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A LINK HOUSE
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MEMBER OF THE AUDIT
BUREAU OF CIRCULATIONS

This month's cover photograph by courtesy of Studer

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Standardising digits?

It must be true that the present lack of digital standardisation is holding up the full flowering of the 'digital revolution'. While there are several systems on the market—both stereo and multichannel—and a number of manufacturers are coming together on several areas, we are still a long way from being able to play a tape recorded on one system back on another. Digital equipment, even for stereo, is a large investment, and it is understandable that many studio owners will hold back until there is some closer form of interchangeability. The recently-announced agreement on sampling rates must be regarded as a great step forward, but it does not solve the problem. And while the Studer/Sony/MCI etc conclave seems to be offering a kind of *de facto* standard, there are still a number of well-respected manufacturers who are not a part of it. It may be true that present state-of-the-art is not sufficiently advanced to set long-term standards—for example, present word-lengths and sampling rates are, some say, respectively too short and too low—but surely we have to start somewhere. It would have been sad if 4-track 'standards' had been held over until 24-track was practicable!

Yet there is more to standardisation than sampling rates, and even word-lengths. The number of ways of stuffing digital information on to tape so that it can't be read by someone else's machine must run to somewhere between 10^{10} and infinity, but even *two* different systems on the market at once is one too many. Even in the consumer area, with video cassette recorders for example, two systems is an expensive nuisance. The VHS/Betamax war must tie up vast amounts of money in both the origination and end-user portions of the market, but both sides are too deeply entrenched to give up now ... but I do wish one of them would: it would make things so much easier! Will we be faced with the same problem in digital audio? I hope not. It may be that the Compact Disc's competitors will vanish away before any of the systems get on to the market: if not, they will be wasting their time and money. The only

potential competitor with a future would seem to be DRC/Soundstream with the 'postcard record', but their launch date is still a couple of years away. Unhappily, it may come too late, just as the Philips V2000 VCR system may have come too late to make a big dent in the home video market. The gamble is whether to get into the market quickly with what you can do today, or wait a bit to do something better but which may miss the boat.

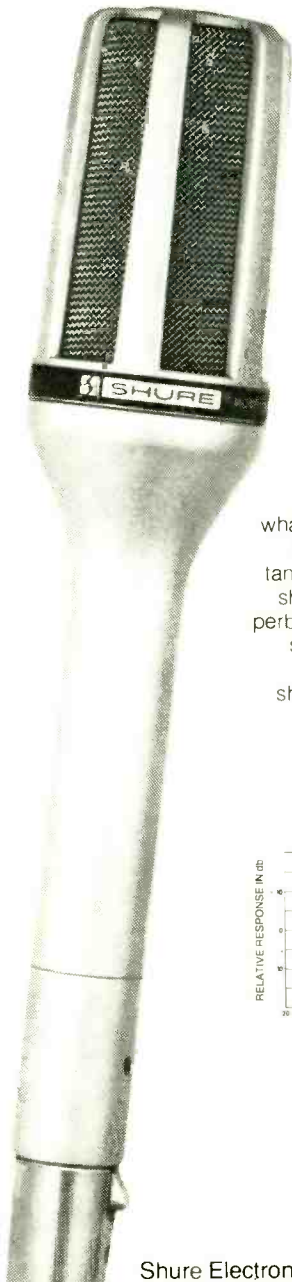
In professional digital audio, we are not talking about £300 digital disc players: we are talking many tens of thousands of pounds per machine. You may like to think that you can offer a complete recording service, from basic tracks to mixdown, but there will always be people who like *your* room for rhythm tracks, *his* room for vocal overdubs, and that place down the street for mixing—and so there should be. Artists, engineers and producers should always be able to go to the places that suit each part of the recording process—for them. But if all three didn't invest in the same multitrack digital, there is little chance of such moves being possible, and that will limit creativity. As it stands today, the producer (or whoever) faced with this dilemma will probably decide to do it analogue. You can probably attract clients today with *anybody's* digital system. If this will pay for itself before there might be a standard, all well and good. But how can you be certain of that? You can't. It isn't like buying a computer system, where inter-machine transferability is less of a problem. Surely, what we need now is a firm standard for *interchangeability*, ie I can play my tapes on your machine without hassles (or at least without too many). We need one as soon as possible, before lots of studios have invested big money in machines which end up being non-standard. Or am I wrong? What do manufacturers think of all this? Could they tell us? Why should XYZ studio buy *your* machine this year—or *anyone's* digital system?

Richard Elen



fact: you can choose your microphone to enhance your productions.

Shure makes microphones for every imaginable use. Like musical instruments, each different type of Shure microphone has a distinctive "sound," or physical characteristic that optimizes it for particular applications, voices, or effects. Take, for example, the Shure SM58 and SM59 microphones:

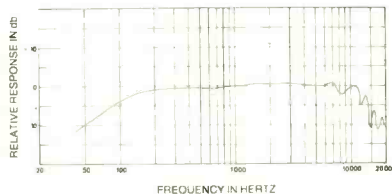


SM59

**Mellow, smooth,
silent...**

The SM59 is a relatively new, dynamic cardioid microphone. Yet it is already widely accepted for critical studio productions. In fact, you'll see it most often where accurate, natural sound quality is a major consideration. This revolutionary cardioid microphone has an exceptionally flat frequency response and neutral sound that reproduces exactly what it hears. It's designed to give good bass response when miking at a distance. Remarkably rugged—it's built to shrug off rough handling. And, it is superb in rejecting mechanical stand noise such as floor and desk vibrations because of a unique, patented built-in shock mount. It also features a special hum-bucking coil for superior noise reduction!

Some like it essentially flat...

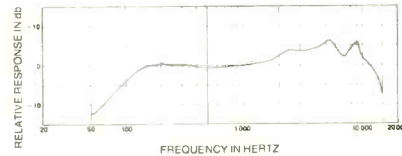


SM58

**Crisp, bright
"abuse proof"**

Probably the most widely used on-stage, hand-held cardioid dynamic microphone. The SM58 dynamic microphone is preferred for its punch in live vocal applications... especially where close-up miking is important. It is THE world-standard professional stage microphone with the distinctive Shure upper mid-range presence peak for an intelligible, lively sound. World-renowned for its ability to withstand the kind of abuse that would destroy many other microphones. Designed to minimize the boominess you'd expect from close miking. Rugged, efficient spherical windscreen eliminates pops. The first choice among rock, pop, R & B, country, gospel, and jazz vocalists.

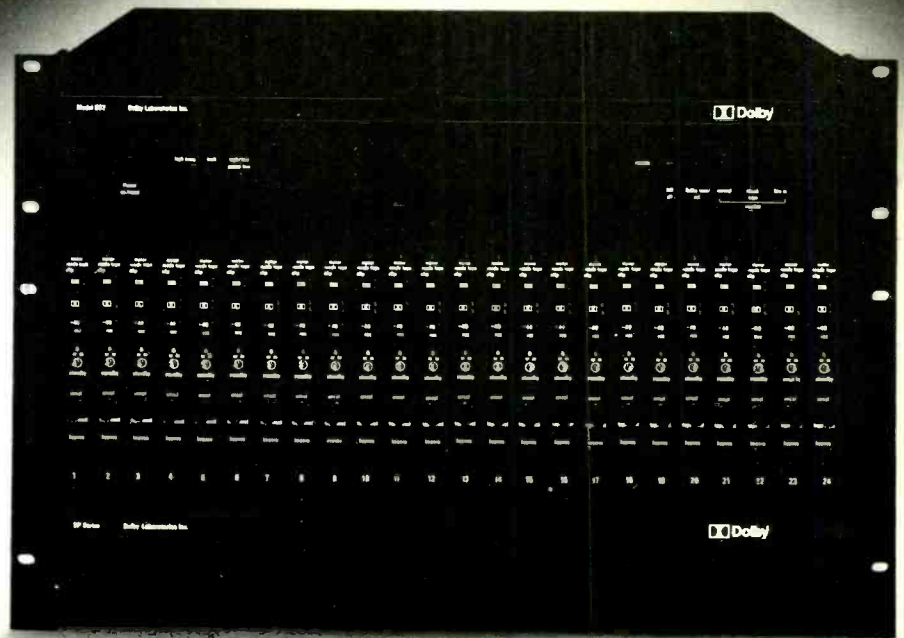
...some like a "presence" peak.



professional microphones...by



Shure Electronics Limited, Eccleston Road, Maidstone ME 15 6AU—Telephone: Maidstone (0622) 59881



New from Dolby Laboratories:

The Dolby SP Series Multi-track noise reduction unit

Dolby noise reduction is an integral part of professional multi-track recording practice in music, radio and TV broadcasting, and film studios throughout the world. A new noise reduction unit, the Dolby SP Series, has been developed for these and other applications, and provides up to 24 tracks of Dolby A-type noise reduction in only 12¼" of rack space. The SP Series' combination of compact size, ease of operation, and new features makes it ideal for equipping new recording facilities and upgrading existing ones.

For further information on the SP Series and other professional noise reduction equipment, contact Dolby Laboratories.

Highlights of the Dolby SP Series:

- Up to 24 tracks in only 12¼" of rack space, including power supply.
- Dolby A-type noise reduction characteristics utilizing standard Dolby Cat. No. 22 modules.
- Separate regulated power supply unit with electronically-controlled output protection.
- Low-noise fan cooling.
- LED display for each track permits accurate Dolby level calibration (within ±0.1 dB if desired) by matching intensity of LED pairs; further LEDs

indicate the presence of signals and clipping, and assist alignment with high-level reference tapes.

- Front-panel "UNCAL" control for each track permits rapid resetting of Dolby level for playback and punch-in on nonstandard-level tapes, then instant restoration of preferred preset studio Dolby level without recalibration.
- User-selectable option of "hard" or electronically-buffered bypass of individual tracks and of all tracks simultaneously.
- Snap-fit connectors on rear panel for rapid disconnection and reconnection.
- Balanced and floating input stages.
- Output stages drive either single-ended or balanced 600-ohm loads at levels up to +28 dB (19.5 V) before clipping.
- Ultra-low-distortion input and output amplifiers.
- Remote ground-sensing output configuration minimizes hum pickup when driving single-ended loads.
- Discrete FET switching for reliable, noise-free routing of audio signals.

Dolby Laboratories, 731 Sansome Street, San Francisco, California 94111, Telephone 415-392-0300, Telex 34409, 346 Clapham Road, London SW9, Telephone 01-720-1111, Telex 919109. "Dolby" and the double-D symbol are trademarks of Dolby Laboratories Licensing Corporation. S81/3621



If everything were perfect...

... a control unit would consist of a volume control and a programme selector switch.

In practice, correctly designed tone controls can make a significant contribution.

For a constant sound level, replay from a gramophone record produces distortion which increases very rapidly at high frequencies — doubling in fact for every major third increase in pitch.

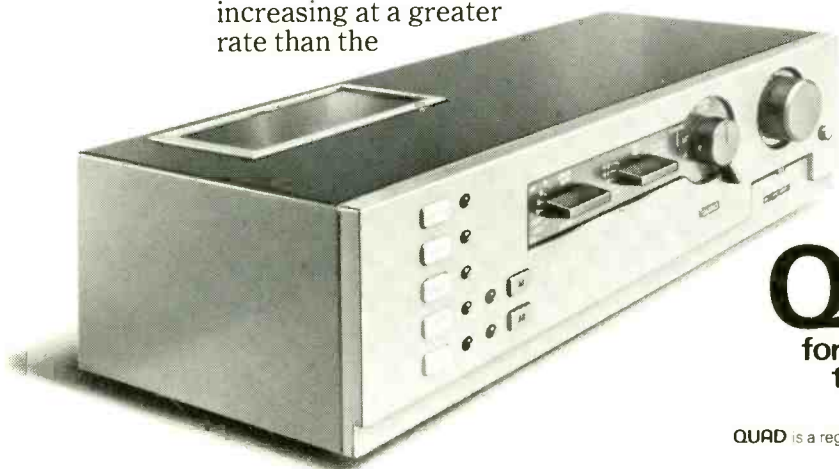
There comes a point when the contribution of this distortion is increasing at a greater rate than the

musical content and this is what decides the optimum setting of the comprehensive Quad filter system, an essential and integral part of every Quad pre-amplifier.

The rate of attenuation can be set anywhere between 0 and 25dB per octave starting at one of three frequencies 5k, 7k, or 10kHz and an appropriate setting can be found for each record to provide more of the music and less of the distortion.

To learn all about the Quad 44 write or telephone for a leaflet.

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The Ultimate

1/2" 8 Track

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- * Click-free punch-in/out.
- * Switchable +4 or -8dBm line input variable or fixed, line output also switchable; XLR input/output connectors.
- * Wide range of bias adjustment, suitable for all tapes.

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- * LED tape timer and peak indicator.
- * Single card per channel modules and externally accessible electronics adjustment.
- * Audio control section has the same functions as the 2" Otari MTR90 series. All audio functions and transport functions repeated on optional remote control.
- * Tacho output and DC servo capstan makes the MKIII-8 most suitable for audio/video locking applications.

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- Comprehensive mixing facilities.
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- Programmable locked sweep delay ratios of the six internal delay lines makes possible many new harmonic and tonal effects.
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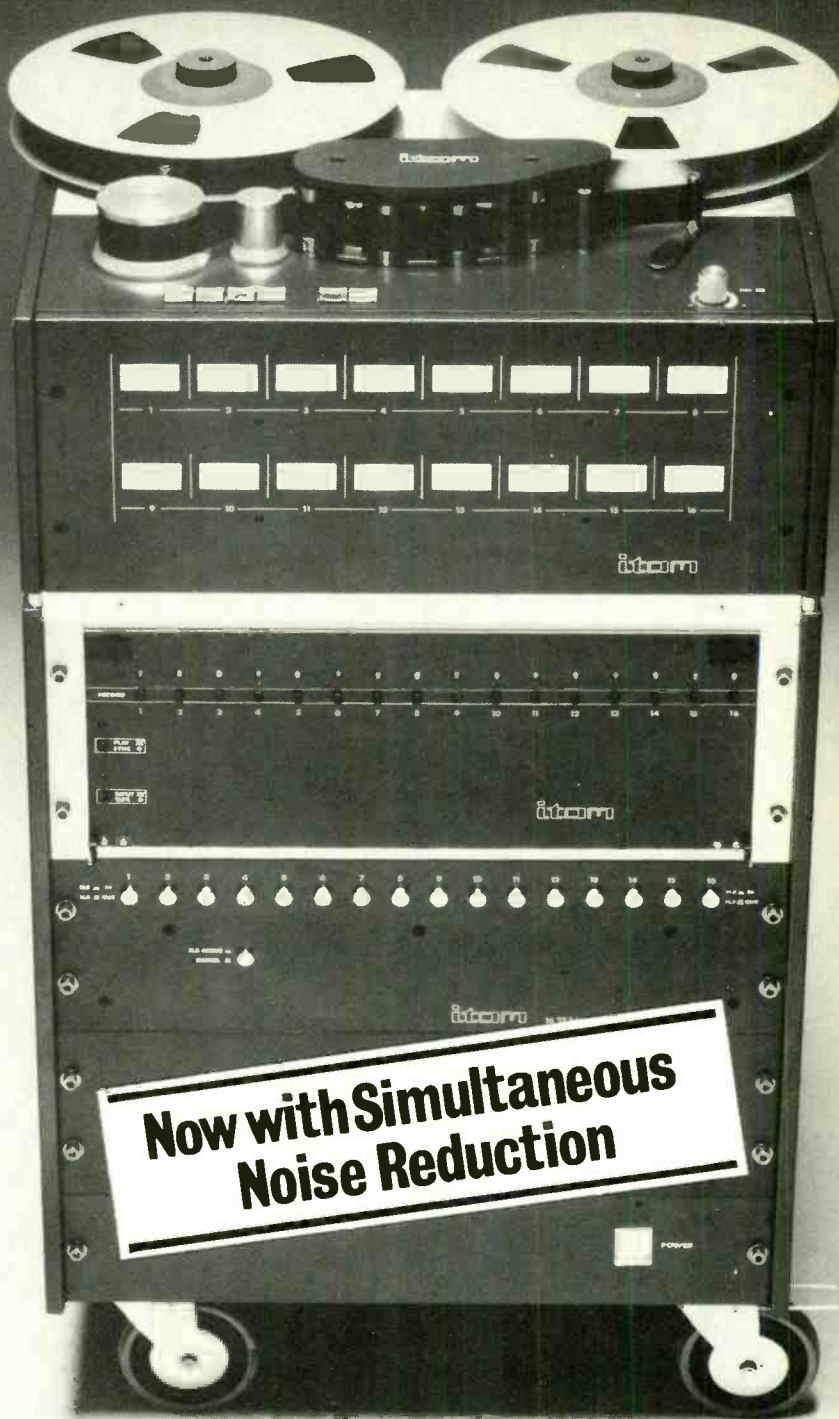
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- * 3 speed 7½/15/30 ips.
- * DC Servo Capstan plus variable tape speeds.
- * Totally modular construction + plug-in EQ Cards.



- * Plug-in heads 8 or 16 track.
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The Revox PR99 is available in several versions: mono or stereo 3 $\frac{3}{4}$ /7 $\frac{1}{2}$ ips NAB or 7 $\frac{1}{2}$ /15 ips NAB or

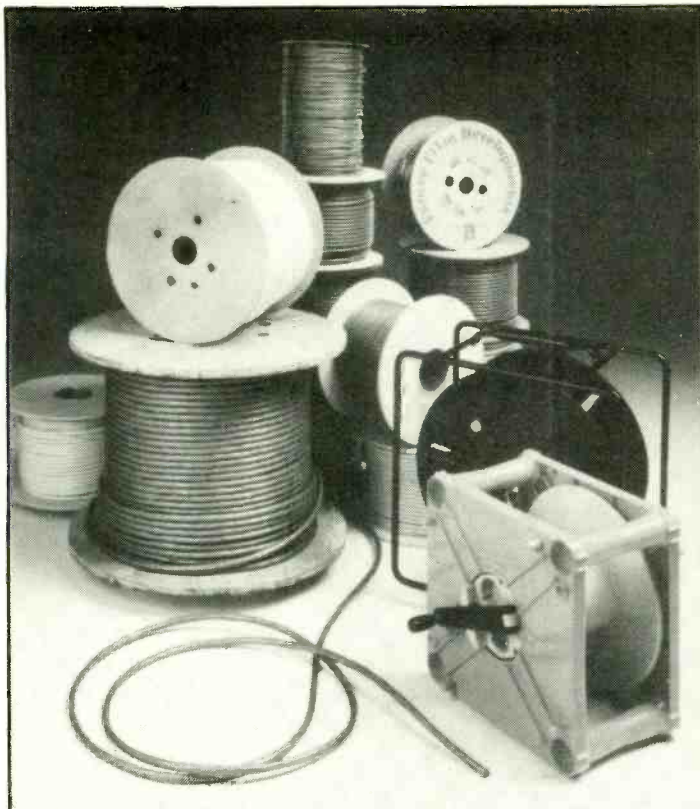
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For more information on the PR99 phone or write for a catalogue.

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Another important feature is that the head assembly is finished to a tolerance of 10 microns, which results in complete compatibility between machines.

And you'll be pleased to hear that all these innovations have resulted in a system which is about half the price of our competitors.

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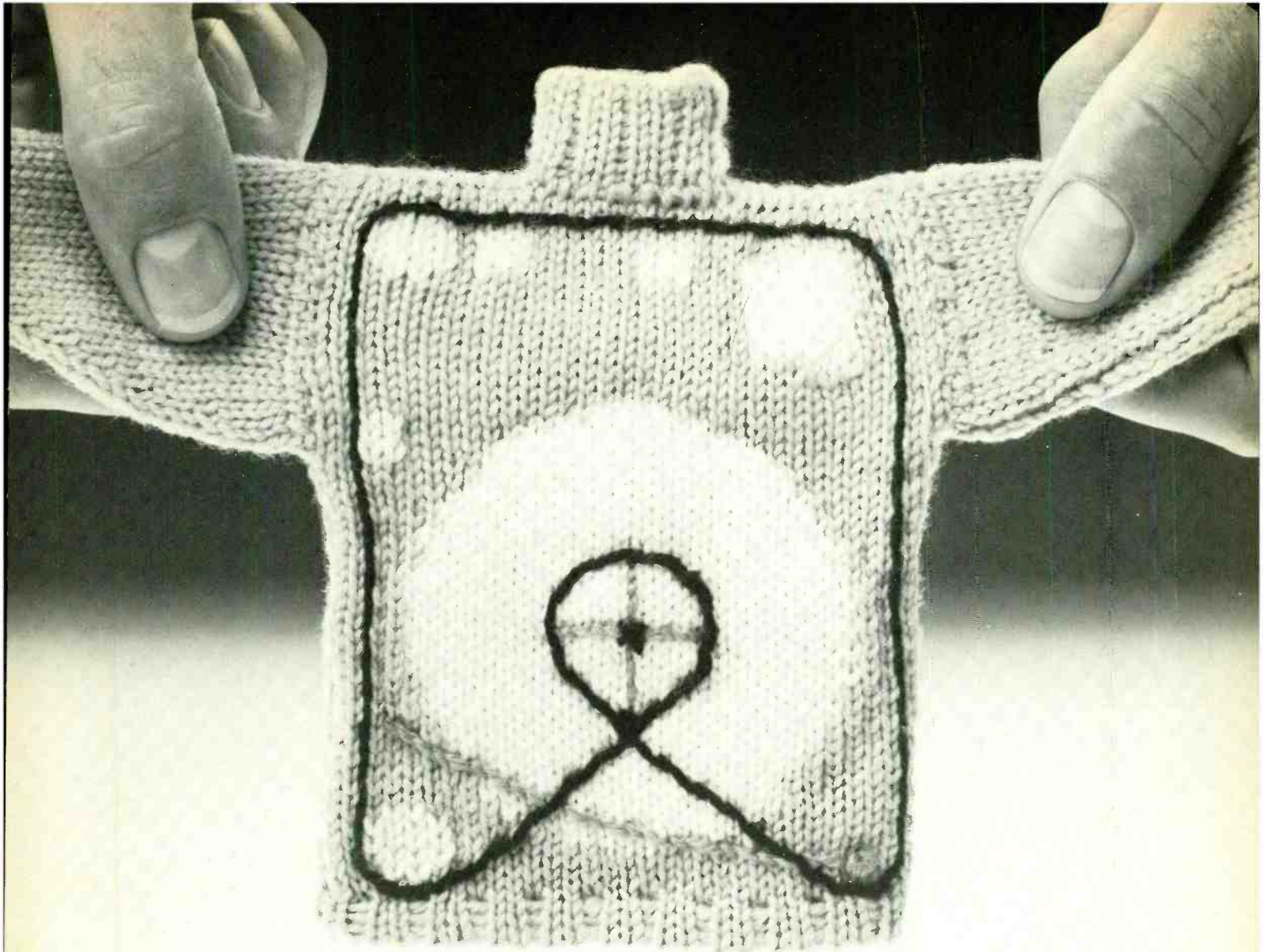


AEG-TELEFUNKEN

MX 80 MX 80a

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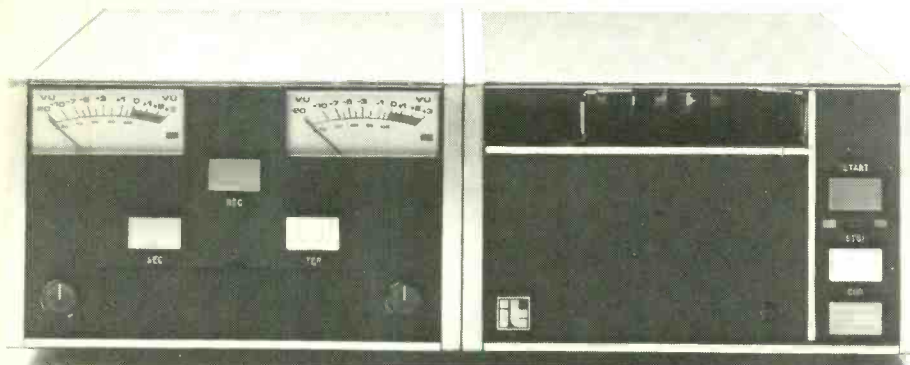
tool plate, the ITC 99 contains such advanced features as a crystal-referenced servo-motor, a positive, mechanical latching solenoid, a micro-adjust head module and a distortion-free cartridge positioning system. To the user, these features mean reduced wow and flutter,

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The ITC 99 microprocessor-controlled cartridge machine and recording amplifier are truly a sound above the rest. If you want to rid your cartridges of their wooliness, talk to F.W.O. Bauch about the ITC 99.



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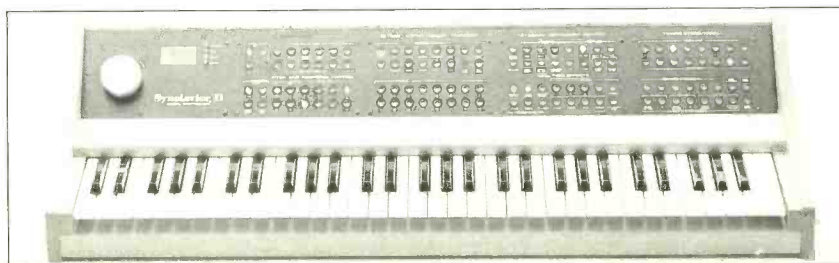
For a copy of Synclavier II's stereo LP, send your address plus £2.50 to: Keyboard Hire Ltd

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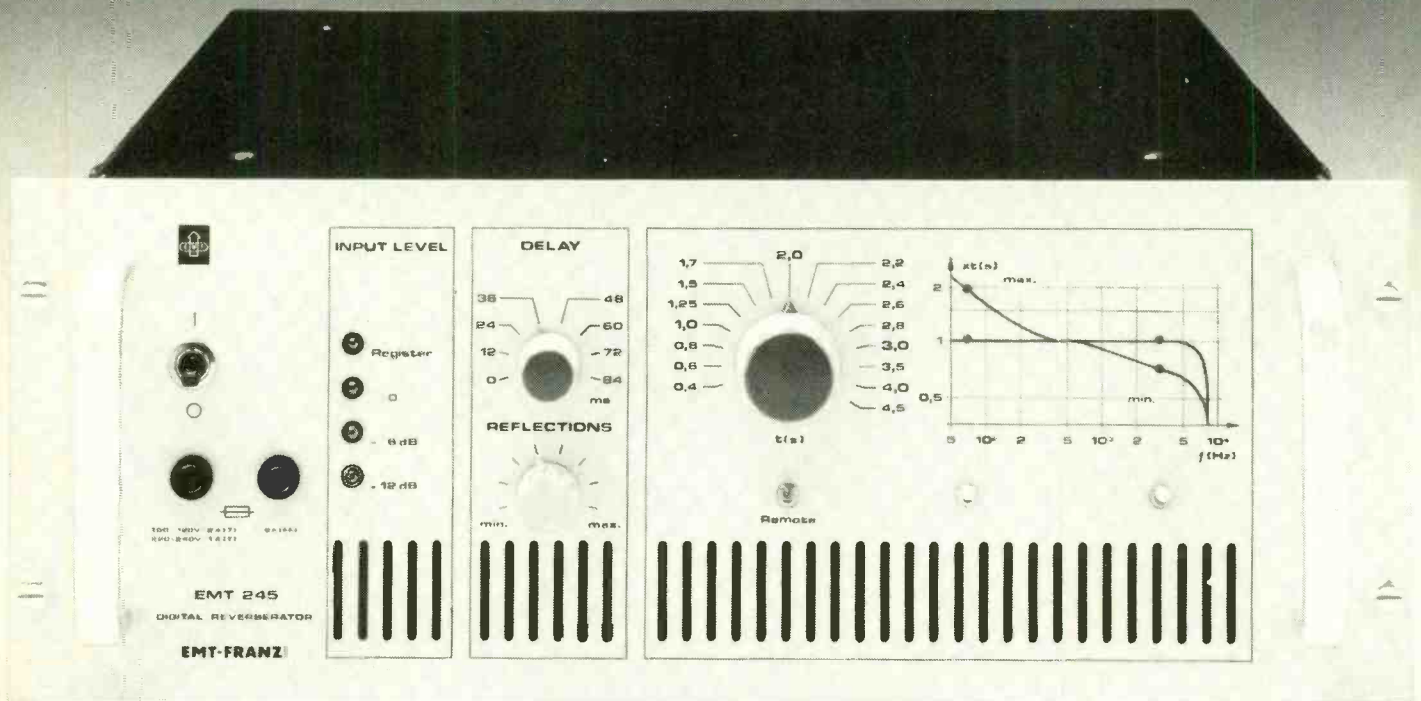
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With improved algorithm, greater programme memory and, of course, a superbly clean decay, the EMT 245 has an extremely low noise floor, making it ideal for studios, broadcast units and mobiles. And you'll warm to its economical price as well.

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Sennheiser MD 421 New each **£60.00**
 Beyer M260 New each **£68.00**
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Lyrec 16-1 Cassette duplication unit master and 4 x slaves **£8,000**
 Decca duplication desk, phasing scope, etc. **£800.00**
 Otari semi automatic cassette loaders each **£1,000**
 Bluthner Grand Piano **£1,850**
 2" tape 10 1/2" reels at empty reel price each **£10.00**
 Selection of Scamp and Rebis racks, modules in stock **P.O.A.**
 Neuman M49 **P.O.A.**
 Neuman KM54 **P.O.A.**
 Neuman U48 **P.O.A.**
 R.C.A. BX77 **P.O.A.**
 R.C.A. BX44 **P.O.A.**

A selection of used equipment available from our showrooms

Lyrec 24T T/Rec with 30 memory autolocate **£13,000**
 Lyrec 24T T/Rec with A/Locate **£11,000**
 3M M79 24T T/Rec with Sonoplan A/Locate **£11,000**
 3M M79 24T T/Rec with 16T H/Block **£11,000**
 Ampex MM1200 24T T/Rec with zero locate **£10,500**
 3M M79 16T T/Rec **£8,500**
 3M M23 8T T/Rec **£2,750**
 Scully 8T T/Rec **£2,500**
 Scully 8T T/Rec with syncmaster **£2,900**
 Teac 3440 4T T/Rec **£600.00**
 Scully 4T T/Rec with DC motor drive etc. **£1,900**
 MCI JH110 Stereo T/Rec **£1,800**
 Ampex AG440B Stereo T/Rec **£1,000**
 Studer C37 T/Rec—Stereo **£600.00**
 Studer A62 Stereo T/Rec **£750.00**
 Leever's Rich E200 Stereo T/Rec **£400.00**

Trident B 24-16-16 Mixing console **£6,000**
 Trident B 24-16-16 Mixing console **£5,000**
 MCI JH436 36-24 Mixing console **£15,000**

Neve 32-24-24 Mixing console **£30,000**
 Neve 32-16-24 Mixing console **£23,000**
 Soundworkshop 1600 28-24 Automated Mixing console—3 months old **£18,000**
 Teac 5 8-4 Mixer **£500.00**
 Alice 828 8-2 Mixer—"mint" with extras **£500.00**
 Decca 12-2 Large desk, Phasing scope etc. **£2,250**
 P.E.P. 12-4-8, as new with remotes **£1,850**

Dolby M16H noise reduction each **£5,000**
 Dolby M24H noise reduction each **£7,000**
 Dolby a360 noise reduction each **£280.00**

JBL L200 Loudspeakers **£1,000**
 JBL 4331A Loudspeakers **£900.00**
 2 x Pultec EQP 1A3 Prog 'EQ' **£450.00**
 Teletronix LA2A Level amp. **£220.00**

Quad 405 amp **£175.00**
 Quad 50E amp each **£60.00**
 DBX 155 Noise reduction **£200.00**
 DBX 122 Noise reduction **£220.00**
 Synton 222 Vocoders (New) each **£350.00**

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Here is a selection from our October 1981 Mailing List. We send out an updated List approximately every 6 weeks.

To receive our up to date List regularly, telephone 0582 27195 or 26693 and ask to be added to our Mailing List.

Stereo Machines

AMPEX AG351	£ 350
AMPEX ATR700 with Remote. 1/4 or 1/2 track — 3 1/2" / 7" ips.	£ 750
AMPEX AG440	£ 800
AMPEX ATR700	£ 700
FERROGRAPH Studio B in Console	£ 900
FERROGRAPH Studio B (Portable)	£ 800
LEEVEERS-RICH PRO LINE 1000	P.O.A.
OTARI MX7000 in Console	£ 500
REVOX A77 1/2 track — 3 1/2" / 7" ips.	£ 250
REVOX A77 1/2 track with DOLBY — 3 1/2" / 7" ips.	£ 300
REVOX A77 1/2 track — 15/30 ips (v.g.c.)	£ 400
REVOX B67 1/2 track (Ex. demo) — 7 1/2" / 15 ips.	£ 500
STUDER B67	£ 1,600
STUDER B62	£ 1,500
SCULLY 280 for Spares	Offers
TECHNICS 1700RS 1/2 track — 3 speed	P.O.A.

Microphones

AKG D20 (v.g.c.)	£ 80
AKG C28 Valve Microphone	£ 150
AKG B40E Battery Powered Power Supply	£ 30
DUTCH BROADCAST Stereo Valve Microphones with Power Supplies (2 available) (v.g.c.)	£350 ea.
AKG C451 with CK5 Capsule	P.O.A.
NEUMANN U 87 (2 available) (NEW)	£ 330
NEUMANN KM53 Valve Microphone with Power Supply	£ 130
NEUMANN KM86 (2 available)	£200 ea.
NEUMANN KM54 Valve Cardioid Mics. with P/Supps & Leads.	£ 150
SENNEHEISER MKH110 Omni-Instrumentation Mic. with P/Supp for Room Equalisation	£ 120

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EMT Wow and Flutter Meter	£ 350
ELECTROHOLME Oistribution Amplifier	£ 175
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IVIE Test Analyser	£ 2,000
Rack 6" — 19" on wheels	£ 100
WOLLEN SACK 2 from 1 Cassette Copier New Heads	£ 700
Metel Supp 10 1/2" x 1/2" (used)	£125 ea.
CERWIN-VEGA Monitor Cabinets (Empty) new.	£ 40
MYSON Electrostatic Air Filter	£ 100
44 AP 1940 Faders with Grouping Switches	P.O.A.
PIIONEER PL 100 Turntable (new) complete with Cartridge	£ 60
GARRARD 401 Record Deck with SME Arm	£ 125
OTARI 6 bay High Speed Copier with REVOX A77 1/2 track with DOLBY	£ 2,500
HELPIINSTALL Piano pick-up	£ 250
250 Way Banister Patch Bay Mounted in Mahogany free standing plinth	£ 150
OTARI MX5050 Slow Speed. New but some parts missing.	Offers

Mixing Consoles

ALLEN & HEATH 12 x 2 (new)	£ 300
ALLEN & HEATH SR20 P.A. Desk in Flight Case — with 50 mtrs. of Multicore cable	P.O.A.
AUDIO DEVELOPMENTS 30 x 8 x 2 P.A. Desk — with Flight Case Stage Boxes and 2 x 19 pair 75 mtr. multicore	£ 6,000
CERWIN-VEGA Disco Mixers	£ 175
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CADAC 24 x 24 x 24 Series M Console — complete with large Patchbay. Currently in use in top Studio	£ 7,000
HELIOS 36 x 24 x 24	£ 7,000
HELIOS 32 x 24 x 24	£ 9,500
HILL K Series 32 x 24	P.O.A.
GELF 24 x 8 x 2 P.A. Desk in Flight Case	£ 1,500
ITAM 10 x 8	£ 700
ITAM 10 x 4	£ 400
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NEVE 32 x 24 x 24	£30,000
NEVE BCM10 10 x 4 — 8 x 2 Modules (v.g.c.)	£ 2,750
PYE 3 3/8 x 4 Broadcast Desk with Full Patchbay	£ 1,250
RSD 30 x 8 x 4 P.A. Desk with 10 band E.Q.	£ 3,000
RAINDIRK 28 in-Line Console — with Producer Unit and Patchbay. NEW. Very Impressive	£ 8,875
RAINDIRK 12 x 8	£ 5,500
RAINDIRK Series 3 1/8 x 4 x 8 (v.g.c.)	£ 3,300
SONY 6 x 2 Portable Mixer (Battery powered)	£ 150
STUDIOMASTER 8 x 4 (Ex. demo)	£ 600
SOUNDCRAFT Series 4 24 x 4 x 2 in Flight Case	£ 2,200
SOUNDCRAFT 1624 (16 x 16) available Mid-January	£ 8,000
SOUNDCRAFT 3B 32 x 24 x 24 with Allison computerised Faders (new)	P.O.A.
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SOUNDCRAFT Series 4 12 x 4 with 6 auxiliary sends (v.g.c.)	£ 1,800

SOUNDCRAFT 1S P.A. Desk 20 x 2 with Flight Case with Multicore (v.g.c.)	£ 1,800
STUDIOMASTER 16 x 8 (Ex. demo)	£ 1,400
TRIDENT TSM 40 x 24 x 32	£30,000
TRIDENT TSM 28 x 24 x 24 in 32 way Frame	P.O.A.
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TRIDENT FLEXIMIX 'B' x 8	P.O.A.
TRIDENT Series 80 32 x 24 x 214 — 10 months old — (v.g.c.)	P.O.A.
TRIDENT B Series 30 x 16 x 16 — many improvements (v.g.c.)	£ 7,750
TWEED 10 x 4 with P & G Faders, PPM's, recently serviced by TWEED. Excellent condition.	£ 2,500
ALLEN & HEATH Model 2 B x 4 x 8 (v.g.c.)	£ 560
NEVE 32 x 16 x 24	£22,000
TRIDENT Series 80 32 x 24 x 24 Console (NEW) Finished in Mahogany. 32 inputs, 5 switchable auxiliary sends including stereo fold back, 4 band EQ. In place solo echo and monitoring. Auto-Mute. 4 echo returns. 24 track monitoring routable to remix, giving a total of 60 line inputs. Computer ready. New style Patchbay with Mitchell & Moses Jack-sockets, with 104 spare sockets for Outboard Equipment.	P.O.A.
ALICE 12 x 4 x 8	£ 1,100
SOUNDCRAFT 12 x 8 Series 2 with 8 channels of sweep E.Q.	£ 2,500
ALICE ACM 20 x 8 x 16 with Patch Bay	£ 5,000
ALICE 20 x 16 x 16 with Patch Bay	£ 5,500
Syncon A 28 x 24 x 24 with Patch Bay and Producers Desk. 15 months old.	£ 7,000

Multitracks

AMPEX MM110 24 track	£ 9,500
AMITY SCHROEDER 24 track with Remote & Varispeed (v.g.c.)	£ 7,000
AMPEX MM1000 16 track with spare 8 track H/Block and Varispeed	£ 5,500
BREBEL Mini 8	P.O.A.
CADEY 16 track 2" (2 available)	£ 3,000
ITAM 805 8 track 1/2" (v.g.c.) with 8 channels of BEL noise reduction	£ 1,800
KLARK TECHNIKS 8 track 1" with Richardson Electronics and 8 channels of BEL N/R	£ 2,750
MCI 24 track with 16 track H/Block. Varispeed and Auto-Locate	£10,000
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3M M79 16 track (NEW)	£11,500
3M M79 24 track (NEW)	£15,000
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3M M79 8 track pre-wired 16 track with Audio Kinetics XT24 Auto-Locate little used	£ 4,000
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SCULLY 280 8 track 1" 7 1/2" / 15 ips.	£ 2,500
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TEAC PORTASTUDIO (NEW) (2 available)	£ 425
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TEAC 3440S 4 track	£ 500
TEAC 3440	£ 550

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CADAC Mini Power House with Audix Amps.	£550 pr.
JBL 4315 (v.g.c.)	P.O.A.
B & W T2/B Speakers	P.O.A.
LOCKWOOD Majors fitted with TANNYO REDS	£ 400
LOCKWOOD 500 Universals with TANNYO REDS	£ 500
LOCKWOOD Universal Majors with Hangers	£ 700
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JBL 4315	£ 1,500
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GAUSS 5831 15" Bass Drivers (5 available)	P.O.A.
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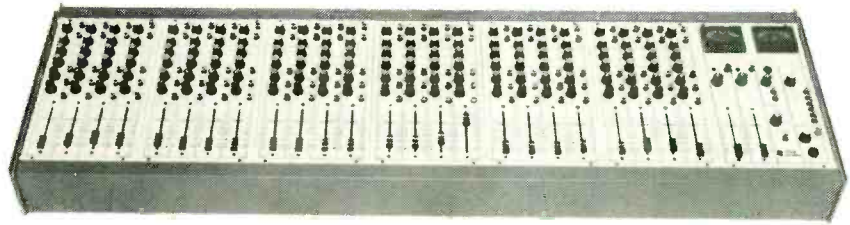
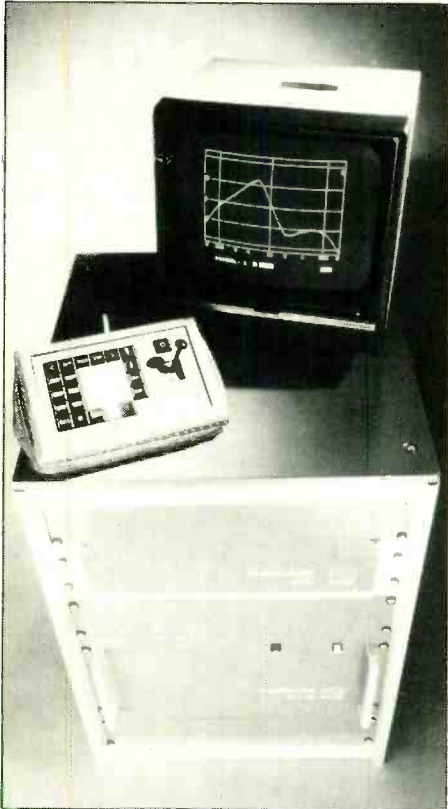
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ALLEN & HEATH Feed Forward Limiter	£ 98
ALLEN & HEATH Stereo ADT Unit	£ 150
ALTEC 27 Band Graphic Equalisers (1 pair)	£ 800
AUDIO & DESIGN E900N Sweep EQ Modules (1 pair)	£ 350
AUDIO & DESIGN F700H Compressors (4 available)	£100 ea.
AMCRON D150 Amplifier (v.g.c.)	£ 275
BENTLEY Drum Machine	£ 75
BEL BF20 Stereo Flanger	£ 275
BTX 4500 Model SMPTE Synchroniser	£ 1,200
DOLBY 301	£ 350
DBX 154	£ 250
DOLBY 360 (2 available)	£275 ea.
DBX 163 Comp/Lims 2 Mono units in 19" Rack	£ 200
EVENTIDE H910 Harmoniser	£ 800
EVENTIDE FL201 Flanger	£ 200
DBX 160 Comp/Lims. (1 pair)	£ 400
EMT 140 Stereo Reverb. Plate Transistor. No Remote.	£ 1,800
EMT 140 Mono Reverb. Plate — electronics available to convert to stereo	£ 2,100
EMT 240 Gold Foil	£ 1,300
FAIRCHILD Reverbation 2 Model 659	£ 2,000
HITACHI Cassette Deck	P.O.A.
KLARK TECHNIKS DN34	£ 150
LEXICON Prime Time	£ 750
MXR Companders (new)	£ 80 ea.
MXR Dual 15	£ 200
MXR Digital Delay Line — 4 memories fitted (2 available)	£650 ea.
MASTER ROOM MR3 Reverb.	£ 700
MASTER ROOM 8 Reverb.	£ 600
NEAL 102 Cassette Deck	£ 150
QUAD 9 CPR 16 Digital Delay	P.O.A.
Rebils RA301 Comp/Lim	£ 300
REBIS RA402 Parametric Equaliser with extra Mic. Amp facilities.	£ 775
MASTER ROOM MR5 Reverb.	£ 200
SCAMP Rack with Power Supply, 2 SOL Comp/Lims, 2 F300 Expander Gates	£ 850
TEAC AN80 Stereo DOLBY Unit (2 available)	£ 75 ea.
TANNYO X05000 Electronic Cross-over	£ 275
TEAC DX8	£ 500

Outboard Equipment

ACCESSIT Power Supply	£ 25
ACCESSIT Booster	£ 25
ACCESSIT Reverbation	£ 25
ACCESSIT Compressor	£ 25
BEL BC3 8 channel Noise Reduction System	£ 400
BEL BF20 Mono Flanger (NEW)	£ 200
OOLBY 320 8 Type	£ 250
LEXICON Delta 7 Model 102 Digital Delay System fitted with 2 cards. Variable delay up to 320ms. per card.	£ 1,000
TEAC 310 Cassette Deck (NEW)	£ 70
LEXICON 224 Digital Reverb. Fitted with 4 cards	£ 4,000

EELA AUDIO STUDIO EQUIPMENT



S100 Consists of a module system, the versatility of which lends itself to the assembly of mixers of multiple configurations, using a method of construction that makes for a simple, sturdy and attractive unit. These mixers have been designed specifically to satisfy the need for compact but high quality professional mixer for use in: mono, stereo and four track studios, broadcast stations, audio-visual units, film and video dubbing studios, hospital broadcast, theatres and other public address systems.



S200 A system designed to construct mixers of advanced design for on-air self-op, multitrack operation, audiovisual, outside broadcast, grams and editing desks.



S191 Particularly suited to audiovisual facilities.



S41 A four input one output battery portable mixer for ENG, EFP and general portable use.

I found the *Param* the most interesting development in analogue audio technology. It is so different from what we have grown used to that it is difficult to describe the impact that it should eventually make. This could well be the end of the 'dinosaur-style' mixing console, messing up the acoustics of the control room, impossible to operate without extension arms and eyes, and still nowhere to put an ashtray! The operating system is, apart from a few minor points which I am sure can be altered without difficulty, an object lesson to designers seeking to use the facilities made possible by computer technology in the audio field. You do not have to be a computer expert or even remotely interested in the subject to get the best out of this unit, and I would think that even die-hard engineers would be seduced by the possibilities offered and find no real objections to this unit (unless it be to the very existence of equalisers!). Unlike the majority of 'Automation' systems the *Param* has no tendency to take over sessions or leave one feeling that the job would have been done better and quicker manually. Instead it merely does a very useful, well-defined job faultlessly and efficiently. In its present configuration it makes few changes to the 'normal' way of doing a session and therefore should meet with little engineer or client resistance. The sheer quality of the construction and unobtrusiveness of the sound has made it a great pleasure to review this item. I am convinced that this is the basis of a sensible marriage of computer and sound technology. If you want to see the future—look this way!

