

# TASCAM

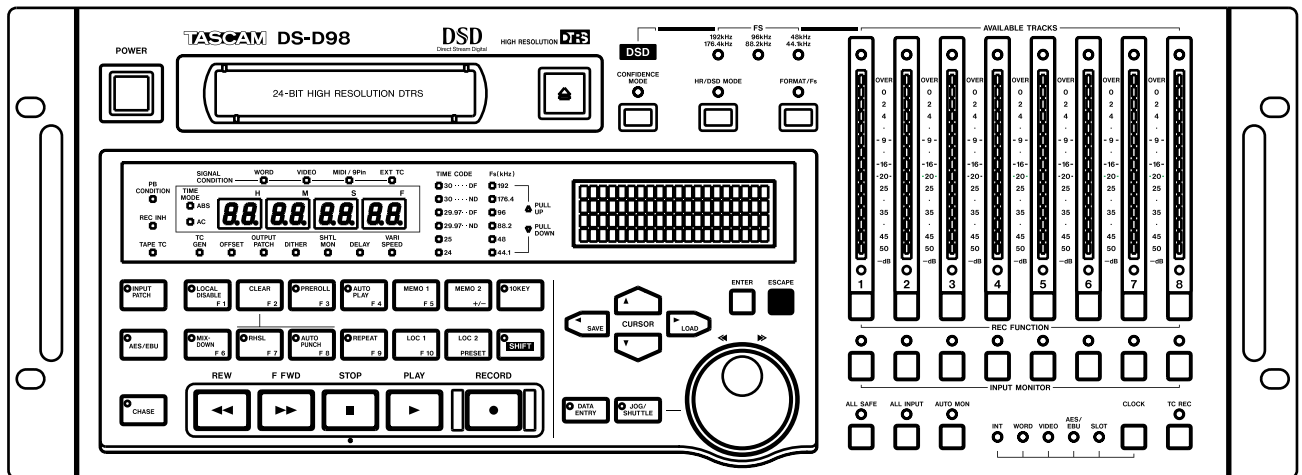
## TEAC Professional Division

D00635720A

# DS-D98

## Digital Multitrack Recorder

**DSD**  
Direct Stream Digital



## OWNER'S MANUAL



**CAUTION**  
RISK OF ELECTRIC SHOCK  
DO NOT OPEN



**CAUTION:** TO REDUCE THE RISK OF ELECTRIC SHOCK, DO NOT REMOVE COVER (OR BACK). NO USER-SERVICEABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED SERVICE PERSONNEL.



The lightning flash with arrowhead symbol, within an equilateral triangle, is intended to alert the user to the presence of uninsulated "dangerous voltage" within the product's enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons.



The exclamation point within an equilateral triangle is intended to alert the user to the presence of important operating and maintenance (servicing) instructions in the literature accompanying the appliance.

This appliance has a serial number located on the rear panel. Please record the model number and serial number and retain them for your records.  
Model number \_\_\_\_\_  
Serial number \_\_\_\_\_

**WARNING: TO PREVENT FIRE OR SHOCK HAZARD, DO NOT EXPOSE THIS APPLIANCE TO RAIN OR MOISTURE.**

# Important Safety Precautions

## IMPORTANT (for U.K. Customers)

### **DO NOT cut off the mains plug from this equipment.**

If the plug fitted is not suitable for the power points in your home or the cable is too short to reach a power point, then obtain an appropriate safety approved extension lead or consult your dealer.

If nonetheless the mains plug is cut off, remove the fuse and dispose of the plug immediately, to avoid a possible shock hazard by inadvertent connection to the mains supply.

If this product is not provided with a mains plug, or one has to be fitted, then follow the instructions given below:

**IMPORTANT:** The wires in this mains lead are coloured in accordance with the following code:

<b>GREEN-AND-YELLOW</b>	: EARTH
<b>BLUE</b>	: NEUTRAL
<b>BROWN</b>	: LIVE

**WARNING:** This apparatus must be earthed.

As the colours of the wires in the mains lead of this apparatus may not correspond with the coloured markings identifying the terminals in your plug proceed as follows:

The wire which is coloured GREEN-and-YELLOW must be connected to the terminal in the plug which is marked by the letter E or by the safety earth symbol  $\equiv$  or coloured GREEN or GREEN-and-YELLOW.

The wire which is coloured BLUE must be connected to the terminal which is marked with the letter N or coloured BLACK.

The wire which is coloured BROWN must be connected to the terminal which is marked with the letter L or coloured RED.

When replacing the fuse only a correctly rated approved type should be used and be sure to re-fit the fuse cover.

IF IN DOUBT — CONSULT A COMPETENT ELECTRICIAN.

For U.S.A

## TO THE USER

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. 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.

### **CAUTION**

Changes or modifications to this equipment not expressly approved by TEAC CORPORATION for compliance could void the user's authority to operate this equipment.

