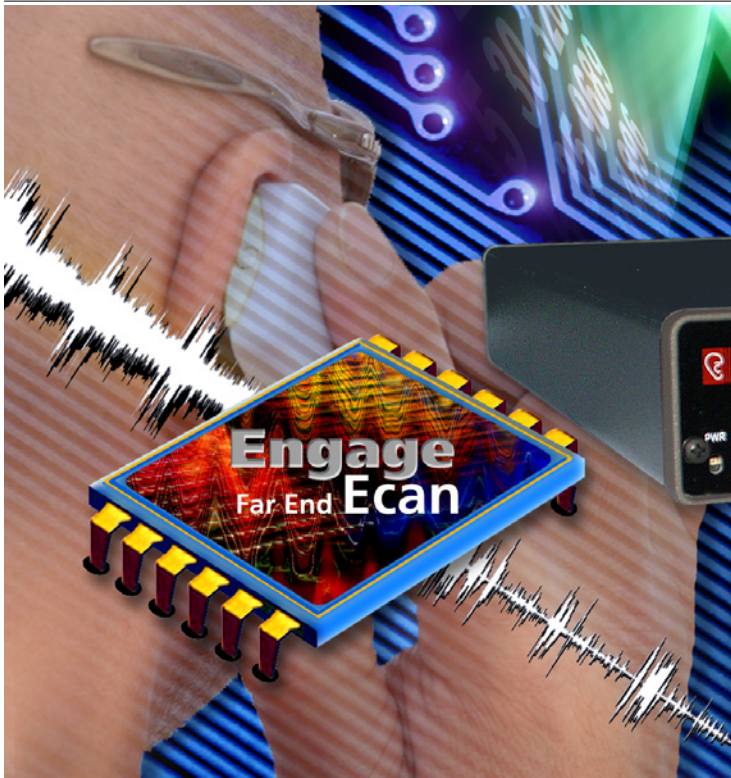


T1 Over IP for Voice with Echo Cancellor



T1 Circuit Extension Over IP

- ROI Measured in Weeks
- On-board Echo Cancellor
- Supports Legacy Switches/PBX
- Crystal Clear Voice across Internet
- Exploits Efficiency of IP/Ethernet

T1 Voice Over IP

The **IP•Tube DLT1-Ecan** encapsulates full and fractional T1 circuits into IP packets. T1 Over IP connections provide for the interconnection of PBXs and Telecom Switches via LANs, WANs, MANs, Satellite and Wireless Ethernet.

The **IP•Tube DLT1-Ecan** ships with two T1 interfaces with either 1 or 2 active and two 10/100 BaseT Ethernet Interfaces. The inactive T1 Port can be activated via a software-based license key for a pay as you grow option.

Transparent Interconnect

The **IP•Tube DLT1-Ecan's** transparent operation maintains the proprietary signaling required to support PBX features such as call conferences, call forwarding, caller ID and SS7.

