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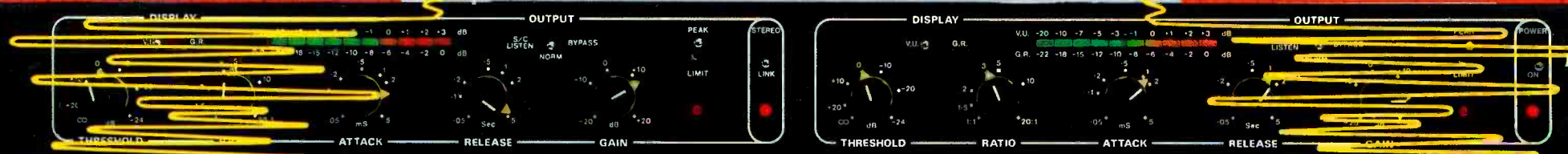
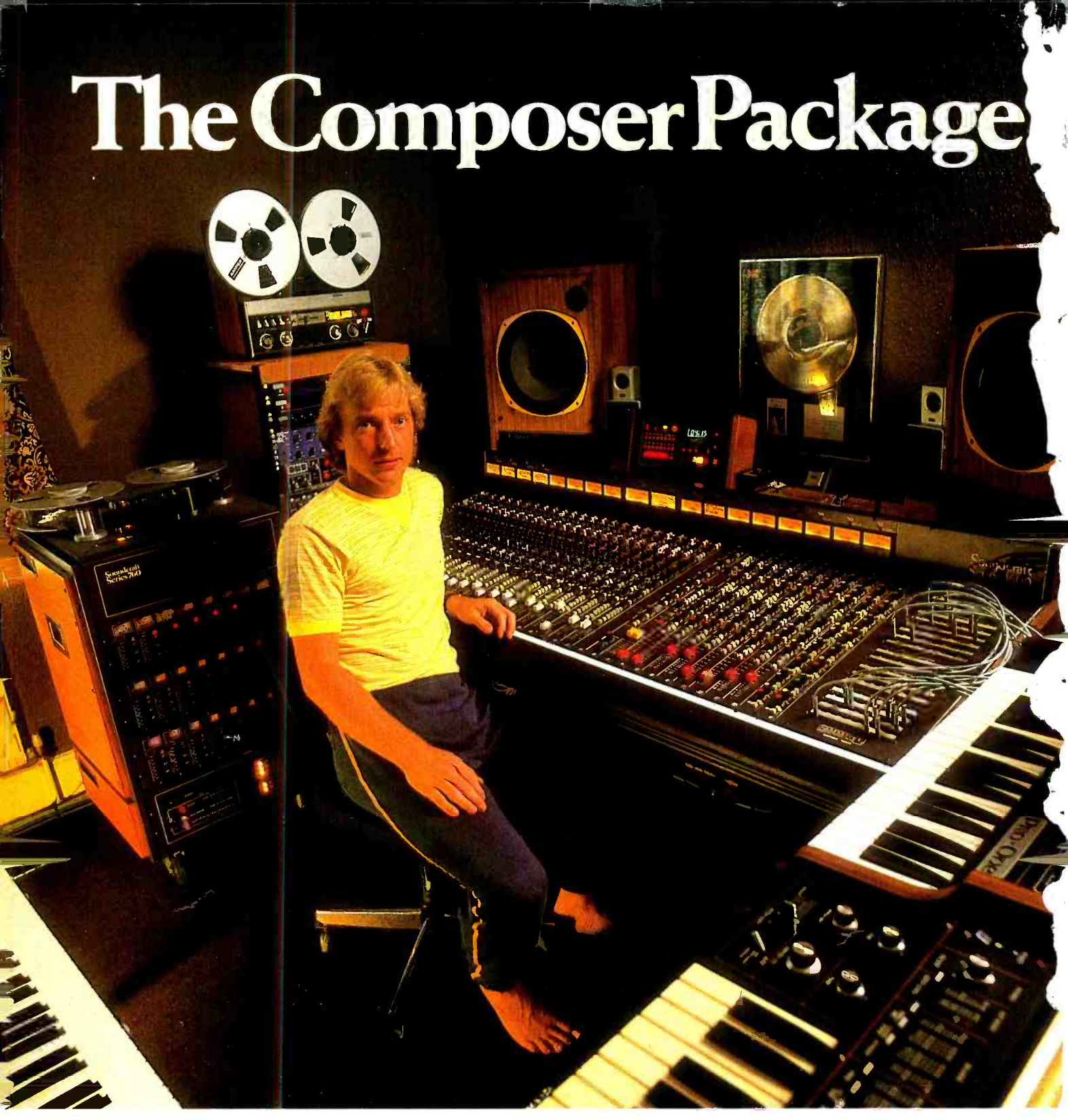
Disc cutting



The Composer Package



Paul Bliss bought his first Soundcraft console in 1978. As a song writer and record producer, he has always enjoyed the benefits of composing straight onto tape – that's why so many of his songs have been hits for performers as varied as Uriah Heep and Olivia Newton John.

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"Soundcraft call the 1600 and 760 the Producer Package. It really feels like it was designed especially for me. So perhaps they should call it the Composer Package too."

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NOVEMBER 1983
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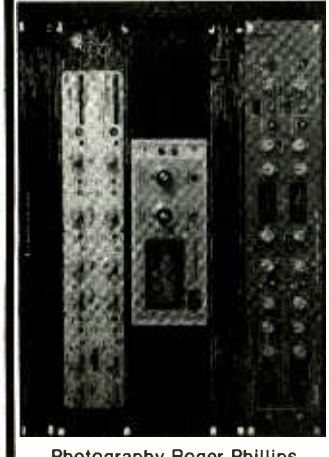
Cover: A collection of compressors from MXR, Valley People, UREI, Drawmer and Orban



Photography Roger Phillips

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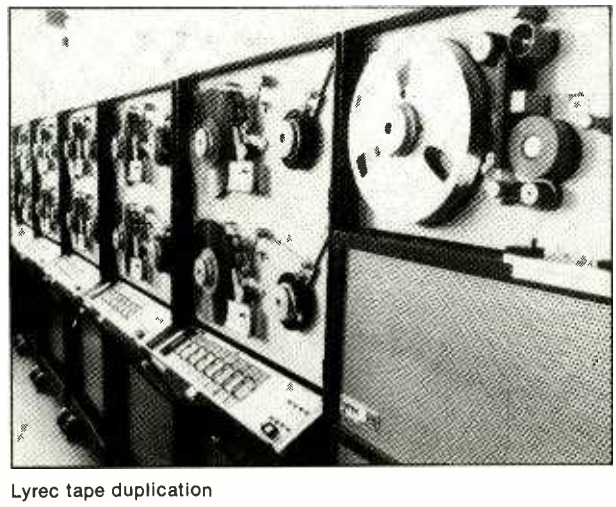
CONTENTS

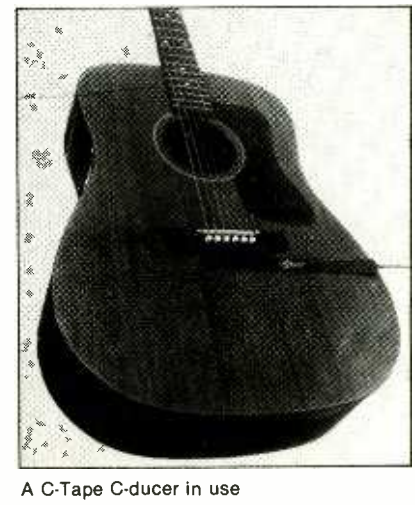
FEATURES

PRODUCT REFERENCE

REVIEWS by Hugh Ford



Lyrec tape duplication



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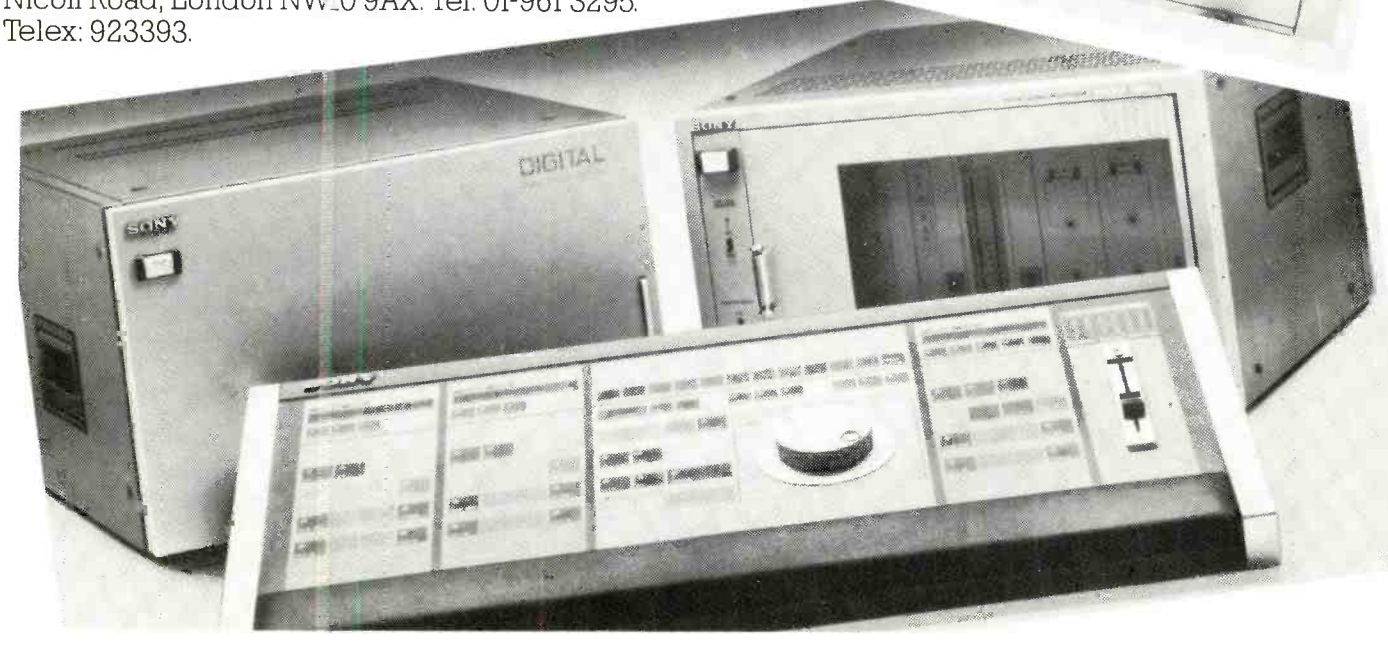

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AND BROADCAST ENGINEERING

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EDITORIAL

Us and Them

I'm getting more and more concerned about some of our listeners. Not the normal, ordinary, sensible people who buy records which are recorded in our studios, but the people—or some of them at least—who make and listen to some of the so-called 'top-end' consumer gear. The current arguments about digital versus analogue have brought a new, and even more objectionable crop of myths.

My attitude to analogue versus digital is quite simple, and I've said it before: digital today is in the Emil Berliner stage—second generation or thereabouts. We have just discovered that flat records are quite nice compared with cylindrical ones. The fact that at such an early stage digital audio can excite comparisons with the *very best* analogue—say 30 in/s ½ in stereo—says to me that whether or not digital is as good, better or worse than such analogue techniques, it is in the same order of magnitude: people can compare the systems pseudo-objectively and come out with different answers. *Next* generation or two, and these won't be a contest. Now, you and I know that there are fundamentally different problems, but on the face of it people think they can compare the two in the same terms. Maybe, without knowing about those different problems, they can. The fact is that today we have our digital systems: people want digital recordings and we need to know how to do them right. We need to grasp the operational technology. Whether or not we know or care about whether the electrons do a better job in one system than the other is only of peripheral concern: we want—and need—to be able to use the stuff. In the course of doing that, we will find benefits and short-comings like we do with any studio system, and we will point them out to the manufacturers—
that's how gear gets better: feedback from end-users to the designers. What we do *not* engage in is things like 'they' out there have been suggesting. Because we are sensible, and 'they' are often rather silly.

The characteristic things that 'their' manufacturers say are generally of the 'ours is better than theirs' type. That's fine, for salesmen at least. Hardly objective (or even user-based subjective) but they are there to make money. Our manufacturers do that too. But how differently! You don't find JBL—or JBL users—saying 'Tannoys are crap' or vice versa, for example. They might say that they have designed their speakers with such-and-such criteria which they regard as important. Their users will say that they like JBLs because they give them the sounds they like—they were brought up on that type of sound so it's only natural. My attitude to Tannoys is the same: I like them because I learned to work that way.

But Barry Fox (among others) has pointed out to me the latest sayings of Ivor Tiefenbrun of Linn, whom Barry calls 'the high priest of the anti-digital faction'. Linn is a British company making very expensive high-end consumer analogue turntables. We don't often see them in studios because they would collapse under the first tape-op's finger. Some might think of them as the Tyrannosaurus Rex of the Analogaceous Period. Tiefenbrun, is now saying, it is alleged, that digital recording destroys the tune so that you can no longer whistle along with the melody, or at least only with difficulty. Shades of Dr Diamond and the Anapestic Beat, or backwards masking. Well, I don't seem to have this problem. I can whistle along to my *CD* with no trouble at all. I have both black plastic and *CD* versions of Fleetwood Mac's *Rumours*, for example, and *Go Your Own Way* is equally whistleable (or hummable, and so are the harmony lines, etc) in both versions. Now before some loony points out that *Rumours* was an analogue recording, it was of course digitised for *CD* release—it just went from A to D a bit later than 'digital' recordings. Anyway, PolyGram say that *all* analogue recordings are digital anyway, don't they, if they are on *CD?* They just put it in a slightly different way. Now Tiefenbrun may have difficulty with his whistling. Perhaps he is out of tune, and all the HF in the digital recording causes phase-cancellation with his whistle and stops it. I don't know. Allegedly also, he has an album on his label which 'makes Abba sound like Stockhausen'—I find Stockhausen's music, much as I like him, rather unwhistleable, digitally *or* 'analogically'. That doesn't mean I don't like it, though. Tiefenbrun might be considered by some people a class AB loony. I might agree with them.

But Tiefenbrun is only one member of a rather extreme wing of the Audio Dictatorship Party. Others tell us more mundane things. They say that records heard on anything other than an X-turntable, Y amp and Z speaker sound like rubbish. That unless your speaker wires are of a special type, and made out of specially pure copper crystals, oriented in the right direction, it sounds like rubbish too. That getting your speaker wires round the wrong way (so the signal travels in the opposite direction) is noticeably nasty. I don't believe it. These things might make little differences, but not fundamental ones. Studio engineers like particular consoles for different reasons, and seldom refer to another console as rubbish—neither do manufacturers. We wire our monitors up with mic cable or mains wire and have loads of switches and plugs and sockets in the audio path. Maybe consumers should be degrading their systems to our level so they more closely approach the 'accuracy' of our monitoring?

It would be fine to let these people make fools of themselves if other people didn't believe them. It would also be fine if these things were true, if they got you a better end result, a better 'listening experience'—but they don't do either of these. If anything, they take the listener further away from what we and the artist liked in the control room. Myths have a valuable place, but it is not here. And the myth extends into our field, to people who will insist that whatever the evidence of our ears, some things are *actually* badly distorted and nasty compared with others, because the figures or the theory says so.

But there's a simple distinction between 'us' and 'them'. *We* are professionals: *they* are amateurs who open their mouths before putting their ears into gear.

Richard Elen

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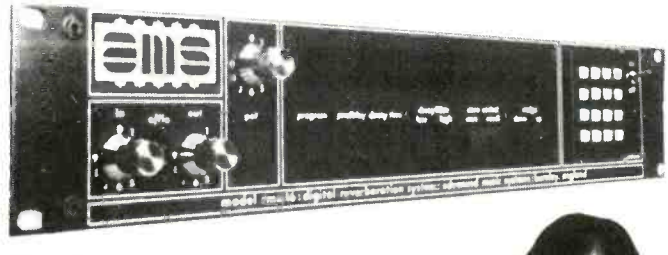

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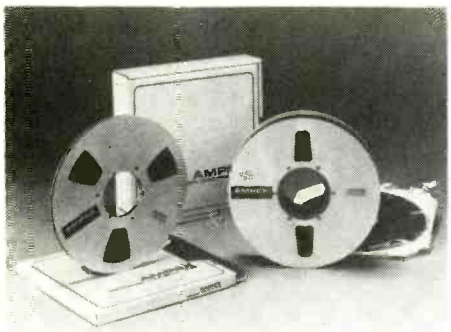

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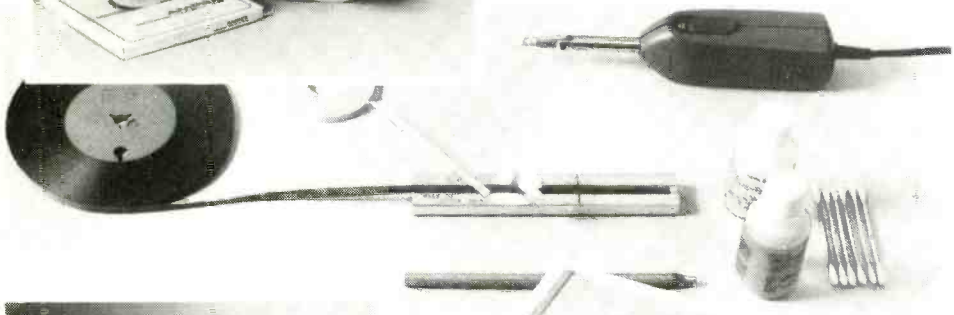

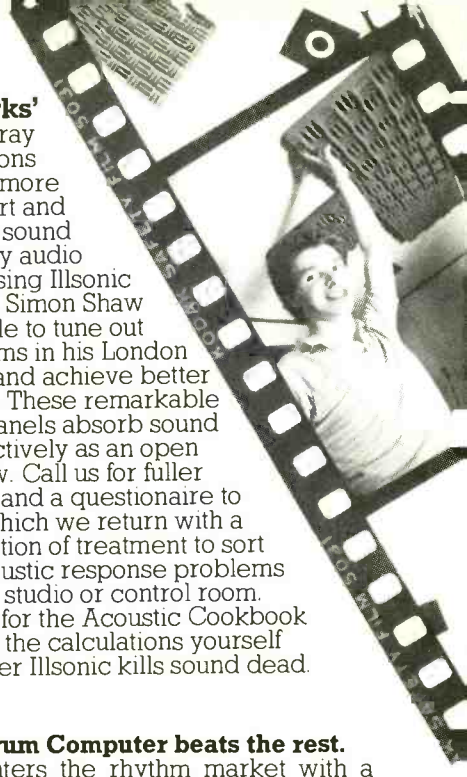

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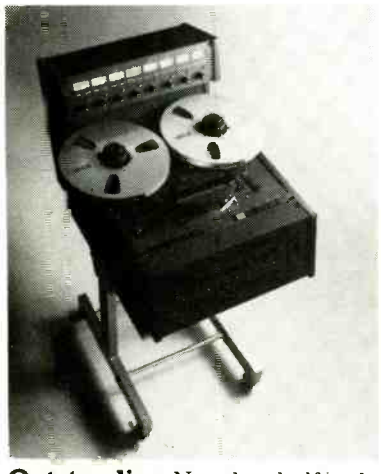

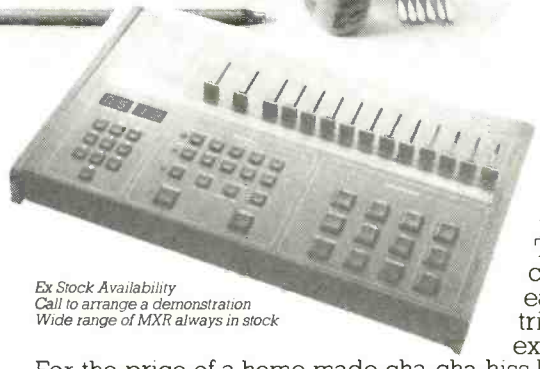

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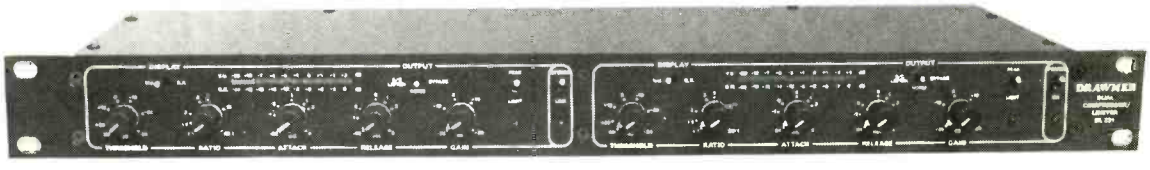

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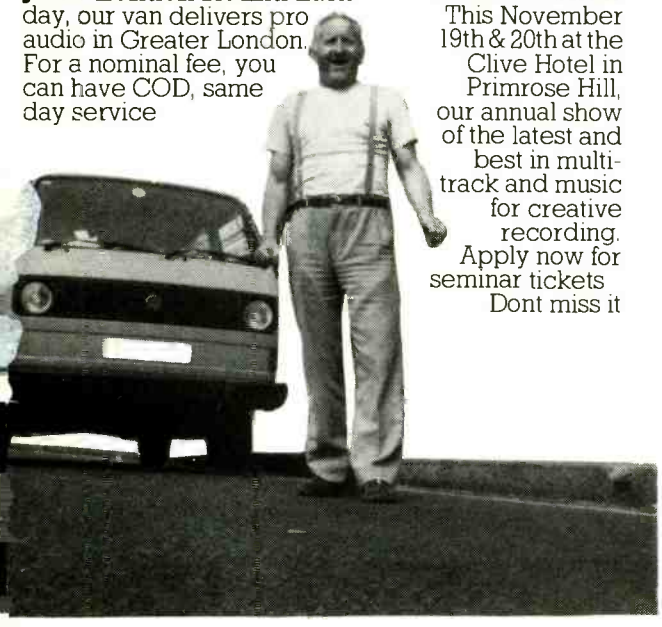

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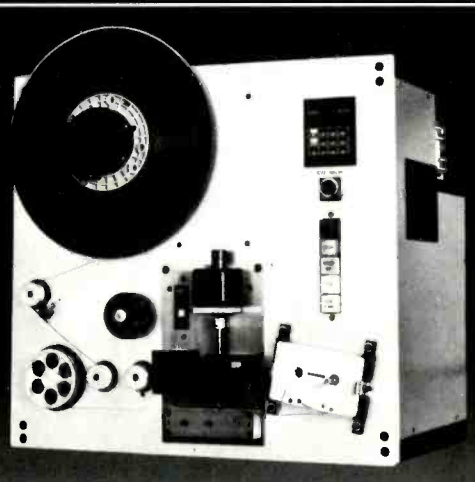

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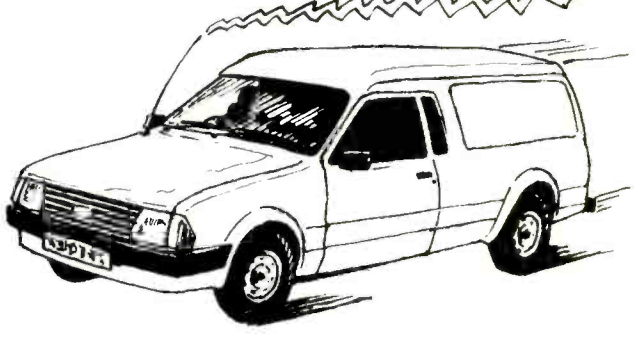

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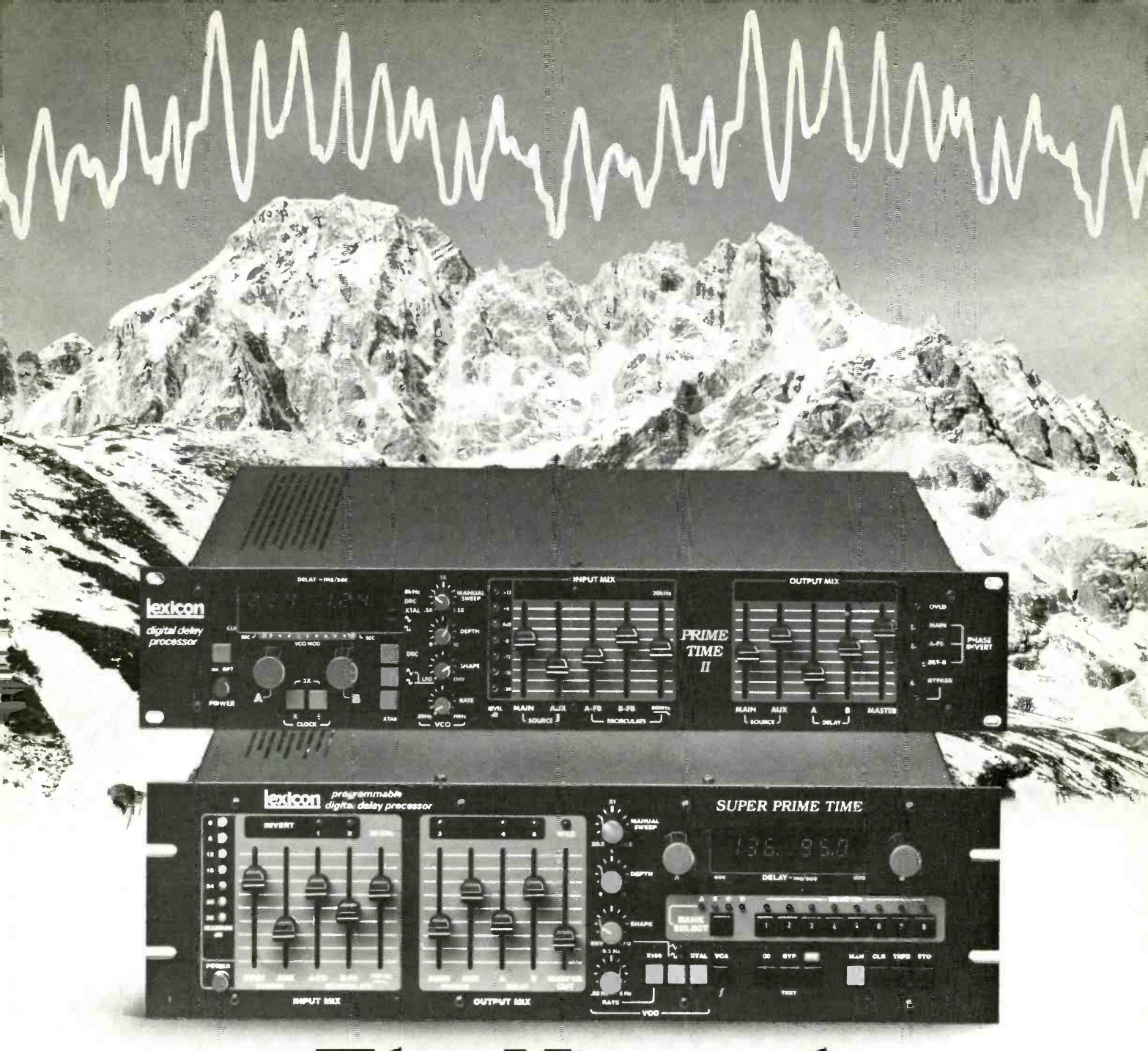

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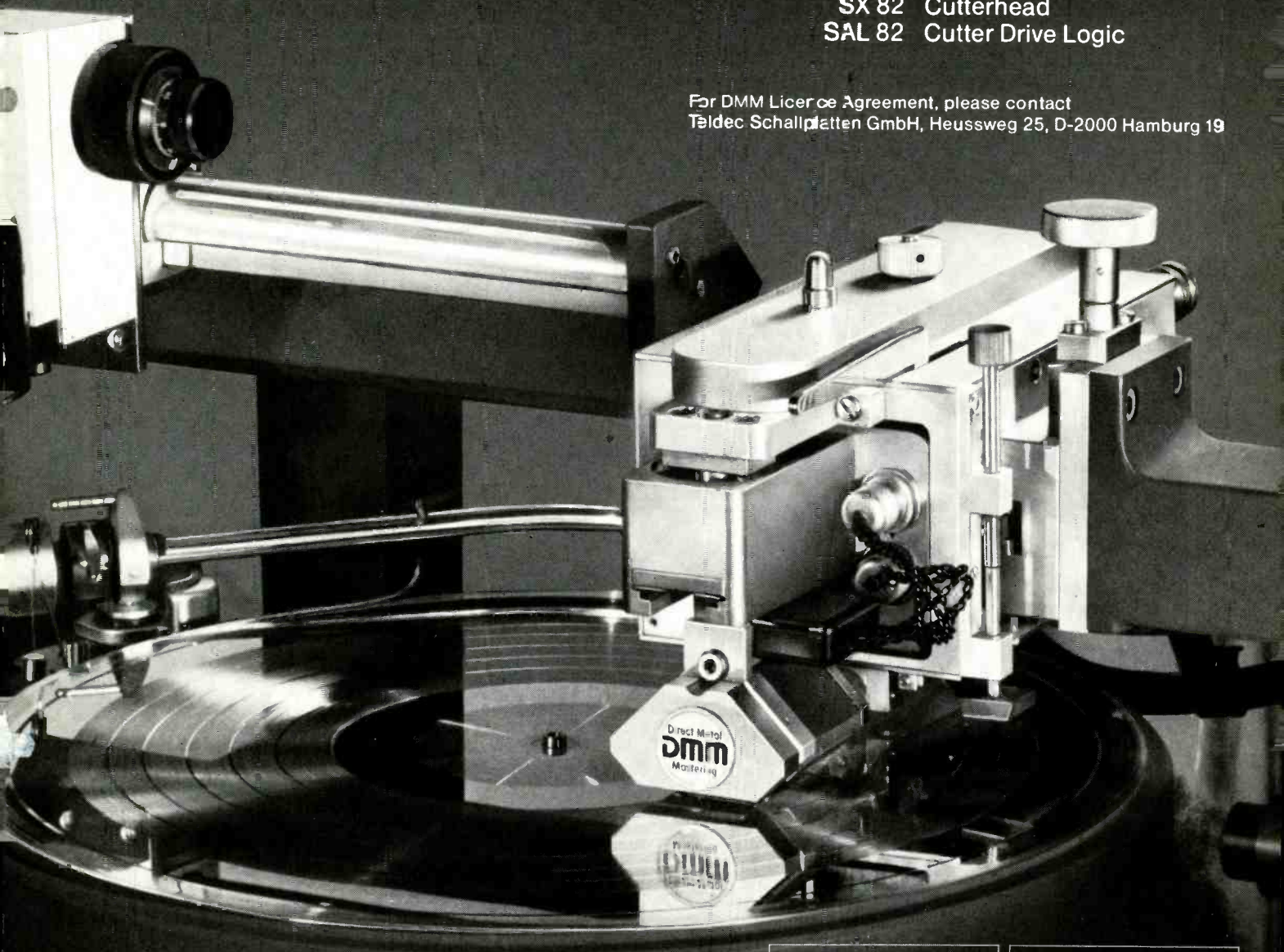

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A comprehensive range of products built to the highest specifications, including:- amplifiers covering all power ratings, versatile mixers for all applications, multitrack cassette systems and effects including the new low cost digital reverb systems.

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The TAC/AMEK range of consoles, continually prove that British design, and workmanship is a major force in the recording industry. Our most recent installations have included 2 automated 2500 consoles.

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Europe's best selling audio cable is now available for all applications in the audio industry. Klotz is noted for its flexibility in use and superior technical spec's.

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For full details of the Quad range of products and the name and address of your nearest dealer contact;
Quad Electroacoustics Ltd.,
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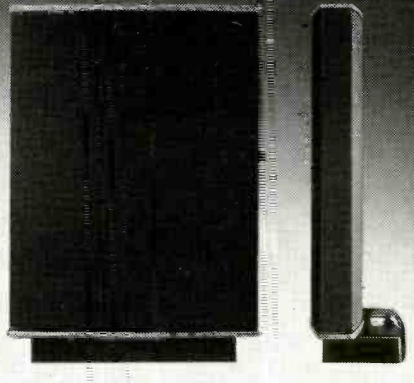
Telephone: (0480) 52561.



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*Above 150Hz and up to 96dB.

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We turn heads..

. . . and the new Series 70 from Trident Audio Developments is certainly stopping everyone in their tracks. It's versatile, it's compact, and the price is very right. Painstakingly and ingeniously designed with the 16/24 studio producer/engineer in mind, this mixing console will be attracting a lot of attention. With it's superb Series 80 styling the Series 70 is configured as a 28-16-24 frame with an additional 4 way echo return. An 8 way monitor module gives you full 24 track monitoring facilities.

The many excellent features include:

- 16 GROUP OUTPUTS AND SEPARATE STEREO MASTER OUTPUTS
- LONG THROW FADERS ON BOTH INPUTS AND OUTPUTS
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- 16 MONITORS ROUTABLE TO REMIX GIVING MAXIMUM 48 LINE INPUTS DURING MIXDOWN

Quality and value from Trident you are used to, but we are always searching for more. Here it is! Call us for more information.

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Trident Audio Developments
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Tel: Chertsey (09328) 60241.
Telex: 88139282 (TRIMIX G)

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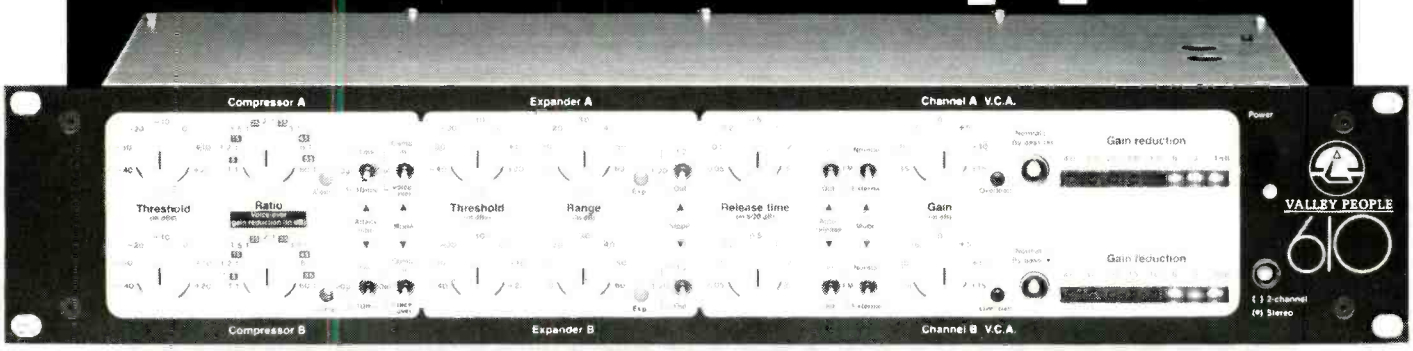
Don Larking Audio Sales
29 Guildford Street, Luton, Beds.
Tel: Luton 450066

Trident (U.S.A.) Inc.
652 Glenbrook Road, Stamford
Connecticut U.S.A.
Tel: 203-357 8337

It knows when to keep quiet.



The new all-in-one Model 610 compression/expansion unit from Valley People gives you the ultimate in control. Both compression and expansion are continuously adjustable, and important new features increase flexibility and high performance.

- ☐ Transition between compression and expansion is imperceptible.
- ☐ Visual warning indicates when signal levels approach clipping.
- ☐ Easy interconnection for stereo processing.
- ☐ Two channel operation.
- ☐ In the interactive expanded compression mode, you can compress the audio signal to reduce dynamic range whilst using the expander to reduce any residual noise 'pumped up' by compression.

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The Tapematic 2000 has made an impressive launch. It has more features than any winder in the world and production experience confirms its performance is tops, too.

The unique two-reel system cuts reel changes to less than 3 seconds; a production bonus of hundreds of cassettes a week.

Functions are computer controlled and production data is available from memory at the touch of a button.

The winder is designed for the user, too, and components are easily accessible for maintenance, even while in use. LED indicators and valve identity help servicing.