George Chkiantz

Reprinted from **STUDIO SOUND**

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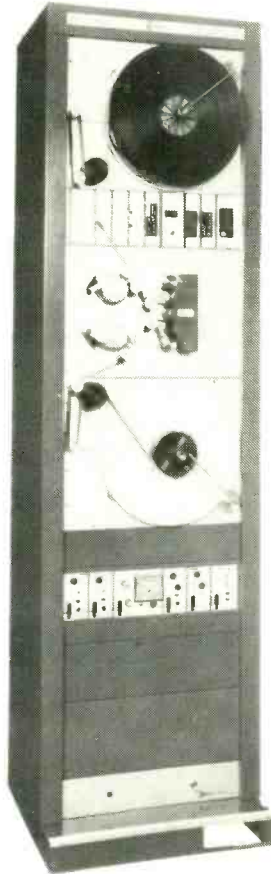
1

Westrex **The** **International** **Number One** **in Sound** **Recording** **Equipment**

Here's Why!

Throughout the world WESTREX is the name, that for over fifty years has been coupled with the finest quality in studio sounds and recording.

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ST-6000 Series reproducers and recorder/reproducers

All the range of ST-6000 Series of machines for use with magnetic film incorporate the new Westrex ST-6200 DC Servo Motor System, and are housed in a cabinet rack.

Basic models are available for 16mm and 35/17.5mm, single or multitrack and the following features are common to all versions of the ST-6000: —

- Forward and Reverse operation at standard speed.
- Fast Forward and Reverse operation when laced through the film sprocket at up to 15 times standard speed for the 16mm machines and up to 6 times for the 35mm machines.
- Electronic speed change 24/25 f.p.s.
- Electronic advance or retard when in motion.
- Post-synchronisation facilities on all Recorder/Reproducers.

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Available on single and multiple channel recorders 16mm or 35/17.5mm. This facility makes it possible to switch into the record/erase mode and back out at any time during the recording process without discernible clicks, noises or changes in recorded level. It is possible to insert corrections, delete errors, add extensions and post-sync dialogue. Selective record/erase is provided on multi-channel machines.

General Data

- Flutter and Wow: Less than 0.1% rms.
- Sound Stability: 150 milliseconds.
- Run-up Time: 100 milliseconds to standard speed. Less than 1 second to high speed.
- Film Capacity: 35mm-600 metres (2000ft). 16mm-725 metres (2400ft).

For full technical data sheet, prices and delivery contact The Westrex Recording Division world wide Headquarters at:



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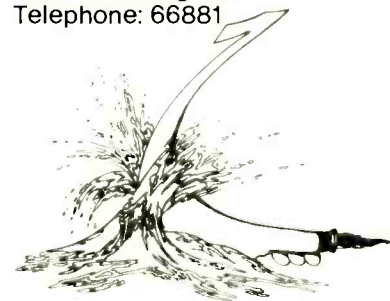
From concerts to films and long term album work – Mobile One is the No.1.

A completely self-contained 46 track recording studio featuring 52 audio input channels, overdub booth with space for full drum kit, air conditioning, radio telephone and a full video facility.

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AC/DC – A&M Records – Ariola Records – Atlantic Records – Charles Aznavour

Barclay Records – BBC – CBS Records – Chrysalis Records – Decca Records – Dr. Hook – EMI Records – Peter Gabriel – James Galway – Genesis – GTO Records – Marvin Hamlisch – Island Records – London Philharmonic Orch. – Barry Manilow – Robert Palmer – Phonogram Records – Polydor Records – RCA Records – Rush – Bruce Springsteen – Stiff Records – Supertramp – Ultravox – United Artists Records – Virgin Records – Rick Wakeman – John Williams – Stevie Wonder – Yes.



MOBILE ONE

Equipment includes • Two MCI 24 track tape recorders (each with full remote control) • MCI 36 in 36 out mixing console • Triad 16 by 4 auxillary console • EMT Digital Echo • Eventide Harmoniser • Eastlake monitoring with JBL Loudspeaker and Amcron amplifiers • UREI limiter compressors • UREI Parametric Equalizers • SMPTE code generator/reader.

the future of 4 track

The Fostex Multitracker is a Personal Recording Studio, that challenges the quality and facilities of open reel.

Separate but together?

Mixer and recorder work as one but you can use them independently. The mixer is four in, four out, with gain, tone, echo and pan. The four track tape deck has remarkable features.

How about noise?

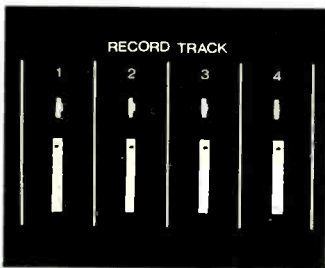
Sound quality is astonishing. The latest Dolby 'C' circuitry achieves a drama-



DOLBY C NR

tic 71dB signal to noise ratio. It's performance you would expect from open reel. And there's more. Dolby's new system has side benefits that result in tighter, more transparent recordings.

Full function four track?



There are no restrictions, all four tracks can be recorded at once. Any input can be switched to any track. Or plug into the recorder direct, from another mixer, to add more channels or to capture a live performance.

Is ping-pong possible?

Selsync is fully automatic, and you can bounce adjacent tracks with quality. With a little forethought, you can perform the ten track bounce with hardly any noise build up.

It's a solenoid transport?

The high speed, two motor design is microchip



controlled, with varispeed and a digital counter plus return to zero. It's all there to speed your creativity.

Why a footswitch?

Have you ever tried to work a tape recorder while playing an instrument? With the Multitracker you simply preselect the tracks you want to overdub or correct, then run the machine in 'record ready' and hit the footswitch on cue.

Are four inputs enough?

The whole point of multitrack is to record a tune a part at a time. With one or two musicians, four is plenty. When you overdub, the inputs are used over again.

Is monitoring complicated?

An automatic 'monmix' switches between live and signal already on tape, depending on which tracks you select for record. All you adjust is level. You can also check the stereo mixer output for quality and balance.

How about effects?

Your echo unit connects to the 'aux' send and return sockets. You can

also use limiters, equalisers etc or existing pedal effects.

Why Personal Multitracker?

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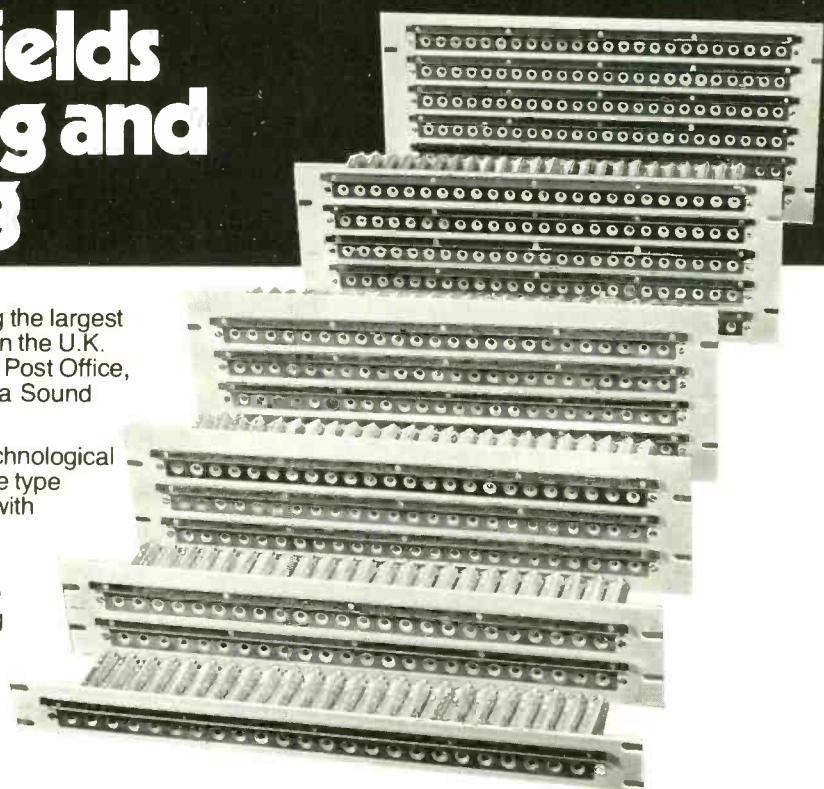
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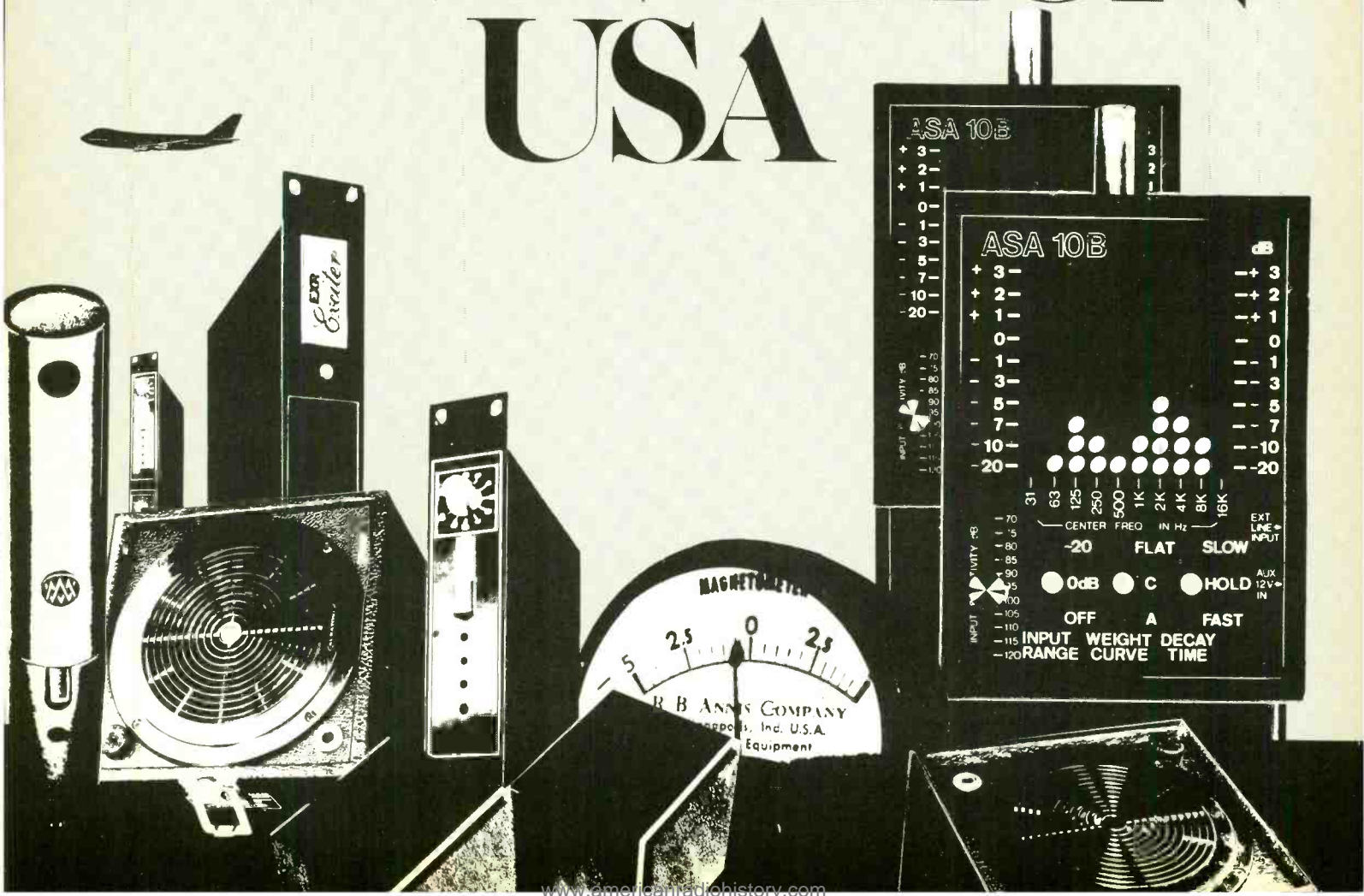
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INNOVATION USA



BBC order Neve digital console

The BBC has announced its intention of ordering the first all-digital sound mixing desk to be produced by Neve. Following three years collaboration between the BBC and Neve a prototype desk has been installed at BBC Broadcasting House for operational assessment, and when the production version of the desk is delivered in the autumn of 1982 it is believed that it will become the first comprehensive all-digital sound mixing desk to enter operational service in broadcasting. This new Neve console, which forms the first concrete example of the *DSP System*, exclusively reported in our January issue, will be a 48-channel console with digital fading, mixing, filtering or compression. In addition, the console will be capable of providing realtime delay in every channel and will be provided with comprehensive signal routing. The production version of the desk, we understand, will be installed in a digitally equipped Radio Outside Broadcast vehicle to be used on a variety of programme applications. This vehicle, we gather, will be equipped with two 1/4in fixed head digital tape machines and will have provision for a digital multitrack machine.

The channel processor design used in the prototype desk is based on the work done by engineers at the BBC's Research Department, who developed COPAS (Computer for Processing Audio Signals), the powerful architecture of the processor enabling the production of versatile software which implements all the digital audio functions. Co-operation between the BBC and Neve has extended beyond the COPAS system, with the BBC's Studio Capital Projects Department and operational user departments contributing to the evolution of the control system. The BBC see the introduction of the new digital desk



as an important step in the provision of a total digital chain extending from the microphone to the transmitter.

It is worth pointing out that the Neve digital console for the BBC is not the first application of digital sound techniques by the BBC. Previous applications include the 13-bit PCM (Pulse Code Modulation) system for distributing stereo sound signals to the BBC's VHF transmitters; the *Sound in Sync* system allowing the television sound signal to be inserted in the television picture signal in digital form; and more recently NICAM (Near Instantaneous Companding Audio Multiplex) equipment has been introduced on radio contribution circuits from Birmingham to London. In addition the BBC has also made a number of digital tape recordings.

As conventional microprocessors and mini-computers are too slow for audio signal processing applications, the COPAS system used in the digital desk uses a bit-slice technique to speed operation. In addition to this technique, multiplication in the COPAS system is done outside the microprocessor in a single-chip multiplier operating at a speed some 16 times faster than the multiplying function of the microprocessor itself. A further technique used by the system is 'pipe-lining' whereby the next micro instruction is put in the 'pipe-line' while the first instruction is being executed, thereby almost halving the cycle time. Together these techniques produce a system in which 16 separate 'activities' can be programmed into each 56-bit micro instruction with an execution time of 140µs.

SPARS office

As from January 1, 1982 the SPARS administrative office has been relocated to Los Angeles. The new address and telephone number is: SPARS, PO Box 11333, Beverley Hills, Cal 90213. Phone: (213) 653-0240.

R-PAD

R-PAD is a recently formed record manufacturing service headed by Steve Smith (ex Aerco) and Sue Powell (ex Music For Pleasure). One of the major aims of the new service is to encourage the issue of independent record releases, and the company offer comprehensive record pressing and sleeve printing services to facilitate this. Working from master tapes and details of the required artwork, the company will supply pressings, including cutting (at Town House Studios), label printing and sleeve graphics and printing; or alternatively the company can handle complete projects from recording and mixdown through to the finished pressing. R-PAD can also advise on all aspects of record manufacture and production. As an independent avenue to the release of singles and albums where the customer specifies what is required the company is probably unique in the quality of service available. Full details of the services provided are available from R-PAD, PO Box 22, Woking, Surrey GU22 7QU, UK. Phone: 04862 20277.

International Music Show

Following an overwhelming response from exhibitors to the International Music Show, but with reservations over the dates and the need for more facilities, the organisers have announced that the show is now to be held at the Wembley Conference Centre from March 14 to 18, 1982. The overall concept of the show remains unchanged, aiming to cover all aspects of the music and recording business, while the new venue provides additional facilities including a large seated auditorium, several smaller theatres and anterooms available for concerts and demonstrations, plus car parking facilities for 5,000 vehicles. Apart from Sunday, when the show opens all day from 10.30am to 11pm, the weekday hours are from 10.30am to 12 noon (trade only) and from 12 noon to 11pm for the public. Full details of the show are available from the International Music Show Sales Office, 26 Kingsland Road, London E2 8DA, UK. Phone: 01-729 2666. Telex: 27535.

Address change

● Project Synthesis International has moved to 500 Hidden Valley Road, Grants Pass, Oregon 97526, USA. Phone: (503) 474-2192.

Agencies

● AEG-Telefunken UK Ltd has appointed Audio & Design (Recording) Ltd as UK distributors of its *Telcom* range of noise reduction equipment. Audio & Design (Recording) Ltd, 16 North Street, Reading RG1 4DA. Phone: 0734 53411. Telex: 848722.

● EXR has appointed Turnkey as sole UK distributor for its range of 'audio enhancers'. Turnkey, 8 East Barnet Road, New Barnet, Herts EN4 8RW. Phone: 01-440 9221. Telex: 25769.

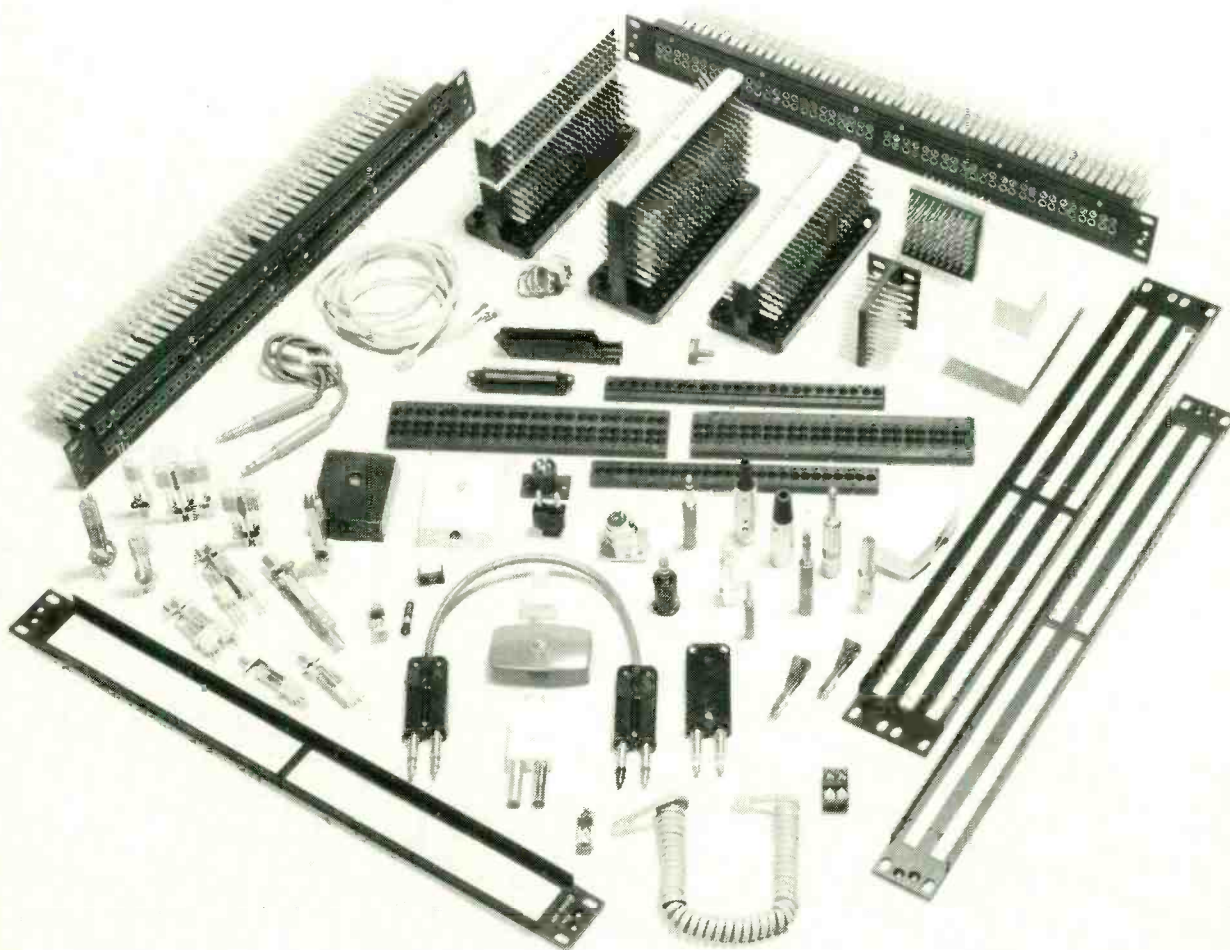
● Allen and Heath Brenell Ltd has appointed Music Laboratory as its main UK warranty and service agents. Music Laboratory Ltd, 72-74 Eversholt Street, London NW1. Phone: 01-388 5392. AHB's agents for Northern England remain: Audio Services Ltd, 25 South Meadway, High Lane, Stockport. Phone: 06632 2442.

Gotham cable price reduction

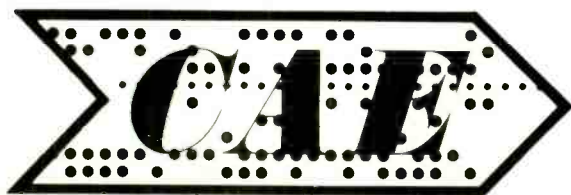
FWO Bauch Ltd, the UK agents for the Gotham range of mic cables, has announced a 25% price reduction on all Gotham cables. This brings the list price of 3-core cable down to £129 for 300m or 43p per metre. Gotham mic cable is available in eight different colours, is highly flexible and features a double 'Reusen' shield. Full details of the new prices are available from: FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ. Phone: 01-953 0091. Telex: 27502.

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new products

Valley People Maxi-Q

Valley People Inc released preliminary information on their new *Maxi-Q* equaliser module at New York's AES. The module (number 812) fits into the same mini-rack system as the *Keplex II* and *Gain Brain II* modules and offers a very flexible EQ facility in a small space. Three overlapping frequency bands are featured, each continuously variable over a 7-octave range, thus giving a wide range of overlap. Each band may be selected to offer peaking or shelving modes, or individually de-selected. In addition, each band has a Q (bandwidth) control: this may be selected over a 0.3- to 3-octave bandwidth in peaking mode, while in shelving mode, the control offers variable slope from 3 to 28dB/octave. At slopes in excess of 12dB/octave, the filter section becomes increasingly under-damped, offering useful phase/frequency characteristics. Below this point, perfect damping occurs, giving a smooth control of the frequency domain. Series filter arrangements, rather than the more usual parallel system, eliminate interactive effects, and a drop in noise and distortion over conventional summing stages is offered. An 'all-feedforward' configuration enables the unit to offer continuous control from 'infinite cut' to 14dB boost on the centre frequencies in both peaking and shelving modes. Notch filtering and variable-slope cutoff functions are available in this way.

An effective extra facility is the 'tune' mode, in which only the output of the selected filter is heard, giving easy aural tuning of the system. An input gain control is also featured, along with a sophisticated overload detection circuit which monitors no less than 13 specific circuit points.

Valley People Inc, PO Box 40306, 2820 Erica Place, Nashville, Tennessee 37204, USA. Phone: (615) 383-4737.

UK: FWO Bauch Ltd, 49 Theobald Street, Borehamwood, Herts WD6 4RZ. Phone: 01-953 0091. Telex: 27502.



Synclavier analysis/synthesis

New from the makers of the *Synclavier II* digital synthesiser, New England Digital, is a digital analysis/synthesis option. Based on a Winchester hard disk storage unit, the sampling system allows real sounds to be captured at a sampling rate of 50kHz (ie full audio bandwidth) for between 100s and 54min, depending on the number of disk units attached. Analysis of the waveform in both the time and frequency domain is possible, and software is provided to allow spectral analysis via Fast Fourier Transform functions on any sampled sound. Components of the sound may be digitally filtered for modifica-

tion and reconstruction of the sound. On the A/D conversion side, 14- and 16-bit converters are available. Further sound modification and graphic editing of the sound is possible on the *VT640* graphics terminal, and up to 24 sounds may be triggered from the Winchester drive. The sampled or modified sound may be performed on up to two octaves on the *Synclavier's* keyboard.

New England Digital Corporation, Box 546, White River Junction, Vermont 05001, USA. Phone: (802) 295-5800.

UK: Keyboard Hire, 8 Thornhill Road, London NW1 1HW. Phone: 01-607 8797.

Dutch mini-mixer

Special Audio Products BV has produced a new six input four output mixer basically designed for 4-track usage, but also suitable for utilisation with small PA systems or as an on-stage keyboard mixer. Called the *Sixmix*, the new mixer has six balanced mic inputs with stereo jacks and six line inputs with unbalanced mono jacks, the line inputs also capable of being used as insertion points when mics are in use. Each channel features gain control, 3-band equalisation (high ± 16 dB at 10kHz, mid ± 12 dB

at 1kHz, and low ± 16 dB at 70Hz), aux/echo send, pan control and routing, plus a channel fader. The output section features channel fader, echo return, an LED peak meter per channel and the necessary output jacks. A feature of each input channel is the provision of a remix switch allowing either line/mic input or 4-track/2-track tape outputs to be fed to the channel.

Special Audio Products BV, Scheldeplein 18, NL-1078 GR Amsterdam, Holland. Phone: 020 79.70.55.



Ampex broadcast recorder

Ampex unveiled a new tape recorder aimed at the international broadcasting market, the *ATR-800*, at the New York AES. It should, however, prove useful to studio owners as well. The recorder can easily be converted between 1-, 2- and 4-channel operation. A cue amplifier is provided to permit monitoring of one or more tracks during editing and cueing, and hands-on-reel and dump editing modes are supported. In addition, a variable shuttle control is fitted to aid the location of edit and cue points. An electronic tape timer offers accurate timing for all three speeds (7½, 15 and 30in/s) in hours, minutes and seconds. A standard feature of the recorder is a single-point search to cue, the cue being stored with a single button. The machine also features PURC (Pick Up Record Capability) to facilitate dubbing and editing.

The *ATR-800* has a metal-laminate head construction, the heads being mounted in a quick-change assembly which can be installed with a single fastener. A fourth head may be added for playback of two different tape formats without changing the head assembly. A closed-loop servo capstan transport is featured, with

constant tape tension in all operating modes. Unlike the *ATR-100*, the new machine has a pinch wheel, but ingenious functional sequencing ensures that the tape glides to a stop, when leaving play for stop mode, before the pinch wheel disengages. Similarly, when entering play mode, the pinch wheel engages smoothly, offering a rapid yet gentle startup. Varispeed facilities are standard, offering $\pm 10\%$ variation.

An unusual feature of the *ATR-800* is that the transport function control panel may be mounted on either side of the machine, to suit left-handed as well as right-handed operators. Options include noise reduction interfacing and rack-mount capability, and a universal power supply is standard, along with both NAB and IEC EQ. The machine will accept 10½in NAB reels and 30cm DIN hubs, and a tape marker/cutter system is also available. The basic 2-channel version costs \$5,450 US.

Ampex Corporation, 401 Broadway, Redwood City, Cal 94063, USA. Phone: (415) 367-4151. Telex: 348464.

UK: Ampex Great Britain Ltd, Acre Road, Reading RG2 0QR. Phone: 0734 85200. Telex: 848346.

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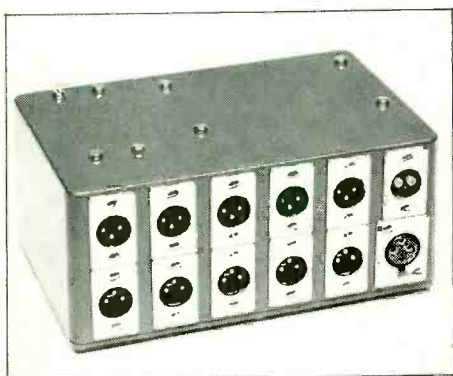
new products

Micmix Dynafex

The *Dynafex* is a new signal processor, on show at AES New York for the first time. As well as offering sophisticated noise gating facilities, the unit's prime function is as a replay-only noise reduction system. Other attempts at 'decode-only' NR systems have been somewhat limited in their capabilities, often causing unpleasant subjective effects. The *Dynafex*, however, appears to offer a way round these problems, thanks to proprietary-design circuitry which is the subject of a patent application. A claimed 30dB of NR is claimed for the slim, 19in rack-mounting unit. The unit is stereophonic, with two independent channels which may be linked for stereo use. A threshold control determines the signal level at which the unit begins to function. A hard-wired bypass switch is also featured.

Micmix Audio Products Inc, 2995 Ladybird Lane, Dallas, Texas 75220, USA. Phone: (214) 352-3811.

UK: Scenic Sounds Equipment Ltd, 97-99 Dean Street, London W1V 5RA. Phone: 01-734 2812. Telex: 27939.



Distribution amplifier

UK manufacturer Surrey Electronics has introduced a new 10 outlet distribution amplifier, the *Mark 3* version of an established product from this company. The new unit is a mains powered distribution amp with a single floating input and a low distortion line driving arrangement providing 10 floating 600Ω outputs. The unit uses a specially designed output transformer with a separate secondary winding for each output giving DC and AC isolation as well as excellent low frequency distortion performance.

The unit is claimed to offer exemplary rejection to RF signal breakthrough and meets the IBA specifications for equipment in the signal path. The distribution amp is designed for use at unity gain; however, an internal preset allows a gain or loss of up to 6dB when feeding 600Ω, or unity to +12dB when feeding a bridged load. The unit is housed in a rugged diecast case, and on request it may be fitted with attenuation on any number of outlets to provide mic level outputs for video and audio recorders which have no line input facility. **Surrey Electronics, The Forge, Lucks Green, Cranleigh, Surrey GU6 7BG, UK. Phone: 04866 5997.**



Lexicon Super Prime Time

Developed from the well-respected *Prime Time* audio processor, the new *Model 97 Super Prime Time* unit from Lexicon, unveiled at AES New York, offers storage of complete panel settings in four banks of eight non-volatile registers. The contents of these registers may be dumped and loaded to and from tape. In addition, there are eight factory-programmed presets. The unit handles flanging, resonant flanging, doubling, tripling, chorus effects, slap echo, short echo and long echo, and consists of a compact 19in rack-mounting case with easily understood front panel control facilities. Settings can be recalled in any sequence. A footswitch may also be used to step through registers, to bypass the system or provide infinite repeats. Unlike many earlier digital delay-based units, the *Model 97* offers full audio bandwidth (20Hz to 20kHz) at all delay settings. The bandwidth is not degraded as the delay is increased. A 'dynamic recirculation control', exclusive to the *Model 97*, enables long delay-time feedback effects to be created without undesirable 'layering' or overlap with the next input signal.

Two separate inputs are provided, with full

input mixing and the facility to cross-link two delay lines for stereo or complex signal processing. Separate mix and delay outputs are provided. In addition, the VCO (which may also be foot-pedal controlled) may be extracted to drive a second processor. Maximum delay is 1.92s, with 90dB dynamic range. A wide sweep range is featured, along with two delay taps which are individually selectable to 3-digit accuracy. LFO modulation range is 10,000:1, and modulation may be sine, square and envelope-based, a continuous blend between either waveform and envelope modulation being available.

Lexicon Inc, 60 Turner Street, Waltham, Massachusetts 02154, USA. Phone: (617) 891 6790. Telex: 923468.

UK: FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ. Phone: 01-953 0091. Telex: 27502.

Lexicon 224X

UK distribution of the Lexicon 224X was incorrectly given in last month's issue. It should have been: Scenic Sounds Equipment, 97-99 Dean Street, London W1V 5RA. Phone: 01-734 2812. Telex: 27939. ▶

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new products

ICC console available in UK

The impressive-looking and sounding International Consoles Corporation 3000 Series modular console system will be available in the UK, following an agreement reached between ICC and Feldon Audio at the New York AES Convention last November, where a complete ICC system was on show for the first time. The system (discussed in our August 1981 issue and shortly to be covered in a feature article) is based around a novel arrangement of freely-assignable non-dedicated busses which allow massive flexibility yet offer exceptional ease of use.

While being a radical departure from traditional console design and ergonomics, the 3000 requires little more than a touch of lateral thinking to grasp the fundamental routing concept, after which everything is remarkably easy. The console is very compact and even a basic 24-channel system can handle two 24-track machines with no trouble. Only three of the 11 modules used in each channel (including the fader) contain active devices, the rest being passive. The mic amp and equaliser are also innovative in design. Although *Fadex* faders are used in the demonstration machine, it is understood that the British automation company, Melkuist, is working on a fader package for the system. This would also enable the fitting of Melkuist automation which would probably also handle the console's system of taking 'snapshots' of all control positions (the control only lighting up when the correct knob position is achieved) in addition to disk-based level and muting automation.

International Consoles Corporation, PO Box 862, Provo, Utah 84601, USA. Phone: (801) 377-9044.

UK: Feldon Audio Ltd, 126 Great Portland Street, London W1N 5PH. Phone: 01-580 4314.

Exposure VII preamp

British manufacturer Exposure Electronics has introduced a new stereo preamp with facilities to accept both moving coil and magnetic phono cartridge inputs. The *Exposure VII* is a passive RIAA type, and additionally features tape and tuner inputs with L and R balance controls; a tape output; and independent gain control on each channel, internally regulated. All inputs and outputs are via phono sockets. The preamp is available in two versions with either single or dual (independent channel) power supplies. Prices are £200 for the single supply version and £250 for the dual type.

Exposure Electronics, Richardson Road, Hove, Sussex, UK. Phone: 0273 777912.

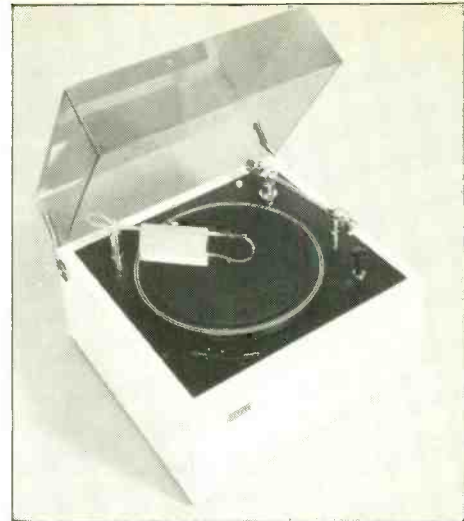


Keith Monks record cleaner

Keith Monks (Audio) Ltd has introduced a new semi-professional record cleaning machine, the *CR-501*, based on the well established *Mark II* model produced by the company. The new cleaner uses the same vacuum pump as the *Mark II* machine, but otherwise is a completely redesigned unit to a more compact and less bulky format. Aimed mainly at meeting the requirements of small radio stations and gramophone libraries, the *CR-501* has a metal deck and is finished in either a white laminate or wood veneer. A major advantage of the new cleaner to customers is that at a price of £395, the *CR-501* is half the price of the *Mark II*.

Keith Monks (Audio) Ltd, 26-28 Reading Road South, Fleet, Aldershot, Hants, UK. Phone: 02514 20568. Telex: 858606.

USA: Keith Monks (USA) Inc, 652 Glenbrook Road, Stamford, Connecticut 06906. Phone: (203) 348-4969. Telex: 643678.



Hazelcom synthesiser

New York AES saw the release of the *McLeyvier*, a remarkable digitally-controlled analogue synthesiser from Hazelcom Industries of Toronto. The compact and elegant system consists of a main keyboard unit with 8-octave spread, programmable slider controls, alphanumeric keyboard and VDU, plus peripherals. Disk storage is utilised in the system, which also features an X-Y pen plotter which enables complete scores composed on the machine to be printed out in manuscript form with a high

degree of accuracy and readability.

Commands for the system, entered via the terminal section, are simply English words, with well-defined meanings, and the entire vocabulary of the machine is explained by a built-in 'operators manual' which uses the system itself to guide the operator through its use, when necessary.

Hazelcom Industries Ltd, 39 Hazelton Avenue, Toronto, Canada M5R 2E3. Phone: (416) 961-7090.



'sync' effect. The contour generator may control the VCF and VCA simultaneously or separately, with the operational mode of the VCA being switchable, and capable of being contoured, operated by keying alone, or bypassed. A unique feature of the *Rogue* is an 'overdrive circuit' allowing the instrument to produce unusually 'fat' or 'hot' sounds through the addition of controlled distortion. The instrument contains an extensive modulation section capable of producing vibrato, tremolo, trills, sample and hold, and automatic triggering. Also incorporated are pitch bend and modulation wheels. Rear panel interface connections consist of S-trig in/out, V-trig in/out, control voltage in/out, and audio input (for processing external signals through the instrument's filter).

Moog Music Inc, 2500 Walden Avenue, Buffalo, NY 14225, USA.

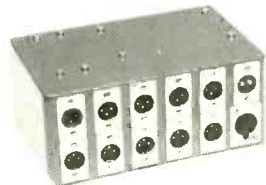
USA: Norlin, 7373 North Cicero Avenue, Lincolnwood, Illinois 60466.

UK: Roy Goudie, 11 Forth Wynd, Port Seton, East Lothian, Scotland. Phone: 0875 812033.

Moog Rogue

Moog has announced the introduction of a new monophonic synthesiser designed as a lead synthesiser for the professional multi-keyboardist. Termed the *Rogue*, the new synthesiser has two audio oscillators and a noise source, the oscillators ranging from 32 to 4ft and producing sawtooth and rectangular waveforms. Additional waveforms may be produced by synchronising oscillator 2 to oscillator 1, the single contour generator's voltage being used to sweep the

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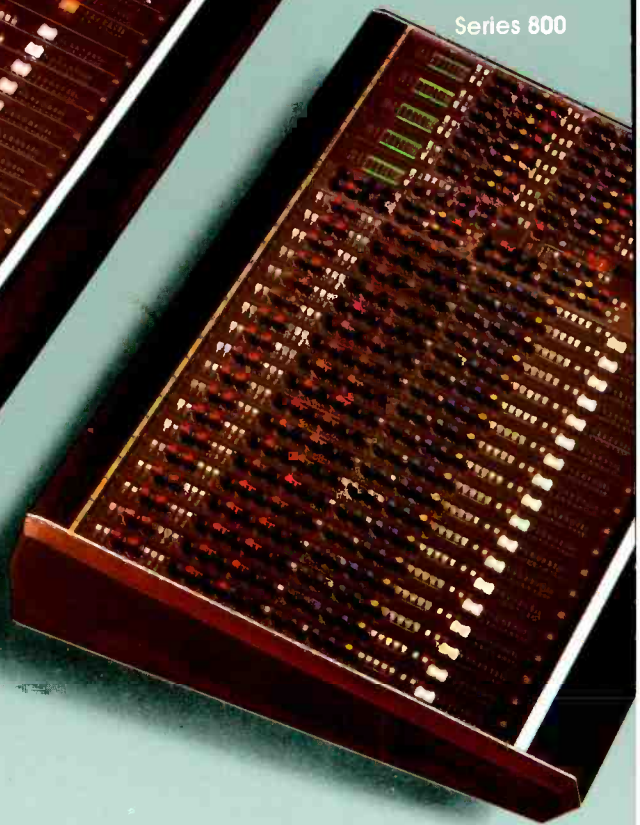
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Series 2400



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No doubt you've heard of us. Many of you have worked with our boards. The purpose of this brochure is to reacquaint or formally introduce you to our full line of consoles.

From the industry accepted portable Series 1S to our most advanced automation ready Series 2400, we design and manufacture all of our products in London, England. Our only business since 1973 has been to produce the most useful, reliable and technically advanced pro audio equipment that doesn't cost outrageous pounds...or dollars. With this philosophy, we have become the largest selling console brand in Europe.

Within our line, there's a console you should get your hands on. Fixed installation or traveling, a Soundcraft board is built to take the incredible demands you ask of a fully professional audio mixer.

The Soundcraft Challengers More for Less

Soundcraft Series 2400, 800, 400 and 1S consoles are sophisticated designs sharing many common features.

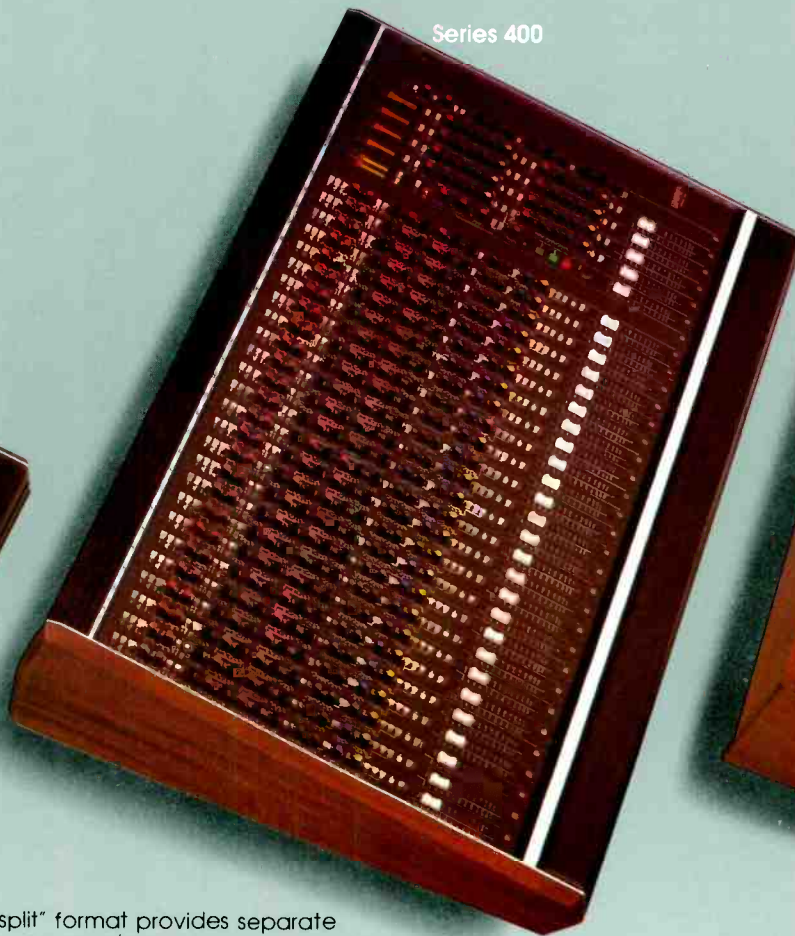
- Transformerless MIC input, electronically balanced insures the lowest possible level of noise, excellent transient response and high frequency common mode rejection.
- MIC phase reversal switch corrects for out of phase mic pickup in multicrophone situations or miswired mics.
- Detented potentiometers with 41 precision positions except for pan and frequency pots which are center detented.
- Push button switches throughout.
- Long-travel faders.

- Full four band equalization, high and low frequency shelving with sweepable high and low mid-range. EQ may be switched in or out, independent of the high pass filter.
- High resolution LED bargraph meters standard on Series 800 and 400, switchable for Peak or VU.
- Penny and Giles faders standard (except Series 1S).

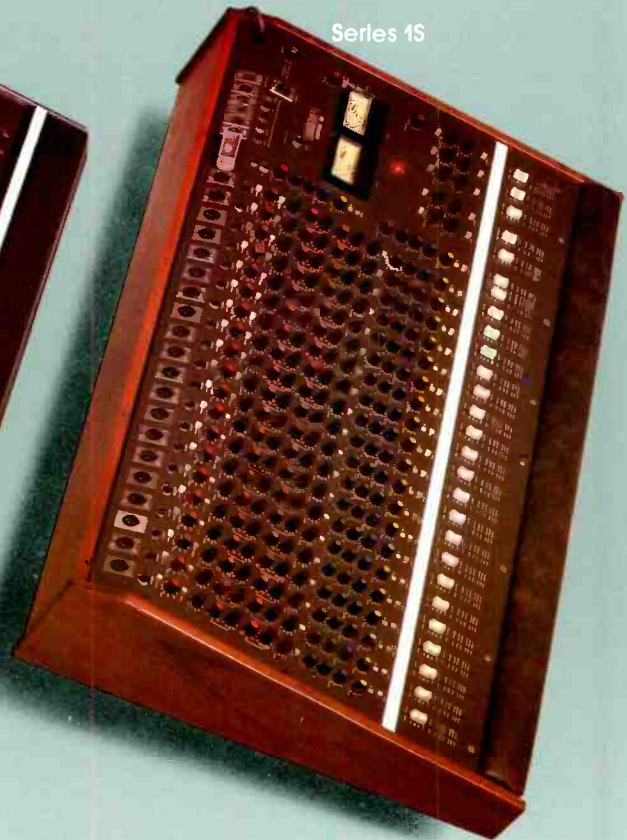
Series 2400

Available in a compact 24 buss 24/16 version with optional 24-track monitoring or full 28/24 mainframe, Series 2400 meets the requirements of the larger 24-track studio to the space conscious 16-track.

THE CHALLENGERS



Series 400



Series 1S

The "split" format provides separate input and output/monitor modules, which gives far greater operational flexibility when tracking and mixing. In mixdown, the 24 monitor channels, each with full EQ and AUX sends, become Effect returns, so a 28/24 console equates with a 52 input inline board. The 24 Group faders provide 12 stereo audio subgroups, optional VCA subgrouping is also available.

The Series 2400 is ready for optional Soundcraft automation and bargraph metering which includes a 27 band 1/3 octave spectrum analyzer. (Standard with VU's.)

Get your hands on a Series 2400 and you will know why it's called "The Challenger."

Series 800

The Series 800 is a compact 8 buss console available in 18, 26 or 32 input mainframes and can be configured for 16

track recording, sound reinforcement or stage monitoring...with no compromises in performance or quality. In fact, the Series 800 is built using the same quality components that go into the Series 2400. The Series 800 18 in/8 out fits in 3½ feet of space and the full bore 32 in/8 out takes less than 6 feet.

Series 400

The Series 400 is a fully modular 4-buss console for up to 8-track recording and for sophisticated sound reinforcement, available in two mainframes, up to 18 inputs or up to 26. Series 400 has more facilities than any other console in its class. All controls are laid out logically and are easy to use. Outputs and playback are nominal +4 dBv, but the console may be modified to -10 dB. Another example of how Soundcraft offers more for less.

Series 1S

The ultimate traveling SR console. Available in 12, 16 or 20 input formats with stereo outputs, plus three auxillary outputs. XLR type inputs with a 20 dB mic pad followed by a variable gain amplifier. Hi-pass filter and 4-band variable EQ standard, 2-band on outputs. Peak clipping LED's and channel switching. Optional conductive plastic faders available. Balanced output available with optional transformers. Available in walnut case as shown or durable aluminum flight case.

More...for the asking.

