VooDoo

MEDIA RECORDER

DCR 6024 / 6128 / 6000

Planning & Installation Manual

THOMSON MULTI MEDIA
BROADCAST SOLUTIONS

Published by

BTS Media Solutions GmbH

Brunnenweg 9
D-64331 Weiterstadt, Germany
P.O. Box 1165

Tel: +49 (0) 6155-870-0
Fax: +49 (0) 6155-870-300

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SAFETY INSTRUCTIONS

Application

The DCR 6024/6128/6000 is a digital **HDCassette Recorder System** designed for recording and playback of video / audio and / or data signals for various DTV– and data standards, according to the SMPTE / D-6 HD-recording format.
The DCR 6024/6128/6000 consists of basic modules:

- Tapedeck incl. Control Panel — DMS 6000 / DCH 6024 CP
- DTV Processor — DTV 6024
- Data Processor — DDP 6128
- Data Switch — DSW 6000

Warnings!

To ensure safe operation please observe the following directions:

The current and voltages present in this equipment are dangerous. All personnel must at all times follow the safety regulations.
Always disconnect power before removing covers or panels. Always discharge high voltage points before servicing.
Never make internal adjustments, perform maintenance or service when alone or fatigued.
In case of an emergency ensure that the power is disconnected.
Any interruption of the protection conductor inside or outside the apparatus, or disconnection of the protective earth terminal, is likely to make this apparatus dangerous. Intentional interruption is prohibited.

LISTED
PROFESSIONAL VIDEO EQUIPMENT
3S13 / 78MA

The DCR 6024/6128/6000 VooDoo Media Recorder is designed accordingly to regulations of the Underwriters Laboratories Inc. ® Northbrook, Illinois US, certificated and registered under file no.:

E184475 (Tapedeck) /
E205276 (DTV Processor)

LISTED
UL 1950
3S13 / 78MA

E159262 (Data Processor)
E159262 (Data Switch)

Conform with the following European directives and CE marked:
Safety: Low voltage directive 73/23/EEC, EN 60 950/1997
EMC / EMI: EMC directive 89/336/EEC,
EN 55103-1/1996,
EN 55103-2/1996
EN 55022/1998

Electromagnetic environment (acc. to EN 55103–1) E4

Warning:	**Warnung:**
This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.	Dies ist eine Einrichtung der Klasse A. Diese Einrichtung kann im Wohnbereich Funkstörungen verursachen; in diesem Fall kann vom Betreiber verlangt werden, angemessenen Massnahmen durchzuführen.

N4067 EMC: AS/NZS 3548

EMC Environment

This unit was designed for use under controlled EMC environment (for example purpose built broadcasting or recording studio), and the rural outdoors environment (far away from railways, transmitters, overhead power lines, etc.).

FCC Rules § 15.105 EN 55022

FCC 47 Part 15 Class A
This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to the part 15 of the FCC Rules and EN 55022. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.
This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.
Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Connection cables

The EMC regulations are only applicable when correctly shielded cables are used for installation of the equipment. This applies to video cables as well as control cables. Corresponding cables can be obtained from Thomson.
Run all connection cables in covered cable ducts (risk of stumbling).

Mains Voltage

The DCR 6024/6128/6000 includes wide range power supply units of 100 – 240 V, so that no changeover is required for different line voltages. Depending on the supply voltage use the proper rated power supply cord.

Installation

For more details see section 5 ”Installation” in the Planning & Installation manual.

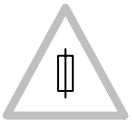
Caution! Double-pole or neutral fusing

Risk of electric shock. Grounded circuit conductor (neutral) provided with over-current protection.
After operation of the protective device, parts of the equipment that remain under voltage might represent a hazard during servicing.

Disconnect power before servicing!

Fuses of Tapedeck

The Tapedeck DMS 6000 is protected by two primary-side fuses (T6.25A / 250V) which are located on the rear panel.



When replacing this fuse, make sure that a fuse link of the same type and of the same current rating is used.
Never use a mended fuse! Do not short-circuit the fuseholder!

Fuse of Processor

The signal Processors DTV 6024 and DDP 6128 and Data Switch DSW 6000 are protected by an automatic fuse, which is located on the Processor rear panel.

During operation

The DCR 6024/6128/6000 may only be operated in closed condition.

Opening the covers or removing parts with tools may give access to live parts. Therefore the system must be completely disconnected from the mains before any cover is opened.

Working on the opened machine

If, however, working on the opened machine is inevitable, this may only be done by an expert who is familiar with the dangers involved.

Warning !
Beware of high speed rotating video heads.
Wear safety glasses!

Capacitors

ATTENTION! Capacitors may still be charged!

If, for example due to a failure, safe operation of the DCR 6024/6128/6000 is no longer possible, take the unit out of operation and secure it against further use.

Batteries

The Tapedeck contains two backup batteries type Varta CR 1/2 AA Thomson part no. 003 119 100 195 which have to be replaced with batteries of the same type (UL-1642 listed).
Battery replacement should be done by Thomson service personnel only.

1. GENERAL

1.1 FEATURES

1.1.1 GENERAL

Digital film and the 1080p universal mastering format are increasingly important in post production applications. Besides the digital HD video formats the data format using SMPTE–rated DPX (digital picture exchange) file format for uncompressed storage and transport of picture information is required. This data format allows higher resolution than specified in video formats with similar freedom in transfer characteristic, color space and so on.

The DCR 6024/6128/6000 supports the HD video formats (1920x1080) as well as data recording of DPX picture information. Using the same tapedeck and different processors for DTV and data applications the system can be configured for the requested application. With the addition of the data switch the same tapedeck can be used to record data or digital HD video in many formats.

1.1.2 HDTV RECORDER DCR 6024

The DCR 6024 is a digital component **HDTV Cassette Recorder** designed for acquisition, production, postproduction and archiving of video and audio signals for various HD-standards, according to the SMPTE/D-6 HD-recording format.

Operating in HD standards HD-SDI IN / OUT SMPTE 292M:

1920 x 1080 @ 24p 1920 x 1080 @ 23.97p 1920 x 1080 @ 25p	**Progressive modes**
1920 x 1080 @ 24sF 1920 x 1080 @ 23.97sF 1920 x 1080 @ 25sF	**”segmented frame” modes**
1920 x 1080 @ 60i 1920 x 1080 @ 59.94i 1920 x 1080 @ 50i	**2:1 interlace modes**

- 10 (60i), 12 (24p, 25p, 24sF, 50) digital Audio in- and outputs according to AES Standard
- Crossplay between varoius modes
- Timecode conversion in crossplay modes
- Visible search 15 times regular speed
- Broadcastable slowmotion range – 0.25 to + 0.25 regular speed
- Automatic Tracking adjustment
- Automatic playback equalization
- Integrated two machine editor

- Control Panel with slot for personal card to store individual setups
- Integrated ASTC (Audio Sector Time Code)
- 1 Video Component output analog R/G/B/S switchable to $Y/P_R/P_B$ for Monitoring. In 24(23.97)p mode the output is switchable to 60i (2/3 pulldown)
- Remote control interfaces: ESBUS , RS422 SONY protocol, iMCS
- ***Option BD 5402:***
  2 Audio analog outputs for monitoring (L/R)
  1 Headphone output

1.1.3 DATA RECORDER DCR 6128

Data recorder system for recording and playback of image data and general purpose data (instrumentation recording)

- Data rates up to 128 MBtes/sec
- 128 MBytes/sec in instrumentation mode (without rewrites)
- 100MBytes/sec in Hippi mode (with rewrites)
- 500 GBytes max capacity on large cassette
- Hippi serial optical interface for data transfer
- iMCS remote control for links to telecines and other Thomson film imaging products
- Flexibilty to adopt future high speed data interfaces
- ***Option BD 5456***
  DPX monitor for dispaying DPX data on a XGA monitor (1024x768)

1.1.4 DIGITAL FILM APPLICATION SYSTEM DCR 6000

Digital Film Applications (DFA) system which combines the DCR 6024 (H)DTV recorder and the DCR 6128 Data Recorder to a versatile, switchable system.

A DSW 6000 Data Switch allows to use the DMS 6000 tapedeck for both DTV and data applications. A changeover from data to DTV mode can be done within seconds.

1.2 OVERVIEW

1.2.1 HDTV RECORDER DCR 6024

The DCR 6024 consists of two basic modules:

- Tapedeck incl. Control Panel — DMS 6000 DCH 6024 CP
- DTV Processor — DTV 6024

Fig. 101: HDTV Recorder DCR 6024

1.2.2 DATA RECORDER DCR 6128

The DCR 6128 consists of two basic modules:

- Tapedeck incl. Control Panel — DMS 6000 DCH 6024 CP
- Data Processor — DDP 6128

Fig. 102: Data Recorder DCR 6128

1.2.3 DFA RECORDER SYSTEM DCR 6000

The DCR 6000 consists of two basic modules:

- Tapedeck incl. Control Panel — DMS 6000 DCH 6024 CP
- Data Processor — DDP 6128
- DTV Processor — DTV 6024
- Data Switch — DSW 6000

Fig. 103: DFA Recorder System DCR 6000

1.3 MECHANICAL DESIGN

Housing

The housings of the Tapedeck and Processor are made of aluminium alloy which is coated inside with alodine to prevent electrostatic discharge influences. Modules can be locked mechanically together and unlocked for easy transport.

19-inch rack installation kit for tapedeck and processors are available

Order no.:

• BD 5197	000 175 602 211	for tapedeck
• BD 5198	000 175 602 310	for DTV processor
• BD 5199	000 175 602 410	for data processor

The rackmount kit for the tapedeck contains telescopic rails for easy access to tapedeck mechanics.

Tapedeck and Processor are provided with four handles which facilitate transport of the machine.

For service works, the Tapedeck can be hinged upwards, being hold by two locking mechanism.

1.4 MACHINE CONTROL

The control of the DCR 6024/6128/6000 is based on a user-friendly menudriven concept. The menus are selected via 12 dedicated keys. All menus (except Setup, Diagnostics and Editor) are designed without any sub menus to ensure easy handling.

The menues are application sensitive, Depending on selected modes (data or video) and installed options there are different menues and controls available.

12 softkeys control different functions in each menu replacing a high number of dedicated keys.

All analog adjustments are done by a digipot which function varies with the different menus (for further informations see chapter 4 “Menu Control” in the “Operating Instructions” manual).

A unique feature for VTR’s is the availability of a credit- card sized personal card which can be inserted in a slot on the control panel. All machine parameters and setups accessible from the control panel can be stored on this card. Information are stored at this card in a S-RAM buffered by a 3 V lithium battery so that it can be loaded everywhere into the recorder. If required, the stored machine setups and adjustments can then be recalled.

1.5 BLOCK DIAGRAM

1.5.1 TAPEDECK DMS 6000

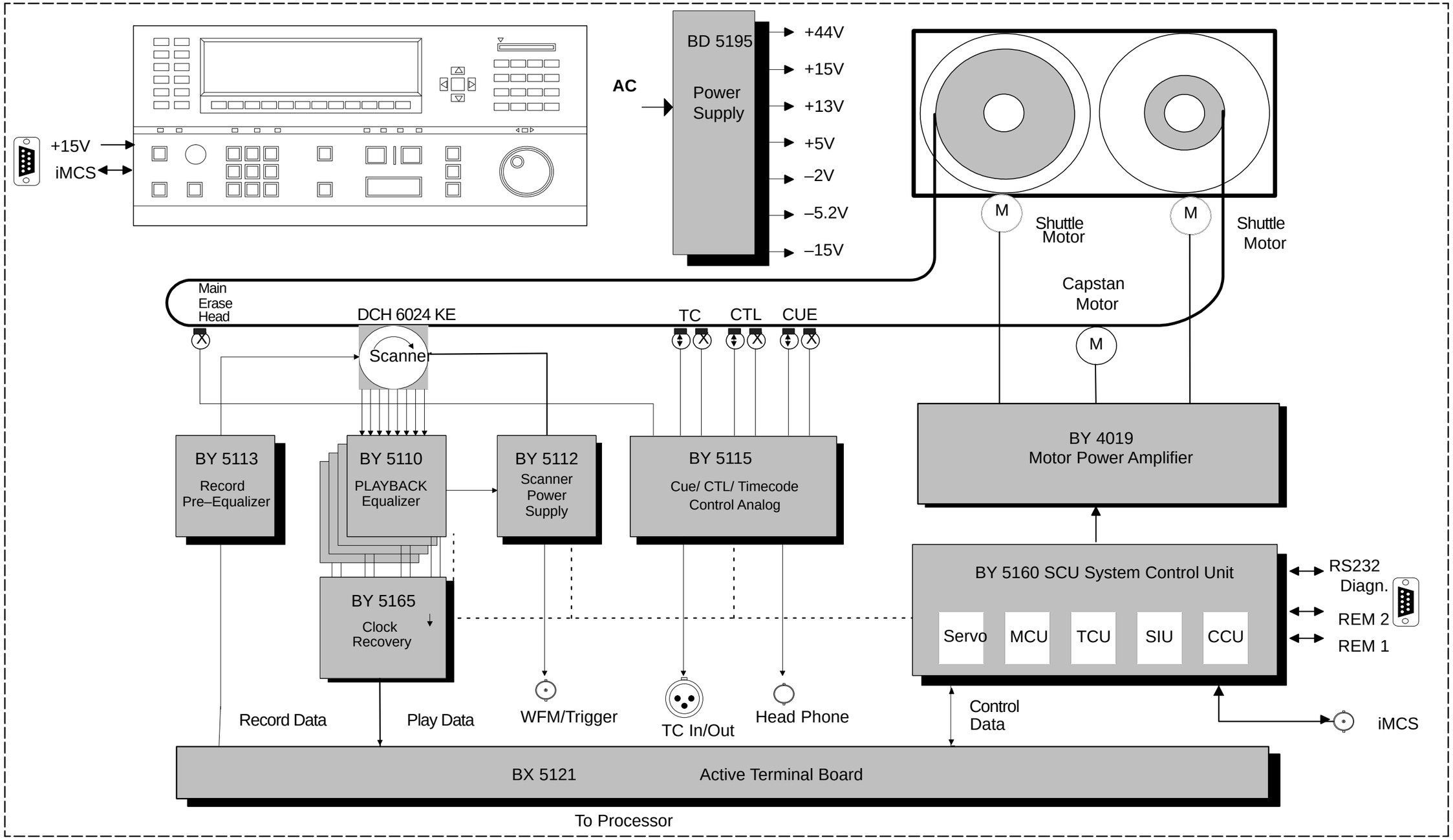


Fig. 104: Block Diagram Tapedeck DMS 6000

1.5.2 DTV PROCESSOR DTV 6024

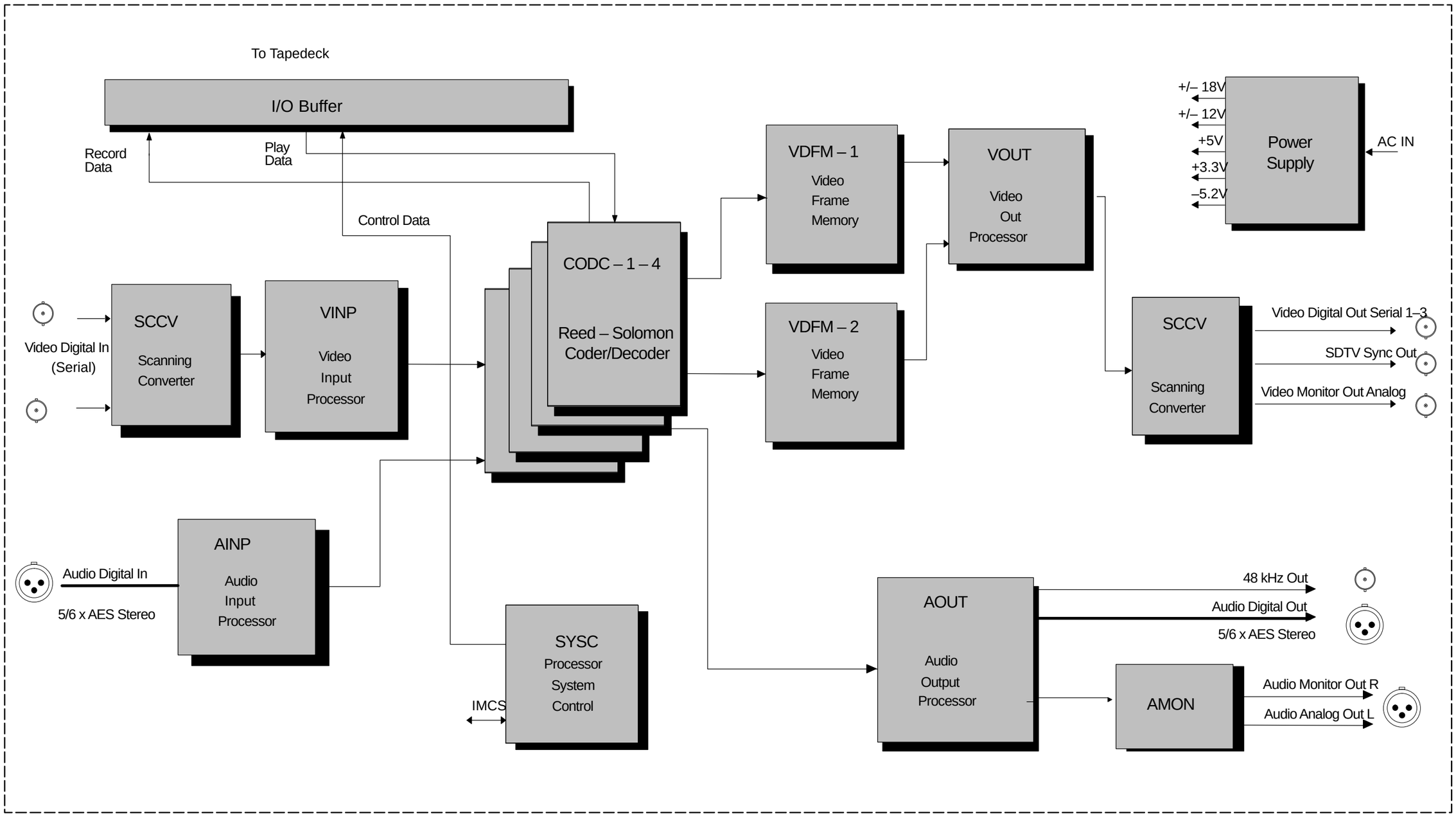


Fig. 105: Block Diagram DTV Processor DTV 6024

1.5.3 DATA PROCESSOR DDP 6128

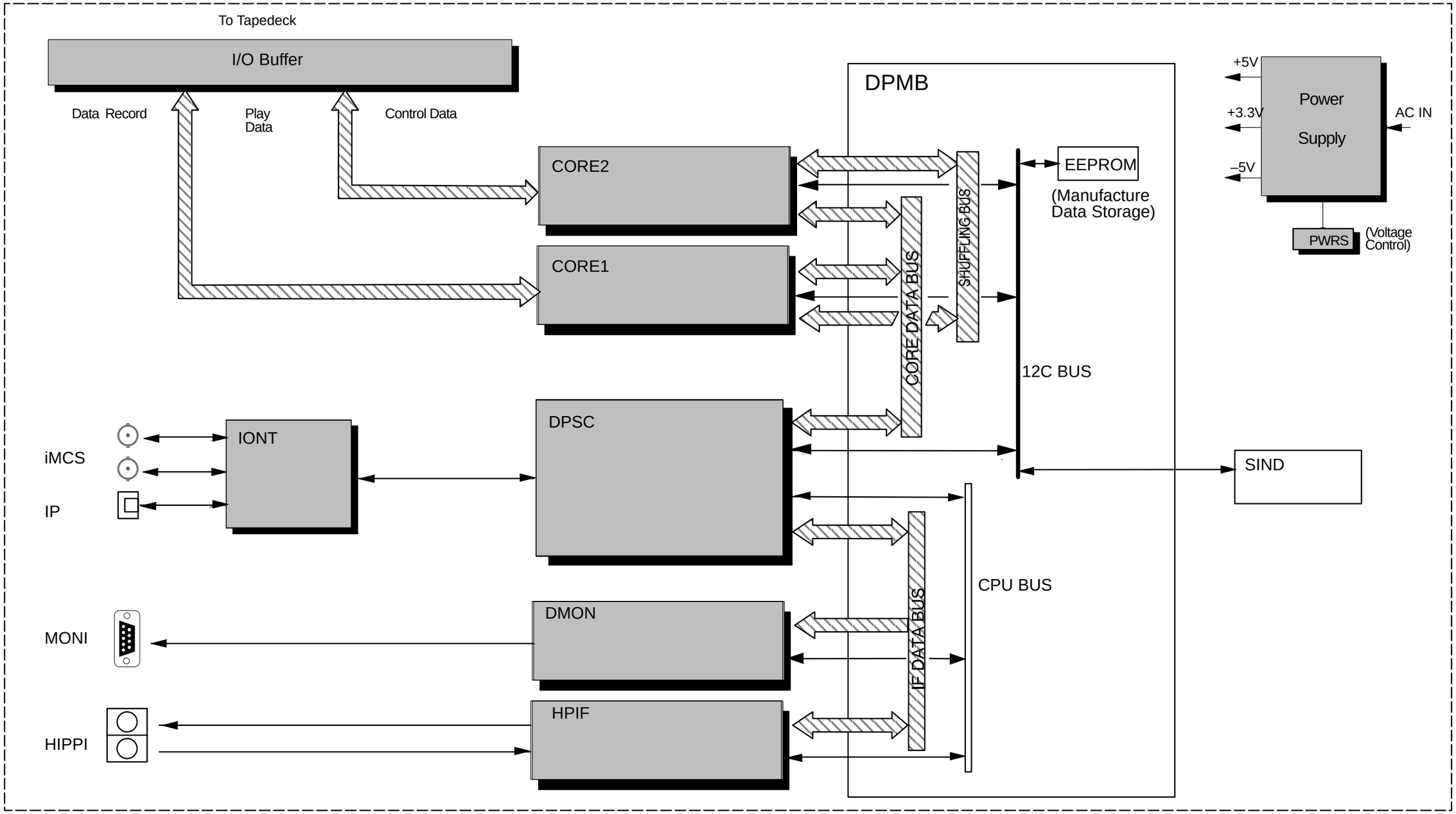


Fig. 106: Block Diagram Data Processor DDP 6128

1.6 FUNCTIONAL OVERVIEW

For details refer to block diagram

1.6.1 D–6 STANDARD

D-6 Track pattern Video

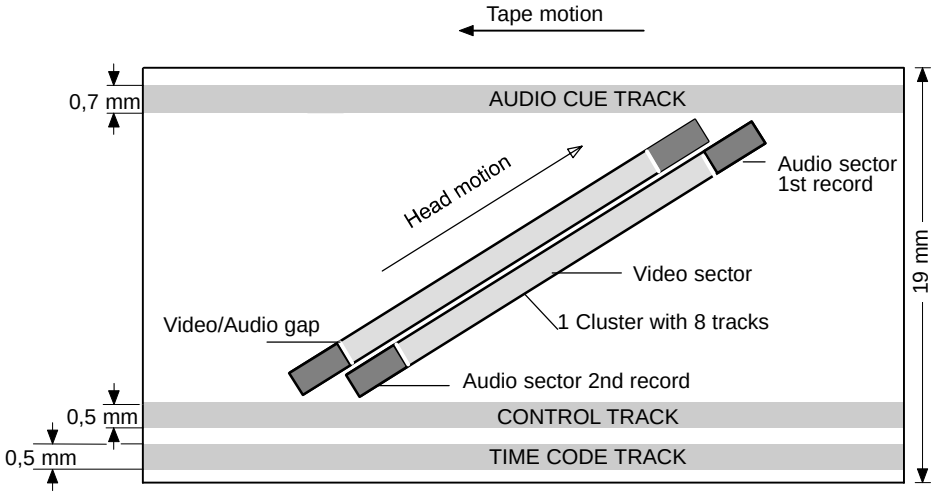


Fig. 107:D–6 Track pattern video

D-6 Track pattern Data

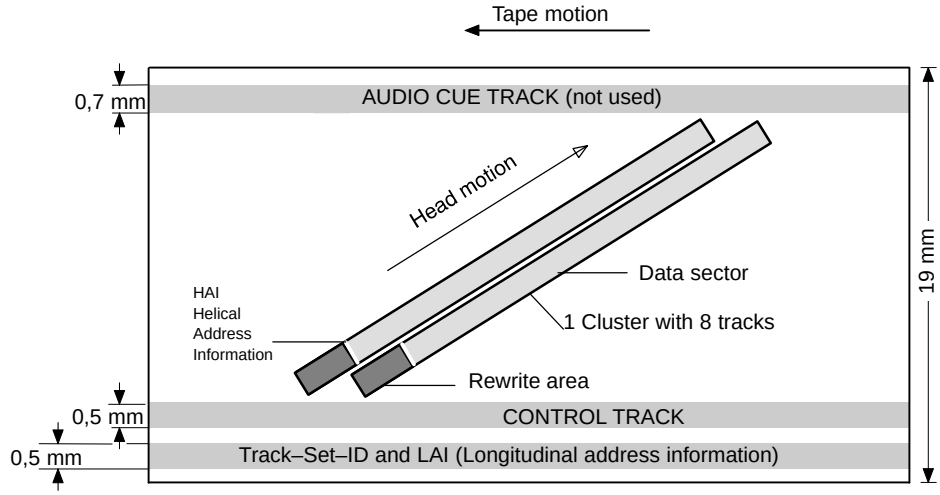


Fig. 108:D–6 Track pattern data

Helical tracks

The track pattern of the recorder contains the helical tracks with the video and audio sectors (DTV mode) and rewrite area (data mode) divided in clusters of 8 tracks each.
It is based on azimuth recording with a track pitch of 22 µm which allows a max recording capacity of 64 min or 500 GBytes with a L-type cassette.
The clusters are separated by guard bands from each other, allowing proper erasement of the individual clusters with a single flying erase head for each cluster.

One field is the minimum edit distance for video audio and data in DTV mode. It is divided into six (24/25 Hz) or five (30 Hz) clusters respectively. In data mode the sytem uses the 25 Hz mode internally.

In DTV mode, twelve (ten) digital audio channels are independent editable in six (five) stereo pairs.

An edit gap between audio and video sectors allows a separate editing of audio and video.

The audio sectors are recorded on the top (1st record) and on the bottom (2nd record) of the helical track for additional error correction.
In data mode there is a special rewrite area at the beginning of each track. In this area, sync blocks with detected errors during recording will be written again.

An additional Sync block located at the beginning of data area contains the HAI (Helical Address Information). In this block all control info about the content of helical tracks like TOC (Table Of Content), and packet info is written.

Longitudinal tracks

One longitudinal analog audio cue track (only used in **DTV mode**), the control track and the time code track complete the track configuration of the D-6 tape format.

The recorder DCR 6024 is capable of recording various progressive, “segmented frame” or interlace standards. HD Standard (frame rate) selection is made in the ”SETUP” main menu.
The selected standard is indicated by the system status indicators at the Control Panel, LED ”frame rate” (either 24/25 Hz or 30 Hz).

In **data mode** the timecode track is used to locate and identfy data and system tracks of data recordings. On tape, a standard 25 fps SMPTE timecode is used. For the internal control interface this information is translated into a TSID (Track Set ID). each timecode frame is one TSID. This TSID is used for display, internal and edit controls.
Timecode 02:00:00:00 is coverted into TSID 00000
Each new partition starts with an offset of 02:00:00:00

The UserBits contain information about type of tracks, file–no., record mode, partition–no. and tape length.

D-6 video casette

The DCR 6024 uses 11 µm thick D-6 tapes in three different cassette sizes S, M, with a maximum recording time of 64min.

The magnetic tape specifications (type of cassette, tape thickness) are detected and interpreted automatically after the cassette has been loaded.

Other 19 mm cassettes (D-1 or D-2 type), not coded according to the D-6 format will be rejected by the DCR 6024 recorder.

Another coding of the cassette prevents unintentional erasure of the cassette.
Use only tapes specified by Philips and Toshiba.

D-6 Recording format

It uses the D-6 recording format, developed and supported by Philips Digital Video Systems and Toshiba.
This format is based on a digital segmented-field video recording system with multichannel audio using a 19 mm cassette housing, (S, L and M) with enhanced 11µm MP tape.The robust segmented tape format with the high sophisticated digital Processor guarantees a reliable production and transfer recording standard for the various standards.

High quality recording and playback

The DCR 6024/6128/6000 offers a confidence playback facility for video and audio tape monitoring during record in DTV mode. In data mode, confidence playback is used to check the recorded data and rewrite if necessary.

Digital recording and playback in conjunction with sophisticated error correction result in excellent picture and sound quality in DTV mode. Even after 20 tape dubbing generations there will be no noticeable loss of quality.

Error Correction

The DCR 6024 includes a very powerful error correction facility with a total output error rate of 10^{-11}.

A two step error correction system, based on the Reed Solomon Code is implemented to correct data reading errors.
There are two types of errors:

- Single errors
- Burst errors

In **data mode** (DCR 6128) the error correction capabilities are increased once more. In conjunction with a rewrite function, controlled by the result of confidence playback functions the corrected bit error rate (BER) will be in the range of 10 E–17.

In both modes the playback quality is checkable by the ”Channel Condition” indicators (LEDs) and/or by the display of the ”ADJUST” menu.

Single error correction

The ”Inner-Code” is used to correct up to 7 single errors in each datablock of 227 bytes (DTV mode) or 230 Bytes in data mode.
With the restriction that the off tape bit error rate is smaller than 10^{-4} and no burst errors occur, the residual error rate after ”Inner correction” will be less than 10^{-16}.

This is about one million times better than D-1 format VTR performance.

Burst error correction

Due to scratches and tape drop outs, not only single errors but also large burst errors can occur. To overcome this problem the DCR 6024/6128 has a powerful ”Outer-Code” too.
Extensive burst errors up to 141 648 bytes of data could be corrected in **DTV mode** by ”Outer correction”. That is 25 times more than a D-1 format recorder can.Using advanced integration techniques the most powerful error correction of existing digital video standards is implemented in the DCR 6024.

In **data mode** (DCR 6128) the “Outer correction” is more than twice as powerful as in DTV mode. In conjunction with the rewrite function during record the corrected BER will be in the range of 10 E–17.

Concealment (DTV–mode)

If the capacity of the error correction system is exceeded by larger defects, an error concealment function becomes active which covers the defective data.

iMCS

The iMCS control interface is designed as Cheapernet-based control link (IEEE 802.3 standard) between machine(s) and control panel(s).

This interface can be used to interconnect up to four machines. Such a cluster configuration allows the design of cost-effective operating configurations as only one control panel is required to operate several machines.The integrated two-machine editing system of the DCR 6024 uses the iMCS (2-machine cluster) as a control link when editing with two DCR 6024.

In data mode (DCR 6128) the iMCS interface is used to control the data recorder from telecine controllers or workstations.

1.6.2 DTV PROCESSOR DTV 6024

Digital Video Interfaces

Digital serial input signal is a serial data stream composed of digital samples of a component video signal Y / P_R / P_B.
The signal formats for video are described in the SMPTE 274M. SMPTE 292M describes the signal parameters for serial interfaces.

The system uses an 10(8) bit quantization for Luminance and a 8 bit quantization for chrominance.

Video Record

SCCV Scanning Converter

The digital serial video input signals are fed to the board SCCV. The signal is converted from serial into parallel. Progressive signals are converted into a segmented signal. For progressive and segmented frame modes (24, 25, 23.97 fr/sec) 2 LSB bits from the 10 bit Y are separated and stored in a memory and inserted as lines of the frame. In case of 8 bit signal processing and 10 bit input, a rounding process is integrated.

VINP Video Input Processor

The selected input data are fed to the serial parallel converter and converted into 4 channel parallel luminance data (Y) and 4 channel chrominance data (Pb/Pr).

After line shuffling, parity bytes for the outer error correction coding are added.

CODC 1-4 Inner Coder/Decoder

The coded data are fed to the board CODC. On this board, the coded data are further shuffled in a field basis.

After mixing with the audio data, parity bytes for the inner error correction coding are added.

In the channel encoder, the eight bits data are transformed into 12 bits data, then the sync words are added.

A head delay compensates for the timing difference between each channel, caused by the difference of the mechanical position of each head on the headwheel.

Finally, the data are converted to serial data (8 channel record data, 2 bit parallel), and sent to the **Tapedeck** as ”record data” via the buffer board I/O1.

AES-/EBU-Standard

The digital audio interface meets the AES-/EBU- standard AES 3, 1992.

A total of 12 (10) channels or 6 (5) stereo pairs is available for the digital recording of audio signals, it uses a sampling frequency of 48 kHz and 20 to 24 bit linear quantization.