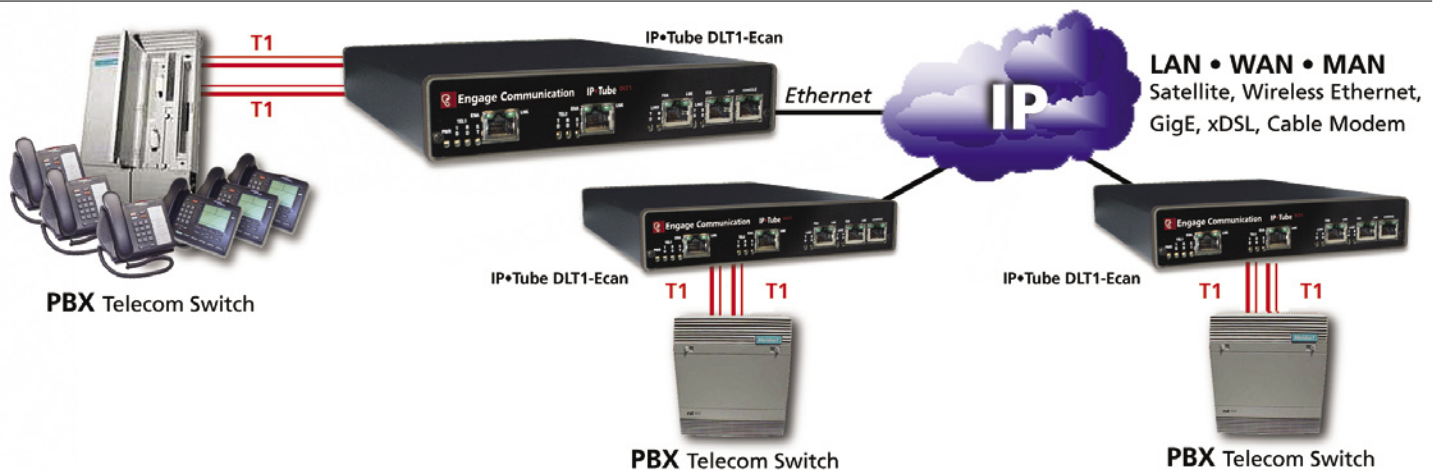
Echo Cancellor

The **IP•Tube DLT1-Ecan** has an integrated T1 Echo Cancellor that cancels up to 64 milliseconds of Far End echo. The echo canceller meets ITU-T G.164, G.165 and ITU-T G.168 requirements for echo cancellation.

Signaling Support

PRI ISDN, SS7, ESF, D4, SLC-96, Proprietary out of band, and robbed bit signaling is supported. Echo cancellation is automatically disabled during FAX and Modem communications. Transparent support for Modem or Fax. Voice quality is not compromised.

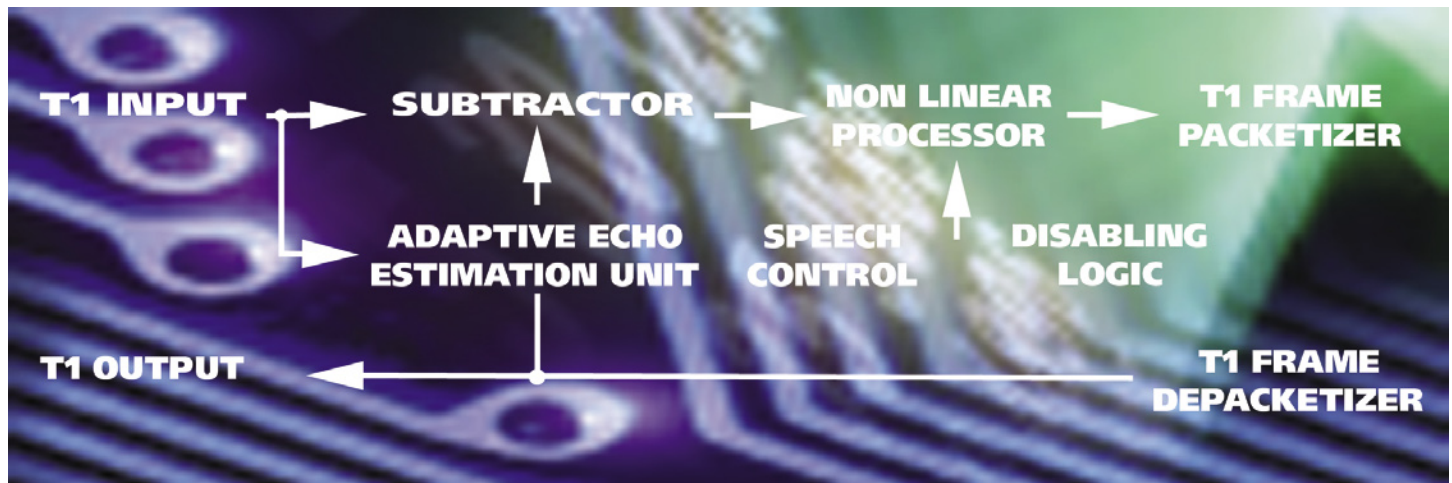
Legacy phone equipment investment is preserved.