Comprehensive brochures with engineering details and full specifications and features on each Soundcraft console are available for the asking. We want you to compare our consoles to anyone's with the confidence that when you do, you will readily see why we claim that with a Soundcraft console you receive **MORE FOR LESS**. Much more.

Specifications

Series 2400

Distortion	Mic pre-amp, -30dBv in, +4dBv out	40Hz: 0-008, 1kHz: 0-008, 18kHz: 0-01, IMD: 0-015
	Channel line in to mix out, +4dBv in, +4dBv out	40Hz: 0-005, 1kHz: 0-005, 18kHz: 0-01, IMD: 0-009
Crosstalk	Line in through pan control to stereo mix buss	40Hz: -64dB, 1kHz: -63dB, 18kHz: -55dB
	Adjacent channel	40Hz: -100dB, 1kHz: -95dB, 18kHz: -85dB
Noise	Equivalent input ref 200Ω	-128-5dBv
	Mix noise: 28 inputs and 24 monitors routed to mix at unity gain	-74dBv (DIN Audio)
Input Impedance	Mic input	2kΩ (5kΩ with pad)
	Line input	10kΩ
Output impedance	Any output	<40Ω
Output capability	Any group or mix into 600Ω	+21dBv
Gain	Max mic	75dB
	Max line	40dB
Frequency response	Mic input at 50dB gain to mix	20Hz: -1.6dB, 1kHz: 0dB, 20kHz: -0.2dB
	Line input at unity gain to mix	20Hz: -0.8dB, 1kHz: 0dB, 20kHz: -0.2dB
Phase response	Line input to mix output	20Hz: +20°, 1kHz: 0°, 20kHz: -20°
Dimensions	24/16 input	73-75x37-23x36-75 ins (1873x964-65x933 mm)
	28/24 input	87-5x37-23x36-75 ins (2222x964-65x933 mm)
NB: 0dBv = 0.775vrms		

Series 800

Distortion	Mic pre-amp, -30dBv in, +4dBv out	40Hz: 0-01, 1kHz: 0-01, 18kHz: 0-05, IMD: 0-02
	Channel line in to mix out, +4dBv in, +4dBv out	40Hz: 0-01, 1kHz: 0-01, 18kHz: 0-05, IMD: 0-02
Crosstalk	Line in through pan control to stereo mix buss	40Hz: -64dB, 1kHz: -63dB, 18kHz: -55dB
	Adjacent channel	40Hz: -100dB, 1kHz: -95dB, 18kHz: -85dB
Noise	Equivalent input ref 200Ω	-127-5dBv
	Mix noise: 32 inputs and 16 monitors routed to mix at unity gain	-74dBv (DIN Audio)
Input Impedance	Mic input	2kΩ (5kΩ with pad)
	Line input	10kΩ
Output impedance	Any output	<75Ω
Output capability	Any group or mix into 600Ω	+21dBv
Gain	Max mic	90dB
	Max line	40dB
Frequency response	Mic input at 50dB gain to mix	25Hz: -2dB, 1kHz: 0dB, 20kHz: -0.5dB
	Line input at unity gain to mix	25Hz: -1.5dB, 1kHz: 0dB, 20kHz: -0.5dB
Phase response	Line input to mix output	25Hz: +30°, 1kHz: 0°, 20kHz: -20°
Dimensions	18 inputs	42-52x29-25x7-64 ins (1080x743x194mm)
	32 inputs	63-5x29-25x7-64 ins (1613x743x194mm)
NB: 0dBv = 0.775vrms		

Series 400

Distortion	From mic input at 50dB gain to +4dBv at Group Output	40Hz: 0-02, 1kHz: 0-015, 18kHz: 0-015, IMD: 0-025
	From line input at unity gain to +4dBv at Group Output	40Hz: 0-015, 1kHz: 0-005, 18kHz: 0-025, IMD: 0-005
Crosstalk	Stereo mix buss measured at mix outputs	40Hz: -58dB, 1kHz: -58dB, 18kHz: -51dB
	Adjacent channel of insert send, line input selected	40Hz & 1kHz: below noise, 18kHz: -102dB
Noise	Equivalent input noise ref 150Ω	-127-8dBv
	Mix noise: 16 channels routed to mix at unity gain	-73dBv (DIN Audio)
Input Impedance	Mic input	>2.5kΩ
	Line input	10kΩ
	Tape return	7.5kΩ
Output impedance	Any output	<40Ω
Output capability	Any group or mix into 600Ω	+21dBv
Gain	Max mic	+75dB
	Max line	+40dB
Frequency response	Mic input at 50dB gain	20Hz: -1.6dB, 1kHz: 0dB, 20kHz: -0.1dB
	Line input at unity gain	20Hz: -0.6dB, 1kHz: 0dB, 20kHz: -0.1dB
Phase response	Line input to mix output	20Hz: +20°, 1kHz: 0°, 20kHz: -20°
Dimensions	18/4	42-2x29-3x7-4 ins (107-3x74-5x18-8cm)
	26/4	54-3x29-3x7-4 ins (137-8x74-5x18-8cm)
NB: 0dBv = 0.775vrms		

Series 1S

Distortion	From mic input raise 50dB to +4dBv at output at any frequency 20Hz to 20kHz	<0.03% THD
Frequency response	at 50dB mic gain	20Hz: -1.5dB, 20kHz: -1dB
Noise	Equivalent input ref 200Ω	-126dBv, 20kHz bandwidth
Input Impedance	Mic input	1kΩ (1.6kΩ with pad)
	Insert return (line)	3kΩ
	Echo return	10kΩ
Gain	Max mic	90dB
	Max line	32dB
	Max echo return	63dB
Output capability	Any output into 600Ω	±21dBu
Input capability	Mic (+20dB with pad)	0dBv @ 30Hz (1% THD)
		+3dBv @ 1kHz (0.1% THD)
	Insert return	+23dBv
	Echo return	any level
Metering	0vuv factory set at +3dBv but may be altered internally down to -10dBv Peak LED confirmation 8dB above 0vuv	
Dimensions	12 input	33x22x10 ins (84x56x26cm)
	16 input	39x22x10 ins (99x56x26cm)
	20 input	45x22x10 ins (115x56x26cm)
NB: 0dBv = 0.775vrms		

Soundcraft Electronics Limited reserves the right to alter design and specifications of its products without prior notice.

Soundcraft
THE CHALLENGER

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Studiofile:1



Kent Kesterson (seated) and Curt Taipale in Control Room A

KBK/Earth City Sound, St. Louis

St. Louis may be the ugliest city in America. Urban blight, the likes of which would be hard to match anywhere west of Calcutta, pervades this town, which has been referred to as a wholly-owned subsidiary of Ralston-Purina and Anheuser-Busch. And yet, not far from the metropolis that gave the world Mark Twain, Stan Musial and Budweiser, is a lovely, modern recording studio, in an area as bucolic as an industrial park can be, known as KBK/Earth City Sound.

The area along the Missouri River, just before it joins the Mississippi, known as Earth City, was originally designed in the late '60s to be a 'total environment', with residential, commercial, recreational, and industrial space. The recession of 1973 put a stop to that, and the Ford Motor Credit Company, the present owners of the 1,175 acre former flood plain, are developing it strictly along industrial and warehousing lines.

Starting in 1969, Kent and Marilyn Kesterson, along with several sets of partners, one of whom is Kent's father, Ellis, operated KBK Custom Records, a company that produced location recordings for church and school groups. Kent's background was in church music, while Marilyn's was in education and music, and, at first, both also had full-time teaching jobs. Over the years, the recording operation, which grew from 2-track to 8-track, began to take up more and more of the Kesterson's time, not to mention their home. In 1976, the move to Earth City began, and in September 1977, the first room at the present location, a 16-track, opened.

Designs for the room were provided by John Storyk, but they were extensively modified during construction by Rudi Breuer. The initial tape machine was an MCI JH-16, and the board was a 20-input Quad Eight. Barely four months after the studio opened, the tape machine was upgraded to 24 tracks, and an MCI JH-428 automated console was installed. A second room was built by Breuer, from designs by the Kestersons, to house the Quad-Eight board. That room, now known as

Studio B, features 3M and Ampex 4-and 2-track decks, and the MCI, with the old 16-track heads, can be wheeled in as well. There is a small attached 'room-within-a-room', lined with mirrors, that serves as an overdub booth for the studio's commercial production work.

Main studio

The main studio is a wrap-around design with 15 ft ceilings, and it's large enough to house 60 musicians. House instruments include a Baldwin 7 ft grand, a Hammond C3 with two Leslies, Moog synthesizers, a Clavinet and a set of Pearl drums.

Control Room A, besides the automated console and the tape machine, is home to MCI and Revox stereo decks, and a wide range of toys, including equipment from UREI, Lexicon, Eventide, Allison, Orban and Marshall. A good selection of reverb units is available as well, including EMT plate and Gold Foil, and AKG, Master Room, and Fairchild springs. Dolby is used throughout the complex. The large mic collection features such respected items as AKG 414s, Sony ECM-65Ps, and several types of Neumanns. Monitors are JBL 4350s and 4311s, and, need I add, Auratones. The large JBLs which are mounted above the window to the studio, may soon be replaced with UREI 813s, a pair of which currently sit on wooden stands directly in front of the console. "We really like the UREIs," says Kent, "but so far we've only used them in a near-field monitoring situation. It's hard to say what will happen when we put them in the ceiling."

The 11,000 sq ft that KBK occupies is, at present, barely two-thirds filled. The Kestersons have plans to use the large undeveloped area in the back to build two more control rooms, identical to A, one of which will have a small studio room, the other an intermediate-sized one. A long hallway extends through much of the rear space, connecting the two current studios. "It wasn't in the original plans," says Kent, "but Rudi stuck around an extra day and built it, for the price of a couple of cases of beer. We've been very happy with everything that he's done here.

When we're ready to expand, he'll be the one we call."

Behind the loading door at the back of the building is a parking lot, surrounded on three sides by loading docks for KBK's industrial neighbours. Curt Taipale, the studio's chief engineer, says, "... it has no windows, and so we can use it to play softball. More seriously, after dark, when no one else is around, it makes a great echo chamber. We run cue feeds out, and have someone bang on a snare drum. The sound is incredible." Taipale, from Joplin, Missouri, met Kent at a SPARS conference and joined his staff soon after. He is a graduate of the recording programme at the University of Miami. The other staff engineer is a graduate of Kent's own engineering classes. Rod Sherrell, Kent says, "... hung around and bothered me enough that I gave him a job."

Projects

KBK has been host to such musical luminaries as Black Sabbath, Carmine Appice, and Joe Travolta, but the bulk of the music that the studio now does is demo work and local independent records, especially for churches, schools, and show groups. "There was a time when we did a lot of live and studio work for Motown, A&M, and CBS artists, and for local radio stations," says Kent, "but most of that has dried up in the last two years." A lot of the studio's time is also spent producing commercial and industrial projects, including spots for Mutual of Omaha, the

soundtracks for their *Wild Kingdom* television show, and tapes for Concordia Publishing House.

But Kent Kesterson is trying to change much of that. "A friend of ours has a video production company, and has covered events like the installation of the Archbishop of St. Louis. He pooled his coverage to two TV stations, and he had more cameras than they did at the Super Bowl. We're working on linking up with him and working his audio. We're also considering building a cyclorama soundstage out back so that he'll have a stationary facility.

"Don Tweedy, a producer in Nashville, is beginning to bring a lot of sessions in. He happens to love the sound of the string section of the St. Louis Symphony. He's thoroughly convinced that the record business is turning the corner, and that the major labels are starting to contract new acts from towns like St. Louis again. We certainly want to be part of that."

The price is right at KBK/Earth City Sound — \$95 per hour and down — and it's in a decidedly attractive part of a singularly unattractive city, only minutes from the airport. The people are knowledgeable and serious, and willing to help new clients of all types. Hopefully, time will prove that such a studio, modest but well-equipped, in the heartland of America, can thrive.

KBK/Earth City Sound Studios, 4288 Rider Trail, Earth City, Missouri 63045, USA. Phone: (314) 291-4840.

Paul D Lehrman

A-Square Studios, Michigan

It doesn't look like much from the dirt approach road. The six acres of cleared land are occupied by a large concrete blockhouse, a metal Quonset hut, a couple of small houses, and a swimming pool. But inside these unprepossessing structures is a fully-equipped vacation studio at which, thanks to clients like Ted Nugent and his New York-based producers, business is booming.

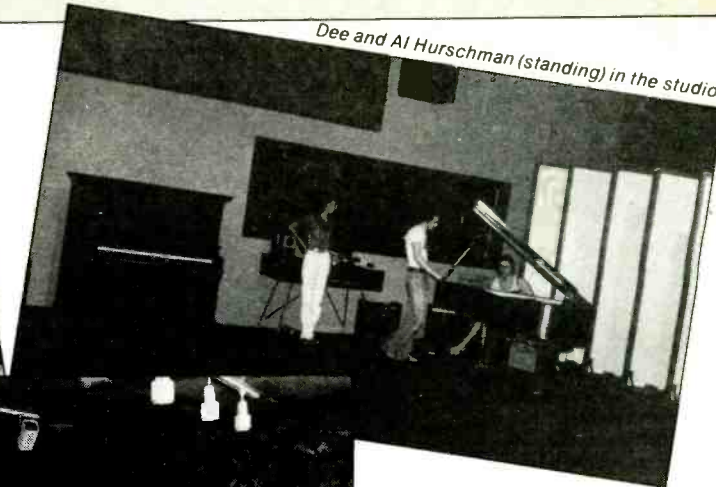
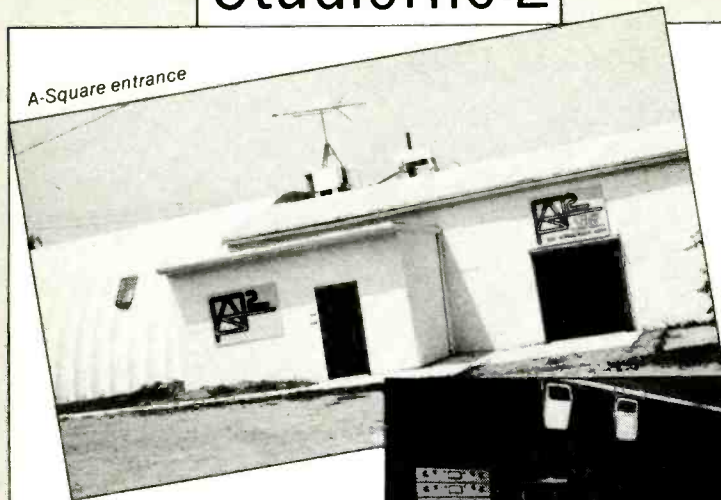
Unlike most resort studios, A-Square developed slowly. The property, which had been a large sod farm at one time, was owned in the early '70s by a local band who used it for rehearsing and recording on Scully and Audio & Design 8-track gear. Bob June and Al Hurschman bought the place in 1976, and a year later, after much remodelling, opened it up as a commercial 8-track studio.

June had been managing bands in the area. He lives on the premises, but is involved in other businesses, keeping a low profile in the studio operation. Hurschman had worked as a designer and installer for the

Flickinger console company, and then spent several years working for studios and console manufacturers around the country. His experience included a year in Nashville and Memphis designing a coffee-proof fader for Auditronics, and building a studio for George Harrison's Dark Horse Records, which was sold off, unfinished, when A&M dropped the label.

Dee Hurschman is Al's wife, and is now his second engineer as well. They met while construction was going on at the studio. Her background, in education and modern dance, was about as foreign to the recording business as possible, but, as she puts it, "I slid into it on the side". She helped to supervise a lot of the construction work, including the casting of a 12in-thick floor for the new control room. Much of the work was being done by temporarily out-of-work bands in exchange for studio time, and when, in the summer of 1977, they all went back to work, Dee enlisted the help of the women she worked with at Blind Pig, a local coffee house and record

Studiofile:2



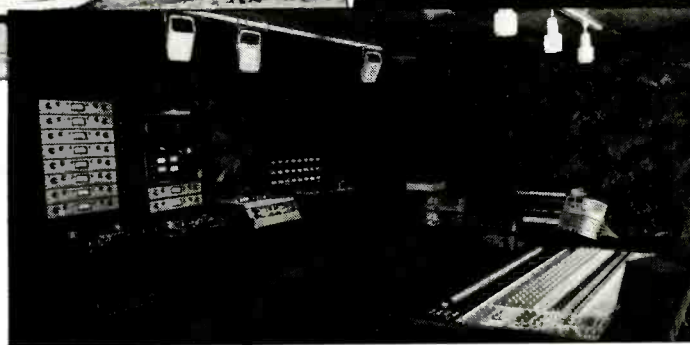
A-Square cont'd

company, to finish off the interior work. "I'm still learning the technical end, slowly but surely." Al laughs. "She had to jump right into it. The first open-reel deck she ever worked on was an MCI 24-track."

It was in the summer of 1978 that A-Square acquired 24-track capability. "Coming as I do from a console background," Al explains, "the Neotek board looked really good. The designer comes from the biomedical equipment field, so for him, working within the audio spectrum was child's play. The only problem we've ever had with our board was when the air conditioner dumped a quart of water on it. Even then, we were only down for an hour and a half." The board is being replaced soon, and Al has been working with Neotek on their new designs. "The routing capabilities on the new boards are so good," Al says, "that I'm not even considering automation. The VCA degradation is just not worth the slight advantage of a memory."

The MCI JH-114 24-track tape machine may also be gone by the year's end. "It's been a workhorse, but it needs constant service," says Al. "We're spec-ing an Otari MTR-90. Some folks are interested in buying the MCI and setting up a mobile unit. They also have some connections with video equipment. We may go in with them, and get SMPTE equipment, so that we can offer 46-track recording."

The other tape machines in the carpeted, 18ft square control room, are MCI, Scully, and Revox 2-tracks, a Teac 4-track, and the old Scully 8-track, which is pulled into service on occasion. Although Al Hurschman prefers to run Ampex 456 tape at 30in/s, dbx 208 noise reduction is available. Monitors are JBL 4333As, sitting on sand-filled columns, as well as 4311s and Auratones. They are powered by Crown and SAE amps, with White $\frac{1}{2}$ -octave EQ on



the main speakers. Other equipment includes two dbx 165 comp/limiters, an EXR exciter, an Eventide 910 Harmonizer with keyboard, a Marshall Time Modulator, a Delta-Lab DL-2 Acousticcomputer, a Scamp rack with several open spaces ("our clients like to supply their own units," says Al), a Dynacord tape echo unit, UREI 1176, Teletronix LA-2A and Orban limiters, and a Time Tech phaser, a locally made device that Al describes as "really noisy and nasty".

Reverb is provided by an EMT 140 stereo plate and a Sound Workshop stereo spring "for people who need that springy Fairchild sound". The 40 x 60ft studio room was built originally as a tractor barn, with a large grease pit in the ground. The pit has been sealed off, and is now used as an acoustic chamber.

The studio room boasts 14ft ceilings and has a raised 20ft deep stage at one end. The stage is separable from the rest of the space by heavy curtains, and has a parquet floor. The other end of the room is carpeted, while the centre is tiled. "We left some standing waves in," explains Al, "to get a really juicy guitar sound". The room is also used to showcase bands and albums, and for occasional video shoots. "We don't pursue that end of it as a money-maker," Al says, "but rather as a service to our recording clients". There are double loading doors, which came in handy when Bob Seger came in to rehearse with a semi-trailer full of equipment, and 200A worth of mains service for lighting the video shoots. The old control room is now a large iso

booth, with a dead floor and a reflective ceiling. A modified Yamaha 16/16 board, used for stage monitor mixes in live situations, hides in one corner. More than a dozen Cerwin-Vega speakers for foldback and studio playback are literally stacked all over the studio.

Instruments include a 1972 Steinway grand piano, a 15-year-old B3, which Al says has never seen the inside of a bar in its life, a rebuilt Leslie, a Rhodes 88, an upright tack piano, and several drum sets.

The microphone collection is very large, and boasts, besides the usual RE20s, SM81s, etc, a pair of Altec M30s and a brand-new matched pair of Neumann U89s.

All this sounds pretty extensive for a one-room studio a few miles from a college town and a 30min drive from Detroit, a city that has seen better economic days. Al Hurschman is quick to explain the apparent contradictions. "When we first started out, we were doing mostly local bands, but now we're directed at an international market. We would much rather have long bookings in, and be able to devote the place completely to one client at a time. Gus Papas, for instance, who is here now working on an album for Nemperor, has the place for seven weeks. Sometimes we'll work 14hr days with a two-man production team, with Dee and myself alternating at the board."

The producers who are in large part responsible for the success, and who are today running around the place in bathing suits, are the team of Rick Browde and Cliff Davies. Davies first came in with a local

band called Salem, and he liked the place so much that he soon returned with Browde and Ted Nugent. Nugent recorded *Screen Dreams* here, and did much of *Intensities*, as well as rehearsals for *State of Shock*.

Browde and Davies have also brought in Butler, recording for Polydor, Gus Papas, Barry T Goldberg, and soft-core porn film producer-turned-singer Gail Palmer.

"As much as I love CBS' studios in New York," he goes on, "I can't afford to pay union engineers, as well as the company's rent and land taxes. The first time we submitted a budget to Nemperor for studio time here, they thought I was kidding, it was so low."

Book rate at A-Square is \$100 an hour, and that can go as low as \$80 for blocks. Any band that books two consecutive full days gets full use of the facilities, which include swimming pool, Jacuzzi, sauna, volleyball, and grape, apple and raspberry picking (in season). The guest-house rooms are large enough to rehearse in, and have stereos and complete kitchens. Ted Nugent brings his family and pets and moves in when he's working here. Clients "usually" take out their own garbage, and will bring in their own food. "Usually it's pizzas and fast food," says Dee Hurschman.

"We've done some commercial and industrial work," says Al Hurschman, "but we don't encourage it. Those people like to work in the morning, and around here, folks get up at the crack of noon."

"Privacy, recreation, a relaxed atmosphere, and all the studio time they need are what we offer our clients," says Dee. "The only thing we're missing is a gourmet cook—and we're working on that."

Paul D Lehman
A-Square Studios, 3691 Morgan
Road, Ann Arbor, Michigan 48104,
USA. Phone: (313) 434-2141.

More time on your hands from MXR.

Providing extended delay times at an affordable price, the new MXR Model 151 Delay System II gives you over three full seconds of delay (three times that of similarly-priced digital devices). Specifically, the Delay System II can offer you up to 800 milliseconds of clean, quiet delay at a full 16 kHz bandwidth (over 200 milliseconds more than the closest competitor). As a digital recorder, the Delay System II's exceptional memory capability lets you capture entire musical phrases or obtain a wide variety of dynamic and *musical* studio-quality effects from flanging and chorus to echo and doubling in one rugged package.

And it's easy to use in real time. The large front panel and simple control format make it a snap to quickly select from a vast range of time delay effects. The Delay System II's high-resolution four digit readout displays the precise amount of delay and the bandwidth is indicated by LED's, so there's no "squinting & thinking" to find out exactly where you are. Level-indicating LED's let you set up the optimum level in seconds.

The Delay System II fits right into your rack, looks great and provides clean, noise-free performance. A level switch is provided to optimize signal-to-noise for professional/home recording and onstage applications. The Delay System II also features easy access with both XLR and phone jack connectors (inputs *and* outputs) on the rear panel for instant interfacing with your patch bay.

MXR Delay System II—More time on your hands and more ways to use it as a creative tool on stage and in the studio. Hand-assembled in the U.S.A. with the finest components available in a compact, easy-to-use rack-mountable package.

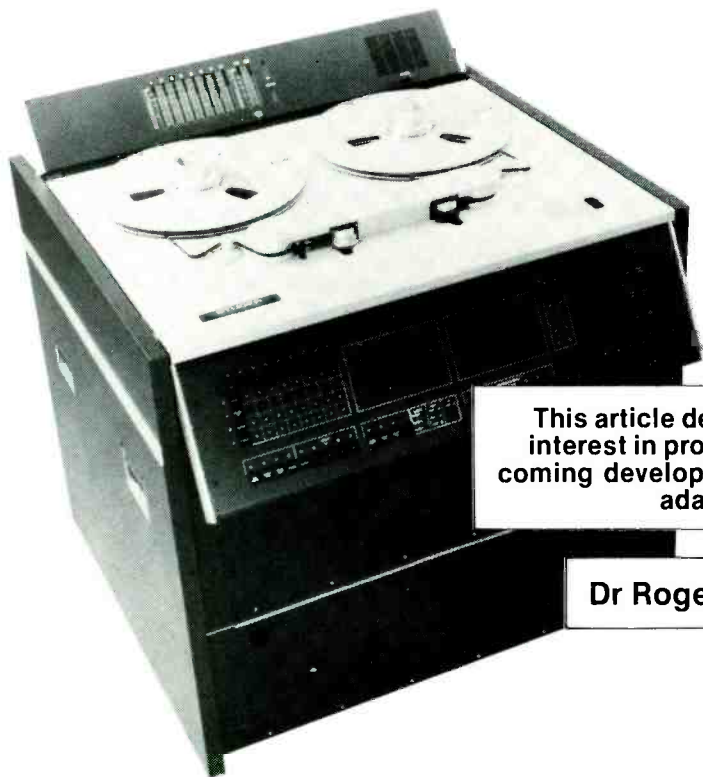
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Digital audio the Studer view



This article describes how Studer, with its strong interest in professional analogue audio, views the coming development of digital audio, and how it will adapt to the new technology.

Dr Roger Lagadec

TODAY, so-called digital records can be purchased in most record shops. Since their appearance a few years ago, digitally- or partly digitally-mastered records have become an accepted sector of the market. Many classical records are now mastered digitally, but classical records are only a small portion of the market at best. The impact of digital mastering on the sales of successful pop records has yet to be seen, and buyers of records tend to grumble about the poor quality of many pressings rather than enthuse about the improvement achieved by transferring bits from a tape into analogue waveforms carved into vinyl.

Yet digital recording is a reality, and already it influences the day-to-day life of recording companies. In addition, a number of digital techniques have been in use for several years for programme transmission, artificial reverberation and the like. There is a degree of truth in saying that the digital age has 'arrived', even though it will continue to arrive for many years.

More importantly, digital techniques are certain to become important because, finally, consumer products in digital audio are on their way, primarily digital discs and digital home recorders. The

scheduled appearance of the *Compact Disc* on the Japanese and European markets in 1982/1983 tells us that, in a few years, digital audio will no longer be a purely technical matter of improving sound quality (a laudable technical objective, which does not automatically lead to improved profits), but will find its rationale in a dynamic, growing, and potentially very lucrative market.

Analogue or digital?

Any visitor to professional exhibitions will notice that, along with conventional recorders, a large number of digital machines are being displayed. Actually, an observer basing his conclusions exclusively on his visits to the APRS, AES, etc. would have to believe that digital and analogue recorders share today's market more or less evenly. A look at the sales figures however, or a glance at the price tags, will immediately qualify such hasty conclusions.

Professional digital recorders, and also digital systems adapted to professional requirements, are on the market today, thanks to several companies' early investment and research in new technology. The quantities, though growing, are

remarkably small when compared to the thousands of professional 1- and 2-channel, and the hundreds of multichannel analogue recorders sold each year.

At the same time, experience is being gained as to the costs, the maintenance effort, the quality and the advantages and disadvantages which are characteristic of the new technology. Three years ago, we really did not know what a 'digital' studio might be like. Today, thanks to the daring of a few pioneers (some of them in the UK), we know much more.

Now what are the markets? Why buy digital? At what price? Where will the profit come from?

Studer's definition of a professional in audio is someone who aims at making money (well, enough at least to survive with a modicum of comfort) by providing technical expertise to the record or broadcasting industry—two admittedly, and justifiably, economy-minded groups. No statement on digital audio, in our view, can escape this almost trivial fact; digital audio will work where there is digital audio money to be made.

Today, there is a growing interest in the record industry in improving the quality provided by the analogue

recorder (there are also far graver concerns having to do with the record industry as a whole, but this is a different matter altogether). A digitally-recorded symphony will, all things being equal, sell better than its analogue counterpart (a subject for much amusement, surely, for Messrs Mozart, Beethoven *et al*). The final product, as we know, is still an analogue record on vinyl, with its advantages—price, familiarity, profit margin—and faults—durability, pressing, sound quality. In such an application, the digital recorder is like an improved analogue recorder, and—most importantly—it is operated just like one (apart, sometimes, from editing).

For example, a multitrack digital recording must, today, be mixed down via analogue, and go through A/D conversion for mastering. The result is a simple operation: the input and output signals are still analogue, and only the admittedly weak link—the actual recording of the signal on to the tape—makes use of digital techniques.

The same situation exists in broadcasting, incidentally. The BBC was not only a pioneer in developing digital recorders, but has been transmitting programmes digitally for many years, replacing a weak link in

their system (the analogue transmission) by its digital counterpart in an otherwise analogue environment.

In both these cases, there is as yet little urgency for worldwide standards. There are so few digital recorders that tape interchange between machines is not yet a grievous concern, nor is the worldwide exchange of master tapes. However, the situation will change radically when the final products (the records, tapes or cassettes and the broadcast programmes) become digital.

The *Compact Disc* is an example of this. A digital disc will bring along a whole digital chain, eventually ranging from the first recording to digital mixing and mastering and finally transfer to the *Compact Disc* (our mention of *Compact Disc* as the digital disc, by the way, reflects our awareness that no other system seems to have any commercial potential at present). Along with a complete digital chain will come the requirement of building a system, and possibly the nightmare of having to build one with incompatible pieces of equipment.

The same will also hold in broadcasting, of course. There will be digital discs there, but also digital broadcasting via satellites, and of course the necessity of mixed-media productions together with analogue, and later digital, video. Even more than within the recording industry, the necessity of setting up a consistent system with a great number of interfaces will exist.

How fast will the new markets, with their digital end products, develop? Will they complement or replace the existing markets? Of course we do not know the answers. But we know that some simple answers are inadequate.

Compact Disc, appearing in some markets in 1982/83, will not make the analogue disc obsolete. It would be a remarkably insane objective for those who introduce *Compact Disc*, and who make their profits exclusively from analogue records and cassettes, to kill their own market in order to create a new, and insecure, one.

Compact Disc is a very exciting product, but its disc and its player will not be very cheap at first. Why should it? It uses expensive technology, and appeals to the audiophile. Selling it cheaply is an efficient way of reducing profits.

Compact Disc will not quickly dominate the market. Digital discs in Europe and Japan—yes. But will the

market in, say, Brazil (a random choice, and a large market) be ready for nothing but the *Compact Disc* in 1986? Not really. Both systems will coexist for a long time. It is true that, last time around, the new and compatible microgroove records established themselves very quickly; but there was not, then, a record player in almost every home of the richer western countries, let alone a large number of other, economically less favoured countries.

It seems rather more probable that the existing market in analogue records will carry on, with a few innovations of its own, such as noise reduction, which are, to the customer, viable, sensible and cheap; and that, in parallel, there will be a new market, small at first but growing briskly, for the new digital end-products.

Standards

Analogue recording has its standards, and has taken a long time in establishing them, sometimes with spectacular failures. Depending on the point of view, one can even say that, today, analogue recording has either far too few standards, or far too many, but they work.

There are standards for bandwidth and frequency response and levels, and for connectors, and for recording (tape speed, tape parameters, spools, tracks, bias, what have you) and—to a far lesser degree—for controlling the recorders.

We need all of these in digital, no more, no less. The difficulty is that each required standard in digital is infinitely more complex. Assume, for instance, two different digital recorders with a sampling frequency of 48kHz. Programme transfer is easy if the interfaces exist. One machine, of course, will have to dictate the sampling frequency. Now who will dictate it when three machines are in use? When one machine feeds the other two, the source machine can do the dictating without conflict. When two machines feed the third one, the destination machine must impose the sampling frequency. Now when four machines . . . As you see, interconnecting is not always easy, and a systems approach is essential.

A natural and simple way of interfacing is via analogue. Its one drawback, of course, is that it makes far too much sense to remain digital—no degradation, no conversion, and basically less cost.

Exchanging digital programmes

between, say, two digital recorders is only possible when they are using the same sampling frequency, unless one is ready to change the programme's pitch. There are still vast misunderstandings here: of course a recorder made for 48kHz can be made to run at 50kHz so as to transfer its own programme to another recorder blessed with a sampling frequency of 50kHz; but the pitch will be off by 4%.

So we need one sampling frequency or at least as few of them as possible. We also need rules for synchronisation, but this is a topic worthy of several years of controversy among manufacturers and users.

If two recorders operate at the same sampling frequency, it becomes simple to exchange programmes: 'simply' connect output to input, which implies, of course, standards relating to connectors and signals. The digital interface (the equivalent of the analogue audio cable) is an absolute necessity.

Exchanging tapes is an obvious requirement in studios. This means, again, agreements on where to write, on which tape, at which speed, with which code on the tape, which data formatted which way. The task is not simple.

Finally, as in analogue (but with more urgency), standards are required for remote-controlling the machines and building up systems.

Analogue recording has, to a large extent, achieved its present quality because the signals and their measurements were defined very precisely. This will be just as imperative in digital audio, where one sometimes comes across the opinion that any digital system with 16 bits automatically may boast a 96dB range and S/N ratio (and, naturally, much more with pre-emphasis . . .). Many of the specs of digital audio systems are still either meaningless or vague, and will remain so until the staggering work of redefining measurements and signal quality for digital audio has been undertaken. It will have no glamour whatsoever, but this is where quality originates.

In retrospect, the developments in standardisation can be described as confusing. Close to a dozen sampling frequencies, for instance, have been proposed for professional digital audio, and defended with ferocity as well as expertise.

At the last meeting of the AES Technical Committee on Digital Audio in New York, a consensus was achieved which will possibly settle the issue of sampling frequen-

cies. Studer proposed that professional digital audio should operate at 48kHz for compatibility with other professional systems such as film, analogue video and digital video, and transmission networks, and at 44.1kHz for the production of consumer products (48kHz is certainly the most sensible choice of a professional sampling frequency; 44.1kHz is by now a commercial necessity due to the appearance of consumer products).

Thus, along with a 32kHz rate which has been a reality in broadcast transmission for a long time, we will probably have three sampling frequencies in professional audio, each aimed at a particular set of applications. It may be a pity; two would have been more advantageous; but three is better than four, or seven, or a dozen.

General state of the art

'State-of-the-art' is not a misnomer: digital audio is still a very new science, and few manufacturers or users can boast a wide experience in it. The best way of assessing where we stand is to compare what digital audio wants to achieve with the results in similar areas in technology.

In digital recording, the density required (both in rotating-head and in stationary-head recorders) is still roughly one order of magnitude higher than that which is available for computer peripherals, and digital audio aims at operating such recorders in studios and homes, rather than in computer centres. For very elementary physical reasons, such high-density recording will never be trivial. That it can be achieved at all is already a great achievement.

Similarly, the recent progress in error protection (as documented by results from the BBC and a large number of Japanese manufacturers) is very impressive when compared with results in data transmission. Here also, very new technology is being put to use.

The same holds, finally, for the integration of complex functions and circuits on to single chips. One-chip D/A converters, error-protection circuitry and digital filters all indicate that digital audio relies on advanced and expensive technology.

It is commonly said that digital makes everything it touches smaller and cheaper. Today, a digital recorder costs approximately three

Digital audio the Studer view

times as much as its analogue counterpart, and is certainly not smaller. The reason is simple: digital with large-scale integration does reduce costs, provided the production quantities are large enough. Otherwise, it improves quality (sometimes), at an increase in costs (always). The quantities, today, are just not large enough, nor will they be, in most cases, for a long time to come. Digital consumer products, of course, will provide welcome exceptions.

As for the products becoming smaller than the analogue ones, this has to be a fallacy. An essential design problem in a 24-channel digital recorder, for instance, is the large power dissipation of the machine. Making it smaller than an analogue recorder means ventilating it heavily, and thus making it both noisy and unreliable. Integration will of course help, as it is inherently a power-efficient technology. But, again, integration requires large quantities.

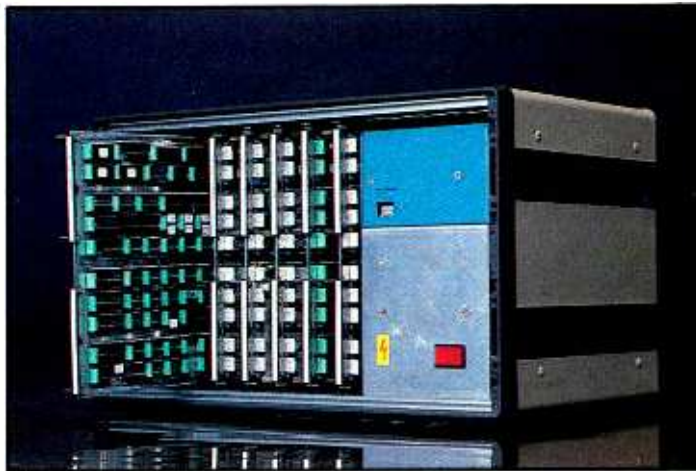
The digital recorder

A digital recorder consists of A/D converters, circuits for error protection of the digital data, modulators to match the signals to the heads and tape; of course, heads and tape; and circuitry for signal detection and error correction, followed by D/A conversion.

As we all must know by now, recording can be made with either rotating or stationary heads. Although some rotating-head systems are in use, there seems to be a clear trend towards stationary heads in professional digital audio, for reasons of reliability, speed and ease of editing. In addition, today's rotating-head machines are restricted to two digital audio channels.

Studer is actively developing digital audio recorders with stationary heads. In May 1980, an agreement with the Sony Corporation was announced which related to a common format for stationary-head digital audio recording. Some of the essential features for the format are:

- a high modularity;
- tape speeds of 30, 15 and $7\frac{1}{2}$ in/s, depending on the number of tracks per channel;
- recorders with up to eight channels on $\frac{1}{4}$ in tape, and 24 channels on $\frac{1}{2}$ in tape;
- extremely strong error protection, and the possibility of tape-cut editing;
- and a high recording density which



The first digital, universal sampling frequency converter for two channels of 16-bit digital audio

will require no increase in the foreseeable future.

Recorders corresponding to this common format are being developed independently by both companies, the common format guaranteeing tape interchangeability. Early this year, Studer will display its prototype recorders, based on its well-proved A800 transport (other models based on the smaller A80 transport, which also has the mechanical quality required by digital audio, will be shown later). Small-scale production will begin in the spring, with newer types of machines being continuously developed. The first type of recorder (with a name still to be disclosed) will be aimed at multitrack digital recording for classical applications and at Compact Disc mastering.

In accordance with the company's policy of careful professionalism, market production will be gradual; the technology is very new, and the degree of ruggedness and reliability which has become expected from professional analogue recorders is still beyond reach.

Considerable effort has gone into evaluating tapes suitable for digital recording, with some encouraging results. The final objective, of course, is to use non-certified tape at a cost level comparable to today's analogue tape, if not lower; today's digital recorders are not only expensive to buy and maintain, they also must be fed expensive tape.

The development effort towards digital recorders at Studer, as befits a professional supplier, does not stand alone; parallel developments in digital editing and signal processing, as well—of course—as in

analogue recorders, are also taking place, with a comparable priority.

Sampling frequency conversion

With at least three sampling frequencies as future standards, the question of sampling frequency conversion automatically arises. First a definition: sampling frequency conversion means changing the sampling rate of a digital audio signal without changing its sound. It is necessary when changing standards (say, when transmitting a Compact Disc programme, recorded at 44.1kHz, over the digital transmission network at 32kHz).

Today, sampling frequency conversion is achieved simply by going analogue, i.e. by using a cascade of a D/A converter, an analogue filter for smoothing and anti-aliasing and an A/D converter for re-digitising the signal. Simple as it is, the approach has the disadvantage of impairing signal quality; today's converters have limited resolution and generate noise and distortion, while the filters add phase distortion and, again, noise. In addition, a very high filter attenuation is required in order to keep aliasing down.

Another possible way is based on some classical papers by a number of scientists at the Bell Laboratories. Conversion can be done by purely digital means, provided the ratio of sampling frequencies is simple (such as 32 to 48kHz, but not 32 to 44.1kHz) and the two frequencies are in perfect lock. The disadvantage is that each ratio requires another digital filter. This method accordingly does not permit free conversion

of the sampling frequency, although it has the advantage of avoiding the impairments due to A/D and D/A conversion. (The method was used, incidentally, in a converter restricted to a fixed ratio of 7 to 8 and built at a Japanese university for Sony.)

What really is required in digital audio is a sampling frequency converter which operates digitally but accepts arbitrarily complex, even varying, ratios of sampling frequencies. Such a converter was invented and is now being produced at Studer, after having been demonstrated late in 1981.

Conventional sampling frequency conversion operates at a conversion frequency defined as the least common multiple of the input and output frequencies; for instance, conversion between 32 and 48kHz occurs at 96kHz (three times the one, and twice the other), and conversion between 32 and 44.1kHz occurs at a formidable 14.112MHz. It would seem that for an arbitrary ratio, an arbitrarily high conversion frequency would be required. The new sampling frequency converter is based on the premise that a finite, although extremely high, conversion frequency is enough for systems with a finite resolution (such as 16 or 24 bits), and that novel techniques can radically reduce the amount of computation required in the digital filters which perform the conversion.

In its present version (as a rack-mountable unit of 19in wide and 11in high), the stereo sampling frequency converter consists of eight boards of medium-speed electronics, including the interfaces. The information necessary for controlling the conversion is extracted from the clock signals themselves via digital signal processing, so that no programming of the sampling frequencies is required. In this way, even varying ratios are accepted by the converter. As the converter is purely digital, its signal impairment is too slight for direct measurement; the measured signal quality shows only the effect of requantisation, which is common to all methods.

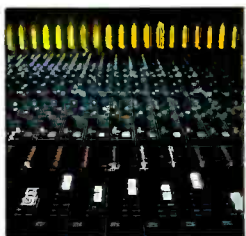
Eight boards of electronics is a lot for such a simple operation as changing the sampling rate of a digital signal, but there is as yet, no alternative. The sampling frequency converter can be used for standard conversion, but also for interconnecting systems such as satellite and terrestrial networks with close, but not necessarily synchronised, sampling frequencies. Other applica-

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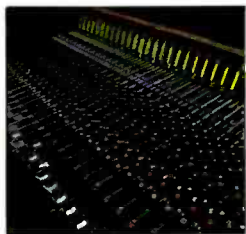
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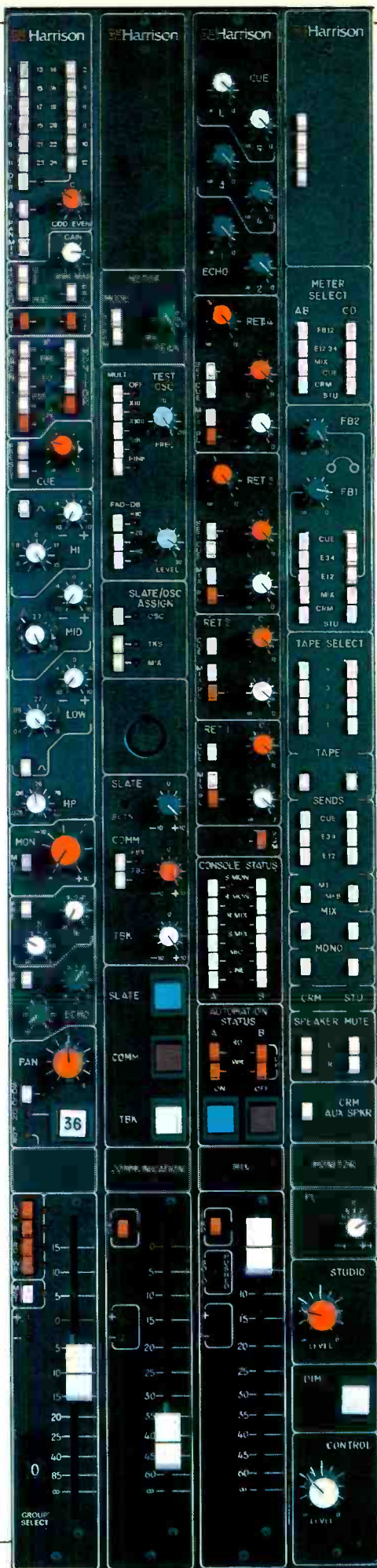


In addition, each module offers six auxiliary sends and a direct assign button for multitrack recording.



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Digital audio the Studer view

tions are already being envisaged. An immediate consequence of the development of the sampling frequency converter by Studer was to permit a tentative agreement on 48kHz as a standard sampling frequency, as its complex ratio to the sampling frequency of the digital disc, 44.1kHz, was no longer an obstacle.

Interfacing

Another fallacy often encountered in discussing digital audio is that it is easy to interface different systems. Anyone who has had to face the frustration of, for example, redesigning a full set of timing signals for each and every A/D converter he wants to investigate will agree that interfacing—even in its simplest form—entails much work and effort.

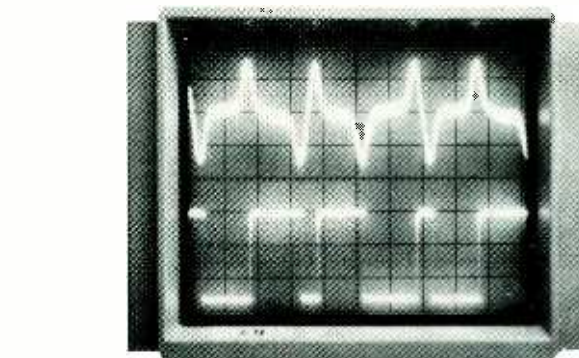
Today, it is not possible to make a connection between two pieces of digital equipment operating with the same sampling frequency unless the connection is made via analogue. The need for a universal digital interface is thus obvious.

Ideally, of course, the universal digital interface should be everywhere, ie at the input and output of each and every item of digital audio equipment which might have to interconnect with others in the digital domain.

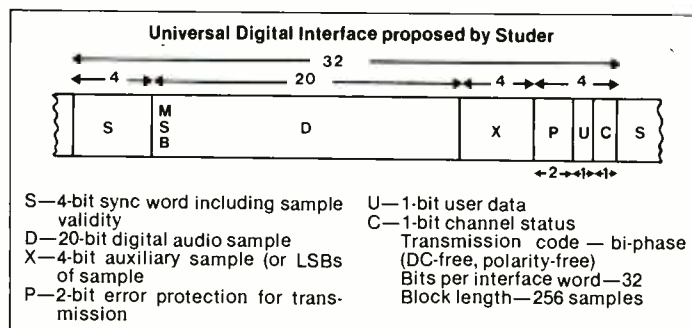
What should the interface perform?