And all at a price under **£9,500**.

Information with pleasure from:

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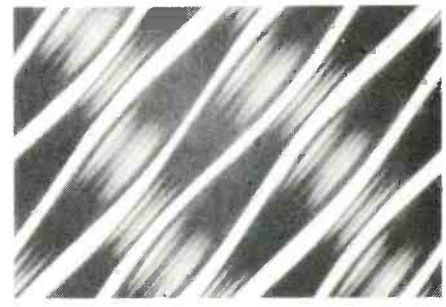
TAPEMATIC srl
Via Vimercate 32, 20060 Ornago Milano, Italy.
Tel: 039-624009 Telx: 340233

CAN YOUR LATHE DO THIS?



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Introducing Yamaha's new Home Recording System. The heart of the system is the MT44 4-channel cassette deck. Now not everybody has a 4-track system, so you need compatibility with stereo hi-fi cassette machines. It's a great idea, but there can be problems:

Problem: The majority of 4-track cassette machines run at 3¾ ips whilst most domestic machines run at 1⅞ ips.

Solved: The MT44 runs at 1⅞ ips and through its Auto-Sensor System can also be used as a hi-fi quality 2-track stereo deck.

Problem: Dolby C noise reduction is superior to Dolby B, but is not commonly found on decks of this type.

Solved: The MT44 is equipped with both systems for multi-use compatability.

Each According To His Needs. An excellent cassette deck in its own right; the MT44 is ideal for use with our MM30 mixer, the RB30 combined rack and patch bay* and the Yamaha MS10 20 watt self-powered monitor speakers. However, you aren't forced into paying for superfluous features as in 'all-in-one' machines. You buy just what you need.

Because at Yamaha, when we shoot for a product, we like to think **our aim is sound**.

*Patch bay (PB44) available separately.

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Please send me further details of the Yamaha Home Recording System

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Address: _____

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Dolby Noise Reduction is in use everyday, everywhere.

Wherever you or your tapes go–for recording, mixdown or disc cutting–it is almost certain Dolby noise reduction will be there to do its job–ensuring reduced hiss, crosstalk and print-through in your recordings.

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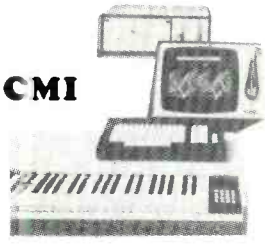
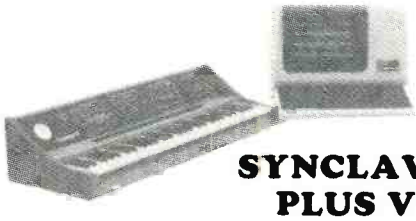
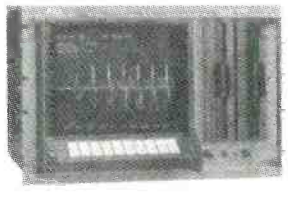


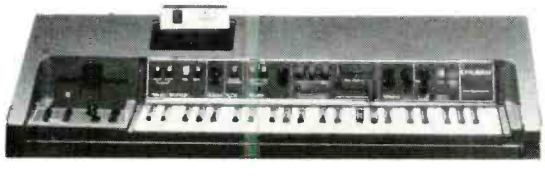


SYNCLAVIER II
PLUS VT100

WAVE 2.2

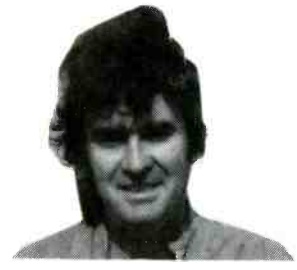
WAVE TERM





EMULATOR

OUR DIGITAL PEOPLE



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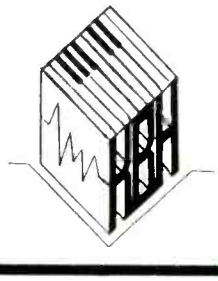

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THE Hi-Tech Hire Co.

Get your hands on the beautiful Fostex X15

The Fostex X-15 Tracker represents the ultimate in portable recording.

At last we have true 4 track recording on cassette, with multitracking further facilitated through track bouncing.

The X-15 features EQ; monitor section (level & pan); as well as remix facilities.

This machine is truly portable not only in its size, but also the fact that it comes supplied with its own battery pack enabling you to just sling it over your shoulder and take off. Use it anywhere!

And if you do want to plug it in at home, you can get the separate mains power supply unit.

All this for a mere £299 inc. What more could anyone want?

Fostex A8

The A8 ¼" 8 track machine is just one item in the extensive range of home recording equipment currently coming out of the Fostex camp.

Make up your own 8 track packages from the full range of machines, mixers and audio processors in stock in our 8 track demonstration studio.

Revox B77

One of the many Revox and Studer machines which we supply. The Revox B77 is a fully professional stereo machine, complete with built-in Varispeed, and you would be hard put to set foot in any professional recording studio without immediately sighting one of these.

A very high quality versatile machine and well worth a look.

Soundtracs 16/8/16 Mixer

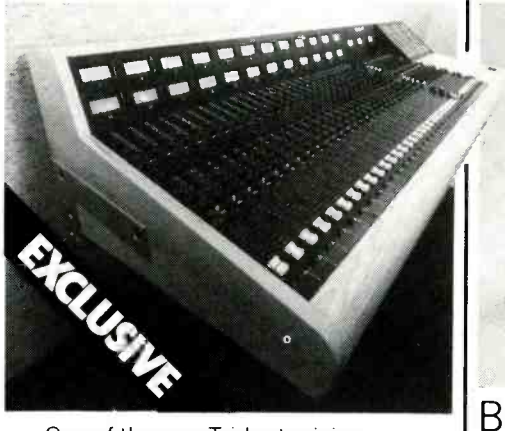
EXCLUSIVE

Brand new from Soundtracs, and continuing a policy of extremely good quality partnered with very accessible pricing.

With this mixer, low budget professional multitrack home recording has really arrived.

It looks the part and certainly carries it out. Features include 3 band EQ, 100mm Long Throw Faders, 3 auxiliary sends, LED metering, plus capability to use the monitor channels as further inputs on mixing. Come and try it for yourself. You'll love it.

Trident Series 70



One of the new Trident mixing consoles which are exclusive to DLAS. This mixer is the ideal instrument for the producer/engineer having been designed specifically with this beast in mind. It comes in many different configurations – full frame size being 28/16/24 with full patchbay.

Bel BD60 DDL

NEW

Another exciting new effects unit from Bel, and the first in a line of Bel digital processors. The BD60 offers an amazing 2 seconds delay at full bandwidth and 4 separately timed outputs. Most of all, you won't believe the price.

Soundcraft Multitrack Machines

Bring 24 track within reach

The Soundcraft Multitrack Machines have created a mini revolution all their own. The pricing has enabled studios everywhere to realise their ambitions of professional multitracking.

They are Europe's largest selling machines and come highly recommended.

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The telcom® challenge to Professional Digital Recorders

telcom c4DM challenges professional digital recording systems to offer for the same price:
Half the dynamic range,
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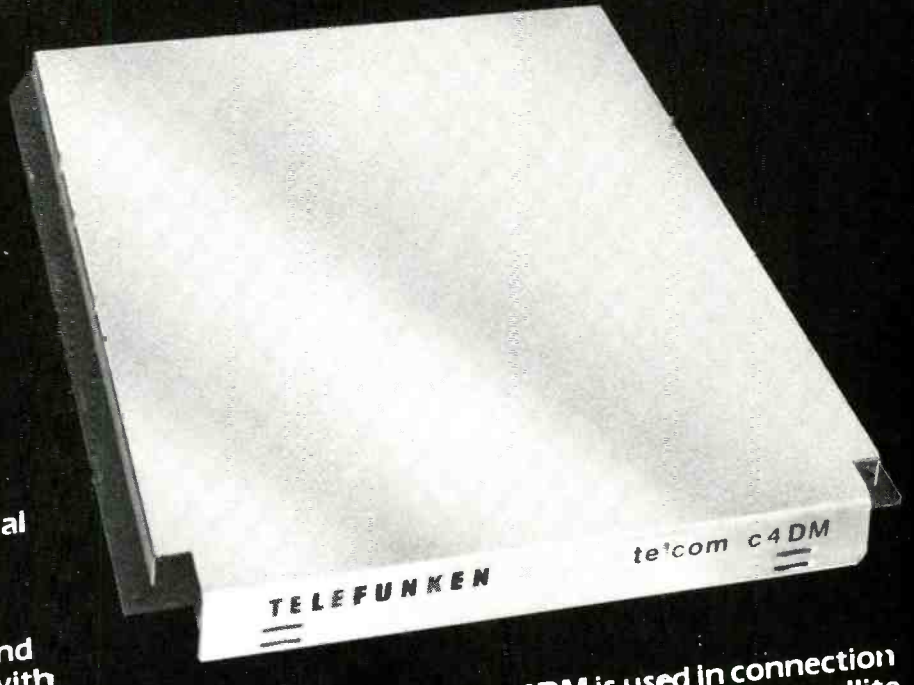
Similar standardisation and interchange ability.
Last but not least the telcom quality of natural sound.
Take an existing analogue recorder (two track or multi-track), add telcom c4DM and listen to the results!
telcom c4DM is the exceptional compander. Only this noise reduction system surpasses digital without the cost of completely new equipment and problems usually associated with implementing new technology.
telcom c4DM creates improved headroom, and high frequency resolution; lower distortion from tape, better crosstalk attenuation plus a 30dB gain in dynamic range.



telcom c4DM is used in connection with ATR's, VTR's and line satellite transmission.
telcom c4DM in its new format will fit your standard noise reduction frame.
Find out more about telcom and how you can make the telcom test.

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"Dear Mom, I'm really making it big in the music business."

Every recording artist and engineer has to start someplace.

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Take the dbx 160 Series of compressor/limiters, for example. They help free your system from overload distortion, so you can turn up the music without turning off the audience.

Our tape noise reduction systems let you bounce tracks without building up tape hiss. Which means you can make a 4-track system sound like 24 tracks.

And our 610 Autographic Equalizer is so completely automatic, it's like having another engineer on your team.

Visit your authorized dbx professional dealer and hear what we have to offer.

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You can start at the top.

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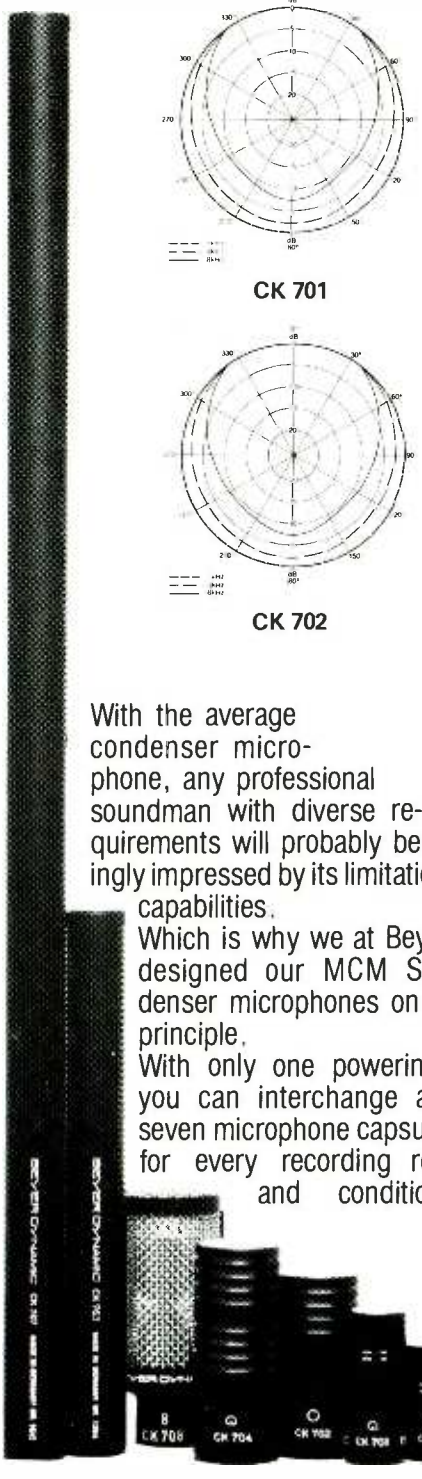
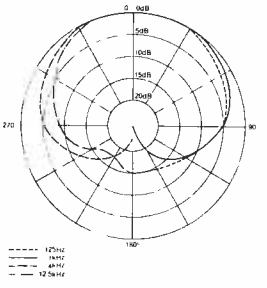
SEVEN HEADS ARE BETTER THAN ONE.

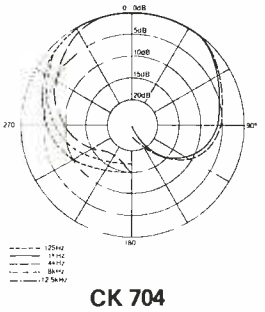


CK 701

CK 702



CK 703



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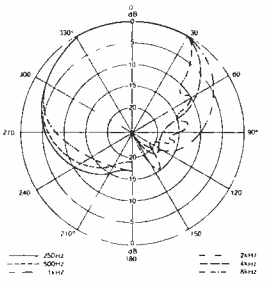
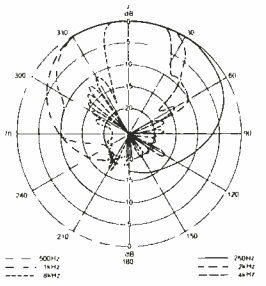


CK 706



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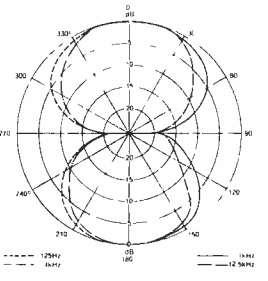


CK 708

With the average condenser microphone, any professional soundman with diverse requirements will probably be more lastingly impressed by its limitations than its capabilities.

Which is why we at BeyerDynamic designed our MCM Series condenser microphones on a modular principle.

With only one powering module, you can interchange any of the seven microphone capsules to cater for every recording requirement and condition. More compact, more convenient and considerably more economic than a conventional system, every item in the MCM Series range is individually available for the maximum ease of adaptability.

But with over fifty years' experience in the refinement of audio technology, our standard of design and manufacture has a considerable reputation to maintain. Engineered around the most advanced components within a slim, functional casing, the MCM Series' crystal clear transient response and overall directional flexibility has established it throughout the country in top studios and broadcasting corporations.

Compare the MCM Series to any other system. Whatever your recording requirements, BeyerDynamic can put you in the right direction.

beyerdynamic

1 Clair Road, Haywards Heath, Sussex RH16 3DP Tel: (0444) 451003

diary

alphaSyntauri demos

Following on from the feature on the *alphaSyntauri* computer synthesiser system in the September issue, author Paul D Lehrman has prepared a demonstration tape of aspects of the system. He tells us, "those who desire a brilliant tape of music performed on the *alphaSyntauri* can send me $5 ($6 outside US) and their name and address."

Paul can be contacted at 31 Maple Avenue, Apt. 1, Cambridge, MA 02139, USA.

Syn-Aud-Con representation

Synergetic Audio Concepts has announced the appointment of nine firms throughout the USA to represent their sound engineering seminars and workshops. These are John G. Humble & Associates in California, Arizona and Nevada; Northshore Marketing in Oregon, Washington, Alaska, West Montana and West Idaho; Peregrine Southwest in Texas, Oklahoma, Arkansas and Louisiana; Marcus Johnson Associates in South Illinois, Missouri, Kansas, Nebraska and Iowa; Seccom Systems in Georgia, Alabama, Tennessee, North and South Carolina and Mississippi; Bencsik Associates in Florida and the Caribbean; Associated Sales Representatives inc in Maryland, Delaware, Virginia, East Pennsylvania, South New Jersey and Washington, DC; Metrotech in North New Jersey; Manhattan, Long Island and Westchester County, New York Steffey Marketing in North and Central Illinois and Wisconsin.

Synergetic Audio Concepts, PO Box 669, San Juan Capistrano, CA 92693. Tel: (714) 496-9599.

Red Acoustics expansion

Monitor speaker manufacturer, Red Acoustics have recently acquired IPM, an OEM company. This has given them new production facilities of 17,000 sq ft which in turn will allow greatly increased production. In the UK this will also mean reduced prices on RED products. The manufacturing and OEM division is now located near Grantham while the professional audio division remains at Chelsea Wharf.

Red Acoustics Ltd, Chelsea Wharf, 15 Lots Road, London SW10 0QH, UK. Tel: 01-351 1394.

If you were trying to sell something like this, would you try to sell it like this?

A recent arrival in our office was a very pretty little American brochure, advertising a product we know personally to be truly excellent. Nicely presented, the brochure features colour pictures of a number of applications of the device, plus specifications and all the sort of things you might expect. But under each picture is a blurb, describing 'situations' which go with the pictures. Here's one:

(Scene: BOY and GIRL are sitting on a rug in the park; picnic food and a Frisbee surround them. GIRL is strumming a guitar and looking in one of those uncertain directions often featured in 'Spot the Ball' contests, ie three feet over BOY's head. BOY is holding a microphone towards GIRL in such a position as to pick up clearly the sound of 747s passing overhead, and maybe a bit of wind and fret noise. FX: Jumbo Jet landing at nearby international airport, crossfade into sound of guitar played, badly, with full orchestra in BG)

VOICEOVER: *(Male, deep, educated New England accent)*

'Relive that afternoon in the park when the guitar was slightly out of tune, but neither of you cared. When you both forgot the words and laughed until you couldn't anymore *(slight smile in V/O; FX: distant laughter of BOY and GIRL. Guitar playing stops and then starts again)*. When the sounds of peaceful reverie all around made you lose track of time. Synchronised in your own space, together. *(Pause)* These best memories are never to be forgotten because your X-15 is there *(cut to CU of PRODUCT, the FOSTEX X-15 MULTITRACKER, for it is he)* recording all the special moments, every special sharing. And the tape you make today can be enjoyed on all the tomorrows to come. Wherever you may be then, you'll be together again *(cut to MCU of BOY, listening at home to X-15 on headphones. He smiles. Cut back to park scene)*. In your own time, your own space, created once, forever.' *(Crossfade to sunset in the park. Fade up music BG to climax. Superimpose CU of FOSTEX X-15 over sunset. Caption: FOSTEX X-15 MULTITRACKER: $495.)*

SECOND VOICEOVER: 'At only $495, the Fostex X-15 Multitracker can capture your memories. Batteries not included, offer void where prohibited, at a theater or drive-in near you.' *(Fade to black)* . . .

There's some more, too, like 'Monday morning, 3am. Can't sleep because it's pouring out there. A few more hours and you'll have to get ready to go. But for now, you have your X-15, your synthesizer, and your instinct . . .'

You get the picture? Now, of course, they aren't aiming this brochure at us. But if you want to see one for yourself, I'm sure that Fostex dealers all over the USA will have one. If not, the Fostex Corporation of America is at 15431 Blackburn Avenue, Norwalk, CA 90650. Tel: (213) 921-1112.

Ms Golden Ears

A loudspeaker manufacturer was having a social dinner with a well known hi-fi reviewer and his wife. The inevitable professional v hi-fi loudspeakers conversation came up, followed by the topical subject of loudspeaker reviews.

"Actually," he said (having established that all recording engineers are cloth-eared) "when it comes to listening tests, my wife does most of the work. Her ears are *so* sensitive. She can detect Nth orders of harmonic distortion better than any test equipment. She can also detect wow and flutter unheard by normal ears, etc, etc, etc".

He then spent the next hour describing how credible his reviews were owing to his wife's super sensitive hearing.

After a pause, as if to confirm this unique ability, his wife looked scornfully at the hotel ceiling. "I wish they would turn off that Muzak: it's incredibly distorted, and the wow must be at least x percent."

The dinner came to an abrupt end when the loudspeaker manufacturer informed the reviewer and his wife that "that Muzak" was in fact an £8,000 Steinway Grand being played in the corner of the restaurant.

Foyer fiery

It was one of those problems that arise with the use of unfamiliar equipment, made worse by being in one of those wretched, isolated theatre sound control rooms.

The play was going well. All cues on time and the balance good. Act I over, refreshments and soft music in foyer. Act II builds tension: first FX cue GO—*loud* thunderclap. OK on control room monitors but stony silence from stage area. Frantic enquiry from stage manager in hall—must have gone somewhere! Quick glance at switch settings finds cause. "Sorry—'fraid I sent that to the foyer . . ." At that moment the house engineer enters with a grin: "You've got two frightened women and 36 broken tea cups out there . . ." Oops.

If you have any humorous stories scribble them on a sheet of paper and send them to us at the address in the front of the magazine. Contributors of published items receive £10.

Address changes

● Tannoy Ltd have moved to larger premises and this will enable their worldwide sales and marketing operation to be centralised in London. Their address is now Tannoy Ltd, Beadman Street, West Norwood, London SE27 0PW. Tel: 01-670 1131. Telex: 291065.

● Altec Lansing have recently consolidated all their manufacturing activities in Oklahoma City and extensively reorganised their Anaheim operation. Their corporate address for administration, engineering, sales, marketing and communications will be 1250 Red Gum Street, Anaheim, CA 92806. The mailing address will be Altec Lansing, PO Box 3113, Anaheim, CA 92803. The new phone number is (714) 632-7717. Telex: 685536 and 655415. Customer service and repair has been transferred to Oklahoma City and all equipment must be sent to Altec Lansing, 10500 West Reno Avenue, Oklahoma City, OK 73126. Tel: (405) 324-5311.

Literature

● West Hyde have a new 100 page brochure detailing their wide range of racks and enclosures for electronic equipment.

West Hyde Developments Ltd, Unit 9, Park Street Industrial Estate, Aylesbury, Buckinghamshire HP20 1ET. Tel: 0296 20441.

● The Sony Corporation of America is issuing a listing of US recording studios equipped to offer digital transcription of analogue master tapes. The list of 17 studios is being published in an effort to increase awareness of the archival preservation value of digital audio technology and is available to a wide range of professional users. A copy can be obtained from PCM-1610 Studios, Sony Professional Audio Products, Sony Drive, Park Ridge, NJ 07656, USA.

Agencies

● Following the consolidation of the JBL acquisition of UREI, all UREI products are now marketed worldwide through JBL. In the UK, however, there will be no change with JBL being distributed through Harman (Audio) UK Ltd and UREI by FWO Bauch Ltd.

Contracts

● CTS Studios, Wembley, London have taken delivery of a Sony *PCM 3324* digital 24-track tape machine together with the *PCM 1610* digital mastering system and *DAE 1100* editing system.

● Cetec Gauss have announced the sale of a *2400* duplicating system and its installation in a new facility belonging to China Records, a leading manufacturer of records and music cassettes in the People's Republic of China. ■

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

Scenic Sounds Equipment Ltd
97-99 Dean Street
London W1V 5RA
Telephone: 01-734 2812/3/4/5
Telex: 27 939 SCENIC G

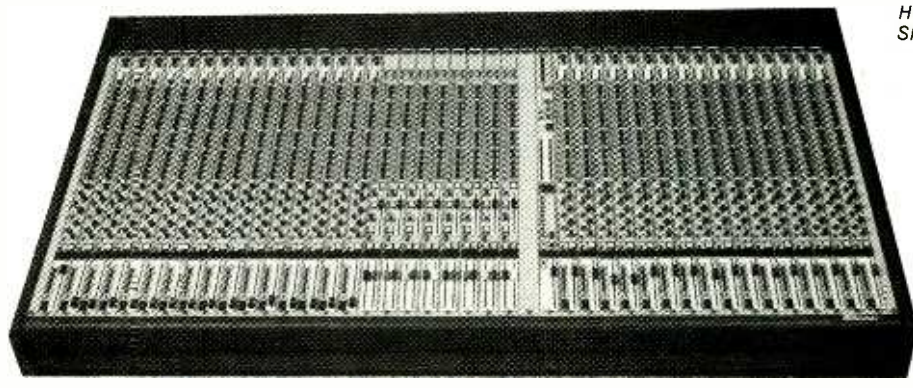
new products

Harrison SM-5 live console

Harrison Systems has just delivered the first of their new *SM-5* stage monitor mixing consoles to Showco for the David Bowie tour. This console is the result of a collaboration between Harrison, Showco and Clair Brothers with the final design being agreed upon in December 1982.

The *SM-5* is currently in full production. Features include 16 main mixing busses, 16 group re-assign busses, 4-band parametric EQ, a group routing matrix and VCA grouping. The main frame is made from welded box steel and has a capacity of 32 inputs.

Harrison Systems Inc, PO Box 22964, Nashville, TN 37202, USA. Tel: (615) 834-1184. Telex: 555133.
UK: FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ. Tel: 01-953 0091. Telex: 27502.



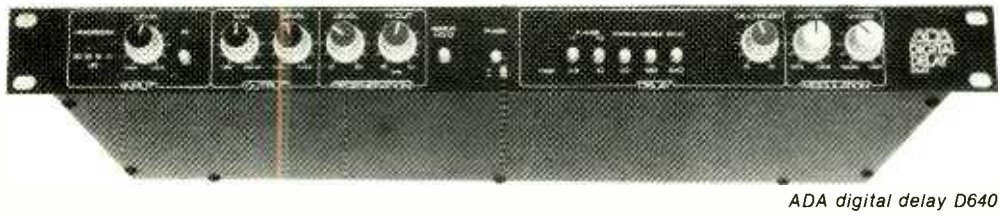
Harrison SM-5

Master-Room DC-2

MicMix Audio Products have just released preliminary information about a rack mount unit known as the *Master-Room DC-2* which they describe as being the only unit of its type available. The *DC-2* allows the user to control the decay time of virtually any reverb device such as a live chamber, plate or spring reverb system. Channel controls are very basic with just a simple decay time control and a bypass switch. Another feature of the *DC-2* is that it will provide up to 30 dB of noise reduction on the used reverb device.

MicMix Audio Products Inc, 2995 Ladybird Lane, Dallas, TX 75220. Tel: (214) 352-3811.

Master-Room DC-2



ADA digital delay D640

ADA D640 digital delay

ADA have announced a new digital delay line for both live and recording applications. The *D640* has a range of delay time from 0.25 ms to 640 ms all with a full 15 kHz bandwidth. Other features include the provision of modulation with depth (10:1 delay sweep range) and speed controls (variable rate of 25 s to 0.1 s). ADA claim a flanging sweep of 3½ octaves for the full depth range, Regeneration facilities include level and a high cut control to reduce the amount of HF content in the regeneration. The repeat hold function allows the infinite repetition of a musical segment up to 640 ms long.

The *D640* requires one unit of standard 19 in rack mount space and has optional facilities that include the FS-2 dual foot switch for repeat hold and effect bypass remote switching.

ADA Signal Processors, 2316 Fourth Street, Berkeley, CA 94710, USA. Tel: (415) 548-1311.

Furman Sound LC-3

Furman Sound has just added the low-cost *LC-3* limiter/compressor to its product line. The *LC-3* is a single unit 19 in rack mount, single channel design offering continuously adjustable attack, release and compression ratio controls. Both input and output levels are also adjustable and the gain reduction is displayed on an LED meter. The input control also adjusts the gain of the input stage and so maximises the signal-to-noise ratio. Care has also been taken to tailor bias currents through the VCA and Furman say that this has resulted in low noise and low distortion with all amounts of gain reduction. The *LC-3* also features side chain and de-ess modes of operation selectable from the front panel.

Furman Sound Inc, 30 Rich Street, Greenbrae, CA 94904, USA. Tel: (415) 927-1225.

Furman Sound LC-3

White Instruments Model 4520

The *Model 4520* ⅓-octave passive equaliser is the latest addition to White Instruments' range of equalisers and the fifth in their series of passive equalisers. The new equaliser features 27 single-tuned, LC filters on ISO ⅓-octave frequency centres from 40 Hz to 16 kHz. These filters are individually tuned to a tolerance of ±3% of centre frequency and continuously adjustable to a maximum insertion of 10 dB on rotary conductive plastic pots. The equaliser features two outputs and an accessory octal socket into which optional, low level crossover networks may be installed for biamp operation. White have a full line of suitable audio filters and crossover networks optimised for constant directivity horns. The EQ in/out switch is located on the front panel to bypass the filters but not the crossover network.

The unit weighs only 6 lb and requires 2U of 19 in rack space. The finish is brushed black aluminium with white lettering. A matching security cover is provided.

White Instrument, Inc, PO Box 698, Austin, TX 78767. Tel: (512) 892-0752. Telex: 776409.
UK: Scenic Sounds Equipment, 97-99 Dean Street, London W1V 5RA. Tel: 01-734 2812. Telex: 27939.

Orban 536A

Orban have announced the availability of a new 2-channel de-esser, the *Model 536A*. This features the same circuitry as the well-known single channel *526A* but the advantages of a single cabinet for two channels and the removal of the *526A*'s mic level input have enabled significant cost savings. De-essing is adjustable independently on the two channels and active balanced inputs and outputs are standard with transformer output balancing optional.

Orban Associates Inc, 645 Bryant Street, San Francisco, CA 94107. Tel: (415) 957-1067. Telex: 171480.
UK: Scenic Sounds Equipment, 97-99 Dean Street, London W1V 5RA. Tel: 01-734 2812. Telex: 27939.

An amazingly versatile, fully programmable Digital Drum Computer...

The MXR Drum Computer. With a full complement of features and functions, it rivals the performance of a high-cost system—at an affordable price. And it's simple to use.

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☐ **Please send me information on the MXR Drum Computer.**

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SS-11

business

BARRY FOX

Free radio

In Britain a gaggle of pirate FM stations jostle for the free spaces in the VHF band. They crash into each other's programmes, especially on a Sunday when the engineers entrusted with tracking down pirate stations prefer to stay at home with their roast beef and Yorkshire pudding. Meanwhile the Government pretends there are no free spaces on the VHF band and refuses to licence legitimate use.

In France, the left wing government, under President Mitterand, solved their problem of pirate radio by the simple expedient of creating the concept of 'free radio'. There are now around 2,000 of these stations in France and astonishingly the potentially chaotic situation seems to be working.

Before Mitterand came to power he used a pirate radio station—Radio Riposte—to help spread his own political gospel. So he could hardly turn a deaf ear to the pleas for liberalisation of the law when he reached the position to change it. In typically French fashion, the rules of the game are confused. Two years ago anyone with a desire to start a free radio station found a free place in the spectrum and started to transmit. The Government engineers then allocated them a frequency, either the same or different depending on airwave crowding in the area. With the allotted frequency comes a temporary licence to transmit.

No commercials are allowed but a little sponsorship is permitted. For instance, a French record shop may supply discs to a local free radio station, in return for a few on-air plugs. Where the station does social work the government will pay salaries for a couple of people to run it full time. Everyone else works as a volunteer. Nice's Radio-Nemo, for example, gets a grant for two salaries because it broadcasts local news and information, and lets the families of prisoners in the local jail talk to them over the air. Another Nice radio station, Radio Baie des Anges, is unashamedly supportive of the city mayor and in turn receives city support. The ban on commercial radio is in tune with the political climate. All the French national radio and TV stations are state-controlled, commercial-free and very bland. But with delightful hypocrisy the French Government is happy to see transmitters in Luxembourg and Monte Carlo provide commercial TV with limited cover, and commercial radio across much of France.

The free radio stations live in the hope of one day getting permanent recognition—and the millions of francs they were originally promised. But the French Government is running out of money, so the days of milk and honey for free radio recede further into the distance. Only stations with political backing can afford to equip themselves properly, such as Radio Baie des Anges which has an impressive OB truck and now often broadcasts music from *Compact Disc*. In contrast Radio-Nemo transmits from the kitchen of an artists cooperative, and makes do with a home-made mixer, an ADC turntable and a Sony cassette deck, with Marantz portables used for interviews. But it gets very wide coverage of the Côte d'Azur area thanks to some clever bargaining with a local priest. His church is up a mountain and the radio station has built a 500 W transmitter on its spire. There's no hope of paying for a land line link from the kitchen studio, so they beam the signal up to the mountain church with a 1 W transmitter on an unused frequency at the top end of the VHF band. In return the priest gets some free religious broadcasting.

CD control

Compact Discs are in very short supply in the US, and already there's a booming trade in unauthorised imports. An American walked into the HMV record shop in Oxford Street recently, and paid cash for 200 *Compact Discs*, often six of the same title. Things might improve now that the Denon pressing plant is coming on stream in Japan. Denon's quality control is daunting. One *U-Matic* master tape sent over from Britain was rejected because the Denon engineers heard three faint clicks. They turned out not to be digital glitches, but the sound of musicians turning over the pages of their music.

This kind of story lends credence to the apocryphal tale about Von Karajan. He insisted that his musicians wear bathing costumes to record digitally, because the system reproduced the sound of rustling clothes with irritating fidelity!

No problem

Some interesting background information has emerged on the Zuccarelli binaural disc cut, and the cassette version now released. Neither, by the way, has sold well. But there never was much of a market for sound effect records was there?

The Sony *F1* tape wasn't, as the CBS press people led journalists to believe, cut on to disc by CBS. Nor did CBS master the cassette tape. Both jobs were done by Tape One, doubtless because the cutting room had known Zuccarelli's partner, Mike King, for years. And it took less stabs than the CBS press people told us. The *F1* tape was transferred to a Sony *1610* and then cut with a Neumann *VMS 80*. Contrary to what you might think, Tape One only used a compressor twice, for a few seconds, where the tape went so crazy that no cartridge could have tracked a straight cut. But what Tape One did do, was pot the tracks, ie cut different tracks at different levels.

"The classic example of potting," reminds Bill Foster of Tape One, "is the old MacArthur Park single. Check it on VUs and you'll see that the level is the same at the beginning as it is at the end."

Tape One used a clever trick to make the cassette master. Again there was no compression, because the object of the exercise was not to do anything that might upset the binaural effect. Instead, they ran it on a digital editor and every time there was a potential problem, dropped in a repeat of the offending sound at a slightly lower level. Obviously the edited master could have been useful for the disc cut. But the order to master a cassette didn't come until after the disc had been cut. Heaven knows why this should have been, because the obvious way to sell a binaural recording is on cassette so people listening on Walkman 'phones get the desired effect.

So, whatever happens to Mr Zuccarelli and his binaurals, he has unwittingly helped to prove two things. It is possible to transfer 16 bit digital recordings on to disc and cassette tape without compression if someone really puts their mind to it, and the CBS factory at Aylesbury can produce some jolly clean pressings if they try.

Hi-fi on show

It's several years since there was a serious hi-fi show in London. They used to be held regularly at a variety of Heathrow hotels but people got sick of trekking out to the airport by tube and bus, or fighting for inadequate car parking space. This year, sister publications *Hi-fi News and RR* and *Stereo* tried to reawaken the old habit at the Penta Hotel. It seems to have worked, doubtless much thanks to the fact that there is now a tube line all the way out to Heathrow and the organisers had commandeered a parking lot just down the road. A couple of exhibits would have interested studio engineers.

KEF used the show as an opportunity to unveil its new *KM 1* monitors. Prototypes have been used in the BBC Maida Vale studios for a year now, and the Beeb is buying production models. One hi-fi buff visiting the show wanted to pay £9,000 cash on the spot to take the demonstration pair off back to his half-million pound home on a golf course. For anyone who hasn't seen the *KM 1*, it looks like a giant version of the Bose *901*, except that all the *KM 1* drivers fire out to the front.

Incidentally, even after several days spent at the Bose HQ near Boston, several seminars with the good doctor himself and hours reading his literature, I still can't follow the train of his acoustic thoughts. In a concert hall we hear mainly reflected sound. A conventional loudspeaker produces mainly direct sound. So in an ideal loudspeaker eight drivers should fire at the wall to produce lots of reflected sound while only one beams it direct at the listener. Dr Bose sees that as a sequitur. I, and plenty of others, don't. Surely the whole point of Blumlein stereo is that a spaced pair of direct radiating loudspeakers will create an *illusion* that simulates the original sound field, not a *replica* of the original sound field. Cue for article on Bose theory?

