point clear.

The moral, dear BBC, is that you can't have your cake and eat it. If you won't talk to journalists, you can't complain about what they write.

Light programme

The Laserium light shows at planetariums around the world have now been going for 10 years. Nearly 10 million people have paid to sit back and listen to recorded music while watching laser patterns traced on the planetarium ceiling. Although it began with rock music, Laserium are now putting on shows with a programme of classical music. And recently at the London Planetarium the 'Keep Synthesisers Live' duo, Helden, performed as near live as you can get with synthesisers to the visual accompaniment of a Laserium light show.

Helden is Hans Zimmer and Warren Cann. Zimmer is part of Buggles, who had a hit with *Video Killed the Radio Star* and Cann is the drummer with Ultravox. Their music is pretty much what you would expect from two well-heeled rock stars who can afford as many synths as they like and have delusions of musical grandeur. It starts loud and pretentious, stays loud and pretentious, and ends loud and pretentious. No light, no shade, and nothing to remember afterwards. In fact, the ideal musical backing to a laser light show, rather than the other way round. If, like people who live in London and have never got round to visiting St Paul's, you haven't seen the Planetarium's Laserium show, then do give it a whirl. It doesn't really matter what the music is; inevitably you'll be curious about how some of the effects are achieved.

Well, it's all done with a single 1 W Krypton laser made by Spectra Physics. The Krypton beam is multicoloured and split by prisms into four pure colour beams; red, green, blue and yellow. These sub-beams are then bounced from galvanometer mirrors which are moved by control signals. If a mirror moves in a circle then the laser beam traces a circle on the planetarium ceiling. Because the mirror can oscillate at frequencies up to 2 MHz, the beam moves so fast that the pattern it traces looks solid. But in fact at any instant in time it's just a spot of light. It's the same effect as you get on the screen of an oscilloscope when the scanning electron beam traces a fixed pattern. When the laser beam is scanning a large pattern over the vast planetarium roof, it's moving over the pattern faster than the speed of sound. Basic patterns are pre-programmed then the pattern, position and size are controlled by manual faders. Other patterns are generated by an *Apple* computer and more are recorded as data on tape. So the light show is in effect a free-form improvisation, using basic pattern building blocks.

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business

BARRY FOX

How live is live?

The annual Battle of the Bands competition was sponsored this year by tape manufacturer TDK, which is not a bad PR move when you bear in mind the flack which the tape industry has been getting from the music industry. TDK chipped in over £80,000 and for six months helped audition 126 amateur rock bands, to select six for the final. This was held early in April at the Hammersmith Odeon, and the BBC taped it for later transmission. The winning band, Sugar Ray Five from Kent, walked off with £5,000 cash, a recording contract worth £5,000, a holiday in the South of France and an Akai reel-to-reel tape deck.

It's no joke getting six bands on and off stage to play just a few numbers each, especially when the whole thing is being videotaped and the audience is as ruly as a football crowd. But somehow everyone got by. The low spot of the evening was a guest appearance by top pop Shakatak. They came on, played two numbers to a decidedly unenthusiastic audience, and left. Some of the kids out front said they though the bands were miming. Others said it wasn't so. Why would the band have gone to all the trouble of wiring up their instruments, and miking up the drums if they weren't plugged in? Surely a professional guest star band booked to round off an amateur contest, and show the competing musicians how it's really done, doesn't mime to a tape? Well that's exactly what Shakatak did. And the same thing happened last year at the Battle of the Bands final, when Dollar mimed to tape for their top of the bill appearance.

TDK weren't happy. They thought Shakatak would be playing live. The competing groups were scornful. The firm Battle of the Bands Ltd that booked the guest group were embarrassed. "We booked them as live, it was intended to be a live guest spot," said BOTB. Shakatak's management had a different story to tell: "We said right from the beginning that we would only do it if we could mime. But three days before they said they thought we were doing it live. It cost £900 in studio time out at Shepperton to pre-record two numbers. The only money we got for the appearance was from the BBC. We're not getting a bean from the Battle of the Bands."

The idea of a Battle of the Bands competition dates back to the swing era, when big jazz bands used to cut each other up on the stage of theatres like the Apollo in Harlem. I wonder what would have happened at the Apollo, up on 125th Street, if a band like Count Basie or Duke Ellington had made a guest appearance by sitting on stage and pretending to blow their instruments while a sound engineer played a disc recording? I doubt whether they would have got out alive.

Arrangements

Did you know that earlier this year there was almost one mother and father of a battle between the BBC, Music Publishers Association and Musicians' Union? The first visible sign was a memo out of Room 308, Langham Place, on January 28, 1983. With effect from February 1, it said, no one in the BBC could commission any new musical arrangements. The only 'new' music was to be note-for-note copies or amendments to existing arrangements. It stemmed from a dispute between the BBC and the MPA, and would have had the most disastrous effect on the livelihood of musicians working for the BBC.

Behind the scenes the MU bared its knuckles. The MPA saw that it was a case of put up or shut up—and subsequently shut up. So the memo went into the waste paper basket and confrontation was averted. As far as I know, news of this never leaked out of Broadcasting House into the popular press even thought the BBC (as Harold Wilson once said in that memorable Dimbleby interview of which pirate tapes abound) ". . . is as leaky as an old battleship". The full story is complicated but interesting.

Arrangers have always had a bad deal. They breathe new life into old songs, convert the whilstled doodlings of musical illiterates into pop hits, and make the most ordinary tunes sound memorable. The partnership between Miles Davis and Gil Evans was symbiotic. *Puppet on a String*, which sold millions round the world, would have been nothing without that Eurovision arrangement. When Midge Ure of Ultravox spent two days in the Mayfair Studio producing a synthesiser version of the Walker Brothers' *No Regrets* he didn't just copy the tune, he copied Steve Gray's arrangement as well. What do you remember about Gene Kelly's version of *Singing in the Rain*? It's the introduction to the title tune, not the tune itself. But usually the arranger gets nothing for his or her work, after an initial flat fee.

For instance Gil Evans never made any money from royalties on those Miles Davis records. I know, I asked him when he was in London recently for some concerts. "I could sure use a cheque from those records, once in a while," he said laconically.

In theory an arranger needs the composer's permission to make a new arrangement of an original composition. By tradition no one bothers to ask. But occasionally the composer puts a block on an arrangement. For instance Leonard Bernstein blocked use of his *America* tune by the pop group Nice, and the Holst estate blocked the import into Britain of Tomita's synthesiser adaptation of *The Planets*. To make life easy all round the BBC has, since the '40s, had a blanket licence from the Music Publishers Association to commission arrangements without seeking individual permission. Meanwhile the Musicians Union has been trying to persuade the Performing Rights Society to pay arrangers royalties for their work. This is the backdrop to the dispute that almost crippled the BBC early in 1983. The BBC is generally liked by arrangers because it's probably the only broadcasting station in the world that recognises copyright in arrangements.

The MPA suddenly told the BBC that in future it would have to assign the copyright in new arrangements to the copyright holder of the original work, ie the publisher. This pulled the rug from under the MU in its plan to get payment for arrangers' copyright. The MPA told the BBC that if it didn't play ball, it would terminate that old agreement which gives the BBC a blanket licence to commission new arrangements of existing works. In a panic the BBC bought time by sending out the memo blocking any new arrangements. It then had to decide whether to fight the MPA or the MU. With memories of the last battle against the MU, two years ago, the BBC decided to take on the MPA instead. The MPA then decided not to take on the BBC and MU, at least not yet. It now remains to be seen whether they will try again.

Sensible levy?

The horse race betting levy is often cited by the record industry as an example of how a tape levy could work in practice. I see that the Department of Veterinary Medicine at Bristol University has just received a grant of £19,507 for a one-year study on 'the uterine tract defence mechanisms in the horse'. Presumably this means that Bristol scientists will be looking at ways of making horse breeding safer. As such, and I'm *not* being sarcastic, it seems an eminently sensible way of using money raised from a levy on horse racing bets. Let's hope that if the record industry does ever get away with a tax on tape, they'll use some of it in similarly sensible ways. Like, for instance, developing a low-noise anti-static vinyl mix for disc pressing.

BBC memories

The National Film Theatre in London recently ran a programme of films with a broadcasting slant, to mark the BBC's 60th anniversary. *Death at Broadcasting House*, made in 1934, is a fascinating insight into BH nearly 50 years ago. The BBC had very recently moved in (May 15, 1932) from Savoy Hill and the film is about a murder that takes place during the broadcasting of a murder play. A contemporary review said: "The picture is able to provide a number of interesting glimpses of Broadcasting House from the inside . . . various technicalities being admirably explained for the benefit of those unfamiliar with the workings of the BBC." There's a John Reith figure, tap dancing on radio, live sound effects and cue lights that go wrong. There are also some control desks, with rotary faders, that look suspiciously like some of the equipment still in use in corners of BH.

Unfortunately we never get to see the real star of the show, the *Blattnerphone*. This steel tape recorder was even then being used by the BBC to record programmes as they went out live for relay transmission to what was then the glorious British Empire. The plot of the film turns on a *Blattnerphone* recording of the murder most foul. It holds a vital clue, the sound of the murderer's watch. As the *Blattnerphone* had a sandpaper signal-to-noise ratio it's all a bit fanciful, but good fun. Unfortunately, and probably because the *Blattnerphone* was such an extraordinary-looking machine, the actors gather round a loudspeaker, not a real live *Blatterphone*, to hear the playback denouément.

Death at Broadcasting House has been sold to TV and has already been transmitted once. If it's transmitted again anyone interested in radio history should make a point of watching. Note by the way that it cost only £16,000 to make, around half the average cost of a British feature film in those days.

As a public service let me at the same time warn you against *BBC Droitwich*, a short film made in the same year by famous documentary producer John Grierson. It's a film record of the BBC's first Long Wave transmitter, operating on 1500 metres. The NFT screened it along with *Death at Broadcasting House*. To be euphemistic I'd say it's probably the most boring film ever made in the history of the cinema, even for someone interested in the content. The commentary, by Stuart Hibberd, has all the excitement of a pregnant snail. So next time some pundit film buff goes starry-eyed about John Grierson's contribution to film history, ask them if they've ever had the misfortune to sit through *BBC Droitwich*. Perhaps if our prisons get too overcrowded, judges could sentence football hooligans to several viewings of *BBC Droitwich*. That would teach them to behave. ■

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Fostex model B-16

MANUFACTURER'S PROVISIONAL SPECIFICATION
Tape speed: 15 in/s ±0.6%.
Wow and flutter: CCIR unweighted ±0.12%, weighted ±0.06%
Pitch control range: ±15%.
Standard playback level (400 Hz): −10 dBV ±0.5 dB.
Playback meter indication (400 Hz): 0 VU ±1 VU.
Playback signal to noise (noise reduction off): 47 dB unweighted, 51 dB A-weighted.
Input monitor level (400 Hz): −10 dBV ±0.5 dB.
Standard record/replay level with noise reduction on (400 Hz): −10 dBV ±0.5 dB.
Record/replay meter indication with noise reduction on (400 Hz): 0 VU ±1 VU.
Channel separation at 1 kHz: >40 dB.
Record/replay signal to noise: noise reduction off 47 dB unweighted, 52 dB weighted.
Erasure with noise reduction off: >70 dB.
Adjacent channel erasure at 10 kHz: <1 dB with noise reduction off.
Click level recorded on tape when switching record on/off: > −26 dBV.
Bias leakage at line output: > −35 dBV.
Manufacturer: Fostex Corporation, Tokyo, Japan.
UK: Bandive Ltd., Brent View Road, London NW9 7EL.
USA: Fostex Corp of America, 15431 Blackburn Ave, Norwalk, CA90650.

AT the start of this review it should be made quite clear that the recorder being reviewed is one of three prototype units, one having been made for each of the domestic (Japanese), USA and European markets. Bearing in mind that the recorder is suitable for mounting into a standard 19 in rack and only 17½ in high and 9 in deep behind the front panel, it is quite an achievement to get 16 tracks into a package this size. In fact the recorder arrived in a solid flight case which could readily be used for transport with no need to remove the recorder for use.

The basis of the tape transport is a ¼ in thick alloy plate which is mounted on to the fabricated steel frame which houses the complete recorder, the rack mounting ears bolting on to alloy bars which are in turn secured to the main plate. Both reels are driven directly from the spooling motors with height adjustment being provided for the solid alloy reel hold-downs which work on a combined spring and cam arrangement. This provides a positive hold-down, but whilst providing a good grip for locking the spools, the large diameter outer locking rings are not suitable for 'rock and roll' editing as they easily unlock the spools.

A single solenoid operates the band brakes which are rather weak in action leading to very slow stopping of the reels on tape run-out but strong enough to bring the tape to a gentle halt if power failed in the fast wind modes. From either spool the tape passes to a spring loaded arm equipped with a twin ball bearing guide. The positions of the arms are sensed optically to control tape tension which was sensibly set at 150 g for take-up and remained remarkably constant without any tape snatching when changing modes.

On the pay-off side the tape then passes to a large diameter roller which is pre-loaded with twin ball bearings, this being followed by the optical tape presence sensor and the headblock area. The head area comprises an alloy plate which mounts on to four posts on the main deck plate, this secondary plate supporting three fixed edge guides and the third plate from which the heads are suspended. In the tape path following the first fixed guide there is a position for an extra head followed by a solenoid operated tape lifter pin and a large diameter fixed guide post which has azimuth adjustment. This is followed by an edge guide which is adjustable in height, before the ferrite erase head which is followed by the second tape lifter pin, the record/replay head and the final edge guide.

Azimuth adjustment of the record/replay head and zenith adjustment of the erase head was by screws opposing spring loading, the springs being rather weak.

Perhaps surprisingly these days the capstan is belt driven from the capstan servo motor, the capstan shaft having a 12 mm diameter sleeve at the tape end and a flywheel at the other end. Engagement of the pinch roller is from a solenoid via a spring-loaded linkage.

After the capstan, the tape passes over a large diameter rubber-covered roller which is equipped with an optical tachometer working on a strobe disc on its underside. This is used to drive the electronic tape timer.

A mechanical tape lifter defeat is provided for listening in the fast modes, but this contraption was rather crude in action and flimsy. Also fitted is a retractable headshield which slides up through the casting to cover the record/replay head.

Below the tape transport a thin full width panel contains the power on/off pushbutton followed by the 16 record/ready buttons, a single input monitor all/individual button and a pitch control on/off button which activates a geared dual concentric pitch control. Both the input monitor button and the pitch control button have nearby red warning LEDs which flash with individual track selection and pitch control in.

Beneath this panel an orange transparent strip has track identifications and red record ready LEDs under each record switch, the LEDs flashing in record ready and being constantly illuminated in the record state. Further to the right is the tape timer which operated in minutes and seconds in real tape time giving indications of ±99 m 59 s relative to timer zero which can be reset by the adjacent set zero button.

To the bottom of the machine the metering takes the form of vertical LED bar type VU meters aligned under their associated record ready buttons and LEDs. Indications of +6, +3, +2 and +1 VU are in red LEDs with green LEDs showing 0, −1, −2, −4, −7, −10, −15 and −20 VU.

To the right of the meter panel a small panel contains six momentary pushbutton switches which provide a return-to-zero function in addition to the normal transport controls which are fully interlocked. Entering the record ready mode flashes a red warning LED which becomes steadily illuminated when any track is in record. Punching in and out of record is possible on the fly without stopping the tape.

The 16 audio electronics boards plug into a full width mother board through the base of the recorder such that access to most of the preset controls is through holes underneath the VU meter panel at the front of the recorder, the panel being hinged at its bottom so that it folds down. These controls consist of an erase level inductor and skeleton presets for bias, record equalisation, record level, replay equalisation and replay calibration. Further potentiometers for meter calibration are on the bottom end of the boards.

With the exception of the power supplies, most of the remaining electronics are on a single board

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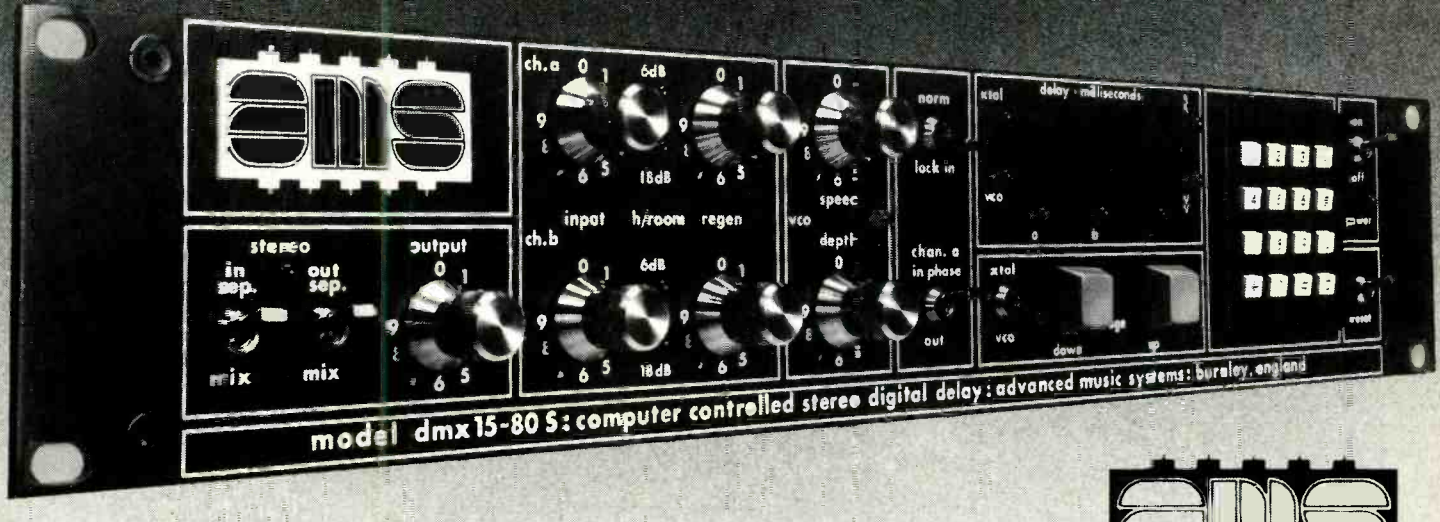
NO NOISE IS GOOD NOISE

SO THIS NEWS *MUST* BE GOOD NEWS



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which occupies the full width of the rear of the recorder and hinges down to give access to the tape transport. This board has 11 preset controls which mainly deal with tape tension and speed. All components were clearly identified and ample test points made obviously available for alignment.