Audio Record

AINP Audio Input

The recording signals are fed to the board AINP. The segment memory stores the recording signals temporarily to establish the segmented recording signal format, which corresponds to the audio data block for error correction coding. Readout signal from the segment memory is supplied to the Read-Solomon encoder which calculates outer parities for the audio data. The encoded output signal is stored in the shuffling memory. This memory generates the first and the second recording data with different shuffling schemes in a unit of inner code word.
The first and second recording data are transmitted to the board CODC to be multiplexed into video data.

Video Play

CODC Encoder / Decoder

The serial data are fed to the decoder board CODC via the board I/O1 from the Tapedeck. In this board, the serial data are converted into parallel form, and fed to the TBC (Time Base Corrector) to reject time base errors. The sync pattern are detected from the reproduced data in the sync detector circuit. The channel decoder converts the 12-bit modulated data into 8-bit data. The inner decoder performs detection and correction of errors. The audio data are separated after inner error correction.

VDFM Video Playback Processor

In the board VDFM, the field deshuffling is done in a field basis, then the outer error correction is carried out.

VOUT Video Out Processor

The corrected data are fed to the board VOUT. In the board VOUT, the data is rearranged into the original data arrangement after the line deshuffling and channel deshuffling.The concealment circuit is provided to interpolate the data in case that the data are not fully corrected by using the outer parity. By using the surrounding non-erroneous pixels the erroneous data are interpolated. The video sync data are added to the blanking interval then the data are converted from parallel form to serial form, and fed to the board SCCV. If the digital I/O option (available only for 60i and 59.94i) is installed the digital signal is fed to the output connector.

SCCV Scanning Converter

The digital parallel signal coming from the VOUT board is converted from a segmented format to the selected output format. Lines containing 2bit Y are stored in a memory and added to the Y signal. A parallel to serial converter generates the output signal according to SMPTE 292M standard.

A video monitoring circuit generates an analog output signal (Y, P_R, P_B, Sync) or R, G, B, Sync according to the selected standard.

Audio Play

AOUT Audio Out Processing

The board CODC supplies reproduced audio data to the board AOUT.In the board AOUT, the reproduced data and inner decoder flags are stored in the deshuffling memory. Storing operation is permitted when the reproduced data are likely to have correct inner code block addresses. When the storing is inhibited, a new/old flag is set to ”1” for corresponding inner code block in order to avoid misdetection by older correct inner code block.The first and the second recording data are readout from the deshuffling memory by turns in a unit of symbol. Then, for each data symbol, optimum one is selected to achieve optimum outer code word. This code word

is fed to the Reed-Solomon decoder for error detection and correction. The decoded output data are stored in the segment memory to get an audio data sequence. The error concealment and the level control are applied to this sequence. (AES/EBU interface encoding is applied to the audio data, and the encoded data are output through rear panel connectors as audio digital output signals)

Analog Audio Option, Audio Monitoring Option

Two channels are available on the audio monitor output through the output connectors of the rear panel and the headphone jack in the Tapedeck.The monitor signals can be selected from the input or reproduced audio signals, the aux input signal, the cue record signal and the cue playback signal.

System Control

The SYSC board consists of System Control block and Sync Generator block. The System Control block controls the system, communicates with the Tapedeck and outputs superimpose data. The sync generator block consists of a diverse sync signal generator, a system clock regenerator, a playback sync signal phase adjuster, a NTSC / PAL sync signal generator and a channel clock generator circuits. The timing of every synchronizing signal is completely switchable to meet each HD standard.

1.6.3 DATA PROCESSOR DDP 6128

To prevent major modifications in the tapedeck, one of the existing video modes is for data recording. When in data mode, the tapedeck runs internally in a video mode (50Hz). So all tapedeck functions like servos, timecode units can be remained unchanged. Only the system software has to be modified for data version.

Record Path

HPIF Board (HIPPI–Interface)

The optical signal is fed from the input to this board. This board is responsible for communication with external Hippi devices. A conversion from optical serial signal to electrical parallel signal is made. A buffer of 128 MBytes allows a flexible handling of incoming data stream. The Hippi header is detected and analyzed. The header is removed and the data is provided to DPSC board.

DPSC Board

On the DPSC board the internal data controls are processed. Control information like helical address information (HAI), table of content (TOC), partition information (PSIT) is generated and inserted in data stream. All required clock generators are located on this board. The incoming data packet is distributed and segmented into 8 channels.
This board contains also the system control unit.

CORE Board

This board is responsible for the standard digital recorder signal processing steps. The functions are comparable with the CODC board of the DTV processor. Each board contains 4 channels, so two identical boards are used in the data processor.

The Reed Solomon error correction encoder adds check bytes to the data bytes. A rewrite memory stores data and inserts this data again if a rewrite due to error rate is required.

After channel coding and conversion from parallel to 2bit serial mode, the data is fed to the tapedeck.

Play Path

CORE Board

The playback data stream (8channels) is fed to the two boards. Similar functions compared to the CODC board are implemented:
Channel decoding
Sync detection
Error detection and correction.
For the rewrite function, a error information for rewrite decision is generated.

DPSC Board

The DPSC board extracts and processes all control information that was inserted in the data stream during record (HAI, TOC). The data signal is combined from the 8 channels.

HPIF Board

The playback data signal is prepared for Hippi transfer. signal information (size) is analyzed and a Hippi header is generated. Communication with Hippi destination device is started and data is sent via optical transceiver. For playback mode the same buffer memory of 128 MBytes is used.

DPX Monitoring (Option)

If the incoming / outgoing data stream is detected as DPX data, the signal is fed to the DPX monitoring board. This board is located on the HPIF –board. The out put of this board is a standard XGA signal (1024x768 / 80Hz). The DPX data is converted into an XGa signal. If the resolution of DPX signal is lower than XGA resolution, the complete picture is displayed. If the resolution is higher, the resolution is reduced by skipping lines and pixels. Because this is only a monitoring feature boarders may appear on the screen depending on DPX resolution.
In record mode, this board is connected to the input data stream, inplayback mode, the board is connected to the output data stream.

DPCU System Control

The system control is responsible for the control of all boards and the communication with tapedeck via iMCS. For service mode a RS232 serial port is installed. Software updates can be done using this port to reprogram the flash Eproms.

1.6.4 TAPEDECK DMS 6000

Auto-Tracking

Automatic Tracking System

This recorder has a permanent auto tracking function which means that the head tracking will be kept on the track during playback continuously. This is accomplished by monitoring the RF envelope signal and automatic adjustment of the head track position.

Alternatively it is possible to perform a manual tracking adjustment.Both adjustment facilities can be selected in the ”ADJUST” menu.

Equalizer Adjust

Automatic Playback Equalizer Adjustment

For optimal playback of a tape that was recorded on another machine, it might be necessary to equalize the frequency response in the playback signal path.

This results in a digital data stream which exhibits minimum error rates and consequently gives concealment-free (error concealment) video and audio signals. The adjustment is effected in the ”ADJUST” or in the ”HOME” menu.

Slow Motion

The use of four field stores allows broadcastable slow motion picture playback at a speed of - **0.25 to +0.25** times of normal speed, around zero.

Visible search

Visible search is possible even at **15 times** the normal speed, in both directions.

Still frame

Moreover, a high-quality still picture reproduction generated from the field store is provided.

Jogging

The jogging mode serves to locate a certain picture in slow motion.The tape speed (-0.25 to + 0.25 from regular speed) is proportional to the ”multi function dial” speed.

- Slow rotation — slow speed
- Fast rotation — fast speed
- Stand still — tape standstill

Analog Cue-Channel (DTV mode)

In addition to the twelve (ten) digital audio channels the DCR 6024 has one analog longitudinal audio channel for recording cue signals. The cue channel can be used to record a signal from an internal or an external (optional) audio signal source.When recording is made using both the digital audio channels and the analog cue channel, the cue channel signal can be used as a reference for editing the digital audio signals.Moreover, the audio cue track enables audio playback during rewinding and at slow motion speeds.The audio cue track is adjusted in the ”CUE TRACK” menu.

Timecode System (DTV mode)

For automatic editing the DCR 6024 must provide a definite identification for each frame.For this purpose, a continuous analog longitudinal timecode (LTC) is recorded on the timecode track. In addition, the machine records and reads the Audio Sector Timecode (ASTC) .

In crossplay modes 24p, sf and 25p, sf a switchable timecode conversion is implemented. This allows to playback 24p, sf tapes in a 25p, sf mode and vice versa.
If timecode crossplay is switched on, the timecode on tape will be translated into an absolute frame number. The frame number will be used to generate the timecode in the currently selected standard.
All interfaces (iMCS, RS422, TC–Out/XLR) will follow the crossplay mode.

Two-Machine (Master-Slave) Editing System

Internal Editing system (DTV mode)

The integrated two-machine (Master-Slave) editor serves for automatic edit execution. It is operated via the ”EDITOR” menu. All common edit modes (Normal, Insert and Assemble) are available. Edit timing is realized by means of IN and OUT marks.A preview function is provided to permit edit simulation. Sequential playback can be selected in the ”EDITOR” menu.

Record Path

BX 5121 Active Terminal Board (Input Buffer)

The serial 8 channel record data (2 bit parallel) coming from the Processor is clocked by clock 7 in the input buffer on the active terminal board (I/O buffer) BX 5121. Clock 7 is used for timing reference. All signals have ECL level.

BY 5113 Preequalizer

On the preequalizer BY 5113 the data will be converted into a one bit serial data stream (LSB first).

A phase locked loop circuit (PLL) generates the necessary double frequency channel clock. The following differential amplifier controls the output level and can be gated by the REC_GATE 0-7 command.

The next differential amplifier is the real preequalizer boosting the high frequencies to compensate H.F. loss of the record heads.

The preequalizer parameters are controlled by two values, C1 and C2.

Then the signal is buffered by a DC controlled 50 Ω output stage.(Separate control voltages are provided for heads 0^o and 180^o heads via I^2C-bus.)

Record current and preequalizer C are adjustable from the control panel (Adjust-Menu), preequalizer C2 is a fixed value adjusted in the factory or by service engineer.

The eight signals are fed to the scanner assembly.

Play Path

BY 5110 Equalizer

The play signal from the scanner is fed to an equalizer circuit to compensate the frequency response of the head-tape system. Thus the equalizer boosts both the high and low frequencies and can be controlled by two parameters available on the control panel, see menu ”Adjust” channel equalizer parameter: I/D and P/D2.

Further more the equalizer contains a signal rectifier to generate an rf-envelope signal which is used for auto-tracking and for waveform-monitoring. The rf-envelope signal can alter due to different tapes, recordings and head conditions.

The following low pass filter BX 5111 cuts noise above 80 MHz. To have a constant output level for the quantized feedback circuit, the level is regulated by an AGC (Automatic Gain Control Circuit).

BY 5165 Clock Recovery

The clock recovery is a PLL circuit which regenerates the clock signal, to be used to clock the data. The VCO is tuned via I^2C-bus for various Standards and data rates in the operation modes play, shuttle, variable. After clocking the data signal is digital in time and level and is parallelized into 2 bits which are fed to output buffer of the active terminal board BY 5121.

BX 5121 Active Terminal Board

The active terminal board contains ECL buffers for the playback clock and data signal.

Cue Audio

Record

From all of the reproduced digital audio data and the aux input data, cue record signal is generated and transmitted to the Tapedeck.

The signal, transmitted in a digital form to the cue control analog board BY 5115, is converted back to an analog signal to be recorded on tape. Before recording level and frequency response are aligned and bias is added.

Play

The cue playback signal passes through a level control and equalizer stage before it is converted back to a digital form on the cue control analog board and transmitted to the Processor.

Timecode

The time code signal, generated in the system control unit BY 5160, is recorded on tape after adding bias on the board cue control analog BY 5115.

The playback signal is fed via the board cue control analog BY 5115 to the waveform monitor stage of the board scanner power supply BY 5112 and after clipping to the system control board BY 5160.

During record, a signal derived from the record current is fed to the waveform monitor stage.

Control Track

The control track signal, generated in the system control unit BY 5160, is recorded on tape after adding bias on the board cue control analog BY 5115.

The playback signal is fed via BY 5115 board to to the waveform monitor stage of the board scanner power supply BY 5112 and after clipping to the system control unit BY 5160.

During record, a signal derived from the record current is fed to the waveform monitor stage.

Main Erase

The main erase stage is located on the cue control analog board BY 5115 and is active during crash and assemble record mode to erase the complete tape.

Scanner Power supply

The scanner power supply board BY 5112 contains the following functions:

1. Two switch mode power supplies (+5V and –12V/–7V) for the scanner record- and play-back amplifiers.
2. Thermal protection of record amplifiers by detecting the headwheel rotation. If the rotation speed of the headwheel goes down, the record mode is cut off. This prevents thermal damages of the record amplifiers.
3. Erase oscillator (30 MHz) for the flying erase heads.
4. Head switch logic realized by a FPGA.
   The FPGA generates all the timing signals for the record and play process in the RF- path as well as EE information for the Processor in simulation mode.
5. Processing of waveform monitoring signals.

Control System

iMCS

The control system of the recorder DCR 6024 is conceived as a multi Processor system.The main components of the control system are connected via the serial iMCS bus system with each other (iMCS = internal machine communication system). This bus is based on standard IEEE 802.3 (ETHERNET). Because of the cable deviating from the ETHERNET-Standard, the bus system is confessed also under name CHEAPERNET. The maximal cable length is specified with 185m.

The participants in the iMCS system are:

- Tapedeck / System Control Unit BY 5160
- Control Panel DCH 6024 CP
- DTV Processor / System Control Unit SYSC
- Data processor / System Control Unit DPCU

Up to four DCR 6024 can be controlled within one iMCS net. Individual recorder station addresses can be set up by local address switches, see chapter 5.3 ”Startup”.

The system control board BY 5160 is divided into two sections, BY 5161 and BY 5162.
The overall function can be separated into seven main groups:

- Central Control Unit CCU
- Gateway (Serial I/O Unit) GW
- Timecode Unit TCU
- Motor Control Unit MCU
- Digital Motor Control DMC
- Clock Generator
- RF & Sensor Evaluation

Central Control Unit CCU

This unit controls all substantial functions of the DCR 6024/ 6128/6000. All commands from the Control Panel and all messages to the Control Panel have to pass this unit. CCU takes over the status information management for the entire control system centrally. Therefore all control setup data has to be stored in this unit. For this purpose several nonvolatile store devices are used.The CCU software controls and monitors following subunits:

- RF-Processing
- Cue Track Processing
- Head Switch Logic
- Wave Form Monitor
- Nonvolatile Memory
- Temperature Sensor (System control unit BY 5160)
- Front Panel Display
- Motor Control Unit MCU via Dual Port RAM
- Timecode Unit TCU via Dual Port RAM
- Gateway GW (Serial I/O Unit) via Dual Port RAM

Some parts of the system CCU software is divided into two parts. One is the DTV version, the other one is the data version. After power up of system the processor type is detected via iMCS and depending on the response application specific software parts are loaded.

Gateway GW (Serial I/O Unit) (DTV Mode)

All external standard control systems are connected to the DCR 6024 via this unit. Different control dialects are converted into the iMCS data format and exchanged with CCU via a Dual Port Ram. Following remote interfaces are available:

- REM1 (ES- Bus with limited implementation).
  ES-Bus-Interface specified by EBU Tech.3245–
  E Supplement 1 and Supplement 2.
- REM2 IN RS422 standard SONY VTR protocol 38.4 K Baud.
- REM2 OUT VTR Serial RS-422 Control Interface according to standard SONY protocol for controlling a Slave-(Playback) VTR which does not have an iMCS interface.

Timecode Unit TCU

The timecode unit includes timecode reader and timecode generator. All commands and messages to the TCU are passed via a Dual Port Ram. The generator circuit provides two output signals. One signal is recorded on tape according to the specified footprint and the other output is passed to the XLR-output connector. The output signal is delayed by a FIFO in order to match the timing of the video signal. A real time clock generator is used as time base for the timecode generator. This device is connected to the battery so that the clock keeps running while power is switched off.The timecode reader circuit can be switched to the tape signal from tape or to the signal from the XLR TC-In connector for synchronization purposes.

Motor Control Unit MCU

All commands and messages to the MCU are passed via a Dual Port Ram. MCU controls the threading logic clock generator and the servo system DMC. Sensor information and control signals to the threading logic are passed via an 8 bit parallel bus. The tape threading motors are controlled via pulse width modulated signals. MCU monitors permanently all sensors and tacho generators during tape travel. All ballistic functions of the Tapedeck are defined by this unit.

Digital Motor Control DMC

This unit is a feedback control system which controls capstan, scanner and winding motors. Six feedback systems are controlled simultaneously (headwheel velocity, headwheel phase, capstan velocity, capstan phase, left and right tape tension).Tacho information of all motors, control track and analog output of tape tension arms are passed to this unit. Motor power amplifiers are interfaced via analog output stages.

Clock Generator

All basic reference clocks which are used by the servo and control system are generated in this unit. It includes also the control track signal generator. All clocks are derived from a frame pulse and a high frequency clock which are delivered by the signal Processor. If no external clock is present the pulse generator will be switched to an internal oscillator automatically. The head switch pulse generator works with clocks derived from a PLL circuit which is locked to the scanner tacho. If the scanner is not running the head switch pulse generator will be switched to the reference clock.

RF & Sensor Evaluation

The RF-evaluation circuit converts the analog signals from the tension arms, the position sensors of the Tapedeck and the RF-envelope signals to a digital value. Sampling and conversion of the RF-envelope is done with respect to the scanner phase. Special software filter algorithms are applied to the conversion process.

1.6.5 SCANNER ASSEMBLY

Function

The Scanner Assembly DCH 6024KE is a high sophisticated and precise unit, developed to record and playback data signals with a rate up to 1.2 Giga bits/s on an enhanced MP magnetic tape.

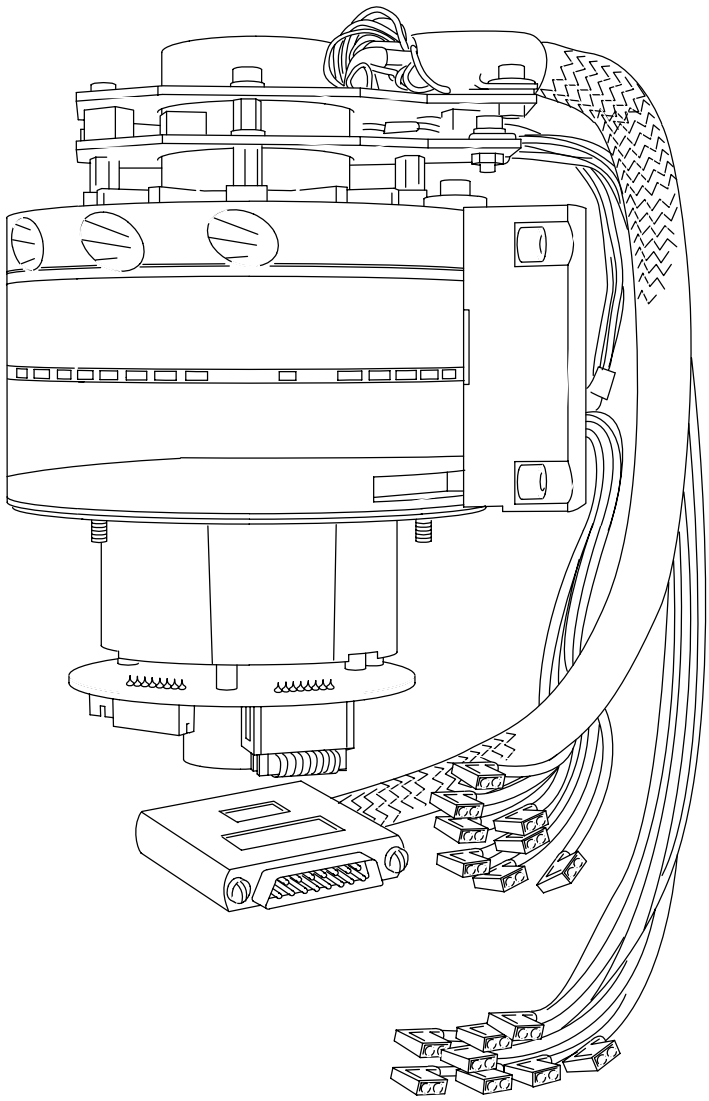


Fig. 109:Scanner assembly

Record Amplifier

The pre-equalized record signal, transferred via a 50 Ω cable to the record buffer BY 5003, passes the rotary transformer.All connections of the rotary transformer (record- part), are first fixed on the connection board BM 5009, then are connected to the record amplifier (hybrid) located on record base board BY 5011.Each record amplifier hybrid is directly connected to the record head or erase head.

Playback Amplifier

The playback signal provided by the playback head passes the low noise pre-amplifier BY 5002 having a balanced output to drive the rotary transformer with a defined symmetrical impedance.After passing the rotary transformer, the play data will be buffered in the playback buffer (BM 5008). Its output signal is transferred via a 50 Ω HF cable to the playback equalizer.

Segmented fields

The recording format is based on a digital segmented-field system with the helical scan technology. That means that only segments of a field of 6 (24/25 Hz) or 5 (60 Hz) clusters of 8 tracks are recorded (see figure LEERER MERKER D-6 track pattern).

With an uncoded bit length of 0.3 µm a cluster of 8 tracks and a length of 150 mm contains the data quantity of 4 Mbit.
300 clusters per second so produce a data quantity of 1.2 Giga bits/s.

The tape wrap angle 180°, so it is necessary that 8 of 16 record heads and 1 of 2 erase heads are located 180° opposite to each other and the same applies to the 8 of 16 play heads.

With one rotation of the headwheel two clusters with 8 tracks will be generated.

So the headwheel rotates with approx. 150 Hz or 9000 revolutions/min for the 300 clusters/s.

The play heads are positioned on the headwheel in a way that they not only serve to playback data but also to monitor the data in record mode.

The record- and playback paths are physically and electrically separated to minimize crosstalk.

Scanner exchange

In case of maintenance the Scanner Assembly should be exchanged by service people only.

1.6.6 CONTROL PANEL DCH 6024 CP

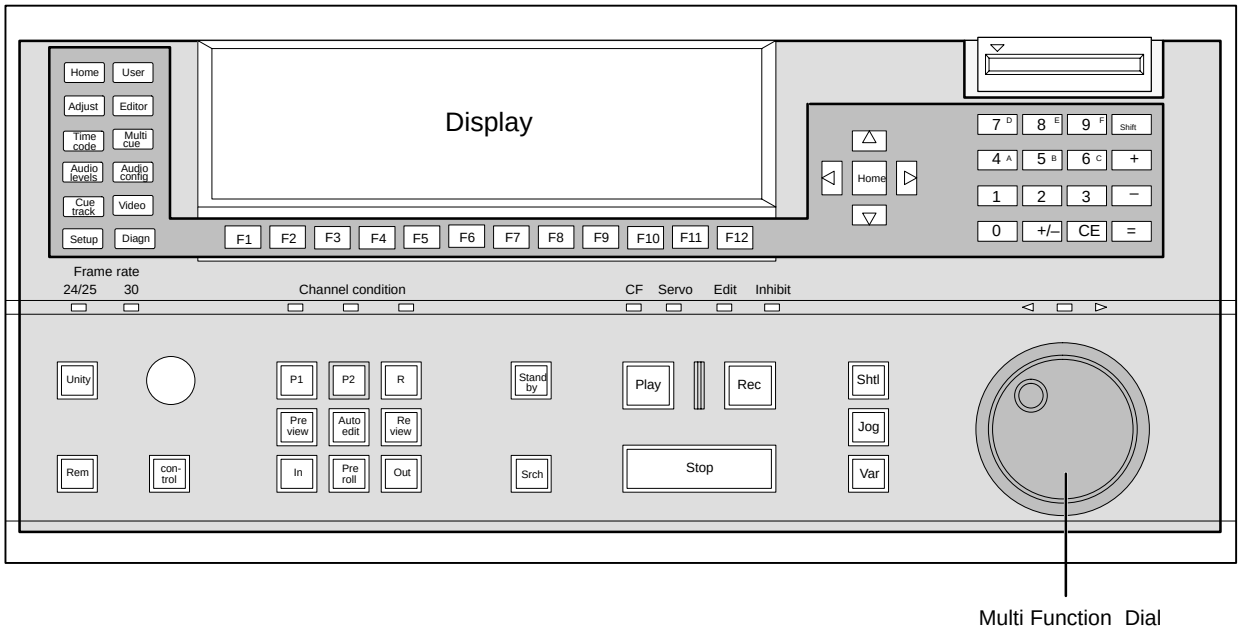


Fig. 110: Control Panel DCH 6024 CP

The control panel software contains features for **DTV** and **data** recorder. depending on system status at power on or switching between DTV and data different menu structure is loaded.

System integration

The Control Panel of the machine can be used either as a local Control Panel or as a remote Control Panel. It connects to Tapedeck via the internal machine communication system (iMCS).

Interface

The interface between the Control Panel and the DMS 6000 consists of a +15V DC supply, a serial high speed data transmission channel and three iMCS address lines.

Display

The display consists of a thin film electroluminiscent device, high voltage MOS driver IC's and a display control logic.
The electrical display interface contains four TTL compatible input signals and the +5V and +15V DC power supply.

1.6.7 DATA SWITCH DSW 6000

The data switch DSW 6000 allows to connect a data and a DTV processor to a DMS 6000 Tapedeck. The switch command is transferred to the data switch via REM3 connector of the tapedeck. All tapedeck signals are switchable between the two different processors:

- Record data
- Play data
- Control signals.

The data switch distributes the remote power on signal from tapedeck to the selected processor, so that only the active processor is powered on.

2. TECHNICAL SPECIFICATIONS

(Status June 2001)

2.1 GENERAL

Dimensions

Tapedeck	width	447 mm / 17.60 inch
	height	397 mm / 15.63 inch
	depth	700 mm / 27.56 inch
DTV – Processor	width	447 mm / 17.60 inch
	height	397 mm / 15.63 inch
	depth	692 mm / 27.25 inch
Data – Processor	width	447 mm / 17.60 inch
	height	220 mm / 8.66 inch
	depth	692 mm / 27.25 inch
Data Switch	width	447 mm / 17.60 inch
	height	88 mm / 3.46 inch
	depth	692 mm / 27.56 inch

Weight

Tapedeck	52 kg approx.
DTV – Processor	52 kg approx.
Data Processor	35 kg approx.
Data Switch	17 kg approx

Voltage supply

Tapedeck, DTV Processor, Data Processor, Data Switch	100V – 240V AC ± 10% switched automatically

Power factor corrected (for the Tapedeck only)	EN61000-3-2	0,9 min.

Power consumption

AC Tapedeck	rated 100 - 240 V	5 - 2.0 A
AC DTV Processor	rated 100 - 240 V	3.5 - 1.8 A
AC Data Processor	rated 100 – 240 V	2.4 – 1 A
AC Data Switch	rated 100 – 240 V	0.6 – 0.25 A
Temperature range	Interchange Edit	+20°C to +35°C
	Interchange Play	+10°C to +35°C
	for storage	–25°C to +70°C
Humidity	non condensing	20% to 80%
Noise intensity (during operation)		< 65 dB(A)

Safety regulations	
Tapedeck	UL 1419 File no. E184475
DTV–Processor	UL 1419 File no. E205276
Data Processor	UL 1950 File no. E159262
Data Switch	UL 1950 File no. E159262
EMC (Electromagnetic compability)	EN 55103–1 EN 55103–2 FCC 47 Part 15 EN 55022/1998
Electromagnetic environment (acc. to EN 55103–1)	E4

Warning:
This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

2.2 TAPEDECK / RECORDING SYSTEM

Tape format	PHILIPS/TOSHIBA	D-6 19 mm (SMPTE 277/278M)
Scanner diameter		96 mm
Cassette sizes	MP tape	L – M – (S)
Recording time	S-type M-type L-type	8 minutes 28 minutes / 215 Gbyte 64 minutes / 491 GByte
Segments per field (8 parallel tracks / cluster) (96 tracks / frame)	Video and Audio	*30 Hz:* 5 *24/25 Hz:* 6
	Data	25 Hz : 6
Audio channels (DTV) (stereo pairs)	editing in pairs	30 Hz*:* 5 24/25 Hz*:* 6
Record heads		2 clusters of 8 (0°/180°)
Play heads		2 clusters of 8 (0°/180°)
Erase heads		2 (0°/180°)
Channel code	randomized	8 – 12
Error correction		Reed Solomon code (2 dimensional)

Longitudinal tracks		Control, Time code, Audio cue
Head to tape speed		~46 m/s
Tape speed		~497 mm/s
Winding speed		20 times normal speed
Servo lock time	< 6s from stop	< 2s from stand by
Edit accuracy (DTV)	with Tape Timer	± 1 frame
	with time code	0 frame
Slow motion (DTV)	within video specification	– 0.25 to + 0.25
Visible search (DTV)	audio mute	Up to 15 times normal speed
Audio edit (DTV)	t = 1 field	Cross fade
Control System	protocol	iMCS IEEE 802.3

2.3 DTV SYSTEM

2.3.1 VIDEO

Video Signal Formats (SMPTE 274M)

1920 x 1080 @ 24p 1920 x 1080 @ 23.97p 1920 x 1080 @ 25p	**Progressive modes**
1920 x 1080 @ 24sF 1920 x 1080 @ 23.97sF 1920 x 1080 @ 25sF	**"segmented frame" modes**
1920 x 1080 @ 60i 1920 x 1080 @ 59.94i 1920 x 1080 @ 50i	**2:1 interlace modes**

Following cross play is possible:
Cross play is possible between 25p and 25sf mode.
Crossplay is possible between 25p, sf and 50i mode
Cross play is possible between 60i and 59.94i mode.
Cross play is not possible between 60, 59.94 interlace and progressive / segmented frame modes

from mode	**to mode**					
	23.97p	24p	25p	23.97sf	24sf	25sf
23.97p		ok	ok	ok	ok	ok
24p	ok		ok	ok	ok	ok
23.97sf	ok	ok	ok		ok	ok
24sf	ok	ok	ok	ok		ok

Remark: Crossplay from 25p, sf to 24 p, sf only possible for video

Timecode in crossplay mode
In crossplay modes 24p, sf and 25p, sf a switchable timecode conversion is implemented. This allows to playback 24p, sf tapes in a 25p, sf mode and vice versa.

Sampling Frequency

Luminance Y	74.25 MHz 74.25/1.001 = 74.1758 MHz
Chrominance C_R, C_B	37.125 MHz 37.125/1.001 = 37.0879 MHz

Quantization

Luminance Y	10 Bits 24/25 fr/sec modes 8 Bits 30 fr/sec modes
Chrominance C_R, C_B	8 Bits

SIGNAL INPUT / OUTPUT

Digital Serial	SMPTE 292M / BNC	
Synchronization	Video IN OUT, trilevel sync	internal/external
Trilevel Sync	±0.3 V_{pp} / 75 Ω	

VIDEO MONITORING OUT (@ 75Ohms):
(Measuring at SDI Input to Video Monitor Output)

Video level (Color Bar)	Y, Pr, Pb, R, G, B	0.7V ±0.5dB
Frequency response (Multiburst)	Y	0...25MHz: ±0.5dB ...30MHz: +0.5dB, –2dB
	Pr, Pb	0...13MHz: ±0.5dB ...15MHz: +0.5dB, –2dB
Signal to noise ratio (Shallow Ramp)	Y, Pr, Pb	less than –52dB
Phase difference (Bowtie)	Y–Pr, Y–Pb	less than 3.5nS
NTSC/PAL SYNC Out (Bowtie)		2Vp-p ±0.5dB @ 75Ohms

2.3.2 AUDIO

30 Frames System: A1 to A10
24/25 Frames System: A1 to A12

Audio standard	special mode for non-audio data	AES/EBU
Sampling frequency		48 KHz
Quantization, digital I/O		20 or 24 bits

Audio Montoring Out Option:
(Measuring at Digital Input to Audio Monitor Output with 4dBu Studio Level)

Item	CH	Specification	Test Signal
Audio level	left	+4dBm, ±0.3dB	1kHz –20dBFS
	right	+4dBm, ±0.3dB	1kHz –20dBFS
Frequency response	left	20Hz...20kHz +0.5, –1dB	20Hz –20dBFS
			1kHz –20dBFS
			20kHz –20dBFS
	right	20Hz...20kHz +0.5, –1dB	20Hz –20dBFS
			1kHz –20dBFS
			20kHz –20dBFS
Dynamic range	left	more than 92dB	1kHz –0dBFS and Silence
	right	more than 92dB	1kHz –0dBFS and Silence
Distortion	left	less than 0.05%	1kHz –10dBFS
	right	less than 0.05%	1kHz –10dBFS

2.3.3 CUE AUDIO

Analog Audio Monitoring Option

Cue output switched to A1 to A10 (A12) in case of variable speed modes

Frequency response	10 Hz to 12 KHz	± 3 dB
Signal to noise ratio	from 3% distortion	more than 44 dB
Distortion	at 0 VU	<1.2%
Wow and flutter	NAB unweighted	<0.2%
Monitor output level, switchable Analog Audio Monitoring Option	Low imped. balanced for Operating Level = –20 dB FS	–3, 0, +4, +8 dBu
Headset output	8 Ω unbalanced	variable

Note:

Operating level (analog audio) 0 VU = 125 nWb/m (–9dB below peak level)
Peak level (analog audio) +9 dB = 352 nWb/m
Peak level (analog audio) +8 dB = 314 nWb/m

2.3.4 CONTROL

Control System	protocol	iMCS IEEE 802.3

2.4 DATA SYSTEM

2.4.1 DATA INPUT / OUTPUT

HIPPI	Duplex, Hippi serial optical acc. to following standards (or equiv.):	
Hippi framing protocol specification		IEC 11518–2
Hippi serial specification		ANSI X3.300–1997
FIBRE OPTIC CABLE		
Type		50/125 MMF
Length		500 m max.
TYPICAL DATA RATES		
Net data rate		100 MBytes/sec.
Typical acheivable data rates:		
Telecine	SPIRIT / SPECTER	approx. 60 MBytes/sec
TransferEngine on SGI platform	OCTANE	approx. 60 MBytes/sec
	ONYX 2000	approx. 85 MBytes

A Transfer rate of approx 60 MBytes will lead to the following typical telecine speeds:

2k (2048 1556)	4 – 5 frames / sec
HDTV (1920 x 1080)	8 frames / sec

Note:
The net data rate is specified in the Hippi standard with 100 MBytes and includes handshake signals which will use some percents of transfer traffic and decreases the net data rate by this amount. The typical data transfer rate depends on the performance of the workstation and may vary depending on actual configuration.

