

NTSC

*Digital* **BETACAM**™

# DVW-500

Component Digital VTR



The development of the Betacam® format in 1982 made possible the introduction of compact camcorders which had a revolutionary effect on ENG operations. In 1987, Betacam SP® was introduced. Based on metal particle tape, its improved picture quality extended the use of the format to post production and transmission applications. With their outstanding performance, production flexibility and reliability, Betacam VTRs soon established the format as a de facto standard throughout the broadcast industry.

Sony was also beginning a major research and development program into digital video technology, a program which led to the introduction of the world's first D-1 component digital VTR and more recently to a wide range of CCIR 601 based products, with Serial Digital Interface (SDI), for emerging full component digital operations.

To provide a smooth transition from existing analog operations to those based on this digital technology, Sony has now developed the DVW-500, one of a range of Digital BETACAM™ component digital VTRs. They inherit the Betacam concept of an affordable workhorse format but add many new advantages made possible by the introduction of innovative technologies.

The DVW-500 provides the superb picture quality and multi-generation performance of component digital recording in a compact VTR with cassette tapes which are the same size as those of analog Betacam machines.

With outstanding performance and a whole range of new functions, the DVW-500 offers real advantages to satisfy the future needs of the television industry and other users.



# Features

## Excellent Picture and Sound Quality

### Superb Picture Quality

The DVW-500 uses component digital recording which provides superb picture quality and multi-generation capability to overcome the limitations of analog recording. This technique provides much greater operational flexibility, for example by minimizing dubbing limitations to allow more efficient and complex multi-layering and editing.

Because it meets the CCIR 601 standard, the DVW-500 is also suitable for emerging 16:9 wide-screen operations.

The development of a very efficient data handling system has made it possible to record these component digital signals within a Betacam size VTR and tape cassette.

### High Quality Digital Audio

The DVW-500 provides four, independently editable, 20-bit digital audio signal channels. To ensure a wide dynamic range for analog audio signals, super linear A/D and D/A converters are used in the DVW-500 to achieve the required high resolution.

### Long Recording Time

To gain maximum performance from high density digital recording, new metal particle cassette tapes have been developed exclusively for Digital BETACAM VTRs. To cover different applications, both large and small size cassettes are available and these have the same dimensions as current Betacam cassettes.

The use of this highly efficient data handling regime achieves a longer recording time than that of the current Betacam format. A large cassette provides a maximum recording time of 124 minutes and a small cassette up to 40 minutes.

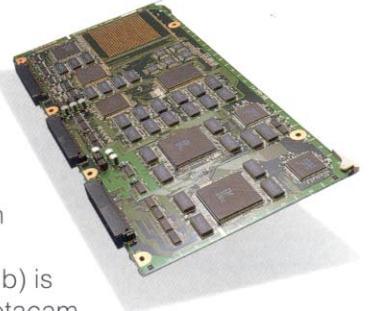


## Versatility for Current System Environments

### Compact and Lightweight

With the development of an efficient data handling system and application-specific LSIs for signal processing and system control, the DVW-500 is compact and lightweight.

It has the same dimensions as current Betacam SP studio models, so it can replace them without any modification to existing system configurations. In addition, its weight of approximately 33 kg (73 lb) is comparable to current Betacam SP studio VTRs. The use of LSIs also contributes to a low power consumption of 220W. This compact, light weight and low power consuming unit is highly practical, particularly in a limited space environment such as inside an OB van.



### Versatile Integration into Current Analog Systems

The DVW-500 has been specifically designed for easy integration into existing analog systems. Built-in A/D and D/A converters for both audio and video

signals allow direct interfacing with analog equipment. In addition to standard analog component interfaces, an optional composite input board BKDW-505 can be installed to provide a direct link with existing NTSC systems. Physical



dimensions that are identical to

BVC-400A those of Betacam SP VTRs and cassettes also mean that Sony Library Management System™ (LMS) and Flexicart® multicassette systems can be easily upgraded to digital operation—and the DVW-CA510 player has been introduced specifically for Sony Betacam® systems.



