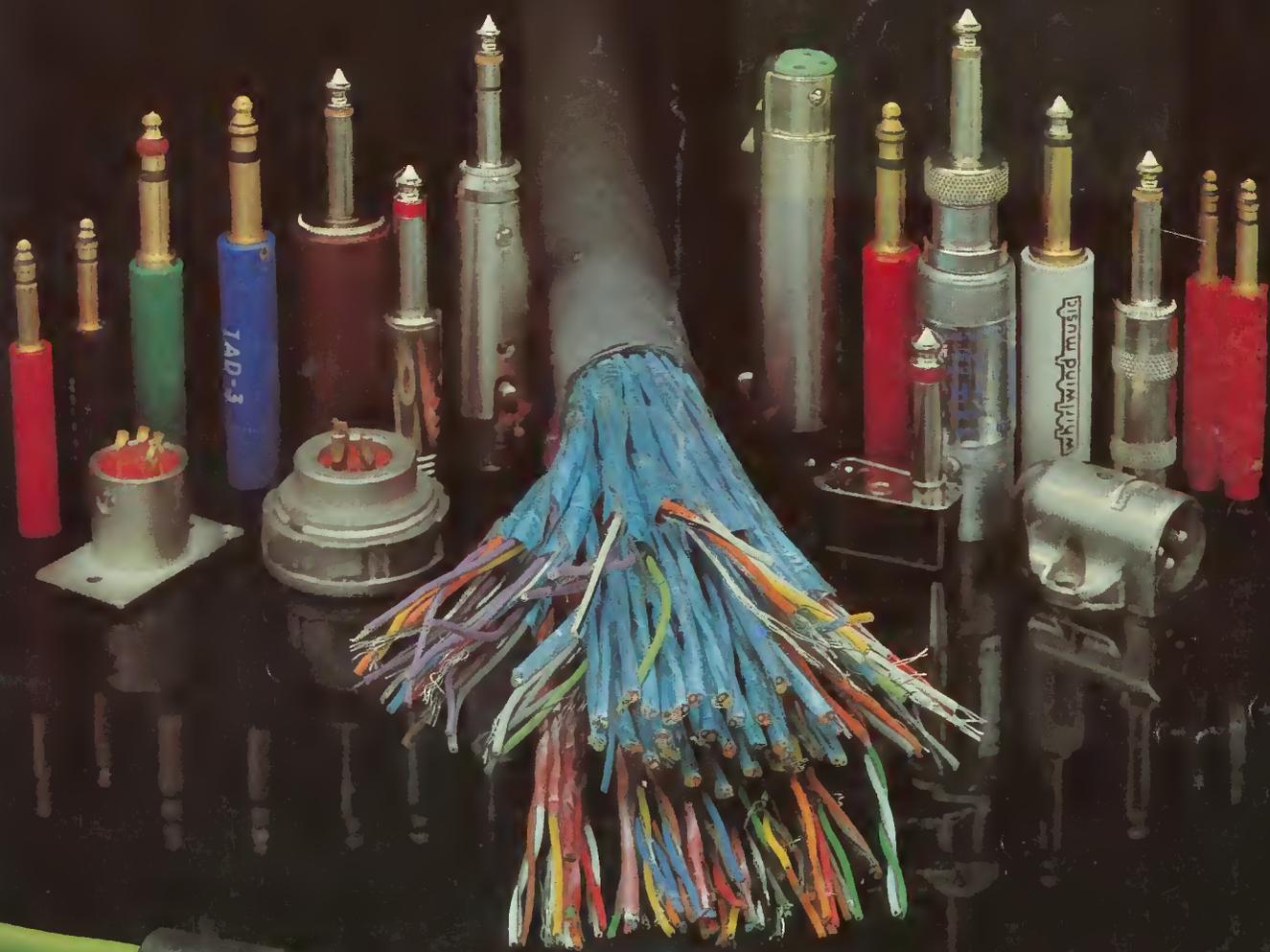


# studio sound

November 1980 £

AND BROADCAST ENGINEERING



A LINK HOUSE PUBLICATION

## Interconnection

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A LINK HOUSE  
PUBLICATION



# studio sound

AND BROADCAST ENGINEERING

NEWS	34
STUDIO DIARY including Forum, Rome; Elmulab, Munich; Phoenix 413, New Jersey	40
LETTERS	46
NOISE MEASUREMENT—Hugh Ford	48
AES 67th CONVENTION—Exhibition Preview	52
DESIGNING A MIXING CONSOLE Part Three—Steve Dove	62
BUSINESS	68
SURVEY: Connectors, Cables and Leads	72
ITALIAN STUDIO SCENE—Terry Nelson	80
BALANCED OR UNBALANCED?—Ted Fletcher	84
REVIEWS: Hugh Ford	
Audio Cables	88
Connectors	96
Dolby Cat 98A filter	102

#### New editors start here

This is the first issue I'm nominally responsible for as the new Editor of *Studio Sound*—I say 'nominally' because I came in rather on the tail-end of the issue, as Angus moved downstairs to concentrate on his excellent Yearbooks. Therefore, I'd like to take a little of your time to introduce myself, and point out a few directions that the magazine will be taking in the future.

I entered the sound business as a tape-op in one of London's larger studios around 1970 and took what I suppose is the normal course for such humble people: a suitable apprenticeship and eventual promotion to engineer, only to disappear off to do freelance work in 1974. Following this period, I was in various people's studios in England and the States, and on the road doing sound-mixing for a number of bands in Europe and the USA. I also did some broadcasting work with a number of local radio stations before returning to the recording side of the industry in 1976 as studio manager of a medium-sized multitrack establishment in Central London. After that I moved over to edit *Sound International* in '78—and now, here I am. I very much hope that my background will help us to make *Studio Sound* even more useful than it has been in the past to you, the readers, and I would very much welcome your comments on what we get up to, to make sure we're succeeding.

One of our intentions is the introduction of 'user reports' to supplement Hugh Ford's much-respected technical evaluations. As someone who still finds the time to do some recording work, I believe that you need to know how a unit performs on a real session, as well as what happens when you squeak it; in this area, I'd be interested to hear from engineers on their experiences with gear we review, so we can pass on the whole picture about the hardware that's around. In addition, I hope to be organising articles on techniques—the technology of sound recording and production are international, and so are the methods we engineers use to produce the final product; hopefully, *Studio Sound* will be able to help you make better music by throwing some useful ideas around. Let's have your views on the subject.

#### A new mixer?

If you're contemplating getting hold of a new console, you may well have been following Steve Dove's series on designing and building one—and I can quite happily say that the design's a good one. But before you commit yourself to building a large console, there's some things that you should consider.

Firstly, it should be remembered that a mixer you build yourself will probably cost a lot more than one you buy with the same kind of facilities, simply because you can't buy your components at discount prices very often, and you will take a fair number of man-hours to build it—when no doubt your maintenance people have other things they should be doing. And simple mass-production techniques offer great economies. When the console is finally built, in addition, you—and only you—will be responsible for its maintenance, and you probably won't have spare cards to swap as a manufacturer would. What you do gain in building your own console, however, is the ultimate in customisation—you can have absolutely anything more-or-less where you want it—but once again, remember that a commercial console will probably offer all you want—and possibly more—for less. It's worth remembering, too, that the majority of respectable manufacturers aren't just in the console business to make money—there are far faster and easier ways—they are specialists who enjoy what they're doing, while your speciality is probably elsewhere.

I'm not saying this to keep the manufacturers happy, nor am I attempting to put you off building a mixer from the series in this magazine (that would be silly!). What I am saying, is that before you take that step, make sure you have good reasons. Check out the marketplace carefully before you begin, and evaluate the project on the simple basis of money, 'usability', maintenance support, and time. If, at the end of it, you find that you need to build your own console, the designs are in front of you now. If you would prefer to buy one, the next two months issues will give you the data you need to make a good choice. A new console is a big decision in more ways than simply money: take your time to check out the facts.

Richard Elen

ISSN 0144-5944

Cover by Paul Burbridge and Ray Hyden

NOVEMBER 1980 VOLUME 22 NUMBER 11

# AKG

ACOUSTICS



## Studio condenser microphone C414EB

The twin-diaphragm system enables the selection of four different microphone polar patterns.

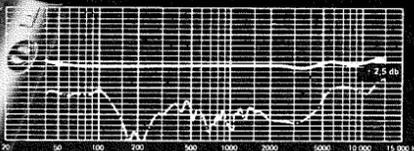
Pre-attenuation before the output stage is incorporated to permit the increase of undistorted maximum

sound pressure level by 10 or 20 dB for close-up recordings.

The incorporated bass-cut circuitry will reduce the risk of distortion at low frequencies. This feature is especially useful to combat wind noise and stage floor vibrations. The slope of the bass-cut filter is more than 12 dB/octave, the cut-off frequency may be set to 75 or 150 Hz.

The all metal housing adds to the rejection of r.f. interference when the microphone is used close to

Cardioid



Hyper-cardioid

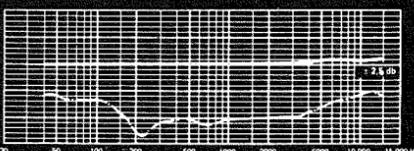
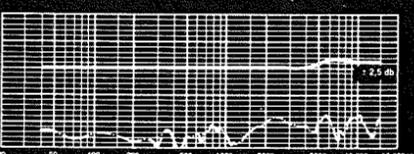
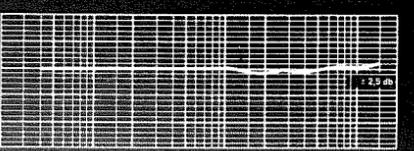


Figure-eight



Omni-directional



transmitter stations or in conjunction with wireless microphones or other communication equipment. A recessed switch on the front enables the user to select any one of four different polar patterns to adjust for different recording situations. Four different types of microphones are thus combined in only one C414EB. The chosen polar patterns are almost frequency independent to guarantee the same sound character for all angles of incidence.

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# Technology

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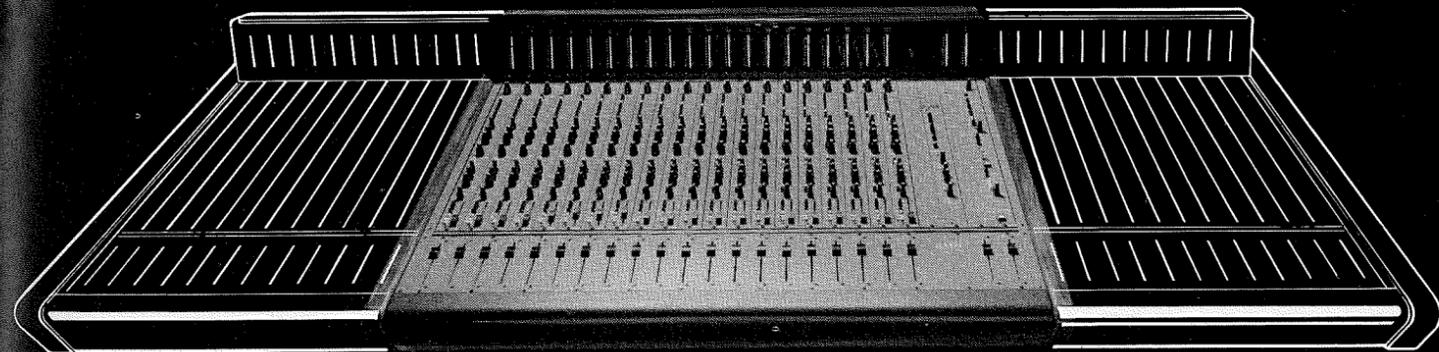


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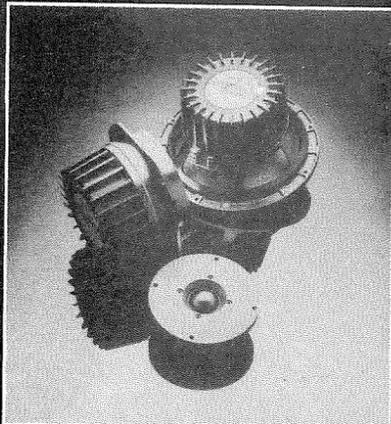
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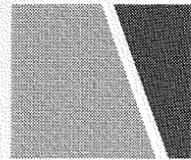


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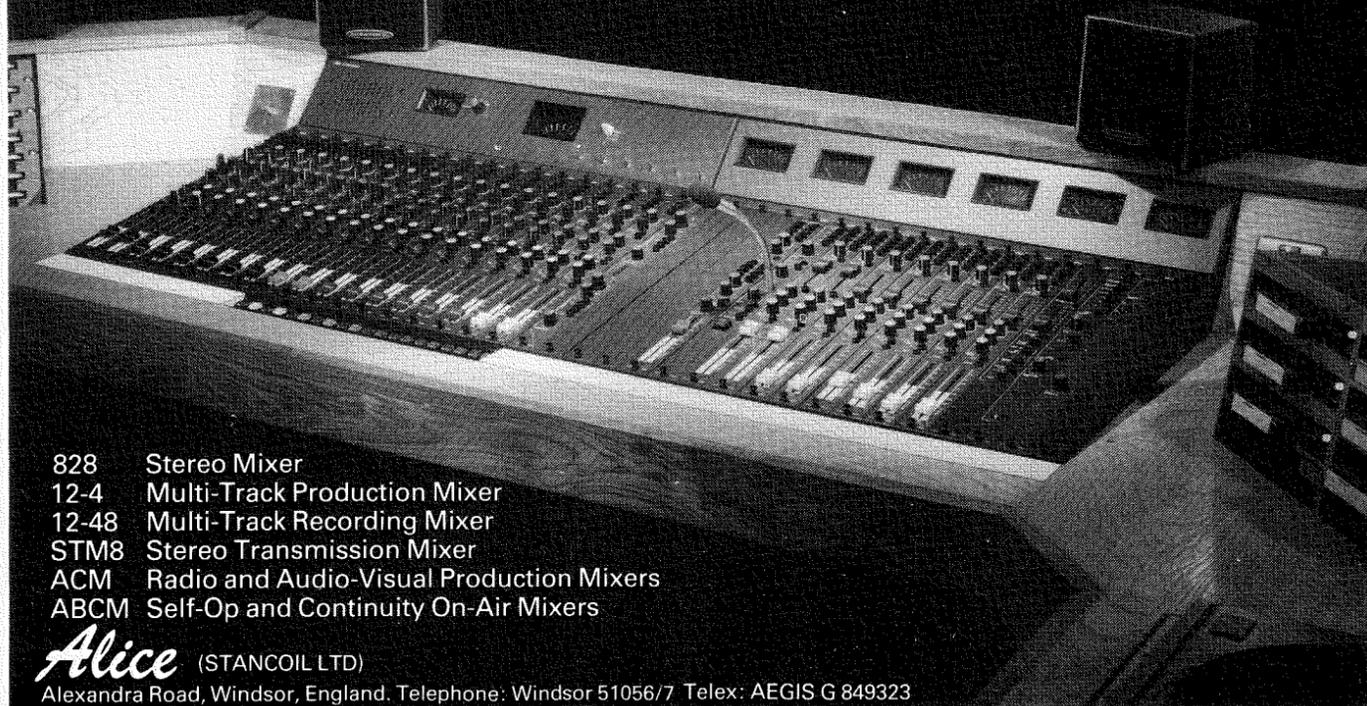


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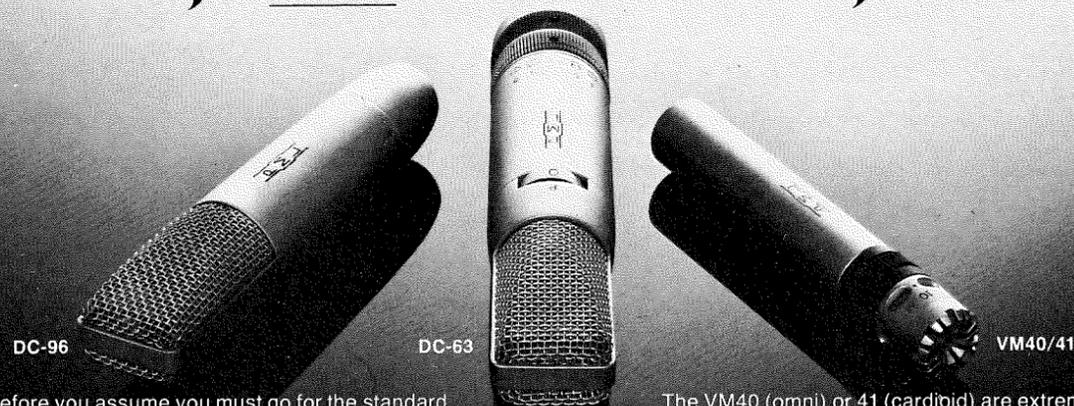


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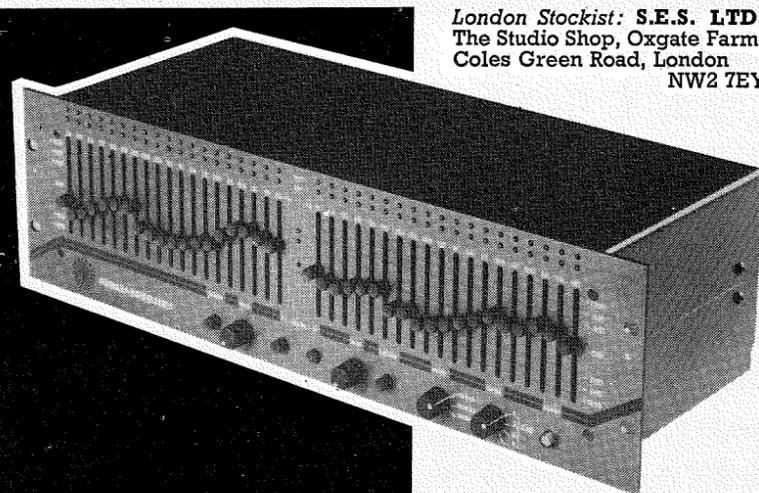
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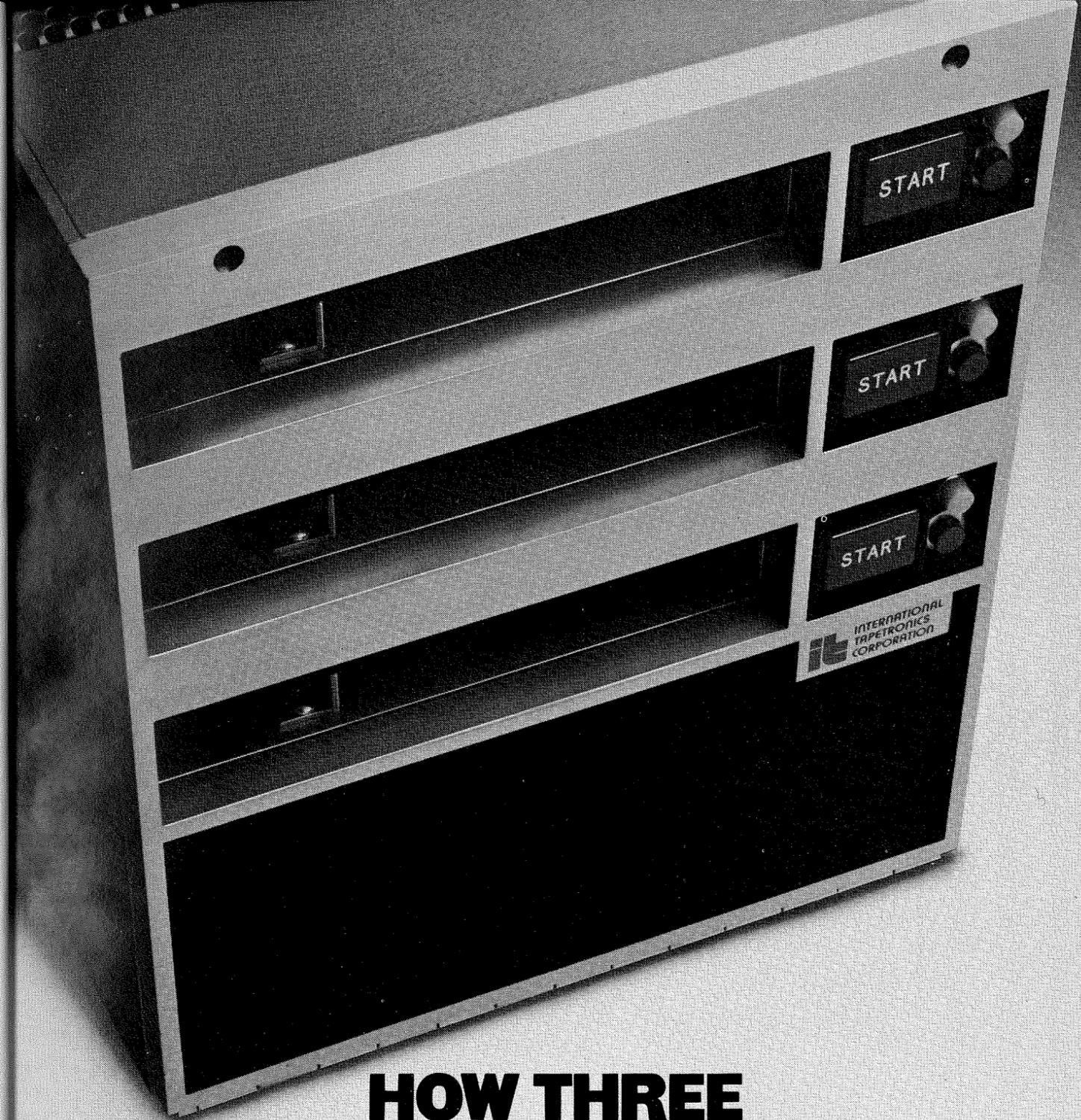
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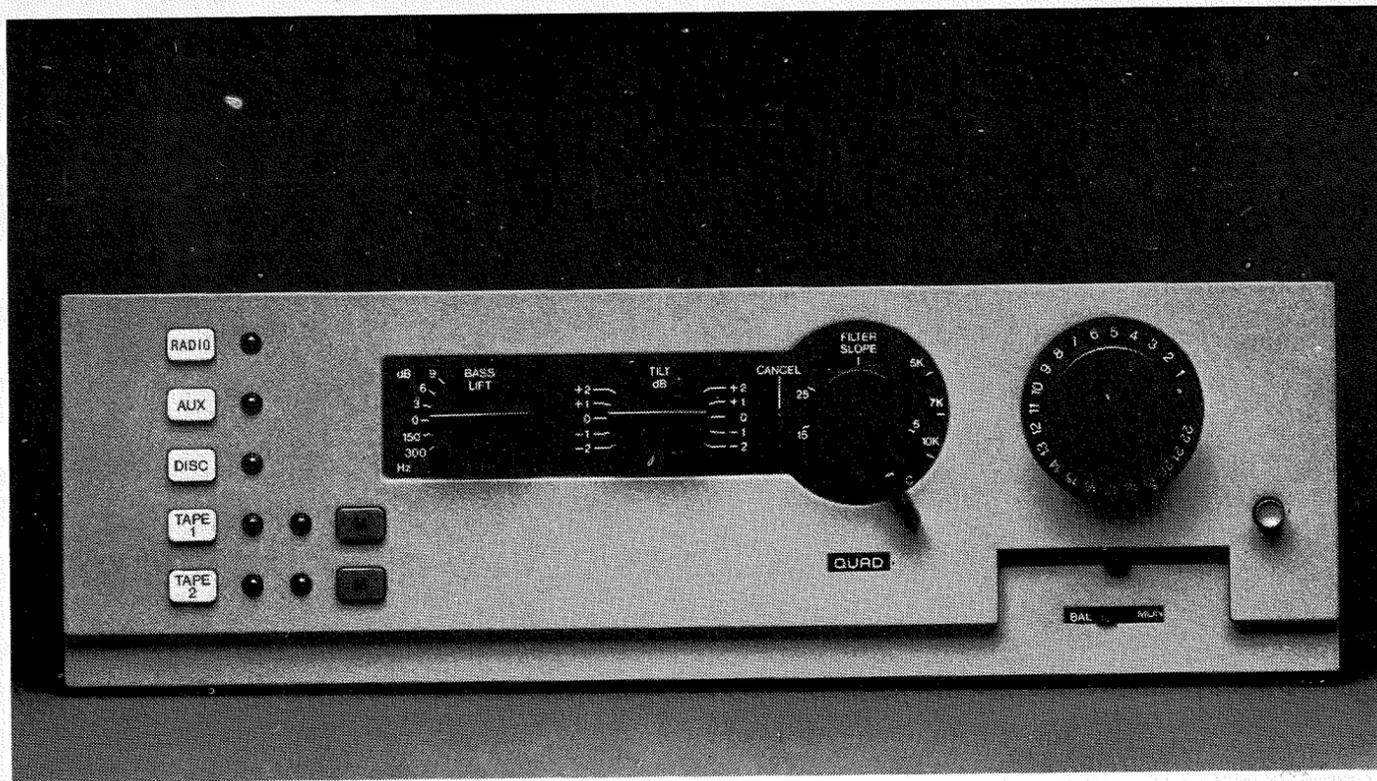
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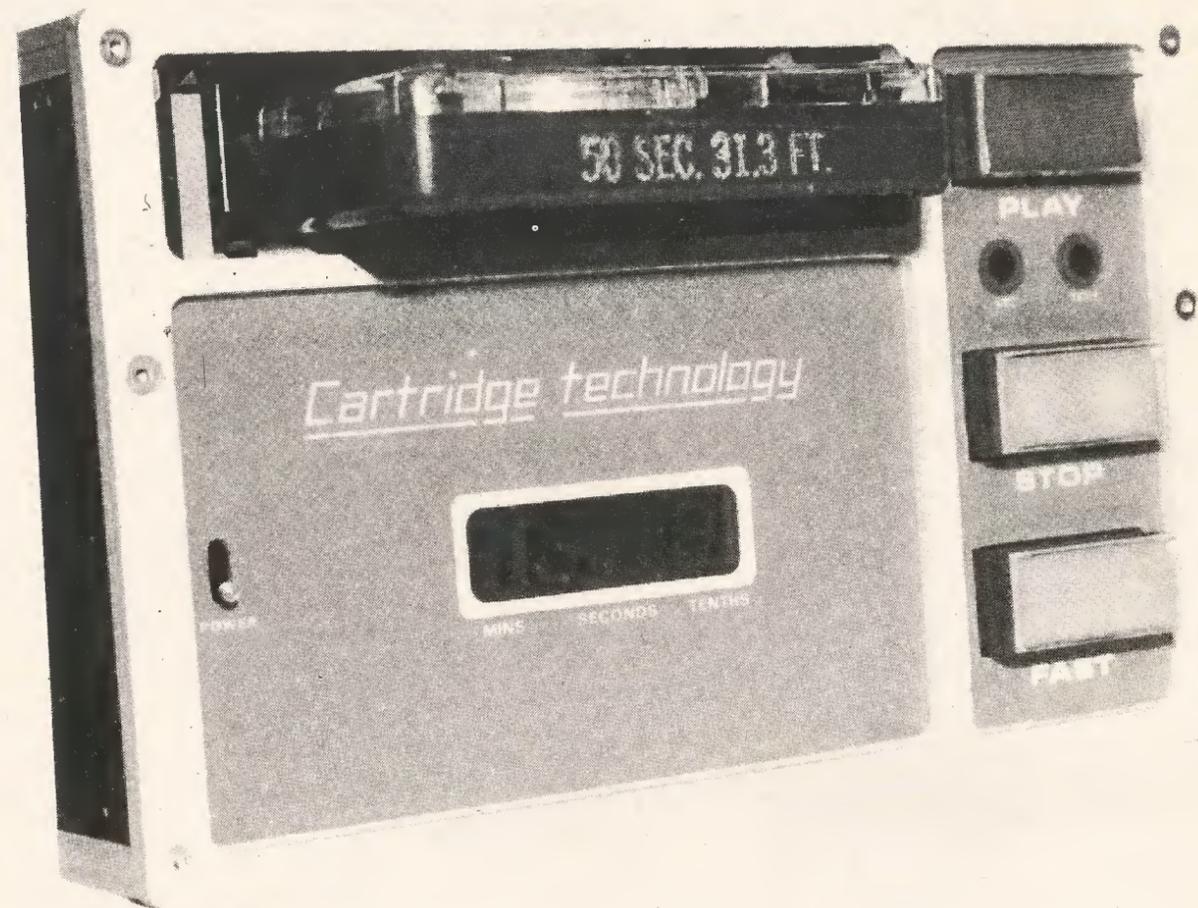
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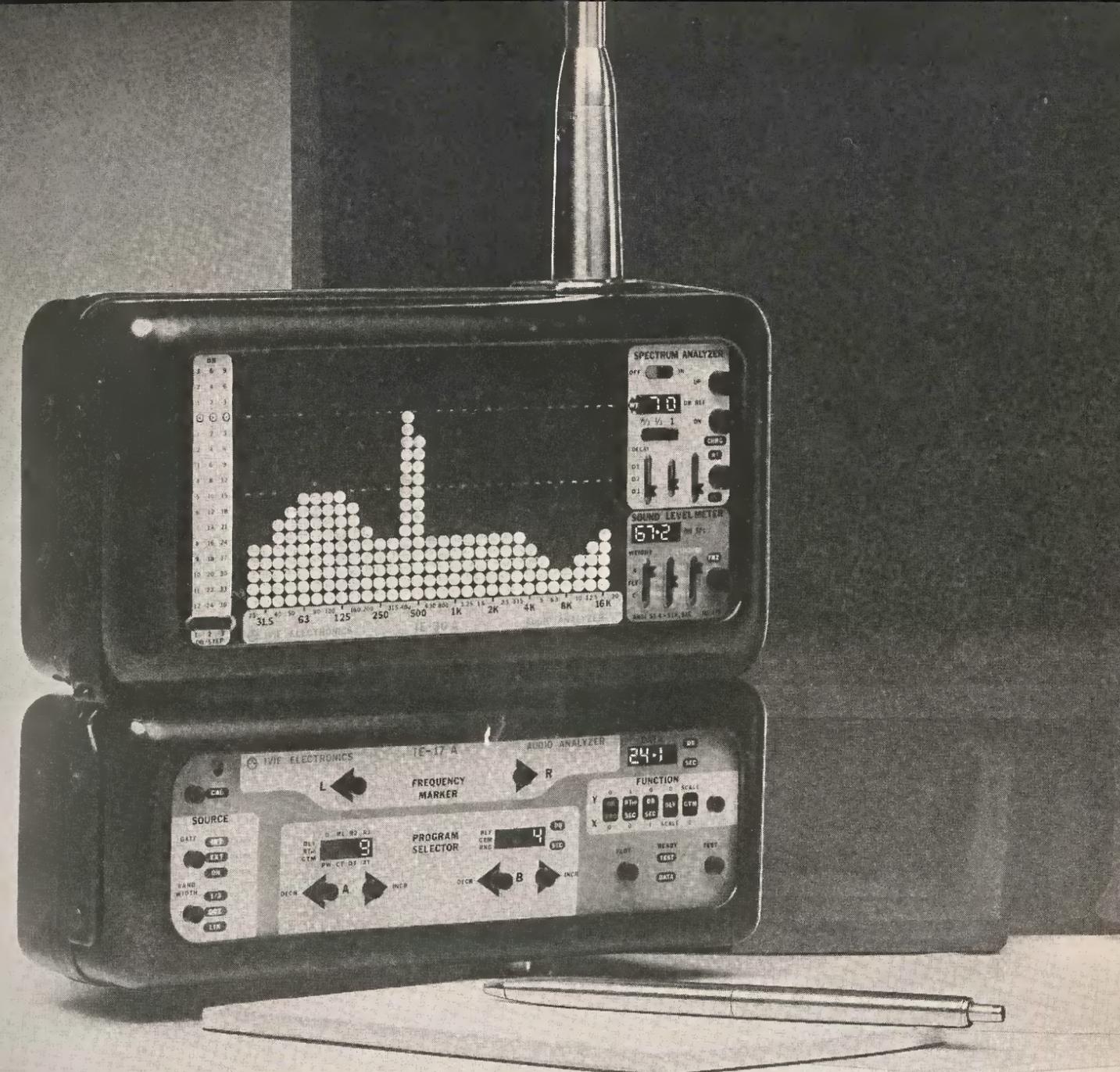
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**IE-30A** Grade 1 Precision Sound Level Meter. 1/3 octave analysis - instantly. Two display memories maintained, even when switched off. 9 to 149 dB SPL range. 0.1 dB resolution. Digital readout of SPL with A and C weighting. Three response speeds, thirty frequency bands, display hold, 15, 30 and 45 dB selectable resolution, outputs for peripheral equipment, eg scope, plotter, line amplifier, etc.

Comes as standard with a precision

laboratory microphone calibrated in dB SPL and remoteable up to several hundred feet, a test probe with two precision attenuator settings for calibrated dB/pV measurements (true rms, average or peak), nickel cadmium batteries with charger and a hard shell, foam-lined travel case.

**IE-17A.** An extremely intelligent microprocessor-based system, capable of calculating acoustic and electrical

delays from 1 m/sec to 100 secs. Measurement of reverberation, distortion, discreet acoustic reflections, narrow band analysis, time-gated amplitude response of direct wave and reflected wave phenomena, articulation losses and other time-related phenomena.

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We system design,  
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TV studio sound  
systems too!



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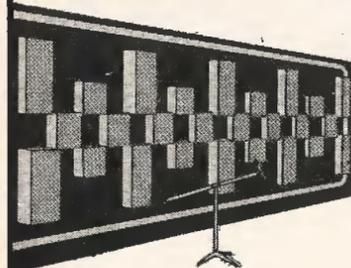
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**THE ACOUSTIC SCREENS from AK**



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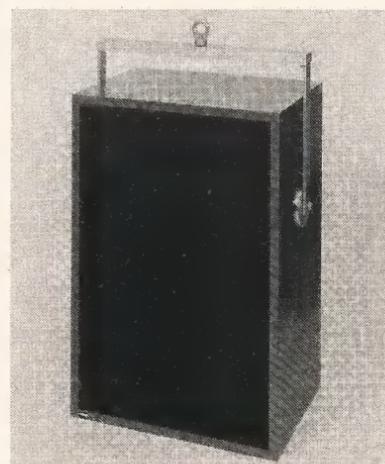


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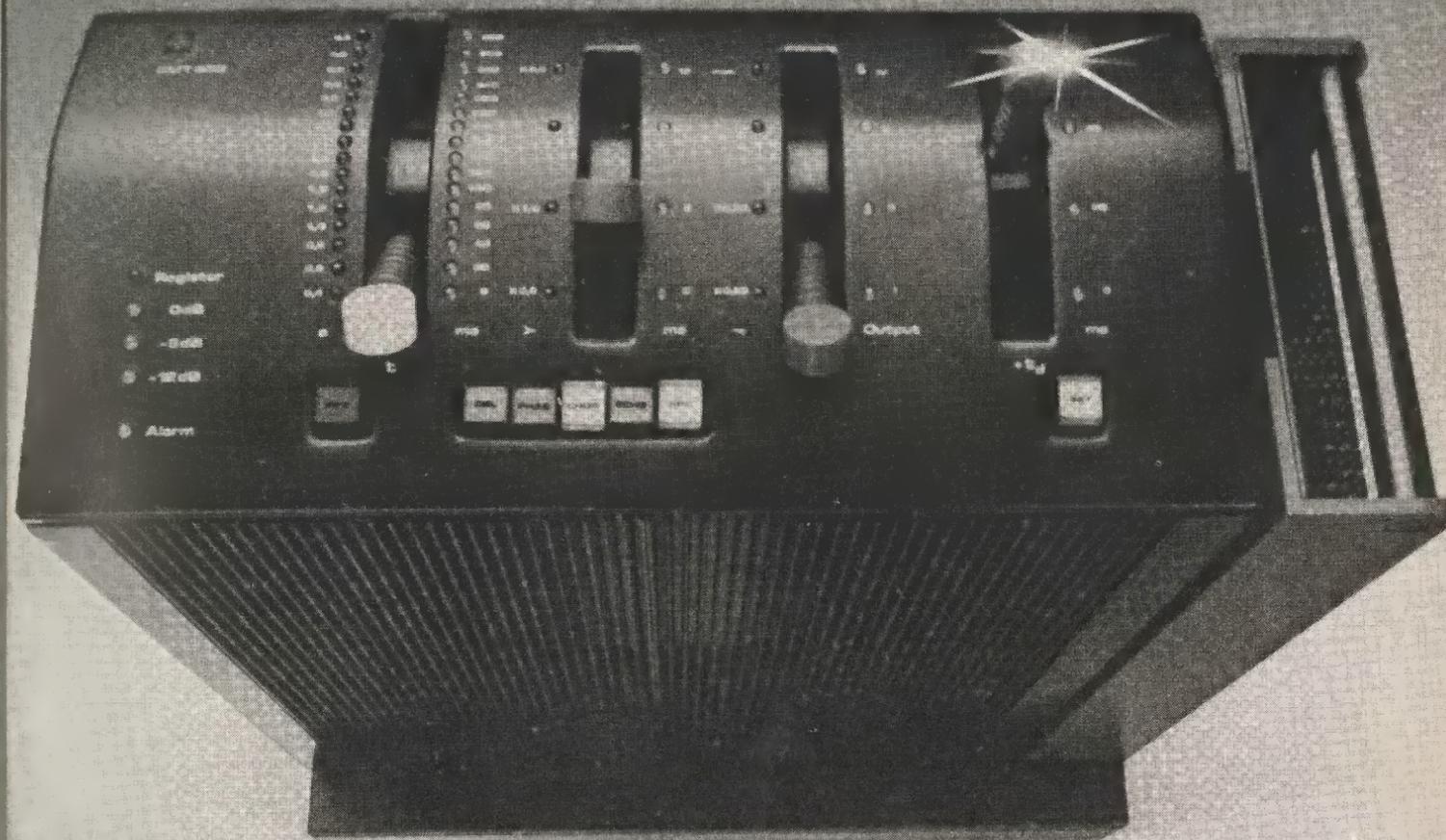
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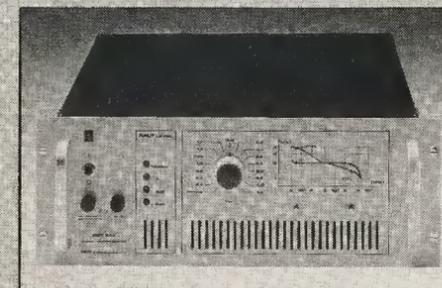
**IMAGINE A STUDIO  
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We can! EMT digital reverberators are judged by experts to be subjectively superior in sound quality, even to the renowned plate and famed foil.

The EMT 250 offers numerous facilities, including the first reflection delay selectable decay characteristics.

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# 18000Hz, 0.9mv Pa $\approx$ 60dbm, 153dbm, 200ohms, > 10000 ohms

These are the specifications that make the Beyer Dynamic M260 NS ribbon microphone the best in its field.

A specially shaped short ribbon, 0.002 mm thick, weighing only 0.000438 grammes guarantees that the M260 NS gives absolute fidelity of reproduction.

Complete absence of non-linear distortion lends startling clarity and transparency to the whole sound spectrum.

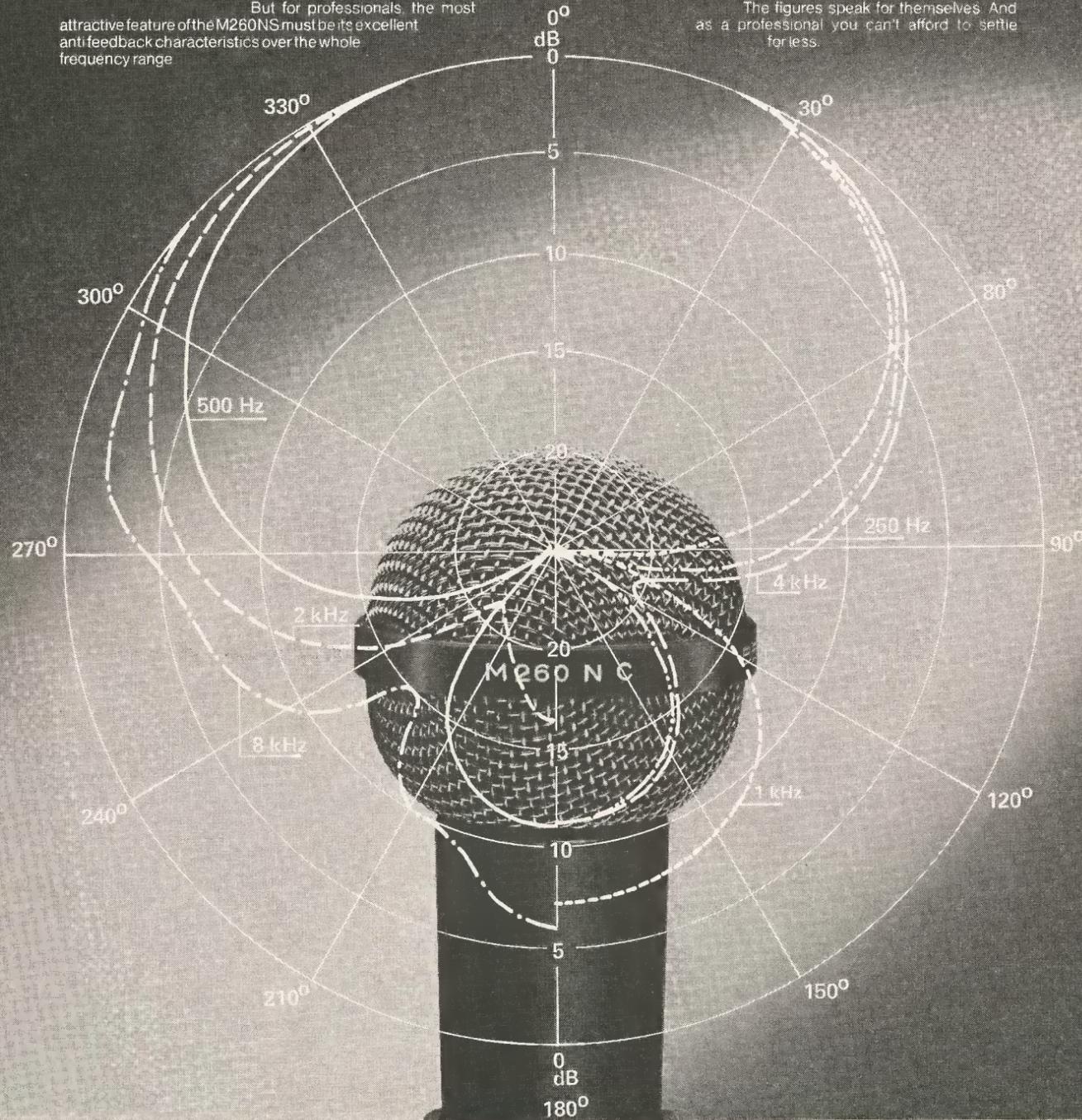
But for professionals, the most attractive feature of the M260 NS must be its excellent anti feedback characteristics over the whole frequency range.

Small wonder it is the world's most popular microphone for vocal and instrumental recordings and public address work.

The M260 NS is only one of the range of ribbon microphones made by Beyer Dynamic.

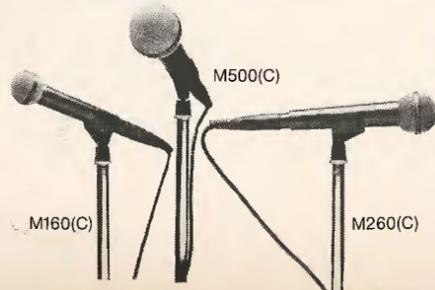
And each one is manufactured to the same high standards, incorporating all that is best in microphone technology.

The figures speak for themselves. And as a professional you can't afford to settle for less.



"The original A77 had set a standard by which I have judged other domestic and semi-professional recorders for many years. It is now clear that the new B77 sets a new standard not easily surpassed at its price"  
Angus McKenzie (March 1978)

For a complete catalogue of Beyer products send to the address below



**Beyer Dynamic**

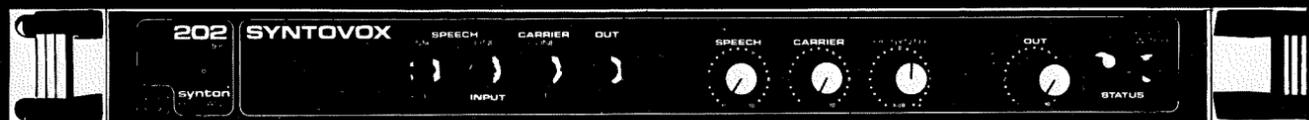
Beyer Dynamic (GB) Ltd. 1 Clair Rd., Haywards Heath, Sussex RH16 3DP. Tel: (0444) 51003

**REVOX**

For the full story contact F.W.O. Bauch Ltd., 49 Theobald St., Boreham Wood, Herts. WD6 4RZ

# SYNTOVOX

## 202 VOCODER



Syntovox 202 is the latest development in vocoders by Synton. It was designed primarily to make a match between a polyphonic keyboard, a boosted bass or a fuzzed guitar and its player.

Syntovox 202 introduces the elegant way of moulding musical sounds into the shape of vocal articulation, enabling the user to impose his timbre upon cliché sounds - instantly!

We could have called Syntovox 202 'The Little Imposer'. We didn't. We called it 'The Incredible Machine'. You'll find out why.

■ Syntovox 202 - a thrilling effect at rock bottom price.

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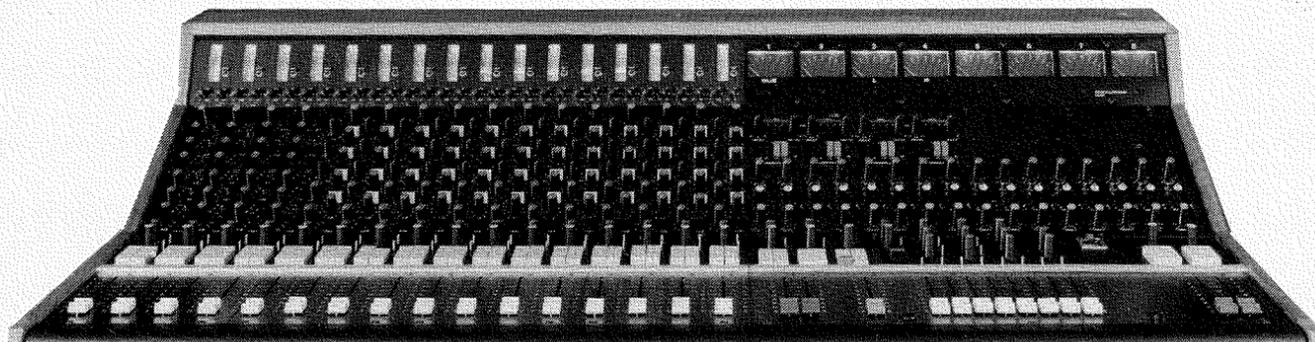
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**DABBLE WITH THE UNEXPECTED!—CONTACT CHILTON**

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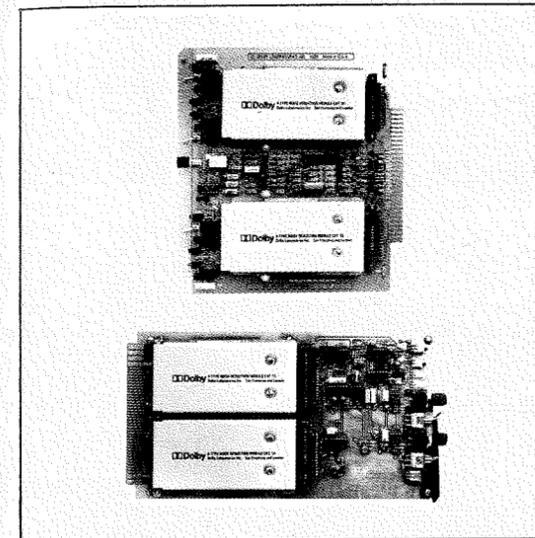
Telephone: 01-876 7957

Telex: 912881

(A basic 12/4 starts at £2000 + VAT)

## With the Dolby system, the sound can match the picture.

A great deal is happening these days to improve the quality of television audio. New distribution methods such as diplexing, new post-production techniques for laying down sound-tracks without having to re-record them repeatedly on VTRs, the reality of stereo TV audio in some countries — these factors and more are combining with the growing audience sensitivity to good sound to put a new emphasis on television sound quality.



