

IMX-2T1/E1

E1 to T1 Inverse Multiplexer Installation and Operation Manual

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The safety status of each of the ports on the IMX-2T1/E1 is declared according to EN 41003 and is detailed in the table below:

| Ports | Safety Status |
|--------------------------|---|
| V.35, V.36, X.21, RS-530 | SELV Circuit operating with Safety Extra-Low Voltage |
| E1, Sub E1 | TNV-1 Circuit whose normal operating voltage is within the limits of SELV, on which overvoltages from Telecommunications Networks are possible. |

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Manufacturer's Name: RAD Data Communications Ltd.

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| | EN 50082-1 (1992) | Electromagnetic compatibility - Generic immunity standards for residential, commercial and light industry. |
| Safety: | EN 60950 (1992/93) | Safety of information technology equipment, including electrical business equipment. |

Supplementary Information:

The product herewith complies with the requirements of the EMC Directive 89/336/EEC and the Low Voltage Directive 73/23/EEC. The product was tested in a typical configuration.

Tel Aviv, January 23rd, 1997



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Quick-Start Guide

Installation of IMX-2T1/E1 should be carried out only by an experienced technician. If you are familiar with inverse multiplexers, use this guide to configure your IMX-2T1/E1. The configuration activities can be carried out either before or after IMX-2T1/E1 is installed in its intended location.

QS.1 IMX-2T1/E1 Jumper Settings

IMX-2T1/E1 contains two sets of jumpers:

- Main Board Jumpers
- E1 Interface Board Jumpers

You can use the default settings of the main board jumpers and switches for the IMX-2T1/E1 operation. If you are using IMX-2T1/E1 with a balanced interface, you can use the default settings of the E1 interface board jumpers.

If you are using IMX-2T1/E1 with an unbalanced interface, perform the following steps:

1. Disconnect all cables from IMX-2T1/E1.
2. Loosen the two screws located at the rear panel of the unit and slide out the top cover.
3. Set the E1 interface board jumpers JP3, JP4, JP5, JP7 to UNBAL.
4. Install the E1 interface board jumper JP6.
5. Install the E1 interface board jumper JP8.
6. Close the IMX-2T1/E1 case.

QS.2 Cable and Power Connections

Before using IMX-2T1/E1, make the following cable connections:

1. Connect the IMX-2T1/E1 E1 link:
 - For balanced interface, use RJ-48C, male connector and connect it to the IMX-2T1/E1 port marked E1.
 - For unbalanced interface, use two BNC connectors and connect them the IMX-2T1/E1 ports marked RX-OUT and TX-IN.
2. Connect the T1 links. Use RJ-48C, male connectors and connect them to the IMX-2T1/E1 ports marked LINK-1 and LINK-2.

3. Connect the Fractional T1 line (if the FT1 port is installed). Use RJ-48C, male connector and connect it to the port designated Fractional T1.
4. Connect the synchronous data channel (if the data port is installed). Use the cables corresponding to the data channel interface of your IMX-2T1/E1. Equipment with V.36/RS-449 interface can be connected to the RS-530 connector by means of adapter cable, supplied with the unit.
5. If you are using a supervisory terminal, connect a cable between the control terminal and the port designated CONTROL DCE on the front panel.
6. If you are using dial-in or dial-out modems for the call-in and call-out purposes, connect the modems to the port designated CONTROL DCE on the front panel.
7. If an external clock signal is to be used, connect the external clock cable. Use RJ-48C, male connector and connect it to the IMX-2T1/E1 port marked STATION CLOCK.
8. Connect IMX-2T1/E1 to the power source.
 - For the AC-powered units, use the 5 ft (1.5m) standard power cable provided with the unit. Make sure the POWER switch on the rear panel is set to OFF, then connect the cable first to the IMX-2T1/E1 rear panel, then to the AC mains outlet.
 - For the DC-powered units, make sure the POWER switch on the rear panel is set to OFF, then connect the cable first to the IMX-2T1/E1 rear panel, then to the DC power source.

QS.3 Configuration

You can configure and operate IMX-2T1/E1 from either the front panel or a supervisory terminal.

► **To configure IMX-2T1/E1 from the front panel:**

1. In the top row of the front panel LCD, scroll to SYSTEM PARAMETER and set the master timing and fallback timing reference.
2. Scroll to LINK PARAM: LINKX, where X is the link number, connect or disconnect a T1 link, set the multiframing mode for the selected link, line coding method used for zero suppression, link interface type and several other parameters.
3. Scroll to CH 2 and set user's data channel or Fractional T1 link parameters (if you have either of the ports installed in your IMX-2T1/E1).
4. Scroll to SP PARAMETERS and set the supervisory port speed, data format, parity and interface.

► **To configure IMX-2T1/E1 from the supervisory terminal:**

1. Configure the supervisory terminal for eight data bits, no parity and one stop bit. You can use the following data rates for the communication session: 1.2, 2.4, 4.8, or 9.6 kbps.
2. If AUTO (Autobaud) mode is enabled, press <CR> three times. IMX-2T1/E1 identifies the operating rate of the terminal and uses this rate for the current session.

After the control session is established, IMX-2T1/E1 displays its prompt **IMX-2T1>**.

3. If the terminal displays a password prompt, enter the password. The default password is **IMX**. If the node number of the IMX-2T1/E1 unit is a number other than zero, enter the node number along with the password; or, if there is no password prompt, just enter the node number. Use the following syntax:
NODE <Space> 'node number' <Space> 'password' <CR>
The prompt **IMX-2T1>** appears.
4. Use the **DEF TERM** command to select the terminal type. IMX-2T1/E1 supports the following terminal types: TV920, VT52 and VT100. use the following syntax to set the terminal type:
DEF TERM 'terminal type' <CR>

Note

If you enter DEF TERM without the terminal type, IMX-2T1/E1 resets all the control terminal codes to 0.

If your terminal requires control sequences different from those used by the terminals listed above, type the command **F** and enter your terminal control sequences. If the current control codes are not compatible with your terminal and you cannot enter the desired codes, enter the **INIT F** command to reset the codes to 0, then use the **F** command to modify the control codes starting from the known field values.

5. Use the **DEF SP** command to set the supervisory port parameters. The supervisory port word format should be the same as of the terminal.
6. Use the **DEF SYS** command to set the system parameters.
7. Use the **DEF CH 2** command to define a data channel or Fractional T1 parameters (if you have either of the ports installed in your IMX-2T1/E1).
8. Use the **DEF LINK** command to set a link parameters. The syntax of this command is **DEF LINK X**, where X is the link number.
9. If you are using an SNMP management application:
 - Use the **DEF NAME** command to assign a different logical name of up to eight alphanumeric characters to each IMX-2T1/E1 unit.
 - Use the **DEF AGENT** command to configure the SNMP agent parameters.

- Use the **RESET** command to reinitialize IMX-2T1/E1.
 - Set the **DNLOAD_MODE** in the **DEF SYS** command to **TS1** to enable the in-band and out-band communications.
 - Use the **DEF SP** command to set **SPEED** to 9.6 kbps.
 - Use the **AUXILIARY_DEVICE** field of the **DEF SP** command to set the Control DCE port management mode to **NMS_SLIP**.
 - Use the **BYE** command to end the current Telnet or NMS SLIP session.
10. If you are using the terminal to control a single IMX-2T1/E1 unit, assign node number 0 to the unit. For multidrop operation, you can assign each IMX-2T1/E1 unit a node number between 1 and 255. Use the **DEF NODE** command to assign a node number.
 11. If you have a dial-out modem connected to your IMX-2T1/E1, you must specify the multiplexer call-out parameters:
 - Use the **DEF SP** command to enable the **CALL_OUT_MODE**.
 - Use the **DEF CALL** command to define the number of dialing retries, wait-for-connect time, dialing mode, primary and alternate numbers.
 12. To end the current session and return control to the IMX-2T1/E1 front panel, use the **EXIT** command.

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Chapter 1

Introduction

This chapter:

- Provides a functional description of the IMX-2T1/E1
- Describes the operating environment
- Describes system application considerations
- Provides technical specifications.

1.1 Functional Description

Purpose and Main Features

The IMX-2T1/E1 inverse multiplexer allows transparent transmission of E1 data (2.048 Mbps), and fractional T1 service or synchronous data channel over two standard T1 (1.544 Mbps) lines. This enables existing E1 equipment to utilize T1 transmission facilities. The IMX-2T1/E1 is completely transparent to the E1 framing pattern (it doesn't even synchronize with the E1 frame), therefore it can transmit E1 data streams using 256N, 256S, with or without CRC-4, proprietary framing methods, and unframed data streams.

With Fractional T1 (FT1) or Data Port installed, the IMX-2T1/E1 utilizes the fractional T1 or synchronous data channel to transfer data on the unused timeslot of the T1 links. The IMX-2T1/E1 data port or FT1 supports user data transmission rates. The data rates are multiple values of 128 kbps ($n \times 128$ kbps for $n = 1$ to 7) ranging from 128 kbps to 896 kbps. 5 types of synchronous data channel input protocols are available: V.35, X.21, RS-530, V.36/RS-449, and Ethernet 10Base T.

The IMX-2T1/E1 can tolerate differential delays of up to 64 msec between the two T1 lines. These capabilities allow routing of the T1 lines used by a given IMX-2T1/E1 over different paths or facilities, thereby increasing flexibility and reliability. Note that although the IMX-2T1/E1 tolerates differential delays of up to 64 msec, the actual latency of an IMX-2T1/E1 link is similar to the maximum differential delay encountered in the T1 lines.

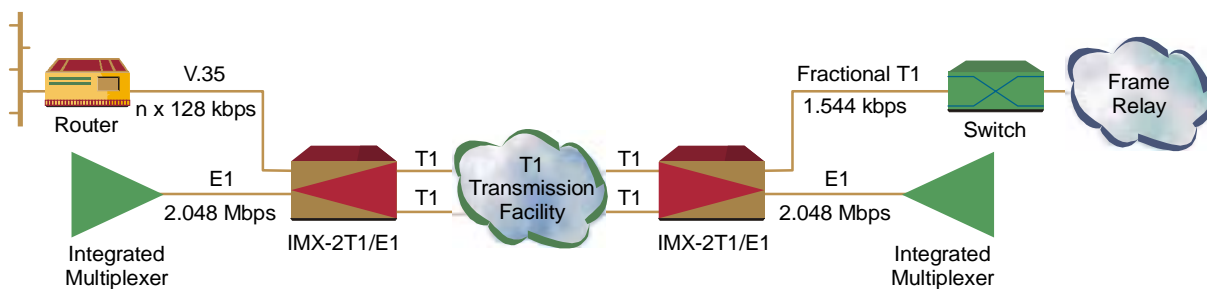


Figure 1-1 Typical IMX-2T1/E1 Application

T1 Link Interface Characteristics

The IMX-2T1/E1 is available as a standard model with two T1 link interfaces. Each of the link interfaces can also be ordered with a built-in CSU.

The IMX-2T1/E1 T1 link interfaces are compatible with virtually all carrier-provided T1 services. The link interfaces support both the D4 (SF) and ESF framing formats, according to the user's selection. Zero suppression over the line is user selectable (transparent [AMI] coding, or B8ZS).

The T1 line interfaces meet the requirements of AT&T TR-62411, ANSI T1.403, and ITU-T Rec. G.703, G.704. Each interface has a 100Ω balanced line interface, terminated in an RJ-48C connector. The nominal transmit level is 3V, and the line signal is software-adjustable for line lengths of 0 to 655 feet according to AT&T CB-119. The maximum line attenuation, without CSU, is up to 10 dB; when the integral CSU option is used, the maximum line attenuation is up to 34 dB. For shorter lines, the CSU transmit level can be set to -7.5, -15, or -22.5 dB.

E1 Port Interface Characteristics

The IMX-2T1/E1 E1 port interface meets the requirements of ITU-T Rec. G.703.

The E1 Port has two physical interfaces:

- 120-ohm balanced line interface terminated in an RJ-48C eight pin connector.
- 75-ohm unbalanced interface terminated in two BNC female coaxial connectors.

Line coding is HDB3. The nominal balanced interface transmit level is $\pm 3V$, and the unbalanced interface transmit level is $\pm 2.37V$. The maximum line attenuation is up to 10 dB. Jitter performance complies with ITU-T Rec. G823.

Fractional T1 Link Interface Characteristics

The IMX-2T1/E1 T1 link interfaces are compatible with virtually all carrier-provided T1 services. The link interfaces support both the D4 (SF) and ESF framing formats, according to the user's selection. Zero suppression over the line is also user selectable (transparent [AMI] coding, B7ZS, or B8ZS).

Fractional T1 line interfaces meet the requirements of AT&T TR-62411, ANSI T1.403, and ITU-T Rec. G.703, G.704. The interface has a 100Ω balanced line interface, terminated in an RJ-48C connector. The nominal transmit level is 3V, and the line signal is software-adjustable for line lengths of 0 to 655 feet according to AT&T CB-119. The maximum line

attenuation, with PSU, is up to 10 dB.

Data Port Interface Characteristics

Data Interfaces:

V.35
RS-530
RS-449/422 (via adapter cable)
X.21
Ethernet 10Base T

Connectors:

| | |
|-------------------|------------------------------|
| V.35 | 34-pin, female |
| RS-530 | 25-pin D-type, female |
| RS-449 | 37-pin D-type, female |
| X.21 | 15-pin D-type, female |
| Ethernet 10Base T | 8-pin shielded RJ-45, female |

The Data port supports the following control lines (except when Ethernet interface is installed):

RTS - Input from locally connected user's equipment.

CTS - The user may permanently set the CTS line as active, or have the CTS line follow the RTS line.

DSR - The DSR line is always active when the IMX-2T1/E1 is powered, except when remote loopback or BER testing are activated.

DCD - The DCD line is active when the data port is synchronized.

Data Channel Timing

The IMX-2T1/E1 data channel has two timing modes available. In both modes the clock signal is derived from the internal IMX-2T1/E1 system timing clock:

- DCE mode: The data port provides transmit and receive clock signals to the user data terminal equipment. The user DTE must read data sent by the data port at the Rate of the receive clock signal, and the data port samples the transmit data arriving from the user DTE according to the transmit signal provide to the user DTE.
- E_DCE mode: Similar to the DCE mode , except the data port samples the transmit data arriving from the user DTE according to an external transmit signal returned by the user DTE. The clock signal must be derived from the transmit signal of the user DTE. This mode is not compatible with X.21 or Ethernet protocols.
- In addition, there is an option for changing the polarity of the clock that samples the incoming data

Ethernet Interface Characteristics

An Ethernet Bridge port can be ordered instead of a sync data port interface. The Ethernet interface has a 10Base T interface complying with the IEEE 802.3 standard, and is terminated in an 8-pin RJ-45 shielded connector. The interface can operate over UTP and STP media.

The Ethernet interface includes a full-feature remote bridge. Operating at the physical and data link layers of the OSI model, it is completely transparent to higher level protocols such as TCP/IP, DEC net, XNS, ISO, and to operating systems such as NetWare, VINES, and 3COM+.

The Ethernet bridge operates as a media access (MAC) layer remote bridge with self-learning capabilities. It learns and automatically recognizes the address of nodes attached to the local LAN (the LAN directly attached to the IMX-2T1/E1 interface). The bridge uses this information to filter the LAN traffic. Address information is stored in a table, which can store up to 10,000 addresses. Address information is automatically updated (aging time is 5 minutes; if no frames are received from a node for 5 minutes, the node address is automatically removed from the tables, ensuring that only fresh addresses are used).

The bridge blocks packets addressed to local nodes, and forwards through the IMX-2T1/E1 link only multicasts, broadcasts, and packets addressed to nodes attached to the remote LAN. To increase transmission efficiency, the bridge compresses short packets by automatically recognizing the padding bits in 64-bit frames, transmitting only the payload, and reconstructing the packets at the remote end.

The filtering and forwarding can be performed at rates of up to 15,000 packets per second (provided the bandwidth selected on the T1 link is sufficient to carry the resulting payload rate). When bridging is not necessary, e.g., for LAN extender applications, the user can disable the bridge. In this case the IMX-2T1/E1 operates as a repeater that transparently transfers all the traffic to the remote end.

System Timing

The IMX-2T1/E1 has five timing modes that allow maximum of flexibility in system integration:

- **Transparent Timing:** the T1 transmit clocks of both T1 links are locked to the E1 receive clock. The E1 transmit clock is locked to the receive clock of T1 link 1 or link 2.
- **External E1 Timing:** the T1 transmit clocks of both T1 links and the E1 transmit clocks are locked to the E1 receive clock.
- **Loopback Timing:** the transmit clocks of both T1 links and the E1 transmit clock are derived from the receive clock of T1 link 1 or 2.
- **Internal Timing:** an internal oscillator with an accuracy of ± 32 ppm is the source for all the E1 and T1 transmit clocks.
- **External Station Timing:** the source for both the E1 and T1 transmit clocks is an external clock signal. The IMX-2T1/E1 requires a framed or unframed "all ones" 1.544 Mbps AMI or B8ZS coded signal.

- **External Fractional T1 Timing:** the transmit clocks of both T1 links and the E1 transmit clock are derived from the receive clock of the fractional T1 link 1 or 2.

The E1 receive timing is always recovered from the receive data, on T1 and E1 sides.

Proprietary circuits, located on each side, provide the jitter attenuation needed to meet the requirements of AT&T TR-62411 on the T1 side, and of ITU-T Rec. G.823 on the E1 side.

In addition to a main system clock source, the user can specify a fallback source, which is automatically selected in case the main source fails, e.g., because of a loss of synchronization condition on the link selected as the main source.

Time Slot Mapping

The 32 time slots of the E1 frame are transferred transparently over the IMX-2T1/E1 link. Time slots of the two T1 links are used as follows

- E1 time slots are inserted into the following 16 time slots of each T1 link: 2, 3, 5, 6, 8, 9, 11, 12, 14, 15, 17, 18, 20, 21, 23, 24.
- T1 time slots 4, 7, 10, 13, 16, 19, and 22 of each T1 link carry the idle code (user-selectable).

When the data channel or FT1 interface is installed, the available T1 time slots are: 4, 7, 10, 13, 16, 19, and 22 on each link. The user selects a data port rate, and it occupies the lowest available time slot. If some time slots are not used, an Idle code is inserted instead. (e.g., if the user selected data port rate is 384 kbps, the used time slots are 4, 7, 10, and 13, and an Idle code is inserted in the remaining time slot). When FT1 is used, the user assigns the time slot on the FT1, arranged in consecutive order.

T1 time slot 1 carries the IMX-2T1/E1 management and link supervision data.

Download Option

The IMX-2T1/E1 has a special download option, enabling an 8 Kbps channel throughout TS1. The TS1 must be transparent on both sides of the link.

Statistics Collection

When operating with the ESF frame format, the IMX-2T1/E1 stores T1 line statistics in compliance with the ANSI T1.403-1989 requirements. IMX-2T1/E1 also provides local statistics support that meets the requirements of AT&T Pub. 54016.

Test and Diagnostics Capabilities

The IMX-2T1/E1 has comprehensive diagnostics capabilities that include local and remote loopbacks on the links, on the E1 data channel, the fractional T1 interface, or data channel interface, and bit error rate (BER) testing. The IMX-2T1/E1 also supports the in-band code-activated network payload loopback. When the T1 links are equipped with CSU interfaces, the IMX-2T1/E1 also supports the in-band code-activated network line loopback.

Maintenance is further enhanced by advanced self-test capabilities, and by an automatic power-up self-test that provides circuit-level diagnostics data.

There are two BERT systems: one operates on the E1 timeslot, the second is transmitted on the FT1/data channel interface.

In-band FT1/data channel interface loop: a code is transmitted that causes the remote FT1/data channel interface unit to loopback.

Alarms

The IMX-2T1/E1 stores alarms detected during its operation in a buffer that can hold up to 100 alarms. During regular operation, the front panel LCD display shows if there are any alarms in the alarm buffer, to notify the local operator that alarm conditions have been detected. The local operator can then review the contents of the alarm buffer on the front panel display, and can delete old alarms.

Alarms can be transmitted automatically via the serial management access port, for display on the supervisory terminal. When SNMP management is used, alarms are sent to certain management stations as enterprise specific traps. Alarms may be read online by the system operator using a network management station, Telnet host, or supervisory terminal. The system operator can perform comprehensive testing on each module to determine the causes of alarm messages, and to return the system to normal operation.

To expedite the handling of alarms, and reduce the information load during malfunctions, certain alarm conditions may be masked. This prevents the continuous or repeated reporting of known alarms.

In addition to the alarm buffer, the front-panel LED indicators display in real time the status of the IMX-2T1/E1 links and the activity of the user's data channel, and alert when test loops are present in the system.

The IMX-2T1/E1 can provide alarm indication by means of an alarm relay. The alarm relay is energized when the IMX-2T1/E1 is powered and operating normally and is de-energized when a major alarm condition is present, or the IMX-2T1/E1 power is off.

Control of IMX-2T1/E1 Operation

The IMX-2T1/E1 system is designed for unattended operation. The configuration of the IMX-2T1/E1 is determined by a data base stored in non-volatile memory.

The IMX-2T1/E1 can be controlled by means of a simple menu, operated by push-buttons located on the front panel.

During set-up, an LCD display guides the operator in the execution of the desired operations. The display provides information on the current system configuration and operating mode, and the available values of each programmable parameter.

Upon operator errors, the IMX-2T1/E1 displays a message that explains the error and helps the operator take the correct action.

Remote Supervision and Monitoring

The IMX-2T1/E1 is equipped with an RS-232 supervisory port. The supervisory port enables:

- Full control over IMX-2T1/E1 operation and configuration, from a standard ASCII data terminal.
- Remote reading of IMX-2T1/E1 status .
- IMX-2T1/E1 alarm messages and history.
- IMX-2T1/E1 testing. remote monitoring of IMX-2T1/E1 operation from a standard ASCII data terminal, using either point-to-point or polling communications.
For polling purposes, each IMX-2T1/E1 can be assigned an eight-bit address, for a maximum of 255 nodes (the zero address is reserved). In addition, it is possible to connect a Hayes™ compatible dial-up modem to the supervisory port, to provide call-in and call-out capabilities.
- Using the call-in function, a remote operator at a central location can perform all the functions available from a supervision terminal connected to the IMX-2T1/E1(DCE port only). Optional password protection is also available.
- The call-out function, available only via the front panel DCE port, is used to dial a user-programmed number when an alarm event occurs.

SNMP Management

The IMX-2T1/E1 includes an SNMP agent that enables SNMP traps (triggered by alarms), using the UDP-over IP protocol. The SNMP agent communicates out-of-band and/or in-band. Each communication mode can be enabled separately:

- Out-of-band communication is performed via the serial ports of the IMX-2T1/E1, via SLIP protocol. For out-of-band communication, the Autobaud function in the SP command must be disabled, and a set data rate must be selected for the port.
- In-band communication is performed via a dedicated 8 kbps channel. This mode uses a proprietary protocol.

Note

When using In-band or Out-of-band communication, Download must be enabled in System Parameters

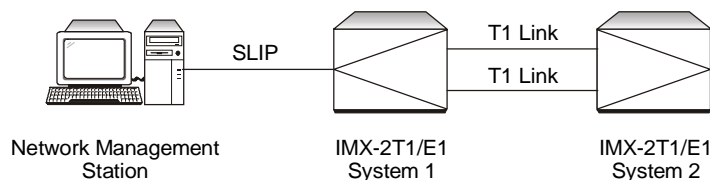


Figure 1-2 Point To Point Remote Management

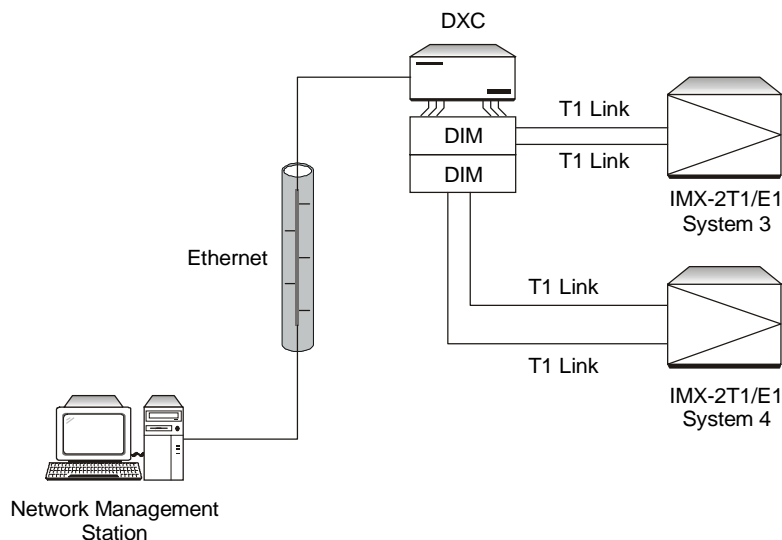


Figure 1-3 Central Solution Remote Management

The network shown in Figure 1-2 and Figure 1-3 can be managed by a single network management station, because the flexible routing capabilities of the SNMP agent can carry the management traffic over many different paths. For example, the following paths can be made available for the management traffic, when the management station is attached to the IMX-2T1/E1:

- The network is connected to the network management station using a single serial communication link, attached to the CONTROL DCE port of the IMX-2T1/E1(system 1) as illustrated in Figure 1-2.
- In-band communication through the IMX-2T1/E1 T1 links is used to manage the remote units connected to the remote ends of the corresponding links.
- The network is connected to the NMS using an Ethernet interface to the DXC located at a central site. Management of the remote site is performed by In-band communication using the DIM module via T1 links. Each DIM module has one download channel, see Figure 1-3.

Thus an entire wide-area network can be managed by means of a network management station connected to any IMX-2T1/E1 unit (or to any of the other RAD equipment which supports SNMP management).

Remote Management using Telnet over IP

The IMX-2T1/E1 supports the Telnet communication protocol, which enables any IP host to access the IMX-2T1/E1 supervision facility using TCP/IP communication. The Telnet user has access to the same command-line interface available to the user of a supervision terminal, using the same management topologies described above for SNMP.

