NOVEMBER/DECEMBER 1983 £1

BROADCAST SOUND

A LINK HOUSE PUBLICATION

Inter BEE '83 Preview

Tape machines
Audio visual production

SOUNDCRAFT SERIES 2400, BBC TELEVISION, GLASGOW.

Sound on Vision

Some rather discerning people are using Soundcraft Series 2400 master recording consoles. They've established that Soundcraft performance and reliability meet the rigorous standards broadcast and video post production impose – within some fairly tight budgets too.

In conjunction with Television Projects in London, Alan Bunting, the Audio Manager for BBC Scotland, specified the Series 2400 for their new dubbing suite – making this the second 2400 the BBC have purchased for their Glasgow studios so far.

If you'd like to find out why more and more Soundcraft consoles are being specified for broadcast and post production audio mixing, contact Soundcraft or your Soundcraft distributor today.

Soundcraft

Soundcraft Electronics Limited, 5-8 Great Sutton Street, London, EC1V 0BX, England. Tel: 01-251 3631. Telex: 21198.
Soundcraft USA, 20610 Manhattan Place, Suite 120 Torrance, Ca. 90501. Tel: (213) 328 2595. Telex 182499.

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Printed in England

A LINK HOUSE PUBLICATION

Cover
As this issue coincides with our attendance at the Inter BEE '83 exhibition in Tokyo, our cover has an eastern flavour. Pictured is Studio CD-807, the main audio/video post-production studio at NHK, Tokyo, which is the subject of a feature article. Photography: courtesy NHK.

BROADCAST SOUND

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EDITORIAL

The Rising Sun

This year's Inter BEE '83 exhibition in Tokyo sees *Broadcast Sound* in attendance for the first time. We, therefore, hope that many of our Japanese and far Eastern readers will visit our stand.

Our attendance at Inter BEE reflects the increasing international importance of broadcasting and professional audio equipment manufacture in the Far East. It is therefore, interesting to speculate how Far Eastern companies are approaching the professional market.

Digital audio is one area in which Far Eastern manufacturers are concentrating their research and development. However, despite the potential of breaking into the professional audio equipment marketplace as we move into new technology, the Europeans and North Americans are still holding their own. While companies such as Sony, JVC, Mitsubishi and Matsushita are all involved in this field, one suspects that is the spin-off applications for consumer audio and video with its vast marketplace and massive potential for return on investment which is the carrot. Turning to analogue equipment, the inroads companies such as Denon, Teac and Otari have made, particularly with tape machines, follows the European tradition of precision mechanical engineering coupled to high quality electronics. Meanwhile smaller companies like Accuphase, Nakamichi and Audio Technica continue their excellent work in more specialist avenues.

While the Far East does not dominate technological innovation, broadcasting here is certainly not a technical back water. NHK (Nippon Hoso Kyokai), for example, is probably—next to the BBC and EBU—the most important broadcast research and development centre in the world. Developments in stereo television sound, bilingual broadcasting and high definition television are particular examples in which NHK has led the world. Thus, the Far East has much to offer our industry and no doubt we will be hearing (*sic*) much more from this part of the world.

Noel Bell

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- 120W Power handling
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For anyone who knows the cost of running out of time.

Ever wished that you could compress or expand recorded material for a commercial to avoid time consuming and costly retakes and editing?

Now you can. With the Lexicon Model 1200, you can speed up programme material by up to 25% -or expand it by up to 10%. Your best 'take' can be time-adjusted to fit the available time slot precisely.

The pitch remains unchanged, and you get broadcast-quality audio, totally free from distortion.

It's been through the hoop on Madison Avenue too: the Lexicon 1200 has been used by 19 of the top 20 US agencies in the production of nationally broadcast commercials.

And the system is equally suited to the time adjustment of special effects and dubbed translations.

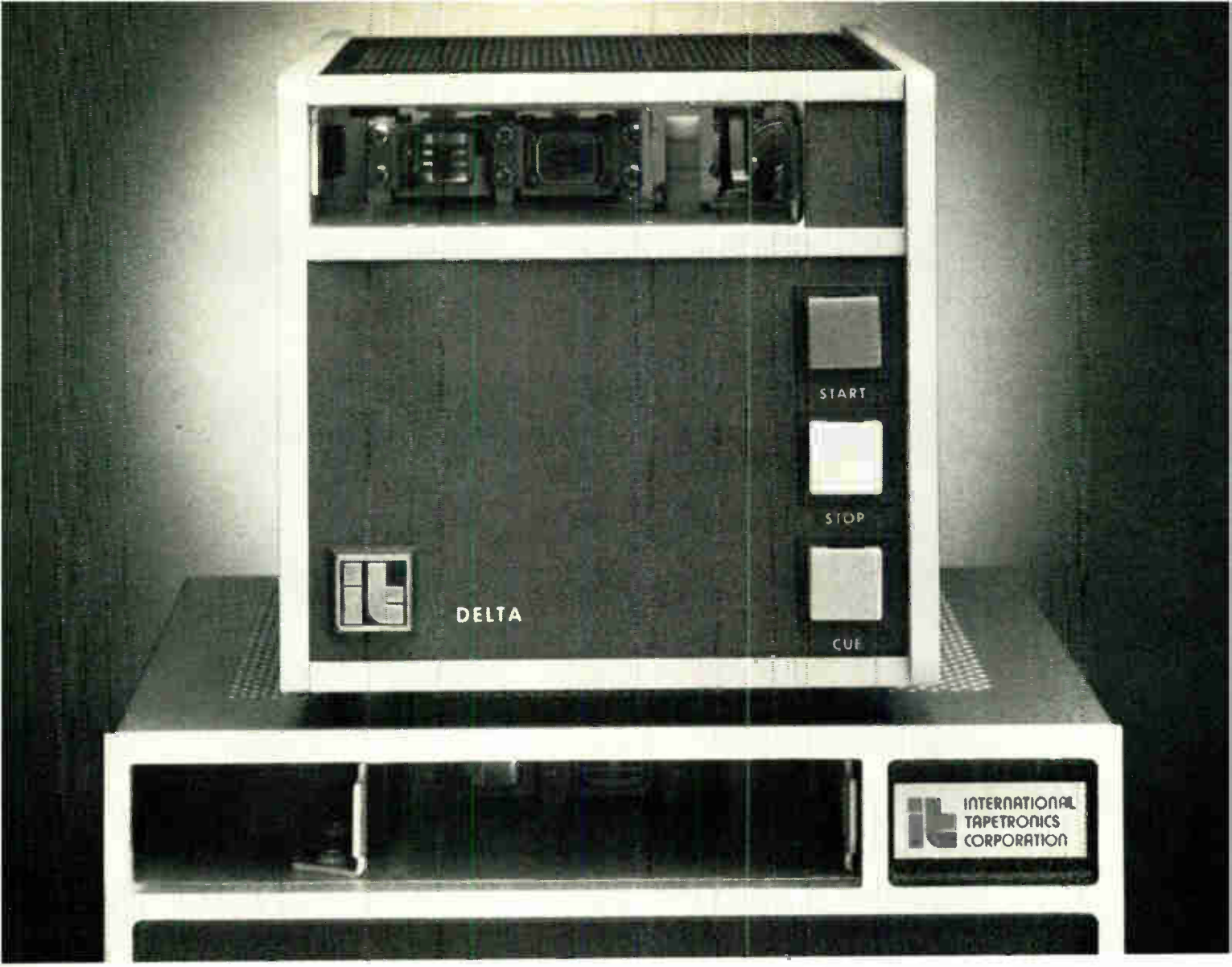
Lexicon 1200. Every production house should have one. It could save you a great deal more than the cost of a parking ticket.

lexicon

International: Gotham Export Corporation
New York, NY 10014 TLX: 129269

F.W.O. Bauch Limited

49 Theobalds Street, Borehamwood, Hertfordshire WD6 4RZ
Telephone 01-953 0091 Telex 27502



WHY CHANGE A WINNER?

Now, a new generation of cartridge machines is available from ITC: the Delta Series. It represents a major advance in practical technology for the studio, and it took time to develop. Because significant breakthroughs don't happen overnight, especially when they have to supersede such a well-proven and dependable workhorse as the Premium Series.

So the Delta Series had to be something special. And it is. The culmination of extensive and intensive research and development over the past few years, the Delta Series is an electronically and mechanically superior range of machines – more compact, with improved performance, incorporating a host of new operating features, and realistically priced!

Of modular construction, Delta Series units are easy and convenient to align and service. Sound quality is optimum, with minimal flutter and smooth frequency. New features include: a microprocessor-controlled digital cue tone detector; a positive cartridge guide system; high-speed cue as standard; high-accuracy crystal-referenced servo capstan motor drive with a ceramic shaft; new low noise amplifier design; space saving fit three compact Delta Series into a 19" rack.

The Delta Series has been rigorously tried-and-tested in the field with outstanding results; for more information, just write or 'phone.

ITC. Sound quality.

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2425 South Main Street,
Bloomington,
Illinois 61701, USA

F.W.O. Bauch Limited

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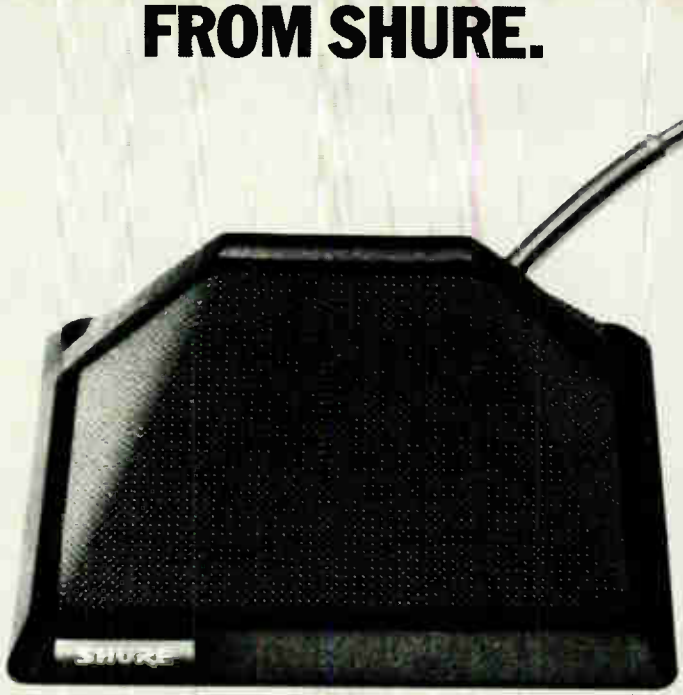
Telephone 01-953 0091, Telex 27502

THE WORLD'S FIRST AND ONLY AUTOMATIC MICROPHONE SYSTEM – FROM SHURE.



(Actual size)

Whenever someone has something to say in public, it's often the microphone system that makes or breaks their speech.

Clicks. Pops. Crackles. Background noises and missed syllables. Just a handful of the hazzards that can turn a speaker's finest hour into a fiasco.

Which is why we'd like to introduce you to something completely new – the Shure AMS. Microphone, mixer and advanced logic technology, combined in a totally dedicated system.

In short – a sound revolution.

At the heart of the AMS are angle-sensitive microphones. Speak into any one of them within its own 120° 'window of acceptance' and it turns on; change the surrounding audio conditions and it compensates. Quickly. Quietly. Automatically.

The rear panel of every AMS mixer features logic terminals that not only give unprecedented flexibility but also eliminate many of the usual adjustments and controls.

As a result no other unit sets up as quickly; handles as easily. And for larger gatherings, AMS mixers combine simply to effectively control over 200 mics.

The new Shure Automatic Microphone System. It makes speeches not mistakes.

IT'S SO SMART IT CAN 'MAKE' SPEECHES

SHURE

You simply can't make it any clearer.

For more information, write to: **HW international**, Dept BS, 3-5 Eden Grove, London N7 8EQ. Tel: 01-607 2717

BBC & Pilkington licence agreement

Russell Fletcher, (right) the BBC's head of Studio Capital Projects department, and Reece Davies of Pilkington Fibre Optic Technologies Ltd, signed a licence agreement at the recent APRS exhibition, licensing Pilkington to manufacture and market a mixed function multiplexer of BBC design, this unit acting as a digital control system using fibre optic cable. The system is designed to provide a flexible means of switching audio, communication and DC circuits, and is a 2-way interactive system. An article on the design principles of the system will appear in a future issue of *Broadcast Sound*.

As an indicator of the system's use, the BBC has placed an order for 50 Pilkington mixed function multiplexers for switching cartridge and reel-to-reel tape machines at its local radio stations.

Pilkington Fibre Optic Technologies Ltd, Glascoed Road, St Asaph, Clwyd LL17 0LL, UK. Tel: 0745 583301. Telex: 61291.

Marconi relaunch historic call sign

The call sign used to introduce Britain's first scheduled radio entertainment broadcast, 2MT, will be heard again on the amateur bands later this year after a 60 year break in transmissions. The historic call sign which was first used on February 14, 1922, on 700 metres from Writtle, near Chelmsford, by Marconi's Wireless Telegraph Co Ltd, ceased to be used in January 1923. Under an experimental licence 2MT was broadcast for half an hour each Tuesday evening and its broadcasts set the pattern for many later public broadcasting programmes; for example, the first radio play was produced (*Cyrano de Bergerac*) and a rudimentary *Childrens Hour* was evolved. A quirk of the experimental licence was that the station was required to cease transmitting for three minutes in every 10, in order to check whether any complaints had been received.

The relaunched call sign which will transmit as G2MT (The 'G' for England being added to accord with current practice) has been granted Home Office approval for use by the Marconi Radio Society. This is a group of amateur radio enthusiasts who are also employees of Marconi. The frequencies used by the society will depend upon prevailing propagation conditions, but it is hoped that contacts with BBC affiliated amateur radio clubs and similar groups within the GEC-Marconi organisation will be made.

Harris forms five new divisions

The communications sector of the Harris Corporation has elevated its Broadcast and RF Communications divisions to Group status and formed five new divisions. The Broadcast Group, based in Quincy, Illinois, will have two new divisions and will be headed by Gene Whicker. This Group will consist of a broadcast transmission division with responsibility for all radio, television and broadcast microwave transmission products and systems; plus a studio division responsible for all radio and television studio equipment including video systems.

The RF Communications Group, based in Rochester, New York, has three new divisions and is headed by Guy Numann. This Group consists of an RF systems division responsible for the design, manufacture and installation of complete turnkey radio communication systems; a long range radio division responsible for HF radio products and accessories including single-sideband equipment; and a short range radio division responsible for short range radio products including car telephone systems, digital pagers, and VHF/UHF two way radios.

Erratum

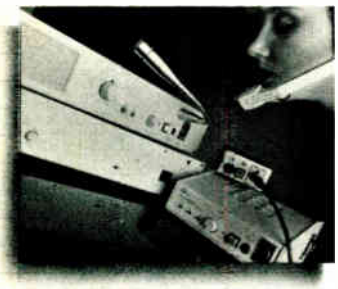
In Hugh Ford's article *A Technical Introduction to Compact Disc*, which appeared in the July August issue, we inadvertently reversed the analogue track formats used on the ¾in *U-matic* video cassettes utilised for *Compact Disc* mastering. The correct track formats are SMPTE-type timecode on analogue track 2 with P and Q sub-code information on analogue track 1.

Contracts

- Marconi has supplied the Ministry of Information, Bahrein, with two transportable MF sound broadcasting stations. Each station comprises a studio, two *B6038* 1 kW transmitters, and an *R5075* tunable umbrella antenna, installed in an air-conditioned 20 ft ISO container.
- Neve is to supply the new Home Box Office satellite distribution centre in Long Island, USA, with distribution amplifiers providing some 6,000 feeds.
- Brabury has delivered a *Series 310* studio talkback system for a new OB unit for London Weekend Television. Brabury has also received orders for a new EFP recording unit for Television South West, and for a new three-camera OB vehicle with sound mixing and microwave link facilities for the BBC.
- Professional Sounds Inc has completed the design and construction of a recording and actuality studio for the American offices of German Broadcasting, the non-profit public radio news service. The new studio is equipped with a Studer *169* console and *B67* tape machines.
- Soundcraft has recently completed delivery of 13 consoles to TV Manchete, Brazil's newest television network. The consoles, six *Series 2400* 28/24 with bargraph metering and seven *Series 800B* 24/8, have been installed in studios in five major cities, including the main production centre in Rio de Janiero.
- Audix has been awarded a contract for the supply of an assignable mixing console with 72 input channels mixing to eight stereo groups, plus main stereo and mono outputs. This mixer which is to be installed in one of the main television studios at the BBC Television Centre, London, will also have 10 auxiliary outputs, 24-track recording facilities, and will incorporate audience reaction and musical directors sub-mixers.
- Marconi is to supply the BBC with four *B6127 Pulsam* SW transmitters, plus antennas and a switching matrix, for the External Services transmitting station at Rampisham, Dorset. Marconi is also supplying the BBC with new VHF FM antennas for its Llangollen and Brighton transmitters.
- Scenic Sounds Equipment is to supply Central Television with five Lexicon *224X* stereo reverberation systems.

Between You And Everyone Else

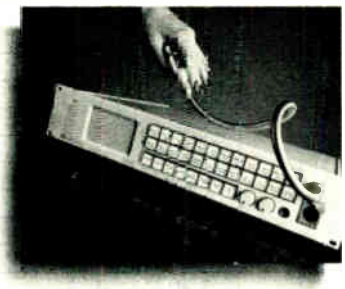
WE'RE THE ONE.



TW INTERCOM SYSTEM

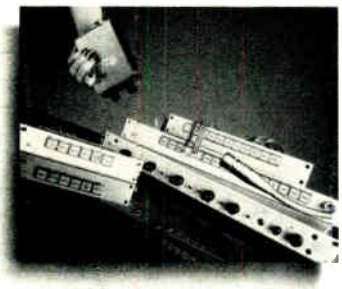
A high performance conference-line communications system featuring over 25 different components and accessories that allow an almost infinite variety of system configurations. It's universally designed for demanding applications in teleproduction and broadcast as well as industrial and commercial installations.

Standard TW features include: up to 75 user stations on line with minimum loading, powerful headphone amplification, carbon/dynamic headset capability, mic-level limiting, and two-channel operation on standard microphone cable. Sophisticated circuitry permits 12-volt power operation, two-, three-, and four-wire line formats, and balanced line operation. A series of versatile options are also available to meet virtually all special requirements.



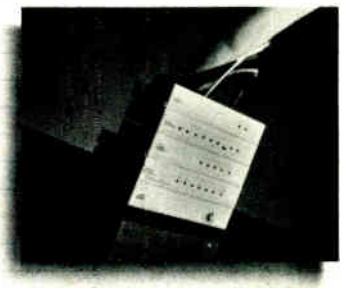
SERIES 800

The 802 Master Station is a unique micro-processor-assisted communications network providing 22 independent signal paths operating in up to six modes. It offers an impressive array of features including intercom, squawk, IFB/SA, station iso, and signalling. An intelligent combination of hardware and software programmability allows the user to conveniently structure an individualized operating format. Since the 802 is completely self-contained, it does not require space-consuming central electronics. Currently used in teleproduction, broadcast, theatre, security, aerospace and other industries, the 802 is both powerful and versatile enough to meet almost every communications requirement.



SERIES 4000 IFB SYSTEM

A one-way communications system created especially to meet the critical requirements of the television broadcast industry. This "program interrupt" system is used primarily to cue on-air talent. It provides program source material to the person on camera that can be interrupted with messages from the producer or director. Its modular building-block design allows the user to configure a system to meet specific requirements. A typical system combines User Stations, Central Electronics, and Control Stations. An essential broadcast tool.



SERIES 400 AMPLIFIERS

Application, performance, and reliability have all been carefully designed into the Series 400. The results: outstanding sound and unique versatility.

MODEL 405 PROFESSIONAL PHONO PREAMPLIFIER: High performance for broadcast stations and high-quality commercial installations.

MODEL 410 10-WATT MONITOR AMPLIFIER: A compact unit designed to power loudspeakers and headphones.

MODEL 424 DISTRIBUTION AMPLIFIER: High performance 1x4 audio D.A. with balanced input and four individually amplified transformer balanced outputs.

MODEL 416 DISTRIBUTION AMPLIFIER: Expanded version of the 424 with six outputs.

MODEL 444 DUAL TWO-CHANNEL BUFFER AMPLIFIER: Provides the necessary electronic interface between +8dBm balanced and −10dBv unbalanced circuits.

MODEL 465 MICROPHONE PREAMPLIFIER: A single-channel wideband preamp with transformer-balanced input and output.

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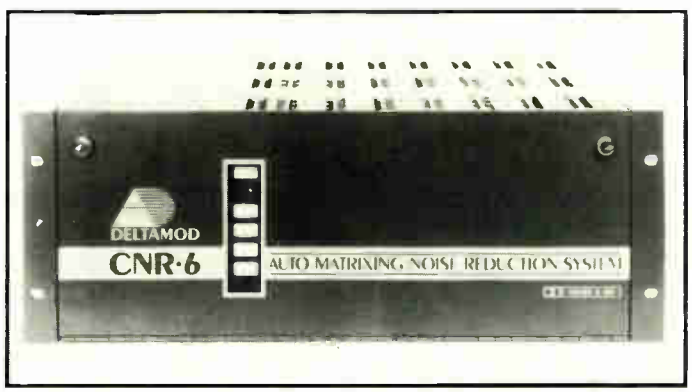
A COMPACT VIDEO COMPANY

Deltamod CNR-6

A unit which we seemed to overlook on its first appearance last year is the *CNR-6* Dolby noise reduction system from Deltamod. This system, which has been specifically designed with broadcasters in mind, is an auto-matrixing professional Dolby C-type noise reduction system giving precise and stable sum-and-difference matrixing, and fully automatic operation without any need for operator intervention.

Applications for the *CNR-6* system include broadcast cart machines, STL's and stereo telco lines, satellite links and videotape recorders. The sum-and-difference matrixing technique ensures mono-stereo compatibility on unequal stereo channel delays and permits easy intermixing of mono and stereo recording formats. This can prevent programme obsolescence when mono media, such as AM radio and television, convert to stereo. Used with any standard NAB cart machine, the system can automatically distinguish between older carts and those recorded with the new noise reduction matrixing format. FET switching offers full remote control as well, and the noise reduction and matrixing features are separately defeatable.

Available in rack mount or free standing configurations, the *CNR-6* system is fully modular comprising a mainframe and up to six stereo encode or decode modules in any combination. The system includes in-built oscillators and high resolution LED meters to allow routine alignment and performance checks on tape machines without test instruments.



Dolby level, channel balance, stereo separation and phase and head azimuth can be optimised for each tape machine. The phase metering can also be used for rapid evaluation of individual cartridge performance. For automatic operation no modification to cart machines is necessary and all the normal cart cueing functions remain fully operational. The system may also be switched remotely by the operator, by photocell sensors, by mechanical fingers on cart or video cassette players, or by computers and automation controllers.

The *CNR-6* system has balanced floating inputs and transformerless differential outputs capable of driving 150Ω telco lines directly. All set-up and calibration controls are behind a hinged front panel, and after installation no adjustments are necessary.

Deltamod Corporation, 2823 Ninth Street, Berkeley, CA 94710, USA. Tel: (415) 548-4858.

Tannoy Broadcast Monitor Eight

Tannoy, renowned for recording studio monitors, has recently been gaining a healthy reputation with broadcasters for its smaller monitor loudspeakers, especially the *Little Red Monitor*. At the recent APRS exhibition, Tannoy added a further model to its range, the *Broadcast Monitor 8*, specifically designed for broadcast applications. The new monitor uses a 200 mm (8 in) bass driver with a polyolefin copolymer cone and 40 mm (1½ in) voice coil, and a 26 mm polyamide soft dome tweeter. These drive units are linked by a new Tannoy crossover network termed *SyncSource*, which is a passive time delay network that aligns the high and low frequency sources in a single plane, thereby reducing time smear distortion.

The monitor cabinet which is 580 × 310 × 280 mm (23 × 12½ × 11 in), is constructed of 9 mm Birch plywood with 18 mm front and rear baffles. A bass loaded design with an offset ducted port, the *Broadcast Monitor 8* has a peak power handling capability of 150 W and a frequency response of 42 Hz to 20 kHz ± 3 dB. Impedance is nominally 8Ω with sensitivity for 1 W at 1 m of 91 dB. System connection is by terminals or a standard *XLR* connector. The monitor also features a treble energy control with a range of +4 dB to −12 dB over the range 3 kHz to 20 kHz.

Tannoy Ltd, Beadman Street, West Norwood, London SE27 OPW, UK. Tel: 01-670 1131. Telex: 291065.
North America: Tannoy Crown, 97 Victoria Street North, Kitchener, Ontario N2H 5C1, Canada.

Wireworks go Neutrik

Wireworks, the American company which markets a wide range of ready made interconnection products, has announced that henceforward all its *XLR*-compatible products will incorporate the Swiss-made Neutrik connectors. Full details of the products affected are available from Wireworks.

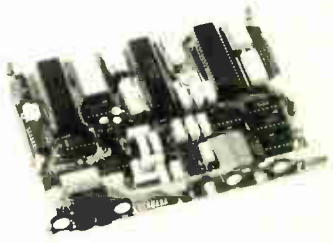
Wireworks Corporation, 380 Hillside Avenue, Hillside, NJ 07205, USA. Tel: (201) 686-7400. Telex: 710-985-4675.

Voice Microsystems tone signalling systems

UK manufacturer, Voice Microsystems, has introduced a range of tone signalling systems for mobile radio applications. The systems offer complete flexibility in the choice of signalling convention and operating protocol, and all functions run under software control such that any user requirement can be readily accommodated. Essentially the system consists of only two components, a programmable state variable filter and a microprocessor controller.

The programmable filter is a bandpass filter with constant Q, whose centre frequency may be set under software control. The microprocessor controller is based on a *Z80* CPU and includes program supervisory hardware to ensure reliability. Tone generation is referenced to a crystal source, with tone detection based on a comparison of in-band and out-of-band energy levels.

Identity setting for the mobile is provided on dual-in-line switches. Provision is made for a 6-tone sequence coded in binary coded decimal, while a 7-tone sequence can be set up if straight binary coding is adopted. Any length of receive tone sequence can be accommodated in the software. Other features of the system include auto-transpond with status indication (including the facility to receive and display status from the base station) and external connections providing an alert output indication and an alarm input.



Voice Microsystems Ltd, Abercynon, Mountain Ash, Mid Glamorgan CF45 4SF, UK. Tel: 0443 740331. Telex: 498606.

WE COMMUNICATE SOLUTIONS

A Production Team, a Video Team, any kind of team needs to communicate effectively. Technical Projects have the range of proven talkback systems for the professional; beltpacks, headsets, loudspeakers, camera adaptors—everything that is needed. Reliable wired and wireless systems, central switching and higher power radio links. We communicate solutions.

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* General purpose stereo or monomixer.
* Fully modular in construction. Range of modules for Broadcast Video or Film use.
* Long throw plastic conductive faders standard.
* Sweepable Mid EQ/ 100Hz – 10KHz standard.
* Adjustable peak l.e.d. indicator on PPM and VU meters.
* Three standard frame sizes 12-18-24 module widths.

* Two large illuminated VU's as standard (PPM's as option) on rear meter bridge, which houses the Cue Loudspeaker and 6 digit stopwatch/ clock (hours-mins-secs).
* Note: stereo Line of Phono input modules are same width – 45mm – as Line/Mic module.
* Transportable for mobile use, or drop through mounting for fixed installations.

The Chilton CM2 and CM4 audio mixing console

CHILTON

EVERYTHING WE DO IS JUST THAT LITTLE BIT BETTER

Magnetic Tapes Ltd, Chilton Works, Garden Road, Richmond, Surrey.
Tel: 01-876 7957 Telex: 912881CW

INTER BEE '83

This year's Inter BEE exhibition will be held at the Tokyo Ryutsu Center. Over 200 companies will be attending and the exhibition will be open from 10 am to 6 pm, Tuesday October 25 to Thursday October 27.

A

● **AB Systems**: range of power amplifiers including the *Model 1200*. ● **ADC**: wide range of audio and video cables. ● **Aiwa**: comprehensive range of audio products aimed at the consumer market, plus professional quality cassette machines. ● **Advancing Technology Corp**: *Discriminate Audio Processor III* AM, FM and TV audio processor. ● **AKG**: wide range of mics, headphones, phono cartridges and reverberation units including the *C414* condenser mic; the recently introduced *Tube* valve mic; and the *BX5E* and *BX25* reverbs. ● **Allen and Heath Brenell**: *Syncon B* mixing consoles and the *M24* multitrack tape machine. ● **Amek Systems & Controls**: *BCO1* portable mixer, *TAC* 10/4/2 small 8-track production mixer, an *M-1000* mixing console and modules from the *M-2500* and *Angela* consoles. ● **Ampex**: *ATR-800* tape machine, plus other models from the company's range. Also the full range of audio tape, cassettes, and video products including the Ampex/Nagra *C/VPR 3*, plus EECO timecode equipment. ● **Aphex**: range of ancillary processing equipment including the *Aphex II Aural Exciter* and the recently introduced *Compellor*. ● **API/Datatronix**: range of broadcast mixers, console modules and amplifiers, plus ancillary processing equipment. ● **Arriflex**: TV camera mounts. ● **Asaca Corp**: range of videoswitchers and test equipment. ● **Ashly Audio**: range of audio equalisers and ancillary processing equipment. ● **Audio Developments**: comprehensive range of portable mixers including the recently announced *AD145 Pico* and *AD160* ENG mixer. ● **Audio Kinetics**: *Q-Lock* timecode synchronising system with a new software control package. Also the *Mastermix* console automation system and the *Event Selector*. ● **Audio Technica**: range of microphones and phono cartridges. ● **Aurora Systems**: computer controlled video graphics system. ● **Autocue**: range of TV prompting equipment, plus caption and subtitling equipment.

B

● **Barco**: colour and monochrome TV monitors and ancillary products. ● **Belden**: comprehensive range of audio and video cabling products. ● **Beyer**: wide range of condenser microphones, plus dynamic mics, headphones and a radio mic system. ● **Bosch**: range of BCN, studio and portable cameras, editing systems, monitors and a digital telecine. ● **Bose Asia**: range of monitor loudspeakers. ● **Brooke Siren Systems**: range of ancillary audio processing gear including frequency dividing units and crossover units. ● **btx**: new *Shadow II* timecode synchronising system.

C

● **Calibration Standard Instrument**: range of video test equipment. ● **Canare**: range of audio and video cables. ● **Canon**: wide range of TV camera zoom lenses and accessories. ● **Central Dynamics**: range of audio and video distribution amplifiers, switchers and automated master control switchers. ● **Clear-Com**: wide range of intercom and talkback systems including the recently introduced *System II* microprocessor controlled system. ● **CMX**: wide range of timecode readers generators, plus video editing systems. ● **Continental Far East**: AMS (Advanced Music Systems) range including the *DMX15-80s* stereo digital delay/pitch changer; *RMX16* digital reverberation system; and the *A/V Sync* audio delay compensator for use with video synchronisers. Also Ortofon phono cartridges and Rebis audio processing equipment. ● **Countryman**: range of sub-miniature microphones. ● **Crest**: wide range of power amplifiers. ● **Crosspoint Latch**: range of video effects generators. ● **Crown**: range of preamplifiers and power amplifiers, plus the full range of *PZM* microphones.

D

● **Datatron**: range of timecode generators/readers and video editing controllers. ● **dbx**: noise reduction systems, *900 Series* signal processing equipment, and the *700 Series* digital audio processor. ● **Dearden Davies Associates**: *ENG Series* portable 4-channel ENG/EFP mixer; the *M Series* mobile and OB modular mixing system; and the *D Series* modular stereo production console. ● **Deltalab**: range of digital delay lines. ● **Dynacord**: range of PA orientated audio equipment including loudspeakers, stage mixers, amplifiers and effects units. ● **Dolby**: full range of professional noise reduction equipment including the recently introduced *M372* 2-channel portable unit.

E

● **Emu Systems**: *Emulator* keyboard instrument. ● **Electori**: wide range of equipment from Amber, Eventide, EXR, Lexicon, Quad-Eight, Telex and Ursa Major. ● **Electro-Voice**: wide range of microphones and monitor loudspeakers, plus the Tapco range of mixers and ancillary processing units. ● **EMT**: range of digital reverberation units, plus the company's studio turntables including the recently introduced *EMT 938*. ● **English Electric Valve**: comprehensive range of broadcast electron tubes. ● **Eventide**: wide range of audio processing equipment including digital delay lines; the *H949 Harmonizer*; *SP2016* effects processor/reverb; *Timesqueeze* time compression/expansion system; and the *RD780 Monstermat* mono/stereo matrix unit. ● **EXR**: *EXR Exciter III* audio enhancement unit.

F

● **Fane Acoustics**: range of monitor loudspeakers and drive units. ● **For-A**: wide range of video products including timebase correctors, pulse and sync generators, etc. ● **Fostex**: wide range of personal multitrack audio products including the *B-16* 16-track tape machine using ½ in tape. ● **Frap**: range of instrument contact transducers. ● **Fuji**: wide range of audio and video tape including audio and video cassettes. Also the full range of camera lenses.

G

● **General Traders**: products from Penny & Giles, Sennheiser and White Instruments (graphic equalisers and audio test equipment).

H

● **Hibino Electro Sound**: products from Klark Teknik, Soundcraft and C-Tape Developments including the C-Tape *C-ducer* contact mic system. ● **Hirakawa Electric Wire**: range of audio video cable products. ● **Hitachi**: complete range of video equipment including cameras. Systems for studio and ENG applications will be shown. ● **Hoei Sangyo**: *Ultimatte* and *Newsmatte* post-production and live video matting products. ● **Hokushin Precision**: 16 mm film projection equipment.

I

● **Ikegami**: full range of studio, EFP and ENG cameras. ● **Imai & Co**: Sound Technology audio test equipment including the *Model 1510 A* microprocessor controlled tape machine test set. Also the Synton range of vocoders. ● **Ivie**: *Gold Standard* reference calibration mic systems and realtime audio analysers.

J

● **JBL**: full range of loudspeaker drive units and monitor systems, plus an automatic mic mixer. ● **Jensen**: range of audio transformers.

K

● **Kangaroo**: audio and video pack soft cases for OB applications. ● **Kawamura Electrical**: wide range of products from Amber, EMT, Lexicon (reverberation units and sound processing equipment), Neumann (microphones), NTP (metering and display units), Solid State Logic, and Studer. ● **Keith Monks Audio**: comprehensive range of mic stands, cable drums, etc, plus record cleaning machines and various ancillary units. ● **Klark Teknik**: range of graphic equalisers, digital delays and audio measurement equipment. New items include the *DN 300 Series* graphic equalisers and the *DN 700* 3-output digital delay. ● **Klipsch**: range of monitor loudspeakers and drive units. ● **Koss**: wide range of headphones. ● **Kudelski**: *Nagra* range of portable and instrumentation tape machines including the recently introduced *T-Audio*.

L

● **Leader**: wide range of audio test instruments. ● **Lexicon**: full range of audio signal processors including the *224X* digital reverb, low cost *200* digital reverb and *LARC* remote for the *224X*.

M

● **3M**: wide range of audio and video products including audio tape, the *M79* analogue

AMEK BC01

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- INTERCHANGEABLE MONO AND STEREO INPUT CHANNELS
- 8 & 12 INPUT CHASSIS (8 INPUT RACK MOUNTING)
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- OPTIONAL TALKBACK/PFL SPEAKER
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U.S.A.
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multitrack, and the 32-track digital system. ● **Magnasync/Moviola**: series of magfilm transports and an optical telecine. ● **Magna-Tech**: *Multi-Lok II* film/video synchroniser and magfilm transports. ● **Martin Audio**: wide range of PA loudspeaker systems and ancillary equipment. New products will include the *M300* midrange horn; *RS1200* horn loaded system; *CX-2* 2-way ultracompact system; *215 MkIII* bass bin; *M600* midrange horn; and the *EX-2* equaliser/crossover. ● **Mathey Printed Products**: range of video delay lines and video filters. ● **Matsushita**: comprehensive range of audio and video equipment including TV monitors and digital audio products. ● **MCI**: see Sony. ● **Mic-Mix**: range of reverberation units, plus the *Dynafex* sound processor/noise reduction unit. ● **Midas Audio Systems**: *PR System* consoles for sound reinforcement, *TR System* modular theatre consoles and *Auditorium* console system. ● **Milab**: wide range of dynamic and condenser mics. New mics include the *MP-30* hemispherical mic and the transformerless *LC-25*. ● **Mitsubishi**: wide range of equipment including turntables, *Compact Disc* player, amplifiers and monitor loudspeakers. Also the *X-80* 2-channel digital tape machine and *X-800* 32-channel digital multitrack. ● **MRL**: wide range of audio test tapes.

N

● **Neumann**: full range of studio condenser microphones. ● **Neve**: wide range of mixing consoles including the *51 Series* and portable consoles. Also details of the company's *DSP* digital audio consol. ● **Nippon Columbia**: Denon range of studio tape machines, studio turntable, and *Compact Disc* player. ● **Nippon Electric Co**: wide range of distribution, switching and satellite communications equipment. ● **NTP**: wide range of audio metering and display units, plus compressor-expander and limiter amplifiers, equalisers and other processing units.

O

● **Oki Electric**: range of video standards converters and transcoders. ● **Orban**: range of audio signal processors including the *424A* and *422A* compressor/limiters and a new 2-channel de-esser. ● **Orrox**: range of timecode readers/generators. ● **J Osawa & Co**: products from Datatron, Rank Cintel (including a digital telecine) and VAS. ● **Otari**: full range of audio tape machines including the *MTR-12* ¼in and ½in stereo machines; *MTR-90* multitrack; and *MX-5050* 4- and 8-tracks. Also the company's cassette duplication machines. In addition products from UREI, Deltalab, RTS Systems and Orban.

P

● **PAG Power**: nickel-cadmium battery products and associated equipment. New items are the *Speedcharge 6000* microprocessor controlled charging system and the *10/90* multicharger/balancer. ● **Penny & Giles**: full range of conductive plastic audio faders including the recently introduced *3000 Series*. ● **Philip Drake Electronics**: wide range of audio distribution systems and intercom and talkback systems including the *Comprehensive* system. ● **Publison**: range of audio processing equipment.

Q

● **Quantel**: comprehensive range of digital video graphics and effects units, plus digital framestores and the *DAS 175* digital audio delay/synchroniser.

