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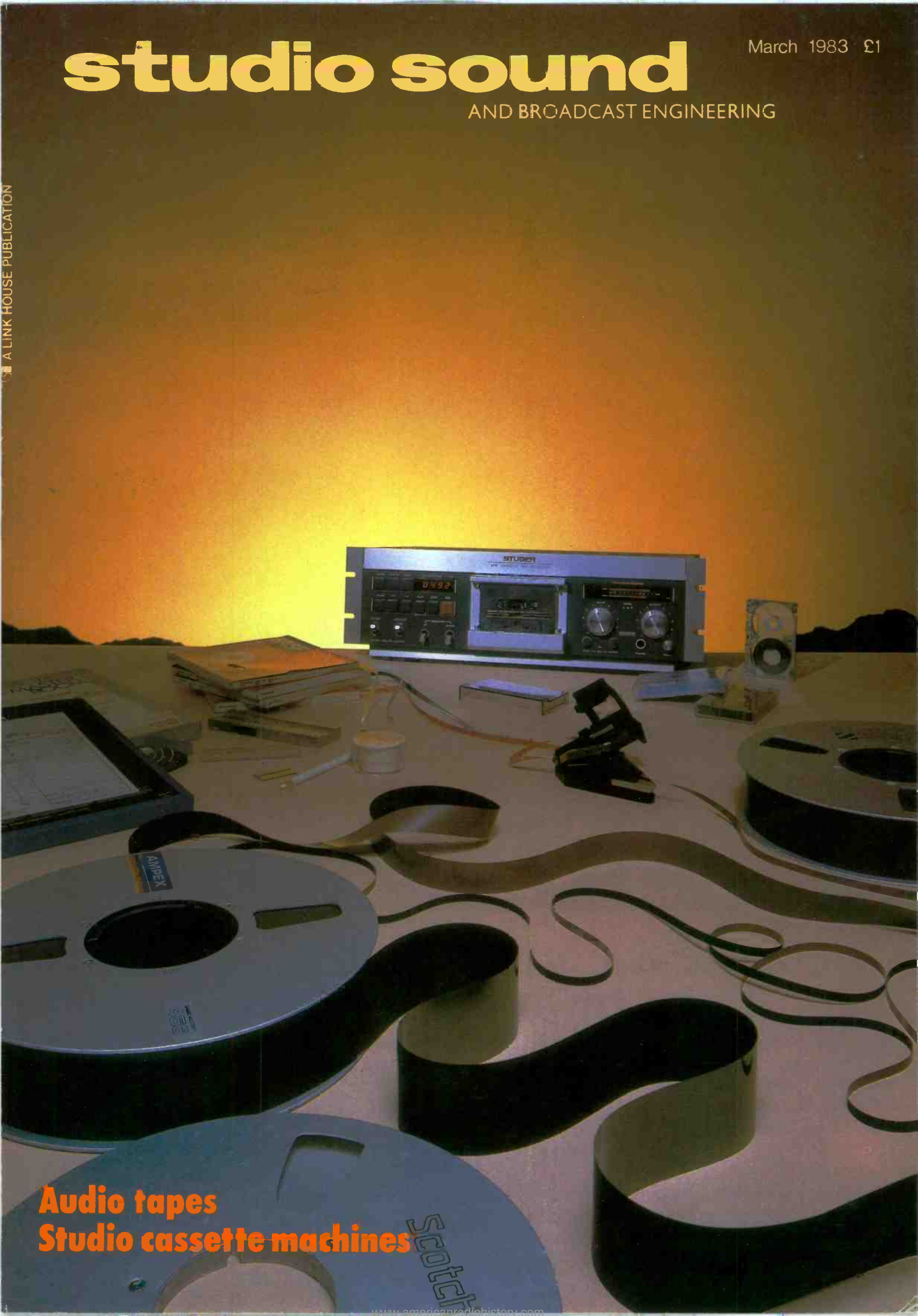
AND BROADCAST ENGINEERING

March 1983 £1

A LINK HOUSE PUBLICATION



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AND BROADCAST ENGINEERING

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A LINK HOUSE PUBLICATION

ABC MEMBER OF THE AUDIT BUREAU OF CIRCULATIONS

Cover by Roger Phillips

Clean up your masters!

By the time you read this, *Compact Disc* players will just be appearing in the UK shops. Our sister magazine, *Hi-Fi News & Record Review*, seems to have managed to assemble around a dozen different players which will soon be enticing us to dip into our pockets for the chance to enjoy music which, by rights, should be virtually identical to that heard in the studio control room when the master was played back. Various people we know have been playing with them and, with one or two exceptions, they've been pleased with the hardware and what it offers.

They haven't, however, been quite so enthusiastic about the software: not because there isn't any (there is in fact quite a lot) and not because the manufacturing process is not quite together yet (by all accounts, it is) but because of the quality of the recordings which are being transferred. Common demo discs seem to have been originated as early as 1977, when the chances of multitrack digital recording being available would have been very small, and even stereo systems were in their early days. There is no doubt that modern digital mastering systems have a significant edge on those available even a couple of years ago, but even this isn't quite the problem. What is noticed is imperfections, often in the multitrack master, which show up on the disc: modulation noise on exposed piano passages; tape hiss coming up at the beginning of tracks. A number of things which never mattered before are now being shown up in all their unimaginable glory. Disc after disc, recording after recording has been listened to critically, and found wanting. This may prove to be a problem when conventional recordings are remastered for *CD* release.

Some have pointed out, quite rightly, that the best we can expect with such recordings is a good replica of what was heard in the control room. "At least," one composer has said to me, "we will be certain that the consumer will be hearing what *we* heard. There won't be all the problems with pressing faults, surface noise, eccentricity and warps. That alone is a great advance, isn't it?" Of course, it is. The trouble is that some recordings are revealing problems which were previously masked by the analogue transfer and manufacturing processes. The result will be *Compact Discs* which vary widely in perceived quality between recordings.

All this is compounded by rather dubious labelling. 'Digitally Mastered' can mean rather too many things, as can 'Digitally Recorded', just 'Digital', and all the other things that record companies have, and will, put on their records. Obviously, any *Compact Disc* has got to have some kind of 'digital recording' process involved somewhere along the line, or it wouldn't be a *CD*. But do any of these terms tell you, unambiguously, how the recording was made? Basically, no. The record could have been recorded on a digital multitrack (in which case mixing analogue would seem to be rather unlikely); it could have been recorded multitrack analogue and the mix recorded digitally; or it could just have been an ordinary analogue tape transferred to digital to make the disc. There are several possibilities, all of which could be claimed to be 'digital', although some are more digital than others. It is difficult to see how these different methods could be classified so that the listener knew what to expect, and even if there *was* an obvious method, I can't see the majority of record companies using it. Up to now, we have been used to a 'digital' flash on a record sleeve being used to help sell analogue pressings. Soon, that will be turned on its head: 'digital' will be obligatory, and you simply won't be told 'how digital' a recording is, because any admission of an analogue component will be a pointer to less than maximum quality – or at least it will be interpreted as such.

The next problem is, of course, that this situation will continue until every album is recorded and mixed digitally. This will not be for a few years. Until then, artists, producers and engineers will have to be ultra-critical in the studio, at every stage of the recording process. This is likely to be both time-consuming and expensive, and most people will already consider themselves to be critical enough.

We may have lumbered ourselves with a domestic technology that will be difficult to match professionally. There are already those who say that domestic hi-fi speakers are generally better than studio monitors. Now we have a whole domestic setup that is capable of better quality than the vast majority of studios. It will be a trap that will cost a good deal of money to get out of, at just the time when we don't have any. Oops.

Richard Elen

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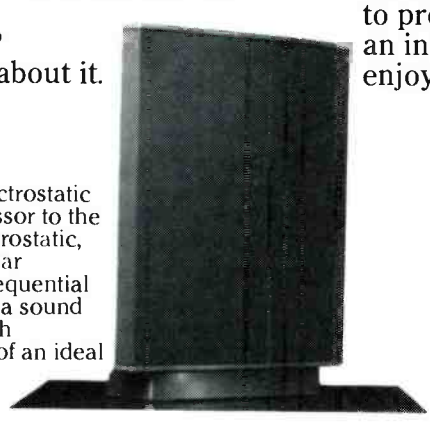

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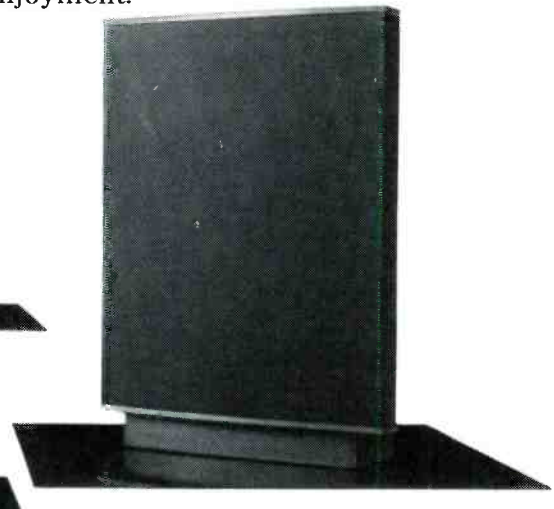

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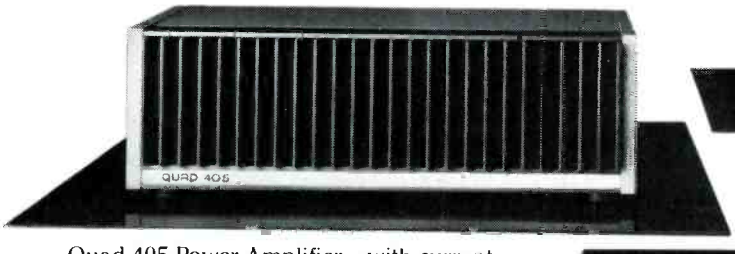

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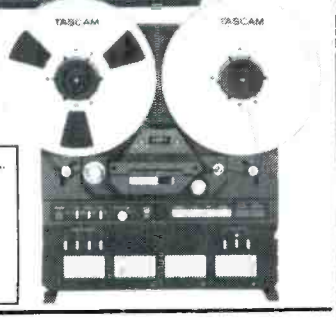

currently on special offer — the 34 recorder with the Seck 10×4 Mixer.

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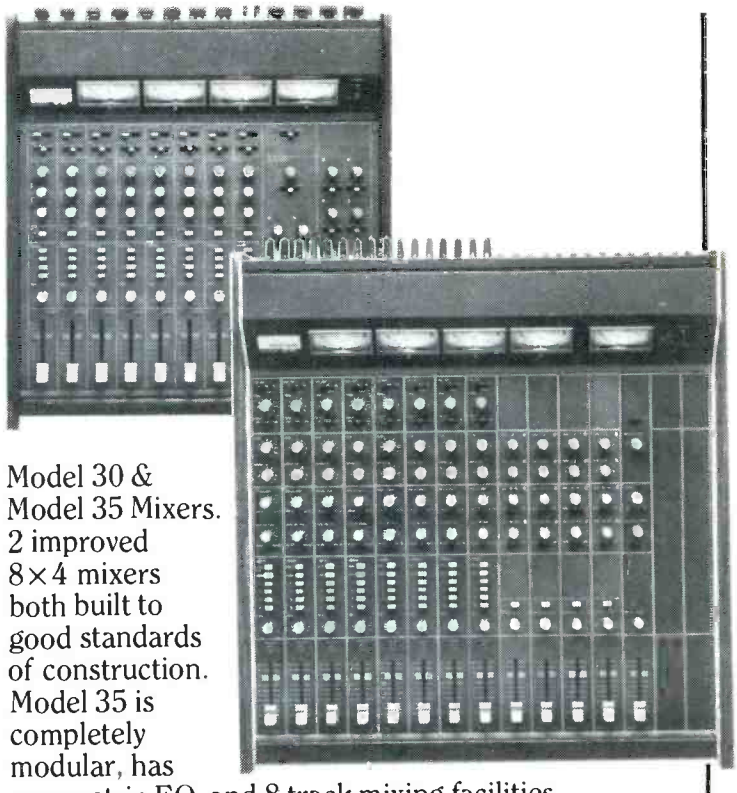

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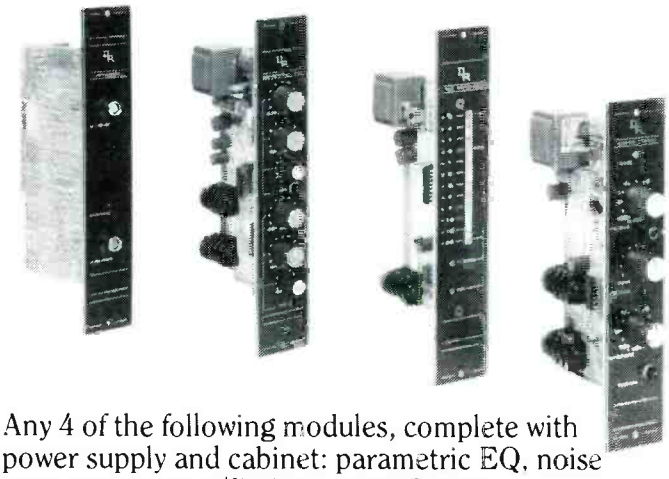

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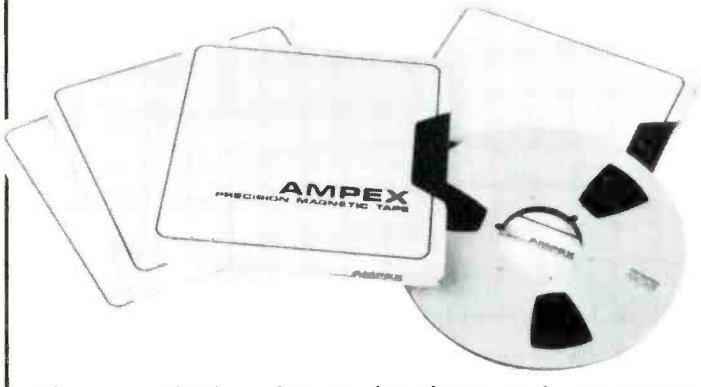

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Tascam 4-track	50	30	20
Tascam 38 8-track ½"	90	50	30
Otari Mk.III-8 8-track ½"	110	60	40
Itam 8-track 1"	150	80	50
Itam 16-track 1"	200	120	75
Otari MTR90 24-track 2"	600	400	150
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Tascam Model 30 8×4	40	25	10
Fostex 350 8×4	35	20	10
Itam Stereo 8 8×2	45	25	15
Seck 10×4	25	15	10
Seck 16×8	75	40	25
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Itam 14×4 8-track monitor	100	60	35
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VARIOUS			
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Quad 405 amp	20	10	—
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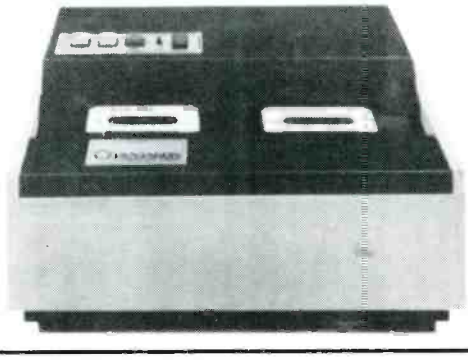

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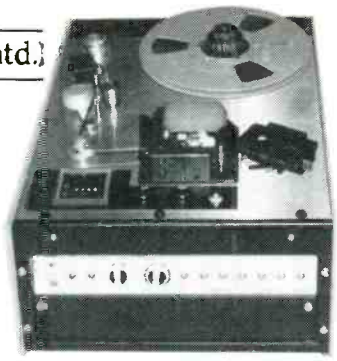


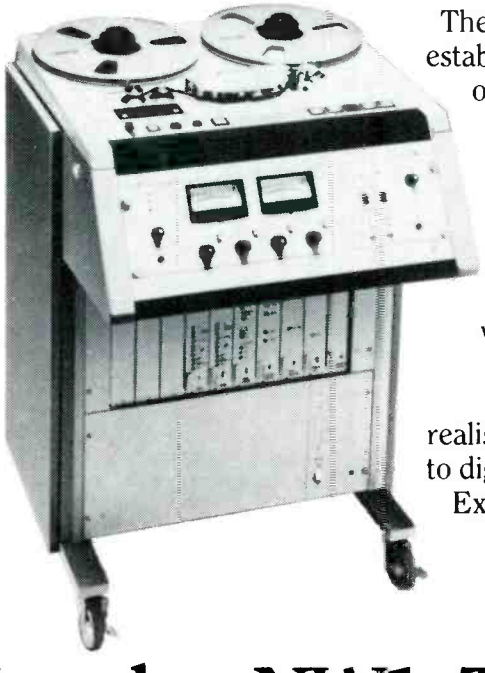
DP2700. An automatic loader for blank or recorded pancakes. Will wind any length precisely. One operator can run up to 3 machines. Reliable and attractively priced.

OTARI 2 TRACKS

NEW MX5050B2II 2 track

Otari's latest compact 2 track features microprocessor controlled transport, LED tape timer, active balanced input/output for better transient response, 3 tape speeds, ref. flux indicator. Now in stock.

MTR10-2 Half inch 2 track



The MTR10-2 has established itself as one of the most user-friendly mastering machines on the market. The new half inch 2 track version runs at 30/15/7½ ips making it a realistic alternative to digital recorders. Excellent editing facilities.

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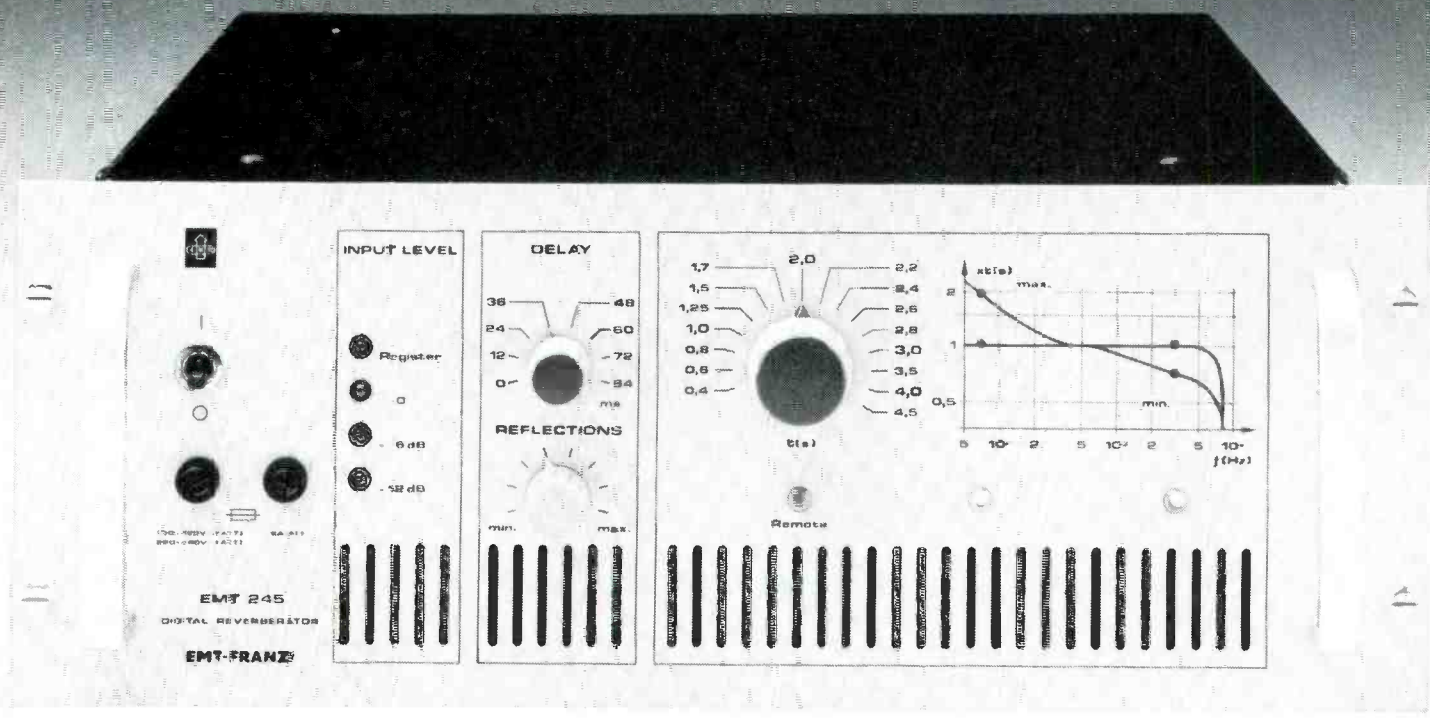

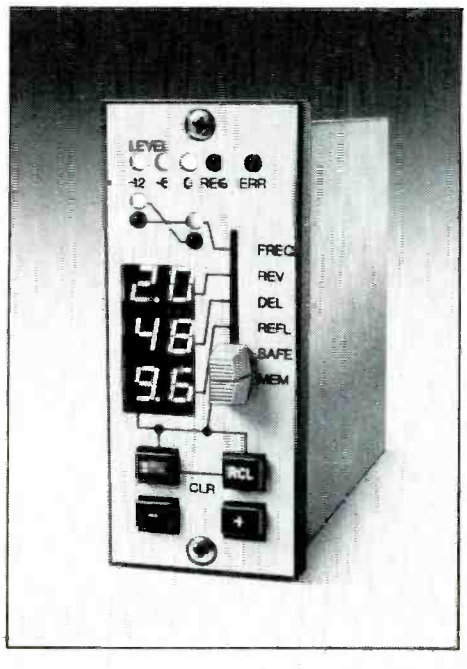

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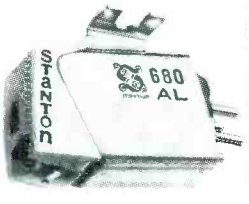

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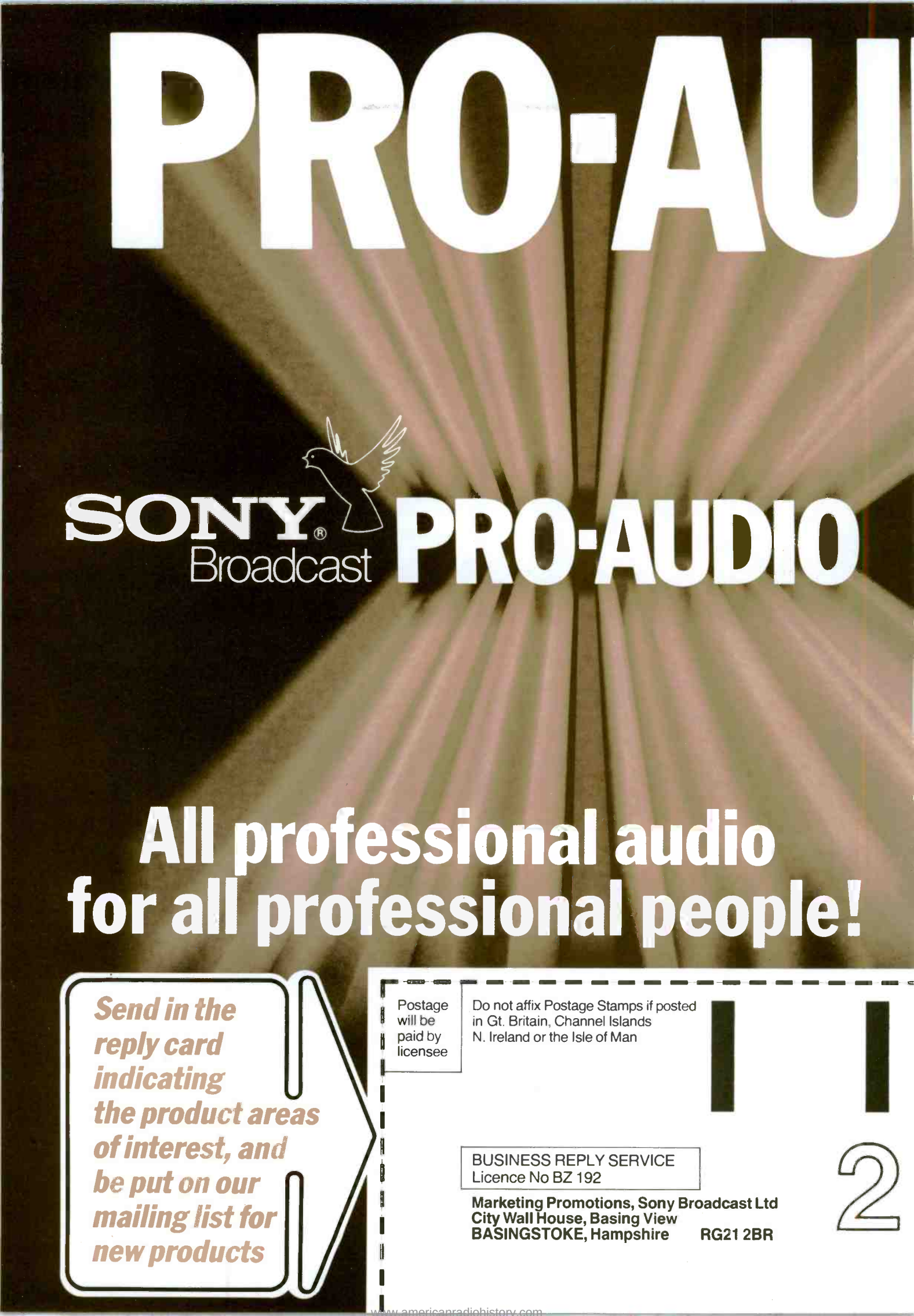


All Pro-Audio products are now available from Sony Broadcast, City Wall House, Basingstoke...
...and Pro-Audio service and spare parts are available from Sony Broadcast, Priestley Road, Basingstoke.

Here are the people to contact:

Pro-Audio, Basingstoke
Tel: 0256-55011
Mike Bennett
Chris Hollebone
Chris Walden

Pro-Audio, Cologne
Tel: Cologne (0221) 593097
Dieter Thomsen

Pro-Audio Service, Basingstoke
Tel: 0256-794011
Terry Lyon

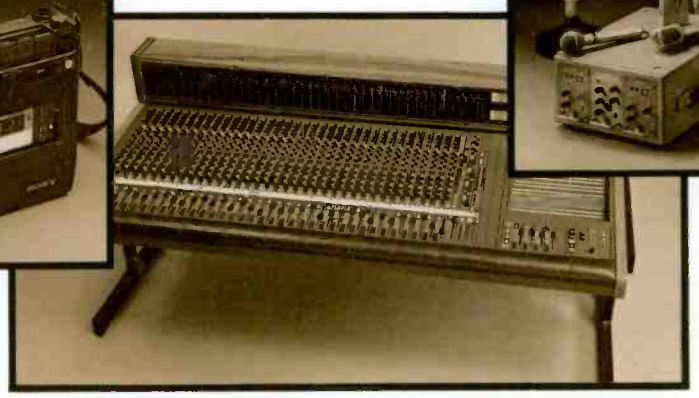
Pro-Audio Spares, Basingstoke
Tel: 0256-794011
Terry Leaphard

Studio Microphones

Wireless Microphone Systems

PCM-3324 Digital Multitrack Recorder

TCD-5PRO Portable Analogue Recorder



Sony/MCI Mixing Consoles

SONY® Broadcast **PRO-AUDIO**

Please send me information on the product areas I have indicated:

Name _____ Position _____

Company _____

Address _____

_____

- ☐ Digital Audio
- ☐ Studio Microphones
- ☐ Wireless Microphone Systems
- ☐ Portable Analogue Recorders
- ☐ Sony/MCI Mixing Consoles
- ☐ Sony/MCI Analogue Tape Machines

Sony Broadcast Limited,
City Wall House, Basing View,
Basingstoke, Hampshire RG21 2LA
Tel: 0256 55011 Telex: 858424

Sony Broadcast Limited,
Service/Spare Parts Department
Priestley Road, Basingstoke, Hampshire
Tel: 0256 794011 Telex: 858373

Sony Broadcast Limited,
Niederlassung Köln, Bleriotstrasse 1-3,
5000 Köln 30, Germany
Tel: 0221-59-3097/98 Telex: 8883042

Sony Broadcast Limited,
Case Postale 414, 1215 Geneva 15,
Switzerland
Tel: 4122 985225/6 Telex: 28737

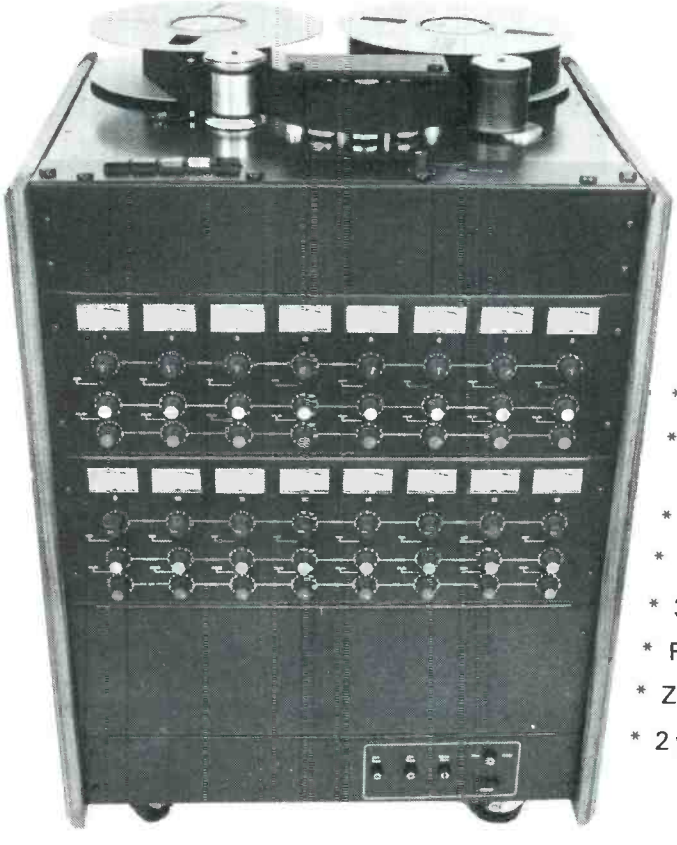
A C E S
Professional Sound Equipment

WE CAN NOW OFFER A COMPLETE 16 or 24 TRACK SYSTEM THAT SURPASSES ALL OTHER MAKES IN TERMS OF VALUE FOR MONEY

MODEL ML 24'24

* Input LED PPM's
* 5 Band Equalization
* 48v Phantom Powering
* Transformer Balanced
* 100mm Cond. Plastic faders
* Built-in Patchbay
* Two year warranty

1	Model TR16 16 track—2 inch..... **£4500**	Plus	**4**	Model SM24'16'2 console . . . **£3000**
2	Model TR24 24 track—2 inch..... **£6000**		**5**	Model ML24'24 24 into 24 in line
3	Model TR2 2 track— ½ inch..... **£1500**	Plus		console with patch bay **£3800**



With our total 'IN HOUSE' manufacturing techniques, we are able to ensure that each product is manufactured to very high standards ensuring the most cost effective use of materials whilst maintaining long-term operational reliability.

MODEL TR16

* ±50% varispeed
* 68dB S/N ref. 320Nwb/m
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* Silent drop in/out
* 30 i.p.s. to order
* Full function remote
* Zero locate
* 2 year warranty

A.C. Electronic Services.
Broadoak, Nr. Shrewsbury, Salop, England.
Tel. (0939) 290574.
Telex: A.C.Elec 337492.

A.C.E.S. (USA)
244 Lyell Avenue, Rochester, N.Y.
Tel. (716) 458 5610

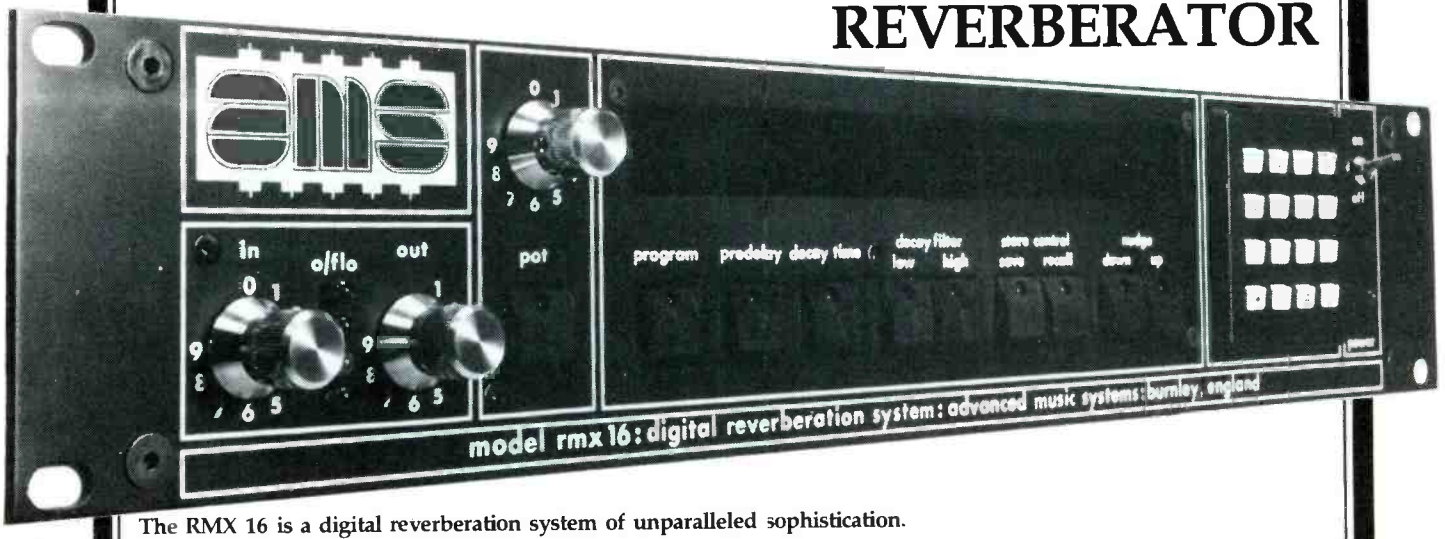
Startek
Via Del Lapidari 8, 4029 Bologna, Italy.
Tel. 3951 321063.
Telex: 214841 MBTI

RDG Audio Products
20 Rue St Guerel, 29230
Landivisiau, Brittany, France.
Tel. (98) 680 742. Telex: 940984

TTS Electronic GmbH
Dammühlenweg 4, 6270 Idstein, West Germany.
Tel. (06126) 2014. Telex: 4182297

M Studio
Im Neumättli 27, 4145 Gempen b Basel, Switzerland.
Tel. 061 72 89 72

RMX 16 DIGITAL REVERBERATOR



The RMX 16 is a digital reverberation system of unparalleled sophistication.

The unit is housed in a 3½" high, 19" rack-mounting case, and offers 9 different programs of reverberation ranging from the smallest room to the largest hall. Unique special effects programs are also included.

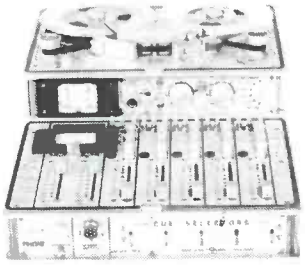
Specifications are the most impressive available with a full 18kHz bandwidth and 90dB dynamic range.