It must permit the exchange of digital audio signals, using one universal format. In addition to the digital audio samples, other information may be carried, eg to indicate sampling frequency, word length, emphasis, origin and destination of channels, auxiliary digital channels, user data, etc. Further requirements are simplicity, as this must be built into even simple equipment, low cost, the possibility of a hierarchy for one, two, possibly four, and more channels, and adaptability to future transmission via optical cable.

Such a universal digital interface was proposed recently by Studer, and has been adopted by Sony, and together both companies presented it at the last AES meeting. The basic interface transmits one channel over one pair of wires or an optical cable, in a format designed with the future capability of accommodating two or four channels per cable. The transmitted word length is 20 or 24 bits, and the interface is purely serial and self-clocking. Although no decision concerning the acceptance of the Studer proposal can yet be reported (discussions will have to cover a



Bits of digital audio, recorded on a tape at 40,000 bits/in, and after detection



myriad of details anyway) it is encouraging to note that professional manufacturers, after due consultations with users, are now co-operating towards producing common formats. This, to say the least, is a marked change from the first efforts towards standardisation.

A universal digital interface for digital audio signals thus seems possible; it will not, by far, mean the end of standardisation efforts. It will be just as important, later in time, to agree on simple interfaces for the remote control of digital equipment. There, as everywhere, the main motivation will come from the marketplace.

The Art of conversion

Strangely enough, there is, in analogue, something similar to the conversion between analogue and digital. In an analogue tape recorder, we can differentiate between the 'wire format' and the 'tape format'. Handling signals in 'wire format' is easy; getting the signals to the tape and back is far less so, and the limitations of today's analogue recorders are mainly to do with the difficulty of getting an analogue signal from wire to tape and back again.

In digital audio, going from analogue to digital with the acceptable loss in signal quality is extremely

difficult. (Putting the bits on to tape and getting them back again is not easy either but such techniques as redundancy, make errors more tolerable.) And getting the bits back into an analogue waveform is not trivial.

Today's D/A conversion (the easy part) is not very far from its theoretical limit. At Studer, for example, D/A converter boards (including also digital interfaces and very complex analogue filters) without adjustment, almost achieve an overall 15.5 bit performance. In D/A conversion, modern techniques involve chips for conversion, along with active circuitry for both

deglitching and filtering, sometimes with phase compensation. New developments, sooner or later, will also cover digital filtering prior to conversion, in order to greatly simplify the design of the analogue filters. As D/A conversion must be performed in every Compact Disc player, the converters (as long as they meet the specs of the Compact Disc player only) will be very cheap, with a performance close enough to 16 bits.

On the other hand, 16-bit accurate A/D conversion still eludes us; it may also not be really all that necessary in the near future. A number of new techniques are being tried along with the classical successive approximation: prediction, over-sampling, multiple conversion with correction, pre-distortion, high-speed ramp conversion, and maybe others. The costs are coming down, while both distortion and resolution are still near those of theoretical 14-bit units. Great care is required when reading and interpreting the specs of A/D converters; but some of the newer designs do sound remarkably good, and slow progress does continue.

Will A/D conversion become cheaper? Certainly, in so far as consumer-type digital recorders with 14- and later 16-bit formats will be introduced. But again, quantity is one of the main factors. The other factor is that guessing at an unknown analogue quantity with an accuracy of better than 300µV within some 20µs will never, ever, be a simple and cheap task.

Economics of digital

As already mentioned, digital audio is extremely expensive today; both high technology and a small market

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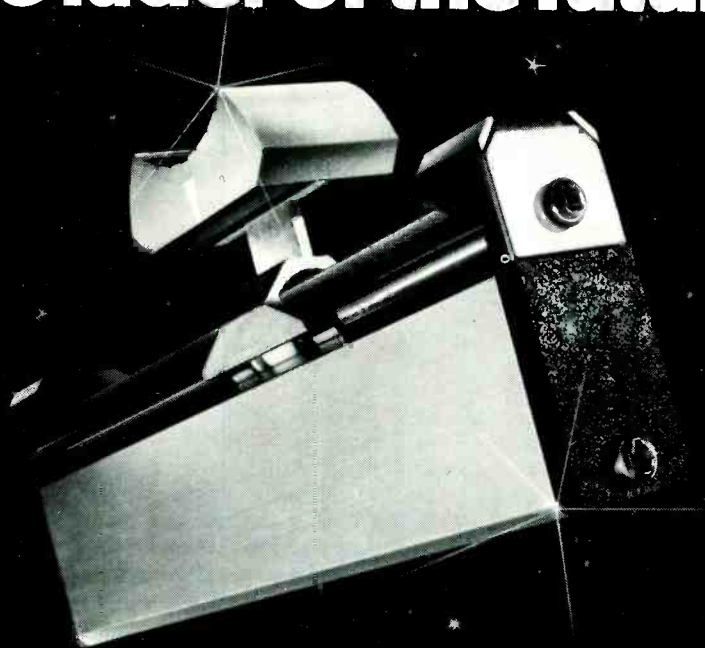
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Digital audio the Studer view

tend to make it so, and only mass technology and a large market will make it less costly to the user.

Is the cost worth it? In some applications, undoubtedly yes; in a few years, the majority of recordings for the *Compact Disc* will surely be purely digital, rather than analogue-multitrack - plus - digitally - mastered, or digitally processed from analogue masters which, incidentally, are most of the time recordings of very impressive quality and value. But there seems to be little doubt that the high cost of digital, along with the higher risk of investing in it, will be a fact of life for many years (the author still has to come across one good argument why a major improvement in recording technology should make tape recorders cheaper in the near future, rather than a good deal more expensive).

The key, again, is the size of the digital audio market, which is linked to the technical maturity of digital audio, which is linked to experience, which comes with low-cost products. So it will take time, and the explosive proliferation of digital audio in the whole professional sphere (those thousands and tens of thousands of analogue recorders . . .) will just not happen; it could neither be financed nor managed anyway. It is far more realistic to expect what took place in, say, telephony: the slow, steady penetration of a new technology (ie digital transmission) over the past two decades, while continuing to make a profit from existing equipment—most of it analogue. Even so, the move towards digital is challenging enough.

Any side effects on the way? Some of them will come, certainly, due to the types of consumer products being introduced. The *Compact Disc* means that recordings with a quality superior to that of today's masters will be everywhere, which will unfortunately lead to imaginative forms of piracy, what with analogue and digital discs in coexistence and even competition . . . Mastering and pressing for the new disc will also be profoundly different from what we know today, with a clear trend towards high technology and very high investment. To say that it will change many companies' working habits, markets, revenues even is rather an understatement.

Another side effect should be mentioned, which is immediately perceivable to anyone working in the development of digital audio. Maintenance, repair, servicing,

trouble-shooting and documentation will all have to adapt to the new technology; again, an argument why it cannot invade the market all at once. Professional machines require professional care and expertise. It is not true, alas, that they either work perfectly, or not at all.

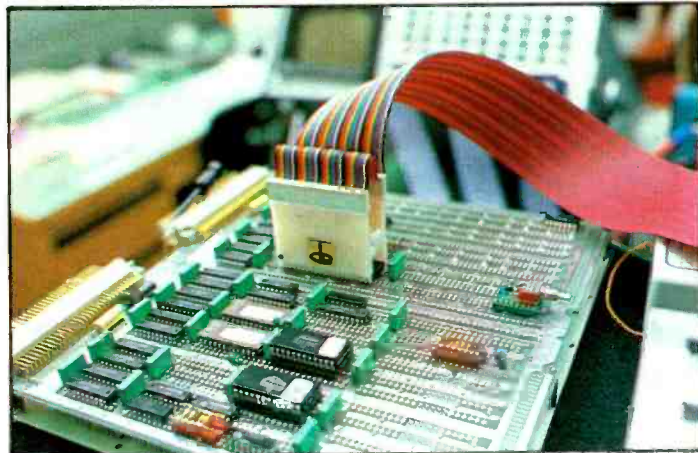
Today, a professional technician can in most cases diagnose a fault in an analogue circuit and repair it. With the complexity of digital circuitry present in a digital recorder, fault diagnosis and repair just does not work, and will not work until at least a degree of fault finding is designed into the circuits themselves. This will take time, both for the design engineers—to whom fault finding is by necessity an afterthought—and for professional users.

The market will shift, due to digital; so will studio operations. The people involved will adapt themselves, hopefully. How else will it ever work? And the return from investment must continue—certainly a difficult thing to imagine if professional equipment were to shift very rapidly to a much more expensive technology.

The parallel effort in analogue

To judge from enthusiastic prophets of things digital, analogue technology is condemned to sudden death. In assessing the reality of digital's progress it may be useful to ascertain whether analogue is at all aware of its impending doom.

Apparently it is not, and for good reasons. The market for analogue is today very sound, as witnessed by sales figures and prices. The reason is, of course, that an enormous



A simple digital board and a probe to a 32-channel logic analyser—testing and fault-finding are a major problem

majority of today's applications accept analogue's quality, require analogue's familiarity, tolerate analogue's price tag, and make money thanks to analogue's profitability.

This, however, does not in any way mean that analogue audio—especially at its professional high end—can afford complacency. Today's machines do often require complex line-up procedures; their remote control can be awkward, as many recorders still have electro-mechanical interfaces rather than electronic ones; and serviceability can always be improved, as well as sound quality.

These are not prestigious topics for discussion, nor do they mean revolutionary changes, but they may make life much easier for many people.

At Studer (and surely at other professional manufacturers), development work is going on towards introducing far more digital features

into the analogue recorder; more digital within the recorder for easy adjustment and calibration, more digital at the inputs and outputs for efficient remote control, more digital between recorders in the form of control busses for building up a system. Slightly remote from the limelight of digital audio, they are still exciting developments, with an enormous commercial and technical potential.

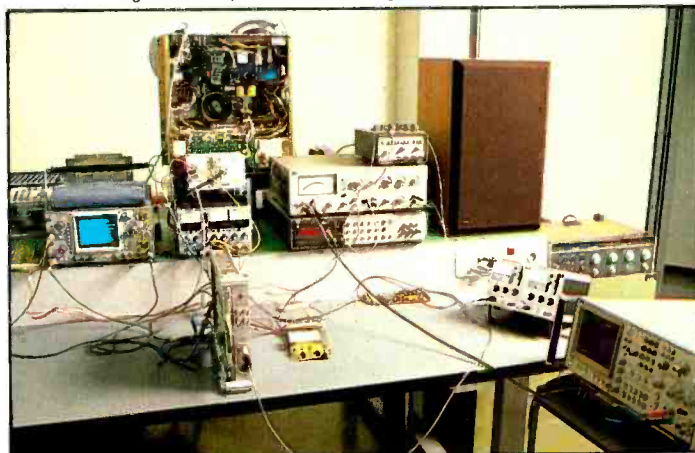
Conclusion

Audio professionals make their living from working with professional audio equipment, and making a healthy return from investment (in capital, in salaries, in time and people) must remain their central concern.

Trying to force the pace of digital—an immensely exciting but expensive technology with small potential for making profits—is not the way to go. The new technology will come anyway, at a pace dictated—we hope, as professionals—by market requirements and common sense. (Sometimes, one cannot get rid of the impression that digital audio generates too much noise.)

It may be more level-headed and less glamorous to work hard at digital, in both the areas of digital and analogue audio, to make it into a profitable technology. There is enough work left without pushing a technology which really does not need it, and remains, for the time being, prestigious, difficult, and expensive. ■

A measurement set for digital audio, with analogue distortion meter, high accuracy voltmeter and digital spectrum analyser



Dr Roger Lagadee is in charge of Digital Audio Products at Willi Studer, Switzerland. Prior to joining Studer, Dr Lagadee spent several years teaching at the Swiss Federal Institute of Technology and in applied research for Swiss industry.

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MIDAS now announce the ultimate in sound reinforcement console systems. The MIDAS CONCERT SERIES. A system designed to realize the increasingly complex demands of the industry today, tomorrow and in the future.

Facilities include; routing to 16 sub-groups and 2 sets of masters for separate mixes to multiple clusters, 8 auxiliary busses, 5-band equalisation and programmable muting. Plus qualities standard to all MIDAS products. Ergonomics. Performance. Reliability.

The first CONCERT SERIES consoles shall be available from March, 1982. If you are a professional, can you afford a future without it?

the future in your hands

AES 71st Convention preview

The 71st Convention of the Audio Engineering Society will be held from Tuesday, March 2 to Friday, March 5 at the Maison des Congres, Montreux, Switzerland. The four days of exhibits, technical papers and parallel activities encompass all aspects of the professional audio industry. Over 110 exhibitors will be showing their products.

Convention

Five sessions of technical papers are scheduled for the Montreux Convention under the following headings: Measurements and Instrumentation; Studio Techniques and Transducers; Sound Reproduction; Sound Reinforcement and Acoustics; and Digital Techniques. In addition to these sessions where a total of 37 papers are to be presented, parallel activities will include a Workshop on Electronic Music, plus a teach-in programme devoted to the fundamentals of digital audio. As an exception to the normal rule, one day (Wednesday, March 3) has been left free of Convention sessions, so that attendees may avail themselves of the technical tours programme. Tours available will include a visit to the new Studer factory at Regensdorf; a visit to the Nagra/Kudelski plant in Cheseaux; a visit to the TV studios in Geneva and the Lausanne radio studios; and a visit to Mountain Studios in Montreux.

Exhibitors

A

● **ACD Electronics:** no information received.
● **AEG-Telefunken:** *M15A* range of 2-track and multitrack recorders, and ancillary equipment, plus *Telcom* noise reduction systems. ● **Agfa-**

Gevaert: range of tapes including *PEM 526*, *PEM 468* and *PEM 428* mastering tapes; plus cassette tapes and cassette pancakes. Also recently introduced *PEM 369* 1/4in mastering tape. ● **AKG:** wide range of condenser and dynamic mics and accessories; full range of reverb units including the *TDU 7000* modular time delay unit; plus the *Micro-Mass Technology* range of phono cartridges. ● **Altec Lansing:** wide range of equipment including monitor loudspeakers, small mixers and intercoms. New products to be shown include *Model 1620* acoustic feedback suppressor; three direct-coupled power amps; three new mixer/preamps; a 1/2-octave graphic equaliser; a 12in and four 15in LF loudspeakers; medium sized *Mantaray* constant directivity horns; and a new 'y-throat' for use with the *Mantaray*. ● **Amcron:** recently introduced *PS200* and *PS400* amps; *MX4* active crossover; and *SL-2* preamp. Also the *PSA-2* and *SA-2* self-analysing power amps; the *PZM* range of pressure zone mics; and the *Badap 1* programmable audio measurement system. ● **Ampex:** first European showing of the *ATR-800* tape machine. *ATR-116* and *ATR-124* 16-track and 24-track recorders. Also the *MM-1200*, *ATR-100* and *ATR-700* tape recorders; the *EECO MQS-100* synchroniser; the *ATR-102* and *ADD-1* disc mastering system; and Ampex tapes and cassettes. ● **AMS (Advanced Music Systems):** *DMX 15R* digital reverb system for use with the *DMX 15-80* programmable DDL; *DMX 15-80SB* stereo broadcast delay line; *Digital Loop Editing System* for the *DMX 15-80 Series*; a digital audio store for film overdubbing of sound effects; the *DM-DDS* digital disc mastering delay line; and the *DM2-20* phaser/flanger. ● **Audio Bauer:** no information received. ● **Audio & Design (Recording):** *Panscan* pan effects unit; the *Transdynamic* tri-band signal processor; plus the full range of *Scamp* modules and racks; and the company's wide range of signal processing equipment. ● **Audio Developments:** *AD055* comp/limiter; *AD070* prographic equaliser; *AD007* portable mixer; *AD045 Pico*, *AD049 Mixette* and *AD031 Micro* mixers; plus a small mixer for ENG use and a PPM. ● **Audio**

Kinetics: *Q-Lock 3.10C* synchroniser; *Q-Lock 210* synchroniser; and the *XT-24 Intelocator*. Demonstration of *Q-LOCK* system for post production and film dubbing usage; also details of the *Q-Soft* range of dedicated software machine interfaces. ● **Audio/Tek:** range of tape duplicating equipment including *Model 2000* and *Model 1200B* duplicators; *Model 511* master recorder; *Model 210* cassette loader; plus ancillary equipment. ● **Audiomatic:** **Electro Sound** tape duplication equipment including the *System 8000* and *System 5000* tape duplicators; the *QCV* quality control reproducer; and *Apex* on-cassette printer. ● **Auditronics:** mixing consoles including a compact sub-mixer; plus audio distribution amps. ● **Auvis-Asona:** range of tape duplicating equipment and turnkey cassette production facilities.

B

● **Barth:** *Param* computer assisted programmable equaliser; *Dynaset U311*, *Audios* and *W308* signal processing equipment; and *Musocoder* vocoder. ● **BASF:** range of professional tapes, cassettes and magnetic film including calibration and test tapes. ● **Beyer:** range of dynamic and condenser mics plus headphones. ● **BGW:** range of amplifiers including the recently introduced *320*, *620* and *1250* power amps. ● **Bose:** *Model 802* loudspeaker plus the *802-E* active equaliser. ● **W H Brady:** range of splicing and sensing tapes for audio and video applications. ● **Bruel & Kjaer:** comprehensive range of audio test instruments.

C

● **Calrec:** range of professional condenser mics including the Ambisonic *Soundfield* mic. Also broadcast consoles and a programmable OB switching unit. ● **Cetec-Gauss:** first European showing of the recently introduced studio monitor loudspeakers. Also Gauss loudspeaker drive units, and a tape duplication system for a master and up to 20 slaves. ● **Cetec-Vega:** range of radio mics and communications equipment.

52 ►



NEUTRIK

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Neutrik is an electro-acoustical/electro-mechanical research and development company.

Twenty international patents have been granted on Neutrik connectors with several more pending.

We are proud that in the U.K., Neutrik connectors are chosen by prominent makers of mixing consoles, audio equipment, broadcast and TV studios and by some of the leading component distributors, which ensures an enthusiastic nationwide distribution.

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AES preview

● **Clear-Com:** RS202 intercom system, plus *System II* remote stations and *KB-124* duplex remote station. ● **Consilium:** wide range of audio test instruments including various analysers. ● **Court Acoustics:** recently introduced *Proflex* range of stage monitor loudspeakers; *GE60* 30-band stereo graphic equaliser; 2, 3 and 4-way electronic crossovers; and the *PM10* programme mixer.

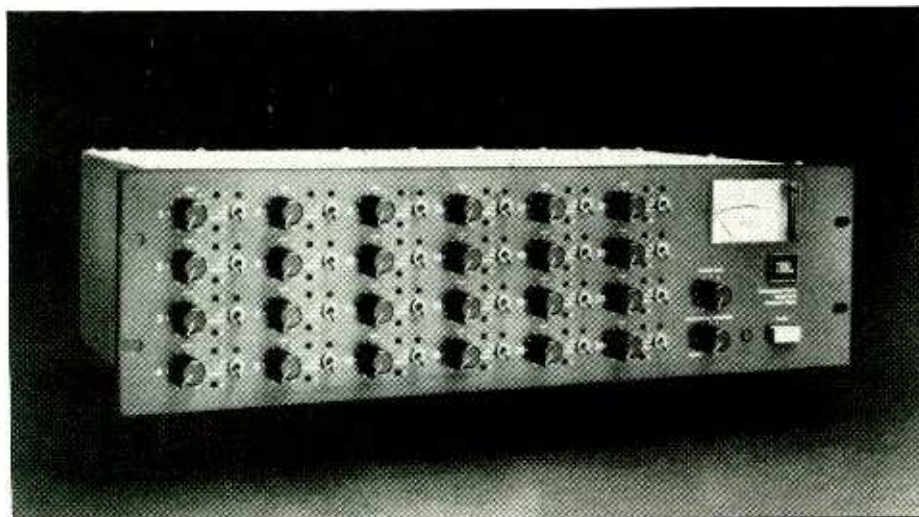
D

● **Dolby Laboratories:** wide range of noise reduction equipment including the new *SP-Series* multitrack noise reduction unit. Also modules for use with C-format videotape recorders. ● **Domain Magnetics:** no information received. ● **D&R Electronica:** wide range of mixing consoles and ancillary equipment.

E

● **Eastlake Audio:** details of the company's consultancy services and studio monitor loudspeakers. ● **Eela Audio:** *Concord* expandable multitrack console; plus *S200* and *S100* compact consoles; and the recently introduced compact *ENG* mixer. ● **Electro-Voice/Tapco:** *Sentry 100* monitor loudspeaker and recently introduced *Panjo* mini-mixers. New items include the *Entertainer 100* sound reinforcement system; *S15-2* 2-way horn loudspeaker for stage use; *EX-18* electronic crossover; and two new graphic equalisers, the *Model 2210* dual channel single octave equaliser and *Model 2230* 1/3-octave equaliser. Also full range of Electro-Voice mics and loudspeakers; plus the Tapco range of mixers and amps. ● **Elektroimpex:** *FIT-IC* modular automation ready console; *STM-610* tape machine; *SL-101* direct drive turntable; and *PCP-101* commentator's desk. ● **EMT:** *EMT 450 Digiphon* digital recorder utilising a digital disk store; *EMT 245* digital reverb; and the company's established range of turntables, reverb units and test equipment. ● **Enertec:** *UPS-4000* automation ready multitrack console; *UPS-5000* and *UPS-5100* consoles; and *F-462* tape recorders. ● **Eventide:** wide range of signal processing equipment including the *SP2016* programmable effects processor; *Model H949 Harmonizer*; and various delay lines.

J&L 7510 automatic mic mixer



F

● **FM Acoustics:** *FM600A* and *FM800A* power amps; plus the *FM212* moving coil phono step-up preamp. ● **Fostex:** *Model 350 8/4/2* mixer; *Model 250 Multitracker* 4-track high speed cassette deck/mixer; *A-2*, *A-4* and *A-8* tape machines using 1/4in tape; plus various ancillary equipment. ● **Future Film Developments:** comprehensive range of cables, cords, connectors, jackfields, wiring aids and associated components, plus a wide range of audio accessories. Also **Soundex** meters and the **Milab** range of condenser mics.

G

● **Genelec:** range of monitor loudspeakers comprising the *1019A* bi-amplifier mini-monitor; *S30* tri-amplified monitor; and *1024A* tri-amplified monitor. In addition a new portable version of the *1019A* for OB work will be shown. ● **Gotham Audio:** wide range of products from **Amber**; **TTM**; **Inovonics**; **Lexicon**; **UREI**; **Switchcraft**; **Valley People**; and **MRL**.

H

● **Harrison:** *MR Series* recording consoles (*MR-1*, *MR-2*, *MR-3*); plus an *Alive* sound reinforcement console; and the *Autoset II* automation programmer. ● **Heino Ilsemann:** *KZM3* automatic cassette loader and *ETK-1* and *ETK-1S* cassette labelling machines.

I

● **Industrial Cassette Developments:** *Graff* range of cassette format tape machines including the *HSCD* high speed cassette duplicator. ● **ICM:** *C-Zero* cassettes; *DO-2000* dropout checker; *ICM 7804* automatic wind tester; and the *C-Box* cassette packaging and storage system. ● **Infonics:** *200 Series* tape duplicators. ● **ITC:** range of cartridge machines including the *Series 99* featuring microprocessor control and modular electronics. ● **Ivie:** *Gold Standard* range of calibration mic capsules, preamps and power supplies. Also the *IE-17A* microprocessor controlled acoustic analyser and *IE-30A* spectrum analyser.

J

● **JBL:** recently introduced loudspeaker drive units for PA and studio monitoring applications; plus the recently introduced *4430* and *4435* studio

monitors. Also the complete range of monitors and the *7510* automatic mic mixer. ● **JVC:** *Series 90* digital recording system; plus the first European showing of the company's prototype digital cassette deck.

K

● **Kajaani:** *10EA Series* compact mixing consoles and **KAJAC** multitrack broadcast consoles. ● **Keith Monks:** new studio turntable unit; producer's playback turntable; wide range of mic stands; *LS-19* monitor with built-in power amp; plus record cleaning machines. ● **King Instruments:** self-feed cassette loaders and various video tape loaders. ● **Klark-Teknik:** wide range of graphic equalisers and effects units; plus the recently introduced *DN772* stereo digital profanity delay unit. Also the *DN60* realtime spectrum analyser and *DN80* 16-bit realtime audio computer. ● **KOVO:** no information received.

L

● **Leevers-Rich:** *Proline 2000TC* and *Proline 1000* 1/4in tape machines; plus **Garner** bulk erasers; *Tomcat* cartridge machines; and **BMX** broadcast consoles. ● **Lyrec:** *TR55* 1/4in tape recorder; *TR532* multitrack recorder and *ATC* remote controller; and the *P-2000* high-speed cassette duplicator.

M

● **3M:** 32-track digital mastering system and 4-track digital recorder; digital delay disc cutting preview unit; and digital editor with crossfade facility. Also *M79* 24-track analogue recorder; **Wollensak** cassette duplicators; and *Scotch* audio tapes including *Scotch 265* digital mastering tape. ● **Marshall:** *Model 5402* time modulator; plus the *Mini-Modulator* digitally programmed analogue delay unit. ● **MCI:** introduction of the *JH-800*, a compact portable general purpose 12 channel audio console. Also a variety of consoles, tape machines and autolocates. ● **Meyer Sound Lab:** range of studio monitor loudspeakers including the *ACD/Meyer* reference monitor system and the *UM-1 Ultra-Monitor*. ● **Midas:** *PR System* consoles for sound reinforcement applications; plus *TR System* modular theatre consoles. Also, new *Concert Series* with following features: inputs assignable to eight stereo subgroups, eight auxiliary groups, stereo and mono master groups with independently controlled multiple outputs and programmable mute system with non-volatile memory and complete editing facilities. ● **Mondial Electronique:** range of broadcast equipment for local radio applications including a mixer, line processing unit and power supply unit.

N

● **Nagra:** range of portable tape recorders in a variety of configurations including the *T-Audio* twin capstan multi-format recorder. ● **Neumann:** *VMS 80* automated disc mastering lathe and associated units; complete range of condenser mics; plus a multitrack console. ● **Neutrik:** comprehensive range of *XLR*-type connectors; *K-Check* cable tester; and new additions to the company's instrumentation range comprising the *3204* constant sound pressure source with compressor amp, and the *3282* artificial ear. ● **Neve:** variety of consoles from the recently announced new ranges of consoles. Items on show will include two *51 Series* consoles; the

QUART INTO A PINT POT ...without spilling a drop!

The **TRANSDYNAMIC** teams with ADRs Complex, Express, Easyrider or Scamp processors to create a superb tri-band control system.

- **Production mastering — DIR-MIX™** a unique dynamic reduction system that transposes any input dynamic range to suit any dynamic format (disc, cassette, broadcast, film or PA). This means that for the first time very wide dynamic programme (especially digital) can be comfortably processed on to any medium without disturbing side effects. Livens digital dryness by enhancing low level detail and natural reverberant characteristics.

- **Internal noise generator** simplifies set-up procedure. It can be 'set and left' to a house standard, or used as a creative tool.

- **Selective processing** by dynamic tri-band equalisation (i.e. momentary attenuation of high level LF and HF) with absolute level control to maximise broadcast, cutting or recording level with minimal modification to original programme.

- **Clean-up and restoration** of older recorded material. Creating of synthesised 'stereo'.

- **High energy Rock-box** as a tri-band processor giving dynamic control of frequency response and optimising signal definition and average sound pressure level — all without modulation effects.



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AES preview

5322 on-air console; and the new 8128 multitrack console. Also on show *Necam II* and a custom 8108 console housed in an OB van by kind permission of NOS, Holland. ● **NTP**: comprehensive range of PPMs, equalisers, phase meters, limiters, and a compressor/expander.

O

● **Olsen Electroacoustics**: no information received. ● **Ortofon**: wide range of ancillary disc cutting units; plus phono cartridges. Also a new audio measurement computer, the *P400*, with CRT display and built-in printer. ● **Otari**: *MTR-90* multitrack tape machine; *MTR-10* 2- and 4-track tape machines; *MX5050 Series 2-*, 4- and 8-track machines; and the *DP4050* cassette duplication system.

P

● **Penny & Giles**: recently introduced *3000 Series* faders; plus the established range of faders and quadraphonic panpots. ● **Perfectone**: range of magnetic film recorders, reproducers and ancillary units. ● **Philips**: *MCR* (multi-channel reverberation) concert hall acoustic systems; *SQ6* modular public address centre; and the company's conference systems. ● **Publison**: range of audio processing equipment. ● **Pyral**: wide range of open reel and cassette tapes; plus magnetic film; master lacquer discs; and a spectrum analyser.

Q

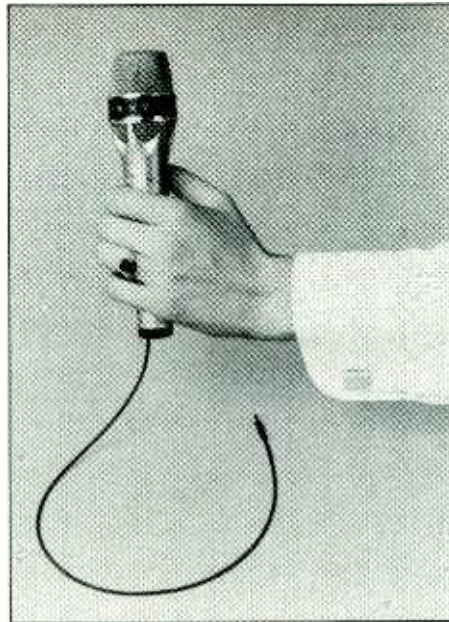
● **Quantek**: no information received.

R

● **Raindirk**: *400 Series* broadcast console and the *Status* range of amplification equipment. The company also hopes to introduce a new stereo console, *System 200*, suitable for film, TV and general production applications. ● **Rank Strand Sound**: *MMS1* and *MMS2* modular mixers for sound reinforcement and theatre applications; plus a wide range of ancillary equipment and intercoms. ● **Red Acoustics**: *A-4 Red Professional* monitor loudspeaker; plus two new monitors, the *A-3* with built-in 150W amp, and the *Red Studio Monitor* which includes a sub-bass system.

S

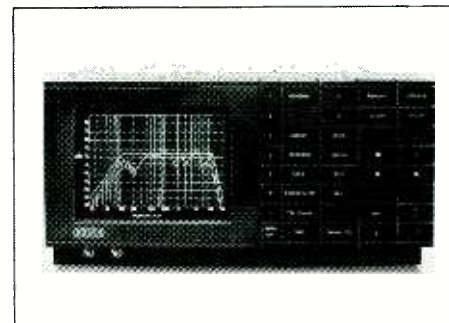
● **SATT**: *SAM82 8/2* portable mixer and the *SAM42 4/2* compact mixer. ● **Schoeps**: comprehensive range of studio condenser mics and accessories, including a new accessory, *GVC*, allowing capsules to be swivelled through 120°. ● **Sennheiser**: full range of condenser and dynamic mics; wireless infrared sound transmission equipment; and the *Mikroport* wireless mic with *Hidyn* noise reduction system. Also new *SKM 4031 Mikroport* soloists mic. ● **Sescom**: wide range of audio modules; transformers; splitter boxes; direct boxes; parametric and graphic equalisers; and a 4-channel mic mixer. Also recently introduced portable audio generator; harmonic distortion analyser; audio voltmeter; millivoltmeter; and audio frequency meter. ● **Shure**: recently introduced *Model 711* loudspeaker system and *Model M267* 4-way mic mixer. Also the company's ranges of condenser and dynamic mics; *Pro Master* sound system;



Sennheiser Mikroport SKM 4031

and ranges of phono cartridges. ● **Sierra Eastlake**: acoustic consultancy service. ● **Solid State Logic**: *SL-4000E Series* automated multitrack console with *Total Recall* system and SSL dynamic mixing system. Introduction of new software and hardware for post production and live mixing applications including a realtime system for sequential preset fader level editing; an events controller for remote control of sound effects sources from tape; an effects controller allowing integrated computer control of external voltage controlled devices; and a synchroniser based on the **Audio Kinetics Q-Lock** system allowing multi-machine synchronisation from the SSL command keyboard. ● **Sondor**: *OMA-3* and *Libra* magnetic film recorders. ● **Sony**: *DAE-1100* digital editor for the *PCM-1600* and *PCM-1610* digital processors and *U-matic* based digital recording systems; *Compact Disc* digital audio disc player; *PCM-3324* stationary head digital multitrack recorder; various ancillary digital studio units; plus a wide range of mics and radio mics. ● **Sound Workshop**: *Series 1600, Series 20, Series 30* and *Series 40* modular consoles; plus *242* and *262* stereo reverb systems. Also *Super-Group* grouping system; *ARMS* automation system; and the first European showing of the *Diskmix* automation storage system. ● **Soundcraft**: *Series 2400 24/16* or *28/24* console; plus the *Series 800, Series 400* and *Series 1S* consoles. Introduction of the *Series 2400* automation package. Also the *SCM 381-8* 8-track tape recorder and *SCM762 16-* or *24-*

Ortofon P400 audio measurement computer



track tape machines. ● **Stanton**: wide range of phono cartridges; plus the *BA-26* pre-preamp and *Model 310* phono preamp/equaliser. ● **Statik Acoustic**: range of ancillary equipment including *SA30* electronic crossover; *SA10* graphic equaliser; *SA100* dynamic delay/flanger; and *SA20* dual reverb system. ● **Stellavox**: *TD88 1/4in, 1/2in* and *16mm* magnetic film tape machine; *AMI48* mini-mixer; and *SM8, SQ7* and *SP8* tape machines. ● **STR**: microprocessor controlled semi-automatic broadcast console. ● **Studer**: new stationary head multitrack digital tape machine utilising the *A800* transport; and a universal digital interface unit. Also the company's established range of analogue tape machines (*A800, A80, B67, Revox PR99, Revox B77*); and consoles. ● **Syn-Aud-Con**: details of the consultancy's professional audio courses, seminars and workshops. ● **Synton**: *Syntovox 222* vocoder; *Syntovox 221* effects vocoder; *Syntovox 202*; and *Syntovox 232 16-channel* vocoder with voltage controlled filter bank.

T

● **TAB**: variety of intercom transmission systems; transmitter control units; and AF measuring units. ● **Tandberg**: *TD20A* tape machine; plus *TCD 420A, TCD 440A, TCD3004* and *TCD 3034* cassette machines. ● **Tannoy**: wide range of professional monitor loudspeakers including the *Dreadnought, Super Red, Little Red* and *SRM Series* monitors. Also the company's hybrid passive/active crossover unit. ● **Tapematic**: *TMD 470/630* automatic cassette winder; *TMD 470* semi-automatic winder; *TMD 530* cassette labelling machine; and *TMD 670* cassette boxing machine. ● **Televic**: *Astatic* range of dynamic mics. ● **Theatre Projects**: range of mixers and intercoms; plus radio mics from **HM Electronics**. ● **Toa**: recently introduced *RX-7 Series* of modular mixers; plus a comprehensive range of communications and PA equipment. ● **Trident**: first European showing of the modular, expandable 8-group *Trimix* console. Also the company's *TSM* and *Series 80* consoles; plus the *TSR 24-track* tape machine with autolocate; and a range of ancillary equipment. ● **Turnkey Two**: details of the company's acoustic design service.

U

● **Ursa Major**: first European showing of the remote control unit of the *8x32* digital reverb. Also the standard *8x32* and *SST-282 Space Station* digital delay line and digital reverb system synthesiser.

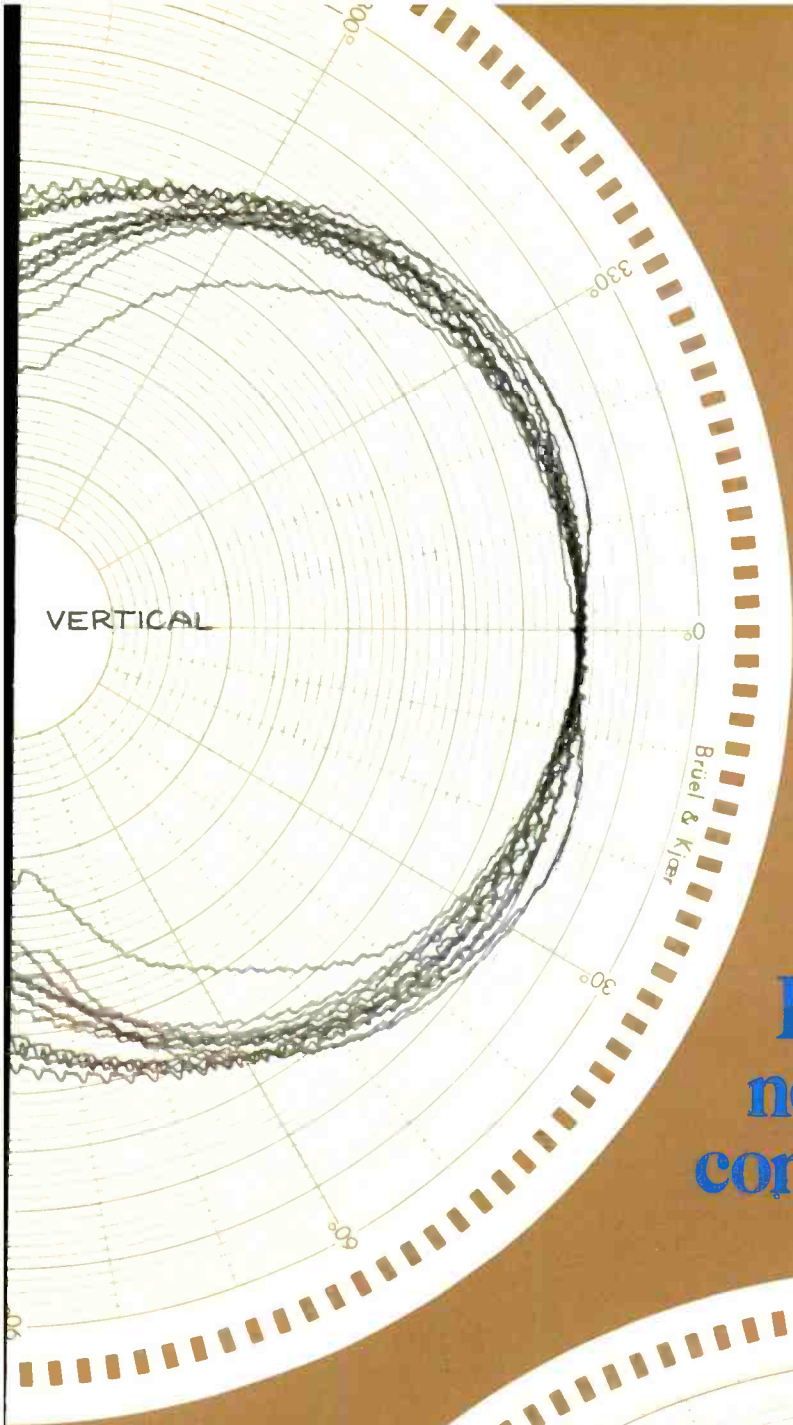
W

● **Woelke**: range of multitrack record, playback and erase heads; plus the recently introduced cue-track heads for *1/4in* tape usage. Also wow and flutter meters; wave analysers; and bias/distortion meters.

Z

● **Zonal**: range of audio tapes and cassettes; plus magnetic film stock. ● **Zoot Horn**: range of modular recording and PA mixing consoles.

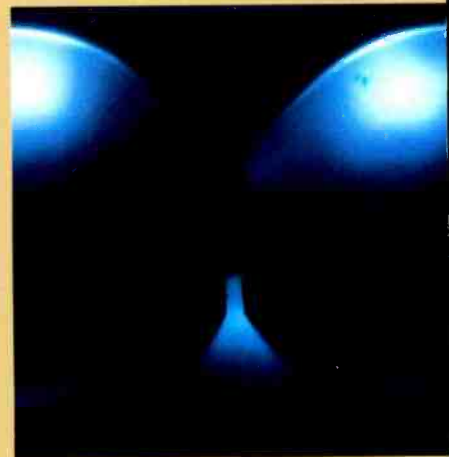
● **Studio Sound**: editor Richard Elen and assistant editor Noel Bell will be attending the Convention together with executive advertisement manager Phil Guy. Copies of *Studio Sound* will be available from our stand. ■



Before you invest in
new studio monitors,
consider all the angles.



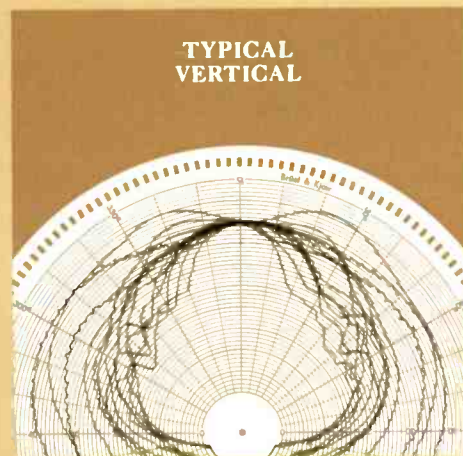
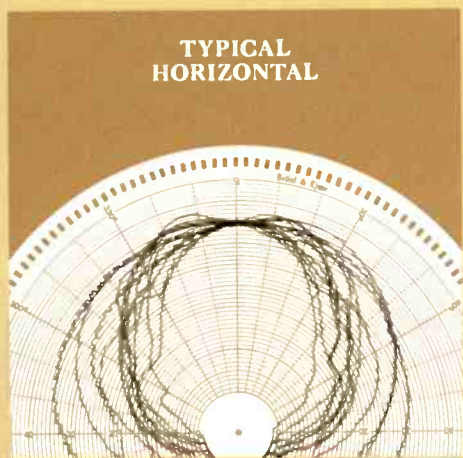
Introducing the JBL Bi-Radial Studio Monitors.



No one has to tell you how important flat frequency response is in a studio monitor. But if you judge a monitor's performance by its on-axis response curve, you're only getting part of the story.

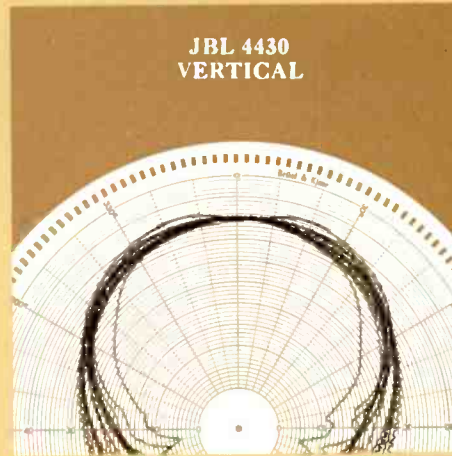
Most conventional monitors tend to narrow their dispersion as frequency increases. So while their on-axis response may be flat, their off-axis response can roll off dramatically, literally locking you into the on-axis "sweet spot." Even worse, drastic changes in the horn's directivity contribute significantly to horn colorations.

Polar response of a typical two-way coaxial studio monitor:



At JBL, we've been investigating the relationship between on and off axis frequency response for several years. The result is a new generation of studio monitors that provide flat response over an exceptionally wide range of horizontal and vertical angles. The sweet spot and its traditional restrictions are essentially eliminated.

Polar response of a 4430 studio monitor:



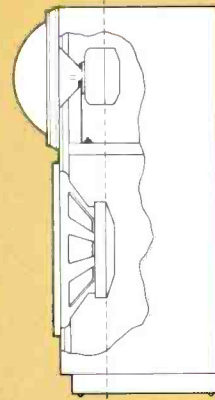
The Bi-Radial Horn

The key to this improved performance lies in the unique geometry of the monitors' Bi-Radial horn! Developed with the aid of the latest computer design and analysis techniques, the horn provides constant coverage from its crossover point of 1000 Hz to beyond 16 kHz. The Bi-Radial compound flare configuration maintains precise control of the horn's wide 100° x 100° coverage angle. Since this angle is identical to the coverage angle of the low frequency driver at crossover, the transition from driver to driver appears seamless and the monitors present a fully coherent sound source.

And the Bi-Radial horn's performance advantages aren't limited to just beamwidth control. The horn's rapid flare rate, for instance, dramatically reduces second harmonic distortion and its shallow depth allows for optimal acoustic alignment of the drivers. This alignment lets the monitors fall well below the Blauert and Laws criteria for minimum audible time delay discrepancies.

The practical benefits of the Bi-Radial horn design include flat frequency response and remarkably stable stereo imaging that remain valid over a wide range of listening positions. The design also allows considerable latitude in control room mounting. Finally, the flat on and off axis frequency response of the horn means that less high frequency equalization will be required to match typical house curves.

But while the Bi-Radial horn offers outstanding performance, it's only part of the new monitors' total package.



Acoustic alignment of drivers (4430)

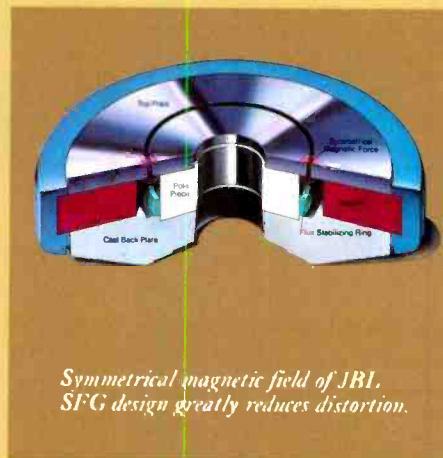
Extended Response in a Two-Way Design

Coupled to the horn is a new compression driver that combines high reliability and power capacity with extended bandwidth and smooth, peak-free response. The driver features an aluminum diaphragm with a unique three-dimensional, diamond-pattern surround! Both stronger and more flexible than conventional designs, this surround provides outstanding high frequency response, uniform diaphragm control, and maximum unit-to-unit performance consistency.

JBL's diamond suspension diaphragm combines performance with reliability.



To ensure smooth response to the lowest octaves, controlled midband sensitivity, extremely low distortion, and tight transient response, the Bi-Radial monitors also incorporate the latest in low frequency technology. The loudspeakers' magnetic structures feature JBL's unique Symmetrical Field Geometry (SFG) design to reduce second harmonic distortion to inconsequential levels. Additionally, the speakers utilize exceptionally long voice coils and carefully engineered suspension elements for maximum excursion linearity, and complete freedom from dynamic instabilities for tight, controlled transient response.



Symmetrical magnetic field of JBL SFG design greatly reduces distortion.