R

● **Rank Cintel**: analogue and digital telecine equipment including the *MK III C* flying-spot telecine and the *FeRRIT* magnetic sound recorder/reproducer. ● **Rank Strand Sound**: mixing consoles and sound reinforcement systems for auditorium applications. ● **Rebis Audio**: range of ancillary audio processing gear including the modular *200 Series*. ● **Revac**: batteries and battery charging equipment. ● **Rikei Corp**: wide range of equipment from Marconi including telecines, audio and video test equipment, and satellite and terrestrial transmission equipment. ● **Roland**: wide range of PA and musical instrument equipment including synthesisers. ● **Rhode & Schwarz**: range of TV and sound broadcasting equipment including FM transmitters and test and measurement equipment. ● **RTS Systems**: wide range of intercom systems including the recently introduced *Model 802* microprocessor controlled unit.

S

● **Sachtler**: camera mounts and tripods. ● **Sanken**: range of condenser microphones. ● **Sansui**: wide range of audio equipment including amplifiers, tuners and turntables. ● **SATT**: *SAM 42* and *SAM 82* portable audio mixers. ● **Schoeps**: wide range of condenser mics, new item is the *BLM 3* boundary mic capsule. ● **Seiwa**: range of audio equipment including amplifiers, cassette decks, etc. ● **Sennheiser**: condenser mics, headphones, radio mics and infrared systems. ● **Sescom**: comprehensive range of audio interface equipment including mic splitters, DI boxes, transformers, equalisers and audio test equipment. ● **Shintron**: range of timecode generators, readers and displays. ● **Shindenshi**: Mic-Mix reverberation units and Orange County equalisation units. ● **Shure**: full range of microphones, headsets, mic mixers and the *AMS 8000* automatic mic mixer system. ● **Sigma System Engineering**: range of sync pulse generators and associated equipment. ● **Solid State Logic**: *SL 6000E* computerised television sound console and the *SL 4000E* music recording console. ● **Sony**: comprehensive range of audio and video equipment. Audio products will include the *CDA-5000/CDP-5000 Compact Disc* analyser/player; *PCM 3324* digital multitrack with new remote; the recently introduced *MXP-61* 12-channel portable mixer; and new condenser mics for the Japanese market. Also the company's other digital products, UHF wireless mic systems including the *Betacam* system; and mixing consoles and tape machines from MCI. ● **Sony/Tektronix**: *TM 500* range of audio test instruments. ● **Soundcraft**: full range of mixing consoles for live sound, post-production, broadcast and music recording applications, plus the company's multitrack tape machines. ● **Sound Technology**: audio test and measurement equipment including distortion analysers and an automated tape recorder test set. ● **Sound Workshop**: variety of multitrack mixing consoles including models with broadcast orientated modules. Also the *Diskmix* automation system. ● **STL**: wide range of audio test tapes, plus audio test tapes for VTRs. ● **Stocktronics**: plate reverberation unit. ● **Studer**: first Japanese showing of the *900 Series* modular broadcast and multitrack console. Also the *A810* microprocessor controlled tape machine; the new *TLS-4000* tape lock system; plus the established range of Studer and Revox tape machines.

T

● **Taber**: wide range of replacement tape heads. ● **Teac**: comprehensive range of audio mixers and tape machines from the *Tascam* range including the recently introduced *50 Series*. ● **Tektronix**: see Sony/Tektronix. ● **Tentel**: *Tentelometer* tape tension gauge. ● **Thomson CSF**: wide range of video equipment including cameras, vision mixers, transmitters, etc. Also audio processing equipment and distribution amplifiers. ● **Toshiba**: wide range of audio and video equipment including cameras, video projection units, VCRs, amplifiers, tuners and a *Compact Disc* player. ● **Toyo Corp**: Barco range of TV monitors and ancillary equipment.

U

● **Ultimatte**: video matting products. ● **UREI**: range of monitor loudspeakers, equalisers and other audio processing equipment. Also broadcast mixers. ● **UNR-Rohn**: details of the company's transmitter towers. ● **Ursa Major**: *Space Station* echo/reverb processor and the *8X32* digital reverb.

V

● **Valley People**: range of audio processing and console automation equipment. ● **Victor Company of Japan**: JVC range of video equipment, plus the *Series 90* digital recording system. ● **W Vinten**: range of camera mounting equipment for studio, EFP and ENG applications. ● **Vital Industries**: range of video mixers, routing switchers, and video distribution equipment.

W

● **Westlake Audio**: details of the company's audio consultancy services, plus its monitor loudspeaker systems.

Y

● **Yamagiwa Technica**: Rank Strand lighting equipment including portable and studio systems. □

Broadcast Sound: deputy editor Noel Bell and executive advertisement manager Phil Guy look forward to meeting visitors on Stand 9 in the Audio Hall. Copies of *Broadcast Sound* plus those of sister publication *Studio Sound* will be available from our stand.

Autumn 1983

Across the Atlantic

Not surprisingly, Neve's largest single market lies across the Atlantic, where the Canadian and U.S. subsidiaries have gained a strong foothold and are an established household name.

The successful penetration of what is probably the world's most sophisticated and competitive audio market, is no doubt due to Neve's individual market approach and philosophy, expressed in a strong concern for "human requirements" in the increasingly complex world of the audio industry. Barry Roche, the new President of Rupert Neve Incorporated, feels very strongly about companies who, by adopting the "bells and whistles" approach, may seem to be moving forwards – at the expense of the basic necessities.

B. J. Roche – President of Rupert Neve Incorporated

Neve's tradition is simplicity embodied in ergonomic design. With the maxim "LESS IS MORE", the 8128 Series has been simplified by eliminating 1500 buttons, giving today's engineers the famous Neve sound without the tedious chores of resetting.

This tradition of simplicity of design and ease of use lies at the heart of Neve's latest development, the DSP Digital Console, and will play an integral part in Neve's approach to the consoles of the future.

Barry Roche adds dependability to the list of Neve qualities. The reliability and durability of the consoles' mainframes and their internal construction have persuaded more and more broadcasters to turn to Neve, even for that type of broadcasting most notoriously unkind to consoles, that of live TV sport.

Neve's position as leader in the audio industry carries strongly across a new North American advertising campaign which stresses those keywords of Neve: QUALITY AND RELIABILITY – sweet music to the ears of broadcasters and recording studios alike.

ATLANTIC RECORDS

With artists such as Paul Simon – Paul Sloman, Studio Manager for Atlantic Recording Studios New York, couldn't take a chance when specifying the new console for his remodelled studio – it had to be Neve.

Many weeks of effort later, the graceful 81 Series console with NECAM Automation takes pride and place as the focal point of studio B. The first Neve ever for Atlantic with the clean musical sound for which Neve are famous, based on the Formant spectrum equaliser.

Atlantic Recording Studios

Electric Lady's Underground Movement

Amid the dust and rubble is the new home for a Neve 8128 56-input console complete with NECAM Automation, making this the fourth Neve console purchased by Electric Lady.

Although the new mixdown room is below street level and down a flight of stairs, the 8128 console comes apart in sections, enabling the console to literally go around corners. This little known fact really makes a difference, especially when replacing an existing console in a room with limited access. Neve plan to install the console directly after the AES show in New York where it will be featured.

NEVE IN ORBIT

High quality, fast turnaround and expertise were the pre-requisites to clinch a $120,000 deal for the supply of distribution amplifiers, providing some 3000 feeds, at the soon to be completed satellite complex at Smithtown, Long Island, for Home Box Office. This latest order from the new HBO Satellite Distribution Centre was again awarded to Neve, who also landed the previous six contracts from the HBO for production and post production audio consoles.

The first edition of Neve Today achieved a circulation of 69,000 copies and we hear that it was well received worldwide.

Welcome to this second edition.

A Stamp of Success . . .

The Republic of the Seychelles, which last year launched its first ever television service, has issued a special set of commemorative stamps in recognition of the World Communications Year.

One of the stamps features the Neve 5432, 8 channel audio console as installed in an Outside Broadcast vehicle now located at Victoria on Mahe Island.

Seychelles stamp

STOP PRESS

World Premiere of First-Ever Digital System

The future is here today! Two years of heavy investment in research and development, human and financial resources and close co-operation with the broadcasting and television industry have resulted in producing a worldwide recognised technological breakthrough: The first all-digital professional audio system, Neve's DSP.

The DSP marks the beginning of a new era in digital sound mixing, as several leading names in the broadcasting industry are going digital with Neve. The forthcoming exhibitions (see "Show Guide" page 4) present an ideal platform for Neve's International Digital Launch and a unique opportunity to discuss the advantages of this system with Neve's digital experts.

BRITISH DIGITAL CONSOLE IS WORLD LEADER

By Richard Elen –
Editor of Studio and Broadcast Sound.

At a time when British music is once again being heard all over the world, it is appropriate that it is British technology that is leading the world in digital console technology, in the form of the Neve DSP (Digital Signal Processing) console. The DSP is unlike any other console currently available in that signals are digitised at the input where necessary and remain in digital format until they are sent to the studio monitoring system; all signal manipulations, including equalization, level control, compression, expansion and even delays are performed in the digital domain. In addition, the console is completely assignable, allowing an almost infinite combination of different configurations to be set

up and stored on floppy disk for instant use.

Although complete digital signal processing may seem an expensive approach, Neve firmly believes that it is the only really cost-effective approach to the problems of the "all-digital studio" of the future. The DSP concept allows far greater and more flexible operation by completely integrating the audio and control aspects of the console. This flexibility is easily used too, with the addition of high-resolution video graphic displays and software-controlled legends on the panels.

Of course, the DSP really comes into its own as part of a complete digital studio, utilising stereo and multitrack digital recorders and no doubt recording for Compact Disc or a similar medium. The digital console as a concept is the final – and central – addition to a studio of this type and, apart from other benefits, a DSP-type console will reduce the number of A/D D/A conversions required between microphone and master – one of the main areas of possible degradation in a digital audio system. The DSP handles AES-recommended digital signals and will thus interface happily with modern digital recording equipment. Ultimately, it will also be possible to patch outboard digital effects into the system without conversion.

Digital recording systems are the subject of major development projects all over the world, and the digital studios of tomorrow will incorporate equipment from many different countries. It is heartening to see a British development – the Neve DSP – at the centre of this new world of high-quality audio.

FIBRE OPTICS – THE MISSING LINK

By Dr. Martin Jones

Few people would have thought ten years ago that by 1983 the most effective studio system "wiring" would use glass instead of copper. Thanks to the Neve DSP digital audio system, recording studios, radio, TV and theatres are now recognising that modulating an LED light source with digital audio and transmitting it down optical fibre cable presents powerful advantages over conventional copper cable:

- 20 channels of 20-bit 48kHz sample rate digital audio on one fibre.
- Equally effective for high-speed control signals.
- Total freedom from earth loops, hum, RF and other electrical interference.
- No crosstalk.
- No audio high frequency loss or other signal degradation.

The fibre itself is drawn out of special glass and is only 50 microns in diameter, though its toughness resembles steel. An outer plastic coating provides immediate protection, then an outer PVC tube sheaths the fibre so that it is suitable for studio "wiring". For mobile and OB use, we fit as an even tougher protection a 9mm diameter highly-flexible polyurethane tube reinforced with "Kevlar" strain members. Normally carrying two fibres for a bidirectional (duplex) link, this rugged cable is resistant to most hazards such as crushing by a 25-ton truck or trapping in a well-fitting door.

Running at the frequency of 25 megabits per second, the standard Neve DSP link guarantees performance up to 1 kilometre, suitable for virtually all studio and mobile applications.

Now that the importance and potential of optical fibre transmission is widely recognised by the professional audio industry, Neve is working with its colleagues from other leading manufacturers to agree standards for connectors and transmission hardware and software. We anticipate the day in the not too distant future when those familiar bundles of twin-screened wire will be superceded by slender fibres.

Kenneth Baker examines fibre optics link.

Could we even be approaching the day when there is *always* enough room in the cable duct for the wiring to that extra multitrack machine?

British Minister of Information Technology communicates with the Neve factory in Scotland via Neve's Teleconference system.

During a recent visit to Neve's Melbourn factory, Mr. Kenneth Baker, Britain's Minister for Information Technology was clearly impressed by Neve's technological achievements.

His interest was captured by the digital sound mixing consoles now at advanced stages of production and Mr. Baker was invited to experience first-hand Neve's optical fibre transmission of multi-channel digital audio.

The Minister's busy schedule also included a demonstration of Neve's Teleconference system which enables groups of people in separate locations to participate in one meeting with an audio quality, as though they were in the same room.

Highlight of Mr. Baker's visit was without doubt the presentation of Neve's major technological breakthrough, the world's first professional digital audio mixing console which is now in its final stages of manufacture. Mr. Baker concluded: "It is encouraging to see this British company as leaders in this important international field of digital audio."

In front of Neve's Headquarters and the large Outside Broadcast vehicle which will accommodate Neve's first all digital sound mixer: Left to right: Laci Nester-Smith, Managing Director of Neve, Kenneth Baker MP, Derek Tilsley, Group Marketing Director, and Dr. Martin Jones, Group Techical Director.

Trading on a Reputation

The name GENERAL TRADERS does not automatically associate itself with high technology – yet General Traders is the leading Japanese distributor of high grade professional audio products.

GENERAL TRADERS is renowned for its outstanding technical service. Customer support at all levels is of prime importance to Mr. Ueshima, Chairman and Managing Director and his partner Mr. Shirushi who have built up a highly qualified team under the leadership of Mr. Yamada, Director of the Electronics Department.

Since their association with Neve back in 1970 both companies have grown together forming an ideal partnership.

In fact, one of Neve's largest single contracts ever placed was the direct result of close co-operation between Neve and General Traders: CBS-Sony Studios now have six Neve consoles and two NECAM systems.

GENERAL TRADERS and Neve look forward to welcoming you at INTERBEE.

General Traders' Chairman, Mr. Ueshima.

High Technology with a Human Touch

With the design of their new studios, Seibu has successfully combined an individual style with the environment of high technology audio equipment. The studios are now nearing their completion, and will be equipped with two Neve 8128 audio consoles which recently completed manufacture at the Melbourn factory.

Seibu's Studio A will be equipped with a 8128 48-channel console and a VCA Fader sub group system. Studio B will have a 56-channel Neve 8128 desk fitted with the NECAM Automation system. Clearly committed to high technology and quality sound, Seibu are planning to install a totally digital audio system in Studio C within the next two years.

Seibu's 8128 undergoes final tests at Melbourn.

How TV Asahi Saves Production Time

TV Asahi, one of Tokyo's leading commercial television organisations, have equipped their largest studio with two Neve mixing consoles. In addition to on-air news programmes, where the multitrack outputs from the audio console are effectively used for numerous network outputs and other cleanfeeds, the studio is used for audio post production.

Centre piece of the studio is a 48-channel Neve 8128 audio console fitted with VCA fader sub-grouping facilities used in conjunction with a 24-channel 5315 auxiliary sub-mixer.

Asahi's Studio 7.

The unique internal memories of the 8128 console enable the operator to recall assignments to suit the operational mode required, thus saving valuable production time.

NEVE TAKES NHK TO THE FOREFRONT OF POST PRODUCTION

NHK, the Japanese National Broadcasting Organisation in Tokyo, has completed a dedicated post production suite which is a topic of conversation throughout the Japanese Broadcasting industry.

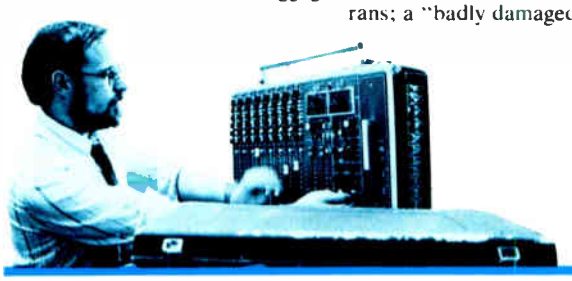
With this totally new approach to television audio post production, NHK has demonstrated its commitment to new technology.

The installation comprises a Neve 5116-48 channel mixing console incorporating NECAM automation interfaced with a Japanese synchronizing system.

NHK's post production suite – much discussed by the Japanese Broadcasting industry.

FALKLANDS' HERO RETURNS TO NEVE

One of the last casualties of the Falklands war has returned to Britain via a Heathrow luggage conveyor belt, receiving a far less ceremonial welcome than that reserved for other Falklands veterans; a "badly damaged" portable Neve 5422 recording console.



As part of the BBC radio broadcasting team, the mixer was in continuous use throughout the Falklands war, keeping Britain and Europe in touch with the latest events, and frequently operating under extremely difficult and dangerous circumstances.

Sadly therefore, that, after completing this vital service, it should be dropped accidentally some 20 feet out of the departing aircraft on to Port Stanley's runway.

However, it seems to take more than that to make a Neve broadcasting console speechless. Alan Archer, Neve's Customer Service Manager, found the system to be fully operational, the actual damage being purely cosmetic; a dented case.

Plastic surgery has been completed and the Neve 5422 is reporting back for duty.

Neve Today Neve Today

HOW NEVE GOT THE MESSAGE

ATTN: MR. G. BILTON
RE: YOUR TELEX OF 31.1.83
1. ACCEPTANCE HAS BEEN SIGNED.
MAY WE HEREBY THANK YOU FOR YOUR EXCELLENT COOPERATION.
CLIENT IS VERY MUCH SATISFIED.
BEST REGARDS
PSS 1-UKELIS
PROJECT MANAGER
ASBU
BOSCH FERNSEH DARMSTADT

The story behind this congratulations telex is a very exciting project undertaken on behalf of the Arab League ASBU (Arab States Broadcasting Union): the Damascus Centre.

An international body of the Arab League, founded in Cairo 14 years ago as a professional, non-political organisation, the ASBU seeks to promote training and co-operation in TV and Broadcasting throughout the Arab world. Member countries include Syria, Saudi Arabia, Iraq, Jordan, Kuwait, Qatar, UAE, Algeria and North Yemen.

The Damascus Centre, a culmination of ideas developed in the Seventies, came to fruition under Mr. Khudr Shah, and was built on prime land donated by the Syrian Government. Incidentally, Damascus is the oldest inhabited capital city in the world.

Using the most sophisticated broadcasting and recording equipment, the Damascus Centre now provides extensive training facilities in a complex which houses a TV Studio, a Sound Studio, a Central Apparatus Room and two classrooms. In association with the Arabic Centre for Viewers and Listeners based in Baghdad (also part of the ASBU), training courses tailored to Arab requirements now cover all technical aspects of broadcasting as well as programming and journalism.

The spectacular Damascus Centre.

Main contractors for this important project were Neve and Bosch Fernseh. As Mr. Khudr Shah pointed out: "We selected these two companies after an extensive survey of equipment and experience in the Arab world. Our main requirement was for high quality, reliable equipment widely used in the Arab world, to be supplied, installed and managed by companies with a proven Turnkey capability who had worked successfully together in the Middle East."

In the early stages, technical co-operation was provided by the British Broadcasting Corporation and the German Government, assisted by the expertise of Arab member countries.

The first phase of the project involved the equipping of TV and Sound Studios to full professional standards, together with a technical training classroom and workshop.

Neve's installation team, headed by Greaeme Bilton arrived at the beginning of February, experiencing the worst winter for 60 years and braving the elements to complete their part of the project which was ready for customer acceptance in May.

Neve supplied two 5104 consoles, distribution amplifiers, patchfields and an intercom system together with third party equipment to complete the audio system.

Bosch installed the video system. Co-ordination was essential at all stages between all contractors and Mr. A. R. Kassem, a technician from Neve's Syrian Agents was involved throughout the installation.

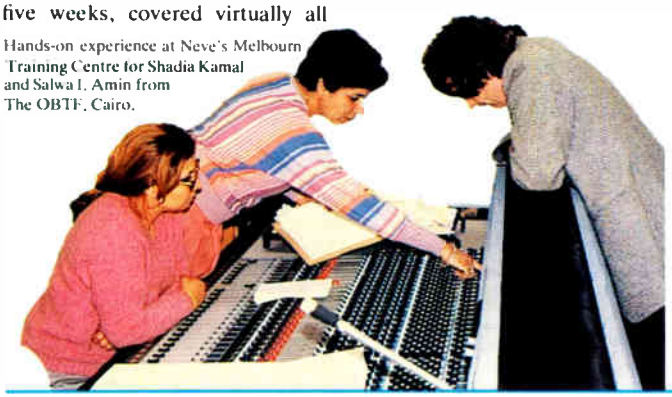
The Neve team returned to Britain in June presenting the customer's acceptance forms and the congratulations message.

Ladies from the Nile

NEVE's Turnkey Systems Division, headed by Adrian Bailey, provides extensive customer training both on-site and at Neve's own training centre. All training programmes are tailored to the needs of each individual installation and are offered on a world-wide scale.

Several months ago, the Organisation for Broadcasting and TV for Egypt (OBTF) delegated six lady engineers for training at Neve's Melbourn Training Centre. The course, which extended over five weeks, covered virtually all aspects of Neve's mixing consoles and included a vital introduction to English Fish and Chips.

The OBTF recently purchased 15 of Neve's new 51 Series stereo broadcasting consoles as well as a special customised music desk. Again, in the face of heavy international competition, Neve equipment was considered superior not only from the technical point of view, but also in terms of cost-effectiveness. Most of the units are now installed and in operation.



Hands-on experience at Neve's Melbourn Training Centre for Shadia Kamal and Salwa I. Amin from The OBTF, Cairo.

INTERNATIONAL RENDEZVOUS WITH NEVE

No important exhibition can be without Neve. Our presence will again be felt at the most important events taking place during the latter part of this year:

CTEAP	Paris, France	21–23 September
SBES 1983	Birmingham, U.K.	27 September
VIDCOM	Cannes, France	5–7 October
AES	New York, USA	9–12 October
Interbee	Tokyo, Japan	25–27 October

PS: Don't let a crowded stand put you off. Neve's post production demonstration always attracts enormous interest. But despite the crowds, you will always get a welcome.

JOIN THE VETERANS CLUB

Neve consoles have been around for over 20 years now and there are hundreds in operation throughout the world.

The very first Neve desk holds a prominent position in Neve's Melbourn museum, but who owns the oldest working console?

Gerry Humphreys of Twickenham Films hopes to claim the title and award for his 12-year old, 36-channel dubbing desk which is still in daily use today. Forest Studios are challenging this position with their multi-track recording console, also still in operation, after completing 13-years of service with the BBC, which proves that Neve consoles are built to last!

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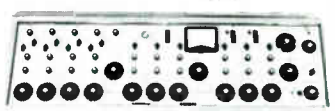

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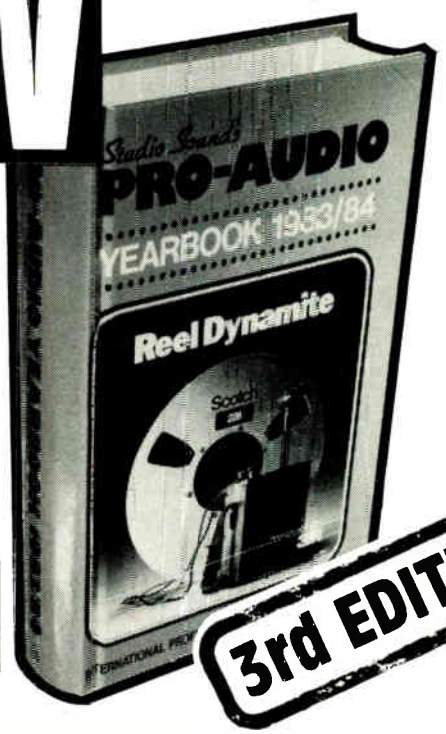

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VOICEOVER

Norman McLeod's regular commentary on events and trends

Radio academy

Proposals are presently being mooted for a Radio Academy, the aims of which are "to promote the quality.and interests of radio, and to stimulate the study and discussion of all questions relating to the medium." The Academy will organise an annual festival and awards scheme, a series of lectures, seminars and publications, and provide support for training.

One contentious proposal has been for membership to be open only to those who partly or wholly earn their living from radio. This caused a ruction in the deliberations of the working party set up to investigate the feasibility of the Academy, with journalist Anne Karpf vigorously dissenting from any proposition which would restrict the ability of anyone interested—including unpaid dissidents from any quarter—to join. Yet the professionals stood firm on requiring at least some paid involvement in the medium as a condition of membership.

The chairperson of the working party is BBC radio producer Caroline Millington. "My argument," she says, "is that it's high time for radio to come out of the closet and proclaim itself, noisily and with confidence. . . . I'm fed up with seeing my chosen medium downgraded and slighted, fed up with being asked: 'But when will you be moving on to television?'." If you want to know more, she can be contacted at PO Box CBF, London W1A 3BF.

Enfranchisement

If you have ever felt an urge to improve local radio—by being involved in an ILR franchise—then you may wish to consult *How to Win the Franchise and Influence People*. This is a blow-by-blow account of how to go about completing an ILR application, written by Wally Butler, principal lecturer in the Department of Communication Arts and Design at Manchester Polytechnic.

Butler is a veteran of three failed attempts to win a franchise from the IBA—Lancastria TV, which took on Granada in the North of England in 1980, Town & Tower Radio who contested the Preston/Blackpool ILR area, and Five Towns Radio in Stoke-on-Trent. So his track record doesn't inspire confidence. Nevertheless, this is a book worth studying should you be considering ILR as a route for broadcasting progress.

There are invaluable lists of contact addresses, and a 'mock' application is set out in some detail, with two possible formats for daily broadcasting. Butler issues many useful reminders about matters which would-be franchise holders may forget, but it's hard to dispel the thought that at the end of the day the stuff which emerges from the transmitters will simply bear the hallmark of the system which gave birth to it, and that franchise applications are just so much waffle. The very fact that a hypothetical Mercury Radio can be postulated as a potential station for the hypothetical area of North and South Stone shows just how vast the common ground is in current ideas about 'local' radio.

In some ways, this book serves to illustrate an approach which is unlikely to impress the IBA. Much of the text contains spelling and grammatical errors, and it would seem that a study of successful applications would be at least as profitable to the would-be broadcasting team as any attempt to emulate 'Mercury's' borderline literacy.

How to win the Franchise and Influence People is published by Visionwise Ltd for Independent Radio Facilities, 59 Riverside Court, Palatine Road, Manchester M20 8UF, UK.

Stereo TV saga

You remember the story of Messrs Ferguson, with their two-speakered 'supersound'? Well, the battle to bring two-channel sound alongside TV pictures is still being fought. The BBC is now saying that a dual-FM system, similar to that employed by the West Germans, is 'workable'. This would involve using an additional low-level FM carrier at about 6.3 MHz, and reducing the level of the existing 6 MHz carrier slightly.

It's all a bit shaky, to say the least, because in some sets the existing sound carrier is only just loud enough to overcome the losses and problems associated with intercarrier sound. Buzz-on-sound can be a problem with existing sets, and can only be made worse by turning the existing carrier down. Why turn it down at all, you ask? Well, apparently the beat pattern between the 6 MHz (sum) and 6.3 MHz (difference) signals can be visible on some sets, occuring at the highly prominent frequency of 300 kHz. This will produce some coarse (and objectionable) patterning on the picture, which can only be reduced by lowering the level of the strongest sound carrier.

The overall conclusions were that ". . . a system of this type might give a largely satisfactory service, but investigations are continuing into alternative possibilities."

The most important alternative possibility is some form of digital signal, using the DPSK (differential phase-shift keying) system originally tested by the BBC for sound radio transmissions in the Pontop Pike digital tests around 1978. (There—incidentally—it was concluded that digital sound radio transmissions might be OK for fixed receivers, but were a bit of a dead loss as far as cars were concerned.)

The DPSK signal would modulate a carrier at about 6.5 MHz with a bit rate of about 700 kb/s, and would carry two multiplexed NICAM signals. In other words, it would not rely on the 6 MHz signal to provide the mono information, but would—after decoding—amount to two extra sound channels in their own right. Because of the greater inherent ruggedness of the digital signal, it is hoped that this will provide acceptable reception with a much lower level of signal than the FM carrier, and that for this reason patterning on the picture due to interaction between the multiple sound signals won't be a problem. It's this system that the BBC will be investigating further.

There are many problems associated with extending stereo sound to the terrestrial TV transmitter network—quite apart from the question of how to transmit it. There's the problem of how to get the stereo signal to the hundreds of UHF TV sites up and down the country. At the moment, sound-in-sync is used to provide mono feeds with about 14 kHz bandwidth. It's being thought that the sync pulses might be stretched to include more information, but . . .

All in all it looks like the satellite will get there first. Eight channels of sound for each TV picture. Two for stereo, another two for stereo in another language, plus four more channels—possibly carrying data for commercial purposes. The mind boggles.

Soft soap

"Nearly everybody has something to gain by using air time, yet most people are appallingly ignorant about how to get it," claim Bruce Parker and Nigel Farrell in *TV & Radio—Everybody's Soapbox*. Parker and Farrell work for the BBC's regional TV outpost in Southampton, which produces a nightly input into *Nationwide* plus the occasional feature programme.

Anyone who has watched *South Today* cannot fail to grasp the truth of this book's assertion that 'broadcasters are often desperate to find interesting material'. This book will be revealing to those who have little idea of what goes on behind broadcasting scenes, giving a light-hearted and at times rather light-weight account of the processes involved in broadcasting.

It is something of a misnomer to call TV and radio 'everyone's soapbox', since the essence of soapbox oratory is that you can talk for as long as you wish, subject only to the ravages of heckling. On broadcasting, as the authors freely admit, your contribution will be processed according to the 'strength' of the subject matter, the 'strength' of you as a subject, and the length of other items in the programme. Whether or not you succeed in getting your message across effectively is less important than that you should make good, popular television. This book ' . . . teaches you how to handle the inevitable superstardom you will achieve when you have read it!', or so it claims, which gives you an idea of its general tone.

This book is an invitation to participate in broadcasting on the broadcaster's own terms—if you don't mind playing the game by the standard set of rules, you should find it helpful. I hope that it improves our local TV, and will be watching with interest.

TV & Radio—Everybody's Soapbox is published by Blandford Press, Link House, West Street, Poole, Dorset BH15 1LL. USA: Sterling Publishing Co Ltd, 2 Park Avenue, New York, NY 10016.

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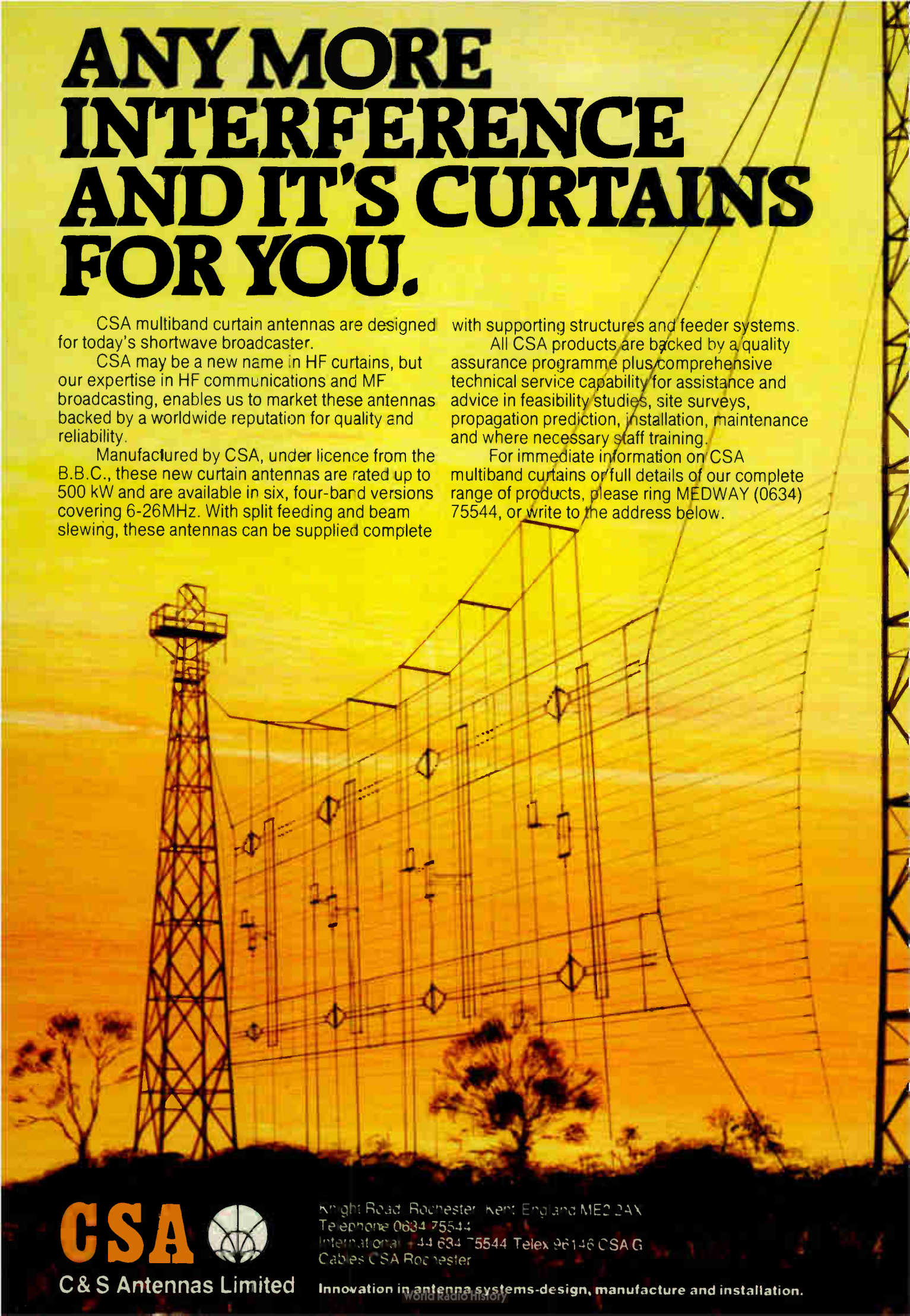

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MULTI-PURPOSE AUDIO/VIDEO POST-PRODUCTION AT NHK

Moitoifumi Tsukatani
Masaki Sawaguchi

NHK (Nippon Hoso Kyokai) the Japanese broadcasting organisation, has recently completed a new multi-purpose audio/video post-production studio in Tokyo. This studio exhibits many unusual features including an NHK developed post-production control system. Moitoifumi Tsukatani of NHK's Engineering Headquarters and Masaki Sawaguchi from NHK's Programme Engineering division reveal all.

In Japan, stereo sound programmes and bilingual broadcasting have been provided since 1979. Although our techniques in this field have progressed substantially, NHK has found that special music programmes—such as television multi-audio programmes, FM stereo programmes and live concerts—demand more sophisticated techniques of audio post-production. Until now NHK's practice has been to use multi-audio VTRs—2 in VTRs with four audio tracks, on to which sound effects and music are loaded—and cinecoders for film. These systems when utilised for post-production purposes unfortunately have two drawbacks: a restriction in the available number of audio tracks; and a degraded sound quality. Also they entail operational restrictions in their ease of use by engineers and producers. To overcome these restrictions NHK therefore introduced tape lock control systems for its post-production work. Whilst these tape lock control systems significantly improved the post-production process, it was felt that since sound engineers and producers have to deal with increasingly complex sound processing, the existing system could be further improved. Accordingly, research and development work was undertaken to produce a new, effective audio post-production system. This new system which comprises a multichannel computer assisted audio console and a modified tape lock system is described here.

Studio CD-807

The new NHK audio post-production system is installed in Studio CD-807, NHK's main post-production room in Tokyo. This studio is a reconstruction of a former dubbing room and has a voiceover booth for commentary insertions. The room is spacious and the equipment layout (**Fig 1**) was carefully designed to give comfortable working conditions. A full listing of the equipment located in the studio is given in **Table 1.**

From the studio layout it can be seen that the centralised mixing position forms the heart of the post-production system, with the mixing console, effects table and tape lock controller situated alongside each other. As the mixing centre we chose a Neve *5116* console—the first of this model to be installed in Japan. This console is a 48 input model with eight groups and is fitted with *Necam II* automation. In choosing this type of console we took into consideration the following factors:

- it is suitable for 24-track mixdown;
- each input includes a limiter and expander;
- the console has eight auxiliary sends, which is convenient for reverb and effects purposes;
- the group modules and subgroups can be effectively divided by using channel status modules.

Table 1 Equipment Roster

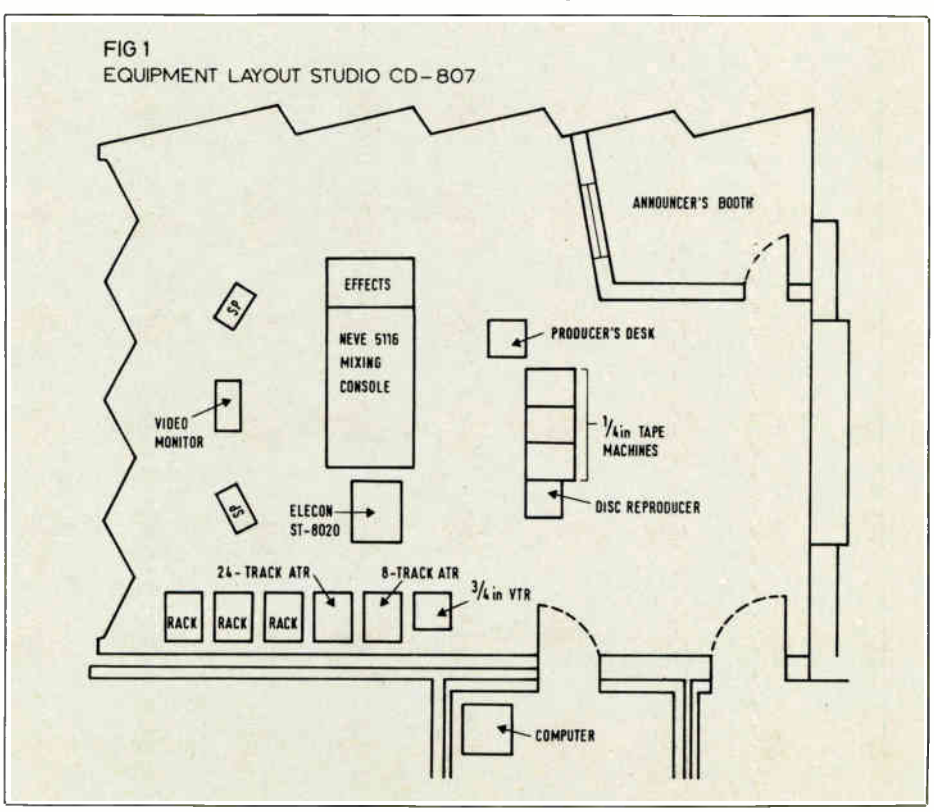
Console:	Neve *5116* with *Necam II* automation
Tape Machines:	Studer *A800* 24-track
	Studer *A800* 8-track
	Denon *DN-3302N* ¼in machines (3)
Synchronisers:	Elecon *ST-8020*
	Neve *Necam II*
Grams:	Denon *DN-308F*
Effects Units:	Eventide *H 949 Harmonizer*
	EXR *EXR-3* aural exciter
	Lexicon *Super Prime Time*
	Valley People *Kepex-II*
	AKG *BX 25ED*
	Matsushita *DPEQ* digital parametric EQ
	Matsushita *DDEQ* digital direction EQ
Monitoring:	Sony *VPP-5011* video projector
	JBL *4345* loudspeakers
	Mitsubishi *AS-3002N* loudspeakers
	Auratone loudspeakers

Synthesiser recording

The choice of *Necam* automation was governed by two factors. Firstly, we wished to have an elaborate fader under fingertip control. Real time adjustment would be possible by using the *Necam* fader, and in addition it was important that a display facility be available in case we used other computer assisted systems. Secondly, we required sophisticated programme editing and mixing with the facility for simple edit or insert corrections. *Necam*'s sophisticated operational software, particularly its 'Label' and 'Mix' functions and 'Merge' and 'Suspend Mode' filled our criteria.