DVW-CA510

## Serial Digital Interface

The DVW-500 is equipped with SDI (Serial Digital Interface) which conforms to the SMPTE259M. A 4:2:2 component digital video signal, together with four digital audio channels and time code are carried via a single coaxial cable, allowing simple connection with other SDI equipped devices—including Sony DVS Series switchers. Furthermore, SDI also gives the benefit of long distance transmission—at least 200 meters without any extra hardware.

## Comprehensive Editing Features

### Digital Jog Sound

Complete reproduction of four channels of digital audio is achieved within the range of -1 to +1 times normal playback speed, even in the Jog mode. This feature is helpful in quickly and precisely establishing an editing point while monitoring the digital audio signals, which remain in absolute sync with the pictures.

## High Speed Picture Search

Recognizable color pictures are provided in shuttle mode at speeds up to approx.  $\pm 50$  times normal playback. In addition, recognizable digital audio playback is also provided up to approx.  $\pm 24$  times normal playback speed.

These capabilities allow the desired picture to be rapidly located.

## Two-way Dial Operation

The DVW-500 features two alternative ways of selecting the Jog and Shuttle modes. For users familiar with current Betacam VTR operation, pressing the search dial switches between these two modes. Additionally, Jog, Shuttle and VAR buttons are located just above the search dial, so that the operator also has push-button mode selection in the same manner as Sony BVH Series 1-inch VTRs and D-1/D-2 DVR Series VTRs.

## Dynamic Tracking™ Playback

A DT playback capability provides broadcast quality pictures over the range of -1 to +3 times normal playback speed.



DVW-500

## **Program Play**

The DVW-500 has a Program Play mode which allows video recordings to be reproduced over a range of  $\pm 15\%$  normal speed, in increments of 0.1%.

With the BKDW-507 optional Audio Program Play board installed, the four digital audio signals can also be compressed or extended (with correct pitch) along with the video signal. This useful feature allows the duration of a program to be extended or shortened so that it will fit into an allocated time period.

## **Read before Write; Preread Editing Capability**

In the DVW-500, DT playback heads are located ahead of the record heads on the scanner. Previously recorded video and audio signals are read by these DT heads and can be processed by external equipment and recorded back onto the same track. This capability is ideal for titling, color correction and layering for video, and mixing or sweetening for audio.

## **Digital Audio Crossfade**

The DVW-500 is equipped with a Digital Audio Crossfade system which achieves smooth audio transitions during audio insert editing. Previously recorded audio signals are read by advance DT heads and then re-recorded onto the same track after being mixed with input audio signal. The crossfade duration can be selected from a range of values.

## **Built-in Editor**

A built-in editor allows simple editing by controlling a playback feeder VTR through a Sony 9-pin remote interface. In addition to insert and assemble edit functions, an audio split editing capability is also supported with independent IN and OUT memories. When a DT equipped VTR is used, the DVW-500 also provides a DMC (Dynamic Motion Control) editing function, memorizing the tape speed trajectory of the feeder over the DT speed range (-1 to +3 times normal speed).

## **Adjustment Free Operation**

### **Pilot Tone Tracking System**

In addition to conventional CTL based tracking, the DVW-500 has a newly developed auto tracking system which enhances trackability. Two pilot tracking signals are recorded within certain channels of the helical tracks and tracking is automatically adjusted by referring to the playback timing and RF level of these signals which are reproduced by the record heads. This system corrects longitudinal tracking errors during servo lock-up time and when an edit is executed it continues to operate during preroll to provide the degree of tracking accuracy required for editing.

An important advantage of this system is that, as with the CTL signal, these tracking signals are not erased with the flying erase heads during insert editing and it continues to operate until the complete edit is finished. This system ensures precise tracking for interchange editing without operational adjustment and improves editing efficiency.

### **Automatic Alignment Systems**

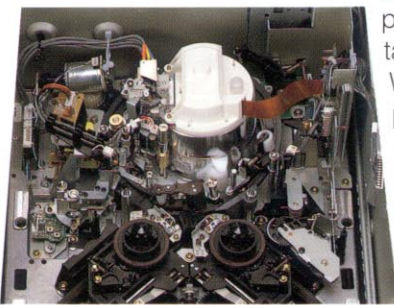
The DVW-500 is fitted with Automatic Alignment Systems to ensure the accurate recording and reproduction of digital data. This includes an Automatic Equalizer which optimizes the gain and phase of the off-tape RF signal. With a powerful error correction and concealment capability, this automatic equalizer provides accurate reproduction of video and audio data ensuring stable picture and sound quality. In addition to this auto RF equalizer, the alignment system also automatically optimizes the current in the record heads during periodic maintenance. It also adjusts the servo systems to optimize tape tension, capstan frequency and drum phase, and DT performance after parts in the tape transport have been replaced.

