

F230X
FOM II Series
DS3
Fiber Optic Modem
Technical Manual

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SECTION 1 DESCRIPTION OF EQUIPMENT

1.1 INTRODUCTION

This manual provides general and detailed information on the installation and operation of the Model F230X FOM II Series DS3 Fiber Optic Modem. Section 1 contains a general description of the equipment. Section 2 contains installation instructions. Section 3 contains operating instructions. Section 4 provides the theory of operation. Section 5 contains maintenance and troubleshooting information. Figure 1 is an overall view of the F230X.

Model Number	Part Number	Description
F2304	30311-04	DS3-standard, multimode, 1300nm LED optics, ST connectors, 2 Km operational distance.
F2305	30311-05	DS3-standard, single mode, 1300nm Laser optics, SC connectors, 10 Km operational distance.
F2305-3	30311-15	DS3-standard, single mode, 1300nm Laser optics, SC connectors, 30 Km operational distance.

1.2 DESCRIPTION OF EQUIPMENT

1.2.1 Functional Characteristics

The F230X FOM II Series products are designed for use as DS3-standard Fiber Optic Modems. The F230X operates up to 2 Km (6,600ft) on multimode fiber optic cable or up to 30 Km (99,000ft) on single mode fiber. The fiber optic circuit consists of two F230X units connected by fiber optic cable and has data rates and electrical signal characteristics that conform to ANSI T1.404, AT&T 728A & B, Bellcore TR-NPL-000320, TR-NPL-000424, DSX-3 CB119 and CCITT G.703 & G.752 standards. Electrical DS3-standard signals on coaxial cable are input via 75Ω BNC connectors and converted to fiber optic signals by the F230X units, and bipolar 3-zero substitution (B3ZS) data protocol is decoded. M13 and C-bit parity framed or unframed signals are transmitted and received by the modems.

1.2.2 Physical Characteristics

The F230X measures 7" x 0.9" x 12.2" (WxHxL) and is designed to be mounted in VERSITRON enclosures or chassis (see Table 1 for dimensions). Standalone options include single- and dual-card enclosures. Rack mount options include 2-slot and 20-slot chassis. Separate power adapters are used for each modem installed in either standalone enclosure or in the 2-slot rack mount chassis. The adapter uses a one-pin connector on the back of the card to provide power. There are two 75Ω coax connectors for the copper signal interface and two ST connectors for the fiber optic interface, also on the back of the card. The F230X draw power from VERSITRON AC150W power supplies when installed in the 20-slot rack mount chassis. Two AC150Ws may be used for power redundancy. The F230X has five indicators: power on (PWR), alarm (ALM), transmit data present (TXD), system ready for synchronous reception (RXD), and remote loopback mode indicator (LOOP).