2.4.2 DPX MONITORING

SIGNAL	XGA–2 standard R,G,B, HD, VD
Resolution	1024x768
Frame rate	80 Hz
Supported DPX modes	3 x 8 bit RGBK 3 x 10 bit RGB 3 x 10 bit exp. to 16 bit 2 x 16 bit Y only 3 x 10 bit Y only
DPX resolutions	256 x 256 to 2048 x 1556 Pixels

2.4.3 CONTROL

Control System	protocol	iMCS IEEE 802.3

2.5 INPUTS / OUTPUTS

2.5.1 TAPEDECK DMS 6000

TIME CODE

Input		XLR / male
Output		XLR / female

REMOTE

Remote 1, RS-422 ES-bus	IN (Tributary)	2x D-Sub, 9 pole / female loop through
Remote 2, RS-422A	IN	1x D-Sub, 9 pole / female
(SONY Protocol)	OUT	1x D-Sub, 9 pole / female
Remote 3,	Data switch	D-Sub, 25 pole / male
iMCS	loop through	2x BNC
Protective ground (PE)	cabinet ground	screw & socket

SERVICE

RS 232C		D-Sub, 9 pole / female
Waveform monitor	Waveform Signal	BNC
	Trigger	BNC

GROUNDING

Protective ground (PE)	cabinet ground	screw & socket
Technical ground (TE)	video ground	screw
	audio ground	screw

MAINS

Mains IN connector	Tapedeck rear	3 pole, according to IEC-320, CEE 22 max. 10A
Mains switch (Power on)	Tapedeck front	low voltage
Mains fuses	Tapedeck	2x Fuses T6.25A/250V (6x32) UL-listed

2.5.2 DTV PROCESSOR DTV 6024

VIDEO INPUTS

Digital serial	SMPTE 292M	BNC active loop trough
Synchronization	Video IN OUT, trilevel sync	internal/external

VIDEO OUTPUTS

Digital serial	SMPTE 292M	3x BNC
Video Monitoring Out	Y / C_b / CR, S	BNC
(with character insertion)	or R / G / B / S	
NTSC/PAL SYNC Out		BNC

AUDIO INPUTS

Digital (AES/EBU)	one audio pair per connector	
30 fr/sec systems		5x XLR/female
24/25 fr/sec systems		6x XLR/female

AUDIO OUTPUTS

Analog Audio Monitoring	switchable	2x XLR / male
(Analog Audio MonitoringOption)		
Headset		∅6mm, Phone jack
Digital (AES/EBU)	one audio pair per connector	
30 fr/sec systems		5x XLR/male
24/25 fr/sec systems		6x XLR/male
Sampling		
frequency reference	48 KHz	BNC

REMOTE

iMCS	loop through	2x BNC

MAINS

Mains IN connector	Processor rear	3 pole, according to IEC-320, CEE 22 max. 10A
Mains Fuses	Processor	Breaker automatic

GROUNDING		
Protective ground (PE)	cabinet ground	screw / socket
Technical ground (TE)	video ground	screw
	audio ground	screw

2.5.3 DATA PROCESSOR DDP 6128

OPTICAL INPUT/OUTPUT		
Hippi		SC duplex
DPX MONITORING		
XGA Out		D-Sub, 15 pole HD / female
REMOTE		
iMCS	loop through	2x BNC
Network (future option)		RJ 45
MAINS		
Mains IN connector	Processor rear	3 pole, according to IEC-320, CEE 22 max. 10A
Mains Fuses	Processor	Breaker automatic
GROUNDING		
Protective ground (PE)	cabinet ground	screw / socket
Technical ground (TE)		screw /socket

2.5.4 DATA SWITCH

MAINS		
Mains IN connector	Processor rear	3 pole, according to IEC-320, CEE 22
Mains Fuses	Processor	Breaker automatic
GROUNDING		
Protective ground (PE)	cabinet ground	screw / socket
Technical ground (TE)		screw /socket

3. INSTALLATION

This section describes the following items:

- Unpacking and repacking
- Mechanical dimensions
- Ventilation
- Mounting

Attention! ***For initial installation of the DCR 6024 / 6128 / 6000, observe the order of the following sections.***

3.1 UNPACKING AND REPACKING

The Tapedeck (including the Control Panel) and the Processor(s) are supplied separately in two (three) stable cardbord packages.

For unpacking, first remove the straps around the packing.

Subsequently open the cardboard box.

After having removed the foam parts, lift the Tapedeck (Processors) out of the packing.

Check that all parts are delivered.

The Tapedeck packing contains the standard accessories comprising the following parts:

- Cable set for internal connection (Tapedeck – Processor– Data switch and power cords)
- Service tools
- Memory card
- Customer's Manual comprising Planning & Installation and Operating Instructions

Please keep the packaging. The DCR 6024/6128/6000 **must only** be sent back in this original packaging, e.g. for servicing.

Information for transport:

The Tapedeck has a weight of approx. 52 kg.
The DTV Processor has a weight of approx. 52 kg (with cable)
The data processor has a weight of approx. 35 kg.
The data switch has a weight of approx. 17 kg.

Four handles on each module are available for convenient transportation.

3.2 MECHANICAL DIMENSIONS

The **DCR 6024** requires a minimum space of 447 x 700 mm at a height of 800 mm or 18 rack units (RU) of 19 inch cabinet.

Additional space for ventilation or rack mount kit is required.

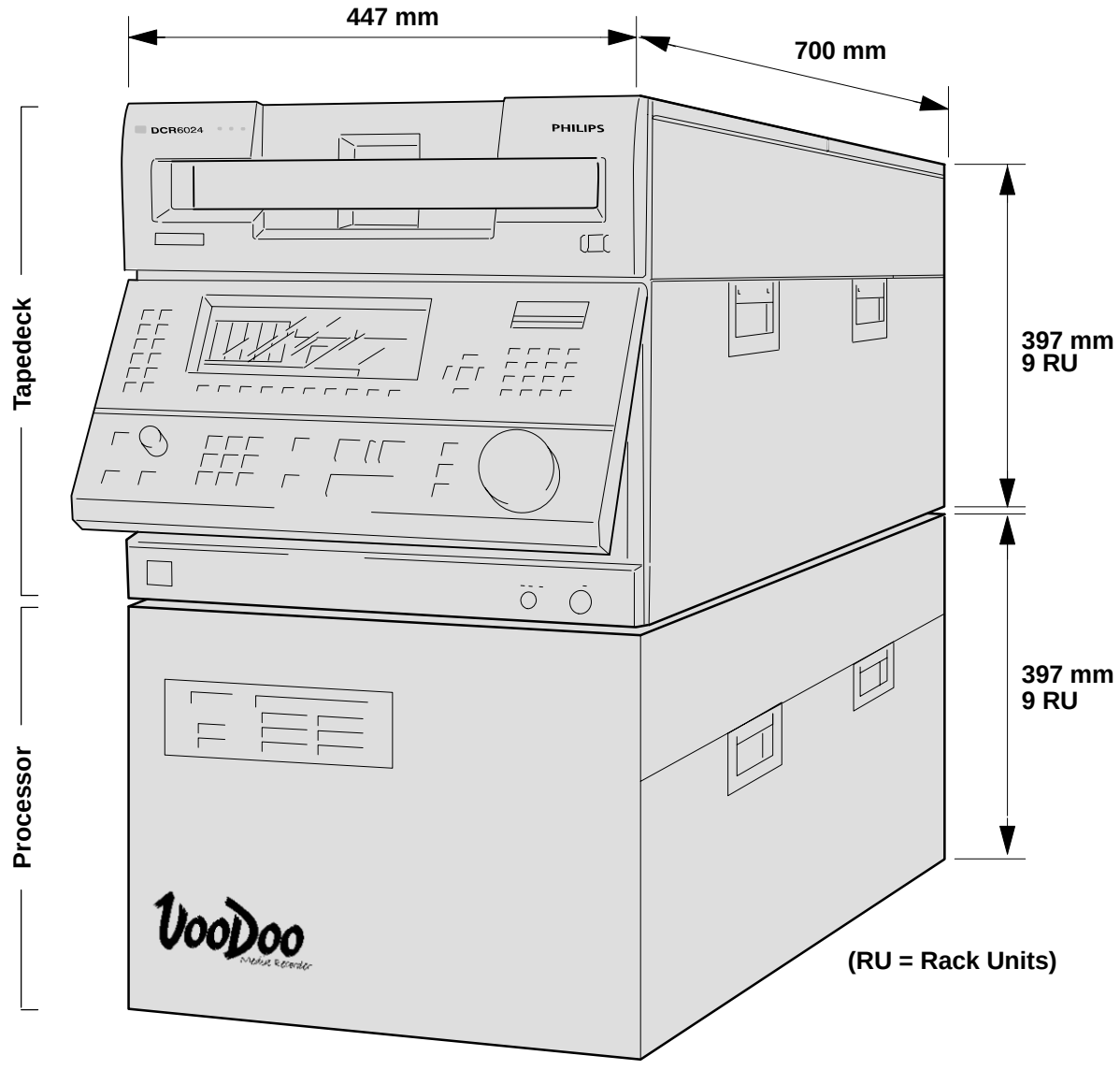


Fig. 301: DCR 6024 dimensions (without required air inputs for a 19 inch cabinet mounting)

The **DCR 6128** requires a minimum space of 447 x 700 mm at a height of 500 mm

or 14 rack units (RU) of 19 inch cabinet. Additional space for ventilation or rack mount kit is required.

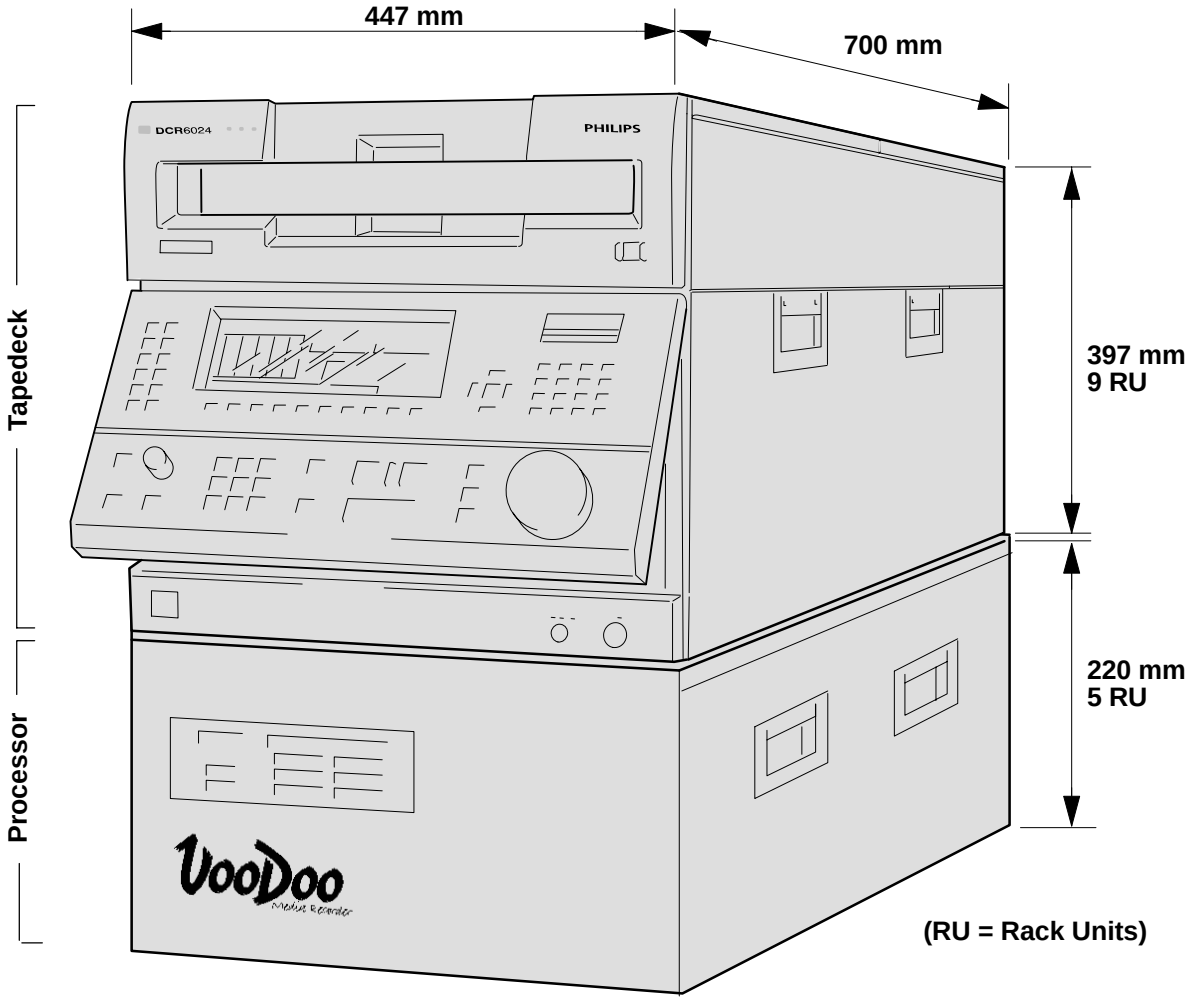


Fig. 302: DCR 6128 dimensions (without required air inputs for a 19 inch cabinet mounting)

The **DCR 6000** requires a minimum space of 447 x 700 mm at a height of 1110 mm

or 25 rack units (RU) of 19 inch cabinet. Additional space for ventilation or rack mount kit is required.

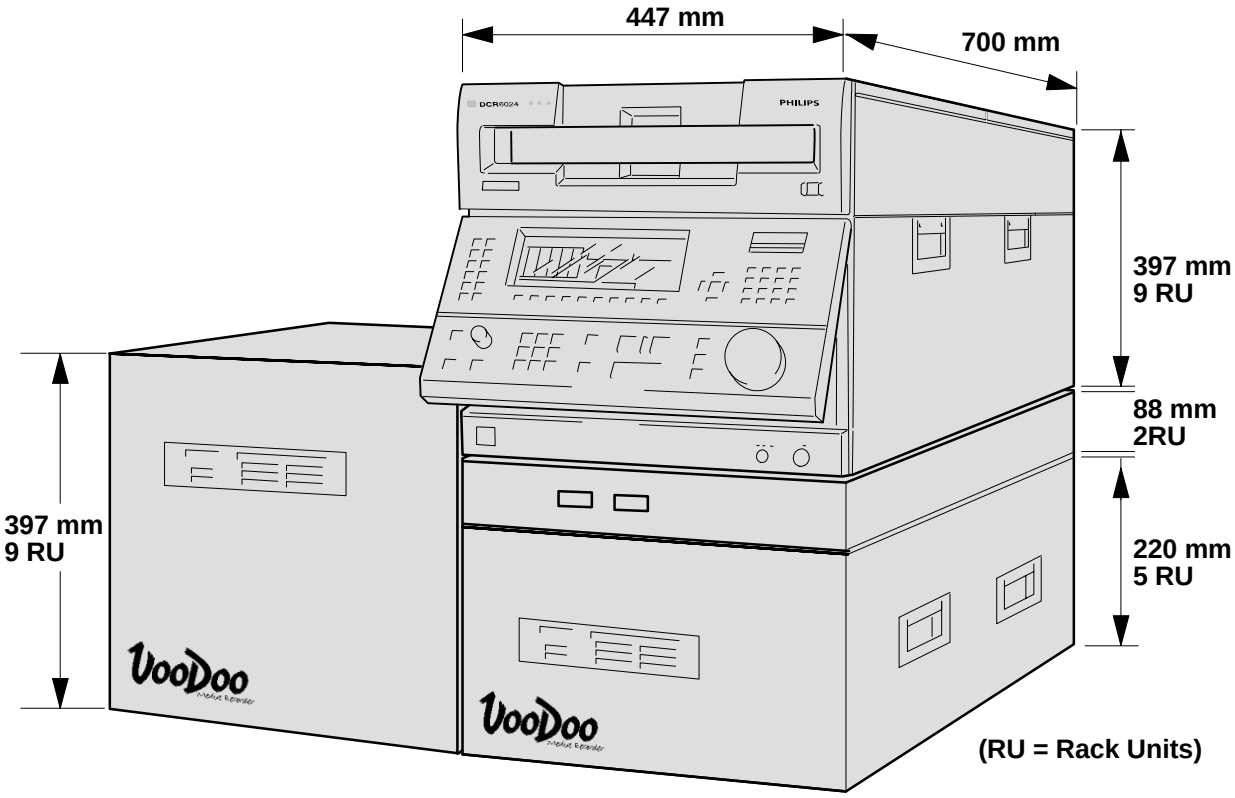


Fig. 303: DCR 6000 dimensions (without required air inputs for a 19 inch cabinet mounting)

3.3 VENTILATION

The ambient temperature during operation must not exceed or fall below the range of + 10 ° C to +35° C. Optimum operation is at an ambient temperature of 25 °C +/– 5 ° C (see the technical data).

The blowers support the air circulation in the respective unit and lead the heated air into the room.

When installing the DCR 6024/6128/6000, care should be taken not to cover the fresh air entries.

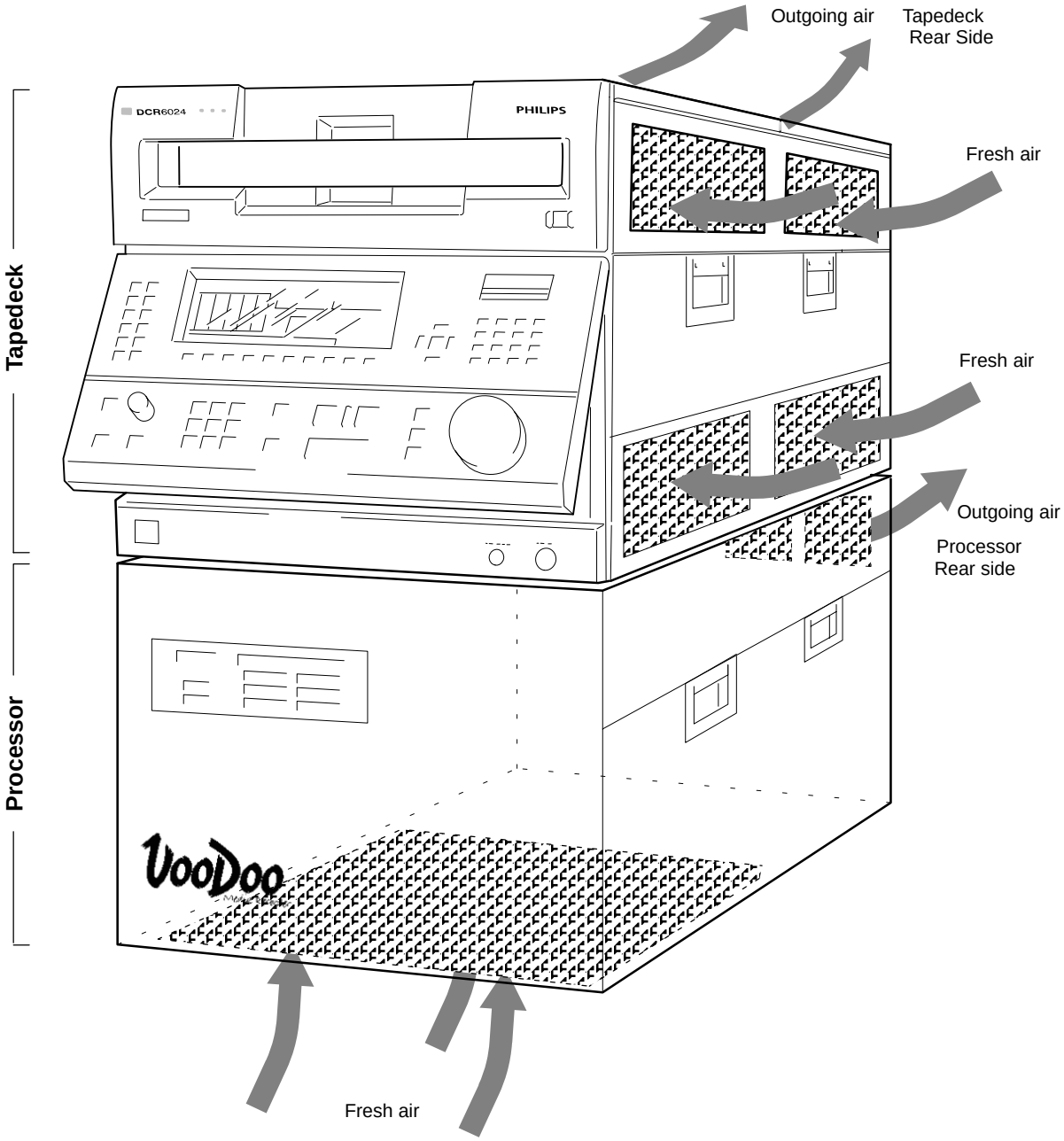


Fig. 304: Ventilation of DCR 6024

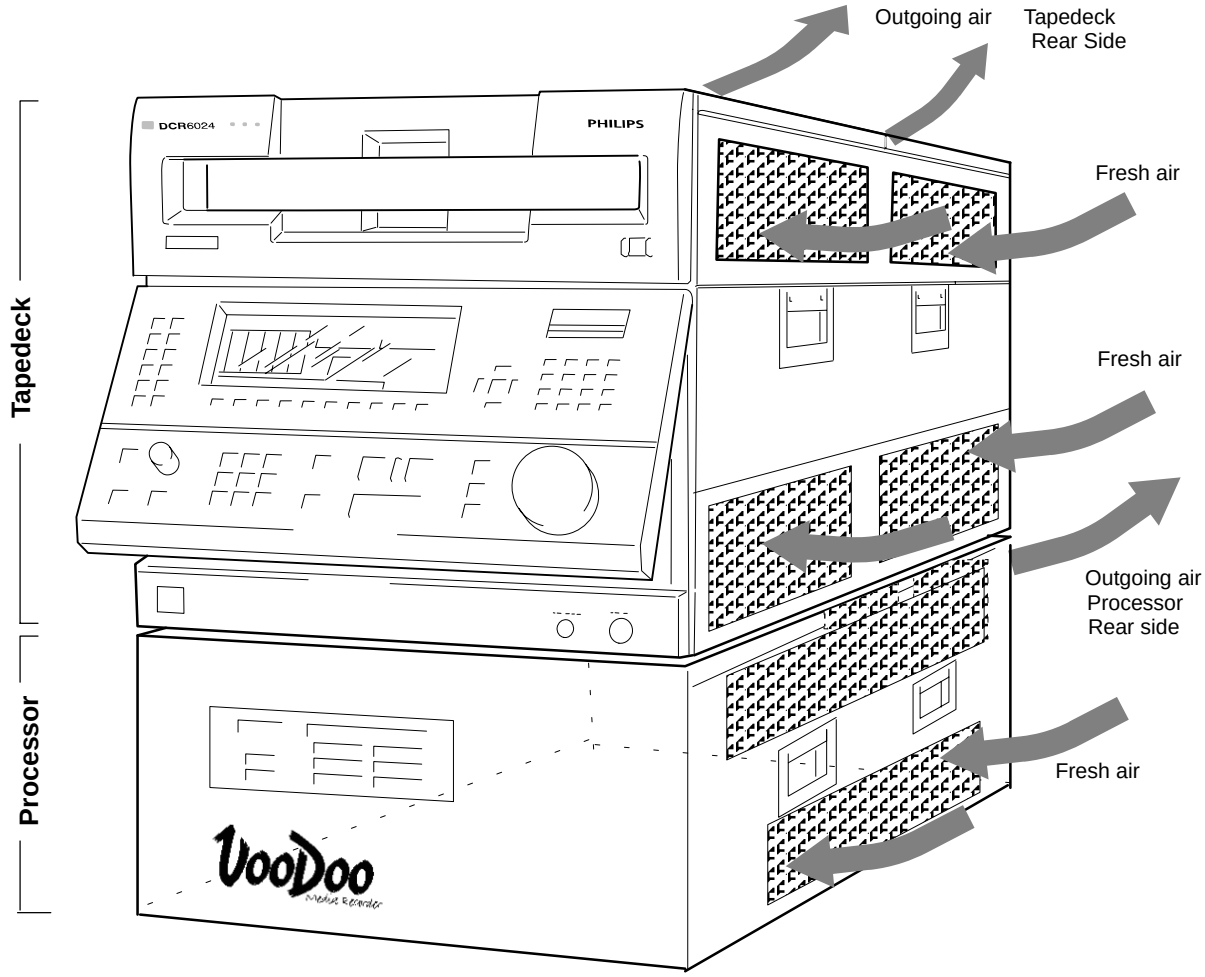


Fig. 305: Ventilation of DCR 6128

Tapedeck

Fresh air for the Tapedeck is supplied from the right side. Behind the air entries, filters are located for filtering the fresh air. The heated air is blown out to the rear.

The Tapedeck is provided with four fan units 1 – 4.
The fan plug-in unit 1 comprises three fans and ventilates the p.c. boards behind the door (see the figure).
The fan plug-in unit 2 comprises one blower and ventilates the vertically arranged p.c. boards in the upper rear part.
Fan units 3 and 4 cool the Tapedeck mechanism.

DTV Processor

The fresh air to the DTV Processor is supplied from below. Behind the air entry, a filter is located for filtering the fresh air. The heated air is blown out to the rear.

The Processor is provided with a fan plug-in unit comprising four blowers to remove the heated exhaust air out of the Processor.
The fresh air circulates along at vertically arranged p.c. boards and leaves the device at the rear.

Data Processor

The fresh air to the Data Processor is supplied from the right side. Behind the air entry, a filter is located for filtering the fresh air. The heated air is blown out to the rear.The Processor is provided with a fan plug-in unit comprising three blowers to remove the heated exhaust air out of the Processor.
The fresh air circulates along at horizontally arranged p.c. boards and leaves the device at the rear.

Data Switch

The fresh air to the Data Switch is supplied from the right side. The heated air is blown out to the rear.The Switch is provided with a fan to remove the heated exhaust air out of the Switch.
The fresh air circulates along at horizontally arranged p.c. board and leaves the device at the rear.

3.4 MOUNTING

There are different ways to install or mount the DCR 6024/6120/6000. In this section, the following possibilities are described:

- Mounting Tapedeck on Processor DCR 6024 / DCR 6128
- Mounting version s of DCR 6000
- Mounting into a 19 inch cabinet

For the future is planned to allow the Control Panel to be remoted from the Tapedeck.

- Installing the Control Panel as a remote panel **(in preparation!)**
- Installing the Control Panel as a local panel (delivery state)

ATTENTION!
When installing the DCR 6024/6128/6000, care should be taken not to cover the fresh air entries to ensure optimum air circulation! See section 3.3 "Ventilation".

3.4.1 MOUNTING TAPEDECK ON PROCESSOR

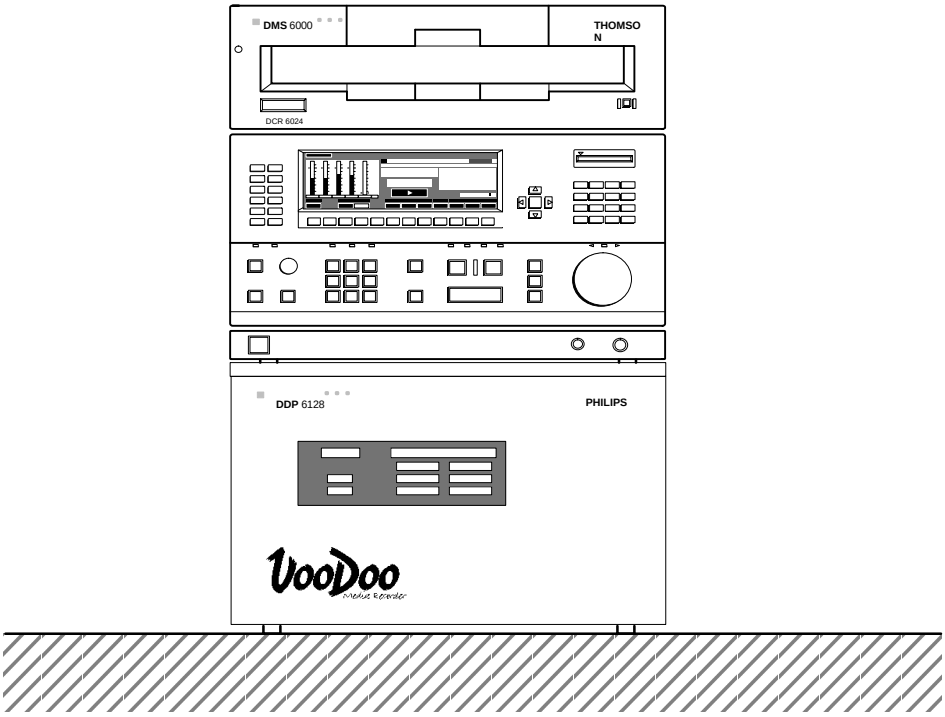


Fig. 306: Mounting Tapedeck on Processor

The Control Panel is already mounted to the Tapedeck when delivered.

The cover of the Processor is provided with four holes for fastening the Tapedeck. The right rear hole has a locking facility which automatically locks when inserting and sliding the Tapedeck.

Mounting has to be made as follows:

1. Place the Tapedeck onto the upper side of the Processor. Make sure that the stands of the Tapedeck fit into the holes in the cover of the Processor.
2. Slide the Tapedeck to the front until the right rear locking facility at the Processor automatically locks.
   Note:
   Unlocking is made by means of a lever, top left at the rear on the Processor.

