Digital transfer

Preparing for digital transfer

This section covers settings which are the same regardless of whether you are transferring in or out.

Before working with UDIO, you should be familiar with track routing and setting track parameters. See "Track Routing" in this manual and "Preparing to record" in the *Audio Editing* manual.

Introduction to Universal Digital I/O

With the Universal Digital I/O (UDIO) hardware installed, you can transfer digital audio between the Direct-to-Disk and another digital device without leaving the digital domain and while retaining the original recorded quality.

You can transfer one or two tracks of audio at a time between the Direct-to-Disk and another digital device using any ProDigi, SDIF, AES/EBU or S/PDIF format. The two available digital channels, DIG 1 and DIG 2, are channels left and right, respectively. Tracks can be routed to or from either of the digital channels.

Note: To prevent system slowdown, digital I/O should be OFF whenever you are not actually transferring digital information. For example, before changing the track parameters, digital format, sampling rate or cabling, make sure the Digital Transfer OFF button in the Selection panel is highlighted.

Monitoring tracks

Although there is never a recording delay when transferring data, a delay can be heard in two instances when monitoring digital I/O.

- Digital input is routed directly to a Direct-to-Disk output.

- A track receiving input from an STM module is simultaneously routed to a digital output.

In these cases, there is a constant output delay of 75 milliseconds.

Connecting the UDIO module to the other digital device

Before performing a digital transfer, your digital device should be properly connected for sending or receiving audio.

The UDIO module contains an input for a composite (house) sync signal, inputs and outputs for digital devices using a ProDigi, SDIF, AES/EBU or S/PDIF format, and lights labeled Data and Word clock. The Data light is on whenever the signal on either channel is greater than -30 dB. Its brightness roughly indicates the strength of the signal. The Word clock light cycles on and off every 32,768 samples whenever the module is active.

Use the connectors labeled SDIF2 DIGITAL I/O for the SDIF two-track format only. Use the connectors labeled PRODIGI for the SDIF multitrack format and any ProDigi format.
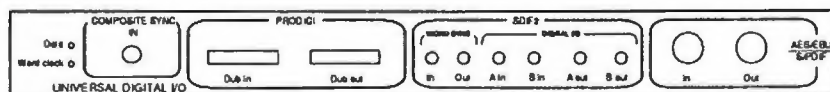
UDIO module

Synchronization and sampling rate

If you are using SMPTE with digital I/O, the system waits for an incoming SMPTE signal before beginning the transfer. When you are striping SMPTE onto tape, the tape machine and the time code generator must be locked to the same house sync signal.

When transferring digital audio, the sample rate of the Direct-to-Disk must be the same as the sample rate of the other digital device. If you are using either drop frame time code locked to color house sync (29.97 fps) or non–drop frame time code locked to black and white house sync (30 fps), set one of the following sample rates on the Project Manager panel of the Audio Event Editor.

set this sample rate	to obtain this actual rate (kHz)
31.9*	31.9680*
32.0	32
44.0	44.0559
44.1	44.1
47.9*	47.9520*
48.0	48
88.1	88.1118
88.2	88.2
95.9*	95.9040*
96.0	96

* these rates are not available when transferring out from the Direct-to-Disk while locked to the internal sync source.

Using non-drop frame time code with color house sync

In some situations, you may be using non-drop frame time code locked to color house sync (29.97 fps). If so, you need to set one of the following special sample rates provided specifically for this case.

set this special sample rate	to obtain this actual rate (kHz)
32.1	32
44.2	44.1
48.1	48
88.3	88.2
96.1	96

Digital transfer out

You can transfer to another digital device an entire Direct-to-Disk track or any cuelist routed through a Direct-to-Disk output.

Selecting the digital format and clock signal source

Before transferring data out from Direct-to-Disk system, you need to select the digital format that corresponds to the digital device to which you are transferring. You also need to select a time base reference for clocking the outgoing signals.

1. On the Audio Event Editor Selection panel, click the box labeled **Digital Transfer** near the bottom left of the panel.

    The following dialog appears.

    Format: Output Sync: [OK] [CANCEL]

2. Set the switch labeled **Format** to the correct format of the six formats listed below.

    ProDigi 2 Track   SDIF 2 Track
    ProDigi Multi   SDIF Multi
    AES/EBU   S/PDIF

3. Set the switch labeled **Output Sync** to the appropriate time base reference for clocking the outgoing samples. Available clock signal sources are on the opposite page.