Further features to the rear of the unit include the fixed power cable and phono sockets for the unbalanced audio inputs and outputs. Multiway ribbon cable type connectors are provided for the remote control unit and for remote metering, it being possible to remove the VU meter panel and use it remotely.

A slide switch at the rear identified as noise reduction internal/external switches the Dolby C internal noise reduction in/out. It is rather surprising that this facility is at the rear and that there is no front panel indication of the noise reduction status. Finally a ¼ in jack socket at the rear, identified as 'punch in/out', allows remote entry into the record mode by means of a single-pole switch.

Overall the standard of construction was good from both an electrical and mechanical point of view having regard to its intended applications. Access for servicing was excellent with all printed circuit boards having sockets or ribbon cable connectors.

Remote control unit

This very neat unit (whd 210 × 180 × 30 mm) connects to the recorder by about 8 m of multiway cable.

Within the unit all the transport controls and the tape timer with its reset button are duplicated and permanently active, together with a cue button and repeat button which makes the recorder cycle between timer zero and the time when the cue button was last pressed.

Pressing the 'remote' button on the control unit activitates its remaining functions which include its own set of record ready buttons and warning LEDs plus an input monitor button allowing input monitoring of all or individual tracks as on the recorder with a warning LED.

Inputs and outputs

As received, replaying a fluxivity of 320 nWb/m gave an output of −6 dBm from all tracks with or without the Dolby C noise reduction in circuit, this level corresponding to +1 VU. The replay level control allowed a maximum output of +1 dBm for 320 nWb/m from a source impedance of 200 Ω.

In the record chain the minimum level to record 320 nWb/m on Ampex *456* tape could be set to −14 dBm, both level controls being of the full range type. The impedance at the unbalanced input was 34.9 kΩ varying slightly with the sensitivity setting.

The record electronics were capable of driving +15 dB relative to 320 nWb/m on Ampex *456* tape, a reasonable margin, with the replay electronics clipping at +8 dB.7 V output corresponding to +14 dB relative to 320 nWb/m—a rather tight margin here.

In the input monitor mode the frequency response from the inputs to the outputs was as shown in **Fig 1** with a −3 dB point at 27 kHz followed by a sensible and rapid roll-off.

Frequency response

The replay frequency response as found was checked with a calibration tape to the CCIR 35 μs standard on three channels which were found to be effectively identical. The results obtained are shown in **Table 1.**

For some reason the alignment instructions recommend a 0.7 dB boost at 10 kHz relative to 1 kHz and these results certainly confirm this high frequency boost. The available range of the replay equalisers is shown in **Fig 2,** the range being far wider than necessary making adjustment rather critical. The opposite was true of the record equalisers which had a completely unsatisfactory range within the audio band as shown in **Fig 3.**

TABLE 1

31.5 Hz	+0.2 dB	4 kHz	+0.4 dB
40 Hz	+1.2 dB	6.3 kHz	+0.8 dB
63 Hz	+1.0 dB	8 kHz	+1.4 dB
125 Hz	−1.4 dB	10 kHz	+1.6 dB
250 Hz	−0.5 dB	12.5 kHz	+1.6 dB
500 Hz	−0.1 dB	14 kHz	+1.4 dB
1 kHz	0 dB	16 kHz	+1.0 dB
2 kHz	+0.1 dB	18 kHz	0 dB

The recommended method of biasing is to bias for optimum frequency response, a practice which does not meet with my approval as it does not optimise bias for distortion performance or modulation noise. Checking the bias as supplied showed this to result in an overbias of only 1.5 dB at 10 kHz.

The number of tracks in record had no significant effect on overall bias levels but inter-track leakage at the erase head lowered a 10 kHz tone on an adjacent track by 0.4 dB.

Fig 4 shows the overall record/replay frequency response with Dolby C off at various levels with respect to a fluxivity of 320 nWb/m, **Fig 5** being the same with the Dolby C switched into circuit. In both cases the low frequency response is remarkably good with no sign of long wavelength ripples.

As expected switching the Dolby into circuit

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FIG.1 FOSTEX B-16 FREQUENCY RESPONSE INPUT TO OUTPUT, LINE IN

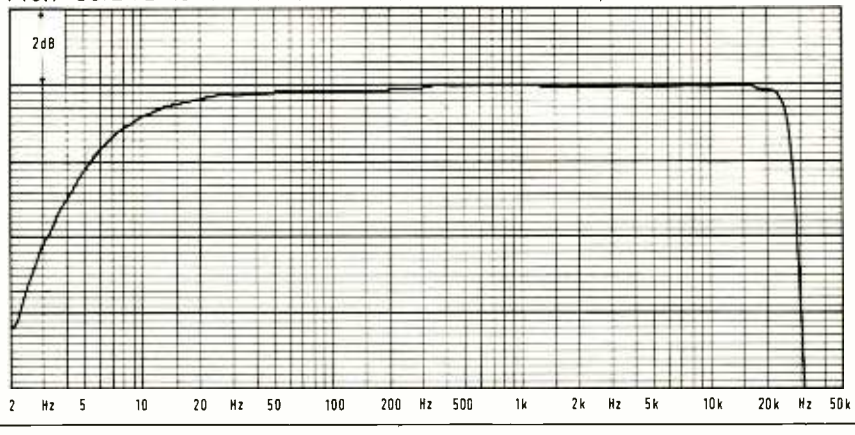


FIG.2
FOSTEX B-16
REPLAY EQUALISER

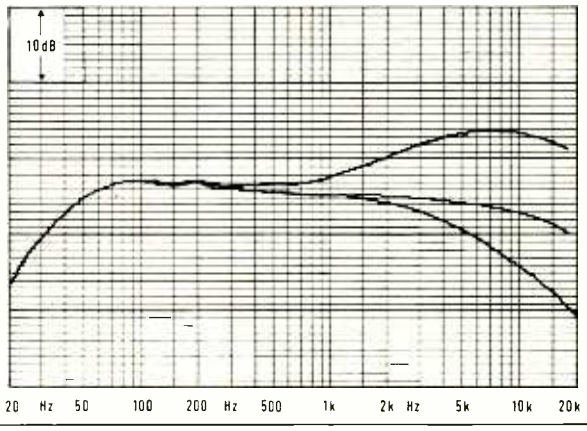
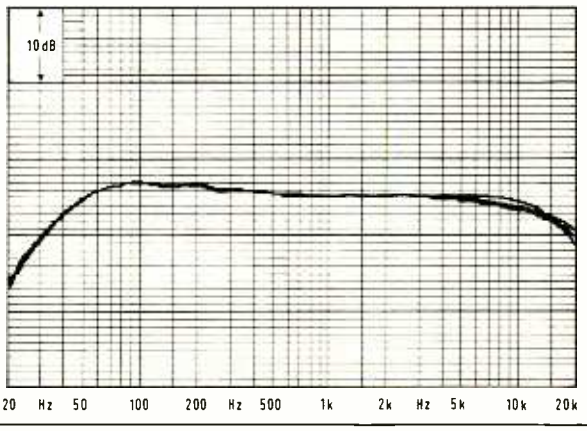


FIG.3
FOSTEX B-16
RECORD EQUALISER RANGE



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increases frequency response errors, but the effect was minimal with little mis-tracking of the Dolby circuits.

Distortion and noise

The maximum output level for 3% third harmonic distortion at 1 kHz was measured on several tracks as was the third harmonic distortion at a fluxivity of 320 nWb/m the results being consistent at +9.5 dB reference 320 nWb/m and 0.4% respectively with zero VU being sensibly set at about 12 dB below the MOL.

Noise was measured in several outputs with and without tape which had been recorded without an audio input to show the margin between machine and tape noise, both with and without the Dolby C in circuit with the results shown in **Table 2** which relate noise to a fluxivity of 320 nWb/m.

With the exception of track 1 which was sensitive to hum there were only small differences between tracks, the above being the average of a number of tracks. As is only to be expected, the cramming of 16 tracks on to ½ in tape creates noise problems due to the very narrow tracks. However the inclusion of the Dolby C circuits more than compensates for the narrow tracks and offers a remarkably good performance.

In the input monitor mode there was no problem with noise which was well clear on the machine replay noise.

Recording and reproducing a 1 kHz square-wave gave the overshoot shown in **Fig 6** with or without the Dolby circuits active, there being a degree of overshoot also in the input monitor mode.

Crosstalk and erasure

Adjacent channel replay crosstalk without the Dolby C is show in **Fig 7** plotted by recording the output from channel 6 whilst replaying a frequency sweep on channel 5, the performance being generally good and of course far better with the Dolby in circuit.

Crosstalk in the sync mode was again evaluated without the Dolby in action. **Fig 8** shows the crosstalk outputs from channels 6, 7, 8 and 9 whilst simultaneously recording channel 5. By any standards this is a good performance.

Erasure of a 1 kHz tone with Dolby was better than 90 dB, being around 73/74 dB without Dolby which is an acceptable level.

Wow, flutter, speed and phase

The IEC weighted quasi-peak wow and flutter was measured at the beginning, middle and end of a full 2400 ft reel of tape and found to be generally 0.05% at the beginning and middle or 0.06% at the end of the reel. However, whilst this applied with the machine horizontal or vertical, repeated stopping and starting could lock the machine into 0.08% wow and flutter with the modulation corresponding to the capstan diameter at about 8.3 Hz. Hopefully this is a defect in the review machine only.

Speed drift from one end of a reel to the other was good at 0.1% with the speed being stable within this limit. The variable speed control offered +20% to −15% speed variation with accurate setting being possible with the geared drive to the potentiometer.

The record and subsequent spectrum analysis of a 10 kHz tone produced **Fig 9** which demonstrates freedom from discrete modulation sidebands but random flutter components.

Similarly recording and replaying a 10 kHz tone on tracks 1 and 16 gave the minimal phase jitter shown in **Fig 10** where the vertical scale is

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TABLE 2 Reference level (320 nWb/m) to noise

	No tape		With tape	
Measurement method	**Dolby**	**No Dolby**	**Dolby**	**No Dolby**
22 Hz to 22 kHz RMS	− 57.5 dB	− 55.0 dB	− 56.0 dB	− 50.5 dB
A-weighted RMS	− 76.0 dB	− 63.0 dB	− 72.0 dB	− 56.0 dB
CCIR-weighted RMS	− 74.0 dB	− 56.0 dB	− 67.5 dB	− 48.0 dB
CCIR-weighted quasi-peak	− 70.0 dB	− 52.0 dB	− 63.0 dB	− 44.0 dB
CCIR-ARM ref 2 kHz	− 81.5 dB	− 63.0 dB	− 74.0 dB	− 54.5 dB

FIG.4
FOSTEX B-16
FREQUENCY RESPONSE AT
DIFFERING LEVELS, DOLBY OFF

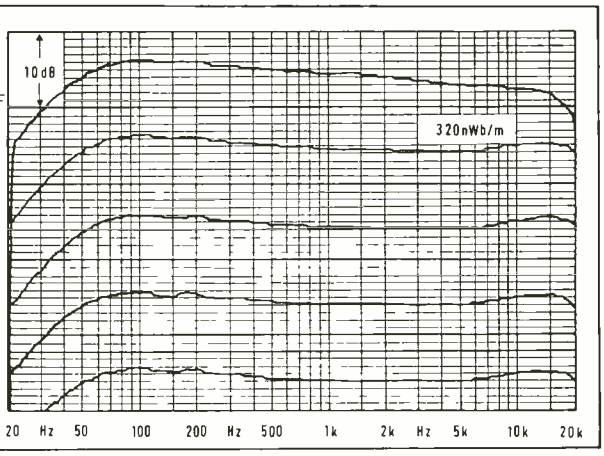


FIG.5
FOSTEX B-16
FREQUENCY RESPONSE AT
DIFFERING LEVELS, DOLBY ON

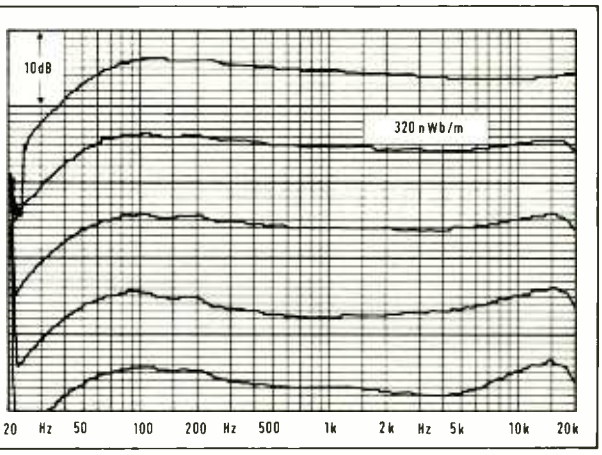
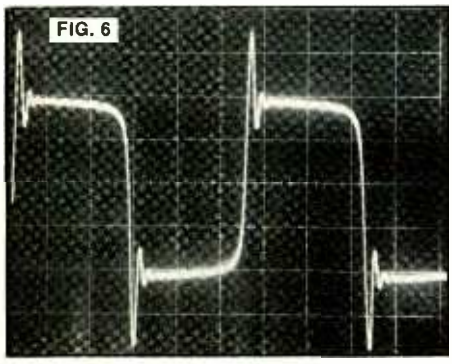


FIG. 6



EQUALIZATION

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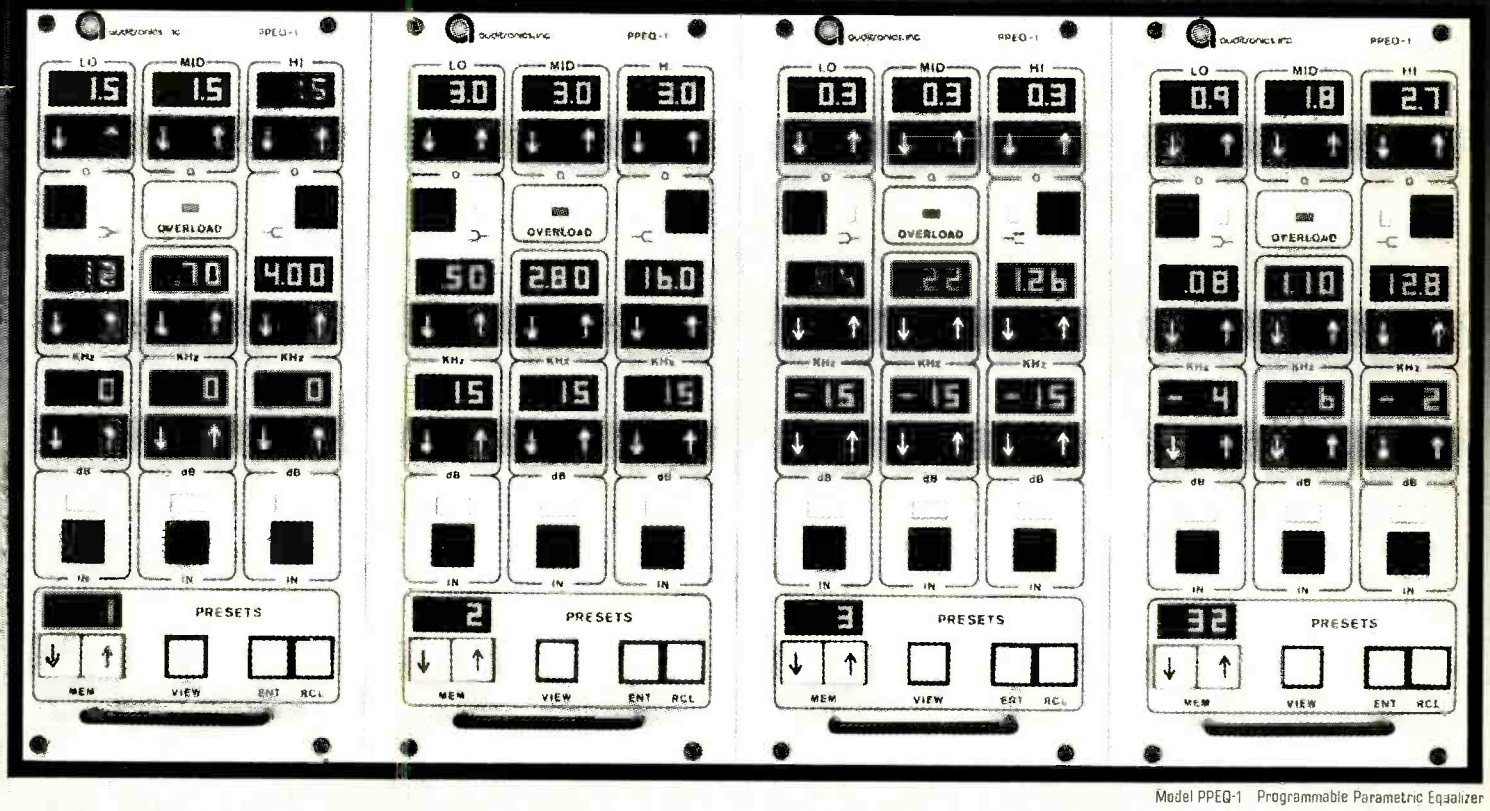

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Other matters

Whilst the level meters are identified as VU meters their performance is nothing like a genuine VU meter. The rectifier characteristics were like a peak rectifier with the rise time to – 1 dB being 80 ms and the fall time to – 10 dB 500 ms.

Generally the machine worked very smoothly and was very practical to operate, but in the vertical position the spool hold-downs would benefit from a more positive grip on the spools. Also the heatsink on the top of the machine ran rather hot, but we understand that the manufacturer is modifying the overall cooling arrangements.

The return to zero function and repeat (cue) functions tended to overshoot zero by about 0.5 s and to be rather slow to find the stopping place. Also for some reason the search for zero function was not disabled until stop or some other command had been given.

The remote control unit was particularly nicely contrived and small enough to be conveniently located on the desk.

Summary

This is an ambitious recorder which provides a fully-portable machine with a 16-track capability. The use of Dolby C noise reduction compensates for the narrow track width inherent in putting 16 tracks on ½ in tape.

Clearly the machine is made to a price but the standard of construction is sensible with good access to all components including the alignment controls.

A limitation is that there is a single record/replay head making alignment of the record electronics rather tiresome and in some circumstances making crosstalk potential something that requires extra thought.

Bearing in mind that the review machine was a prototype I trust that the manufacturer will take note of the few criticisms that I have raised as this is a machine with great potential.

