ORION TELECOM NETWORKS INC.

VCL-MX Version 6
80 E1, 160Mbps Voice & Data Multiplexer

System Guide

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Warranty

This Orion product is warranted against defects in material and workmanship for a period of one year from the date of shipment. During the warranty period, Orion will, at its discretion, either repair or replace products, which prove to be defective. For warranty service or repair, this product must be returned to a service facility designated by Orion. The buyer shall prepay shipping charges to Orion and the company shall pay shipping charges to return the product to the buyer. However, the buyer shall pay all the shipping charges, duties and taxes for products returned to Orion from another country.

Limitation of Warranty

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by the buyer. The buyer-supplied firmware or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product or improper site preparation or maintenance.

Exclusive Remedies

The remedies provided herein are the buyer's sole and exclusive remedies. Orion shall not be liable for any direct, indirect, special, incidental or consequential damages, whether based on contract or any legal theory.

Notice

Safety Warnings

The exclamation point within a triangle is intended to warn the operator or service personnel of operation and maintenance factors relating to the product and its operating environment, which could pose a safety hazard.

Always observe standard safety precautions during installation, operation and maintenance of this product. Only qualified and authorized service personnel should carry out adjustment, maintenance or repairs to this instrument. No adjustment, maintenance or repairs should be performed by either the operator or the user.

QUALITY ASSURANCE PROGRAM

Orion's products are designed and manufactured under a strict Quality Assurance Program based on the ISO 9001:2008 philosophy and principles. Orion pays very special attention to its vendor development program which ensures an "end-product" of the highest quality at the most cost effective prices.

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Foreword

The VCL-MX Version 6 - 80 E1, 160Mbps Multiplexer is a compact, carrier class and cost-effective bandwidth provisioning equipment designed to manage and deliver services from the optical core to the access.

This system guide presents the technical specifications along with the functions and features of the product. It gives a brief description of the hardware and software associated with the VCL-MX Version 6 - 80 E1, 160Mbps Multiplexer. This user guide also gives an overview of the various applications in which VCL-MX Version 6 - 80 E1, 160Mbps Multiplexer can be used. These are explained with the use of application diagrams. These application diagrams are useful for the Network planning and design engineers.

Product Overview

VCL-MX Version 6 – 80 E1 Multiplexer may be used for inter-connecting legacy voice and data networks, provisioning and managing bandwidth on a E1 channelized level as well as 64Kbps and sub-rate multiplexing at DS-0 time-slot level and as a digital-access cross-connect equipment. Due to the changing traffic patterns, there is a need to support multiple services from the same equipment like integrated data transport, better network management etc. This necessitated evolution to next generation E1 Multiplexer.

Redundant control card and power supply options make it an ideal chose for network service providers seeking to integrate and provide legacy and the next generation services from a single platform.

Next generation E1 Multiplexer has emerged as one of the most economical and technologically viable solutions for transmitting both voice and data (lower than 2Mbps) over carrier networks. This technology offers savings on investments/power and space to service providers.

Orion provides efficient solutions in this field using the E1 Multiplexer series products. E1 Multiplexer provides a full range of solutions in this evolving field of next generation telecom solutions. E1 Multiplexer family provides the unique advantage of carrying both data and voice over PDH. In addition to being affordable, these products have built-in modularity, which allow easy upgradeability. This upgradeability feature allows the customer to evolve in a “build-as-you-grow” concept. Along with the Orion as Network Management solution the E1 Multiplexer family provides the following features:

- Easy network manageability
- Lower cost per line
- Easy upgradeability
- Carrying both data and voice (lower than 2Mbps) over PDH
- Easy integration to SDH network
- Higher reliability

Key Features

VCL-MX Version 6 – 80 E1, 160Mbps Multiplexer provides the advanced features and capabilities, listed below:

- 160Mbps, 80 E1 fully non-blocking cross-connect at 64Kbps (DS-0) level (2480 DS-0 – any to any time-slot cross-connect)
- Sub-rate multiplexing to provide up to 4 asynchronous data channels in a single 64Kbps time-slot.
- Multi-service platform – may be used to provide a wide variety of voice and data services (lower than 2Mbps) from single chassis
- 1+1 E1 Link Protection / E1 Port Redundancy
- 1+1 Control Card Processor Redundancy
- 1+1 Cross-Connect Redundancy
- 1+1 Timing (Synchronization Clock) Redundancy. User selectable synchronization priority.
- 1+1 48V DC Power Supply Redundancy (Dual Power Input – allows the equipment to be powered from two separate sources

- 144 FXO or 144 FXS channels per unit.
- 72 E&M 2-wire / 4-wire channels per unit
- Any “mix” of data and voice channels in a single unit
- Universal Slots – slot independent system so that any type of interface card may be inserted and used in any card slot.
- Supports R2 CAS, ITU-T Q.421 and ITU-T Q.422 signaling
- Supports CAS Custom / User Programmable ABCD Signaling
- Bit Error Rate (BER) monitoring – BER thresholds to generate BER alarms automatically whenever alarm limits are exceeded.
- Supports Long Loops of up to 1200 Ohms
- Supports 75 VRMS and 90 VRSM Ring Voltage Options
- Supports A-law and Mu-law voice coding.
- Supports sinusoidal un-balanced ring output
- Provides a ring of ≥75 volts RMS into a load of 5 R.E.N. on each channel with a 0.30 Erlang traffic pattern (5 R.E.N. load = 5 parallel phone load on each line).
- May be used in a Point-to-Point, Point-to-Multi point, Add-Drop (drop-insert), Tree and Star topology
- Telnet
- SSH for secured access
- SNMP traps
- Maintains Access Security Log
- GUI (Graphical User Interface)
- In-band management option only available with optical interface card for Network connectivity. Not available when E1 interface card is used for Network connectivity.

Additional Features

- Voice and Digital Data services
- Any combination ("mix-n-match") of Voice and Digital Data services deployed from a single VCL-MX "Smart Shelf” - 4, 8, 16 channels per card
- Integrated IEEE C37.94 Differential / Distance Protection Interface
- 4 Binary Command, Integrated VCL-TP Teleprotection / Protection Coupler Interface Card
- Digital Data option may be used for internet access or video conferencing application
- Wireless applications including Cellular Networks
- Digital Microwave Radio
- SCADA applications
- ATM/Frame Relay circuit termination
- Powerful Network Management System (NMS) for monitoring and network control at card (64Kbps) level
- Compliance with all relevant ITU-T (CCITT) recommendations
- 19-inch, 6U high construction.

Highlights

- Field upgradable to provide voice, data or both services
- Flexibility on use of transmission medium-copper, fiber or wireless
- Choice of Interfaces for Voice and Data Applications
- USB and RS232, Interface for local connection through the serial interface to the "Network Control and Management Software”
- Channel assignment independent of slot position in the sub-rack
- Extensive set of alarms
- User Selectable Internal, External and Loop-timed clock synchronization priority options
- Universal slots - any interface card can plug in at any interface slot.
- OAM Card
- Hot Swappable Cards

Security and Password Features:

System Access, Control and Management Options:

- Telnet
- SSH
- CLI Control Interface (HyperTerminal or VT100)
- SNMP V2 Traps (MIB File provided).

OAM: Operation and Management Ports

- RS232 Serial Port
- USB COM Port
- 10/100BaseT Ethernet for remote access.

Security and Protection

- Secured Access via SSH V2
- Password Protection: Password Protection in compliance with the mandatory clauses of the
- GR-815-CORE-2 specifications for secured access control.
- Logging: Maintains a log of all successful and un-successful attempts. Logged information includes the ID and the IP address of the accessing entities. Alerts the administrator if the un-successful logging attempts exceed 3.
- Security Audit: All access logs for up to 30 days are maintained for security audit purposes.
- Security log entry of any request or activity including that user-ID (including IP address, if applicable), to establish user accountability
- Report Generation / Audit Trail
- Security Administration.

Transmission Mediums

The VCL-MX offers an excellent flexibility on the choice of transmission medium over which it may be deployed. The transmission medium can be either of the following:

- Copper
- Optical Fiber
- Wireless.

Multi-service platform

VCL-MX Version 6 - E1 160Mbps Multiplexer supports both data and voice traffic.

For voice traffic, it supports the following interfaces:

- FXO
- FXS
- E&M (2Wire / 4Wire)
- Hot-Line (Ring-Down)
- Ring Generator (75V RMS)

For data traffic, it supports the following interfaces:

- Channelized E1 / Fractional E1 data
- RS-232 asynchronous data
- Sub-rate multiplexing to provide 4 asynchronous data channels in a single 64Kbps time-slot
- V.24 synchronous data / asynchronous data
- G.703, @ 64 Kbps, co-directional
- V.35, V.36, X.21, V.11, RS530, RS449 synchronous, “n”x64Kbps data
- Relay I/O Card (Dry Contact)
- Universal DCE / DTE synchronous “n”x64Kbps data interface
- IEEE C37.94 Differential / Distance Protection Interface
- 4 Binary Command, Integrated VCL-TP Teleprotection / Protection Coupler Interface Card
- 8E1 plus 100Mbps Ethernet fiber optical transport interface along with the following:
    - EOW (Engineering Order Wire) channel for end to end installation and maintenance
    - Local and remote loop back test for diagnostics
    - 1+1 Fiber Path protection
    - ALS (Auto Laser Shutdown) facility for eye safety
    - 10/100M Ethernet Port - 100 Mbps Ethernet data transmission rate complies with IEEE8 02.3

Configuration and Flexibility

VCL-MX Version 6 - E1 160Mbps Multiplexer can be configured as an Add-Drop Multiplexer (ADM) and Terminal Multiplexer (TMUX). It can support diverse topologies like point-to-point, ring, star and tree.

