

**F270X
Fiber Optic
Tele-Data Modem
Technical Manual**

Revision B

Copyright May 2002

VERSITRON, Inc.
83 Albe Drive / Suite C
Newark, DE 19702
www.versitron.com

A020519685

PROPRIETARY DATA

All data in this manual is proprietary and may not be disclosed, used or duplicated, for procurement or manufacturing purposes, without prior written permission by **VERSITRON, Inc.**

WARRANTY

All VERSITRON products purchased after January 2001 are warranted against defects in materials and workmanship for the lifetime of the product. Purchases made prior to January 2001 are warranted for a period of one year from date of delivery. VERSITRON reserves the right to repair or, at our option, replace parts which during normal usage prove to be defective during the warranty period provided that:

1. You call VERSITRON at (302) 894-0699 or (800) 537-2296 and obtain a Return Maintenance Authorization (RMA) number. Please reference your RMA number on the outside of the shipment box.
2. Shipping charges are pre-paid.

No other warranty is expressed or implied and we are not liable for consequential damages. For repairs outside of the warranty period, the same procedure must be followed.

TABLE OF CONTENTS

PARAGRAPH	TITLE	PAGE
SECTION 1: DESCRIPTION OF EQUIPMENT		
1.1	INTRODUCTION	1
1.2	DESCRIPTION OF EQUIPMENT.....	1
1.2.1	Functional Characteristics	1
1.2.2	Audio and Data Transmission Characteristics	2
1.2.3	Physical Characteristics.....	2
1.3	TELE-DATA MODEM SPECIFICATIONS.....	5
SECTION 2: INSTALLATION		
2.1	GENERAL	6
2.2	SITE SELECTION AND MOUNTING.....	6
2.3	SWITCH AND JUMPER SETTINGS.....	6
2.3.1	RS-485 / RS-422 Data Transmission Settings	6
2.3.2	Fiber Optic or Copper Transceiver Network Settings.....	7
2.3.3	Interface Impedance Selection	7
2.3.4	Default Jumper	8
2.4	POWER REQUIREMENTS.....	8
2.4.1	Installation with AC Power	8
2.4.2	Installation with DC Power	8
2.5	INTERFACE WIRING	9
2.5.1	Fiber Optic Cable Installation.....	10
2.6	INITIAL CHECKOUT PROCEDURE.....	10
SECTION 3: OPERATION		
3.1	INTRODUCTION	11
3.2	STATUS INDICATORS / AUDIBLE ALARM.....	11

SECTION 4: THEORY OF OPERATION

PARAGRAPH	TITLE	PAGE
4.1	INTRODUCTION	12
4.2	POWER SUPPLY AND ALARM CIRCUITRY	12
4.2.1	Power Supply Circuit.....	12
4.2.2	Alarm Circuit.....	12
4.3	FUNCTIONAL DESCRIPTION	13
4.3.1	Ring Detection.....	13
4.3.2	Loop Current Detection Circuit.....	13
4.3.3	Reverse Battery Detection Circuit	13
4.3.4	Analog-to-Digital Conversion.....	13
4.3.5	CPLD (Mux / Demux).....	13
4.3.6	RS-485 / RS-422 Data Transmission Circuit	14
4.3.7	Fiber Optic / Copper Transceiver Circuit	14

SECTION 5: MAINTENANCE AND TROUBLESHOOTING

5.1	INTRODUCTION	15
5.2	FAULT ISOLATION.....	15

LIST OF ILLUSTRATIONS

FIGURE	TITLE	PAGE
1.1	FRONT VIEW, F270X MODEM	3
1.2	REAR VIEW, F270X MODEM	3
1.3	BACK PANEL, F270X MODEM.....	3
1.4	APPLICATION EXAMPLE	4
1.5	SWITCH AND JUMPER SETTINGS.....	8
1.6	DC POWER SUPPLY CONNECTIONS.....	8

LIST OF TABLES

TABLE	TITLE	PAGE
1.	DIMENSIONS OF ENCLOSURES AND CHASSIS	2
2.	SW1 SWITCH SETTINGS	6
3.	JP4 JUMPER SETTINGS	7
4.	SW2 SWITCH SETTINGS	7
5.	LINE IMPEDANCE JUMPER SETTINGS	7
6.	(J4) TELEPHONE / ANALOG WIRING.....	9
7.	(P1) CHASSIS POWER / ALARM WIRING.....	9
8.	(J1) RS-485 / RS-422 DATA TRANSMISSION WIRING	10
9.	COPPER INTERFACE WIRING	10
10.	STATUS INDICATORS	11
11.	NONOPERATIONAL INDICATORS	15

SECTION 1 DESCRIPTION OF EQUIPMENT

1.1 INTRODUCTION

This manual provides general and detailed information on the installation and operation of the Model F270X FOM II Series Fiber Optic TeleData Modems. Section 1 provides a general description of the equipment. Section 2 provides installation instructions. Section 3 provides operating instructions. Section 4 provides the theory of operation. Section 5 provides maintenance and troubleshooting information. Figures 1.1 and 1.2 provide an overall view of the Model F270X Tele-Data Modems.