Hugh Ford

Manufacturer's Comment

1. Prototype reel clamps were supplied with the machine. The production version locks the reels tightly, eliminating chatter and allowing easy rock and roll editing.
2. The output headroom is determined by the Dolby IC used. The highest output version has been selected for the *B-16*; + 14 dB above 320 nWb is considered ample.
3. The playback equalisation range has been reduced to + 5/ – 10 dB at 10 kHz. The record equalisation range is intentionally limited, to prevent serious misalignment.
4. The 'VU' meters are, in fact, peak reading bargraph types. The panel graphics have been corrected in accordance with this.
5. Response discrepancies on track 1 are not characteristic of the *B-16* record/replay production head.
6. There are, in fact, three 'stop' modes. As well as the 'return to zero' mode, there are both brake locked and shuttle modes. These latter two are selected by successive operation of the stop key.
7. Inclusion of only one head is a cost consideration.

FIG. 7
FOSTEX B-16
REPLAY CROSSTALK 5 TO 6, NO DOLBY

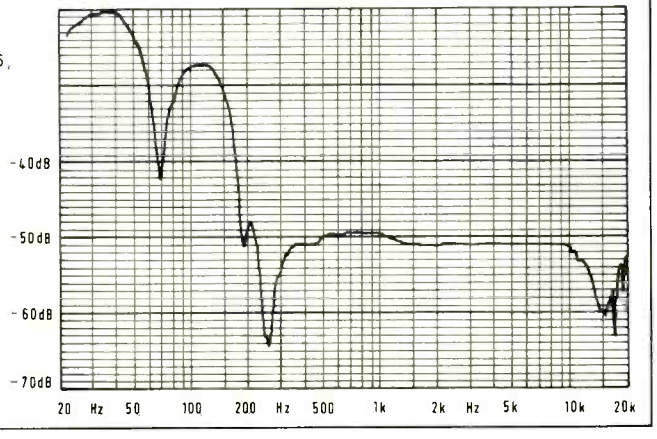


FIG. 8
FOSTEX B-16
SYNC CROSSTALK, RECORD 5, PLAY 6,7,8,9 NO DOLBY

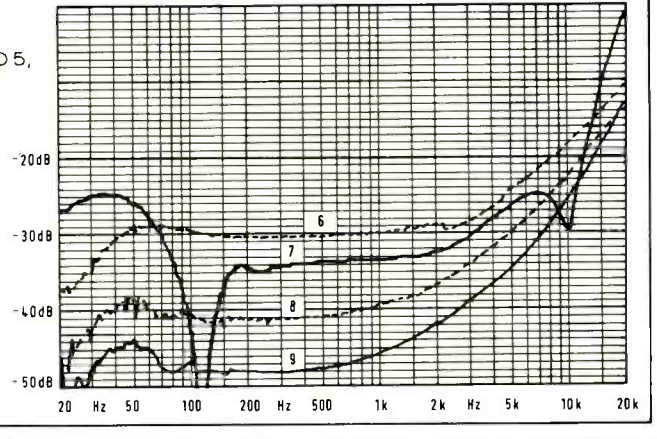


FIG. 10

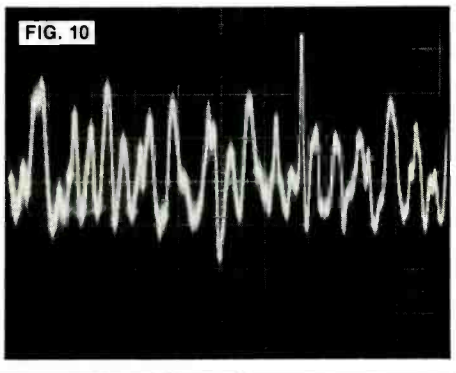
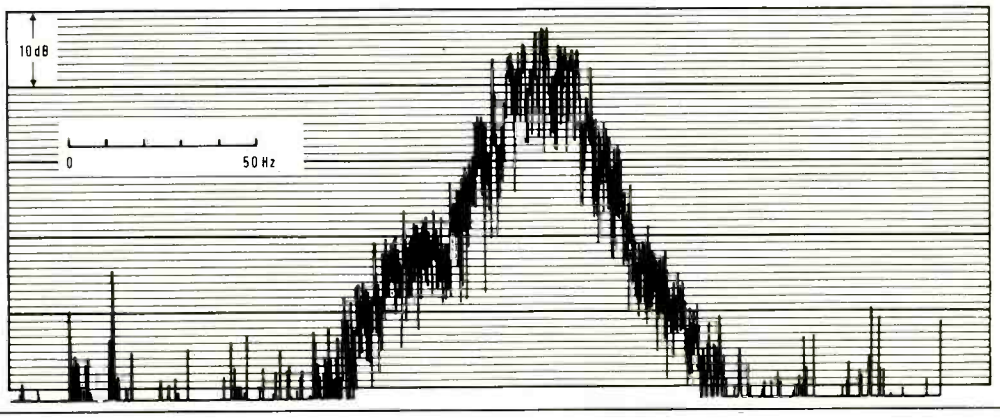


FIG. 9
FOSTEX B-16
SPECTRUM ANALYSIS OF 10kHz RECORDED AND REPLAYED TONE



CMI-Extending your compositional creativity...

Consistent with Fairlight's policy of always offering the musician a choice, the CMI offers no less than three compositional programs – a real-time multitrack sequencer (Page 9), a non-real time music composition language (MCL) and the revolutionary Rhythm Sequencer. Each specifically designed to suit different styles and methods of composition. Together they are probably the most complete compositional package available today.

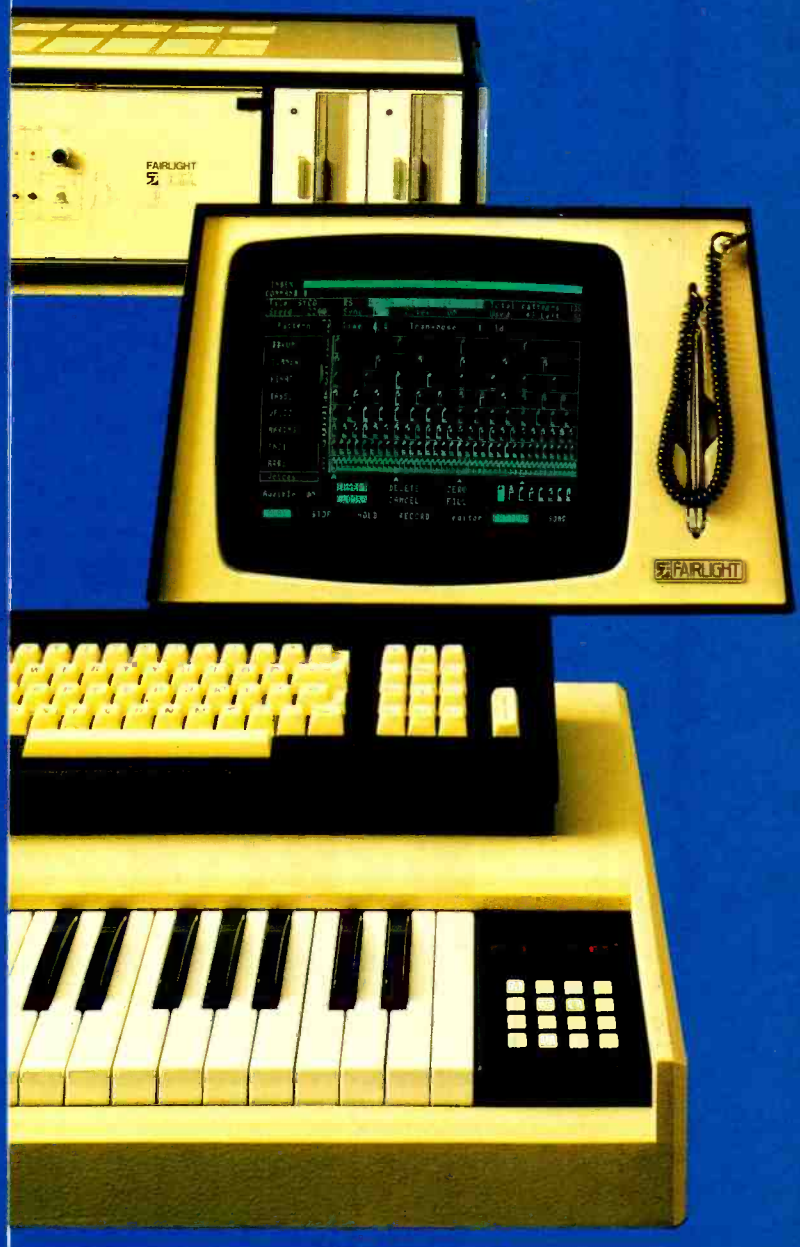
The Real Time Multitrack Sequencer records performances from the CMI's six octave dynamic keyboards together with all expressive nuances from either the keys or the six real time controllers. The recorder is organised in such a way that there is no limit to the number of tracks that may be laid down or overdubbed, and total storage capacity is in excess of 50 000 notes. After recording, each track may be easily 'patched' to any of the CMI's voice channels, allowing orchestration and arrangements, even while the music is replaying.

MCL is a non-real time composition language that allows all the parameters of a composition to be specified from the alphanumeric keyboard. Designed primarily to allow non-keyboard players to record music within the CMI, great attention has been paid to the expressive control of each sound. Powerful editing facilities allow any part of the score to be located and changed as necessary. MCL incorporates an error detection program that assists the composer by pinpointing any error he might have made while entering the music.

The Rhythm Sequencer, which has caused more excitement amongst CMI users than any other single development, allows real-time composition of complex rhythmic phrases which may then be combined to form complete songs. After specifying a phrase length eight separate channels of sound may be combined while that phrase is looping. The interactive program displays notes on the screen as they are played. All pitch, timing and dynamic information is recorded and an adjustable time correction facility will correct any playing inaccuracies. The Rhythm Sequencer may also be used in non-real time using a combination of the keyboard and the lightpen.

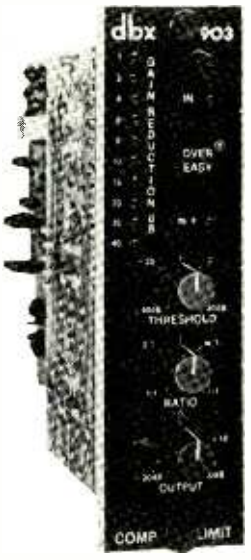
Each channel in the CMI benefits from a separate audio output allowing it to be independently equalised and echoed: the complete composition may then be recorded onto tape in one take. With the use of the analog interface, a hardware/software peripheral for the CMI, that musical information may be extracted as voltages and used to control up to eight analog synthesisers simultaneously.

If you are a composer you will find the CMI one of the most creative tools you have ever used. If you're not, we have a feeling that very soon you will be.



For further information on the CMI please contact:
Syco Systems Ltd, 20 Conduit Place, London W2.
Telephone: 01-724 2451.
Telex: 22278 Syco G.

dbx 900 series



MANUFACTURER'S SPECIFICATION

Common to all units
Input impedance: balanced 25 kΩ, unbalanced 18.5 kΩ.
Output impedance: 22 Ω designed to drive 600 Ω or more.
Maximum input level: +24 dBm.
Maximum output level: +24 dBm into 600 Ω or more.
Frequency response 20 Hz to 20 kHz, +0/−1 dB.
Dimensions: (wdh) 1½ × 5¼ × 9½ in (except 906 flanger which is 3 in wide).

Model 902 de-esser
Total harmonic distortion: less than 0.02% at 1 kHz.
Equivalent input noise: −82 dBm, 20 Hz to 20 kHz bandwidth unweighted.
Attack rate: programme-dependent—to achieve 63% gain reduction, 2 ms for 10 dB spectrum shift above threshold and 600 μs for 20 dB spectrum above threshold.
Release rate: 925 dB/s.
De-essing range: operates uniformly over input of −40 to +24 dBm without requiring adjustment.
Maximum 'ess' attenuation: variable, 0 dB to >20 dB.
De-ess crossover point: variable, 800 Hz to 8 kHz.
Filter type: 12 dB/octave lowpass, 6 dB/octave derived highpass, phase-coherent.
Gain: unity.
Controls: frequency, range.
Switches: in/out, mode (HF only/normal).
Metering: LED column, 1, 2, 3, 4, 6, 8, 10, 12, 15, 20 dB gain reduction.
Power requirements: ±15 V regulated at 60 mA, ±24 V unregulated at 30 mA.

Model 903 compressor
Distortion: at infinite-compression, 1 kHz, 0 dBm, typically 0.05% 2nd harmonic and 0.2% 3rd harmonic.
Equivalent input noise: −88 dBm, 20 Hz to 20 kHz unweighted.
Attack rate: programme-dependent—to achieve 63% gain reduction, measured in the infinite-compression region of the over easy curve, 15 ms for 10 dB above threshold and 5 ms for 20 dB above threshold.
Release rate: 120 dB/s.
Threshold: variable from −40 dBm to +20 dBm (7.75 mV to 7.75 V).
Compression ratio: variable from 1:1 through infinity to −1:1.
Output gain: variable, −20 dB to +20 dB.
Detector input impedance: balanced 250 kΩ, unbalanced 185 kΩ.
Controls: threshold, ratio, output.
Switches: in/out.
Metering: LED column, 1, 2, 4, 6, 8, 10, 15, 20, 30, 40 dB gain reduction.
Power requirements: ±15 V regulated at 60 mA, +24 V unregulated at 30 mA.

Model 904 noise gate
Total harmonic distortion: <0.02% at 1 kHz.
Equivalent input noise: −82 dBm, 20 Hz to 20 kHz bandwidth unweighted.
Attack rate: variable, 500 dB/ms to 2.5 dB/ms.
Release rate: variable, 2.5 dB/ms to 22 dB/s.
Threshold: variable, −40 dB to +10 dB (7.75 mV to 2.5 V).
Expansion ratio: variable, 1.5:1 to 5:1.
Maximum attenuation: more than 60 dB.
Key input impedance: balanced 250 kΩ, unbalanced 185 kΩ.
Controls: attenuation limit, ratio, threshold, attack, release.
Switches: in/out, PLM, key.
Metering: LED column, 2, 4, 6, 8, 10, 15, 20, 30, 40, 60 dB gain reduction.
Power requirements: ±15 V regulated at 60 mA, ±24 V unregulated at 30 mA.

Model 905 parametric equaliser
Total harmonic distortion: under any boost or cut condition, less than 0.03% at 1 kHz.
Equivalent input noise: −88 dBm, 20 Hz to 20 kHz bandwidth unweighted.
Filter type: each band symmetrical peak/dip, each switchable to notch mode, high and low bands switchable to symmetrical shelving.
Centre frequencies: low band 20 to 500 Hz, middle band 200 Hz to 5 kHz, high band 800 Hz to 20 kHz.
Range: ±15 dB peak or shelved.
Notch attenuation: more than 40 dB at maximum Q, greater at minimum Qs (typically −70 dB).
Controls: frequency, Q, boost/cut (each band).
Switches: in/out, shelving (two bands), 'infinite' notch (all bands).
Metering: LED overload indicator, monitors all critical circuitry points.
Power requirements: ±15 V regulated at 100 mA, ±24 V unregulated at 30 mA.

Model F-900 powered frame
Power requirements: 100, 120, 220, 240 V AC, 50/60 Hz ±10% externally switchable at rear panel.
Power consumption: 40 W nominal.
Connectors: input/output, barrier terminal, power output and input, 6-pin Jones female, ±24 V, ±15 V.
Module capacity: eight operational bays, one spare.
Power supply current capacity: >1.0 A, ±15 V DC regulated, > 0.5 A, ±24 V DC unregulated.
Switches/indicators: illuminated power switch.
Weight: 16.6 lb.
Dimensions: (whd) 19 × 5¼ × 14 in.
Manufacturer: dbx Inc, 71 Chapel Street, Newton, MA 02195, USA.
UK: Scenic Sounds Equipment Ltd, 97/99 Dean Street, London W1V 5RA.

THE F-900 frame contains a power supply (an unpowered version being available) to the right of the rack mounting unit which is three rack units in height. Constructed from strong alloy sides and cross members the rack forms a stable frame for the power supply and modules. It can house eight operational and one spare single width modules which fit into card guides and plug into printed circuit sockets on a mother board. This connects to the power supply which is fixed in the frame and to multiway rear connectors. These in turn connect to the rear panel which has eight 10-way barrier strips, one for each operational module. In addition, a 6-way Jones socket on the rear panel gives access to the nominal ±24 V and ±15 V power supply rails.

The power input is via a combined IEC connector, fuse holder and tap changer with an on/off illuminated switch being fitted to the front of the power supply module to the right of the unit. Although the 24 V supplies are unstabilised giving +22.98 and −22.60 V at 240 V input, the ±15 V supplies are stabilised giving +14.88 and −14.99 V with mains inputs down to less than 200 V with very good regulation.

In addition to being able to accept the dbx *411* noise reduction modules the *900 series* signal

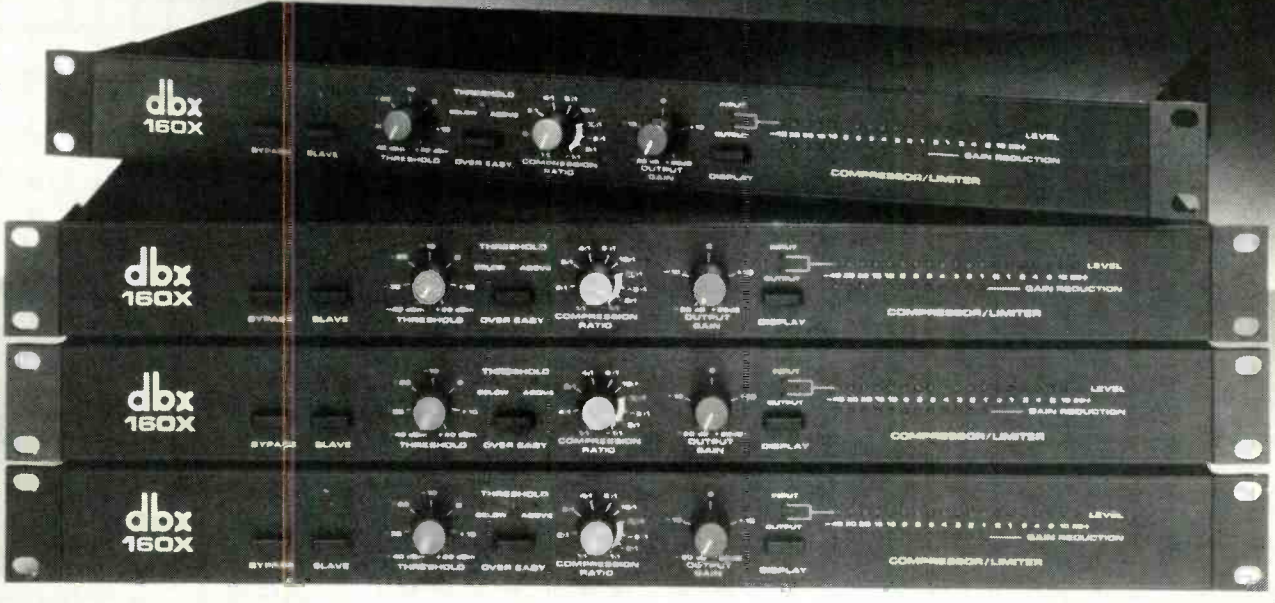
115 ▶

dbx

We listened to you– now we would like you to listen to us.

