VERSITRON®
Your Copper to Fiber Connection

Versimux II
Fiber-Optic Multiplexer
Technical Manual

Revision C

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Safeguarding Communications Since 1958

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Table of Contents

1 Introduction

This manual provides general and detailed information on the installation and operation of the Versimux II Fiber Optic Multiplexer. Section 1 provides a general description of the equipment. Sections 2,3, and 5 provide installation and configuration instructions. Section 6 provides operating instructions. Section 7 provides the theory of operation. Section 8 provides maintenance and troubleshooting information. Finally, section 9 provides details for Versimux II high-density configurations.

1.1 Description of Equipment

Currently, the Versimux II supports those applications involving 2-wire analog telephone systems(POTS) and RS-530 or RS-232 digital serial interfaces. Additional interfaces will be introduced in the future to further enhance the flexibility of the Versimux II multiplexer inherent in its modular design.

The Versimux II telephone multiplexer products provide the capability to connect an exchange-side PBX to subscriber-side telephones via a single fiber optic cable. This fiber optic cable can be 1-strand or 2-strand construction. Standalone configurations and basic rack-mount configurations are available with either 4-channel or 8-channel capacity[1]. High-density, rack-mount configurations are available for up to **152 channels**. For ease of installation, both standalone and rack-mount configurations utilize the same Versimux II "building blocks". These consist of the following products:

- VMX4E   4-channel exchange side multiplexer port card
- VMX4S   4-channel subscriber side multiplexer port card
- VMX4ED   4-channel exchange side multiplexer port card
                 with 1-channel RS-485/RS-422 data
- VMX4SD   4-channel subscriber side multiplexer port card
                 with 1-channel RS-485/RS-422 data
- VMX8E   8-channel exchange side multiplexer port card
- VMX8S   8-channel subscriber side multiplexer port card

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[1] Note: For those applications where a dedicated 1-channel exchange/subscriber device is required, the following models are available:

F270XA	1-channel exchange side port card
F271XA	1-channel subscriber side port card
F270XAD	1-channel exchange side port card with 1-channel RS-485/RS-422 data
F271XAD	1-channel subscriber side port card with 1-channel RS-485/RS-422 data

Refer to their specific technical manuals for additional details about these models.

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In addition to the above listed cards, the Versimux II is capable of multiplexing RS-530 and RS-232 interfaces utilizing the following products:

- F280XD   RS-232 interface card; data rates up to 128kbps
            (also supports RS-423 and MIL-STD-188-114A, unbalanced)
- F282XD   RS-530 interface card; data rates up to 1Mbps
            (also supports RS-422, RS-449, V.35, and MIL-STD-188-114A, balanced)

The above port cards can be used in the following Versimux II enclosures and chassis:

- HF1   Single-slot standalone enclosure
- HF2SS   2-slot rack-mount chassis
- VMX20   20-slot rack-mount chassis.

Depending on the specific configuration, the following Versimux II accessory products may be required:

- VMX4800   SmartCard used with VMX20 chassis for high-density applications
- AC300WR   Power supply used with VMX20 chassis
- PSAC20   100-240VAC(50/60Hz) to 12VDC power supply for standalone
                and basic rack-mount configurations
- SFP modules   Provides fiber optic interface between devices

Using the proper combination of the above products, a fiber optic telephone multiplexer can be configured with a **minimum of 4 channels and a maximum of 152 channels.**
Here are some sample product configurations (power supplies not shown):

Illustration 1: VMX4S and VMX4E in HF1 enclosures(4 Channel Setup)

Illustration 2: VMX8S and VMX8E in HF1 enclosures(8 Channel Setup)

Illustration 3: VMX8S and VMX8E in HF2SS enclosures(8 Channel Setup)
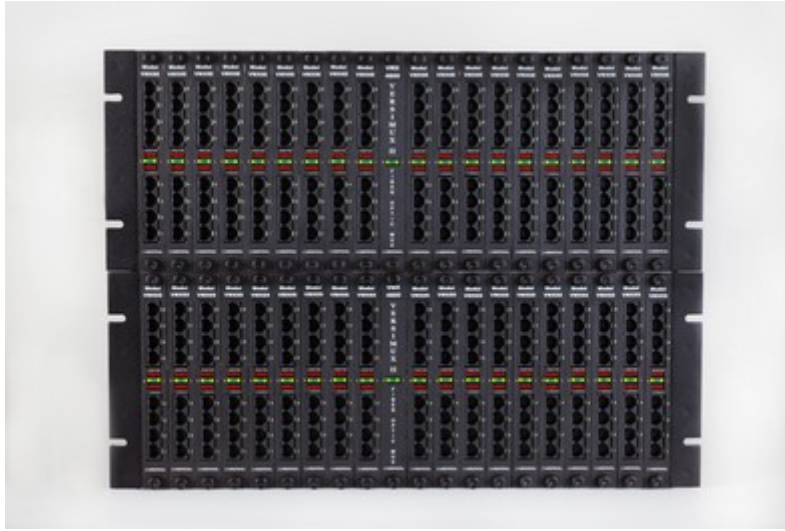
Illustration 4: Two VMX20 enclosures Fully loaded with VMX8E and VMX8S cards(152 Channel Setup)

    The exchange side port cards and subscriber side port cards are used in pairs. The channels on each port card are mapped to its "sister" card. For example: Port 1 on the VMX4E exchange side card is mapped to Port 1 on the VMX4S subscriber side card and vice versa. Port 4 on the VMX8E is mapped to Port 4 on the VMX8S, and so forth.

2   Configuring 4-Port Versimux II Fiber-Optic Telephone Multiplexers

2.1   Functional Characteristics

For applications requiring 1 to 4 phone lines linked over one fiber optic cable, the Models **VMX4E** and **VMX4S** multiplexers are used. Multiplexer models VMX4ED and VMX4SD are used where a link supporting telephone <u>AND</u> RS-485/RS422 data is required. The maximum data rate is 64kbps. The VMX4E or VMX4ED is installed at the exchange side(PBX) and the VMX4S or VMX4SD is installed at the subscriber side(telephone handsets). The main characteristics of these devices are:

- Multiplexes telephone audio from all four ports
- Transmits/Receives multiplexed audio signals over fiber optic cable
- Multiplexes 1-channel RS-485/RS-422 data with telephone audio from all four ports (product specific)

Models VMX4E, VMX4S and VMX4ED, VMX4SD use SFP fiber optic modules to achieve transmit/receive distances of up to 20 km over a single pair of single-mode fiber optic cable or 2 km over a single pair of multi-mode fiber optic cable. Single strand SFP devices are also available with the same distance capabilities. LC optical connectors are standard.

