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RADAR 24
TDIFLINK

Memo Date: November 14, 2000

TDIFLINK CARD

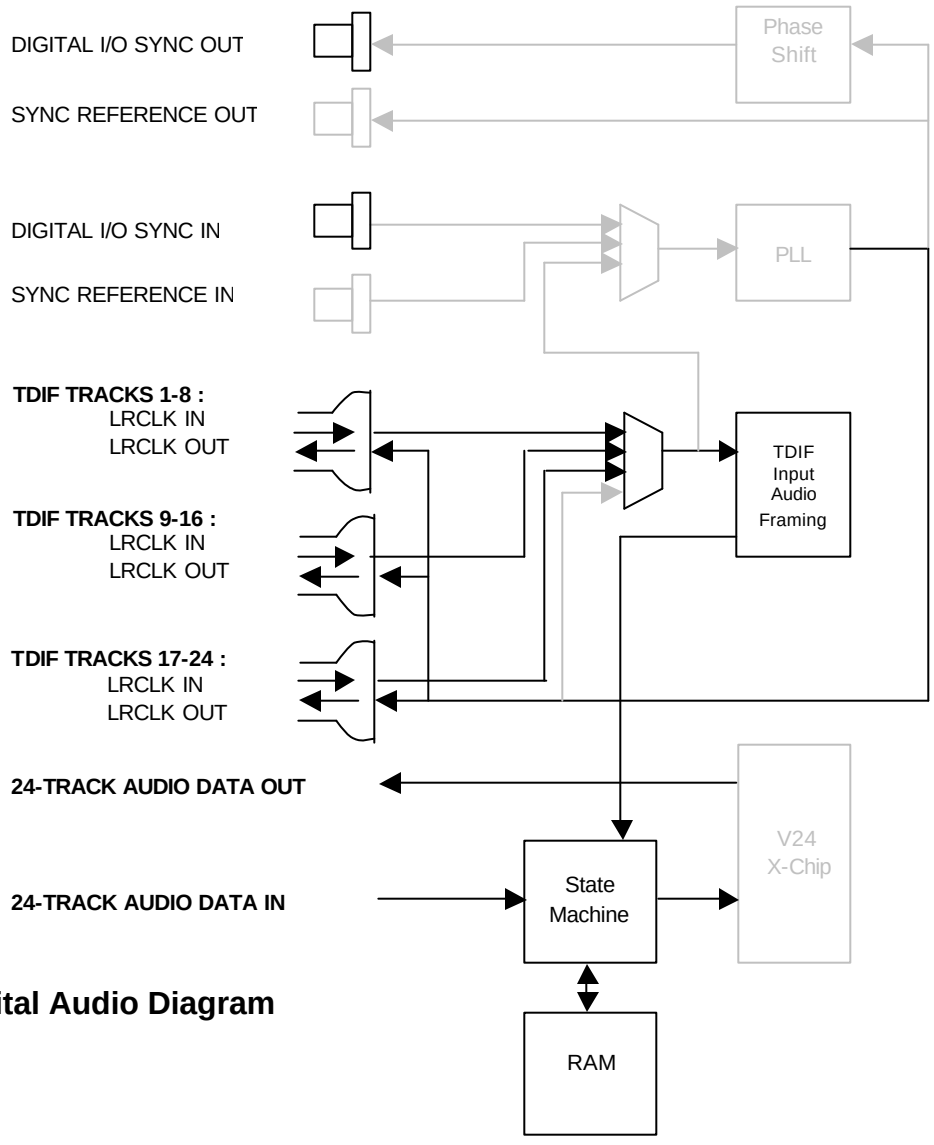
Description

TDIFLINK is an interface card for RADAR 24 that provides 24 tracks of 24-bit digital audio input and output. The digital audio is divided into three DB25 connectors of 8 tracks each, and conforms to the TDIF connector standard found on Tascam DA88 digital recorders.

Block Diagram

Functional blocks located on the TDIFLINK card are darkened in the diagram.

Clock Diagram



Digital Audio Diagram

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USING THE TDIFLINK DIGITAL INTERFACE CARD

TDIF Output – No Problem

With RADAR 24 as a master, transferring digital audio from RADAR 24 to an external box is quite straight forward. RADAR 24 is always outputting TDIF digital audio, the TDIF LRCLKs (one for each 8-track cable), and both the Sync Ref and TDIF Word Sync outputs.

Just plug in the required cables and perform the transfer.