Physical Characteristics

The IMX-2T1/E1 is a compact unit, intended for installation on desk tops or shelves. Unit height is only 1U (1.75"). An optional rack-mount adapter kit enables the installation of the IMX-2T1/E1 units in a 19" rack.

Power

The IMX-2T1/E1 is powered by 115 VAC and 230 VAC, 47 to 63 Hz or

Requirements by -48 VDC power source.

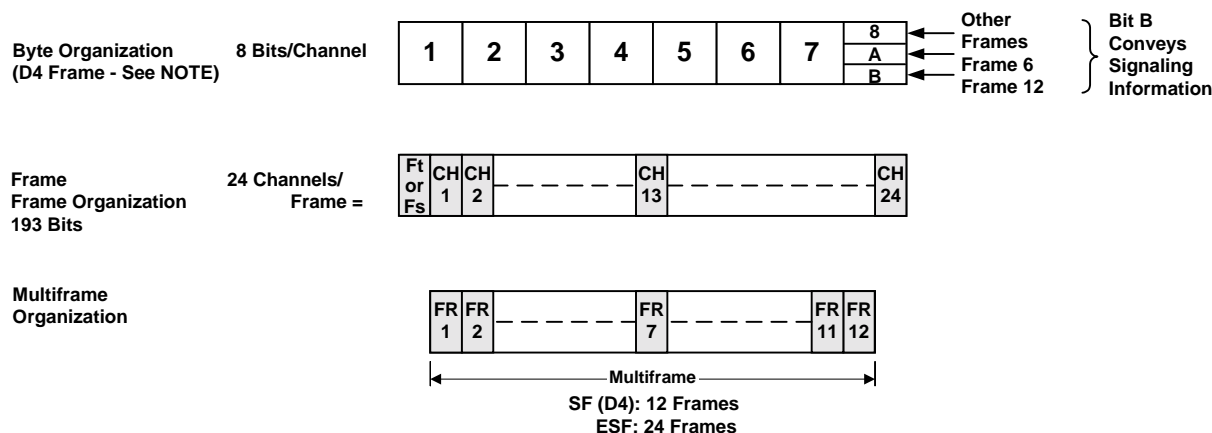
1.2 The T1 Environment

This section describes the T1 environment, to provide background information required for understanding the IMX-2T1/E1 configuration parameters.

The T1 line interfaces of the IMX-2T1/E1 comply with the applicable requirements of AT&T Pub. 62411, and ITU-T Rec. G.703, G.704, G.711, G.733, and G.824.

The T1 Signal Structure

The T1 line operates at a nominal rate of 1.544 Mbps. The data transferred over the T1 line is organized in frames. Each T1 frame includes 193 bits. The 193 bits consist of 24 time slots of eight bits each, that carry the data payload. An additional time slot, including one bit (the F bit) carries framing and supervision information. As a result, the data rate supported by each payload time slot is 64 kbps. The data rate of the framing slot is 8 kbps. The T1 frame format is shown in Figure 1-4.



NOTE:
In addition, ESF has a C-bit in frame 18 and a D-bit in frame 24

Figure 1-4 T1 Frame Format

In order to enhance link/system supervision capabilities, the frames are organized in larger patterns, called super-frames. Two types of super-frames are used:

- SF (also called D4), consists of 12 T1 frames.
- Extended SF (ESF), consists of 24 T1 frames.

The SF format provides limited supervision capabilities such as end-to-end reporting of local loss-of-signal (yellow alarm).

The ESF format provides much improved supervision capabilities, and allows better utilization of the 8 kbps framing time slots. The major advantage of the ESF format is that it supports on-line link performance monitoring (by

means of a 2 kbps Cyclic Redundancy Check (CRC) channel) and in addition provides a 4 kbps end-to-end supervision and control data link.

The implementation of the multiframing format is based on the use of various F-bit patterns. The F-bit pattern is used to perform three functions:

- Framing Pattern Sequence (FPS), defines frame and multiframe boundaries.
- Facility Data Link (FDL), allows transfer of supervisory data, e.g., alarms, error performance, test loop commands, etc., to be passed through the T1 link.
- Cyclic Redundancy Check (CRC), allows the measurement of the bit error rate and enhances the reliability of the framing algorithm.

The F-bit pattern defines the structure of frames and multiframes. In the D4 (SF) frame format, the F-bit of consecutive frames is alternately interpreted as an F_t bit (terminal framing bit) or F_s bit (frame signaling bit).

- F_t pattern: alternating 0's and 1's, defines the frame boundaries.
- F_s pattern: fixed 001110 pattern, defines the multiframe boundaries, so that one frame may be distinguished from another. In particular, the F_s pattern is needed so that frames 6 and 12 may be identified for the recovery of signaling bits.

In the ESF frame format, the multiframe structure is extended to 24 frames, but the frame and channel structure are the same as in the D4 (SF) format.

T1 Line Signal

The basic T1 line signal is coded using the alternate mark inversion (AMI) rules. In the AMI format, ones are alternately transmitted as positive and negative pulses, whereas zeros are transmitted as a zero voltage level. The AMI format cannot transmit long strings of zeros, because such strings do not carry timing information. Therefore, the AMI signal source must generate a signal with guaranteed minimum "ones" density.

The minimum average "ones" density is 1:8, so when a T1 signal is transmitted over an AMI line each frame time slot must include at least one "1" bit. In certain applications, this would effectively reduce the data rate available to the user to only 56 kbps per time slot, and would preclude the provision of clear channel capability (CCC). To circumvent this problem, modified line codes, which perform zero suppression by substituting special codes for long strings of "zeros", are used.

A widely used zero suppression method is B8ZS. The B8ZS zero suppression method provides clear channel capability, and the ones density requirement no longer restricts user data characteristics. This means that each T1 frame time slot can support the full 64 kbps.

T1 Alarms

The basic alarm conditions are Red alarm and Yellow alarm:

- **Red Alarm.** A red alarm is generated when the local unit has lost frame synchronization for more than 2.5 consecutive seconds. Loss of frame synchronization may be caused by Fs or Ft errors, by the reception of an AIS signal, or by the loss of the input signal.
According to AT&T TR-62411, a system automatically recovers synchronization when there has been a period of 10 to 20 consecutive seconds free of the loss of sync condition. Since in many system applications this is a overly conservative specification, the IMX-2T1/E1 allows the user to select a "fast" mode, which reduces the time necessary to declare synchronization to approximately one second free of the loss of sync condition.
- **Yellow Alarm.** A yellow alarm is sent from the remote unit to inform the local unit that a red alarm exists at the remote end.
- **Alarm Indication Signal (AIS).** The AIS signal is an unframed all-ones signal, and is used to maintain line signal synchronization when an alarm condition occurs in the equipment that supplies the line signal.
- **Excessive Bit Error Rate.** The bit error rate is measured on the framing bits. An excessive error rate condition is declared when the measured bit error rate exceeds 10^{-3} .

1.3 The E1 Environment

This section provides background information to aid in understanding the IMX-2T1/E1 configuration parameters.

The E1 port interface of the IMX-2T1/E1 complies with applicable ITU-T Rec. G.703 and G.823 requirements.

E1 (CEPT) Signal Structure

The E1 operates at a nominal rate of 2.048 Mbps. Data transferred over the E1 line is organized in frames. Each E1 frame has 256 bits.

The E1 frame format is shown in Figure 1-5.

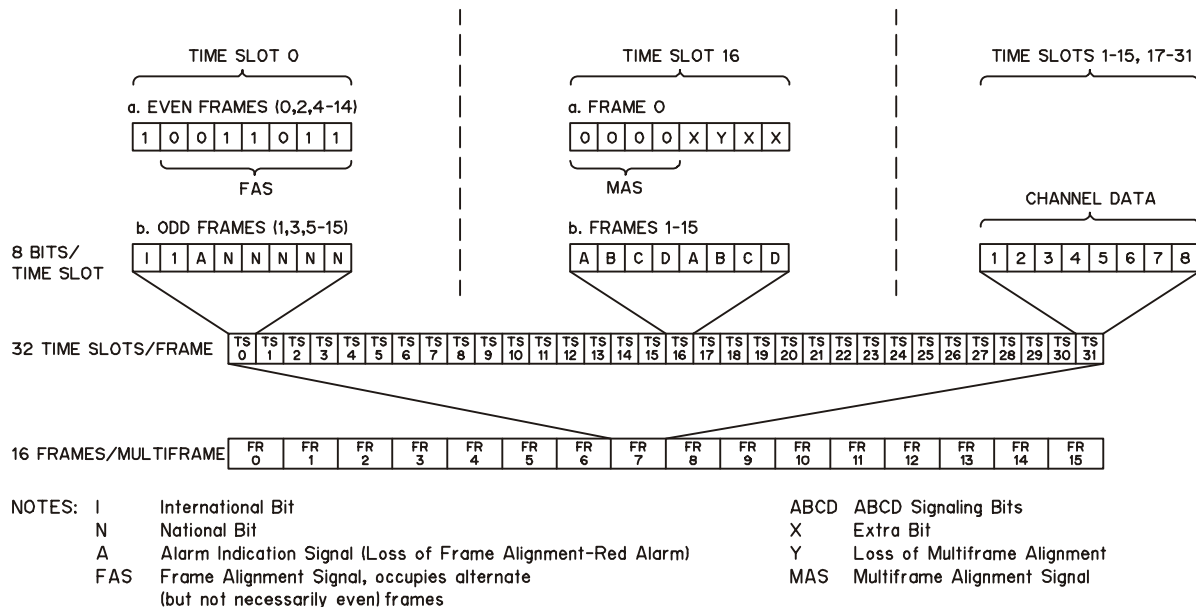


Figure 1-5 E1 (CEPT) Frame Format

The 256-bit frame consists of 32 time slots, eight bits per slot, that carry the data payload. Frame repetition rate is 8,000 per second, and therefore the data rate supported by each time slot is 64 kbps. In practice, 32 time slots are available for data.

The frames are organized in large patterns, named multiframes. Two types are commonly used: G.732N, which has 2 frames, and G.732S, with 16 frames:

- The G.732N multiframe is generally used when time slot 16 is available to the user, or serves for transmission of end-to-end signaling using common-channel signaling (CCS).
- The G.732S multiframe is used when time slot 16 serves for transmission of end-to-end signaling using channel associated signaling (CAS). CAS is typically utilized on links that transfer voice channels.

As the IMX-2T1/E1 transfers E1 frames transparently, it is not sensitive to the framing method utilized, and can transfer unframed data too.

E1 (CEPT) Line Signal

The E1 signal is coded using the High Density Bipolar 3 (HDB3) coding rules. HDB3 coding is an improvement on the alternate mark inversion (AMI) code.

In the AMI format, "ones" are alternately transmitted as positive and negative pulses, while "zeros" are transmitted as a zero voltage level. The AMI format cannot transmit long strings of "zeros", since such strings have no timing information.

HDB3 coding restricts the length of a "zero" string to 3 pulse intervals. Longer strings are encoded at the transmit end to introduce non-zero pulses. To allow the receiving end to detect the artificially introduced pulses and remove them (to restore the original data string), the HDB3 encoding introduces intentional bipolar violations in the data sequence. The receiving end detects these violations, and removes them if they appear to be part of a "zero" string.

E1 (CEPT) Line Alarm Conditions

- **Alarm indication signal (AIS)** - the AIS is an unframed "all ones" signal, used to maintain line signal synchronization in case of loss of input signal, e.g. an alarm condition occurring in the device supplying the line signal. Note that equipment receiving an AIS signal loses frame synchronization.
- **Loss of frame alignment (loss of synchronization)** - this condition is declared when too many errors are detected in the frame alignment signal (FAS), such as 3 or 4 FAS errors detected in the last 5 frames. Loss of frame alignment is cleared after no FAS errors are detected for two consecutive frames. Loss of frame alignment is reported by means of the A bit. As the IMX-2T1/E1 transfers the E1 frame transparently, irrespective of structure, it need not retrieve the frame alignment signal, and so this alarm is not relevant and not supported.
- **Excessive bit error rate** - bit error rate is measured in the frame alignment signal. The alarm threshold is an error rate higher than 10^{-3} that persists for 4 to 5 seconds. The alarm condition ceases if the error rate drops below 10^{-4} for 4 to 5 seconds. Since the IMX-2T1/E1 does not retrieve the frame alignment, this alarm is not supported.

1.4 System Application Considerations

This section presents typical IMX-2T1/E1 applications and explains special application considerations.

Clock Waveforms

The IMX-2T1/E1 distributes the incoming user's data (E1) and either fractional T1 or data channel interfaces bits between the two T1 links on a bit-by-bit basis.

The IMX-2T1/E1 utilizes 16 time slots of each frame transmitted on a T1 link for the transmission of E1 user's data, the remaining 7 time slots are assigned to the fractional or data channel interface. As it is transmitted over two T1 links, the E1 port rate is 2.048 Mbps. The remaining bits of each T1 frame (these are the eight bits of time slot 1 and the 193-th bit of the frame) are used to transmit the overhead data. The overhead data includes the standard T1 frame synchronization and housekeeping data (see Figure 1-4), and information generated by the IMX-2T1/E1. The information generated by the IMX-2T1/E1 is used for the following main purposes:

- Determining the differential delays among the active T1 links.
- Reassembling the bits in the correct order, to restore the original user's data stream at the remote end of the IMX-2T1/E1 link.
- In-band remote management.
- Out-band remote management.

1.5 System Timing Considerations

This section discusses the timing modes available in the IMX-2T1/E1. The IMX-2T1/E1 has six system timing modes:

- Internal Timing
- External (station) Timing
- Loopback Timing
- External E1 Timing (CH1)
- Transparent Timing
- External fractional T1 Timing (CH2)

Internal Timing

In this mode, an internal crystal oscillator (accuracy ± 32 ppm) provides the system clock of the IMX-2T1/E1. This in turn determines the T1 transmit clock signal, and the E1 and FT1 or data port outgoing clock signal. When internal clocking is used by an IMX-2T1/E1, the IMX-2T1/E1 at the remote end of the link must use loopback timing.

Figure 1-6 illustrates the flow of the timing signals for the internal timing mode.

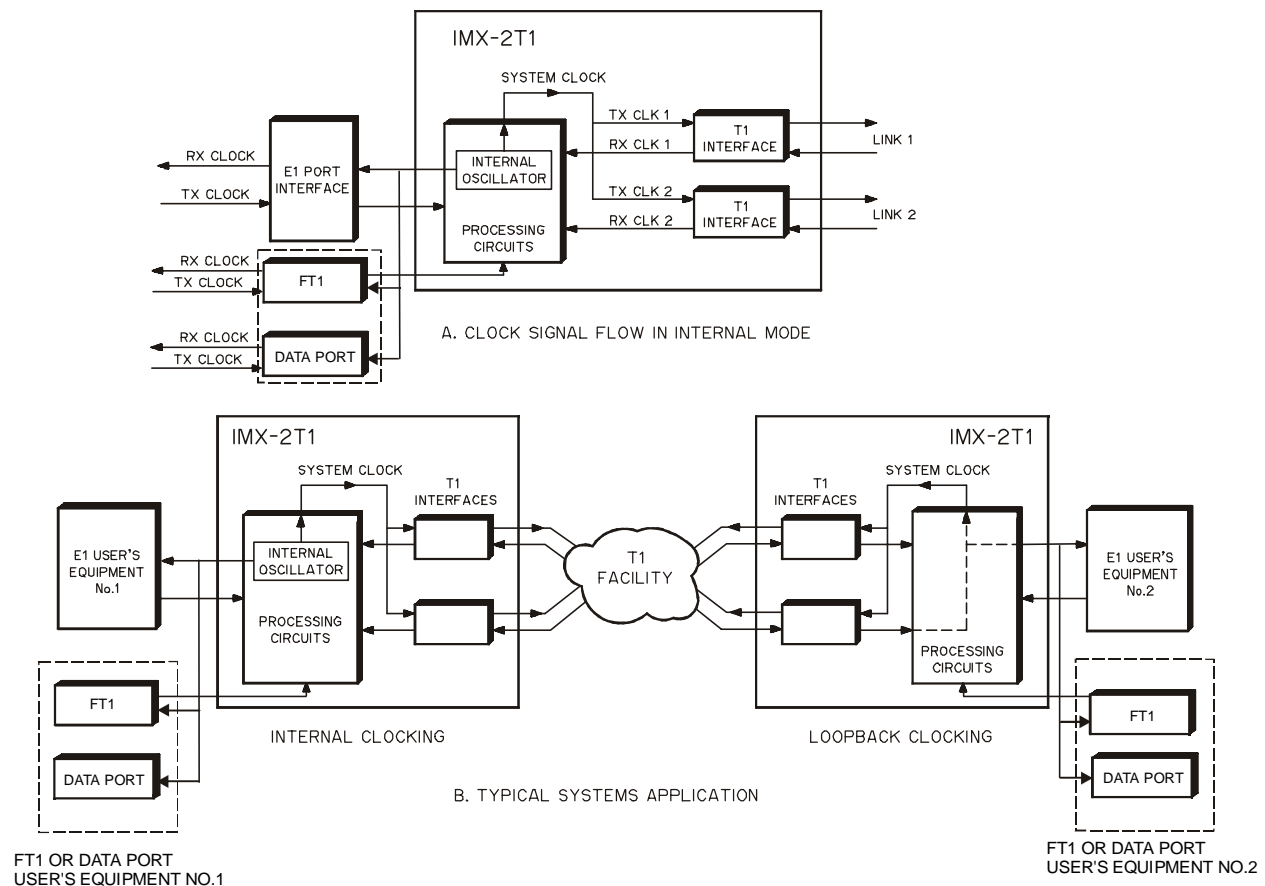


Figure 1-6 Flow of Timing Signals in Internal Timing Mode

Note

The receive paths of the T1 link and FT1 work with their own recovered clocks. These clock signals must originate at the same source.

Loopback Timing

With loopback timing, the system clock (which dictates the T1 transmit, and the E1 and FT1 or data port outgoing clock signals) is locked to the recovered receive clock signal of a user-selectable T1 link. Figure 1-7 A shows the flow of timing signals in an IMX-2T1 using the loopback timing mode, where the timing source is the recovered clock signal of T1 link interface 2.

Since the network reference clock of most T1 carriers is locked to a master clock with very high accuracy and stability, the use of loopback timing at both ends of a link is a simple and effective means for locking the system clocks of the two IMX-2T1/E1 units to the T1 network clock. This application is illustrated in Figure 1-7 B.

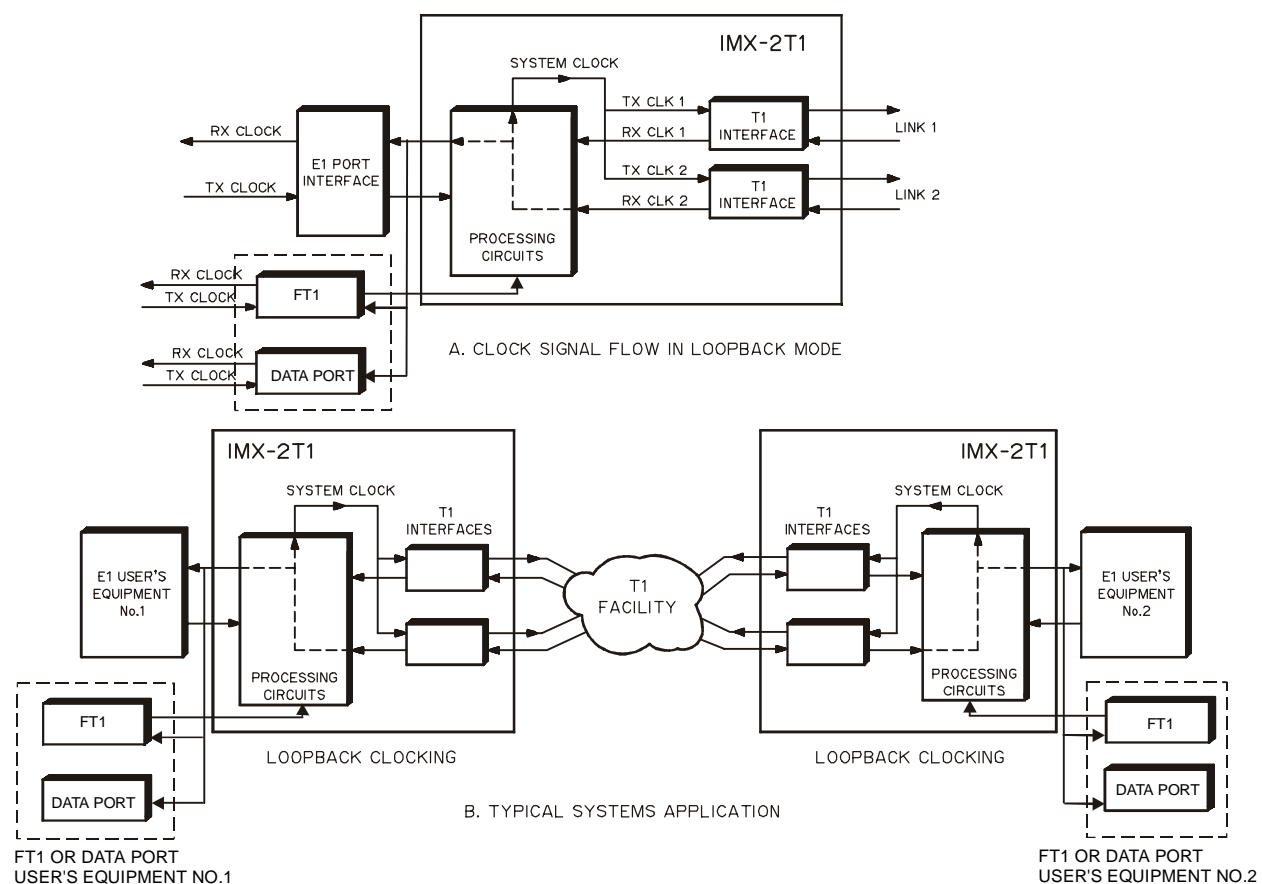


Figure 1-7 Flow of Timing Signals in Loopback Timing Mode

External (Station) Timing

With external timing, the system clock (which dictates the T1 transmit, and the E1 and FT1 or data port outgoing clock signals) is locked to an external ("station") clock signal. The external clock interface is available as a separate RJ-48C connector, designated STATION CLK. The external clock interface accepts a balanced unframed "all-ones" AMI or B8ZS signal having a nominal rate of 1.544 Mbps, and the maximum acceptable tolerance is ± 130 ppm.

Figure 1-8 A illustrates the timing signal flow using the station timing mode. Note that the receive paths of the T1 link and FT1 work with their own recovered clocks. These clock signals must originate at the same source.

When external timing is used by the IMX-2T1/E1, the IMX-2T1/E1 at the remote end of the link must either use loopback timing, or external (station) timing derived from the same source. An external (station) clock signal is usually available at locations that are equipped with higher level multiplexers, such as T3 multiplexers.

Figure 1-8 B illustrates the timing signal flow in a system using station timing at one end of the link, and loopback timing at the other end.

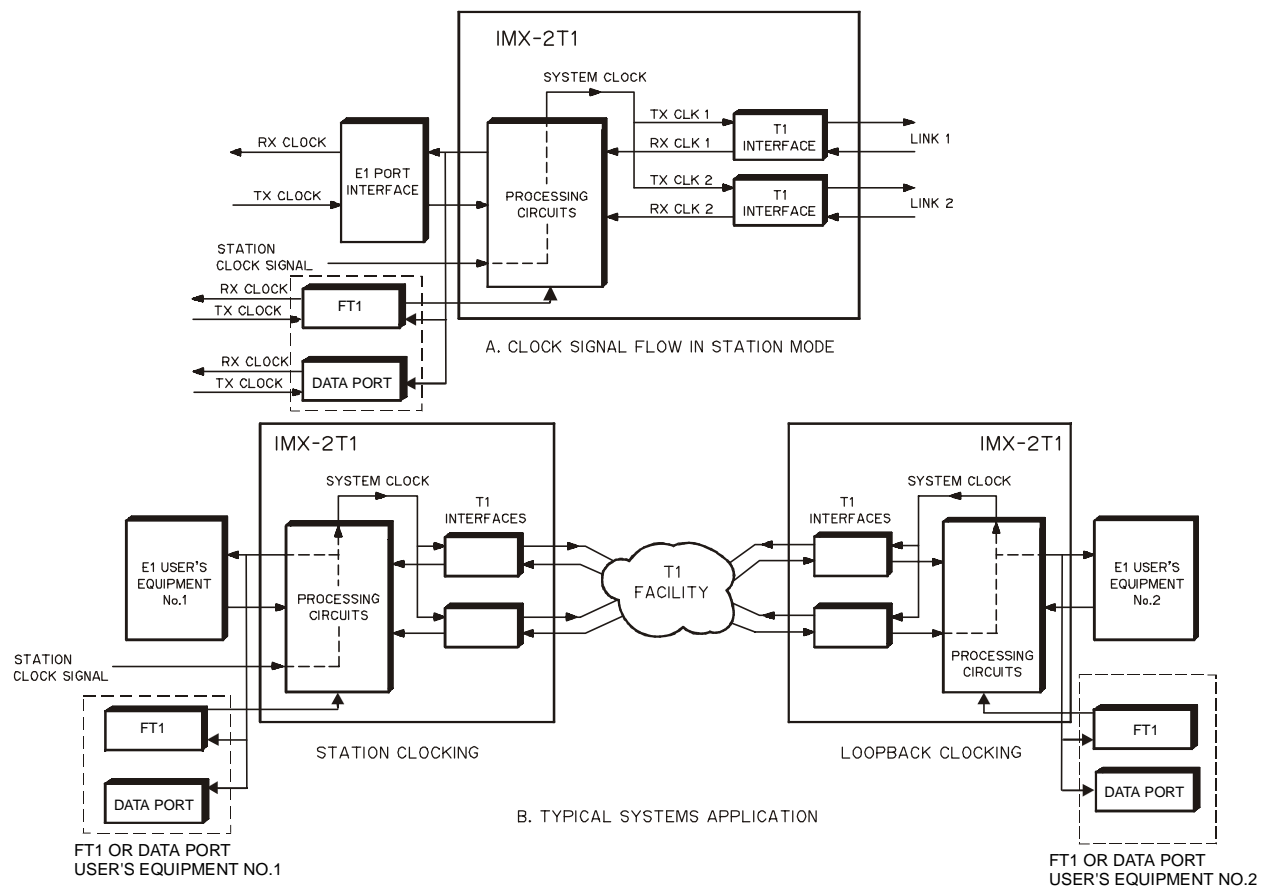


Figure 1-8 Flow of Timing Signals In Station Timing Mode

External E1 Timing

The system clock (which dictates the T1 transmit, and the E1 and FT1 or data port outgoing clock signals) is locked to the incoming E1 signal, originating in the E1 equipment connected to the E1 port of the IMX-2T1/E1.