2.2   Physical Characteristics

The VMX 4-port multiplexers measure 7.0" wide x 0.84" high x 11.6" long (17.8 x 2.1 x 28.9 cm) and are designed to be installed in a variety of Versimux II enclosures and chassis. (See Table 1 for dimensions of enclosures and chassis.) For standalone or "desktop" applications, the HF1 single-card enclosure is used. For basic rack-mount applications the HF2SS dual-card chassis is used. For either of these configurations, each VMX 4-port multiplexer requires the use of the PSAC20 AC/DC power transformer providing 12VDC @2.0 amps. The one-pin power connector for this power transformer input is on the back of the port card. There are four RJ11 jacks for the telephone line connections on the front of the card. There is an SFP module slot on the back of the port card for the SFP fiber optic interface module. See Table 2 for a selection of currently available SFP modules used with the VMX 4-port multiplexers.

Table 1: Dimensions of Enclosures and Chassis

Model # (Part #)	Dimensions	Description	Power Supply Required*¹	
HF1 (19052)	1.3" H x 7.1" W x 11.6" D (3.3 x 18.0 x 29.5 cm)	Single Card Desktop Enclosure	**PSAC20**	**PSAC21**
HF2SS (19629)	1.7" H x 19.0" W x 13.8" D (4.3 x 48.0 x 35.0 cm)	Dual Card Rack-Mount Chassis*² (Side-by-Side)	**PSAC20**	**PSAC21**
HF20A*³ (32406)	7.0" H x 19.0" W x 11.6" D (17.8 x 48.0 x 29.5 cm)	20 Card Rack-Mount Chassis	**AC300WR** (32410)	
VMX20	7.0" H x 19.0" W x 11.6" D (17.8 x 48.0 x 29.5 cm)	20 Card Rack-Mount Chassis (Multiplexed Slots)	**AC300WR** (32410)	
*¹ Note: US Model – PSAC20; European Model – PSAC21 ***² Note:** One Power Supply per Modem required. ***³ Note:** In this chassis each port card requires dedicated fiber-optic cable (Maximum of 20 port cards).				

High-Density Configurations: The VMX4E, VMX4S and VMX4ED, VMX4SD multiplexers also have a 12-pin power connector(P1) and a 55-pin link connector(J5) on the back of the port card. These connectors are utilized when installing the port cards in the 20-slot Model VMX20 rack-mount chassis. In this configuration, no SFP module is required for the port cards. Instead, the VMX4800 SmartCard, and its on-board SFP module, is installed in slot 10 of the VMX20 chassis.

All the VMX 4-port multiplexers have eight LED indicators as shown in Table 3.

Table 2: Available Fiber-optic SFP Modules

SFP modules for Versimux II 4-port and 8-port Installations			
Model Number	**Wavelength**	**Max. Distance**	**Fiber-Optic Cable Type**
FE2MM	850nm	2km	Multi-Mode Duplex
FE10SM	1310nm	10km	Single-Mode Duplex
FE2MMSFA	1310nm/1550nm	2km	Multi-Mode Simplex
FE2MMSFB	1550nm/1310nm	2km	Multi-Mode Simplex
FE20SMSFA	1310nm/1550nm	20km	Single-Mode Simplex
FE20SMSFB	1550nm/1310nm	20km	Single-Mode Simplex
Note: Duplex fiber is a pair; Simplex fiber is a single fiber.			

Table 3: VMX4E, VMX4S and VMX4ED, VMX4SD Front Panel LEDs

Link	Port 4
TX	Port 3
RX	Port 2
System	Port 1

2.3 Audio Transmission Characteristics

The VMX4E (or VMX4ED) accepts a telephone audio signal on each of the four RJ11 connectors from the exchange and digitizes it with an analog-to-digital converter. Each of the digital samples is then multiplexed with the others, encoded, and applied to the SFP for transmission over the fiber-optic cable. The remote VMX4S (or VMX4SD) unit decodes the signal from the SFP module and de-multiplexes the signal. Each de-multiplexed, digitized signal is applied to a digital-to-analog converter for each of the four ports to recover the analog audio. The converse occurs in the other direction for the VMX4E (or VMX4ED). The multiplexer transmits analog signals of 300 to 3400Hz for each port.

2.4 Data Transmission Characteristics

The VMX4ED or VMX4SD accepts an RS-485/RS-422 data signal on the RJ45 connector, and sends the sampled data multiplexed with the telephone audio from the four telephone ports. The RS-485/RS-422 data port supports rates up to 64kbps. Table 4 and Illustration 5 depict the pin-out of the RJ45 for RS-485/RS-422 data.
Note: only full duplex, asynchronous data is supported.

Table 4: RS-485/RS422 Data Transmission Wiring

SW1-4 OFF	SW1-4 ON	RJ-45 Pin Numbers	Signal Designation
Normal Data	Inverted Data	1	RX+
		2	RX−
		3	TX−
		6	TX+
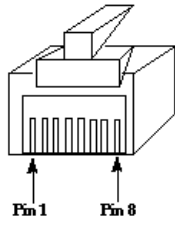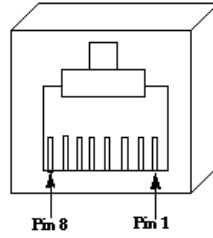
RJ-45 Jack Plug   RJ-45 Jack Face

Illustration 5: RJ45 Pin-out

3   Configuring 8-Port Versimux II Fiber-Optic Telephone Multiplexers

3.1   Functional Characteristics

For applications requiring up to 8 analog phone lines linked over one fiber optic cable, the Models **VMX8E** and **VMX8S** multiplexers are used. The VMX8E is installed at the exchange side(PBX) and the VMX8S is installed at the subscriber side(telephone handsets). The main characteristics of the VMX8E and VMX8S are:

- •   Multiplexes telephone audio from all eight ports
- •   Transmits/Receives multiplexed audio signals over fiber optic cable

Models VMX8E and VMX8S use SFP fiber optic modules to achieve transmit/receive distances of up to 20 km over a single pair of single-mode fiber optic cable or 2 km over a single pair of multi-mode fiber optic cable. Single strand SFP devices are also available with the same distance capabilities. LC optical connectors are standard.

3.2   Physical Characteristics

The VMX8E and VMX8S multiplexers measure 7.0” wide x 0.84” high x 11.6” long (17.8 x 2.1 x 28.9 cm) and are designed to be installed in a variety of Versimux II enclosures and chassis. (See Table 1 for dimensions of enclosures and chassis.) For standalone or “desktop” applications, the HF1 single-card enclosure is used. For basic rack-mount applications the HF2SS dual-card chassis is used. For either of these configurations, each VMX8E and VMX8S requires the use of the PSAC20 AC/DC power transformer providing 12VDC at 2.0 amps. The one-pin power connector for this power transformer input is on the back of the port card. There are eight RJ11 jacks for the telephone line connections on the front of the card. There is an SFP module slot on the back of the port card for the SFP fiber optic interface module. See Table 2 for a selection of currently available SFP modules used with the VMX8E and VMX8S multiplexers.