Far End Echo Cancelling

IP•Tube DLE1-Ecan utilizes a Digital Signal Processor that detects and cancels echo at the far end so that the packet network delay has no impact on echo. The echo canceller samples the voice signal, estimates and removes the echo, leaving the original speech. The linear digital signal processor (DSP) models the echo and performs the main echo cancellation task. A non-linear DSP processor is then optimally employed to subtract out any residual echo or reflected noise components.

Echo is one of the most important factors that affects voice quality. The presence of echo depends on both echo level and echo delay. The primary source of echo is the impedance mismatch at the hybrid that links a 2-wire analog loop to a 4-wire digital trunk. The hybrid is not completely efficient in carrying the electrical energy and a certain amount of the electrical energy, or voice signal, is reflected back and may be perceived as echo. Occasionally, acoustic feedback of certain phones also causes noticeable echoes. These sources of echo are able to be cancelled by the human brain as long as the time between our speech and the echoed speech is not greater than 32 milliseconds.



Engage's T1 Over IP products have a minimum delay configuration, 1 millisecond packetization and 4 packet buffering, which introduces a round trip delay of 5 milliseconds. The amount of delay introduced by the packet network depends upon its switching times, packet processing, packet jitter, transmission, loading and quality of service configuration.

For example a network connection that utilize Gigabit Ethernet switches, which introduce delays in the microseconds, does not require echo cancellation. Wide Area Networks that traverse an intranet or internet backbone have varying degrees of delay which can easily exceed 28 milliseconds. Total round trip delays in excess of 32 millisecond makes echo perceptible.

The IPTube's Echo Cancellation provides the elasticity to support clear connections across networks with significant delay and packet jitter.

T1 Private Line Services over IP

Businesses, Education Districts, Universities, National, State and Local Government, incur significant recurring monthly costs for rigid-bandwidth leased lines used only for the interconnection of PBXs and Telecom switches.

The **IP•Tube DLT1-Ecan** provides enterprises with the ability to interconnect their existing phone systems over flexible bandwidth lines that are used to carry data, voice, and video. The Voice Only Leased Line Toll charges assessed by long distance and local carriers are eliminated or dramatically reduced by transporting voice traffic across:

LANs

The most compelling option for the interconnection of T1 based systems is when it can be accomplished over a Local Area Network. The deployment of Fiber based LANS such as FDDI and Gigabit Ethernet, provides organizations with high performance and high quality bandwidth that is especially well suited for the interconnection of PBXs and Telecom Switches.

WANs

Wide Area Networks that have sufficient bandwidth and Quality of Service provisioning result very significant cost savings especially for Multinational Corporations. The **IP•Tube DLT1-Ecan-C** with loss less data compression, detects idle and redundant data within each voice circuit resulting in a 56 to 1 bandwidth savings. WAN bandwidth is not consumed by silence or redundant samples.

T1 PBX over IP Broadband Networks

Broadband Service Providers

Companies, that are able to provide IP Ethernet access networks generate new revenue by offering traditional T1 leased line and private line services, such as:

Cable Operators

Cable operators connect traditional T1 leased line and private line services over their hybrid fiber coax (HFC) cable networks. HFC Cable network latency typically requires echo cancellation.

Metropolitan Area Networks

Metropolitan carriers with IP or Ethernet access networks deliver traditional leased line and private line services.

Utilities

Utilities generate new revenue by offering traditional T1 leased line and private line services over their fiber or power line networks.

Incumbent Carriers

Telcos reduce costs by delivering profitable leased and private line services over their flexible Ethernet infrastructures.