These automatic systems eliminate the need for time consuming manual equalizer and servo system adjustments, ensuring stable and consistently high recording and playback performance.

## Sophisticated Mechanical Design

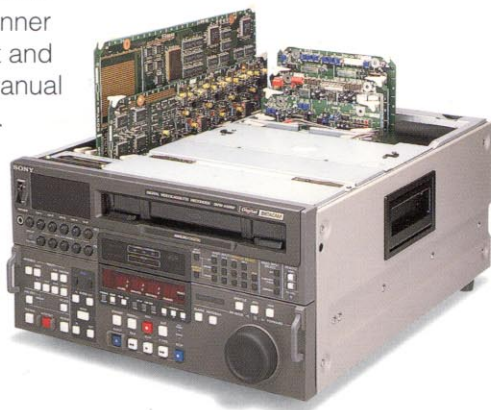
### Reliable Tape Transport

The tape transport mechanisms of the DVW-500 is designed for precision and robustness. It uses a mid rotary type scanner which is positioned between the upper and lower drums to obtain fine head-to-tape contact. Additionally, several dust-protection systems maintain the proper recording and reproduction of digital data. This includes head cleaners for both rotary and time code/cue audio heads, a tape cleaner and an enclosure to prevent air flow into the tape transport housing. With the use of powerful error correction and concealment systems, these dust-protection features maintain accurate data recording and playback.



### Easy Maintenance

A sophisticated diagnostic system advises of malfunctions within the VTR. When a fault occurs, an error message is provided on both the tape timer display and those video outputs which have a character superimposition facility. The precise location and nature of a fault can then be quickly determined before it becomes a major problem. In the DVW-500, most of the circuits are arranged on plug-in boards to allow quick and easy maintenance. Additionally, the drum assembly has been primarily designed to achieve easy, low cost maintenance and simplify both mechanical and electric alignment after scanner replacement. This helps to drastically reduce the time taken for periodic scanner replacement and minimizes manual adjustments.



## Easy Operation

### Channel Condition Monitoring

The DVW-500 has a three-color channel condition indicator, each color representing a particular error rate threshold level. Green indicates a good condition, yellow advises caution but operation can continue and red warns of a problem with either the tape or VTR. Details of the error rate of each channel can be observed through an RS-232C communication port, allowing the monitoring of multiple VTRs. For the simultaneous monitoring of recorded signals, the DVW-500 is fitted with confidence heads. These trace each recorded track immediately behind the one currently being recorded, providing reliable editing operations.

### Built-in Signal Generator

A built-in signal generator is included to help system set-up and maintenance. This internal generator provides 16 test signals, including color bars, ramp, multiburst, black burst, etc. Tone is also provided for audio line-up.

### Input Selection and Audio Monitoring

Input selection for both video and audio can be executed by simply pushing select buttons which are located on the upper control panel. The video record signal can be selected from either the serial digital or analog component inputs. An analog composite signal can also be selected if the optional input decoder board has been installed. A matrix of push buttons is assignable to the dual roles of audio record input selection and audio monitoring switching. In its input selection mode each of the four audio channels can be individually selected from their SDI, AES/EBU or analog inputs. When the matrix is assigned to its audio monitoring role, each of the four playback channels (and the cue channel) can be switched to either the left or right monitor outputs.

The audio level meters and the recording and playback level controls for the four digital audio channels and the cue channel are located on the upper control panel.

### Ease of Initial Set-up

Set-up parameters of the DVW-500 can be set in its menu-style operation using the search dial. While a simple, single line, menu is provided on the tape timer display, a descriptive, multi-line menu is also superimposed on one of the analog composite and one of the serial digital outputs. In order to be able to set up VTRs quickly, the DVW-500 is equipped with three user memories of set-up parameters. These memories are simply recalled with the set-up select switch and set-up parameters are instantly changed to the stored values. With the use of these set-up memories, a VTR can be immediately set up for a specific application.