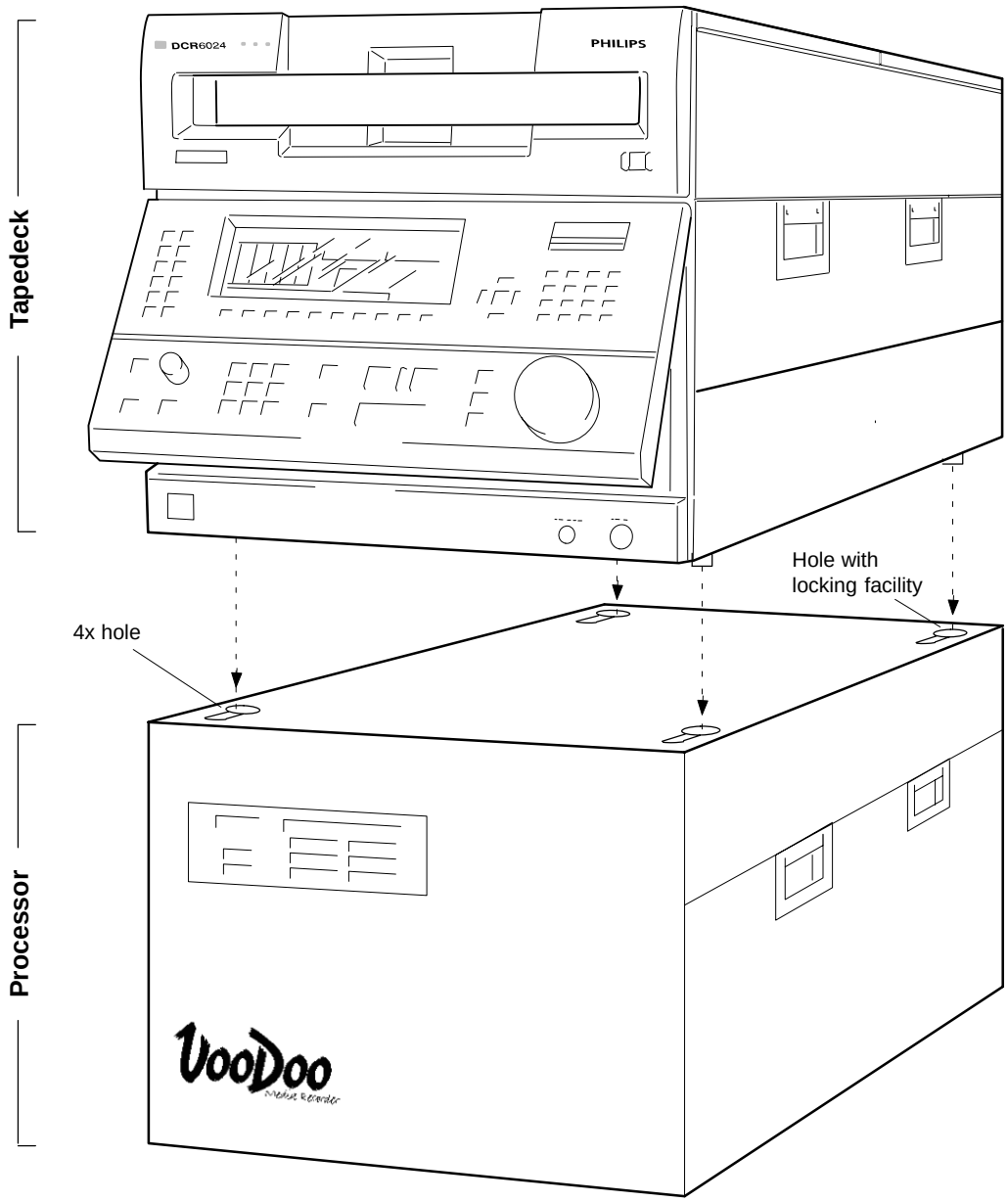


Fig. 307: Mounting DCR 6024

3.4.2 MOUNTING TAPEDECK AND PROCESSOR SIDE BY SIDE

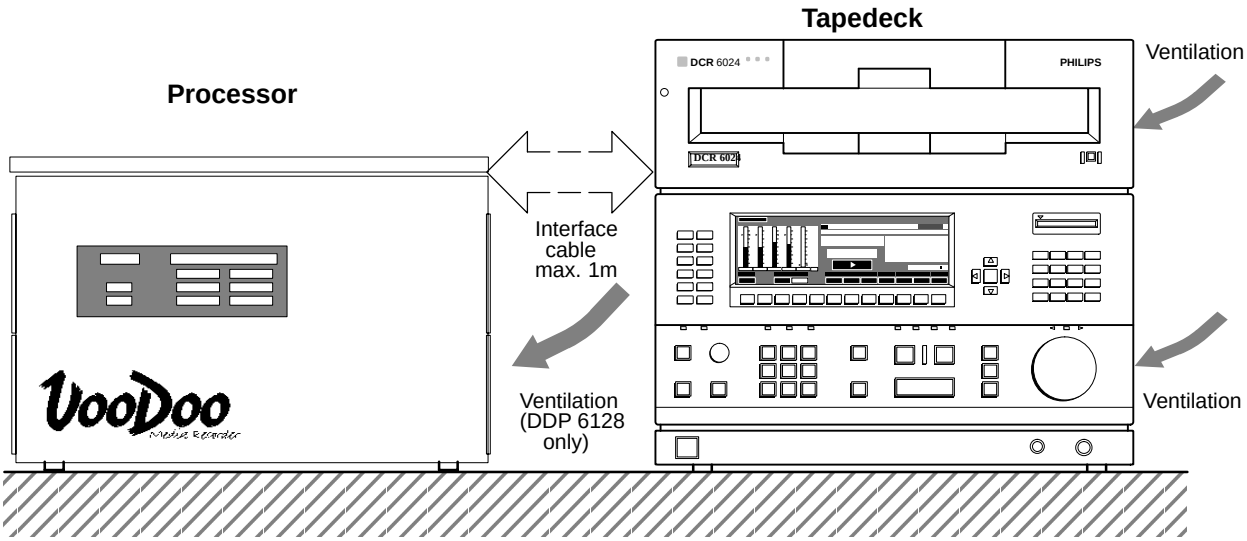


Fig. 308: Side by side mounting

The modules Tapedeck and Processor can be also arranged side by side with a space given by the digital interface cable length of 1m at maximum.

ATTENTION! **Take care of space for ventilation!**

3.4.3 MOUNTING VERSIONS OF DCR 6000

There are two different ways to install the DFA recording system DCR 6000. First is one stack, the second is using one stack for tapedeck and data processor and a second stack for the DTV processor.
In each configuration the DFata switch should be located under the tapedeck:

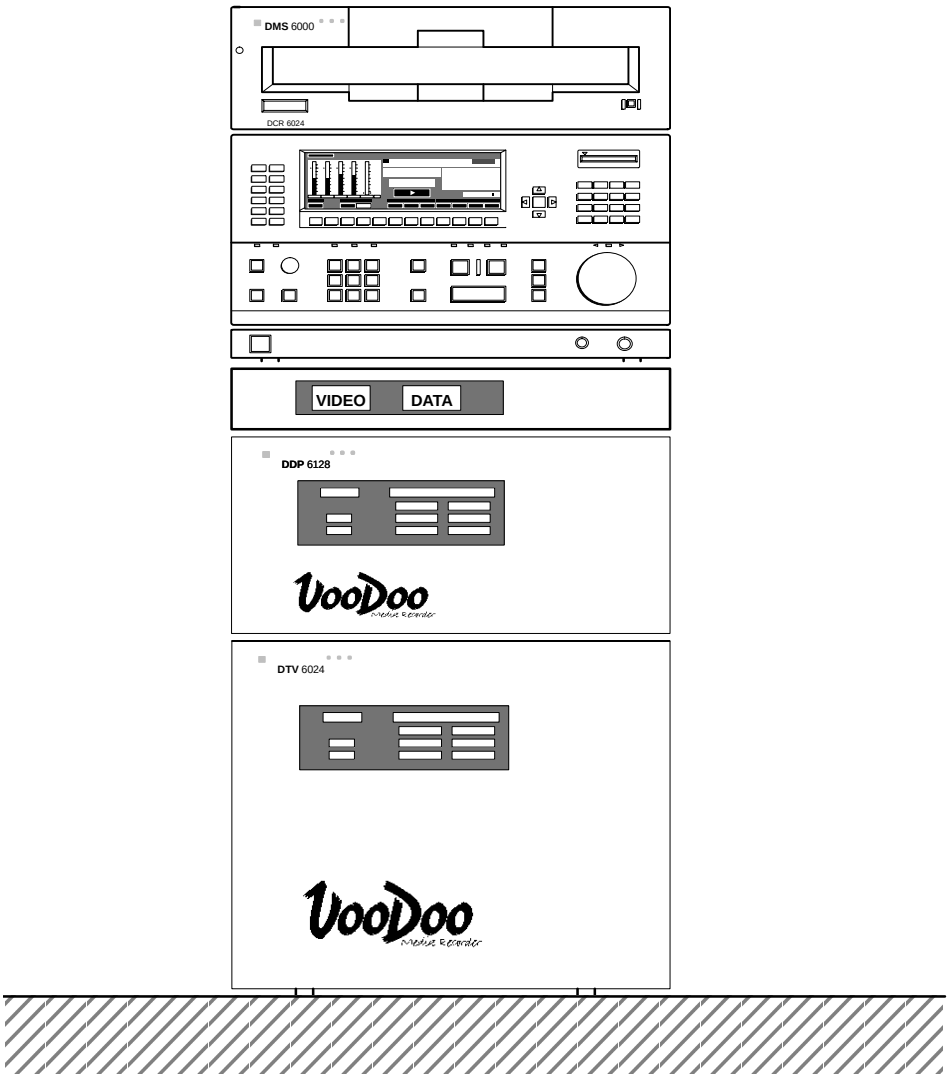


Fig. 309: Mounting DCR 6000 in one stack

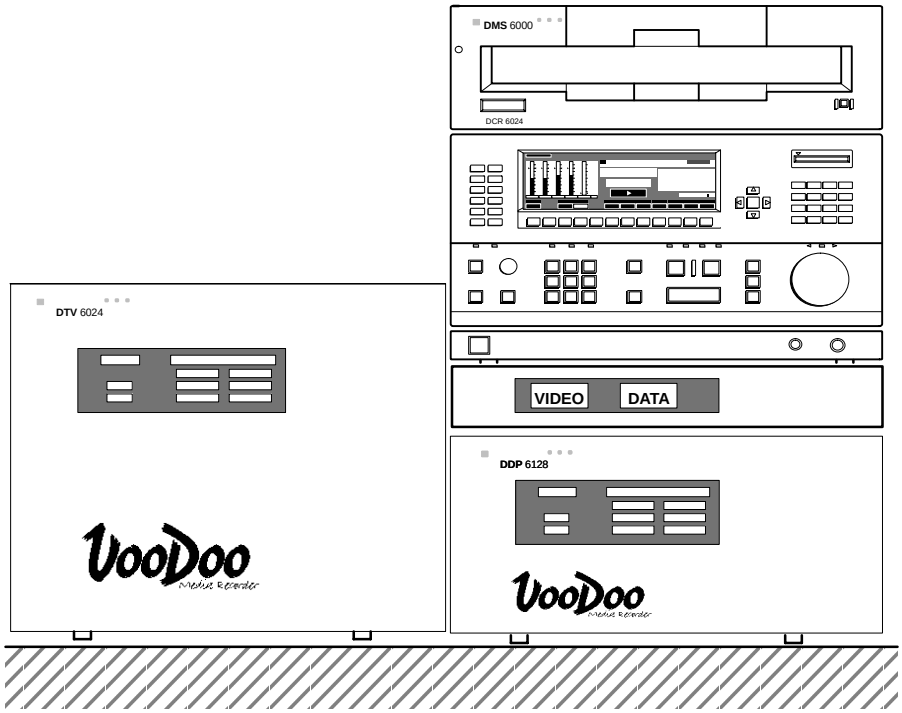


Fig. 310: Mounting DCR 6000 in two stacks

Data Switch

The Data Switch DSW 6000 was designed to use only in combination with a DMS 6000 tapedeck and a processor DDP 6128 or DTV 6024.

3.4.4 MOUNTING INTO A 19-INCH CABINET

19-inch rack mount kits are provided for mounting the Processors and the Tapedeck into a 19-inch rack cabinet and allows sliding out the Tapedeck for service and maintenance works:

designation	**19-inch rack mount kit for Tapedeck DMS 6000**
type	**BD 5197-2**
order number	**0 175 602 211**

designation	**19-inch rack mount kit for DTV Processor DTV 6024**
type	**BD 5198**
order number	**0 175 602 310**

designation	**19-inch rack mount kit for Data Processor DDP 6128**
type	**BD 5199**
order number	**0 175 602 410**

THOMSON recommends cabinets with a mounting depth of **900 mm**.

The maximum mounting height depends on the selected version and configuration.

3.4.4.1 SAFETY HAZARDS

- **Prior to mounting the rack mount kit into a 19-inch rack cabinet, secure the cabinet against overturning (e.g. fasten it on the floor).**

- In order to ensure free air circulation, make sure that the fresh air entry on the front, bottom and right side and the outlet of the warmed air on the rear side are not obstructed.

For mounting the DCR 6024 into a 19-inch rack cabinet use the separate description “Mounting Instruction for DCR 6024/6128/6000 into a 19-inch rack cabinet”.

3.4.4.2 Example : DCR 6024 built-in into a 19 inch cabinet

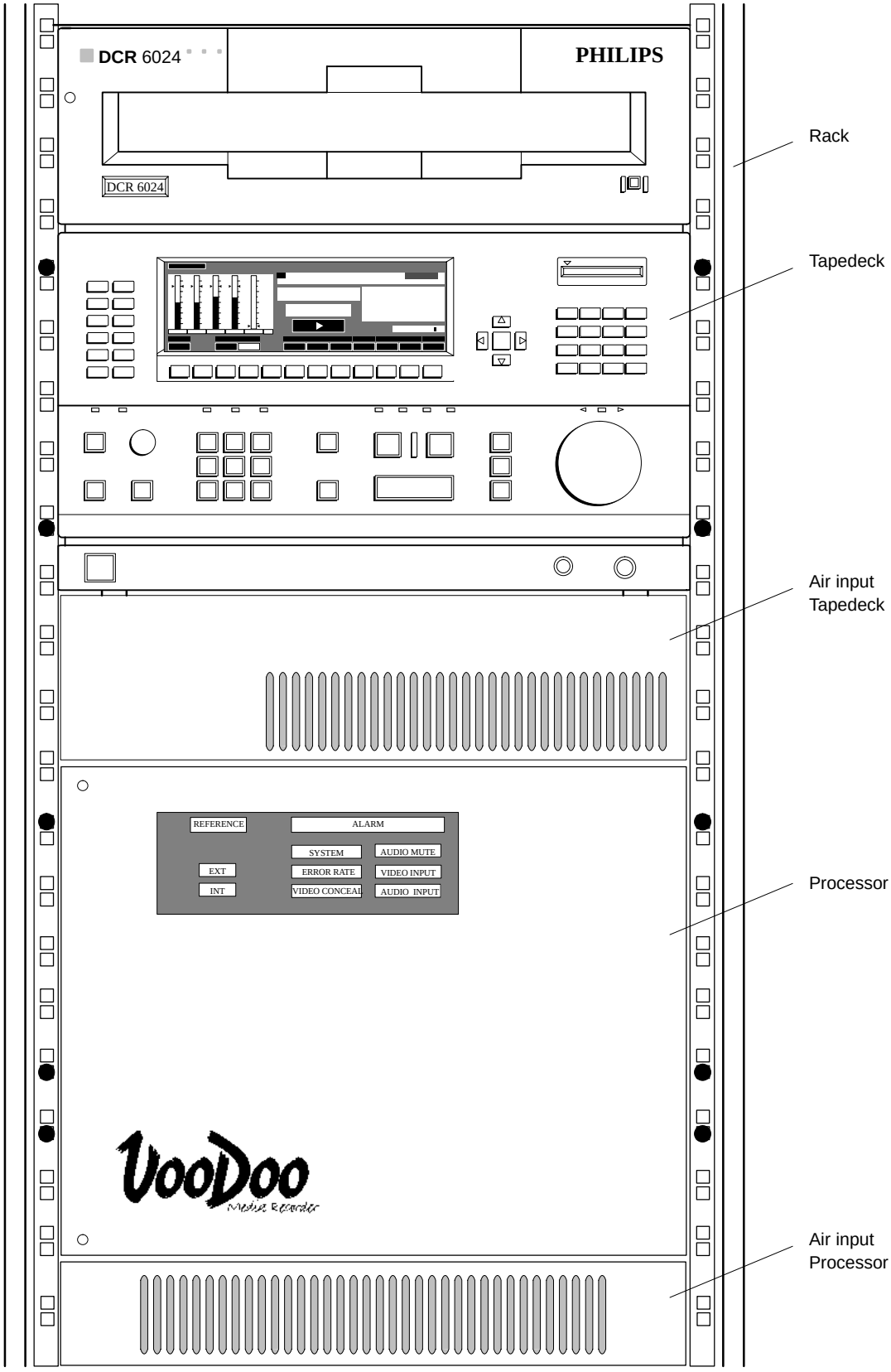


Fig. 311: DCR 6024 built-in into a 19 inch cabinet

3.4.5 INSTALLING CONTROL PANEL AS REMOTE PANEL

(in preparation)

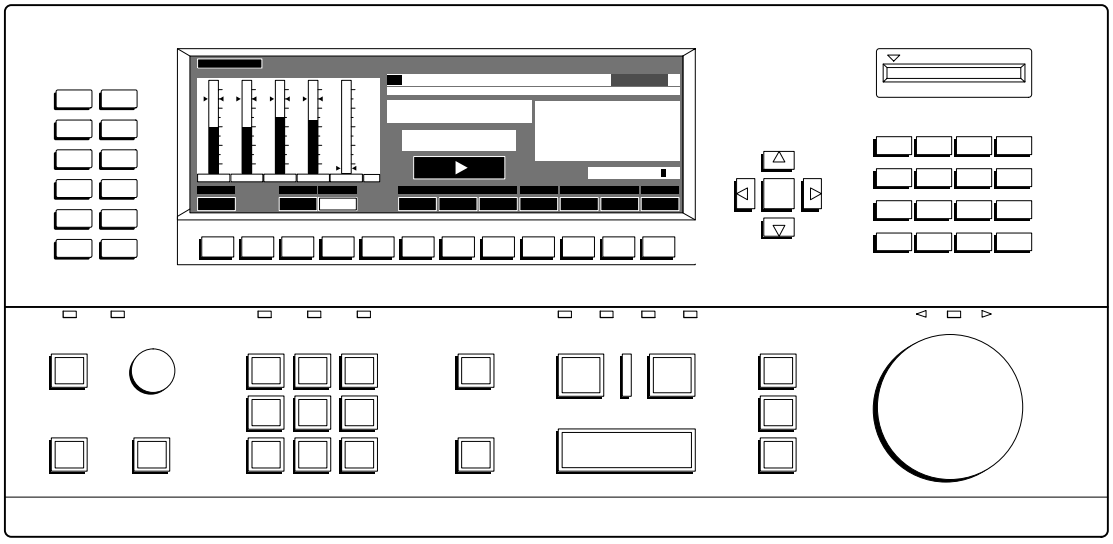


Fig. 312: Control Panel DCH 6024 CP of the DMS 6000, front view

3.4.6 INSTALLING THE CONTROL PANEL AS LOCAL PANEL

Control Panel installation at the Tapedeck for local operation

For local operation, the Control Panel is mounted at the front of the Tapedeck as follows:

1. Open the mounting locks at the upper left and right side of the Panel (fig. **A**.1) by counterclockwise rotation with an appropriate screwdriver or a coin.
2. Push the locking buttons at the lower left and right side of the Panel (fig. **A**.2) and keep them pushed. Place the panel in the mounting brackets (oblique downwards) (fig. **B**.3). Release the locking buttons and slightly tilt the Control Panel up until the locking bolts lock in one of the holes (fig. **B**.2) of the mounting brackets on both sides.
3. Bring the mounting locks (fig. **A**.1) into the holes (if necessary, slightly move the Control Panel up and down) and tighten them by clockwise rotation.
4. Connect the panel at the 15-pin socket and fasten the connector (fig. **C**.1) with a small screwdriver.

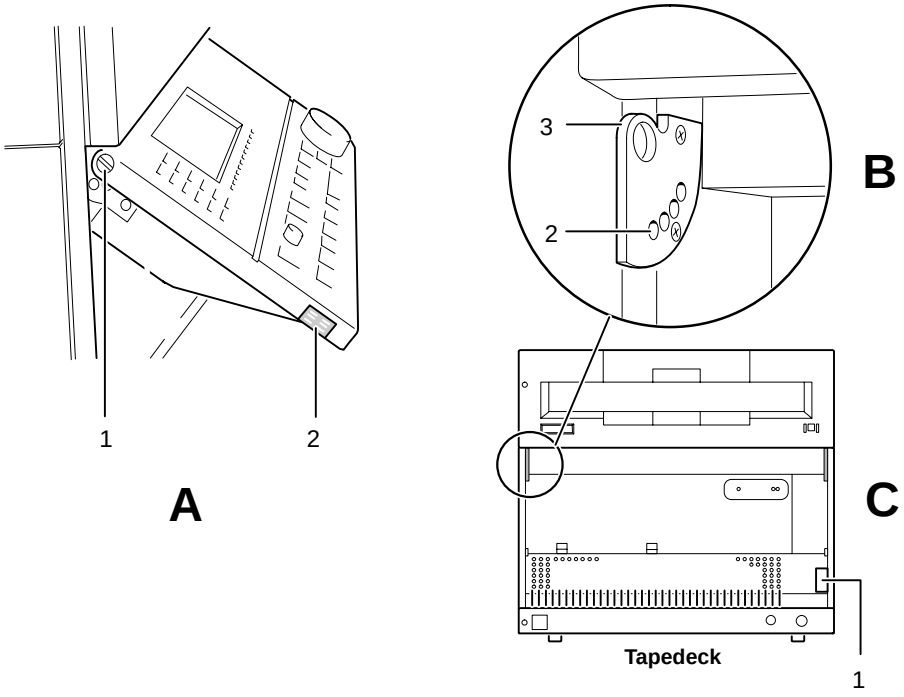
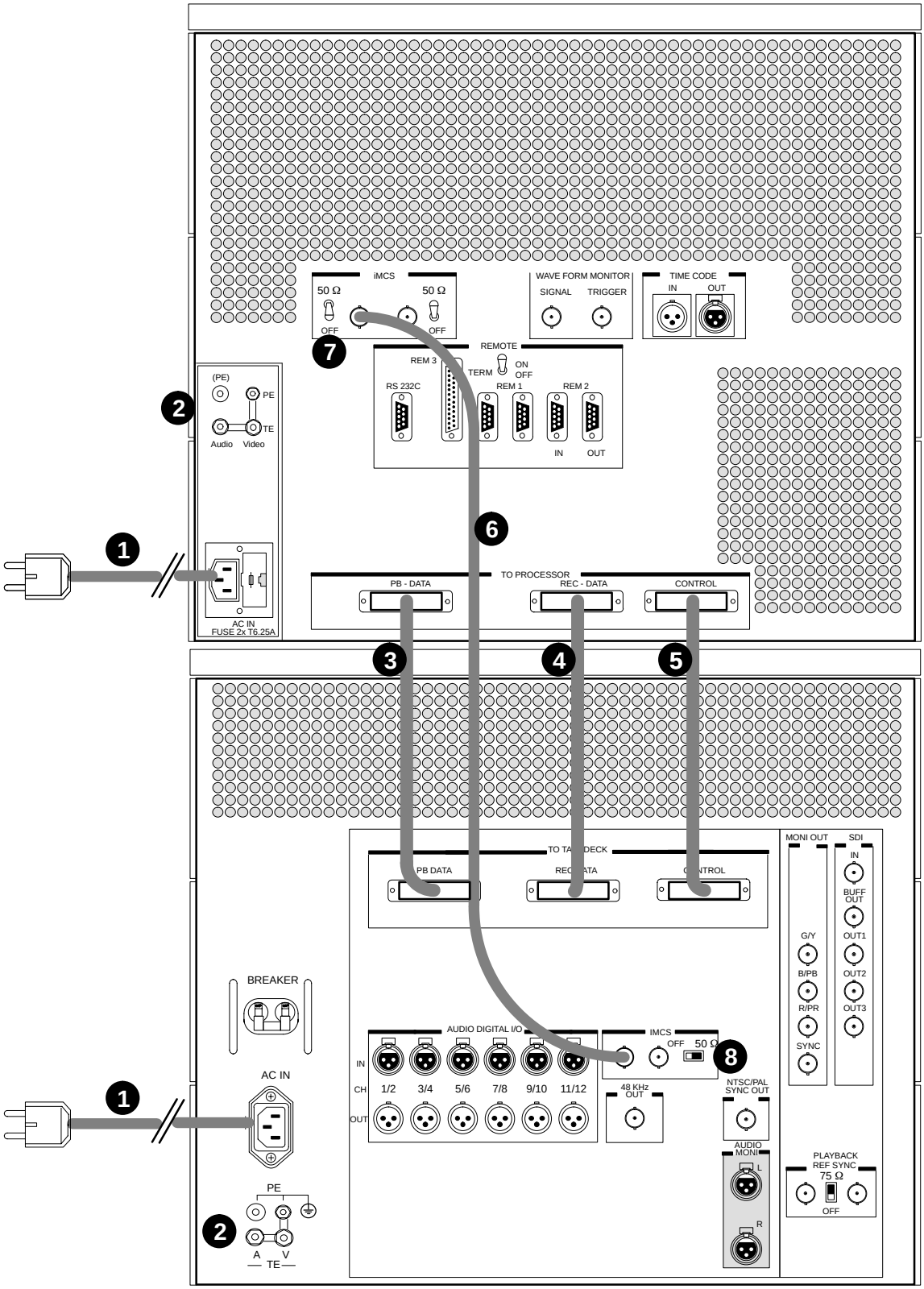


Fig. 313: Mounting the control panel

3.5 STANDARD CONNECTIONS DCR 6024



3.5.1 CONNECT THE CONNECTION CABLES (included in the delivery)

Power connection

Tapedeck and Processor are connected separately to the line voltage.

The Tapedeck , the Processors and the Switch Box include wide-range power supply units of 100V – 240V so that no changeover is required for different line voltages.

Type label

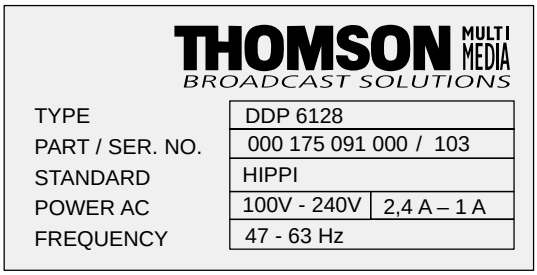


Fig. 314: Type label at the Tapedeck rear

For connecting to power, two cables have to be connected:

Mains cord

2x mains cable

The mains cables ❶ have to be connected to Tapedeck and Processor at the MAINS IN sockets

Earth connection

The protective earth is connected via the available protective contact of the mains connector. The mains cable, however, must be plugged into an earthing-contact type socket **only**.

Tapedeck and Processor are provided on the rear with separate terminals for connecting protective earth (PE) and technical earth (TE) ❷.

Details about these connection facilities are contained in the section 4.5.1.1 ”Grounding of the Tapedeck” and section 4.6.1.1 ”Grounding of the Processor”.

When the device is delivered, the terminals PE and TE are joined by jumpers. These jumpers have only to be broken for separate technical (Video/Audio) earth connections.

The case of the DCR 6024 is always connected to the protective conductor PE.

Any disconnection or break of the protective earth (PE) conductor inside or outside the device may entail that, in the event of a failure, the operational safety of the device will no longer be ensured.

Signal connection

For the data signals between Tapedeck and Processor, the following three cables, supplied with the Processor have to be connected:

1. 50-pole connection cable

   Connect the connection cable ❸ at Tapedeck and Processor to the sockets **PB DATA.**

2. 50-pole connection cable
   Connect the connection cable **4** at Tapedeck and Processor to the sockets **REC DATA.**

Control connection

For control between Tapedeck and Processor, connect the following two cables (included in the delivery):

1. 50-pole connection cable
   Connect the connection cable **5** at Tapedeck and Processor to the sockets **CONTROL.**
2. Cheapernet cable KV 0770
   Connect the Cheapernet cable **6** at Tapedeck and Processor to one of the the two iMCS sockets.
   The associated switch **7** at the iMCS socket of the Tapedeck has to be set to **OFF.**
   The switch **8** at the iMCS socket of the Processor has to be set to **50** Ω.

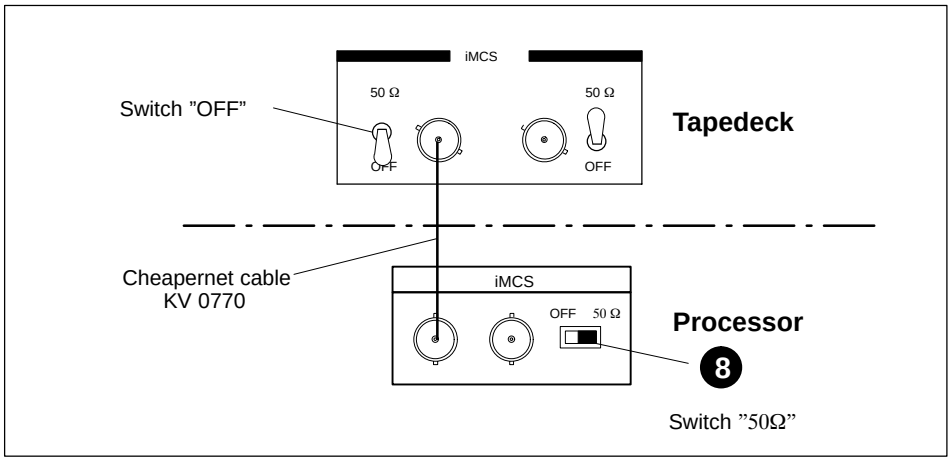


Fig. 315: Cheapernet connection

External connection

The individual external connections are described in the section 6 ’Connections’. Connection facilities or connection proposals are contained in the section 4 ’System Configuration’.

3.6 STANDARD CONNECTIONS DCR 6128

Connect the inputs and outputs for data and DPX monitoring and iMCS

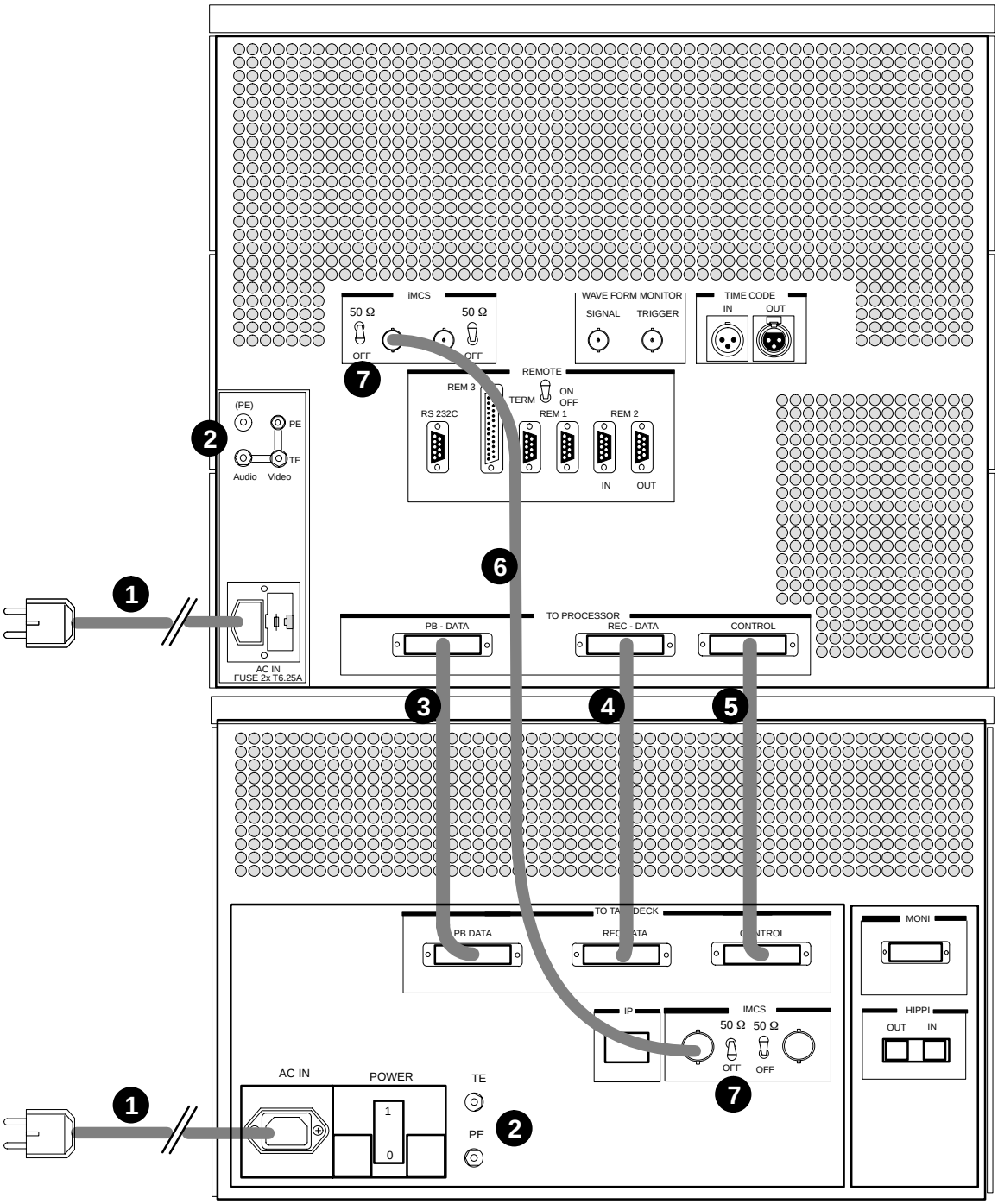


Fig. 316: Standard connections DCR 6128

3.6.1 CONNECT THE CONNECTION CABLES (INCLUDED IN THE DELIVERY)

Power connection

Tapedeck and Processor are connected separately to the line voltage.

