

F272X
4-Wire TeleData
Fiber Optic Modem
Technical Manual

Revision F

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SECTION 1 GENERAL INFORMATION

1 INTRODUCTION

This manual provides general and detailed information on the F272X TeleData modem. Section 1 contains general information and operating specifications. Section 2 contains the installation procedures. Section 3 contains operating instructions. Section 4 contains theory of operation. Section 5 contains maintenance and troubleshooting.

Model Number	Part Number	Description
F2722	19929-02	4-wire Analog and/or RS-422 or 485, multimode, 850nm, ST optics, 115Kbps asynchronous, distances to 2km*.
F2724	19929-04	4-wire Analog and/or RS-422 or 485, multimode, 1300nm, ST optics, 115Kbps asynchronous, distances to 6km*.
F2725	19929-05	4-wire Analog and/or RS-422 or 485, single mode, 1300nm, ST optics, 115Kbps asynchronous, distances to 14km*.

* Note: Multimode tests performed @ 100Kbps on 62.5/125 fiber optic cable.
Single mode tests performed @ 100Kbps on 10/125 fiber optic cable.

1.2 GENERAL DESCRIPTION

The F272X is a 4-wire single line teledata modem providing one telephone and one data interface. It can be used to provide an intercom link, PA system, or other 4-wire analog service. It can also be used for single channel RS-485/422 data transmission. Basically, F272X modems can be used to multiplex analog and digital signals. A typical link configuration is shown in Figure 1.1.

1.2.1 Functional Characteristics

The F272X converts the telephone audio signal into an equivalent digital signal. The aggregate signal, which includes digitized analog and RS-485/422 data, is used to turn a light source on and off, generating a series of light pulses, which are sent through the fiber optic cable to the remote end.

At the local unit the audio bridge and the transmit A/D circuit are enabled when a signal is present and sent to the multiplexer optics. At the remote end the light pulses are recovered and the aggregate signal is de-multiplexed. On the F272X modem, the received signal is brought through a second D/A circuit to recover the audio.

1.2.2 Physical Characteristics

The F272X modem is shown in Figure 1-2. The DB9 connector (J4) is for connection to the user equipment. There are two connectors for power that are wired in parallel: Modular jack (J3) is used when the modem is in the standalone configuration; 12-pin connector (P1) is used when the modem is placed in the VERSITRON 20-slot chassis Model HF-20.

