

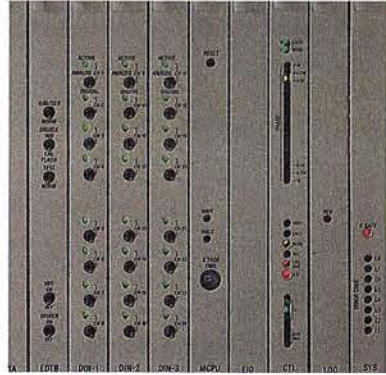
SONY®

Sony Digital Audio Multi-Channel Recording System

Tomorrow's
Technology
Today



Today's, Tomorrow's, Leading Multi-Channel Recording System



The Sony PCM-3324 stationary-head 24-channel digital audio recorder, when used with the optional RM-3310 synchronizer/auto locator/remote control, offers an ideal combination of digital performance and convenience, in addition to all the prime functions of analog recorders. Precise auto locate, punch in/out with electronic crossfade, cut-and-splice editing, synchronized operation to accommodate up to 72 channels, and ultrahigh fidelity.....All are yours with this compact, reliable recording system. The PCM-3324 also incorporates "DASH" (Digital Audio Stationary Head) Format* to offer compatibility regardless of brand.

So if you are for digital as the top-quality recording medium, you need wait no longer. The PCM-3324/RM-3310 system puts you immediately at the leading edge of audio recording—and keeps you stay there even in the years ahead.

*"DASH" (Digital Audio Stationary Head) Format has been established to solve the long-pending question of compatibility among stationary-head digital audio recorders. It has been agreed upon by Sony, Willi Studer AG., Matsushita Electric Industries and MCI, all in the forefront of digital audio technology. For details of this format, please refer to the last page.



PCM-3324 24-Channel Digital Audio Recorder

The Spotlight is on Both Performance and Convenience.



1. All the Superiority of Digital Recording

Ultrahigh Fidelity

The PCM-3324 brings a dramatic improvement to the quality of your master tape. It provides an exceptional 90dB-plus dynamic range. Distortion is a minuscule 0.05%. Frequency response is wide and flat, and wow and flutter are too low to be measured. In addition, incorporating "DASH" (Digital Audio Stationary Head) Format with its effective error correction system, the PCM-3324 can maintain this ultrahigh fidelity even under the most adverse operating conditions.



Editing and Dubbing with Zero Signal Degradation

With the PCM-3324, the full quality assured by these extraordinary specifications can be perfectly retained, however many second thoughts and reruns you may have

when recording and editing. The recorded tape can be duplicated any number of times, without suffering from generation loss, added noise and distortion until now unavoidable when copying in the analog domain. Each duplicate master remains exactly identical with the original.

High Density

Recording on 1/2" Tape
Based on the Fast Version "DASH" (Digital Audio Stationary Head) Format, the PCM-3324 not only proclaims unexcelled quality but also offers outstanding tape economy and handling ease. A standard half-inch tape is enough to record 24 channels. The tape runs at 30 ips (76.20cm/sec.) and gives one full hour of recording from a 14" reel (at 48kHz sampling frequency). The 24 digital tracks are located across the width of the tape, with two analog tracks on the outside plus control and external data tracks in the center. Complete with these option tracks, no digital track needs to be sacrificed for time coding to perform external synchronization.