Note that more complex configurations for TDIF digital outputs are possible when RADAR 24 syncs to an external box. This will be reviewed in the TDIF Input section.

TDIF Input – Confusion

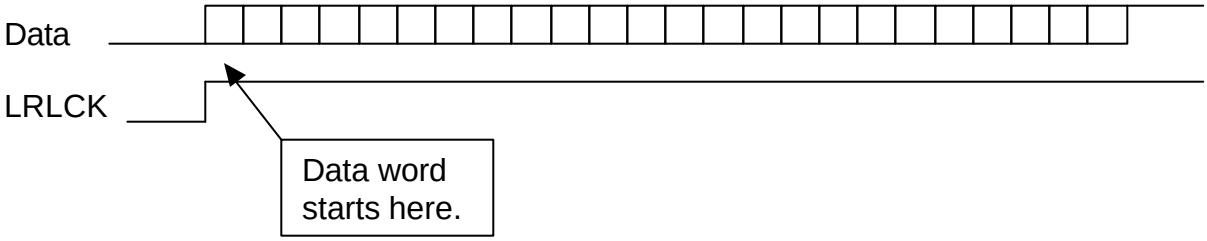
THE MYTH: "Sync up the TDIF machines, and away we go…"
THE FACT: When it comes to TDIF digital transfers to the RADAR 24, the user must be concerned with syncing and framing. Although related, they are separate issues.

Syncing

Who is the clock master? It will either be the RADAR 24 or an external box.

Framing

How does the input TDIF circuit frame the input audio data? Input TDIF digital audio data consists of samples. Each sample is 24-bits in length, as shown below:



The TDIFLINK card has an Audio Framer clock circuit. This circuit always needs the user to tell it what LRCLK must be examined to determine the audio sample starting location in the input TDIF data stream.

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Configuring RADAR 24 for a TDIF Transfer

Step 1 – Sync up the RADAR 24.

1. Press SYNC.
2. Select SYNC SOURCE: TDIF.
3. Select CLOCK REF: INTERNAL, TDIF L/R IN, TDIF WORD SYNC, WORDCLK: 48KHZ, OR VIDEO: NTSC.

Step 2 – Provide the Framing Details.

4. Select 1-24 IN FRAMING REF: L/R IN 1-8, L/R IN 9-16, L/R IN 17-24, or L/R OUT (O2R).
5. Select TC REF: INT or EXT (chase to TC).

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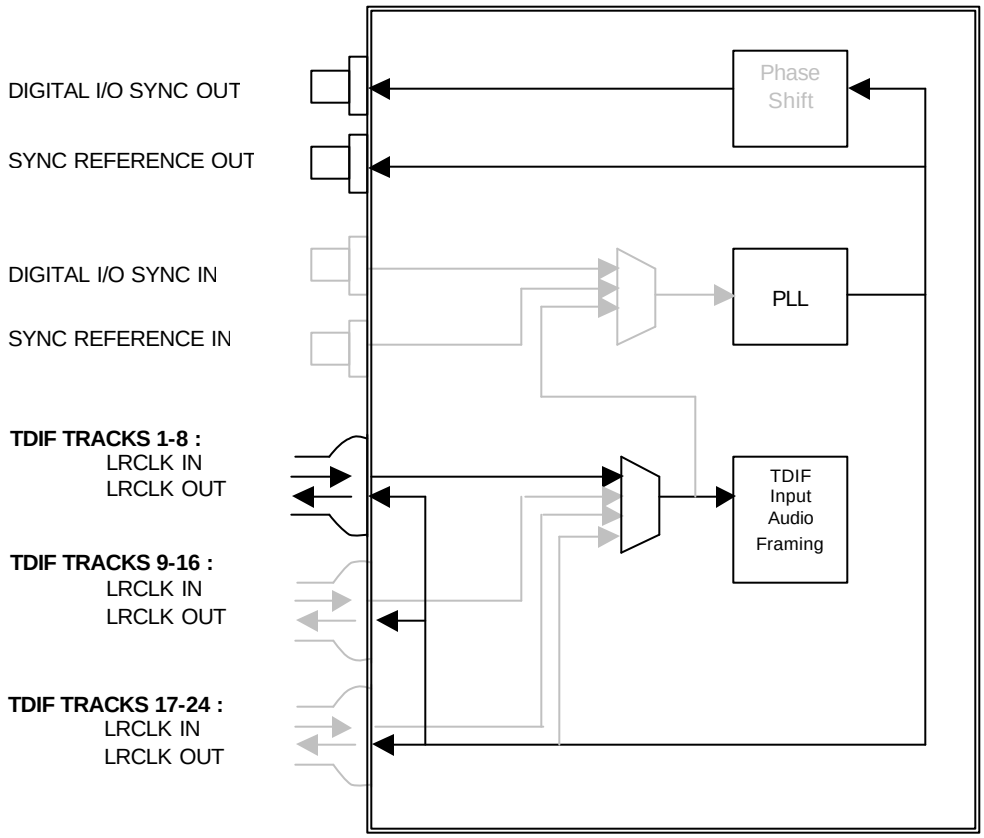
Example 1



