

# *MR-2024T*

## **Operation Manual**

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## 1. Introduction

### 1.1. Equipment overview

The Prism Sound MR-2024T is an interfacing device specifically for use with a Tascam DA-88 multitrack digital tape recorder.

The MR-2024T provides AES/EBU (or SPDIF) digital input and output capability for the DA-88 in a similar manner to Tascam's own IF-88AE unit. However, the MR-2024T has a number of additional features, for example:

- As well as providing eight 16-bit tracks, the MR-2024T can also be configured for six 20-bit tracks or four 24-bit tracks; this allows ultimate-quality recording and archiving in conjunction with extended precision A-D converters.
- Two DA-88s can be connected to each MR-2024T for backup recording. An A/B monitor switch selects the playback machine.
- More versatile synchronization and interfacing options are included.

**IMPORTANT NOTE:** Early versions of the DA-88 SYSCON software do not allow correct operation with the MR-2024T. It is therefore **VERY IMPORTANT** to check the SYSCON version number in your DA-88. This can be done by powering the DA-88 with the <STOP>, <PLAY> and <RECORD> buttons held in, after which the version number is shown in the timecode display window. Versions up to v2.00 **DO NOT WORK** correctly; v2.01 and above are OK. If your SYSCON software needs updating, contact your local Tascam representative who will provide an upgrade free of charge.

## 1.2. Using this manual

This manual is provided as an operator's guide to the MR-2024T. Although the functionality of the unit is fairly simple, it is important that certain operations are performed correctly if reliable and trouble-free recordings are to be made. In order to accommodate personal preferences in the presentation of this sort of information, the main body of the manual is divided into four sections as follows:

- 'Getting started' guide  
A step-by-step approach - how to use the MR-2024T;
- Summary of connections and controls  
A brief description of everything it does;
- Operation reference  
A detailed description of everything it does;
- Application examples  
Notes and diagrams describing some typical setups;

These sections cover much the same information, but in a variety of styles and degrees of detail. If your preference is to 'try it out and read the manual if it doesn't work', you should still be able to quickly find the help you need in one or more of the above by use of the index.

In this manual, some conventions are used to identify the various features of the MR-2024T front panel:

The boxed areas of the panel are referred to in double quotes e.g. "**TRACK MODE**". Pushbuttons are referred to by the name of the box in which the pushbutton is located, enclosed in angular brackets; thus, for example, the leftmost pushbutton of the MR-2024T front panel is designated <**TRACK MODE**>. Where LED indicators are referred to in the text, apostrophes are used; for example '**8T16b**' designates the leftmost LED.

## 2. Getting started with the MR-2024T

### 2.1. Unpacking the MR-2024T

The MR-2024T package should contain the following items:

- MR-2024T unit
- IEC mains lead with appropriate local connector
- MR-2024T-IC TDIF-1 interface cable (25-pin male 'D'-'D')
- Sync cable (BNC-BNC)
- This Operator's Manual

Unpack your MR-2024T and check that you have all the items listed above. Check that the packaging and its contents are undamaged; if not contact your distributor or Prism Media Products Limited immediately.

The type of mains lead supplied may vary according to the country in which the product is sold. Check that the mains lead supplied is suitable for your local supply. Note that the MR-2024T can accept any mains voltage in the range 90VAC to 260VAC **without adjustment**.

### 2.2. Turning on the MR-2024T

Before turning the MR-2024T or the DA-88 on, connect the TDIF-1 interface cable from the MR-2024T 'M/C A' connector to the TDIF-1 connector of the DA-88. Whilst you're round the back, make sure that the slide switch adjacent to the SPDIF connectors is set in the normal 'DI ON' position.

Switch the MR-2024T and the DA-88 on. After switch-on, all the LEDs of the MR-2024T should illuminate for a short time, after which only the active LEDs remain lit. Set the DA-88 to '**INT**' clock in the bottom right-hand corner of its front panel, and set the MR-2024T to '**DA-88**' sync mode using the **<SYNC MODE>** pushbutton. Select the '**DIGITAL IN**', '**AUTO INPUT**' and '**INSERT**' functions on the main DA-88 control panel. Arm all the DA-88's tracks using the **<REC FUNCTION>** pushbuttons beneath the bargraphs.

The state of the sampling rate LEDs in the MR-2024T's "**SYNC MODE**" box should agree with those at the top of the DA-88 panel. Only one of the LEDs in the "**TRACK MODE**" box should be lit, and this selection should cycle as the pushbutton is operated, accompanied by a flash of the '**ERR**' LED. If any of these responses is NOT observed, check the location of the TDIF-1 interface cable and the settings of both units.

Note that the LEDs in the "**DI ERRORS**" box are illuminated since there is no valid AES/EBU data coming into the MR-2024T. Note also that only the first three LEDs are operative in '**6T20b**' Track Mode, and only the first two LEDs in '**4T24b**' mode. This is because the remaining track-pairs are unavailable in these Track Modes.

Operating the <**SPDIF I/O**> pushbutton will cycle a single LED in that box, including an 'all off' position in which the SPDIF interface is not selected.

Since only one DA-88 is connected, the MR-2024T prevents any action when the <**MONITOR**> pushbutton is operated.

Before making any recordings with the DA-88, it is advisable to pre-stripe ('Format') the tape at the desired sample frequency. Although it is possible to make a continuous recording whilst formatting the tape, this method is not recommended by Tascam.

If the behaviour of your MR-2024T is not as described above then contact Prism Media Products or your distributor.

### 2.3. Connecting a digital audio source

Connect a digital audio source to track 1/2 input in order to make a test recording. If the source has an AES/EBU output, connect this to the MR-2024T's '**DI 1/2**' input with an XLR cable and press the **<SPDIF I/O>** pushbutton until all LEDs in the "**SPDIF I/O**" box are extinguished. If the source has an SPDIF output, connect this to the MR-2024T's '**SPDIF DI**' connector with a phono (RCA) lead, and operate the **<SPDIF I/O>** pushbutton until the '**1/2**' LED is lit.

If the source can be externally synchronized via a WORD SYNC (wordclock) input, connect this to one of the MR-2024T '**WORD SYNC OUT**' BNCs. If the source can be externally synchronized via an AES11 (DARS or AES/EBU) input, connect this to the MR-2024T '**DO 7/8**' output. In either case, set the source to external sync.

If the source CANNOT be externally synchronized, the recording system must be synchronized to the source. This is achieved by connecting one of the MR-2024T '**WORD SYNC OUT**' BNCs to the '**WORD SYNC IN**' connector of the DA-88 with the BNC cable provided, and selecting **WORD** clock mode on the DA-88 and '**DI**' in the "**SYNC MODE**" box of the MR-2024T. Note that in this mode, the sampling rate of the source should match the formatted state of the DA-88 tape.

### 2.4. Making a recording

The digital output of the source should now be visible on the leftmost pair of bargraphs on the DA-88. Any necessary line-up adjustments to the source can thus be made.

The **<TRACK MODE>** pushbutton should be used to set the correct Record Track Mode, according to the desired word-length and number of tracks. Note that there is no benefit in using a longer word-length than that of the source - i.e. making a 24-bit recording from a CD will not improve on the 16-bit word-length inherent in that medium.