The dbx 160 was one of the world's best selling compressors, but still there were a few areas you wanted improved; stereo linking, mounting, clearer meters, easier rack selectable compression characteristics.

We listened and the result is the 160X.



Austria: Kain Ges. m.b.h. & Co. KG, dba/Stereo Center Kain, Muenchner Bundesstrasse 42, A-5020 Salzburg. **Belgium/Luxembourg:** Trans European Music SA, Koeivyerstradt 105, B-1710 Dilbeek. **Denmark:** SLT, Helgesvej 9-11/DK-2000, Kopenhagen. **England:** Scenic Sound Equipment, 97-99 Dean Street, London W1V 5RA. **Finland:** Studiotec Ky, Eljaksentie 9, 00370 Helsinki 37. **France:** Cineco, 72, des Champs-Elysees, 75008 Paris. **Greece:** Bon Studio Sound Systems, 14 Zaimi Str. Athens 48. **Hong Kong: Phillipines, South Korea, Thailand, People's Republic of China:** Studer Revox (Far East) Ltd, 5th Floor, Parklane Bldg, 233-5 Queens Road, Central, Hong Kong. **Italy:** Scientel Audio SRL, Via Pietri 52 (or) Via Venturi 70, Modena 41100. **Japan:** BSR (Japan) Ltd, Tokyo 101. **Netherlands:** Special Audio Products B.V. Scheldeplein 18, 1078 GR Amsterdam. **New Zealand:** Videx Systems Ltd, Ellice Industrial Estate, P.O. Box 31-029, Auckland 10, 48 Ellice Road, Glenfield. **Norway:** Lydrommet, St Olavsgate 27, Oslo 1. **Spain:** Commercial Lavilla, Legaledad, 64066, Barcelona 24. **Sweden:** Tal & Ton AB, Kungsgatan 5, 411 19 Goeteborg. **Switzerland:** Audio Bauer AG, CH-8064 Zurich, Bernerstrasse-Nord 182. **West Germany:** Audio Vertrieb, Bargweg 45b, 2000 Norderstedt.

At last a rival for the SCM762

The new Soundcraft SCM 760

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Yet you can still buy the SCM 760 for less than you'd pay for a second hand model of any other multitrack. And that makes Soundcraft the all round winners for 24 track recording – every time.

Soundcraft

Soundcraft Electronics Limited, 5-8 Great Sutton Street, London, EC1V 0BX, England. Tel: 01-251 3631. Telex: 21198.

Soundcraft Electronics USA, 1517 20th. Street, Santa Monica, California 90404. Tel: (213) 453 4591. Telex: 664923.

processors are designed for the frame. At the time of writing these include *902* de-esser, *903* compressor, *904* noise gate, *905* parametric equaliser plus the *906* flanger and *907* stereo gated compressor slave which are not included in this review.

902 de-esser

The *902* de-esser is a single-channel device with the minimum of front panel controls and five internal preset potentiometers.

At the top of the front panel is a locking pushbutton in/out switch which when in the 'out' position connects the input directly to the output—this could cause confusion when using the input balanced as the output is unbalanced when the unit is in circuit. Both this switch and the similar 'HF only' switch beneath it have associated warning LEDs. The latter switch allows gain reduction when de-essing to be either wide band or in the high frequency spectrum alone.

To the left of these switches a vertical array of 10 LEDs indicate the current amount of gain reduction in 1 dB steps up to 4 dB and then 6, 8, 10, 12, 15 and 20 dB.

The remaining controls are two potentiometers one of which selects the amount of compression irrespective of the absolute input level such that the de-essing function depends upon the spectrum of the input signal rather than the absolute level.

The second potentiometer selects the frequency over which the de-essing function will become operative, this control covering 800 Hz to 8 kHz.

Inputs and outputs

The balanced input was found to have an impedance of 21.9 kΩ in the balanced connection or 10.9 kΩ when operating unbalanced. In both cases the input could handle +25 dBm before the onset of serious distortion. Common mode rejection was better than 80 dB up to 2 kHz falling to 65 dB at 20 kHz.

At the unbalanced output the source impedance was low at 22 Ω with a drive capability of +24.9 dBm into 600 Ω which matches the maximum input level as the maximum gain is unity.

Finally there is the control voltage output which varies with the amount of compression from 0 V for zero compression to 1 V for 20 dB compression with a law of 20 mV/dB. The source impedance of this output was very low and less than 1 Ω with the compression indicators being accurate to within 0.2 dB over the full range.

Frequency response

The overall frequency response when not de-essing is shown in **Fig 1** where the low frequency roll-off is −1 dB at 30 Hz which is slightly on the high side, there not being any effective high frequency roll-off. The effective frequency response when de-essing depended upon the front panel frequency setting and the setting of the 'HF only' switch. This performance was assessed by applying a high frequency tone to initiate de-essing and then sweeping the frequency of a very low level tone whilst tracking the output with a selective filter.

The result with the 'HF only' switch in and out is shown in **Fig 2.** In the 'HF only' setting the response is flat as when de-essing is not operative but with gain reduction. With the 'HF only' function in circuit the high frequency response depends upon the setting of the frequency control the effect of the frequency control being shown in **Fig 3.**

TABLE 1

Measurement method	Output noise (dBm)
22 Hz to 22 kHz RMS	−79.3 dBm
A-weighted RMS	−83.3 dBm
CCIR-weighted RMS ref 1 kHz	−74.5 dBm
CCIR-weighted quasi-peak ref 1 kHz	−70.3 dBm
CCIR-weighted ARM ref 2 kHz	−81.2 dBm

Noise

Noise in the output appeared to remain constant with the amount of compression with no resulting noise breathing, the output noise being identical to the effective noise at the input at the maximum gain of unity.

No power line hum or other undesirable effects were found in the output noise which was as shown in **Table 1.**

Distortion

Whilst the third harmonic distortion remained below 0.02% from 20 Hz to 20 kHz irrespective of level below clipping and control functions the second harmonic was affected to a large extent by the input configuration and input level.

The effect on second harmonic distortion of grounding the positive or negative inputs is shown in **Fig 4** at +10 dBm input level the distortion with the negative input grounded increasing by 10 dB at +20 dBm output. When operating balanced the second harmonic was satisfactory and the same as when operating with the positive input grounded.

Other matters

The de-essing function became operative at input levels above −40 dBm being self-adjusting up to

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FIG.1 dbx 902 DE-ESSER FREQUENCY RESPONSE WITHOUT DE-ESSING

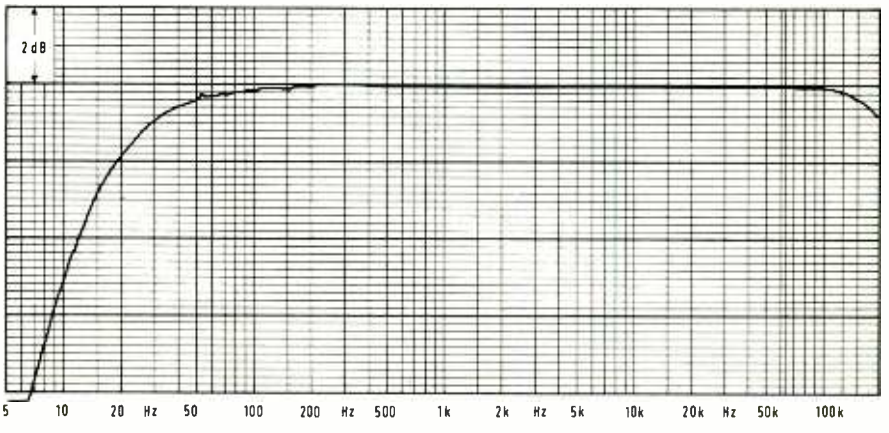


FIG. 2
dbx 902 DE-ESSER FREQUENCY RESPONSE WITH DE-ESSING

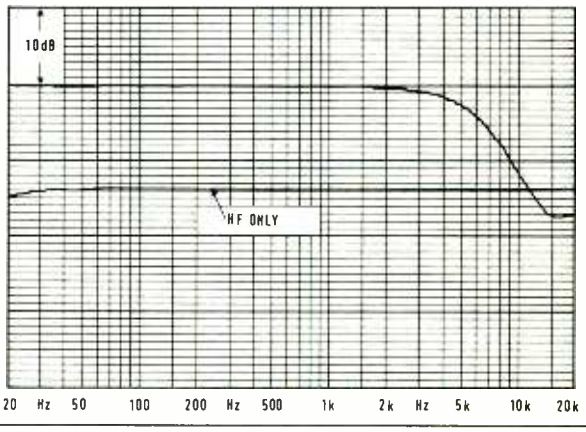
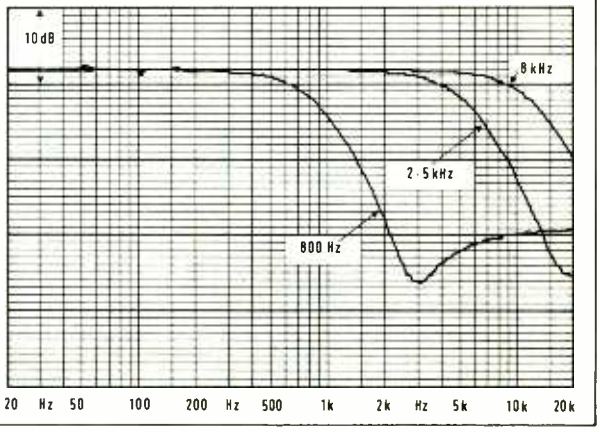


FIG.3
dbx 902 DE-ESSER HF RESPONSE WITH FREQUENCY CONTROL



the maximum input level. Indication of the gain reduction was very rapid in action with the attack and release times depending upon the programme content with the attack time being as fast as 10 μs.

The subjective effect of the de-esser was generally very good without objectionable clicks etc. However, when operating in the wide band mode, not surprisingly, some nasty subjective effects could be obtained. This is not, however, a criticism of the de-esser itself.

903 compressor

The front panel controls of the compressor comprise three potentiometers and a pushbutton in/out switch with its associated LED indicator, there being eight preset potentiometers on the printed circuit board.

One front panel potentiometer sets the threshold between −40 dB and +20 dB with calibrations at −20 dB and 0 dB with a second control setting the output level between −20 dB and +20 dB with calibrations at zero and ±10 dB. The third control is the ratio control which provides ratios from 1:1 to infinity to one then to −1:1.

The current amount of gain reduction is indicated by a vertical row of 10 red LEDs which operate at 1, 2, 4, 6, 8, 10, 15, 20, 30 and 40 dB gain reduction.

Whilst little information was available on the unit it is understood to use true RMS detection in conjunction with a feed forward type limiter. Gain control detector inputs and outputs allow ganging of compressors for stereo use.

Inputs and outputs

The balanced input was found to have an impedance of 19.9 kΩ in the balanced mode or 9.94 kΩ in the unbalanced mode, being able to accept up to +25.6 dBm in either mode. Common mode rejection was better than 70 dB up to 1 kHz as shown in **Fig 5.**

At the unbalanced output the impedance was adequately low at 22 Ω with the drive capability being +26.5 dB.7 V into a high impedance or +25.8 dBm loaded into 600 Ω.

With no compression or expansion in action the front panel gain control varied the gain from +19.8 dB to −19.5 dB with reasonably accurate calibrations.

The control voltage output varied from 0 V at zero gain reduction to nominally +2 V at 40 dB gain reduction with a constant law of 0.05 V/dB and a very low source impedance less than 1 Ω.

Frequency response

The frequency response from the input to the output when not compressing or limiting is shown to be very flat within the audio band in **Fig 6** and to remain sensibly flat when compressing 20, 30 and 40 dB as shown in **Fig 7.** The slight rise in the low frequency response increased below 20 Hz which is probably a sensible feature stopping very low frequency input excursions affecting the gain.

In all other circumstances the frequency

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FIG.4
dbx 902 DE-ESSER SECOND HARMONIC DISTORTION WITH INPUTS GROUNDED

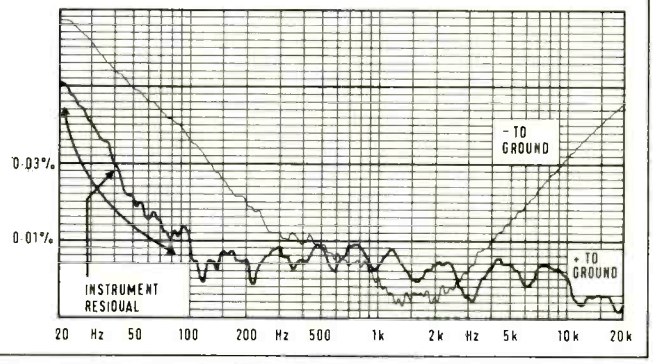


FIG.5
dbx 903 COMPRESSOR COMMON MODE REJECTION

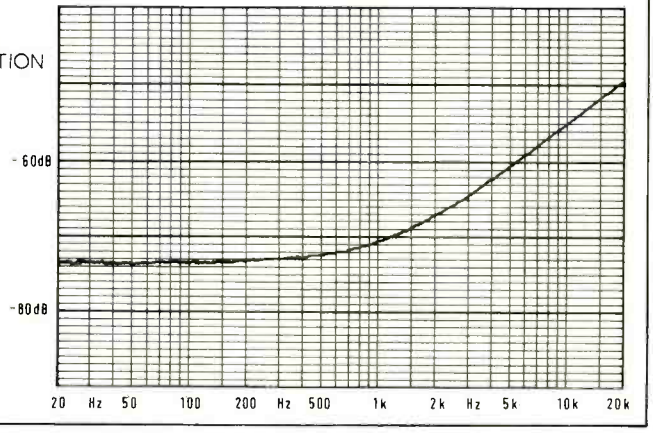


FIG.7
dbx 903 COMPRESSOR FREQUENCY RESPONSE WHEN LIMITING

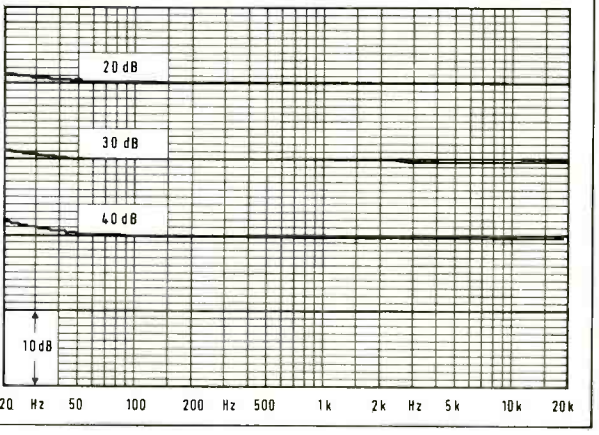
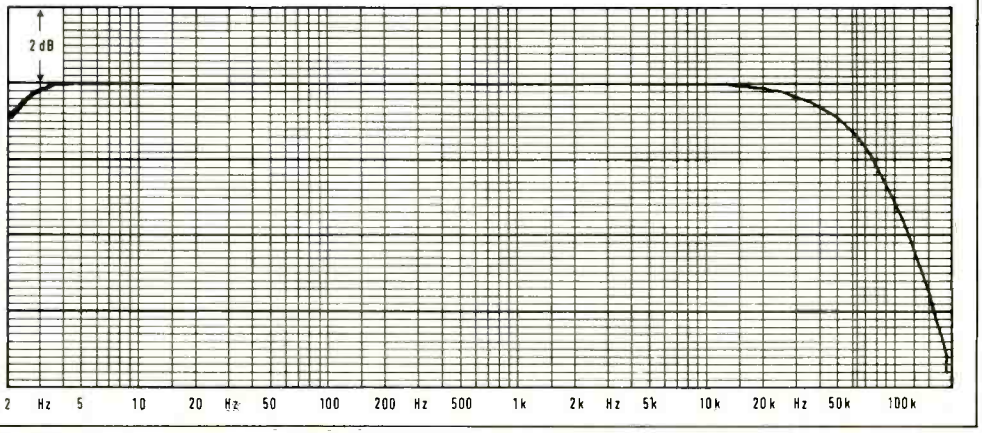


FIG.6
dbx 903 COMPRESSOR FREQUENCY RESPONSE



The great 16track package from Music Lab.

Tascam's deservedly successful **85-16B** 16 track/1" Recorder and Allen & Heath's sensational new **1616** Mixer. Each represents top value-for-money in its class; put them together and you have a professional performance recording team that will amaze even the most sceptical ear! The 1616 desk complements perfectly the 85-16B -- the truly affordable multitrack package for the musician or studio with unlimited creative resources, but a not-so-unlimited budget.

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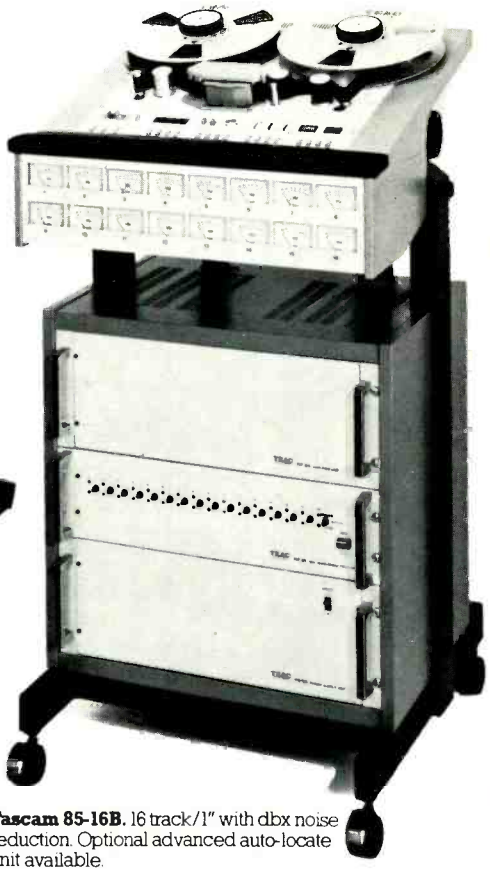
16-8-2 format with flexible 16 track monitoring and metering. Comprehensive EQ with frequency switching. 3 auxiliaries. Phantom powering. External power supply. Fully compatible with all current recording equipment. Optional 8 input add-on expander module available.



