

MDR

M A S T E R I N G
D U P L I C A T I O N
R E P L I C A T I O N

PRODUCT GUIDE

The Essential Equipment List

MASTERING

CEDAR CR-1 and DC-1
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tc electronic M5000

DUPLICATION

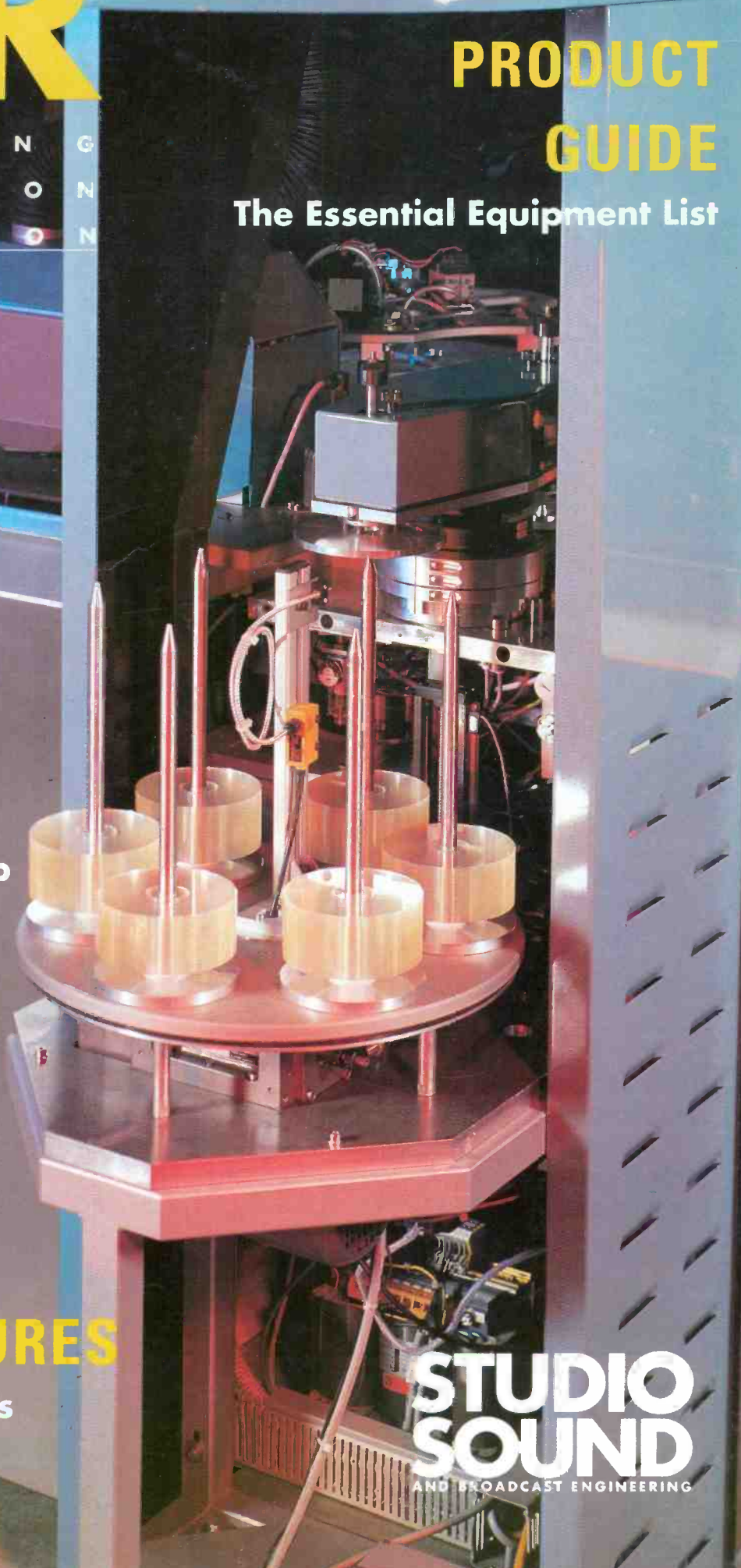
Tapematic ST31

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Data Disc Starline 480

OPTICAL FUTURES

Tomorrow's CD formats



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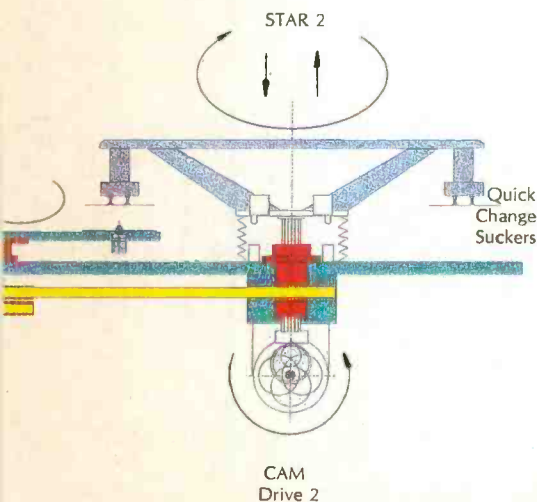
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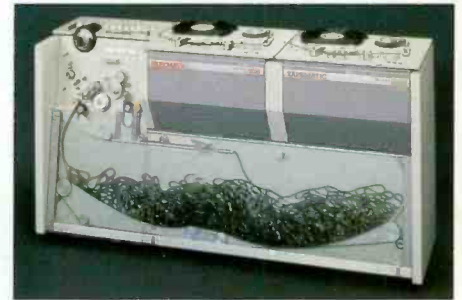
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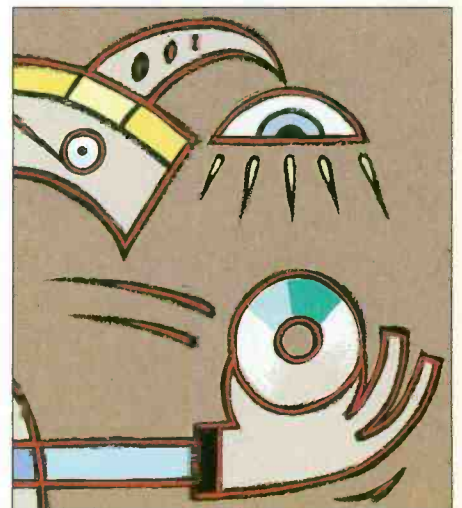
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The Swedish krona has become about 25% cheaper.

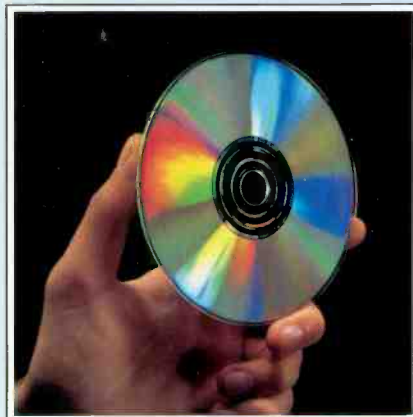
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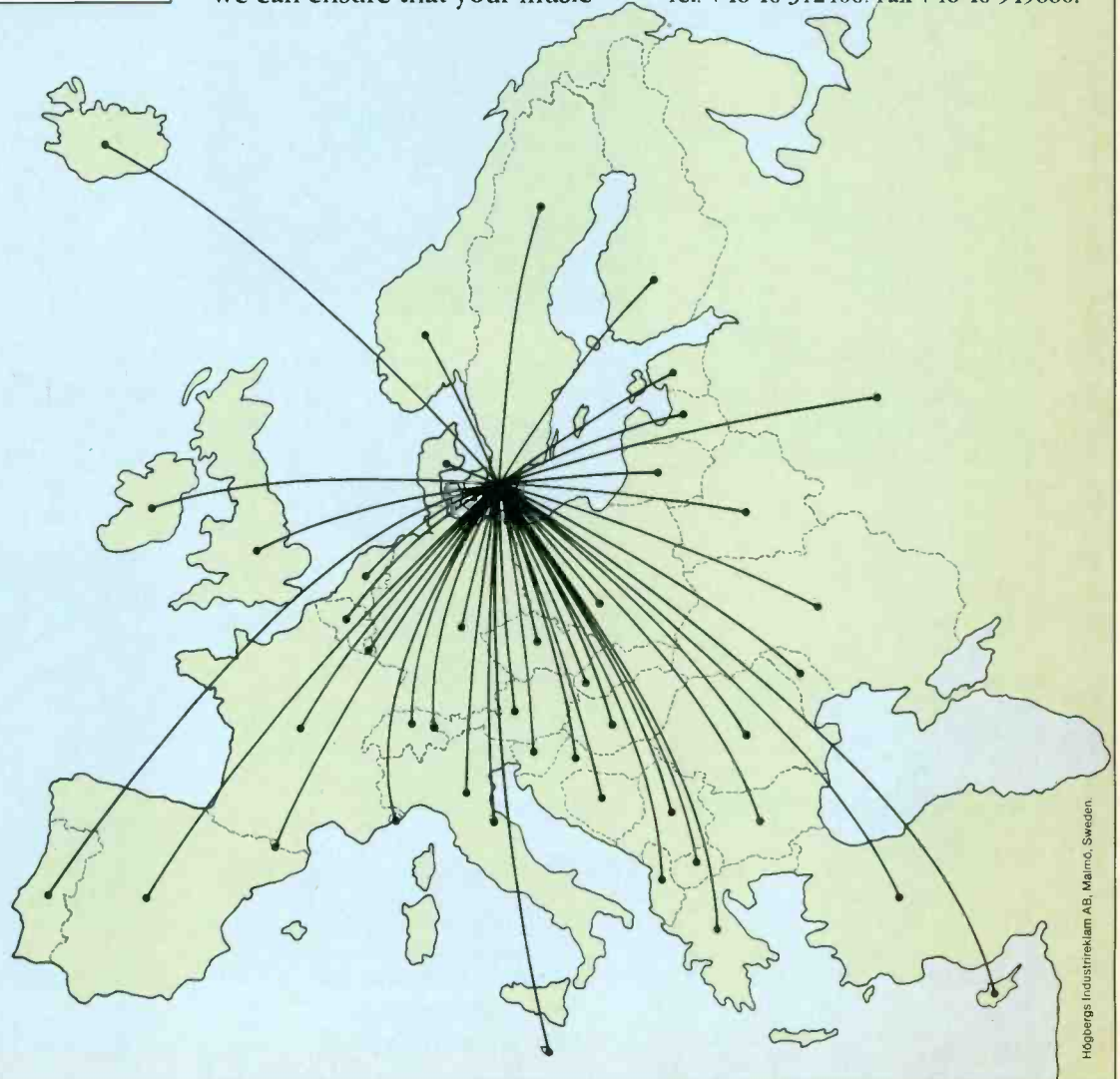
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EDITORIAL

The democratisation of technology

Photography was once the exclusive pleasure of the wealthy, for it was only they who could afford the necessary equipment. Without it—and the time to master it and photography's techniques—photography was closed to you. With advances in technology, however, photography became available to the masses. Slowly at first, but with increasing speed until almost all of us own and use a camera. The spread of the technology gave increased numbers of people the opportunity to become expert—and even professional—in the art.

Sound recording once depended on similarly exclusive technology. The use of expensive microphones, tape recorders and other equipment placed it beyond the reach of the general public no matter how enthusiastic they may have been about the output of those mystical recording studios.

It is technology that made photography accessible, and when it turned its attention to music (and cars and aeroplanes) it produces the same results: more equipment, more users, wider experience and expertise. Although, significantly, a professional photographer confided in me many years ago that there were 'more cameras and fewer photographers' around than there had ever been before.

But take the example of the revolutionary Fairlight CMI—a ground-breaking but prohibitively expensive computer-based musical instrument. Initially there were a limited number of people skilled as operators—as such these people were able to command not only considerable respect for their skills but considerable sums of money. As the same facilities (sampling, sequencing) became available through cheaper instruments, the importance of the Fairlight operator faded.

Today the world has a wealth of recording studios of all sorts and sizes. Some are used purely for pleasure; others demonstrate the faith their owners have in breaking through into professional recording. Many, of course, are entirely professional. But even here there is considerable variety. Technology no longer dictates that professional facilities are 'better' than non professional facilities. Instead, a more power definition of professional has arrived—simply that of being used for professional ends.

The same is true of film and video. Although the spotlight has turned somewhat away from film as a popular medium, video cameras have never been so cheap or freely available. The result, of course, is that more people are taking an active interest in using them—some of them with professional intent. Cheap video editing is a reality in spite of its sophistication, and increasing numbers of feet of broadcast footage are being derived from modest facilities.

And the advance continues. The democratisation of recording is presently taking it further into the realms of premastering, mastering and duplication-replication. Once it was commonplace for young bands to produce their own cassettes. Then they were pressing records. Next they began making their own videos. Now they are making CDs. And where 'signed' bands, once obliged to record in professional studios, found they could spend the recording advance on their own studio they are finding CD making increasingly interesting—Data Disc Robots have even developed their system (mentioned in conjunction with the *Starline 480* elsewhere in this issue) with 'beginners' in mind.

It has long been said that you cannot resist the march of progress. And it is certainly true that those who most attentively read the writing—wherever she is writ—produce the best game plans. Currently, the active interest being shown by newcomers to the mastering, duplication and replication field continues to grow, whether these newcomers are from the music, data or any other areas of business matters little; their interest is all.

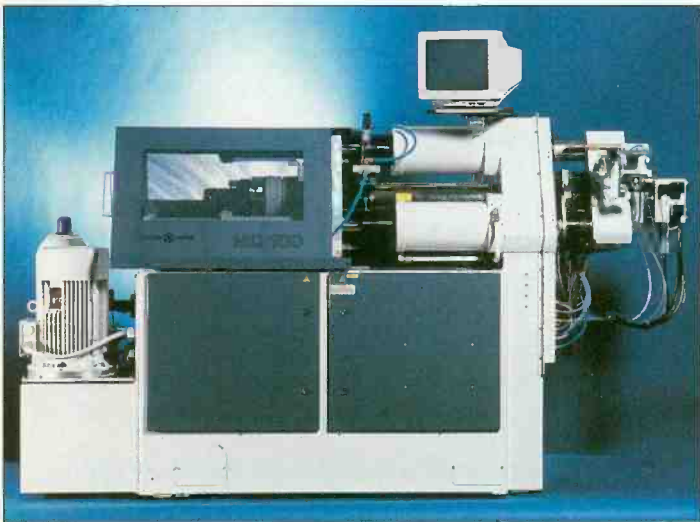
Their interest is one of the reasons *MDR* was launched. It is the reason you are reading this Editorial.

And it is focused on you. ■

Tim Goodyer

Cover: Data Disc Robots *Starline 480*

International News



Winbo Zibo in the Chinese Province of Shandong recently took delivery of a complete turnkey system for the manufacture of double-density optical discs. The system consists of a Nimbus mastering system fed by a Toolex Alpha MD100 injection moulding machine.

Greencorp grow

The Australian tape manufacturer, Greencorp Magnetics, have met growing demand for their tape products with increased production capacity. Currently, manufacturing a variety of pancakes, the expansion will not only allow an increase in existing production but enable Greencorp to move into diskettes.

Established in 1927 and based in Sydney, the company manufacture pancakes for high-speed and in-cassette duplication, preleadered pancakes for blank-cassette loaders, magnetically-coated polyester rolls for slitting into pancakes, magnetic card stripes and 'other specialised tapes for magnetic media requirements'. There are presently four tape lines—XD386, a super gamma ferric; DX38 and XD36, gamma ferric music-quality tapes; and CR230, chrome dioxide.

Greencorp Magnetics Pty.

Tel: +61 2 611 6511.

Fujii International.

Tel: +1 818 368 1871.

Verbatim-Sanyo

As a result of a recent agreement, the Verbatim Corporation and Sanyo Laser Products Inc are set to become one of the largest independent CD-ROM and Audio-CD producers in North America.

Under the agreement, Verbatim's optical disc technology will be made available to Sanyo's Richmond, Indiana CD plant, and Verbatim will

contribute a cash sum (presently undisclosed) towards expansion of the facility. On the announcement of the agreement—September 22nd—Sanyo President, Hidetaka Iijima stated: 'An immediate expansion [of the plant] will allow the joint venture to produce 50 million units of CD and CD-ROM discs annually. We expect to increase the annual capacity to 100 million units within two years.'

Verbatim President Nicky Hartery said... 'Many of our customers have asked us about expanding our CD-ROM services. Now we can offer them the full range of CD-ROM services from premastering and mastering to replication, custom packaging and fulfilment services for large volume applications.'

Verbatim Corporation.
Tel: +1 704 547 6500.

ODC demo 3.3

What is claimed to be the first HDCD production demonstration recently took place at Time Warner's Allied Record plant in Los Angeles recently. ODC announced that they had been working with 'major consumer electronic manufacturers' to support 3.3Gb players.

The prototype HDCD was mastered on an ODC Series 500 Mastering Module and replicated at the Allied plant. It offers approximately four times the capacity of existing CD-ROMs and was replayed on a prototype player. Where existing video CD formats carry around 72 minutes of MPEG1 video, the HDCD format is claimed to

be capable of holding up to 135 minutes of MPEG2 video at data rates of up to 3.3Mbit/s.

ODC founder Richard Wilkinson said: 'We are pleased to make this technology available to player manufacturers who have a serious interest in exploiting its capability, which is certainly within our grasp.' Consumer players are intended to be available by late-1995 to early-1996.

ODC's Blue Book HDCD standard has already been published and are available from ODC World HQ.

ODC. Tel: +1 310 946 3050.

Fax: +1 310 94 6030.

Sound Investment

London's Sound Mastering CD mastering facility have recently made a considerable investment in new technology and new equipment.

Top of the list is a SADiE hard-disk editing system with 12Gb of storage which now compliments an AMS Neve AudioFile system. The existing B&W 801 monitoring has been enhanced by the installation of a DynaudioAcoustics C2 Sub-bass system, while new outboard equipment includes two Valley Audio Dynamap 730 digital comp-limiters, two Yamaha DEQ5 digital equalisers, and Eventide DSP4000 with Patch Editor and two Sony 2700 DAT recorders.

Sound Mastering are expecting to open a third room during 1995.

Sound Mastering.

Tel: +44 181 961 1741.

Fax: +44 181 961 8725.

ODME go Apex

July 7th saw the signing of a contract between the Dutch-based Optical Disc Manufacturing Equipment company and the American Apex Systems test equipment manufacturer giving ODME a 60% holding in Apex.

The contract was signed by ODME's Rob van Dorp and Apex' President, Scott Hamilton, and Vice President, Mark Matlin. The arrangement is seen as a unique venture by both parties facilitating test equipment covering all types of optical media testing and mastering.

Of particular significance is the positioning of ODME and Apex with respect to the further development of HDCD formats.

ODME Bv. Tel: +31 40 433877

Apex Systems Inc.

Tel: +1 303 443 3393.

DAT to Disc

Three new mastering systems from Accurate Sound of California will be launched at the San Francisco AES Show. Capable of delivering a complete, PQ-encoded CD suitable for use as a pressing master from a DAT master, the new systems use Kodak's high-speed writers—a PCD 225 for the low-cost system and a PCD 600 for the more costly, higher productivity system.

Two of the complete systems include the Kodak Writer, Apple Mac computer platform, hard disk, DAT machine, audio-acquisition board and all software necessary for driving the system and CD authoring. As well as producing CD conforming to Red Book standard, the Accurate systems will support CD-ROM authoring.

The third system, the stand-alone Alea CD maker, employs a Yamaha 4x burner, DAT and hard disk drive and will operate without assistance from a PC. It will, however, accept software updates via an integral diskette drive.

Accurate Sound Corporation.

Tel: +1 415 365 2843.

Fax: +1 415 365 3057.

New opticals

From the Liechtenstein-based Balzers, come two optical manufacturing units: the CDI 905 metalliser and SDS 100 sputtering unit.

Joining Balzers' existing 900-series metallisers, the CDI 905 offers a 1.8 second cycle time and tool-less target and mask changes. The SDS 100 is a single-disc sputtering unit for M-O and MiniDisc applications, with a capacity of up to 360 discs per hour.

Balzers. Tel: +41 75 388 41 11.

Fax: +41 75 388 54 23. ■



Balzers CDI 905 metallisation system needs no tools for target and mask change

The ODME CD-manufacturing system



- * Media Conversion System - MCS
- * Automatic Mastering and Stamper making system - Masterliner AMS 100
- * CD-Replication System - Monoliner® MK IV
- * Test equipment - Q-Liner ABC 200 DS and Q-Liner ODT

The strength of a modular approach

ODME is the worldwide market leader in the field of manufacturing systems for CD-Audio, CD-ROM and Laser Discs. Their supply programme includes premastering, mastering, electroforming (stamper making), replication, printing, packaging and quality control.

In offices in Eindhoven, Veldhoven (both in the Netherlands), Charlotte (USA) and Taipei (Taiwan), ODME is constantly working on product improvement and intensive customer support. The focus of ODME's company strategy is total commitment to customer relations and their market needs.

OPTICAL DISC MANUFACTURING EQUIPMENT

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ODME USA 7516 E. Independence Blvd. Suite 106 Charlotte, NC 28227 USA Phone: +704 536-6363 Fax: +704 536-6034

New Facilities



Laura and Ronnie Garrity, owners of Tape To Tape with their new Aiwa XKS7000 cassette decks

Tape to Tape

UK: 'The new digital room must rank as one of London's finest mastering suites—not only from an audio point of view, but also aesthetically.'

This is the claim of Richard Beecham, newly appointed Mastering Engineer at the London Tape to Tape mastering facility. It is a bold claim, but one that is supported by the choice of equipment which has recently found itself installed there. The two new Sonic Solutions systems are supported by Prism Sound AD-1 20-bit A-D converters, Summit valve processors, Jünger digital compressors and Genelec monitoring.

The additional Sonic systems bring Tape to Tape's total up to three. Beecham, a Sonic system operator of some five years' standing continues, 'We spent a great deal of time assessing the various digital-editing systems available and eventually decided on the Sonic Solutions because of the productivity advantage, reliability and flexibility that the system offers.'

The 20-bit compatibility interfaces well with the Prism Sound converters which themselves employ a proprietary noise-shaping system for mapping 20-bit programmes to

16 bits. Managing Director Ronnie Garrity adds: 'The new rooms are the first stage in a long-term investment that will build Tape to Tape into a one-stop mastering complex.'

Additionally, Tape to Tape have seen the opening of short-run CD-R production and DAT duplication facilities, and are expecting to be able to offer vinyl disc cutting later in 1994.