Who is the clock master?

RADAR 24. It generates a clock from its internal sync reference, or may be locked to externally generated SMPTE, MIDI, etc.

How does the input TDIF circuit frame the input audio data?

The input LRCLK on TDIF tracks 1-8 are examined by the Audio Framer to determine the start of each audio word and the point at which each audio data bit must be sampled. Ensure that the Audio Framer is fed an LRCLK! – If there is no LRLCK on the selected Audio Framer clock source, you will likely hear clicks and pops.

When do I use this configuration?

This is a typical configuration when a simple TDIF digital audio transfer is required between the RADAR 24 and a single external box, such as a DA-88.

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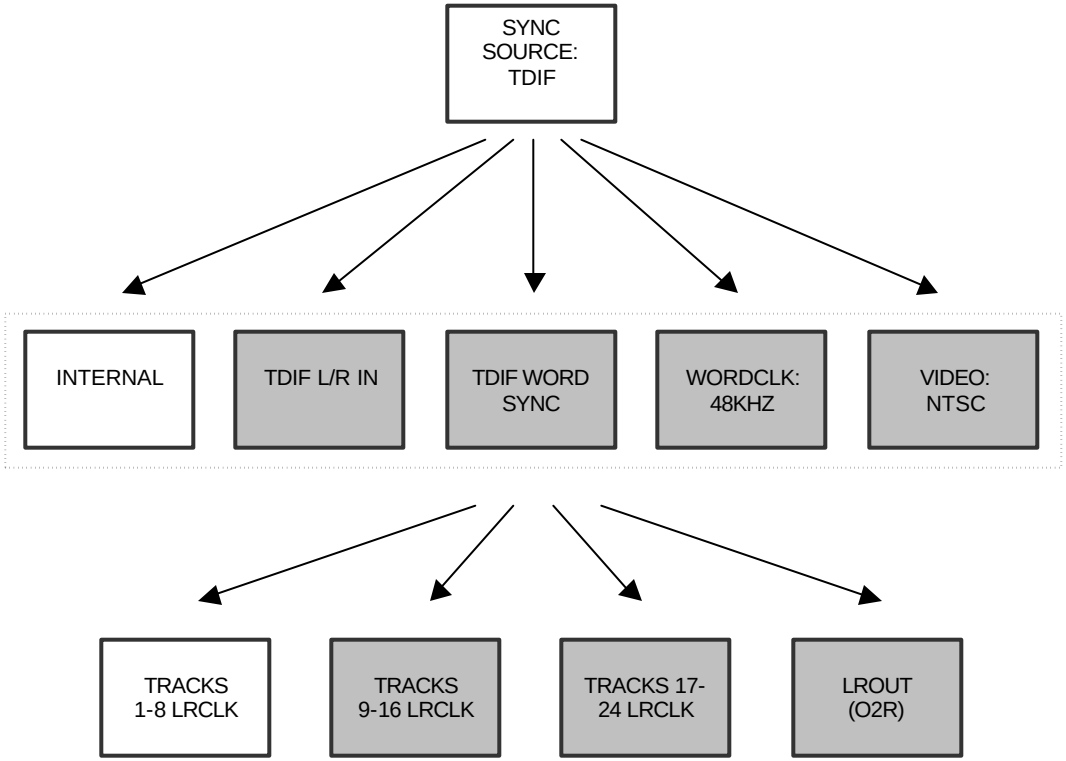
Example 1



