Sierra Automated Systems & Engineering Corporation (SAS)

RIOlink Protocol Description

The RIOlink is a serial TDM protocol used to transfer 32 discrete channels of digital audio plus ancilliary data over a Cat5 twisted pair cable or duplex fiber.

The RIOlink uses transformer balanced transmitter and receiver with similar impedance and voltage levels to 100 Meg Ethernet. It is full duplex, with one pair for transmit and one pair for receive, using Cat5 minimum rated 100 ohm twisted pair. The RIOlink connector is an RJ-45 shielded socket on the chassis.

The RIOlink chassis transmits on pins 7 and 8, and receives on pins 1 and 2.

The 32KD Mainframe interface [KDL-16/RIO I/F] transmits on pins 1 and 2, and receives on pins 7 and 8.

The RIOlink chassis and 32KD Mainframe also provide a location for a pluggable SFP fiber transceiver and the link can optionally be carried over fiber. The RIOlink ,may use one of, not both, Cat5 or fiber. SAS can provide single mode LC connected duplex fiber transceivers.

The RIOlink data is transmitted at a symbol rate per:

[Audio Sample Rate] X [32 bits] X [32 channels] X 5/4 (4B/5B encoding)

Common Audio Sample Rates are 48000 and 44100 samples per second.

When Audio Sample Rate = 48000, Symbol Rate = 61,440,000 symbols per second

When Audio Sample Rate = 44100, Symbol Rate = 56,448,000 symbols per second

The RIOlink may operate as a Slave device, synchronized to a 32KD Mainframe. The 32KD Mainframe, when connected to a RIOlink chassis, shall be clock master at all times. When operating in Slave mode, the RIOlink chassis extracts clock from the 5B coded bit stream, and therefore the stream must be continuous and uninterrupted.

The RIOlink may also operate in Master Mode, either standalone or as a Master to another RIOlink chassis. In this mode the audio sample rate shall be determined by crystal oscillator or an external AES-11 Sync Input to the RIOlink chassis.

RIOlink 4B/5B data coding is shown below.

Words are 32 bits long before coding (40 bits long after 4B/5B coding).
Of 32 bits, first 4 bits are Preamble, next 28 bits are data (before 4B/5B coding).
32 Words are transmitted each Audio Sample Time.
A special SYNC preamble character, X' (5B X' = 10000) is inserted in first Word of 32, each sample time, except for once each 192 sample times, when replaced by Z (5B Z = 11001). Z signifies start of Block. One Block = 192 sample times.

Coding Example (xxxx = 4B preamble; ppppp = 5B preamble):

	LSN (bit 0)						MSN (bit 31)
Binary Channel Data:	xxxx 0100	0011	0000	0001	1111	0010	1101
4b/5b Encode:	ppppp 01010	10101	11110	01001	11101	10100	11011

All allowed 5 bit patterns are shown below:

Encoded Preamble, ppppp above [xxxx = first 4 bits of each 32 bit word]

x	00100
y	10001
z	11001

Modified preamble (inserted each Frame, 192 sample times):

SYNC	x'	10000
	y'	00111
	z'	00110
	DSP	00101

All Data (other than Preambles shown above):

[Using the 5b Data encoding rules defined within AES10-1991, page 7]

Transcribed from AES10:

4b	5b
0000	11110
0001	01001
0010	10100
0011	10101
0100	01010
0101	01011
0110	01110
0111	01111
1000	10010
1001	10011
1010	10110
1011	10111
1100	11010
1101	11011
1110	11100
1111	11101