The Tapedeck , the Processors and the Switch Box include wide-range power supply units of 100V – 240V so that no changeover is required for different line voltages.

Type label

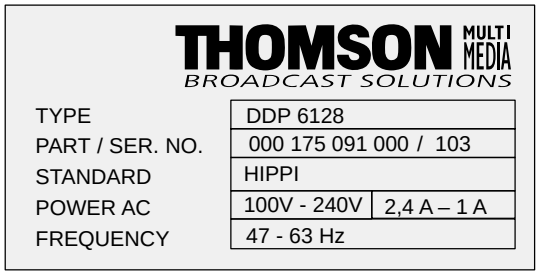


Fig. 317: Type label at the Tapedeck rear

Mains cord

For connecting to power, two cables have to be connected:

2x mains cable

The mains cables (1) have to be connected to Tapedeck and Processor at the MAINS IN sockets

Earth connection

The protective earth is connected via the available protective contact of the mains connector. The mains cable, however, must be plugged into an earthing-contact type socket **only**.

Tapedeck and Processor are provided on the rear with separate terminals for connecting protective earth (PE) and technical earth (TE) (2).

Details about these connection facilities are contained in the section 4.5.1.1 ”Grounding of the Tapedeck” and section 4.6.1.1 ”Grounding of the Processor”

When the device is delivered, the terminals PE and TE are joined by jumpers. These jumpers have only to be broken for separate technical (Video/Audio) earth connections.

The case of the DCR 6128 is always connected to the protective conductor PE.

Any disconnection or break of the protective earth (PE) conductor inside or outside the device may entail that, in the event of a failure, the operational safety of the device will no longer be ensured.

Signal connection

For the data signals between Tapedeck and Processor, the following three cables, supplied with the Processor have to be connected:

50-pole connection cable

Connect the connection cable (3) at Tapedeck and Processor to the sockets **PB DATA**.

50-pole connection cable

Connect the connection cable (4) at Tapedeck and Processor to the sockets **REC DATA**.

Control connection

For control between Tapedeck and Processor, connect the following two cables (included in the delivery):

50-pole connection cable

Connect the connection cable **5** at Tapedeck and Processor to the sockets **CONTROL**.

Cheapernet cable KV 0770

Connect the Cheapernet cable **6** at Tapedeck and Processor to one of the the two iMCS sockets.

The associated switch **7** at the iMCS socket of the Tapedeck and Data Processor have to be set to OFF.

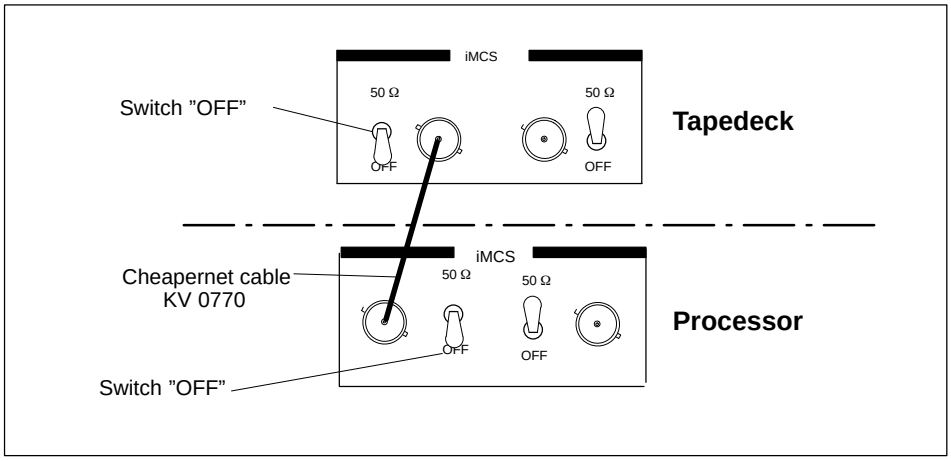


Fig. 318: Cheapernet connection

External connection

The individual external connections are described in the section 6 ’Connections’. Connection facilities or connection proposals are contained in the section 4 ’System Configuration’.

3.7 STANDARD CONNECTIONS DCR 6000

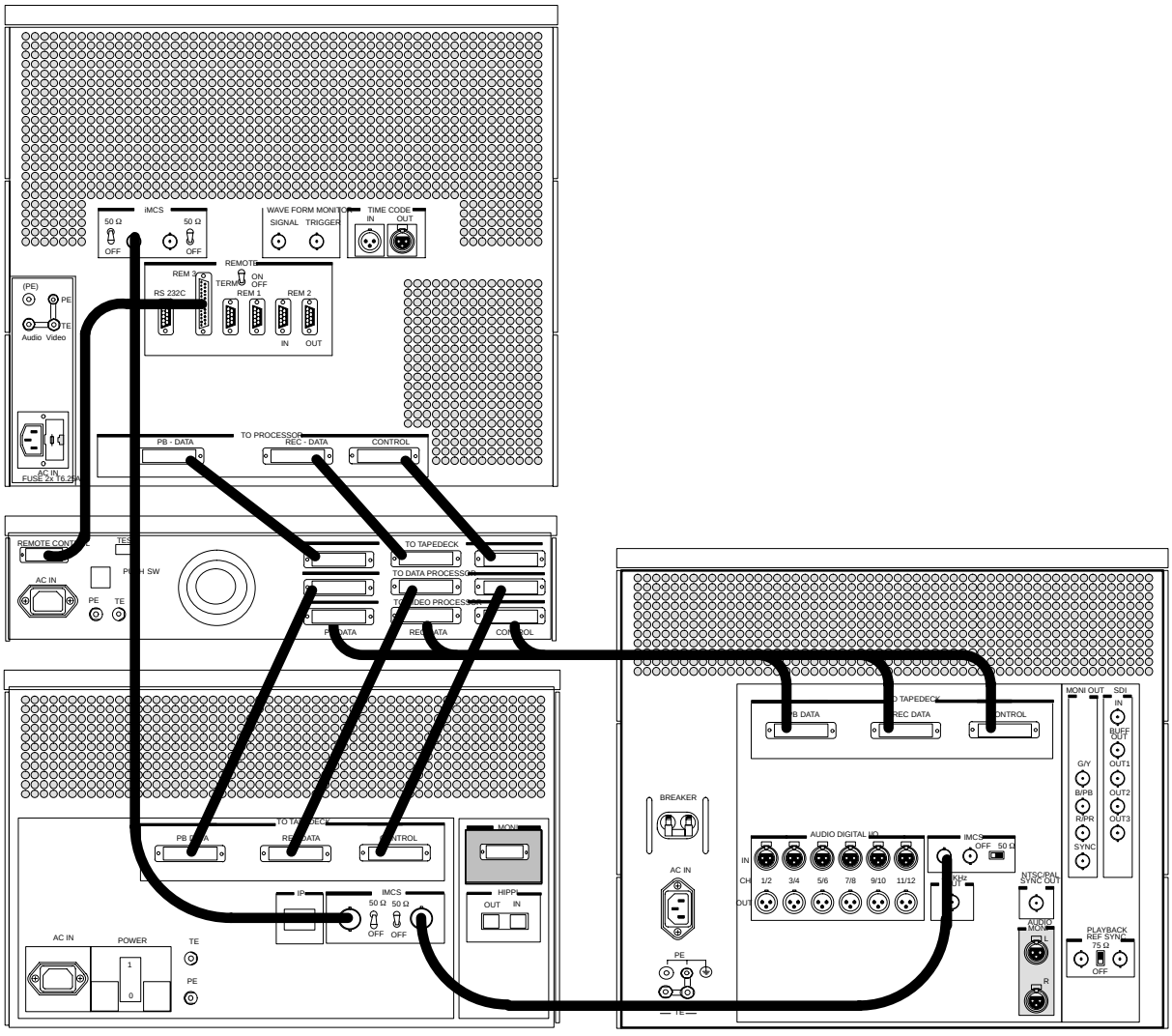


Fig. 319: Standard connections DCR 6000

3.7.1 CONNECT THE CONNECTION CABLES (INCLUDED IN THE DELIVERY)

Power connection

Tapedeck,Processors and Data Switch are connected separately to the line voltage.The Tapedeck, the Processors and the Switch Box include wide-range power supply units of 100V – 240V so that no changeover is required for different line voltages.

For Earth connections refer to the instructions of DCR 6024 or DCR 6128

Signal connection

Connect the three cables **PB DATA REC DATA** and **CONTROL** from Tapedeck, to the corresponding connectors of the Data Switch

Connect the three cables **PB DATA REC DATA** and **CONTROL** from DTV Processor to the corresponding connectors on the Data Switch

Connect the three cables **PB DATA REC DATA** and **CONTROL** from Data Processor to the corresponding connectors on the Data Switch

Install iMCS network between Tapedeck, DTV Processor and Data Processor. check for proper termination.

Connect the remote control cable for the Data Switch from **REM 3** of Tapedeck to the **REMOTE CONTROL** connector of the Data Switch.

4. CONNECTIONS

4.1 REAR VIEW DMS 6000

This section describes all connections of the DMS 6000

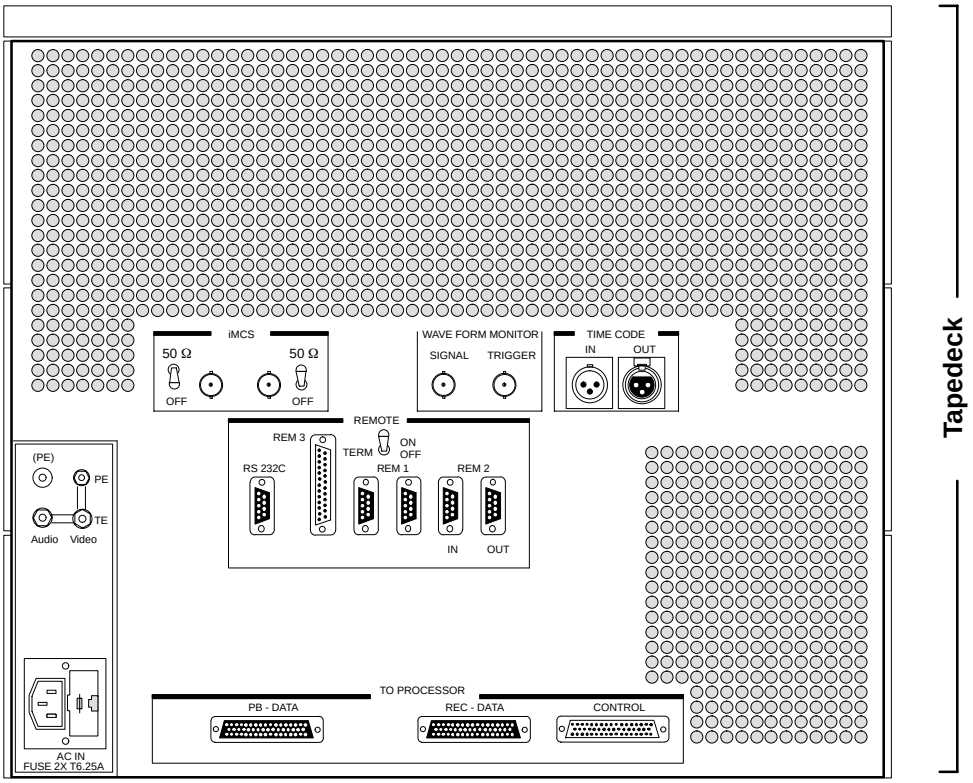


Fig. 401: Connections (rear view) DMS 6000

4.2 REAR VIEW DTV 6024

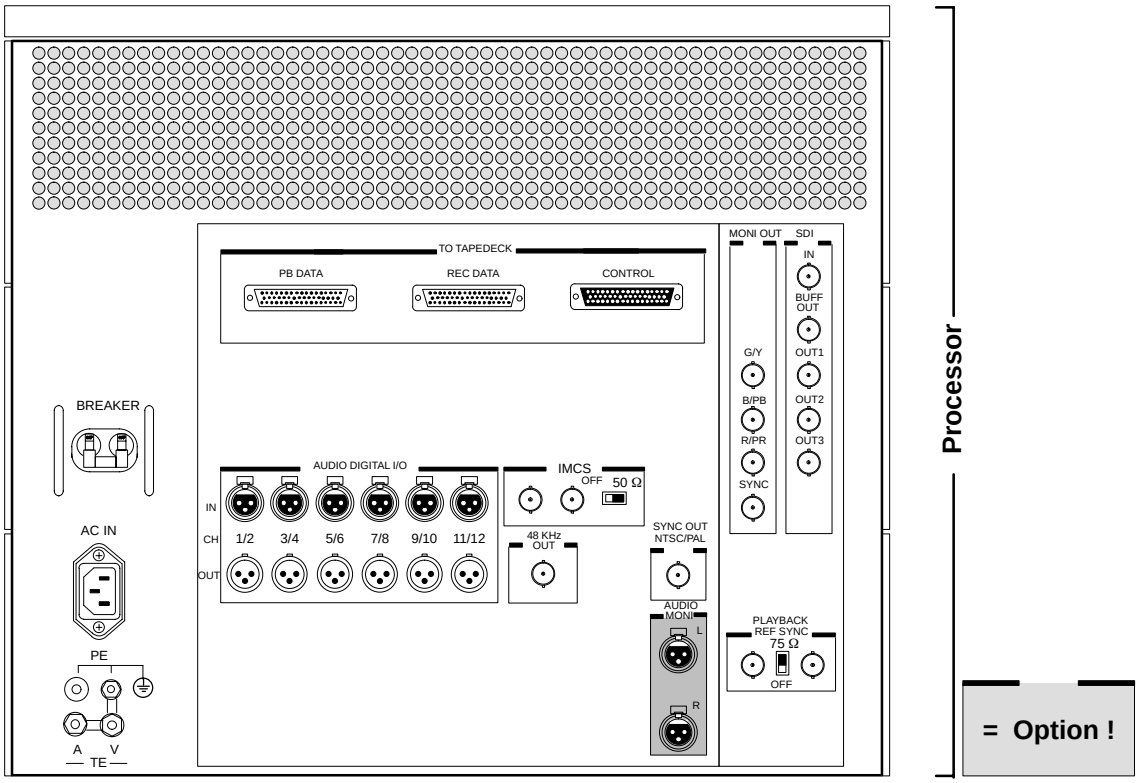


Fig. 402: Connections (rear view) DTV 6024

4.3 REAR VIEW DDP 6128

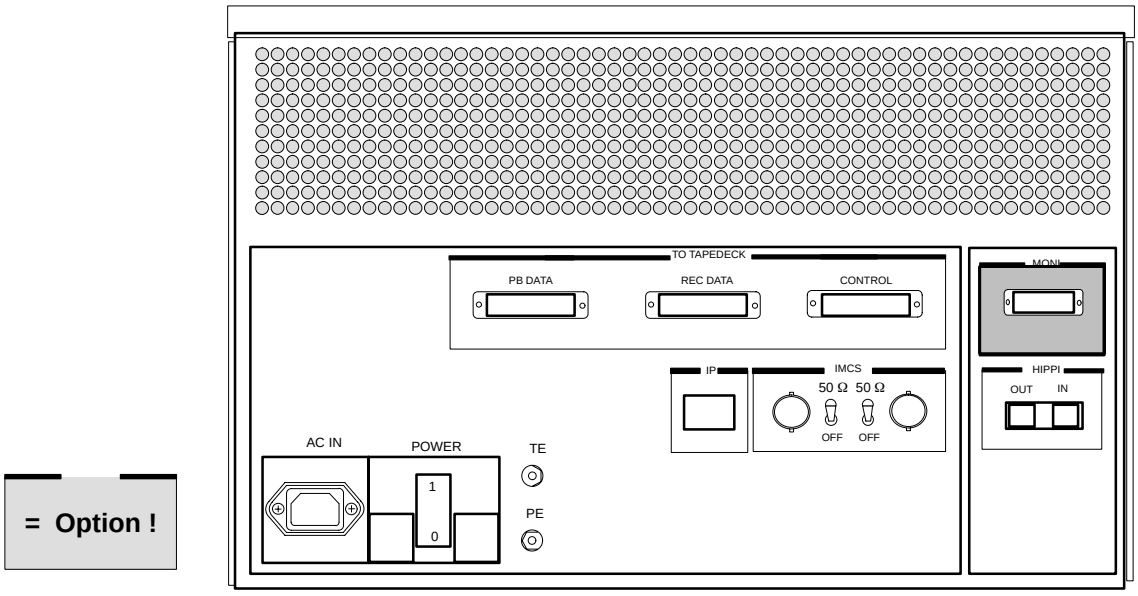


Fig. 403: Connections (rear view) DDP 6128

4.4 REAR VIEW DWS 6000

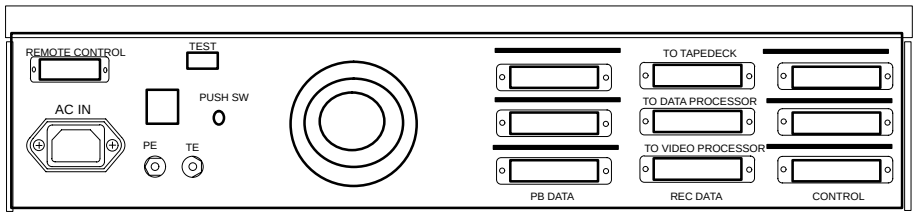


Fig. 404: Connections (rear view) DSW 6000

4.5 TERMINAL PANEL – TAPEDECK DMS 6000

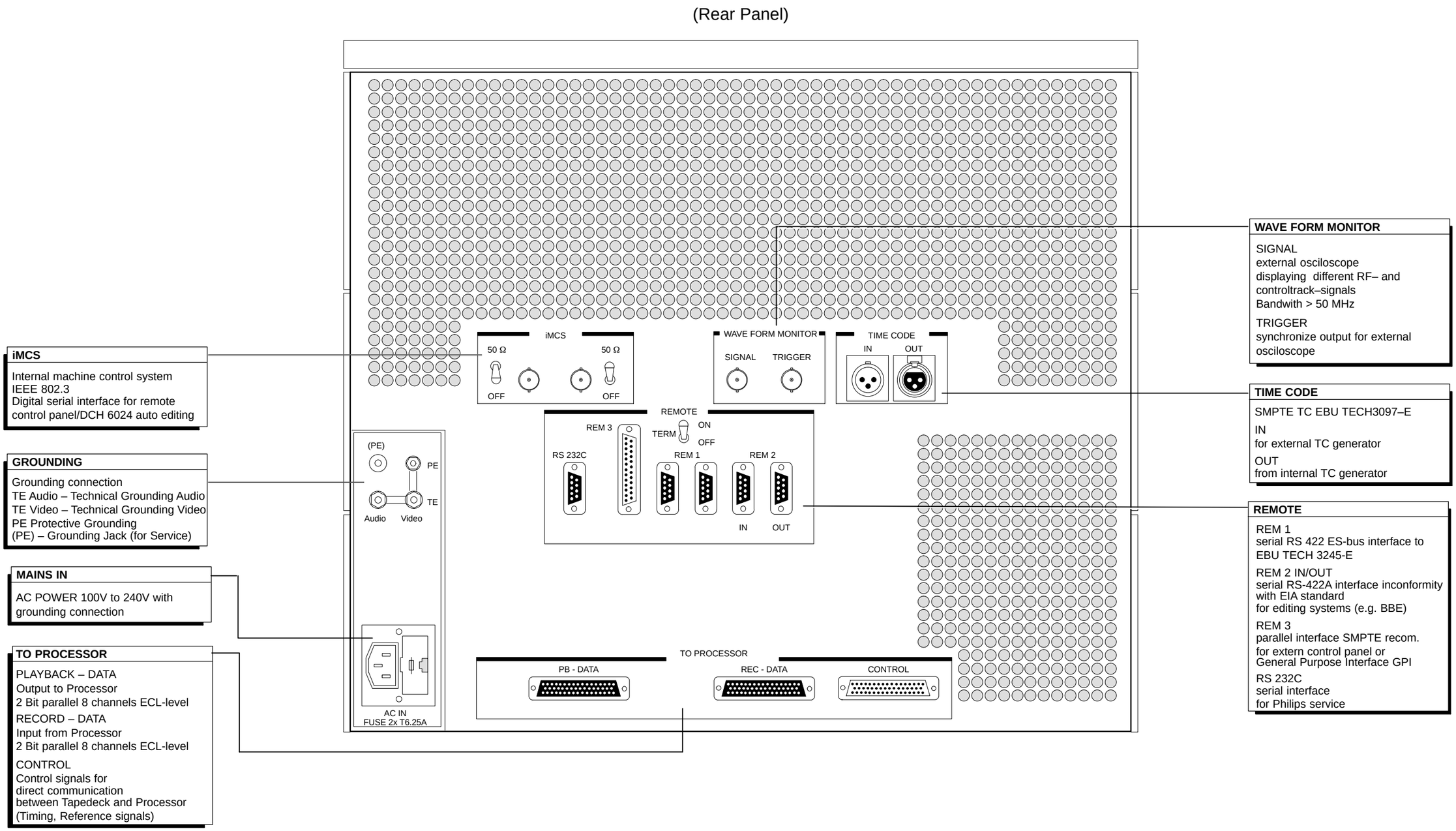


Fig. 405: Terminal panel of the Tapedeck DMS 6000

4.5.1 AC POWER TERMINAL UNIT BD 5146

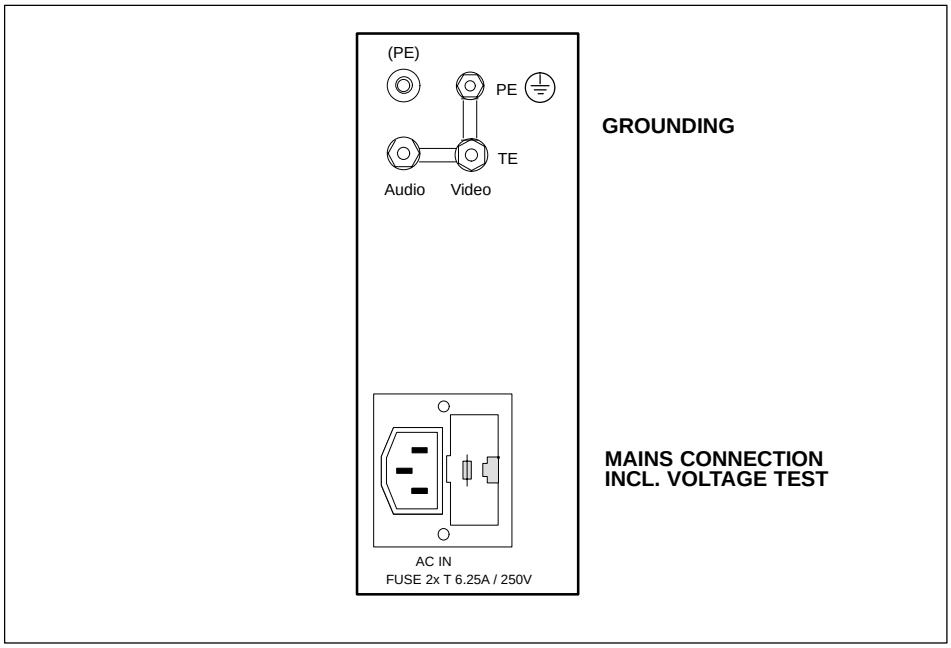


Fig. 406: AC power terminal unit BD 5146 of the Tapedeck

4.5.1.1 GROUNDING

The Tapedeck is to be connected to ground according to VDE 0800/part 2 and/or the applicable national regulations. The protective conductor must always be connected before the unit is connected to the mains.

The DMS 6000 has separate protective (PE) and functional (TE) grounds. Their terminals are located at the rear.

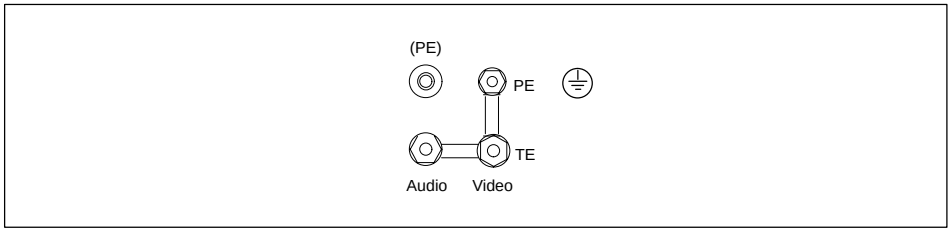


Fig. 407: Grounding connector of the Tapedeck

The enclosure of the DMS 6000 is always connected to the protective ground (PE) conductor.

The machine is supplied with the PE and TE grounding terminals bridged.

GROUNDING CONNECTIONS TE AUDIO
TE VIDEO
PE

Grounding in case of non-stationary application

In case of non-stationary application the grounding is ensured by the leading grounding contact of the mains cord. The power cord may only be plugged into a grounding contact socket outlet.

Do not cancel the protective effect by using an extension cable without a protective ground conductor nor disable its function in any other way.

The jumpers across the PE and TE terminals must remain installed.

Exception:
When the jumpers are broken, a functional ground must be connected to the TE terminal screw before the mains cord is connected!

TN-C Mains

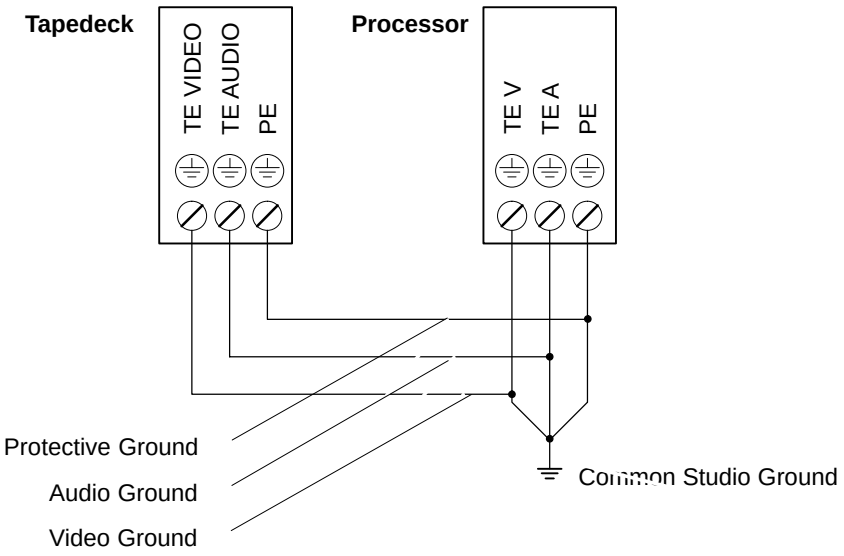
In case of TN-C mains configurations (mains without protective conductor and with neutralization for protection purposes),
VDE 0100 T.410 (IEC 364–4–41, IEC 304–4–47);
VDE regulation 0100 T.540 (IEC 364–5–54)
or the applicable national regulations must be observed.

Attention!
Any disconnection or break of the protective conductor inside or outside the video tape recorder may impair the accidental contact protection in case of a defect.

Studio Grounding

Grounding can be effected as follows:

Common Grounding: Connect the central protective conductor of the studio with the PE terminals of the Media Recorder. The jumpers connecting the PE terminals and the TE terminals have to remain installed.
In this case the cross section of the protective conductor has to correspond to that of the neutral conductor in the mains cable, however, it must not be less than 2 qmm (in line with VDE 0800/part 2, table 1).



Remark: Audio Ground not available in data version

Fig. 408: Connecting protective, video and audio ground at DCR 6024

Separated Grounding

If necessary (for example in studios having separate protective and functional grounds), the jumper between PE and TE may be removed. In this case, also the central functional ground (video and audio ground) must be connected to the TE terminal screw. It should be designed as functional ground with protective ground properties and free of noise voltage in line with VDE 0800/part 2.

The cross section of the conductor should meet the requirements mentioned at the beginning of this section. A low impedance interconnection of the two ground conductors should be made at the central studio terminal or at the ground distributor.

4.5.1.2 MAINS CONNECTION

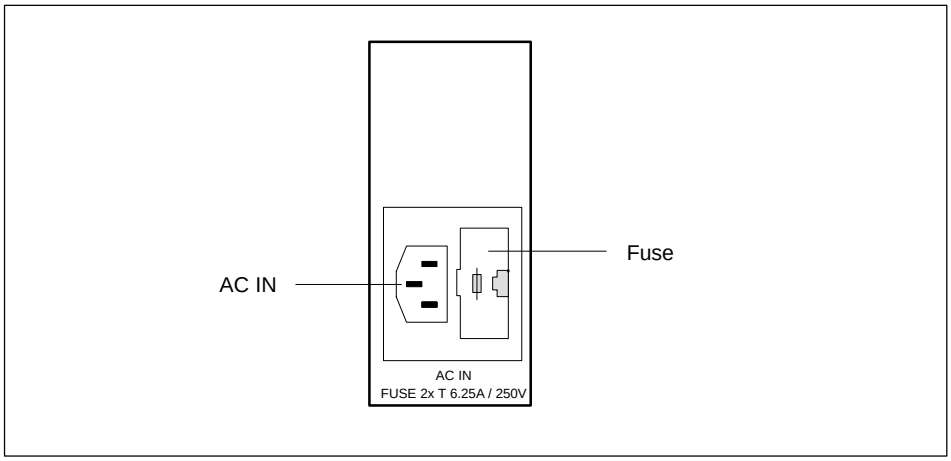


Fig. 409: AC Power IN of the Tapedeck

AC IN

For the mains connection of the DMS 6000 Tapedeck, the mains cord is connected to the mains connection socket (AC IN). The mains cord is included in the shipment.

Fuses

Main fuses on connector panel:

2x T6.25 A / 250V slow, UL-listed (valid for the entire voltage range 100 - 240 V).

Caution!
Double-pole or neutral fusing. Risk of electric shock. Grounded circuit conductor (neutral) provided with over-current protection. After operation of the protective device, parts of the equipment that remain under voltage might represent a hazard during servicing. Disconnect power before servicing!

Changing of power supply voltage

The Tapedeck and the Processors include a wide-range power supply unit of 100 - 240V so that no changeover is required for different line voltages.

4.5.2 PROCESSOR INTERFACE

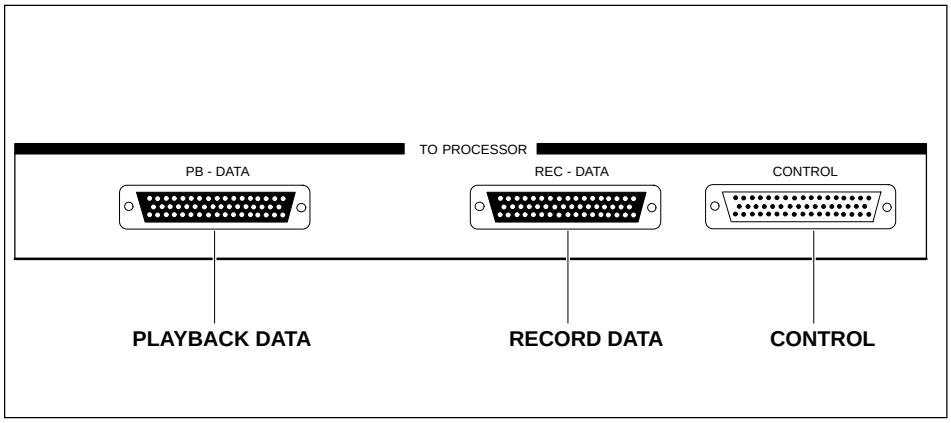


Fig. 410: Processor interface

PLAYBACK DATA Output to Processor (50 pole D-sub).
2 Bit parallel 8 channels ECL level

RECORD DATA Input from Processor (50 pole D-sub).
2 Bit parallel 8 channels ECL level

CONTROL Control signals (50 pole D-sub) for direct communicating between Tapedeck and Processor (Timing, Reference signals).

4.5.3 TIMECODE IN/OUT (DTV–MODE)

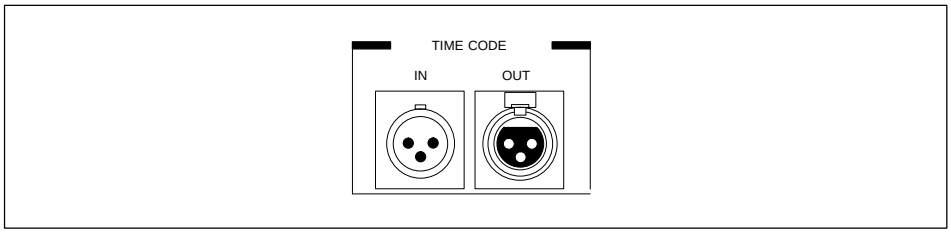


Fig. 411: Timecode in/out

For an external connected timecode reader the following signals are available at the TC-OUT socket:

In play mode:
Timecode signal off tape

In any other mode:
The signal of the internal timecode generator or the signal assigned at the TC-IN socket.

The selection of the timecode source is effected in the TIMECODE menu (section 4.6.).