The Heathrow show was also a battleground for increasingly bitter digital-versus-analogue disputes. Plenty of exhibitors were hedging their bets, by demonstrating their loudspeakers and amplifiers with a *Compact Disc* player as well as an analogue turntable. High priest of the anti-digital faction is Ivor Tiefenbrun of Linn. Ivor is every journalists dream. He's only too happy to be quoted as saying outrageous things, like digital recording destroys the tune so you can no longer whistle along with the melody. To 'prove' his point, and sell a few records at £5.50 a time, Ivor has produced an LP of Scottish folk group Ossian. One side is recorded analogue, the other digital. They sound different, but neither dramatically worse than the other. If you get hold of one, look closely at the sleeve note.

The analogue side was recorded on an Otari *MTR 10*, running ½ in tape at 30 in/s. (That's 12.5 mm at 76 cms for foreigners.) The digital side was recorded on a Sony *F1* and *PCM* processor. What the sleeve doesn't note is the comparative cost. I checked with Turnkey who sell both systems. An Otari *MTR* costs £5,500 + VAT and a 2,400 ft reel of ½ in tape, running for 16 minutes at 30 in/s, costs £23. A Sony *F1* system fetches just £1,400, and a Beta cassette running for over 3 hours costs around £8. The fact that the two systems produce such a similar sound when transferred to analogue disc must prove something, though maybe it's not what Linn had in mind. But as Turnkey point out, try editing on the Sony *F1!* ■

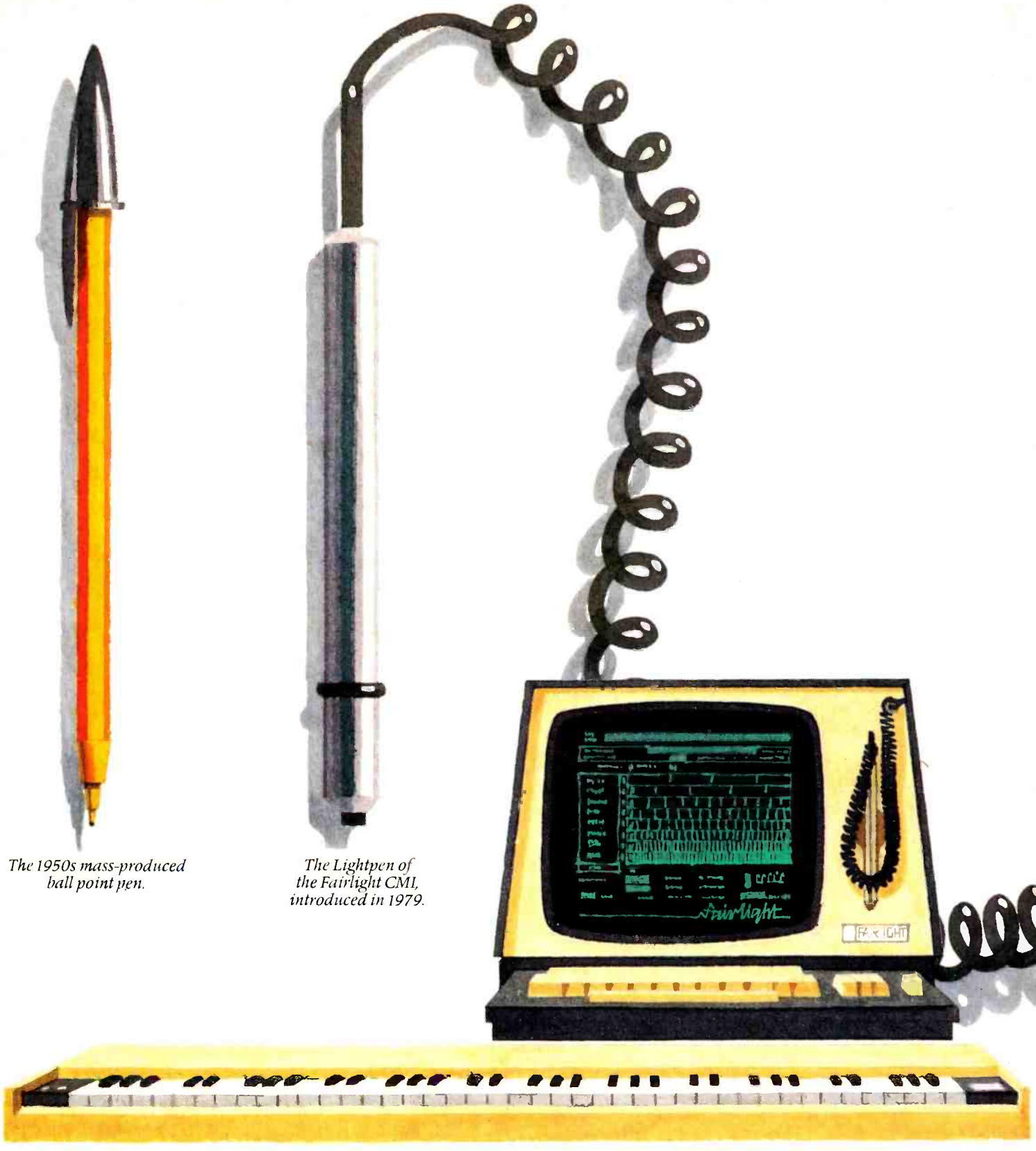
The quill, used until the first quarter of the 19th century.

The mass-produced steel nib from the 1830s until 1930s.

The perfected fountain pen introduced in the 1920s.

The improved fountain pen introduced in the 1940s.

Today, creativity is even more at hand...



The 1950s mass-produced ball point pen.

The Lightpen of the Fairlight CMI, introduced in 1979.

For the composer and songwriter the ink pen was always to hand. Now there is a new pen. A Lightpen. A pen that will put a new world of creative freedom at your fingertips. The Lightpen of the Fairlight CMI.

The Fairlight CMI is much more than a musical instrument. It's a music production system with very advanced software which has been researched and refined to offer the musician virtual limitless sonic and compositional possibilities.

It is a system designed to inspire, and to capture inspiration. A system where an idea can become a reality and finally a piece of music – arranged, orchestrated, recorded.

Amongst its myriad of innovative features this system boasts four methods of sound generation, three compositional programs, the Lightpen, two six octave dynamic keyboards, six real-time controllers, nine audio outputs and 32 analog inputs/outputs.

And with such creative potential it is hardly surprising that more Fairlight CMI's have been installed in the UK than any other digital music system.

We're not saying that a more advanced pen will make you a better musician. We're simply saying that our Lightpen, linked to the Fairlight CMI, will greatly extend your creativity.

SYCO SYS

We are today.

Syco Systems Ltd.
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Advances in cassette duplication

Mike Jones

OVER the years the cassette duplicating industry has come in for some severe criticism regarding the quality and reliability of pre-recorded cassettes. In the opinion of many reviewers and critics—including myself—this criticism has been richly deserved because of the widespread use of cheap cassette tape, poor quality C-0s and inferior masters. Much of which is caused by the ridiculously low amount paid to the duplicator when compared to the final selling price of the cassette in the shops. Indeed, the average consumer feels that he can obtain a better quality recording at home by illegally copying from a disc than he would from the average high-speed duplicated cassette.

Yet recent developments have seen a transformation in quality to such an extent that on some recordings the critics and record reviewers prefer the cassette version to the album and the designers of Dolby *HX-Pro* are saying that they can now produce higher quality recordings on ferric tape, duplicated at high speed than the average home recordist can achieve at home, unless his recorder is fitted with *HX-Pro*, of course. Furthermore, they are claiming metal tape performance when chrome is used in conjunction with *HX-Pro*.

These developments are due to the efforts of a few duplicators and manufacturers who were determined to raise the quality of the music cassette so it could compete with the album on an equal footing and one could argue that there are sound commercial reasons for doing this. With the duplicating industry being notoriously seasonal, many of the plants work well below capacity for large periods of the year which in turn reduces the potential profit that would otherwise be available if the plant ran to full capacity for the whole year.

So, to attract more orders during the slack periods the duplicator has to make his product more attractive to his potential customers. One way is to reduce prices and try to maintain margins by skimping on quality either by using cheap, low quality tape, inferior C-0s or a combination of both. Alternatively, the duplicator can offer a higher quality product than his competitors and maintain production and margins in this way. Indeed many of the record companies are demanding the use of high performance tapes, such as chromium dioxide and are quite happy to feature this in their advertising, albeit in conjunction with the tape manufacturer. Furthermore, this demand is reinforced as the consumer and musicians become aware of the enhanced quality that these new cassettes have to offer.

Although chrome tape has gained a lot of publicity over the last year or so, it would be totally wrong to suggest or assume that it is solely responsible for the improvements we have seen in music cassettes to date, for it is only one essential part of the story. Unless care and attention is given to both the equipment and the masters from which the cassettes are duplicated it is impossible to realise the full benefits that chrome tape or Dolby *HX-Pro* have to offer.

So before we start looking at these new developments in detail, let's begin by looking at the duplicating system and the sort of problems that the duplicator is faced with in electroacoustic terms.

Fig 1a

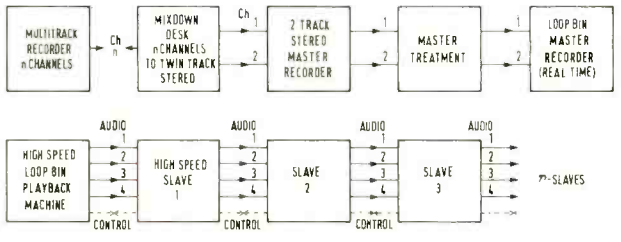


Fig 1b DUPLICATION & TAPE SPEEDS

Duplicating Ratio	Loop Bin	Real time Master Speed	Slaves
32:1	240	7½	64
64:1	240	3¾	120
128:1	240	1⅞	240

Real time cassette speed 1⅞ in/s.
All speeds inches per second

The master

The major stages of the duplicating process are shown in **Fig 1a.** While the mixdown from the multitrack master to the stereo master can be carried out at whatever speed the studio wishes to use, once we come to record the loop bin master we find ourselves being restricted in the choice of recording speed by the design of the duplicating equipment and the speed at which we wish to duplicate the cassettes.

In **Fig 1b** we can see the various duplicating speeds that are available on current Electrosound and Gauss duplicating equipment. The equivalent real time master speeds—of which 7½ in/s is the fastest—results in a reduction in performance when compared to the stereo master which was probably recorded at 15 in/s.

However, this reduction in quality is not a great problem as the performance of the master exceeds the capability of the cassette tape which is being recorded on the slaves at 32 times normal speed. But what happens should we decide to duplicate at 64:1? **Fig 1b** tells us that to achieve this we have to record the master tape at 3¾ in/s which means a further reduction in performance as is clearly shown by **Fig 2.** This indicates the varying degrees of dynamic range we can expect from the master and cassette tape when operated under different conditions using the noise floor as the reference point. Looked at in this way it appears that the 3¾ in/s master and the cassette tape, without Dolby *HX-Pro,* are fairly evenly matched.

Alternatively, we can take a closer look at the amount of compression that will occur at 10 and 15 kHz using the low frequency MOL as a reference point. This is exactly what is shown in **Fig 3**, where you can see that the performance of the 3¾ in/s masters is worse than any of the cassette tapes. Even at 7½ in/s there is little room for error, if any.

In considering the information contained in both **Figs 2** and **3,** it must be remembered that they are based on manufacturers' specifications, confirmed by measurement and include Dolby B noise reduction. They do not, however, allow for any loss of signal caused by head wear, misalignment or variations in tape quality, any of which will cause variations to the performance of either the master or the duplicated cassettes.

The graph clearly shows the additional demands placed on the mastering process by the use of chromium dioxide cassette tape and/or Dolby *HX-Pro* and we can see why so many people in the duplicating industry believe that with current mastering technology you can only obtain the maximum performance from chrome or *HX-Pro* by using carefully prepared masters recorded at 7½ in/s, which means a duplicating ratio of 32:1.

In view of the severe imbalance between the low and high frequency MOLs it is unlikely that anyone would record a master at such a high level. Indeed, I would hope they would choose a lower level of flux so they can balance the performance of the master tape throughout the entire spectrum and reduce print through at the same time. And while none of the duplicators are prepared to talk about their mastering techniques in detail, I am certain that the majority of those I spoke to, take great care in producing their loop bin masters in such a way as to obtain the optimum performance from the cassettes they produce. In fact, as we shall see later, some of them go to extraordinary lengths to maintain the highest standards of quality.

For example, one company, Tape Duplicating of London, categorise all the incoming masters into specific groups depending upon the spectral density of the master. Once the master has been classified in this way it is duplicated on a line which has been specifically set up for that classification of master. Others are equally meticulous, each in their own particular way.

Whatever your views on mastering or your comments on the implications shown in **Figs 2** and **3** I think everyone would agree that the mastering is the weakest stage in the process and is in need of urgent attention. Apart from the severe restrictions in dynamic range at high frequencies one of the biggest problems with 3¾ in/s masters is that they suffer from poor phase response due to the master recorder, which means that the cassettes copied from these masters at 64:1 are likely to have a very poor stereo image. Ideally, of course, what is needed is a radically new approach to the whole question of producing high speed masters. Futuristic ideas could consider digital or optical techniques, but the very wide bandwidth that would be required for high speed mastering would seem to preclude the use of present day digital audio techniques.

But to return to our present problems, there are several major improvements just around the corner.

Studer are developing new heads and electronics for their duplicating mastering machine the *A80/MR* which will be available in the form of a retro-fit kit. This kit will improve the phase response at 3¾ in/s, the replay frequency response and will enable the recorder to be used with the new generation of high performance master tapes.

BASF, who have been in the forefront in improving duplicating technology with their chrome cassette tape, have now extended their research activities in this field to produce a new chromium dioxide mastering tape called *Studio 80* currently undergoing its second set of field trials. The electroacoustic results of the first trial were, according to the duplicators who used it, very promising, although there were some shedding problems on certain high speed loop bins. **Fig 4** shows the difference in performance between BASF *SPR 50LH* and the new product, *Studio 80*.

But perhaps the most exciting area of development is the work being carried out by Dolby Laboratories in San Francisco to apply Dolby *HX-Pro*. This was developed firstly for real time cassette decks such as the B&O *8000* and is being extended to cover high speed duplicators and the duplicator master recorder. They have just released preliminary results shown in **Fig 5** which shows up to 5 dB improvement at 10 kHz, over 10 dB at 15 kHz and 20 dB plus at 18 kHz, all on a tape recorded at 3¾ in/s. I must stress that these are early results and I am indebted to Dolby Laboratories for having allowed us to publish them, but the implications of *HX-Pro* combined with the new improved *A80/MR* and a new generation of master tapes are quite stupendous and I don't think it will be too long before we will be listening to cassettes that have been duplicated at 64:1 with astonishing fidelity.

There is one very important aspect of mastering I have not touched upon yet and that is the quality of the stereo master which of course determines the quality of both the loop bin master and the cassettes themselves. One duplicator I spoke to recently said that he wished record producers would spend as much on producing stereo masters for cassette duplication as they do on cutting the master lacquers used for albums. Record producers should realise that if they send the duplicator a stereo master which is noisy or lacking in dynamic range there is very little the duplicator can do to improve it.

Likewise there is very little point in asking the duplicator to use chrome cassette tape unless there is enough high frequency energy on the stereo master to take full advantage of the increased performance that chrome tape has to offer. There are other factors which should be taken into account, such as the superior modulation noise performance of chrome when compared to many ferric tapes. Record companies and producers please take note.

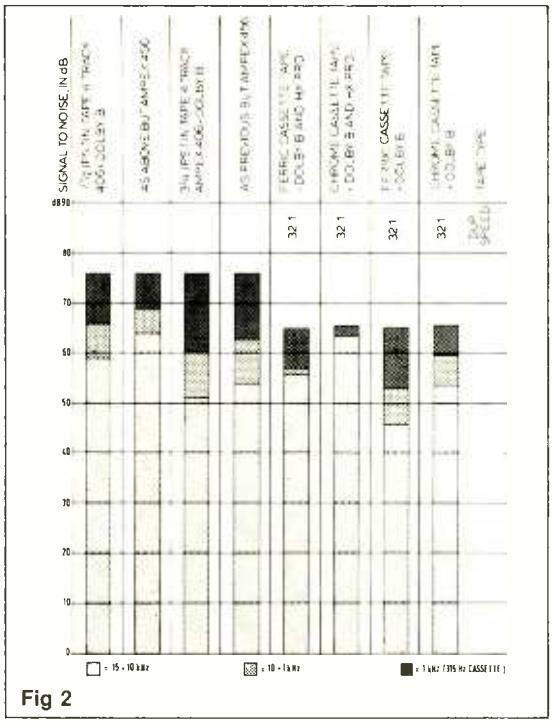


Fig 2

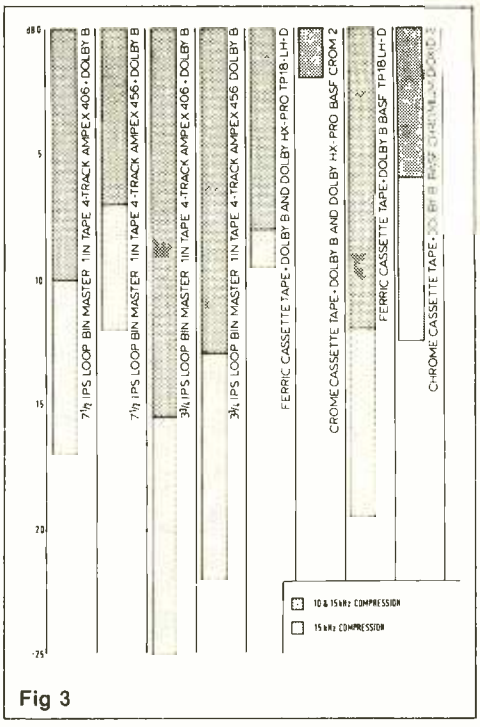


Fig 3

The tape

Now we turn from mastering to discuss the whole area of tape, covering the special tapes that are used for the master and cassette duplication. I say special because the physical demands on both types of tape are far higher than they would encounter at normal speed. In particular, the demands on the master are particularly strenuous as it is expected to make many thousands of passes through the loop bin and across the replay heads.

It is very important to remove the master tape from the loop bin when the bin is not running. This is because of the excessive print through that can occur on high output tapes caused by the layers of oxide coming into contact with each other. So whenever the bin is not being run the tape should be wound onto a reel, even if it is only left stationary over lunch.

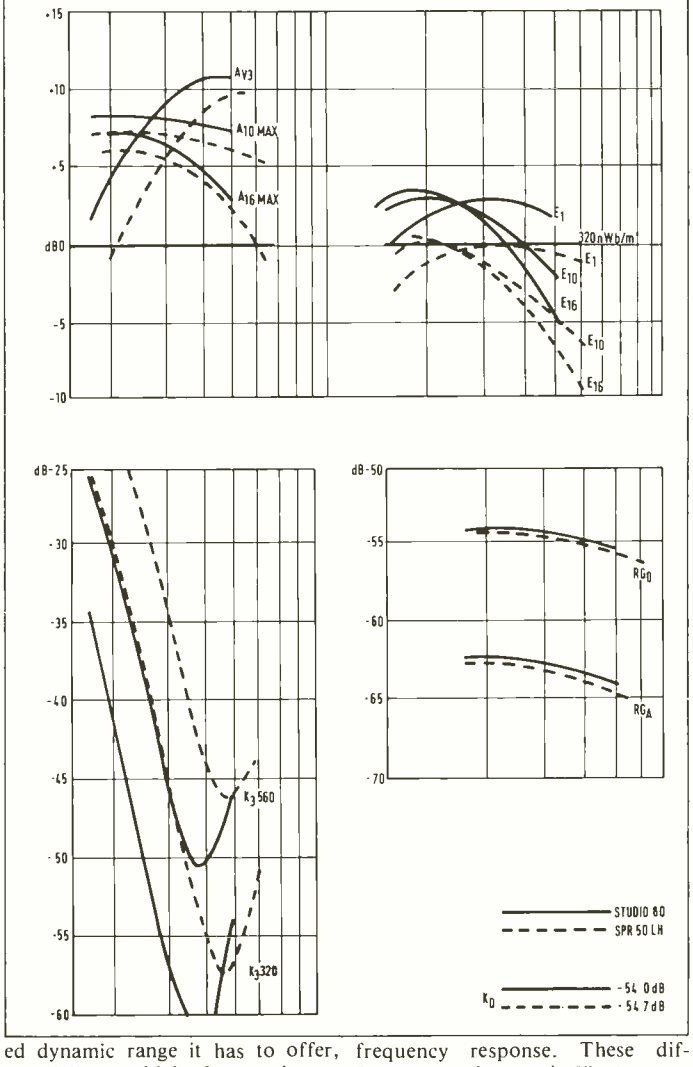
Choosing the correct quality of cassette tape is crucially important in producing reliable and consistent cassettes. The duplicator needs a tape that will not vary from cassette to cassette or from delivery to delivery, ie the short and long term variations are kept to within very close tolerances by the tape manufacturer. The duplicator also needs a tape that is clean and will not deposit oxide and dirt all over the slaves and loaders. The duplicator further needs a tape that will maximise production combined with minimum wastage. What he does *not* need is to be used as a development laboratory while the manufacturer irons out the latest problem he has with his tape.

You have only to carry out a subjective comparison between chrome and ferric cassette tape on any good quality cassette recorder to realise that chrome is superior in several ways. This is because of the improved dynamic range it has to offer, especially at high frequencies, a lowering in bias noise level and a considerable reduction in modulation noise. It is this last improvement that makes the use of chrome worthwhile even when the master cannot make full use of the extended frequency response. These differences can be seen in **Fig 6.**

The current generation of chrome tapes, which were introduced by Agfa Gevaert and BASF in 1982 are a great improvement over the earlier types especially in the areas of low

44 ▶

Fig 4



cassette duplication

frequency MOL and print through. But although both companies in Europe have been producing large quantities of chrome tape, Agfa Gevaert have been using the majority of theirs for video production and now they have the additional capacity of their new factory in Berlin they are presently commencing field trials of a new chrome duplicating tape.

On the other hand, BASF are well experienced in the use of chrome tape with high speed duplicators and have been working very closely with various companies around the world for some years now.

The initial trials that were carried out on chrome tape in the late 70s were not very successful because of the demands made on the duplicating equipment by the original chrome formulations and because at that time the slaves were set up so the tapes could be played back using 70 μs playback equalisation. This means that higher levels of flux were required during the recording stage than is necessary at 120 μs, which meant that the record heads could run into saturation more easily.

But with the introduction of *Chromium Dioxid II* and a return to 120 μs playback EQ meant that for the first time we could make full use of all the benefits that chrome had to offer in a high speed duplicating situation. But having a system that worked and getting it accepted commercially are two different things.

EMI Records were the first major record company in the UK to release cassettes duplicated onto chrome tape. The new cassettes received wide acclaim from such critics who hitherto had been very sceptical of the quality of pre-recorded cassettes. Since then many duplicators and major record companies have switched to chrome tape for their recordings in both the classical and pop fields.

What's obvious is that you cannot throw a reel of chrome tape onto one of your duplicating slaves and expect to resolve the full potential of the tape without having checked the capabilities of the equipment first. It is all to easy for the equipment to restrict the performance of the chrome tape to such an extent that in many respects it will sound no different to ferric. If this is the case then the tests should be conducted again, after checking the equipment and the quality of the master.

In **Fig 7** I have shown two examples of how the master or equipment can restrict the performance of the tape. **Fig 7a** shows the overall dynamic range being restricted by a noisy master or system and **Fig 7b** demonstrates how easy it is for the high frequency output to be restricted either because the master is lacking in HF information or, as is more likely, the record heads on the slave are running into saturation.

The heads

An interesting point here is that many people do not realise the relationship between head wear, loss of HF response and noise. As the slave record heads wear they develop less output at high frequency and this is corrected by increasing the HF gain of the record amplifier which in turn increases the noise floor thus restricting the dynamic range of the tape. Also, as the heads wear they will saturate earlier which becomes worse as the EQ is adjusted. **Fig 8** shows what happens to the saturation and noise floor as the heads wear and the adjustments are made. Although in practice the degradation in performance is spread out over a far greater period of time the principles are the same.

Fig 8 also shows the effect different quality standards have on head life. On chrome tape the HF is not allowed to drop below −2 dB, whereas on ferric −3 dB is allowed before the record heads of the duplicating slave are re-lapped or replaced. Because of the increased tolerance allowed for ferric the heads stay on the slave longer before they are re-lapped. Had the same tolerances been used for both types of tape then the head life would have been identical, for as the diagram shows, the rate of wear (indicated by the angle of the slope) is the same.

The slave record heads will have to be re-lapped and replaced more often if higher quality standards are to be maintained. However, in practice this may not be a problem as once the performance of the heads fall outside the inner tolerance allowed for chrome the slave can be used for ferric. Then once they fall outside the outer tolerance they can be re-lapped. Obviously there are many permutations on this theme and the sensible duplicator will choose the one that best suits his own operation. And incidentally, there are no reasons why tapes duplicated on ferric should not be subject to tighter tolerances.

For a duplicator to establish if his existing equipment will handle chrome tape it is necessary for him to carry out a series of measurements, which should include the loop bin master recorder to establish the limitations of the system which should then be compared to **Figs 2** and **3**.

System alignment

Measurements on the duplicating equipment itself should be carried out at the appropriate frequencies as depicted in **Fig 1c**. When a calibration tape is played back through the loop bin the frequency response should be flat when measured at the bin output. By achieving this it is then a simple matter to inject signals at this point in the chain so the record electronics of the slaves can be adjusted. These adjustments are normally monitored by a special playback head which is fitted to the slave while it is being adjusted, having been carefully set up with a calibration tape. However,

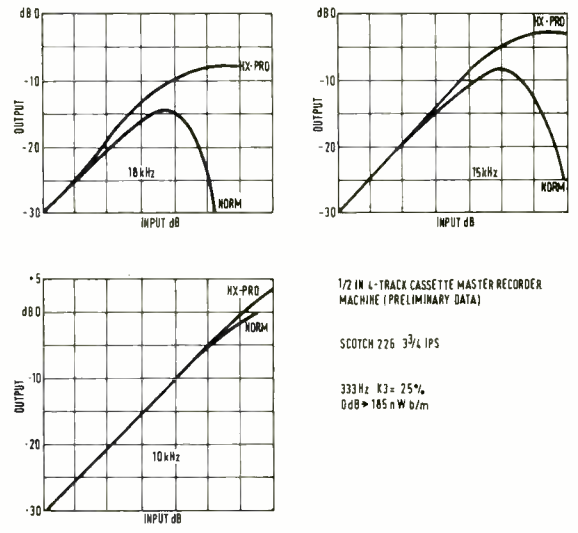


Fig 5

Fig 6

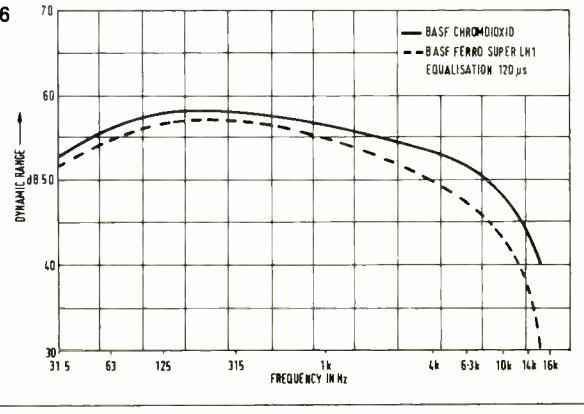


Fig 7

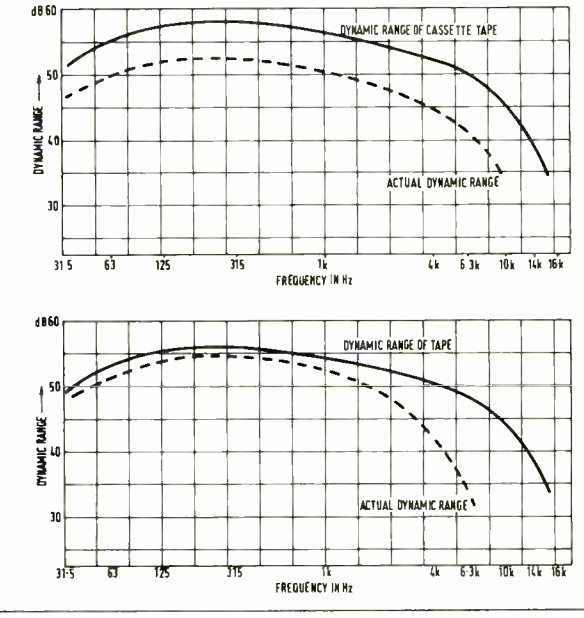


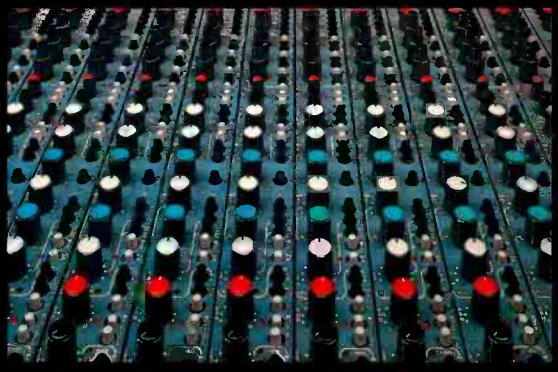
FIG 1c Frequencies used in duplicating

Bias 4 to 10 MHz

Real Time	32:1	64:1
100 Hz	3.2 kHz	6.4 kHz
400 Hz	12.8 kHz	25.6 kHz
1 kHz	32.0 kHz	64.0 kHz
3.15 kHz	100.8 kHz	201.8 kHz
6.3 kHz	201.6 kHz	403.2 kHz
10 kHz	320.0 kHz	640.0 kHz
15 kHz	480.0 kHz	960.0 kHz

46 ▶

ANGELA 28/24 at Sanwa Video, Osaka, Japan



ANGELA 28/24 at Castle Audio, Dallas, Texas

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because these monitor heads are detachable, they may not always provide the same results and any information gained from them should be confirmed by additional measurements carried out on either the open reel QC machine or a cassette recorder having first loaded the tape into a high quality cassette housing with no azimuth errors. **Fig 9** shows a typical setting-up sequence for a 32:1 duplicating system and **Fig 10** gives details of a test tape that is designed to test all aspects of the system.

To achieve these measurements fairly sophisticated test equipment is required.

Even when the equipment has been carefully set up for optimum performance, regular checks have to be carried out to ensure that the quality standards are maintained and there are several ways in doing this. The first would be to make up a test tape as outlined in **Fig 10** and to play this through the bin while recording the test cassettes on the slaves. These can then be loaded, tested on a normal cassette recorder and the results compared to the original master tape. However, this is a long and laborious process and it would be better to use some form of automatic quality control system such as the *4300* series designed and developed by Electrosound.

The *4312* test signal generator can be interfaced to work with any 32:1 or 64:1 duplication system and automatically records a sequence of test signals onto the spare tape that is normally available at the end of every pancake. In addition to the automatic sequence, individual test signals can be selected for maintenance or calibration purposes and once the signals have been recorded onto the end of the tape the pancakes can be transferred to either an Electrosound *4301* or Studer *A80/QC* QC reproducer fitted with the Electrosound *4316* system monitor which measures the signals put onto the tape by the *4312* generator and provides a print-out of the results as shown in **Fig 11**.

The beauty of this type of system is that it does affect the output from the slaves and only marginally extends the QC process. Although Gauss do not have an identical system at present, they have made provisions for one on their new *2400* system. At the end of each pancake the system automatically switches the four audio channels to a common test socket. A pink noise generator or the *4312* can be connected to this input and a *4316* or a third octave analyser to the QC reproducer. This would provide an accurate indication of any variations occurring within the system itself or on the tape. Finally on this point, a third octave analysis of the programme material can be compared with the test section of the tape and the original analysis of the master to check on any deterioration of the loop bin master itself.

As mentioned earlier, some duplicators have gone to great lengths in their quest for quality. At EMI, Hayes, for instance, they have replaced the electronics in the Gauss slaves with those of their own design so they could obtain the maximum performance from chrome tape and as a result have produced some of the best pre-recorded cassettes I have ever had the pleasure of listening to.

The engineers at CBS, Aylesbury, UK have designed and intalled a special distribution system which not only allows them to have maximum flexibility between the masters and slaves but also reduces the signal losses that are often associated with larger systems. To reduce losses that occur in the long cable runs connecting the masters to the slaves CBS have used *UR67* which has half the attenuation of *UR43* which is normally used for signal distribution. They also use buffer amplifiers between the master and every five slaves or so to reduce the loading on the replay electronics of the master and finally each slave can be individually routed to any one of several loop bins to allow for maximum flexibility in production combined with minimum downtime. A similar layout is shown in **Fig 12.**

Fig 8

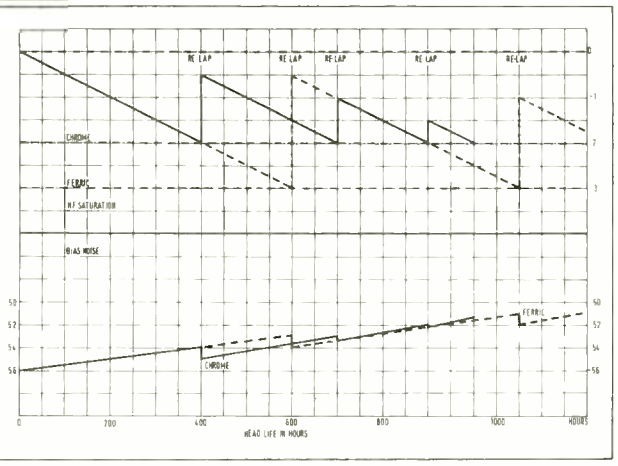


Fig 9

Recommended setting up procedures for a duplication system.

1. Check accuracy of all test instruments and meters being used.
2. Clean and check mechanics, tape path and tape tensions of master recorder, open reel QC reproducers and cassette recorders.
3. Using appropriate calibration tapes align playback electronics, including playback head azimuth of master recorder, open reel QC reproducer and cassette recorder. *It is vitally important that great care is taken at this stage*, for any errors here will be magnified by the duplication system.
4. Adjust record electronics of master recorder using identical tape to that used in the loop bin following recorder manufacturer's instructions. Check overall frequency response—it should be within 1 dB.
5. Measure bias noise, distortion, saturation, print through and wow and flutter of master recorder and master tape, ensuring performance exceeds the capability of the cassette tape.
6. Record a *new* loop bin test tape as detailed in **Fig 10.** Note: the life of calibration tapes is limited and should therefore be replaced at regular intervals. The high speed experienced in the loop bin accelerates the deterioration of the calibration tapes.
7. Check mechanics, tape path alignment and tape tensions on loop bin and all slaves. Pay particular attention to mechanical adjustments required by the service manual and ensure the correct tools and gauges are available. Clean system thoroughly and look out for variations in tension as tape winds. Finally, ensure all guides that should rotate do so freely and all heads have been de-magnetised.
8. Connect voltmeter and scope to output from bin.
9. Load calibration tape into loop bin and adjust replay electronics on all four channels for flat frequency response in accordance with manufacturer's instructions. Also adjust replay head azimuth if necessary.
10. With a spectrum analyser check tuning and purity of bias system, first at master oscillator then on the four channels at each slave, ensuring that any distortion is kept to within the specification for the system.
11. Pre-set bias level to approximate amount for tape being used. (This is normally determined by experience.)
12. Mount monitor head onto first slave to be adjusted making sure the head assembly has been mounted onto the slave properly.
13. Load all slaves with the tape they are being set up for.
14. Following manufacturer's instructions, adjust bias and record EQ of the four channels of each slave. Make sure that by adjusting one slave you do not affect any of the others. This problem if it exists can be cured by the use of buffer amplifiers.
15. When all slaves have been adjusted load test tape made from the details in **Fig 10** and record a few cassettes on each slave, which should then be analysed on the open reel QC reproducer and cassette recorder using test instruments.
16. Correct any discrepancies found in (15).
17. Keep an accurate record of all results.