The tape lock controller, which is situated to

FIG 1
EQUIPMENT LAYOUT STUDIO CD-807



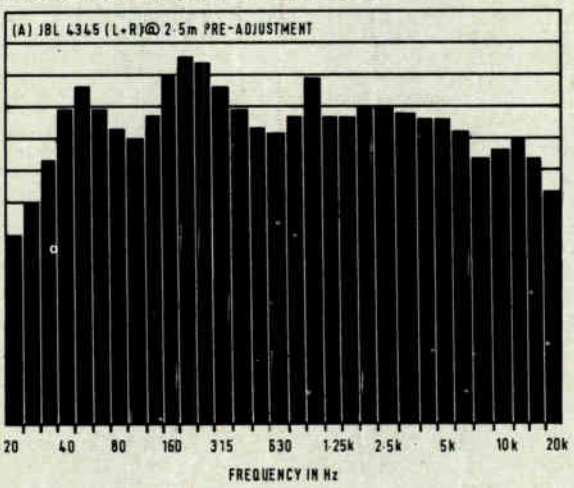
Neve console & Elecon synchroniser

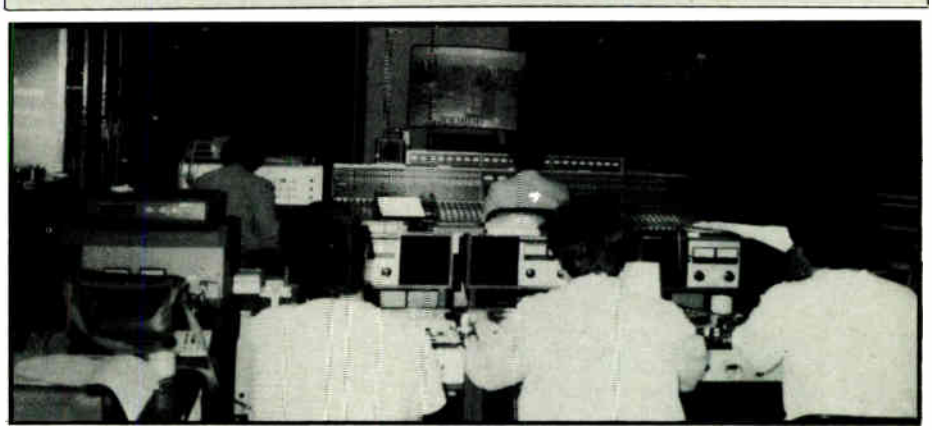
the left of the Neve console, is based on the Elecon *ST-8020* tape lock system, and its main functions are designed for efficient operation. The controller uses SMPTE timecode for synchronisation, with a ¾in VTR as the master and with the audio tape machines as slaves. This controller can give a full range of commands to multitrack tape recorders, events control instructions to three ¼in machines, etc. The controller also has a remote for the ¾in VTR for searching edit points, plus a unique A, B and C mode selector, and a TTY (teletype keyboard) which is useful for continuous operations such as drama programmes, etc.

With regard to monitoring facilities in the studio, we have a 50in Sony video projection monitor which was chosen especially to give a picture capable of matching the main JBL *4345* monitors. *Auratones* are also provided as smaller 'reference' loudspeakers. The JBL's, incidentally, were chosen for 'full-power' monitoring as an additional alternative to the NHK standard—Mitsubishi *AS-3002N Diatone*—reference monitors.

As Studio CD-807 was reconstructed from a former dubbing and music recording studio, it has a slightly live acoustic. This characteristic, after installation of the equipment and ⅓-octave room equalisation, has been retained. We believe the slightly live acoustic atmosphere to be favourable and it is particularly appreciated by users who are bored with the tight and dead sound found in most 'fusion' music. Following installation of the equipment the acoustical frequency response of the room was fine tuned to achieve an optimum relationship between the monitor loudspeakers and the mixing position. **Fig 2** illustrates the acoustical response at the mixers' seat before and after acoustic tuning. Optimal monitoring balance was also checked via aural tests using the monitors and room equaliser.

FIG. 2
ACOUSTIC RESPONSE STUDIO CD-807





Silk Road post production

System configuration

The most painstaking effort involved in the new NHK audio post-production system, was the problem of how to efficiently combine the facilities of the Elecon *ST-8020* domestic tape lock system and *Necam II*. Besides which we had also to make the studio suitable not only for music programme mixdown, but also for complicated TV post-production. In this instance we drew on our operational experiences of our other post-production studio at NHK fitted with the same tape lock control system.

The Elecon *ST-8020* has the following functions:

- synchronisation of the master VTR and the slave multitrack recorder (maximum two slaves);
- timecode offset in synchronisation;
- events control (maximum 200 events);
- automatic location of the master and slave to the editing point;
- data filing.

With these functions we connected the *ST-8020* and *Necam* such that we could divide the system combination into three modes of operation—A, B and C. **Fig 3** schematically illustrates these three modes.

Mode A is designed to be used for sound multiplexed TV programmes, main stereo music programmes, stereo drama productions and the soundtracks of internationally exchanged programmes. The most important feature of this

mode in the system's configuration is the control of the master VTR. Because *Necam* has no shuttle and jog mode to search for a VTR's editing point—which is inconvenient particularly when searching for very critical cutting points in drama scenes—we made it possible to control the VTR both by *Necam* and by the *ST-8020*. Accordingly, we can give commands such as FF, REW, PLAY and STOP to the VTR from both the controllers, and shuttle and jog from the *ST-8020*. Editing data is flown from the *ST-8020*.

To summarise, mode A is a control system in which *Necam* functions are added to the *ST-8020*.

With regard to events control in mode A, we remove the event functions from *Necam*, and a maximum of 200 events are input from the *ST-8020* only.

Turning to mode B, this is designed only for use on mixdown of music programmes. In this mode we can utilise the full functions of the tape lock system. It is possible to synchronise slave 1 and slave 2, that is the master 8-track Studer *A800* and the slave 24-track *A800* and increase the available number of audio channels to 30—the other two tracks being used for SMPTE timecode.

Finally, mode C is where the system is controlled solely by *Necam*. Incidentally, the *Necam* controller can be moved from the main control console to the mixer if required.

In our view it is effective to use the same raw audio material for both TV and FM programmes. For instance, original material is first mixed for a TV programme, and then the same material is used to mix pure FM music programmes. These three modes are ideal for fulfilling the various media broadcasting requirements of NHK.

FIG 3 POST-PRODUCTION MODES

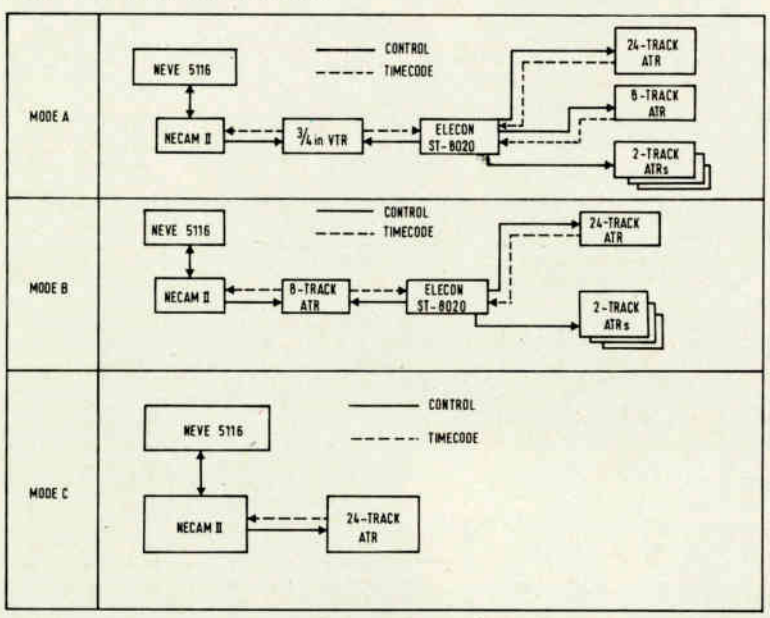
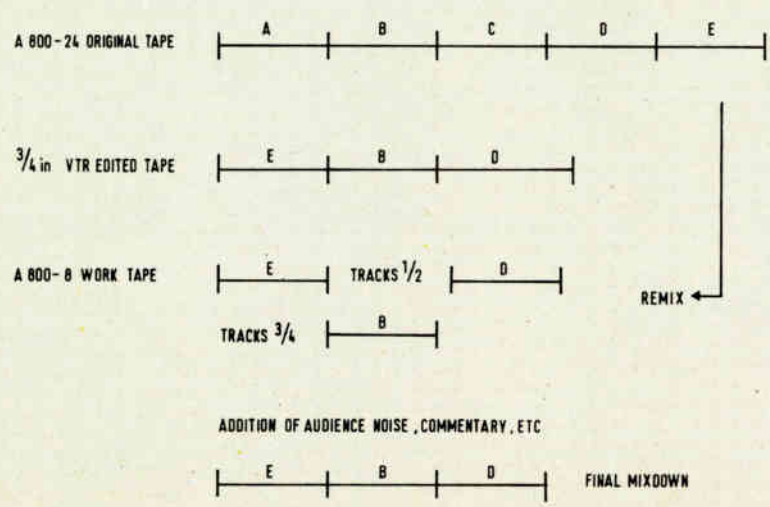


FIG 4 REMIXING SEQUENCE FOR LIVE RECORDING



Utilisation

Studio CD-807 is the main television and FM broadcast audio post-production studio. The type of programmes for which the studio is used are musical programmes (TV and FM), and television documentaries and drama. The ratio of use is approximately 70% : 30%.

Music programmes are either recorded in a studio or as an outside broadcast with a multitrack recorder, and then remixed and completed in Studio CD-807. Occasionally, however, this studio is utilised for recording programmes with synthesiser or other keyboard music. Composers or players, play in the studio and complete takes or overdubs are recorded on site. Finally, these are mixed down in the usual manner. Thus, the studio can also be used for recording purposes.

A typical post-production mixdown can be as simple as remixing TV or FM programmes, or a multitrack tape with (or without) the VTR master. Mixed programmes are recorded onto a Studer *A800* 8-track, and for remixing live recordings this machine is usued to produce a 'working tape' with offsets. **Fig 4** illustrates the sequence of remixing for outside broadcast live performance recording. (Such productions are usually of popular music with artists such as YMO Shakataku, UB 40, Christopher Cross, etc.). Here we record the video and audio separately on the VTR and multitrack with SMPTE timecode synchronisation. The programme director then edits the video tape and the mixing engineer remixs the multitrack sound along with the video. Where necessary audience noise, title themes, or commentary is added at final mixdown. In instances where we have to broadcast the same programme on the air both on TV and FM, we change the sound balance respectively for the TV and FM versions.

With regard to television drama and documentaries we are in a rather special position. NHK began broadcasting sound multiplexed TV programmes some five years ago—NHK were the pioneers in this field. Accordingly, we have attempted to make stereo television documentaries and drama programmés. This is one of the most difficult TV production tasks we undertake. We have completed two kinds of drama documentary programmes of this type. Broadcast on 5th May was an original television drama, entitled *Room*. This was recorded both in a studio and on location, all on video. The second programme was an NHK special *Silk Road*. This is one of the most famous programmes in Japan, and has been broadcast with stereo sound monthly since 1982. NEK's reporting team started in China and then moved to Turkey to report on the country, its people and its culture. The programme uses music composed by the popular Japanese synthesiser composer Kitaro.

Conclusion

We will continue to develop the post-production system currently in use, and will attempt to ensure that audio makes an even bigger contribution to our broadcasting services. In addition, we will endeavour to persuade mixers and producers to make more creative use of the system. □

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SARNER AUDIO VISUAL

Pippa Lewis

Audio-visual production has long been considered a poor relation to the more glamorous world of film, television, radio and music recording. However, as Pippa Lewis relates, at one UK facility, Sarner Audio Visual, this attitude is totally reversed.

Sarner Audio Visual is a fascinating network of studios, control rooms, viewing theatres, workshops, offices—to avoid confusion the studios have all been given different coloured drapes—all cleverly planned and co-ordinated in the company's custom-built premises in Woodstock Grove, West London.

Sarner has produced some of the most complex soundtracks ever made and to date has put out some 75,000 hours work. They specialise in producing multi-channel, multilingual soundtracks; and recordings are in use throughout the world for applications such as sales and training activities, large scale promotions, permanent exhibitions for museums and leisure parks and a wealth of communications type recordings. These range from the simplest form of announcement recording, such as an in-flight announcement system for airliners to gigantic highly complex six channel soundtracks for applications such as spectacular product launches and recordings for public multi-media 'Experience' shows. Sarner also do complete post-production video soundtracks.

The company has been in business since 1967, and during the mid-70s had begun to attract such a large amount of work that the premises they then occupied—with three sound studios and a room for visual synchronisation—had become far too small. While Sarner had established a strong client base and a good reputation in the audio visual industry, the decision to move to new premises incorporating twelve studios was an ambitious one. In addition, just after the building was completed came the beginning of the recession. Despite the economic circumstances, Sarner managed through sheer determination and, according to managing director Peter Sarner, "by deciding not to go the route of price cutting, but by improving even further our standard of service", to increase growth and production to the extent that it is now probably the most experienced audio visual studio complex in Europe.

The company is split into three divisions. The Facilities Division which comprises five broadcast standard sound recording studios—2-track to 16-track, specialising in soundtracks in virtually any language (28 at the last count ranging from Icelandic to Swahili!), and including computerised VTR sync-lock facilities for video soundtracks—plus dubbing studios and two visual theatres fully equipped for computerised multivision programming and tape/slide sync-pulsing.

The Equipment Division specialises in the design and installation of permanent audio visual and communications systems including custom engineering and turnkey projects. Sarner is also a main dealer for most leading audio visual equipment, and sole European distributor for several important manufacturers. There is also a very large range of equipment available for hire.

The third and complementary side of the organisation is the Professional Division, which acts as a consultancy service for advice, research, systems design, specifying, project management and subsequent certification.

Sarner carries a large library of music and sound effects—around 30,000 tracks, and rarely uses live musicians. Accordingly, as much of the music is pre-recorded the five recording studios are small and compact. Whilst the studios are not usually used for live music, if it is required this is usually catered for by using synthesisers, drum machines and suchlike.

Studio One is the largest and uses an Ampex *MM1200* 16-track with an Alice *ACM* 16/16 custom built desk, Audio Kinetics *Q-Lock* synchroniser, full quadraphonic monitoring and room for up to 10 artists. A unique feature on Sarner's Alice *ACM* is a 640 way switching matrix to handle patching and routing. There is also video monitoring in both the studio and control room, and tie lines from the control room and the studio to all other control rooms and studios for dubbing or any special requirements.

Moving to Studio Two this has an Ampex 8-track with a Soundcraft *2400* console and room for up to five artists. Although Studio 3 was only commissioned three years ago it is currently being upgraded and is to be refitted with a Soundcraft *2400* console. "We want to improve all the time" says Peter, "and feel we have to do things properly. We try not to be fashion conscious and try to do things that make good sense. When modifying the capability of a studio, one takes the opportunity to raise the standard continually. We particularly wanted to expand the specification. Alice were very helpful when we had problems finding a console—particularly as we need something inbetween a music console and a broadcast console. They literally custom built from scratch and we have the prototype of the *ACM* range in one of our dubbing rooms."

Studio Four is 2-track with another Alice *ACM* console and can also hold up to five artists. This studio is ideal for most audio-visual work and also caters for broadcast production live mixes. Studio Five is at present under reconstruction.

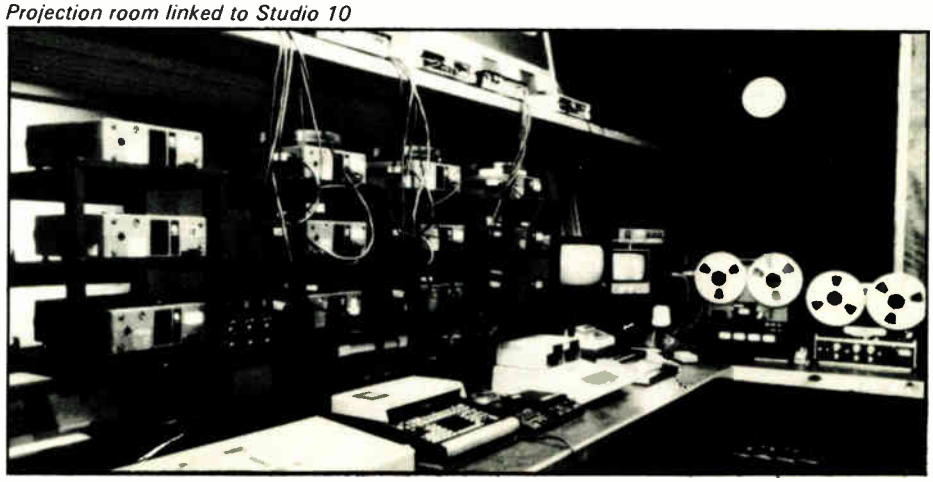
All the studios are fully suspended and floating for sound-proofing. They all have air-conditioning, refrigeration and isolated mains supply. Control room and studio lights, air conditioning and ventilation come up on remote controls on the consoles throughout. The control rooms are large and extremely comfortable. "With soundtracks the ratio of use is around 1:6", Peter points out, "one hour in the studio and six in the control room; we wanted really comfortable control rooms".

Equipment in use in the sound dubbing studios includes Ampex and MCI tape machines, Alice and Soundcraft mixing consoles, Audio Kinetics synchronisers, Sony VTR's, Neumann and AKG studio mics, dbx and Dolby noise reduction and Tannoy monitoring. Due to its refurbishment programme Sarner currently has a surplus of equipment, so if you're interested good homes are being sought for Neve, Alice and Midas desks which are no longer in service. A number of multitrack and 2-track studio machines are also surplus to requirements.

Studios 6 to 9 cover pre- and post-production services, ie. music selection, audio and video dubbing and transfers and multiple copying. Studio 6 handles high speed cassette copying, Studios 7 and 8 handle sound transfer and dubbing, with Studio 9 being used for pre-production selection of music and sound effects. Studio 10 is a programming and visual synchronisation suite where complete audio visual programmes are assembled. The suite includes a multi-image theatre which seats ten and its associated control and projection room. Features of the suite include microprocessor controlled slide projection equipment, programmable lighting facilities, laser projection equipment, and quadraphonic monitoring. Studio 11 is for visual sync encoding and viewing.

In addition to the aforementioned facilities Sarner also has its own technical workshops

Projection room linked to Studio 10



which includes a limited metalworking capability.

Sarner numbers among its clients literally hundreds of audio visual and production companies throughout the world as well as numerous industrial, commercial and leisure organisations. Studio work varies from training and communication programmes for clients such as British Telecom, through major sales launch soundtracks for users such as IBM and Rolls Royce, to giant quadraphonic (or more) multilingual blockbusters as used for the international presentations of British Leyland or Rank Xerox. However, a job might also be simply the recording of automatic emergency announcements as used in public aviation, or the preparation of a set of special audio effects to enhance, say, tableaux at a wax museum. Regardless of the complexity Sarner always treats each project with respect and enthusiasm which is perhaps why they have won numerous gold and silver awards for excellence both in Europe and America. International work has included a complete series of radio dramas for Radio Nederland and also the final assembly of the BBC's marathon 6½ hour History of World Broadcasting for New York's Museum of Broadcasting. Clients regularly fly in from Europe, the Middle East and America; and more recently a customer came all the way from Indonesia to do 'a couple of days' work in the studios. Sarner has numerous foreign translators and actors on its books, and pioneered the system of synchronising multiple language productions on multitrack tape.

"We try to be very flexible" says Peter "and provide many options. If the client prefers we will provide a studio on a self-op basis if the producer wants to control his own soundtrack; at the other extreme we will do literally everything from rewriting the script and selecting the actors to attending to all copyright clearances and licensing, and subsequently marrying sound with vision. The whole A/V industry seems to use us as an information centre about anything, be it technical or whatever. In terms of competence I like to think we are well respected in the whole industry; nearly all audio visual production companies have worked in our studios and do so currently. Even the BBC have, on occasion, found it more satisfactory to use us rather than one of their own studios, and we have had many comments made on the happy atmosphere here.

"One advantage of having a reasonable number of studios is that we can very precisely match the job in hand to the studio requirement, and the engineer to the personality of the client. We match the chemistry together so that things go well and the job becomes a pleasure. There is quite a bit of competition around at the moment, but we think one of the benefits here is that the client feels safe with a company like ours—we not only have the safety and security of scale, and tremendous equipment and personnel resources at the disposal of the client, but we also provide a very personal service and usually enjoy the job in hand.

"Everything in the building has been designed around the specific type of work we are doing. You can certainly go to a music studio for a soundtrack or voice production, but the engineers are not specialists in our particular market. We have a team of 25 people and on the recording side alone there are six studio engineers who are all very professional and have good pedigrees. I am very proud of what we've got."

16-track Studio 1 is capable of SMPTE locked video sound production

Interesting projects undertaken by the Sarner organisation include the complete technical responsibility for the Mandarin Singapore Conference Centre. This was a massive installation which took more than a year to design and incorporates three separate control rooms linked to a huge automatic and stage lighting system, simultaneous translation facilities, a 120-way automatic digital switching system, an array of remote control and communications facilities, and an incredible sound system capable of 48 channel mixing and utilising some 48 power amplifiers feeding more than 40 large loudspeaker systems. Sarner also recorded and installed all the automatic audio throughout Copenhagen's Louis Tussauds Wax Museum. In this installation some 120 dual concentric loudspeakers were arranged through 23 sound zones with tape replay coming from Mackenzie Laboratories continuous loop cartridge machines (for which Sarner are the international distributors). Auto sensing systems activate various audio effects at appropriate times and the Mackenzie machines go through literally hundreds of thousands of start/stop cycles repeatedly. The total number of automatic performances completed so far is estimated at over four million and Sarner's are particularly pleased that this unique 'power-drive' cartridge system has averaged more than 100,000 performances between the need for tape changes. These machines have also been installed with appropriate soundtracks in many applications throughout the world including the Science Museum, British Telecom, The National Gallery, Gatwick Airport, The Imperial War Museum, and theme parks such as Disneyland and other notable places.

Sarner's studios have also been popular with the record companies for book cassette productions and recordings including such personalities as Britt Ekland reading her autobiography *True Britt*, and Margot Fonteyn reading her autobiography. Other famous people recently recorded by Sarner include James Mason, Sophia Loren and Lord Snowdon.

At present Sarner have just completed another first for the audio visual industry—producing a major ambisonic soundtrack. Ambisonic encoding enables the producer to have his finished soundtrack on two tracks of tape which is completely mono/stereo compatible but which, when decoded, contains stored information for producing 'surround' sound—very much like quadraphonic. This gives a very stable sound image so that from any position in the audience the perspective is correct. Ambisonics can be 'retro-added' to existing masters or tracks laid in the normal way via a 'transfer' for re-recording onto a 2-track master tape. The real benefit of Ambisonics is that encoded tapes can be replayed through normal stereo-type audio visual setups, for small presentations, and the same tape give complete 'surround' sound through a suitable decoder feeding several speakers placed around the auditorium.

Besides Ambisonics, Sarner is also involved in various specially created music and effects tracks, mainly using synthesisers and other electronic devices. The future looks full of promising challenges but, as Peter points out, "We grew from modest beginnings often handling work which others seemed to find uninteresting and have today become one of the very few major studios set up primarily to handle audio visual and video soundtracks. In terms of our specialised activities and the many related peripheral services offered it is nice to hear that we are so frequently acclaimed as the leaders in Europe."

Last word from a satisfied customer, Caribiner Inc., probably the world's most respected audio visual productions corporation, "We like the place and we like the people, and have never come away without the sound we are looking for." □

Sarner Audio Visual, 32 Woodstock Grove, Shepherds Bush, London W12 8LE, UK. Tel: 01-743 1288. Telex: 85715.

Solid State Logic

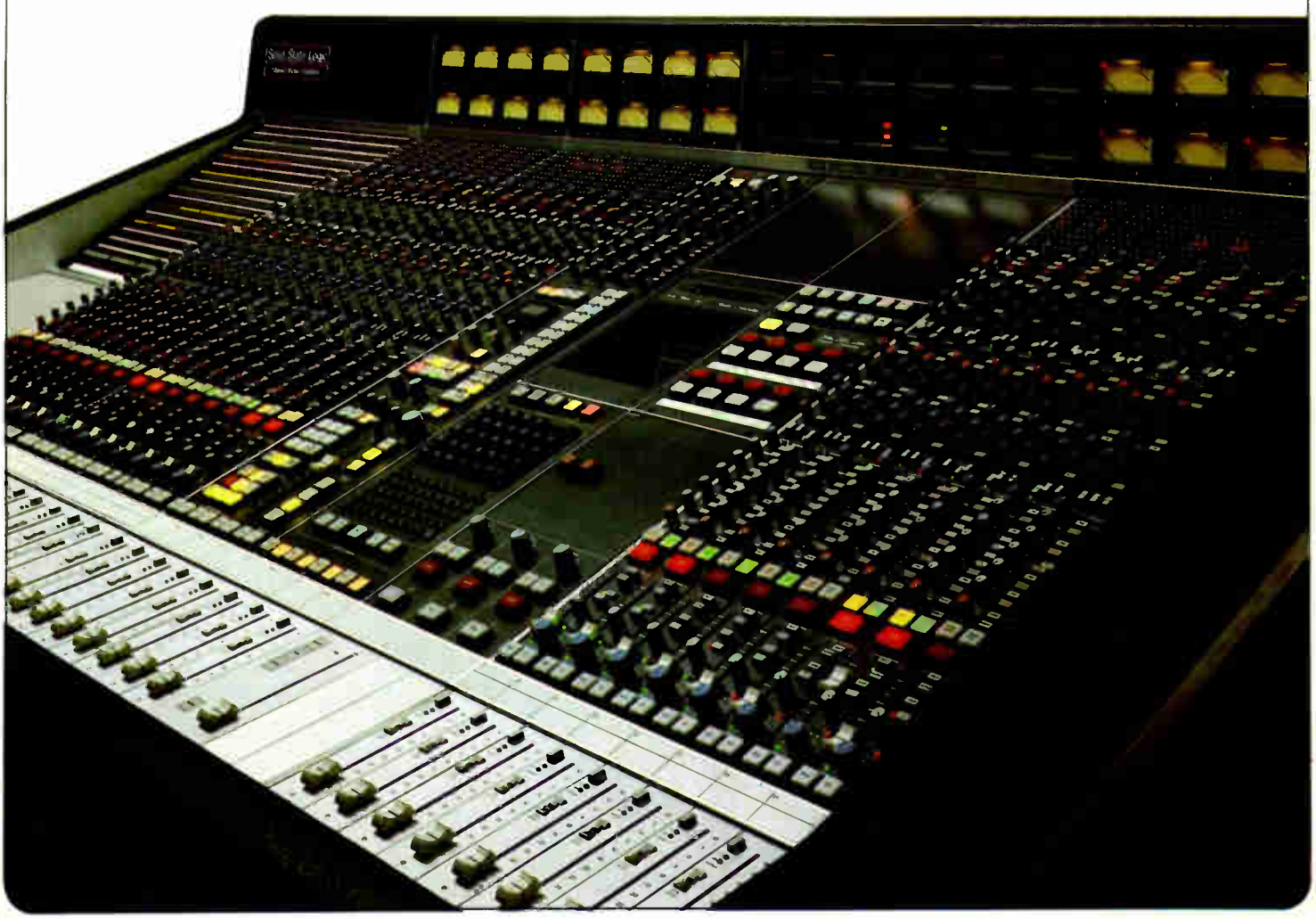
In the Foreground of Television Audio

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

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

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

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



Format Flexibility

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

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

Comprehensive Signal Processing

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

Total Recall

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

Computer Assistance. Live And In Post.

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

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

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

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

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

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Stereo Video Systems

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TESTING TIMES— STUDIO TEST PARAMETERS

Chris Daubney

Testing and maintenance of studio equipment are essential tasks in the quest to ensure the quality of sound heard by audiences. Chris Daubney, head of the Independent Broadcasting Authority's engineering quality control section, here reflects various aspects of test procedures with particular attention to some less well known concepts.

This article is based on extracts from a paper published in the special issue of the Institution of Electrical Engineers Proceedings, Volume 129, Part A, Number 7, (September 1982). These extracts are reprinted by kind permission of the IEE.

Broadcasting is essentially a spatial, and frequently temporal, communications bridge; it should convey the original scene, or the broadcaster's interpretation of that scene, with the minimum of degradation. Throughout the world, the aim of the broadcasting engineer should be to devise and operate, within a given economic framework, a system capable of satisfying that criterion, whether it is required by an Act of Parliament, contractual obligation or as a self-imposed ideal.

It is reasonable to assume that, in the ultimate, everybody who listens to the radio or watches television does so entirely subjectively; ie the aural and pictorial images carry all the information which the broadcaster wishes to convey. Therefore it would be delightful if all assessments could be made purely subjectively. However, it is a well known fact that human beings, and even experienced broadcasting engineers, are rather variable in their assessment of the seriousness of impairments. The CCIR (International Radio Consultative Committee) has established a Recommendation (500) which sets out controlled conditions under which some subjective assessments should be made, but this still relies on the assessor being able to recognise various levels of quality.

To try to overcome this, broadcasting engineers resort to objective testing as a much more reliable and consistent way of quantifying the quality of their equipment.

So what are the reasons for objective testing of equipment?

Reasons for testing

In general, objective tests fulfil one of the following needs:

(*a*) acceptance testing of new equipment against a given purchase specification;

(*b*) routine testing to check maintenance and line-up standards;

(*c*) fault diagnosis.

Sound and vision

Although the programme services which broadcasters provide are categorised as television and radio, a more logical division would be between vision and sound.

The difference between a vision and a sound studio installation can be summarised as follows:

'Vision is a number of complicated black boxes joined together simply, whereas sound is a very large number of simple black boxes joined together in the most complicated way imaginable.'

Although no generalisation can ever be wholly true, the length of time needed to test the average sound installation is considerably longer than that for its vision counterpart, simply because of the number of measurements.

Sound: The present

The testing of current and, therefore, almost entirely analogue sound equipment will be considered under the following headings:

- microphones;
- signal paths;
- signal storage: magnetic and mechanical;
- loudspeakers;
- signal-level indicators.

Microphones

Testing of microphones is only undertaken in very controlled and specialised environments. Comparative testing of samples for sensitivity and frequency response together with a determination of the polar response can be undertaken in a 'dead' room, ie a room with an extremely low reverberation time. Absolute measurements of sensitivity and frequency response require sophisticated acoustical/mechanical coupling to the microphone diaphragm. Almost all of the measurements are only undertaken by manufacturers.

Signal paths

The signal chain between the microphone in a broadcasting studio and a loudspeaker in a domestic environment consists essentially of five parts:

(i) microphones and microphone amplifiers: to increase the signal to a standard level for control and distribution;

(ii) mixing, storage and distribution equipment within a studio centre;

(iii) PTT circuits between the studio centre and transmitter;

(iv) transmitter equipment;

(v) receiving equipment.

This article is mainly concerned with the first two of these aspects. However, as all broadcasters need to be able to monitor the output of their transmissions, the testing of audio monitoring equipment must also be considered.

Although parts (i) and (ii) above were shown with the microphone amplifier separated from the mixing and distribution equipment, in practice the mixing function is closely associated with the microphone amplifier. The signal finally leaves the mixing equipment at a standard level ready for storage and/or distribution.

It is important, first of all, to consider the types of signals likely to be encountered. A study of the variety of physical sounds which microphones have to handle shows that the intensity can vary over a range of as much as 100 dB from the quietest of sound effects to the output of a microphone at a rocket launch or very close to the bell of a trumpet. This range of microphone inputs means that some of the signal spectra and transient conditions will also be greater than would be heard by a normal listener in a conventional position. The testing of studio electrical signal paths must take account of this enormous dynamic range and wide spread of frequencies.

A list of the conventional monophonic and stereophonic tests is given in **Table 1**. Most of the measurements listed are well known, but the following may help to explain some of the more specialised techniques. The relative importance of some tests may vary, as will the tolerances, but essentially the techniques will be similar whether the tests are to be performed on an individual item of equipment or on a chain.

Amplitude/frequency response: Because of the difficulties at times of achieving the full CCIR bandwidth of 40 Hz–15 kHz [1], it has become traditional to specify this test in terms of a performance requirement for the full bandwidth and a considerably tighter tolerance for a smaller and relatively more important proportion of the band. This smaller proportion is usually taken as the range 125 Hz to 10 kHz. The test is an assessment of the relative amplification of the equipment across the frequency band and it is conventional to specify the results with respect to the measurement at one particular frequency—quite often 1 kHz. Measurements are usually made outside the 40 Hz to 15 kHz bandwidth to ensure that no undue amplification takes place in those parts of the spectrum. In general, it is desirable that the relative amplification should decrease in those areas because there are a number of mechanical and electrical interfering signals, which could cause problems in other parts of the system if they were allowed to pass through. In particular, susceptibility to radio interference is important at the high-frequency end, and to mechanical rumbles (e.g. from mic booms) at the low-frequency end.

Distortion: Apart from testing that the entire chain of equipment produces minimal (harmonic) distortion at all reasonable signal levels,

TABLE 1 Audio signal paths: list of common measurements

Monophonic and stereophonic
Overall gain
Gain stability
Gain difference between actual level at given output and indicated level on relevant meter(s)
Amplitude/frequency response
Distortion—harmonic, intermodulation, transient
Signal/noise ratio
Rejection of interfering signals
Input impedance
Output impedance
Input balance
Output balance
Vision-to-sound crosstalk
Stereophonic only
Level difference between left and right channels
Crosstalk between left and right channels
Phase difference between left and right channels

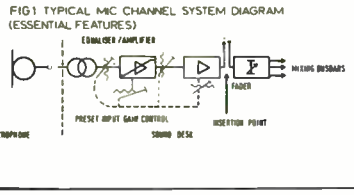


FIG 1 TYPICAL MIC CHANNEL SYSTEM DIAGRAM (ESSENTIAL FEATURES)

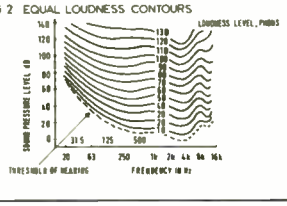


FIG 2 EQUAL LOUDNESS CONTOURS

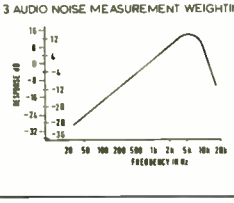


FIG 3 AUDIO NOISE MEASUREMENT WEIGHTING CHARACTERISTIC

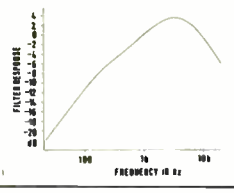


FIG 4 MEASUREMENT OF REJECTION OF UNWANTED AUDIO SIGNALS WEIGHTING CHARACTERISTIC AND TOLERANCES

there is an important additional area of concern in microphone mixing equipment. The initial chain of such equipment is shown in **Fig. 1**. In practice, a sound balancer will adjust the preset control of each channel to match the amplification of the electronic path to the signal level from the particular microphone in use. However, as such a preset control will have to accommodate the 90 or 100 dB range which microphones may produce, the control itself will be of too coarse a nature for normal operation. The first point at which fine adjustments of signal level may be made will be at the 'fader', which is at a later stage in the equipment chain. It is possible, under any given line-up of the initial amplification, for the peak signal level to vary by as much as 40 dB during a programme, and the first point of control under those conditions is, of course, the fader. Therefore, it is important not only to test the overall distortion performance of the chain, but to explore the signal-handling capability of the initial amplifiers in particular.

Traditionally, all such measurements have been based on the concept of harmonic distortion. It is well known that inter-modulation distortion is much less acceptable to the human ear than harmonic distortion, but very little work has been done to specify standardised intermodulation distortion testing. In the same way, transient distortion is also not specified on an international basis, although several attempts have been made to propose appropriate methods.

Signal-to-noise ratio: Two particular aspects of the signal-to-noise assessment are important apart from testing to ensure that the signal-to-noise ratio is appropriate.

First of all, in the operation of microphone mixing equipment, the amount of microphone amplification will vary very considerably from as much as 80 or 90 dB for the quietest signals, to virtually nothing for the loudest normally encountered. Each microphone has a finite output impedance, and there is a theoretical noise level corresponding to each value of impedance beyond which it is not possible to improve the performance. However, it is very important that the theoretical signal-to-noise ratio is approached as nearly as possible, and that this condition is maintained irrespective of the gain configuration of the amplifiers. Therefore, it will be important not only to test the signal-to-noise ratio at one gain setting, but over a range to ensure that the change in signal-to-noise ratio approaches as closely as possible the change in gain of the amplifiers themselves.