Blending the Elements—The Dividing Network Challenge

Tailored to the acoustical characteristics of the Bi-Radial monitors' high and low frequency drivers, the dividing network provides the smoothest possible response over the widest bandwidth while restricting any anomalies to an extremely narrow band. During the network's development, JBL engineers paid considerable attention to on-axis, off-axis, and total power response. As a result, the electrical characteristics of the network are optimized for flat response

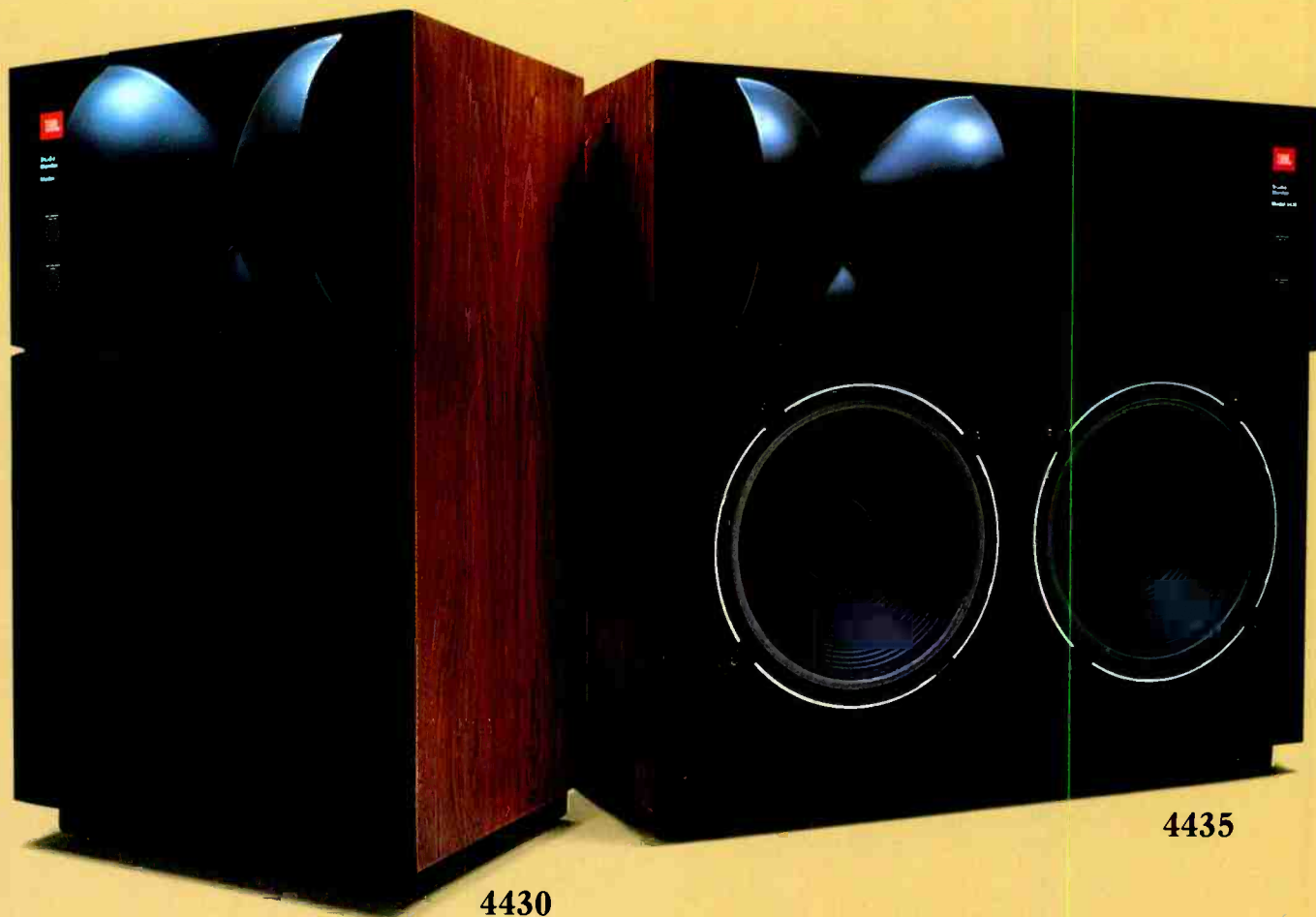
over the monitors' full coverage angle.

The network also provides equalization of the compression driver for flat power response output. This equalization is in two stages with separate adjustments for midrange and high frequencies.

Judge For Yourself

Of course, the only way to really judge a studio monitor is to listen for yourself. So before you invest in new monitors, ask your local JBL professional products dealer for a Bi-Radial monitor demonstration. And consider all the angles.

1. Patent applied for.



4430

4435

Specifications	4430	4435
Frequency response (± 3 dB)	35 - 16,000 Hz	30 - 16,000 Hz
Power Capacity (Continuous Program)	300 W	375 W
Sensitivity (1 W, 1 m)	93 dB	96 dB
Nominal Impedance	8 Ohms	8 Ohms
Dispersion Angle (- 6 dB)	100° x 100°	100° x 100°
Crossover Frequency	1 kHz	1 kHz
Network Controls	Mid Frequency Level High Frequency Level Switchable Bi-Amplification	



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Division**

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Northridge, California 91329 U.S.A.

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JBL/harman international 8-4430/35 8-81 Printed in U.S.A.

APRS 82

INTERNATIONAL PROFESSIONAL RECORDING EQUIPMENT

A.C. Electronic
Ampex GB Ltd
Alice (Stancoil)
AKG Acoustics
Audio & Design
Audio Developments
Audix
Audio Kinetics
Atlantex Music
Agfa Gevaert
Allen & Heath Brenell
Avcom Systems
Advance Music Systems
Audio Video Marketing
BASF United Kingdom
Bruel & Kjaer (UK)
F.W.O. Bauch
Beyer Dynamic (GB)
Cetec International
Clive Green & Co
Canford Audio
Calrec Audio

Cliff Electronics
Clyde Electronics
Dolby laboratories
Eardley Electronics
Eela Audio International
Electro-Voice (Gulton Europe)
F.M. Acoustics
Fraser Peacock Associates
Feldon Audio
Formula Sound
Future Film Developments
Gresham Wood Industries
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RAINDIRK 400 SERIES BROADCAST SYSTEM CONSOLE

A new range of consoles designed for studio and OB use. High quality and flexible format with comprehensive facilities. The system may be adapted to meet individual requirements, i.e. separate patch bay and reduced mixer profiles for OB requirements. Performance exceeds IBA requirements.

BRIEF DETAILS

10 to 36 inputs 4 to 8 group outputs and one master group output to line and programme. 2 auxiliaries, 1FB, one reverb send and return. 2 compressor/limiters and telefx unit.

Input levels -80dBm to +10dBm

Output levels +24dBm (+26dB nominal)

Frequency response (-1dB points) 20Hz to 20kHz

Crosstalk at 20kHz better than -90dB between group outputs -80dB between auxiliary outputs

Balancing Inputs and outputs fully balanced via transformers

Fader insert points are electronically balanced

Noise: Mic, better than -127dB referred to input at gain of 60-80dB

Line, better than -90dB noise output at zero gain through the system

Distortion better than .16% at +8dBm output at 20Hz, typically better than .02% at 1K and 20kHz.



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Red Herring rides again (and again . . .)

The BPI, MCPS and Musicians' Union have joined forces to try to persuade the government to change its mind over the copyright Green Paper which rejected the idea of a levy on blank tape. An advertising campaign has begun and a press conference was called to coincide with the first appearance of half-page advertisements in the national press claiming that "Home taping is wiping out music".

The press conference seemed more an industry campaign meeting. The BAFTA theatre in Piccadilly was packed full of record company executives, recording artists, producers, engineers and retailers. Relatively few press were present (well under 20% of total attendance) and anyone daring to ask an unpopular question risked heckling by a hostile audience. This neatly sums up one of the problems which the record industry faces. A press conference for the music business means a jolly get-together with the stars over a few drinks. No one rocks the boat. A press conference for the national newspapers and specialist press means a short sharp presentation, followed by hard talking and questioning from the floor. The BPI, MCPS and MU were effectively preaching to the converted and doubtless felt reassured by the sympathetic response from the congregation. Here's how it went, with verbatim quotes taken from a cassette tape recording of the type which, if the industry has its way, will in future carry a 100% tax to reward recording artists for lost income.

Sir Joseph Lockwood kicked off the conference by mumbling through a prepared speech of little consequence. There then followed a tedious and surprisingly unadventurous slide show, with over-loud and non-too-clean sound. Chris Wright, Chairman of the BPI, confirmed that the advertising campaign is being jointly sponsored by the BPI, Mechanical Rights Society, Mechanical Copyright Protection Society and Musicians' Union. Curiously there was no mention of the IFPI, another trade body which is collecting money to combat piracy.

Chris Wright was co-opted onto the IFPI board in May 1981. According to Wright, "The ad which appeared in today's *Times* and *Guardian* shows the strength of feeling in the industry for this government-sanctioned theft".

Bob Montgomery of the MCPS explained how the levy scheme would be administered. The MCPS would determine 'total use' of recorded material: "... this would be related to the amount of money available, and the distribution would result". In other words, the most successful artists today would receive pro-rata payments from the levy kitty—likely to be at least £100 million a year at the hoped-for rate of £2 for each C90 cassette sold in Britain.

Predictably, the BPI advertising campaign almost immediately produced exactly the opposite effect to that which was presumably intended. "People like Cliff Richard, Elton John and Gary Numan are supporting the campaign to raise the price of blank tapes . . . these people are already millionaires," a bitter member of the public wrote to the national press.

To rapturous applause Michael Kuhn, a lawyer for Polygram, attacked the government with sarcasm and scorn: "disingenuous",



"twaddle", "embarrassing writhing" and "lack of leadership" were among the phrases used. Kuhn also referred to: "A hastily prepared Department of Trade paper" which "backtracks" on some of the Green Paper proposals. But what paper is this? The press haven't seen it. The BPI won't give us one. More anon if we locate a copy.

With commendable frankness Michael Kuhn brushed aside the spoiler red herring. "A totally effective spoiler signal is as much a mirage as the prospect of making gold from dross," he said. Unfortunately his positive position was later undermined by Chris Wright who refused to state categorically that the BPI has abandoned all thoughts of a spoiler. "The door remains open," he told the audience in answer to a question. But what happens if the spoiler dream comes true? A levy would tax people for taping and a spoiler would prevent taping. You can't have both. "It's a problem we'll deal with at the time," said Wright, doubtless giving heart to the Government whose Green Paper had promised support for the alchemists stone spoiler as an alternative to the levy.

Michael Kuhn also cited the Horserace Betting Levy Board as justification of the viability of a levy. No one cited page 85 of the *1978 Royal Commission on Gambling* which commented: "The industry (British racing) is today hopelessly addicted to subsidy. Withdrawal would mean collapse."

Charles Levison's speech for the BPI also showed signs of another divergence of opinion. Following Michael Kuhn's bitter attack on the Government, Levison referred to the Government "whose help is desperately needed to enact the necessary legislation". As with spoilers, you can't have it both ways.

John Butcher, MP, described himself as a "rapidly ageing ex-rock and roller" and was hastily frozen into silence as he started to say the wrong thing for the occasion. "You may . . . do something about the redistribution of income within your particular industry . . ." he fumbled, before realising that he'd better change tack for the particular meeting in hand.

On some occasions during question time it seemed that those present had forgotten that there were any press listening to what they said. When asked about how long it would be before a new copyright bill reached parliament, Michael Kuhn gave a fascinating insight into industry strategy.

"If we can find some sneaky way of getting our levy going by shoving in a schedule, to a schedule, to a sub-schedule, to a sub-clause in a Finance Bill that no one goes to vote on in the House of Commons, we will do it. Absolutely."

Inevitably now MPs who are opposed to the

idea of a levy will be watching out for any small print amendment clauses that could railroad a disguised levy law through parliament.

No one talked about stimulating record sales, for instance by putting up the quality and bringing down the price of discs and tapes. The BPI committee on disc quality still hasn't offered a progress report. No one talked about improving availability, so that customers can actually buy what they want to buy. But an angry *Daily Express* editorial made these points in response the next day:

- no one talked about educating the public into understanding that taping records instead of buying them is immoral as well as illegal;
- no one explored the idea of appealing to the better nature of the great British public.

The accent, as always, was on taxing prospective customers, to punish them for not buying as many records as anyone in the record or studio business would like them to buy.

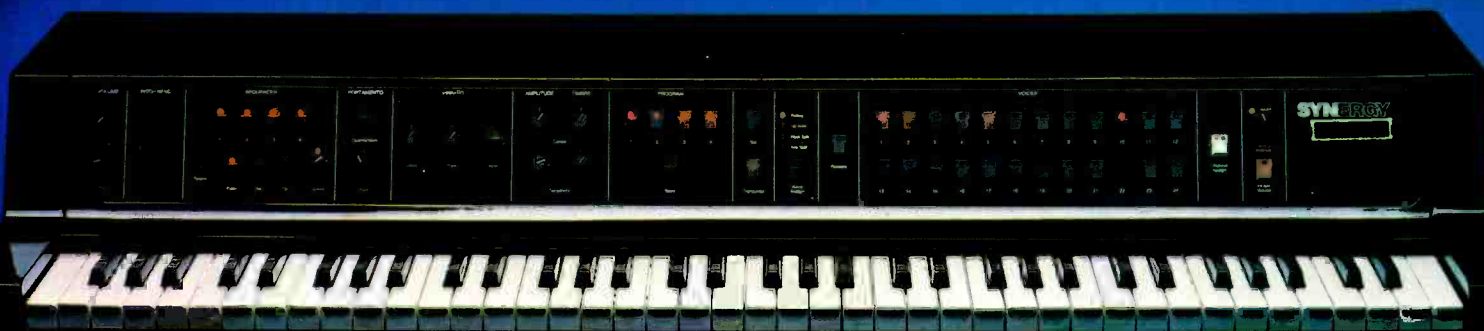
Patent queries

Normally inventors keep quiet about their patent applications until they are published, or even until long after they are published. That way there's less risk of someone objecting that the idea isn't really new, and thereby blocking the official grant of a fully blown patent. But not always. In the summer of 1981 I must have received at least a dozen calls from people in the loudspeaker business who had been tipped off about a patent application which was filed by the Audio Reproduction Company of Stretford, Manchester. As the patent application hadn't at that time been published, the tip off could only have come from someone closely connected with ARC.

Everyone who phoned was worried because the ARC patent was said to claim legal monopoly on any loudspeaker which could be used either as a passive system or an active system, ie either bi- or tri-amped without a filter network, or driven by a single amp through a plug-in filter. Well the patent application, number 2 070 386, has now been published by the British Patent Office and, yes it's true, ARC do claim legal monopoly on the basic idea of any loudspeaker system which is convertible between passive and active operation.

What's more, the examiners of the British Patent Office haven't been able to find any prior publication of this broad idea. So there's a good chance that the patent may go through to grant. But whoever stirred up interest in the ARC patent in the first place has now ensured that anyone who thinks the idea isn't as new as claimed will have plenty of time to lodge a formal objection at the British Patent Office. Perhaps this was the object of the exercise. Who knows? Whatever the reason, the procedure for lodging objections is very simple. Anyone with hard proof (*not* heard-it-in-a-pub second-hand vagaries) should look at British patent application number 2 070 386, for instance in the public library attached to the British Patent Office. If they want to object they simply write to the Comptroller of the British Patent Office, 25 Southampton Buildings, London WC2 detailing any proof of prior publication, or use, of the claimed idea that took place before the patent application was filed.

The Synergy. At £2975 it makes other synths sound like a waste of money.



Let's face it, a 48-voice digital synthesiser at £2,975 is good value for money. Especially as the Synergy is a totally digital polyphonic performance synthesiser. Its six octave dynamic keyboard controls 48 voices-24 preset and 24 on interchangeable cartridge. In total over 1000 sounds are available.

That's comparable to machines over four times its price! And if that sounds good, listen to some of its other features - different performance characteristics may be assigned for each voice; key

sensitivity with respect to volume, timbre and modulation; vibrato rate, depth and delay; speed of portamento (three modes - smooth with retrigger, smooth with no retrigger of envelopes and semi-tone quantization).

Each voice may be panned to left or right outputs, both outputs, or alternating left and right.

Each voice may be assigned to the keyboard in one of four modes, polyphonic, monophonic, key-split or rolling mode and the keyboard can accommodate up to four sounds simultaneously.

A four function joystick offers further performance control - pitchbend up and down, and leadline or global vibrato. A four channel sequencer may be used monophonically or polyphonically and recalls all phrasings, pitchbends, nuances and key velocity. Tracks may be repeated and transposed independently.

If you think all this sounds good, send for a free demo tape.

Syco Systems Ltd 20 Conduit Place London W2. Telephone 01-723 3844 for an appointment.



product Noise reduction & gating guide

BEL (UK)

BEL Electronics, 48 Aylesbury Street, Bletchley, Milton Keynes. Phone: 0908 641063.
UK: Don Larking Audio Sales, 50 Cheapside, Luton, Beds. Phone: 0582 27195/26693/422387.
USA: The Mike Shop, PO Box 366, Elmont NY 11003. Phone: (516) 437-7925.

BC3 Noise Reduction: 8- or 2-channel formats with simultaneous encode/decode; 19in rack-mounting; 8-channel version frame carries spare channel; 30dB of noise reduction; 2:1 compression and expansion; available with XLR, jack or multipin connectors.

DB ELECTRONICS (UK)

DB Electronics, 2 Ash Street, Buxton, Derbyshire SK17 6LL. Phone: 0298 3756.

Codec: encoding/decoding linear dynamic filter system, ie response determined by the spectral content of the signal, independent of signal level. Companding of signals with dominant spectral content above 1.2kHz with HF noise reduction by pre/de-emphasis applied to signals prominent below 1.2kHz. **M41** is a 4-track, switchable free-standing unit with bypass and record/play on each channel; LED indication. **M42** is similar but has LED level meters on each channel. **M1** is a single-channel simultaneous encode/decode unit available as a PCB or modular rack-mounting unit. **M1b** is similar but restricted bandwidth (30Hz to 12kHz) for mobile broadcast use. **M82** is an 8-track remote or machine switchable unit with separate 8-track LED level display.

dbx (USA)

dbx Inc, 71 Chapel Street, Newton, Mass 02195. Phone: (617) 964-3210. Telex: 922522.
UK: Scenic Sounds Equipment Ltd, 97-99 Dean Street, London W1V 5RA. Phone: 01-734 2812. Telex: 27939.

Model 142: 2-channel unit for broadcasters; switchable encode/decode; can also be used for 'normal' noise reduction on, for example, tape machines, or for improving S/N ratio of land lines or microwave links.

Model 150: 2-channels of simultaneous encode/decode for small studio usage; phono connectors; rack mountable; multiple unit operation possible.

Model 155: four channels of encode or decode, allowing simultaneous recording and monitoring of stereo recorders; phono connectors; rack-mountable in pairs.

Model 158: eight channels of simultaneous encode/decode; modular system including power supply unit and a spare noise reduction unit for emergencies.

Model 208: Similar to 158 but electronically balanced inputs and outputs and prewired Cannon XLR interface.

Model 216: modular 16 or 24-channel system providing simultaneous encode/decode. Each module contains the processing circuits for two channels of noise reduction, and can be remote controlled.

K9-22: plug in replacement for the Dolby Cat 22 module.

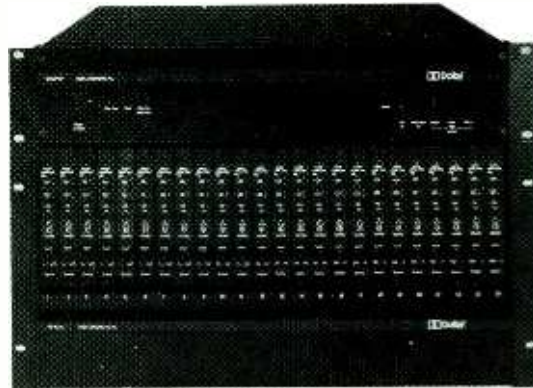
Model 148: 8-channel decode-only unit principally for broadcast use; two types of module — 408 for tape playback and 409 for dbx encoded discs; rack-mounting.

Model 193: 2-channel simultaneous encode/decode unit designed for use with Nagra IV-S tape recorder and bolts to its case.

Model 904: part of the dbx 900 Series. Noise gate module featuring adjustable attack and release rates, threshold adjustable from -40 to +10dB, attenuation limit adjustable from 0 to 60dB, with dbx 'Over Easy' downward expansion. Also features a 'Key' input. Attack time variable 500dB/ms to 2.5dB/ms; release rate variable 2.5dB/ms to 22dB/s; expansion ratio variable 1.5:1 to 5:1.

DOLBY (UK)

Dolby Laboratories Inc, 346 Clapham Road, London SW9. Phone: 01-720 1111. Telex: 919109.



New Dolby SP Series

new

SP Series: provides up to 24 channels of Dolby-A noise reduction in a 19in rack width. Separate regulated power supply unit. Each channel consists of a standard Cat 22 module plus a new self-contained interface card. The new interface card features an 'uncal' control permitting rapid resetting of Dolby level for non standard level or external tapes and allowing instant restoration of internal preset level without recalibration. Further features include an LED level display for each

channel allowing accurate ± 0.1 dB Dolby level calibration; and further LEDs to indicate clipping and assist in alignment with peak reference level (DIN) reference tapes. All the input stages are balanced and floating, while all outputs drive single ended or balanced loads up to +26dB at 600 Ω and above. Additionally, a remote ground-sensing output minimises hum-pickup with single ended load impedances. Relay-controlled and balanced 'hard' bypass of each channel is possible, or alternatively a buffered bypass mode can be selected, switching off the noise reduction characteristics electronically.

USA: Dolby Laboratories Inc, 731 Sansome Street, San Francisco, Cal 94111. Phone: (415) 392-0300. Telex: 34409.

Model 360/361: rack-mounting, single-channel unit with Dolby-A characteristics; switchable between encode and decode. **Model 361** is identical to **Model 360** except for built-in relay switching of operating mode; changeover can be controlled automatically to follow the record/replay functions of a tape machine.

MH Series: multichannel rack-mounting unit with built-in encode/decode changeover facilities; available in 8, 16, 24, 32 and 48-track formats.

Model 330: 2-channel unit incorporating Dolby-B encoder/decoder for use in tape duplication and quality monitoring.

Model 334: 2-channel Dolby-B encoder/decoder for use in FM broadcasting.

CP50: optical soundtrack cinema processor designed to replay Dolby encoded stereo optical or mono optical, or conventional mono optical; allows presentation of 4-track magnetic tracks, but without

any processing. The stereo unit contains two Dolby-A cards, three $\frac{1}{3}$ -octave equalisers, centre channel and surround decoder and an optical preamplifier for mono or stereo. Numerous options.

CP200: rack-mounting cinema processor for magnetic and optical soundtracks; can handle up to four projectors in any sound format (including Dolby Stereo optical 35mm and Dolby Stereo magnetic 70mm) and also several non-sync sources. With options, it will also handle 70mm stereo surround and most future systems. Basically includes four channels of Dolby-A noise reduction; three channels of $\frac{1}{3}$ -octave loudspeaker EQ; 70mm bass enhancement for tracks 2 and 4; preamplifiers for mono and stereo optical; matrix decoder for deriving centre and surround channels where applicable.

Cat 55: very compact module containing one channel of Dolby-A noise reduction designed for small size and low power consumption, switchable for record/play and signal selection for playback purposes; designed for incorporation in other equipment.

Cat 155/255: incorporating two channels of **Cat 55** noise reduction mounted on a board designed to plug into specific video tape recorders — **Cat 155** for the Sony **BVU1100/1000**, and **Cat 255** for the Ampex **VPR2/1** recorders.

Cat 22: basic noise reduction module used in all Dolby-A equipment, includes a single-channel of processing switchable encode/decode, with line output monitoring and line-up facilities.

Cat 40: similar to **Cat 22**, but half speed allowing noise reduction when replaying master tapes at half speed for mastering, the four bands of processing are lowered by one octave.

Cat 35: NRM test set comprising a noise reduction module tester and test extender; allows go/no-go testing.

NRU-10: 2-channel Dolby-A rack-mounting unit with built-in encode/decode changeover; VU or PPM meters; easily accessible gain controls for VTR soundtracks and applications where playback and record gains are frequently changed.

FABEC (Sweden)

Fant & Beckman AB, Eketräget 22, S-41712 Goteborg.

UK: Scenic Sounds Equipment Ltd, 97-99 Dean Street, London W1V 5RA. Phone: 01-734 2812. Telex: 27939.

USA: Gotham Audio Corp, 741 Washington Street, New York, NY 10014. Phone: (212) 741-7411. Telex: 129269.

TTM Frame: accepts Dolby, dbx and Telefunken **Telecom** noise reduction cards, 24 being accom-



dbx 904

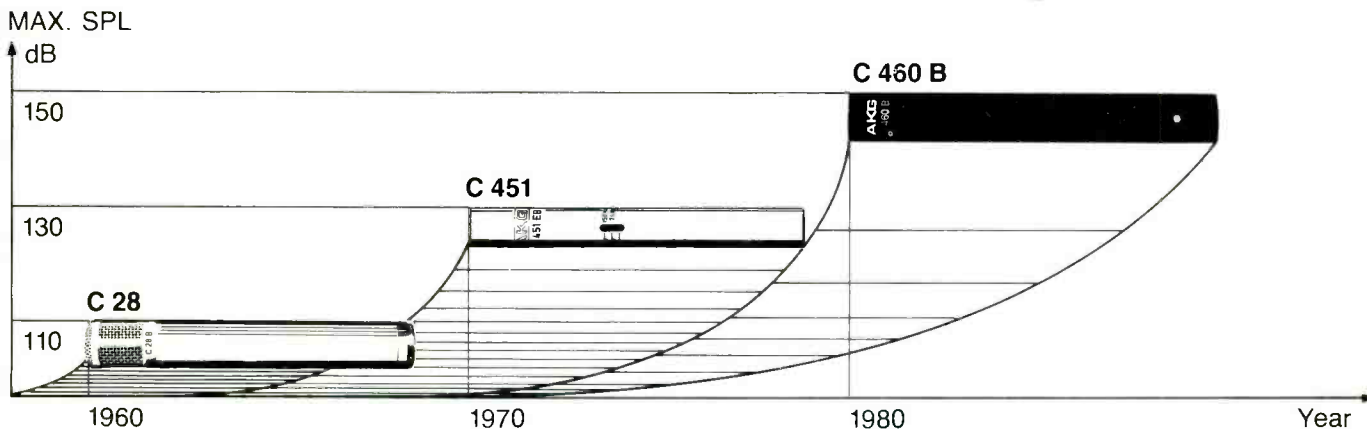
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ADV 302/1/E

product Noise reduction & gating guide

modated across a 19in rack; encode/decode and bypass remotely switchable; power failure bypass; electronically balanced inputs and outputs; front panel multitrack pots for level setting in record and playback, and pots for output line level and green/red LED threshold for level setting, separate PSU.

TTM202B: accepts two noise reduction modules with similar facilities.

FUTURE FILM (UK)

Future Film Developments, 36-38 Lexington Street, London W1V 3LE. Phone: 01-437 1892. Telex: 21624.

DNR Series: portable unit containing two Dolby Cat 22 modules; interfaces with Nagra IV tape machines; dimensions match that of the Nagra case and weight is under 4.5kg; power derived from internal batteries.

MICMIX (USA)

MicMix Audio Products Inc, 2995 Ladybird Lane, Dallas, Texas 75220. Phone: (214) 352-3811. UK: Scenic Sounds Equipment, 97-99 Dean Street, London W1V 5RA. Phone: 01-734 2812. Telex: 27939.

new

Dynafex: noise reduction unit/noise gate offering up to 30dB of noise reduction. Fits standard 19in rack and features two independent channels operable from either a single stereo source or two different mono sources. Facilities include a threshold control to determine the signal level at which the expander operates and a bypass switch.

MXR (USA)

MXR Innovations Inc, 740 Driving Park Avenue, Rochester, NY 14613. Phone: (716) 254-2910. Telex: 978451.

UK: Atlantex Music Ltd, 34 Bancroft, Hitchin, Herts SG5 1LA. Phone: 0462 31511. Telex: 826967.

Compaer: stereo noise reduction system using a 2: 1 compress/expand ratio.

MXR Compaer



RUBY (UK)

Database, 1 Vale View Place, Clarendon Road, Bath BA1 6QW. Phone: 0225 316102.

Ruby: noise reduction unit designed to reduce the noise of stage effects boxes. Features instrument-level input; an effects send; an effects return; and an output with 600Ω drive capability; plus a bypass facility.

STRAMP (West Germany)

Peter Struven GmbH, Bornheide 19, D-2000 Hamburg 53. Phone: 040 801028.

NLS-8: 8-channel compander; 35dB noise reduction claimed with no alignment necessary; simultaneous encode/decode. Also available in 2- or 4-track models and as 'chips' for mounting internally in equipment; jack socket connectors.



tts NG2

TELEFUNKEN (West Germany)

AEG-Telefunken, Postfach 2154, D-7750, Konstanz. Phone: 07531 862460. Telex: 733233.

UK: Audio & Design (Recording) Ltd, 16 North Street, Reading RG1 4DA. Phone: 0734 53411. Telex: 848722.

USA: Gotham Audio Corp 741 Washington Street, New York, NY 10014. Phone: (212) 741-7411. Telex: 129269.

Telcom c4: system based on a 2-way compression/expansion principle using a 1: 1.5 slope; input split into four bands — 30Hz to 215Hz, 215Hz to 1.45kHz, 1.45kHz to 4.8kHz, 4.8kHz to 20kHz — before compressing; c4 is a 2-channel switchable encode/decode unit for use with the Telefunken M15A multitrack, while the c4D is a direct replacement for the Dolby Cat 22 module.

tts(West Germany)

TTS-Electronic GmbH, Dammühlenweg 4, D-6270 Idstein. Phone: 6126 2014. Telex: 4182297.

NR-2: simultaneous High-Com noise reduction encoder/decoder. Modular format for 19in rack mounting. Offers >20dB noise reduction, bypass facility.

NG-2: noise gate giving >65dB of attenuation. Facilities for external triggering and bypass mode. Adjustable release 0.1 to 10s. Up to eight modules may be accommodated in a rack unit.

EG-2: effects gate/noise gate offering gate attenuation of over 100dB through use of VCA components. Gain reduction displayed on an LED bargraph. Controls include attack, attenuation, release, threshold, delay and range. Switchable bypass, trigger, key and external DC. Features include automatic fade in/out plus reverse and 'audio softner' sound effects. External trigger facilities for grouping, automation faders and computer mixdown. Hold function offers adjustable delay of gain reduction from 1ms to 3s. Control range variable from 0 to -50dB. Two units may be linked for stereo operation.

UREI (USA)

United Recording Electronics Industries, 8460 San Fernando Road, Sun Valley, Cal 91352. Phone: (213) 767-1000. Telex: 651389.

UK: FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ. Phone: 01-953 0091. Telex: 27502.

Model 1181: professional standard CX noise reduction encoder/decoder. Unit is 19in rack mounting and provides preview, programme and 'audition' facilities in stereo. (See New Products, February issue for full details).

Q-LOCK WORLD- WIDE

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06524385+

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Tel No: 90520604 Tlx No: (0083) 121394

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Tel No: (010 49) 2101141 Tlx No: (003) 8517511

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Contact: Paul Horber
Tel No: (010 27) 11 293066 Tlx No: (007 958) 9416+

SPAIN

Telco SL
Gravina 27, Madrid 4, Spain
Contact: Joaquin Escrig
Tel No: (010 34) 2317840 Tlx No: (0061) 27348

SWEDEN

Ercotron AB
S-183 21 Tabby, Stockholm, Sweden.
Contact: Fredrik Ericsson
Tel No: (010 46) 8 7680795 Tlx No: (0023) 13800

USA

Quintek Distribution Inc
Suite 209, 4721 Laurel Canyon Boulevard, North
Hollywood, California, USA
Contacts: Rodney Pearson/Sandee Allen
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Kinetic House, Verulam Road, St. Albans, Herts. AL3 4DH, England
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Please send me full details on Q-LOCK

Name

Company

Address Post Code

Telephone no

Type of business Audio Video Film Broadcasting

product Compressors & limiters guide

ACCESSIT (UK)

Bandive Ltd, 8 East Barnet Road, New Barnet, Herts EN4 8RW. Phone: 01-440 9221. Telex: 25769.
USA: The Mike Shop, PO Box 366, Elmont, NY 11003. Phone: (516) 437-7925.

Compressor: simple compact compressor for small studio use. Requires external 24V power supply; attack 0.5ms to 5ms; release 0.1s to 2s; ratios approx 6 to 1.

ADM (USA)

ADM Technology Inc, 16005 Sturgeon, Roseville, Michigan 48066. Phone: (313) 778-8400. Telex: 23114.

UK: Ampex GB Ltd, Acre Road, Reading RG2 0QR. Phone: 0734 85200. Telex: 848346.

302 Limiter Module: attack time 1ms; release time 50ms to 2.5s; threshold -16 to +24dBm; power \pm 20V 50mA.

ALICE (UK)

Alice (Stancoll Ltd), 38 Alexandra Road, Windsor, Berks. Phone: 07535 51056. Telex: 849323.

9908 module: contains two comp/limiters with switched stereo ganging built into Alice desks, and not available separately. Attack time 1 to 10ms, limiter 100 μ s; release time auto 600ms to 5s, manual 400ms to 1.2s; ratio 1.3 to 5:1.

ALLEN & HEATH (UK)

Allen & Heath Brenell Ltd, Pembroke House, Campsbourne Road, London N8. Phone: 01-340 3291. Telex: 267727.

USA: Audio Marketing Ltd, 652 Glenbrook Road, Stamford, Connecticut 06906. Phone: (203) 359-2312. Telex: 996519.

Feed Forward Delay Limiter: variable threshold, release time and output level; overload indicator; stereo linkage and a 3-position LED PPM.

Pro limiter: portable limiter designed for use with small studios and PA systems. 7:1 compression ratio, balanced mic input, line input, low level hi-Z input for guitar, switchable attack and decay times, overload indicator, variable input gain.

ALTEC (USA)

Altec Corp, 1515 South Manchester Avenue, Anaheim, Cal 92803. Phone: (714) 774-2900.

Europe: Altec Lansing International Ltd, 17 Park Place, Stevenage, Herts SG1 1DU, UK. Phone: 0438 3241. Telex: 825495.

UK: Theatre Projects Sound Ltd, 10 Long Acre, London WC2E 9LN. Phone: 01-240 5411.

1612A Limiter: 2-input device that functions either as a line amp or a limiter amp. Attack time typically 10 μ s (fast), 33 μ s (slow); release time typically 800ms (fast), 2.8s (slow); threshold variable from -74dBm input with 1588C mic preamp, from -40dBm direct input; slope nominally 20:1 from threshold to 25dB compression.

ASHLY (USA)

Ashly Audio Inc, 100 Fernwood Avenue, Rochester, NY 14621. Phone: (716) 544-5191.

UK: Atlantex Music Ltd, 34 Bancroft, Hitchin, Herts SG5 1LA. Phone: 0462 31511. Telex: 826967.

SC-50: 19in rack mounting peak limiter/compressor with balanced inputs, detector patch point for frequency sensitive limiting and LED gain reduction indicator. Ratio 2:1 to ∞ ; attack time 200 μ s to 20ms; release time 100ms to 2s.

SC-55: Similar to SC-50 but stereo unit. Limiting determined by the louder channel.

AUDIO & DESIGN RECORDING (UK)

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



New ATC units

ATC (USA)

Applied Technology Corp, 27106 46th South, Kent, Washington 98031. Phone: (206) 854-4486.

F600 Broadcast Limiter: 'straightforward' 2-channel limiter for use in systems that have critical overload conditions, such as optical film recording, disc cutting, and broadcast transmitters. Attack 40, 25, 500 μ s, 1, 2.5, 25ms; release: 25, 50, 100, 200, 400, 800ms, 1.6, 3.2s, plus 'automatic'; threshold input -19dBm max for limiting output up to +15dBm.

F690 Music-Voice Ratio Limiter: F600 stereo limiter fitted with voice-operated threshold switching circuit.

F760X Compex Limiter: variable ratio compressor plus overall peak limiter and low-level, noise-reducing expander/gate. Mono or stereo rack-mounting system, or mono module. Three limit pre-emphasis values -50, 75 or 100 μ s - can be supplied. Attack time, limiter 250 μ s for 100% control of overshoot without over-limiting, compressor 250 μ s, 2.5 and 25ms, expander 20 μ s, 2 and 40ms; release time, limiter 250ms, compressor 25, 50, 100, 200, 400, 800ms, 1.6 and 3.2s, plus 'automatic', expander/gate variable between 25ms and 5s; threshold, limiter +14dBm max ref unattenuated output, compressor calibrated wrt peak limiter threshold and marked 0-20dBm in 2dB steps, expander/gate -40 to +14dBm wrt input.

F769X Vocal Stressor: combines F760X Compex limiter and E900 sweep equaliser. Equaliser can be positioned before or after the limiter, or inserted into the limiter's control side chain, thus modifying its response to frequency content. Not only de-essing, but 'de-rumbling' and 'de-bass end modulating' are among the applications.

E500/E560 Band Processor/Limiter: specifically designed for band-split limiting, the E500 features the following: high and lowpass sweep filters for dynamic and static shelf type eq; parametric notch filter of variable 'Q' for dynamic or static peaking/limiting; monitoring of selected area for adjustment and use as effect; switched threshold control that converts variable input/output limiters or expanders to unity gain; electronic crossover with zero phase shift; simulated 'stereo' from mono tracks, and phasing effects by altering sweep notch control. The E560 combines the selective notch section of the E500 with an F600 limiter.

S01 Compressor-Limiter Module: member of the Scamp family of modules. Attack time, limiter 500 μ s, compressor 500 μ s, 2 and 25ms; release time, limiter 250ms, compressor variable between 25ms and 3s, with an 'automatic multiple network' position that gives a fast recovery time over 5dB gain reduction range on a slowly changing release platform; threshold, limiter -4 to +16dBm max output level, compressor linked to ratio selection so that for 10dB compression on any slope the output level remains constant, and above that level of compression the slope tightens to 30:1 as the peak level limiter becomes operational; compression ratio 1, 1.5, 2.3, 5 and 10:1.

Gemini Compact: available as Gemini Compact or iTAM Compliment. Attack time 500 μ s and 5ms; release time variable between 25ms and 3s, plus 'automatic'; threshold -10 to +10dBm at output (-20dBm at input); ratio limiter 20:1, compressor 1.5 and 3:1; stereo matching \pm 1dB on control voltage tracking over 10dB range.

Gemini Easy Rider: twin-channel comp/limiter with the facility to link control signals for stereo use. LED metering of gain. Attack time, fast 500 μ s, slow 5ms, dynamically controlled; release time: fast 15ms, slow 4s, plus automatic; thresholds automatically change in relation to ratio; ratios, switched 1:1, variable 1.5:1 to 20:1; stereo matching \pm 1dB channel to channel over 20dB gain reduction.

Discriminate Audio Processor III: broadcast multi-band levelling amp to be used ahead of a peak limiter. Features true RMS action with VCA control and has adjustable gain, attack, release, compression and output. Bargraph display of level, both VU and dB gain reduction, plus separate bargraph displays for LF/MF/HF adjustable sections. Limiting function may be disabled.

Maximod: digital peak limiter incorporating a micro-processor which compares and samples the audio prior to the output. Features front panel keypad for entry commands. Functions available include setting of positive and negative modulation limits; symmetrical or asymmetrical modulation; phase reversal; amount of limiting; high and low pass filtering for AM broadcast purposes; pre-emphasis for FM operation; gain; output level; and variable release time. The keypad is locked by entering a private code to prevent tampering by unauthorised personnel. Because of the unit's digital processing the usual attack and release times are not present - attack time being measured in minus seconds and the release being instantaneous.

Ex-press Limiter: compact stereo compressor/limiter/expander. Digital logic switching, memory to retain 'last use' settings when switched off. Meter calibrated in VU and gain reduction scales. Attack time 500 μ s to 5ms for 10dB over limit threshold; release time 25ms to 3s on 10dB over limit threshold, auto position 25ms on 5s; ratio 1.5:1, 2:1, 5:1 and limit (20:1) turning into a limit slope after 10dB of compression.

Transdynamic System: three-band processing system for broadcast use, also applications in mastering and tape duplication. Normally sold as a package with three Audio & Design compressor-limiters. Two independent channels; tunable band-splitting filters, 6dB/12dB per octave phase compensated; separate control of compressor attack/release/ratio for each band; wide-band VCA limiter at output; selectable pre-emphasis (0, 25, 50 or 75 μ s) in control circuits of output limiter; adjustable peak modulation asymmetry for AM; switchable HPFF/LPF; simple setup with LED bargraph metering and built-in pink noise generator; tamper-proof solid-state audio switching. Optional 19in rack mount panel housing 3 Compex modules and smoked perspex security cover for all packages.

AUDIO DEVELOPMENTS (UK)

Audio Developments, Hall Lane, Walsall Wood, Brownhills, West Midlands WS9 9AU. Phone: 05433 5351. Telex: 338212.

USA: Coherent Communications, 13733 Glenoaks Blvd, Sylmar, Cal 91342. Phone: (213) 362-2566.

AD055: 2-channel rack mounting unit. Channels are completely independent but can be linked for stereo operation; DIN, XLR and audio jack connectors. Attack time 250, 500 μ s, 1, 2, 4 and 8ms, switchable; release time 75, 150, 300, 600ms, 1.2 and 2.4s, switchable; threshold two ranges, 'low ratios' adjustable from -10 to +10dBm in 2dB steps, 'limit' adjustable from 0-20dB in 2dB steps; ratio 1, 2, 3 and 5:1, plus 'limit' (20:1).

AUDIX (UK)

Audix Ltd, Station Road, Wenden, Saffron Walden, Essex CB11 4LG. Phone: 0799 40888. Telex: 817444.

4B02 Module: compressor-limiter module with noise gate; attack time 1, 2, 5, 10, 20 and 50ms; release time 100, 200, 500ms, 1 and 2s, plus 'auto' which gives a time related to depth of compression; threshold -10 to +12dB steps; ratio 1.5, 2, 3, 4 and 6:1, plus 'limit'. Noise gate: sets gate to cut off input signal below -50, -40, -30, -20 and -10dBm, and 'off'.

SP 704 Limiter Amplifier: designed for insertion into programme lines operating at 0dBm. Facilities for slave (tandem) and voice-over application. Attack time 'auto' (nominally 5ms for 12dB of control); release time 100, 200, 500ms, 1 and 2s, plus 'auto'; threshold -12 to +4dBm in 2dB steps and 'off'; ratio 8:1 internal drive and 2:1 external drive.

BARTH (West Germany)

R. Barth KG, Grillparzerstrasse 6a, D-2000 Hamburg 76. Phone: 040 229-8883. Telex: 212095.

USA: Audicon Marketing Group, 1200 Beechwood Avenue, Nashville, Tennessee 37212. Phone: (615) 256-6900. Telex: 554494.

UK: Eela Audio, 13 Molesworth, Hoddesdon, Herts. Phone: 09924 68674.

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Telex: 27 939 SCENIC G



Sweden Tal & Ton Musik & Electronic (Göteborg)

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product Compressors & limiters guide

Dynaset U311: compressor/limiter with capability of two independent operational bands above and below the chosen dynamic range. Each band can be set for separate threshold, limiting/compression ratios. Upper range is between -12dBm and +12dBm while lower range is below 0 and -30dB below the upper band setting. Available in single channel for rack mounting within master frame or stereo unit with channel coupling. Single module has additional expander position. Attack time 'Fast' 330ms/20dB, 'Slow' 1.2s/20dB, variable 200ms to 1.2s; release time 'Fast' 330ms/20dB, 'Slow' 1.2s/20dB, variable 200ms to 1.2s, or automatically optimised setting on two bands.

B & B AUDIO (USA)

Aphex Systems Ltd, 7801 Melrose Avenue, Los Angeles, Cal 90046. Phone: (213) 655-1411. Telex: 910-321-5762.

UK: AKG Acoustics Ltd, 191 The Vale, London W3 7QS. Phone: 01-749 2042. Telex: 28938

CX1: compressor/expander module which may be accommodated in the R7 10 module rack. Compressor release time variable 50ms to 2.5s, threshold variable -40 to +20dBV. Expander depth control allows 0 to 50dB max gating. Expansion release time variable 50ms to 2.5s with threshold -75 to -10dBV. Attack time for both functions <1µs. Module features bypass facility and 10 segment bargraph meter.

BE (USA)

Broadcast Electronics Inc, 4100 North 24th Street PO Box 3606, Quincy, Illinois 62301. Phone: (217) 224-9600.

UK: Lee Engineering Ltd, Napier House, Bridge Street, Walton-on-Thames, Surrey KT12 1AP. Phone: 09322 43124. Telex: 928475.

AM-400: AM compressor/limiter. Symmetrical or asymmetrical modes, the latter allowing positive peaks of 25% higher than negative peaks. Can be operated as compressor/limiter, compressor only or fixed gain conventional line amplifier. Rack mounting format and tamper-proof front controls. VU meter. Attack time 1.0ms; release time 5 to 40s for 20dB release; ratio 30:1 maximum.

AM-500: similar to AM-400 but includes audio gating for optimum low noise operation, over modulation protection and a gain indicator meter.

FM-600/FM-601: mono and stereo FM broadcast limiters. Several operational compression ranges varying from sampling incoming signal and only applying compression where necessary to 20dB dynamic range. Modular construction. Mode switching for pre-emphasis, frequency response and test position, gating and limiting. Automatic stereo balance. Specification similar to AM-400.

BIAMP (USA)

Biamp Systems Inc, 9600 SW Barnes Road, Portland, Oregon 97225. Phone: (503) 297-1555.

Quad Limiter: all purpose, multi-channel limiter/compressor. Four independent channels each with threshold control and LED to indicate when limiting or compression is occurring. Release time set by screwdriver adjustment on each channel. Attack time 1ms; release time 150ms to 1.5s.

CATHEDRAL (UK)

Cathedral Sounds Ltd, Fourways, Morris Lane, Halsall, Ormskirk, Lancs L39 8SX. Phone: 0704 840328.

CL4: quad comp/limiter, self powered. Ratio continuously variable from 1:1 to 20:1; threshold operates from -24dB upwards; release time 100ms to 5s approx.

dbx (USA)

dbx Inc, 71 Chapel Street, Newton, Mass 02195. Phone: (617) 964-3210. Telex: 922522.