Model Number	Part Number	Description
F2702	19685-02	Exchange side tele-data modem for audio and/or RS-485 or RS-422 data, multimode, 850nm ST optics, 2 Km operational distance.
F2704	19685-04	Exchange side tele-data modem for audio and/or RS-485 or RS-422 data, multimode, 1300nm ST optics, 8 Km operational distance.
F2705	19685-05	Exchange side tele-data modem for audio and/or RS-485 or RS-422 data, single mode, 1300nm St optics, 14 Km operational distance.

1.2 DESCRIPTION OF EQUIPMENT

1.2.1 Functional Characteristics

The Model F270X Fiber Optic Modems are designed to be used as an interface extender from a single-line exchange of a PBX or direct dial service from a telephone company. These units are used with Model F271X Fiber Optic Modems that provide a subscriber interface. These Modems are designed to transmit audio (Telephone) and/or data (RS-485 or RS-422) on duplex fiber or 4-wire twisted pair cable (depending on the application). The main characteristics of Model F270X Tele-Data Modems are:

- Multiplexes Data (RS-485 or RS-422) and Analog (Telephone audio signal), if desired
- Transmits multiplexed Data / Audio signal on fiber optic or copper interface cables

Model F270X and F271X Modem pairs use multimode fiber optic cable of up to 2 Km (6,560 ft/1.2 mi) for 850nm LED optics, up to 8 Km (26,240 ft/5 mi) for 1300nm LED optics, or single mode fiber optic cable of up to 14 Km (46,200 ft/8.7 mi) for 1300nm ELED optics. If a copper interface is used then up to 1 Km (3,300 ft/.625 mi) 4-wire twisted pair cable may be used to complete the circuit between the exchange (F270X) and subscriber (F271X) side modems.

1.2.2 Audio and Data Transmission Characteristics

The F270X series operates by accepting the audio signal at the RJ11 connector from the exchange and digitizing it, using an A/D converter. This signal is then multiplexed with data (RS-485 or RS-422) signals coming from the RJ45. The combined signal is applied to a light pulse and transmitted over fiber optic or 4-wire twisted pair cable to the remote F271X series unit.

The remote F271X series unit converts the light pulse (in cases of fiber optic connection) back into an electrical signal, demultiplexes the combined data / audio signal and applies the digitized signal to an A/D converter to recover the audio signal. The separated data and audio signals are then sent to their respective destinations. The outgoing signal path (subscriber-to-exchange) is similar. The audio signal is digitized and multiplexed together along with the data (RS-485 or RS-422) signals and transmitted to the F270X series unit. Finally, the F270X Modem recovers the audio and data signals.

The Model F270X / F271X transmits analog signals of 300 to 3400Hz and full duplex asynchronous or isochronous data (RS-485 or RS-422) signals up to 64Kbps and is fully transparent.

1.2.3 Physical Characteristics

Model F270X / F271X FOM II Series Tele-Data Modems measure 7.0 x 0.85 x 11.8in, HWD, (17.78 x 2.2 x 29.98cm) and are designed to be mounted in a variety of VERSITRON enclosures and chassis (see Table 1 for dimensions of enclosures and chassis). "Desktop" options include both single- and dual-card enclosures. Rack mount options include a 2-card and 20-card 19" standard rack mountable chassis. For either desktop enclosure or 2-card rack mount chassis, each F270X / F271X unit requires a wall transformer, VERSITRON Model PSAC08 (US) or PSAC09 (European), providing 12 VDC, 1A. The one-pin power connector for electrical input is on the back of the card. There are two RJ11 jacks for the telephone and copper interface (used in applications where there is no fiber optic cable), a RJ45 jack for EIA RS-485 or RS-422 data connection and two ST connectors for the fiber optic interface, also on the back of the card as shown in Figure 1.3. For HF-20 chassis installations, power is provided by VERSITRON Model AC150W Power Supply / System Monitor. One AC150W utilizes two slots in the HF-20. Two AC150W units are recommended for power redundancy. Both F270X and F271X models have six indicator LEDs: power (PWR), off-hook (HOOK), ring signal (RING), loop detection (LOOP), reverse battery signal (RBAT), and alarm (ALM). No audible alarm is available.

Model # (Part #)	Dimensions (WHD)	Description	Power Supply Required*1
HF-1 (19052)	7.1 x 1.3 x 11.6in (3.3 x 18.0 x 29.5cm)	Single Card Standalone Enclosure	PSAC08 PSAC09 (LTWPD1210PLX) (LTWPD1210EPL)
HF-2*2 (19053)	7.1 x 2.3 x 11.6in (5.9 x 18.0 x 29.5cm)	Dual Card Standalone Enclosure	PSAC08 PSAC09 (LTWPD1210PLX) (LTWPD1210EPL)
HF-2SS*2 (19629)	19.0 x 1.7 x 13.8in (4.3 x 48.0 x 35.0cm)	2-Slot Rack Mount Chassis	PSAC08 PSAC09 (LTWPD1210PLX) (LTWPD1210EPL)
HF-20 (19032)	19.0 x 7.0 x 11.6in (17.8 x 48.0 x 29.5cm)	20-Slot Rack Mount Chassis	AC150W (19320-03)

*1 **Note:** US Model - PSAC08; European Model - PSAC09

*2 **Note:** One Power Supply per Modem required.