Fig 10

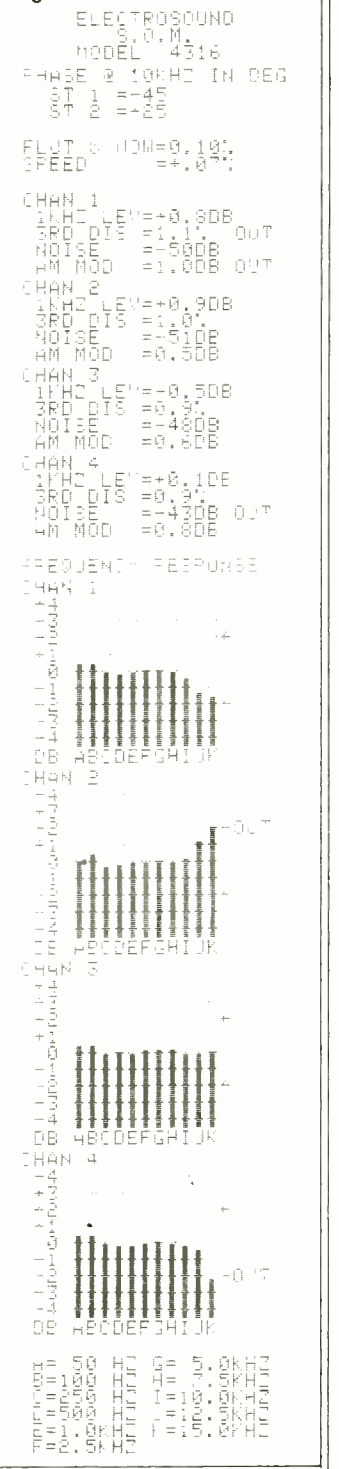
Duplication Test Tape

The tape should contain the following bands of signals:

1. Reference level section; 315 Hz at 250 nWb/m.
2. Azimuth section. (Only required if the slave record heads are adjustable.) Reference tone: 315 Hz at 25 nWb/m; 10 kHz at 25 nWb/m.
3. Frequency response. 20 Hz to 18 kHz at 25 nWb/m.
4. Distortion measurement section. 1 kHz at 250 nWb/m.
5. HF compression section. (Note: 15 kHz is only needed for Chrome tape and Dolby HX-Pro.) a) 10 kHz at 250 nWb/m; b) 15 kHz at 250 nWb/m; c) 10 kHz at −10 dB; d) 15 kHz at −10 dB.
6. Saturation tests section. Use only if there is a suitable level recorder or XY plotter available. Record a 10 kHz tone gradually increasing in level from −30 dB to +10 dB (Re-250 nWb/m). Repeat the process at 15 kHz if using Chrome or Dolby HX-Pro.
7. Wow and flutter. 3.15 kHz at −10 dB.
8. Noise floor, with and without Dolby B noise reduction with voice identification.
9. Phase response. Record both left and right channel in phase. 1 kHz at 250 nWb/m.
10. Left and right channel identification by voice.
11. Band of Pink noise.
12. Classical music test.
13. Popular music test.
14. Voice quality test.

A third octave analyser is required for items 11, 12 and 13. For items 12 and 13 choose high quality masters with wide dynamic range.

Fig 11



While not all installations are as large as the two I have mentioned, even duplicators with just one master and a few slaves can improve quality by keeping signal losses to a minimum, especially at HF by using decent cable and connectors. By doing so less gain is required from the record electronics in the slave at high frequency which improves the signal to noise ratio.

A great deal of work has been done in the area of record and replay heads. Although Studer are about to launch a new head and electronics for the *A80/MR* some of the duplicators have already beaten them to it and have had special heads designed and made for the master recorders to improve the HF and phase response. On the duplication equipment, many of those who are only running at 32:1 are using electronics and heads designed for 64:1 operation which has led to significant improvements at the lower speed.

There are those who try cheaper heads, only to discover at a later stage that the audio quality of their cassettes has been ruined and they are limited in the range of tapes they can use due to lack of bias.

The hardware advances

Technical advances in the hardware field include a new duplicator from Gauss, loaders from Electrosound and Tapematic, a multicolour version of the Apex *C30* direct onto cassette printer and the *4300* series of quality control equipment from Electrosound which I have already discussed along with the improvements being introduced for the Studer *A80/MR* master recorder.

Although there are many new ranges of duplication equipment on the market, the new Gauss *2400* is quite different from the others in the way it has been designed to handle tape. It is the only duplicator I have seen where you can stop a reel of C120 tape from 240 in/s to stop and then start it up again while keeping perfect control of the tape at all times. The secret of this lies in the two independent servos which control the supply and take up reels. They are so finely balanced that you can load a tape onto the slave, switch the slave to 'ready' and then move the tape back and forth just by turning one of the two guide rollers, in a way similar to the action of the Ampex *ATR-100* master recorder.

The two capstans are driven by a crystal controlled servo and the speed of the second capstan can be varied slightly so the tape tension across the heads can be adjusted between 30 to 100 g. Other features of the *2400* include two microprocessors—one for control and the other for diagnostics; built-in tape cleaner cartridge; remote DC level control of the bias system enabling the bias of the whole system to be controlled from the master machine; production data output; metal tape compatability and new low noise electronics to provide enhanced performance. The *2400* is probably the most advanced duplicator currently available and although it is the most expensive, it could be argued that it is the most cost effective. For if it proves to be as reliable as the *1200* series it will give the duplicator many years of service.

The two new loaders are quite revolutionary and yet different in their approach to some of the problems associated with loading tape into the cassette C-0s. The Electrosound *ES1860* uses a 4-station turntable which takes the cassette through the four stages of the machine. Station 1 accepts C-0 and extracts leader. Station 2 cuts leader. Station 3 splices tape to the leader, winds the tape into the cassette and cuts magnetic tape. Station 4 splices leader to tape, winds in remaining leader, tests cassette. The finished cassette is then removed.

Because all four stations are working simultaneously the loader can load a C60 in under six seconds, which is very fast indeed.

The Tapematic *2000,* on the other hand, has the unique ability of being able to change pancakes without the aid of the operator. So when the old pancake runs out the machine automatically starts using the second, having first located the correct start point on the new reel prior to the changeover operation.

Another feature on the machine which costs less than £10,000, is that the cassette supply system will always load the tape into the same preselected side of the cassette no matter how you load the cassettes into the hopper. To avoid damaging the tape, the tape tension is kept very low to around 10 g and other features include production data print out, providing the quantity of each type of cassette produced and number of rejects plus the number of C-0s consumed. The loader can also stamp a product code onto the spine of the cassette and is provided with a horizontal stacker which can feed straight onto a conveyor or automatic labeller.

Both loaders are microprocessor-controlled and have built-in diagnostics to aid servicing. They can be used for loading blank tape or duplicated material with cue tones and although they load the tape at a very high speed, acceleration and de-acceleration ramps ensure gentle tape handling at all times.

While we are on the subject of loading, now is a good opportunity to touch upon the quality of C-0s and although they have improved a lot recently, there are still many which will destroy all the efforts you have put in to improve the quality of duplicating. As Dave Bowman, vice president of Electrosound, said to me:

"Although the plastics used in the industry are better than they were, if

48 ▶

cassette duplication

I take a pancake from one slave that I know has been recorded to a given azimuth and level and I then load the tape into half a dozen shells, I will get half a dozen different azimuths and half a dozen different levels and sound qualities. It's a plastics problem which we can do nothing about until the plastics people get their act together."

There *is* something the duplicator can do about this and that is to be more selective about the C-0s he is prepared to use. By adopting stringent quality control methods it is possible to find the most cost-effective housing of a specific quality level. Incoming quality control procedures such as azimuth tests, visual inspection, torque and life tests, combined with accurate production analysis of rejects and output can provide an extremely accurate assessment of a C-0s performance. (I would be pleased to discuss this with anyone who would like to have further information.)

Of course it is not only the C-0s that can cause damage and problems with the tape in a production situation. Dirty and faulty guides or worn pinch rollers can have a disastrous effect on the edge of the tape, which in turn will lead to unreliable cassettes in the marketplace and unsatisfied customers. Ensuring a perfect tape path on all the production machinery is just as important, if not more so than tuning up the electronics. For while a customer may not notice a slight loss of HF they will soon complain about the one that jams up in their nice new cassette player.

Dolby HX-Pro

Without a doubt the most significant development taking place in the duplicating industry at the moment is the introduction of Dolby *HX-Pro* which will take pre-recorded cassettes up to a new plateau of performance. *HX-Pro* was designed and developed with the help of Dolby Laboratories by J Selmer Jensen of Bang and Olufsen, Denmark. Both Electrosound and Gauss are producing *HX-Pro* options for their respective ranges of duplication equipment under licence from Dolby Laboratories.

HX-Pro works on the principle that when you apply an audio signal to the record head it has a self-biasing effect with high frequencies being more effective than low frequencies. In practice, this means that although we use the term 'fixed bias', once we apply an audio signal to the head—especially one with a lot of high frequency information in it—the bias is anything other than fixed and becomes very dynamic, moving in sympathy with the spectral density of the HF signal. One has only to look at the bias curves for Agfa *PE619* **(Fig 13)** to see what would happen to the various parameters of the tape as the bias swings back and forth.

It is very easy to demonstrate one part of this and to see how a low level high frequency signal can affect the low frequency distortion. In **Fig 14** a 400 Hz signal is being recorded onto the tape with an input level of 220 nWb/m with the bias set to the optimum low frequency MOL. As **Fig 14a** shows, at this level of bias and with this level of signal input the third harmonic distortion measured at 1200 Hz is 25 dB below the signal.

By introducing a third octave band of pink noise centred on 16 kHz whose level is 35 dB lower than the 400 Hz signal we can see that there has been a dramatic improvement in the third harmonic distortion of the 400 Hz signal and that its output has increased slightly. Both these facts suggest that the effective bias has increased, simply because of the introduction of the small high frequency signal.

Dolby *HX-Pro* works by measuring the sum of the audio signal, including any pre-processing and the bias being delivered to the record head via a passive filter. After the filter has modified the signal from the head it is rectified to produce a control voltage which is an accurate representation of the flux across the record head gap. The control voltage is compared to a reference voltage, which can be adjusted for static bias to suit the tape being used. The comparator produces a correction signal which is used to adjust a voltage controlled amplifier which in turn controls the amplitude of the bias signal being supplied to the record head. A constant bias level is thus maintained which is suitable for the signal being recorded.

As the HF content of the incoming signal increases the *HX-Pro* system will reduce the bias accordingly so that the flux level across the record head gap remains constant. In addition to improving distortion at low frequency, *HX-Pro* has the added advantage of increasing the headroom at high frequencies. **Fig 15** shows the dramatic improvement that is made to the high frequency MOL when *HX-Pro* is used on a high speed duplicator running at 32:1 the photograph showing the improvement that can be gained on a music cassette.

Setting up the slaves for *HX-Pro* is fairly simple and all you do is record a 400 Hz signal at a flux level of 250 nWb/m and then increase the bias until the third harmonic distortion reaches 1% or 3% which has been measured on a suitable analyser (38.4 kHz at 32:1 and 76.8 kHz at 64:1). To obtain the best results from *HX-Pro* the tape should be

50 ▶

Fig 12

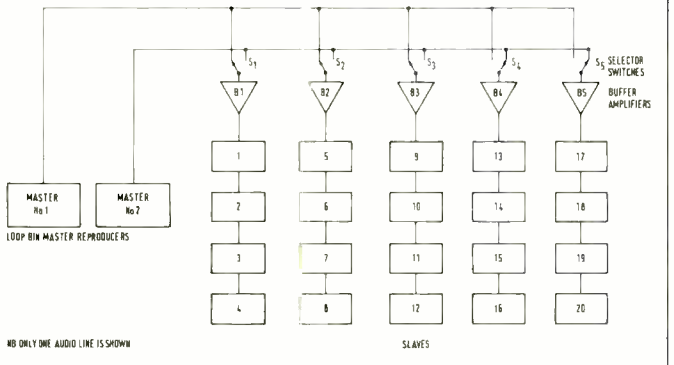


Fig 13

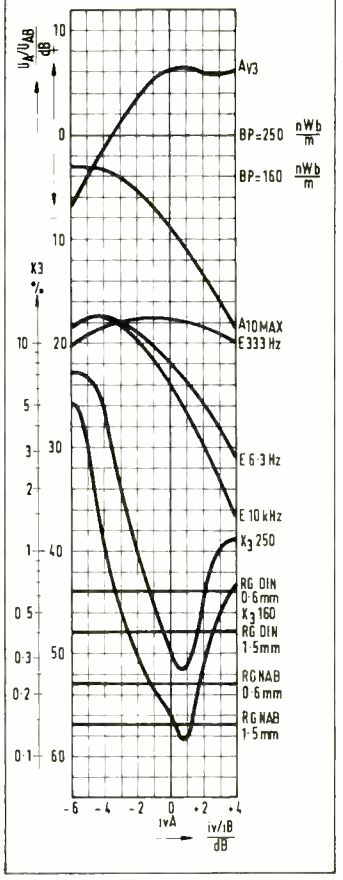


Fig 14

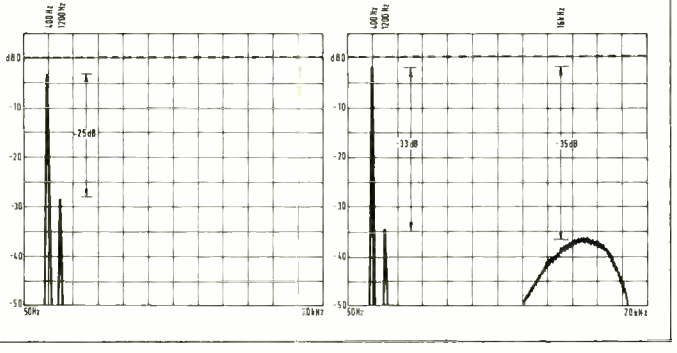
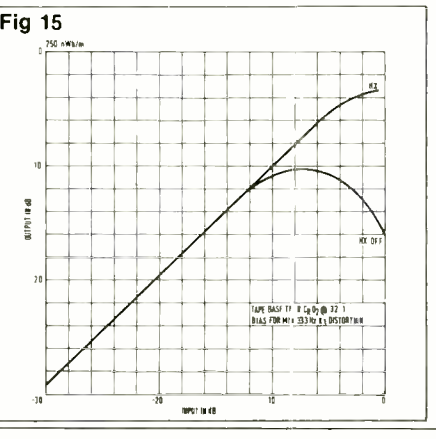
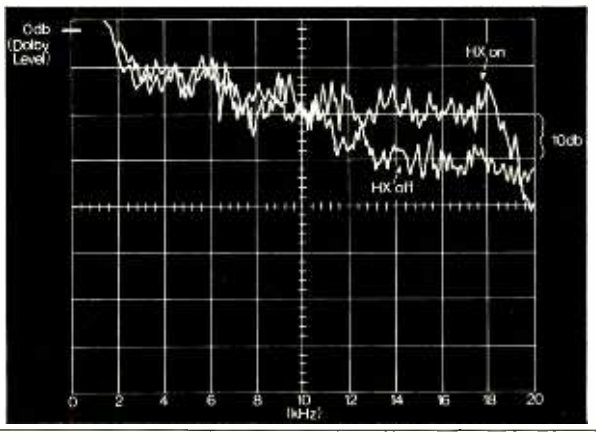


Fig 15





SPOILT FOR CHOICE.

When you come to choose your new multitrack, deciding on a Studer will probably be easy. What will be a little more difficult will be *which* Studer to take - the new A80/VU Mk III or the new A800.

Both machines are superb examples of Studer precision. Both come with the new narrow head block that cuts the travel distance between the erase and record heads to 88 millisecs at 30 ips (now available as a conversion for existing A80/VU models). And both are available in several tape width/channel number configurations.

Whatever your criteria, choosing between the A80/VU Mk III and the A800 won't be easy. But then Studer never have been in the habit of taking the easy way out when it comes to performance.

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INTERNATIONAL AG
CH-8105 Regensdorf Telephone (01) 840 29 60

F.W.O. Bauch Limited
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Telephone 01-953 0091, Telex 27502

STUDER REVOX AMERICA INC Nashville Telephone (615) 254-5651 STUDER REVOX S A R L Paris Telephone 533 5858 STUDER REVOX CANADA LTD Toronto Telephone (416) 423-2831

cassette duplication

driven fairly hard with 250 nWb/m being used as the peak recording level as opposed to 200 nWb/m which is more usual with Dolby encoded cassettes. Otherwise there will be insufficient HF level to take full advantage of the *HX-Pro* system and this is why setting the static bias is so critical. Dolby *B* and *C* noise reduction is not affected by this higher level as the increase in gain takes place before encoding.

Tests carried out on both Electrosound and Gauss duplicators show that HX-Professional improves the overall performance including master as follows:

Frequency	32:1	64:1
5 kHz	+1.5 to 2 dB	0
10 kHz	+4.0 dB	0
15 kHz	+10.0 dB	0 to +2.0 dB

In laboratory tests carried out on just the slave, the results obtained at 64:1 equal those obtained at 32:1, providing yet further proof that the master is the limiting factor at the higher speed and for the time being the system can only sensibly be used at 32:1. But as mentioned earlier, the whole question of mastering is receiving urgent attention by several companies including Dolby Laboratories, of course. Further results are shown in **Figs 2** and **3, Fig 2** showing the dynamic range that can be expected from a system using Dolby *HX-Pro* and Dolby *B* noise reduction while **Fig 3** shows the improvement to high frequency compression in greater detail.

Electrosound were the first duplicator to commit themselves to *HX-Pro* and were demonstrating a fully operational system at the European AES in March 1983. At the moment this is only being offered as an option to their new *8000* series of duplicator. On the other hand, Gauss have introduced a retro-fit kit for the *1200* series which can be fitted to the slave on site and will have it available as an option to the *2400* series soon.

So far several major duplicators in the United States have already bought or ordered systems from Electrosound or kits from Gauss. They include Monarch, RCA and Warner. In the UK many of the major duplicators are buying the retro-kits from Gauss and many of them intend to use it in conjunction with chrome tape. This supports the view of Dolby Laboratories who think that there are sufficient additional benefits to be gained from chrome tape to make its use with Dolby *HX-Pro* worthwhile.

But it is EMI of Hayes in the UK who are going to be the first plant in Europe to use *HX-Pro* in production, having designed and built their own electronics after obtaining a licence from Dolby Laboratories. The first cassettes recorded with Dolby *HX-Pro* are expected to be released before Christmas 1983.

Conclusions

In conclusion we have seen what chrome and Dolby *HX-Pro* have to offer the duplicator by way of enhanced performance. We have also looked at some of the new equipment that has arrived or is on its way, which will further increase the quality of the finished product. However, there are several points which we should remember if we wish to take full advantage of the technology that is now available to us. They are:

- The quality of the finished cassette is limited by the weakest link in the chain, which at 64:1 is definitely the master but could well be your equipment.
- Poor quality masters will not produce high quality cassettes.
- For the highest quality cassettes, only use C-0s which have minimum azimuth errors and control the quality of all incoming materials by using proven quality control procedures.
- Keep both the electronics and mechanics of your duplication and production equipment well maintained at all times.

Obviously it will be up to individual duplicators to decide if they wish to take advantage of the above developments and by doing so offer higher quality cassettes to their customers. But judging by the reaction of the industry—and the record companies in particular—to the arrival of chrome tape and the initial reaction to *HX-Pro* in the USA I think many duplicators will find themselves under pressure from their own customers to upgrade the quality of their cassettes, if they haven't already done so.

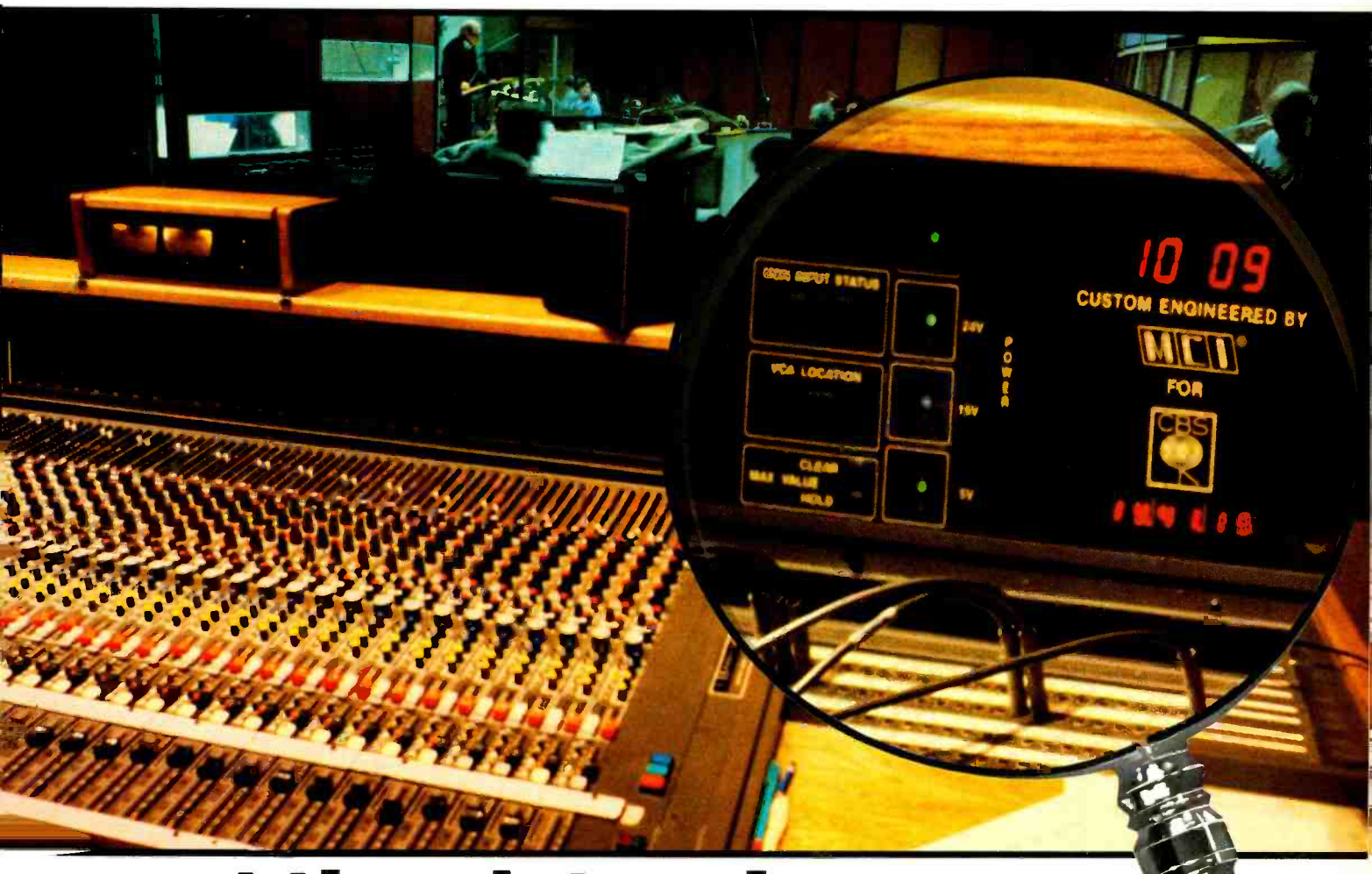
However, there will be those duplicators, who are involved in producing budget, speech or data cassettes, who will think that the expense of these developments is not worthwhile and to them I would say that many of the points covered by this article cost very little and yet can make all the difference to the quality of the finished product *and* profits.

Returning to data cassettes just briefly, two of the leading music duplicators in the UK who both use chrome tape for their highest quality music cassettes just happen to be two of the country's leading data cassette copiers with a zero rejection rate due to faulty program. Their customers are quite happy to pay a little more for quality and reliability.

I would be delighted to hear from anyone who disagrees with or would like to add to what I have discussed in this article—any comments, news and views are always welcome and could assist others in improving the quality of their cassettes. ■

Acknowledgements
I would like to thank John Baxter and Hank Botino of Dolby Licencing Corporation of San Francisco in the USA, Bob Hine of BASF (UK) Ltd, Fred Brooks of CBS, Aylesbury, UK and Richard Watts of Cetec International, London without whose help this article would never have got started let alone finished!

CBS Studios know what the score is...



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JH 110 B-14-2-VP


JH 24-24

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Basing View, Basingstoke
Hampshire RG21 2LA
United Kingdom

Telephone (0256) 55 0 11
International +44 256 55 0 11
Telex 85 84 24

product reference

Disc Cutting

ALLIED RECORDING (USA)
Allied Recording Company, 3232 Green Point Avenue, Long Island City, NY 11101. Tel: (212) 784-2318.
UK: Walter Luther Ltd, 102 Chaldon Road, Caterham, Surrey CR3 5PH. Tel: 0883 48666.

Range of recording blanks up to 14 in.

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

Two-channel digital delay for preview applications and ½ in headblock for mastering use to fit *ATR-100*.

AMS (UK)
Advanced Music Systems, 1-3 Wallstreams Lane, Worsthorne Village, Nr. Burnley, Lancs. Tel: 0282 36943. Telex: 63108.
USA: Harry Harris Sound Services, 7138 Santa Monica Boulevard, Hollywood, CA 90046. Tel: (800) 637-5000.

DM-DDS stereo disc mastering preview digital delay line.

AUDIODISC (USA)
Capitol Magnetic Products, 1750 N Vine Street, Hollywood, CA 90028. Tel: (213) 462-6252.
UK: Thorn-EMI Tape Ltd, Alma Road, Windsor, Berks SL4 3JA. Tel: 07535 59171.

Master and reference laquer discs.

CAPPS (USA)
Capps & Co Inc, 20 Addison Place, Valley Stream, NY 11580. Tel: (516) 825-4413.
UK: Walter Luther Ltd, 102 Chaldon Road, Caterham, Surrey CR3 5PH. Tel: 0883 48666.

Vari-pitch/depth computer and cutting styli.

COUNTY RECORDING (UK)
County Recording Service, London Road, Binfield, Bracknell, Berks. Tel: 0344 54935.

Disc cutting systems less lathe. Cutting styli.

CYBERSONICS (USA)
Cybersonics, 11128 Weddington Street, North Hollywood, CA 91601. Tel: (213) 766-7104.
UK: Feldon Audio Ltd, 126 Great Portland Street, London W1N 5PH. Tel: 01-580 4314. Telex: 28668.

Electronically controlled lathe.

DIGITAL SYSTEMS (UK)
UK: Feldon Audio Ltd, 126 Great Portland Street, London W1N 5PH. Tel: 01-580 4314. Telex: 28668.

PCM preview unit.

FAIRCHILD (USA)
Fairchild Sound Equipment Corp, 75 Austin Boulevard, Commack, Long Island, NY 11725. Tel: (516) 543-5200.

Range of cutting heads.

JVC/ADAMANT (USA)
JVC Cutting Center Inc, RCA Building, Suite 500, 6363 Sunset Boulevard, Hollywood, CA 90028. Tel: (213) 467-1166.

Disc cutting styli, acetates and cutting system.

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

Digital 4-track recorder with preview head.

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

Mastering recorder for disc cutting.

MICRO-POINT (USA)
Micro-Point Inc, 150 Clearbrook Road, Elmswood, NY 10523. Tel: (914) 347-3550.

Disc cutting styli.

MSR (UK)
MSR Electronics Ltd, Meeting House Lane, Balsall Common, Coventry, Warwicks. Tel: 0676 32468.
USA: Rupert Neve Inc, Berkshire Industrial Park, Bethel, CT 06801. Tel: (203) 744-6230. Telex: 969638.

DC servo controlled lathe.

Neumann VMS 80 disc cutting lathe

NEUMANN (West Germany)
Georg Neumann GmbH, Charlottenstrasse 3, D-1000 Berlin 61. Tel: 030 251-4091. Telex: 184595.
UK: FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ. Tel: 01-953 0091. Telex: 27502.
USA: Gotham Audio Corp, 741 Washington Street, New York, NY 10014. Tel: (212) 741-7411, Telex: 129269.

Computer controlled lathe, stereo cutter head, cutting console etc.

NEVE (UK)
Neve Electronics International Ltd, Cambridge House, Melbourn, Royston, Herts, SG8 6AU. Tel: 0763 60776. Telex: 81381.
USA: Rupert Neve Inc, Berkshire Industrial Park, Bethel, CT 06801. Tel: (203) 744-6230. Telex: 969638.

Digital and analogue mastering consoles.

ORTOFON (Denmark)
Ortofon Manufacturing A/S, 11B Mosedalvej, DK-2500 Copenhagen-Valby. Tel: 01 46.24.22. Telex: 27587.
UK: Feldon Audio Ltd, 126 Great Portland Street, London W1N 5PH. Tel: 01-580 4314. Telex: 28668.
USA: Cybersonics, 11128 Weddington Street, North Hollywood, CA 91601. Tel: (213) 766-7104.

Stereo cutting heads.

PYRAL (France)
Pyral SA, 47 rue de L'Echat, F-94001 Creteil, France. Tel: (1) 207.48.90. Telex: 23742.
USA: Gotham Audio Corp, 741 Washington Street, New York, NY 10014. Tel: (212) 741-7411. Telex: 129269.

Disc recording blanks.

SCULLY (USA)
L J Scully Manufacturing Co, 128 Hurd Avenue, Bridgeport, CT 06604. Tel: (203) 368-2332.
UK: Identimation Ltd, Stratden House, 38 Heath Road, Helpstow, Peterborough PE6 7EG. Tel: 0733 253075. Telex: 32225.

Cutting lathe and automated console.

SONTEC (USA)
Sontec Corp, 10120 Marble Court, Cockeysville, MD 21030. Tel: (301) 628-2283.

Disc mastering EQ and comp/limiter, micro-processor based lathe control system.

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

Disc mastering recorder with preview head.

tam (UK)
tam, 13a Hamilton Way, London N3 1AN. Tel: 01-346 0033.

Ortofon designs made under licence including limiters, equalisers, phase meters, test tone generators etc.

TECHNICS (Japan)
UK: National Panasonic (UK) Ltd, 300-318 Bath Road, Slough SL1 6JB. Tel: 0753 34522. Telex: 847652.
USA: Panasonic Professional Audio Division, 1 Panasonic Way, Secaucus, NJ 07094. Tel: (201) 348-7000. Telex: 710-992 8996.

Direct drive motor and electronics for lathes.

TELDEC (West Germany)
Teldec Schallplatten GmbH, D-2000 Hamburg 19, Heussweg 25.
UK: FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ. Tel: 01-953 0091. Telex: 27502.
USA: Gotham Audio Corp, 741 Washington Street, New York, NY 1004. Tel: (212) 741-7411. Telex: 129269.

Direct metal mastering system.

TRANSCO (USA)
Transco Products International, 875 Merrick Avenue, Westbury, NY 11590. Tel: (516) 333-2000.
UK: FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ. Tel: 01-953 0091. Telex: 27502.

Disc cutting blanks.

WESTREX (USA)
Westrex, 2629 West Olive Avenue, Burbank, CA 91505. Tel: (213) 846-3394. Telex: 698254.
UK: Westrex Co Ltd, Bilton Fairway Estate, Long Drive, Greenford, Middx. Tel: 01-578 0957. Telex: 923003.

Complete disc cutting system, HF limiters, stereo cutterheads etc.

ZUMA (USA)
Zuma Audio Inc, 4150 W Gelding Drive, Phoenix, AZ 85023. Tel: (602) 938-8347.

Disc mastering computer system. ■

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HOLLINGBOURNE
MAIDSTONE
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062-780 555

HILL AUDIO INC
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LILBURN
GA 30247
USA
404 923 3193
Telex: 293 827 HLAD

product reference

Compressors & Limiters

ACCESSIT (UK)
Bandive Ltd, Brent View Road, London NW9 7EL. Tel: 01-202 4366.
USA: Omnisound Ltd, PO Box 366 Elemont, NY 11003. Tel: (516) 437-7947.

Simple compact compressor.

ADM (USA)
ADM Technology Inc, 1626 E Big Beaver Road, Troy, MI 48087. Tel: (313) 524-2100. Telex: 231114.

Limiter module.

ALICE (UK)
Alice (Stancoil) Ltd, 38 Alexandra Road, Windsor, Berks. Tel: 07535 51056. Telex: 849323.

Module containing two compl/limiters for installation in Alice consoles.

ALTEC (USA)
Altec Lancing, PO Box 3113, Anaheim, CA 92803. Tel: (714) 632-7717. Telex: 685536.
UK: Rank Strand Sound, PO Box 51, Great West Road, Brentford, Middlesex TW8 9HR. Tel: 01-568 9222. Telex: 27976.

Rack mount limiter.

APE (France)
SCEPA, 23 Rue Emile Duclaux, 92150 Suresnes. Tel: 506.38.78.

Adjustable band compressor.

APHEX (USA)
Aphex Systems, 13340 Saticoy Street, North Hollywood, CA 91605. Tel: (213) 765-2212. Telex: 910-321 57672.
UK: AKG Acoustics Ltd, 191 The Vale, London W3 7QS. Tel: 01-749 2042. Telex: 28938.

Compressor/expander module and rack mount compressor/limiter/leveller unit.

ASHLEY (USA)
Ashley Audio Inc, 100 Fernwood Avenue, Rochester, NY 14621. Tel: (716) 544-5191.
UK: Atlantex Music Ltd, 1 Wallace Way, Hitchen, Herts SG3 0SE. Tel: 0462 31511. Telex: 826967.

Range of compressor/limiters.

AUDIO & DESIGN (UK)
Audio & Design (Recording) Ltd, North Street, Reading RG1 4DA. Phone: 0734 53411. Telex: 84872.
USA: Audio & Design Recording Inc, PO Box 785, Bremerton, WA 98310. Tel: (206) 275-5009. Telex: 152426.

Wide range of compressor/limiters include three band processors, models with expansion capability and EQ/compressors.

AUDIO DEVELOPMENTS (UK)
Audio Developments, Hall Lane, Walsall Wood, Brownhills, West Midlands WS9 9AU. Tel: 05433 5351. Telex: 338212.
USA: Audio Developments, 1640 Fifth Street, Suite 224, Santa Monica, CA 90401.

Two-channel rack mount compressor.

AUDIX (UK)
Audix Ltd, Station Road, Wenden, Saffron Walden, Essex CB11 4LG. Tel: 0799 40888. Telex: 817444.

Limiter amplifier and compressor/limiter module.

BARTH (West Germany)
R. Barth KG, Grillparzerstrasse 6a, D-2000 Hamburg 76. Tel: 040 229-8883. Telex: 212095.
USA: Audicon Marketing Group, 1200 Beechwood Avenue, Nashville, TN 37212. Tel: (615) 256-6900. Telex: 554494.

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BIAMP (USA)
Biamp Systems inc, 9600 SW Barnes Road, Portland, OR 97225. Tel: (503) 297-1555.

Four channel compressor/limiter.

CATHEDRAL (UK)
Cathedral Sounds Ltd, Fourways, Morris Lane, Halsall, Ormskirk, Lancs L39 8SX. Tel: 0704 840328.

Four channel compressor/limiter.

dbx (USA)
dbx inc, 71 Chapel Street, Newton, MA 02195. Tel: (617) 964-3210. Telex: 922522.
UK: Scenic Sounds Equipment, 97-99 Dean Street, London W1V 5RA. Tel: 01-734 2812. Telex: 27938.

Rack mount and modular compressor/limiters.

D & R (Netherlands)
D & R Electronica BV, Chassestraat 26, 1057 JE, Amsterdam. Tel: 020-183556. Telex: 18503.
UK: DSN Marketing Ltd, Westmorland Road, London NW9 9RJ. Tel: 01-204 7246. Telex: 8954243.