4. Click [OK] or click Digital Transfer again.

    The dialog disappears. The format and the clock signal source are selected.

Sync setting	Use
Internal	Selects the Direct-to-Disk's internal crystal as a time base reference.
External Default	Selects a clock signal that corresponds to the digital format being used (for example, selects an SDIF word clock signal for a transfer using the SDIF format).
NTSC B+W	Selects a 30 fps composite (house) sync signal as the time base reference.
NTSC Color	Selects a 29.97 fps composite (house) sync signal as the time base reference.
PAL/SECAM	Selects a 25 fps composite (house) sync signal as the time base reference.
Ext ProDigi 2 Track	Selects a ProDigi two-track word clock signal as the time base reference for a transfer using any of the digital formats.
Ext ProDigi Multi	Selects a ProDigi multitrack word clock signal as the time base reference for a transfer using any of the digital formats.
Ext SDIF	Selects an SDIF word clock signal as the time base reference for a transfer using any of the digital formats.
Ext AES/EBU or S/PDIF	Selects an AES/EBU or S/PDIF derived clock signal as the time base reference for a transfer using any of the digital formats.

Connecting the Output Sync signal

If you set the switch labeled Output Sync to **Internal,** the time base reference is an internal clock signal. For any other sync source, you must connect the appropriate sync signal to the connector listed in the following table.

sync source	sync signal connector
NTSC or PAL/SECAM	COMPOSITE SYNC IN
ProDigi	PRODIGI Dub in
SDIF	SDIF2 WORD SYNC In
AES/EBU or S/PDIF	AES/EBU In

Transferring a track or cuelist out

The following instructions presume that you have already set the sampling rate, selected the appropriate digital format and synchronization source, set up the digital tape recorder for recording and connected the sync signal.

To avoid full-level noise in your speakers, keep the audio levels down until you are sure that the sync signal is locked and the sampling rate and digital format are correct.

1. With the Audio Event Editor on the screen, display the Project Manager panel in Show Project mode and the Sequencer Motion Control panel.

2. For each track you want to transfer out, set the Status to **Safe** on the Project Manager panel.

3. To transfer a Direct-to-Disk track, set the Mode to **Repro.** To transfer a cuelist, set the Mode to **CuePB.**

4. Assign the Direct-to-Disk track or cuelist to the desired output. (See the section "Direct-to-Disk track routing" in this manual.)

5. For the assigned output number, enter **1** or **2** in the column labeled DDT on the right side of the Project Manager panel.

    Audio from the selected output is routed to the specified digital I/O channel. Volume and pan settings have no effect on the digital signal.

6. Click the Digital Transfer OUT button near the bottom left of the Selection panel to turn on digital I/O.

Digital transfer out (con't)

Transferring a track or cuelist out (con't)

7. The UDIO module requires two minutes to lock to house sync. If you are using house sync, wait until the module is locked to the sync signal.

8. Start recording on the digital tape recorder.

9. Click START on the Sequencer Motion Control panel to start playback on the Direct-to-Disk.

   The Direct-to-Disk tracks or the cuelists routed to the digital I/O channels are recorded on the digital tape recorder.

10. Click STOP on the Sequencer Motion Control panel to stop playback.

11. Stop the tape recorder to stop recording.

12. Click the Digital Transfer OFF button on the Selection panel to turn off digital I/O.

Transferring individual cues

You can transfer out individual cues directly from the track on which they were recorded. When you transfer a cue, any information about cue synchronization and output routing is ignored.

1. From the Audio Event Editor Selection panel, select the Project Manager and Cue Directory panels.

2. On the Project Manager panel, select the project containing the cues you want to transfer.

    The names of cues in the current project are displayed in the Cue Directory panel.

3. At the top of the Cue Directory panel, set the switch labeled Function to **Recall & Play.**

4. Click the Digital Transfer OUT button near the bottom left of the Selection panel to turn on digital I/O.

5. Start recording on the digital tape recorder.

6. In the Cue Directory panel, click the name of the cue you want to transfer.

    The cue is transferred to the digital tape recorder.

7. Stop the tape recorder to stop recording.

8. Click the Digital Transfer OFF button on the Selection panel to turn off digital I/O.

Digital transfer in

You can transfer into the Direct-to-Disk digital audio from another digital recorder or other device.

