

# AceCom Networks

## **VCL-T1oP (2T1 Port FE Version) E1 over Packet / TDM over IP**

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### Product Brochure & Data Sheet

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## Product Overview

AceCom 'VCL-T1oP' T1 over Packet (2 T1 Port FE Version) TDM over IP equipment supports transmission of up to 2 x T1 links over IP / Ethernet, MEF or MPLS networks.

The 'VCL-T1oP' T1 over Packet (2 T1 Port FE Version) TDM over IP equipment, equipped with a powerful ARM-Cortex Processor which provides a highly reliable clock recovery mechanism for low jitter and wander control, even under variable network conditions.



2 x T1 Port T1oP (T1 over Packet) TDM over IP equipment is available with various Electrical (10/100BaseT) and Optical (100BaseFX) Ethernet port options which allow the users to implement 1+1 add-drop (Drop-Insert), Ethernet link redundancy (using Port Trunking / Port Bonding) and 802.1p based QoS mechanisms for network optimization.

The 'VCL-T1oP' T1 over Packet (2 T1 Port FE Version) TDM over IP equipment also optimizes on the network usage, such that the bandwidth used by the T1oP equipment on the packet network is limited to the corresponding to the number of T1 ports and the time-slots that are being transported over the Ethernet / packet network.s and the time-slots that are being transported over the Ethernet / packet network.

## Purpose of T1oP technology

Telecom companies and enterprise users can save significant network and equipment cost and generate additional revenue by offering different types of services over a single packet-switched infrastructure by the use of T1oP equipment. The T1oP equipment is also suitable for connecting to Ethernet / packet wireless equipment to achieve fast deployment of T1 services over wireless Ethernet networks. One particular application is to build T1 links with low cost Wireless LAN bridges, replacing expensive TDM / T1 microwave radios.

The 2 x T1 over Ethernet (VCL-T1oP) multiplexer may be used to provide legacy TDM services over Ethernet optical fiber, or wireless Ethernet/IP networks.

## How the 'VCL-T1o IP' (2 T1 Port FE Version) equipment works

The T1 data streams received on the T1 interfaces are converted by the T1oP engine of the T1oP equipment to Ethernet data packets (of a fixed size) and transported over the Ethernet network with UDP / IP, MEF or MPLS headers. At the receiving end the T1oP reconstructs the original data streams by removing the IP, MEF or MPLS headers and converts the Ethernet data packets back to T1 frames using highly reliable and accurate clock recovery mechanism. The 'VCL-T1oP' (2 T1 Port FE Version) offers the user a choice of standard, T1 to packet and packet to T1 conversion mechanisms that include SAToP and CESoPSN technologies.

## Hardware Highlights

- › 19-Inch rack mountable
- › 1U form factor (44mm high)
- › 1+1 Redundant Power Supplies, AC and DC, or AC plus DC
- › Redundant power supply inputs
- › Extended Temperature Range: (-20° C to +60° C)
- › EMI / EMC Complaint
- › Real time battery backed clock with life in excess of 10 years
- › Power over Ethernet (PoE) - Optional

### T1 Clock recovery and synchronization techniques:

- Adaptive Clock Recovery (ACLK)
- Recovered Clock (RCLK) / Loop-Timed Clock
- Asymmetrical (One-Clock and Two-Clock) Clock
- Synchronization to an External Clock (ECLK)
- Synchronization to an Internal Clock
- Automatic clock priority selection with fall back
- Plesiochronous Clocking

### Key Features - T1 and T1oP Interface

- Supports 2 independent T1 interfaces.
- Internal, External, Adaptive, Recovered clock and Asymmetrical (One-Clock and Two-Clock) options for the T1 TDM port synchronization. Automatic clock priority selection with fall back.
- Absolute and Differential times tamps.
- Jitter and Wander conforms to G.823 / G.824 and G.8261 and TDM specifications.
- Supports three T1 framing modes - Framed, Unframed and Multi-framed with CAS signaling.
- Supports IETF-PWE3 (pseudo-wire), SAToP and CESoPSN transport mechanisms.
- Supports CESoPSN payload mechanism to support the fractional T1 with data rate of 64Kbps to 2.048Mbps (DS0 timeslot level). User configurable data rate from 64kbps to 2048kbps, in steps of 64kbps.
- CESoPSN payload mechanism feature allows the user to optimize the packet switched network by limiting its usage to the corresponding number of timeslots carried by an T1 channel.
- Supports SAToP payload mechanism to transport full T1 (transparent to the structure of the TDM frame useful for transporting framed / unframed T1 channels).
- Supports network latency / packet delay variation / jitter buffer of up to 512ms.
- Supports IP, MPLS and MEF8 (Metro Ethernet) addressing.
- 120 ohms balanced T1 interfaces. Optional 75 Ohms BNC interface (120 Ohms to 75 Ohms cables provided).
- T1 Loopback facility for testing and diagnostics.

