

## TELTREND'S ENHANCED T1 INTELLIGENT OFFICE REPEATER MODEL IOR7231E

(\*CLEI™ Code: T1R3PU02AA)

CONTENTS	PAGE
1. GENERAL	1
2. APPLICATIONS	2
3. FUNCTIONAL OPERATION	2
4. OPTIONS	10
5. INSTALLATION	10
6. TESTING	10
7. SPECIFICATIONS	10

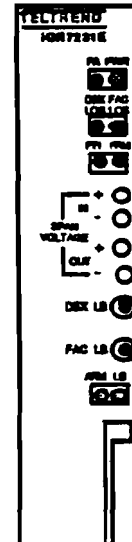
### 1. GENERAL

**1.01** Teltrend's Enhanced T1 Intelligent Office Repeater, Model IOR7231E (also described throughout this practice as the EIOR), is an AT&T, 220 mounting compatible, Powering Office Repeater. The IOR7231E provides 60mA simplex current for powering bi-directional span lines. The IOR7231E has the capability of providing full T1 or Fractional T1 (FT1) service. When providing FT1 service the EIOR restricts the bandwidth of the payload data in the Customer-to-Office direction. This bandwidth restriction capability limits the amount of usable DS0 channels available to the customer. The EIOR can also function as a Fiber Extension Repeater or as a Network Interface Unit (NIU). Teltrend's IOR7231E provides enhanced maintenance capabilities including looping back T1 transmission signals toward the DSX-1 or toward the Network Interface. This loopback feature enhances carrier maintenance operations by allowing the Local Exchange Carrier (LEC) to rapidly sectionalize span faults.

**1.02** Whenever this practice is reissued or revised, the reason for reissue or revision will be stated in this paragraph.

**1.03** Features of Teltrend's Enhanced T1 Intelligent Office Repeater (IOR7231E) are as follows:

- SIDE 1 Transmit Line-build-out (LBO adjustable for 0 to 27.0dB of Loss)
- Side 2 Receive Automation Line Build-out (ALBO) regenerates T1 signals subjected to cable losses of 0dB to 35dB.



**CAUTION**  
This product incorporates static sensitive components. Proper electrostatic discharge procedures must be followed.

- Metallic Loopback toward the DSX-1 (or test center)
- Logic Loopback toward the Network Interface (NI)
- Manual loopback capability toward the DSX-1 or toward the Network Interface
- Provides Loopback Indication Signal (LIS)
- Conventional Fault Locate Output
- Switch-selectable, bandwidth allocation allows for selecting the number of active DS0 channels available to 2, 4, 6, 8, 10, 12 or 24
- A 2-position slide-switch allows for selecting the appropriate fill code (ONES/IDLE) to be inserted in the restricted DS0 channels
- Temporary, remote bandwidth limit override
- Switch-selectable, Span Powering option (ENABLE/DISABLE); When set to ENABLE, provides span powering at 60mA up to  $\pm 130Vdc$
- Remote Span Power Disable

- Span Current and voltage test points
- Arming code for security
- Remote Repeater Identification capability
- 3 unique addresses for full T1 operation
- NIU dual-loopback mode
- Alarm Indication Signal (AIS) upon loss-of-signal from the DSX-1 or from the Network Interface
- Lightning and power cross protection
- Front panel LEDs provide quick visual indication for: Fuse Alarm (FA), Power (PWR), DSX Loss-Of-Signal (DSX LOS), Facility Loss-Of-Signal (FAC LOS), Fractional T1 active (FT1), Framed T1 (FRM), Arming (ARM), and Loopback (LB)
- 7-year warranty

## 2. APPLICATIONS

**2.01** Teltrend's IOR7231E is used to provide either Full T1 or Fractional T1, High Capacity Digital Service (HCDS) over metallic cable pairs that transport bipolar data at the DS1 rate (1.544Mb/s). The EIOR is typically located at the end-serving central office, fiber hubbing location or at the customer premises. The EIOR can also be deployed in-place-of the standard Network Interface Unit. The typical application for the EIOR in the NIU mode is in applications where a fiber multiplexer is deployed on the customer premises and HCDS is provided. Refer to Figure 1 for the IOR7231E Typical Application Diagrams.

**2.02** The IOR7231E supports 60mA bi-directional spans. T1 Span design, including repeater powering and end-section design, should be done in accordance with standard T1 span design or local company procedures. In addition to providing HCDS, Teltrend's IOR7231E facilitates maintenance testing, and fault location by providing a maintenance Loopback that can be activated toward the DSX-1 or Network Interface.

**2.03** While in loopback, the IOR7231E allows the tester to pin-point a problem in the span line by looping back test signals and verifying the operation of the IOR7231E, the individual Intelligent Line Repeaters (ILR7239), the Network Interface Unit (NIU) and the cable pairs.

## 3. FUNCTIONAL OPERATION

**3.01** Refer to Figure 2, the IOR7231E Block Diagram, as needed while reading the following functional description.

### Transmit To Span (Side 1)

**3.02** Incoming bipolar signals from the DSX-1 are applied to the Side 1, "FROM DSX IN" port, pins 42 and 43 (T&R). These signals are routed to the Side 1 Code Detector circuit and the XMT LBO circuitry. The DSX Code Detector monitors the incoming signal for maintenance control codes, for a DSX Loss-of-signal and for the presence of a framed T1 signal. The XMT LBO switches, located on S2, insert the selected amount of artificial line in the Side 1 Transmit path. The XMT LBO can be adjusted for 0dB, 4.5dB, 7.5dB, and 15.0dB, of artificial line additive to 27.0dB. This artificial line has a shaped frequency characteristic consistent with the response of twisted wire pair cable used by the Local Exchange Carrier (LEC). From the XMT LBO circuit the signal is transformer-coupled through the Lightning And Power Cross Protection circuit to the span line via the XMT TO SPAN port, pins 34 and 35 (T1&R1).

### DSX Loss-of Signal Detection

**3.03** The EIOR constantly monitors the incoming transmission from the DSX for a Loss-of signal (LOS). If a LOS occurs the front panel red DSX LOS LED lights. And an unframed all ones, Alarm Indication Signal (AIS) is transmitted toward the facility. When the signal is restored the DSX LOS LED will extinguish and the AIS is terminated.

### Framing Detector

**3.04** The Side 1 transmission path is equipped with a framing detector. Whenever SF or ESF format transmission is detected from the DSX-1 the EIOR lights the front-panel green FRM LED.