Start the recording by pressing **<RECORD>** and **<PLAY>** simultaneously on the DA-88. The red light above the record button should light, along with those below each bargraph. The sample-rate indicators on the DA-88 and the MR-2024T should not be flashing. Flashing indicates that the DA-88 is receiving data at a different sampling rate than its tape was formatted for.

You may notice, if you are using '**6T20b**' or '**4T24b**' modes, that there is some signal present among the right-hand bargraphs, even though only the first track-pair is being recorded. This is a consequence of the way the MR-2024T tape format uses the high-numbered tracks to record and label the extra information for the extended word-lengths.

When the recording is complete, it can be played back in the usual way. Even if '**6T20b**' or '**4T24b**' modes have been used, the recording can be monitored (albeit with reduced quality) via the DA-88's internal D-A converters. The AES/EBU and SPDIF outputs of the MR-2024T obviously contain the full number of bits recorded, so playbacks and transfers



made by this route are at full quality. To monitor the full resolution during playback, a high quality D-A converter must be connected to the appropriate track-pair AES/EBU output, or to the SPDIF output which can be switched to each track-pair in turn (see section 4.1.4).

### 3. Summary of connections and controls

Figure 1. shows the front and rear panels of the MR-2024T.

The XLR connectors provide four two-channel AES/EBU inputs and outputs to the four track-pairs of the DA-88. The single phono (RCA) input and output provide an alternative two-channel SPDIF interface which can be selected to the required track-pair, or turned off, using the **<SPDIF I/O>** pushbutton and LEDs.

The MR-2024T indicates any problems in the incoming AES/EBU or SPDIF data streams on the LEDs in the **"DI ERRORS"** box.

The 25-way 'D' connectors are for connection to the DA-88 using the interface cable supplied. Two connectors are provided so that two DA-88s may record the data simultaneously for reasons of security. When two DA-88s are connected, the **<MONITOR>** pushbutton and LEDs are used to select the playback machine.

The **<SYNC MODE>** pushbutton selects either **'DA-88'** or **'DI'** Sync Mode, as indicated by the LEDs adjacent to the sampling rate indicators.

In **'DA-88'** mode, the tape recorder is sync master, and should be set to **'INT'** clock on the lower right-hand corner of its control panel. All other connected equipment, for example outboard A-D converters, must be synchronized to the recorder by using the WORD SYNC OUT connectors provided on the MR-2024T, or spare AES/EBU or SPDIF outputs.

**'DI'** mode is provided for use with digital audio sources which cannot be externally synchronized, e.g. domestic CD players. In this mode, the system is automatically synchronized to the lowest-numbered DI connection bearing valid data. The DA-88 must be set to **'WORD'** clock on its control panel must have its WORD SYNC IN connected to one of the WORD SYNC OUTs of the MR-2024T. The others may be used to synchronize other devices in the normal way.

The **<TRACK MODE>** pushbutton and associated LEDs select the tape format for RECORDING as either the normal eight-track 16-bit format (**'8T16b'**), or one of the special six-track 20-bit (**'6T20b'**) or four-track 24-bit (**'4T24b'**) formats. The tape format is logged within the audio data, so the playback circuitry can adopt the correct format (or 'Track Mode') automatically. When the Playback Track Mode detected is different from the currently-selected Record Track Mode, the Record Track Mode LED remains lit and the Playback Track Mode LED flashes. The **'ERR'** LED indicates an error in detection of the playback format.

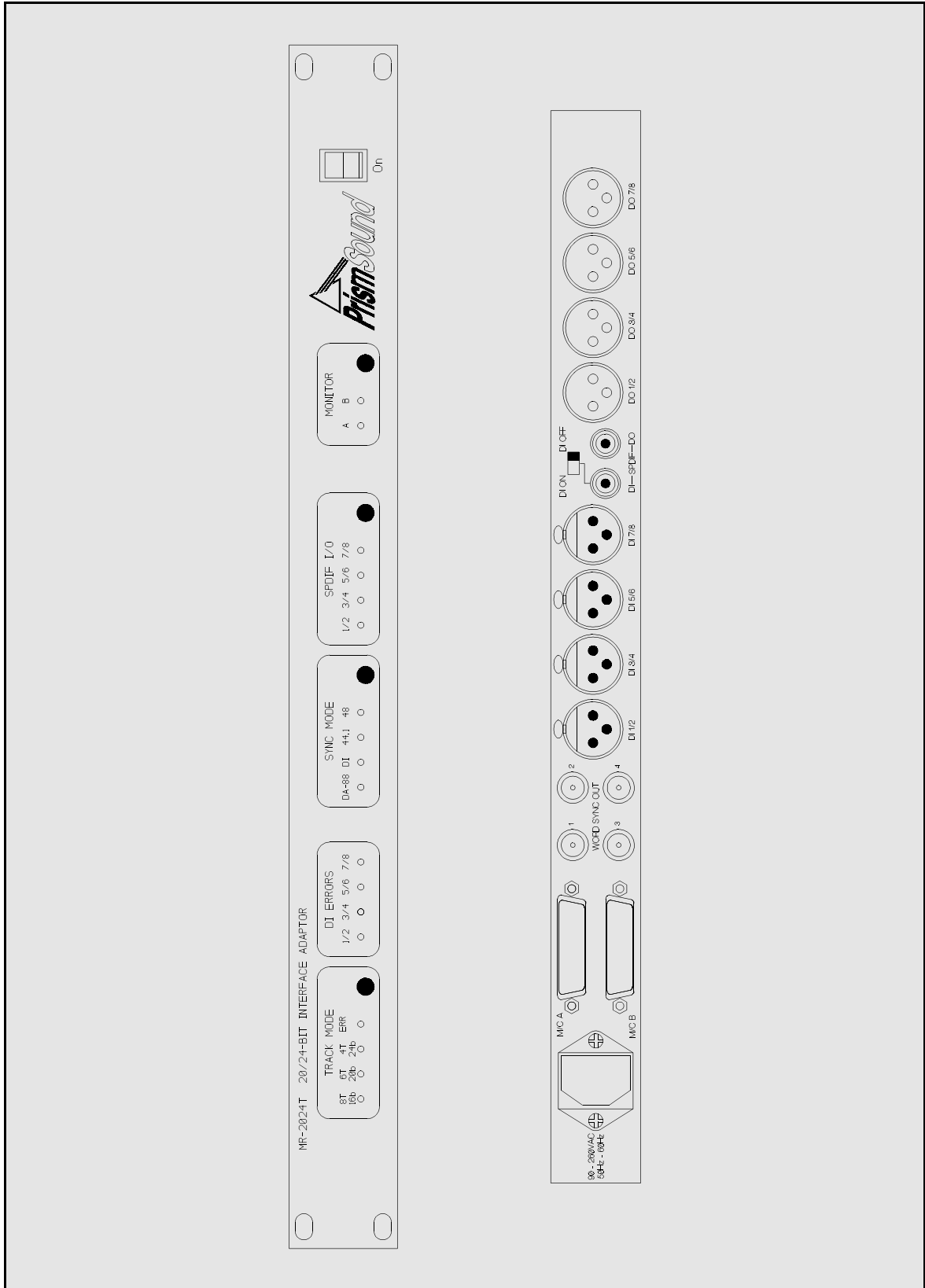


Figure 1. MR-2024T front and rear panels

## 4. Operation Reference

This section provides a detailed reference of the operation of the MR-2024T controls and indicators, and explains important operating concepts.