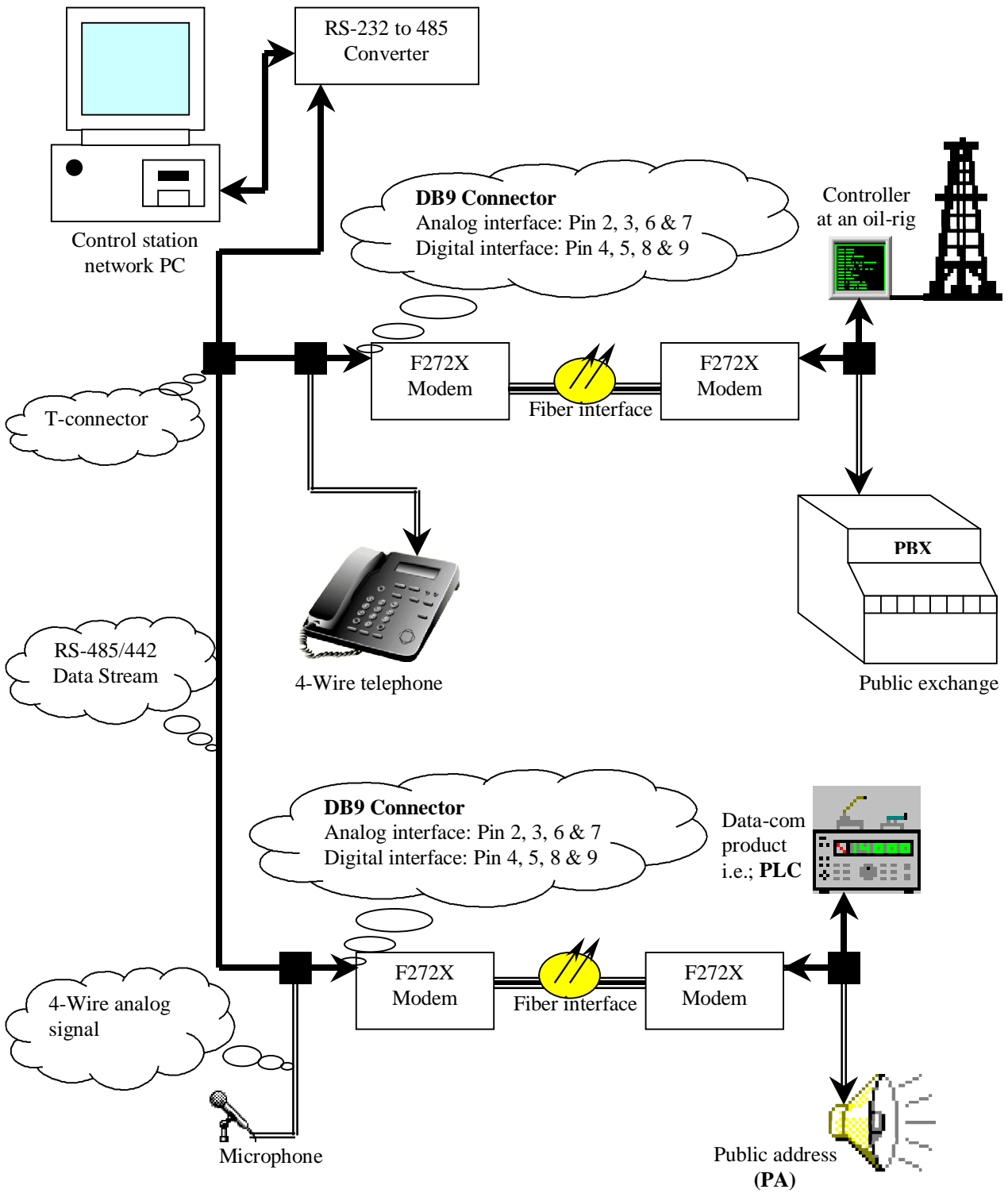


FIGURE 1-1. SIMPLIFIED SYSTEM DIAGRAM

1.3 SPECIFICATIONS

Frequency Response:	300-3400 Hz
Digital Data Rate:	115 Kbps asynchronous
Operating Mode:	As a single line or STU III telephone. Either dial pulse or multi-tone signaling. Transmits full duplex RS-485/422 data
Dimensions:	7 x 1 x 11 in. (H x W x L); (17.8 x 2.1 x 27.9 cm)
Weight:	12.0 oz (0.34 kg)
Power Requirements:	12 VDC, 6 Watts Center positive on connector
Fiber Optic Interface:	ST Connectors
Transmit Output Power:	-20 dBm (multimode), -10 dBm (single mode) \pm 1 dBm
Receiver Sensitivity:	-40 dBm \pm 1 dBm
Maximum Range:	850nm multimode - 2 km 1300nm multimode - 6 km 1300nm single mode - 14 km
Fiber Optic Cable:	Multimode 50/125, 62.5/125, 100/140 Single mode 8/125, 9/125, 10/125
Electrical Interface:	DB9 connector is provided. Interface signals include <u>Analog</u> : Tip/Ring (transmit); Tip1/Ring1 (receive) <u>Digital</u> : Differential RS-485/422 input and output
Signal:	4-Wire analog and 4-Wire differential digital
Idle Channel Noise:	-55 dBm0
In-Band Spurious:	-40 dBm0
Out-Band Spurious:	-30 dBm0
Talk Battery:	45 to 50 VDC
Loop Current:	20 mA Max
Line Impedance:	600 Ω
Environmental:	Operating temperature is 0°C to +50°C. Relative humidity up to 95% (non-condensing), altitude up to 10,000 feet



FIGURE 1-2. OVERALL VIEW

SECTION 2 INSTALLATION

2.1 GENERAL

This section contains information for installing F272X modems. Paragraph 2.2 describes user-selected options. Paragraph 2.4 describes installation procedures.