Figure 1-9 A illustrates the timing signal flow in an IMX-2T1/E1 utilizing external E1 timing. Note that the receive paths of the T1 link and FT1 work with their own recovered clocks. These clock signals must originate at the same source as that of the E1 clock.

When external E1 clocking is used, the IMX-2T1/E1 at the remote end of the link must either use loopback timing, or external timing derived from the same source.

Figure 1-9 B illustrates the timing signal flow in a system using external E1 timing at one end of the link, and loopback timing at the other end.

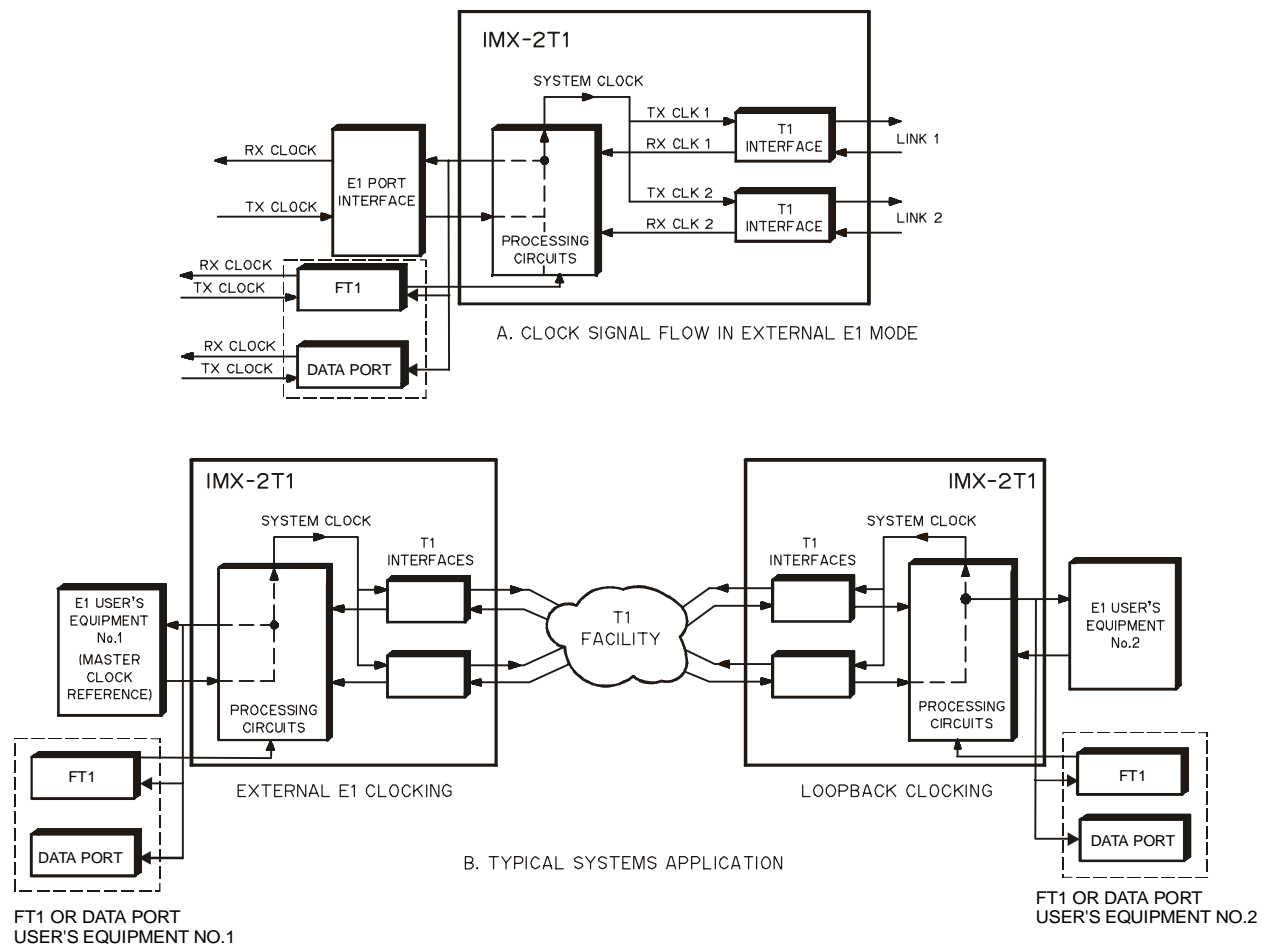


Figure 1-9 Flow of Timing Signals In External E1 Timing Mode

Transparent Timing

The system clock and transmit clock signals for the T1 link are locked to the incoming E1 signal, originating in the E1 equipment connected to the E1 port of the IMX-2T1/E1. The outgoing E1 and the FT1 or data port clock is locked to the receive clock of a user-selected T1 link.

Figure 1-10 A illustrates the timing signal flow using transparent timing. Note that timing is transferred transparently through the link, allowing the timing to be locked either to the E1 equipment clock, as shown in Figure 1-10 B, or the T1 network clock, as shown in Figure 1-10 C

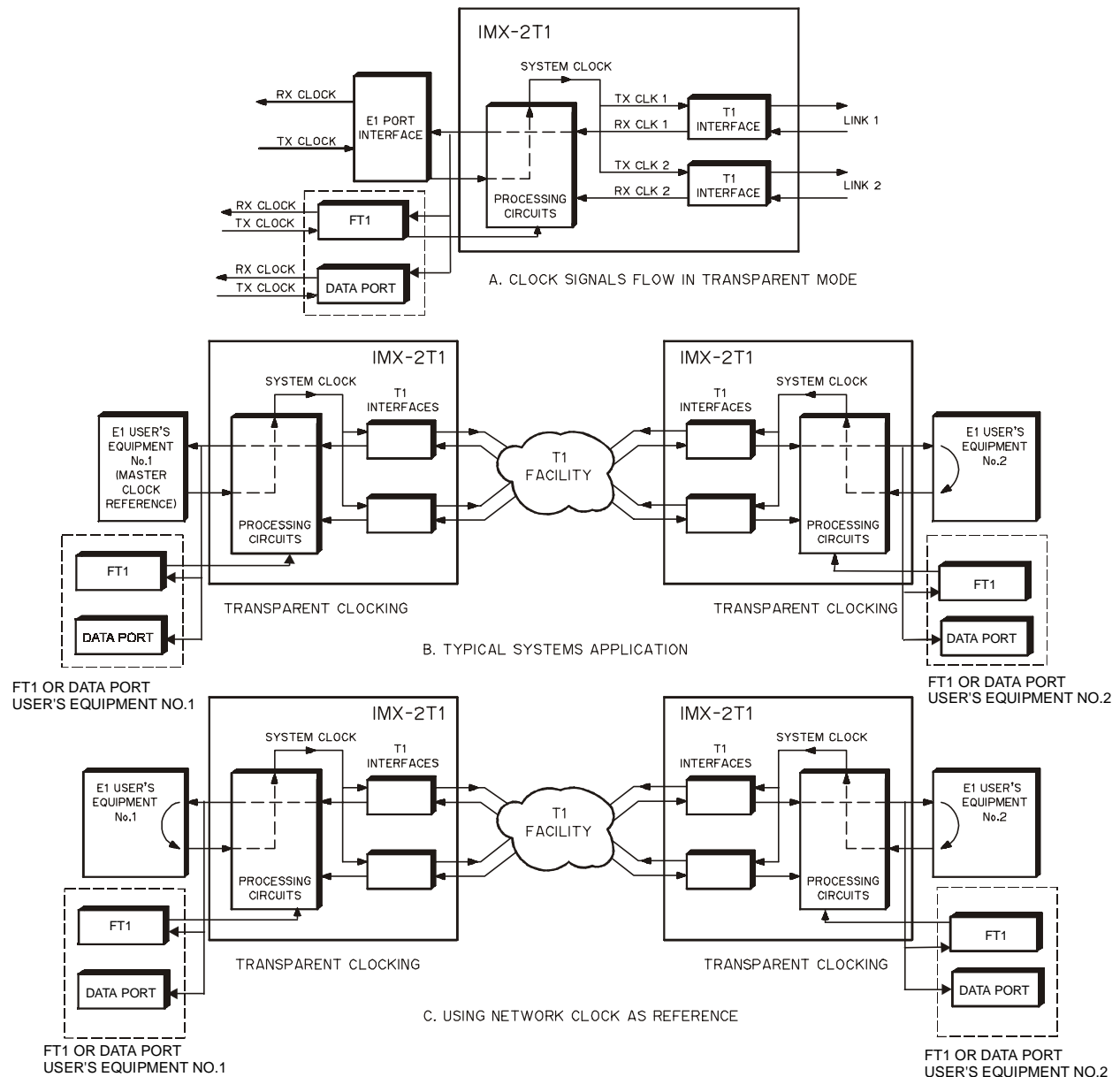


Figure 1-10 Flow of Timing Signals In Transparent Timing Mode

External Fractional T1 Timing

The system clock is locked to the recovered receive clock of the FT1 interface. The IMX-2T1/E1 at the remote end of the link must utilize loopback timing, or external FT1 derived from the same source.

A typical application has one side of the link utilizing loopback timing, and the other utilizing external FT1 timing, as illustrated in Figure 1-11 B.

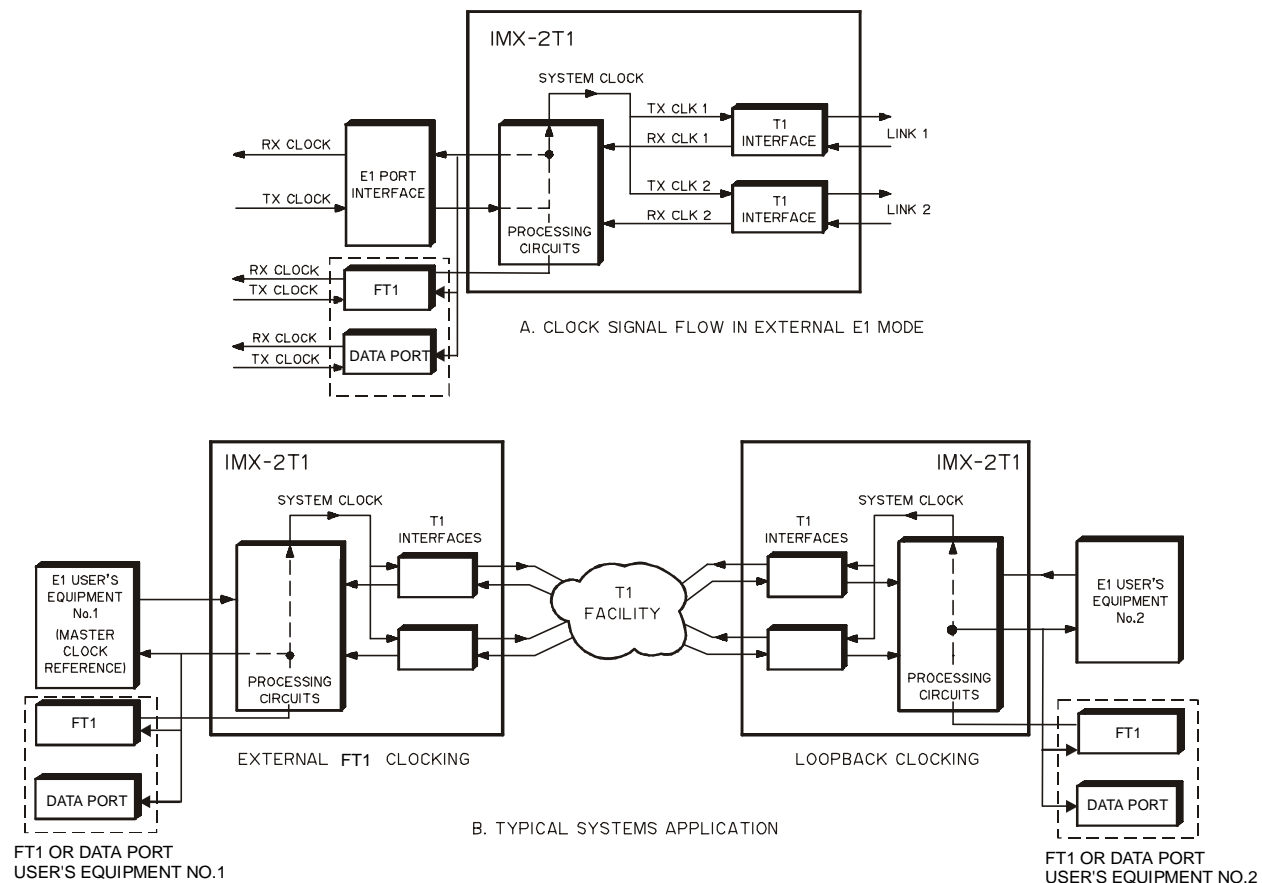


Figure 1-11 External Fractional T1 Timing

**Main/Fallback
Timing Sources**

To prevent the loss of system timing when a selected external timing source fails, the IMX-2T1/E1 automatically switched to internal timing when the outside source malfunctions.

To ensure system timing integrity, the user can specify an alternative timing source in case of a malfunction. When the main timing source malfunctions, the alternate timing source is selected, and if that should fail, the IMX-2T1/E1 automatically switches to internal timing. Upon recovery of the main timing source, the IMX-2T1/E1 will revert to that timing source.

**Interaction
Between E1 and
T1 Links**

If a problem arises on the T1 side of the link, the IMX-2T1/E1 sends an AIS signal at the E1 side.

The following cases warrant an AIS signal being sent:

- Loss of either of the T1 input signals.
- Loss of local frame synchronization on either of the T1 links.
- Reception of the AIS signal on either of the T1 links.

**Interaction
Between
FT1/Data Port and
T1 Links**

An idle code is inserted in the unused time slot of the T1 links, defined by the DEF LINK command. In addition, a 7F hexadecimal signal is sent over the unused timeslot of the fractional T1 to the fractional equipment. If a T1 link fails, an OOS code is sent over all the time slots to the fractional equipment. The OOS and idle codes are identical.

When a problem arises in CH2 (fractional T1), an OOS code is sent over the time slot to the remote IMX-2T1/E1.

Potential problems are:

- Loss of T1 input signal.
- Loss of frame synchronization.
- Receiving an AIS signal.

Note

CH1 is the E1 port interface, and CH2 is either the fractional T1 or the data channel interface.

1.6 Technical Specifications

| | | |
|---|--|--|
| General | Number of Links | 2 |
| | Maximum Differential Delay between Links | 64 |
| | Latency | Equal to the highest actual differential delay between links |
| T1 Link Interfaces Characteristics | Applicable Standards | AT&T TR-62411, AT&T Pub. 54016, ANSI T1.403, ITU-T Rec. G.703, G.704 |
| | Framing | D4 (SF), ESF |
| | Nominal Line Data Rate | 1.544 Mbps |
| | Line Code | AMI |
| | Line Impedance | 100Ω, balanced |
| | Zero Suppression | <ul style="list-style-type: none"> • Transparent (no zero suppression) • B8ZS <p>The mode is software-selectable</p> |
| | Transmit Levels | <ul style="list-style-type: none"> • Nominal Level ±3V ±10% • Levels with CSU 0 dB, -7.5 dB, -15 dB, -22.5 dB • Levels without CSU Software adjustable to be measured at 0 to 655 ft • Receive Levels 0 to -34 dB with CSU 0 to -10 dB without CSU |
| | Connectors | RJ-48C |

E1 Port Interface Characteristics

| | |
|------------------------|---|
| Applicable Standards | ITU-T Rec. G.703, G.823 |
| Framing | Supports unframed E1 signals, and all E1 framing formats. Framing is transferred transparently |
| Nominal Line Data Rate | 2.048 Mbps |
| Line Code | HDB3 |
| Line Impedance | 120 Ω , balanced (selectable by jumper) 75 Ω , unbalanced (selectable by jumper) |
| Transmit Levels | Balanced - $\pm 3V \pm 10\%$ Unbalanced - $\pm 2.37V \pm 10\%$ |
| Receive Levels | 0 to -10 dB |
| Jitter Performance | Complies with ITU-T Rec. G.823 |
| Connectors | Balanced: RJ-48C connector Unbalanced: two BNC coaxial connectors |

Fractional T1 Interfaces Characteristics

| | |
|------------------------|--|
| Applicable Standards | AT&T TR-62411, ITU-T Rec. G.703, G.704 |
| Framing | D4 (SF), ESF |
| Time Slot Allocation | <ul style="list-style-type: none"> • Sequential time slots • User defined time slots |
| Nominal Line Data Rate | 1.544 Mbps |
| Line Code | AMI |
| Line Impedance | 100 Ω , balanced |
| Zero Suppression | <ul style="list-style-type: none"> • Transparent (no zero suppression) • B8ZS • B7ZS <p>The mode is software-selectable</p> |

| | | |
|--------------------------------|--|---|
| | Transmit Levels | |
| | <ul style="list-style-type: none"> • Nominal Level | $\pm 3V \pm 10\%$ |
| | <ul style="list-style-type: none"> • Levels | Software adjustable to be measured at 0 to 655 ft |
| | <ul style="list-style-type: none"> • Receive Levels | 0 to -10 dB |
| | Connector | RJ-48C |
| Station Clock Interface | Nominal Rate | 1.544 Mbps |
| | Line Code | AMI or B8ZS |
| | Impedance | 100 Ω , balanced |
| | Format | Unframed or framed "all-ones" signal |
| | Connector | RJ-48C |
| Timing Modes | | <ul style="list-style-type: none"> • Loopback timing (locked to a selected T1 link), acceptable tolerance ± 130 • External (station) timing, acceptable tolerance ± 130 • External E1 timing (locked to E1 incoming clock), acceptable tolerance ± 130 • External FT1 timing locked to fractional T1, acceptable tolerance ± 130 • Transparent timing (T1 transmit clocks locked to E1 incoming clock, E1 outgoing) • Internal timing (accuracy: ± 32 ppm) |

Diagnostics

- Local or remote E1 (CH1) Port loopbacks
- Local or remote CH2 Port loopback
- Local and remote T1 loopbacks
- Code-activated network loopback per ANSI T1.403
- BER testing (CH1 and CH2)
- In-band code activated loopback on CH2

Statistics

- Full support of ANSI T1.403 statistics
- Local support of AT&T Pub. 54016 statistics

Front Panel Controls

LCD

Two rows of 16 characters

Push-buttons

CURSOR, SCROLL, ENTER

Indicators

10 Base T port only:

- T1 link alarms 1 and 2: Red, Yellow for each
- E1 Port: RD, TD
- Fractional T1: Red, Yellow
- Data Port: DCD, RTS, RD, TD
- Test active
- Ethernet port link status
- Ethernet port collision indicator
- Ethernet port transmit and receive data activity

| | | |
|-------------------------|---|--|
| Supervisory Port | Function | Full control over IMX-2T1/E1 operation using supervisory terminal or Telnet(SLIP). Remote monitoring and remote data collection. |
| | CONTROL DCE and Inband functions | SNMP and Telnet support In-band management via a dedicated 8 kbps channel |
| | Port Connectors | 9-pin D-type female connector |
| | Port Interfaces | V.24/RS-232 (asynchronous) DCE and DTE ports |
| | Data Rates: | |
| | CONTROL DCE port | 300, 1200, 2400, 4800, 9600, and 19200 bps, or automatic detection of data rate (Autobaud) |
| | Data Word Format | <ul style="list-style-type: none"> ● One start bit ● 7 or 8 data bits ● Even, odd, or no parity ● One stop bit |
| | Dial In Capabilities (CONTROL DCE port) | Supports all the Supervisory Port functions |
| | Dial Out Capabilities (CONTROL DCE port) | Event activated. Supports a dial up modem (Hayes™ compatible) to dial out to a preset number to report alarm events. |
| | Alarm Relay | Via the STATION CLOCK RJ-48C connector |
| | Normally Closed (NC) | On pin 7 and 8 |
| | Normally Open (NO) | On pin 6 and 8 |
| Physical | Height | 4.4 cm / 1.7 in (1U) |
| | Width | 43.2 cm / 17 in |
| | Depth | 24.2 cm / 9.5 in |
| | Weight | 2.3 kg / 5.0 lb |

| | | |
|---------------------------|-----------------------|---|
| Power Requirements | AC Voltage | 115 VAC ($\pm 10\%$) and 230 VAC ($\pm 10\%$), 47 to 63 Hz |
| | DC Voltage | - 48 VDC |
| | Power Consumption | 18.5 Watts |
| Environment | Operating Temperature | 0 to 45°C (32 to 113°F) |
| | Relative Humidity | Up to 90%, non-condensing |

Chapter 2

Installation

This chapter:

- Describes the site requirements for installing the IMX-2T1/E1
- Provides configuration information
- Describes the connections made during installation.

1.1 General

The IMX-2T1/E1 is delivered completely assembled. It is designed for installation as a desk-top unit or for mounting in a 19" rack.

Mechanical and electrical installation procedures for the IMX-2T1/E1 are provided in the following paragraphs.

After installing the unit, refer to Chapter 3 for system configuration information and procedures using the front panel controls, or Chapter 4 for system configuration using an ASCII terminal connected to the IMX-2T1/E1 supervisory port.

If a problem is encountered, refer to Chapter 5 for test and diagnostics instructions.

1.2 Unpacking

A preliminary inspection of the equipment container should be made before unpacking. Evidence of damage should be noted and reported immediately.

Unpack the equipment as follows:

- Place container on a clean flat surface, cut all straps, and open or remove top.
- Take out the IMX-2T1/E1 carefully and place it securely on a clean surface.
- Inspect the product for damage. Report immediately any damage found.

1.3 Site Requirements

Power

AC-powered IMX-2T1/E1 units should be installed within 1.5m (5 feet) of an easily-accessible grounded AC outlet capable of furnishing the nominal supply voltage (115 or 230 VAC).

DC-powered IMX-2T1/E1 units require a -48 VDC power source, which must be adequately isolated from the mains supply.

Link and Station Clock Connections

The IMX-2T1/E1 has one RJ-48C connector for each link interface, and one for the external (station) clock interface. Appendix A provides the pin allocation for the RJ-48C connectors.

The maximum allowable line attenuation between the IMX-2T1/E1 port and the network interface depends on the IMX-2T1/E1 interface:

- For the station clock interface, and for link interfaces without CSU, the maximum range is 10 dB.
- For link interfaces with CSU, the maximum range is 34 dB.

E1 Port Connection

The IMX-2T1/E1 has two physical interfaces:

- A balanced line interface terminated with an RJ-48C connector, pin assignments for the connector are described in Appendix A.
- An unbalanced line interface terminated with two BNC female coaxial connectors.

Maximum line attenuation for the E1 port is 10 dB.

Fractional T1 Connection

The fractional T1 interface has an RJ-48C connector, pin assignments for the connector are described in Appendix A.

Maximum line attenuation for the T1 port is 10 dB.


Data Channel Interface Connections

The IMX-2T1/E1 user's data port connector depends on the interface type installed in the unit:

- V.35 interface: 34-pin female connector
- X.21 interface: 15-pin D-type female connector.
- RS-530 interface: 25-pin D-type female connector.
- V.36/RS-449 interface: a 37-pin D-type male connector is provided by means of an adapter cable that connects to the RS-530 port connector.
- Ethernet 10BaseT: 8-pin RJ-45 female connector.

| | |
|---------------------------------------|---|
| Supervisory Port Connection | Connect a cable prepared according to descriptions in Appendix A between supervision terminal and the supervisory port connector (marked DCE), on the front panel of the IMX-2T1/E1. If the supervision terminal is connected via modems, use a cross-over cable. A modem, set to auto-answer, can be used to dial preset numbers and automatically report alarms to a central location. Before you start operations, the supervisory terminal must be set to the same data rate, data word format and parity type as the IMX-2T1/E1. |
| Front and Rear Panel Clearance | Allow at least 90 cm (36 inches) of frontal clearance for operator access. Allow at least 10 cm (4 inches) clearance at the rear of the unit for interface cable connections. |
| Ambient Requirements | The ambient operating temperature of the IMX-2T1/E1 should be 32°F to 113°F (0°C to 45°C), at a relative humidity of up to 90%, non-condensing. |

1.4 IMX-2T1/E1 Configuration Information

| | |
|---|--|
| General | <p>This paragraph provides information on the functions of the internal jumpers, to help you select the correct setting for your particular application, and gives you step-by-step instructions for setting these jumpers. The default settings for each jumper are also listed.</p> <p>All the other configuration actions can be performed from the front panel or from a supervision terminal, after the installation is completed. Information and detailed instructions for these operations appear in Chapters 3 and 4, respectively.</p> <p>Prior to IMX-2T1/E1 installation, it is necessary to check the positions of its internal jumpers and switches. If necessary, change the settings following with the specific requirements of your application.</p> |
|  Warning | <p>Disconnect the unit from the power line and from all the cables before removing cover.</p> <p>Dangerous high voltages are present inside the IMX-2T1/E1 when it is connected to power and/or to the links. Any adjustment, maintenance, and repair of the opened instrument under voltage should be avoided as much as possible and, when inevitable, would be carried out only by a skilled person who is aware of the hazard involved. Capacitors inside the instrument may still be charged even after the instrument has been disconnected from its source of supply.</p> |
| Caution | <p>The IMX-2T1/E1 contains components sensitive to electrostatic discharge (ESD). To prevent ESD damage, avoid touching the internal components, and before moving jumpers, touch the IMX-2T1/E1 frame.</p> |

Opening the IMX-2T1/E1 Case

To reach the internal jumpers and switches of the IMX-2T1/E1, use the following procedure:

1. Disconnect all the cables connected to the IMX-2T1/E1.
2. Unscrew the large captive screws fastening the top cover to the rear panel.
3. Remove IMX-2T1/E1 top cover.