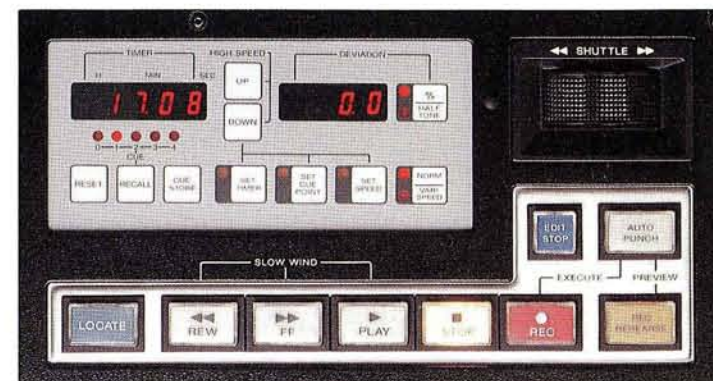
2. A New Level of Control Precision and Flexibility

Adoption of Sector Address

Using the sector address as the basis of all operations, the PCM-3324 offers the highest level of auto locate, punch in/out and synchronization accuracy ever achieved in the recording industry. The editing accuracy of this recorder is zero, and resolution is 1 sector*.

The adoption of the sector address also results in an extremely powerful error correction system. For formatting the control track with the sector address, the PCM-3324 features the Advance Rec Mode.

*1 sector = 1 msec. at fs = 48kHz

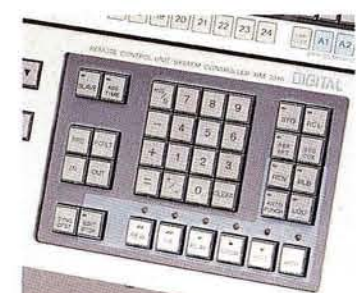


Comprehensive Auto Locate Function

Besides the shuttle dial for manual search in either tape direction, the PCM-3324 provides a convenient auto locate function. A maximum of 4 points on the tape can be memorized as cue points, to be located automatically at the touch of a button. In addition, pressing the LOCATE key in the play mode causes the recorder to start playing as soon as the specified cue point is reached. To perform the same in the other modes, the PLAY key must be pressed in addition to the LOCATE key. When modification of the

memorized cue point is necessary, there are the UP and DOWN keys for shifting it quickly on the tape.

Behind the exceptional locate accuracy of this recorder is an elaborate timer roller reading out the tape time in 1 sector units. With the RM-3310: Add the RM-3310 and you have a truly flexible, time-saving auto locate system. The cue points to be memorized are increased to 100.



The 10-key pad enables instant, direct cue point search and entry. And best of all, four additional automatic operations—return, repeat, roll back and roll back to play—become feasible for a total of six including auto locate and auto locate to play.

Punch In/Out with Crossfade

Punch in/out could hardly be simpler and more accurate, with convenient rehearsal. Unlike

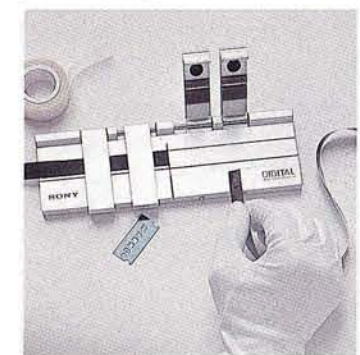
analog recorders, there's no need to deliberate on the exact timing, keeping the erase delay in mind. The punch in/out points are memorized in the PCM-3324 for automatic operation at exactly the same timing. They are also completely free of noise, with the electronic crossfade insuring smooth, natural continuation of sound. The crossfade time is variable in 16 steps. By virtue of digital operation, moreover, punch in/out with the PCM-3324 never introduces signal deterioration however many times it's repeated—even 100 times!

With the RM-3310: Modification of the punch in/out point can be achieved in 1 msec. steps on the RM-3310, allowing such a demanding operation as spot erase. If the RM-3310 is connected to an external computer via IEEE-488 bus, multi-point editing and sequential punch in/out become possible. Just as important, the crossfade time can be set individually for each channel.

Cut-and-Splice Editing

This feature means that tapes recorded on the PCM-3324 can be edited precisely in the same way as analog tapes. For the

extensive code errors generated when the tape is cut, the PCM-3324 automatically carries out the electronic correction and 5.20 msec. crossfade for a completely inaudible result—no noise, no interruption at all. The signals before and after the splice join as smoothly as if they are part of a single take.