### **For the consumers in Europe**

#### **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.

### **Pour les utilisateurs en Europe**

#### **AVERTISSEMENT**

Il s'agit d'un produit de Classe A. Dans un environnement domestique, cet appareil peut provoquer des interférences radio, dans ce cas l'utilisateur peut être amené à prendre des mesures appropriées.

### **Für Kunden in Europa**

#### **Warnung**

Dies ist eine Einrichtung, welche die Funk-Entstörung nach Klasse A besitzt. Diese Einrichtung kann im Wohnbereich Funkstörungen verursachen ; in diesem Fall kann vom Betreiber verlangt werden, angemessene Maßnahmen durchzuführen und dafür aufzukommen.

# IMPORTANT SAFETY INSTRUCTIONS

## CAUTION:

- Read all of these Instructions.
- Save these Instructions for later use.
- Follow all Warnings and Instructions marked on the audio equipment.

- 1) Read Instructions** — All the safety and operating instructions should be read before the product is operated.
- 2) Retain Instructions** — The safety and operating instructions should be retained for future reference.
- 3) Heed Warnings** — All warnings on the product and in the operating instructions should be adhered to.
- 4) Follow Instructions** — All operating and use instructions should be followed.
- 5) Cleaning** — Unplug this product from the wall outlet before cleaning. Do not use liquid cleaners or aerosol cleaners. Use a damp cloth for cleaning.
- 6) Attachments** — Do not use attachments not recommended by the product manufacturer as they may cause hazards.
- 7) Water and Moisture** — Do not use this product near water — for example, near a bath tub, wash bowl, kitchen sink, or laundry tub; in a wet basement; or near a swimming pool; and the like.
- 8) Accessories** — Do not place this product on an unstable cart, stand, tripod, bracket, or table. The product may fall, causing serious injury to a child or adult, and serious damage to the product. Use only with a cart, stand, tripod, bracket, or table recommended by the manufacturer, or sold with the product. Any mounting of the product should follow the manufacturer's instructions, and should use a mounting accessory recommended by the manufacturer.
- 9)** A product and cart combination should be moved with care. Quick stops, excessive force, and uneven surfaces may cause the product and cart combination to overturn.

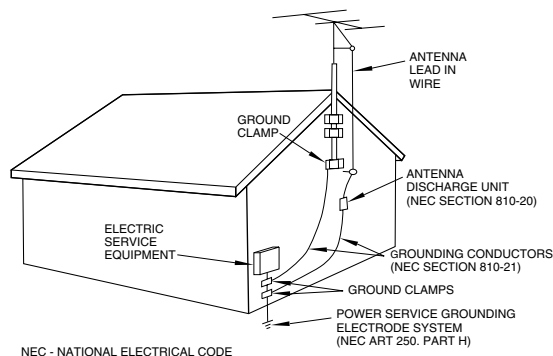


- 10) Ventilation** — Slots and openings in the cabinet are provided for ventilation and to ensure reliable operation of the product and to protect it from overheating, and these openings must not be blocked or covered. The openings should never be blocked by placing the product on a bed, sofa, rug, or other similar surface. This product should not be placed in a built-in installation such as a bookcase or rack unless proper ventilation is provided or the manufacturer's instructions have been adhered to.
- 11) Power Sources** — This product should be operated only from the type of power source indicated on the marking label. If you are not sure of the type of power supply to your home, consult your product dealer or local power company. For products intended to operate from battery power, or other sources, refer to the operating instructions.
- 12) Grounding or Polarization** — This product may be equipped with a polarized alternating-current line plug (a plug having one blade wider than the other). This plug will fit into the power outlet only one way. This is a safety feature. If you are unable to insert the plug fully into the outlet, try reversing the plug. If the plug should still fail to fit, contact your electrician to replace your obsolete outlet. Do not defeat the safety purpose of the polarized plug.
- 13) Power-Cord Protection** — Power-supply cords should be routed so that they are not likely to be walked on or pinched by items placed upon or against them, paying particular attention to cords at plugs, convenience receptacles, and the point where they exit from the product.
- 14) Outdoor Antenna Grounding** — If an outside antenna or cable system is connected to the product, be sure the antenna or cable system is grounded so as to provide some protection against voltage surges and built-up static charges. Article 810 of the National Electrical Code, ANSI/NFPA 70, provides information with regard to proper grounding of the mast and supporting structure, grounding of the lead-in wire to an antenna discharge unit, size of grounding conductors, location of antenna-discharge unit, connection to grounding electrodes, and requirements for the grounding electrode.

## "Note to CATV system installer:

This reminder is provided to call the CATV system installer's attention to Section 820-40 of the NEC which provides guidelines for proper grounding and, in particular, specifies that the cable ground shall be connected to the grounding system of the building, as close to the point of cable entry as practical.