These modules are designed for incorporation into existing Ampex and Sony 1" Type C video tape recorders. Installation takes as little as 20 minutes utilizing a flexible printed circuit board interface provided with each module.

However, a major bottleneck remains: noise. The better the rest of the studio and distribution chain becomes, the more the noise from the audio tracks of VTRs limits the ultimate fidelity of television sound. The audio signal-to-noise ratio of 2" quad machines is typically worse than 50 dB, while the specs for the new generation 1" machines are typically 52-56 dB. That kind of performance is not as good as many consumer audio tape recorders, and unless improved, may always keep television sound in second place to the high fidelity color picture.

Dolby noise reduction is the proven way to break the noise bottleneck, here and now. It provides 10 dB of noise reduction (rising to 15 dB at

higher frequencies), without audible degradation of the original signal. It reduces hiss, hum, rumble, the effects of multiple-generation re-recording — *all* noise not part of the original signal. It reduces print-through, even years later. It can reduce distortion by permitting the use of lower record levels. And Dolby noise reduction is the key to taking full advantage of the wider frequency range now increasingly being provided in the rest of the TV audio chain.

Since its introduction 15 years ago, Dolby noise reduction has become universally accepted for quality audio tape recording, both professional and consumer. It is also regularly used to improve the audio quality of VTRs in several European countries. Just ask any professional audio recording engineer about the benefits of the Dolby system, or contact us for full technical information. Let us help you in your efforts to provide television sound which matches the television picture.

**Dolby**

**Dolby Laboratories**

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# Custom built studio? Call the professionals.



## BRENELL MINI 8

A truly professional machine within the reach of anyone seriously considering 8 track. I.C. logic transport control, sync facilities, silent drop in/drop out record functions, and everything that makes this 1 inch machine probably the best value for money on the market.



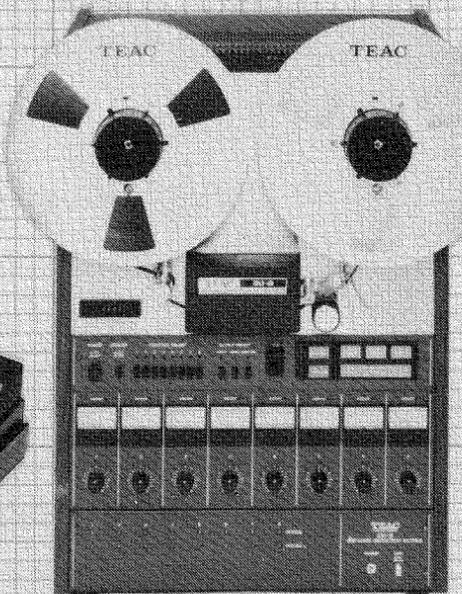
## REVOX B77

The ideal mastering machine for the small studio giving really excellent results at a reasonable price. And for those who want to go even better we also stock the Revox A700.



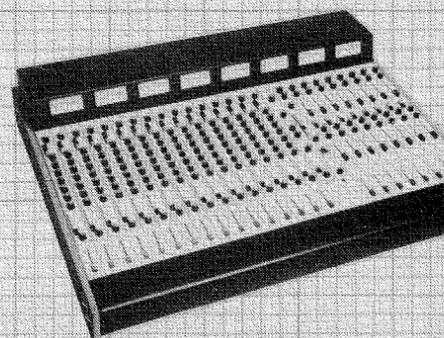
## TEAC A3440

The new four channel machine replacing the famous A3340S. Now with even more facilities: — I.C. logic control, built-in pitch control, improved function select layout with auto sync for silent drop ins/drop out and a new monitor select system for easy monitoring in any mode direct from the machine.



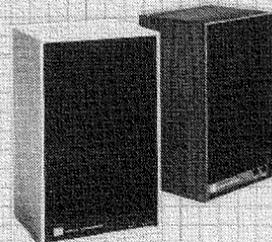
## TEAC 80-8

The 1/2 inch 8 track for the budget conscious studio. Giving high quality at a very reasonable price. The 80-8 has all the facilities normally associated with a machine of this calibre. And with the optional DBX unit gives excellent results.



## A&H MODEL III

The high quality modular mixer for the quality 4, 8 or 16 track studio. Available in virtually any configuration up to a maximum frame size of 24/8. This mixer is available together with the Brenell Mini 8 at a special package price.

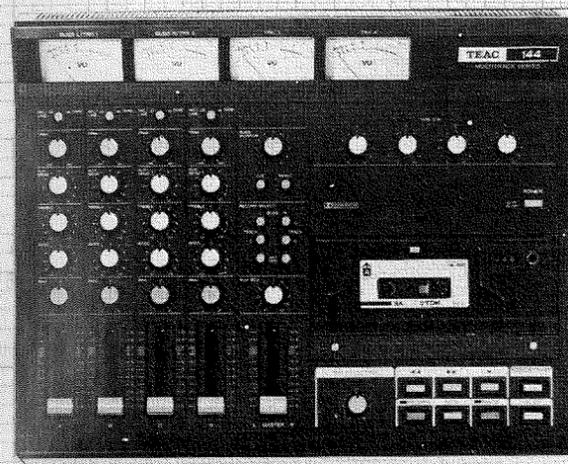


## JBL MONITORS

We can supply the full range of JBL Monitor speakers from the small 4301 broadcast monitor; the 4311, popular with the small studio, through to the 4343 for more critical monitoring purposes.

# REW

## Introduce the first 15in x 18in. Studio



Now you can have the essential functions and flexibility of multitrack recording in one compact, self contained unit. It's called the Model 144 Porta-Studio and it lets you record basic tracks, overdub in sync and remix to stereo. On standard cassette tape.

TEAC engineers created a totally unique format for Porta-Studio. Four tracks in sync on cassette tape at 3 1/4 ips. It's fast, simple, reliable and economical. Rehearse on it. Learn on it. Create on it. Just plug in a microphone or instrument and go to work on it.

Porta-Studio's versatile 4x2 mixer section gives you mic/line/tape switching, trim control, high and low EQ, fader, pan and Aux Send for each input. The failsafe group switching matrix lets you record on up to two tracks at the same time. And there's a master fader that gives you overall level control during recording and mixdown.

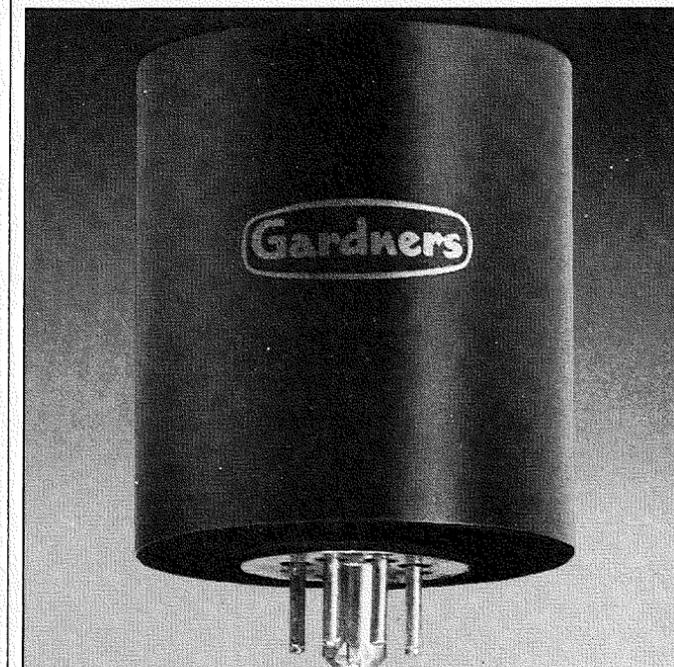
The full-logic cue system in Porta-Studio lets you hear everything you're

doing all the time. Input and tape cueing, monitoring for recording or mixdown are all available. And every signal can be metered. Coming or going.

Porta-Studio's drive system is built specifically for the rugged needs of multitrack recording. Transport controls are all solenoid-operated for faster, easier switching. And you get a built-in variable speed control that lets you add special effects, fix a flat note or solve timing and cueing problems.

You can work with Porta-Studio using nothing more than headphones. Or send the output through your home audio system. You'll also find the patch points and controls that let you use Porta-Studio with equipment like echo or delay units, equalizers and additional mixers.

Come in to REW for a demonstration of the very affordable Porta-Studio. Nothing else in the world puts so much multitrack function into a small package.



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# Talk is Cheap.

While others talk about performance and reliability, BGW is at work proving it, day after day after day. That's why so many pros Depend on BGW.

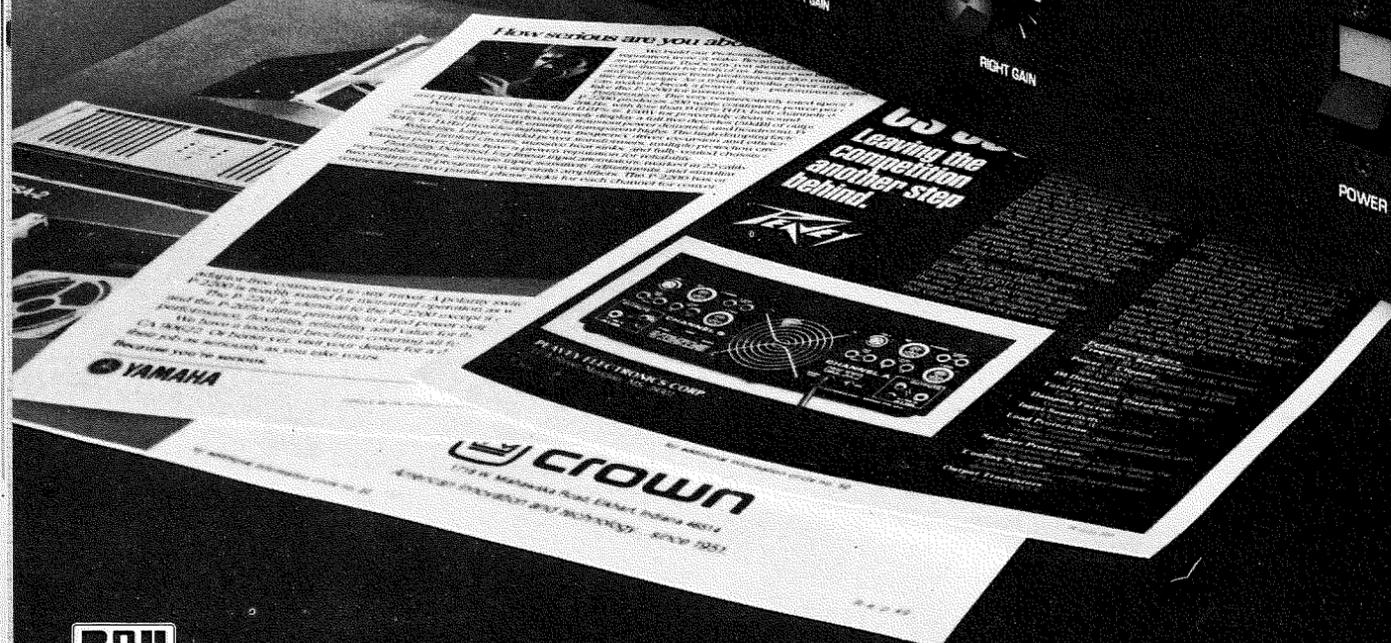
You already know BGW is pre-eminent in discos... recording studios... and on the road. Tough, demanding applications. But, BGW is chosen for even tougher assignments.

Consider the 1980 Winter Olympics. Future Sound, Inc. of Weston, CT was faced with providing PA, background music and network feeds for the Alpine events on Whiteface Mountain. The four amplifier sites were inaccessible by road. The only access was by snowmobile or on foot. Temperatures are, at their mildest, bitter. Naturally, Future Sound selected 20 BGW 750's because of their proven reliability.

And, when the Pope celebrated Mass on Washington's mile-long Mall, BGW 750's were there again (along with BGW 250's and 600's)... selected by Audio Technical Services, Ltd. of Vienna, VA for their reliability and because they can be operated right up to the clip point for hours with no problems.

In fact, the BGW 750 outperforms Crown's latest amplifier, the PSA-2. The 750 delivers more power at 4 and 8 ohms, has more output devices, and uses audibly superior full complementary circuitry.\* One thing the Crown does have... a higher price, it's 37% higher.\* And you know the BGW 750 is dependable. If you don't know from personal experience... ask the Pope.

\*Based on Manufacturer's specifications.

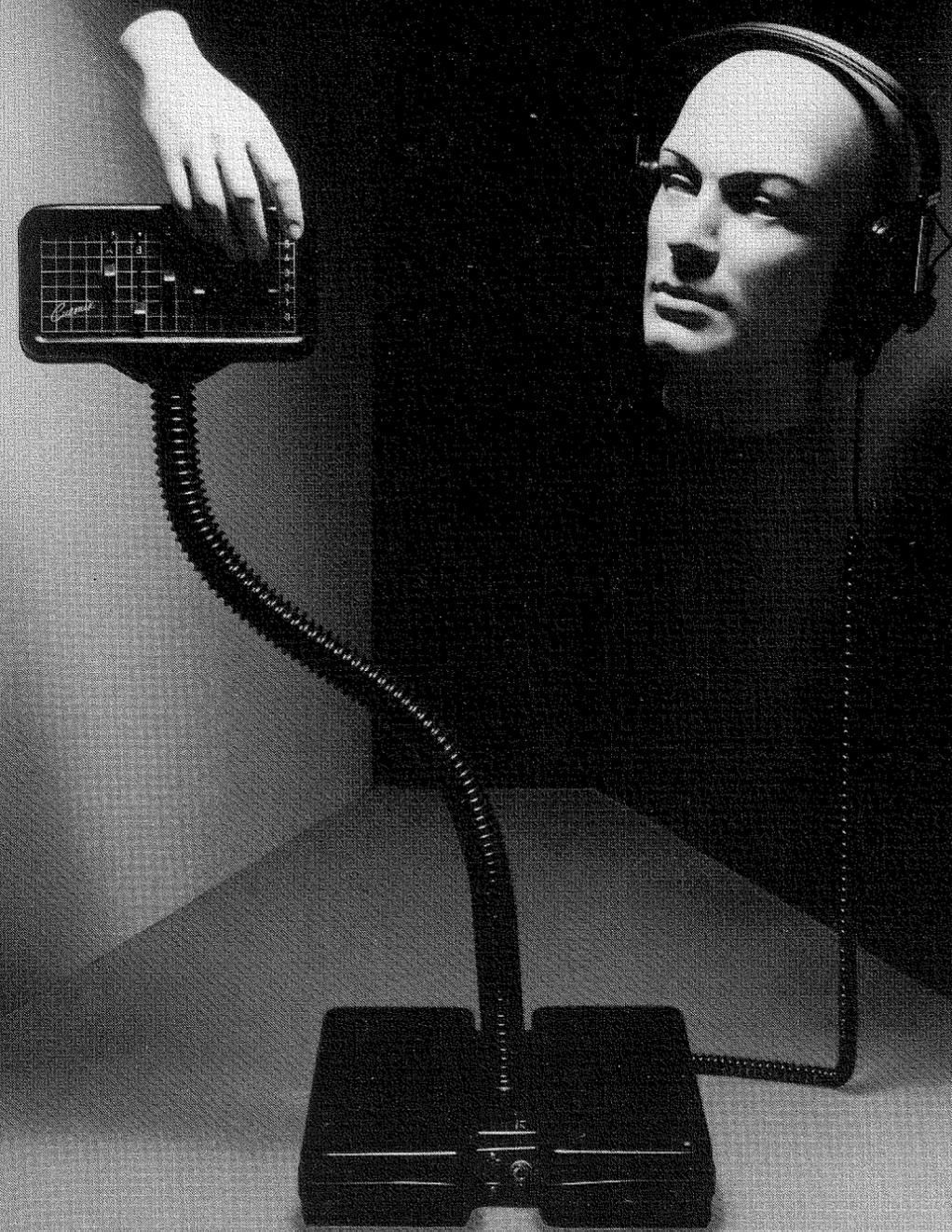


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For the name of your nearest U.S. dealer call 800 421 1274, in California call 213 973 8090. Exclusive U.K. dealer Court Acoustics, 35/39 Britannia Row, London N1 8QH, England, Tel: 01-359 0956

# No strings attached.

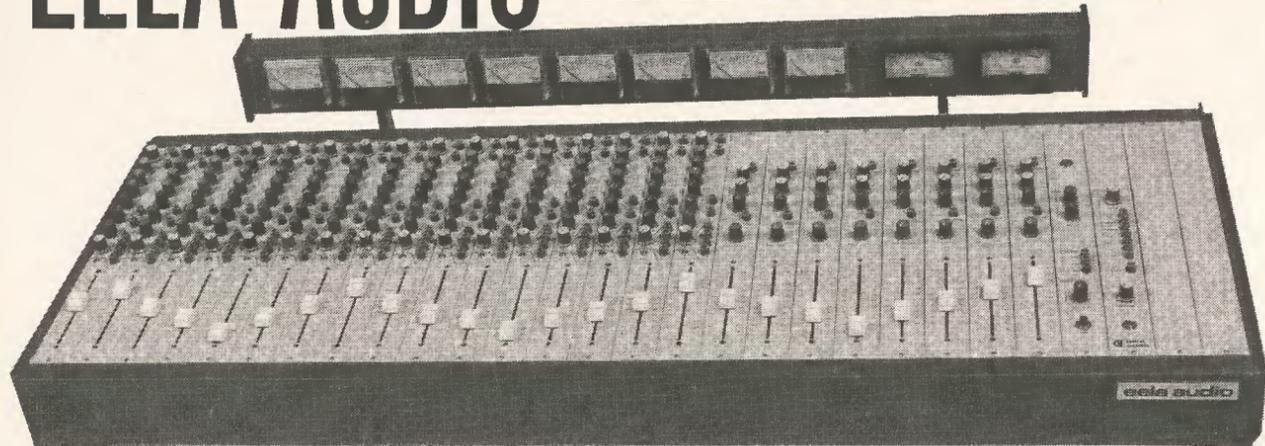


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EELA AUDIO S200—16 INTO 8

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The S100—A compact system based on a 4 unit module. Available with stereo, 4-track or 8-track output with as many microphone or stereo line input channels as required. (The performance of this mixer exceeds the IBA code of practice.)

The S200—A system with a performance to meet the most stringent requirements where technical excellence is of supreme importance. Mixers are available with from 1 to 8 outputs and multiple microphone or stereo line input channels.

These mixers are compact, light and sturdy—in keeping with the latest developments in electronic technology. They can be equipped with a multitude of special facilities.

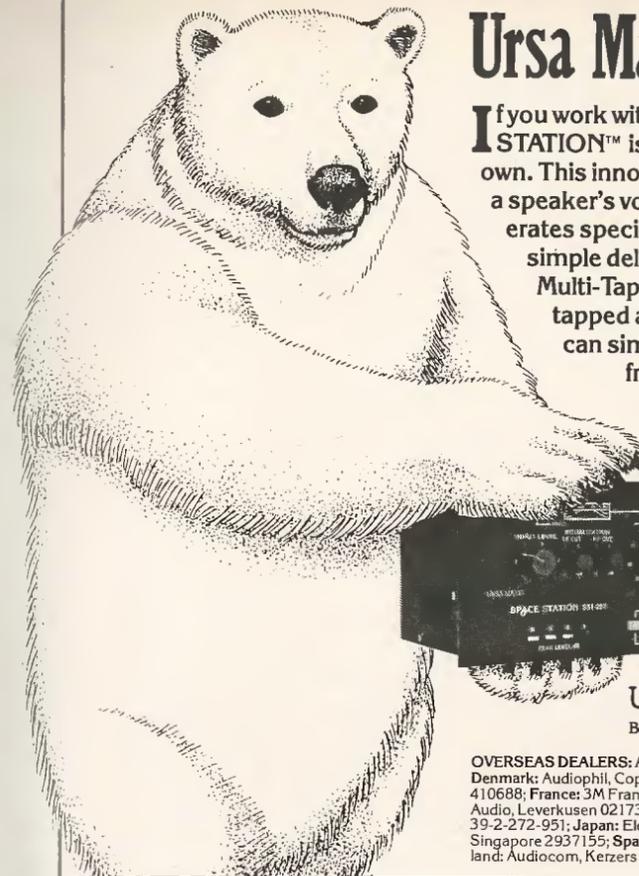
EELA AUDIO mixers are available as small as a 4 into 1—as large as a 28 into 24. Professionals choose EELA AUDIO mixers because they are the mixers with the growing reputation.

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Check out the SPACE STATION soon. For reverberation quality and variety, for special effects features, and for price, the SPACE STATION is the best sound improvement you can make.



Demonstration cassettes for broadcast and recording applications are available for \$2.00 each.

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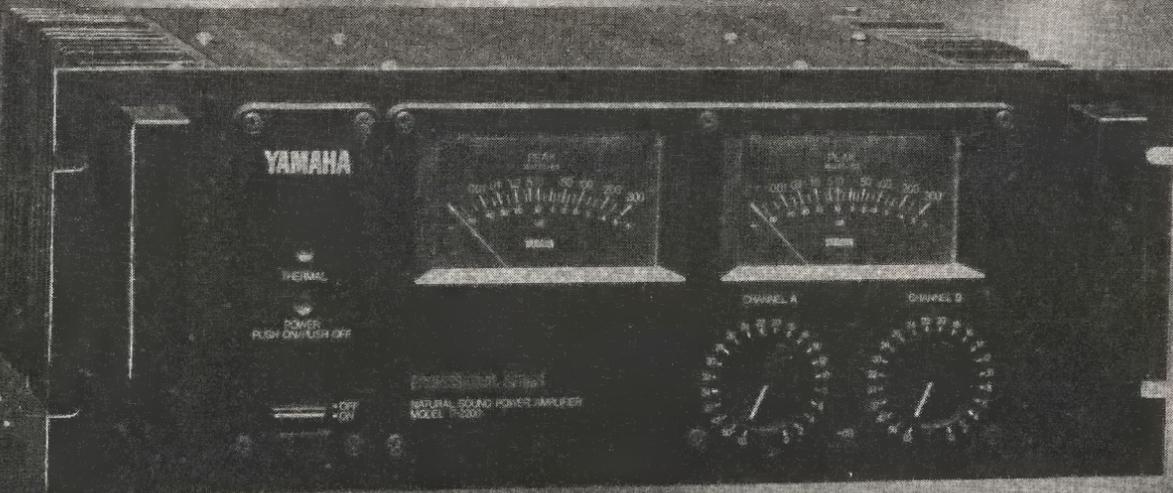
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**F.W.O. Bauch Limited**

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Telephone 01-953 0091 Telex 27502

## Acoustilog Impulser

A new device from Acoustilog, known as the *Impulser*, has been introduced which allows users to see as well as measure the polarity, phase alignment and impulse response of loudspeakers, microphones and electrical systems. The device emits a positive-going pulse with a frequency which is variable from 40Hz to 10kHz and with a repetition rate which may be varied between 0.3 and 10 pulses/s. This signal is fed to an amplifier and loudspeaker and the received impulses from the measuring mic are amplified and displayed on any triggered oscilloscope. Using the unit such acoustical effects as time delay, loudspeaker clipping, ringing, flutter echo, rear wall slap echo, and loudspeaker alignment can be displayed. Features of the *Impulser* include variable send level, variable receive level, a pause switch, phantom mic powering, and battery-powered operation. The *Impulser* costs \$225 and is available as a free-standing unit. Alternatively, the unit may be retrofitted to the Acoustilog Model 232 and Model 232A reverberation timers. Acoustilog Inc, 19 Mercer Street, New York, NY 10013, USA. Phone: (212) 925-1365.



## UREI electronic crossover

First shown at AES Los Angeles, UREI has introduced the Model 525 variable electronic crossover unit featuring four panel-selectable operating modes (either 2-way or 3-way stereo, or 4-way or 5-way mono). Crossover frequencies are continuously adjustable from 50Hz to 10kHz, with the actual frequency measured and displayed on a digital frequency counter which has a 1Hz resolution. For security purposes the mode select and crossover frequency controls are all via front panel

screwdriver slot adjustments, while as an additional precaution optional security covers are available. Other features of the Model 525 include a rear-panel mounted, switch-selectable subsonic filter to roll-off frequencies below 30Hz, and input/outputs via either Switchcraft QG XLRs or terminal strips. United Recording Electronics Industries, 8460 San Fernando Road, Sun Valley, Cal 91352, USA. Phone: (213) 767-1000. UK: FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ. Phone: 01-953 0091.

## Soracitel taken over

Augereau-Heuliez, the French company which specialises in the design and construction of mobile OB units, has taken over Soracitel, the French agents for Neve and French distributors of the Ampex ATR-700. Augereau-Heuliez are at 17 boulevard Beausejour, F-75016 Paris, France. Phone (1) 525.87.66. Joël Didier and sales director Michel Martin can be contacted at the company's factory, Route de Chartres, F-28160 Brou, France. Phone: (37) 47.07.91. Telex: 780170.

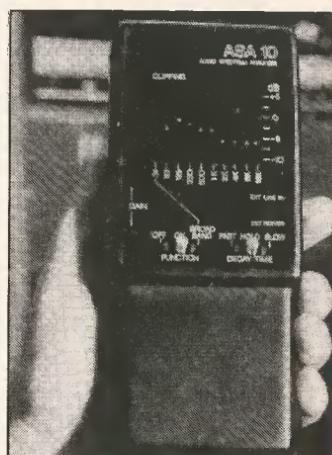
## APRS courses

The APRS informs us that there are still a limited number of places available on its technical courses to be held at Great Fosters in Surrey during November. Two courses are being run; the first, entitled *Digital Electronics for Studio Staff*, takes place from November 7 to 9, while the second, covering basic electronic engineering, runs from November 21 to 23. Anyone interested in attending either course should contact the APRS Secretary, Edward Masek, 23 Chestnut Avenue, Chorleywood, Herts WD3 4HA. Phone: 09237 72907.

## ASA-10 spectrum analyser

FIMC has supplied us with details of its ASA-10 handheld 10 octave audio spectrum analyser. This unit features a built-in mic; adjustable display of dynamic range of up to 35dB, selectable detector response for either pink or white noise, or signal monitoring; a hold mode for ease of use; and filters at ISO centre frequencies. Response is logarithmic and the ASA-10 may be either battery- or mains-powered (110V or 220V). An optional PN-2 pink noise generator is also available to extend the system.

FIMC, 403 W Yarmouth Road, West Yarmouth, Mass 02673, USA. Phone: (617) 398-0176.



## Neptune new products

Neptune Electronics has introduced a number of new products which although primarily aimed at the sound reinforcement field also have studio applications. First off is the 2711 1/3-octave graphic equaliser offering ±12dB of boost or cut at the standard ISO centre frequencies. This is a 19in rack-mount unit and features a bypass switch, input gain control, and balanced and unbalanced inputs and outputs. The second new unit is the 2709A realtime analyser. Again a 19in rack unit, the analyser features an in-built pink noise generator with self checking response, a sensitivity control with switchable range, balanced input and line in/out, and an LED matrix display consisting of 27 1/3-octave bands with nine amplitude steps. Third is the repackaged 19in rack mount 1021 dual channel graphic equaliser offering ±12dB of boost or cut on 10 bands at ISO centre frequencies. Fourth new product is the 821 stereo mixer featuring built-in reverb with master level and pan; separate input preamp input/output jacks for signal processing; master output controls (L/R with LED VU indicators) and

master monitor control.

Input channel features include mic/line switching; transformer balanced mic and line inputs; monitor, reverb and aux sends (aux with pre or post eq/fader switching); 3-band eq; and pan. The master section features balanced and unbalanced line outputs; aux send master with hi or low level returns; a return control with panning; and facilities for interconnection to another 821. Finally, Neptune has introduced the 1420 14/2 console which incorporates many of the features found on the 821. Features include transformer balanced mic and line inputs; monitor, effects and aux sends; 3-band eq; gain control with peak LED indicator; solo switch and pan control; rear panel channel patching; headphone monitoring system; balanced and unbalanced line outputs; L/R and monitor controls with LED VU metering; and pan on both effects and aux returns.

Neptune Electronics Inc, 934 N E 25th Avenue, Portland, Oregon 97232, USA. Phone: (503) 232-4445. UK: Court Acoustics Ltd, 35 Britannia Row, London N1 8QH. Phone: 01-359 0956.

## Inovonics recording electronics

Inovonics has introduced a fourth generation of magnetic recording electronics designed to replace existing electronics in tape machines. Two new models have been introduced—the Model 370, designed mainly for studio use, and the earlier Model 375.

The Model 370 features low-noise circuitry and is compatible with most studio transports and a wide range of original and replacement tape heads: cost is \$580. The Model 380 may be used alongside tape

transports to create custom machines or alternatively may be used to upgrade the electronics of older machines including Sepmag film recorders. Features include special circuitry to reduce the effects of tape compression and phase distortion; improved signal and bias headroom for full compatibility with high-coercivity tapes; standard eq and bias settings; an 'optimised mode'; and sync, auto-mute, and remote control of all functions. Price of the Model 380 is \$820. Inovonics Inc, 503-B Vandell Way, Campbell, Cal 95008, USA. Phone: (408) 374-8300. 36 ▶

# New realms of expression from MXR.

The Pitch Transposer is MXR's newest addition to our professional line. It is one of our most innovative products, and possibly the most revolutionary signal processor in the music industry today. It is a unique, high-quality unit which provides a cost effective and flexible package for today's creative artists.

The Pitch Transposer extends your musical boundaries by creating live instrumental and vocal harmonies. It has 4 presets which allow the artist to predetermine the intervals to be processed. Transposed intervals can be preset anywhere from an octave below to an octave above the original pitch. The chosen interval is activated by means of touch controls or a rugged footswitch. LED indicators display which of the four presets has been selected.

A mix control is provided, enabling the unit to be used in one input of a mixing console, or with musical instrument amplifiers. A regeneration control provides for the recirculation of processed signals, creating more and more notes, depending upon the selected interval. This results in multitudes of voices or instrumental chords. An entire new range of sound effects and musical textures, unattainable with any other type of signal processor, is suddenly at your fingertips.

With many other pitch transposition devices a splicing noise, or glitch, is present. The MXR Pitch Transposer

renders these often offensive noises into a subtle vibrato which blends with the music, and is, in some cases, virtually inaudible. The result is a processed signal which is musical and usable.

We have been able to maintain a high level of sonic integrity in this most versatile signal processor. The frequency response of the processed signal is beyond 10 kHz, with a dynamic range exceeding 80 dB.

A micro computer based display option allows the user to read the created harmonic interval in terms of a pitch ratio, or as a musical interval (in half steps). This unique feature allows the pitch to be expressed in a language meaningful to both musicians and engineers.

We designed our Pitch Transposer as a practical musical tool for those actively involved in creative audio. It reflects our commitment to provide the highest quality signal processors with the features and performance that will satisfy the creative demands of today's musical artist. See your MXR dealer.

Atlantex Music, Ltd., 34 Bancroft Hitchin, Herts. SG51LA, Eng.; Phone 0462 31513, Tx 826967



**Quiet-Chamber**

An unusual product available from Lab-Aids Ltd of Warwick is the *Quiet-Chamber*, a transportable mini sound-insulated booth. Constructed from six separate panels which are easily bolted together, the booth can be erected or taken down by two persons in under 20 minutes. The booth is fully fitted with ready-to-use lighting, power points and two-speed ventilation fan, while the sound-damped interior is complete with desk and carpeting. The booth has internal measurements of 45x45x75in and is capable of up to 40dB sound attenuation.

Lab-Aids Ltd, New Lodge, Ashorne, Warwick CV33 9QN, UK. Phone: 092-685 209.

**CTEAP Exhibition, Paris**

The third CTEAP exhibition of the Association pour les Techniques Electro-Acoustiques Professionnelles is to take place at the Hotel Sofitel Paris, 12 rue Louis Armand, F-75015 Paris, from Saturday November 29 to Tuesday December 2, 1980. As with the previous exhibitions, an associated lecture programme will be mounted. Exhibitors include Agfa-Gevaert, AEG-Telefunken, AP France, Ampex, Audiovision Equipement, Augereau Neve, Brandt, Canetti, Cabasse, Cineco, Comel, Enertec, ELNO, Freevox, Girardin, Lazare, LEM, LTM, 3M, Nagra, Publison, Pyral, Ramses, RED Studio Centre, Reditec, Regie Scene, SAJE, SCV Audio, Schaeffer, Sonetec, Son Professionnel, Spectrick, Studer, Studio Equipement, Technicobel, and Tekelec Airtronic. Further details are available from ATEAP, 17 boulevard de Beausejour, F-75016 Paris. Phone: (1) 525.51.51.

**Track Tech mixers**

A new addition to the ranks of companies manufacturing mixers is Track Technology of Kingston-on-Thames, Surrey. The company has introduced a range of three low cost mixers—the *MBM 2020/16*, the *MBM 1616/18* and the *MBM 1212/4*. These are all of the in-line input/output configuration and are 20-, 16 and 12-channel mixers with respectively 16-, 8- and 4-groups. The input/output channels feature odd/even buss pan capability through respectively 4-, 8- and 16-channel output assign matrixes (with direct outputs on the remaining channels); mic and line gain controls; A/B line switching; ping switch; and mic phase reverse. Each channel has a 3-band quasi-parametric equaliser with eq in/out, eq monitor insertion switch and eq solo. The monitor



**Abacus 1/3-octave analyser**

Latest product from Abacus Electrics is the company's *ARTA 600* 1/3-octave realtime audio analyser adaptor designed to feed any dc-coupled oscilloscope or large screen display capable of X/Y mode operation. Three display modes are available—analyser, X/Y, and both. In the analyser mode the input is analysed and the energy level in 1/3-octave bands is displayed over a range of 25Hz to 20kHz. Displayed dynamic range is 20dB, input sensitivity controls allow line-level signals in the range -60dBm and +20dBm to be observed, and switchable fast or slow detector ballistics are available to cater for

programme or noise analysis. In the X/Y mode line signals X and Y are displayed for phase comparisons, while in the 'both' mode the selected input channel in analyser mode and the X/Y mode line inputs are simultaneously displayed. The unit includes a pink noise generator for frequency response measurements. Other controls include a bypass switch and calibration controls which, in conjunction with an electronically-generated graticule, allow calibration of an existing oscilloscope graticule. Price of the *ARTA 600* is £495.

Abacus Electrics, 10 Barley Mow Passage, London W4 4PH, UK. Phone: 01-994 6477.

**Chilton improvements**

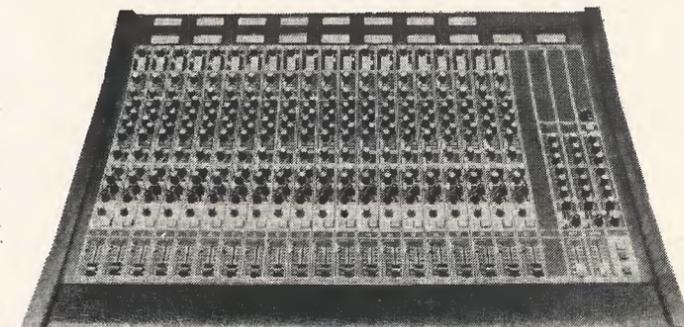
Magnetic Tapes Ltd has made a number of improvements to its range of studio mixers. The successful Chilton *QM2* series of small to medium sized mixers have been succeeded by the introduction of the Chilton *QM3* series, the new range offering improved performance. Prices start at £2,000 for a basic 12/4 mixer with 8-track monitoring. Features include an auto-mute system and 'in-place' stereo solo monitoring, optional on all *QM3* mixers but standard on 8-group output versions. Another option is the provision of new high resolution, high definition LED bargraph meters having a peak

reading characteristic with a range of -30dB to +10dB. These are fitted on each input channel to read either the channel output post-fader or the tape return. Yet another option is a stereo comp/limiter that may be fitted to all the main outputs. This option, termed the *C30*, costs £330 and its quoted specification includes distortion at 'limit' less than 0.03% with an input of +10dB at 1kHz; stereo matching better than 0.15dB; and noise better than -80dBm (unweighted) in any mode.

Magnetic Tapes Ltd, Chilton Works, Garden Road, Richmond, Surrey TW9 4NS, UK. Phone: 01-876 7957.

section has a pot under the control of the mixdown switch (allowing it to act as a monitor fader or alternatively as a channel output level control), plus solo and mute. The cue send section consists of two level pots and a pre/post switch. Each channel also has two echo sends with a common pre/post button. The stereo panning section

consists of an L/R panpot and the mixdown switch which controls mic and line routing. The final section consists of the mute/solo in place button and local switch, plus the channel fader. As an addition to the mixer's conventional VU meters there is also a peak reading LED metering system alongside the channel fader.



**Acoustic instrument hire**

Environmental Noise Studies Ltd has announced a new acoustic measurement instrument hire service based upon the successful Ivie equipment range. Any item of Ivie's acoustic measurement range may be hired either by the day, week, or on special contract terms. The service includes the portable *IE30/17A* audio analysis system, which is an extremely useful tool for the acoustician and recording and maintenance engineer.

Environmental Noise Studies Ltd, 38A High Street, Castle Donnington, Leics DE7 2PP, UK. Phone: 0332 810789

**EMO DI box**

The original EMO single channel DI box has been available for some time and has achieved a good reputation. The company has now introduced a dual-channel version giving the obvious but worthwhile advantages of two fully independent channels in one unit. In practice this allows, for example, signals to be taken from both high and low level instrument/amplification stages using the one unit.

The DI box features fully floating outputs capable of driving mixer input impedances above 200Ω, transformer isolation to 1500V, earth lift switches to minimise hum, and a frequency response of 20Hz to 20kHz ±1dB. Inputs are either instrument (100kΩ impedance, 1V max input, 20dB attenuation); amp/slave (8kΩ impedance, 30V max input, 40dB attenuation); or loudspeaker (100kΩ impedance, 100V max input, 60dB attenuation). EMO Systems Ltd, Durham Road, Ushaw Moor, Durham City DH7 7LF, UK. Phone: 0385 730787.

The mixer's master section is split into L and R master channels with each having two echo returns, an echo send, foldback source selection and a master fader. Finally the mixers have a communications channel with selection buttons and gain controls for slate, communicate and talkback, plus an instrument test oscillator, and studio/control room mute and level controls. All the mixers are supplied in a foam lined wooden transport case, however, stands are also available. Optionally, the mixers can be supplied with Penny & Giles 60mm conductive plastic faders. Prices of the mixers are £1,950 (12-channel), £2,485 (16-channel) and £3,029 (20-channel).

Worldwide distributors: Music World Merchandise Co, 159 Park Road, Kingsforn, Surrey KT2 6BX, UK. Phone: 01-549 9130. 38

**dbx**

'dbx professional noise reduction holds 73% of the US market'

Billboard September 29 1979

why?

- because it offers at least 30dB reduction in tape noise at a price that even the smaller studio can afford



**Scenic Sounds Equipment Ltd**  
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Telephone: 01-734 2812/3/4/5  
Telex: 27 939 SCENIC G

France **3M France SA, Mincom Div.** Boulevard de l'Oise, 95000 Cergy Tel: Paris 749 0275  
Holland **Peter Bollen Geluidstechniek** Hondsruglaan 83A 5628DB Eindhoven Tel: 040 42445  
Sweden **Tal & Ton Musik & Electronic AB** Kungsgatan 5, 411-19 Gothenburg Tel: Gothenburg 130 216  
Spain **Mike Llewelyn-Jones** AP Postal 8.178 Madrid Tel: Madrid 637 0752

**Active M/S matrix decoder**

Audio Engineering Associates has introduced an active solid state M/S matrix decoder, the *MS 38*, for use when making stereo recordings utilising the M/S system. (The M/S system matrixes a forward facing directional mic M with a laterally oriented bi-directional mic S). The *MS 38* is a single-knob device which is placed between the mic pre-amp and the input channel controls, and decodes the M/S signals either as full mono or any stereo position through to super-wide stereo. Inputs are balanced differential, while outputs are single ended. The unit also has the facility that if an original tape recorded the M and S channels separately, the *MS 38* may be used to decode it into conventional L and R stereo signals. Audio Engineering Associates, 1029 North Allen Avenue, Pasadena, Cal 91104, USA. Phone: (213) 798-9127.

**Tannoy UK servicing**

Tannoy has announced that all servicing and spare parts for its professional monitor loudspeakers will now be carried out by Elliott Brothers (Audio Systems) Ltd, 114-115 Tottenham Court Road, London W1. Phone: 01-388 1833. This arrangement will not affect servicing and spare parts offered by other Tannoy dealers, while servicing facilities for Tannoy in the north of England and Scotland will be available from the Tannoy factory at Rosehall Industrial Estate, Coatbridge, Strathclyde, Scotland. Phone: 0236 20191.

**B & B compressor/expander**

Due to an editorial oversight we omitted the B & B *CX1* compressor/expander from our July survey of noise reduction equipment. We apologise to Aphex Systems for the omission.

**B & B (USA)**

Aphex Systems Ltd, 7801 Melrose Avenue, Cal 90046, USA.  
Phone: (213) 655-1411. Telex: 910-321 5762.  
UK: Aphex Audio Systems UK Ltd, 35 Britannia Row, London N1 8QH.  
Phone: 01-359 5275. Telex: 268279.

**CX1**

Compressor/expander module which may be accommodated in the *R1 10* module rack. Compressor release time is variable from 50ms to 2.5s with threshold being variable from -40dBV to +20dBV. Expander depth control allows 0 to 50dB maximum gating, while expansion release time is variable from 50ms to 2.5s with threshold operating from -75dBV to -10dBV. Attack time for both functions is less than 1µs. The module features a bypass facility and a 10 segment bargraph meter displaying either of four functions: compression, or expansion gain reduction; compression plus expansion gain reduction; and output level. Prices: *CX1* \$495, *R1 10* module rack \$195, *PS1* rack power supply \$250.

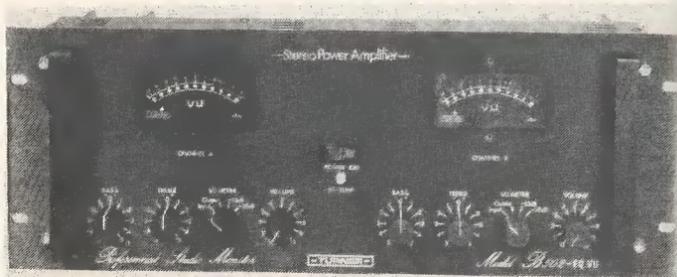
**Studio course**

Cherry Recording Studio, Croydon is offering a three-day introductory course on studio balance engineering. The course, which is being run by Tony Patrick who has engineered sessions for bands such as Bad Company and Uriah Heep, covers the basics of studio construction and acoustics, mic techniques, multitrack equipment and techniques, and includes hands-on 16-track mixdown experience. Full details are available from Cherry Recording Studio, 41 Leslie Park Road, Croydon, Surrey, UK. Phone: 01-654 1197.

**Switchcraft mini-connectors**

Switchcraft has introduced a new range of miniature audio connectors known as the *Tini QG* range. Available in four series with 3, 4 or 5-pins/contacts, the series comes in male/female plug and chassis/panel mount configurations. Features include cable clamp and flex relief, 'through connector' shielding, latch locking, 'scoop proof' pin protection, panel/chassis and pcb termination, polarised mating, and escutcheons in a choice of seven colours. To facilitate simple connection to Switchcraft's standard *QG* connector range, audio adaptors are also available.

Switchcraft Inc, 5555 N Elston Avenue, Chicago, Illinois 60630, USA. Phone: (312) 792-2700.  
UK: FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ. Phone: 01-935 0091.



Turner B502-EQ VU

**Turner power amps**

Turner has introduced two new ranges of power amplifiers, which collectively add up to a total of no less than 12 new models. All the amplifiers are stereo power amps and the ranges comprise a studio monitor series and a professional series. The first range consists of four models, the *A300*, *A300 VU*, *A500* and *A500 VU*. Power outputs are respectively 100W and 190W into 8Ω with the VU meter versions having true VU meters with range selectors; all these units feature dual power supplies. The professional series comprise the *B302* and *B502*

power amplifiers available in four formats: standard, fitted with front panel mounted XLR connectors, fitted with logic controlled LED type VU meters, or additionally fitted with equalisation controls. Power outputs are again 100W and 190W respectively. Quoted specifications of the amplifiers are similar for all models with frequency response ±0.1dB, 20Hz to 20kHz at 1W into 8Ω; THD typically 0.002%; rise time 3.5µs; and slew rate 10V/µs. Prices range from £325 to £725.

Turner Electronic Industries Ltd, 175 Uxbridge Road, London W7 3TH. Phone: 01-567 8472.

**Change of name**

● Greenpar Engineering Ltd, the Harlow based manufacturer of coaxial connectors and rf components, has changed its name to Greenpar Connectors Ltd.

**Address changes**

● Progressive Electronic Products Ltd has moved to 83 Leonard Street, London EC2A 4RB. Phone: 01-729 5411.

● Audio & Design (Recording) Ltd has moved into a new custom-built factory in North Street, Reading RG1 4DA, Berkshire, UK. Phone: 0734 53411. Telex: 848722.

● Millbank Electronics Group Ltd has moved into a new 14,000 sq ft factory adjacent to its present premises. Millbank's new address is Millbank Electronics Group Ltd, Uckfield, Sussex TN22 1AT. Phone: 0825 4811.

**Contracts**

● Raindirk is to supply 25 mixing consoles to the South African Broadcasting Corporation. The order is for twelve 12/4 consoles, five 24/4 studio consoles, and eight 12/4 OB consoles to be installed in mobile vehicles.

● Pye TVT is to supply the Zambian Broadcasting Service with two 10kW mf radio transmitters and ancillary equipment.

**Agencies**

● Allen and Heath Brenell has appointed the following overseas agents: Canada—White Electronics, 6300 Northam Drive, Malton,

Ontario L4V 1H7; Japan—Otari Electric Company Ltd, Industrial Products Division, Otari Building, 4-29-18 Minami Ogikubo, Suginamiku, Tokyo 167; and USA (West Coast)—ACI Filmways Inc, 7138 Santa Monica Boulevard, Hollywood, Cal 90046.

**People**

● 3M UK Limited have appointed David Dutton as an engineer with responsibility for the company's digital audio equipment.

● Peter Giddings has joined Clear-Com Intercom Systems as its international sales manager.

● Orange County Electronics has appointed Gareth Nelson as national sales manager. Mr Nelson is based at 2100 West 98th Street, Minneapolis. ● British Member of Parliament, Geoffrey Johnson Smith, has been appointed special consultant to the board of the Maldwyn Bowden International Group.

● Eunice Adams, formerly international sales manager for HM Electronics Inc, and Shelley Brown-Phelan, formerly with Shure and the Filmways Audio Services Group, have formed a marketing company to represent professional audio products. Named Sunwest Marketing, the company is based at 4401 Kraft Avenue, No 2, North Hollywood, Cal 91602, USA. Phone: (213) 506-0615.

● Mark Fehlig has joined the broadcast products division of the Harris Corporation as product marketing manager for its satellite and microwave products.



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# studio diary

## Forum Studio, Rome

At least one studio in Rome could be expected to hark back to the Imperial past of the city as Forum recording studios has. (In many ways a rather apt name as the Forum was where ideas were exchanged and recorded—by human pen recorders.) The complex is situated in one of the more elegant residential areas of Rome and is within easy striking distance of the main thoroughfares leading in and out of the city, making it easily accessible. The RAI-TV production studios are also fairly close by. At the time of my visit Forum had been open for only four months but had been working to full capacity which is encouraging as far as the studios are concerned. The complex is situated underneath a very large octagonally shaped church (the name of which even the studio staff were unsure about but all agreed that it was St Maria of something or other!) with easy access down a short flight of steps leading from the church grounds so load-ins are not a big problem. Layout of the basement area is a wide circular corridor with the studios leading off into the central area. At present Forum consists of two studios. The smaller Studio B which is used for small group work, overdubs, etc, is scheduled to be completely refurbished in the near future so we will concentrate on the new, much larger Studio A.