**Tape to Tape, 19 Heathmans Road, London SW6.
Tel +44 171 371 0978.
Fax: +44 171 371 9360.**

Data Audio Technologies

Australia: Jointly owned by Warner Music Australia and EMI Music Australia, the Sydney-based Data Audio Technologies facility have recently been undergoing an expansion of their CD production capabilities.

Centring around the installation of a *Series 500 CD Mastering Module* from the American Optical Disc Corporation, the Data Audio initiative will allow production of a variety of optical formats including CD-ROM, CD-i and Video-CD as well as CDs for audio applications. Firmly in the facilities sights is the option to

move into MiniDisc production when the time is right.

The specific demands of the Australian replication market. Long, high-volume production runs defer to shorter runs, with the consequence that rapid changeover of stampers is a major consideration. Data Audio Managing Director Ken Harding, feels that the ODC option offers this

and other advantages in materials operating costs. His acute awareness of the damaging effects of downtime—whether for stamper changeovers or through equipment failure—is another factor in the choice of the *Series 500*. 'Each day of downtime is terribly expensive,' Harding confirms, 'and I reached the conclusion that ODC's technical service team headed up by Asian Regional Manager David Standridge was simply the best in all of South-East Asia.'

Harding anticipates that 80% of the plant's output will feed the local Australian market, with the remaining 20% being directed to New Zealand. This is expected to equate to some \$30m (Australian) worth of sales.

Zhuhai Mastering

China: A new company is to appear on the stage of the World's largest single market to service it with a state-of-the-art CD mastering plant. The company—Zhuhai Gold Laser Mastering Ltd—will be located in the Chinese city of Zhuhai and service existing Chinese replication facilities with stampers mastered on an ODC *Series 500 Mastering System*.

The initiative for the venture came about as a result of a political visit by Chinese statesmen Bai Lichen (Chairman of the Ningxia region of the People's Republic of China) and Zhang Zhi Gang (Director of the Bureau of Economic Relations in Ningxia) to the US manufacturer's Californian base. ■



Left to right: Henry Fai, President of Data Link; Zhang Zhi Gang, Director of Foreign Economic Relations, Ningxia Hui, Autonomous Region, China; Bai Lichen, Chairman, Ningxia Hui Autonomous Region, Yinchuan, China

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CEDAR SERIES 2 DC-1 AND CR-1

CEDAR's Series 2 badge marks a significant improvement in performance

Earlier this year, CEDAR's stand-alone processors (derived from the company's computer-based audio-restoration system) saw an addition to the range. The established *CR-1 DeCrackler* and *DC-1 DeClicker* (see reviews in *Studio Sound*, October 1993 and February 1994 respectively) were joined by the *AZ-1 Azimuth Corrector*, whose purpose is to re-align time differences between left and right channels of a stereo signal such as those produced by incorrect replay-head azimuth on an analogue tape machine. This is not intended as a comprehensive review of the *AZ-1* (see Issue 2 of *MDR*) but since CEDAR's latest offerings incorporate ideas and changes introduced in the *AZ-1* a brief recap is in order.

The *AZ-1* uses the same processing engine as the other units, but its software looks for the best fit of any signals common to both channels and applies compensatory delay to bring those common points back into line. The compensation is checked and adjusted 44 times per second in order to allow for continual changes in the amount of error, a common phenomenon with misaligned tape paths, and can be manually overridden in the unlikely event that other factors—deliberate delay effects for instance—make it difficult for the system to detect the required alignment.

CEDAR set out very deliberately to make these units as cosmetically similar as possible—the front panels of the *DC-1* and the *CR-1* are effectively identical apart from the delicate shade of grey. The differences only become apparent when the units are switched on, when the large LCD panel shows the different available parameters and the roles of the five main function keys.

The *AZ-1* continues this tradition, using a particularly interesting display on its screen to announce its function. This takes the form of a graphic representation of the stereo soundfield based on Lissajous figures, with the refinement that the amplitude of the display is logarithmic rather than the linear trace an oscilloscope would give, producing a tighter, clearer picture of the signal's spatial distribution. Phase discrepancies between the two channels show as a lateral elongation of the basically circular pattern. The

audible effects of misaligned azimuth should be familiar enough—loss of focus, poorly defined localisation, central images losing their presence and a general muddiness.

Switching the correction process in shows its result immediately on the display, which generally appears as a vertical elongation of the pattern with central bunching of the dots making up the picture. This corresponds to the audible effect, which is the removal of the ambiguities in the stereo image, a greater presence and clarity, a better-defined bass and an overall tightening and stabilising of the whole picture. The system works remarkably effectively, and should be a godsend to, for instance, mastering houses presented with copies made with misaligned machines—once an azimuth error has been copied it cannot be corrected by the normal method of realigning the playback machine's heads and would not be salvageable without the *AZ-1*.

Despite the *AZ-1*'s evident similarity to the other CEDAR models, the sharp-eyed will notice a small visible difference: the rack ears are no longer simply the ends of the front panel but are detachable. This change means that the unit looks neater when sitting on a table top, but has more far-reaching implications—it is the only outward sign that the entire physical platform for the processor has been re-engineered.

The front-panel construction has been redesigned to effectively screen the internal boards from interference from the display or the data on the controls, and to form part of a Faraday cage surrounding the entire processing circuitry. CEDAR point out that new regulations are going to force manufacturers to think more carefully about keeping interference safely locked inside their products, and this was a factor in the redesign; they also point out that the new regulations incorporate basic sound-design practice which can significantly improve a circuit's noise performance. CEDAR claim a dynamic range of 103dB for the *AZ-1* as a result.

CEDAR are justifiably proud of the construction of the new chassis and the boards within it, which have a striking appearance of

uncompromising quality. The next stage has been to put the original processors into this chassis, and this, together with further modifications, has led to the introduction of the *DC-1* and *CR-1* Series 2.

The other main change is the addition of dedicated processing for the I-O; formerly this tied up about 10% of the DSP chip's time, so separating it out in this way frees that time for further refinements of the processing algorithms. The resulting improvement is audible; while there were never any really significant side-effects of the processing the new versions sound even cleaner and make it even easier to achieve the desired result. This is helped further by increased resolution of the parameter controls, such as the *DeCrackler*'s THRESHOLD control which now operates in 0.1dB increments. Again, setting up the units before was very easy—it was harder to produce a bad result than a good one—but now the absolute optimum seems easier to find, with a much wider band between the extremes at which the processing starts to become apparent.

It is good to see that CEDAR are not resting on their laurels, despite the continuing success of their very specialised products. The Series 2 processors show worthwhile improvements in audio performance and processing power, and all for the same price as the original versions. ■

Dave Foister

CEDAR Audio, 5 Glisson Road, Cambridge CB1 2HA, UK. Tel: +44 1223 464117.

UK: HHB Communications Ltd., 73-75 Scrubbs Lane, London NW10 6QU. Tel: +44 181 960 2144. Fax: +44 181 960 1160.

USA: Independent Audio, 295 Forest Avenue, Suite 121, Portland, Maine 04101-2000. Tel: +1 207 773 2424. Fax: +1 207 773 2422.



Series 2 times two - the new DC-1 and CR-1



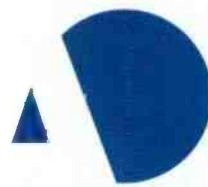
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THE STANDARD!



Because of our continuous research and product developments, outstanding system performance has made the CD CATS the worldwide standard measuring equipment for quality control of compact discs.

The CDM4 optical chassis from Philips, now the standard on the entire CD CATS product line, represents the latest advancement from Audio Development. To maximize test system accuracy and minimize tester-to-tester variability, the CDM4 optical chassis are carefully selected exclusively for us by Philips according to the specifications set by our product development team. The selection criteria are strict and only the best chassis are accepted for use in the CD CATS systems. The chassis are also upgraded mechanically to enhance the design for use in the demanding production testing environment.

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AUDIO DEVELOPMENT

PLEASE CONTACT US FOR MORE INFORMATION ABOUT THE CD CATS PRODUCT LINE:
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STARLINE 480

Tim Goodyer looks at the new flagship CD production system from Data Disc Robots and assesses the significance its greatly reduced cycle time

At the time of its arrival in the market, CD was received with the kind of incredulous reception enjoyed by other technical developments such as *Concorde* and nuclear power. As such, it experienced a 'honeymoon' during which both business and consumer were (largely) happy to tolerate any shortcomings it might have had.

Today, the honeymoon is over and the pressure is on for CD to produce unprecedentedly high standards of audio reproduction and also lend itself to an ever-increasing variety of data-based developments. The pressure is on, too, for it to present a sound business opportunity for all concerned. With competition at the heart of most business, the designers of CD replication systems have consistently sought a way by which they might offer the means by which replication plants might steal a lead over each other. The result,

inevitably, is that CD manufacture has become a highly evolved affair, with limited opportunities for advancement unless facilitated by a serious technical breakthrough.

Based in Würselen, in the heart of Europe, German manufacturer Data Disc Robots have devoted their three years of trading entirely to the development and service of automated CD replication systems. That Data Disc should now be able to offer a system capable of a sub-two-second cycle time is, therefore, logical reward for their efforts.

Development

The *Starline* system represents what Data Disc Robots had come to regard as 'what was actually missing from within the wide range of replication systems'. The elements of this missing link include an improvement over 4–5 second cycle-time systems of a sub-two-second cycle time, accurate handling of the replication of a wide variety of CD formats and flexibility of application to allow replication plants freedom to benefit from its installation. The architectural design of the *Starline 480* included requirements for ease of installation and maintenance, a small footprint, speed and accuracy of operation, minimal downtime, monoliner and duoliner applications, opportunities for use in established replication facilities and new facilities and finally a competitive price point.

The *Starline 480* is designed, therefore, as a fast downstream system. The topology of the line includes loading (either from a single CD turntable or a 6-spindle loading station), metallising, coating, UV curing, scanning and off-loading via two 6-position spindles. The pairing of the *Starline 480* with one or more injection moulding machines is an important consideration of its design and application. The line has a footprint of 3.2m x 1.3m and stands 1.85m high. Fig.1 shows the handling layout of the *Starline 480*. All system components are controlled via two control cabinets.

Operation

Data Disc concluded that a sub-two-second cycle time is beyond the scope of a robot-based handling system and chose instead to develop a new, proprietary alternative. This appears in the form of the Link Drive system—a gear-train drive arrangement using toothed belts an interlocked handling stars. The absence of cylinders, single motor and few necessary sensors are intended to minimise operational wear and consequently greatly improve mechanical reliability. The schematic Fig.2 details the *Starline 480*'s Link Drive system.

One of the key elements of the *480* is the incorporation of the new Balzers *CDI 905* metalliser. As this element alone has a cycle time of just 1.8 seconds, it can readily be seen that it matches Data Disc's low cycle-time philosophy.

OEM elements also have their part to play in the system, as evidenced by the use of two Hamatech lacquering pots for spin coating. The proven field reliability of the Hamatech units is obviously an important factor—to date there have been over 100 units sold and support is readily available worldwide—but where other CD production systems using these pots have opted for the whole Hamatech 'package', Data Disc have been particularly selective and incorporated much of their own design.

Alongside sourced, third-party elements, the *Starline* relies on Data Disc's own proprietary expertise to enable the system to meet its brief. Consequently, UV drying is taken care of by Data Disc's own *QL-1* lamp (Fig.3). This permits drying in under one second and is specifically designed in to the *Starline 480* to allow the easy-access maintenance essential to a commercially advantageous optical-disc production line.

The scanning duties are also down to new technology—in this case, Data Disc's CDIS or Compact Disc Inspection System. CDIS is based on CCD cameras and is capable of identifying disc defects less than 20µm when running at a cycle time of one second. The basic CDIS system fitted to the *Starline 480* may be upgraded to incorporate a lacquer checker and bar-code reader if required.

The *Starline 480* also employs an integrated flow system using three fans and an ionisation unit which gives a Class 100 clean room for processing.

Control

In keeping with many modern production-line systems, the *Starline 480* employs a software-based graphic operation and fault-finding system based on a screen display—however, while not all such systems use touch-sensitive screens, the *480* does. This combination of concise and informative display, and immediate control endows any production system with a particularly high level of integrated control. The *Starline* control system offers detailed control over all the system modules.

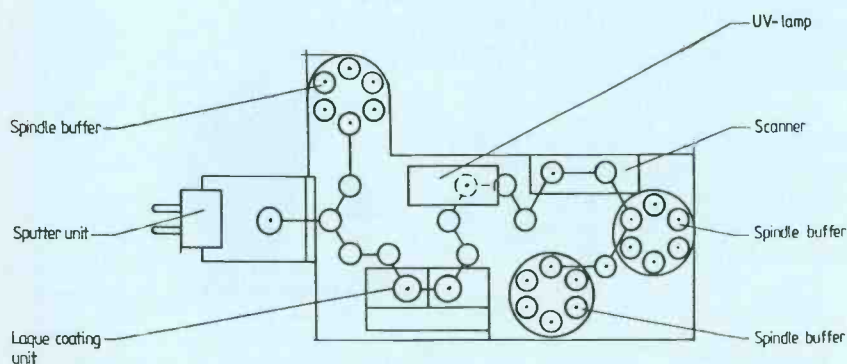


Fig. 1: Handling layout



The Starline 480

In the case of a production failure, the 480's on-line alarm-management system offers a detailed account of the event, a fault analysis and possible approaches to fault elimination. Additional benefits of the control system allow manual operation of all components and the facility for all operator actions to be registered.

Also, as the operating system is software-based, it may be regularly updated, with new versions of the software being transmitted via telephone line and modem. As the future evolution of replication facilities is likely to involve increasing levels of centralised control, the Starline control software will enable a single PC to effect comprehensive control of up to four or five mono-duoliner systems via host control connection. This control station need not be local to the systems themselves, but might be situated in the office of the production manager.

Configuration and savings

Having employed a specific strategy within the coating, drying, metallising, and Link Drive systems to ensure that the *Starline 480* is able to deliver a sub-two-second disc-manufacturing cycle

and ensured that downtime is limited through reliability and ease of access (Fig.4), Data Disc Robots are eager to promote the advantages of such a system.

The short-cycle time itself lends well to duoliner application. Assuming a cycle time of four to five seconds for injection moulding, the *Starline 480* can be fed by two moulding machines and comfortably deliver a 2.25s cycle time. Further, the unused capacity of the 480—given its 1.8s cycle time potential—leaves it ready to take advantage of such developments as the smaller and faster moulds promised by ICT Axxicon. These machines are expected to have a maximum cycle time of four seconds and will require downstream processing of no more than two seconds to for optimum use.

Also awaited are new manufacturing materials from Bayer, which should offer a significant improvement in terms of cycle times over those currently in use.

As any seasoned CD plant manager will tell you, even a small loss of potential capacity can have serious implications in a fiercely competitive market.

Employing a measure of efficiency known to the initiated as the Krebsler Factor. This measure of the commercial viability of any optical-disc production system came about as a result of a trade

show liaison between Data Disc and Netstal's Rudolf Krebsler and can be summarised as follows:

Investment sum x Cycle time = Krebsler Factor

The smaller the Krebsler Factor on any installation, the higher the return on the investment. ►

As the operating system is software-based, it may be regularly updated

CD REPLICATION SYSTEM

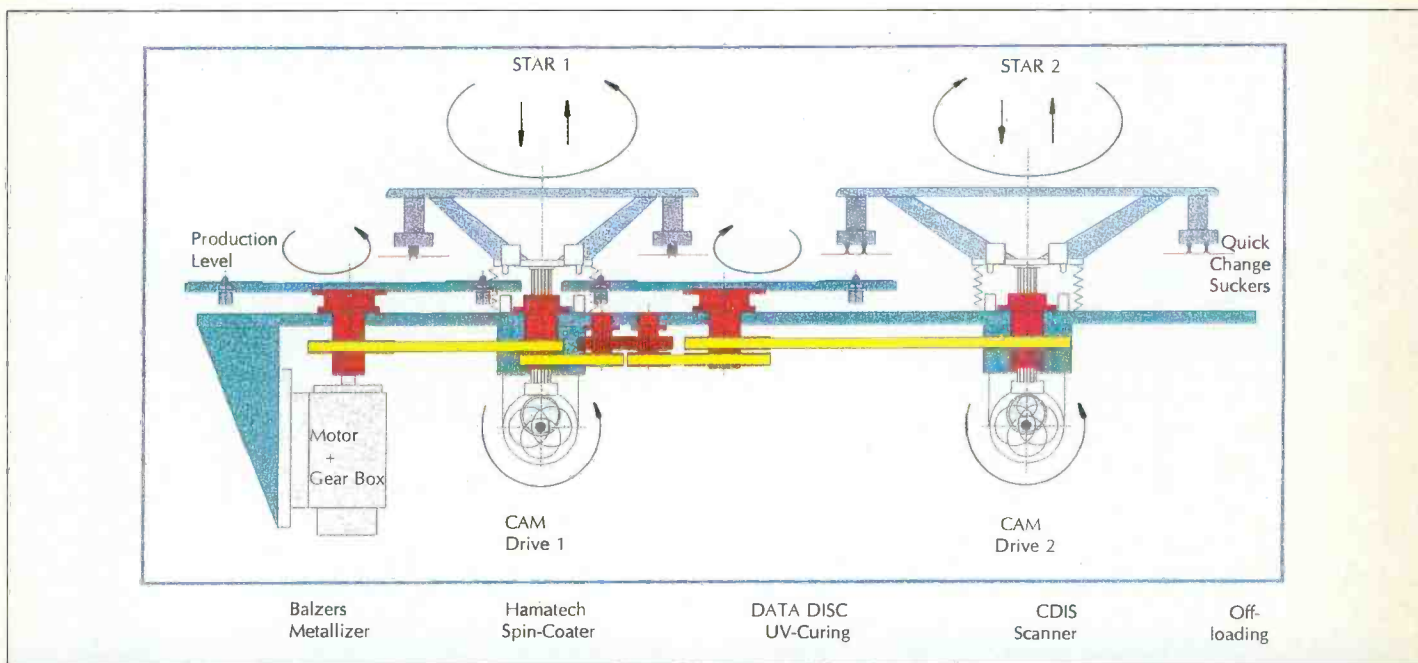


Fig. 2: The Link Drive system

The future

Although this article has concentrated on the *Starline 480*, Data Disc Robots have a number of new products appearing on the market, some of which play their part in the *Starline 480* itself. These new products include the Pro-CD optimisation system for improved performance of existing replication systems (this is not part of the *Starline 480* as it is already fully optimised), the CDIS quality-control system which may be used in in-line or off-line situations and resulted from a collaboration with Data Disc and the Bavarian ConTec company, and the *QL-1* UV radiation lamp for curing spin-coated optical discs. Data Disc Robots are quite unequivocal in their claims

regarding the design philosophies behind all these items—that the operational times have been optimised in recognition of the fact that replication time is replicators' money. It is difficult to argue to the contrary.

Of particular significance is the sister to the *Starline 480*, the *Starline 140*. Based on the development and technology of the *480*, the *140* is aimed specifically at newcomers to optical-disc replication—possibly from cassette or diskette manufacture, or from the expanding recording studio complex. The *Starline 140* is intended to be an easy-to-handle production system offering a cycle time of under six seconds (which equates to a potential capacity of 3–4m CDs per year) and will represent an investment of less than

\$1m (US).

One inescapable aspect of technical business development is that the nature of new equipment has to be based on practical operational principles backed up by experience in the field of operation. Data Disc Robots are eager to acknowledge these considerations also, and claim that the development of the *Starline 480*—along with their other products—is a result of their use and the company's relationship with its customers. Data Disc would further claim that these are the keys to the future. I would have to agree. ■

Data Disc Robots GmbH, Monnet Strasse 2, D-52146 Wurselen, Germany. Tel +49 2405 69020. Fax: +49 2405 18696



Fig. 3: UV drying with the QL1



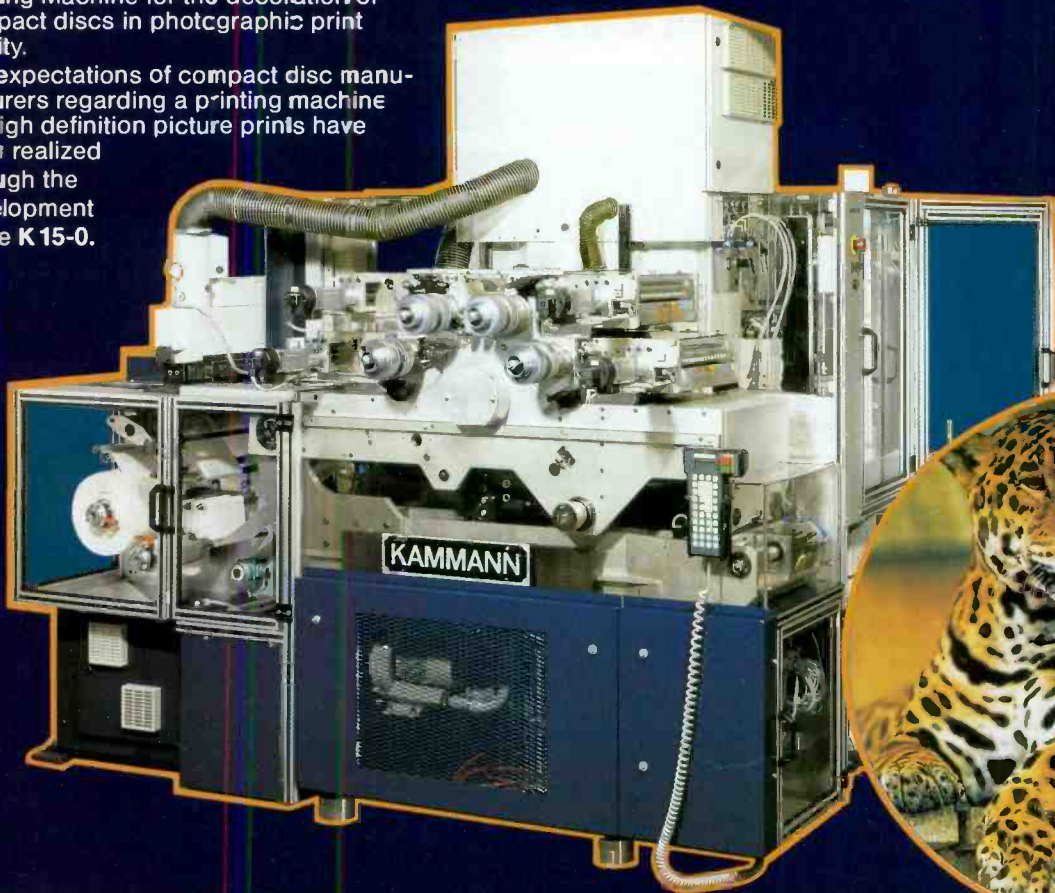
Fig. 4: Stamper changing

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M5000 MAINFRAME

A multifunction digital processor from tc electronic, the *M5000*, has steadily been winning worldwide acclaim with studio users since its release two years ago.