High-Density Configurations: The VMX8E and VMX8S multiplexers also have a 12-pin power connector(P1) and a 55-pin link connector(J5) on the back of the port card. These connectors are utilized when installing the port cards in the 20-slot Model VMX20 rack-mount chassis. In this configuration, no SFP module is required for the port cards. Instead, the VMX4800 SmartCard, and its on-board SFP module, is installed in slot 10 of the VMX20 chassis.

Both the VMX8E and VMX8S multiplexers have twelve LED indicators as shown in Table 5.

Table 5: VMX8E and VMX8S Front Panel LEDs

Port 8	Link	Port 4
Port 7	TX	Port 3
Port 6	RX	Port 2
Port 5	System	Port 1

3.3 Audio Transmission Characteristics

The VMX8E accepts a telephone audio signal on each of the eight RJ11 connectors from the exchange and digitizes it with an analog-to-digital converter. Each of the digital samples is then multiplexed with the others, encoded, and applied to the SFP for transmission over the fiber-optic cable. The remote VMX8S unit decodes the signal from the SFP module and de-multiplexes the signal. Each de-multiplexed, digitized signal is applied to a digital-to-analog converter for each of the eight ports to recover the analog audio. The converse occurs in the other direction for the VMX8E. The multiplexer transmit analog signals of 300 to 3400Hz for each port.

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4   Configuring RS-232 and RS-530 Versimux II Fiber Optic Port Cards

4.1   Functional Characteristics

For applications requiring RS-232 or RS-530 data, the F280XD and F282XD can be used. The main characteristics of the F280XD and F282XD are:

- Multiplexes data, clock and control pins
- When used in a VMX20 chassis, the VMX4800 can multiplex multiple F280XD and F282XD port cards

For configuration of these devices consult their respective technical manuals, as their operation in Versimux II configurations is identical, with the exception of RS-530 maximum data rate.

5   Installation of VMX 4-port and VMX 8-port Telephone Multiplexers

5.1 General

      This section contains detailed information on the installation and initial checkout of the VMX4E, VMX4S, VMX4ED, VMX4SD, VMX8E, and VMX8S telephone multiplexers. Section 5.2 contains general information on site selection and mounting. Section 5.3 contains the description for selecting different options on the multiplexers. Sections 5.4 and 5.5 contain detailed instructions for connecting multiplexer products to your system. Section 5.6 contains initial checkout procedures.

5.2 Site Selection and Mounting

      The models VMX4E, VMX4ED, and VMX8E products are designed to be used as interface extenders and multiplexers for four and eight exchange lines of a PBX or direct dial service from a telephone company.   The Models VMX4S, VMX4SD, and VMX8S products are designed to be used as interface extenders and multiplexers for four and eight subscriber(phone handset) lines. When connecting these devices to a system, the copper and fiber-optic cable should be securely installed so as to prevent accidental disconnection. Care should be taken to ensure that the copper and fiber-optic cables are not mechanically separated from the devices during operation. When installed in either the HF1 standalone enclosure or in the HF2SS dual-card rack-mount chassis, space for the power transformer(s) must also be provided.

5.3 Switch and Jumper Settings

      There is one set of switches and two jumpers provided for configuration of selectable options. Switch and jumper settings are shown in Tables 6 and 7.

5.3.1 Multiplexer Configuration Settings for VMX4E, VMX4ED, and VMX8E

      The VMX4E, VMX4ED, and VMX8E have no user-selectable configuration settings.

Table 6: S1 Switch Settings for VMX4E, VMX4ED and VMX8E

Position	On	Off
S1-1		Factory setting*
S1-2		Factory setting*
S1-3		Factory setting*
S1-4		Factory setting*
S1-5		Factory setting*
S1-6		Factory setting*
S1-7		Factory setting*
S1-8		Factory setting*
Note: *Factory setting for all S1 positions is Off. Do Not Change.*		

5.3.2 Multiplexer Configuration Settings for VMX4S, VMX4SD, and VMX8S

The VMX4S, VMX4SD, and VMX8S have one user selectable configuration setting. For ring-down operations (i.e. subscriber to subscriber) S1-1 is set to the 'ON' position. In the 'OFF' position the subscriber card will be set for normal operations.

Table 7: S1 Switch Settings for VMX4S, VMX4SD and VMX8S

Position	On	Off
S1-1	Ring-down Operation	Normal Operation
S1-2		Factory setting*
S1-3		Factory setting*
S1-4		Factory setting*
S1-5		Factory setting*
S1-6		Factory setting*
S1-7		Factory setting*
S1-8		Factory setting*
Note: *Factory setting for S1-2 to S1-8 positions is Off. Do Not Change.*		

5.3.3 SFP Module Settings for VMX4E, VMX4ED, VM4S, VMX4SD, VMX8E, and VMX8S

There are no user configurable SFP settings

Table 8: SFP Rate Jumper Settings (J2)

Jumper	Jumped	Functional Description
J2	Off*	Do Not Change
Note: <u>Factory Setting</u>: Do Not Change		