Example of Antenna Grounding as per National Electrical Code, ANSI/NFPA 70



- 15) Lightning** — For added protection for this product during a lightning storm, or when it is left unattended and unused for long periods of time, unplug it from the wall outlet and disconnect the antenna or cable system. This will prevent damage to the product due to lightning and power-line surges.
- 16) Power Lines** — An outside antenna system should not be located in the vicinity of overhead power lines or other electric light or power circuits, or where it can fall into such power lines or circuits. When installing an outside antenna system, extreme care should be taken to keep from touching such power lines or circuits as contact with them might be fatal.
- 17) Overloading** — Do not overload wall outlets, extension cords, or integral convenience receptacles as this can result in risk of fire or electric shock.
- 18) Object and Liquid Entry** — Never push objects of any kind into this product through openings as they may touch dangerous voltage points or short-out parts that could result in a fire or electric shock. Never spill liquid of any kind on the product.
- 19) Servicing** — Do not attempt to service this product yourself as opening or removing covers may expose you to dangerous voltage or other hazards. Refer all servicing to qualified service personnel.
- 20) Damage Requiring Service** — Unplug this product from the wall outlet and refer servicing to qualified service personnel under the following conditions:
  - a) when the power-supply cord or plug is damaged.
  - b) if liquid has been spilled, or objects have fallen into the product.
  - c) if the product has been exposed to rain or water.
  - d) if the product does not operate normally by following the operating instructions. Adjust only those controls that are covered by the operating instructions as an improper adjustment of other controls may result in damage and will often require extensive work by a qualified technician to restore the product to its normal operation.
  - e) if the product has been dropped or damaged in any way.
  - f) when the product exhibits a distinct change in performance — this indicates a need for service.
- 21) Replacement Parts** — When replacement parts are required, be sure the service technician has used replacement parts specified by the manufacturer or have the same characteristics as the original part. Unauthorized substitutions may result in fire, electric shock, or other hazards.
- 22) Safety Check** — Upon completion of any service or repairs to this product, ask the service technician to perform safety checks to determine that the product is in proper operating condition.
- 23) Wall or Ceiling Mounting** — The product should be mounted to a wall or ceiling only as recommended by the manufacturer.
- 24) Heat** — The product should be situated away from heat sources such as radiators, heat registers, stoves, or other products (including amplifiers) that produce heat.

## DS-D98 recorder

The DS-D98 recorder provides the facility to record using the Direct Stream Digital (DSD) digital audio representation, as employed by the Super Audio CD format, using the convenient industry standard DTRS digital multitrack medium.

Based around the DA-98HR recorder, the DS-D98 has many features in common with its “parent” unit. PCM recordings made on this unit can be replayed on other DTRS units (subject to the sampling frequency and word length restrictions of the other units) and PCM recordings made on other DTRS units can be replayed on the DS-D98.

Please read the relevant portions of the DA-98HR manual, as supplied, in order to gain a full understanding of the basic operations of this unit.

The main differences between the DS-D98 recorder in DSD mode and the PCM digital audio mode (in which it acts in the same way as a DA-98HR recorder) are:

- The recording format and input sources. In DSD mode, the DS-D98 uses digital audio I/O in SDIF-3 or DSD raw audio format or the analog connectors fitted to the DSD slot board (compared with the TDIF and AES/EBU interfaces of the standard DA-98HR). In DSD mode, these standard TDIF and AES/EBU interfaces are not used.
- The number of tracks. In PCM mode, the DS-D98 is capable of recording eight, four or two tracks of

PCM digital data, depending on the sampling frequency selected. IN DSD mode, the DS-D98 recorder is capable of recording two tracks (per unit).

- Chaining units. For most DTRS units, up to 16 units may be chained together using the built-in synchronization facilities. With the DS-D98, up to 256 DTRS units may be branched together, providing up to 512 tracks of audio (see “SYNC BRANCH functions” on page 10).