Now, with the addition of new software, the Danish unit looks set to impress the mastering community.

Described by tc electronic as a 'Digital Audio Mainframe', the idea behind the *M5000* being that the unit can take on a variety of guises all controlled via the same user-interface, dependent upon the software loaded. Although there is nothing particularly revolutionary about this, where the *M5000* does break new ground is in offering modular processing. This allows up to four DSP modules to be installed at the rear of the unit, each of which can operate totally independently with its own inputs and outputs.

The most recent addition to the *M5000* is *MD2* software. This has been specifically developed for mastering operations. This currently offers comprehensive dynamics processing and features a multiband facility capable of 3-band, frequency-conscious processing.

Overview

Rather than go into too much detail about the unit itself, I will outline the unit and then concentrate on the *MD2* software.

In its most basic form, the *M5000* is fitted with one DSP-1 module which provides a block of processing and digital I-Os (AES-EBU, SPDIF and optical). Sample rates between 32kHz and 48kHz are supported and the internal resolution of the unit is 24 bit. For analogue signal interfacing, an ADA-1 module must be fitted to provide 18-bit, 64x oversampled input and 20-bit output. The two modules can be installed in various combinations in the *M5000*'s four module slots, but to run the *MD2* software, just one DSP-1 module is required. It is, however, preferable to include an ADA-1 to allow analogue input and output.

New software may be loaded into the system in various ways: via memory card, 3½-inch diskette drive or via MIDI from another *M5000* or a suitable equipped computer.

The 2U-high front panel features a back lit, 80-character display window below which are five assignable rotary controls. Dedicated keys are provided for mode switching—Program mode (Select, Store or Rename Presets), Edit mode (Edit parameters in current Preset), Utility mode (various utilities for setup)—and Bypass.

Depending on the present mode of operation, the two Page keys will flick backwards and forwards between the available pages of parameters. Also included are DO and UNDO keys that provide an Execute function, and allow edited presets to be quickly compared with their indicators, showing presence of time code, MIDI, digital input and so on. There is also a 'device' selector which assigns front-panel control between installed modules, with



tc electronic's *M5000* makes moves into mastering

indicators showing which modules are currently under control. The memory card slot and diskette drive are also fitted at the front of the unit.

Operation has been logically thought out, and once the topology of the *M5000* is understood—and this does not take long—the unit is quick and easy to use.

MD2 software

As with all new *M5000* software, *MD2* is integrated into the complete package and requires an access code to allow it to run permanently. However, tc electronic allow it to be used free of charge for 100 hours before deactivating its 'demo' stage.

Rather than offering a standard dynamics package with compression, limiting and expansion a major feature of *MD2* is multiband dynamics. This splits the frequency range into two or three bands allowing frequency-conscious processing—thus it becomes possible to expand the low end, compress the mid band and limit the high frequencies from a single device.

The software currently includes 13 factory presets (written by four mastering engineers), the first three of which configure the unit as either a single-band compressor, 2-band compressor or 3-band compressor. This provides a good starting point from which the user may learn the system and its operation, as well as offering a platform from which to make modifications.

Excluding the single-band compressor, which effectively works across the full frequency spectrum, the multiband compressors can be tuned to operate over user-specified frequency ranges. This is achieved by adjusting the crossover points between bands. Thus, with the 3-band compressor, if high and low crossover points are set at ►

*tc electronic's
Digital Audio
Mainframe
moves into
mastering with
its MD2 software.
Patrick Stapley
reports*

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100Hz and 4kHz respectively, then the low-band compression will function up to 100Hz, mid-band will operate between 100Hz and 4kHz, while high-band compression will take place above 4kHz. Each crossover point has a reasonably gentle slope to avoid abrupt changes between bands.

The crossover settings relate equally to the three types of dynamic processing—so it is not possible, for example, to have different mid-high crossover points for a compressor and limiter. All three types of dynamic processing can function simultaneously for each band, and parameter control for each dynamic element remains completely independent. However, it is possible to link common parameters such that adjustment in one band will affect the others—for example, if the attack time for the mid-band limiter is adjusted, the same limiter attack values will be duplicated to the low and high-band limiters.

During parameter adjustment, the LCD window displays a horizontal bargraph which is sectionalised to show the three bands and the individual gain reduction taking place for each process. This provides a very useful overview of the processing, which potentially can become extremely complex and keeps the user in clear visual touch with its overall affect.

Additional control is provided for filtering sub-bass frequencies (including DC), input and output levels, and balance between left and right signals. The levels of the individual bands themselves may also be set, and a further control allows an internal unity gain reference to be set up.

Apart from the usual Threshold, Attack, Release, and Ratio parameters, the compressor also features a Crest control. This adjusts whether the compressor reacts to Peak levels, RMS levels or settings in between the two. Simply put, the Peak setting is best suited to program containing lots of spiky transients, while RMS suits program with much smoother dynamic changes, sharp crags against undulating hills if you like!

The compressor also features automatic gain make-up that will adjust the compressor output to match the unity gain reference level. The action of gain make-up is shown for each band in a Gain display.

The limiter is intended to function as a 'brick wall' device to avoid any full-scale overloads, and has a fixed ratio of $\infty:1$. Accordingly, its threshold level is referenced to full-scale: -12.0dB, and in most mastering applications this would be set a few dB down from zero. However, as an alternative to this dead-stop effect, which can sometimes be a little drastic, the unit also includes a Soft Clip function. This is a fixed-parameter process that comes into play at -6dB, rounding off any stray transients rather than cutting them dead. When driven hard, the Soft Clip response is not dissimilar to the effect of tape compression, and can produce some quite pleasing analogue sounding results.

An important consideration for a mastering compressor-limiter is an advanced side-chain feed, and the *M5000* includes a feed-forward circuit. By delaying the audio signal by a nominal amount (0ms–25ms), a feed-forward signal can be created that enables pre-emptive rather than reactive processing, thus enabling the unit to function

without any dynamic overshoots. Both compressor and limiter feed-forward times can be set independently for all bands, but must not exceed the Nominal Delay setting.

MD2 and Metropolis

One of the first mastering facilities worldwide to purchase an *MD2*-equipped *M5000* was London based Metropolis. In fact they ordered two, each equipped with two DSP-1 modules. To find out why they chose it and how they've been using it, I spoke to the facility's Technical Coordinator Crispin Murray.

'Interestingly enough, it was not so much the multiband dynamics that attracted us to the *M5000*, but the fact that it was an all digital dynamics processor. Out of the digital dynamics units we looked at, the *M5000* had the most analogue feel about it which appealed strongly to us. We felt it was doing all the right sort of things, and provided plenty of control which some of the other units didn't. The other advantage, of course, is that apart from dynamics the unit also offers us high quality digital reverb and a delay time, plus any other goodies they come up with in the future—and that's why we've got two DST modules in each unit.'

Before buying their units, Metropolis had tested one for some months; what were their first impressions?

'At first it looks quite daunting, and we all through this is going to take ages to learn; but once you've played with it for half-an-hour or so it really comes together pretty quickly. It's also frightfully easy, at least at the beginning, to go completely and utterly over the top with it—I think a lot of people will probably do that to start with and then switch it all off and start again with the basics. We certainly did that here but we're generally using it in a much more subtle way now.'

Although Metropolis do not appear to use the multiband capability to a huge extent, they have found some uses for it as Crispin Murray explains: 'It has some obvious uses, for example where you have a very loose bass end that you want to tighten-up without affecting the whole track, or there's a vocal you want to try and lift out. With a lot of dance music you find that the hi-hat has been mixed far too loud, because the track's been mixed in someone's bedroom. Now as soon as you try and reduce it using EQ, it starts drying-up and dulling everything else, especially vocals, but with the band split dynamics you can quite often cure the problem with some careful tuning without causing any adverse side effects, which is great.'

'You can also virtually remix the whole track at the mastering stage, and more so than most people would imagine possible. It really isn't difficult to make a track sound completely different, and you have to be very careful how you approach that. So far the guys here have used it with absolute discretion, but because *MD2* offers so many possibilities, I think we'll be continually finding new things it can do.'

A function that springs to mind immediately with frequency conscious dynamics is De-essing, but are Metropolis using the *M5000* for this purpose?

'You can't get quite the tight effect that a dedicated de-esser gives you because, although you can tune where the high band begins, you can't adjust where it stops. That works okay with high end, broad-band signals like the hi-hat example, but with sibilance which is typically between 6.5kHz and 8.5kHz you really need to be able to tune in without affecting what's up at 14kHz, say. Now tc electronic are working on a de-esser and we've been passing on some thoughts to them, and from what I gather it sounds as if they could be developing something really powerful.'

Expanding digital program may seem something of a contradiction, but the facility is one that Metropolis are finding a use for.

'Having a digital expander is a very good idea particular now as you can hear the noise floor of 16-bit. A couple of years ago what with various monitoring systems and large chunks of console in the way it was more difficult to hear what was happening at -90dB, but not it's a lot clearer. Also, if you put 12dBs of compression on something you've more or less reduced it to 14-bit, so in certain circumstances being able to push the dither back out of the way can be extremely useful.'

A function that Crispin Murray is currently exploring is the use of MIDI to facilitate quick and easy preset changes.

'We're looking at the possibilities of using MIDI program-change messages from our *DMC1000* console to switch various pieces of gear, including the *M5000*. What would be a nice addition to the unit is user specifiable crossfade times between presets to allow gradual rather than instant changes. If you're mastering an album that hasn't got any gaps, but has sections that need to be treated differently, you really need to be able to change settings gradually rather than firing off instant preset changes which will be audible. Having said that it's perfectly possible at the moment to manually sweep controls without introducing an audible artefacts such as clicks.'

The future

The *MD2* software is being radically expanded, and although too early at the time of writing to give very specific information, it is understood to include a filtering section with 4-band parametric EQ; dithering; auto fade-in/fade-out with Fletcher-Munson filtering; MS encoding and decoding; a balance section with phase inversion; SMPTE capabilities including a Cue List that allows presets to be stored and recalled against time code; and an internal routing facility for cascading presets. Also to be included are large, high-resolution level meters, and phase correlation meters.

The update package will be free to existing *MD2* owners, and will be shown for the first time at AES. Another important development that tc electronic also hope to launch at the San Francisco show is a remote controller capable of controlling multiple *M5000*s. ■

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TAPEMATIC ST-31

MDR looks at the popular ST-31 cassette-duplication spectrum analyser and setup unit, and offers an update on its latest features

Before being able to discuss an instrument like the Tapematic *ST-31* spectrum analyser and line-up unit, we should reflect for a moment on the music cassette industry and where it is presently going.

There is little argument that, over the lifetime of the compact cassette, there has been a marked improvement in overall sound quality. Many observers would attribute this to the arrival of CD which, since its introduction 12 years ago, has set an extremely high standard in domestic sound reproduction that is very difficult to better. Nevertheless improvements in the cassette since the mid-1980s have made the gap between the two media very small indeed.

During this time, raw material manufacturers have been forced to improve their products close to the maximum possible potential of today's technology, although some of the credit for these improvements is down to the introduction of DCC, where more stringent material specifications are necessary than is the case with its older counterpart. These improvements in raw materials, should, of course, be considered in conjunction with the latest developments in hardware—such as digital loop bins and noise-reduction systems like *HX-Pro* and *Dolby S*.

To ensure that the maximum is gained from both the

materials and equipment, however, it is necessary to optimise the duplicating machinery to suit the various replay formats that are being used. Today, with the number of different tape types and other variables, this can be a painstaking task requiring many hours of meticulous alignment. Even so, it is often impossible to be sure that the best results have been obtained. What is even more disturbing is the fact that these alignments can be left unchecked for long periods of time—sometimes long enough for duplication quality to fall to the point that there is a noticeable deterioration in the overall sound quality.

If the music cassette industry is to survive the next few years into the year 2000, sound quality must be recognised as being of major importance. The purchase of digital loop bins, new slaves and the use of chrome tape, however, is not enough. Methods used align the equipment and to gain the maximum from the tape will play an equally important role. No longer will 'old ways' of the 1960s, 1970s and 1980s be good enough.

Operation

While being simple to operate and user friendly, the Tapematic *ST-31* is also a highly complex alignment unit, which allows the adjustment of a complete duplication system with considerable ease and accuracy. All the standard controls of a conventional slave unit (level, bias, low, mid and

high frequencies) can be adjusted and set to any predetermined settings to suit different duplication ratios and types of tape.

One track of a slave recorder—even if deliberately misaligned—can be perfectly aligned in less than one minute. When only minor adjustment or routine checks are required, all four tracks of a slave unit can be set accurately and with confidence in less than a minute. Any engineer knowing how much work normally goes into setting up a slave unit with conventional means would be justified in treating such a claim with scepticism. If it is true, then, just how is this possible?

The *ST-31* generates 13 frequencies and has a display which shows the output of a mobile head mounted onto the slave. The units internal memory provides a straight line on the display once the required curve is obtained. Bias is adjusted by setting the desired amount of third-harmonic distortion, while the overall level adjustment is a question of raising or lowering the overall spectrum so that it sits on the 0dB line. An engineer with an *ST-31* line-up unit requires no other auxiliary equipment, having everything that is necessary in one small box that is easy to set up, easy to operate, easy to transport and above all gives him a detailed and accurate indication of the setup that is clear and simple to understand.

When the composite signal from the *ST-31* (all 13 frequencies) is used, the output signal level is 30dB below the standard working level. It is also



Tapematic's ST-31—helping cassettes compete with newer formats

possible to use single frequencies at -20dB, individually or as a fast or slow sweep. The Fast Sweep option is to allow normal timing between frequencies when played back in real time on a pancake checker or once the tape is wound into a shell and placed in a cassette player. The output of the player can even be feed back into the *ST-31* when an optional 'x1' input stage is installed. The Slow Sweep option is for checking a slave unit when it is running at high speed.

During the alignment procedure, the fact that

*No longer will
'old ways' of the
1960s, 1970s and
1980s be good
enough*

you can switch the *ST-31's* function back and forth between a frequency spectrum and a third-harmonic distortion value, allows a slave not only to be aligned for its optimum performance, but also enables tapes to be tested for their MOL (Maximum Output Level) and other specifications.

Level and bias can be adjusted to different settings and the output results from the tape can be monitored on the screen without any time delay, therefore tape saturation or other limitations—such as heads and circuitry—can also be seen at a glance.

The advantages of using the *ST-31* over alternative line-up methods are numerous. Apart from the obvious, that no longer are mountains of instruments required, interconnected with a mass of wires and switches, the most important benefits fall into the area of quality, safety and time saving.

When aligning masters and slave units, if the engineer can not 'see' the full picture, mistakes can be made by adjusting the wrong control to obtain a given result. Tweaking a level control instead of bias, or high frequency instead of level is not uncommon. With the 13 frequencies displayed and switching back and forth to the third-harmonic distortion, any wrong adjustments are immediately seen and may be readily corrected.

The *ST-31* offers a total of six Memory Curves which can be set by the user. These will be determined by the type of tape being used or by ▶

TECHNICAL SPECIFICATION

Duplication ratios: 64, 100, 128.

Other ratios: (80, 96) instead of 100 can be supplied on request.

Frequency generator at all ratios (Hz): 31.5, 63, 125, 250, 500, 1k, 2k, 4k, 6.3k, 8k, 10k, 14k, 16k.

Output level

Single frequency: -10dB to -30dB.

Composite: -30dB.

Third harmonic distortion test:

1kHz 0dB (1.55V)

Input

Master: -30dB

Slave test head.

Auxiliary test head.

Memory banks

Two memories for each ratio six in total.

Dolby HX-Pro test

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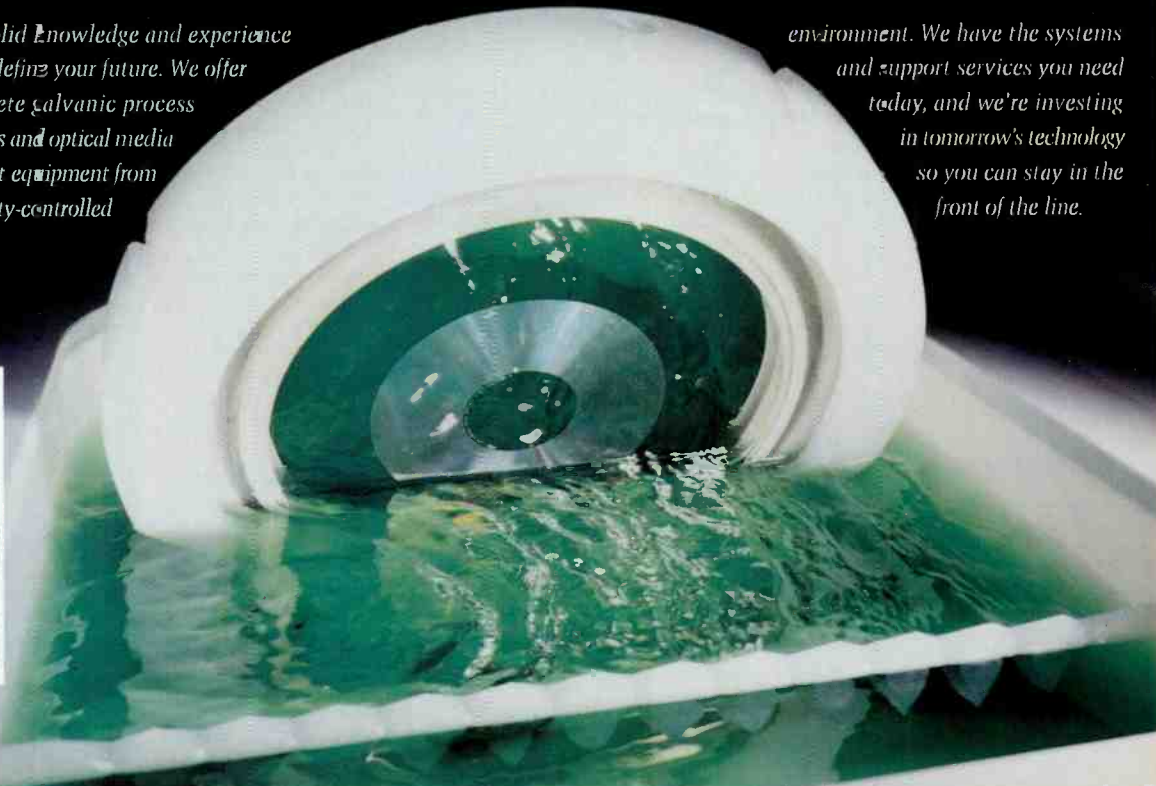
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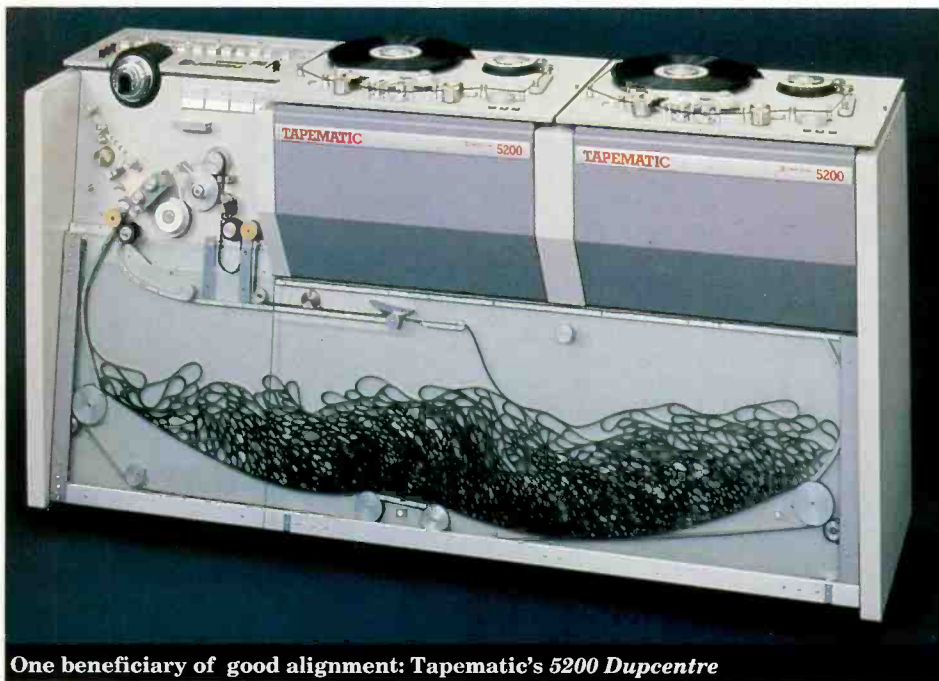
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GALVANICS



One beneficiary of good alignment: Tapematic's 5200 Dupcentre

the duplication ratio, and make the checking of a slave line quick and easy. Consequently, slave checking can be carried out frequently and with higher precision than with other methods used to date.

This speed and ease of use can make frequent alignment of equipment an achievable aim which would lead to a higher overall standard of operation of a duplication room—and a far higher level of consistency between slave units. In this case, not only will the difference be noticed by the quality-control personnel but in a very short period of time the difference will also be noted in the management of such areas as material waste.

So far we have only touched on slave alignment, but the ST-31 has more to offer.

At certain times, only one output is available to feed the studio's master recorder, producing a running master that in turn can be loaded in the

loop-bin to align the duplication master. Once the master is running in the loop-bin the four tracks of the master can be connected to the line level input and in a similar way to slave line-up the master can be set for a flat output.

Although slaves would normally be aligned using the output from the ST-31 patched directly into the slave, a test can be carried out by checking the full system and testing the output from the slave with the master test tape as the source. The normal practice would be to align one slave at a time—off line—while the rest of the system is in operation.

Development

Since its introduction some seven years ago, the basic functions of the ST-31 have remained the same, but recently some features have been added. The 'x1' input (mentioned earlier) was added to allow the unit to function as a real-time analyser at normal playback speeds, this is useful so that a cassette can be played back and the results monitored on the same unit, this eliminates any errors which may occur should another spectrum analyser be used.

Another feature which was added, is the provision for testing Dolby HX-Pro circuits and the possibility to control the amount to which the effect of the circuit is functioning.

The output of the unit can be increased, while at the same time the input is decreased by an equal amount, thereby maintaining a constant zero point on the monitor. There is one 10dB step and 10 steps of 2dB. Also, a 1kHz frequency is mixed with a random combination of 8kHz, 10kHz, 12kHz, 16kHz which engineers find very useful when setting bias and Dolby settings and to see the effects of switching the Dolby processing in and out.