### Key Features - Ethernet / IP Network Interface

- Optical SFP based (100Base-FX) and Electrical (100Base-T) Ethernet port and PoE options.
  - ▶ 4 x 10/100BaseT Copper Ports.
  - ▶ 2 x 10/100BaseT Copper Ports, 2 x 10/100BaseT Ports with PoE.
  - ▶ 2 x 100BaseFX Optical Fiber Ports, 2 x 10/100BaseT Copper Ports.
  - ▶ 2 x 100BaseFX Optical Fiber Ports, 2 x 10/100BaseT Ports with PoE.
- 4 GigE Ports Point-to-point and point-to-multipoint applications based on IP addressing.
- Power over Ethernet (PoE) (available options as above). Meets and exceeds the Telcordia GR-1089-CORE Lighting and Power Contact Protection requirements.
- VTC Virtual Cable tester on all PHY (Electrical Ethernet) Ports.
- Point-to-point and point-to-multipoint applications based on IP addressing.
- Supports drop and insert applications.
- 1+1 Ethernet Link Redundancy (Hitless) Redundant Link Protection.

## Key Features - Ethernet / IP Network Interface Continued...

- Supports QoS, 802.1p based packet priority.
- Port Control Egress Mode (Tagged/ Un-Tagged/ Un-Modified) 802.1Q Mode.
- Q-in-Q Tagging.
- User configurable MTU (T1oP payload) packet size. May be configured from 1 to 1800 Bytes.
- Switch supports jumbo frame sizes of up to 2048 Bytes.
- Port based and Tag based VLANs Supports 1-4095 VLAN Ids.
- Supports Ethernet rate limiting on each port.
- Supports Packet priority assignment (IP Diffserv / DSCP).

## Key Feature - System Management, Monitoring and Alarm Interfaces

- NMS (Network Management System) to monitor multiple units from single Central Location.
- External Alarm - Dry contact relay alarms are also available at rear of the system to connect the system to an external alarm.
- Supports system temperature monitoring with High Temperature and Low Temperature alarms and SNMP Traps.
- Supports SNMP V2 Monitoring and Traps.
- UDP-specific "Special" Ethernet type.
- Self-test for checking system errors upon system bootup.
- Event Logging.
- Clock Performance Alarms.
- Network Performance Alarms.
- Network Performance Monitoring and Diagnostics.
- Online / remote upgrade of firmware.