IN Input for external (central) timecode (3 pole XLR)
(SMPTE timecode, wave form according to EBU TECH 3097 E)
Nominal level: 2.2 V_{PP} = 0 dBu

OUT Timecode output (3 pole XLR)
(SMPTE timecode, wave form according to EBU TECH 3097 E)
Nominal level: 2.2 V_{PP} = 0 dBu

4.5.4 IMCS

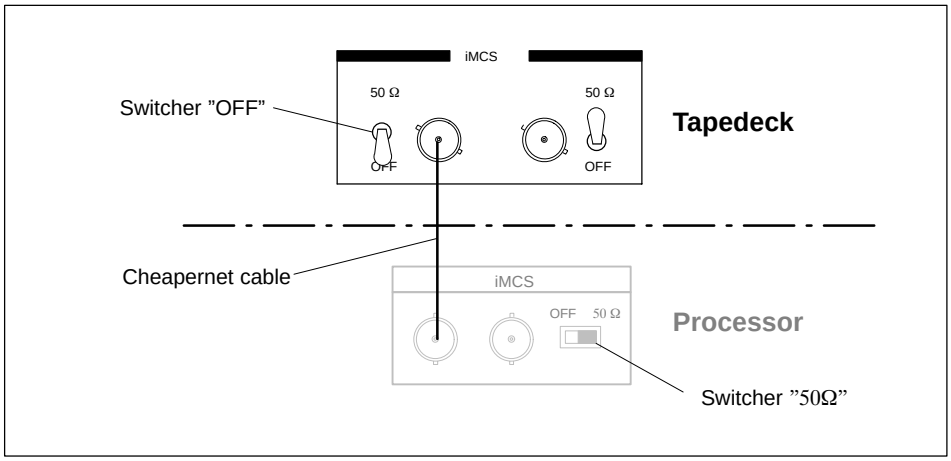


Fig. 412: iMCS standard position

IMCS loop input for the Integrated Machine Control System (BNC) for connecting a D-6 slave recorder when using two DCR 6024 in conjunction with the two-machine editor or **for controlling up to 4 DCR 6024 D-6 machines** (in preparation).

Note:
This system is based on the Cheapernet System and uses 50 ohm KV 770 cables (also RG 58). Do not terminate with 75 ohm. Terminate only with the internal 50 ohm terminators which can be switched into circuit with the corresponding switches.

Switching iMCS terminations	**Important**! Switch that toggle switches ”iMCS” in position ”50 Ω”, which is not connected with a cheapernet cable.

4.5.5 REMOTE CONTROL REM 1, REM 2, REM 3, RS 232C

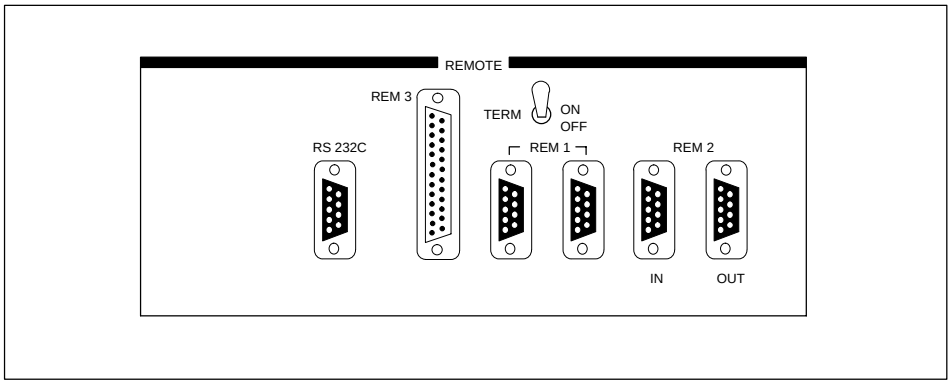


Fig. 413: Remotes

Remote control connections for REMote mode. The desired interface is selected in the REMIF submenu (see Operating Instructions, section 4.12.4)

REM 1 RS 422 loop input (9 pole D-sub)
This input is used to control the machine via the ES-BUS protocol. If the signal is not looped to a further unit, the input has to be terminated with the switch located at its side (TERM-ON).

REM 2 IN This socket serves (9 pole D-sub) for the control of the DCR 6024 by editing systems (e.g. BBE), graphic systems and film to tape productions via the RS 422A protocol.

REM 2 OUT This socket serves (9 pole D-sub) for the control of other equipment via the RS 422A protocol.

REM 3 Remote interface for Data Switch DSW 6000.

RS 232C Serial RS 232C interface (9 pole D-sub) for connecting a terminal for Thomson service.

4.5.6 WAVEFORM MONITORING

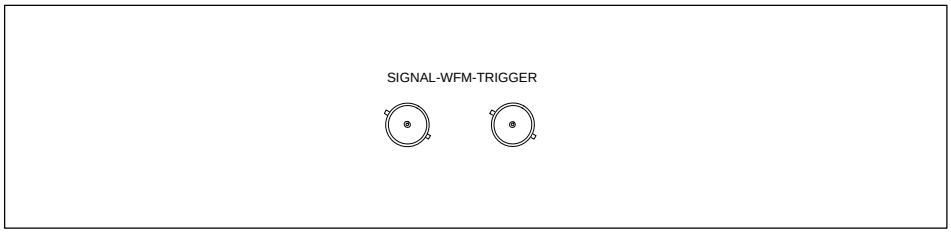


Fig. 414: Waveform monitoring, Trigger

SIGNAL WFM The connector ”SIGNAL-WFM” can be used for output the signals of the control track, time code track or the envelopes of the 8 RF - signals (oscilloscope bandwidth > 50 MHz).

TRIGGER Connection (BNC) for synchronization of the oscilloscope.

The selection of the output signals is made in the diagnostic menu with window ”Waveform Monitor” (see Operating Instructions, section 4.13.3).

4.5.7 CONNECTION CONTROL PANEL AND HEADPHONE WITH VOLUME ADJUSTMENT

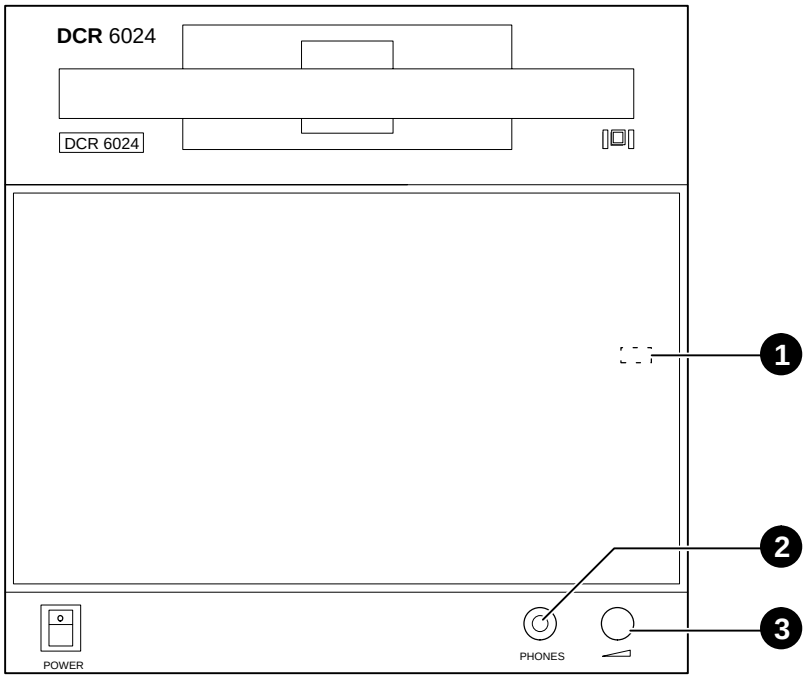


Fig. 415: Front view of the Tapedeck DMS 6000

1. 15 pole subminiature socket to connect the control panel; visible if the front door is opened.

2. Head phone jack to connect a standard 6.3 mm jack plug (stereo). (for selection of the output signal please refer to section 4.9 ”Audio Levels” Operation Instruction).

3. Potentiometer to adjust the volume at the head phone jack (2).

4.6 TERMINAL PANEL OF THE PROCESSOR DTV 6024

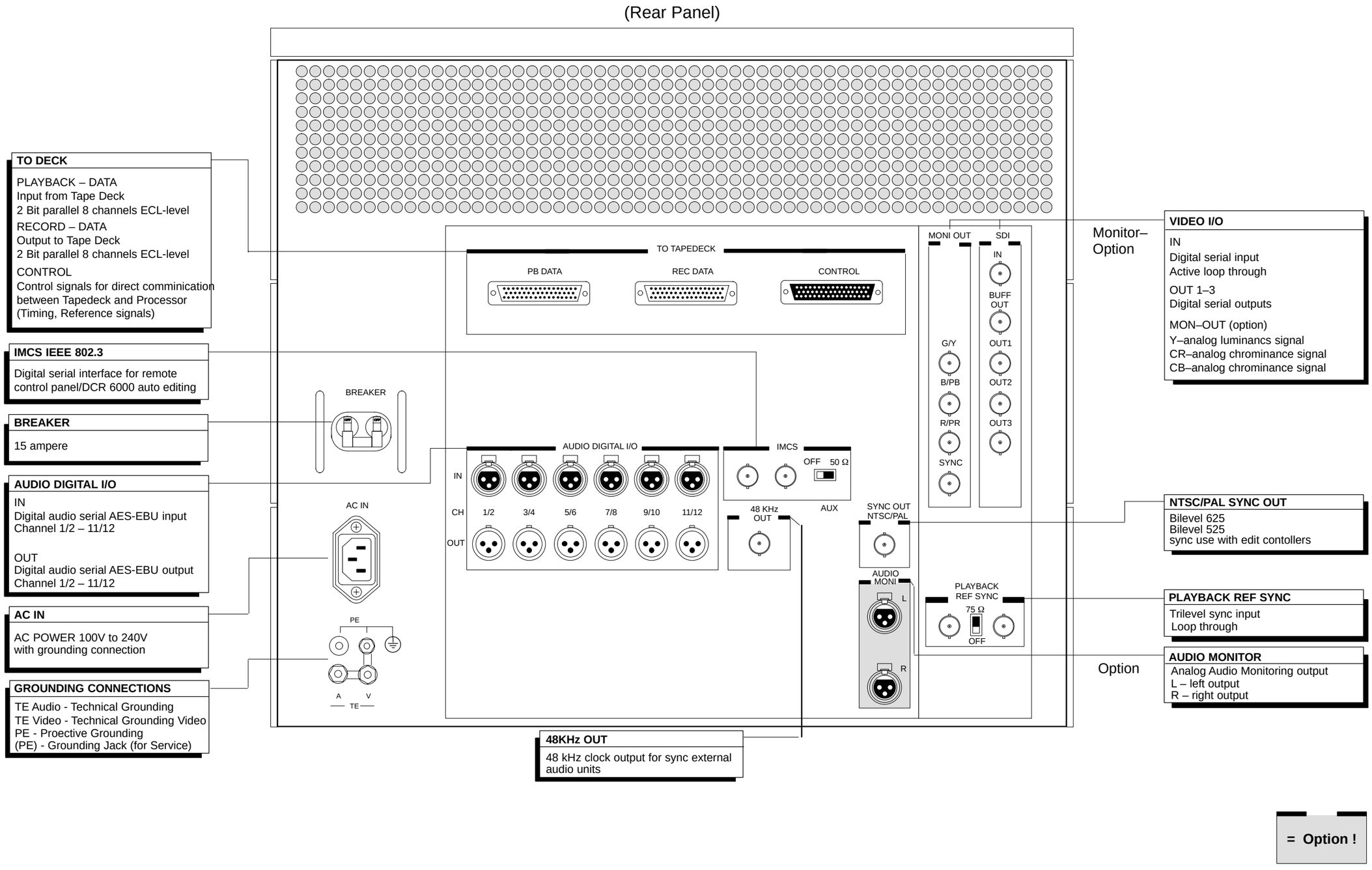


Fig. 416: Terminal panel of the Processor DTV 6024

4.6.1 AC POWER TERMINAL

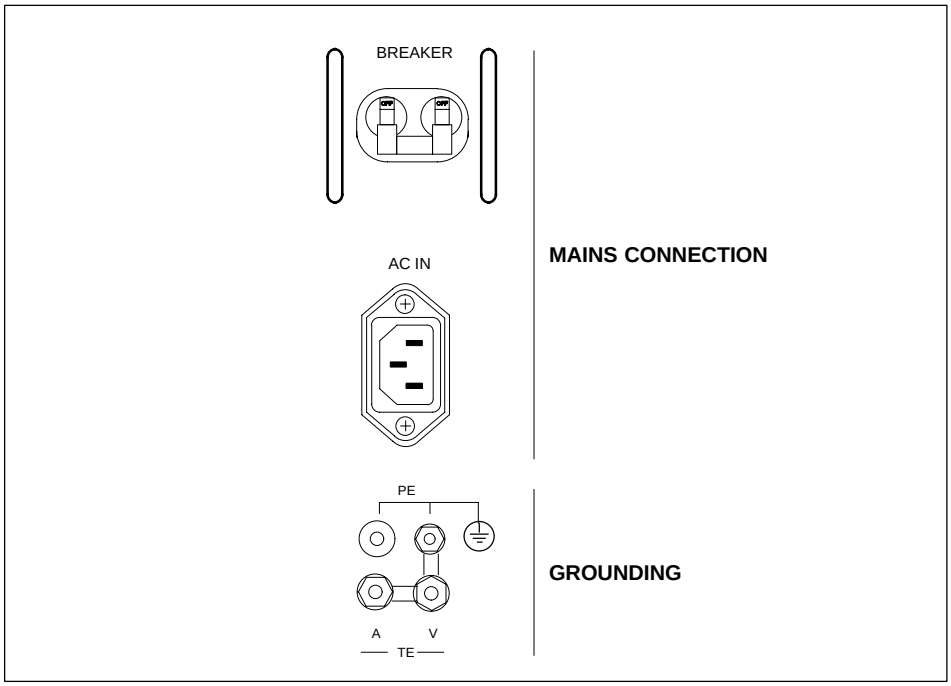


Fig. 417: AC power terminal unit of the Processor

4.6.1.1 GROUNDING

The Processor is to be connected to ground according to VDE 0800/part 2 and/or the applicable national regulations. The protective conductor must always be connected before the unit is connected to the mains.

The Processor has separate protective (PE) and functional (TE) grounds. Their terminals are located at the rear.

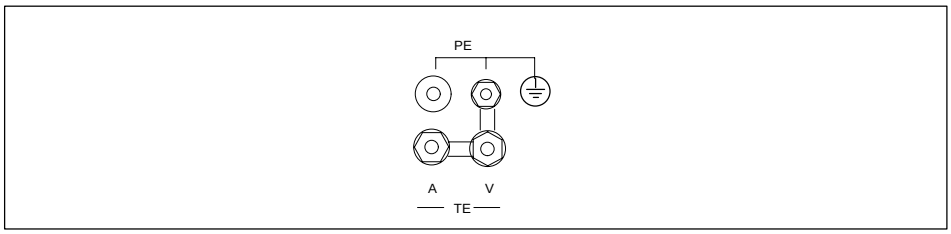


Fig. 418: Grounding connector of the Processor

The enclosure of the Processor is always connected to the protective ground (PE) conductor.

The machine is supplied with the PE and TE grounding terminals bridged.

GROUNDING CONNECTIONS TE A (Audio)
TE V (Video)
PE

4.6.1.2 MAINS CONNECTION

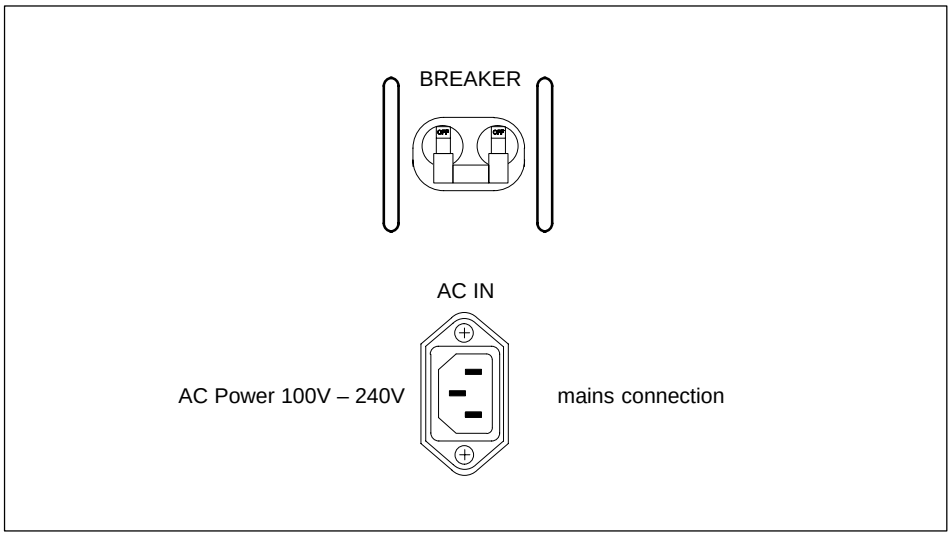


Fig. 419: Mains connection of the Processor

AC IN

For the mains connection of the Processor, the mains cord is connected to the mains connection socket (AC IN). The mains cord is included in the shipment.

For Processor DTV 6024:

The Processor includes a wide-range power supply unit of 100-240 Volts so that no changeover is required for different line voltages.

BREAKER

15 Amperes

4.6.2 TAPEDECK INTERFACE

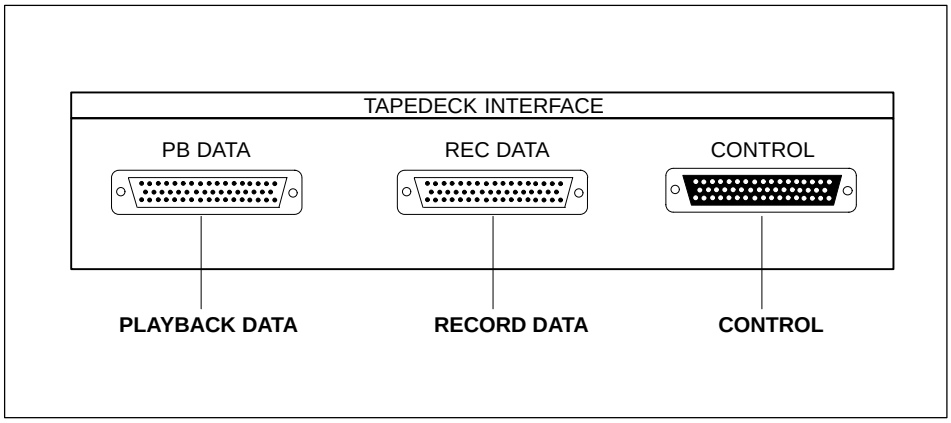


Fig. 420: Tapedeck interface

PLAYBACK DATA Input from Tapedeck (50 pole D-sub).
2 Bit parallel 8 channels ECL level

RECORD DATA Output to Tapedeck (50 pole D-sub).
2 Bit parallel 8 channels ECL level

CONTROL Control signals (50 pole D-sub) for direct communication between Tapedeck and Processor (Timing, Reference signals).

4.6.3 VIDEO ANALOG MONITOR OUT

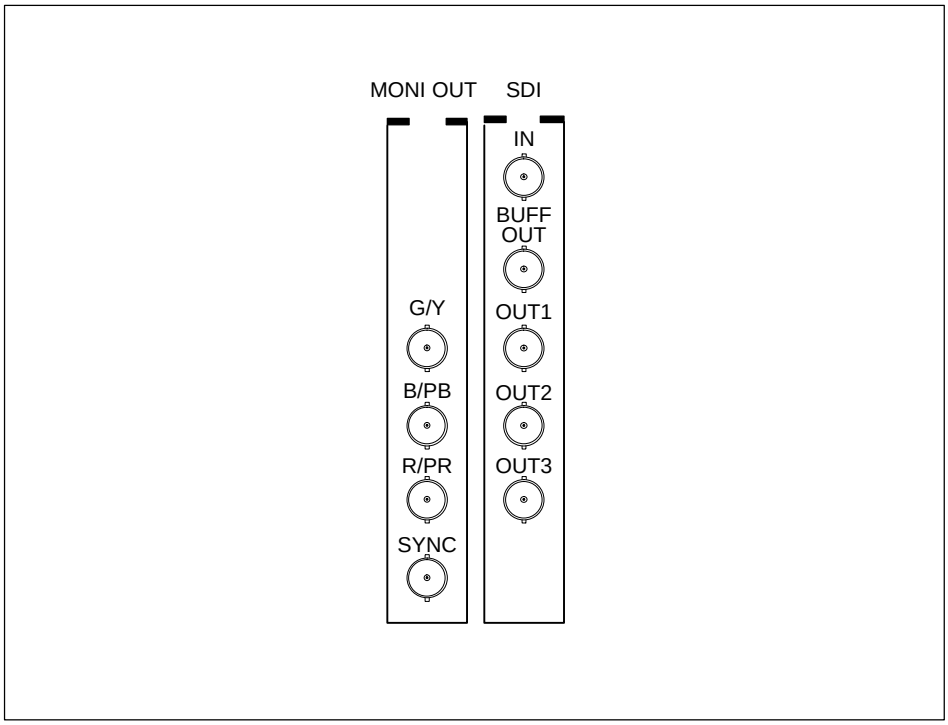


Fig. 421: Video analog monitoring out

MON-OUT Analog Y / CR / CB or R / G / B signal outputs (Sync On / Off is switchable) (BNC)
Sync output 4 Vpp (BNC)

4.6.4 AUDIO DIGITAL IN/OUT

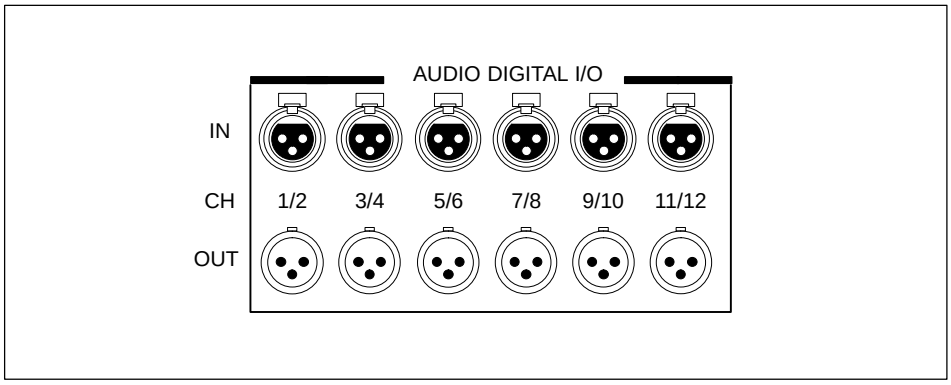


Fig. 422: Audio digital in/out

The Processor DTV 6024 has six / five digital audio inputs and outputs.

They are selected in the AUDIO CONFIG menu.
The selection for editing is made in the EDITOR menu.

IN/OUT

Digital serial interfaces according to the AES standard
(AES Recommended Practice Draft AES 3-1992, ANSI S 4-40, 1992)

Impedance 110 Ω
Level: inputs 0.2 V_{PP} to 10 V_{PP} - outputs 2 V_{PP} to 7 V_{PP}
Pin assignment: 1 shield - 2 signal - 3 signal

All Inputs are two channel signals. The externally connected audio equipment has to operate according to the AES/EBU standard. The sampling frequency is 48 kHz, it must be locked to the video signal. The 48 kHz OUT socket (please refer to section 4.6.6) serves to synchronize an external audio unit.
During cross play modes the output sampling frequency may vary.

4.6.5 AUDIO MONITORING (OPTION)

Option

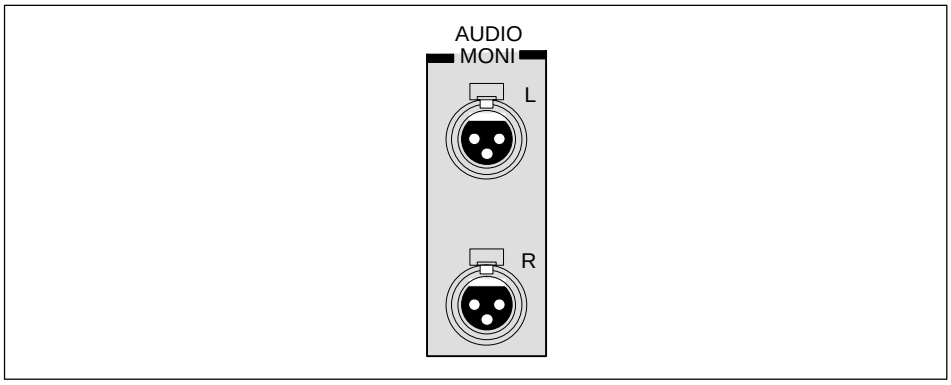


Fig. 423: Audio monitor (option)

L/R

Symmetric monitoring outputs (3 pole XLR) - Impedance < 40Ω
Level: -3, 0, 4, 8 dBu adjustable at 20 dB headroom
(please refer to Operating Instructions section 4.9 ”Audio Levels”).

4.6.6 AUDIO SYNC 48KHZ

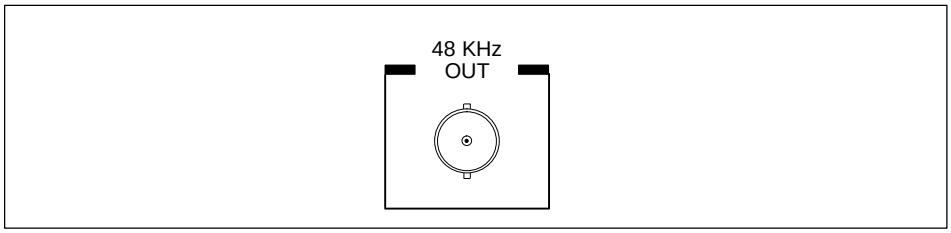


Fig. 424: Audio sync 48 kHz out

Synchronization signal for external audio machines (TTL level) operating in the AES/EBU standard (BNC)

4.6.7 SDTV / NTSC SYNC OUT

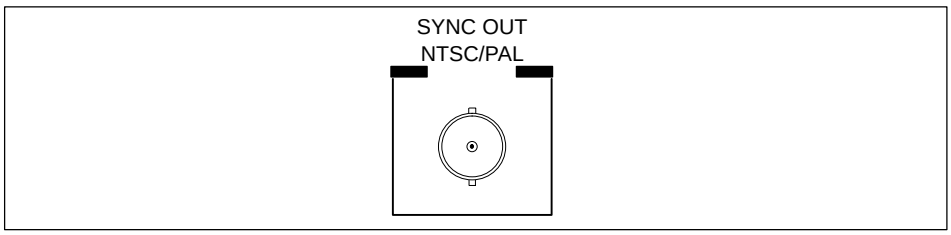


Fig. 425: Sync out

25/50 Hz: Bilevel 625 sync use with edit controllers.

30/60 Hz: Bilevel 525 sync use with edit controllers.

4.6.8 PLAYBACK REF SYNC

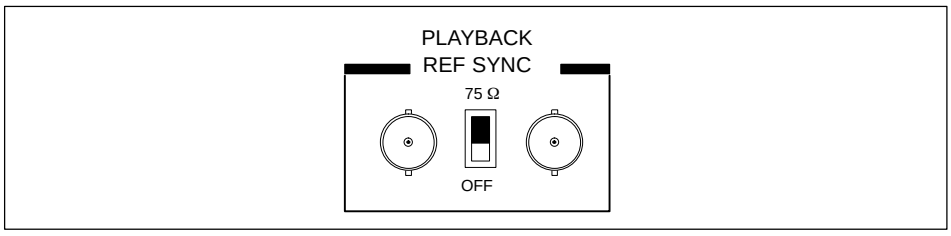


Fig. 426: Extern sync input

Trilevel sync input.

4.6.9 IMCS

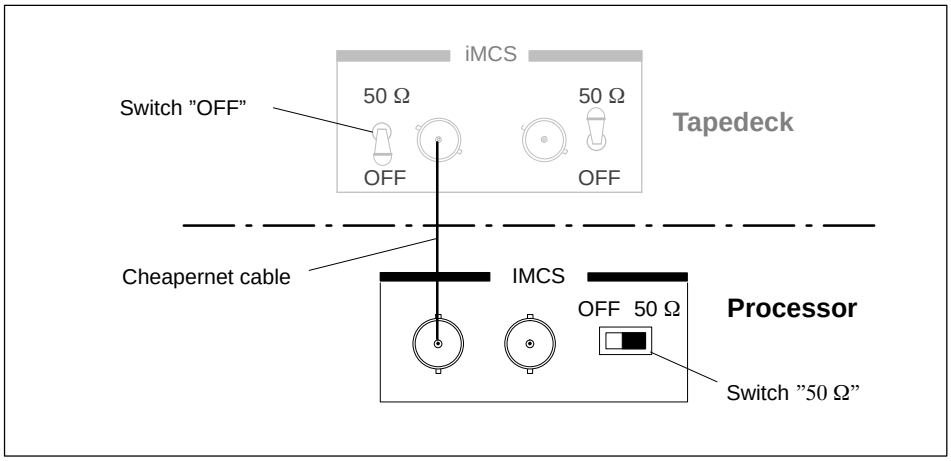


Fig. 427: iMCS

IMCS loop input for the Integrated Machine Control System (BNC)

for connecting a the slave recorder when using two DCR 6024 in conjunction with the internal two-machine editor

or

for controlling up to four DCR 6024 machines

or

for connecting one or more control panels.

Note:
This system is based on the Cheapernet System and uses 50 ohms KV 770 cables (also RG 58). Do not terminate with 75 ohms. Terminate only with the internal 50 ohms terminators which can be switched into circuit with the corresponding switches.

Switching iMCS terminations	**Important**! Switch toggle switch ”iMCS” in position ”50 Ω”, if it is connected only to one Tapedeck.

4.7 TERMINAL PANEL OF THE PROCESSOR DDP 6128

(Rear Panel)

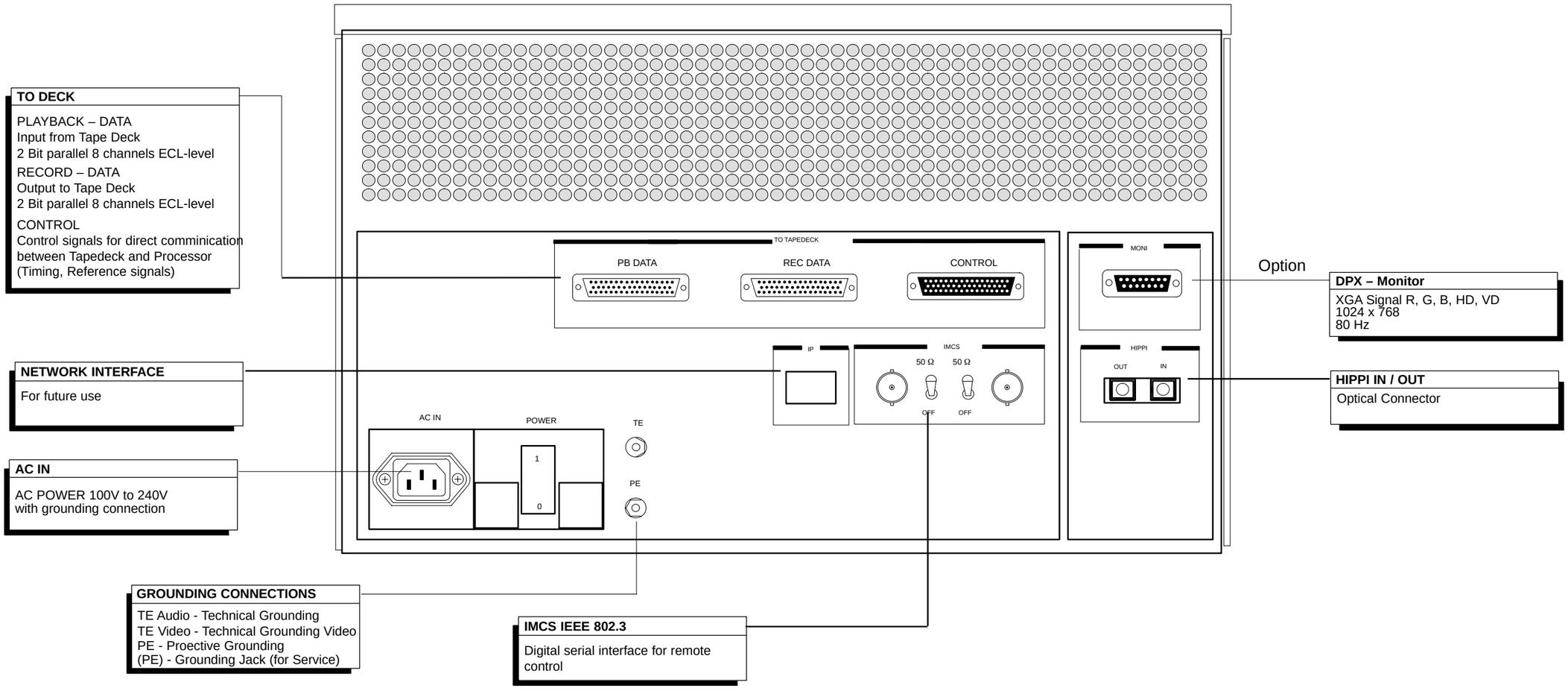


Fig. 428: Terminal panel of the Processor DDP 6128

4.7.1 AC POWER TERMINAL

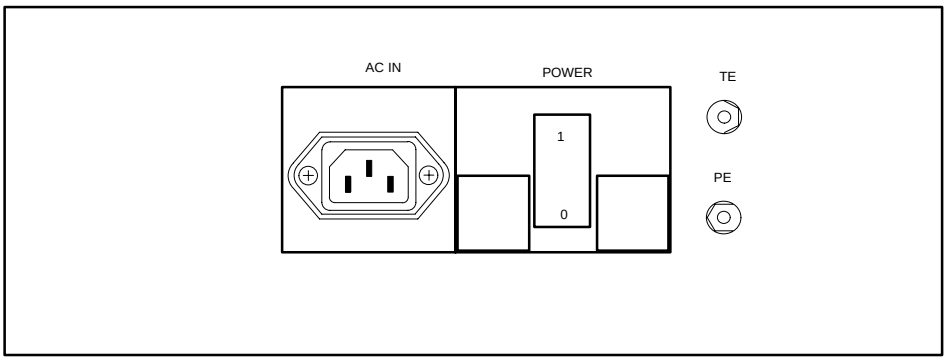


Fig. 429: AC power terminal unit of the Processor

4.7.1.1 GROUNDING

The Processor is to be connected to ground according to VDE 0800/part 2 and/or the applicable national regulations. The protective conductor must always be connected before the unit is connected to the mains.