The studio itself—or Hall A as it is referred to and they are not joking—is very large and capable of holding 50 to 70 musicians, depending upon the disposition in the studio. Basement studios are not necessarily short of space and in the case of Forum this means a ceiling height of around 23ft. Finish is tastefully conservative with parquet floor, wooden panelling and acoustic tiles with the ceiling in angled sections. There are at least three permanent isolation booths used for drums, guitars and bass, vocals, etc, with appropriate acoustic treatments for the situation in hand. High mobile separation screens are also in evidence and a small studio within the studio can be created should conditions or the desire dictate. This happened during my visit where a group was doing overdubs and one musician was in the 'small studio' with a Leslie while a second was out in the open, as it were, in order to get a larger sound. Connections with the church are also in evidence with large organ pipe motifs on the walls in various places—which act as excellent poly-cylindrical diffusers.

For orchestral work various platforms are available to stagger the

height of the different instrument sections. The studio has a very wide range of in-house instruments and you can take your choice between console Hammond organ, Steinway and Petrof pianos, electric upright, harpsichord, celeste, glockenspiel, chimes, vibes and marimba, xylophone, full drum kit, tympani, congas and other assorted percussion, all of which adds up to quite a sizable selection. There is also a good range of guitar and bass amplifiers. This is not all, however! How many studios can you think of that offer a large church organ (complete with church acoustics) as part of their 'instruments at disposition' list? As far as Forum are concerned this is top of the list and when they told me about it I just had to go and take a look. Access to the organ is by a flight of steps up to ground level and a few yards round to a side door of the church where the console is located. Though I did not have time to try the organ I was able to get an idea of the church's marvellous acoustics by using the time honoured method of speech and handclapping/fingersnapping! A selection of mic lines are permanently wired into the church and permit a variety of ways of miking up the organ—close mics for the different chests, central stereo pair or distant mics for heavy reverberation effects. Microphones available for all this are from a selection of AKG, Neumann, Sennheiser and Schoeps. A Calrec Soundfield mic is also under consideration.

Coming down from the church it was the moment to check out the control room. This is the domain of Franco Patrignani who is also co-owner of Forum. His partner, engineer Sergio Marcotulli looks after Studio B, with Mrs. Patrignani looking after the administrative side of things. Franco and Sergio have been working together for a good number of years and it was this, coupled with a solid reputation, that decided them to take the plunge and run a studio of their own.

The control room decor is homegrown and has been professionally done with the accent on carpets and furnishing fabrics concealing the acoustic treatment. An unusual feature is the ceiling which slopes down to the control room window making the overall height of the room higher than is usual giving a spacious feel. In fact space is not at a premium with large cushioned chairs giving ample seating both in front of and behind the console and the overall air of the room is like a comfortable lounge which gives rise to a relaxed working



... pianos, drums, church organ ... Church Organ? (the pipes are located behind and above the altar)

atmosphere.

Work centres around a Harrison 3232 console and Studer A80/24 recorder plus A80/RC master recorder and 28 channels of Dolby. Automation is planned, with the decision likely to be between the Allison and the Harrison Autoset systems. There is also a 3M 4-track machine with extra stereo headblock and varispeed should the need arise. Monitoring is by Tannoy *Buckingham*s (complete with crossunder) powered by SAE amplifiers and equalised by UREI 537 graphics. The speakers are free standing on magnificent chromed stands and, rather than enter into a debate as to whether monitors should be part of the wall construction or not, I will just note that the sound was more than satisfactory. The toy department is quite comprehensive and consists of two racks mounted within easy reach to the right of the console. Contents thereof consist of UREI 545 parametrics and 537 graphics, 1176 and LA4 compressor/limiters, Orban 627 graphic parametrics, Lexicon *Prime Time*, Eventide *H949 Harmonizer* with keyboard and an *Instant Flanger*, ADR compressors and for the nostalgic, some Pultec equalisers. Reverberation and echo effects are courtesy of an Ursa Major *Space Station* and AKG *BX20*. The studio also has a natural echo chamber hidden away in the depths with an Altec speaker and *KM84* microphone. Cleaning up operations are also assisted by *Kepexes* and 12 EFT noise gates. During a session I studied the efficiency of the EFT gates which were unnoticeable in operation as far as opening and closing went and all in all were quite impressive.

Forum are also fully equipped for

film recording with the projection room being on the floor above the studios. The large screen in Hall A is at the far end of the room in direct line of vision from the control room. Equipment consists of Prevost 16mm and 35mm projectors as well as 6-plate editing table and 3-channel recorder for 35mm with full Dolby. Though the studio is intended to be used for all types of work it is no surprise that a large percentage has been for film owing to the space and up-to-date facilities—as well as the fact that the co-owners are very well known in this particular field.

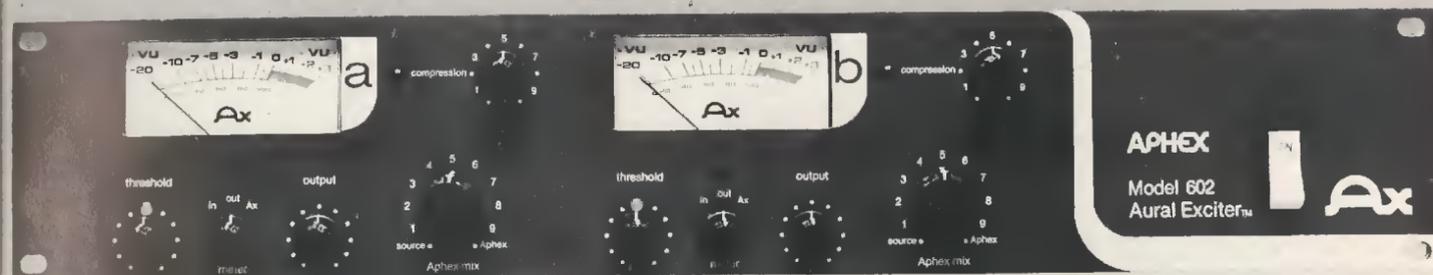
At the time of my visit the group Up were in session, a trio consisting of keyboards, guitar, bass guitar and electronic drums and were in the process of getting some interesting sounds down onto tape. Once again I was struck by the relaxed—on might almost say jovial—working atmosphere where the work progresses without hardly being noticed, even when the work in hand is very demanding, such as the 'sequencer' Minimoog part that had to be played. The particular sound for this part was quite fun as well with the straight signal panned centre with each channel of the *Prime Time* left and right respectively with differing delay times giving a positively enormous sound, especially as the part was based around alternating octaves for about three minutes, enough to give anybody a broken wrist!

It was times to catch my train so I took leave of Franco and his charming wife, thanking them for their warm welcome. Forum would appear to have got off to a good start and can look forward to a successful future.

Terry Nelson  
Forum Studio, Piazza Euclide 34,  
I-00197 Rome, Italy. Phone: (6)  
80.60.34/80.46.44. 42 ▶

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TLX: 06986766 (TOR)

**Aphex Denmark**  
(Copenhagen)  
Tel: (01) 59-1200

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Recording gear



Toys and instruments

### Elmulab Electronic Music Studio, Munich

Normally one would not expect to find a professional studio in the basement of a block of flats—or, more exactly, in one of the tiny rooms that form the cellars for the individual apartments. However, in the case of Elmulab I think we can stretch a point and it can also most certainly qualify for the title of Munich's smallest studio! The studio itself can in some ways be regarded as the extension of owner/composer/performer Klaus Netzle's hobby, whose early retirement from his other professional activities permitted him to install the studio on a serious basis. As readers will have implied from the title, the studio is axed towards the production and recording of electronic music, including productions by

Carlos Futura, Claude Larson and VC People on the Metronome, Sonoton and Jupiter Records labels respectively. Because of the specialised nature of the work, the control room/studio configuration becomes unnecessary, both the recording and performing being done in the same room and often enough as a one man operation.

The studio itself is crammed into a small room about 4 x 4m (and is also H-bomb proof, so I'm told!) with the main acoustic treatment being the sponge version of egg boxes (often seen in small broadcast studios) on the walls, acoustic tiles on the ceiling and industrial type moquette for the floor. As can be deduced, the acoustic has a very low reverb time though not low enough to be virtually anechoic. During the hour or so that my visit lasted I

didn't notice a feeling of being hemmed in. The recording equipment could almost be straight out of a display stand for Teac-Tascam, and consists of a *Model 15* console, 24/8 with 16-track monitor, linked to a *Tascam 90/16* 16-track recorder on 1in tape with dbx noise reduction on each channel, a *Teac 3340* 4-track recorder and two 2-track recorders; one for workhorse duties and the other a *Teac Master Recorder* for, well, mastering! Monitoring is by two JBL column PA type speakers which give quite good results though it is possible that this is now changed as at the time of my visit discussions were in progress to install a new monitor system based on BGW and Tannoy. As well as by the 'special effects' tape recorders available, echo and reverb are obtained with a *Swiss Echo 2000* (a limited production custom-built unit, made in Switzerland and, if I remember correctly, is based around an AKG unit with in-house electronics and construction) and a *Roland 301 Space Echo*. Outboard devices include an Audio & Design *Scamp* rack (surprise, surprise) with compressor, noise filter, sweep eq, autopan and adt modules, *Eventide Harmonizer* and a Schaller rotor-sound. So much for the recording side of things but what about the electronic music production capabilities?

Heart of the production instruments is the *Roland System 700* modular synthesiser. This is spread over the main console and four wing cabinets and offers enough modules and facilities to keep one happy for some time! The system features nine VCOs, four VCFs, five VCAs, three LFOs, Interface, phaseshifter, audio-delay, four dual ADSRs, envelope follower, noise generator, sample and hold, multimode filter and analogue switch. Quite a few toys to play with as well as providing some extra effects units that can be patched in should they be needed. The synthesiser is augmented by the

presence of a *Roland MC8 Microcomposer*. More than just a digital sequencer, the *MC8* brings computerisation into the synthesist's art and permits control and recall of a large variety of parameters. Also in the monophonic domain—or should I say duophonic to be strictly accurate—is the *ARP 2600* for those occasions when the complexity of a fully modular system is not required; or when you simply want the ARP sound. Moving up from two to four voices, the *Oberheim 4-voice synthesiser* is the next on the list. Again a completely different instrument in terms of conception from the *Roland* and the *ARP*, the *Oberheim* is also fitted with a programmer module. Polyphonic possibilities in realtime are courtesy of a *Polymoog* with *Polypedal*. Further expansion of ideas can be had with a *Korg vocoder* which, while not yet *Sennheiser*, *Syntovox* or *Bode*, can give interesting results as well as providing an extra keyboard and sound source. As space is rather limited and a drum kit would take up rather a lot of space, percussion tracks can be made with two *Synare* drum synthesisers, the advantage being that you can always book a drummer to play them if you are not great shakes with the sticks yourself and you want drummer's nuances.

As can be seen, Elmulab has a lot to offer for the electronic composer—or just for those who want electronic effects in their music. Having heard some of the records produced in the studio, the Tascam equipment certainly gives up to standard results so no worries there. All in all, Elmulab was an interesting little visit, a bit out of the ordinary, and strongly recommended to those seriously into electronic music. You can get patched in at Elmulab, *Possenbacherstrasse 3a, D-8000 Munich 71, West Germany*. Manager: Klaus Netzle. Phone: 089 7916577.

Terry Nelson

44 ▶

### New home for Anvil

Anvil, the Denham based film and recording group well known for its film score recording activities, is moving its headquarters to a specially adapted building some 300 yards from its present premises. The move has been necessitated by the expiry of Anvil's current lease on the building housing the former main music stage at Denham Studios, which we understand is to be demolished.

The move will be phased over the next three months and will involve the separation of the company's production and post production facilities from its music recording activities. The latter will now be centred at the EMI Studios in Abbey Road, where a new company Anvil Abbey Road Screen Sound Ltd, is being formed. In conjunction with EMI, Anvil is equipping the large Studio One with film and projection equipment in order that the company can continue recording major film music sessions, such as those completed at Denham for *Star Wars*, *Alien*, *The Empire Strikes Back*, and *Superman*.

EMI Abbey Road are also placing their other studios and facilities at Anvil's disposal. In addition, utilising Abbey Road's mobile facilities, film music recording will also be available in the Kingsway Hall and on location in the UK and abroad.

At Denham, the new production and post production facilities will comprise an air-conditioned dubbing theatre with vocal booth, fully equipped for 16mm and 35mm recording including Dolby stereo; an air-conditioned post-sync theatre with variable acoustics and vocal booth, fully equipped for 16 and 35mm recording plus high speed roll back (ADR), and including facilities for foreign version work, effects work and 4-track dubbing; a transfer bay able to cope with all formats; and 12 large cutting rooms.

Anvil Film and Recording Group Ltd, Denham Studios, North Orbital Road, Denham, Uxbridge, Middx UB9 5HH. Phone: 089583 3522.

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**Studio Madeleine, Brussels**

Brussels celebrated her 1,000th anniversary last year. It's an old city, but the word 'old' certainly doesn't count for the numerous up-to-date recording studios located in the city. Studio Madeleine is one of them, a small, but very busy 16-track recording studio, situated in the heart of the oldest part of the city.

Built in 1963, Studio Madeleine was one of the first independent Belgian recording studios. At that time, most record companies in Belgium had their own studio and rarely recorded elsewhere so it was quite a risk to put money into the project. However, the studio was a success and the investment paid off. Manager Roger Verbestel brought the studio to the top of the business and although 'only' 16-track, it is now one of the busiest in Belgium.

The studio measures approximately 450sq ft, enough to accommodate 15 musicians, there's a drum booth, and Yamaha grand and honky-tonk pianos. Microphones are the usual Neumann, AKG and Shure collection. The control room which is as big as the studio was designed by Roger Verbestel and built by Brussels carpenters Pallet. Recording is via an MCI JH16 16-track recorder, linked to a 16-track dbx noise reduction unit. The autolocator and remote controls are built into the mixer which is a home-built direct in/out. The master recorder is also MCI, a



Studio at Madeleine looking towards control room

2-track JH110-2. Monitoring is via 529 room equalisers, Altec crossover circuits, HH amplifiers and Altec speakers. There is also a separate monitoring circuit with amateur equipment and a mono cassette player to check the sound on that level of playback quality. Among the ancillary equipment, is an Aphex Aural Exciter, Lexicon Delta-T delay, Parasound de-essers, Kepex and Gain Brain, Audix equalisers and two reverb plates—EMT140 and EMT500.

The equipment might appear quite basic but the sound isn't. Recordings made at Madeleine have reached high

points in the national playlists. "The success of the studio lies in the acoustic design, the artistic knowledge of the experienced engineers and the competitive rates," says Roger Verbestel. "Many studios in Belgium may be technically bigger but Studio Madeleine is big in sound." When I heard Roger say this, I thought of the words of Miro Bevc about his 16-track Studio Akademi in Ljubljana (*Studio Sound*, June 1980)—"Small studio BIG sound". **Reinout Goddyn**

Studio Madeleine, 13 Rue de la Madeleine, B-1000 Brussels, Belgium. Phone: 02 511.67.28.

with four video monitors above it, displaying different areas of the studios.

Along the sides of the console are: a Scully 16-track tape recorder, JBL and Auratone monitors, dbx noise reduction, Kepex gates and Gain Brain compression units.

The closed-circuit system also allows security control of traffic from the reception area into the studio rooms. When the engineer sees someone standing outside the door, he activates a system of lights which signal when to enter: a red light indicates—do not enter, recording in progress; red and green lights together indicate—enter if you are involved with the session; a green light indicates—all clear.

Nise is proud of the growth and success of Phoenix 413. "We stayed 16-track when everyone else went to 24 to accommodate disco work. Now the disco fad has passed and 16-track is adequate for recording simple rock and roll. The biggest mistake that owners make is to run the equipment race and then find that they don't have the money to cover the expense.

"We grew with our business, adding equipment as we could afford it, and choosing pieces which would do the job for us. Today, we are totally solvent and we are ready to upgrade to 24-track and then, shortly after, to computer editing." Other plans include the construction of a video tape production facility for audio/visual projects.

Business is divided 50/50 between advertising agency work and recording work for labels and soundtracks. In 1979, the studio was awarded two Liberty Bell Awards for Excellence on work done for advertising agencies in the Philadelphia Metropolitan area. The awards are given annually by the Television Radio Ad Club of Philadelphia.

The studio has recorded gospel, folk, pop and rock and roll artists for a wide range of labels including Warner Brothers, Decca, Capitol and Philadelphia International. Sountrack work has included Bruce Lee's film *The Return of the Dragon* and the theme to the hit ABC situation comedy *Mork and Mindy*.

Phoenix 413 has been built with common sense and good business practice. Nise's philosophies are unique and his studio's success shows that his approach is well-received by clients. A growing and viable studio has earned an excellent reputation. Nise is confident that the quality of his product will rival that of the best houses in NY and LA. He says with pride, "When it goes out of here, it's a Nise Production."

**Claudia Kienzle**

**Phoenix 413, New Jersey**

Ancient legend tells of a bird called the Phoenix which after being consumed by fire, returned to life to achieve great things. This legend is symbolic of the desire of Mike Nise, head of Nise Productions Inc, to put Camden, NJ—now a deteriorated urban area—back on the map as a leading recording centre. Thus, he built a studio at 413 Cooper Street, Camden, NJ, and named it the Phoenix 413.

This is no ordinary studio. A townhouse near the city centre, 413 Cooper Street was once a suite of offices for a law firm. Structurally, its small rooms and low ceilings are not conducive to building a recording studio, that is, without extensive and costly remodelling. However, when Nise took it over in 1978, he decided not to break down the walls to create one large studio, instead, he left the walls and ceilings intact, using them as natural barriers to isolate and control the quality of the recorded sound. So, the studio at Phoenix 413 is made up of five rooms, acoustically-designed to deliver a certain quality of sound.

The first room, 17 x 10ft, is

covered from ceiling to floor with blue carpeting, and delivers a dead or dry sound used primarily for vocals, string guitar, or any situation where reverberation is not desirable. The second room, 16 x 17ft, is partially carpeted along the walls, and used primarily for recording keyboards and string sections as it delivers a bright, lively ambience. This room is equipped with a grand piano, ARP synthesiser, DC 6 clavinet, Hammond B3 organ, and Fender-Rhodes piano.

The third room, a drum booth 6 x 10ft, is almost fully carpeted leaving a small area of the ceiling just above the drums. Tiles have been mounted here at a 45° angle to deflect excessive noise into the carpeted walls where it is absorbed. Without this adjustment, the sound would hit the ceiling and bounce back to the drums.

The two remaining studios are isolated vocal booths. All five rooms are covered by standard mics including AKG 551Es, 414s, EV RE20s, EV RE16s, EV RE11s, Neumann U87s and KM84s.

The rooms have been designed by Nise himself for the convenience and comfort of his studio musicians, for

example, junction boxes, usually found along the base boards, have been placed at hand level and within easy reach. Carpeting and subdued lighting inspire a warm, relaxed working environment.

Unlike conventional studios, no glass window separates performer from producer and those who are recording the performance cannot view the musicians directly. Instead engineers and visitors, who sit on a couch at the back of the control room, watch the studios via a one-way closed-circuit television system. "The presence of observers peering into the window," explains Nise, "causes the musicians to become distracted. Musicians are sensitive people and they become uneasy when they see people commenting on their performance, but can't hear what is being said. The cameras allow them privacy." A talkback system is designed for two-way unobstructed conversation between engineer and musician.

The control room, 16 x 16ft resembles the control room of a broadcast studio. As there is no traditional studio window, the MCI 16-track console is against the wall

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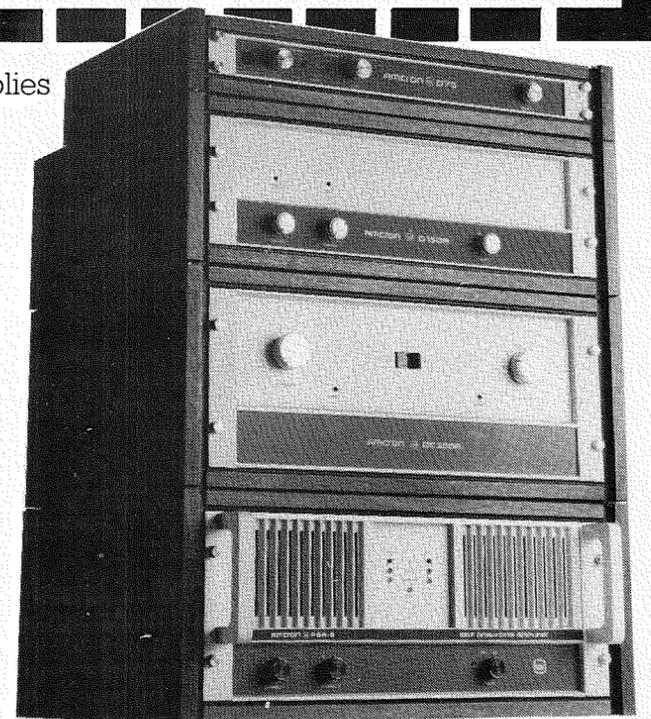
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# letters

## Reverb unit

Dear Sir, In the July issue Hugh Ford reviewed the Stockronics reverberation unit. Some points in that review merit a comment.

The frequency response, as Mr Ford assumes, can be suitably modified by equalisation, and trim potentiometers for the adjustment of bass and treble response are provided on the pcb. The plate tested by Mr Ford was adjusted to Scandinavian 'taste' to give a rather bright sound. Plates for continental Europe are normally set for more bass and less treble giving a 'fuller' sound.

An important point is the suspension of the plate. The steel plate is given an inherent structural pretensioning by a special metallurgical treatment which eliminates most of the need for external tensioning and also makes retensioning unnecessary. The use of springs for suspending the plate is dictated by the need to minimise the change in plate tensioning caused by temperature variations. The suspension is, so to speak, self-adjusting.

Although variations between units are theoretically possible, especially if we don't manage to control the structural tensioning of the steel, we have not yet observed differences of audible significance.

Mr Ford's test curve (fig 3, page 118) is probably measured with a B & K level recorder while we measured our reverberation plates with both Inovonics and Acoustilog analysers. Recently we have discovered a severe inaccuracy in this type of instrument which we believe is caused by an inability of the level detectors to cope with the excessive 'decay flutter' typical for reverberation plates. We have found that the error is an inversely proportional function to increasing frequency.

The decay time is selectable (within limits) by loading the plate with self-adhesive pads. The basic decay time of 5s may be decreased to 4 or 3s. Yours faithfully, Lars Liljeryd, Stockronics, dB Cassette, Katarinav. 20, S-116 45, Stockholm, Sweden.

## Tonmeister course

Dear Sir, It was very pleasant to read Adrian Hope's article about the Tonmeister course at the University of Surrey, especially as I was involved in setting up the course. While much of what he says is incontrovertible, some of the emphases and juxtapositions could mislead readers.

Firstly, when Battersea Polytechnic was being converted to the technological University of Surrey it was extremely doubtful that the music department would continue, and many of us were concerned. The Tonmeister course, based on the courses in Germany and Poland was conceived by staff in the physics and music departments as a way by which we could convince the University Grants Committee (who, ultimately, are responsible for funding) that a technological form of music education could exist. I was one of those who gave evidence to the UGC, based on interviews with both large and small recording and broadcast organisations. From the beginning, the physics department wished to create a balance between music and science as

much like the successful continental courses as possible, allowing for the three year degree course structure of British universities, and we did not wish to be too restrictive about entry qualifications. Unfortunately, this proved not to be acceptable, though the balance does seem to be changing towards science recently possibly as a result of representations from the industry.

The Physics with Musical Acoustics course was created by the physics department in 1977 (seven years after the Tonmeister course) in response to requests from such organisations as the BBC and EMI to train physicists with a special knowledge of acoustics and electro-acoustics. There has never been any suggestion of conflict between the two courses as they aim to train different people recruited from different backgrounds. It is erroneous of Mr Hope to imply that the two courses arose out of a dispute between two departments.

The plan to restrict access to the recording facilities by first year students was a regrettable necessity as we wanted to be able to allow final year students (in particular) as much hands-on practice as possible. There is still only one control room and somebody had to have priority. The change of emphasis which started to occur in 1977 was only possible because final year students were not allowed such licence as in earlier years.

Approaches to the recording industry were made by many people, principally by George Harlow and myself, starting about two years before the course began. We found considerable interest, but much scepticism and ignorance of the continental schemes, and judged it better not to ask for extensive sponsorship until the course had run for a while, so that the industry could see the product. By that time Mr Borwick had arrived and we were unable to follow up our earlier approaches.

Finally, I welcome David Pickett's arrival. The course is already beginning to pick up the earlier enthusiasm and I hope that it goes from strength to strength.

Yours faithfully, Dr J M Bowsher, Department of Physics, University of Surrey, Guildford, Surrey GU2 5XH.

## Studio monitoring

Dear Sir, May I make the following observations; prompted by Stephen Court's article in your September issue.

Whilst not denying that magnets can lose total flux, I know of several K12/20 units manufactured in 1947 with Ticonal magnets which appear to have the same gap flux after 30 very active years of service! All my investigations of loudspeaker mechanisms from cinemas and other entertainment facilities indicate the prime cause of performance deterioration to be fatigue of the rear suspension, closely followed by that due to the increased cone weight created by deposits of nicotine tar and dust!

My late father, when passing on to me some of the folklore of moving coil loudspeakers and their construction, used to recommend a form of 'running in' of the magnet and suspension. Enough mains frequency current was applied to the voice coil to achieve maximum excursion. This

was kept up until the temperature rise of the magnet assembly levelled off! To the best of my knowledge this practice is still carried out by at least one American manufacturer of high power drivers.

It is indeed wise to regularly check the performance of all loudspeakers; so many organisations religiously maintain system electronics, leaving the transducers to fend for themselves.

Finally, a personal hobby-horse admittedly, but does anyone take into account the variations in control room air temperature and humidity—both influence sound propagation.

Yours faithfully, Haydon G Warren, consultant in electro-acoustics, 27 Ailsworth Road, Luton LU3 2UG.

Stephen Court replies: Mr Warren rightly observes that many drivers using cobalt based magnets do retain their flux over many years—I think it is fair to point out that degeneration of flux is not necessarily a permanent feature of the design, but an effect through usage. The cinema speakers he refers to are rarely if ever subjected to extreme bass conditions. It is an occasional feature but nevertheless one worth keeping in mind, that speakers subjected to extreme cone excursions such as those encountered from bass guitars, organ keyboards, and studio monitoring require a lot of drive at low frequencies. The situation is aggravated by poor damping—usually thin speaker leads—again causing excessive cone motion.

This feature is measurable with a flux meter—the deterioration of the cone assembly is another factor. Naturally dust and other sediments will affect the mass of the cone and therefore its performance. Humidity is also a problem, or rather the lack of it. Dehydration over a period of time can cause minute cracks in the cone and surround as well as the spider.

Mr Warren's final point about control room humidity is mentioned in my article where I refer to the settlement of structural material, which in turn partially affected by room humidity and the method of seasoning used in the enclosure timber as well as the control room itself.

So far as propagation is concerned, the dimensions (being relatively small compared with a concert hall for example) and acoustic properties of control rooms have negligible effect on the actual air propagations—the variances in sound are largely due to the factors discussed previously. ■

## agony

A Swedish engineer was being shown round a run-of-the-mill country studio in the UK and was quite impressed with the amount of instruments in the studio.

"Is the band French?" he asked. He was told no, but there was a member called French and maybe this was confusing him.

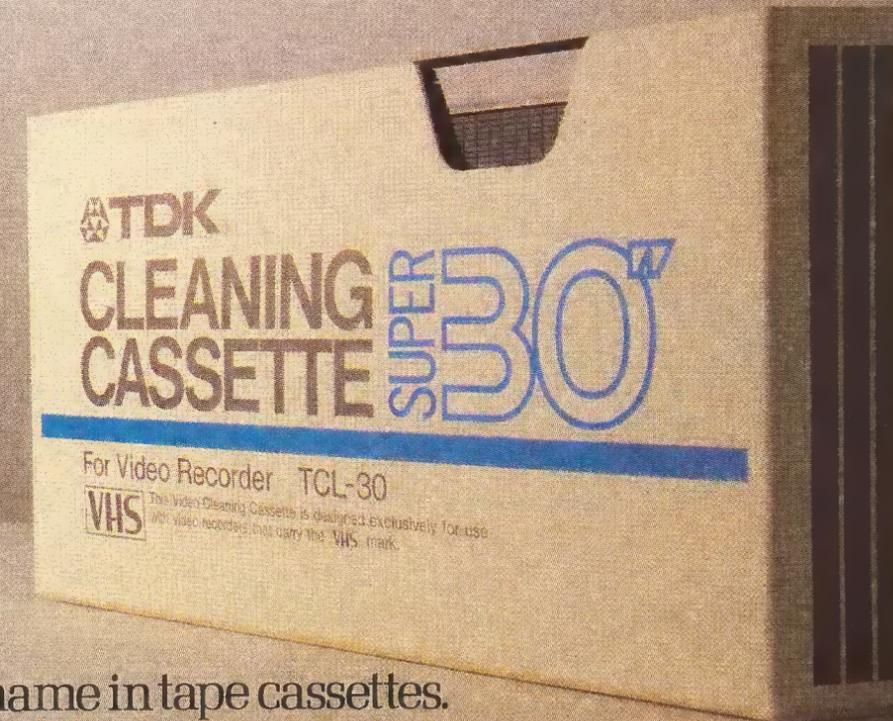
"No," he replied, "but they have their name on everything—Maurice Placquet."

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# Noise Measurement

Hugh Ford

SO FAR AS audio equipment is concerned, any measurement of electrical noise must attempt to correlate with the subjective effect of the noise where the specified performance of a piece of equipment is concerned. However, other noise measurements may be useful for the purpose of quality control where some defects may not be apparent from the former noise measurements.

Unfortunately the human ear is a very complex device which has different sensitivities to different frequencies. Furthermore, not only does this sensitivity variation alter with the loudness of the noise but also the balance changes with the age of the listener. Fig 1 shows the variation of the ear's sensitivity against frequency and sound pressure level for sinusoidal tones as

The measurement of electrical noise has always been a subject of some controversy with many different standards organisations all having their own ideas about weightings. Hugh Ford first explains the background to noise measurement and the various techniques involved, and on page 102 reviews the Dolby Cat 98A Noise Weighting Filter.

reported by Fletcher and Munson in 1933. Whilst these original curves have been redetermined by others subsequent to the original work with some modification, the general shape of the curves has remained unaltered and they are commonly referred to as the Fletcher Munson curves.

These equal loudness contours for pure tones show that at low sound pressure levels, where hopefully equipment noise will be found, the

ear has a peak sensitivity at mid-frequencies, rapidly reducing at low frequencies and falling off at high frequencies. These contours suggest that when measuring noise we must apply some modification to the frequency response of the noise meter in order to correct the sensitivity of the meter to correlate with the ear's sensitivity to different frequencies. Such corrections are commonly made with 'noise weighting networks'.

Partly as a result of great improvements in audio equipment performance over the years, a number of noise weightings have come into existence which include the IEC (International Electrotechnical Commission) A, B and C curves to IEC Publication 179 as shown in fig 2. The IEC 'A' weighting is identical to the NAB (National Association of Broadcasters) and other 'A' weightings and is commonly used throughout the world. Whilst the 'B' and 'C' weightings have been used for audio equipment measurements, they are little used as is the 'D' weighting shown in fig 3. This weighting was originally intended for measuring aircraft noise and is different from the DIN and the CCIR weightings shown in fig 4.

The former DIN (Deutsche Industrie Normenausschuss—German Industry Standard) 45 405 weighting curve is still widely used for the specification of hi-fi equipment in conjunction with a special quasi-peak meter also specified in DIN 45 405. Over recent years the CCIR (Committee Consultatif International de Radio) recommendation 468 weighting curve shown in fig 4 has become more popular because it appears to give a better correlation with the subjective effects of noise.

The CCIR recommendation 468 also specifies a quasi-peak meter similar to the meter specified in DIN 45 405 (it used to be identical but the performance has been tightened) whilst the IEC 'A' weighting and others were intended to be used in conjunction with a true rms (root mean square) meter.

Quasi-peak meters to the CCIR recommendation 468 are only manufactured by a handful of firms and are expensive, as are true rms meters

FIG. 2 IEC A, B AND C NOISE WEIGHTINGS (A IS IDENTICAL TO NAB)

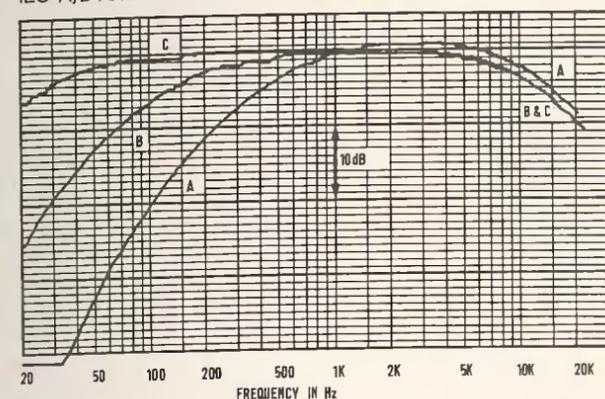


FIG. 3 IEC D NOISE WEIGHTING

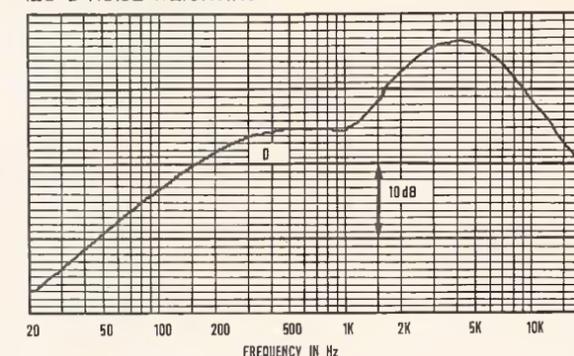
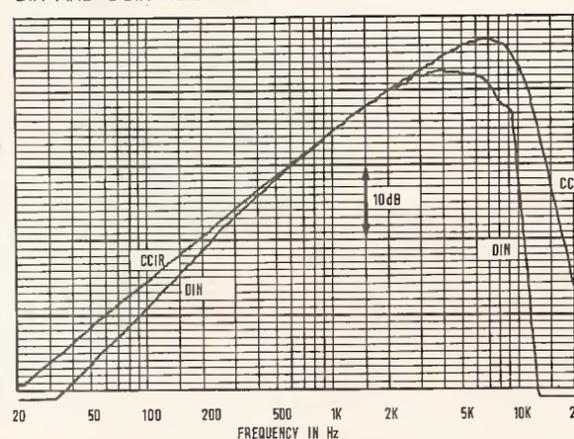


FIG. 4 DIN AND CCIR NOISE WEIGHTINGS



as opposed to average reading meters calibrated in terms of an rms sine wave. In view of this, Dolby Laboratories have proposed the use of the CCIR recommendation 468 weighting in conjunction with an average reading meter such as a VU meter to the ASA (American Standards Association) standard C16.5. Whilst many meters labelled 'VU' do not meet this standard, genuine instruments remain far cheaper than quasi-peak meters or true rms meters. Such measurements would be identified as CCIR/ARM but unlike other measurements where the unity gain point is at 1kHz, Dolby Laboratories propose that unity gain should be at 2kHz. The reason behind this is that the use of the CCIR weighting gives a poor-looking noise performance when unity gain is at 1kHz and using unity gain at 2kHz gives an apparent improvement of 5.6dB. Personally, I am strongly against this form of 'commercial cheating' which I feel has no scientific justification and just creates inconvenience.

Detailed examination of the 'A' weighting curve and the CCIR recommendation 468 curve together with the specified tolerances as shown in figs. 5 and 6 shows that the general tolerance of the 'A' weighting is larger than that of the CCIR weighting. With much modern audio equipment where the frequency range is very wide, there is significant high frequency noise above say 10kHz. It follows that when using the 'A' weighting with its very wide tolerance above 16kHz, different weighting networks can, and do, give significantly different noise measurements whilst remaining within the IEC specifications.

Turning now to the measurement of unweighted noise, the type of meter used is of course equally important. Normally either a true rms meter, which is preferable, or an average reading meter will be used and the type of meter must be specified for the measurement to be meaningful. In addition the band-

width over which noise is measured must be specified because with random 'white noise' the noise power is proportional to the bandwidth.

This introduces the concept of 'effective noise bandwidth'. Unless very sharp filters are used to define the measurement bandwidth, noise will leak into the measurement from outside the required spectrum, and the effective measurement bandwidth will be larger than that specified. An alternative arrangement is to use filters which are not sharp in cutoff and to accept an 'effective noise bandwidth'. Such an arrangement, which is not uncommon, is to define an effective noise bandwidth of 20kHz by using a 6dB per octave lowpass filter with a -3dB point at 15.7kHz as shown in fig 7. From this figure it can be seen that noise between 10kHz and the desired 20kHz is attenuated, but it is 'replaced' by noise from the spectrum above 20kHz appropriately attenuated.

## Practical measurements

Once it has been decided which weighting and measuring method to use, or what bandwidth to use—the most conventional bandwidth being

20Hz to 20kHz—the method of measurement depends upon the device being measured. In the case of power amplifiers it is common just to report a measure of the noise voltage at the output with the input shorted and any gain control set to maximum. However, in many amplifiers fitted with a gain control this is not the worst case and maximum noise frequency occurs around mid gain setting.

With any noise measurement it is advisable to check to see if power line hum is significant and the

simplest way to do this is to connect an oscilloscope to the output of the noise meter if this is available.

In the case of microphone amplifiers, the noise performance is normally specified as the equivalent noise at the input with the input terminated in an appropriate resistance corresponding to the intended microphone impedance. The method here is to measure the noise at the output and then to determine the equivalent input noise by subtracting the gain of the amplifier. For

FIG. 1 EQUAL-LOUDNESS CONTOURS FOR PURE TONES (H. Fletcher & W.A. Munson)

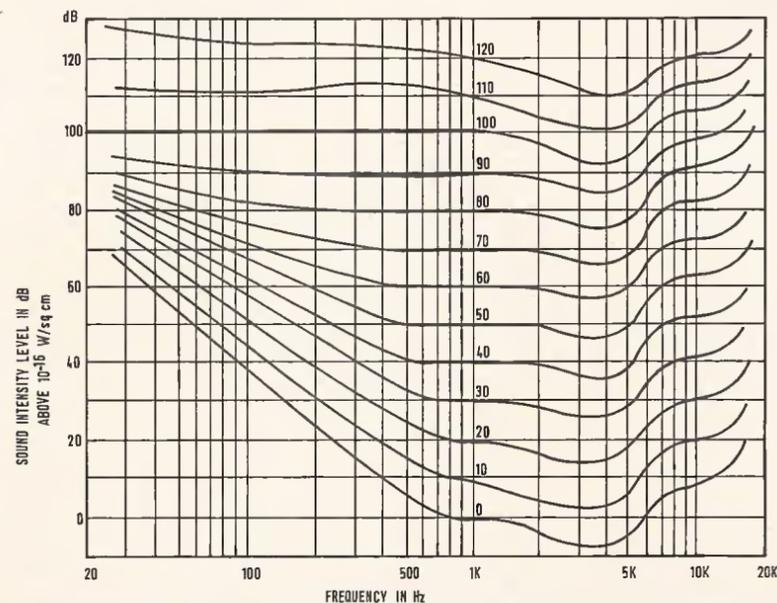
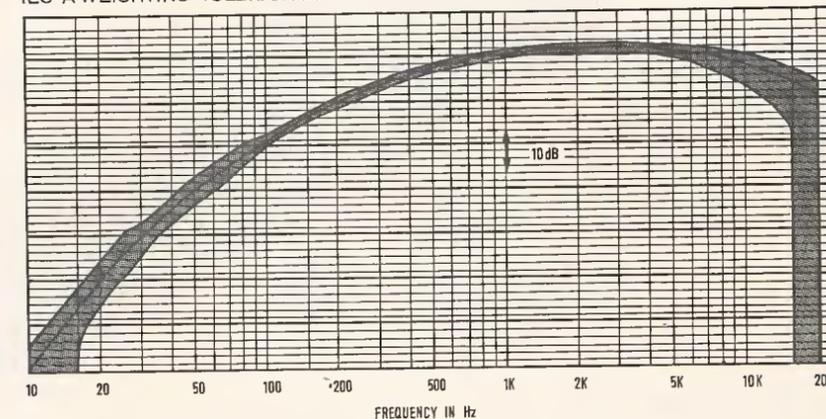
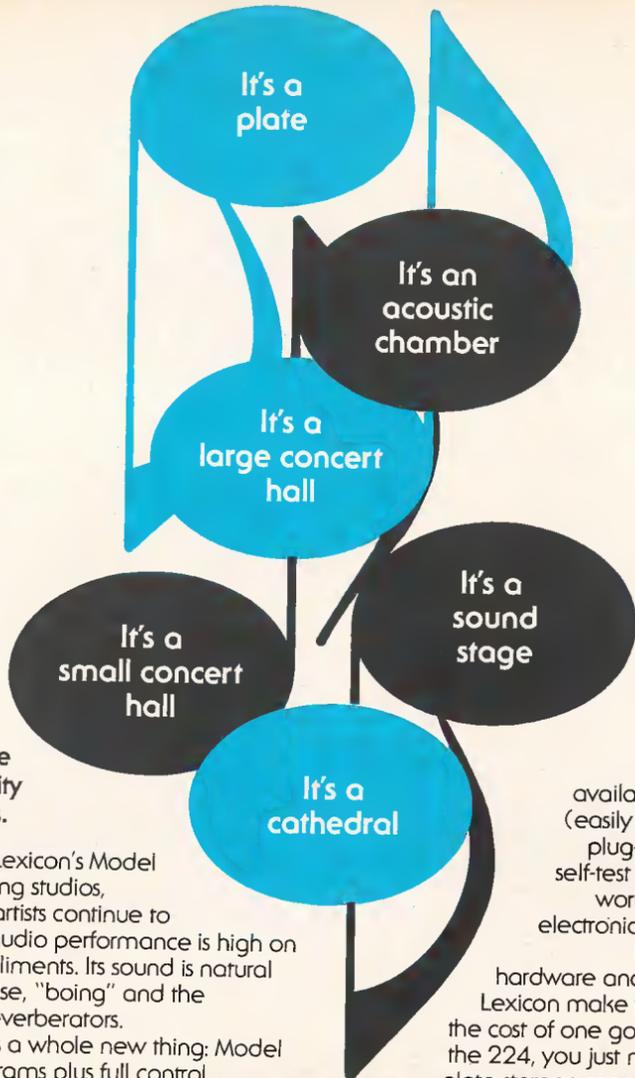


FIG. 5 IEC A WEIGHTING TOLERANCES





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## Noise Measurement

instance if the output noise was measured as  $-42\text{dBm}$  and the gain was  $80\text{dB}$ , the noise referred to the input would be  $-42\text{dBm} - (80\text{dB}) = -122\text{dBm}$ .

Bearing in mind that any resistance (if its temperature is above absolute zero,  $-273^\circ\text{C}$ ) generates noise, the measured performance may be compared with the theoretical minimum noise to arrive at the noise figure which is the difference between the two. The noise generated by resistors is known as 'Johnson noise' and this noise may be calculated from the formula:

$V^2 = 4kTR \times (\text{bandwidth in Hz})$   
where  $V$  is the noise voltage,  $T$  the absolute temperature,  $R$  the resistance in  $\Omega$  and  $k$  is Boltzmann's Constant which is  $1.38 \times 10^{-23}$ .

Assuming a bandwidth from  $20\text{Hz}$  to  $20\text{kHz}$ , noise from the common resistances varies little with temperature in practical terms as shown in Table 1.

If we have determined the noise referred to the input as  $-122\text{dBm}$  with the input terminated in  $600\Omega$  using the above bandwidth with an rms meter at  $20^\circ\text{C}$ , the noise factor becomes  $124.9\text{dBm} - 122.9\text{dBm} = 2.9\text{dB}$ .

An alternative way of determining the equivalent input noise of a microphone amplifier is to measure the output noise with the input appropriately terminated and then to feed the input from a noise

generator and to adjust its output until the amplifier's output has increased by  $3\text{dB}$ . The output voltage from the noise generator is then equal to the amplifier's equivalent input noise irrespective of the amplifier's gain.

When measuring the noise associated with tape or disc, it is necessary to refer the noise to a reference level. In the case of tape this will be one of the standard recorded fluxivities found on calibration tapes,  $320\text{nWb/m}$  being common to tape speeds of  $7\frac{1}{2}\text{in/s}$  or higher with

$250\text{nWb/m}$  dealing with lower tape speeds. Alternatively  $200\text{nWb/m}$  may be used at all speeds.

Converting from one fluxivity to another is simple as the difference in decibels may be found from the formula:

$$db = 20 \log_{10} \frac{\theta_1}{\theta_2}$$

where  $\theta_1$  and  $\theta_2$  are the two fluxivities.

When measuring the noise from tape (and in some other circumstances), unwanted background noise may be close to the noise being measured—for instance the recorder noise may be near tape noise. In circumstances where the noise difference is less than  $12\text{dB}$  it is necessary to correct the measured noise for the background noise. This may be done from the chart in fig 8. First find the difference between the measured noise and the background noise and find the corresponding figure on the horizontal axis of fig 8—the noise correction to be added to the measured performance will then be found on the vertical axis of fig 8. If the level difference is less than  $2\text{dB}$  the method is inadequately accurate and the noise measurement should be abandoned.

As an example, if the noise from a tape was measured as  $-68\text{dB}$  and

that of the replay unit without the tape as  $-73\text{dB}$  the difference is  $73 - 68 = 5\text{dB}$ . Referring to fig 8 this gives a correction of  $1.6\text{dB}$  so that the actual tape noise is  $-(68 + 1.6) = -69.6\text{dB}$  instead of the measured  $-68\text{dB}$ .

### Availability of testgear

Whilst there is an ample choice of rms meters with the facility of 'A' weighting, there are few suppliers of either instruments with the CCIR Recommendation 468 weighting or the quasi-peak meter included in the recommendation.

For those readers who wish to construct their own weighting networks the circuits for both the CCIR and the 'A' weighting are included in fig 9. Components of 1% tolerance should be used and the CCIR network requires inductors having a Q of at least 200 at  $10\text{kHz}$ .

So far as meters to the CCIR recommendation are concerned the current instruments known to me are Bruel & Kjaer 2439, Sennheiser UPM-550 and Wayne Kerr Radford ANM3 and ANM4. I believe that other instruments are manufactured and Studio Sound will be pleased if other manufacturers will make themselves known.