It is important to appreciate that the line-up unit does not impose any curve or sound quality on the frequency spectrum. Your current 'situation' can be stored in any of the memories. Let us take a

practical example of how the unit can be used: one track of one slave is already set up to the conditions that are considered to be optimum. The next step is to store this curve in one of the unit's memory locations—a simple operation carried out by selecting the correct duplication ratio and a memory slot that is empty or which contains a curve that is no longer required.

With the composite single feeding into the slave, tape is run across the heads at the desired duplication ratio; the head picks up the curve and at the push of a button the data is stored. Using the unit with this memory selected during the alignment will allow all the other tracks of all the other slaves to be exactly the same.

If, during later testing and quality assurance controls, a modification is required across all the slaves, the same procedure is carried out again, but in this case another memory should be used, so that if necessary the slaves can be realigned by selecting the original memory setup.

Audio-cassette duplicators must offer the highest quality if they are to maintain consumer interest in the cassette format and to remain competitive in business. To achieve and maintain these goals, equipment setup, alignment and consistent quality assurance are greatly aided through the use of a line-up unit. ■

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Tapematic 5256 slave

Slave checking can be carried out frequently and with higher precision than with other methods used to date

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VALLEY AUDIO DYNAMAP

This American digital compressor-limiter offers a variety of I-O configurations as well as powerful dynamics processing. Terry Nelson finds it particularly well suited to mastering applications

One of the oldest—and most respected—names in dynamics processing, Valley Audio (the nostalgic will remember them as Valley People or even Allison) have carried on the tradition with the production version of the model 730 *DynaMap*.

The digital compressor-limiter is still somewhat of a rarity and the temptation will be there to make an 'all singing, all dancing' unit rather than a unit that is ergonomic and easy to use.

Valley equipment has always been in the latter category and though first appearances may be misleading, the 730 is no exception. However, whereas before you could generally plug in and go, with the digital unit the first thing to do is read the manual.

The Valley Audio 730 chassis can be loaded to suit requirements (and budget) and is available as an all-digital unit (730D), a digital unit plus analogue I-O (730AD), with multiple digital I-O (730DD) and with multiple digital plus analogue I-O (730ADD).

The review version was fully loaded with analogue and digital I-O and was tested using the analogue section and the SPDIF digital path.

There is a co processor slot in the 730 which will

be used for an option to make the High Frequency Compressor broadband. The expander section is also due to be modified from -60dB attenuation to full muting for totally silent keying operations.

The rear of the unit contains all connectors together with trim multi turn pots for the XLR analogue inputs and outputs. If the analogue path is to be used, levels have to be set up before putting the 730 into the rack. This could be inconvenient but as it is a 'set it and forget it' adjustment, it does keep the trimmers away from compulsive twiddlers.

The front panel initially appears complicated but quickly becomes surprisingly fast and easy to use. Starting from the left are two rows of two illuminated push buttons. Next to these are two pairs of LED meters and a status display, followed by an LCD, a rotary SET control.

Interfacing is thorough: digital connections include AES-EBU on XLR connectors, SPDIF on RCA phono, optical via Toslink, auxiliary external sync input and output, RS232 port and MIDI In and Out on 5-pin DINs. There is also an 8-pin fader port for connection to a pair of passive linear remote faders.

The analogue path, in addition to the XLRs and trimmers, includes internal jumpers for input and output gain ranges and for configuring the XLRs to different balanced and unbalanced wiring options.

There are three main-menu functions: Setup facilitates configuration of the unit, Panel permits configuration of the meter displays, and File is for storing and recalling factory and user setups. Pressing one of the menu buttons causes it to be illuminated and the LCD to show the first level of the menu. The display will show up to four functions and these are selected individually by the top row of buttons. Read-outs in the LCD are in upper and lower-case lettering—capitals mean that you have reached the last the function selected. Variable parameters are accessed via the SET wheel, while the ENTER key allows you to scroll back through menu levels and CANCEL returns the read-out to its operational mode.

Operation and metering

The 730 offers four main operating modes: Standard compressor, Enhanced compressor, DynaMap and High Frequency compressor.

The unit operates as a compressor-limiter-expander, where the expander and limiter functions can be switched in or out as required.

Control of the unit for normal operation is by the top row of keys and only selected functions appear in the display—if a compressor function has been selected, then only compressor parameters will be available. If the limiter is then selected, the limiter page will be added and so on.

The 730 features two sets of meters, the upper pair showing left and right signals and the lower

pair, gain reduction and-or increase. The A and B keys toggle all meters between user-programmable read-outs. The LR meters are toggled between input and output levels and these can be selected to be LR signals, Sum and Difference or High-Low Frequency levels (for HFC mode only). The gain meters can be selected to read gain reduction-increase from the compressor, expander and limiter sections.

Other metering facilities include different scales for the read-outs, bar graph or moving dot characteristics, adjustable peak hold (LR only) and top or centre 'home' points (Gain only). The LR meters also include red Over level LEDs with the Gain meters featuring similar indication for Limiting.

Compression

The 730's compressor emulates a 'typical' analogue process and has controls for Compression Ratio, Threshold, Make-up Gain, Attack Time and Release Time. Although these are standard facilities, the range of settings is wide and allows room for a lot of experimentation. I found the range—and sound—of the effects pleasing on a wide variety of programme material, although where I might normally have expected to use a ratio of, say, 6:1 on a particular programme, I found myself between 3:1 and 4:1 on the 730. Subtle ratios such as 1.5:1 were interesting on string sections and often provided smoothing out without noticeably affecting the overall sound.

The Enhanced Compressor overcomes the problem of interaction between the ratio, threshold and gain controls found with most compressors, and uses different parameters.

In operation, the Enhanced mode is quite subtle but its main feature is that it allows creative changes to be made without having to worry too much about resetting other controls.

DynaMap

Arguably the most interesting feature of the Valley 730 (and the one that gives the unit its name), this facility allows you to construct a 'dynamics map' by selecting different gain reduction characteristics over eight segments—including a mixture of compression and expansion.

The THR parameter selects the threshold of an end point (of a segment) and the Gain parameter



sets the gain or loss at the threshold point. The ratio of each segment is automatically calculated by the 730 depending on the THR-Gain settings, with ratios greater than 1:1 being compressed and less than 1:1 expanded.

After experiencing a mixture of good and disastrous (or interesting) results, using the *DynaMap* started to become almost intuitive. It goes without saying that you can totally alter the characteristics of a sound or instrument through processing, and at one stage I had five pianos for the price of one.

Once you overcome the temptation to over process, the facility is excellent for tweaking dynamics on vocals and solo instruments or subtly altering ensemble sounds.

In use, I found it easier to work down from 0dB to the lower thresholds, due to the interactive nature of the end points for each segment. Starting from the bottom you often have to jump around segments for large threshold changes.

As noted, the 730 can combine the Compressor modes with Expander, Limiter and Static (see later) functions.

HF compressor

The High Frequency Compressor allows the 730 to be used as a frequency selective compressor for de-essing or removing excessive amounts of high frequency without overall compression of the programme material.

The compression band is variable from 4.4kHz—16kHz and features four filter shapes: broad and sharp shelf, broad and sharp peak. This permits overall or selective high frequency compression to be applied.

The compressor section features controls for Ratio, Threshold, Floor (or attenuation) and Release. As with the other compressor functions of the 730, the control ranges are very wide.

The Normal setting offers, as one would expect, normal operation, Tune leaves only the high frequency band audible while Invert attenuates the broadband signal by 24dB and inverts the high frequency portion, raising its level when the threshold is exceeded. This latter facility is useful for exposing problem areas.

Frequency-selective compression can often be the solution to the problem track that cannot be redone or that has everything but an annoying frequency. The range of control of the 730's HFC facility is very useful but I could not help making comparisons with my Audio + Design 560 selective limiter which provides limiting over the whole frequency range. As well as de-essing, this opens

the door to de-popping and de-honking vocals where the singer decidedly appears to have a severe cold. What about it, Valley?

Expander

The Expander is comprehensive and includes such 'standard' parameters as Ratio, Threshold, Range, Attack and Release. As with the compressor functions, the range of the controls is wide (ratios from 1:1 to 1:16, 20µs attack time and up to -60dB attenuation).

Additional control parameters include Shape, which selects the release characteristics from Linear (constant rate of decay), Log (decay accelerates with release) and Semilog (a compromise between the two) and Mix.

Taking advantage of very fast attack times and smooth operation tends to mask the fact that previously one would have been less critical. Also, in the final mix, would you really notice it? The Shape function is also useful and often provides that final means of putting everything into place.

Limiter

Limiting is the final link of the chain—the peak stops here. The bulk of processing will be handled by the compressor and the limiter is the final security to stop overload in digital applications while getting the last 0.01dB out of the programme material.

The DRIVE control allows you to set the input level to the Limiter section and is adjustable over a -10dB to +10dB range, thus offering a useful final gain trim.

Ceiling is Valley's term for limiter threshold, this being adjustable in 0.01dB steps from -1dB to 0dB. This level of resolution should keep most mastering engineers happy. Release is as standard and adjustable from 24ms to 8.53 s.

Static

The final mode of the Valley 730 is called Static, and covers both setup and operational parameters: Main In adjusts the signal level of the Main inputs from +6dB to Mute in 0.5dB steps. This is a useful facility which requires a word of warning, any reduction will not be shown on the LR meters when reading input level. While it is certainly useful to know the level being presented at the input of the 730, it would be handy to have an extra line in the meter menu to read input level after reducing input gain.

K-M In allows the Key-Mix input levels to be reduced when using the 730 in Key or Mix mode.

The Output parameter controls the final processed output level from 0dB to Mute in 0.5dB increments. Again, this adjustment is not shown on LR output meters.

Width is a parameter that will probably see a lot of use; it enables the stereo image to be varied from +6dB to -71.5dB to full mono in 0.5dB increments.

The effect is obviously less pronounced on solo instruments but on ensembles recorded in stereo, the effects can be striking. These vary from varying front-to-back depth to adding or smoothing out 'relief' to the programme material—or even literally changing the balance of a recording. It was also interesting to note that I often preferred the 0dB setting for stereo material to +6dB.

Conclusion

The File (or memory) facility provides a Common memory bank (presumably for commonly-used programs) of 99 positions plus four Memory Banks, each with 99 positions. Programs can be saved as full setups or with just selected parts—the dynamics setup, for example.

After some consultation with Valley Audio, I was able to get the Key function working very satisfactorily. However, the Application Notes for the 730 which are soon due off the press should fill in the holes in the present manual dealing with this application. Basically, the program is assigned to the main inputs with the key source being assigned to one of the others (digital or analogue). Correct assigning will be shown in the status display where the key input symbol and key read-out will flash together while the main input remains static. ▶

*You can totally
alter the
characteristics of
a sound or
instrument through
processing*



The Valley Audio 730—expect to see it in mastering studios soon

DIGITAL COMPRESSOR-LIMITER

The Valley Audio 730 *DynaMap* is a very sophisticated piece of equipment and it is difficult to cover all aspects thoroughly in a short review such as this. The unit has been around as a prototype in various forms for some time now but the production model has been worth the wait.

As well as the functions covered above, are more intrinsic features such as status read-outs of the channel status bytes of the digital channels, internal clock for dating file entries and other useful metering and referencing facilities.

Obvious applications are mastering studios and final programme outputs in broadcast and postproduction facilities, where that last dB can make all the difference. It is also a very desirable piece of studio gear but it is strongly recommended that time be spent to get the most return.

Apart from the fact that I would like to have broadband selective compression rather than being restricted to high frequencies, the one omission was a RESET button. When there are few parameters to play with you can live without it, however, with as many possibilities as shown by the 730, you often want to be able to start from somewhere—particularly with the *DynaMap*. Agreed, where do you reset to on dynamics units? Possibly at least to unity gain and 1:1 ratios.

A small niggle concerns the fact that you

Obvious applications are mastering studios, broadcast and postproduction

cannot bypass the Compressor section as you can the Limiter, Expander and Static sections. There could easily be times when expansion and limiting without compression are all that is required. This cannot be difficult to implement (subsequent discussion with Valley Audio revealed that the compressor stage is the only section with gain, which is why it is always in circuit. If you want a bypass effect, they recommend setting the ratio to 1:1 or the threshold to 0dB).

The review model did not include factory presets but Valley inform me that models made from August onwards will include an EPROM with factory presets. Just down the pipeline are the remote fader (or controller) option and the RS232 interface. Other interfaces scheduled for release in autumn include SDF2, dual AES and Glass ST high quality optical.

Overall, the 730 is a very impressive piece of equipment and in spite of its complexity, it friendly and easy to use. I would expect to see it being quickly accepted in mastering and broadcast studios as well as by discerning recording studios and high quality audio installations. ■

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Enh	I	RATIO	UNITY	THRmin	GAINmax
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HFC	I	FREQ	RATIO	THRESH	FLOOR
1*	21	6.2kHz	3.20:1	-12.0dB	-15.0dB

Map	0Sel	1	+14.5dB	(RATIO)	+4.5dB
1f*	2Gain1	-17.0dB	11.0:1	-6.0dB	

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DIGITAL PRESS HELLAS

Zenon Schoepe reports on CD premastering and manufacture in Greece

Situated at the sunnier edge of Europe, the Greek music industry enjoys and suffers the same shifts and dips of fortune as other countries. Where Greece is a little special, however, is that these variations have to be considered in proportion to its relatively small population being spread over a relatively large and curiously fragmented land mass. Add to this a language that makes its local recorded produce difficult to export and a very definite character to what it does produce, and the picture that is painted is one of a small but specialised market. However, it has good geographical proximity to the Middle East, a healthy appreciation of music as a part of life, and a well structured industry with a collection of interesting recording studios in Athens, a brand-new and world-class cultural centre in the Athens Concert Hall, and a CD replication industry comfortably up to the job of demand in its market.

Situated on one of the enormous drags that lead out from the bustling centre of Athens—complete with its tired taxis and alternate day odd-even car number plate curfew aimed at reducing the city's pollution problems—Digital Press Hellas was founded in 1988. It opened with a recording studio, premastering suites and CD replication facilities that put it ahead of the game in the country by a leap. Yet the risk was enormous. The recording studio, equipped with Greece's first Sony 24-track DASH machine and a Sony MXP3036 console, was launched to introduce the potential of digital recording to the market and, while run as a separate operation to the premastering and manufacturing side, has served as a pertinent adjunct to the country's first CD plant. Essentially, Digital Press Hellas kick-started CD in Greece.

The plant

Digital Press Hellas boasts no-holds-barred premastering facilities with Sony DAE3000 editor, SDP1000 multiprocessor and DAQ1000 PQ editor along with PCM1630 and DMR4000. The object was to make DPH a one-stop shop for CD production—and it worked. Technical Manager Ionnas Ionnides claims that as the only true premastering service in Greece, 99% of masters

stay with the company for manufacture and it has exclusive deals with all the local major multinational music companies and distributes for a number of Greek artists. Additionally, it enjoys exclusive worldwide manufacturing and distribution rights on major Lebanese, Egyptian and Gulf repertoires and it has also looked towards the rest of Europe for its business.

'We started working with the European market because the Greek market was and still is very small. With a capacity for two million CDs a year we can cover the entire Greek production,' says Ionnides, adding that other European work has since diminished.

'There is now over capacity everywhere in Europe, there are even CD plants in the Eastern Bloc countries and each prints mainly for its local market.' Consequently price competition has now become an issue, according to Ionnides, and is in stark contrast to the self-enforced competitive pricing policy that Digital Press Hellas adopted to attract business when it first started.

'We kept our prices steady for two years by keeping down all our other expenses,' he explains. 'We are now planning to start another production line to double our capacity and this will help us to remain competitive for our customers.'

The purchase of a yet-to-be-decided new line to complement the existing ODME *Monoliner* is essential to Ionnides as the company's throughput is being seriously stretched at the peak periods of Christmas and Easter.

'We don't really have the capacity we need anymore,' he says. 'The record business is not steady, there are many up and downs, and when it's up you have to be able to serve your clients, you

can't tell them to go somewhere else. Therefore we have to buy another line and we have to take this risk and this cost.'

New formats

Given the amount of attention being paid to the growing CD business, it is not surprising that Ionnides is less than keen on taking chances with getting behind DCC and MD particularly as he points out that while CD sales may have risen by some 25–30% in recent years in Greece, they are still less than expected.

'As a consumer, I would buy MD for myself, but as a businessman, I won't invest anything in these formats until they become standard,' he says explaining that both formats are available in Greece with very little prerecorded material and none of the local material which would be of essential interest to the market. It's also difficult to produce and manufacture according to Ionnides and he's not about to stick his neck out again.

'There are many difficulties,' he says. 'First you have to invest a lot of money in hardware to start producing something that there is little of. The chain starts with the record companies for the software, manufacturers who have to invest a lot of money to buy the gear and the consumer market hardware has to move to sell the software. If you do it on your own you lose a lot of money and the investment in both DCC and MD is high. If we don't see any interest in the whole chain we won't do a thing.'

'We did it once with CD, we made them without a market but we were very sure. We knew how much money was needed to make our ►



The Cedar Suite at DPH

*'We tried to create
the local market in
digital'*

investment work and we tried to create the local market in digital,' he observes.

Even so he is acutely aware of the pressures to continually upgrade equipment in the manufacturing process but believes that well-applied traditional values also have a place.

'What we have here is extremely good maintenance engineers who can keep the equipment in very good condition, to keep the quality at the highest possible level,' says Ionnides. 'If you know what you're doing and what you want to do you can make your decisions about buying equipment safely every time. Of course it depends on the nature of your production, whether you

really do need a new monoline with a cycle time of, say, 4½ seconds instead of 7 seconds but you do have to be very realistic about it.'

The complex was designed by David Hawkins of Eastlake Audio and has two mastering suites in addition to the studio control room and recording area. Three engineers handle mastering with Ionides who worked in disc cutting and musi cassette production at PolyGram for ten years before joining Digital Press Hellas for mastering, the studio and now has responsibility for CD production. He believes that mastering is an essential element of the complete service Digital Press Hellas provides

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particularly as the majority of work comes in on DAT or analogue tape and has to be transferred.

'Premastering is one of our biggest advantages,' he believes. 'In Europe you find good premastering outside of the CD plants because you rarely find premastering in the CD plants themselves. They can transfer from DAT to U-matic but that's not really what I call premastering because if there's a click on the recordings or a small bit of distortion nobody will care. We do, and we listen carefully and that is the big difference.'

A recent addition is a CEDAR Sound Restoration system which is taking advantage of a rekindled interest in old recordings. 'There is treasure chest of 78rpm records out there and we do a lot of this type of work,' claims Ionnides. 'There aren't that many places that have the CEDAR system but there is more to it than that because you also have to have the proper old equipment and it's hard to find a proper pick up and player for these records. We have a very good EMT machine here but it's now extremely difficult to find a needle for 78rpm. We have two and just keep our fingers crossed.'

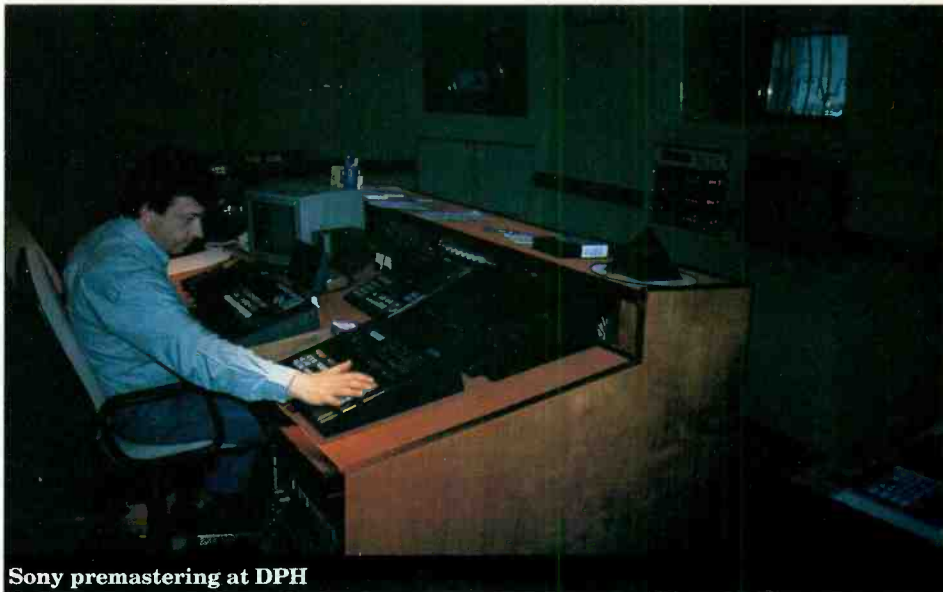
He is enamoured with the Sony's PCM9000 Master Disc as a mastering format but has reservations particularly about the cost of the M-Os. 'It's a more proper medium for CD mastering and the only one I see as specifically designed and treatable for CD premastering. Personally I don't believe in CD-R or Exabyte because they're not what we need—they're an alternative not a solution,' he states. 'The price of M-Os must drop and the fact that Sony says they can be reused is ridiculous. You might want to sometimes but in most of the cases if you charge the client for something you have to give it to them and it's their decision what to do with it not ours. In practice it's a write-once medium.'

He adds that the 20-bit capability of the system is not an issue in Greece geared as it is most obviously to classical recording—a musical form that enjoys very limited success in Greece against popular music and folk music. However, he acknowledges that the balance may be shifted slightly with the opening of the classically-oriented Athens Concert Hall and believes in the idea that professional equipment ought to be a step-up in quality over that available to the consumer.

With Digital Press Hellas poised to double its manufacturing capacity this year it begs the question of where Ionnides believes all the new work required will be coming from. 'The business is on small labels and small quantities of 500—that is a market where we could attract work from everywhere,' he replies. 'Every year I see too many amateurs at the MIDEM exhibition—people walking around with productions trying to sell them.'