### 4.1. Front panel

#### 4.1.1. "TRACK MODE" box

The <TRACK MODE> pushbutton cycles the Record Track Mode between the three alternative settings. The '**8T16b**' setting provides the standard eight tracks with 16-bit resolution; '**6T20b**' gives six tracks at 20-bits, and '**4T24b**' enables maximum-precision 24-bit recording on four tracks. For help on how to select the appropriate word-length, see section 4.6.

The Track Mode information is written on to the tape during recording, and this enables the MR-2024T to automatically select the appropriate Playback Track Mode, even if a variety of Track Modes are recorded at different points on the same tape. If the MR-2024T senses that the Track Mode of the signal coming from the DA-88 is different from the currently-selected Record Track Mode (i.e. during playback of a recording made using a different Track Mode), this is indicated by the detected Playback Track Mode LED being flashed while the Record Track Mode LED is held on.

The '**ERR**' LED is lit to indicate that the Track Mode information being read from the DA-88 does not agree with the current setting of the Playback Track Mode. This may be because the Track Mode recorded on tape is changing, in which case the LED will blink briefly as the new Playback Track Mode is automatically adopted. If the LED blinks (or remains illuminated) when there is no change in the recorded Track Mode, a tape error is signified, or fault in the connection between the DA-88 and the MR-2024T.

See also Appendix A for explanation of how the operation of the "**TRACK MODE**" box is changed if the Fixed Playback Track Mode option is implemented.

#### 4.1.2. "DI ERRORS" box

This box contains an error LED for each AES/EBU input (or the SPDIF input if it has been selected to replace that track pair). The LED is lit for any input which has one of the following errors:

- No lock (AES/EBU signal not recognised);
- Parity error or biphas-coding violation;
- Sample-slipping (source not locked to MR-2024T)

If one of the error LEDs is blinking rhythmically, it is probable that sample-slipping is occurring where the source is operating at the same nominal sample rate as the MR-2024T, but is not locked to it. This might be because the source is set to internal instead of external sync, or it may not be connected to a WORD SYNC or AES/EBU output from the MR-2024T; or possibly the intention was to lock the MR-2024T to the source by selecting '**DI**' sync mode.

Note that if '**6T20b**' Record Track Mode is selected, the '**7/8**' LED is always extinguished since this input is not required. Similarly in '**4T24b**' mode, the '**5/6**' and '**7/8**' LEDs are both disabled.

### 4.1.3. "SYNC MODE" box

The <SYNC MODE> pushbutton selects between '**DA-88**' and '**DI**' Sync Modes. '**DA-88**' is the normal and preferred Sync Mode, in which the MR-2024T and, via the MR-2024T, all other connected equipment is synchronized to the DA-88, which must be set to '**INT**' clock. In this instance, the sampling rate is determined by the DA-88's tape, which must have been formatted at the desired sampling rate.

If a recording is to be made from a device which cannot be externally synchronized, for example a from the digital output of a domestic CD player, then the MR-2024T, and hence the DA-88, must be synchronized to the source. This is achieved by setting the Sync Mode to '**DI**', and the DA-88 to the '**WORD**' clock setting. A BNC-BNC cable must be connected from one of the MR-2024T's WORD SYNC OUT connectors to the WORD SYNC IN of the DA-88. Where several sources are connected to the MR-2024T's inputs, the LOWEST NUMBERED ERROR-FREE source is used as the synchronization master. Any other sources to be recorded at the same time must be slaved to the MR-2024T and must occupy higher-numbered inputs.

The '**44.1**' and '**48**' indicators indicate the current sampling rate, and should agree with those on the DA-88. If these indicators flash, an error condition is indicated. In '**DI**' Sync Mode, the error is that the incoming sampling rate is not sufficiently close to 44.1k or 48.0k; in '**DA-88**' Sync Mode, the condition signifies that the DA-88 is flagging a sampling rate error or that the connection between the machines is faulty. If the sampling rate LED on the DA-88 flashes, this indicates a mismatch of the sampling rate formatted onto the tape and the sampling rate of the MR-2024T, which could, for instance, result from use of '**DI**' Sync Mode with a source of a different sampling rate from the tape.

#### 4.1.4. "SPDIF I/O" box

The MR-2024T has four AES/EBU input and output connectors, each input and output tied to its own DA-88 track pair. There is also a single SPDIF input and output, the mode of operation of which is governed by the SPDIF DI Mode slide switch, located above the SPDIF connectors at the rear of the unit.

With the switch set to the '**DI ON**' position, the SPDIF input and output can be assigned to any of the DA-88 track-pairs using the **<SPDIF I/O>** pushbutton. Whichever track-pair is selected takes its input from the SPDIF connector rather than the AES/EBU connector, and the track output feeds both formats. Operation of the pushbutton cycles the selection around all the track pairs available in the current Record Track Mode, plus an 'off' state where no track pair is assigned to SPDIF.

With the SPDIF DI Mode switch set to '**DI OFF**' the SPDIF input is disabled, but the SPDIF output still operates in parallel the AES/EBU output of the selected track pair. The 'off' state is not now required. This mode is provided so that a single high-resolution D-A converter can be connected to the SPDIF output for the purpose of monitoring all track pairs in turn, without operation of the AES/EBU inputs and outputs being affected. The **<SPDIF I/O>** pushbutton then acts as the monitor selector for the single D-A converter.

#### 4.1.5. "MONITOR" box

The MR-2024T has two TDIF-1 connectors, and can therefore record to two DA-88s simultaneously for reasons of data security. The **<MONITOR>** pushbutton selects machine '**A**' or machine '**B**' for playback.

The MR-2024T detects the presence of DA-88s on its two TDIF-1 connectors and, when only one machine is connected, the other selection is disabled. Note that the retained setting of the pushbutton (see section 4.1.6) is not affected by this until the button is pressed. So that if two DA-88s are connected and machine 'A' is selected and then unplugged or powered down, machine 'B' is then automatically selected in its place. However, machine 'A' will always be re-selected on its return (even if the MR-2024T has been powered down in the meantime) unless the **<MONITOR>** pushbutton is pressed to confirm the selection of machine 'B'.

#### 4.1.6. Retention of control settings

The settings of the MR-2024T front-panel controls are retained indefinitely during power-down and automatically reinstated when the unit is re-powered.

### 4.2. SPDIF DI Mode switch

The SPDIF DI Mode slide switch above the SPDIF connectors on the rear of the MR-2024T turns the SPDIF input (DI) function on or off. Refer to section 4.1.4 for operating details of this switch.

### 4.3. DA-88 control settings

It is important that the DA-88's controls are properly set for use with the MR-2024T.

The **'DIGITAL IN'** setting should always be selected to enable audio inputs to be taken from the MR-2024T. Note that this setting does not prevent operation of the DA-88's D-A converters.

The clock selection in the bottom right-hand corner of the DA-88 front panel should normally be set to **'INT'**, corresponding to the MR-2024T **'DA-88'** Sync Mode setting. When recording from a digital audio source which cannot be externally synchronized, the MR-2024T should be set to **'DI'** Sync Mode; in this case the DA-88 must be set to **'WORD'** clock - in this case remember to connect a BNC-BNC cable from one of the MR-2024T WORD SYNC OUT feeds to WORD SYNC IN of the DA-88.