2.2 USER-SELECTED OPTIONS

The following paragraphs describe the different user-selected options for the F272X. Figure 2-1 identifies the location of the different options.

2.2.1 Signal Interface

Table 2-1 lists signal interface wiring for the F272X modem. The DB9 connector (J4) is used with single line equipment. The interface provides both transmit and receive paths for the full duplex 4 wire analog circuit with a 600Ω interface impedance. It also provides a separate full duplex 4-wire RS-485/422 interface.

F272X modems utilize standard FOM II optical modules, TX1 (J2) and RX1 (J1). The module on J2, (TX1) has a selectable jumper JP1, which is used to invert transmit data before it is sent to the optical emitter. Connect JP1 pin 1-2 to select normal data and 2-3 to select inverted data. The jumper JP2, next to J1 is for inverting receive data as it comes from the optical detector. Connect JP2 pin 1-2 to select normal data and 2-3 to select inverted data. JP3 has a default jumper setting of pins 2-3.

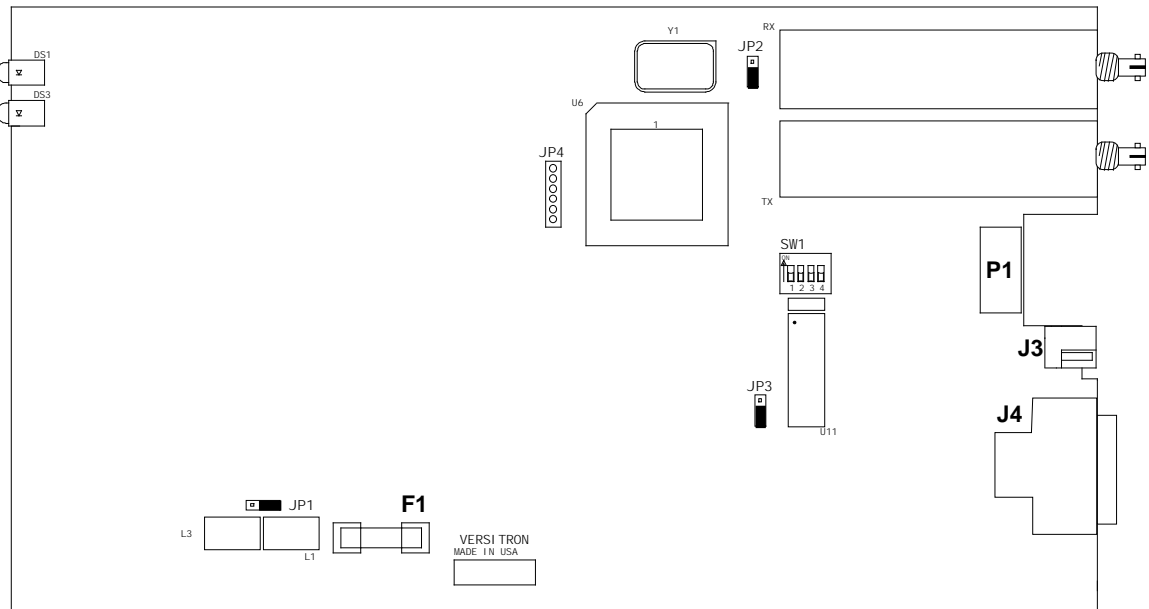


FIGURE 2-1. LOCATION OF USER-SELECTED OPTIONS

2.2.2 Signal Interface

Tables 2-2 and 2-3 list the power interface wiring for the F272X modem. The modular connector (J3) is wired in parallel with the 12-in connector (P1) for power. When installing the teledata modem as a standalone unit, a power cube is used and (J3) modular jack is used. When installing the teledata modem in a 20-slot rack mount (Model HF-20) chassis with optional power supplies the 12-pin connector (P1) is used. The jumper JP1 is used for selecting between regulated power (i.e. HF-20 power supply) and an unregulated power supply (i.e. AC/DC wall transformer). To select regulated power on the input connector, connect JP1 on pins 2-3 and for unregulated power supply connect pins 1-2.

Note: Not placing the power jumper (JP1) correctly can cause the unit to operate incorrectly.

Pin Number	Signal Designation	SW1-2	SW1-3
1	Ground		
2	Receive +		
3	Transmit +		
4	RS-485/422 (TX+)	Off	Off
5	RS-485/422 (TX-)	Off	Off
6	Receive -		
7	Transmit -		
8	RS-485/422 (RX+)	Off	Off
9	RS-485/422 (RX-)	Off	Off

TABLE 2-1 (A). J4 (INTERFACE CONNECTOR) WIRING

Pin Number	Signal Designation	SW1-2	SW1-3
1	Ground		
2	Receive +		
3	Transmit +		