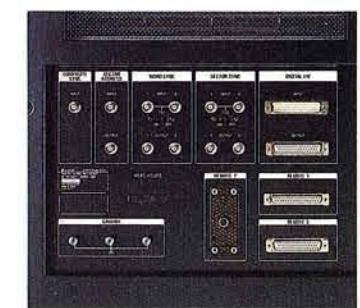
Synchronized Operation

With each PCM-3324 paired with the RM-3310 which is connected to each other through the IEEE-488 bus, two or three recorders can be operated in synchronization to accommodate 48 or up to 72 channels. The synchronization accuracy of this system is on the order of the internal reference clock and this means that there isn't even the slightest chance of phase difference between the master and slave recorders.

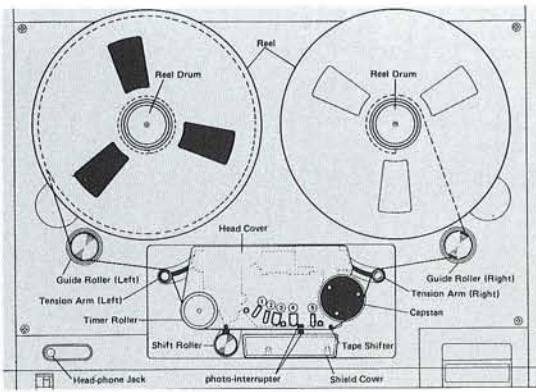
With the VCLK board that will be available as an option, the PCM-3324 can also be locked to external sync signals such as NTSC or CCIR (PAL/SECAM) composite video signals, frame sync from film equipment, and 50/60Hz power frequency—an exceptionally convenient feature for total audio/video studios.

Remote Interfacing

The rear panel of the PCM-3324 provides 3 types of remote I/O connectors. The REMOTE 1 connector accepts parallel bus for controlling the tape transport. REMOTE 2 also connects parallel bus for control of channels and transport functions as well as remote display of meters. REMOTE 3 allows the most



extensive data communication for regulating virtually every function of this recorder. For the present, the RM-3310 connects to REMOTE 3.



3. And That Proven Sony Mechanism

Precision Heavy-Duty Transport

Wow and flutter of a digital recorder are theoretically said to be zero, because they are determined by the extremely high accuracy of the internal reference clock. In actual application, however, the accuracy of the tape transport has not a negligible effect on the error rate and hence on the quality of the recorded sound. For this reason, the PCM-3324 incorporates a precision heavy-duty transport built with Sony's vast reservoir of knowhow.

Variations in the tape tension is detected by a potentiometer of a tension arm, one each located on both sides of the head assembly, and fed back to the reel motor to control its rotation.

With this elaborate servo system, the tape tension is kept uniform at 200g on the take-up side, with a consistent back tension of 130g in the play mode.

This means wow and flutter are totally dependent on the rotational precision of the capstan, for which an oversize Sony original BSL motor is employed. This motor has no brushes, no slots, and cogging is just impossible. It also engages a quartz-locked FG for precise velocity and phase control. As a result, mechanical wow and flutter of the PCM-3324 is as low as 0.03% (weighted, at 30 ips), which can be easily reduced to zero by being passed through a memory. The tape transport of this recorder also handles the tape very gently and allows fool-proof operation.



(BSL Capstan Motor)

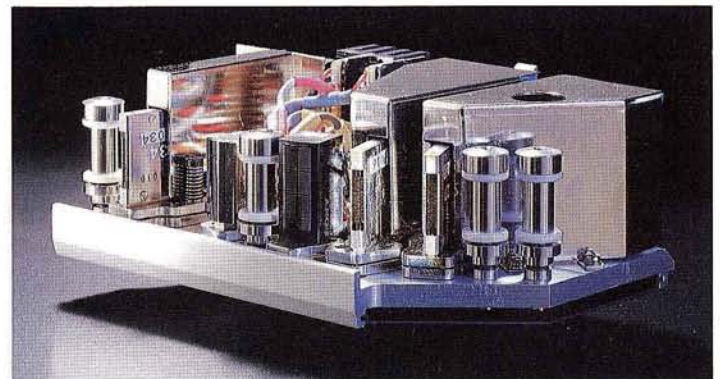


(Reel Motor)