5.3.4 Default Jumper

The remaining jumper (J1) is open and should not be changed.
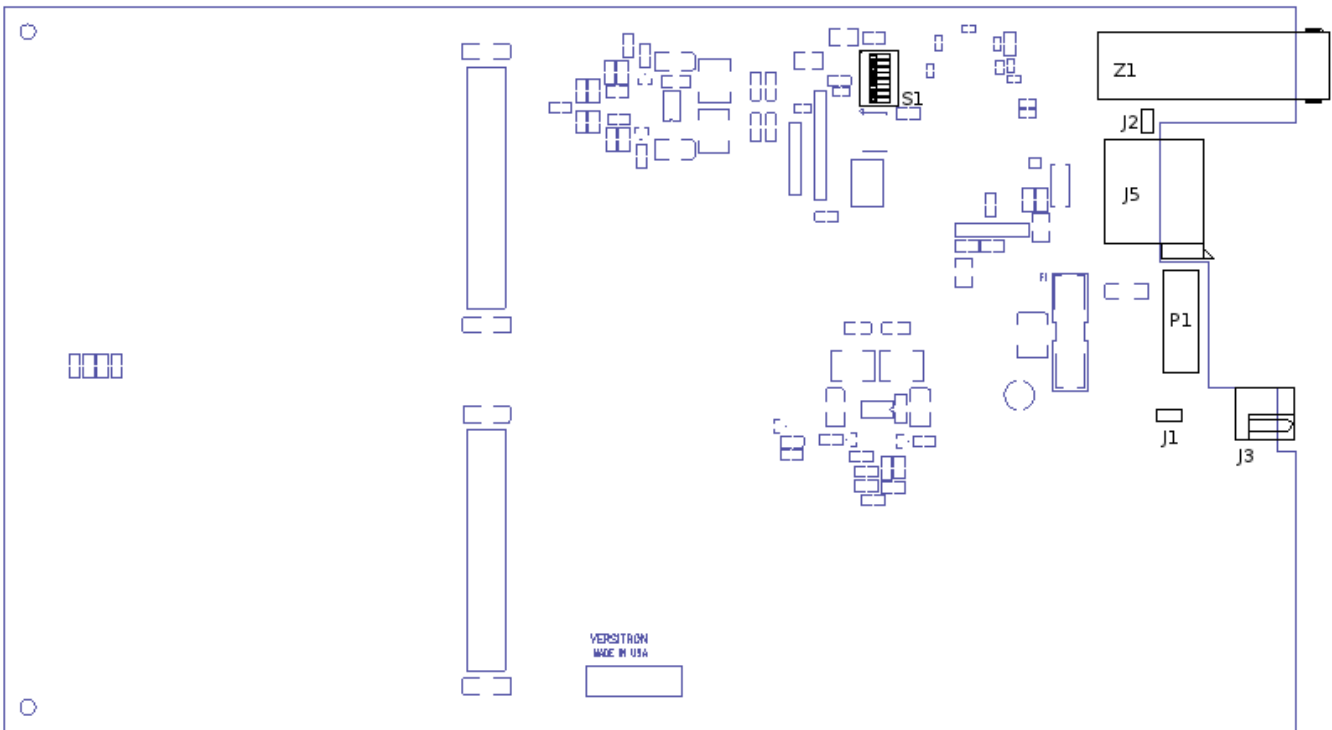
Illustration 6: Switch and Jumper Locations

5.4 Power Requirements

The VMX4E, VMX4ED, VMX4S, VMX4SD, VMX8E, and VMX8S products are designed to operate from a DC power source in the range of +10 to +16 VDC at 2 Amps.

5.4.1 Installation with AC Power

Before inserting the VERSITRON power transformer, PSAC20 (US) or PSAC21 (EUR), into an AC power source, the plug should be connected to the Versimux II multiplexer port card. There are no special tools required.

5.4.2 Installation with DC Power

DC power may be used instead of a power transformer. This requires a 2.5 mm socket, J3 (location shown in Illustration 6) with the positive voltage on the center and the common on the concentric supplying 12VDC at 2.0A as shown below (Illustration 7):

2.5mm Center Pin =
+12VDC, 2.0A
Clip   = Ground
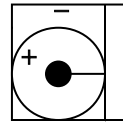
Illustration 7: DC Power Supply Connection

5.5 Interface Wiring

Tables 9 and 10 list the interface wiring for VMX4E, VMX4ED, VMX4S, VMX4SD, VMX8E, and VMX8S multiplexers. The RJ11 connectors are used with a single line 2-wire telephone as shown in Table 9. The modular connector (J3) is wired in parallel with the 12-pin connector (P1) for power. When installing the telephone multiplexers in a standalone(HF1) or dual-card rack-mount chassis(HF2SS), a power transformer is plugged into modular jack (J3). When installing the telephone multiplexers in the 20-card rack-mount chassis(VMX20 or HF20A) with power supply AC300WR, the 12-pin connector (P1) is used. Wiring for the 12-pin connector is shown in Table 10. Hard Metric Type-C connector (J5) is used for backplane communications, when the multiplexer is placed in a VMX20 chassis. Illustration 6 identifies the locations for the 12-pin power connector (P1), modular power jack (J3), and HM Type-C (J5) connector.

Table 9: Telephone/Analog Wiring (all ports)

Pin Number	Signal Designation	Color
1	Not Used	—
2	Not Used	—
3	Ring	Green
4	Tip	Red
5	Not Used	—
6	Not Used	—

Table 10: (P1) Chassis Power/Alarm Wiring

Pin Number	Signal Designation
1	+12 VDC
2	+12VDC
3	Signal Ground
4	Signal Ground
5	Signal Ground
6	Frame Ground (Chassis)
7	System Alarm Interface (Not Used)
8	Signal Ground
9	Signal Ground
10	+12 VDC
11	+12 VDC
12	+12 VDC

5.5.1 Fiber-Optic Cable Installation

After the electrical and digital interface cables have been wired according to Table 9, insert the SFP module into the SFP cage (Z1) and attach the fiber-optic cable to it (see Illustration 6 for location of Z1). The SFP module slides into the RFI Cage label side up. There will be a slight click when it locks into place. After the SFP module is installed, the fiber-optic cable can be installed. The cable must be an LC type connection. The cable should be oriented with the thumb tab at the top. When completely inserted, the tabs will click into place.

5.6 Initial Checkout Procedure

The VMX4E, VMX4ED, VMX4S, VMX4SD, VMX8E, and VMX8S multiplexers contain no power on/off switch. Once power is connected, the multiplexer will go through its power-up sequence, which will take a few seconds. When the System LED (see Table 3 or Table 5) is lit. The multiplexer is ready for use. Before beginning system operation check the following to verify proper installation:

1. Verify that the power plug is seated fully into the multiplexer port card <u>or</u> the multiplexer port card is seated fully in the rack-mount enclosure (VMX20 or HF20A).

2. Verify that the fiber-optic cable is connected on each end.

3. Verify that the Link LED (see Table 3 or Table 5) is lit when the fiber-optic cable is connected and the units, both local and remote, are powered.

If a malfunction is detected during the initial checkout procedure, refer to Section 8.2 for information on isolating the malfunction in the unit.

6   Operation

6.1   Introduction

This chapter contains a description of the operating controls and indicators associated with the telephone multiplexer port cards. Since the VMX4E, VMX4ED, VMX4S, VMX4SD, VMX8E, and VMX8S are designed for continuous and uninterrupted operation, there are no setting requirements after the unit is operational. Once the Multiplexer is powered up, it should remain in service as long as required.

6.2   Status Indicators: VMX4E, VMX4ED and VMX4S, VMX4SD

There are 8 indicators on the VMX4E, VMX4ED and VMX4S, VMX4SD: Link Status(Link), Transmit Data(TX), Receive Data(RX), System Status(System), and one multi-function LED for each of the four ports (see Table 11 for descriptions).