Selecting the digital format

Before transferring data in to the Direct-to-Disk system, you need to select the digital format that corresponds to the digital device from which you are transferring.

1. On the Audio Event Editor Selection panel, click the box labeled **Digital Transfer** near the bottom left of the panel.

   The following dialog appears.

   Format: Output Sync: [OK] [CANCEL]

2. Set the switch labeled **Format** to the correct format of the six formats listed below.

   ProDigi 2 Track   SDIF 2 Track
   ProDigi Multi   SDIF Multi
   AES/EBU   S/PDIF

3. Click [OK] or click Digital Transfer again.

   The dialog disappears. The format is selected.

Transferring data in

These instructions presume that you have set the sampling rate, set up the digital tape recorder for playback and selected the appropriate digital format.

To avoid full-level noise in your speakers, keep the audio levels down until you are sure that the sync signal is locked and the sampling rate and digital format are correct.

1. With the Audio Event Editor on the screen, display the Project Manager panel in Show Project mode, the Record Control panel and the Sequencer Motion Control panel.

2. On the Project Manager panel, set the following parameters for each destination track.

Status	Mode	Input source	Input channel
READY	Input	DIG	1 or 2

3. Set the mode and trigger switches on the Record Control panel for the type of recording you want to do. (See "Recording" in the *Audio Editing* manual for details.)

(con't next page)

Digital transfer in (con't)

Transferring data in (con't)

4. Click the Digital Transfer IN button near the bottom left of the Selection panel to turn on digital I/O.

5. If the trigger switch on the Record Control panel is set to Manual, click READY and RECORD on the Record Control panel. If the trigger switch is set to Sequencer, click READY and RECORD on the Record Control panel and click START on the Sequencer Motion Control panel.

    Recording begins.

6. Start playing back the digital tape recorder.

    Digital transfer begins. Audio is recorded on the Direct-to-Disk tracks.

7. Stop the tape recorder to stop playback.

8. Click STOP on the Record Control panel to stop recording.

9. Click the Digital Transfer OFF button on the Selection panel to turn off digital I/O.

1. Connect the digital device to the UDIO module.

2. Select the appropriate sampling rate from the Project Manager of the Audio Event Editor.

3. Click the Digital Transfer button on the Selection panel and select the appropriate digital format from the dialog.

4. If transferring out from the Direct-to-Disk, select the appropriate clock signal source from the Digital Transfer Dialog and connect the appropriate sync signal.

5. Set the track parameters from the Project Manager.

6. Click the Digital Transfer IN or OUT button on the Selection panel.

7. Start the destination device and then the source device.

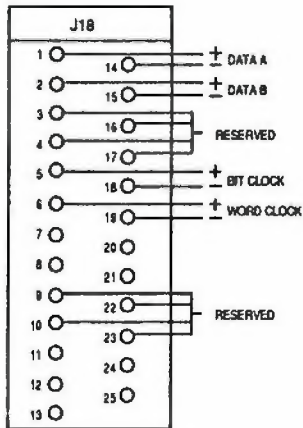8. When finished, stop the source device and then the destination device.

UDIO hardware specifications

This section describes the input and output specifications for each digital format. Also included are specifications for subcode, the auxiliary information transmitted along with the audio sample data by some digital formats.
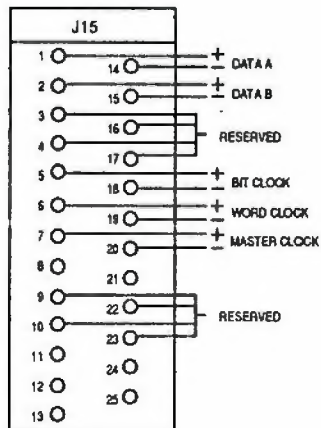
ProDigi two-track format

Input clocking	slave to source, ±150 ppm
Output clocking	
internal crystal oscillator	±25 ppm
composite sync	±150 ppm
SDIF word sync	±150 ppm
AES/EBU input signal	±150 ppm
ProDigi two-track/multitrack word clock	±150 ppm
Input connector type	25-pin DSUB male
Output connector type	25-pin DSUB female
Connector pin assignments	See opposite page
Number of tracks	2
Sampling rates	32, 44.1, 48, 88.2 or 96 kHz
Sample size	16 bit
Cable	twisted pair (100 Ω)
Maximum cable length	20 feet
Level	TTL open collector (100 Ω)
Signal format	PRODIGI 2-channel dub