Exquisite Multi-Head Assembly

The newly developed multi-head assembly of the PCM-3324 is a kind of masterpiece. Reflecting the latest in Sony's video head technology, it enables extremely

high density recording, yields remarkable efficiency for perfect signal detection, and minimizes crosstalk to the vanishing point. Extremely durable, it also ensures extended life and consistent high performance throughout the lifetime.



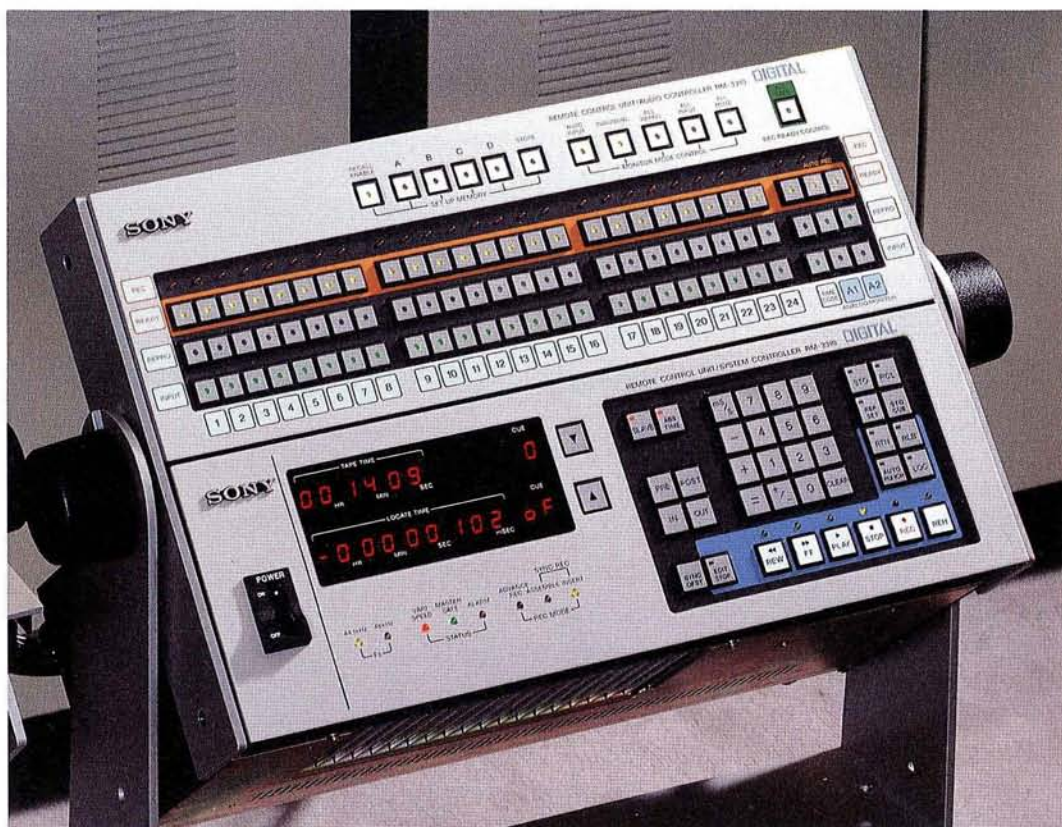
RM-3310

Synchronizer/Auto Locator/Remote Controller

With the RM-3310, the PCM-3324's upward flexibility comes into play, with the extra useful feature of synchronized operation of up to 3 recorders. Consisting of compact, separately built audio and system control units, the RM-3310 can also be used anywhere it's convenient in your studio. All controls are arranged in function groups and work with laboratory precision to give unprecedented control over the creative recording process.