### Receive From Span

**3.05** T1 signals appearing on the Side 2, "RCV FROM SPAN" port, pins 26 and 27 (T&R), pass through the Lightning And Power Cross Protection circuit. These signals are transformer-coupled to the Extended Range Automatic line buildout. The extended range Automatic Line Build-out (ALBO) circuit regenerates signals experiencing from 0 to 35dB of loss. The output of the ALBO is applied to the Side 2 Code Detector circuit and the Bandwidth Limiter. The Side 2 Code Detector circuit monitors the incoming signal for maintenance control codes, and a Facility Loss-of-signal. The Bandwidth Limiter restricts the number of DS0 channels delivered to the DSX. From the Bandwidth Limiter signals are passed to the Output Driver. The Output Driver provides a 6 Volt base-to-peak (12 Volt peak-to-peak) output signal. From the Output Driver, the signal is transformer coupled to the Side 2, "TO DSX OUT" port, pins 49 and 50 (T1 & R1).

### Facility Loss-of Signal Detection

**3.06** The EIOR constantly monitors the incoming transmission from the Facility for a Loss-of signal

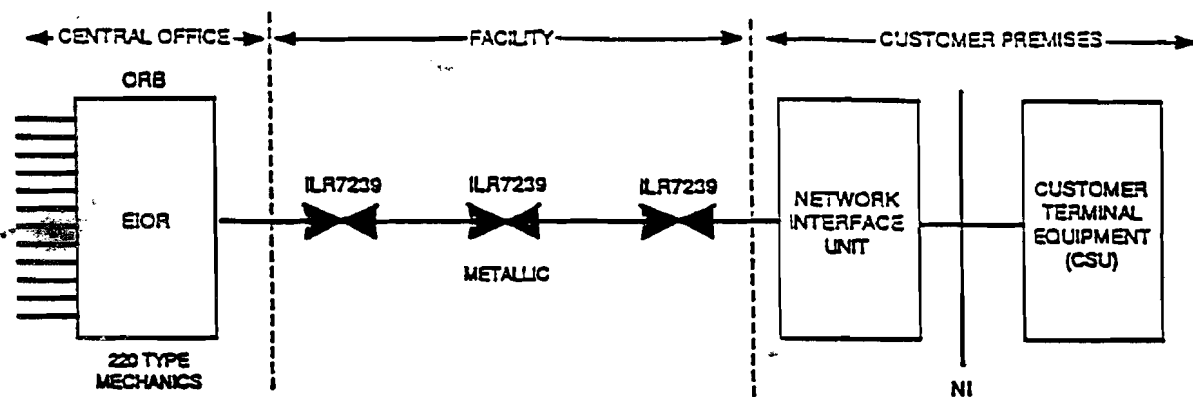


Figure 1A. EIOR shown in a Central Office Application powering Intelligent Line Repeaters, the Network Interface Unit and the Customer Terminal Equipment

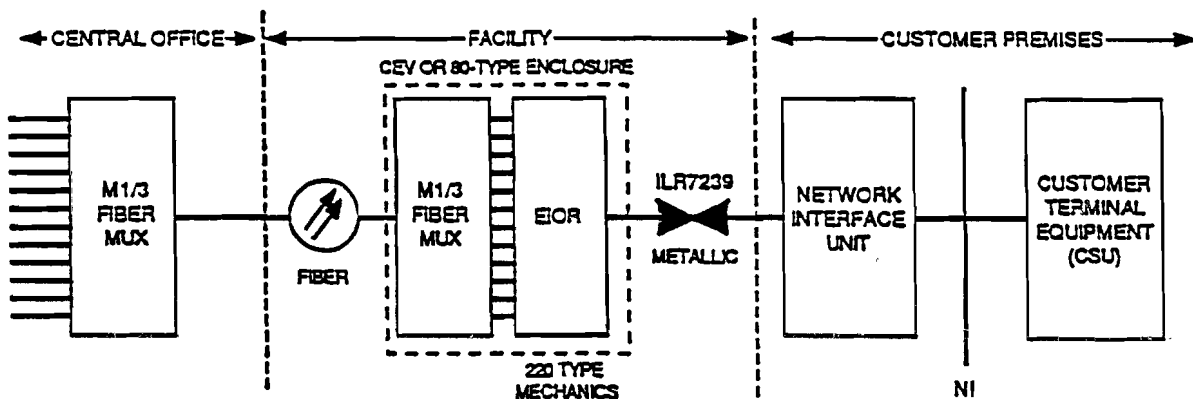


Figure 1B. EIOR shown in an Outdoor Enclosure functioning as a Fiber Extension Repeater powering Intelligent Line Repeaters, the Network Interface Unit and the Customer Terminal Equipment

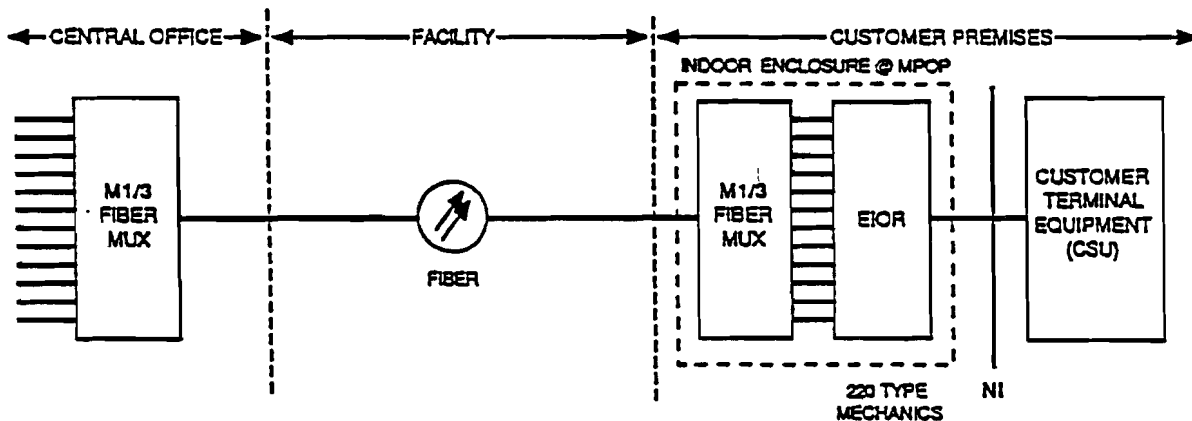


Figure 1C. EIOR shown in an Indoor Enclosure at the MPOP functioning as a Network Interface Unit. The EIOR can be optioned to power the Customer Terminal Equipment.