TABLE 1: DIMENSIONS OF ENCLOSURES AND CHASSIS

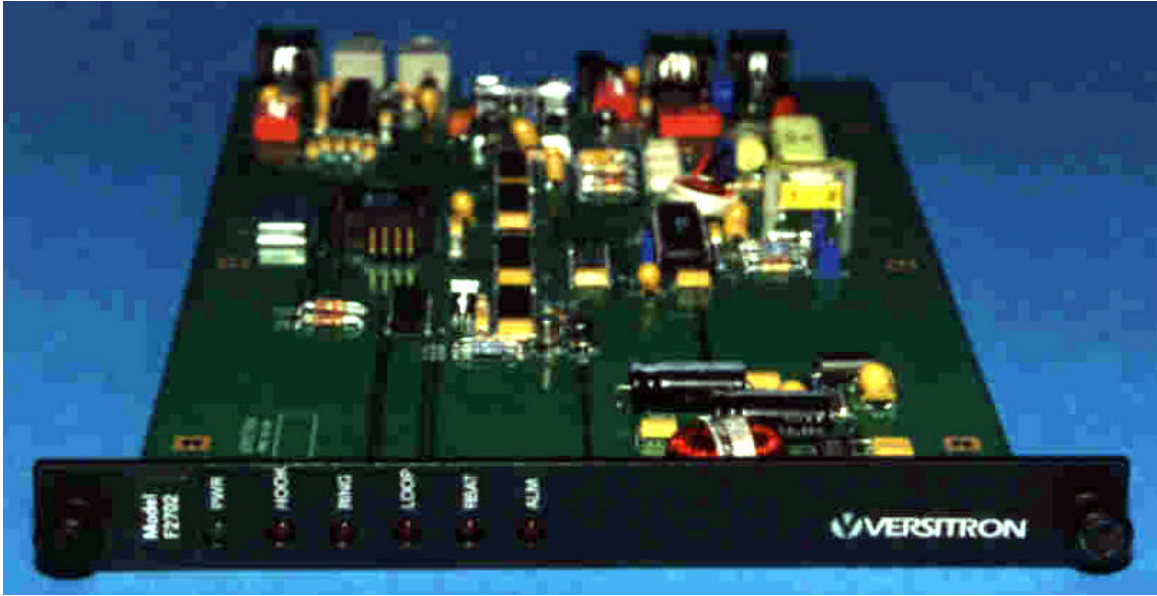


FIGURE 1.1 FRONT VIEW, F270X MODEM

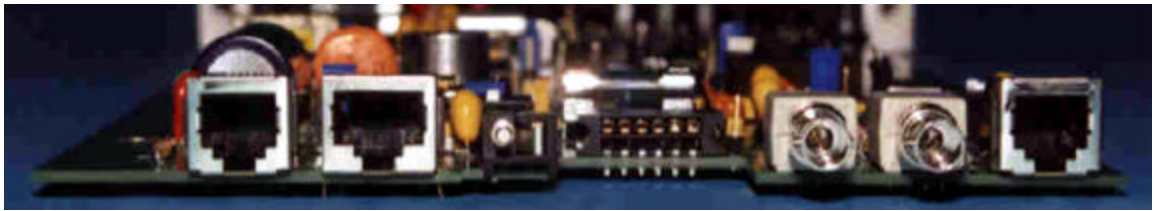


FIGURE 1.2 REAR VIEW, F270X MODEM

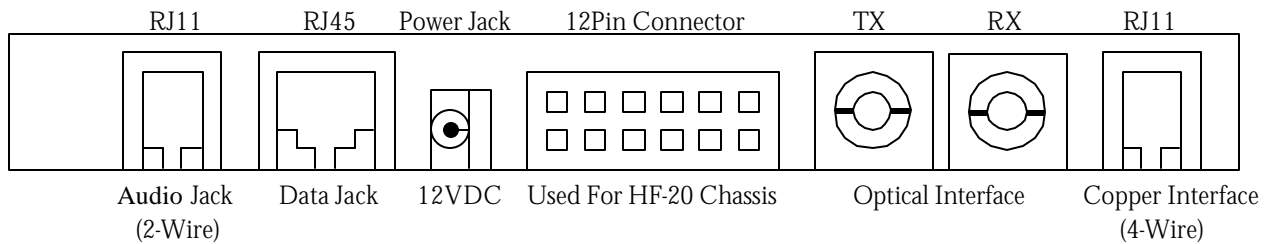
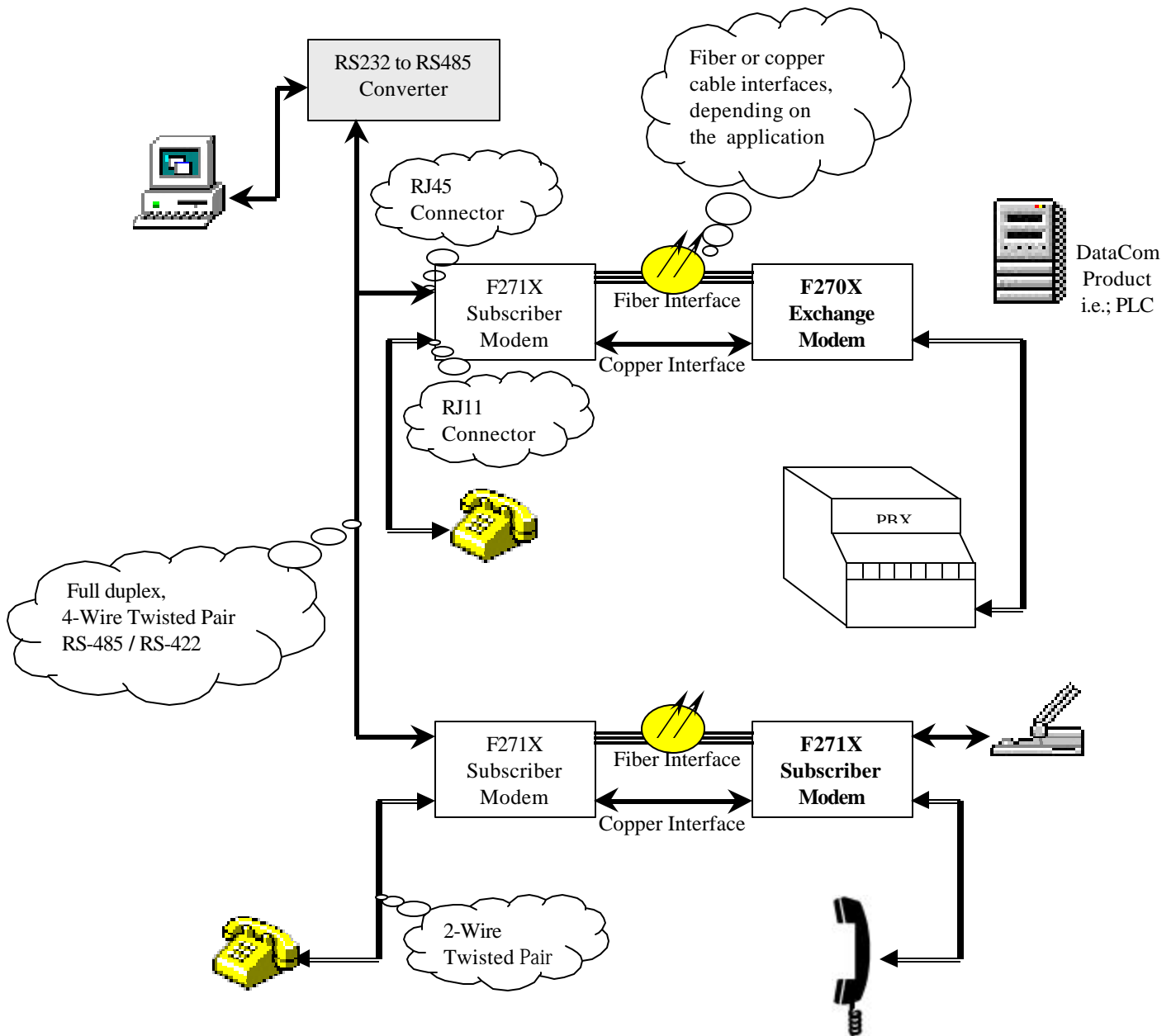


FIGURE 1.3 BACK PANEL, F270X MODEM



Where,

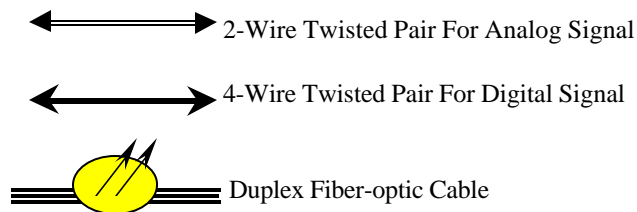


FIGURE 1.4 APPLICATION EXAMPLE

1.3 Specifications

General

Dimensions (WHD)	7.0 x .85 x 11.8in (17.78 x 2.2 x 29.98cm)
Weight	0.31kg (11.0oz)
Operating Temperature	0° to 50°C (32° to 100°F)
Humidity	Up to 95% relative humidity (noncondensing)
Altitude	Up to 10,000 ft

Electrical Interface

Power Requirements	12VDC, 1Amp
Connector (Tip & Ring)	RJ11, 2-Wire Twisted Pair
Copper Interface Connector	RJ11, 4-Wire Twisted Pair
Data Transmission Connector	RJ45, CAT 5 UTP
Audio Signal	Analog, 300Hz to 3.4Khz
Data Signal	RS-485 or RS-422 asynchronous or isochronous
Data Rate	Up to 64Kbps
Idle Channel Noise	-55dBm
In-Band Spurious	-40dBm
Out-Band Spurious	-30dBm
Talk Battery	45 to 55 VDC
Loop Current	20mA max (off hook)
Ring Signal	80-150VAC, 15 to 68Hz
Line Impedance (Jumper selectable)	600 Ω or 900 Ω