UK: Scenic Sounds Equipment, 97-99 Dean Street, London W1V 5RA. Phone: 01-734 2812. Telex: 27938.

Model 160: single-channel unit using true RMS sensing. Two units may be ganged for rack-mounting. Attack time 15ms for 10dB level change above threshold, 5ms for 20dB change, 3ms for 30dB change; release rate 120dB/s; compression ratio 1:1 to infinity; threshold -38 to +12dBm.

Model 162: 'true-stereo' unit utilising true RMS sensing, feed-forward circuitry and ganged threshold, compression and output gain controls. Two or more units can be linked. Specification virtually identical to Model 160.

Model 163: one knob only on the front panel which increases or decreases the amount of compression, automatically maintaining a consistent output level. Features 'Over Easy' transfer curve gradually adding compression over several dBs around the threshold point. 12 LED level display. Threshold -36dBm to +4dBm; output +18dBm into 2kΩ; attack time 5ms for 20dB level change; release time 120dB/s in ∞ compression region; ratio automatically varies from 1:1 below threshold to ∞:1 above threshold.

Model 164: stereo version of 163 in 19in rack format.

Model 165: professional comp/limiter featuring automatic or manual control of attack and release rates. 'Over Easy' compression. Stereo coupling. Threshold -40 to +10dBm; ratio 1:1 continuously variable to ∞:1; attack time manual 1 to 400dB/ms, automatic mode 15ms for 10dB level change, 5ms for 20dB, 3ms for 30dB; release time manual 10 to 4000dB/s, automatic 120dB/s.

Model 903: part of the dbx 900 Series modular signal processing system. Uses the dbx 'Over Easy' compression curve and offers negative compression that begins reducing the output volume once threshold is exceeded. RMS level sensing. Attack time programme dependent -15ms for 10dB above threshold, 5ms for 20dB over threshold; release time 120dB/s; ratio variable (1:1)-(∞:1)-(-1:1); threshold -40dBm to +20dBm.

D & R (Netherlands)

D & R Electronica BV, Keizersgracht 284, NL-1016 EW, Amsterdam. Phone: 020 25.01.30.

Compressor: frame mounting compressor, mains powered, adjustable compression ratio, stereo coupling, LED compression indicator. Attack time 20ms to 100ms; release time 20ms to 5s; ratio 1:1 to 20:1.

Stereo Limiter: frame mounting limiter, mains powered, linked input and output controls, LED limiting action indicator bypass. Attack time <1ms; release time 20ms to 2s.

DUKANE (USA)

Dukane Corp, International Division, 2900 Dukane Drive, St. Charles, Illinois 60174. Phone: (312) 584-2300. Telex: 720426.

Model 2A80B Compressor/Noise Gate: 2-input line amp combining a compression amplifier with an 'instantly operating' noise gate that reduces the no-signal noise by 15dB. Noise 70dB at threshold of compression -80dB dynamic noise level with amp on. Attack time 30µs; release time 1.5s; compression ratio 10 and 5:1.

Model 2A103 Compressor Module: Attack time 1ms; release time 1.5s; compression ratio 10:1. Power ±24V, 20mA via octal plug.

Model 2A165 Compressor Amplifier: pcb module designed to plug into standard 19in rack-mounting chassis. Attack time 500ms; release time 3-5s; compression ratio 20:1. Power ±22.5V, 20mA.

EMT (West Germany)

EMT-Franz GmbH, Postfach 1520, D-7630, Lahr. Phone: 78025 512. Telex: 754319.

UK: FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ. Phone: 01-953 0091. Telex: 27502.

USA: Gotham Audio Corp, 741 Washington Street, New York, NY 10014. Phone: (212) 741-7411.

EMT 156: 2-channel unit with identical controls of dynamic compression and limiting to avoid any

displacement of stereo image. Limiting or compression, or both, are pushbutton controlled. Limiter: threshold -2 to +7.5dB (referred to internal reference level of 0dB); attack time <100µs; release time 250ms to 2.5s adjustable, for 10dB gain variation. Compressor ratio 1.5 to 4:1; attack time 1-4ms, internally adjustable; release time 500ms to 3.5s adjustable, for 10dB gain variation. Expander expansion ratio 1.5 or 2.5:1; attack time coupled with compressor release time; release time 1.5 to 7.5s, adjustable for 10dB gain variation; about 4-5s in automatic mode. Internal gain can be varied over 40dB range by means of a 6V DC signal applied to a rear-panel socket.

EMT 257 Limiter: in 'equalisation' mode an amp with a frequency weighting network is inserted into the control loop. Components for the pre-emphasis are fabricated on a plug-in unit, and can be changed for any desired frequency weighting of the limiting threshold. Attack time 50 to 500µs; release time 250ms to 20s/10dB; threshold -2 to +10dB relative to internal zero; other can be switched between linear or pre-emphasised mode. Power 24V DC (either polarity).

EMT 260 Filter-Limiter: amplifier and limiter linked by frequency crossover network. Below the limiting threshold, LF components are fed via the amp branch and HF via the limiter. If the threshold is exceeded, gain is reduced in the HF branch. Attack time 50 to 500µs/10dB; release time 0.25-10s/10dB; range 15dB at 20kHz; control responsive to average value below threshold; peak value above threshold; turnover frequency 4.5kHz; weighting 60 or 180µs. Power 24V DC (either polarity), approx 130mA.

EMT 258 Noise Filter: comprises a bandpass, highpass and lowpass filter, all three set for the same frequency between 1 and 20kHz, linked to an expander circuit, which is automatically switched in and out as necessary, and functions in the range below 1kHz to supplement the effects of the lowpass filter. Thus the unit adjusts itself in such a way as to leave the signal modulation unchanged, while attenuating the HF noise components. Expander release time 50ms for 10dB; filter release time 50ms to 2s, adjustable; turnover frequency 1 to 20kHz, dependent on signal amplitude; threshold of signal that determines turnover frequency is adjustable between -25 and -65dB. Power 24V DC (either polarity).

EMT 261 Compressor-Limiter: provides limiting, compression and expansion with variable adjustment of static and dynamic characteristics. Ratio 2:1 to 20:1, 1:2.5 expanding; attack time 400µs limiting, 2.5ms compression; release time 250ms to 10s (or automatic); threshold 3dB above normal level for limiter, expander -35 to -55dB. Power 24V DC, roughly stabilised.

EMT 266 Transient Limiter: suitable for FM broadcast modulation, disc cutting and cassette duplication. The input signal is delayed by 0.3ms while the input for the limiting control is taken before the delay. The limiter can then be fully prepared to respond to the programme signal and ensure no excessive signals are present at the output. Variable pre-emphasis stereo operation.

EVENTIDE (USA)

Eventide Clockworks Inc, 265 West 54th Street, New York, NY 10019. Phone: (212) 581-9290.

UK: Feldon Audio Ltd, 126 Great Portland Street, London W1N 5PH. Phone: 01-580 4314. Telex: 28668.

2830 Omnipressor: combines the characteristics of a compressor, expander, noise gate and limiter in a rack-mounting unit. Also capable of dynamic reversal, +10dBm input produces -10dBm output and vice versa. Attack time 100ms to 100s, continuously variable; release time 1ms to 1s, continuously variable; compression ratio 1:1 through infinity to -10:1, continuously variable, (infinite compression setting gives constant output ±1dB for 60dB change in input level); expansion ratio 1 to 10:1, continuously variable. 70 ▶



Harris MSP-90 Tri-Band AGC Audio Processor

OTARI

Otari Electric Co., Ltd.
4-29-18 Minami-Ogikubo, Suginami-ku
Tokyo 167, Japan
Phone: (03) 333-9631, Telex: J26604



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For full details of the heavy-duty machine, please contact us.

product Compressors & limiters guide

FURMAN SOUND (USA)

Furman Sound Inc, 616 Canal Street, San Rafael, Cal 94901. Phone: (415) 456-6766.
UK: Atlantex Music Ltd, 34 Bancroft, Hitchin, Herts SG5 1LA. Phone: 0462 31511. Telex: 826967.

Model LC-2: comp/limiter with input/output level controls and LED display of gain range. Selectable normal compression, de-essing, or side chain modes. Two units may be interconnected for stereo operation. Attack time 400 μ s to 25ms; release time 200ms to 5s, programme adjusted; ratio 2:1 to 50:1.

HARRIS (USA)

Harris Corp, Broadcast Products Division, PO Box 4290, Quincy, Illinois 62301. Phone: (217) 222-8200.



Harris MSP-95 Audio Composite Processing Unit

UK: Dynamic Technology Ltd, Zonal House, Alliance Road, London W30BA. Phone: 01-9932401. Telex: 935650.

MSP-90 Audio Processor: broadcast audio processor available in a variety of configurations: as a mono or stereo AGC amp; AM limiter; dual AM limiter; mono or stereo FM limiter; AGC amp/AM limiter; or AGC amp/FM limiter. Comprises main frame including power supply which houses any two modules. Three modules available. AM limiter module: limit range 15dB; limit slope 18:1; attack time <40 μ s; recovery time switchable 1.3s to 7.5s. FM limiter module: limit range 15dB; limit slope 30:1; attack time <40 μ s; recovery times switchable 1.3s to 7.5s. AGC amp module: expansion range 3dB, 6dB, 9dB or 12dB; expansion slope approx 2.5:1; expansion attack time selectable 100, 200, 300, 500ms, 1s; expansion recovery time selectable 1, 2.5, 5, 15s; expansion threshold \pm 5dB; compression range 24dB; compression slope selectable 3:1, 6:1, 12:1 or 24:1; compression attack time selectable 250 μ s, 1, 2.5 or approx 25ms; compression recovery time selectable 580, 750ms, 1.4 or 3.5s.

MSP-90 Tri-band AGC amp: automatic gain control amp with RMS control of compression. Turnover frequencies adjustable over three octaves. Fits the MSP-90 main frame. Expander section: range 3, 6, 9 or 12dB; slope 2:1; threshold \pm 5dB; attack time 0.1, 0.2, 0.3, 0.5 or 1s; recovery time 0.25, 0.5, 1, 2, 4, 8 or 16s. Compressor section: range 24dB; slope selectable 24:1, 12:1, 6:1 or 3:1; attack time programme dependent 2.5 to 250ms; recovery time 0.25, 0.5, 1, 2, 4, 8 or 16s.

MSP-95 FM Audio Composite Processing Unit: features a stereo limiter/generator specifically designed for FM stations using an STL link. FM limiter: range 15dB; slope 30:1; attack time <40 μ s; recovery time switch selectable 1.3 to 7.5s; switch selectable pre-emphasis 25, 50 and 75 μ s; input amp gain, switch selectable over a 40dB range. Stereo generator utilises digitally synthesised modulation with overshoot protection provided by a dynamic transient response filter.

INOVONICS (USA)

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

Model 201: suitable for recording, mastering and broadcast work. Operates as fast peak limiter and independent average-responding limiter. Gain reduction meter and 19in rack-mounting. Stereo coupling facility. Attack time variable between 1 μ s/dB and 1ms/dB limiting; release time variable

between 5ms/dB and 50ms/dB limiting; average level limiter response 10ms/dB limiting.

ITAM (UK)

Industrial Tape Applications Ltd, 1-7 Harewood Avenue, Marylebone Road, London NW1 0AE. Phone: 01-724 2497. Telex: 21879.

Compliment: Only available in Europe. For specifications see Audio & Design's entry for *Gemini Compact* stereo compressor limiter.

JBL (USA)

James B. Lansing Sound Inc, 8500 Balboa Blvd, Northridge, Cal 91329. Phone: (213) 893-8411. Telex: 674993.

UK: Harman (Audio) UK Ltd, Mill Street, Slough, Berks SL2 5DD. Phone: 0753 76911.

7130: dual input compressor/limiter switchable for mic or line input. Compression threshold set by input level control. VU meter to show amount of compression or output level. Rack mounting. Ratio 1:1, 2:1 switchable; attack time 400 μ s, 3ms, 140ms switchable; release 30dB/s, 8dB/s, 4dB/s switchable; threshold -10 to +6dBm continuously variable.

ROGER MAYER (USA)

Roger Mayer Associates, 225 East 57th Street, New York, NY 10022. Phone: (212) 486-1544.
UK: Scenic Sounds Equipment, 97-99 Dean Street, London W1V 5RA. Phone: 01-734 2812. Telex: 27939.

Model RM68: Noise gate with 150ns attack capability and key input. Release time 30ms to 5s; attenuation range adjustable 0 to 30dB; output noise -96dB, 20Hz to 20kHz; sensitivity adjustable -56dBm to 20dBm. Power requirements +24V DC at 40mA. *RM68X* is retrofit for other manufacturers' racks.

MM (UK)

MM Electronics, PA: CE Musical Equipment Ltd, 63 Kneesworth Street, Royston, Herts. Phone: 0763 452075.

EP 141: stereo compressor/limiter for line level operation in recording and PA applications. Rack mounting. Attack time 2ms; release time 50ms to 1s; ratio 1:1 to 1-limit; threshold -15dBm to +20dBm.

MOSELEY ASSOCIATES (USA)

Moseley Associates Inc, Santa Barbara Research Park, 111 Castilian Drive, Goleta, Cal 93017. Phone: (805) 968-9621. Telex: 658448.

TFL-288 Audio Limiter: single-channel broadcast limiter. Supplied with 75 μ s pre-emphasis, can be converted for other time constants. An output de-emphasis network can be switched in when flat response operation is required. Attack time HF controller 20 μ s, wideband controller 20 μ s to 2ms (factory set to 100 μ s); release time HF controller 50 to 500ms programmable, wideband controller 200ms to 5s programme-operated triple-timing; plug-in lowpass filter located prior to HF AGC; control range 35dB.

Model TAL-320: AM Broadcast limiter featuring switchable low pass filtering and stereo strapping facility. Attack time continuously adjustable 0.2 to 3ms; release time 100ms to 5s.

Model TGR-340: automatic gain rider. Includes recovery enabling gate to stop gain riding during programme pauses, control to allow time delay to be added to AGC recovery, switchable HF AGC. Attack time 2ms; release time 200ms on transients, 5 to 25s on programme.

MXR (USA)

MXR Innovations Inc, 740 Driving Park Avenue, Rochester, NY 14613. Phone: (716) 254-2910. Telex: 978451.
UK: Atlantex Music Ltd, 34 Bancroft, Hitchin, Herts SG5 1LA. Phone: 0462 31511. Telex: 826967.

Mini Limiter: threshold level -30 to +10dBm; attack time approx 1ms; release time variable via rear-panel trim pot, and dependent upon amount of gain reduction. Power +15 to 30V, 22mA.

Dual Limiter: two independent limiters that may be ganged for stereo applications, each channel having in-out switch, slope, input, output, attack and release controls with LED meter showing gain reduction. XLR and jack connectors, detector available on jack socket. Ratio 4:1 or infinity; attack time 0.5 to 50ms; release time 100ms to 5s.

NEVE (UK)

Neve Electronics International Ltd, Cambridge House, Melbourne, Royston, Herts SG8 6AV. Phone: 0763 60776. Telex: 813811.

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

22 Series: available in a variety of formats. All models can be linked for stereo or multichannel operation. Independent limit and compress functions are featured. The compression section samples ahead of the output amp, thus enabling mean programme level to be raised after compression. Compression threshold -20 to +10dB in 2dB steps; ratio 1.5, 2, 3, 4 and 6:1; attack time 5ms (nominal); release time 400, 800ms and 1.5s, plus 'auto' (50ms/5s); limit ceiling +4 to +12dB in 0.5dB steps; attack time 'fast' 100 μ s to 5ms, programmable; release time 100, 200 and 800ms, plus 'auto' (50ms/5s); slope 'at least' 100:1.

33609/10/11/12: range of limiter/compressors that may be linked for stereo and multichannel operation and which sample ahead of the amplifier allowing the mean output level to be raised after compression. Threshold limiting +4dBm to +15dBm, compression -20dBm to +10dBm; attack time limiting 2ms, 4ms, compression 3ms; recovery time limiting 50ms, 100ms, 200ms, 800ms and auto, compression 100ms, 400ms, 800ms, 1.5s and auto. 33609 double unit with power supply, 33610 single unit with power supply, 33611 double unit less power supply, 33612 single unit less power supply.

NTP (Denmark)

NTP Elektronik A/S, 44 Theklavej, DK-2400, Copenhagen NV. Phone: 01-10.12.22. Telex: 16378.

179-120 Compressor: in order to operate with long attack times, a fast symmetrical limiter is provided. Control voltages of two units can be linked for equal gain stereo operation. Attack time 100 μ s to 200ms/20dB, adjustable in 11 steps; release time 60ms to 4s/20dB, plus 'auto' (200ms upon 15s), in 11 steps; release delay 0 or 50ms, switched; compression ratio 1, 2, 3, 5 and 20:1; threshold +6dB (normal), +19dB (normal). Power 24V DC, either polarity, approx 100mA. Version for \pm 15V DC known as 179-140.

179-230 Limiter: incorporates a combination of a relatively long attack time with a symmetric log clipping curve to eliminate transient noise during striking. Recovering circuit is programme dependent based on a dual-time constant principle. Control voltages of two units can be linked for stereo operation. Attack time 1.5ms; release time T1: 100, 200, 400, 1, 2 and 4s, T2: 1, 2, 4, 10 and 20s, and 'off'; threshold +6 \pm 0.5dB, referenced to output; range 30dB; pre-emphasis 50 μ s (normally not connected). Power 24V DC, either polarity, approx 75mA.

179-240/340: same amplifiers as the 179-230 but do not have the external controls of gain and attack. 240 is for 24V DC operation and the 340 for \pm 15V DC. **179-300 Limiter Card:** based on same circuitry found in 179-230 limiter. Attack time 1.5ms; release time dual time constants 200ms upon 15s; control voltage 1V/5dB may be linked for stereo operation. Power \pm 15V DC, 60mA.

179-310 Limiter: built on a card system and intended for the protection of transmission lines. High input overload margin. Via the 31 pole connector external controls may be used for threshold and release. Switches for output threshold and pre-emphasis. Attack time 1.5ms; release time dual time constant 0.1s upon 20s. Power 22V to 32V DC or \pm 11V to \pm 16V DC, 80mA.

179-160 Compressor/Expander: modular unit containing compressor, expander, limiter and gate functions. Possible to remote certain functions. Stereo linkable. Adjustable reference level to match external equipment separate from output level. In bypass mode acts as a linear amplifier. Fully

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Brooke Siren Systems, 92 Colney Hatch Lane, London N10. Tel: 01-444 7892. Telex: 912881 BSSAudio.

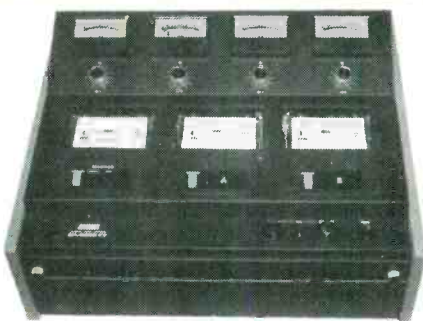


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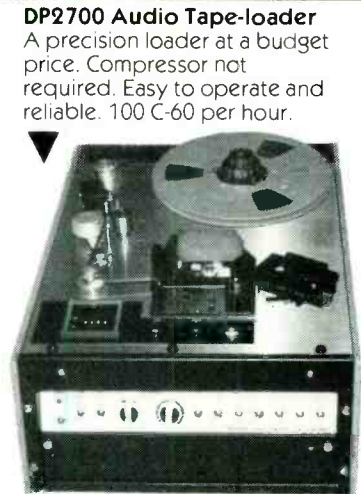
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comprehensive controls for each function with indicator LEDs. Ratio 1.3: 1 to 20: 1 compression; attack time 0.1ms to 100ms compressor, 1.5ms for limiter; release time 0.1s to 6s or programmable controlled frequency dependent position for compressor/limiter/recovery programme dependent with dual time constants. Power 22 to 32V DC, 130mA.

179-170: compact 19in rack mounting compressor/limiter in the form of two channels of 179-160 with identical technical specification. Input and output connections on XLR plugs and 220V AC powered.

ORANGE COUNTY (Canada)

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

VS-1 Stressor: combined single-channel equaliser, limiter, compressor, expander and gate. The equaliser can be routed 'pre' or 'post' compressor/limiter, or inserted into the latter's control side chain. Attack time compressor 250µs, 2.5 and 25ms, limiter 10µs, expander 20µs, 2.5 and 40ms; release time compressor 25, 50, 100, 200, 300, 400, 800ms, 1.5 and 3-2s plus 'automatic'; limiter 20ms, expander 25ms to 8s, continuously variable; threshold compressor 0 to -20dB ref peak limiter in 2dB steps, or frequency sensitive, limiter +18dBm output unattenuated, expander -40 to +30dBm input, continuously variable; compression ratio 1, 2, 3, 5, 10 and 20: 1.

CLX-S-FM Stereo Processor: combined limiter, compressor, expander, gate and high-frequency limiter. The two channels may be used independently, or coupled for stereo operation. Attack time compressor 250µs, 2.5 and 25ms, limiter 10µs, expander 10µs, 2.5 and 40ms, HF limiter 10µs; release time compressor 25, 50, 100, 200, 300, 400, 800ms, 1.6 and 3-2s, plus 'automatic'; limiter 20ms, expander 25ms to 8s, continuously variable; HF limiter 20ms; threshold compressor 0 to -20dB ref peak limiter in 2dB steps, limiter +18dBm output unattenuated, expander -40 to +30dBm output continuously variable, HF limiter varies dynamically with frequency, follows 25, 50 or 75µs characteristic; ratio compressor 1, 2, 3, 5, 10 and 20: 1, limiter 250: 1.

CLX Module: combined single-channel compressor, limiter, expander and gate. Attack time compressor 250µs, 2.5 and 25ms, limiter 10µs, 2.5 and 40ms; release time compressor 25, 50, 100, 200, 300, 400, 800ms, 1.6 and 3-2s, plus 'automatic'; limiter 20ms, expander 25ms to 8s, continuously variable; threshold compressor 0 to -20dB ref peak limiter in 2dB steps, limiter +18dBm output unattenuated, expander -40 to +30dBm, continuously variable; ratio compressor 1, 2, 3, 5, 10 and 20: 1, limiter 250: 1, expander 1:2 and 1:20.

VS-2 Stressor: combines the features of several units into one while maintaining uncomplicated set-up and operation. Programme controlled comp/limiter and expander/noise gate, loudness contour mode. Limiter: ratio 250:1, attack 10µs, release auto. Compressor: internal adjustments for ratio 2:1 to 20:1 attack 250µs to 25ms, release 25ms to 4s or auto. Expander: internal adjustments ratio 1:2, 1:20, attack 20µs to 40ms, release tracks with

compressor; stereo couple on barrier strip.

VS-3: similar to VS-2 but stereo with additional HF limiter using 25, 50 or 75µs characteristics, ratio 250: 1, attack 10µs, release 20ms.

ORBAN (USA)

Orban Associates Inc, 645 Bryant Street, San Francisco, Cal 94107. Phone: (415) 957-1067. Telex: 171480.

UK: Scenic Sounds Equipment, 97-99 Dean Street, London W1V 5RA. Phone: 01-734 2812. Telex: 27939.

UK: (Broadcast units): Lee Engineering Ltd, Bridge Street, Walton-on-Thames, Surrey KT12 1AP. Phone: 09322 43124. Telex: 928475.

418A Stereo Limiter: attack time HF limiter 3ms, broadband limiter 1-2ms programme controlled, release time HF limiter varies around 15ms according to programme history, broadband limiter continuously variable; compression/limiting ratio 200:1; HF time constant 75, 50, 37.5, 25µs, and 'flat'.

Optimod-FM Model 8100A: broadcast FM compressor/limiter/stereo generator suitable for wideband or multiband operation. Incorporates 'master' band compressor above 200Hz; 'bass' band compressor below 200Hz; HF limiter; FM 'smart clipper' output processor; and frequency-contoured side chain overshoot compensator. Unit available in two formats — standard single chassis, or dual chassis (studio/transmitter) option. Standard units are for 75µs pre-emphasis, 50µs to order — 25µs when used with the Dolby 334 broadcast encoder. Features include VCA gain control; peak reading gain reduction meters; stereo/mono mode switching; and built-in crosstalk test generator. Attack time 1ms master band, 5ms HF limiter, programme controlled bass band; release time programme controlled master (adjustable fast/slow) and bass (non-adjustable), 20ms HF limiter; gain reduction 0 to 25dB master band, 0 to 30dB bass band.

Optimod-TV Model 8180A: stereo multiband compressor and HF limiter derived from the Optimod-FM. Optional accessory chassis houses compression controls.

Optimod-AM Model 9000A: AM broadcast processor incorporating a 6-band (150, 300, 700Hz, 1.6, 3.7 and 7.5kHz) frequency selective limiter with 'smart clipping'; a broadband gain-riding compressor; and a programme equaliser. Other features include a transmitter equaliser; a polarity follower; output filter and clipper; and VCA gain reduction of the 'smart clipper'. Attack time 2ms broadband compressor, 2 to 10s limiter, dependent on band frequency; release time programme controlled, non-adjustable broadband compressor, programme controlled adjusted to band frequency limiter; compression ratio >200: 1 broadband compressor, >10: 1 limiter; compression range broadband compressor 20dB, limiter bands 1 to 4 20dB, bands 5 and 6 30dB.

PROTECH (USA)

Protech Audio Corp, Flowerfield Building, Suite 1, St. James, Long Island, NY 11780. Phone: (516) 584-5855.

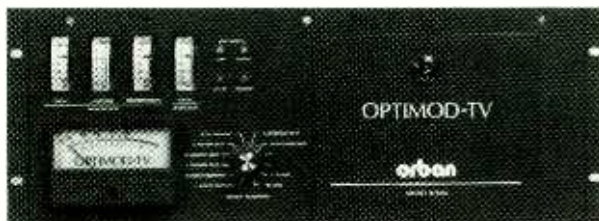
Model 663CL: rack mount, general purpose comp/limiter for use in broadcast production, recording and PA systems. Units may be interconnected for stereo or multichannel operation. Max compression 20dB, ratio approx 2.5: 1. Threshold, attack and release times adjustable.

PYE (UK)

Pye TVT Ltd, Coldhams Lane, Cambridge CB1 3JU. Phone: 0223 45115. Telex: 81103.

USA: Philips Broadcast Equipment Corp, Audio Division, 94 McKee Drive, Mahwah, New Jersey 07430. Phone: (201) 529-3800.

Orban Optimod-TV Model 8180A



LDM0090 Compression Amplifier: available as a stereo (2-channel) or mono unit. Attack time compression 0.5ms, limiting 1s ±0.5ms; release time 100ms to 3-2s in six switched steps; compression ratio 1, 2, 3, 5: 1 (switched) plus linear for line-up; threshold level compression -24 to +16dBm, limiting -16 to 24dBm, both controls calibrated in 2dB steps.

QUAD/EIGHT (USA)

Quad-Eight Electronics, 11929 Vose Street, North Hollywood, Cal 91605. Phone: (213) 764-1516. Telex: 662446.

UK: Audio Kinetics (UK) Ltd, Verulam Road, St Albans AL3 4DH. Phone: 0727 32191.

CL-22: compressor/limiter/expander. VCA controlled circuitry. De-ess switch offering 3dB at 5kHz and -10dB at 20kHz. Meter with +30dB range. Available in three formats — horizontal and vertical modular or stereo rack mounting. Attack 0.002ms/10dB to 5ms/10dB; release 100dB/s to 5dB/s; ratio 2: 1 to 20: 1; expansion threshold to -20dB.

RAG (UK)

Rugby Automation Consultants, 220 Alwyn Road, Rugby CV22 7RA. Phone: 0788 810367.

LIMI Board: pair of PCBs for incorporating a limiter into existing equipment. Attack time 20µs; release time 33ms/700ms combination; compression ratio 4: 1 at -10dB threshold, to 25: 1 at +13dB threshold. Power 24V DC.

RACLIM 2 Module: mains powered unit for rack-mounting. Attack time 20µs; release time switchable, four positions; compression ratio 1 to 25: 1; threshold -20 to +10dB in six switched positions.

RCA (USA)

RCA Broadcast Systems, Front and Cooper Streets, Camden, New Jersey 08102. Phone: (609) 338-3000. Telex: 834357.

UK: RCA Ltd, Lincoln Way, Windmill Road, Sunbury-on-Thames, Middx TW16 7HW. Phone: 09327 85511. Telex: 24246.

BA-145/BA-145S: mono and stereo rack mounting automatic gain control amps, max gain 46dB with max expansion, min gain 20dB with 24dB compression. Expander section: range 16dB; attack time selectable 5, 15 and 30s; release time selectable 4, 6 and 10s dependent on compression release time. Compressor section: range 24dB; ratio >30: 1; attack time selectable 0.2, 2 and 30ms; release time selectable 10, 20 and 40s.

BA-146A/BA-147A: rack mounting broadcast limiters. BA-146A is intended for AM applications, BA-147A which includes a peak clipper is for FM radio or TV audio channel applications. Peak clipper module available for conversion of the BA-146A. Mono unit features symmetrical and asymmetrical limiting. Attack time 1µs/dB; recovery time selectable 0.2, 0.5 and 5s; compression ratio 50: 1; compression range 26dB.

BA-150: digital overshoot control processor for use with any FM exciter or stereo generator. Essentially a sophisticated peak limiter with an attack time of 50µs, the unit also incorporates predictive peak level restoration and phase compensation circuitry.

REBIS (UK)

Rebis Audio, Kinver Street, Stourbridge, West Midlands DY8 6AB. Phone: 0384 71865.

USA: Klark-Teknik Electronics Inc, 262A Eastern Parkway, Farmingdale, NY 11735. Phone: (516) 249-3600.

RA 301: 2-channel 3½in rack-mounting unit for independent compression and limiting, or ganged for stereo operation. VU metering of input, output and compression. Attack time 20µs to 1.5ms; release time 50ms to 3s; compression/limiting ratio 1 to 40: 1; minimum threshold -20dBm.

RA 203: 5¼in by 1in module compatible with the Rebis rack. Spec as for RA 301 except threshold control instead of separate input and output controls.

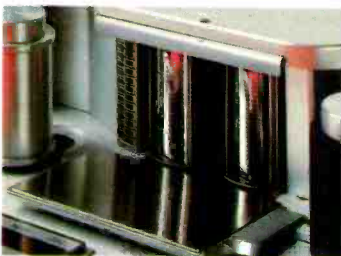
SCV (France)

SCV Audio, Bât 3418 C, Rue de la Jeune Fille, F-95705 Roissy Cedex, France. Phone: 862.43.04.

Compressor/de-esser: two channel unit in 19in rack format. Stereo coupling. LED gain reduction meters on both channels. Attack time 0.2ms to 70ms; release time 300ms to 3s.



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www.americanradiohistory.com

product Compressors & limiters guide

Symetrix Model 501 peak-RMS compressor/limiter



SESCOM (USA)

Sescom Inc, PO Box 590, Gardena, Cal 90247. Phone: (213) 770-3510.

UK: Atlantex Music Ltd, 34 Bancroft, Hitchin, Herts SG5 1LA. Phone: 0462 31511. Telex: 826967.

C-2 Compressor Module: plug-in, octal-based unit with adjustable AGC time constant between 0.1 and 1s by means of an external resistor. Compression range: input varying between -43 and +14dBm provides constant 0dBm output. Power +24V DC.

SHURE (USA)

Shure Brothers Inc, 222 Hartrey Avenue, Evanston, Illinois 60204. Phone: (312) 328-9000. Telex: 724381. UK: Shure Electronics Ltd, Eccleston Road, Maidstone ME15 6AU. Phone: 0622-59881. Telex: 96121.

SE30-2E Gated Compressor/Mixer: combines a 3-input mono mixer and a gated memory compressor in one unit. A 40dB compression range is featured, with a ratio of approx 10:1 in the normal operating range. The response rate (averaging time constant) is adjustable to compensate for various types of programme material. Attack and recovery are variable between 100ms and 8s, and in the 'hold' condition the gated memory holds the gain recovery to less than 20dB after 60s to prevent pumping. A stereo parallel jack allows two units to be synchronised.

Model M625 Voicegate: voice-activated microphone gain controller, typically for PA applications to block out unwanted background noise below a pre-set level.

SOLIDYNE (Argentina)

Solidyne SRL, Tres de Febrero 3254, 1429 Buenos Aires. Phone: 701-8622.

250-XC Compressor: compressor/limiter/expander. The attack as well as the recovery times are automatic and are controlled by an analogue computer which adjusts the action of the compressor to suit the programme. Expansion threshold between -50/-35dB; expansion ratio 3:1; limiter ratio 3:1 to 50:1.

SONTEC (USA)

Sontec Corp, 10120 Marble Court, Cockeysville, Maryland 21030. Phone: (301) 628-2283.

DRC-202: designed for tape and disc transfer. All controls continuously variable. Stereo tracking between channels on compression but independent on limiting to avoid image shift on transients. LED metering. Threshold +4 to +24dBm; attack time adjustable for the RMS detectors only. Affects both limit and compression; release time affects both peak and RMS timing.

SPECTRA SONICS (USA)

Spectra Sonics, 770 Wall Avenue, Ogden, Utah 84404. Phone: (801) 392-7531.

UK: Sun Recording Services, 34-36 Crown Street, Reading, Berkshire. Phone: 0734 595647.

Model 610 Complimiter: unit can be used for peak-limiting and volume-compression, either independently or simultaneously. Compression/limiting ratio 1.1 to 100:1, continuously variable; attack time limiter 0.1 to 2 μ s, compressor 0.1 μ s to 1.2ms, both automatically variable; release time limiter 0.09 μ s, compressor 50ms to 10s, continuously variable both for 90% recovery; threshold 40dBm.

SYMETRIX (USA)

Symetrix Professional Audio Products, 109 Bell Street, Seattle, Washington 98121. Phone: (206) 682-3076.

CL-100: comp/limiter using monolithic VCA gain control element (not an FET) with additional de-ess control and side chain insertion allowing the control signal to be passed through an external equaliser etc, 5 LED indication of gain reduction. Stereo

linking. Ratio 2 to 50:1; attack time 1ms to 5s., release time 1ms to 5s.

Model 501: peak-RMS compressor/limiter: features include a 'soft knee' threshold characteristic plus a 'feed-forward' side-chain, these features permitting high compression ratios to be used whilst maintaining freedom from distortion and modulation effects. Other facilities include automatic or manual attack/release, plus stereo interconnect. RMS comp/limiter: threshold -40dBV to +10dBV; attack 400dB/ms to 0.5dB/ms; release 2KdB/s to 5dB/s; ratio 2:1 to ∞ :1. Peak limiter: threshold 0 to +20dBV; output gain -20 to +20dB, +21dBV peak; gain reduction range 20dB. **SG-200:** dual channel signal gate.

THOMSON-CSF (USA)

Thomson-CSF Broadcasting Inc, 37 Brownhouse Road, Stamford, Connecticut 06902. Phone: (203) 327-7700.

Volumax Model 4101/4111 Limiter: limiter for monaural (Model 4101) and stereo (Model 4111) FM broadcasting. Attack time between 1 μ s and 3ms, depending on programme waveform and rise time; release time 200ms (low frequencies), 10ms (mid frequencies), 2ms (high frequencies), all field changeable; compression ratio 10:1/infinite; control range 15dB.

Volumax Model 4300 Limiter: AM broadcast limiter. Attack time between 1 μ s and 2ms, depending on programme waveform; release time 200ms; compression ratio 10:1/infinite; control range 15dB; threshold level selectable 100, 115 or 125% of negative peaks.

Audimax Model 4440A/4450A Compressor: compressor for mono (Model 4440A) or stereo (Model 4450A) broadcasting. Attack time 10-150ms, depending on programme; release time 0.9, 1.5, 3s, gated and adjustable; compression ratio 10:1; control \pm 12dB of gain; gating threshold levels: adjustable from -20dB to normal input.

TRACK AUDIO (USA)

Track Audio Inc, 33753 9th Avenue South, Federal Way, Washington 98003. Phone: (206) 838-4460.

LM-1R: rack mountable comp/limiter, illuminated VU meter switchable to read actual output level, or gain reduction. Connections by barrier strip; ratio variable 2:1 to infinity; attack time 200 μ s to 20ms; release time 100ms to 2s.

Discriminate Audio Processor II: 3-band compressor with each band having full separate controls, metering, compression in/out with separate output meter; attack 2 to 20ms; release 1 to 2s; ratio 2:1 to 30:1.

TRIDENT (UK)

Trident Audio Developments Ltd, PO Box 38, Studios Road, Shepperton, Middx WW17 0QD. Phone: 09328 60241. Telex: 8813982.

USA: Trident USA Inc, 652 Glenbrook Road, Stamford, Connecticut 06906. Phone: (203) 357-8337.

CB9146: compact comp/limiter occupying $\frac{3}{4}$ in of rack space, versatile operation, VU meter indication of gain reduction, XLR connectors. Ratio cont variable 1:1 to 20:1; attack time cont variable 20 μ s to 200ms; release time cont variable 25ms to 500ms; threshold internally set at -20dBm.

TWEED (UK)

Tweed Audio Electronics, Rosewood Industrial Estate, Kelso, Roxburghshire. Phone: 05732 2983. Telex: 727633.

CL603 Limiter Module: side-chain pre-emphasis option is available for FM broadcast applications. Two units can be supplied in a 19in rack for ganged operation. Attack time 20, 200 μ s and 2ms; release time 70ms to 2s, variable, or automatic self-adjusting 70ms/5s; threshold 0 to 12dB above reference level in 2dB steps; ratio 100:1.

CL604 Compressor-Limiter Module: two or more units may be linked. Attack time 5ms (CCITT method) but self-adjusting on programmes; release time 100ms to 3s variable, or automatic self-adjusting; threshold -20 to +10dBm in 5dB steps;

ratio 1.5, 2, 3, 4, 6 and 9:1, plus 'limit' (20:1). **CL605 noise gate:** attack time 50 μ s; release time equal hold and fade times 100ms to 2s; threshold -10dB to -5dB; depth: 10 to 30dB. Bypass switch provided with LED.

UREI (USA)

United Recording Electronics Industries, 8460 San Fernando Road, Sun Valley, Cal 91352. Phone: (213) 767-1000. Telex: 651389.

UK: FWO Bauch Ltd, 49 Theobald Road, Boreham Wood, Herts WD6 4RZ. Phone: 01-953 0091. Telex: 27502.

LA-4 RMS Compressor/Limiter: utilises an electro-optical attenuator for 'smooth, predictable performance coupled with ease of operation'. Because the unit's gain reduction circuitry is RMS-responding, it is not recommended for overmodulation protection of transmitters, disc or optical recorders, unless followed by a peak limiter, such as Model 1176LN.

Two units can be linked for stereo applications. Attack time 1-10ms for 63% correction, depending on waveform; release time 100ms to 1s for 63% return, depending on duration of limiting; compression ratio 2, 4, 8, 12 and 20:1, front-panel switched; threshold of limiting: -30 to +20dBm.

BL-40 Modulator: designed specifically for AM broadcasting, but with TV signal processing applications. A 'phase optimiser' circuit automatically maintains most favourable signal polarity, reversing phase whenever negative peaks exceed positive ones by a pre-set amount. Independent controls (plus meters) for RMS and peak limiting, and variable positive modulation up to 125%. Attack time RMS section 1 to 50ms for 63% correction, dependent on signal, peak section 5 μ s for 10dBm limiting; release time RMS section 50ms to 2s for 63% return, dependent on duration of compression, peak section 100ms.

1176LN Peak Limiter: utilises an FET as a voltage-variable resistor ahead of the first stage of amplification. Two units can be coupled for stereo applications. Attack time 20 to 800 μ s for 100% recovery; release time 50ms to 1.1s for 63% recovery; threshold level dependent on input and output levels and compression ratio setting.

1178 Dual Peak Limiter: two channel version of 1176LN.

VALLEY PEOPLE (USA)

Valley People Inc, 2820 Erica Place, Nashville, Tennessee 37204. Phone: (615) 385-4737. Telex: 558610.

UK: FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ. Phone: 01-953 0091. Telex: 27502.

Dyna-mite: multi-purpose processor capable of operating in 18 specific modes including limiting, expansion, de-essing, noise gating, ducking, keying and effects. Available as either mono or stereo models, plus mono version upgradable to stereo. Gain reduction range variable -60dB max to 0dB min; attack time 100 μ s/20dB peak detection, 20ms/20dB linear integration detection; release time variable 50ms to 5s/20dB; threshold variable -40dBV to +20dBV; output gain (Exp/Duck/Gate modes) variable \pm 15dB; output level (Limit/De-ess modes) variable -15 to +15dBV; limiting ratio ∞ :1; expansion ratio 1:2; gating ratio 1:20; ducking ratio 1:20.

Gain Brain II: compressor/limiter/ducker with LED readout of attenuation. Unit has provision for stereo intercoupling, side chain operation for frequency dependent gain control, and for remote VCA and/or remote GR metering. Gain reduction range 0 to 48dB; attack time 0.2 to 200ms; release time 0.05 to 5s, lin/log switchable; limiting ratio 1.3:1 to ∞ , ducker 1: -50; threshold +20 to -40dBV with in/out/external mode switch.

Kepex II: keyable programme expander for noise control applications. Gain reduction range variable 0dB to 80dB; threshold variable -40dBV to +20dBV; expansion ratio variable 1:1.1 to 1:100; attack time for 20dB gain increase variable from 20 μ s to 20ms; release time for 20dB gain decrease variable 0.04 to 10s; release shape switchable lin/log. Gain reduction indicated 0 to 50dB on 13 element LED display. Provision for stereo intercoupling. Input mode switchable in/out/key. ■

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Tel: 2-520-0827

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Tel: 416-495-0688

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Tel: 35-17722

India Kapco Sound Studio, New Delhi.
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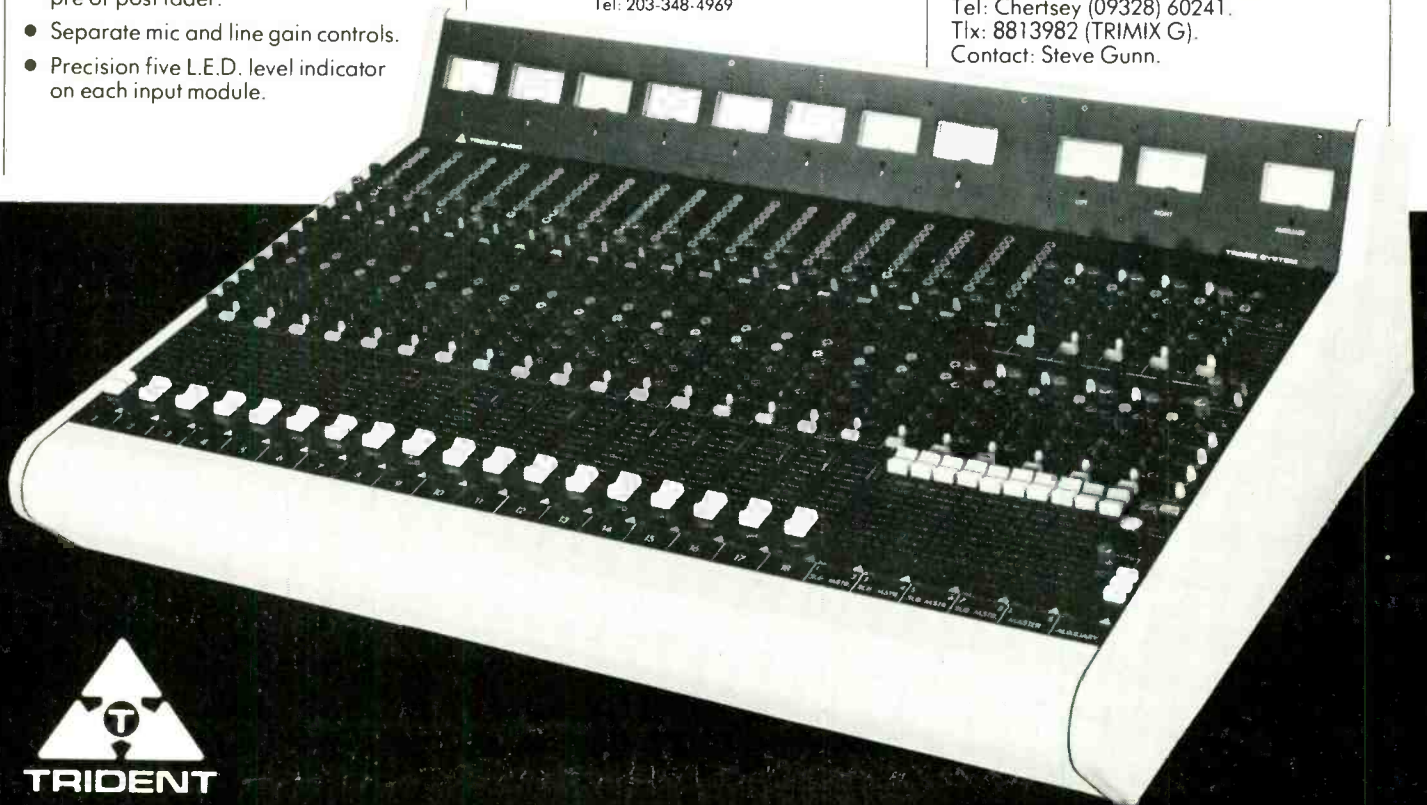
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TRIDENT

AES 70th Convention report

Noel Bell

Last November's New York AES Convention once again witnessed a plethora of technical papers and workshops. As usual we report here on the most interesting papers and workshops; however, in keeping with our new editorial format, details of new products shown at the accompanying exhibition will appear in our New Products section in this and future issues.

NO less than 11 technical workshop sessions were scheduled at this Convention covering the full gamut of professional audio applications. By far the most interesting was a two part session devoted to mixing consoles, with respected representatives from the console manufacturing industry dealing with such matters as console design philosophy and the topic of console automation. Subjects discussed included input module design, recent advances in VCAs, equaliser design, metering options, measurement techniques, and the practical implementation of console automation. To summarise two rather lengthy sessions, the basic philosophy of all participants was to provide consoles which feature sound ergonomics, flexibility of application, reliability, high technical performance, and which are cost effective. Naturally different manufacturers approach these goals from different viewpoints; however, it was interesting to note that the workshop panel showed a somewhat unexpected unanimity in their general approach and design philosophies. Such items as transformerless inputs, input filtering, the choice of op-amps, earthing and the problems of RF evoking similar responses from all the participants. The question of digital audio of course reared its head and while Jon Brown of Neve indicated his company's intentions in this area (ie the *DSP System*) the consensus view of the panel was that digitally controlled analogue

consoles would be the next progression in console design—fully digital consoles not being cost effective alternatives. As an aside to this debate, Paul Buff of Valley People claimed that using the latest VCAs, because the dB/V control is very tight, a VCA controlled analogue 24-track console's S/N ratio is approximately 81dB while the S/N ratio of a digital tape is around 70dB, ie an 11dB difference favouring the VCA controlled console.

