

# JungleMUX T1 Multiplexer



## 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

## 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 speciality 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.

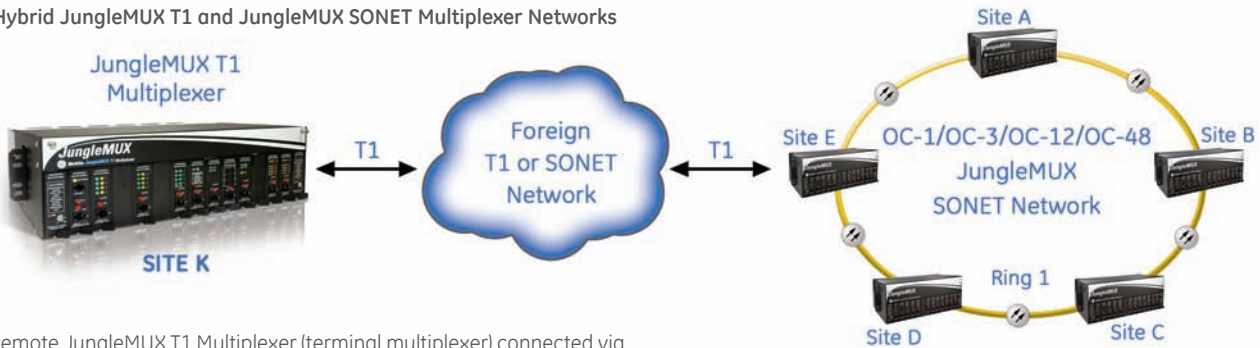
### Transportation Corridors

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.

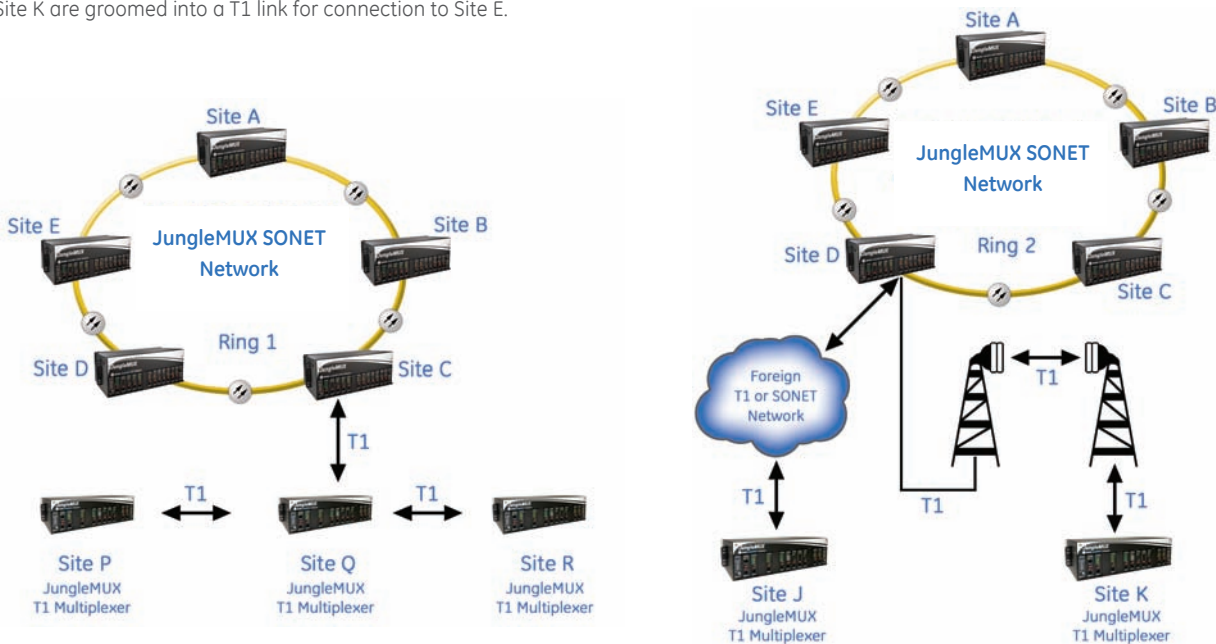
## Network Applications

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.

### Hybrid JungleMUX T1 and JungleMUX SONET Multiplexer Networks



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.

# JungleMUX T1 Multiplexer



- 19" rack mount
- 3 rack units (RU) high
- 15 shelf slot positions
- Optional redundant power supply and CDAX units
- Software configurable, no hardware dip switch settings

## Specifications

### T1 INTERFACES

Line Rate	1.544 Mb/s ± 50 ppm
Line Code Options	B8ZS, AMI
Framing Format	SF, ESF
PRBS Generator	2 <sup>11</sup> -1, 2 <sup>15</sup> -1, 2 <sup>20</sup> -1
Pulse Shape	T1.102 Compliant
	ITU G.703 Compliant
Nominal Line Impedance	100Ω balanced pair ± 5% resistive
Connectors	RJ-48C for 100Ω T1 LC for SFP optical T1
	3 pin header for both major and minor shelf alarm contact outputs
	3 pin header for shelf power supply(s) alarm contact input

### TELEPROTECTION INTERFACES

Transfer Trip	Separate Transmit and Receive units
Nx64 kb/s Data Optical	N = 1 to 12 64 kb/s channels
	IEEE C37.94 standard for fiber optic connection to protection relays

### DATA INTERFACES

Low Speed Data	RS232 interface Sub-rate multiplexing
High Speed Data	Point-to-point and multi-point 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
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### 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
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### 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

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