Fiber Optic Interface

Models	F2702 / F2712	F2704 / F2714	F2705 / F2715
Wavelength	Multimode 850nm	Multimode 1300nm	Single Mode 1300nm
Connector	ST	ST	ST
Link Budget	20 ± 1 dB	20 ± 1 dB	14 ± 1 dB
Maximum Range	2 Km	8 Km	14 Km
Fiber Optic Cable	50/125, 62.5/125, 100/140	50/125, 62.5/125, 100/140	8/125, 9/125, 10/125

Features

<ul style="list-style-type: none"> • Intercom or Ring Down Application with two Subscribers, F271X • Copper-to-Copper Option (Applications which don't require fiber) maximum distance of 1000 feet • Copper-to-Fiber Network Application Option • 850nm Multimode, 1300nm Multimode, and 1300nm Single Mode Options • Data and Audio Multiplexing • Line Impedance Option of 600 Ω or 900 Ω
--

SECTION 2 INSTALLATION

2.1 GENERAL

This section contains detailed information on the installation and initial checkout of the Model F271X FOM II Series Modems. Paragraph 2.2 contains general information on site selection and mounting. Paragraph 2.3 contains the description for selecting different options on the Modem. Paragraphs 2.4 and 2.5 contain detailed instructions for connecting Model F271X products to your system. Paragraph 2.6 contains initial checkout procedures.

2.2 SITE SELECTION AND MOUNTING

The Model F270X FOM II modem is designed to be used as an interface extender from a single line exchange of a PBX or direct dial service from a telephone company. This particular series can also be connected directly to the serial port (RS-485 or RS-422) of terminal or data communication equipment with a CAT-5 UTP cable (customer supplied). When connecting the F270X Modem to a PC, Fax, or STU III, 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 Modem during operation. When installed in either desktop chassis or in the dual-card rack mount chassis, space for the power transformer must also be provided.

2.3 SWITCH AND JUMPER SETTINGS

Internal switches and jumpers are provided to select between available options on the F270X. Switch and jumper locations are shown in figure 1.5. Switch and jumper settings are as follows:

2.3.1 RS-485 / RS-422 Data Transmission Settings

The F270X Modem has an option of changing the polarity of the transmit or receive data signals at the RJ45 jack. This eliminates a need to reterminate the UTP cable and change the wiring in a RJ45 plug.

Position	On	Off
SW1-1	Factory setting*	Factory setting*
SW1-2	Inverts the phase/polarity for the RS-485/RS-422 receiver inputs	Normal phase/polarity for the RS-485/RS-422 receiver inputs
SW1-3	Inverts the phase/polarity for the RS-485/RS-422 transmitter outputs	Normal phase/polarity for the RS-485/RS-422 transmitter outputs
SW1-4	Not used	Not used
<i>* Note: Factory setting for all SW1 positions is Off.</i>		
<i>* Note: Do not set SW1-1 in the On position.</i>		

TABLE 2: SW1 SWITCH SETTINGS

2.3.1 RS-485 / RS-422 Data Transmission Settings (cont'd)

Slew rate for the data being transmitted:

	Jumped*	Functional Description
JP4	2 & 3	Slew rate set to 10Mbps
<i>* Note: Factory setting. Do not change.</i>		

TABLE 3: JP4 JUMPER SETTINGS

2.3.2 Fiber Optic or Copper Transceiver Network Settings

A new feature to the VERSITRON class of Modems is the ability of the F270X and F271X Series Modems to multiplex data (RS-485 or RS-422) and analog (Telephone audio signal) onto a fiber OR copper network, depending on the application. Figure 1.4 shows an example for a copper and fiber network circuit. The selection for a copper (4-wire twisted pair) or a fiber optic interface is accomplished by the following dip switch settings:

Position	Copper Interface	Fiber Interface
SW2-1	On	Off
SW2-2	Off	On
SW2-3	On	Off
SW2-4	Off	On

TABLE 4: SW2 SWITCH SETTINGS

2.3.3 Interface Impedance Selection

The telephone / analog frequencies look into impedance known as the line impedance. In the USA and North America it is about 600Ω. In Europe and the Far East it is usually 900Ω. F270X and F271X comply with both standards, depending on the jumper settings. These settings are as follow:

Jumper	Jumped*	Functional Description
JP1	1 & 2	900 Ω line impedance
JP1	2 & 3	600 Ω line impedance
JP2	Jumper off / removed	900 Ω line impedance
JP2	Jumper on / in	600 Ω line impedance
<i>*Note: Factory Setting: JP1: (2 & 3 are jumped) and JP2: (Jumper on / in)</i>		

TABLE 5: LINE IMPEDANCE JUMPER SETTINGS

2.3.4 Default Jumper

The remaining jumper (JP3) is set in the default position and **should not be removed**. This jumper, if removed, will cause the Modem not to work properly.