It can be configured in various topologies supporting both electrical and optical interfaces. It can take modular cards, which would enable the customers to start small and grow as traffic demands scale.

Synchronization

Timing Options	Internal Clock, Loop-Timed Clock, External Clock. User selectable synchronization priority
Synchronization Sources	Internal Clock, span clock timing derived from incoming HDB3 links (Loop-Timed), External Clock, 75 Ohms (TTL), 2.048 Mbits and 120 Ohms (Bits clock)
Default Option	Internal Clock (Stratum 3)

System Overview and Architectural Details

The VCL-MX Version 6 – 80 E1, 160Mbps Multiplexer provides full range of POTS (voice) and digital data services to subscribers located at different locations, requiring to interconnect and establish a voice and data network over an E1 Link. The VCL-MX is a simple, yet powerful E1 Channel Bank for connecting and integrating analog communication equipment with digital E1 services.

The VCL-MX Version 6 – 80 E1, 160Mbps Multiplexer provides cross connect, voice telephony and digital data services for applications, which may include:

E1 Multiplexer platform has been envisaged to address the growing demand for an ultra-compact Add-Drop Multiplexer (ADM) and provide Ethernet-over-PDH mapping functions. It can be configured in various topologies such as linear, star, ring and bus.

VCL-MX Version 6 – 80 E1, 160Mbps Multiplexer has a multi-slot chassis with TDM backplane. In the chassis, there are ten (10) traffic slots meant for tributary cards (line cards). The line cards can support various type of interface cards, which include E1, Voice and very wide variety of Data interfaces.

Two slots are reserved for 1+1 redundant system / control cards, which include the redundant cross connect, processor and aggregate interface functions. One dedicated slot exists for an OAM card, one for ring generation and two slots for 1+1 redundant power supply.

Safety: Laser protection

The optical interfaces of the VCL-MX Version 6 - E1 160Mbps Multiplexer come with Class 1, Small Form-factor Pluggable (SFP)-based optical line interfaces with digital diagnostics capability for SFPs on the optical interface cards.

Application of VCL-MX

POTS (voice), digital data or real-time video conferencing services (V.35, V.36, X.21) high-speed digital data interface options allow point-to-point network solutions for providing a video conferencing channel of up to 1920 / 1984 Kbps.

- Junction Mux - for digital interconnection of analog exchanges
- Point-to-Point, Point-to-Multi point, Add-Drop (drop-insert), Tree and Star topology applications
- Wireless network applications
- High-speed data ports for digital communication links providing Leased Lines access to Internet Service Providers (ISPs) with speeds ranging from 64Kbps up to 1920 / 1984 Kbps digital data interface options
- Micro-Cellular infrastructure applications for providing cell-switch connectivity
- Wide area networking
- Internet access over POTS lines - All POTS interfaces operate @ 64Kbps and support V.34 (33.6Kbps) dial-up modems.
- Up to 80 E1 Digital Access Cross-Connect. Large, completely non-blocking cross-connect for up to 64Kbps 2480 time-slots - any” time-slot to “any” time-slot.

Application

VCL-MX Version 6, Voice and Data Multiplexer
E1 / Microwave Application

Communication Interfaces

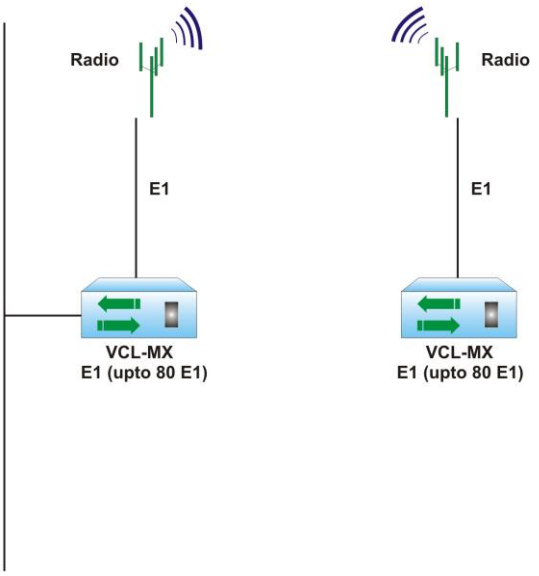
8 E1
8 E1 + 8 E1 (Redundant)
8 E1 + Ethernet

Voice Interfaces

E1 (upto 80 E1)
FXO
FXS
Hotline
E&M

Data Interfaces

Ethernet
IEEE C37.94 Differential / Distance Protection
Binary Teleprotection
RS232
V.24/V.28
V.35, V.36
EIA530
V.11
Relay I/O
Sub-Rate
G.703
X.21
RS530
RS449
RS485
RS422



VCL-MX Version 6, Voice and Data Multiplexer
Optical Transport Application

Communication Interfaces

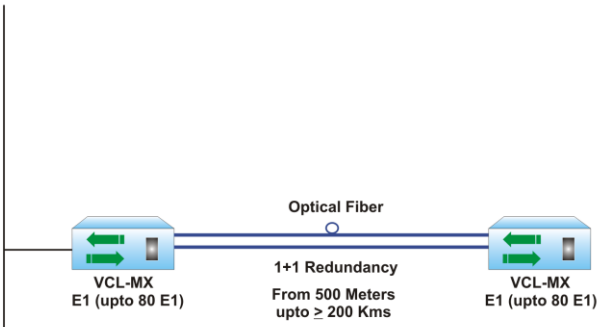
8 E1
8 E1 + 8 E1 (Redundant)
8 E1 + Ethernet