4	RS-485/422 (TX-)	On	On
5	RS-485/422 (TX+)	On	On
6	Receive -		
7	Transmit -		
8	RS-485/422 (RX-)	On	On
9	RS-485/422 (RX+)	On	On

TABLE 2-1 (B). J4 (INTERFACE CONNECTOR) WIRING

Pin Number	Signal Designation
Center	+12 VDC 1A
Clip	Ground



TABLE 2-2. J3 (MODULAR POWER JACK) 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 2-3. P1 (CHASSIS POWER/ALARM) WIRING

	ON	OFF
SW1-1	Factory setting	Factory setting
SW1-2	Inverted phase/polarity for the RS-485/422 receiver inputs	Normal phase/polarity for the RS-485/422 receiver inputs
SW1-3	Inverted phase/polarity for the RS-485/422 transmitter outputs	Normal phase/polarity for the RS-485/422 transmitter outputs
SW1-4	Not used	Not used
<i>Note: Factory setting: all switches are turned off (set for normal phase/polarity)</i>		

TABLE 2-4. SWITCH SW1 SETTINGS

2.3 INSTALLATION PROCEDURES

The following paragraphs provide information for installing an F272X modem.

2.3.1 Modem Installation

The F272X can be installed in any of the FOM II style housings: HF-1 single card standalone enclosure, HF-2 dual card standalone enclosure, HF-2SS dual card mount chassis, or the HF-20 20-slot 19" rack mount chassis. The HF-20 is 7" high and has a 20-slot capacity if no power supplies are installed. With redundant power supplies installed in the chassis, the HF-20 has a 16-slot capacity.

2.3.2 Cable Installation

After the analog interface cables have been wired in accordance with paragraph 2.2, the cables may be attached to the F272X modem. Attach the interface cables to the appropriate connectors. Figure 2-1 identifies the location of the connectors.

SECTION 3 OPERATION

3.1 INTRODUCTION

This section contains general information on the annunciator lamps for the F272X. With the exception of the user-selected strap options, the modem does not contain any controls or adjustments and is designed to operate for extended periods without operator intervention.

3.2 STATUS INDICATORS

Figure 2-1 illustrates the status indicators (DS1 and DS3) on the F272X. The status indicators are color coded to simplify operation. A green lamp provides a positive indication of normal operation. A red lamp indicates a loss of traffic, an alarm condition.

PWR (green) – Indicates operating voltage is present at the power interface connector.