The Processor has separate protective (PE) and functional (TE) grounds. Their terminals are located at the rear.

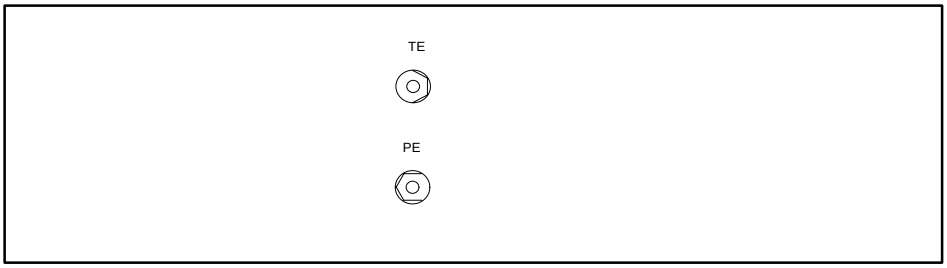


Fig. 430: Grounding connector of the Processor

The enclosure of the Processor is always connected to the protective ground (PE) conductor.

The machine is supplied with the PE and TE grounding terminals bridged.

GROUNDING CONNECTIONS TE
PE

4.7.1.2 MAINS CONNECTION

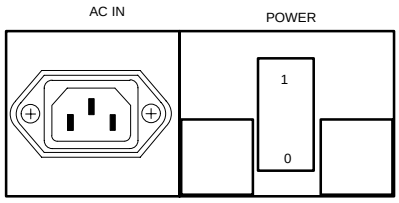


Fig. 431: Mains connection of the Processor

AC IN For the mains connection of the Processor, the mains cord is connected to the mains connection socket (AC IN). The mains cord is included in the shipment.

For Processor DDP 6128:

The Processor includes a wide-range power supply unit of 100-240 Volts so that no changeover is required for different line voltages.

SWITCH / BREAKER 15 Amperes

4.7.2 TAPEDECK INTERFACE

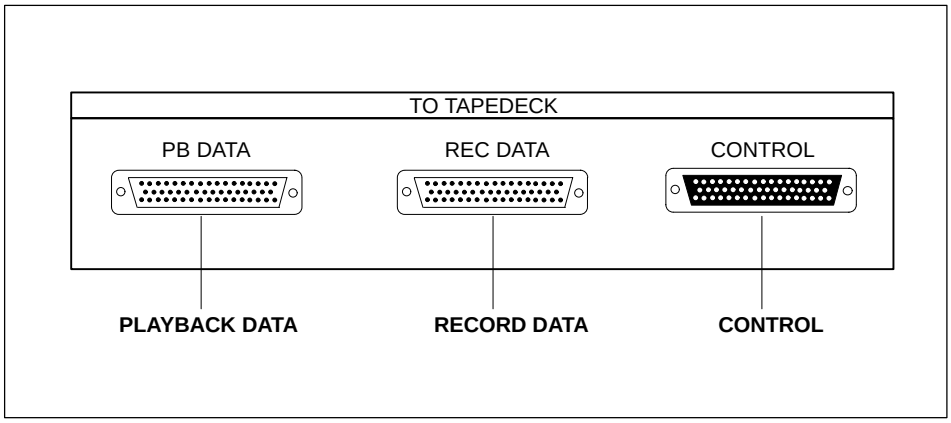


Fig. 432: Tapedeck interface

PLAYBACK DATA Input from Tapedeck (50 pole D-sub).
2 Bit parallel 8 channels ECL level

RECORD DATA Output to Tapedeck (50 pole D-sub).
2 Bit parallel 8 channels ECL level

CONTROL Control signals (50 pole D-sub) for direct communication between Tapedeck and Processor (Timing, Reference signals).

4.7.3 DPX MONITOR OUT (OPTION)

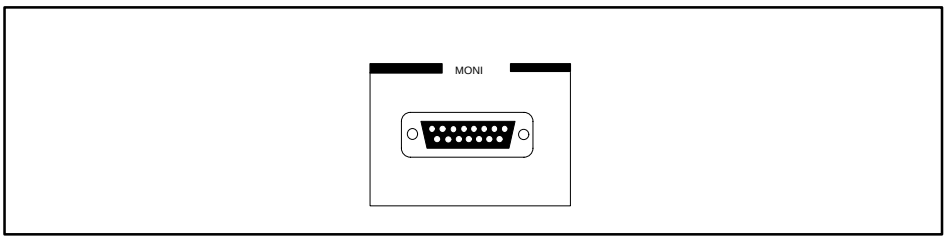


Fig. 433: DPX monitoring out

MON-OUT XGA Output D–SUB 15 pol. HD. R, G , B, HD, VD

Framerate 80Hz

4.7.4 HIPPI IN/OUT

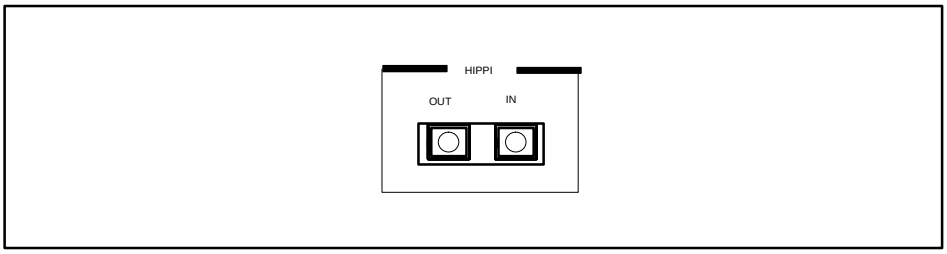


Fig. 434: HIPPI in/out

Optical connection (in/out) according to serial optical HIPPI specification

4.7.5 NETWORK INTERFACE

Future use

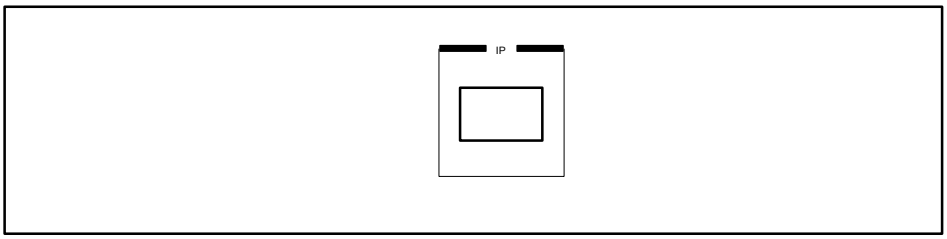


Fig. 435: Network interface

RJ 45 connector. Interface (gateway) between internal iMCS communication and Ethernet networks. Gateway is not implemented yet.

4.7.6 IMCS

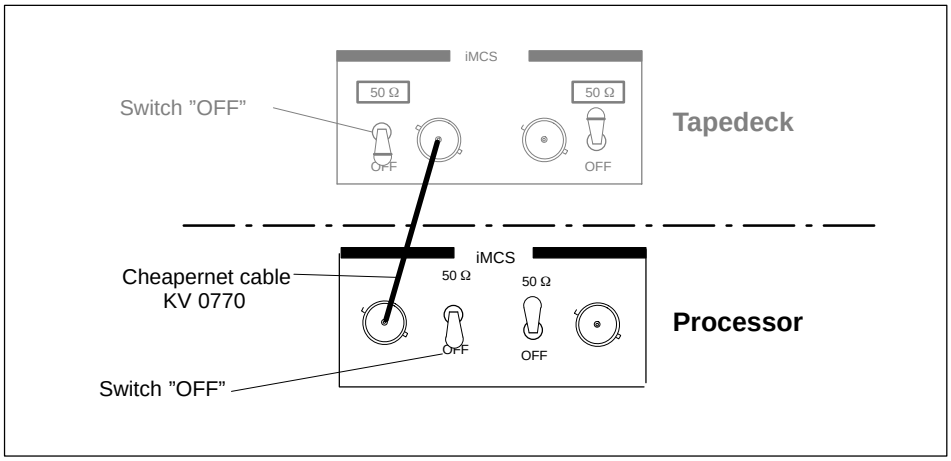


Fig. 436: iMCS

IMCS loop input for the Integrated Machine Control System (BNC) for connecting the system to remote controllers (Pandora, TransferEngine etc).

Note:
This system is based on the Cheapernet System and uses 50 ohms KV 770 cables (also RG 58). Do not terminate with 75 ohms. Terminate only with the internal 50 ohms terminators which can be switched into circuit with the corresponding switches.

Switching iMCS terminations	**Important**! Switch toggle switch ”iMCS” in position ”OFF”, if it is connected only to one Tapedeck or other iMCS device.

5. STARTUP

This chapter describes startup of the DCR 6024/6128/6000, including the followings sections:

- Installation check
- Switching on
- Selecting HD standard / data mode
- Selecting machine address
- Control of the reference signal / input data
- Operation

Note:
For initial installation of the DCR 6024/6128/6000, observe the order of following sections!

5.1 INSTALLATION CHECK

1. Ventilation
   Take care that incoming and outgoing air can circulate free.
   See also chapter 5.3 ”Ventilation”.
2. Internal connections
   Check the internal connections 1 to 7 and the iMCS-switches 8 to 9 according chapter 5.5 ”Standard Connections”.
3. Grounding
   The mains cable, however, must be plugged into an earthing-contact type socket **only**.

   Details see chapter 4.5.1.1 ”Grounding of the Tapedeck” and
   4.6.1.1 ”Grounding of the Processor”.
4. Power switch
   The Power switch of the Data–Processor on the rear side must be set to on (position ”1”).
   The Breaker of the DTV–Processor on the rear side must be set to the upper position.

5.2 SWITCHING ON

The DCR 6024/6128/6000 is switched on with the ”Power” switch at the lower left hand side of the Tapedeck front.

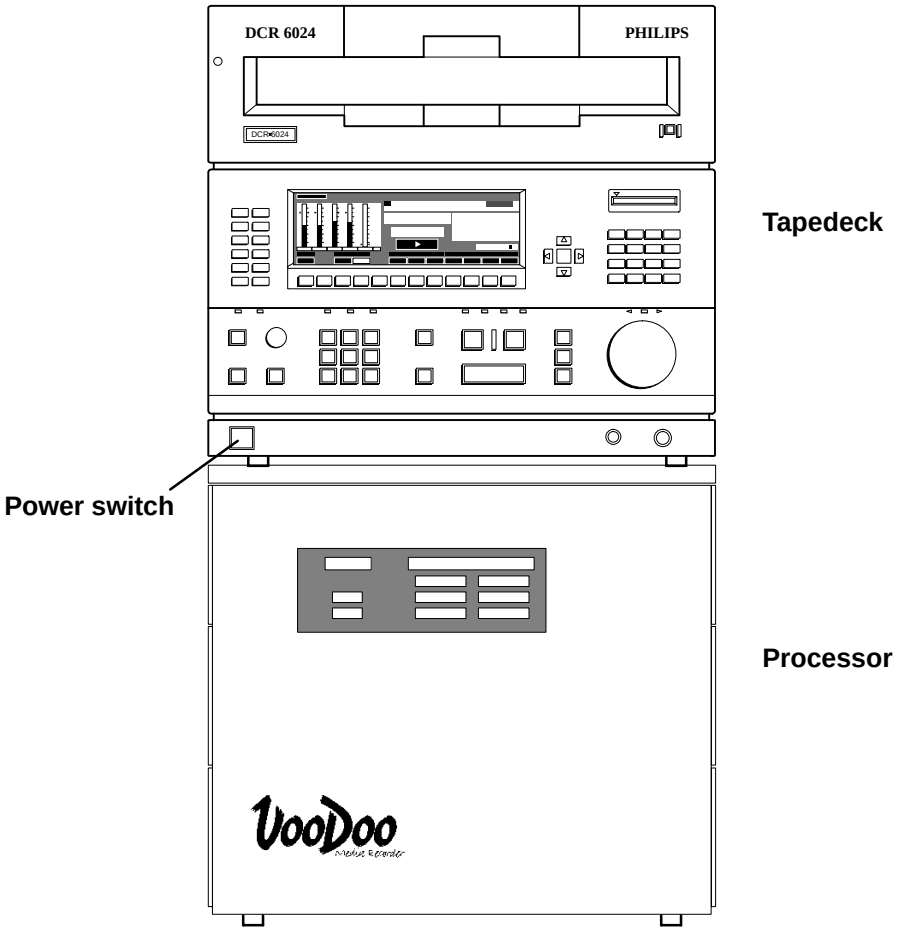


Fig. 501: DCR 6024 Power Switch

The power up test appears on the display of the Control Panel.

Next, the HOME menu appears on the display. It permits the user to handle the most important machine settings and operating modes.

Depending on selected configuration or selected mode two different home menus will appear.

Note:

Regarding the selected standard mode, the indication on the Switchbox, Door Display and Control Panel can be different if the Data– or DTV–Processor have no power or it is not switched on.

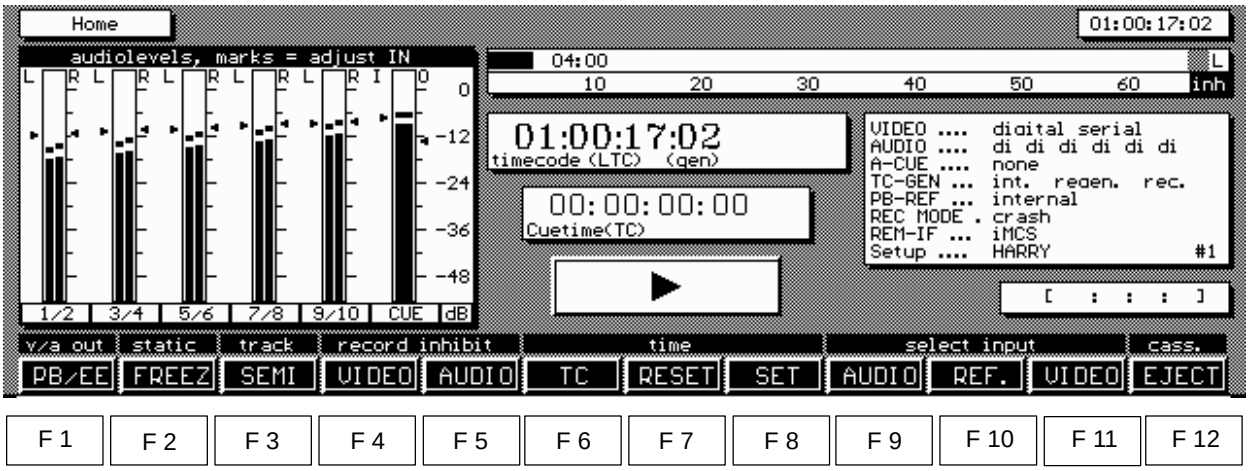


Fig. 502: Home Menu DTV mode

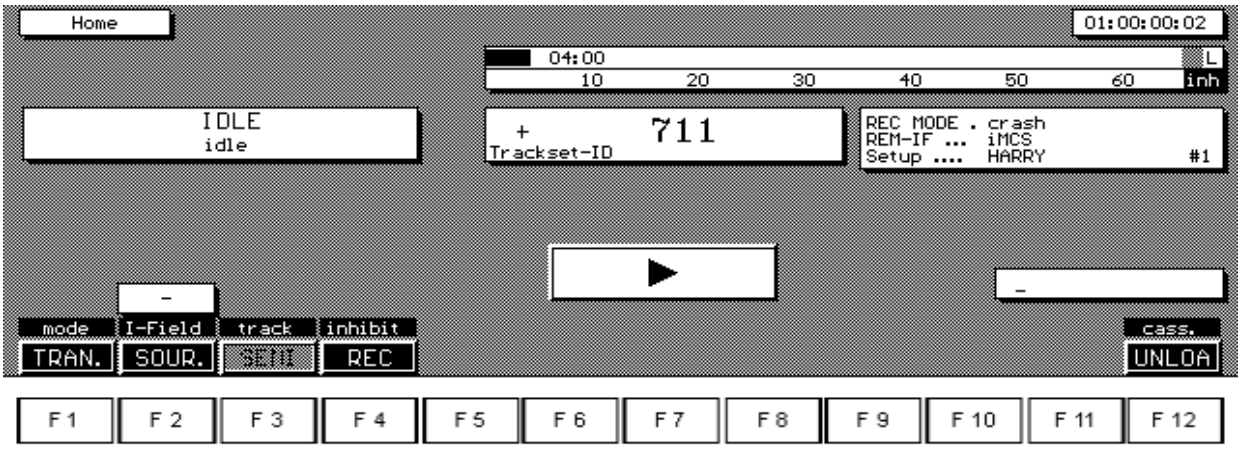
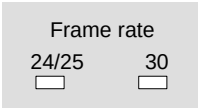


Fig. 503: Home menu Data mode

5.2.1 SELECTING HD STANDARD/ DATA MODE

- When the system is DCR 6024 the HD standard can be selected.
- When the system is DCR 6000 the HD standard or data mode can be selected.
- The data recorder DCR 6128 is set to data mode.

The current HD-standard/field rate is indicated by two LEDs which are located below the display on the Control Panel.



24/25 = **Frame rates 24, 25, 23.97 Hz.**
30 = **Frame rates 30, 29.97 Hz.**

The HD standard or the data mode may be selected in the SETUP menu (Operating Instructions, section 4.12) with the help of the function key F11.

5.3 SELECTING MACHINE ADDRESS

If several machines are to be operated in a cluster configuration using the iMCS interface, each machine in the cluster must have its own address (1 - 4) which is indicated in the door display on the left hand side below the video cassette compartment.

1. Switch off the DCR 6024/6128/6000 and disconnect it from the mains.
2. Open the front door of the Tapedeck as follows.
   Loosen the two screws on the left hand side of the front door with a hex socket wrench (opening 2.5) and open the door to the right.
   The p.c. boards are now visible.
3. Set the hex-decimal switch (**iMCs address selection**) on the upper board BY 5160 (System Control) to the desired position ”0, 1, 2, 3” (Fig. 504).

   Setting 0 = machine address #1
   Setting 1 = machine address #2
   Setting 2 = machine address #3
   Setting 3 = machine address #4
4. After the machine address has been selected, close the front door, connect the mains and switch the machine on.

Now, the selected machine address (for example ADDR #1) is shown in the door display on the left hand side below the video cassette compartment.

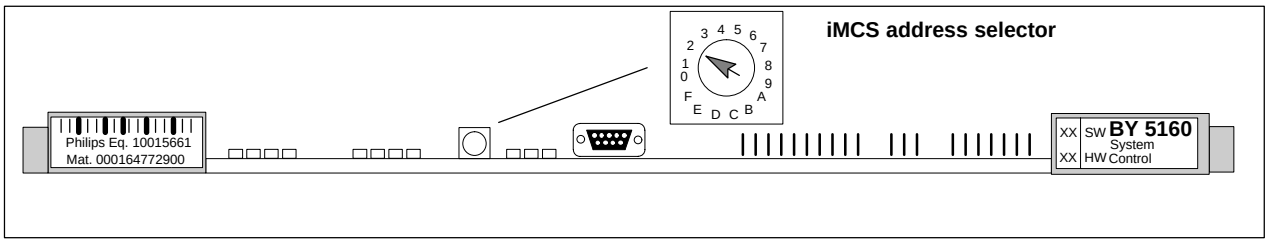


Fig. 504: Address selector

5.4 CONTROL OF THE INPUT / REFERENCE SIGNAL

5.4.1 DTV MODE

Select the connected video input signal and/or the reference signal in the VIDEO menu as reference source.

Since the machine can also be operated with an internal reference signal, it is only necessary to select a reference if the machine is operated in conjunction with other machines (please refer also to Operating Instructions section 4.11.2 ”VIDEO menu, Setup REFERENCE”).

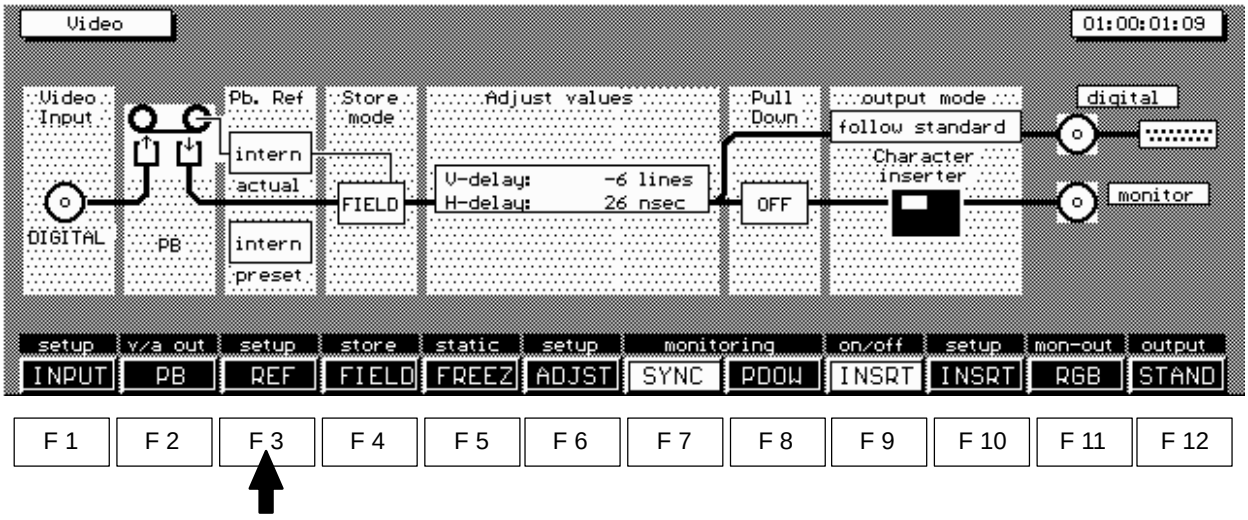


Fig. 505: DTV Video menu

Synchronization

Note:
In Record mode the machine is always synchronized with the selected video inputsignal. Only in Play and Crash Record mode (operating instructions section 4.5. ”EDITOR”) the machine is synchronized with one of the signals selected in the VIDEO menu with the SETUP and REF keys.

Reference inputs

The following signals can be selected at the Control Panel:

INTERNAL	selected when no external reference is present or needed (Free run mode)
EXTERNAL	selected when an external analog reference is present (EXT SYNC)
VIDEO IN	Digital Video Input dependent on Setup Input, refer to operating instructions section 4.11.1.

Studio Timing (timing delay)

The machine output signal can be delayed or advanced with respect to the reference signal over a range of ± 4.85 µs in the horizontal position and delayed by –12 and advanced by +4 lines in the vertical position.

By pressing the function key F6 ”Setup, ADJUST” in the VIDEO menu, the horizontal and vertical signal positions in the H and V-delay window may be matched with that of the reference signal position using the Adjust Dial on the Control Panel (refer to operating instructions section 4.11.3 ”Setup Analog Adjustments”).

Audio Timing

External delay times of the audio signals, compared to the video signals as a result of e. g. audio effect devices (advance: 0 - 10ms) can be compensated as well as matching of e. g. video delay times from frame buffers (delay: 0, field, frame) in the Audio Config menu with window ”Setup Output Timing” (please refer to Operating Instructions section 4.8.4.).

5.4.2 DATA MODE

When the system is configured as data recorder, a check of input signal an HIPPI communication is recommended.

The HIPPI protocol requires both optical paths to be connected (send/receive) independent of play or record mode.

Because some optical cables have no indication of input and output this check is required for proper operation. The indicator for correct configuration is the **DATA INPUT** indicator.

If the cable set up is correct, the data input indicator will be off.

If the data recorder is connected via an HIPPI router, the destination address has to be set up prior to manual operation of the data recorder. The destination address (I–field in HIPPI protocol) can be selected in the home menu. See Operation manual for details.

5.5 OPERATION

See **Operating Instructions:**

Record and Playback modes: section 3.4 & 3.5.
Menu control: section 4.

6. INTERFACES

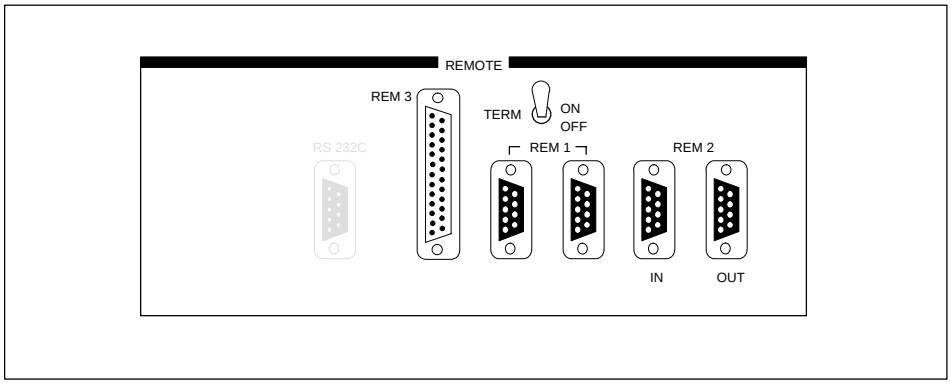


Fig. 601: Part of terminal panel Tapedeck

6.1 RS 422 ES - BUS (DTV MODE ONLY) REM 1 ES-BUS PORT ACCORDING TO EBU-TECH 3245-E

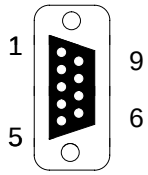
REM 1 – RS 422	Pin No.	Signal
 9 pole D-type female	1	Ground
	2	Transmit A
	3	Receive B
	4	Ground
	5	Not used
	6	Ground
	7	Transmit B
	8	Receive A
	9	Ground

Fig. 602: Pin assignment remote 1

For details see the interface description TECH-3245-E ”Remote control systems for television productions equipment” incl. Supplement I and II.

European Broadcasting Union
Technical Center
Avenue Albert Lancaster 32
B - 1180 Bruxelles (Belgium)

6.1.1 COMMAND LIST DCR 6024 FOR REMOTE CONTROL SYSTEM EBU/SMPTE (ES-BUS).

CODE	Messages		Remarks
SYSTEM SERVICE CONTROL MESSAGES			
00	Snop		
01	Reserved (BEGIN)	*	
02	Reserved (ENG)	*	
03	Streset		
04	Initial Segment		
05	Subsequent Segment		
06	Block		
07	Virtual Machine/Group Select		
08	Error Response		
09	Virtual Group Attach		
10	Assign Linkage		
11	Linkage Deassigning		
12	Assign Supv Level Grp		
13	Supv Level Grp Deassigning		
14	Assign Virtual Grp		
15	Virtual Grp Deassigning		
16	Bc read		
17	Bc I/F Response		
18	Request Time Transmit		
19	Bc User Defined		
1F	Extension		
I/F Names (System Service)			
10	Linkage		
11	Status		
12	Supv Level Group		
13	Virtual Group		
COMMON MESSAGES			
20	Cnop	*	
21	Crest	*	
22	Read	*	
23	I/F Item Response	*	
24	Timeline Source		Source fixed
25			
26	Execute Procedure		
27	Define Event	*	
28	Clear Event	*	
29	Error	*	
2A			
2B			
2C			
2D	Failure	*	
2E			
2F	Timeline Stop	*	

CODE	Messages		Remarks
30	Timeline Run	*	
3E	User Defined		
3F	Extension	*	
I/F Names (Common Messages)			
20			
21	Virtual Machine Type	*	
22	Equipment Type	*	
23	Time Standard	*	
24	Timeline Time	*	
25			
26	Event Buffer Status	*	
27	Virtual Mach Status	*	
3E	User Defined		
3F	Extension		
VTR-DIALECT			
41	Stop	*	
42	Variable Play	*	
43	Std. Play	*	
44	Step		
45	Visible Fast	*	
46	Shuttle	*	
47	Tape Speed Override	*	
48	Ready Select	*	
49	Servo Reference Select	*	
4A	Record Mode Select	*	
4B	Entry	*	
4C	Exit	*	
4D	Tape Code Select	*	
4E	Target Search	*	
4F	Preroll Search	*	
50	Sync	*	
51	Color Farmer Select	*	
52	Edit Field Select	*	
53	Chase		
54	TCG Source Select	*	
55	TCG Time Source VITC		
56	TCG User bit Select	*	
57	TCG User bit Source VITC		
58	Eject/Unthread	*	
59			
5A			
5B			
5C			
5D			
5E	Tracking Select		

CODE	Messages		Remarks
5F	Anti-Clog Control	*	
60	Preset	*	
65	Playback Channel Sel		
66	Channel Mute Select		
67	Tape/EE select	*	
	I/F (VTR-DIALECT)		
41	LTC From Tape	*	
42	VITC From Tape		
43	Select Tape Code	*	
44	Userbits from Tape LTC	*	
45	Userbits from Tape VITC		
46	TT 1 (Tape Timer 1)	*	
47	TT2 (Tape Timer 2)	*	
48	Ready Tally	*	
49	Servo Ref. Tally	*	
4A	Record Mode Tally	*	
4B	Channel Record Status	*	
4C	Channel Record Mask	*	
4D	Tape Code Select	*	
4E	Sync Velocity		
4F	Preroll Duration	*	
50	Sync Point	*	
51	Color Framer Tally	*	
52	Edit Field Tally	*	
53			
54	TCG LTC SRC Tally	*	
55	TCG VITA SRC Tally		
56	TCG LUB SRC Tally	*	
57	TCG VUB SRC Tally		
58			
59			
5A	Tape length	*	
5B	Parking Accuracy	*	
5C	Synchronism Accuracy	*	
5D			
5E	Tracking Sel Tally		
5F	Anti-Clog Control	*	
	I/F (VTR-DIALECT)		
60			
61	TMC Tally	*	
62	Velocity	*	
63	Timeline Correction Tally	*	
64			
65	Playback Channel		
66	Channel Mute Tally		

CODE	Messages		Remarks
67	Tape/EE Tally	*	
68	TC to Tape LTC	*	
69	TC to Tape VITC		
6A	UB to Tape LTC		
6B	UB to Tape VITC		
6C	Prst Time Src LTC	*	
6D	Prst Time Scr VITC		
6E	Prst UB Src LTC	*	
6F	Prst UB Src VITC		
Extension Set (Common Messages)			
3F03	Function Poll	*	
3F04	Function Response	*	
3F05	Field Poll	*	
3F06	Field Response	*	
3F07	Update	*	
3F08	Cycle	*	
3F09	Mute	*	
3F0A	Simultaneous Read		
3F0B	Define Procedure		
3F0C	Delete Procedure		
3F0D	Recall Procedure		
3F0E	Procedure Response		
3F0F	Recall Event		
3F10	Event Response		
3F11	Simult Read Response		
3FFF	Extension		

* currently implemented

6.2 REM 2 IN – RS 422A INTERFACE, SONY PROTOCOL (DTV MODE ONLY)

General

The DCR 6024 remote control terminal panel carries a 9-pole female subminiature D connector (REMOTE-2 IN) which serves to establish the connection to a control system, involving the use of serial data transmission. The following description explains the contents of the serial protocol and the serial transmission sequence.