Figure 1. Typical Applications Using Teltrend's IOR7231E

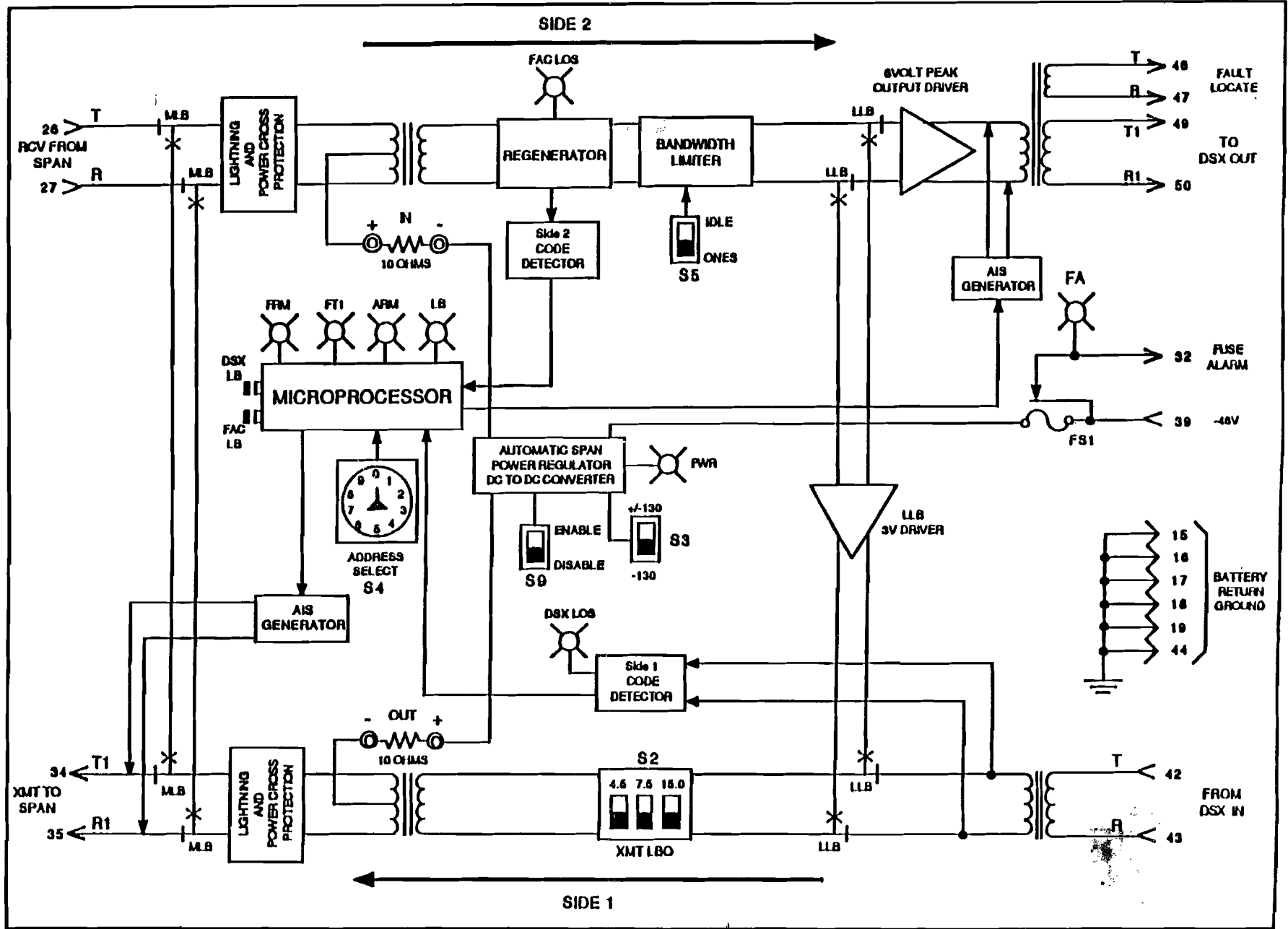


Figure 4. Enhanced T1 Intelligent Office Repeater (IOR7231E) Block Diagram

(LOS). If a LOS occurs the front panel red FAC LOS LED lights. If the EIOR is programmed for Full T1 or Fractional T1 service AIS is transmitted toward the DSX. If the EIOR is programmed for the NIU mode the EIOR enters loopback. When the signal is restored the FAC LOS LED will extinguish and the AIS or Loopback is terminated.

#### Fault Locate Output

**3.07** The IOR7231E provides a fault locate output for use with an external fault locate system. The EIOR does not require termination of the fault locate pair if external fault locate filters are not being deployed.

#### Span Powering

**3.08** Teitrend's Enhanced T1 Office Repeater is equipped with an Automatic Span Power Regulator (ASPR) circuit. The EIOR automatically provides the required voltage, up to  $\pm 130$  Volts dc, to power a 60mA bi-directional span line from the -48Vdc battery supply. The IOR7231E has two switch options S3 and S9 that control the operation of the ASPR circuit.

#### Maximum Span Voltage Control (S3)

**3.09** Switch S3 controls the maximum voltage delivered to the span line. When optioned for -130V, the IOR7231E supports spans with up to 2160 Ohms of simplex resistance. When optioned for +/-130V, the IOR7231E supports spans with up to 4330 Ohms of simplex resistance.

**NOTE:** To minimize the effects of electrolysis the EIOR should be optioned for -130V whenever the maximum simplex resistance is below 2160 Ohms.

#### Span Power Enable/Disable (S9)

**3.10** Switch S9 (SPAN PWR) is used to enable or disable the ASPR. When set to "ENABLE" the EIOR provides span powering for downstream line repeaters, the DS1 Interface Connector (NIU) and when required the Customer Terminal Equipment (CSU). When set to "DISABLE", the Span Power Regulator is off and no span power is provided.

**NOTE:** The Disable position is useful in applications where the EIOR is not required to power other network elements.

#### Input Power Indication

**3.11** The IOR7231E is equipped with a green Power (PWR) LED. The PWR LED lights when -48Vdc office battery and battery return ground are present on pins 39 and 17. It also provides an indication that the internal power supply is functioning properly and span current is being detected. If Switch S9 is "DISABLED" or if an open power loop exists the PWR LED will pulse at 1 second intervals. When the EIOR is placed in the remote Power Down mode the PWR LED flashes. If the PWR LED is not illuminated the -48Vdc battery supply is absent.

