JungleMUX T1 Multiplexerer

Multiplexing Solutions for Critical Communications
The JungleMUX T1 Multiplexer (T1MX) is a powerful, flexible and reliable solution for converged service networks. The JungleMUX T1MX extends critical channel access into harsh utility environments over microwave radio, leased line and dedicated fiber optic or copper cable networks.

Key Benefits
• Secure and dependable transport of critical utility information over public or private communication infrastructures
• Supports standalone T1 networks, T1 spurs and T1 access applications for higher order systems
• Upgradable to a JungleMUX SONET Multiplexer to satisfy increasing bandwidth requirements
• Network managed providing complete system monitoring and diagnostics for each individual DS0 channel

Application Specific Solutions
Energy
• Communication between substations, generation plants, control centers and administration offices
• Supporting teleprotection, video surveillance, SCADA, substation automation, voice and data

Oil & Gas
• Communication between well clusters, production platforms, tank storage and control centers
• Voice, data, CCTV, IP/Ethernet telecom services for SCADA, safety/fire and security sub-systems

Water & Wastewater
• Communication between remote wells, dams, metering, treatment facilities, pumping / compressor stations and control centers
• Voice, data, CCTV, IP/Ethernet, security and safety sub-systems

Transportation
• Communication for train platforms, traction power substations, wayside cabinets, maintenance facilities and control centers
• Data, voice, transducers and contacts, IP/Ethernet

Utility Hardened
• Meets IEEE 1613 specification for communications networking devices in electric power substations
• Reliable operation in extreme temperatures from -4°F to +140°F (-20°C to +60°C)
• Meets Earthquake Risk Zone 4 shock and vibration specification

Scalable Design
• T1 multiplexer with integrated Compact Digital Access X-Connect (CDAX)
• Supports a wide range of JungleMUX SONET compatible DS0 interface units including voice, data, teleprotection and Ethernet applications

Robust & Reliable
• Built-in test capabilities
• No external power converter required and no internal fans
• Hot swappable units eliminate the need to power down the multiplexer, minimizing traffic disruptions
• Optional 1:1 protected CDAX units improve reliability and circuit availability

Network Managed
• End-to-end circuit monitoring
• Integrated NMS solution with JungleMUX SONET Multiplexer networks
JungleMUX T1 Multiplexer

Application Flexibility
The JungleMUX T1 Multiplexer (T1MX), a part of the field proven JungleMUX digital transport and access system, supports a wide range of DS0 applications.

The T1MX can be deployed in several network configurations such as:

- Terminal multiplexer
- Add/Drop multiplexer
- Cross connect configuration

The T1MX’s Compact Digital Access and X-connect (CDAX) unit provides integrated multiplexer control including network management, T1 line interfaces and DS0 cross connect. The 96 x 96 cross connect permits the grooming and consolidation of DS0 channels between multiple T1s, or from multiple T1s to a T1 drop port on the CDAX unit paddleboard.

The T1MX can be used in T1 leased line, microwave radio, or SONET networks, as well as dedicated copper and fiber optic cable applications. Standalone T1 networks connecting multiple facilities, or multiple sites within a single large facility, provide an efficient and cost effective telecommunication solution.

The T1MX is a powerful solution to extend the reach of JungleMUX SONET Multiplexer networks.

The T1MX provides best of class solutions for electric power grid protection and control, pipeline control, as well as water, rail and highway mission critical applications.

Interface Units
Supporting a wide range of DS0 interface units, the JungleMUX T1MX has voice, data, teleprotection and Ethernet options. For high circuit count applications, the T1MX offers expansion shelves to grow with the network's requirements.

Reliability
Designed for critical infrastructure applications, the JungleMUX T1MX supports full duplex T1.102 (ITU-T G.703) 1.544 Mb/s channelized circuits ensuring low latency for DS0 applications.

With hot swappable units, the T1MX eliminates the need to power down the multiplexer for unit additions, minimizing traffic disruptions. In addition, the T1MX offers an optional redundant multiplexer control and T1 line unit (CDAX unit). This protects against CDAX unit failure and ensures rapid, automatic cutover to a hot standby CDAX unit, maximizing system uptime and reliability.

Local or Remote Configuration
Allowing simple installation, ongoing management and maintenance of the multiplexer, without expensive workstations, the JungleMUX T1MX offers local or remote configuration, performance monitoring and diagnostics. With settings and configuration parameters maintained in non-volatile flash memory, configuration is maintained after loss of power.

Network Management System
VistaNET provides remote configuration, monitoring and testing of all common equipment and telecommunication service interface units at any node in the system, minimizing disruption and maintenance costs. More than one user is able to simultaneously configure and monitor the system. Time stamped logging of alarms and intelligent processing of alarm lists, assists in identifying hard-to-find problems, facilitates alarm acknowledgement and provides immediate update on current system status.