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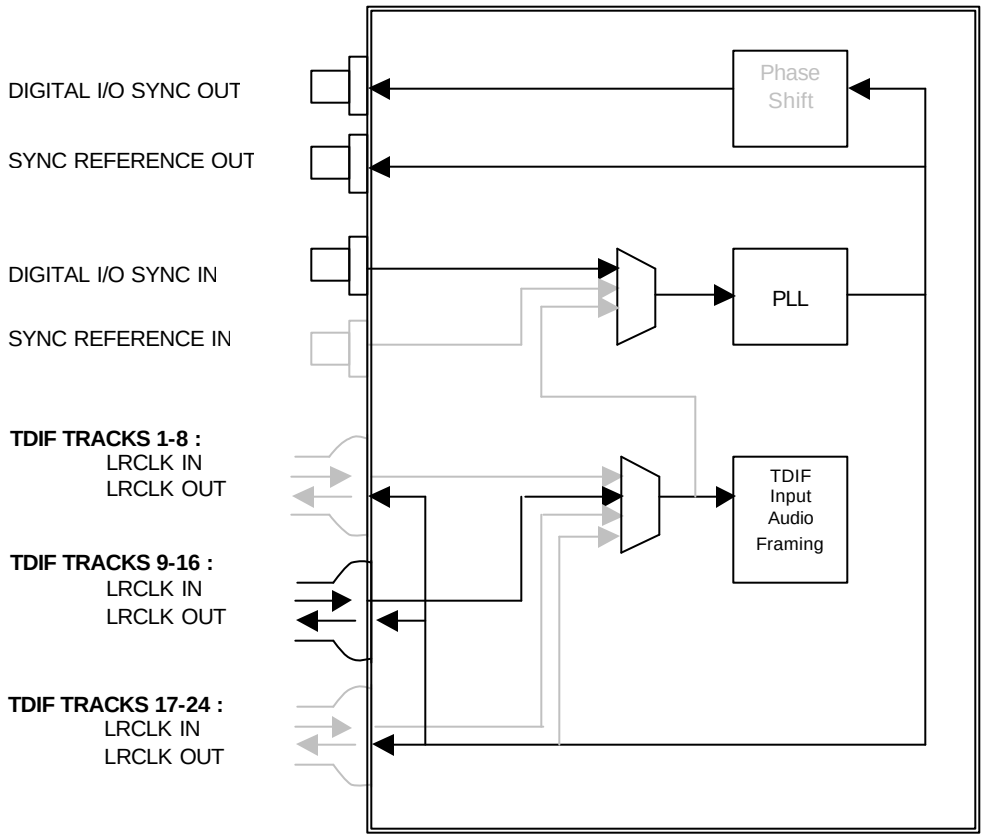
Example 2



Who is the clock master?

An external box, such as a DA-88. The RADAR 24 generates a clock from the external digital I/O sync input.

How does the input TDIF circuit frame the input audio data?

The input LRCLK on TDIF tracks 9-16 are examined by the Audio Framer to determine the start of each audio word and the point at which each audio data bit must be sampled. Ensure that the Audio Framer is fed an LRCLK! – If there is no LRLCK on the selected Audio Framer clock source, you will likely hear clicks and pops.

When do I use this configuration?

This is an alternate configuration to Example 1. Different environments (external equipment, temperature, humidity, electrical noise, reference jitter) result in more reliable performance with Example 1. Others are more reliable with Example 2.