#### Input Power Fuse and Alarm LED

**3.12** The EIOR has a PCB-mounted replaceable 3/4 Amp fuse, that when open, lights the red FA (Fuse Alarm) LED and provides -48Vdc to the output of the Power Alarm Lead, pin 32.

#### Span Current and Voltage Pin Jacks

**3.13** The EIOR is equipped with four pin-type test jacks that are used for monitoring span current and span voltage. Span current is measured as a voltage across precision 10 ohm resistors. The "IN + and -" jacks are used to measure the simplex current on the RCV FROM SPAN simplex lead. The "OUT + and -" jacks are used to measure simplex current on the XMT TO SPAN simplex lead. The span current indicated on the "IN" or "OUT" pin jacks should be balanced within 2%. Span voltage is measured across the "IN + " and "OUT - " jacks. The span voltage measured should be consistent with the calculated span voltage.

#### Special Attention

The DC to DC converter of the IOR7231E will fold back during open circuit conditions. The open circuit voltage measured across the "IN + " and "OUT - " pin jacks is approximately 95Vdc with option switch S3 in the -130V position and approximately 190Vdc with S3 in the +/-130V position. The voltage measured across the "IN + and - " and "OUT + and -" jacks will be 0Vdc indicating no span current and an open circuit condition.

#### REPEATER MODE & ADDRESS SELECT

**3.14** The IOR7231E is equipped with a 10 position rotary switch (S4) that programs the EIOR's mode of operation and loopback address. The EIOR has 3 modes of operation, the IOR Mode (Full T1 ), the FT1 Mode and NIU Mode (Full T1). Refer to Table 1 Enhanced Intelligent Office Repeater Loopback Activation and Maintenance Control Codes, Figure 3 IOR7231E Option Location and Front Panel Description Diagram and the following paragraphs for a description of the Mode & Address capabilities of the EIOR.

#### IOR Mode (Full T1)

**3.15** Rotary switch positions 0, 9 and 8 on S4 program the EIOR's 3 unique Full T1 16-bit loopback addresses. Position 0 programs the EIOR for address #1, position 9 programs the EIOR for address #2 and position 8 programs the EIOR for address #3. In this application, the IOR7231E provides full access to all 24 DS0 channels. No blocking of DS0 channels occurs.

#### FT1 Mode

**3.16** When optioned for the FT1 mode the EIOR restricts the bandwidth of the payload data in the Customer-to-Office direction and lights the front panel

red FT1 LED. Rotary switch positions 1 through 6 on S4 program the EIOR for fractional T1 service. Each of the switch positions (1 through 6) has a different total bandwidth allocation, from two to 12 DS0 channels. Setting the rotary switch to position 1 yields two DS0 channels; position 2 yields four DS0 channels, position 3 yields six DS0 channels, etc.

**3.17** The inactive DS0 channels are stuffed with all-ones or idle code as selected by switch S5. When S5 is set to the IDLE position the EIOR inserts Idle Channel Code 01111111 (7F hex) into the restricted DS0 channels. When S5 is set to the ONES position, the restricted DS0 channels are stuffed with All-ones (FF hex) code.

**NOTE:** The setting of S5 must match the fill code transmitted by the Customer Terminal Equipment.

#### **NIU Mode (Full T1)**

**3.18** When optioned for the NIU mode, switch S4 set to position 7, The EIOR provides access to all 24 DS0 channels. In the NIU mode the EIOR recognizes the standard Inband and ESF data link Loopback activate and deactivate codes.

#### **REMOTE MAINTENANCE OPERATION**

**3.19** Refer to Table 1, Enhanced Intelligent Office Repeater Loopback Activation and Maintenance Control Codes, and the following paragraphs for a description of the remote maintenance capabilities of the EIOR.

#### **EIOR Full T1 and FT1 Mode Loopback**

**3.20** The IOR7231E when optioned for either the IOR Full T1 or the FT1 mode provides a metallic loopback toward the DSX-1 and a logic loopback toward the Network Interface.

##### **Metallic Loopback**

**3.21** Metallic Loopback (MLB) is activated and monitored from a test location on the DSX-1 side of the EIOR. The Metallic Loopback point is on the span side of the EIOR. Metallic Loopback allows tests of all components, including the Span side transformers and lightning and surge protection circuitry.

##### **Logic Loopback**

**3.22** Logic Loopback (LLB) is activated and monitored by a field technician at the NI. Logic Loopback is an electronic loopback located before the output transformers and lightning and surge protection.

#### **EIOR Full T1 or FT1 Mode Arming**

**3.23** Before maintenance testing can be performed the EIOR must be armed to accept further control codes.

#### **Inband Arming**

**3.24** The IOR7231E can be armed from the DSX-1 side or NI side by sending the Inband NIU Loopback Activate code 11000 unframed, SF or ESF format, for greater than 5 seconds.

#### **EIOR NI Side Arming Block**

**3.25** When the EIOR receives arming code for three seconds from the NI, the EIOR sends an unframed, all ones Alarm Indication Signal (AIS) to the DSX-1 to block the arming code from disrupting other network elements in the path.

#### **Far End NIU Loopback Activation**

**3.26** In order to loopback the far end NIU from the near-end Network Interface the EIOR blocking must be disabled. To activate the far-end NIU, send the Inband NIU Loopback Activate code for greater than 5 seconds. Then send the 16-bit Unblock Code 1100 0101 0101 0100 for greater than 5 seconds; finally reapply the NIU Loopback Activate code for greater than 5 seconds to activate the far end NIU loopback. To deactivate the Far-end NIU loopback, transmit the Inband Loopback deactivate code 11100 for greater than 5 seconds.

#### **ESF Data Link Arming - IOR Full T1 Mode**

**3.27** An EIOR optioned for the IOR Full T1 mode can also be armed from the DSX-1 side by sending the 16-bit ESF data link NIU Loopback Activate code 0001 0010 1111 111 for greater than 4 repetitions.

**3.28** When the EIOR is armed, the front-panel ARM LED will light. The IOR7231E, and the span line, remain armed for two hours unless the All Loopdown and Disarm code is received before the Arming Timeout expires.

#### **EIOR Full T1 Mode Loopback Activation**

**3.29** Once armed the EIOR will respond to 1 of the 3 16-bit inband IOR Full T1 mode loopback activation codes programmed on positions 0, 9 or 8 of switch S4. After the code has been received for a minimum of 5 seconds loopback is activated. Loopback will automatically timeout in 30 minutes.

