User Manual

SL9003T1
Digital Studio Transmitter Link

Doc 602-14322-01 Rev. E

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SL9003T1 Manual Dwg # 602-14322-01 Revision Levels:

Date	Rev	Summary of Changes
6/22/05	B	
March 2007	C	Revised manual to correct errors, remove legacy data, and update with new information
July 2007	D	Moved existing section 7. Customer Service to Section 8. Added new Section 7. T1 Relay. Changed references to the "Intelli-Mux" to "I-Mux (6-Port Mux)"
January 2008	E	Updated sections 4.2, 4.4, 5.2.2, 7.2.2 and 8

WARRANTY

All equipment designed and manufactured by Moseley Associates, Inc., is warranted against defects in workmanship and material that develop under normal use within a period of (2) years from the date of original shipment, and is also warranted to meet any specifications represented in writing by Moseley Associates, Inc., so long as the purchaser is not in default under his contract of purchase and subject to the following additional conditions and limitations:

1) The sole responsibility of Moseley Associates, Inc., for any equipment not conforming to this Warranty shall be, at its option:

A) to repair or replace such equipment or otherwise cause it to meet the represented specifications either at the purchaser's installation or upon the return thereof f.o.b. Santa Barbara, California, as directed by Moseley Associates, Inc.; or

B) to accept the return thereof f.o.b. Santa Barbara, California, credit the purchaser's account for the unpaid portion, if any, of the purchase price, and refund to the purchaser, without interest, any portion of the purchase price theretofore paid; or

C) to demonstrate that the equipment has no defect in workmanship or material and that it meets the represented specification, in which event all expenses reasonably incurred by Moseley Associates, Inc., in so demonstrating, including but not limited to costs of travel to and from the purchaser's installation, and subsistence, shall be paid by purchaser to Moseley Associates, Inc.

2) In case of any equipment thought to be defective, the purchaser shall promptly notify Moseley Associates, Inc., in writing, giving full particulars as to the defects. Upon receipt of such notice, Moseley Associates, Inc. will give instructions respecting the shipment of the equipment or such other manner as it elects to service this Warranty as above provided.

3) This Warranty extends only to the original purchaser and is not assignable or transferable, does not extend to any shipment which has been subjected to abuse, misuse, physical damage, alteration, operation under improper conditions or improper installation, use or maintenance, and does not extend to equipment or parts not manufactured by Moseley Associates, Inc., and such equipment and parts are subject to only adjustments as are available from the manufacturer thereof.

4) NO OTHER WARRANTIES, EXPRESS OR IMPLIED, SHALL BE APPLICABLE TO ANY EQUIPMENT SOLD BY MOSELEY ASSOCIATES, INC., AND NO REPRESENTATIVE OR OTHER PERSON IS AUTHORIZED BY MOSELEY ASSOCIATES, INC., TO ASSUME FOR IT ANY LIABILITY OR OBLIGATION WITH RESPECT TO THE CONDITION OR PERFORMANCE OF ANY EQUIPMENT SOLD BY IT, EXCEPT AS PROVIDED IN THIS WARRANTY. THIS WARRANTY PROVIDES FOR THE SOLE RIGHT AND REMEDY OF THE PURCHASER AND MOSELEY ASSOCIATES, INC. SHALL IN NO EVENT HAVE ANY LIABILITY FOR CONSEQUENTIAL DAMAGES OR FOR LOSS, DAMAGE OR EXPENSE DIRECTLY OR INDIRECTLY ARISING FROM THE USE OF EQUIPMENT PURCHASED FROM MOSELEY ASSOCIATES, INC.

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1. Overview

The Moseley SL9003T1 is an all-digital, open-architecture, modular system for CD-quality audio transmission over T1 or E1 circuits. The versatility and power of the SL9003T1 comes from a complete range of "plug and play" personality modules.

AES/EBU digital audio I/O, combined with a built-in variable sample rate converter, provide seamless connection to the all-digital air chain without compression. Analog inputs are standard for those who have not yet upgraded to all-digital air chains. Plug-in MPEG audio modules and a digital multiplexer support additional program, voice, FSK, async and sync data channels.

1.1 Features

In addition to establishing a new industry standard for studio-transmitter link performance, the SL9003T1 incorporates many new features:

- Linear 16 bit digital audio performance
- Degradation-free multiple hops
- No crosstalk between channels
- Built-in AES/EBU digital audio interface
- Operation through fractional T1/E1 networks
- Peak-reading LED bargraph display for audio channels
- Status functions displayed on external LED indicators
- Modular construction that provides excellent shielding, high reliability, easy servicing, and upgrade capability
- Sample Rate Converters (SRC) for digital audio operation from 32 to 48 kHz
- T1 Relay (Requires special order from Moseley. See Section 7 for details.)

1.2 Specifications

1.2.1 System Specifications

Audio Capacity Simplex or Duplex T1	1 linear stereo pair (44.1 kHz sample rate) + 1 data channel or 1 linear stereo pair (32 kHz sample rate) + 1 MPEG encoded stereo pair + data channels
Audio Frequency Response vs. Sample Rate:	
32 kHz:	5 Hz-15 kHz; -3 dB bandwidth, +/- 0.2 dB flatness
44.1 kHz:	5 Hz-20 kHz; -3 dB bandwidth, +/- 0.2 dB flatness
48 kHz:	5 Hz-22.5 kHz; -3 dB bandwidth, +/- 0.2 dB flatness
Audio Distortion	<0.01% <0.01% at 1 kHz (compressed)
Audio Dynamic Range	92 dB Digital (AES/EBU) IN/OUT, 83 dB Analog IN/OUT
Audio Crosstalk	< -80 dB
Audio Data Coding Method	- Linear - ISO/MPEG (Layer II) or Sub-band ADPCM
Audio Coding Time	- Linear: 0 ms

Delay	- ISO/MPEG: 22 ms
Audio Sample Rate	Selectable 32, 44.1, 48 kHz; built-in rate converter
Async Data Channels	One for each audio pair
Aggregate Transmission Rates	Depends on number of audio channels
Temperature Range	Specification Performance: 0 to 50º C, Operational: -20 to 60º C

1.2.2 Audio Encoder Specifications

Sample Rate	32/44.1/48 kHz selectable, built-in rate converter
Audio Inputs	XLR female
Analog Audio Level	-10 dBu to +18 dBu, rear panel accessible, electronically balanced, 600/10k ohm selectable, CMRR > 60 dB
Digital Audio Input	AES/EBU: Transformer balanced, 110 ohm input impedance SPDIF: Unbalanced, 75 ohm input impedance
Data Input	9-pin D male RS-232 levels, Async. 300 to 38400 bps selectable (4800 max for ADPCM)
ISO/MPEG Modes	Mono, dual channel, joint stereo, stereo (ISO/IEC 111172-3 Layer II) **Sample Rate:** 32/44.1/48 kHz selectable **Output Rate:** 32/48/56/64/80/96/112/128/160/192/224/256/320/384 kHz selectable

1.2.3 Audio Decoder Specifications

Sample Rate	32/44.1/48 kHz selectable, built-in rate converter
Audio Outputs	XLR male
Analog Audio Level	-10 dBu to +18 dBu, rear panel accessible electronically balanced, low Z/600 ohm selectable
Digital Audio Output	AES/EBU: Transformer balanced, 110 ohm output impedance SPDIF: Unbalanced, 75 ohm output impedance
Data Output	9-pin D male RS-232 levels, Async 300 to 38400 bps selectable (4800 max for ADPCM)
ISO/MPEG Modes	Mono, dual channel, joint stereo, stereo (ISO/IEC 111172-3 Layer II). **Sample Rate:** 32/44.1/48 kHz selectable. **Input Rate:** 64/128/192/256/384 kHz selectable

1.2.4 Intelligent Multiplexer Specifications

Capacity	2 Serial Ports + 4 Local Ports can multiplex 8 audio cards
Aggregate Rates	Up to 16 Mbps
Resolution	1/2/4/8 kbps
Clocks	Internal, Derived, External
Local Port Interfaces	- Voice - Low Speed Async Data (built-in RS-232) - High Speed Sync Data (built-in V.35, RS-449) - Ethernet (802.1 Q tagged full size Ethernet Frames)
Data Rates	- Voice: 16, 24, 32, 64 kbps - Low Speed: 300-38400 bps - High Speed: up to 2040 kbps - Ethernet: 10/100 Mbps I/O
Trunk	T1, E1 or V35 or RS449

1.3 Regulatory Notices

FCC Part 15 Notice

Note: 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.

Any external data or audio connection to this equipment must use shielded cables.

1.4 Acronyms/Special Terms

The following acronyms and special terms may be used in this document.

10base-T	Standard for carrying 10Mb data over a twisted pair cable
100base-T	Standard for carrying 100Mb data over a twisted pair cable
A/D, ADC	Analog-to-Digital, Analog-to-Digital Converter
ADPCM	Adaptive Differential Pulse Code Modulation
AES/EBU	Audio Engineering Society/European Broadcast Union
AGC	Auto Gain Control
ATM	Asynchronous Transfer Mode. Standard for conveying high-speed information between computers
B8ZS	8-bit zero-suppression. A type of T1 circuit encoding
BER	Bit Error Rate
CAT3	Category 3 cable – Specified to 10Mbps
CAT5	Category 5 cable – Specified to 100Mbps
CMRR	Common Mode Rejection Ratio
Codec	Coder-Decoder
CPFSK	Continuous-Phase Frequency Shift Keying
CSU	Channel Service Unit. Interfaces TELCO to voice data.
D/A, DAC	Digital-to-Analog, Digital-to-Analog Converter
dB	Decibel
dBc	Decibel relative to carrier
dBm	Decibel relative to 1 mW
dBu	Decibel relative to .775 Vrms

DCE	Data Circuit-Terminating Equipment
DS0	Digital Signal Level 0 64Kbps
DS1	Digital Signal Level 1 1536Kbps payload, 1544Kbps with framing
DSP	Digital Signal Processing
DSTL	Digital Studio-Transmitter Link
DSU	Data Service Unit. Interfaces TELCO to data
DTE	Data Terminal Equipment
DVM	Digital Voltmeter
EMI	Electromagnetic Interference
ESD	Electrostatic Discharge/Electrostatic Damage
ESF	Extended Super Frame. A type of T1 circuit framing.
FET	Field Effect Transistor
FMO	Frequency Modulation Oscillator
FPGA	Field Programmable Gate Array
FSK	Frequency Shift Keying
FT1	Fractional T1
IC	Integrated circuit
IEC	International Electrotechnical Commission
IF	Intermediate frequency
IMD	Intermodulation Distortion
ISDN	Integrated-Services Digital Network
Kbps	Kilobits per second
kHz	Kilohertz
LED	Light-emitting diode
LO, LO1	Local oscillator, first local oscillator
LSB	Least significant bit
MAI	Moseley Associates, Inc.
Mbps	Megabits per second
Modem	Modulator-demodulator
ms	Millisecond
MSB	Most significant bit
MUX	Multiplex, Multiplexer
μs	Microsecond
μV	Microvolts
NC	Normally closed
NMS	Network Management System
NO	Normally open
PCB	Printed circuit board
PCM	Pulse Code Modulation
PGM	Program
PLL	Phase-Locked Loop

QAM	Quadrature Amplitude Modulation
RF	Radio Frequency
RPTR	Repeater
RSL	Received Signal Level (in dBm)
RSSI	Received Signal Strength Indicator/Indication
RX	Receiver
SCA	Subsidiary Communications Authorization
SCADA	Security Control and Data Acquisition
SNR	Signal-to-Noise Ratio
SPDIF	Sony/Philips Digital Interface (SPDIF) is a standard audio transfer file format. Allows transfer of audio from one file to another without the conversion to and from an analog format, which could degrade the signal quality. Essentially a minor modification of the original AES/EBU standard for consumer use.
SRD	Step Recovery Diode
STL	Studio-Transmitter Link
TDM	Time Division Multiplexing
THD	Total Harmonic Distortion
TP	Test Point
TTL	Transistor-Transistor Logic
TX	Transmitter
Vrms	Volts root-mean-square
Vp	Volts peak
Vp-p	Volts peak-to-peak
VRMS	Volts, root-mean-square
VSWR	Voltage standing-wave ratio
ZIN	Input Impedance
ZOUT	Output Impedance

1.5 Audio Considerations

Why dBm?: In the early years of broadcasting and professional audio, audio circuits with matched terminations and maximum power transfer were the common case in studios and for audio transmission lines between facilities. Console and line amplifier output impedances, implemented with vacuum tube and transformer technology, were typically 600 Ohms. Equipment input impedances, again usually transformer-matched, were also typically 600 Ohms. Maximum power transfer takes place when the source and load impedances are matched. For such systems, the dBm unit (dB relative to one milliwatt) was appropriate since it is a power unit.

Audio Meters: However, actual power-measuring instruments are extremely rare in audio. Audio meters and distortions analyzers are voltmeters, measuring voltage across their input terminals. They do not know the power level, current value, nor source impedance across which they are measuring. Since the audio industry had "grown up" with 600 Ohm power-transfer systems in common use, audio test instrument manufacturers typically calibrated their voltmeters for this situation. Most audio test instruments and systems manufactured before approximately 1985 used only Volts and the dBm unit on their meter scales and switch labels. The dBm unit was calibrated with the assumption that the meter would

always be connected across a 600 Ohm circuit when measuring dBm. Since the voltage across a 600 Ohm resistor is 0.7746 Volts when one milliwatt is being dissipated in that resistor, the meters were actually calibrated for a zero "dBm" indication with 0.7746 Volts applied. But, they were not measuring power; change the circuit impedance, and the meter is incorrect.

Voltage-Based Systems: Modern audio equipment normally has output impedances much lower than input impedances. Output impedance values from zero up to 50 Ohms are typical, and input impedances of 10 kilohms are typical. Such equipment, connected together, transfers negligible power due to the large impedance mismatch. However, nearly all the source voltage is transferred. As noted earlier, a 10 kilohm load reduces the open-circuit voltage from a 50 Ohm source by only 0.5% or 0.05 dB. Thus, modern systems typically operate on a voltage transfer basis and the dBm, as a power unit, is not appropriate. A proper unit for voltage-based systems is the dBu (dB relative to 0.7746 Volts). The dBu is a voltage unit and requires no assumptions about current, power, or impedance. Those older audio meters calibrated in "dBm" are really dBu meters.

Old Habits Die Hard: Unfortunately, the "dBm" terminology has hung on long after its use is generally appropriate. Even some of the most competent manufactures of high-technology digital and analog professional audio equipment still use the dBm unit in their setup instructions. Users are told to apply an input signal of "+4 dBm" and then to adjust trim pots for an exact 0 VU indication on a 24-track digital audio tape recorder, for example. Yet, the line input impedances of that tape recorder are 10 kilohms. What the manufacturer clearly wants is a +4 dBu input level (1.22 Volts). If we truly applied +4 dBm to that 10,000 Ohm input, the resulting 5.0 Volts would probably not even be within the trim pot adjustment range for 0 VU. So, a good general rule when working with modern audio equipment unless you know it to be terminated in 600 Ohms is to read the manufacturer's "dBm" as "dBu".

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1.6 About This Manual

Section 1. System Features and Specifications: Provides a short discussion of the SL9003T1 features and specifications.

Section 2. Quick Start: For the experienced user who wants to get the system up and running as soon as possible.

Section 3. Installation: Primary power requirements (AC/DC) and Site installation details. (environmental, rack mount, etc.)

Section 4. Front Panel Operation: Reference section for front panel controls, LED indicators, LCD display and software functions.

Section 5. Module Configuration: Listings of jumpers, settings and options useful for diagnosis and custom systems.

Section 6. System Description: Describes each of the components in the system.

Section 7. T1 Relay: Describes the procedures for upgrading you SL9003T1 to support T1 Relay.

Section 8. Customer Service: Information to obtain customer assistance from the factory.

2. Quick Start

2.1 Unpacking

Your shipping container should include the following items for each terminal:

Description	Quantity
SL9003T1 Chassis	1
Rack Ears (w/hardware)	2
Power Cord (IEC 3 conductor)	1
Manual / Soft Copy	1
Test Data Sheet (customer documentation). An example Test Data Sheet is shown at the end of this section.	1

Retain the original boxes and packing material in case of return shipping. Inspect all items for damage and/or loose parts. Contact the shipping company immediately if anything appears damaged. If any of the listed parts are missing, call the distributor or Moseley immediately to resolve the problem.