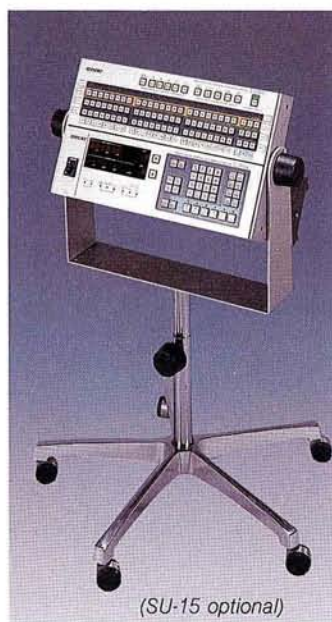
Features

- Single cable connection to the PCM-3324.
- Consists of a compact system control unit and a separate keyboard for audio control; can be placed on a desk, mounted on the SU-15 stand, or installed in a 19" standard rack.
- Makes it possible to operate up to three PCM-3324 recorders in perfect synchronization. Offset time between the master and slave recorders will be automatically detected for one-touch adjustment.
- Selectable cue memory points (max. 10 or 100).
- 10-key pad for time data and cue number entries. Arithmetical keys (+, -, and =) are also provided for quickly shifting the tape time or calculating the time interval between 2 points on the tape.
- Instant and precise auto locate functions. The point to be located can be instructed either by tape time or cue number, while the recorder can be commanded to stop or start playing at the point located.
- Return, roll back, roll back to play, and repeat operations can be programmed for a total of six automatic operations including



auto locate and auto locate to play.

- Spot erase and auto punch in/out



at exactly the right timing and with electronic crossfade; rehearsal function is also provided.

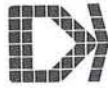
- Setup memory and keys for registering the channel setups of the recorder for convenient one-touch recall (max. 4)
- Complete master control—Rec ready control disable and 5-mode monitoring facility (AUTO INPUT, INDIVIDUAL, ALL REPRO, ALL

INPUT, and ALL MUTE).

- Digital readouts of absolute or relative tape time and locate time. The locate time display is switchable between sec. and msec. indications. It also shows various other time information such as pre-roll time, post-roll time, and sync offset time.
- LED indicators for the recorder's sampling frequency, operation status, and recording mode.

Specifications

Control capability:	One PCM-3324 unit with 24 digital channels, 2 analog channels and 1 time code channel
Cue memory:	100 points max., 10 or 100 points switchable
Setup memory:	24-channel digital x 4 sides
In/out point memory:	1 point each
Pre-roll/post-roll duration:	0 to 1 hour
Repeat operation:	Between any 2 cue memory points
Synchronized operation:	Up to three PCM-3324 recorders, using matching RM-3310 for each
Synchronization accuracy:	0
Synchronization resolution:	1 sector (1.00 msec. at $f_s = 48\text{kHz}$ or