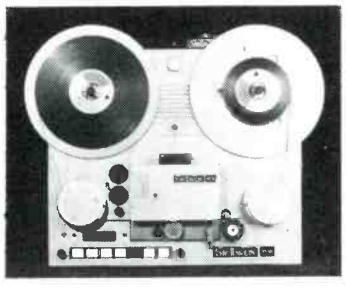
A hand-held remote terminal is available which can also store 90 user programmed settings as well as supporting a light pen input for ease of program updating.

ams

Advanced Music Systems
England: Tel. (0282) 36943
U.S.A.:
Quintek Tel. (213) 980-5717
Trident Tel. (203) 357-8337

Australia	A.M.S. (Inti) Pty Ltd.	Sydney	Finland	Into Oy	Helsinki
Switzerland	ABQ	Zurich	France	Lazare Eqpt.	Paris
Norway	Pro Technic A/S	Oslo	W.Germany	Elmus GmbH	Berlin
Canada	Octopus Audio	Toronto	Italy	Professional Eqpt.	Milan
Japan	Continental Far East Inc.	Tokyo	Singapore	Auvi Private	Singapore
Spain	Singleton Productions	Barcelona	Denmark	Sweet Silence	Copenhagen
Hong Kong	Audio Consultants	Kowloon	Holland	Audio Script	Looadrecht





FROM THE LIGHT MONO-STEREO (SYNC) RECORDER SP8, THE PERFECT MIXER AMI 48, TO THE PORTABLE MULTI-STANDARD STUDIO TAPE RECORDER—TD88—(1/4"—1/2"—perfo-film 16mm)
all are distinguished by:
MOBILITY—MUSICALITY
BATTERY OPERATION
MODULARITY—VERSATILITY

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☎ 038 33 42 33 Tx 35380

Can so much space in Central London really be so cheap?

Empire Hall, Olympia
205,000 sqft of fully fitted space suitable for many uses.

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Also at 97/99 West Regent Street, Glasgow G2 2BA. Telephone 041-332 1133. Telex 778269.

1710A

1700B

1701A

THREE GREAT WAYS TO CLEAN UP YOUR ACT.

The Sound Technology 1700 Series

Introducing three fast, accurate and easy-to-use Distortion Measurement Test Systems. All three deliver precise information for the audio professional. All three offer a multitude of features that make them indispensable tools for the engineer/technician.

Every system in the 1700 Series combines a flexible, ultra-low distortion sine-wave signal generator, a high resolution automatic-measuring THD analyzer, optional IMD analyzer and an accurate A.C. level meter in one instrument. Not only will a 1700 analyzer clean up your act, it'll clean up your bench too.

THE FEATURES

- Fully automatic nulling circuitry that measures distortion as low as .0009%. In less than five seconds.
- A simultaneously tuned, balanced and floating oscillator that's capable of 10Hz to 110kHz. With three digit pushbutton frequency selection that's both repeatable and fast. And, adjustable from −90 to +26dBm with three precision attenuators in 10dB, 1dB and .1dB steps (with ± 1dB vernier).
- You can measure signal-to-noise ratios with a 100dB dynamic range; floating sources from 30μV to 300 V; power in either dBm or watts; push a button and reject hum and high frequency noise with built-in 18dB/octave filters (30kHz, 80kHz and 400Hz).

WHICH ONE IS BEST FOR ME?

For most applications, the 1700B will do a big job for very few dollars. With the 1701A you get ultra-low residual distortion spec's, higher output level and integral, selectable meter detection circuits. Both models are great for R and D, engineering maintenance or Q.C. The 1710A was specifically designed for the broadcast and recording industry. It's the only distortion analyzer available with balanced and floating outputs and RFI shielding.

The 1700 Series Distortion Measurement Test Systems. Fully guaranteed for one year, parts and labor.

They're designed to be three great ways to clean up anyone's act.

SOUND TECHNOLOGY
Precision Audio Marketing, Bimini House, Christchurch Road, Virginia Water, Surrey, England. Tel. Wentworth 4416

Please send me more information on how the Sound Technology 1700 Series can help me clean up my act.

NAME _____

COMPANY _____

ADDRESS _____

_____ COUNTY _____

POST CODE _____ PHONE _____

PRECISION AUDIO MARKETING

24 Track + Remote + 1600 Series 24 by 8 by 16 = £15,200
As above but 24 by 8 by 24, patchbay, stand = £16,600
(plus VAT etc)

Package Soundcraft Systems from Turnkey

Sounds the same, but one comes as two large boxes, the other's hands on from the word go.

When we turn a package into a system, more of our expert staff become involved with your needs than any manufacturer could dream of sparing.

There are finance, acoustic and building considerations. The ancillaries, the installation, the commissioning and the backup.

And of course the deal.

Because as well as the same price as buying the package direct, we'll offer the best deal we can for anything else you need to get your system up and running. Total savings buying this way can be dramatic.

In fact, we're so eager for your business, that if you only want the boxes, with a little arm twisting, we'll throw in the chair.

For more information on the Producer systems, call Andrew or Garry now on 440 9221.

diary

Memory Lane 2

We have had an excellent response to our request for information on the history of British recording, and we would like to thank the many people who have offered to help. Many of the areas we specifically needed to find out about have been covered, but there are still some outstanding subjects. Specifically, we still have very little on the Levys, de Lane Lea and CTS (before the move to Wembley), Decca, early Philips/ Fontana recording activities, and some further data on Abbey Road pre-war activities. In addition, we would like to know about activities in other parts of the country. Although London was the major centre, some studios in the provinces have been in operation for a very long time, and we'd like to hear about them, up to 1975 or thereabouts. We intend to start running the series in July or August.

Address changes

● Audio Kinetics (UK) Ltd have moved to larger premises and their new address and telephone number is **Audio Kinetics (UK) Ltd, Kinetic Centre, Theobald Street, Boreham Wood, Hertfordshire WD6 4PJ. Phone: 01-953 8118. Telex: 299951.**

● **Professional Sounds Inc** have also moved to larger premises and are now to be found at **2737 Dorr Avenue, Merrifield, Fairfax, Virginia 22031. Phone: (703) 698-8888.**

● **Hayden Laboratories Ltd** have changed their telephone number and they are now contactable on **Gerrards Cross (0753) 888447 and 889221.**

● SAJA SA have moved and are now to be found at **3 rue Verte, 95100 Argenteuil, France. Phone: 961. 15. 62.**

Correction

Goodness-knows-how-it-happened dept: under the heading of Drawmer in the January issue effects product guide, we unfortunately gave the wrong company name for the UK distributor – correct address and phone number though. The correct company title should be **Recording Maintenance Services**. Our apologies for any difficulties this may have caused.

There are also two other corrections to be made to recently published product guides. Firstly, the brand B&B Audio does not apply any more and products listed as such in the December '82 and January '83 issues should read **Aphex**, although all other information is correct.

Finally, the UK distributor for the **Valley People** *Maxi-Q* should of course be **FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ. Phone: 01-953 0091. Telex: 27502.** and not as stated.

Act of God

The producer from a local public radio station had arranged to record a program of organ music at a downtown church. The church was happy to let the station use the organ as long as recording was done during normal working hours and the doors to the building were left unlocked so the public could see the church. (It was the tourist season and the church was something of an attraction.)

The organ was the only instrument of its kind in the entire area and, pressed to meet a deadline, the producer agreed. Appropriate signs were placed and with areas barricaded or roped-off to limit traffic inside, the session started. Surprisingly things went reasonably well for a time, but one particular piece had suddenly become very difficult to get through. The summer sun was slowly causing the organ to go out of tune and frustration was running high. On what seemed like the millionth take of this very long piece, the producer's luck turned. The organist was playing well, the organ seemed all right, blaring at the top of its lungs, when the main doors to the church silently swung open and a tall, dark figure slipped in with a blaze of sunlight. Immediately the producer jumped up to see who had come in and signal him to keep quiet and remain still. With the doors closed, it was clear that this gentleman, dressed for the dead of winter, was quite old and had obviously been a long time down on his luck. Looking directly at the producer, the man ambled down the aisle at a snail's pace as the producer wildly waved his arms trying to get the old man to stop.

Despite the loudness of the organ, footsteps could now be clearly heard on the tape and as the organist turned into the homestretch, the producer shouted for the musician to stop. As the organist looked down from the loft to see what the commotion was, the old man reached the mic stand. Pausing a moment, he looked at the producer with great cow eyes and said softly, "I don't mean you no harm, mister".

The producer shook his head in understanding as the old man, having stated his intentions, slowly walked to the back of the church to sit down and rest.

People

● David Neal has been appointed marketing manager at **Audio Kinetics (UK) Ltd.**

Agencies

● We have been informed that the UK main agent for Broadcast Electronics is Ramson Audio who are also the Irish and Swedish agents. Lee Engineering are also agents for BE, although not the principal in the UK. **Ramson Audio Ltd. Cardee Scarff Ridge Road, Dreemskerry, Isle of Man. Phone: 0624 24404/ 812964. Telex: 629770.**

● Feldon Audio have been appointed as UK distributor for the full line of audio consoles and accessories manufactured by Auditronics Inc.

Highland scotch rumours

Highland Recording Studios of Inverness, Scotland have asked us to mention the fact that they are still very much in business. Apparently, various reports have been circulating that they had gone down following an advert appearing offering an unnamed Scottish multitrack studio for sale. Scotland is not exactly blessed with a studio at every corner and Highland is one of the better known. Unfortunately, certain less informed people have subsequently assumed that it was Highland for sale and besieged them with phone calls.

Rod McQueen from Highland has asked us to emphasise that the studio is not for sale and never has been and being very busy, need all their equipment – no more phone calls please.

Shure UK changes

Shure Electronics Ltd, the UK distributor for Shure products, have announced the restructuring of their distribution and sales throughout the UK. Shure Electronics was a subsidiary of the US parent company and set up in 1961 by US Shure as they did not feel that there was a suitable existing company to handle their products.

The changes announced bring the UK into line with the rest of the world where distribution is always handled by independent local firms who are aware of their market and its specialisations.

As from November 15th 1982 distribution of Shure products was transfered to HW International. We understand that although changes are to be made in the future, the address, telephone number and most of the staff remain as with Shure.

Canford Audio trade counter

By the time this is published **Canford Audio** should have opened a London trade counter at **10 Warren Street, London W1. Phone: 01-380 1125.** Provisional opening date was mid-January and the vast majority of their stock will be available over the counter giving central London another useful supplier. ■

Public Service Announcement

In recent years there has been a great deal of research into the effects of prolonged exposure to high level sound. Most studio personnel and other involved in high level sound are now becoming aware, to varying degrees, of the risks that they may be taking with future losses in their hearing. There has, however, been much less made of the potential dangers of high level headphone monitoring – possibly because of the relatively low power amplification levels involved and the subsequent assumed lack of danger.

However, one eminent Japanese headphone manufacturer (whose name sounds like a lot of things piled up on top of each other) very commendably now includes a little information sheet with each of their models. It's about the risks that you may be running by using headphones at the very high levels that many of their models (and other professional types) are quite capable of sustaining. This is obviously an area that needs some definitive research with particular application to studios and the responsibility of the studio itself towards the ears of its clients (remember that in most cases the foldback level is set by the engineer with the musician actually having to ask for volume changes to be made rather than having the physical ability to reach out and change it for himself as in control room monitoring).

To this end we have reproduced passages from this leaflet for your benefit, so please read it so that you may become better informed.

PLEASE BE CAUTIOUS!

Recently we have been told by specialist doctors of ear's diseases about some cautions to be taken for that listening with headphones in a loud volume for long hours is harmful hygienically to the ear very often by television, through the press etc. To keep your valuable ear long in best condition you are requested to enjoy music with a...superior earspeaker in a moderate sound pressure.

A headphone of poor clarity is illusively considered if the volume is raised much, it may be more clearly audible. To listen in a loud volume is the worst for the ear and it is proved that it may lead to hard hearing at length.

In a district of Africa an old man was found who has kept same sensitivity and frequency response as lad's and its cause is that he has lived in an extremely quiet noiseless environment. (By Medical Department of Osaka University.)

Truly superior. We'll prove it!

The Orban 424A Gated Compressor/ Limiter/De-Esser

There are lots of production limiters out there. Old favorites. Pretenders to the throne. The competition is fierce. So, when Orban set out to design a new production limiter, we knew it had better be superior.

The result of our research is the "Studio Optimod"—a Gated Compressor/Limiter/De-Esser with versatile controls, simple set-up, and a natural, transparent sound that must be heard to be appreciated.

Try one and A/B it against your current favorite. You'll notice the **sound**—remarkably smooth and natural over a wide range of control settings—even at high compression ratios where apparent loudness and punch are significantly enhanced. It's no accident: The unit is a direct descendent of our super-popular, second-generation OPTIMOD-FM broadcast limiter. So it exploits our years of experience in making an AGC device sound natural on diverse program material without critical re-adjustments. Yet full versatility exists for special effects in production.

A bonus is a smooth, natural de-esser. It's independent of the compressor/limiter section so you can simultaneously compress and de-ess vocal material without compromise. You can even de-ess sibilant vocals which have been mixed with other program.

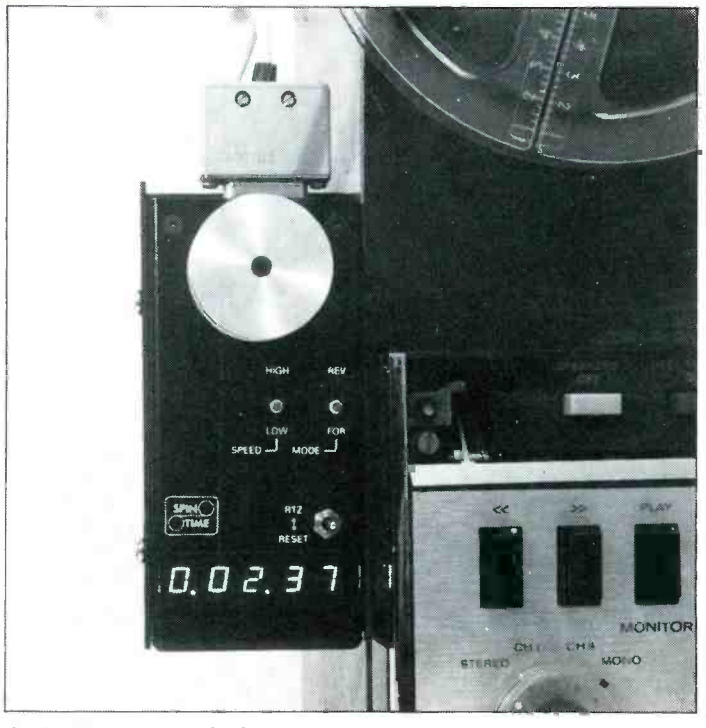
The icing on the cake is unique gating and "idle gain" functions which prevent unnatural noise-producing gain variations during pauses and abrupt gain changes when the unit is switched in.

Our new Model 424A (dual channel) and 422A (single channel) are destined to become the new industry standards in dynamic range control. Prove it to yourself. Contact your Orban dealer today.

orban

Orban Associates Inc.
645 Bryant Street
San Francisco, CA 94107
(415) 957-1067
Telex: 17-1480

new products



Spin Time tape timing

For anyone using semi-pro machines such as Revox *A77*s, *B77*s or Teac *A-3440*s for professional applications, the major drawback is not usually quality problems but the need to rely on their rather inadequate mechanical tape counters that normally count in reel revolutions rather than real time. For those occasions when you need to estimate the amount of tape used or the running time left, a mechanical tape counter is not the most useful device.

Spin-Time is a self-contained unit designed to clip on to the side of one such machine and give a five digit LED readout of the tape position in hours, minutes and seconds up to 9hr, 59min and 59s. The unit itself is about 2½in wide and so does not stick out from the side of the machine any more than the overhang of a 10½in reel. Normal tape machine operation is preserved with the only difference being the need to include the aluminium idler wheel of the Spin-Time in the tape path. The counter is coupled to a dual photo transistor measuring the rotation of the strip encoded idler wheel. It is capable of operating at any tape speed between 3¾in/s and 30in/s by the use of internal jumpers and the chosen two most common speeds are available to be switched on the top of the unit. There is a top panel switch to reverse the tape count so that timings may be made in rewind.

The Spin-Time is also capable of a return-to-zero function if interfaced with the tape recorder. In the case of the *A77* and *B77*, this just means connecting it to the remote sockets where it is also able to derive its power requirements. Interfaces for other machines are being added as they are developed. The power requirements of the unit are +17 to 35 VDC and it is internally regulated. A suitable power supply is available as are a number of other versions of the Spin-Time such as an assembly for direct attachment to the existing transport and the soon to be added slave remote control and time displays.

Applied Microsystems Ltd, Baker Street, Weybridge, Surrey, UK. Phone: 0932 54778.

New Bel products

Bel Electronics have several interesting items that were launched at the last APRS exhibition. Firstly there is a new 24/16/2 modular mixing console with 4-band EQ including two sweep mid sections, three aux sends and the facility to use the monitor section as extra line inputs on mixdown. The Bel active DI box with instrument and amplifier inputs and 20 dB switchable pad, *XLR*-type 600 balanced and ¼in stereo jack socket outputs. Powering is by 9 V battery or 48 V phantom power.

Bel are also now manufacturing a range of studio wall boxes with female *XLR*-type sockets and stereo jack sockets in two sizes. Special units may also be made to order.

Lastly the 16-channel version of the Bel *BC3* noise reduction system has been redesigned and is now 16 separate modules in one 3 U 19 in rack mounting case.

Bel Electronics, Don Larking Audio Sales, 29 Guildford Street, Luton, Beds. LU1 2NQ, UK. Phone: 0582 450066. Telex: 825488.

Lexicon's new *Prime Time*

The *Prime Time II, Model 95*, is an enhanced version of the original, widely-used unit, offering all the functions of the original plus improved A/D and D/A conversion, input overload protection, longer delay times (up to 1.92 s standard, 7.7 s with optional memory expansion), multiple-waveform modulation with a unique sweep display, regeneration effects and a clock output. The last is particularly interesting: a pulse output subdivides the delay period for synchronised delay loops, facilitating its use as a metronome or for driving rhythm generators, etc. Repeats can thus be made to fall exactly on the beat.

Lexicon Inc, 60 Turner Street, Waltham, Massachusetts 02154. Phone: (617) 891-6790. Telex: 923468. UK: FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Hertfordshire WD6 4RZ. Phone: 01-953 0091. Telex: 27502.

Auditronics EQ

New from Auditronics, and previewed at Anaheim, was a programmable equaliser in prototype form. Up to four mono or stereo EQ units may be included in each self-contained 19 in rack-mounting package. Each EQ unit has three bands with 10-step variable Q, 12 programmable frequency steps in ⅓-octave increments (bands overlapping by over an octave), and 17 programmable steps of boost/cut up to ± 15 dB. High and low bands also include peak/shelf capability. Sixteen memories are provided with on-board storage and battery backup.

All settings are made with up/down switches and LEDs display all the parameters. An RS-232 serial interface is provided for computer control.

Auditronics Inc, 3750 Old Getwell Road, PO Box 18838, Memphis, Tennessee 38118. Phone: (901) 362-1350. Telex: 533356.

EMS Synthi 100 update

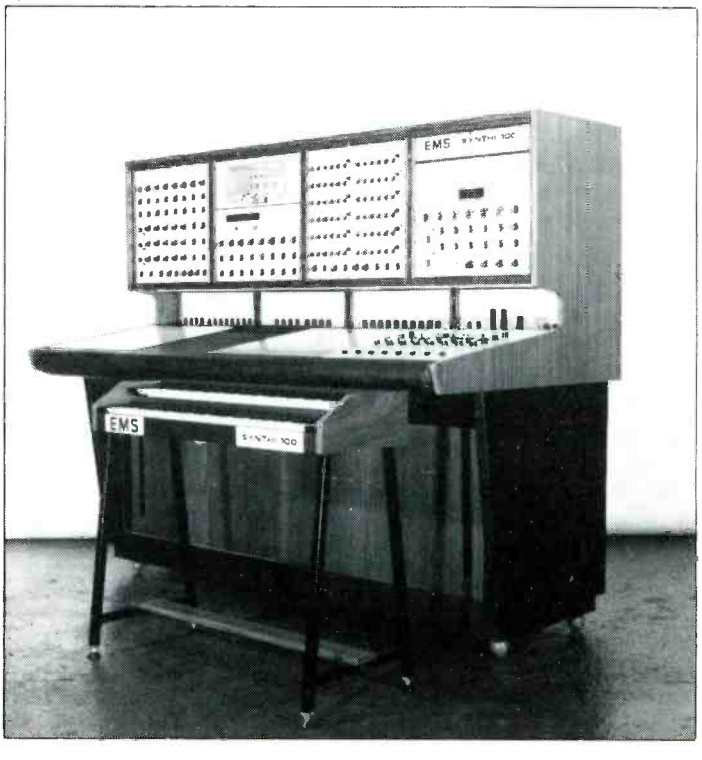
Datanomics have released information on the extensive alterations and improvements that have been made to the EMS *Synthi 100* which they currently have in production. Design emphasis has apparently been placed on more recent technology.

All 12 oscillators have been completely redesigned giving greater stability and better tracking. They are also now identical each having switch selection of voice or LF operation with individual outputs of sine, sawtooth, pulse or triangle waveforms with level control. All the filters are now 24 dB/octave types having been redesigned for improved tracking and stability. The three envelope shapers now have VC delay, attack, decay, sustain and release. Microprocessors have been incorporated for keyboard scanning and a separate unit for the sequencer.

As well as the integral spring reverb facility, an analogue delay line has been incorporated. Patch boards have been extended to allow more facilities to be programmed and finally, all input and output lines are now balanced giving working levels up to +16 dBm.

Datanomics Ltd/EMS, Westminster Road, Wareham, Dorset BH20 4SP. Phone: 09295 6311. Telex: 418480.

Synthi 100



Bye Barnet
Hello Hendon

February 7th

Turnkey and Bandive are leaving Barnet and moving west to the warmer climes of Hendon

Our new address is;

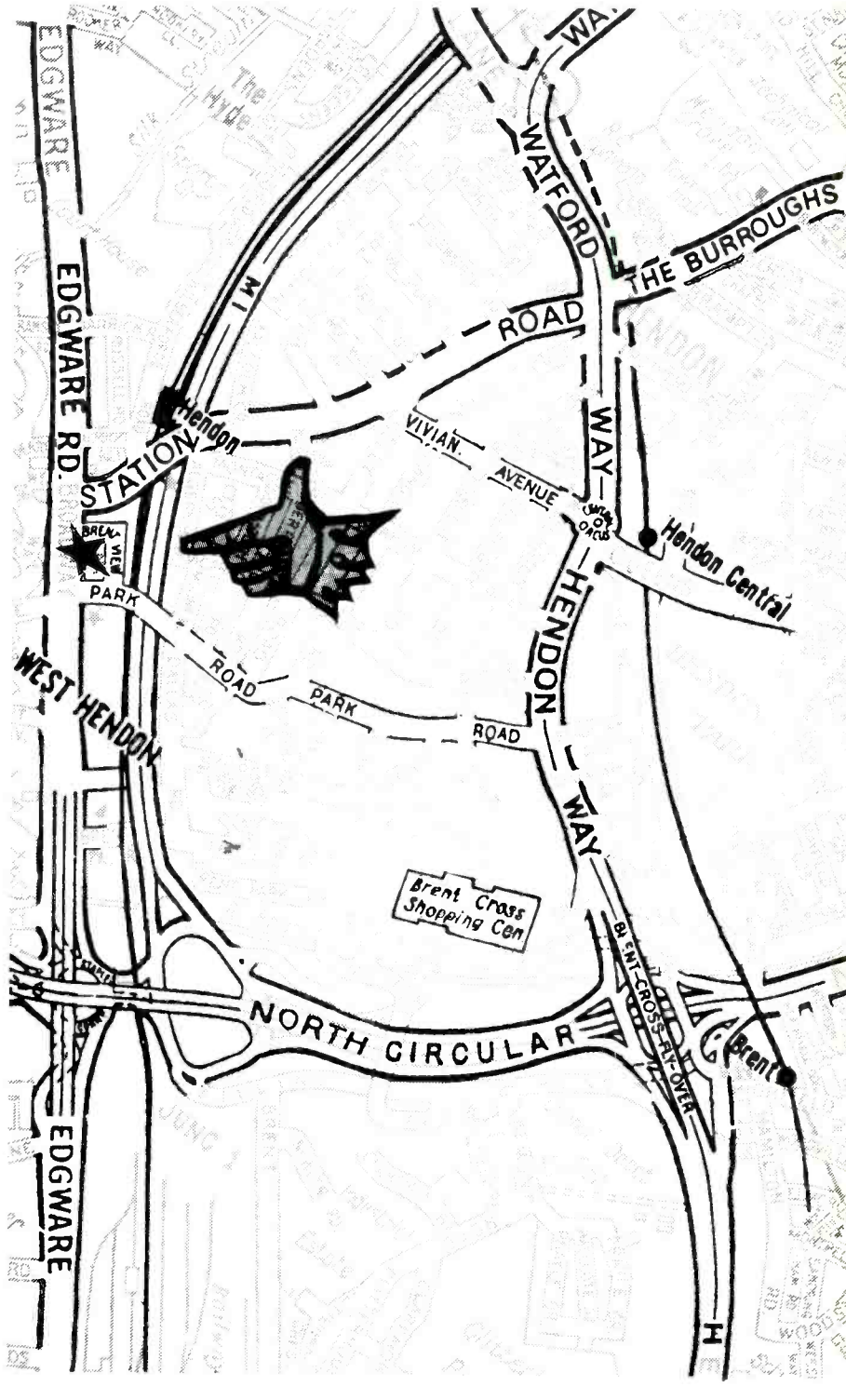
Brent View Road
LONDON NW9 7EL

(Our building is so big you don't need a number).

The new phones;

Turnkey:
01-202 4366

Bandive:
01-202 4155



Write it everywhere

A nice safe place for a Nakamichi—in the rack

Cassette machines for the studio

A cassette recorder is a useful machine to have available in the studio control room or copying suite. In this article, Richard Elen discusses some of the criteria on which the selection of a suitable machine can be based.

MODERN hi-fi cassette recorders are capable of a level of quality not too far distant from 7½ in/s open-reel 2-track on ¼ in. As a result, and because it is a fact that while not everyone has a reel-to-reel recorder at home, virtually everyone has a cassette recorder available at home or in the record company office, the cassette recorder has long been a feature of the copy room, if not the control room itself. Cassettes are a convenient way of giving band members, producers and even engineers, copies of rough mixes to take away, and they are a useful medium for presenting to the record company to justify the weeks their clients are spending in your studio, if you hold with the idea of giving *anyone* important a rough mix at all! Add to that the fact that, while of useful quality, cassettes are generally regarded (except in special cases) as being of insufficient quality for cutting, and you have a medium which is both useful and protects the studio from the not unheard-of problem of non-paying customers releasing records cut from copy tapes because you wouldn't give them the masters.

Any old cassette machine isn't really good enough, however. The right machine needs to have a combination of factors in its favour. You need the right functions, the right technical capabilities, even the right shape for the machine to be truly useful in the studio environment. We will consider these requirements in some kind of order and try and come up with a general specification which will be useful in selecting a machine.

Shape

Surprisingly, shape is quite an important consideration. There are not that many flat surfaces in control rooms which have not already been allocated to synthesisers, places to write out tracksheets, or places where producers like to twiddle their thumbs during the session. So the long, low top-loaders once so common in homes all over the world are generally out as far as studio use is concerned. Luckily, the current fashion in hi-fi is for front-loading machines of quite compact size. Some – the Tascam *122* for example – have rack-mount kits available, and this is a viable means of mounting a machine if there is rack space available. Alternatively, rack-mount 'ears' can often be made up by the maintenance department to do the job. Generally a strip of L-section aluminium can be cut to the height of the machine and holes drilled to suit; if the machine is much less than 19in wide, a rectangular hole can be cut without too much difficulty in a blanking panel, and the machine mounted into it. The alternative not to be recommended is placing the machine on top of an ancillary unit in the rack, resting on the unit below. The top of a large signal processor may seem attractive, but cassette recorders are generally quite heavy and their presence may well restrict ventilation holes in the unit below. In short, this common practice may cause considerable mechanical or electronic damage. If it really proves impossible to rack-mount the machine properly, you could place it on a raised surface at the bottom of the rack, the disadvantage being that it will therefore be too low to operate easily.

Some manufacturers, notably Tandberg (*TCD 330/440A*) and Nakamichi in some cases, make recorders which are designed to be optionally wall-mounted. This offers what is perhaps the best of all possible worlds. Cables can be run behind the wall-covering, laid in amongst the Rockwool or whatever, and all you need are a couple of battens with reasonable strength mounted to the wall to which the machine can be attached. The Tandbergs, for example, have a pair of 'keyhole' slots on the rear which allow the machine to be slotted on to a couple of wall-fixed screws. Care should be taken here, however: if the screws stick out of the wall too far, it is possible for one of them to cause internal damage to the recorder, as I know to my cost. My Tandberg's capstan motor is driven off a 110V winding on the mains transformer – or at least it was, until one of the screws open-circuited the winding! The basic concept, however, if executed carefully, enables the machine to be found a place completely out of the way in otherwise dead space. It can look nice there too, if you *don't* have trailing leads. It is generally difficult otherwise to wall-mount a recorder, as the depth of most front- or top-loaders is such that a good deal of strain is placed on a wall-mounting shelf's brackets, but try it if you know of a particularly ingenious method of fixing to walls. Remember to leave room for the connectors at the back!

Tape types

If you have a number of cassette recorders, or a busy studio, it will be well worth buying tape in bulk. Most of the tape manufacturers also produce cassettes and will do good deals with you if you order the cassettes in sufficient numbers, along with your reel-to-reel requirements. For most purposes, Type I (ferric) tapes are quite sufficient, and all recorders will accept them. They are also the cheapest and most common tapes you can buy, but remember that there are some very nasty ones about. The quality does need to be

good enough for you to be able to discern things in the mix, the HF end being particularly important. It is probably false economy to buy discounted unheard-of tapes in your local hi-fi store, even if they are cheaper than anywhere else.

A fair number of people will ask for better tape than the average Type I, and it is worth having a superior type on hand for such applications, and you can mark them up more on the invoice. You will need to, anyway, as all the engineers will invariably use them without telling you. Metal tape is probably overkill, and there is thus no real reason to install machines with metal capability unless the machine has other attributes which warrant the extra expense. Ferrichrome (Type III) tapes seem to be a little out of favour these days, too, so the best 'superior' type to stock is probably a Type II ('CrO_2') variety, although some of the newer 'pseudochrome' formulations probably have the edge in noise figure over conventional CrO_2 types. It should be noted, however, that there is quite a wide variation in bias requirements between different manufacturer's Type II brands. Once you have found one you like, stick to it or you will be forever lining up machines, and cassette recorders are often more fiddly than studio machines (see later).

Another thing to watch here is machines with automatic tape-selection. You put the tape in the machine, and it senses notches in the housing to tell it what type the cassette is, and switches bias and EQ accordingly. This would be a great idea if everying could agree on where the notches should be. *Almost* everyone agrees that Type II notches should be next to the 'write-protect' knockouts on the rear of the housing, but there is still disagreement about metal (Type IV) tapes. Some manufacturers place the notches near the centre of the rear of the housing: others place them along the side. Some have no notches at all. The most insidious cases are those where a manufacturer has just decided to fit notches in the housing and there is still old stock which doesn't have any. In addition, it may well be that you will want to override automatic sensing from time to time, so best not to have it in the first place.

Heads

Three heads are better than two for studio operation, without a doubt. Apart from the fact that lining-up is, at the very least, tedious on a 2-head recorder, separate record and replay heads at least allow you to know how much worse the off-tape signal is than you would like. Apart from that, with the exception of sync capability, the reasons for choosing a 3-head machine over a 2-head variety are the same as they are for mastering recorders. Personally, I would have said that 3-head machines were obligatory for studio applications. All engineers (and other studio staff) have a fatal fascination for A/B comparisons and it will keep their minds at rest if the facility extists. Additionally, the fact that record heads are ideally different from replay heads is even more true with cassette recorders, and those which offer the extra head are probably better in other ways too.

Line-up

Like reel-to-reel machines, cassette machines need a lineup from time to time, too. In fact, they probably need one more often, although it is perhaps not so important that they get it. With this in mind, a studio cassette recorder should have respectable access to record and play level calibration, EQ and bias, preferably at the front panel. Some machines offer automatic or semi-automatic line-up for the selected tape type. This may be as complex as on the new Alpage, which places sets of tones on tape and twiddles itself correctly before rewinding to the front of the tones and placing itself into record-pause; alternatively, there may be 'default' bias and EQ positions which may be modified with front-panel twiddlers in conjunction with a calibration switch. This is implemented in a particularly interesting way on the Sony *TCK-81* and later models in the range. A switch is set to either 'bias' or 'EQ', and the presents are adjusted until both meters read zero. It does assume that left and right channels are similar (which might be true on good tape) but despite its rather primitive principles (you adjust bias with two tones, one on each channel, until they balance, rather than so-many dB over) it gives consistently good results. Some Aiwa machines have a similar system. Overall, these facilities are probably a good investment, as they allow you plenty of leeway, although they have the disadvantage that they can be twiddled inadvertently by passing tape-ops or bored band members.

Other than simple bias and EQ lineups, azimuth is a vital consideration, and should be easily accessible for adjustment. Unfortunately, there are no fewer than five 'correct' azimuth settings recommended by various manufacturers and tape makers, and it's difficult to know which is which. Their test-tapes vary accordingly, too. You will have to decide this for yourself by whatever criteria you think fit: generally, the azimuth setting should be such that tapes recorded in the studio sound right on your personal machine at home (which might, however, be aligned to the reverse criteria). With three heads, the problem is compounded. Lock the replay head azimuth screw with the perennial nail varnish or other locking compound if everybody can agree on its setting, and then, of course, reference the record head setting to it. Unfortunately, there is sufficient asymmetry between the two halves of a cassette housing for the record head azimuth on a 3-head machine to be right on one side and wrong on the other, so adjustment is a good idea for each side. A 10kHz tone from the desk will normally be sufficient, although some machines (eg the Tandberg recorders) have a built-in oscillator and 'test' switch for this purpose. The difference may be quite a surprise.

Unfortunately, replay-head azimuth is not going to be the immutable constant assumed in the previous paragraph. The first band who want to check the demo before they go out to record will demonstrate this quite conclusively. The test-tape is thus absolutely necessary. A rather less reliable reference in the even of non-availability of a test-tape is to record a cassette of white noise as the first thing you do after the machine is plugged in for the first time, using the tape to twiddle replay azimuth for maximum top end by ear after subsequent readjustment. This seemingly crude method is sometimes incredibly useful and passably accurate. At least, as *originators* of cassettes, the studio has a chance to define the replay azimuth settings of their clients' cassette recorders. Everyone I know – including myself – has gone though a number of cassette machines in their time, and has a library of cassettes with different recorded azimuth requirements. They have therefore all twiddled their azimuths habitually for years and an extra twiddle will not hurt them. Record companies are a different matter, however, as the A&R man may get quite the wrong impression of your studio if he plays your tape with the wrong setting. Better, therefore, to ask him to give you a quick cassette copy of a track from a record in his office for you to align to, thus avoiding unnecessary loss of credibility in these difficult times. Again, adjust for best HF replay.

Another cause of embarrassing incidents like that referred to above is misalignment of Dolby level. We will talk about noise reduction later, but for now let us consider the omni-prevalent Dolby-B. Time was when there were outboard Dolby units which had plenty of twiddlers on them to enable you to get the settings just right. Names like Kellar may come to mind here. Unfortunately, almost every cassette machine this side of Alpha Centauri now has an inbuilt NR system, and many of them are only capable of alignment if you have a capacity for psycho-kinetic adjustment of invisible and inaccessible twiddlers which would make Uri Geller insanely jealous.

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Spot the cassette recorder under the record deck— not recommended practice!