'And an amateur only knows how to make mistakes,' he adds. 'In most cases it's the manufacturers who teach these people how to make records.' ■

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Facility design: Eastlake Audio Ltd.
Tel: +44 171 262 3198. Fax: +44 171 706 1918.**



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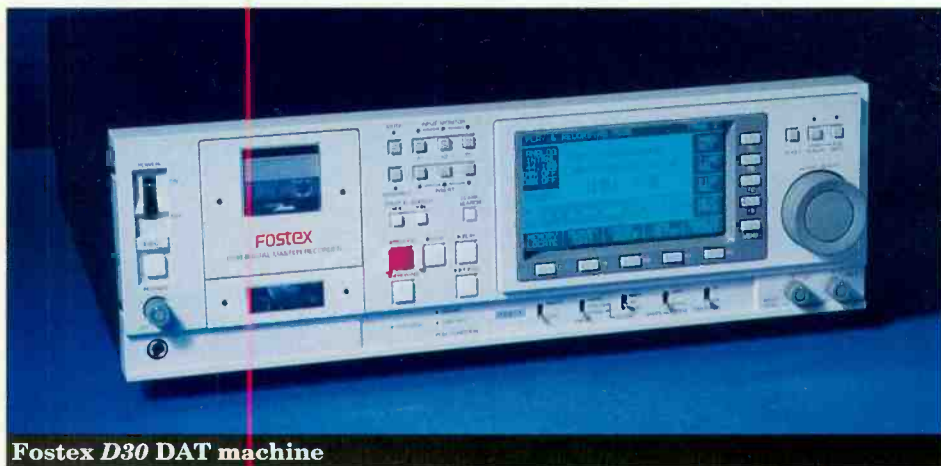
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MDR PRODUCT GUIDE



Fostex D30 DAT machine

Pre/Mastering

While the duplicators and replicators benefit from a wide range of custom-built equipment, the relative size of the premastering market has meant that this sector is often obliged to 'pick up the crumbs' from the recording industry. Very few pieces of equipment are specifically tailored for use by the premastering facility—and those that are can be prohibitively expensive.

For example; despite the obvious need to keep digital recordings in the digital domain there is currently no dedicated digital premastering console being manufactured. Facilities are forced to choose between a desk that has been principally designed for recording, or one of the numerous computer-based workstations, although these are becoming less and less suitable for premastering as their designers concentrate on tailoring them to suit the far more lucrative film and television markets.

Another factor causing concern to both the premastering and mastering sectors is the uncertainty over a future standard for the interchange of master tapes. All parties agree that the *PCM-1630* is reaching the end of its useful life, but there is considerable disagreement over its successor. The requirement for a format that provides all the features offered by the *PCM-1630* does not necessarily sit comfortably with the need for the higher throughput now demanded by the replicators.

No one appears to dispute that one universally acceptable replacement format should be agreed upon—the problem is, which one? It is an issue which is unlikely to be resolved overnight; meanwhile formats such as CD-R and DDP-Exabyte are beginning to gain popularity.

DAT Recorders

● ADT-Pioneer 24-bit

ADT have taken the double speed, 96kHz sampling Pioneer *DO7* and modified it to offer 24-bit recording at 48kHz sampling. The machine incorporates ADT's DSP56001-based sample-rate converter which allows digital recording and playback at 96kHz, 48kHz or 44.1kHz at 16 bits, or 48kHz at 24-bit resolution.

A number of classical recording engineers are using the machine in conjunction with the *dCS 902* A-D converter sampling at 96kHz, a combination which gives a potential audio bandwidth in excess of 40kHz.

ADT: Audio Digital Technology, 178 High Street, Teddington, Middlesex TW11 8HU, UK. Tel: +44 181 977 4546. Fax +44 181 943 1545.

● Fostex D-30

The replacement for the successful *D-20*—which was the first DAT machine to offer a time-code facility. The *D-30* is completely restyled and has a large LCD, around which are located ten 'soft keys'.

Features include AES-EBU I-O, scrub wheel for cueing, independent channel record, 2Mb (minimum) internal RAM for instant start and onboard editing. The machine also offers both LTC and VITC time-code synchronisation.

Fostex Corporation, 3-2-35 Musashino, Akishima, Tokyo 196, Japan.

Tel: +81 425 46 4974. Fax: +81 425 46 9222.

● Fostex D-10

A 2-head lower-cost recorder, but with a number of high-end features. These include RAM scrub, instant start and—using a recently introduced optional board—time-code record and playback, and 9-pin remote control.

A pair of *D-10*s can be linked together by a cable to provide a simple 2-machine assemble editing system.

Fostex Corporation (see above)

● Tascam DA-60

Recently introduced 4-head /4-motor machine with AES-EBU I-O and external word sync. Variable

digital cross-fade for punch-ins, RAM buffer for instant start, varispeed, two locate points and auto fade-in and out are among the features included in this machine. An optional sync board gives 9-pin RS422 control, generates time code or converts existing A-time.

Tascam, Teac Corporation, Musashino-Ctr, 1-19-18 Naka-cho, Musashino-shi, Tokyo 180, Japan. Tel: +81 422 52 5081.

Fax: +81 422 52 6784.

● RTW Dual DAT-Control DC-3

The *DC-3* has been designed to work with either the Sony *PCM-7000 Series* or Otari *DTR-90* DAT machines. Large and well spaced illuminated buttons provide control of all transport functions, while ID set and edit functions, locate to program number or time code, and record in-out locate are controlled by other buttons on the clearly laid out panel.

Twenty locate memories are accessed by the numeric key pad; all settings are shown on the back-lit LCD, which also displays time code, tape counter or elapsed time.

RTW, Elbeallee 19, D-50765 Köln, Germany. Tel: +49 221 709130. Fax +49 221 7091332.

Digital Recorder

● Sony PCM-9000

Introduced a little over a year ago as the successor to the *PCM-1630*, it is only now that production models of this M-O disc-based digital recorder are beginning to appear.

The *PCM-9000* provides between 60 and 100 minutes of stereo recording at 24, 20 or 16-bit resolution. Onboard assemble editing facilities are provided.

This machine is being targeted at both premastering houses and recording studios, where it is hoped that the higher resolution recording capability will ultimately replace the popular 1/2-inch analogue format.

Sony Corporation, Communication Products Group, 4-10-18 Takanaawa, Minato-ku, Tokyo, Japan. Tel: +81 3 3448 7358.

Fax: +81 3 3447 2880.

Editing Systems

● Fostex Foundation 2000

A random-access digital recording, mixing and editing system which uses dedicated hardware and tape machine style controls. The *Foundation 2000* offers eight tracks delivering 16 simultaneous events with crossfades, and allows editing across all tracks.

The system is expandable from 2-18 inputs and from 4-20 outputs. A removable proprietary hard disk (RPE) means that projects can be moved easily to a unit in another location.

Full synchronisation facilities are provided, including reverse chase for film applications.

Fostex Corporation, 3-2-35 Musashino, Akishima, Tokyo 196, Japan.

Tel: +81 425 46 4974. Fax: +81 425 46 9222.

● **Sony DAE-D5000**

A digital-audio workstation designed specifically for CD mastering. It acts either as a linear editor when used in conjunction with Sony's PCM-1630/DMR-4000 or the M-O disc-based PCM-9000, or as a random-access editor when connected to external disc drives.

The DAE-D5000 operates at all the usual professional sampling frequencies at three levels of resolution: 16, 20 and 24-bit. It incorporates 4-band EQ and dynamics, as well as providing full PQ editing facilities.

Sony Corporation, Communication Products Group, 4-10-18 Takanawa, Minato-ku, Tokyo, Japan. Tel: +81 3 3448 7358. Fax: +81 3 3447 2880.

Upgrades and additions to existing editing systems

● **Digidesign MasterList CD**

A new software addition to the *Sound Tools* range allows interface with a number of CD recorders and 8mm-Exabyte drives enabling the creation of a full *Red Book* specification write-once CD or DDP format tape.

PQ codes are derived from the playlist and are fully editable. The facility is provided to add catalogue numbers and ISRC codes, as well as Emphasis and Copy prohibit flags.
Digidesign, 1360 Willow Road, Menlo Park, CA 94025, USA. Tel: +1 415 688 0600. Fax: +1 415 327 0777.

● **SA&V SADiE**

(Software revisions: v2.1and v2.2)

A number of enhancements have been added to SADiE in recent months. Version 2.1 saw the addition of full, real-time, mix automation, automated mix bounce down, the ability to import CMX and ASCII text EDLs, autoconforming from an existing EDL and background networking using an ethernet link. Hardware support included a 9-pin control interface and support for *Orange Book* CD-R machines via the SPDIF digital output.

Version 2.2 provides a new automatic speech editor, M-O disc support for on-line 20-bit stereo editing and backup, an interface to the JL Cooper CS10 controller, access to CD write-once drives via SCSI (for *Red Book* standard CD masters), and support for the Exabyte-based DDP CD mastering format.

Studio Audio & Video Ltd, The Old School, Stretham, Ely, Cambridge CB6 3LD. Tel: +44 1353 648888. Fax: +44 1353 648867

● **Sonic Solutions DiscVideo**

The recent agreement between JVC, Philips, Matsushita and Sony on a standard MPEG1-based video format, Video-CD, has prompted Sonic Solutions to add a new option to their CD mastering system.

DiscVideo will enable editing of audio, encoding of digital video and audio, and interleaving and formatting of the data stream. Non-real-time and real-time options will be made available, although the latter will require additional hardware.

Sonic Solutions, 1891 E. Francisco Boulevard, San Rafael, CA 94901, USA. Tel: +1 415 485 4800. Fax: +1 415 485 4877.

Outboard Equipment

● **CEDAR DH-1 DeHisser**

The latest extension of CEDAR's stand-alone processor range brings real-time hiss removal out from its PC-based parent. Employing a new algorithm developed from CEDAR's Hiss-2, the DH-1 no longer requires a 'noise fingerprint'. Both SPDIF and AES-EBU inputs and outputs are provided, with the latter handling the full 24 bits. Internal processing uses twin 32-bit floating point processors, and the 18-bit converters are quoted as having specs of >103dB for the A-D converters and >93dB for the D-As.

CEDAR Audio, 5 Glisson Road, Cambridge CB1 2HA, UK. Tel-Fax: +44 1223 464117.

● **CEDAR AZ-1 Azimuth Corrector**

This recent addition to CEDAR's range of stand-alone audio-restoration processors is designed to correct the phase error (and resulting poor mono compatibility) caused when recordings have at some stage been transferred 'off azimuth'.

The AZ-1 automatically detects any error and corrects it in real time. Applications include mastering, broadcast, archiving, and film and TV production.

CEDAR Audio (see above)

● **CEDAR Series-2 DC-1 DeClicker and CR-1 DeCrackler**

As well as offering a redesigned hardware platform (similar to the AZ-1), these new versions of the DC-1 and CR-1 feature a number of improvements to the original specification. They include 18-bit A-D and D-As, an improved phase-locked loop to reduce jitter on outputs, external sync options on the analogue I-Os, and improved digital metering with increased range and peak hold facility.

New software algorithms have enhanced the scratch and crackle processing, and improved internal data handling has resulted in a 10% increase in processing power. TPDF dithering is provided on both SPDIF and analogue outputs.

CEDAR Audio (see above)

● **Drawmer 1961**

Introduced to complement the 1960 valve compressor, the 1961 valve equaliser offers four main equaliser sections, each with six switchable, overlapping frequencies, variable bandwidth from third-octave to three octaves and ±18dB of boost and cut. Variable high-pass and low-pass filter sections give 12dB/octave roll-off.

Increased harmonic clarity is claimed by the use of separate active valve stages for each of the four main equaliser sections.

Drawmer, Charlotte Street Business Centre, Charlotte Street, Wakefield, West Yorkshire WF1 1UH, UK. Tel: +44 1924 378669. Fax: +44 1924 290460.

● **Fletcher ElectroAcoustics**

Joe Meek Compressor

A highly unusual piece of outboard equipment based upon the design used by the late Joe Meek on his many 1960s hits. The original version comprised a low-voltage light bulb driven by a power amplifier which shone onto a photo-sensitive resistor. As level increased so did the resistance, thus reducing level.

The new compressor uses essentially the same

technique with the 'punch' of the original system being retained, although the circuit design has been updated to meet the demands of modern recording technology. The 2U-high front panel has been given a 1960s feel: compression ratio, attack, release and input gain are all controlled by old-style rotary knobs, with the amount of compression being indicated by a traditional VU meter.

ISL, Swillett House, Chorleywood, Herts WD3 5BB, UK. Tel: +44 1923 285266.

Fax: +44 1923 285166.

● **Focusrite Blue 315**

The 315 isomorphic mastering equaliser's circuitry is based around the ISA 110 equaliser, except that all controls on this 2-channel unit (except gain trims) use rotary switches which allow for easy setup and recall.

Each channel offers 4-band equalisation with 11 frequencies in each band. The fine adjustment needed for mastering is made possible by the 23-step lift and cut, giving ±10dB of gain control. The two centre bands have two ranges and 11 Q settings. Overall, the EQ extends from 33Hz-22kHz, as do the high and low-pass filters. There is also EQ bypass, phase reverse on either channel, and both coarse and fine adjustments for input levels with overload indication.

Focusrite Audio Engineering, Unit 2, Bourne End Business Centre, Cores End Road, Bourne End, Buckinghamshire SL8 5AS, UK. Tel: +44 1628 819456. Fax: +44 1628 819443.

● **Focusrite Blue 330**

A companion to the Blue 315, the 330 mastering compressor and limiter once again draws on an existing circuit Focusrite design—this time the Red 3—but with the ergonomic design tailored specifically with the mastering engineer in mind. The most significant difference—apart from the distinctive, anodised, electric-blue front panel—is probably that there is only one set of controls, the unit having been designed primarily for stereo operation. As with the 315, the majority of the controls are switchable rather than continuously variable. Two PPM meters indicate input, output or gain change.

The compressor ratios start at 1.2:1, going up through 1.4, 1.7, 2, 3, 4.5, 6, 8, 10, 15 to a maximum of 20:1. Attack is variable from 300µs to 100ms in 22 steps, while there are 11 release settings from 100ms to 4s, plus an auto mode. The input threshold covers a wide range from 126dB to +16dB and 22dB of gain make up is available in 1dB steps. The limiting threshold of between 0dB and +22dB is switched in 1dB steps with limiting action indicated by an LED.

Focusrite Audio Engineering (see above)

● **Jünger Digital Dynamics Processors**

A 'family' of three units, each designed to serve different markets. The comprehensive range of features on the d03 mastering processor include five different digital I-Os (AES-EBU, SPDIF, Optical, Yamaha Y2 and SDIF2) supporting 32kHz, 44.1kHz and 48kHz sampling rates, an automatic or manually selectable de-emphasis filter, integrated sampling-rate convertor with internal or external reference and multicoloured LED display indicating input level, output level or gain change.

The limiting and compression curves are ▶

claimed to be entirely free of processing effects such as pumping or breathing, making it possible to achieve digital full scale signals without clipping.

There are two other versions available. These both have the addition of an expander and are designated *d01* and *d02*. They have no SRC but the *d01* provides an 18-bit D-A convertor, while the *d02* contains a 20-bit A-D convertor as well as 18-bit D-A.

Jünger Audio, Rudower Chaussee 5, D-12489 Berlin, Germany. Tel: +49 30 63 92 61 45.

Fax: +49 30 63 92 61 46.

● **tc electronic M5000**

A totally modular approach to outboard equipment has been introduced by tc electronic with the launch of their *M5000* digital-audio mainframe. The basic 2U-high unit contains a CPU, control surface with softkeys and knobs, 3½-inch diskette drive, computer industry standard PCMCIA card slot, and MIDI and SMPTE interfaces. Users can choose between analogue and digital I-O modules (up to four in total), giving the capability of handling up to four stereo channels simultaneously.

The *M5000* can currently function as a reverb, delay line, sampler and digital dynamics unit. The various software options are purchased as required and downloaded into the Flash ROM from diskette. The *MD2* multiband, digital-mastering, dynamics software package offers 3-band stereo processing with compression, limiting and expansion, as well as a number of other features tailored for mastering applications.

tc electronic, Grimhøjvej 3, DK-8220

Brabrand, Denmark. Tel: +45 86 26 28 00.

Fax: +45 86 26 29 28.

● **Tube-Tech LCA 2B**

Based on the *LCA 2A*, this new stereo compressor and limiter features independent compressing and limiting. The compressor has six attack and release presets as well as manual control, while the limiter attack-release is fixed. Apart from the power supply and side-chain circuit the unit is entirely valve based, the VCA being a dual triode placed between the (fully floating) input transformer and output stage.

The 2U-high panel has separate controls for each channel. These include output level control and limiter on-off switch. Stereo linking is optional with the two bidirectional link busses being accessible by two ¼-inch, stereo, jack sockets on the rear panel.

Tube-Tech, Lydkraft Aps, Ved Damhussøen 38, DK-2720 Vanløse, Denmark.

Tel: +45 31 710021. Fax: +45 31 790091.

● **Valley Audio Model 730 Dynamap**

The *730* compressor-limiter-expander is one of the few dynamics units currently on the market to offer digital I-O as standard. The AT&T DSP provides 24-bit internal processing, accessible through 20-bit digital ports or (optional) 18-bit sigma-delta convertors.

Features include traditional or unity gain matching compression, zero-attack limiting, keyable expansion, and gating and ducking.

Valley Audio Products Inc, A Division of Galaxy Audio, 625 East Pawnee Avenue, Wichita, Kansas 67211, USA.

Tel: +1 316 265 9500. Fax: +1 316 263 0642.

Convertors & Dynamic Range Enhancers

● **Apogee UV-1000**

Apogee's solution to the problem of achieving higher than 16-bit resolution on a 16-bit medium—which they have designated the UV22 process—involves the addition of an inaudible high frequency 'bias' to the digital bitstream. This, in their words, adds an 'algorithmically generated clump of energy at around 22kHz', very much like bias on an analogue-tape recorder. It is claimed that even existing 16-bit recordings can gain from the UV-22 process, which requires no special hardware for replay.

The *UV-1000* accepts two AES-EBU, two SPDIF, SDIF, SDIF2 and optical inputs and provides dithered outputs in the same choice of formats. DC removal, an 'auto black' facility and a digital oscillator are among the other features included in this unit.

Apogee Electronics Corporation, 3145 Donald Douglas Loop South, Santa Monica, CA 90405, USA. Tel: +1 310 915 1000.

Fax: +1 310 391 6262.

● **Apogee AD-1000**

In addition to providing conversion from analogue mic or line sources to 20-bit or UV-22 processed 16-bit digital audio, the *AD-1000* 20-bit convertor offers a number of other features. A built-in mic preamp has optional limiting to maintain maximum level into the convertor, and there is also an 'over' indication for each channel.

In addition to the usual digital outputs, an ADAT format output is also provided. By using the *AD-1000*'s AES-EBU, SPDIF and TOSLink inputs, the unit can also serve as a format convertor. A sync source selector on the front panel allows the *AD-1000* to be locked to a variety of digital signal, word clock, video or film references.

Apogee Electronics Corporation (see above)

● **Audio Design ProBox 4**

According to the manufacturer's specification, *ProBox 4* 18-bit convertor utilises an A-D with fifth-order sigma-delta modulation and 64x oversampling, producing dynamic range and noise+distortion of better than 105dB. Analogue inputs are electronically balanced XLR, adjustable from 0dBm to +20dBm in 2dB steps. A front panel LED meter display shows input level.

AES-EBU, SPDIF and optical digital outputs are provided, selectable between 18 and 16-bit. In addition there is a word clock output on BNC and both BNC and AES-EBU word clock inputs. The BBC's AES-EBU chip is employed for both external input and digital output, ensuring extremely reliable lock with very low jitter.

Audio Design, Unit 3 Horseshoe Park, Pangbourne RG8 7JW, UK.

Tel: +44 1734 844545. Fax: +44 1734 842604.

● **dCS 900B (Upgraded filter)**

A new retrofitable digital filter board has been introduced for the *dCS 900B* A-D convertor. In addition to the original first order, noise-shaping algorithm, second and third orders have been added, as well as a ninth order psychoacoustically shaped output suitable for end-user applications

such as CD premastering.

New units can be supplied with the board factory fitted and will be designated *dCS 900C*.
Data Conversion Systems, The Jeffreys Building, St John's Innovation Park, Cowley Road, Cambridge CB4 4WS, UK.

Tel: +44 1223 423299.

Fax: +44 1223 423281.

● **dCS 902**

A double sampling frequency version of the *dCS 900B* for use in conjunction with 'high speed' digital recorders such as Mitsubishi's *X-86HS* and the ADT-Pioneer DAT machine.

Data Conversion Systems (see above)

● **dCS 950**

dCS' first D-A convertor uses a discrete multibit oversampling architecture and accepts up to 24-bit signals. The analogue circuitry features fully differential low-distortion amplification with a Class A discrete balanced-output stage.

AES-EBU, SDIF2 and SPDIF inputs are fitted as standard, as are both balanced (XLR) and unbalanced (phono) outputs.

Data Conversion Systems (see above)

● **Meridian 618**

The *618* mastering processor is a digital I-O system designed to work with A-D and/or D-A convertors of 16 to 24 bits. It offers ten user-selectable, noise-shaper, characteristics, including four utilising pre-emphasis, which can give up to 23.5dB subjective improvement over normal 16-bit performance.

Internal processing is to an accuracy of 72 bits and twin-phase locked-loop circuits help to keep jitter to a minimum, thereby improving D-A performance.

Meridian Audio, 14 Clifton Road, Huntingdon, Cambridgeshire PE18 7EJ, UK.

Tel: +44 1480 52144.

Fax: +44 1480 459934.

● **Prism Dream AD-1 Classic**

An A-D convertor incorporating noise-shaping to achieve a S-N ratio of -115dB. The output of the convertor can be 16 or 20-bit dithered, or 20-bit noise-shaped.

A unique feature of the *AD-1* is its Dynamic Range Enhanced (DRE) mode. A 20-bit digital signal (from the convertor or other digital source) can be output in 16-bit format for storage on a media such as DAT, and subsequently restored to 20-bit word length via the unit.

Prism Sound, William James House, Cowley Road, Cambridge CB4 4WX, UK.

Tel: +44 1223 424988. Fax: +44 1223 425023.

● **Weiss ANR**

Weiss Engineering—the company responsible for the design of Harmonia Mundi's *BW102* interfaces—has developed their solution to the problem of increasing the resolution of 16-bit media, called Advanced Noiseshaping Redither.

Input word lengths up to 24 bits can be accepted. The output is selectable to 16, 18, 20 or 24 bits and can be programmed to put out either digital zero or dither noise whenever a few consecutive zero input samples are detected.

Weiss Engineering, Florastrasse 10, 8610 Uster, Switzerland. Tel: +41 1 940 20 06.

Fax: +41 1 940 22 14. ►

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Sample Rate Convertors

● **ADT**

This unit accepts a 32kHz, 44.1kHz, 48kHz, or variable rate input in either AES-EBU or SPDIF format and will output to either a 32kHz, 44.1kHz or 48kHz master studio reference, or the built-in reference generator. Four levels of psychoacoustically-shaped dither are available when an output word length of less than the input is required.