# Versatile System Interface

## Digital I/O

### Serial digital video and audio

The DVW-500 is equipped with SDI (Serial Digital Interface) which conforms to the SMPTE259M. SDI carries one digital video signal, four digital audio channels and time code through a single coaxial cable.

### Serial digital audio

Digital audio input and output ports conform to AES/EBU format synchronized to video. The four channels of digital audio are coupled into pairs, CH1/CH2 and CH3/CH4.

## Analog I/O

I/O ports for analog component video, four channels of analog audio and cue audio, together with analog composite video output ports are built into the DVW-500. They allow direct installation of these VTRs into analog systems without extra A/D and D/A converters.

Additionally, with the BKDW-505 optional Decoder Board installed, an analog composite video signal can be directly input to the DVW-500. Front control panel buttons select any combination of the four audio channels or cue audio to the monitoring outputs.

## Remote

### RS-422A

The DVW-500 is equipped with RS-422A serial communication ports to interface with Sony VTRs and edit controllers.

### RS-232C

For communication with various equipment such as personal computers, an RS-232C serial communication port is incorporated. Various parameters can be set up and monitored through this port allowing comprehensive monitoring of the entire system.

### Parallel I/F

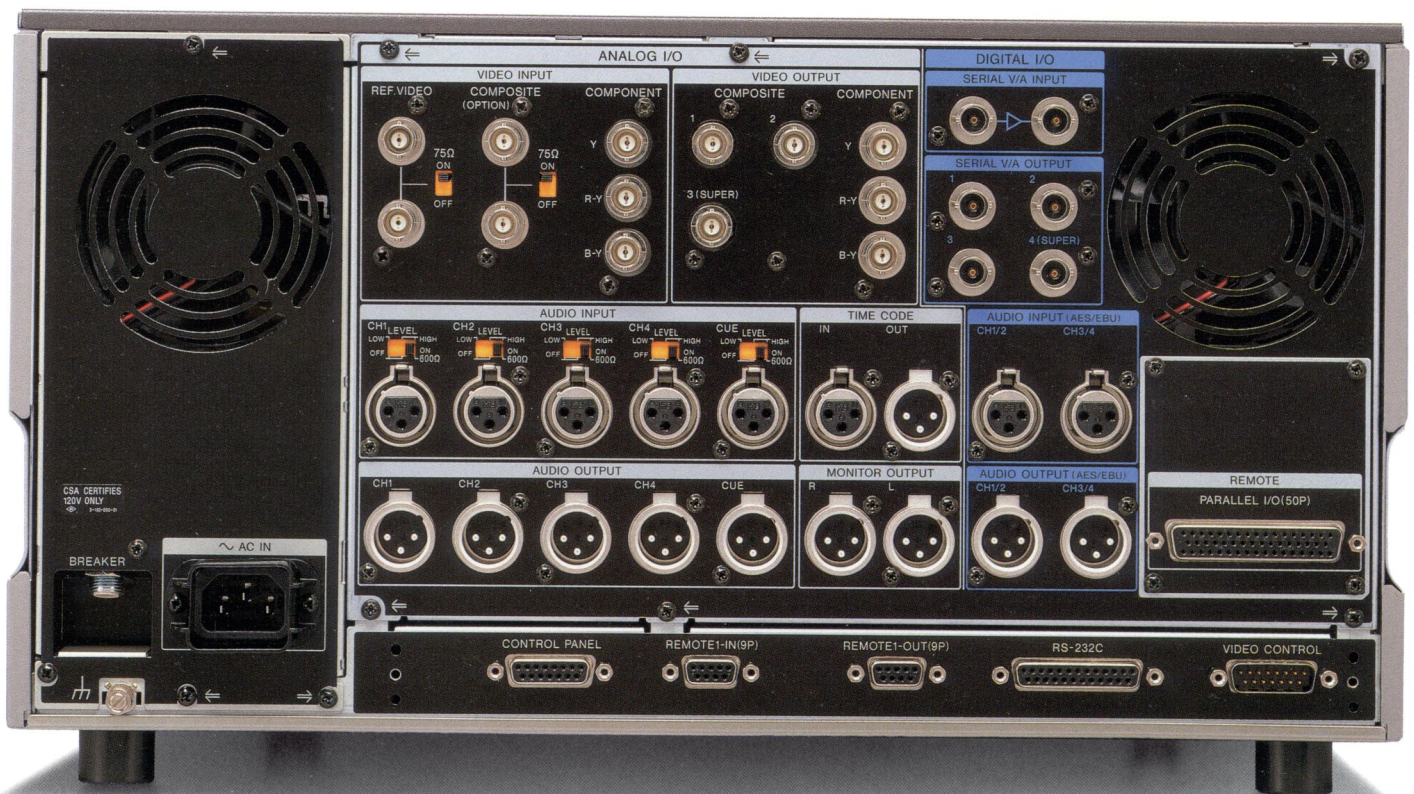
For customized applications, an optional BKDW-509 Parallel (50P) Interface Kit is available, which allows remote control of basic VTR functions through the 50-pin parallel communication port.