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DRAWMER (UK)
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DUKANE (USA)
Dukane Corp, International Division, 2900 Dukane Drive, St. Charles, IL 60174. Tel: (312) 584-2300. Telex: 720426.

Range of compressors.

EMT (West Germany)
EMT-Franz GmbH, Postfach 1520, D-7630, Lahr. Tel: 78025 512. Telex: 754319.
UK: FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ. Tel: 01-953 0091. Telex: 27502.
USA: Gotham Audio Corp, 741 Washington Street, New York, NY10014. Tel: (212) 741-7411.

Wide range of modular and rack mount units including compressor/limiters, filter limiters and transient limiters.

EVENTIDE (USA)
Eventide Clockworks Inc, 265 West 54th Street, New York, NY10019. Tel: (212) 581-9290.
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Compressor/limiter/expander/noise gate unit.

FOSTEX (Japan)
UK: Bandive Ltd, Brent View Road, London NW9 7EL. Tel: 01-202 4366.
USA: Fostex Corporation of America, 15431 Blackburn Avenue, Norwalk, CA 90650. Tel: (213) 921-1112.

Two channel compressor/limiter/expander.

FURMAN SOUND (USA)
Furman Sound Inc, 616 Canal Street, San Rafael, CA 94901. Tel: (415) 456-6766.
UK: Atlantex Music Ltd, 1 Wallace Way, Hitchin, Herts SG4 0SE. Tel: 0462 31511. Telex: 826967.

Rack mount compressor/limiter.

INOVONICS (USA)
Inovonics Inc, 503-B Vandell Way, Campbell, CA 95008. Tel: (408) 374-8300.
UK: Feldon Audio Ltd, 126 Great Portland Street, London W1N 5PH. Tel: 01-580 4314. Telex: 28668.

Mastering limiter.

JBL (USA)
James B. Lansing Sound Inc, 8500 Balboa Blvd, Northridge, CA 91329. Tel: (213) 893-8411. Telex: 674993.
UK: Harman (Audio) UK Ltd, Mill Street, Slough, Berks SL2 5DD. Tel: 0753 76911.

Compressor limiter.

LOFT (USA)
Phoenix Audio Laboratory Inc, 91 Elm Street, Manchester, CT 06040. Tel: (203) 649-1199.

Four channel limiter/gate.

MXR (USA)
MXR Innovations Inc, 740 Driving Park Avenue, Rochester, NY 14613. Tel: (716) 254-2910. Telex: 978451.
UK: Atlantex Music Ltd, 1 Wallace Way, Hitchen, Herts SG4 0SE. Tel: 0462 31511. Telex: 826967.

Two channel limiter.

NEUMANN (West Germany)
Georg Neumann GmbH, Charlottenstrasse 3, D-1000, Berlin 61. Tel: 030 251-4091. Telex: 184595.
UK: FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ. Tel: 01-953 0091. Telex: 27502.
USA: Gotham Audio Corp, 741 Washington Street, New York, NY 10014. Tel: (212) 741-7411. Telex: 129269.

Modular compressor/limiter/expander.

NEVE (UK)
Neve Electronics International Ltd, Cambridge House, Melbourn, Royston, Herts SG8 6AV. Tel: 0763 60776. Telex: 81381.
USA: Rupert Neve Inc, Berkshire Industrial Park, Bethel, CT 06801. Tel: (203) 744-6230. Telex: 969638.

Range of rack mount compressor/limiters.

NTP (Denmark)
NTP Electronik A/S, 44 Theklavej, DK-2400, Copenhagen NV. Tel: 01-10.12.22. Telex: 16378.

Range of compressor/limiters.

ORANGE COUNTY (Canada)
Orange County Electronics Corp Ltd, 1125 Empress Street, Winnipeg, Manitoba R3E 3H1. Tel: (204) 775-8151.

Range of compressor/limiters, some with expander functions.

ORBAN (USA)
Orban Associates Inc, 645 Bryant Street, San Francisco, CA 94107. Tel: (415) 957-1067. Telex: 171480.
UK: Scenic Sounds Equipment, 97-99 Dean Street, London W1V 5RA. Tel: 01-734 2812. Telex: 27939.

Stereo limiter, compressor/limiter/expander and multiband compressors.

PROTECH (USA)
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58 ▶

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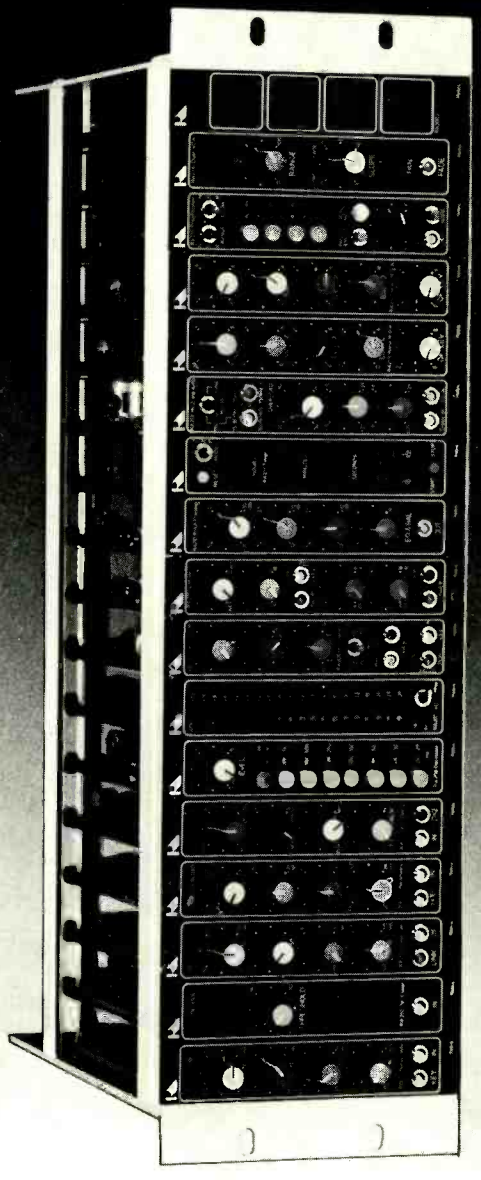

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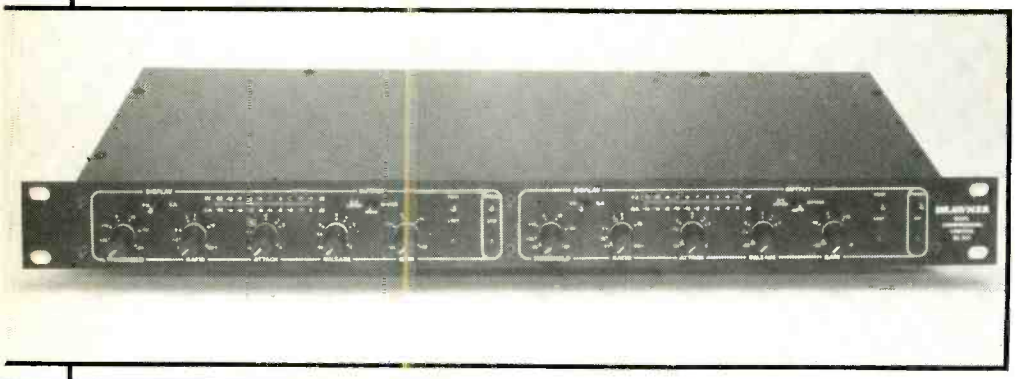
Drawmer DL221-a user report

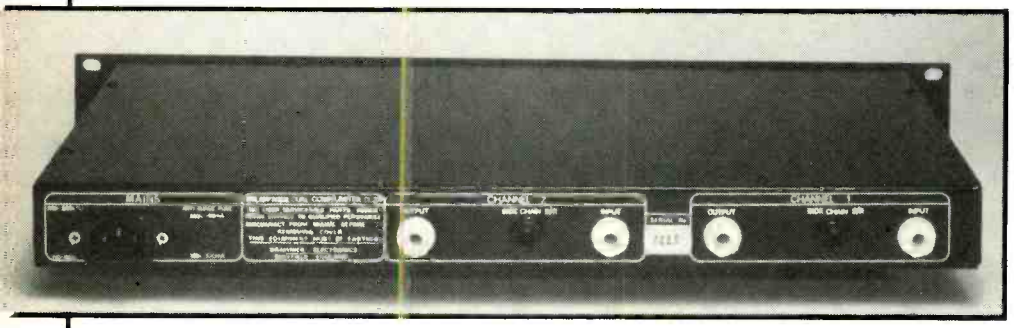
Dave Ward

Gateway Studios in London was the location for a user report on the new Drawmer comp/limiter.

COMPRESSOR limiters have been around in varying forms for many years. A decade ago they were fairly expensive but the last few years have seen a steady stream of new devices in a price range suited to most pockets. Generally, the quality and flexibility of the unit are reflected in the price.

Most of the compressors I have used have been excellent in one or two areas but have had some limitation (no pun intended) ergonomically or audibly. When the Drawmer *DL221 Dual Compressor* arrived at our studio I was immediately delighted to see the forethought that had gone into its design and could not wait to get my hands on it.





Like its partner, the *DS201 Dual Gate*, the unit is a very compact 1 U high 19 in rack mounting unit split into two independent sections that are linkable for stereo operation with a toggle switch in the centre.

Controls

The first control at the left of the unit is the threshold (variable from —24 dBV to infinity). This sets the point above which gain reduction commences. A nice feature is that this control determines the signal level going into the side chain and not the overall input level. As the manufacturers state, the input level can usually be adjusted on preceding equipment.

Next comes the ratio control continuously variable between 1:1 (zero compression) and 20:1 (limiting). Above these controls is the function switch for the metering display unit. This is a 2-way toggle switch clearly marked to switch the metering between normal VU metering and gain reduction (GR).

The LED bar type display is arranged, with the switch in the VU position, to give from left to right green illumination below 0 VU, amber at 1 dB and red above 0 dB.

In the gain reduction position of course, the meter works from right to left giving the green indication at 0 dB gain reduction and red indications of progressive amounts of gain reduction up to 22 dB. The VU meter is calibrated to show 0 VU at +4 dBV. Below the metering are attack and release controls. Attack is continuously adjustable between 50 μs and 5 ms and the release continuously adjustable between 50 ms and 5 s. After these is the output gain control (—20 dB to +20 dB) which controls the output only in the operating or 'normal' mode. Above the output gain control is the unit mode switch which allows the engineer to monitor either the input signal in the 'by-pass' position or the compressor output in the 'normal' position. One major feature of this unit is that the output control is by-passed in the unit 'by-pass' mode. This generally enables the engineer to make a true A/B test with no output level difference in this mode due to the output gain control.

The third position of this toggle switch routes the side chain to the output so the engineer can listen to any equalisation being applied to the side chain during frequency conscious compression. This I found to be a very useful feature when using the compressor as a de-esser and indeed, on one or two occasions, when applying frequency conscious compression to a bass guitar. The LED display is also linked to the mode switch such that with the monitor switch in the VU position and the mode switch in by-pass, the display will read the input to the unit. This again is particularly convenient as it allows the engineer to make a visual and audible comparison of input and output signals.

At the far right of each section is an on/off toggle switch for the separate peak limiter. This limiter is designed to complement the compressor section by allowing the engineer to use slow attack and/or gentle compression slopes and still have protection from overload. The manufacturers state that the limiter has an internally pre-set threshold of +6 dB (ref +4 dBV), fast attack and automatic release based on programme content. It has a fixed ratio of 50:1. The limiter is connected after the output gain control and the amount of reduction from limiting is indicated on the display along with compression. In addition the LED to be found under the limiter switch indicates the onset of limiting.

At the far right of the unit is the power on/off switch. This again is a toggle switch with an LED indicator.

On the back of the unit, inputs and outputs are on ¼ in jack sockets (*XLR* sockets are available as an extra) and both inputs and outputs are unbalanced. There is also a stereo jack socket for access to the side chain of the compressor. The ring is the send and the tip the return. Of course, with the use of the mode switch any device plugged into the side chain can be monitored in-situ.

In Use

I found the *DL221* a joy to use and I am continuously impressed by its performance. The amount (or rather lack) of low frequency distortion at 'silly' attack and release settings is comparable to devices many times the price of this unit. This is one of those compressors that sounds 'right' in the solo situation as well as sounding 'right' in the mix. I have put it to good use with extreme settings on vocals and bass guitar. Use of the side chain insert points can also produce some interesting effects.

As a stereo unit I have found it particularly useful for 'tightening up' a couple of somewhat flabby mixes (this is allowed south of the Thames) and there was no obvious movement in the stereo picture. Because of its ease of operation I have been able to get the desired effects very quickly. The engineer gains a sense of security being able to listen to the side chain and having the A/B monitoring capability. Any manufacturer who can give me a greater sense of security is likely to be a friend for life.

Conclusions

The Drawmer *DL221* is a well made compact and comprehensive device which I can only think was designed with the engineer in mind. The designers have incorporated several features that I have been looking for in a compressor/limiter and they have been able to make this available at a price that didn't freak the accounts department. Needless to say, having reviewed the *DL221* we could not bear to part with the unit and had to buy it. It makes an ideal companion to the *DS201 Dual Gate*. The incorporation of a fixed ratio peak limiter on the output is an added bonus that was most unexpected. I am told that there is also a single channel module of this unit that fits into the Audio and Design *Scamp* rack system.

I would recommend a *DL221* to any studio large or small. ■

Dave Ward is manager of Gateway Studios and organises and tutors on the Gateway multitrack course.

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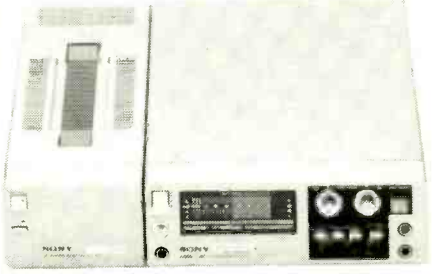

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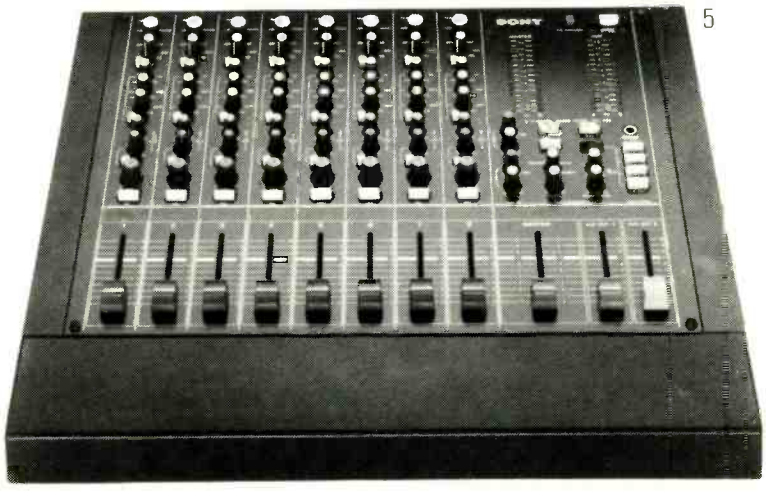

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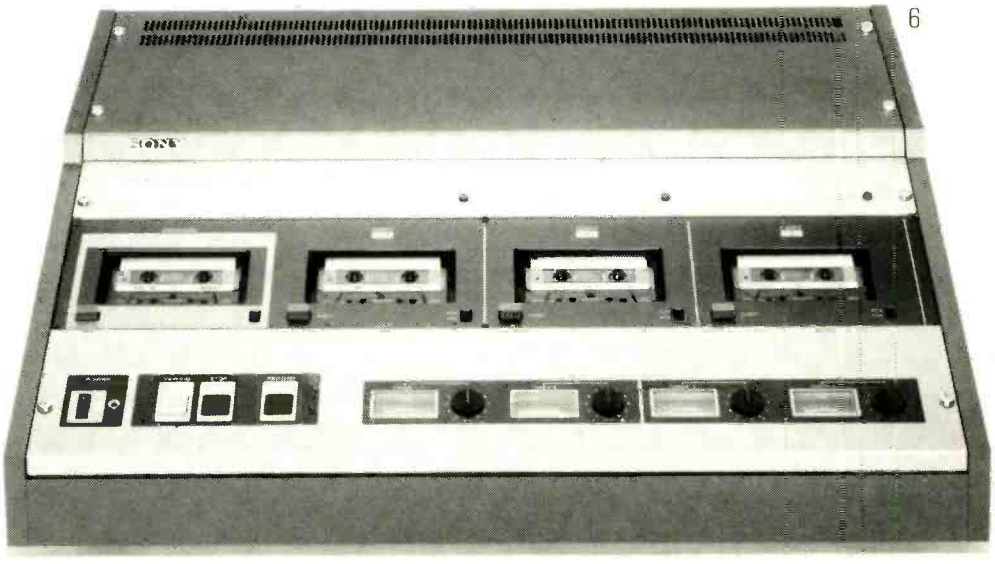

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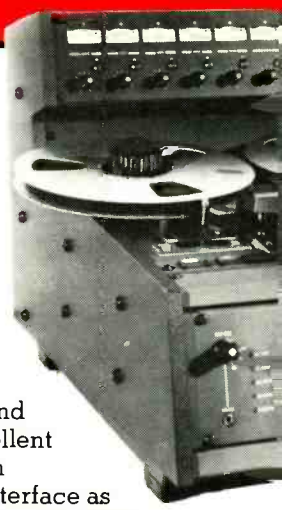

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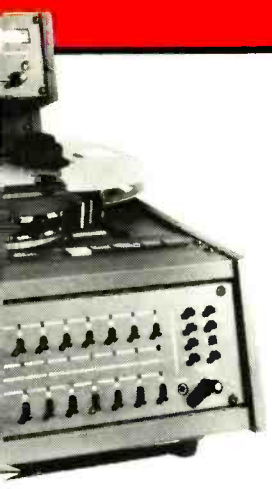

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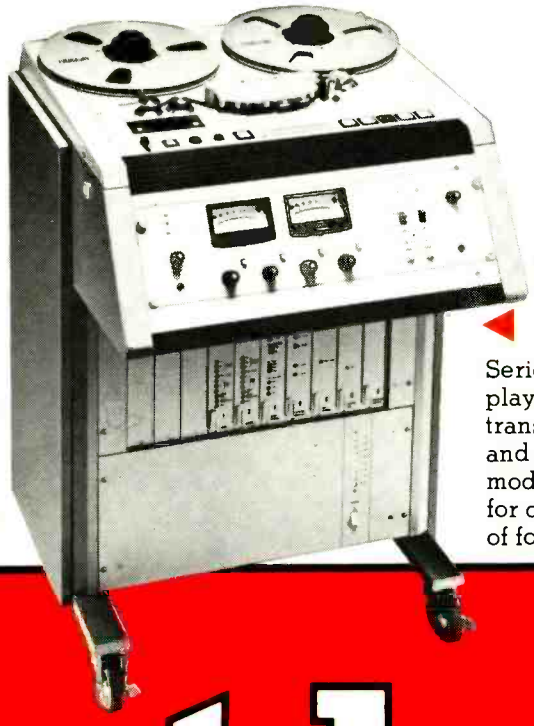

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C-ducers-user C-ducer

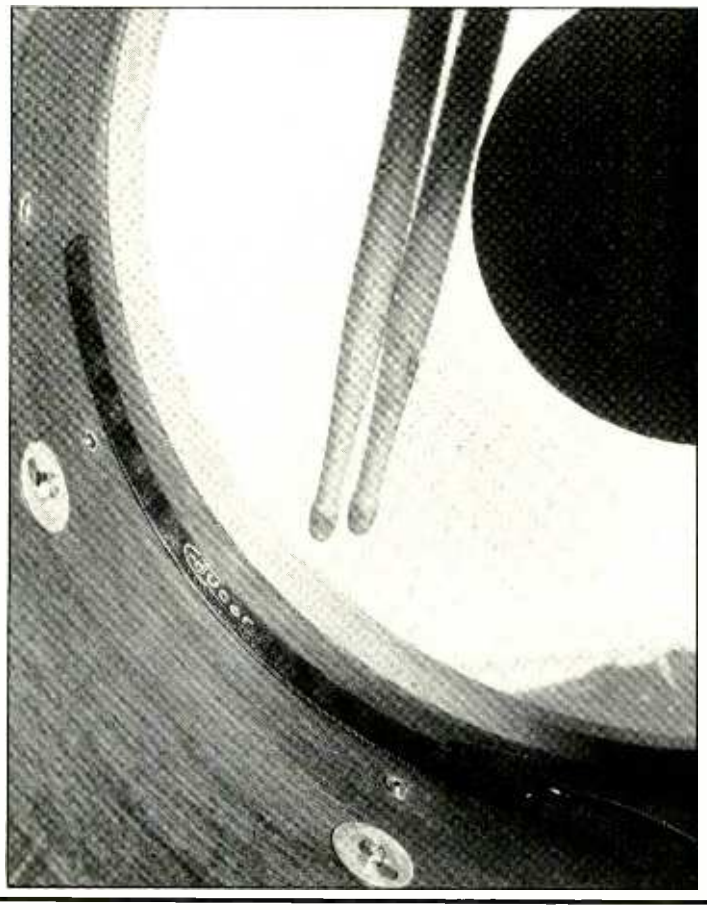
Part two of this article covers basic rules and techniques, possible application areas and some of the ways in which C-ducers are currently being applied.

Keith Spencer-Allen

The first step in using *C-ducers* is the selection of the most suitable tape for the instrument under discussion. There is a choice of 3 or 8 in types and which length is used depends on the instrument. Generally, the smaller instruments use the smaller tape although I have found that this is not always the case. The definition of small instruments includes violin, banjo, mandolin and in some cases acoustic guitar, although the latter does depend on the type of construction and design. All other instruments would generally use an 8 in tape.

A 3 in tape on a large instrument will generally sound OK although you may have the feeling that it is not giving the best response at the extremes of the frequency range. Using an 8 in tape on a small instrument, assuming that it will fit, often leads to a somewhat ill-defined bass response and a lack of sounding 'quite right'. (This can largely be corrected with EQ but it is really simpler to use the correct length tape.) Exactly why this should be the case, I am not too sure but it may be that the 8 in tape being in contact with the instrument body picks up low frequencies that the instrument is designed not to project into the air around it. These energies are at frequencies below the fundamentals of most of the notes played and the 8 in tape with its marginally better LF response will transduce them while the 3 in tape is less sensitive to these frequencies and so sounds better.

Where to place the tape is the next decision. A sound of some description will be obtained no matter where the tape is placed although such a positioning is unlikely to meet the requirements for a 'good basic' sound. My normal procedure for a stringed instrument is to listen carefully to the sound from various parts of the instrument to familiarise yourself with the type of results you are likely to achieve (as you would before placing a mic). Then by touching the body of the instrument, try and find the area of greatest resonance. Note this position and then consider at which point the vibration of the strings is transferred most directly to the body of the instrument this usually being the bridge. The initial positioning of the *C-ducer* would then be somewhere between these two points and the ideal position found by movement within this area. A tape at the position of maximum resonance will often sound ill-defined and the HF content of the signals will sound distant. Moving towards the bridge will improve definition and even out any predominant frequencies. I find that positioning too close to the bridge gives a slightly over-hard and close sound. This is useful sometimes but a generally preferable sound is normally found no closer than 3 in from the bridge. On some instruments this may mean that the tape is under the strings and there seems to be little wrong with this as long as proper tape-to-instrument contact can be achieved. I have found that certain steel strung acoustic guitar/plectrum combinations are not satisfactory with the tape in this position and so as a rule the tape will be on the tail side of the bridge for acoustic guitars. Sounds on different positions of the guitar are actually very similar to the sounds that you would achieve with a close mic at the same point—bass light towards the edges of the guitar and very boomy around the sound hole.



There are, of course, exceptions to these stringed instrument guidelines. For instance, a full size concert harp will normally require a tape to be placed around the soundboard section somewhere near the floor and may need a second tape higher up the frame to cover the high notes. Keyboard instruments, although usually stringed instruments, are quite different.

There are very few guidelines that work consistently and you will definitely need two tapes but their placement will depend, to a fair degree, on the construction of the instrument. The usual positioning will be under the soundboard although even that is not definite. The problem is further compounded by the range of piano sounds that are considered normal and to achieve these the tape positions will vary considerably. Usually, the best area to start is around the physical middle of the piano and concentrate on the lower and middle string areas. The top end will tend to look after itself quite well and so can often be forgotten until the final adjustments to the sound.

Perhaps more than other instruments, the piano typifies the differences between *C-ducers* and mics. Firstly, you have to learn to listen to the instrument *without* the sound of the room that you can still hear even with fairly close miking. This can be somewhat disconcerting at first

although it is easily adapted to. Once other instruments playing in the same room are added, even without reverb, the slight spill from the piano will completely cover up this effect. Another result of the use of *C-ducers* on piano is the increased sustain that the piano has although in practice this has never proved a problem—rather an advantage, as it meant that it is possible to add less reverb (if any) and so keep faster piano passages more distinct.

Drums are another area of *C-ducer* application and again the results are hard to predict as they depend very much on the instrument and the types of sound wanted. The first area to be checked out is the inside of the shell. The tape should be tried on the inside wall around the circumference parallel-ish to the head. Movement nearer the head will increase the stick on skin sound while the sound on the drum is found lower in the shell. This is somewhat different with double head drums. Drums are not an area that I have looked at in any great detail myself but there will be examples from users later on. The bass drum can actually be *C-duced* fairly successfully and is well worthwhile trying. The method described for tom-toms works quite well although I have been told that fixing a tape to the section of a tom support post that is left in the bass drum, the bulk of the attacking sound being airborne, is very effective.

There are other points worth mentioning about *C-ducers* in general and their uses.

- Just as close miking often reveals physical problems with an instrument (eg squeaky drum pedals and rattles), the use of *C-ducers* can have a sometimes even more revealing effect.
- Even with *C-ducers* quite close together, it is possible to achieve an effective spread in a stereo picture.
- With percussive instruments, levels at the front end of a console have to be watched as the attacking transients can cause clipping without even a nod of any metering. It may be necessary to lower front end gain to prevent this occurring.
- Bad tape-to-instrument contact will sound very unpleasant—like a badly overloaded front end.

Applications

My main area of concern has been recording but the separation offered by the use of these tapes gives them very real stage applications. For instance, with a grand piano equipped with *C-ducers*, I have had a full drum kit just by the side of it and the problems I encountered were very small and much of the spill I imagine was induced in the piano soundboard and then picked up by the *C-ducer* rather than direct acoustic spill.

It is the unusual areas of application that I am exploring at present and these include unusual percussion instruments, mainly being hand-held types that need to be shaken, the sound always changing with the position of the instrument as well as being difficult to mic closely. The *C-ducer* may be able to help in this respect.

One application that was quite successful was to use tapes on a solid bass guitar. The vibration in the body of a Fender *Jazz Bass* or *Precision* is ample. After experimenting I found that the best sound from a frequency point of view was concentrated in the upper 'horn' of the *Jazz* with an 8 in tape but the sound was a little distant. So I moved the tape to about 2 in behind the bridge and it was far better. The sound was a cross between the standard DI bass sound and a double bass. This was combined with the DI output and together they formed a very full complementary pair of sounds. I also added a second tape, a 3 in on the rear of the head stock and this gave a very interesting spread in the stereo together with the DI output.

Virtually any instrument appears to be *C-ducable* to some degree. The only remaining obstacle is the human voice. There is no real need to achieve this but it is an area worthwhile experimenting with for special effects. No matter how successful it could be made, I don't think that many vocalists will agree to having a *C-ducer* stuck around their neck with double-sided adhesive tape which is just as well because it doesn't really give very good results—a distinct lack of HF—although there may still be a way if we look to the mouth. (Don't take this paragraph too seriously, although the principles do present a challenge.)

Real life uses

The early days of *C-ducer* marketing were, in retrospect, well intentioned but misleading. C-Tape knew that their new product worked and needed a rather different approach to obtain results. To familiarise users with the techniques known at that time they produced some literature that over simplified the guidelines and tended to suggest that if you followed these rules, then suddenly an excellent sound would issue forth like magic. The effect this had on potential users was either to alienate them completely from the units if results were less than excellent from their test instruments or to cause them to reject/ignore the suggested applications and do their own experimenting. As a result of this situation, there is now a wide variety of applications and experience available —both conventional and unconventional across a wide spectrum of use.

To try to illustrate what results are being obtained and areas of use, I compared notes with a selection of regular users. These come from a cross-section of professional sound applications but it will be noticed that most experimenting has been done by those who are not regular studio engineers rather underlining the fact that time for experiment is the most important aspect.

Alan Leeming is a recording engineer of many years experience based at central London studios, PRT. Although keen on experimenting with new techniques, his problems are fairly typical of many engineers—a real lack of time to experiment with the more esoteric applications. In the 18 months he has been playing with the tapes, they have become a fairly regular part of his mic technique.

"The first aspect of *C-ducers* to attract me was separation. One of the main studios that I work in is PRT No 1 which is a fairly large ambient studio. We can have quite a lot of problems with separation especially with a large rhythm section incorporating piano or acoustic guitars, all at the same time. I felt that anything that would ease this situation without sounding appalling was worth trying.

"Firstly they were tried on the Bosendorfer in No 2 but following the diagrams supplied at the time, the sound I achieved was not completely flattering for this good-sounding piano. As No 2 is an Eastlake room, there are not many separation problems anyway, so next I tried it on the Bechstein in No 1. This piano is not quite so special-sounding but the *C-ducers* rather flattered its sound. Subsequently I have found that by experimenting with positions and really knowing the instrument you can achieve good results. You have to be prepared to experiment a little as similar instruments can be quite different in their best positions for *C-ducer*.

"An instrument that I have used *C-ducers* mainly on is the double bass. It works best with the guy who stands up and plucks it in a jazz sense or a style vaguely akin to that. I have found that it works far better on instruments of this type than guitars. In my experience the 8 in *C-ducer* positioned about 3 in below the bridge will give me an MF lift around 1 to 2 kHz which I quite like to add to basses anyway. Usually this would be used within an open sound context with the drums out in the open and spilling in a controlled amount into other mikes. This will also give a better personal ambience between musicians.

"You have got to think differently to the way you would with a pair of *47*s or *87*s. Positioning of the *C-ducer* differs very much from one instrument to another."

Another regular *C-ducer* user is **Keith Grant**, chief engineer/studio manager of Olympic Studios, Barnes, London. The studio has a very long history, having seen many music milestones. Studio No 1 is a very large room equipped for film work, something they do quite a lot of.

Keith's attitude to *C-ducers* is that they are a useful tool and that dependent on the music, he is quite happy to use them widely. Principal areas of his use are piano, acoustic guitar and drums.

An object of affection for the studio is a large Bosendorfer grand piano but it is rather prone to spill on large sessions. Keith has found that it is possible to achieve a similar sound out of a smaller piano, such as a Yamaha 5 ft grand, that is easier to screen off. This is done by using an 8 in *C-ducer* on the bass bridge and this is then carefully EQ'd to bring out the bass harmonics while the main piano sound is achieved with a pair of Neumann *U87*s.

With these large film sessions separation can really be a problem and so he has done a fair amount of experimenting with *C-ducers*. Acoustic guitars that are used within a section are *C-duced* almost as a matter of course. Keith says that he might have to try various positions to achieve the sound he is after but the result is generally good and often, following corrective EQ, the results within the mix might be better than if a mic had been used. He has also had experience of live use and pointed out that on occasions when musicians might be changing guitars, the *C-ducer* will allow the engineer the freedom not to have to mute the guitar that is set down but maybe just reduce its level.

Keith also mentioned some other successful applications: on sitar—a very good sound quite unlike what can be achieved with a mic, the best place for the tapes being around the gourd itself. It was also very effective on the Indian drums that went with it—a larger version of the tabla; on mandolin—excellent results particularly where there may be more than one with the noise of the pick against strings becoming too predominant when close miking. Using *C-ducers,* this scraping can be reduced and results are clearly audible in the Walls ice cream *Cornetto* ad.

Double bass always seems a popular instrument to *C-duce*—any comments? He replied that he had a very good technique for double bass already and felt that there was little need for *C-ducers* in this area. He then went on to stress that he never holds himself to a single technique but fits his technique to the demands of the session. His method with drums is interesting and shows another application of the tapes. He will not use them for recording, preferring to use standard miking techniques, but will use *C-ducers* placed on the outside rims of the drums to key noise gates. The signals from the drum mics are routed through the noise gates individually. The delay on the *C-ducer* output compared to the close mic, is just enough to remove the attacking transient from the mic signal. Keith finds this a valuable technique when recording digitally, particularly with disastrous results that can occur with overload of a digital system.

Blue Weaver is a producer/writer/engineer, although probably better known as a musician of much repute. Following over 20 years of studio experience on the other side of the glass, looking over the

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C-ducers

engineer's shoulder and earning gold discs; he set up a 24-track studio in part of his West London home. Being a keyboard player, it was natural that he should spend a lot of time with synths and, in particular, the Fairlight *CM1*. This instrument spends a lot of its time being used for its real time sampling capabilities. Blue, however, found that the ambience of any instrument sampled with a mic was liable to give him noise problems. In addition, he felt that the acoustics of his largely electronics-oriented studio was not too good for some instruments. He had been using a pair of 8 in *C-ducers* to record an upright piano in the studio and found that they were very effective if used to give the *CM1* a sample input. The sampling input is equalised slightly (HF boost) before feeding the *CM1,* although not to the degree that he found necessary with a mic, and hence another saving in noise. This gives a basic sound that he finds can be manipulated more effectively within the Fairlight than a mic-derived sample. This was particularly true on the percussive inputs from drums that were used to assemble rhythm tracks.

C-ducer placement is largely by feel although drums are always recorded with the tapes inside the shell and close to the skin but precise positioning varies considerably with the required result.

Did he find any problems with the subjective lack of treble or bass that is sometimes claimed?

"No, not at all. I have recorded some instruments completely flat from the *C-ducer* and it requires less treble boost for the Fairlight applications than a mic does."

What about the sometimes claimed opposite situation of overbrightness?

"It is true that I need less treble *EQ* for Fairlight sampling but I don't think that it is overbright. On one occasion I recorded a Washburn acoustic guitar with a *C-ducer* and compared the sound with that of the internal Washburn pickups. The *C-ducer* was not so hard a sound and far more preferable to the internal pickups, although these are generally considered to be quite good."

A contrast in drum recording styles in found in the techniques of **Jon Hiseman**. Jon has been recognised as leading British drummer since the late 60s and he has a very well equipped personal 24 track studio in suburban South London that has been designed especially with drum recording in mind, ie ceilings of at least 12 ft and a flattering degree of liveness.

As drummer with Barbara Thompson's Paraphernalia, his drums are recorded almost completely flat. For a forthcoming album *Shadowshow* with Rod Argent, Barbara Thompson and Clem Clemson engineered by Martyn Webster, the approach is quite different.

Jon's kit is a Rogers with four toms using double heads. It is miked in a fairly standard way with AKG *D125*s about 4 in from the tom heads, *D202* on the snare, a pair of *414*s as crossed pair overheads, a *C460* with *CK3* capsule positioned exactly 4 drum sticks height above the snare with the addition of bass drum and high hat mics—a total of 10 mics. All the drums use fairly light heads, Remo *CS* on top and Clear Ambassador bottom, and so require a fair degree of damping. This is achieved by taping 8 in *C-ducers* onto the skins to achieve the required amount of damping with gaffer tape. This is done on all the drums except the bass drum which is left alone. Even the high hat has a *C-ducer*; about 1 in gaffered to the bell and the rest of the body fixed to the central post. This has virtually no effect on the tonal quality of the high hat.