A feature of this unit is its ability to use the reference input and output as an audio-signal path. This then acts as the synchronising source for the normal I-O, allowing two machines with different sampling rates to be fed to, for example, a digital mixer.

ADT: Audio Digital Technology, 178 High Street, Teddington, Middlesex TW11 8HU, UK. Tel: +44 181 977 4546. Fax +44 181 943 1545.

● **Audio Design ProBox 10**

The *ProBox 10* can be locked to any external word-clock frequency—including 44.056kHz—or to an incoming signal on either the AES-EBU, SPDIF or optical inputs. It will also handle varispeed and is designed to be used in conjunction with Audio Design's modified digital output Denon CD player.

Inputs and reference inputs, sample rates and outputs are all selectable from the front panel. TPDF dither is used to produce the required 20, 18, or 16-bit output.

Audio Design, Unit 3 Horseshoe Park, Pangbourne RG8 7JW, UK.

Tel: +44 1734 844545.

Fax: +44 1734 842604.

● **Seem Audio DDC-1**

In addition to normal rate adaption functions the *DDC-1* digital synchroniser offers a number of features not found on a normal sampling rate convertor, and it is priced accordingly.

In synchroniser mode the unit monitors both input and output sample-rates. When a sample slip, change of sample rate or loss of sync occurs it will switch in a correction algorithm in order to avoid loss of sync 'downstream'. Where appropriate the audio will be muted until sync is restored.

Other features include optional automatic de-emphasis, and gain and balance controls for digital-domain level adjustment.

Seem Audio, Aamotveien 2, PO Box 115, N-1380 Heggedal, Norway. Tel: +47 66 79 77 30. Fax: +47 66 79 61 54.

● **Weiss SFC 1/SFC 1A**

Converts between arbitrary sampling frequencies in the range of 32kHz-55kHz, fixed or varispeed. The output sampling frequency can be derived from the audio or wordclock input, or internally generated. A third option maximises jitter suppression by regenerating the incoming sampling frequency via an internal PLL.

AES-EBU, SPDIF and SDIF2 interfaces are provided, giving the unit a secondary function as a format convertor. The *SFC 1* also features ANR (see 'Convertors and Noise Shapers'), while the *SFC 1A* does not.

Weiss Engineering, Florastrasse 10, 8610 Uster, Switzerland. Tel: +41 1 940 20 06. Fax: +41 1 940 22 14.

● **Weiss Clockwork**

The *Clockwork* is not actually a sample-rate convertor, but neither is it a simple digital signal reshaper operating at either 44.1kHz or 48kHz $\pm 0.01\%$. The incoming AES-EBU or SPDIF signal is resampled with an extremely stable, low jitter clock and output via a high-speed, buffer-transformer combination. This serves to minimise the effect of any jitter introduced earlier in the signal chain by long cables or low-grade equipment and restore the high-quality signal required in a professional audio data transmission chain.

The input signal is not decoded and the unit is therefore absolutely transparent to all user, channel status and other auxiliary bits.

Weiss Engineering (see above)

Digital Audio Level Metering

● **DK-Audio MSD550**

The *MSD550* master stereo display features a high resolution LCD, and combines the functions of level meter, audio vectorscope and correlation meter into a single unit. An FFT module is available as an option.

Five different international level meter standards are loaded into the system and these can be easily selected by keys on the front panel. Also included are true digital peak and 'flying peak' readings.

DK-Audio, Randvolden 23, DK-2730, Denmark. Tel: +45 44 53 02 55. Fax: +45 44 53 03 67.

● **RTW MasterMonitor 1069-120**

The *1069-120* provides a full colour display of audio level and phase on the unit's integral 82 x 62mm TFT screen or external PAL-RGB monitor, from either the analogue or AES-EBU inputs.

Menus allow a number of user selectable options, including DIN, British and Nordic PPM standards, a variety of colour setups and display of AES-EBU channel status information.

RTW, Elbeallee 19, D-50765 Köln, Germany. Tel: +49 221 709130. Fax +49 221 7091332.

● **Totalsystems DBM-1A**

Available once again by popular demand, the *DBM-1A* is designed specifically for remote monitoring of Sony's *PCM-1610* and *1630* systems.

The 19-inch rackmount unit connects directly to the digital processor's status port and provides visual indication of audio level, sampling frequency and emphasis, as well as the various levels of error correction being employed by the system.

Selectable memory modes allow the error, peak and over level indications to be 'held' until cancelled.

Totalsystems, 59 Hatch Lane, Old Basing, Hampshire RG24 0EB. Tel: +44 1256 54786. Fax: +44 1256 54785.

Digital Test-Measurement Equipment

● **ADT Serial Digital Analyser**

A hand-held analyser for use with AES-EBU and SPDIF systems. Front panel LEDs show sampling frequency, link errors and channel status (professional or consumer protocols). AES-EBU and SPDIF inputs have optional terminations. +ve and -ve connectors enable the input signals to be monitored on an oscilloscope.

In Edit mode, channel status bits can be modified. If, for example, 'professional' is changed

to 'consumer' all associated bits also change. The validity flag can also be inverted before it is retransmitted.

The unit can be mains or battery powered, and incorporates a built-in speaker and headphone socket for audio monitoring.

ADT: Audio Digital Technology, 178 High Street, Teddington, Middlesex TW11 8HU, UK. Tel: +44 181 977 4546. Fax +44 181 943 1545.

● **Audio Design-Rayfield Electronics PANDA-J1**

A general purpose, hand-held processor and analyser for digital audio signals. In addition to displaying—and allowing the manipulation of—AES-EBU and SPDIF channel-status flags plus CD and DAT user subcode, the *PANDA-J1* offers a number of signal-processing functions. These include digital-domain gain adjustment and psychoacoustic noise-shaping of the incoming signal while simultaneously adjusting gain, DC filtering and stripping pre-emphasis.

The 128 x 64 pixel LCD screen can show a frequency domain plot of the incoming digital audio to give a visual indication of distortion components, while the digital domain metering can be viewed as either bar graphs or in figures on the LCD screen. As well as multiformat digital I-Os, a 16-bit A-D and D-A, line level analogue I-Os, internal speaker and headphone jack are built into the unit.

Audio Design, Unit 3 Horseshoe Park, Pangbourne RG8 7JW, UK. Tel: +44 1734 844545. Fax: +44 1734 842604.

● **CRL DAA-50**

A battery-mains-powered, compact, 'belt clip' analyser which has been designed to give a quick visual check of an AES-EBU or SPDIF connection. LEDs indicate whether the signal is audio or nonaudio, professional or consumer format and if an emphasis flag is present. Sample frequency and clock accuracy are measured at 48kHz, 44.1kHz, 44.056kHz and 32kHz.

The transmission link is checked for biphase coding, parity, CRC and slipped sample errors, while in consumer mode the various SCMS-related flags are displayed. A D-A convertor feeds a variable output headphone socket.

Circuit Research Laboratories, 2522 West Geneva Drive, Tempe, Arizona 85282-3192, USA. Tel: +1 602 438 0888. Fax: +1 602 438 8227.

● **Prism Sound DSA-1**

Hand-held analyser designed to aid easy identification of audio interconnection problems in an AES-EBU environment. Active bits and auxiliary sample activity are indicated on LEDs, as are various channel status fields. Sampling frequency is also measured to a high degree of accuracy. The unit is programmed with a selection of templates to give an operator a simple go/no-go reading on the in-built LCD.

The *DSA-1* can also make a variety of more complex measurements such as data-related and sample jitter, and wide and narrow band carrier amplitude. A built-in D-A convertor feeds an internal monitor speaker.

In loop through mode a re-clocking facility cleans up jittery or low amplitude signals for retransmission.

Prism Sound, William James House, Cowley Road, Cambridge CB4 4WX, UK.
Tel: +44 1223 424988. Fax: +44 1223 425023.

CD Recorders (CD-R) and Accessories

● **Apex CD-R 2000**

While there have been *Red Book*-compatible CD recorders on the market since 1989, this is believed to be the first dual *Red-Orange Book* machine available as a self-contained unit.

In addition to standard *Orange Book* features the *CD-R 2000* CD master recorder offers a number of Auto Track Increment functions, including variable delay to compensate for late start IDs. A built-in sample rate convertor allows recordings from 32kHz and 48kHz sources and double speed copying is possible via the optical SPDIF port.

Options include a SMPTE board for precise PQ coding (99 tracks-99 index points per track) and a SCSI board for the production of CD-ROM(XA), CD-I and CD-Audio when linked to an external computer or workstation.

Apex, Bosdel 52, B-3600 Genk, Belgium.

Tel: +32 89 306313. Fax: +32 89 306016.

● **HBB Bit Box CD-R Optimiser**

Designed to act as an interface between DAT and CD-R machines, the *Bit Box* incorporates a number of features which overcome the problems associated

with this operation. It is compatible with Marantz and other Philips-based systems.

A built-in sample-rate convertor automatically detects the incoming frequency and where necessary converts it to 44.1kHz. DAT start IDs are translated to track increment flags, with an optional delay to accommodate 'late' IDs on the tape. The unit will also act in reverse, allowing DATs to be copied from CD with correctly positioned start IDs.

HBB Communications, 73-75 Scrubs Lane, London NW10 6QU, UK. Tel: +44 181 960 2144.

Fax: +44 181 960 1160.

Duplication

Were this to have been written 12 months ago the main topic of discussion would have been DCC. But, as the saying (almost) goes,



Tape duplication at TDC

12 months is a long time in consumer electronics. DCC has all but disappeared, while the number of analogue cassettes being duplicated shows no sign of the rapid decline predicted by Philips' marketing people.

Admittedly, music product on CD and computer games in cartridge form now outsell their cassette counterparts by a large margin—in the major territories, ►

MasterDisc™

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MasterDisc™ is a new series of CD-Recordable discs by Audio Design. Experience indicates that users, who intend their CDs to be masters, require the best possible disc performance. All discs have variations in tolerance and many makes are marginal in certain areas. This fact, coupled with further variations in the CD-Recorder mechanisms, can mean higher error rates than ideal.

Audio Design's policy for *MasterDisc™* is to constantly monitor disc manufacturing sources, so as to select the best disc available for mastering purposes.

Each *MasterDisc™* has two additional top protective layers, so that information can be safely written with a soft felt-tip, or used with the Audio Design label segments.

Audio Design offer a range of competitive CD-R media, plus specialist CD-R services, including fast turn-round custom screening, small quantity label and inlay printing in mono-chrome, full process or line colour.

™ *MasterDisc* is a trademark of Audio Design



AUDIO DESIGN

Unit 3 Horseshoe park, Pangbourne, RG8 7JW, UK
Tel: +44 (0) 734 844545; Fax +44 (0) 734 842604

at least—but the huge increases in the market for talking books and other speech-related titles have stepped in to fill the gap.

Technological advances in analogue duplication also continue to be made. As well as the all-digital mastering chain offered by DAT intermasters and digital loop bins, improvements in other areas such as noise reduction, cassette-shell design and tape formulation all serve to bring the quality of today's cassette tantalisingly close to that of the CD.

Market research by Philips—ironically used to support their case for DCC—shows a vast world market for the analogue cassette, and while there remains a price difference with DCC and MD of around 30% at the shop counter, we are unlikely to see sales decline in favour of the so-called replacement formats.

All this bodes well for the future of the duplication industry. However, the conflict of continuing downward pressure on prices and demand for 'CD quality' means that those contemplating further investment in their duplication facilities must inevitably look for equipment that is at the same time more efficient and capable of delivering even higher quality.

Most of the equipment manufacturers have recognised this need, with the result that in addition to introducing new products, many existing lines have been upgraded to meet the demands of the 1990s.

Duplication Equipment

● Duplitrionics DHS-1

The DHS-1 digital bin platform employs an open architecture which allows a duplicator to build from a basic entry level set up to the most advanced Duplitrionics system.

The design avoids the expense of retrofits. Memory can be expanded and other features added by adding plug-in modules as the need arises.

Duplitrionics, 160 Abbott Drive, Wheeling, IL60090, USA. Tel: +1 708 459 6610.

Fax: +1 708 459 6615.

● Gauss MAX

The MAX—Maximum Audio eXpression—digital bin is a high-speed, solid-state, master system capable of duplication ratios up to 128:1. Memory is expandable up to C126 and the system is capable of simultaneous real-time background loading while downloading.

Gauss, 9130 Glenoaks Boulevard, Sun Valley, CA 91352, USA. Tel: +1 213 875 1900.

Fax: +1 818 767 4479.

● Lyrec Twin Slave and Loop-master (Upgrade)

A new bias circuit which generates a bias frequency of 12MHz means that this system can now deliver an audio response up to 20kHz at the 128:1 duplicating ratio when using ferric tape.

Additionally, Lyrec have added Dolby HX Pro to their Twin Slaves in order to cope with the higher audio frequencies.

Lyrec Manufacturing, Box 123, DK-2740 Skovlunde, Denmark. Tel: +45 44 53 25 22.

Fax: +45 44 53 53 35.

● Otari DP-70 Series

A twin-slave system which offers three duplicating ratios including 80:1 and 128:1. Up to 20 DP-75 slaves can be linked to Otari's recently introduced *Binloop Master DP-73*, which features digital production-data control, or to a variety of digital bins.

Otari, 4-33-3 Kokuryo-cho, Chofu-shi, Tokyo 182, Japan. Tel: +81 424 81 8626.

Fax: +81 424 81 8633.

● Tapematic SAM Junior

SAM Junior has only a single memory store and forms part of Tapematic's new range of smaller products targeted at companies that do not require the high output offered by the larger systems.

Tapematic, Via Vimercate 32, 20060 Ornago (Milano), Italy. Tel: +39 39 601 0145.

Fax: +39 39 601 0558.

Loaders

● Gauss CD 9002

A microprocessor-controlled, double-pancake, automatic loader. The unit features vacuumless extraction, which is claimed to shave up to one second off the cycle time per cassette.

Gauss, 9130 Glenoaks Boulevard, Sun Valley, CA 91352, USA. Tel: +1 213 875 1900.

Fax: +1 818 767 4479.

● Otari—AL-631, AL-632, AL-662

A range of double and single-pancake loaders that can be readily converted to handle DCC.

Otari, 4-33-3 Kokuryo-cho, Chofu-shi, Tokyo 182, Japan. Tel: +81 424 81 8626.

Fax: +81 424 81 8633.

● Tapematic 200 Mini Series, 2002 CR

A smaller version of Tapematic's 2002 loader for duplicators not requiring such high-production output. The 200 does not have the automation of its larger counterpart and has been designed to complement the Tapecentre or a system based around the SAM Junior digital bin.

The 2002 CR, meanwhile, has been upgraded to operate 25% faster, making it capable of producing up to 3,000 cassettes per shift.

Tapematic, Via Vimercate 32, 20060 Ornago (Milano), Italy. Tel: +39 39 601 0145.

Fax: +39 39 601 0558.

Printing Machines

● Apex Machine Company RS-1001 Rotoscreen System

The RS-1001 can achieve high-quality opaque printing directly onto cassette at a production speed of around 120 parts per minute. The system comes complete with an automatic hopper feed, one colour Rotoscreen print section and the Apex ultraviolet drying system.

Printing onto other products such as videocassette, DCC, and Norelco and CD boxes is also possible with the RS-1001.

Apex Machine Company, 3000 Northeast, 12th Terrace, Ft. Lauderdale, FL 33334, USA.

Tel: +1 305 566 1572. Fax: +1 305 563 2844.

● Apex Machine Company CA-20

A computer-controlled, on-cassette, printer capable of automatically feeding, printing in one or two colours on both sides, ultraviolet drying and restacking up to 150 cassettes per minute.

The CA-20 incorporates Apex's new Closed Capsule Inking System, which uses air pressure as the means of predictably distributing the correct amount of ink throughout the printing rollers.

Apex Machine Company (see above)

● Lyrec Gepro II

A dry offset printer designed specifically for printing on compact cassette. Features include variable printing speed up to 140 cassettes per minute, cassettes vacuum cleaned before printing, infeed conveyor for 100 cassettes, outfeed for boxing machine (which will stop if upstream machine cannot keep up).

The *click-És* are held by vacuum. They can be metal, rubber or plastic; the latter is recommended by the manufacturer as they are simple and inexpensive to produce in-house.

Lyrec Manufacturing, Box 123, DK-2740 Skovlunde, Denmark. Tel: +45 44 53 25 22.

Fax: +45 44 53 53 35.

Packaging Equipment

● Ecofina CF 6000

Designed to interface with audio loaders, labelling and printing machines, the CF 6000 cassette feeder can remove 500 cassettes from a carton in a single operation, while maintaining the same packaging order for the next step.

The machine will also sort randomly stacked cassettes into the correct position for the next production stage. The manufacturer claims a throughput of up to 6,000 cassettes an hour.

A twin-loading version is also available to handle, for example, two different colour C-0s at the same time.

Ecofina, Via V. Monti 44, 20123 Milano, Italy. Tel: +39 2 481 6121. Fax: +39 2 498 0463.

● Emerald Technology JC76-JC7700

Emerald have recently introduced two accessories for their JC7000 cassette-inserting system.

The JC76 is an inline conveyor system with passive cassette orientating stops. It will accept the output from a cassette label printer, reposition the cassette and feed it directly into the JC7000 box feeder. The JC76 incorporates sensors and a relay; should the JC7000 stop it will stop the feed from the label printer.

The JC7700 provides an automated box infeed to the JC7000. The hopper holds twice as many Norelco boxes as the original and will feed them at the 100 parts per minute operating speed required by the JC7000.

Emerald Technology, 233 South 13th Street, Suite 1706, Lincoln, NE 68508, USA.

Tel: +1 402 435 6464. Fax: +1 402 435 7576.

● Production Automation J-1000

The microprocessor controlled J-1000 J-Card inserter automates the folding and placing of a J-Card and cassette into the cassette box, at a speed of 40 pieces per minute.

The system is specifically designed for smaller production runs where a larger system—which, according to the manufacturer, could cost three to six times more—would be uneconomic.

Production Automation, 1145 12th Avenue NW, Suite C7, Issaquah, WA 98027, USA.

Tel: +1 206 391 9775. Fax: +1 206 392 4610. ▶

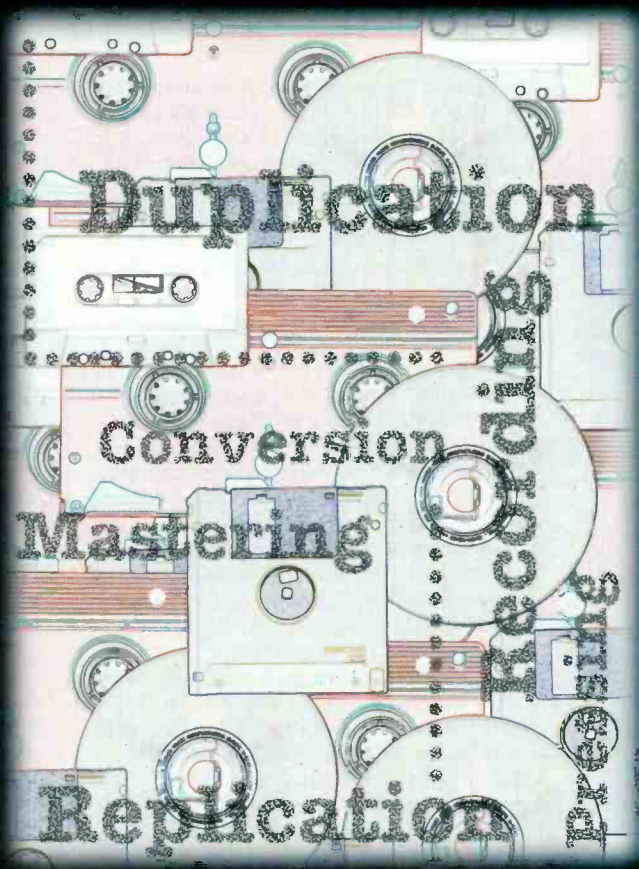
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Quality Control

● **CRL AQAID**

A PC computer-based system for checking the quality of duplicated cassette copies against a master reference. AQAID stores a sample of the master material, for example from the DAT intermaster, and compares the spectral content of the signal with the same section of the finished cassette.

Frequency response, speed and azimuth are all checked for errors and presented in easy to digest form, making it unnecessary for operators to have specialist training.

CRL, Dawley Road, Hayes, Middlesex UB3 1HH, UK. Tel: +44 181 848 9779. Fax: +44 181 848 6565.

Degaussers

● **Audiolab CDS-1500, CDS-2500, CDS-3500**

A range of high-speed, continuous-duty, conveyor belt degaussers which can handle a wide range of magnetic products, including computer diskettes, video tapes, DAT and audio cassettes.

The CDS-1500 is capable of processing up to 8,500 audio cassettes per hour.

Audiolab Electronics, 5831 Rosebud Lane, Bldg. C, Sacramento CA 95841, USA. Tel: +1 916 348 0200. Fax: +1 916 348 1512.

Replication

Three years ago, Tape One Studios compiled a guide to the various CD formats. It ran to 15 different variations. Two of that original list—CDTV and CD-Video—have since fallen by the wayside, but the number has still grown considerably in the space of the past 36 months. And to the 5-inch and 3-inch CD formats must now be added Sony's 2½-inch MiniDisc and the recently announced MD-ROM and MD-DATA discs.

The rapid growth in the optical media market has meant healthy business for manufacturers of replication hardware. The

result has been intense competition to produce production lines with faster cycling times, better printing techniques and equipment versatile enough to handle the diverse range of packaging that is increasingly being used in place of the ubiquitous jewel box.

When it comes to data integrity on CDs, the original parameters laid down in the *Red Book* have been left way behind. The more exacting requirements of CD-ROM have meant a general raising of standards, with the error rates on all discs from the major replicators now comfortably exceeding the base specification—many by a factor of ten, or more. As a result the range and precision of the QC equipment has had to be enhanced to match this improved performance.

The past year has also seen a number of new entrants into the replication field, many of these being major players in the data and audio-cassette industries who have realised the potential of the CD market.

Ultimately this increased competition must surely benefit customers, although in the short term it is likely to result in a degree of confusion as they attempt to evaluate the quality and scope of the products and services being offered by the various replicators, measured as always against the ever-important delivery time and price.

Mastering

● **Del Mar Avionics Firetrac**

Unique, desk-top, laser-beam recorder which is capable of producing masters for all types of CD, including Video-CD. The disposable polycarbonate master disc is tray-loaded into the system in a similar manner to a CD player.

During mastering the quality is checked by a DRAW laser and the manufacturers claim average BLERs of between 10 and 20. The finished master is immediately ready for metallisation and

galvanic processing to stamper.