Input

J18

1 14 ± DATA A
2 15 ± DATA B
3
4 16 RESERVED
17
5 18 ± BIT CLOCK
6 19 ± WORD CLOCK
7 20
8 21
9 22 RESERVED
10 23
11 24
12 25
13

Output

J15

1 14 ± DATA A
2 15 ± DATA B
3
4 16 RESERVED
17
5 18 ± BIT CLOCK
6 19 ± WORD CLOCK
7 20 ± MASTER CLOCK
8 21
9 22 RESERVED
10 23
11 24
12 25
13

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

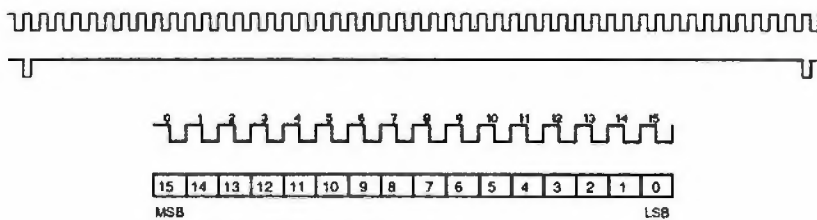| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

MSB   LSB

ProDigi two-track format

Connector pin assignments

Signal format
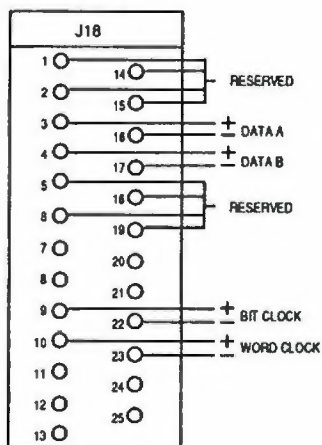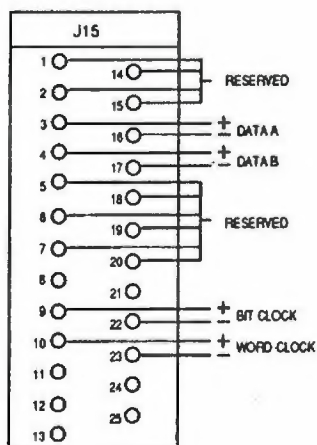
master clock
word clock

bit clock
data A or B

Digital transfer **3.17**

UDIO hardware specifications (con't)

ProDigi multitrack format

Input clocking	slave to source, ±150 ppm

Output clocking
internal crystal oscillator	±25 ppm
composite sync	±150 ppm
SDIF word sync	±150 ppm
AES/EBU input signal	±150 ppm
ProDigi two-track/multitrack word clock	±150 ppm

Input connector type	25-pin DSUB male
Output connector type	25-pin DSUB female
Connector pin assignments	See opposite page
Number of tracks	2
Sampling rates	32, 44.1, 48, 88.2 or 96 kHz
Sample size	16 bit
Cable	twisted pair (100 Ω)
Maximum cable length	50 feet
Level	RS422 (100 Ω)
Signal format	PRODIGI multichannel dub

Input

```
         J18
  1 O        14 O ─────┐
  2 O        15 O ─────┴── RESERVED
  3 O        16 O ──── ± DATA A
  4 O        17 O ──── ± DATA B
  5 O        18 O ─────┐
  8 O        19 O ─────┴── RESERVED
  7 O        20 O
  8 O        21 O
  9 O        22 O ──── ± BIT CLOCK
 10 O        23 O ──── ± WORD CLOCK
 11 O        24 O
 12 O        25 O
 13 O
```

Output

```
         J15
  1 O        14 O ─────┐
  2 O        15 O ─────┴── RESERVED
  3 O        16 O ──── ± DATA A
  4 O        17 O ──── ± DATA B
  5 O        18 O ─────┐
  8 O        19 O ─────┴── RESERVED
  7 O        20 O
  8 O        21 O
  9 O        22 O ──── ± BIT CLOCK
 10 O        23 O ──── ± WORD CLOCK
 11 O        24 O
 12 O        25 O
 13 O
```