IMX-2T1/E1 Construction

Figure 2-1 shows the inner IMX-2T1/E1 construction. The main components of the IMX-2T1/E1 are the motherboard, two T1 link interface boards, the E1 port interface board, and FT1 or Data Sync boards (optional).

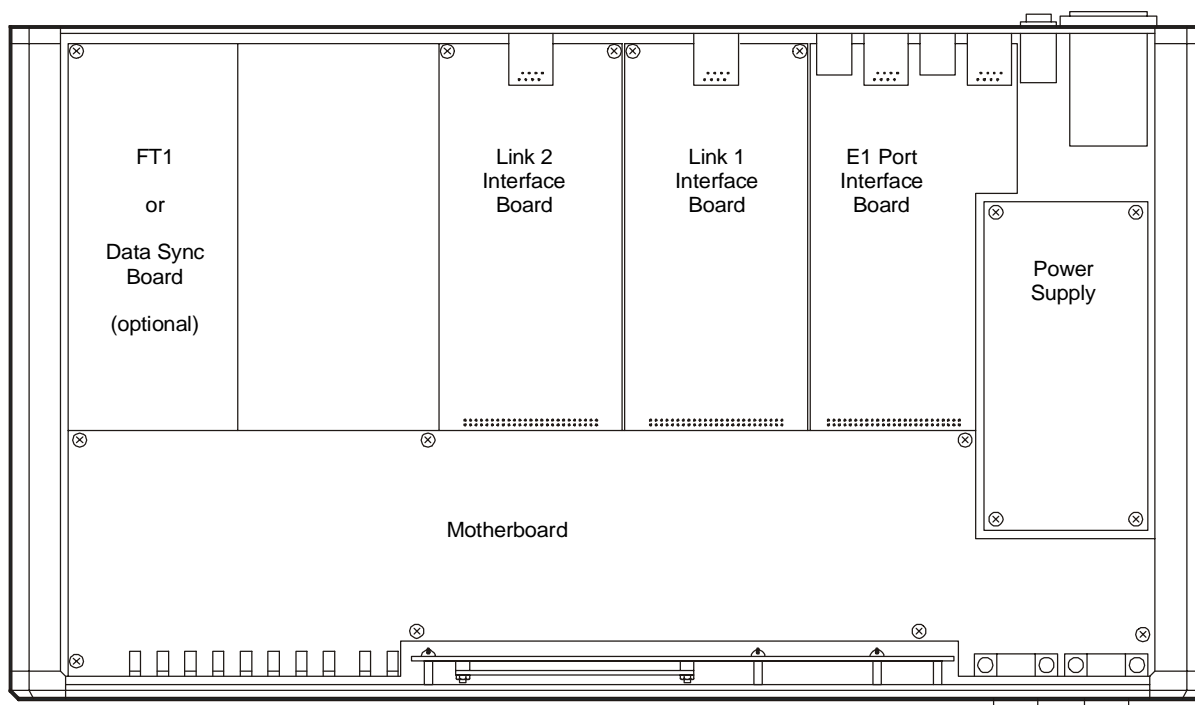


Figure 2-1 IMX-2T1/E1 Internal Construction

Motherboard Jumpers and Switch, Location and Functions

The jumpers and switches located on the IMX-2T1/E1 motherboard are identified in Figure 2-2. Their functions are described below.

In addition to the jumpers listed below, the IMX-2T1/E1 has additional jumpers shown in Figure 2-3, that are set by the manufacturer and must not be changed by the user.

WD Selection, Jumper JP11

The WD (watchdog) jumper is used to disable the internal watchdog function during maintenance. The WD jumper JP11 has two positions:

- NO: watchdog enabled.
- YES: watchdog disabled.

The IMX-2T1/E1 is shipped with the jumper set at ON.

FGND=SGND Jumper JP2

The jumper JP2 controls the connection between the IMX-2T1/E1 signal ground and the frame (chassis) ground.

- YES : signal ground is connected to the frame (chassis) ground.
- NO : signal ground is not connected to the frame ground.

The IMX-2T1/E1 is shipped with the jumper set at YES (connected).

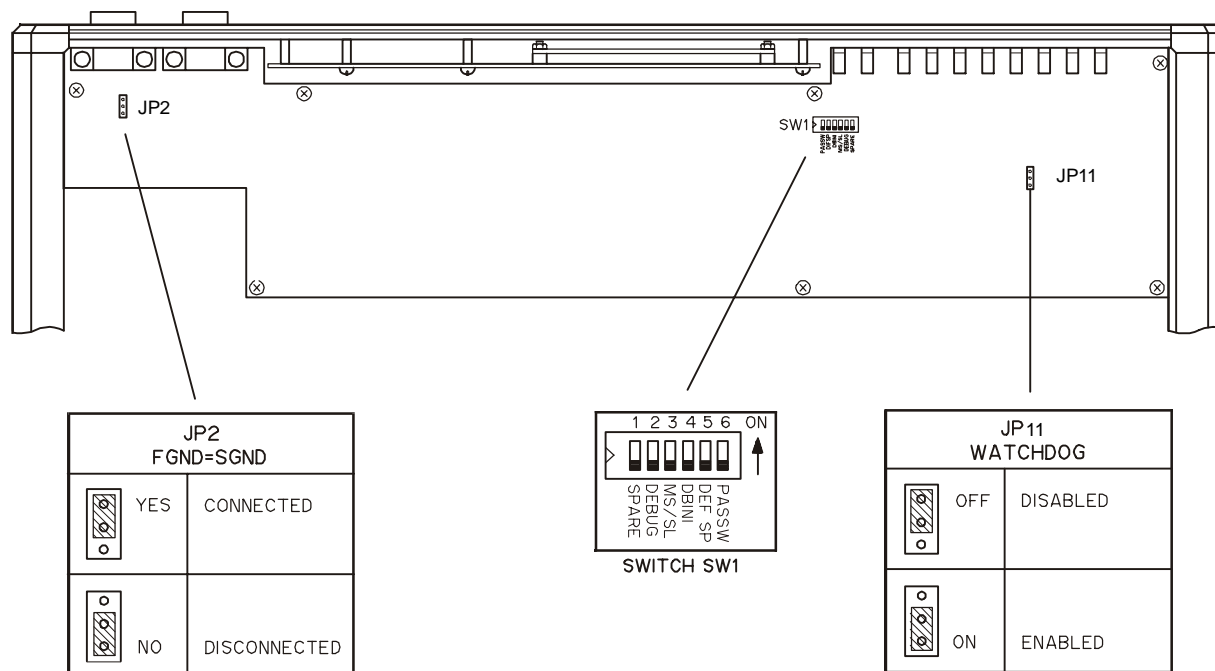


Figure 2-2 IMX-2T1/E1 Motherboard, Internal Settings

Switch SW1

The IMX-2T1/E1 is delivered with a set of default parameters that allow the user to start the configuration activities from a known state. These parameters are stored in its program EPROM, and therefore cannot be modified. By configuring the IMX-2T1/E1, the user specifies custom parameter values; these parameter values are stored in the IMX-2T1/E1 data base (located in non-volatile memory), and are automatically loaded each time the IMX-2T1/E1 is powered up.

Note

If during the power-up self-test, it is found that the user's configuration has been corrupted, the IMX-2T1/E1 will automatically reload the default parameters from its EPROM.

Switch SW1 allows the user to control the reloading of the desired group of default parameters. The functions of the user-selectable sections are as follows:

- **Section 1 - PASSW.** A password, consisting of four to eight alphanumeric characters, can be used to prevent unauthorized personnel from changing IMX-2T1/E1 parameters from the front panel, and from using the IMX-2T1/E1 supervision program. Note that the personnel can read the configuration parameters of the IMX-2T1/E1 from its front panel even when the password is used.

The IMX-2T1/E1 is delivered with a default password **IMX**, but normally the password is selected by the user.

Section 1 of SW1 is used to select between the default IMX-2T1/E1 password (the ON position) and the user-selected password (the OFF position). The IMX-2T1/E1 address (node number) is also affected by section 1: with the section set at ON, the node number is set to 0.

Upon first-time operation, you should use the ON position to start the configuration. You can select this position again to restart with the default password and node address 0 in case the current user password was lost.

The IMX-2T1/E1 is shipped with section 1 set to OFF.

- **Section 2 - DEFSP.** This section selects the source of the supervisory port parameters:
 - ON IMX-2T1/E1 uses the default parameters stored in its program EPROM. The default values are Autobaud, eight data bits, and no parity.
 - OFF IMX-2T1/E1 uses the user-selected parameters.

Upon first-time operation, you should use the ON position to start the configuration. You can select this position again to restart with the default parameters in case the current values are not known, and it is not possible to communicate with the IMX-2T1/E1 through its supervisory port.

The IMX-2T1/E1 is shipped with section 2 set to OFF.

- **Section 3 - DBINI.** This section selects the source of the data base configuration parameters:
 - ON IMX-2T1/E1 uses the default parameters stored in its program EPROM.
 - OFF IMX-2T1/E1 uses the user-selected parameters.

The IMX-2T1/E1 is delivered with the data base loaded with the default parameters. You can select the ON position again to restart with the default parameters in case the current values are not known.

The IMX-2T1/E1 is shipped with section 3 set to OFF.

Note *User-selected parameter values are not erased by setting one or more of SW1 sections 1, 2, or 3 to ON: this action merely causes the IMX-2T1/E1 to use the default values. However, if the IMX-2T1/E1 is turned off and then powered up again, the default values replace the user values.*

- **Section 4 - 64.** This section defines the maximum differential delay between links as 64 msec. It is factory-set to 64 msec and cannot be changed.
- **Section 5 - DEBUG.**
- **Sections 6-9 - SP1-SP4** position switches. In certain IMX-2T1/E1 models these switches are factory-installed. **Do not** change the factory settings.

T1 Link Interface Boards

The two T1 link interface boards do not include user-selectable jumpers.

Note

Each CSU interface board has protection fuses for surge protection circuits located on the line side of the line isolation transformers.

E1 Port Interface Board

The E1 port interface board includes several selectable jumpers, as identified in Figure 2-3.

Termination Selection Jumpers

Jumpers JP3, JP4, JP5 and JP7 are used to select the E1 port interface. ***These jumpers must all be set in the same position, i.e., all BAL or all UNBAL***

- **BAL** - sets operation with balanced interface.
- **UNBAL** - sets operation with unbalanced interface.

The IMX-2T1/E1 is shipped with all these jumpers set to BAL.

Transmit Side Frame Ground Reference, Jumper RXGND JP6

The RXGND jumper connects the outer contact of the E1 RX OUT BNC connector to the frame ground reference of the E1 port output when an unbalanced interface is used.

In compliance with ITU-T recommendations, JP6 is installed when an unbalanced interface is used.

The IMX-2T1/E1 is shipped without the JP6 jumper being installed (i.e., set for balanced interface).

Receive Side Frame Ground Reference, Jumper TXGND JP8

The TXGND jumper connects the outer contact of the E1 RX OUT BNC connector to the frame ground reference of the E1 port input when an unbalanced interface is used.

In compliance with ITU-T recommendations, JP8 is optional when an unbalanced interface is used (the line is normally grounded at the transmit side). It may also be utilized with balanced interface operation.

The IMX-2T1/E1 is shipped with JP8 not installed.

Station Clock Source Selection Jumper JP2

The jumper designated JP2 on the E1 Port interface board is used to select the station clock interface type. The two settings of this jumper, shown in Figure 2-3, are as follows:

- CLK – for RS-422 type station clock interface.
- ALL_1 – for G.703 type station clock interface.

The IMX-2T1/E1 is shipped with the jumpers set for the ALL_1 source.

Data Channel Layout

Jumper JP4 settings are as follows:

NOR: The incoming data is sampled with the falling edge of TCLK.

INV: The incoming data is sampled with the rising edge of TCLK

Default: NOR

Note

For IMX-2T1/E1 with fractional T1 interface there are no jumpers for the user to configure.

Internal Settings Procedure

Please refer to Figure 2-2 and Figure 2-3 to identify the jumper and switch locations. Make the required settings, and then reassemble the top cover of the IMX-2T1/E1, fastening the two spring loaded screws to the body to secure the cover.

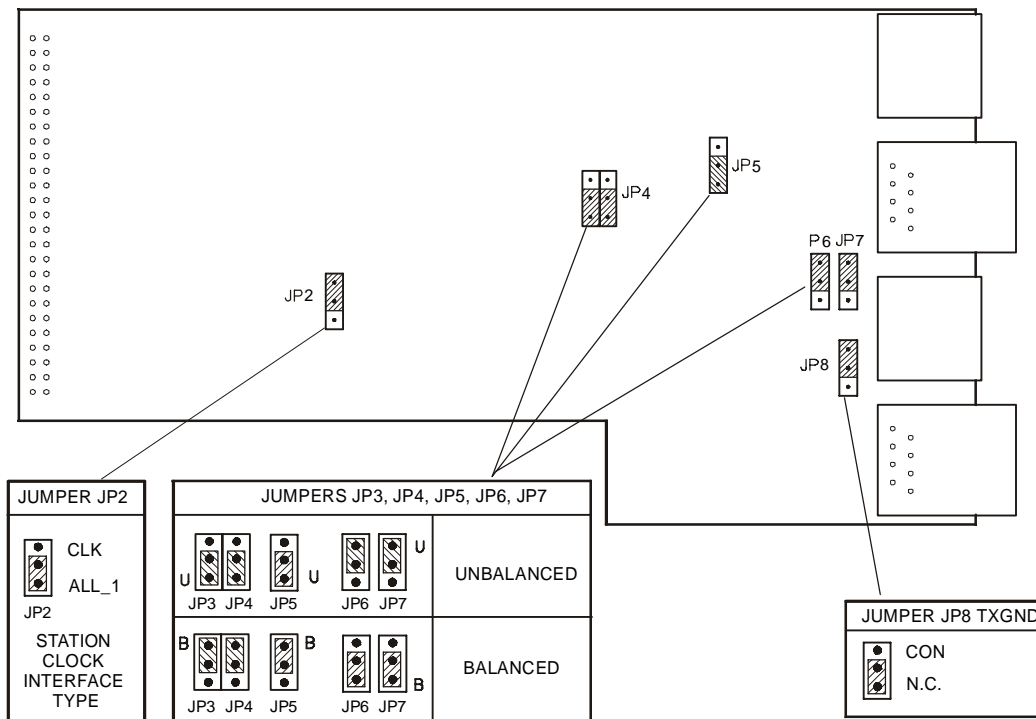


Figure 2-3 E1 Port Interface Board, Jumper Settings

1.5 Installation in 19" Racks

General

The IMX-2T1/E1 can be installed in 19" racks. Unit height corresponds to 1U (1.75"). The hardware necessary for rack installation is available as a kit, **RM-7/NEW**. Below are instructions for rack installation of a unit.



Disconnect all the cables, including the power cables, from the unit while performing the following procedure.

Installation Procedure

The rack adapter kit includes two brackets. The brackets are fastened by means of screws to the two side walls of the case, as shown in Figure 2-4.

To prepare the unit for rack installation, attach the two brackets to the side walls of the unit. Each bracket is fastened by means of two screws (with flat washers), which are inserted into the two front holes on the wide wall (nuts are already in place, on the inner side of the wall).

After attaching the brackets, the unit is ready for installation in the 19" rack. Fasten the brackets to the side rails of the 19" rack by means of four screws (not included in the kit), two on each side.

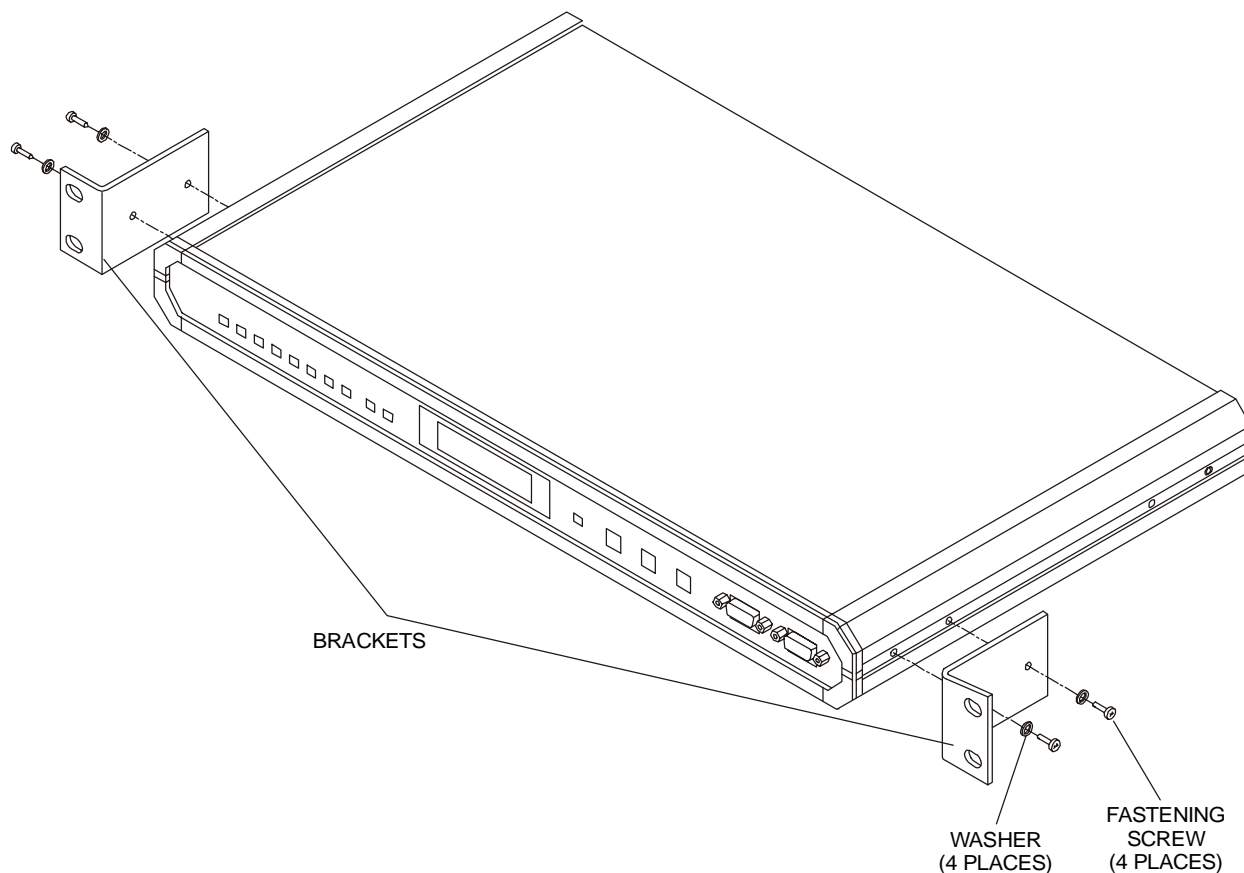


Figure 2-4 Installation of IMX-2T1/E1 in 19" Rack

1.6 Interfaces and Connections

Connector Locations

Figure 2-5 shows the rear panel of an AC-powered IMX-2T1/E1 unit and identifies connector locations. In DC-powered IMX-2T1/E1 units, a circular 3-pin DC power connector is provided.

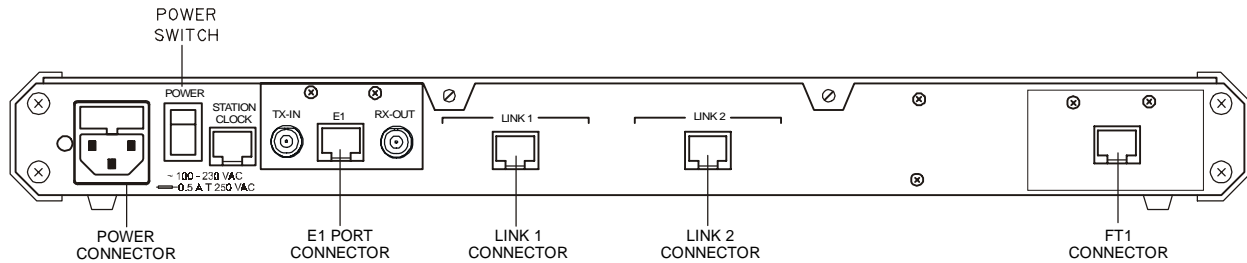


Figure 2-5 IMX-2T1/E1 Rear Panel

Grounding

Any interruption of the protective (grounding) conductor (inside or outside the instrument) or disconnecting the protective earth terminal can make this instrument dangerous. Intentional interruption is prohibited.



Warning

Before switching on this instrument and before connecting any other cable, the protective earth terminals of this instrument must be connected to the protective ground conductor of the (mains) power cord. The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. To preserve this protection, use only extension cords (power cables) with protective grounding.

Make sure that only fuses with the required rated current, as marked on the IMX-2T1/E1 rear panel, are used for replacement. The use of repaired fuses and the short-circuiting of fuse holders must be avoided.

Whenever it is likely that the protection offered by fuses has been impaired, the instrument must be made inoperative and be secured against any unintended operation.

AC Power Connections

AC power should be supplied to the IMX-2T1/E1 through a 5 ft (1.5m) standard power cable terminated by a standard 3-prong plug.

- Check that the ON/OFF switch on the IMX-2T1/E1 rear panel is set to OFF.
- Connect the power cable first to the connector on the IMX-2T1/E1 rear panel, then to the mains outlet.

DC Power Connection

- Check that the ON/OFF switch on the IMX-2T1/E1 rear panel is set to OFF.
- Connect the power cable to the DC power connector.

Link Connections Connect each of the link cables to the connector corresponding to the link interface to be used, LINK-1, LINK-2.

Station Clock Connection If an external clock signal is to be used, connect the external clock cable to the STATION CLOCK connector.

E1 Port Connection Connect the E1 port cable(s) to the corresponding connector(s) of the interface being used.
Do not connect to both balanced and unbalanced connectors of the E1 port!

- For a balanced interface, connect to the RJ-48C connector.
- For an unbalanced interface, connect to the two BNC connectors (labeled RX-OUT and TX-IN).
 - The cable from the transmit (signal out) of the E1 equipment is to be connected to the TX-IN of the IMX-2T1/E1.
 - The cable from the receive (signal in) of the E1 equipment is to be connected to the RX-OUT of the IMX-2T1/E1

Data Channel Interface Connection The connection of data terminal equipment is made at the rear panel connector marked Data port. The interface type installed in the IMX-2T1/E1 is indicated by the label displayed above the connector. Connector pin allocations and adapter cable wiring data appear in Appendix A.

V.35 Interface The V.35 interface has a 34-pin female connector, wired for direct connection to V.35 DTE interfaces.

X.21 Interface The X.21 interface has a 15-pin D-type female connector, wired for direct connection to X.21 DTE interfaces.

RS-530 Interface The RS-530 interface has a 25-pin D-type female connector wired for direct connection to RS-530 DTE interfaces.

V.36/RS-449 Interface If the required interface is V.36/RS-449, connect first the interface adapter cable to the RS-530 connector, then connect the user's data cable to the 37-pin D-type male connector at the other end of the adapter cable.

Ethernet 10BaseT The Ethernet port has a shielded RJ-45 connector, wired for direct connection to 10BaseT interfaces.

FT1 Connection

Connect the FT1 cable to the corresponding FT1 data channel interface connection on the rear panel of the IMX-2T1/E1

Supervisory Port Connection

Connect a cable (prepared as described in Appendix A) between the supervisory port connector marked DCE on the front panel of the IMX-2T1/E1, and the supervision terminal. If the supervision terminal is connected via modems, use a cross-over cable.

To enable automatic alarm reports to a central location, the modem can be set to "auto answer" and preset to dial the desired remote location phone number. A cross-over cable must be used, connected to the DCE port.

To enable communication with the IMX-2T1/E1, the supervisory terminal should be set to the same data rate, data word format and parity type as the IMX-2T1/E1, before you start operations.

Chapter 3

Control via the Supervisory Port

This chapter provides the following:

- Describes the supervision terminal hardware specifications, including the terminal hardware, communication requirements and handshaking protocol
- Supervisory port setup
- Supervisory port commands
- IMX-2T1/E1 command set detailed description
- Supervisory terminal operating instructions
- Configuration error messages

3.1 Hardware Specifications

Terminal Hardware

Any standard ASCII terminal (dumb terminal or PC emulating an ASCII terminal) equipped with an RS-232 port may be used to control IMX-2T1/E1 operation. The software necessary to run the IMX-2T1/E1 supervision program is contained in the IMX-2T1/E1.

Telnet (IP) Host Characteristics

Typically, a Telnet host is a PC or UNIX workstation, equipped with the appropriate suite of TCP/IP protocols.

The host can be connected directly to the IMX-2T1/E1 using one of the communication ports. The host may also be located remotely, the only prerequisite being that IP communication be established between the remote site and the IMX-2T1/E1.

Telnet enables communication with multiple IMX-2T1/E1 units, using either in-band or out-of-band communication. When using Telnet, the SNMP agent of the system must be configured. In addition, a Name must be given to each unit, using the NAME command.

Communication Requirements

The SNMP agent includes an IP router function, enabling the transfer of IP management traffic to other IMX-2T1/E1 units. In-band communication is performed through the TS1 at a rate of 8 kbps. Out-of-band communication is achieved via the supervisory DCE port. Both methods require the download switch in the DEF SYS to be enabled.

For SLIP operation, Auxiliary_Device must be set to MS-SLIP.

The supervision terminal is connected either directly to the IMX-2T1/E1 supervisory port, or via a modem or any other type of full-duplex data link. The IMX-2T1/E1 supervisory port interface type must be set according to connection method (see Table 4-10).

The connection methods are as follows:

- DCE: For direct connection, and also for connection through a modem or data link (cross cables must be used at the DCE front-panel connector).
- DTE: Future option that will allow connection through a modem or data link without requiring the use of cross cables at the DTE front-panel connector.

The IMX-2T1/E1 can communicate with the supervision terminal at 300, 1200, 2400, 4800 or 9600 bps. The word format consists of one stop bit and either seven, or eight data bits. Parity can be odd, even or disabled.