Voice Interfaces

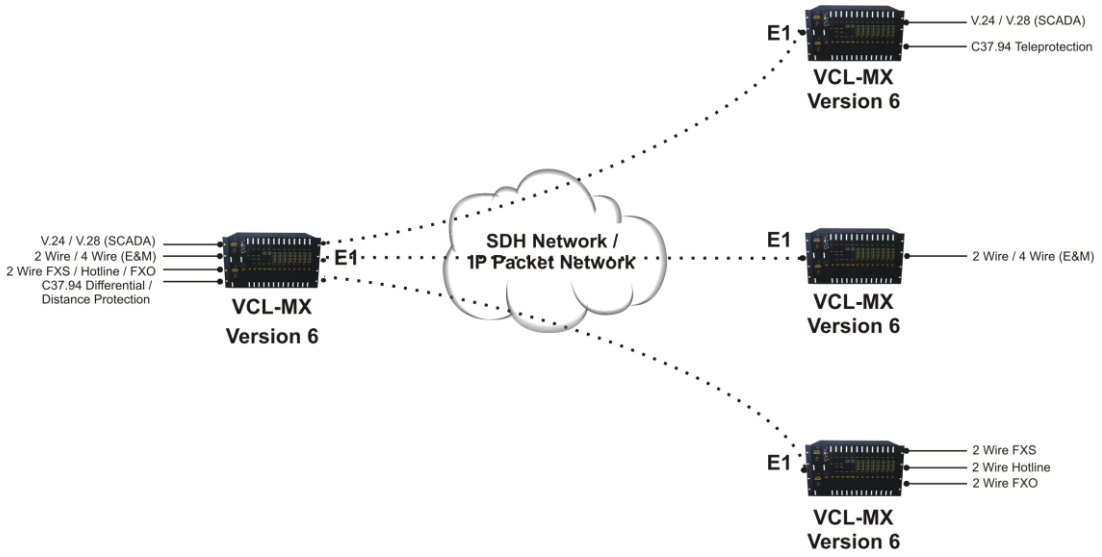
E1 (upto 80 E1)
FXO
FXS
Hotline
E&M

Data Interfaces

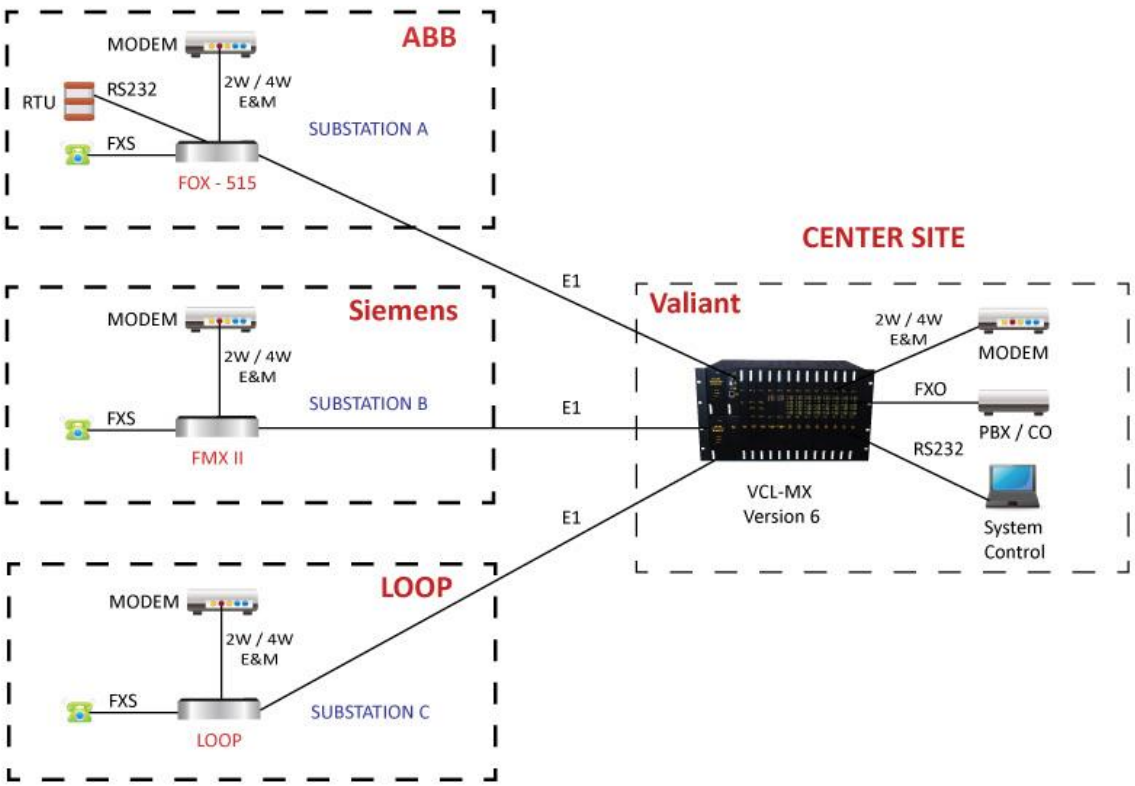
Ethernet
IEEE C37.94 Differential / Distance Protection
Binary Teleprotection
RS232
V.24/V.28
V.35, V.36
EIA530
V.11
Relay I/O
Sub-Rate
G.703
X.21
RS530
RS449
RS485
RS422



VCL-MX Version 6, Voice and Data Multiplexer
Power Utility Application Diagram

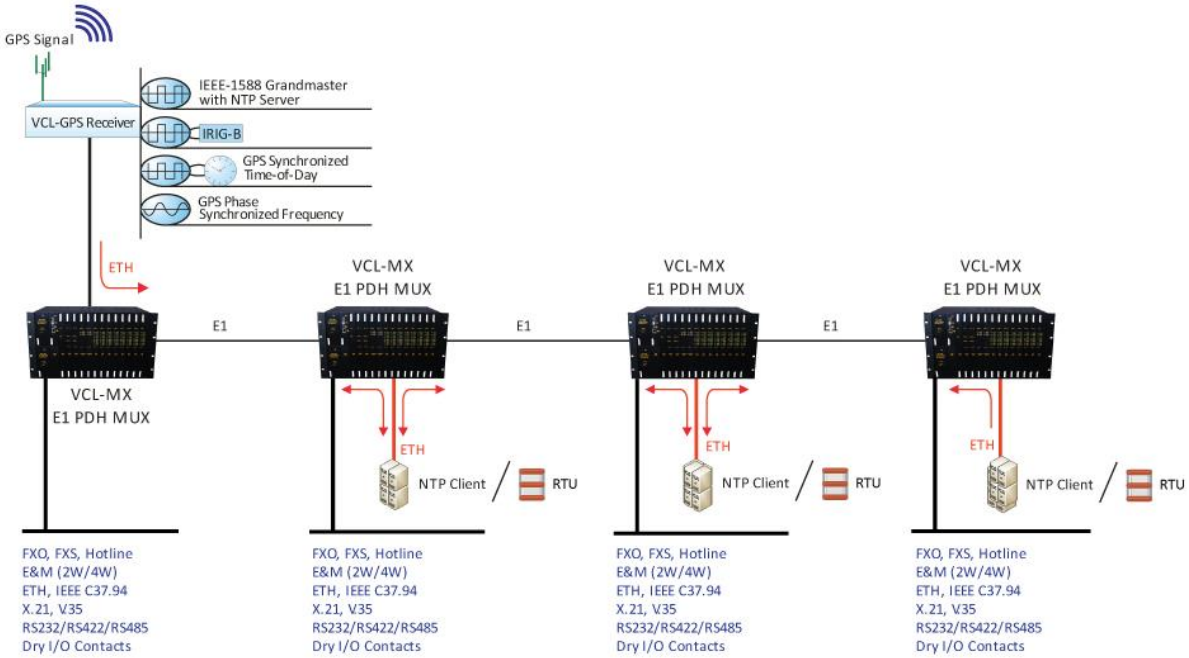


Interoperability of VCL-MX Version 6 E1 PDH Multiplexer



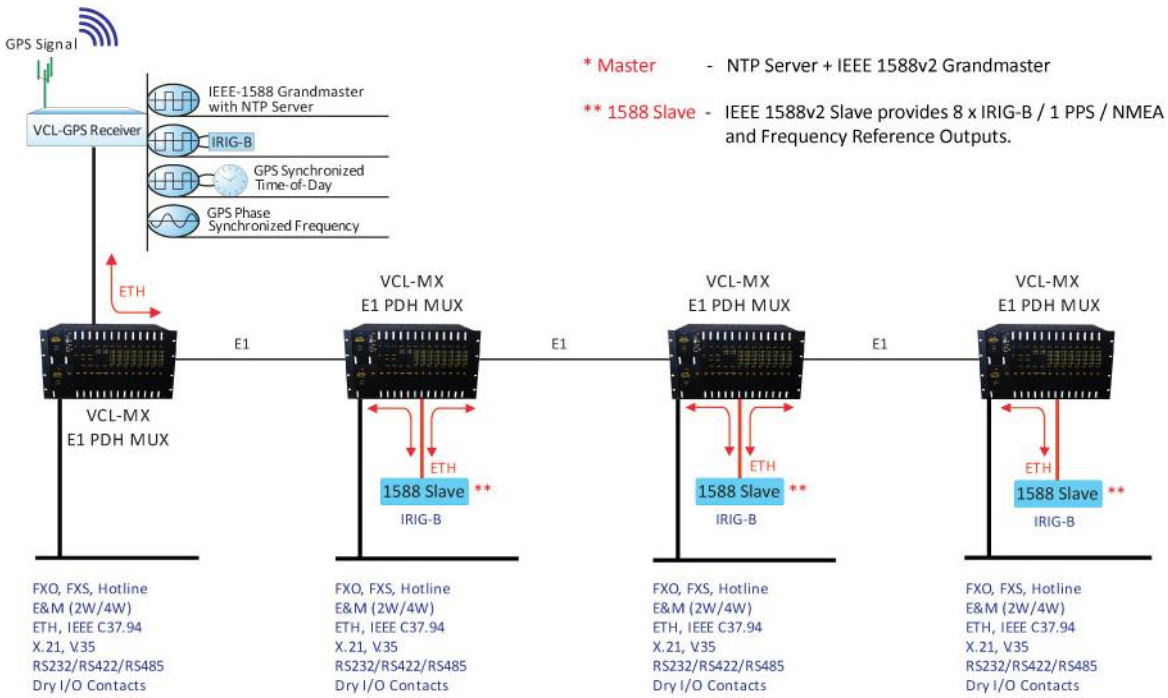
Application - Distributed Ethernet over an E1 Link

Providing Time Synchronization from NTP Server to RTUs using distributed Ethernet over an E1 Link