FIG. 6  
CCIR WEIGHTING  
TOLERANCES

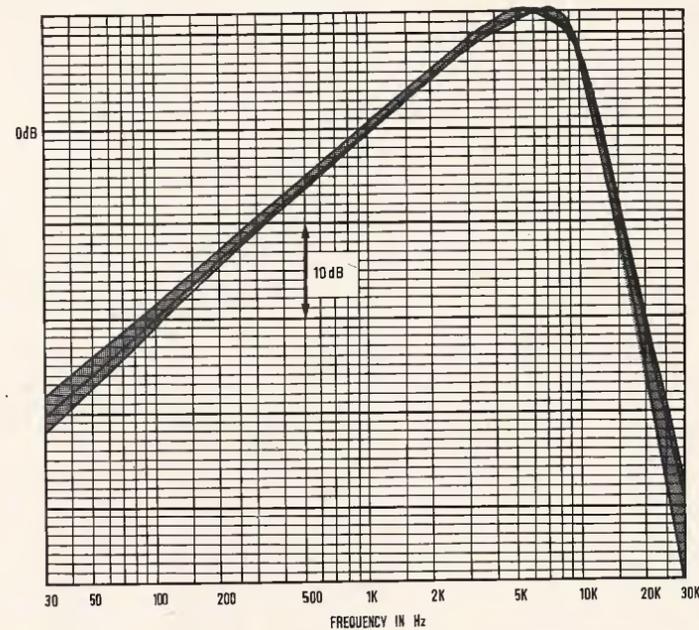


TABLE 1  
Resistance

Resistance	Noise voltage		
	15°C	20°C	25°C
200 $\Omega$	$-129.77\text{dBm}$	$-129.696\text{dBm}$	$-129.623\text{dBm}$
600 $\Omega$	$-125.00\text{dBm}$	$-124.925\text{dBm}$	$-124.851\text{dBm}$

FIG. 7  
'EFFECTIVE NOISE BANDWIDTH' MEASUREMENT WITH  $6\text{dB/OCTAVE}$  LOW PASS FILTER

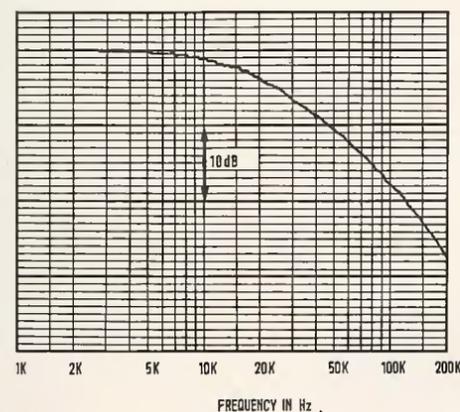


FIG. 8  
NOISE CORRECTION CHART, SEE TEXT

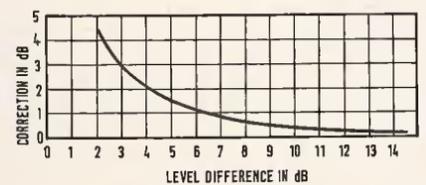
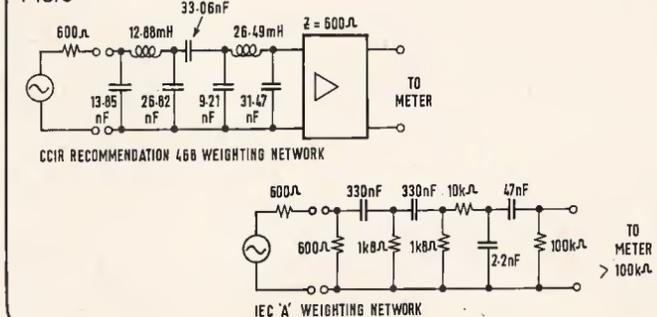


FIG. 9



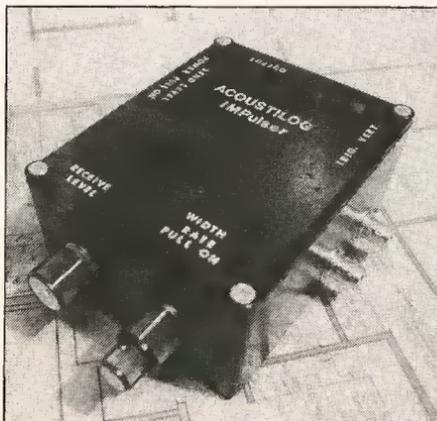
# AES 67th Convention, New York—a preview

The 67th Convention of the Audio Engineering Society will be held from Friday, October 31 to Monday, November 3 at the Waldorf-Astoria, New York. Products will be shown by over 180 exhibitors covering all aspects of the audio industry.

● **AB Systems Design:** Model 1200A power amplifier, Model 2400 electronic frequency divider, Model 912 pre-amp/mixer, and Model 730 tri-amp system. ● **Acoustic Design by Jeff Cooper:** display of professional recording studio, control room, and film studio designs including details of recent design projects. ● **Acoustilog:** Model 232A reverberation timer and the new Impulser impulse excitation option which allows checking of loudspeaker polarity, phase and alignment in multi-speaker systems. Also the company's time delay spectrometry equipment used in conjunction with its acoustic consultation service. ● **Agfa-Gevaert:** range of tapes including PEM-568 and PEM-368 mastering tapes; PEM-526 bin tape; PE-611, PE-811 and PE-1211 bulk cassette tapes; and PE-36 duplicating tape. Two new professional tapes types PER-528 and PEM-428 will also be shown. ● **AKG:** new C-567 condenser lavalier mic; the C-414E condenser mic; D-300 series of vocalists mics; full range of mics and accessories; reverb units; and the TDU 7000 modular time delay unit. ● **Allen and Heath Brenell:** Syncon Series B modular in-line console expandable up to 44/24; 16:4:2 console, first in a new range of budget mixers; the MBI Series 24A modular broadcast console; plus the company's established range including the Syncon Series A and SR Series consoles, and the AHB 8-track package system. ● **Alpha Audio:** Sonex acoustical foam. ● **Amber:** Model 3500 miniature distortion analyser with built-in oscillator, automatic operation, battery powering, and performance to 0.002% residual. Also the Model 4400A multi-purpose audio test set. ● **Ampex:** ATR-116 and

ATR-124 16-track and 24-track recorders. Also the MM-1200, ATR-100 and ATR-700 tape recorders; the ECCO MQS-100 synchroniser; the ATR-102 and ADD-1 disc mastering system; and Ampex tapes and cassettes. ● **Ampro/Scully:** broadcast equipment plus the Scully LS76 disc cutting lathe; Auto/Master automated disc master console; 284B 8-track recorder with varispeed; and 280B Series 2 and 4-track recorders. ● **AMS (Advanced Music Systems):** stereo version of the DMX15-80 programmable DDL; DM-DDS digital disc mastering delay line; and the DM2-20 phaser/flanger also new pitch changing option for the DMX15-80 and DMX15-80S. ● **Analogic:** no information received. ● **Anvil Cases:** range of equipment cases including the Amp Rack series. ● **Aphex Systems:** Model 712 Aural Exciter plus the established Model 602; Model 602B broadcast version; Model 1537A VCA; OAS-24 grouping and automation system; CX-1 compressor/expander; and EQF-2 parametric equaliser. ● **APSI (Audio Processing Systems):** range of units including the Model 559, 561 and 562

Acoustilog Impulser



Audio Kinetics QLOCK 310 synchroniser

equalisers. ● **Ashford Audio:** no information received. ● **Ashly:** SC-44 keyboard input processor; 2-, 3- and 4-way electronic crossovers; SC-66A 4-band parametric equaliser and the SC-63 (mono) 3 band parametric; plus updated versions of the SC-50 (mono) and SC-55 (stereo) peak limiter/compressors. ● **Audico:** range of cassette rewriter/exerciser/timer units for duplication operations including the Model 200-9 tape timer. Also Hockey-Puck splicers for 1/2in audio or 3/4in video tape and the MF-6 50Hz pulsing system. ● **Audicon:** The Plate reverb systems; Alpha One and Alpha Two monitors; multipair audio cable; and studio accessory items. Additionally, Barth signal processing equipment; EELA Audio mixers; Raindirk mixing consoles; Woelke test equipment and tape heads; and the Court Acoustics GE60 30-band graphic equaliser. ● **Audio Arts:** Model 4100 parametric equaliser; Model 2100A parametric electronic crossover. ● **Audio & Design (Recording):** comprehensive

54 ▶

It's a reliable recorder with foresighted features. A new constant-tension transport has a full symmetric tape path, the most advanced electronic servo and a large diameter capstan without pinch roller. The latest electronics includes single-card-per-channel modules, full-fledged remote

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## AES preview



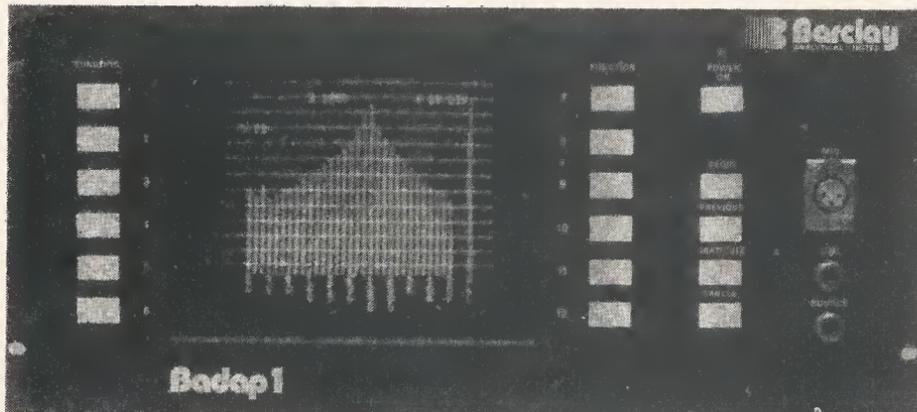
BGW Model 1250 power amp

ranges of signal processing equipment. Items include the *Scamp* mini-rack; a 19in rack mount *Scamp* power supply unit; the *Scamp S25* de-esser module; the *Gemini Easy Rider* rack-mount comp/limiter; and the first in a new range of rack-mount effects units, the *Panger* developed from the *Scamp S23* pan effects module. ● **Audio Developments:** *AD055* compressor/limiter; *AD070* prographic equaliser; *AD007* portable mixer; *AD045 Pico*, *AD049 Mixette*, and *AD031 Micro* mixer; plus a small mixer for ENG use and a new PPM. ● **Audio Kinetics:** new *QLOCK 310* synchroniser; the *QLOCK 210* synchroniser; and the *XT-24 Intelocator*. ● **Audio by Zimet:** professional and semi-professional recording studio packages. ● **Audio Technica:** the *AT803R* tie-clip electret condenser phantom powered mic; the *ATM11R* and *ATM91R* phantom powered mics; and the *AT8501* remote 9V battery supply unit. ● **Audiotronics:** details of the company's sales, rental and service operations, and a selection of professional recording equipment. ● **Audiotronics:** *Model 532* automated modular console with up to 32 input channels and eight master effects modules. Also the *Model 110A* expandable, modular recording/remixing/on-air console designed to accommodate up to 16-track mixing.

● **BASF:** range of professional tapes, cassettes and magnetic film including calibration and test tapes. ● **Beyer:** range of dynamic and condenser mics plus headphones. ● **BGW:** range of amplifiers including the recently introduced *320*, *620*, and *1250* power amps. ● **B & K Instruments:** comprehensive range of audio measurement instruments. ● **Bose:** *Model 802* loudspeaker plus the *802-E* active equaliser and other units. ● **BTX:** *Model 4600* SMPTE tape controller—an audio controller and editing system for two, three or four audio or video recorders.

● **CA Audio Systems:** improved *P Series* of the Cadac 'In-Line' series of consoles with full function flexibility and optional dc subgrouping, automation, and centralised routing. ● **Calzone:** range of flight cases for amplifier rack units,

Barclay Badap 1 audio measurement system



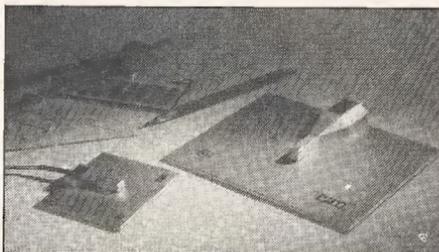
mixers, effects units, etc. ● **Cerwin-Vega:** range of monitor loudspeakers and amplifiers. ● **Cetec Gauss:** tape duplication system for a master and up to 20 slaves, plus Gauss loudspeaker drive units. ● **Cetec-Vega:** new *Model 80* and *81* hand-held radio mics, plus the company's established range of communication equipment. ● **Clear-Com:** new *RS202* intercom system plus the *System II* remote stations and *KB-124* duplex remote station. ● **Community Light & Sound:** range of high-level sound reinforcement equipment including the *PBL-90* cabinet. Also the *Z10D* range of radial horns. ● **Con Brio:** *ADS 100* and *ADS 200* digital music synthesisers. ● **Consillium:** *SPA 11* narrow band spectrum analyser and *GNA 11M* network analyser; plus the *RTA 11* and *RTA 12P* realtime analysers, and *PNG 11* pseudo noise generator unit. ● **Convergence:** no information received. ● **Crest:** range of power amplifiers. ● **Cross Music:** *CT-1800* automatic cassette labelling machine. ● **Crown International:** range of amplifiers including the *PSA-2* and *SA-2* self-analysing power amplifier. Also *PZM* range of pressure zone mics, plus the *Badap 1* programmable audio measurement system from Barclay Analytical.

● **David Lint Associates:** *ITI P-12* colour label printer and *L-1* cassette labeller; *QC-8/Q* quality control playback unit; and laminated sendust recording heads suitable for use with metal tapes.

● **D & D Engineering:** no information received. ● **dbx:** *900 Series* modular signal processing system, plus variety of noise reduction units and comp/limiters including the *Model 164*, a stereo version of the *Model 163*. ● **DeltaLab:** *Memory Module* delay extender; *DL-1* digital delay module; *DL-2 Acousticcomputer*; *DL-3* digital delay line; and *DL-4 Time Line*, a multi-function special effects delay line. ● **Design Electronics:** *Cuemix* studio foldback system. ● **Dolby Laboratories:** range of professional Dolby A noise reduction units, plus details of the Dolby FM system and the *HX* cassette headroom extension system.

● **East Coast Sound:** no information received. ● **Eastern Acoustic Works:** *MS-50*, *MS-200*, and *MS-300* monitor loudspeakers. ● **Electro-Voice:**

Crown PZM mics



Clear-Com RS-202S remote intercom

full range of professional mic and loudspeaker systems, plus mixers and amplifiers from sister company Tapco. New products include the Tapco *C-12* mixer and the *XEQ-1* electronic crossover/equaliser from Electro-Voice. ● **Electro Harmonics:** no information received. ● **Emilar:** range of loudspeaker drive units and dividing networks. ● **Empirical Audio:** details of the company's consultancy service. ● **Eumig:** no information received. ● **Eventide:** *Model H949 Harmonizer*; range of plug-in realtime spectrum analysers for use with home computers; the *BD955* broadcast delay line; and the *RD770 Monstermat* mono/stereo broadcast matrix unit. Additionally, the *Instant Flanger* and *Omnipressor*; the *BPC-101* plug-in card which converts the *Instant Flanger* to an *Instant Phaser*; and the *J1193* and *CD254* DDLs.

● **Fairlight:** *CMI* computer controlled synthesiser. ● **Furman Sound:** *RV-1* spring reverb system; *TX-2* tunable crossover/bandpass filter; and *PQ-6* stereo parametric eq/pre-amp.

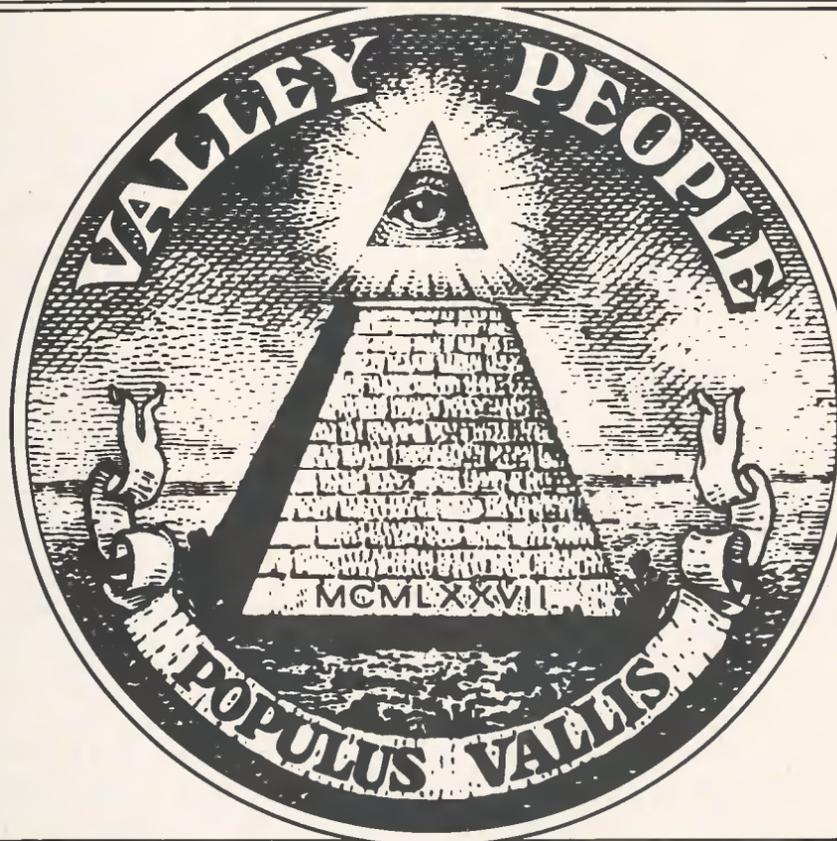
● **Gotham Audio:** *Telefunken M15A* 32-track recorder; *TTM 24*-channel noise reduction frame and power supply unit; *EMT* reverb units, console components and test equipment; Neumann condenser mics; and other units from these manufacturers. ● **Grandy:** *Promix 1* adjustable multitrack head assembly with independent control of azimuth, zenith, tape height and wrap. Also replacement tape heads and a range of single crystal ferrite record heads for high speed duplicating.

● **Harrison:** *Model 864 Autoset* micro-computer based control system; *4832C* and *3624 Series* automated consoles; and *DCI* (Distributed Control Intelligence) *MR-1* digital/analogue hybrid console. Also *PPI* post-production console; an *Alive* console; and the new *Autoset II* automation programmer. ● **Heino Ilsemann:** *Type KZM3* automatic cassette loader and the *Type ETK-1* and *ETK-1S* cassette labelling machines. ● **Hewlett-Packard:** range of audio test instruments. ● **HH Electronics:** *TPA Series D* and *S500D* professional power amplifiers and the company's *MOSFET* power amps. Also electronic echo units and portable stereo sound

56 ▶

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## AES preview

control mixers. ●HM Electronics: wide range of radio mics and receivers including road-cases and accessories. ●Hutco: no information received.

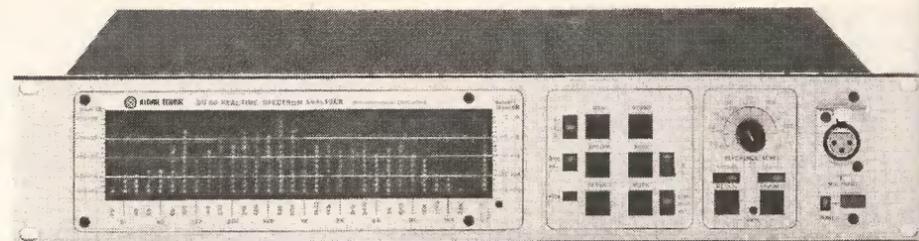
●ITAM: Model 1610 1in compact 16-track recorder with modular electronics and full function remote control; Model 806 ½in 8-track recorder; and the 10-4 and Model 882 mixers. ●Infonics: 200 Series of tape duplicators including a high speed metal tape cassette duplicator. ●Inovonics: range of audio processing, recording and instrumentation equipment including the Model 500 audio analyser; Model 201 average/peak limiter; Model 231 octave-band compressor; and the Map-II broadcast audio processor. Also the 'Gordon Headroom Meter' a UK/EBU-responding level meter. ●Institute of Audio Research: president Al Grundy and executive director Phil Stein will be available to give details of the Institute's training programmes. ●Interface Electronics: range of mixers designed for recording, sound systems, theatres, stage monitoring and other applications. Available configurations range from 8/2 to 48/16 and features include wide range parametric equalisers. ●International Audio: Alpha high speed in-cassette copiers. ●Ivie Electronics: IE-17A microprocessor controlled acoustics analyser and IE-30A spectrum analyser.

●JBL: complete range of studio monitor loudspeakers and the 7510 automatic mic mixer. ●JVC: Series 90 digital recording system.

●Keith Monks: new LS-19 monitor with in-built power amp; EDC radio mics; semi-professional record cleaning machine; and a comprehensive range of ancillary studio equipment. ●Kimball International: Bösendorfer grand pianos and new Kimball professional grand pianos. ●King Instruments: self-feed cassette loaders and various video tape loaders. ●Klark-Teknik: new DN60 ½-octave realtime spectrum analyser; plus the DN27 and DN22 graphic equalisers; DN70 DDL and DN71 controller; and the DN34 and DN36 analogue time processors. Also the Statik Acoustic range including the SA30 electronic crossover; SA20 dual reverb system; SA10 dynamic delay/flanger; and SA100 dynamic delay/flanger. ●Klipsch: range of monitor loudspeakers.

●Lexicon: new Model 1200 audio time compressor; PCM41 DDL; and 122 series of stereo delays. Also the Model 224 digital reverb system; Model 92 and Model 91 digital delay units; and the Model 93 Prime Time digital delay/processor/mixer. ●Lockwood: range of studio monitor loudspeakers.

●3M: 32-track digital mastering system; plus 4-track digital recorder; digital delay disc cutting preview unit; and digital editor including the new crossfade facility. Also the M79 24-track recorder; Wollensak cassette duplicators; and Scotch audio tapes including Scotch 265 digital mastering tape. ●Marconi Instruments: range of test equipment. ●Marshall: new Model 5402 time modulator; Mini-Modulator digitally programmed analogue delay unit; 5002A time modulator; 5050 stereo effects expander; HP400 expander; P250 pre-reverb delay unit; and P500 half-time variable delay unit. ●Martin Audio Video: a 14Hz film sync generator, and ranges of toroidal power transformers, metal rack cases and other components and hardware. ●MCI: JH600 console; JH500D console; JH50 automation; JH45 synchroniser; JH24 tape recorder; and the JH110 Series recorders in various configurations. Also the Autolock III and RTZ III locating devices. ●Meyer Sound Lab: range of studio



Klark-Teknik DN60 realtime spectrum analyser

monitor loudspeakers including the Swiss-produced ACD/Meyer reference monitor system. Also the new UM-1 UltraMonitor. ●MicMix: XL-305 reverb unit and the 265 Dynaflanger. Also the XL-500 and XL-210 reverb units. ●Midas: PR System consoles in a variety of input/output configurations for sound reinforcement, on-stage monitoring, recording and production applications. Also the TR System modular theatre consoles available in 24, 30 and 36 into 8-8 formats. ●Modular Sound Systems: no information received. ●MTI: no information received. ●Music Power: no information received. ●Music Technology: Crumar General Development System, a Z80 based computer controlled digital synthesiser. ●MXR: range of ancillary equipment including 31-band and dual 15-band graphic equalisers; the flanger/doubler; the digital delay; and the pitch transposer.

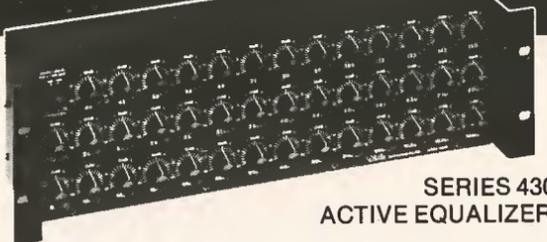
●Nady Systems: range of 'Nady Cordless' and 'Nasty Cordless' radio transmission systems. Also the recently introduced Nady VHF600 and VHF700 transmitter/receiver systems. ●Nagra: range of portable tape recorders in a number of configurations. ●NEAL-Ferroglyph: modular



Lexicon Model 1200

SP7 ¼in tape recorder, available in a number of customised configurations. Also the Logic 7 and Studio 8 recorders; the RTS/2 and ATU/1 test instruments; and the NEAL range of cassette recorders. ●Neve: Model 8108 56/48 console with micro-processor controlled assignment facility. Features include channel to track routing memory; 4-band parametric eq; high and low pass parametric filters; quad mixdown; 4-mono and one stereo aux send; in-line monitor facilities; programmable muting of inputs; and optional manual, VCA or Necam fader system. ●Noise Ltd: custom-built portable console cabinets designed to accommodate various manufacturers modules. 58 ▶

## DOUBLE PRECISION EQUALIZATION ONE-SIXTH-OCTAVE



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## AES preview

● **Omnisound:** no information received.  
 ● **Orange County:** *VS-1 Stressor* and the *PEQ* parametric equaliser. Also the *Stereo Processor*, a self-contained signal processing system including peak limiter/compressor/expander/noise gate.

● **Orban:** *Model 672A* quasi-parametric equaliser; *526A* single-channel de-esser; and an improved version of the *111B* dual spring reverberation unit. Also the *245E* stereo synthesiser; *418A* stereo comp/limiter; and *622B* parametric equaliser. ● **Otari:** *MTR-90* 2in, 16/24-track multitrack recorder; *MX5050* and *MX7800* tape recorders; and the *DP4050* cassette duplication system.

● **Panasonic:** no information received.  
 ● **Peavey:** *EQ-27* graphic equaliser; *SP-2* loudspeaker system which utilises a 15in *Black Widow* 1f driver; *CS-800* power amplifier; and full range of loudspeakers, amplifiers and ancillary equipment. ● **Pentagon:** range of cassette copiers including the *Pro-Series* and *1100 Series*. Also cassette-to-cassette copiers including the new *C-10*. ● **Pioneer:** *X-80* 2-channel 16-bit PCM recorder; a 16-bit audio laser disc system; and ribbon sendust tape heads. ● **Pro-Tech Audio:** *DA1521* audio distribution amplifier.  
 ● **Publison:** range of audio processing equipment.

● **QSC Audio Products:** no information received. ● **Quad-Eight:** *MS-4024CX Coronado* 40/40 console which includes the *Compumix III* automation system and has equalised automated echo returns, automated programmable muting and group solo features, and discrete amplifiers in the main signal path. Also the *CL-22* comp/limiter which has a feed-forward VCA design, and the *EQ-333* equaliser. ● **Quantum Audio:** mid priced *Gamma A* modular 8-buss automated console, with separate stereo mixdown busses and 4-buss special effects. The main frame is available in 20/28/32-input configurations with or without patchbay. Also the *QM-128* console.

● **Raindirk:** recently introduced *Britannia* range of in-line consoles, plus the *Status 500* MOSFET power amp and *Status 20* modular stereo control unit. ● **Rank Strand Electric:** modular *Theatre Series* and *Concert Series* consoles in various configurations for live and recording applications. Also examples from the company's range of theatre loudspeakers.

● **Renkus-Heinz:** range of loudspeaker drivers, horns and passive crossover networks. ● **Roland:** *RSS Series* of rack-mount signal processing units plus the *RE Series* of units. ● **RTS Systems:** range of intercom systems; a small battery-operated mixer; a phono pre-amplifier; audio distribution amplifiers; and dual-buffered amplifiers. Also the *TW-1* telephone interface equipment.  
 ● **RWO/Fostex:** wide range of studio monitor loudspeakers and drive units.

● **SATT Elektronik:** *SAM82* 8/2 portable mixer; the *SS Series*; and the *SAM42* 4/2 mixer.

● **SAE:** *P-150* and *P-300* power amps; *EQ-4* parametric eq; *AC-3* active crossover; plus various other parametric equalisers. ● **Saki Magnetics:** range of hot pressed glass bonded ferrite heads including new heads for in-cassette duplicators and high speed metal tape duplicators. ● **Sansui:** wide range of audio units including power amplifiers. ● **Sescom:** expanded range of audio modules and transformers; and a new range of electronic products including a 3-band parametric equaliser, 10-band graphic equaliser, and 4-channel mic-mixer; plus several new 3-way splitter boxes. ● **Shure:** *SM81* cardioid

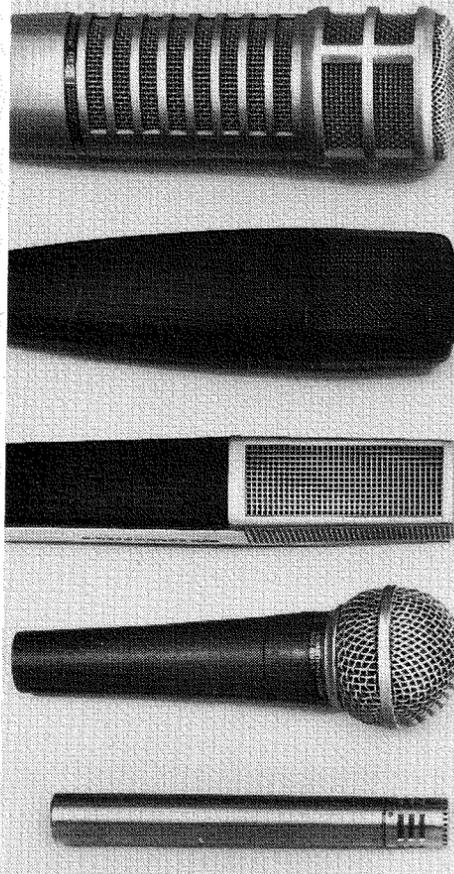
condenser mic; *SC39 Series* phono cartridges; and *Pro Master* sound system; plus the company's range of dynamic mics. ● **Sierra Audio:** details of the Sierra/Hidley facilities which have been designed and constructed over the past year and information on the company's consultation services and monitor systems. ● **Solid State**



Raindirk Britannia In-line console

Logic: *SL-4000 E Series* automated console and *SSL* studio computer system, including several hardware and software extensions, and a *Total Recall* option using a satellite computer to store and recall each control setting of the console's I/O modules. ● **Sontec:** *Compudisc* digital control system for Neumann and Scully lathes; plus the *DTC-400* dynamic range controllers; and a range of equalisers. ● **Sound Incorporation:** no information received. ● **Sony:** wide range of digital audio units including the *PCM-1600* 2-channel, 16-bit digital audio processor for recording PCM audio onto Sony *BVU-200A U-Matic* video cassette recorders. Also the *DEC-1000* digital editing controller; *DXR-2000* digital reverb; *DSX-87* digital sampling rate

60 ▶



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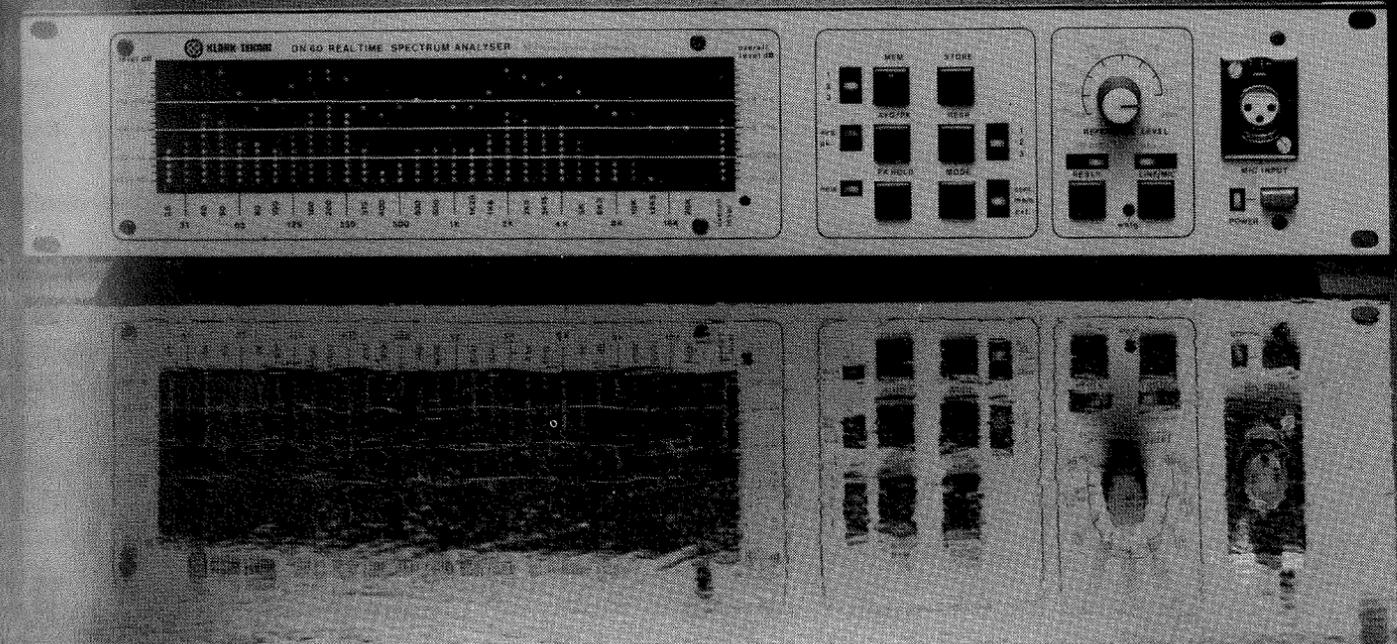
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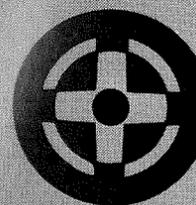
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## AES preview

converter; and the *PCM-3224* 24-track, 1in digital recorder. ● **Soundcraft**: new *Series 800* consoles; the new *SCM 382-24* multitrack; plus the established *Series 1624*, *Series 400*, and *Series 1S* consoles. ● **Soundstream**: digital audio recording system. ● **Sound Technology**: *Model 1500A* microprocessor based automatic tape recorder test instrument. Also *Model 1710A*, *Model 1700B* and *Model 1701A* distortion measurement systems. ● **Sound Workshop**: *Series 1600* console; the *421* broadcast mixer; *Series 30* console; *242* and *262* stereo reverb systems; and *Super-Group* which extends the grouping capability of the *ARMS* automation system. ● **Spectra Sonics**: *Model 1024-24B* console; *3000B* and *3085B* loudspeakers; and an assisted resonance system for sound reinforcement. Also *Spectra Sound 1000B* 10-band graphic equaliser, *4000* flanger, *4010* phase shifter, and *4020* delay line. ● **Star Instruments**: no information received.

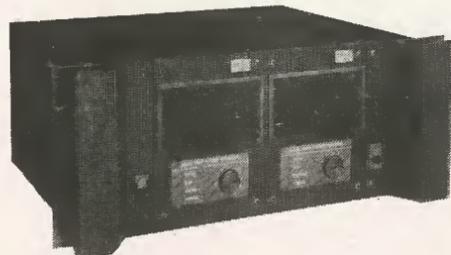
● **Stanton**: *Model 310* phono preamplifier/equaliser and *Dynaphase 55* headphones. Also the *500 Series*, *680 Series*, *681 Series* and *881S Series* phono cartridges. ● **Stephens Electronics**: *821B* range of tape recorders featuring capstan-less and pinch roller-free drive. Models on show will include a 40-track, 2in machine, and a 24-track portable machine. Also the *Q-II* autolocator and other accessories. ● **Stramp**: range of products including the *Echo 700* effects unit plus autolocators, synchronisers and a noise limiting system. ● **Strand Century**: range of intercom equipment; the *TP* range of semi-professional mixers; the *Mark II* portable concert mixer; and a range of amplifiers. ● **Studer**: *A800* and *A80VU* multitrack recorders; *TLS2000* SMPTE sync/edit system; 20-memory autolocator; remote control unit for the *A80VU*; *A80* disc cutting preview machine for use with the Neumann *VMS-80*; and the *Revox* range. Also the *Model 369 32/4* console; *Model 069* OB console; package stereo local radio console; telephone hybrid; and stereo balancing unit. ● **Studio Technology**: no information received. ● **Swintek**: *Q-dB-S* pocket receiver for radio mics; range of radio mic systems; hand-held lavalier cordless mics with multiple diversity antennae; and *MK200* communicator. ● **Synergetic Audio Concepts**: pressure zone microphones and details of time-energy-frequency measurement systems. ● **Synton**: *Syntovox 222* vocoder, a simplified version of the *Syntovox 221* effects vocoder; *Syntovox 202* vocoder designed for guitar players; and *Syntovox 232* 16-channel vocoder with a voltage controlled filter bank.

● **Taber**: *Taberaser* bulk tape erasing unit and a range of reconditioned and replacement tape heads. ● **Tangent**: *Model 3216* console available in 16/24/32-channel formats, plus the new *Series 4* sound reinforcement consoles. ● **Tannoy**: *Buckingham 3-way* monitor loudspeaker system; *Classic Dual Monitor* and *Super Red* loudspeakers; new small dual-concentric *Super Red* monitors; and the company's hybrid passive/active crossover with time compensated circuitry and parametric equalisation for the low frequency section. ● **Tapemaker Sales**: no information received. ● **Teac**: comprehensive range of units from the *Tascam Series* including consoles, tape recorders and accessories. ● **Technics**: *SP-02* direct drive motor and drive electronics for a disc cutting turntable, plug-in compatible with Neumann lathes. Also turntable console for recording and broadcast use; professional PCM recording system; digital audio

## SPARS Conference

The third audio recording conference to be held by SPARS (the Society of Professional Audio Recording Studios) will be held in the Doral Inn adjacent to the Waldorf-Astoria on Thursday, October 30. Three seminars are being offered on the subjects of 'Studio Marketing Techniques', 'Technical Downtime', and 'Good Engineering Practices'. Advance registration for non-SPARS members can be obtained from Malcolm Pierce Rosenberg, SPARS Administrator, 215 South Broad Street (7th Floor), Philadelphia, PA 19107, USA. Phone: (215) 735-9666.

disc system; and *SP-15* and *SP-25* studio turntables. ● **Tektronix**: *TM500* range of audio test equipment. ● **Telex Communications**: range of headsets, intercoms, and cassette duplicators. ● **Trident**: *TSR Series* multi-track tape recorder with autolocate and compact remote control unit; *Series 80* modular console; *TSM Series* console available in 32/24 or 40/32 configurations; and *Fleximix* modular console system expandable to 24-track. Also the rack-mount parametric equaliser/filter and stereo limiter/compressor.



UREI Model 6500 modular power amp

● **UREI**: new *Model 6500* modular power amp and *325/315* DI boxes, plus a wide range of signal processing units including the *Model 562* feedback suppressor; *Model 533* (single) and *Model 535* (dual) 10-band octave graphic equalisers; and the *Model 811* single duplex and *Model 815* super woofer time aligned loudspeaker systems. ● **Ursa Major**: *8X32* digital reverb system and the *SST-282 Space Station* digital delay line and digital reverberation system synthesiser.

● **Valley Audio**: *Allison Kepex II* keyable program expander; *Fadex* programmable fader system; the *65K* automation system; plus the various *Allison VCA* modules. Also the *Trans Amp LZ* transformerless mic pre-amp.

● **White Instruments**: *System 200* microprocessor controlled realtime analyser; plus numerous active and passive equalisers.

● **Wireworks**: range of hard-wired mic cables and multicable together with a number of audio accessories. ● **Woelke**: range of professional record, playback and erase heads for 16/24-channel multitracks, plus the company's other ranges of multitrack heads. Also wow and flutter meters; wave analysers; and bias/distortion meters.

● **Xedit**: drift and flutter meter plus splicing blocks and a film strip pulser/converter.

● **Yamaha**: wide range of audio products including the *PM-2000* console available in 24 or 32-input channel configurations.

● **Studio Sound**: editor Richard Elen and assistant editor Noel Bell will be attending the Convention together with advertisement manager Phil Guy. ■

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# Designing a professional mixing console

Steve Dove

## Part Three~Op~amps, Friend or Foe?

FASHIONS change, the laws of physics don't. A simple and irrefutable statement, one would think. Unfortunately this industry, like most of the others which survive off the entertainment media, is populated with large numbers of persons who persistently refuse to believe it. Such are the individuals who are responsible for sweeping condemnations based on statements that tickle the sense of plausibility rather than sufficient breadth of comprehension and depth of knowledge to substantiate or explain them. So many of these proclamations are made for political and commercial reasons, totally unrelated to actual technological facts.

Such are the statements from which fashions are born—inertia sweeping them forward until the original criticisms have been well laid to rest but the engendered antipathy lingers on irrationally, supported dim-wittedly by those similarly incapable of substantiating their own opinions. Sadly, in an industry where abstract notions are a stock-in-trade and everyone has a pair of ears it is quite difficult to make clarifying statements based on facts—someone somewhere will always be at hand to propose yet another set of glazed-eyed contradictory waffle.

“... people have got used to treating op-amp ICs as plug-in blocks of gain with little consideration for the fact that inside is a real, live collection of electronic bits which still have all the problems 'real' electronics always had...”

Consoles utilising integrated circuit op-amps have suffered from this exact syndrome, collecting a (sometimes deserved) dreadful reputation in the early days which has stuck.

This article is an attempt to explain the history and shortcomings of IC op-amps from conception to present day, to point out how some shortcomings are overcome and to provide reassurance that there is nothing really evil about those funny square black spiders after all. It is also an example to those prone to wistful opining that this, along with most other technology, is well understood and quantified, the concepts if not the details having been defined probably well before their birth.

### Devices

Many years ago, the author remembers deeply coveting then eventually giving in and forking out nearly five late 1960s pounds for a tiny transistor sized eight-legged queer-thing. At long last he actually held between quivering fingers a real, live Fairchild UA709!

This breakthrough opened up whole new avenues of creative ways to generate spurious oscillations. Many happy and otherwise hours were spent trying to get the wretched thing to do anything other than squegg. Never the most stable of creatures, the 709 once tamed provided a faltering education in the idiosyncracies of op-amp circuit design until expiring sadly and silently attempting to drive 15dBu into a screwdriver. Output stage protection was *not* one of its notable strongpoints.

At this stage in the game, discrete transistor circuitry still ruled supreme in audio. The new fangled spidery things were eventually compensated sufficiently to remain operationally stable but little high-frequency loop gain remained to guarantee enough feedback for adequately low hf distortion. Also, crime of all crimes, they were so wretchedly noisy. Although their parameters could be set up to be acceptable for any set application and gain setting, the very nature of control in consoles is variable so the

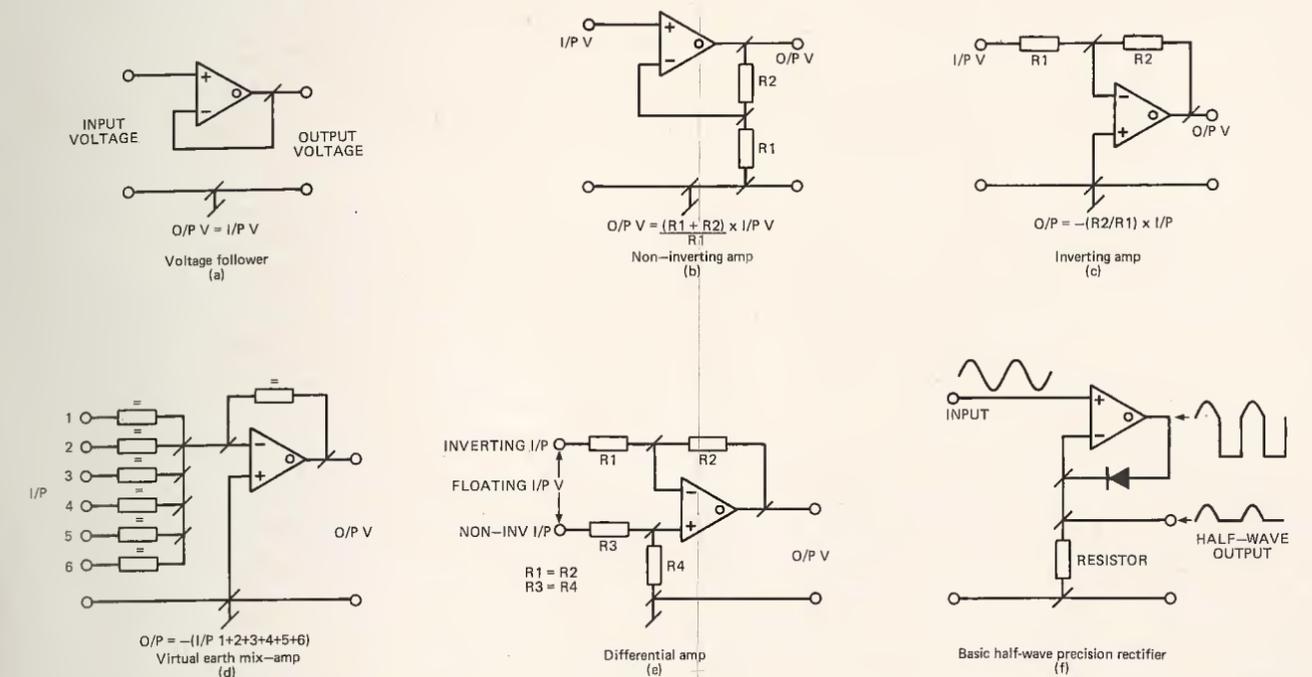
devices would almost inevitably end up operating away from their optimum.

Hot on the heels of the 709 came the now much loved and despised dirty old 741. Best known in its plastic encapsulated 8-pin dual-in-line incarnation, it still took our industry many years to catch on to the fact that here existed a seemingly almost vice-free op-amp. Well, at least free of some of the 709s vices, let's say—it was heavily internally compensated hence stable (unless you did something daft to it) the penalty for which was rapidly disappearing open loop gain with increasing frequency. There was just enough gain left in hand to get away with 20dB of broadband gain safely over a 20kHz bandwidth. Absolutely no mention will be made of the many (some well respected) mixer manufacturers who actually used them in mic-amps and mix-amps with anything up to 45-50dB gain around them...

Some IC manufacturers actually came up with pleasant 741s which were usably quiet and did not have output offset voltage problems on the scale of earlier devices. The 741 was also output protected to the extent of being short circuit proof. Sighs of relief all round.

Subsequent generations of op-amps to the 709 included the 748 (the

FIG.12a-f



uncompensated sister to the 741) and the 301—again some versions of which were excellent for the class of device. The 748 and 301, being user-compensated did allow for more optimal parameter setting and in most circuits only required one capacitor to achieve this, as opposed to the 709's necessary two resistor/capacitor networks.

This, although on the surface appearing to be of great convenience to the user, disguised the fact that far superior bandwidth and phase-margin performance could be obtained by carefully considering the nature of the compensation network. Rather than just a simple capacitor of sufficient value to hold the amplifier stable (which also turned the internal compensated transistor into a Miller integrator doing absolutely nothing for the device's speed) a more complex network such as a 2-pole C/R network (fig 12) improved matters greatly.

External feedforward whilst in use as an inverting or virtual-earth mixing stage also enabled a dramatic increase in bandwidth and hence speed over the more conventional compensation arrangements (fig 13).

Full treatment of the compensation of the 301 family together with performance graphs are given in some manufacturers' data books, possibly the best being by Advanced Micro Devices a company who, oddly enough, don't seem to really specialise in op-amps at all.

All these early devices had one great failing though, one which has quite recently been leapt upon vigorously by the hi-fi fraternity and audio engineers alike in a frantic witch-burning ceremony for the like of which both categories are well noted, from time to time. Please stand up, the magic buzz-word

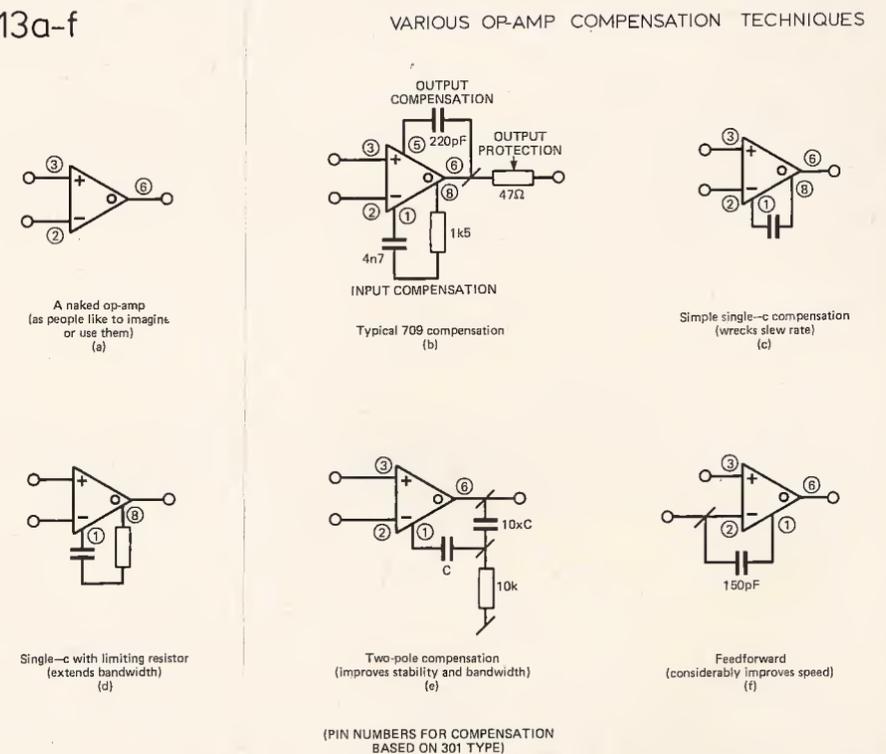
(buzz-phrase?) *slew-rate*. Slew rate is the speed (measured usually in  $V/\mu s$ ) that an amplifier output shifts at when a step source of extremely high speed is applied to the input. All the early generation op-amps had slow rates in the order of  $0.5V/\mu s$  which by today's standards does not bear mentioning in polite company, but

no-one really knew much better then.