"DASH" (Digital Audio Stationary Head) Format

- Editing accuracy: 1.088 msec. at $f_s = 44.1\text{kHz}$
- Editing resolution: 0
- Tape time display: 1 sector (1.00 msec. at $f_s = 48\text{kHz}$ or 1.088 msec. at $f_s = 44.1\text{kHz}$)
ABSOLUTE
0 to 74 hr. 33 min. 55 sec. ($f_s = 48\text{kHz}$)
0 to 81 hr. 09 min. 34 sec. ($f_s = 44.1\text{kHz}$)
RELATIVE
 ± 9 hr. 59 min. 59 sec.
- Locate time display: ABSOLUTE
0 to 74 hr. 33 min. 55 sec. (455 msec.) at $f_s = 48\text{kHz}$
0 to 81 hr. 09 min. 34 sec. (645 msec.) at $f_s = 44.1\text{kHz}$
RELATIVE
 ± 9 hr. 59 min. 59 sec. (999 msec.)
NOTE: Sec. or msec. indication selectable with a switch for locate time.
- Cue number display: 0—99
- Indication of PCM-3324's operation status: Status: VARI SPEED, MASTER SAFE, and ALARM
Record mode: ADVANCE, ASSEMBLE and INSERT
Sampling frequency: 48kHz or 44.1kHz
REC/REC READY, SAFE, REPRO, INPUT, AUTO INPUT, ALL MUTE, ALL REPRO, DISABLE, ALL INPUT and SETUP MEMORY
Format: Byte serial/bidirectional data
Electrical spec: RS-422
Data rate: 250k byte/sec.
Connector: D-sub 50-pin
- Channel mode indicators: Format: Asynchronous parallel transmission
Electrical spec: RS-422, TTL level
Connector: D-sub 50-pin
- SRIF 3 interface: IEEE 488 Standard
AC100—120, 220—240V, 50/60Hz 42W
- Interface between system control and audio control units: System control unit
424 (W) \times 152 (H) \times 260 (D)mm
(16 $\frac{3}{4}$ \times 6 \times 10 $\frac{1}{4}$ ")
Audio control unit
424 (W) \times 132 (H) \times 51 (D)mm
(16 $\frac{3}{4}$ \times 5 $\frac{1}{4}$ \times 2 $\frac{1}{8}$ ")
including projected parts and controls
- GPIB interface: System control unit
7.5kg (16 lb 9 oz)
Audio control unit
2.5kg (5 lb 8 oz)
- Power requirements: AC power cord
- Power consumption: Remote cable (10m, for connection to PCM-3324)
- Dimensions: Unit cable (1m, for connection between system control and audio control units)
- Weight: SMK-0032 IEEE 488 interface cable
SU-15 stand
AH-3U rack mount adaptor
- Supplied accessories:
- Optional accessories:

"DASH" (Digital Audio Stationary Head) Format specifies the sampling frequency, tape format, linear packing density, and error correction for 2-channel to 48-channel recorders using either 1/4" or 1/2" tapes.

Tape Speed and Sampling Frequency

Sampling Frequency	Tape Speed		
	Fast	Medium	Slow
48kHz	76.20cm/s (30 ips)	38.10cm/s (15 ips)	19.05cm/s (7.5 ips)
44.1kHz	70.01cm/s (27.56 ips)	35.00cm/s (13.78 ips)	17.50cm/s (6.89 ips)

The sampling frequency is switchable between 48kHz and 44.1kHz. As to the tape speed, Fast, Medium and Slow versions have been determined to offer three different recording times using the same tape. The number of tracks used for recording one channel is one for the Fast version, two for the Medium, and four for the Slow.

Track Density and Channel Numbers

Tape Width	1/4"		1/2"	
	Normal	Double	Normal	Double
Track Density	8	16	24	48
Digital Tracks	4	4	4	4
Aux. Tracks	8	16	24	48
Digital Audio Channels	Fast	—	8	—
	Medium	—	—	24
	Slow	2	4	—

Optional Accessories

Master Tapes

- D-1/2-2920 (14")
Recording time: 60 minutes ($f_s = 48\text{kHz}$), 65 minutes ($f_s = 44.1\text{kHz}$)
- D-1/2-1460 (10")
Recording time: 30 minutes ($f_s = 48\text{kHz}$), 32minutes ($f_s = 44.1\text{kHz}$)

Tape Splicer

- CY-24
Easy-to-use splicer for 1/2" and 1/4" digital tapes.

The increased linear packing density applies to all these versions. The newly developed "HDM-1" modulation code allows recording of 1.51k bits/mm (38.4k bits/inch), with the minimum wavelength to be recorded 50% longer than conventional codes such as "MFM".