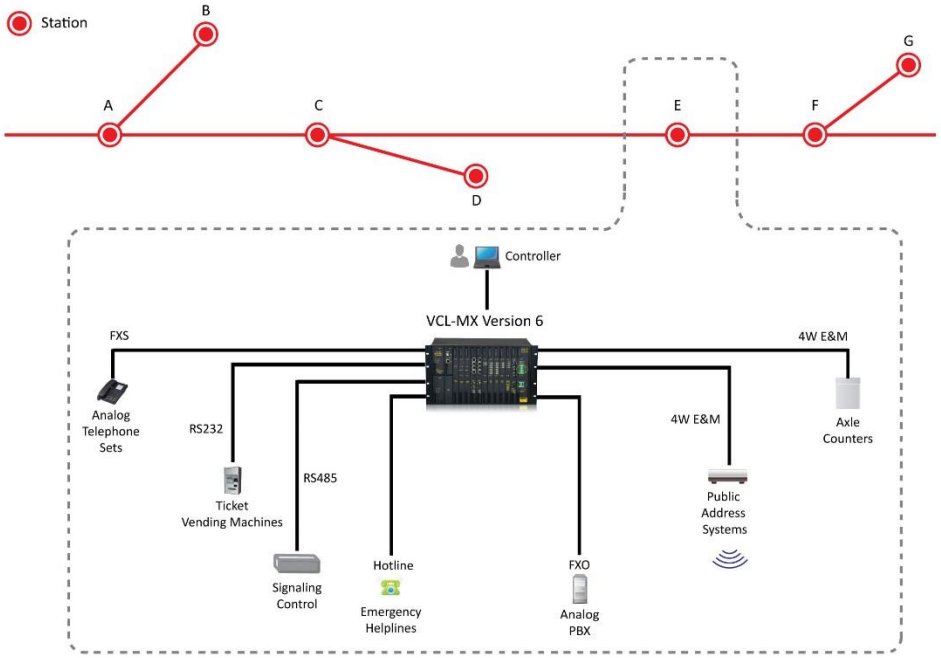


Application - Distributing ToD (Time-of-Day) over an E1 Link

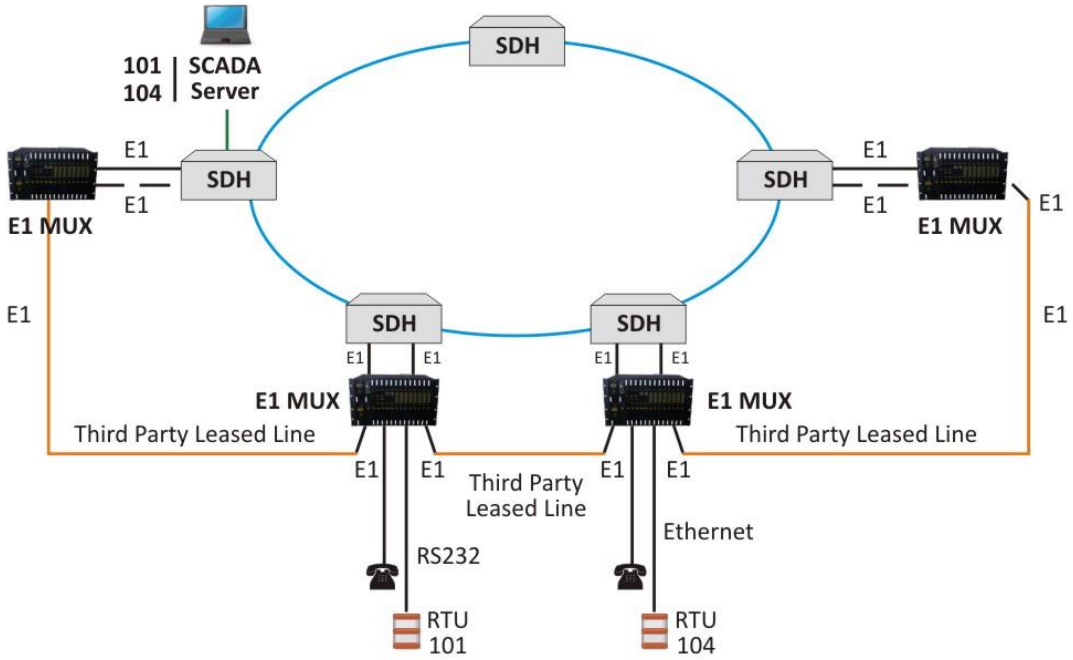
Using IEEE 1588v2 over distributed Ethernet to provide NTP Services, IRIG-B / 1 PPS, NMEA and GPS Synchronized Frequency Reference over an E1 Link



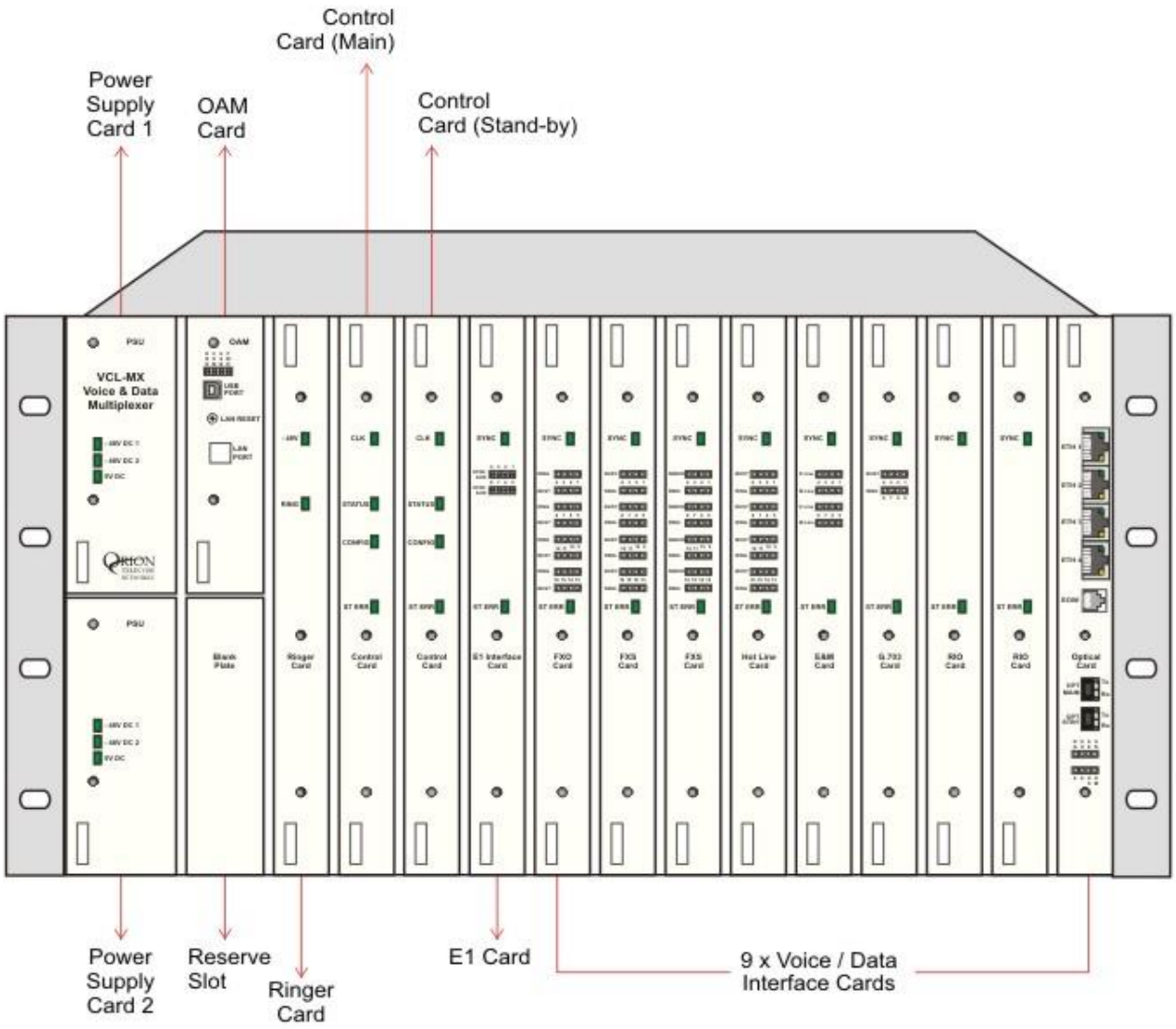
Railways - Inter-Station Communication Over SDH Network



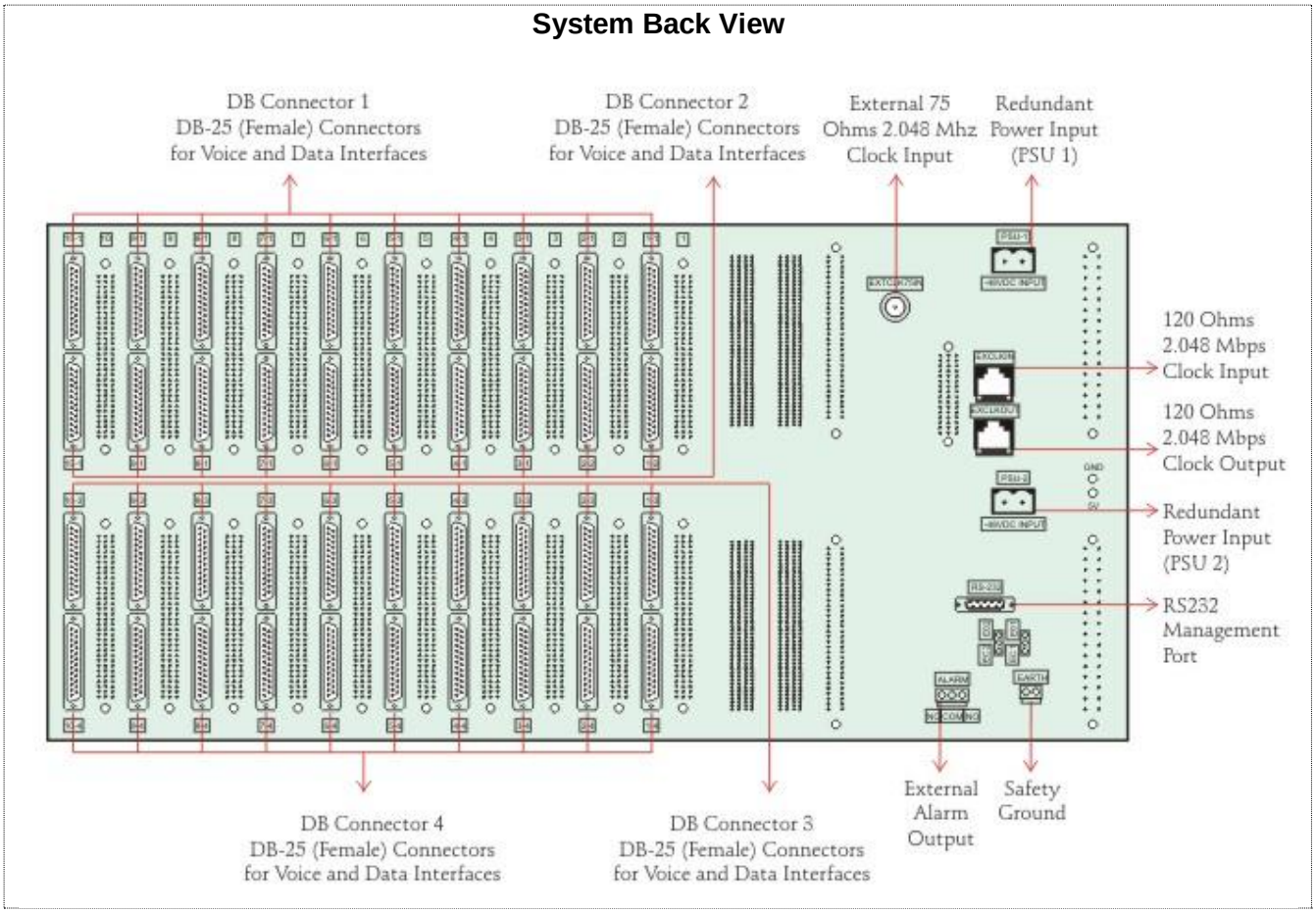
E1 Protected Network Overview



System Front View



System Back View



The Multiplexer may be used in Terminal or Drop-Insert configuration to provide:

- Toll Quality Voice Services
- Interconnect LAN (Campus Network)
- Interconnect computer terminals various types of data terminals
- Provide LAN-WAN Interconnectivity.

Voice Interfaces

For voice traffic, it supports the following interfaces:

- FXO
- FXS
- E&M (2-wire and 4-wire)
- Hot-Line (Ring-Down)
- Ring Generator (75V RMS)

Data Interfaces

For data traffic, it supports the following interfaces:

- Channelized E1 / Fractional E1 data with full cross-connect capability at 64Kbps, DS-0 level
- RS-232 asynchronous data
- Sub-rate multiplexing to provide 4 asynchronous data channels in a single 64Kbps time-slot
- V.24 synchronous data / asynchronous data
- G.703, @ 64 Kbps, co-directional
- V.35, V.36, X.21, V.11, RS530, RS449 synchronous, “n”x64Kbps data
- Relay I/O Card (Dry Contact)
- IEEE C37.94 Differential / Distance Protection Interface
- 4 Binary Command, Integrated VCL-TP Teleprotection / Protection Coupler Interface Card
- Universal DCE/DTE synchronous “n”x64Kbps data interface
- 8E1 plus 100Mbps Ethernet fiber optical (1+1) protected transport interface

Chassis / System Backplane

All connections are made at the rear of the chassis, providing interconnections between the various plug-in cards and to the network. VCL-MX Version 6 - E1 160Mbps Multiplexer and supports high-density PDH cards. The line cards terminate a combination of Voice, Data and E1 Interfaces.

The VCL-MX E1 Multiplexer has a 160 MBits/sec backplane and provides a host of features including, channel drop and insert facility over a network of VCL-MX E1 Multiplexers, for voice and data applications. An extensive set of alarms, for easy maintenance are provided in the system.

System Management

VCL-MX Version # 6 - Voice and Data Drop-Insert Multiplexer offer a variety of management options, The VCL-MX E1 multiplexer management software can be configured using CLI (English text) commands and GUI (Graphical User Interface). The management and configuration commands may be executed from a VT100 terminal, Windows HyperTerminal, any DOS based system, Linux or UNIX based system, or Telnet (remote management).

The equipment provides a wide choice of access ports for connecting to and executing management and configuration commands through its OAM Card

The OAM card provides:

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

The VCL-MX has an effective, CLI (text) and GUI based "Network Management Interface", which may be used for configuring and monitoring multiple systems from a single central location.

Technical Specifications:

E1 Interface: (Part No. VCL-MX-1520-E1-5.0)

Maximum number of interface cards (in a single chassis)	As per requirement and upto 10 Used to map with Voice and Data Interface
Number of interfaces per E1 Interface Card	8 E1 Interfaces
Conformity (electrical)	G.703
Frame structure	As per ITU (CCITT) G.704
Signaling	Channel Associated Signaling
PCM Sampling Rate	8000 Samples / sec
Bit rate	2048 Kbps ± 50 ppm
Code	HDB3, 50 % Duty Cycle
Nominal Impedance	120Ω balanced / 75Ω unbalanced
Peak voltage of a mark For 120 Ω Balanced interface 75 Ω Unbalanced interface	 3.0 V ± 0.3 V 2.37 V ± 0.237 V
Peak voltage of a space For 120 Ω Balanced interface 75 Ω Unbalanced interface	 0 V ± 0.3 V 0 V ± 0.237 V
Nominal pulse width	244 ns
Pulse mask	As per ITU (CCITT) Rec. G.703
Output jitter	<0.05 UI (in the frequency range of 20Hz to 100 KHz)
Permissible Attenuation	6 dB at 1 MHz
Return loss at: 51.2 KHz to 102.4 KHz 102.4 KHz to 2048 KHz 2048 KHz to 3072 KHz	 > 12dB > 18dB > 14dB
Jitter tolerance	As per ITU (CCITT) G.823
Frame alignment	As per ITU (CCITT) G.732
Loss and recovery of frame alignment	As per clause 3 of ITU (CCITT) G.732
Loss and recovery of multi-frame alignment	As per clause 5.2 of ITU (CCITT) G.732
Performance Monitoring	Has in-built feature to test and monitor E1 links and provide G.821 performance data: AS, ES, SES, DM, etc. via NMS

FXS, Voice Frequency Interface: (Part No. VCL-MX-1525-16-5.0)

Maximum number of interface cards	9
Number of channels per card	16
Interface type	FXS, A-law, 8 bit/sample, A=87.6 / 87.7, 13 segment coding as per ITU-T Rec. G.711
Maximum number of channels (In a single chassis)	144
Transmission performance	Fully compliant to ITU (CCITT) G.712 specification
Line impedance	600 Ω (900 Ω optional)
Voice channel frequency	300Hz-3400Hz
Insertion loss / gain	-2.0 dB Nominal (user adjustable) Adjustable range –30 dB to +3 dB in steps of 0.5dB
User selectable range for gain / insertion loss	0 dB to 18 dB
Idle channel noise	≤ - 65 dB
Return loss	300Hz – 600Hz - ≥ 12 dB 600Hz – 3400Hz - ≥ 15 dB
Longitudinal balance	≥ 46 dB between 300Hz to 3400Hz
Ring frequency	16 Hz, 20 Hz, 25 Hz, 50 Hz
Ring voltage	≥ 75 volts RMS into a load of 5 R.E.N. with a 0.30 Erlang traffic pattern
Subscriber loop current	≥ 30mA into a subscriber loop of 1200 Ohms
Overload level	+3.14 dBm ± 0.5 dBm
Battery reversal	All channels, Loop-start Signaling
Dial pulse speed	50 pps – Pulse Dialing ≤ ± 2 ms / DTMF Dialing
Protection	As per ITU-T Rec. K.20

FXO, Voice Frequency Interface: (Part No. VCL-MX-1530-16-5.0)

Maximum number of interface cards	9
Number of channels per card	16
Interface type	FXO A-law, 8 bit/sample, A=87.6 / 87.7, 13 segment coding as per ITU-T Rec. G.711
Maximum number of channels (In a single chassis)	144
Transmission performance	Fully compliant to ITU (CCITT) G.712 specification
Line impedance	600Ω (900Ω optional)
Voice channel frequency	300Hz-3400Hz
Insertion Loss / Gain	-2.0 dB Nominal (user adjustable) Adjustable range –30 dB to +3 dB in steps of 0.5 dB
User selectable range for gain / insertion loss	0 dB to 18 dB
Idle Channel Noise	≤ -65dB
Return loss	300Hz – 600Hz - ≥ 12 dB 600Hz – 3400Hz - ≥ 15 dB
Longitudinal balance	≥ 46 dB between 300Hz to 3400Hz
Overload Level	+3.14 dBm ± 0.5 dBm

Battery reversal	All channels, Loop-start Signaling
Dial pulse speed	50 pps – Pulse Dialing ≤ ± 2 ms / DTMF Dialing

Hot-Line Interface Card: (Part No. VCL-MX-1525HTL-16-5.0)

Number of channels per card	16
Maximum number of interface cards	9
Maximum number of channels	144
Interface type	Hot-Line A-law, 8 bit/sample, A=87.6 / 87.7, 13 segment coding as per ITU-T Rec. G.711
Transmission performance	Fully compliant to ITU (CCITT) G.712 specification
Line Impedance	600Ω (900Ω optional)
Loop resistance	Upto 2000 Ohms
Voice channel frequency	300Hz-3400Hz
Insertion loss / gain	-2.0 dB Nominal (user adjustable) Adjustable range –30 dB to +3 dB in steps of 0.5 dB
User selectable range for gain / insertion loss	0 dB to 18 dB
Idle channel noise	≤ -65 dB
Return loss	300Hz – 600Hz - ≥ 12 dB 600Hz – 3400Hz - ≥ 15 dB
Longitudinal balance	≥ 46 dB between 300Hz to 3400Hz
Ring frequency	16 Hz, 20 Hz, 25 Hz, 50 Hz
Ring voltage	≥ 75 volts RMS into a load of 5 R.E.N. with a 0.30 Erlang traffic pattern
Subscriber loop current	≥ 30mA into a subscriber loop of 1200 Ohms
Overload level	+3.14 dBm ± 0.5 dBm
Dialing	Ring-down