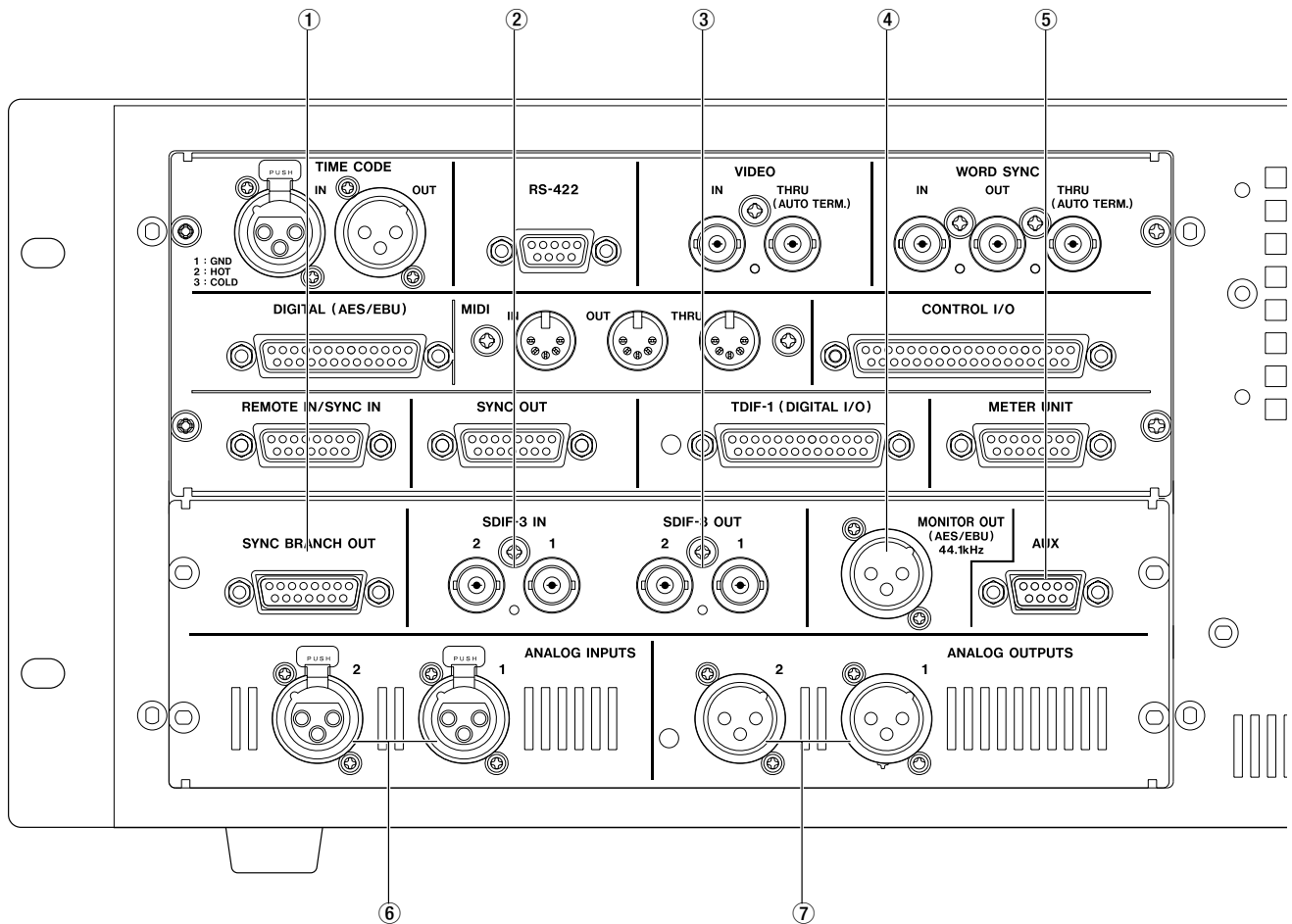
### NOTE

*Note that the DSD board must be fitted and the appropriate version of firmware fitted in the unit for these DSD operations to work. If these conditions are not present, error messages will be displayed.*

Key features of the unit include:

- Direct conversion between DSD and analog signals, using the onboard  $\Delta\Sigma$  AD and DA convertors.
- A newly-developed VCXO PLL reduces the jitter rate and improves the sonic performance.
- An OS-CON condensor improves sonic performance, decoupling the power supply circuitry from the audio circuitry.
- Filtering: two types are available on the DS-D98: the Standard (GIC) filter, recommended when working with SACD, and the Custom filter for more general work.

## Rear panel connections

**NOTE**

All items not mentioned here are explained in the main DA-98HR manual. Consult 2.2, "Rear Panel connectors" for full details.

① **SYNC BRANCH OUT** Connect this to the **REMOTE IN/SYNC IN** of a branched DTRS unit using a PW-88S cable. See "SYNC BRANCH functions" on page 10 for details.

② **SDIF-3 IN** This pair of BNC connectors is used for inputting DSD data (each connector carries one channel).

Connect these inputs to suitably-equipped DSD devices, and select the format using the menu item ("DSD Digital I/O" on page 7).

③ **SDIF-3 OUT** This pair of BNC connectors is used for outputting DSD data (each connector carries one channel).

The exact signals being monitored depend on the transport status and the status of the **INPUT MONITOR** of the tracks as well as the confidence

mode. See 5, "Monitoring modes" of the DA-98HR manual for full details of monitoring modes.

Connect these outputs to suitably-equipped DSD devices, and select the format using the menu item ("DSD Digital I/O" on page 7).

④ **MONITOR OUT (AES/EBU) 44.1kHz**

This XLR-type connector outputs AES/EBU data at 44.1 kHz for the purposes of monitoring. Connect this to a suitably-equipped device to allow monitoring of the recordings made on the DS-D98

⑤ **AUX** This 9-pin D-sub connector is reserved for future expansion, providing remote control of the **REC FUNCTION**, as well as AES/EBU outputs.