### Video control

The DVW-500 also has a 15-pin video control port through which the video processor can be adjusted from an optional BVR-50 Video Processor Controller.

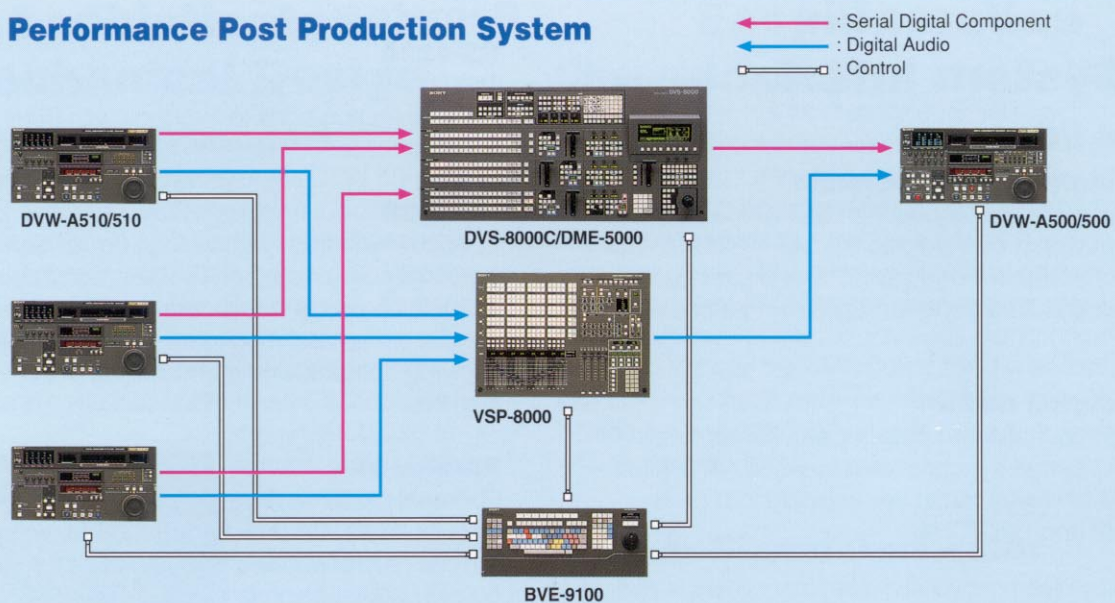
### Control panel

The control panel can be completely detached from the DVW-500 and remote operation can be extended up to 10m with an optional BKDW-510 Control Panel Extension Kit and BKDW-511 Control Panel Case.