The speed limitation was nearly always in the differential dc level-shifting stages of the devices, it being quite difficult to fabricate on the IC wafer ideal classes of transistors in configurations

64 ▶

FIG.13a-f



## Mixing console

necessary to improve matters without compromising other device characteristics (such as input bias current which affects both input impedance and offset performance).

'Feedforward', in which a proportion of the unslewed input signal is fed around the relatively slow-responding lateral pnp stages, improving slew-rate and bandwidth appreciably, is used for example in the LM318. A device with still a notable number of devotees, with an achievable slew-rate by this technique of some 70V/ $\mu$ s.

It was in this area of slew-rate, combined with a significantly improved noise performance (again another parameter suffering from difficulty in fabricating appropriate devices in a relatively 'dirty' wafer) the next major breakthrough occurred in devices commonly used for audio applications; the Harris 911. Although dramatically improved, the slew-rate was still not that fast and was also asymmetrical, being +5 and -2V/ $\mu$ s.

In recent years from the realms of the hitherto specialist domain of ultra-high input impedance instrumentation op-amps, has emerged a breed called 'Bi-FETs'. These have a closely matched and trimmed field-effect transistor input differential pair (hence the typically unimaginably high  $10^{12}\Omega$  input impedance) and a very fast 13V/ $\mu$ s structure throughout. These wonderful creatures are typified by the Texas Instruments 'TLO' series and devices such as the National Semiconductors LF356. Selected versions can, when source impedance optimised, give noise figures bettering 4dB at audio—thoroughly remarkable for units costing very few pence more than a 741.

The device speed has been

achieved by the replacement of the conventional bipolar transistor differential input and level shifting circuit by the FET configurations. Incidentally, the intrinsic noise characteristic of these FET front ends is significantly different from that of bipolars and seems perceptually less objectionable. Needless to say, these are the devices around which most of the circuitry in this series has been designed, with minimal exceptions.

Talking of exceptions, there is one IC device that was designed specifically and optimised totally for inclusion in high quality audio equipment. With a quoted noise figure of better than 1dB, slew-rate again of 13V/ $\mu$ s and the ability to drive a 600 $\Omega$  termination at up to +20dBm, the Signetics NE5534 (TDAI034) is truly a chip amongst chips. It is also expensive.

This on its own is a perfectly valid reason for not using them everywhere, but more to the point, how many actual circuitry circumstances demand each and all of these characteristics? Not many and although a fairly detailed reasoning of design criteria is given in each of the circuit descriptions during the series, a brief explanation to put the minds of the 'purists' at rest who would otherwise demand using 5534s throughout, is in order here.

Noise in any competently designed and operated console can be attributed mostly to two sources, these being; (a) mixing amplifiers with an appreciable number of sources and hence a lot of 'make-up' gain, but predominantly (b) the input stage, especially a microphone amplifier with a fair amount of gain in it. Once a background noise level is established from the front end stage (at a level obviously dependent on the amount of gain employed there) the difference in noise contribution between an amplifier with a typical unity gain noise of

-120dBu and one of -115dBu is for the vast majority of considerations totally insignificant.

The output driving capability of the 5534 is not really worth putting to the test since conventional line-amp designs are still cheaper to construct than even the 1,000-off prices. The performance and ease of using the 5534 as a microphone amplifier far outweigh the hassle of a similarly performing discrete transistor design, which in this specific area is still its main close rival.

Unfortunately, the 5534s are still the audio industry's favourite 'flavour of the week', and anything that isn't liberally peppered with them is regrettably considered déclassé.

In the realm of altogether more esoteric devices fall the purpose-designed encapsulated discrete amplifier modules such as the JE990, designed by Deane Jensen of Jensen Transformers. Many fascinating solutions to op-amp internal design problems, (some of which even IC designers evidently haven't realised existed) are implemented in this design whose features demand a total reappraisal of contemporary audio circuit design and philosophy. Optimum input source impedance (normally about 10k $\Omega$  with most IC and discrete amplifiers) is reduced to about 1k $\Omega$  by the use of an IC multi-parallel input transistor differential pair whilst small inductors in the emitter provide isolation from potential hf instability due to the gain/bandwidth characteristic of that first differential stage shifting with varying source impedances. Unity-gain noise is a staggeringly low -133.7dBu whilst the output is capable of delivering full voltage swing into a 75 $\Omega$  load so permitting the use of exterior circuit elements of far lower impedance and hence reducing thermal noise generation due to them.

This elegant device inevitably carries an elegant price-tag. Its many attributes point the direction for design, it being the only direct improvement upon currently adopted techniques. It is a leap in advance of any devices available in IC form and also, to the author's knowledge, of any universal discrete circuitry elements used to date in console manufacture.

### Instability

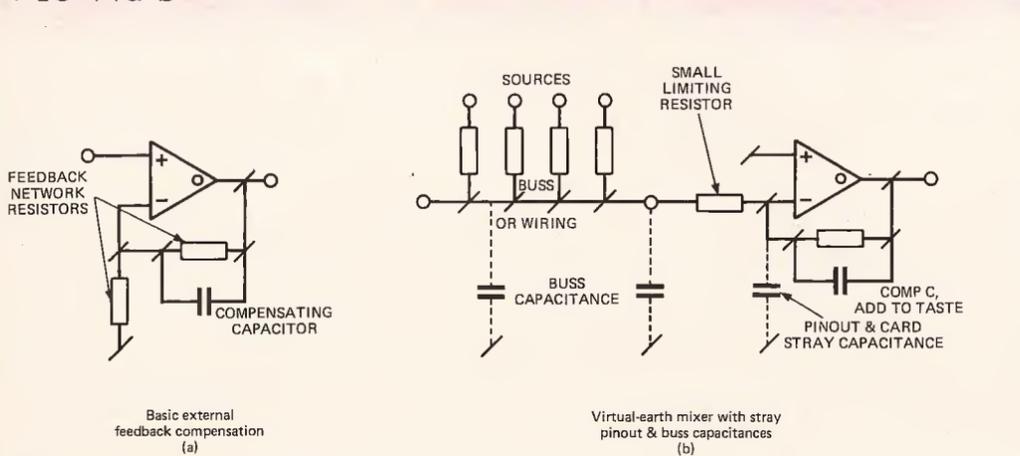
An unexpected thrill facing designers as they upgraded to the newer, much faster devices was the tendency for all their previously designed circuits to erupt in masses of low-level instabilities like an attack of chicken-pox, even in what had been perfectly tame boards.

Layout anomalies, such as track proximity were a major contributor toward this so new layouts had to be generated with a whole new set of conditions added to the already hazardous game of card design. However, the real roots to this problem lay with the devices themselves and a lack of appreciation of the relationship between their internal configurations and the outside world. Everyone who had been brought up designing around 741s and their ilk had got rather too used to treating them in a somewhat cavalier fashion and for good reason—there was precious little you couldn't do with them and without even showing a hint of oscillation. People got used to treating ICs as plug-in blocks of gain with little consideration for the fact that inside was a real, live collection of electronic bits which still had all the problems 'real' electronics always had. The reason the 741 was relatively impervious to user inflicted nasties is analogous to the fact that it's quite difficult to get anything that is bound, gagged and set in treacle to *not* behave itself.

Mistake number one with the new devices was believing that they were unity-gain stable because the data sheet said so. What that *really* means is 'does not burst into oscillation at unity gain' which is not the same thing at all.

It is important to maintain as large a margin as possible between the internally structured gain/bandwidth rolloff set for open loop and the rolloff around the external circuitry determining the closed-loop gain. This is in order to preserve sufficient phase margin at all frequencies the circuit has gain. Failure to do this can result in the feedback being shifted in phase sufficiently to become reverse-phase to that intended, positive feedback, and oscillation resulting. Even if the phase isn't shifted quite that far, the feedback is tending toward positive,

FIG 14a-b



# Some people like our coloured mike stands because they're colourful .....

## most people like them because they're better!

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## Mixing console

and damped ringing when transients hit the circuit is a possibility. Also, these resonance effects are extremely high in frequency, typically many MHz, so any radio signal that gets as far as the circuitry will absolutely adore an amplifier that is critically resonant at its frequency! A reasonable phase margin to aim for at all gain frequencies is better than 45°, but in practice a compromise between desired circuit bandwidth traded-off against the need to tighten that bandwidth for phase-margins' sake can be fairly easily reached with the newer devices.

The normal and most flexible way to determine a circuit's closed-loop rolloff is by means of a feedback phase-leading capacitor across the main output-to-inverting-input feedback resistor, a typical arrangement is shown in fig 14.

A fairly common eroder of phase margin and progenitor of instability is stray capacitance from the amplifier's inverting input to ground. This capacitance, a combination of internal device, pinout and printed-circuit layout proximity capacitances, reacts against the feedback impedance to increase the closed loop gain at high frequencies. In normal circuits, even the typical 5 or so pF is enough to tilt up the closed-loop response well within the open-loop gain parameters, threatening stability. Far worse is the situation where the inverting input is extended quite some distance along wiring and a buss, as in a virtual-earth mixing amplifier—hundreds of pF may be present there. It can arise that despite a sizeable time-constant being present in the feedback leg, none of the expected hf rolloff occurs since it is merely compensating for the gain hike created by the buss capacitance. Ensuring required response and phase characteristics using any virtual-earth mixer can only be done properly with the finished system up and running complete, since any additional sources modify the impedance seen by the buss.

A small limiting resistor to define just how much this unwanted gain can rise may be added as close to the amplifier inverting input terminal as possible, but this is at the expense of the 'virtual-earth' point now having an impedance based on the value of that resistor. The resistor, incidentally, is also a measure of protection against rf on the buss being rectified by the input stage's junctions.

## Time domain

There is invariably a finite time taken for a signal presented at any

amplifier's input to show an effect at the amplifier's output—the so called transit-time. This transit-time, as the frequency increases, becomes an appreciably greater proportion of the signal's wavelength and as such has to be taken into account due to its detraction from phase margin with increasing frequency.

Remember the great hoo-hah a few years ago about Transient Intermodulation Distortion? The effect that collected this name is due nearly totally to amplifier transit-times and not surprisingly, as is nearly always the case with 'fad' problems, has been known about and appreciated for as long as there have been negative feedback amplifier circuits—some 60 years. It is and always has been totally predictable.

TID is a direct result of the 'servo' nature of an amplifier with a large amount of negative feedback that is intended to provide a correction signal derived as a difference between the amplifier output and the applied input signal. Since there exists a time delay in the amplifier, the circuit has to 'wait' for that time before its correction signal arrives—the output during this time is uncontrolled and just flies off in the general direction the input tells it to. Once the correction arrives, the amplifier has to wait again to find out how accurate that correction was, see-sawing on until the amplifier output settles. Fortunately this all takes place rapidly (dependent on the amplifier external circuitry) but it still represents a discrepancy between input and output. It is an effect peculiar to amplifiers with large amounts of negative feedback (as is typical of most contemporary circuitry), it quite frequently displaying itself audibly especially in power amplifiers where the transit-time is quite long with the usual huge, slow output devices.

Amplifiers which rely on their own basic linearity, such as valve amplifiers, rather than on a servo non-linearity correction system are often held to be subjectively 'smoother', this certainly being a principle reason. Nowadays, though, with device speeds as they are, settling times are becoming insignificant in relation to the signal transients they are expected to cope with, so hopefully this nit has been well picked.

## Output impedance

Most newer devices, particularly the 'TLO' series of BI-FETs have a quite significant open-loop output impedance which although, by virtue of the enormous amount of feedback used, normally gets reduced to zero, is still present and included as part of the feedback path. Obviously, then, any reactive

element at the output is going to materially affect the feedback phase and phase margin. And it does!

Any capacitance from the output to ground will form a feedback phase-lagging network, shifting the phase inexorably toward the point where the total amplifier and network phase shift reaches 180° at the inverting input (therefore a full 360° total) and the circuit oscillates. The frequency at which it oscillates is inversely relative to the capacitance value—it isn't unusual to find oscillations right at the edge of an oscilloscope's high frequency sensitivity with small values. Hanging a long bit of wire on the amplifier output (especially screened cable with its high screen to inner capacitance) is a surefire guarantee of instability for this very reason, with the added complication that there is a measure of inductance there, too. If you're really lucky, a long cable might start to look like a mismatched tuned stub at a frequency where the amplifier still has some gain. As a good stable rf signal generator it could probably win awards, but in a mixer . . . ?

Fortunately a simple cure for this is to buffer away the load from the output/feedback termination with a small resistor of typically 33 to 150Ω. This usually does it, but at the expense of headroom loss due to the attenuation from the buffer resistor against the load termination. Provided the load is greater than about 2kΩ, which it would really have to be in order to prevent getting close to current drive limiting in the IC output stage, this headroom loss should not exceed 0.6dB. An altogether more elegant way is to buffer off with a small inductance, giving increasing isolation with frequency and a phase shifting characteristic opposite to that of the (normally) capacitive load providing a total termination that is phase-constant at the higher frequencies. At the lower audio frequencies, of course, the inductive reactance is very low and the load sees the very low dynamic output impedance of the amplifier.

Both of these techniques also provide a measure of protection against the possibility of rf finding its way into the amplifier by means of rectification in the output stage or inverting input.

Some devices with a quite low output impedance before applied feedback (say those with unbuffered complementary emitter-follower output stages) are not likely to be phased as much by these problems (pun totally intentional) but it is just as well to habitually design in these considerations.

## Voltage followers

The above precautions, in addition to the feedback phase-leading capacitor, are now required circuit

practice for using the newer fast devices in many op-amp configurations. It should be said here that because there is no facility for implementing phase-leading around the standard voltage-follower configuration and that this is the most critical configuration for stability, it is not a preferred circuit element. The manufacturer will have designed the IC to be just stable enough at unity gain to be able to say so unblushingly. All hanging a compensation capacitor across the appropriate pins will do is slow up the slew-rate—better not to tempt fate.

Some good news. If it is the internal stage around which the external compensation capacitor is hung which is tending to instability, then the capacitor should cure it. Now the bad news. It rarely is that stage. If a previous stage, say the input differential amplifier is unstable, all the capacitor will do is slow up the amplifier and reduce the slew-rate to the extent that the oscillation is no longer visible at the output. It does not cure the instability. It's still there, hiding.

The use of a standard voltage-follower implies that in order to maintain the same system headroom in that stage, the input has to rise and fall to the same potentials as the output is expected to. It can't. In most op-amps, especially those with bipolar inputs, the differential input stages saturate or bottom significantly before the power supply rails are reached, which means that they not only cease to follow, but also will spend a considerable amount of time in unlatching. Once an amplifier internal stage has latched the feedback loop is broken and that stage has no assistance from the servo mechanism to unstick itself. Once the loop is re-established it has to settle again as if from a hefty transient before it can resume 'following'.

The IC manufacturers commonly specify the common-mode input voltage range, and it is precisely this limit that would be exceeded in use as a follower. For reference, it is ±13V for the 5534, ±11.5V for an LM318 and +15V to -12V for a typical BI-FET. All fall far short of the supply-rail maxima. Provided enough gain is put around the amplifier to prevent these common-mode limits being reached, there should be no latching hang-ups and the feedback network will also provide some 'meat' to hang closed-loop compensation around in addition to allowing the amplifier's full output voltage swing to be utilised.

Similar settling-time problems occur any time any stage is driven into clipping, but given the high supply-rail voltages, hence large headroom common today, clipping should be rare. Shouldn't it?

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### Ten per cent interpretation

By the time you read this you will probably have read some reassuring reports in the British national, music and magazine press that very loud disco music presents only a very small risk to human hearing. Any such published reassurances will have stemmed from a press release jointly issued in mid June by the Noise Advisory Council and the Department of the Environment. This press release, which for the benefit of editors and journalists synopsis a lengthy technical report prepared by Leeds Polytechnic for the Noise Advisory Council, is unambiguous in its reassurance and cites clearly reassuring figures.

"People attending discos run a small but detectable risk of damaging their hearing . . . the proportion of sufferers is probably very small—of the order of one in 40,000" says the leading paragraph. Unfortunately, the cited figure is wrong by a factor of 10 and this of course undermines the reassuring conclusions drawn and fed to the press. The true figure of regular disco attenders who are likely to suffer a 30dB hearing loss in the mid range frequencies (1 to 3kHz) which are vital to speech, is 0.025% of an estimated six million regular attenders. This is one in 4,000 or a total of 1,500. Quite a difference!

The apparent discrepancy was raised with the DOE and NAC. Their initial reaction was predictable; of course there's no error. Under further pressure, the DOE tried to reconcile the "one in 40,000" figure with some quite different statistics buried in the report (page 51). Although this successfully confused the issue it certainly didn't resolve it. Surely it's a straightforward calculation error, was persisted. The main conclusion of the report (para 1 page 59) is that "out of an estimated six million regular attenders some 0.025% might be expected to reach the 'low fence' impairment level of 30dB ave at 1, 2 and 3kHz at the end of their attendance period". That adds up to one in 4,000 regular attenders. So where the joint press release from the DOE and NAC refers to six million attenders and one in 40,000 at risk, it is clearly just a wrongly placed decimal point. Isn't it?

"Talk to Leeds Polytechnic," said the DOE, finally owning up to the now obvious fact that no-one in the DOE or NAC had actually read and understood their own report. Leeds Poly was spoken to as tactfully as possible (bearing in mind the fact that it was commissioned by the NAC to the tune of over £13,000 to prepare the report) and agreed that the press release was wrong. Finally, after days spent on the telephone and burrowing through the report, the DOE climbed down, said "thank you" and promised to issue a further press release correcting the original.

This hasn't yet arrived and will have presented the Department and Council with a considerable problem. They can hardly issue a "sorry we made a tenfold error" apology. A wholly revised conclusion must surely be drawn from the tenfold increase in risk which the correct figures will now show. In any event, whatever the DOE and NAC now say in any new release they cannot un-publish any press reports already based on the original reassuring but erroneous conclusion.

It is a pity that this administrative cock-up will undermine credibility of an obscure but otherwise commendable report from Leeds

Polytechnic. Over a two and a quarter year period the researchers conducted over 4,000 interviews and measured peak sound levels and sound energy doses (in Leq) in nearly 50 disco premises. They found amplification equipment of between 300W and around 5kW in use and with sound energy dose meters worn by members of staff, students, friends and normal attenders a total of 154 dose meter measurements were obtained. These gave a mean Leq of 97dBA. Peak levels of up to 128dBA were noted on 'fast response' meter settings. The estimate of six million regular attenders to discos in the UK is based on a once a month or more criterion. The estimate that 0.025% of these regular attenders may be expected to suffer a 30dB hearing loss in the speech frequencies during later life is a statistical prediction based on formulae established 10 years ago by Burns and Robinson to quantise hearing loss induced by industrial noise. The Leeds Poly survey thus equates unpleasant industrial noise which is suffered as part of a working day with the sound of music heard for pleasure.

This may or may not be a justifiable equation. Some light on this may be shed when another Leeds Poly worker, Ronald Fearn finishes his current audiometric work on the actual hearing loss suffered by regular disco attenders. Incidentally the present report offers the valid reminder that any damaging effect of noise at work and of music for pleasure will be additive, ie anyone who works in a sheet metal factory during the day and goes to discos every night stands a greater chance of needing a hearing aid in later life than a worker who hates music or a disco dancer who hates work.

Although there is clearly room for argument on many counts the figures add up to a predicted hearing problem for an unlucky 1,500 people who are currently regularly attending discos. This is not the kind of prediction simply to ignore. So what to do?

In 1973 Leeds council made infamous history by taking the early work of Ronald Fearn and using it to justify an absurd 96dBA peak level limit for all public music performances in Leeds. As this effectively banned orchestral concerts and audience applause as well as pop music there was a predictable outcry. Politics reared its ugly head and Leeds tried to save face by quietly changing the requirement (on January 1, 1975) with an edict that public music noise should not exceed "a reasonable level". But no-one had any idea what a "reasonable level" was and the medical officers of Leeds Environmental Health Department were specifically instructed by the politicians not to talk to outsiders about the local limits.

Fortunately there was then a change in political power inside the council. The restrictions were lifted (to the obvious relief of those who had been gagged) and the level limits were quietly dropped. But Leeds by then had become a dirty word in the language of sound reproduction technology and this is doubtless why the new Leeds Poly report ends with two very safe and uncontroversial conclusion proposals.

Firstly, it is suggested that a Code of Practice be produced to help local promoters and disco club owners safeguard their patrons, eg by correctly placing loudspeakers. All the signs are that this Code of Practice will also recommend a top Leq limit of between 102 and 105dBA.

The other Leeds Poly proposal is that the public should be better educated on the risks of regular exposure to very loud music. As they point out, discos are now a part of the social structure. It would clearly be a wholly unacceptable intrusion into personal liberty if any attempt were made to put any limit on attendance. There are many who will argue that any limit on sound level is a similar intrusion. Although "health warning" notices could be posted in discos they would have as little value as the notices found on cigarette packets and advertisements.

The real answer, argues Leeds Poly, is to educate at school level. Children are now educated on the risks of smoking and they should at least be warned that prolonged exposure to very loud music (especially when in addition to noisy work conditions) may slowly build up hearing trouble for later years. Anyone who wishes to send their views on these and other points raised in the report is invited to contact John Bickerdike at Leeds Polytechnic, School of Constructional Studies, Brunswick Terrace, Leeds LS2 8BU.

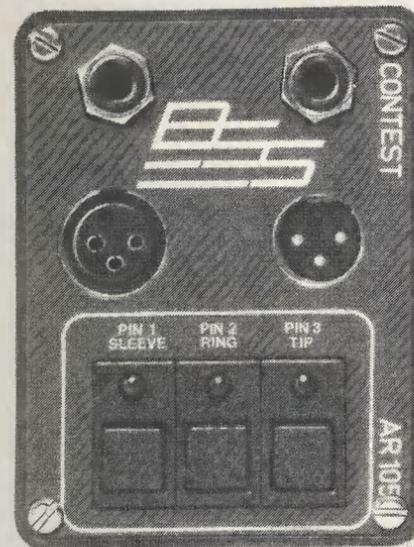
Almost a month to the day after release of their erroneous press release, the Noise Advisory Council issued a correction. This followed all manner of prodding on our part. At first the Government financed Council seemed quite surprised that we were expecting a correction. "Surely a wrong decimal point in an important statistic warrants correction" we insisted, "or do you do it every day?" Having now received the correction we rather wish we hadn't bothered to pursue the matter. In a 10 line press release the Noise Council disguises the original error in a ridiculous confusion of fresh and quite different figures.

Frankly, there isn't a chance in Hell of any music or national press journalist understanding the new release, let alone realising that it corrects anything. There's no apology and only a bracketed admission of the error. Most significant there's no hint of a suggestion that reassuring conclusions drawn on the basis of a one in 40,000 risk can hardly hold equally good for the correct figure of one in 4,000.

### Voice controlled equipment

Voice controlled audio equipment is closer than you may think. In fact it already exists in prototype form. As in so many areas of technology, the development is a spin-off from space and military research. Already fighter planes have speech recognition circuitry which enables the pilot to choose his weapons by verbal command. Hopefully the final 'fire' command isn't yet under verbal control.

Toshiba in London recently showed a television set and audio reproduction system that switches itself on and off, and changes functions, under voice control. The operator need only speak each control word once into a microphone to 'teach' the circuitry to recognise the voice. Thereafter the circuitry responds to those same spoken commands from the same voice. It can just be a question of time before studio engineers are offered the chance to control console functions verbally. This could be especially useful when the desk is too large and ancillary controls too widely spaced, for one pair of hands to reach.

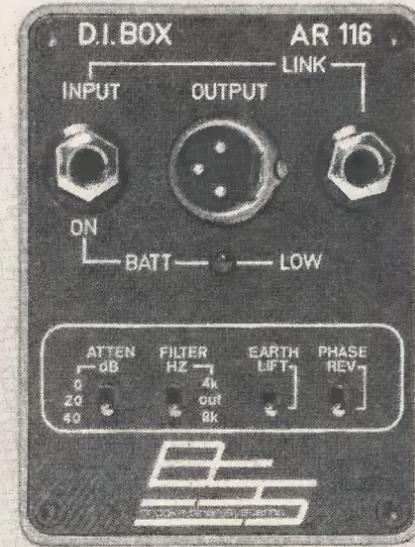


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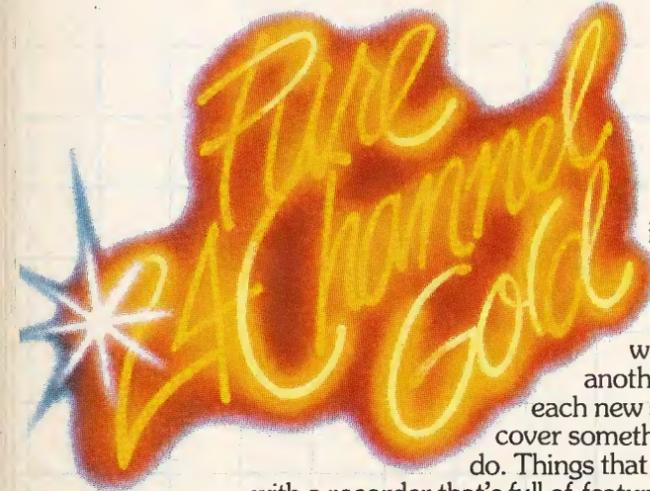
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having to rethink what you did. Just touch the memory button and it'll all come back to you. ATR-124 lets you rehearse what you've got in mind without recording it, to make sure what you've got in mind is right. Tape can be manipulated faster which means you'll get the sound you want sooner. And the chance to try something "a little different." All because of the speed and accuracy that ATR-124 puts at your fingertips.

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A repeatable, variable speed oscillator for pitch correction and special effects is built in. In addition

to the standard output, there is an optional auxiliary output with each channel that enhances flexibility. So don't think that ATR-124 is going to

Memory, and Record Mode diagnostics. The point is this: If you like the ATR-100, you're going to love working with the ATR-124.



ATR-124's Control Panel. Speed and accuracy at your fingertips.

replace anything that you do. On the contrary, it's going to improve the skills you have, if not help you develop some new ones.

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## ATR-124 options.

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ATR-124's Multi-Point Search-To-Cue (MPSTC). Provides 100 cue locations.

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As you scan the points we've covered, remember that you're scanning just a small portion of ATR-124's story. We haven't even begun to discuss the accessibility of key components for easy servicing and minimal downtime, or the features we've built in to give you greatly improved tape handling. To find out more, write to us at the address shown below. We'll send you a brochure on ATR-124, our latest audio effort.

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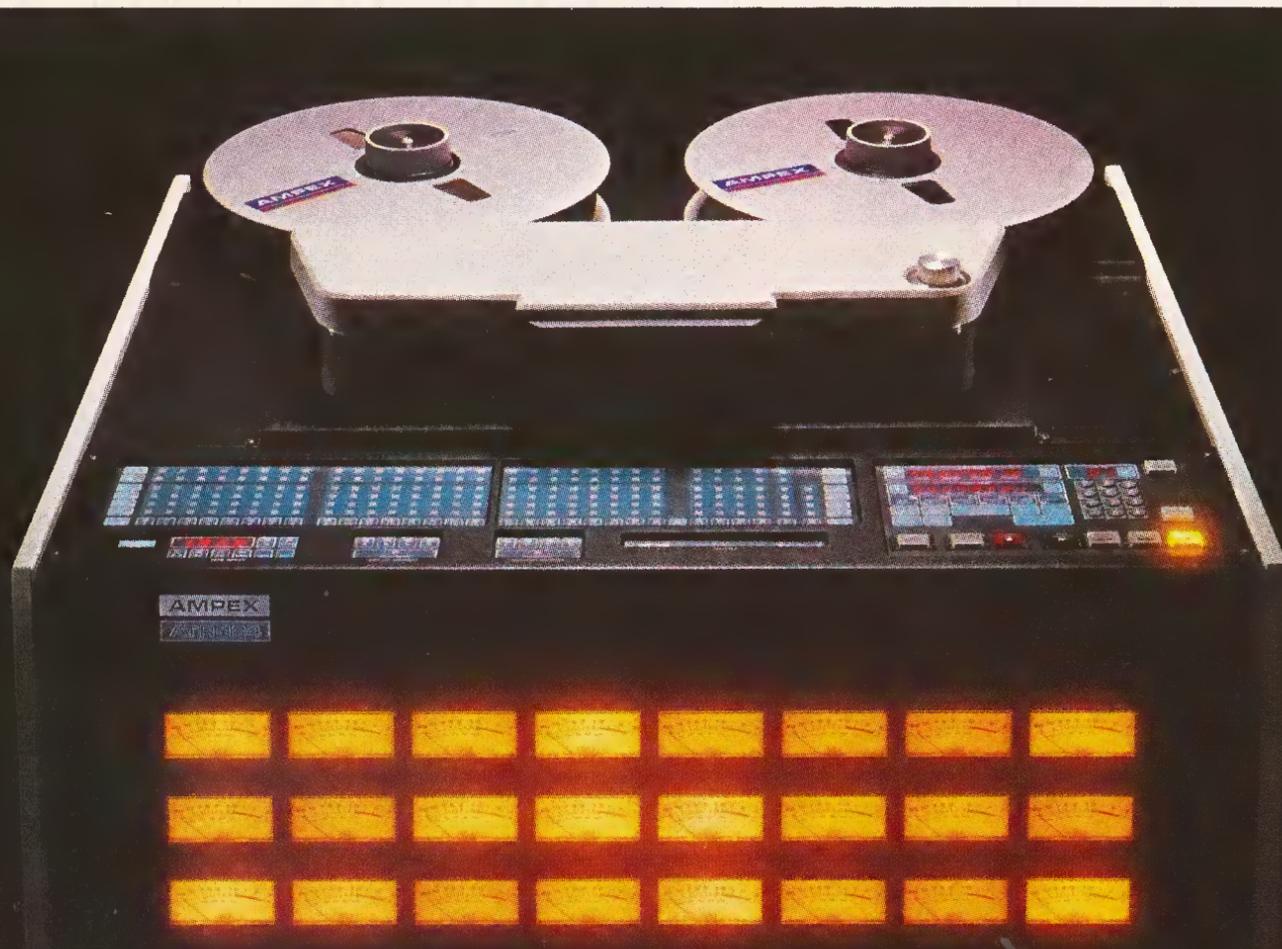
ATR-124's rugged, precision-machined casting provides unsurpassed mechanical stability.



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# Survey: connectors

## ADC (USA)

ADC Products, 4900 W 78th Street, Minneapolis, Minn 55435, USA.  
Phone: (612) 835-6800. Telex: 290321.  
UK: Atlantex Music Ltd, 34 Bancroft, Hitchin, Herts SG5 1LA.  
Phone: 0462 31511. Telex: 826967.

## Long frame jack panels

Range of 1/4 in jack strips, single, two or three rows to a panel, with 24 or 26 jacks per row, available with or without jack sockets, rack mounting.

## Single long frame jacks

Range of 1/4 in jack sockets, available as 2- or 3-way, with single or double breaks.

## Long frame patch cords

Range of 2- or 3- conductor shielded or unshielded patch cords with 1/4 in jack plugs, available in 1, 2, 3, 4 and 6ft lengths. Also available with double plugs.

## Bantam jack panels

Range of 0.125in Bantam jack strips, available with 48 jacks across a bay width, either single or paired, wide range of sockets with various break contacts.

## Bantam Patch cords

Range of two or three conductor patch cords with 0.125in Bantam jacks, single or double jack, plugs, 6in, 1, 1 1/2, 2, 2 1/2, 3, 4, 5ft lengths.

## AMPHENOL-TUCHEL (West Germany)

USA: Amphenol Connector Division, Buker Ramo Corp, 2801 S 25th Avenue, Broadview, Illinois 60153.  
Phone: (312) 345-9000. Telex: 910-226 1974.  
UK: Future Film Developments, 36/38 Lexington Street, London W1R 3HR.  
Phone: 01-437 1892. Telex: 21624.

## Tuchel Screw Connectors

Range of DIN standard connectors with a screw locking ring, fitted as standard to many cameras and tape recorders. Available in 3-, 4-, 5-, 6-, and 7-pole types. Model A as line style and right angled types, with a combination of cable clamp and clear plastic strain relief bush designed to accommodate cables up to 5mm diameter, and line Style B with alternative cable clamp and end bell (which has no provision for a strain relief bush) designed to accommodate cables up to 8mm. Also panel mounting types. All available as male or female.

## XLR Connectors

Range of XLR connectors in both metal and plastic cased types.

## AUDIO ACCESSORIES (USA)

Audio Accessories Inc, 163 Water Street, Keene, New Hampshire 03431, USA.  
UK: Technicord Ltd, Melbourn House, 2 Black Bank Road, Little Downham, Ely, Cambs CB3 2TZ.  
Phone: 035387 721.

## Jack systems

Range of jack systems including jack panels with 16, 18, 20, 22, 24, or 26 jacks per row with various spacings, up to 16 rows per panel. Wide variety of jack sockets, 2- or 3-pole, various breaks and types.

## CAE (UK)

Communication Accessories & Equipment Ltd, 70/82 Akeman Street, Tring, Herts HP23 6AJ, UK.  
Phone: 044282 4011. Telex: 82362.

## Jack systems

Wide range of jack systems including jackfields, panels, patch cords and components in both standard 1/4 in (B gauge/longframe), and the smaller Bantam types, which allow a 50% increase in packing density. Complete panels or prewired units may be supplied.

## CANNON (USA)

ITT Cannon Electric, 666 East Dyer Road, Santa Ana, Cal 92702.  
Phone: (714) 557-4700.  
UK: Future Film Developments, 36/38 Lexington Street, London W1R 3HR.  
Phone: 01-437 1892. Telex: 21624.

## XLR connectors

Range of high quality cable and panel mounting latch lock connectors for use in pro-audio and instrumentation, shell material is light alloy, satin nickel finished, silver-plated brass contacts. Available with 3-, 4-, 5-, 6- or 7-pole types, male or female, cord or wall types. Wide variety of spares also available.

## CLIFF (UK)

Cliff Electronic Components Ltd, 97 Coulsdon Road, Caterham, Surrey CR3 5NF, UK.  
Phone: 0883 47713. Telex: 8813346.

## Jack plugs and sockets

Range of jack plugs and sockets, available as mono or stereo 1/4in, screened or unscreened (metal or plastic covers respectively), straight or side entry. Also 3.5mm types. Sockets are plastic moulded, in mono or stereo types.

## DELTRON (UK)

Steve Graham Audio Ltd, 20 Victoria Road, New Barnet, Herts EN4 9PF, UK.  
Phone: 01-449 3663/4044. Telex: 8955127.  
USA: Canford Audio (USA) Ltd, 652 Glenbrook Road, Stamford, Conn 06906.  
Phone: (203) 324-2889. Telex: 643678.

## XLR connectors

Range of XLR format connectors, built-in terminals for screening continuity between locked mating connectors, silver plated contacts, nickel-plated housings. Cable female plug and chassis socket are available in 3-, 4- and 5-pole, cable male plug and chassis plug also in 6- and 7-pole.

## MOSSES & MITCHELL (UK)

Mosses & Mitchell Ltd, Wyndon Lane, Farnham, Surrey GU9 8QL, UK.  
Phone: 0252 721236. Telex 858820.

## Audio jackfields

Wide range of jackfields, available with row lengths of 20, 24 or 26 jacks, each row assembled on a plastic moulding, and mounted on a 19in panel. Basic jackfields available as one, two or three row modules, while flat front types are available with one to six row, providing up to 120 jacks on a panel. 440 range jackfields are miniature jackfields using Bantam jacks, provides 40, 42 or 48 jacks across a row, in single or double rows.

## Sockets

Wide range of sockets with a variety of contact formats, plain or threaded mounting, also available in 440 range.

## Patch cords

Range of patch cords available in various lengths in multiple colours, either fitted with standard BPO 376 plugs, or 440 range plugs, either single or dual.

## NEUTRIK (Liechtenstein)

Neutrik AG, Obergass 16, FL-9494 Schaan, Liechtenstein.  
Phone: 075 2.63.83. Telex: CH-77771.  
UK: Eardley Electronics Ltd, Eardley House, 182/4 Campden Hill Road, London W8 7AS.  
Phone: 01-221 0606. Telex: 299574.  
USA: Philips Audio Video Systems Corp, 91 McKee Drive, Mahwah, New Jersey 07430.  
Phone: (201) 529-3800.

## XLR connectors

Range of XLR format latching connectors, reinforced hard plastic insert with two ribs of soft polyurethane damping material, tapered to intro-

duce an increasing radial force when inserted into the matching connector, easing noise problems with loose fitting connectors. Self adjusting cable clamp for diameters between 4 and 7mm, no metal or screws, but withstands 50kg loads, uses 3-jaw chuck. Diecast zinc alloy bodies, sand blasted, copper and nickel-plated. Available as 3-pole male or female, cable or panel mount types. Also manufacture a 1/4 in 2-pole jack plug.

## D-Series

XLR-compatible sockets for direct to PCB-mounting, vertical or horizontal formats, sockets may be used to retain PCB. Available with latch lock or retaining spring; 3-pole male or female; diecast zinc alloy bodies; nickel or black chrome housings.

## RENDAR (UK)

Wilmot Breeden Electronics Ltd, Durban Road, Bognor Regis, West Sussex PO22 9RL, UK.  
Phone: 0243 825811. Telex: 86120.

## Jack plugs and sockets

Range of jack plugs, available in gauge 'A' (large tip diameter) and gauge 'B' (small tip, BPO standard type), in 2- or 3-pole versions using moulded insulation and nickel-silver-plated brass contact rings. Available with plastic or metal caps, straight or side entry, screened or unscreened. Also 3.5mm jacks. Sockets are moulded plastic with 2- or 3-poles, A or B gauges.

## SWITCHCRAFT (USA)

Switchcraft Inc, 5555 North Elston Avenue, Chicago, Illinois 60630, USA.  
Phone: (312) 792-2700. Telex: 910-221 5199.  
UK: FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ.  
Phone: 01-953 0091. Telex: 27502.

## Audio connectors

Wide range of audio connectors including XLR types, phono plugs and jack systems. Q-G is a range of XLR format connectors with captive design insert screws, die cast zinc case, satin nickel finish, neoprene cable strain relief bushing, available in 3-, 4-, 5-, 6- and 7-pole versions, as straight cord plugs, right angle cord plugs, cord plugs with on/off switch, circular or rectangular receptacles, surface mounting receptacle, wall plate receptacles, range of adaptors.

Tiny Q-G is a new range of miniature audio connectors with similar styling to the XLR types, but very much smaller, in 3-, 4- or 5-pole types with latch locking metal and plastic construction, moulded inserts, cord plugs, round or rectangular receptacles.

## Jack systems

Wide range of jack systems including broadcast pattern audio jackfields with 20, 24 or 26 jacks per row, available in modules with up to six rows. Various long frame type sockets and switches, also lamps. Jackfields are also available in made-up form, with jacks wired to multiway connectors on the panel rear.

## TECHNICORD (UK)

Technicord Ltd, Melbourn House, 2 Black Bank Road, Little Downham, Ely, Cambs CB3 2TZ, UK.  
Phone: 035387 721.  
USA: Audio Accessories Inc, 163 Water Street, Keene, New Hampshire 03431.  
Phone: (603) 352-2320.

## Patch cords

Range of jack patch cords, cable has 100 strand conductors and a Reusen double lap 76-strand copper screen, sheath is PVC and available in six colours. Available with either standard 1/4 in 3-pole jacks, or 0.175in miniature jacks.

## TRIMM (USA)

Trimm Inc, 400 Westlake Street, Libertyville, Illinois 60048, USA.  
Phone: (312) 362-3700.  
UK: Future Film Developments, 36/38 Lexington Street, London W1R 3HR.  
Phone: 01-437 1892. Telex: 21624.

## Jack systems

Wide range of jack sockets and plugs, including standard 1/4 in telephone pattern types with a wide variety of connections, also lamps. 94 series miniature telephone jacks in a variety of contact combinations. Also jacks plugs and cords. ■

# Amber 3500 distortion measuring set

The piece of test equipment that no-one working with quality audio products can afford to be without. £950.00 buys an auto nulling, auto level setting distortion analyser measuring THD to below .002% between 10 Hz and 100 KHz and a noise meter capable of narrow band measurements down to -129 dBv. In the same package is an entirely new (patent pending) low distortion signal generator. The whole unit is highly portable and weighs less than 3.5 kgs. Do not be misled by price - this is the state of the art distortion measuring system of the 80's. For full information contact:



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

# Allison Research 65k Console Automation Programmer

Over one hundred units in world-wide daily use with API, Harrison, Helios, Sphere, Trident and other fine mixing consoles.

Allison Research's 65K second generation programmer accepts and processes control voltages in the range 0 to 5.6 VDC from VCA type faders. These analogue control voltages are converted by the 65K programmer to data words which can be stored on any non-critical tape medium. Upon replay of the data the original DC levels are re-created accurately and unerringly.

Applications of the 65K programmer to any recording console fitted with suitable VCA faders permits comprehensive and reliable level automation. The 65K Programmer illustrated can be expanded from a basic 16 fader capacity (UK list £2362) to 64 fader capacity (UK list £3153) simply by the insertion of expander cards.



Unlike other console automation programmers, the Allison 65K when fully expanded can handle 8000 analogue functions or 65,000 digital bit functions - sufficient capacity to allow it to be used with subsequent generations of programmable equalisers and other devices.

For full information on Allison Research's Industry Standard Automation programmer, contact:

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

# Survey: cables

This survey includes a wide variety of cables designed for audio applications, but due to the extensive range available, does not include availability nor pricing. There are, however, few actual manufacturers of cable as such, and many of the companies in this survey are exclusive distributors for custom cable, made by these cable manufacturers, but not generally marketed by any other companies.

**ALPHA (USA)**  
Alpha Wire Corp, 711 Lidgerwood Avenue, Elizabeth, New Jersey 07207, USA.  
Phone: (201) 925-8000.  
UK: Alpha Wire Ltd, Central Way, North Feltham Trading Estate, Feltham, Middx.  
Phone: 01-751 0261. Telex: 8813660.

Manufacture an extensive range of wire and cables, many of which are suitable for audio and transmission use. Constructions available are straight-lay, paired, twisted pair, and triples; with a choice of overall or individual screening in braid or foil, or plain jacketed up to 100 conductors. Mic and RG co-axial cable are also available.

**AUDICON**  
Audicon Marketing Group, 1200 Beechwood Avenue, Nashville, Tenn 37212, USA.  
Phone: (615) 256-6900.  
UK: Trad Electronic Sales Ltd, 149b St Albans Road, Watford WD2 5BB.  
Phone: 0923 47988. Telex: 262741.

**Multipair audio cable**  
Range of multicore cable, available in 32, 24, 10, 8, 4 or single pair configurations.

**BELDEN (USA)**  
Belden Corp, PO Box 1331, Richmond, Indiana 47374, USA.  
Phone: (317) 966-6661.  
UK: Leonard Wadsworth & Co (Electronics) Ltd, Warehouse Block F, Imber Court Trading Estate, Orchard Lane, East Molesey, Surrey KT8 0DA.  
Phone: 01-398 4288. Telex: 264028.

Belden manufactures a vast range of cable for most electrical and electronic applications, and those listed here are a selection of those more appropriate for audio.

**Sound and broadcast cables**  
Range of cables with stranded conductors, 100% Beldfoil foil shielding, solid copper drain wire, high reliability, ease of termination, but not designed for flexible use. Single pair 22 gauge cables with 7/30 stranded conductors, 8767 is 0.175in diameter, 9467 is 0.18in with bonded shield and jacket for auto stripping, 8450 has 0.118in diameter, 8451 has 0.135in diameter, 9451 has 0.02in diameter with bonded shield and jacket. 20 gauge cables with 7/28 stranded conductors, single pair, 8762 is 0.204in diameter, 9464 is similar but with bonded shield and jacket, 9754 is 0.198in diameter. 18 gauge

cables have 16/30 stranded conductors, 2092 is 0.222in diameter, 9460 is similar with bonded shield and jacket. Larger cables include 8719 16 gauge with 19/29, 8720 14 gauge with 19/27, 8718 gauge with 19/25.

**Multiple pair cables**  
Range of multiple pair cables with individual screening for each pair (overall screened also available), stranded conductors, 100% Beldfoil foil shielded, stranded tinned copper drain wire, high reliability, ease of termination but not designed for flexible use. 22 gauge cables with 7/30 stranded conductors, 8777 three pairs (0.301in diameter), 8778 six pairs (0.416in diameter), 8774 nine pairs (0.443in diameter), 8775 11 pairs (0.486in diameter), 9768 12 pairs (0.486in diameter), 8776 15 pairs (0.565in diameter), 9769 17 pairs (0.615in diameter), 8769 19 pairs (0.625in diameter), 8773 27 pairs (0.745in diameter). 20 gauge cables with 10/30 stranded conductors, 9873 three pairs (0.356in diameter), 9874 six pairs (0.471in diameter), 9875 nine pairs (0.555in diameter), 9876 11 pairs (0.58in), 9877 12 pairs (0.6in diameter), 9879 15 pairs (0.655in diameter). 18 gauge cables with 16/30 stranded conductors, 9773 three pair (0.392in diameter), 9774 six pair (0.57in diameter), 9775 nine pair (0.625in diameter), 9776 12 pair (0.75in diameter), 9777 15 pair (0.82in diameter).

**Microphone cables**  
Range of microphone cables: vinyl plastic jacket cables have lower capacitance, lower loss, greater ozone and oil resistance, lighter weight, smaller diameter; rubber cables have greater abrasion and impact resistance, and extra limpness so cable will lie flat on stage or studio floor; neoprene and Hypalon cables are resistant to effects of sun, oil and ozone, and recommended for outside use and cold weather. 8410 25 gauge cable has single 7/33 stranded conductors, rubber jacket (0.245in diameter), 24 gauge cables with 45/40 stranded conductors, rubber jacket, 8413 is two conductor, 8406 three conductor (0.025in diameter), 9399 two conductor (0.3in diameter). 20 gauge cables, with 26/34 stranded conductors, neoprene jacket, 9394 single conductor (0.19in diameter), 8412 two conductors (0.263in diameter), 8402 two conductor Hypalon jacket (0.263in diameter), 8423 three conductor (0.272in diameter), 8424 four conductor (0.29in diameter), 8425 five conductor (0.318in diameter), 8426 six conductor (0.344in diameter), 8427 seven conductor (0.355in diameter), 8418 eight conductor (0.381in diameter). 18 gauge cables with 41/34 stranded conductors, neoprene jacket, 9395 single conductor (0.235in diameter), 8428 two conductor (0.29in diameter). 16 gauge cables with 65/34 stranded conductors, 8408 two conductor Hypalon jacket (0.385in diameter), 8407 four conductor neoprene (0.416in diameter). 25 gauge single conductor 7/33 stranded conductors, vinyl jacket, 8411 (0.144in diameter), 8401 (0.2in diameter), 9396 (0.1in diameter). 24 gauge 8420 45/40 stranded conductors, two conductors with vinyl jacket (0.185in diameter), 9397 105/44 stranded conductors, two conductors (0.176in diameter), 9398 three conductor (0.186in diameter), 8422 22 gauge 16/34 stranded conductors, two conductors (0.231in diameter), 20 gauge 26/34 stranded conductors, 8403 three conductors, vinyl jacket (0.244in diameter), 8404 four conductors, (0.248in diameter), 8405 five conductor (0.275in diameter).

**BICC (UK)**  
BICC General Cables Ltd, Helsby, Warrington, Cheshire WA6 0DJ, UK.  
Phone: 092-82 2700.

Wide range of PVC and polythene insulated cables including multipairs, mic and loudspeaker cables.

**BOFA (Sweden)**  
Cliff Electronic Components Ltd, 97 Coulsdon Road, Caterham, Surrey CR3 5NF, UK.  
Phone: 0883 47713. Telex: 8813346.

**Screened cables**  
Range of low cost, aluminium foil screened with integral drain wire, not intended for flexible applications. LF2x.16 is 21/0.1mm stranded conductors, two conductors (2.7 x 3.5mm), range of overall screened, multicore cables, 7/0.21mm stranded conductors, available in 1, 2, 4 and 5 conductors versions, plastic jacketed.