E&M 2 Wire / 4 Wire Voice Frequency Interface (Part No. VCL-MX-1535-08-5.0)

Number of channels per card	8
Maximum number of interface cards	9
Maximum number of channels	72
Interface type	2W / 4W E&M, Type I, Type II and Type V A-law, 8 bit/sample, A=87.6 / 87.7, 13 segment coding as per ITU-T Rec. G.711
Transmission performance	Fully compliant to ITU (CCITT) G.712 specifications
Line impedance	600Ω (900Ω optional)
Voice channel frequency	300Hz-3400Hz
Insertion loss / gain	-2.0 dB Nominal (user adjustable) Adjustable range –30 dB to +7.5 dB in steps of 0.5 dB
User selectable range for gain / insertion loss	0 dB to 18 dB

Idle channel noise	≤ 65 dB
Return loss	300Hz – 600Hz - ≥ 12 dB 600Hz – 3400Hz - ≥ 15 dB
Longitudinal balance	≥ 46 dB between 300Hz to 3400Hz
Dial pulse speed	50 pps – Pulse Dialing ≤ ± 2 ms / DTMF Dialing
Maximum M-Lead resistance	1200 Ohms
Maximum M-Lead current drain	≤ 5 mA
Maximum E-Lead current	≤ 100mA

Low Speed Data Interface Asynchronous RS232 (Part No. VCL-MX-1559-08-5.0)

Number of interfaces per card	8
Maximum number of interface cards	9
Mode	Asynchronous, RS232 (V.24/V.28 line drivers) - DCE
Bit rate	50 bps to 19.2 Kbps
Character length	5 / 6 / 7 / 8 (auto-select)
Stop bits	1 / 1.5 / 2 (auto-select)
Parity	Even / Odd / 0's / 1's / none (auto-select)

64Kbps Universal Data Interface (Part No. VCL-MX-1545-04-48)

Number of interfaces per card	4
Maximum number of interface cards	9
Mode – Synchronous - Interface	V.35 / V.36 / X.21 / RS530 / V.24 / V.11 / V.28 - DCE
Mode - Asynchronous - Interface	RS232 / RS485 / V.24 / V.11 / V.28 - DCE
Mode - Sub Rate Multiplexing - Interface	RS232 / RS485 / V.24 / V.11 / V.28 - 4 Asynchronous data channels multiplexed into one single 64 Kbps timeslot - DCE
Mode – Multi-drop and Omnibus operation	Asynchronous RS232 / RS485 / V.24 / V.11 / V.28 – Master / Slave operation
Conformity	EIA and ITU-T
Synchronous Bit rate	V.35 / V.36 / X.21 / RS530 / V.11 @ 64 Kbps V.24 @ 300, 600, 1200, 2400, 4800, 9600, 19200, 64000 bps
Asynchronous Bit rate	50 bps to 19200 bps

G.703 @ 64kbps, Synchronous Data Interface: (Part No. VCL-MX-1560-08-5.0)

Interface	G.703 @ 64 Kbps
Number of interfaces per card	8
Maximum number of interface cards	9
Conformity	To (CCITT) Rec. G.703
Mode	Synchronous, Co-directional
Bit rate	64Kbps

Dual Link O/E Ethernet Interface Card (Part No. VCL-MX-1561-02-5.0)

Interface	Electrical / Optical
Number of interfaces per card	1x10/100BaseT (Electrical) 1x100Base-FX (Optical)
Maximum number of interface cards	9
Application	Point to point / Point to multipoint
Bandwidth	("**N**" x 64 Kbits/sec. interface minimum value of "**N**" =1 maximum value of "**N**" =31) - user selectable
Aggregate bandwidth	64 Kbps to 1920 Kbps for PCM30 E1 link 64 Kbps to 1984 Kbps for PCM31 E1 link
Conformity (Electrical)	10/100BaseT Ethernet Electrical
Standards Compliance (Optical)	IEEE 802.3-2002, RFC1662, RFC2615, X.86, RMII
Protocol (Optical)	HDLC/X.86 (LAPS) Encapsulation
Connectors (Optical)	LC
Interface Rate	Electrical – 10/100BaseT Optical - 100Base-FX optical limited to E1 transmission rate

Relay I/O Interface Card: (Part No. VCL-MX-1547-16-48)

Description: This interface card provides 16 Relay I/Os that may be used to extend either Dry Relay Contacts (Relay Normally-Open or Relay Normally-Close) or operate switches remotely (using Dry Relay Contacts rated 2A @ 60Volts DC) between any two Multiplexers using a 64 Kbps time-slot.

Maximum number of channels	144
Maximum number of interface cards	9

Relay Specifications (Drivers)

Maximum Number of Dry Contact Sensors	16
Maximum switching power	60 W (approximately)
Maximum switching voltage / current	60V DC, 2 A, 250V AC, 2 A
Isolation	2.5 KVA Minimum
Typical number of operations	> 1 million

Dry Contacts Sensors

Maximum number of dry contact sensors	16
Maximum current	50 mA
Typical current	20 mA
Reference source voltage	3.3 Volts

Universal Data Interface: High Speed Synchronous "n x 64" Data Interface Type - User Configurable DCE-DTE: (Part No. VCL-MX-1558-04-48)

Interface	V.35 (DTE/DCE), V.36 (DTE/DCE), X.21 (DTE/DCE) V.11 (DTE/DCE), RS422 (DTE/DCE), RS530 (DTE/DCE)
Number of interfaces per card	4, ("**N**" x 64KBits/sec. per card)
Maximum number of interface cards	9
Bandwidth	("**N**" x 64 Kbits/sec. interface maximum value of "**N**" =31)-user selectable
Conformity	Universal user-configurable as above
Mode	Synchronous
Bit rate	64 Kbps to 1920 Kbps for PCM30 E1 link 64 Kbps to 1984 Kbps for PCM31 E1 link
User interface	DCE/DTE (User programmable for DTE/DCE mode)

High Speed "n x 64" Data Interface Type: 10/100BaseT Ethernet with Electrical Ethernet: (Part No. VCL-MX-1595-04-5.0)

Interface	10/100BaseT (Electrical)
Number of interfaces per card	4 Ports (4 x 10/100BaseT Electrical)
Maximum number of interface cards	9
Application	Point to point
Bandwidth	("**N**" x 64 Kbits/sec. interface minimum value of "**N**" =1 maximum value of "**N**" =31) - user selectable
Aggregate bandwidth	64 Kbps to 1920 Kbps for PCM30 E1 link 64 Kbps to 1984 Kbps for PCM31 E1 link
Conformity	10/100BaseT Ethernet Electrical
User interface	10/100BaseT

Integrated IEEE C37.94 Differential / Distance Protection Interface (Part No. VCL-MX-1564-04-MM-ST) - Type 1

Number of interfaces per card	4
Maximum number of interface cards	9
Maximum number of channels	36
Standards	IEEE C37.94
Optical	820nm Multi-Mode (1.5 KM)
Optical connector	ST
Optical Transmitter	LED

Integrated IEEE C37.94 Differential / Distance Protection Interface (Part No. VCL-MX-1554-04) - Type 2

Number of interfaces per card	4
Maximum number of interface cards	9
Maximum number of channels	36
Standards	IEEE C37.94
Optical	0850nm / 1310nm Multi-Mode, 1310nm / 1550nm Single-Mode
Optical connector	LC (SFP based)
Optical Transmitter	LED

Integrated Binary Teleprotection Interface (Part No. VCL-TP)

Number of Input Commands per Card	4 (Binary)
Number of Output Commands per Card	4 (Potential Free)
Maximum number of Interface Cards	9
Maximum number of Commands	36 Input / 36 Output
Command Voltage Option	110V DC / 250V DC

Input Commands

Command	**Minimum Operating Command Voltage**	**Maximum Operating Command Voltage**	**Sense Off**	**Consumption on a digital input (W)**
110V DC	75V DC	140V DC	< 60V DC	≤ 5mA @ 110V DC; < 0.55W
250V DC	172V DC	290V DC	< 140V DC	≤ 5mA @ 250V DC; < 1.25W

Output Commands

Maximum Switching Voltage: 400V AC or 300V DC
Closing Ability (W/VA): 91W / 1,000VA
Short time current (0.5 sec.): 20A
Crossing a continuous-current (A): 5A
Maximum breaking current at 220V DC: 8A
Surge protection arrestor module: Built-in / Integrated, MOV Protected @ > 350 VDC

Input / Output Commands Combination Options

off	When all 8 inputs are independent
and	When two adjacent inputs are used logically, **"and-ed"**
or	When two adjacent inputs are used logically, **"or-ed"**

log	When two inputs are used in a combination In-a In-b Out 0 1 0 1 0 1 1 1 Previous 0 0 Previous