The second area of concern is caused by the number of microphone channels which have to be mixed together. To ensure reasonable isolation between the channels themselves so that signals from one channel cannot feed back into another, the output of each channel will be fed to the input of a mixing amplifier via an attenuator and busbar. If care is not taken over the level at which this mixing busbar operates, the final signal-to-noise ratio of the sound mixing desk in total may well be limited, not by the microphone amplifiers at the beginning of the chain, but by the amount of amplification needed after the mixing busbar. Tests to ensure that this design criterion is satisfied will also be necessary.

Some considerable debate has gone on over a number of years as to how the characteristics of the noise should be measured. From the work of Fletcher and Munson and others, it is well known that the frequency response of the human ear is not the same at all loudness levels. The curves of equal loudness contours are shown in **Fig. 2**. From these it can be seen that, assuming the noise level is not less than, say, 50 dB below the wanted signal level, some form of weighting characteristic would be appropriate for the measurement of the noise. The weighting curve most commonly adopted in broadcasting is CCIR Recommendation 468 (**Fig. 3**).

The other area of concern is the type of indicating instrument. A number of different meters have been used—average, RMS, quasi-peak, peak. After a very considerable amount of discussion, the CCIR Recommendation 468 now embodies a specification for the measuring meter as well. Essentially, this is a quasi-peak detector and is similar to the PPM used in British broadcasting for both programme level indication and signal-to-noise ratio measurements. The essential difference between the standard PPM and the new noise meter is one of the time constants in the detection circuitry. On the kinds of 'steady-state' white noise met theoretically in broadcasting studios, the two meters give similar readings. However, they differ when measuring impulsive interference, such as that met on PTT circuits, etc.

Rejection of unwanted signals: The generalisation quoted earlier describing the differences between vision and sound installations is particularly relevant when testing for immunity to interfering signals. This is a test which is almost impossible to carry out completely because of the very large number of combinations of interference possible. One area of concern was mentioned in the discussions on signal-to-noise ratio above—the provision of adequate isolation between channels fed to the same mixing busbar. Another is with the rejection of radio-frequency interference and a third with the rejection of signals due to capacitive coupling, etc.

As the human ear is quite capable of detecting some forms of periodic signals even when they are as much as 10 dB below the random noise threshold, there is a need to be able to measure such signals in the presence of noise, and this implies the use of highly selective filters to provide the necessary discrimination. The question then arises as to whether the use of a weighting characteristic, similar to that adopted for signal-to-noise measurements, should be applied. Since the interfering signals being assessed will, on many occasions, be connected with other programme sources rather than purely random noise sources, the same philosophy based on the Fletcher Munson curves etc. would be applicable so long as account is taken of the differences in spectra between white noise and typical programme signals. There is no established weighting characteristic for such a measurement, but that shown in **Fig. 4** is under active consideration.

Input and output balances: In television studios, and particularly in outside broadcasts where very long cable lengths between the microphone and amplifier may be involved, it is essential that any common-mode signal induced into the microphone cable is suitably rejected at the input of the microphone amplifier. To test this, a common-mode signal is induced via two very accurately matched resistors (or by the equivalent transformer) into the balanced input of a microphone channel, and the ratio of the common-mode voltage to that induced across the balanced winding is determined.

Part of the normal agreement between a PTT and a broadcaster is a requirement to ensure that the common mode signals fed onto the PTT circuits are kept below a certain level. This requires the measurement of the output balance—the ratio of the voltage across the balanced output to that at the centre point of two very accurately matched equal resistors which are connected across the balanced output.

Level difference between the left and right channels: This measurement is essentially an extension of the amplitude/frequency-response tests described above. If unwanted movement of the stereophonic image is to be avoided, it is essential that the relative gains over the frequency band of the two channels conveying the stereophonic information do not vary beyond certain well defined limits. In general, this measurement is carried out by a mathematical calculation from the amplitude/frequency-response measurements on the two chains.

Crosstalk between left and right channels: This is essentially a test to ensure that signals which are intended to be only on the left channel are only on the left channel, and vice versa. However, since both channels of information are wanted in order to provide a stereophonic effect, the measurements of crosstalk between the left and right channels are made without any form of weighting characteristic.

Phase difference between the left and right channels: Although in recent years a view has been expressed that the absolute phase performance of audio equipment is important, there is still a very general assumption that it is at least a second-order effect. However, what is vital in a stereophonic installation is the phase-difference performance between the channels. It is important because any significant phase difference leads to an imprecise image in the stereophonic ▷

reproduction. In addition, any monophonic signal derived from the addition of the left and right signals will suffer an unacceptable cancellation if the phase difference is too great.

In signal-path equipment, there is no normal mechanism in which the phase difference at any frequency may vary (unlike magnetic recordings). The difference can therefore be determined using a double-beam oscilloscope or some more sophisticated phase meter.

Signal storage: magnetic

With the exception of portable (news) recorders, the majority of magnetic tape recorders, and similar equipment such as cartridge machines, operate at unity gain. Depending on whether or not they are stereophonic machines, some or all of the following tests are applicable:

- Overall gain
- Amplitude/frequency-response
- Distortion
- Signal-to-noise ratio
- Level difference } between the left and right
- Crosstalk } channels
- Phase difference } channels
- Absolute speed
- Wow and flutter

In essence, a magnetic recorder is like a signal path, except that it has a time delay built into it. The same general philosophies apply to the testing, but, because of the nature of the tape transport, the measurements become rather harder to execute. In particular, the measurement of phase difference needs considerable care because the weave of the tape past the recording and reproducing heads can cause both random and cyclic variations, which need to be taken into consideration. There can be some considerable debate as to the significance of the rate of variation of the phase difference, and there is, as yet, no international standard for such a measurement. Perhaps the most common way of measuring phase difference with magnetic recorders is to use a double-beam oscilloscope and to observe the fluctuations in phase of one channel with respect to the other. This can be particularly effective as a diagnostic tool, as well as in determining whether the variations are symmetrical about a mean, the value of the mean itself, the rate of oscillation and whether it is random or periodic.

The main additional parameter which needs assessment with magnetic recorders is the speed stability—usually quantified as the measurement of wow and flutter. There is a CCIR recommended method which includes a weighting curve to take account of the ear's sensitivity to various frequencies of speed variation. CCIR Recommendation 409 defines this weighting characteristic, shown in **Fig. 5**, and the characteristics of the measuring meter.

Signal storage: mechanical

Most broadcasting systems make use of a considerable amount of pre-recorded material available on conventional gramophone records.

The parameters which need assessment for disc-reproducing equipment are the same as for magnetic recorders, but with one addition.

The susceptibility of the pick-up stylus to mechanical vibrations transmitted to it whilst tracking the wanted modulation on a record needs quantifying. These mechanical vibrations may originate in the motor-drive system of the turntable itself, or in the surrounding mountings, or come via the mountings from various acoustical sources such as loudspeakers or from other structure-borne sounds. All of these interfering signals are assessed in one measurement called 'rumble'. There is a British Standard, BS4852, which specifies two measurements, weighted and unweighted.

The two characteristics are shown in **Fig. 6**; the measuring instrument itself has a true RMS detector.

Measurements of rumble are taken in a similar way to electrical signal-to-noise and might reasonably be classified as signal-to-mechanical-noise. A disc with pre-recorded signals at a known velocity is replayed for line-up. Then unmodulated tracks across a special record are reproduced and the level of rumble is determined.

Loudspeakers

There is no doubt that the greatest area of difficulty in measuring audio equipment is that of loudspeaker assessment. Although many attempts have been, and still are being, made to use conventional testing techniques such as amplitude/frequency-response and distortion measurements, none of these has achieved any form of international standardisation for the *absolute* assessment of a loudspeaker.

One of the problem areas concerns the interaction of the loudspeaker with the acoustical environment in which it is assessed. It does not seem to have been possible to establish any reliable correlation between the subjective impression of the sound emitted by a loudspeaker and the objective measurements of the conventional parameters. Whilst it is, of course, possible to correlate gross errors of coloration and distortion with the reproduced quality, the ear is remarkably sensitive to very small changes of frequency response, etc.

One method is to listen to each speaker reproducing short excerpts of speech and music and to compare those with direct assessments of the original speech and music. Instrumentation of such tests is very difficult because the comparison has to be made within, say, 30 seconds or else the memory of the first is not sufficiently accurate. In addition, there is the question of the acoustics of the original speech or music and the interaction of those with the acoustics of the room in which the loudspeaker is assessed. Much work remains to be done on loudspeaker assessments, but impulsive testing and digital processing may produce useful advances.

FIG 5
WOW AND FLUTTER MEASUREMENT WEIGHTING CHARACTERISTIC

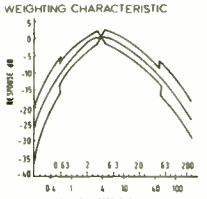
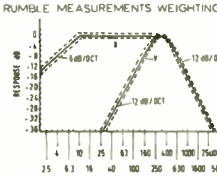


FIG 6
RUMBLE MEASUREMENTS WEIGHTING CHARACTERISTIC



Signal level indicators

Whilst the human ear is remarkably adept at detecting changes in loudness or response, etc., and making comparisons between two sequential signals, it is far less good at making absolute judgments of loudness, etc. Therefore, a broadcaster has to resort to objective forms of level measurement in order to ensure that signal-handling equipment is optimally used.

If the primary purpose of the meter is to ensure that the absolute signal levels do not exceed the defined maximum in the equipment at any time, then it would seem most sensible to use some form of peak detector; eg the quasi-peak programme meter (PPM).

Most of the PPMs in use in the UK conform to British Standard BS4297. Recently, a proposed revision has come into existence which specifies some of the parameters more precisely. Testing PPMs is vitally important, not only to ensure that their static characteristics are accurately aligned, but, perhaps more importantly, that their dynamic characteristics are consistent, if there is to be reasonable agreement between staff assessing levels during real programme transmissions at different parts of a broadcasting chain. The tests are specified in BS4297, as are the tolerances: amongst the parameters are 'static' conditions such as calibration, frequency response and input impedance; and 'dynamic' conditions (tested with defined bursts of sinusoidal signals) such as rise time, fall-back time and response to unidirectional pulses.

Sound: The future

I have summarised briefly the present situation in testing the sound side of broadcasting studios. Essentially, the current procedures centre on analogue systems. However, there are already items of equipment in use which have analogue interfaces with other equipment, but which use digital techniques within them.

What new problems do digitally based equipment present to the measurement engineer? Since international digital audio standards have not yet been agreed, some points must be a matter of speculation, but it would seem that they fall into two parts.

First, for the next few (possibly 10 to 15) years, significant parts of the broadcasting chain will remain analogue, but with these digital 'islands' increasing in number. Therefore it seems likely that analogue testing will still have a relevance—so long as it relates to the subjective effect. The need will be to assess those peculiarly digital defects—but as they manifest themselves in the analogue domain. The most obvious one is quantising noise, and particularly where digital companding is in use. Likewise distortion, as a function of signal level, will need further consideration.

The second area of concern is with failure in the digital sections. Bit-error-rate detection is the main consideration. □

Acknowledgments
The author is grateful to many colleagues within the IBA and in other broadcasting and equipment-manufacturing organisations for all their thoughts, inspiration and guidance, and to the Director of Engineering of the IBA for permission to publish this article.

Reference

1. 'Audio frequency parameters for the stereophonic transmission and reproduction of sound'. CCIR Report 293–4, Kyoto, 1978.

Many options are available with the MXT-1200 – they include pre or post fade balanced insertion points: a full cue/remote start switching system with two independent external drive circuits for all microphone channels to operate on air lamps and loudspeaker mute circuits; balanced independent channel outputs; PFL/AFL options on faders and push buttons. Auxillary modules are options on the MXT-1200 too – they include compressor/limiter, oscillator talkback and a selection of monitor modules, some with monitor mixdown for 4 and 8 group systems.

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REEL THOROUGHBRED—THE STUDER A810

Andre Bourget

The advent of new technologies does not necessarily mean that existing techniques are immediately rendered obsolete, a prime example of this in the audio world being that digital does not mean the death knell of the traditional analogue tape recorder. At least, not for the present. With all it's possibilities, digital recording still means a costly investment in a product that is still very much in its evolutionary stages. At the same time the demands of modern recording have increased greatly due to a greater awareness on the part of the people who make the recordings, the audio industry, and the people who listen to—and buy—the end product. While modern equipment can produce very satisfactory results there is always room for improvement and it is with this thought in mind that the Studer *A810* tape recorder was developed.

On the face of it, modern technology has a lot to offer tape recorder design in the way of microprocessors, CMOS chips, new construction materials, rationalised production, etc, at the same time combining the far from negligible aspect of availability and decreasing prices. Rather than rehash existing concepts and techniques, the time was ripe for a return to first principles and a whole new approach to tape recorder design. What is the purpose of a tape recorder and what does it do? Pretty stupid sort of question you may think, but give it a little thought and it is not so silly after all. We need a machine that transfers audio signals onto magnetic tape with the highest possible fidelity and with the capability of recording them with that same fidelity. The design target is now different. It is not 'how can I improve on an existing machine', but a brief to design a tape recorder that uses modern technology and can meet the strenuous demands of today's recording and broadcast industries. The only resemblance with previous machines being that it uses reels, three motors and tape heads.

Design brief

Undertaking the design of a new product involves the establishment of all possible user requirements, plus a few more that the user has not thought about yet! In the case of the *A810*, the design requirements were the following:

- compact 19 in rack mount size;
- no compromise user facilities for all

Table 1a shows the advantages and disadvantages of both electronic (transformerless) and magnetic (with transformer) balancing methods. The choice of one solution rather than the other can be made by taking into account the definitive field of application of the corresponding unit.
Table 1b helps to decide whether to go transformerless or not.

TABLE 1a

Parameter (line output amplifiers)	Transformer	Transformerless
Frequency response	**	***
Intermodulation, IMD	**	***
Harmonic distortion, THD	**	***
Transient intermodulation, TIM	***	**
Phase modulation distortion ØMD	*	***
Phase response	***	***
Radiated stray-field	**	***
Common mode rejection ratio CMRR	***	***/**
Safety	***	**
Common mode rejection range	***	*/**

TABLE 1b

Field of application	Transformer	Transformerless
Disc recording studio	**	***
Mastering studio	*	***
Film production	***	*
Film-audio post-production	**	***
Video production	***	*
Video-audio post-production	**	***
Radio live recording	***	*
Radio broadcasting	***	**
Logging	***	*

*** very good, ** average, * poor

FIG 1
TAPE TRANSPORT AND AUDIO ELECTRONICS MICROPROCESSOR CONTROLLED FUNCTIONS

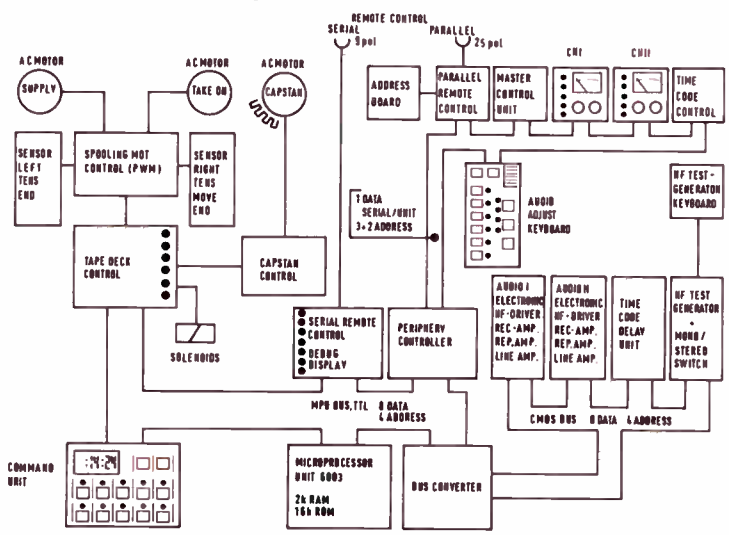


FIG 2
SCHEMATIC TRANSFORMERLESS BALANCED AND FLOATING LINE INPUT

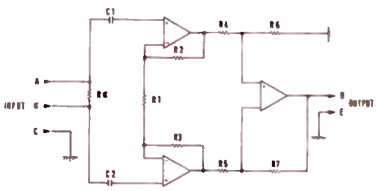


FIG 3
SCHEMATIC TRANSFORMER BALANCED AND FLOATING LINE INPUT

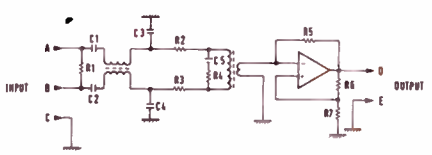
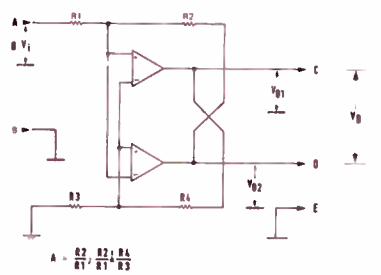


FIG 4
SCHEMATIC TRANSFORMERLESS BALANCED AND FLOATING LINE OUTPUT



operating modes;
- highest possible audio quality;
- extremely easy servicing enabling maintenance to be carried out by non-service engineers (not every audio facility can afford an in-house service dept);
- tape transport to be highly accurate and very reliable;
- basic design to permit a wide range of easily available configurations;
- easy conversion from one version to another;
- the machine to be of low to medium cost resulting in an extremely favourable quality price ratio.

Design solutions

The design brief having been established, the requirements were solved in the following manner.

Compact size. This was realised by the use of a special light alloy diecast chassis, this being the only way to fulfil the requirements for high precision machine tooling with light weight and high stability over long periods of time. Studer have long experience in this kind of chassis and have developed metallurgical techniques where the metal is 'aged' and is thus immune to instability, while at the same time keeping costs to reasonable limits.

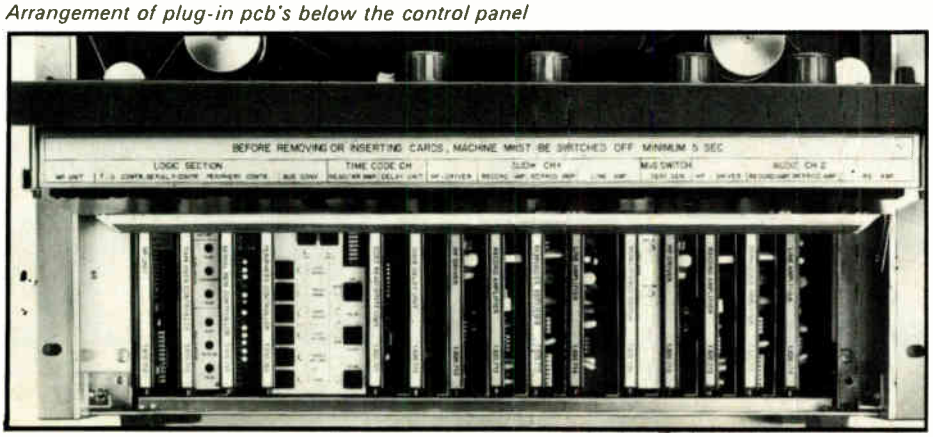
User facilities. The emphasis was on the need for the machine to adapt to the operator and not the reverse. This meant that the push buttons on the front panel had to be kept to the minimum whilst retaining full flexibility. Research showed that the ideal number of controls varied between 10 and 13; the *A810* uses 12. However, the machine has roughly 20 different functions of high importance to the user and this has led to the control 'keyboard' being split into two groups of buttons, one featuring fixed programmed functions and the second with user programmable possibilities (see **Fig. 1**). This ensured that maximum flexibility was guaranteed.

All tape transport and audio switching operations are microprocessor controlled (Ah! The mighty micro!) with all programs being in EPROM. The transport features no less than four speeds. $3\frac{3}{4}/7\frac{1}{2}/15/30$ in/s, each having individually programmable equalisation and adjustments. Two tape types (A and B) are selectable at the touch of a button for all speeds and equalisations, as are NAB/IEC characteristics for all speeds and types of tape. Once on the transport the tape is fully protected from all eventualities (if you drop it on the floor between the tape cupboard and the machine, that's your problem) such as power failures, loose winding, mis-threading or whatever other abuse you can think up. Computers are now a part of daily life and the *A810* is no exception being optionally equipped with a socket to connect any computer terminal to the machine using RS232 or RS422 codes. The software and hardware have been designed to enable full machine remote control, either parallel (basic functions only) or serial RS 232/422 (all functions).

Audio quality. To meet the standards imposed, totally new audio electronics were required. These feature extremely low-noise circuitry with high headroom/low distortion characteristics. Transformerless fully floating and balanced input and output stages are available, as well as more conventional transformer stages (see **Tables 1a, 1b,** and **Figs 2, 3, 4**). A significant design feature is the use of totally phase compensated circuitry with cascaded all-pass filters to ensure proper time delay compensation instead of simple signal polarity reversal, making for record/reproduce capabilities of the highest quality. For complete serviceability, all audio circuitry is mounted on 100 × 128 mm pcb's, with each channel having separate cards for HF driver, record amplifier, repro and sync amplifier and line amplifier. Another innovation is that all audio parameters are adjusted by the microprocessor via programmable potentiometers, these being linked to a data bus and enabled by an address bus (for example see **Fig 5**). The magnetisation curve of tape vs. frequency is approximated by third order, three pole high frequency boost circuitry, this also being phase compensated. Each of the four available speeds have their respective equalisation characteristics programmable, these varying from 0, 17.5, 35, 50, 70, 90 and 120 µs for high frequency and 3,180 and ∞ µs for low frequency. This ensures correct matching for all norms and standards such as NAB, IEC, DIN, CCIR, etc. Finally, channel meters are switchable VU or peak and correspond to ANSI, NAB, and IEC norms.

Easy servicing. Not every audio facility has

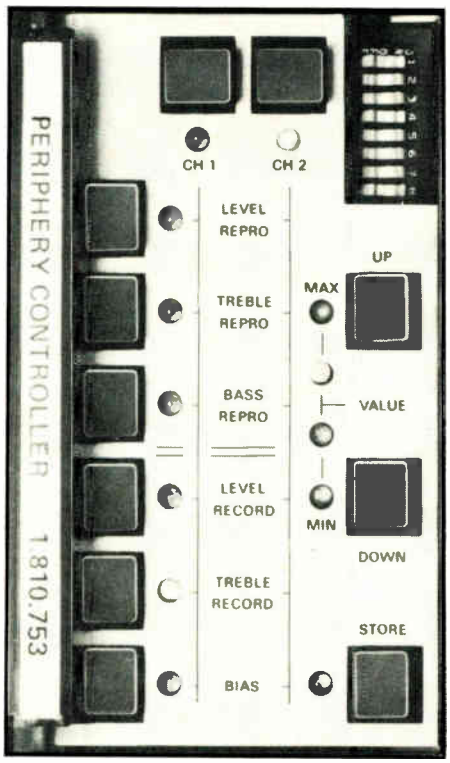
Arrangement of plug-in pcb's below the control panel



the means to keep a permanent service department so it was necessary to produce a machine that could be serviced, or changed from one version to another with the minimum of effort whilst retaining complete reliability and precision engineering. As a start, only two sizes of screwdriver and two sizes of Allen keys are needed to completely dismount and re-assemble most of the machine. Thanks to good all round clearance, access to the three motors is extremely easy and makes motor changing a quick job. Changing the machine from one version to another will certainly often mean changing the head assembly and this is accomplished with the minimum of worry. All heads are mounted on a solid, stable metal die-cast base, eliminating the need to readjust azimuth and zenith when changing headblocks, this latter function only requiring the removal of three screws. A further refinement is that the reproduce preamplifier is included in the headblock to ensure perfect audio matching in the electronics, thus maintaining maximum quality in all configurations with the minimum of fuss. Similarly, the fact that all audio circuit cards are set up and aligned by the microprocessor means that cards can be changed in a matter of seconds and that the machine is ready to go without the need to use up valuable time in re-aligning the machine. To ensure perfect compatibility between cards the maximum deviation permissible from one to another is ±0.2 dB. As a further aid to servicing and reliability, the microprocessor is self analysing and continually checks machine status while running and upon power-up. Should an error or fault occur it is immediately shown on the LCD display with an appropriate code to indicate the malfunction, ie: if you know what is going wrong, you can do something about it immediately!

Further flexibility is added by the serial interface which enables the machine to be connected to the outside world. This enables direct access to all audio parameters giving easy recall, update and store possibilities to any individual function; the hexadecimal position of any programmable potentiometer being recalled is shown on the LCD display. The serial parallel interface also means easy transfer of the RAM contents of the recorder to any other memory medium due to adjustable baud rate, eg compact audio cassette, telephone line, any audio tape, home computer, etc, etc. Thus the machine has full remote control possibilities for all functions as well as remote testing. A built-in test generator with frequencies at 60 Hz, 125 Hz, 1 kHz, 10 kHz and 16 kHz is also available as an option.

Tape transport. A three motor tape deck is used to ensure gentle tape handling and eliminates the need for mechanical transmission systems such as belts or gears. Brushless motors are powered by a switching power supply with pulse width modulation operating at a sampling frequency of 76 kHz, which in turn means no heating, high efficiency, high torque and, most importantly, very little maintenance. All mechanical parts are die-cast and high precision machine tooled. This ensures a high accuracy of moving parts



Periphery controller card and access keys

with low wear, without too high an inertia or mechanical skew. The metals used in construction are specially selected so that the effects of temperature are mostly self compensated. This again means that nominal specifications are guaranteed over a wide temperature range. High precision positioning of the capstan motor and shaft also means that field replacements can be carried out without adjustments.

Available configurations. Through the use of modular construction any option can be produced to the requirements of the user. Versions available are:

- mono full track;
- stereo—2 × 2.75 mm track width;
- two track—2 × 2.00 mm track width with separate erase and sync;
- two track TC—as for two track machine, but with centre track for timecode record replay;
- VU—all versions with meter panel included;
- VUK—all versions with separate meter panel so that the machine can be console or rack mounted.

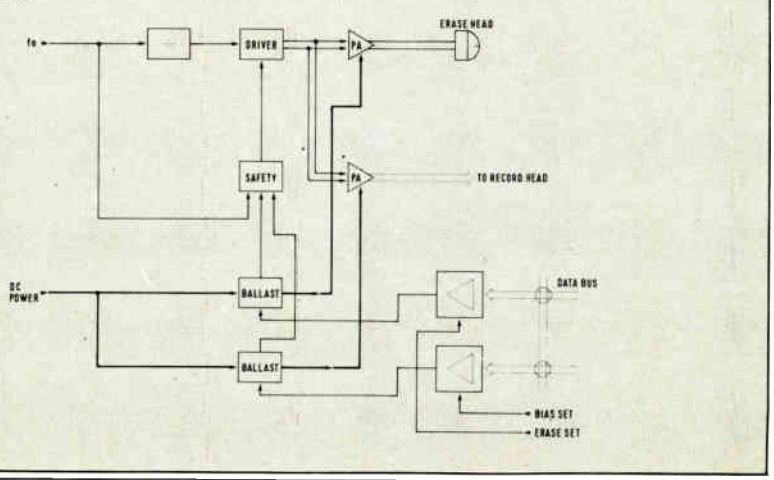
Due to it's wide range of configurations, the *A810* recorder can be used perfectly in the following applications: direct stereo recording (stereo version); radio drama (2-track); audio-visual post-production (2-track plus timecode); film sound editing (as for AV work); TV simulcasting (again 2-track plus timecode); and AM radio broadcasting (mono full track).

Easy conversion. The modularity of both the electrical and mechanical forms of construction ensure fast and easy changeovers. Actual hard wiring is kept to the bare minimum and connection between modules is made via flexible flat ribbon cable for maximum flexibility and freedom of mechanical tolerance. All *A810* configurations are programmed in the EPROM's of the microprocessor, meaning that any change in configuration is controlled by the microprocessor software at the simple flick of a switch.

Cost effectiveness. The construction of the machine relies only on components and materials that are readily available in all parts of the world and that are offered on the market by at least two or more independent manufacturers. This ensures freedom from technological and or political changes in the world, whilst competition in the market place between manufacturers means long life availability coupled with reasonable prices. This ensures that the prospective client is offered a machine with built-in long life at a low to medium price and is thus offered the maximum return on initial investment.

The result of the foregoing solutions is the Studer *A810* ¼ in master recorder, the first in a totally new generation of tape recorders. Available in a wide variety of versions, the machine can be equipped with either high or

FIG 5
MICROPROCESSOR CONTROLLED BIAS AND ERASE CURRENT ADJUSTMENT



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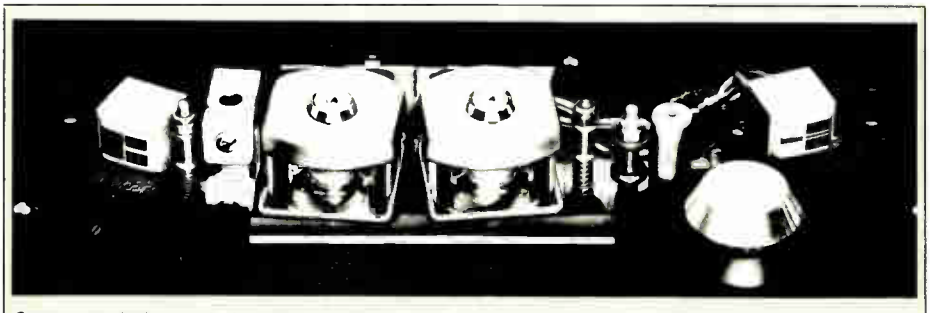


Centre track timecode headblock. Note the pair of ferrite combi-heads—left: TC repro/audio erase; right: TC erase/TC record

FIG 6
TWO TRACK AND CENTRE TIMECODE TRACK CONFIGURATION

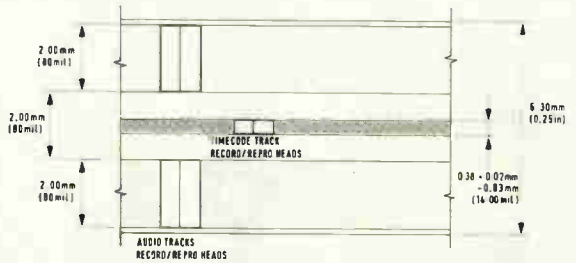


FIG 7
HEAD CONFIGURATION FOR SIMULTANEOUS RECORD/REPRO OF AUDIO AND TIMECODE SIGNALS WITHOUT TIME OFFSET

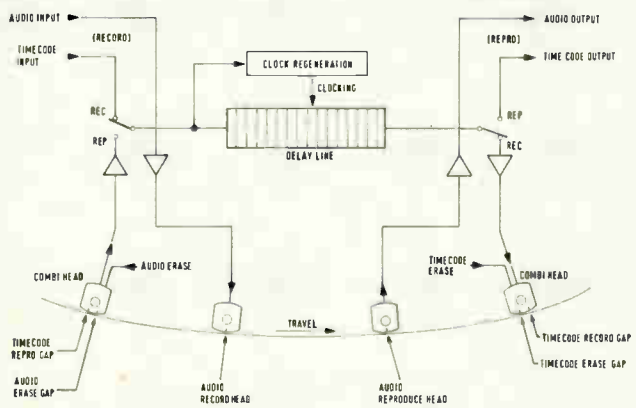
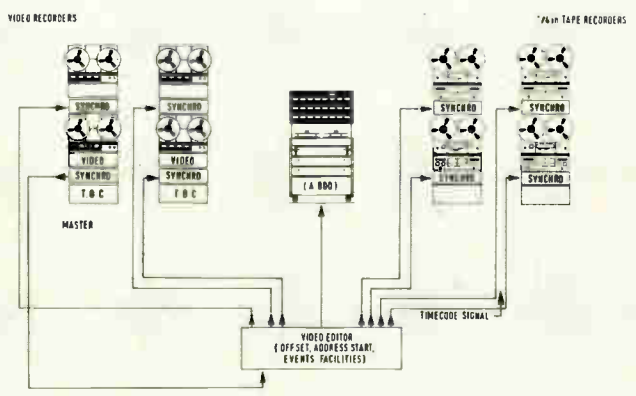


FIG 8
TYPICAL SMPTE SYNCHRONISED AUDIO/VIDEO POST-PRODUCTION SYSTEM



low speed motors. Another feature is full varispeed control over a range of ± seven semitones, available by applying a discrete frequency (nominal 9.6kHz) to the servo loop of the capstan motor. As well as gentle tape handling controlled by separate tape tension sensors, the machine offers ease in mechanical and electronic editing with four spooling speeds and full locator functions.

Innovative features

The two innovations that really set the *A810* apart from other studio recorders are complete microprocessor control and the possibility of recording timecode on a centre track (see **Fig 6**).

By being able to programme all parameters—and transfer them to outside storage—means that one machine is capable of fulfilling a maximum of functions. Indeed, if simultaneous use is not required, one basic machine with spare cards can do the work of three or four separate recorders, with the necessary conversions being done in a matter of minutes, ensuring a minimum of down time. No worry about re-alignment, either, as the microprocessor is taking care of that. Remote work is no longer a problem either, as thanks to the serial interface, the machine (or series of machines) can be controlled from a central point with machine status available on a display for all parameters.

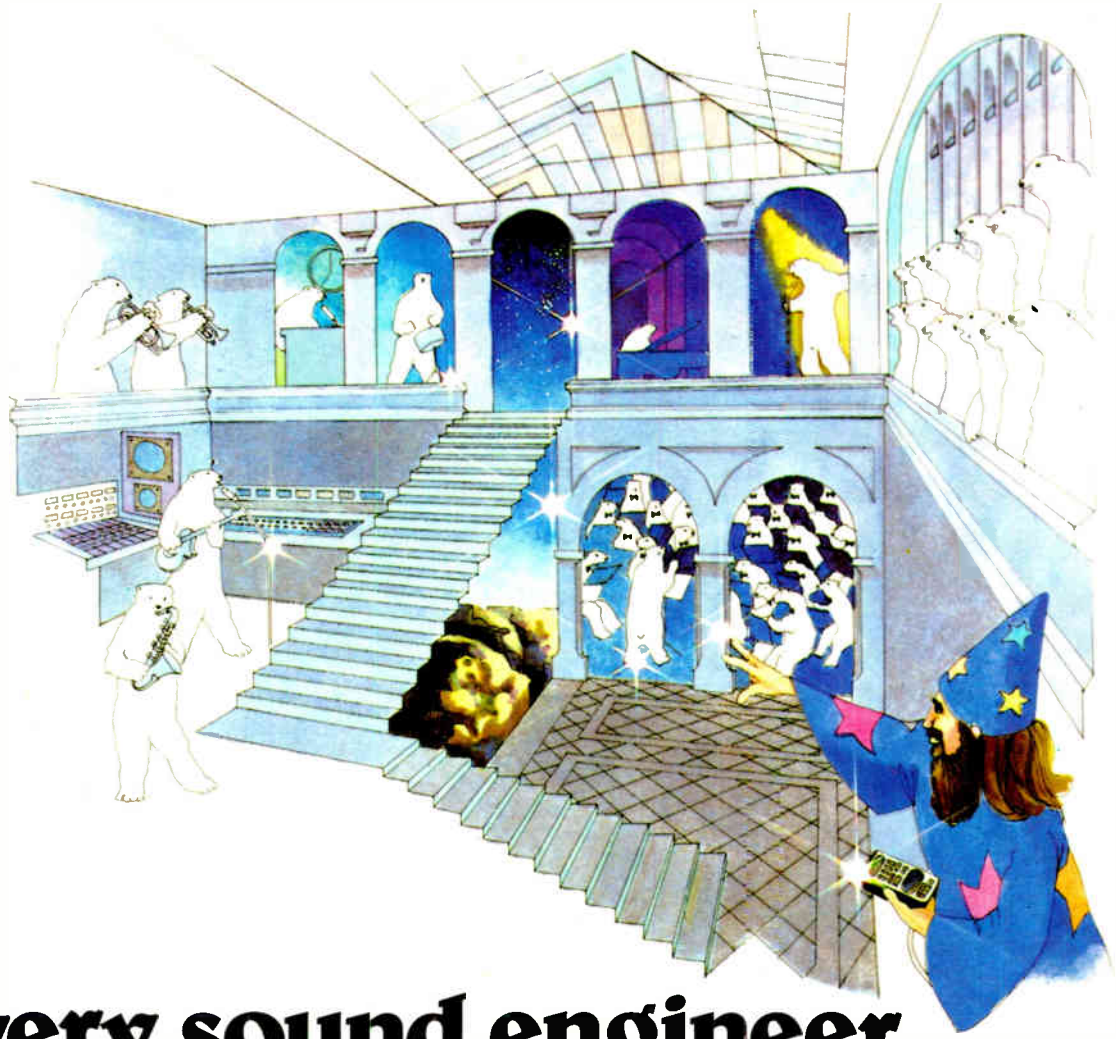
Once the prerogative of multitrack machines, timecode working with a master recorder is now possible with the *A810*, complete with real-time encoding or programmed offset (see **Fig 7**). This means that the recorder can be fully integrated into an audio-visual system, TV or film, under timecode control and or with multitrack recorders (see **Fig 8**). In fact you could probably do some very fancy effects with locked up recorders by making use of the programmable facilities.

Conclusion

While a machine for today's demands—and for the forseeable future—the *A810* takes into account some very important practical considerations. High return for a moderate investment, wide flexibility coupled to maximum reliability and worldwide serviceability. Whilst modern technology produces some pretty astounding electronics in the form of specialised chips, it is also true to say that obtaining these same chips can often be fraught with difficulty. The use of modern techniques with readily available components means long service life and confidence by the customer in the product. The audio industry likes workhorses that in can rely on without worry—the *A810* would appear to be the first of a new generation of such horses! □

Biography

Andre Bourget is a physics graduate of the Swiss Federal Institute of Technology in Lausanne. Prior to joining Studer International AG in 1980, he was with Kudelski SA (Nagra) where he became head of the Technical Training Department. Mr Bourget is currently head of the Systems Engineering Department at Studer's headquarters in Regensdorf.



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SCA DEREGULATION

Paul D Lehrman

In April the Federal Communications Commission announced a deregulatory ruling, removing most restrictions on the use of SCAs by FM broadcasters. This decision opens up many opportunities for American FM stations to provide new services and generate new revenue. Paul Lehrman has been following the unfolding SCA story and here reports the ramifications of the ruling.