**BIW (USA)**  
Boston Insulated Wire & Cable Co, 65 Bay Street, Boston, Mass 02125, USA.  
Phone: (617) 265-2102. Telex: 940604.  
UK: Boston Insulated Wire (UK) Ltd, 1 Canbury Park Road, Kingston-upon-Thames, KT2 6JY.  
Phone: 01-546 3384. Telex: 21885.

Specialists in the manufacture of usual cables such as camera types with combinations of coaxial, control, shielded and power types, all within a single sheaf. Types of sheathing available includes PVC for fixed installations, neoprene for studio or OBs, and polyurethane for OBs and particularly rugged environments. Also available audio cable, including 24AV7M with two conductors of 7/0.0076 (diameter 0.156mm), 22AV7M with two conductors of 14/0.0076, (diameter 0.18in).

**CANFORD AUDIO (UK)**  
Canford Audio, Stargate Works, Ryton, Tyne and Wear NE40 3EX, UK.  
Phone: 089422 4515. Telex: 537792.  
USA: Canford Audio (USA) Inc, 652 Glenbrook Road, Stamford, Conn 06906, USA.  
Phone: (203) 324-2889. Telex: 643678.

**Automatic cable tester Mk2**  
Type: advanced 3-way audio cable tester, operated by a single push button which activates the logic test sequence, tests cables in seven ways—A or B core open circuit, screen open circuit, A or B short to screen, A and B out of phase, A and B short circuit, LED indication of each fault, eight second test sequence for intermittents, can test any cable fitted with XLR, PO or Bantam jacks, only requires one end of cable to be connected to the tester, other end to special connector.

**DAVU (UK)**  
Davu Wire & Cables Ltd, Harrow Manorway, Abbey Wood, London SE2 9AA, UK.  
Phone: 01-310 7036. Telex: 896767.  
Spiral lap screened cables

Range of cables with stranded conductors, and helical lap screening with PVC or polyethylene insulant, and PVC sheathing. LS4620 single core 7/0.1 (2mm diameter), LS4634 2-core 7/0.2 (4.8mm diameter), LS4648 4-core 7/0.1 (4.6mm diameter).

**Microphone cables**  
Range of cables, braided shielding, PVC insulant and sheath, low noise types are specially designed to reduce to a minimum microphony caused by flexing or vibrating the cable. 7/0.2, MC5009 single core (3.25mm diameter), MC5010 2-core (4.85mm diameter), MC5006 3-core (5mm diameter), MC5014 low noise single core (4.5mm diameter). 16/0.2, MC5011 single core (3.5mm diameter), MC5012 2-core (6.3mm diameter), MC5013 10/0.1 single core (3mm diameter).

**Subminiature cables**  
Range of overall screened cables, PVC insulant and sheath, braided screen, 7/0.1 stranded conductors, 2, 3, 4, 6, 9, 12, 15, 18, 25 or 36 core overall screened, 5, 8, 10, 12, 15 or 20 pairs, overall screened. Also small multicore cables with up to 60 cores.

**EMT (Switzerland)**  
EMT Franz GmbH, Postfach 1520, D-7630 Lahr, West Germany.  
Phone: 07825 512. Telex: 754319.  
UK: FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ.  
Phone: 01-953 0091. Telex: 27502.

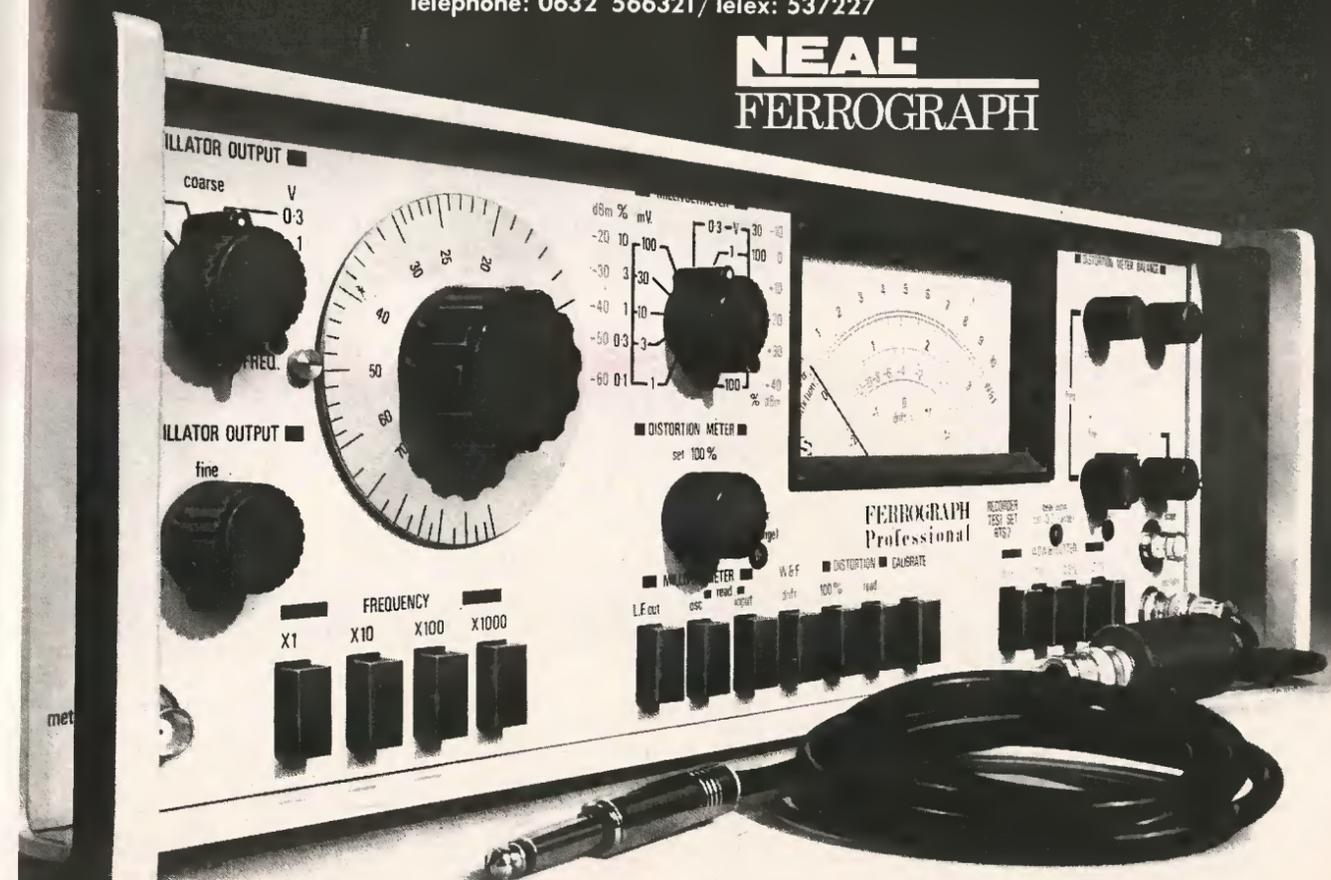
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**NEAL FERROGRAPH**



## Survey

USA: Gotham Audio Corp, 741 Washington Street, New York, NY 10014.  
Phone: (212) 741-7411. Telex: 12969.

### Audio cables

Range of cables specifically designed for audio applications. It is recommended that normal cutting and stripping implements are not used for these cables, but that the insulation is burnt off using a thermal wire stripper. These cables use a special type of screening called Reusen shielding, which comprises two or four layers of closely spaced copper wires, helically wound in opposite directions, and which is claimed to provide shielding up to 50MHz and 500MHz respectively for double or four layers, whereas normal copper braid or foil is only effective up to 100kHz. All jackets are PVC.

EMT1700 is a low capacitance coax cable with braid shield, (4.5mm diameter); 7919 is a stranded steel suspension cable for microphone winch installations; 2111 is a 2-conductor audio cable with Perlon rip thread for simplified removal of the outer jacket, 7/0.2 (4.7mm diameter); 2112 is high flexible audio cable 15/0.07 (2.7mm diameter); 2121 is audio and mains power cable two conductors 42/0.15 (6.5mm diameter); 2202 is microphone cable with two steel reinforcement strands, four Reusen layers highly flexible two conductors 30/0.1 (6mm diameter); 2510 is audio cable with two solid conductors for fixed installations with Perlon rip thread 1/0.5 (3.8mm diameter); 4113 is audio cable with two separately shielded pairs, without steel reinforcement strands 15/0.07 (5mm diameter); 4126 is similar with reinforcement (7.3mm diameter); 6209 is condenser microphone cable with steel core, two conductors of 133x0.07 and four conductors of 37x0.07 (6.3mm diameter) overall screened; 8203 is twin microphone with signal cable three steel reinforcement strands, twin separately screened pairs, four conductor screened cable, all 41/0.07 and within overall shielding making four layers (8mm diameter); 9224 is five individually screened pairs within overall shielded cable (four layers) 30/0.1 conductors (11.5mm diameter); 9225 is similar but 10 pairs (16.1mm diameter); 9622 is five individually screened pairs for fixed installations, 1/0.5 conductors, four layers of screening (9.8mm diameter); 9623 is similar but 10 pair (13.5mm diameter).

### FUTURE FILM

Future Film Developments, 36/38 Lexington Street, London W1R 3HR, UK.  
Phone: 01-437 1892. Telex: 21624.

### Microphone cables

Range of single and twin conductor microphone cables designed to withstand rough handling. All have braided screens. HDR is heavy duty rubber twin 26/0.16mm (6.8mm diameter); HDS is similar but single core (6.1mm diameter); HDX is extra heavy duty neoprene twin 41/0.16 (7.4mm diameter). Tripleflex is very flexible 3-conductor 102/0.05mm cable with Reusen double lap shielding.

### Multipair cables

Two separate types of multicore cables, M-series has individually screened pairs, each with drain wire and aluminium foil screen with polyester coating for insulation, and then overall screened and jacketed. J-series is similar but each pair has a plastic jacket in addition to insulation, the jackets being individually numbered every inch for identification. Signal pairs are 7/0.2mm, M-series is available in 1, 2, 3, 6, 9, 11, 12, 15, 17, 19, 27 and 51 pairs, J-series is available in 1, 2, 4, 8, 10, 12, 16, 20, 24, 26 and 32 pairs.

### GOTHAM (West Germany/Austria)

Gotham Audio Corp, 741 Washington Street, New York, NY 10014, USA.  
Phone: (212) 741-7411. Telex: 129269.  
UK: FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts WD6 4RZ.  
Phone: 01-953 0091. Telex: 27502.

### Microphone cables

Range of high quality microphone cables with double Reusen layer shielding to protect against EMI and RFI, three conductors for phantom powering, 96/0.05mm stranded conductors,

available in several colours. Also 10-pair cable with double shielding.

### ILLINOIS (USA)

Illinois Cable Company, 8225 N Christiana, Skokie, Illinois 60076, USA.  
Phone: (312) 679-0160.

### Two and three conductor cables

Range of shielded cables, tinned copper conductors, polyethylene insulated, aluminium polyester shield, drain wire, vinyl jacket. 7x30 gauge, 7001 2-conductor, (0.171in diameter), 7008 3-conductor (0.179in diameter); 7x28 gauge, 7002 2-conductor (0.2in diameter), 7009 3-conductor (0.204in diameter); 16x30 gauge, 7003 2-conductor (0.222in diameter), 7010 3-conductor (0.236in diameter); 19x29 gauge, 7004 2-conductor (0.292in diameter), 7011 3-conductor (0.31in diameter); 19x27 gauge, 7005 2-conductor (0.34in diameter), 7012 3-conductor (0.365in diameter); 19x25 gauge, 7006 2-conductor (0.4in diameter).

### Multiple pair cable

Range of multiple pair cables, individually screened pairs with aluminium polyester shield, overall vinyl jacketed, but not overall shielded. Available in 3, 6, 9, 11, 15, 19 and 27 pairs, in 7x30 or 16x30 gauge.

### LECTRIFLEX

Lectriflex Cables & Accessories Ltd, The Paddocks, Frith Lane, Mill Hill, London NW7 1PS, UK.  
Phone: 01-349 2011. Telex: 28915.

### Instrumentation cables

Range of cables, includes multiscreen pairs, 7/0.3mm stranded conductors with plastic coated aluminium tape shield and drain wire, overall shielded, PVC jacketed. Available in single, 2, 4, 7, 12, 20, 30, 50 and 100 pairs.

### KEITH MONKS (UK)

Keith Monks (Audio) Ltd, 26-28 Reading Road, South Fleet, Aldershot, Hants, UK.  
Phone: 02514 20568. Telex: 858606.  
USA: Keith Monks (USA) Ltd, 652 Glenbrook Road, Stamford, Conn 06906.  
Phone: (203) 348-4969.

### Cable drums

Range of cable drums, CD1 small cable drum takes approx 300ft of standard microphone cable, finished in black nylon dipped steel, fully stackable. CD2 medium drum takes approx 600ft of mic cable or 150ft of 1/2in multicore cable. CD3 large drum takes 300ft of 1/2in multicore cable.

### SGAL

Steve Graham Audio Ltd, 20 Victoria Road, New Barnet, Herts EN4 9PF, UK.  
Phone: 01-449 3663/4044. Telex: 8955127.  
USA: Canford Audio (USA) Inc, 652 Glenbrook Road, Stamford, Conn 06906.  
Phone: (203) 324-2889. Telex: 643678.

### Musiflex

Range of microphone cables in 10 colours, thermo conductive plastic screened with stranded drain wire, two 7/0.25mm stranded conductors, soft PVC sheath, (6mm diameter). Also special multicore cable designed for stage boxes providing separately layered send and return cables, includes central core with three pairs of 7/0.2mm, drain wire and conductive plastic shielding, followed by outer layer of 16 pairs of similar stranded cable, overall screened and PVC sheathed.

### Multipair cables

Range of foil screened multicore cables, 7/0.2mm conductors, foil shielding, available in 6, 12, 15, 19, 27, and 31 pairs.

### WIREWORKS (USA)

Wireworks Corp, 380 Hillside Avenue, Hillside, New Jersey 07205, USA.  
Phone: (201) 686-7400. Telex: 710-985 4675.

### TE-2

Mic cable tester, has both XLR and 1/4in jack sockets, both ends of cable must be connected to the tester. Three LEDs indicate shorts to connector cases, shorts, open circuits and out of phase wiring.

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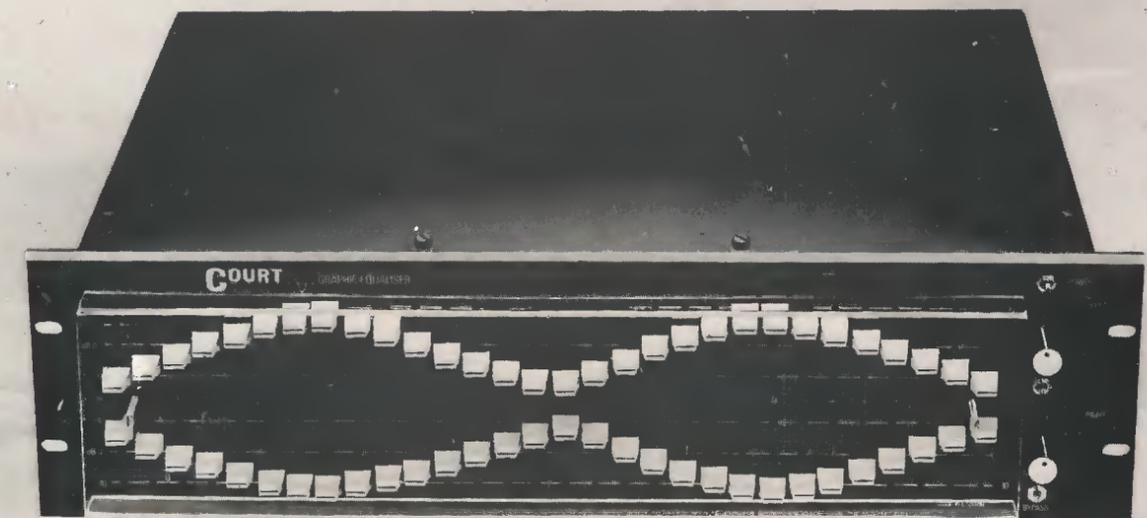
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# Survey: snakes and leads

**PLAN AUDIO (UK)**  
Plan Audio, 9 South Street, Epsom, Surrey  
KT18 7PJ, UK.  
Phone: 03727 41822.

**Powerline cables**  
Range of cables, including instrument cables in 10, 20 or 30ft lengths with jacks either end; guitar cables similar lengths also coiled; split stereo guitar cables which have a stereo jack at one end, and a splitting block with two cables terminating in mono jacks at the other; patch cables for effects boxes, etc., 1, 2 or 4ft jack to jack, 2 or 4ft male to female XLR; microphone cables in 20 or 40ft lengths, unbal to jack, or bal to male XLR, all female XLR other end; speaker cables designed around a multistrand low loss cable, various types.

**PRO SOUND (USA)**  
Pro Sound, 13717 S Normandie Avenue, Gardena, Cal 90249, USA.  
Phone: (213) 770-2330.

**Microphone cables**  
Range of coloured microphone cables, rubber sheathed cord, Switchcraft XLR connectors in either standard, QGP professional or black velvet finish, six colours of cable, lengths of 5, 10, 25, 50 and 100ft.

**PROPHON (UK)**  
Prophon Sound Ltd, 90 Wilsden Avenue, Luton LU1 5HR.  
Phone: 0582 30726.

**MX8A/16A**  
Active stage boxes that provide 8 and 16 inputs respectively, comprise a send and receive box, either standard jack or XLR connectors. An electronic scanning technique 'multiplexes' the 8 or 16 separate circuits down a single coaxial cable, units individually mains powered, may be separated by up to 200m of coax cable. Bandwidth is 15Hz to 20kHz and 20dB gain is provided.

**SGAL (UK)**  
Steve Graham Audio Ltd, 20 Victoria Road, New Barnet, Herts EN4 9PF, UK.  
Phone: 01-449 3663/4044. Telex: 8955127.  
USA: Canford Audio (USA) Ltd, 652 Glenbrook Road, Stamford, Conn 06906.  
Phone: (203) 324-2889.

**Modular stage link systems**  
Range of cables, connectors and stage boxes, multipair cables available with 6, 12, 15, 19, 27 or 31 pairs, 25m in length, additional lengths available, fitted with multipin male connectors at either end. Adaptor leads with a multipin socket, and either XLR, 2- or 3-pole jacks enable the multipair cables to be connected to a console without multipin sockets. Stage boxes are available which also have multipin sockets, and either XLR, 2- or 3-pole jacks. Types are available with 8, 10, 12, 16, 20 and 24 inputs circuits and three output circuits, or with 24 inputs and 7 outputs.

**SOUND APPLICATIONS (USA)**  
Sound Applications Ltd, 342 Lexington Avenue, Mount Kisco, NY 10549, USA.  
Phone: (914) 241-0034.

**Audio cables**  
Range of audio cables, polyurethane jacketed, types available with 20 or 24 gauge, range of colours, leads available in lengths of 1, 3, 5, 10, 15, 20, 25, 50, 75 and 100 ft. Range includes guitar cables, headphone cables, mic cables male or female XLRs and either phone plug, jack or phono, similar but in stereo, XLR double enders, speaker cables.

**STATESIDE (USA)**  
Peavey Electronics Corp, 711 A Street, Meridan, Mississippi 39301, USA.  
Phone: (601) 483-3565.

**UK: Peavey Electronics (UK) Ltd, Unit 8, New Road, Ridgewood, Uckfield, Sussex TN22 5SX.  
Phone: 0825 5566.**

**Stage leads**  
Range of stage leads, straight or curled, using Belden cable and Switchcraft jacks, various lengths.

**TECHNICORD (UK)**  
Technicord Ltd, Melbourn House, 2 Black Bank Road, Little Downham, Ely, Cambs CB6 2TZ, UK.  
Phone: 035387 721.

**Studio leads**  
Range of audio leads including PVC sheathed lead in 10 colours with Switchcraft XLR connectors, 5 or 8m long; similar but ultra flexible cable with Reussen screen; equipment lead with twin lead and twin phonos either end; similar but with jacks at one end.

**WHIRLWIND (USA)**  
Whirlwind Music Inc, PO Box 1075, Rochester, NY 14603, USA.  
Phone: (716) 663-8820.  
UK: Atlantex Music Ltd, 34 Bancroft, Hitchin, Herts SG5 1LA.  
Phone: 0462 31511. Telex: 826967.

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Range of cords with very high quality brass military jack plugs, available in 18½ft and 6¾ft versions, also curled types, also short patch cords with lengths from 1ft. Microphone cables are available with neoprene jacketed cable with Switchcraft and Amphenol connectors, as low impedance types with 15, 25, 30, 50 and 100ft lengths with male and female XLRs, and various high impedance mic cables, 18½ft long with various connectors.

**Medusa multiple wiring system**  
Range of multiway systems with stage boxes, multicore and multiple connectors for mixer. Various types, including 50ft cable with six mics in, no sends, 100ft cables with 6, 8, 9, 12, 14, 16, and 24 mics, each with three sends. Mics are terminated in XLRs for the mixer, sends (returns) are jacks. Also available with quick disconnect multipin connectors, and junction box with optional monitor split.

**WIREWORKS (USA)**  
Wireworks Corp, 380 Hillside Avenue, Hillside, New Jersey 07205, USA.  
Phone: (201) 686-7400. Telex: 710-985 4675.

**Hardwired microphone multicables**  
Range of systems comprising stage box, multicore and individual tails for mixer, in capacities of from 3 to 50 individual channels in 50, 100, 150, 200 and 250ft lengths, types include female XLR chassis to male XLR tails; male XLR chassis to female XLR tails; boxes with three returns, remainder sends; similar but with jacks for returns; female XLR tails to male XLR tails.

**Microphone multicable components group**  
Range of systems comprising floor or wall mounting boxes with from 3 to 50 circuits, terminating in various combinations of multipin connectors, also models with returns, and for rack mounting. Models available providing loop through for the multicore cables, or providing transformer splitters to drive two separate multicores, with ground lift switches, also transformer loop through. Multitails are available terminating in various connectors, and chassis mount multipin connectors with blunt end pigtails. Multitrunk multicore cables are available in 3 to 50 channels with lengths of 10, 25, 50, 100, 150, 200 and 250ft. Line boxes and line tails have the stage box wired to cable terminating in a multipin connector.

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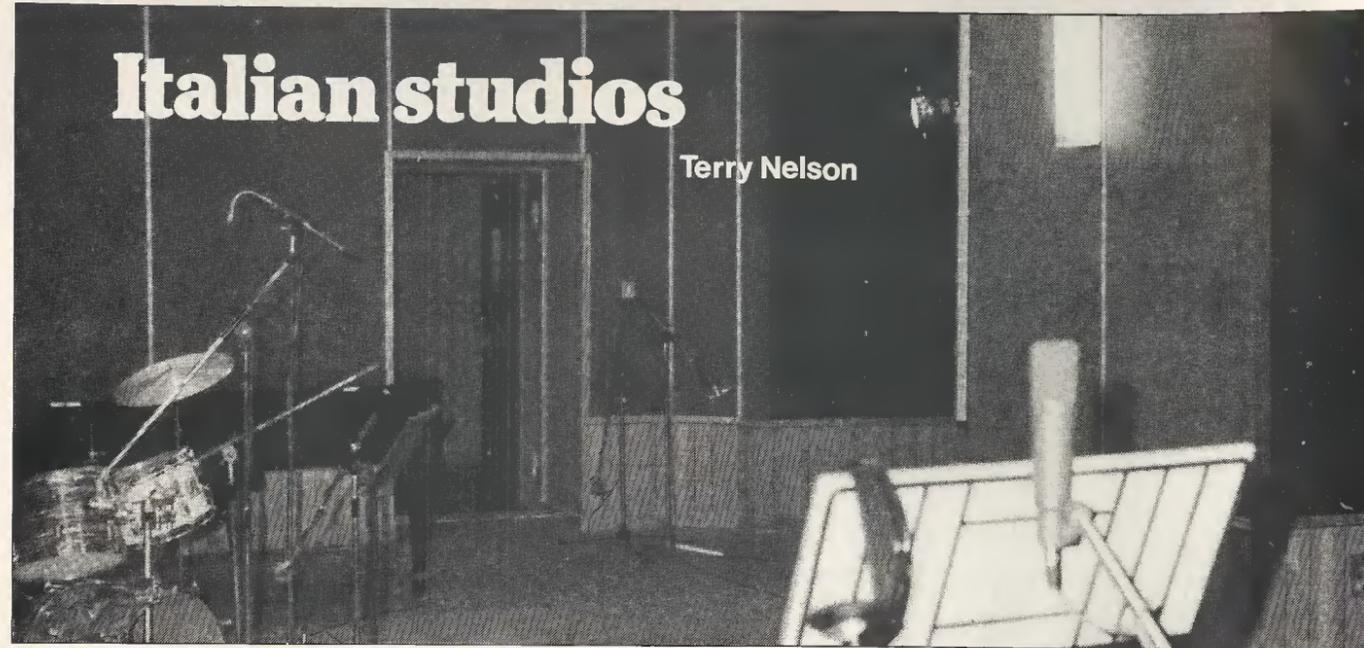
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# Italian studios

Terry Nelson



**I**N our recent International Issue we were regrettably unable to include Italy. Considering the importance of the music industry in that country, and to put things right, I recently visited several Italian studios and met people involved in the industry in Naples, Rome and Milan. These three cities are the main recording centres in Italy with the possible addition of Turin which also has 24- and 16-track studios, however, due to lack of time a visit was impracticable. Another time, perhaps. Milan has by far the greatest number of studios and is the main centre for equipment distribution for which Rome is also important. This article attempts to give an overview of the Italian situation trying not to duplicate too much of the information to be included in Studio Diary.

## Naples

The city of Naples conjures up for most people the image of sin and song — oops!! Sun and song, making it a logical place for a recording centre. This was recognised early this century by studios such as Phonotype Record who were among the very first studios and record labels in Italy and who are still going strong today. The mainstay of the musical activity in Naples is still very much the Neopolitan folk song, a style that is world famous. Naples is also a city of musicians — but there is quite a large exodus to Rome, Milan and other cities. The main reason for this is that Naples has become somewhat a victim of its own success and the hold exercised by the traditional forms of music has tended to exclude other styles, much to the frustration of musicians who would like to diversify. For this reason most of the work done in studios such as Zeus and Phonotype is 'local' with little else getting a look in.

**Last autumn in our special International Issue we reported on the state of the recording and music business throughout the world, but were unable to include Italy. However, Italy has much to offer as Terry Nelson explains.**

Five years ago a certain Signor Faiella — otherwise known to millions as popular singer Peppino di Capri — had his own studio built so he could make records in his own time and, as the story often goes, ended up with a commercial studio on his hands, called Splash. From the start Splash specialised in album work so it was able to encourage the rock and pop oriented musicians to stay in Naples to record while still attracting some outside custom. The studios were originally equipped with a 20/16 Cadac console and Ampex MM1200 16-track recorder. New studios, which are now almost complete, will house the already delivered and used Solid State Logic SL4000E 40-channel desk and Studer A800 24-track recorder with McIntosh/Tannoy Buckingham monitoring and collection of goodies. The present studios will be used as rehearsal rooms and for budget priced recording/demo work.

Daniilo Rustici, chief engineer and musician, told me that the original plan had been to build the new Splash on the island of Capri but after considering likely communications problems, ie, no ferries in bad weather, it was decided to build the new studios on the mainland just outside Naples. The studios have been built from the ground in a little canyon (should make for a great natural echo) just minutes from the city and I hope to be able to cover them in a future instalment!

In fact update would seem to be the keyword for the Naples studios with Phonotype building a new complex

for record production being scheduled to include a top-line studio, and Zeus re-equipping and expanding its operation to two studios. There is a definite campaign to put Naples on the recording map and to encourage the local musicians to stay as well as attracting clients on a national and international scale. Though none of these studios would really qualify as 'get away from it all' types, the city of Naples is a big enough attraction in itself and you wouldn't want to get away from it! After the jet-set studios you might like to try something completely different.

## Rome

Next port of call was Rome and due to shortage of time I was only able to visit two studios, Trafalgar and Forum, with the latter being a new studio that had only opened its doors four months beforehand. As well as being a music recording centre Rome is also where a lot of film work is done and it comes as no surprise to find that most studios are fully equipped for recording film music. As far as discs are concerned the bulk consists of material destined for the hit parade or popular markets. The disco market appears to be still strong in Italy and has not suffered the rather sharp decline experienced elsewhere so quite a bit of disco music is still being recorded though it does tend to have a certain 'looseness' about it that renders it less rigid than that generally heard. At the moment few foreign artists are recording in Italy and there is a definite will to try to change this. Equipment in the Rome

studios for the most part can be called 'state of the art', to use a well-worn phrase. Though automation would still seem to be the exception rather than the rule most studios planning to update intend to include automation. If there can be said to be a deficiency anywhere it is on the human side. Speaking to engineers I got the impression that there is a shortage of people who really know how to use the modern equipment to its full advantage, though, as is often the case, this may be due to the lack of opportunity for experimentation. Because of this, the gap between the 'good' engineer and the 'average' one is a lot wider than would be usual elsewhere. There is also little opportunity for trainee engineers though to be fair when I did run across assistant engineers they really were assisting and not just making the coffee! For many people one of the best training grounds for engineers in Italy is still the RCA studios in Rome. Unfortunately, I was not able to visit this studio due to my rather rushed itinerary (that will be for my next Roman visit) but as both the engineers at Trafalgar were ex-RCA men I was able to get some snippets of information, one of them being that the studio continues to keep up to date with equipment and were the first in Rome to install a Harrison console — recorders are Studer.

RCA is something of an institution in Rome as regards the recording world and all agree that an engineer trained by the RCA studios has no problem whatsoever in going on to better things though the feeling is that they sometimes tend to be a bit old-fashioned. It would appear that it is this conservatism that encourages engineers to leave RCA once they gain a reputation.

In spite of its importance in the music industry Rome is not exactly

overflowing with studios and as far as I could gather there are only about five, possibly six, fully professional multitrack studios in the Rome area. One of the reasons ventured for this is that Rome is considered above all as a film city and that 'music city' is Milan and while there is enough work in film and disc to keep the studios going happily, there is not the demand to encourage many newcomers into the field. New studios are obviously not unheard of as Trafalgar and, much more recently, Forum bear witness though in both cases the studios are staffed by people who are well known in the Roman recording world. I think that the potential is there but that it will come when the existing studios encourage and open up the rock and international scene and give the incentive for musicians and artists to come to Rome to record.

## Milan

Containing what must be about 80% of the studios in Italy, Milan is by far and away the recording centre in the peninsula. It must also be remembered that Milan is also the capital of the industrial north and a very important commercial and business centre with easy access through to France and central and eastern Europe. Most of the studios visited were 24-track and ranged from fairly modest setups to complete complexes offering recording, disc mastering and pressing, duplicating and printing. The most complete complex in Milan is probably CGD-Messaggerie Musicali SpA, or Sugarmusic, which in one group of buildings houses recording studios of considerable sophistication including a brand new Eastlake mixing suite with Solid State Logic SL4000E computerised desk, copy room, disc mastering suite, record pressing plant and cassette duplica-

tion, printing presses for sleeves, jackets, promotional material, music publishing and musical instrument importation. What might be referred to as a complete service! Another large complex consists of the new Polygram studios in the centre of Milan. The company activities take up most of a new office block with the studios occupying the top floor of the building. (Don't worry, service lifts are available!) The whole studio area is Tom Hidley's design handiwork and Polygram are very pleased with the results. The other Eastlake studio in Milan is Il Mulino which was in the country and moved into town just over two years ago. Such well known names as Ricordi and Durium also have their studios in Milan and the Italian penchant for unusual studio locations is satisfied with La Basilica which is in a church and with acoustics that most people only dream about! Modernisation is also in the air as studios with older equipment feel they ought to move up into line with the newer facilities. There is, however, very much a 'wait and see' attitude. Whereas those wishing to update are ready to invest, they want to see how the equipment marketplace is going in order not to find themselves with equipment that will be outdated after only a year's use.

Musically, things are a lot more varied in Milan and while there is still

a lot of 'traditional' and hit parade material, the rock and progressive sides of things are also more dominant. One must not forget the classical music area, either, and the opera house of La Scala provides a rich source of musicianship.

Like everywhere else, Italy has its own getaway from it all studios and the prime example of this is Stone Castle at Carimate, Como near Milan. This is the brainchild of producer Tony Casetta and despite initial difficulties that would have deterred the less hardy, the studios are now well underway. As he says, you have to be a little bit crazy to want to build recording studios in a 15th century castle but the two Eastlake designed rooms are now working nonstop and in fact a good 30% of the Italian hit parade is recorded here. Mr Casetta's aim was to have world class studios to attract customers from everywhere and to make them "take Italy seriously and see that we mean business".

## General

A few comments on the subject of equipment are probably in order and from the studios visited it would seem that the Italians like British desks with Cadac taking the lead followed by Trident, though there is now quite a strong showing by Harrison. Recorders would seem to be almost

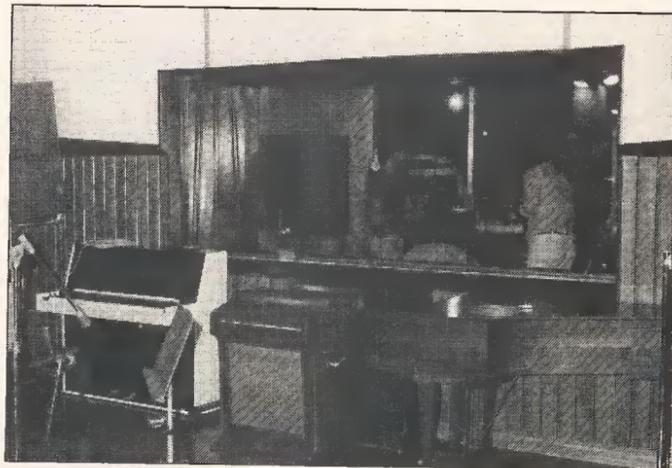
they would like! The high duty situation may also be a reason for the rather surprising lack of 'Teac-Tascam' type studios. From what I could gather there seemed to be very few of these, or at least very few studios that were open for public business. Monitors also have their partisans and the JBL 4350 would appear to be quite widespread though there is also the Eastlake/Tannoy camp!

One thing that was very noticeable and I have made allusion to it elsewhere, is the very relaxed attitude in the studio and the freedom from the somewhat tense atmosphere that often reigns at studios elsewhere. Though things tend to tighten up a bit in the North (in keeping with the northern character) the overall impression is the same. Not that this in any way represents a slap-happy attitude to the job in hand but rather stems from a camaraderie from all involved in the recording. Another point worth mentioning is that studios start work early in the morning and 9.00 am sessions are not at all uncommon! Italian studios tend to have a large selection of instruments available to the visiting musician so you don't have to hire a truck if you have to do a session.

## Market

Record distribution for labels such as EMI, WEA, Polygram group, etc, are handled by their Italian offices whereas the large Italian labels such as CGD, Ricordi, Durium and RCA handle the distribution for foreign records as well as their own national artists. In some cases this also involves the recutting of certain records as happened to a Boney M album when I was at Durium. Naturally enough, the subject of pressing quality came up when I was visiting studios with their own pressing plants and the overall impression was that they were proud of the quality of their records and that as far as they were concerned, all steps were taken to ensure a reliable product. CGD, for instance, have a very rigorous spot check procedure with five people working full time on record testing. Should a faulty disc be found then all records pressed by that particular press since the time the test sample was taken are rejected and a new test made to see whether the stamper is at fault or the vinyl. The manager of the CGD plant, Luciano Zemignani, felt that most problems, such as warped records, occur after the discs leave the plant and are caused by bad stocking conditions. As I was able to see for myself the care taken at CGD in stocking is considerable, to say the least. I must admit that I have heard quite a selection of Italian pressings and not noticed anything unduly untoward.

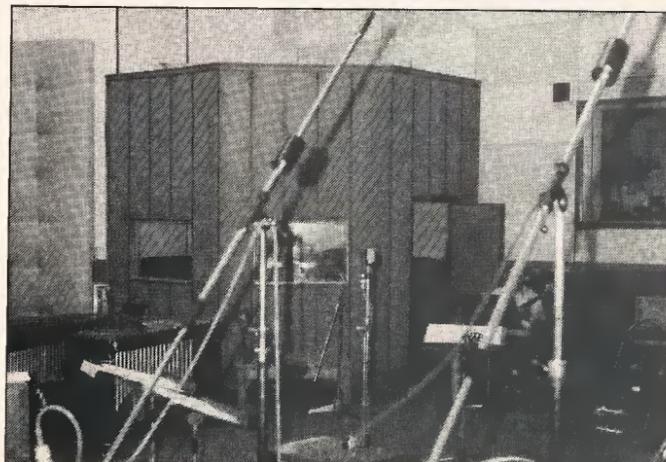
As far as the actual market is concerned, there has been a fall off in the



(left) Studio at Zeus, Naples

(right) View from the studio at Forum, Rome

(below) Phonotype's studio and drum booth, Naples



exclusively Studer and Telefunken. Italian engineers are very axed on quality and feel that an initially higher investment is more economic in the long run. Another fact that influences decision making is the rather swingeing import duty on audio equipment and the often less-than-perfect service provided by importers. This latter point was a source of grievance to many engineers I talked to as well as the economic infighting that goes on to keep customers buying only the range of products distributed by that particular importer and as it is the manager that pays the bills, the engineers often have to content themselves with what the manager says they can buy rather than with what

## Italian studios

sales of LPs and an upswing in singles, the latter being in a very healthy situation. Some people thought that this marked a resurgence of a strong hit parade market with less emphasis being placed on buying albums. As always, opinions differ on this kind of subject as to the results. One record producer felt that the present music scene was such a hotch-potch that no one knows in which direction things are going to go and this, coupled with the large percentage of mediocrity being issued at the moment, was a large influence on the uncertain state of affairs. Another prominent personage had some quite strong words to say about the record companies and felt that the present situation was no small fault of their own. His view was that record companies should make a return to the 60s style of doing things which is searching out raw talent and developing it, without giving out vast hand-outs in advances and not making huge outlays on 'superstar' attractions that only just break even, if that! While being the first to agree that records need publicity, this often gets transformed into a good excuse for large expense accounts bringing in little or no promotional value. So there you go, another example of

*Studio Sound's* finger on the industry pulse! Coming back to the serious business or record sales, Italy would certainly appear to be a marketplace for an extremely wide variety of music with records in the hit parade by British, American, French and other continental artists as well as the whole gamut of Italian styles. Magazine coverage of the music scene, both records and concerts, is very thorough and again ranges from serious trade magazines such as *Musica e Dischi* to the very worst type of fan rag, with all stops in between.

Live music is also very popular and judging from the amount of posters and publicity one sees in Italy, alive and well. Concerts run from multi-thousand attendance in sports stadiums to small clubs specialising in folk, traditional song and what-have-you. To give a list of all the important artists would be impossible (unless you want a special edition on them) but it is worth mentioning some. On the rock front probably the best known group internationally are PFM with perhaps Banco claiming a select following. Pooh are huge in Italy but not really known outside of the peninsula, in spite of their superstar status and the fact that they have been going for about fourteen years.

Several concerts are organised in collaboration with the Communist Party as part of their cultural pro-

gramme. It also means a reasonable security service and that things are ready on time — or almost! Having had some experience of touring in Italy where the concerts were involved with the Communist party I can only say that in the main things went pretty smoothly — and that no speeches were involved. The public seem to like it loud and if they don't think they are hearing well enough they soon let you know about it!

Outside of the United States, Italy must be the country with the most television channels. Certainly in Europe. The RAI or state radio and television still holds the monopoly on the radio with three programmes but no longer has the same hold on TV. Around Milan alone it is possible to tune into over 30 stations! These comprise the three RAI TV channels, Antenne 2 from France, Italian speaking Swiss TV, TV Monte Carlo and a host of local stations. Programmes to suit all tastes are available, even to the extent of late night porno films and integral striptease at closedown! The three radio channels are much on the lines of the old BBC Light, Home and Third programmes whereas the RAI TV channels 1 and 2 are fairly competitive with channel 3 being similar to BBC 2 with a higher proportion of 'serious' programmes. In fact there is a debate going on in Italian musical circles as to the type of music

coverage there should be on channel 3, which is in itself very recent. Many people would like to see a wide variety of styles presented from classical and light music to rock, jazz, folk and local musical activities, with perhaps an accent on filmed concerts.

Music obviously takes a big place in Italian way of life and certainly the music industry, while suffering the ups and downs like everywhere else, would appear to be in a pretty healthy state. The wish to become more international in their dealings is evident and in the long run this must be to the benefit of everyone. However, there is one point that must be raised and that is the question of language. Whether we like it or not, English is the international studio language — in much the same way as it is for airlines and air traffic — and though the majority of engineers that I spoke to knew English in varying degrees of proficiency, hardly any of the secretaries I spoke to on the phone, did, which meant my scraping to the hilt my meagre quota of Italian phrases! In several studios I visited we also spoke in French which is fine for French visitors or people like me who live abroad but bad news for many Anglo-Saxons! On the other hand, there was never any doubt about the warmth of the welcome at all the studios visited and I can only say to all those that I met "Ciao e grazie!"

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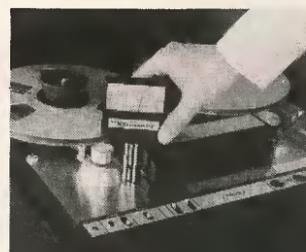
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# Balanced or unbalanced?

Ted Fletcher (Alice)

**H**ISTORICALLY a 600Ω line should be loaded with a 600Ω resistor at its termination. Under this condition it will operate at its correct level; however in this article, we will be considering low impedance drives that require no loading.

## Unbalanced line

The simplest form of interconnection of audio signals is the unbalanced line. A device or amplifier creates an ac voltage (the signal) at a single point. The difference in voltage between that point and a ground reference is the output (see fig 1).

Similarly, an unbalanced input senses a signal with reference to its own ground; this is fine provided that the two grounds are precisely the same. Bear in mind that if any current is flowing in a piece of wire, the voltage at one end is not the same as at the other; the wire possesses resistance and if the current is ac, a signal will be present between the two ends. In a ground wire this signal will be added to the audio signal and will appear generally as hum. The classic example is of two pieces of equipment grounded to different earths — producing a 'hum loop'. Although adequate for very small installations it is obvious that this arrangement is less than satisfactory for serious system building.

## Balanced line

The classic balanced line is formed by a device or amplifier producing two equal out of phase signals via a transformer. The signals are carried via shielded cable to a second transformer which re-converts the signals to unbalanced form and, in so doing, cancels any interference which may have encroached on the line (interference signals would appear as in-phase components which cancel each other in the input transformer).

Fig 2 shows the familiar floating balanced arrangement used extensively in broadcast systems. Earlier arrangements used a centre-tap on the transformers to provide a fixed ground reference.

**During the setting up of any audio installation, engineers come up against the problem of 'matching' unrelated equipment. This is an area where a little understanding can overcome a host of problems.**

## Transformer

The transformer was developed to a high degree of sophistication partly because — until the use of high performance silicon devices — impedance conversion and balanced operation were difficult and inefficient. The transformer combines the following facilities:

- 1 impedance conversion with minimum power loss;
- 2 electrical (dc) isolation;
- 3 wide bandwidth;
- 4 common mode rejection in balanced systems.

These facilities are compromised by economic and size considerations; high performance demands accurate manufacturing techniques and good materials. Good audio transformers are bulky and expensive, so equip-

ment designers look to avoid them wherever possible. Modern circuit technology readily eliminates the requirement for facility (1): output circuits are now available with impedances from zero to infinity. Isolation of dc can be achieved in other ways, and facilities (3) and (4) are catered for much more efficiently by solid state circuitry than by transformers. For example, the common mode rejection (CMR) of a good differential amplifier can be as high as 100dB throughout the audio band, while a transformer struggles to meet 60dB at high frequencies. The low frequency response of a transformer is limited by the ferrous core while an operational amplifier is efficient down to dc. It would seem, therefore, that transformers are redundant —

but solid state circuits bring their own problems.

## Differential input

Integrated circuits have been used for some years as 'balanced' (or more correctly, 'differential') inputs. The integrated circuit operational amplifier is a very high gain device with high impedance inputs and low impedance output.

In fig 3, the operational amplifier is arranged in unity gain mode. If an unbalanced signal is fed into either positive or negative inputs, the output will be unity gain — the disadvantage (compared to a transformer) is that as soon as the input becomes unbalanced, it is immediately referenced to the ground of the amplifier, making ground loops possible. When fed from a transformer, the input stage becomes a floating input with all advantages of transformer coupling but without the limitations of an input transformer. This set-up holds good provided that common mode 'interference' signals are small. Should they approach the supply voltage for the device then failure can occur but this is extremely unlikely. This interconnection system is widely used in recording and broadcasting studios in the UK.

## Differential output

A growing number of manufacturers, particularly in North America, use transformerless balanced outputs. Fig 4(a) has the major disadvantage that any loading of either output phase can cause malfunction; fig 4(b) resolves the loading problem, although the arrangement is more complex. Both circuits have the prime disadvantage that all outputs refer directly to the amplifier ground — a condition to be avoided. I have not yet tested a satisfactory transformerless 'balanced' output.

## Making the best of it

Modern line amplifier designs provide very low unbalanced output impedances with distortion and response figures many times better than

## Definitions

**Impedance.** The amount of resistance which when applied across a signal, reduces its amplitude by 6dB.

**High Impedance Input.** An input of resistance greater than 10kΩ which will have little effect on a low impedance source.

600Ω. (Zero impedance meaning that any reasonable load applied will not affect signal level.)

transformers. These low impedances make the amplifiers perfectly suitable for driving moderate distances (until wire resistance becomes significant) with no difficulties from induced noise; the problem arises when the signal meets its destination.

A 'best of both worlds' answer is shown in fig 5. A high performance line amplifier is connected via a long line to a differential input amplifier. The 'balanced' input sees a low impedance source which is not connected to its own ground reference (G2). If a difference of potential exists between G1 and G2, it will not appear at the output because any signal appearing on G1 will form a common mode signal and is consequently rejected. This system possesses most of the advantages of a true balanced system but without the performance limitations.

If a jackfield is wired in accordance with fig 6, the system will interface with balanced and unbalanced systems with minimum chance of problems with varying ground potentials. Care should be taken to connect all chassis grounds to a single ground point to eliminate the risk of common mode signals exceeding the input capability of differential inputs thus causing severe distortion or the destruction of the input devices. This system of connection is becoming increasingly useful because of the wide acceptance of recording studio 'goodies' whose specifications quote balanced inputs and outputs. They are most often transformerless systems and can be troublesome on conventional jackfield wiring.