ALM (red) – Indicates the following when lit:

- +5V power supply circuit is not working.
- -5V power supply circuit is not working.
- There is a problem with the data transmission

SECTION 4 THEORY OF OPERATION

4.1 INTRODUCTION

The F272X is an analog/digital teledata modem with fiber optic ST connectors. F272X modems are designed to work in pairs and interface with voice or RS-485/422 data signals coming from the user equipment. These units are housed in VERSITRON'S FOM II chassis: HF-1, HF-2, HF-2SS, HF-20.

4.2 POWER SUPPLY AND ALARM CIRCUITRY

4.2.1 Power Supply Circuit

The power supply circuit used in the F272X modems is a non-switching supply. This unit has the option of using either a regulated or unregulated supply. This option is selected using a three-position jumper (JP1).

Twelve volts can be supplied to the unit through connector P1 for connection through the rack or connector J3 for standalone configurations. After the voltage is applied to one of these points, it goes through a 800mA Slo-Blo fuse (F1) then on to the three-pin jumper (JP1).

If the unit is connected to an unregulated supply, then JP1 must have a jumper between pins 1-2. This will direct the power to the input of a +12 volt regulator (VR1) and transient filter the input with C3. The output of VR1 is protected against back voltage with a rectifier diode (CR8), then filtered by C2 and C32. This +12 volt regulated output is then used throughout the board.

If the unit is connected to a regulated supply then JP1 must have a jumper between pin 2 and pin 3. This will direct the power directly to the filters C2 and C32, bypassing the unit's regulator and maintaining the +12 volts throughout the board.

4.2.2 Alarm Circuit

The alarm indicator is activated when one of the following occurs: +5Vdc, -5Vdc, or the mux clock are not present at U4 (HC123). This activates 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 on P1 pin 7, which activates the system alarm circuit on the power supply.

4.3 FUNCTIONAL DESCRIPTION

The unit consists of the following circuits: LED display, Analog to Digital converter (A/D), CPLD (which multiplexes the digital data and control signals), and fiber optic transceiver.

4.3.1 Analog to Digital Converter

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 receive path the digital data stream is reconstructed to analog voice signal. The sample rate on the voice signal is 256Khz to ensure a high quality voice signal.

4.3.2 CPLD (Mux/Demux)

CPLD U6 is used to perform the MUX/DEMUX of data and control signals as well as data synchronization functions. The CPLD was designed by VERSITRON and the VHDL code is proprietary to VERSITRON. The clock input to the CPLD is provided in series by a crystal oscillator Y1 (20.48Mhz).

4.3.3 Fiber Optic Circuit

The optical transmitter and receiver are modular boards, which allow on site replacement and upgrades (i.e. 850nm multimode (2 Km) to 1300nm multimode (6 Km)).

SECTION 5 MAINTENANCE AND TROUBLESHOOTING

5.1 INTRODUCTION

This chapter contains general information designed to isolate a malfunction in the F272X 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

5.2.1 LED Indicators

The following steps should be taken to check a non-operating modem:

1. Check indicator LED's (PWR, ALM) which are present
2. If +12 VDC power (PWR) is off, check F1 fuse. If necessary, replace with 250V 800mA slo-blo.
3. If ALM indicator is on and PWR is present, check to confirm fiber optic cable is connected correctly and the remote modem at the other end is powered on
4. Check jumper JP1 for regulated or unregulated power
5. Check JP2 for inverted receive signal
6. Check optical transmit jumper JP1 for phase inversion
7. Check that the copper cable is connected in accordance with Table 2-1
8. Check if switch SW1 settings are not reversed and they are the same on both modems connected in the circuit

5.2.2 Insertion Loss

<u>Frequency</u>	<u>Attenuation</u>
200 Hz	<-2.0 dB
304 Hz	0.3 dB<x<-1.5dB
1004 Hz	0.3 dB<x<0.5 dB
2400 Hz	0.3 dB<x<-1.0 dB
3400 Hz	0.3 dB<x<-1.0 dB
4000 Hz	<-2.0 dB

Note: The above measurements have a tolerance of $\pm .5$ dB.