The Reagan administration has quite a few enemies in the broadcasting world; not necessarily in the boardrooms of the major commercial networks, but certainly among those who seek to ensure that independent voices maintain their traditional access to the airwaves. Flying the twin banners of 'deregulation' and 'marketplace decision', the Federal Communications Commission has in recent years effectively acted to restrict the diversity and productivity of the airwaves—often to the advantage of larger established broadcasters and at the expense of smaller organisations—by refusing to intervene in such matters as licence renewals, ownership restrictions, and programme content, and by stifling technological improvements like stereo and low-power TV and stereo AM by refusing to act positively on them. At the same time the very existence of many of the sources of alternative programming such as the Corporation for Public Broadcasting and the National Endowments for the Arts and Humanities has been imperiled by federal spending cuts.

Still, even the most callous of governments can't do *everything* wrong, and one recent deregulatory decision by the FCC is actually being praised to the skies by just about everyone who has anything to do with the business of radio broadcasting. For the most part, it's an American dream: everyone makes money, from the major commercial radio networks to the most miniscule independent and educational stations, and virtually nobody gets hurt. The ruling (which was to take effect immediately when it was announced on April 7, but in typical FCC fashion was not *published* until almost two months later) removes most of the restrictions surrounding the use of Subsidiary Communications Authorisation sub-channels (SCAs) by FM broadcasters.

A Little History

Since the mid '50s, SCAs have provided background music like Muzak, 'talking books' for the blind, and assorted other services for various types of subscribers. About a quarter of American FM stations operate them, and most of those lease them to outside programme services, who also supply and maintain subscribers' receivers. Such an arrangement provides the stations with a steady, and often very necessary income: rents of $6000 per month for a channel are not unheard of.

Under the old law, SCAs were allowed to occupy only the space within each 200 kHz-wide FM channel from 53 to 75 kHz away from the base carrier, and the only type of modulation of the subcarrier allowed was FM. Common practice has been to use a 67 kHz tone as the subcarrier, frequency-modulated with audio that is bandwidth-limited to 5 kHz. Most significantly, except in a few cases where the FCC granted special permission to a station to do otherwise, the use of SCAs was restricted to 'broadcast-related' services, ie music and speech.

The new regulations change all that. Now, any part of the FM channel between 53 kHz (the edge of the main stereo audio sub-channel) and 99 kHz (1 kHz from the boundary of the station's assigned frequency) is fair game for a sub-channel. Any type of modulation can be used, and provisions are made for a station to broadcast *multiple* SCAs. Stations no longer need special dispensation to carry non-broadcast-related services, which opens the door for transmission of data, paging signals, utility load-management information, digital audio, and even computer software over the sub-channels. Stations are also no longer required to turn off their SCAs when their main audio goes off the air.

What took so long?

Needless to say, both commercial and educational broadcasters have announced their utter delight with the ruling, which many say was long overdue. Although 'glacial' is not an unfair word to describe the FCC's usual pace when acting on technological changes, there are some good reasons why that august body took almost 30 years to update its SCA rules. Historically, an annoying by-product of SCAs has been the creation of strange noises in the main audio. Under ideal circumstances, there should be enough room between the SCA and the main stereo audio to prevent any problems, but given the vagaries of circuit components like tubes and RC filters, said ideal circumstances are often hard to come by.

Most of this has to do with distortion products—particularly the odd-order kind—that have a way of cropping up in older transmitter and receiver circuits. For example, a typical transmitter will use a 76 kHz crystal and a pair of dividers to produce its 19 kHz stereo pilot tone, so that it is as accurate as possible. Somewhere along the way, a small amount of 57 kHz 3rd harmonic often leaks out. At the receiver, this beats against the 67 kHz SCA sub-carrier, creating a 10 kHz whistle, which the receiver cheerfully decodes and passes along to the audio stage. Since the 67 kHz tone is not steady (remember, it is being frequency modulated) the 10 kHz beat wavers, producing what is known in common parlance as a 'birdie'.

A similar problem occurs in receivers. Since the 38 kHz stereo carrier on a standard FM signal is suppressed, the receiver has to synthesise it, by doubling the 19 kHz pilot tone. If there is any distortion at all, a bit of 57 kHz or 76 kHz will be generated, which will beat against any 67 kHz sub-carrier that gets into the detector.

With the advent of PLL circuits and various solid-state switchers, however, most transmitter-generated birdies are now a thing of the past. Older receivers still produce them, of course, but the general thinking among the industry is that, since most truly discerning listeners upgrade their equipment regularly, those whose ears are most sensitive to such problems are the ones who will be the first to eliminate them.

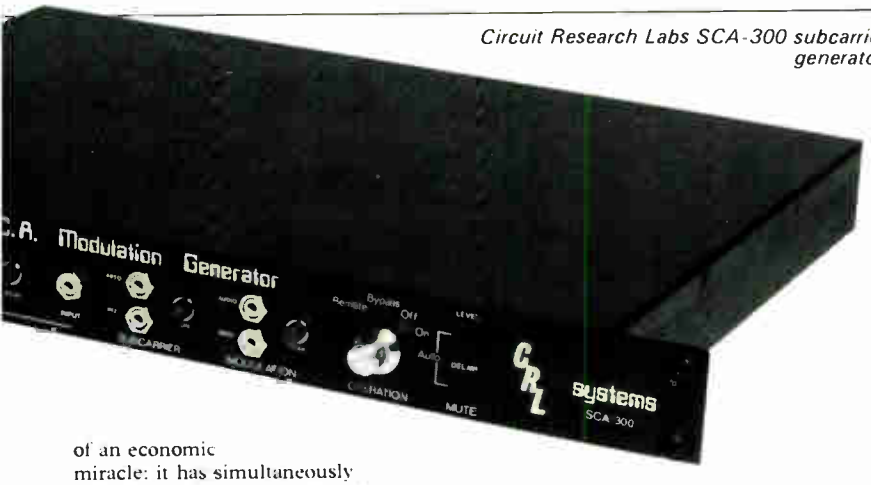
Another disadvantage of SCAs is that they limit the range of an FM station. The amount of total modulation that can be applied to an FM carrier is limited by law to 100%, and when an SCA is broadcast, the subcarrier uses up a certain amount of that total—typically around 10%. That means that there is less sideband energy available for the main and stereo audio signals, with the result that fringe listening areas get a less-powerful signal. How to deal with this effect is a matter of strong debate in broadcasting circles. The FCC at one point proposed extending the modulation limit to 110%, and several broadcasting groups, including Westinghouse (which own Muzak), ABC, and National Public Radio, argued for even higher levels.

However, the Consumer Electronics Group of the Electronic Industries Association told the FCC that one receiver it tested experienced significant degradation in second-adjacent-channel interference when that channel was modulated 110%. So the FCC has ducked the issue (for now—it has promised to look into the situation), and will keep the 100% limitation. Its 'Report and Order' includes the rather specious statement: "Listeners experiencing slightly degraded reception can correct it by improving or adjusting their receiving antennas."

What does it mean?

What with the proliferation of databases and other services for the growing number of domestic and business computers, media for inexpensive transmission of data are becoming more and more in demand. Using an FM station's SCA for the purpose has some unique advantages, among them the ability to traverse the 'last mile' between provider and user at a much lower (and more stable) cost than telephone, cable-TV, or microwave lines.

By both opening up the spectrum to greater numbers of SCAs and allowing a wider range of services, the FCC has achieved something



Circuit Research Labs SCA-300 subcarrier generator

of an economic miracle: it has simultaneously created both a buyer's and a seller's market. The next couple of years promise to be something of a free-for-all as programme suppliers frantically bid for spectrum space while broadcasters just as enthusiastically upgrade their SCA equipment and jack up their rates. Already, SCA leases are being renegotiated by broadcasters at prices as high as 10 times the previous rent, and communications companies are almost daily announcing new techniques for using the channels and new services to go out over them. One New York City station, for example, recently renewed its 15-year-old contract with a background-music service, but with two important changes: the new agreement is provisional for only three months, and the rent has been increased by 250%. The station is hoping to go on line before long with a system being developed by a new local electronics company that will multiplex no fewer than 24 data channels onto one subcarrier.

At this point it seems that imagination is the only limitation to the uses for SCA. Supermarkets and chain stores can broadcast price changes that can be instantaneously fed into every cash register at every branch. Commodities traders can receive current market prices at their desk, or even on the street with miniature Walkman-style receivers equipped with LCD displays. A utility company in South Dakota plans to use an SCA to turn on and off air conditioners and water heaters within its area by remote control, thereby efficiently controlling electric power usage. Fire, police, and other municipal services can use SCAs for communication—not only would they provide extra capacity, they could also significantly lower equipment costs. Other proposals involve slow-scan television, electronic mail, and facsimile.

Where the big money is going to be, however, is in national services, and this is why the public radio establishment is so ecstatic about the FCC ruling. Then-president of National Public Radio Frank Mankiewicz went so far as to proclaim "April 7 should be called public radio's independence day." Thanks to some rather astonishing foresight on the part of NPR's planners several years ago, the network is the owner of a huge amount of satellite transponder space—far more than it can possibly use just to distribute its own programmes (see *Broadcast Sound*, Nov/Dec, 1982). Linked to nearly 300 FM transmitters covering some 70% of the country, NPR's satellite system provides an almost totally unique distribution network for any kind of transmittable signal. Already NPR Ventures, the company set up, among other reasons, to market the excess satellite capacity, is talking about things like a nationwide paging service and a kind of 'pay-per-view' software-downloading service for home computer users.

By itself, the network does not have the capital to institute any of these systems, but it is actively seeking out private companies with whom it can enter into partnerships. The benefit for NPR, of course, is money: in the face of dwindling funds, the network will be able to support its non-profit broadcasting operations by renting as much of its satellite space as it can to the higher and/or most profitable bidder.

Will it hurt?

There are three reservations that have been voiced about the new ruling. One is of no practical significance whatsoever: allowing non-broadcast signals to fill completely the unused segment of every FM channel sounds the death knell for discrete 'quadraphonic' audio broadcasts, an idea that—for better or worse—the FCC killed anyway several years ago, by refusing to standardise a format.

The second has to do with reading services for the blind. These have long been provided by public stations, but in the current gold rush, if such stations were required to continue them, they would be put at a significant commercial disadvantage. The FCC decision wisely steers a middle course: "A public radio station that uses sub-carriers for remunerative activities must ensure that (reading) services are not diminished in quantity or quality by the pursuit of commercial sub-carrier undertakings." Translated, this means that a public radio station in any market is obliged to provide a subcarrier for reading services *only* if it is broadcasting another, commercial subcarrier; if no one else in the market is carrying a reading service; and if the service requests it. Therefore, each public station is free to lease at least one of its sub-carriers for commercial purposes, and if it chooses to lease out its second SCA, and there is a need for a reading service, it is free to try to find another station in the market to carry it.

An example of this is in Boston, where there are two National Public Radio affiliates, WGBH and WBUR, neither of which carries a reading service. Instead one can be found on the SCA of WERS, the station of Emerson College, which covers most of the metropolitan area, while towns immediately south of the city are served by a sub-carrier belonging to WATD in Marshfield, a commercial station.

The most serious objections to the rulemaking were raised by various companies already involved in radio paging and similar services. Although their arguments were accompanied by plenty of legal and technical examples (among other things, they claimed that using FM SCAs for paging was an 'inefficient' use of spectrum space), what they boiled down to was that the companies considered that the new uses for subcarriers would result in unfair competition.

To the FCC's credit, it dismissed these arguments, and quoted from its own charter, that it should ". . . generally encourage the larger and more effective use of radio in the public interest". In a footnote to its published decision, the Commission neatly countered the 'inefficient use' argument and provided a fine example of what can happen on those rare occasions when a regulatory body really knows what it's doing.

"Under the changes adopted herein, an FM station could utilise semi-discrete quadraphonic broadcasting to enhance its entertainment broadcasting to its general audience; provide radio reading service on a sub-channel to serve the visually handicapped; permit the more efficient operation of a utility company through utility load management services to the benfit of the utility's customers and energy conservation; and provide paging services to those who desire such specialised communications services. All of these services could be provided in the same spectrum that was originally allocated for monophonic FM." Amen. □

Harris MSG-95 remote SCA generator

LETTERS

AM detection

Dear Sir, In the May/June 'Voiceover', Mr Norman McLeod has criticised a number of points raised in our article on improved AM reception techniques carried in the 1983 edition of the *World Radio TV Handbook*.

Your column claims that the *WRTH* article "carries on as if (exalted carrier reception) had just been invented". A careful reader would have taken note of the following on the fourth page of our article:

> "... it should be noted for the historical record that the advantages and design of exalted carrier receiving systems predate the RA1772 (eg. cf the reprint of a talk given by Murray G. Crosby on January 25, 1945, 'Exalted-Carrier Amplitude- and Phase-Modulation Reception', appearing in *Proceedings of the IRE*, USA, Vol 33, No 9, September 1945)."

You question, without citing specifics, the appropriateness of our awarding "most of the credit to a microprocessor" for the existence of exalted-carrier detection. It's a pity your columnist did not bother to distinguish between detection circuitry, on one hand, and microprocessor functions, on the other. The microprocessor does not replace detection circuitry or otherwise "reinvent the wheel"; rather, it allows for the elimination of phase misatch between the AM signal's carrier and the internally-generated carrier ("BFO"). Until PLL circuits were made available for this purpose, exalted-carrier reception was of limited practical utility.

You comment that having wider bandwidths and more stations as a result of the widespread use of single-sideband in lieu of double-sideband modes of transmission is "having your cake and eating it". With an approximate doubling of available spectrum space resulting from this technological advance the opportunities of greater bandwidth and increased channel allocation represent poles on a continuum. The choice is not "either-or", as Mr McLeod suggests, but, rather, which variable receives what proportion of the spectrum pie. It is worth adding that there is a distantly secondary "cake and eat it" aspect to the substitution of SSB for DSB. The expansion of a DSB signal is in both directions, given the placement of the audio frequency spectrum within the modulation envelope (lows inner edge, highs outer edge). With DSB, the envelopes of adjacent signals shoot toward each other, whereas with SSB the expansion is limited to only one direction. Given the modest shape factors of low-pass transmitter filtering circuits, this in itself allows for SSB to provide a modest increase in usable bandwidth even if all other factors remain unchanged and channel spacing is halved.

PLL tuning and PLL exalted-carrier detection collectively allow for inexpensive, foolproof exalted-carrier reception by the general public of MF and HF broadcasts in the AM mode. These circuits also allow for reception of SSB signals with modestly reduced carriers. Accordingly, the impact of this technology is twofold: first, improved-fidelity reception of MF and HF signals in the existing normative AM mode; second, removal of the main impediments—receiver cost and complexity of operation—to MF/HF broadcasting's conversion to SSB.

The issue is not one of diode *vs.* product detection; rather, it is that practical means finally exist to upgrade fidelity and expand available spectrum space for the two forms of broadcasting which are most commonly relied on throughout the world.

Yours faithfully, Lawrence Magne, International Broadcasting Services Ltd, Penns Park, PA 18943, USA.

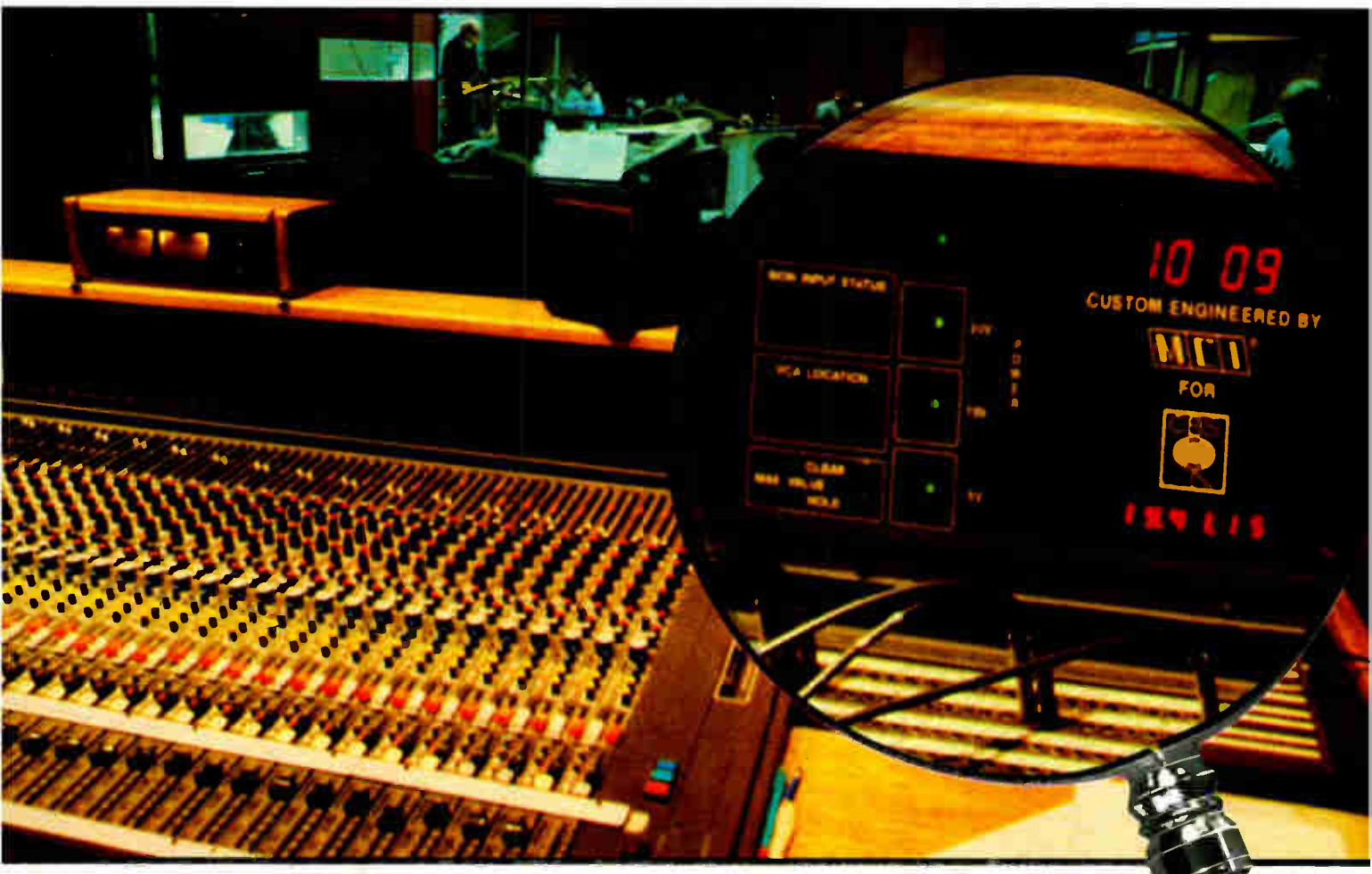
Norman McLeod replies

I thank Mr Magne for his interesting comments and apologise to him and to readers if I have made any serious omissions or errors of fact.

In the case of replacing AM broadcasts with incompatible SSB transmissions, one major hurdle would be the need for every receiver and transmitter involved in the exercise to be replaced or substantially modified. It is perhaps unfortunate, I would agree, that compared to other radio users broadcasters are especially inhibited from re-engineering services by the presence of a vast number of old receivers. But disappointing as it may be, it does pose a problem of some magnitude.

There is also the question of securing international agreement and co-operation over this change. At the moment, the level of jamming and congestion on both HF and MF frequencies is not a good advertisement for the success of international regulation. □

CBS Studios know what the score is...



...get the picture!


JH 800 Console


JH 110 B-14-2-VP


JH 24-24

MCI, a division of Sony Corporation of America, manufacture a complete range of analogue mixing consoles and professional reel to reel tape machines. For further details consult your local distributor.

SONY Broadcast PRO-AUDIO

Sony Broadcast Ltd.
City Wall House
Basing View, Basingstoke
Hampshire RG21 2LA
United Kingdom

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

Tape machines

This guide includes details of analogue tape machines ranging from mono to 40-track. In addition to these, the following companies manufacture digital recording systems: Denon (Japan); EMT (West Germany); JVC (Japan); Mitsubishi Telefunken (Japan/West Germany); 3M (USA); Sony (Japan); Studer (Switzerland); Teac (Japan); and Technics (Japan). These digital systems use one of three types of recording format: longitudinal tape recording; helical scan video-tape recording; or a magnetic disk stack.

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

MTR Series: 8-track on 1 in; 16-, 24- or 32-track on 2 in; 7½/15 in/s; CCIR or NAB EQ.

ACES (UK)
AC Electronic Services, Broad Oak, Albrighton, Near Shrewsbury, Shropshire SY4 3AG. Tel: 0939 290574.
USA: ACES (USA), 244 Lyell Avenue, Rochester, NY 14608. Tel: (716) 458-5610.

TR2: 2-track on ½ in; 15 in s; NAB EQ.
TR16/TR24: 16 or 24-track on 2 in; 15 in/s; NAB EQ.

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

Model 2600: tape transport with Inovonics or ASCO electronics; 2-track and full track on ¼ in; 4-track on ½ in or ¼ in; 8- or 16-track on 1 in; 16- or 24-track on 2 in; 3¾/7½/15/30 in/s.

ALLEN AND HEATH (UK)
Allen and Heath Brenell Ltd, 69 Ship Street, Brighton BN1 1AE. Tel: 0273 24928. Telex: 878235.
USA: Audio Marketing Ltd, 652 Glenbrook Road, Stamford, CT 06906. Tel: (203) 359-2312.

Brenell Mini 8: 8-track on 1 in; 7½/15 in/s.
Syncon M16/M24: 16- or 24-track on 2 in; 15/30 in/s; NAB IEC AES assignable EQ.

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

ATR100: 1- or 2-track on ¼ in; 4-track on ½ in; also 2-track on ½ in mastering format; 3¾/7½/15/30 in/s; 4-speed dual EQ padnet.
ATR700: 1-, 2-track or ¼-track on ¼ in; 3¾/7½ or 7½/15 in/s.
ATR800: 1-, 2- or 4-track on ½ in; 7½/15/30 in/s; NAB or IEC EQ.
ATR 124/116: 16- or 24-track on 2 in; 7½/15/30 in/s. NAB/IEC/AES assignable EQ.
MM1200: 8-track on 1 in; 16- or 24-track on 2 in; 7½/15 or 15/30 in/s.

ASC (West Germany)
Audio System Componenten GmbH & Co. Seibelstrasse 4, D-8752 Hosbach. Tel: 0 60 21 53021. Telex: 04188571.
UK: Uher Sales and Services Ltd, 30–31 Lyme Street, London NW1. Tel: 01-485 0943/4.

AS 6002: 2-track on ¼ in; optional ¼-track; 3¾/7½/15 in/s.

AUDIO SYSTEMS COMPONENTS (UK)
Audio Systems Components Ltd, 19 The Green, Theale, Berks RG7 5DR. Tel: 0734 302108.

Revox PR99: customised version of the Revox *PR99* for broadcasters.

AUDIO VIDEO MARKETING (UK)
Audio Video Marketing Ltd, Unit 20/21, Royal Industrial Estate, Jarrow, Tyne & Wear NE32 3HR. Tel: 091 4893092. Telex: 537227.

Series 77: ½-track mono on ¼ in; 1⅝/1⅞, 1⅞/3¾ or 3¾/7½ in/s; NAB EQ.

CEI (Australia)
Consolidated Electronic Group, PO Box 21, Anderson Road, Thornbury, Victoria 3071. Tel: 44 07 91. Telex: 32463.

Cuemaster 77: full and 2-track on ¼ in, 4-track also available; 3¾ 7½ 15 in s; IEC EQ, NAB option.
Cuemaster Series 2000: mono or stereo on ¼ in; 3¾ 7½ in s or 7½/15 in s.

CUNNINGS (UK)
Cunnings Recording Associates, 19 Burcote Road, London SW18 3LQ. Tel: 01-874 8471.

Ferrograph Studio 8: 1- or 2-track on ¼ in (or 0.15 in to special order); 3¾/7½ or 7½/15 in/s; available with penthouse electronics.

DENON (Japan)
Denon, Nippon Columbia Co Ltd, No 14-14, 4 chome Akasaka, Minatoku, Tokyo 107. Tel: 03 584-8111. Telex: 22591.
UK: Hayden Laboratories Ltd, Hayden House, Chiltern Hill, Chalfont St. Peter, Gerrards Cross, Bucks SL9 9UG. Tel: 0753 888447. Telex: 849469.
USA: Denon America Inc, 27 Law Drive, Fairfield, NJ 07006. Tel: (201) 575-7810.

DN 85: full track mono or 2-track stereo ¼ in machines; 3¾ 7½ in/s; CCIR NAB EQ.
DN 3300 Series: full track mono, or 2-track stereo on ¼ in; 7½/15 in s or 3¾/7½ in/s; CCIR/NAB EQ.

ELECTRO SOUND (USA)
Electro Sound, 160 San Gabriel Drive, PO Box 60639, Sunnyvale, CA 94088. Tel: (408) 245-6600. Telex: 346324.

Tape recorder: full, 2-track and stereo on ¼ in; 4- and 8-track on 1 in; ¼ in transport 3¾/7½ or 7½/15 in/s; 1 in transport 7½/15 or 15/30 in/s; NAB EQ, IEC option.

ENERTEC (France)
Enertec SA, Dept Audio Professional, 1 Rue Nieuport, F-78140 Velizy-Villacoublay. Tel: 946. 96. 50. Telex: 697430.
UK: Crow of Reading, PO Box 36, Reading RG1 2NB. Tel: 0734 595025. Telex: 847056.

F462: full, 2-track or stereo on ¼ in; 7½/15 in/s, options for 3¾/7½ or 15/30 in/s; CCIR/NAB EQ; optional pilot track models.
F500: mono, mono/stereo compatible (0.75 and 2 mm), 2-track, 2-track with sync play, mono with *Neopilot*, stereo with *Synchrotone*, and stereo with *Nagrasync* on ¼ in; 3¾/7½ 15 in s; CCIR/NAB EQ.

FERROGRAPH (UK)
Ferrograph Recorders, Unit 21, Royal Industrial Estate, Jarrow, Tyne & Wear NE32 9XX. Tel: 091 4893092. Telex: 537227.
USA: Neal-Ferrograph (USA) Inc, 652 Glenbrook Road, Stamford, CT 06906. Tel: (203) 348-1045. Telex: 643678.

SP7: 1- (full or ½) or 2-track (¼ or ⅛) on ¼ in; 3¾/7½/15 in/s, 1⅞/3¾/7½ in/s or 1⅜/1⅞/3¾ in/s; IEC or NAB EQ; logging and delay versions available.
Logic 7: 2-track (¼ or ⅛) on ¼ in; speeds as for *SP7*.
Edit: replay only machine; 3¾/7½/15 in/s; mono or stereo versions.
SP744: 4-channel version of the *SP7*.

FOSTEX (Japan)
Fostex Corp, 512 Miyazawacho, Akishima, Tokyo. Tel: 0425-45-6111. Telex: 2842-203.
USA: Fostex Corporation of America, 15431 Blackburn Avenue, Norwalk, CA 90650. Tel: (213) 921-1112.
UK: Bandive Ltd, Brentview Road, London NW9 7EL. Tel: 01-202 4366. Telex: 25769.

A-2: 2-track on ½ in; 7½/15 in/s; NAB EQ, optional IEC.
A-4: 4-track on ¼ in; 7½/15 in/s; NAB EQ, optional IEC.
A-8: 8-track on ¼ in (2 × 4-channel record, 8-channel repoduce); single speed 15 in/s; IEC EQ; incorporates Dolby-C noise reduction.
B-16: 16-track on ½ in; single speed 15 in/s; IEC EQ; combined record/reproduce head; incorporates Dolby-C noise reduction.

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

1100A Series: 1- or 2-track on ¼ in; 4-track on ½ in; 7½/15/30 in/s.
1100B Series: 4-track on ½ in; 8-track on 1 in; 7½ 15/30 in s.
1000 Series: 8-track on 1 in; 16- or 24-track on 2 in; 7½/15/30 in s.

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

806: 8-track on ½ in; single speed 15 in/s; Dolby-A and dbx noise reduction.
810: 8-track export only version of the *1610*; 8-track on 1 in; 7½/15/30 in/s; dbx noise reduction.
1610: 16-track on 1 in; 7½ 15/30 in s; optional dbx noise reduction.

LEEVERS-RICH (UK)
Leevers Rich Equipment Ltd, 319 Trinity Road, London SW18 3SL. Tel: 01-874 9054. Telex: 923455.

Proline 2000TC: 1- or 2-track on ¼ in; 3¾/7½, 7½/15 or 15/30 in/s; NAB/IEC EQ; various control panel options for TV and radio applications.
Proline 1000SC: 1- or 2-track on ¼ in; 3¾/7½, 7½/15 or 15/30 in/s; NAB/IEC EQ.
E200: 1- or 2-track on ¼ in; 3¾/7½ or 7½/15 in/s; NAB IEC EQ on plug-in cards.

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

TR55: 1- or 2-track on ¼ in; 7½/15 in/s; NAB or CCIR EQ.
TR532: 8-track on 1 in; 16- or 24-track on 2 in; 15/30 in/s; NAB or CCIR EQ.

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

JH-110 Series: 1- or 2-track on ¼ in; 4-track on ½ in; 8-track on 1 in; 3¾/7½/15 in/s or 7½/15/30 in/s; NAB/CCIR EQ.
JH-24: 8-track on 1 in; 16- or 24-track on 2 in; 15/30 in/s; NAB/CCIR/AES EQ.

MECHLABOR (Hungary)
Electroimpex, PO Box 296, H-1392 Budapest. Tel: 321330. Telex: 225771.

STM-610 Series: mono, stereo, 2-track on ¼ in; 3¾/7½ or 7½/15 in/s.

MONDIAL (France)
Mondial Electronique, Division Audio, 13 Boulevard Gallieni, F-94130 Nogent-sur-Marne. Tel: 873. 37. 77.

MP10: 2-track on ¼ in; 7½/15 in/s; NAB or CCIR EQ. Available in two versions—*3001-ME* recorder and *2001-ME* editing machine.

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

M79: 8-track on 1 in; 16- or 24-track on 2 in; 7½/15 or 15/30 in/s.

NAGRA (Switzerland)
Kudelski SA, CH-1033 Cheseaux-sur-Lausanne. Tel: 021 91.21.21. Telex: 24392.
UK: Hayden Laboratories Ltd, Hayden House, Chiltern Hill, Chalfont St Peter, Bucks SL9 9UG. Tel: 0753 888447. Telex: 849469.
USA: Nagra Magnetic Recorders Inc, 19 W 44th Street, Room 715, New York, NY 10036. Tel: (212) 840-0999. Telex: 710-581 2443.

IV-S: 2-track plus *Nagrasync* on ¼ in; 3¾, 7½ and 15 in/s; NAB/CCIR EQ; mains or battery powering; optional Dolby noise reduction. ▷

Tape machines

4.2: 1-track plus *Neopilot* on ¼in; speeds and features similar to *T1-S*.
SN: 1-track (with or without pilot-tone) on 0·15in; 1⅞ and 3¾in s; miniature battery powered portable.
SNS: ½-track; 1⅝ and 1⅞in s; similar to model *SN*.
T-1: 4-channel on ¼in; 1⅝ 1⅞ 3¾/7½ 15/30/60in/s. *T-1* is an instrument recorder designed to operate to the IRIG intermediate band.
T-Audio: based on the *T-1*; 2- or 4-track on ¼in; 3¾ 7½ 15 30in s.
T-RVR: 1- or 2-track plus timecode track on ¼in; 1⅝ 1⅞ 3¾ 7½in s.
IS: full track plus optional *Neopilot* on ¼in; 3¾ 7½in s; NAB or CCIR EQ.

OTARI (Japan)
Otari Electric Co, Otari Bldg 4-29-18 Minami, Ogikubo, Suginamiku, Tokyo. Tel: 03 333-9631. Telex: 26604.
USA: Otari Corp, 2 Davis Drive, Belmont, CA 94002. Tel: (415) 592-8311.
UK: Otari Electric (UK) Ltd, Herschel Industrial Centre, 22 Church Street, Slough SL1 1TP. Tel: 0753 38261. Telex: 849453.

MX-5050B: 1- or 2-track on ¼in; 3¾ 7½ or 15in s; NAB EQ, optional EIA, CCIR and IEC.
MX-5050 BQII: 4-track on ¼in; 7½/15in/s; NAB or IEC EQ.
MX-5050 MkIII-8: 8-track on ½in; 7½ 15in s; NAB or IEC EQ.
MTR-10: 2-track on ¼in; 4-track on ½in; 3¾ 7½ 15 or 7½ 15 30in s; NAB IEC AES EQ.
MTR-12: similar to *MTR-10*, but accepts 12in reels.
MTR-90: 16- or 24-track on 2in; 15 30in s; NAB IEC AES EQ.

SCULLY (USA)
Ampro/Scully, Newton Yardley Road, Newton, PA 18940. Tel: (215) 968-9000.
UK: Lee Engineering Ltd., Napier House, Bridge Street, Walton-on-Thames, Surrey KT12 1AP. Tel: 09322 43124. Telex: 928475.

280B Series: full, ½-, 2- and 4-track on ¼in; 4-track on ½in; 8-track on 1in; 3¾ 7½ 15 30in s.
250: 1- or 2-track on ¼in; 3¾ 7½ or 15in s.
255: 3¾ 7½in s replay only version of the model *250* for broadcast use.

SOUNDCRAFT (UK)
Soundcraft Magnetics Ltd, 5–8 Great Sutton Street, London EC1 0BX. Tel: 01-253 9878. Telex: 21198.
USA: Soundcraft Inc, 1517 20th Street, Santa Monica, CA 90404. Tel: (213) 433-4591. Telex: 664923.

SCM381: 8- or 16-track on 1in; 15in s single speed; NAB EQ.
SCM762: 16- or 24-track on 2in; 15 30in s; NAB EQ, others to order; many options available.
SCM760: 16- or 24-track on 2in with an interchangeable headblock; 15/30in/s; NAB EQ.

STELLAVOX (Switzerland)
Stellavox, CH-2068 Hauterive/NE. Tel: 038 33.42.33. Telex: 35380.
UK: Future Film Developments, 114 Wardour Street, London W1V 3LP. Tel: 01-434 3344. Telex: 21624.
USA: Zollan Enterprises Ltd, 250 W 57th Street, New York, NY 10019. Tel: (212) 245-1598. Telex: 125122.

SM8/SQ7: 2-track (*SM8*) and 4-track (*SQ7*) on ¼in; 7½ and 15in/s; battery or mains powered portable.
SP8: 1- or 2-track on ¼in; 3¾, 7½ and 15in/s; similar to *SM8* with 50 60Hz pilot generator and cuetrack playback amp or synchroniser; *SP8T* is similar, but includes centre track EBU timecode.
TD88: 1-track (optional *Neopilot*) or 2-track (optional *Synchrotone*) on ¼in; 2-, 4- or 8-track on ½in and *Perfotape* for 16mm magnetic tape; 1⅞, 3¾, 7½, 15 and 30in s, plus 24 and 25 frames s.

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

Capstanless Multitrack: 4-track on ½in; 8-track on 1in; 16-, 24-, 32- or 40-track on 2in; 15 30in s, plus 60in s scan; capstanless tape transport system.

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

B67 Mk II: 1- or 2-track on ¼in; 3¾ 7½ 15in/s or 7½ 15 30in s; NAB or CCIR EQ via plug-in cards.
A700: 2-track (½- or ¼-track) on ¼in; 3¾ 7½ 15in s.
B77: 2-track (½- or ¼-track) on ¼in; 3¾ 7½ or 7½ 15in s; NAB or IEC EQ. Almost 70 variants of the *B77* are available including 1⅝ 1⅞ and 1⅞ 3¾in s slow speed versions.
PR99 Series: 2-track on ¼in; 3¾ 7½ or 7½ 15in s; NAB EQ.
A80/RC: 1- or 2-track on ¼in; 3¾ 7½, 7½/15 or 15 30in s; NAB or CCIR EQ on plug-in cards.
A80/VU Mk II: 1-, 2- or 4-track on ¼ or ½in; 4- or 8-track on 1in; 7½/15 or 15/30in s; CCIR or NAB EQ.
A80/VU Mk III: 16- or 24-track on 2in; 7½/15 or 15 30in s; CCIR or NAB EQ.
A800: 8-track on 1in; 16- or 24-track on 2in; 7½ 15 or 15 30in s; NAB CCIR EQ switching.
A810: full track, stereo 2-track and 2-track with timecode on ¼in; 3¾ 7½ 15 30in s; switchable NAB CCIR AES2 EQ.

TANDBERG (Norway)
Tandberg A/S, Fetveien 1, PO Box 53, N-2007 Kjeller.
UK: Tandberg (UK) Ltd, Unit 1, Revie Road Industrial Estate, Elland Road, Leeds LS11 8JG, West Yorkshire. Tel: 0532 774844. Telex: 557611.
USA: Tandberg of America Inc, Labriola Court, Armonk, NY 10504. Tel: (914) 273-9150. Telex: 137357.

TD20A: 2-track (½- or ¼-track) on ¼in; ¼-track 3¾ 7½in s; ½- and ¼-track 7½ 15in/s; NAB/IEC EQ.
TD20A-SE: similar to *TD20A* but features special equalisation facility (in addition to NAB IEC).
TD20A-P: similar to *TD20A* but playback only.
TD20A-L: 4-track logging recorder; 1⅝ 1⅞in s.

TEAC (Japan)
Teac Corp, 3-7-3 Naka-Cho, Musashino, Tokyo 180. Tel: 0422 53 1111. Telex: 2822551.
UK: Harman (Audio) UK Ltd, Mill Street, Slough SL2 5DD, Berks. Tel: 0753 76911. Telex: 849069.
USA: Teac Corp of America, 7733 Telegraph Road, Montebello, CA 90640. Tel: (213) 726-0303. Telex: 677014.

32: 2-track on ¼in; 7½ 15in s; NAB EQ.
34: 4-track on ¼in; 7½ 15in s; NAB EQ.
38: 8-track on 1in; single speed 15in s; NAB EQ.
52: 2-track on ¼in; 7½ 15in s; NAB or IEC EQ.
58: 8-track on 1in; single speed 15in s; IEC EQ.
85-16: 16-track on 1in; single speed 15in s; IEC EQ; optional dbx noise reduction.

TECNICOBEL (France)
Tecnicobel, 8 rue de la Croix-Matre, BP26. F-91122 Palaiseau Cedex. Tel: (1) 920.80.39. Telex: 692543.

MGB 60: 1- or 2-track on ¼in; 7½ 15in s standard, 3¾ 7½ or 15 30in s to order.