#### **FT1 Mode Loopback Activation**

**3.30** An Armed EIOR programmed for the FT1 mode, positions 1 through 6 of switch S4, will respond to the 16-bit Address #1 Loopback Activate Code. After receiving 1101 0011 1101 0011 for a minimum of 5 seconds loopback is activated. Loopback will automatically timeout in 30 minutes.

**NOTE:** When loopback is activated from the NI the EIOR reverts to the Full T1 mode until loopback is deactivated.

#### **Loopback Indication Signal (LIS)**

**3.31** An EIOR programmed for either the Full T1 or FT1 mode upon entering loopback from the DSX-1

side, transmits an unframed all ones Loopback Indication Signal (LIS) toward the NI. When Loopback is activated toward the NI, LIS is transmitted toward the DSX-1.

### **NIU Mode Loopback Activation**

**3.32** The EIOR when programmed for the NIU mode will respond to either the NIU Inband loopback Activate code or to the ESF data link loopback activate code transmitted from the DSX-1 side only. After the EIOR Inband code 11000 has been received for a minimum of 5 seconds or the ESF data link code 0001 0010 1111 1111 has been received for a minimum of 4 repetitions loopback is activated toward the DSX-1. Loopback will automatically timeout in 30 minutes.

### **NIU Mode Dual Loopback**

**3.33** After the EIOR has been placed in loopback toward the DSX-1 the unit can be remotely controlled to provide a loopback toward the Customer Terminal Equipment. To activate Dual Loopback, transmit the 16-bit inband code 1100 0101 0101 0111, after 5 seconds the EIOR Dual Loopback is activated. Dual loopback allows the Customer Installation (CI) to verify cable continuity of the house wiring. Dual Loopback will automatically timeout in 30 minutes.

### **NIU Mode Loss-of-Signal Loopback**

**3.34** The EIOR programmed for the NIU mode, upon detecting a loss-of-signal (LOS) from the Customer Terminal Equipment lights the FAC LOS LED and enters loopback toward the DSX-1. LOS loopback does not timeout. When the customer's signal is restored the EIOR will deactivate loopback. LOS Loopback can be remotely disabled by sending either the Inband or ESF data link NIU loopback deactivate code. After entering the LOS Loopback override mode, the test person can:

- 1) Leave the EIOR in the LOS LPBK override mode - The EIOR will return to the normal operating state when the customer's signal is restored

or

- 2) Send NIU loopback activate code - The EIOR will enter normal loopback. This loopback will stay in effect until deactivated or until the 30 minute loopback timeout period expires. The EIOR will then return to normal where it will react to the status of the customer signal.

### **DSX Manual Loopback**

**3.35** The EIOR can be manually Looped back toward the DSX-1. When programmed for the IOR Full T1 or FT1 mode, pressing the front-panel recessed DSX LB push-button switch, activates loopback toward the

DSX-1. When programmed for the NIU mode pressing the front panel DSX LB push-button switch, for less than five seconds, activates loopback toward the DSX-1. Pressing the DSX LB push-button switch for greater than 5 seconds activates the Dual Loopback. When loopback has been activated manually, the EIOR will remain in loopback until the DSX LB push-button switch is reactivated or the appropriate loopback disable code is received.

### **Facility Manual Loopback**

**3.36** The EIOR can be manually Looped back toward the Facility. When programmed for the IOR Full T1 mode or the FT1 mode, pressing the front panel recessed FAC LB push-button switch activates loopback toward the NI. When programmed for the NIU mode the FAC LB push-button switch has no effect. When loopback has been activated manually the EIOR will remain in loopback until the FAC LB push-button is reactivated or the appropriate loopback disable code is received.

### **Loopback LED**

**3.37** An EIOR programmed for either the Full T1 or FT1 mode upon entering loopback toward the DSX-1 lights the yellow LB (loopback) LED. The LB LED flashes when loopback is activated toward the NI. The EIOR programmed for the NIU mode upon entering loopback toward the DSX-1 lights the LB LED and flashes the LB LED when placed in Dual Loopback.

### **Loopback Acknowledgment**

**3.38** The Loopback Acknowledgment is the method used by the EIOR to verify that the unit has entered loopback or has successfully completed any of the other remotely accessible features. The EIOR injects errors corresponding to the address and operational mode programmed on switch S4.

**3.39** The Loopback Acknowledgment is operational toward the DSX-1 or NI when the unit is programmed for the Full T1 IOR or NIU mode. When programmed for the FT1 mode the EIOR will only provide an accurate error response toward the NI. To provide an accurate error response toward the DSX-1 the EIOR FT1 mode must be placed into the Temporary Full T1 mode.

### **Temporary Full T1 Mode**

**3.40** To place the EIOR into the Temporary Full T1 mode, transmit the Clear FT1 code 0101 0111 1101 1111 for greater than 5 seconds from the DSX-1 direction. The EIOR must first be armed or in Loopback to accept this code. After arming or loopback have been disabled the EIOR will return to the FT1 mode.

**3.41** While entering loopback, the EIOR sends the following Loopback Acknowledgment toward the direction loopback is activated:

- 2 seconds of AIS (Alarm Indication Signal), followed by
- 5 seconds of Loopback Activate code, followed by
- Logic errors corresponding to the mode of operation and address programmed on switch S4. Bit-error responses are provided in Table 1.
- Loopback Activate code until the code is removed.

**NOTE:** The Error response is not returned toward the DSX-1 when the EIOR is programmed for the FT1 mode, unless the Temporary Full T1 mode is remotely activated.

#### **Loopback Timeout Disable**

**3.42** Stress testing of an EIOR may exceed the 30 minute loopback timeout. To disable the loopback timeout from the DSX-1 or NI locations place the EIOR into loopback. After receiving Loopback Acknowledgment, send the loopback Timeout Disable Code 1101 0101 1101 0110 for greater than 5 seconds. The EIOR responds with its Loopback Acknowledgment. The EIOR will remain in loopback until loopback is remotely or manually deactivated. The EIOR will default to the 30 minute loopback timeout when loopback is reactivated.

**NOTE:** The Error response is not returned toward the DSX-1 when the EIOR is programmed for the FT1 mode, unless the Temporary Full T1 mode is remotely activated.

#### **EIOR Loopback Deactivate (RPTR LPDN)**

**3.43** Sending the 16-bit inband code 1001 0011 1001 0011 for greater than 5 seconds deactivates the EIOR loopback; when programmed for the IOR Full T1 mode or the FT1 mode. The EIOR remains armed. The NIU or the EIOR when programmed for the NIU mode do not deactivate loopback.