Tascam 85-16B. 16 track/1" with dbx noise reduction. Optional advanced auto-locate unit available.

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response remained flat irrespective of the compression ratio or limiting threshold.

Noise

Noise in the output appeared to decrease slightly with gain reduction in action, but not to a measurable extent. However, noise varied in a not wholly logical manner with the setting of the output level control as shown in **Table 2.**

Distortion

Second and third harmonic distortion with no compression in action at +10 dBm input and output is shown in **Fig 8** which remained similar in the balanced and unbalanced input configurations. At lower input levels the third harmonic changed little but the second harmonic dropped up to 10 dB giving a good performance.

With compression in action the low frequency distortion increased as might be reasonably expected, the results with 2:1 compression of 10 dB being respectable as shown in **Fig 9.**

Intermodulation distortion to the CCIF twin tone method was good with or without compression in action with the second order component remaining at 0.03% with or without compression up to 20 kHz and the third order component remaining at less than 0.3% under all conditions.

TABLE 2
Measurement method

Measurement method	Noise at output level setting −20 dB	0 dB	+20 dB
22 Hz to 22 kHz RMS	−83.4 dBm	−81.2 dBm	−68.0 dBm
A-weighted RMS	−98.8 dBm	−93.4 dBm	−77.6 dBm
CCIR-weighted RMS	−90.3 dBm	−84.8 dBm	−69.7 dBm
CCIR-weighted quasi-peak	−85.3 dBm	−80.4 dBm	−65.5 dBm
CCIR-weighted ARM	−97.0 dBm	−91.4 dBm	−76.5 dBm

TABLE 3 Actual threshold at given settings

Law setting	Threshold setting −40 dB	−20 dB	0 dB	+20 dB
1:1		infinite		
2:1	−38 dB	−26 dB	+4 dB	+18 dB
infinity:1	−40 dB	−33 dB	−3 dB	+12 dB
−1:1	−44 dB	−37 dB	−5 dB	+9 dB

FIG. 8
dbx 903 COMPRESSOR
HARMONIC DISTORTION
WITHOUT COMPRESSION

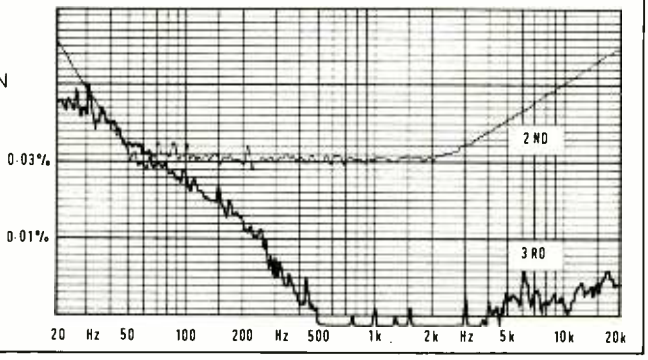


FIG. 9
dbx 903 COMPRESSOR
HARMONIC DISTORTION AT
10 dB COMPRESSION

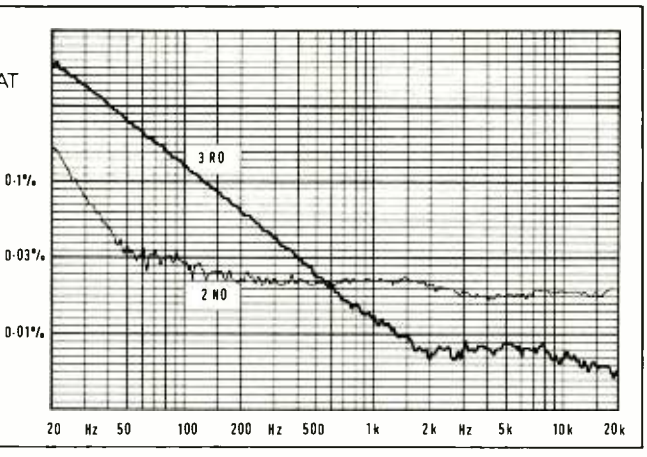
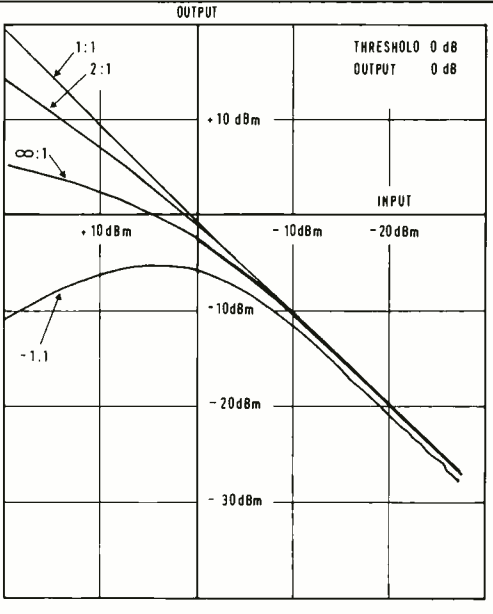


FIG. 10
dbx 903 COMPRESSOR
THRESHOLD SHIFT



Thresholds and compression

The actual threshold of compression depended upon the setting of the threshold control in addition to the setting of the compression law with the measured onset of compression being as given in **Table 3** for various control settings.

This downward shift in threshold is further shown in **Fig 10** where the input level is plotted against the output level for 0 dB threshold and output setting at compression laws of 1:1, 2:1, ∞:1 and −1:1.

Attack and release times

Both the attack and the release times very much depended upon the programme content with typical release times of 10 ms to 63% for a 10 dB compression or 2 ms for a 40 dB compression.

At all frequencies the unit appeared to behave well without serious distortion even under unlikely conditions, the subjective performance always being good. The gain reduction indicators were accurate and fast in operation giving a useful indication for gain reductions as short as 10 μs.

904 noise gate

Like the other units in this series the noise gate has an in/out pushbutton (with a warning LED) which bypasses the unit in a direct wired mode. Two further locking pushbuttons with adjacent LEDs are fitted. One of these, the 'key' button, allows external control of the gating action via a balanced rear panel input, disconnecting the internal gating mechanism. The second 'PLM' or programmed latch mode button is associated with a dual colour red/green LED.

In the PLM mode the unit waits with the red LED illuminated whilst attenuating by the amount shown on the LED attenuation level display. Once the input signal exceeds the preset threshold the green LED becomes illuminated and the gate latches into the linear (no gain reduction) mode until the unit is reset.

This is a useful feature for keeping a channel muted and free from noise or crosstalk until the wanted programme starts, whereupon the channel is latched open without any form of compression or gating.

The current gain reduction is indicated on a vertical array of 10 red LEDs showing 2, 4, 6, 8, 10, 15, 20, 30, 40 and 50 dB gain reduction. Four further front panel controls are fitted in the form of potentiometers, there being four sealed internal pre-set potentiometers. The upper potentiometer sets the maximum attenuation with calibrations at 10 dB intervals from 0 dB

120 ▶

down to −60 dB. The second potentiometer sets the compression ratio of the attenuation from 1.5:1 to 5:1 below the threshold set on the third potentiometer between +10 dB and −40 dB with calibrations every 10 dB.

The fourth control takes the form of a dual concentric potentiometer for setting the attack and release times. These are uncalibrated with the specified attack being between 500 and 2.5 dB/ms and release between 2.5 dB/ms and 22 dB/s.

Inputs and outputs

The electronically balanced input was found to have an impedance of 21.9 kΩ in the balanced mode or 10.9 kΩ in the unbalanced mode with a signal-handling capability of +25.1 dBm in either mode. Common mode rejection was 52 dB up to 10 kHz decreasing to 51 dB at 20 kHz.

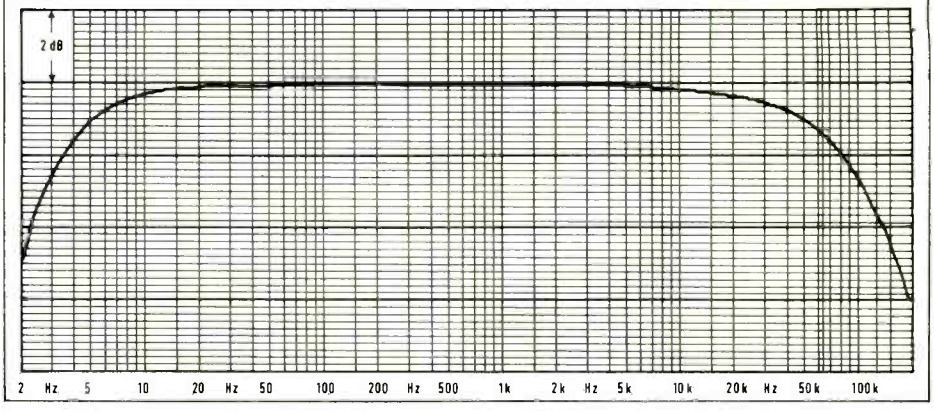
At the unbalanced output the source impedance was adequately low at 22 Ω with a drive capability of +25.4 dB.7 V into a high impedance of +25.1 dBm loaded into 600 Ω with the gain from input to output being +0.2 dB.

The control voltage output had a linear law per dB gain reduction of 50 mV/dB from a relatively low impedance with the gain reduction indicators being adequately accurate.

The balanced key input was found to have an impedance of 226 kΩ in the balanced mode or 194 kΩ when operating unbalanced. The effective 'sensitivity' of the key input was identical to that of the normal audio input so far as the threshold setting was concerned.

So far as the degree of compression was concerned the effective frequency response of the key input was identical to that of the normal audio input. The possibility of triggering the PLM (programmed latch mode) from the key input offers some interesting possibilities.

FIG.11
dbx 904 NOISE GATE
FREQUENCY RESPONSE
WITHOUT GAIN REDUCTION



Frequency response

With no gain reduction in action the frequency response from the input to the output was as shown in **Fig 11**, being effectively flat from 20 Hz to 20 kHz. However, the frequency response of the gain reduction chain in action either from the audio input or via the key input had significant effects.

Fig 12 shows the effect upon a 1 kHz tone being transmitted through the unit when the frequency of the key input is being swept, the plot being for 1.5:1 and 5:1 compression of 10 dB when 1 kHz is applied to the key input with the attack and release times set to slow. Significant gain deviations can occur at both high and low frequencies, however, in practical use mid-frequencies are likely to predominate in which case the gain tracking would be correct.

TABLE 4

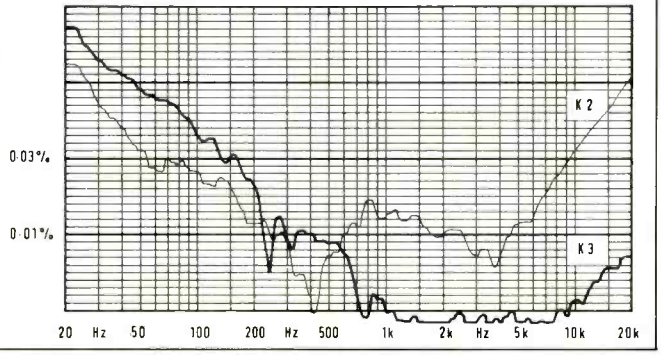
Measurement method	Gain reduction 0 dB	10 dB	20 dB
22 Hz to 22 kHz RMS	−78 dBm	−83 dBm	−86 dBm
A-weighted RMS	−83 dBm	−88 dBm	−93 dBm
CCIR-weighted RMS ref 1 kHz	−74 dBm	−80 dBm	−85 dBm
CCIR-weighted quasi-peak	−70 dBm	−76 dBm	−80 dBm
CCIR-weighted ARM ref 2 kHz	−81 dBm	−84 dBm	−88 dBm
50 Hz hum	−83 dBm	−88 dBm	−98 dBm
100 Hz hum	>−100 dBm	>−100 dBm	>−100 dBm
150 Hz hum	−83 dBm	−90 dBm	−90 dBm

Noise

Noise in the output depended upon the degree of gain reduction in action as did mains hum components in the output. The figures in **Table 4** were recorded for 0 dB, 10 dB and 20 dB gain reduction.

It was found that the output had significant noise at radio frequencies and that the unit was prone to radio frequency interference—the presence of a low power 150 MHz transmitter was most unwelcome!

FIG.13
dbx 904 NOISE GATE
HARMONIC DISTORTION
AT +20 dBm



Distortion

The second and third harmonic distortion at +20 dBm input and output without gain reduction is shown in **Fig 13** which was a worst case with or without gain reduction. At lower levels without gain reduction both harmonics dropped below 0.01%. Above 500 Hz similar levels were achieved with any level of gain reduction in action, with as expected, the low

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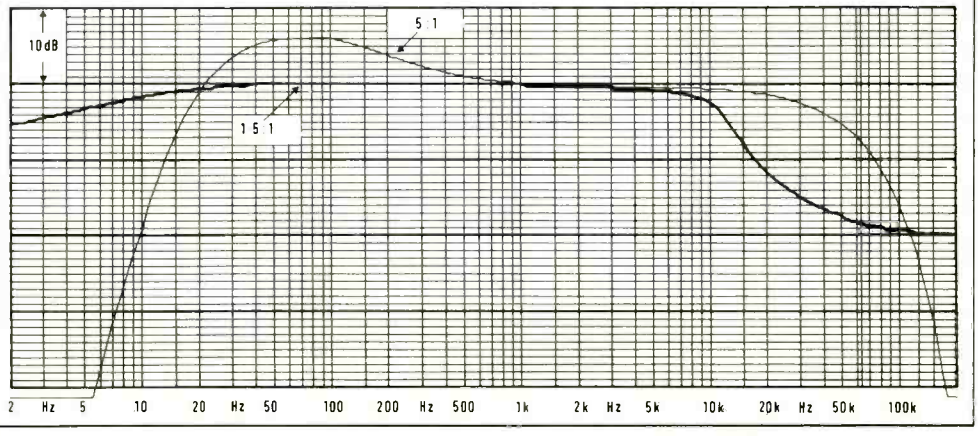
FIG.12
dbx 904 NOISE GATE
RESPONSE 1kHz TONE WITH SWEEP



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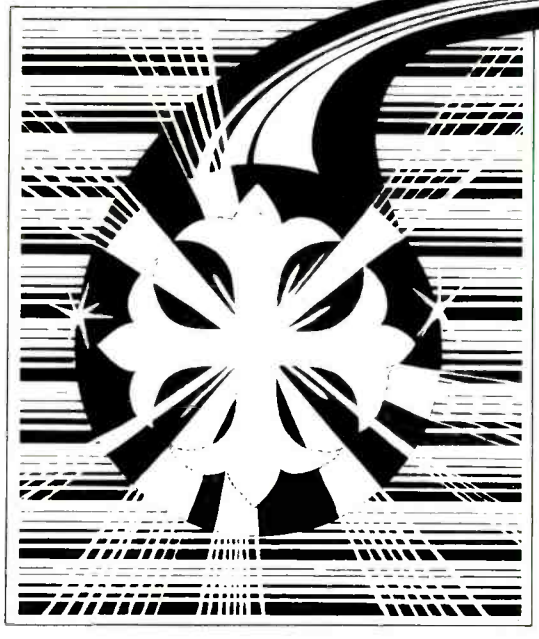

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freqency distortion increasing dependent upon the attack and release time settings.

Intermodulation distortion to the CCIF twin tone method was measured using tones separated by 150 Hz centered on 1 kHz and 10 kHz and found to vary enormously with the release time setting.

At the maximum release time the distortion was constant with centre frequency and depended upon the gain reduction ratio irrespective of the input level and amount of gain reduction. Typically the distortion was 0.3% at 3:1 gain reduction ratio increasing to 0.5% at 5:1 gain reduction ratio.

Gain reduction, attack and release

The steady state gain reduction ratios were as shown in **Fig 14** for a +10 dB threshold setting at the mid setting and extreme settings of the ratio control, the plot accurately following the specified ratios.

The attack and release envelopes took the form shown in **Fig 15** where the upper trace is the input waveform with 3:1 gain reduction leading to 20 dB indicated reduction on the fast metering. Varying the attack time control led to stable gain conditions in 2 ms in the fast setting or 25 ms in the slow setting without overshoot or distortion even at low frequencies. Similarly the release time control offered clean release waveforms taking between 6 ms and 600 ms according to the control setting.

Sensibly the programmed latch mode did not release on transients but required a signal exceeding the threshold for at least 6 ms before releasing.

As with any type of compressor or expander some care is needed to select appropriate ratios and operating times if unpleasant sounds are to be avoided. With suitable settings the noise gate was relatively unobtrusive in use, the attenuation limit control being particularly useful.

905 parametric equaliser

The high, mid and low frequency sections each have three front panel controls, a frequency potentiometer giving overlapping bands and a dual concentric potentiometer. The outer knobs set the cut/boost over a nominal ±15 dB range with the inner knobs altering the Q of the filters. An additional feature of the Q control is a switched position when fully anti-clockwise providing an 'infinite' notch for the removal of unwanted tones in each band.

Whilst the equalisers are normally of the peaking type the high and low frequency sections each have a locking pushbutton switch with a warning LED to switch these sections into a shelving mode.

The remaining front panel features are a red overload LED and the equaliser in/out switch with a warning LED, there being four preset controls on the printed circuit board.

Inputs and outputs

The electronically balanced input was found to have an impedance of 21.8 kΩ working balanced or 10.9 kΩ when working unbalanced. In the balanced mode the common mode rejection was 57 dB below 10 kHz decreasing to 55 dB at 20 kHz with the maximum permitted input being +24.5 dBm balanced or unbalanced.

At the output the unit could drive +25 dBm from a suitably small source impedance of 22 Ω, the gain from the input to the output being within ±0.5 dB with the controls in the 'flat' position within the audio band. With the unit switched out of circuit the input terminals were connected directly to the output terminals without buffering.

Frequency response

The overall frequency response with the frequency and depth controls in their mid position is shown in **Fig 16** which demonstrates a sensible high frequency roll off with the response in the audio band being within ±0.5 dB.