The communication interface of the terminal and the IMX-2T1/E1 must be configured for operation with the same parameters.

The IMX-2T1/E1 supports two types of modems:

- Dial-up HayesTM compatible modems; for example, RAD's miniature DLM/AT modem. The IMX-2T1/E1 features call-in/call-out capability.
- Multidrop modems; for example, RAD's SRM-6 miniature multidrop modem.

For multidrop operation, each IMX-2T1/E1 can be assigned a node address in the range of 1 through 255. Assigning address 0 to the IMX-2T1/E1, enabling it to accept and answer any message, is not permitted in multidrop operation. Address 0 is, however, recommended for use with both point-to-point and dial-up modes.

Each IMX-2T1/E1 can be assigned a logical name of up to eight characters. The logical name is sent in each transmission of alarm messages. The name identifies the source of messages received by the supervision terminal.

The relevant IMX-2T1/E1 configuration parameters are described in Sections 4.5 and 3.4. Instructions for configuring the IMX-2T1/E1 supervisory port are provided in Table 4-6 and Section 4.5.

AUTOBAUD Function

When the AUTOBAUD function is enabled, the IMX-2T1/E1 can identify the operating data rate of the terminal by analyzing the timing of three consecutive Carriage Return + Line Feed characters (generated by pressing the carriage return key three times). The detected data rate is then used for the current communication session.

The automatic baud rate identification procedure is performed (or repeated) whenever three consecutive carriage returns are received after one of the following events occurs:

- The DTR line has been switched OFF.
- The EXIT command has been executed.
- The idle disconnect time-out expired because no data has been exchanged with the supervision terminal.

When one of these events occurs, the IMX-2T1/E1 assumes that the current communication session has been terminated. Therefore, when the password protection is enabled, the password must be entered again before the supervision terminal can resume communication with the IMX-2T1/E1.

Note *When using SLIP protocol, the terminal rate must be set to 9600 bps.*

Handshaking Protocol

The handshaking between the IMX-2T1/E1 and the supervision terminal uses the control lines in the DCE connector located on the front panel of the IMX-2T1/E1.

The control lines being used in each connection method and the direction of the control signals is detailed in Table 4-1.

Table 3-1 Handshaking Protocol Lines

| Interface Type | DCE | DTE |
|----------------|----------|----------|
| CTS | Out | Not used |
| DCD | Out | Out |
| DSR | Out | Out |
| DTR | In | In |
| RI | Not Used | In |
| RTS | In | In |

Clear to Send (CTS)

The CTS line is set by the CTS parameter, as follows:

ON: The CTS line is always ON (active).

=**RTS**: The CTS line follows the RTS line.

Data Carrier Detect (DCD)

The state of the DCD line depends on the communication address (node number):

- When the node address is 0, the DCD line is always ON (active).
- When a non-zero node address is used, the DCD line becomes ON (active) when data is detected on the RD line, provided the IMX-2T1/E1 recognizes its own address in the data stream.

To simulate DTE operation, the delay between these events can be set by the user (by means of the DCD-Delay parameter).

Data Set Ready (DSR)

Usually, the DSR line is configured to track the DTR line. In this case, if the supervisory port interface is DTE, the DSR line will be set to ON for 5 seconds when the RI line is ON and the DTR line is OFF.

- If the supervisory port interface is DCE, the DSR line can also be configured to be continuously ON. However, if the DTR line switches to OFF, the DSR line will also switch to OFF for 5 seconds.

In addition, the IMX-2T1/E1 always sets DSR OFF (inactive) for 5 seconds when the EXIT command is executed, or the disconnect time-out expires.

Data Terminal Ready (DTR)

The terminal sets the DTR line ON (active) to gain control over the IMX-2T1/E1 and start a configuration/monitoring session.

When the DTR is ON, the front panel controls are disabled, and the LCD shows: **TERMINAL ON LINE**.

The DTR line is OFF (inactive) when terminal control is not required. This ends the terminal control connection, and returns the control to the IMX-2T1/E1 front panel. If password protection is used, the password must be entered again the next time the DTR line is set ON to start a new session.

Ring Indications (RI)

The RI line is used only with dial-up modems (INT=DTE). The RI line is normally OFF (inactive), and switches to the ON (active) state when the modem attached to the IMX-2T1/E1 front-panel DCE connector detects an incoming call. See also the DSR line.

Request to Send (RTS)

The RTS line is normally ON (active) when the supervision terminal is in session.

When the RTS line is OFF (inactive), the IMX-2T1/E1 interprets any data received from the terminal on the TD line as MARK.

3.2 Supervisory Port Setup

Internal Settings

See Section 2.4 for detailed information.

Note that in general you must enter a password when you start a control session. If the password is incorrect, the IMX-2T1/E1 will not respond. This can be corrected by appropriate setting of the PASSW section of SW1. Set the PASSW section of SW1 as follows:

OFF: In this position, you can define your own password and node address.

ON: Set the switch section to ON to restore the default IMX-2T1/E1 password (IMX), and change the node address to the default value of 0. To activate the change, you must turn the IMX-2T1/E1 off and then on again.

Supervisory Port Configuration

Configure the IMX-2T1/E1 supervisory port as required.

See Sections 4.4 and 4.5 for configuration parameters and procedures.

If the supervisory port parameters are not correct, the IMX-2T1/E1 will not respond. This can be corrected by appropriate setting of the DEFSP section of SW1. Set the DEFSP section of SW1 as follows:

OFF: In this position, you can define the desired supervisory port parameters.

ON: Set the switch section to ON to restore the default supervisory port parameters. To activate the change, you must turn the IMX-2T1/E1 off and then on again.

Supervision Terminal

Configure the terminal for the same communication parameters you selected for the IMX-2T1/E1 supervisory port.

Connections

Connect the cable from the terminal or from the modem used to connect the terminal to the front-panel DCE connector of the IMX-2T1/E1. See Appendix A for cable wiring information.

Turn the supervision terminal on and, as needed, the modems and the other communication equipment used to connect the terminal to the IMX-2T1/E1.

3.3 IMX-2T1/E1 Supervisory Port Commands

This paragraph presents the IMX-2T1/E1 supervision commands language syntax, options, protocol, and command set.

Language Syntax The supervisory port command syntax rules are as follows:

- Commands can only be entered when the IMX-2T1/E1 supervisory port prompt, **IMX-2T1>**, is displayed. The prompt always appears at the beginning of a new line. The cursor appears to the right of the prompt.
- Commands are not case-sensitive, that is, you can type commands in either lower case, or upper case.
- To correct typing errors, backspace by pressing the BACKSPACE key until the error is cleared and retype the correct command.
- Use the spacebar as a separator between command fields and parameters. Commands must end with a carriage return <CR>.
- To cancel the current command, press BREAK or type CTRL-C; the IMX-2T1/E1 prompt is redisplayed.

Command Options

The command options are summarized in Table 3-2.

Table 3-2 Option Commands

| Option | Meaning | Example of Usage |
|--------|--|---|
| /A | All | CLR ALM/A Clear all the alarms stored by the alarms buffer. |
| /C | Clear | DSP ALM/C Displays all the alarms stored by the alarm buffer, and then clears all the alarms in the ON state stored by the alarm buffer. |
| /CA | Clear all | DSP ALM/CA Displays all the alarms stored by the alarm buffer, and then clears all the alarms stored by the alarm buffer. |
| /R | Repeat command execution automatically. Available only when node address is 0. | DSP ST LINK/R Enables you to monitor the status of Link 1. |

Command Protocol

The supervisory port command protocol is as follows:

- If AUTOBAUD is on, start any session by pressing the <CR> key three times in sequence. This will ensure identification of terminal data rate.
- When the IMX-2T1/E1 uses a non-zero node address, it expects an address before responding to the terminal commands. No response will occur until the node number is received and acknowledged by the addressed IMX-2T1/E1.

Acknowledgment is indicated by the echoing of the node address part; that is, Node<SP>nnn<SP>, where <SP> stands for space.

- The address is in the range of 1 through 255 (0 indicates that the selective addressing function is disabled). The address is a prefix sent in the following format: Node<SP>nnn<SP>.
- When password protection is on, the addressed IMX-2T1/E1 waits for the password before continuing. After the correct password is received, the IMX-2T1/E1 sends the working prompt, IMX-2T1/E1 >.

If password protection is off, this step is omitted and the working prompt appears after the node address conditions are fulfilled.

- After the working prompt is displayed, every character typed on the terminal keyboard is immediately evaluated by the IMX-2T1/E1 and echoed to the terminal screen. Full duplex communication with the terminal is therefore necessary, to provide on-line feedback to the terminal operator.
- Command evaluation starts only when the <CR> key is pressed.
- In case an error is detected during command evaluation, the command is not executed. In this case, the IMX-2T1/E1 sends the erroneous command back to the terminal, and the message BAD COMMAND OR PARAMETER. TYPE 'H' FOR HELP is displayed in the lower row. The correct command must then be sent again.
- The command is executed only after it is validated.
- Command execution can be interrupted by pressing BREAK or CTRL-C. In this case, the IMX-2T1/E1 prompt is redisplayed and a new command can be entered.

Use the BREAK key (or CTRL-C) to stop the automatic repetition of commands (/R option).

- If an idle disconnect time-out is specified, the IMX-2T1/E1 will automatically disconnect the ongoing session if no command is received from the terminal for the specified time-out interval.

Index of Commands

Table 3-3 lists the IMX-2T1/E1 commands in alphabetical order.

Table 3-3 IMX-2T1/E1 Command Set Index

| Command | Purpose | Options |
|--|--|---------|
| • BERT OFF | Deactivate the BER test on the IMX-2T1/E1. | |
| • BERT ON | Activate the BER test on the IMX-2T1/E1. | |
| • BYE | Close Telnet session. | |
| • CLR ALM | Clear the alarms stored in the IMX-2T1/E1 alarm buffer. | /A |
| • CLR LOOP BERT CH 2 CLR LP BERT CH 2 | Deactivate the BERT loopback on channel 2, either fractional T1 or Data channel interface | |
| • CLR LOOP INBAND CH 2 CLR LP INBAND CH 2 | Deactivate the specified loopback on channel 2, either fractional T1 or Data channel interface | |
| • CLR LOOP L CH X CLR LP L CH X CLR LOOP R CH X CLR LP R CH X | Clear user initiated loopbacks on the E1 or CH2 data channel. Where X=1 for CH1 (E1), X=2 for CH2. | |
| • CLR LOOP L LINK CLR LP L LINK CLR LOOP R LINK CLR LP R LINK | Clear user-initiated loopbacks on the IMX-2T1/E1 links. | |
| • CLR TST | Clear all user-initiated tests and loopbacks. | |
| • DATE | Set the date for the IMX-2T1/E1 internal clock. | |
| • DEF AGENT | Display and modify SNMP agent parameters. | |
| • DEF BERT CH 2 | Define the BER test conditions for CH 2. | |
| • DEF CALL | Define the call-out parameters. | |
| • DEF CH 1 | Define the link connections. | |
| • DEF CH 2 | Define channel 2 parameters for fractional T1 or Data channel | |
| • DEF LINK X X=Link no. 1 or 2 | Define the link parameters. The parameters can be defined for a specified link, or simultaneously for all the links. | /A |
| • DEF NAME | Define the logical name of the IMX-2T1/E1. | |
| • DEF NODE | Define the node number of the IMX-2T1/E1. | |

Table 3-3 IMX-2T1/E1 Command Set Index (Cont.)

| Command | Purpose | Options |
|--------------------------------------|---|----------------|
| • DEF PWD | Define new password. | |
| • DEF SP | Define the supervisory port parameters. | |
| • DEF SYS | Define the system parameters. | |
| • DEF TERM | Define the control codes for use with one of the terminal types. | |
| • DSP AGENT | Display local agent parameters. | |
| • DSP ALM | Display the contents of the alarm buffer and optionally clear the buffer. | /C /CA |
| • DSP BERT | Display the last results (errors, seconds) of the on-going BER tests. | /R /C |
| • DSP BERT CH 2 | Displays the BER test results while a BER test is being performed. | /R /I /C /S |
| • DSP ST CH 1 | Display current IMX-2T1/E1 link utilization, the CH1 interface type, and the state of the loops on the CH1 (E1) interface. | |
| • DSP HDR TST | Display hardware faults (detected during the power-on self-test and during normal operation). | |
| • DSP PM X X=Link no. 1 or 2 | Display the contents of the performance monitoring registers and optionally clear these registers. | /C /CA |
| • DSP REM AGENT | Display information on SNMP agents that are known to the IP router of the IMX-2T1/E1 when SNMP management is enabled. | |
| • DSP ST CH 2 | Display status information on channel 2. | |
| • DSP ST LINK X X=Link no. 1 or 2 | Display status information on the selected link (link interface type and function, and link error events counters), and optionally clear the link error event counters. | /R /C |
| • DSP ST SYS | Display system status information (node name and number, software and hardware versions, and clock source). | |
| • EXIT | End the current control session. | |
| • F | Select the codes for the "clear the screen", "cursor right", and "cursor home" commands sent to the supervisory terminal. | |
| • HELP | Displays a concise index of commands and option switches. | |
| • INIT DB | Load the default configuration instead of the user configuration, Table 4-5 lists default parameter values. | |
| • INIT F | Reset the codes for "clear the screen", "cursor right", and "cursor home" to 0. | |
| • LOOP BERT CH 2 LP BERT CH 2 | Activate CH 2 BER testing | |

Table 3-3 IMX-2T1/E1 Command Set Index (Cont.)

| Command | Purpose | Options |
|---|--|---------|
| <ul style="list-style-type: none"> LOOP INBAND CH 2 LP INBAND CH 2 | Activate a user-controlled in-band loopback on Channel 2 | |
| <ul style="list-style-type: none"> LOOP L LINK LP L LINK LOOP R LINK LP R LINK | Activate a specified user-controlled loopback on the IMX-2T1/E1 links. | |
| <ul style="list-style-type: none"> LOOP L CH X LP L CH X LOOP R CH X LP R CH X | Activate a specified user-controlled loopback on the user's data channel. Where X= 1 for E1, X=2 for Data channel or FT1 interface. | |
| <ul style="list-style-type: none"> NODE | Send the node address to the IMX-2T1/E1; followed by the node address itself. | |
| <ul style="list-style-type: none"> RESET | Reset the IMX-2T1/E1 system. Available only if the Watchdog utility is on. | |
| <ul style="list-style-type: none"> TIME | Set the time of the IMX-2T1/E1 internal clock. | |

3.4 IMX-2T1/E1 Command Set Detailed Description

This section provides a detailed description of the IMX-2T1/E1 command set. The commands are listed in alphabetical order. The description includes command format, use, and options.

The following notation conventions are used below:

[]: Square brackets indicate optional entry/parameter

' ': Single quotes delimit user entry

<CR>: Indicates the pressing of the carriage return key

X: Identifies the link number.

BERT OFF

- Purpose** Deactivate (stop) the BER test.
- Format** BERT OFF
- Use**
1. To deactivate the BER test, type:
BERT OFF <CR>
 2. You will see the time and date, followed by the IMX-2T1/E1 prompt.

BERT ON

- Purpose** Activate the BER test.
- To perform the BER test, it is necessary to activate a loopback at the appropriate location along the signal paths, or to activate the BER test at both ends of the link.
- Format** BERT ON
- Use**
1. To activate the BER test, type:
BERT ON <CR>
 2. You will see the time and date, followed by the IMX-2T1/E1 prompt.

BYE

- Purpose** To end the current Telnet session.
- Format** BYE
- Use** Type:
BYE <CR>

CLR ALM

- Purpose** Clear the alarm buffer.
- Format** CLR ALM [/A]
- Use**
1. To clear only alarms of the ON type stored in the alarm buffer (see Table 5-1):
CLR ALM <CR>
 2. To clear all the alarms stored in the alarm buffer (including ON/OFF alarms):
CLR ALM /A <CR>

3. You will see the time and date, followed by the IMX-2T1/E1 prompt.

CLR LOOP CH 1

- Purpose** Deactivate the specified user-initiated loopback on the E1 data channel interface.
- Format** CLR LOOP [looptype] CH or CLR LP [looptype] CH Use
1. To deactivate a local (L) or a remote (R) loopback on the IMX-2T1/E1 E1 data channel:
CLR LOOP L CH <CR>
CLR LOOP R CH <CR>
 2. You will see the time and date, followed by the IMX-2T1/E1 prompt.
 3. If no loopback of the specified type is now activated, you will receive ERROR 8.

CLR LOOP CH 2

- Purpose** Deactivate the specified loopback on channel 2, either Fractional T1 or data channel interface.
- Format** CLR LOOP L CH 2 or CLR LP L CH 2
CLR LOOP R CH 2 or CLR LP R CH 2
- Use** To deactivate a local (L) or a remote (R) loopback on channel 2, type:
CLR LOOP L CH 2 <CR>
CLR LOOP R CH 2 <CR>

CLR LOOP LINK

- Purpose** Deactivate the specified user-initiated loopback on the IMX-2T1/E1 links.
- Format** CLR LOOP [looptype] LINK or CLR LP [looptype] LINK
- Use** 1. To deactivate a local (L) or a remote (R) loopback on the IMX-2T1/E1 links, type:
CLR LOOP L LINK <CR>
CLR LOOP R LINK <CR>
2. You will see the time and date, followed by the IMX-2T1/E1 prompt.
 3. If no loopback of the specified type is now activated, you will receive ERROR 8.

CLR TST

- Purpose** Deactivate all the user-initiated tests and loopbacks on the IMX-2T1/E1.
- Format** CLR TST
- Use** 1. To deactivate all the user-initiated tests and loopbacks, type:
CLR TST <CR>
2. You will see the time and date, followed by the IMX-2T1/E1 prompt.

DATE

- Purpose** Set the date for the IMX-2T1/E1 internal real-time clock.
- Format** DATE
- Use**
1. Type
DATE <CR>
 2. The IMX-2T1/E1 sends the date entry form:
DAY = 06
MONTH = 09
YEAR = 1994
 3. Bring the cursor to the first field to be changed by pressing <CR>.
 4. To change the selected field, press F to increase and B to decrease the displayed values. When done, press <CR> to move to the next field.
 5. To end, press <CR> after the YEAR field. The IMX-2T1/E1 will display the TIME and DATE fields (note that DATE has changed), followed by the IMX-2T1/E1 prompt.

DEF AGENT

- Purpose** Display and modify SNMP agent parameters. Refer to Appendix B for additional explanation.
- Format** DEF AGENT
- Use**
1. To define SNMP agent parameters, type:
DEF AGENT <CR>
 2. The current agent parameters are displayed:
OLD AGENT PARAMETERS
TELNET_APATHY_TIME
 3. After selecting the required value, press <CR> to display the second line. Continue until all the parameters are defined, then press <CR> to end.
 4. After parameters have been defined, a Reset must be performed. The following message will appear:
WARNING: NEW IP ADDRESS WILL BE ACTIVE ONLY AFTER RESET.
 5. A typical display is shown below:
CURRENT AGENT PARAMETERS
=====
- ```

IP_ADDRESS: = XXX.XXX.XXX.XXX
MAC_ADDRESS: = XXX.XXX.XXX.XXX.XXX.XXX
READ COMMUNITY: = PUBLIC
WRITE COMMUNITY: = PRIVATE
TRAP COMMUNITY IS: = PUBLIC

```
- The agent parameters are defined as follows:
- TELNET\_APATHY\_TIME Using the F or B keys, select the time in minutes after which the Telnet connection will be terminated if no incoming activity is detected. 10, 15, or 20 minutes

- |                 |                                                                                                                                                                                    |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| IP_ADDRESS      | Type the IMX-2T1/E1 assigned IP address.                                                                                                                                           |
| MAC_ADDRESS     | Type the MAC address assigned to the IMX-2T1/E1 SNMP agent.                                                                                                                        |
| READ COMMUNITY  | Type the name (up to 7 characters) of the SNMP community that has read -only authorization (the IMX-2T1/E1 SNMP agent will accept only GET REQUEST and GET NEXT REQUEST commands). |
| WRITE COMMUNITY | Type the name (up to 7 characters) of the SNMP community that has read -write authorization (the IMX-2T1/E1 SNMP agent will now accept SET REQUEST commands as well).              |
| TRAP COMMUNITY  | Type the name (up to 7 characters) of the community to which the IMX-2T1/E1 agent will send traps.                                                                                 |
6. Set the DNLOAD\_MODE in the DEF SYS command to TS1 to enable the in-band and out-band communications.
  7. Use the DSP AGENT command to display the local agent parameters.
  8. Use the DEF NAME command to assign a different logical name of up to eight alphanumeric characters to each IMX-2T1/E1 unit.
  9. If you are using Telnet or SNMP (SLIP):
    - Use the DEF SP command to set SPEED to 9600 bps.
    - Use the AUXILIARY\_DEVICE field of the DEF SP command to set the Control DCE port management mode to NMS\_SLIP.

## DEF BERT CH 2

- Purpose** Define the BER test conditions.
- Format** DEF BERT CH 2
- Use**
1. To define BER test parameters, type:
 

```
DEF BERT CH 2 <CR>
```
  2. The BERT parameters data form is displayed:
 

```
PATTERN ERROR_INJECT_RATE
511 NO_ERROR
```

The fields are as follows:

|                   |                                                                                                                                                                                                                                                                                      |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PATTERN           | Selects the test pattern. The selections available are the QRSS test pattern, and the following pseudo-random sequences: 2E3-1, 2E4-1, 2E5-1, 2E6-1, 2E7-1, 511, 2E10-1, 2047, 2E15-1, 2E17-1, 2E18-1, 2E20-1, QRSS, 2E21-1, 2E22-1, 2E23-1, 2E25-1, 2E28-1, 2E29-1, 2E31-1, 2E32-1. |
| ERROR INJECT RATE | Enables the injection of a calibrated rate of errors in the transmitted test pattern.<br>Select NO ERR to disable.<br>Set rate at:<br>Single, 10E-1, 10E-2, 10E-3, 10E-4, 10E-5, 10E-6, 10E-7.                                                                                       |

- With the spacebar, move the cursor to the required field, and change with the F and B keys. After selection, press <CR> to end.

## DEF CALL

### Purpose

Define the call-out parameters for the IMX-2T1/E1 supervisory port (connector CONTROL DCE). For proper cabling, refer to Appendix A.

The specified call-out parameters are used by the IMX-2T1/E1 to build the call command that is sent to the dial-out modem. The modem connected to the CONTROL DCE connector must be set up as follows (for convenience, the Hayes™ commands required to select the specified parameters are listed in brackets):

- Auto-answer mode (AT S0=1)
- Call set up in response to the CONNECT string (AT X0)
- No echo (AT E0)
- Verbose mode (no codes, e.g., CONNECT string instead of 0) (AT V1)

### Format

DEF CALL

### Use

- To define the Supervisory port call parameters, type:

```
DEF CALL<CR>
```

- You will see the first page of the call-out parameters data form. A typical display is shown below.

| NUM_OF_RETRIES | WAIT_FOR_CONNECT | DIAL_MODE | ALT_NUM_MODE |
|----------------|------------------|-----------|--------------|
| 0              | 30 SEC           | TONE      | NO           |

- Change the parameter values as follows:
  - Bring the cursor to the beginning of the first field to be changed by pressing the spacebar.
  - To change the selected field, press F or B to scroll among the available selections.
  - When the desired selection is displayed, press the spacebar to move to the next field.
- In the DEF SP command, enable the CALL\_OUT\_MODE, in order for the Call Out function to be operative. The call-out parameters displayed on the first page of the data form, and their range of values, are as follows:

|                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NUM_OF_RETRIES   | <p>This parameter is used to control the number of dialing retries.</p> <ul style="list-style-type: none"><li>• 0 - no redialing attempts are made in case the call is not established on the first attempt.</li><li>• 1 through 8 - in case the call is not established on the first attempt, the IMX-2T1/E1 will redial the specified number of times.</li></ul> <p>The NUM_OF_RETRIES parameter applies to both the primary and the alternate numbers:</p> <ul style="list-style-type: none"><li>• If the call is not established after dialing the primary directory number the specified number of times, the IMX-2T1/E1 attempts to establish the call by dialing the alternate directory number (provided the use of an alternate number is enabled by means of the ALT_NUM_MODE parameter).</li><li>• If the call cannot be established within the specified number of redialing attempts on neither of the two directory numbers, the IMX-2T1/E1 stops the call attempts. When a new alarm report must be sent, the call attempts are started again.</li></ul> <p>The user is notified that the call attempts failed by a message recorded in the alarm buffer (separate messages are provided for each directory number).</p> |
| WAIT_FOR_CONNECT | <p>This parameter specifies the time the IMX-2T1/E1 will wait for an answer after each dialing attempt. If the called station does not answer within the specified time, the IMX-2T1/E1 disconnects. If additional call attempts are allowed, the IMX-2T1/E1 will redial immediately after disconnecting.</p> <p>The available selections are 30, 45, or 60 seconds.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| DIAL_MODE        | <p>This parameter is used to select the dialing mode:</p> <ul style="list-style-type: none"><li>• TONE - the modem is instructed to use DTMF dialing.</li><li>• PULSE - the modem is instructed to use pulse dialing.</li></ul> <p>The appropriate dialing mode depends on the dialing mode supported by the telephone network.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| ALT_NUM_MODE     | <p>This parameter is used to control the use of an alternate number. The alternate number is dialed after the specified number of call attempts on the primary number failed:</p> <ul style="list-style-type: none"><li>• NO - no alternate number. In this case, the IMX-2T1/E1 stops the call attempts after the specified number of call attempts on the primary number failed.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

- YES - the use of an alternate number is enabled.

5. When done, press <CR> to display the second page of the call-out parameters data form. A typical display is shown below.

```
NEW_PRIMARY_NUMBER [MAX 20 CHARS] =
CURRENT_PRIMARY_NUMBER = 'primary number'
```

The second page is used to enter a new primary directory number, and the second row displays the current primary directory number. The directory number can include up to 20 digits, including the \* and # symbols.