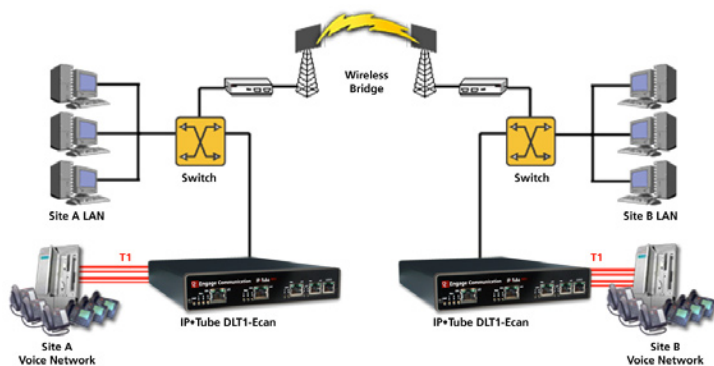
CLEC PBX Back Haul

The **IP•Tube DLT1-Ecan** provides CLECs with a way to back haul T1 DS0s from a customer's phone systems over their Internet connection. The back hauled DS0s are connected to the CLECs phone switch for connection to the Public Switched Telephone Networks. Local Exchange Carriers are able to offer an economical alternative to the local Phone Company.

Wireless Ethernet

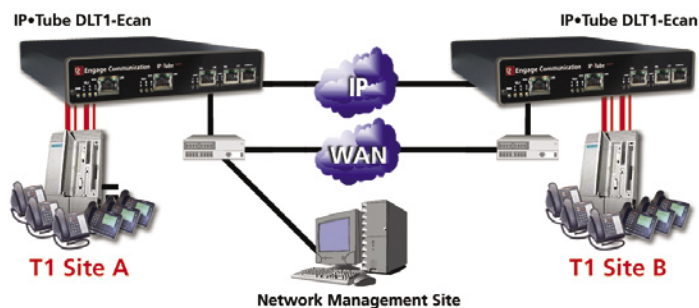
Connecting phone systems across a wireless Ethernet connection has a return on investment that is measured in weeks. Eliminating the wired connection for the T1 based communication equipment is made possible with the **IPTube's** T1 Over Ethernet capability.

Echo Cancellation enables Wireless connections to support T1 Over IP real time connections in a point to multipoint configuration.



VPN Network Management

Interconnecting the **IP•Tube DLT1-Ecan** through a Virtual Private Network with sufficient real time committed information rate ensures that the required quality of service is provisioned. The second Ethernet interface provides a management port. Each LAN interface features independent IP network configurations.

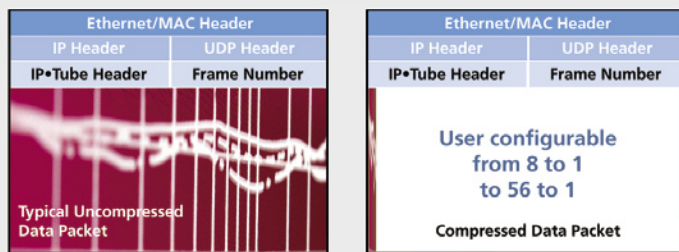


IP•Tube DLT1 Optional Features

Lossless Data Compression OPTION

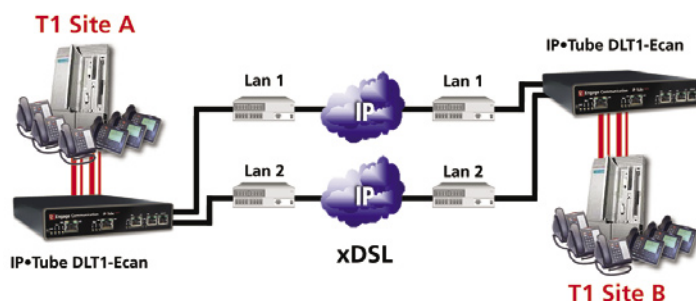
The **IP•Tube DLT1-Ecan-C** continuously detects idle and redundant data within each T1 Voice circuit resulting in as much as a 56 to 1 bandwidth savings.

TDM over IP WAN bandwidth is not consumed by silent or redundant circuits. Note: Compression only supported with **IPTube•DLT1-Ecan-C** models.