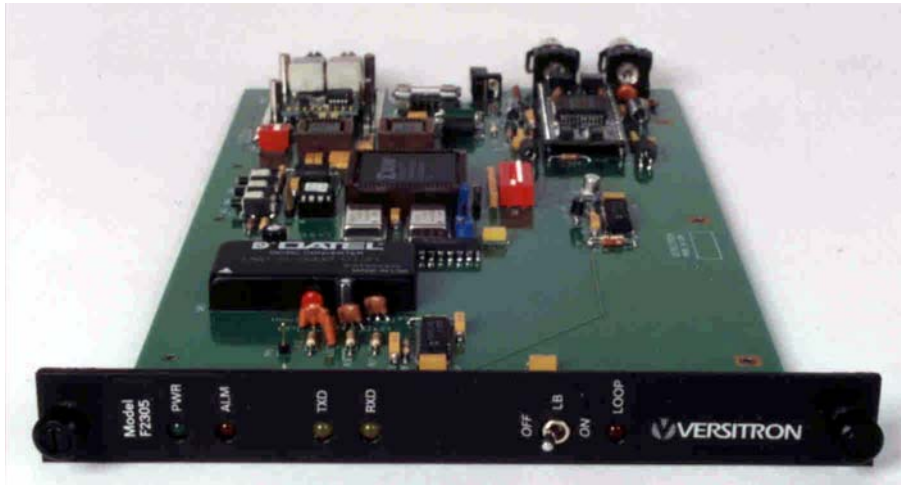


FIGURE 1. OVERALL VIEW, F230X MODEMS

Model	Dimensions	Description	PowerAdapter
HF-1 * ¹ (19052)	7.1" W x 1.3" H x 11.6" L	Single Card Standalone Enclosure	PSAC10 (LTWPS1212AP6)
HF-2 * ¹ (19053)	7.1" W x 2.3" H x 11.6" L	Dual Card Standalone Enclosure	PSAC10 (LTWPS1212AP6)
HF-2SS * ¹ (19629)	19" W x 1.7" H x 13.8" L	2-Slot Rack Mount Chassis (Side-by-Side)	PSAC10 (LTWPS1212AP6)
HF-20 (19032)	19" W x 7.1" H x 11.6" L	20-Slot Rack Mount Chassis	AC150W (19320-03)

*¹ Note: One Power Adapter per DS3 Modem is required.

TABLE 1. ENCLOSURES / CHASSIS

1.3 SPECIFICATIONS

Data Format: B3ZS, framed or unframed.

Protocol: Synchronous.

Data Rate: 44.736 Mbps.

Operation: Full duplex operation over fiber optic cable pair. Maximum operating range is 2 Km (6,600ft or 1.25mi) with 1300nm multimode LEDs, 10 Km (33,000ft or 6.25mi) with 1300nm single mode lasers or 30 Km (99,000ft or 18.75mi) with 1300nm single mode lasers.

Optical Interface: F2304: ST connectors, compatible with 50/125, 62.5/125 or 100/140 μM fiber optic cable for 1300nm multimode operation; F2305 or F2305-3: SC connectors, compatible with 8/125, 9/125 and 10/125 μM fiber optic cable for 1300nm single mode operation.

Error Rate: Better than 10^{-12} .

Digital Interface: Signal levels conform to ANSI T1.404, AT&T 728A & B, Bellcore TR-NPL-000320, TR-NPL-000424, DSX-3 CB119 and CCITT G.703 & G.752 standards. F230X products have two 75 Ω BNC connectors for the electrical interface.

Sampling Rate: 112 MHz, after serial-to-parallel conversion.

Dimensions: 7.0"H x 0.9"W x 12.2"L (17.8 x 2.3 x 31 cm).

Weight: 16.0 oz. (0.45 kg).

Power Requirements: Regulated 12 VDC @ 1.2A, 12 watts, 60Hz

Environment: 0° to +50°C (32° to +122°F) operating temperature; up to 95% relative humidity (non-condensing); up to 10,000 feet altitude; storage temperature -40° to +70° C.

	1300nm Multimode*	1300nm Single Mode*	1300nm Single Mode*
Operating Range	2km / 1.25mi / 6,600ft	10km / 6.25mi / 33,000ft	30km / 18.75mi / 99,000ft
Link Budget	19 \pm 1 dB	16 \pm 1 dB	24 \pm 1 dB
Recommended Fiber Optic Cable	50/125, 62.5/125, 100/140 μM	8/125, 9/125, 10/125 μM	8/125, 9/125, 10/125 μM

*Note: Multimode tests were performed on 62.5/125 μM fiber optic cable.
Single Mode tests were performed on 9/125 μM fiber optic cable.

SECTION 2 INSTALLATION

2.1 GENERAL

This section contains information on the installation and initial checkout of the F230X FOM II Series DS3 Modems. Paragraph 2.2 contains general information on site selection and rack mounting. Paragraphs 2.3 through 2.6 contain detailed instructions for connecting F230X units to your system and selecting the different options. Paragraph 2.7 contains initial checkout procedures.

2.2 SITE SELECTION AND MOUNTING

The F230X is designed to connect directly to the serial port (two 75Ω BNC connectors) of PBX or multiplexer equipment with cables (customer supplied). The F230X is designed to be mounted in a single- or dual-card standalone enclosure (Model HF-1 and HF-2, respectively) or may be rack mounted in a 2- or 20-slot chassis (Model HF-2SS or HF-20, respectively).