6. After entering the desired directory number, press <CR>:

- If the ALT\_NUM\_MODE parameter is NO (no alternate number), the IMX-2T1/E1 will display the TIME and DATE fields, followed by the IMX-2T1/E1 prompt.
- If the ALT\_NUM\_MODE parameter is YES, you will see the third page of the call-out parameters data form, used to enter a new alternate directory number. A typical display is shown below.

```
NEW_ALTERNATE_NUMBER [MAX 20 CHARS] =
CURRENT_ALTERNATE_NUMBER = 'alternate number'
```

- After entering the desired directory number, press <CR> to end.

## DEF CH 1

### Purpose

Define the IMX-2T1/E1 link connections. See Section 4.3 for selection recommendations.

### Format

DEF CH

### Use

1. To define the link connectivity data form, type:  
DEF CH <CR>
2. You will see the link connectivity data form. A typical display is shown below.

```
LNK-1 LNK-2 LNK-3 LNK-4
YES YES N/A N/A
```

3. The data form includes one field for each link. The field shows the current connection status:

- YES: link is used.

4. To change the link status, use the following procedure:

- Bring the cursor to the beginning of the desired field by pressing the space bar.
- Select between NO and YES by pressing F or B.

5. After updating the link status, press <CR> to end. The IMX-2T1/E1 will display the TIME and DATE fields, followed by the IMX-2T1/E1 prompt.

**DEF CH 2**

**Purpose** Define channel 2 parameters for fractional T1 interface.

**Format** DEF CH 2

- Use**
- To define the link connectivity data form, type:  
DEF CH 2 <CR>
  - You will see the link connectivity data form. A typical display is shown below

|       |      |      |      |
|-------|------|------|------|
| FRAME | CODE | MASK | SYNC |
| ESF   | B8ZS | 000  | FAST |

|          |           |
|----------|-----------|
| START_TS | NUM_OF_TS |
| 02       | 00        |

- When Ethernet connection is installed, the following parameters are displayed:

|          |     |         |
|----------|-----|---------|
| SPEED    | CTS | RCV_CLK |
| 896 kbps | ON  | DCE     |

|               |          |
|---------------|----------|
| ETHERNET_MODE | BRIDGING |
| HALF_DUP      | FILTER   |

|       |                                                |
|-------|------------------------------------------------|
| FRAME | Indicates the type of frame used:<br>ESF or SF |
|-------|------------------------------------------------|

|      |                                                  |
|------|--------------------------------------------------|
| CODE | Indicates the line code:<br>B8ZS, B7ZS, or TRANS |
|------|--------------------------------------------------|

|      |                                                                |
|------|----------------------------------------------------------------|
| MASK | Indicates the line mask:<br>000, 133, 266, 399, 533, or FCC68A |
|------|----------------------------------------------------------------|

|      |                                                        |
|------|--------------------------------------------------------|
| SYNC | Indicates the synchronization method:<br>FAST or 62411 |
|------|--------------------------------------------------------|

|          |                                                              |
|----------|--------------------------------------------------------------|
| START_TS | Start time slot from which the CH 2 data will be multiplexed |
|----------|--------------------------------------------------------------|

|           |                                                                                |
|-----------|--------------------------------------------------------------------------------|
| NUM_OF_TS | Number of time slots starting for START TS to be multiplexed (increments of 2) |
|-----------|--------------------------------------------------------------------------------|

**DEF LINK**

**Purpose** Assign values to the link parameters for a selected IMX-2T1/E1 link.  
See Section 4.3 for parameter description and allowable ranges, and Section 4.5 for practical selection recommendations.

**Format** DEF LINK [link]

**Use**

- To define the parameters of each link, type:  
DEF LINK X <CR>  
where X is the link number (1 or 2).
- To define the parameters of all the installed links, type:  
DEF LINK /A <CR>
- The link parameters data form for the selected link is displayed. A typical display is shown below.

|     |       |      |      |      |              |
|-----|-------|------|------|------|--------------|
| CON | FRAME | CODE | MASK | SYNC | IDLE_TS_CODE |
| YES | ESF   | B8ZS | 000  | FAST | 3F           |

- Change the parameter values as follows:
  - Bring the cursor to the beginning of the first field to be changed by pressing the spacebar.
  - To change the selected field, press F or B to scroll among the available selections. When the desired selection is displayed, press the spacebar to move to the next field.
- After the desired parameter values are selected, press <CR> to display the second page of the link parameters data form. Change the parameter values as explained above.
- After the desired parameter values are selected, press <CR> to end. The IMX-2T1/E1 will display the TIME and DATE fields, followed by the IMX-2T1/E1 prompt.

**DEF NAME**

**Purpose** Define the node name (up to eight alphanumeric characters).

**Format** DEF NAME

**Use**

- To define the IMX-2T1/E1 node name, type:  
DEF NAME <CR>
- The IMX-2T1/E1 displays the node name entry form:  
ENTER NODE NAME (MAX 8 CHARACTERS) =  
CURRENT NODE NAME = 'name'  
where 'name' is the node name the IMX-2T1/E1 is currently assigned.

3. Type the desired name, and then press <CR>. The IMX-2T1/E1 will display the TIME and DATE fields, followed by the IMX-2T1/E1 prompt.

---

**Note** *Before entering a node name, make sure that section 1, PASSW, of the IMX-2T1/E1 internal switch SW1 is not set to ON, because in such a case the default name (blank) is enforced.*

---

## DEF NODE

**Purpose** Define the node number, or address, of the IMX-2T1/E1. The allowed range is 0 to 255.

**Format** DEF NODE

- Use**
1. To define the IMX-2T1/E1 node number, type:  
DEF NODE <CR>
  2. The IMX-2T1/E1 displays the node entry form:  
NODE (0 to 255) = 0
  3. Type the desired number in the range of 0 to 255, and then press <CR>. The IMX-2T1/E1 will display the TIME and DATE fields, followed by the IMX-2T1/E1 prompt.

---

**Note** *Before entering a node name, make sure that section 1, PASSW, of the IMX-2T1/E1 internal switch SW1 is not set to ON, because in such a case the default number (0) is enforced.*

---

## DEF PWD

**Purpose** Define a new user password for the IMX-2T1/E1. The password must have 4 to 8 characters.

**Format** DEF PWD

- Use**
1. Type  
DEF PWD <CR>
  2. The password entry screen appears; for example,  
NEW PASSWORD (4 to 8 CHARS) =  
CURRENT PASSWORD = 'password'  
where 'password' is the current password.
  3. Type the required password. Carefully check that the specified password has been indeed typed in, and then press <CR>. The IMX-2T1/E1 will display the TIME and DATE fields, followed by the IMX-2T1/E1 prompt.

**Note**

*Before entering a password, make sure that section 1, PASSW, of the IMX-2T1/E1 internal switch SW1 is not set to ON, because in such a case the default password (IMX) is enforced.*

*Also make sure that the PWD field of the DEF SP command is set to YES to enable the password protection.*

---

**DEF SP**

**Purpose** Assign values to supervisory port parameters. See Table 4.6 for parameter description and allowable ranges, and Section 4.5 for selection recommendations.

**Format** DEF SP

**Use** 1. Type: DEF SP<CR>

2. The first page of the supervisory port parameters data form is displayed. A typical form is shown below. The form presents the current parameter values as defaults.

|       |      |        |           |      |         |     |
|-------|------|--------|-----------|------|---------|-----|
| SPEED | DATA | PARITY | INTERFACE | CTS  | DCD_DEL | DSR |
| AUTO  | 8    | NO     | DCE       | =RTS | 0_MS    | ON  |

3. Change the parameter values as follows:

- Bring the cursor to the beginning of the first field to be changed by pressing the spacebar.
- To change the selected field, press F or B to scroll among the available selections.
- When the desired selection is displayed, press the spacebar to move to the next field.

4. When done, press <CR> to display the next page of supervisory port parameters. A typical form is shown below.

|         |     |         |               |                      |
|---------|-----|---------|---------------|----------------------|
| POP_ALM | PWD | LOG_OFF | CALL_OUT_MODE | AUXILIARY_DEVIC<br>E |
| NO      | NO  | NO      | NONE          | TERMINAL             |

5. Repeat the procedure given in Step 3 above to select new parameter values.

**SPEED** Selects supervisory port data rate (in bps):  
300, 1200, 2400, 4800, and 9600 bps, or automatic detection of data rate (Autobaud)

Note: Select AUTO whenever feasible, and start the communication with 3 carriage returns <CR> to ensure positive identification of the terminal data rate.

Do not use AUTO if the modem is to be used for the call in/call out function, the port speed must match the modem data rate.

When using SLIP protocol, the speed must be set to 9600 bps.

**Default: AUTO**

**DATA** Selects the number of data bits in the word format:  
7 or 8 data bits.

|           |                                                                                                                                                                                                                                                                                                                              |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|           | <b>Default: 8</b>                                                                                                                                                                                                                                                                                                            |
| PARITY    | Controls the use of Parity:<br>ODD - Odd parity<br>EVEN - Even parity<br>NONE - disabled (available only for 8 data bits)                                                                                                                                                                                                    |
|           | <b>Default: NONE</b>                                                                                                                                                                                                                                                                                                         |
| INTERFACE | Selects the supervisory port interface function:<br><br>DCE - The IMX-2T1/E1 functions as a DCE for the supervisory terminal.<br><br>DTE - The IMX-2T1/E1 functions as a DTE, for connecting via modem to the supervisory terminal.<br><br>Note: for both settings use the DCE supervisory port connector of the IMX-2T1/E1. |
|           | <b>Default: DCE</b>                                                                                                                                                                                                                                                                                                          |

---

**Note** *The following parameters can be programmed only from the terminal:*

---

|         |                                                                                                                                                                                                                                                                                        |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PWD     | Password protection: select YES or NO<br><br><b>Default: NO</b>                                                                                                                                                                                                                        |
| LOG_OFF | Idle disconnect time:<br><br>NO: Automatic session disconnection disabled<br>10_MIN: Automatic disconnection after ten minutes if no input data is received by the IMX-2T1/E1<br><br><b>Default: NO</b>                                                                                |
| CTS     | Determines CTS state:<br><br>ON: The CTS line is always ON (active)<br>=RTS: The CTS line follows the RTS line.<br><br><b>Default: =RTS</b>                                                                                                                                            |
| DCD_DEL | With IMX-2T1/E1 supervisory port defined as DTE, indicates delay (in msec) between DCD=ON and the sending of data.<br><br>If INTERFACE is set to DCE, the DCD_DEL must remain at the default value of 0 msec.<br><br>Values: 0, 10, 50, 100, 200, 300 msec<br><br><b>Default: 0 MS</b> |
| POP_ALM | Controls the automatic display of alarms in the terminal:<br><br>YES: The terminal automatically displays the alarm status every 10 minutes (or whenever an alarm changes state to ON)<br>NO: The automatic display feature is disabled                                                |

**Default: NO**

**DSR** Determines the DSR state:  
 ON: The DSR line is continuously on. It will switch to OFF for five seconds after the DTR line is switched OFF.  
 DTR: The DSR line tracks the DTR line.  
 When INTERFACE=DTE, the DSR line will switch to ON for five seconds when the RI line is ON and the DTR line is OFF.

**Default: ON**

**CALL\_OUT\_MODE** Controls the use of the call-out function.  
 NONE: The call-out function is disabled.  
 ALL: The IMX-2T1/E1 will initiate a call after each new alarm

**Default: NONE**

**AUXILIARY\_DEVICE** Selects the management mode supported by the CONTROL DCE port:  
 TERMINAL: management via supervision terminal.  
 NMS-SLIP: Telnet management using the SLIP protocol.

**Default: TERMINAL**

Note that when NMS-SLIP is selected, the Terminal control will not be operative. Any further configuration, including returning the Terminal to operation must be performed via the IMX-2T1/E1 front panel.

6. After the desired parameter values are selected, press <CR> to end. The IMX-2T1/E1 will display the TIME and DATE fields, followed by the IMX-2T1/E1 prompt.

**DEF SYS**

**Purpose** Assign values to system parameters. See Section 4.3 for parameter description and allowable ranges, and Section 4.5 for selection recommendations.

**Format** DEF SYS

**Use** 1. Type  
 DEF SYS <CR>

2. The system parameters data form is displayed. A typical form is shown below. The form presents the current parameter values as defaults.

|            |           |           |               |          |
|------------|-----------|-----------|---------------|----------|
| CLK_MASTER | CLK_FBACK | BROADCAST | ETHERNET_MODE | BRIDGING |
| INT        | NONE      | NO        | N/A           | N/A      |

|             |              |              |         |          |              |
|-------------|--------------|--------------|---------|----------|--------------|
| DNLOAD_MODE | STATE_REPORT | EVENT_REPORT | RCV_CLK | POLARITY | INBAND_LOOPS |
|-------------|--------------|--------------|---------|----------|--------------|

NONE                      NO                      NO                      N/A                      N/A                      ENABLE

3. Change the parameter values as follows:

- Bring the cursor to the beginning of the first field to be changed by pressing the spacebar.
- To change the selected field, press F or B to scroll among the available selections.
- When the desired selection is displayed, press the spacebar to move to the next field.

4. After the desired parameter values are selected, press <CR> to end. The IMX-2T1/E1 will display the TIME and DATE fields, followed by the IMX-2T1/E1 prompt.

## DEF TERM

**Purpose** Define control codes for one of the following terminal types: TV920, VT52, or VT100, or reset the codes to 0.

The codes used for each terminal are listed in Table 3-4.

For terminals not listed here, use the F command to define the control codes.

*Table 3-4 Supervision Terminal Control Codes*

| Function     | Terminal Type |          |          |
|--------------|---------------|----------|----------|
|              | TV920         | VT52     | VT100    |
| Clear Screen | 1B2A0000      | N/A      | 1B5B324A |
| Cursor Home  | 1E000000      | 1B480000 | 1B5B4800 |
| Cursor Right | 0C000000      | 1B430000 | 1B5B3143 |

**Format** DEF TERM

- Use**
1. To reset the terminal control codes to 0, type:  
DEF TERM <CR>
  2. To select the control codes for your terminal type:  
DEF TERM 'terminal type' <CR>  
where 'terminal type' is: TV920, VT52, or VT100.
  3. Press <CR> again to end.

**DSP AGENT**

- Purpose** Display local agent parameters.
- Format** DSP AGENT
- Use**
- To display the agent parameters type:  
DSP AGENT
  - To display the format type:  
AGENT PARAMETERS  
IP ADDRESS IS: xxx.xxx.xxx.xxx  
MAC ADDRESS IS: xxx.xxx.xxx.xxx
- Where xxx.xxx represents the IP address number or MAC address number.

**DSP ALM**

- Purpose** Display the contents of the alarm buffer. This buffer can contain up to 100 alarms.
- Format** DSP ALM <CR>
- Use**
- To display the complete contents of the buffer, type:  
DSP ALM <CR>
  - To display the complete buffer contents and then clear the type-ON alarms, type:  
DSP ALM /C <CR>
  - To display the complete buffer and then clear all the stored alarms, type:  
DSP ALM /CA <CR>
- Display Format** The contents of the alarm buffer are displayed as a table with four columns: the alarm record number, the alarm number and alarm syntax (description), alarm status and time of occurrence. Each block of alarms received from a IMX-2T1/E1 is preceded by a header. The header lists the assigned node name and the node number of the IMX-2T1/E1 unit which sent the alarm block, and thus it serves as an easily-identified separator between alarms transmitted by different IMX-2T1/E1 units.

Table 3-4 lists all the alarm messages that can be displayed by the terminal. where X is the link number, 1 or 2.

---

**Note** *When an attempt is made to access parameters for Link 3 or Link 4, the IMX-2T1/E1 will display the error message CONFIG ERROR 4.*

---

Table 3-5 Supervision Terminal Alarm Messages

| Alarm No. | Alarm Syntax                        | Meaning                                                                                                                     | Status        | Time     | Type  |
|-----------|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|---------------|----------|-------|
| 01        | SIGNAL LOSS, LNK:X,<br>CH 2         | Loss of input signal on link X.                                                                                             | [ON]<br>[OFF] | hh:mm:ss | State |
| 02        | BPV ERROR, LNK:X, CH 2              | A bipolar violation error has been detected on link X.                                                                      | [ON]          | hh:mm:ss | Event |
| 03        | FRAME SLIP, LNK:X, CH 2             | A frame slip occurred on link X.                                                                                            | [ON]          | hh:mm:ss | Event |
| 04        | NETWORK LLB, LNK:X                  | A network-activated line loopback is currently activated on link X.                                                         | [ON]<br>[OFF] | hh:mm:ss | State |
| 05        | NETWORK PLB, LNK:X                  | A network-activated payback loopback is currently activated on link X.                                                      | [ON]<br>[OFF] | hh:mm:ss | State |
| 06        | EXCESSIVE BPV, LNK:X,<br>CH 2       | The rate of bipolar violation errors on link X is too high.                                                                 | [ON]<br>[OFF] | hh:mm:ss | State |
| 07        | Reserved for future use.            |                                                                                                                             |               |          |       |
| 08        | EXCESSIVE ERR RATIO,<br>LNK:X, CH 2 | Excessive bit error rate (higher than $10^{-3}$ ) detected in data received by the local link                               | [ON]<br>[OFF] | hh:mm:ss | State |
| 09        | AIS OCCURED, LNK:X,<br>CH 2         | AIS is being detected on link X.                                                                                            | [ON]<br>[OFF] | hh:mm:ss | State |
| 10        | AIS RED ALARM, LNK:X,<br>CH 2       | AIS and loss of frame alignment on link X.                                                                                  | [ON]<br>[OFF] | hh:mm:ss | State |
| 11        | RED ALARM                           | Local loss of frame alignment on link X.                                                                                    | [ON]<br>[OFF] | hh:mm:ss | State |
| 12        | DB CHECKSUM ERROR                   | The database currently stored in the non-volatile memory of IMX-2T1/E1 is corrupted. Message can appear only upon power up. | [ON]          | hh:mm:ss | Event |
| 13        | ALARM BUFFER<br>OVERFLOW            | The IMX-2T1/E1 alarm buffer is full, and new alarms overwrite the older alarms.                                             | [ON]          | hh:mm:ss | Event |
| 14        | CLOCK WAS CHANGED<br>TO FALLBACK    | The main clock source of the IMX-2T1/E1 failed, and the IMX-2T1/E1 switched to the clock source selected as fallback.       | [ON]          | hh:mm:ss | Event |
| 15        | CLOCK WAS CHANGED<br>TO INTERNAL    | The current clock source of the IMX-2T1/E1 failed, and the IMX-2T1/E1 switched to the internal oscillator.                  | [ON]          | hh:mm:ss | Event |
| 16        | SELF TEST ERROR                     | A fault has been detected during the power-up self test.                                                                    | [ON]          | hh:mm:ss | Event |
| 17        | HARDWARE FAILURE                    | A hardware fault has been detected.                                                                                         | [ON]          | hh:mm:ss | Event |
| 18        | PSWRD SWITCH IS ON                  | Section 1, PASSW, of switch SW1 is set to ON.                                                                               | [ON]          | hh:mm:ss | Event |
| 19        | SP-PAR SWITCH IS ON                 | Section 2, DEFSP, of switch SW1 is set to ON.                                                                               | [ON]          | hh:mm:ss | Event |

Table 3-5 Supervision Terminal Alarm Messages (Cont.)

| Alarm No. | Alarm Syntax                  | Meaning                                                                                                                                                                                                                                                   | Status        | Time     | Type  |
|-----------|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|----------|-------|
| 20        | SB-INIT SWITCH IS ON          | Section 3, DMINI, of switch SW1 is set to ON.                                                                                                                                                                                                             | [ON]          | hh:mm:ss | Event |
| 22        | YELLOW ALARM, LNK:X, CH 2     | The remote unit connected to the other end of link X reports loss of frame alignment.                                                                                                                                                                     | [ON]<br>[OFF] | hh:mm:ss | State |
| 35        | CH 1 BPV ERROR                | A bipolar violation error has been detected on the E1 port interface. This usually indicates a problem on the link to the equipment connected to the E1 port.                                                                                             | [ON]          | hh:mm:ss | Event |
| 36        | CH 1 AIS RED ALARM            | An unframed "all ones" signal is received at the E1 port interface. This usually indicates a problem in the equipment connected to the E1 port.                                                                                                           | [ON]<br>[OFF] | hh:mm:ss | State |
| 37        | CH 1 SIGNAL LOSS              | Loss of signal at the E1 port interface. Improper cable connection or defective cables may be the cause. If additional communication equipment is in the connection loop between the E1 equipment and the E1 port, this equipment should also be checked. | [ON]<br>[OFF] | hh:mm:ss | State |
| 38        | RECEIVE OOS CODE, LNK:X       | The out-of-service (OOS) code is being received from the equipment connected to the other end of link X.                                                                                                                                                  | [ON]          | hh:mm:ss | State |
| 39        | LAN NOT CONNECTED             | The Ethernet interface is not connected to an operating LAN (at least one station must be active on the LAN).                                                                                                                                             | [ON]<br>[OFF] | hh:mm:ss | State |
| 40        | DP DIAL CYCLE FAILED          | The dial-out cycle failed and the IMX-2T1/E1 stopped the redial attempts until a new alarm must be reported.                                                                                                                                              | [ON]          | hh:mm:ss | Event |
| 41        | DP PRIMARY CALL FAILED        | The call set-up attempts to the primary directory number failed.                                                                                                                                                                                          | [ON]          | hh:mm:ss | Event |
| 42        | DP ALTERNATE CALL FAILED      | The call set-up attempts to the alternate directory number failed.                                                                                                                                                                                        | [ON]          | hh:mm:ss | Event |
| 43        | MANAGEMENT PORT IS DOWN       | IMX-2T1/E1 cannot communicate with the management station due to malfunction or incorrect setup.                                                                                                                                                          | [ON]<br>[OFF] | hh:mm:ss | State |
| 44        | MANAGEMENT PORT IS LOOPED     | A loopback has been activated on the communication path used for SNMP management.                                                                                                                                                                         | [ON]<br>[OFF] | hh:mm:ss | State |
| 45        | DUPLICATE NAME IN THE NETWORK | Another node in the network has the same logical name.                                                                                                                                                                                                    | [ON]<br>[OFF] | hh:mm:ss | State |

## DSP BERT

- Purpose** Displays the BER test results while a BER test is being performed. The BER test results are given as the number of error seconds detected since the BER test has been started or since the results have been last cleared (the greater of these two events). The error-seconds counter range is 0 through 63555. If the count exceeds the maximum count, the counter continues showing 65535 and an overflow message will be displayed.
- Format** DSP BERT [Option]
- Use**
1. To display the current BER test results, type:  
DSP BERT <CR>
  2. To monitor continuously the BER test results, type:  
DSP BERT /R <CR>  
The display will be continuously updated. To stop the monitoring, press the BREAK key (or CTRL+C).
  3. To display the current BER test results and then clear the counter, type:  
DSP BERT /C <CR>

## DSP BERT CH 2

- Purpose** Displays the BER test results while a BER test is being performed. While monitoring the BER results, error injection may also be started or stopped, and the error count may be restarted by clearing the accumulated error results. Monitoring is not possible via Telnet. The error injection rate is defined by the DEF BERT command.
- Format** DSP BERT CH 2
- Use**
1. To display the current BER test results, type:  
DSP BERT CH 2 <CR>
  2. To display the current BER test results and then clear the counter, type:  
DSP BERT CH 2 /C <CR>
  3. To monitor the BER test results, type:  
DSP BERT CH 2 /R <CR>  
Additional commands for monitoring the BER test results are displayed, followed by the test results.  
PRESS I FOR ERRORS INJECT  
PRESS S FOR STOP ERRORS INJECT  
PRESS C TO CLEAR ERROR BITS  
To stop monitoring and return to the command prompt, press BREAK.

4. When using Telnet, it is not possible to monitor the results. Therefore, use the following command to display results and start error injection:

```
DSP BERT CH 2 /I <CR>
```

To display results and stop error injection:

```
DSP BERT CH 2 /S <CR>
```

**Display Format**      The BER test results displayed on screen are correct for the instant that the display command was given (or the last time the error counters were cleared, whichever event came last). When the /R switch is used, results are periodically updated (refreshed). Results are presented as follows:

```
BERT OF HIGH SPEED CHANNEL
```

| ERROR_BITS | RUN_TIME (SEC) | ERRORS (SEC) | SYNC_LOSS (SEC) | ERROR_INJECT(SEC) |
|------------|----------------|--------------|-----------------|-------------------|
| 0          | 200            | 0            | 200             | OFF               |

```
DSP BERT CH2
```

| ERROR_BITS | RUN_TIME (SEC) | ERRORS (SEC) | SYNC_LOSS (SEC) | ERROR_INJECT(SEC) |
|------------|----------------|--------------|-----------------|-------------------|
| 0          | 240            | 0            | 240             | ON                |

the display fields are as follows:

|                 |                                                                    |
|-----------------|--------------------------------------------------------------------|
| ERROR_BITS      | Total number of bit errors detected                                |
| RUN_TIME (SEC)  | Total time test is running                                         |
| ERRORS (SEC)    | Total number of seconds in which errors have been detected         |
| SYNC_LOSS (SEC) | Total number of seconds for which loss of frame alignment occurred |
| ERROR_INJECT    | Indicates that error injection is ON or OFF                        |

---

**Note**      *The counters have a maximum range of 65535. When this value is reached, the counter freezes, therefore a value of 65535 generally indicates a counter overflow.*

---

**DSP ST CH 1**

- Purpose** Display the current IMX-2T1/E1 link connections, the CH1 interface type, and the state of the loops on the user's CH1 (E1) interface.
- Format** DSP ST CH 1
- Use**
- To display the link connectivity data form, type:  
DSP ST CH 1 <CR>
  - You will see the link connectivity data form. A typical display is shown below.  
STATUS OF CHANNEL
 

| LNK-1     | LNK-2 | LNK-3  | LNK-4 | INTERFACE |
|-----------|-------|--------|-------|-----------|
| YES       | YES   | N/A    | N/A   | E1        |
| CH LOOPS: | LOCAL | REMOTE |       |           |
|           | NO    | NO     |       |           |
  - The data form includes one field for each link. The field shows the link connection status:
    - NO: link is not used.
    - YES: link is used.
  - For the user's data channel, the form lists the data channel interface type, and the state of the loops:
    - NO: loop not connected.
    - YES: loop connected.