## System Access, Control and Management Options

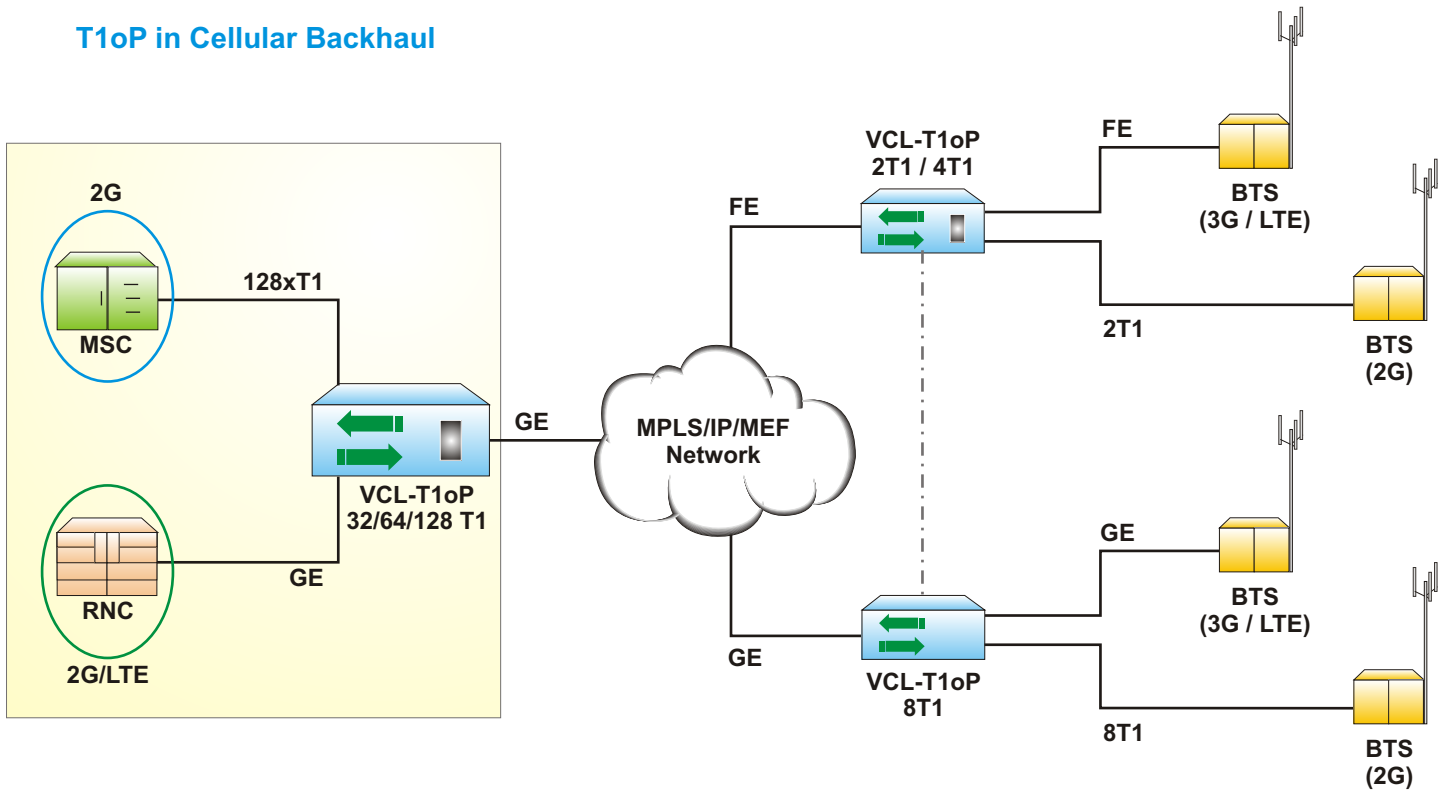
- Telnet.
- CLI Control Interface (HyperTerminal or VT100).
- SNMP V2 Traps (MIB File provided).
- Windows based GUI (Graphical User Interface) for easy configuration, management and access. Ability to monitor multiple units from a single NMS.
- Password Protection.

## OAM: Operation and Management Ports

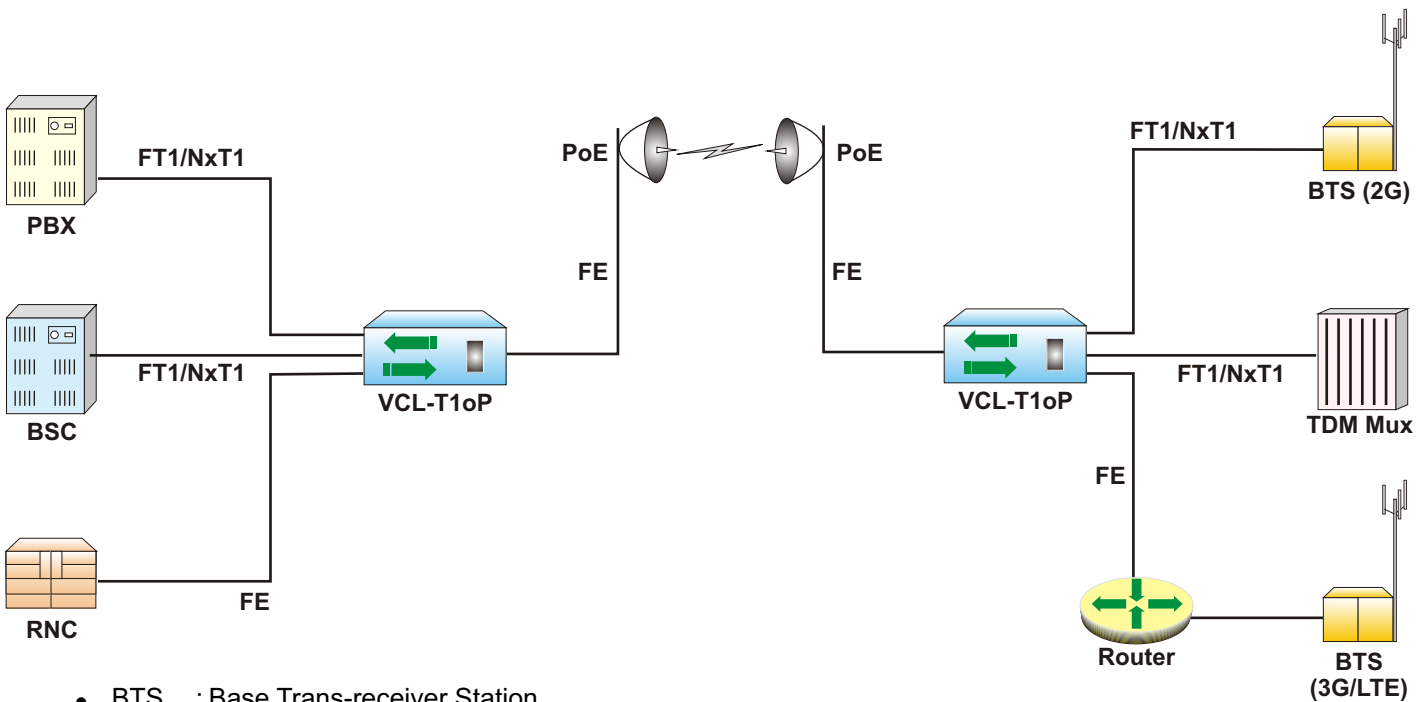
- RS232 (DB9) Serial Port.
- 10/100/1000BaseT Ethernet Management for In-band remote access.