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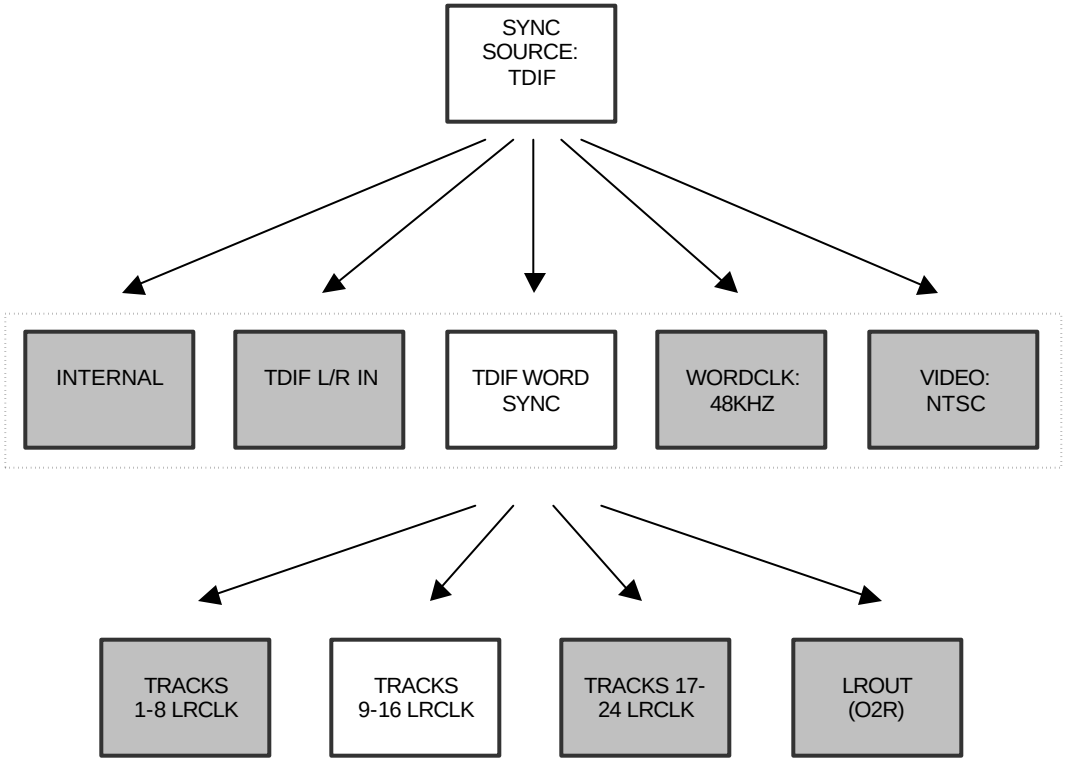
Example 2



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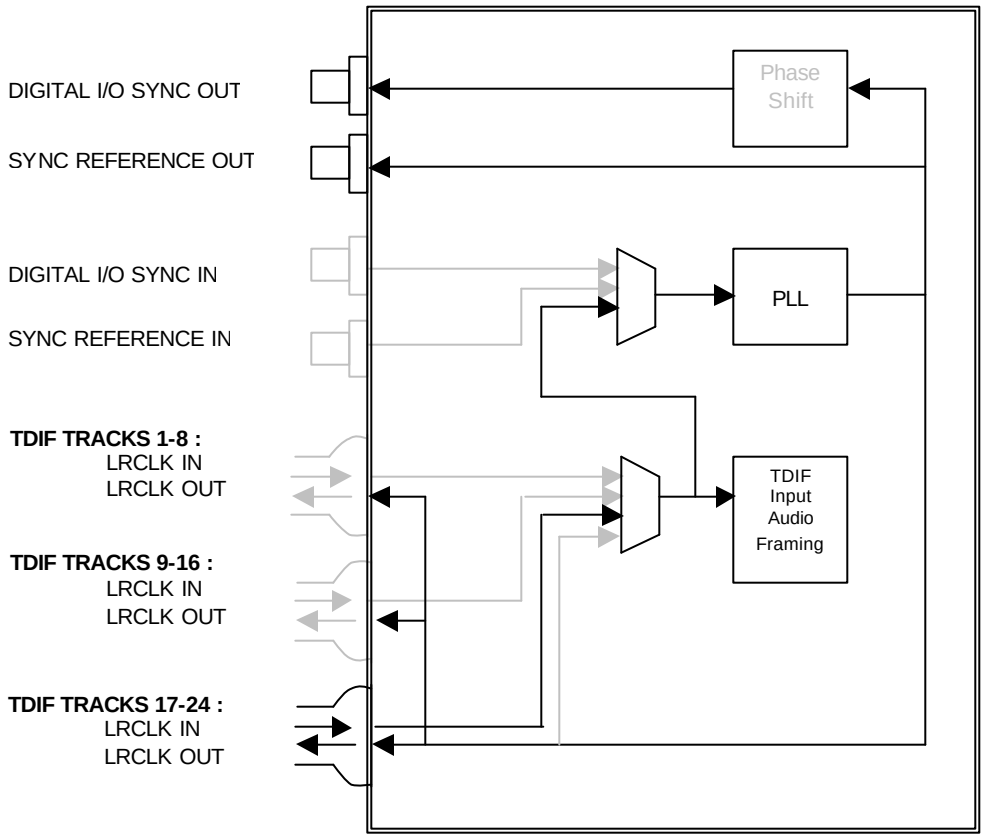
Example 3



Who is the clock master?

The external TDIF device, such as a DA-88 or DA-38. The PLL syncs directly to the LRCLK in one of the DB25 TDIF connectors – in this case tracks 17-24.