#### **Loopback Query**

**3.44** The span line can be queried from the DSX-1 or from the NI to determine if the EIOR or another Intelligent Repeater is in loopback. The side requesting the query sends the inband Loopback Query code 1101 0101 1101 0101. Upon receiving this code, The EIOR returns one of the following response:

- no pattern sync - indicates no equipment is in loopback
- continuous pattern sync with no errors - indicates NIU is in loopback
- 5 seconds of Query code followed by bit errors corresponding to the mode of operation and address programmed on switch S4 of the EIOR. Bit-error responses are provided in Table 1. EIOR in loopback.
- 5 seconds of pattern sync followed by 10, 20, 30,...200 logic errors - indicates address of the line repeater in Logic Loopback

- 5 seconds of pattern sync followed by 15, 25, 35,...205 logic errors - indicates address of the line repeater in Metallic Loopback.

**NOTE:** The Error response is not returned toward the DSX-1 when the EIOR is programmed for the FT1 mode, unless the Temporary Full T1 mode is remotely activated.

#### **Power Loop Query (LPBK RPTR In PWR LOOP)**

**3.45** The tester can query an armed span line, from the DSX-1 direction only, to determine if an open power loop exists. An Intelligent Repeater in the Open Power Loop mode will enter loopback and return its Loopback Acknowledgment after receiving the inband Power Loop Query Code 0101 1011 0101 1011 for greater than 5 seconds. The Loopback Acknowledgment (bit errors) identifies the location of the cable cut within the span line. If the cable cut is located between the EIOR and the first line repeater the EIOR will enter loopback, return 5 seconds of Query code followed by bit errors corresponding to the mode of operation and address programmed on switch S4 of the EIOR. Bit-error responses are provided in Table 1. The EIOR if in Power Loop will light its yellow LB LED and will pulse the green PWR LED at 1 second intervals. The EIOR loopback will timeout in 30 minutes.

**NOTE:** The Error response is not returned toward the DSX-1 when the EIOR is programmed for the FT1 mode, unless the Temporary Full T1 mode is remotely activated.

#### **EIOR Power Down (PWR DOWN)**

**3.46** From the DSX-1 side only, an armed EIOR can be remotely commanded to disable span line power. This is accomplished by sending the Power Down code (0110 0111 0110 0111) for longer than five seconds. After five seconds, the EIOR removes power to the span line. In a powered down condition the front-panel PWR LED will flash. Power to the span line remains off until the Power Down code is removed. After the code is removed, the EIOR remains in the power down mode for an additional five seconds. After five seconds power is restored to the span line and all equipment returns to idle.

#### **All Loopdown And Disarm**

**3.47** Sending the Inband All Loopdown and Disarm code (11100) deactivates all equipment and disarms the EIOR and span line. The All LPDN and Disarm code returns all equipment, including the NIU, to normal operation.

**NOTE:** The Inband Loopdown and Disarm code can be sent from either the DSX-1 or NI side.



Table 1. Enhanced Intelligent Office Repeater Maintenance Control Codes

FUNCTION	Send Control Code	IOR7231E ACTION			
ARMING FROM DSX-1	11000 (2-in-5) Inband Code (> 5 SEC.) or ESF DATA LINK Code > 4 repetitions	EIOR arms and NIU loopback is activated. When armed, EIOR yellow ARM LED lights. If NIU enters loopback, pattern sync is recognized at T1 test location. Arming timeout = 2 hours			
CLEAR FT1	0101 0111 1101 1111 57DF HEX	Temporarily sets EIOR to Full T1 mode - accessed while armed or in loopback (from DSX-1 only).			
ARMING FROM NI	11000 INBAND (> 5 SEC.)	Near-end EIOR arms. When armed, EIOR's yellow ARM LED lights. NOTE: After receiving arming code for three seconds, the EIOR blocks the inband code from arming Far-end repeaters. Arming timeout = 2 hours			
FAR-END NIU ACTIVATE	Unblock Code 1100 0101 0101 0100 C554 HEX	To activate far-end NIU from the near-end Network Interface, send the ARMING FROM NI code, followed by the unblock code, followed by the NIU loopback activate code.			
	SEND CODE (> 10 Seconds)	HEX CODE	Switch (S4) Position	BIT-ERROR RESPONSE	IOR7231E ACTION
<b>IOR Mode - (Full T1)</b>					
LPBK EIOR #1	1101 0011 1101 0011	D3D3	0	231	Activates EIOR #1 loopback
LPBK EIOR #2	1100 0101 0100 0001	C541	9	221	Activates EIOR #2 loopback
LPBK EIOR #3	1100 0101 0100 0010	C542	8	211	Activates EIOR #3 loopback
<b>NIU Mode - (Full T1)</b>					
LPBK	SF/ESF NIU LPBK ACTIVATE CODE	-	7	300	Loopback activated toward DSX-1
DUAL LPBK	1100 0101 0101 0111	C557	7	305	Loopback activated toward DSX-1 and NI
<b>FT1 Mode</b>					
2 DS0's	1101 0011 1101 0011	D3D3	1	242	Loopback activated toward DSX or NI
4 DS0's	1101 0011 1101 0011	D3D3	2	244	Loopback activated toward DSX or NI
6 DS0's	1101 0011 1101 0011	D3D3	3	246	Loopback activated toward DSX or NI
8 DS0's	1101 0011 1101 0011	D3D3	4	248	Loopback activated toward DSX or NI
10 DS0's	1101 0011 1101 0011	D3D3	5	250	Loopback activated toward DSX or NI
12 DS0's	1101 0011 1101 0011	D3D3	6	252	Loopback activated toward DSX or NI
LOOPBACK TIMEOUT DISABLE	1101 0101 1101 0110 (> 5 SEC.)	D5D6			Upon receiving LOOPBACK TIMEOUT DISABLE code, EIOR in loopback disables its 30 minute loopback timeout and responds with Loopback Acknowledgement sequence. The repeater remains in loopback until loopback is deactivated. Repeater defaults to the 30 minute loopback timeout when loopback is reactivated
LPBK QUERY	1101 0101 1101 0101 (> 5 SEC.)	D5D5			Upon receiving LPBK QUERY code, first repeater in loopback responds with Loopback Acknowledgement sequence
LPBK RPTR IN PWR LOOP	0101 1011 0101 1011 (> 10 SEC. from DSX-1)	5B5B			Armed EIOR in PWR LOOP enters loopback, sends Loopback Acknowledgement (Loopback times out in 30 minutes)
PWR DOWN	0110 0111 0110 0111 (> 5 SEC. from DSX-1)	6767			Upon receiving PWR DOWN code, the Armed EIOR powers down the span and flashes the green PWR LED. EIOR remains in PWR DOWN mode for five seconds after PWR DOWN code is removed
RPTR LPDN	1001 0011 1001 0011 (> 5 SEC./ Repeater)	9393			Repeaters in loopback, loop-down but do not disarm after receiving the RPTR LPDN code
ALL LPDN & DISARM	11100 (3-in-5) Inband Code (> 5 SEC.) or ESF DATA LINK Code > 4 repetitions				From the DSX-1: Repeaters and NIU in loopback, loop-down and disarm after receiving the inband, or ESF Data Link, ALL LPDN & DISARM code From the NI-side: Repeaters in loopback, loop-down and disarm after receiving the inband ALL LPDN & DISARM code

## 4. OPTIONS

4.01 Teltrend's IOR7231E contains switch options that are used to configure the unit for proper operation in various applications. Refer to Figure 3 for the location and a brief description of each option.