With the three sections in the notch mode at the mid frequency setting the response was as shown in **Fig 17** and the frequency range and maximum attenuation is given in **Table 5.**

At the mid frequency setting the maximum

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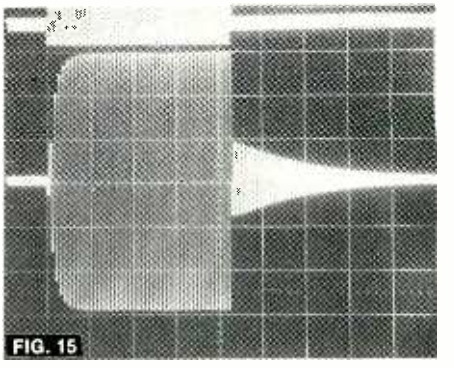


FIG.14
dbx.904 NOISE GATE
STEADY STATE GAIN REDUCTION

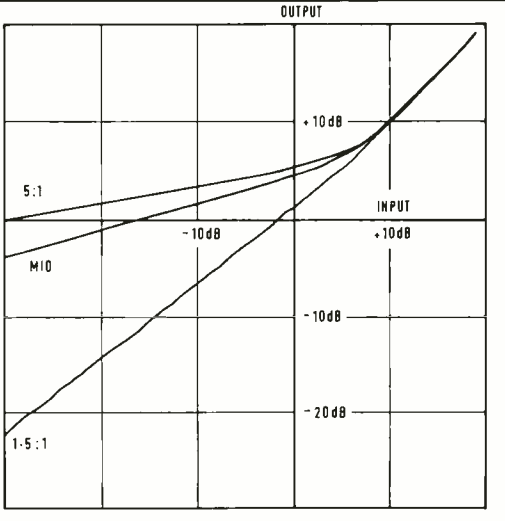


FIG.16 dbx 905 PARAMETRIC EQUALISER OVERALL FREQUENCY RESPONSE

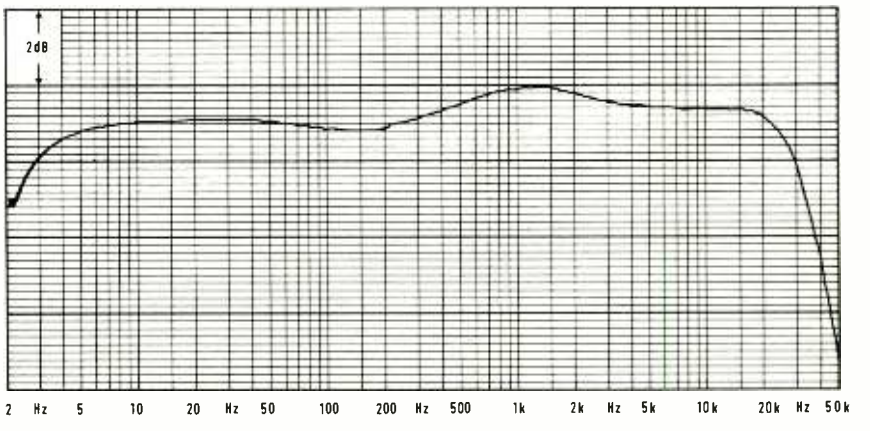
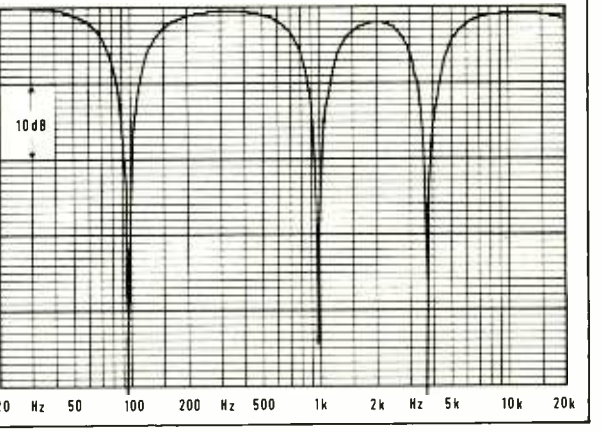


FIG.17
dbx 905
PARAMETRIC EQUALISER
RESPONSE WITH THREE
SECTIONS IN NOTCH MODE



AKG
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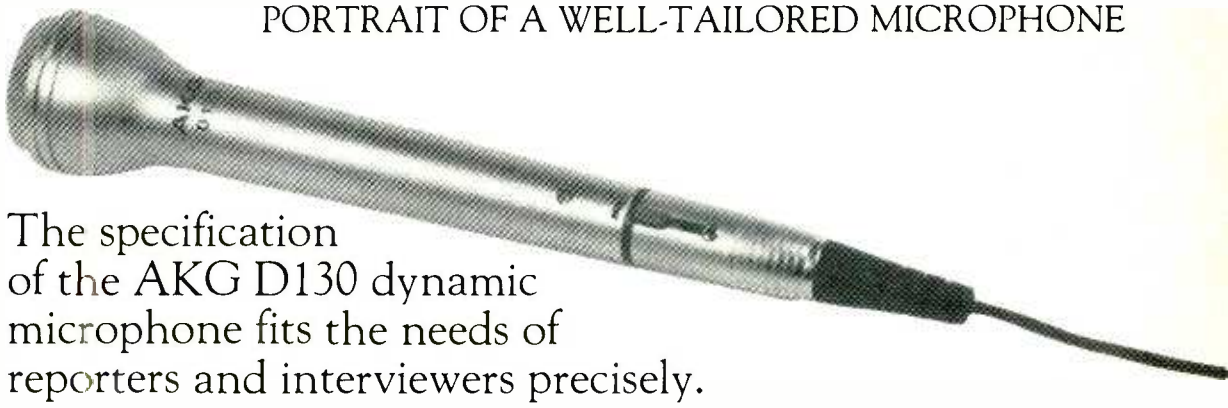
PORTRAIT OF A WELL-TAILORED MICROPHONE



The specification of the AKG D130 dynamic microphone fits the needs of reporters and interviewers precisely.

The omni-directional polar pattern, the insensitivity to handling noise, the robust metal housing and the frequency response tailored for speech purposes have made the D130 first choice for many broadcast stations.

The sintered bronze cap reduces wind and pop noise and the entire unit is extremely resistant to inclement weather, making the D130 an ideal microphone for outside location work.

All in all, the D130 is decidedly a cut above the rest. Whatever the weather.

Technical Specifications

- **Directional characteristics:** omni-directional
- **Frequency response:** 50 to 14,000 Hz
- **Sensitivity at 1000 Hz:** 1.7 mV/Pa (0.17 mV/μb) ≙ − 76 dBV
- **Impedance at 1000 Hz:** 220 ohms
- **Max. sound pressure level for THD of 1%:** 50 Pa ≙ 128 dB SPL
- **Hum sensitivity at 50 Hz:** 3μV/5 μT
  at 100 Hz: 6 μV/5 μT
- **Permissible climatic conditions:** temperature range: −10°C to +65°C relative humidity: 90% at +20°C
- **Connector:** 3 pin XLR-type
- **Housing material:** die-cast zinc alloy, non-reflective nickel plated
- **Dimensions:** 43 Ø × 173 mm (1.7 Ø × 6.8 inch)
- **Net weight:** 240 g (6.8 oz)

AKG

To: **AKG Acoustics Ltd.** 191 The Vale, London W3 7QS
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TABLE 5

Equaliser	Minimum frequency	Attenuation	Maximum frequency	Attenuation
Low	21.4 Hz	>80 dB	501 Hz	55 dB
Mid	216 Hz	>80 dB	4960 Hz	45 dB
High	814 Hz	68 dB	19.9 kHz	47 dB

TABLE 6

Measurement method	Noise in dBm Flat	Shelf up	Shelf down
22 Hz to 22 kHz RMS	– 72.5	– 72.5	– 68.5
A-weighted RMS	– 83.5	– 83.5	– 77.5
CCIR-weighted RMS ref 1 kHz	– 78.5	– 78.5	– 69.5
CCIR-weighted quasi-peak	– 74.5	– 74.5	– 65.0
CCIR-weighted ARM ref 2 kHz	– 85.5	– 85.0	– 76.0

attenuation was between the above figures which applied with the high and low sections set to the peaking mode. If the shelving mode was selected the high frequency limits fell to 102 Hz and 3960 Hz with the maximum attenuation being unaffected. The overlapping frequency ranges of the three sections allows the attenuation of two sections to be combined to obtain even deeper notches, tuning of the frequencies being easily accomplished.

The characteristics of the low frequency equaliser are shown in **Fig 18** for the minimum and maximum frequency settings for maximum cut, boost and Q. The shape of these curves is very good. Whilst the Q control has no effect in the shelving mode its range in the peaking mode is shown in **Fig 19.**

Similar characteristics were exhibited by the high frequency equaliser as shown in **Fig 20** for the 800 Hz settings. The general shape of the curves was similar at other frequencies with a degree of mid frequency shift at extreme cut/boost settings. This comment also applies to the peaking mid frequency equaliser with its frequency range being 200 Hz to 5 kHz. The similarity of the curves were such that frequency plots have not been included in this review.

Noise

Noise in the output was measured with the equalisers flat and under various cut/boost conditions where the noise remained virtually constant with cuts but increased when boosting. **Table 6** shows the output noise when flat and with the high and low frequency equalisers at their mid frequency setting at maximum shelving up/down.

Bearing in mind the available headroom the above represents a good performance with the unit being free from hum or other extraneous tones.

Distortion

The second and third harmonic distortion above 100 Hz remained below 0.01% at any input/output level but at 20 Hz the second harmonic rose to 0.1% and the third harmonic to 0.02%.

Intermodulation distortion to the CCIF twin tone method was also very good remaining below 0.01% at any frequency within the pass band of the equaliser.

It was found that the overload LED was very fast in action operating 1 dB below waveform clipping under a variety of overload conditions.

Summary

The dbx *900 series* frame and modules were to a good standard of construction with all components being clearly identified for servicing. However, at the time of writing, very little information about the modules was available.

All the modules reviewed had a good performance standard, in virtually all respects meeting the manufacturer's claims.

Overall the *900* system is a most versatile signal processing system which can be readily configured to meet any particular requirements with the minium of difficulty. **Hugh Ford**

Hugh Ford comments: Some time after writing this review the preliminary instruction manuals for the system were made available.

These manuals include a considerable amount of user information such as connection instructions and general operational information. In addition some information is given on user modifications such as linking stereo units and modifying time constants.

Whilst circuits are included no servicing information as such or information about the functions of internal preset controls is given: the only advice being to return any faulty units to the manufacturer.

FIG.18 dbx 905 PARAMETRIC EQUALISER LF EQ CHARACTERISTICS

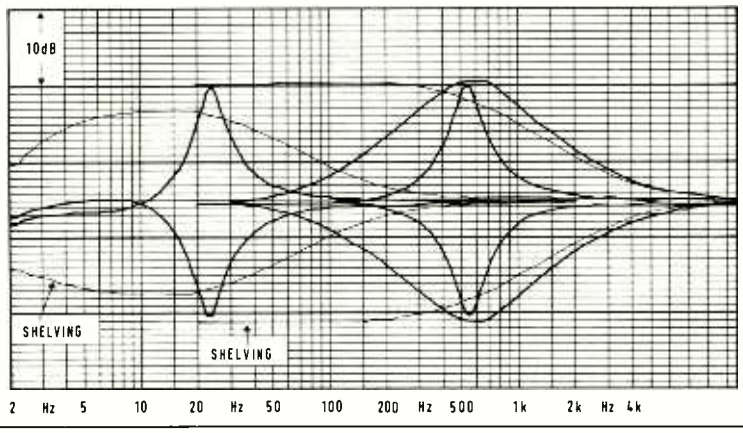


FIG.19 dbx 905 PARAMETRIC EQUALISER LF EQ AT 100Hz Q CONTROL IN PEAKING MODE

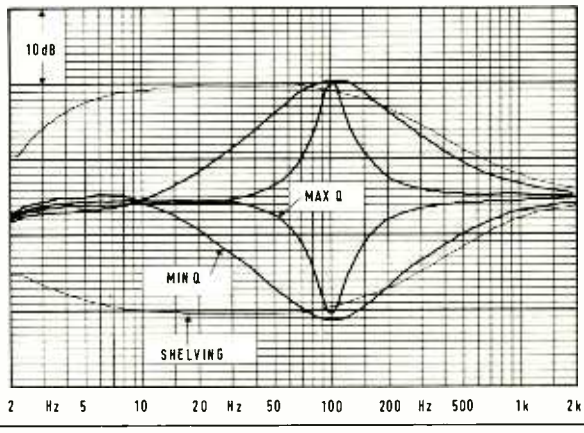
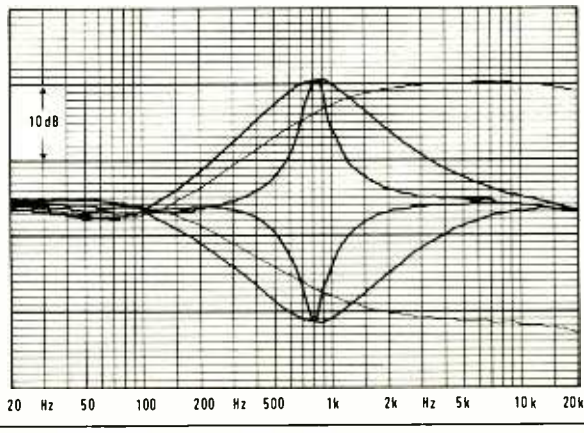
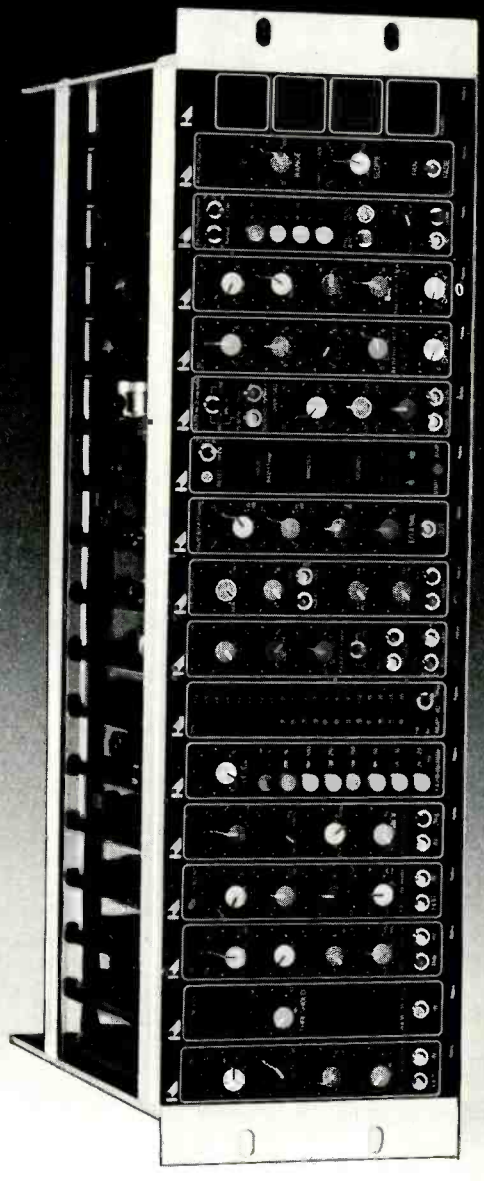


FIG.20 dbx 905 PARAMETRIC EQUALISER HF EQ AT 800Hz



Rebis RA200 Series

The No1 Gate



The No1 System

Get the full facts on the most creative modular system in the world.

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TRIDENT TSM 40 input		**£27000.00**			
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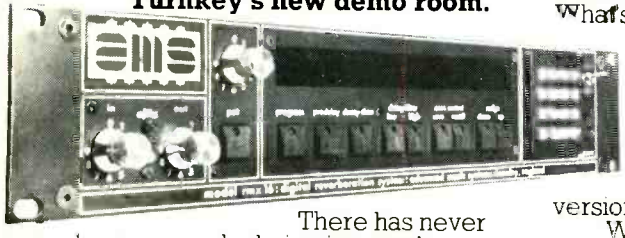

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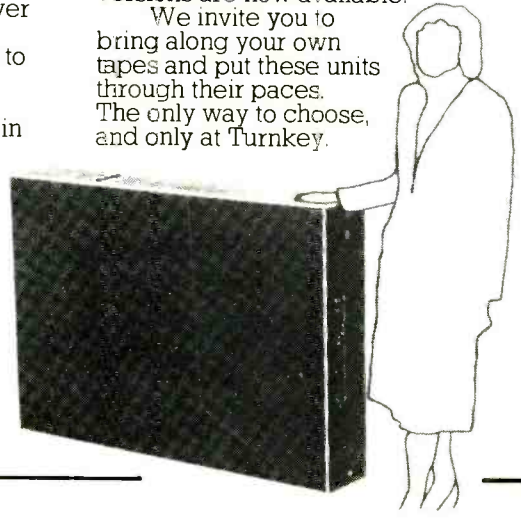