Cassette machines

Rather more luckily, they are today generally right. In the old days, the chances of your Dolby level being anything like anybody else's was something like 10^{11}:1, but now things are better, which is just as well as you still couldn't adjust it even if you wanted to. It is a long time since I have seen a cassette recorder with record cal, let alone replay, as a front-panel control. For the consumer, this is fine, because no pre-recorded cassette known to man tells you what the Dolby level is, and whatever it is, it certainly ain't 185nWb/m or anything familiar like that. It is a Great Unknown which it would be embarrassing to discuss further. I have long since given up trying to persuade people to put Dolby tone on pre-recorded cassettes. In the studio, however, it is far *more* embarrassing. There can be few more depressing sounds than the muffled replay which results from the wrong Dolby calibration, or the immense hiss which results when you switch the Dolby out, hoping it will sound better. A quick tone on the front of the tape will at least give you an excuse if the needle never reaches the 'double-D' symbol on the A&R man's machine. If you *can* line up the Dolby, and you still have the Dolby level cassette supplied with your Kellar in 1897, do so. Otherwise, hope for the best.

Here it is worth a moment's discourse on *relative* Dolby levels in cassette recorders. Almost every machine has some point on the meter scale labelled 'Dolby cal' or with the 'Double-D'. They are probably all supposed to be at the same *absolute* level, but relatively speaking, they are all over the place. Some have them at zero VU (or dB or whatever arbitrary and misleading units the meter is calibrated in), while others have them at +3, +5, −3, −something else, or whatever. It is a fairly good bet that where the manufacturer puts the Dolby mark has some moderately arcane relationship to the available headroom. Thus, my trusty Tandberg, which has its Dolby mark somewhere off the unreadable left-hand end of the scale, around minus infinity, is capable of recording cassettes which will saturate the heads of any normal domestic recorder and overload the replay amps just as surely as *LR-56* recorded at NAB +7dB (remember those days?). The Tandberg has *loads* of headroom. Machines with the Dolby mark at zero, in deference to some assumed reference level having true validity, are quite satisfactory, and this particular setup is increasingly common. The machines to watch, however, are those which have the Dolby mark at +3 or higher: they can tend to run out of 'oomph', especially on studio material, which has a lot of transients.

Metering

Much in vogue at the moment are LCD or LED bar meters, which are, of course, capable of the most absurd response. They can have attack times so fast that a standard PPM has not had time to twitch, although they are generally slugged somewhat. Other forms of metering are those based on analogue meters, which may pretend to be VU meters but usually aren't, or may pretend to be peak reading, looking like VU meters. These usually aren't either. Then there are the combination types, ranging from VU-style meters with peak LEDs which flash when the recorded level exceeds −20, up to the ultra-confusing Aiwa double meters which offer peak and VU simultaneously and have the facility for infinite peak hold which makes them look as if the needles are stuck. I don't believe that you will find a cassette machine which has a real PPM, although there may be some which approximate to real VU metering. In any event, a studio cassette machine needs peak indication of some sort, even if it's only a peak LED. Masters have very fast transients and will over-record very easily, even if you are squashing them to a degree which would make you think that US radio stations had a wide dynamic range. Even if you would never have anything other than VU's on your console, you should have peak indication on the cassette recorder, because transients that your Studer can happily cope with may cause saturation on cassette, particularly at the top end and on bass transients (notably bass and snare drums). Consider meters along with the position of the Dolby mark discussed above, bearing in mind that headroom is peculiarly important. Even some alleged 'studio' type cassette machines fall down here and will distort horribly during seemingly innocuous passages which will leave you peaking at −10 and worrying whether you will hear the string section over the noise level. All the things that you learned about recording when you thought it was just a hobby will come back to haunt you with a vengeance, because even a modern cassette machine still owes a lot more to the 3¾ in/s quarter-track portable you had years ago than it does to your ¼-in mastering machine. Cassette recorders are capable of excellent results, but only if you are kind to them, and headroom is one of the areas in which kindness is obligatory. It is easy for studio people, used to being annoyed with the shortcomings of studio tape recorders, to forget this fundamental difference.

Noise reduction

Just as there are fashions in studio noise reduction, so there are in cassette recorders. You once had the choice of Dolby-B or nothing, and although you may have heard from some people that Dolby-B is better than Dolby-A in terms of changing the sound, you may have had experience with early Dolby machines which either drifted out of alignment in the course of an album side or were never aligned correctly in the first place, and thus never had the chance to find out, as you always left it switched off. Today, all that has changed. Dolby are very good at ensuring that a manufacturer using the system (hereinafter referred to as 'the Licensee') does it properly. But now there is greater choice, too. You can have Dolby B, Dolby HX, Dolby C, dbx and nothing. Sometimes there is an extra NR system known as 'ext', which means that you didn't buy it, or forgot to plug it in. There are some modern cassette recorders which have more than one type available, and give you interesting chances to compare them, and I have often wondered whether the NR manufacturers actually like this idea very much. There is a Technics machine on the market (alas with only two heads) which only costs £160 and offers Dolby B and dbx as well as 'out', and even switches miraculous new meter scales into view depending on your selection. With dbx in, a whole new scale springs into view, calibrated up to +18 in bright glowing red, and this would be marvellous if anyone who ever used your studio also had dbx. Regrettably, everyone else's machines have dbx in the 'ext' (haven't bought one) position. Instead, they all have Dolby B alone. So, whatever exotic noise reduction system you wish to use on your own cassettes, you must have Dolby B for your clients, or at least Dolby B *replay* so that you can play back tapes that bands bring into the studio, or that engineers like to listen to at 110dB SPL (see 'levels', later) while maintenance are trying to find out why track 19 has gone intermittently noisy on sync replay. Dolby HX is a useful variant on this: as you no doubt know, HX is a variant of Dolby B which fiddles the bias on record (replay is straight B) to make the top end better. This means that you will be able to use up that box of Supa-Cleer Ferrox Gamma Oxide Wundertone cassettes that you bought as a job lot against my earlier advice, without your more aged clients noticing that they are only flat up to 3.4kHz. Some machines, regrettably, only sound decent with *any* tape in the HX position, but despite this HX is basically a good idea, apart from the feeling that it is

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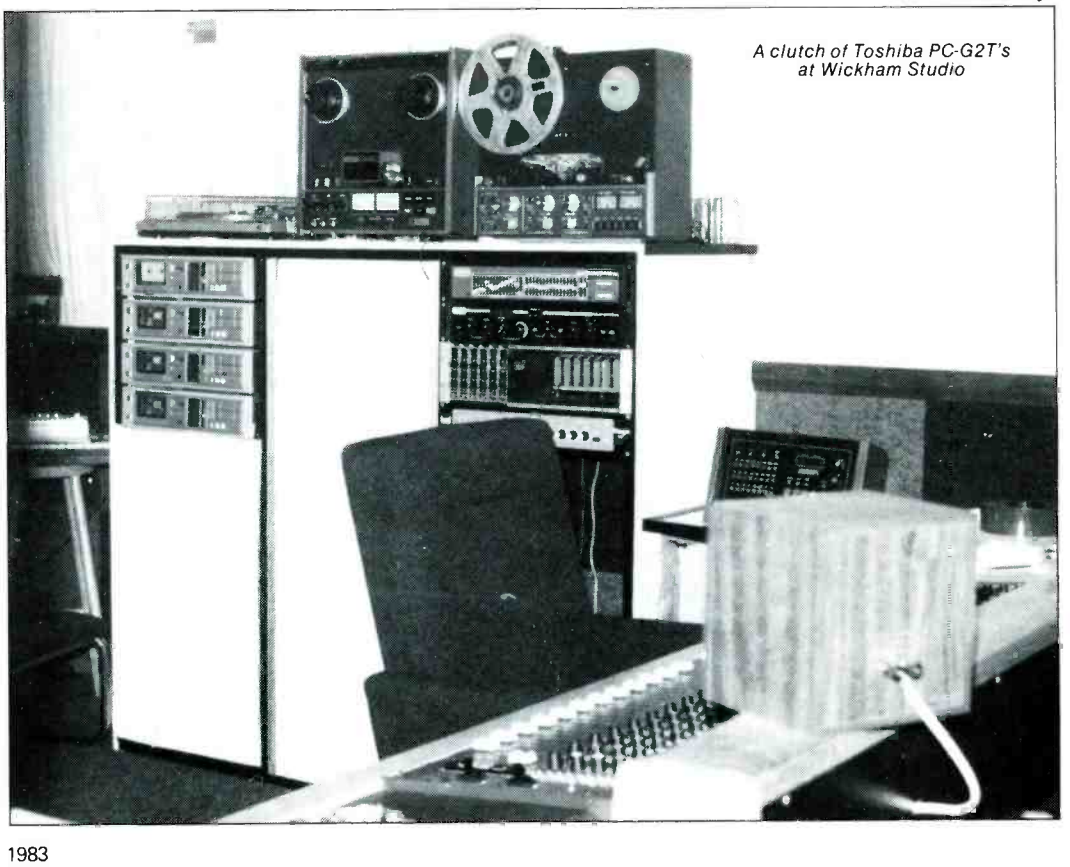

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cheating somewhat. Comments that your maintenance department may make about it doing funny things to the bass end when it modifies the bias for the top end should be ignored.

Dolby C is available on some machines, and as an add-on 'ext' box from some manufacturers and offers more dB of noise reduction than good old 'B'. As to its efficacy in a studio cassette recorder, we can think of it much as we consider dbx in this application: very nice, but not many people have got it yet. The basic rule, then, is Dolby B for certain, HX if you like the rest of the machine, and any other secondary system should be chosen if you like the machine without it, and a straw poll of your engineers indicates that a given system is prevalent (if *your* home machine does not conform to your engineers' consensus, modify your decision accordingly).

Levels and interfacing

An annoying feature of almost every cassette recorder is that they do not present their inputs and outputs to the world at a level consistent with any other machine in the building (Teac and Fostex users should avoid reading this sentence). They talk to the world at a level of about −10 dB, which is far enough removed from 0.775 V to make it impossible to play a cassette back at normal monitoring levels without patching it into a pair of channels. This may be a good thing in a sense, but it also means that normal line-out from the desk will bend the meters unless you have the level controls down at such a low setting (eg −1) that the pots mis-track badly and have a nasty habit of turning themselves off if you breathe on them. There is also the added difficulty that the average socket on the back of the cassette recorder is either a so-called RCA phono plug or an infamous DIN plug, whose soldering makes the preparation of a 64-way multicore with *XLR*s on one end and a massive Cinch connector on the other seem positively inviting to the average maintenance engineer. Neither will such connectors be balanced, unlike the patchbay they will have to talk to, and neither will the plugs be obtainable from your usual suppliers (if your usual suppliers are XY Components, substitute for the above, 'will only be obtainable in packets of 200 at exorbitant prices' – although you will get them the next morning).

Luckily, help is at hand with all these little problems of Life. More than one manufacturer produces a box which will drop the level going in by 10dB and boost the level coming out, and will also have the right sockets on its business end. In some cases, the phrase "more than one manufacturer" may mean your maintenance engineer, in which case he will make it with flying leads to the cassette machine constructed from cannibalised hi-fi leads to avoid soldering RCA phono plugs or DINs, thus proving that a box with a couple of op-amps and a handful of resistors in it is easier to make than a 64-way multicore, which will now have to wait until next week. As a result, you will not be able to commission the new effects rack until after he comes back from holiday, and you will lose 14 clients (have you considered going into real-time cassette duplicating?).

Seriously, though, it is worth investing in a 10dB level-shifting box to interface between the console mix output and the cassette ins, and the cassette outs back to a spare stereo replay input on the board. At our studio we have a pair of the Technics cassette recorders (plus a tuner/timer, which enables producers to tape programmes with their bands on them without everyone else having to listen) referred to earlier, interfaced with a Bantam patchbay taking the same leads as the console uses for patching. The console mix output is additionally normalled to the input of machine A, while its output is normalled back to a spare replay input on the master module, extra machines and a record deck with RTS phono preamp (in the same rack) being patchable as required. This seems to be about the best way of doing things, even if you need to derive an extra output for it. Since they were installed, they have seen a good deal of use. And, to be fair, XY Components do in fact supply the right plugs, and very high quality ones they are too, in packs of five.

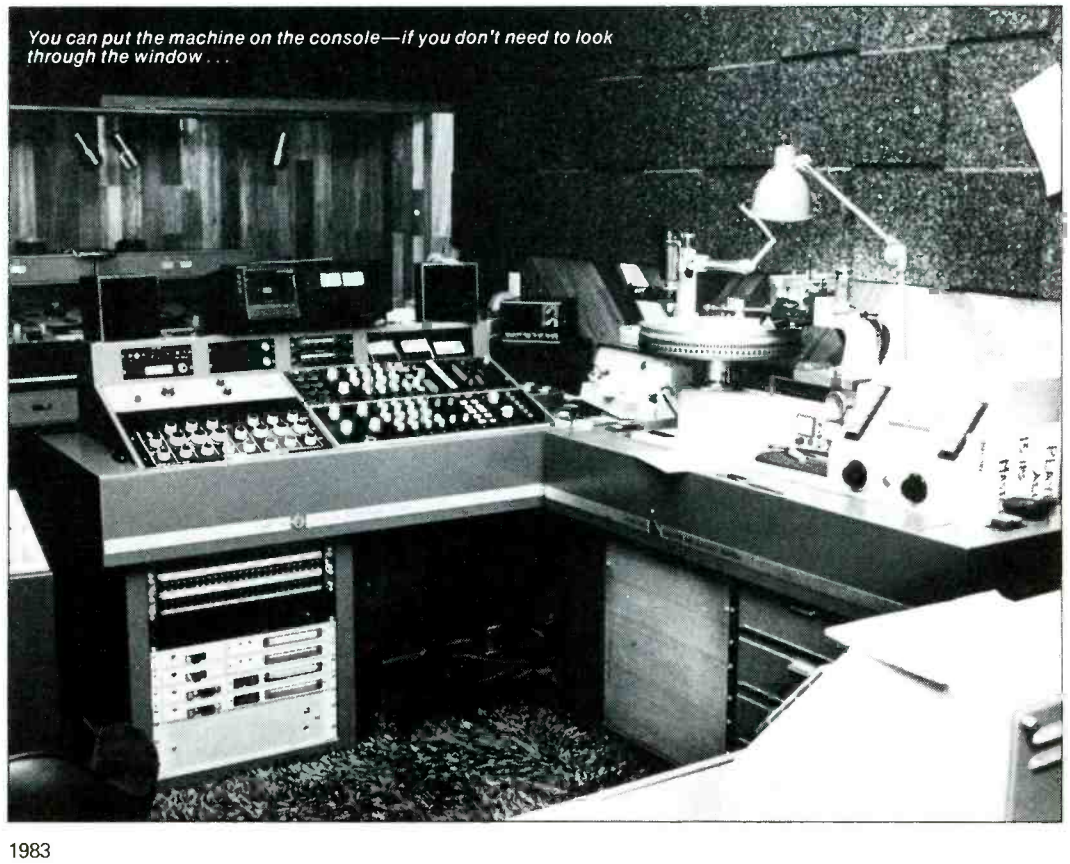
Other features

You can get a number of cassette machines which have a whole load of extra goodies on them, like double-speed (3¾ in/s, and I wonder what Philips think of it) and varispeed. There are also multitrack models aimed at the AV market which also record normal cassettes, and these may be a good investment if you offer such facilities. Variable and double-speed options, however, although they may be useful for something, may be more of a hindrance than a help. Varispeeds can get misadjusted, and double speed, while offering exceptional quality, is only compatible with multitrack home studios and other people with the option as well, so it may never see any use. Indeed, as with studio recorders, there is much to be said for cassette machines which you can line up and use, with as few extraneous knobs and buttons as possible, as the more controls there are, the more likely they are to be in the wrong position when you discover this fact after you have done six cassettes for the band at 4.30 am and try to play one of them back. Apart from such options there is a point in considering a remote control, if you can put it near the other machines' transport controls, and there should be a good timer with a return-to-zero so that you can wind back to the right place when you discover that the record level is too high, without having to switch a large number of switches on the console or making numerous patches to check your place (you will doubtless run out of patchcords anyway, which will result in dismantling that great stereo effect and forgetting how you did it, which will be a pity, as during the playack you are transferring to cassette, the lead vocalist – who was out of the room during the mix – will point out that you used the wrong track during the second verse, where he sang the wrong words, and you will have to do the mix again: this will also be at 4.30 in the morning, and generally just after you have zeroed the desk and put the multitrack tape away).

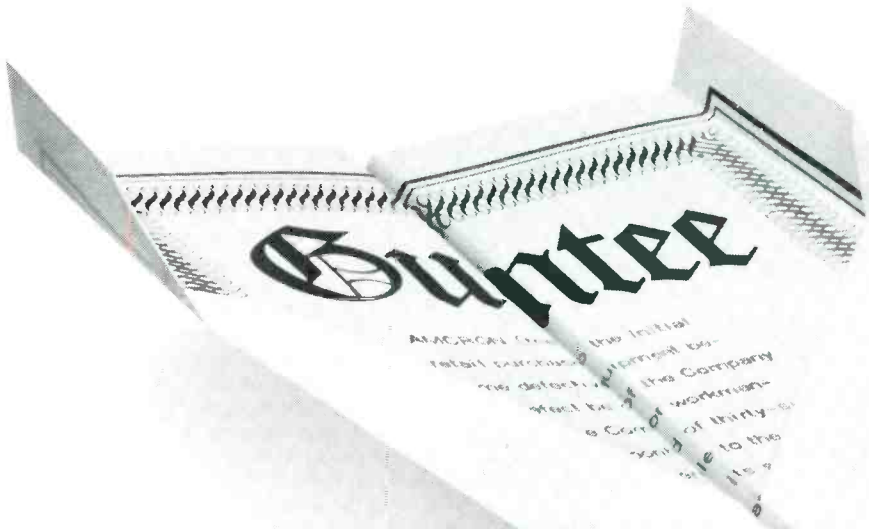
Conclusions

There are a wide variety of cassette recorders which will find a useful place in the studio. Some manufacturers make special versions for professional applications, and these generally have much to commend them. The machine should be robust and reliable – solenoid rather than mechanical transport controls will be a significant advantage here – and should be capable of being mounted on the wall or in a rack, and should be permanently wired into the system so that it is easily accessed when needed. Levels should be matched if the machine does not like line level (*some* machines are designed this way) or it will be a source of continual annoyance. Bias and EQ should be accessible, as should Dolby calibration (unlikely). Dolby B should be fitted, plus HX if you like. The machine should have some sort of peak indication and plenty of headroom, and should be capable of taking at least Type I and Type II tapes, of which stocks should be available. Don't skimp on tape quality. Azimuth should be capable of alignment, and the machine should have three heads.

Last, but not least, it is worth noting that some professional equipment manufacturers also make cassette recorders, some of which they aim at the 'professional' market. They have generally done a good job, and there may be advantages in terms of price and backup. Try them first. ■



You can put the machine on the console—if you don't need to look through the window . . .



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Studiofile:1

Focus, London

When Hermann Goering & Co were desperately trying to flatten London during that unfortunate bit of nastiness back in the early 40's, power stations were obviously a prime target. So much so that the London Electricity Board decided that it might be expedient to build a small emergency power station for the very necessary business of keeping the South London hospitals going. They found a site in Sanctuary Street, just five minutes walk from London Bridge, tucked away behind the Borough tube station. The new building was intended to be bomb-proof, so a high percentage of the total area was underground, and the walls varied in thickness between 18 in and 2 ft 6 in. The LEB vacated that building some 12 years ago, but it wasn't until five years later that Dave Meyers and John Worsley stumbled across it after a two-year search in the London area for suitable studio premises.

As owners of Tangerine Studios in Dalston, which was financed by writing the Clodagh Rodgers hit *Jack In A Box*, Dave and John had already achieved moderate success, the most notable product of the studio being Billy Ocean's single *Love Really Hurts Without You*. However, London was where they wanted to be, and they reckoned the old power station was tailor-made for a recording studio. They called it Vineyard, after the tiny cul-de-sac that skirts the building on three sides, and set about creating a production company that was to last the next seven years.

Many artists passed through the studio in this period including Nine Below Zero, Level 42, Rocky Sharp and the Replays, Ami Stuart, etc, but eventually Vineyard ended up in the same cut-price war as most other lesser known London studios when the recession began to snap at the purse strings. At the beginning of '82, Vineyard's hourly rate was half what it had been two years previously, so it was time for drastic action.

John Worsley decided to pull out and devote his energies to song writing, but Dave had other ideas for Vineyard. He noticed that most of the more up-market, and not to mention highly priced, studios were riding out the recession on the backs of big-selling album artists who book for long periods. It also occurred to him that spare studio time could be most profitably used for recording artists signed to your own label.

Around this time, Dave met producer Barry Andrews, and Phil Lowery, Island Records' head of promotion for eight years. The three decided to start their own label with a view to the label and the studio growing side-by-side.

The studio is in the underground section of the building and the main area measures 30 × 25 ft with a ceiling height of 18 ft. Acoustic treatment is minimal with just a few Rockwool panels breaking up the natural stone surface that gives the studio a fairly live sound. There are three separate booths off the main area, each measuring around 9 × 7 ft, one being a live room, and another housing the studio's sedate Bechstein grand. A good selection of around 40 mics is available and Tannoy *Golds* handle studio foldback. Also in this area are the tape store and workshop, and access is via one flight of stairs down from the street.

The 17 × 14 ft control room is situated directly above the tape store and workshop and its large window looks directly down into the main studio area. The 40-channel *TSM* desk stands at 90° to the window, and is a fairly recent acquisition for Focus. For three years previously they were the proud owners of a Trident *A-Series*, a desk that is very popular in America. Dave thinks it's because they're big, "our mixer was actually 11 ft long"! Dave reckons he had calls every week from studios in the States trying to buy his desk, and in the end representatives from Cherokee studios turned up on his doorstep. It seems Cherokee already had five *A-Series* desks in their multi-studio facility, and all were completely tied up for months ahead. Meanwhile, they had been offered six months' album work for a top flight artist and reckoned they would build yet another studio specifically for this purpose, if they could only acquire the console to go in it. Cherokee made their offer and Dave couldn't refuse. "and the money we made on the desk helped to finance the building; you need a bit of luck now and again". Apparently, the last *A-Series* desk is in Europe, and Dave wouldn't mind betting that there's a bunch of Cherokees lying in ambush just waiting to take that last scalp home.

The other pride and joys of the control room are the Urei *815* monitors that both Dave and freelance engineer 'Sweepie' Durdent-Hollamby are passionately in love with. They're also very keen on the new David *Visonik* mini-speakers which, according to 'Sweepie', beat the opposition hands down—"*Auratones* are aurible!". Tape machines include a Lyrec 24-track with autolocate, Studer *A80* and *B67* machines, and a Revox for tape delay. There's also a list of processing gear as long as your arm that includes names like AMS, Bel, Marshall, dbx, Rebis, Lexicon, EMT, *Kepex*, and so on.

Recent visitors to the refurbished studios have included the Pinkees, Blonde on Blonde and Dollar.

"Sound-wise, I know we've got it now," says Dave. Other full-time members of staff include assistant engineer John Smith and tape-op Tania Collier, who also brews the odd cup of coffee in the studio kitchen. Between the kitchen and the large reception area lies the all-important lounge, complete with pool table, comfy seating, TV and upright joanna.

The Focus Records offices are upstairs, where Jeana Rattee takes care of label administration. At the time of writing, Dave had two acts signed to the label: Legator, formed by ex-Rubettes drummer John Richardson, and Perfect Zebras, a kind of Ultravox-cum-Talking Heads outfit. Though they've had some success in Europe, Legator's Red Indian-style single *Human Beings* has suffered from a lack of airplay in the UK. According to Dave, one play on radio sold 1,000 copies the next day, but that was all they got. Both bands have singles and albums out on the Focus label, and these are distributed in the UK by Virgin and in the rest of the world via Polygram. Dave is quietly confident and reckons the label is doing very well: "I think we'll break the Zebras eventually. They've just started gigging and we've got some European dates coming up."

Oh, one final detail I nearly forgot. According to Dave, the LEB built their emergency power station on the site of the torture chamber that belonged to the old Clink prison. Apparently one or two of the inmates who perished therein pop back for a visit every now and then, and scare the life out of everyone at the studio. Engineer 'Sweepie' Durdant-Hollamby reckons that a couple of spooky sounds have actually appeared on tape, and Dave adds: "Things have happened that really scare you when you're working here all night. I just don't understand it, and I don't believe in bloody ghosts."

Focus Studios, Vineyard, Sanctuary Street, London SE1. Phone: 01-403 0007.

Roger Phillips

Streeterville, Chicago

In an inconspicuous brown 4-storey building off (and underneath) Chicago's Michigan Avenue is located one of the most successful recording studios in the Midwest. Streeterville Recording Studios is a sprawling, incredibly busy complex of five studios that is solidly entrenched in just about every aspect of audio entertainment and communications, from rock albums, to commercials, to educational multi-media presentations.

The wide variety of work that comes through Streeterville's doors reflects Chicago's status as one of the blues and R&B capitals of the world, as well as being one of the nation's corporate and advertising centres. Clients such as United Air Lines, RCA, McDonald's, Pizza Hut, RC Cola, Marlboro, and Schlitz, to name just a few, keep the studio busy by day. Evenings are filled with bookings for rock bands, blues bands, chamber consorts, and other representatives of Chicago's lively music scene.

Streeterville set up shop at the present location in 1968, in association with a radio and TV production company known as Shield Productions. The original facility consisted of a 16-track music room with enough room for 40 players, now known as 'Music I', and two production studios with 4- and 8-track capability. The next ten years were spent expanding the facility and establishing Streeterville as a vital part of Chicago's vast production scene. "I watched the growth of the recording media in Chicago over the years," says studio manager Jim Dolan Jr, "and I realised that we needed to expand. In 1979, we chose Perception Inc—George Augspurger and Jack Edwards—to design two new 24-track rooms, Music II, a 25-man room, and the mixing suite, which includes a 10-man sweetening booth." Music I was rebuilt a year later.

"The concept behind the expansion," says Dolan, "had to reflect the diversity of our clientele. We needed versatile but compatible rooms which could be used simultaneously or independently. These factors are used to their fullest advantage when we have 'staggered-call' sessions, which are prevalent in our commercial work. For a Budweiser Lite commercial for example, I recorded the rhythm tracks in Music II, large orchestra overdubs in Music I, and vocals and dubdowns in the Suite, all in the same day.

"Needless to say, it was essential that the room changes be made very smoothly. While rhythm tracks were still being laid down, the assistant engineer was setting up for an overdub of 16 strings, 10 horns, and six reeds in the large studio. He also duplicated the cue mixes, monitor

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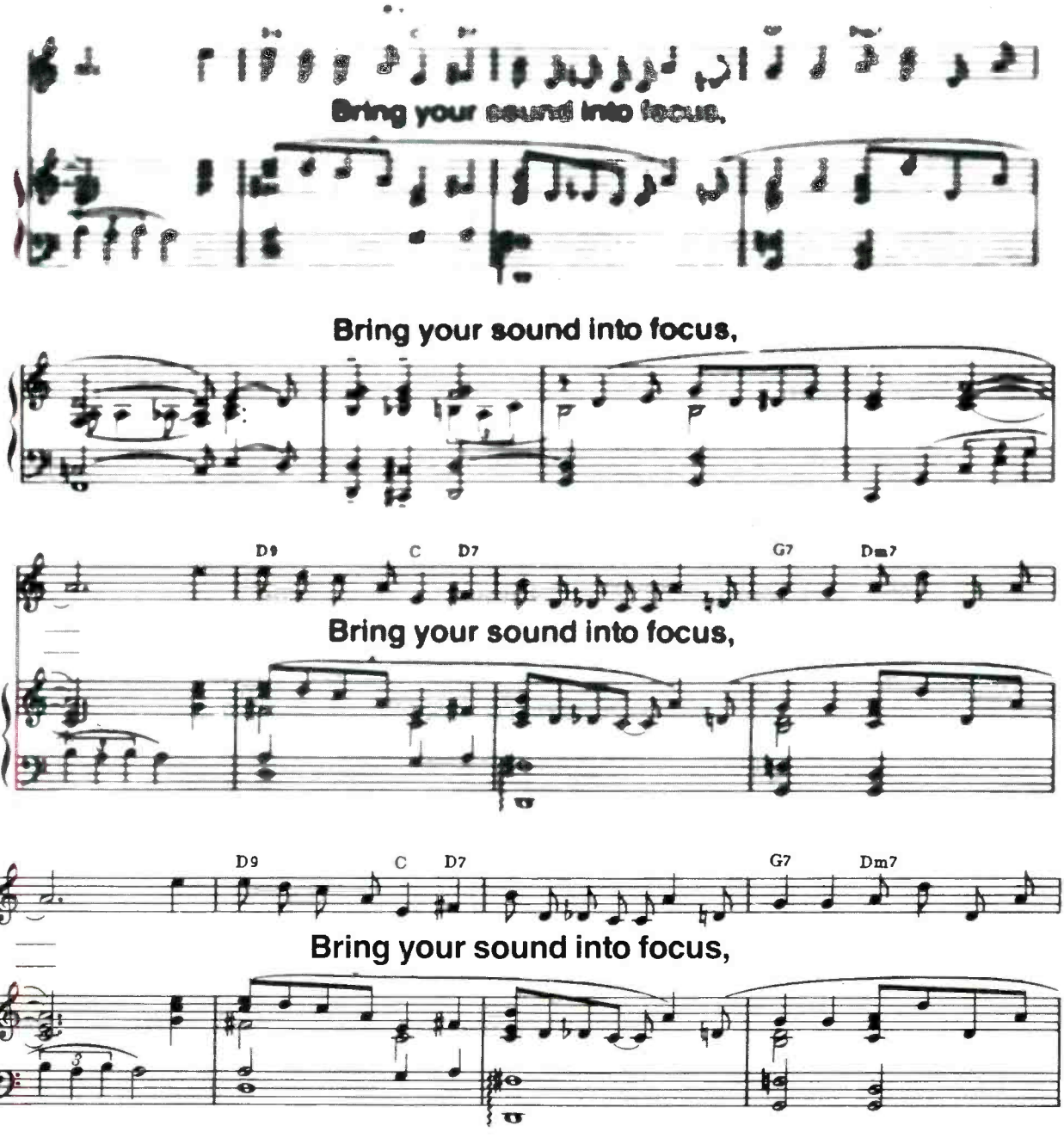

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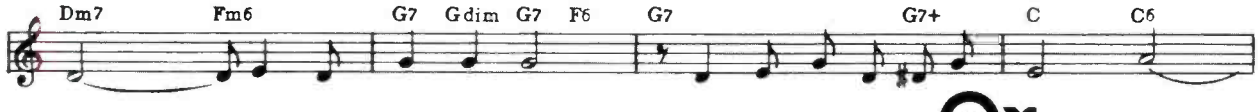

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Studiofile:2

Cabum Recording Studio – Rome

Cabum is a villa in the village of Monte Porzio, perched up in the hills. Rome is only about 30 miles away up the Rome-Naples autostrada, say half an hour to the city centre. Before somebody says "Not another get away from it all...", Cabum is not quite in that category. Owned by two brothers, Guido and Maurizio De Angelis, Cabum is more a studio of convenience than anything else.

Starting out as studio musicians in their teens, the De Angelis brothers soon found themselves in demand as writers, arrangers and producers. One thing led to another and scoring for films was added to their list of accomplishments, notably for the films starring Bud Spencer. All this meant that a lot of studio time was having to be bought with the added problem of not always finding one free at the right time. The obvious course of action was to have their own studio in the villa at Monte Porzio. This provided round the clock availability as well as doing away with the frequent trips into Rome. Above all, it was economically viable.

The bulk of the work done at Cabum is film music or the brothers' own productions, the latter going under the name of Oliver Onions! These productions are very much hit parade oriented and they manage to have regular hits once or twice a year. This success is not confined to Italy, either, but on a European basis with several different language versions. All this means that there is little time for the studio to be hired out on a commercial level though it is used by friends in the business who do, in the time honoured phrase, want to get away from it all and work in quiet surroundings.

At the time of my visit a music session was in progress for the latest Bud Spencer film with Guido De Angelis in the producer's chair, Maurizio in the guitarist's and the engineer (affectionately known as Réré) in, or rather on, the engineer's upturned tub with 'Produce of Scotland' marked upon it!

The studio itself is installed in the basement of the villa with access from the house itself or an outside door by the drive. The space inside the door serves as a storage depot for a multitude of instruments with the entrance to the studio leading off it. The control room serves a dual purpose as control room and office with the desk (office type) being in the daylight end. If needs be, this part can be curtained off from the rest of the room.

Though possibly not a studio designer's idea of a control room, the atmosphere is pleasantly informal with carpeted walls and acoustic tiles on the ceiling. The impression is certainly one of working at home rather than in a studio. The sound was bright and solid and the absence of acoustic 'nasties' seems to be borne out by the fact that work done at Cabum presents no problems in the cutting or transfer room.

Equipment for the studio centres around an MCI package including a *JH-500* console with 28 I/O channels and 32-track routing, two 24-track recorders and two stereo machines. The console is fully automated with synchronisation for the multitracks. Monitoring consists of vertically mounted JBL *4350*'s with the inevitable desk-mounted *Auratones*. For outboard equipment graphic EQ's, compressors and time domain units are the order of the day with equalisers from MXR and SAE, compressors from dbx and Audio & Design and echo/reverb from Roland, Dynacord, EMT, Lexicon and MXR. More signal bending is available in the form of an Electro-Harmonix vocoder. Cassette copies are taken care of by two Teacs and it is nearly superfluous to add that a Revox is also present!

For film work a U-Matic VTR is used in sync with the multitrack(s), the TV monitor being placed right in front of the console for easy viewing. Working with a cassette copy of the film is certainly a lot easier than messing around with projectors in the studio.

The control room is placed at 90° to the studio with the door for the latter to the left of the console. Basically, a rhythm track and overdub studio, the room can handle six people with comfort and more with squeezing. The décor is similar to the control room with the same tiles and carpet plus a bit of wood panelling to break things up a bit. There is also an alcove for drums, etc. The sound of the room is suitably tight and crisp and leaves a lot of latitude for the use artificial reverb and echo effects. The studio is well equipped with instruments in the way of drums, guitars, and amplifiers, effects pedalboards and a variety of electronic keyboards such as pianos, organ and synthesizers.

It was time to be getting back to Rome and thanks were especially due to Guido De Angelis for taking the time to tell me about the studio during the session.

Thanks are also due to Roje Telecomunicazioni s.p.a. for having kindly arranged my series of studio visits while in Rome and to their engineer, Renzo Mengascini, for ferrying me around!

Cabum Recording Studio, 00040 Monte Porzio Catone (RM), Italy. Phone: (06) 942 47 90.

Terry Nelson

Streeterville cont'd

mixes, and external patches on the console. This allowed the producer up-to-the-minute time with the rhythm section, and enabled him to walk into the second room with the musicians all ready. I have found that these room changes not only save time and create more available studio time, but they also can rejuvenate the personnel and the overall spirit during long sessions."

For more conventional long sessions in one room, both Music I and Music II have lounges, kitchens, and shower facilities.

Recording consoles today in all three 24-track studios are Harrisons: a *4032C* in Music I, a *2824* in Music II and a *4032B* in the Suite. Music I and II are equipped with a large complement of outboard gear that includes *Gain Brains, Kepexes,* digital delay lines from MXR, Lexicon and Eventide, UREI limiters, and Pultec and Orban equalisers. The Suite boasts all of these plus a few additional goodies, like a Lexicon *Prime Time,* a *Scamp* rack with auto-panner, and Harrison's *Autoset* automated mixing system.