How does the input TDIF circuit frame the input audio data?

Syncing and framing use the same clock – the LRLCK on tracks 17-24.

When do I use this configuration?

This configuration eliminates the need for a BNC word clock cable when syncing a RADAR 24 to a DA-88, or any other external TDIF box. Because the DA-38 has no word clock output, it can not use Example 2 when used as a master. It must use this configuration.In our tests, this configuration often changes the susceptibility of the system to noise – sometimes for the better and sometimes for the worse.

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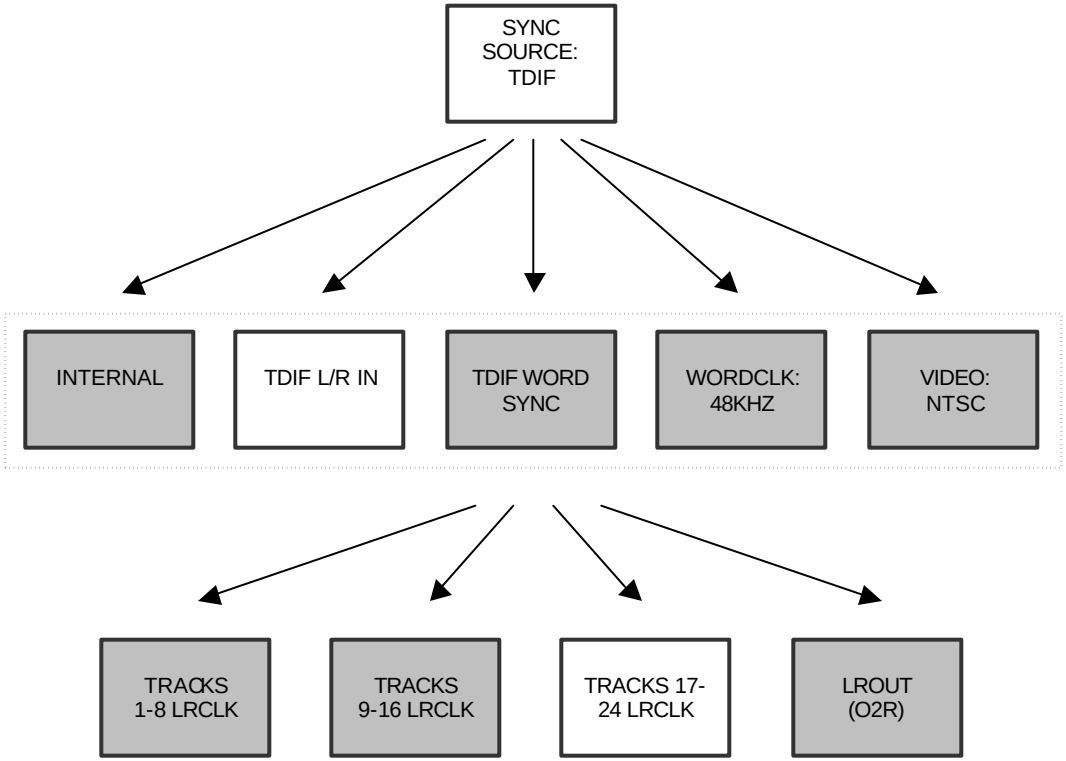
Example 3