The output of the *C-ducers* pass through the desk where they are EQ'd to maximise the attack and effect of that particular drum. The signal is then sent to the key input of the noise gates, a selection of Keepex *I*s, Roger Mayer and Rebis types. The outputs of the mics are routed through the gates and the controls set up to achieve the best results from the mic signal. The bass drum and the crossed pair overheads are left untouched but the overheads are positioned and EQ'd to reduce the amount of MF and LF that they pickup. The *C460* above the snare is gated with a paralleled key from the snare gate. This gives the 'distant thwack' sound that is normally sent to the reverb units.

The results of this set-up are quite stunning. There is almost total separation between drums that are adjacent to each other. This allows complete freedom of processing the drums in a way that is usually restricted purely to electronic drums. There is of course a slight trade-off on the straight acoustic side of the drums with the sustain being slightly short but with judicious use of the overheads this can be overcome although of course the real reason for recording drums in this way is to make them easily processable discretely and so 'unnaturalness' is not a problem. Most surprising is the high hat. This has the advantage of a mic giving a very discrete sound in a position that would normally have picked up the complete kit.

Jon described the system as a somewhat critical business to set up and adjustments have to be made number to number. The drummer has to learn to work within a certain range of dynamics. Would the system be usable if the drummer was not in production control?

"If the producer was strong-minded enough to insist on how the drummer played then perhaps it would work, although being both drummer and producer I have a better chance of succeeding. This is not a system that we invented but I think that we have taken it farther."

Andrew Jones is a freelance live sound engineer who is currently chief engineer for Sky. They use *C-ducers* on piano, harpsicord and double bass.

"We started off following the diagrams from C-Tape but found that they didn't really work quite like they suggested. This was with the 30 in tapes. However, with the 8 in we found that you could get in between the struts and achieve a good separation between the two tapes. Sky always hire a piano for concerts and we specify either a Steinway or Yamaha. This means that for every new piano we have to find the tape positions from scratch. We have now developed a system of using a stethoscope to listen to the bottom of the piano first."

Are you listening for anything in particular?

"Basically I'm trying to get rid of a very hard mid peak—around 5 kHz. I always find that there is a position where you don't get any of that. I tend to put the tapes around that position and then bring the mid in with EQ if I have to. Listening to an instrument with the stethoscope is strange as the sound can be quite dramatically different over a distance of 3 or 4 inches."

You obviously go through a lot of pianos. Do you find that positions tend to be similar for all Steinways?

"No, not for Steinways. Sometimes there are dramatic positional differences occasionally going right to the bottom end of the piano. With Yamahas the positions are remarkably consistent."

Having optimised your positioning, what EQ would you use?

"I tend to EQ only to prevent bass feedback and perhaps a little the top end. I use a graphic 27-band to notch out anything that is bad news but these are more functions of the hall and stage rather than the piano/*C-ducer* combination. The stage positioning of the piano is right across the front of the drummer and we don't really have any problems but there is a 3 ft high perspex screen around the drums which stops the direct spill. John Williams used to use an electric guitar whose amp sat under the piano, and there was virtually no pickup at all.

"The double bass played by Herbie Flowers presented a lot of trouble. There seemed to be a lot of fluctuations in the front of the instrument that would cause the tape to come slightly loose and with about ¼ in unstuck we would hear this 'clipping' sound. To minimise this high level of resonance problem, the tape was positioned below the bridge towards the tail. Unfortunately the bass was damaged and after repair, the best position is now above the bridge towards the neck. Also since the repair it is possible to hear the creaking of the wood where another panel has been added when using the *C-ducer*. The double bass used in Australia is a Yamaha and that instrument is a problem as wherever you place the tape it sounds bad because the bass sounds bad anyway so that is a lot of EQ work."

Where are your pickups mounted on an average grand piano?

"Basically where the piano cutaway comes into the full length of the piano. I tend to go right up to the very edge of the piano towards the middle—that is about four struts down from the keyboard. This is very close for the top end but away from the middle of the piano. With the bass I'm almost going to the far end of the piano, about another four or five struts down. We always use the 8 in tapes and always positioned underneath. In addition to the tapes I use a *C451* mic over the piano and I reverse the phase on this so that it causes some cancellation in the mid register of the piano sound. Last year in Australia when recording the live album, the recording pickup was taken from the *C-ducers* together with a Neumann instead of the *451*. This was after experimenting with other mics and positionings but it was found that with the stage limitations the *C-ducers* were the best that could be achieved.

"With harpsicord the problems are different. The soundboard is very light but the *C-ducer* seems to damp it down less than other pickups and the output is bright enough to compensate for this anyway. The actual positioning is underneath the soundboard and more towards the top end.

"The only real problem we have encountered with *C-ducers* has been the sensitivity of the tapes. Using strange pianos all the time we find noise problems such as tin tacks on the soundboard, cracked soundboards, small screws and matches that have been dropped in—even a thick layer of dust can sometimes be heard. Set against that you have the amazing separation between top and bottom of the piano, the acoustic separation and full sustain even at HF and you cannot fault them in performance. In Australia, the critics were saying that this was the first classical piano they heard with a rock 'n' roll band that sounded like a classical piano with a rock 'n' roll band."

A conclusion

There is a wealth of valuable information emerging on what has to be considered a valuable addition to the engineers' arsenal. It is not the answer to everything and does not pretend to be but contact mics appear to be coming of age and this is certainly a good thing in live sound and the studio. If this means that acoustic screens can be removed while retaining separation and for no degradation of the sound, this will be good for music in general which must be better for us all eventually.

Out of space and I still haven't covered *C-ducers* on steel drums and the way the Penguin Cafe Orchestra *C-duce* Coca-Cola cans... ■

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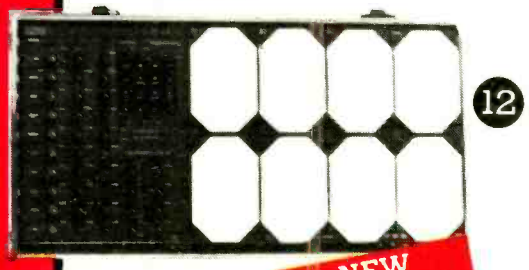

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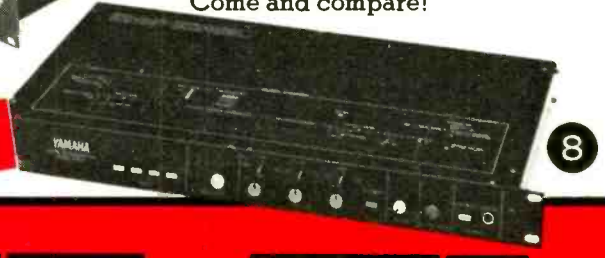

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456 ½ 10½ NAB	18.95	18.00	7
456 1 inch NAB	29.90	27.90	5
456 2 inch 10½ NAB	62.50	59.50	2
456 2 inch 14 NAB	144.00	140.00	2
457 7 inch (LP)	6.95	6.60	10
457 ¼ 10½ HUB Bulk pack	—	12.25	10

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A personal view of psychoacoustics–

IN the 'Human Ear' article (August 1983) much space was given to the biophysics of dynamic range. The first in the series on 'Overload' (May 1983) discussed at length the volume window that humanity is so fortunate to possess—the ability to hear such a vast range of sound levels, from the beating of one's own heart (in anechoic conditions) to the near pain of the front row at an AC/DC concert. This is just to reiterate the facts about the extraordinary dynamic control of the ear/brain combination.

Compressors and limiters

A limiter is an electronic device which works as a linear amplifier at all levels up to a predetermined threshold. If the input rises beyond that threshold, the amplifier gain reduces itself to prevent any further increase in output.

A compressor is an amplifier whose gain is proportional to (or a function of) the level at its output. In less precise language this means that a limiter 'limits' the output to a fixed level and a compressor 'squashes' the signal reducing its dynamic range. These devices are essential in the recording and broadcasting business, not only to avoid exceeding the dynamic range of the medium; but also for the comfort and convenience of the vast majority of listeners. Dynamic range of domestic equipment is hardly startling by present day professional standards (see the articles on digital/analogue techniques, *Studio Sound* October 1983) and even if discs, cassettes and tape were superb in this respect the 'party wall annoyance factor' would still demand a degree of dynamic compression to enable the quiet bits to be heard at all.

The other important psychoacoustic reason for the use of dynamic controllers is to produce a musical effect that makes the programme seem louder than it really is; to fool the brain into thinking that the ear itself is applying dynamic control. This added solidity that volume compression produces is not instantly recognised as any sort of 'fooling' process but as an effect that, in moderation, sounds indefinably 'better'.

Limited effect

If a limiter was really perfect, any signal passing through it would be absolutely controlled in level, right down to the leading edges of transients which characterise so many familiar sounds. Unfortunately, very often the identification information for the exact character of the sound is contained in the shape of the transient at the beginning. This means that it is essential that the limiter shall have a finite attack time if it is to preserve these characteristics. Luckily the ear is not too bothered about very short term distortions; it seems to base its quality recognition on a combination of the transient front and a more careful examination of the following bits. Thus, if the transient is essentially there but modified a little, and the main signal is limited, the result is not instantly recognised as a distortion of the original signal. The optimum attack time for a limiter to have minimal effect on the quality and musicality of the signal is in the range 200 μs to 1 ms. Very fast attack times produce apparent distortion (and over limiting due to the transient setting the gain) while longer times defeat the object of the exercise.

The compressor

The purpose of the compressor (whether the engineer knows it or not) is to play tricks on the ear of the listener. The ear and brain are pretty good at the interpretation of dynamics in the real world and this allows the compressor to do its job fairly easily. The ideal compressor for this purpose is one that fits the original description; a device with gain proportional to output. Paradoxically this means that it shall have no threshold at all, the gain varying at all times. In practice, very few compressors meet this criterion; the side chains usually have some form of threshold which can be set with front panel controls, but this is not strictly necessary and is a positive encumbrance to the pure approach. It is an undeniable fact that a 'true' compressor is the best tool for making signals seem louder with the minimum of perceived distortion, this being of enormous importance in the audio processing of classical music. However, a true compressor does some pretty awful things to the noise floor (ever listened to a dbx processed tape?) so some form of modification of the compression curve at low levels is often essential—a 'threshold'.

Compression attack and release

When looking at a compressor it is better to view attack time a little differently to ideas in limiters. In this context, 'attack' means the length of the signal that is allowed to pass through the amplifier before the gain changes to accommodate it. Ideally, this time should be zero, but in practice the ear is not particularly sensitive to small transient level changes provided that they are non-violent. Any change to an audio signal is a distortion. A device which changes its own gain as a function of the signal has to be treated with considerable respect as, not only is it

FIG 1

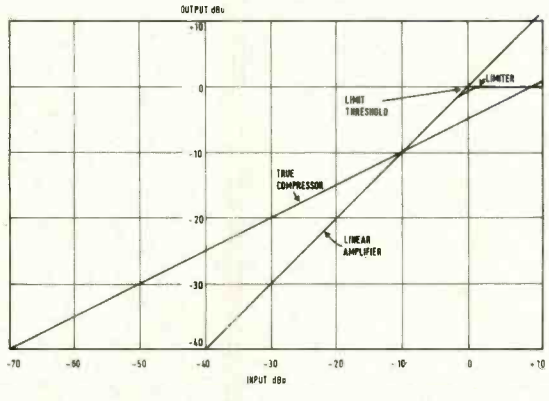


FIG 1 COMPRESSION CURVES
The diagram is calibrated in dB units. The linear amplifier line is shown as a comparison (an input/output ratio of 1:1). The compression line is drawn as a compression ratio of 2:1 dynamic range compression. The limiter threshold is shown at zero level output and clearly demonstrates how the amplifier controls its own gain and refuses to allow any level above this threshold. It should be noted that the compression curve is that of a true compressor and that most commercial units make use of a notional 'threshold' to minimise the noise increases due to low level compression.

FIG 2

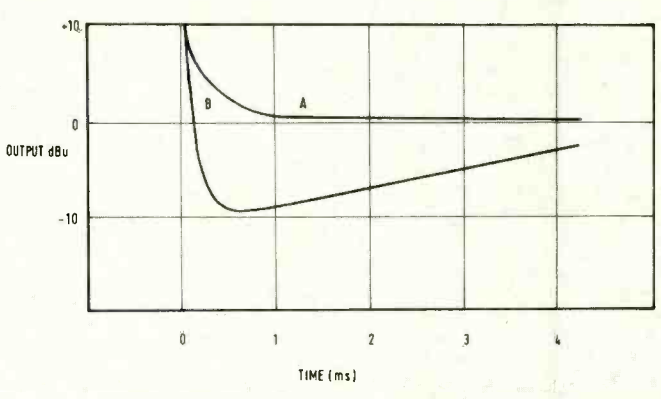


FIG 2 LIMITER ATTACK TIMES
Output level is shown with respect to time and demonstrates the effect of an over-short attack time. Curve A represents a suddenly applied tone and the gain of the limiter stabilises after about 0.6 μs. Curve B shows the same tone applied but with a limiter attack time that is too short for the stability of the side chain. This results in overlimiting and the production of audible dynamic distortion. Even with a well designed and stable side chain this effect can be seen if a high energy transient is applied; the limiter will react to it and reduce its gain further than is required by the useful programme content.

FIG 3 COMPRESSION SPECTRA
The original signal is shown as having a dynamic range of 70 dB with a noise level of −60 dBu and a 'mean' level of

the transparent compressor

Ted Fletcher

introducing distortion, but it is doing it outside the direct control of the engineer. There are one or two interesting and potentially dangerous side effects. If the attack time of a compressor is substantially longer than the wavelength of recurring high frequencies, these frequencies can be emphasised giving the real effect of HF lift. If release time is too short, even using low ratios of compression the ear will discern the waving about of gain and the effect will become disconcerting. An over long release time is self defeating as the programme content becomes effectively decompressed—the side chain can't catch up.

Historic compressors

Earliest compressors made use of 'variable mu' vacuum tubes. These had the property of a very simple but most effective gain changing mechanism. Early 'Westrex' and 'Presto' units, while being cumbersome, were incredibly easy to use and most effective, giving the result of gentle dynamic compression up to a fierce punchy effect, just by winding more gain in. Whether they would stand up to present day analysis is debatable but they bring back fond pre-1960 memories.

In the days of 'Telstar' (the record and the satellite) I was experimenting with photo-electric systems with Joe Meek in an attempt to produce a simple-to-use compressor with the effect of the 'Westrex' but without its second harmonic distortion. The results of this development took the form of a simple attenuator using an ORP12 cadmium sulphide cell and a small power amplifier driving a flashlight bulb to activate it. The attack and release times implicit in the bulb illumination provided an ideal characteristic, a small amount of adjustment being possible by applying a variable DC bias to the bulb to speed up the attack and slow down the decay time. The circuits were used on countless pop records of the time.

Up-to-date

Present day designs for limiters and compressors tend to make use of voltage controlled amplifiers as the active elements. This is understandable as VCA's eliminate the problems of noise, harmonic distortion and reaction time, as well as possessing a linear voltage to logarithmic gain change characteristic that is essential to correct compressor operation. All the clever work is done in the side chain; the electronics that sets the attack, release, ratio and law of the system. The only danger now is that the devices have become so versatile that manufacturers tend to market them as all things to all engineers and fit far too many variable functions—fine for the designer but useless to the harassed engineer who has another quarter of an hour to get the voice down. The situation is improving with excellent simple devices to do specific jobs in dynamic control.

Noise reduction

The psychoacoustic picture would not be complete without the expander and noise gate. These devices are used exclusively for improving signal to noise ratios either as 'one shot' units to reduce noise during silent passages, or in combination with compressors in two part noise reduction (viz Dolby, dbx, etc). One shot devices are generally used when a noise problem exists and removal of the distraction of unwanted sounds is certainly preferable to the small transient distortions that are produced by a good noise gate.

The psychoacoustics of noise reduction have been examined most thoroughly and notably by Dr Ray Dolby whose thinking is based on the 'masking' effect of specific frequency sound over noise within a spectrum that contains that frequency. By experimentation, Dr Dolby deduced that provided the bandwidth of the noise was not too wide, the ear was unable to separate out and detect it under a similar bandwidth of signal. Practical considerations dictated that splitting the audio into four bands was an adequate compromise and in the classic Dolby A system, there are four compressors and expanders with complementary attack and release characteristics.

Whilst there are engineers and audiophiles who claim to be able to hear or sense the presence of a Dolby, it cannot be denied that the system works—perhaps they should try an 8-band system? The dbx and other companders approach noise reduction in a very much simpler way. The theory says that if an audio signal is accurately compressed and then expanded again using identical law and characteristics, the resultant signal will be identical to the original . . . Gong. It sounds good but physics doesn't work that way. Once a signal enters the side chain of a compressor, it is subject to time constants, when it is reconstituted in the expander, the levels have altered in a non-linear manner and the action of the 'mirror image' constants create small level variations compared to the original. On artificially created sounds (sorry pop industry) this small discrepancy is not enough to be a problem but the use of simple companding on classical music and natural sounding speech is a discernible abomination—the noise pumping and distortions fuelling the fires of the digital revolution. ■

FIG 3

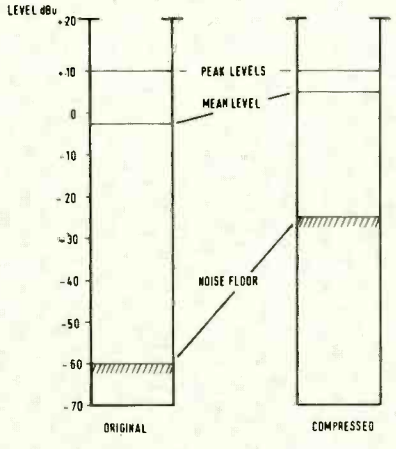
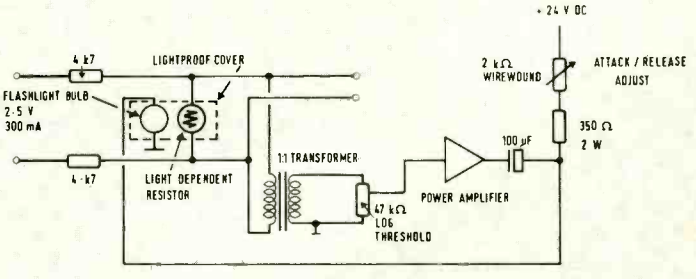


FIG 4



– 4 dBu.

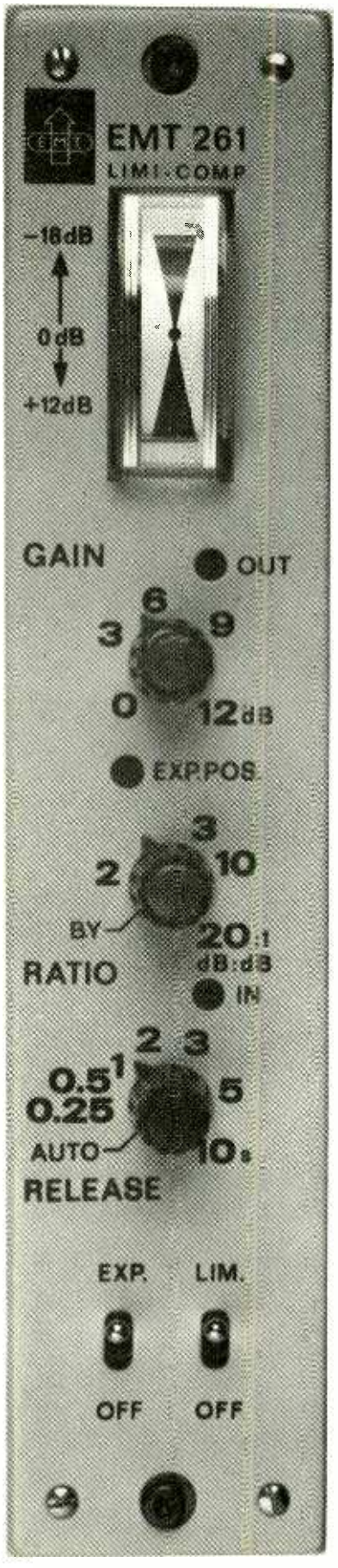
After compression the mean level (apparent loudness) has increased to approx + 3 dBu but the noise floor has risen to – 25 dBu, a compression ratio of 2:1 resulting in an output advantage of 7 dB, a noise figure degraded by 35 dB but retaining the + 10 dBu peak level. It just goes to show that you can't get something for nothing!

FIG 4 AN HISTORIC COMPRESSOR

For anyone interested in recreating the 'suck and blow' of the '60s pop records, the circuit block is shown of the original Joe Meek compressor; a slackly guarded secret for 20 years.

The circuit is in balanced form and was used straight off the output of an ancient (even then) *BTR2* during his tape-to-tape mono dubs. The power amplifier then was a single tube horror capable of all of a watt. In reality, anything will do as long as the switch-on surge doesn't blow the bulb (this was a constant hazard in the old days, and was difficult to detect with the bulb and ORP12 wrapped in black plastic tape to keep the light out!). The low value of coupling capacitor was a crude attempt to frequency shape the side chain and is useful in the reduction of LF bumps. The DC adjuster allows a standing current in the bulb; not enough to attenuate too much, but enough to speed up the heating of the filament.

Back to mono! . . . Well psychoacoustics was getting far too serious.



EMT 261

Hugh Ford

MANUFACTURER'S SPECIFICATION
Power supply:
Operation from 24 VDC supply stabilised to ±1 V, grounding arbitrary, constant current consumption approximately 160 mA, constant power consumption approximately 3.8 W. The unit may be supplied from a higher DC voltage through an external series resistor (6.25 Ω per V).

Input connections: balanced, floating.
Source impedance: 30 to 600 Ω.
Input impedance: approximately 10 kΩ.
Input level: —10 to +6 dB, adjustable by means of the preset control IN (up to —20 dB with internal connection change).
Overload margin of the input: 20 dB above the chosen nominal value, but maximum +21 dB.

Output: balanced, floating.
Load impedance: ≥200 Ω.
Output impedance: approximately 40 Ω.
Output level: —20 dB to +6 dB adjustable by means of the control screw **OUT.**
Overload margin of the output: maximum +21 dB with 600 Ω load.

Meter and control elements (on front panel).
Meter shows instantaneous gain with zero gain in the centre; Control knob COMPR. GAIN continuously adjustable 0 to 12 dB; Control knob RATIO continuously variable 2:1 to 20:1 (dB to dB); in the counterclockwise position (position BYPASS) the compressor, limiter and expander functions are disabled by means of a switch; control knob RELEASE TIME for compressor/limiter release time constant continuously variable 0.8 s/10 dB to 8 s/10 dB; in the counterclockwise position (AUTO) the recovery time is controlled by the programme; preset IN; preset OUT; preset EXP POS; the LIM switch switches the limiter in and out; the EXP switch switches the expander in and out.

Unit overall
Frequency response: 40 Hz to 15 kHz ±0.5 dB with 200 Ω load —1 dB at the band limits.
Distortion: less than 0.5% at internal nominal level and automatic control at 1 kHz.
Signal to noise ratio: 73 dB RMS with compression gain = 0 dB.

Compressor
Attack time: approximately 2.5 ms.
Total compression gain: 30 dB = +12 dB/ —18 dB.

Expander
Attack time: automatic.
Release time: automatic.
Ratio: 1:2.5 (dB:dB) expander threshold adjustable by means of the preset EXP POS from —55 to —35 dB abs.

Electrical connections: via 13 pole connector Tuchel T2706 at rear.
General Weight: 0.6 kg (1.3 lb).

Manufacturer: EMT-Franz GmbH, Postfach 1520, D-7630 Lahr, West Germany.
UK: FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ.

THE EMT *261* is a very small compressor/limiter with the additional facility of being able to expand low level signals to effectively reduce system noise. Intended for mounting into a system's cabinet the unit requires external powering from positive or negative rails in excess of 24 VDC, higher rails required a series resistance of 6.25 Ω per additional volt. The 190 mm high by 40 mm wide front panel has at the top a meter showing the operational gain over the range +12 to —18 dB with a central 0 dB mark.

Beneath this there are three potentiometers with knobs in addition to three recessed screwdriver operated potentiometers. The top knob controls the gain of the unit when operating below the compression threshold giving 0 to 12 dB gain at low levels. Next there is the compression ratio potentiometer with calibration points at 2, 3, 10 and 20:1 ratios plus a fully anticlockwise position which operates a bypass switch—this leaves the input and output stages in circuit and bypassing the gain control section. The third potentiometer controls the release time of the compressor over the range 250 ms to 10 s with a fully anticlockwise 'auto' switched position where the release time is programme controlled.

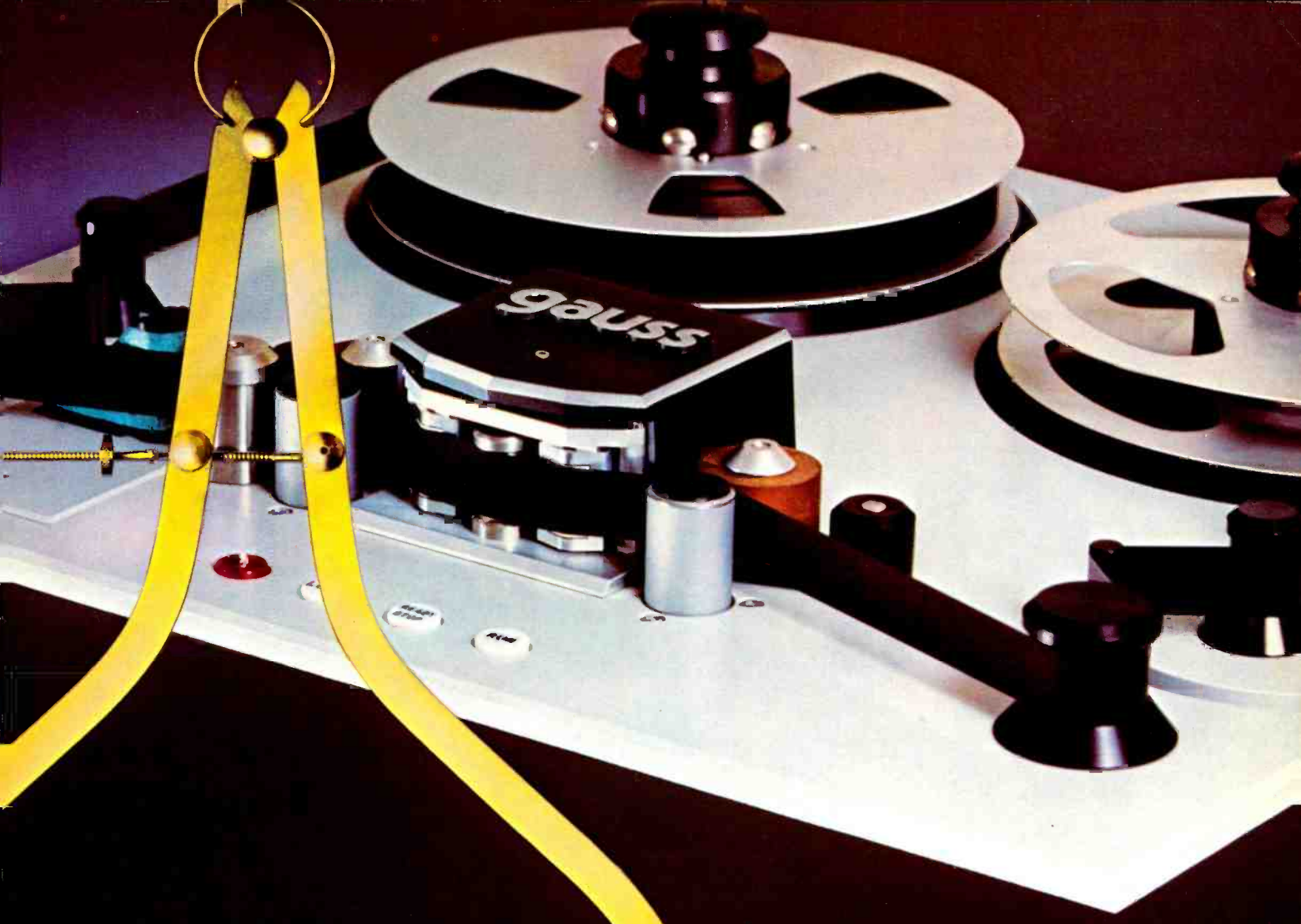
At the bottom of the panel two miniature toggle switches turn the low level expander and the peak limiter on/off. The three screwdriver operated potentiometers set the input and output gain and also the threshold at which the low level expander operates.

To the rear there is a single 13-way connector which in addition to handling the balanced input and output and power, has pins for an external gain meter and for either external gain control or stereo linking. Access for servicing is obtained by loosening two screws at the rear so that the metal cover can be removed. Loosening two further captive screws allows one of the two good quality printed circuit boards to be hinged up to give ready access to all the components. Whilst only one of the glass epoxy printed circuit boards had component identifications the instruction manual includes full layout diagrams, circuits and alignment instructions for the user controls—information about the 11 internal preset potentiometers is not included!

The general standard of construction was very good with the integrated circuits being socketed for ease of servicing and the front panel controls uncluttered and clearly identified.

Inputs and outputs
The transformer coupled input had an impedance which varied from 10 kΩ at minimum gain to 21.1 kΩ at maximum gain. The impedance being relatively high means that the 2:1 variation is unlikely to be troublesome. The maximum input level at the onset of input clipping was satisfactory at +24.5 dBm with the

74 ▶



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common mode rejection being good as shown in **Fig 1**.

At the floating transformer coupled output the impedance was 34 Ω at 1 kHz with the output being capable of driving +21.8 dBm loaded into 600 Ω or +24.8 dB.7V into a high impedance. The output level control allowed the output to be varied between +11.8 dBm and —20.5 dBm when the unit was set to limit.

At the control voltage (stereo linking) terminal the relation between gain and control voltage was approximately 0.35 V/dB from a high impedance.

Frequency response

In the bypass mode the overall frequency response was as shown in **Fig 2** with the bandwidth being sensibly limited to 80 kHz, the unit being free from radio frequency interference problems. Using a probe tone, an identical response was obtained when compresssing 10 dB with a 3:1 compression ratio. In all other modes the frequency response remained equally flat in the 20 Hz to 20 kHz area.

Noise

Noise was measured in the output with the unit set for unity gain and the limiting output corresponding to +3 dBm and the results are shown in **Table 1**. These figures must be interpreted bearing in mind the limiting output and the output drive capability.

Altering any control settings failed to produce unwanted clicks or other aberrations and provided care was taken in screening the control (stereo link) lines no noise problems occurred.

Distortion

In the bypass mode the second and third harmonic distortion at +10 dBm in/out was as shown in **Fig 3**. At lower input/output levels the harmonic distortion did not exceed these levels but remained much the same down to —10 dBm in/out.

When compressing 10 dB with the release time set to maximum the harmonic distortion was as **Fig 4** showing a very rapid rise in third harmonic at high frequencies. Whilst this probably doesn't matter, the twin tone CCIF intermodulation distortion above 10 kHz shown in **Fig 5** is a different matter. These plots of distortion were relatively insensitive to the setting of the compression ratio and did not vary widely with the degree of compression.

At low levels using the expand or gain function had no significant effect upon distortion with the harmonic distortion remaining as per **Fig 6** and the third order twin tone intermodulation distortion being 0.3% at 20 kHz increasing at 6 dB/octave.

Gain characteristics

The limiter section when switched in was found to be fast acting, reducing overloads to the threshold level of +3 dBm in 50 μs.

76 ▶

FIG 1
EMT 261 COMMON MODE REJECTION

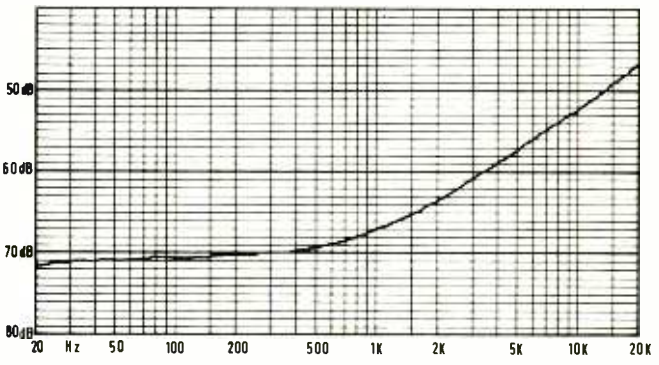


TABLE 1

Measurement method	Bypass mode	Output noise in dBm Low level gain maximum	Any other setting
22 Hz to 22 kHz RMS	—73.5 dBm	—64.3 dBm	—70.7 dBm
A-weighted RMS	—78.6 dBm	—69.3 dBm	—72.2 dBm
CCIR-weighted RMS	—70.0 dBm	—60.6 dBm	—63.8 dBm
CCIR-weighted peak	—66.4 dBm	—56.5 dBm	—59.7 dBm
CCIR-ARM ref 2 kHz	—76.8 dBm	—67.2 dBm	—70.4 dBm

FIG 2
EMT 261 FREQUENCY RESPONSE IN BYPASS MODE

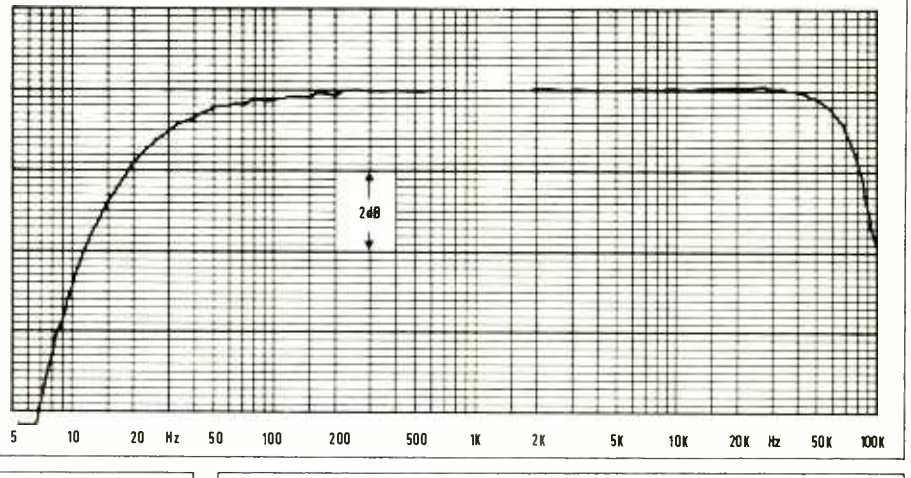


FIG 3
EMT 261 HARMONIC DISTORTION BYPASS MODE

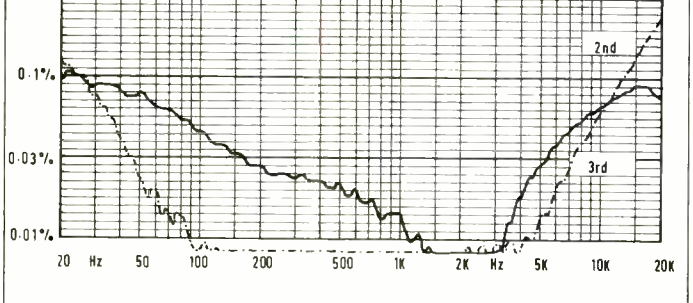


FIG 4
EMT 261 HARMONIC DISTORTION, 10dB COMPRESSION, 3:1 RATIO

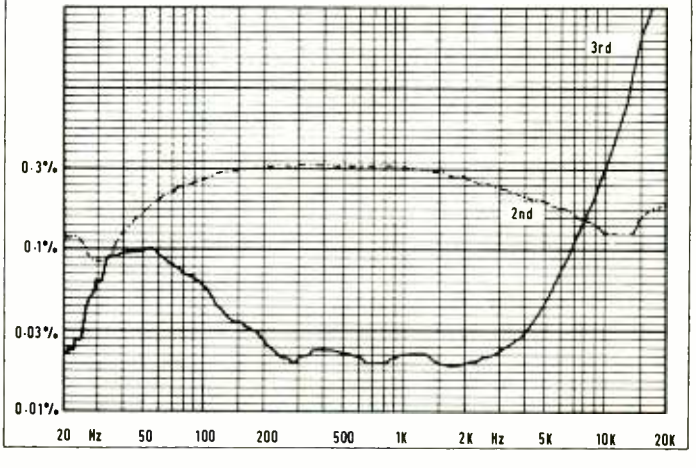


FIG 5
EMT 261 IM DISTORTION

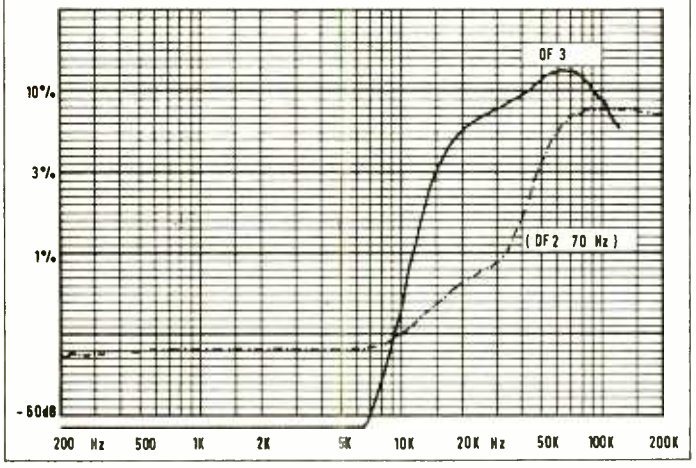


FIG 6
EMT 261 HARMONIC DISTORTION AT LOW LEVELS

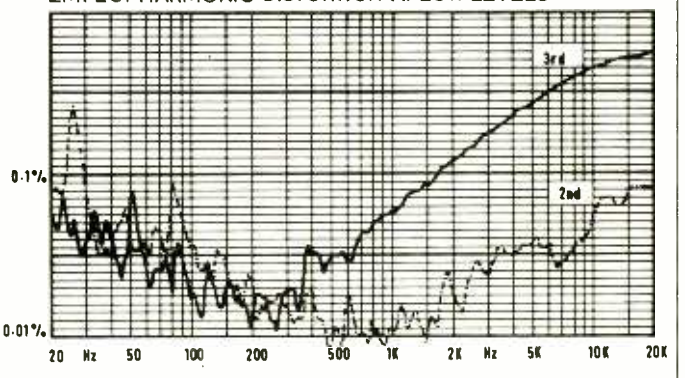


FIG 7
EMT 261 COMPRESSION CHARACTERISTICS

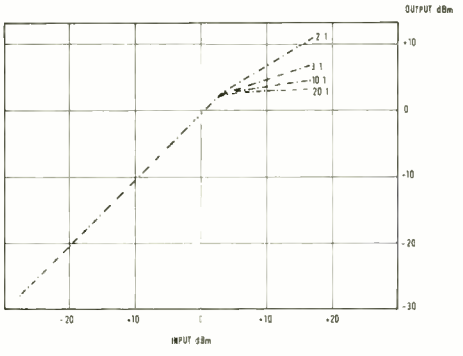
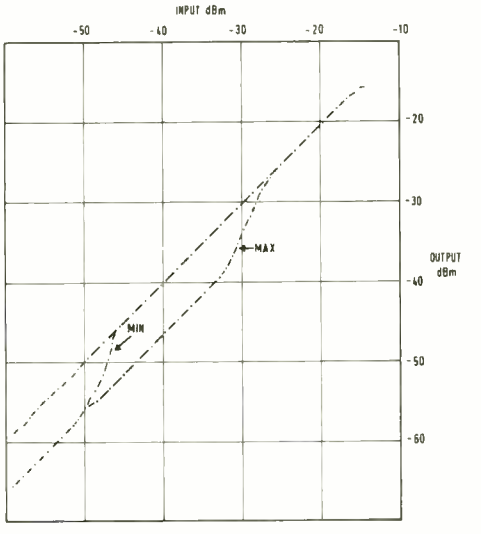


FIG 8
EMT 261 THE EXPANDER



As the compressor acts about the same threshold, more persistent 'overloads' also introduce compression with the appropriate release time effecting the gain recovery from limiting. The compression characteristics are shown in **Fig 7** for various compression ratios, it being seen that the compressor's threshold is very well defined.