Table 11: Status Indicators for VMX4E, VMX4ED and VMX4S, VMX4SD

LEDs*	Color	Function
Link	Green	Indicated the remote link is active and synchronized
TX	Green	Indicates transmit data
RX	Green	Indicates receive data
System	Green	Indicates System is active and configured (ready for operation)
1-4	Red	Indicates the following : • Off: Phone is On-Hook • On: Phone is either Off-Hook or Call is in progress • Flashing: Phone is ringing.
* See Table 3 for LED mapping		

6.3   Status Indicators: VMX8E and VMX8S

There are 12 indicators on the VMX8E and VMX8S: Link Status(Link), Transmit Data(TX), Receive Data(RX), System Status(System), and one multi-function LED for each of the eight ports (see Table 12 for descriptions).

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Table 12: Status Indicators for VMX8E and VMX8S

LEDs*	Color	Function
Link	Green	Indicated the remote link is active and synchronized
TX	Green	Indicates transmit data
RX	Green	Indicates receive data
System	Green	Indicates System is active and configured (ready for operation)
1-8	Red	Indicates the following : • Off: Phone is On-Hook • On: Phone is either Off-Hook or Call is in progress • Flashing: Phone is ringing.
* See Table 5 for LED mapping		

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7   Theory of Operation

7.1   Introduction

The VMX4E, VMX4ED, and VMX8E are exchange side telephone multiplexers with an SFP port for fiber optic connections. These multiplexers are designed to work with the VMX4S, VMX4SD, and VMX8S subscriber side telephone multiplexers in pairs and interface with voice grade signals. The subscriber side devices also have a SFP port for fiber optic connections. The VMX4E, VMX4ED, VMX4S, VMX4SD, VMX8E, and VMX8S Telephone Multiplexers can be housed in a choice of standalone enclosure or rack-mount chassis: HF1, HF2SS and VMX20. (See Table 1 for complete descriptions.)

7.2   Power Supply and Alarm Circuitry

7.2.1   Power Supply Circuit

When 12VDC is applied to the circuit, the unit should draw between 200mA and 2000mA depending on the multiplexer state. The unit has a series of switching power supply circuits, which converts 12V to the voltages required by the rest of the multiplexer.

7.2.2   Alarm Circuit

This unit does not have an alarm circuit. Therefore, the Alarm signal on the P1 connector will not be driven by this unit.

7.3   Functional Description

The unit consists of the following circuits:

7.3.1- Ring Detection
7.3.3- Analog-to-Digital Conversion
7.3.4- FPGA (Mux/Demux)
7.3.5- Fiber-Optic Transceiver Circuit
7.3.6- Backplane Transceiver Circuit (VMX20 installations only)

7.3.1   Ring Detection

Ring detection for the VMX4E, VMX4ED, and VMX8E is handled by the phone CODEC chipset for each port. The chipset will detect ringing in the range of 10Vrms to 35Vrms at a

frequency range of 13Hz to 68Hz.

The VMX4S, VMX4SD, and VMX8S detect, through their FPGA, a multiplexed ring signal coming through the fiber interface for each of the ports and then enable the ringing signal on the appropriate port.

7.3.2 Ring-Down Feature: VMX4S, VMX4SD, and VMX8S

In the ring-down configuration, the VMX4S, VMX4SD, or VMX8S detect off-hook conditions and assert the ring signal for the appropriate port for transmission over the fiber to the down-stream VMX4S, VMX4SD, or VMX8S. On the other end, the VMX4S, VMX4SD, and VMX8S handle the ringing signal normally by generating the ringing signal for the handset. Ring-down is enabled by setting S1 position 1 to 'ON' as shown in Table 7.

7.3.3 Analog-to-Digital Conversion

Analog to digital conversion is handled by the phone CODEC Chipset for each port. A sample is gathered for each port at an 8kHz sampling rate. On the return side digital to analog conversion is handled in a similar way.

7.3.4 FPGA (Mux/Demux)

The FPGA is used to mux/demux the digitized voice signal from each of the ports. In essence, it is an asynchronous-to-synchronous converter encoded using proprietary VHDL programming designed by VERSITRON. A 8.192MHz Oscillator, Y1, provides the clock input to the FPGA. The FPGA also performs configuration operations for the phone CODEC chipsets for each of the ports.

7.3.5 Fiber-Optic Transceiver Circuit

Fiber-optic communications are handled by the SFP module. The power for this module is isolated from the other power circuits through filters. This helps reduce the supply noise being coupled into the SFP module. The SFP interfaces directly with the FPGA.

7.3.6 Backplane Transceiver Circuit (VMX20 installations only)

Backplane communications are handled by the FPGA. Upon insertion of the port card into a VMX20 chassis, the SFP module will be disabled, and serial communications will occur across the backplane connection (J5).

8   Maintenance and Troubleshooting

8.1   Introduction

This chapter contains general information designed to isolate a malfunction in the telephone multiplexers to a replaceable unit. These units are not equipped with redundancy, therefore, a failure in one of these units would interrupt service.

8.2   Fault Isolation

The steps in Table 13 should be taken to check a non-operating telephone multiplexer. Contact VERSITRON Customer Service for additional diagnostic assistance or to arrange for repair as necessary.

Table 13: Non-operational Indicators

STATUS INDICATOR	PROBABLE CAUSE	CORRECTIVE ACTION
System Status (System) LED is OFF	No AC power	Check that both ends of the transformer are connected
	Over current condition	Power off the unit for a few minutes and retry
	Other	Contact VERSITRON for assistance
Link Status (Link) LED is OFF	Incorrect optical signal level received at receiver input	1. Check that fiber-optic cables are properly connected 2. Check that the remote unit power is on and the fiber-optic connectors are properly attached 3. Check that the SFP module on each end is seated properly 4. Contact VERSITRON for assistance
Ports Indicator LED is ON(Ports 1-4 or Ports 1-8)	Possible problems ranging from a telephone set in an Off-Hook position to a problem with the Off-Hook circuit	Check if the telephone set receiver is seated in the cradle correctly. If this is not the case, contact VERSITRON for assistance
Port card is not working properly	Default jumpers and switch settings are not set properly	1. Check if S1 positions are all off 2. Check that jumper J2 is off 3. Contact VERSITRON for assistance