The three studios have 3M *M79* 24-track tape decks, and in Music I there is also an MCI *JH-24* for multitrack transfers and, in conjunction with a BTX SMPTE synchronising system, 46-track recording. dbx *216* noise reduction is used in the rooms, and the Suite also has 24 channels of Dolby. *Sentry III* monitors with White ⅓-octave equalisation and, of course, *Auratones,* are to be found in all three rooms, and the Suite has an additional pair of Tannoy *12*s and space for any supplementary monitors a client would want.

The two production studios, which are used for voiceovers for radio and TV, multi-media presentations, slide films, and educational projects, use MCI and Scully 4-track decks, although the studio is at present considering some changes. All of Streeterville's 2-track and mono machines are Studer *B67*s.

The microphone collection is what you might expect from a studio of Streeterville's size. Included are plenty of Neumanns, new and old AKGs, Sennheisers, Beyers, Shures, a set of Crown *PZM*s, and a PML stereo valve mic.

The studio owns five EMT reverberators—two *240*s and three *140*s, some of which date back as far as 1959. There is also a breathtaking collection of musical instruments, much of which lives in a corridor between Music I and Music II. There are Steinway and Yamaha grand pianos, a honky-tonk upright, a Wurlitzer and two Rhodes electric pianos, an original *Clavinet,* a Hammond *B3,* a Musser celeste, a Dowd 2-manual harpsichord, and synthesisers from Moog, Prophet and Oberheim, along with vibes, marimba, xylophone, tympani and chimes.

Sony TV monitors and ¾in video decks are used throughout the facility for referencing tracks for television work, and the studio is looking towards getting involved in video sweetening. "Any studio of our size and with our style of work must gear itself up to combining video and audio," says Dolan. "We're looking forward to doing a heavy amount of video sweetening, and potentially video mixing, in the Suite in the next year or so."

Streeterville's extensive post-production services include fast but high-quality 16mm and 35mm mag transfers, mono and stereo dubs in all track formats, and cassette duplication. There is also a very specialised mass-duplicating system for ¼in tape which is used by Sears, True Value Hardware and other major accounts.

There are ten engineers on staff at Streeterville: four music mixers, three production mixers, two assistants and one tech. All of the mixers are capable of doing any of the work, which can be very beneficial in dealing with the needs of the diverse clientele. "We do a lot of speed sessions around here," says engineer Fred Breitberg, "and the temperament for doing that kind of work separates the men from the boys. Mixing a tape is the easy part. How not to turn a client off is something else." There are also four full-time office staff.

As evidenced by the amount of activity at the studio when we visited, the Streeterville staff works hard, but they also play hard. That can be attested to by the well-used 'Kiss' pinball machine in the outer lobby. "We have six or seven of the top players in the city," proclaims Breitberg, "and we will challenge any other team, any time, any place." And that's not just pinball.

Streeterville Studios, 161 East Grand Avenue, Chicago, Illinois 60611, USA. Phone: (312) 644-1666.

Paul D Lehrman ■

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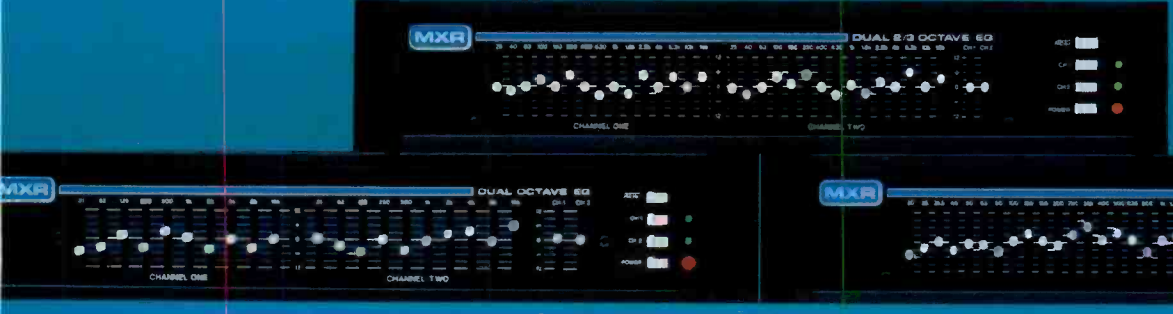

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Inside the PCM-F1

Tony Faulkner

THE arrival on the audio scene last year of Sony's low cost 16-bit digital audio processor raised many questions for most of us professionally engaged in sound-recording. Up until the *F1*, discussion of PCM audio remained an academic one for most studios, unless they were intent on a 'pioneering' spirit of embracing expensive new technology which took their fancy or there was some long-term commitment to the *Compact Disc* project.

The original concept behind this article was to outline a series of modifications to the *PCM-F1* in order to make it more readily suitable for professional applications and requirements, rather in the same way as the original *Studio Sound* Revox mods published some years ago by Angus McKenzie. After many weeks of research, I decided to approach the project with a greater degree of caution, rather than following Adam & Eve's example of taking a bite from the apple in the enthusiasm of the moment.

In sonic terms, the *PCM-F1* in conjunction with a good quality video recorder can produce sound favourably comparable with that from a well-aligned conventional analogue reel-to-reel machine running at 15in/s or 30in/s and costing several times the price. Differences are in my experience audible, with the digital system showing improvements in pitch/speed stability, lack of hiss, smoothness and extension of bass, with the analogue system (on first generation) showing occasionally sweeter low-level quality and a more friendly overload characteristic. In practice, though, analogue recordings degenerate with copying, however carefully done, and this is not a problem with a digital master which remains in pristine condition unless there is a major problem with the video recorders. Measurement and audition of the *PCM-F1* yields results to put the fear of God into the hearts of most manufacturers of analogue tape and tape-machines, and it is plain to see that the future will hold many shocks and surprises for those companies entrenched in the old technology.

Unfortunately, Sony *PCM-F1* recordings are not directly compatible with those done on the *1600/1610* or the JVC systems, and this means that editing cannot be carried out directly with the precision necessary for more demanding commercial jobs such as classical music recording. Accurate digital editing can be done using the existing electronic editing suites developed by JVC, Matsushita, Sony, Soundstream, Denon or Mitsubishi, but this has to be achieved at present by transferring the *F1* recordings to the other digital systems via an analogue conversion. Although the quality loss will be arguably small, it is obviously preferable to do any transfers in the digital domain, avoiding the effects of repeated bandwidth filtering and compounded quantisation errors.

The *F1* uses a coding according to the EIAJ consumer digital audio format (modified slightly to accommodate 16-bit resolution rather than the original 14-bit laid down) and it is only possible currently to do direct editing by playing the *F1* recording through a Sony *PCM100* which has all of the electronic interfacing required to decode the top 14 bits of the *F1* recording, unfortunately disregarding the bottom two least significant bits. Investigation of the workings of the Sony *PCM-F1* reveals that, internally, the digits are moved around the various signal-processing areas in a format bearing more than a passing resemblance to the coding within the Sony *PCM1610*, Sony *PCM100*, Sony *DAE100* editor, and for that matter the *CDP-101 Compact Disc* player.

This format is shown in **Fig 1** and is basically a serial stream of data starting with left-channel MSB down to left-channel LSB followed immediately by right-channel MSB down to right-channel LSB followed

immediately by left-channel MSB, ad infinitum. Synchronised with this stream is a word-clock where the level is high to indicate left-channel, and low to indicate right-channel. In addition to this word-clock there is a DC line used to indicate the presence or absence of audio pre-emphasis (50μs – 15μs). One's immediate reaction is to reach for the RS Components catalogue and improvise a circuit-board to convert this internal Sony data-format into a form directly interfaceable with other digital equipment.

As technically feasible as such modification obviously is, in my considered opinion it is most unadvisable unless one is highly confident about what one is doing, and equally enlightened about the internal workings of digital audio, to avoid serious potential pitfalls. The Sony Corporation are adamant in not recommending modification of the *PCM-F1* (presumably for fear of claims for damages in the event of problems), and it is their avowed intention to make no professional machines based on the EIAJ format.

Harmonia Mundi in Freiburg, West Germany, advertise a service to transcode *PCM-F1* recordings to *PCM1610* format for editing, and RTW of Cologne intend to demonstrate a commercial add-on unit for the *F1* to facilitate digital-to-digital interfacing with the *1610* at AES Eindhoven during March. At this stage, I think modification for digital-to-digital interfacing of the *F1* is best left to the few rather than as a general practice.

It is apparent that for a studio to go over to Sony *PCM-F1* for stereo mastering must be regarded as an interim measure only. The complications of editing and transcoding to other formats will inevitably limit the widespread adoption of the system unless some manufacturer other than Sony comes up with a fully professional compatible unit incorporating the interfacing and editing facilities required for studio work. Nonetheless, at its price, the *F1* offers a unique opportunity for studios to taste the benefits of digital recording with a top quality hi-fi recorder capable of embarrassing most studio recorders, without the risk of laying out vast sums of money on technology which will probably be out of date within months of delivery! The use of standard video recorders means that any studio going into *PCM-F1* technology will have gear which can be used for video work as well, and this also ensures a reasonable second-hand resale value for the recorders when the time comes in a couple of year to purchase the long-term professional-standard digital audio recorders currently under development.

After many months of using the Sony *PCM-F1* on recording sessions, and a total of five years using pseudo-video output PCM converters, I have reached a number of conclusions. In my experience, the number of problems tracked down to malfunction of the digital converters can be counted on the fingers of one hand (defective PSU or blown op-amps), even after well over 100 albums and dragging equipment on location many miles from home. Any dropout problems I have encountered have been tracked down to the video tape, or to the state of repair of the recorders (especially head-wear). I believe that by far the greatest obstacle in the way of achieving excellent results from the *PCM-F1* is the use of domestic *Betamax* and *VHS* recorders which are simply not robust enough for professional applications. Used with well-maintained *U-matic* recorders and good tape, the *F1* will perform phenomenally well, but with anything less, I have encountered occasional difficulties. The error-correction circuitry incorporated in the *F1* is very powerful indeed, but some of the signal disturbances present in video dropouts (particularly disturbances in time-domain, rather than just temporary loss of signal) cause havoc and ask too much of the medium. I always take a small black-and-white TV monitor on recording sessions which is hooked onto the video output of the tape-machines in order to observe any irregularities, and on the occasions I have taken any domestic recorder I have been shocked by some signal disturbances I have seen. I know of two studios who bought *PCM-F1*'s and used them with the 'Ferguson from under the telly', and have had some serious troubles in the field. All of the Sony and JVC editors I have seen work with *U-matic* tape-machines only. *U-matic* is the standard medium for *Compact Disc* mastering and is a very well established format for industrial video, so I believe this is the only sensible choice for serious *PCM-F1* recording unless the portable feature of the little *SL-F1 Betamax* makes it irresistible. Many of the commercially available *U-matics* are dual standard (NTSC-PAL) so there is no problem at this stage as to which standard to adopt, and it is only really necessary to carry out one monitor modification to ensure compatibility of recordings.

This modification concerns the record head-cross point of the *U-matic* recorder. All of the original Sony digital audio editing installations to date utilise the expensive *BVU* type broadcast-standard *U-matic* recorders, and these machines often take exception to replaying video-recordings made on standard low-band industrial *U-matics* (*2630, 2631, 2800, 2850, 2860, 5630, 5800, 5850,* etc). The incompatibility arises because the broadcast *BVU* has its record-head switch-point set to a slightly different point in the TV picture, and when confronted with a recording made with the head-cross in what it considers the wrong place it tries to 'correct' the irregularity and this causes a dropout. With rotary-head recorders, there has to be a point somewhere in the TV waveform where the signal switches from one head to the other, and the modification required is a simple screwdriver internal electronic preset adjustment easily carried out by a qualified industrial video supplier or servicing-agent to shift the record head-cross into the same position as a broadcast *BVU* recorder. Transcoding your *PCM-F1* recordings to *PCM1610* format for editing or transfer to *Compact Disc* will almost definitely require some kind of U-matic set-up, and almost equally certainly utilising *BVU*'s, so you might as well ensure complete video compatibility from the start.

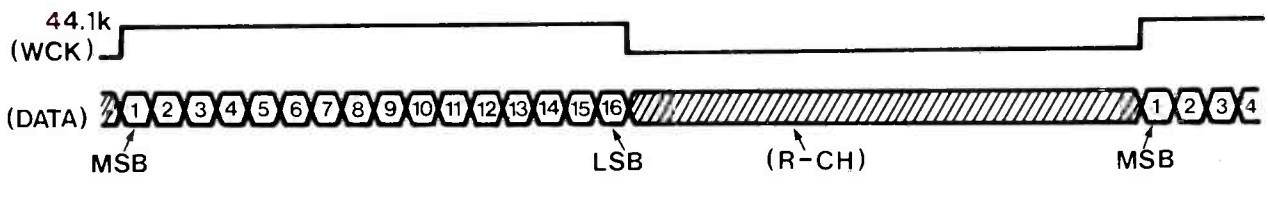
The audio circuitry of the *PCM-F1* does not require extensive modification for professional applications – although standard audio interconnection is via consumer-type phono sockets, there are no insuperable problems with level interfacing. The audio line input shows no clipping problems, despite its domestic high sensitivity, and this is because it is essentially a passive attenuator pad feeding directly thereafter onto the main level front-panel control. Those committed to audiophile modifications may choose to bypass the mic-line input selection relay, and connect the line-input direct to the low-pass filter driver via appropriate level-setting, but I do not consider such a modification any great priority at all, and it would remove the mic input facility which, although not really up to professional standard (unbalanced and prone to ground-loop hums), might occasionally prove useful on location as a battery portable.

The phono audio output is at typical domestic low-level, but this is easily overcome by making up a jack lead to interconnect with the headphone output socket on the front panel. My experiences with the robustness of home-made jack leads have lead me to believe that a good answer is to purchase, from a hi-fi store, a moulded headphone splitter lead (one stereo jack plug to two separate jack sockets, usually intended to feed two pairs of headphones from one socket) and then to chop off the two line-sockets and substitute *XLR* male 3-pin sockets appropriately wired so that one is connected to the left audio (tip of jack). The earths can be commoned to the signal-low and ground pins of both *XLR*'s. The headphone amplifier is of high quality, and when set to the 0dB attenuator position (ie maximum) gives a perfectly compatible studio console level. Input levels can be set to give unity gain in-to-out, and one is effectively operating 'business as usual' only with the digital recorder in circuit (via *XLR*-to-phono leads for input, and headphone-jack-to-phono leads for output).

Setting record-levels for digital recording is important and to this end Sony have incorporated fast-reading LED meters in the *PCM-F1* which are much more helpful than most desk VU's and PPM's. In my experience it is best to forget about the meters on one's desk (assuming that the operating levels have been set up appropriately), and to use the internal meters of the *F1* only. The sound quality of the *F1* degrades slightly (particularly at high frequencies) as the level reaches peak modulation, and I would recommend leaving the last few decibels as headroom rather than succumbing to the temptation of wrapping the meters around the end-stop until

40 ▶

FIG 1



clipping is audible. The *F1* has internal presets for the meters on the main side-cheeks (engraved L and R) and I recommend making the meters 2 or 3dB more sensitive to discourage over-recording. In addition to the horizontal green LED level display there is a red 'over' light which comes on when you are on the brink of clipping (it lights when the record-encoder detects a signal corresponding to all 1's in the data). When replaying tapes, the red 'over' light will *not* indicate an overmodulated tape unless the front 'copy' switch is set to 'on', since the record and replay circuits are strictly isolated unless copying is in progress. The isolation of A/D and D/A circuitry can be most useful if you want to prepare an equalised copy of a digital master-tape. It is not possible at present to equalise *F1* tapes in the digital domain, so one connects the audio line-output of the *F1* into the line-input of the desk – equalisation of the recording may be carried out (monitoring the output of the desk) and then the output of the desk is fed to the line input of the *F1*. The *F1* meters will continue to read the original unequalised source-recording since they cannot be selected to read the input signal, but the record-circuitry will process the equalised signal from the desk and it can be recorded on a second video-recorder. This process has to be carried out using the 'copy' switch set to off and with the video feed to the playback machine disconnected, since you are not asking the *F1* to do a straight one-to-one copy: it is being presented instead with a new analogue signal from the desk for recording. The low noise and flat response of the *F1* system mean that overdubs can be carried out in similar fashion by bouncing from one *U-matic* to the other via the mixer adding extra tracks on each pass. Copying from one *U-matic* to the other for 1:1 digital-to-digital transfers could not be much easier, but it is important always to use the 'copy' function of the *F1* rather than do straight video-video copying which can produce clicks and crackles if the error-correction facility of the *PCM-F1* is not taken advantage of.

On the back-panel of the *PCM-F1* there are three video interconnection sockets. One is a video return for playback, and the others are for feeds to two recorders. In standard (ie 'copy off') mode, both video outputs are live and it is possible to make parallel recording with two decks (a wise precaution when making irreplaceable live concert-recordings where a recorded tape dropout would be disastrous). In 'copy on' mode only the second 'copy' socket is functional, since the presence of the 'copy' signal at the video-input of the master-playback recorder could cause problems if the machine employed a playback-servo system and tried to 'chase its tail' in a signal-loop.

Until the arrival of Sony's *PCM-F1* there was no particular problem of video standard compatibility, since apart from a few hand-built PAL prototype consumer converters from Sharp, Akai and Technics, all of the PCM adaptors operated in accordance with the Japanese and US TV standards of 525 lines, 60 fields. Since the Sony *PCM-F1* is aimed primarily at the consumer audiophile market, it was decided to introduce two versions: one NTSC-525 lines/60 fields compatible, and the other PAL-625/50 fields compatible. Fortunately Sony have spared us one half of the standardisation problem since on playback the *PCM-F1* PAL and *PCM-F1* NTSC both recognise and replay either video format, with 'copy' outputs as determined by the particular model. So if you are presented with an NTSC-525 lines/60 fields tape you can play it back on your dual-standard *U-matic* (such as *VO2630* or *VO5630*), through your PAL *F1*, and make a copy in 'copy' mode to PAL-625/50 fields format. The choice of which system to buy is difficult for European studios since on the one hand PAL is useful to interconnect with standard domestic and industrial equipment, and yet all of the editing and transfer suites presently operating utilise NTSC/EIA format. Within the *PCM-F1* the electronic differences between the PAL and NTSC models are not great, although the PAL one includes some extra components to facilitate the different 'read' and 'write' clock frequencies required. My own solution was to buy a PAL model, and perform a simple internal modification in order to set it to give an NTSC output unless a simple jumper connection is shifted and a switch moved. In this way I use the *F1* nearly always in NTSC mode, but if I have to give a client a listening copy on, say, a PAL *Betamax* tape, then I can swap the jumper connection over and do the copy straight off. The master-clocks and therefore sampling rates of PAL and NTSC models are very slightly different (PAL $f_s = 44100$ Hz; NTSC $f_s = 44055.94$ Hz), but this only results in a speed error of 0.1% which is less than the replay speed error of LP analogue tape on a tape-deck set up for standard play tape! In practice this means that my NTSC recordings are 0.1% slow when played back on a standard NTSC set-up, but it is worth remembering that the Philips and Sony *Compact Disc* players both operate at a sampling rate of 44.1 kHz, and my recordings will therefore run at correct speed. In order to make the PAL/NTSC changeover relatively speedy I have made the operation two-fold – firstly, the 16-bit/14-bit resolution switch has been rewired to select 60 fields/50 fields and secondly the phase-lock-loop in the master-clock 'read' section is jumpered in or out of circuit by connecting J502 for PAL or J501 for NTSC (see **Fig 2a**). I do not consider that the 14-bit/16-bit resolution switch serves any useful purpose for most professional applications since it should always remain in 16-bit, and this switch operates by feeding or not feeding a −5 V DC signal into pin 2 of IC534 which is a bus driver for setting IC508, the main data processor, in the recording section. This bus driver also controls the 60/50 fields setting or the record data processor and is normally fixed

42 ▶

FIG 2

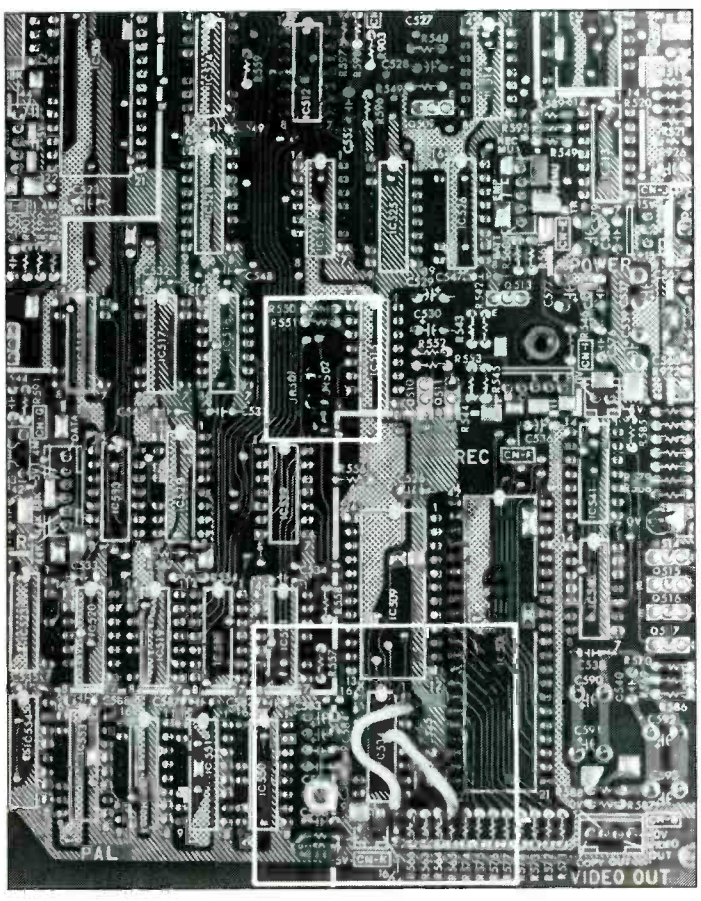


FIG 2a

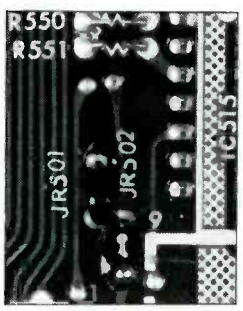
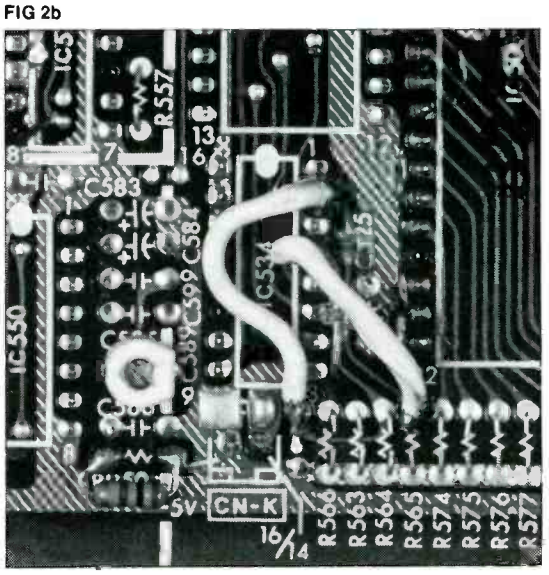
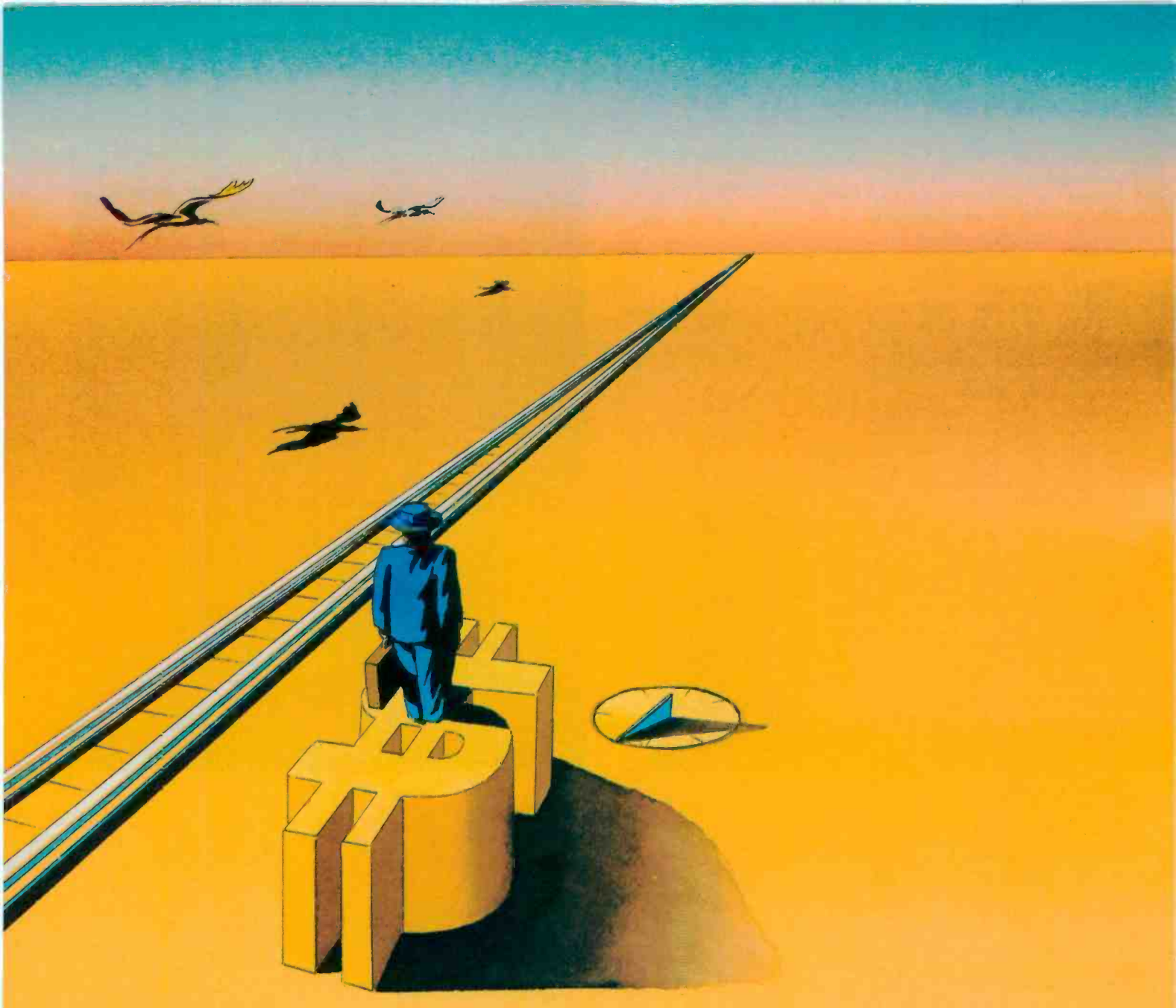


FIG 2b





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permanently (−5 V for PAL) but by reconnecting the 14/16-bit switch to pin 4 of IC534 instead of pin 2, the function is changed appropriately (**Fig 2b**).

The huge reduction in cost of the *PCM-F1* compared with previous adaptors comes from the domestic consumer market orientation and the mass-production of specially designed A/D and D/A converters and data processing integrated circuits. The converters employ a dual-ramp technique, offering fast conversion combined with good stability and resolution close to the 16-bit specification. In order to give optimal performance the data inputted to the D/A converter has to be very smoothly clocked and I suspect that the use of less-than-ideal domestic consumer video cassette decks might impair the ability of the D/A converter to operate at its best, because of clock-jitter stretching the system to its limit.

There are several presets within the *PCM-F1*, but with the exception of the meter FSD adjustment they are probably best left alone. The DC offset prior to A/D conversion (RV103/RV203—**Fig 3**) can be adjusted to advantage with some samples, and is achieved by attaching a black and white TV monitor to the video output and adjusting the presets to make the appropriate vertical bar stay as close as possible to the critical midpoint between all black and all white with no audio signal applied to the input. This adjustment should be carried out after the *PCM-F1* has been switched on for at least 10 minutes, and can be a source of aggravation since it has to be carried out with the case removed – and replacing the case changes the setting! The offset itself will not degrade the quality unless very badly out of adjustment, but cosmetically it is disconcerting to see the bottom LEDs of a *PCM1610* sensing the offset on replay of a transcoded tape since they operate in digital domain and sense DC. **Fig 4** shows the method of disassembly to access the innards for adjustment.

There has been much discussion about the audibility of low-pass filters and it is a shame Sony did not opt for Philips' elegant solution of oversampling to reduce the audibility of the filter following the D/A converter. But although I suspect the input filtering does not sound quite as sweet as it might, it is nonetheless a remarkably clear, accurate sound at a very acceptable price, and will undoubtedly bring a large number of studios into the Digital Age with a jolt, setting the stage for the next generation of studio equipment. It is alarming how the transparancy of digital sound exposes the hisses and hums we have all been happy to put up with for years, and the new technology should bring the soldering irons and oscilloscopes out to track the faults from the old ancillary gear! ■

FIG 3a

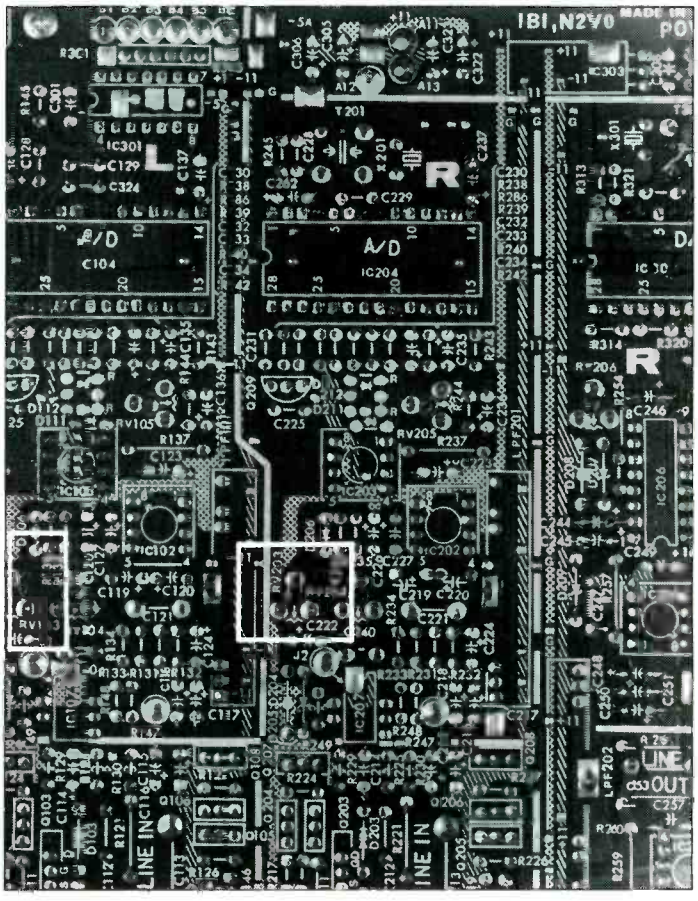


FIG 3

FIG 3b

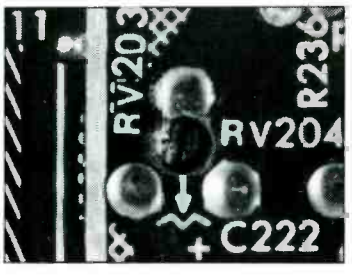


FIG 4

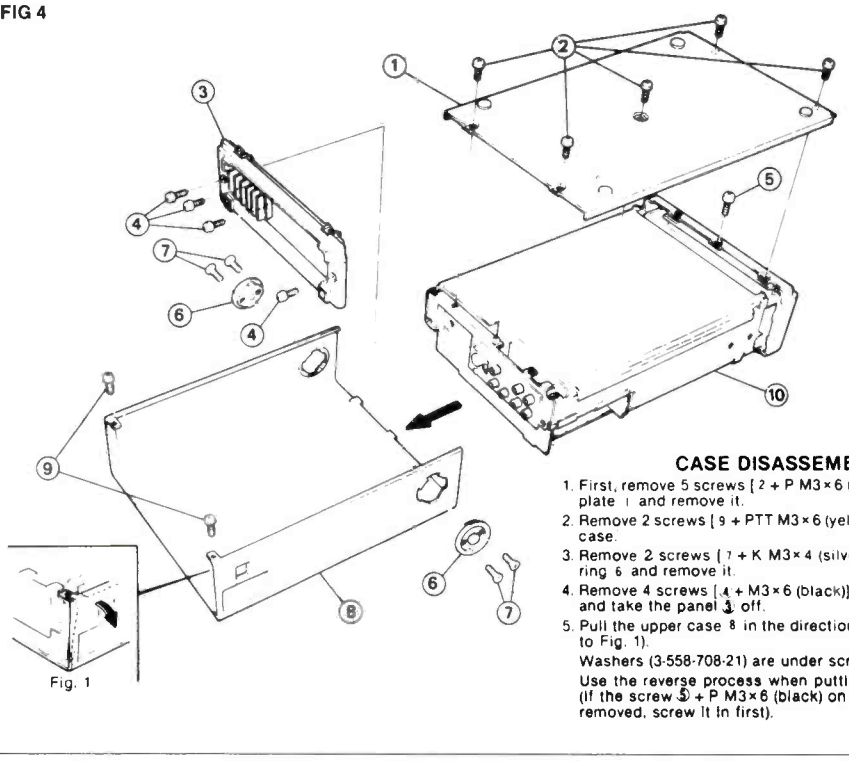


Fig. 1

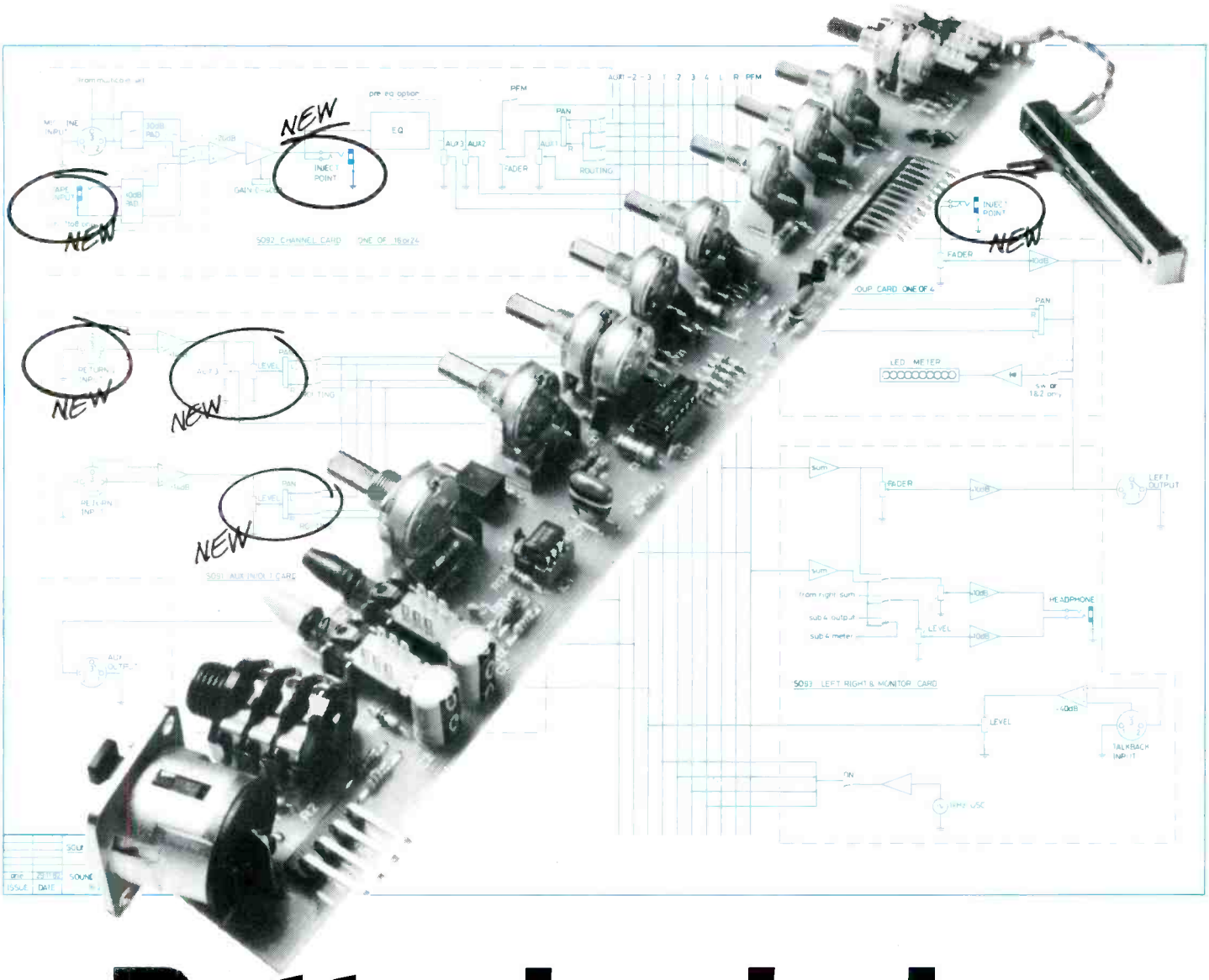
CASE DISASSEMBLY

1. First, remove 5 screws [2 + P M3×6 (black)] from bottom plate 1 and remove it.
2. Remove 2 screws [9 + PTT M3×6 (yellow)] from the upper case.
3. Remove 2 screws [7 + K M3×4 (silver)] from the handle ring 6 and remove it.
4. Remove 4 screws [4 + M3×6 (black)] from the rear panel and take the panel 3 off.
5. Pull the upper case 8 in the direction of the arrow (Refer to Fig. 1).