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

M12A: 1- or 2-track (optional pilot-tone) on ¼in; 3¾ 7½ or 7½ 15in s; NAB CCIR EQ.
M15A: 1- or 2-track (optional pilot-tone or timecode) on ¼in; 4-track on ½in; 8-track on 1in; 16-, 24- or 32-track on 2in; 7½ 15 or 15 30in s; NAB CCIR AES switchable EQ.
M21: mono, stereo or 2-track on ¼in; 3¾ 7½ 15/30in/s; 12½in reel capacity; NAB/CCIR/AES switchable EQ.

TELEX (USA)
Telex Communications Inc, 9600 Aldrich Avenue South, Minneapolis, MN 55420. Tel: (612) 884-4051. Telex: 297053.
UK: Avcom Systems Ltd, Newton Works, Stanlake Mews, London W12 7HA. Tel: 01-749 2201. Telex: 897749.

1400 Series: 1- or 2-track on ¼in; 3¾ 7½ 15in/s.
230: series of heavy duty tape transports with two speeds and available in a wide variety of formats including a logging version.
3000 Series: 1-, 2- or 4-track on ¼in; 3¾ 7½ or 7½ 15in/s.

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

TRS Series: 16- or 24-track on 2in; 15 30in s; autolocator supplied as standard.

TTS (West Germany)
TTS-Electronic GmbH, Dammuhlenweg 4, D-6270 Ildstein. Tel: 61 26 2014. Telex: 4182297.

PR-8: 8-track on ½in; 15in/s (optional 7½in/s); IEC EQ (NAB option); uses Studer transport and incorporates *High-Com* noise reduction.

UHER (West Germany)
Uher Werke Munchen, Barmseestrasse 11, D-8000, München 17. Tel: 089 78721. Telex: 0522932.
UK: Uher Sales and Services Ltd, 30–31 Lyme Street, London NW1. Tel: 01-485 0943 4.

SG630: 2-track (½- or ¼-track) on ¼in; 1⅞ 3¾/7½in/s.
4000 Series: ½-track mono, ½-track stereo, ¼-track stereo on ¼in; 1⅝/1⅞/3¾/7½in/s; battery or mains powered portables with built-in monitor loudspeakers.
1200 Synchro: 1-track plus *Neopilot* on ¼in; single speed 7½in s. □

AUDIO SWITCHING SYSTEM

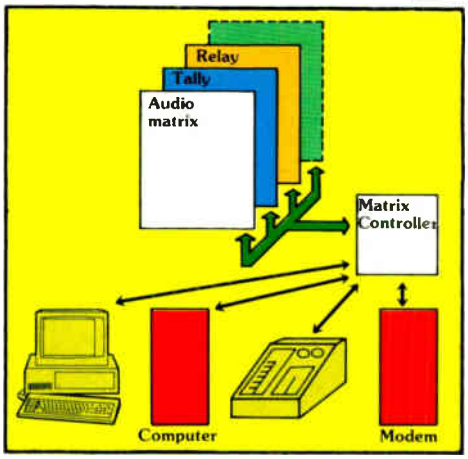
The **NTP 512 Routing Switcher System** has been developed to meet the needs for high performance routing of audio, high-speed time-code, tally information, and intercom signals in broadcasting stations, recording studios or telecommunication authorities. The performance specifications fulfil the high standards required by the European Broadcasting Authorities.

Compactness.

A compact system gives great user benefits so we put 128 electronic crosspoints on each audio crosspoint card. In fact, the packaging density of the **NTP 512 system** is unmatched - imagine, a 96 × 96 audio matrix takes up only 12 units of panel space! The **512 system** is designed in a modular form which allows implementation of switching systems to any desired size.

Key features include:

- Same superior technical specifications for all sizes of systems.
- Positive feed-back information of crosspoint-status obtained from the crosspoint itself.
- Multiple-level signal switching - parallel switching or individual switching.
- Power-failure memory - years of memory retention with battery-powered RAM back-up.
- Standard interface RS232C and RS422.
- Master control panel with full matrix control.
- Standard control panels - or custom-designed panels.
- High-speed time-code switching possible.
- Ease of maintenance - any card can be replaced under power.

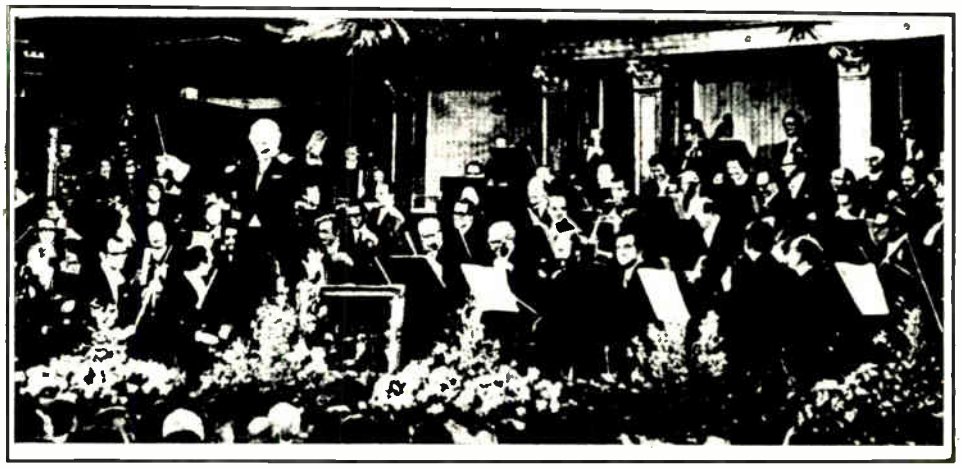


Reliability.

This is in our opinion one of the most important factors in a routing switcher, and has been given very high attention during development of the **512 system**. A modern rear-panel technique with press-fit connectors ensures minimum cabling and soldering. Redundancy, by means of a dual-power supply with dublicated power busses throughout the system, and dual matrix controllers is optionally available.

Control.

The control functions of the **512 system** are managed by a centralized 16-bit matrix controller which can handle anything from a single small matrix to many large matrices - from a few and simple controlpanels to a great number of complex panels with alphanumeric displays, etc.



Performance.

Superior performance specifications have been achieved by careful design employing the latest advanced technology. An output switch is provided on each crosspoint card output to minimize crosstalk, a feature which eliminates crosstalk build-up with increased matrix size. The output stage is a true line driver stage with a built-in muting function when »on-the-air« signals are switched.

For more information on the **NTP 512 switching system**, please contact:

NTP ELEKTRONIK A/S

Theklavej 44, DK-2400 Copenhagen NV
Denmark,
Phone: +45-1 10 12 22
Telex: 16378 ntp dk

THE SUNNY SOUND OF SUSSEX

Norman McLeod

Almost exactly a year on from the award of the Brighton ILR franchise to Southern Sound, the new station goes on air. Norman McLeod concludes his series, overseeing the development of an ILR station, with the arrival of the fateful day of first transmission.

On the surface, rivalry between the BBC and the IBA is quite obvious and sometimes intense. Scoring prestigious points off each other is a popular activity between BBC executives and their opposite numbers in Brompton Road. However, at the level of engineering, more sober attitudes prevail. UK viewers would not be able to receive all TV programmes on one UHF aerial were it not for a long-standing policy of co-operation over TV and radio transmitting sites. All four TV transmitters are always in the same place: sometimes the site is owned by the BBC, sometimes by the IBA. In the case of Southern Sound, both MW and VHF transmissions are radiated by BBC masts, and it was as a forerunner to the arrival of Southern Sound that BBC Radio 2 was taken off the air last summer for a little over a week. This was done to enable new units to be fitted to the combiner assembly at the base of the MW mast at Shoreham. There's a collection of twenty-five cages, each containing a resonant circuit, to enable five transmitters to drive the same mast.

Shoreham is one of a number of sites where a large number of transmissions come from the one mast: it puts out transmissions on 1485, 1332, 1215, 1053 and 693 kHz simultaneously. (Pride of place in the UK goes to the Redmoss transmitter near Aberdeen which manages six frequencies.) In the feed to the mast from each transmitter, there needs to be an acceptor circuit to let the wanted frequency through, and rejector circuits to stop all the others from blowing the transmitter up. Hence all the coils in cages.

Fitting the new combiners is a job which has been contracted out to Marconi. As someone who dabbles on the amateur bands with a handful of watts here and there, I find seeing this kilowatt-rated gear quite exciting. But the Marconi engineer is unmoved. "This is kid's stuff," he says. His last job was the massive BBC World Service sender at Orfordness, which can boil an egg at half a mile.

Back in the main transmitter building, the BBC team kindly show me round. I ponder on the effects of having all these volts per metre quivering through the human frame. The BBC engineer isn't worried about this. "Transmitter engineers live longer than studio ones," he assures me.

At the moment, a temporary aerial is in use, with Radio Brighton, Radio 3 and Radio 1 going out with reduced power via a temporary combiner. This aerial slants up from the transmitter building towards the main mast, with the cables running out through a disabled extractor fan. This makes it rather hot inside.

The transmitters used are Eddystone *B6038Es*: a solid-state sender with eight paralleled output modules capable of raising a kilowatt of power. A modern transmitter like this will use about 2.5kW of power for a kilowatt of RF out, while the older generation of thermionic transmitters consumed about twice as much.

The IBA's transmitters are housed in a separate building, and are fed with programme signals from a British Telecom landline, with a crystal-controlled receiver tuned to the VHF transmitter as a standby feed. The IBA MF stations have a very steep 5kHz low-pass filter fitted to the programme input, which rises in response slightly between 3 and 5 kHz and then falls very rapidly, being more than 40 dB down at just above 7 kHz and beyond. After the filter, a limiter/compressor prevents overmodulation, and also reduces the dynamic range of the input by 12 dB.

The transmitting station also has an over-the-air alarm system, which can transmit up to six different panic/fault messages using a low-level sub-carrier—at 4.7 kHz for the MW transmitters, and 14 kHz for the VHF stations. In this way, the programme contractor can be alerted about malfunctions at the transmitting station, and can advise the IBA accordingly. Of course, this form of telemetry won't work if the transmitter goes off the air entirely, but that particular fault condition has fairly obvious effects!

Southern Sound's installation is less remarkable than some of the transmitting stations developed by the IBA for local radio. It's an omnidirectional station using a frequency assigned for high-power use in Europe (Rome runs 300 kW on the same frequency.) Stations sharing the UK high-power channels such as 1152 or 1548 kHz use sophisticated four-mast directional aerials developed with the aid of consultants from the United States.

These aerials are designed to produce nulls as deep as 26 dB over selected arcs—for example, at the Manchester aerial towards Birmingham, and vice versa. The money to pay for these sophisticated engineering exercises is raised from ILR stations by means of a rental system.

The rental payable is more closely related to the value of the service provided that to the literal costs of providing each service, although the overall aim is to cover costs and repay a Government loan. Stations which make profits (and 20 ofthe first 26 ILR stations now do) pay a graded secondary rental which is then recycled through various prestigious projects or training.

Warming up the ether

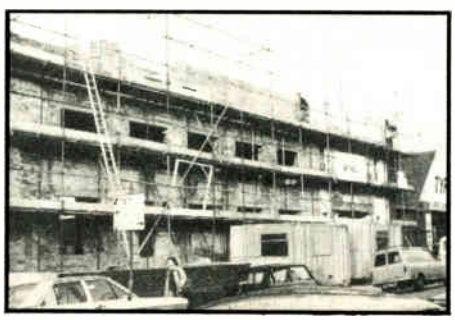
The IBA transmitters come on air a few weeks before programme service is due to start, carrying tapes of pre-recorded music and announcements warning listeners of what is in store. As time goes on, more and more trails and promotions from Southern Sound appear, interspersed by announcements about the IBA and its Southampton office.

The music played was intended to be representative of the sort of stuff listeners could expect to hear, and contained—in addition to the usual pop records—odd bits of light classical music and records even I don't remember. This in itself is enough to gain a large audience, since many people regard their radios as a source of background music as much as anything else.

Down at Southern Sound's Radio House the week before air date, managing director Keith Belcher is overseeing last-minute publicity. We watch the Southern Sound video, 20 s of the sun rising and the frequencies displayed with a voice-over heralding the arrival of the new service. This will be shown on Channel 4 and ITV over the weekend at peak times. They'll keep the film to hand in case they want to use it again in the future, since it cost them £2,000 to make.

Keith has been studying the behaviour of human beings in connection with memory retention and recall. Or, rather, swarms of marketing scientists have. What you do is implant a memory in the subject's brain, deep in the unconscious mind, by handing him or her a Southern Sound sticker or by parking the mobile truck in their driveway. This sunny symbol then lurks dormant until you trigger it.

It was like listening to a hypnotist. "It's no good triggering it (this hidden thought pattern) too soon," says big Keith, "it's pointless triggering it two weeks before." What happens instead is that you get publicity galore in the Evening Argus (Brighton's local paper) on the Monday, and zap 'em with the TV ads all weekend. Then if there are any still holding out after this, you



make sure you're on the TV South news, and finally sock it to 'em with 330,000 multicoloured free sheets, each with a picture of a pretty girl on the front.

What you're up against are the radio listening habits of a lifetime. Most members of the public are staggeringly ignorant of the way radio works and find tuning their receivers quite perplexing. Shops in the area dealing in radio and TV have been busy twiddling dials, but to get someone to tackle the receiver on their own takes a mighty amount of cajoling.

A deal has been struck with the Post Office to have letters franked with Southern Sound publicity. Every radio and hi-fi shop will be supplied with a groovy poster. And, on September 10th, the good folks of Brighton will awake to a sunny Southern Sound message as they collect their morning pintas. 150,000 leaflets will greet the misty dawn with the legend: "Southern Sound —as fresh as the morning milk." At this point I cannot retain my normal diplomatic cool any longer and let slip a chortle or two.

"You may be cynical," says big Keith with avuncular disdain, "but it works!" I may be cynical, 'tis true. I am looking at a man who is positively beaming now with the prospect of a very successful radio station under his management. We're not on the air yet, but he knows he's on to a winner.

What about the dry runs? How are they getting on? Downstairs, the daily presenters are putting in normal hours in Control Room 'A', working through the schedule and format as if they were on the air. Programme controller Rory McLeod has the output from the studio available in his office, and from time to time he listens to it. (The first question anyone walking into Control Room 'A' is asked concerns whether or not Rory is listening. If he's not, they visibly relax.)

"You explain programme concepts and listen to how they're putting it across... how you might change a junction, how going in and out of an ad would make it a more continuous programme . . . the nicest way to handle a sticker spot," says Keith. Rory adds that they're seeing if their policy of not naming famous old records works.

What is going to happen come the glorious day? The Board are being invited to listen at home until 8 : 30 am, and then to come down to the station for breakfast. By ten o'clock, though, Southern Sound will be a normal radio station. "No launch party, no series of guided tours, no messages from dignitaries, no state opening by King Kong, no well-meaning but dull people boring the audience..." we are assured.

Keith is pleasantly surprised by the signal which the IBA transmitters are providing him with, having driven round the area for five hours the day they start the regular test schedule. But he's heard tell that the frequency of the BBC Radio Sussex transmitter at Heathfield is to be 103.1 MHz, which may impair reception of his own signal on 103.4MHz north of the Downs. VHF reception off the Whitehawk Hill transmitter north of the Downs is weak and variable: the service area here is prominently medium wave.

The glorious 29th

That feeling of impeding something, of which Keith Belcher spoke last time, turned into a reality at 7:45 am on Monday, 29th August 1983. First they played the National Anthem. Then, instead of closing down at once, which is what most sensible stations do after the National Anthem, came the station's first immortal words:

"It's a quarter to eight on Monday, the 29th of August, 1983. Welcome to Southern Sound."

There followed the Southern Sound theme tune (which, you may recall, sounds a bit like the theme to *Hawaii Five-O*) all the way through. Then:

"The Southern Sound theme, written by David Arnold and played by the Royal Philharmonic orchestra."

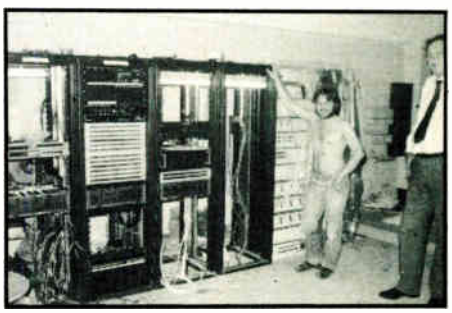
They then went straight into a gramophone record by the Beach Boys, *Good Vibrations*, after which the voice identified itself:

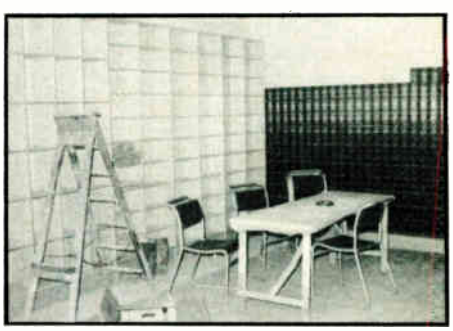
"Good morning, this is Louis Robinson on Southern Sound, on a Bank Holiday morning in Sussex. Thanks to everybody who's rung and written to the station over the last eight days or so, saying how much they enjoyed the music in our test transmissions, and they're asking if that's the sort of thing we're going to be playing (dramatic pause here) Well, the answer is.... *You bet*! At eight o'clock, Paul Woodley with the news."

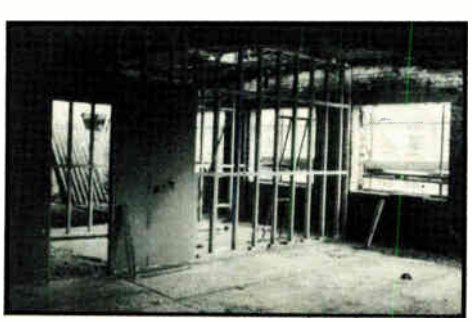
One *Bridge over Troubled Water* later, we run into the kids from Fame without a break, after which we had the weather forecast. It was cloudy, looked like rain and was the coldest it had been all summer. However, after forecasting cloudy skies and 68 degrees, we were informed that it was "perfect for a bank holiday". If he was taking the mickey it didn't show.

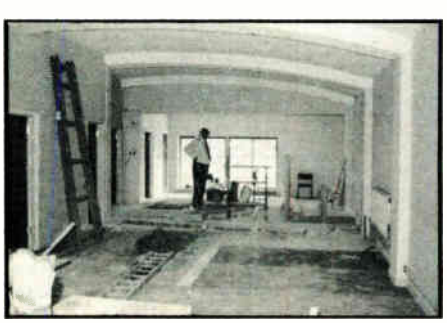
Cheerful and glossy

On commercial radio you have to make the best of things like a lousy weather forecast because the overall tone of the station must never be dismal or depressing. Indeed the "sound" of the station must be right regardless of any of the content. That's why they didn't carry on with









the classical bits used in the test tapes, despite the above promise. They didn't *work*.

What works, apparently, is a regime of one 'A', one 'gold'. Put another way, every other record played on Southern Sound is a hit from years gone by, recorded on a cartridge because in many cases the originals belong to someone else. 1,600 records are cycled in a highly arcane manner, with codes relating to the year-span of issue, to the category (male vocal, instrumental, etc) and to the speed. The timing and intro length are also put down on the cartridge label to help with programme planning.

In this way the music can be categorised and rotated in a clinical, but effective way, to create the right mood and tempo for the time of day. This assumes a mindlessly pre-set pattern of activity—"time to put the spuds on, mum, he'll be home for dinner soon", chirps Stewart Macintosh at 12:15 pm, as a crowd of captive stereotypes rush to do his bidding. But it works.

Blazing switchboards

Vince Geddes' programme partly overlaps the slot he used to occupy on BBC Radio Brighton: the mid-afternoon time. *Sussex Afternoon* is now his, from after the lunchtime news until 4:00 pm every weekday. I spoke to him after the station had been on the air for four days, and he looked pleased, but tired. There is more strain in working for this station than at the leisurely pace of BBC operations. The contents of each hour are plotted on circular charts with a couple of dozen slices and marks. In a week Vince will have to assemble over a thousand snatches of sound in an exact and largely predetermined order. In addition, he has to speak and conduct interviews, assembling a paper running order of things to be said as well as done. It sounds a lot easier than it looks, and it looks a lot easier than it is.

He likes working with the MBI *Series 24A* desk, his only complaint being that the script space isn't quite big enough to hold all the messages he needs to scatter about him. He also likes the response which the audience have made to the station's arrival. "Just look at those trays," he says, pointing to a series of wire baskets containing messages and dedications. "Where did all these listeners come from? There are hundreds of dedications. I never got anything like that at BBC Radio Brighton."

The switchboard has been blazing too. They have taken 2,100 calls so far, an average of one every 23 s. There has never been anything like it. Rory is beaming. "They've got good music—people who are on their wavelength," he assures me, when asked to proffer an explanation for this wave of enthusiasm from the general public.

What the general public is doing is making the most of a station which will play a dedication or recite a family message at the drop of a hat. BBC Radio Brighton did this from time to time, in between worthy excursions into collections of tea towels, but Southern Sound does it all day long. "It only works if everyone is listening," says Vince, "and they seem to be." All his old regulars have transferred their allegiance, with boundless extras besides. "If they can keep the pace and the image up, they're onto a winner!"

Keith Belcher is beaming too. Impending something has turned into impending success. There's an audience around that hasn't been catered for before and Southern Sound is mopping them up like a sponge.

In order to balance the picture I look around for someone who isn't beaming. A certain member of the MBI team (not Mel Bowden) looks nonplussed by it all. "Huh," he says, as I seek his opinion on the Sunny Sound of Sussex, "I've been listening to Radio Caroline most of the time." (As a matter of coincidence, the old pirate ship resurfaced with an AOR format just a week before.)

This man is clearly a deviant. He does not like the sunny sound, he is not impressed with today's recipe, and he wouldn't tune in unless he was paid to (which I suppose he is). There are others: I heard people confessing to BBC Radio 4 addictions quite openly in the engineering area. There is still hope.

Professional discipline and bondage

Meanwhile, it seems the station is being run by the firm hand of Mr. McLeod. Rory is quite capable of summoning up stern authority in true Calvinist style, to judge by the notes about untidy studios and the withered look of Marco Pelloni, who played a tape over a news bulletin, but still lives! There have been some moments of confusion, some bores cut off in their stride, some quite inappropriate STD codes given out for the 'phone number, a few blunders here and there. But nothing that you would notice. The sunny sound of Sussex is scrupulously professional. (A BBC newsman working for the opposition grudgingly admitted that their travel news was a lot tidier and punchier.) As a machine for handling information sugared with bonhomie and a general feeling that everything is 'great' (a word they use far too often) it hums away with well-oiled vigour.

For myself, I would like commercial radio a good deal more if it wasn't for the ads. The first time I hear about the compensations of being a lighthouse keeper (it gives you plenty of time to work out the best way to invest your savings) I might be mildly amused. The tenth time this morsel attempts to secure my attention it is greeted with a rapid twist of the tuning dial.

It is nice to hear lists of events happening at places you've heard of. To give them their due, the information packaging and presentation on Southern Sound is usually very crisp and effective. At times it gets carried away with spurious enthusiasm, but it is much better than BBC Radio Brighton's rambling efforts in this direction.

The music constitutes an agreeable enough background noise if you like that sort of background noise, but it scarcely repays critical listening. You gain no more from ILR by sitting down and listening hard than you do from letting it burble away to itself. Anything which interests you will catch your ear, and the rest can safely be ignored. It's only Derek sending a message to Cynthia or the kids saying hello to their teacher, or the umpteenth play of some Sony ad, or a record sufficiently unremarkable to fit easily into a neat category.

Rory's policy of not naming famous old hits ("what's the point in telling them it's Elvis Presley if they all know?") only serves to highlight their complete irrelevance to the rest of the programme. ILR is a sequence of wholly unconnected noises: ideas are not presented, developed and refined over a leisurely hour or two. Instead, a barrage of ads, jingles and music is presented with no trace of discursive intent. Listening to it is popular because it is much easier than paying attention.

Southern Sound will probably make a lot of money. Most people seem agreed on this. Perhaps in years to come it will spend some of this wealth on producing a wider range of quality programmes: at the moment they are scarcely ambitious. It is certainly assured of a secure place on the dial for nearly a decade.

Now, as I tune the Stereofetic across the FM band, I get Radio 2, Radio 3, Radio 4, Radio Brighton and the sunny sound of Sussex in that order and nothing else apart from a few coppers. Still I cannot help asking: is this all there is?

Conclusion

I'd like to thank Keith Belcher and Rory McLeod and the MBI team for their patience and assistance while I was writing this series, and also acknowledge the help of Southern Sound staff. I hope the station helps them realise a dream or two.

"Well that about wraps it up for another time. Coming up next, the news here on Broadcast Sound, the Cheerful Crowd from Croydon, where it's fifteen minutes past eight o'clock and coming soon a really great feature on microphone preamps. . . ." □

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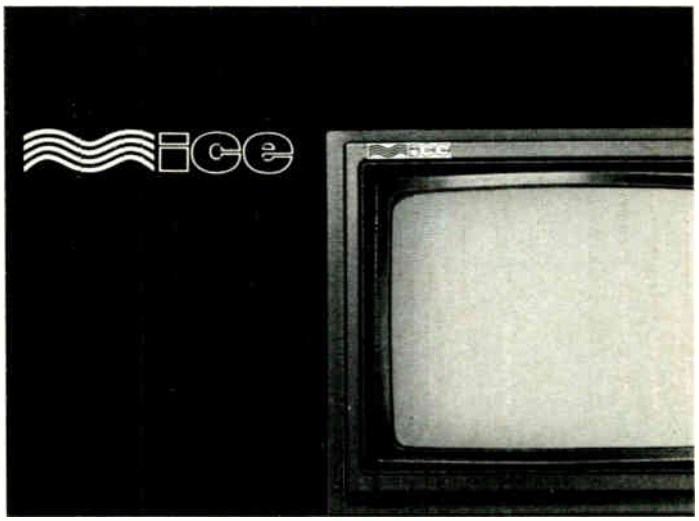

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AMBISONICS FOR AUDIO VISUAL

Richard Elen

Ambisonics is a British-developed surround-sound system currently backed by the British Technology Group. It offers a number of advantages over conventional 'Quad' systems in the A/V and conference environments. The intention of this article is to give sound engineers in A/V production houses, and those in charge of sound systems on-site in these areas, an insight into how to obtain the best results from this technology. A set of reprints of relevant articles from *Studio Sound* and *Broadcast Sound* magazines may be obtained from the Ambisonic Technology Centre in Reading; these will answer basic questions on the system not covered here, plus specific techniques which will be useful in Ambisonic music production.

Ambisonics differs significantly from so-called 'Quadraphonics' in a number of ways. 'Quad' is simply a development of pan-potted stereo, spread between four loudspeakers. Localisation (the positioning of apparent sound sources in the listening environment) is achieved by level alone—which is only one of the different mechanisms used by the ear and brain to position sounds. In addition, the speakers are placed at angles close to 90 , at which normal stereo effects tend to collapse into the loudspeakers. The result of this in a typical A/V environment is that sound sources are 'sucked into the speakers' and there is little spread between them. Additionally, the use of level-only localisation means that with a large number of listeners in the room, each will perceive a different image, as a listener positioned near the front left speaker, for example, will hear mainly the sound from that speaker and little else.

Ambisonics does not seek to produce four totally different signals to feed four speakers in a square. It aims instead to recreate a 'soundfield'—either a real one, captured with a microphone like the Calrec *Soundfield* microphone at a concert or whatever, or a synthesised soundfield created in the studio with the Ambisonic analogue of panpots. In either case, Ambisonics produces an exciting and stable surround-sound effect in which the speakers are often not noticeable as the sources of the sound. As Ambisonics uses both level and phase to localise sound sources, the image is highly stable and not nearly so dependent on the position of the listener within the listening area. Indeed, even sitting next to one speaker, the listener will still be aware of the soundfield image, even though he will appear to be closer to some sound sources than others (just as if you were close to one section of an orchestra: you would expect to hear, say, the violins louder than other instruments, but you would still be fully aware of the rest of the orchestra and the concert hall).

Ambisonics is generally listened to with four speakers arranged in a rectangle (although height information can also be reproduced, with more speakers and slightly more complex equipment—this is called 'periphony'—this will not be considered here as there is little available in the way of equipment at present). The source for replay can be a 2-channel recording encoded with surround information (called 2-channel UHJ) in the form of a disc, radio broadcast or tape; or a 3-channel recording in what is known as 'B-format'. Both 2-channel UHJ and 3-channel B-format are useful in the A V field: the exact format used will depend on the source material and the equipment available at the production facility and on-site.

Ambisonics was originally developed as a domestic format for commercial recordings and radio broadcasts. There are today over 150 albums produced in 2-channel UHJ-encoded form, including several *Compact Discs*. In addition, the BBC have made numerous UHJ broadcasts of concerts and drama. However, the audio-visual environment is ideally suited to Ambisonics for a number of reasons. Firstly, a large number of production houses and on-site users have been working with discrete multi-channel audio presentations for some time. Very often as a result, both production studios and site equipment have been based around the use of four speakers and four channels of amplification, and audio tracks have been laid on 4-track recorders with stereo front audio tracks, rear mono track and data for projectors on the fourth track.

Ambisonics gives the user the possibility of encoding a complete surround-sound image on either two or three audio tracks which allows the producer complete freedom to position sounds—music, effects or voiceovers—anywhere around the listener in such a way that the intended effect will be heard by everyone in the room. If a 4-track machine is in use, then B-format can be used, giving very accurate localisation in the listening environment. Alternatively, if desired, 2-channel UHJ can be used, leaving a blank 'guard-band' channel between audio and data and thus reducing annoying breakthrough of tone or pulses on to the audio system. 2-channel UHJ also means that surround-sound can still be used even in small installations based around 3-channel (2 audio, 1 data) 'A/V' cassette machines. In many cases, the only additional equipment required on-site will be an Ambisonic decoder positioned between the tape machine and the four amps driving the speakers: this will cost between £35 and £200. The British Technology Group also has arrangements to allow first-time users to borrow decoders free of charge to evaluate the system.

Another advantage of UHJ is that it is completely mono and stereo compatible: therefore, if an Ambisonic decoder and four speakers are not available, the same audio can be replayed in mono or stereo without compromising the balance. And on a stereo system, UHJ gives a wider and more stable stereo image than conventional 'pan-potted' stereo, so it is often worth considering an Ambisonic production even if the material will only be heard in stereo. This factor will be considered later in relation to library music.

Ambisonics in production

Although Ambisonics has been around for over 10 years, it is only recently that equipment has become available which will enable the use of Ambisonics in audio-visual applications. Three pieces of equipment are now available, and are currently manufactured by Audio & Design Recording of Reading. They are the Pan-Rotate unit, the Converter, and the Transcoder. The appropriate units for any given production will depend on a number of factors, primarily which format is to be used for replay: UHJ or B-format. UHJ requires only two audio channels and is compatible with stereo and mono; B-format requires three audio channels and would need encoding to UHJ (simply a matter of copying the material through an encoder) to become mono stereo compatible. By virtue of having the extra channel, B-format can give more accurate localisation of signals, and the format is somewhat more 'robust', being less sensitive to machine lineup errors. Because of the extra information encoded on a UHJ tape, lineup (especially azimuth) is a little more important than on ordinary material. If normal maintenance practices are observed, however, no problems will occur. In any event, the main effect of azimuth errors will be to affect mono compatability only, and this is seldom a problem in A/V production.

Transcoder

The Transcoder is a very useful unit which will satisfy many of the requirements of A/V production, if the final tape is to be a 2-channel UHJ-encoded master. The Transcoder takes four inputs, corresponding to the four channels of a conventional 'quad' system, and places them across two 'sound stages', one at the front and one at the rear. The width of the 'stages' may be varied between 0 and 180 at the front, and 0 and 150 at the rear. The output is a UHJ 2-channel encoded signal which may be recorded on an ordinary stereo machine, or on two channels of a 4-track. This means that you can produce your material in the normal way on 16 or 24-track, laying music beds, voice-overs and effects exactly as you would normally do. When it is required to mix, however, instead of routing the soundtrack to three groups feeding the 4-track, your route four groups to the Transcoder input, feeding the Transcoder output to two tape tracks and monitoring the result through an Ambisonic

decoder driving the monitor speakers in the control room. You can pan between any of the four groups to localise a given source exactly where you require it.

There are only two places you cannot place a signal: the positions between the edges of the front and rear stages. These are 30 sectors just behind the 'East' and 'West' directions (in Ambisonics, we refer to centre-front as 'North', centre-rear as 'South', and so on, to avoid confusion with 'Quad' speaker designations. In addition, 'North-West' will only refer to the left-front speaker if the replay speakers are arranged in a square, and they don't have to be. The cardinal points make it easy to refer to a direction in the soundfield, and it doesn't matter if there is a speaker there or not: it will still work!). These 'missing sectors' are not in important places, however, and you will probably never notice!

The effect of the Transcoder is to take a 'Quad' mix and 'transpose' it into Ambisonics, making the image you perceive at the centre of the 'Quad' listening room more stable and accurate, and experienced anywhere inside the Ambisonic listening environment. Indeed, the Transcoder was originally designed to convert 'Quad' recordings to Ambisonics, which is exactly what you are doing if you use the Transcoder for a presentation in this way.

Ambisonic library music

One of the most important aspects of an A/V production is the music, and this is often derived from library sources. This presents no problem in an Ambisonic presentation, as you can position stereo music material across the Transcoder sound-stages as you require. Typically, you might place a stereo music track across the front stage: thus if your front groups are 1 and 2, you simply route the music bed to them in the mix. This will spread the sound right across 180 —very impressive. If you often place a piece of music across the front and a synchronised, delayed underscore to the same piece on the rear channel, you can do the same with the Transcoder, routing the main track to 1 and 2 and the delayed underscore to 3 and 4. This will give you the advantage of both front and rear stereo images instead of just a mono rear signal as you would usually get. The best delay to use will depend on your application: as a guideline, use the same kind of delay as you would use for ADTing a mono source into stereo—around 25 ms or more. Just as in ADT stereo, if the delay is too short, you will get apparent localisation in the soundfield instead of a delay. Changing the delay from zero to about 10 ms will give the impression of the image rushing past your head: this may be interesting but also somewhat distracting for the audience.

Until now, only stereo library music has been available. However, an Ambisonic library album—the first of a series—has now been released by KPM. Titled *Contact*, this album, composed by Keith Mansfield, is the first Ambisonic library album and the first Ambisonic album to be derived from multitrack recording techniques. It is released as a normal LP and, of course, master copies are available from KPM. Both the album and the tapes are in UHJ 2-channel format, and are thus completely mono and stereo compatible. If you are producing a normal stereo or 3-channel A/V, you can treat the tracks as normal stereo: they exhibit the wider and more stable stereo image that characterises an Ambisonic recording. If, however, you are contemplating an Ambisonic A/V, the album really comes into its own. The tracks have been mixed specifically with A/V in mind, such that the rhythm tracks and most of the 'weight' of the tracks have been localised across the front, so as to be heard across the width of the screen. Percussion effects are often wider, stretching from East to West, while ambient sounds, echoes, strings, effects and the like are positioned all the way round the soundfield. This means that when replayed Ambisonically the tracks will give a great deal of clarity and dynamics, but will also create an atmosphere that surrounds the audience without distracting their attention from the visuals. In addition, this type of mix leaves plenty of room for powerful rear effects to be added by the producer without losing either the clarity of the music or the impressiveness of the effect. Tracks from this album should not be routed through the Transcoder, as they are already UHJ-encoded: they should be transferred to multitrack on their own tracks and mixed bypassing the Transcoder direct to the main stereo output to the 4-track. In other words, they should be routed to the mix bus on mixdown, through two channel faders for balancing. The Transcoder outputs should also be returned to the mix bus, perhaps through a pair of console channels, enabling the mixing of UHJ material with material encoded with the Transcoder. This is generally a simply subgrouping operation.

Commentary and effects

Voiceovers and mono effects may be panned into position with the desk panpots: simply route the channel to the appropriate groups to pan across the desired 'stage'. Joysticks, if you have them, may be useful for effects: you can pan a signal anywhere in the soundfield with them, for example, panning a jet aircraft from South to North is very impressive. With two such controls, you can do it in stereo!

UHJ or B-format

For the time being, it is likely that UHJ will be the preferred Ambisonic format for most applications, just as it is for album and broadcast release. UHJ is easy to handle: it behaves as 'enhanced stereo' until it is replayed via a decoder, when the surround information is completely recovered. Ultimately, however, B-format offers even more flexibility on three tape channels. The other units currently available for production purposes both produce B-format signals: of course, these B-format outputs can be fed to the B-format input on the Transcoder to give 2-channel UHJ with or without an intervening B-format tape stage: the other units can therefore be used if desired for either application. However, for the majority of UHJ productions, the Transcoder will give sufficient flexibility; it is also exceptionally easy to set up and use.

The other Ambisonic production units are the Pan-Rotate unit and the Converter unit, and both have specific applications. Their use in music production is covered in the article 'An introduction to Ambisonic mixing', published in the September 1983 edition of *Studio Sound*, and many of the points detailed there have applications in the A/V field. Also included in the article are detailed diagrams of typical mixing setups.

Pan-Rotate Unit

The Pan-Rotate unit is basically an 8-channel Ambisonic panning unit. Eight mono inputs are provided, that may be patched out of post-fade console channels. A B-format output is provided which may be used to feed other units or the tape machine. The panpots are 360 continuously rotatable controls, and rotating a control through the full 360° pans the sound source all the way round the soundfield: in other words, the panpot position corresponds exactly to the perceived localisation. A further 'rotate' control is provided, which can be used to rotate the soundfield created by the eight panpots as a whole through 360 , enabling complex balances and localisations to be rotated around the listener for impressive effects. The rotate control may be switched in or out of circuit. Two B-format inputs are also provided, so that external Ambisonic signals from other units may be added to the panned signals. One B-format input is before the rotate control; the other after it.

Production models of the Pan-Rotate unit also include an extra control adjacent to each panpot. This is a 'radius vector' control and adjusts the apparent distance of the source from the centre of the soundfield. It is a 270° switched control which allows the distance to be varied from '+' (the switch position, designated 'normal'), the edge of the soundfield, through '0' (centre), to '−', the opposite edge of the field. Thus rotating this control through its full travel moves the sound routed to that panpot across a diameter, whose 'normal' position is determined by the pan control. Placing the panpot at zero (centre front—North) and rotating the radius control therefore pans the sound from North to South, for example. Impressive 'spiralling' effects into and away from the centre of the field can therefore be created by rotating both controls simultaneously. In addition, by using both controls, a sound can be positioned anywhere in the field.