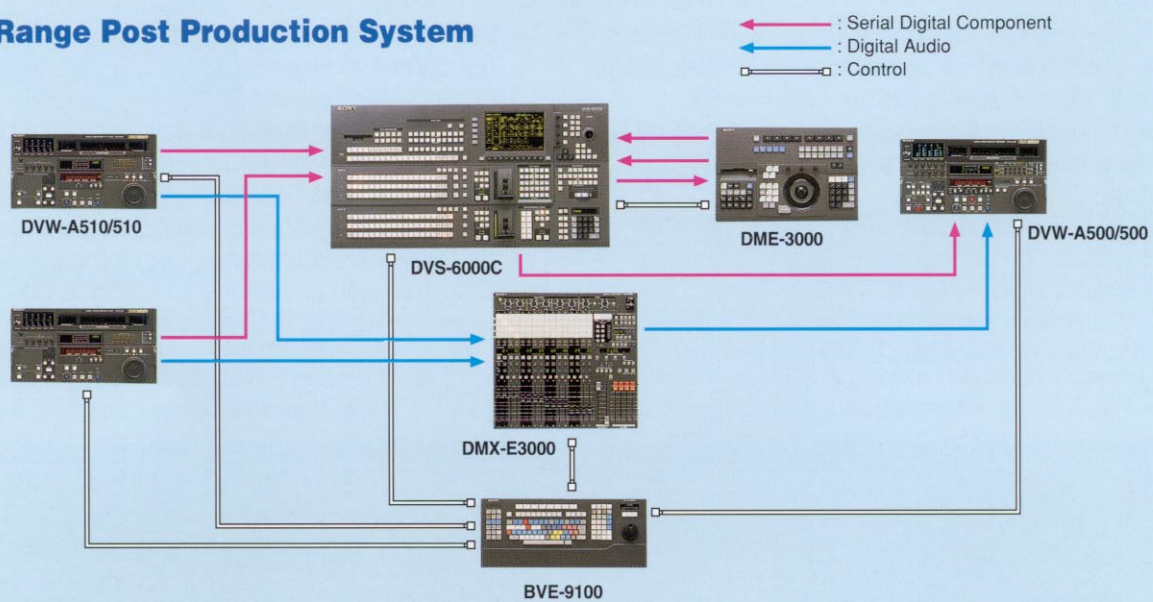


# System Configuration

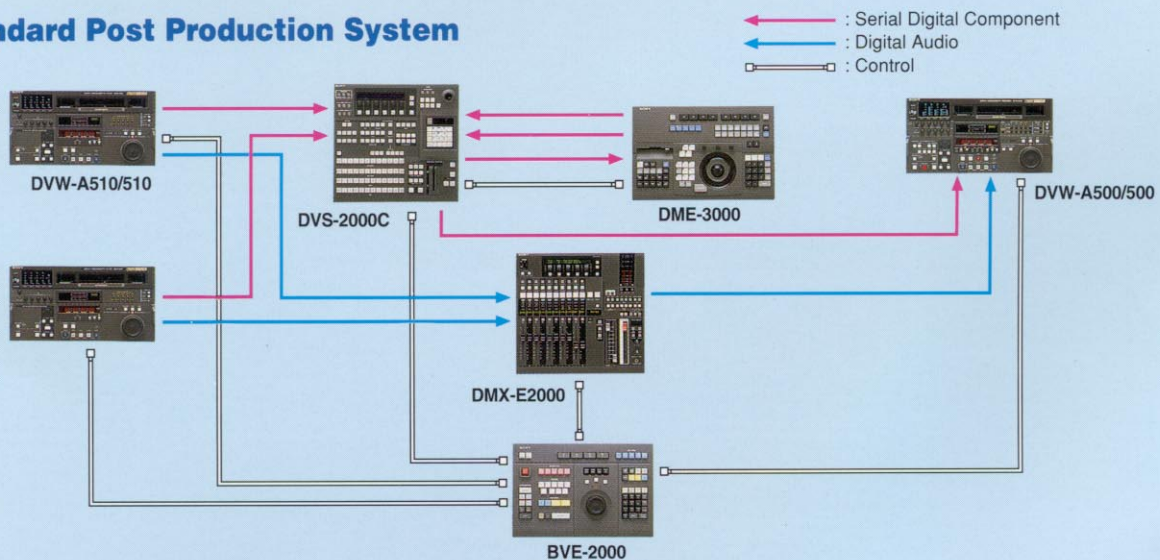
## High Performance Post Production System