9   High-Density Telephone Configurations

9.1   Introduction and General Description

The Versimux II fiber optic telephone multiplexer system can be configured to handle up to **152 analog phone lines**. This is accomplished by using the required number of VMX4E, VMX4ED, VMX4S, VMX4SD, VMX8E, and VMX8S multiplexer port cards, along with the VMX20 chassis and high-density accessory items. In these applications, the Versimux II telephone multiplexer port cards plug directly into the VMX20 chassis and provide an interface point between the external equipment and a "multiplexing SmartCard". This SmartCard, our Model VMX4800, accepts the signals from the port cards and multiplexes them onto the fiber optic cable. At the receiving end, the signals are de-multiplexed and sent to the appropriate port card on the far end. The ports are mapped on a one-to-one basis. For example: Port 1 on the local end maps to Port 1 on the remote end. Thus, it is important for mating cards to be populated in the same slot number in the local and remote VMX20 chassis. **Note: Slot 10 in the VMX20 chassis must be populated with the VMX4800 SmartCard only. No other card should be inserted into this slot.**   The Versimux II system will multiplex 19 port cards. The VMX4800 SmartCard contains an SFP slot for the fiber optic interface. A choice of SFP modules are available to accommodate either 1-strand or 2-strand fiber optic cable. See Table 14 for a selection of available SFP modules. See Illustration 8 for a sample of a high-density configuration using the Versimux II products. The VMX20 chassis requires the use of the AC300WR power supply. See Table 15 for dimensions of the VMX20 chassis and AC300WR power supply.

Table 14: VMX4800 Compatible SFP modules

SFP modules for Versimux II High-Density Installations			
Model Number	**Wavelength**	**Max. Distance**	**Fiber-Optic Cable Type**
3GBMM	850nm	160m	Multi-Mode Duplex
3GB20SM	1310nm	20km	Single-Mode Duplex
3GB20SMSFA	1310nm/1490nm	20km	Single-Mode Simplex
3GB20SMSFB	1490nm/1310nm	20km	Single-Mode Simplex
3GB40SMSFA	1310nm/1490nm	40km	Single-Mode Simplex
3GB40SMSFB	1490nm/1310nm	40km	Single-Mode Simplex
3GB60SMSFA	1310nm/1490nm	60km	Single-Mode Simplex
3GB60SMSFB	1490nm/1310nm	60km	Single-Mode Simplex
3GB80SMSFA	1510nm/1570nm	80km	Single-Mode Simplex
3GB80SMSFB	1570nm/1510nm	80km	Single-Mode Simplex
Note: Duplex fiber is a pair; Simplex fiber is a single fiber.			

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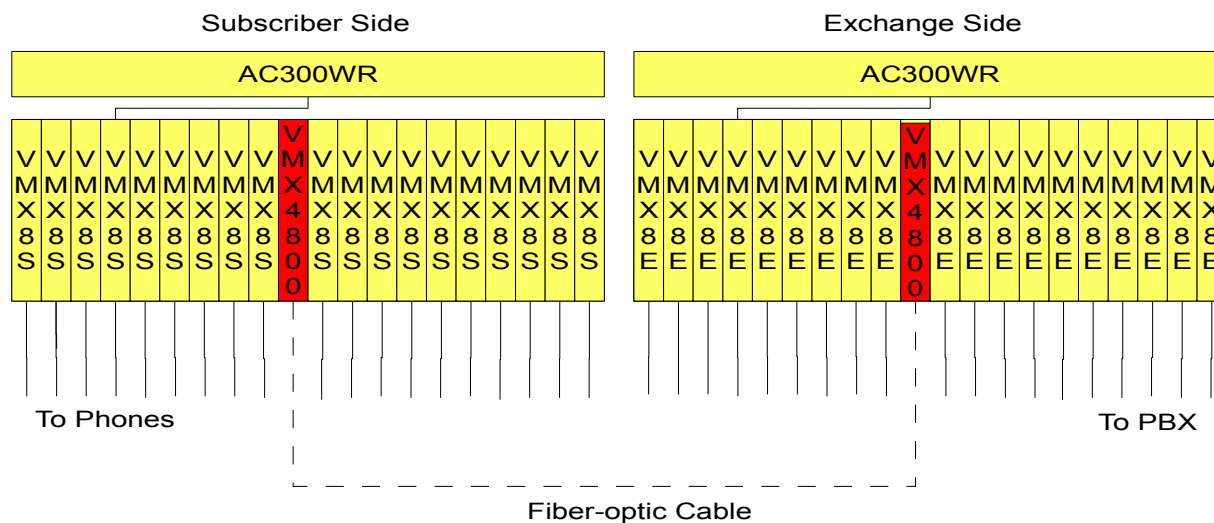
Illustration 8: Versimux II High-density Phone Multiplexer

Table 15: High-Density Chassis Dimensions

Model # (Part #)	Dimensions	Description	Comments
VMX20	7.0" H x 19.0" W x 11.6" D (17.8 x 48.0 x 29.5 cm)	20 Card Rack-Mount Chassis (Multiplexed Slots)	Used with **AC300WR** Power Supply **(19320-03)**
AC300WR	(1.75" H x 19" W x 12.12" D) (4.45cm x 48.26cm x 30.78cm)	300W Redundant Power Supply	Used with **VMX20** Chassis

9.2   Installation

9.2.1   General Information

This section contains detailed information on the installation and initial checkout for the

following Versimux II equipment used for high-density telephone multiplexer configurations:

- VMX20   20-slot, rack-mount chassis
- VMX4800   Multiplexer SmartCard
- AC300WR   Power Supply

See the Table of Contents for information on the individual exchange side and subscriber side multiplexer port cards used with the Versimux II system.

9.2.2 Site Selection and Mounting

The Versimux II VMX20 chassis is designed to be mounted into a standard 19 inch rack and utilizes 7 inches of vertical mounting space (4U). It must be powered by the AC300WR power supply, which is also designed to be mounted in a standard 19 inch rack. The VMX20 should not be mounted near any other equipment that generates excessive heat. **The VMX4800 is designed to be inserted into the VMX20 chassis in Slot 10 only. It must not be inserted into any other slot.**

9.2.3 VMX4800 SmartCard

The VMX4800 is designed for use in the VMX20 chassis in Slot 10 only. Locate Slot 10 (marked in black), align the card into the guides, and slide it in until it has completely mated with the backplane of the VMX20 chassis.

9.2.4 VMX4800 Configuration Settings

The VMX4800 has no user selectable configuration settings.

Table 16: S1 Switch Settings for VMX4800

Position	On	Off
S1-1		Factory setting*
S1-2		Factory setting*
S1-3		Factory setting*
S1-4		Factory setting*
S1-5		Factory setting*
S1-6		Factory setting*
S1-7		Factory setting*
S1-8		Factory setting*
**** Note:** Factory setting for all S1 positions is Off. Do Not Change.*		
See Illustration 9 for switch location.		