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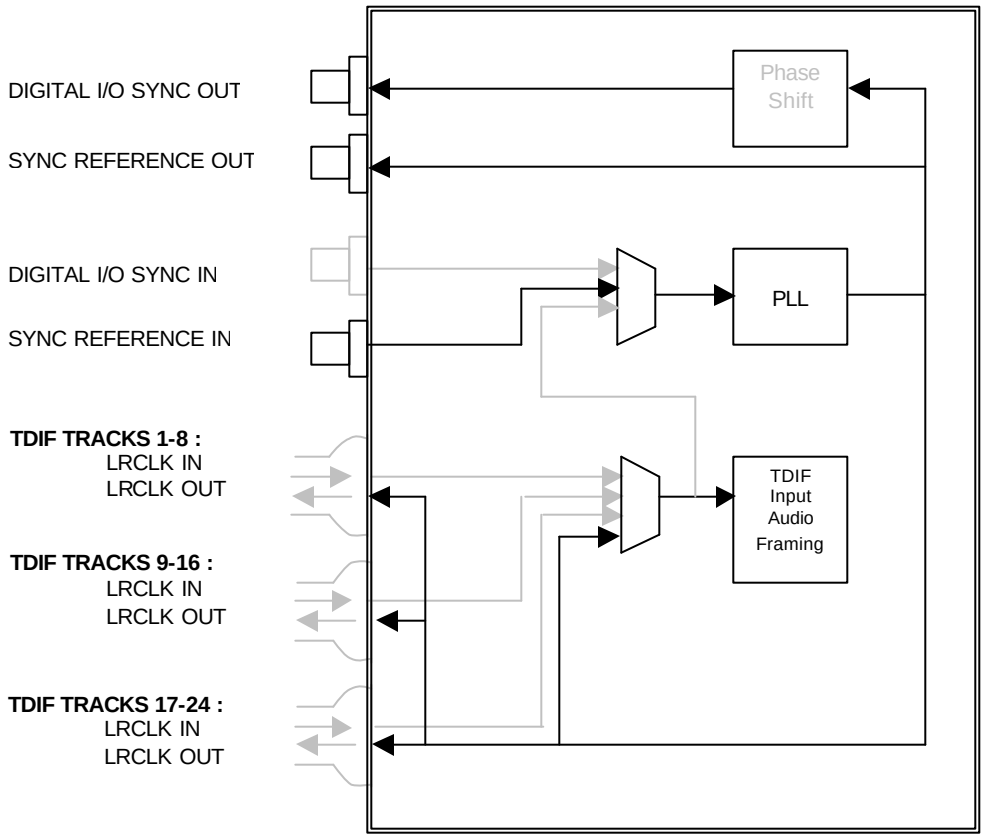
Example 4



Who is the clock master?

An external device, such as an O2R. A clean house clock, to which all boxes slave, may be used in this configuration.

How does the input TDIF circuit frame the input audio data?

This may look strange… The Audio Framer ignores the input LRLCK on the various groups of tracks and, instead, frames the input data according to the phase of the output TDIF LRCLK. Why does it do this? Certain boxes, such as the O2R, frame their output TDIF data according to the phase of their input TDIF LRCLK! So the RADAR 24's TDIFLINK card must be configured to do the same thing in order to avoid clicks and pops.

When do I use this configuration?

Older versions of O2R TDIF interface cards require this configuration. It appears that there is a newer version that does not.

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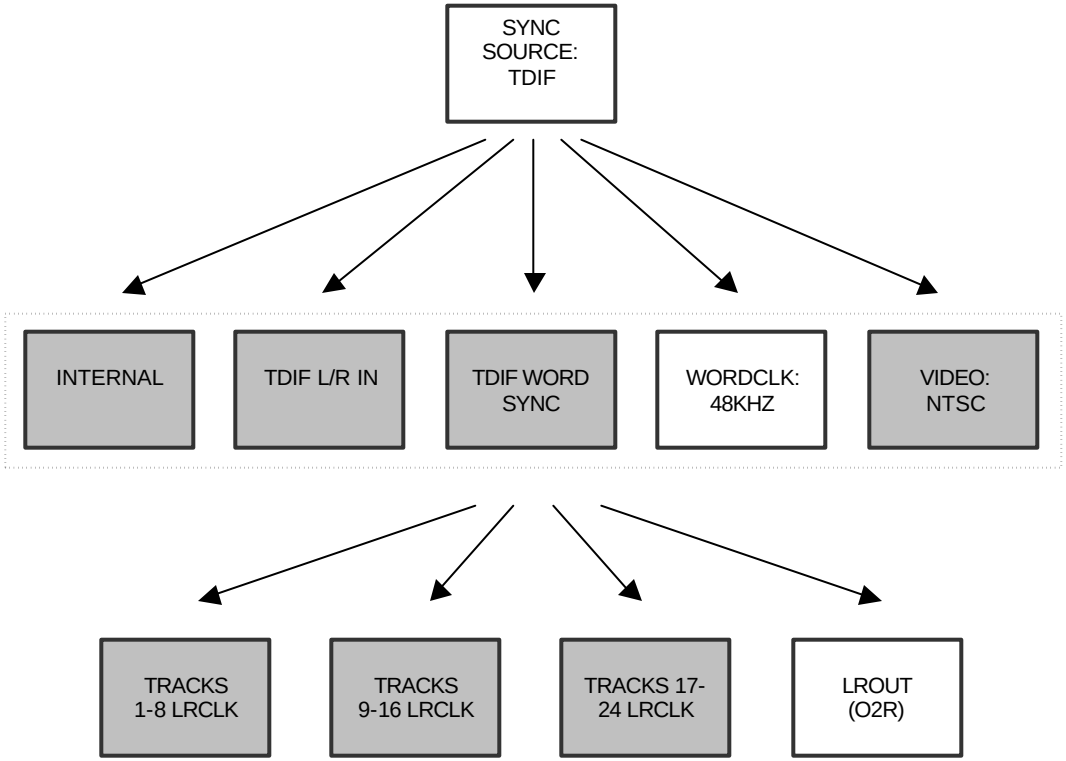
Example 4