## 'Semi-professional' equipment

Enterprising engineers often make use of equipment designed for domestic use and with unsophisticated terminations. The circuit in fig 7 offers an interface to professional systems following the guidelines given above. This circuit is a line drive amplifier with high input impedance, variable gain up to 30dB, and very low output impedance. It is ideal for interfacing 'semi-professional' tape machines and equipment into a professional system where it is possible that VU meters may be directly connected across the line. Noise is about 100dB below the input level (add the gain in dB to 100 to get the output noise figure) and, when working at gains of less than 15dB, the distortion and overload characteristics are adequate. The maximum output is +19dBm with a 24V supply

FIG. 4 TRANSFORMERLESS BALANCED OUTPUTS

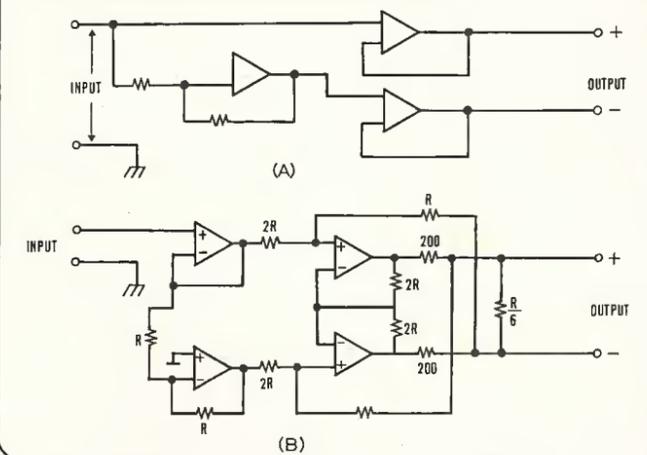
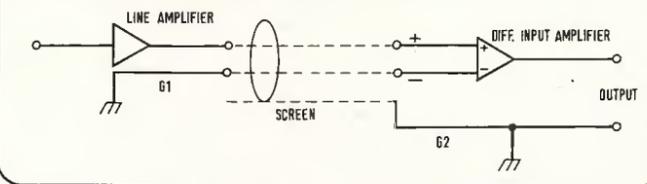


FIG. 5 LINE AMP TO DIFFERENTIAL INPUT AMP



always been used to interface the microphone with the input circuitry. The reasons are many:

- 1 it is difficult to design a circuit with optimum noise at a source resistance of 200Ω;
- 2 transformers offer good com-

- mon mode rejection and excellent dc isolation;
- 3 transformers can offer optimum impedance to the input circuit with zero power loss;
- 4 phantom powering is simplified;

86

FIG. 6 WIRING FOR INTERFACE WITH BALANCED AND UNBALANCED SYSTEMS

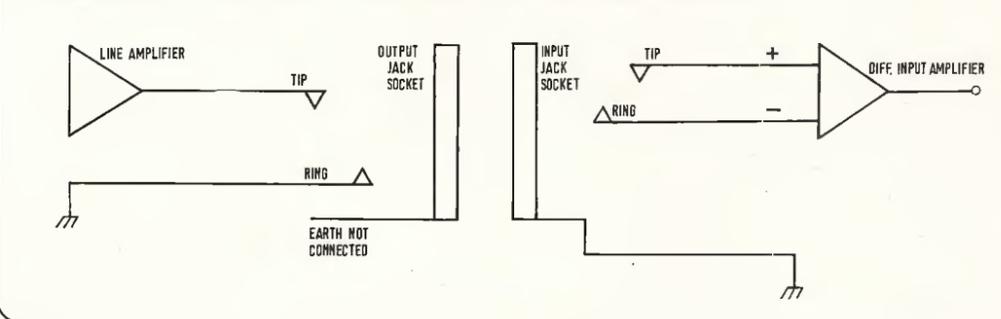
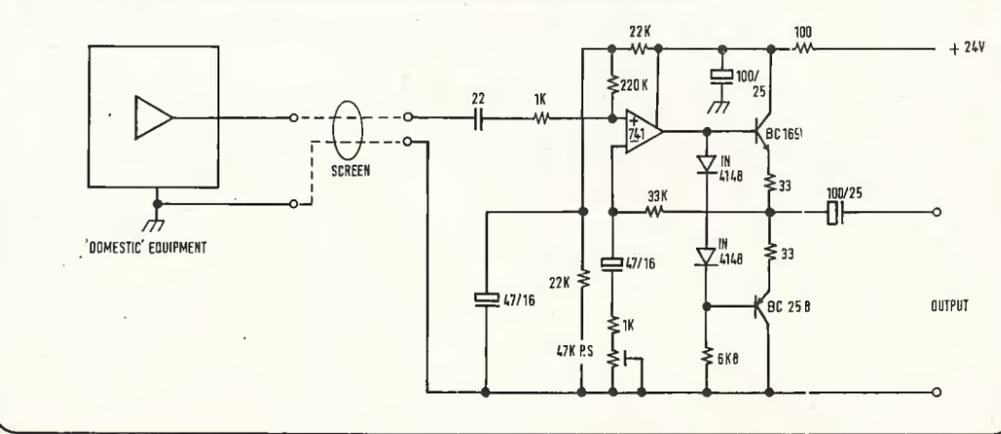


FIG. 7 CIRCUIT TO INTERFACE DOMESTIC TO PROFESSIONAL EQUIPMENT



## Balanced or unbalanced?

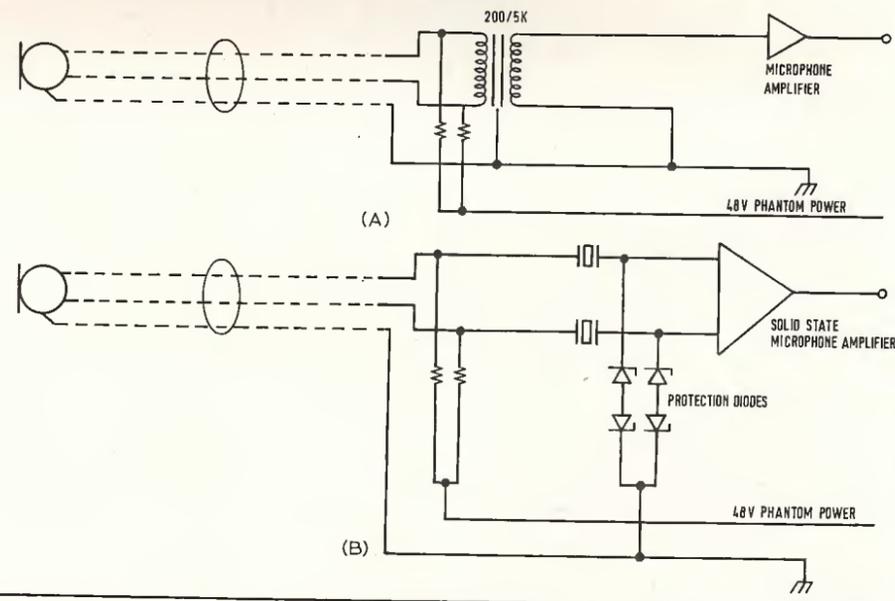
5 transformers are usually resistant to rf transfer.

The only real disadvantages are those of cost and size.

Very recently, the technology has been developed to eliminate most of the disadvantages of transformerless inputs and these are slowly being accepted into professional equipment. It is now realistic to produce an audio system completely devoid of transformers and with a performance superior to anything available five years ago.

Fig 8(a) shows the normal microphone input to a sound mixer. The signal is converted from 200Ω to 5Ω impedance by the transformer — with a consequent voltage amplification. This is then amplified and converted back to low impedance by the microphone amplifier. The input impedance of the amplifier has to be high in order to reflect an 'open circuit' condition at the microphone; this avoids power loss. Because of the voltage gain across the transformer, the input level is restricted to the input capability of the amplifier divided by the voltage gain of the transformer. In fig 8(b) the input amplifier has a basic input impedance of about 6kΩ which is ideal for a

FIG. 8 MICROPHONE INPUT TO SOUND MIXER



microphone (1kΩ is adequate). Having overcome noise problems in the design, the major bonus is its input signal capability. A normal transformer input will accept levels up to -15dBV (allowing for an overload margin of 20dB) which is a marginal level for some capacitor micro-

phones. The solid state input is 15dB better in its signal handling capability — and with vastly improved distortion and phase performance.

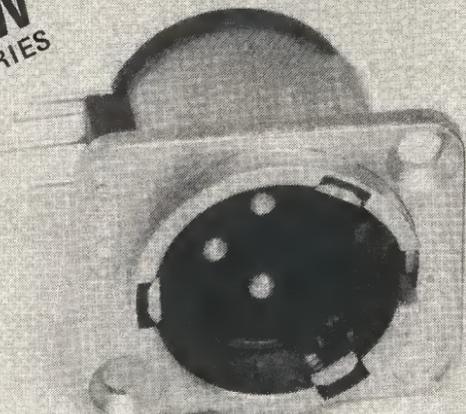
Cost is still a problem with these new circuits, but it must be concluded that the days of the microphone transformer are numbered. The line transformer will have its place in large systems for many years yet, for

although the problems with differential systems can be minimised by careful attention to ground references, in broadcasting one is not able to control the conditions of the various terminations — it would indeed be folly to attempt to drive 10 miles of cable without a terminating transformer. ■

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## Audio cables

**M**ODERN AUDIO EQUIPMENT uses a number of means for interconnecting the audio signals, both within a piece of equipment and between different units.

In small pieces of equipment, the interconnections consist of printed circuit tracks and maybe short lengths of unscreened wire — no special cables are required for these short length runs in an already screened environment. However, as the equipment becomes larger and more complex it is necessary to contain the audio signals for a number of reasons. Firstly, it may be necessary to avoid the pickup of power frequency hum and its harmonics; secondly, it becomes necessary to isolate the inputs from the outputs of any amplification stages to eliminate any feedback which could cause instability; and thirdly, it becomes necessary to isolate the audio signals from each other.

Within equipment, much of this is achieved by using single screened cables but as we proceed to the outside world the problems frequently become more severe.

Whilst the use of balanced or floating interconnections between equipment is common, there remains the problem of pickup of extraneous signals by the interconnecting cables, bearing in mind that these may pass close to power cables, which in some situations may feed high currents to such evil devices as thyristor controls, which often place fast transients into the power frequency signals. There is also the problem of passing close to transformers and other electromagnetic devices which radiate a magnetic field.

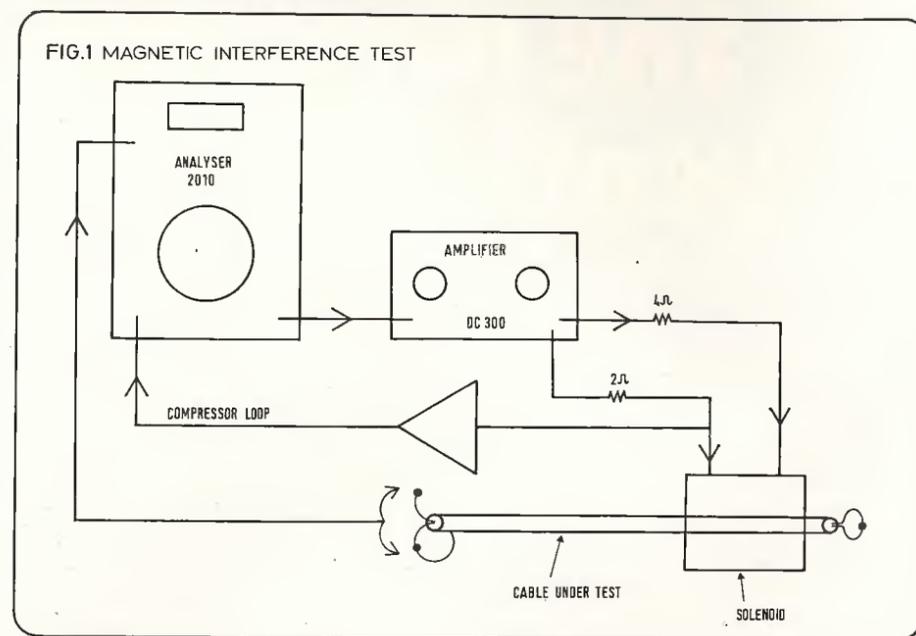
The above remarks apply equally to cables interconnecting equipment as to microphone cables where the signal levels are much lower and better screening is required, but in the world of professional audio, the latter are invariably balanced connections.

As the studio environment has become more complex, the use of a single cable for each interconnection and for each microphone, etc has become unwieldy; if 72 or more cables are required to connect a 24-track recorder, they need careful handling if some infernal 'birds-nest' is to be avoided. Also, careful and logical cable identification is required.

These complexities have led to the use of multipair cables, not only for connecting recorders to the desk, but also for connecting the microphone inputs of the desk to the studio. The latter application may not only feed the desk input to a 'stage box' equipped with XLR connectors, but may also connect the desk foldback to the stage box. Clearly the latter application imposes very severe crosstalk restrictions upon the multipair interconnecting cable which in this instance is handling both low level and high level signals.

In this review of audio cables, both microphone cables and multipair cables have been examined and tested, with the separate results for the two types of cables being shown separately. However, many of the tests on the two types of cables were similar.

All suppliers of the samples were requested to supply 10m of each cable type. As is all too common with reviews, the degree of cooperation left something to be desired, with some lengths being



short and others long with requests not to cut the cable!

### Tests

Initially, the overall physical dimensions of the cables were measured, with the cables being carefully stripped to count the number of conductors and measure their diameter with a micrometer to within 0.003mm.

Next, the other end of the cables was stripped and the ends bared so that the capacitance between the conductors and the shield, and between the conductors themselves could be measured with a 0.1% accuracy bridge. Also using a bridge, the resistance of the conductors was measured by shorting one end of a conductor pair and then measuring the resistance of the loop so formed. These results are reported in Tables 1, 2 and 3 in terms of capacitance (pF/m) and resistance (in mΩ/m) for a single conductor.

Using a non-destructive high voltage insulation tester the resistance between conductors was measured at 500V dc, and the worst-case breakdown voltage, either between conductors or between a conductor and the shield, was determined with the breakdown current limited to 0.1μA and the maximum voltage limited to 30kV.

As a cable may be close to, or touch, hot objects such as water pipes and lamps, the performance of the cables was assessed by applying a hot, temperature-controlled soldering iron to the outside and the resistance to damage reported as good, medium or poor 'burn resistance'.

With some cables, excessive heat when soldering makes the insulation shrink, and may bare the conductor at its junction with the shield. These difficulties were assessed and reported in terms of good, medium or poor 'soldering'.

Terminating cables also involves clamping the cable in the connector by means of some com-

pressing device. The cable should be capable of being clamped without damage to the conductors, and preferably with the shield and conductors both being adequately clamped. If the conductors can slip within the shield, strain may be put upon the conductors' terminations, particularly if the shield can stretch. Cables were assessed here as good, medium or poor clamping capability.

In general, stiff cables are easier to coil than very flexible cables, which are not only prone to getting into knots, but also difficult to coil by hand into a neat coil — this feature was assessed as good, medium or poor coiling.

The final physical feature to be checked was the stiffness of the cables at room temperature and at -5°C to simulate storage in a mobile in winter conditions. In general, stiff cables lie better on the floor or stage without forming loops — which are not only a danger to personnel who may trip on them, but also may catch on mobile equipment or become visible to an audience. On the other hand, very flexible cables are better for handheld microphones, and can be bent into a smaller radius without becoming damaged.

### Pickup of interference

Two different tests were undertaken to evaluate the degree of screening offered by the samples. In the first test, the cables had the end of one pair shorted, with the other end of the pair being fed to a Bruel and Kjaer 2010 heterodyne analyser set to 3.16Hz bandwidth. The sample cable was then passed through an air-cored solenoid which was fed at constant current from the heterodyne analyser's oscillator via an Amcron DC300 amplifier (see fig 1). The resulting pickup of the signal by the cables was plotted against frequency from 20Hz to 20kHz.

In the second test, an attempt was made to evaluate the sample's capability of rejecting inter-

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ference from power cables which may transmit transients into the audio circuits. The current waveform from thyristor-controlled equipment may take the form of the waveform sketched in fig 2, or a similar waveform containing transients.

The set-up used for this measurement is shown in fig 3, where a pulse generator is used to produce a fast 1kHz squarewave which is fed to an electronic switch which is used to produce high-current squarewaves in a single wire attached to a 27mm thick board. A 1m length of the cable under test is attached to the other side of the board, thus being separated from the induction wire by a constant spacing. At one end of the cable under test the ends are shorted (excluding the screen in the case of twin cables) and the other end is fed to the input of a differential high gain oscilloscope with an amplifier having an output giving 68dB gain.

A spectrum analysis of this output was performed using a Bruel and Kjaer 2010 heterodyne analyser and a 2305 level recorder, thus analysing the unwanted signal induced into the cable under test. In all cases the 1m length of cable under test was arranged with care to produce the maximum output as shown on the oscilloscope.

Measuring the crosstalk in the multiway cables was achieved by passing a constant-current audio frequency sine wave signal at 1A through one pair and then measuring the voltage induced in the adjacent pair by means of a tracking spectrum analyser and plotting the results which showed an increase of crosstalk with frequency at 6dB/octave.

Clearly, testing the adjacent pair is a worst-case test, and it must also be borne in mind that the crosstalk depends upon the length of the cable. In order to make direct comparisons possible, the crosstalk has been normalised for a 1m length of

FIG. 2 CURRENT WAVEFORM FROM THYRISTOR-CONTROLLED EQUIPMENT

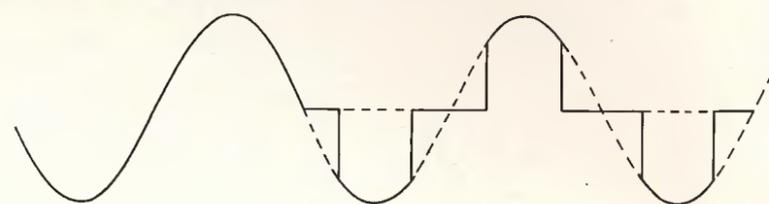
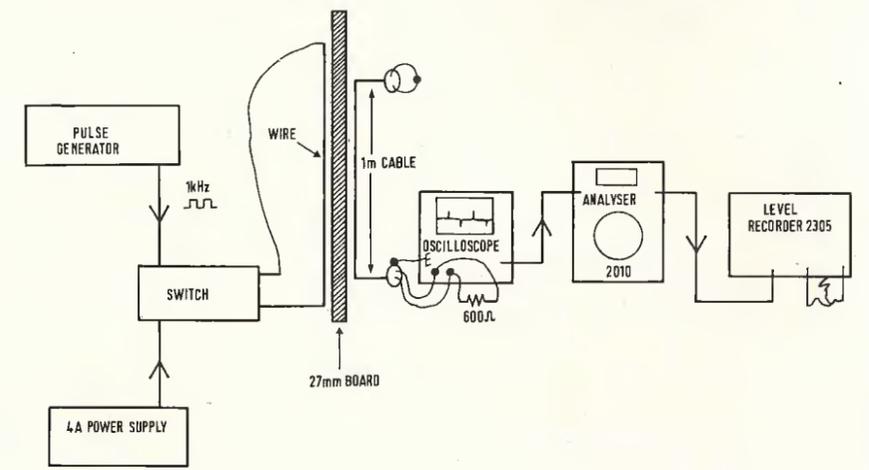


FIG. 3 IMPULSIVE INTERFERENCE TEST



	BELDEN 8412	EMT2111 Terra	GOTHAM	MUSIFLEX	FUTURE FILM DEVELOPMENTS					NEUMANN BV2461
					CAB HDR	CAB HDS	CAB HD	CAB MED	CAB STD	
Number of conductors	2	2	3	2	2	1	2	2	2	3
Size of conductors (mm)	26/0.17	7/0.21	78/0.05	7/0.25	26/0.16	26/0.16	41/0.16	7/0.19	13/0.20	102/0.048
Type of screen	TINNED BRAID	TWIN WRAP	TWIN WRAP	CONDUCTIVE	TINNED BRAID			SINGLE LAP	BRAID	TWIN LAP
Drain wire (mm)	NONE	NONE	NONE	7/0.25	NONE	NONE	NONE	NONE	NONE	NONE
Outer diameter (mm)	6.68	4.56	4.8	6.1	6.5	5.7	7.2	4.7	5.8	4.9
Outer material	RUBBER	PVC	PVC	SOFT PVC	RUBBER		NEOPRENE	PVC	PVC	PVC
Insulation material	RUBBER	PVC	POLY-ETHYLENE	POLY-ETHYLENE	RUBBER			PVC	PVC	PVC
Bore (mm)	5.4	3.4	3.2	2.4	4.2	3.4	4.7	3.7	2.8	3.7
Conductor colours	W/Bk	Bk/Gy	Bn/Gn/W	Y/CLR	Bk/W	Bk	Bk/W	R/Bk	R/Bk	W/Bn/Gn
Outer colours	BLACK	L't Bn	RED	10 off*	BLACK ONLY			10 off*	10 off*	Dark Bn
Resistance (mΩ/m)	34.5	77	88	49	34	33	21	44	85	84
Capacitance (pF/m): between conductors conductor to screen	107 198	53 103	139 232	63 131	111 193	N/A 245	112 198	134 242	157 299	102 177
Insulation resistance (mΩ/m at 500V dc)	10 <sup>4</sup>	>10 <sup>7</sup>	3 × 10 <sup>6</sup>	>10 <sup>7</sup>	>10 <sup>7</sup>	>10 <sup>7</sup>	>10 <sup>7</sup>	33 × 10 <sup>3</sup>	>10 <sup>7</sup>	>10 <sup>7</sup>
Breakdown voltage (kV)	25	>30	10	>30	>30	>30	>30	>30	>30	>30
Weight (g/m)	52	32	34	44	50	40	81	35	48	35
Burn resistance	GOOD	MEDIUM	POOR	MEDIUM	GOOD	GOOD	GOOD	POOR	MEDIUM	MEDIUM
Soldering	GOOD	GOOD	MEDIUM	GOOD	GOOD	GOOD	GOOD	MEDIUM	MEDIUM	MEDIUM
Solenoid pickup (dB)	77	85	90	90	77	90	75	83	85	83
Stiffness: at 20°C at -5°C	POOR MEDIUM	MEDIUM POOR	GOOD V GOOD	MEDIUM V POOR	MEDIUM MEDIUM	MEDIUM MEDIUM	POOR MEDIUM	MEDIUM V POOR	MEDIUM V POOR	GOOD V POOR
Colling	GOOD	GOOD	MEDIUM	GOOD	GOOD	GOOD	GOOD	GOOD	MEDIUM	MEDIUM
Clamping	V GOOD	GOOD	GOOD	V GOOD	V GOOD	V GOOD	V GOOD	GOOD	GOOD	GOOD
Price (p per metre)	69.6	29.9	37.4	24.0	55.8	45.2	66.8	22.7	21.5	?

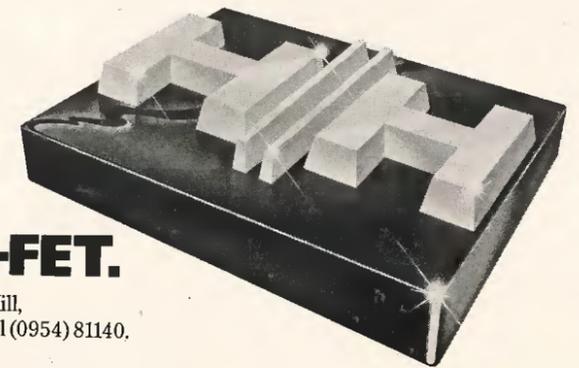
\*Ten resistor code colours.



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cable at 1kHz, it being possible to calculate the crosstalk for other lengths and frequencies bearing in mind that the crosstalk increases with frequency at 6dB/octave and is related to length by the following formula:

$$\text{Change in crosstalk (dB)} = 20 \times \text{Log} \frac{\text{LENGTH A}}{\text{LENGTH B}}$$

Having dealt with the testing procedures used, we will now look at the individual cables, referring as necessary to the tabulated results, which will not always be mentioned in the text.

**Microphone cables**

Table 1 summarises the characteristics of the selection of microphone cables, which differed significantly in their form of construction. The heavier cables such as the Belden 8412 and most of the Future Film Developments range were most suitable for heavy punishment such as stage and television use where they are quite likely to be run over by heavy equipment. On the other hand, these cables are not very suitable for handheld microphones where lighter cables such as the EMT, Gotham and Steve Graham *Musiflex* are much more suitable.

In general, the heavier cables were constructed with a reinforced inner around the insulation followed by a tinned copper braid, sometimes sheathed in polyester, encased in a tough rubber outer sheath. In the case of the lightweight microphone cables the EMT, Gotham and Neumann products all had a twin wire-wrap screen consisting of a clockwise-laid layer and an anticlockwise-laid layer with an overall cover of PVC. Whilst these cables are flexible at room temperature, they become stiff when cold — such as after storage in a vehicle out of doors.

A cable which deserves special mention is the Steve Graham *Musiflex* which uses a loaded PVC outer as a conductive screen and, like two of the Future Film products, is available in the ten resistor colour-code colours. The screening performance of this cable was equal best in the solenoid pickup test but unfortunately did not fare very well in the impulsive interference pickup test.

Reference to the plotted spectrum analysis from the latter test reveals substantial difference between cables, with the high frequency performance not relating to the lower frequency performance in the order of merit. Whilst the Belden product

was easily the leader at lower frequencies it was certainly not the leader above 20kHz where it was bettered by the Gotham and EMT products.

It is interesting to note that, in these respects, the lap-screened products such as the Gotham and Neumann cables generally gave a better performance than the braid-screened products.

Whilst the differences in cable resistance are unlikely to be significant, with very long cable runs the capacitance may be of concern and it is here that the EMT and the *Musiflex* could be of interest, with about half the capacitance per metre of other cables.

With the price of cables varying by more than 3 to 1, it is very worthwhile to take some trouble over the choice of microphone cables, as not only may the most expensive not be justified, but also, it may not give the optimum performance for a particular application.

**General purpose cables—single and twin**

The single and twin cables examined were of types that would be used for wiring *within* equipment, rather than for interconnecting equipment, where physical protection is needed.

In these circumstances, a range of colours is very useful for identifying cables and I find it surprising that the only samples available in a range of colours were the Future Film Developments products. Another factor of interest was the performance of the insulation material when soldering the cables, and here the grade of PVC used for the insulation makes a great difference—in several of the cables there was severe shrinking of the insulation if the conductors were heated for a significant time.

The Belden, the Lectriflex and the two Cliff Electronic Components cables had a foil screen which is generally more fiddly to terminate than the wire-wrap screen of the Future Film Developments products. Reference to Table 2 shows that the performance of the wire-wrapped screens was significantly better than the foil screens in the solenoid pickup test.

Reference to the plots resulting from the impulsive interference tests shows large differences between the cables, and this suggests that crosstalk within a bunch of cables will also show large variations.

The choice of cable may also be based on its resistance, as the thin cables such as the Future

Film Developments flexible, with a resistance of about 0.25Ω/m, may be unacceptable in some situations. On the other hand the range of capacitance was small.

**General purpose cables—multipair**

The range of cables examined was small, but in all cases the manufacturers offer a range of different numbers of conductors which should have a performance which relates to the samples tested.

Table 3 shows a large variation in the crosstalk performance and also in the results of the solenoid pickup test. Reference to the plots of interference pickup shows that the Lectriflex cables fared particularly well in this respect but not in the solenoid test. On the other hand the Steve Graham Audio cable did well in the solenoid test, but not so well on interference pickup.

When wiring multipair cables, the identification of pairs can be troublesome, and in this respect the Lectriflex cables were particularly good as they used different coloured wrap foils to identify groups of conductors and had numbers on the wrap foils within each coloured group. The worst cable in this respect was the Cliff Electronic Components cable with its 2-colour insulation — anyone with defective colour vision (which is common in men) wouldn't have a hope with this cable! The form of this 18-pair cable was 15 pairs within the outer sheath with the remaining six pairs shielded within an inner sheath.

This cable and the Steve Graham Audio cable were the most flexible and the least prone to damage by being passed round sharp bends, with the Lectriflex and the Steve Graham Audio products being the best for clamping securely within a connector. **Hugh Ford**

**Individual suppliers**

Belden manufactures cable in the USA and has an enormous range — 8,000 different types, I am told. Of those reviewed here the 8777 style is available with 3, 6, 9, 11, 12, 15, 17, 19 or 27 pairs. Similarly, about 30 different types of microphone cable are available from Belden.

**Manufacturer: Belden Corporation, PO Box 1331, Richmond, Indiana 47374, USA.**

**UK: Leonard Wadsworth & Co (Electronics) Limited, Unit F, Imber Court Trading Estate, Orchard Lane, East Molesey, Surrey.**

Cliff Electronic Components distributes a range 94 ▶

TABLE 2

GENERAL PURPOSE AUDIO CABLES — SINGLE AND TWIN

	BELDEN 8451	CLIFF LF2	CLIFF FKAK-2	FUTURE FILM DEVELOPMENTS MIN SOLID	FUTURE FILM DEVELOPMENTS FLEXIBLE	LECTRIFLEX KJAAM
Number of conductors	1pr	2 + DR	2 + DR	2	2	2
Size of conductors (mm)	7/0.28	21/0.096	7/0.22	1/0.493	7/0.11	7/0.30
Overall screen type	FOIL + DRAIN	FOIL + DRAIN	FOIL + DRAIN	WIRE WRAP	WIRE WRAP	FOIL WRAP
Drain wire (mm)	7/0.24	20/0.096	7/0.22	NONE	NONE	7/0.30
Outer diameter (mm)	3.43	2.6 x 3.7	3.3	2.8	3.05	5.59
Outer material	VINYL	PVC	PVC	PVC	PVC	PVC
Insulation material	POLYPROPYLENE	PVC	PVC	PVC	PVC	POLYPROPYLENE
Bore (mm)	2.4	2.0	2.7	1.7	1.7	3.2
Outer colour	BLACK	BI or Gr	BI or Gr	10 off*	10 off*	GREY
Resistance (mΩ/m)	49	106	69	93	249	36
Capacitance (pF/m): between conductors	104	70	119	99.5	101	74.4
conductor to screen	200	135	212	170	158	133
Insulation resistance (mΩ at 500V dc)	>10 <sup>5</sup>	>10 <sup>5</sup>	>10 <sup>5</sup>	>10 <sup>5</sup>	>10 <sup>5</sup>	>10 <sup>5</sup>
Breakdown voltage (kV)	20	>30	>30	>30	>30	26
Soldering	GOOD	GOOD	MEDIUM	POOR	POOR	GOOD
Solenoid pickup (dB)	90	78	85	97	95	85
Price (p per metre)	19.4	9.2	9.76	17.57	19.22	30.3

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TABLE 3

GENERAL PURPOSE AUDIO CABLES — MULTI PAIR

	BELDEN 8777	STEVE GRAHAM	KJAAM	LECTRIFLEX COMPUTERFLEX	KJAAM	CLIFF FKFK
Number of conductors	3pr	19pr	2pr	2pr	30pr	18pr
Size of conductors (mm)	7/0.25	7/0.21	7/0.30	18/0.10	7/0.32	7/0.20
Overall screen type	NONE	NONE	NONE	BRAID	NONE	CONDUCTIVE
Individual screen	TAPE	TAPE	TAPE	NONE	TAPE	NONE
Drain wire (mm)	16/0.16	7/0.22	7/0.30	14/0.19	7/0.31	7/0.20
Outer diameter (mm)	7.6	14.5	7.5	5.3	22.6	13.6
Outer material	VINYL	??	PVC	PVC	PVC	PVC?
Insulation material	POLY- PROPYLENE	??	POLY- PROPYLENE	??	POLY- PROPYLENE	PVC?
Bore (mm)	5.2	11.5	5.6	3.6	19	12.6
Outer colour	GREY	GREY	GREY	LIGHT GREY	GREY	GREY
Resistance (mΩ/m)	50	80	36	124	36	77
Capacitance (pF/m): between conductors conductor to screen	84 163	112 210	74 133	90 129	74 133	109 112
Insulation resistance (mΩ at 500V dc)	>10 <sup>5</sup>	>10 <sup>5</sup>	>10 <sup>5</sup>	>10 <sup>5</sup>	>10 <sup>5</sup>	>10 <sup>5</sup>
Breakdown voltage (kV)	20	>30	26	>30	>30	>30
Soldering	GOOD	MEDIUM	GOOD	MEDIUM	GOOD	MEDIUM
Crosstalk (dB)	97	108	112	104	112	66
Solenoid pickup (dB)	85	92	83	80	83	67
Price (p per metre)	63.4	279	55.99	36.58	455.73	??

of electronic components in addition to the range of cables manufactured by Bofa in Sweden.

The type *FKAK* cable reviewed here is available in 1, 2, 4 or 5 pair forms. In addition Cliff supplies a range of PVC connecting cables and mains cables plus a range of moulded mains plug assemblies.

**Manufacturer:** Bofa Kabel, Kungsbacka, Sweden.  
**UK:** Cliff Electronic Components Limited, 97 Coulsdon Road, Caterham, Surrey.

EMT has a range of cables designed for studio use, covering coaxial cable and suspension cable for microphone winches up to a specialised range of multipair cables specifically designed for studio and mobile audio use.

**Manufacturer:** EMT Wilhelm Franz GmbH, Hardstrasse 41, CH-5430 Wettingen, Switzerland.

**UK:** F.W.O. Bauch Limited, 49 Theobald Street, Boreham Wood, Hertfordshire WD6 4RZ.

Future Film Developments supplies a large range of connectors for audio, plus cables and accessories such as specialised tools. Not reviewed here is its range of multipair cables ranging from single pair to 27-pair. Also available is a lap-screened microphone cable and general purpose wiring cables.

**UK Supplier:** Future Film Developments, 36/38 Lexington Street, London W1R 3HR.

Steve Graham Audio, in addition to supplying cables, supplies various connectors and made-up assemblies such as adaptors and stage boxes.

Of the range of multipair cables, foil-screened cables with 6, 12, 15, 19, 27 or 31 pairs are available in addition to conductive-screened cables.

**UK Supplier:** Steve Graham Audio Limited, 20 Victoria Road, New Barnet, Hertfordshire.

Gotham Audio I am quite sure that Gotham doesn't need introduction to anyone in the audio business!

**Manufacturer:** Gotham Audio Corporation, 741 Washington Street, New York 10014, USA.

**UK:** F.W.O. Bauch Limited, 49 Theobald Street, Boreham Wood, Hertfordshire WD6 4RZ.

Lectriflex supplies a wide range of cables, connectors and accessories for the electronics industry.

Of the types reviewed the *KJAAM* is available with 1, 2, 4, 7, 12, 20, 30, 50 or 100 pairs and the *Computerflex* with up to 55 pairs. The latter cable is also available with a braid screen.

**UK:** Lectriflex Cables and Accessories Limited, The Paddocks, Frith Lane, Mill Hill, London NW7.

Neumann is well-known for its professional microphones, it is logical that Neumann should also supply a microphone cable. **Supplier:** Audio Export Georg Neumann & Co. GmbH, D-7100 Heilbronn, Fleinerstrasse 29, West Germany.  
**UK:** F.W.O. Bauch Limited, 49 Theobald Street, Boreham Wood, Hertfordshire WD6 4RZ. ■



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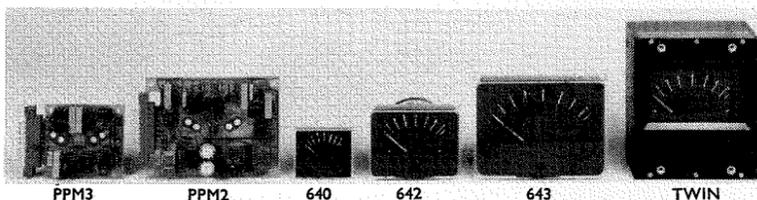
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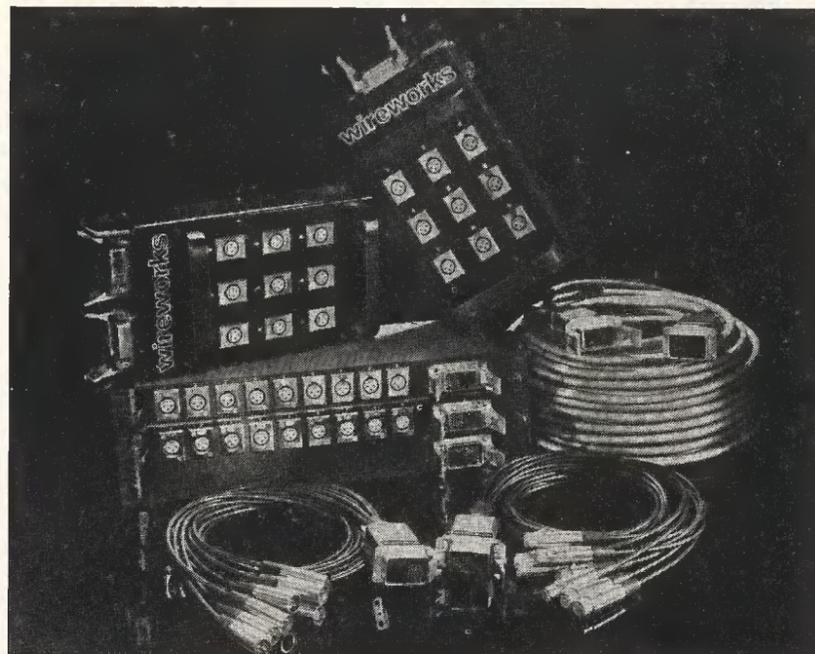
The Furman range includes mono and stereo parametric equalisers with pre-amps, tunable crossover/bandpass filter, and (shown here) the neat reverb system with limiter and equaliser. The simple layout and wide range of control gives full scope for creative engineering at a price which gives great value for money.

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## Connectors and connecting leads

### Whirlwind audio accessories

Atlantex Music Limited, the UK agent for Whirlwind products, submitted a selection of audio accessories for review. Whilst the complete Whirlwind range includes microphone cables, cable reels and various connectors, these were not submitted. Also, several of the items reviewed are available in different lengths and different versions.

The review includes a short summary of the standard of construction of each item submitted and the reader should refer to the Whirlwind catalogue for information on the complete range.

Reference to the reviews shows that the standard of construction varies considerably, largely depending upon the types of connectors used and how ambitious the accessory is—for instance, phono sockets do not mix easily with professional cables!

#### 10ft Ultra Snake

This accessory, available in 1ft, 10ft, 18ft 6in, 25ft and 50ft lengths consists of mono ¼in jack to mono ¼in jack leads using Belden cable. The 10ft (3.05m) sample had an actual overall length of 10ft 5in (3.18m) with good quality jacks at both ends. The cable was properly sleeved at the entry to the jacks and the overall standard of soldering and construction was good.

Price: £3.07.

#### 10ft Snake

Available in 1ft, 6ft, 10ft, 18ft 6in, 25ft and 50ft lengths using Belden cable, this is another ¼in jack to ¼in jack accessory, but this time using

plated brass connectors with the outer of the cable crimped for strain relief at the all-metal connectors. The end-to-end length of the review sample was found to be 10ft 3½in, the accessory being well made with a good standard of soldering.

Price: £2.63.

#### 50ft Mk4 Microphone Lead

This microphone lead, also available in a 25ft length, comprised a 49ft 7in length terminated at each end with Switchcraft XLR type connectors—a plug at one end and a socket at the other.

Pin 1 was the earth with pins 2 and 3 correctly connected. The standard of stripping and soldering was good as was the clamping of the cable at both ends of the Belden microphone cable.

Price: £11.73.

#### 18ft 6in Viper

This ¼in jack to ¼in jack mono accessory was found to be 18ft 11in end-to-end using Belden cable. The jack connectors had a spring type strain relief to prevent damage at the connectors due to bending the cable and the overall standard of soldering and construction was good.

Price: £5.95

#### Y Mono 1F/2M Adaptor

The accessory consists of a mono ¼in jack socket connected to two ¼in jack plugs in parallel with an overall length of 1ft 3½in for each branch. Inspection of the socket end of the accessory

showed this to be untidy: also, the cable was not clamped at this end and not adequately sleeved. At the jack plug end of the Belden cable the standard was reasonable with all-metal plugs.

Price: £3.50.

#### Y Mono 2F/1M Adaptor

This accessory consists of lengths of cable with a ¼in mono jack plug at one end leading to two separate ¼in female jack sockets wired in parallel with the length of each branch being 1ft 4½in. The cables were unclamped at the plug end of the accessory and the wiring untidy with no proper strain relief being provided.

Whilst the clamping at the sockets was satisfactory an intermittent short circuit was experienced at one socket due to a poor standard of soldering.

Price: £3.50.

#### AD1 Connector Lead

This connector lead, with a nominal 1ft length, joins a ¼in jack socket to a 'banana plug' accessory with the standard ¼in spacing with an actual end-to-end length of 1ft 1½in. The standard of construction of this accessory was completely satisfactory.

Price: £2.09.

#### AD2 Connector Lead

This mono jack plug to mono jack socket lead, with a nominal length of 10ft, used Belden cable

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with an actual end-to-end length of 10ft 3in. At the all-metal plug end the strain relief was by means of a crimped ring and all was well, but no strain relief was provided at the jack socket end. Price: £2.13.

**AD3 Connector Lead**

Comprising a mono 1/4in jack to phono socket lead with a nominal length of 10ft of Belden cable, all was well at the all-metal jack end of the 10ft 1/2in length of Belden cable. However the phono socket end was far from tidy and appeared to be decidedly prone to short circuits due to lack of sleeving. Price: £2.85.

**Manufacturer: Whirlwind Music Incorporated, PO Box 1075, Rochester, New York 14603, USA. UK: Atlantex Music Limited, 34 Bancroft, Hitchin, Hertfordshire.**

**Whirlwind Medusa multiple wiring system**

The Whirlwind range of stage boxes or 'snakes' consists of types for 24, 16, 14, 12, 9, 8 or 6 microphone feeds all with three sends and 100ft (30.5m) of multiway Belden cable. In addition to these there are two 50ft (15.3m) types for six microphones with or without three sends.

The review sample consisted of the latter type with six microphone feeds and three sends. At the stage box end the microphone connectors took the form of Switchcraft XLR type sockets mounted into the top of a diecast alloy box by means of pop rivets with the three sends taking the form of single pole 1/4in jack sockets arranged down the middle of the diecast box.

Measuring about 2in deep by 4 3/4in wide and 7 1/2in long, excluding the substantial gland for the multiway cable, the box had a black crackle finish and was fitted with a rubber mat at its base which was secured by six recessed screws.

A substantial cable-clamping arrangement was included to relieve bending of the cable near the entry, and within the box the multiway foil-lap screened Belden cable was firmly secured. From the securing point the individual feeds were neatly led to their appropriate connectors, with the individual drain wires being soldered to the connectors without any added sleeving, which I would have preferred to have seen on all connections.

Identification of the feeds was by a clear label identifying them as 'A', 'B' and 'C' with the microphone connections being identified by engraved numbers on the XLR type sockets; identification would have been better if the engravings had been filled with coloured wax.

The same comments apply at the remote end of the cable where the Switchcraft XLR type plugs for the microphone feeds and the 1/4in jack plugs for the sends are also identified by engraving the connectors.

Turning to this end, the individual feeds are separated 3ft from the end, and sleeved red for sends and black for microphone feeds, with the separation point being protected by a heat-shrunk sleeve adjacent to which is a moveable wire mesh strain relief of considerable strength—a very sensible feature.

Inspection of the connectors showed that the jacks for the sends were well secured and tidily wired; however, the cable clamping within the

XLR type plugs was unsatisfactory because the overall diameter of the wiring was too small—the wires could well have more added sleeving to overcome this trouble. Within the connectors the standard of soldering was quite good, but I would have liked to have seen a sleeve over the drain wire connection. Price: (as reviewed) £54.84.

**Manufacturer: Whirlwind Music Incorporated, PO Box 1075, Rochester, New York 14603, USA. UK: Atlantex Music Limited, 34 Bancroft, Hitchin, Hertfordshire.**

**Steve Graham Audio stage boxes and adaptors**

These stage boxes consist of a metal box at the end of which is a multiway connector and on top of which there are individual connectors for inputs and outputs. All types of box have three outputs with different types offering 8, 10, 12, 16, 20 or 24 inputs all in the form of either unbalanced 2-pole jacks, 3-pole balanced jacks or XLR connectors (female for inputs and male for outputs).

In the case of the balanced boxes, an additional configuration is available with 24 inputs and seven outputs. A compatible range of adaptor cables is available for connecting the stage boxes to the mixing desk with the standard length being 80ft (25m). These adaptors consist of multipair cables terminated at one end with an 8016 series connector to fit the appropriate stage box. At the other end, the multipair cable is split into individual pairs which are terminated in unbalanced jacks, balanced jacks or XLR connectors as desired.

The review samples were in the form of twelve input and three output facilities with XLR connectors on both the stage box and the adaptor cable.

**Stage box**

The box, manufactured from folded steel finished in matt black paint, was 2in deep by 5 1/2in wide and 10in long excluding the multiway 8016 series connector at the end.

On the top surface of the box, the 12 Switchcraft XLR input sockets and the three XLR output plugs were pop-riveted to the box with the connectors being rather crudely identified by means of a punch; the inputs being numbered one to 12 and the outputs identified 'L', 'R' and 'FB'.

At the bottom of the box, a sheet-steel cover was secured to the main part of the box by means of four machine screws which fitted into clinch-nuts. Not only were these screws not secured with washers or by other means, but also, they were unprotected and could create damage to flooring etc.

Within the box the internal wiring was arranged in colour-coded pairs soldered to the multiway connector and to the XLR connectors. These terminations were unsleeved and the overall standard of workmanship could be readily bettered! Individual pairs were not twisted and no effort had been made to separate the output circuits from the input circuits.

**Adaptor cable**

The individually foil-lap screened cable with a grey coloured outer sheath was crimp connected to the 8016 series multiway plug with the individual drain wires being properly sleeved

before being terminated. The cable also was properly sleeved before being clamped at the multiway connector end.

At the other end the individual circuits were separated 3ft from the end and sleeved in black for the inputs and red for the outputs, a heavy heat-shrunk sleeve protecting the point of separation. Adjacent to the Deltron XLR connectors the inputs were identified by yellow numbered sleeves zero to 12, with the three outputs being identified as 13, 14 and 15 instead of 'L', 'R', and 'FB'.

Inspection within a few samples of the XLR connectors showed that no connections were sleeved and, in particular, there was danger of the unprotected drain wire shorting on to the signal connections. The standard of soldering also left something to be desired. In addition, the security of the cable clamping was not as good as it might have been, because the sleeved individual circuits were rather too thin for proper clamping within the XLR connectors.

**Summary**

Stage box systems like these clearly reduce the 'birdsnest' which occurs if individual connections are used, but clearly there are dangers where inputs and outputs are fed down the same cable.

Overall, the standard of construction of the review samples left something to be desired, and this could be easily improved with a little more thought by the manufacturer.

Price: (review samples) stage box £66.96, adaptor cable £104.41.

Manufacturer: Steve Graham Audio Limited, 20 Victoria Road, New Barnet, Hertfordshire, UK.

**Technicord audio accessories**

Technicord Limited supply a series of patch leads using both 1/4in and 0.175in jacks in addition to supplying a range of jackfields utilising 'Audio Line' jacks for which Technicord Limited are the UK agents, the manufacturers of the jacks also being the US agents for Technicord Limited.

In addition, Technicord Limited are now supplying microphone leads with XLR type connectors at both ends. All types of lead use the same cable which is available with PVC sheaths coloured red, blue, grey, white, green or yellow. The cable has a double-lap Reusen screen of 76 strands with the three conductors each having 100 strands; consequently this is a very flexible cable; however, the sheath can be damaged by excessive heat such as that from contact with a soldering iron.

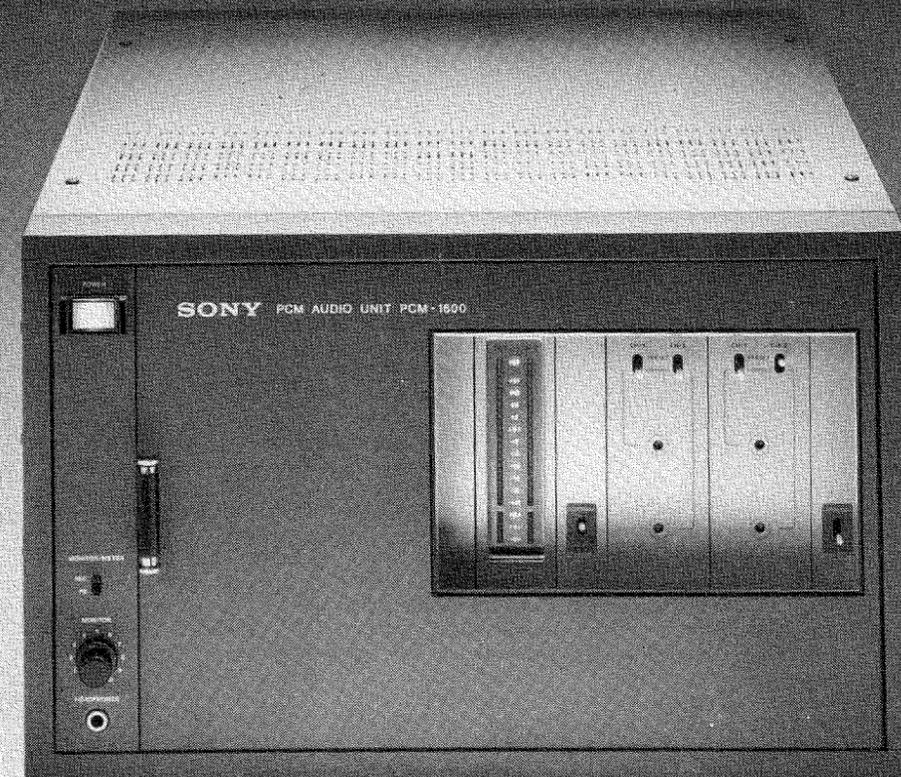
**Type PC801 audio patch cord**

Three patch cords, which are available in any length, terminated at each end with a tip, ring and sleeve brass 1/4in jack plug to British Post Office No 316. Inspection of the terminations showed that first-class workmanship was used in the three 2ft long samples supplied. Each conductor had an eye crimped to its end, the eye being screwed to the connections within the jack sockets. The actual length of free cable was exactly 2ft.