Converter

Whilst the Pan-Rotate unit is designed to be used for effects purposes, the other unit, the Converter, is designed for 'static' localisation: ie, sources which are required to remain stationary (or nearly so) during the performance. The Converter enables the console panpots to be used to pan a sound across one 90 quadrant of the soundfield. To do this, the console panpots must be of the 'constant power' type—these are used on many standard consoles. The compromise between constant power and constant voltage used by several manufacturers (Soundcraft, for example) also works very effectively. Constant

voltage types are not recommended. To determine which type your console uses, meter the sum of the left and right stereo bus. Pan a constant level tone across from left to right. If the meter reading at the centre drops by 6 dB you have constant voltage types. Constant power types will show a 3 dB drop, and 'compromise' designs will show a drop of about 4·5 dB. The Converter unit will work successfully if the drop in the centre is less than 6 dB: if you have constant voltage panpots they can be modified by your maintenance department; alternatively you may require two or three Pan-Rotate units.

The Converter requires five inputs which are simply derived from the console as four groups plus an auxiliary send. There are in fact two independent and identical sections in the Converter so that two sets of signals may be routed in this way, giving two B-format outputs independent of each other. We will consider only one half of the unit here, therefore. The unit assumes that you can pan between odd and even groups. Let us assume that you will use groups 1–4 and Aux 1. Panning across a quadrant is achieved by routing to two of the groups and panning between them. Thus routing to 1 and 2 will pan across the front quadrant (North-West to North-East); 2 and 3 will pan across the East quadrant; and so on. Aux 1 should be set to postfade on the desired channels, and the level of the send pot on each channel should be set so that the aux level is the same as the level from the direct channel output, postfade. Typically, this will be achieved by setting the Aux 1 master level control to full and the channel send pot to about 6 on a scale of 10 (this is the setting for a Soundcraft *2400* console). The Aux setting can also be done by ear: decoding the soundfield, route a channel to group 2 only (either by panning hard right, or by routing only to group 2 with the desk panpot switched out). Set the Aux 1 master level to full. Now fade up the channel with the aux send on the channel set at zero. The sound will emerge from the monitoring (speech is a good signal to use for this), but it will not have any clear direction. Increase the channel aux send level. As you do so, you will notice that the sound will gradually be drawn towards the right front (North-East). At a certain point, it will be accurately localised 45 right. Beyond that setting, the sound will tend to be drawn to centre front. By experiment, find the setting at which localisation is best, and set the Aux 1 sends on all the desired channels to this level. The Converter is then set up.

Monitoring and use on-site

Good monitoring is essential to success with an Ambisonic presentation, both in the field and in the production studio. The concept is very straightforward, but a few points must be observed for best results.

Just as you would not expect very good results from a stereo system which has a large speaker and amp on one side, and a small one on the other, so it is with Ambisonics. Do not expect accurate images from a playback setup with one pair of large monitors at the front and a couple of transistor radio speakers at the back. You will get something out of it, which may well be interesting, but it will not be 'right'. Try for four identical speakers and amps for best results.

Loudspeakers should be arranged in a rectangle, with the sides in any ratio up to 2 : 1. Speaker positioning is usually a matter of 'put them where you can': within this kind of constraint, try to get them in some kind of rectangle. Point the speakers in toward the centre of the listening area, so that opposite speakers face each other: this will ensure that most of the listeners will experience some top end, where most of the localisation information occurs (just as in stereo). Don't use speakers which are highly directional at high frequencies, or large audiences won't hear ordinary stereo either! Ensure that all four channels of amplification are set to the same level, and, of course, that all wiring is in phase. Having set up speakers and amps, pace out the sides of the rectangle, and set the layout control to the appropriate ratio. There is a 'test' button on the decoder; when pressed, it routes the same source to all the outputs. If you want to be particularly accurate, you can send tone through the system and measure the SPL or the speaker terminals with a meter and set the amp drive levels up accordingly. Otherwise, simply stand in the listening area and see that the sound appears to be 'in your head' on the decoder test position around about the middle of the listening area. Ambisonics is far less critical about speaker setups than its designers imagined, and acceptable decoding occurs with all manner of things wrong, so don't worry if you can't get the speakers exactly in a rectangle or exactly at the same height, etc. It will probably work fine.

Ambisonic decoding

The source material should be routed to the decoder as appropriate. In the studio, UHJ is easily monitored by plugging the decoder inputs to the monitor speaker output of the console. If you are using a speaker setup other than your main monitors for Ambisonics, it may be helpful to feed the decoder from the auxiliary monitoring or studio playback source on the desk. That way you can check stereo on your main monitors at the press of a button, if that is important. With B-format, you will need to derive a three-channel feed which allows you to monitor the output of the control units and the 4-track recorder for playbacks. If your console is set up for 'Quad', this will be straightforward. On-site, simply route the tape channels to the decoder UHJ or B-format input as appropriate.

A selection of controls are provided on the decoder for different applications. 'Bypass' will route the input signal to the front two speakers only: useful in the studio, as it means that normal monitoring in stereo is restored merely by pressing this button. When the decoder is switched off, bypass is automatically selected: this is a hard-wired bypass and the signal only passes through relay contacts. Another button selects the distance of the speakers from the centre of the listening area. You merely set this button according to whether the speakers are more than 3 m away or not. In the studio, they are usually closer; on-site they will be further away. The layout control, already discussed, sets the decoder up for your particular speaker arrangement.

Note: The settings of these two controls vary from one listening environment to another. As a result, good decoding will not be achieved if you try recording the decoder outputs instead of B-format or UHJ at the production stage! For good results, a decoder must be used on-site!

For Ambisonic decode, you simply select the appropriate button on the decoder: UHJ if the source is 2-channel UHJ; and B-format if the source is 3-channel B-format. If the wrong selection is made, nothing will be heard. The source material must be connected to the correct input on the decoder.

There is one final control, called 'forward preference'. This is usually set to minimum. However, if you wish to emphasise the front of the layout, increase this setting until you are happy with the results. This should only be done with care, as there is a slight degradation of definition at the rear if this control is increased. It should be used only if there is a tendency for the rear information to come across too powerfully in the particular auditorium because of acoustic peculiarities and the like. It should not be necessary in the studio.

Some decoders have an additional control, called 'super stereo'. This usually consists of a 'stereo' button and a rotary control. If you make an Ambisonic decoder a standard part of your on-site equipment, these facilities enable the playing of ordinary stereo through the Ambisonic 4-speaker system. Ordinary stereo information is fed into the unit, and the stereo width control enables the spread of the image to be increased from mono to about 180 . This facility is not unlike that of the Transcoder in this respect: it enables you to 'enhance' an ordinary stereo soundtrack if you have four amps and speakers available and the decoder.

Ambisonic equipment: basic specifications

All the production equipment described in this article is available from Audio & Design Recording. They will be producing decoders shortly. Decoders are also available from Minim Electronics, and a number of other manufacturers. Equipment is available for purchase, or in limited quantities for free evaluation from the Ambisonic Technology Centre, 16 North Street, Reading, Berkshire RG1 7DA, UK. Tel: 0734 597083. Telex: 848722. The ATC should also be contacted for information on Ambisonics, including reprints of useful articles, and details on demonstrations of the system.

The Keith Mansfield Ambisonic album, *Contact*, is available on tape or disc in 2-channel UHJ format from KPM Music, 21 Denmark Street, London WC2H 8NE, UK. Tel: 01-836 6699. KPM can also arrange for Ambisonic remixes of KPM material to be produced at normal studio rates, and can refer enquiries on Ambisonics to the appropriate sources for information or equipment. KPM will be producing further Ambisonic albums in the future. □

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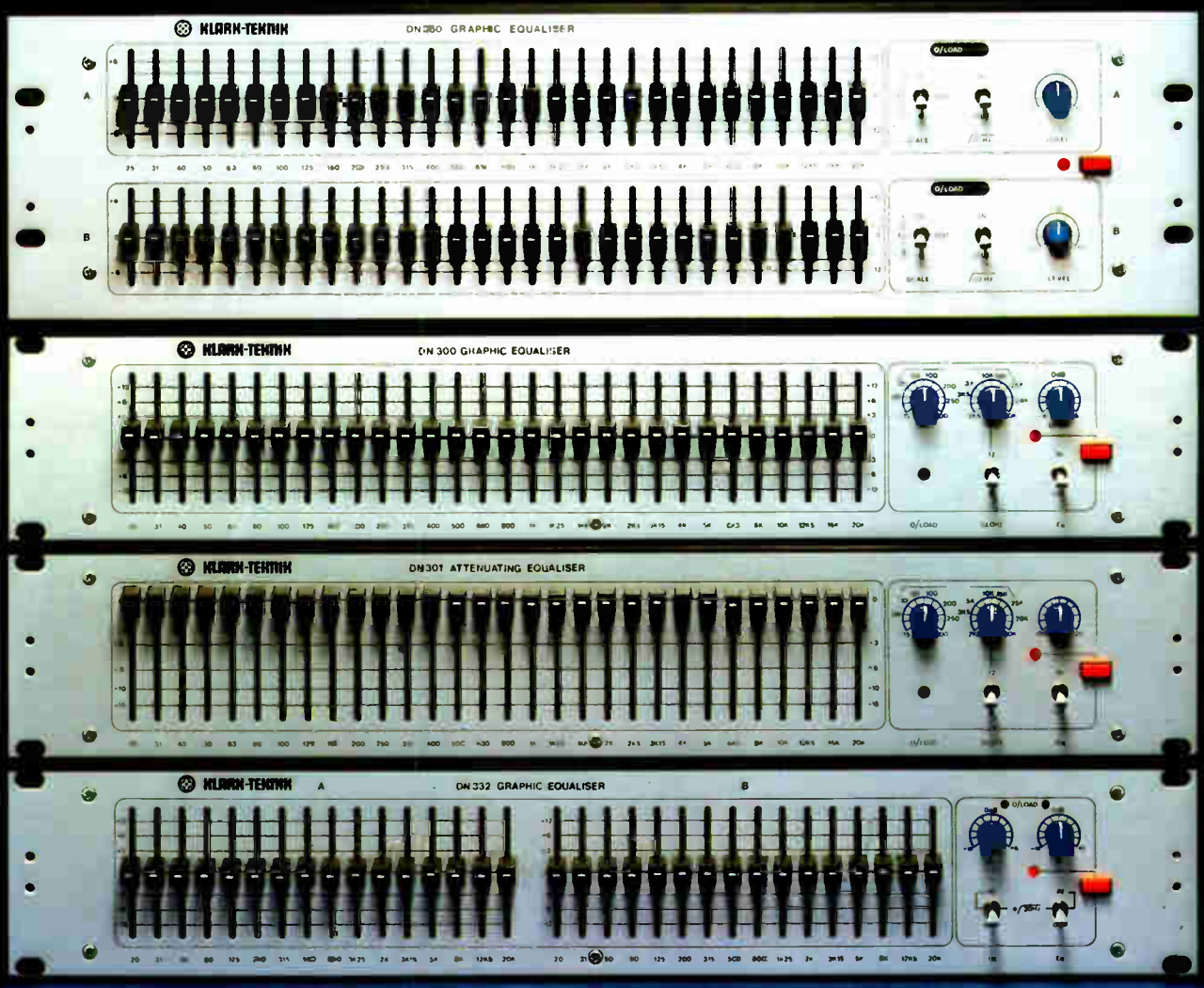

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Cutting the cost of certainty

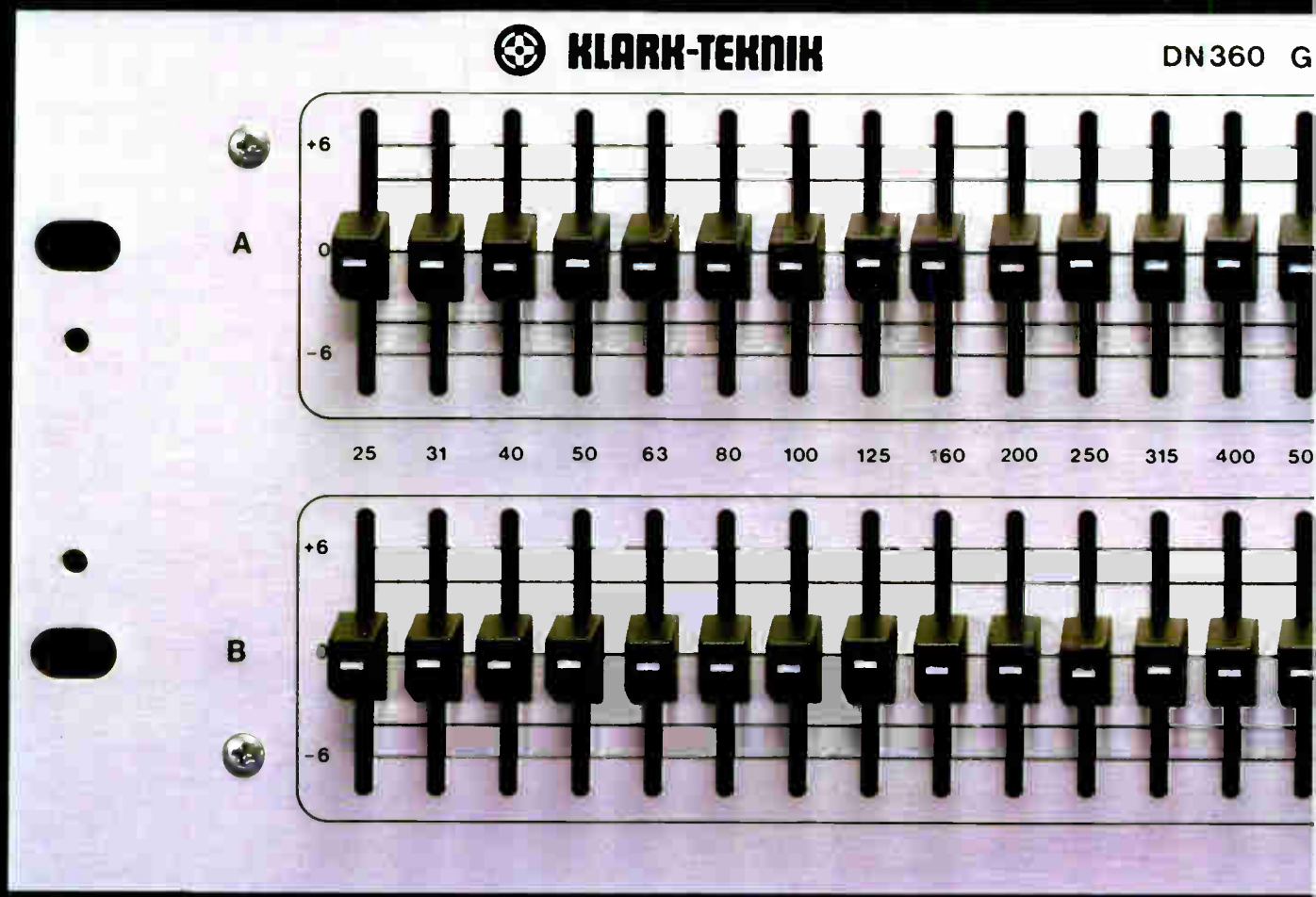
In 1975 Klark-Teknik launched the DN27 – the graphic equaliser that brought the price of high reliability and precision performance down to a new affordable level. Now our policy of constantly watching new advances in technology has led through a series of design breakthroughs to yet another generation of graphic equalisers. Every equaliser in the Series 300 from Klark-Teknik has been given extra heart by innovative use of microelectronic circuitry engineered with thick-film technology.

Result: our Series 300 equalisers don't only equal the performance of the DN27 – they actually improve on both its impressive reliability record and its unrivalled price: performance ratio. The whole family of related instruments show greatly increased capability over a wide variety of applications ranging from monitor and recording equalisation to sound system tuning. But that's not all ... Klark-Teknik have designed the Series 300 around a philosophy of maximum affordability.

FITTING INTO YOUR PLANS

How did we do it? By pursuing a policy of dedicated attention to our design objectives, we were able to fulfil the professional's need for greater control over sound. By giving attention to production engineering detail we have been able to maximise the economic as well as the performance benefits from the new technology, so that this new family of instruments fits in with your needs and your budget better than ever before. As an added benefit, all the instruments in this prolific family now fit into just 2U of rackspace – except the DN360 that fits *two whole channels* of equalisation into 3U of rack.

The photograph of the DN360 below, is ACTUAL SIZE.



RELIABILITY CONTROL!

Even with the advanced technology incorporated, these instruments are given the full backing of Klark-Teknik ***'reliability control'***, which proves each equaliser against a specification consistent with the highest professional standards. Only top quality components are used, and every unit is bench-tested and aligned before a burn-in period and final performance test.

THE INVISIBLE EXTRA

Careful design of microelectronic filter circuits and the application of thick film technology have effectively raised our previously outstanding reliability standards by a measurable amount. This makes it possible for Klark-Teknik to back every equaliser in the series with a unique ***five year warranty.****

*Parts only.

Many features not found in similar equipment!

DN360 SAVES ON RACKSPACE

This novel stereo equaliser combines two ⅓ octave channels over a full 30 ISO centre frequencies from 25Hz to 20kHz – in a single 3U panel. This saves valuable rackspace and gives compact equipment layout. Frequency spacings match those of Klark-Teknik analysers, for easier operation under difficult conditions of live performance or against-the-clock recording sessions.

Typical of this new styled family, the DN360 front panel has an elegant simplicity that promises peace of mind to the recording professional behind a hard-working desk. Almost all the sophistication is hidden inside – it does its job superbly with little attention from the user. High-accuracy thick-film packaged circuitry results in an instrument that never needs tuning.

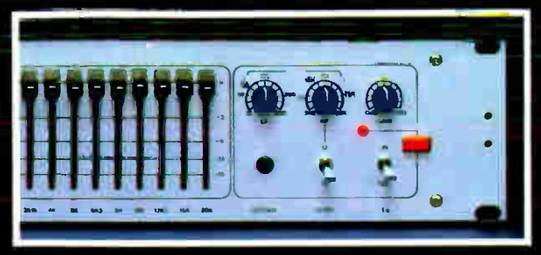
Thirty ⅓ octave precision faders for each DN360 channel provide a full 12dB boost and cut when necessary. Their design and accurate matching make the pattern of equalisation graphically visible. Each one is oil-damped, with neutral centre detent to allow accurate 'flat' setting. The 30 centre frequencies exactly match the ISO centre frequencies displayed by the Klark-Teknik DN60 spectrum analyser – making it easy to relate settings to measured frequencies.

With two channels in one instrument the DN360 not only saves cost and rackspace, but makes it easy to balance the frequency spectrum between channels.

Electronic balancing is standard on all Series 300 inputs. Output circuitry is unbalanced. Inputs and outputs can be transformer balanced as an optional extra.

SCALE switch controls fader boost and cut for each DN360 channel, allowing choice of normal 12dB maximum – or a high resolution setting with 6dB maximum. Centre position bypasses the faders, making it easy to compare 'dry' and equalised signals.

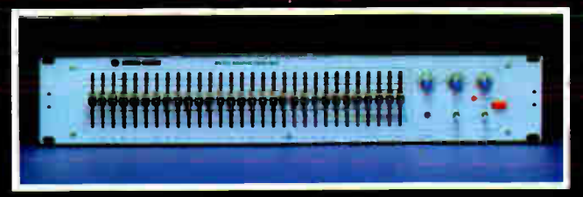
FILTER switch switches 30Hz subsonic filter in or out of each DN360 channel.



Extra versatility. *Accurate sweepable low and high cut filters are incorporated in the DN300 and DN301 models, together with a high cut slope selection switch that makes it easier to set the house system response.*

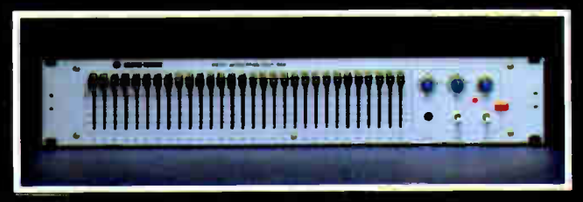
INPUT LEVEL controls. From 6dB system gain to infinite attenuation – making it easier to interface the equaliser to output signals of other equipment. An added feature is additional RF input filtering – now standard on all Series 300 equalisers.

DN300 THE EQUATION IS RIGHT



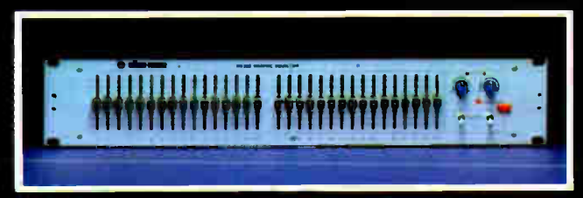
The innovative production engineering and high Klark-Teknik specification are well balanced against cost to meet your demands for a high quality single channel graphic equaliser with extra versatility built-in including: 30 precision faders; input with level control and electronic balancing; overload LED; tunable low and high cut filters and fail-safe bypass.

DN301 FOR PRECISION TUNING

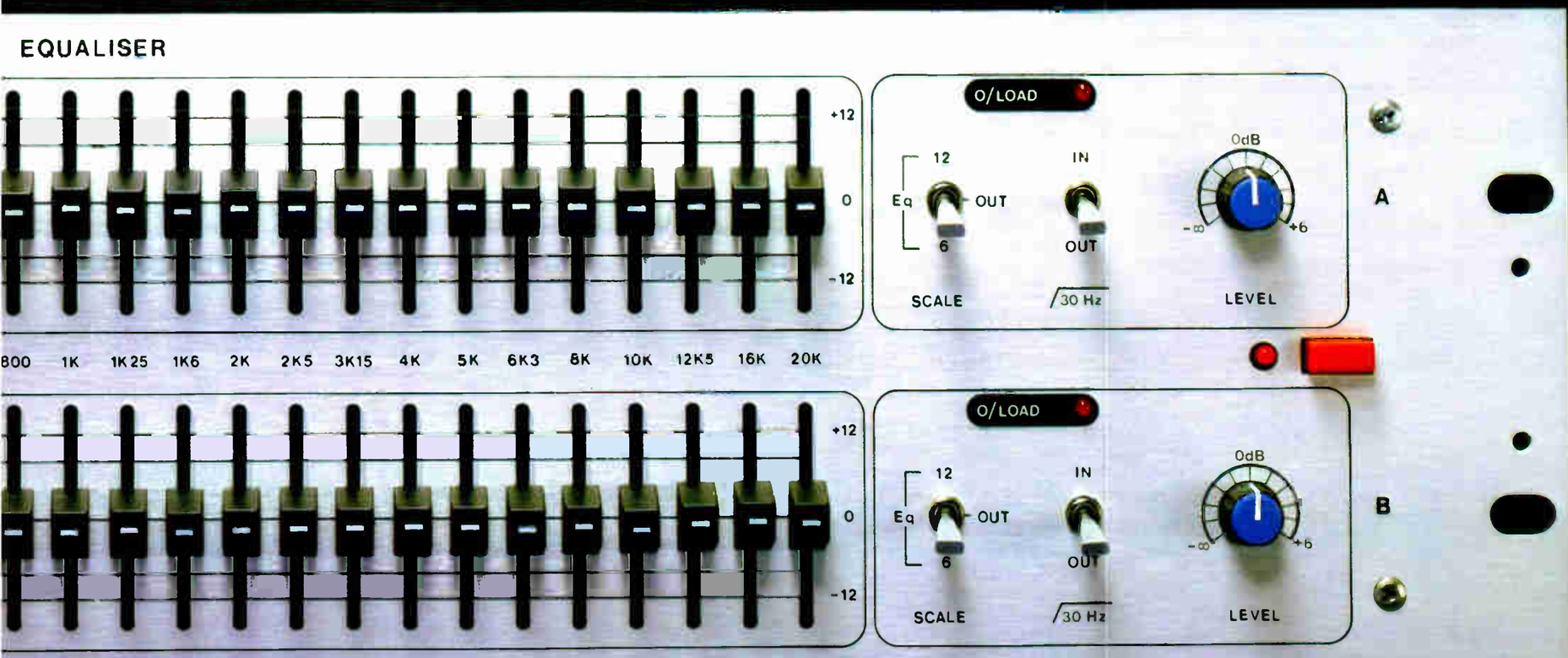


The DN301 single channel attenuating equaliser maintains the family's high performance record where the sound contractor needs to increase overall sound levels in a particular installation. It offers: 30 precision faders; output gain control and electronic input balancing; overload LED; tunable low and high cut filters and fail-safe bypass.

DN332 FOR LESS DEMANDING CONTROL



For many new applications or to upgrade existing installations, this less sensitive dual 16 channel ⅔ octave graphic equaliser provides the stereo performance you need in one compact 2U package - with all the usual Klark-Teknik user-oriented design and 'reliability control'. It offers: 32 precision faders covering two channels; twin input level controls and electronic balancing; overload LED; subsonic filter for each channel.



MELT® — Thick film engineered microcircuit.

Failsafe feature – an innovation from Klark-Teknik research – in the event of power failure to the equaliser, input signals are instantly connected direct to output, bypassing the equaliser.

Signal inputs and outputs are through three-pin XLR type sockets.

110-240V Supply selection is controlled by a two-position slide switch reached from the rear panel.

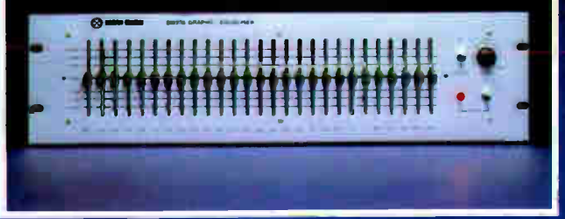
An Earth-lift switch on the rear panel allows the signal ground to be linked to or isolated from the mains and chassis ground, often providing a simple solution to earth-loop problems.

Overload LED on each DN360 channel shows if signal levels exceed +19dBm anywhere in the unit, to give 3dB 'headroom' before onset of clipping. This also provides protection against overload damage to external equipment.

ON/OFF pushbutton is backed by relays that prevent switching 'transient noise' from reaching the outputs – and so ensure a silent switch-on. A status LED by the switch indicates when power is on.

World proven DN27A equaliser

is our 'golden oldie' – the patriarch of our range, carrying the 'genes' of the successful design and engineering policies which are implemented in the Series 300 new generation graphic equalisers. Although created before the days of microelectronics, this instrument not only set an enduring standard for price and performance, it is so well proven that it is still a top seller all over the world.



Specification

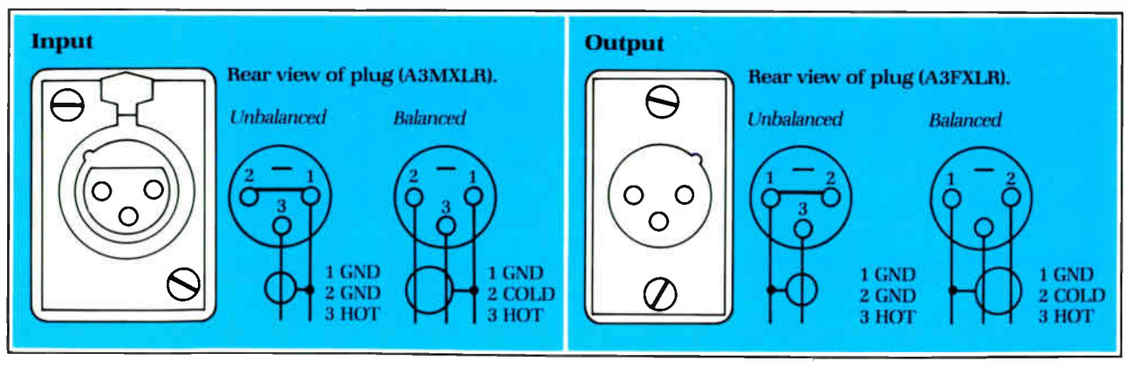
	DN360	DN300	DN301	DN332	DN27A
Input					
Electronic balancing	Balanced	Balanced	Balanced	Balanced	Unbalanced
Impedance (ohm)					
Balanced	20k	20k	20k	20k	10k
Unbalanced	10k	10k	10k	10k	10k
Output					
Type	Unbalanced	Unbalanced	Unbalanced	Unbalanced	Unbalanced
Min. load impedance	600 ohm	600 ohm	600 ohm	600 ohm	600 ohm
Source impedance	<60 ohms	<60 ohms	<60 ohms	<60 ohms	<60 ohms
Max. level	+22dBm	+22dBm	+22dBm	+22dBm	+22dBm
Frequency response (20Hz-20kHz) Eq out	±0.5dB	±0.5dB	±0.5dB	±0.5dB	±0.5dB
Eq in	±0.5dB	User defined	User defined	±0.5dB	±0.5dB
Distortion (@+4dBm)	<0.01%@1kHz	<0.01%@1kHz	<0.01%@1kHz	<0.01%@1kHz	<0.01%@1kHz
Equivalent input noise (20Hz-20kHz unweighted)	<−90dBm	<−90dBm	<−90dBm	<−90dBm	<−90dBm
Channel separation	>75dB@1kHz	N.A.	N.A.	>75dB@1kHz	N.A.
Overload indicator	+19dBu	+19dBu	+19dBu	+19dBu	N.A.
Auto-bypass (failsafe)	YES	YES	YES	NO	YES
Gain	+6dB	+6dB	+20dB	+6dB	+6dB
Filters					
Type	MELT	MELT	MELT	MELT	LCR
Centre frequencies ISO	2×30 25-20kHz ⅓ octave	30 25-20kHz ⅓ octave	30 25-20kHz ⅓ octave	2×16 20-20kHz ⅔ octave	27 40-16kHz ⅓ octave
Tolerance ...	±5%	±5%	±5%	±5%	±2%
Maximum boost/cut	±6/12dB	±12dB	−15dB	±12dB	±12dB
Subsonic filter	18dB/octave −3dB @30Hz	N.A.	N.A.	18dB/octave −3dB @30Hz	N.A.
High pass filter slope	N.A.	15Hz-300Hz 12dB/octave	15Hz-300Hz 12dB/octave	N.A.	N.A.
Low pass filter slope	N.A.	2k5Hz-30kHz 6/12dB/octave	2k5Hz-30kHz 6/12dB/octave	N.A.	N.A.
Power requirements					
Voltage	110/120/220/240V 50/60Hz	110/120/220/240V 50/60Hz	110/120/220/240V 50/60Hz	110/120/220/240V 50/60Hz	110/120/220/240V 50/60Hz
Consumption	<15 VA	<15 VA	<15 VA	<15 VA	<15 VA
Weight					
Nett	4.5kg	3.5kg	3.5kg	3.5kg	6.5kg
Shipping	7kg	6kg	6kg	6kg	8kg
Dimensions					
Width	482mm (19 inch)	482mm (19 inch)	482mm (19 inch)	482mm (19 inch)	482mm (19 inch)
Depth	205mm (8 inch)	205mm (8 inch)	205mm (8 inch)	205mm (8 inch)	205mm (8 inch)
Height	133mm (5¼ inch)	89mm (3½ inch)	89mm (3½ inch)	89mm (3½ inch)	133mm (5¼ inch)
Terminations					
Inputs	3 pin XLR	3 pin XLR	3 pin XLR	3 pin XLR	3 pin XLR
Outputs	3 pin XLR	3 pin XLR	3 pin XLR	3 pin XLR	3 pin XLR
Power	3 pin CEE	3 pin CEE	3 pin CEE	3 pin CEE	3 pin CEE

*MELT – Proprietory Microcircuit.

The whole Series 300 family of graphic equalisers comply with standard 19 inch rack mounting requirements.

As part of a policy of continual improvement, Klark-Teknik reserve the right to alter specifications without notice.

PIN CONFIGURATIONS

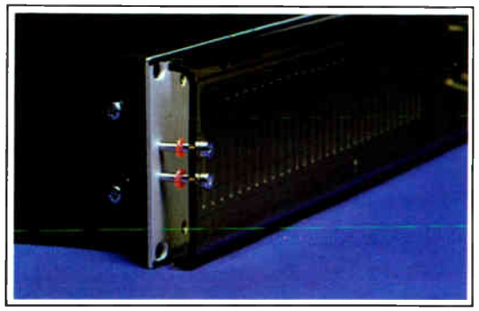


Options

Security covers

An optional perspex security cover is available to prevent unauthorised interference with calibrated equaliser settings in permanent sound installations.

For DN300 Order number SC30
For DN301 Order number SC30
For DN332 Order number SC30
For DN360 Order number SC36
For DN27A Order number SC27



Transformer balancing

Retrofittable output balancing transformers:
For all Series 300 models Order number BU37

Transformer input balancing is available on all Series 300 equalisers but must be specified with initial order. Order number BN37

For DN27A (In/Out) Order number BA27

THE RIGHT PERFORMANCE LEVEL AT THE RIGHT PRICE

Series 300 equalisers are designed with inbuilt capability for a very wide range of applications – including:

In live performance – sound reinforcement, wide-band equalisation and monitor tuning.

In the recording studio – monitoring, system equalisation and 'second thoughts' track clean up.

In the motion picture industry – dialogue sound equalisation ... and B-chain equalisation in the re-recording studio.

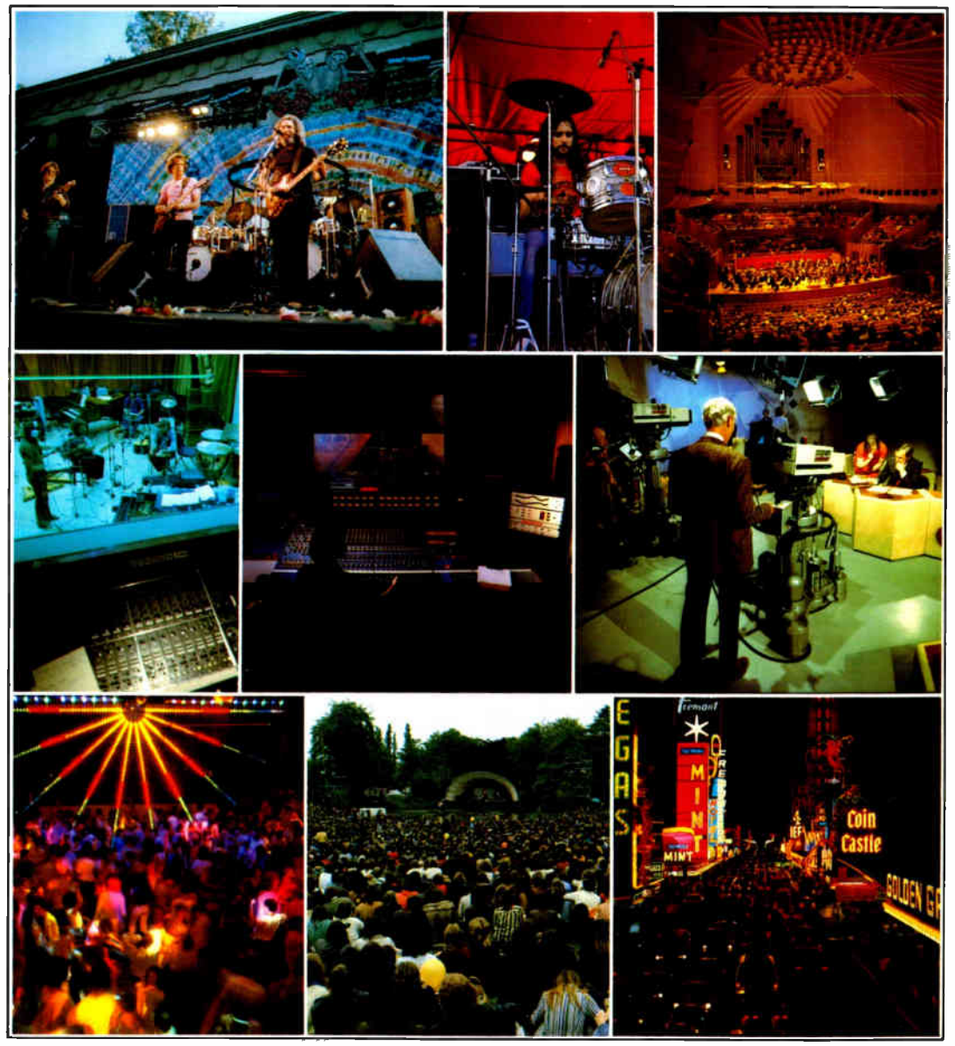
In stereo broadcasting – announcer microphone enhancement and stereo channel equalisation to give maximum on-the-air brightness and punch.

In the discotheque to give bass with substance – and aggressive top for increased accentuation.

For contractors and others who need effective equalisation to achieve spot-on public address system intelligibility.

In the theatre for front-of-house system and grouped microphone equalisation.

Ask around, you'll find that Klark-Teknik equipment is known for its ability to take the roughest conditions with the smoothest performance, in the studio or on the road.



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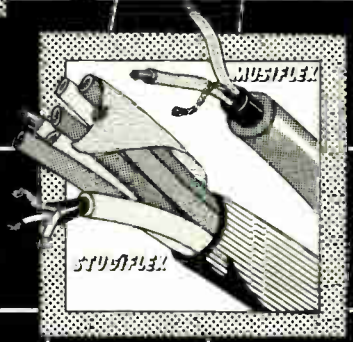
- Extra-low capacitance audio cable, (4 x Phonoflex)
- Conductive Thermo-plastic Shield
- High-speed preparation
- For: Audio sends and returns, Hi-Fi, effects rack feeds, etc.

PHONOFLEX

- Extra-low capacitance audio cable
- Conductive Thermo-plastic Shield
- High-speed preparation
- For: Audio, Hi-Fi, HiZ Mics, effects racks patching etc.



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Studer A810

Hugh Ford

The Studer *A810* whilst being fairly conventional so far as the tape transport is concerned is far from conventional in the electronics and tape control departments. The advanced digital control of almost all functions including equalisation, bias and audio switching makes this an individual machine.

Available as a portable/rack mounted or console version, the machine tested was a three speed machine with any two speeds out of three being programmable. Production machines from the factory are now available as four-speed with a rotary control to select speed range from $3\frac{3}{4}$, $7\frac{1}{2}$, 15 and 30 in/s. Various plug-in headblocks cover not only mono, stereo and two track configurations, but also include a centre track timecode version which can be fitted to the stereo and two track head block versions.

As will become apparent numerous options are available many of which were fitted to the review machine which is a portable version.