2.3 POWER REQUIREMENTS

WARNING: Power must be supplied to the circuit board prior to connecting either the copper or fiber signal cables. This permits the programmable logic on the circuit card to initialize properly. Failure to supply power to the board first could result in incorrect functioning of the product.

The F230X is designed to operate from an AC power transformer or a DC power source with a DC voltage of +12 VDC, 1.2A. Before inserting the power transformer into an AC power source, the plug should be connected to the modem. No special tools required. DC power may be used instead of the power transformer if available. This requires a 2.5 mm socket with the positive voltage on the center and the common on the concentric using +12 VDC at 1.2A.

2.4 SWITCH SETTINGS

Each F230X has five switches on the circuit card. Only one, the loopback switch, labeled "SW1", is used after the initial configuration of the modem. The loopback switch is set from the front panel of the circuit card, should be set OFF for the initial configuration and installation. The loopback function is discussed in Section 2.6. The switches labeled "SW2", "SW4", "SW5", and "SW6" are used to reset the XILINX FPGA and the TX and RX TAXI chips. These are for diagnostic use only, and should never be touched. The 3-position switch labeled "SW3", near the edge of the card near the BNC connectors, is positioned such that the "ON" setting of each of the 3 switch positions is toward the FPGA (or "up" as the card is held vertically with the front panel to the left). **This setting should not be tampered with.**