Del Mar Avionics, Laser Optics Division, 1621 Alton Avenue, Irvine, CA 92714-4878, USA. Tel: +1 714 250 3200. Fax: +1 714 261 0529.

● **Liconix 55PM**

This upgraded version of the 45PM laser power meter is suitable for measuring HeCd, HeNe or argon lasers and has six factory calibrated wavelengths: 325nm, 354nm, 442nm, 488nm, 514nm and 633nm.

Eight selectable power ranges are available—from 100µW to 300mW—and the built in zero suppression makes it easy to measure either a small fluctuation in a strong laser beam or weaker signals in the presence of strong ambient background.

Liconix, 3281 Scott Boulevard, Santa Clara, CA 95054, USA. Tel: +1 408 496 0300. Fax: +1 408 492 1303.

● **Nimbus-Halliday LBR (upgrade)**

A recent upgrade to the Nimbus-Halliday Laser Beam Recorder means that the system is now capable of mastering CD-ROM discs from 8mm Exabyte masters at speeds of up to 3x real time. Other formats such as CD-Audio and Video CD are handled at 2.8x real time.

Masters can also be produced from CD or CD-R at double speed, while a future upgrade will allow 4x speed when using a hard disk as the source.

Nimbus Technology & Engineering, Wyastone Leys, Monmouth NP5 3SR, UK. Tel: +44 1600 890682. Fax: +44 1600 890779.

● ODC 530A and 532B

The combination of ODC's 530 LBR CD mastering system and 532B high-speed multiformat subsystem provides the facility to master at speeds higher than real time. There is a choice of input media available, including Exabyte (fitted as standard) and CD-ROM/CD-Audio double-speed readers.

Masters can be produced directly from both CD-R and *Red Book* premastered CDs in a variety of formats, including Video CD and Photo CD.

Optical Disc Corporation, 12150 Mora Drive, Santa Fe Springs, CA 90670, USA. Tel: +1 310 946 3050. Fax: +1 310 946 6030.

● **ODME Media Conversion System**

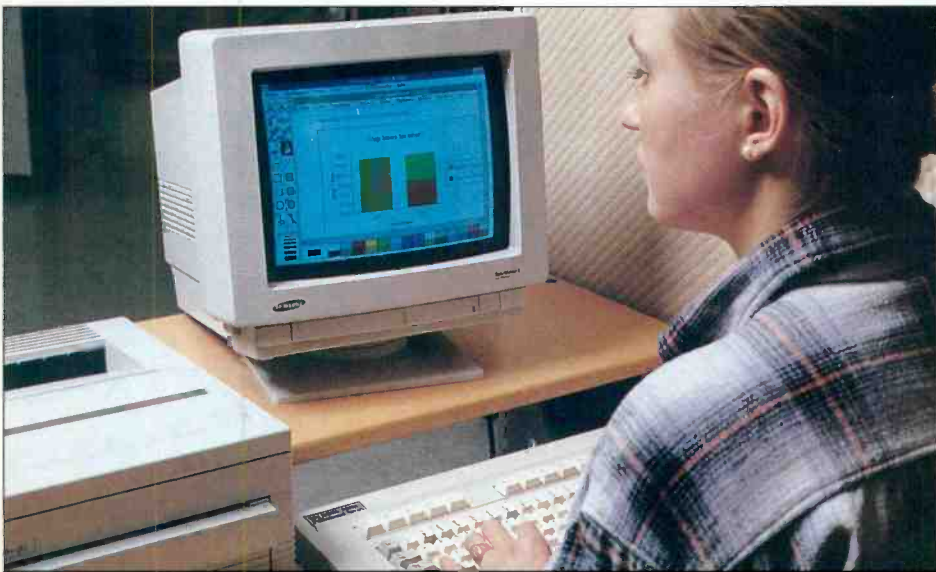
The MCS has been designed to provide premastering for the increasingly diverse range of material now being released on CD. It accepts input from a wide variety of media and outputs data to the Exabyte-based ANSI standard Disc, Description Protocol (DDP).

ISO 9660 formatting for CD-ROM and mixed mode discs is also supported. In addition, a recently announced collaboration between ODME and Elektrotron should see enhancements such as CD+Graphics and CD-I authoring added to the system in the near future.

Optical Disc Manufacturing Equipment, PO Box 832, 5600 AV Eindhoven, The Netherlands. Tel: +31 40 465555. Fax: +31 40 465050.

● **ODME AMS 100**

An in-line mastering and stamper-making system which fully automates the process from master tape to a finished stamper ready for replication. All CD formats are supported with the system's menu-



Real-time access to CD-production data is offered on the new Toolex Alpha Hermes monitoring program

driven software enabling one operator to supervise the entire process.

ODME (see above)

● **StageTech d2d**

The *d2d* disc-to-disc mastering system provides the facility to master directly to the LBR from CD-R or other CD media. The system emulates the functions of *PCM-1630/DMR-4000* and requires no modification to the mastering setup. A change-over switch allows either source to be selected.

BLER and other errors related to A-time can be displayed or printed out. Read-after-read minimises the risk of errors being transferred to the glass master. Upgrades to the basic system include double-speed playback and support for CD-I, Photo CD and CD-ROM XA.

StageTech, PO Box 80, S-201 20 Malmö, Sweden. Tel: +46 40 150018. Fax: +46 40 150019.

Electroplating-Moulding

● **Galic Maus Ventures CD-94**

The *CD-94* is a faster cycling system for Krauss Maffei *CD-86* moulds, which replaces the conventional robot arms and suction cups usually needed to remove discs from the mould. A saving of at least 0.5s—even over moulds using the fastest robot arms—is claimed by GM.

The new mechanism can be retrofitted into any

Krauss Maffei *CD-86* mould in one day. After conversion the mould can produce 20%–35% more CDs without any loss of quality.

Galic Maus Ventures, 5140 St Moritz Drive, Columbia Heights, MN 55421-1344, USA. Tel: +1 612 571 7961. Fax: +1 612 572 2531.

● **Nobler—NTG-170**

The *NTG-170* galvanic electroplating system offers high-precision stamper preparation to a tolerance of within 5 microns. Each plating cell is equipped with its own reservoir tank which avoids the contamination problems associated with multiple-plating cells attached to a single reservoir.

Maintenance of the plating cell has been reduced by eliminating baffles and motorised rotating heads, while the system's 'carry case' design permits Glass, Father and Mother changeover in less than 30 seconds.

Nobler Technologies, 111a Island Street, Stoughton, MA 02072, USA. Tel: +1 617 344 0999. Fax: +1 617 341 2427.

Duplication-Replication

● **Accurate Sound Corporation CD Maker**

A self-contained unit for producing low runs of CD-R discs. A DAT player is optional, while a 1Gb hard disk gives sustained high speed data transfer. Up to four 4x speed drives provide the capability to produce 16 CDs an hour.

Accurate Sound Corporation, 3475a Edison Way, Menlo Park, CA 94025, USA.

Tel: +1 415 365 2843. Fax: +1 415 365 3057.

● **MicroTech Conversion Systems' ImageMaker**

The *ImageMaker* duplication system has recently been upgraded with multiple drives. Up to eight drives are supported, with a choice of either the Yamaha *CD-R 100 4x* or Kodak *PCD 200 2x* being offered. In addition, MicroTech has integrated the new Kodak *PCD 600 6x* drive and transport system.

As well as verifying all discs, the *ImageMaker*'s tracking and reporting capabilities keep the user informed of the number of good discs produced and reports the estimated time to completion.

MicroTech Conversion Systems, 192 Rancocas Road, Mount Holly, NJ08060, USA.

● **ODME Monoliner Mk IV**

According to ODME, the newly designed *Mk IV* brings a number of improvements. Output is claimed to be in excess of 6 million discs a year, with an uptime of better than 95%.

A choice of injection-moulding equipment is offered. If a vertical injection moulder is chosen, this can be supplied with a sliding mould which allows stamper exchange to be achieved in a few seconds.

ODME—Optical Disc Manufacturing Equipment, PO Box 832, 5600 AV ▶

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Eindhoven, The Netherlands.

Tel: +31 40 465555. Fax: +31 40 465050.

● **Nobler MSI-2000**

The production throughput of the *MSI-2000* doubleline CD replication system has recently been increased by 0.5s, from 2.75s to 2.25s, enabling an additional 290 discs per hour to be produced.

The enhancement involves all elements of the *MSI* replication line, from the dual cathode metalliser through to the spin coaters, inspection systems and line automation.

Nobler Technologies, 111a Island Street, Stoughton, MA 02072, USA.

Tel: +1 617 344 0999. Fax: +1 617 341 2427.

● **Robi-System Rondo Line**

This latest system from Robi-System CD replication system is capable of single cavity, dual cavity, on-off line and twin-line operation, with disc-to-disc output of less than 3.0s. It can be matched with any available moulding subsystem.

Discs are placed onto a locating pin on a rotary indexing table and move through each process without leaving the pin, ensuring accurate disc placement. A comprehensive touchscreen operator interface can be networked for remote location production.

Robi-Systemtechnik, Wiesengasse 20, CH-8222 Beringen, Switzerland.

Tel: +41 53 36 14 11. Fax: +41 53 36 14 09.

Metallisers

● **Balzers CDI 905**

The latest member of the *CDI 900* family of CD metallisers and, according to the manufacturer, the smallest and fastest, with a 1.8s cycle time yielding up to 2,000 discs per hour.

The *CDI 905* remains under vacuum during target and mask changes, reducing downtime for scheduled maintenance. It uses 50% fewer moving parts than previous models, and a universally accessible handling-system interface allows easy integration into all production lines.

Balzers, FL-9496 Balzers, Liechtenstein.

Tel: +41 75 388 4831.

Fax: +41 75 388 5426.

● **H20 AMCS Series II**

Designed to meet the needs of larger optical disc manufacturers, the *AMCS Series II* automatic metalliser mask cleaning and conditioning system has the ability to process up to eight mask sets simultaneously, with a typical cycle time of two hours.

Air extract and chemical tank bonding provides the operator with a safe working environment, free from harmful chemicals and fumes.

H20 Plant Automation, 2 Garrick Way, London NW4 1TA, UK. Tel: +44 181 202 4850.

Fax: +44 181 203 7752.

● **Leybold LH Speed Line**

A fully integrated system which cycles injection moulded CDs through metallising, lacquer coating, quality control and title verification.

According to the manufacturer, the *LH Speed Line* gives a daily output in excess of 40,00 discs by offering a cycle time of less than 2s.

Leybold, Wilhelm-Rohn Strasse 25, D-63450 Hanau, Germany. Tel: +49 6181 341051.

Fax: +49 6181 341690.

Printing and Print Inspection

● **Apex Machine Company HSCD-1**

A high-speed CD printing machine that is capable of automatically feeding from spindles, printing in up to five colours, ultraviolet drying and restacking on spindles over 100 discs per minute. The system uses a direct printing process capable of producing a process print similar to a photograph.

The *HSCD-1* incorporates a simple plate-mounting technology which allows rapid set up and changeover. It is also designed as a modular system; a machine can, for example, be supplied for two-colour printing only and upgraded to full colour later.

Apex Machine Company, 3000 N E 12th Terrace, Fort Lauderdale, FL 33334, USA.

Tel: +1 305 565 2739. Fax: +1 305 563 2844.

● **Apex Machine Company CD-63**

The *CD-63* dry offset semiautomatic printer has been designed specifically for low volume applications such as the CD-ROM market. According to the manufacturer, it can achieve detailed and very tightly registered three colour printing, and ultraviolet cure the CDs in a simple one-up format.

Apex Machine Company (see above)

● **Integral Vision CDI-P**

Using three chip or standard-colour CCD cameras, the *CDI-P* Print Inspection System can be interfaced into single or double pad, screen or offset-printing machines from a variety of manufacturers, without requiring extensive modification.

The system, which uses the latest artificial intelligence techniques, can detect misregistration, foreign particles, blocked screens and colour-shade variance to a resolution of 24 bits (over 16 million colours) and 0.06mm/pixel. A masking function allows areas not requiring inspection to be masked out.

Integral Vision, Unit 12 Railton Road, Woburn Road Industrial Estate, Kempston, Bedfordshire MK42 7PW, UK.

Tel: +44 1234 843345. Fax: +44 1234 843390.

● **Kammann 15-0**

Among the features offered by the *15-0* 4-colour screen-offset printing machine is the ability to measure the thickness of each CD to an accuracy of within 1/1,000mm. The printing pressure is automatically adjusted to ensure a constant pressure between the blanket rubber cylinder and the disc.

The facility is provided to perform a print trial on blank paper, avoiding the need to use actual discs during set up. The *15-0* is equipped with two screen-printing heads in addition to the four-colour, offset-print unit, allowing an additional background colour, clear-varnish overprint or extra colour to be handled in the same pass.

Werner Kammann Maschinenfabrik, PO Box 2109, Elsemohlenweg 83-89, D-32257 Bünde, Germany. Tel: +49 5223 1810.

Fax: +49 5223 181130.

● **Machines Dubuit 528**

Designed with the production of picture discs in mind, the *528* offset-screen printer features two offset and two screen-printing heads. These can be operated independently as each has its own

brushless motor drive. The offset heads each handle two colours, which is claimed to offer a number of advantages including production speeds of up to 2,800 discs per hour.

The static UV dryers have independent power adjustment for each head and the system incorporates a number of safety devices. These include 'no object no print' and immediate stop if two discs stick together or to the underside of the screen.

Machines Dubuit, 10-12 rue du Ballon, ZI Les Richardets, F-93160 Noisy-le-Grand, France.

Tel: +33 1 43 04 96 05. Fax: +33 1 45 92 89 80.

● **Machines Dubuit 429**

A lower cost CD printer for those who do not require the speed or number of colours offered by Dubuit's higher speed automatic machines.

Output for four colours is 800 discs per hour, rising to 2,000 per hour for a single-colour process.

The *429* can be used as a monoline or off-line printer. In the off-line version, it is equipped with spindles and load-unload attachments, a centring device and optional ID-code-inspection system.

Machines Dubuit (see above)

● **Microcircuit Engineering Corporation NEC-CD1**

Until now principally a supplier to the military, microelectronics, medical and automotive industries, Microcircuit Engineering are now offering a precision screen-making service for manufacturers of CDs.

The *NEC-CD1* is a cold-rolled screen which has been specifically designed for use in CD and CD-ROM printing. It fits many of the popular CD printers, including those made by Kammann and Autoroll.

Microcircuit Engineering Corporation, 940 Industrial Avenue, Palo Alto, CA 94303 USA.

● **Teca-Print CDST 3120**

The *3120*'s print screens can be set in the X-Y-Z and R(otary) axes; each screen-printing station is independently adjustable and the system is designed for quick changeover and set up. Screen-printing heads can be interchanged with optional pad-printing heads.

The handling system comprises a spindle infeed-outfeed belt with a precentring and intermediate buffer station. The machine's two reject spindles can be used to separate different defects, or to store two different titles.

Teca-Print, Bohlstrasse 17, CH-8240

Thayngen, Switzerland. Tel: +41 53 39 23 33.

Fax: +41 53 39 25 96.

Stamper Inspection Systems

● **Aerosonic CDQ1002**

A regular CD player is incorporated into the *CDQ1002* stamper analyser system to allow tests to be carried out independently on both stamper and sample pressing prior to releasing the stamper for full production. Data from the both the stamper and pressing resides on the same database, providing easy comparison between the two manufacturing stages.

Aerosonic, Unit 9, St Giles Technology Park, Newtown, Powys SY16 3AJ, UK.

Tel: +44 1686 627355. Fax: +44 1686 627494.

● **CD Associates SP100**

Designed for use with the company's CD Analyser to provide correlation between stamper and disc, CD Associates' SP100 advanced measurement stamper analyser can be fitted with a number of options for the measurement of jitter and track pitch (actual and average), eccentricity, scanning velocity and radius.

A double-speed option is also available and up to six SP100s can be mounted in one rack, either to analyse six stampers of the same title or six different titles simultaneously.

CD Associates, 15375 Barranca Parkway, Suite I-101, Irvine, CA 92718, USA.

Tel: +1 714 733 8580. Fax: +1 714 453 0868.

● **Koch Digitaldisc CS-4/SA**

The CS-4/SA stamper analyser is fitted with a stamper holder to ensure the flatness of the stamper during testing and avoid the risk of damage to the surface. The holder, which also protects the stamper from contamination while testing, can be assembled in five seconds. A clean air flow box is available for use in dusty environments.

Most of the modular hardware components and all software functions of the stamper analyser are the same as for the CDCS 4 test player.

Koch Digitaldisc, A-6652 Elbigenalp 91, Austria. Tel: +43 5634 6444.

Fax: +43 5634 6105.

● **ODME Q-liner ABC 200 DS**

An inspection system for both stampers and CDs, the ABC 200 DS features double-speed drives for faster testing. It also offers accurate correlation between stamper and CD test results.

The system tests all Red Book parameters, and is expandable with the addition of optional CD-ROM and jitter test modules.

ODME—Optical Disc Manufacturing Equipment, PO Box 832, 5600 AV Eindhoven, The Netherlands. Tel: +31 40 465555.

Fax: +31 40 465050.

CD Inspection and QC Systems

● **Aerosonic CDQ1000, CDQ1001**

In the CDQ1000's design, Aerosonic claim to have addressed a criticism that many CD and CD-R testing systems are too complicated. Twin PC control handles the fully-automatic test cycle, including split tests, and offers a high degree of repeatability. The user-interface can be programmed to display a number of different languages.

Up to eight drives are supported by the CDQ1000, with double speed and 16 drive options also available. A companion unit, the CDQ1001, provides testing for CD-R discs and incorporates up to two CD drives.

Aerosonic, Unit 9, St Giles Technology Park,

Newtown, Powys SY16 3AJ, UK.

Tel: +44 1686 627355. Fax: +44 1686 627494.

● **Audio Development**

CD CATS SA3 Advanced

This latest addition to the range of CD CATS test equipment measures jitter and effect length deviations in accordance with the latest Philips-Sony recommendations, and also provides a graphic image of the tested disc to help isolate and locate any problems in the CD manufacturing process. Parameters BLER, E11-E32, I11, REF, RN and SYM are displayed, showing where the problem areas are located. Any area can be highlighted and magnified to show the defects.

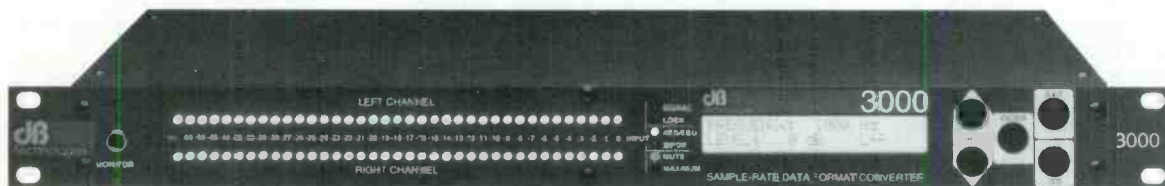
A further refinement to the system will see only selected Philips CDM4 optical chassis used in the SA Advanced system. The drives are upgraded mechanically in order to minimise the risk of differing test results caused by variations in player chassis.

Audio Development, Kabingatan 11, S-212 39 Malmö, Sweden. Tel: +46 40 28 71 70.

Fax: +46 40 18 55 45.

● **Automatic Inspection Devices iNSPECT**

The iNSPECT Series comprises a range of inspection devices which can be configured to meet the needs of the individual CD manufacturer. The system's computer can be supplied with either a flat touchscreen or super VGA display and features ►



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a new 16-bit ISA compatible camera interface module that can accept data at 10MHz camera data rates. Inspection time is approximately 0.75 seconds for 38 microns by 60 microns maximum resolution at the outer mirror band.

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Automatic Inspection Devices, PO Box 6295, Toledo, OH 43614, USA. Tel: +1 419 536 1983. Fax: +1 419 536 2793.

● **AID CD Birefringence Tester**

Birefringence—or disc stress—is a direct indication of moulding problems, pressure cooling and so on. AID's *CD-BIRE* table-top, CD birefringence evaluator has been designed to produce a production analysis of a CD in less than 15s. Special features of the test include auto scaling, video zoom, 3-D disc view and a polar map of disc birefringence. Measurement range is -145nm to 145nm with scaling in 1nm increments.

Both clear substrate and metallised discs can be evaluated, with the birefringence data being shown as a topographical map of location, amplitude and phase. Data is displayed on the system's colour CRT and a hard copy can be printed on demand.

Automatic Inspection Devices (see above)

● **CD Associates SL100**

A self-contained, single player CD analyser which supports *Red*, *Green*, *Orange*, *Yellow* and *White Book* formats. It can be used in the R & D lab, studio or production floor, where it will network in real time into a process control environment.

The *SL100* is capable of a wide range of measurements, including BLER, E11, E21, E31, BURST, E12, E22 and E32 (uncorrectables). VTOC listing, detrack detection and audio monitoring are also provided. Options include measurement of modulation amplitude, symmetry, crosstalk, radial noise, track pitch and jitter.

CD Associates, 15375 Barranca Parkway, Suite I-101, Irvine, CA 92718, USA.

Tel: +1 714 733 8580. Fax: +1 714 453 0868.

● **Clover Systems QA-101**

The *QA-101* CD analyser provides what is claimed by the manufacturers to be the first low-cost means for manufacturers, distributors, recording studios, CD-ROM publishers and end users to make simple quantitative measurements of a CD's performance.

The analyser is a self-contained system that will measure all error syndromes, plus dropouts. It displays current and peak values for each parameter on the front panel display, and also has BNC connectors with buffered HF and TRK outputs to enable oscilloscope measurements of asymmetry and push-pull tracking in relation to pit geometry. An RS485 jack provides a connection to an optional computer for storage of the data.

Clover Systems, 31642 S. Pacific Coast Highway #101, Laguna Beach, CA 92677, USA. Tel: +1 714 499 9566. Fax: +1 714 499 4844.

● **Dr Schenk VCD 120-STL**

The *VCD 120-STL* automated CD-MD online inspection system has been designed to check both sides of a disc in a single pass, with the software program providing not only details of production yields but also an indication of the likely source of a problem. Errors are identified as uncorrectable or cosmetic.

New CCD cameras with a scan frequency of under 6kHz are employed, giving an inspection time of 1.2s (0.7s for MD).

Eight classes of defects are identified, plus a further 12 specific factors contributing to these conditions. These include scratches, pinholes, metal particles and bubbles. Statistics can be printed out, with the option to show the types of defects and their location on a graphics interface.

Dr Schenk, Einsteinstrasse 37, D-82152 Martinsried/Munich, Germany.