⑥ **ANALOG INPUTS (1, 2)** This pair of balanced XLR-type connectors is used for the input of analog audio.

⑦ **ANALOG OUTPUTS (1, 2)** This pair of balanced XLR-type connectors is used for the output of analog audio.

# DS-D98 recorder

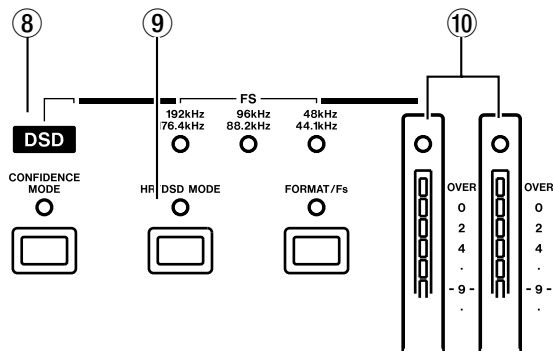
The exact signals being monitored depend on the transport status and the status of the **INPUT MONITOR** of the tracks as well as the confidence mode. See 5, “Monitoring modes” of the DA-98HR manual for full details of monitoring modes.

## NOTE

These analog connectors (input and output) are wired according to the usual standard: 1=ground, 2=hot, 3=cold.

## DSD mode

Whenever a tape is formatted in the DS-D98 in DSD mode (see below), or a tape previously formatted in DSD mode is inserted, the unit enters DSD mode.



The blue **DSD** indicator on the front panel (8) lights to show this mode is now active.

Unbalanced equipment should not be connected to the analog input or output connectors.

Since the metering is performed using a 44.1 kHz PCM conversion, the levels of signals which have a frequency of more than 20kHz are not shown on the meters.

In DSD mode, the **AVAILABLE TRACK** indicators for tracks 1 and 2 (10) light green, also showing that DSD mode has been selected.

When the unit is in DSD mode, the explanations given in this document apply.

When a DSD-formatted tape is ejected and a standard PCM DTRS tape is inserted (or a blank tape is formatted in PCM mode), the unit reverts to PCM mode. The **DSD** indicator goes out.

In DSD mode, only 44.1 kHz-based sampling frequencies may be used. 48 kHz sampling frequencies are invalid in this format.

However, the sampling frequency indicators to the right of the tape counter do not light in DSD mode. If pull-up or pull-down Fs shift is enabled (9.4.1, “Pull up and pull down (Fs shift)”, however, the **PULL UP** and **PULL DOWN** indicators light appropriately.

## Formatting the tape

As with all DTRS recorders, it is necessary to format a tape before using it in the DS-D98 recorder.

See 6.2, “Formatting a tape” in the main DA-98HR manual for details of how the tape is formatted.

However, there is a significant addition to the options available for the DS-D98, which is the provision of the DSD mode.

- 1 Switch on the DS-D98 and load a tape into the tape loading slot. As the tape is loaded and threaded, the tape counter shows --LORD--.
- 2 Press **REW** to take the tape to the beginning. When the beginning of the tape is reached, the tape counter shows *bot* (“beginning of tape”).

- 3 Press the **FORMAT/Fs** key. The indicator starts blinking. Press the **FORMAT/Fs** key again within five seconds. The indicator then lights steadily.

If you do not press the **FORMAT/Fs** key twice within five seconds, the indicator goes out. This is a feature designed to stop you formatting a tape accidentally.

## NOTE

If you do press the **FORMAT/Fs** key twice so that the indicator lights steadily and you then change your mind about formatting the tape, you can use the **STOP** key, the **CLEAR** key or the **ESCAPE** key to cancel the operation.

- 4 Use the **HR/DSD MODE** key (9) to select the DSD mode. Repeated presses of this key cycle between the following status modes:

PCM 16 bit  
 PCM 24 bit  
 DSD

When the DSD mode is selected, the blue DSD indicator ⑧ lights.

- 5 With the DSD option selected (the DSD indicator is lit), start formatting the tape by holding down the RECORD key and pressing the PLAY key.

**NOTE**

The tape counter may show a negative ABS time for a short while at the start of the formatting process. While it is displaying a negative value, no audio recording can take place.

The tape formats to the end, and then rewinds automatically, stopping at the 00 00 00 position.

You are now able to use the tape for recording.

## Clock settings in DSD mode

When recording in DSD mode, take note of the following clock settings.

These settings are made using the **CLOCK** key, as described in the DA-98HR manual (6.1.1, “Selecting the word sync clock”).

**NOTE**

Note that in DSD mode, the AES/EBU digital audio connectors are not used for audio I/O and cannot therefore be used as clock sources.

## Digital recording

When recording in DSD mode through the digital BNC connectors, the appropriate clock indicator should be lit (depending on the clock source to which the unit is to be synchronized).

If WORD sync is used, the sampling frequency must be 44.1 kHz.