Washers (3-558-708-21) are under screws 2, 4, 5.

Use the reverse process when putting the set together. (If the screw 5 + P M3×6 (black) on the front panel was removed, screw it in first).

2-362-358-11



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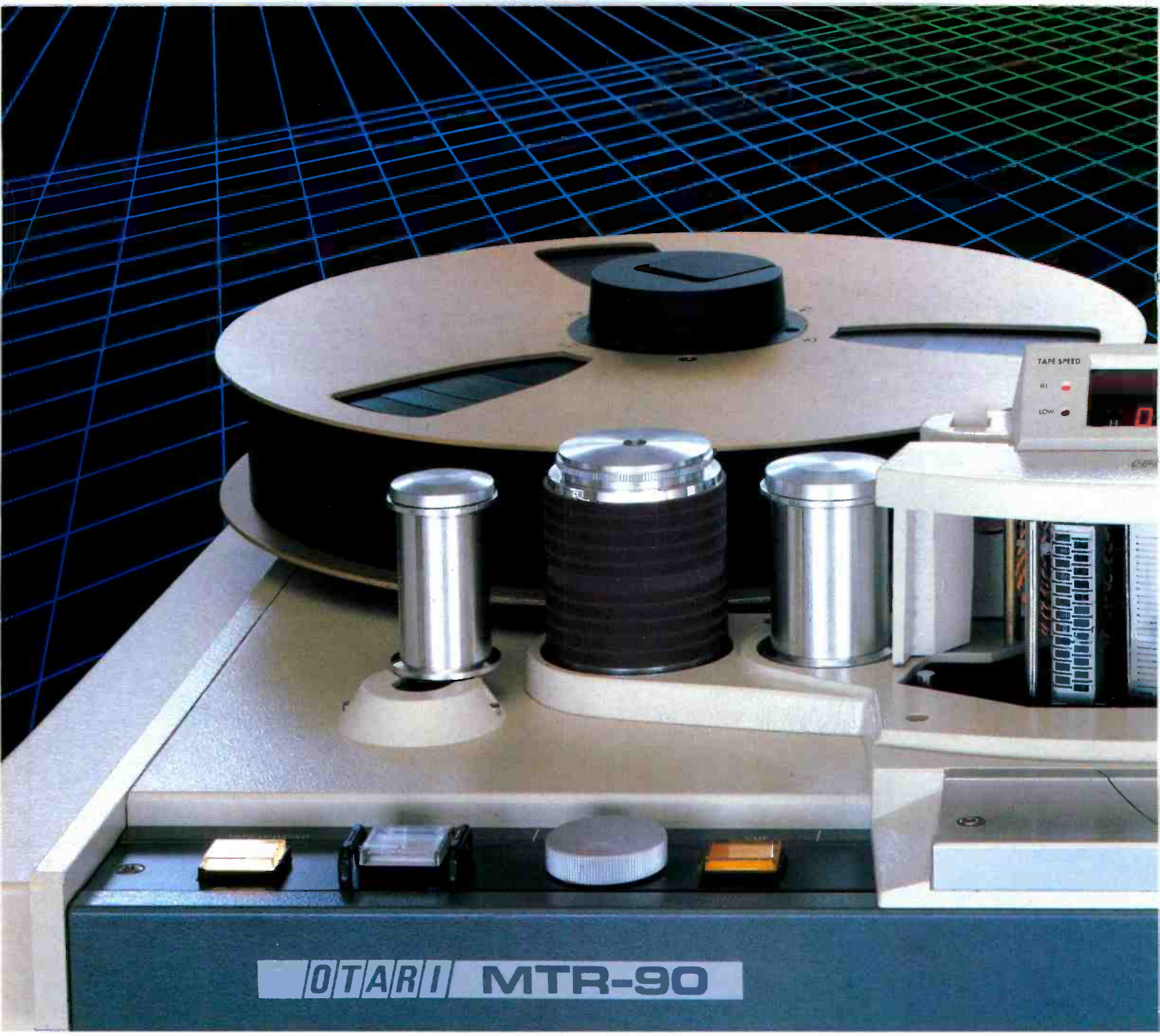

THE NEW OTARI MTR-90 SERIES II

"...thoroughly recommended,"

Hugh Ford, Studio Sound, November 1982

"The Otari MTR-90 Series II is a very well-built machine with the tape transport having many of the features of the premier recorders of European manufacture...

"Both the remote control and auto-locator are highly practical with excellent layouts. Full and foolproof interlocking is provided for all functions with clear displays of the machine's status.

"This machine is to be thoroughly recommended, particularly when comparing its price with competition."

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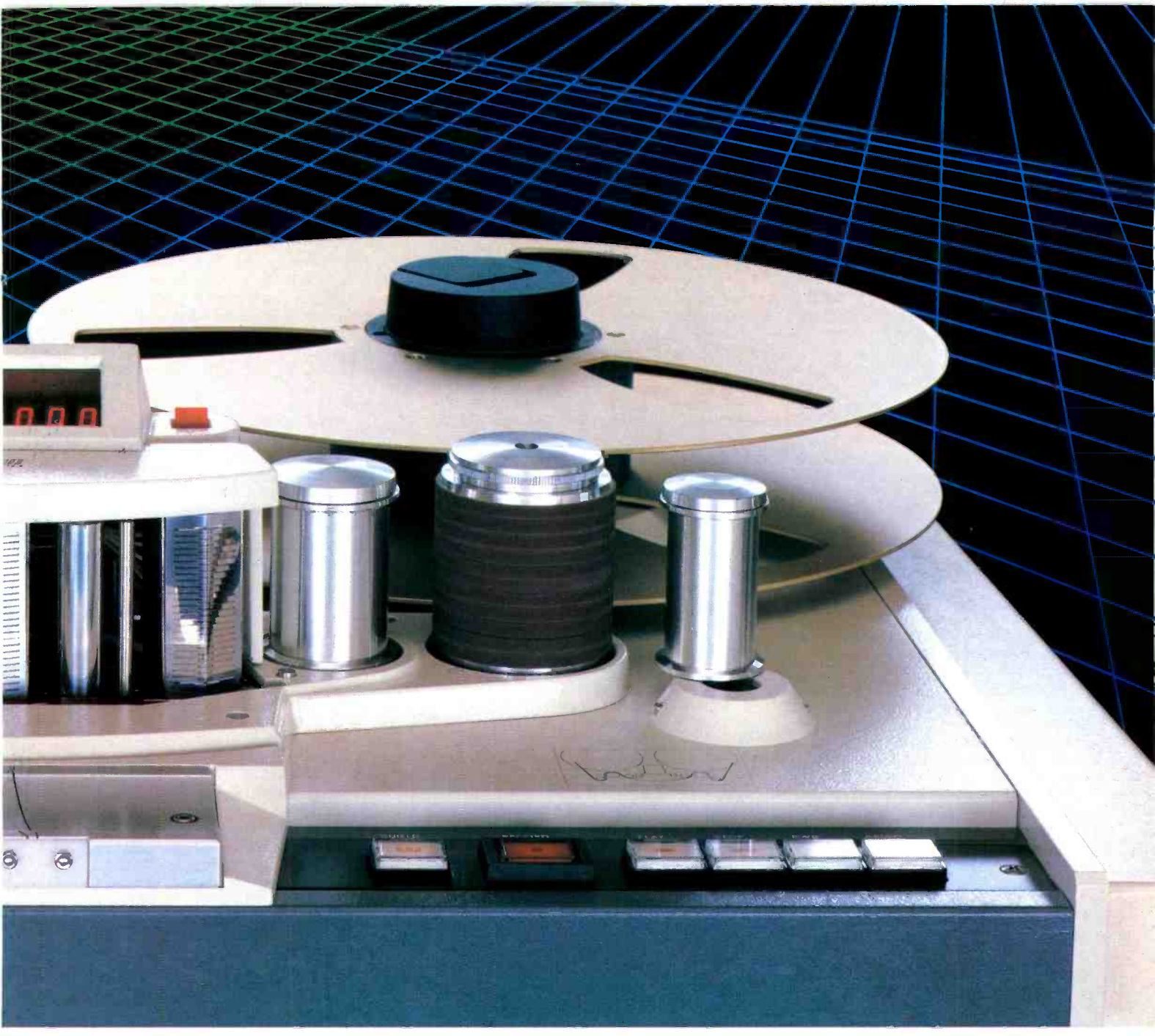

interface with any SMPTE-based video editing system, machine controller or synchronizer.

The complete text of Hugh Ford's review, plus a comprehensive technical brochure and price details are available now. Further, should you desire your own "hands-on" review of the MTR-90, ring us directly at 0753-38261 and ask for Mick Boggis.

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business

BARRY FOX

CX confusion

There's some interesting news on the *CX* front. CBS has now sold a million *CX* discs in America. But it's thanks to a pretty tricky ploy. The discs are single inventory releases and identified as *CX*-encoded only by a very tiny logo at the bottom corner on the back of the sleeve. There's no note to explain what *CX* is or what it does. So a million people have bought *CX* discs, without knowing it. Sales of these *CX* discs has been helped because CBS has encoded mainly popular titles, from artists like Shakin' Stevens, Julio Iglesias, Barry White and the Goombay Dance Band. Also, owning up internally that 20 dB of compression *isn't* compatible, CBS is now using only 15 dB of compression when the incompatibility is most likely to be noticeable. You can just about get away with the replay of 20 dB encoded material on non-*CX* equipment if what you start with is a narrow dynamic range pop-music in the first place. But on classical music, you can't raise quiet passages by 20 dB and not notice. Hence the compromise at 15 dB compression on wide dynamic range material. It's unclear who in CBS first coined the phrase "compatible". Perhaps he's now left the company and is working in a Siberian salt mine. If not, he deserves to be.

In Europe, the marketing push is concentrated in Germany. In Deutschland, hi-fi enthusiasts love knobs, dials and add-on units so they are receptive to *CX* decoders. What's more, Germany is the home of Telefunken, the ailing failing electronics giant that wanted to launch a mechanical digital audio disc system in competition with laser read *Compact Disc*. When Telefunken's mechanical *Mini Disc* failed (inevitably) the company looked for something, anything, other than *Compact Disc*. Its subsidiary, Teldec, had already developed the *Direct Metal Mastering* technique for cutting analogue discs so Telefunken decided to back *CX* as a partner for *DMM*. At the Dusseldorf Hi-Fi Show in autumn 1982, Telefunken showed a record player with *CX* circuits built in. There's little doubt that a *CX* disc, correctly decoded, can produce good results. But so can dbx discs!

On the video front, *CX* is making some headway. RCA has adopted the system to improve the sound on its stereo videodisc system. In both the USA and Japan, *CX* is now standard for *Laservision*. It was adopted because there were problems in America in getting a good signal-to-noise ratio off NTSC-format videodiscs. The best they could get was 55 dB which isn't really good enough for the hi-fi sound promised from *Laservision*. But, because of that same old compatibility problem, the compression was reduced from 20 dB to 14 dB.

The big question a year ago was whether Philips would adopt *CX* for *Laservision* in Europe. I put the question to Philips when we visited the Blackburn *Laservision* disc pressing plant long before the system was launched in Europe. Let's get it right from day one, I said—either have *CX*, or don't have *CX*, but don't create a muddle on the market. I was assured that *CX wouldn't* be used for *Laservision* in Europe. Thanks to the PAL system, and better pressing techniques, Philips was getting a 65 dB signal-to-noise ratio for its *Laservision* discs, so it didn't need noise reduction.

There was a limited launch of *Laservision* in Britain in May 1982. The national launch followed in October. Then, in November, Pioneer announced that it, too, was going to sell *Laservision* players in Europe. We will also, said Pioneer, be selling *Laservision* discs pressed at our plant in Europe. And yes, you've guessed it, the Pioneer player has *CX* circuits built-in and the Pioneer discs will be *CX*-encoded. What on earth is happening? I asked Philips. The answer was predictable. At some unspecified time in the future, the Philips pressing plant in Blackburn will start producing *CX* discs. Also at some unspecified time in the future Philips will start selling players with *CX* decoders built in. Until then, anyone buying a *Laservision* disc from Blackburn will get a non-*CX* disc. Anyone buying a disc from Pioneer will get a *CX* disc. Anyone buying a current Philips player will get no *CX* circuits. Anyone buying a Pioneer player now, or a Philips player later, will get switchable *CX*. So there's now exactly the kind of confusion on the market that could so easily have been avoided.

A *CX* disc played on a non-*CX* player will sound unnaturally compressed. Philips argue that this could be useful where the original material is of wide dynamic range—a film sound track for instance. But that sounds very much like a tailor-made justification for a commercial cock-up. There's certainly no possible justification for what an ordinary disc will sound like when replayed, with artificial expansion, through a *CX* decoder. And this will happen, because people who have *CX* decoders built into their Pioneer *Laservision* players will probably leave them on all the time. After all, if you've paid for a feature and a little green light, you want to use it, don't you?

It would be nice to think that both Philips and Pioneer had sat down carefully before deciding to switch to *CX* mid-stream, and given due consideration to the trade and consumers. But it wasn't like that. The switch news just filtered through. When quizzed, both companies fell back on the standard copout that we've heard so often over the last couple of years in the audio business. There's no problem, both Pioneer and Philips said, because *CX* is "compatible".

Too loud to be real—too real to be quiet?

The public has now forgotten what live sound sounds like. When the Count Basie Band, Ella Fitzgerald and Oscar Peterson appeared recently at the Royal Festival Hall, their glorious live sound was piped through a pair of ageing Altec PA bins, one each side of the stage. For the Silk Cut Jazz Festival at the Barbican Centre, the subtle sound of Peggy Lee was blasted out from the stage by rock speaker stacks. Some of the audience complained that they had only paid to hear one performance at a time. I'm lucky. Near where I live in North London there are a couple of places where I can hear music truly live. One is at the old building called Burgh House, in the centre of Hampstead, and the other is the small theatre of University College School, also in Hampstead. Both places put on concerts of all kinds of music and whenever possible don't use any amplification at all.

One recent UCS concert featured four piano players who were chosen for their quite different musical styles. Andrew Lowe-Watson played flowery classical études, Dave Lee swung standards, Michael Garrick rambled melodically and Johnny Parker remembered rags, boogie and Jelly Roll Morton. The piano at UCS is a Bluthner concert grand, freshly tuned for each concert. The hall holds around 200 people and has a pretty live acoustic. So the grand sounds pretty loud. Mikes were used, but only for announcements and recording. During the interval I overheard a lovely conversation.

"Oh, it's *so* loud," said one lady, "it's really hurting my ears." "Yes, mine too," said her friend rubbing her ears and gritting her teeth, "it's all that amplification they will insist on using these days."

BFBS 'Spoiler'

More on the CBS anti-taping system. What a pity EMI and the BPI didn't talk to BFBS, the British Forces Broadcasting Service, before deciding (in late 1976) that it wasn't worth testing a signal trigger system of the type now being proposed by CBS (see February issue). BFBS engineers now tell me that they have been using a notch system for as long as they can remember. It works like this.

BFBS tapes programmes in London, copies the tapes many times over and sends them off to BFBS radio stations all round the world. When a programme runs over more than one reel of tape, they put a very tight 25 Hz notch in the audio signal at the end of the first tape. A pulse in the notch is sensed to start a second recorder when the first tape is running out. The trailing edge of the pulse stops the first machine and winds the tape off. A steep filter keeps the pulses off air. This system works reliably and doubtless all round the world other radio stations and studios are using similar notch-pulse trigger systems. Does anyone know of a system that notches in the mid frequency band (around 3 or 4 kHz) as first proposed by Murray Crosby, and now proposed by CBS, but rejected by the BPI and EMI as unworkable in the mid-'70s?

I suppose there couldn't be any connection between EMI's rejection of the idea and the fact that at that time the company was still making tape?

Agony I

Will the promised return of Music While You Work on BBC Radio 2 be live? It used to be, and a few of the bands got very over-confident towards the end. They'd hang out in the pub round the corner until the very last minute, then they'd make a carefully timed dash to the studio, sit down and start sight reading just as the on-air light went on. One day the inevitable happened. The pub clock wasn't as fast as usual. Over the pub radio a bunch of musicians heard the familiar sounds of the MWYW signature tune played by the novel combination of trombone, violin and engineer depping on drums.

Agony II

Since I started wondering in print why there is still no Blumlein biography, I have received some very curious and entertaining phone calls. First there was a threatening call in an odd pseudo-American accent. Then there was a series of calls from the same voice but this time clumsily disguised as a half dead Charles Aznavour. It was offering to sell me Blumlein diaries. Then there was the same voice sounding like a pseudo-American half dead Maurice Chevalier.

It's all good clean fun and on wet evenings when there's nothing on television, I replay the tapes I made of each call for light entertainment. The sad thing, however, is that none of this pantomime behaviour does anything to secure Alan Blumlein his rightful place in the history of electronics. ■

product Audio tape guide

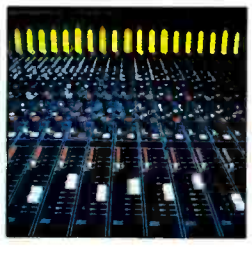
This product guide only contains audio tapes suitable for professional analogue or digital mastering purposes. Audio tapes for cassette duplication, audio cartridges and hi-fi applications are excluded. The standard unit under the tape width columns is a 10½ in reel.

Manufacturer's and agents	Type	Tape widths (10½ in reels)				Larger reel sizes		Additional information
		¼	½	1	2	12½	14	
AGFA-GEVAERT (West Germany) **Agfa-Gevaert AG, D-509 Leverkusen.** **UK:** Agfa-Gevaert Ltd, 27 Great West Road, Brentford, Middlesex TW8 9AX. Phone: 01-560 2131. Telex: 28154. **USA:** Agfa-Gevaert Inc, 275 North Street, Teterboro, New Jersey 07608. Phone: (201) 288-4100. Telex: 0134410.	PEM 468 PEM 428 PEM 369 PEM 526	● ● ●	●	● ● ●	● ●	2in		 Long play version of *PEM468* Long play 2,800ft length
AMPEX (USA) **Ampex Corp, 401 Broadway, Redwood City, California 94063. Phone: (415) 367-2011. Telex: 348464.** **UK:** Ampex Great Britain Ltd, Acre Road, Reading RG2 0QR. Phone: 0734 875200. Telex: 848346.	406 407 456 466 (Digital)	● ● ● ●	● ● ● ●	● ● ● ●	● ● ●		¼in, ½In, 2in	 Extended play
BASF (West Germany) **BASF AG, Carl Bosch Strasse 38, D-6700 Ludwigshafen/Rhein. Phone: 0621 601. Telex: 464811.** **UK:** BASF UK Ltd, Haddon House, 2–4 Fitzroy Street, London W1P 5AD. Phone: 01-388 4200. Telex: 28649. **USA:** BASF Systems Inc, Crosby Drive, Bedford, Massachusetts 01730. Phone: (617) 271-4000.	SPR 50LH	●	●	●	●		2in	
3M (USA) **3M Magnetic Products Division, 3M Centre, St. Paul, Minnesota 55101. Phone: (612) 736-9567. Telex: 297434.** **UK:** 3M UK Ltd, PO Box 1, Bracknell, Berkshire RG12 1JU. Phone: 0344 26726. Telex: 849371.	256 262 226 227 265 (Digital)	● ● ● ●	 ● ●	 ● ●	 ● ●	 ½in, 1in	 2In	 BBC specification Long play version of *226* Not available on 10½ in reel
MAXELL (Japan) **UK:** Maxell UK Ltd, 1 Tyburn Lane, Harrow, Middlesex HA1 3AS. Phone: 01-243 0688. **USA:** Maxell Corp of America, 60 Oxford Drive, Moonachie, New Jersey 07074. Phone: (201) 440-8020.	UD35 UDXL35	● ●						
PYRAL (France) **Pyral SA, 47 rue de L'Echat, F-94001 Creteil. Phone: (1) 207.48.90. Telex: 23742.**	CJ90	●		●	●			
RACAL-ZONAL (UK) **UK:** Stanley Productions, 147 Wardour Street, London W1. Phone: 01-439 0311. Telex: 269836.	675	●						BBC specification
SONY (Japan) **UK:** Sony UK Ltd, Pyrene House, Sunbury-on-Thames, Middlesex TW16 7AT. Phone: 09327 89591/876441. Telex: 266371. **USA:** Sony Corporation of America, 9 W 57th Street, New York, NY 10019. Phone: (212) 371-5800. Telex: 424595.	FeCr ULH	● ●						Ferrichrome Low noise
TDK (Japan) **UK:**TDK Tape Distributors (UK) Ltd, Pembroke House, Wellesley Road, Croydon CR0 9XW. Phone: 01-680 0023. Telex: 946727. **USA:** TDK Electronics, 755 Eastgate Boulevard, Garden City, New York 11576. Phone: (516) 627-0238.	LX35B GX35B LX50B GX50B LX35	● ● ● ● ●						Long play version of *LX50B* Long play version of *GX50B* Version of *LX35B* without back treatment

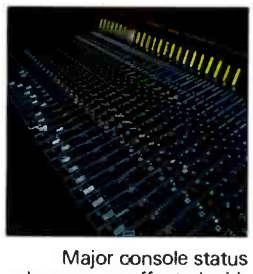
Facilities:

The MR-3 is supplied complete with integral patchbay and varying frame sizes to accommodate up to 56 input channels.

Each input module has a full 24-track output-assign matrix and three bands of parametric E/q, with a high pass filter and optional variable 'Q' on each band.

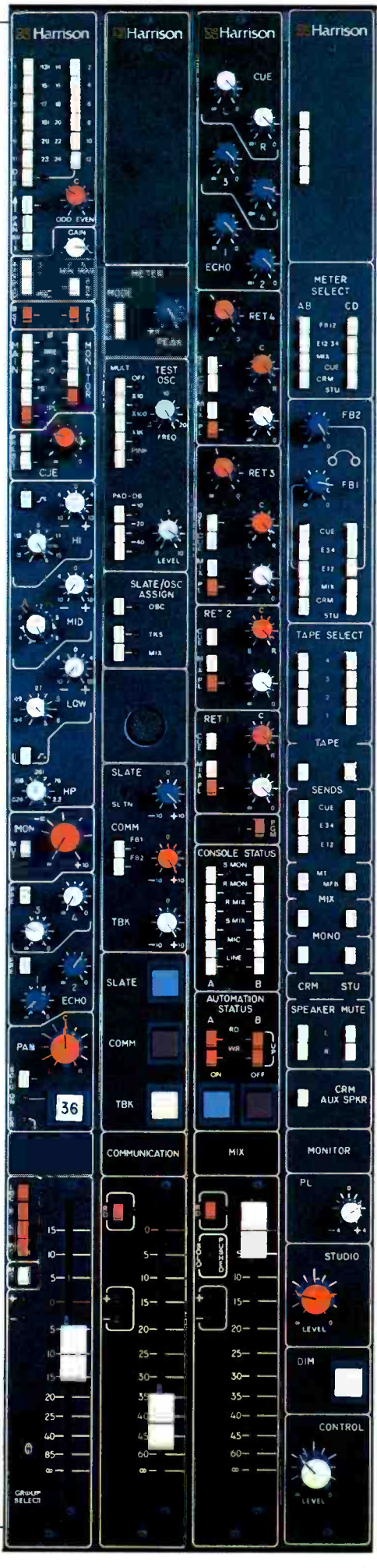


In addition, each module offers six auxiliary sends and a direct assign button for multitrack recording.



Major console status changes are effected with one-button ease. Six modes of operation are available including two new statuses for broadcast and video post production.

The standard VCA faders enable the operator to establish VCA groups when recording and mixing. The console is prepared for rapid installation of three proven automation systems: Melkuist, Allison and Harrison's own Auto-set.



The Harrison MR-3. High on Features, Low on Price.

You can never afford to buy cheaply. What you must do these days is buy economically.

Recognising this, Harrison has developed the MR-3 music desk. High on impressive features, but not on cost, the MR-3 represents excellent value and a unique opportunity to invest in Harrison performance.

In other words the MR-3 guarantees maximum efficiency in 24-track recording.

The Harrison MR-3. Underpriced it may be, undermade it's not.

To find out more about the Harrison MR-3 contact F.W.O. BAUCH at the address below.

Harrison

F.W.O. Bauch Limited

49 Theobald Street, Boreham Wood, Hertfordshire WD6 4RZ
Telephone 01-953 0091 Telex 27502

product Cassette recorders guide

For the purposes of this product guide, we have included those machines that have been specifically designed for professional use as well as a selection of models from the hi-fi field that may be suitable for less demanding requirements. Due to the marketing techniques that prevail in consumer electronics, some of these models may not be available throughout the world or may have differing model numbers. In addition, this guide is far from exclusive in these areas and so should perhaps be treated more as a guide to which manufacturers are worthy of investigation.

AIWA (Japan)

UK: Aiwa (UK) Ltd. 163 Dukes Road, Acton, London W3 0SY. Phone: 01-993 1672.
USA: Aiwa America Inc, 35 Oxford Drive, Moonachie, New Jersey 07074. Phone: (201) 440-5220.

AD3800: 3 heads; Dolby B & C; metal tape capability; auto bias and EQ; auto demagnetisation.
Other models **AD3700, AD3500.**

AKAI (Japan)

UK: Akai (UK) Ltd, Haslemere Heathrow Estate, Silver Jubilee Way, Parkway, Hounslow, Middlesex TW4 6NF. Phone: 01-897 6388.
USA: Akai America Ltd, 800 W Artesia Boulevard, PO Box 6010, Compton, California 90220. Phone: (213) 537-3880.

GX-F91: 3 heads; Dolby B & C; auto bias; direct drive transport; electronic tape counter; LED metering, swing down front cover panel leaves only transport controls visible; metal tape capability.
Also **GX-F71.**

ALPAGE (Japan)

UK: Howland West International, Eccleston Road, Maidstone, Kent ME15 6AU. Phone: 0622 59881.

AL-300: 3 heads; Dolby B; metal tape capability; adjustable bias and Dolby level; varispeed; remote control as standard.
Also **AL-80.**

ASC (West Germany)

Audio System Componenten GmbH & Co, Seibelstrasse 4, D-8752 Hosbach, West Germany. Phone: 06021 53021. Telex: 04188571.
UK: Uher Sales & Services Ltd, 30/31 Lyme Street, London NW1. Phone: 01-485 0943.

AS 3000: 3 heads; High Com noise reduction with Dolby B replay; varispeed; peak level fluorescent meter; electronic counter; 3 motors; remote control; auto EQ and bias facility.

FOSTEX (Japan)

Fostex Corporation, 512 Miyazawzcho, Akishima, Tokyo 196. Phone: 0425 456111. Telex: 2842203.
UK: Bandive Ltd, 8 East Barnet Road, New Barnet, Hertfordshire EN4 8RW. Phone: 01-440 9221. Telex: 25769.
USA: Fostex Corporation of America, 15431 Blackburn Avenue, Norwalk, California 90650. Phone: (213) 921-1112.

Model 250: not a standard cassette machine but a 4-track recorder with integral 4-channel mixer. Tape speed 3¾ in/s, Dolby C noise reduction and varispeed.
Also Model **250AV.**

HITACHI (Japan)

UK: Hitachi Sales (UK) Ltd, Hitachi House, Station Road, Hayes, Middlesex UB3 4DR. Phone: 01-848 8787.
USA: Hitachi Sales Corp of America, 401 West Artesia Boulevard, Compton, California 90220. Phone: (213) 537-8383.

D2200M: direct drive motors, Dolby B & C, 3 heads, metal tape capability, bargraph metering with HF peak indicators, electronic tape counter with elapsed time display; auto bias and EQ adjustment.
Other models are **D3300M, DE99, DE66, DE65.**

JVC (Japan)

UK: JVC (UK) Ltd, Eldonwall Trading Estate, Staples Corner, London NW2. Phone: 01-450 2621. Telex: 923320.
USA: US JVC Corp, 41 Slater Drive, Elmwood Park, New Jersey 07407. Phone: (201) 794-3900.

DD-99: 3 heads; Dolby B & C and ANRS; auto bias, EQ and sensitivity; electronic display with two memories, tape timer and counter; direct drive motor; metal capability.
Other models **DD-77, DD-66** and **KD-D55.**

NAKAMICHI (Japan)

UK: Natural Sound Systems Ltd, Unit 7, Greycaine Road, Watford WD2 4SB. Phone: 0923 36740. Telex: 892478.
USA: Nakamichi USA Corp, 1101 Colorado Avenue, Santa Monica, California 90401. Phone: (213) 451-5901. Telex: 652429.

1000ZXL: 3 heads, auto azimuth, bias and EQ calibration; internal oscillator; memory store; Dolby B; remote control.
Other models: **ZX-9, 700ZXL, 700ZXE, 682ZX, ZX-7, LX-5.**

NEAL (UK)

Lee James Electronics Ltd, Unit 21, Royal Industrial Estate, Blackett Street, Jarrow, Tyne & Wear NE32 3HR, UK. Phone: 0632 899379.

320: 3 heads; 3 motors; full calibration facilities; internal oscillator; Dolby B & HX; mechanical tape counter; peak reading analogue meters; metal capability; remote ready; 19in rack mount.
Also **330** and **340.**

SONY (Japan)

UK: Sony (UK) Ltd, Pyrene House, Sunbury Crescent, Sunbury-on-Thames, Middlesex, TW16 7AT. Phone: 09327 87644.
USA: Sony Consumer Products Co, Sony Corporation of America, 9 W 57th Street, New York, NY 10019. Phone: (212) 371-5800. Telex: 424595.

TC-FX1010: 3 heads; Dolby B & C; all touch sensitive controls; fluorescent bargraph display; auto set-up; fully automated; metal capability; electronic tape display.
Also **TC-K555.**

STUDER/REVOX (Switzerland)

Studer International AG, Alhardstrasse 150, CH-8105 Regensdorf. Phone: 01 480.29.60. Telex: 58489.
UK: FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Hertfordshire WD6 4RZ. Phone: 01-953 0091. Telex: 27502.
USA: Studer Revox America Inc, 1819 Broadway, Nashville, Tennessee 37203. Phone: (615) 254-5651. Telex: 554453.

Studer A710: cassette machine for studio use. Rack mounting with 4 motors, microprocessor control, Dolby B and C noise reduction, 24 hr timer with switch functions, audio interface for pro levels and fader start etc. **Revox B710** very similar but with fewer studio-suitable features.

TANDBERG (Norway)

Tandberg A/S, Fetveien 1, N-2007 Kjeller, Norway. Phone: 02 71.68.20. Telex: 11886.
UK: Tandberg Ltd, Revie Road, Leeds LS11 8JG. Phone: 0532 774844. Telex: 557611.
USA: Tandberg of America Inc, Labriola Court, Armonk, New York 10504, Phone: (914) 273-9150. Telex: 137357.

TCD 3014: 3 heads; 4 motor servo-controlled transport; real time tape counter with revolution counter display, self calibrating operation; Dolby B & C; full manual bias adjustment.
Also **TCD 3004, TCD 440A.**

TEAC/TASCAM

UK: Harman (Audio) UK Ltd, Mill Street, Slough, SL2 5DD. Phone: 0753 76911. Telex: 849069.
USA: Teac Corporation of America, 7733 Telegraph Road, Montebello, California 90640. Phone: (213) 726-0303. Telex: 677014.

Tascam 122 and Teac C-3X: 3 heads; 2-speed; rack mounting; Dolby B & HX; mechanical tape counter; metal capability; VU meters.
Also **V-80, 244** (4-channel recorder/mixer), **133, V-1RX, V-95RX.**

TECHNICS (Japan)

UK: National Panasonic (UK) Ltd, 300-318 Bath Road, Slough, Berkshire SL1 6JB. Phone: 0753 34522. Telex: 847652.
USA: Panasonic Co, One Panasonic Way, Secaucus, New Jersey 07094. Phone: (201) 348-7000.

RS-M275XK: 3 heads; dbx, Dolby B & C noise reduction; dbx disc decode facility; 3 bargraph meters with peak hold; real time counter; fine bias adjustment; auto tape selection.
Also **RS-M260.**

"Untwisting all the chains that tie the hidden soul of harmony." Milton, 1608-1674.

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!