Moving on to the technical papers, William Allen of dbx gave a most interesting paper on the many applications of VCAs (AES Preprint No 1846). This paper, which includes a brief introduction to VCAs, describes the use of VCAs as a building block in a number of designs including VCOs, VCFs, tracking filters, spectrum analysers and distortion analysers. The paper also goes on to discuss methods of remote gain control and VCA applications in consoles, including digital control techniques, with a comparison of designs using VCAs and faders.

Loudspeakers

The topic of loudspeaker design and performance stimulated a number of interesting papers. Roy Allison of Allison Acoustics and Edgar Villchur of the Foundation for Hearing Aid Research jointly presented a paper (AES Preprint No 1844) which discussed the audibility of Doppler distortion in loudspeakers. This paper raised the question of Doppler distortion in music reproduction and theoretically investigates, in conjunction with the results from double-blind listening tests, its audibility in simple direct radiators. The reported results of the author's investigations is that Doppler distortion for any practical cone velocity is inaudible, experimental listening tests confirming this assertion. In a similar vein, Stanley Lipshitz and John Vanderkooy presented a paper (AES Preprint No 1857) discussing whether phase linearisation of loudspeaker crossover networks

is possible by time offset and equalisation. While conventional crossover networks result in systems whose acoustic transfer function has an all-pass phase characteristic, many systems introduce or eliminate time delays between the drivers in order to 'acoustically align' the system. However, the authors' investigations have led them to conclude that no choice of time offset between system drivers using standard all-pass crossover networks can render the system linear-phase. The best that can be achieved is a flat all-pass system with a more complicated minimum-phase characteristic utilising delay equalisation to achieve good transient behaviour.

Loudspeaker design produced three interesting papers. James Allen of Allen Engineering presented a paper (AES Preprint No 1826) introducing the concept of Helium Reflex loudspeakers. These loudspeakers use helium gas inside the enclosure instead of air, as a means of increasing the apparent volume of an enclosure. This substitution takes advantage of the thermodynamic Joule-Thompson effect whereby a gas with a negative Joule-Thompson coefficient heats upon expansion and cools on compression. The result is a helium-filled enclosure which under compression counterbalances increases in pressure with temperature decreases which in turn lower the pressure, ie there is no net increase of pressure. This principle accordingly allows enclosure volumes to be substantially reduced or alternatively permits a considerable improvement in performance at a given volume. Another interesting paper was presented by engineers from Matsushita (AES Preprint No 1843) describing a newly-developed bass driver unit which uses an air-coupled diaphragm. This unit has a bandpass of 50 to 150Hz and a sensitivity in excess of 100dB when mounted in a 2cu ft enclosure, and uses an air chamber installed between the voice coil and diaphragm. This design has high Q and narrow bandpass characteristics caused by resonance due to the mass of the diaphragm and the compliance of the

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AES 70th Convention report

air chamber. Finally, engineers from Sansui described a newly-developed diaphragm (AES Preprint No 1835) which takes the form of a glass-fibre reinforced composite graphite polyimide diaphragm. This diaphragm has a high Young's modulus giving an elasticity some 10 times higher than that of paper-pulp diaphragms, but with approximately the same inner loss. An advantage of the new diaphragm is that it is not susceptible to humidity or to temperature extremes, it can be easily formed, and is able to withstand high power inputs.

Acoustic design prompted two papers of interest. The first from Finnish Broadcasting (AES Preprint No 1817) discussed the use of acoustic scale models in the design of sound control rooms. While such techniques have often been used for concert hall design it is less usual for such techniques to be used for control rooms. However, this paper deals with the general principles of acoustic scale modelling including such practical aspects as how to find the correct type of model absorbers and loudspeakers. The paper also gives practical results of a 1:10 model of a music control room. The second paper from Milton Putnam of the United Recording Corporation (AES Preprint No 1858) deals with the design and measured performance of a loudspeaker and control room in which the monitor loudspeaker is a horn coupled to the room. In such a system the console and room become a manifold section of the horn, with an increase in acoustical efficiency. Other advantages claimed include an extended low frequency limit and improved response in the amplitude and time domain, plus nominal control over the ratio of direct to indirect sound while maintaining excellent diffusion, hence eliminating critical listening positions.

Binaural normalisation

Binaural recording using a dummy head has long been considered to be one of the best methods of capturing an original soundfield (direction, distance, ambience, etc) in stereo. However, its incompatibility with conventional stereo reproduction via loudspeakers has always proved a stumbling block to its adoption as a standard recording method. In an effort to overcome this problem research teams at Matsushita and the Acoustic Research Laboratory have been endeavouring to produce a normalisation method. After several years' investigation into the problems of dummy head recording the teams have now produced a proposal for normalisation for binaural recording (AES Preprint No 1811). This paper proposes a normalisation based on transfer-function equalisation of the dummy head itself which when used during recording preserves the sound quality and distance and direction when played back by conventional stereo loudspeakers. The precept of the proposal being that equalisation of the dummy head transforms the signals such that they become equal to those obtained by intensity recording. Full details of the theory and proposals are given in the paper.

Turning to synthesisers, Dave Smith and Chet Wood of Sequential Circuits, presented a paper (AES Preprint No 1845) proposing a standard electronic music synthesiser interface. The authors made their proposal because the increasing diversity of electronic music synthesisers and related accessories (sequencers, remote key-

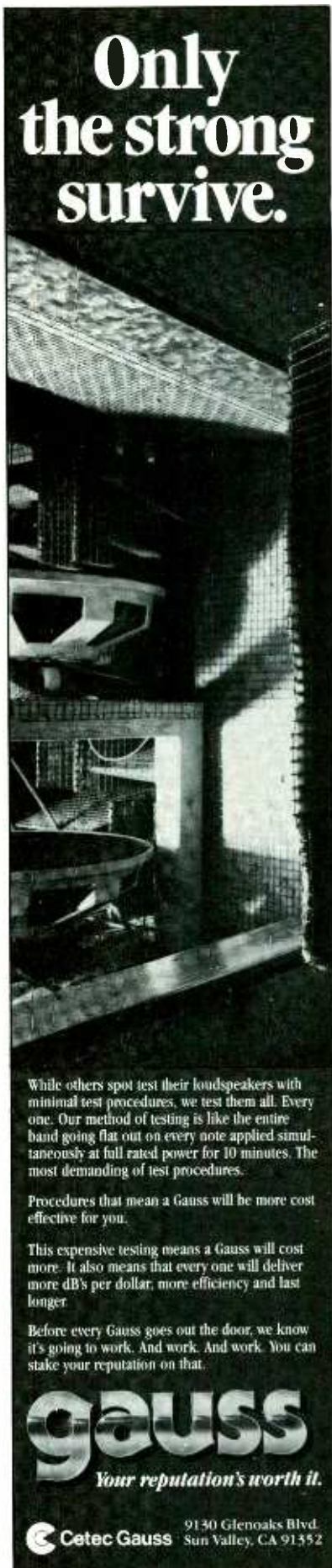
boards, etc) points to the need for an industry standard interface. Such a standard being beneficial to both manufacturers and users. In their preliminary proposal, the authors propose an interface which is serial, operating at 19,200 baud, with a start bit, 8 data bits, an odd parity bit, and a stop bit, ie 11 bits with a time of 573µs per byte. Electrically the interface would operate at nominal TTL levels with separate data transmit and data receive, open collector drivers, and with pull-ups on receivers. Interconnection would be via standard ¼in phone jacks using ordinary shielded cable, and with separate cables for transmit and receive. The interface is designed to be expandable and includes status bytes for bulk loading and saving of program status.

A further paper from Dave Smith of Sequential Circuits, presented in conjunction with Steve Salani (AES Preprint No 1820) described a programmable modular signal processing system with microprocessor control allowing all control settings to be stored and recalled from a non-volatile memory. The system's interface is capable of controlling analogue modules with each module being able to accommodate up to eight switches and eight potentiometers.

Another paper concerning microprocessor control was presented by Oscar Juan Bonello of Solidyne (AES Preprint No 1834). This paper discusses and analyses a digitally controlled tape-transport system with constant tape tension, developed for a professional stereo recorder. The tape-transport system is electronically controlled with few mechanical moving parts and operates with five optical sensors, without relays. Accordingly, the system uses less moving parts than a conventional transport and because all the sensors are of a digital type the system avoids the use of tachometric generators and other analogic devices. In addition to these features a microprocessor-based system controls all the transport functions, including multipoint search, with nine memories, through a calculator style keyboard. Full details of the control system including equations of the tape movement and the theoretical optimisation of the fast search-to-cue algorithm are given in the paper.

Continuing with digital matters, a research team from Sony presented a paper on high-speed digital processing based on microprogramming (AES Preprint No 1841). This paper describes a microprogrammed high-speed signal processor capable of simulating complicated reverb algorithms, or other algorithms such as a voice synthesiser, a linear predictive vocoder, a pitch converter, etc. The processor uses bit-slice arithmetic-logic units together with high-speed parallel multipliers to enable the processing programs, such as digital filtering and reverb simulations which require many additions and/or multiplication operations to be executed speedily and efficiently. The paper also describes the micro instructions and the microprogramming development system for the processor.

Another digital paper from Sony, by Toshi Doi (AES Preprint No 1856), describes several new channel codes for digital recording. After briefly discussing the fundamental parameters required for channel coding and giving an overview of conventional channel codes, Dr Doi then gives details of two new codes. These are the HDM (High Density Modulation) Series developed for Sony's professional stationary head recorder, and the EFM (Eight to Fourteen Modulation) code developed for the Compact Disc format. Both these codes feature improved packing density and reliability over conventional



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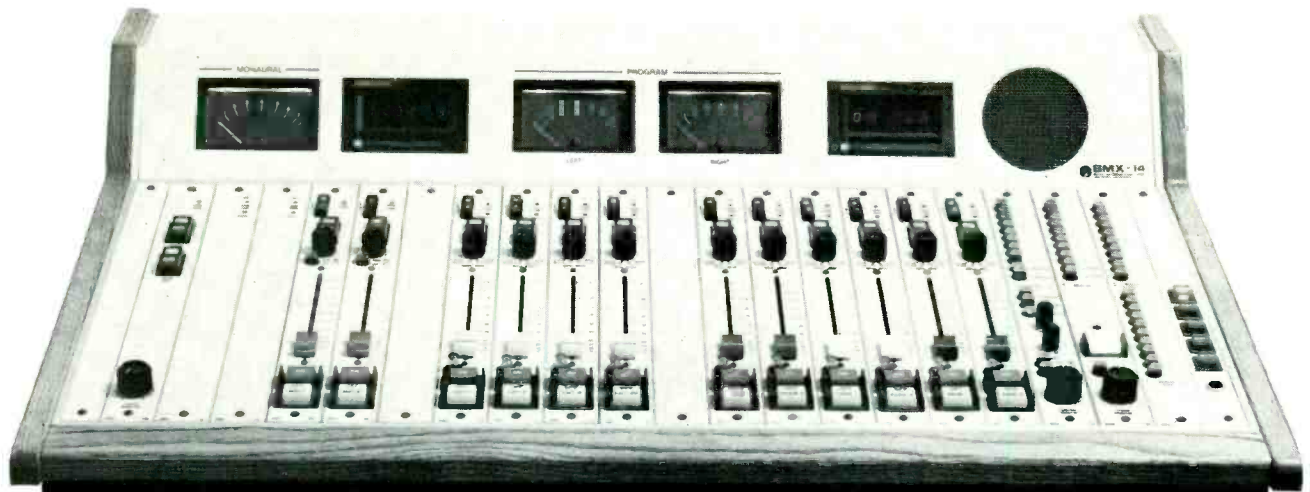
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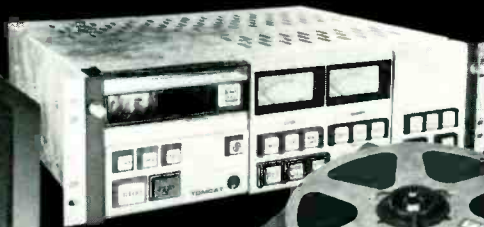
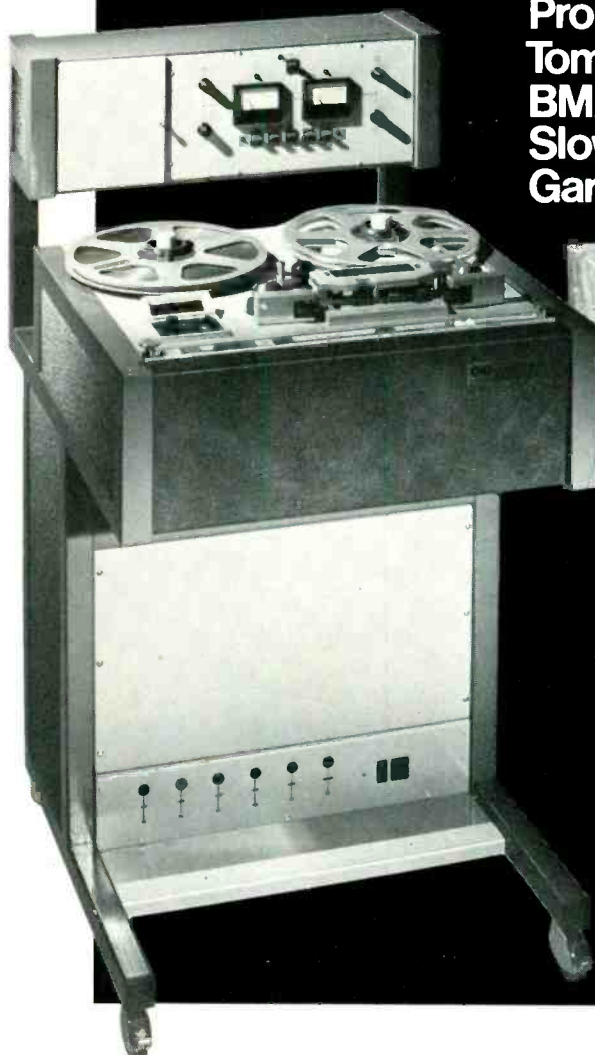
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Miller type codes, and full details of the modulation schemes are given in the paper.

Further papers on modulation codes were also presented by Mitsubishi and Pioneer. The first (AES Preprint No 1839), details an improved modulation code designed to increase packing density, and describes a coding rule and decoding method using a run-length-limited code. Characteristics of the code include simple hardware, easy sub-data synchronisation, and less susceptibility to the influence of raw errors. The second paper (AES Preprint No 1827), describes a similar run-length-limited code developed for high density recording on digital audio discs, the code under discussion being dissimilar to the Sony/Philips Compact Disc EFM code mentioned above.

Philips prototype

An interesting paper from the Philips Research Laboratory (AES Preprint No 1832) described a prototype multitrack digital audio recorder for consumer applications. The recorder has two audio channels which are recorded via a 16-track ferrite head stack, coding is 14 bit linear, sampling rate 44.1kHz, tape speed 9½cm/s (3¾in/s), and tape width ¼in. The channel code (a DC free block code) is matched to the characteristics of the audio signal being recorded, and error correction and concealment techniques are applied to compensate for random and burst errors. Whilst only a description of a prototype machine, the paper provides an interesting pointer to the future—although why 14-bit rather than 16-bit quantisation is preferred, considering the similar debate concerning digital audio use of videocassette machines, seems rather strange to me.

Another digital paper, this time from Samuel Wilensky of the Hybrid Systems Corporation (AES Preprint No 1805), gave details of a decoded D/A converter for audio purposes. This paper presented a D/A conversion scheme which utilises a decoded or segmented approach. The design technique employed giving improved differential linearity and stability. Results from a number of converters employing this technique are presented in the paper and the range of converters covered ranges from 18-bit hybrids to a 14-bit monolithic converter.

Yet another digital paper, from the Acoustic Research Laboratory, Japan (AES Preprint No 1809), covered the design of digital equalisation and mixing circuitry. In particular dealing with the circuit design of a digital filter used to change the frequency response in the digital domain by a realtime calculation of the input signal data, the paper gives details of how to use digital devices to control frequency response in a digital audio mixer. Another paper from the same research team (AES Preprint No 1810) described the development of a 2-channel digital audio reverb. The reverb unit under discussion giving three types of reverberation, with the initial delay time and reverb time of three frequency bands being independently controllable. This digital reverb unit uses similar digital filters to those described in the previous paper.

Finally, on digital matters, a research team from Sony presented a paper concerning the direct transmission of digital audio programmes by satellite (AES Preprint No 1855). This paper gives details of a prototype system where the transmission of 12 stereo (or 24 mono) digital audio channels is accomplished using the same

bandwidth as a single video channel. The system which includes error correction, has a 32kHz sampling frequency and 28-bit stereo (14-bit mono) quantisation, and uses time division multiplexing with 4-phase PSK encoding for transmission. Transmission being over the 12GHz band.

Returning to the analogue world, Douglas Preis presented a paper giving an overview of the effects of phase distortion and phase equalisation on analogue recording (AES Preprint No 1849). This paper concisely and authoritatively presents definitions and measures of phase distortion with many examples. As a complete view of the problems and remedies including methods of phase equalisation and phase equaliser design, the paper is probably unrivalled. However, the author does not confine himself to these matters alone, but also presents a new time-frequency display (time-domain performance display), and additionally considers a number of prospective applications of phase equalisation designed to improve the performance of digital audio systems.

Masatsugu Kitamura of the Victor Company of Japan presented a paper (AES Preprint No 1816), describing a simplified method for level-variance analysis of magnetic tapes. This method is based upon an analysis of errors in level-variation estimation in connection with measuring-time length, and the method is applied to measurements of variances in levels of magnetic tapes. The technique termed 'band limited variance analysis' allows rapid automatic calibration of a tape recorder with minimal calibration errors, and allows the attainment of a flat frequency response with optimum bias adjustment and MOL balance. Although the technique is likely to be of most use for calibrating cassette recorders, the technique is also useful for optimising the design and performance of tape machines.

Two further papers concerning analogue recording emanated from Ray Dolby of Dolby Laboratories and Jorgen Selmer Jensen of Bang & Olufsen. In the first paper (AES Preprint No 1850), Ray Dolby gives comprehensive details of the Dolby C-type noise reduction system which gives a maximum 20dB noise reduction. The second paper (AES Preprint No 1852), describes a method of recording with feedback-controlled effective bias. This method which operates by dynamically reducing the supersonic bias present in an audio signal by the same amount as the added effective bias of the audio signal, results in a constant effective bias. Claimed advantages of the method include improved MOL and improved dynamic frequency response.

Finally, Tom Owen of the Rodgers and Hammerstein Archives of Recorded Sound and John Fesler of ITC, jointly presented a paper (AES Preprint No 1854), discussing the electrical reproduction of acoustically recorded cylinders and discs. This paper is a mine of information about the recording techniques and recording technology used in making early cylinder recordings. In addition the paper gives details of the methods used by Tom Owen to transfer to tape early Edison recordings made by Lionel Mapleson at the Metropolitan Opera, New York in 1901, 1902 and 1903. As a further bonus, John Fesler gives details of a replica acoustical cylinder recording session held at the Illinois Wesleyan University in late 1980 and early 1981. The experimental session giving several insights into the techniques required to capture live acoustical recordings. This authoritative paper is essential reading for anyone with an interest in early recorded sound. ■



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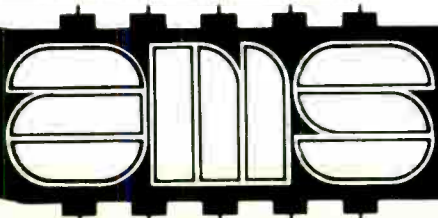
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Back to the land

Pippa Lewis

Andy at a Beacon Radio desk

THIS is the second part of a series of interviews with Andy Gemmell-Smith, former chief engineer of Radio 210, Reading's independent local radio station, and at present chief engineer of Essex Radio, a new ILR station. This month he talks about his first experiences in independent local radio.

I applied for a job at Beacon Radio in Wolverhampton just before Easter 1976, and was staying with an old friend in Manchester when a letter came from Beacon to my home in Kent, asking me to ring them to arrange an interview. I rang the chief engineer, Bruce Warburton, and explained that I was calling from Manchester and he said "Oh, really, I have to come to Manchester at the weekend", and we arranged to meet in a pub situated under Piccadilly Radio in Manchester, where Bruce had worked previously. A couple of days later I met the managing director of the station in Wolverhampton and after being given the 'Cook's Tour' of the station was formally offered the job. I was surprised how friendly a bunch of people they all were—after

being offered the job I was immediately escorted to the pub over the road by the chief engineer and the rest of the engineers to celebrate my appointment! Like many other people moving to a strange area I was faced with the problem of where to live, so for the first three months I lived in the YWCA. Even so, it didn't seem too bad a place to live! (The establishment actually caters for men as well!) Although the station was on air and had been for about a month when I joined, it was still not completely finished; the builders were still building the upper floor of the engineering workshop. Some of the original wiring had obviously been done in a bit of a hurry, and one of our first jobs was to re-do some of it. The original equipment at the station was supplied by Alice and even in the five years that have passed since then it is amazing how things have changed, especially things like turntables. The original turntables were American Sparta and owed their quick start-up time to nothing more than a massive motor and conventional idler wheel rim-drive system. Many of the radio



stations that went on air at that time were equipped with turntables similar to this but I think, one by one, most of them have changed over now to high start-torque direct-drive turntables such as the Technics SP10, which seem to need very much less maintenance and appear to pass the IBA Technical Code of Practice (which all independent radio stations are governed by) with very little difficulty. I think, on the other hand, in one way Beacon was a little ahead of its time as we had five single-slot cartridge players in each of the control rooms, and this seems to have become an increasing trend recently. Unlike cartridge machines of the 3-stack variety it allows the use of a fast forward system to ensure rapid recueing of cartridges. Obviously, a

3-stack cartridge machine cannot, by definition, offer this facility, as the motor spindle is shared by all three slots. If the motor speeds up to put one of the cartridges into fast forward, any cartridge playing in another slot would be spinning round at three times its normal speed!

The original microphones at Beacon had been Calrec capacitor mics but these suffered from popping when used on close speech, even with a pop shield, and had to be taken out in preference to AKG D202 mics which I believe the station still has in use. The tape machines on the station were modified Revox A700s for playback in the main on-air control rooms and editing booths but B62 Studers were fitted in the commercial production control room where the majority of serious recording would also be done. I could never quite understand why Studer stopped making the B62 as, in my opinion, it still ranks as the best tape machine for radio station use. I can remember only about two or three occasions during the four years that I was at Beacon Radio when the B62s became faulty and these were usually silly things anyway and normally quite easily fixed. About the only thing we had to do in our maintenance schedule to the B62s was check the azimuth, which constant editing against the play head would affect. Apart from that they used to stay lined up like no other machine I know. The Revox A700s, on the other hand, whilst not a disaster, were not quite in the same league. We quite often had the odd fault particularly with the logic circuitry, and they certainly benefited from being lined up regularly. The mixing consoles were of an early Alice design and seemed to work fairly well even though their standard of construction was not quite as high as, for example, Neve at that time. I feel also that the lack of script space

"There was a time when we decided to cover two OBs on one afternoon... we made it with only half a minute to spare."



on those early Alice desks was a big disadvantage. The presenter ended up putting his traffic reports or weather reports over the controls he was about to operate. I don't think one could levy this criticism against the new generation of Alice desks which seem better in both layout and construction.

I think Beacon is fairly well-equipped in terms of the number of control rooms, studios and tape editing booths—there are two on-air control rooms, one of which looks into a news reading booth and the other which looks into a large talk studio. In addition to this there are two news editing/dubbing booths annexed to the studio block and upstairs a commercial production/music studio and control room. One of the economies that the station originally made was to buy a small non-modular 8-into-2 Alice mixer as the commercial production desk and it was quite quickly decided that the desk lacked the facilities that were thought to be needed to take advantage of the large studio which was capable of taking a good number of musicians. The station's management at that time were keen to record jingle-style commercials for clients, and so it was decided to change the desk for one which would meet both the needs of the commercial producer and that of music recording. After contacting the leading manufacturers of such consoles we came to the conclusion that in order to get a desk that was as customised as we wanted at a price we could afford we would have to build it ourselves, so it became an engineering department project to design the new desk. The desk contained a 20 mic/line music mixer and a two mic, eight stereo line channel, commercial production desk within the same frame and could either be used for direct 2-track recording whilst a 16-track master was also taken or vice versa, in which case the 2-track mix might have been a live music broadcast but with the chance of remixing the 16-track for a later broadcast.

A regular part of the programming of the station, particularly in the summer, was outside broadcasts; this generally meant taking out the outside broadcast caravan which incorporated a rolling stage with a sales area for souvenirs for the station. One side of the caravan would fold out to become the stage on which the portable studio equipment—consisting of Technics *SP10* turntables together with a station-built mixer and a couple of cart machines—would be set up. The audio output would then be relayed back to the station either by means of temporary post office music lines or by using a 10W radio link transmitter into a small pump-up mast fitted to the *Landrover* which would tow the caravan to the OB. From there the signal would be picked up at our receiver site situated on a very tall block of flats in the centre of

our coverage area, and from there brought back to the station on permanent music lines into the on-air desk, where things like the news, phone calls, and commercials could be mixed in with the outside broadcast material to make up the complete programme that went to air.

One of the difficult things to satisfy on an outside broadcast is the need to keep the live audience entertained with suitable competitions, which are mostly visual, and as such are of no interest to the listener at home. The mixing desk on the outside broadcast unit was therefore designed so that any source or number of sources could be played to the crowd whilst a record or the commercial breaks might be playing for the listeners at home—particularly useful if somebody asks the presenter to make an announcement over the PA about a lost child or a car blocking up the car park. As well as this type of outside broadcast there are also less-complicated sports commentating and regular reports from people like the AA and the police and the financial reports originated from the local banks—the list goes on. Very quickly the need for some sort of multiple input channel for outside broadcast sources becomes apparent. One of the problems with the early Alice desk at Beacon was the lack of such a channel and this required the use of the jackfield to route outside broadcast sources to a spare fader. Most of the more recently installed ILR stations incorporate at least one of these outside source selector channels.

One of the funniest memories I have of outside broadcasts was the very first one I was involved with at Beacon, when the presenter asked me if I would segue the next record in. At the end of the record he still hadn't returned so I segued another one in; I was getting a bit worried at this stage and during the record popped my head out of the marquee to see what had happened to him. There he was, at the back of the ice-cream queue, completely unconcerned about the matter! There was also a time when we decided to cover two outside broadcasts with our caravan on the same afternoon. We had an hour to derig one outside broadcast, move the caravan to its new site several miles away and rig up for the next one. We were still connecting up the post office lines to the caravan during the news that immediately preceded our broadcast going on air. We made it with only half a minute to spare!

On another occasion, during the time of an electricity workers' dispute we suffered a power cut and the only thing left at this showground with power was a hamburger stand which had its own little generator so I thought, 'Great Idea—I can hook up to his power' . . . only to find that his generator was 110V! By some miracle I found a transformer in the back of my car, the primary of which was

2×110V windings connected in series. I connected this up as an auto transformer and much to my surprise the transformer rated at only 100W took the 500W load that I put on the other side of it without catching fire—just! Not unsimilar was the outside broadcast from a football ground where the outside broadcast caravan was powered from a lead plugged into one of the rooms underneath one of the stands. When I plugged in I decided to tape the plug and socket together with gaffer tape; I also put up a notice which said "Beacon Radio Outside Broadcast Unit—DO NOT SWITCH OFF OR REMOVE". I needn't have bothered—halfway through the broadcast everything

switching the channel to 'cue'. This led to presenters opening the fader about halfway when they were cueing records and adjusting the channel gain with the fader in this position to get the right level on the cue meter; however, when they switched to air the fader would be fully opened, and there would be no shortage of level! As well as this it was quite easy to cue a record on air by mistake but I suppose every desk will have something that somebody doesn't like. The turntables were again Technics *SP10*s and the tape machines in the station were mostly Ferrograph *Studio 8*s of a few years' vintage, and a couple of fairly new *B67*s. The on-air presenter's mics were Neumann *U47*s which were

Control room at Radio 210



went dead! My first reaction was to run into the room to check the power source, only to find a half-shaven gentleman with his electric razor plugged into our power point and our lead loose on the floor. To add insult to injury he was reluctant to let me plug back in until he had finished shaving!

The second ILR station I worked for was Radio 210 in Reading where I moved from Beacon to become chief engineer. The station's equipment had been a Neve installation; there were two main on-air control rooms and two associated talk studios. In terms of reliability and performance the Neve desks were excellent though in many ways the desk seemed to be a little bit over-difficult to operate. Many of the controls that you needed most were on your lefthand side and the ones that you needed least were on your right—fine if you are left-handed! But the desk did have a very nice script area and two somewhat limited outside broadcast source selector modules. I think my pet hate of the Neve desk was the postfade-listen system which needed the operator to open the fader before

excellent, and a variety of other microphones such as AKG *C45*s and Beyer *201*s filled up the other requirements like interview and news readers' microphones.

The actual day-to-day life of the two stations is, not surprisingly, similar but in terms of my job, seemed quite different. At Beacon, where I was a rank-and-file engineer, most of my day was taken up with pure engineering matters, but as a chief engineer I found myself to some extent an engineer, to some extent a diplomat and the station's engineering public relations officer! For example, if a listener phones up the station to complain about a funny whistle that interferes with his reception at night, the listener will normally blame it on the chief engineer. ♪

Andy's stay with Radio 210 was comparatively short, lasting less than a year, but this was for a very good reason—which he talks about in our next interview—the opportunity to set up a new independent local radio station, Essex Radio.

To be continued



Furman LC2

MANUFACTURER'S SPECIFICATION

Input: standard 10k Ω unbalanced, 1/4 in phone jacks at main and side chain inputs. Optional 20k Ω balanced at main input, Cannon-style connector as well as phone jack.

Maximum input level: before clipping for unbalanced input, unlimited, depends on input level control setting; for balanced input 8.7V RMS (+21dBm).

Output: standard 270 Ω output impedance unbalanced, 1/4 in phone jacks at main and side chain outputs; optional 600 Ω balanced at main output, Cannon-style connector as well as phone jack.

Maximum output level: 8.7V RMS (+21dBm) unbalanced, 17.4V RMS (+27dBm) balanced.

Minimum terminating impedance: 2.5k Ω .

Attack: 400ms to 25ms.

Release: 200ms to 5s.

Compression ratio: 2:1 to 50:1.

Frequency response: ± 0.5 dB, 20Hz to 20kHz.

S/N ratio: 92dB with 5dB of gain reduction (noise measurement unweighted DC to 80kHz).

Distortion: total harmonic distortion 0.04% with no gain reduction, 0.07% with 5dB of gain reduction.

Construction: steel chassis, brushed and black anodised 1/2 in aluminium front panel, glass epoxy PCB.

Dimensions: (whd) 19 x 1 1/4 x 8 in.

Weight: 5lb.

Power requirements: 5W, 115VAC, 60Hz or 230VAC 50Hz to 60Hz versions.

Manufacturer: Furman Sound Inc, 616 Canal Street, San Rafael, Cal 94901, USA.

UK: Atlantex Music Ltd, 34 Bancroft, Hitchin, Herts SG5 1LA.

standard 19in rack, occupying a single rack unit of height.

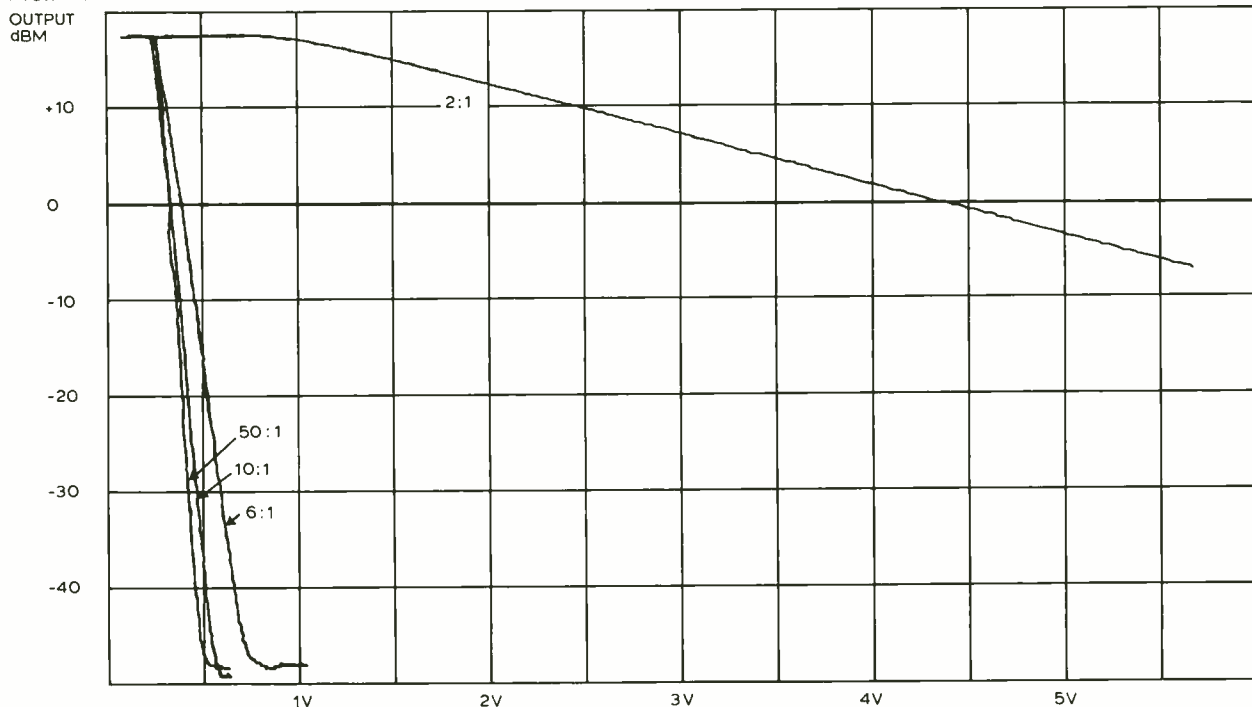
Within the unit, with the exception of the connectors and the power transformer, all components are mounted on to a single small printed circuit located behind the front panel and supporting the front panel controls. Components on the PCB are clearly identified, with a circuit diagram being provided in the instruction manual which also includes servicing information and general operating instructions.

In the review sample which did not have balanced input and output connections (these are usually XLR connectors) all signal connectors were single-pole 1/4 in jack sockets on the rear panel, the power input being a fixed lead connecting to the mains transformer within the

86 ▶

THE Furman Sound *Model LC-2* is a single-channel compressor/limiter which can be connected to other units to form stereo or multi-channel compressor/limiters. The unit, contained in a steel case, is intended for mounting into a

FIG.1 FURMAN LC2 SIDE CHAIN INPUT (RMS)



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unit at the rear. As the mains tags are at the bottom of the transformer and there is no insulation on the chassis below the tags, foreign bodies in the unit could short the chassis to the mains.

Reverting to the signal connections these not only include the audio input and output, but also side chain input and output and the stereo link connection.

All the controls on the black anodised front panel were clearly identified, with potentiometers at the extremes of the panel controlling the input and output levels. Next to the input level control a small red LED indicator is used to indicate input overload with an LED power indicator by the output level control.

Three interlocked pushbuttons select the function of the unit between compress, de-ess and side chain operation. If the latter function is selected without the side chain in use it acts as a bypass function.

Attack and release times are potentiometer controlled with rough calibrations being provided at attack times of 0.4ms, 5ms, 10ms and 25ms and at release times of 0.2s, 0.5s, 1s, 2.5s and 5s.

The final control is the compression ratio potentiometer calibrated at ratios of 50:1, 10:1, 6:1 and 2:1. Adjacent to this control are five gain reduction LED indicators being illuminated at gain reductions of 4dB, 8dB, 12dB, 16dB and 20dB.

Overall this is a tidy and well made unit with clear control identifications and a good standard of mechanical finish.

Inputs and outputs

At the audio input the signal feeds directly to the input level control with the input impedance being effectively constant at 9.4k Ω and the minimum input signal for input overload being 0.36V (-6.7dBm).

The input overload LED indicator was found to be adequately rapid in action but it did not have any hold and was illuminated just at the onset of input stage clipping.

On the audio output end no overload indication was provided and in some circumstances the output could be driven into clipping without any indication of overload conditions which occurred at an output level of 10V or +18.5dBm loaded into 600 Ω , the output impedance being 273 Ω . At maximum input and output gain the threshold of compression occurred at about 12mV input corresponding to 1.4V output or a gain of 43.5dB.

The side chain input was found to have an impedance of 10.9k Ω with the input voltage/compression characteristic being as shown in Fig 1 for compression ratios of 50:1, 10:1, 6:1 and 2:1. The side chain output follows the same characteristic with the output impedance being 40 Ω .

At the stereo link output 3VDC corresponded to 20dB compression with the input/output impedance being about 2k Ω .

Frequency response

Checking the frequency response without compression and at various compression conditions showed it to be within 0.5dB from 2Hz to 20kHz as shown in Fig 2. In the de-ess mode the degree of compression becomes intentionally frequency sensitive by the insertion of a highpass filter in the side chain. The result of this is shown in Fig 2 for an indicated 16dB ultimate compression, it being seen

FIG.2 FURMAN LC2 FREQUENCY RESPONSE

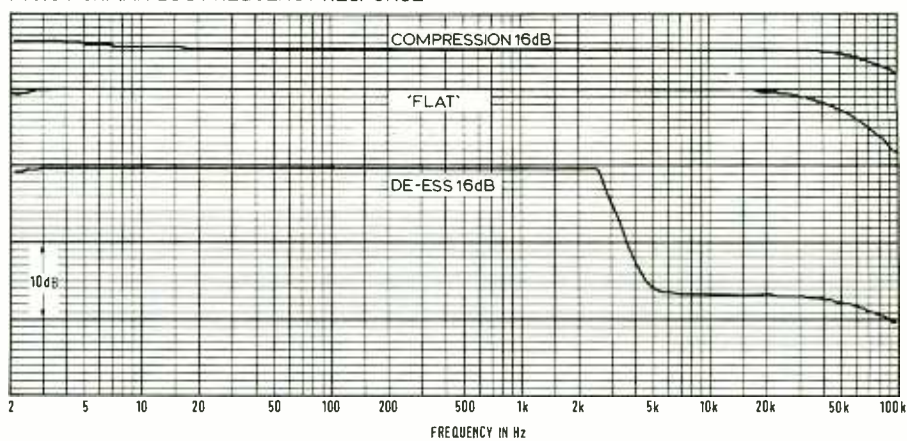


FIG.3 FURMAN LC2 INPUT/OUTPUT RELATIONSHIP

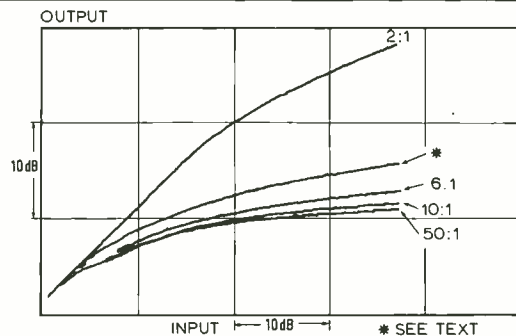


FIG.4 FURMAN LC2 RELEASE 5s

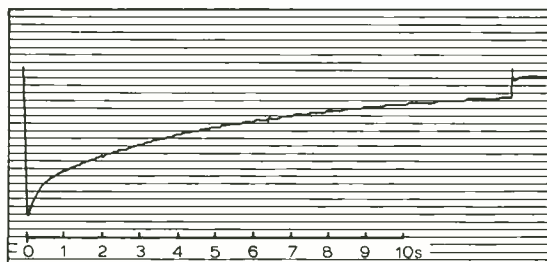


TABLE 1

Nominal time	Actual time
0.2s	0.2s
0.5s	2.5s
1.0s	6.0s
2.5s	6.0s
5.0s	6.5s

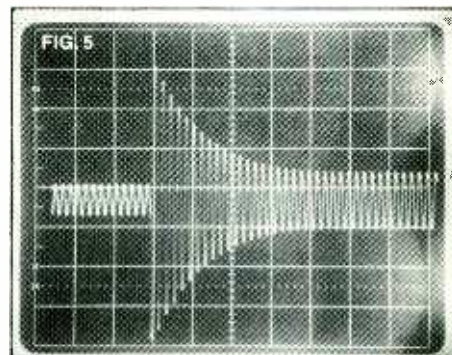
that the compression characteristic changes rapidly above 3kHz properly compressing sibilants.

Compression characteristics

The input/output relationship for various compression ratio settings is shown in Fig 3 which shows that the actual compression ratios are substantially correct but that the control is rather cramped around the higher compression ratios. 2:1 ratio is with the control fully anticlockwise with the curve identified with an asterisk being at 9 o'clock.

The release times were investigated using tone bursts giving 20dB compression and the times for recovery to within 3dB gain are shown in Table 1.

Clearly under these conditions, whilst the



overall range of the control is good the control law is very poor, the characteristics of the 5s setting being shown in Fig 4.

Similar criticisms apply to the attack time control, the maximum speed of which is shown in Fig 5 for a 10kHz sine wave giving 16dB compression, the horizontal scale being 0.5ms/

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division for the 0.4ms attack time setting. Attack time settings of 10ms and 25ms gave identical results with a time to full compression of 40ms.

The gain reduction LED display was found to be fast in operation and to be accurate to within 1dB which is quite adequate.

Noise

Although there was little evidence of noise breathing effects at any attack/release time settings, during test the noise performance of the overall unit was far from good. At maximum output gain, noise with respect to the threshold of limiting (+6dBm output) is given in Table 2.

At minimum output gain the noise in the output was around the manufacturer's specified 92dB, but in practical use nothing like this figure could be obtained.

Distortion

The second and third harmonic distortion without compression in action is shown in Fig 6 for +10dBm output and maximum gain, the distortion products falling substantially at lower output levels such that at mid frequencies the distortion had fallen by 20dB at 0dBm output.

With compression in action the harmonic distortion fell to typical levels as shown in Fig 7 subject of course to suitable attack and release time settings—this distortion performance being good and little affected by the operational compression ratio or amount of compression.

Similarly the intermodulation distortion of the

TABLE 2

22Hz to 22kHz RMS	-62dB
A-weighted RMS	-64dB
CCIR-weighted RMS ref 1kHz	-57dB
CCIR-weighted quasi-peak ref 1kHz	-53dB
CCIR/ARM ref 2kHz	-63dB

CCIF twin tone method was respectable at around 0.1% up to 50kHz with compression in action.

Other matters

Subjective testing of the unit confirmed the poor law of the compression controls as well as the not so good noise performance. However, where dynamic range is not of prime importance the unit behaved in a useful and unobtrusive manner both as a compressor and a de-esser. It was however found that the input overload indicator was not bright enough and would be far more useful if it operated below input clipping and had a hold circuit.

Summary

Certainly this is an inexpensive compressor/limiter suitable for use with semi-professional studio equipment and in this application it may be of interest.

Whilst the unit is well made, some aspects have clearly received inadequate attention by the manufacturer such as the compressor control laws. Other aspects may or may not be acceptable depending upon the particular application.