Alternator Load Balancing OPTION

The **IP•Tube DLT1-Ecan-ALT** Alternator option alternatively sends the IP packetized T1 frames on LAN 1 and LAN 2. The Alternator option enables fractional and full T1 circuits to be split over two IP WAN connections such as xDSL. The Lossless Data Compression option can be combined with the Alternator option to minimize the bandwidth required from the alternative paths.



Pay-As-You-Grow Field Upgrades

The IP•Tube DLT1 Ecan are designed for Pay-As-You-Go growth from 1 T1 to 2 T1s. Customers can elect to economize initial installations, buy purchasing a single active T1 port and enable the additional T1 Port via a software-based license key.

Field Upgrade benefits are extended to our Industry-Best Loss less Data Compression. Just as T1 ports are field upgrade able, so is Loss less Data Compression. At any time, each T1 port on the IP-Tube DLT1-Ecan can be upgraded to Loss less Data Compression with a simple software-based license key installation. If you determine that your IP•Tube DLT1-Ecan is best deployed with Loss less Data Compression, your still in business with the per port field upgrade!

Rack Mount Kit

The IP-Tube family is ready for central office or data center environments with 17" and 23" Rack Mount Kits.

Technical Specifications

LAN Network Interface:

- Two 10/100BaseT Full/Half Ethernet
- Autonegotiation or Configurable Speed and Duplex

LAN Network Protocols Supported:

- IP, TCP, UDP, ICMP

Echo Canceller:

- Voiceband Echo Cancelling according to ITU G.165 and G.168
- u- and A-Law coding according to ITU G.711
- 24 channels with end echo path delay of less than 63.75 ms

T1/Fractional T1 Specifications:

- One or two Port Models • Connects directly to T1 or DS1
- Framing - ESF or D4 • Coding - B8ZS or AMI
- Supports DS0 assignments from 1 to 24
- Not Contiguous Configuration x-y,z Supported

T1 Over IP Protocol:

- TDM Over IP
- Circuit Extension Services Over IP - CESOIP
- HDLC Over IP - HDLCOIP
- Frames Per Packet Configurable 8 to 56
- Low Latency Mode: 1 millisecond 8 T1 frames

Lossless Data Compression Option:

- Detects idle and redundant data within each DS0
- Interconnect bandwidth is not consumed by silent or redundant data
- Compression settings from 8 to 1 to 56 to 1



TFTP Online Upgrade Capable (FLASH ROMs)

- IPTube is fully operational during upgrade

Quality of Service Support:

- IP Type of Service (TOS) CLI configurable • IANA Registered UDP Port 3175

Regulatory:

- CE • Safety -IEC60950
- EMC - CFR 47 Part 15 Sub Part B:2002,
- EN55022:1994+A1&A2, EN55024, ICES-003 1997, CISPR 22 Level A
- Telecom Part68

Management:

- Telnet support with Edit and Paste Template Files
- Console Port for Out of Band Management
- SNMP support (MIB I, MIB II) • Remote config., monitoring, & reset

Rear Panel/Power:

- 12-24 VAC/VDC, 1.0A. International Adapters Available
- Optional -48V 0.25 Amp
- Dimensions: 9" (L) x 7.3" (W) x 1.50" (H)

How to Order — IP•Tube DLT1-Ecan

Part No.	Description	Notes
221-1544-0x	IP•Tube DLT1-Ecan, xT1 (x=1 - 2 Ports)	Base Model Specify # of T1 Ports Enabled
222-1544-Cx	IP•Tube DLT1-Ecan with xT1 Compression	w/Lossless Data Compression Option
Base Option		Specify as suffix
-ALT	IP•Tube Alternator Load Balancing	Enable Alternator Load Balancing
Power Options		Specify as suffix
-DCMOD	Power Module 12/26 VDC/AC ADAPTER	Ships with Universal Adapter 90/240 50/60
-WIREDC	Power Supply Module 12/26 VDC Screw Term	
-N48VDC	Power Supply Module Negative 48 Volt DC	Isolated Negative 48 Volt Power
Rack Mount Option		
-RACKMNT	19" Wide Rack Mount Brackets	Enclosure Nut Serts Installed