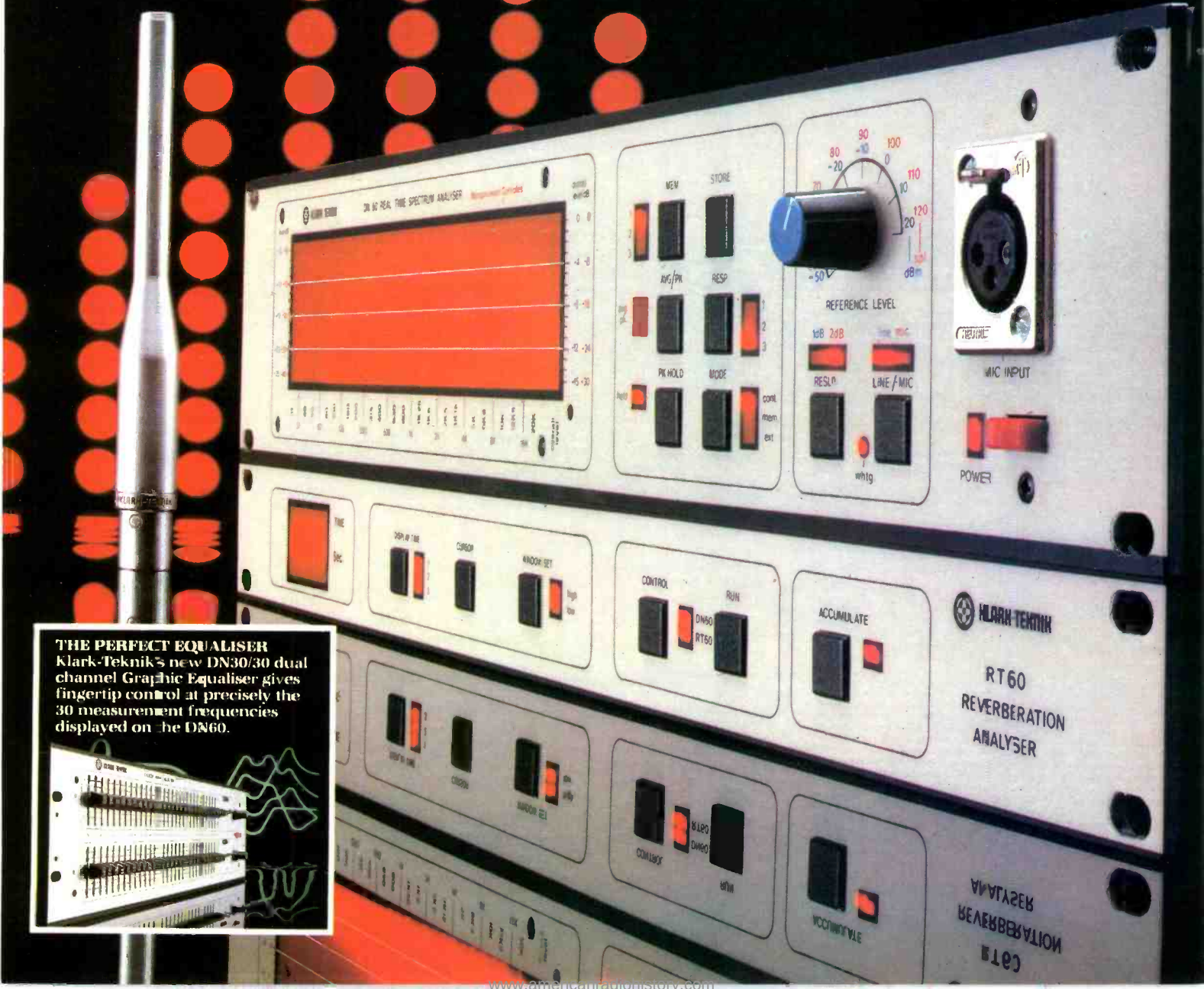
- Tape recorder alignment
- Room acoustical analysis
- Microphone/loudspeaker design and testing
- Reverberation checks
- Continuous system quality control
- Audio components research and development
- Fast semi-automatic production testing
- Selective noise level checks and environmental analysis
- 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: 339821

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.

CX - an approach to

John Roberts

We as a magazine have not been entirely kind to CBS' CX noise reduction system, our main complaint not being with the system itself (which as an encode/decode system appears to have some significant advantages) but with the way it has been marketed, in particular the suggestion inherent in the name CX ('Compatible Expansion') that encoded records are 'listenable' without a decoder. To give the other point of view, we asked John Roberts, a CX licensee, to discuss the system, how it works, and his experiences.

BY now you have no doubt heard of *CX*, the disc noise reduction system developed by CBS. For some years now studios have been able to create master recordings with dynamic ranges well in excess of what can be captured in vinyl. If the recording engineer doesn't limit the dynamics of a master recording, the cutting engineer may have to. While the *CX* system is a 2:1 compander (similar to dbx), the amount of noise reduction has been intentionally limited to 20dB. More than 20dB of compression would raise the noise floor of anything but the quietest master unacceptably above the surface noise of the record. This is important because one of the design considerations for the *CX* system is that the record be listenable when played back without decoding. Along that line the compressor control circuitry has been well-designed to minimise audible side effects even when not decoded (more details later).

No one really expects the encoded disc to sound as good as the properly decoded version: after all, it is compressed more than 20 dB. What is hoped is that the *CX* encoding can take the place of some of the compression/limiting often applied by the cutting engineer and/or the record producer. In fact, the cutting engineer should never have to do more than set the cutting level for a 0dB reference and let it rip.

The recording engineer has a somewhat more difficult task. At present there are not many encoders available, so the best one can do is deliver the most dynamic master tapes and hope for the best. As more encoders become available, the compressed version can be monitored during mixdown, just as most studios use a pair of small limited-range speakers to test the mix for listening over low cost systems. This will require some discipline as that much compression switched in and out will sound fairly severe.

There will be some recordings that just don't work with 20dB of compression, like most classical pieces. Paradoxically, classical recordings have the most to gain from another 26dB of dynamic range (20dB down and 6dB peak expansion). I have heard some spectacular classical demo pressings.

Fortunately, popular music is much more tolerant of compression, and while I've yet to hear one I prefer compressed – some can sound quite decent. There may even be cases where the encoded format is desirable, such as playback in an automobile providing background music, or even listening to music in your parlour at less than 'live' sound pressure levels. What good is 90dB dynamic range if you can't hear the bottom 40dB over street noise?

Stand-alone decoders are currently available for about $100, with the price expected to drop sharply as more manufacturers build the decoders into their new equipment. (Hitachi has reduced the *CX* system to a single $1.80 IC.) Records require no additional processing and will cost no more than standard releases.

How it works

CX is essentially a wideband 2:1 companding system referenced to a nominal 0dB level of 3.54cm/sec. Signals applied to the input of the encoder between +12dB and −40 dB are compressed 2:1. Signals above +12dB and below −40dB pass through at 1:1. The 20db of compression at low level dramatically improves signal-to-noise performance, while the 6dB of compression above 0dB reduces the modulation levels that must be cut into the record. While *CX* is generally considered a wideband (flat) system, there is a roll-off in the gain control circuitry of −6 dB/octave below 100Hz. This has the effect of overcompressing low frequencies during encode, with a complementary over-expansion of low frequencies during playback. This reduces preamp (mains) hum and turntable rumble even more than the 20dB of wideband noise reduction provided to the rest of the signal.

The gain control voltage is derived by first full wave rectifying both channels and then sensing the greater of the two (peak). This control signal is then run through a smoothing filter with a 0.9ms attack time and 9ms release time. In the following stage the control signal is processed by four different time constants. For low steady-state distortion, the control signal is averaged by a 2s RC lowpass. This network is paralleled by three other networks which use diode thresholds to switch in faster attack or release time constants. For large signal drops, the release time is 200ms, fast enough to avoid audible pumping. When the control voltage falls to within a diode drop of the new signal level it gracefully switches back to the 2s time constant for minimum distortion. The other two time constants are related to the fast attack circuitry. Similar to the release circuitry a 30ms attack time constant is switched in whenever the control signal is more than a diode drop above the control voltage. In parallel to these is a high pass circuit with a 30ms time constant also switched in by a diode threshold. The leading edge of a sharp transient will be passed by the high pass network, while the 30ms low pass will change the control voltage quickly but without excessive distortion. The

disc noise reduction

combined network realises a 1ms overall attack time for transients, 30ms attack time for large increases, 200ms release time for large decreases and a 2s steady-state time constant. Both left and right channels are driven by this one control voltage to avoid any wandering of the stereo image with compression.

While this combination of time constants gives a reasonably benign compression, I expect the results will still require listening to the encoded signal during mixdown.

Where now?

My guess is no better than anyone else's on how widely *CX* will be accepted. CBS has signed most major record labels to the system, and hi-fi manufacturers are already building *CX* chips into their new receivers. Stand-alone decoders have been around for almost two years now.

CX is presently being used on Laserdisc and CED with CBS actively lobbying for the use of *CX* in the new (US) stereo TV standards now being discussed.

Despite those gains, *CX* has yet to be widely accepted by the engineers and producers who 'make the records'. The major criticism seems to be one of sound quality. A large part of the sound quality issue is semantic or political debate over 'Compatible Expansion' (*CX*). As CBS has learned, to nobody's surprise, it is impossible to make any kind of music sound good to audio professionals with an extra 26 dB of compression on top of the finished product, especially in side by side listening tests to the original full range (decoded) recording. It is most unfortunate that the debate has stalled upon the sound quality of the non-decoded record, as it completely ignores the potential benefits. The hardware costs to implement the system are quite reasonable and there are no incremental software costs.

Murphy and the demonstrator

While I was not involved – or even present – at early *CX* demonstrations, I have heard several reports describing variable sound quality. While this is pure speculation on my part, 'Murphy' has had plenty of opportunity to lay down his Law.

During the early development stages of *CX*, CBS used 500Hz as the low frequency breakpoint in the control chain. There were several pressings cut with this old time constant before changing over to 100Hz. (Note: Laserdiscs still use 500Hz). I know there are some of these demos floating around because I have a few myself. Should an unlucky demonstrator play back a 500Hz recording on a 100Hz decoder (all decoders made are 100Hz), the upper bass region will be unnaturally compressed.

Another potential source of difficulty for our fearless demonstrator is alignment of 0dB levels. While CBS has stated that alignment is not critical (± a few dB), I hope their demonstrators don't believe that. Their logic that 0dB level alignment is not critical is based upon the benign nature of the *CX* compression. 'If non-decoded compression sounds OK, how bad can a few dB mismatch be?'. Well, if the playback expansion window doesn't match up with the encode compression window, you only get the 'compatible' compression at one end. At the other end you get some very non-compatible expansion. Anyone who has ever listened to dbx decode on a non-encoded tape has an idea of how nasty 1:2 single-ended expansion can sound!

The third way a demonstration can go wrong has nothing to do with set-up. As I mentioned earlier, classical recordings are the latest compatible with *CX* while being the most in need of noise reduction. In early *CX* pressings of classical master tapes, the tape hiss after 20dB of compression became very noticeable. Somebody got the brilliant idea of only compressing the signal 15dB during encode, while maintaining the 20dB of expansion on playback. This does make the encoded disc a bit more listenable (5dB less tape hiss), but at the expense of playback dynamics. That 1:2 single-ended expansion we were trying to avoid by proper calibration will now always occur over a 5dB window at −30dB. This rather severe expansion occuring where it does is rather annoying on classical recordings causing unnatural instrument and room decays. So if you happen to have a *CX* encoder with a 15/20dB switch on it, *please* leave it in the 20dB mode.

The above scenarios describe things that could go wrong, in addition to Murphy's usual bag of tricks (like mislabelled records). *When properly decoding a correctly-encoded recording,* CX *does exactly what it's supposed to do. The record surface noise disappears and you hear music instead of just a recording.*

Although over a million *CX* pressings have been shipped, the *CX* case has not been well argued by software. While I have heard any number of popular *CX* records (typically re-releases) that work fine, I've yet to hear the definitive classic that properly showcases *CX* at its best. Gasparo, a small Nashville label, has cut some very clean recordings but unfortunately their choice of material, mostly chamber music, is a bit esoteric for mass appeal.

As it will still be quite a while before digital playback displaces the analogue disc in the mass market, I feel *CX* offers a smooth transition to, not a substitute for, 'all-digital' systems.

John H. Roberts, a member of AES and IEEE, is president/chief engineer of Phoenix Audio Laboratory and president/owner of Phoenix Systems. Phoenix Audio Laboratory Inc manufactures: Loft Professional Products, Loftech (personal test equipment), and P.A.L. Medical (speech therapy products). Phoenix Systems markets low cost, hi-fi kits.

Author's Note: I am a *CX* licensee, and have been brainwashed by the good engineers at CBS Technology Center into believing that *CX* is an excellent noise reduction system. They've got me so convinced that I became a licensee, and sell a kit version *CX* record decoder (Phoenix Systems). I have yet to be convinced otherwise. My customers are also enthusiastic about the *CX* system. By far the most frequent comment I get from them is where can they find more *CX* records! What should I tell them? ■

Studer A710

MANUFACTURER'S SPECIFICATION

Transport mechanism: 4-motor dual capstan drive for Compact Cassettes; two DC spooling motors controlled by microprocessor; two capstan shafts individually driven by quartz controlled MDD motors.
7-segment display: 4-digit tape counter switchable to time clock.
Tape speed: 4.76cm/s (1⅞ in/s) ±0.3%.
Wow and flutter (as per DIN 45507) IEC 368: 0.1% with C60 and C90 cassettes.
Start time: maximum 0.1s to rated wow and flutter.
Usable cassettes: C46 to C120; specified data guaranteed up to C90 only.
Winding times: approximately 45s for C60; approximately 65s for C90.
Noise reduction systems: Dolby B and Dolby C processors in the recording/reproducing channels, switchable MPX filter.
Tape selection: IEC I – Ferric; IEC II – chrome IEC IV – metal; AUTO – automatic sensing of coded cassettes.
Playback equalisation: 3180 + 120μs, IEC I; 3180 + 70μs; IEC II and IV.
Recording level: 200nWb equals 0dB on peak level meters.
Distortion at 315Hz, 0dB (K3): IEC I better than 1.0%; IEC II better than 1.5%; IEC IV better than 1.5%.
Frequency response (measured via tape at −20dB): noise reduction off – IEC I 60Hz to 10kHz ±2dB, 30Hz to 16kHz ±3dB; IEC II and IEC IV 60Hz to 14kHz ±2dB, 30Hz to 18kHz ±3dB. With Dolby B/C on (measured with pink noise and a spectrum analyser – IEC I 30Hz to 10kHz ±3dB; IEC II and IEC IV 30Hz to 14kHz ±3dB.
S/N referred to 3% distortion weighted as per IEC/A: IEC I 55dB without NR, 64dB with Dolby B, 69dB with Dolby C; IEC II 57dB without NR, 65dB with Dolby B, 71dB with Dolby C; IEC IV 58dB without NR, 66dB with Dolby B, 72dB with Dolby C.
Separation at 1kHz: better than 40dB.
Bias and erase frequency: 105kHz.
Erasure (measured with IEC IV tape): better than 70dB at 1kHz, Dolby off.
Inputs: symmetrical, floating; minimum impedance 5kΩ (30Hz to 20kHz).
Input level for 200nWb/m: calibrated +4dBu (0dBu = 0.775V) (range −8 to +21dBu); uncalibrated, sensitivity can be increased 10dB.
Outputs: symmetrical, floating; output impedance less than 50Ω (30Hz to 20kHz).
Output level for 200nWb/m: calibrated +4dBu (R1 = 600Ω), range −3 to +14dBu; uncalibrated, level can be increased 10dB, maximum +21dBu.
Voltage selector: 100/120/140/200/220/240VAC (voltage selector) ±10%, 50Hz to 60Hz, maximum 55W.
Fuse: 100V to 140V, 500mA. 200V to 240V, 250mA.
Weight: 10.4kg (22lb 15oz).
Dimensions: (whd) 19 × 6 × 13.85in (483 × 151 × 352mm).
Manufacturer: Willi Studer, CH-8105 Regensdorf, Althardstrasse 30, Switzerland.
UK: FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Hertfordshire, WD6 4RZ.
USA: Studer Revox America Inc, 1425 Elm Hill Pike, Nashville, Tennessee 37210.

THE Studer *A-710* cassette recorder is the professional version of the Revox *B-710* machine, its functions being mostly identical. However the *A-710* includes an audio interface board which provides floating transformer coupled inputs and outputs capable of handling professional signal levels into appropriate impedances. The other main differences are that the professional version excludes the low level microphone inputs and has different interface connections allowing fader start etc. In addition the unit is provided with ears for mounting into a standard 19in rack.

At the centre of the front panel is the front loading cassette transport of unusual design. The cassette is simply pushed on to the transport face where it is located against two steel guide posts by two spring loaded arms which grab the bottom of the cassette. This system gives a very

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positive cassette location as the top of the cassette is also located against a reference by a third spring loaded arm.

The drive mechanism is of a 4-motor design with separate left and right spooling motors and twin capstan motors – a common technique for digital cassette control. This provides almost complete isolation between the sections of tape by the hubs and the tape passing the heads in addition to providing accurate tension control across the heads. Both capstans are directly driven by the motors which are phase locked to a crystal reference by means of 75-segment tachos in the motors.

The pinch rollers and the heads (plus other features) are mounted on a head carriage in the form of an alloy casting which is hinged about 2in behind the cassette. Movement of the carriage from the disengaged position to the operating position is by means of a large solenoid with a damping dashpot. The pinch rollers are mounted on spring loaded arms and the springs have screw adjusters to set the pinch roller pressure.

On the left end of the carriage, the ferrite erase head enters the left-hand hole in the cassette next to the left-hand pinch roller. The record and replay heads which are close together are inserted at the centre of the cassette, the two heads having conventional spring loaded azimuth adjustment with the replay head having a U-shaped tape guide. Before the second capstan an optical end of tape sensor is located in the hole before the pinch roller.

The pay-off and the take-up motors are both controlled by the microprocessor via D/A converters, the motors having speed sensors which feed the microprocessor.

FIG.1
STUDER A710
FREQUENCY RESPONSE
INPUT MONITOR MODE AT 0dB

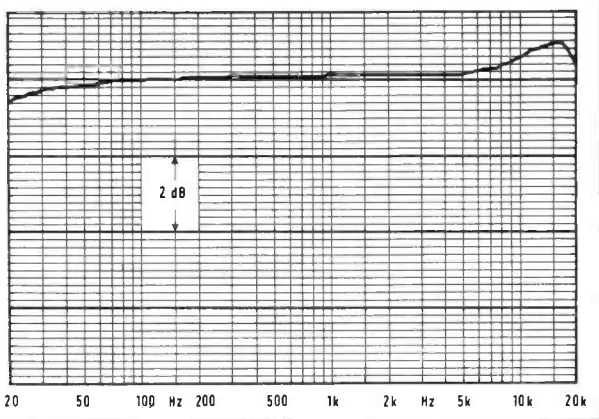


FIG.2
STUDER A710
FREQUENCY RESPONSE
IN THE FERRIC SETTING
USING TDK OD

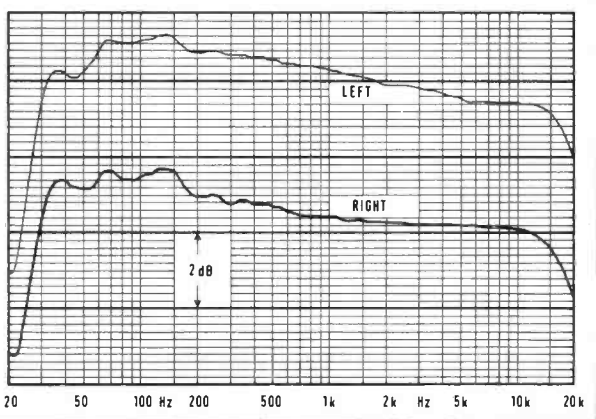
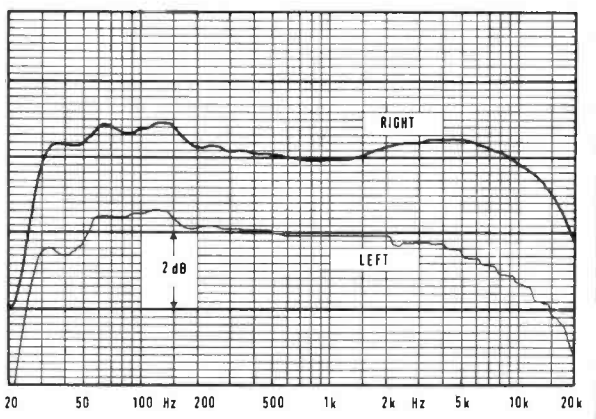


FIG.3
STUDER A710
FREQUENCY RESPONSE
USING IEC II REFERENCE TAPE
WITH CHROME SETTING



Additional features of the transport are a plunger-operated microswitch which tells the microprocessor that a cassette is inserted, and three lever-operated switches which sense the holes in the top of the cassette for record inhibit and either IEC type II (chrome) or type IV (metal pigment) tape.

On the front panel, all tape drive functions are controlled by the microprocessor including tape location and timing functions. To the left of the front panel, a horizontal row of six pushbuttons controls the tape movement with appropriate interlocking being achieved by the microprocessor. Normal play, fast wind, stop and record buttons are provided together with a pause button which for some reason only operates in the record mode. A useful and unusual feature is that when the tape is rewound, it does not remain on the transparent leader but automatically advances to the coated section of the tape so that recording or replay can begin immediately.

Below these pushbuttons are four toggle switches. The power switch has an on position and a standby/remote control position, the latter position being used with the internal timer to enter the record or replay modes; more about this later. The second switch allows the audio outputs to be derived either from the input or from tape in the replay or record modes. The other two switches select the Dolby B or Dolby C functions and switch noise reduction on/off.

The remaining feature to the left of the unit is a 4-digit, 7-segment display with three momentary pushbuttons. The first of these switches the display between time of day (with am/pm indication) and tape location which is unfortunately not in terms of tape time. The second pushbutton is a 'run up' button used to set the display in either mode, the indication automatically advancing when this button is depressed. Thirdly the set-zero button sets the tape indicator to zero or the clock display to 12.00 am without altering the real time clock – this function is associated with the timed record/replay facility which we will come to shortly.

To the top right of the front panel are twin horizontal peak level meters in the form of segmented displays, the upper segments above 0dB indication being wider than the lower levels. Above 0db (corresponding to 200nWb/m) there are eight increments each corresponding to 1dB. Below 0dB the increments are 1dB, down to −6dB with the remaining ten increments providing indications down to −30dB. Small annunciators to the right of the level display indicate whether Dolby is on, if the multiplex filter is switched in and if the automatic tape type (IEC I, II or IV) selector is switched on.

Below the level indicators, two pairs of coaxial potentiometers set the input and output levels when two locking pushbutton switches are set to the uncalibrated positions for the inputs and outputs. Nearby a ¼in stereo headphone jack with a single level pot provides headphone monitoring.

A strip above the front panel features hinges down to gives access to the controls for the timer functions, tape type selection and a slide switch for inserting the multiplex filter. Four interlocked buttons select IEC I (ferric), IEC II (chrome) or IEC IV (metal pigment) tape settings with a fourth button allowing automatic selection with 'coded' cassettes.

To the left a 3-position slide switch selects normal operation or timer operation with the options of time replay or timer record when the unit enters replay or record automatically at a preset time.

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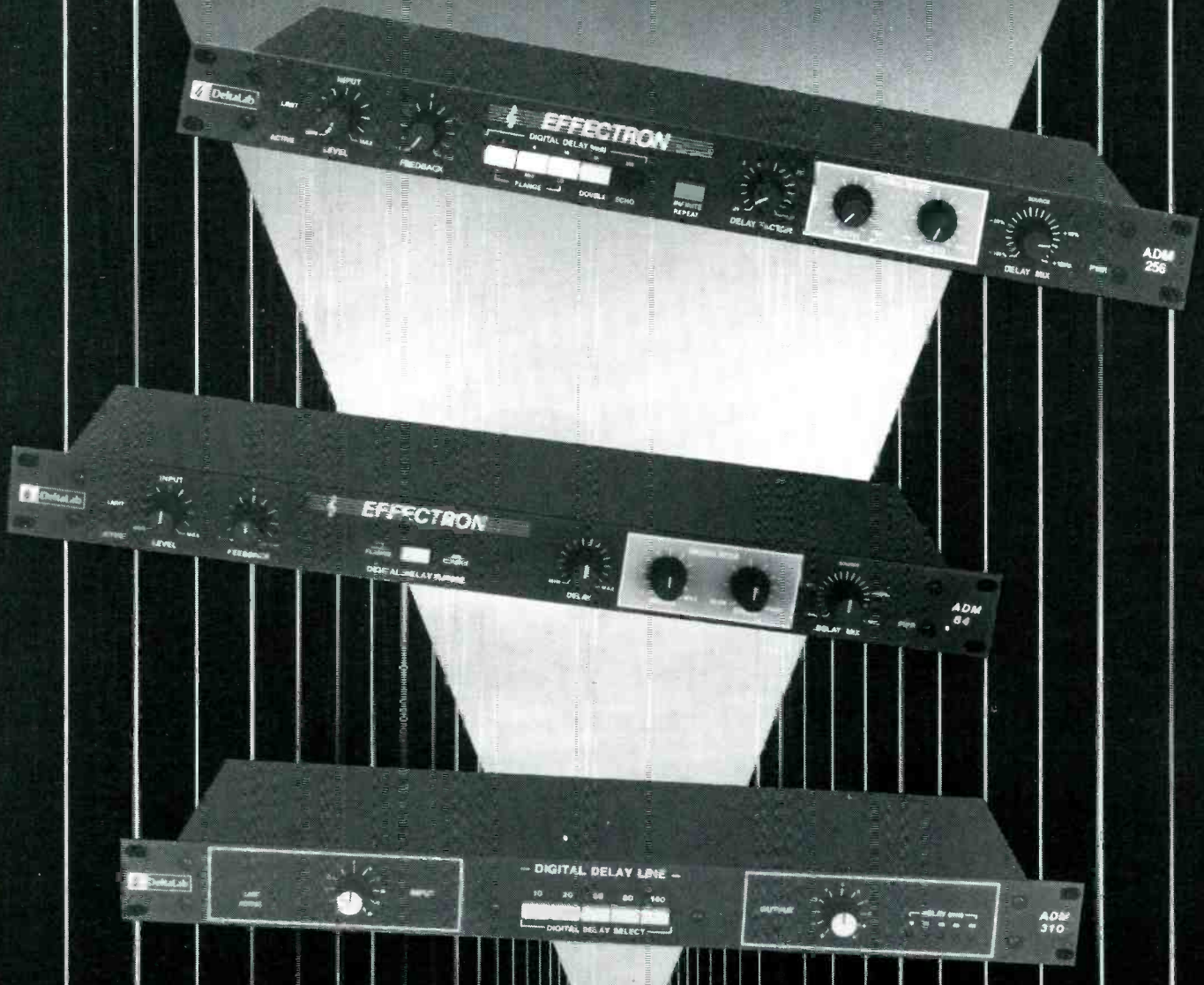

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FIG.4
STUDER A710
FREQUENCY RESPONSE
IN METAL SETTING
USING TDK MA-R

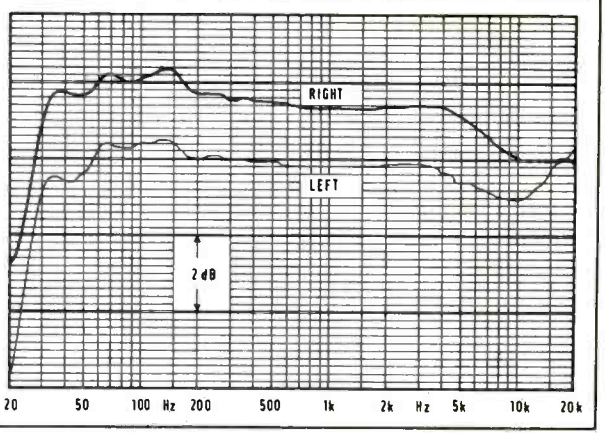


FIG.5
STUDER A710
RECORD EQUALISATION RANGE
FERRIC SETTING

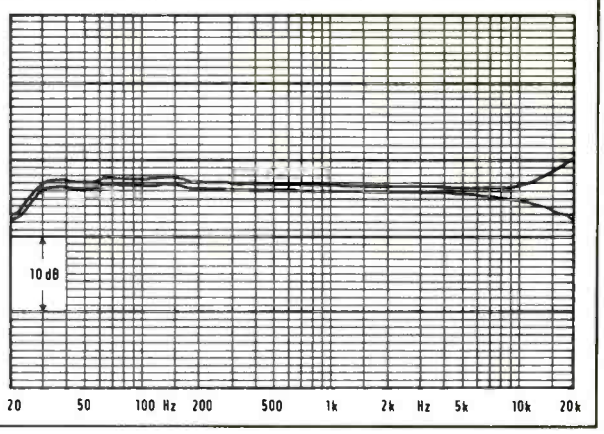


FIG 6
STUDER A710
RECORD EQUALISATION
RANGE METAL SETTING

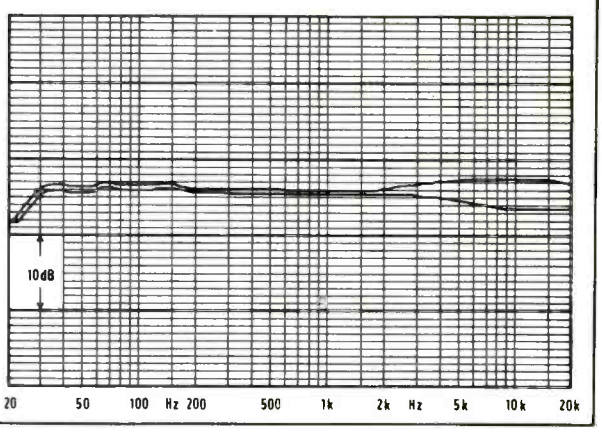
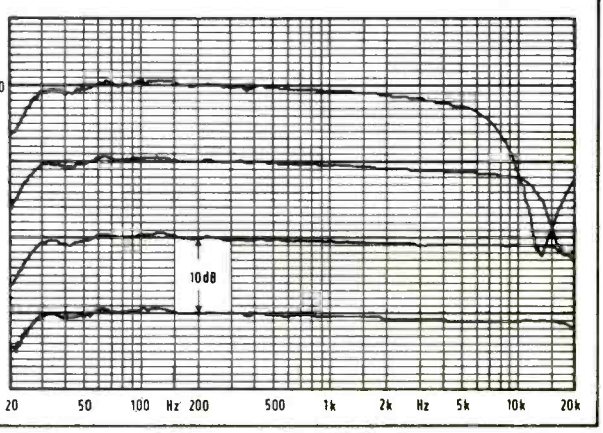


FIG 7.
STUDER A710
FREQUENCY RESPONSE,
FERRIC TAPE, NC DOLBY AT
250nWb/m



To use the timer, the power switch is set to standby/remote when the tape transport mechanism is disengaged. The clock is then set to the desired start and stop times using set, start and stop pushbuttons and the timer switch set to replay or record as desired. The transport then automatically switches into replay or record at the desired times and subsequently disengages and reverts to standby at the preset stop time.

A further feature is that instead of time the buttons may be used to set start and stop tape positions with the tape recycling over a preset section – this feature can also be used to search for a preset tape location.

Rear panel features of the *A710* include four *XLR* audio input and output connectors together with an IEC power connector, properly identified power fuse and voltage selector.

A 4-pole DIN connector is provided for fader start in addition to a +10V output for relay operation at programmed starts. A further 10-pole DIN connector is provided for remote control, this providing control of all tape movement functions including record and pause by means of normally-open pushbutton switches. In addition, a remote toggle switch can select tape/source monitoring and the fader start connection is duplicated.

Within the unit, access to all components is good and the tape transport can be readily removed from the chassis for major servicing. All printed circuit boards plug in and many integrated circuits are socketed. However the boards lack component identifications but the very good servicing manual incudes board layouts and full circuits for the Revox *B-710* version. A supplement provides information on the differences between the Studer *A-710* and the Revox *B-710* versions and it is understood that a separate manual will be forthcoming for the *A-710*.

All alignment controls take the form of skeleton presets, six of which are located on the bias oscillator board for the adjustment of left/right bias for the three tape types. Twelve further presets on the record amplifier board set left/right record equalisation and level for the three tape types with two controls setting the metering levels.

These controls are common with the domestic versions, the professional input/output board having additional input and output level controls.

Frequency response

The replay frequency response was checked using BASF ferrite and chrome calibration cassettes for the 120μs + 3180μs ferric equalisation and the 70μs + 3180μs chrome and metal pigment standards.

In the ferric setting the two channels matched within ± 0.5dB above 315Hz with the individual channels being within ±1dB from 125Hz to 18kHz, no adjustment of replay equalisation being available in either setting.

In the chrome/metal setting the two channels were effectively identical but there was significant high frequency boost to the extent of 2dB at 10kHz and 2.5dB at 12.5kHz. Examination of the replay amplifier time constants suggested that this unwanted boost may have been associated with an incorrect ratio between the ferric and chrome time constants.

The frequency response from the line inputs to the line outputs in the input monitor mode is shown in **Fig 1** which shows a 1dB boost at 15kHz which remained irrespective of output loading. ▶

THE FIRST CASSETTE DECK DESIGNED FOR THE STUDIO

The cassette is playing a growing role in the professional sound field. In recording studios it is the media for producers' and artists' take-home dubs and for general demos. And in the broadcast studio it is being used more and more for recorded spots in place of the traditional "carts."

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The TASCAM 122: the professional cassette deck.

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In the record/replay mode without Dolby the frequency response 'as found' for various tape types was measured at a fluxivity 20dB below 250nWb/m. **Fig 2** shows the results for the two channels in the ferric setting using the recommended TDK type *OD* tape both channels showing a virtually identical performance.

Fig 3 shows the same results using an IEC II reference tape in the chrome setting with a slight imbalance between channels, but still a good performance extending to −2dB at 20kHz. This could however be improved with adjustment of the record amplifier settings.

In the metal setting using TDK *MA-R* tape, there was again a slight imbalance between the two channels but a better overall response as shown in **Fig 4**. In all cases the low frequency response was remarkably free from 'head bumps'.

Fig 5 and **Fig 6** show the rather restricted range of the record equalisers for respectively ferric and metal tape, however, the available range of bias was quite adequate in both cases.

In order to demonstrate the advantages of metal tape over ferric tape and to demonstrate the accuracy of the Dolby tracking, the frequency response was plotted at a fluxivity of 250nWb/m and at 10dB increments below to −30dB. For ferric tape **Fig 7** shows severe tape saturation above 6kHz at 250nWb/m and 10 kHz at 10dB down. Comparison with **Fig 8** for metal tape shows no saturation at this level and a far better performance at 250nWb/m.

Similar frequency response plots with Dolby B and Dolby C in circuit show any mis-tracking which would be associated with incorrect alignment of the Dolby levels. Ferric TDK *OD* tape was used to produce **Fig 7** without Dolby, **Fig 9** with Dolby B and **Fig 10** with Dolby C. Comparison of these plots shows that as expected low level frequency response errors increase with Dolby, the degree of actual mis-tracking being minimal.

Noise and distortion

Noise, reference a fluxivity of 250nWb/m, was initially measured for the machine alone without tape for the 120μs + 3180μs and 70μs + 3180μs equalisations with and without the Dolby B and C in operation. Subsequently noise was measured with tape recorded on the machine with bias alone to give an indication of the margin between machine noise and typical tape noise using TDK *OD, SA* and *MA-R* cassettes.

With the exception of the unweighted noise the two channels were virtually identical so only one channel is quoted. This is the worst channel for unweighted noise, the better channel giving an improvement of 2 to 3dB with tape irrespective of the Dolby circuits.