2.2 Notices

WARNING! HIGH VOLTAGE IS PRESENT INSIDE THE POWER SUPPLY MODULE WHEN THE UNIT IS PLUGGED INTO AC MAINS. REMOVAL OF THE POWER SUPPLY COVER WILL EXPOSE THIS POTENTIAL TO SERVICE PERSONNEL.

TO PREVENT ELECTRICAL SHOCK, UNPLUG THE POWER CABLE BEFORE SERVICING.

ONLY QUALIFIED PERSONNEL SHOULD SERVICE THE POWER SUPPLY.

2.3 Pre-Installation Notes

- Always pre-test the system on the bench in its intended configuration prior to installation at a remote site.
- Avoid cable interconnection length in excess of 1 meter in strong RF environments.
- Do not allow the audio level to light the red "clip" LED on the front panel bar graph, as this causes severe distortion (digital audio overload).
- We **highly** recommend installation of lightning protectors to prevent line surges from damaging expensive components.

2.4 Rack Mounting

The SL9003T1 is normally rack-mounted in a standard 19-inch cabinet. Leave space clear above (or below) the unit for proper air ventilation of the card cage. The rack ears are typically mounted as shown in the following illustration.

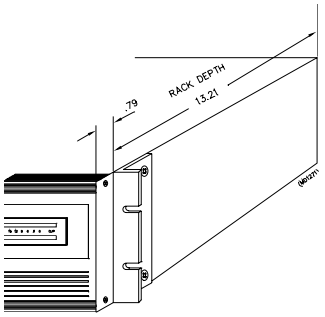


Figure 2-1. SL9003T1 Typical Rack Mount Bracket Installation

2.5 Quick Start Guide

A T1 system usually consists of two chassis. Each SL9003T1 Chassis can contain these modules and plug-in cards:

- Audio Encoder Module that may include an MPEG Encoder plug-in Card
- Audio Decoder Module that may include an MPEG Decoder plug-in Card
- Intelligent Multiplexer (I-Mux (6-Port Mux)) which may include the following plug-in cards:
    - T1 Card
    - Ethernet Card
    - 4-W E&M (Order-wire) Card
    - FXS Card
    - FXO Card
    - Dual AES/EBU Card & I/O Panel
    - Sync (V.35 or RS-449/EIA-530) Card
    - Universal Serial Interface (Sync/Async) Card

  NOTE: Refer to the I-Mux User Manual for a detailed description of the I-Mux (6-Port Mux) Module.
- Unless otherwise specified, your system is pre-configured for B82Z with ESF - no network clock.

2.5.1 Connection Diagram

Warning! **Be sure to use the appropriate cable for each interface. Failure to observe this precaution can cause module damage.**

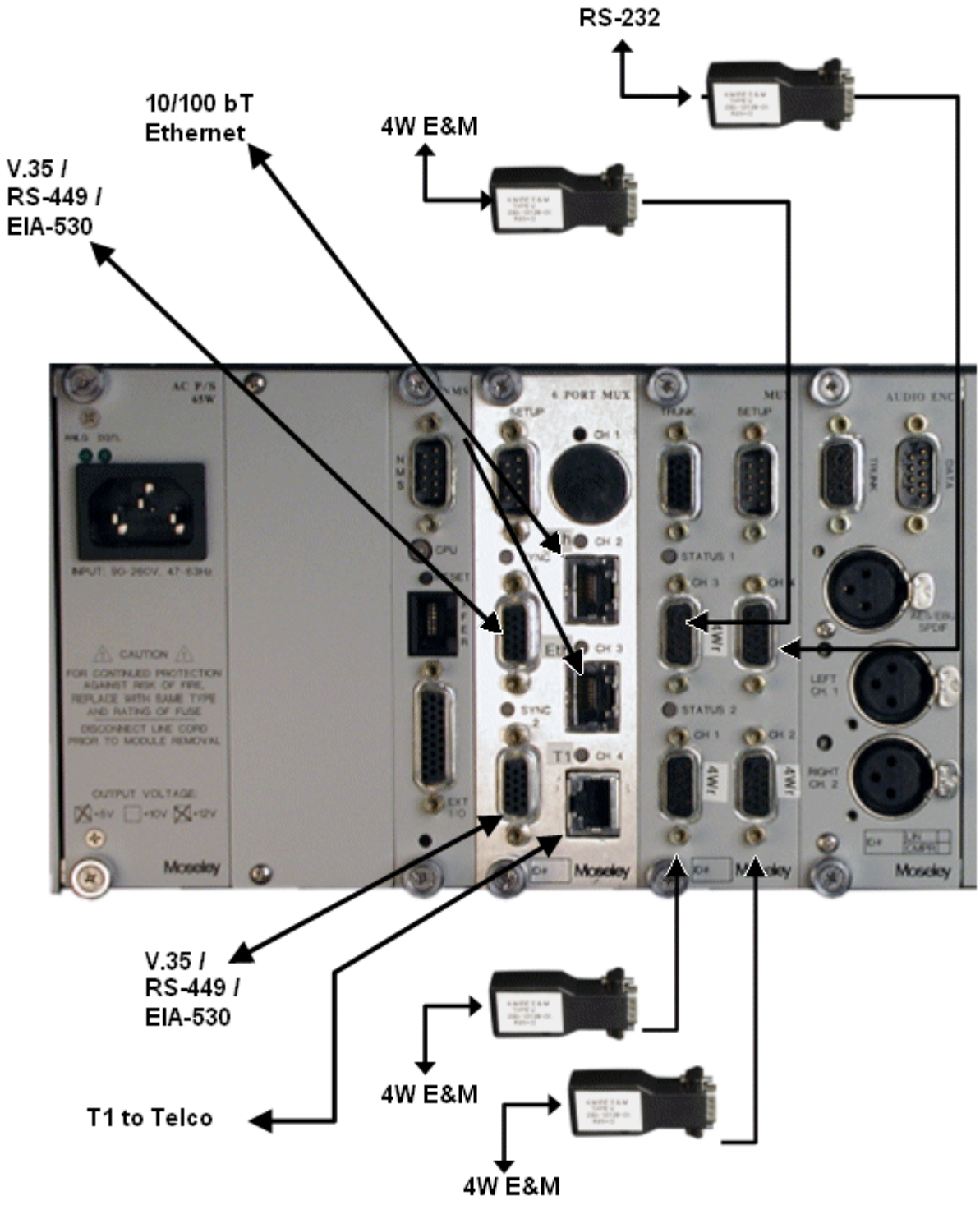


Figure 2-2. Rear Panel Connections

Use a straight-through T1 cable to connect from the T1 adaptor jack to the TELCO jack. Moseley recommends a B8ZS, ESF, no clock configuration for the TELCO T1 circuit. Use a straight-through CAT3 or CAT5 cable if the connected device is a LAN hub or switch. Otherwise, it should be a crossover CAT3 or CAT5 cable.

2.5.2 Connectors

Moseley products use T1, Ethernet, and 4-Wire E&M Connectors. It is important to understand the similarities and differences in order to understand how to connect the correct cables and equipment. All of these interfaces convey bi-directional, analog-encoded data over copper wires. More importantly, they all use the same connector, the modular RJ45 (or RJ48). The RJ45/48 plug looks like a modular RJ11 phone plug on the end of your phone cord:

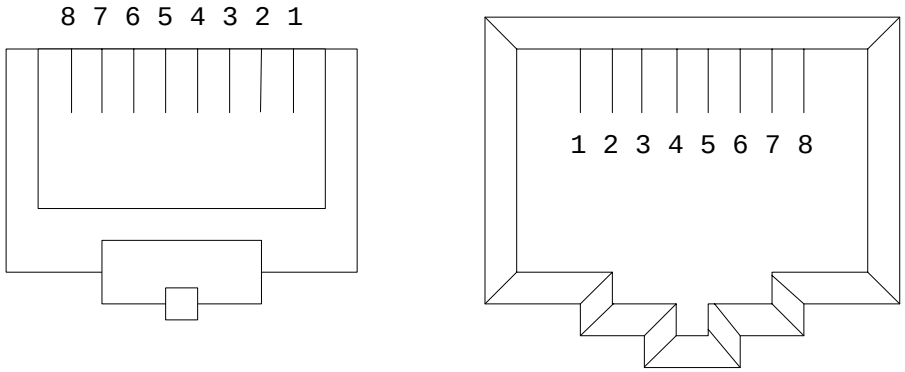


Figure 2-3. RJ45/RJ48 Connector Pins

Please note that wire colors vary depending on which standard is being used. The important thing is to pay attention to the pairs of pins (these are all differential signals) that are wired together.

2.5.3 T1 Connector

A T1 (or DS1) circuit is used to convey up to 1536 Kbps of digital information, typically measured in 64 Kbps chunks, often called DS0s. There are up to 24 DS0s in a DS1 or T1 circuit. When you include framing, the aggregate rate is 1544 Kbps.

T1 Pin Connections: This table shows the standard pin out of a T1 TELCO User connector.

RJ45 Pin	Function	*DB15 Pin	Bantam
1	RX Ring (-)	11	Ring
2	RX Tip (+)	3	Tip
3	not used	-	
4	TX Ring (-)	9	Ring
5	TX Tip (+)	1	Tip
6	not used	-	
7	not used	-	
8	not used	-	

* The DB15 or Bantam connectors are found on some equipment instead of the RJ45.

A TELCO jack usually has the functions reversed (i.e., RX & TX are swapped) so that a straight-through cable can be used to connect the CSU/DSU/TSU jack to the TELCO jack. To determine which connection you have, use a wide-band oscilloscope or DVM to measure across the TX and RX pairs. The TX pairs should have activity and the RX pairs should not.

Note that many T1 jacks provided by the telephone company are terminated with a "smart jack". This jack has an automatic loopback feature built-in, so that if no connector is inserted, the TX pair is connected to the RX pair. The telephone company uses this feature to test the line from the CO before turning it over to you. A common mistake during installation is to reverse the TX & RX pairs, so it is best to insert a plug/cable into the jack before you do your testing.

T1 Cross-Over Cable: To connect two T1 jacks that have the same pin-out, you will need a T1 cross-over cable with these connections:

Cable End A RJ45 Pin	Cable End B RJ45 Pin
1	4
2	5
4	1
5	2

T1 Loopback Connector: A T1 loop-back connector will have these connections on the same jack or plug:

RJ45 Pins
1-4
2-5

2.5.4 Ethernet Connector

An Ethernet circuit is used to convey up to 10 Mbps or 100 Mbps of digital information, sent as packets of information. The packets are most often TCP or UDP packets. These are the protocols used for conveying information via the internet.

Ethernet Pin Connections: The standard pin-out of an Ethernet User connector is:

RJ45 Pin	Function
1	TX +
2	TX -
3	RX -
4	not used
5	not used
6	RX +
7	not used
8	not used

An Ethernet Hub or Switch usually has the functions reversed (i.e., RX & TX are swapped) so that a straight-through cable can be used to connect the Hub or Switch jack to the PC or other equipment jack. Many new Switches have auto-sensing capabilities, so either a straight or crossover cable is useable. To determine which connection you have, use a wide-band oscilloscope or DVM to measure across the TX and RX pairs. The TX pairs should have activity and the RX pairs should not.

Ethernet Cross-Over Cable: To connect two Ethernet jacks that have the same pin-out, you will need a Ethernet cross-over cable with these connections:

Cable End A RJ45 Pin	Cable End B RJ45 Pin
1	3
2	6
3	1
6	2

Ethernet Loopback Cable: An Ethernet loop-back connector will have these connections on the same jack or plug:

RJ45 Pins
1-3
2-6

2.5.5 4-Wire E&M (Voice Connector)

A 4-Wire E&M or order-wire circuit is used to convey analog voice information and associated signaling.

4-Wire E&M Connections: The standard pin-out of a 4-Wire E&M connector is:

RJ45 Pin	Function
1	M-return
2	M-lead
3	RX Ring (-)
4	TX Ring (-)
5	TX Tip (+)
6	RX Tip (+)
7	E-lead
8	E-return

A PBX may have the functions reversed (i.e., RX & TX are swapped) so that a straight-through cable can be used to connect the PBX jack to the 4-Wire E&M jack. To determine which connection you have, use a wide-band oscilloscope or DVM to measure across the TX and RX pairs. The TX pairs should have activity and the RX pairs should not.

4-Wire E&M Cross-Over Cable: To connect two 4-Wire E&M jacks that have the same pin-out, you will need a 4-Wire E&M cross-over cable, which has these connections:

Cable End A RJ45 Pin	Cable End B RJ45 Pin
3	4
6	5
4	3
5	6

Signaling leads are not indicated here, as they vary according to the signaling standard used.

4-Wire E&M Loopback Connector: A 4-Wire E&M loop-back connector will have these connections all on the same jack or plug:

RJ45 Pin
3-4
6-5

2.5.6 ATM

An ATM circuit is used to convey up to 155 Mbps of digital information, sent as packets of information. The standard pin-out of an ATM User Equipment connector is:

RJ45 Pin	Function
1	TX +
2	TX -
3	not used
4	not used
5	not used
6	not used
7	RX +
8	RX -

An ATM Switch usually has the functions reversed (i.e., RX & TX are swapped) so that a straight-through cable can be used to connect the Hub or Switch jack to the PC or other equipment jack. Many new Switches have auto-sensing capabilities, so either type of cable is useable. To determine which connection you have, use a wide-band oscilloscope or DVM to measure across the TX and RX pairs. The TX pairs should have activity and the RX pairs should not.

ATM Cross-Over Cable: To connect two ATM jacks that have the same pin-out, you will need a T1 cross-over cable with these connections:

Cable End A RJ45 Pin	Cable End B RJ45 Pin
1	7
2	8
7	1
8	2

ATM Loopback Connector: An ATM loop-back connector will have these connections on the same jack or plug:

RJ45 Pin
1-7
2-8

2.6 LEDs

The following paragraphs describe the LEDs that can be found on each module installed in an SL9003T1 system.

2.6.1 Power Supply

There are two LEDs on the power supply module. They are labeled "ANLG" and "DGTL" (See 2.7.1 Power Supply Module for location). These LEDs show the two power supply voltages: analog and digital. They should be illuminated when power is supplied to the unit.

2.6.2 NMS/CPU

The LED on the NMS/CPU board indicates that the CPU board is functioning. It should be illuminated at all times. See 2.7.2 NMS Module for LED location.

2.6.3 I-Mux (6-Port Mux)

Sync 1 and Sync 2 LEDs indicate the Multiplexer and Demultiplexer status on the I-Mux (6-Port Mux).

LED Color	Indication
Dark	Problem with module
Yellow	Module is working, not locked
Green	Module is working and clock and frame are locked

See 2.7.3 I-Mux (6-Port Mux) Module for LED locations.

2.6.4 Fractional/Full T1

The D5 Led on a T1 card indicates the status of the T1 link. On some systems, this LED is replicated on the rear panel of the I-Mux (6-Port Mux). The following table describes the D5 T1 LED for v1.1 and later.

D5 LED Color	Full T1 Meaning	Fractional T1 Meaning	Notes
GREEN	T1 signal present, T1 clock present, data normal	T1 signal present, T1 clock present, data normal	Normal Operation
ORANGE	Incoming frequency out of tolerance (FIFO over/under run)	Incoming frequency out of tolerance (FIFO over/under run)	Check signal source
RED/OFF 1 pulse/sec	N/A	T1 Fractional Error	Check signal source or external link
RED/OFF 2 pulses/sec	N/A	FT1 Fractional Error	Check signal source or external link
RED/GREEN alternating	Bipolar Violation	Bipolar Violation	Check signal source
RED	Loss of Signal	Loss of Signal	Check cabling, this end
OFF	No power or no firmware	No power or no firmware	Check board seating

The following table describes the D5 T1 LED for v1.0.

D5 LED Color	Meaning	Notes
RED	T1 signal present, no T1 clock or data (all 0s)	Check T1 circuit
GREEN	T1 signal present, T1 clock present, no data (all 1s)	Check cabling on far end or A1S error from far end
ORANGE (normal)	T1 signal present, T1 clock present, data present	Normal operation
OFF	No T1 signal or no power	Check cabling on this end

The following table describes the D5 T1 LED for v0.5.