Tel: +49 89 856950. Fax: +49 89 8569560.

● **Integral Vision CDI-D**

Using what the manufacturers claim to be the most advanced OCR available today, the *CDI-D* ID code checker will read and confirm that a CD has the correct ID code for printing. This the system can do whatever the disc's orientation. Cycle time is between 100ms and 900ms.

Other features include bar code verification and the ability to identify degraded characters. The unit's artificial intelligence is able to learn new fonts, avoiding the need for software changes.

Integral Vision, Unit 12, Railton Road, Woburn Road Industrial Estate, Kempston, Bedfordshire MK42 7PW, UK.

Tel: +44 1234 843345. Fax: +44 1234 843390.

● **Koch Digitaldisc**

This plug-in, time-base, error-analysis board and accompanying software can be used to upgrade any Koch CS-4 test player, turning the system into a fully-integrated production tester for checking almost all CD quality parameters.

The board includes a time interval analyser, some additional electronics for signal conditioning and a micro-controller capable of delivering a full analysis of jitter and effect length deviations relative to the new Philips and Sony recommendations.

Koch Digitaldisc, A-6652 Elbigenalp 91, Austria. Tel: +43 5634 6444. Fax: +43 5634 6105.

● **Robi-System ODIS 100**

To complement their range of CD and MD replication lines, Robi-System have introduced their own in-line optical inspection system. A wide range of criteria can be verified and compared against stored test parameters of varying complexity, depending on the product.

The system's optics have been designed to detect defects with extremely weak contrast, while the option to verify the entire varnish surface for inclusions and flaws is also available.

Robi-Systemtechnik, Wiesengasse 20, 8222 CH-Beringen, Switzerland.

Tel: +41 53 36 14 11. Fax: +41 53 36 14 09.

● **RMV CD 2001**

A compact, modular CD inspection system offering a high daily throughput of CD-Audio, CD-ROM, CD-I, CD-R or MD. The *CD 2001* can operate under central production control and lacquer inspection is directly integrable into the system.

RMV—Rheinmetall Machine Vision, Pempelfurtstrasse 1, D-40880 Ratingen, Germany. Tel: +49 2102 902905. Fax: +49 2102 902311.

Packaging and Handling Systems

● **Basler Paperwork Inspection System**

The automated PWI System is capable of identifying even minor differences in booklet and inlay card artwork—Vol.2 instead of Vol.1, for example. When used in conjunction with Basler's *CD Ident Code Reader* the replicator is assured that only matching assemblies are delivered to the customer.

Basler Image Processing, An der Strusbek 30, D-22926 Ahrensburg, Germany.

Tel: +49 4102 47940. Fax: +49 4102 45030.

● **Data Disc Robots Starline 480**

Starline is claimed by its makers to be the fastest optical-disc handling system, with its 1.8 second cycle time providing the capability to output 41,000 discs per day. The system can be operated from a touchscreen console known as the Big Touch Simulator.

Data Disc Robots, Monnet Strasse 2, D-52146 Würselen, Germany. Tel: +49 2405 69020.

Fax: +49 2405 18696.

● **deVille Integrated EAM Ranges**

The *EAM* range is a 'family' of CD jewel box handling machine capable of processing 120 parts per minute. The Unstacker feeds jewel boxes to an overwrapper at 120ppm, while the Stacking machine automatically stacks finished jewel boxes, conveys them to deVille's Carton Loading Machine where an operator loads the stacks into cardboard boxes.

The *5000 CD Jewel Box Buffering Machine* compensates for differences in speed between packaging, overwrapping and stickering machines. As its name implies, up to 5,000 CDs can be accommodated.

deVille Integrated, 55 Ward Hill Avenue, Haverhill, MA 01835, USA.

Tel: +1 508 372 2889. Fax: +1 508 372 3386.

● **EIT Laser CD Stack Counter**

According to Electronic Instrumentation and Technology, conventional counting techniques based on the height of a stack can be out by as much as 10%, due to varying thickness of discs or warpage. The laser CD stack counter uses a measurement well into which the spindles are lowered. Two laser beams then count and verify the stack and an error rate of less than 0.1% is claimed for the system.

The count is displayed on a 3-digit, front-panel readout, along with a 6-digit running count for the batch. This helps to eliminate waste due to over production.

EIT Instrumentation Products, 108 Carpenter Drive, Sterling, VA 20164, USA.

Tel: +1 703 478 0700. Fax: +1 703 478 0815.

● **Emerald Technology CD-8000**

Produced in collaboration with Paktec Automation, the *CD-8000* CD packaging system features fully-automated in-feed of discs and jewel boxes, with the output capable of feeding directly to a wrapping station of being accumulated in hoppers for bulk wrapping or cartoning.

The system supports a number of jewel box

formats without the need for major modification or outboard accessory packages. In addition to the popular 3-piece jewel box with tray, the CD-8000 can handle 2-piece, trayless and multidisc boxes.

Emerald Technology, 233 South 13th Street, Suite 1706, Lincoln, NE 68508, USA.

Tel: +1 402 435 6464. Fax: +1 402 435 7576.

● **Marden Edwards ME4-12**

Capable of wrapping up to 60 packs per minute, the ME4-12 features high level hinged and interlocked safety guards for easy access, and a cantilevered film spindle and splice deck for fast changeover.

The unit is also suitable for jobbing lines where other recordable media, such as videos and diskettes, are produced and wrapped.

Marden Edwards, 3 Cobham Road, Ferndown Industrial Estate, Wimbourne, Dorset BH21 7PD, UK. Tel: +44 202 861200.

Fax: +44 202 861400.

● **Scandia Model 350**

Designed for users who want increased productivity coupled with low operating-and-capital costs, the Model 350 overwrapper-bundler offers 3-dimensional changeover in less than 15 minutes.

Features include a stepper-motor film feed, crank adjustments with digital read-out for fast and precise setups, bottom sealing for seamless wraps and drop-in folding line for 'tool-less' changeover.

Scandia Packaging Machinery, 180 Brighton Road, Clifton, NJ 07012, USA.

Tel: +1 201 473 6100. Fax: +1 201 473 7226.

● **Tapematic Discmatic 6000**

The Discmatic CD packaging line has been designed to meet the needs of both small and larger manufacturers who have a requirement for small production runs. It is based on modules and peripheral devices that can be added depending upon the individual requirements of the customer.

The heart of the system is a module that receives the case and tray from an outside source. The inlay, booklet and CD are held in magazines. Each module can handle 30 parts per minute, with four modules working in-line from an infeed source magazine for the cases and trays delivering 120ppm. The addition of automated pallet loading and unloading stations serves to offer a very flexible system for short runs.

Tapematic, Via Vimercate 32, 20060

Ornago/Milan, Italy. Tel: +39 39 6010145.

Fax: +39 39 6010558.

Miscellaneous

● **Audio Matrix Poly bags**

Instead of using chemicals or coatings to protect CD fathers, mothers and stampers, Audio Matrix have come up with the idea of sealing them in plastic bags. This effectively eliminates any staining problems and protects them from air oxidation.

This solution is less expensive than existing methods—a standard box used to protect a father or mother costs in the region of US \$9, against 40 cents for a bag.

Audio Matrix, 400 Madison Avenue, New

York, NY 10017, USA. Tel: +1 212 308 6888. Fax:

+1 212 308 5817.

● **Eurodat ICE ISRC Code Extractor**

A PC-compatible board which will decode and display the International Standard Recording Codes (ISRC) recorded on a CD, DCC or MiniDisc, along with the relevant track number. Connection is via an SPDIF input, allowing easy connection to any player with a digital output. Codes can be printed, saved or exported to a database.

Eurodat, 514 Chemin des Hautins, F-01280

Prevessin, France. Tel: +33 50 40 54 00.

Fax: +33 50 40 51 58.

● **Toolex Alpha Hermes**

Hermes production data-logging programme enables users of Toolex Alpha's MD 100 moulding systems and Duomax replication systems to

monitor the production process in either real time or at user-defined intervals. It can carry out a number of tasks including automatic data logging, manual requesting of data and event logging.

A visual display of the production process aids troubleshooting, making it easier for the production manager to monitor the system and make adjustments to maximise productivity.

Toolex Alpha, PO Box 1176, S-172 24

Sundbyberg, Sweden.

Tel: +46 8 28 90 30.

Fax: +46 8 28 95 32. ■

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THE FUTURE OF THE CD

I have a soft spot for the Compact Disc because in many respects I grew up with it. The year CD was launched and also the year I left the computer industry in the hope of finding something a bit more interesting. Having spent several years in mass storage and Winchester discs, the Compact Disc was very much a *déjà vu* machine but with a new application and I remember spending a lot of time explaining how it worked. In the technological sense I failed to leave the computer industry because my timing coincided with the move to digital techniques in video and audio, but in the main goal of a more interesting life I am more than pleased.

I remember the launch of CD in Eindhoven and the overselling by salesmen who hadn't the faintest idea how it worked. For those of us who knew what CD could and could not do it was all rather embarrassing. It was several years before it became widely known that many early CDs sounded pretty awful because of the mediocre converters used to master them and the general ignorance about subjects such as dither and recording levels in PCM. The other consequence of the introduction of CD was that it allowed transparent delivery into the home of the hums, buzzes and distortions which many studios added and which were inaudible on



CD is now over 12 years old and the technology it is based on is even older. Here John Watkinson looks at the physics which determined the shape of the original CD and speculates what could be done with the technology of today or tomorrow

vinyl. The resultant scurry to fix things did the consumer a service and the sound quality of the average studio went up noticeably.

CD is based on optical-storage technology which was patented by Philips as far back as 1972. At the time everybody and his dog were trying to design a video-disc which could be produced as cheaply as a gramophone record so that TV programmes could be sold in the mass market. Most attempts failed because of the complexity of the resultant discs. In contrast, Philips invented a disc which was simplicity itself. Instead of trying to make disks in which the light beam was modulated by variations in opacity or density, the Philips disc was uniformly reflective. It modulated the read-out beam by a method known as phase contrast in which light reflected from pits or bumps in the disc interferes with light reflected from the body surface. Such a disc could be replicated by stamping just as its vinyl predecessor was.

The first product based on this technology was LaserVision, an analogue video disc of remarkable picture quality. LaserVision was not a runaway success, not because of its picture quality, but because it could not record. People wanted a machine which could time shift broadcast television as well as play prerecorded material.

It was not long before the optical carrier of LaserVision was combined with digital audio to produce the Compact Disc as we know it today.

CD has been a great success and has effectively obsoleted the vinyl disc. Although the sound quality of CD is extremely good, its success must also be due to its rapid access and ease of handling although the

jewel box designed to store the CD is an abomination.

From the original Compact Disc there have been a number of spin-offs. CD-ROM was one of the first and has had a long gestation period before finally taking off relatively recently. The latest is video CD in which a heavily compressed television signal and accompanying sound is carried within the standard CD bit rate on a disc which plays for the same time as an audio CD. From a duplication standpoint video CD is identical to an audio CD, differing only in the processor needed to produce the master tape.

Video CD uses the MPEG-1 compression technique which is an internationally standardised way of getting moving pictures into the bare-minimum bit rate. All compression systems work by removing redundancy or predictable elements in images and then by exploiting similarities between successive images so that only the differences need be sent. In systems which remove only the redundancy the effect of the compression process is virtually undetectable. However, the bit rate allowed in Video CD is not sufficient to allow only the redundancy to be removed. The compression factor is almost 200 to 1 and this can only be achieved by throwing out a good deal of information as well as redundancy. The first stage of information rejection is to neglect every other line in the picture and to filter the remaining lines to half their original resolution. This results in one quarter as much information before compression begins. The result of this prefiltering is a soft picture which is noticeably *steppy* on nearly horizontal lines. The Discrete-cosine-transform-▶

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D-40880 Ratingen / Germany
Phone (0 21 02) 902905
Fax (0 21 02) 90 23 11

 **RMV RHEINMETALL MACHINE VISION**

COMPACT DISC

based compression system converts the image into spatial frequencies and then describes the coefficients using fewer bits by increasing the size of the steps. The excessive compression used means that this only works properly on simple subjects such as cartoons. On natural subjects, particularly those which combine motion and detail (for example trees) the artefacts are quite noticeable. Quality is substantially lower than that of the analogue LaserVision system whose only drawback is the large size of the discs. It seems strange when television is moving in the direction of enhanced picture quality to launch a system such as Video CD in which the quality is so poor.

The playing time of a CD is determined by the spot size of the replay laser. If details of the track are too short, they get lost within the spot and the player cannot resolve them. If the tracks are too close together the spot illuminates more than one at a time and crosstalk results. The spot size is a function of the wavelength of the laser and the aperture of the objective lens. When the CD was designed, the spot size was that which resulted from selecting a laser which could be mass produced cheaply and selecting an aperture which would allow a reasonable depth of focus.

In the intervening decade, progress has been made with lasers and shorter wavelengths are becoming available at reasonable cost. By

tightening up the focus servo, a smaller depth of focus can be handled. This allows a larger lens aperture. In conjunction with a short wavelength blue laser the spot size can be made less than half the size of that in a standard CD. As the smaller spot allows details along the track to be smaller as well as the track spacing to be reduced, the storage capacity would go up by a factor of about six.

Mastering would be little different except for tighter tolerances and thinner resist coating to allow destructive interference at a shorter wavelength. Duplication would also not present any great challenge except for avoidance of contamination and so there is no real obstacle to making such discs in the near future.

Clearly the resulting disc is not a CD as it does not adhere to the *Red Book* and the chances of a normal player being able to read it are virtually nil. We might call it a high density CD, or HDCD for short. In fact this incompatibility with CD may not matter. The *Red Book* CD is fine as it is and does a good job. Everyone is happy with the sound quality and the playing time is more than adequate as very few CDs are made with the maximum duration exploited. The apathy with which the public has treated the MiniDisc shows that as far as they are concerned the CD is what they want. Thus there is no point in making a CD which plays for seven hours or one which is much smaller. Thus

the future of the audio Compact Disc is secure for some time yet.

In my view the application for the HDCD is in video duplication. With six times the bit rate of a CD the compression artefacts of Video CD could be largely avoided and a compact replacement for the analogue video disc would be available with picture quality suitable for the growing home theatre market. The next generation home video-cassette recorder will be digital and will use compression. It would be relatively easy to incorporate a HDCD player in a digital VCR using the same replay decompression circuits. ■

John Watkinson

JOHN WATKINSON is an independent consultant in digital audio, video and data technology and is the author of seven books on the subject, including the definitive *The Art of Digital Audio*, acclaimed as the definitive work on the subject. He is a Fellow of the Audio Engineering Society and is listed in *Who's Who in the World*. He regularly presents papers at conventions of learned societies, and has presented training courses for studios, broadcasters and facilities around the world and is currently writing a book on audio and video compression. ■

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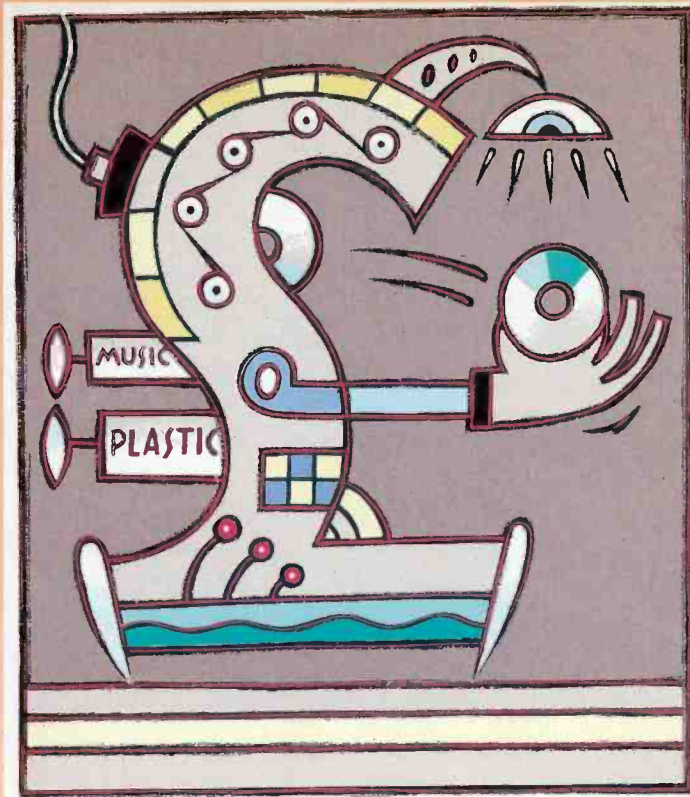
After a relative hiatus as the occasional single voice, accusations of declining quality in recorded media for sale to the music consumer are being heard again. The end of the 1970s and the beginning of the 1980s were a difficult time for our industry, as we killed off the Long Playing record—supposedly over the issues of audible and physical quality. The reality of today's record buyer can be best summed up by a recent study that identified 78% of the consumers sampled as being willing to or actually having returned a record for quality concerns at some time during the last 24 months. The returns were due to scratched or otherwise acoustically flawed recordings, recordings made from flawed tapes on A&R office shelves rather than from master tapes, CDs housed in cardboard sleeves, physically damaged CDs and so on...

Current complaints also centre on the use of inferior housings for CDs, resale of returned discs by retail stores, poor general quality of recorded cassettes, and the continued presence of discs and tape made from flawed masters.

The effort to further cost-reduce the recorded media manufacturing process, either by management fiat or by low-bid on media manufacturing orders, is at the root of the increasing problem of CD defects. One must remember that the rationale for the adoption of the CD over the LP in the early 1980s was the guarantee of a virtual 'lock' on production quality for the finished product—if the Philips-Sony *Red Book* specifications were followed to the letter.

Just as important today is the reduction of QC checks on the just 'pressed' CD and on the completed CD product. QC adds time and money to the CD pressing process but CD pressing is a high-technology manufacturing process that benefits from scrupulous quality control. The audio cassette is a completely different case study—doomed by its mechanical design to suffer the 'slings and arrows' of audio-quality degradation unless all factors in the duplication process are of the highest quality.

Record company return policies have an inverse relationship to the commitment to product quality on the part of record retailers. It was assumed that the elimination of the CD 'long box' in the US would save record labels anywhere from 5c to half of a dollar on each CD sold in the US. It was felt within the industry that the savings would allow some easing to strict return policies; necessary due to the temptations available to the retailers who might opt for the shrink wrapping and the reselling of record returns in the conventional jewel box. The long box prevented that ploy in most cases since the customer would destroy the cardboard 'shroud' in unwrapping the record. In fact, some label return policies on defects have been 'adjusted' and others have remained draconian, at least as seen by some retailers. The end result is that shrink wrap machines are frequently busy in record



When the biz kills the LP, who keeps the CD alive?

merchant back rooms, with a consequent loss of faith from the consumer.

The bottom line here is that the relentless pursuit of increased profitability carries a high penalty. Clearly driven to improve overall bottom line at all costs and to supplement earnings and stock prices savaged by less successful divisions, record labels today are part of corporate empires in electronics and electronic entertainment. With sagging revenues, huge debt, motion picture losses and other financial vagaries, the record label is frequently looked upon as the successful medium. The pressure to recover pennies, nickels and dimes from the recorded media manufacturing process is one manifestation of this corporate attitude. So are stringent return policies that penalise the honest record retailers who try to remove flawed recordings from the consumer marketplace. This is not to say that all labels are sacrificing quality in their record releases and return policies, but any transgression is seen by the public as all encompassing.

The emergence of the new technologies has further exacerbated the pressure on conventional music media to pay the bills for what are at best—at this point in time—experimental and not-yet-profitable forays into high technology retailing such as the CD-ROM.

Pressing plants may want to turn out the very best work, with quality control raised to the max. But low-bid work on record-label pressing contracts leave little room between economic survival and quality. As long as there are more CD pressing facilities and tape duplicators than jobs, the labels will continue to play 'both ends against their middle'.

Those who lament quality concerns past and present in the music and replicating business like to point out that consumers have much lower tolerance for flawed recordings than in the past. But many in label management acknowledge that from their perspective, physical ownership or if you prefer physical licensing of a performance, is but a

transitional step to downloading of music directly into the home. That would dispense with manufacturing, both internally and via contract, warehousing, distribution, shipping and all contacts with record retail.

Though most in the music business point out that this total reliance on so-called 'digital downloading' is unlikely to transpire in our lifetimes, the threat is very real.

Critics respond that a veritable plethora of research studies show that the retail sales of recorded music via record stores with a steady flow of advertising—co-op and otherwise—is necessary for the public to utilise other methods of direct musical delivery. They point to the motion picture industries' discovery that the public's perception of movies supplied on video cassettes for home VCRs, via pay-per-view and ordinary pay cable and so on, is totally dependent upon the public exposure and advertising attendant with exhibiting movies in 'old fashioned' theatres. Features that are

transferred directly to electronic distribution without public exposure via theatrical exhibition end up being nonevents.

That lesson is an important one for the record industry. It seems clear that all of the new technology distribution schemes need recorded music retail exposure to validate further successful distribution of record titles. And that means providing recorded musical performances of uniform and acceptably high quality. If quality concerns are allowed to muddy the waters of record retail and consumer confidence is allowed to descend to the level it reached at the beginning of the 1980s, the record industry may inadvertently kill the goose that will lay the golden egg.

Replicators, too, have to take some responsibility. Clearly the duplicating community is in the business for the 'long run', and is not interested in seeing the demise of recorded quality drive the industry into direct electronic digital distribution as a replay of the LP-CD changeover. Replicators have an incentive to stand up to customers who wish to cut costs so substantially that the finished product becomes a threat to future purchases by the consumer.

Unfortunately, even if the record labels, their pressing contractors and-or subsidiaries and the record retailers were to decide to maintain the highest level of product quality an quality control no matter the cost the damage is to some great extent already done. Consumers have already made a judgment as to record quality based on perceptive factors—some of which may be totally or partially out of control of the record business. It is not clear in a logical sense that all of the accusations are true for every record company or even for one record company all of the time. But whether these quality concerns are anecdotal, apocalyptic, apocryphal or allegorical; there is a buzz out there about the decline in quality of recorded musical media and that is what the record community has to stop. ■

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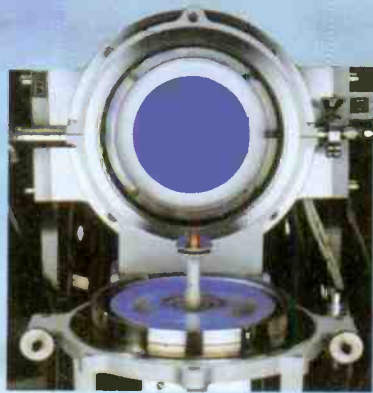
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