## Mid-Range Post Production System



## Standard Post Production System





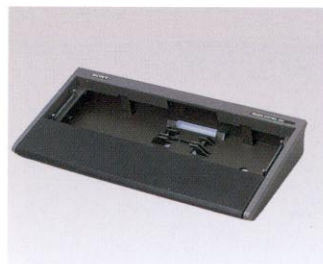
# Optional Accessories



Parallel (50P) Interface Kit  
**BKDW-509**



Control Panel Extension Kit  
**BKDW-510**



Control Panel Case  
**BKDW-511**



Video Processor Controller  
**BVR-50**



Digital Rate Converter  
**DFX-2101**



Digital Rate Converter  
**DFX-1201**



Digital Audio Delay Unit  
**DDU-2100**



Digital Color Corrector  
**BVX-D10**



Digital Video Interface Unit  
**PFV-D50/D100/D200**



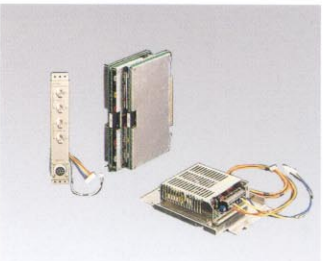
Audio Converter Unit  
**DAF-2000A**



Digital Audio Sampling Rate Converter  
**DFX-2400**



Dynamic Motion Controller  
**DTR-3000**



Digital 4:2:2 Input Kit  
**BKM-2085**  
(for BVM-1911/1912/1916/1311/1316 Series)



Digital Monitor Interface  
**DMIF-1000**  
(for PVM-1344Q/1944Q)



Digital Audio Cable  
**ECD-3C/10C/30C**  
(3m, 10m, 30m)



Remote Control Cable D-sub 9-pin  
**RCC-5G/10G/30G**  
(5m, 10m, 30m)



Rack Mount Kit  
**RMM-110**



Digital Video Cassette  
**BCT-D6/D12/D22/D32/D40**  
(Small Cassette)  
**BCT-D34L/D64L/D94L/D124L**  
(Large Cassette)



Cleaning Cassette  
**BCT-5CLN**

Analog Composite Decoder Board  
**BKDW-505**

Audio Processor Board  
**BKDW-507**

Extension Board

Maintenance Manual (Part II)

# Specifications

## General

Power requirements	AC 90V to 265V, 48Hz to 64Hz
Power consumption	480VA (220W)
Operating temperature	+5°C to +40°C (41°F to +104°F)
Storage temperature	-20°C to +60°C (-4°F to +140°F)
Humidity	25 to 80% (relative humidity)
Weight	33kg(73 lb)
Dimensions (WxHxD) (including feet)	427 x 237 x 520 mm (16 7/8 x 9 3/8 x 20 1/2 inches)
Recording format	Digital BETACAM
Tape speed	96.7mm/s
Record/playback time	Max. 124 min with BCT-D124L cassette
Recommended tape	Sony BCT-D6/D12/D22/D32/D40 (small cassette) BCT-D34L/D64L/D94L/D124L (large cassette) or equivalent
Fast forward/rewind time	Approx. 3 min with BCT-D124L cassette
Search speed (Shuttle mode)	Still to approx. ±50 times normal playback speed
Dynamic tracking range (Variable mode)	-1 to +3 times normal playback speed
Servo lock time	0.5s or less (from standby on)
Load/unload time	6s or less

## Input/output signals

<b>Video</b>	
<b>Input</b>	
Serial digital interface	BNC (x1) with active through out, SMPTE259M, 270Mbits/s
Analog component	BNC (x1, Y/R-Y/B-Y) Y: 1.0Vp-p, 75Ω R-Y/B-Y: 0.7Vp-p, 75Ω
Analog composite (option)	BNC (x1) with loop through 1.0Vp-p, 75Ω (with use of optional BKDW-505)
Reference	BNC (x1) with loop through 0.3Vp-p, 75Ω