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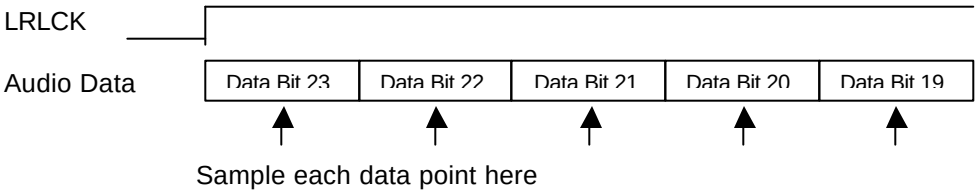
TDIFLINK Diagnostics Menu

Several parameters of the TDIFLINK digital audio interface can be by the TDIFLINK user. They are found in the "Diagnostics Menu" under "TDIF Menu".

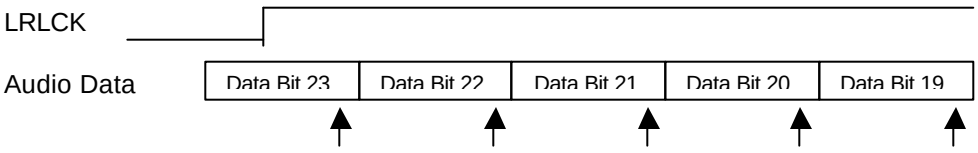
In Sample Point

When receiving TDIF digital audio, the TDIFLINK card's Audio Framer examines the user selected LRCLK to determine the start of each audio word. The Audio Framer defaults to sampling each audio bit in its exact center, as shown below. It uses the start of the LRCLK to determine this sampling position.



Sample each data point here

Sometimes, this can lead to problems. In some external TDIF boxes, the LRCLK is not output properly aligned to the output audio data. Also, cable length and driver/receiver delays can change this relationship. So we end up with the situation shown below.



Sample each data point here

The Audio Framer has no way of knowing that the LRCLK and audio data are not properly aligned. It ends up sampling each audio bit near the end of the bit, rather than in the middle. If there is any jitter on the clock, this could result in sampling a bit at a bit boundary! The result?… *The invalid audio sampling will result in clicks and pops in the audio.*

If the user experiences clicks and pops in a noisy clock environment, he may suspect that the TDIF audio data and LRCLK are not properly aligned. He can go into the TDIF diagnostics menu and change the sampling point from its default ½ bit (center of the bit) to ¼ bit or ¾ bit.

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Sample Rate In and Emphasis In

Each TDIFLINK connector contains a pair of input sample rate indicator signals and an emphasis signal. These signals do not necessarily reflect the actual sample rate or emphasis of the input audio data. Some boxes ignore these signals, while others do not. RADAR 24 simple provides the user with this information in the Diagnostics Menu. Note that the indicated sample rate is from the connector selected DIG I/O ROUTING: TDIFLINK menu (either tracks 1-8, 9-16, or 17-24).

The four possible sample rates are 48 KHz, 44.1 KHz, other, or no connect. "No connect" is indicated when the cable is not plugged in.

The two possible emphasis values are simply "on" or "off".

Sample Rate Out and Emphasis Out

Each TDIFLINK connector contains a pair of output sample rate indicator signals and an emphasis signal. The output sample rate is set automatically by RADAR 24 and matches the sample rate of the box. The three possible sample rates are 48 KHz, 44.1 KHz, and other.

The value of the emphasis out is set by the user in the Diagnostics Menu.

Note that all output tracks (1-8, 9-16, and 17-24) always output the same sample rate and emphasis indicator values.

Card Type

In the TDIF Diagnostics Menu, the user is informed of the number of TDIF tracks on the installed TDIFLINK card. Currently, there is only a 24-track version of the card.