8 E1 Plus 100Mbps Ethernet Fiber Optical Transport Interface (Part No. VCL-MX-1551-5.0-WLWL-DKM)

Optical	
Number of optical ports	1+1 redundant, automatic link protection
Channel capacity	8E1 Plus 100Mbps Ethernet
Jitter character	ITU-T G.742, G.823 complaint
Type of transmitter	Class 1 Laser
Transmitter power	-11 dBm to +3 dBm - as ordered 20 km, 40 km, 80 km, 120 km reach – as ordered
Receive sensitivity	- 34 dBm
Bit rate	155 Mbps
Wavelength	850 nm multimode / 1310nm singlemode / 1550nm singlemode (optional)
Optical connector	LC (MSA Complaint SFP Module)
Fully compliant with ITU-T G.957, G.958 Specification	
Class 1 Laser Product, Compliant with IEC 60825-1	
Compliant with Telcordia (Bellcore) GR-468-CORE	
Safety	
Class 1 Laser	
Auto Laser Shut Down in the event of fiber break.	
Ethernet Interface - 10/100BaseT	
Number of interfaces	4
Interface	RJ-45 Ethernet 10BaseT or 100BaseT-TX (auto sensing)
Compliance	Ethernet Version 2.0 IEEE802.3 10Base-T & 100Base-TX Activity, Full/half duplex.
Interface rate	100 Mbps Ethernet data transmission rate
Order Wire Interface	
Phone set	Standard 2-wire phone set
Bandwidth and coding	64 Kb/s PCM Channel, A-Law Coding

Protection

Remote / FXS (subscriber side) interface is protected against power surges and transients occurring from lightning and electric induction as per ITU-T Rec. K.20 towards line side.

Management Interface

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

Power Supply

Input DC Voltage	-48V DC (nominal)
Range of Input	-36V to -72V DC
Output Voltage	5V filtered -48V (for terminal cards)
Full Load Current	4A at 48V DC
Input Voltage Reversal Protection	Provided in the Card
Over Current Protection	6A at 48V DC
Short Circuit Protection	Current limit – 6A. Recovers on removal of short
Maximum Surge Withstand	As per IEC 61000-4-2, IEC 61000-4-4, IEC 61000-4-5 Level 4 specifications, 1.2/50 – 8/20 us surges @ 4kV
Efficiency at Full Load	>91%
Ripple at Full Load	<5mVrms
Spike at Full Load	<50mV

Power Consumption

Power Consumption	50 to 290 watts depending upon configuration

Environmental

Operating Temperature	-20^0C to $+60^0$C
Maximum Operating Humidity	95% R.H., Non-Condensing
Maximum Operating Altitude	Up to 3,000 meters above sea level
Operation	Complies with ETS 300 019 Class 3.2
Storage Temperature	-40^0C to $+70^0$C
Storage	Complies with ETS 300 019 Class 1.2
Maximum Storage Humidity	98% R.H., Non-Condensing
Maximum Storage Altitude	Up to 3,000 meters above sea level
Transportation	Complies with ETS 300 019 Class 2.3

EMI, EMC, Surge Withstand and other Compliances

EN 50081-2	EN 50082-2	IEC 60068-2-29
IEC 61000-4-6 (Conducted Immunity)	IEC 60068-2-6	IEC 60068-2-2
IEC 60068-2-78	IEC 60068-2-1	IEC 60068-2-14
CISPR 22 / EN55022 Class B (Conducted Emission and Radiated Emission)		
IS 9000 (Part II Sec. 1-4, Part III Sec. 1-5, Part IV, Part 14 Sec. 1-3)		
IEC 60870-2-1	IEC 61000-4-5	IEC 61000-4-12
IEC 61000-4-3 (Radiated Immunity)	IEC 61000-4-8	IEC 61000-4-16
IEC 61000-4-2	IEC 61000-4-10	Telcordia GR-1089 Surge and Power Contact
IEC 61000-4-4	IEC 61000-4-11	

- ESD, Voltage and Surge Withstand: Meets and exceeds IEC 61000-4-2, IEC 61000-4-4, IEC 61000-4-5, Level 4 specifications.

- Immunity to Voltage Dips, Short Power Supply Interruptions and Voltage Variations meets and exceeds IEC 61000-4-11, Level 1 specifications.

Other Regulatory Compliances:

- Meets CE requirements
- Complies with FCC Part 68 and EMC FCC Part 15

Dimensions and Appearance

Height	266 mm (19” 6U high)
Width	482 mm
Depth	270 mm
Weight	12 Kgs.
Chassis Color	Matte Black - Powder coated

Applications

The VCL-MX Version 6 - E1 160Mbps Multiplexer can be configured in Linear and Bus architectures. It can be used in the core of the network to provide high-speed backbone network.

The VCL-MX Version 6 - E1 160Mbps Multiplexer could provide the core for cellular or mobile networks between Mobile Switching Centers with subtended.

VCL-MX Version 6 - E1 160Mbps Multiplexer could also be used to provide versatile cross-connect functionality to connect telephone exchanges in VCL-MX Version 6 - E1 Multiplexer in dense metro areas.

Telco Networks Providing Voice and Data Services

VCL-MX Version 6 - E1 160Mbps Multiplexer is an ideal platform to provide high-end data and voice requirement of clients. VCL-MX Version 6 - E1 160Mbps Multiplexer can be installed at the regional and gateway Points of Presence (POP) locations in order to cater to the ever-growing data requirements of the customers while supporting legacy services at the same time.

The advantage that the VCL-MX Version 6 - E1 160Mbps Multiplexer provides the Telecom Service provider is as follows:

- The VCL-MX Version 6 - E1 160Mbps Multiplexer enables network simplifications by collapsing networks, nodes and services into a single multi service device. A smaller number of higher-density nodes and node types enable cost savings as a result of a smaller, more homogenous network to manage.

- The flexible architecture of the VCL-MX Version 6 - E1 160Mbps Multiplexer series ensures that the network is future proof, and the service provider has the flexibility of choosing a technology he thinks useful at any time in the future with minimal investment.

Ordering Information

VCL-MX E1 Core System (Common Equipment)

S. No.	Part #	Product Description
1.	VCL-MX-1500	Control Card Central processor, cross-connect and system control Card may be used in a 1 + 1 redundant Configuration **Note:** Please order 2 numbers for 1 + 1 redundancy
2.	VCL-MX-1510	(-) 48V DC Input Power Supply Card may be used in a 1 + 1 redundant Configuration **Note:** Please order 2 numbers for 1 + 1 redundancy
3.	VCL-OAM-2104-5.0-v6	Management Card [SNMP, Telnet (RJ45 Port) and Serial Port (USB and DB-9 COM Port)], OAM - Operations and Management Card for connecting the multiplexer to be managed in a LAN - allows the USER to assign a unique IP address to each multiplexer connected in a LAN to be managed from a single point. Telnet, SNMP (V2)
4.	VCL-MX-1506	19" Shelf 6U High (Sub-Rack) fitted with 75Ω / 120Ω DB25 (F) Connectorised Backplane Max. Ten (10) traffic slots meant for tributary cards (line cards)

VCL-MX Version 6 [User Configurable Interfaces]

S. No.	Part #	Product Description
1.	VCL-MX-1520-E1-5.0	8 E1 Interface Card Full capability to cross connect at DS-0, 64Kbps time-slot level as well as to inter-connect to voice and digital data services between 80 incoming E1 Ports (i.e., 80 separate E1 Links, 2480 DS-0 – any to any time-slot cross-connect). (For 8E1 Redundancy please order 2 Cards each Chassis)
2.	VCL-MX-1525-16-5.0	16 Port VF, RT (FXS) Line Interface Card 64Kbps/Sec. VF Channels per Remote Terminal Line Card. (Programmable Tx and Rx settings / VF range -30 dB to +3dB in steps of 0.5dB). (9 Cards / 144 Ports (Max) per Chassis)
3.	VCL-MX-1525HTL-16-5.0	16 Port VF, Hot-Line (FXS-Ring-Down) Line Interface Card: 64Kbps/Sec. Hot-Line Channels per Card. (Programmable Tx and Rx settings / VF range -30 dB to +3dB in steps of 0.5 dB) (9 Cards / 144 Ports (Max) per Chassis)
4.	VCL-MX-1530-16-5.0	16 Port VF, CO (FXO) Line Interface Card 64Kbps/Sec. VF Channels per Central Office Line Card. (Programmable Tx and Rx settings / VF range -30 dB to +3dB in steps of 0.5 dB) (9 Cards / 144 Ports (Max) per Chassis)