D5 LED Color	Meaning	Notes
RED	T1 signal present, no T1 clock or data (all 0s)	Check T1 circuit
GREEN	T1 signal present, T1 clock present, no data (all 1s)	Check cabling on far end or A1S error from far end
ORANGE (normal)	T1 signal present, T1 clock present, data present	Normal operation
OFF	No T1 signal or no power	Check cabling on this end

2.6.5 Audio Encoder

The LED above and to the left of the AES/EBU connector indicates the status of the Audio Encoder:

LED Condition	Meaning
Fast Flashing	Module problem or clock not locked
Slow Flashing	Clock locked, frame not locked
Steady	Clock and frame locked

See 2.7.4 Audio Encoder Module for the location of this LED.

2.6.6 Audio Decoder

The LEDs above and to the left of the AES/EBU connector indicates the status of the Audio Decoder:

LED Condition	Meaning
Fast Flashing	Module problem or clock not locked
Slow Flashing	Clock locked, frame not locked
Steady	Clock and frame locked

See 2.7.5 Audio Decoder Module for the location of this LED.

2.6.7 Ethernet

There are 3 LEDs associated with each of the two Ethernet connectors.

LED	Meaning
Round GRN (Chan x)	On = 100base-T, Off = 10base-T
Rectangular GRN (On RJ45)	On = Link Active, Off = Link Inactive
Rectangular ORG (On RJ45)	On = Activity Present, Off = No Activity

2.7 System Description

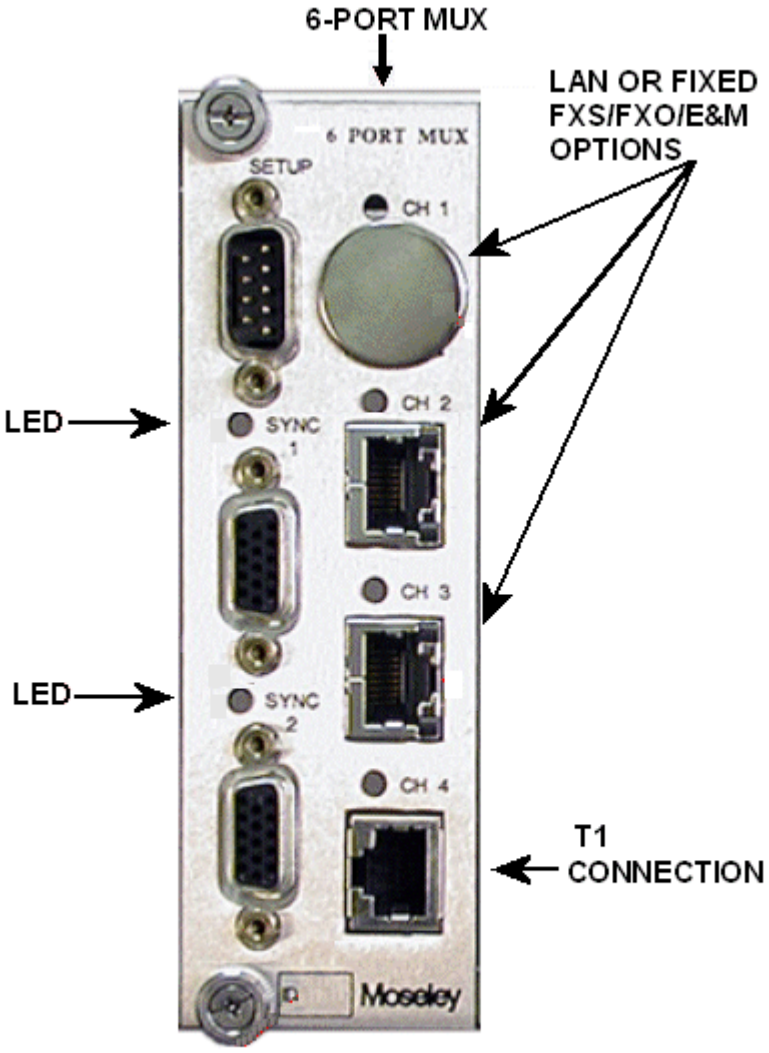
2.7.1 Power Supply Module

- Typical Power Consumption: 60 Watts for two audio boards
- Input Options: AC – Universal Input, 90-260V, 47-63Hz. DC – 24v/48v (Isolated Input)
- See paragraph 2.6.1 for a description of the LEDs

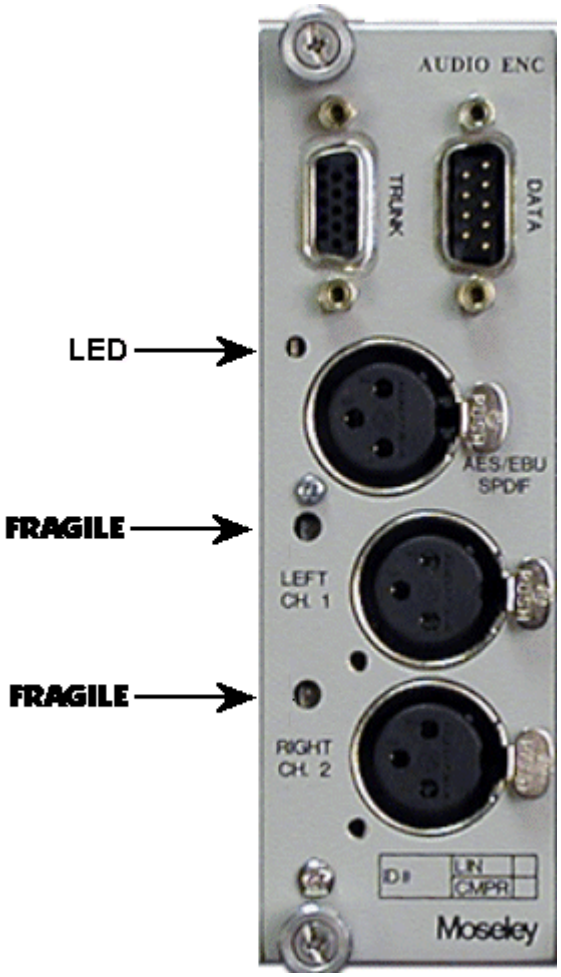
2.7.2 NMS Module

- Provides system CPU control, front panel interface
- ***I/O Port:*** RS232 PC access
- ***Status LED:*** Green LED indicates CPU OK
- ***Reset Switch:*** Activates hard system reset

2.7.3 I-Mux (6-Port Mux) Module



2.7.4 Audio Encoder Module



Audio input cards accept digital or analog audio. A/D conversion is performed for the analog inputs. The stereo digital audio is encoded for linear (or MPEG) operation. The resulting data stream is applied to the MUX inputs. An auxiliary data channel is available in linear mode only.

I/O PORTS

DATA: Data inputs – RS232 levels, 9-pin D male. Asynchronous 300-38400 bps

TRUNK: Not used.

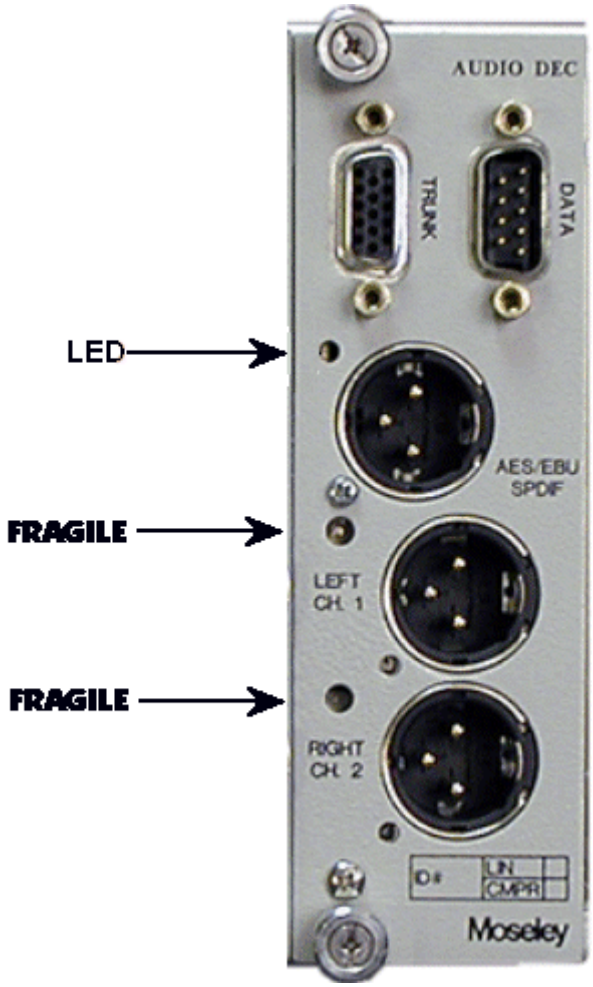
AUDIO INPUTS

LEFT (CH-1) / RIGHT (CH-2): Z_{in} 10 kohm, active balanced, +10dBu=O VU

AES/EBU/SPDIF: Z_{in}

FRAGILE: For fragile potentiometer adjustments. Use Jeweler's screwdriver only.

2.7.5 Audio Decoder



Audio output with both active AES and analog audio. An auxiliary data channel is available for linear mode only.

I/O PORTS:

DATA: Data inputs – RS232 levels, 9-pin D male. Asynchronous 300-38400 bps

TRUNK: Not used.

AUDIO OUTPUTS:

LEFT (CH-1) / RIGHT (CH-2): Zout 600Ω active balanced, +10dBu=O VU

AES/EBU/SPDIF: Zout 110 ohm, transformer balanced, 30-50 kHz sample rate

FRAGILE: For fragile potentiometer adjustments. Use Jeweler's screwdriver only.

2.8 Default Settings and Parameters

The following paragraphs describe the typical default module settings and parameters. These settings can be accessed through board jumpers or software switches. See Section 5 (Module Configuration) for a detailed description of the various module settings and parameters.

2.8.1 Audio

Audio Source Input Switching	Digital Audio = Primary Analog Audio = Secondary (Automatic switch from AES to Analog Input when AES signal is not present)
Analog Audio Connectors	XLR female (input), XLR male (output)
Analog Audio Input	Electronically balanced, 10 kohm
Analog Audio Output	Electronically balanced, low-Z (<100 ohms)
Analog Audio I/O Levels	+10 dBu Note: 0 dBu = 0.7746 VRMS (1 mW @ Z=600 ohms)
Digital Audio I/O Parameters	AES/EBU: Transformer balanced, 110 ohm impedance, 30-50 kHz input sample rate
Data Coding Method (System Dependent)	▪ Linear (16 bit) ▪ ISO/MPEG (Layer II)
ISO/MPEG Mode	Stereo (ISO/IEC 111172-3 Layer II)
ISO/MPEG Sample Rate	48 kHz
ISO/MPEG Output Rate	256 kbps

In a 4 channel system, there are two physically identical encoders in the transmitter unit and two corresponding decoder modules in the receiver unit. The modules are identified with an ID number (ENC1, ENC2, DEC1, DEC2) on the rear panel. The audio configuration of the module can be checked on the Test Data Sheet supplied with the units. An example Test Data Sheet is shown at the end of this section.

2.8.2 Audio Data Channel

The normal serial data channels are located on the encoder/decoder modules (except for special configurations). ENC1 contains Data Channel 1, and so on. Dip-switches on the encoder/decoder modules configure the data channel rates and bit length (see Section 5, Module Configuration). Unless otherwise specified at the time of order, the factory default configuration is: 9-pin D male, RS-232 levels, Asynchronous 1200 baud, 8 bits, 1 start bit, and 1-2 stop bits. Check the Test Data Sheet for factory setting.

The default configuration for 4-channel systems has no I/O data channels present on the MUX module. Note, however, that certain special factory configurations will require data channels to be stacked in the MUX module, and each MUX channel (1-4) can be configured differently (SYNC, ASYNC, voice, etc.). Consult the Test Data Sheet for details regarding your system. Also see Section 5, Module Configuration, for more information.

2.8.3 External Communications Equipment

Customers who are installing a CSU for T1 backup applications may be required to configure timing clock settings.

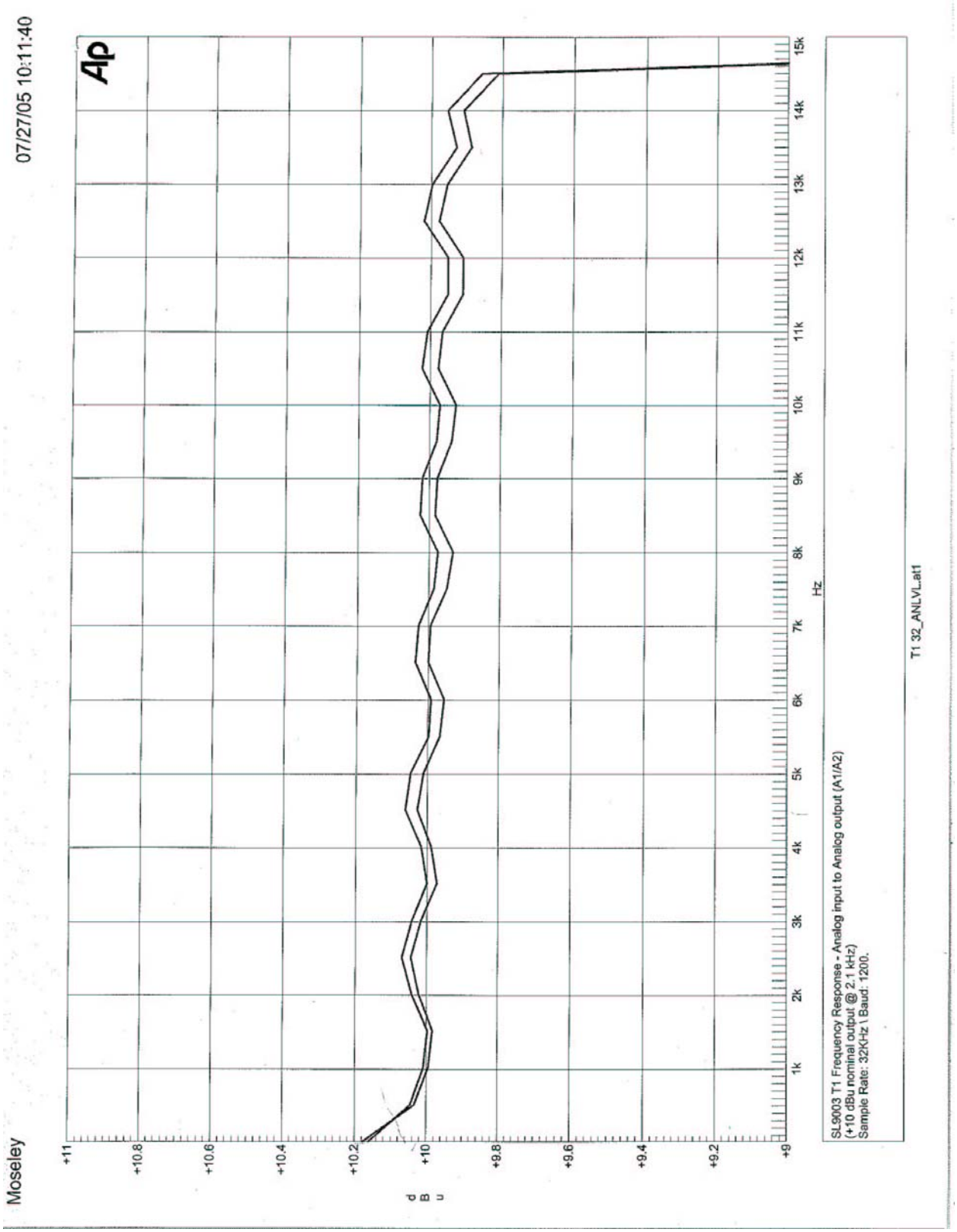
2.8.4 Performance

After the link is installed, certain performance parameters may be interrogated through the front panel for verification. Section 4 (Front Panel Operation) contains an LCD Menu diagram and information about navigating to the appropriate screen.

2.9 Example Test Data Sheet

Your Test Data Sheet will show a range of frequencies (in Hz) that you can expect given a certain input power (in decibals (dB)). The Test Data Sheet is a graph with power input values on the Y-Axis and expected frequencies on the X-Axis. For example, the analog

frequency of T1 given a dB of +10.2 through +9.8 provides a frequency in the range up to 14.7K.