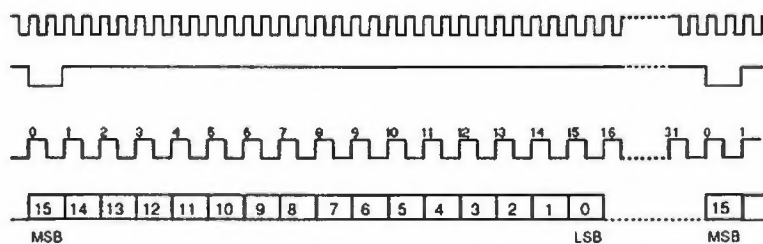| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | ... | 15 |
| MSB | | | | | | | | | | | | | | | LSB | | MSB |

ProDigi multitrack format

Connector pin assignments

Signal format

master clock
word clock

bit clock

data A or B

Digital transfer 3.19

UDIO hardware specifications (con't)

SDIF two-track format

Input clocking	slave to source, ±150 ppm

Output clocking

internal crystal oscillator	±25 ppm
composite sync	±150 ppm
SDIF word sync	±150 ppm
AES/EBU input signal	±150 ppm
ProDigi two-track/multitrack word clock	±150 ppm

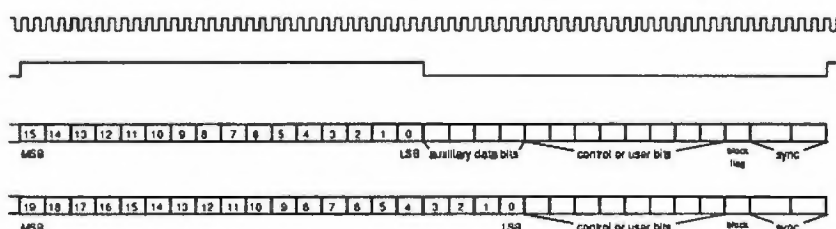|	
Word sync	BNC-R
Number of tracks	2
Sampling rates	32, 44.1, 48, 88.2 or 96 kHz
Sample size	16 or 20 bit
Connector type	BNC-R
Cable	COAX (75 Ω)
Maximum cable length	50 feet
Level	TTL (75 Ω)
Signal format	SDIF2

master clock
word clock

data A or B (16-bit)

data A or B (20-bit)

SDIF subcode

When using the SDIF format to transfer out from the Direct-to-Disk, Emphasis bits and Dubbing Prohibition bits are set to zero to indicate that emphasis is not used and that dubbing is possible.
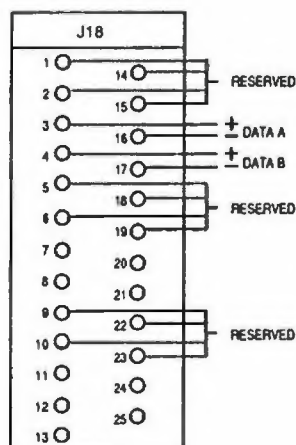
When transferring in to the Direct-to-Disk, the Emphasis and Dubbing Prohibition bits are ignored.

UDIO hardware specifications (con't)

SDIF multitrack format

Input clocking	slave to source, ±150 ppm
Output clocking	
internal crystal oscillator	±25 ppm
composite sync	±150 ppm
SDIF word sync	±150 ppm
AES/EBU input signal	±150 ppm
ProDigi two-track/multitrack word clock	±150 ppm
Word sync	BNC-R
	TTL (75 Ω) COAX
Input connector type	25-pin DSUB male
Output connector type	25-pin DSUB female
Connector pin assignments	See opposite page
Number of tracks	2
Sampling rates	32, 44.1, 48, 88.2 or 96 kHz
Sample size	16 or 20 bit
Cable	twisted pair (100 Ω)
Maximum cable length	50 feet
Level	RS422 (100 Ω)
Signal format	SDIF2

Input   **Output**
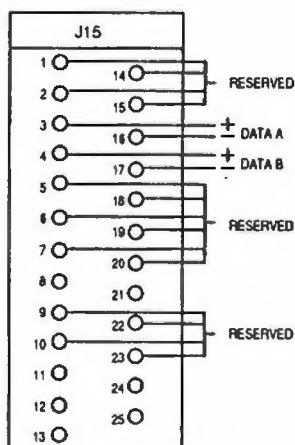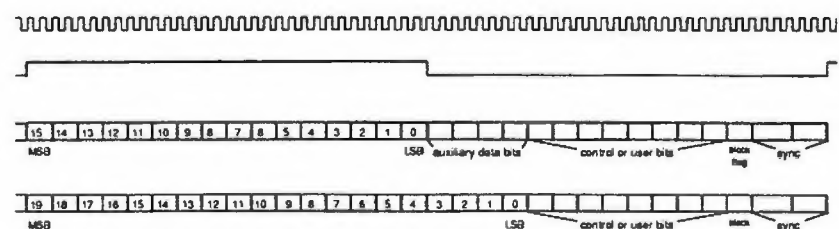
*Connector pin
assignments*