**Application Diagram**

**T1oP in Cellular Backhaul**



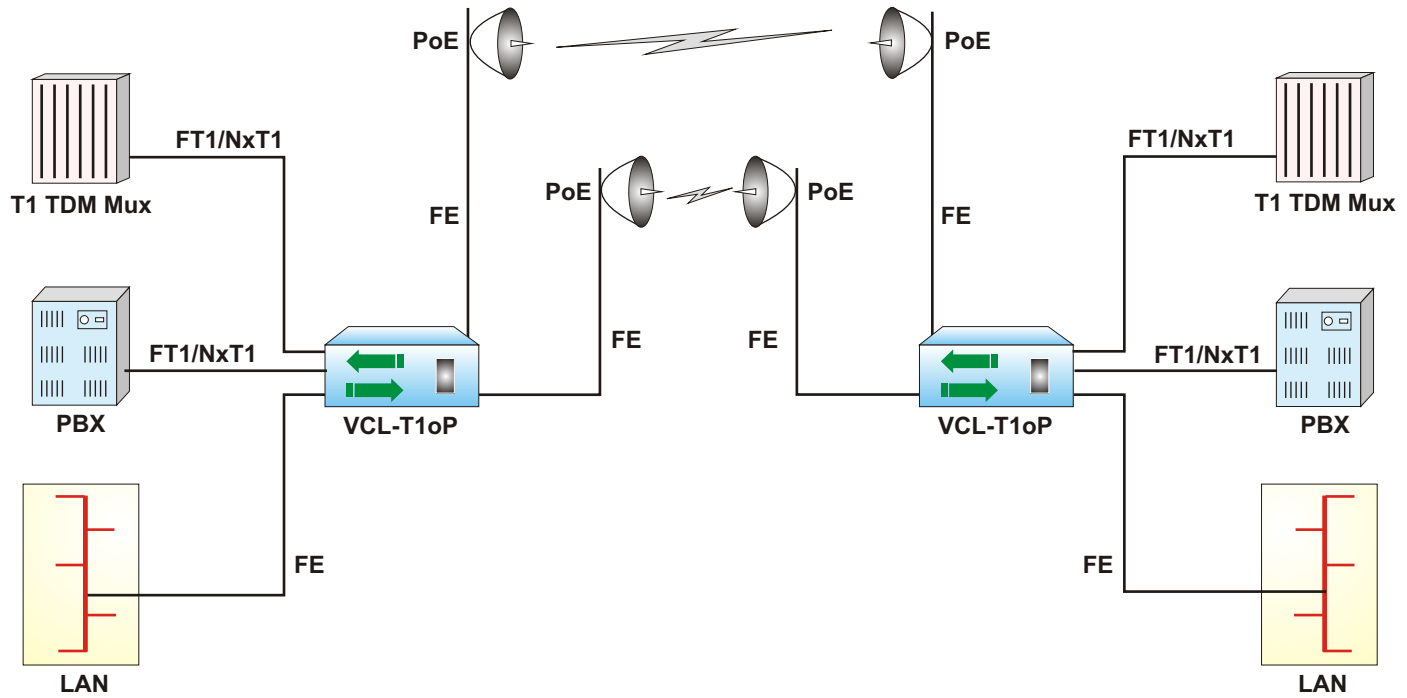
**Typical Application Diagram in Wireless Network**