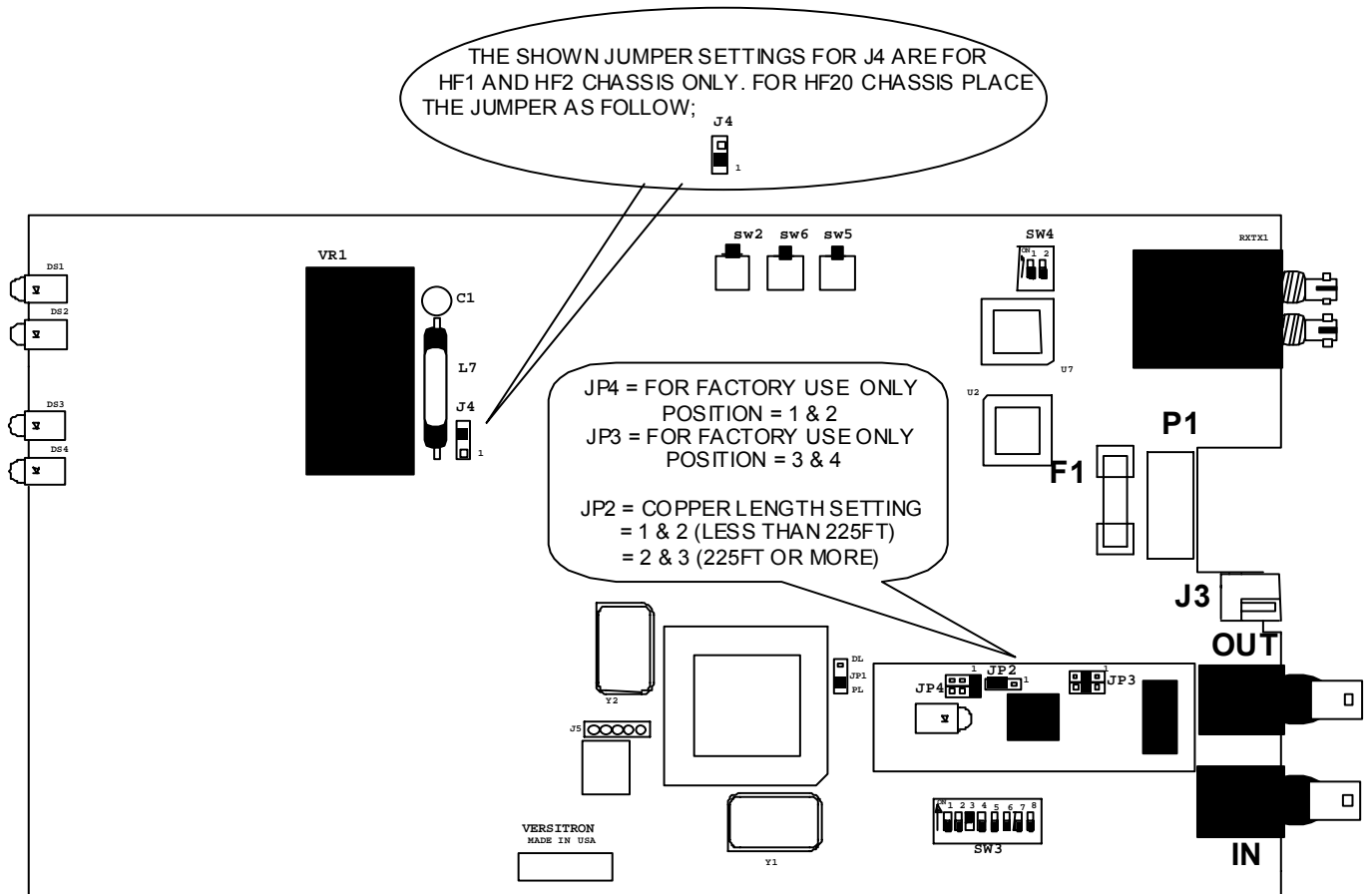


FIGURE 2. JUMPER AND SWITCH SETTINGS

2.5 OUTPUT CONNECTIONS

The F230X DS3 Modems transmit and receive bipolar, B3ZS-encoded signals using standard BNC connectors for the electrical signal interface.

2.6 LOOPBACK

The F230X has two loopback features. The first ("remote") allows the user to test the fiber optic circuitry of the local unit, and the copper/fiber circuitry of the remote unit. The second ("local") loops the individual unit to itself (a fiber optic patch cable is required for this test).

2.6.1 Remote Unit Loopback

A front panel loopback switch (LB) controls the F230X fiber optic inputs and outputs. When switched ON, optically received serial data from a remote terminal is converted from serial to parallel, reconverted back to serial and clocked back out via the optical transmitter. With the local and remote unit's fiber systems and remote unit's copper system working properly, the remote unit will experience a few errors and then re-sync to the incoming data. Meanwhile the local unit will have errors due to no data being transmitted through the local unit. This test proves that the optical interface circuitry of both units and the copper circuitry of the remote unit are operating properly.

2.6.2 Local Unit Loopback

For this loopback function, a small fiber optic patch cable is required. The patch cable is used to loop back the optical transmitter to the optical receiver. In a working unit, B3ZS data from the copper interface is encoded and transmitted through the optical circuit via fiber optic patch cord. The data is then received by the optical receiver and decoded back to B3ZS data stream. This procedure is used to test the optical and electrical circuits of an individual unit.

2.7 INITIAL CHECKOUT PROCEDURE

WARNING: AVOID LOOKING INTO THE TRANSMITTER OPTICAL OUTPUT ONCE POWER IS APPLIED. EYE DAMAGE DUE TO LASER CAN OCCUR.

The F230X has no power on/off switch. Once installed and power is applied it is considered fully operational. The power indicator (PWR) should remain on as long as power is supplied. Upon initial power up, with no signal connections made, the power (PWR), system ready for synchronous reception (RXD), and alarm (ALM) LED indicators should be ON. When signal connections are properly made, the transmit data present (TXD) and system ready for synchronous reception (RXD) indicators should be ON and the ALM LED should go OFF. Before beginning system operation verify the following:

1. The power plug is seated fully into the F230X or seated firmly in the rack mount enclosure.
2. The PWR and RXD LEDs lit up when the power is applied to the modem.
3. The fiber optic cable is crossed transmit to receive from unit one to unit two.
4. The ALM LED go out when fiber optic connections are applied to the F230X.
5. The TXD LED lights up when the BNC copper interface is connected.
6. The switch settings are correct for the circuit configuration.