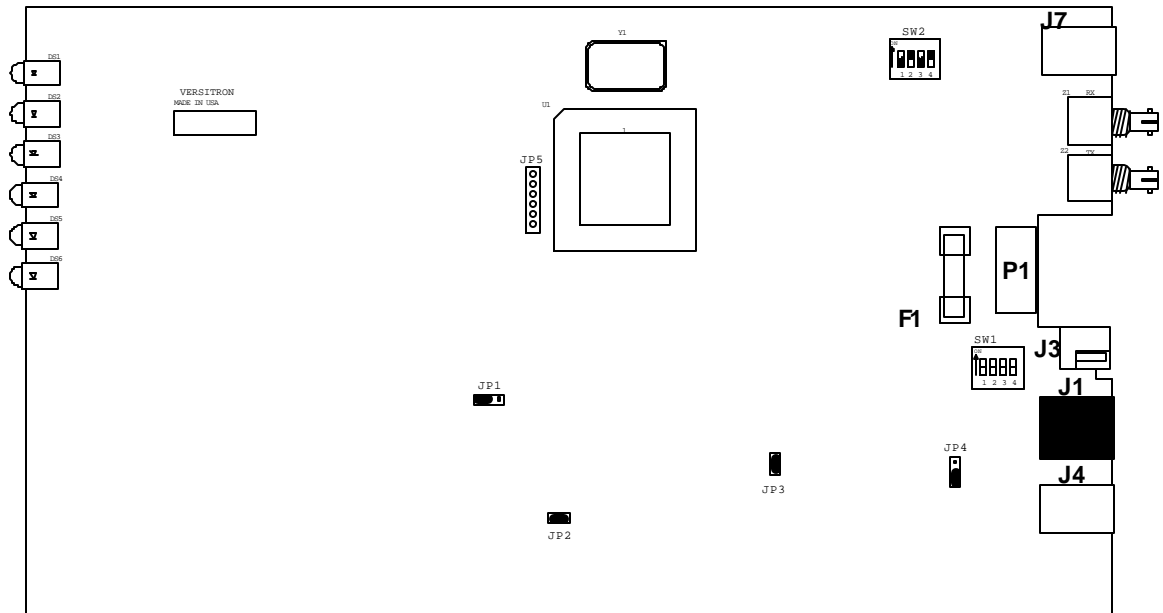


FIGURE 1.5 SWITCH AND JUMPER SETTINGS

2.4 POWER REQUIREMENTS

The Model F270X FOM II products are designed to operate from an AC power transformer or a DC power source in the range of +12 to +18 VDC.

2.4.1 Installation with AC Power

Before inserting the VERSITRON power transformer, PSAC08 (US) or PSAC09 (EUR), into an AC power source, the plug should be connected to the Modem. There are no special tools required.

2.4.2 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 figure 1.5) with the positive voltage on the center and the common on the concentric supplying 12VDC at 1A as shown below:

Center = + 12VDC, 1A
Clip = Ground

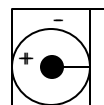


FIGURE 1.6 DC POWER SUPPLY CONNECTIONS

2.5 INTERFACE WIRING

Tables 7, 8, 9 and 10 list the interface wiring for Model F270X FOM II Series Modems. The RJ11 (J4) is used with a single line 2-wire telephone. Wiring for (J4) is shown in Table 7. The modular connector (J3) is wired in parallel with the 12-pin connector (P1) for power. When installing the telephone Modem in a standalone or dual-card rack mount chassis, a power transformer is plugged into modular jack (J3). When installing the telephone Modem in a 20-card rack mount chassis (HF-20) with optional power supplies (AC150W) the 12-pin connector (P1) is used. Wiring for the 12-pin connector is shown in Table 7. RJ45 (J5) is used for RS-485 or RS-422 data transmission. Wiring for J5 is shown in Table 9. RJ11 (J6) is used in applications where data, audio or both are meant to transmit on a copper, instead of fiber optic network. Settings for the copper interface are previously explained in section 2.3.3. Wiring for the copper interface is shown in Table 10. Figure 1.5 identifies the locations for RJ11 jack (J4), 12-pin power connector (P1), modular power jack (J3), RJ45 (J5) and RJ11 (J6) jacks.

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

TABLE 6: (J4) TELEPHONE / ANALOG WIRING

Pin Number	Signal Designation
1	+12 VDC
2	+12 VDC
3	Signal Ground
4	Signal Ground
5	Signal Ground
6	Frame Ground (Chassis)
7	System Alarm Interface
8	Signal Ground
9	Signal Ground
10	+12 VDC
11	+12 VDC
12	+12 VDC

TABLE 7: (P1) CHASSIS POWER / ALARM WIRING

Interface	SW1-2	SW1-3	Pin Number	Signal Designation	Color
Normal Phase/Polarity	Off	Off	1	RX+	Orange w/ White Line
			2	RX-	Orange
			3	TX-	Green w/ White Line
			6	TX+	Green
Inverted Phase/Polarity	On	On	1	RX-	Orange w/ White Line
			2	RX+	Orange
			3	TX+	Green w/ White Line
			6	TX-	Green

TABLE 8: (J5) RS-485 / RS-422 DATA TRANSMISSION WIRING

Pin Number	Signal Designation	Color
1	Not Used	—
2	RX-	Yellow
3	RX+	Green
4	TX+	Red
5	TX-	Black
6	Not Used	—

TABLE 9: (J6) COPPER INTERFACE WIRING

2.5.1 Fiber Optic Cable Installation

After the electrical and digital interface cables have been wired according to paragraphs 2.4 and 2.5, attach the fiber optic cable to the F270X. The transmitter module of each unit should be connected to the receiver module of the other unit. That is, the transmitter optic of the exchange side Modem, F270X, should be connected to the receiver optic of the subscriber side Modem, F271X. On the other hand, the F271X transmitter optic should be connected to the F270X receiver optic.