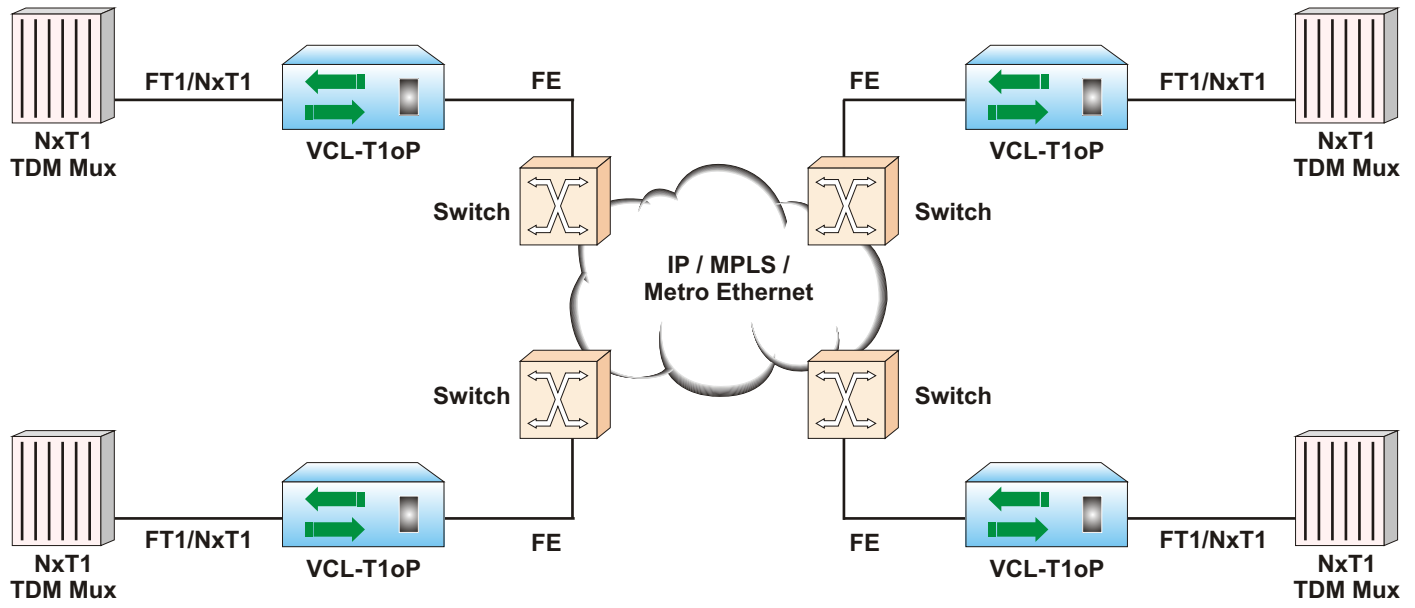
- BTS : Base Trans-receiver Station
- MSC : Master Switching Center
- RNC : Radio Network Controller
- LTE : Long Term Evolution
- FT1 : Fractional T1
- FE : Fast Ethernet
- GE : Gigabit Ethernet
- PoE : Power over Ethernet

**Application Diagram**

**Typical Application in Wireless Network - 1+1 Link Redundancy**



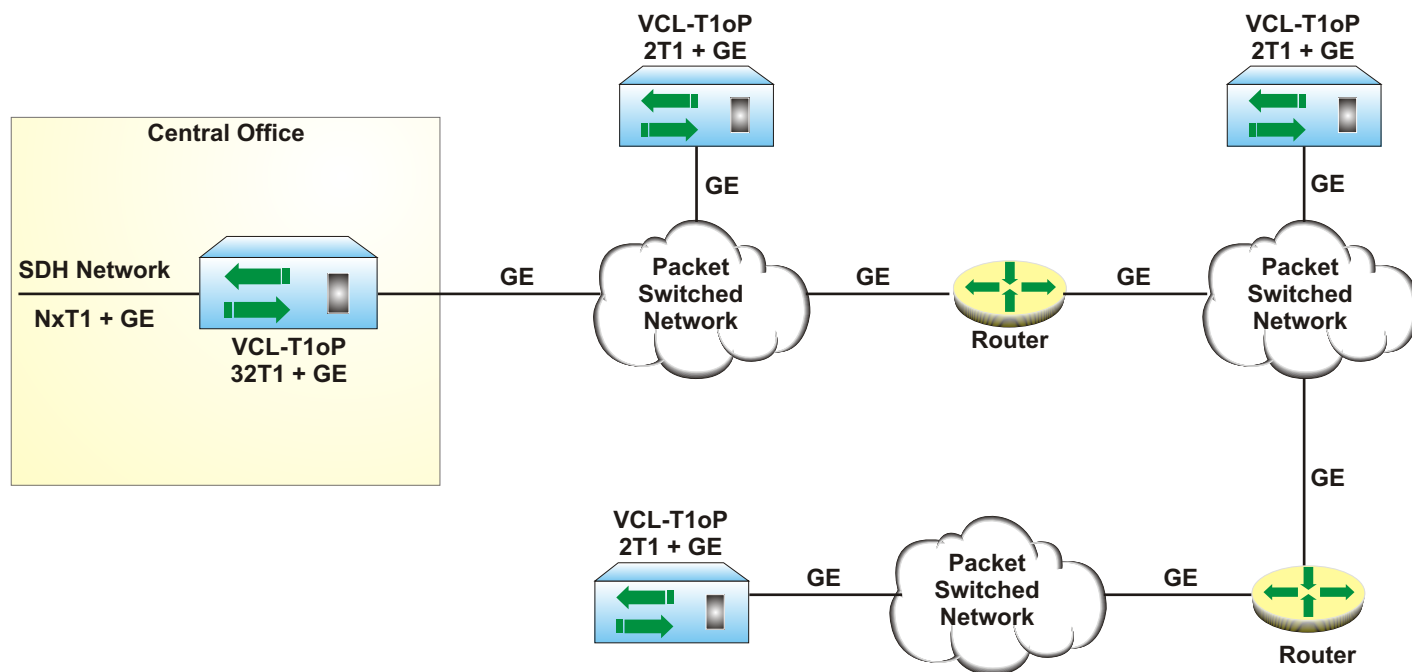
**Typical Application in Wired Network**