In general, it is recommended that the DA-88 be set to **'AUTO INPUT'** and **'INSERT'**. This causes the digital inputs to be monitored at the outputs at all times other than during playback mode. All of the **'REC FUNCTION'** buttons underneath the bargraphs should always be activated, except in special conditions of individual track recording (see section 4.5), since otherwise there exists the risk that supplementary data will not be recorded in extended-precision Track Modes (see section 4.4).

A useful check that the DA-88 and MR-2024T are in proper communication prior to the start of recording is to cycle the **<TRACK MODE>** pushbutton around all the modes whilst the DA-88 is in input monitor (i.e. any state except PLAY if the above settings are used). If all is well, the **'ERR'** LED will flash between each selection and then go out, and no flashing indication of a Playback Track Mode different from the Record Track Mode will occur.



#### 4.4. MR-2024T tape format and the DA-88 meters

In **'8T16b'** Track Mode, the DA-88 tape format is exactly the same as that employed in analogue recording. Recordings made digitally using the MR-2024T can be played back normally via the DA-88's internal D-A converters. Similarly, analogue recordings made on any DA-88 can be played back in AES/EBU form using the MR-2024T.

The extended-precision Track Modes are more complicated since the extended audio words must be accommodated over more than one track.

In **'4T24b'** Track Mode, this is achieved by recording a 16-bit version of each of the four input tracks onto the first four tracks of the tape, and putting the extra information for each track onto tracks 5-8 respectively. A tape-mode tagging sequence is also added to a spare bit of track eight. This has the benefit that the first four meters operate as normal for the four tracks in use, and the DA-88's D-A converters can be used to monitor the signals, albeit at a lower quality than that at which they are actually being recorded.

In **'6T20b'** Track Mode, the first six tracks work in the same way, allowing normal operation of the DA-88's meters and D-A converters. However, the additional data for these tracks now has to be combined, along with the tape-mode tagging sequence, onto tracks 7 and 8.

The extra data recorded on tracks 5-8 in **'4T24b'** Track Mode and tracks 7-8 in **'6T20b'** Track Mode results in some activity at the bottom of these meters. On meter 8, the Track Mode tag determines the height of the bar, and this can be used to recognise which Track Mode is in use. **'6T20b'** Track Mode is indicated by a constant -20dB displacement of meter 8, and **'4T24b'** Track Mode by a constant -40dB displacement.

**NOTE: Because extra data is recorded onto the high-order tracks in the extended-precision Track Modes, it is vital that the <REC FUNCTION> buttons for these tracks are activated during recording, otherwise the extended data will not be recorded. See section 4.5 for more information about recording individual tracks.**

## 4.5. Recording tracks individually

It is normally recommended that all the **<REC FUNCTION>** buttons below the bargraphs of the DA-88 remain activated throughout a session, since this prevents the accidental failure to record either the primary tracks or the supplementary tracks which carry the extra information in the extended-precision Track Modes.

However, in **'4T24b'** Track Mode, since the supplementary data for each track is recorded alone on one other track, it is possible to record the track individually. This achieved by arming the DA-88 **<REC FUNCTION>** buttons for tracks 1 and 5 to record track 1, tracks 2 and 6 to record track 2 etc. Note, however, that automatic sensing of the Playback Track Mode will not operate unless track 8 has been recorded, since this is where the Track Mode tag is recorded. Therefore it is advisable to record all four tracks on the first pass followed by such individual tracks as are required on subsequent passes.

Individual recording of tracks is NOT possible in **'6T20b'** Track Mode, since the supplementary data for three tracks is held on each 'spare' track. However, if it were of any advantage, tracks 1,3 and 5 could be recorded alone by also arming track 7; similarly for tracks 2,4 and 6 by also arming track 8. The same condition of pre-recording track 8 exists as in **'4T24b'** Track Mode.

As regards the use of mid-program punch-in and punch-out functions of the DA-88, a few points should be borne in mind:

Firstly, the audio precision of any cross-fading will be limited to 16-bits, since the supplementary data cannot be properly cross-faded.

Second, if it is required that the punched-in audio has the full precision of the selected Track Mode, then the supplemental track must be punched-in too; for example when punching-in track 3 in **'4T24b'** Track Mode, track 7 must also be punched-in.

Finally, if track 8 is punched-in in one of the extended-precision Track Modes, the Track Mode tag sequence is momentarily corrupted, so long cross-fades must be avoided if spurious switching of Playback Track Mode is not to result. Alternatively, the fixed Playback Track Mode option can be used, as described in Appendix A.

In general, it is not a good idea to use extended-precision, mid-program punch-in when using **'6T20b'** Track Mode, since the attempt to cross-fade the supplementary data on tracks 7 and 8 causes interaction between the different tracks, and with the Track Mode tag, during the cross-fade (albeit at a very low level). Punching-in track 4/8 in **'4T24b'** Track Mode is similarly inadvisable.

## **4.6. Use of adequate audio word-length**

In all digital audio systems it is important that signals are correctly 'dithered' at any point where precision is discarded. This usually involves the addition of some kind of noise to linearize the transfer function through the truncation, and to remove noise modulation effects. For this reason, almost all digital audio devices (other than those which are merely concerned with transmission or storage) add dither, often among other places, at their digital audio output, since the signal is usually being reduced in accuracy (or word-length) here. At this point, the signal has essentially been degraded, and cannot normally be recovered to its previous accuracy.

When recording the output of an item of digital audio equipment it is important to know its word-length, or the extent to which it has already been dithered and then truncated. To record fewer bits than this will be to degrade the signal further, and in a way which will sound much more unpleasant than mere dithering! To record more bits than this is not so problematic since signal quality is not inherently lost, but may give the impression to a subsequent process that the signal is of better quality than in actuality, and thus may cause more degradation by the addition of further unnecessary dither.

Like most digital tape recorders, the MR-2024T/DA-88 system makes no attempt to automatically set its recording word-length (nor to re-dither its input data) according to incoming Channel Status. This would generally be disastrous since, in this respect, implementation of Channel Status in equipment is often poor. Therefore, in order to make proper quality recordings it is important that the operator makes this decision accurately.

It is important to determine the word-length of the source, and to set the Record Track Mode of the MR-2024T to the same (or if this is not possible to the next highest) value. Often operators seek to improve a 16-bit DAT recording by using a 20-bit A-D converter, when in fact a good 16-bit converter (or at least the 20-bit device re-dithered to 16-bits) would actually be better.

Obviously this is also true if the source is simply another storage device. There is no possibility of improving a 16-bit CD recording by making a 20-bit transcription.

## 4.7. Channel Status support

The MR-2024T takes no notice of incoming Channel Status at its AES/EBU or SPDIF inputs, except in consideration of emphasis information, as discussed below. No note is taken of copy protection - any input can be recorded; no notice is taken of sample-rate indication - the rate flagged to the DA-88 by the MR-2024T when in DI sync mode is actually measured.