5.	VCL-MX-1535-08-5.0	8 Port, VF, E&M 2 Wire / 4 Wire Interface Card 64Kbps/Sec. (Programmable Tx and Rx settings / VF range -30 dB to +7dB in steps of 0.5 dB) (09 cards / 72 Ports (Max) per Chassis)
6.	VCL-MX-1540-15	Ring Generator Card (15 Watt) Central Office Ring Generator (75 volts RMS). [Supports up to 4 x 16 Port VF, FXS Cards] (To be ordered with FXS card (s) - one card per Chassis)
7.	VCL-MX-1540-30	Ring Generator Card (30 Watt) Central Office Ring Generator Card (75 volts RMS). [Supports up to 9 x 16 Port VF, FXS Cards] (To be ordered with FXS card (s) - one card per Chassis)
8.	VCL-MX-1526-15R	1+1 Redundant Ring Generator Card (15 Watt x 2) Central Office Ring Generator (75 volts RMS). [Supports up to 4 x 16 Port VF, FXS Cards] (To be ordered with FXS card(s) - one Ringer card per Chassis)
9.	VCL-MX-1526-30R	1+1 Redundant Ring Generator Card (30 Watt x 2) Central Office Ring Generator (75 volts RMS). [Supports up to 9 x 16 Port VF, FXS Cards] (To be ordered with FXS card(s) - one Ringer card per Chassis)
10.	VCL-MX-1545-04-48	4 Port, 64Kbps DCE [V.35, V.36, X.21, RS530, V.24, V.11, V.28] Synchronous OR [RS232 or RS485] Asynchronous Data Interface Card with Sub Rate Multiplexing (9 Cards / 36 Ports (Max) per Chassis)
11.	VCL-MX-1547-16-48	16 Port, Relay I/O Interface Card (RIO) [Extend either Dry Relay Contacts (Relay Normally-Open or Relay Normally-Close) or operate switches remotely (using Dry Relay Contacts rated 2A @ 30Volts DC) between any two Multiplexers using a 64 Kbps time-slot] (9 Cards / 144 Ports (Max) per Chassis)
12.	VCL-MX-1551-5.0	8 E1 Plus 4 Ethernet [100Mbps, Electrical RJ45 (F)] over Fiber Optical Transport Interface Card [2 x SFP based / without SFPs] (without SFPs - SFPs must be ordered separately) (9 Cards / 72 Ports (Max) per Chassis)
13.	VCL-MX-1558-04-48	4 Port, “n x 64” High Speed 64 Kbps to 1920 Kbps (User Configurable) DCE/DTE Synchronous Universal Data Interface Card [DCE/DTE (User programmable for DTE/DCE mode)] [V.35, V.36, X.21, V.11, RS442, RS530] (9 Cards / 36 Ports (Max) per Chassis)
14.	VCL-MX-1559-08-5.0	8 Port, RS232 (V.24/V.28 Line Drivers) 50bps to 19.2Kbps DCE Asynchronous Data Interface Card (9 Cards / 72 Ports (Max) per Chassis)
15.	VCL-MX-1560-08-5.0	8 Port G.703 @ 64Kbps, Synchronous Codirectional Data Interface Card (9 Cards / 72 Ports (Max) per Chassis)

16.	VCL-MX-1561-02-5.0	Dual Link O/E Ethernet {Electrical [RJ45 (F)] + Optical [SFP based / without SFP]} Card [for Point-to-Multi Point applications] User configurable from 64Kbps to 2Mbps. User Selectable Data Transfer Rate (Max. bandwidth per card 2Mbps.) (9 Cards / 36 Ports (Max) per Chassis)
17.	VCL-MX-1595-04-5.0	4 Port Ethernet [10/100BaseT, Electrical] Card [for Point-to-Point applications] User configurable from 64Kbps to 2Mbps. User Selectable Data Transfer Rate (Max. bandwidth per card 2Mbps.) (9 Cards / 36 Ports (Max) per Chassis)
18.	VCL-TP	4 Binary Command, Integrated VCL-TP Teleprotection / Protection Coupler Interface Card (1531). 110VDC / 250VDC Command Options (4 Cards (Max) per Chassis) **Note:** This interface card is to be used a plug-in card option with the VCL-MX, Version 6 Multiplexers.

VCL-MX [Cables and Accessories]

S. No.	Part #	Product Description
1.	VCL-1505-TER-DB37F-RJ45F-16PP	16xE1/T1, DB37 [2 x DB37F] to RJ45 [16 x RJ45F] Termination Panel 19" Metal case 1U High Rack Mount Version with Hardware Set [RJ45 cables not included]
2.	VCL-1505-TER-DB37F-RJ45F-32PP	32xE1/T1, DB37 [4 x DB37F] to RJ45 [32 x RJ45F] Termination Panel 19" Metal case 1U High Rack Mount Version with Hardware Set [RJ45 cables not included]
3.	VCL-1505-TER-DB37F-RJ45F-48PP	48xE1/T1, DB37 [6 x DB37F] to RJ45 [48 x RJ45F] Termination Panel 19" Metal case 1U High Rack Mount Version with Hardware Set [RJ45 cables not included]
4.	VCL-1514_1513-TER-DB37F-BNCF-16PP	16xE1, DB37 [2 x DB37F] to BNC [32 x BNCF] Termination Panel 19" Metal case 1U High Rack Mount Version with Hardware Set [BNC cables not included]
5.	VCL-HRNS 1264-4E1O	E1/T1 4 Port Connectorized Cable [DB25M-Open] [1 cable each 4 Port E1/T1 card]
6.	VCL-HRNS 1268-8E1Y37M	E1/T1 8 Port Y Connectorized Cable [2xDB25M-DB37M] [1 cable each 8 Port VCL-1505-TER-DB37F-RJ45F]
7.	VCL-HRNS 1247-03M	75 Ohms Connectorized Cable (BNCM-BNCM, 3m)
8.	VCL-HRNS 1247-05M	75 Ohms Connectorized Cable [BNCM-BNCM, 5 meter]
9.	VCL-HRNS 1247-10M	75 Ohms Connectorized Cable [BNCM-BNCM, 10 meter]
10.	VCL-HRNS 1264FXO	FXS/FXO/HTL 8 Port Connectorized Cable [DB25M-Open] [1 cable each 8 Port FXS/FXO card]

11.	VCL-HRNS 1264ENO	E&M 2 Port Connectorized Cable [DB25M-Open] [1 cable each 2 Port E&M card]
12.	VCL-HRNS 1264RS2V2ORev1	RS232/V.28 1 Port 64Kbps Connectorized Cable [DB25M-Open] [1 cable each 1 Port RS232/V.28 64Kbps card]
13.	VCL-HRNS 1264IOOD	RIO 8 Port Drive Connectorized Cable [DB25M-Open] [1 cable each 8 Port RIO card]
14.	VCL-HRNS 1264IOOS	RIO 8 Port Sense Connectorized Cable [DB25M-Open] [1 cable each 8 Port RIO card]
15.	VCL-HRNS 1073V35F	V.35 1 Port 64Kbps Connectorized Cable [DB25M-Winchester F] [1 cable each 1 Port V.35 64Kbps card] OR
16.	VCL-HRNS 1075V35M	V.35 1 Port 64Kbps Connectorized Cable [DB25M-Winchester M] [1 cable each 1 Port V.35 64Kbps card]
17.	VCL-HRNS 1083V36F	V.36 1 Port Connectorized Cable [DB25M-DB37F] [1 cable each 1 Port V.36 64Kbps card] OR
18.	VCL-HRNS 1083V36M	V.36 1 Port Connectorized Cable [DB25M-DB37M] [1 cable each 1 Port V.36 64Kbps card]
19.	VCL-HRNS 1084X21F	X.21 1 Port Connectorized Cable [DB25M-DB25F] [1 cable each 1 Port X.21 64Kbps card] OR
20.	VCL-HRNS 1084X21M	X.2 1 Port Connectorized Cable [DB25M-DB25M] [1 cable each 1 Port X.21 64Kbps card]
21.	VCL-HRNS 1082RS5V1O	RS530/V.11 1 Port Connectorized Cable [DB25M-Open] [1 cable each 1 Port RS530/V.11 64Kbps card]
22.	VCL-HRNS 1082RS5V1F	RS530/V.11 1 Port Connectorized Cable [DB25M-DB25F] [1 cable each 1 Port RS530/V.11 64Kbps card]
23.	VCL-HRNS 1264RSO	RS232 2 Port Connectorized Cable [DB25M-Open] [1 cable each 2 Port RS232 card] OR
24.	VCL-HRNS 1264RS9F	RS232 2 Port Connectorized Cable [DB25M-2xDB9F] [1 cable each 2 Port RS232 card] OR
25.	VCL-HRNS 1264RS9M	RS232 2 Port Connectorized Cable [DB25M-2xDB9M] [1 cable each 2 Port RS232 card]
26.	VCL-HRNS 1264G7O	G.703 4 Port Connectorized Cable [DB25M-Open] [1 cable each 4 Port G.703 card]
27.	UMIKitMXV6	System Core Cables, Blank Space Blocking Plates, Installation Accessories, Documentation, System User Manual / Disk, etc [Set]

VCL-MX Version 6, TeleProtection (User Configurable Interfaces)

S. No.	Part #	Product Description
1	VCL-MX-1564-04-MM-ST	Integrated, 4 Port, C37.94 Differential / Distance Protection Interface Card, Multi-Mode, 820nm, 1.5Km, ST Connector (May be used to multiplex and connect up to 4 x C37.94 Distance Protection Relays, or 4 x VCL-TP Teleprotection Terminals with C37.94 Optical Interfaces) (9 Cards / 36 Ports (Max) per Chassis) **Note:** This interface card is to be used a plug-in card option with the VCL-MX, Version 6 Multiplexers.
2	VCL-MX-1554-04	4 Port, Integrated IEEE C37.94 Differential / Distance Protection, SFP based Interface Card (without SFPs - SFPs must be ordered separately) (9 Cards / 36 Ports (Max) per Chassis) **Note:** This interface card is to be used a plug-in card option with the VCL-MX, Version 6 Multiplexers.

Technical specifications are subjects to changes without notice.
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