Signal format

master clock
word clock

data A or B (16-bit)

data A or B (20-bit)

SDIF subcode

When using the SDIF format to transfer out from the Direct-to-Disk, Emphasis bits and Dubbing Prohibition bits are set to zero to indicate that emphasis is not used and that dubbing is possible.

When transferring in to the Direct-to-Disk, the Emphasis and Dubbing Prohibition bits are ignored.
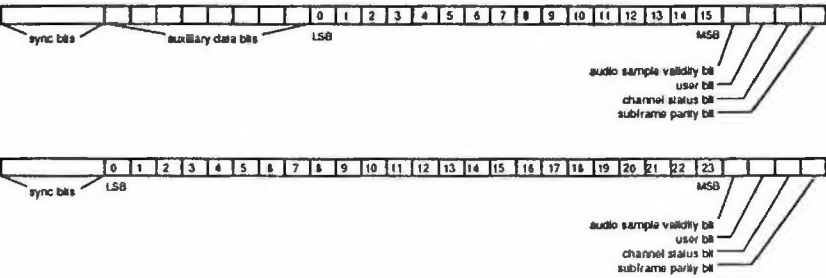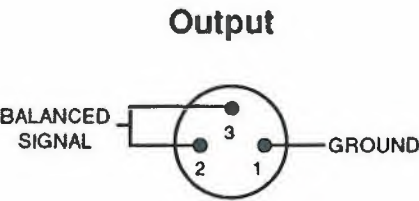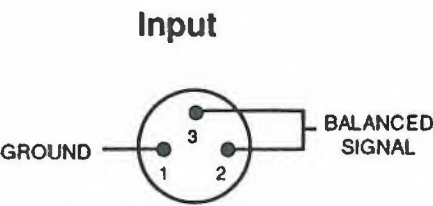
UDIO hardware specifications (con't)

AES/EBU format

Input clocking	slave to source, ±150 ppm

Output clocking
internal crystal oscillator	±25 ppm
composite sync	±150 ppm
SDIF word sync	±150 ppm
AES/EBU input signal	±150 ppm
ProDigi two-track/multitrack word clock	±150 ppm

Input connector type	3-pin XLR female
Output connector type	3-pin XLR male
Connector pin assignments	See opposite page
Number of tracks	2
Sampling rates	32, 44.1, 48, 88.2 or 96 kHz
Sample size	16–24 bit
Cable	twisted pair (100 Ω)
Maximum cable length	50 feet
Level	RS422 (100 Ω)
Signal format	AES/EBU

Input

GROUND

3

1   2

BALANCED
SIGNAL

Output

BALANCED
SIGNAL

3

2   1

GROUND

16-bit

sync bits   auxiliary data bits   LSB   0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15   MSB

audio sample validity bit
user bit
channel status bit
subframe parity bit

24-bit

sync bits   LSB   0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23   MSB

audio sample validity bit
user bit
channel status bit
subframe parity bit

Digital transfer 3.25

AES/EBU subcode

When using the AES/EBU format to transfer out from the Direct-to-Disk, User Data bits are set to zero. Validity bits are set to zero to indicate that the Audio Data bits are valid. The settings for Channel Status Data bits are shown in the chart on the opposite page. Status byte 23 is the CRCC byte.