The MR-2024T has fully-implemented Channel Status on both its AES/EBU and SPDIF outputs, as follows:

AES/EBU outputs:

- Professional
- Audio use
- " Emphasis, see below
- Source locked
- " Fs 44.1k or 48.0k according to operation
- Two-channel mode
- No user-data mode indicated
- " Auxiliary data undefined for 16-bit and 20-bit Playback Track Modes, audio word for 24-bit Track Mode
- " Audio word-length as per Playback Track Mode
- Not a reference
- " CRCC correct

SPDIF output:

- Consumer
- Audio use
- Copy allowed
- " Emphasis, see below
- Two-channel mode
- Category code: General
- SCMS generation status unknown
- " Fs 44.1k or 48.0k according to operation
- Clock accuracy grade II

All other fields zeroed; fields marked "" change according to operating mode;

### 4.7.1. Emphasis support

The DA-88 has some degree of emphasis support, in that a flag bit is provided to indicate whether emphasis is or is not in use; this flag applies to all of the tracks. The flag refers to 50/15us (CD) emphasis. The MR-2024T passes the emphasis state of the lowest-numbered, error-free AES/EBU (or SPDIF) input to the DA-88 to provide this indication for recording. Conversely, the emphasis state read from the DA-88 during playback is represented in the Channel Status of the AES/EBU and SPDIF outputs.

There is, however, an anomaly in the way that the DA-88 handles the emphasis flag, in that it is **ONLY RECORDED DURING TAPE FORMATTING**. That is to say, during audio recording, no account is taken of the flag, and during playback the issued state of the flag is that which was present when the tape was formatted. This need not be an insurmountable problem if you remember to specially format tapes which will be used to record emphasised material. **If you do this, take care, because any material subsequently recorded on these tapes will cause activation of de-emphasis circuitry during playback, both in the DA-88 and in any D-A converter connected via the MR-2024T.**

## 5. Application Examples

### 5.1. Recording from high-resolution A-D converters

Figure 2. shows the setup for recording four 24-bit tracks from a pair of Prism Sound AD-1 Classic A-D converters. The DA-88 is clock master, and the AD-1s are slaved via WORD SYNC OUTs from the MR-2024T. Also illustrated is the method of monitoring with a single high-resolution D-A converter, using the **<SPDIF I/O>** pushbutton as a monitor selector.

### 5.2. Recording from CD

Figure 3. shows the setup for recording from a source which cannot be externally synchronized. In this case the DA-88 is slaved from the MR-2024T via a WORD SYNC cable. Note that only one non-synchronizable source can be recorded at a time by this method; any other sources recorded simultaneously must be slaved from the MR-2024T, and must source a higher-numbered track pair.

### 5.3. Noise-shaping onto DAT

Figure 4. shows how a 20-bit or 24-bit recording on the DA-88 can be noise-shaped down to 16-bits using an AD-1 in SNS (Super-Noise-Shaping) mode to produce a DAT or CD master.

### 5.4. Track expansion using multiple DA-88s and MR-2024Ts

Figure 5. illustrates the method for expanding the number of tracks by linking a number of DA-88s and MR-2024Ts together. The three-machine setup shown can provide eighteen 20-bit tracks, twelve 24-bit tracks, or twenty-four basic 16-bit tracks.