## 5. INSTALLATION

5.01 Upon receipt of the equipment, visually inspect it for signs of damage. If the equipment has been damaged in transit, immediately report the extent of damage to the transportation company and to Teltrend.

### CAUTION

This product incorporates static sensitive components. Proper electrostatic discharge procedures must be followed.

### Installer Connections

5.02 The IOR7231E is designed to mount in any one of the following AT&T bay-type configurations: -48V bays (J98725P, R, and S), a 220-type Mounting Assembly (J98725A, B, C, D and F), and in the T-Carrier Small Cross-Section Shelf (SXSS). The EIOR may be used in other 220-type bays providing no more than five Office Repeaters are installed per shelf (unless the Office Repeater Bay has been upgraded for -48V operation). Pin-outs used by Teltrend's Enhanced Intelligent T1 Office Repeater are given in Table 2.

Table 2. Office Repeater Pin Assignments

PIN DESIGNATIONS		PIN
SIDE 1	T - FROM DSX	42
INPUT	R - FROM DSX	43
SIDE 1	T1 - XMT To SPAN (to Span Line)	34
OUTPUT	R1 - XMT To SPAN (to Span Line)	35
SIDE 2	T - RCV From SPAN (from Span Line)	26
INPUT	R - RCV From SPAN (from Span Line)	27
SIDE 2	T1 - TO DSX	49
OUTPUT	R1 - TO DSX	50
Power - -48Vdc Office Battery		39
Ground - Battery Return (see NOTE 1)		17
Fuse Alarm (see NOTE 2)		32
<b>NOTES</b>		
1) Ground lead can be wired to pins 15, 16, 17, 18, 19, or 44		
2) The Fuse Alarm Output, pin 32, provides a -BATT output when the PCB-mounted fuse opens		

## 6. TESTING

6.01 Testing consists of performing the procedures outlined in Section 3 or by using Table 1. These procedures are intended only to ascertain proper operation of the unit and, if problems should occur, to isolate those problems to the most probable area. These procedures are not designed to effect repairs or modifications. Tests beyond those outlined, or repairs made beyond replacing a faulty unit, are not recommended and may void the warranty.

6.02 If trouble is encountered, verify all connections and option settings. Also verify the unit is making a positive connection with the mounting assembly's back plane connector. If trouble persists, replace the unit and repeat the procedures outlined. If technical assistance is required, contact Teltrend's Customer Service Department by calling:

1-800-TELTREN (1-800-835-8736) or, if busy,

(708) 377-1700 (8am to 5pm - Central Standard Time)

For after hours, weekends and Holidays, call our 24-hour number (708) 377-2255.

6.03 If a unit needs repair, call Teltrend for a Return Material Authorization (RMA) number and return the defective unit, freight prepaid, along with a brief description of the problem, to:

Teltrend Inc.  
620 Stetson Ave.  
St. Charles, Illinois 60174  
ATTN: Repair And Return Dept.

6.04 As specified in our warranty, Teltrend will repair and return the unit at no charge to the customer providing the warranty of the unit has not expired. If an out-of-service situation exists, a replacement unit can be obtained; however, a purchase order number will be required to ensure return of the replacement unit.

## 7. SPECIFICATIONS

### Transmission

Operation: Passive transmit; Regenerative receive

Line Impedance: 100 Ohms at 772kHz

Automatic Line Build-Out (capture range): 0 to 35dB of loss

Transmit Line Build-Out: Adjustable from 0 up to 27dB in increments of 0dB, 4.5dB, 7.5dB and 15dB

### Signal

Line Rate: 1.544Mb/s ( $\pm 200$ b/s)

Line Signal: Bipolar, return-to-zero

Line Signal Pulse Width: 324nsec. ( $\pm 30$ nsec.)