The attack time of the compressor was independent of the degree of compression, taking about 4 ms to complete compression with the release time in the auto or manual mode. Manual release times could be varied from 120 ms to 12 s with the automatic position varying the release time with the programme content.

The effect of the gain control was to change the unit's gain at low levels by up to 12 dB whilst switching in the expander had a rather different effect shown in **Fig 8**. Setting the expander threshold to minimum or maximum shifted the expansion characteristics as shown with the expansion ratio remaining at 2.5:1 dB-wise over a 10 dB output range.

Other matters

The gain meter tended to be rather slow in action so that it was sometimes rather difficult to comprehend what was happening within the unit.

Subjectively the compressor section worked well with the manual release time control having a more than satisfactory range. However the automatic release system could in some circumstances lead to noise breathing.

The gain control had excellent subjective effects, in particular giving a smooth increase in loudness without objectionable effects.

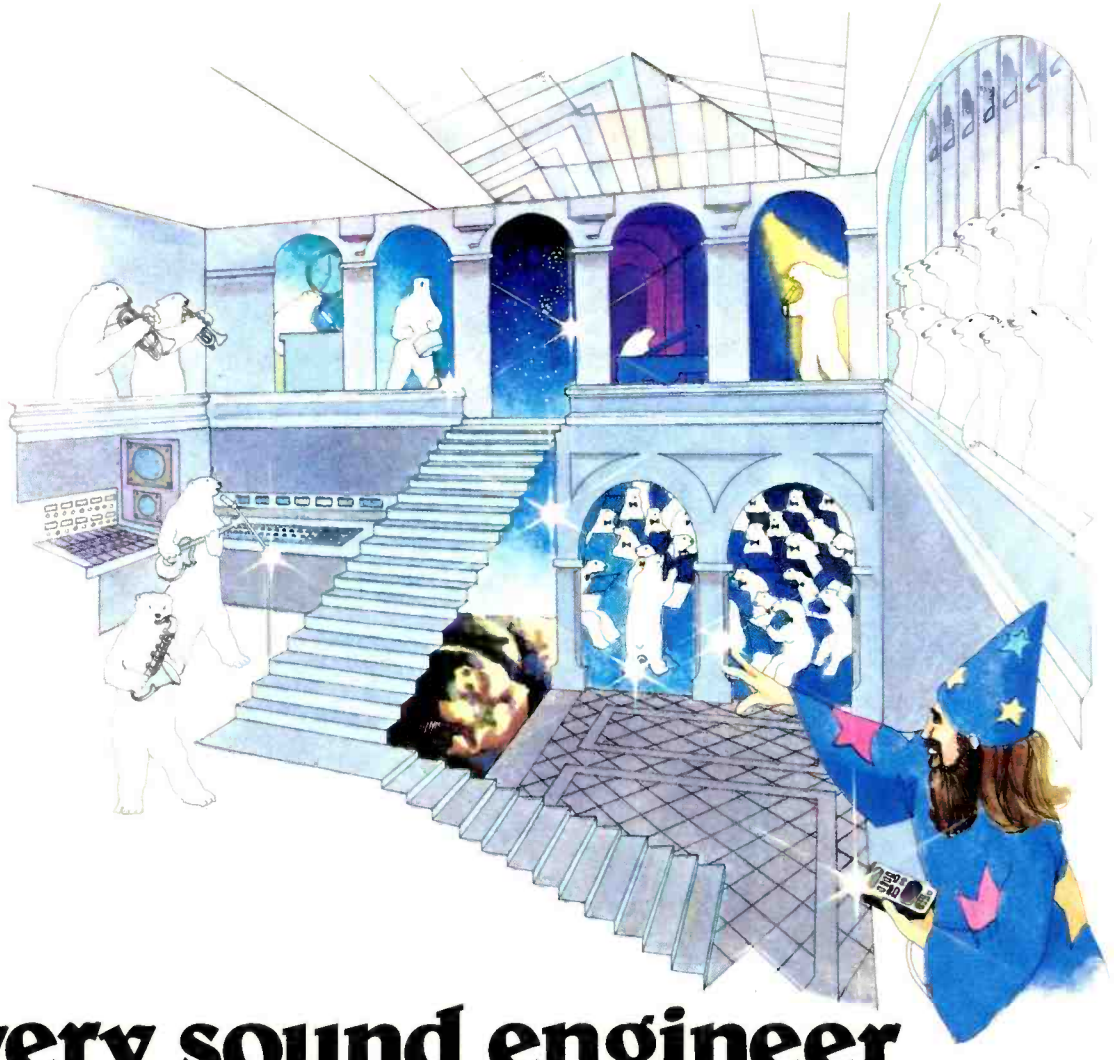
Whilst the expander section is useful the time constants seemed to be too long leading to noise breathing effects on noisy programme material.

Summary

The EMT *261* 'Limi-Comp' is a very compact compressor/limiter et al which is well made to proper professional standards.

In operation the unit met all that is claimed by the manufacturer. However the distortion performance is bettered by other manufacturers.

If the unit is used with care excellent results can be obtained but careless use easily leads to gain pumping in one form or another. ■



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UREI LA4

Hugh Ford

MANUFACTURER'S SPECIFICATION
Input: balanced bridging differential amplifier.
Input impedance: 40 kΩ, used as a balanced input. 20 kΩ, used as an unbalanced (sing e-ended) input.
Equivalent input noise: less than −90 dBm (15.7 kHz bandwidth) input and output terminated with 600 Ω load.
Maximum input level: determined by rear panel switch to allow for optimum operation in different level environments, HIGH range maximum +20 dB*, LOW range maximum 0 dB*.
Gain: adjustable with front panel gain control. Maximum 20 dB with input level switch in LOW position or 40 dB with switch in HIGH position.
Frequency response: ±0.5 dB, 20 Hz to 20 kHz.
Attack time: 1 to 10 ms for 63% correction, depending on signal waveform.
Release time: 100 ms to 1 s for 63% return, depending on duration of limiting.
Compression ratio: 2:1, 4:1, 8:1, 12:1, or 20:1, switch selectable from front panel.
Threshold of limiting: adjustable with front panel threshold control and rear panel input level switch. Minimum level (±2 dB) to achieve 1 dB limiting is:

Ratio	Low range	High range
2:1	−61 dB*	−41 dB*
4,8,12,20:1	−45 dB*	−25 dB*

Output: floating, transformer isolated.
Output load: 150 Ω or greater.
Power output: +24 dBm into a 600 Ω load (12.8 V) +20 dB* into a 150 Ω load.
Power requirements: 100 to 125 VAC or 200 to 250 VAC, 50/60 Hz, switch selectable, less than 10 W.
Environment: operating, 0° C to +50° C, storage −20° C to +60° C.
Connections: input and output, through rear chassis barrier strip. Stereo interconnect through phono jack. Power through 3-wire IEC style connector.
Indicators: standard VU meter, switch selectable to read output level (0 VU reference +4 dBm or +8 dBm) or amount of gain reduction. LED indicator for input overload. LED power indicator.
Dimensions: 216 × 89 mm (WH) rack panel, depth behind panel 203 mm. (8½ × 3½ × 8 in WHD).
Finish: panel 3.18 mm (⅛ in) brushed, clear anodised aluminium in two shades. Chassis is cadmium plated steel.
Weight: 2.95 kg (6.5 lbs).
Shipping weight: 3.63 kg (8 lbs).
Accessories: single rack mount kit, No SR-1. Double rack mount kit, No DR-1. Model 301 XLR/QG adaptor kit for input and output.
* 0dB = 0.775 V RMS.
Manufacturer: United Recording Electronics Industries, 8460 San Fernando Road, Sun Valley, CA 91352, USA.
UK: FWO Bauch Limited, 49 Theobald Street, Boreham Wood, Hertfordshire.

THE UREI model *LA4* is a single channel compressor/limiter having the option of ganging units for stereo operation, there being an accessory rack mount kit available for single or twin units.

Contained in a steel box the unit has a brushed aluminium front panel with clear black control identifications. To the left of the panel an illuminated VU meter may be switched to indicate gain reduction or output level in two ranges—0 VU corresponding to +4 dBm or +8 dBm.

The VU meter switch is the outer of a concentric control to the right of the panel, the inner of this pair being the output level potentiometer.

A further pair of concentric controls at the middle of the front panel consists of an outer rotary switch selecting the compression ratio and an inner compressor threshold potentiometer. The selected compression ratio may be 2:1, 4:1, 8:1, 12:1 or 20:1.

Further front panel features are a red LED giving warning of input overload, a stereo/mono switch and the power on/off switch with an adjacent red power on LED—this being superfluous as the illumination of the VU meter serves this purpose.

To the rear the electronically balanced input and floating transformer coupled output are at a barrier strip which includes a single ground connection. Mains power is applied by an IEC connector with a properly identified power fuse and tap change switch near by.

There remains to the rear a phono socket for stereo linking and a slide switch selecting high or low input gain.

Within the unit all components except the power input and mains transformer are mounted onto a single, good quality epoxy glass printed circuit board with clear component identifications.

Five internal preset potentiometers are fitted, the instruction manual advising upon the setting of these and including general maintenance information in addition to full circuits and operational information—all very well

80 ▶

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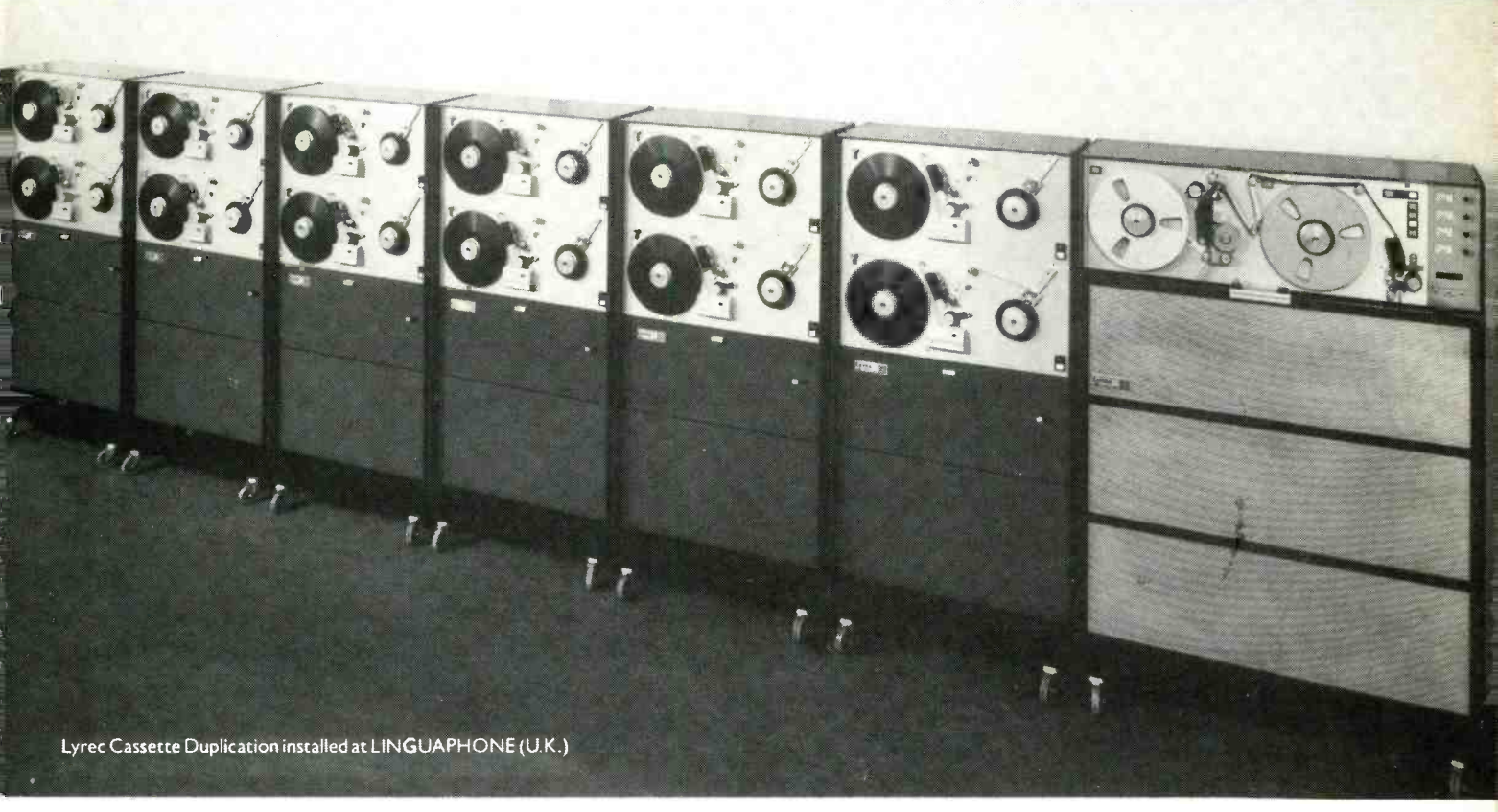

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presented.

The general standard of electrical and mechanical construction was very good with integrated circuits being socketed and access to all components being very easy.

Inputs and outputs

The electronically-balanced input had an impedance of 44 kΩ when working balanced or 22 kΩ when working single-ended, both constant with control settings. In the high level input mode the unit could accept +21.3 dBm at the onset of input clipping, this being 20 dB lower in the high sensitivity setting of the rear panel switch.

Common mode rejection was very good at low frequencies as shown in **Fig 1** with the overload warning LED operating on the verge of input clipping with the unit needing about 5 ms of overload to give a readable indication.

At the output the transformer coupled floating connection had a source impedance of 40 Ω at 1 kHz with a drive capability of +26 dB.7 V or +25 dBm when loaded into 600 Ω.

The VU meter, which is sensibly wired across the outut terminals when measuring the output level, correctly indicated 0 VU for either +4 dBm or +8 dBm output according to the front panel switch setting.

At the switched stereo link input/output the impedance was 4.6 kΩ with the link being unusual in function as it does not operate with a DC control signal but an AC audio waveform.

Frequency response

The overall frequency response when not compressing was as shown in **Fig 2** being very flat within the audio band with a well placed roll-off at ultrasonic frequencies.

The response of the VU meter was flat to 16 kHz where it fell to −0.5 dB with a further fall to −1 dB at 20 kHz.

When compressing under any conditions the sinewave frequency response was flat within 0.5 dB from 20 Hz to 20 kHz.

Noise

Noise in the output was measured at maximum output gain where the gain from the input is 21 dB in the normal input setting or 41 dB in the high sensitivity setting.

Output noise was found to be completely independent of other control settings in the idle mode and to vary almost linearly with compression (see **Table 1**).

No mains hum or other unwanted noise occurred with all controls being silent in operation and the unit operating over a very wide range of mains input voltages.

Distortion

Second and third harmonic distortion at +10 dBm in and out with no compression is shown to be low in **Fig 3** the distortion reducing further at lower operating levels. The same applied to the CCIF difference tone intermodulation distortion shown in **Fig 4** but this rose to rather high levels at ultrasonic frequencies.

The use of photoresistors as gain control elements is fraught with complex relations between gain and harmonic distortion and the UREI *LA 4* is no exception. Distortion in general

82 ▶

Table 1

Measurement method	Noise in output: Normal gain, No compression	Noise in output: High gain, No compression	High gain 10 dB COMP
22 Hz to 22 kHz RMS	−73.0 dBm	−56.0 dBm	−66.0 dBm
A weighted RMS	−76.0 dBm	−58.6 dBm	−69.0 dBm
CCIR weighted RMS	−67.5 dBm	−49.8 dBm	−61.0 dBm
CCIR weighted quasi peak	−63.5 dBm	−46.0 dBm	−56.2 dBm
CCIR weighted ARM	−76.0 dBm	−56.0 dBm	−67.4 dBm

FIG 1
UREI LA4 COMMON MODE REJECTION

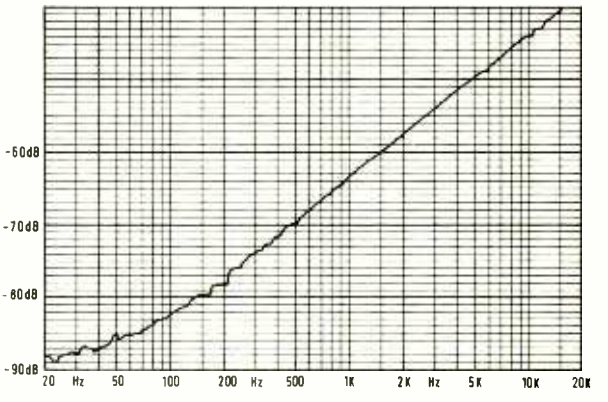


FIG 2
UREI LA4 OVERALL FREQUENCY RESPONSE, NO COMPRESSION

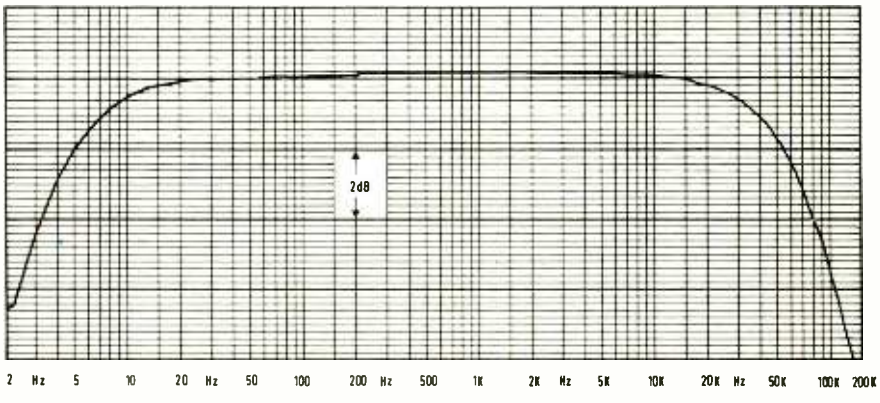


FIG 3
UREI LA4 HARMONIC DISTORTION, +10 dBm, NO COMPRESSION

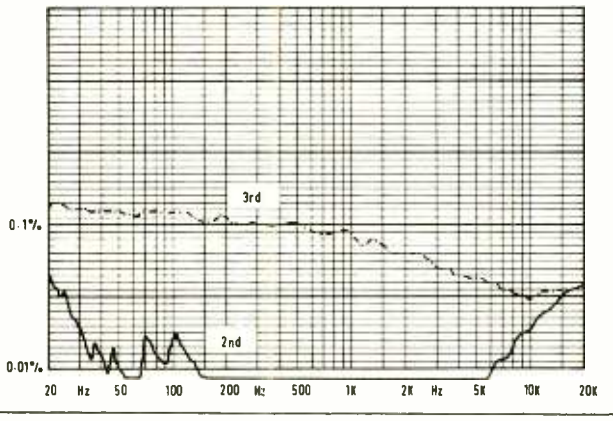


FIG 4
UREI LA4 IM DISTORTION, +10 dBm, NO COMPRESSION

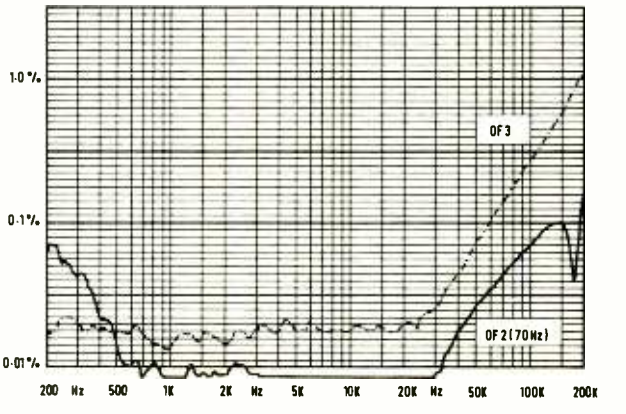


FIG 5
UREI LA4 HARMONIC DISTORTION,
+10dBm, 10dB GAIN REDUCTION 8:1 RATIO

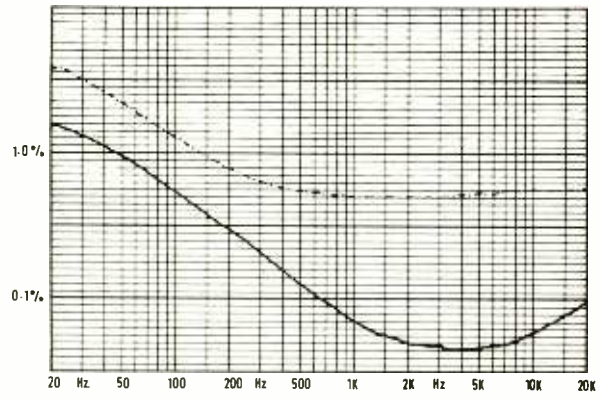


FIG 6
UREI LA4 HARMONIC DISTORTION,
+10dBm, 5dB GAIN REDUCTION 8:1 RATIO

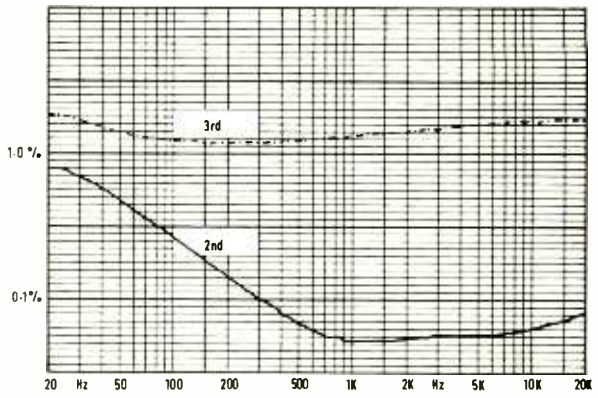


FIG7
UREI LA4 IM DISTORTION,
+10dBm, 5dB GAIN REDUCTION 5dB

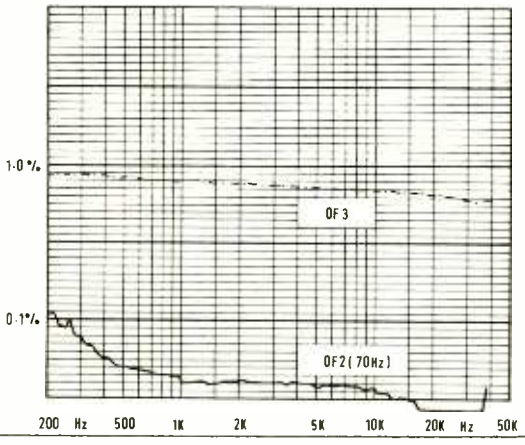
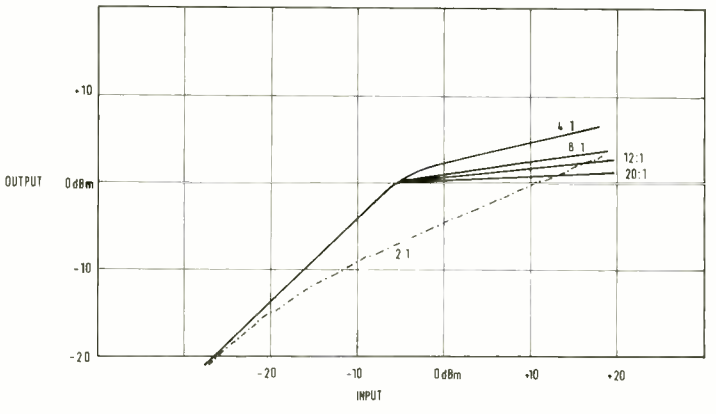


FIG 8
UREI LA4 COMPRESSION CHARACTERISTIC



was insensitive to the compression ratio and levels under compression conditions but had a complex relation with the amount of gain reduction.

Fig 5 shows the harmonic distortion at +10 dBm in and out with 10 dB of gain reduction and 8:1 compression ratio with **Fig 6** showing harmonic distortion with 5 dB gain reduction under otherwise identical conditions.

The conditions under which **Fig 6** was made appeared to be a worse case condition, but unfortunately 5 dB gain reduction is a common user condition.

Unlike harmonic distortion, the intermodulation distortion was insensitive to the compression ratio or the amount of compression once compressed conditions were entered. Typical results are shown in **Fig 7** which was plotted at +10 dBm input and output with 5 dB compression at 8:1. Altering the input/output levels made little difference to the IM distortion under compression conditions.

Compression, attack and release

The static input/output characteristics for the available compression ratios are shown in **Fig 8** for a constant threshold setting, it being noted that the 2:1 ratio differs from the others. This is intended by the manufacturer with the threshold in the 2:1 ratio being dropped by 16 dB which is apparent in **Fig 8**.

Under any conditions the threshold control had a range of 20 dB which was found to be more than adequate.

Both the attack and the release time were programme dependent with the attack being 1 ms for heavy compression ranging to 10 ms for less violent compression. Release was a maximum of 1 s ranging to 200 ms when releasing from mild compression.

Other matters

The VU meter was found to be too slow to meet the correct dynamics making −1 dB on a 300 ms toneburst which should produce an overshoot past 0 VU with the fall time from 0 VU being too fast at 200 ms. The rectifier characteristic was, however, correct.

Not having any manual control over the attack and release times means that noisy programme material could give serious noise breathing.

Summary

This is a well made unit supplied with a very good instruction manual giving comprehensive servicing information.

The controls on the unit make this a fairly basic compressor/limiter with rather limited useful applications as there is no manual control of the time constants.

From a performance point of view all was well except for the distortion performance which is not particularly good in view of the use of photoresistors which are not easy to use as gain control elements. ■

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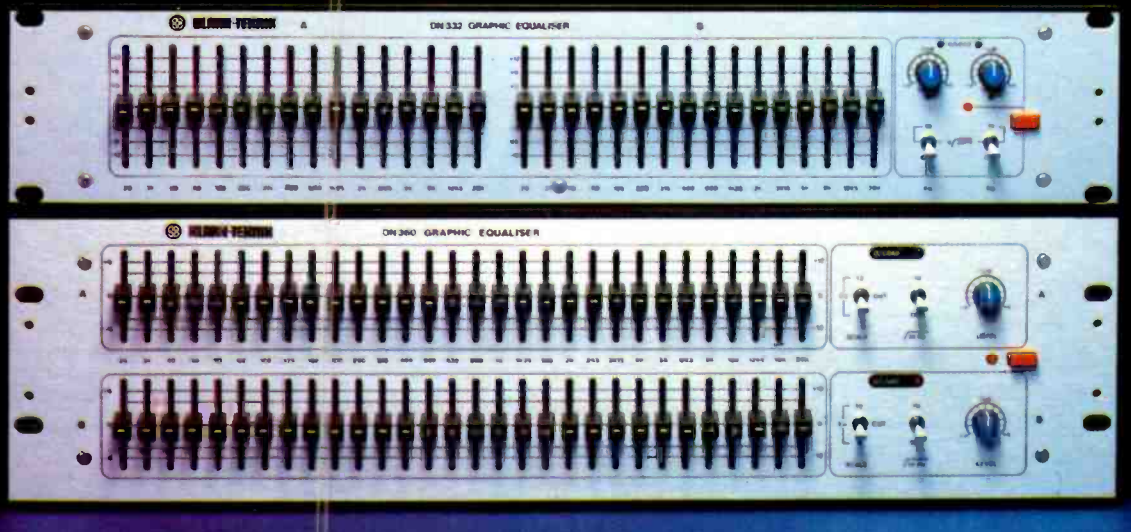

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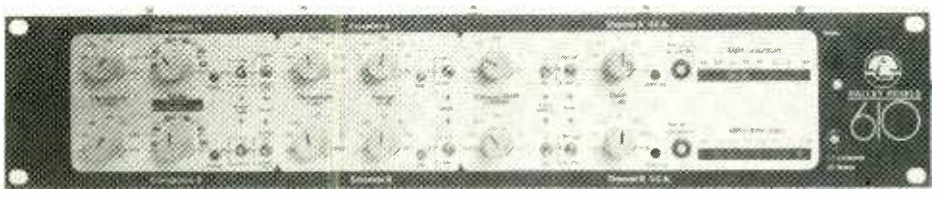

Valley People 610

Hugh Ford

MANUFACTURER'S SPECIFICATION
Input impedance: >47 kΩ.
Maximum input level at 1 kHz: +24.5 dB.
Nominal input level at 1 khz: 0 dB.
Range of input levels for 0 dB output, no compression at 1 kHz: ±15 dB.
Input CMR at 50-60 Hz (ref input): >60 dB.
Output source impedance, balanced: <40 Ω.
Output impedance, unbalanced: <27 Ω.
Nominal output level, 600 Ω balanced: 0 dBm.
Nominal output level, 600 Ω unbalanced: 0 dBm.
Maximum output level, 600 Ω balanced*: +24 dBm.
Maximum output level, 600 Ω unbalanced*: +21 dBm.
Static total harmonic distortion at 1 kHz, 0 dBv input, unity gain RL = 600 Ω: 0.015%.
*0.1% total harmonic distortion into 600 Ω.
Static SMPTE IMD, 0 dB input, unity gain, RL = 600 Ω: 0.2% Dynamic THD at 1 kHz +20 dB input, 20 dB compression, RL = 600 Ω: 20 μs attack 0.2%. 1 ms attack 0.1%, 10 ms attack 0.05%.
Compression ratio: adjustable from 1:1 to 50:1.
Expansion ratio: selectable for 1:2 (expand) or 1:20 (gate).
Output noise at unity gain, R source 1 kΩ, RL = 600 Ω: −82 dB.
Power supply: 50-60 Hz (100, 120, 200, 220, 240 VAC).
Power consumption: 12 VA.
Dimensions: Model 610 Dual Compressor/Expander is packed in a 482 mm rack mount, 2 units high 88 mm and 216 mm deep (19 × 3½ × 8½ in).
Weight: 3 kg (6.5 lbs).
Manufacturer: Valley People Inc, PO Box 40306/2820 Erica Place, Nashville, TN 37204, USA.
UK: FWO Bauch Limited, 49 Theobald Street, Boreham Wood, Hertfordshire.

The Valley People *610* is a dual channel compressor limited of considerable complexity. The two channels may be used independently or ganged for stereo use, in which case the controls must be fairly closely matched if odd effects are to be avoided.

Logically, the unit comprises three sections, a compressor section, an expander section and the voltage controlled amplifier section.

The compressor section to the left of the 19 in rack mounting panel can perform two separate functions, either to act as a variable slope compressor or as a voiceover gate. In either case a potentiometer to the left sets the threshold of operation between +20 dBm and −40 dBm input. The adjacent ratio potentiometer serves two purposes; in the compressor mode it sets the compression ratio between 1:1 and 60:1 with a mid point of 2:1. In the voiceover mode it sets the amount of 'ducking' between 5 dB and 55 dB with the control signal being derived from a second rear panel audio input.

Further controls in the compressor section are two 3-position toggle switches for each channel plus a yellow LED which is illuminated when compression is in action. One switch selects the mode between off, compressor and voiceover with the second switch selecting the compressor's attack line between 20 μs, 1 ms and 10 ms.

Within the expander section a 3-position toggle switch sets the expander's slope to 1:2 or 1:20 with the third position off. Like the compressor, a potentiometer sets the threshold from +20 dBm to −40 dBm input with a second potentiometer setting the range over which expansion occurs.

In practice, the threshold controls the upper input level of the expanded section with the range of expansion controlling the lower limit of the expansion curve. Using the 1:20 expansion ratio means that the unit can act as a normal noise gate. Finally, within the expander section a green LED is illuminated when expansion is in action.

The third section of the unit to the right of the panel is the VCA section which may be controlled by the compressor and expander sections or from an external control voltage with the selector switch having a third position which inserts FM pre-emphasis into the VCA section to reduce the overload of FM transmitters.

The release time of the VCA may be switched to automatic or manual, in which case a potentiometer sets the release time between 50 ms and 5 s per 20 dB release. There are two further controls in the VCA section—an overall gain potentiometer varying the gain ±15 dB and a self-illuminating locking pushbutton switch which bypasses the complete unit by directly connecting the input to the output.