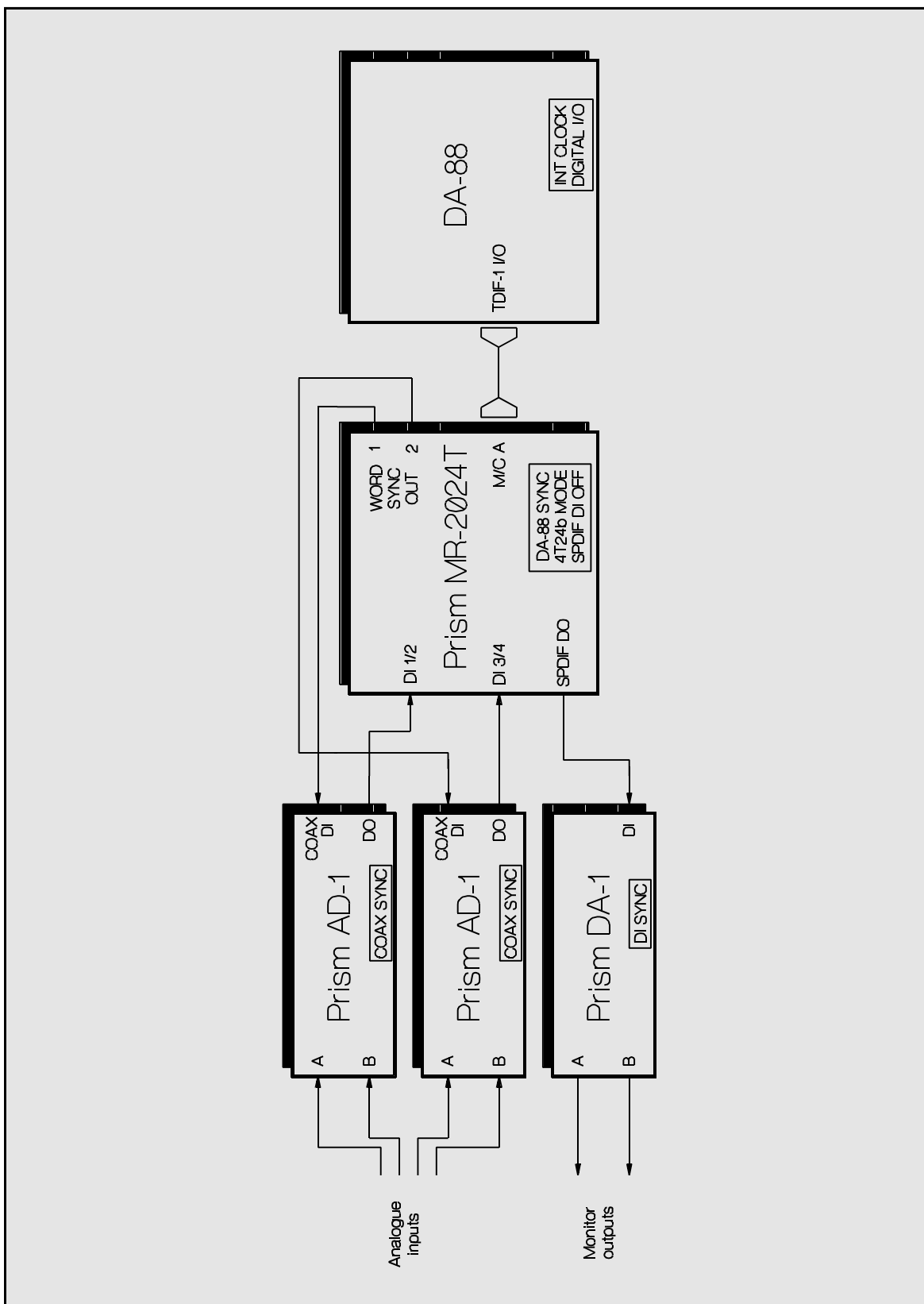


Figure 2. Recording from high-resolution A-D converters

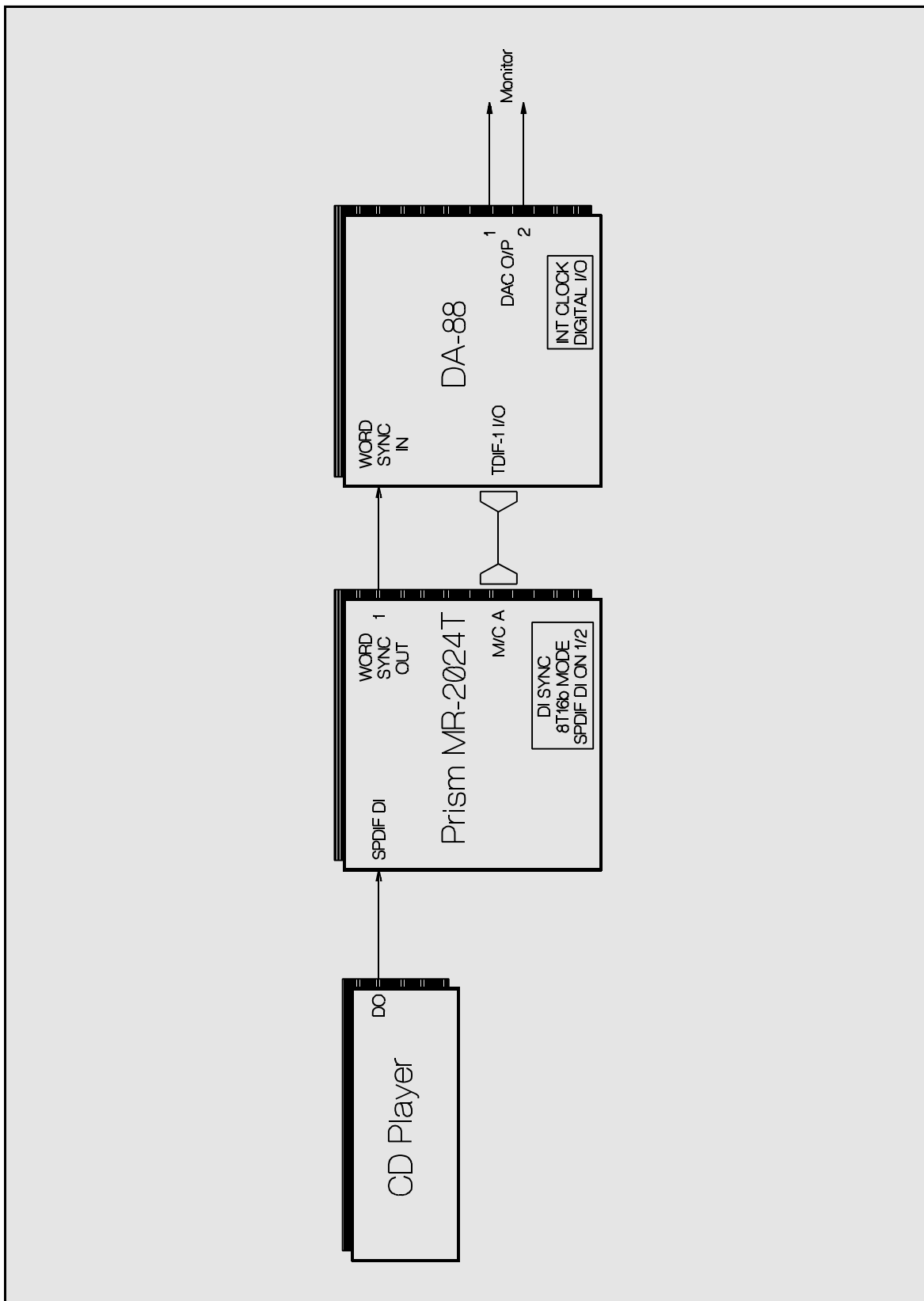


Figure 3. Recording from CD



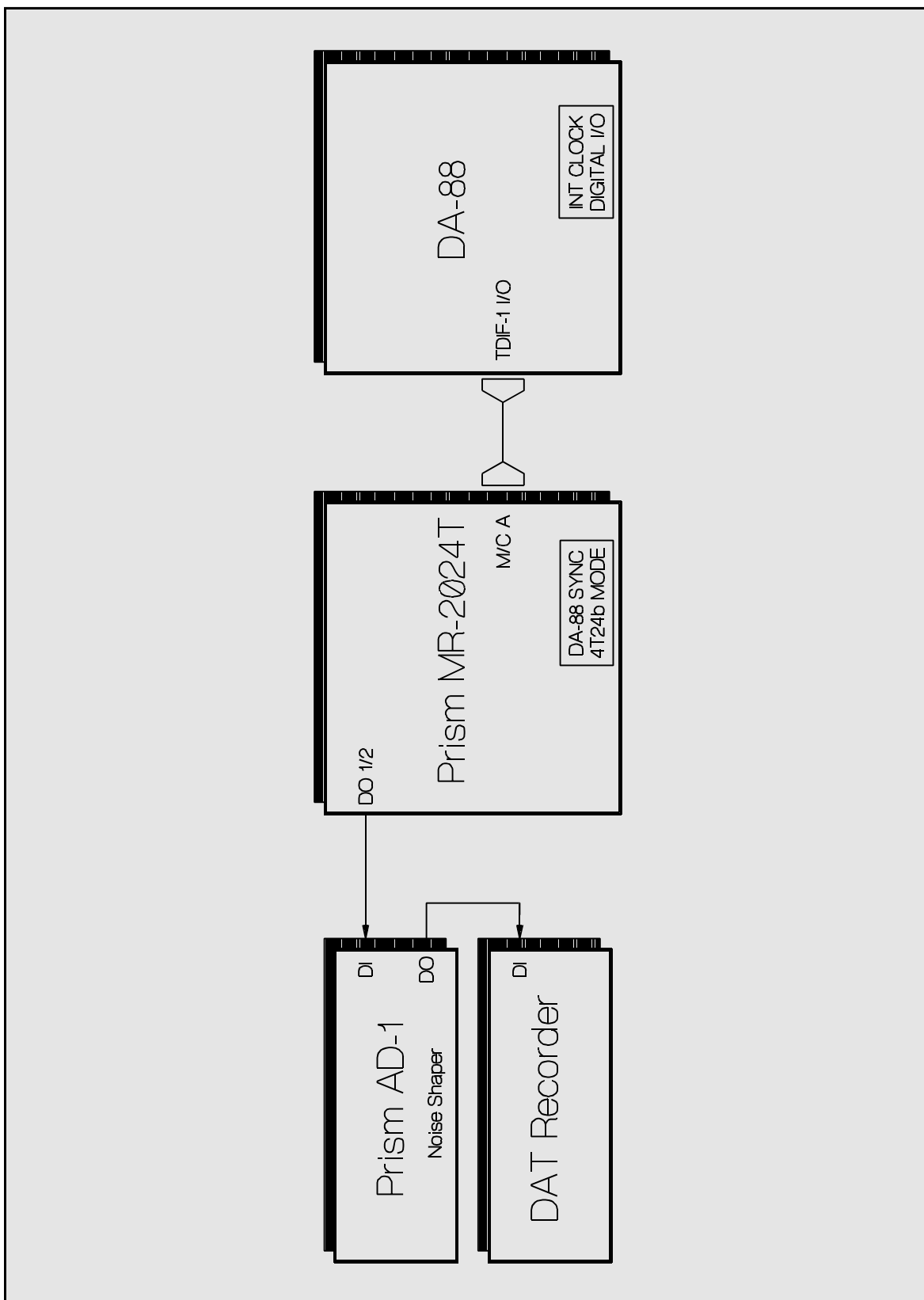


Figure 4. Noise-shaping onto DAT

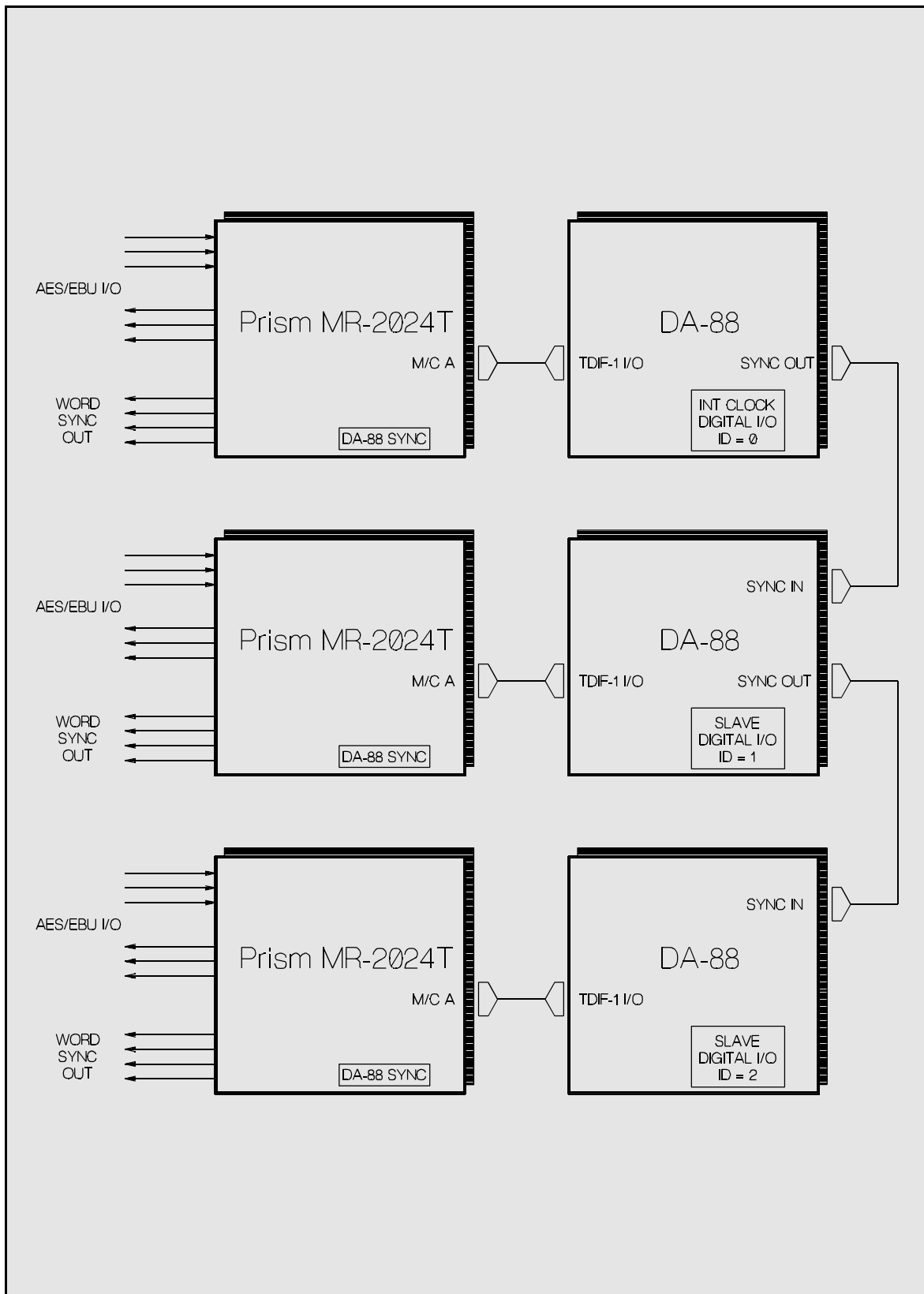


Figure 5. Track expansion using multiple DA-88s and MR-2024Ts

## 6. Specification

### Audio Performance:

- 8-track: 16-bits (THD+n: - 93.4dB, 0.0021%; 0dBFS w. TPDF dither)
- 6-track: 20-bits (THD+n: -117.5dB, 0.00013%; 0dBFS w. TPDF dither)
- 4-track: 24-bits (THD+n: -141.6dB, 0.0000083%; 0dBFS w. TPDF dither)

Sampling rates supported: 44.1kHz, 48.0kHz

### Digital Audio Formats:

#### DI (digital audio input) formats supported:

- 110S balanced XLR female (AES3, IEC958, 'AES/EBU')
- 75S phono (RCA) jack (AES3, IEC958, CP340, 'SPDIF')

#### DO (digital audio output) formats supported:

- 110S balanced XLR male (AES3, IEC958, 'AES/EBU')
- 75S phono (RCA) jack (AES3, IEC958, CP340, 'SPDIF')

#### Tape deck I/O format:

- Two Teac 'TDIF-1' connections on 25-way D-sub female

#### WORD SYNC OUT format:

- 75S coaxial squarewave, TTL-level 'Wordclock' on BNC jack

### Mains power:

IEC 6A inlet automatically accommodates 90-260VAC, 50-60Hz

Consumption: 7W max

Note: Specification offered in good faith, subject to change without notice.

## 7. Troubleshooting guide

The following table is intended for first-line assistance in diagnosing any operational difficulties. If problems persist, contact Prism Media Products or your local distributor.

Symptom	Possible cause / Suggested action
<ul style="list-style-type: none"> <li>No LEDs lit when unit switched on</li> </ul>	<ul style="list-style-type: none"> <li>No mains voltage present</li> <li>Internal damage - service required</li> </ul>
<ul style="list-style-type: none"> <li>No LED responses to pushbuttons</li> </ul>	<ul style="list-style-type: none"> <li>Repower unit</li> <li>Internal damage - service required</li> </ul>