**DSP HDR TST**

- Purpose** Display the results of the last hardware test (made during power-on self-test and during regular operation).
- Format** DSP HDR TST
- Use** To display the hardware test report, type:  
DSP HDR TST <CR>
- Display Format** The display has one field that shows NO HARDWARE FAILURE or lists one of the following problems:
- DATABASE FAILURE
  - EPROM FAILURE
  - I/O EXPANDER ERROR
  - COUNTER ERROR

**DSP PM**

**Purpose** Displays the contents of the performance-monitoring registers specified by AT&T Pub. 54016. This option is available only on T1 links with ESF framing. For an explanation of the performance monitoring registers, refer to Section 5.3.

**Format** DSP PM X [Option]

**Use** 1. To display the performance monitoring registers of any link, type:

DSP PM X <CR>

where X is the link number, L1, L2.

To display the performance monitoring registers of any link, and clear only the event register of another link, type:

DSP PM X /C <CR>

where X is the link number, L1, L2.

To display the performance monitoring registers of any link, clear all the performance monitoring registers of another link, and restart the count intervals, type:

DSP PM X /CA <CR>

where X is the link number, L1, L2.

2. If the current framing mode is SF (D4), you will receive an error message (illegal command for current link mode).

**Display Format** The performance monitoring registers displayed for a T1 link with ESF framing are listed in the following order:

|                                                            |                     |
|------------------------------------------------------------|---------------------|
| ESF ERROR EVENTS                                           | = [0] ..... [65535] |
| CURRENT ES                                                 | = [0] ..... [900]   |
| CURRENT UAS                                                | = [0] ..... [900]   |
| CURRENT SES                                                | = [0] ..... [900]   |
| CURRENT BES                                                | = [0] ..... [900]   |
| CURRENT LOFC                                               | = [0] ..... [255]   |
| CURRENT CSS                                                | = [0] ..... [255]   |
| CURRENT TIMER                                              | = [0] ..... [900]   |
| INTERVAL mm ES=nnn UAS=nnn BES=nnn SES=nnn LOFC=nnn CS=nnn |                     |
| 24 HOUR ES                                                 | = [0] ..... [65535] |
| 24 HOUR UAS                                                | = [0] ..... [65535] |
| 24 HOUR SES                                                | = [0] ..... [65535] |
| 24 HOUR BES                                                | = [0] ..... [65535] |
| 24 HOUR LOFC                                               | = [0] ..... [255]   |
| 24 HOUR CSS                                                | = [0] ..... [255]   |
| LAST 24 DEGRADE MIN                                        | = [0] ..... [1440]  |
| 24 HOUR INTERVAL                                           | = [0] ..... [96]    |

The numbers in brackets indicate the range of values for each register.

**DSP REM AGENT**

- Purpose** Display information on SNMP agents that are known to the IP router of the IMX-2T1/E1 when SNMP management is enabled.
- Format** DSP REM AGENT
- Use** 1. To display the remote agent information type:  
       DSP REM AGENT
2. If no agent is known, the message - CANNOT FIND ANY REMOTE AGENT is displayed. Otherwise, a table of the remote agents is displayed as follows:

```

IP ADDRESS MUX NAME DISTANCE
=====
192.114.50.2 IMX2T1 006

```

The fields displayed for each agent are as follows:

- IP ADDRESS** The IP address of the remote agent.
- MUX NAME** Logical name of the remote agent.
- DISTANCE** The logical distance (through the management network) to the remote agent.
- Each segment between two IP routers is assigned a weight of 6. For example, if the path to an agent passes two IMX-2T1/E1 with their SNMP management enabled, the distance is 12.
  - When the management network includes one or more additional distinct (alternate) paths between two IP routers that connect to the same remote agent, each such path is assigned a weight of 6 + n per segment. For example, if the route described above has an additional path in parallel with one segment, the additional route has a distance of 13. When additional paths are found in parallel with each segment, their distances will be 13, 14, 15 etc.

**DSP ST CH 2**

- Purpose** Display status information for channel 2.
- Format** DSP ST CH 2
- Use** To display the current status information for any link, type:  
       DSP ST CH 2 <CR>

Typical display for Data channel interface:

STATUS OF HIGH SPEED CHANNEL

```

LOOPS TYPE= LOCAL REMOTE BERT T_INBAND R_INBAND ERR_INJ
NO NO NO NO NO NO NO

```

HIGH SPEED PORT STATE = NOT CONNECTED

HIGH SPEED PORT SPEED = NC

OCCUPIED TIME SLOT NUMBER BY HIGH SPEED CHANNEL:

RTS STATE = OFF

INTERFACE = V.35

Typical display for FT1 interface:

STATUS OF - CH2

TYPE = T1

FUNCTION = DSU

```

ALARMS RED YELLOW
 =====
 ON OFF

```

```

LOOPS TYPE= LOCAL REMOTE BERT T_INBAND R_INBAND ERR_INJ
 NO NO NO NO NO NO

```

START TIME SLOT NUMBER: 1

NUMBER OF TIME SLOTS: 14

#### FT1 Parameters

TYPE Indicates the type of interface installed on CH 2

FUNCTION Indicates T1 function:  
DSU

ALARMS Indicates CH 2 alarm status:  
Red alarm ON/OFF, Yellow alarm ON/OFF

#### Data Channel Parameters

LOOP Shows the status of tests running on CH 2:  
Local, Remote, Transmit Inband, Receive Inband, Error Injection (ON/OFF for all parameters)

T\_INBAND Displays ON to indicate the user requested sending an in-band remote loopback activation sequence

R\_INBAND Displays ON when a loopback has been connected as a result of receiving the in-band remote loopback activation sequence

START TIME SLOT NUMBER Starting time slot from which CH 2 data can be multiplexed

NUMBER OF TIME SLOTS The number of time slots from the start time slot, to be multiplexed

**DSP ST LINK**

**Purpose** Display status information on a selected link, and optionally clear the event registers.

**Format** DSP ST LINK X [Option]

**Use** To display the current status information for any link, type:

DSP ST LINK X<CR>

where X is the link number, 1 or 2.

To display status information for any link, and then clear all the event registers of another link, type:

DSP ST LINK X /C<CR>

where X is the link number, 1 or 2.

To monitor continuously the status information of any link, type:

DSP ST LINK X /R<CR>

where X is the link number, 1 or 2.

The display will be automatically updated. To stop the monitoring, press BREAK (or CTRL+C).

**Display Format** A typical link status display for a T1 link is shown below. X stands for the link identification: L1 for link 1, L2 for link 2.

## STATUS OF LINK X

```

TYPE = T1
FUNCTION = CSU
ALARM = RED YELLOW
 NO NO
LNK LOOPS = LOCAL REMOTE PLB LLB
 NO NO NO NO
BPV LAST MINUT = 0
BPV WORST MINUT = 1

```

The fields included in the status information display are listed below:

|                 |                                                                                                                                                                                         |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| TYPE            | Displays the type of the selected link, T1.                                                                                                                                             |
| FUNCTION        | Displays the type of interface hardware installed on the selected link: CSU or DSU.                                                                                                     |
| ALARM           | Indicates the status of the link alarms.                                                                                                                                                |
| LNK LOOPS       | Displays the state of each type of loopback, including network-initiated loopbacks, that can be activated on the selected link.                                                         |
| BPV LAST MINUT  | Displays the number of BPV events detected during the worst minute since the last time the counters were cleared. This counter is displayed only when the link framing mode is SF (D4). |
| BPV WORST MINUT | Displays the number of BPV events detected in the worst minute. This counter is displayed only when the link framing mode is SF (D4).                                                   |

**DSP ST SYS**

**Purpose** Display system status information.  
**Format** DSP ST SYS [option]  
**Use** To view the current system status, type:

DSP ST SYS <CR>

**Display Format** A typical status information display is shown below.

```

NODE = 0
NAME = 'IMX-2T1/E1 name'
NODAL CLOCK = INT
INBAND LOOPS = ENABLE
CH1 BERT STATE = OFF
CH2 BERT STATE = OFF
SOFTWARE REV = X.Y
HARDWARE REV = X.Y

```

The system status fields are as follows (from top to bottom):

|              |                                                                                                                             |
|--------------|-----------------------------------------------------------------------------------------------------------------------------|
| NODE         | The node number of the IMX-2T1/E1.                                                                                          |
| NAME         | The node name of the IMX-2T1/E1.                                                                                            |
| NODAL CLOCK  | Indicates the current source for the IMX-2T1/E1 system clock:<br>INT, ST, LNK-1, LNK-2, TRAN, CH 1, CH 2 (see Section 4.3). |
| INBAND LOOPS | Indicates the current state of the in-band PLB and LLB loopbacks: DISABLE or ENABLE.                                        |
| BERT STATE   | Indicates the current state of the BER test: ON or OFF.                                                                     |
| SOFTWARE REV | IMX-2T1/E1 software version.                                                                                                |
| HARDWARE REV | IMX-2T1/E1 hardware version.                                                                                                |

**EXIT**

**Purpose** End the current session and return control to the IMX-2T1/E1 front panel.  
**Format** EXIT  
**Use** Type:  
EXIT <CR>

**F**

**Purpose** Define the codes used to be sent to the supervision terminal to perform the following terminal control functions:

- Clear screen
- Move cursor to screen home position
- Move cursor to the right by one position

The codes used by typical terminals are listed in Table 3-6:

*Table 3-6 Terminal Codes*

| Function     | Terminal Type |          |          |                 |             |
|--------------|---------------|----------|----------|-----------------|-------------|
|              | TV920         | VT52     | VT100    | Freedom 100/110 | Freedom 220 |
| Clear Screen | 1B2A0000      | N/A      | 1B5B325A | 1B2A0000        | 1B5B324A    |
| Cursor Home  | 1E000000      | 1B480000 | 1B5B4800 | 1E000000        | 1B5B4800    |
| Cursor Right | 0C000000      | 1B430000 | 1B5B3143 | 0C000000        | 1B5B3143    |

**Format** F

- Use**
1. To display the current codes, type:  
F <CR>
  2. The terminal function entry screen is displayed. The screen includes three separate lines, displayed one after the other. A typical screen, showing all the three lines, is shown below:  
CLEAR SCREEN = hhhhhhhh (clear screen code)  
CURSOR HOME = hhhhhhhh (cursor home code)  
CURSOR RIGHT = hhhhhhhh (cursor right code)  
where h indicates hexadecimal digits.
  3. To change a code, bring the cursor under the first digit of the code to be changed, by pressing <CR>, then enter the appropriate hexadecimal digit.
  4. Repeat the procedure until all the necessary digits are changed.

**HELP**

**Purpose** Display an index of the supervisory port commands and the options available for each command.

**Format** H <CR>

**& Use**

When this option is selected, the first HELP page is displayed. Press any key to advance to the next page.

**INIT DB**

- Purpose** Load default parameter values instead of the user configuration (Table 3-6).
- Format** INIT DB <CR>
- Use**
1. Type:  
INIT DB <CR>
  2. The IMX-2T1/E1 will display the TIME and DATE fields followed by the IMX-2T1/E1 prompt.

*Table 3-7 IMX-2T1/E1 Default Configuration Used with Supervision Terminal*

| Parameter Type       | Parameter Designation | Default Value                        |
|----------------------|-----------------------|--------------------------------------|
| General              | PASSWORD              | IMX                                  |
|                      | NODE (node number)    | 0                                    |
|                      | CLEAR SCREEN          | 00000000                             |
|                      | CURSOR HOME           | 00000000                             |
|                      | CURSOR RIGHT          | 00000000                             |
| System               | CLK_MASTER            | INT                                  |
|                      | CLK_FBACK             | NONE                                 |
|                      | BROADCAST             | N/A                                  |
|                      | ETHERNET_MODE         | N/A                                  |
|                      | BRIDGING              | N/A                                  |
|                      | DNLOAD                | NONE                                 |
|                      | STATE_REPORT          | NO                                   |
|                      | EVENT_REPORT          | NO                                   |
|                      | RCV_CLK               | N/A                                  |
|                      | POLARITY              | N/A                                  |
| INBAND_LOOPS         | ENABLE                |                                      |
| CHANNEL              | LNK-1                 | YES                                  |
|                      | LNK-2                 | YES                                  |
|                      | LNK-3                 | N/A                                  |
|                      | LNK-4                 | N/A                                  |
| LINK                 | CON                   | YES (provided link is installed)     |
|                      | CON                   | YES (provided the link is installed) |
|                      | FRAME                 | ESF                                  |
|                      | CODE                  | B8ZS                                 |
|                      | MASK                  | 000                                  |
|                      | SYNC                  | FAST                                 |
|                      | I_TS_CODE             | 3F                                   |
| CH 2                 | SPEED                 | NC                                   |
|                      | CTS                   | ON                                   |
|                      | RCV_CLK               | DCE                                  |
|                      | ETRNET                | HALF                                 |
|                      | BRIDGING              | FILTERED                             |
|                      | FRAME                 | ESF                                  |
|                      | CODE                  | B8ZS                                 |
|                      | MASK                  | 000                                  |
|                      | SYNC                  | FAST                                 |
|                      | START_TS              | 1                                    |
|                      | NUM_OF_TS             | NC                                   |
| SP(Supervisory Port) | SPEED                 | AUTO                                 |
|                      | DATA                  | 8                                    |
|                      | PARITY                | NONE                                 |
|                      | INTERFACE             | DCE                                  |
|                      | CTS                   | =RTS                                 |
|                      | DCD_DEL               | 0_MSEC                               |
|                      | DSR                   | ON                                   |
|                      | POP_ALM               | NO                                   |
|                      | PWD                   | NO                                   |
|                      | LOG_OFF               | NO                                   |
|                      | CALL_OUT_MODE         | NONE                                 |

AUXILIARY DEVICE

TERMINAL

**INIT F**

**Purpose** Resets the terminal control codes used to clear the terminal screen, to move the cursor to the right, and to return the cursor to the home position to 0.

**Format & Use** INIT F <CR>

**LOOP BERT CH 2**

**Purpose** Activate CH 2 BER testing

**Format** LOOP BERT CH 2 or LP BERT CH 2

**Use** 1. To activate a BER test on CH 2, type:  
LOOP BERT CH 2 <CR> or LP BERT CH 2 <CR>

---

**Note** *An error message: CH2 NOT CONNECTED will be displayed if the CH2 transmit rate has not been defined for the LOOP BERT CH2.*

---

**LOOP CH 1**

**Purpose** Activate a user-controlled loopback on the IMX-2T1/E1 user's data channel (see Section 5.3 for a description of loopback test functions).

**Format** LOOP [looptype] CH or LP [looptype] CH

**Use** 1. To activate a local (L) or remote (R) loopback on the user's data channel, type:  
LOOP L CH <CR> or LP L CH <CR>  
LOOP R CH <CR> or LP R CH <CR>

2. You will see the time and date, followed by the IMX-2T1/E1 prompt. You can activate only one loopback on the IMX-2T1/E1 user's data channel at a time. If you try to activate a second loopback on the user's data channel, you will see an error message (illegal link loop combination). You must deactivate the other loopback before you can activate the new one.

**LOOP CH 2**

**Purpose** Activate a user-controlled loopback on channel 2 (see Section 5.3 for a description of loopback test functions).

**Format** LOOP [looptype] CH 2 or LP [looptype] CH 2

**Use** 1. To activate a or remote (R) loopback on the remote channel 2 of the IMX-2T1/E1, type:  
LOOP L CH 2 <CR> or LP L CH 2 <CR>  
LOOP R CH 2 <CR> or LP R CH 2 <CR>

**LOOP INBAND CH 2**

**Purpose** Activate a user-controlled inband loopback on channel 2 (see Section 5.3 for a description of loopback test functions).

**Format** LOOP INBAND CH 2 or LP INBAND CH 2

**Use** 1. To activate a local (L) or remote (R) inband loopback on channel 2, type:  
LOOP INBAND CH 2 <CR> or LP INBAND CH 2 <CR>

## LOOP LINK

- Purpose** Activate a user-controlled loopback on the IMX-2T1/E1 links (see Section 5.3 for a description of loopback test functions).
- Format** LOOP [looptype] LINK or LP [looptype] LINK Use
1. To activate a local (L) or remote (R) loopback on the IMX-2T1/E1 links, type:  
LOOP L LINK<CR> or LP L LINK<CR>  
LOOP R LINK 1<CR> or LP R LINK<CR>
  2. You will see the time and date, followed by the IMX-2T1/E1 prompt.
- At any time, you can activate only one loopback on the IMX-2T1/E1 links. If you try to activate a second loopback on the IMX-2T1/E1 links, you will see an error message (illegal link loop combination). You must deactivate the other loopback before you can activate a new one.

## RESET

- Purpose** Reset the IMX-2T1/E1. This will cause the IMX-2T1/E1 to initialize, therefore the traffic through the IMX-2T1/E1 will be disrupted until the IMX-2T1/E1 returns to normal operation. Available only if the Watchdog utility has been set to on.
- Format** RESET
- Use**
1. To reset the IMX-2T1/E1, type:  
RESET <CR>

## TIME

- Purpose** Set the time for the IMX-2T1/E1 internal real-time clock.
- Format** TIME
- Use**
1. Type  
TIME <CR>
  2. The IMX-2T1/E1 sends the time entry form:  
HOUR = 12  
MINUTE = 25  
SECOND = 16
  3. If necessary, change the time as follows:.
    - Bring the cursor to the beginning of the first field to be changed by pressing the spacebar.
    - To change the selected field, press F or B to scroll among the available selections.
    - When the desired selection is displayed, press the spacebar to move to the next field.
  4. Set the time about one minute beyond the current time, and then press <CR> at the right moment.  
The IMX-2T1/E1 will display the TIME and DATE fields (note that TIME has changed), followed by the IMX-2T1/E1 prompt.

---

---

### 3.5 Supervision Terminal Operating Instructions

Before using the supervision terminal, make sure the preparations listed in Section 3.2 were completed and all relevant equipment has been turned on.

#### Starting a Session - Single IMX-2T1/E1

When the terminal is used to control a single IMX-2T1/E1, always assign node address 0 to the IMX-2T1/E1. Use the following start-up sequence to connect to a IMX-2T1/E1 that has been assigned node number 0.

1. If you use the AUTO (Autobaud) mode, press the <CR> key three times. This allows the IMX-2T1/E1 to identify the terminal baud rate.
2. Assuming that the IMX-2T1/E1 successfully identified the baud rate of the supervision terminal, you will be notified if the IMX-2T1/E1 failed the power-up self-test:
  - If you see IMX-2T1/E1 SELFTEST FAILED, the IMX-2T1/E1 is out of use and must be repaired.
  - If the IMX-2T1/E1 successfully passed the power-up self test (IMX-2T1/E1 SELFTEST OK), it sends the following message:  
IMX SUPERVISORY PORT ON LINE. TYPE H FOR HELP
3. Now, the IMX-2T1/E1 prompt should already be displayed on the terminal screen, after the ON-LINE announcement.  
If the word PASSWORD is displayed,  
password protection is enabled. In this case, type the password and press <CR>; the display shows only asterisks.  
The default password is IMX.  
If your password is accepted, you will see the prompt IMX-2T1/E1 >.
4. The IMX-2T1/E1 is now in session, under your control:
  - The following prompt is displayed:  
IMX-2T1/E1 >
  - On the IMX-2T1/E1 front panel, you will see the message:  
TERMINAL ON LINE

The front panel controls are disabled as long as the IMX-2T1/E1 is under remote control.

#### Note

---

*While the supervision terminal is in session with the IMX-2T1/E1, the IMX-2T1/E1 local operator can regain control by disconnecting the cable from the IMX-2T1/E1 front-panel DCE connector, or by sending the EXIT command from the supervision terminal.*

*The IMX-2T1/E1 will automatically return to front panel control if no commands are received for a certain period of time (controlled by the LOG\_OFF parameter). This time-out can be disabled.*

---

## Starting a Session - Multiple IMX-2T1/E1s

When one terminal is used to control several IMX-2T1/E1 connected via modems, non-zero node addresses are assigned to each IMX-2T1/E1. The node addresses, in the range of 1 through 255, are assigned during the first session, by means of the command DEF NODE. Use the following procedure to establish a session with a specific IMX-2T1/E1.

**IMPORTANT** If you are using a multidrop configuration, do not assign address 0 to any IMX-2T1/E1 connected to a given terminal. Make sure the interface type is set as DTE, and select the appropriate DCD\_DEL parameter.

1. Press the <CR> key three times.
2. Type NODE, space, the desired IMX-2T1/E1 node address and another space, and then type the desired command and press <CR>. For example, with node address 234, type:

```
NODE<SP>234<SP>'command' <CR>
```

3. If the addressed IMX-2T1/E1 does not use password protection, it will immediately execute the command.
4. If the addressed IMX-2T1/E1 is password protected, you will see the prompt:

```
PASSWORD>
```

Enter the node address again, followed by the password. For example, for node address 234, type :

```
NODE<SP>234<SP>'password'<CR>
```

5. If the password is correct, the IMX-2T1/E1 will execute the command. Otherwise, ENTER PASSWORD is displayed.

## Control Session

1. During the control session, type the desired commands at the terminal keyboard. You must see the IMX-2T1/E1 echo character by character. If a bad command appears, backspace to clear the error, and then type in the correct character.
  - When you see the correct and complete command in the echo line, press <CR> to execute the command. The IMX-2T1/E1 will process the command and display the appropriate response. At the end of the command execution, the IMX-2T1/E1 displays the current time and date, and then provides a new prompt for the next command line.
  - If you changed your mind, and want to abort the command, press BREAK or CTRL+C. You will receive the prompt again, allowing you to enter another command.

### Note

---

*You can also use BREAK or CTRL+C to stop automatic repetition of commands sent with the /R option.*

---

2. If your command is not correct, the IMX-2T1/E1 will not execute it, but will echo the command again, with a bad command message in the following line. Enter the correct command again.
3. If the terminal screen fills up during the exchange with the IMX-2T1/E1, you will see the message:  
HIT ANY KEY TO CONTINUE  
After pressing any key except BREAK, the terminal scrolls to the next page.

### Ending a Control Session

1. To end the control session, type:  
EXIT
2. The IMX-2T1/E1 prompt will disappear. Now you can control the IMX-2T1/E1 from its front panel.

**Note** A control session may also be terminated by the IMX-2T1/E1 if the idle disconnect time-out is enabled, or when the DTR line switches to the inactive (OFF) state.

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## 3.6 Configuration Error Messages

The IMX-2T1/E1 provides configuration error messages for the supervision terminal user. The configuration messages display the word ERROR, followed by a two-digit code. The IMX-2T1/E1 will display a short description of the error message after the ERROR code.

The error messages are as follows:

- |                 |                                                                                                                                                                                                                                                                         |
|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>ERROR 01</b> | MASTER AND FALLBACK CLOCKS ARE SAME<br>You are trying to select the same source as both master and fallback clock source. Check and change as required.                                                                                                                 |
| <b>ERROR 02</b> | CLOCK SOURCE FROM NOT VALID LINK<br>You are trying to select as clock source a link that is not connected to the IMX-2T1/E1. Check and change as required.                                                                                                              |
| <b>ERROR 03</b> | ILLEGAL LOOP COMBINATION<br>Illegal combination of loopbacks: you are trying to simultaneously activate local and remote loopbacks on links or on the data channel (it is not allowed to connect a local channel loopback and a remote link loopback at the same time). |
| <b>ERROR 04</b> | LINK 3 AND LINK 4 ARE NOT AVAILABLE IN THE E1/2T1 configuration. You are attempting to display the status of a link which is unavailable in the IMX-2T1/E1.                                                                                                             |

- ERROR 05** MAPPING UNCONNECTED LINK  
You are trying to map a link that is not active.
- ERROR 06** CONNECTING TO UNEXISTING LINK  
You are trying to activate a link which is not connected to the IMX-2T1/E1. Check and change as required.
- ERROR 07** UNCONNECTING LINK THAT SUPPLIES CLOCK OR MAPPED TO CHANNEL  
You are trying to disconnect a link that has been selected as clock source, or a link that is mapped to the user's data channel. Check and change as required.
- ERROR 08** LOOP IS NOT ACTIVE  
You are trying to disconnect a loopback that is not active.
- ERROR 09** LINK IS NOT ACTIVE  
You are trying to display the status of a link which is not active. Check and change as required.
- ERROR 11** ILLEGAL DCD\_DEL AND INTERFACE COMBINATION  
Using DEF SP command to define interface parameter DCE and to define parameter DCD-DEL as other than 0 msec.
- ERROR 12** CONFLICT IN INTERFACE AND DSR PARAMETERS  
Using DEF SP command to define interface parameter DTE and DSR parameter to on.
- ERROR 19** WRONG IP ADDRESS  
An invalid IP address has been entered, not in xx.xx.xx.xx format where x is in range of 0-255.
- ERROR 20** WRONG MAC ADDRESS  
Invalid MAC address entered, not in x.x.x.x.x format where x is in range of 0-255.
- ERROR 21** ILEGAL LOOP ON ETHERNET MODE  
You are trying to activating a remote loop on CH2 when CH2 has an Ethernet interface.
- ERROR 22** CH-2 NOT CONNECTED  
You are trying to activate BERT/loops on CH2 while CH2 speed or TS is 0. For example DEF CH2 = 0, LP R CH2.
- ERROR 23** LOOP ALREADY ACTIVE  
You are trying to connect a loopback that is already active.
- ERROR 24** ACTIVE LOOP CANNOT CHANGE CH-2 CONFIGURATION

- You are trying to change CH2 configuration while loop on CH2 is active.
- ERROR 25** ILEGAL COMMAND FOR INSTALLED CH-2 INTERFACE  
You are trying to define an illegal CH2 RCV clock.
- ERROR 26** ILEGAL SP CONFIGURATION IN NMS-SLIP MODE  
You are trying to set the speed in SP parameters to AUTO while in NMS-SLIP AUX\_DEVICE mode.
- ERROR 27** REPETITIVE MODE CANNOT BE APPLIED DURING TELNET SESSION  
You are trying to activate a display in repetitive mode while in a Telnet session.
- ERROR 28** FRACTIONAL TIME SLOT ALLOCATING OUT OF RANGE  
You are trying to allocate time slots from a FT1 link that exceeds 23 TS. Meaning that TS\_START + TS NUM is greater than 24.
- ERROR 52** ILLEGAL FIELD VALUE  
You are trying to enter the wrong date.