*Note: Application illustrate link protection using spanning Tree Protocol between all nodes.*

## Application Diagram

### T1s and Gigabit Ethernet Traffic over a Packet Switched Network



- BTS : Base Trans-receiver Station
- MSC : Master Switching Center
- RNC : Radio Network Controller
- LTE : Long Term Evolution
- FT1 : Fractional T1
- FE : Fast Ethernet
- GE : Gigabit Ethernet

## Technical Specifications

### T1oP Specifications

Max number of T1 Ports	Number of Ports 2
Max number of logical links	Up to 32
Synchronization clock	<ul style="list-style-type: none"> <li>- Adaptive Clock Recovery recovery (ACLK) Options</li> <li>- Recovered Clock (RCLK) / Loop-Timed Clock</li> <li>- Asymmetrical (One-Clock and Two-Clock) Clock</li> <li>- Synchronization to an External Clock (ECLK) and an Internal Clock</li> <li>- Automatic fall back</li> </ul>
Max number of Ethernet Ports	2 x FE (100BaseFX) Optical 2 x 10/100Base-T Electrical Ethernet Ports 4 x 10/100Base-T Electrical Ethernet Ports
Supported Transport	ETF-PWE3, SAToP and CESoPSN Mechanisms
Supported PSN (Packet Switched Networks) type	UDP, IP, MPLS and MEF
QoS	802.1q, 802.1p packet priority

### T1 Interface

Number of Ports	Number of Ports 2 (supporting 64Kbps upto 1.544Mbps on each port)
Framing Formats	Unframed, framed and Multi-frame (with or without CRC-4)
Line Coding	HDB3
Compliance	ITU-T G.703, G.704, G.706 and G.732
Jitter and Wander	Complies to ITU-T G.823, G.824
Line Impedance	120 Ohms balanced - Optional 75 Ohms
Protection	<ul style="list-style-type: none"> <li>- Optional Metallic and Longitudinal Protection</li> <li>- ESD protection</li> </ul>

### Ethernet Interface

Number of Ports	<ul style="list-style-type: none"> <li>- 2 x FE (100BaseFX) Optical Ethernet (SFP) Ports</li> <li>- 2 x 10/100Base-T Electrical Ethernet Ports Or</li> <li>- 4 x 10/100Base-T Electrical Ethernet Ports</li> </ul>
Electrical	10/100 Auto-negotiation/MDI-X (Auto-sensing), Full-Half Duplex, RJ45 Electrical Connector, PoE (Power of Ethernet) option on 2 x 10/100BaseT Ports
Protection	ESD protection
Optical	100Base-FX (Fast Ethernet), SFP
Power over Ethernet (PoE)	40 Watts per port
PoE Protection	Complies with Telcordia GR-1089-CORE Issue 6 Specifications and ITU-T K.44 (2012*) specifications
Maximum Frame Size	2048 Bytes (Jumbo Frames)



### 100BaseFX (Optical) Ethernet Specifications

Type	SFP
Compliance	MSA Compliant, RoHS, EMI, ESD, DDM
Safety	Class 1 Laser Safety / IEC-60825 Compliant
Bit Rate	100 Mbps
Wavelength	1310 / 1550 nm
Distance	550m to 120Kms, as per order
Optical Connector	LC

### Power Consumption

Power Consumption	<15 Watts (without PoE) PoE 40 Watts per channel
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### Power Supply Options

- Dual Redundant (AC + DC)
- 1+1 AC power (100 to 240V AC, 50/60 Hz)
- 1+1 DC (-48V) power (40 to 72V DC)
- 1+1 DC (-24V) power (18 to 40V DC)
- AC plus DC (AC + DC), AC or DC
- EMI/EMC compliant.