3. Installation

3.1 Power Requirements

3.1.1 Power Supply Card Slot Details

The left-most slot in the SL9003T1 card cage (as viewed from the rear of the unit) is designated as the PRIMARY A power supply. The main bus voltages (+5 and +12) are routed to the backplane and provide power to the plug-in modules.

NOTE: The front panel LCD screen displays the system supply voltages and the nomenclature follows the physical location of the power supply modules.

3.1.2 AC Line voltage

The SL9003T1 uses a high reliability, universal input switching power supply capable of operating within an input range of: 90 – 260 VAC; 47-63 Hz. The power supply module can be removed from the unit. A cage protects service personnel from high voltage.

WARNING! HIGH VOLTAGE IS PRESENT INSIDE THE POWER SUPPLY MODULE WHEN THE UNIT IS PLUGGED INTO AC MAINS. REMOVAL OF THE POWER SUPPLY COVER WILL EXPOSE THIS POTENTIAL TO SERVICE PERSONNEL.

TO PREVENT ELECTRICAL SHOCK, UNPLUG THE POWER CABLE BEFORE SERVICING.

ONLY QUALIFIED PERSONNEL SHOULD SERVICE THE POWER SUPPLY.

3.1.3 DC Input Option

An optional DC input power supply is available for the SL9003T1 using a high reliability, DC-DC converter capable of operation within the following input ranges (dependent on nominal input rating):

Nominal DC Input	Operating Input Range
24 Volt:	18 – 36 VDC
48 Volt:	36 – 72 VDC

The DC input is isolated from chassis ground and can be operated in a positive or negative ground configuration. The power supply module is removable from the unit and no high voltages are accessible.

3.1.4 Fusing

For AC modules, the main input fuse is located on the switching power supply mounted to the carrier PC board and the protective cage may be removed for access to the fuse.

For DC modules, all fusing is located on the carrier PC board.

Always replace any fuse with same type and rating. Other fuses are present on the board, and are designed for output fail-safe protection of the system. All output fuse values are printed on the front or back side of the PC board to aid in replacement.

NOTE: If a fuse does blow in operation, investigate the possible cause of the failure prior to replacing the fuse, as there is adequate built-in protection margin.

3.2 Site Installation

The installation of the SL9003T1 involves several considerations. A proper installation is usually preceded by a pre-installation site survey of the facilities. The purpose of this survey is to familiarize the customer with the basic requirements needed for the installation to go smoothly.

Before taking the SL9003T1 to the installation site, verify that the audio connections are compatible with the equipment to be connected.

3.2.1 Installation

The T1 interfaces are set at the factory such that the T1 line from the TELCO should be ordered as B8ZS with ESF no network clock. The SL9003T1 should be less than 100 feet from the Telco T1 jack.

3.2.2 Power Requirements

The AC power supply uses a universal input switching supply that is adaptable to power sources found worldwide. The line cord is IEC (USA) compatible. This may need to be adapted to the proper physical AC connector in use.

For DC input units, double-check that the input voltage marking on the rear panel matches the voltage range provided by the facility. Verify that the power system used at the installation site provides a proper earth ground. The DC option for the SL9003T1 has isolated inputs by default. You may hard-wire a positive or negative chassis ground inside the module (if desired).

An Uninterruptible Power Supply (UPS) backup system is recommended for remote locations that may have unreliable power sources. Lightning protection devices are highly recommended for the power sources and all critical inputs and outputs.

3.2.3 Rack Mount Installation

The SL9003T1 is designed for mounting in a standard 19-inch rack cabinet using the brackets (rack ears) included with the unit. The rack ear kit is designed to allow flush mount front extended telecom-mount. Be sure to provide adequate air space near the ventilation holes of the chassis (top, bottom, and sides).

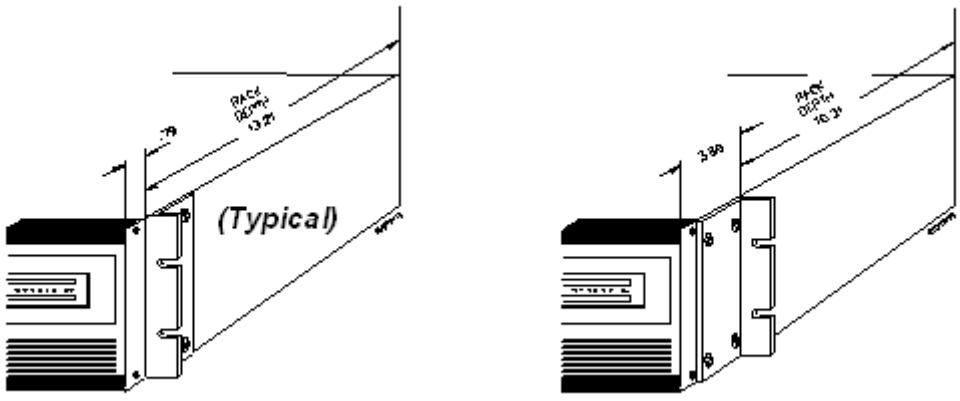


Figure 3-1. Rack Mount Bracket Installation

4. Front Panel Operation

This section describes the SL9003T1 front panel:

- LCD display
- Cursor and screen control buttons
- LED status indicators
- Bargraph Display

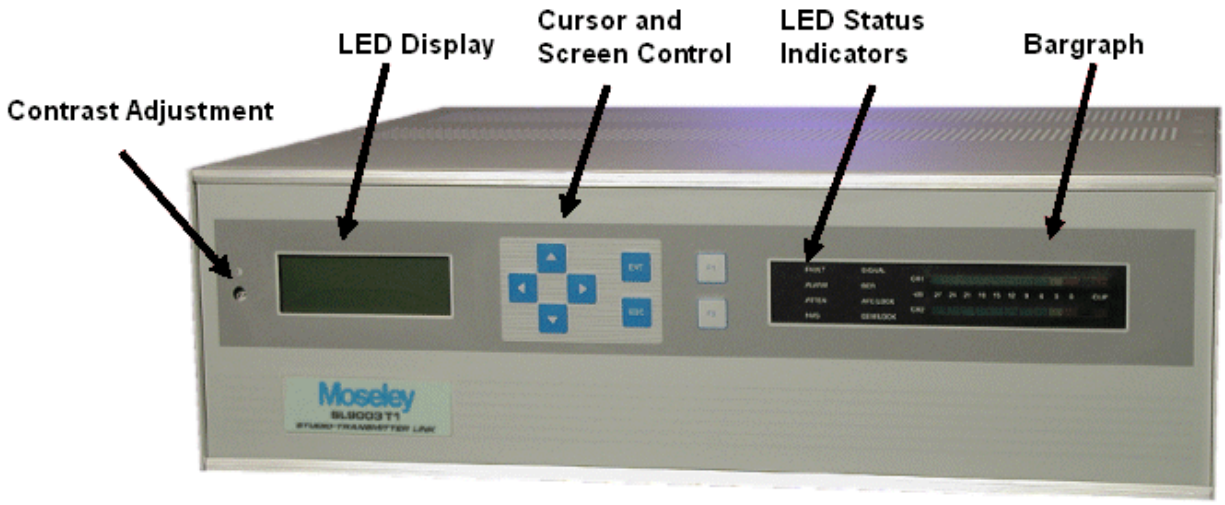


Figure 4-1. Front Panel

4.1 LCD Display

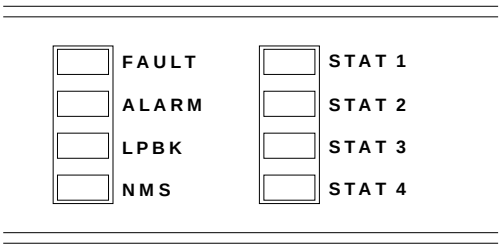
The Liquid Crystal Display (LCD) on the SL9003T1 front panel is the primary user interface and provides status, control, and calibration functionality.

Backlight: An automatic backlight is built-in to the LCD for better clarity under low-light conditions. This backlight is enabled on power-up and will automatically turn off if there is no button activity. The backlight will automatically turn on as soon as any button is pressed.

Contrast Adjustment: The contrast adjustment is front panel accessible (to the left of the LCD). A small flathead screwdriver can be used to adjust for optimum visual clarity.

4.2 LEDs

There are eight LEDs on the SL9003T1 front panel:



At power-up, each LED will light momentarily in sequence from left to right and top to bottom (i.e., FAULT, RX, ALARM, etc.). During normal operation, all LEDs on the front panel should be off.

NOTE: The FAULT LED will light to indicate a T1 link failure if the T1 Relay feature is installed and enabled. See Section 7 for details.

4.3 Cursor and Screen Control Buttons

The buttons on the SL9003T1 front panel are used for LCD screen interface and control functions:

ENTER: Used to accept an entry (such as a value, a condition, or a menu choice).

ESC: Used to "back up" a level in the menu structure without saving any changes.

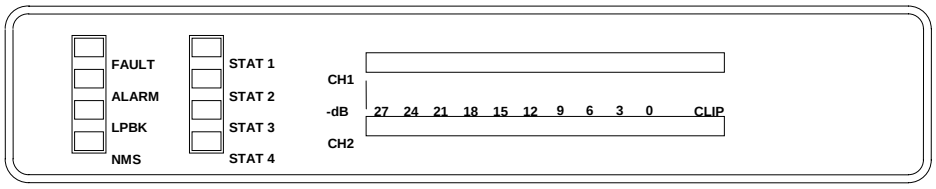
UP-ARROW/DOWN-ARROW: Used in most cases to move between the menu items. If there is another menu in the sequence when the bottom of a menu is reached, the display will automatically scroll to that menu.

LEFT-ARROW/RIGHT-ARROW: Used to select between conditions (such as ON/OFF, ENABLED/DISABLED, LOW/HIGH, etc.) as well as to increase or decrease numerical values.

FUNCTION: Software programmable buttons (to be implemented in a later software revision)

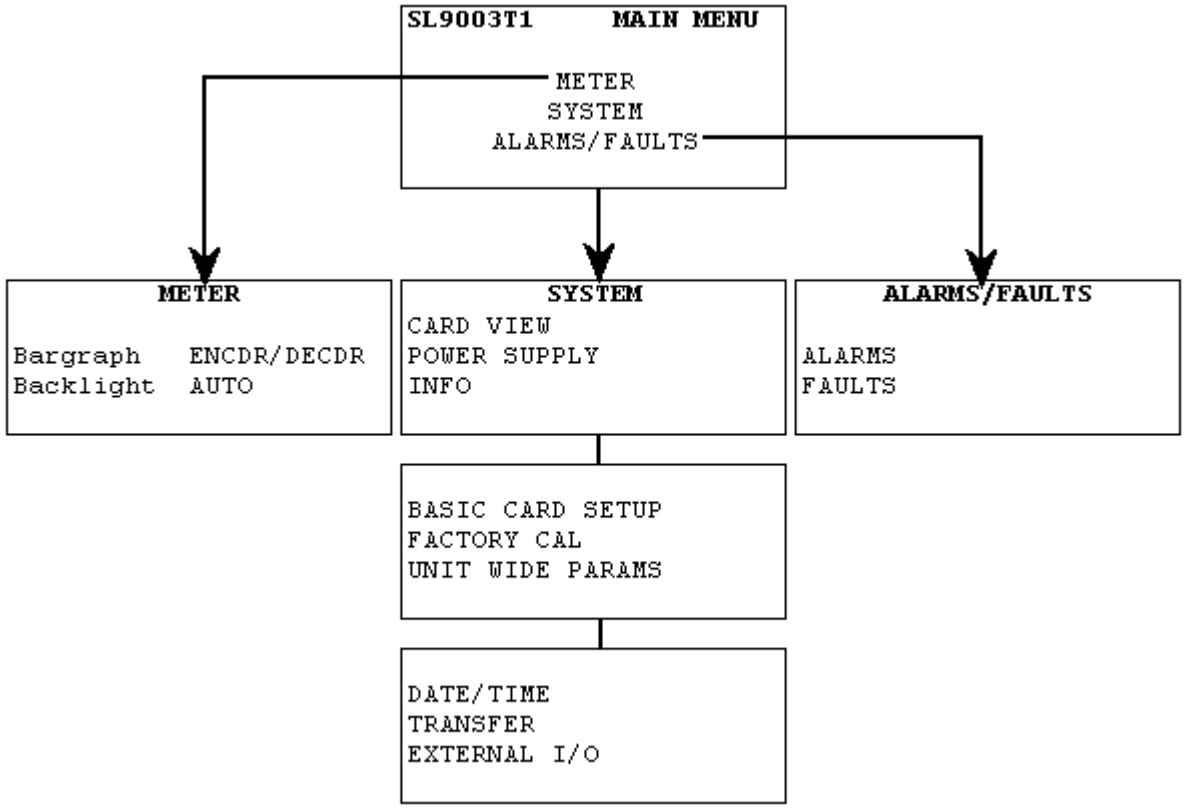
4.4 Bargraph

The bar graph (just to the right of the LEDs) is used with the encoder and decoder to provide a measurement of sound output.



The channel levels (shown by LED activity) are: -27 to -6 dB (green), -6 to -3 (yellow), 0 (red), and CLIP. The levels are for both channel 1 (CH1) and channel 2 (CH2). Audio quality is best when LEDs are lit in the green area (-27 to -6 dB). When the audio level gets into the CLIP area, the distortion makes the audio unrecognizable.

4.5 LCD Menu Tree Structure

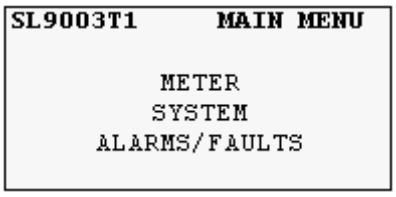


The current software revision is shown in the **SYSTEM INFO** menu. In general, the **ENTER** button will take you to the next screen from a menu choice. The **UP-ARROW** and **DOWN-ARROW** buttons will scroll through screens within a menu choice. The **ESC** button will return to the previous menu level.

DO NOT change any settings in the FACTORY CAL(ibrate) screens. The security lock-out features of the software may not be fully implemented. Changing a setting will most likely render the system non-operational!

4.6 Main Menu

When the power-up sequence is complete, the LCD will show the main menu:



- Press the DOWN-ARROW and UP-ARROW buttons to move the cursor next to each field in the MAIN MENU.
- Press the ENTER button to show the METER, SYSTEM, or ALARMS/FAULTS menu.

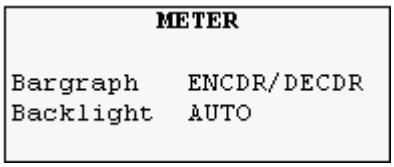
METER: This option shows the METER menu.

SYSTEM: This option shows the SYSTEM menu.

ALARMS/FAULTS: This option is applicable if you installed and activated T1 Relay. See Section 7 for details.

4.7 Meter

The METER selection in the MAIN MENU shows the METER menu:



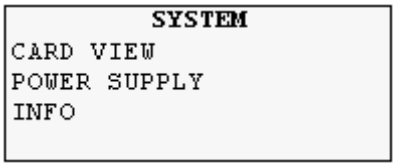
Bargraph: This field selects the audio source for display on the audio level bargraph. It can be set to one of the encoders (ENCDR1, ENCDR2, etc…), decoders (DECDR1, DECDR2, etc…) or OFF.

Backlight: This field controls the LCD backlight. It can be set to: AUTO (*default*) or OFF. When set to AUTO, the LCD Backlight will turn off after 5 minutes if there is no button activity on the front panel. When set to OFF, the Backlight is always off.

- Press the DOWN-ARROW and UP-ARROW buttons to move the cursor next to each field in the METER MENU.
- Press the LEFT-ARROW and RIGHT-ARROW buttons to select an option in each field.
- Press the ENTER button to save a field selection.
- Press the ESC button to return to the MAIN MENU.

4.8 System Menus

The SYSTEM selection in the MAIN MENU shows the first SYSTEM menu:



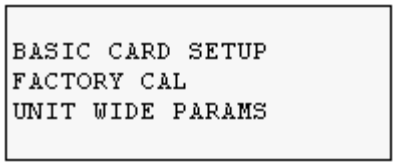
- Press the DOWN-ARROW and UP-ARROW buttons to move the cursor next to each field in the SYSTEM MENU.
- Press the DOWN-ARROW button in the INFO field to show the next SYSTEM MENU.
- Press the ENTER button to select a SYSTEM MENU item.
- Press the ESC button to return to the MAIN MENU.