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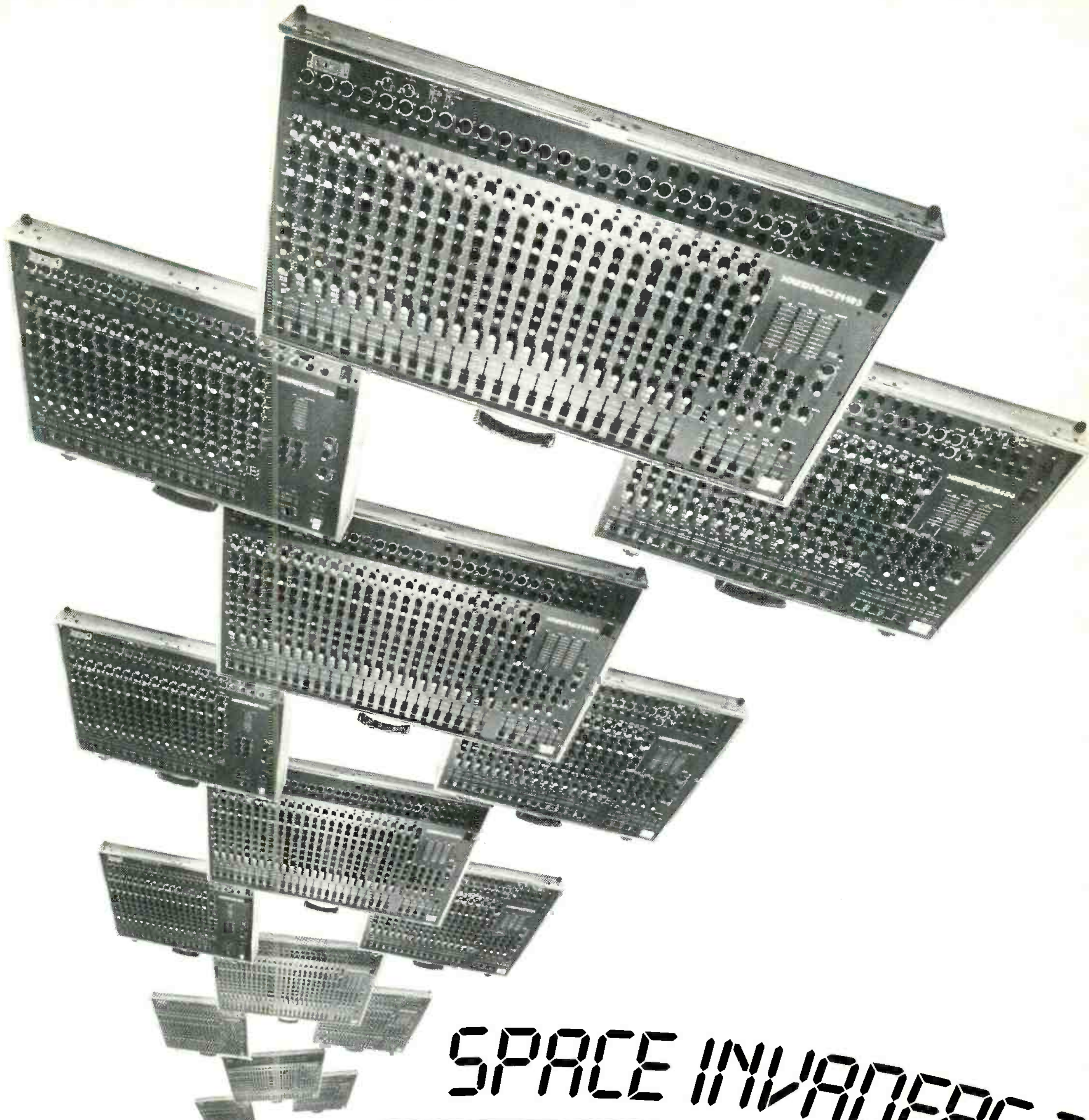

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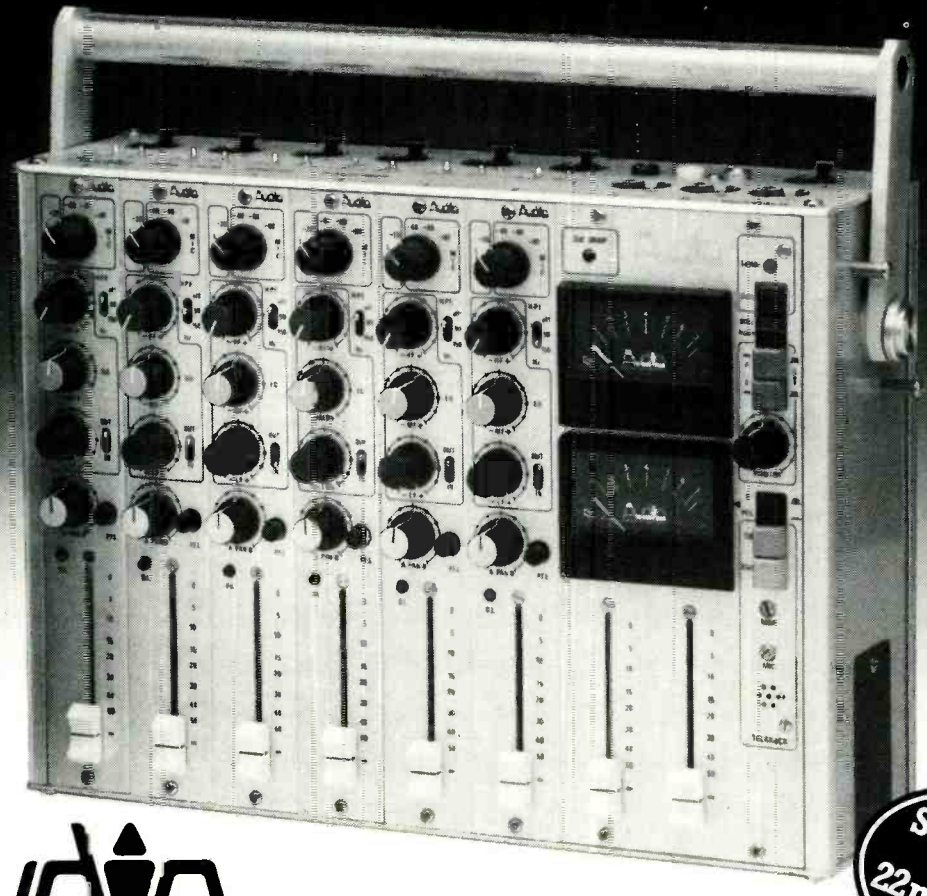

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natural Progression

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You can set up everything from a single mono mix, to a stereo mix to an eight channel direct feed for your multitrack. You can even set up all three mix feeds at once!

You've got the flexibility to insert effects to individual channels. And you'll appreciate the convenience of the tape return to the monitor section.

An instant, easy way to check your tape, or the output of an outboard compressor.

With Mic/Line switches on all channels, audio and video squad people can monitor multitrack playbacks without patching – just press a button. Multitrack mixdown in the field? Absolutely. And with no compromise in quality because you feed line inputs directly – NOT padded down through the mic. preamp. You'll love the ability to edit electronically through the flexible Solo system and channel mute... It can be a great time saver.

Doing a live remote? THE LOCATION MIXER is perfect. All four mix busses (2 main, 2 AUX) drive a 600ohm line to 20dBm (with balanced Xfmr option) giving both mono/stereo and back up feeds at the same time. And the ability to solo pre or post fader with the channels on or off makes set-up and trouble shooting a bad cable or mic. easy.

What's in THE LOCATION MIXER for film people? Plenty! No more battery or power supply hassles for your T-power mics. Just flip a switch. And there's a low-cut filter ahead of the mic. transformer to keep wind and boom movement from saturating your tape. This filter is independent of the EQ section. The EQ itself has sweepable mid, detented pots for resetability and can be totally bypassed with the EQ in/out switch. Need a quick talk-back system for your boom man? Just use the pre fade Aux bus on an unused mic. input, and he can hear his mic., cues, and your closed-circuit directions – his own custom mix!

For reliability and quick positive switch indication, we've used self-indicating colour-coded push button switches that – along with colour-coded knobs – keep you informed of control status at a glance.

So for your next location job, get a LOCATION MIXER and you're ready for anything.

***Just unlock it, open the cover and you'll find the most versatile 8- input mixer you ever uncovered. Compare features, compare performance, compare price. You'll choose* THE LOCATION MIXER.**

AT £975.00 CAN YOU AFFORD NOT TO?

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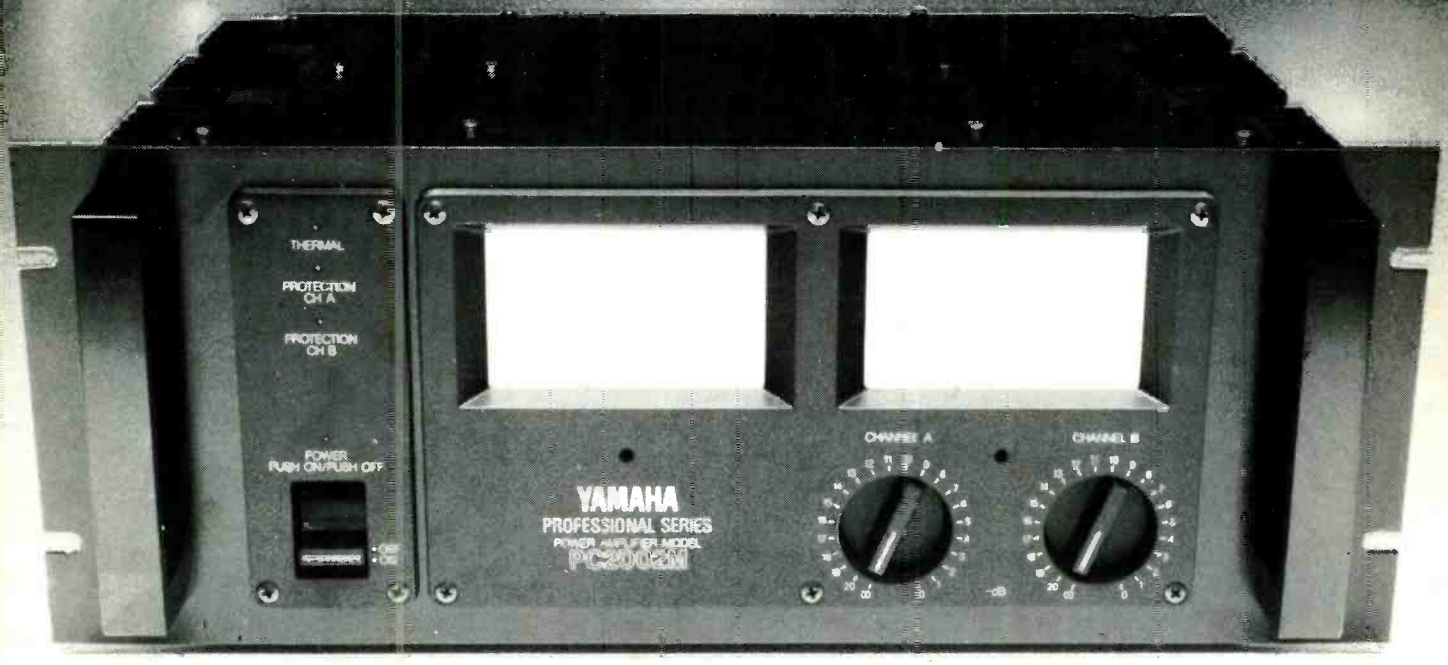
The Quiet Powerhouse

We're talking about noise, not volume



True, the main purpose of any high-power amplifier is to pump out high-power sound, and in this respect the Yamaha PC2002M is up there with the best of them. But any amount of volume won't help if the sound reproduction is poor, prone to hum and noise, or just plain distorted.

And that's where the design of the Yamaha PC Series scores. For a start, we've used two large-area, side mounted heat sinks, diffusing excess heat thoughout the whole structure, doing away with noisy and potentially unreliable motor-driven cooling fans. And the excellent thermal dispersion is backed up by newly designed protection circuitry which senses the unlikely onset of thermal stress, as well as protecting against DC offset and excessive peak power levels.

Moreover, the PC circuitry is designed for barely measurable distortion — less than 0.05% THD at its conservatively rated full output of 240W + 240W into 8 ohms. A flick of a rear-panel switch transforms the PC2002M into a 700W Mono amplifier ideal for parallel full-range systems and the like.

*The PC2002 is identical to the PC2002M but without the twin Peak Output meters.

Add to all this a smooth, accurate frequency response (10Hz -50kHz), a slew rate of 60 Volts/microsecond even at maximum output, and the result is an amplifier that can power anything from broadcast and recording studio systems to Disco or Rock PA, with hum, noise or distortion definitely a thing of the past.

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Because quality matters just as much as power.

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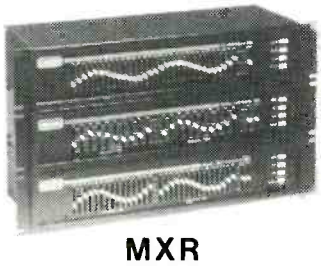

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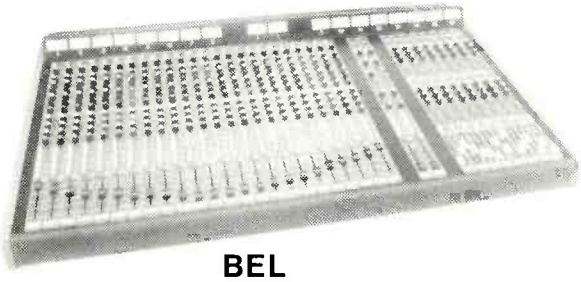

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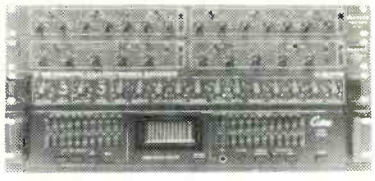

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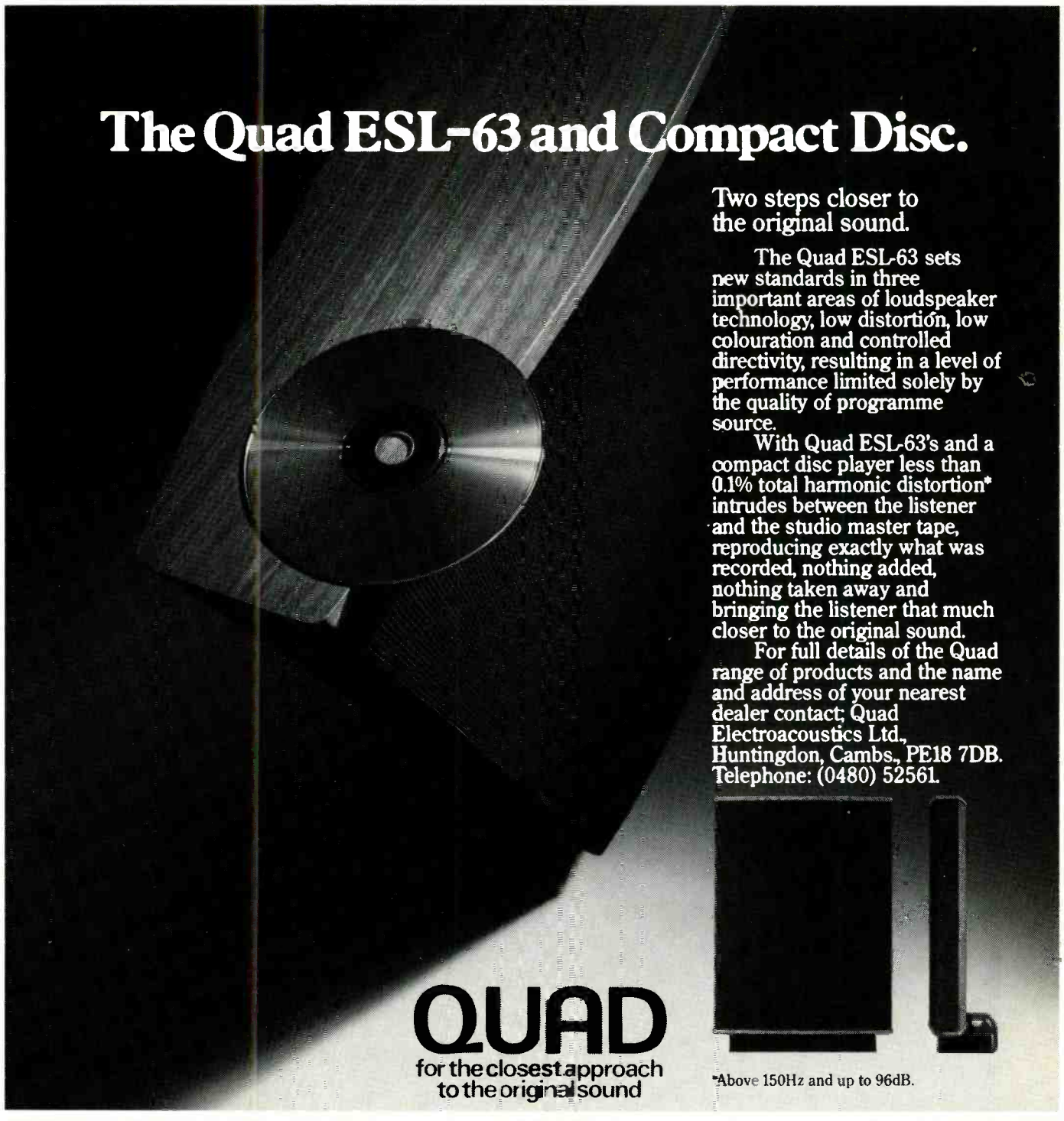

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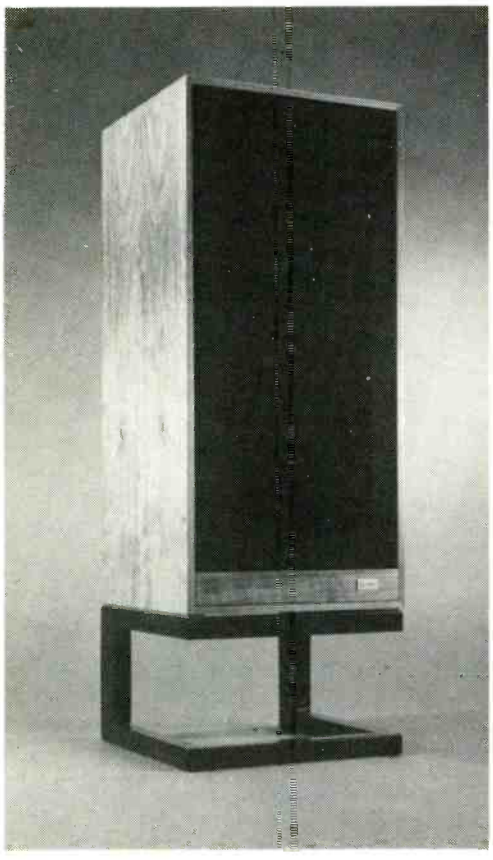

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The new Spendor SP1 loudspeaker has been developed from the standard BC1 system, over two thousand of which are in use with broadcasting studios worldwide.

The SP1 possesses the neutrality and transparency of the BC1 together with increased power handling, sensitivity and improved bass control.

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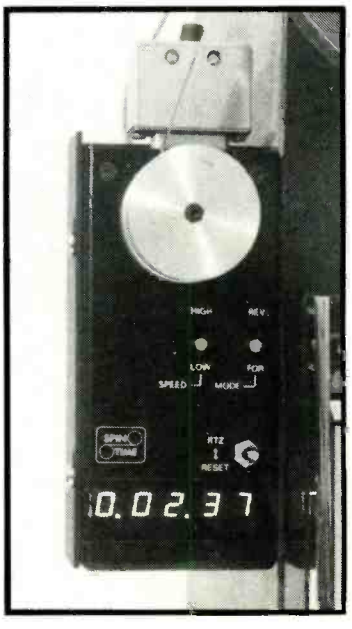
SUCCESS IS GOOD TIMING



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Room Simulation

More than just a Reverberator.