Features

- In conformity with EIA-Standard RS 422A.
- 4-wire-transmission system.
- Asynchronous, bit serial and word serial data transmission.

Standard transfer rate of 38.4 kbit/s. The structure of the data words used in the interface system is as described below:

1 Start bit + 8 Data bits + 1 Parity bit + 1 Stop bit — Mark

Start bit	D0 (LSB)	D1	D2	D3	D4	D5	D6	D7 (MSB)	Parity (Odd)	Space

PARITY ”ODD”: The sum of D0 + D1 + ... D7 parity bit corresponds to an odd number.

MARK B > A (Voltage on line B is higher than that on line A).

SPACE A > B (Voltage on line A is higher than that on line B).

Command telegram format

Communication between control system and DCR 6024 uses the following command telegram format:

CMDI/DATA COUNT, CMD2 and data checksum (CHECKSUM). If DATA COUNT is zero, no data is transmitted. If it is not zero, the data corresponding to the existing values are inserted between CMD2 and checksum.

Bit 4-7	Bit 0-3					
CMD 1	Data count	CMD 2	DATA 1		DATA n (n=15max.)	CHECKSUM

CMD 1

CMD1 assigns the command to the following main function groups which serve to define the function and the transfer direction of the data words which follows (see table below):

CMD 1	Function	Transfer direction Control system DCR 6024
0	System control	------->
1	System control - return message	<-------
2	Tape deck control	------->
4	Setup and selection control	<-------
8	Data request	------->
7	Data request return message	<-------

Data count

Defines the number of the data words which are inserted after CMD2 (0 to F hex).

CMD 2

Is the specific command to the DCR 6024 or the command return message from the DCR 6024, respectively.

DATA

The number of data words and their contents are defined by the CMD2 command.

CHECKSUM

The sum of the data (D0 to D7) contained in each data word i.e. from CMD1/DATA COUNT up to the last data word before the checksum. The Checksum is used to verify that the data are error free and makes sure that transmission sequences which are affected by bit errors are rejected.

Connector pin assignment

The interface of DCR 6024 uses a 9-pin female subminiature D connector whose pin out is shown in the table below.

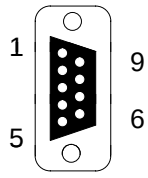
REM 2 IN – RS 422A	Pin-No.	Signal
 9 pole D-type female	1	Ground
	2	Transmit A
	3	Receive B
	4	Ground
	5	Not used
	6	Ground
	7	Transmit B
	8	Receive A
	9	Ground

Fig. 603: Pin assignment remote 2 IN

A and B are defined as shown below:

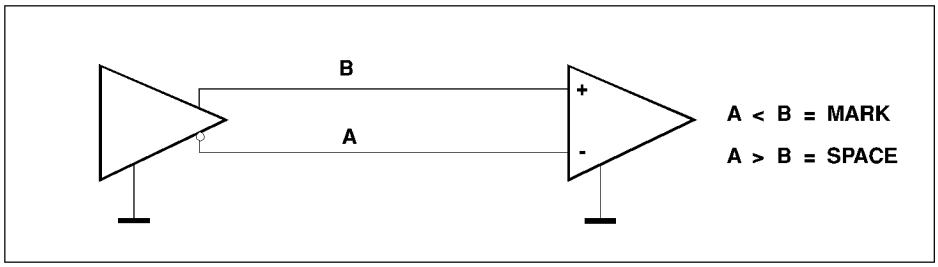


Fig. 604:

Communication protocol

When the DCR 6024 receives a command telegram from the control system, it sends back the following return telegram:

- If the DCR 6024 receives a command without data request:
  ... AK (10H, 01H) = acknowledgement of receipt.
- If the DCR 6024 receives a command with data request:
  ... answer code + data
- If transmission error is detected or if an undefined command is received:
  ... NAK (11H, 12H) + error code

Error code:	Bit0 (01H):	Command not defined
	Bit2 (04H):	Checksum error
	Bit4 (10H):	Parity error
	Bit5 (20H):	Overrun error
	Bit6 (40H):	Start/stop bit error (framing error)
	Bit7 (80H):	Time out

The control system must not send any additional command telegram before having received a corresponding response to the previous command.

The control system must not interrupt the transmission of a command telegram for more than 10 ms. As soon as the DCR 6024 has detected such a break which is longer than 10 ms it proceeds with a time out error sequence. The DCR 6024 ignores the command telegram received and transmits a NAK (time out).

As soon as the DCR 6024 receives a command telegram from the control system, it sends a return message within 9 ms. Therefore, unless having received a return message from the DCR 6024 within 10 ms after the execution of a command telegram transmission, the control system must proceed as if the communication had not taken place under normal circumstances.

When an error is detected, the DCR 6024 immediately sends a NAK to the control system. Upon receipt of a NAK, the control system in turn must immediately abort the data block transmission.

6.2.1 COMMAND LIST OF THE IMPLEMENTED RS 422A COMMANDS AT DCR 6024:

CODE	DCR 6024 commands	meaning	response	remarks/footnotes
00 11	DEVICE TYPE REQUEST	machine ID-reg	12 11 XX YY	machine id 0)
20 00	STOP		10 01 (ACK)	
20 01	PLAY		10 01	
20 02	RECORD	Crash-Record	10 01	
20 04	STANDBY OFF	release-tape	10 01	
20 05	STANDBY ON	unrelease	10 01	
20 0F	EJECT	EJECT-Tape	10 01	
20 10	FAST FWD	max. forward	10 01	
21 11	JOG FWD	slow motion	10 01	1) 2)
22 11	JOG FWD high-res.	slow motion	10 01	1) 4)
21 12	VAR FWD	variable	10 01	1) 2)
22 12	VAR FWD high-res.	variable/shtl.	10 01	3) 4)
21 13	SHUTTLE FWD		10 01	2)
22 13	SHUTTLE FWD high res.		10 01	4)
20 14	STEP-FWD	field step	10 01	
20 20	REWIND	max. reverse	10 01	
21 21	JOG REV	slow motion	10 01	1) 2)
22 21	JOG REV high res.	slow motion	10 01	1) 4)
21 22	VAR REV	variable	10 01	1) 2)
22 22	VAR REV high res.	variable/shtl.	10 01	3) 4)
21 23	SHUTTLE REV		10 01	2)
22 23	SHUTTLE REV high res.		10 01	4)
20 24	STEP REV	field step	10 01	
20 30	PREROLL	park before IN	10 01	5)
24 31	CUE UP WITH DATA	tc search	10 01	5) 6)
21 38	PROG-SPEED-PLAY+		10 01	7)
21 39	PROG-SPEED-PLAY-		10 01	7)
20 40	PREVIEW	simulation	10 01	8) 9) 10)
20 41	REVIEW	playback of last	10 01	8) 9) 10)
		AUTO EDIT		
20 42	AUTO EDIT	edit IN-OUT	10 01	8) 9) 10)
20 54	ANTI-CLOG TIMER	disable autom.	10 01	not executed
	DISABLE	tape release		
20 55	ANTI-CLOG TIMER	enable autom.	10 01	not executed
	ENABLE	release		
20 60	FULL EE OFF		10 01	
20 61	FULL EE ON		10 01	
20 63	SELECT EE ON	EE with sel. heads	10 01	9) 11)
20 64	EDIT OFF	PLAY from REC.	10 01	
20 65	EDIT ON	REC from PLAY	10 01	9)
20 6A	FREEZE OFF		10 01	
20 6B	FREEZE ON		10 01	

44 00	TIMER-1-PRESET	Tapetimer set	10 01	6)
44 04	TIME CODE-PRESET	Timesource set	10 01	6)
44 05	USER BIT PRESET	User bit set	10 01	12)
40 08	TIMER-1-RESET	Tape timer = 0	10 01	
40 10	IN ENTRY	mark as IN point	10 01	8)
40 11	OUT ENTRY	mark as OUT point	10 01	9)
44 14	IN DATA PRESET	set IN pnt.	10 01	6) 9)
44 15	OUT DATA PRESET	set OUT pnt.	10 01	6) 9)
40 18	IN SHIFT +	IN = IN + 1	10 01	
40 19	IN SHIFT -	IN = IN - 1	10 01	
44 1A	OUT SHIFT +	OUT = OUT + 1	10 01	
44 1B	OUT SHIFT -	OUT = OUT - 1	10 01	
40 20	IN FLAG RESET	clear IN	10 01	
40 21	OUT FLAG RESET	clear OUT	1001	
40 24	IN RECALL	recall IN	10 01	
40 25	OUT RECALL	recall OUT	10 01	
41 30	EDIT PRESET 1Byte		10 01	13)
42 30	EDIT PRESET 2Byte		10 01	13)
43 30	EDIT PRESET 3Byte		10 01	13)
44 31	PREROLL TIME PRESET	set preroll	10 01	6)
41 32	TAPE/AUTO SELECT	select of the autom. EE	10 01	14)
41 33	SERVO REF SELECT	select of the Servo Ref.	10 01	15)
41 36	TIMER MODE SELECT		10 01	18)
41 3A	EDIT FIELD SELECT	start field for RECORD	10 01	19)
41 3B	FREEZE MODE SELECT	freeze mode	10 01	20)
40 40	AUTO MODE OFF		10 01	
40 41	AUTO MODE ON		10 01	
61 0A	TC GEN DATA SENSE		tc gen data	21)
61 0C	CURRENT TIME SENSE		tc data	22) 23) 24)
60 10	IN DATA SENSE		74 10 TC	set by in/out
60 11	OUT DATA SENSE		74 11 TC	entry or preset
61 20	STATUS SENSE		status data	25)
60 30	EDIT PRESET SENSE		71 30	26)
60 31	PREROLL TIME SENSE		PREROLL	
			TIME	
60 36	TIMER CODE SENSE		TIMER	
			MODE	

Footnote 0

xx = data -1
yy = data -2
This ID can be set via the RS232 diagnostics interface.
Default data -1 = 00
data -2 = E0
For 50 Hz field rate version the LSB of data -1 is always set to ”1” automatically

Footnote 1

This function is limited to - 0.25 ... 0.25 times PLAY speed.

Footnote 2

The low resolution speed data consists of one byte (Value = 0 ... 255).
The real tape speed in multiples of play is defined as

Tape Speed = $10^{(value/32-2)}$

This means, the speed data is the logarithmic translation of the tape speed.
(eg. value = 32 : 0.1 x play, value = 64 : 1 x play, value = 96 : 10 x play)

Footnote 3

The speed range from -0.25 .... 0.25 times PLAY speed is executed as VARIABLE. The ranges above and below are executed as SHUTTLE to allow synchronization of the machine with this command.

Footnote 4

The high resolution speed data consists of two bytes, but only the first data byte is used to calculate the tape speed (refer to footnote 2).

Footnote 5

The parking accuracy depends on the parking accuracy value set on the Control Panel.

Footnote 6

The Timecode data consists of 4 byte coded in BCD:

data 1 : Frames
data 2 : Seconds
data 3 : Minutes
data 4 : Hours

Footnote 7

The command allows synchronization of the machine. The argument (0 ... 255) is a deviation (0 % ... 25,5 %) to 1 x PLAY speed in steps of 0,1 %

DEVIATION (%) = 0,1% x SPEED DATA

Footnote 8

The time base for this operation can be set with the TAPE CODE SELECT command.

Footnote 9

The operation is done with the selected tracks and record mode of the EDIT PRESET command.

Footnote 10

The IN- and OUT-point must be set before with IN/OUT ENTRY or IN/OUT DATA PRESET command.

Footnote 11

If the servo is not locked this command will be executed as a FULL EE ON to allow to do BVB (BLACK-VIDEO-BLACK) simulation.

Footnote 12

The user bits data consists of 4 byte (high nibble/low nibble):

data 1 : binary group 2 / binary group 1
data 2 : binary group 4 / binary group 3
data 3 : binary group 6 / binary group 5
data 4 : binary group 8 / binary group 7

Footnote 13

The high resolution EDIT PRESET is the bit transparent representation of record mode and the track selection:

Byte 1 is identical for all three modes.

Byte 1:	Bit 0:	CUE track	Bit 4:	video track
	Bit 1:	CUE track	Bit 5:	record mode assemble
	Bit 2:	LTC-track	Bit 6:	record mode insert
	Bit 3:	CUE track	Bit 7:	unused

2 Byte mode:

Byte 2:	Bit 0:	DA1-track	Bit 4:	DA5-track
	Bit 1:	DA2-track	Bit 5:	DA6-track (24/25fps only)
	Bit 2:	DA3-track	Bit 6:	unused
	Bit 3:	DA4-track	Bit 7:	unused

Audio bits will be interpreted as audio channel pairs.

A1,A2 = CUE track
DA1 = Voodoo audio channel pair A1/2
DA2 = Voodoo audio channel pair A3/4
DA3 = Voodoo audio channel pair A5/6
DA4 = Voodoo audio channel pair A7/8
DA5 = Voodoo audio channel pair A9/10
DA6 = Voodoo audio channel pair A11/12

3 Btye mode:

Byte 2:	Bit 0:	DA1-track	Bit 4:	DA5-track
	Bit 1:	DA2-track	Bit 5:	DA6-track
	Bit 2:	DA3-track	Bit 6:	DA7-track
	Bit 3:	DA4-track	Bit 7:	DA8-track
Byte 3:	Bit 0:	DA9-track	Bit 4:	unused
	Bit 1:	DA10-track	Bit 5:	unused
	Bit 2:	DA11-track	Bit 6:	unused
	Bit 3:	DA12-track	Bit 7:	unused

Audio bits will be interpreted as audio channel tracks.

A1,A2 = CUE track
DA1 = Voodoo audio channel pair A1/2
DA2 = Voodoo audio channel pair A1/2
DA3 = Voodoo audio channel pair A3/4
DA4 = Voodoo audio channel pair A3/4
DA5 = Voodoo audio channel pair A5/6
DA6 = Voodoo audio channel pair A5/6
DA7 = Voodoo audio channel pair A7/8
DA8 = Voodoo audio channel pair A7/8
DA9 = Voodoo audio channel pair A9/10
DA10 = Voodoo audio channel pair A9/10
DA11 = Voodoo audio channel pair A11/12
DA12 = Voodoo audio channel pair A11/12

Footnote 14

The TAPE/AUTO SELECT data is defined as:

00H: automatic (tape or EE)
01H: tape
FFH: as locally selected

Footnote 15 The SERVO REFERENCE SELECT data is defined as:

01H: external analog ref
02H: video input
FFH: as selected locally

Footnote 18 The TIMER MODE SELECT data is defined as:

00H: LTC
01H: TT1
02H: TT2
FFH: as defined locally

Footnote19 The EDIT- FIELD SELECT data is defined as:

00H: edit starts every field depending start of edit command
01H: edit starts in field 1
02H: edit starts in field 2
FFH: as selected locally

Footnote 20 The FREEZE MODE SELECT data is defined as:

00H: field freeze
11H: frame freeze

Footnote 21 The TC GEN DATA SENSE data is defined as:

01H:	request generator timecode	response=74H, 08H, 4 byte BCD timecode
10H:	request generator userbits	response=74H, 09H, 4 byte userbits
11H:	request generator ub + tc	response=78H, 08H, 8 byte BCD tc + ub

Footnote 22 The CURRENT TIME SENSE data is defined as:

T8 Bit 1 = ON	01H:	request LTC tc	response = 74H, 04H, 4 byte LTC
		or	response = 74H, 14 H, 4 byte corr. LTC
	03H:	request LTC tc	response = 74H, 04H, 4 byte LTC
		or	response = 74H, 06H, 4 byte VITC
	04H:	request timer 1	response = 74H, 00H, 4 byte timer data
	08H:	request timer 2	response = 74H, 01H, 4 byte timer data
	10H:	request LTC userbits	response = 74H, 15H, 4 byte userbits
	11H:	request LTC tc + ub	response = 78H, 04H, 8 byte LTC tc + ub
T8 Bit 1 = OFF	01H:	request LTC tc	response=74H, 04H, 4 byte LTC
		or	response=74H, 14 H, 4 byte corr. LTC
	02H:	request ASTC tc	response= 74H, 06H,4 byte ASTC
	03H:	request LTC/ASTC tc	response=74H, 04H, 4 byte LTC
		or	response=74H, 06H, 4 byte ASTC
	04H:	request timer 1	response=74H, 00H, 4 byte timer data
	08H:	request timer 2	response=74H, 01H, 4 byte timer data
	10H:	request LTC userbits	response=74H, 15H, 4 byte userbits
	20H:	req ASTC userbits	response=74H, 00H, 4 byte timer data
	11H:	request LTC tc + ub	response=78H, 04H, 8 byte LTC tc + ub
	33H:	req LTC/ATC tc+ub	response=78H, 04H, 8byte LTC tc+ub
		or	response=74H, 06H,8 byte ASTC tc+ub

Footnote 23 There is a field-ID in the LTC-TIME-Data:

60Hz/Data 2	50Hz/Data 4	Field
MSB	MSB	Selection
0	0	Field 1
1	1	Field 2

Footnote 24 There is a DROP FRAME ID in the LTC-TIME-Data:

Data 1	Drop
Bit 6	Frame
0	OFF
1	ON

Footnote 25 The STATUS SENSE Data is defined as:

high nibble (bits 4..7): first data byte no. of status field
low nibble (bits 0..3): number of data bytes out of status field

response: 7xH, 20H, and X data bytes of status filed:

Byte 0: Bit 0 = LOCAL
Bit 5 = TAPE UNTHREAD

Byte 1: Bit 0 = PLAY, Bit 1 = RECORD
Bit 2 = FAST FORWARD, Bit 3 = REWIND
Bit 5 = STOP, Bit 7 = STANDBY

Byte 2: Bit 0 = CUE UP, Bit 1 = STILL
Bit 2 = TAPE DIR., Bit 3 = VAR
Bit 4 = JOG, Bit 5 = SHUTTLE
Bit 7 = SERVO LOCK

Byte 3: Bit 0 = IN DATA SET, Bit 1 = OUT DATA SET
Bit 6 = FREEZE, Bit 7 = AUTO MODE

Byte 4: Bit 0 = PREROLL, Bit 1 = PREVIEW
Bit 2 = AUTO EDIT, Bit 3 = REVIEW
Bit 4 = EDIT, Bit 6 = FULL EE ON
Bit 7 = SELECT EE ON

Byte 5: Bit 0 = A1, Bit 1 = A2
Bit 2 = A3, Bit 3 = A4
Bit 4 = VIDEO, Bit 5 = ASSEMBLE
Bit 6 = INSERT

Byte 6: no bits used

Byte 7: no bits used

Byte 8: Bit 0 = REC INHIBIT, Bit 3 = CF LOCK
Bit 4 = EOT

Byte 9: Bit 7 = FUNCTION - ABORT

Footnote 26 The response of the EDIT_PRESET_SENSE command will follow the EDIT_PRESET format

Standard EDIT_PRESET_SENSE format 60 30 or 1 byte format 61 30 01
Response 71 30 md
md: see 1 byte format EDIT_PRESET

Extended EDIT_PRESET_SENSE 2 byte format 61 30 02
Response 71 30 md1 md2
md1,md2: see 2 byte format EDIT_PRESET

Extended EDIT_PRESET_SENSE 3 byte format 61 30 03
Response 71 30 md1 md2 md3
md1,md2,md3: see 3 byte format EDIT_PRESET

6.3 REM 2 OUT – RS 422A INTERFACE BBE, SONY PROTOCOL (DTV MODE ONLY)

General

The DCR 6024 remote control terminal panel carries a 9 pole female subminiature D connector REMOTE 2 OUT which serves to establish the connection to a slave VTR, involving the use of serial data transmission.

Features

- In conformity with EIA-Standard RS 422A.
- 4-wire-transmission system.
- Asynchronous, bit serial and word serial data transmission.

Standard transfer rate of 38.4 kbit/s. The structure of the data words used in the interface system is as described below:

1 Start bit + 8 Data bits + 1 Parity bit + 1 Stop bit Mark

Start bit	D0 (LSB)	D1	D2	D3	D4	D5	D6	D7 (MSB)	Parity (Odd)	Space

PARITY ”ODD”: The sum of D0 + D1 + ... D7 parity bit corresponds to an odd number.

MARK B > A (Voltage on line B is higher than that on line A).

SPACE A > B (Voltage on line A is higher than that on line B).

Command telegram format

Communication between control system and DCR 6024 uses the following command telegram format:

CMDI/DATA COUNT, CMD2 and data checksum (CHECKSUM). If DATA COUNT is zero, no data is transmitted. If it is not zero, the data corresponding to the existing values are inserted between CMD2 and checksum.

Bit 4-7	Bit 0-3					
CMD 1	Data count	CMD 2	DATA 1		DATA n (n=15max.)	CHECKSUM

CMD 1

CMD1 assigns the command to the following main function groups which serve to define the function and the transfer direction of the data words which follows (see table below):

CMD 1	Function	Transfer direction Control system DCR 6024
0	System control	------->
1	System control - return message	<-------
2	Tape deck control	------->
4	Setup and selection control	<-------
8	Data request	------->
7	Data request return message	<-------

Data count

Defines the number of the data words which are inserted after CMD2 (0 to F hex).

CMD 2

Is the specific command to the DCR 6024 or the command return message from the DCR 6024, respectively.

DATA

The number of data words and their contents are defined by the CMD2 command.

CHECKSUM

The sum of the data (D0 to D7) contained in each data word i.e. from CMD1/DATA COUNT up to the last data word before the checksum. The Checksum is used to verify that the data are error free and makes sure that transmission sequences which are affected by bit errors are rejected.

Connector pin assignment

The interface of DCR 6024 uses a 9-pin female subminiature D connector whose pin-out is shown in the table below.

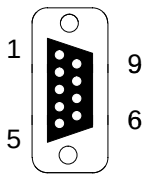
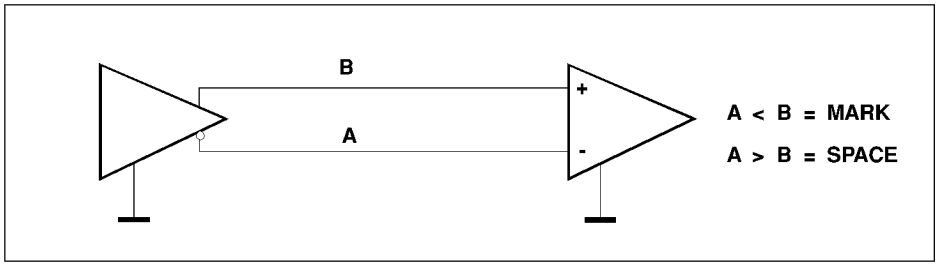
REM 2 OUT – RS 422A	Pin-No.	Signal
 9 pole D-type female	1	Ground
	2	Receive A
	3	Transmit B
	4	Ground
	5	Not used
	6	Ground
	7	Receive B
	8	Transmit A
	9	Ground

Fig. 605: Pin assignment remote 2

In order to control a ”PLAYER” VTR the editor setup status field ”player control” has to indicate RS 422A.

A and B are defined as shown below:



7. DTV APPLICATIONS

7.1 LIST OF EXTERNAL DEVICES ABLE TO CONTROL DCR 6024

7.1.1 VTR EDITORS

Type	Designation	Manufacturer
BBE 600	Editing system	Philips Digital Video Systems
BBE 900	Editing system	Philips Digital Video Systems
BVE 600	Editing system	Sony
BVE 900	Editing system	Sony
BVE 9000	Editing system	Sony

7.1.2 TELECINE CONTROLLERS

- Spirit Datacine SDC 2000 and
- Specter Virtual Datacine VDC 2000 applications

Type	Designation	Manufacturer
Renaissance + Mainframe “ 2K “	Telecine Controller Color Correction	DaVinci
Pogle + MegaDef	Telecine Controller Color Correction	Pandora

Remark: List will be extended continuously. Please ask for newest version.

7.2 OPERATION UNDER CONTROL OF EDITING- AND GRAPHIC SYSTEMS

General remarks

The RS 422A port is only defined in its electrical parameter and its timing. Depending on the machine type additional commands are added to the standard ones. The overall system performance is furthermore influenced by the ballistics of the tape deck and the video/audio electronics timing.
In general an adoption done by the graphics- or editing-system supplier is required to ensure smooth operation.
Please refer to the user's manual of those systems for installation procedures.

We recommend the following setups:

Editor Menu - Editor setup

Parameter	relevant for	min	max	default
Preroll time	Graphic systems using the internal editing-routines.	01	99	05
Parking accuracy	Edit- and graphic systems using the internal search routine.	00	99	00
Edit field	Edit- and graphic systems which do not modify the edit field via the RS 422 port.	F1	F2	F1
Cue track sel. by RS 422	Automatic select/deselect trigger of audio analog cue track. Selection during track select (A1 ... 4) see **Remark 1**	off	any	off
Exit search (cue) op. with	Determines in which mode the internal search routine is ended.	SHTL-0	STOP	SHTL-0
RS422/ESBUS tc delay	Edit- and graphic systems not capable to compensate the picture/TC-delay"-due to the video store. For setting of the "TC delay" switch, please refer to the Editor-Handbook.	off	auto	off

Remark 1: Single tracks used to select the cue-track are not edited, only in case of a common selection in position ANY the selected audio tracks are edited as well.

Home Menu

Parameter	relevant for	min	max	default
Rec inhibit	Record inhibit for all tracks of this machine.	off	on	off

In conjunction with the BBE 900, BBE 900 K, BBE 910 and BVE 9000 series select following values:

Editor Menu -Editor setup

Parameter	for	Value
Parking accuracy	Player and Recorder	00
TC delay	Player and Recorder	AUTO
Exit search (cue)	Player and Recorder	SHTL-0

7.3 PARAMETER SHEET BBE 900

Setup-Parameter for Editing-Systems BBE 600, BBE 900, BBE 900K and BBE 910

For each DCR 6024 connected to one of these editors the following parameter have to be set for the according VTR-port (SETUP GROUP 2-4) at the initial installation.

It is recommended to install these parameters at all ports to ensure correct machine control on all ports if other configurations are used (e.g. RS-422 router).

BLOCK	BYTE	Name	Value	Remarks
1	1 2	DEV-TYPE	01 / 00H E0H	DCR 6024 identification. 01H at 50 Hz 00H at 60 Hz
1	3 4	MIN PREROLL TIME	00H 64H / 78H	 64H at 50H 78H at 60H
1	5	EDIT DELAY	05H	
1	6	EE DELAY	05H	
1	7	OVERRUN	05H	
1	8	TRAJECTORY CON.	1FH	
2	1	TC READ DELAY	0FH	
2	2	START DELAY	07H	
2	3	AFTER SYNC DEL-	FFH	
2	4	AFTER SYNC DEL+	00H	
2	5	CONST 11	01H	
2	6	CONST 12	64H	
2	7	PREROLL SPEED	FFH	
3	1	A1 ANALOG	undef	
3	2	A1 DIGITAL	A1	
3	3	A2 ANALOG	undef	
3	4	A2 DIGITAL	A2	
3	5	A3 ANALOG	undef	
3	6	A3 DIGITAL	A3	
3	7	A4 ANALOG	undef	
3	8	A4 DIGITAL	A4	
4	1	SYNC/A4 SELECT	SYNC	

Remark: Settings of Block 3 and 4 are not necessary for BBE 600 and BBE 900.

7.4 PARAMETER SHEET BVE 9000

Setup-Parameter for Editing-Systems BVE 9000 (Software Version 2)

For each DCR 6024 connected to the editor BVE 9000 the following parameters have to be set for the according VTR-port (SETUP/IDC/MACHINE PARAMETER GROUP) at the initial installation.

It is recommended to install these parameters at all ports to ensure correct machine control on all ports if other configurations are used (e.g. RS-422 router).

BLOCK	BYTE	Name	Value	Remarks
1	1 2	DEV-TYPE	01 / 00H EOH	DCR 6024 identification 01H at 50 Hz 00H at 60 Hz
1	3 4	MIN PREROLL TIME	00H 64H / 78H	 64H at 50H 78H at 60H
1	5	EDIT DELAY	05H	
1	6	EE DELAY	05H	
1	7	OVERRUN	05H	
1	8	TRAJECTORY CON.	1FH	
2	1	TC READ DELAY	0FH	
2	2	START DELAY	07H	
2	3	AFTER SYNC DEL–	FFH	
2	4	AFTER SYNC DEL+	00H	
2	5	CONST 11	01H	
2	6	CONST 12	64H	
2	7	PREROLL SPEED	FFH	
2	8	QUICK PVW PR TIME	4BH / 5AH	4BH at 50 Hz 5AH at 60 Hz
3	1	A1 ASSIGN	08H	
3	2	A2 ASSIGN	09H	
3	3	A3 ASSIGN	0AH	
3	4	A4 ASSIGN	0BH	
4	1	MODE	01H	

7.5 PARAMETER SHEET ...

(more in preparation)

8. DATA APPLICATIONS

This chapter will be extended if additional applications will be available.

8.1. DCR 6128 and Phantom Transfer Engine OCTANE

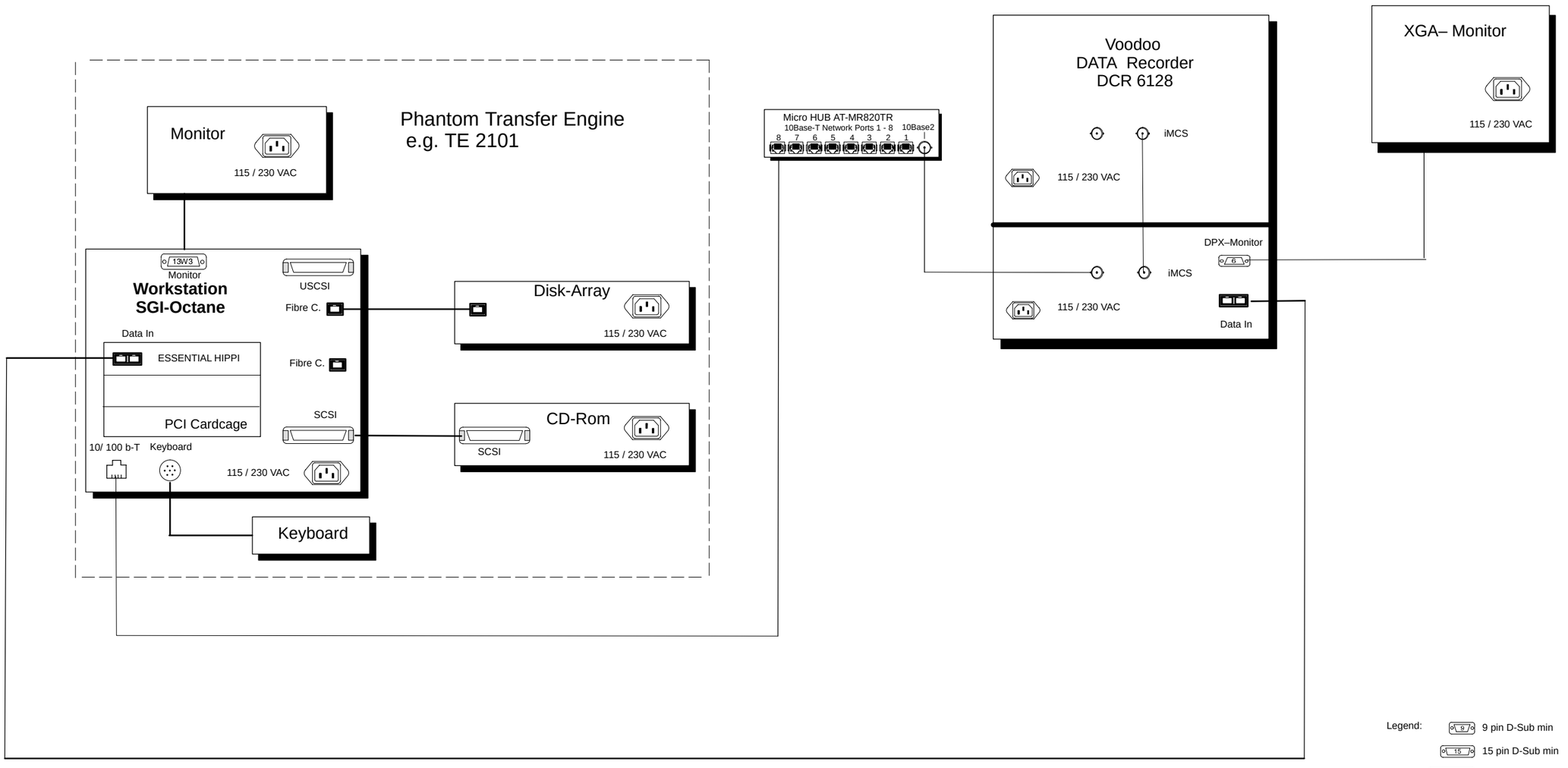


Fig. 801: DCR 6128 VooDoo data recorder with Phantom Transfer Engine

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