CARD VIEW: Choose this option to show the modules installed in the system.

POWER SUPPLY: Choose this option to show power supply system.

INFO: Choose this option to show system information (unit number, security, and firmware version number).

When you press the DOWN-ARROW button in the INFO field, the system shows the next SYSTEM MENU:



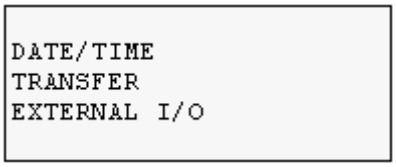
- Press the DOWN-ARROW and UP-ARROW buttons to move the cursor next to each field in the SYSTEM MENU.
- Press the DOWN-ARROW button in the UNIT WIDE PARAMS field to show the next SYSTEM MENU.
- Press the ENTER button to select a SYSTEM MENU item.
- Press the ESC button to return to the MAIN MENU.

BASIC CARD SETUP: Choose this option to define basic card setup parameters.

FACTORY CAL: This option defines factory calibration parameters. Do not change these parameters unless you are instructed to do so by Moseley Technical Support.

UNIT WIDE PARAMS: This option shows unit-wide parameters.

When you press the DOWN-ARROW button in the UNIT WIDE PARAMS field, the system shows the next SYSTEM MENU:



- Press the DOWN-ARROW and UP-ARROW buttons to move the cursor next to each field in the SYSTEM MENU.
- Press the ENTER button to select a SYSTEM MENU item.
- Press the ESC button to return to the MAIN MENU.

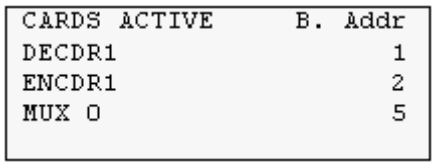
DATE/TIME: Press the ENTER button next to this field to set the system date and time.

TRANSFER: This option is not currently applicable for the SL9003T1.

EXTERNAL I/O: This option is not currently applicable for the SL9003T1.

4.8.1 System: Card View

The CARD VIEW option in the SYSTEM MENU shows the modules that are currently installed. Example:



This menu shows the modules that are currently installed and active in the system and the base address of each card. Press the ESC button to return to the SYSTEM MENU.

4.8.2 System: Power Supply

The POWER SUPPLY option in the SYSTEM MENU shows the following menu:

```
      POWER SUPPLY
Primary          AC
-5VD             5.00V
```

This menu shows the voltage level (e.g., 5.00V) of the Primary (-5VD) power supply. Press the ESC button to return to the SYSTEM MENU.

4.8.3 System: Info

The INFO option in the SYSTEM MENU shows the following menu:

```
   SYSTEM INFORMATION
Unit No          1
SECURITY         USER
FIRMWARE         Vx.xx
```

This menu shows the unit number, security level, and firmware version number. The SECURITY level can be one of the following: LOCKOUT = No control available, USER = Limited control of parameters, FACTORY = Full configure and calibration. Press the ESC button to return to the SYSTEM MENU.

4.8.4 System: Basic Card Setup

The BASIC CARD SETUP option in the SYSTEM MENU shows the following menu:

```
    Basic Card Setup

CARD          ID
```

- Press the DOWN-ARROW button to show the next BASIC CARD SETUP MENU.
- Press the ESC button to return to the MAIN MENU.

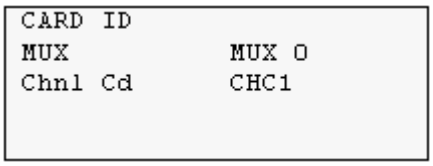
```
CARD ID

AUDIO ENC     ENC1
AUDIO DEC     DEC 1
```

AUDIO ENC: Can be set to ENC1, ENC2,… Audio Encoder installed and identified (affects meter selection of bargraph)

AUDIO DEC: Can be set to DEC1, DEC 2,… Audio Decoder installed and identified (affects meter selection of bargraph)

- Press the DOWN-ARROW and UP-ARROW buttons to move the cursor next to each field in this menu.
- Press the LEFT-ARROW and RIGHT-ARROW buttons to select an option in each field.
- Press the ENTER button to save a field selection.
- Press the ESC button to return to the SYSTEM MENU.



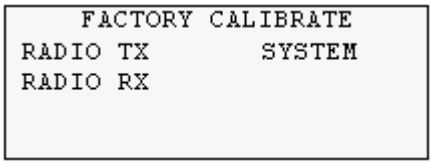
MUX: Can be set to MUX 0, MUX 1, …. Mux installed and identified

Chnl Cd: Can be set to CHC1, CHC2,… Channel Card installed and identified

- Press the DOWN-ARROW and UP-ARROW buttons to move the cursor next to each field in this menu.
- Press the LEFT-ARROW and RIGHT-ARROW buttons to select an option in each field.
- Press the ENTER button to save a field selection.
- Press the ESC button to return to the SYSTEM MENU.

4.8.5 System: Factory Calibration

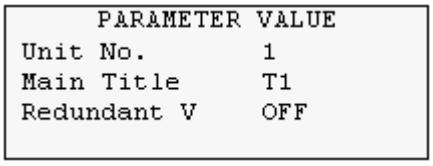
The FACTORY CAL option in the SYSTEM MENU shows the following menu:



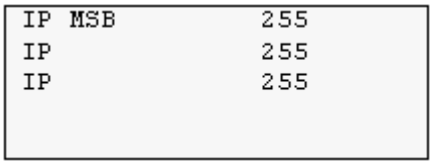
Do not change the fields in this menu unless you are instructed to do so by Moseley Technical Support. Press the ESC button to return to the SYSTEM MENU.

4.8.6 System: Unit Wide Params

The UNIT WIDE PARAMS option in the SYSTEM MENU shows the following menu:

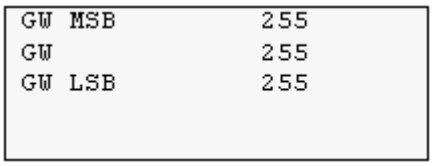


- Press the DOWN-ARROW and UP-ARROW buttons to move the cursor next to each field in this menu.
- Press the LEFT-ARROW and RIGHT-ARROW buttons to select an option in each field.
- Press the ENTER button to save a field selection.
- Press the ESC button to return to the SYSTEM MENU.



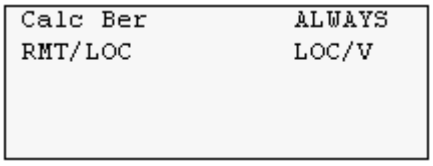
The fields in this menu are not currently applicable for the SL9003T1.

- Press the DOWN-ARROW button to show the next UNIT WIDE PARAMS MENU.
- Press the ESC button to return to the SYSTEM MENU.



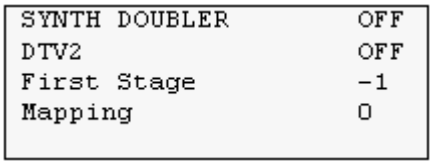
The fields in this menu are not currently applicable for the SL9003T1.

- Press the DOWN-ARROW button to show the next UNIT WIDE PARAMS MENU.
- Press the ESC button to return to the SYSTEM MENU.



The fields in this menu are not currently applicable for the SL9003T1.

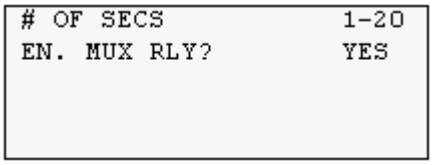
- Press the DOWN-ARROW button to show the next UNIT WIDE PARAMS MENU.
- Press the ESC button to return to the SYSTEM MENU.



The fields in this menu are not currently applicable for the SL9003T1.

- Press the DOWN-ARROW button to show the next UNIT WIDE PARAMS MENU.
- Press the ESC button to return to the SYSTEM MENU.

The fields in the following menu are only applicable if you ordered and installed the T1 Relay feature. See Section 7. T1 Relay.



 # OF SECS: Selects the period at which to detect failure (1...20 seconds).

EN. MUX RLY: Enables (YES) or disables (NO) T1 Relay.

- Press the DOWN-ARROW and UP-ARROW buttons to move the cursor next to each field in this menu.
- Press the LEFT-ARROW and RIGHT-ARROW buttons to select an option in each field.
- Press the ENTER button to save a field selection.
- Press the ESC button to return to the SYSTEM MENU.

4.8.7 System: Date/Time

The DATE/TIME option in the MAIN MENU shows the following menu:

```
      SYSTEM DATE
DAY                  28
MONTH                12
YEAR                 06
```

This menu sets the system date used for NMS and Fault/Alarm logging.

Day: Sets the day of the month (01...31).

Month: Sets the month of the year (01...12).

Year: Sets the year (00...99).

- Press the DOWN-ARROW and UP-ARROW buttons to move the cursor next to each field in this menu.
- Press the LEFT-ARROW and RIGHT-ARROW buttons to select an option in each field.
- Press the ENTER button to save a field selection.
- Press the ESC button to return to the SYSTEM MENU.

```
      SYSTEM TIME
HOUR                 10
MINUTE               11
SECONDS              12
```

This menu sets the system time used for NMS and Fault/Alarm logging.

Hour: Sets the hour of the day (00...23).

Minutes: Sets the minutes in the hour (00...59).

Seconds: Sets the seconds (00...59).

- Press the DOWN-ARROW and UP-ARROW buttons to move the cursor next to each field in this menu.
- Press the LEFT-ARROW and RIGHT-ARROW buttons to select an option in each field.
- Press the ENTER button to save a field selection.
- Press the ESC button to return to the SYSTEM MENU.

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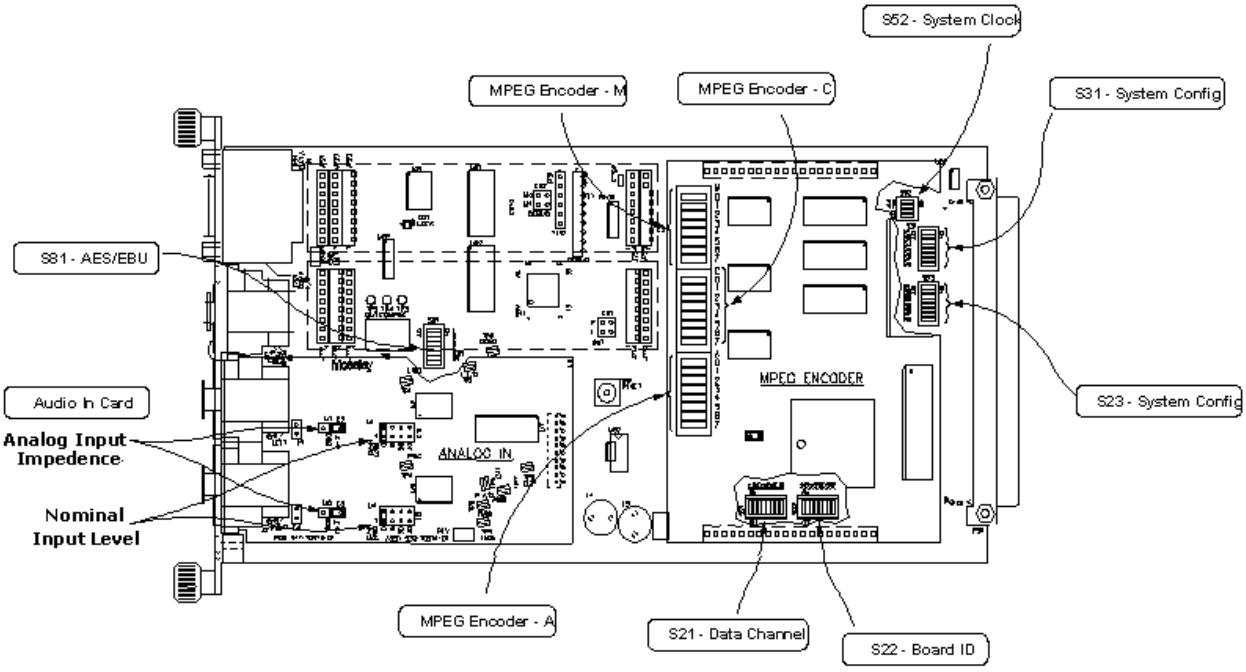
5. Module Configuration

This section provides detailed information about board-level switches, jumpers and test points that may be necessary for configuring or troubleshooting modules in the SL9003T1. Do not change these settings unless you are instructed to do so by Moseley Technical Support. Changing these settings may render the system unusable, proceed with caution!

5.1 Audio Encoder Module

The following illustration shows the location of the switches and jumpers on the Audio Encoder module:



5.1.1 AES/EBU Switches (S81)

Switch S81 configures the digital audio input (Encoder) for the AES/EBU professional standard (3 wire XLR balanced) or SPDIF consumer standard (2 wire unbalanced). AES/EBU is the factory default.

S81-A	S81-B	S81-C	S81-D	S81-E	Selection
OFF	OFF	OFF	OFF	ON	AES/EBU (default)
ON	ON	OFF	OFF	OFF	SPDIF

If AES/EBU is selected, the following wiring should be followed for proper level and phasing:

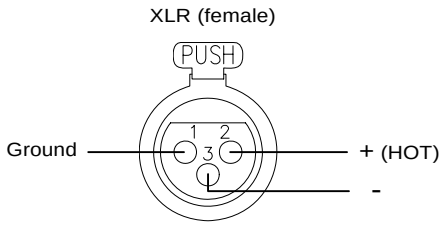


Figure 5-1. AES/EBU-XLR Encoder Connection

If SPDIF is selected, the following wiring should be followed for proper level and phasing:

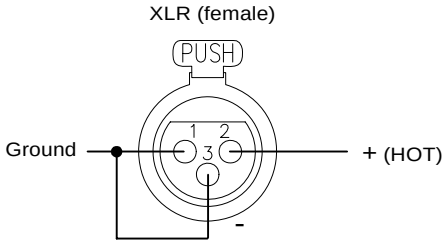


Figure 5-2. SPDIF-XLR Encoder Connection

Error Flag Selections: The VERF and ERF switches define error flag selections.

S81-VERF	S81-ERF	Selection
ON	OFF	Validity Bit and Error Flag
OFF	ON	Error Flag Only (Default)

5.1.2 Audio In Card Jumpers

Jumpers E2-E5 set the left and right channel input impedance. HI-Z is the default. It can be set to 600 ohm for external equipment compatibility.

E2-E5	Analog Input Impedance
600	600 Ohms
HI-Z	>10K Ohms (default)

Jumpers E3-E6 set the gain for the analog input stage. The unit can be set to up to 40 dB of additional gain if the external equipment has a low output level.

E3-E6	dB Gain	Nominal Input Level
0	0 (default)	+10 dBu (default)
6	6	+4 dBu
20	20	-10 dBu
40	40	-30 dBu

5.1.3 MPEG Encoder M Switches

The MPEG Encoder M switches (labeled 0...7) select the ISO/MPEG Coding Mode, Output Rate, Network Rate, and number of output bits.

ISO/MPEG Coding Mode (M0/M1): These switches set the ISO/MPEG Coding Mode as shown in the following table:

M1	M0	Mode
OFF (0)	OFF (0)	Mono
OFF (0)	ON (1)	Dual Channel / Double Mono (C5)
ON (1)	OFF (0)	Joint Stereo (Default)
ON (1)	ON (1)	Stereo

Output Rate (M2/M3/M4/M5): These switches set the Output Rate as shown in the following table:

M5	M4	M3	M2	Output Rate
OFF (0)	OFF (0)	OFF (0)	OFF (0)	Reserved
OFF (0)	OFF (0)	OFF (0)	ON (1)	32K BPS
OFF (0)	OFF (0)	ON (1)	OFF (0)	48K BPS
OFF (0)	OFF (0)	ON (1)	ON (1)	58K BPS
OFF (0)	ON (1)	OFF (0)	OFF (0)	64K BPS
OFF (0)	ON (1)	OFF (0)	ON (1)	80K BPS
OFF (0)	ON (1)	ON (1)	OFF (0)	96K BPS
OFF (0)	ON (1)	ON (1)	ON (1)	112K BPS
ON (1)	OFF (0)	OFF (0)	OFF (0)	120K BPS
ON (1)	OFF (0)	OFF (0)	ON (1)	160K BPS
ON (1)	OFF (0)	ON (1)	OFF (0)	192K BPS
ON (1)	OFF (0)	ON (1)	ON (1)	224K BPS
ON (1)	ON (1)	OFF (0)	OFF (0)	256K BPS (DEFAULT)
ON (1)	ON (1)	OFF (0)	ON (1)	320K BPS
ON (1)	ON (1)	ON (1)	OFF (0)	384K BPS
ON (1)	ON (1)	ON (1)	ON (1)	Reserved

Network Rate (M6): Switch M6 selects the Network Rate: OFF=64K bps, ON=56K bps.