2.6 INITIAL CHECKOUT PROCEDURE

F270X Series Modems contain no power on/off switch. Once properly installed and power is applied it should be fully operational. The power indicator should remain on as long as power is supplied to the unit. Before beginning system operation check the following to verify proper installation:

1. Verify that the power plug is seated fully into the Modem or into the rack mount enclosure.
2. Verify that the fiber cable is crossed transmit to receive from unit one to two and two to one.
3. Verify that the alarm LED goes out when the signal is applied to the optical receiver of the F270X, or when 4-wire UTP is connected between the F270X and F271X in a copper network application.
4. Verify the switch settings for the circuit configuration. (i.e. copper or fiber optic network interface).

If a malfunction is detected during the initial checkout procedure, refer to Section 5 for information on isolating the malfunction in the unit.

SECTION 3 OPERATION

3.1 INTRODUCTION

This chapter contains a description of the operating controls and indicators associated with the Model F270X FOM II Series Modems. Since the Model F270X is designed for continuous and uninterrupted operation, there are no setting requirements after the unit is operational. Once the Modem is powered up it should remain in service as long as required.

3.2 STATUS INDICATORS / AUDIBLE ALARM

There are 6 indicators on the Model F271X: power (PWR), off-Hook (HOOK), ring detect (RING), loop detect (LOOP), reverse battery (RBAT), alarm (ALM). No audible alarm is available.

LEDs	Color	Function
PWR	Green	Indicates operating voltage is present at the power interface connector
HOOK	Red	Indicates that the telephone set has gone OFF-HOOK, when lit
RING	Red	Indicates RING signal coming from the exchange (switch), when lit or blinking
LOOP	Red	Indicates the successful loop closure on the exchange side Modem upon receiving an OFF-HOOK signal from the subscriber side Modem, when lit
RBAT	Red	Indicates Reverse Battery condition when lit
ALM	Red	Indicates the following when lit: 1. +5V power supply circuit is not working 2. -5V charge pump circuit is not working 3. +12V Power supply is not working 4. A problem exists with data transmission

TABLE 10: STATUS INDICATORS

SECTION 4 THEORY OF OPERATION

4.1 INTRODUCTION

The F270X is an exchange side Tele-Data Modem with ST single or multimode fiber optic connectors. These Modems are designed to work with F271X subscriber side Modems in pairs and interface with audio and RS-485 or RS-422 data grade signals. These units are housed in VERSITRON FOM II chassis: HF-1, HF-2, HF-2SS and HF-20. Chassis descriptions are found in paragraph 1.2.3.

4.2 POWER SUPPLY AND ALARM CIRCUITRY

4.2.1 Power Supply Circuit

When 12VDC is applied to the circuit, the unit should draw between 100mA and 130mA depending on the Modem state. The unit has a switching power supply circuit converting 12V to 5VDC and a charge pump circuit converting 5V to -5VDC. The switching power supply has a switching frequency of 44.4Khz determined by capacitor C28 (1800pF) and an under voltage lockout feature. This feature is produced by CR5 (1N755) and CR6 (1N4148). The under voltage lockout is accomplished as follows:

When the input voltage becomes lower than the zener breakdown voltage, the output transistor is turned off. This occurs because diode CR6 at that time becomes forward bias, allowing resistor R42 to sink a greater current from the non-inverting input than is sunk by the parallel combination of R43 and R44 at the inverting terminal.

4.2.2 Alarm Circuit

Alarm LED goes off when one of the following occurs:

1. +5V power supply circuit is not working
2. -5V charge pump circuit is not working
3. +12V power supply is not working
4. A problem exists with data transmission and a mux clock is not present at U5 (HC123)

These conditions activate the base of Q3, which activates the base of Q2 and starts current flowing through DS6, the alarm LED. When Q2 is activated this also changes the voltage level of connector P1 pin 7 that activates the system alarm circuit on the power supply.

4.3 FUNCTIONAL DESCRIPTION

The unit consists of the following circuits:

- 4.3.1 Ring detection
- 4.3.2 Loop circuit detection circuit
- 4.3.3 Reverse battery detection circuit
- 4.3.4 Analog-to-digital conversion
- 4.3.5 CPLD (Mux / Demux)
- 4.3.6 RS-485 / RS-422 data transmission circuit
- 4.3.7 Fiber Optic / Copper transceiver circuit

4.3.1 Ring Detection

The Ring signal from the Central Office (which is normally 65 Vrms to 104 Vrms, with $20\text{Hz} \pm 3\text{Hz}$) is detected by the optocoupler U14 and sent to CPLD, U1 via the D flip-flop U7. When there is no Ring signal, C20 is charged to +5 and the D flip-flop is cleared.