Applications and Operation

It is QUANTEC's aim to present the sound engineer the most comprehensive tool for influencing the diverse parameters relating to room acoustics. Conceptual ideas pertaining to acoustical size and capacity of any selected space may be accurately reproduced via the clearly defined acoustical parameters of the reverberating signal. Whether employed for film sound dubbing, theater-, or musical productions, the QRS serves all demands of any given room acoustic simulation. E.g., it enriches the typically sound-insulated character of a commentator's or speaker's chamber in the process of film synchronisation and creates the natural sound concomitant to the staging of the film.

This sophisticated tool is completely stereophonic, and the first reflection, which may be separately adjusted in level and delay time, appears on an opposite side of the stereo image. Besides being able to define the spatial volume in cubic meters, further parameters available are the reverberation time and its high- and lowfrequency deviations, as well as the ability of defining both level and time delay of the reverberation effect at will and in fine increments. All eight parameters of each adjustment are simultaneously displayed on the front panel of the mainframe as well as on the remote-control unit connected to it.

The built-in nonvolatile memory fixes up to 64 parameter combinations of which several are pre-programmed by the manufacturer, the largest portion being left open to the operater's discretion. The special "Enhance-Programme" provides new dimensions in stage- and film productions. The "Freeze-Effect" (i.e. infinite decay time) enables continous overlapping, or addition of successive entries, and allows for instantaneous building up of choral effects as well as the creation of impressive sound clusters. The QRS corresponds to the very latest demands placed upon operational efficiency, ton quality, and reproduction as well as technical conception to meet the standard of professional broadcast utilization and recording industry.

Display and Programming

The input and output levels are displayed by a total of six LED bar graphs spanning the intire dynamic range of -78dB to +12dB. The clearly legible LED display panel provides instant information concerning all adjustable parameters. Accurate and rapid programming and operation are guaranteed by sensitive touch buttons and a comprehensively elaborated logic system. To programme a given value, a pair of touch buttons corresponds to each indicator, whereby the desired parameter is selected by a quick touch of the proper button, thereby also allowing the so chosen parameter to be further adjusted until the following one is actuated in its turn. This readiness for adjustment is indicated by a short, intermittent flashing of the corresponding LED readout. Upon having chosen a particular value, adjustments may either be accomplished through further tapping of the set of buttons or via a centrally positioned, rotating knob.

The memory section is devided into 8 files of 8 locations and enables a clear definition of parts of memory, e.g. for different users. By means of an ingeniously designed operational logic, it is possible to transfer parameter combinations within a file and from file to file, in order to reorganize the stored programmes. A safety circuit prevents unintended erasing or altering of memory contents. Of course all stored programmes are safe in case of mains faults and long periods without power supply.

Technical Concept and Connections

The QRS, via its computerized systems, reproduces more than 10000 reflections per second, constituting the basis of pure and bounce-free reverberation. Due to a completely new conception of the antialiasing filters an almost total subduing of the often-discussed "roaring" and "ringing" of conventional filters is accomplished. High-efficient RF-lowpass filters at the inputs of the A/D-converters eliminate all problems of RF demodulation effects.

The QRS has a total of six connections comprising XLR plugs: 2 inputs (left and right) and 4 outputs. The QRS is provided with XLR connectors: Two inputs (stereo) and four non-correlating reverb outputs (quadro). In addition outputs 1 + 2 contain the mix with the first reflections appearing on the opposite side.
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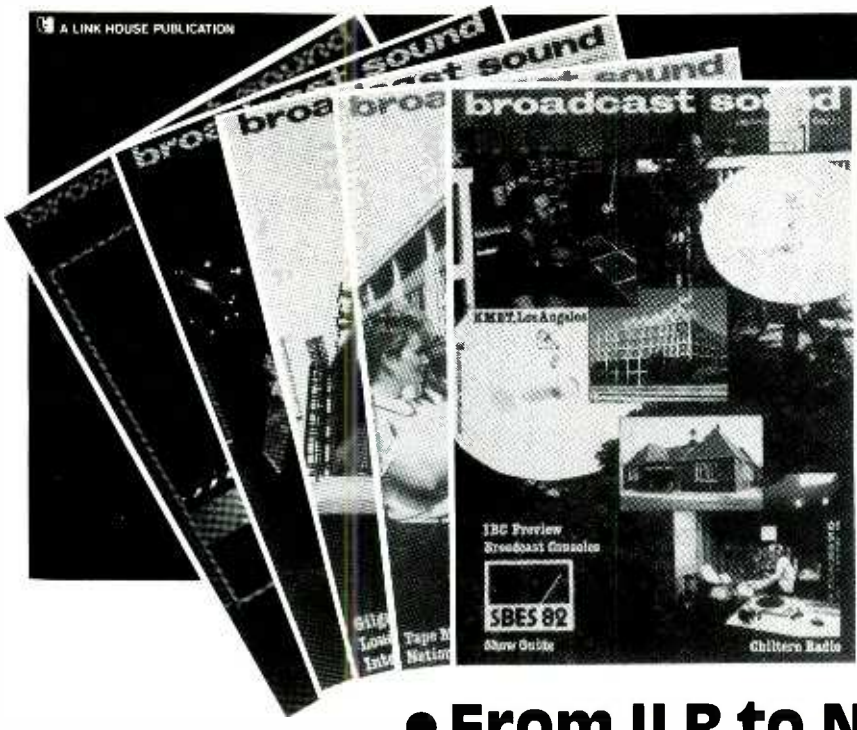

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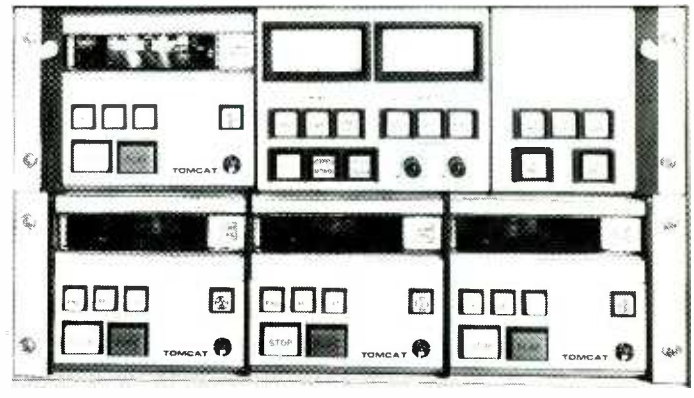

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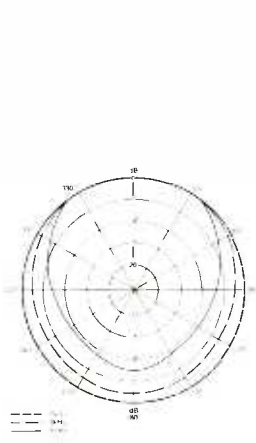

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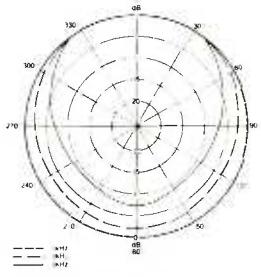

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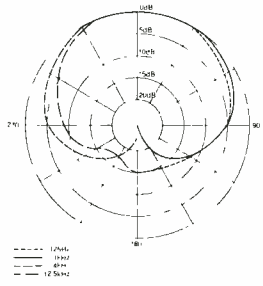

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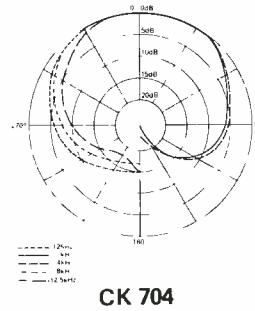

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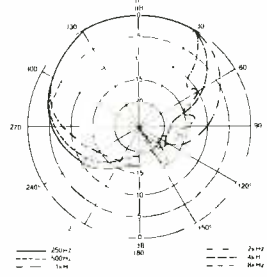

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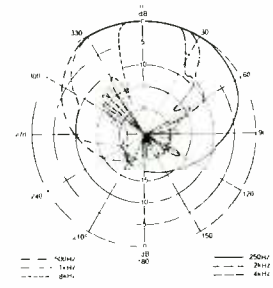

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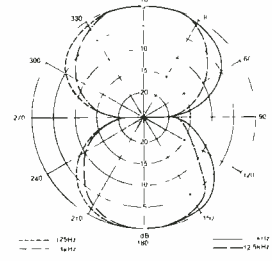

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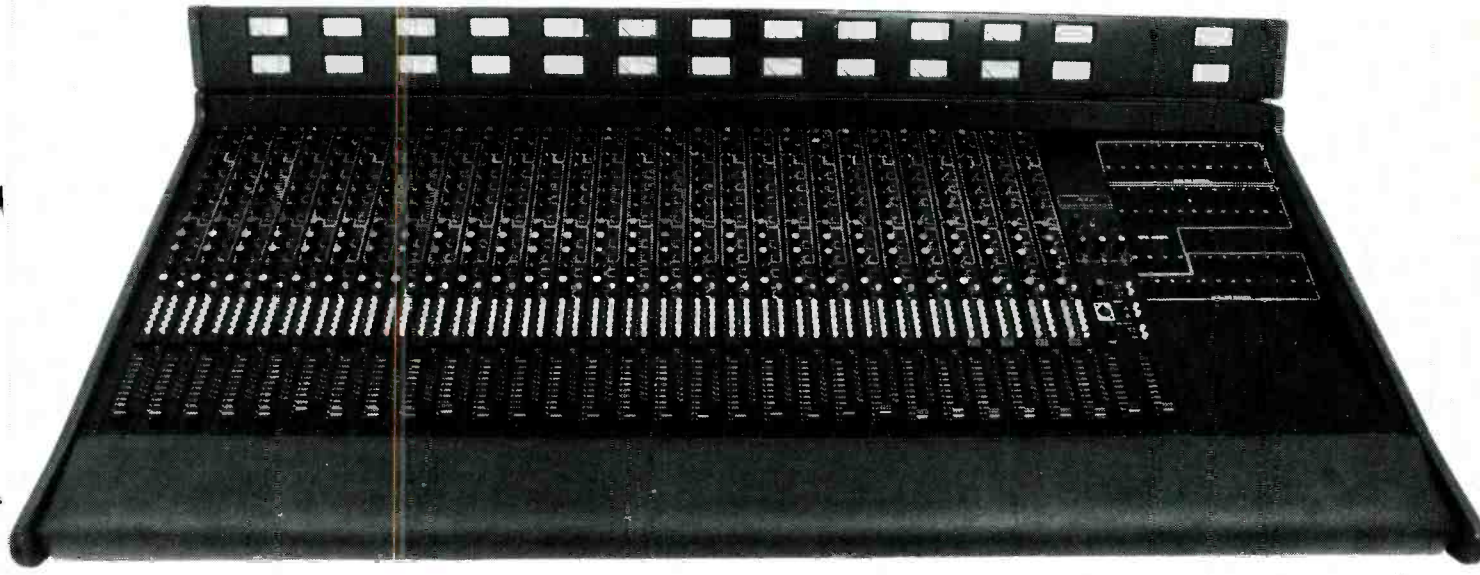

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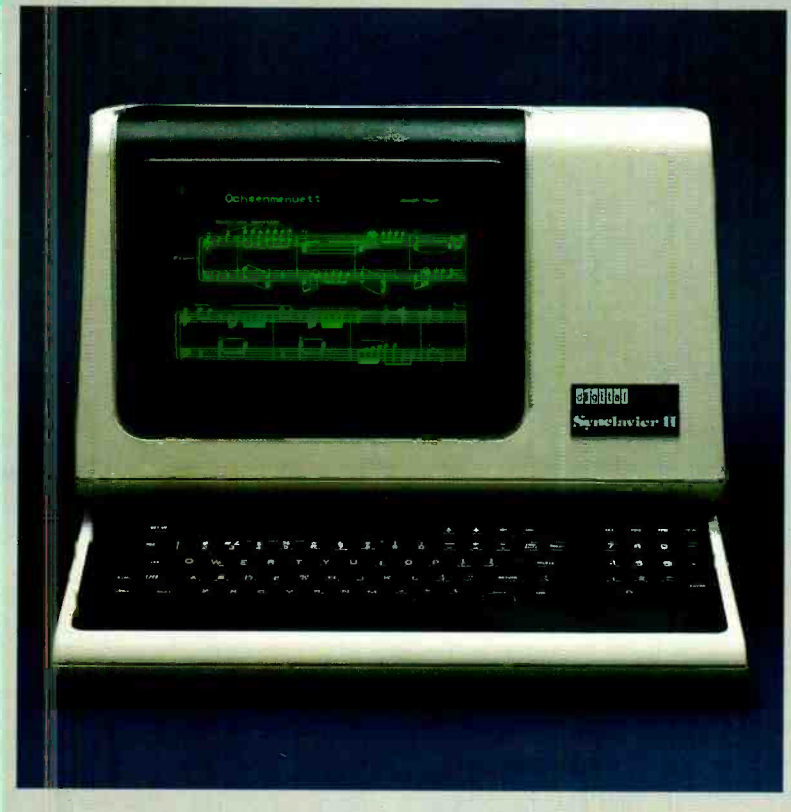

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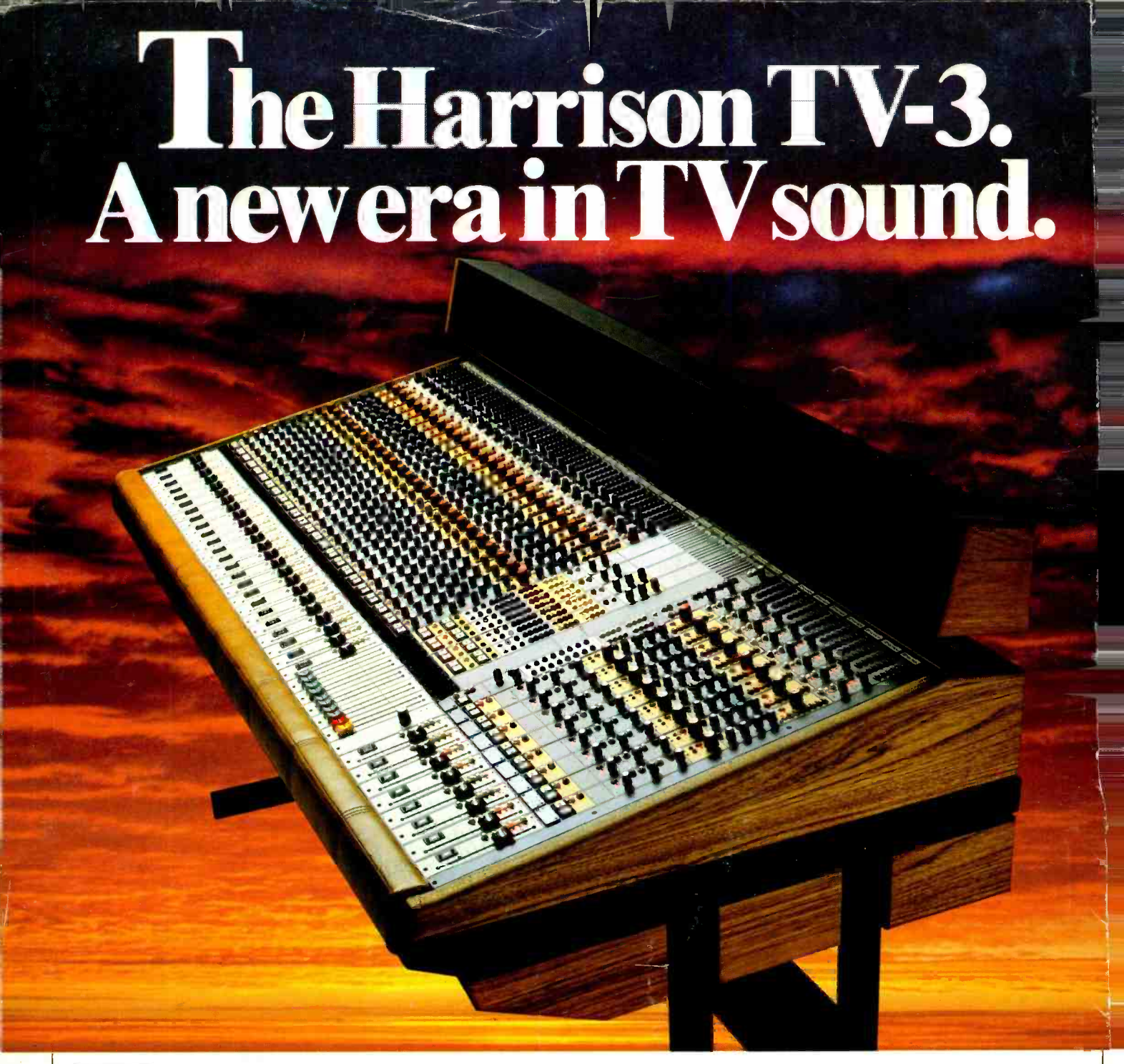

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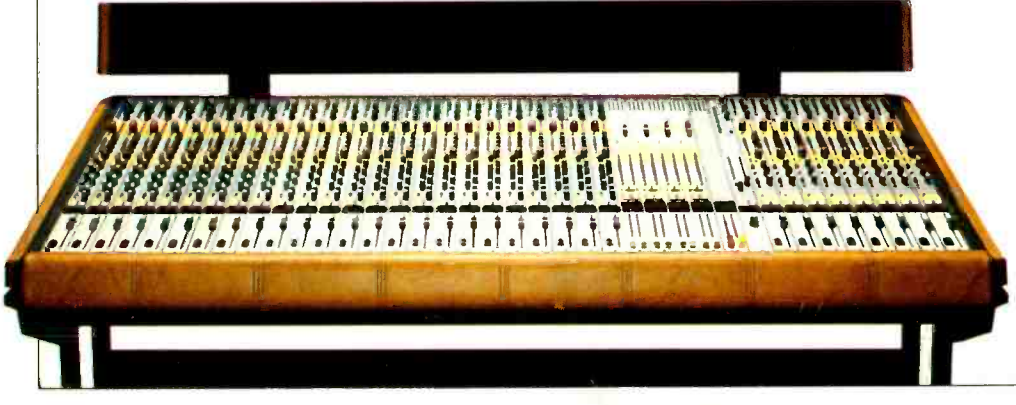

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