As can be seen from **Table 1** the margin

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FIG 11

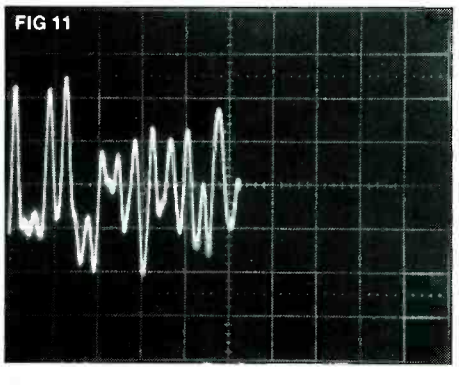


FIG 8.
STUDER A710
FREQUENCY RESPONSE,
METAL TAPE, NO DOLBY AT
250nWb/m

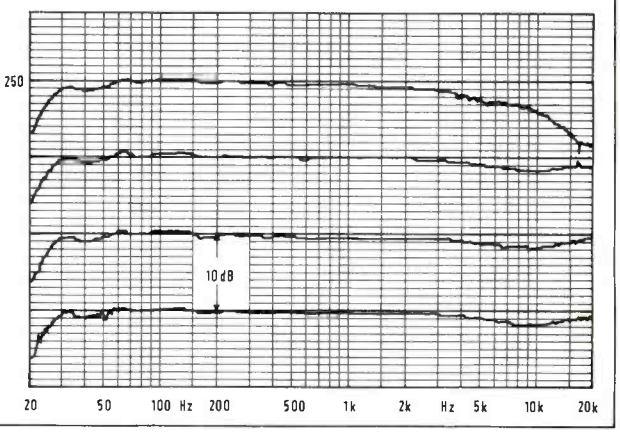


FIG 9.
STUDER A710
FREQUENCY RESPONSE,
FERRIC TAPE, DOLBY B AT
250nWb/m

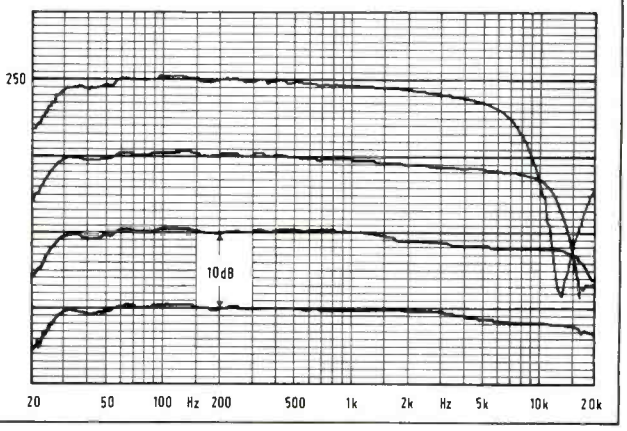


FIG 10.
STUDER A710
FREQUENCY RESPONSE,
METAL TAPE, DOLBY C AT
250nWb/m

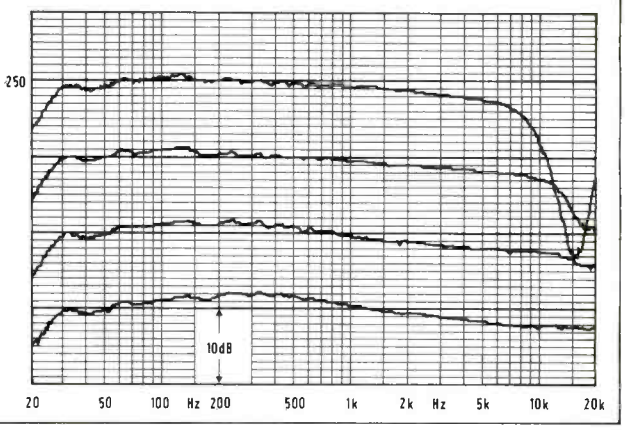
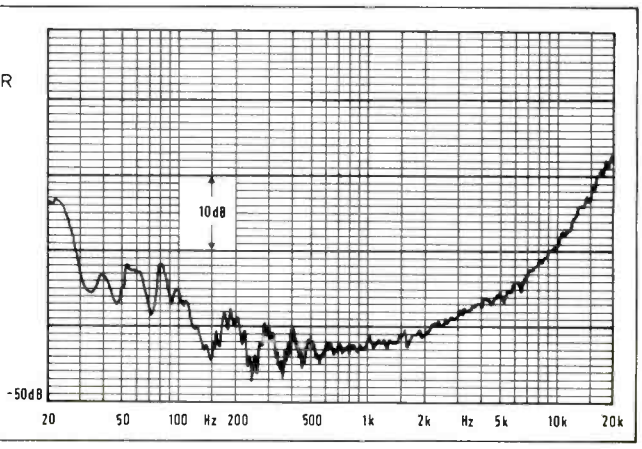


FIG 12.
STUDER A710
CROSSTALK USING TDK M-AR
METAL TAPE AT -10dB



Alpage AL-300

THE *AL-300* is not a studio bred machine at all but one of those obscure items: a hi-fi type machine with certain features that make it a potential contender for a variety of professional applications. These features include a closed loop dual capstan transport, three heads, remote facility, varispeed and fine bias adjustment. In common with many hi-fi type units, and in particular most Japanese models, it also possesses loads of features that will be of virtually no identifiable use to the professional while acting as a source of amusement for bored musician's fingers. The machine, however, has to be accepted as a package and as there are no options other than the subsequent use of a soldering iron and guess-work or the liberal use of front panel gaffer tape. The models above and below the *AL-300* in the Alpine range unfortunately lack some of the features that make this model interesting for studio use.

The *AL-300* is a free-standing unit. It is possible that it could be rack mounted, although it would require rather more than just fixing 'ears' to the side panels due to the lightweight construction of the side panels and the rear position of weights such as the mains power transformer. External dimensions of 17⅛in wide and 4⅝in height with depth of 12in do not preclude rack mounting either, but it's just not as easy as it might be.

The front panel is fairly typical of the average brushed metal hi-fi design and may even be considered somewhat dated in appearance. It does, however, have a reassuring solidity about the controls, and their action together with the front panel, itself being ⅛in thick, that suggests a slightly more robust design than the 'average'.

Controls to the left of the transport include two large push buttons for power and cassette eject and a rotary pot for varispeed control. With the power applied there is illumination behind the cassette housing and the panel meters that remains in all modes. Pressing the eject button opens the cassette housing door which swings open being hinged at the bottom. The eject button is locked unless the transport is in the stop mode. The action of the door is mechanically damped with an intricate system of springs, cord, rotating cogs and a paddle wheel using wind resistance as damping that works quite well. The tape heads face upwards and the cassette to be loaded is mounted in the retaining guides in the door, tape downwards. As the door is pushed in, the drive motor for the capstans starts running and the capstans rotate when the halfway closed position is reached. These remain running all the time a cassette is loaded. If the door is shut with no cassette loaded the motors start but cut out when the door actually closes. Surprisingly, all the transport functions are operative with the door in a closed-enough position to run the motor. In practice this presents no problems and can actually be a useful visual method of checking the transport function without a cassette loaded.

Previous experience of vertical loaders with upwards-facing heads has made me wary of the vast amounts of dust and oxide debris that can accumulate around the crucial transport areas with a little help from gravity. After following the discipline of shutting the door immediately the cassette was loaded or unloaded has meant that the unit was still clean enough not to need any more than head cleaning after 12 months' use. Proper access to the heads for cleaning requires the removal of the door but this is a 10 second job that needs only finger pressure to unscrew the two knurled screws in the door and the clear panel and metal frame of the door come free. This gives full cleaning access although azimuth controls are not accessible and would appear to require rather more dismantling of the transport than one would care to undertake without the workshop manual.

The varispeed control offers a range of ±10% on the standard cassette speed of 1⅞in/s. This is only operative in the play mode, being bypassed in record. The travel of the control has a centre detent at the 0 position and this enables the user to be sure that it is switched out, but due to the small size and location of the control it is quite possible to leave it in. As it is locked out on record, no nasty errors can really be made but for operators benefit an LED indicator could be useful.

The transport mode selected is indicated by a row of LEDs below the cassette housing door. These are green for all modes except red for record with there being no indication of stop.

The transport controls are on an angled ledge below this. They are all feather-touch, non-latching miniature switches. The output of these switches feeds a logic control circuit and all modes are allowed in any order with no trouble. All the standard modes are included with the addition of pause, which will hold a play or record mode until pushed a second time. While in this mode the capstans are disengaged. To enter the record mode, both play and record have to be pressed.

Perhaps the major feature of the *AL-300* is its remotability. The control panel may be simply pulled away from the front and mounted remotely. Supplied with the *AL-300* is a suitable lead of about 16ft long with 8-pin DIN connectors at either end. This panel may even be removed from the *AL-300* while it is still running and the selected mode will remain operative. It can be console-mounted quite easily.

Alpine Electronics Inc., 1-7 Yukigaya Otsuka Cho, Ota-ku, Tokyo, Japan.
UK: H. W. International, Eccleston Road, Maidstone, Kent ME15 6AU.

To the right hand side of the transport lie the remaining controls. Tape position is indicated by a 3-position mechanical counter with a reset button. This has a reasonable degree of accuracy, although should not be too closely relied upon after a period of fast winding.

Below this are three switches with indicators for auto play, auto rewind and memory. Auto play when selected puts the tape in play mode after having rewound to the top of the cassette; auto rewind sets the transport into rewind at the end of the cassette and memory stores position 000 from the tape counter and will either stop the tape at 000 when memory is selected or enter auto play if that is also selected.

The record mute is a non-latching switch that also illuminates a red warning LED to the left of the meters. This feature may have certain useful applications when copying to eliminate unwanted counts and take announcements from the top of mixes etc.

Continuing on the bottom row on controls, there is a stereo headphone jack socket that is positioned electronically just before the main outputs and so follows the selected monitor mode. The headphone volume is set by the main output level control. This socket can delivery 2mW into 8Ω. However, this may be rather low for monitoring properly if the main output control is set at less than maximum.

There then follows a pair of low impedance jack mic sockets (with mono facilities on US models) and the tape timer control. The *AL-300* has no internal timer but using this slide switch the machine may be set so that when mains power is applied to the unit by an external timer, it will enter either the record mode or play depending on what has been selected.

The *AL-300* can handle all four of the common tape types (I, II, III, IV) with the selection being made by a four-position rotary switch just to the right of the cassette door. This switches the equalisation as well as setting the approximate bias levels for that type of tape. More precise bias adjustment is available in the form of two small rotary controls to the right of the tape timer selector giving ±10% adjustment. These are individual settings for left and right channels and there is a centre detent position on the travel for the preset positions. If the adjustments are left in the detent position, good, average results are obtained from most brands of tape in all tape classes. For more precise settings, the *AL-300* has internal oscillator tones for bias adjustment (10kHz) and Dolby calibration (400 Hz). I will return to the recommended calibration methods later but it is interesting to note that the detent position on the calibrations is almost always too high for the optimum bias setting and adjustments normally consist of reducing the bias level.

The *AL-300* is equipped with Dolby B. When

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BGW SYSTEMS

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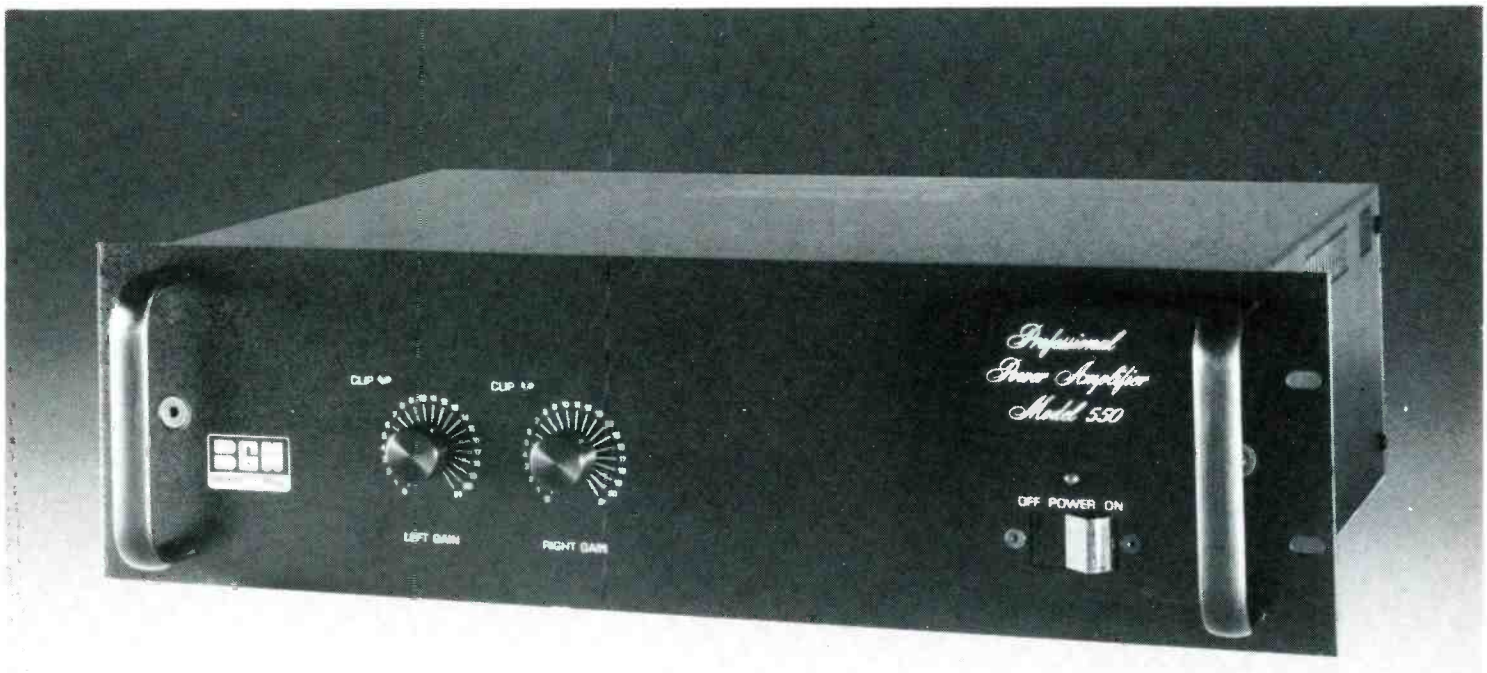

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viewed in purely noise reduction terms, this is one of the least powerful types when set against dbx or Dolby C. However, it is by far the most established and widely used type and the only thing that would be better than having just Dolby B would be to have the complete set. Noise reduction in/out and the MPX filter in are set by a three-position switch to the right of the tape type select switch. Selecting Dolby illuminates a green LED just to the left of the meters. Encode and decode circuits are installed permitting simultaneous tape monitoring while recording with the Dolby system in.

The only major areas not covered so far are the level and monitoring facilities. Monitor selection is in the form of a paddle switch that selects between line in or line out. As mentioned earlier, both the main outputs and the headphone outputs follow this choice, as do the meters. The actual output level is controlled by a single rotary pot that is internally ganged, making it impossible to adjust the individual left/right levels.

The *AL-300* is equipped with simple mixing facilities, having a larger master record level control and two dual concentric controls for the mic/DIN inputs and the line inputs. Both the DIN and line inputs are situated at the rear and will be covered later. Suffice it to say that for studio applications, the mic/DIN control will probably never be used and is probably first in line for some mod to prevent the level control being used as raising the level on the control introduces noise even with no input. I did find the left and right sections of the line input level concentric knob very difficult to turn equally as there is no friction at all between the two knob sections and it depends entirely on finger pressure on both parts. I soon found that I was running the line input level just below maximum in most cases and altering the master level control where left and right levels had to be altered with no chance of an error.

Metering is in the form of two medium-sized VU type meters behind a clear panel graduated from −40dB to +8dB with all the graduations being back lit so that the meters are easily seen – or rather the graduations are, as the needle itself is fine and black and has a tendency to appear in silhouette against the graduations and so not be very visible. There is also a front panel switch allowing VU or peak modes. In the VU mode the meters do appear to behave as a VU although the extended scale is somewhat misleading. In the peak mode, the meter reads peaks about 2dB higher than in the VU position, so making it perhaps better to use peak for record level setting. The actual difference in movement to the eye when following the meters is fairly small.

The rear panel contains a pair of phono sockets for line and line out although in this case the line level in question is referenced to −10dB rather than full studio line level. In addition there are two DIN sockets (on European models only) to interface to a hi-fi system with differences in the wiring so that one or other of the sockets will match correctly. I tend to avoid the use of DIN sockets for audio signals as much as I can and would continue to do so with the *AL-300*. The fixed mains power cable and the mains voltage selector are located at the other end of the front panel.

Internal construction is neat and above average hi-fi standards. It is also good to see extensive use of screws, rather than welding or glue, as this gives a feeling of repairability to the machines.

The handbook is good on the operational aspects and one or two points arising out of the techniques, but contains no information on circuitry or other technical features. Far more informative in this respect is the sales brochure which at least includes a schematic diagram. A little gentle persuasion would, I suspect, actually extract a workshop manual from the distributors and this may be worthwhile as the construction makes it appear repairable by the studio technical department, *himself*.

The transport

As with all three head cassette systems there are problems as to where the heads can be fitted so that they will have access to the tape through the Compact Cassette frame. Alpage have adopted the combined record/replay head as being the best solution. To overcome the difficulties of tape to head contact that this design brings (only one pressure pad on the cassette) the transport is a closed loop dual capstan type enabling constant tape-to-head contact across the heads. The transport uses two motors, one for tape wind and the other for capstan drive. The speed differential between the two capstans necessary for the closed loop system is achieved by the use of a drive band from the motor running around two large spindles of slightly differing diameters, which in turn drive the capstans. The capstans and pinch wheel assembly is solenoid operated and at rest is approximately ¾in from the operating position. Pressing any of the transport modes switches shows that the transport is rather 'clunky' as the solenoids pull the drive into the cassette. This does actually take some getting used to after rather quieter units, although it works and very reliably too. There are no provisions for automatic sensing of tape type other than the standard prerecorded erasure prevention tabs.

In Use

These observations are based on fairly intensive use of the *AL-300* over a period of about 12 months. This has included some periods of heavy-duty copy use as well as use replaying demo cassettes from a wide variety of sources. Generally for copying, ferric or chrome cassettes have been used and the results have been very good. The tape selections with the fine adjustments set to centre detent position are apparently aligned for reference tapes of that type, although it was not stated exactly what these are. As I mentioned earlier, reasonable results were achieved in all types without touching the fine adjustments although the internal oscillator made precise alignment an easy operation. For bias adjustment the oscillator is switched to 10kHz and this mutes the input signal and when the monitor is switched to source (line in) the tone is audible at the output and the meters read to the calibration level mark which is by the 0dB position. With the transport placed in the record mode and the monitor switched to off-tape, the fine bias controls are adjusted until the meter reads to the calibration point. With most of the tapes used with the machine, this adjustment is normally a reduction in the bias level although there is always a very close tracking between the left and right channels. Virtually all the common cassette types in the Type I and II categories have been tried and excellent results have been achieved with most, TDK *SA* and Maxell *UDXL-II* having been selected for regular chrome use and BASF *Ferro Super LHI* and Ampex *Grandmaster* for ferric requirements.

Metal type tapes always seems rather extravagent for most studio applications and somewhat unneccessary. Although the *AL-300* has a metal tape position, I have had trouble in optimising the bias for types such as Sony *Metallic* – there was just not enough bias level available. The recorded result sounds impressive – increased dynamic range and clarity but somewhat light in high frequences when referenced to the line-in signal. Whether this is a result of internal misalignment or out of spec cassette tapes is not clear.

Dolby calibration uses a similar technique to that for the bias but with the 400Hz tone and uses a Dolby reference mark which is also at 0dB although in practice, the actual meter reading when switched to line-in is about 1dB higher. With the tapes in regular use, very good Dolby B results can be achieved and I have overcome my earlier reluctance to use it on cassettes, at least with this machine.

Recording levels using the internal metering are quite easy to set. Maximum levels for metal and ferri-chrome tape are recommended in the manual as being +4 to +7dB, +5 to +2dB for chrome and 0 to −3dB for ferric. These values are with the meters switched to peak reading. I tend to think that these readings are a little too high and my general practice is to treat the meters as if they were standard VU meters such as on a good reel-to-reel machine using a tape with little headroom. Following this guideline and allowing peaks of about +3dB on a music signal will ensure a clean recording even on a ferric tape. Pushing levels beyond this results in what sounds like HF head saturation followed shortly by a gradual increase in tape distortion although generally I have found that chrome tape will be tolerant of brief peaks almost to FSD without audible distortion.

Once you get used to the 'clunky' feel of the transport and the slightly noisy capstan drive motor you will find the results are very good. Tape to head contact is never a problem even with damaged tape. It has never damaged a tape itself except for an occasion when a retaining clip fell unknown into the mechanism and fouled on one of the capstans causing a slight crease in the tape but this still replayed perfectly on the *AL-300*.

Although the wind on a cassette is largely the product of the cassette mechanism itself, sudden switching in of the varispeed with the transport in play did not cause any jumps in the tape pack, suggesting a well-adjusted system. Except with very low quality cassettes, wow and flutter was very low. Rewind time in both directions is approximately 90s and there is a 6s cut-out on the transport controls before they are operative after the power has been applied.

Erasure of signals – even 100% modulation reference tones – was good and was never a problem.

In operation, the controls of the *AL-300* fell to hand quite readily, although the actual positioning of the front panel controls seems to have been decided largely by graphic design rather than ergonomic study and some of the indicator lights could be positioned so that they relate more to their operation controls.

Generally, the *AL-300* is a machine to be seriously considered for general studio duties and copying. It is not a fully-fledged studio machine but is a good example of a hi-fi design with features that may well have studio application and the capability of making very good cassette copies on ferric and chrome tape. A further attraction must be the reasonable price when compared to a dedicated professional machine.

Keith Spencer-Allen

Tascam 122

MANUFACTURER'S SPECIFICATION
Track system: 4-track, 2-channel.
Capstan Motor: 1 FG servo DC motor.
Reel motor: 1 DC motor.
Head: three – erase, record, play.
Wow and flutter: 0.05% (1⅞ in/s); (NAB weighted) 0.03% (3¾ in/s).
Frequency response (overall):
20 Hz to 20 kHz (1⅞ in/s)
20 Hz to 25 kHz (3¾ in/s) metal
20 Hz to 19 kHz (1⅞ in/s)
20 Hz to 24 kHz (3¾ in/s) $Co(CrO_2)$
20 Hz to 16 kHz (1⅞ in/s)
20 Hz to 21 kHz (3¾ in/s) normal
S/N ratio (overall): 59 dB (1⅞ in/s); (3% THD weighted) 61 dB (3¾ in/s).
Fast wind: 80 s approx for C-60.
Inputs: line (× 2) 60 mV, 50 kΩ.
Outputs: line; 0.3 V into 50 kΩ; phones; 100 mW (max) into 8Ω.
Power: 100/120/220/240 V AC, 50/60 Hz, 41 W.
Dimensions: (whd) 482 × 147 × 345 mm.
Weight: 9 kg (net).
Teac Corporation, 3-7-3, Naka-cho, Musashino, Tokyo, Japan.
UK: Harman (Audio) UK Ltd, Mill Street, Slough SL2 5DD.
USA: Teac Corporation of America, 7733 Telegraph Road, Montebello, California 90640.

THE Tascam *122* cassette recorder is part of the 'Teac Production Products' range of equipment, and would appear to be aimed at the 'home studio' market as a mastering recorder. However, it would also be a likely contender for the studio control room or copying suite.

In essence, the *122* is a 'special' version of the Teac *C-3X* up-market domestic cassette recorder, the primary obvious difference being the inclusion of a second line input on the front panel instead of a mike input.

The *122* is an impressive-looking machine, almost 6in high and 19in wide (rack-mount 'ears' are provided, most usefully). Considering the front-panel from left to right, we find a push-on, push-off power switch above a 3-position 'memory' switch, operating in conjunction with the tape position indicator to offer either stop-at-zero or play-from-zero options, plus off. Below this is a headphone level control giving up to 100 mW into 8Ω, with associated ¼ in stereo jack socket.

To the right of this control strip is the cassette loading window, a tinted plastic panel which hinges smoothly down on pressing the 'Eject' button. The panel is also removable for transport cleaning and alignment, although, as if often the case, it is somewhat easier to remove than to replace. The transport itself has a single-capstan, DC servo-controlled drive system with a second motor for the reels, and features the type of 3-head configuration generally found on Japanese machines, namely a combined record-replay 'double head' with the two gaps quite close together. This approach avoids a number of nasty problems that can arise with separate heads, namely variation of azimuth between record and replay heads, and doubtful tape-to-head contact at the record head, where it does not have the benefit of a pressure-pad within the cassette. It does, however, mean that the head assembly has to be a very compact piece of engineering, as the gaps must be very close together to allow both to benefit from the pressure-pad's action.

The transport controls take the form of a panel to the right of the cassette well consisting of seven electronic controls and one mechanical button (eject). The buttons controlling tape motion handle: record enable (pressed with the play button in the usual way, or in conjunction with pause); record mute, which removes audio from the record head during recording until cancelled by the play or pause buttons; pause, which unusually is released by pressing play; rewind and fast forward; play (really a 'transport forward' button); and the stop button. These controls are much like calculator keys in feel, with a positive action. Record, rec mute and pause have associated LEDs which indicate if they have been enabled, and the buttons are colour-coded for easy recognition. Above the controls is a 3-digit mechanical counter with reset button, which is about as accurate as such devices normally are.

Next to the right are two large analogue meters labelled 'VU' and calibrated from −20 to +5 with a fair degree of scale expansion around the −3 to +3 mark. There is no indication of Dolby reference level: it appears to be 0 VU. The meters have a useful peak LED fitted which flashes for a reasonable length of time on peaks.

Below the meters are three knurled aluminium knobs with skirts calibrated 0 – 10, the left-hand pair handling left and right record levels and the

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right-hand knob controlling the stereo output level. This latter is placed before the metering in the usual way. A novel feature of the record level controls is that whilst they adjacent rather than dual-concentric, they are mechanically ganged together such that both rotate when either one is turned. They may be adjusted individually, however, by holding one and turning the other, overcoming the friction ganging. As a result, the left and right input levels can be tracked together with any desired amount of left-right imbalance. This is a similar system to that used on the Uher *CR-240*, with the difference that the latter machine has a slide switch to engage or disengage the ganging.

Beneath these controls we find the area in which the *122* differs from the *C3-X*: a secondary line input via a pair of ¼in mono jacks which has the same specifications as the other line input accessed via the rear panel; next to this is a bias/record cal panel which contains four screwdriver presets for bias and record level setting, left and right. Adjacent to these, a push-on, push-off button and associated LED determines whether the inbuilt tape-type selectors are in operation or the panel settings are overriding them.

To the far right of the machine we find a column of 'slide/toggle' switches (you find a better name for them) which control what might be termed 'intrinsic functions'. At the top is the source/tape monitor switch. Below this is a noise reduction 3-way selector, offering Dolby *B*, Dolby *HX*, and off. The 'off' position activates a set of eight phono sockets on the rear panel which may be used to connect an optional dbx unit: hence the labelling of this switch position 'dbx (ext), out'. As supplied, the dbx connectors are jumpered so that this position offers no noise reduction. Next switch down is a line input selector with three positions, selecting between the front panel input and the rear panel input, the third position being a 'test' setting for lineup purposes. The fourth switch controls another novel feature of this machine: normal or double speed. The machine will operate at the normal 1⅞in/s or at 3¾in/s, and EQ is modified accordingly. This means that the machine is somewhat compatible with 4-track cassette/mixers like the *144/244* or Fostex *250*. I say 'somewhat', because, of course, the *122* only has stereo capability (with the normal track format common to all 2-channel cassette recorders) and is thus only capable of recording or playing two out of the possible four tracks at a time. The final two switches are 3-position selectors handling EQ and bias for the various tape types for which the machine is factory-set. This bias selector may be overridden by the front panel pushbutton referred to earlier. The three types are labelled Normal, Co (CrO_2), and Metal, corresponding to Types I, II and IV respectively. The EQ settings, which obviously apply to both recording and playback correspond to 120μs, 70μs and metal EQ respectively.

The machine is supplied with three documents: an owner's manual, circuit diagrams and an 'information supplement', which basically introduces the reader to cassette recorders, cassettes, and how to look after them, get the best out of them, and so on. The circuit diagrams are respectably detailed, but give no servicing information, general practice for Japanese manufacturers being to produce a comprehensive and detailed service manual available to order. The diagrams are sufficient to 'get you by', but I would recommend professional users to obtain the service manual. The owner's manual is remarkably comprehensive, covering the use of the machine for a number of reasonable purposes in three languages (in our case, English, French and German: in some countries the manual may not be multilingual in the same way).

The rear panel of the *122* is quite sparse, being fitted with two pairs of RCA phono sockets for Line 1 input and output, four pairs of dbx interfacing phonos, clearly labelled L or R, 'to decoder' or 'to encoder' and 'rcv' or 'send' as appropriate. Associated with these sockets is an adjacent multiway connector which is used to send encode/decode switching commands to the optional *RX-8* dbx unit. The phono dbx interface sockets are jumpered with metal 'U' rods when the dbx unit is not fitted. A second multiway connector allows remote control of all transport functions with the optional *RC-90* remote unit.

In operation

Interfacing the *122* to a normal system, we first of all encounter the fact that the machine talks to the world at −10dB. The input level controls are very smooth, and track well, so this is not a serious problem on the input side, but the output level may be found a touch quiet in comparison to other machines if the *122* is brought up a stereo machine return to a console. A certain amount of gain can be squeezed out of the *122* by twiddling the innards, but it would be better to elevate it with a separate unit such as one of the interface boxes now available for connecting −10dB reference equipment to line level systems. Both the line inputs have the same specifications, and I have a nasty suspicion that, once installed, the front panel jack sockets will not get a great deal of use. Indeed, for some applications the standard *C-3X* may be more suitable with its front panel mike input capability: a point worth considering before purchase.

Operating the transport controls with the intention of recording, we encounter two minor oddities in the control logic. First, unlike many cassette recorders, the record button has to be pressed with some other control for it to do anything. Many recorders, especially those with mechanical controls rather than logic-controlled ones, allow record to be pressed on its own to set recording levels. This is not necessary (or possible) with the *122*. With the monitor switch set to source, record levels may be adjusted, while the only way of entering record without invoking tape motion is to press record and pause. And this brings us to the next oddity: the pause button is not a toggle. Although you enter pause by pressing the button, you leave pause by pressing another button, typically 'play' (or stop of course). It would be nice to say that such little oddities will become second nature after you've used the deck for a few days (or weeks, or whatever). Unfortunately, human brains don't seem to work quite like that. I still find myself getting confused between my computer's keyboard at home, and my typewriter's keyboard at work, and then there's a terminal which is different again... you know what I mean? I'm all in favour of standardisation when it comes to which key or button does what.

Coming on to recording with the *122*, the performance with Type I tapes (Maxell *UDXL-I* and *TDK D*) was found to be satisfactory in terms of noise level, with or without noise reduction. However, the HF response was not as good as I would have hoped, until Dolby *HX* was switched in. This produced very good quality recordings, but I was rather surprised that it needed *HX*'s bias/EQ twiddling to get them. I would recommend that the *HX* setting be used for recordings at all times unless there's a good reason (eg dbx) not to.

With Type I tapes, the meters gave a good indication of what was going to tape. Average levels of 0VU resulted in good S/N ratio and respectable lack of distortion. The peak LEDs, alleged to come on at +8, indicated transients well, and were a distinct asset.

A number of Type II tapes were also tried, both standard CrO_2 (BASF) and 'pseudochrome' types (TDK *SA* and *SA-X*) and the comments on HF response still applied. There was an added problem, too, in that some kind of saturation appeared to occur at average levels above about −10 and great care had to be taken with Type II tapes in general to avoid distortion at comparitively respectable levels. Comparing the recorded level with my Tandberg *TCD-330* indicated that the reference levels were similar on both machines, but for some reason I seemed to run out of headroom on the *122*. On a later occasion I found that a *C-3X* suffered from the same problem so it was not simple misadjustment. Why there should be less headroom on Type II tapes that Type I's on this machine I hate to think, and I would recommend the manufacturer to look into it.

Type IV (TDK *MA-R*) tape once again produced very good results, making the Type II performance even more of an anomaly. Again, the best results were achieved with *HX*.

Upping the tape speed to 3¾in/s produced very impressive results, particularly in the HF response, there also being an added 'cleanness' to the sound – basically, just what you'd expect.

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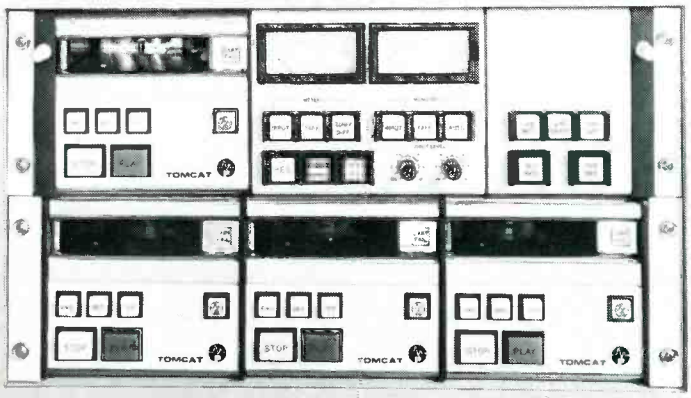

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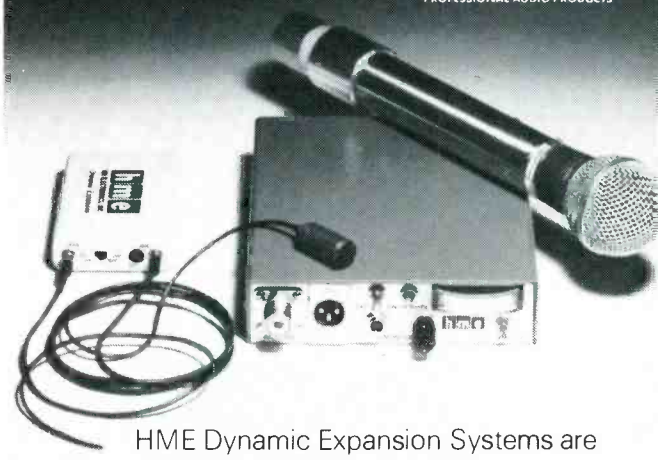

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It was very much like the difference between 15 and 30in/s on open reel recorders. If there were more 3¾in/s cassette recorders around, this would be a very useful facility. The only trouble at present is that if you gave people tapes recorded at the high speed they probably wouldn't be able to play them back unless they had similar machines or 4-track cassette mixers (in which case they would not want noise reduction unless it was dbx for a Tascam *244*). Obviously, the double-speed EQ characteristics are a bit non-standard, but this doesn't matter too much unless more manufacturers start offering it. I have wondered from time to time how options like four tracks and double speed relate to the Philips specifications of the *Compact Cassette*. Do Philips get upset about it?

Trying a number of different Type II tapes in an effort to see what the machine was actually lined up for seemed to indicate that the factory-set values were about right for TDK *SA* tape, with a bias level slightly higher than the recommended value for Type II (which suits *SA* tape fine).

The front-panel presets were adjusted for TDK *SA-X* according to the instructions in the manual, which recommends the use of a 6.3kHz tone and biasing to 1.5dB over peak (0.5dB for metal tape). I felt it rather a pity that there was not a simple test oscillator built into the machine. I guess it would be asking too much to expect some kind of semi-automatic lineup (as found on the Sony *TCK-81* and some Aiwa machines): after all, you don't expect such bells and whistles on a mastering machine, do you? There is an optional Teac test-tone oscillator (*TO-8*) which offers three frequencies, 400 Hz, 6.3 kHz, and 12.5kHz, at two levels, −30 and −10dB.

Fine bias adjustment was performed, again as recommended, by alternating 12.5kHz and 400Hz for flattest response. The record level was also set up, and the result of all this work was a setting which was absolutely identical to the Type II preset! I was still not happy with the HF end, however, and tried setting up the bias by recording white noise and adjusting for maximum top end off-tape. In fact, it was a matter of finding a bias setting which gave the best A/B, as the quality of the noise changed quite markedly with bias level. Adjusting for the best source/tape comparison led to a setting which yielded the same results as doing it properly, whatever that tells us.