<ul style="list-style-type: none"> <li>'ERR' LED flashes</li> </ul>	<ul style="list-style-type: none"> <li>Normal in changing Track Mode</li> <li>Tape damage</li> </ul>
<ul style="list-style-type: none"> <li>'ERR' LED continuously lit</li> </ul>	<ul style="list-style-type: none"> <li>Tape damage</li> <li>See Appendix A</li> </ul>
<ul style="list-style-type: none"> <li>Extra Track Mode LED flashing</li> </ul>	<ul style="list-style-type: none"> <li>Normal during playback of tape with different recorded Track Mode from current selection</li> <li>If during record or stop, check settings of DA-88 pushbuttons and location of interface cable</li> </ul>
<ul style="list-style-type: none"> <li>DI ERROR LED lit</li> </ul>	<ul style="list-style-type: none"> <li>No AES/EBU or SPDIF input on that track input</li> <li>Biphase or parity errors (cable?)</li> <li>Source unsynchronized</li> </ul>
<ul style="list-style-type: none"> <li>DI ERROR LED flashing</li> </ul>	<ul style="list-style-type: none"> <li>Source unsynchronized</li> </ul>
<ul style="list-style-type: none"> <li>Sample-rate LEDs flashing</li> </ul>	<ul style="list-style-type: none"> <li>In 'DI' Sync Mode, MR-2024T locked at different rate from tape</li> <li>Misconnected interface cable</li> </ul>
<ul style="list-style-type: none"> <li>SPDIF input not working</li> </ul>	<ul style="list-style-type: none"> <li>SPDIF DI Mode switch set to 'DI OFF' on rear panel</li> <li>SPDIF I/O track selection wrong</li> </ul>
<ul style="list-style-type: none"> <li>&lt;MONITOR&gt; switch inoperative</li> </ul>	<ul style="list-style-type: none"> <li>Only one TDIF-1 device connected</li> </ul>
<ul style="list-style-type: none"> <li>DA-88 fails to record</li> </ul>	<ul style="list-style-type: none"> <li>Check DA-88 controls, e.g. 'DIGITAL I/O' and 'REC FUNCTIONS'</li> </ul>