**Line Signal Pulse Overshoot:** 10 to 30% of pulse height

**DSX Pulse Amplitude:** 6V Base-to-Peak (non-pre-equalized)

**DC Span Current:** 60mA ( $\pm 3$ mA)

**Span Voltage Range:** Up to  $\pm 130$ V (balanced)

**Line Current Regulation:**  $\pm 0.5\%$  from -42 to -56Vdc

**Current Drain:** 500mA at -48Vdc, maximum

**Fuse Protection:** GMT-type 3/4 Amp

**Operating Environment:** Temperature, -40°F to 150°F (-40°C to 65°C); humidity, 0 to 90% (no condensation)

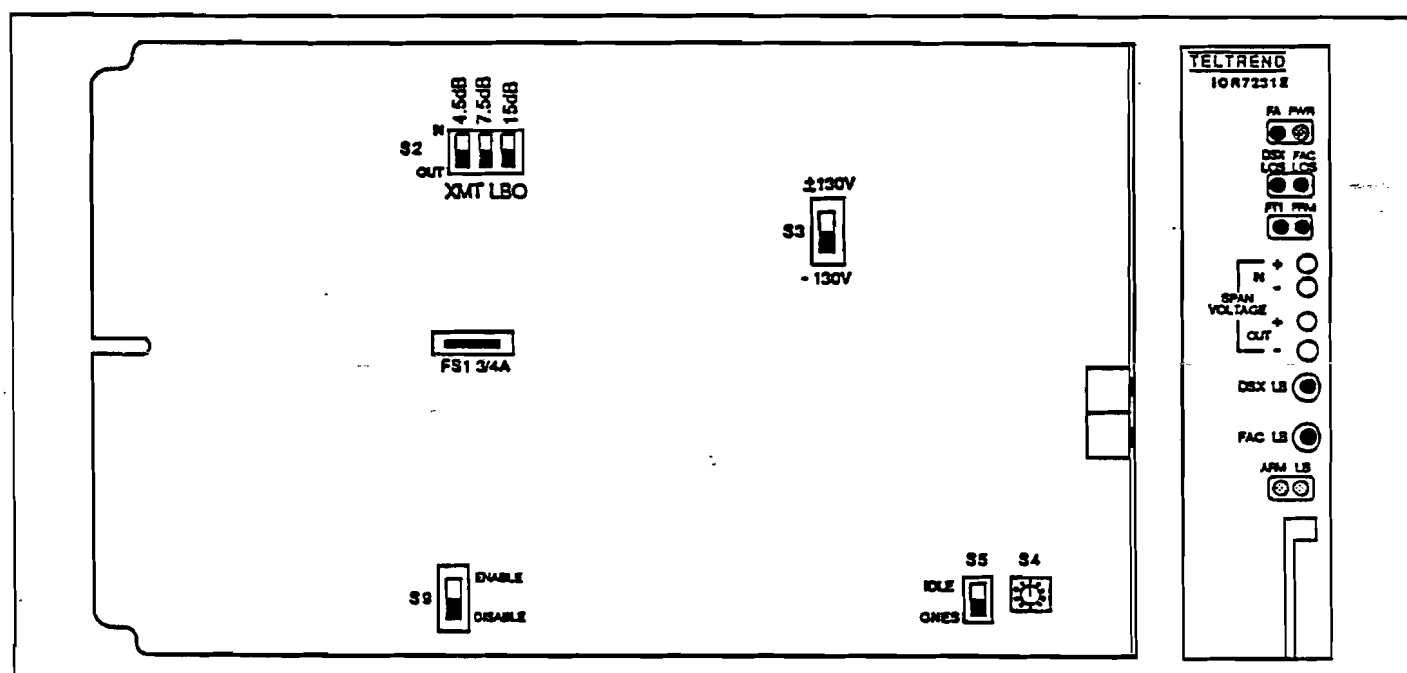
**Unit Dimensions:** Height, 6.0 in. (15.2cm); width, 1.4 in. (3.55cm); depth, 10.25 in. (26cm)

**Unit Weight:** Approx. 13 oz. (405g)

#### ORDERING INFORMATION

Order in accordance with the following:

7231E EIOR - Enhanced T1 Intelligent Office Repeater



OPTION	POSITION	FUNCTION
S9 Span Power	ENABLE DISABLE	Enables Span Power Disables Span Power
S2 XMT LBO	IN OUT	Inserts designated value of artificial line into Side 1 - XMT path. Switches provide 0dB (all segments "OUT"), 4.5, 7.5 and 15dB - additive to 27dB (all segments "IN") Removes designated value of artificial line from Side 1 - XMT path
S3 Maximum Span Voltage	+/-130V -130V	Allows DC to DC converter to supply up to $\pm 130$ Vdc of span voltage. Maximum simplex resistance equals 4330 Ohms Allows DC to DC converter to supply up to -130Vdc of span voltage. Maximum simplex resistance equals 2160 Ohms

Figure 3. IOR7231E Front-Panel And Option Location Diagram & Description

OPTION DESCRIPTIONS ARE CONTINUED ON THE NEXT PAGE

OPTION	POSITION	FUNCTION
S4 Rotary Switch	0, 9, 8	<b>OFFICE REPEATER MODE</b> POS. 0 selects Full T1 - address #1 POS. 9 selects Full T1 - address #2 POS. 8 selects Full T1 - address #3
	7	Selects NIU mode <b>FRACTIONAL T1 MODE (In This Mode, All Addresses Are Address #1)</b>
	1 - 6	POS. 1 selects FT1 mode - 2 DS0's POS. 2 selects FT1 mode - 4 DS0's POS. 3 selects FT1 mode - 6 DS0's POS. 4 selects FT1 mode - 8 DS0's POS. 5 selects FT1 mode - 10 DS0's POS. 6 selects FT1 mode - 12 DS0's
S5 FT1 Fill Code	IDLE	Inserts Idle Code into restricted DS0's as fill code (0111 1111) HEX Code - 7F
	ALL ONES	Inserts All Ones into restricted DS0's as fill code (1111 1111) HEX Code - FF  <b>NOTE: To eliminate BPVs, S5 must be optioned to transmit the same code as the customer equipment</b>
FS1		Protects circuit from excess current drain. When fuse opens, red FA (Fuse Alarm) LED lights

FRONT PANEL	FUNCTION
FA LED	Red LED - On indicates an open fuse; Check and replace FS1
PWR LED	Green - LED On indicates unit is powered and span current is flowing 1-sec pulse indicates unit is powered but no span current is flowing Flashing indicates unit is in power down mode
DSX LOS LED	Red LED - On indicates Loss-of Signal from the DSX is being detected
FAC LOS LED	Red LED - On indicates Loss-of Signal from the Facility is being detected
FT1 LED	Red LED - Lights steady when in the Fractional T1 mode
FRM LED	Red LED - On indicates either SF/ESF framing is detected from the DSX-1
ARM LED	Yellow LED On indicates unit is ARMED IOR (Full T1) and FT1 modes only
LB LED	Yellow LED When set for Office Repeater or Fractional T1 Mode: On indicates loopback is established toward DSX Flashing indicates loopback is established toward NI  When set for NIU Mode: On indicates loopback is established toward DSX Flashing indicates unit is in the Dual Loopback mode
SPAN VOLTAGE AND CURRENT (PIN JACKS)	IN " + " and IN " - " jacks are used to measure simplex current on "RCV from SPAN" simplex lead OUT " + " and OUT " - " jacks are used to measure simplex current on "XMT to SPAN" simplex lead  <b>NOTE: Voltage across pin jacks should measure 0.57 to 0.63 Volts = 57 to 63 mA. Span voltage is measured across the IN " + " and OUT " - " jacks</b>
DSX LB (MANUAL LB Button)	When set for Office Repeater or Fractional T1 Mode: Push to activate permanent loopback toward DSX. Push again to deactivate  When set for NIU Mode: Push <5 sec to activate permanent loopback toward DSX. Push again to deactivate Push >5 sec to activate Dual Loopback. Push again to deactivate
FAC LB (MANUAL LB Button)	When set for Office Repeater or Fractional T1 Mode: Push to activate permanent loopback toward Facility; Push again to deactivate  When set for NIU Mode: Pushing this button has no affect

Figure 3 (Continued). IOR7231E Front-Panel And Option Location Diagram &amp; Description