The innards of the machine were examined briefly, revealing a rather better than usual Japanese standard of construction, but I would not have called it the simplest machine to fix. If the service manual is as good as is usual from this manufacturer, it should be reasonably easy to locate components and adjustments, but this was not supplied with the review machine so it is difficult to say. Modern manufacturers are exceptionally good at getting a lot of circuitry into a small volume, but this brings its penalties on occasion in terms of maintenance access. I have seen far worse, though.

Conclusions

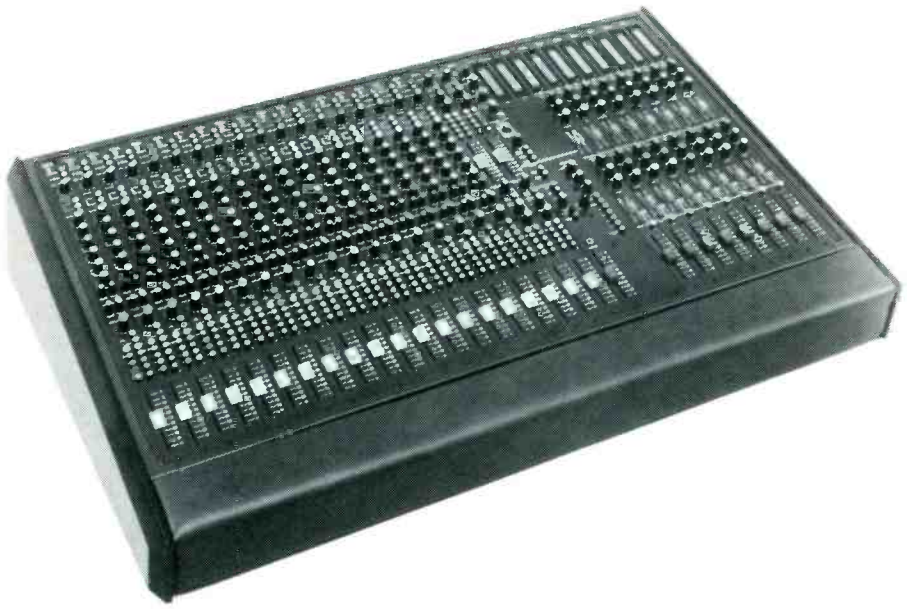
This is a very nice cassette recorder. I enjoyed using it, despite having to think about how to get out of the pause mode, and the machine is well-constructed and robust, able to stand the rigours of studio life. It has very positive transport controls, and rewinds acceptably quickly (about 90s for a C-60). In addition, the unit can be rack-mounted and remotely controlled. In general, the recording quality is very good, and the machine overall conforms to many of the criteria which I consider important in a cassette machine for the studio (see page 28).

I also find it a rather frustrating recorder as well. I do feel that it should be possible to improve the top end – although it is fine with Dolby *HX* selected, it manages an HF response which some other machines don't need *HX* to obtain (I own one of them), and this is a little disturbing. More worrying is the way it overloads on Type II tapes at a level below what I would have thought it should.

I do not understand this at all: all I know is that there is a *C-3X* installed in a copy room in central London which does exactly the same things. The owners of said machine have had it for some months, and they like it a lot. They find the HF end quite acceptable, using it in *HX* mode all the time, and I don't think they ever use other than Type I tapes on the machine. So perhaps I am being a little over-critical. I just feel that here is a recorder (or two, because you should think about whether the *C-3X* or the *122* would be the best choice) which has so many excellent things about it, it is very nearly ideal. It just falls down, inexplicably, in a couple of areas which are quite out of keeping with the rest of the machine and its pedigree. Unfortunately, those two points could be important.

I would say, overall, that the verdict is 'Very good, but could have done better'. A worthy contender: check it out and see what you think.

Richard Elen



Itam Sigma mixer

MANUFACTURER'S SPECIFICATION

Inputs
Microphone: impedance 1kΩ, electronically balanced. Available gain 15 to 80dB (without 20dB pad).
Line and echo returns: impedance 12kΩ unbalanced. Sensitivity adjustable −20dBm to +6dBm for 0dBm at insert send (preset to 0dBm).
Insert returns: impedance 2.5kΩ, 0dBm.
Tape returns: impedance 10kΩ (mulitrack returns), 15kΩ (2 track returns). Sensitivity +4dBm = 0VU.

Groups and stereo outputs
Monitor feed auxiliary sends: level at onset of clipping at 1kHz +20dBm into 600Ω, +22dBm into 10kΩ. Source impedance 150Ω unbalanced. Level 0VU = +4dBm ±0.5dB.
Channel insert sends: source impedance 100Ω, 0dBm.

Performance
Noise: residual noise at output, nothing routed, group fader down −95dBm. Residual noise at output nothing routed, group fader up −88dBm.
Noise: referred to input, line < −80dBm (0dB gain).
Noise: referred to input, microphone < −123dBm (maximum gain).
Crosstalk: < −83dB at 1kHz.
Distortion: <0.015% total harmonic distortion at +20dBm output into 600Ω at 1kHz. <0.03% total harmonic distortion at +20dBm output into 600Ω at 10kHz.
Frequency response: 20Hz to 20kHz, +0.5dB, −1dB (equalisation flat). Distortion and frequency response figures measured between line input and group output.
Dimensions: 1365 × 890 (max) × 280mm (max) (whd) (Width for 18 input channel version).
Manufacturer: Industrial Tape Applications, 1–7 Harewood Avenue, London NW1 6LE, UK.

THE Itam Sigma mixer is a reasonably priced desk intended for use by musicians in conjunction with multitrack recorders such as the Itam *1610* 16-track.

In the normal configuration there are 16 input channels, each of which may be routed to eight busses in addition to four cue busses and a dedicated stereo buss.

As standard, two echo return modules are fitted each handling two channels with the same routing possibilities as the input modules except for the cue sends which are restricted to busses 1 or 2 plus busses 3 or 4. Two spare spaces in the desk may be occupied by additional input or echo return modules which may be added at any time.

Eight output modules are fitted each acting as a group to which the busses are fed and passed to the group fader. Each output module handles two channels to and from tape designated normal and auxiliary. In practice the 'normal' setting deals with tracks 1 to 8 and the 'auxiliary' tracks 9 to 16. A switch by the group fader feeds the group output to either the normal or auxiliary feed to tape. Each track has its own monitoring section enabling the signal from tape to be panned into the stereo buss or fed to cue busses 1 and 3. Similarly the group output can be panned into the stereo buss or fed to cue busses 1 and 3.

The final type of module, the master module, contains the stereo output with its metering, master controls, talkback and a test oscillator.

The complete mixer is based on a lightweight metal frame into which the modules are secured by two self-tapping screws, a padded surface being provided at the front of the mixer. Interconnection between the modules is by means of a daisy chain arrangement of ribbon cables with insulation displacement connectors which plug into the modules.

At the rear are XLR connectors for the microphone inputs with all other inputs and outputs with the exception of the remote power supply being unbalanced ¼in jack connections. The leads from the rear connectors secure to the printed circuit boards with pin connectors.

The power supply is fully enclosed in a metal case with one end having the IEC power input connector, a properly identified 20mm power fuse and further fuses and indicator LEDs for the ±15V and 48V supplies. Within the power supply a toroidal transformer feeds the voltage stabilisers located on a single printed circuit board with a second transformer being used for the 48V phantom microphone supplies.

None of the printed circuit boards had component identifications and the operating manual contained little servicing information, but apparently a better manual is currently being produced including circuits.

Overall the standard of mechanical and electronic construction was to a satisfactory standard but it would be good to see better identification of the internal connectors which could well be keyed to prevent incorrect alignment.

From the point of view of operation, all controls were clearly identified by white markings on the chocolate brown front panels with the use of coloured knobs easing quick control identification. Possibly the use of further coloured knobs on the equaliser potentiometers would ease operation further.

Input modules
Starting from the top of the module there is a phantom power on/off toggle switch followed by locking pushbuttons for a microphone 20dB pad and phase reverse. These are followed by a self-illuminating mike/line switch, the microphone gain potentiometer with a 60dB range and a screwdriver-operated line sensitivity control.

From here the middle section of the module is occupied by the filter and equaliser controls with locking switches for the high pass and low pass filters and also an equalisation in/out switch which does not affect the filters.

The equalisers comprise treble and bass equaliser potentiometers plus the mid-frequency equalisers covering the ranges 530Hz to 7kHz and 170Hz to 2kHz with their separate frequency and cut/boost potentiometers.

There follow send level controls for the four cue busses with a pre/post fade switch for cues 1 and 2 and a separate switch for cues 3 and 4. The pre-fade signal to the cues is fed before channel muting and the insert point but after the equalisers.

Below this are the panpot and self-illuminating pushbuttons for pre-fade listen and on/off, the latter having a green warning LED nearby. Also in this area is a red LED which gives a channel overload warning derived from four locations in the channel, line in level, microphone in level, post equaliser and panpot feed.

Above the Audiofad fader (cheaper faders being optional) are nine output routing pushbuttons which allow feeds to any pair or pairs of odd and even numbered group modules plus the stereo buss. The final feature is the mute buss switch which allows the mute switch on the master module to mute any combination of input modules.

Echo return modules
Each of these modules contain two identical channels which receive their inputs from the rear panel echo return jacks. The echo return signal then feeds to cue level potentiometers and the echo return fader.

One cue control can be switched to feed busses

76 ▶

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inputs varied from 4.7kΩ for the tape and auxiliary returns to 10.4kΩ for the echo returns, 4.7kΩ being on the low side for interfacing with some semi-professional equipment.

At the headphone output the maximum level was +22 dB.7 V with the source impedance varying with the level setting but remaining adequately low for most types of headphone.

Similarly, the impedance of the oscillator output varied with the level setting being 225Ω at the maximum output level of +20.3 dB.7V and rising to 1.2kΩ at mid gain setting. With the switched attenuator in circuit the maximum level fell to −26.5 dB.7 V from a source impedance of 100Ω which is suitable for testing microphone inputs.

Frequency response

The overall frequency response from the microphone inputs to the group outputs was flat from 20Hz to 20kHz with sensible high and low frequency roll-offs as shown in **Fig 1** with the equalisers and filters out of circuit.

Insertion of the high and low pass filters produced **Fig 2** which shows the filters to have attenuations of 12dB/octave with the −3dB points occurring at 106Hz and 7.8kHz−that latter being considered far too low a frequency.

Putting the equalisers in circuit at their nominal flat position gave a frequency response deviation in the order of ±1dB from 20Hz to 20kHz as shown in the plot marked zero in **Fig 3** which also shows the performance of the bass equaliser at its extreme settings and half-way settings. A similar plot for the treble control is shown in **Fig 4**, both controls having a sensible range but the law of the treble control being rather cramped about its mid-position.

The mid 1 and 2 equalisers had a very similar performance (other than frequency range) **Fig 5** showing the frequency range of the mid 2 equaliser with the mid 1 equaliser going from 530Hz to 7kHz. Both the frequency controls and the cut/boost controls had a good law, a typical cut/boost characteristic being shown in **Fig 6**.

The frequency response of other inputs and outputs was entirely satisfactory as were various combinations of routing.

Noise

Noise referred to the microphone inputs loaded with 200Ω was good at −124dBm band limited 20Hz to 22kHz or −126.5dBm A-weighted with no hum problems.

Table 1 shows the noise in the group outputs with the group shut, open with no routing, and routed to one or four line inputs at 10dB gain with the equalisation out. Inserting the equalisers with their controls in the nominal flat position degraded the channel noise by 3dB in all the figures.

This shows a generally satisfactory performance for the group outputs. However, the basic noise of the stereo output and the monitor outputs was similar and higher as shown in **Table 2**.

Allowing for the signal handling capability, there is a more than adequate dynamic range under these conditions and no other noise problems were encountered.

Distortion

Harmonic distortion was measured at various levels from the microphone inputs and the line inputs to the group outputs and found to be generally insensitive to input/output levels below clipping. **Fig 7** shows a typical performance from the microphone input driven at −20dBm with

80 ▶

FIG.4
ITAM SIGMA
FREQUENCY RESPONSE WITH TREBLE EQ IN CIRCUIT

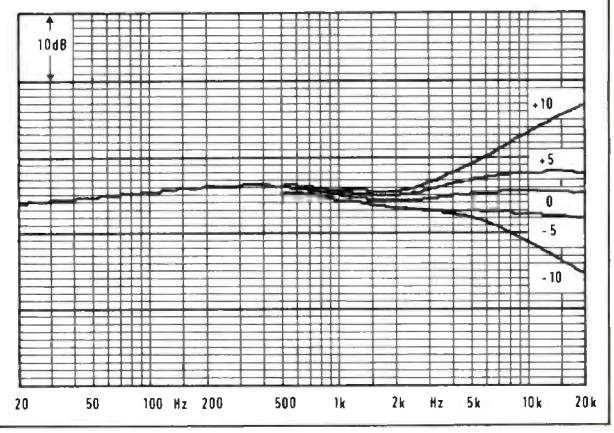

FIG.5
ITAM SIGMA
MID 2 EQ RANGE

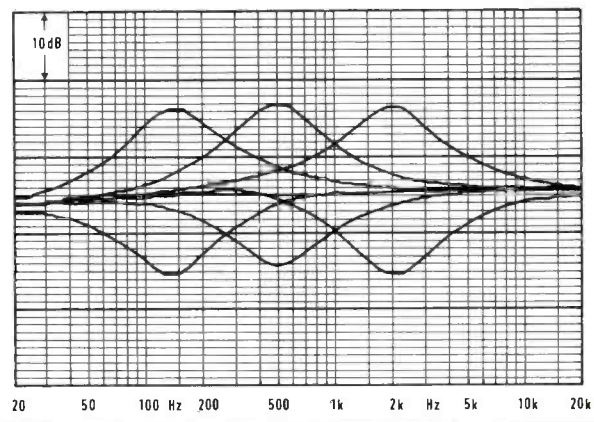

FIG.6
ITAM SIGMA
TYPICAL MID EQ CUT/BOOST

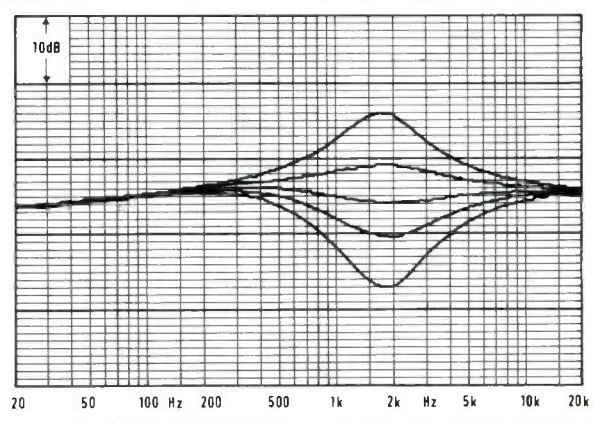

TABLE 1

Measurement method	Noise dBm					
	Shut	Open	1-input	4-inputs	1-open	4-open
22Hz to 22kHz RMS	−100	−94	−89	−78	−85	−78
A-weighted RMS	−108	−99	−93	−83	−89	−82
CCIR-weighted RMS	−100	−90	−86	−79	−81	−73
CCIR-weighted quasi-peak	−95	−86	−83	−75	−77	−70

TABLE 2

Measurement method	Noise dBm	
	No routing	4-lines routed
22Hz to 22kHz RMS	−79	−75
A-weighted RMS	−83	−79
CCIR-weighted RMS	−80	−75
CCIR-weighted quasi-peak	−76	−72

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the gain set for an output of +4dBm, the line input giving a similar performance. At maximum microphone gain there was some increase in harmonic distortion with the second harmonic predominating as shown in **Fig 8**.

Twin tone intermodulation distortion was also checked to the CCIF method using tones separated by 70Hz and found to be very good, remaining around 0.01% right up to 200kHz.

Other matters

The pan controls were not found to be satisfactory as their operation had little effect about the centre position and jumped the stereo image near the extremes of rotation where there was a sudden switch-off of one channel.

Having informed the manufacturers, they suggested a lower value of control which certainly improved the operation. Crosstalk across the channel faders was as shown in **Fig 9** leading to the necessity of switching unwanted channels off in some circumstances. On the other hand the crosstalk when routing one input module to group 1 with the adjacent module to group 2 (a severe test) gave the good results shown in **Fig 10**.

Metering when switched to the VU meter mode was such that the start of the red indications corresponded to +2dBm output with the rectifier characteristic being something like the required 'average'. The rise time to 0VU was close to the 300ms requirement of a VU meter, but the fall time was on the long side at 450ms as opposed to the normal 300ms.

When switched to the PPM mode, the meters had a peak rectifier characteristic with zero indication corresponding to +3dBm output. The rise time was found to be quite fast at 10ms with the fall time increasing to 1.7s.

The brilliance of the LEDs in the meters was not satisfactory in high ambient light levels and also being flat on the module's panel the visibility was not particularly good.

The overload indicators in the input modules were found to be very good, being extremely fast in action, operating on one cycle of 10kHz tone, with the hold time giving good visibility.

Finally, the internal oscillator was investigated, the sinewave output being within +0/−0.5dB reference 1kHz over the full frequency range from 15Hz to 29.7kHz with useful calibrations. As is common with low distortion circuits there was annoying bounce at low frequencies, but the harmonic distortion was good at 0.03% third harmonic at 100Hz falling to less than 0.005% at 1kHz and 10kHz.

When using the squarewave mode the rise and fall times were 2.5μs with the mixer being free from ringing. The 'pulse' output for checking phase took the form of an assymetrical squarewave.

Summary

The Itam Sigma mixer is a versatile unit at a very reasonable price. The available routing is sometimes rather complicated and 'driving lessons' are needed to take advantage of the available facilities. However the basic facilities are completely straightforward.

As has been seen, the mixer has some shortcomings in its present form, but the manufacturer has taken the criticisms seriously and intends to put the faults right.

Overall, the electronic performance was to a good standard with the mechanical construction being satisfactory but fairly basic as one might reasonably expect in view of the low cost.

Hugh Ford

FIG.7
ITAM SIGMA
HARMONIC DISTORTION
AT -20dBm INPUT LEVEL

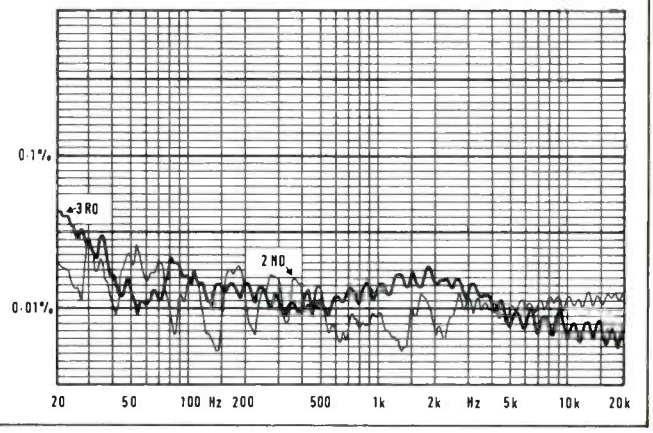


FIG.8
ITAM SIGMA
HARMONIC DISTORTION
AT MAX MIKE GAIN

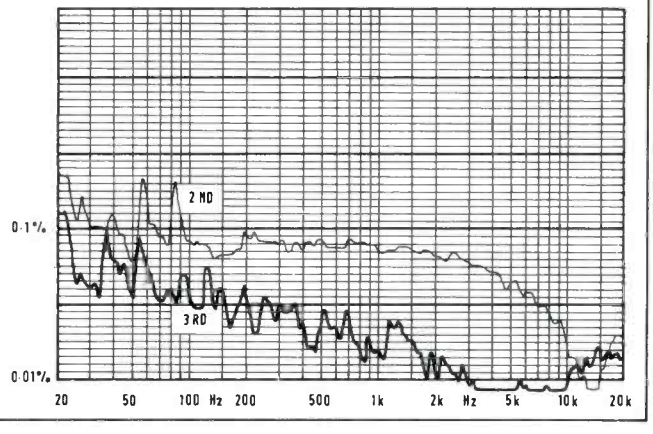


FIG.9
ITAM SIGMA
CHANNEL CROSSTALK

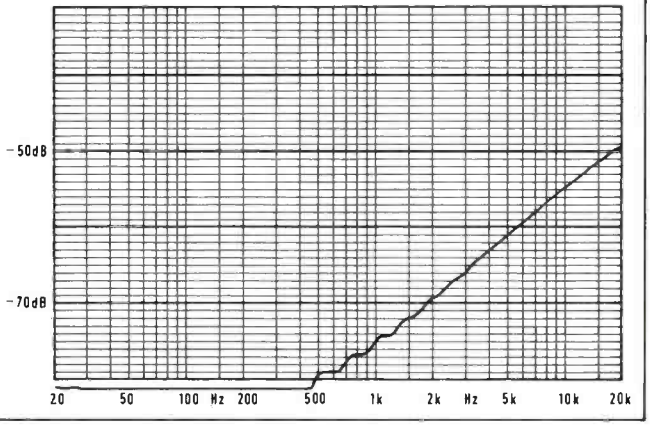
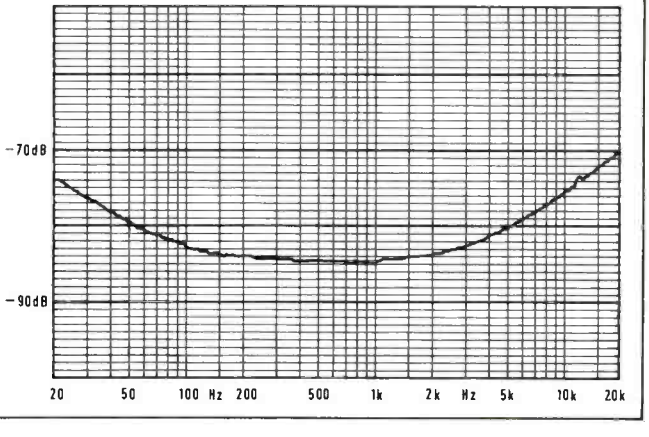


FIG.10
ITAM SIGMA
CROSSTALK WITH
INPUTS ROUTED



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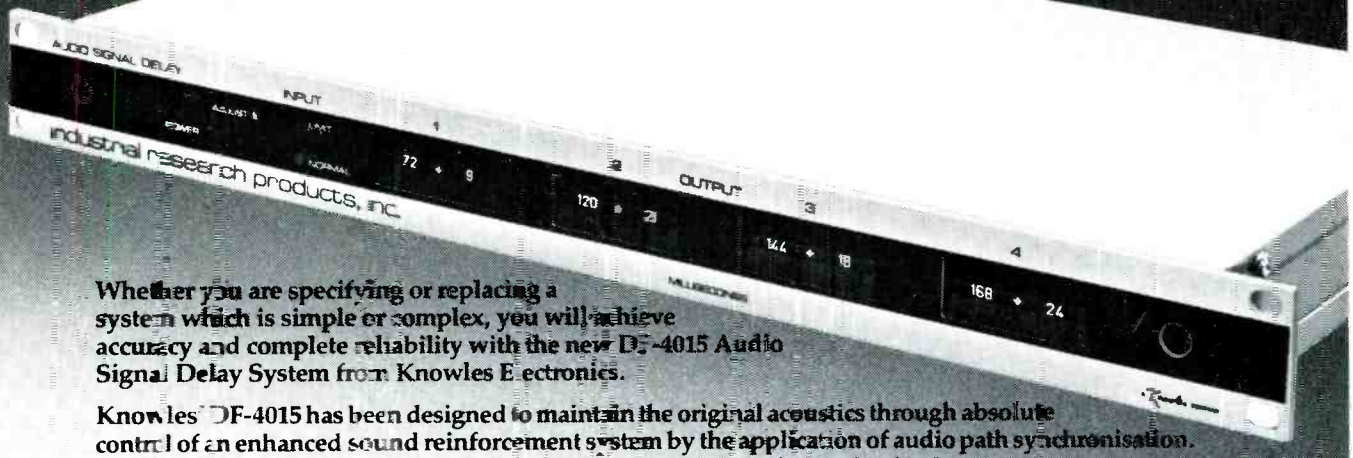

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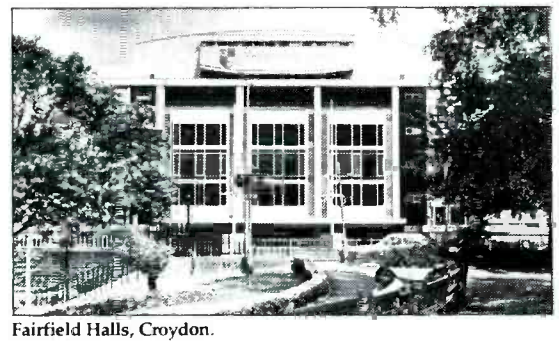

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Fabec AE1025 driver amp

MANUFACTURERS SPECIFICATION
DC parameters
Supply voltage: ±18V max.
Supply current: max ±25mA typically ±10mA.
DC offset at output: typically 20mV. Max 60mV balanced, 65mV unbalanced.
Audio specification for supply voltages±12V to ±18V and ambient tempeatures 0 to 70°C.
Min output level for less than 0.15% THD 20Hz to 15kHz: for ±18V supply +28dBV balanced into 10kΩ, +22dBV unbalanced. +21dBm balanced into 600Ω, +19dBm unbalanced. For ±12V supply +25dBV balanced into 10kΩ, +19dBV unbalanced. +19dBm balanced into 600Ω, +16dBm unbalanced.
Total harmonic distortion at 2.5V peak to peak input (20Hz to 15kHz): typically 0.03%, maximum 0.1%.
Small signal bandwidth: balanced typically −1dB at 250kHz, −3dB at 500kHz, min 200kHz and 400kHz respectively. Unbalanced typically −1dB at 100kHz, −3dB at 200kHz, min 85kHz and 150kHz respectively. Power bandwidth for the onset of slew rate limiting into 10kΩ: balanced typically 150kHz, min 90kHz. Unbalanced typically 100kHz, min 75kHz.
Output noise A weighted: balanced typically −90dBV max −88dBV. Unbalanced typically −88dBV max −86dBV.
Slew rate (typical): balanced 25V/μs, unbalanced 12V/μs.
Balanced-unbalanced level deviation: typically 0.3dB, max 0.8dB.
Manufacturer: Fabec AB, Gothenburg, Sweden.
Worldwide: Gotham Audio Corporation, 741 Washington Street, New York, NY 10014, USA.

THE Fabec *AE1025* is a thick film hybrid circuit intended for driving unbalanced or balanced lines with the output being insensitive to the symmetry of the load.

Being encapsulated in a package about 50×10×18mm it is much smaller and lighter than any form of output transformer and also takes less space than output stages constructed from discrete components as few external components are required.

Two inputs are available to the input buffer amplifier, a virtual earth input and a high impedance input, the former being an inverting input. Gain is controlled by a single external resistor which is in the feedback loop of the input buffer stage.

The input stage feeds positive and negative output driver stages which feed and load sensing and DC servo stage which controls the output stages.

The only other external components required are a capacitor to control the time constants of the DC servo loop and coupling or decoupling capacitors as required by the desired circuit configuration.

Inputs and outputs
The input impedance using the virtual earth input is theoretically equal to the value of the input resistor, but in practice the input has a small additional impedance as the virtual earth is not perfect. Measurement of the impedance of the virtual earth showed it to vary with the gain setting being at 1kHz 3.3Ω at 12dB gain or 5.3Ω at 16dB gain. The relation between the impedance and frequency was such that the impedance increased at 6dB/octave with increasing frequency.

Overall gain is controlled by the value of the input resistor and the value of the feedback resistor with a minimum available gain of 12dB. In practice the overall gain into 600Ω was found to be 0.27dB higher than the theoretical gain when working at theoretical 12dB and 16dB gains.

The impedance of the voltage input was found to be 100kΩ in parallel with 7.5pF with the gain depending upon the termination of the current input and the feedback resistor. With the gain set for 12dB the gain of the voltage input with the current input open circuit was found to be 11.47dB.

At the outputs the impedance was insensitive to the gain setting being 47Ω in the balanced mode or 44/46Ω for the outputs in the unbalanced mode with the unused output grounded.

In this respect the amplifier is very unusual as it can handle highly asymmetrical loads with little change in gain. For instance, when working balanced into 600Ω the gain changed +0.24dB when one leg was grounded and −0.34dB when the other leg was grounded.

The DC offset at the outputs always remained less than 30mV with the actual offset varying with the output load and configuration.

Using a ±18V supply the maximum output levels for less than 0.1% individual harmonic distortion were as shown in **Table 1** for the balanced and two unbalanced outputs with the unused output grounded.

Frequency response and noise
Fig 1 shows the frequency response at 16dB gain for the balanced and unbalanced outputs which are not the same at very high frequencies. Working at 12dB gain the frequency response at 0dBm and +12dBm balanced outputs is shown in **Fig 2**. At lower levels the −1dB point was at 175kHz and −3dB point at 420kHz which is not very different from the plotted response at +12dBm outputs.

With the output feeding into 10kΩ the response improved with the −1dB point at 315kHz and the −3dB point at 690kHz working balanced or 90kHz and 200kHz respectively unbalanced.

Noise was measured at the output with the gain set to 12dB with little difference being noted at 16dB gain but with significant differences between the unbalanced outputs (see **Table 2**).

Distortion
The total harmonic distortion at the balanced output was measured at various output levels

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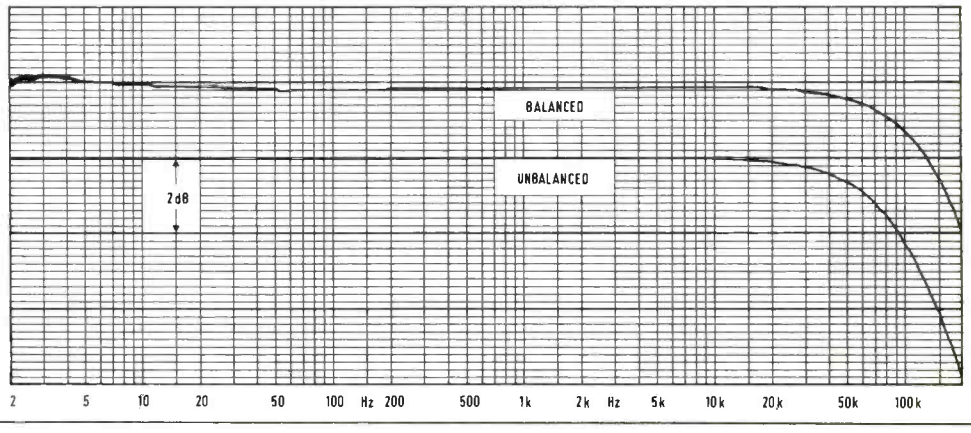
FIG 1.
FABEC DRIVER AMP
FREQUENCY RESPONSE AT 16dB



into loads of 10kΩ and 600Ω with the supply rails set to ±18V. The input resistor was 10kΩ and the gain was set to 12dB (see **Table 3**).

When working unbalanced the positive output has a distortion very close to that when working balanced with distortion at the negative output consistently 6dB higher.

Intermodulation distortion to the CCIF twin tone method using tones separated by 70Hz was measured at various levels with 10kΩ and 600Ω loads and found to vary little with load or level below the maximum output, the plots in **Fig 3** being typical of the performance.

Other matters

The squarewave performance was excellent when working into resistive or capacitive loads with no overshoot or droop. Rise and fall times were symmetrical at 800ns working into 600Ω or 600ns into 10kΩ balanced.

Working balanced the slew rate was very fast at 25V/μs and there was no triangulation of sinewaves within the audio band at any level.

Summary

The Fabec *AE1025* driver amplifier offers a respectable performance in a very small space. It further has the advantage of being a summing amplifier when required in addition to having a separate high impedance input.

It was completely tolerant of load conditions behaving much the same way as an isolating transformer with assymetrical loads.

Hugh Ford

TABLE 1

Load		at 1kHz	at 15kHz
600Ω	balanced	+21.6dBm	−19.9dBm
600Ω	unbalanced +	+19.3dBm	+16.1dBm
600Ω	unbalanced −	+19.1dBm	+14.8dBm
10kΩ	balanced	+27.1dBV	+26.1dBV
10kΩ	unbalanced +	+21.4dBV	+22.6dBV
10kΩ	unbalanced −	+21.1dBV	+21.2dBV

TABLE 2

Measurement method	Balanced	Unbalanced	
A-weighted RMS	−89.5dBV	−87.5dBV	−88dBV
CCIR-weighted RMS	−83dBV	−79dBV	−82dBV
CCIR-weighted quasi-peak	−78.5dBV	−79dBV	−82dBV

TABLE 3

Frequency	1kHz	10kHz	15kHz
+22dBV into 10kΩ	<0.002%	0.0045%	0.0065%
0dBV into 10kΩ	<0.0045%	<0.0035%	<0.004%
−20dBV into 10kΩ	Below noise	Below noise	Below noise
+20dBm into 600Ω	0.02%	0.06%	0.09%
+10dBm into 600Ω	0.0065%	0.025%	0.028%
0dBm into 600Ω	<0.01%	0.04%	0.06%
−10dBm into 600Ω	<0.024%	<0.024%	<0.024%

FIG 2. FABEC DRIVER AMP FREQUENCY RESPONSE AT 0dBm AND 12dBm BALANCED OUTPUT

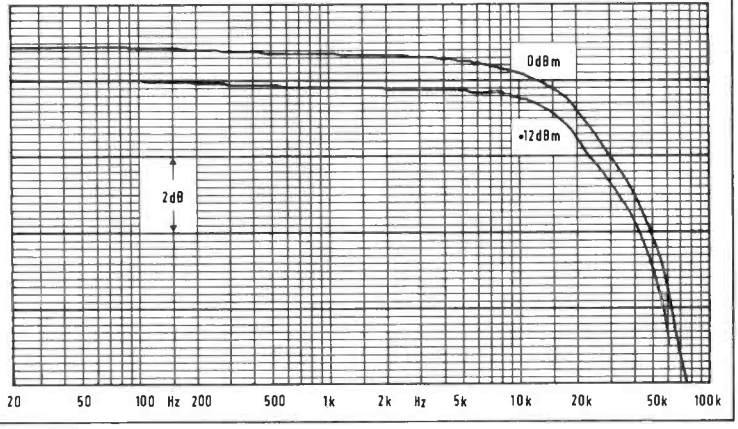
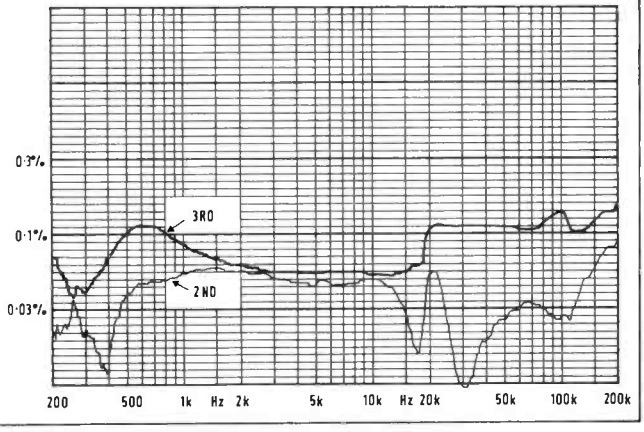


FIG 3. FABEC DRIVER AMP IM AT +10dBV OUTPUT



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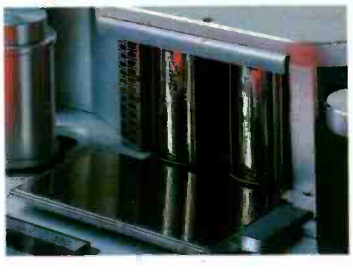

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