The error correction system is the CIC (Cross Interleave Code), with increased interleaving done between even- and odd-numbered words. This results in remarkably improved correction capability which, in turn, protects against such serious errors as those caused in cut-and-splice editing. In addition, encoding and decoding of the error correction code is done independently for each track. Even if one of the track is seriously damaged, therefore, the correction capability of the other track will not be affected, safeguarding the recording in operation under adverse conditions.

All in all, "DASH" (Digital Audio Stationary Head) Format insures outstanding production efficiency and reliability—plus the extra important benefit of compatibility regardless of brand. It is destined to become a worldwide standard for digital stationary-head recorders.

Empty Reels

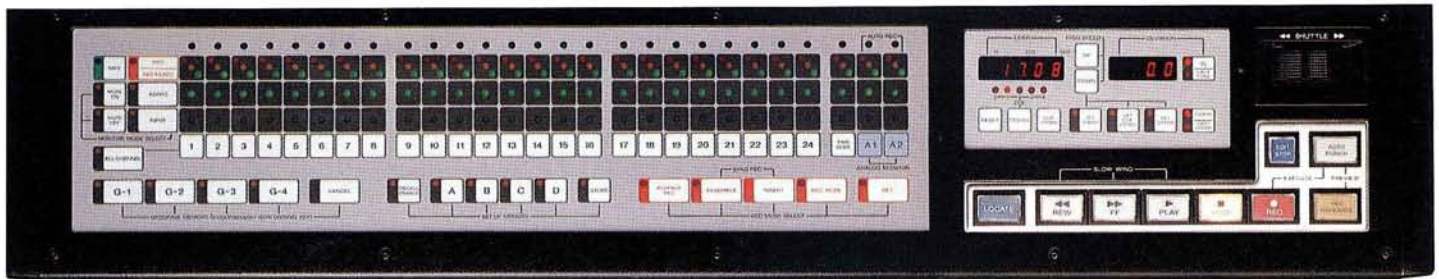
- RH-14DA (14")/RH-10DA (10")

Stand

- SU-15
Compact stand with adjustable height and angle. For use with the RM-3310.

Rack Mount Adaptor

- AH-3U
For mounting the RM-3310 in a 19" standard rack. Height: 3U.



Features

- 24-channel digital audio recorder complying with "DASH" (Digital Audio Stationary Head) Format.
- One full hour of high fidelity recording with 1/2" wide, 14" reel tape.
- Switchable 48kHz and 44.1kHz sampling frequencies.
- Bi-directional manual search to any desired point on the tape using shuttle dial.
- Auto locate of any cue point.
- Electronic punch in/out with crossfade variable in 16 steps. Splice editing also possible.
- Four memories each for cue points, channel setups, and channel groups.
- Precision-engineered heads for exceptional durability, recording density and accuracy.
- Tension servo controlled heavy-duty tape transport with BSL capstan motor.
- Variable pitch control ($\pm 12.5\%$) and half-tone adjustment.
- External synchronization and external servo control possible.
- 16-segment LED peak level meter for each channel.



Specifications

Recording format:	Fast version "DASH" (Digital Audio Stationary Head)
Channel coding:	HDM-1 (High Density Modulation)
Error correction:	CRCC (Cyclic Redundancy Check Code) and CIC (Cross Interleave Code)
Number of tracks:	28 tracks (24 PCM tracks, control track, external data track and 2 analog tracks)
Tape speed:	76.20 cm/sec. (at $f_s = 48\text{kHz}$) or 70.01 cm/sec. (at $f_s = 44.1\text{kHz}$), $\pm 12.5\%$ adjustable
Recording time:	60 minutes (14" reel at $f_s = 48\text{kHz}$) 65 minutes (14" reel at $f_s = 44.1\text{kHz}$)
Rewind and fast forward time:	4 min. 40 sec. (with 14" reel)
Tape:	D-1/2-2920 (14") D-1/2-1460 (10")
Sampling rate:	48kHz and 44.1kHz (switchable)
Quantization:	16-bit linear/channel
Dynamic range:	More than 90dB (emphasis ON at 1kHz)
Frequency response:	20Hz to 20kHz $\pm 0.5\text{dB}$
Total harmonic distortion:	Less than 0.05%
Wow and flutter:	Below measurable limit
Inter-channel crosstalk:	More than 80dB (20Hz—20kHz)
Synchronization accuracy:	0
Editing accuracy:	0
Editing resolution:	1 sector (1.00 msec. at $f_s = 48\text{kHz}$, 1.088 msec. at $f_s = 44.1\text{kHz}$)
Editing:	Sync recording, punch in/out, and splice