## Analog recording

When recording in DSD mode through the balanced analog connectors on the DSD board, with no reference to any other digital audio, the **SLOT** clock indicator should be lit (that is, the A/D converters in the DSD slot card act as the clock sync source). This minimizes jitter.

In the case of the recording being synchronized to other clock sources, the appropriate clock sources should be selected as described in 6.1.1, “Selecting the word sync clock”.

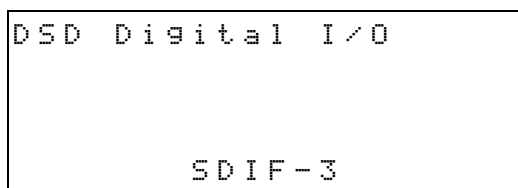
## Additional DSD mode menus

There are two additional menu items which affect the operation of the unit. Both of these are in menu group

D: DSD Digital I/O (DsdDigitalI/O) and DSD Analog Out Filter (DsdFilter).

### DSD Digital I/O

In this menu item, the type of digital audio received at the slot card’s digital input connectors and transmitted from the output connectors can be selected:



Change this value between SDIF-3 format and “raw” DSD data (DSD Raw) as appropriate.

The input and output formats are set together using this screen.

Note that the raw DSD data may contain very low frequencies which may cause artifacts in analog signals. SDIF-3 changes the tone by eliminating such ultra-low components.

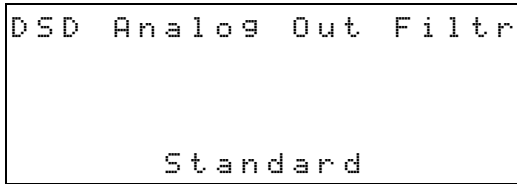
## DS-D98 recorder

Some units from other manufacturers output raw data and some use SDIF-3. The DS-D98 allows you to make the appropriate selection, depending on the other units.

Note that if another unit also provides a choice of either raw or SDIF-3, SDIF-3 is the recommended choice, because of the low-cut filtering capabilities.

### Output filter

The type of analog output filter employed by the DS-D98 can be selected in this menu:



Either the “standard” filter (*Standard*), as used in the SACD process, or the *Custom* TASCAM filter can be selected.

The *Custom* filter provides better frequency characteristics and its use is recommended for use in recording or editing in order to maintain sonic quality throughout these stages of the project.

However, when actually performing the mastering process, the *Standard* filter should be selected in order to maintain compatibility with the standard.

In technical terms, the standard filter attenuates at 100 kHz by about 30dB, and the custom filter by about 20dB.

### Features of the DA-98HR in DSD mode

A number of menu items and options available have no meaning in DSD mode. Although these menus appear on the screen and it appears that values may be set for the parameters, these settings actually do not have any effect in DSD mode.

The numbers here refer to the paragraph numbers describing these options in the DA-98HR manual.

**Dithering** Dithering has no place when DSD is selected, and therefore the dithering options (7.12, “Dither”) have no relevance here.

**Sine oscillator** The sine oscillator (7.9, “Sine oscillator”) cannot be operated in DSD mode.

**TDIF input word length** Since the TDIF inputs are not used in DSD mode, the concept of TDIF input word length (7.10.2, “Selecting input word length”) is not appropriate here.

**AES dual/fast selection** Since the AES/EBU digital formats are not used in DSD mode, this selec-

tion (7.10.3, “Setting the high-frequency AES/EBU I/O transfer mode”) is not appropriate here.

**AES Cbit mode** The AES/EBU format is not used in DSD mode, and therefore this option (7.10.4, “Cbit mode”) is not meaningful.

**Output word length** Since word length has no meaning in DSD mode, this option (7.13, “Output word length”) has no effect.

**TDIF Ebit mode** Since TDIF format is not used in DSD mode, this option is not meaningful here.

**Mix input select** This option (5.4, “Mixdown patchbay”) is not available in DSD mode. In DSD mode, track 1 is tied to channel 1 and track 2 is tied to channel 2.

**Mixdown** This option (5.4, “Mixdown patchbay”) is not available in DSD mode.

**METER UNIT** This rear panel connector cannot be used in DSD mode.

### Input patchbay

When using the **INPUT PATCH** key to perform input patching on the DS-D98 in DSD mode, the situation is slightly different from that in PCM mode.

The options available are **A** (analog inputs of the slot card), **D** (digital inputs of the slot card) or **M** (muted).

Each individual input can be routed to either of the two input channels, so the choices are:

Channel 1	A1, A2, D1, D2, T1, M
Channel 2	A1, A2, D1, D2, T2, M

See 6.3.3, “Selecting input sources” for full details of how to perform input patching.



**Shuttle mode**

In PCM mode, shuttle operations are possible (7.6, “Shuttle operations”), but when shuttling, no sound is output.

The concept of shuttle muting (7.6.2, “Shuttle muting”) therefore has no meaning in DSD mode.