4.3.2 Loop Current Detection Circuit

The Loop indication signal can be detected only when there is an ON-HOOK condition at the subscriber side Modem. The current supplied by the central office can vary from 17mA to 25mA. When this condition is present U13 optocoupler detects the current and discharges C23 (68 μ F) to trigger the LOOP signal or LED.

4.3.3 Reverse Battery Detection Circuit

Normally Tip is 48VDC with respect to Ring. When this condition is reverse, that is Ring is 48VDC with respect to Tip, U12 optocoupler detects the condition and triggers the REVBAT signal which turns on the RBAT LED.

4.3.4 Analog-to-Digital Conversion

A 2W / 4W Hybrid circuit is used before the A/D circuit, this signal is then digitized and band limited for the digital system. On the reverse path the digital data stream is reconstructed into an analog audio signal. The sampling rate on the audio signal is 256Khz to ensure signal quality.

4.3.5 CPLD (Mux / Demux)

The CPLD is used to mux / demux the digitized audio and RS-485 or RS-422 digital data signal. In essence, it is an asynchronous-to-synchronous converter encoded using proprietary VHDL programming designed at VERSITRON. A 20MHz Oscillator, Y1, provides the clock input to the CPLD.

4.3.6 RS-485 / RS-422 Data Transmission Circuit

In the data transmission circuit, a RS-485 / RS-422 interface IC, U18, is used. This IC takes in a balanced data signal and converts it into a TTL signal. The TTL data signal is then fed to the CPLD, where it is multiplexed with the digitized audio signal. During the data reception, the TTL signal is obtained from the CPLD, which then enters the interface IC. Here the data is reformatted to a RS-485 or RS-422 signal and is transmitted out of the RJ45 connector.

4.3.7 Fiber Optic / Copper Transceiver Circuit

This design has an option of multiplexing data (RS-485 or RS-422) and analog (Telephone audio signal) onto either a copper or fiber network. The selection for a copper (4-wire twisted pair) or fiber interface is accomplished by dip switch settings as described in paragraph 2.3.2.

When the multiplexed audio and data signals are transmitted out of the CPLD, it goes into the JFET, Q1 (VN10KM). By turning on and off Q1 JFET VN10KM, the fiber optic transmitter Z2 is turned on and off respectively. This is how the optical signal is transmitted out of the Modem. On the receive side, optical receiver Z1 takes the optical signal from the fiber and converts it into a low voltage current. This current signal is fed into the fiber optic quantizer IC, through a $0.01\mu\text{F}$ coupling capacitor, C8. This chip converts the low voltage signal into a TTL signal, which then goes into the CPLD where the multiplexed audio and data signals are de-multiplexed and sent to their respective destinations.

When a copper-to-copper interface is selected, the multiplexed audio and data signal is transmitted out of the CPLD, which then goes into U17, a full duplex RS-485 / RS-422 interface IC. This chip converts the TTL data signal into a RS-485 / RS-422 signal and is transmitted on a 4-wire twisted pair telephone wire. On the reception side, U17, a full duplex RS-485 / RS-422 interface IC, receives the signal from a 4-wire UTP. The RS-485 or RS-422 data signal is converted into a TTL data signal and is transmitted to the CPLD, U1. Here the multiplexed audio and data signals are de-multiplexed and sent to their respective destinations.

SECTION 5 MAINTENANCE AND TROUBLESHOOTING

5.1 INTRODUCTION

This chapter contains general information designed to isolate a malfunction in the Model F270X to a replaceable unit. These units are not equipped with redundancy. Therefore, a failure in one of these units would interrupt service.

5.2 FAULT ISOLATION

The steps in Table 12 should be taken to check a nonoperating Modem. Contact VERSITRON Customer Service for additional diagnostic assistance or to arrange for repair as necessary.

STATUS INDICATOR	PROBABLE CAUSE	CORRECTIVE ACTION
POWER (PWR) LED is OFF	No AC power	Check that both ends of the transformer are connected
	Blown Fuse	Replace with 250V 1A slo-blo fuse
	Other power supply circuit problem	Contact VERSITRON for assistance
ALARM (ALM) LED is ON	Incorrect optical signal level received at receiver input	<ol style="list-style-type: none"> 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. Measure the optical levels on both ends (if possible) in order to check the optical link 4. Contact VERSITRON for assistance
HOOK LED is ON	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
LOOP LED is ON	Current supplied by the central office is fluctuating from 17mA to 25mA	Check the exchange the exchange line coming from the central office or the Switch
RBAT LED is ON	Voltage between Tip and Ring are reversed	Check that the Tip and Ring on the 2-wire UTP coming from the central office are not reversed. That is, Tip wire is not connected to the Ring on the Modem's RJ11 connector and vice versa
Modem is not working properly	Default jumpers and switch settings are not set properly	<ol style="list-style-type: none"> 1. Check if SW1-1 is OFF and JP3 is not removed 2. Check if SW2 is properly set for the desired interface (i.e. copper or fiber network application, see table 4) 3. Contact VERSITRON for assistance

TABLE 11: NONOPERATIONAL INDICATORS