# of Bits Output (M8): Switch M8 selects the number of bits output: OFF=24 (default), ON=16.

5.1.4 MPEG Encoder C Switches

Switch 5 in the MPEG Encoder C switches selects the Coding Mode: OFF=Dual Channel (default), ON=Double Mono. All other switches in this group are reserved.

5.1.5 System Clock Switches (S52)

The switches at S32 set the board configuration for operation in the system. These switches SHOULD NOT be changed. The information is provided here for a detailed description of the configuration of the board. The switches labeled TXD and TXC select the following options.

TXD	TXC	Modem Tx Compressed
OFF	X	TXDATA disabled (default)
ON	X	TXDATA enabled
X	OFF	TXCLK disabled (default)
X	ON	TXCLK enabled

The third and fourth switches in this group select the following options:

S52-3	S52-4	Modem TX Linear
OFF	X	TXDATA disabled (default)
ON	X	TXDATA enabled
X	OFF	TXCLK disabled (default)
X	ON	TXCLK enabled

5.1.6 System Configuration Switches (S31)

The switches at S31 set the board configuration for operation in the system. These switches SHOULD NOT be changed. The information is provided here for a detailed description of the configuration of the board.

M1/M2: These switches select the Input Rate:

M1	M2	Input Rate (A/D & AES/EBU/SPDIF & SRC)
OFF	OFF	44.1K Hz (Internal Oscillator)
OFF	ON	48.0K Hz (Internal Oscillator)
ON	OFF	32.0K Hz (Internal Oscillator) Default
ON	ON	AES/EBU (variabled from AES/EBU/SPDIF)

M3: This switch selects the AES/EBU/SPDIF Mode: OFF=AES=Master, A/D=Secondary (default), ON=No Input Switching (M1, M2=Source).

M4/M5/M6: These switches select the VCO Clock Source

M4	M5	M6	VCO Clock Source	Bus Clock
OFF	OFF	OFF	Input Mode (M1, M2)	Ignore
OFF	OFF	ON	Internal Oscillator	Ignore
OFF	ON	OFF	Trunk Compressed	Ignore
OFF	ON	ON	Trunk Linear	Ignore
ON	OFF	OFF	Reserved	Input
ON	OFF	ON	Reserved	Input
ON	ON	OFF	MUX Compressed	Input
ON	ON	ON	MUX Linear	Input

M7/M8: These switches select the Linear Data Rate

M7	M8	Linear Data Rate
OFF	OFF	44.1K Hz
OFF	ON	48.0K Hz
ON	OFF	32.0K Hz (default)
ON	ON	44.0K Hz

5.1.7 System Configuration Switches (S23)

The switches at S23 set the board configuration for operation in the system. These switches SHOULD NOT be changed. The information is provided here for a detailed description of the configuration of the board.

R1/R2: These switches select the Sample Rate Converter Data Source:

R1	R2	Sample Rate Converter Data Source
OFF	OFF	AES/EBU/SPDIF (default)
OFF	ON	A/D Converter
ON	OFF	Zeros (Ground)
ON	ON	Sine Generator

R3: This switch selects the Bus Master Clock: OFF=Receive Clock from Mux Bus (default), ON=Supply Clock to Mux Bus.

R4: This switch selects Aux RS-232 Data: OFF=Diabled, ON=Enabled (default).

R5/R6: These switches select 2-/4-Channel options:

R5	R6	2-/4-Channel Select
OFF	OFF	2-Channel
OFF	ON	Reserved
ON	OFF	4-Channel Master (1st Pair)
ON	ON	4-Channel Slave (2nd Pair)

R7: This switch selects LEDs and Metering: OFF=Disabled/FP Select (default), ON=Enabled/Forced On.

R8: This switch selects debug options: OFF=Normal (default), ON=Debug (B-bus outputs).

5.1.8 MPEG Encoder A Switches

A6/A7: These switches select the ISO/MPEG Input Rate

A7	A6	ISO/MPEG Input Rate
OFF	OFF	44.1K Hz
OFF	ON	48.0K Hz
ON	OFF	32.0K Hz (default)
ON	ON	RESERVED

A0/A1/A2/A3/A4/A5: These switches should always be OFF on the MPEG encoder. They select data channel options and data channels cannot be used on the MPEG encoder.

5.1.9 Data Channel Switches (S21)

Switch S21 sets the data channel parameters for the card. The following illustration shows the pin assignments for the data channel connector:

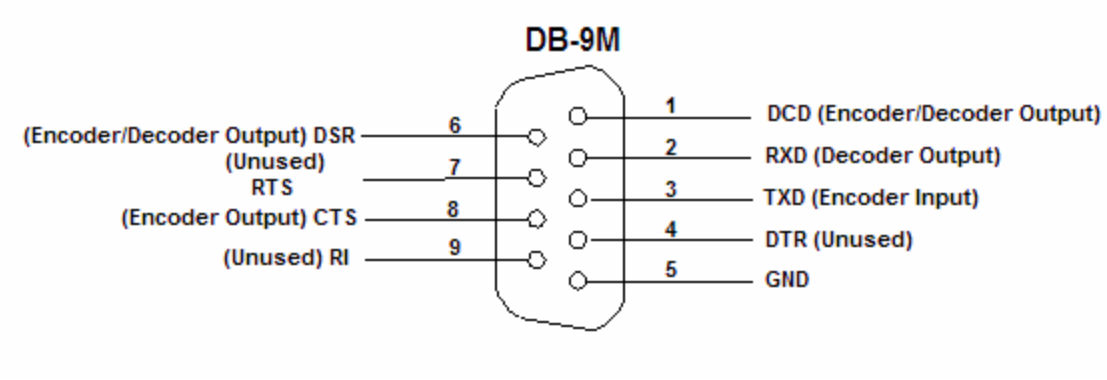


Figure 5-3. Data Channel Connector (DSUB (9-pin))

NOTE: CTS must be used for data rates above 4800 baud on the encoder.

D1 / D2: These switches select the following options:

D1	D2	Aux Data # of Bits
OFF	OFF	6 (6N/5E/5O)
OFF	ON	7 (7N/6E/6O)
ON	OFF	8 (8N/7E/7O) DEFAULT
ON	ON	9 (9N/8E/8O)

D3 / D4 / D5: These switches select the following options:

D3	D4	D5	AUX DATA RATE
OFF	OFF	OFF	300
OFF	OFF	ON	600
OFF	ON	OFF	1200 (DEFAULT)
OFF	ON	ON	2400
ON	OFF	OFF	4800
ON	OFF	ON	9600 +
ON	ON	OFF	19200 +
ON	ON	ON	38400 +

The 9600, 19200, and 38400 selections must use CTS Line.

D6: This switch is reserved.

D7: This switch selects the test mode: OFF=Disabled (default), ON=Enabled.

D8: This switch selects the debug mode: OFF=Normal (default), ON=Enabled.

5.1.10 Board ID (S22)

This switch group selects the board ID. These switches SHOULD NOT be changed.

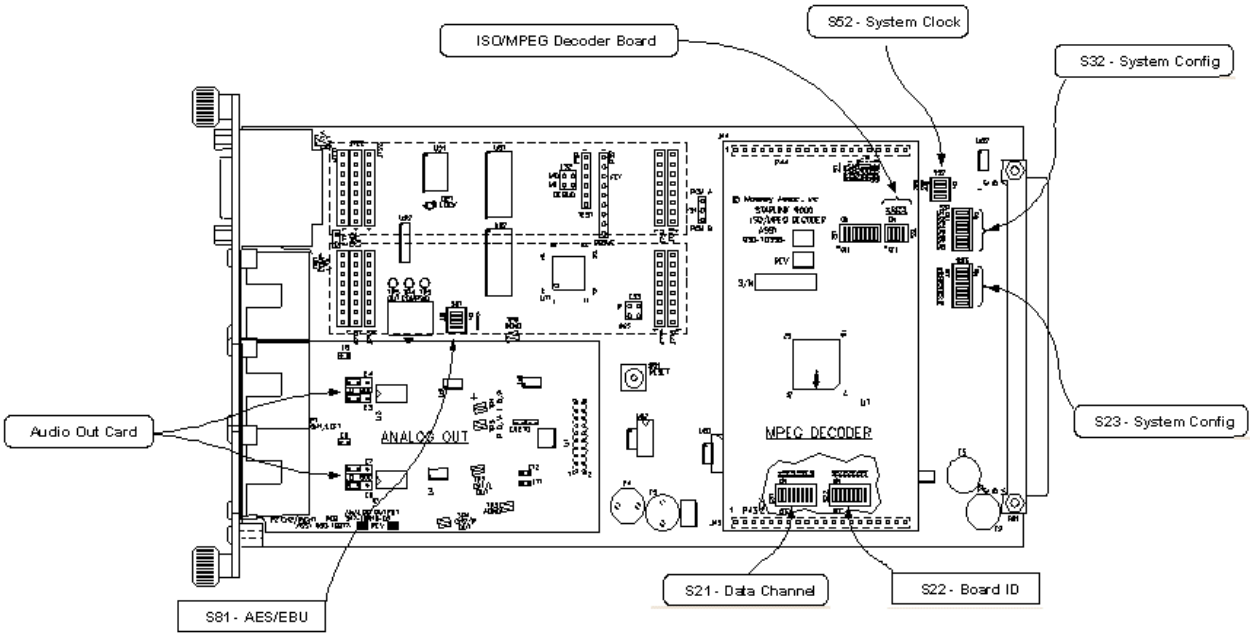
A2	A3	A4	A5	A6	A7	A8	A9	Board#	Base Address
OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	0	0
ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	1*	4
OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	2	8

A2	A3	A4	A5	A6	A7	A8	A9	Board#	Base Address
OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	3	16
OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	4	32
OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	5*	64
OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	6	128
OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	7	256
OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	8	512

* Not allowed when used with 6-port mux

5.2 Audio Decoder Switches/Jumpers

The following illustration shows the location of configurable switches and jumpers on the Audio Decoder module:



5.2.1 Audio Out Card Jumpers

Jumpers E3/E4 and E7/E8 set the left and right channel output impedance. LO-Z is the default setting. It can be set to 600 ohm for external equipment compatibility.

E3-E4-E7-E8	Analog Output Impedance
LO	<5 Ohms (default)
600	600 Ohms

5.2.2 AES/EBU Switches (S81)

Switch S81 configures the digital audio output (Decoder) for the AES/EBU professional standard (3 wire XLR balanced) or SPDIF consumer standard (2 wire unbalanced). The AES/EBU setting is the factory default.

S81-A	S81-B	S81-C	S81-D	Selection
OFF	OFF	OFF	OFF	AES/EBU (default)
ON	ON	OFF	OFF	SPDIF

If AES/EBU is selected, the following wiring should be followed for proper level and phasing:

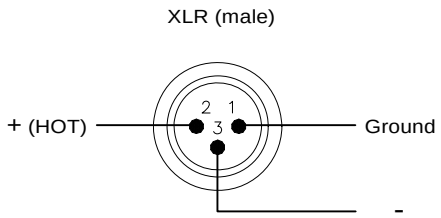


Figure 5-4. AES/EBU-XLR Decoder Connection

If SPDIF is selected, the following wiring should be followed for proper level and phasing:

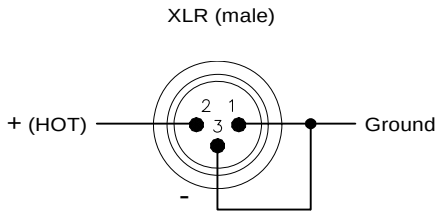


Figure 5-5. SPDIF-XLR Decoder Connection

5.2.3 ISO/MPEG Decoder Board Switches

The ISO/MPEG Decoder Board switches (labeled M1...M4) select the ISO/MPEG Rate.

M1	M2	M3	M4	ISO/MPEG Rate
OFF (0)	OFF (0)	OFF (0)	OFF (0)	Reserved
OFF (0)	OFF (0)	OFF (0)	ON (1)	32K BPS
OFF (0)	OFF (0)	ON (1)	OFF (0)	48K BPS
OFF (0)	OFF (0)	ON (1)	ON (1)	58K BPS
OFF (0)	ON (1)	OFF (0)	OFF (0)	64K BPS
OFF (0)	ON (1)	OFF (0)	ON (1)	80K BPS
OFF (0)	ON (1)	ON (1)	OFF (0)	96K BPS
OFF (0)	ON (1)	ON (1)	ON (1)	112K BPS
ON (1)	OFF (0)	OFF (0)	OFF (0)	120K BPS
ON (1)	OFF (0)	OFF (0)	ON (1)	160K BPS
ON (1)	OFF (0)	ON (1)	OFF (0)	192K BPS
ON (1)	OFF (0)	ON (1)	ON (1)	224K BPS
ON (1)	ON (1)	OFF (0)	OFF (0)	256K BPS (DEFAULT)
ON (1)	ON (1)	OFF (0)	ON (1)	320K BPS
ON (1)	ON (1)	ON (1)	OFF (0)	384K BPS

M1	M2	M3	M4	ISO/MPEG Rate
ON (1)	ON (1)	ON (1)	ON (1)	Reserved

5.2.4 System Clock Switches (S52)

The switches at S52 set the board configuration for operation in the system. These switches SHOULD NOT be changed. The information is provided here for a detailed description of the configuration of the board.

The switches labeled RXD and RXC select the following options.

RXD	RXC	Modem Rx Compressed
OFF	X	RXDATA disabled (default)
ON	X	RXDATA enabled
X	OFF	RXCLK disabled (default)
X	ON	RXCLK enabled

The third and fourth switches in this group select the following options:

S52-3	S52-4	Modem RX Linear
OFF	X	RXDATA disabled (default)
ON	X	RXDATA enabled
X	OFF	RXCLK disabled (default)
X	ON	RXCLK enabled

5.2.5 System Configuration Switches (S32)

The switches at S32 set the board configuration for operation in the system. These switches SHOULD NOT be changed. The information is provided here for a detailed description of the configuration of the board.

M1/M2: These switches select the Input Rate:

M1	M2	Input Rate (A/D & AES/EBU/SPDIF & SRC)
OFF	OFF	44.1K Hz (Internal Oscillator)
OFF	ON	48.0K Hz (Internal Oscillator)
ON	OFF	32.0K Hz (Internal Oscillator) Default
ON	ON	Linear Rate (M7, M8)

M3: This switch selects the VCO Test Mode: OFF=Normal (External), ON=Test (Internal).

M4: This switch selects the FIFO Data Source: OFF=Trunk, ON=Mux.

M5/M6: These switches select the VCO Clock Source as shown in the following table:

M5	M6	VCO Clock Source
OFF	OFF	Trunk Compressed
OFF	ON	Trunk Linear
ON	OFF	Mux Compressed
ON	ON	Mux Linear

M7/M8: These switches select the VCO Rate and Clock Frequency as shown in the following table:

M7	M8	VCO Rate	Clock Frequency
OFF	OFF	44.1K Hz	11.2896M Hz
OFF	ON	48.0K Hz	12.2880M Hz
ON	OFF	32.0K Hz (default)	8.1920M Hz
ON	ON	44.0K Hz	11.2640M Hz

5.2.6 System Configuration Switches (S23)

The switches at S23 set the board configuration for operation in the system. These switches SHOULD NOT be changed. The information is provided here for a detailed description of the configuration of the board.

R1/R2: These switches select the Sample Rate Converter Data Source:

R1	R2	Sample Rate Converter Data Source
OFF	OFF	Compressed
OFF	ON	Linear
ON	OFF	Zeros (Ground)
ON	ON	Sine Generator

R3: This switch selects the Trunk Compressed Input Clock: OFF=Normal (default), ON=Inverted.

R4: This switch selects the Trunk Linear Input Clock: OFF=Normal (default), ON=Inverted.