**Board versions**

When the DSD board is fitted and the input and output board firmware version is checked using the menu system (menu group D), the input and output

board information is displayed in an identical way on the two screens.

**Error messages**

Most error messages displayed in DSD mode are identical to those displayed in PCM mode, except for the following:

If the board PLL clock becomes unlocked, either on the input or output stage, `Input Slot Unlocked` will always be shown.

Note that in PCM mode, if an attempt is made to select the **SLOT** option as the clock source with the 48kHz family of sampling frequencies, an error message is displayed: `no clock`, as the DSD slot card cannot be used with these sampling frequencies.

**Analog reference levels**

The DS-D98 is capable of accepting and outputting analog signals at one of three reference levels:

	Reference level	Nominal level	Maximum level
TASCAM	-16dBFS	+4dBu	+20dBu
European standard	-18dBFS	+4dBu	+22dBu
SMPTE	-20dBFS	+4dBu	+24dBu

As the unit is shipped, it conforms to the TASCAM standard. If this is to be changed, this must be done by changing jumpers on the DSD board.

Both input and output reference levels should be set together. It is not possible to set only the input or only the output reference level.

**WARNING**

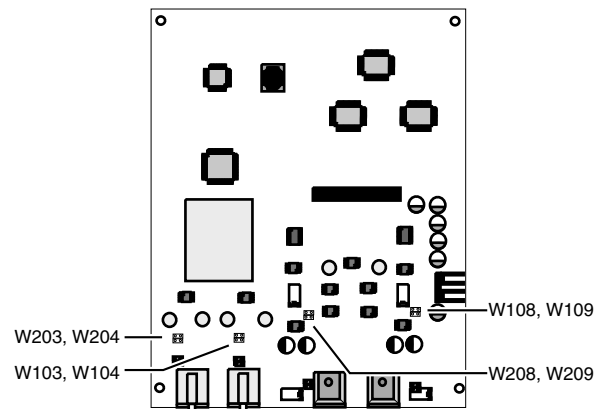
*Regarding installation and configuration details, consult your nearest TASCAM dealer.*

*These instructions are for use by authorized service personnel. Fitting and removing slot boards are not user operations and such operations carried out by unauthorized personnel will void the warranty.*

A cross-head (Phillips) screwdriver and a flat anti-static surface on which to lay the boards while you are working will be necessary, as well as sufficient space to work (if the DS-D98 is mounted in a rack, it

will probably have to be removed from the rack in order to fit the boards).

There are four jumpers to be set on the board:

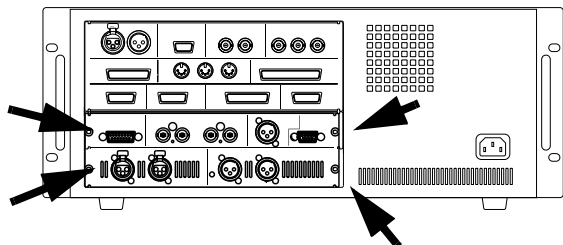


These jumpers have the following meaning (where ✓ is closed and ✗ is open).

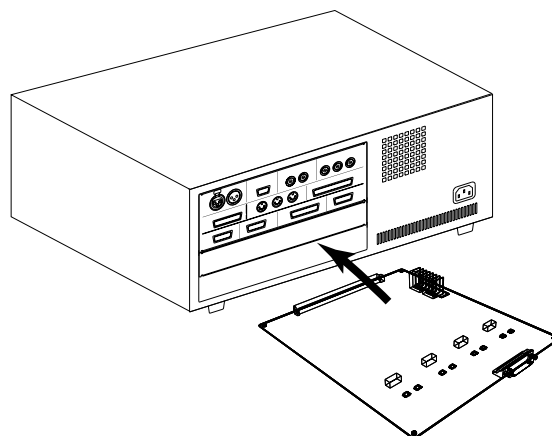
	W103 W203	W104 W204	W108 W208	W109 W209
TASCAM -16dBFS)	✗	✗	✓	✓
European -18dBFS	✓	✗	✗	✓
SMPTE -20dBFS	✓	✓	✗	✗

## DS-D98 recorder

- 1 Make sure the power to the DS-D98 is turned off and the power cord is removed. Disconnect all other equipment from the DS-D98.
- 2 Unfasten the screws retaining the board at the rear of the DS-D98



- 3 Remove the board. Set aside the retaining screws for later use.
- 4 Set the reference levels on the board as requested by the customer, as described here.



- 5 Slide the board, component side uppermost, into the slot, until you feel the fingers of the board mesh with the internal socket.
- 6 Push the board firmly, but without excessive sudden force, until it can go no further. The rear panel of the board should now be flush with the rear panel of the DS-D98.
- 7 Fasten the board in place using the screws which retained the board removed in step 3.
- 8 Replace the DS-D98 in the rack, reconnect the other equipment (including the analog connections) and reconnect the power.