A red LED is illuminated in the case of output overload with the current gain reduction being shown on a horizontal bargraph meter with segments at 1 dB, 3 dB and 6 dB gain reduction and then in 5 dB increments down to 40 dB.

At the far right of the front a locking self-illuminating pushbutton allows stereo ganging of the channels with a second button switching the power and is indicated by a red LED.

To the rear the two audio inputs (normal and voiceover) plus the audio outputs are at electronically balanced XLR connectors with RFI protection.

Tip, ring and sleeve ¼ in jack sockets give access to the VCA control voltages with recessed screwdriver-operated potentiometers trimming the control voltage rejection.

Power input is at an IEC connector combined with a fuseholder which is properly indentified for 120 V and 240 V operation. In addition, all connector pins are clearly identified and the front panel controls uncluttered with their functions being clear and logical.

Within the unit, each channel has a printed circuit board supporting all the components including connectors and separate voltage stabilisers, the power supply being a separate board secured to the side of the steel chassis. Everything within is to an exceptional standard of layout and construction, with shorting connectors selecting the FM time constants and all integrated circuits being socketed.

The preliminary operating manual provides operational information plus circuits and a layout diagram but does not attempt to provide full servicing information.

Inputs and outputs
The electronically balanced main inputs had a satisfactory input impedance of 92 kΩ when operating balanced or 46 kΩ single-ended with an overload limit of +24.5 dBm in either case. Common mode rejection for the two channels is shown to be satisfactory in **Fig 1**.

The voiceover inputs have a similar configuration and impedance but are not trimmed for optimum common mode rejection as this should not be necessary.

At the outputs the electronic balancing compensates for unbalanced loads so that the full drive capability of +25 dB.7V or +24.3 dBm loaded into 600 Ω is always available from the source impedance of 46 Ω. The output overload warning LED operated at +23 dBm output and was extremely rapid in action giving a clear indication of very short term overloads.

At the rear panel jack connector the control voltage output was +1 VDC per 20 dB attenuation from a source impedance of 47 Ω with the external input having the same scale into a load of 3.1 kΩ. A feature which is slightly annoying is that the gain reduction metering is insensitive to external DC gain control inputs. However, in the external condition of the VCA, the auxiliary external audio input feeds the compression and expansion sections providing a variety of special effects.

Frequency response
The overall frequency response without compression or expansion in use is shown to be sensibly tailored in **Fig 2** with −3 dB points around 5 Hz and 80 kHz.

With 10 dB expansion or compression in action the audio band frequency response remained extremely flat as shown in **Fig 3** for the normal state of the unit. With the FM de-emphasis switched in, the frequency response depended upon the degree of compression or expansion as the de-emphasis is located in the control chain, only before the signal processing.

Noise
Noise was measured in the output with the unit set to unity gain under various no-signal conditions see **Table 1** with very good results which must be related to the effective overall gain bearing in mind the degree of expansion or compression. Controls other than those varied and the output gain control had no effect upon the noise performance.

86 ▶

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Distortion

As measured at unity gain without compression or expansion (but with the facilities in circuit) the second and third harmonic distortion was very low at all operating levels, **Fig 4** showing the performance at +10 dBm with the distortion reducing at lower levels. Similarly, the CCIF twin tone intermodulation distortion was excellent as shown in **Fig 5** for +10 dBm, again falling at lower operating levels.

As is normal with compressors, the distortion under compression conditions varied with the release time at low frequencies. It was not, however, effected by the setting of the attack time switch. **Fig 6** shows a very good harmonic distortion performance when compressing 10 dB at the maximum release time. This and the intermodulation distortion were plotted at +10 dBm in and out.

The CCIF twin-tone intermodulation distortion shown in **Fig 7**, whilst low in the audio band, does show a sharp increase at ultrasonic frequencies. This was, however, sensitive to level and was much less at lower audio levels.

When expanding 10 dB over a 20 dB range the second and third harmonic distortion was extremely low being 0.01% or less from 20 Hz to 20 kHz provided that the release time was long at low frequencies, with the intermodulation distortion being in the same order up to 24 kHz.

Compression and expansion

The static compression curves for −10 dBm threshold are shown in **Fig 8** which shows that varying the compression ratio control produces a mild shift in gain below the threshold which itself is well defined.

The second function of the compressor section, that of voiceover, where the auxiliary audio input is used to vary the gain from the main audio input is illustrated in **Fig 9.**

This plot was made with a constant main input with the threshold set to −10 dBm and the voiceover control set to 5 dB, 15 dB and 35 dB gain ducking. It can be seen that the control (voice) input effects a very well defined shift in

FIG 1
VALLEY PEOPLE 610 COMMON MODE REJECTION

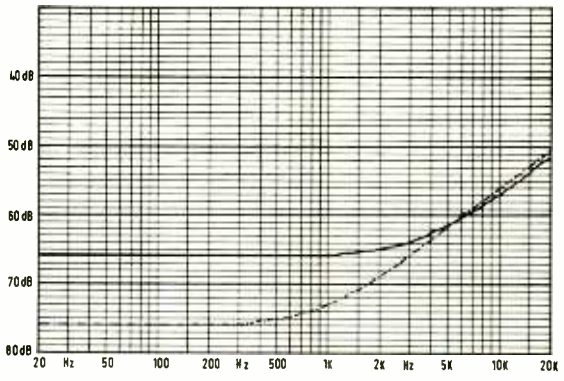


FIG 2
VALLEY PEOPLE 610 OVERALL FREQUENCY RESPONSE IN BYPASS MODE

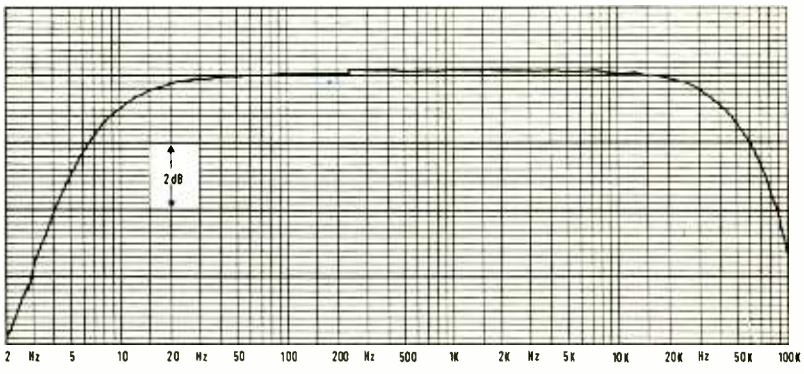


FIG 3
VALLEY PEOPLE 610 FREQUENCY RESPONSE WITH 10dB EXPANSION OR COMPRESSION

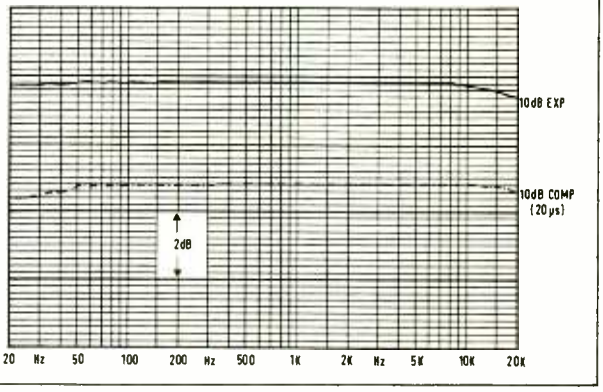


TABLE 1

Measurement method	Output noise in dBm: Comp and Exp out	Comp 3:1 − 40 dB	Comp 60:1 Threshold	Expand 20 dB
22 Hz to 22 kHz RMS	−74.0	−67.5	−47.0	−90.0
A weighted RMS	−85.0	−73.5	−54.0	−93.4
CCIR weighted RMS	−76.0	−65.5	−46.5	−84.0
CCIR weighted quasi peak	−72.0	−60.0	−39.5	−79.7
CCIR weighted ARM	−83.0	−72.0	−53.5	>−90.0

FIG 4
VALLEY PEOPLE 610 HARMONIC DISTORTION AT +10dB

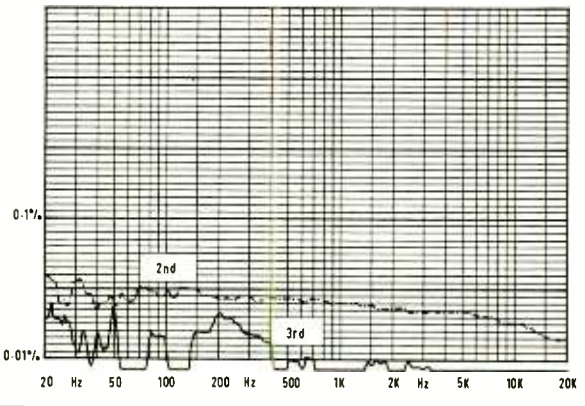
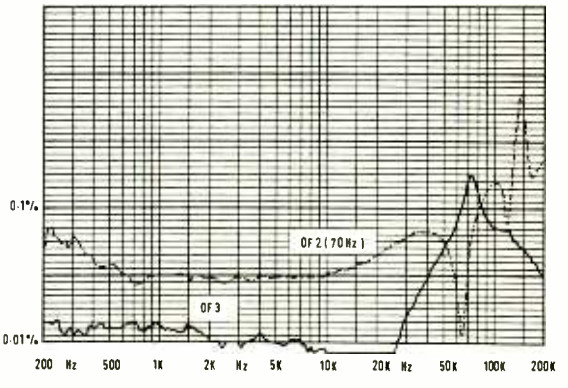


FIG 5
VALLEY PEOPLE 610 IM DISTORTION AT +10dBm



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the system gain with the desired gain variation being accurately calibrated.

The action of the expansion function is shown in **Fig 10** for a constant threshold setting. The effect is shown of expanding 20:1 over a 10 dB range and 30 dB range in the right hand curves and expanding 2:1 in the other curves.

The dynamics

The attack time of the compressor was found to accomplish complete compression in 20 ms for the 15 ms setting, 1.5 ms for the 1 ms setting and 100 μs for the 20 μs setting. In the latter case the initial action was very rapid with compression to within 1 dB of the final target taking only 2 μs making the compressor suitable for protecting broadcast transmitters.

Attack time was independent of the duration of the 'overload' and the degree of compression with the compression warning lamp and the gain reduction meter being fast and easy to read.

The rate of operation of the expander was found to be a complex matter depending upon the expansion ratio and the setting of the release time control.

In the manual mode the release time control was found to provide an exponential release with the times varying from 50 ms to 5 s as specified, whilst in the automatic release mode the control had a complex function in relation to the practical release time.

Other matters

Static and dynamic tracking between the two channels was found to be very good with no noticeable image shifting under operational conditions.

In operation, provided that sensible control settings were used, the unit was completely free from clicks and other abrupt and disconcerting effects, the release control having a wide range to give pleasant characteristics. In particular, the expander could be used to give useful noise reduction without being obtrusive in operation whilst also being capable of acting as a rapid noise gate.

Summary

The Valley People model *610* compressor/expander is a most versatile device offering a host of applications.

Not only is the unit outstandingly well made but its electronic performance is certainly very good.

Clear grouping of the controls makes it easy to use with clear indication of the functions in use. Verdict—excellent. ■

FIG 6
VALLEY PEOPLE 610 HARMONIC DISTORTION AT 10dB COMPRESSION

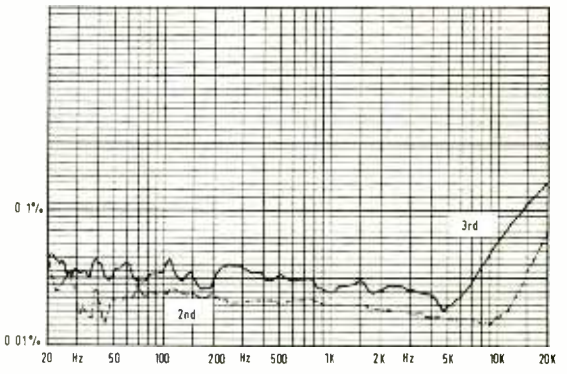


FIG 7
VALLEY PEOPLE 610 IM DISTORTION

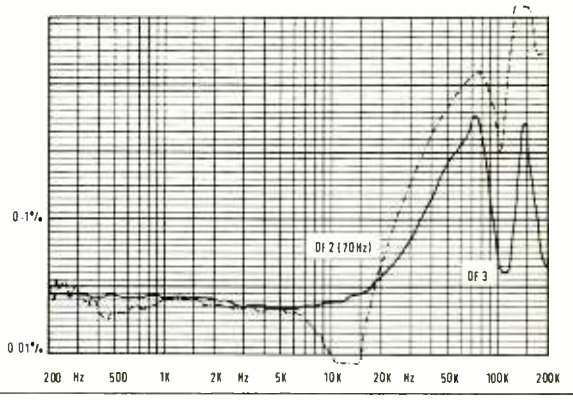


FIG 8
VALLEY PEOPLE 610
COMPRESSION CHARACTERISTICS

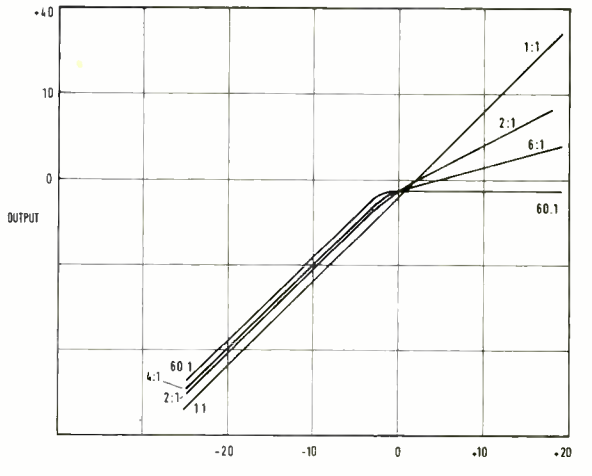


FIG 9
VALLEY PEOPLE 610 VOICE OVER MODE

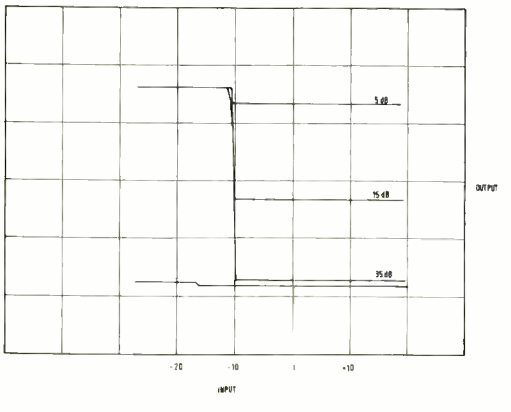
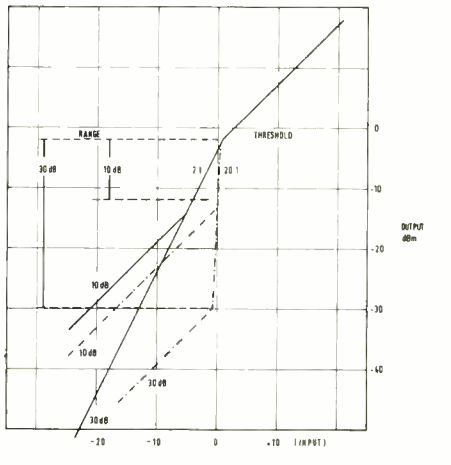
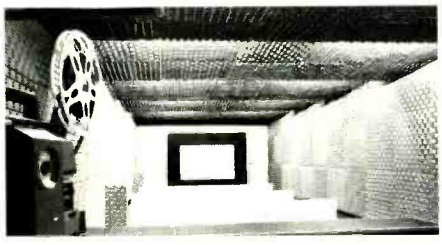


FIG 10
VALLEY PEOPLE 610
EXPANSION FUNCTION





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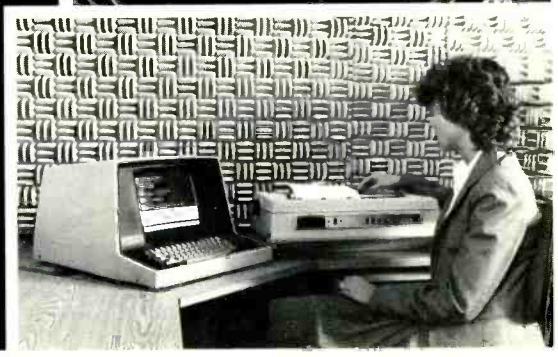

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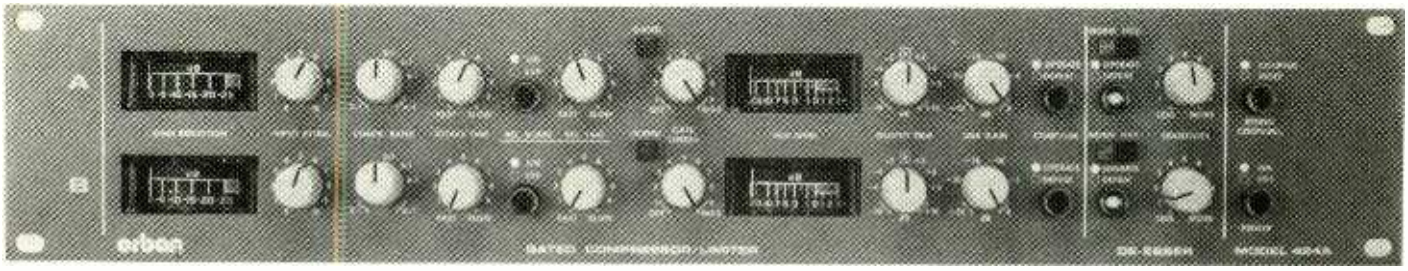
Orban 424A

Hugh Ford



MANUFACTURER'S SPECIFICATION

Input
Impedance: >10 kΩ active balanced, RF suppressed.
Level: —15 dBm produces 10 dB gain reduction with ATTACK TIME control centered, INPUT ATTEN control fully CW, and RATIO control at ∞ :1.

Output
Impedance: approximately 100 Ω, electronically balanced to ground, RF suppressed.
Level: +4 dBm nominal, absolute peak overload occurs at +26 dBm.

Frequency response: ±0.25 dB 20 Hz to 20 kHz below limiting and de-esser thresholds.

Compressor limiter section
Attack time: manually adjustable in approximate range of 500 μs to 200 ms, automatically scaled by programme content.
Release time: adjustable in approximate range of 0.8 dB/s to 20 dB/s, automatically scaled by programme content; switch-selectable LINEAR and EXPONENTIAL release shapes.
Compression ratio: adjustable from 2:1 to ∞ :1 at threshold; lower ratios automatically increase beyond threshold.
Range of gain reduction: 25 dB.
Tracking of multiple channels: ±0.5 dB.
Total harmonic distortion: (attack and release time controls centered, infinite RATIO, 15 dB gain reduction): less than 0.03% at 1 kHz; typically 0.11% at 20 Hz, 0.02% at 100 Hz, 0.01% at 1 kHz, 0.04% at 10 kHz.
SMPTE IM distortion (controls set as above 60/7000 Hz 4:1, 15 dB gain reduction): typically 0.05%.

De-esser section
Attack time: approximately 1 ms.
Release time: approximately 30 ms.
Harmonic distortion: less than 0.05% total harmonic distortion introduced by de-essing action at 10 kHz.
Available gain reduction: greater than 25 dB.

System noise
RMS noise: 20 Hz to 20 kHz bandwidth better than 85 dB below output clipping threshold for any degree of gain reduction, 90 dB typical.

General
Power requirements: 115/230 VAC ±10%, 50 to 60 Hz; U-ground power cord attached, RF suppressed.
Dimensions (whd): 19 × 3.5 × 10 in (483 × 89 × 254 mm).
Operating temperature: 0-45°C.

Manufacturer: Orban Associates Inc, 645 Bryant Street, San Francisco, CA 94107, USA.
UK: Scenic Sounds Equipment Ltd, 97-99 Dean Street, London W1V 5RA.

THE Orban *424A* is the twin-channel version of the Orban *422A* gated compressor/limiter/de-esser. Other than the facility for stereo linking the two units have identical channels. There are two distinct sections of the unit, the compressor/limiter section and the de-esser section. The latter has two controls for each channel, a self illuminating in/out switch and a potentiometer controlling the sensitivity and labelled 'less' or 'more' de-essing. This is associated with red and yellow LEDs for each channel which are illuminated for heavy or normal de-essing respectively.

In the stereo unit the channel controls are in vertical array with two illuminated horizontal meters to the left of the panel indicating the current gain reduction with 5 dB calibration points up to 25 dB gain reduction. There follows the input level and the compression ratio potentiometers calibrated from 2:1 to ∞ :1. Potentiometers form the conventional attack and release time controls, however an unconventional feature is that the shape of the release envelope may be switched to linear or the conventional exponential shape. Using these controls the operation of the compressor/limiter is quite conventional with a fixed threshold, there being no need to use the more 'clever' features that follow.

The next feature is the 'gate' function which bears no relation to a conventional noise gate. In normal compressor/limiters the release time can cause noise breathing at the unit's gain increases when the release time is relatively fast. The gate function in the Orban *424A* is intended to overcome this problem.

As the gain increases on release, the Orban first follows the release envelope set with the release time control and the release envelope switch, however with the gate function in circuit the gain increase envelope switches to a fixed long release time as a preset threshold is reached. This long time constant removes noise breathing effects.

A single potentiometer for each channel sets the gate threshold over a wide range with an adjacent green LED being illuminated as the gate function passes the preset threshold.

To the right of the gate function two further illuminated meters show the VCA level on VU meter type scales, the VCA level being the output level from the VCAs which is fed to the line outputs via the rear panel gain controls. The level trim potentiometers on the front panel having a ±10 dB nominal range and feeding the VCA control inputs.

Next there is a potentiometer for each channel identified as 'idle gain'. This performs two functions. Firstly with the compressor/limiter switched out of circuit the idle gain control sets the unit's gain by introducing a fixed amount of

92 ▶

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gain reduction. This allows the compressor/limiter to be switched in and out of circuit without introducing unpleasant level changes in programme material.

The second function of the idle gain control is with the compressor/limiter in circuit and the gating function in use. In this mode once the gate function is activated the gain drifts very slowly to the final gain set by the idle gain control. This final gain may be higher or lower than the gain reduction introduced by the action of the compressor on the previous signals.

Proceeding to the right of the front panel there are the two compressor/limiter operate/defeat switches, the de-esser section and finally the self illuminating power on/off and coupled/independent switch for the two sections.

All the controls on the blue alloy front panel are clearly identified with white markings, the remainder of the chassis being plated steel.

To the rear of the unit the pairs of inputs and outputs are balanced connections on a barrier strip which includes separate signal ground and chassis ground terminals. Removal of a blanking plate allows XLR connectors to be fitted to the ready-made holes. Two separate potentiometers permit the setting of the output levels.

The mains power input is via a correctly colour coded fixed lead with the nearby voltage selector and imperial size mains fuse which was properly identified. However although the unit was supplied for 230 V operation the higher rated fuse for 115 V operation was fitted.

Within the unit each channel occupies a separate, good quality printed circuit board extending almost the full width of the rack mounting chassis. The boards have a good layout but few component identifications, however, the operating manual contains a good layout diagram and complete parts lists, circuits and maintenance information.

Access to all components is very good with almost all of them mounted on to the printed circuits each of which has four preset controls with the integrated circuits being socketed for ease of maintenance.

Inputs and outputs

The balanced inputs had an adequately high impedance of 19.8 kΩ with the ability to handle +22 dBm before the onset of distortion. Common mode rejection was in excess of 60 dB from 20 Hz to 20 kHz for both channels. Depending upon control settings minimum input level for the onset of compression was around —30 dBm. The maximum gain from the inputs to the outputs was 47.5 dB with the outputs capable of delivering +25.5 dB.7V or +23.5 dBm loaded into 600 Ω from a source impedance of 95 Ω when operating balanced or 47 Ω single ended.

Frequency response

The overall frequency response with the compressor and de-esser out of circuit is shown in **Fig 1** which demonstrates a sensible high frequency roll-off above 20 kHz. This and other factors reduce the susceptibility of the unit to RF interference and this was not a problem.

With the compressor/limiter in action there is an on-board link that offers a low frequency roll off to stop LF noises affecting the gain reduction. In **Fig 2** frequency response curves are shown for 10 dB compression at a 3:1 compression ratio, the plot without the bass cut being very flat.

In the case of the de-esser the frequency response depends upon the degree of de-essing

94 ▶

FIG 1
ORBAN 424A OVERALL FREQUENCY RESPONSE WITH COMPRESSOR AND DE-ESSER OUT OF CIRCUIT

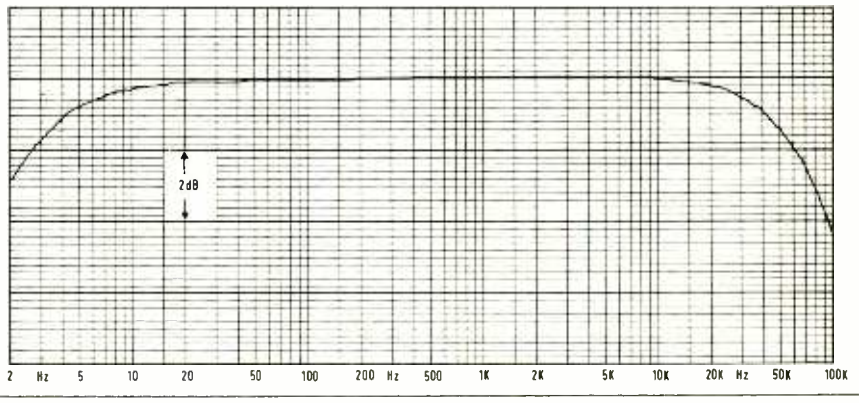


FIG 2 ORBAN 424A FREQUENCY RESPONSE WITH 10 dB COMPRESSION AND 3:1 RATIO

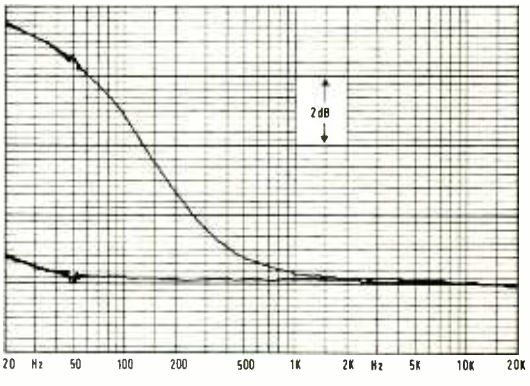


FIG 3 ORBAN 424A FREQUENCY RESPONSE WITH MAXIMUM DE-ESSING AT DIFFERENT INPUT LEVELS

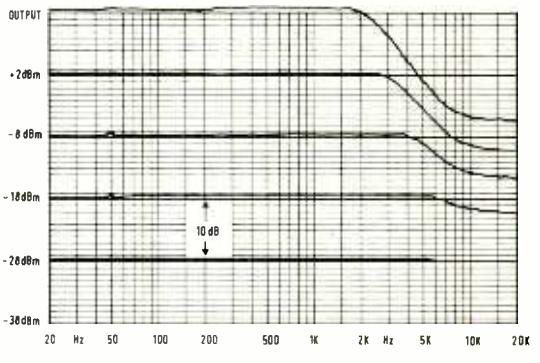
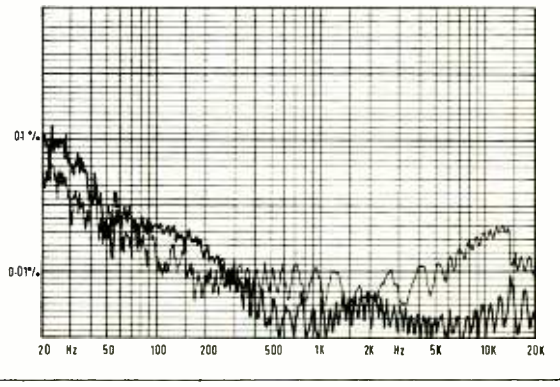


FIG 4 ORBAN 424A HARMONIC DISTORTION WITH MID ATTACK AND RELEASE SETTINGS



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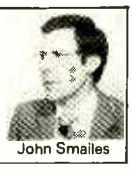
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and thus the level as shown in **Fig 3** which was plotted at maximum de-essing. Changing the de-esser's sensitivity purely shifted the level at which these characteristics occurred.

Noise

Noise in the output remained constant with all control settings except the gain trim control which had a relatively minor effect. **Table 1** shows the noise in the outputs, both of which were identical, referred to the output clipping level versus gain reduction.

This very good performance was completely free from power line hum components or other unwanted effects.

Distortion

In the straight through mode with the compressor/limiter and the de-esser switched out second and third harmonic distortion was less than 0.01% from 20 Hz to 20 kHz at 0 dBm, in and out. Increasing the levels to + 10 dBm only produced a mild increase in the third harmonic at high frequencies, reaching 0.03% at 20 kHz.

With the compressor in action the harmonic distortion varied little with compression ratio or the degree of compression, typical results being shown in **Fig 4** for the mid setting of the attack and release time controls. This excellent performance was also reflected in the CCIF twin tone intermodulation distortion performance a typical example of which is shown in **Fig 5**.

Attack and release

The attack time control had a wide range allowing the attack time for effective complete compression to be varied from 500 μs to 800 ms with a mid point setting of 2 ms. Similarly the normal release time could be varied from 200 ms to 9 s with a mid point of 2 s. The shape of the release envelope remained constant with the degree of compression being exponential or linear depending upon the setting of the shape switch. The effect of this is shown in **Fig 6**.

When using the gate function the release from the gated condition was slow as shown in **Fig 7** and remained exponential irrespective of the setting of the shape switch.

The compression characteristics are shown in **Fig 8** for ∞ :1, 4:1 and 2:1 where the measured ratios are slightly above those specified. These characteristics held irrespective of other control settings including the shape switch.

Other matters

Crosstalk between the channels was negligible at less than − 100 dB below 6 kHz. Tracking of the channels was within 0.5 dB under static conditions over the full available 25 dB of gain reduction.

The gain reduction meters were sensibly accurate with their time constants depending upon the attack and release time settings etc. Similarly the VCA output meters were accurate with 0 dB indication corresponding to a maximum output of + 16 dBm depending upon the setting of the rear panel gain controls.

Summary

In addition to the measured performance being very good the subjective impressions of the unit were excellent.

This product has many novel and highly practical features all of which are quite simple to use but need not be used if simplified operation is required.

Overall a very good compressor/limiter, well made and easy to service. ■

TABLE 1
Measurement method

	Gain reduction 0 dB	10 dB	20 dB
22 Hz to 22 kHz RMS	−86.0 dB	−88.5 dB	−88.5 dB
A-weighted RMS	−89.5 dB	−92.0 dB	−92.5 dB
CCIR-weighted RMS	−81.5 dB	−83.0 dB	−84.0 dB
CCIR-weighted quasi peak	−77.0 dB	−79.0 dB	−80.5 dB
CCIR/ARM ref 2 kHz	−88.0 dB	−90.0 dB	−91.0 dB

FIG 5 ORBAN 424A IM DISTORTION WITH MID ATTACK AND RELEASE SETTINGS

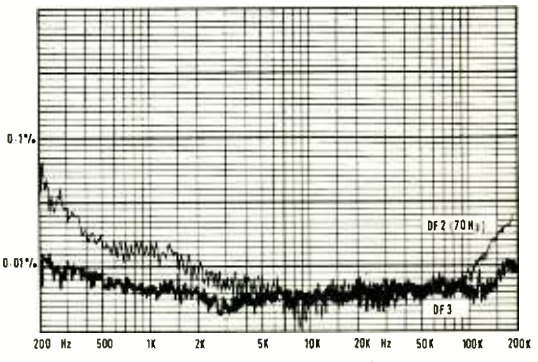


FIG 6 ORBAN 424A RELEASE FROM 10dB COMPRESSION

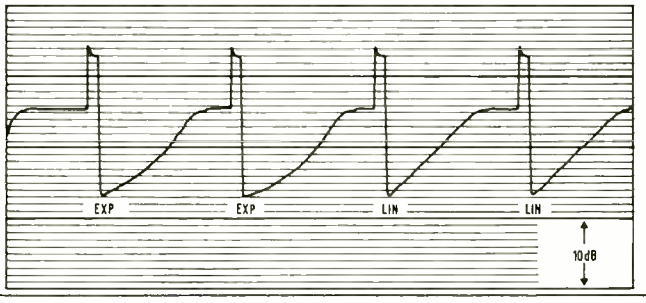


FIG 7 ORBAN 424A RELEASE FROM GATED CONDITION

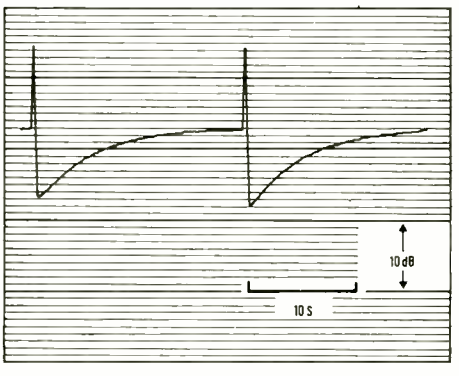
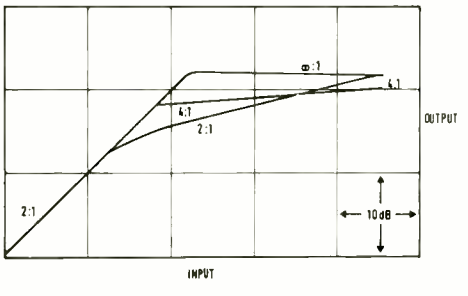


FIG 8 ORBAN 424A COMPRESSION CHARACTERISTIC



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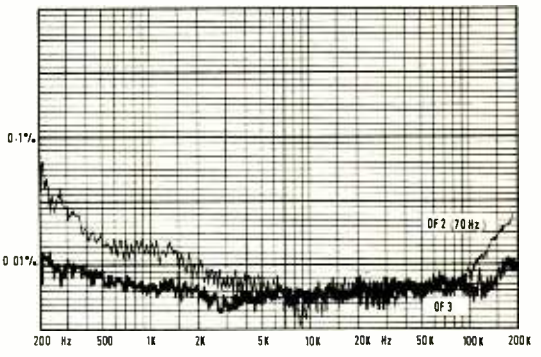

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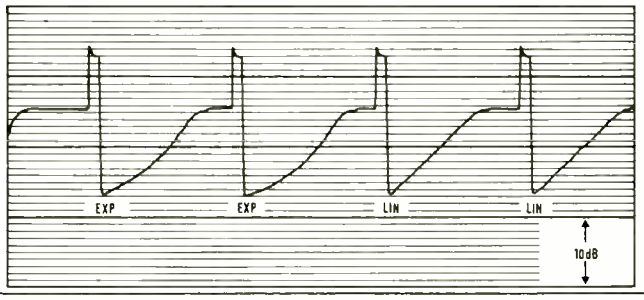

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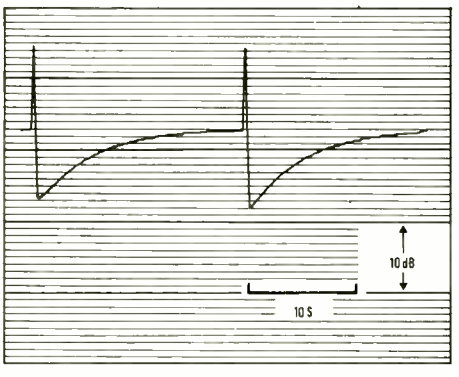

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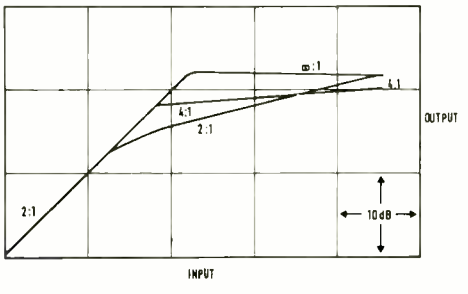

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