When transferring in to the Direct-to-Disk, only Audio Data bits are used. All Channel Status Data, User Data and Validity bits are ignored by the Direct-to-Disk.

| Status Bit Number	Status Byte 0		Status Byte 1		Status Bytes 2 – 22
	Bit Value	indicates	Bit Value	indicates	
7	Z*	sampling frequency	0	reserved but undefined	0
6	Y*		0		0
5	X*	0: sampling rate locked 1: sampling rate unlocked	0		0
4	0	no emphasis with manual override enabled	0		0
3	0		0	channel mode not indicated	0
2	0		0		0
1	0	normal audio mode	0		0
0	1	professional use	0		0

*Note: When sampling rate is 48 kHz, Z=1 Y=0 X=0
       When sampling rate is 44.1 kHz, Z=0 Y=1 X=0
       When sampling rate is 32 kHz, Z=1 Y=1 X=0
   For any other sampling rate, Z=0 Y=0 X=1

S/PDIF format

Input clocking	slave to source ±150 ppm

Output clocking
internal crystal oscillator	±25 ppm
composite sync	±150 ppm
SDIF word sync	±150 ppm
AES/EBU input signal	±150 ppm
ProDigi two-track/multitrack word clock	±150 ppm

Input connector type	RCA phone plug adapted to 3-pin XLR female
Output connector type	RCA phone plug adapted to 3-pin XLR male
Connector pin assignments	See opposite page
Number of tracks	2
Sampling rates	32, 44.1, 48, 88.2 or 96 kHz
Sample size	16–24 bit
Cable	COAX (75 Ω)
Maximum cable length	20 feet
Level	RS422 compatible with single-ended 100 mV
Signal format	S/PDIF

Input

COAX (75 Ω)
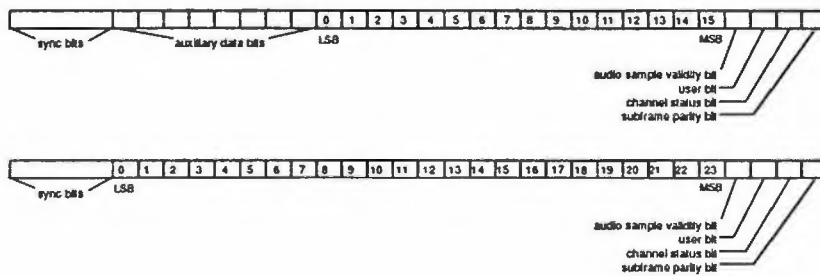
RCA   XLR

3
1   2

Output

COAX (75 Ω)

3
2   1

XLR   RCA
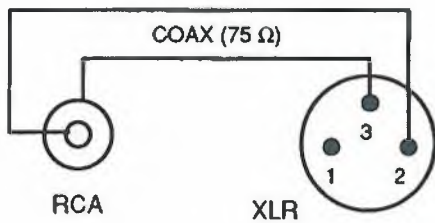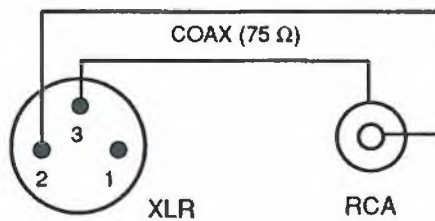
Connector pin assignments

The S/PDIF format requires that you make an adapter as shown in the diagram. Be sure that XLR pin 1 is not connected to anything.

Signal format

16-bit

| sync bits | | auxiliary data bits | LSB | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 MSB | | | | |

audio sample validity bit
user bit
channel status bit
subframe parity bit

24-bit

| sync bits | LSB | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 MSB | | | | |

audio sample validity bit
user bit
channel status bit
subframe parity bit

UDIO hardware specifications (con't)

S/PDIF subcode

When using the S/PDIF format to transfer out from the Direct-to-Disk, User Data bits are set to zero. Validity bits are set to zero to indicate that the Audio Data bits are valid. The settings for Channel Status Data bits are shown in the chart on the opposite page.

When transferring in to the Direct-to-Disk, only Audio Data bits are used. All Channel Status Data, User Data and Validity bits are ignored by the Direct-to-Disk.

Status Bit Number	Status Byte 0		Status Byte 1		Status Bytes 2 – 23
	Bit Value	indicates	Bit Value	indicates	
7	0	sampling frequency not indicated	0	reserved but undefined	0
6	0		0		0
5	0	sampling rate locked	0		0
4	0	no emphasis	0	channel mode not indicated	0
3	0		0		0
2	1	copy ok	0		0
1	0	normal audio mode	0	general category	0
0	0	consumer use	0		0

UDIO hardware specifications (con't)

Composite sync source

Frame rate	30, 29.97, 25 Hz
NTSC standard levels	1—4v peak-to-peak positive polarity
Input frequency	Must be accurate to within ± 100 PPM
Input termination	Unterminated; user must provide 75 Ω termination