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## SYNC BRANCH functions

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The DS-D98 introduces a new concept for slave units: *branching*. Using the **SYNC BRANCH** connector, connected to the **REMOTE IN/ SYNC IN** of another DS-D98 unit, or any other TASCAM DTRS unit, one DS-D98 can be used to control up to 15 other such branch units.

The first unit connected to the head of such a branch must be set to have a machine ID of 2, and the other branch units in the branch should have IDs following this, in order. See 8.2, “Machine ID and master/slave settings” in the DA-98HR manual.

Subsequent branch units are connected using the **SYNC OUT** to **REMOTE IN/SYNC IN** chain, as is standard with DTRS units. See 8.1, “Synchronization connections” for details.

The last unit in the chain must be terminated.

When units are connected in this way, the transport controls of the first unit in the branch are used to control the slave units, when these branch units are set to chase (ABS chase, not timecode chase—see 8.2.3,

“Master/slave settings (CHASE mode)” for full details of how to set this.

In addition, if the slave branch units are set to be in 2-track mode (this means either DSD mode in the case of DS-D98 units, or quad sampling frequency mode in the case of DS-D98 or DA-98HR units), the following features are also available from the master DS-D98:

- Level meters. The first branch slave (ID=2) uses meters 3 and 4 on the master branch unit, slave ID=3 uses 5 and 6, and slave ID=4 uses 7 and 8.
- **AVAILABLE TRACK** indicators (the master unit displays the status of the available tracks on the branch slaves—green for DSD, red for quad sampling frequency tracks). Assignments as for the level meters.
- **REC FUNCTION** keys and indicators (assignments as for the meters)
- **INPUT MONITOR** keys and indicators (assignments as for the meters)

In addition to these controls and indicators, the following settings are transmitted “down the chain” from the master to the slave branch units (for these settings, the appropriately-labeled master branch unit key controls the status of the slaves):

- ALL SAFE condition (6.3, “Recording the first tracks”)
- ALL INPUT condition (5.1.1, “ALL INPUT and INPUT MONITOR”)
- AUTO MON condition (5.1.2, “AUTO MON”)

The end result of this arrangement is that the DS-D98, when acting as a master in this way, can appear to be a multi-track recorder. With three branch slaves connected, a single unit can control a full eight tracks of DSD recording.

**NOTE**

*Strictly speaking, the branch slave units do not need to be in 2-track mode, but only the first two tracks of a slave unit are accessible from a master when they are connected in this way.*

**Branches and chains**

Since sixteen machine IDs are available, the maximum number of units which can be branched in the way described above is sixteen (one master branch unit and up to fifteen branch slaves).

However, it is also possible to use the standard DTRS chaining method, so that one remote controller such as the RC-898 can control a chain of DTRS nodes. If these node devices are DS-D98 units, each one of these chain node slaves can act as a branch master of up to fifteen branch slaves (a total of up to 256 machines).

As far as the ID of the master node of each branch is concerned, this must follow the conventions of the

node chain (in other words, the IDs of the branch master units — that is, the nodes in the chain — must go in sequence from 1, starting with the machine closest to the remote control unit).

The first slave branch units in the branches must be numbered with ID 2, and the others must follow in sequence.

Since there are two ways of connecting: the node chain and the branch, it is therefore possible to have the same machine ID occurring twice in a branch (once for the branch master, and once for one branch slave). It is not possible to have the same ID occurring twice in a node chain, however.

**Specifications**

**Audio characteristics**

These figures are measured with the I/O Clock Range set to Narrow (see 6.1.3, “Clock range with slot board” in the main manual):

Frequency response:	10Hz to 20kHz ±0.5dB 10Hz to 50kHz -3dB (±1dB)
Distortion:	0.005% (1 kHz, AES-17 filter)
S/N ratio:	> 102dB (1 kHz, AES-17 filter and A-weighting)
Dynamic range:	> 102dB (1 kHz, AES-17 filter and A-weighting)
Channel separation:	> 95dB (1 kHz)

**Analog performance**

Input connectors	XLR-3-31 type (x 2)
Nominal input level	+4dBu
Reference level	-16dBFS <sup>a</sup> , -18dBFS, -20dBFS
Maximum input level:	+20dBu <sup>a</sup> , +22dBu, +24dBu (jumper-selectable)
Input impedance:	> 15kΩ
Output connectors	XLR-3-32 type (x 2)
Nominal output level	+4dBu
Reference level	-16dBFS <sup>a</sup> , -18dBFS, -20dBFS

# DS-D98 recorder

Maximum output level	+20dBu <sup>a</sup> , +22dBu, +24dBu (jumper-selectable)
Output impedance	<30Ω

a. Factory setting

## Digital details

Output level	5V TTL
Output impedance	10Ω
Input level H	V <sub>oh</sub> > 2.4V (minimum)
Input level L	V <sub>ol</sub> < 0.55V (maximum)
Input impedance	75Ω terminated

# TASCAM

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# DS-D98

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