Tape transport

At first sight the tape transport is conventional with outer rotor type reel motors equipped with solenoid operated band brakes, the tape passing from each reel to tension sensing arms fitted with roller guides. However, the reel motors are in practice controlled by pulse width modulation at 76 kHz giving high efficiency and low heat dissipation. This system derives its control signal via the tension arms which are also unconventional.

The arms which are spring loaded and pneumatically damped have two position sensing systems, an infrared optical system for tape presence sensing and an inductive position sensing system of non-contact type—the pickup being formed by a metal cam which is inserted within a transformer.

An unusual feature is that the tension arms may be locked in any position by a solenoid which operates a toothed section which engages in a similar section on the tension arm assembly. These locks operate whenever the machine enters the stop mode and leads to a very smooth start operation without any tape slinging or violent tension deviations.

Before the head block the tape passes over a large diameter inertia roller/roller guide with a similar lightweight guide after the head block having an optical tachometer used to drive the tape timer and microprocessor.

The head block which is formed from an alloy casting—machined on its top surface to receive the heads and with three spigots on its bottom to reference the tape transport—is secured by three Allen screws. All connections are via a 25-way 'D' connector which handles all signals plus powering for the integral replay preamplifier.

At the entry to the head block is the fixed ferrite erase head which in the timecode version also includes a 0.4 mm wide code read head which is used in the replay mode. This is followed by a flutter roller combined with ceramic edge guides before the metal audio record and replay heads which are heavily spring loaded against ball bearings.

There follows a spring loaded ceramic edge guide and the typical long shaft Studer capstan motor operating within a phase locked servo loop, the pressure roller arm and solenoid assembly also being conventional. After this are inbuilt editing scissors. Finally there may be the spring loaded ferrite timecode head used for timecode replay in the fast modes or record/erase in the timecode record mode.

As with other Studer machines the tape transport is based on a substantial alloy casting which is machined to accept the major transport components, all of which are easily replaced in view of the easy access and use of connectors for wired connections.

The remaining features on the top of the tape transport are solenoid operated tape lifters, the left hand one of which may be manually operated by a button in the head shield thus removing the tape from the erase and record heads. In addition a manually operated tape marker in front of the heads makes an ink mark on the tape at the record head.

The spool hold-downs are of the cine type typical of Revox machines. NAB adaptors are also provided with optional European spool adaptors.

Main frame

Alloy castings forming the side of the machine are used to support the tape transport together with other components, the sides being fitted with 19 in rack mounting flanges which can accept a wooden trim when the machine is used in the portable version. Two substantial carrying handles are fitted to the wooden trim.

When operating vertically a steel sheet metal chassis forms the top of the machine to which the power transformer and power supplies are attached, the mains power components being exceptionally well protected. These consist of the IEC input connector, and a combined voltage selector/fuseholder covering 100/120/140/200/220/240 V operation. In addition there is the power on/off switch located at the top of the tape transport and a mains interference filter.

Also mounted on this plate are the input/output connectors for the two audio channels and the timecode channel in the form of balanced *XLR* connections, a 25-way remote 'D' connector, a 9-way digital interface connector, and a small pcb connector. The latter accepts a printed circuit containing a dual in line switch for selecting the address of the machine when used with a digital control system. Quite why this is a plug-in switch I have no idea!

A fixed printed circuit on the right side of the unit effects the spooling motor control with a second printed circuit beneath the tape transport controlling the capstan motor. Other than a few subsidiary printed circuits the remainder of the electronics is within a card cage below the tape transport.

Electronics section

Loosening two captive Allen screws allows the complete control panel to be hinged upwards to give access to the electronics boards, all of which plug into a mother board at the back of the machine. Inspection of the electronics revealed an exceptionally good standard of construction and layout with all integrated circuits being socketed for easy servicing.

The audio section for each channel consists of four boards, HF driver, replay amplifier, record amplifier and line output. The HF driver and record amplifier have test points for bias and erase current/voltage with the record amplifier having a 'piggyback' equalisation board with none of these boards having any adjustments. Similarly the only user control on the replay amplifier is a plug-in line giving narrow or wide sync replay bandwidth—all equalisation and level setting is done by digital control from the digital section with the audio boards having many digital/analogue 8 bit converters.

The line output board has a single potentiometer for a fine gain trim with the nominal output and input levels being selected digitally from the processor section. There is however, a 10-way DIL switch offering various options as follows.

The first two switches insert the monitor output either at the line outputs or before the output muting. The remaining eight switches allow the machine to be used with or without a VU meter panel and with or without the optional mono/stereo switch and test oscillator board.

This option allows stereo machines to be switched to mono record and replay with levels being automatically corrected. Potentiometers on the front of the board set record/replay level compensation. The second section of this board is a test sinewave oscillator, the nominal level of which is set by a third front panel potentiometer with a momentary pressbutton providing 10 dB attenuation and illuminating a nearby LED. A second momentary pressbutton steps the oscillator frequency through 60, 125, 1,000, 10,000 or 16,000 Hz with the current frequency begin shown by one of five LED's with the switch sequencing the frequency and then having an off position.

The double width periphery controller board in addition to other functions is used to set bias, levels and equalisation in conjunction with eleven momentary pushbuttons and a number of LED'S. All these functions are stored digitally in random access memories which have battery backup to retain the settings when power is switched off.

When aligning the recorder the first action is to select the desired channel (1 or 2) by means of two buttons which illuminate adjacent LED's. The desired parameter is then selected by means of six buttons with the selected parameter having an illuminated LED, the parameters being bias, replay bass, record and replay level and high frequency equalisation.

Once the desired channel and parameter have been selected two things happen. Firstly the value (0 to 255) of the stored parameter is displayed in the tape timer in hexadecimal (00 to FF) preceded by the letters AA. Secondly one of four LED's on the board are illuminated to give a rough indication of the setting between maximum and minimum, the switching thresholds of the LED's being 16, 51 and A1. Adjustment of the settings is accomplished by two momentary buttons labelled 'UP' and 'DOWN'—the longer these

are pressed the faster the setting changes. Once the desired setting is found all that is necessary is to press the 'STORE' button whereupon the new setting is stored.

The machine is capable of storing alignment data for the two tape speeds, two tape types and two replay equalisations. A very nice feature of this system is that it is possible to note alignment settings for various tape types, equalisations, etc. and to enter them into the machine when for instance using a different tape type.

So much for alignment, the periphery controller board also has an eight-way DIL switch, the first two switches of which set the erase mode between record off, full track, twin track or timecode. The third switch affects the channel switching such that the audio routing can be individually selected or paralleled.

The fourth switch gives optional muting in the fast wind modes with the next two switches selecting the nominal line level between 0, +4, +8 or +10 dBm. The next switch allows the relation between the CCIR and NAB replay equalisations to be either individually set or related automatically. Finally the last switch is a protection switch which disenables the periphery controller's keyboard.

The remaining standard controls are six potentiometers on the tape deck controller board for adjusting tensions at the reel motors, both motors having play, peak and forward tension adjustments.

A number of pluggable links exist on the microprocessor board, but their function is not known with the bus converter board not having any links or controls.

When timecode is fitted this occupies two further boards, the read/write unit and the delay unit, the latter compensating for the time delay between the two code heads and the record or replay heads.

Controls and meter panel

Whilst the facilities so far described are somewhat complex, this is far from the end of the story! The control and metering panel may be conveniently divided into three sections—the control and timer section, the twin audio control sections and the monitoring and tape selection section—each section being readily removed.

The most straighforward are the audio control sections each of which has a meter which can indicate VU or PPM according to the setting of a pluggable link. Record and replay/sync levels may be fixed (calibrate) or varied by potentiometers if individual locking pushbuttons are depressed—a warning LED being illuminated in the uncalibrated condition.

Five momentary pushbuttons with associated LED's provide the usual functions of record ready/safe and line output selection between input, replay or sync.

Within the monitoring section there is a fixed level stereo headphone jack in addition to a level potentiometer for the small internal monitoring loudspeaker which may be switched to monitor either or both channels.

The remainder of this section consists of three momentary pushbutton switches each of which has two associated LED's. The top switch is dedicated to selecting NAB or CCIR equalisation with the second switch being assignable to either select one of two tape types or act as a mono/stereo switch. The third switch selects one of two tape speeds.

Selection of the desired tape speeds and the function of the second switch is from a 20-way DIL switch underneath the panel—the other functions of this switch will be described later.

Turning now to the control and timer section, there are the usual fast, play, stop and record switches in the form of momentary pushbuttons with warning LED's at the bottom of the section.

At the top of the section is the four digit liquid crystal display which is used as the tape timer display in addition to other uses. When indicating tape time, minutes and seconds are displayed. Changing the tape speed automatically corrects the display which indicates ±99 m 59 s. The display, as already mentioned, is also used to indicate the various digitally stored settings. At switch on it also displays the date and update version of the software followed if necessary by any self check error messages. It can also display total running time in hours.

Next to the display are the timer reset button and a zero locate button which serves two purposes.

Beneath this combination are five momentary pushbuttons each of which has a yellow LED. Two of these are dedicated with the remaining three being assignable.

The left button identified as 'TRANS' and 'REDUCED' in small letters serves a number of purposes. Firstly with a locate store selected (there may be up to four), pressing 'TRANS' followed by a store number key stores the current tape timer information. A second function is to control the fast winding speed in four steps down to 1 m/s—in this case pressing 'TRANS' followed by fast wind selects the slowest speed. Alternatively pressing 'TRANS' when in fast wind progressively slows the winding speed—an excellent arrangement. 'TRANS' followed by 'ZERO LOCATE' displays the total machine running hours.

The button next to 'TRANS' is dedicated to LOCATE store number one with the remaining three buttons being programmed by the DIL switches. The functions of these buttons may be any combination of the following: LOCATE STORE 2; LOCATE STORE 3; LOCATE STORE 4; LOCATE START POINT; TAPE LIFTER INHIBIT; TAPE DUMP EDIT; FADER START; TIMECODE READY; and REMOTE ENABLE.

Out of the 20 DIL switches beneath the panel seven are used to set these functions, three are used for tape type selection when the tape type switch is used for mono/stereo switching, three further switches are used for selecting the two out of three available tape speeds and three further switches select the timecode standard and offset when timecode is fitted.

Here the available standards are the 24 fps common film standard, the 25 fps European standard, the 30 fps US monochrome standard or the 29.97 fps US colour standard. The third switch selects the timecode offset to the Studer standard or the pilot tone standard.

The remaining switches allow the tape lifter control to act as a momentary control or a flipflop control, turn the drop in (erase and record) delay on/off and turn drop out delay on/off.

As all these alternatives are user functions the machine is supplied with self adhesive labels for re-identifying the controls.

Remote control

A small remote control unit about 150 mm square connects to the 25-way 'D' connector on the recorder via a multi-way cable. Within the unit the basic tape movement controls are duplicated together with their indicator LED's. In addition the 'TRANS' and 'LOC 1' buttons are duplicated, plus a TAPE LIFTER button. Remaining features are a 'RECAP' button which fast rewinds the tape when depressed and reverts to replay when released, and a 'VARI SPEED' button. The latter disconnected the internal 9.6 kHz capstan reference oscillator and replaces it by an input to a BNC socket on the remote control unit. ▷

FIG.1
STUDER A810
COMMON MODE REJECTION RATIO

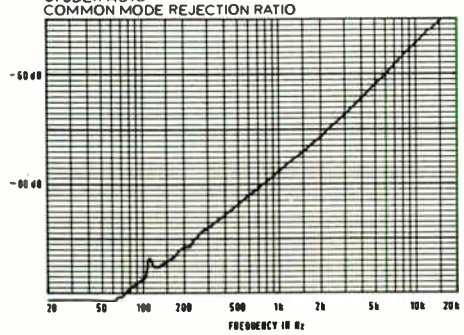
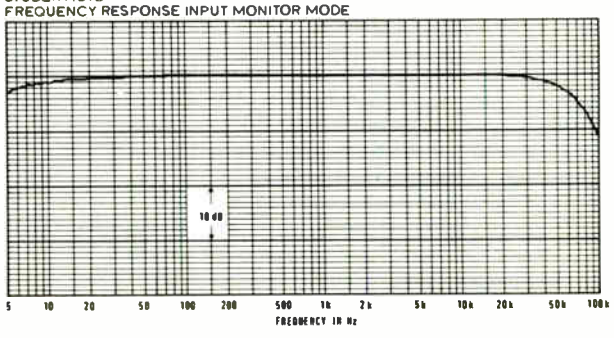


FIG.2
STUDER A810
FREQUENCY RESPONSE INPUT MONITOR MODE



Inputs and outputs

The balanced audio inputs were found to have an impedance of 10.8 kΩ, remaining constant with input gain in either the balanced or unbalanced mode, the gain range of the front panel control being ±10 dB relative to the calibrated gain setting. As received an input of approximately +4 dBm recorded a fluxivity of 320 nWb/m corresponding to 0 VU indication on the level meters with the absolute maximum input level being +28.5 dBm in the calibrated setting or +32.5 dBm at minimum gain in the uncalibrated setting.

Common mode rejection was similar for both channels and excellent at power line frequencies as shown in **Fig 1.**

At the audio outputs the floating connections had a source impedance of 42 Ω with a good drive capability of +26.5 dBm into 600 Ω, or +28.5 dB.7 V into a high impedance. The output level for a recorded fluxivity of 320 nWb/m for both channels was +3.8 dBm with NAB equalisation or +3.6 dBm for CCIR equalisation approximating 0 VU. Changing the internal DIL switches altered this level between 0, +4, +8 or +10 dBm.

Frequency response

In the input monitor mode the overall frequency response was as shown in **Fig 2,** showing a very flat audio response with a sensible roll-off above 50 kHz. Checking the replay frequency response with both equalisations and at both tape speeds showed the two channels to be very closely matched with a worst case difference of 0.4 dB.

Using a BASF calibration tape for 15 in/s CCIR, and MRL tapes for the NAB equalisation gave the frequency response shown in **Table 1.** Taking into account the variations between calibration tapes these results show careful alignment.

Using Ampex *456* tape, for which the machine had been aligned, the record/replay frequency response was remarkably flat. At 30 in/s the results shown in **Fig 3** show an amazing lack of the low frequency deviations that plague so many high speed machines. The 15 in/s results shown in **Fig 4,** however, had a slight 'hump' around 25 Hz.

The record/replay −1 dB and −3 dB points for the two tape speeds were very good as shown in **Table 2.**

The replay equalisation had a more than adequate range as shown in **Fig 5** for CCIR 15 in/s with the range being similar at 30 in/s. As the setting has 256 steps the individual steps were less than 0.1 dB providing a very fine 'tuning'.

Using Ampex *456* tape the record equalisation was as **Figs 6 and 7** for 30 and 15 in/s respectively, the available range being unnecessarily wide in terms of treble boost. This, however, does not matter as again the 256 steps provide more than adequate resolution.

Similarly the bias range was enormous with the machine being capable of over biasing Ampex *456* in excess of 20 dB at 20 kHz and 30 in/s. In terms of bias setting the 256 steps only just provided adequate resolution to give confidence in finding the maximum output point.

The replay frequency response in the sync

Table 1

Frequency	63 Hz	125 Hz	1 kHz	4 kHz	10 kHz	14 kHz	18 kHz
15 CCIR	+0.8 dB	+0.4 dB	0 dB	+0.2 dB	+1.0 dB	+1.4 dB	+1.8 dB
15 NAB	+1.6 dB	+1.2 dB	0 dB	+0 dB	+0.3 dB	+0.6 dB	+0.8 dB
30 AES	+1.3 dB	+1.4 dB	0 dB	+0 dB	+0.1 dB	+0.3 dB	+0.4 dB

Table 2

Tape speed	−1 dB	−3 dB
30 in/s	42 Hz to 27.7 kHz	31.4 Hz to 31.9 kHz
15 in/s	16 Hz to 28.8 kHz	13.5 Hz to 31.5 kHz

FIG.3
STUDER A810
RECORD/REPLAY FREQUENCY RESPONSE
AMPEX 456 AT 30 IN/S

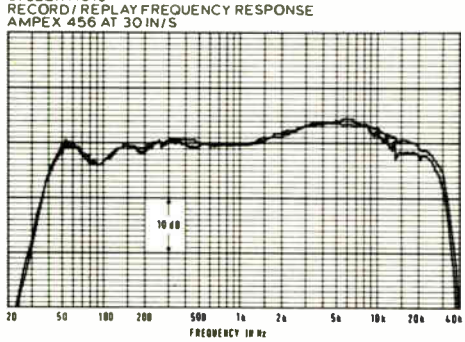


FIG.4
STUDER A810
RECORD/REPLAY FREQUENCY RESPONSE
AMPEX 456 AT 15 IN/S

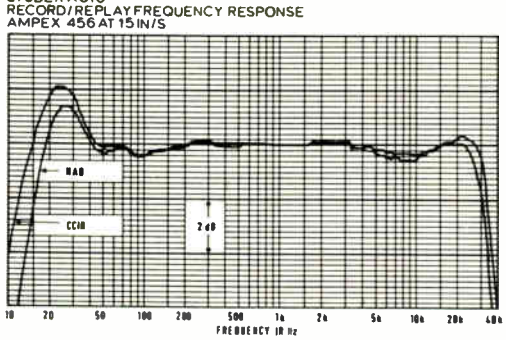


FIG.5
STUDER A810
CCIR REPLAY EQUALISATION
AMPEX 456 AT 15 IN/S

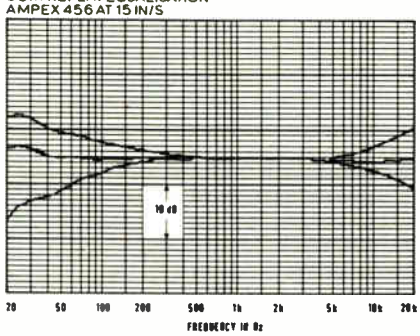


FIG.6
STUDER A810
AES RECORD EQUALISATION
AMPEX 456 AT 30 IN/S

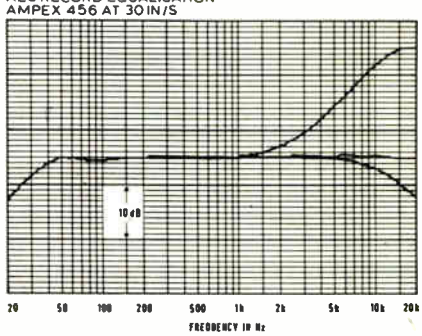


FIG.7
STUDER A810
CCIR RECORD EQUALISATION
AMPEX 456 AT 15 IN/S

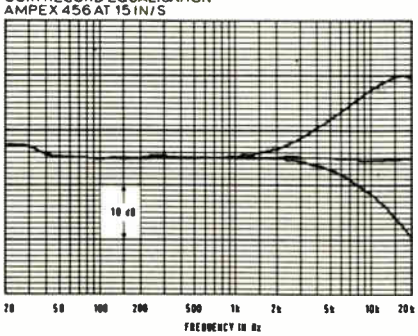
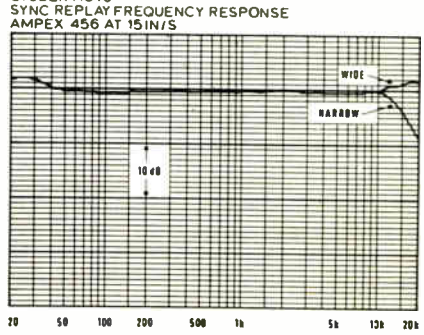


FIG.8
STUDER A810
SYNC REPLAY FREQUENCY RESPONSE
AMPEX 456 AT 15 IN/S



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mode is shown in **Fig 8** for 15 in/s, the response being very flat up to 20 kHz in the wide response mode and sensibly attenuated to −3 dB at 12 kHz in the narrow response mode. At 30 in/s the high frequency performance was similar with the bass being slightly degraded as with the direct replay mode.

Distortion

The third harmonic distortion was measured at 0 VU using Ampex *456* tape and found to be very low at less than 0.2% at either speed.

Three percent third harmonic distortion occurred, in round terms, at 10 dB above a fluxivity of 320 nWb/m at 1 kHz as would normally be expected from the tape type when properly used.

Recording and reproducing a 1 kHz square wave produced **Fig 9** using 15 in/s tape speed with CCIR equalisation, demonstrating good phase compensation within the recorder—similar results occurred with NAB equalisation and at a tape speed of 30 in/s.

Noise

Noise was measured in the normal replay output with the machine without tape in motion, and with machine erased Ampex *456* tape both in the replay mode and the record/replay mode, there being no difference between the latter (**Table 3**). Comparison of the with and without tape performance shows an excellent margin between machine and tape noise with the only unwanted tones in the output occurring at 76.9 kHz at a level of −65 dBm in the replay or record/replay modes. It is not considered that this will be troublesome.

As with the replay mode the two tracks in the sync mode had a virtually identical performance, there being some low level hum in the sync mode which was completely absent in the normal replay mode. The use of narrow or wide sync bandwidth had no effect upon the margin between tape and machine noise in the sync mode, the wide band mode increasing noise by up to 1 dB as might well be expected.

The results shown in **Table 4** were obtained using the narrow band sync replay mode. Certainly the performance is very good for sync replay which is commonly significantly degraded in comparison with the normal replay modes.

Wow, flutter and speed

The IEC-weighted wow and flutter (**Table 5**) was measured at the beginning, middle and end of a full NAB reel of standard play tape with the machine mounted vertically and horizontally, there being no difference with the mounting.

By far the largest wow and flutter component was at 4.7 Hz at 15 in/s corresponding to the pinch roller diameter and it is suspected that the above figures could be readily improved.

Using standard play tape the relation between the 30 in/s and 15 in/s tape speeds was that the 30 in/s was 0.05% slow with the drift in speed from one end of the reel to the other being less than 0.01%.

The varispeed facility, with a nominal 9.6 kHz input for nominal speed, offered a very wide range of speed control with acceptable wow and flutter, being −75%, +50% at 30 in/s and greater at lower nominal tape speeds.

Table 3
Replay reference level (320 nWb/m) to noise

No tape—play Measurement method	30 in/s AES	15 in/s CCIR	15 in/s NAB
22 Hz to 22 kHz RMS	60.5 dB	59.0 dB	59.0 dB
A-weighted RMS	69.0 dB	66.0 dB	64.5 dB
CCIR-weighted RMS	63.0 dB	61.0 dB	59.5 dB
CCIR-weighted quasi-peak	59.0 dB	56.5 dB	55.5 dB
CCIR-weighted ARM	69.5 dB	67.0 dB	66.0 dB
Replay with machine erased tape			
22 Hz to 22 kHz RMS	53.5 dB	52.0 dB	50.5 dB
A-weighted RMS	56.5 dB	55.0 dB	53.5 dB
CCIR-weighted RMS	48.5 dB	47.0 dB	45.5 dB
CCIR-weighted quasi-peak	44.5 dB	43.0 dB	41.5 dB
CCIR-weighted ARM	55.0 dB	53.5 dB	52.0 dB

Table 4
Sync reference level (320 nWb/m) to noise

No tape—sync replay Measurement method	30 in/s AES	15 in/s CCIR	15 in/s NAB
22 Hz to 22 kHz RMS	54.0 dB	54.0 dB	55.0 dB
A-weighted RMS	67.5 dB	66.0 dB	64.5 dB
CCIR-weighted RMS	61.5 dB	59.0 dB	57.5 dB
CCIR weighted quasi-peak	58.0 dB	55.0 dB	53.0 dB
CCIR weighted ARM	68.5 dB	65.5 dB	64.0 dB
Sync replay with machine erased tape			
22 Hz to 22 kHz RMS	51.5 dB	50.5 dB	50.5 dB
A-weighted RMS	57.5 dB	54.5 dB	53.0 dB
CCIR-weighted RMS	48.5 dB	45.5 dB	43.5 dB
CCIR weighted quasi-peak	44.0 dB	41.5 dB	39.5 dB
CCIR weighted ARM	55.5 dB	52.0 dB	50.0 dB

Table 5
IEC-weighted peak wow and flutter

	Beginning	Middle	End
30 in/s	0.012%	0.013%	0.015%
15 in/s	0.025%	0.025%	0.032%

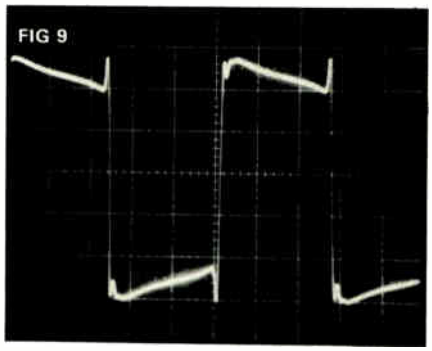

FIG.10
STUDER A810
SPECTRUM ANALYSIS OF 10kHz TONE
RECORDED AND REPLAYED AT 15 IN/S

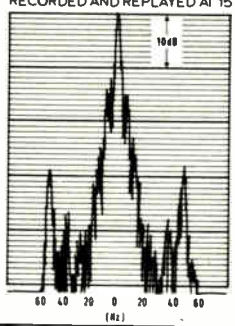

FIG.11
STUDER A810
CROSSTALK REPLAY MODE
AMPEX 456 AT 30 IN/S

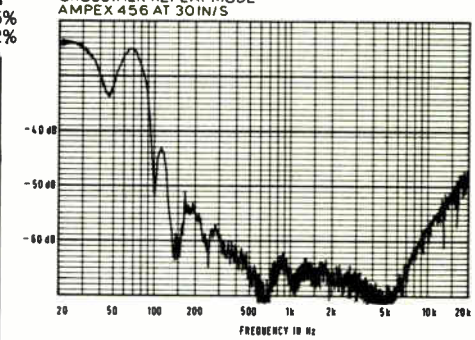

FIG.12
STUDER A810
SYNC CROSSTALK
AMPEX 456 AT 30 IN/S

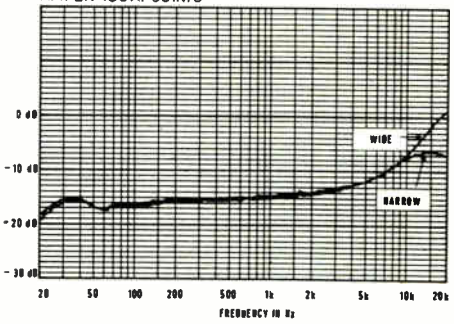

Fig 10 shows a narrow band spectrum analysis of a 10 kHz tone recorded and replayed at 15 in/s. Whilst there is little random flutter there are distinct sidebands at aprroximately ±50 Hz. At 30 in/s these sidebands fell 10 dB in amplitude, but remained at the same frequency. The origin of the sidebands appeared to be associated with the reel motors.

Erasure and crosstalk

Using Ampex *456* tape the erasure of a 1 kHz tone at 30 in/s was good at −85 dB on both tracks.

Crosstalk between the two tracks in the replay mode is shown in **Fig 11** for 30 in/s with the lower tape speed shifting the plot down in frequency by one octave in the low frequencies—the results being unusually good. When recording one track and replaying the other in the sync mode—a severe test—the crosstalk in the narrow and wide band sync replay modes (**Fig 12**) was quite acceptable.

Crosstalk from the timecode track to the audio tracks was negligible. In the absence of a recorded timecode, spurious code outputs could occur due to crosstalk from the audio tracks but, in the presence of timecode crosstalk from high level signals on the audio tracks only produced some jitter in the signal from the code track. Clearly the effect of this jitter will depend upon the code reader particularly in the fast modes when it was more severe.

Internal oscillator

As measured at the line outputs, without tape in the 'circuit', the performance of the optional test oscillator is summarised in **Table 6.** The ▷

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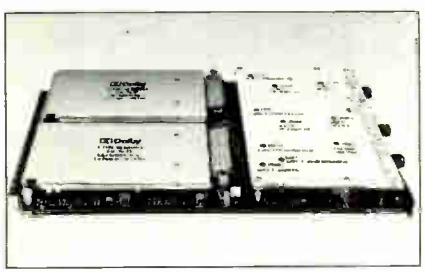

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not very good frequency response was identical with the 10 dB attenuator in circuit, this being accurate to better than 0.05 dB.

Whilst the oscillator is potentially a useful option in the machine its performance is not very satisfactory and more frequencies are desirable for alignment at all tape speeds.

Interfaces

The rear 25-way 'D' connector forms the parallel remote control for use with the Studer remote unit or other devices. All normal tape movement functions and feeds for their indicator lights are available at this connector including varispeed on/off, fader start and repeat.

Commands are initiated by grounding the appropriate line, with the drive to the indicator lights providing up to 300 mA and using up to a 28 VDC supply, which may be derived internally or externally.

More sophisticated facilities are available at the 9-pin 'D' type remote connector when the optional serial interface board is fitted. This may be configured to conform to the 'Studer bus' or to the RS232 serial standard at 300, 1200, 9600 or 76800 baud data rates. The connection of a RS232 terminal allows all front panel functions to be accomplished under computer control, plus the ability to locate specified tape times, set the timer to specified times and fast wind at set speeds. An additional interesting facility is that the recorder when under computer control can store its internal alignment data onto tape (even its own tape). The data can subsequently be used to automatically align the machine, a verify function being available for checking the recorded alignment data.

Information about the RS232 bus facilities is at the time of writing a little scanty and I imagine that with enough knowledge of the architecture some interesting facilities can be achieved under computer control.

Other matters

Metering when set to the VU characteristic was found to correspond to the correct rectifier characteristics and to the correct ballistics for a genuine VU meter.

Setting the meters to the PPM characteristic gave an extra 6 dB gain in the metering cicuits, as is desirable, with the rise time of the meters to −1 dB indication becoming 7 ms and the fall time to zero indication 3.5 s. In addition, the rectifier characteristics of the metering became a genuine peak detecting rectifier.

The quality of tape winding was generally good with the lower fast wind speeds offering a first class wind for archiving tapes. Normal tape tension was 80 g which is highly satisfactory, with the maximum tensions when accelerating reaching 300 g with no jolting of the tape or loop slinging under any conditions.

The excellent tape control undoubtedly contributes to the remarkably small phase jitter between tracks, shown in **Fig 13** for a 10 kHz tone at 15 in/s to be less than ±2°, the horizontal scale being 200 ms/division.

Dropping in and out of record failed to produce any clicks with the bias and erase ramping being completely effective.

Monitoring with the internal loudspeaker was generally satisfactory, but the rotation of the openings in the reel flanges produced a wow and flutter effect which could be irritating.

FIG 13

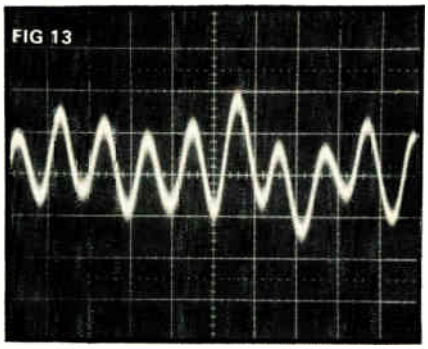

Table 6

Nominal frequency	Actual frequency	Level ref 1 kHz	Harmonic distortion K2	K3	K5
60 Hz	62.1 Hz	−0.3 dB	0.2%	0.3%	1.0%
125 Hz	124.2 Hz	−0.2 dB	0.2%	1.4%	0.3%
1 kHz	993.4 Hz	0 dB	0.2%	1.0%	0.3%
10 kHz	9812 Hz	+0.5 dB	0.3%	0.7%	0.8%
16 kHz	15696 Hz	+0.8 dB	0.5%	1.0%	—

Summary

This ambitious machine has many unique facilities and offers an excellent performance with the option of centre track timecode. The digital storage of alignment data eliminates all knob twiddling and greatly facilitates alignment, in addition to dispensing with almost all potentiometers which is bound to increase reliability. Whilst setting up the configuration of the machine requires experience with this particular machine, operation includes completely conventional controls which provide the normal facilities when the more complex functions are not required. Whilst the optional alignment oscillator is useful I feel that its frequency range could be usefully extended and the oscillator generally have an improved performance.

Overall verdict—an excellent machine.□

Manufacturer: Studer International AG, CH-8105 Regensdorf, Althardstrasse 150, Switzerland.
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The attention of advertisers is drawn to "The Business Advertisements (Disclosure) Order 1977", which requires that, from 1st January 1978, all advertisements by persons who seek to sell goods in the course of business must make that fact clear. From the above date, consumers therefore should know whether an advertisement relates to a sale by a trader or a private seller.

· SERVICES ·

A.J. SOUND FOR BROADCASTING QUALITY. OB's location recording and P.A. Fully equipped vehicles with engineers available. Make a note of our number. Contact Tony Lloyd on 01-360 2098. (L)

· FOR SALE TRADE ·

NEVE 5303 self-op Broadcast Console. 4 Mono mic/line with EQ, 6 stereo line plus 1 Telephone (C/F) Input. Stereo plus mic group plus C/F outputs. Central script space plus remotes for tapes, carts etc. Left, right and mono PPM's. Complete with comprehensive jackfield and Cannon connector panel. Offers invited in region of £3,500. For further information telephone Paul Robbins on 0734 413131. (L)

STUDER/A.80/8TK MK II V.U. (wired 16TK). Studer 16TK audio remotes included. 3 yrs old. Immaculate condition. £9,000. Ring 734 5784. (H)

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· FOR SALE TRADE ·

Uher 4200 Report Monitor portable reel/reel, new only £415.00. **Uher 4000AV** new, only £355.00. Prices subject to VAT. Full range of accessories and full after-sales service available. Michael Stevens & Partners, The Homesdale Centre, 216/218 Homesdale Road, Bromley, Kent. 01-464 4157.

VIDEO CINE SOUND

FILM SOUND & PROJECTION EQUIPMENT FOR SALE

BAUER 16mm telecine projector Selecton studio floor standing type	**£1,900**
SIEMENS Novocord 16/35 recorder max speed 30X, will interlock with Cintel MK III at all speeds	**£11,000**
WESTINGHOUSE Xenon lamp rectifier with meters	**£500**
BELL & HOWELL 16mm projector, marx 300 lamp Sync interlock motor	**£450**
BAUER 16mm double band projector, remote control, 35W extension speaker	**£1,900**
BAUER P7 optical sound, 10W extension speaker (new)	**£440**
BAUER P7 marc 300 optical/mag sound, 35W extension speaker (new)	**£800**
BAUER P6H optical/mag sound+mag record (new)	**£650**
BAUER P6 Synchron push button local and remote control, modified for telecine 25fps	**£950**
PHILIPS floor standing 16mm telecine projector, similar to Kinoton FP18TV	**£3,000**
PHILIPS (Kinoton FP18) rock and roll 16mm projector with Xenon lamphouse	**£7,300**
COUNTER INTELLIGENCE film footage counter with additional time display and tacho	**£750**
PHILIPS/PYE LDK65 broadcast telecine camera, floor standing (new)	**£15,000**
M.T.M. 16/35mm 3T film recorder, high speed unit, with interlock facilities to most types of eqpt.	**£15,000**
AVIM 16mm 1T sound reproducer for interlock with any projector c/w tacho	**£2,000**
AVIM 16mm 1T recorder, for interlock with projectors c/w tacho	**£2,420**
1 **M.T.M.** transfer unit comprising 16/35 reproducer and 16/35 recorder interlocked	**£10,000**
1 **M.T.M.** transfer unit comprising 2 off 16/35 recorders interlocked	**£11,500**
1 **PHILIPS** FP20 35mm telecine projector convertable for normal projection with Xenon lamphouse	**£5,000**
5 **RCA LM66** 35mm film transports with spool panels	ea. **£250**

Numerous other items available, including Selsyn and synchrostart interlock generators, spare parts for Fedi and Bauer projectors, motors, transformers etc.

TEL: V.C.S. LTD. 01-948 3615

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Suppliers of new and used professional audio equipment. See back page of this issue for a sample of our current stocks.

· FOR HIRE ·

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Studer 24-16-8-4-2 track

Otari 24 track

Sony PCM Digital

Q-lock, Maglink

Sony U-matic VCR+monitors

Headblocks, Dolby, Fairchild

Revox, Teac

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the latest and the best...

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AMS RMX-16 Digital Reverb
Lexicon 224X Digital Reverb
Lexicon 224 Digital Reverb
Lexicon 200 Digital Reverb
Linn Drum Computers

We also have a comprehensive range of Tape Machines, Mics, Mixers, Amps, Speakers, EQ etc.

Immediate delivery and collection service

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76 Eversholt Street, London NW1 1BY

· PUBLICATIONS ·

RECOMMENDED by Broadcast Sound—"Radio Directory" the definitive trade guide with thousands of addresses, contacts, schedules etc, £6.00. Also "TV Directory" £7.00. Updated twice yearly. Both for £9.50. Dept 8, Hamilton House Publishing, Brixworth, Northampton. Phone 0604 881889. (L)

· FOR HIRE ·

Specialists in Studio Equipment Hire

A whole range of digital and analog processing equipment

Phone Andy on **01-708 0483**

10 Steedman Street, London SE17

· WANTED ·

STUDER 24 track A.80 (with remote) Dolby 24 track. Trident series 80 spare modules. Ring 01-734 5784. (L)

· SITUATIONS VACANT ·

SENIOR BROADCAST ENGINEER

NORTHSOUND RADIO, the I.L.R. Station serving Aberdeen & N. E. Scotland seeks an engineer experienced in local radio

Duties include Operations, Maintenance, Development and Installation of Studio Equipment

Contact **Bob Barrow,** Chief Engineer

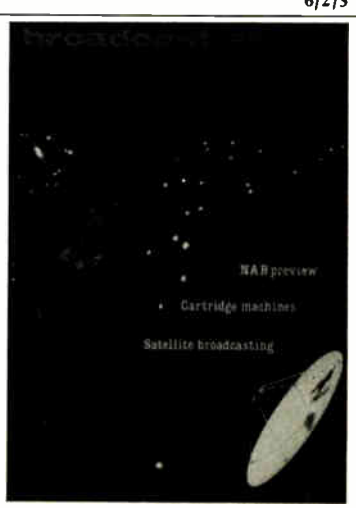
NORTHSOUND RADIO

PO Box 290 ABERDEEN AB2 6BL

NORTHSOUND Radio

INDEX TO VOLUMES 1 & 2

This index covers the period of the first eight issues of *Broadcast Sound*—from September/October 1982 through to, and including, November/December 1983. Accordingly, the index covers volume 1 numbers 1 and 2 (1982), plus volume 2 numbers 1 to 6 (1983). References are given in the format: page number/volume number/issue number. Thus, 42/2/6 refers to page 42, volume 2 (1983), issue number 6 (November/December).



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Hugh Ford, Studio Sound, December 1981

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