9.2.5   SFP Module Settings

There are no user configurable SFP settings

Table 17: SFP Rate Jumper Settings (J2)

Jumper	Jumped	Functional Description
J2	Off*	Do Not Change
Note: Factory Setting: Do Not Change		
See Illustration 9 for jumper location		
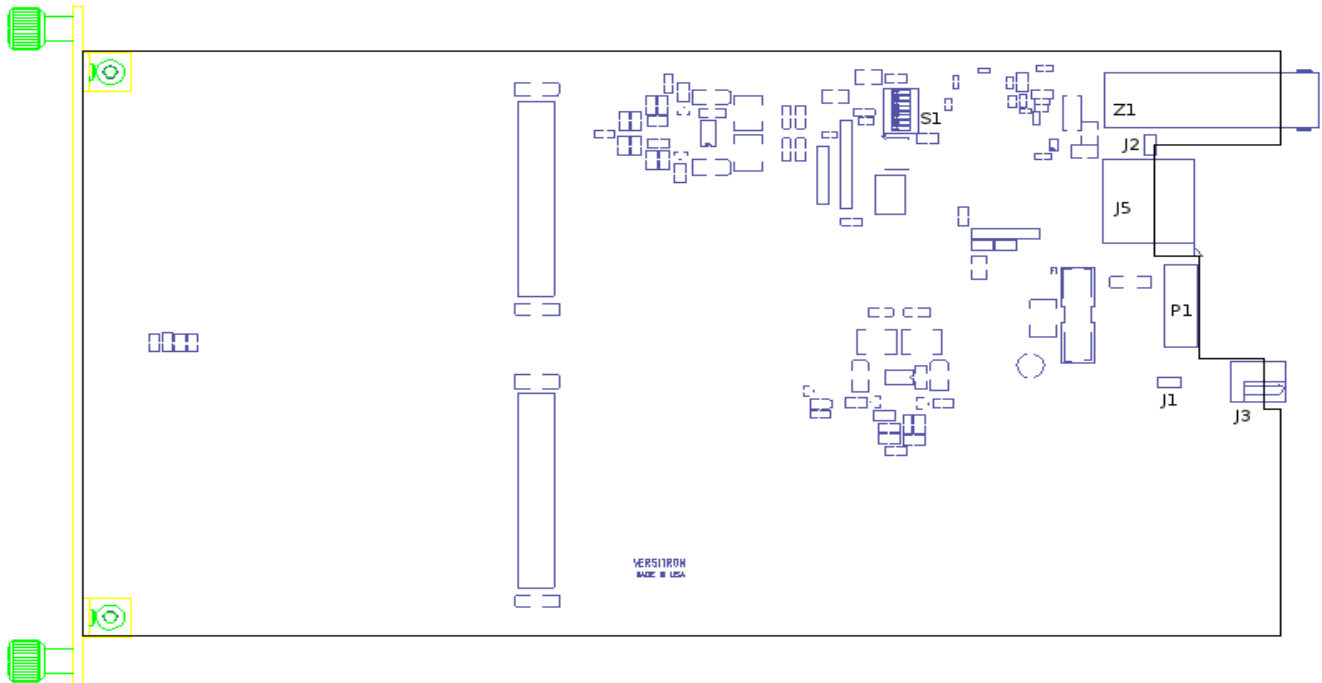
Illustration 9: VMX4800 Switch and Jumper Locations

9.2.6   Default Jumper

The remaining jumper (J1) is open and should not be changed. See Illustration 9 for jumper location.

9.2.7   Operating Power

The Versimux II VMX20 chassis is designed to be powered by the AC300WR. Before power is applied to either unit, AC300WR or VMX20, they should be mounted in a standard 19 inch rack.   The AC300WR will be plugged into the AC service. The rectangular connector from

the AC300WR will be connected, via the supplied cable, to the circular connector on the back of the VMX20 chassis.

9.2.8 Port Cards

Individual telephone multiplexer port cards(VMX4E, VMX4ED, VMX4S, VMX4SD, VMX8E, and VMX8S) can be installed by aligning the card into any one of the remaining 19 slots, and inserting it in the VMX20 chassis until it is seated in the back plane. Secure the port card by screwing in the thumb screws on the front panel of the port card.

9.2.9 Fiber-Optic Cable Installation

Insert the SFP module into the SFP cage (Z1 on the VMX4800 SmartCard) and attach the fiber-optic cable to it (see Illustration 9 for location of Z1). Connect the Fiber-optic cable to the female LC connector on the SFP module.

9.2.10 Initial Checkout Procedure

The VMX20 power is controlled by the on/off switch on the AC300WR. Once power is applied to the unit, it will go through its power-up sequence. When the System LED (see Table 19) on the VMX4800 is lit, the VMX20 chassis is ready for use. Before beginning system operation, check the following to verify proper installation:

- Verify that the power plug is seated fully into the VMX20 chassis, and the VMX4800 SmartCard and all telephone multiplexer port cards are completely seated into the VMX20 backplane.
- Verify that the fiber cable is properly connected on each end.
- Verify that the Link LED (see Table 19) is lit when the fiber-optic cable is connected and the units, both local and remote, are powered.

If a malfunction is detected during the initial checkout procedure, refer to Section 9.5 for information on isolating the malfunction in the unit.

9.3 Operation

9.3.1 Introduction

This chapter contains a description of the operating controls and indicators associated with the Versimux II fiber optic telephone multiplexer system.. Since the Versimux II system is designed for continuous and uninterrupted operation, there are no setting requirements after the unit is operational. Once the VMX20 is powered up, it should remain in service as long as required. Operating instructions for the exchange side and subscriber side telephone multiplexer

port cards can be found elsewhere in this manual. See Table of Contents.

9.3.2 Status Indicators

There are 4 indicators on the VMX4800: Link Status(Link), Transmit Data(TX), Receive Data(RX), System Status(System) (see Table 18 for descriptions).

Table 18: Status Indicators for VMX4800

LEDs*	Color	Function
Link	Green	Indicated the remote link is active and synchronized
TX	Green	Indicates transmit data
RX	Green	Indicates receive data
System	Green	Indicates System is active and configured (ready for operation)
* See Table 19 for LED mapping		

Table 19: VMX4800 Front Panel Status LEDs

Link
TX
RX
System

9.4 System Configurations

9.4.1 Introduction

The VMX20 chassis can be populated with 2-wire, analog phone port cards, RS232 port cards, or RS-530 port cards. These interfaces are multiplexed by the VMX4800 SmartCard and transmitted over the fiber-optic cable.