<b>Output</b>	
Serial digital interface	BNC (x4), SMPTE259M, 270Mbits/s (including 1 character out)
Analog component	BNC (x1, Y/R-Y/B-Y) Y: 1.0Vp-p, 75Ω R-Y/B-Y: 0.7Vp-p, 75Ω
Analog composite	BNC (x3) 1.0Vp-p, 75Ω (including 1 character out)
<b>Audio</b>	
<b>Input</b>	
Digital	XLR 3-pin (CH 1/2, 3/4), AES/EBU format, stereo mode, balanced, BNC (SDI, video & audio), SMPTE259M, 270Mbits/s
Analog	XLR 3-pin (CH 1,2,3,4,Cue) LOW OFF : -60dBu, high impedance, balanced HIGH OFF : +4dBu, high impedance, balanced HIGH ON : +4dBm, 600Ω termination, balanced
<b>Output</b>	
Digital	XLR 3-pin (CH 1/2, 3/4), AES/EBU format, stereo mode, balanced BNC (SDI, video & audio), SMPTE259M, 270Mbits/s
Analog	XLR 3-pin (CH 1,2,3,4,Cue) +4dBm at 600Ω load, low impedance, balanced
Monitor L/R	XLR 3-pin, +4dBm at 600Ω load, low impedance, balanced
Headphones	JM-60 stereo phone jack, -∞ to -12dBu at 8Ω load, unbalanced
<b>Time code</b>	
Input	XLR 3-pin, 0.5 to 18Vp-p, 10kΩ, balanced
Output	XLR 3-pin, 2.2Vp-p, low impedance, balanced
<b>Remote</b>	
Remote 1 in	D-sub 9-pin, RS-422A interface
Remote 1 out	D-sub 9-pin, RS-422A interface
RS-232C	D-sub 25-pin, RS-232C Interface
Parallel I/O (Remote 2)	D-sub 50-pin, (with optional BKDW-509 Parallel (50P) Interface Kit)
Video control	D-sub 15pin, (for optional BVR-50 Remote Controller)
Control panel	15-pin, (for optional BKDW-510 Control Panel Extension Kit)

## Processor adjustment range

Video level	$\pm 3\text{dB}/-\infty$ to $+3\text{dB}$ selectable
Chroma level	$\pm 3\text{dB}/-\infty$ to $+3\text{dB}$ selectable
Setup/Black level	$\pm 210\text{mV}$
Chroma phase/Hue	$\pm 30^\circ$
System Sync phase	$\pm 15\mu\text{s}$
System SC phase	$\pm 200\text{ns}$

## Video/Audio performance

### ● Digital Video

Sampling frequency	Y: 13.5MHz R-Y/B-Y: 6.75MHz
Quantization	10 bits/sample
Error correction	Reed-Solomon code
Error concealment	Adaptive three dimensional

### Digital input to analog component output

Bandwidth	Y: 0 to 5.75MHz $\pm 0.5\text{dB}$ R-Y/B-Y: 0 to 2.75MHz $\pm 0.5\text{dB}$
S/N ratio	62dB or more
K-factor (2T pulse)	1% or less

### Analog component input to analog component output

Input A/D quantization	8 bits/sample
Bandwidth	Y: 0 to 5.75MHz $+0.5/-0.7\text{dB}$ R-Y/B-Y: 0 to 2.75MHz $+0.5/-0.7\text{dB}$
S/N ratio	56dB or more
K-factor (2T pulse)	1% or less
LF non-linearity	2.5% or less

### Analog composite input (option) to analog composite output

Bandwidth	Y: 0 to 5.75MHz $+0.5/-0.7\text{dB}$
S/N ratio	58 dB or more
Differential gain	2% or less
Differential phase	$2^\circ$ or less
Y/C delay	15ns or less
K-factor (2T pulse)	1% or less

### ● Digital Audio (DA 1 to DA 4 channels)

Sampling frequency	48kHz (synchronized with video)
Quantization	20 bits/sample
Analog input to output A/D and D/A quantization	18 bits/sample
Frequency response (0dB at 1kHz)	20Hz to 20kHz $+0.5\text{dB}/-1.0\text{dB}$
Dynamic range (at 1kHz, emphasis ON)	More than 95dB
Distortion (at 1kHz, emphasis ON, reference level)	Less than 0.05%
Cross talk (at 1kHz, between any two channels)	Less than -80dB
Wow & flutter	Below measurable level
Head room	20dB (18dB selectable)
Emphasis (ON/OFF selectable)	T1 = 50 $\mu\text{s}$ , T2 = 15 $\mu\text{s}$

### ● Analog Audio (Cue track)

Frequency response	100Hz to 12kHz $\pm 3\text{dB}$
S/N ratio (at 3% distortion level)	More than 45dB
Distortion (T.H.D at 1kHz reference level)	Less than 2%
Wow & flutter	Less than 0.2% rms

\* Reference level: +4dBm

## Supplied accessories

AC power code	(1)
RCC-5G 9-pin remote control cable	(1)
PSW 4 x 16 screws for rack mounting	(4)
Operation manual	(1)
Installation manual	(1)
Maintenance manual (Part I)	(1)

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