Recording of network configuration changes provides an audit trail for future reference. A single integrated system view for interconnected and discrete network segments simplifies management. Security is enhanced through a multi-level password and privilege system with automatic expiration interval, controlled by a system administrator. Optical status information and BER statistics provide preliminary indications of system level problems, such as fiber cable and equipment component degradation.

Applications
Electric Power Utilities
Originally designed for the unique needs of electric power utilities, the JungleMUX T1MX system supports a wide range of specialty traffic including teleprotection (direct transfer trip and IEEE C37.94 optical interface to protection relays), surveillance video, substation automation, Ethernet WAN/IP and telephony.

High system availability is provided through redundant common equipment and compliance with industry standards.

The JungleMUX T1MX goes beyond industry standards for T1 communications by incorporating design characteristics that allow it to meet IEC/IEEE RFI, SWC and EMC standards for operation in harsh utility environments.

Industrial Facilities
The rugged design, compact size and low power consumption of the JungleMUX T1 Multiplexer makes it the ideal solution for oil and gas, water, as well as mining related applications.

The JungleMUX T1MX creates greater value by carrying a multitude of services such as low speed polling data, SCADA, power measurement data, video surveillance, Ethernet WAN/IP and PBX phone drop extensions over a single T1 link.

Transportation Corridors
For highway, roadway, bridge, tunnel, rail transit, freight railway, and airport applications, the JungleMUX T1MX system cost effectively integrates services previously provided by proprietary and legacy standards based equipment. For applications such as video surveillance, toll collection, traffic monitoring and control, VMS, emergency voice, SCADA, signaling and loop detection the JungleMUX T1MX is the multiplexer of choice.
Network Applications

The JungleMUX T1 Multiplexer can be deployed in a variety of applications, from T1 circuit extensions through leased lines, T1 microwave radio links and spurs, as well as in standalone T1 networks connecting multiple facilities or multiple sites within a single large facility.

Remote JungleMUX T1 Multiplexer (terminal multiplexer) connected via a T1 link to a JungleMUX SONET network. DS0 circuits from remote Site K are groomed into a T1 link for connection to Site E.

Remote JungleMUX T1 Multiplexers |Add/Drop| are connected to a JungleMUX SONET network over a T1 link. DS0 channels from Sites P and R are consolidated at Site Q and groomed for T1 connection to Site C.

Remote JungleMUX T1 Multiplexers are installed at Site J and Site K. DS0 channels from Site J and Site K are groomed and consolidated at Site D along with other DS0 channels and transported in a SONET shared VT to another site, such as Site A.
### Specifications

**T1 INTERFACES**
- **Line Rate**: 1.544 Mb/s ± 50 ppm
- **Line Code Options**: B8ZS, AMI
- **Framing Format**: SF, ESF
- **PRBS Generator**: 2^{11} – 1, 2^{15} – 1, 2^{20} – 1
- **Pulse Shape**: T1.102 Compliant
- **Nominal Line Impedance**: 100Ω balanced pair ± 5%
- **Connectors**: RJ-48C for 100Ω T1, LC for SFP optical T1

**DATA INTERFACES**
- **Low Speed Data**: Sub-rate multiplexing, Point-to-point and multi-point
- **High Speed Data**: 64 (56) kb/s rates, RS422, V.35, G.703 and OCUDP interfaces
- **Nx64 kb/s Data Electrical**: N = 1 to 12 64 kb/s channels, V.35 and Ethernet bridge interfaces

**TELEMETRY INTERFACES**
- **Contact Input/Output**: Transport of contact closure

**VOICE INTERFACES**
- **4W VF**: Optional E&M signaling, Point-to-point and multi-point
- **2W VF**: Optional E&M signaling
- **2W Foreign Exchange**: Loop or groundstart signaling

**POWER**
- **24 VDC, 48 VDC, 130 VDC or 115 VAC choices**
- **Optional redundant power supply units**

**NETWORK MANAGEMENT**
- **VistaNET**, operating on MS-Windows based PCs, allows network access via JungleMUX T1 or SONET Multiplexer nodes for system monitoring and diagnostics
- **Alarm logging and time stamping**
- **Simple troubleshooting and network maintenance**
- **RS-232 serial and IP LAN access, as well as SNMP software license choices**

**ENVIRONMENTAL**
- **Operating Temperature**: -4° F to +140° F (-20° C to +60° C)
- **Storage Temperature**: -40° F to +158° F (-40° C to +70° C)
- **Humidity**: 5-95% non-condensing
- **Earthquake**: Earthquake Risk Zone 4 shock and vibration

**ENVIRONMENTAL – ELECTRIC POWER SUBSTATION**
- **Meets IEEE 1613, which includes the following**: EMI/RFI – IEEE C37.90.2
- **Isolation/SWC – IEEE C37.90.1**

**PHYSICAL DATA ON SHELF**
- **Height**: 5.25 inches (133 mm)
- **Width**: 19 inches (483 mm)
- **Depth**: 16.25 inches (413 mm)
- **Weight**: Dependent upon configuration