9.4.2 Telephone Port Cards

The VMX20 chassis accepts two types of analog telephone cards: (1) a card which is to be connected to an exchange or public telephone service, and (2) a card which is to be connected to subscriber equipment, such as a telephone handset. Each of these cards is available in a 4-port and 8-port version. The models are as follows:

VMX4E   4-Port exchange side multiplexer port card
VMX4ED   4-Port exchange side multiplexer port card with 1-channel RS485/RS-422 data
VMX8E   8-Port exchange side multiplexer port card
VMX4S   4-Port subscriber side multiplexer port card

VMX4SD   4-Port subscriber side multiplexer port card with 1-channel RS-485/RS-422 data
VMX8S   8-Port subscriber side multiplexer port card

These cards are designed to be used in pairs. For example, an 8-port exchange card could be used on the local end, and an 8-port subscriber card would be used on the remote end. Up to 19 cards can be populated in the VMX20 chassis. If all 19 slots are populated with the 8-port cards, a total of **152** telephone lines would be available. Note: The port cards are paired by the slot in which they are populated. For example, the port card in first slot on the local end communicates with the port card in the first slot on the remote end.

9.5   Maintenance and Troubleshooting

9.5.1   Introduction

This section contains general information designed to isolate a malfunction in the VMX20 chassis or VMX4800 SmartCard to a replaceable unit. These units are not equipped with redundancy. Therefore, a failure in one of these units would interrupt service.

9.5.2   Fault Isolation

The steps in Table 20 should be taken to check a non-operating VMX20 chassis or VMX4800 SmartCard. Contact VERSITRON Customer Service for additional diagnostic assistance or to arrange for repair as necessary.

Table 20: VMX4800 Non-Operational Indicators

STATUS INDICATOR	PROBABLE CAUSE	CORRECTIVE ACTION
System Status (System) LED is OFF	No AC power	Check that both ends of the transformer are connected
	Over current condition	Power off the unit for a few minutes and retry
	Other	Contact VERSITRON for assistance
Link Status (Link) LED is OFF	Incorrect optical signal level received at receiver input	1. Check that fiber-optic cables are properly connected 2. Check that the remote unit power is on and the fiber-optic connectors are properly attached 3. Check that the SFP module on each end is seated properly 4. Contact VERSITRON for assistance
VMX4800 is not working properly	Default jumpers and switch settings are not set properly	1 Check if S1 positions are all off 2 Check that jumper J2 is off 3 Contact VERSITRON for assistance

9.5.3   AC300WR Fault Isolation
The model AC300WR redundant power supply/system monitor has AC POWER, Power 1, Power 2 and SYS OK LEDs which should be illuminated. If one of the AC POWER LEDs

embedded in the front panel switches is not ON, check the AC power cord for proper connections to both the Model AC300WR and the AC source. If the embedded AC POWER LEDs are ON but the other status indicators are not correct, first check that the 12-pin power connector from the AC300WR is fully connected to the VMX20, i.e. the DC power cord is fully inserted into the round plug and secure. Next proceed with the fault isolation procedures for the multiplexer port cards sharing the VMX20 chassis with the power supply. If you believe that there is a problem with the Model AC300WR, please contact VERSITRON Customer Service for assistance.

Appendix A: Technical Specifications

A.1 VMX4E, VMX4ED, VMX8E, VMX4S, VMX4SD, and VMX8E Telephone Multiplexer Specifications:

A.1.1 General Specifications:

Models	VMX4E/VMX4ED/VMX8E/VMX4S/VMX4SD/VMX8S
Dimensions	(7″ H x 7/8″ W x 11″ L) (17.8 x 2.1 x 27.9 cm)
Weight	0.28 kg (10.0 oz)
Operating Temperature	0° to 50°C (32° to 100°F)
Humidity	Up to 95% relative humidity (non-condensing)
Altitude	Up to 10,000 ft

A.1.2 Electrical Interface:

Models	VMX4E/VMX4ED/VMX8E/VMX4S/VMX4SD/VMX8S
Power Requirements	12VDC, 2.0Amp
Phone Connectors (Tip & Ring)	RJ11, 2-Wire Twisted Pair
Audio Signal	Analog, 300Hz to 3.4Khz
Idle Channel Noise	−65dBm
Single Frequency Distortion	−46dB
2nd Harmonic Distortion	−55dB
Talk Battery	44 to 52 VDC
Loop Current	40mA max (off hook)
Ring Signal	92Vpeak(max), 15 to 67Hz
Line Impedance	600 Ω
Data Rate (VMX4ED/VMX4SD only)	64kbps RS485/RS-422 full-duplex, asynchronous
Data Connector (VMX4ED/VMX4SD only)	RJ45, 4-wire twisted pair

A.2 VMX4800 Telephone Multiplexer SmartCard Specifications:

A.2.1 General Specifications:

Models	VMX4800
Dimensions	(7″ H x 7/8″ W x 11″ L) (17.8 x 2.1 x 27.9 cm)
Weight	0.28 kg (10.0 oz)
Operating Temperature	0° to 50°C (32° to 100°F)
Humidity	Up to 95% relative humidity (non-condensing)
Altitude	Up to 10,000 ft

A.2.2 Electrical Interface:

Models	VMX4800
Power Requirements	12VDC, 1.0Amp

A.3 VMX20 Versimux II Chassis Specifications

A.3.1 Physical

Dimensions	4U(7.0" H x 19.0" W x 11.6" D);(17.8 x 48.0 x 29.5 cm)
Weight	Approx. 5.6 lb. = 2.5kg = 89oz

A.4 AC300WR Power Supply Specifications

A.4.1 Electrical

Output Voltage	12VDC
Output Ripple	Typical 100 mV
Output Current	25 Amps per power supply in redundancy
Output Power	300 Watt per power supply in redundancy
Total Output Power	600 Watt (300Watt per power supply)
Input Voltage	Universal 90VAC to 264VAC input (2 AC inlet plugs for complete redundancy)
Input Frequency	47Hz to 63Hz
Input AC Current	Approximately 3 Amps (continuous)
Remote Monitoring Interface	RS485/RS422

A.4.2 Typical Safety Rating for Internal Power Modules

Designed in full compliance with	UL60950 CSA 22.2 No. 234 EN60950
EMI	EN55022 "Class B"
EMS	EN61000-4-2,-3,-4,-5,-6,-8,-11
Harmonics	EN61000-3-2 Class D

A.4.3 Environmental

Overload Protection	Auto-recovery
Functional Temperature	0 to 70 °C
Storage Temperature	-20 to 85 °C
Over voltage Type	Latch off
Efficiency	80-90% Typical

A.4.4 **Physical**

Dimensions	1U (1.75" H x 19" W x 12.12" D); (4.45cm x 48.26cm x 30.78cm)
Weight	13.25 lb. = 6.01kg = 212oz