R5/R6: These switches select 2-/4-Channel options:

R5	R6	2-/4-Channel Select
OFF	OFF	2-Channel
OFF	ON	Reserved
ON	OFF	4-Channel Master (1st Pair)
ON	ON	4-Channel Slave (2nd Pair)

R7: This switch selects LEDs and Metering: OFF=Disabled/FP Select (default), ON=Enabled/Forced On.

R8: This switch selects debug options: OFF=Disabled (default), ON=Enabled.

5.2.7 Data Channel Switches (S21)

Switch S21 sets the data channel parameters for the card. The following illustration shows the pin assignments for the data channel connector:

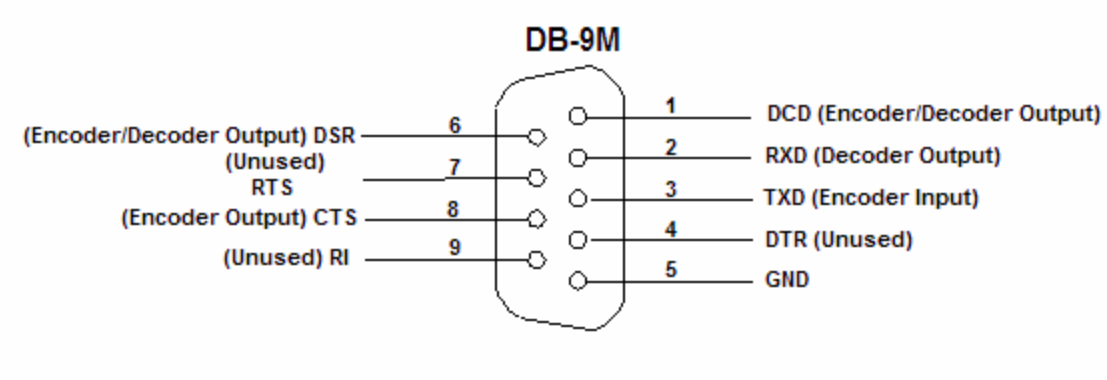


Figure 5-6. Data Channel Connector (DSUB (9-pin))

D1 / D2: These switches select the following options:

D1	D2	Aux Data # of Bits
OFF	OFF	6 (6N/5E/5O)
OFF	ON	7 (7N/6E/6O)
ON	OFF	8 (8N/7E/7O) DEFAULT
ON	ON	9 (9N/8E/8O)

D3 / D4 / D5: These switches select the following options:

D3	D4	D5	AUX DATA RATE
OFF	OFF	OFF	300
OFF	OFF	ON	600
OFF	ON	OFF	1200 (DEFAULT)
OFF	ON	ON	2400
ON	OFF	OFF	4800
ON	OFF	ON	9600 +
ON	ON	OFF	19200 +
ON	ON	ON	38400 +

The 9600, 19200, and 38400 selections must use CTS Line.

D6: This switch is reserved.

D7: This switch selects the test mode: OFF=Disabled (default), ON=Enabled.

D8: This switch selects the debug mode: OFF=Normal (default), ON=Enabled.

5.2.8 Board ID (S22)

This switch group selects the board ID. These switches SHOULD NOT be changed.

A2	A3	A4	A5	A6	A7	A8	A9	Board#	Base Address
OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	0	0
ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	1*	4
OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	2	8
OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	3	16

A2	A3	A4	A5	A6	A7	A8	A9	Board#	Base Address
OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	4	32
OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	5*	64
OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	6	128
OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	7	256
OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	8	512

* Not allowed when used with 6-port mux

5.3 Analog Input and Output Adjustment

The gain is set at the factory using the ports accessible on the rear panel of the audio boards as follows:

1) On the decoder:
   - Turn on the internal sine generator. [digital full scale]
   - Adjust the decoder output level on both channels to +12dBu. [2dB above nominal]
   - Turn off the internal sine generator.
2) On the encoder
   - Apply +10dBu sine wave to the encoder inputs.
   - Monitor the decoder output levels.
   - Adjust the encoder so that the decoder output levels are +10dBu. Do not change the decoder pots.

In this way, the headroom is always set to 2dB above nominal +10dBu. Since the clip circuitry is approximately 1 dB above nominal and 1 dB below full scale, the clip light is always set correctly.

5.4 NMS/CPU Module

There are no user adjustments on this card. All calibrations are factory-set and configuration settings are controlled remotely by software (via the front panel or serial port).

6. System Operation

6.1 Audio Encoder

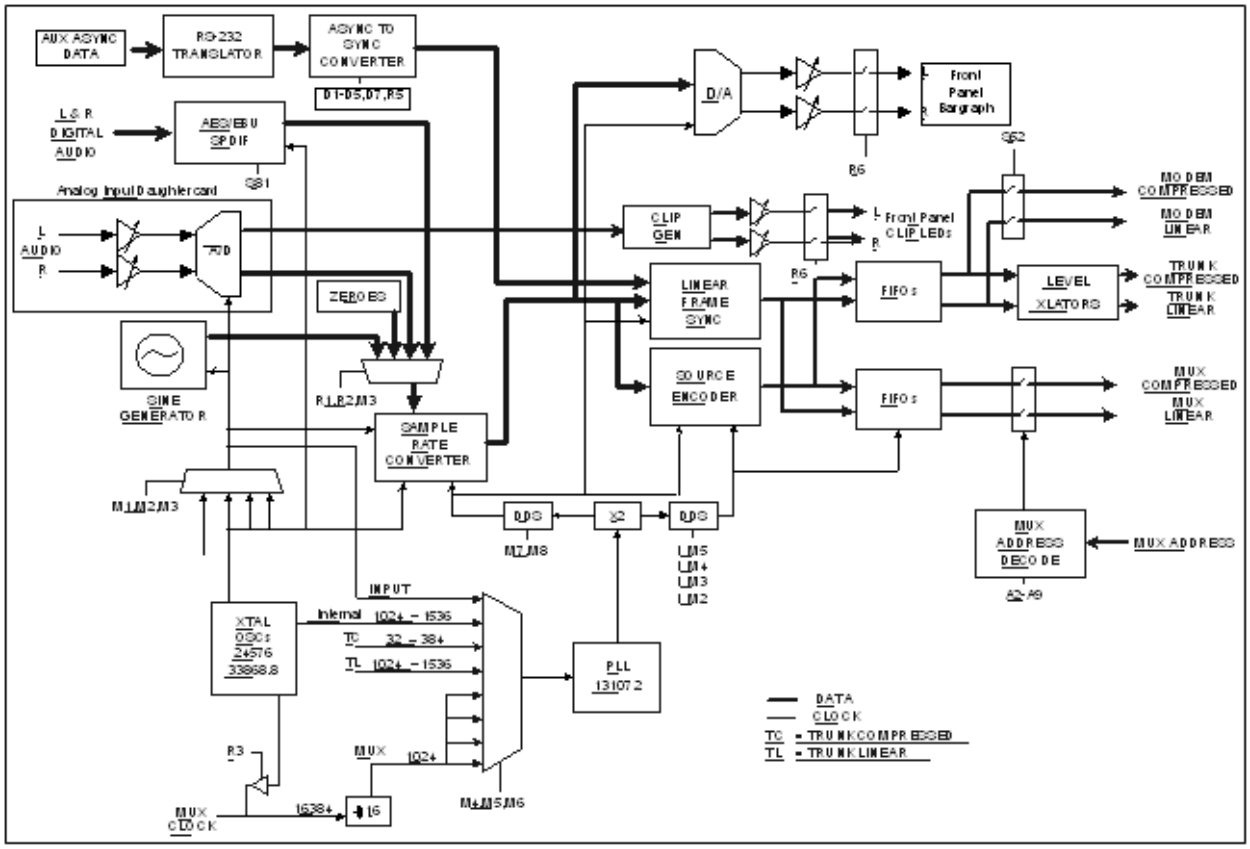


Figure 6-1. Audio Encoder Block Diagram

The Audio Encoder module directly receives and decodes the AES/EBU digital audio into a digital stereo audio data stream. Optionally, the analog audio inputs can be used (located on the Analog Input daughter card), and these inputs are converted to 16-bit digital stereo data. The SRC (Sample Rate Converter) passes the digital audio data stream to a data multiplexer while synchronizing/converting the incoming sample rate (30-50 kHz) to the internal sample rate clock (32, 44.1, 48 kHz selectable). For example, data could be provided by a CD player at 44.1 kHz, while the internal sample rate to be transmitted across the link is at 32 kHz (the default rate).

The digital audio is optionally compressed (using MPEG or ADPCM) in the Audio Encoder module to allow for higher bandwidth efficiency (more audio channels per RF channel) at the expense of aural masking compression disadvantages. However, some users may require the compression algorithm for existing system compatibility.

Sine wave and "zeroes" test signal generators are available on the card (switch selectable) for system testing. The stereo D/A converter transforms the signal back to analog for use in monitoring the signal from the front panel. This conveniently allows for level monitoring of the digital AES/EBU audio inputs on the bar graph.

The digital audio data (linear or compressed) and the auxiliary data channel are subsequently coded into a single data stream. In a 2-channel system, this data stream can be sent to the T1 module directly.

Intelligent Multiplexer: In a 4-channel system, two Audio Encoders provide two data streams to the Intelligent Multiplexer (MUX). The MUX frames and multiplexes the data to form an aggregate data stream for the T1 Link. The MUX can also provide additional data channels for the link, multiplexed into the aggregate data stream.

6.2 Receiver

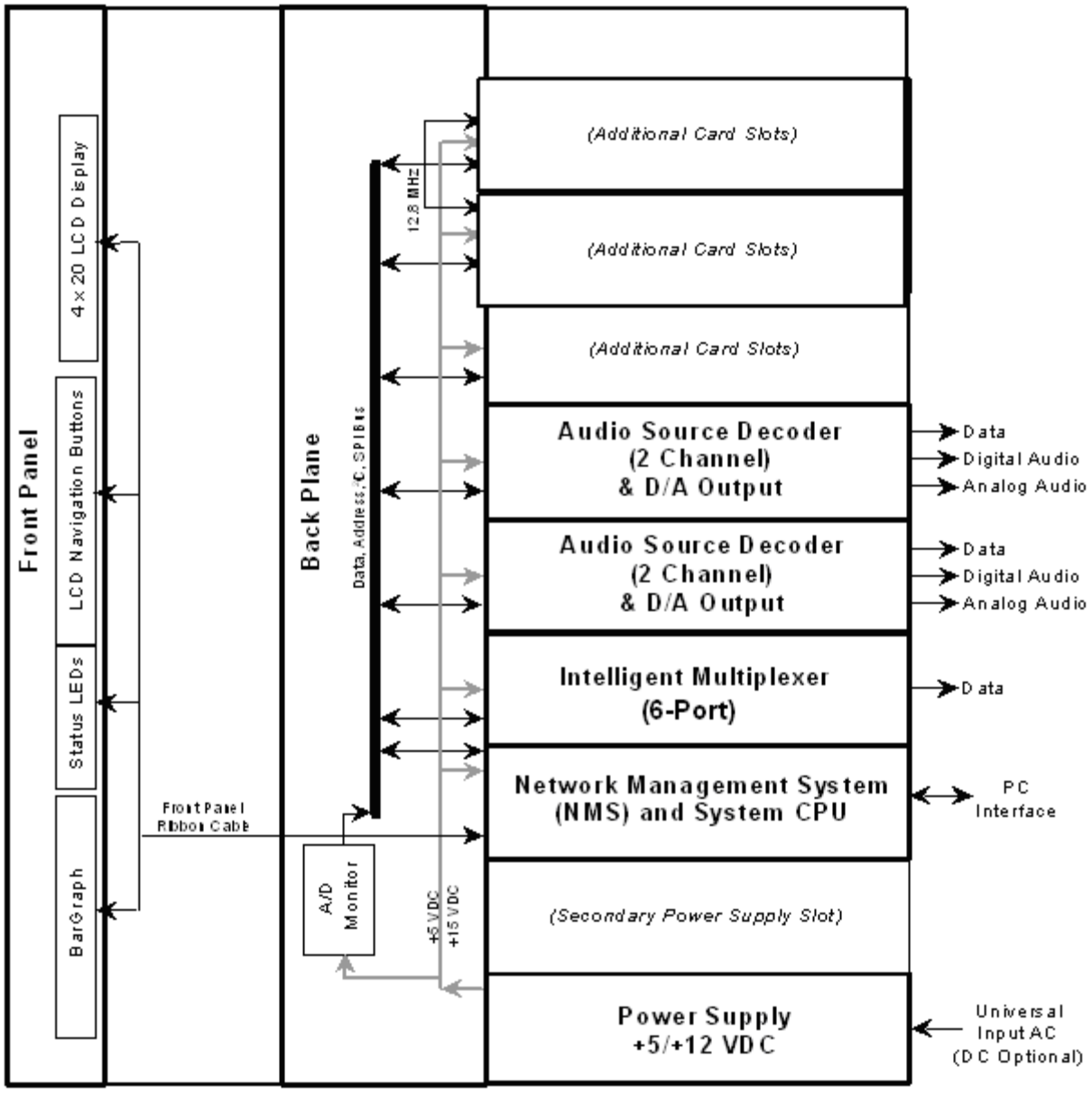


Figure 6-2. SL9003T1 Receiver System Block Diagram

The NMS/CPU card incorporates microprocessor and FPGA logic to configure and monitor the overall operation of the system via front panel controls, LCD screen menus, status LEDs and the bar graph display. Module settings are loaded into the installed cards and power-up default settings are stored in non-volatile memory. LCD menu software is uploaded into

memory, providing field upgrade capability. A Windows-based PC interface is available for connection at the rear panel DATA port.

Intelligent Multiplexer: In a 4 channel system, the MUX de-multiplexes the aggregate data stream, from the QAM Modulator, into its separate components, typically providing two data streams to the two Audio Decoders. The MUX can also de-multiplex any other data that was added to the data stream in the link, directing these to the data channels on the MUX card I/O.

6.3 Audio Decoder

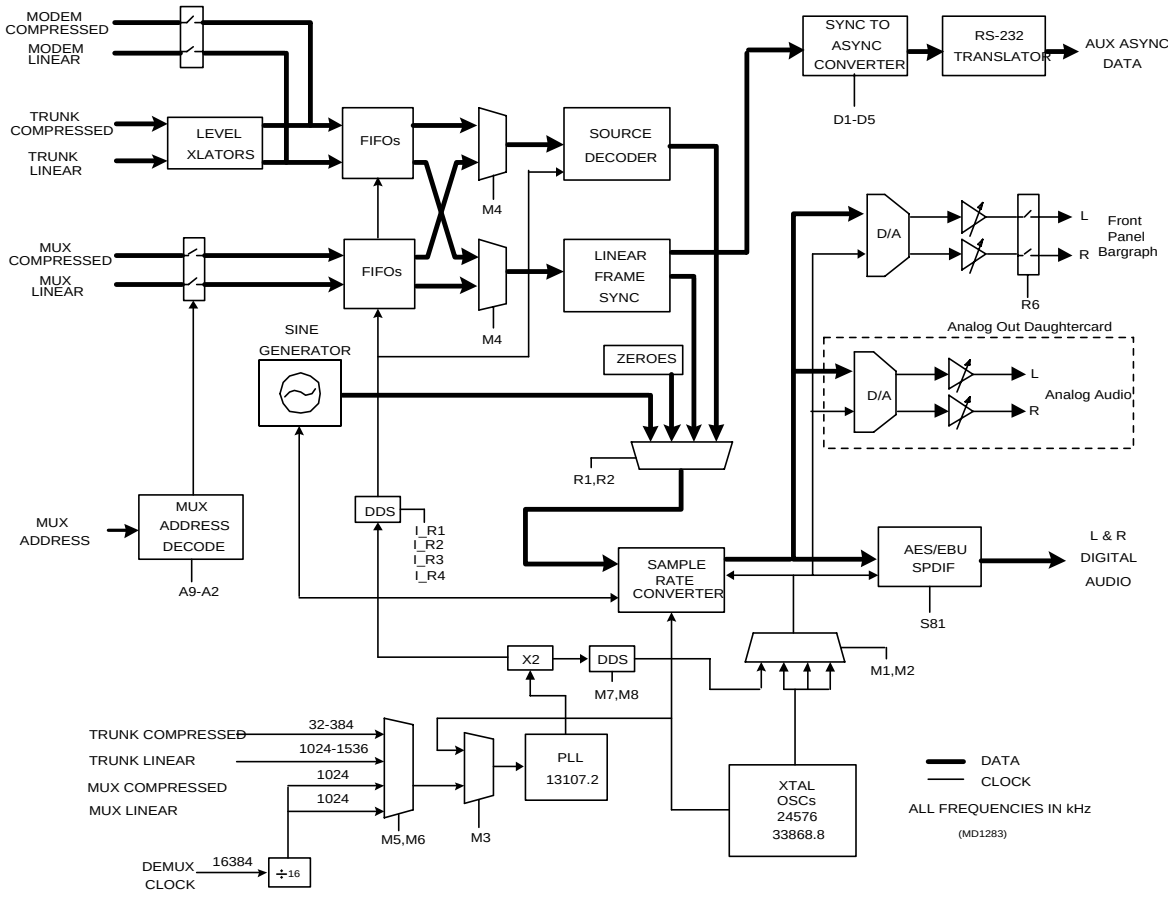


Figure 6-3. Audio Decoder Block Diagram

The Audio Decoder module accepts the data stream and the recovered clock from the backplane (MUX or T1 card). This data (compressed or linear) is fed to the FIFO (First In First Out) buffers. The data is then passed through the FIFOs to an initial data multiplexer. Sine wave and "zeros" test signal generators are available on the card (switch selectable) for system testing.