**Note:**\* Excludes 0.76A (300 Ohms) and 0.38A (600 Ohms) and 0.23 (1000 Ohms) AC Power Cross.

### Command Language

- Windows based GUI (Graphical User Interface).
- 1Command Line Interface (English text commands)

### Management and Control Interfaces

- COM Port (RS232 Serial Port)
- USB Port
- 10/100/1000BaseT Ethernet Port (each multiplexer may be assigned an IP address and connected to a LAN / IP network for remote access and management through the 10/100/1000BaseT Ethernet Port for in-band configuration, management and access).
- Telnet
- SNMP, V2
- Additionally, a Windows based GUI (Graphical User Interface) for easy configuration, management and access.

### AC Power Supply Specifications

Input AC Voltage	110 / 220 Volts AC
Range of input AC voltage	100 V to 240 V AC, 50Hz/60Hz.
AC Input Connector	IEC Connector

### 24V DC Power Supply Specifications

Power Supply	24V DC
Range of input	18V to 40V DC
Input voltage reversal protection	Provided
Under voltage protection	< 4.85V
Over voltage protection	> 5.15V
Efficiency at full load	> 90% @ 5V/8A (when input voltage 24V)
Ripple at full load	< 5mVrms
Spike at full load	< 50mV

### 48V DC Power Supply Specifications

Power supply	-48V DC
Range of input	-40V DC to -72V DC
Under voltage protection	< 4.85V
Over voltage protection	> 5.15V
Efficiency at full load	> 91% @ 5V/10A (when input voltage -48V)
Ripple at full load	< 5mVrms
Spike at full load	< 50mV

### Environment

Temperature	-20°C ~ +60°C for Operation
Humidity	5% to 95% (35°C) Non-condensing

### Regulatory Compliance

- Safety - IEC 60950 Safety - IEC 60950
- CE
- RoHS
- Complies to ANS/IEC standards
- Complies with Telecom Part 68, FCC Part 15 and CISPR 22 Class A
- EMC EN55022: 1998 + A1 and A2
- EMC EN55024,
- Operation ETS 300 019 Class 3.2
- Storage ETS 300 019 Class 1.2
- Transportation ETS 300 019 Class 2.3

### NMS (with Telnet) OAM port Specifications

Network Interface	RJ-45 Ethernet 10BaseT or 100BaseT-TX (auto sensing)
Compatibility	Ethernet Version 2.0IEEE802.3
Protocols supported	ARP, UDP/IP, TCP/IP, Telnet,SNMP
Management	SNMP, Serial login, Telnet login

### External Alarms

- 
- Dry Contact Relay - 2 Form C
  - Rated upto 72V DC, 1 Amp.
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### Chassis

- 
- 1U High (44mm)
  - 19-inch rack-mounting shelf
  - Also available in Desktop / Table Top Version.
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### Mechanical Specification

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Height	44 mm (1U)
Depth	260 mm
Width	480 mm (19 inch rack mountable)
Weight	4 Kgs.

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**Ordering Information**

S. No.	Part #	Product Descriptions	Remarks
1	VCL-T1oP-2T1 FE-4EE-XXXX	VCL-2T1 over Ethernet Multiplexer (T1 over Packet / TDM over IP) 19-inch 1U High Rack Mount version Supports: <ul style="list-style-type: none"> <li>● Upto 2 x T1 [RJ45 (F)]</li> <li>● 4 x Ethernet Ports [100Mbps, Electrical RJ45 (F)]</li> <li>● OAM [10/100BaseT Ethernet - RJ45 (SNMP, Telnet) and Serial Port (USB and DB-9 COM Port)]</li> </ul>	CORE UNIT without PSUs.
2	VCL-T1oP-2T1 FE-2OE-XXXX	OR VCL-2T1 over Ethernet Multiplexer (T1 over Packet / TDM over IP) 19-inch 1U High Rack Mount version Supports: <ul style="list-style-type: none"> <li>● Upto 2 x T1 [RJ45 (F)]</li> <li>● 4 x Ethernet Ports (100Mbps)                             <ul style="list-style-type: none"> <li>› 2 x Electrical Ethernet Ports [RJ45 (F)]</li> <li>› 2 x Optical Ethernet Ports [100Mbps SFP based / without SFPs]</li> </ul> </li> <li>● OAM [10/100BaseT Ethernet - RJ45 (SNMP, Telnet) and Serial Port (USB and DB-9 COM Port)]</li> </ul>	
3	VCL-T1oP-2T1 FE-2PE-XXXX	OR VCL-2T1 over Ethernet Multiplexer (T1 over Packet / TDM over IP) 19-inch 1U High Rack Mount version Supports: <ul style="list-style-type: none"> <li>● Upto 2 x T1 [RJ45 (F)]</li> <li>● 4 x Ethernet Ports (100Mbps)                             <ul style="list-style-type: none"> <li>› 2 x Electrical Ethernet Ports [RJ45 (F)]</li> <li>› 2 x Power over Ethernet (PoE) Ports [RJ45 (F)]</li> </ul> </li> <li>● OAM [10/100BaseT Ethernet - RJ45 (SNMP, Telnet) and Serial Port (USB and DB-9 COM Port)]</li> </ul>	
	applications	<ul style="list-style-type: none"> <li>● MPLS, MEF (Metro Ethernet)</li> <li>● CESoPSN, PWE3 (pseudo-wire), SAToP T1oP modes</li> <li>● T1 data rates of 64Kbps to 2.048 Mbps on each T1 port</li> <li>● Point-to-point, point-to-multipoint drop and insert</li> <li>● Alternate Route Protection (for 1+1 Ethernet link redundancy on WAN side)</li> <li>● Clocking options: Adaptive / Loop-timed / External / Internal / Asymmetrical (One-Clock and Two Clock)</li> </ul>	