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**Type PC901 audio patch cord**

Except for the use of Switchcraft type TT-253 0.175in miniature jack plugs, these patch cords are identical to the type PC801. Again the standard of construction was excellent with the screen and earth wires being crimped to the jack plugs and crimped eyes being used for the audio lines. The leads were exactly to their nominal length and the standard of workmanship was beyond reproach.

Price (for up to 1m length): 1-9 off £6.84, 10-49 off £6.21, 49-99 off £5.65.

**Type MC501 microphone lead**

Again using the same flexible cable, these microphone leads have Switchcraft XLR type connectors—male at one end and female at the other. The colours available are restricted to grey or yellow with the 5m sample supplied being exactly 5m between connectors. Within the connector the screen wires are properly sleeved and linked to the connectors' shells which are also linked to pin 1, this being the ground pin. If this link is not required it may be readily removed. As with the other products the standard of workmanship was excellent.

**Jack panels**

Technicord offer a great variety of jack panels which may be fitted with many different types of jack socket. Two samples were supplied for review, a 48-way panel fitted with 0.175in Audio Line type 820A jacks and a 24-way panel fitted with 1/4in Audio Line jack sockets. Both panels were designed for mounting into a standard 19in rack by means of swivelling ears fitted with chrome plated screws.

In both cases, the finish of the jack field was excellent with a transparent designation strip being fitted just below the sockets, which formed a single row divided into two sets of 24 sockets in the case of the 0.175in type. Other than the chrome fixing screws for the designation strips and for fixing into a rack the front of the panels was free from any markings and finished in a clean black colour.

At the rear the jacks were secured by single screws which threaded into tapped holes in the jack field, making it a very simple matter to change faulty jack sockets.

Whilst in the review samples the jacks were isolated from each other, foil bonding or busbar bonding is available upon request as are cable tie bars. A feature which the manufacturer claims is that the jack fields can be easily made to fill gaps in non-standard rack sizes.

Overall, these are very well-finished jack fields, which do not require any additional trim when fitted into a rack space.

Price: 96-way 1 3/4in x 19in field with ADCPJ839 jacks £100.55, fitted with Audio Line 820A jacks £144.00.

UK: Technicord Limited, Melbourn House, 2 Black Bank Road, Little Downham, Ely, Cambridgeshire.

US: Audio Accessories Incorporated, New Hampshire, USA.

**Three-pin XLR type connectors**

Whilst the type identification 'XLR' is strictly associated with the version of the connector manufactured by ITT Cannon, there are a number of alternative suppliers of compatible

TABLE 1

Manufacturer	Part number	Price (£)	Weight (gm)
<b>Chassis plugs (Male)</b>			
Cannon	XLR-3-32	1.42	20
Deltron	2033	1.68	21
Neutrik	NC3MP	0.89	20
Switchcraft	D3M	0.97	20
<b>Chassis sockets (Female)</b>			
Cannon	XLR-3-31	2.54	47
Deltron	2023	3.20	42
Neutrik	NC3FP	1.70	32
Switchcraft	D3F	1.69	42
<b>Free plugs (Male)</b>			
Cannon	XLR-3-12C	1.44	22
Deltron	2013	2.00	40
Neutrik	NC3MC	1.18	28
Switchcraft	A3M	1.17	26
<b>Free Sockets (Female)</b>			
Cannon	XLR-3-11C	1.88	28
Deltron	2003	2.88	42
Neutrik	NC3FC	1.39	40
Switchcraft	A3F	1.34	40

connectors in up to 7-pin versions.

Within the professional audio industry the 3-pin version is almost universally used for microphone connections and for interconnecting pieces of equipment at line level where the cost of good connectors can be justified.

Four manufacturers' versions of the connector are considered here: Cannon, Deltron, Neutrik and Switchcraft being manufactured respectively in Australia, the UK, Switzerland and the USA.

Whilst the design of these connectors was very different they were all found to be compatible electrically and mechanically with the review samples comprising free plugs and sockets and fixed chassis-mounted plugs and sockets.

As will be seen from Table 1 there are significant differences in the cost of the various manufacturers' products, such that it can be worthwhile mixing the various manufacturers' plugs and sockets if price is at a premium. Also, the weight of the products varies substantially and—particularly in the case of portable equipment—this may be a serious consideration. The other constructional features will be dealt with manufacturer by manufacturer.

**Cannon**

The Cannon range of connectors is manufactured from alloy castings which are nickel-plated, the contacts being of silver-plated brass. The socket inserts are of a rubber type material with the plug inserts being of a hard plastic with no case connections being available on the free plugs and sockets.

Cables of diameters ranging from 4.5mm to 6.5mm could be clamped with the clamping force being excellent provided that the clamping screws did not work loose. The fact that these screws were not recessed meant that they could catch on things; also, they could be easily lost when assembling the free connectors. Some care was required to read the rather indistinct pin numbering, and severe overheating during soldering could damage the plug inserts but not the socket inserts.

Insertion and withdrawal of the connectors was easy without undue force being required, with positive locking into the inserted position.

**Deltron**

The shells of the Deltron range were manufactured from nickel-plated metal with the contacts being silver-plated brass. The inserts of

the plugs were of hard plastic and those of the sockets of soft plastic, which in both cases could be burnt with a hot soldering iron.

With the exception of the free socket, the pin numbering was not easy to read and whilst both the free plug and the free socket were equipped with case earths, the one in the plug fell out during assembly and was generally fiddly to assemble.

Cables from 5mm to 7mm diameter could be clamped with very good effect by means of the two recessed clamping screws with the design of the free plugs and sockets being clean and free from protrusions which could snag on other cables etc. Insertion and withdrawal was rather stiff, with the mating of the free plugs and sockets allowing rather a lot of freedom of contact movement.

A rather confusing feature during assembly was that the free socket's insert was secured with a threaded screw and that of the plug with a self tapping screw of similar size.

**Neutrik**

Unlike the other connectors, the Neutrik range uses a plastic grommet for cable entry as opposed to the sealing rubber on the other connectors; furthermore, cable clamping is by means of a collet system instead of a clamp secured with screws.

The body of these connectors is manufactured from diecast zinc with copper- and nickel-plating, with the brass contacts being copper-plated, anodised and silver-plated. As with the other connectors, the plug inserts were of hard plastic and those of the sockets of soft plastic, both of which could be melted with a hot soldering iron.

The cable clamping, which could manage a range of diameters from 2.9mm to 7.5mm, was effective but not as positive as the mechanical clamps. However, there were no parts to lose on assembly and the clamping by the collet system was unlikely to work loose in use.

Neither the fixed socket or the free socket had a grounding tag, but assembly was eased by clear identification of pin numbers and the fact that the only part that needed to be removed was the screw securing the free plug's insert.

In use, the locking of the connectors was positive with only light insertion and withdrawal forces being required.

**Switchcraft 'Q-G' series**

This series has a completely smooth metal casing with all screws being fully recessed, plated brass contacts mounted into a hard plastic insert which could not be damaged with a hot soldering iron.

Cable clamping by means of two recessed grub screws which press metal inserts onto the rubber grommet was excellent with the usable range of cable diameters ranging from 4.5mm up to 8mm.

The fact that no parts needed to be removed during assembly, and that the pin identifications were clear, eased assembly with a case ground being available on both types of free and fixed connectors.

Insertion and withdrawal of the connectors was smooth and required little force with the locking of the connectors being positive.

Hugh Ford

**Samples supplied by:-**

Cannon and Neutrik—Future Film Developments, 36/38 Lexington Street, London W1, UK. Deltron—Steve Graham Audio Limited, 20 Victoria Road, New Barnet, Hertfordshire, UK. Switchcraft—F W O Bauch Limited, 49 Theobald Street, Boreham Wood, Hertfordshire, UK. ■



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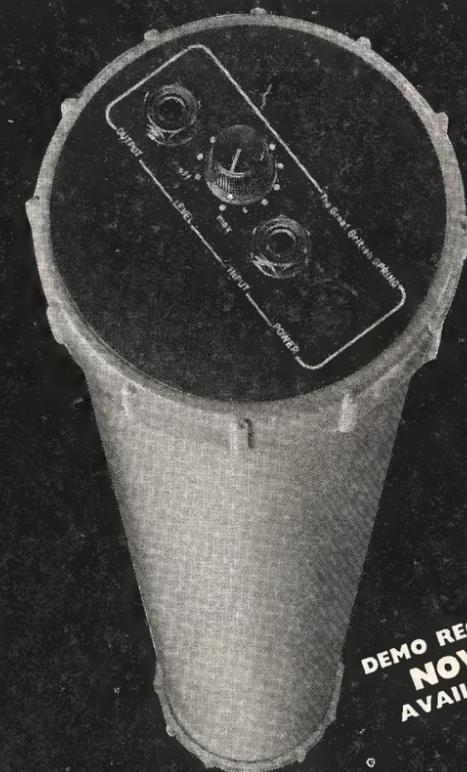
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# reviews

## Dolby CAT98A noise weighting filter



### SPECIFICATION

This is not a formal manufacturer's specification, but consists of extracts from information supplied by the manufacturer.

**Noise weighting characteristic:** to CCIR recommendation 468.

**Switched facilities:** bypass, set level, read noise.

**Unity gain frequency:** 2kHz with reference to 'set level'.

**Variable gain control range:** 10dB approximately.

**Metering:** requires external meter.

**Power supply:** 80V to 260V rms 50/60Hz without adjustment.

**Price:** £145.

**Manufacturer:** Dolby Laboratories Inc, 346 Clapham Road, London SW9.

**US:** Dolby Laboratories Inc, 731 Sansome Street, San Francisco, Cal 94111.

THE Dolby CAT98A noise weighting filter is basically an active filter for electrical noise measurement to the CCIR recommendation 468 standard which is rapidly becoming popular. No meter is included as it is Dolby's intention that the filter be used with an external average rectifier instrument calibrated rms. Most millivoltmeters comply with these requirements, thus such metering may be found in any reasonably equipped studio or maintenance shop. However there is no reason why the alternative quasi-peak type reading instrument should not be used.

The filter comprises a small solid box which has a permanently attached mains lead, an LED power indicator and two controls. All functions are clearly indicated on the box and the power input is self-adjusting over the range 80V to 260V at 50Hz or 60Hz.

The internal construction is simply one glass fibre printed circuit board onto which all components and controls are mounted and to which are attached the input and output leads. These feed standard banana socket terminals on 3/4in spacing which fit normal coax socket adaptors.

Both controls have good sized knobs of the collet fixing type, one control being a three position rotary switch which selects 'bypass', 'set level' or 'read noise' and the other control being a potentiometer which is used in the 'set level' and 'read noise' positions of the switch.

In the 'bypass' switch position the input to the filter is directly connected to the output terminals, both the input and the output being unbalanced connections with a common ground. It is thus possible to read the input voltage on the meter connected to the filter's output in the 'bypass' switch position. If the switch is then turned to 'set level' the gain potentiometer is connected into circuit as are input and output buffer amplifiers, such that the gain can be set to a convenient meter reading for noise measurement (such as zero dB indication). In operation the switch is then turned to 'read noise' which inserts the weighting filter between the input and output buffer amplifiers such that the meter connected to the output reads weighted noise without any alteration to the input or output impedance of the filter box.

The gain of the filter is internally set for unity at 2kHz, as opposed to 1kHz which is normal for all other weighting networks and is a convenient frequency for alignment. Personally I take exception to the practice of setting unity gain at 2kHz because this is done simply to provide a 'better' noise figure for commercial purposes as opposed to scientific reasons, giving a theoretical 5.5dB improvement.

### Performance

Measurement of the input and output impedance showed that the input impedance was adequately high at 108kΩ in parallel with 27pF which will not present an excessive load to even domestic equipment, whilst the output impedance was

satisfactorily low at about 150Ω.

As with all noise weighting systems which do not have overload indicators, it is essential not to apply too large an input signal which would result in overloading. With the variable gain control set to minimum, gain distortion occurred at +14dBm input, and at maximum gain at +8dBm at frequencies below 2kHz. Thus normal professional alignment levels can be handled but an attenuator is essential for some purposes such as measuring power amplifiers.

The effect of the variable gain control was to alter the overall gain of the weighting box between -4dB and +6.6dB, thus providing a range of 10.6dB which allows any meter with a 10dB per step attenuator to be set to a convenient reference point.

The overall frequency response in the 'set level' mode was generally within +0/-0.3dB from 20Hz to 20kHz depending slightly upon the gain setting which had substantial effects above 20kHz to the extent of changes in gain from -1.7dB to -10.2dB at 20kHz. Thus the weighting filter box should not be in circuit for frequency response measurements which extend outside the audio frequency band.

In the 'measure noise' mode the frequency response should comply with the CCIR recommendation 468 which specifies a standard response curve together with permitted tolerances. Fig 1 shows the measured frequency response of the weighting box which with the few exceptions shown in Table 1 was very well within the specified tolerances.

TABLE 1

Frequency	Measured gain	Specified gain
8kHz	+11.0dB	11.4±0.4dB on limit
10kHz	+7.3dB	8.1±0.8dB on limit
12.5kHz	0dB	0±1.2dB on limit

A final aspect to be considered is the residual noise generated within the weighting networks which varied between -84.6dBm and -93.0dBm according to the setting of the gain control and as measured at the output with an average reading meter. Such a performance is more than adequate for measurements on most devices provided that an adequate input signal level is available.

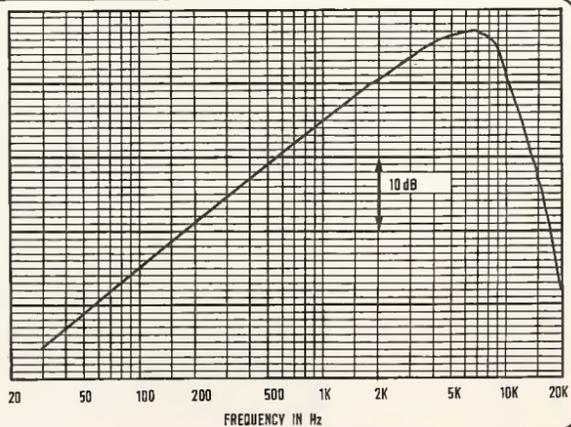
### Summary

The Dolby CAT98A CCIR noise weighting network provides a much needed facility at a sensible price. Its performance is generally good, and in spite of being designed specifically for measurements on other 'Dolbyised' equipment, the unit is quite suitable for measurements on most professional audio electronics.

Operation is very simple, and a first class instruction book is supplied with the unit.

Hugh Ford

FIG.1 DOLBY CAT 98A NOISE WEIGHTING UNIT FREQUENCY RESPONSE IN 'MEASURE MODE'



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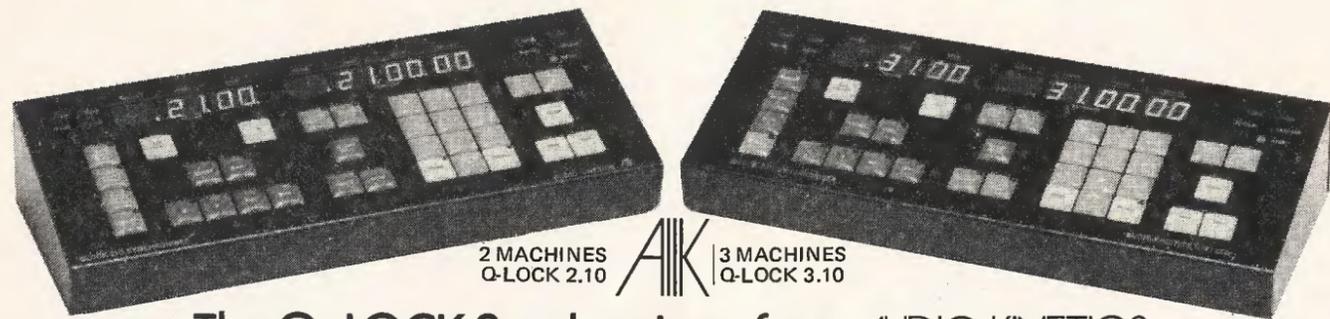
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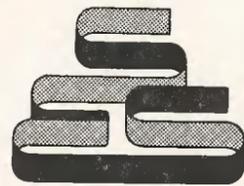
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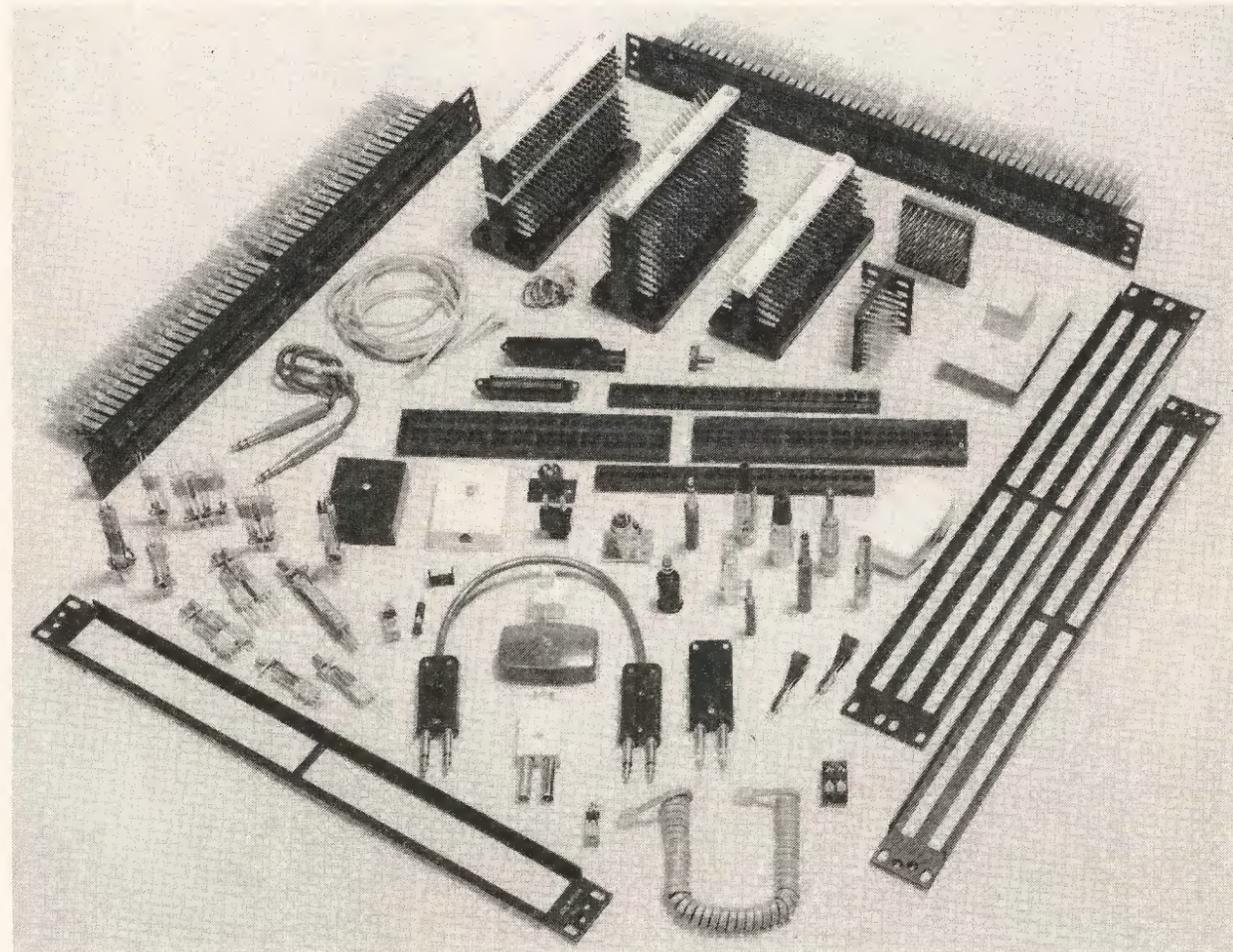


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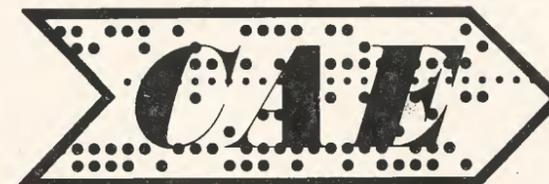
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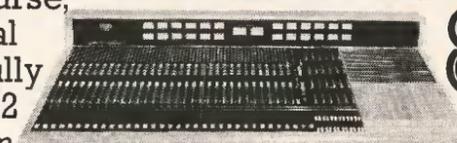
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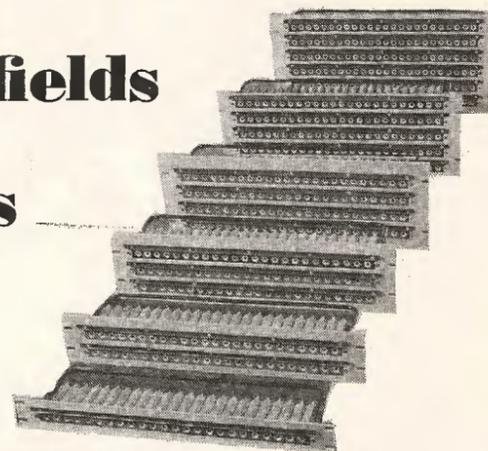
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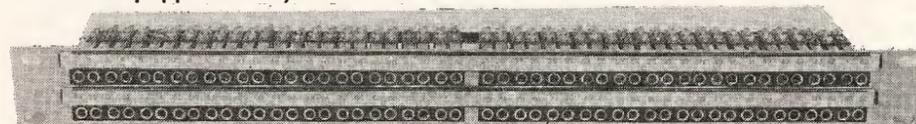
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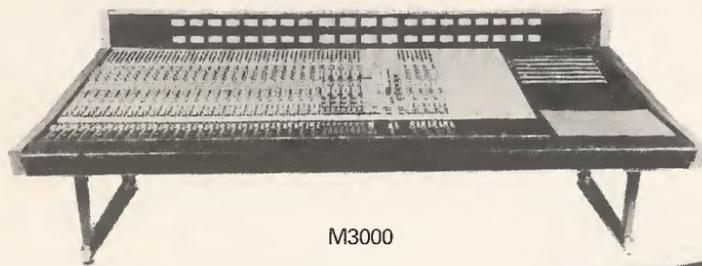
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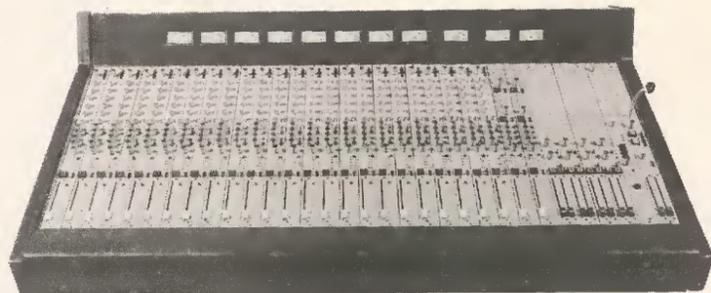


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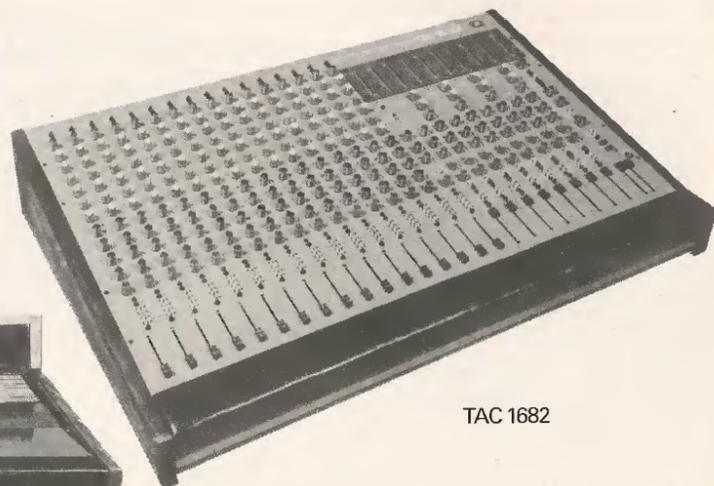
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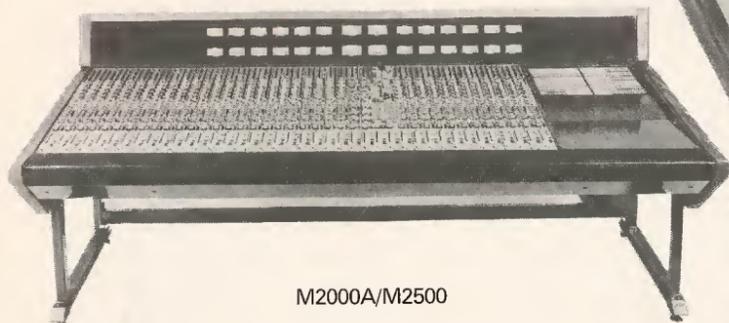
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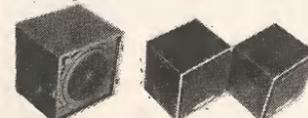
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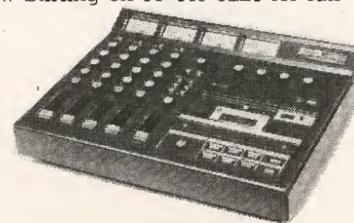


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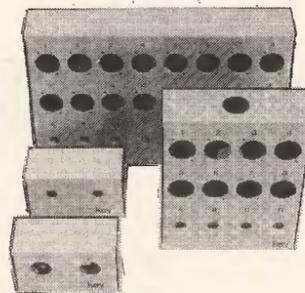
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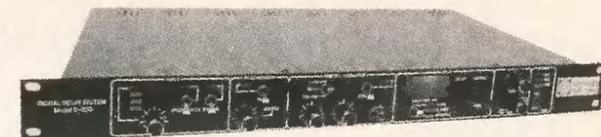
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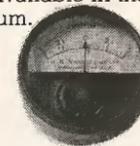
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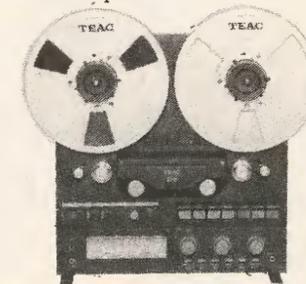
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It works somewhat like a compass, but tells you when. Put it next to a tape head, guide or capstan, and you get an accurate reading of the residual magnetic field. The scale is accurately calibrated, 5-0-5 Gauss, and an extension probe for awkwardly positioned heads is available. Exclusively from Turnkey.

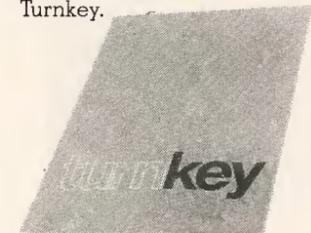
## 12 by 2 SPECIAL

We have acquired a batch of quality branded stereo recording or PA mixers. Each channel has wide range mike or line inputs, insertion points, four band eq, and two auxiliaries. The output section features echo returns, VU metering and powerful headphone monitoring. A snip at £360.00 plus VAT.



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As predicted in the last Mix, Teac's new stereo mastering machine proves to be a winner. Switchable NAB/IEC equalisation, varispeed, big VU's, motion sensing and a closed loop type tape path all contribute to its success. What's more, it's priced well below the competition.



## GREEN BOOK

Much more than a catalogue, the new "Turnkey by Mail", 28 page book includes hints on setting up a studio, choosing equipment, and other practical advice. Call or write for a copy or use the reply coupon in the September issue of Studio Sound.

All the products that we sell can be bought using Access or Barclaycard/Visa. Order by phone for fast delivery. Call or write for a copy of our new "Turnkey by Mail" catalogue or visit our demonstration room in North London during normal office hours. Our business is helping you with yours.



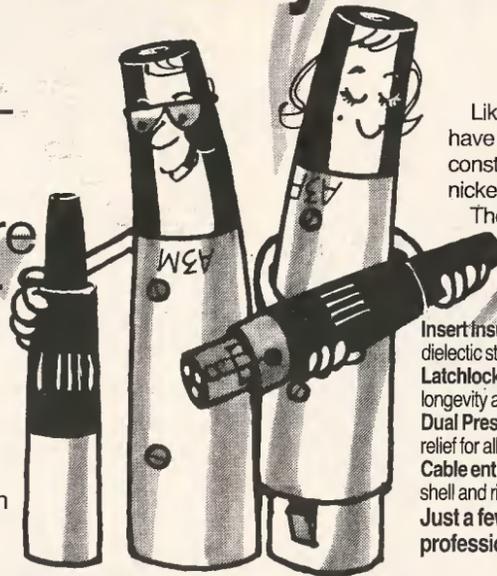
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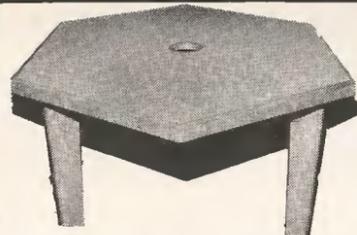
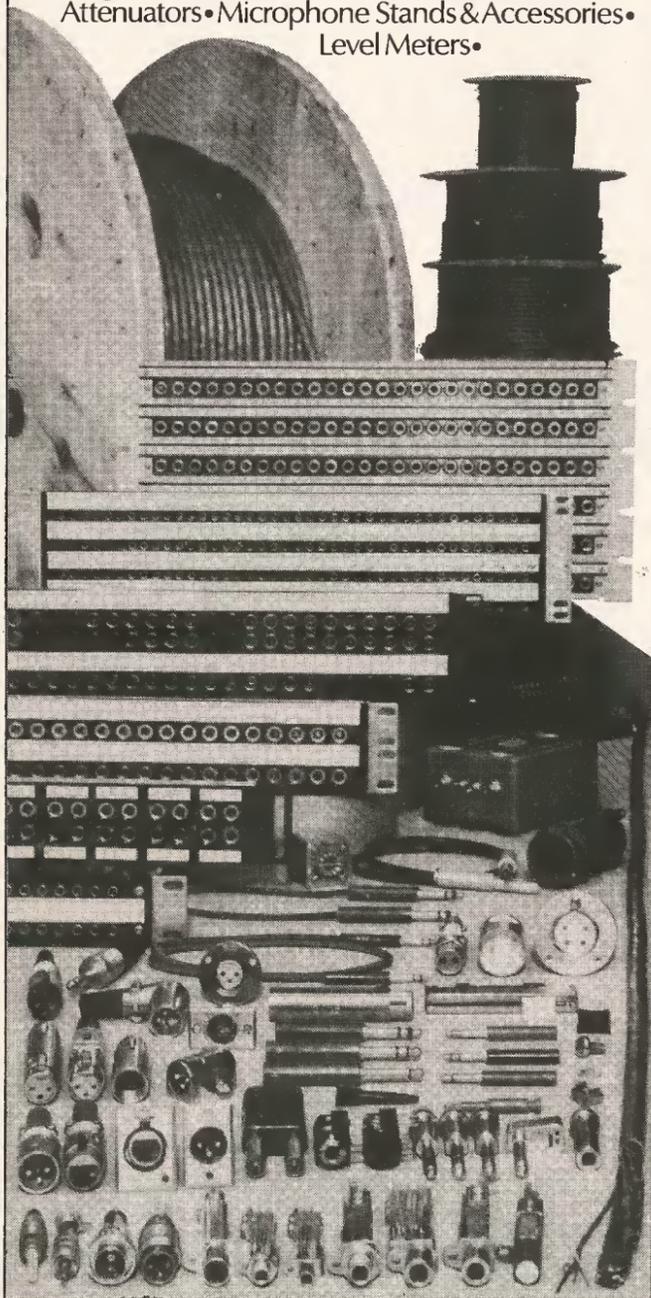
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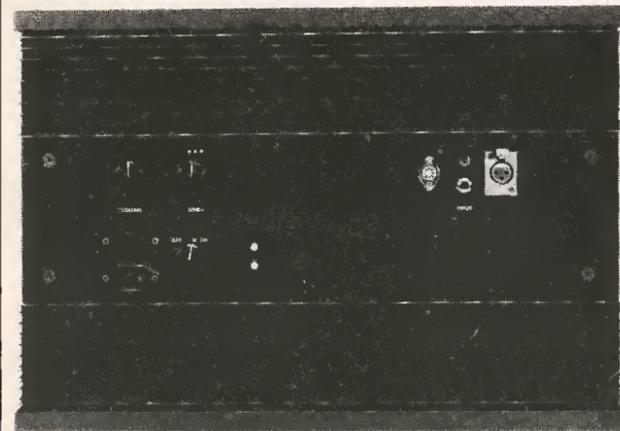
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If you would like to know how Lake Audio can help you, telephone us on Rickmansworth (092 37) 70488

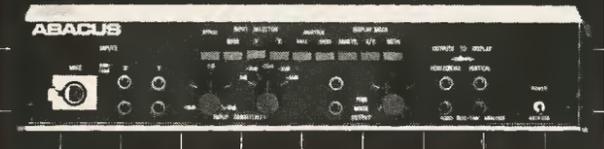
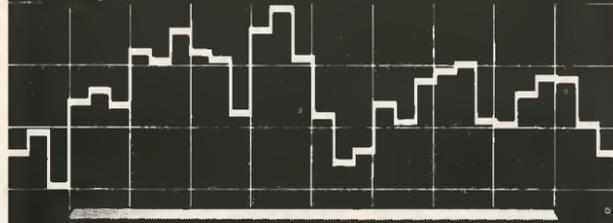
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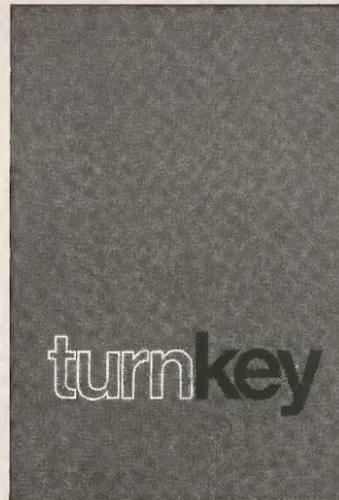


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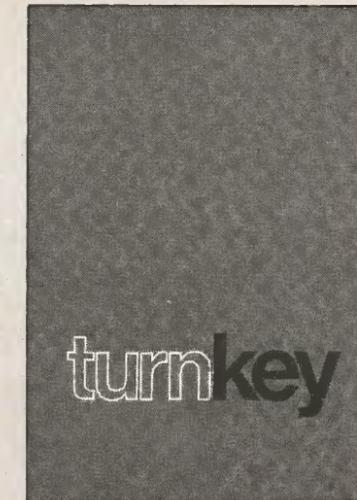
PLAN AUDIO —

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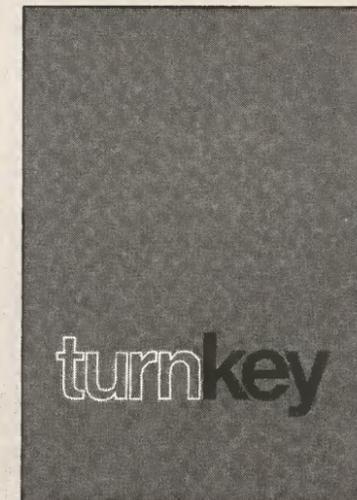
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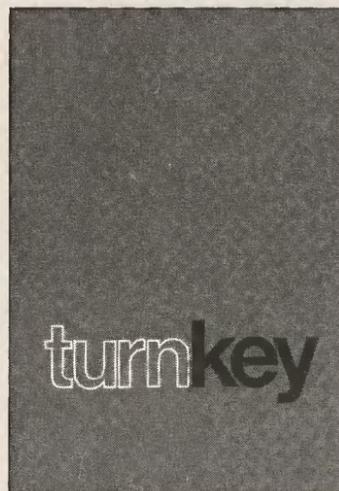
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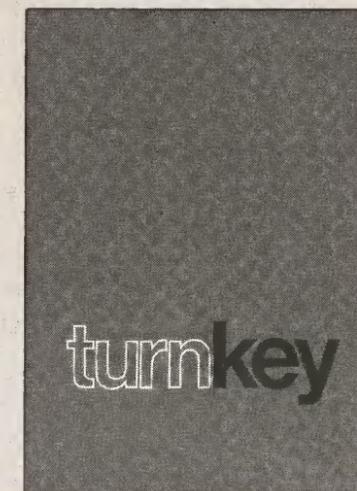
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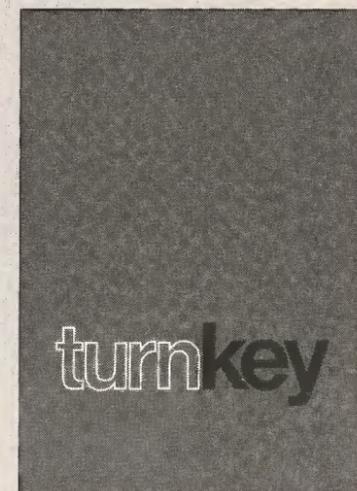
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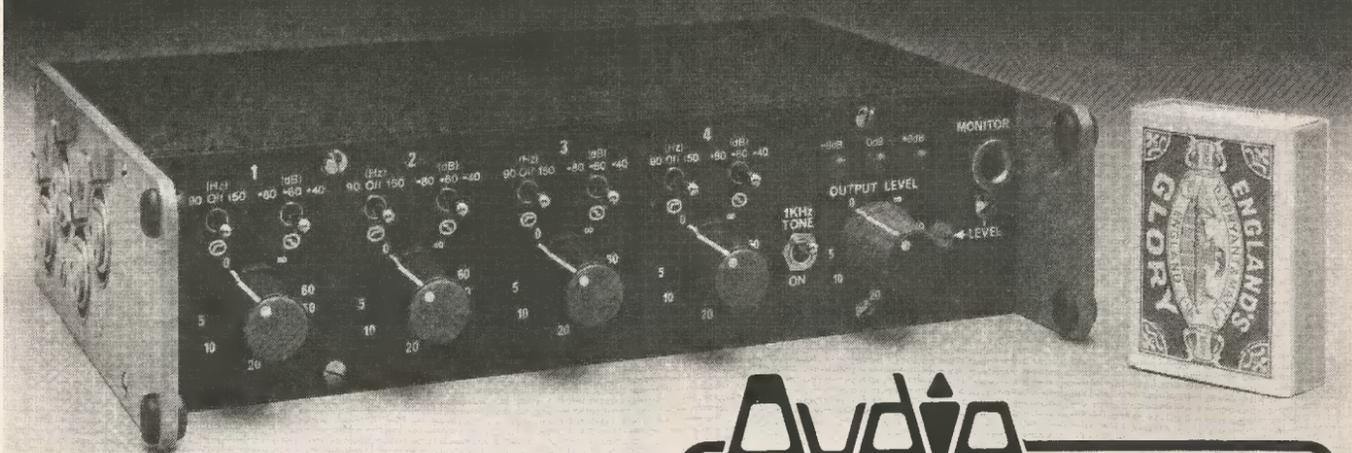


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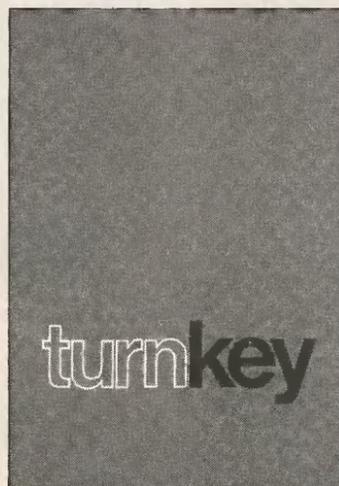


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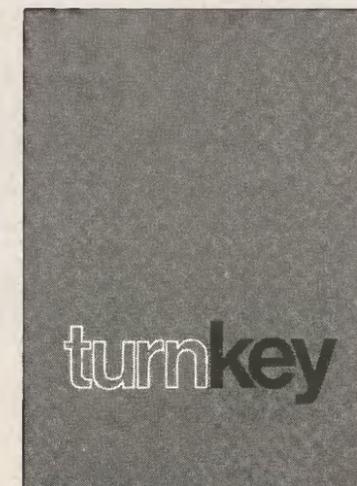
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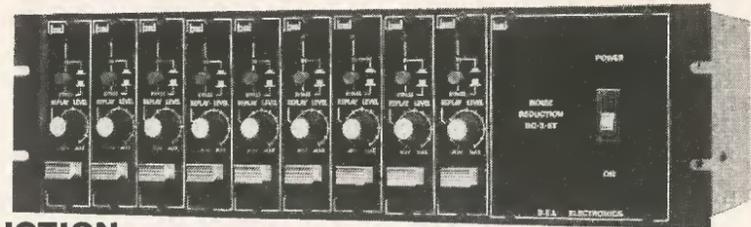
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Advertisements for this section must be pre-paid. The rate is 30p per word, minimum £6.00. Box Nos. £1.00 extra. Semi-display rates on application. Copy and remittance for advertisements in **DECEMBER 1980** issue must reach these offices by 3rd **OCTOBER 1980** addressed to: The Advertisement Manager, **Studio Sound**, Link House, Dingwall Avenue, Croydon CR9 2TA.

**Note:** Advertisement copy must be clearly printed in block capitals or typewritten.

Replies to Box Nos. should be addressed to the Advertisement Manager, **Studio Sound**, Link House, Dingwall Avenue, Croydon CR9 2TA, and the Box No. quoted on the outside of the envelope. The district after Box No. indicates its locality. **SEX DISCRIMINATION ACT 1975:** No job advertisement which indicates or can reasonably be understood as indicating an intention to discriminate on grounds of sex (e.g. by inviting applications only from males or only from females) may be accepted, unless (1) the job is for the purpose of a private household or (2) it is in a business employing less than six persons or (3) it is otherwise excepted from the requirements of the Sex Discrimination Act. A statement must be made at the time the advertisement is placed saying which of the exceptions in the Act is considered to apply.

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.

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10-49	51p	53p	55p	59p	63p	67p	72p	80p	87p	97p	107p	117p		
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150-249	43p	45p	47p	48p	50p	52p	60p	69p	74p	84p	94p	104p		
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500-999	39p	40p	41p	42p	43p	44p	51p	59p	67p	77p	87p	97p		
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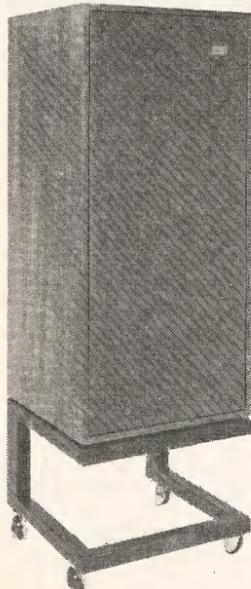
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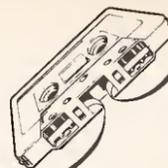
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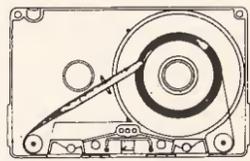
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## INDEX TO DISPLAY ADVERTISERS

AKG Acoustics .. .. .	4
Abacus Electronics .. .. .	114
Acoustic Transducer Co. Ltd. .. .. .	8
Acoustical Manufacturing Co. .. .. .	16
Advanced Music Systems .. .. .	89
Alice Stancoil .. .. .	12
Allen & Heath/Brenell .. .. .	6, 7
Amek .. .. .	108
Ampex .. .. .	70, 71
Aphex Systems Ltd. .. .. .	41
Atlantex Music .. .. .	95
Audio & Design (Recording) Ltd. .. .. .	83
Audio Developments .. .. .	114
Audio Kinetics .. .. .	20, 104
Audix Ltd. .. .. .	20
Ban Electrical .. .. .	32
Bauch, F. W. O. Ltd. 15, 17, 19, 21, 23, 33, 106, 110, IBC .. .. .	22
Beyer Dynamics .. .. .	28
BGW .. .. .	30, 31
Britannia Row .. .. .	69
Brooke Siren Systems .. .. .	110
Bulgin Electronics Soundex Ltd.) .. .. .	105
C.A.E. Ltd. .. .. .	112
Canford Audio .. .. .	12
Cara International .. .. .	77
Court Acoustics Ltd. .. .. .	29
Design Electronics .. .. .	25
Dolby Laboratories Inc. .. .. .	94
Dominus .. .. .	86
Eardley Electronics .. .. .	30
Eela Audio .. .. .	87, 99
Feldon Audio .. .. .	101
FM Acoustics .. .. .	14
Formula Sound .. .. .	112
Future Film Developments Ltd. .. .. .	27
Gardeners Transformers Ltd. .. .. .	91
H/H Electronics .. .. .	5
Hayden Laboratories Ltd. .. .. .	45
HHB PA Hire and Sales .. .. .	9, 11, 13
I.T.A. .. .. .	18
John A. Steven .. .. .	59
Klark Teknik Research Ltd. .. .. .	113
Lake Audio Components Ltd. .. .. .	116
Larking, Don, Audio .. .. .	50
Lexicon Inc. .. .. .	20
Lockwood & Co. .. .. .	39
M.C.I. Ltd. .. .. .	24
Magnetic Tapes Ltd. .. .. .	93
Melkuist Ltd. .. .. .	110
Mick's Electronic Workshop .. .. .	IFC
Midas Amplification .. .. .	58
Mike Shop, The .. .. .	65
Monks, Keith, Audio .. .. .	106
Mosses & Mitchell .. .. .	112
Mustang Communications .. .. .	35
MXR .. .. .	75
Neal Ferrograph .. .. .	OBC
Neve International Ltd. .. .. .	53
Otari Electric Co. Ltd. .. .. .	114
Plan Audio .. .. .	97
Plus 30 .. .. .	79
Progressive Electronic Products .. .. .	14
Rank Strand Sound .. .. .	113
Red Acoustics .. .. .	23
Revox .. .. .	26, 27
R.E.W. .. .. .	37, 73
Scenic Sounds .. .. .	76
Sescom Inc. .. .. .	10
Shure Electronics .. .. .	110
Simmon, Paul .. .. .	43
Solid State Logic .. .. .	57
Soudercraft Electronics .. .. .	79
Spectra Sonics .. .. .	116
Spendor Audio Systems Ltd. .. .. .	103
Statik .. .. .	104
Studio Equipment Services .. .. .	94
Surrey Electronics .. .. .	110
Switchcraft .. .. .	24
Synton Electronics BV .. .. .	47
T.D.K. .. .. .	60, 61
Tannoy .. .. .	82
Technicord Ltd. .. .. .	82
Tentel .. .. .	67
3M UK Ltd. .. .. .	111
Trad Sales & Services .. .. .	107
Trident Audio Developments Ltd. .. .. .	78, 101, 109, 115
Turnkey .. .. .	31
Ursa Major .. .. .	55
Valley People Inc. .. .. .	56
White Instruments Ltd. .. .. .	



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Our 5316 is designed for both radio and television production with facilities for multi-track recording. It is available with 24 or 36 input channels each assignable to 8 group busses with outputs for 8 track or, via the group master switching system, to two main outputs for broadcasting or tape monitor mixing.

The Neve 5315 is a 12 or 24 input channel console with 4 sub-groups, 2 main outputs and 4 auxiliary outputs.

Neve quality in design and construction not only enables the 5316/5315 range of consoles to operate under the rigorous demands of broadcast OB van and studio operation, but also results in less expense over long operational life.

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Photograph courtesy of Thames Television.

## 5316/5315 – proven quality in action

You have probably heard from us already – Neve 5316/5315 audio consoles have been chosen by many international radio and television broadcast organisations for their quality and versatility.

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