If a malfunction is detected during the initial checkout procedure, refer to Chapter 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 F230X FOM II Series DS3 Modems. Since the F230X is designed for continuous and uninterrupted operation, there are no operating requirements. Once the F230X is powered up it should remain in service as long as required.

3.2 STATUS INDICATORS AND ALARM CIRCUITS

There are five LED indicators on the F230X: power (PWR), alarm (ALM), transmit data present (TXD), system ready for synchronous reception (RXD), and remote loopback (LOOP). No audible alarm is available. The F230X contains alarm circuits to monitor the copper connection, optical connection and power supplies. The ALM LED is activated when there is no signal present at the fiber optic interface. The RXD LED comes ON when power is supplied to the unit. It shows that the unit is ready for synchronous data reception. (NOTE: An additional red LED is located on the daughter board of the circuit card assembly which indicates a loss of copper signal on the transmit (IN) BNC connector.)

3.3 OPERATING CONTROLS

The only operating control associated with the F230X is the front panel switch. The LB switch is used to enable the remote loopback capability of the circuit. This is described in Section 2.6 and is normally only used for diagnostic purposes when initializing or reconfiguring the system using the F230X. The switch settings onboard the circuit card are described in Table 2 in Section 2.4 and are set prior to first using the F230X. Further changes are not required unless the system requirements change.

SECTION 4 THEORY OF OPERATION

4.1 INTRODUCTION

The F230X FOM II Series DS3 Modems provide a transparent, synchronous path for DS3-standard signals. By converting to fiber optic signaling, a distance of 2 Km (6,600ft or 1.25mi) on multimode fiber optic cable or 30 Km (99,000ft or 18.75mi) on single mode fiber optic cable may be traversed without the need for a repeater or amplifier. In addition, the use of fiber optic cable as the transmission medium provides EMI/RFI protection and data security.

In the F230X transmitter circuitry, the DS3-standard data and clock are received via the BNC connector, decoded from B3ZS, processed and transformed to TTL logic with a Field Programmable Gate Array (FPGA). The serial data stream is converted to an eight-bit parallel stream and synchronized. The signal is then converted into an optical signal input. The parallel data inputs are sampled using an AM7968 TAXI chip, at a rate of approximately 112 Mbps and a balanced +5V ECL signal format. The optical signal transmitter then sends the signal out onto the fiber optic cable.

Through the receiver circuitry of the F230X the same process occurs in reverse. First, the optical signal is received and converted back to an electrical signal. The TAXI receiver decodes the serial data stream. The data signal is then re-encoded to the B3ZS protocol and output to the BNC electrical signal interface. To the multiplexer or PBX terminal equipment connected to the F230X pair, the transition from copper to fiber and back is transparent.

SECTION 5 MAINTENANCE AND TROUBLESHOOTING

5.1 INTRODUCTION

This chapter contains general information designed to isolate a malfunction in the F230X 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 3 should be taken to check a non-operating 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 800 mA, 5 x 20 mm Slo-Blo fuse.
	Other power supply circuit problem.	Contact VERSITRON Customer Service 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 cable is properly connected to RX connector. 2. Check that the remote unit power is on and the TX fiber optic connector is connected properly. 3. Measure the optical levels on both ends (if possible) in order to check the optical link. 4. Contact VERSITRON Customer Service for assistance.
DATA (TXD) LED is off or not responding as expected	No input on the BNC electrical interface connector.	<ol style="list-style-type: none"> 1. Check that the switches are set for the correct electrical interface protocol. 2. Check that the interface connector is 75Ω and connected securely.
DATA (RXD) LED is off or not responding as expected.	Unit is not ready for synchronous data reception. Internal circuitry problem.	Contact VERSITRON Customer Service for assistance.
HF-20 chassis, SYSTEM ALARM LED is on.	No input on the BNC electrical interface connector.	<ol style="list-style-type: none"> 1. Check that the switches are set for the correct electrical interface protocol. 2. Check that the interface connector is 75Ω and connected securely.

TABLE 3. NON-OPERATIONAL INDICATORS