**Power Supply Options**

1	AC220	1 x 100-240V AC Power Supply Input	Any One Option.
2	DC048	1 x (-) 48V DC Power Supply Input	
3	ACDC	1 x 100-240V AC Power Supply Input 1 x (-) 48V DC Power Supply Input	
4	AC220R	2 x 100-240V AC Power Supply Input [Redundant]	
5	DC048R	2 x (-) 48V DC Power Supply Input [Redundant]	

**Gigabit Ethernet SFP Options**

1	VCL-EMOD 0193	155Mbps Fast Ethernet SFP Transceiver Duplex LC, 1310nm, 15km, SMF	Maximum 2 SFPs per CORE UNIT As per Site Requirement.
2	VCL-EMOD 0194	155Mbps Fast Ethernet SFP Transceiver Duplex LC, 1310nm, 40km, SMF	
3	VCL-EMOD 0217	155Mbps Fast Ethernet SFP Transceiver Duplex LC, 1550nm, 80km, SMF	
4	VCL-EMOD 0156	155Mbps Fast Ethernet SFP Transceiver Duplex LC, 1550nm, 120km, SMF	
5	VCL-EMOD 0243	155Mbps Fast Ethernet SFP Transceiver Duplex LC, 1550nm, 150km, SMF	
6	VCL-EMOD 0171	155Mbps Fast Ethernet SFP Transceiver Duplex LC, 1550nm, 200km, SMF	

**Cables and Accessories Options**

1	VCL-HRNS 1280	1E1 75 Ohms Connectorized Cable [RJ45M-2BNC, 28cm]	As per Site Requirement.
2	VCL-HRNS 1229	Optical Patch Cord Connectorized Cable [2LC-2LC, 3m, SM]	
3	VCL-HRNS 1238	Optical Patch Cord Connectorized Cable [2LC-2LC, 10m, SM]	
4	VCL-HRNS 1242	Optical Patch Cord Connectorized Cable [LC-FC, 10m, SM]	
5	VCL-HRNS 1243	Optical Patch Cord Connectorized Cable [2LC-2FC, 10m, SM]	
6	VCL-HRNS 1239	Optical Patch Cord Connectorized Cable [LC-SC, 10m, SM]	
7	VCL-HRNS 1258	Optical Patch Cord Connectorized Cable [2LC-2SC, 10m, SM]	
8	VCL-ECON 1172	Connector (Attenuator LC-LC (10 db.))	
9	VCL-ECON 1173	Connector (Attenuator LC-LC (20 db.))	
10	VCL-ECON 1186	Connector (Attenuator FC-FC (10 db.))	
11	VCL-ECON 1187	Connector (Attenuator FC-FC (20 db.))	
12	VCL-ECON 1197	Connector (Attenuator SC-SC (10 db.))	
13	VCL-ECON 1198	Connector (Attenuator SC-SC (20 db.))	
14	UMIKit2T1oPDLX	System Core Cables, Installation Accessories, Documentation, System User Manual / Disk (Set)	

- Note:**
1. SPFs to be added if 100BaseFX (Optical) Ethernet Ports are required.
  2. Redundant power supply to be added, if required.
  3. Select VCL-HRNS 1280 for T1 75 Ohms BNC (F).

Technical specifications are subject to changes without notice.  
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