Crossfade:

editing (Crossfade is available at every editing point)

1.33 msec. to 0.341 sec. ($f_s = 48\text{kHz}$) or 1.45 msec. to 0.375 sec. ($f_s = 44.1\text{kHz}$) for electronic editing

(variable in 16 steps)

5.20 msec. ($f_s = 48\text{kHz}$) or 5.66 msec. ($f_s = 44.1\text{kHz}$) for splice editing

ON/OFF switchable for each channel

Emphasis:

Inputs/ outputs:

DIGITAL AUDIO IN ($\times 24$)

+ 4dBm (+ 24dBm max.), 10k ohms, balanced, XLR-3-31

DIGITAL AUDIO OUT ($\times 24$)

+ 4dBm (+ 24dBm max.) at 600-ohm load, balanced, XLR-3-32

ANALOG AUDIO IN ($\times 2$)

+ 4dBm (+ 12dBm max.), 10k ohms, balanced, XLR-3-31

ANALOG AUDIO OUT ($\times 2$)

+ 4dBm (+ 12dBm max.) at 600-ohm load, XLR-3-32

DIGITAL I/O

Serial format, 1.53M bits/sec. ($f_s = 48\text{kHz}$)

or 1.41M bits/sec. ($f_s = 44.1\text{kHz}$), RS-422,

balanced, D-sub 50P and D-sub 50S

WORD SYNC IN ($\times 2$)

TTL level, 75 ohms, unbalanced, BNC

WORD SYNC OUT ($\times 2$)

TTL level, 75 ohms, BNC

SECTOR SYNC IN ($\times 2$)

TTL level, 75 ohms, unbalanced, BNC

SECTOR SYNC OUT ($\times 2$)

TTL level, 75 ohms, BNC

COMPOSITE SYNC IN ($\times 1$)

1Vp-p, 75 ohms, unbalanced, BNC

REMOTE 1 IN ($\times 1$)

SRIF-1 format, TTL level, 200 ohms, balanced, D-sub 37P

REMOTE 2 IN ($\times 1$)

SRIF-2 format, RS-422, AMP 104P

REMOTE 3 IN ($\times 1$)

SRIF-3 format, RS-422, D-sub 50P

TIME CODE IN ($\times 1$)

0.5—10Vp-p, 10k ohms, balanced, XLR-3-31

TIME CODE OUT ($\times 1$)

+ 0.8dBm at 600-ohm load, balanced, XLR-3-32

SECTOR ADDRESS I/O ($\times 2$)

TTL level, 75 ohms, BNC

EXT. SPEED CONTROL IN ($\times 1$)

$\pm 10\text{V}$, 10k ohms, balanced, XLR-3-31

EXT. PHASE CONTROL IN ($\times 1$)

$\pm 10\text{V}$, 10k ohms, balanced, XLR-3-31

Power requirements:

Power consumption:

Dimensions:

Weight:

AC100—120V or 220—240V, 50/60Hz

1.8kW

830 (W) \times 1,002 (H) \times 740 (D)mm

(32 $\frac{3}{4}$ \times 39 $\frac{1}{2}$ \times 29 $\frac{1}{4}$ ")

Approx. 220kg (435 lb 10 oz)



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