## Appendix A - Fixed Playback Track Mode option

In normal operation, the Playback Track Mode is determined automatically by the MR-2024T, and may thus be different from the currently-selected Record Track Mode. An option exists, selectable by removal of an internal jumper, to force the Playback Track Mode to be the same as the Record Track Mode set in the "TRACK MODE" box.

This mode is activated by removal of the jumper linking pins 3 and 4 of LK2 on the main PCB of the MR-2024T. Since this involves removal of the MR-2024's cover which presents an electric shock hazard, **do not attempt this modification yourself. The modification should be carried out by your local Prism Sound representative.**

The behaviour of the LEDs in the "TRACK MODE" box is different with this option selected. There is no longer the possibility for a different Playback Track Mode LED to flash, since the Playback Track Mode is locked to the Record Track Mode. The 'ERR' LED is now permanently lit if the tape being played was recorded with a different Track Mode from that now selected, rather than blinking briefly while the new Track Mode is automatically adopted.

## Appendix B - Checking the system with a Prism Sound Dscope

Figure 6. shows how a Prism Sound Dscope digital audio analyzer can be used to verify the performance of the system. Note that in the 'DA-88' Sync Mode, the Dscope generator must be synchronized to the MR-2024T as shown.

Set the Dscope generator dither on, and the word-length to 16-bits, and the MR-2024T Record Track Mode to **'8T16b'**. The THD+n at 0dBfs (equivalent to the total dynamic range) is about 93.4dB, which is normal for an ideal 16-bit system.

Note that this figure is not improved by selecting an extended-precision Track Mode.

Setting the Dscope generator word-length to 20-bits shows an apparent small improvement if the MR-2024T Record Track Mode is still at **'8T16b'**; the dynamic range rises to about 98.4dB. However, the spectrum of the noise floor as shown by the FFT trace is now full of harmonically-related spurious - the system is inadequately dithered. By setting the MR-2024T Track Mode to **'6T20b'** the dynamic range should be about 117.5dB with a white noise floor; it is now an 'ideal' 20-bit system.

Finally, by setting the word-length of the Dscope to 24-bits, and the Track Mode on the MR-2024T to **'4T24b'**, a dynamic range of about 137.3dB is measured. The actual dynamic range of the MR-2024T/DA-88 is over 141dB, the lower result is actually a consequence of distortion products in the Dscope generator!

A number of interesting experiments can be done using the Dscope which help to illustrate the principles of word-length and dithering. For example, try turning the generator dither off altogether - the spectrum of the resulting quantization distortion is a convincing argument for dithering!

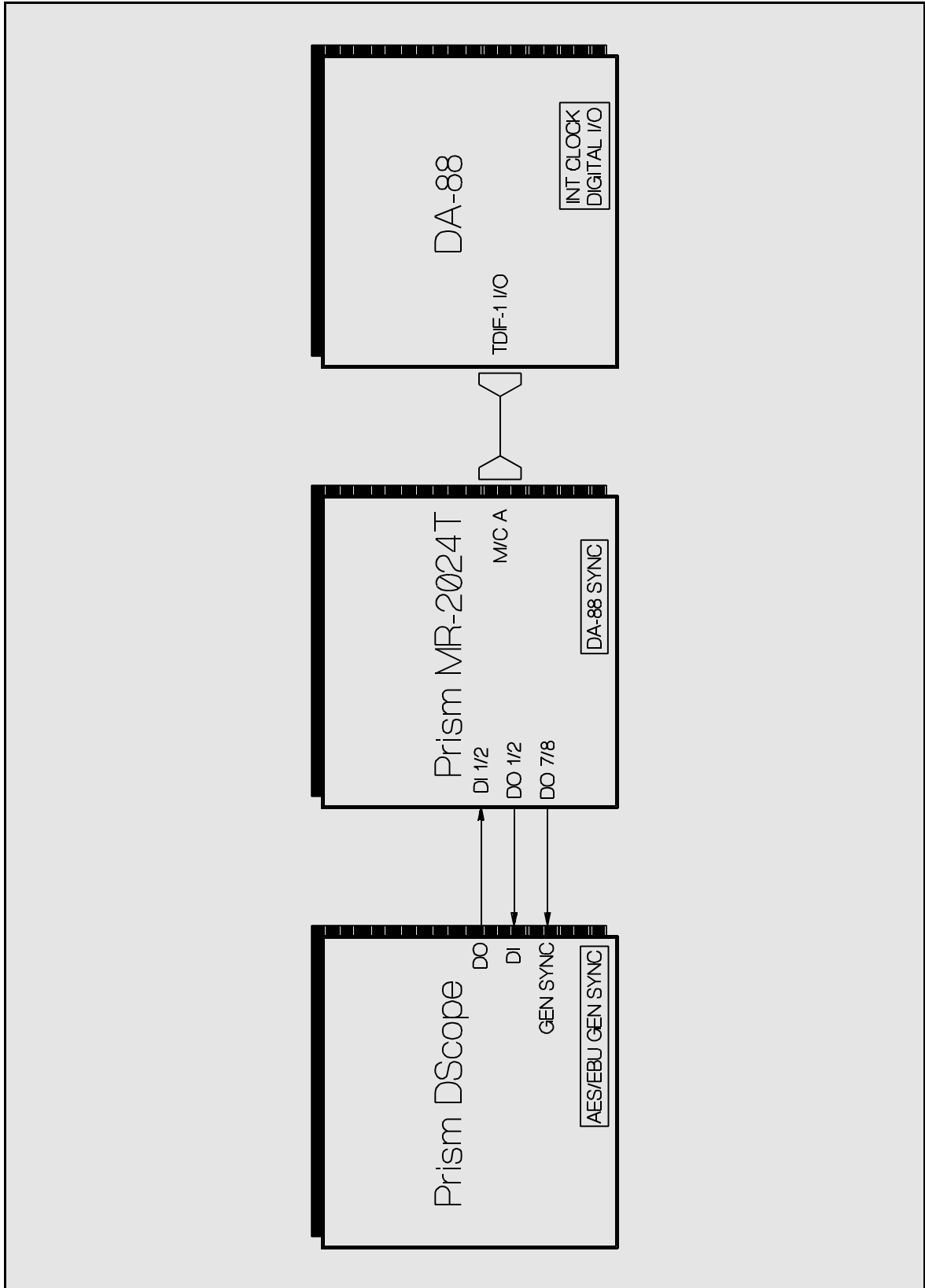


Figure 6. Checking the system with a Prism Sound Dscope

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