Hugh Ford

FIG 6
FURMAN LC2
HARMONIC DISTORTION
WITHOUT COMPRESSION

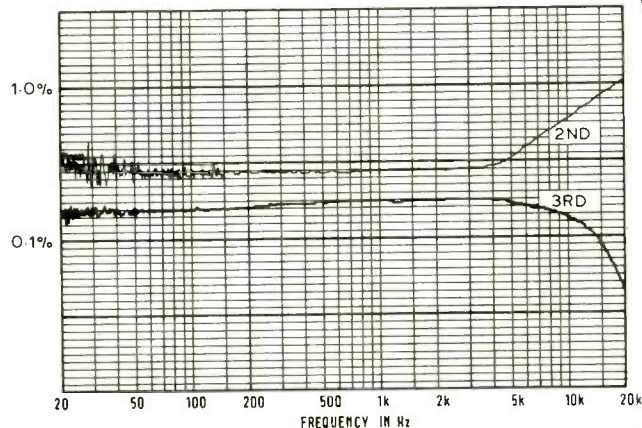
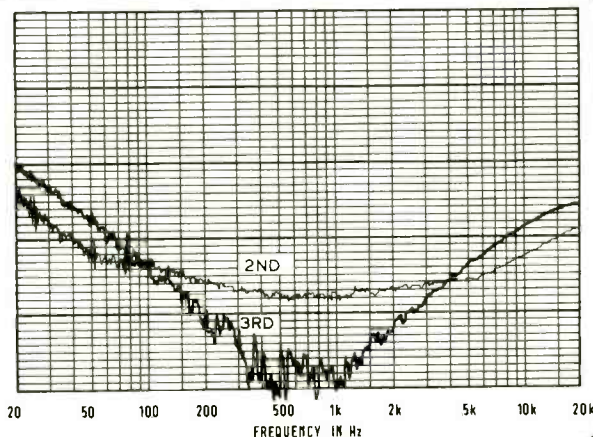


FIG 7
FURMAN LC2
HARMONIC DISTORTION
WITH COMPRESSION



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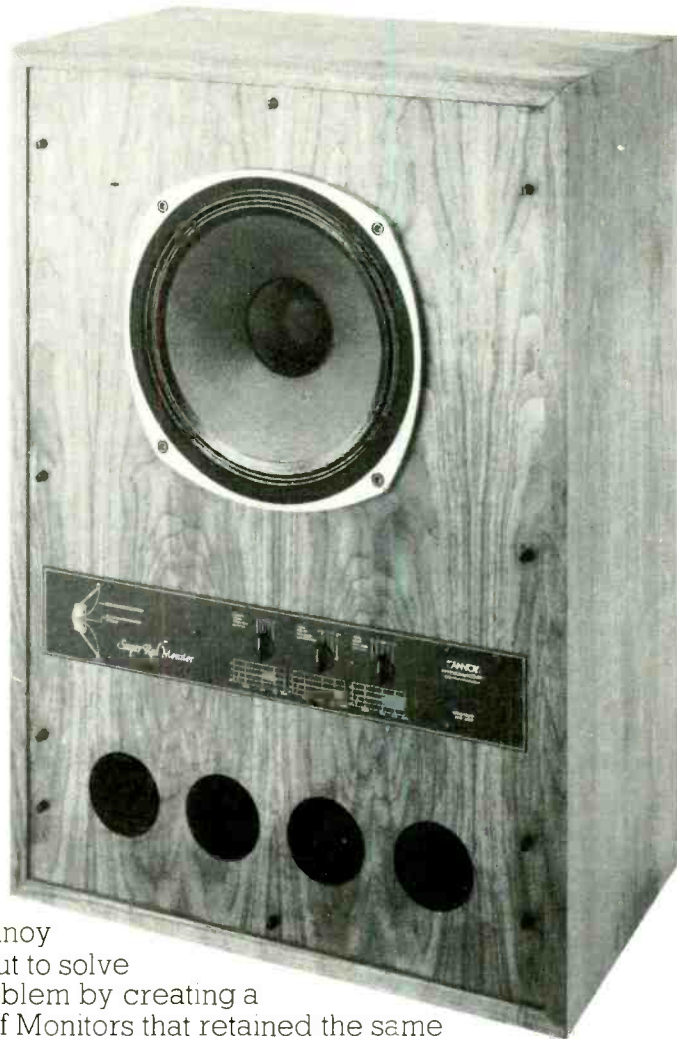
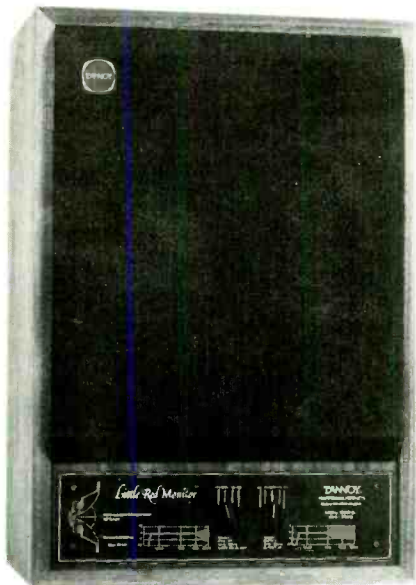
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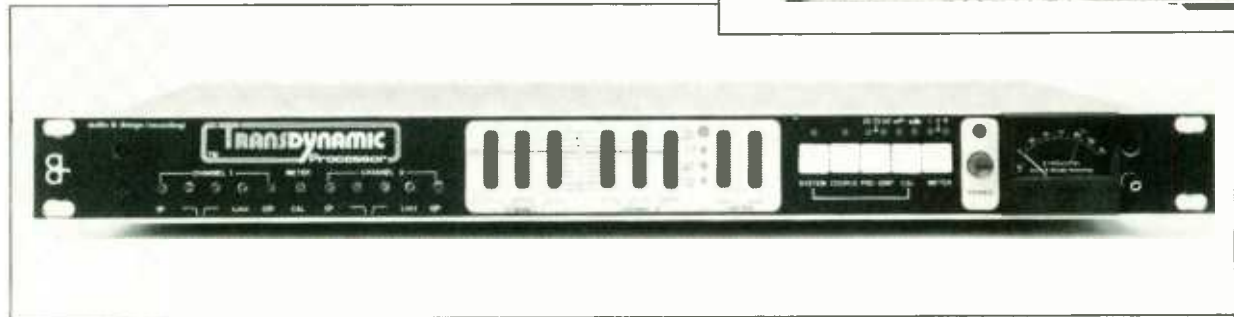
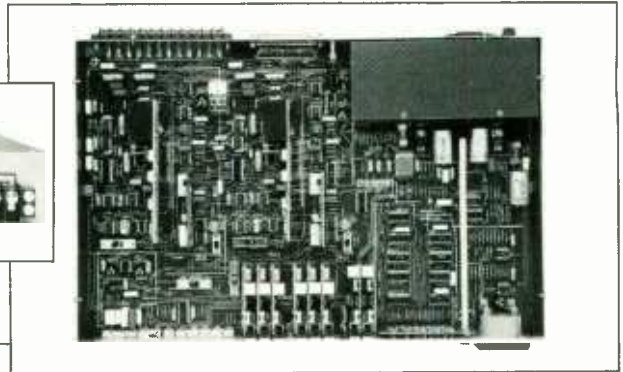
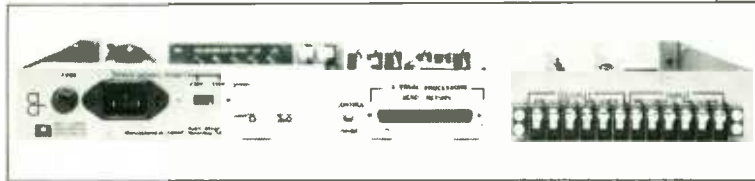
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MANUFACTURER'S SPECIFICATION

Frequency response without conditioning filters: 20Hz to 20kHz - 0.5dB reference 1kHz.
Studio filter card: 20/20 input conditioning filter (bandpass) - 3dB at 24Hz and 25kHz, - 1dB at 28Hz and 20kHz reference 1kHz; attenuation outside pass band 24dB/octave Butterworth response.
Standard FM filter card: 19kHz lowpass; combined response of input and output filters is - 1dB at 28Hz and 15kHz, - 25dB at 18kHz, - 50dB at 19kHz.
Distortion: less than 0.06% at all bandpass frequencies below limit threshold; unity gain, less than 0.25% at 1kHz with 4dB gain reduction.
S/N ratio: better than -90dB reference limiting threshold (- 4dBm to + 15dBm) unity gain.
Stereo matching: ±0.5dB over 10dB limiting.
Triband splitter: 6dB/octave filter, crossover points adjustable via front panel presets.
Splitter bands: lowpass - mid 75Hz to 1kHz; highpass - mid 1.1kHz to 15kHz.
Optional 12dB/octave splitter: plug-in 4th order phase compensated filter, frequencies selected by plug-in single inline resistor networks.

Internal peak limiter

Attack and release: programme controlled attack dependent on input level and frequency changes.
Threshold: output - 4dBm to + 15dBm; max input sensitivity - 5dBm for limit input threshold.
Compression ratio: 20: 1 static at 1kHz.

Metering

Analogue PPM: movement to BS4297; switchable between input, output, channel 1 and 2.
Bargraph displays: eight indicators provide triband spectrum analysis of the return signals for channels 1 and 2; also indication of peak limiter gain reduction for channels 1 and 2.

Input/output

Input impedance: > 10kΩ.
Maximum input level: + 20dBm.
Configuration: differential electronically balanced input with common mode rejection better than -50dB at all bandpass frequencies - RF suppressed.

Output impedance: 600Ω resistive, electronically balanced.

Limiting output threshold level: variable - 4dBm to + 15dBm.

Rear panel connections: terminal strip for audio input and output; latching 37-way 'D' type connectors for Triband sends and returns also monitor outputs and voiceover mix returns; IEC AC receptacle.

Send/return

Send: low impedance drive to external processors at line level.

Return impedance: 10kΩ.

External controls

Push switches: system in/out + switches modulation meter to monitor input/output signal in test modes. Stereo link of peak limiters. Pre-emphasis 75μs, 50μs, 25μs and off. Test select pink noise or audio or off. Meter select channel 1 or 2 or 1 + 2. All push switches are backed by rechargeable battery giving up to six months' memory on selected switch positions. All push switches can be inhibited by back panel inhibit switch.

Presets: input level. Crossover points for highpass and lowpass (6dB/octave only). Limiter input level. Output level (+ 15dBm maximum threshold level). Meter calibrate (calibrated modulation meter to line levels) - 4dBm to + 15dBm for 100%.

Internal controls

Alignment presets: limit thresholds; direct mix returns; meter zero and level calibration.

Switches: 6dB/octave - 12dB/octave - splitter filters with 'select' indication on front panel; 100% to 125% positive modulation; clipper in/out with 'select' indication on front panel; direct mix/in/out with 'select' indication on front panel; balanced/unbalanced (for balanced/unbalanced outputs).

Power requirements: 115/230VAC + 10% - 7% 50/60Hz 20W.

Dimensions: (whd) 19 x 1 3/4 x 11in (14in inc con-

nectors); 481.8 x 45 x 280mm (355mm inc connectors).

Weight: unit 4.5kg

Safety and confidence features: all high voltage components AC switch, fuse holder, IEC socket, voltage selector and transformer contained within earth screened box. Input directly connected to output via relay under AC failure conditions or if any internal power supplies fail.

Manufacturer: Audio & Design (Recording) Ltd, North Street, Reading, Berks RG1 4DA.

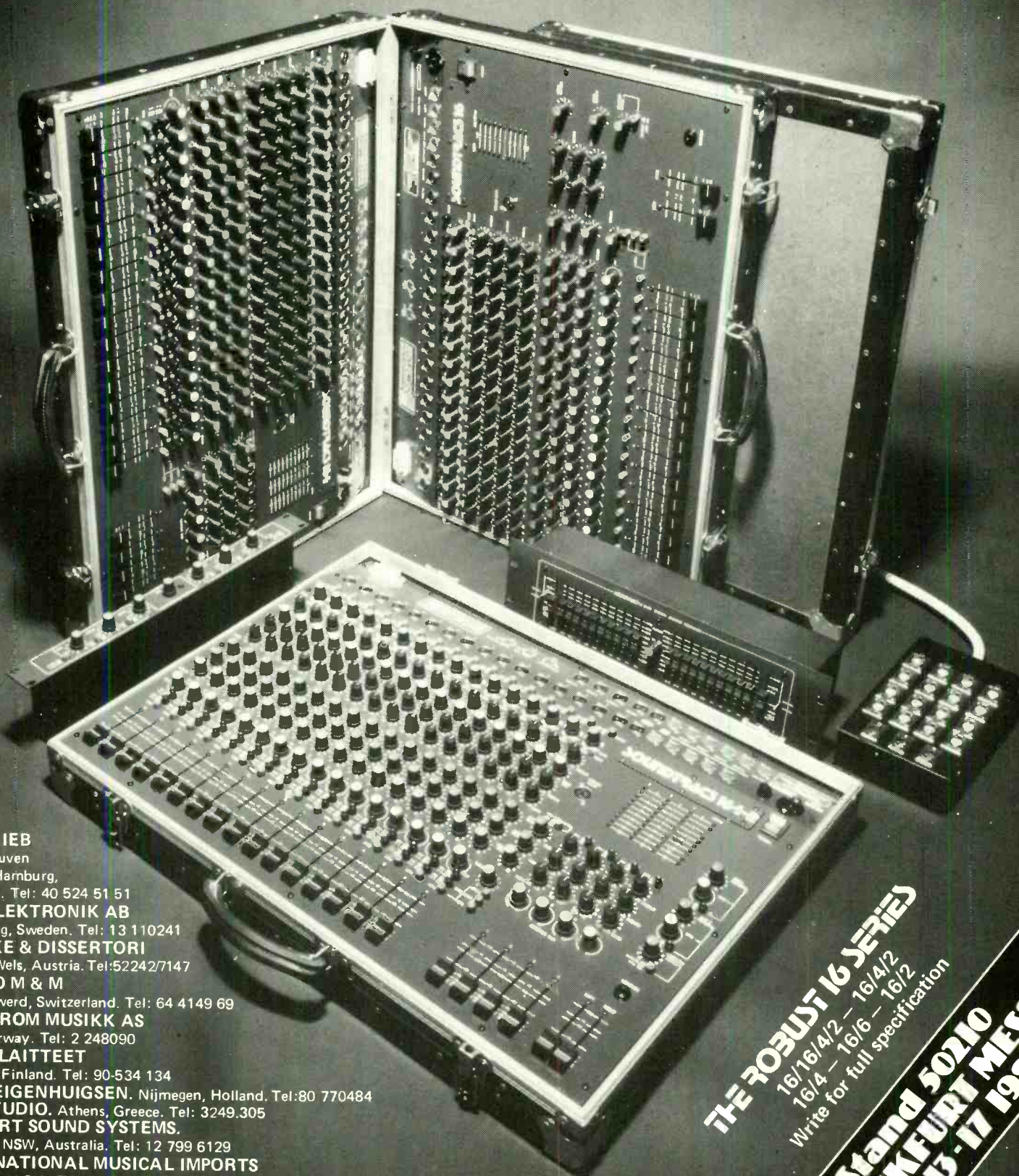
USA: Audio & Design Recording Inc, PO Box 786, Bremerton, Washington 98310.

AUDIO and Design's *Transdynamic* signal processor is intended to work in conjunction with three separate compressor/limiters each operating in a separate frequency band, however, in certain applications the unit is used without additional signal processing. Briefly, the *Transdynamic* splits the stereo input signal into three frequency bands (high, low and mid) to be fed to separate external compressor/limiters. This means that each external compressor/limiter can have not only its threshold and gain reduction separately adjusted, but also its attack and release times optimised for each frequency band so that effects quite impossible with a single compressor/limiter can be achieved. Not only can this give impressive effects, but more important, it enables the input signal to be completely optimised for disc cutting or transfer to magnetic tape allowing for the limitations of the medium.

The signals from the three external compressor/limiters are recombined in the *Transdynamic* and fed to a further limiter which includes the standard 25μs, 50μs, and 75μs switchable pre-emphasis for

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broadcast use with an off option. There follows a peak clipper switchable for 100% or 125% modulation or off, followed by a PPM modulation meter, then an output filter which can be wideband audio or 19kHz rejection for use in FM stereo broadcasting.

This is but a very brief description of the *Transdynamic* which has many refinements which will be described with reference to the block diagram Fig 1.

From the electronically balanced inputs the signals can follow two paths, in the case of power line or rail failure the input is connected directly to the output by the failsafe relay. At switch-on this relay delays the connection of the signal processor for a few seconds so that switching on or off is completely click free.

Normally the inputs are fed to a radio frequency filter (so essential in broadcast equipment and always desirable) followed by unity gain buffers before being combined into an unbalanced signal. There follows an input conditioning filter to eliminate out of band signals below 24Hz and

above 20kHz which can lead to mistracking of many compressor/limiters.

With the *Transdynamic* switched out the signals then pass to a further conditioning filter which can either comprise the broadcast 19kHz and 38kHz rejection filter with a -1dB point at 15kHz or be a direct path for studio use. Next come the electronically balanced outputs which may be switched to unbalanced with appropriate gain correction being applied.

When the *Transdynamic* is switched into circuit the signals from the input conditioning filters can follow two paths, to a direct mix line which bypasses the external compressor/limiter with an internally adjustable preset level and in/out switch. The second path feeds front panel screwdriver adjustable input level controls after which the audio may be replaced by a pink noise source for alignment of the external processors.

From here the signals are split into three frequency bands which are normally 6dB/octave filters with -3dB points at 700Hz and at 4kHz, these frequencies being adjustable by screwdriver

operated front panel controls. Optional 12dB/octave filter boards may be fitted with internal slide switches giving the option of 6dB or 12dB/octave attenuation. The turnover frequency of the 12dB/octave filters may be altered by interchanging DIL resistor packages with the high and lowpass filters each having five frequencies with -3dB points between 1.35kHz to 6.1kHz and 110Hz to 520Hz respectively.

The highpass, lowpass and bandpass outputs return from the three external processors to three LED bar displays before being recombined together with the switchable direct mix signal and optionally with an external mix input. Whilst the bar displays give an idea of the audio signal level they are primarily intended for alignment of the external processors when using the pink noise source.

The combined audio signals are then passed to the internal limiter which includes the 25 μ s, 50 μ s, 75 μ s pre-emphasis and has its threshold adjusted by an internal preset potentiometer. In addition the limiters can be stereo coupled by a front panel switch.

The amount of limiting is indicated by two front panel bar displays one segment of each being used to indicate the action of the following hard clipper. This may be switched in or out of action and has its threshold internally adjustable. Finally, before the output stages there are screwdriver operated front panel output level controls followed by the PPM modulation meter which is switchable between the output and the filtered input signals.

All these electronics are contained in a standard 19in rack-mounting chassis one rack unit in height. Within the unit a high quality PCB covers the base with a screened compartment containing the mains fuse and the toroidal power transformer. The board layout was excellent with all components being clearly identified and ICs socketed for easy maintenance.

A good instruction book is provided complete with operational hints, maintenance information and clear full circuit diagrams.

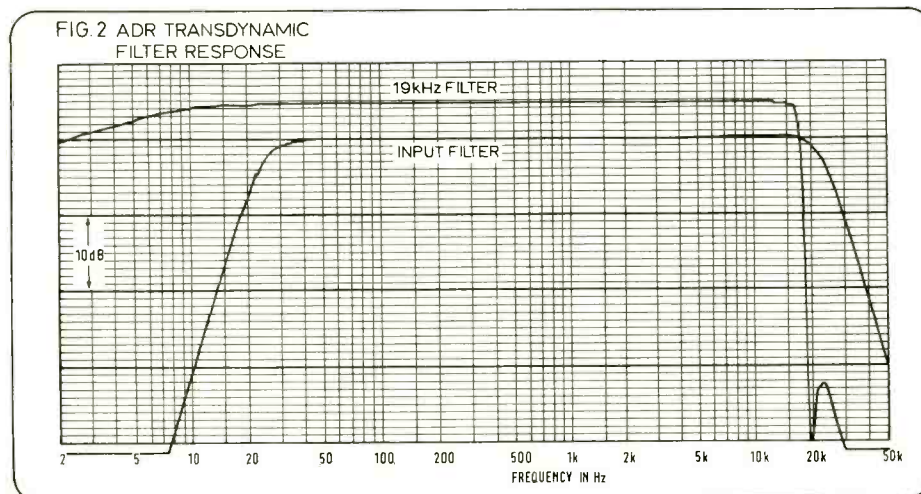
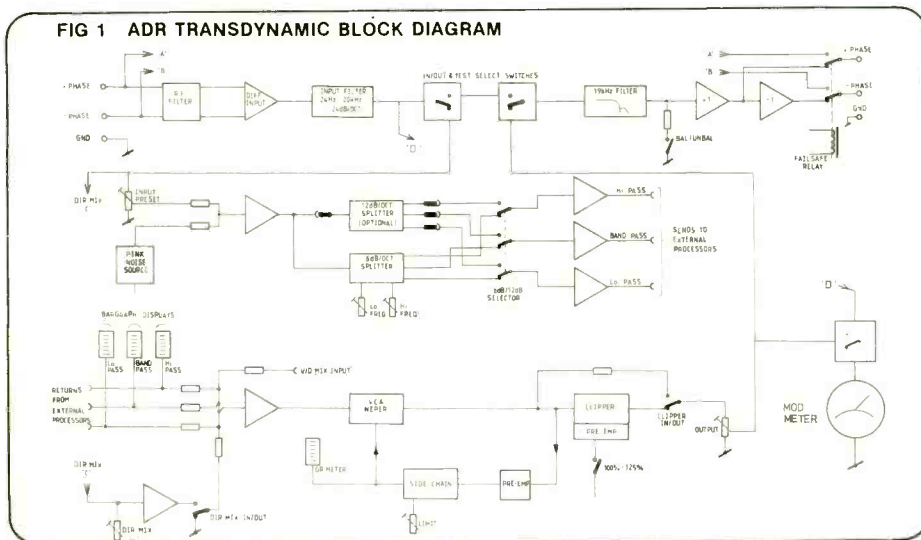
Within the unit separate plug-in PCBs are used for each of the LED bar displays and also for the output filters, the 12dB/octave bandsplitting filter and the internal compressor.

To the rear of the unit the incoming power enters via an IEC socket with a clearly identified power fuse and voltage selector for 230/115V operation nearby. The audio inputs and outputs take the form of a barrier strip mounted on the main PCB with the feeds to the external processors, two mix inputs and two monitor outputs being fed by a 37-way 'D' connector.

Finally a hole in the rear panel gives access to a switch which locks out all the front panel switches (except for power). When this safety switch is operated the front panel switch settings are stored digitally with the memory having a battery back-up such that the switch settings are retained even if the power is disconnected. This feature is primarily intended for broadcast applications so that knob twiddlers can't wreck the station's output!

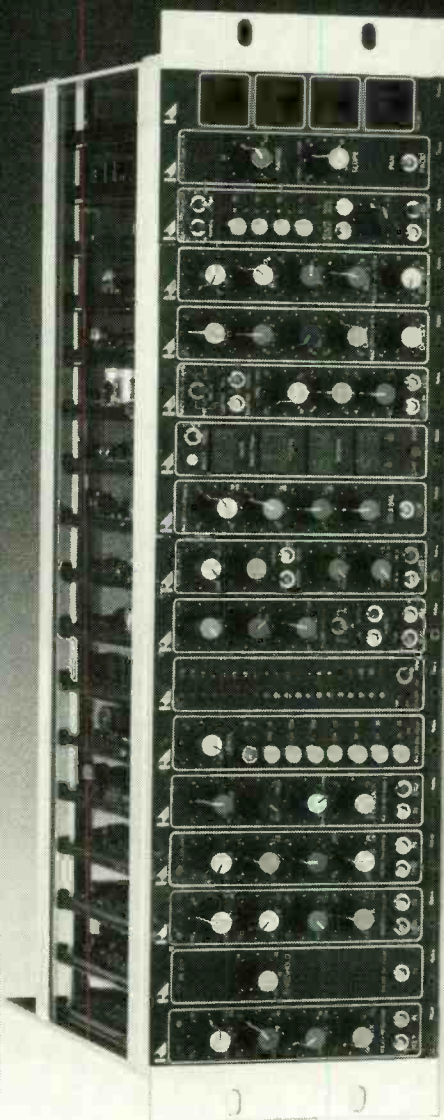
Front panel

At the left of the front panel, eight screwdriver-operated potentiometers behind the panel adjust the two channels for input and output level and set the frequencies of the high- and lowpass bandsplitting filters. A further potentiometer adjusts the



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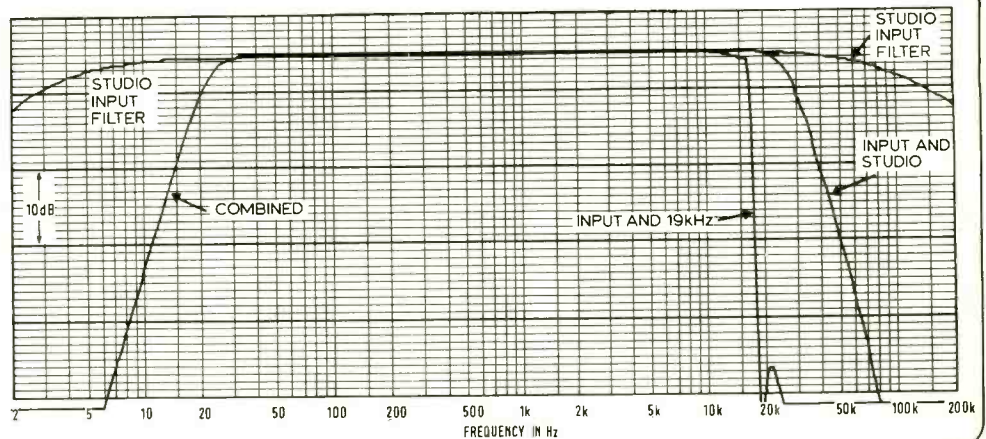
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FIG. 3
ADR TRANSDYNAMIC
COMBINED FILTER RESPONSE



PPM sensitivity. To the centre, six vertical red LED bar displays (three for each channel) indicate the received level from the three external processors in 1dB increments from +3dB to -1dB and then -3dB, -5dB, -7dB, -10dB and -20dB.

Then to the right of the panel, four recessed LED indicators are used to indicate 'on air', 12dB/octave filter in circuit, direct mix switched in and clipper switched on. Next two green vertical LED bar indicators show the gain reduction of the internal compressor in nine steps with the bottom bar being illuminated when the internal clipper operates. Next are five momentary press switches which feed digital logic which, as previously explained, enables their settings to be stored and the switches locked out by the recessed rear panel safety switch. The first of these switches puts the system in or out of circuit, an LED being illuminated when the system is in. With the system out of circuit the audio input is fed to the output via the input filter and the output filter (if fitted) allowing alignment of the compressor/limiters using the pink noise source or the audio input whilst 'on air' signals continue to pass between the inputs and outputs.

The system pushbutton operates in conjunction with a calibrate button, sequential pressing of which initiates three conditions shown by two LED indicators. In the non-calibrate position the PPM monitors the audio outputs and the system switch puts the compressor in circuit (on air) or out of circuit. In the two calibrate positions (indicated by illuminated LEDs) the input to the outboard compressor/limiters is either from the pink noise generator or the audio input. In these circumstances the PPM monitors the final compressor's output with the system in, or the audio input with the system out.

The further three switches with appropriate LED indicators switch the stereo coupling in/out, select the pre-emphasis in the compressor and switch the PPM to read left, right or the sum of the two channels, the PPM being calibrated in percentage modulation up to 120%.

Finally there is the power on/off press switch with a power indicator LED, the switch itself being in the screened power department at the rear of the unit.

Whilst the layout of the front panel is very clear, it was felt that the calibrate switch's relation with the system switch could be simplified possibly by

FIG. 4
ADR TRANSDYNAMIC
COMPRESSION SECTION
FREQUENCY RESPONSE

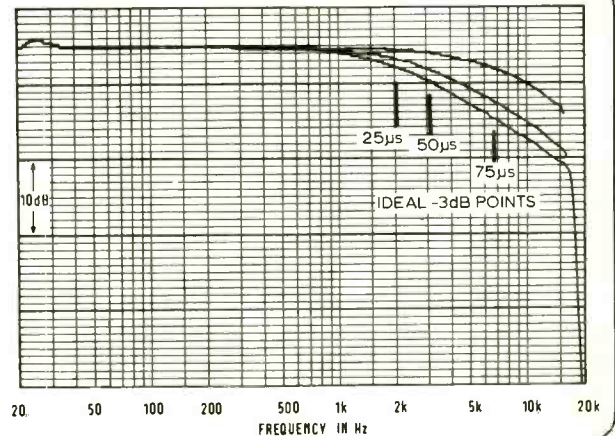
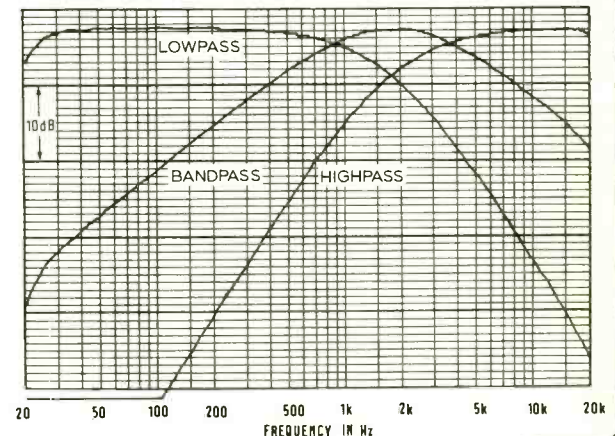


FIG. 5
ADR TRANSDYNAMIC
BANDSPLITTING FILTERS AT
STANDARD SETTINGS



indicators showing which source is feeding the PPM.

Inputs and outputs

The input impedance at the balanced audio inputs was found to be 2MΩ (1MΩ in either leg) with provision for adding loading resistors on the PCB. The input could handle in excess of +22dBm before the onset of clipping with the common mode rejection ratio being constant at 55dB from 20Hz to 20kHz.

In the unit supplied the onset of compression occurred at +10dBm input which was at

maximum input gain, the gain control being a full range type.

At the unbalanced direct mix input the impedance was satisfactory at 10kΩ, again with a maximum input level capability in excess of +22dBm.

At the outputs which may be switched balanced or unbalanced, with accurate gain compensation the output impedance was less than 10Ω with an adequate drive capability of +19.6dBm into 600Ω or +20.1dB (ref 7V) into a high impedance. The feeds to the external compressor/limiters had a

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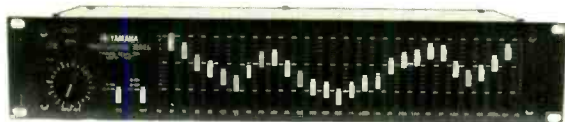
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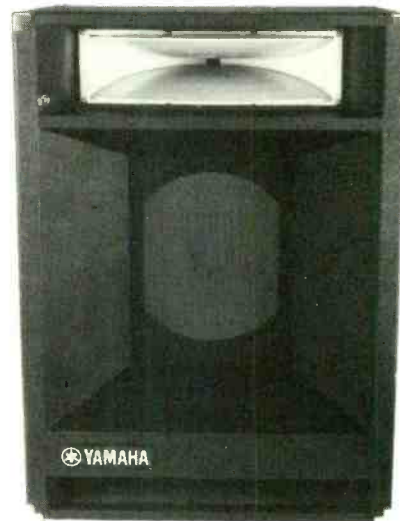
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maximum gain of -3dB referred to the input with the output impedances being adequately low at less than 10Ω . At the returns the input impedance was rather on the low side and varied between $3.5\text{k}\Omega$ and $4\text{k}\Omega$ but with a good signal handling capability of greater than $+22\text{dBm}$.

Frequency response and noise

The overall frequency response in any mode, except power off, is controlled by the input and output filters both of which are included on plug-in PCBs. When using the 19kHz broadcast filter the response of the input and the output filters is as shown in Fig 2 which shows that the input filter is a 24dB/octave bandpass filter with -3dB points at 24Hz and 20kHz . The 19kHz filter shows an extremely rapid attenuation above the -1dB point at 15kHz with the measured 19kHz rejection being $48\text{dB}/50.5\text{dB}$ and the 38kHz rejection $68\text{dB}/71\text{dB}$ for the two channels, the accuracy of the notch frequency being excellent.

Fig 3 shows the effect of the combined filters in both the broadcast and studio configurations, the upper plot being the effect of the studio input filter which has effectively a flat response with the overall effect of the studio filter rolling off at 24dB/octave below 24Hz and above 25kHz (-3dB points).

These highly desirable characteristics were held with the system in or out provided that the signal was below the compression threshold.

Examination of the frequency response of the compression section showed the $25\mu\text{s}$, $50\mu\text{s}$ and $75\mu\text{s}$ pre-emphasis characteristics to be exactly correct as shown in Fig 4. Using a spectrum analysis of white noise it was found that the frequency response of the compressors remained flat under conditions of compression.

Turning to the band splitting filters, as supplied, the three filters were as shown in Fig 5 all filters being 6dB/octave types — the optional 12dB/octave filters not being provided for review.

The very wide range of adjustment of the filters is shown in Fig 6 which shows that adjustment of the high- and lowpass filters automatically tracks the bandpass filter characteristics.

A criticism of all the front panel controls was that their adjustment was rather coarse as a result of the use of ordinary potentiometers rather than multiturn types.

Measurement of noise at the output referred to the threshold of compression at $+9\text{dBm}$ with the system in or out of circuit, gave excellent results as shown in Table 1.

The two channels were virtually identical except for the unweighted measurement which was affected by power line hum in one channel.

Checking the noise performance under compression conditions showed slight noise breathing to the extent of 4dB CCIR weighted quasi-peak, but the overall noise performance is such that this is insignificant.

Distortion

In the direct mode, that is passing the signal through the input/output buffering and the conditioning filters, the second and the third harmonic distortion was less than 0.03% within the passband at any working level.

Inserting the system produced the harmonic distortion products shown in Fig 7 at 7dBm output — that is just below the onset of compression — the distortion products falling to less than 0.03% at

0dBm output and less than 0.01% at -10dBm and lower levels. As is to be expected the harmonic distortion increased, particularly at low frequencies, when compression was introduced, the situation at 6dB limiting being shown in Fig 8.

Intermodulation distortion to the CCIF twin tone method showed similar characteristics with a good performance at 0dBm output as shown in Fig 9 for the difference frequency between the two tones of 70Hz . At 6dB limiting the difference frequency component rose rather alarmingly to

TABLE 1

Measurement method	System in	System out
22Hz to 22kHz		
RMS unweighted	90.5/89dB	98/94dB
A-weighted RMS	92dB	98dB
CCIR-weighted		
RMS ref 1kHz	83dB	89dB
CCIR-weighted		
quasi-peak ref 1kHz	79dB	85dB
CCIR/ARM ref 2kHz	90dB	95dB

FIG 6
ADR TRANSDYNAMIC
BANDSPLITTING FILTERS
ADJUSTED

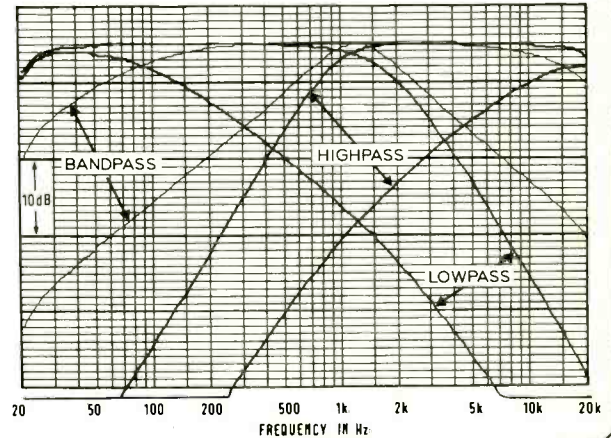


FIG 7
ADR TRANSDYNAMIC
HARMONIC DISTORTION
AT 7dB OUTPUT

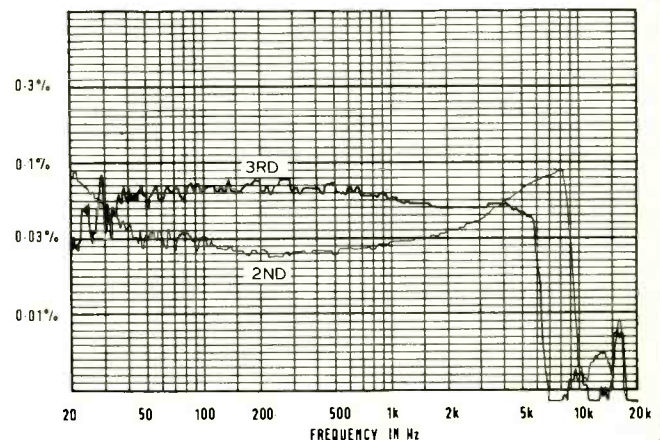
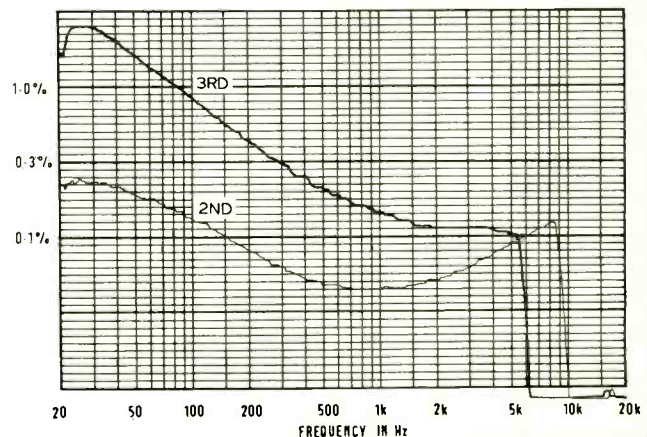


FIG 8
ADR TRANSDYNAMIC
HARMONIC DISTORTION
AT 6dB LIMITING



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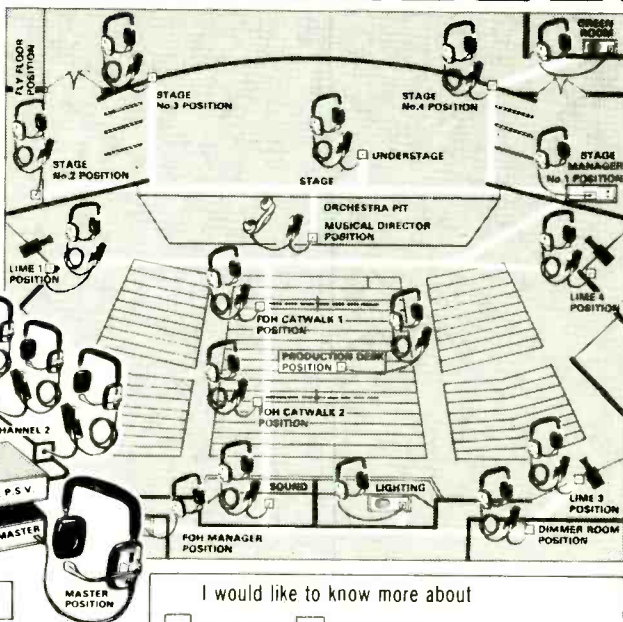
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1% constant between 200Hz and 15kHz with the third order difference frequency components (f_1 or $f_2 \pm (f_1 - f_2)$) remaining below 0.03%.

Compression and limiting

The compression and limiting section includes two separate functions. First the signal passes through the compressor with its switchable pre-emphasis in the side chain feeding the gain reduction meter and the Valley People VCA. After this the signal passes to the switchable fast limiter section mainly intended for protecting broadcast transmitters from over modulation.

The compressor section was found to have a 20:1 compression ratio with the input/output characteristic having a very sharp knee as shown in Fig 10, the threshold being variable from -20dBm input upwards at maximum input gain.

The attack time of the compressor was extremely fast, the response to a burst of 10kHz tone leading to 10dB compression being shown in Fig 11 where 100% modulation corresponds to ± 2 vertical divisions. The attack to low frequencies was completely clean and the recovery time remained constant at about 100ms for full gain recovery.

Switching in the peak limiter showed slight overshoot as shown in Fig 12 for a burst of 10kHz tone giving 10dB limiting with the clipper set for 100% modulation, there being an appropriate increase in level with the limiter set for 125% modulation.

Meters

The six band level LED bar meters were found to be accurate within their readability with the response time to full scale being 50ms and the fall time 2.5s, this performance giving good readability when using pink noise. As explained earlier in this review the meters are intended for alignment with pink noise and not for reading signal levels. Consequently the frequency response of the three meters for each channel is not flat.

Turning to the gain reduction LED bar displays these too were accurate to within their readability

with a very fast attack time giving a readable display with a tone burst of only 100 μ s, the fall back time depending upon the length of the compression.

Similarly the LED clipping indicators were very fast in response, also giving a readable display with only 100 μ s of clipping.

Like the bar meters the PPM was found to have a peak rectifier characteristic but to have a dB linear scale as the British Standard PPM but with the meter being scaled from 0 to 120% modulation. However the PPM is not intended to be a standard PPM and has a very fast response time with little loss from the steady state indication with 100 μ s tone bursts and a fall back time of 1s giving good readability.

Other matters

Crosstalk between the two channels was good, being 80dB at frequencies below 600Hz and rising

at 6dB/octave with frequency to 55dB at 12kHz.

The maximum level errors between the two channels never exceeded 0.5dB under any conditions, limiting or otherwise with the stereo tracking being completely effective when switched into circuit.

Variation of the nominal power line voltage from 230V down to 200V had no effect upon the performance and no trouble was experienced from power line interference.

Summary

The Audio and Design *Transdynamic* is an extremely effective system with many applications not only in broadcasting but also in disc cutting, tape duplication and general studio sound 'treatment'.

Overall the performance was excellent, with the unit being very well engineered in all respects.

Hugh Ford

FIG 9
ADR TRANSDYNAMIC
IM DISTORTION

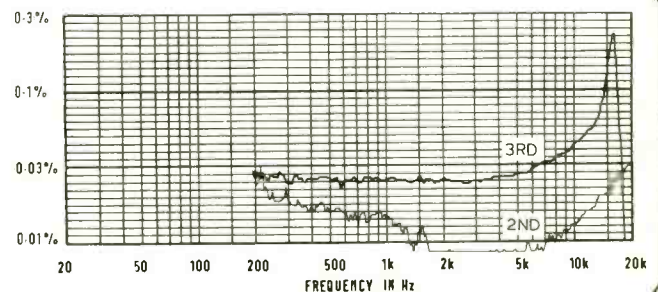
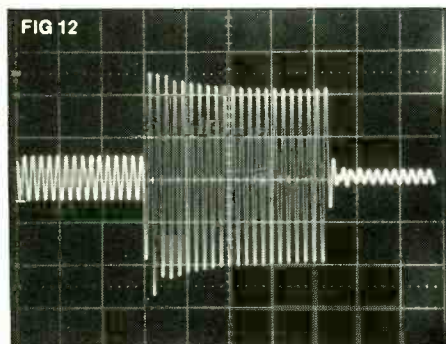
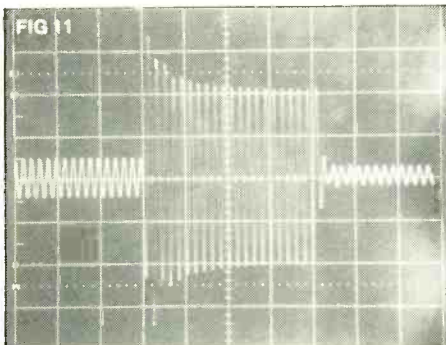
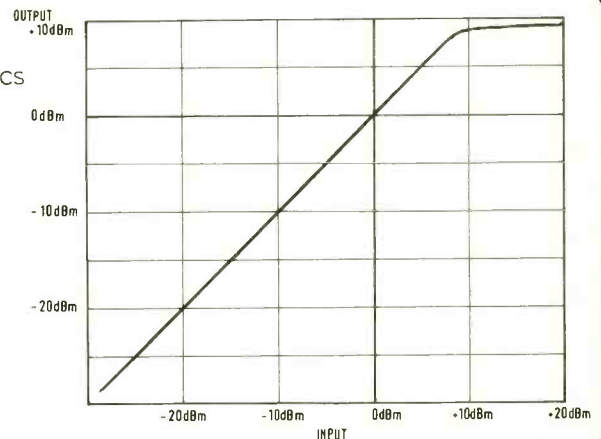


FIG 10
ADR TRANSDYNAMIC
INPUT/OUTPUT CHARACTERISTICS



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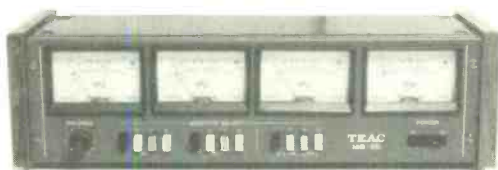


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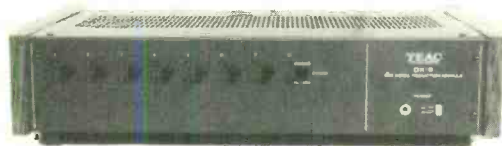
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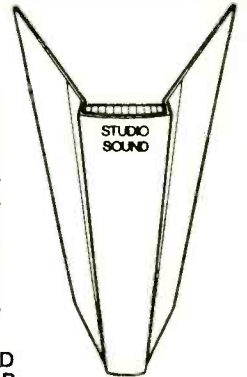
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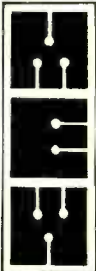


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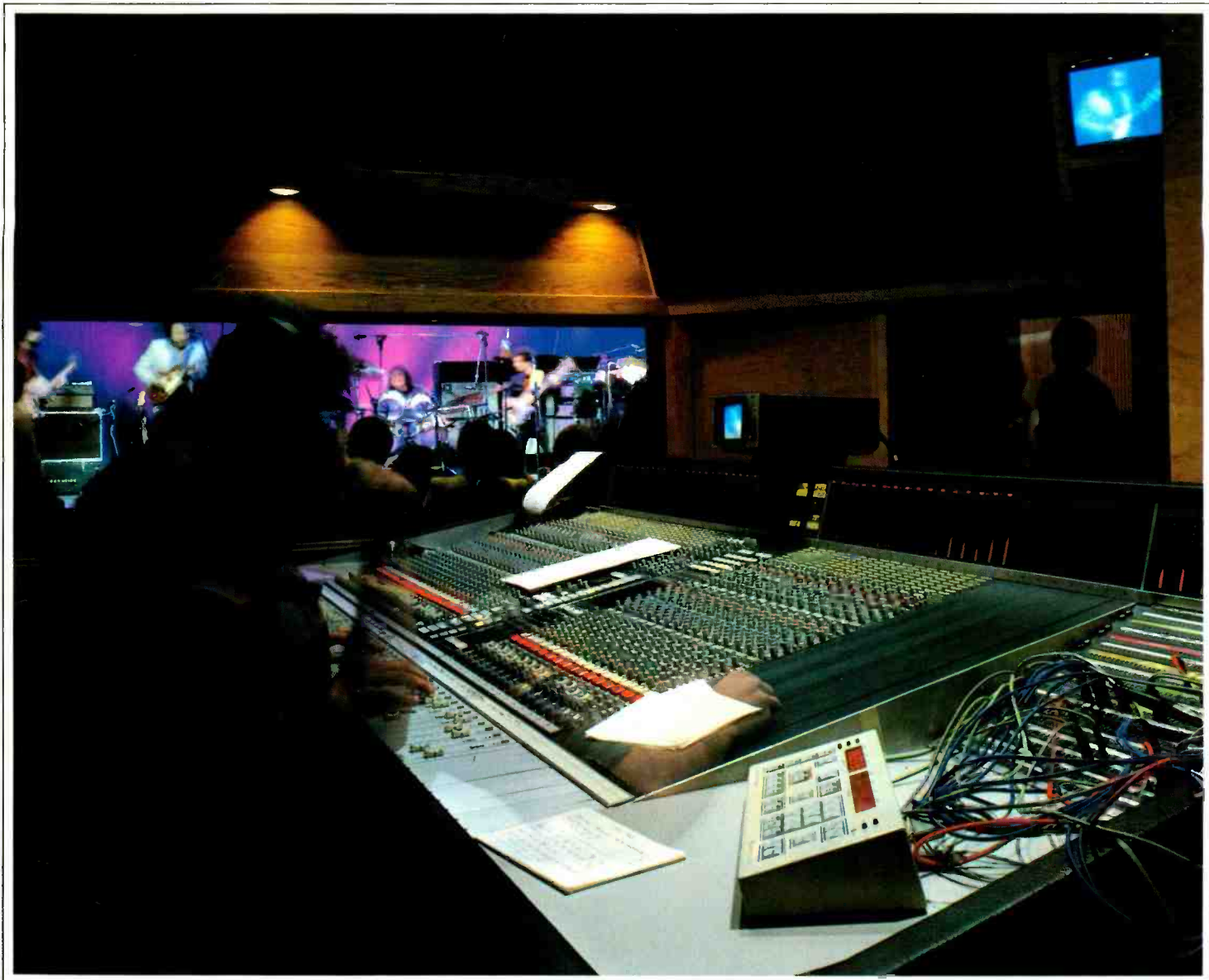
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