Compressed: The audio decoder add-on card decodes the compressed data per the appropriate algorithm (ISO/MPEG or ADPCM). This decoded information is passed on to the Sample Rate Converter (SRC) via a second data multiplexer.

Linear: Using embedded coding, the linear inputs are analyzed and synchronized for transmission to the Sample Rate Converter via a second data multiplexer.

The second data multiplexer chip selects one of the three inputs (Compressed Audio Decoder, Linear Frame Sync, or Internal Sine Generator) that will be sent to the SRC. As an option, zeros can also be sent through the multiplexer chip to test the noise floor.

The SRC receives the data stream via the second data multiplexer. This information is compared to the clock rate determined at switches M7 and M8 for conversion to the final output decoding segment.

From the SRC, the data is bussed to the AES/EBU encoder for left and right digital audio output, to the 16 bit D/A converter (located on the Analog Out daughtercard) for the main analog channel outputs, and to a 12 bit D/A converter that provides an analog output to the bargraph monitor on the front panel.

The clock source provides the ability to synchronize the various components of the system with a single device, such as the on-board crystal oscillator, the internal multiplexer clock, the bus, the AES/EBU input, the trunk, etc. The user can determine whether the card will generate its own clock or if it will use a different source's clock as reference. This information is then sent to the SRC for conversion of the incoming data to the rate of desired output.

7. T1 Relay

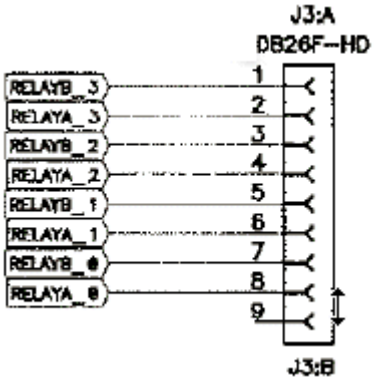
With the T1 Relay feature installed, the SL9003T1 can be configured to automatically engage the T1 Relay when there is a break in the T1 line. The Fault Log (available from the Front Panel menus) will identify when the break occurred and if the T1 line ever recovered. This information will also help to determine the cause of the failure (i.e., the SL9003T1 itself or the T1 line provided by the telephone company). T1 Relay features include:

- The T1 relay will be engaged when there is a break on the T1 line
- The front panel will show a fault when the T1 link breaks
- The time the link was lost and the time link recovery will be indicated in the fault log
- The relay can be configured for a delay [1 to 20 seconds] after a fault is defected.
- The T1 Relay can be enabled or disabled.

The T1 Relay is only available for installation in the SL9003T1 product line. It requires a special version of the I-Mux firmware (FPGA) and a special version of the NMS firmware. This feature also required special order from Moseley. Contact your sales representative for details.

7.1 Relay Configuration

- The PVG612 Series Photovoltaic Relay is a single-pole, normally open solid-state relay that can replace electromechanical relays in many applications. It utilizes International Rectifier's proprietary HEXFET power MOSFET as the output switch, driven by an integrated circuit photovoltaic generator of novel construction. The output switch is controlled by radiation from a GaAlAs LED which is optically isolated from the photovoltaic generator. Additional details are available at: http://www.datasheetcatalog.com/datasheets_pdf/P/V/G/6/PVG612.shtml.
- Relay #3 corresponds to Relay #4 on the front panel of the NMS (Pins 1 and 2 of the Connector). This relay is energized when the T1 is faulty.



- The Ext I/O Connector on the NMS card is the Relay Connector. Facing the back of the unit, the top left pin is Pin 1. Pin 2 is immediately below it. This represents Relay #4 on the front panel.

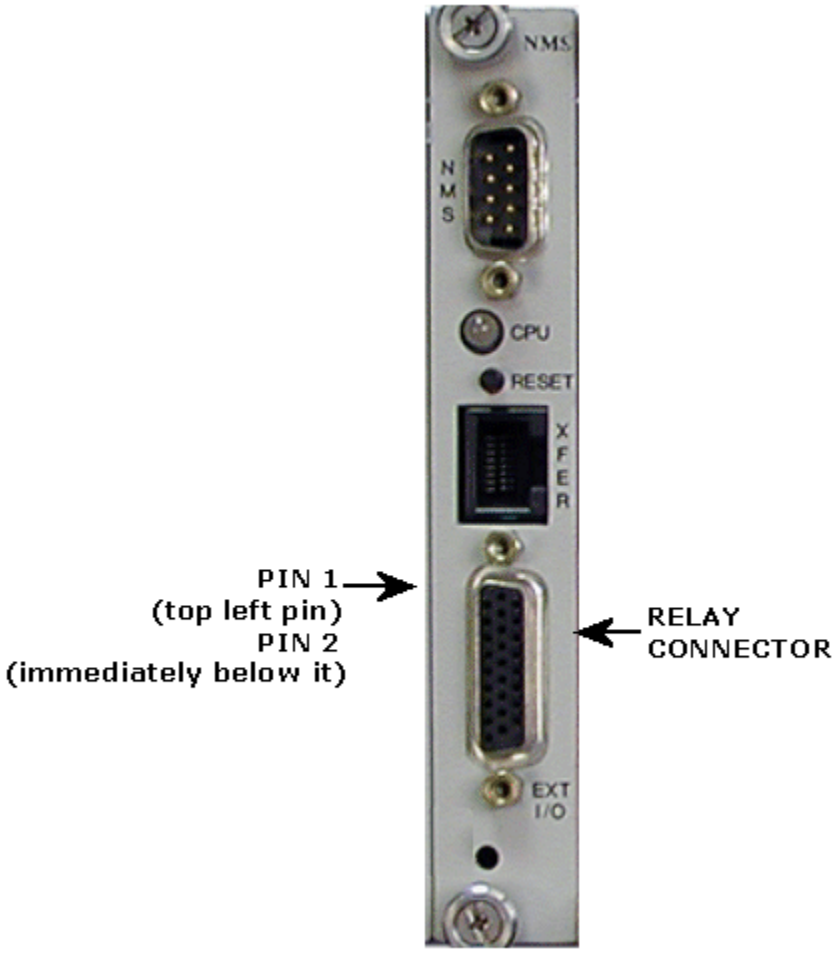


Figure 7-1. T1 Relay Connector

7.2 Using The T1 Relay

With the T1 Relay installed, you can:

- Configure when T1 Relay is activated
- Be notified of a T1 link failure with the FAULT LED
- Examine the Fault Log

7.2.1 Configure The T1 Relay

You can enable and disable the T1 Relay and configure the number of seconds of T1 link failure before the T1 Relay is activated in the SL9003T1 front panel menus.

NOTE: See Section 4 if you need more information about how to use the SL9003T1 front panel menus.

- Select SYSTEM from the Main Menu
- Select UNIT WIDE PARAMS from the SYSTEM menu.
- Press the DOWN-ARROW button until the following menu is shown:

```
# OF SECS            1-20
EN. MUX RLY?         YES
```

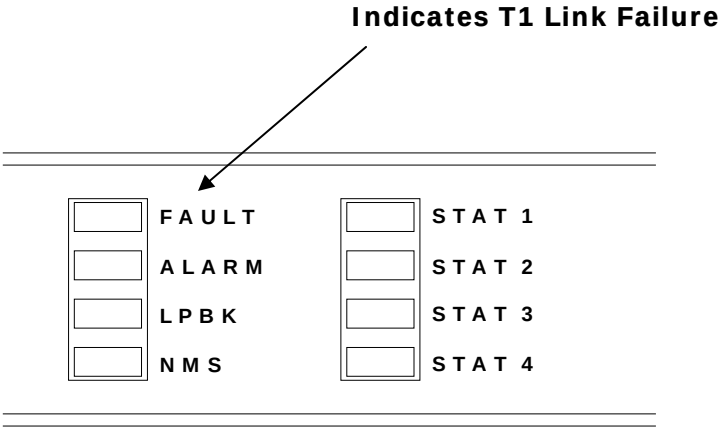
 # OF SECS: Press the LEFT-ARROW and RIGHT-ARROW buttons to select the period at which to detect failure (1...20 seconds). The default value is 5 seconds.

EN. MUX RLY: Press the LEFT-ARROW and RIGHT-ARROW buttons to enables (YES) or disable (NO) T1 Relay.

- Press the ENTER button to save the configuration.
- Press the ESC button to return to the SYSTEM MENU.

7.2.2 LED Indicator

When a T1 link failure occurs for the configured number of seconds, the FAULT LED on the SL9003T1 front panel will light and remain illuminated until the T1 link is restored.



7.2.3 Fault Log

Information about when the T1 Link failure occurred and recovered is stored in the Fault Log. The Fault Log is available in the SL9003T1 front panel menus.

- Select ALARMS/FAULTS from the Main Menu
- Select FAULTS from the ALARMS/FAULTS menu.

The LCD will show the most current faults indicating the date and time the T1 Link failed and recovered (if possible), which is shown below:

```
T1 error: RLY 4 ON
12:15:01 05/07/07
```

8. Customer Service

Moseley Associates will assist its product users with difficulties. Most problems can be resolved through telephone consultation with our technical service department. When necessary, factory service may be provided. If you are not certain whether factory service of your equipment is covered, please check your product Warranty/Service Agreement.

- Do not return any equipment to Moseley without prior consultation.
- The solutions to many technical problems can be found in our product manuals. Please read them and become familiar with your equipment.
- We invite you to visit our Internet web site at http://www.moseleysb.com/.

8.1 Technical Service

Please have the following information available prior to calling the factory:

- Model number and serial number of unit
- Shipment date or date of purchase of an Extended Service Agreement
- Any markings on suspected subassemblies (such as revision level)
- Factory test data, if applicable

Efficient resolution of your problem will be facilitated by an accurate description of the problem and its precise symptoms. For example, is the problem intermittent or constant? What are the front panel indications? If applicable, what is your operating frequency?

Technical consultation is available at (805) 968-9621 from 8:00 a.m. to 5:00 p.m., Pacific Time, Monday through Friday. During these hours a technical service representative who knows your product should be available. If the representative for your product is busy, your call will be returned as soon as possible. Leave your name, station call letters if applicable, type of equipment, and telephone number(s) where you can be reached in the next few hours.

Please understand that, in trying to keep our service lines open, we may be unable to provide "walk-through" consultation. Instead, our representative will usually suggest the steps to resolve your problem. Try these steps and, if your problem remains, do not hesitate to call back.

Emergency consultation is available through the same telephone number from 5:00 p.m. to 10:00 p.m. Pacific Time, Monday through Friday, and from 8:00 a.m. to 10:00 p.m. Pacific Time on weekends and holidays. Please do not call during these hours unless you have an emergency with installed equipment. Our representative will not be able to take orders for parts, provide order status information, or assist with installation problems.

8.2 Factory Service

Arrangements for factory service should be made only with a Moseley technical service representative. You will be given a Return Authorization (RA) number. This number will expedite the routing of your equipment directly to the service department. Do not send any equipment to Moseley Associates without an RA number.

When returning equipment for troubleshooting and repair, include a detailed description of the symptoms experienced in the field, as well as any other information that well help us fix the problem and get the equipment back to you as fast as possible. Include your RA number inside the carton.

If you are shipping a complete chassis, all modules should be tied down or secured as they were originally received. On some Moseley Associates equipment, printing on the underside or topside of the chassis will indicate where shipping screws should be installed and secured.

Ship equipment in its original packing, if possible. If you are shipping a subassembly, please pack it generously to survive shipping. Make sure the carton is packed fully and evenly without voids, to prevent shifting. Seal it with appropriate shipping tape or nylon-reinforced tape. Mark the outside of the carton "Electronic Equipment - Fragile" in large red letters. Note the RA number clearly on the carton or on the shipping label, and make sure the name of your company is listed on the shipping label. Insure your shipment appropriately. All equipment must be shipped prepaid.

The survival of your equipment depends on the care you take in shipping it.

Address shipments to:

MOSELEY ASSOCIATES, INC.

Attn: Technical Services Department
82 Coromar Drive
Santa Barbara, CA 93117-3024

Moseley Associates, Inc. will return the equipment prepaid under Warranty and Service Agreement conditions, and either freight collect or billed for equipment not covered by Warranty or a Service Agreement.

8.3 Field Repair

Some Moseley Associates equipment will have stickers covering certain potentiometers, varicaps, screws, and so forth. Please contact Moseley Associates technical service department before breaking these stickers. Breaking a tamper proof sticker may void your warranty.

When working with Moseley's electronic circuits, work on a grounded antistatic surface, wear a ground strap, and use industry-standard ESD control.

Try to isolate a problem to a module or to a specific section of a module. Then compare actual wave shapes and voltage levels in your circuit with any shown on the block and level diagrams or schematics. These will sometimes allow the problem to be traced to a component.

8.3.1 Spare Parts Kits

Spare parts kits are available for all Moseley Associates products. We encourage the purchase of the appropriate kits to allow self-sufficiency with regard to parts. Information about spares kits for your product may be obtained from our sales department or technical service department.

8.3.2 Module Exchange

When it is impossible or impractical to trace a problem to the component level, replacing an entire module or subassembly may be a more expedient way to correct the problem. Replacement modules are normally available at Moseley Associates for immediate shipment. Arrange delivery of a module with our technical services representative. If the shipment is to be held at your local airport with a telephone number to call, please provide an alternate number as well. This can prevent unnecessary delays.

8.3.3 Field Repair Techniques

If an integrated circuit is suspect, carefully remove the original and install the new one, observing polarity. Installing an IC backward may damage not only the component itself, but the surrounding circuitry as well. ICs occasionally exhibit temperature-sensitive characteristics. If a device operates intermittently, or appears to drift, rapidly cooling the component with a cryogenic spray may aid in identifying the problem.

If a soldered component must be replaced, do the following:

- Use a 40W maximum soldering iron with a 1/8-inch maximum tip. Do not use a soldering gun. Excessive heat can damage components and the printed circuit. Surface mount devices are especially heat sensitive, and require a lower power soldering iron. If you are not experienced with surface mount components, we suggest that you do not learn on critical equipment.
- Remove the solder from the component leads and the printed circuit pads. Solder wicking braid or a vacuum de-solderer is useful for this. Gently loosen the component leads and extract the component from the board.
- Form the leads of the replacement component to fit easily into the circuit board pattern.
- Solder each lead of the component to the bottom side of the board, using a good brand of rosin-core solder. We recommend not using water-soluble flux, particularly in RF portions of the circuit. The solder should flow through the hole and form a fillet on both sides. Fillets should be smooth and shiny, but do not overheat the component trying to obtain this result.
- Trim the leads of the replacement component close to the solder on the pad side of the printed circuit board with a pair of diagonal cutters.
- Completely remove all residual flux with a cotton swab moistened with flux cleaner.

For long-term quality, inspect each solder joint – top and bottom – under a magnifier and rework solder joints to meet industry standards. Inspect the adjacent components soldered by the Moseley production line for an example of high reliability soldering.