# Chapter 4

## Front Panel Operating Instructions

This chapter describes the structure and functions of the IMX-2T1/E1 front panel. It includes the following information:

- Describes the IMX-2T1/E1 front panel components
- Provides a general description of IMX-2T1/E1 operation, including control, display, pushbutton functions, and LCD display structure
- Describes the IMX-2T1/E1 configuration parameters
- Provides IMX-2T1/E1 operating procedures, including power up, checking configuration, operating indications, performance monitoring and power down
- Details IMX-2T1/E1 local configuration setup
- Describes IMX-2T1/E1 configuration error messages

The IMX-2T1/E1 can also be operated and monitored from a remote site by a supervision terminal. Refer to Chapter 3 for a detailed description of remote operation.

### 4.1 IMX-2T1/E1 Front Panel

Figure 4-1 shows the front panel of the standard IMX-2T1/E1. The front panel consists of indicators, an LCD display, pushbuttons and connectors. Table 4-1 describes the functions of each of these components. The numbered labels in Figure 4-1 correspond to the list numbers in Table 4-1.

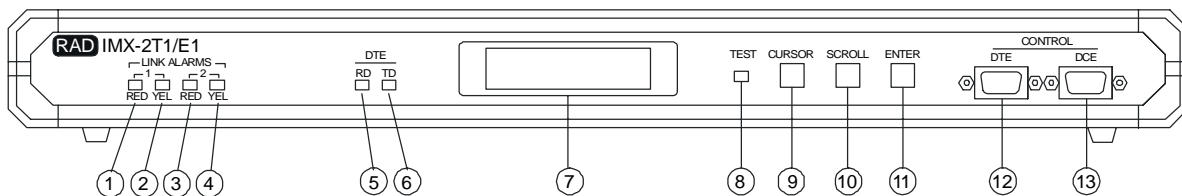


Figure 4-1 Standard IMX-2T1/E1 Front Panel

Table 4-1 IMX-2T1/E1 Front Panel Components

| No | Control or Indicator | Function                                                                                                                        |
|----|----------------------|---------------------------------------------------------------------------------------------------------------------------------|
| 1  | LINK 1 RED indicator | Lights when a red alarm is detected on link 1                                                                                   |
| 2  | LINK 1 YEL indicator | Lights when a yellow alarm is detected on link 1                                                                                |
| 3  | LINK 2 RED indicator | Lights when a red alarm is detected on link 2                                                                                   |
| 4  | LINK 2 YEL indicator | Lights when a yellow alarm is detected on link 2                                                                                |
| 5  | DTE RD indicator     | Lights when data is present on the receive line of the E1 port                                                                  |
| 6  | DTE TD indicator     | Lights when data is present on the transmit line of the E1 port                                                                 |
| 7  | Alphanumeric display | Liquid Crystal Display (LCD) used to display messages and status information. The display contains 2 rows of 16 characters each |
| 8  | TEST indicator       | Lights when a test is active                                                                                                    |
| 9  | CURSOR pushbutton    | Used to move among the information fields                                                                                       |
| 10 | SCROLL pushbutton    | Used to scroll among the available options of the displayed functions                                                           |
| 11 | ENTER pushbutton     | Used to enter the changes made in the IMX-2T1/E1 operation, and initiate operation under the new setup                          |
| 12 | DTE connector        | Reserved for future use                                                                                                         |
| 13 | DCE connector        | Connection to supervision terminal                                                                                              |

Table 4-2 outlines the features of the front panel of the IMX-2T1/E1 with Fractional T1 channel installed, as shown in Figure 4-2.

The numbered labels in Figure 4-2 correspond to the list numbers in Table 4-2.

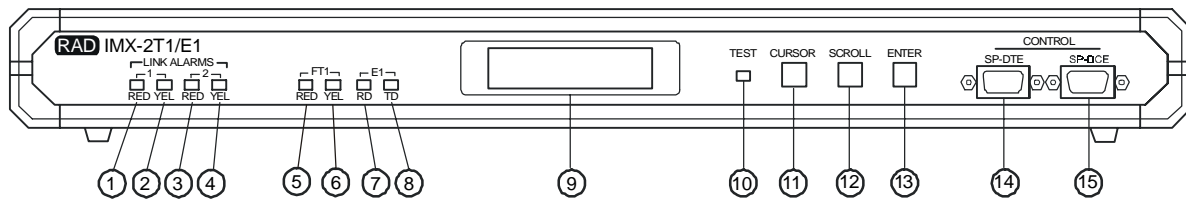


Figure 4-2 Fractional T1 IMX-2T1/E1 Front Panel

Table 4-2 IMX-2T1/E1 with FT1 Front Panel

| No | Control or Indicator | Function                                                                                                                        |
|----|----------------------|---------------------------------------------------------------------------------------------------------------------------------|
| 1  | LINK 1 RED indicator | Lights when a red alarm is detected on link 1                                                                                   |
| 2  | LINK 1 YEL indicator | Lights when a yellow alarm is detected on link 1                                                                                |
| 3  | LINK 2 RED indicator | Lights when a red alarm is detected on link 2                                                                                   |
| 4  | LINK 2 YEL indicator | Lights when a yellow alarm is detected on link 2                                                                                |
| 5  | FT1 RED indicator    | Lights when a RED alarm (local unit loss of synchronization) is detected on FT1                                                 |
| 6  | FT1 YEL indicator    | Lights when a YELLOW alarm (remote unit loss of synchronization) is detected on FT1                                             |
| 7  | E1 RD indicator      | Lights when data is present on the receive line of the E1 port                                                                  |
| 8  | E1 TD indicator      | Lights when data is present on the transmit line of the E1 port                                                                 |
| 9  | Alphanumeric display | Liquid Crystal Display (LCD) used to display messages and status information. The display contains 2 rows of 16 characters each |
| 10 | TEST indicator       | Lights when a test is active                                                                                                    |
| 11 | CURSOR pushbutton    | Used to move among the information fields                                                                                       |
| 12 | SCROLL pushbutton    | Used to scroll among the available options of the displayed functions                                                           |
| 13 | ENTER pushbutton     | Used to enter the changes made in the IMX-2T1/E1 operation, and initiate operation under the new setup                          |
| 14 | SP-DTE connector     | Reserved for future use                                                                                                         |
| 15 | SP-DCE connector     | Connection to supervision terminal                                                                                              |

Table 4-3 outlines the features of the front panel of the IMX-2T1/E1 with Data Port channel installed, as shown in Figure 4-3.

The numbered labels in Figure 4-3 correspond to the list numbers in Table 4-3.

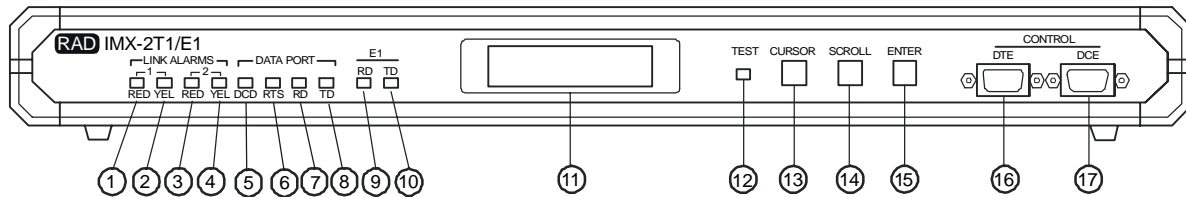


Figure 4-3 Data Port IMX-2T1/E1 Front Panel

Table 4-3 IMX-2T1/E1 with Data Port Front Panel

| No | Control or Indicator    | Function                                                                                                                        |
|----|-------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| 1  | LINK 1 RED indicator    | Lights when a red alarm is detected on link 1                                                                                   |
| 2  | LINK 1 YEL indicator    | Lights when a yellow alarm is detected on link 1                                                                                |
| 3  | LINK 2 RED indicator    | Lights when a red alarm is detected on link 2                                                                                   |
| 4  | LINK 2 YEL indicator    | Lights when a yellow alarm is detected on link 2                                                                                |
| 5  | DATA PORT RTS indicator | When Loop R CH and/or BERT are activated, the RTS indicator is shut off.                                                        |
| 6  | DATA PORT DCD indicator | The DCD indicator shuts off when a loss of synchronization occurs on the T1 link.                                               |
| 7  | DATA PORT RD            | Lights when data is present on the receive line of the Data port                                                                |
| 8  | DATA PORT TD            | Lights when data is present on the transmit line of the Data port                                                               |
| 9  | E1 RD indicator         | Lights when data is present on the receive line of the E1 port                                                                  |
| 10 | E1 TD indicator         | Lights when data is present on the transmit line of the E1 port                                                                 |
| 11 | Alphanumeric display    | Liquid Crystal Display (LCD) used to display messages and status information. The display contains 2 rows of 16 characters each |
| 12 | TEST indicator          | Lights when a test is active                                                                                                    |
| 13 | CURSOR pushbutton       | Used to move among the information fields                                                                                       |
| 14 | SCROLL pushbutton       | Used to scroll among the available options of the displayed functions                                                           |
| 15 | ENTER pushbutton        | Used to enter the changes made in the IMX-2T1/E1 operation, and initiate operation under the new setup                          |
| 16 | DTE connector           | Reserved for future use                                                                                                         |
| 17 | DCE connector           | Connection to supervision terminal                                                                                              |

## 4.2 IMX-2T1/E1 Operation

### Configuration

The IMX-2T1/E1 operating mode is determined by a set of parameters

stored in non-volatile memory. These parameters are set by the user, using the IMX-2T1/E1 front panel pushbuttons, or a supervision terminal. After the operating parameters are loaded, the configuration setup process begins and no further operator attendance is required.

The configuration stored in the IMX-2T1/E1 memory is not affected when power is turned off. Upon power up, the IMX-2T1/E1 checks the validity of the stored configuration data; if the data is valid, it loads the last selected configuration.

If the configuration does not require modification, the IMX-2T1/E1 is ready for operation immediately after power up. If the configuration data is not valid, the IMX-2T1/E1 loads a default configuration from the program EPROM.

## Process

Operations are performed with three pushbuttons, using a menu-driven interface displayed on a two-row LCD display. The IMX-2T1/E1 guides the operator in the execution of required tasks with clear and simple messages, presenting available parameter values and checking user inputs.

Detailed operating instructions for the IMX-2T1/E1 are provided in Section 4.4 and Section 4.5.

When input parameters conflict, the IMX-2T1/E1 rejects the erroneous configuration selections and displays an error message that identifies the error.

Section 4.6 describes the configuration error messages and offers remedies to the problems.

## Display Functions

The IMX-2T1/E1 displays the following:

- Status messages
- Diagnostics performance data
- Test functions
- Configuration parameters.

### Status Messages

When the IMX-2T1/E1 is not being configured and no test is active, it displays status messages.

The status messages appear under the header ALARM BUFFER, which stores up to 100 alarms. The IMX-2T1/E1 status messages are described in detail in Chapter 5.

### Diagnostic Functions

The IMX-2T1/E1 displays the traffic performance parameters gathered when operating with ESF framing. The IMX-2T1/E1 can also display BPV statistics when operating with SF (D4) framing.

The diagnostics data appear under the header DIAGNOSTICS. The IMX-2T1/E1 diagnostics data are described in detail in Chapter 5.

### Test Functions

The IMX-2T1/E1 test functions include:

- Local and remote loopbacks for rapid isolation of faults.
- BER test CH 1 and/or CH 2
- IN-band CH 2 loopback
- Network line loopback and network payload loopback for T1 links with the CSU interface that are controlled by the network. These loopbacks have highest priority and override all other loop requests.

The test function messages appear under the header TEST OPTIONS. The IMX-2T1/E1 test functions are described in detail in Chapter 5.

### Configuration

#### Parameters

The IMX-2T1/E1 displays the system configuration parameters. Refer to Section 4.3 for a detailed description of these parameters.

## Pushbutton Functions

The IMX-2T1/E1 is operated by the following pushbuttons:

### CURSOR

Press this pushbutton to select the fields containing the values that you want to change. The pushbutton moves the cursor from field to field in the current display. When the cursor is in a field, the field value is underlined indicating that it has been selected.

### SCROLL

Some fields list several values. To select a value from such a field, select the field with the cursor and press SCROLL. Each time you press SCROLL, the next value in the list is selected.

## ENTER

The ENTER pushbutton has the following functions:

- Records new values:  
When you enter a new value in a selected field, the new value replaces the old value. Press the ENTER pushbutton to accept the new value. If you enter an incorrect value, the system generates a CONFIG ERROR message in the following format: CONFIG ERROR xx, where xx is the error code number. Refer to Section 4.6 for a detailed description of the configuration errors and how to correct them.
- Purges the alarm buffer:  
When the alarm buffer is displayed, press the ENTER pushbutton to delete all the alarms from the buffer.
- Resets the system error counters:  
When DIAGNOSTICS is displayed, press the ENTER pushbutton to reset the system error counters. These counters are:  
ERROR EV, ERROR CRC, AV ERROR CRC, CURR ES, CURR SES,  
CURR BES, CURR UAS, CURR LOFC, CURR CSS, CURR SECS,  
BPV COUNT, L. TERM ES, L. TERM SES, L. TERM BES, L. TERM UAS,  
L. TERM LOFC, L. TERM CSS, L. TERM INT, CUR DEG MIN,  
BPV WORST, LST DEG MIN.

## The LCD Display

The IMX-2T1/E1 LCD display has two rows, each 16 characters wide:

The upper row displays one of the following:

- The name of the displayed function
- A group of configuration parameters
- A test option

The lower row displays the following:

- Parameter name and value
- Status messages
- Loopback status
- Error messages
- Diagnostics messages

### 4.3 IMX-2T1/E1 Configuration Parameters

The IMX-2T1/E1 has four groups of configuration parameters:

- System configuration parameters
- Link configuration parameters
- Supervisory port configuration (SP) parameters
- Channel 2 configuration parameters

These configuration parameter groups are detailed in Table 4-4.

**Note** *The IMX-2T1/E1 supports additional parameters, which may only be modified via the supervisory port. These parameters are explained in Chapter 3.*

Table 4-4 Configuration Parameter Groups

| Display                         | Description                                                                                                                                                                                                                                                                            | Refer to  |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| SYSTEM CONFIGURATION PARAMETERS | <ul style="list-style-type: none"> <li>• Master clock source</li> <li>• Fallback clock source</li> <li>• Download</li> <li>• State Report</li> <li>• Event Report</li> <li>• Inband loops</li> </ul>                                                                                   | Table 4-5 |
| LINK CONFIGURATION PARAMETERS   | <ul style="list-style-type: none"> <li>• Framing</li> <li>• Synchronization time</li> <li>• Link interface function</li> <li>• Idle time slot fill-up code</li> <li>• Zero compression coding</li> <li>• Transmission signal masking/attenuation</li> <li>• Link connection</li> </ul> | Table 4-6 |
| CH MAP                          | IMX-2T1/E1 links                                                                                                                                                                                                                                                                       | Table 4-7 |
| SP PARAMETERS                   | <ul style="list-style-type: none"> <li>• Data rate</li> <li>• Number of data bits</li> <li>• Parity</li> <li>• Interface type</li> <li>• Auxiliary Dev</li> </ul>                                                                                                                      | Table 4-8 |

Table 4-4 Configuration Parameter Groups (Cont.)

| Display         | Description                                                                                                                                                                                    | Refer to               |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
| CH 2 PARAMETERS | Data Channel:                                                                                                                                                                                  | Table 4-8<br>Table 4-9 |
|                 | <ul style="list-style-type: none"> <li>● Speed</li> <li>● CTS</li> <li>● Receive Clock</li> <li>● BERT Pattern</li> <li>● Bert Error</li> <li>● Ethernet</li> <li>● Bridging</li> </ul>        |                        |
|                 | FT1:                                                                                                                                                                                           |                        |
|                 | <ul style="list-style-type: none"> <li>● Frame</li> <li>● Code</li> <li>● Mask</li> <li>● Time Slot Start</li> <li>● Time Slot Number</li> <li>● BERT Pattern</li> <li>● Bert Error</li> </ul> |                        |

**Note** *In addition to the parameters configured from the front panel, there are parameters that are accessed only from the supervision terminal. These parameters are described in Chapter 3.*

After configuration, if alarm messages are stored in its ALARM BUFFER, the IMX-2T1/E1 automatically displays status messages.

## System Configuration Parameters

Table 4-5 provides the system configuration parameters, their function, and their available values.

*Table 4-5 System Configuration Parameters*

| Designation  | Function                                                                                      | Values                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------|-----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CLK_MASTER   | Selects the master timing.                                                                    | LNK 1: Locked to the recovered receive clock of link 1.<br>LNK 2: Locked to the recovered receive clock of link 2.<br>TRAN: Transparent timing.<br>CH 1: Locked to the recovered incoming clock of the E1 port.<br>CH 2: Locked to the recovered receive clock of the fractional T1 port.<br>ST: External clock signal connected to the STATION CLK connector.<br>INT: Internal oscillator.<br><br>Default: INT |
| CLK_FBACK    | Selects the alternate (fallback) timing reference for use in case the master reference fails. | NONE: No fallback source is used.<br>LNK1: Locked to the recovered receive clock of link 1.<br>LNK2: Locked to the recovered receive clock of link 2.<br>CH 1: Locked to the recovered incoming clock of the E1 port<br>CH 2: Locked to the recovered receive clock of the fractional T1 port.<br>ST: External clock signal connected to the STATION CLK connector.<br><br>Default: NONE                        |
| DOWNLOAD     | Enables/disables download option                                                              | TS1: Enables download, on 8 kbps channel for in-band and out-band communication.<br>NONE: Disables download<br><br>Default: NONE                                                                                                                                                                                                                                                                                |
| STATE REPORT | Enables/disables traps<br>State alarms                                                        | Yes: Sends SNMP traps of State alarms to SNMP manager station.<br>NO: Disable<br><br>Default: NO                                                                                                                                                                                                                                                                                                                |
| EVENT REPORT | Enables/disables traps<br>Event alarms                                                        | Yes: Sends SNMP traps of Event alarms to SNMP manager station.<br>NO: Disable<br><br>Default: NO                                                                                                                                                                                                                                                                                                                |
| INBAND LOOPS | Enables/disables the FDL in-band loops activation from any T1 interface.                      | ENABLE: The in-band loops can be activated.<br>DISABLE: The in-band loops cannot be activated.                                                                                                                                                                                                                                                                                                                  |

## Link Configuration Parameters

Table 4-6 provides the link configuration parameters, their function, and their available values.

Parameter values can be selected independently for each link.

*Table 4-6 Link Configuration Parameters*

| Designation | Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Values                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |             |         |       |      |         |      |         |      |         |      |         |      |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|---------|-------|------|---------|------|---------|------|---------|------|---------|------|
| CON         | Activates or deactivates the link.<br>For an activated link to work, it must first be assigned to the data channel (refer to the channel map configuration parameters)                                                                                                                                                                                                                                                                                                                                                                                                                                                          | YES: Link is activated.<br>NO: Link is deactivated.<br><br>Default: YES (provided the link is installed)<br><br>Note: Cannot be changed by user, constantly set to YES.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |             |         |       |      |         |      |         |      |         |      |         |      |
| FRAME       | Selects the multiframing mode for the selected link.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | SF: 12 frames per multiframe.<br>ESF: 24 frames per multiframe.<br><br>Default: ESF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |             |         |       |      |         |      |         |      |         |      |         |      |
| CODE        | Selects the line-coding method used for zero suppression.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | TRAN: Transparent (AMI) coding; no processing for zero suppression.<br>B8ZS: B8ZS coding.<br><br>Note: Clear channel capability is available only with B8ZS coding.<br><br>Default: B8ZS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |             |         |       |      |         |      |         |      |         |      |         |      |
| MASK        | Controls the link's signal transmission line characteristics.<br><br>The displayed options depend on if the link interface hardware includes a CSU, as follows: <ul style="list-style-type: none"> <li>When the link interface does not include a CSU, the transmit signal mask can be selected in accordance with the transmit line length, to meet DSX-1 requirements, as specified by AT&amp;T CB-119, or operation in accordance with FCC Rules Part 68.</li> </ul><br>When the link interface includes a CSU, the transmit signal can be attenuated by 7.5, 15, or 22.5 dB, to meet the requirements of FCC Rules Part 68. | For links without CSU: <ol style="list-style-type: none"> <li>DSX-1 operation: The following selections are available: <table border="1"> <thead> <tr> <th>Length (ft)</th> <th>Display</th> </tr> </thead> <tbody> <tr> <td>0-133</td> <td>000-</td> </tr> <tr> <td>133-266</td> <td>133-</td> </tr> <tr> <td>266-399</td> <td>266-</td> </tr> <tr> <td>399-533</td> <td>399-</td> </tr> <tr> <td>533-655</td> <td>533-</td> </tr> </tbody> </table> </li> <li>For compliance with FCC Rule 68.308, Option A, set to FCC68.</li> </ol><br>Default for links without CSU: 0-133<br>For links with CSU:<br>0: No attenuation.<br>7.5: Attenuation of 7.5 dB relative to the nominal transmit level.<br>15: Attenuation of 15 dB relative to the nominal transmit level.<br>22.5: Attenuation of 22.5 dB relative to the nominal transmit level.<br>Default for links with CSU: 0 | Length (ft) | Display | 0-133 | 000- | 133-266 | 133- | 266-399 | 266- | 399-533 | 399- | 533-655 | 533- |
| Length (ft) | Display                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |             |         |       |      |         |      |         |      |         |      |         |      |
| 0-133       | 000-                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |             |         |       |      |         |      |         |      |         |      |         |      |
| 133-266     | 133-                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |             |         |       |      |         |      |         |      |         |      |         |      |
| 266-399     | 266-                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |             |         |       |      |         |      |         |      |         |      |         |      |
| 399-533     | 399-                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |             |         |       |      |         |      |         |      |         |      |         |      |
| 533-655     | 533-                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |             |         |       |      |         |      |         |      |         |      |         |      |

Table 4-6 Link Configuration Parameters (Cont.)

| Designation | Function                                                                                                                                                            | Values                                                                                                         |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|
| SYNC        | Sets the time required for the selected link to return to normal operation after local loss of synchronization.                                                     | 62411: After 10 seconds.<br>Complies with AT&T TR-62411 requirements<br>FAST: After 1 second.<br>Default: FAST |
| I_TS_CODE   | Selects the code transmitted to fill idle (unused) time slots in the frames transmitted on the selected link when the link is not in use or not mapped.             | 00 to FF (hexa).<br>Default: 3F                                                                                |
| FUNCTION    | Indicates the type of interface installed on the selected link.<br><br>This value corresponds to the hardware installed on the selected link and cannot be changed. | CSU: The link interface has a CSU.<br>DSU: The link interface does not include a CSU.                          |

**CH 1 Map Parameter**

Table 4-7 lists the channel map configuration parameters, their function, and available values.

Table 4-7 CH Map Parameter

| Designation                         | Function                                                 | Values                                                                                                                                                                                                                                                                      |
|-------------------------------------|----------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| LINK X<br>(X = the link no. 1 or 2) | Sets if the link can be used by the user's data channel. | YES: Link can be used by the user's data channel (provided the link is installed on the IMX-2T1/E1).<br>NO: Link cannot be used to carry user data, even if it is installed on the IMX-2T1/E1 channel.<br>Default: YES<br>Note: This option is disabled, always set to YES. |

**CH 2 Parameters** Table 4-8 and Table 4-9 list the CH 2 configuration parameters respectively for the data channel and Fractional T1, their function, and available values.

*Table 4-8 CH 2 Parameters - Data Channel Interface*

| Designation | Function                                                                                                        | Values                                                                                                                                                                                                                                                                            |
|-------------|-----------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SPEED       | Selects the data channel communication rate                                                                     | Rates are available as multiples n (for n= 1 to 7) of the basic rate:<br>128 kbps, 256, 384, 512, 640, 768, 896<br><br>In unframed mode, the multiple 24 is also available for a rate of 1544 kbps.<br><br>NC: Disconnects the channel<br>Default: NC                             |
| CTS         | Selects state of the CTS line in the data channel<br>Not applicable for Ethernet interface.                     | ON: CTS is on continuously<br>=RTS: CTS line follows the RTS line<br>Default: ON                                                                                                                                                                                                  |
| RCV_CLK     | Selects the clocking mode for the data channel.<br><br>For Ethernet and X.21 interfaces, only DCE is supported. | DCE<br>E-DCE<br><br>Default: DCE                                                                                                                                                                                                                                                  |
| BERT PTRN   | Selects the BER test pattern.                                                                                   | The selections available are the QRSS test pattern, and the following pseudo-random sequences:<br>2E3-1, 2E4-1, 2E5-1, 2E6-1, 2E7-1, 511, 2E10-1, 2047, 2E15-1, 2E17-1, 2E18-1, 2E20-1, QRSS,2E21-1, 2E22-1, 2E23-1, 2E25-1, 2E28-1, 2E29-1, 2E31-1, 2E32-1<br><br>Default: 2E3-1 |
| BERT ERR    | Enables/disables error injection in the BER test.                                                               | Select NO ERR to disable.<br>Set rate at:<br>Single, 10E-1, 10E-2, 10E-3, 10E-4, 10E-5, 10E-6, 10E-7<br>Default: NO ERR                                                                                                                                                           |
| ETRNET      | Selects the method used to handle LAN traffic.                                                                  | HALF_DUP: Half-duplex mode<br>FULL_DUP: Full-duplex mode<br>Default: HALF_DUP                                                                                                                                                                                                     |
| BRIDGING    | Creates a LAN extender or remote bridge on the T1 link.                                                         | FILTER: Operates the T1 link as a remote bridge (recommended).<br>TRANS: Operates the T1 link as a LAN extender or repeater.<br>Default: FILTER                                                                                                                                   |

**Note** *The ETRNET and BRIDGING parameters appear only when Ethernet 10 Base T is installed in the IMX-2T1/E1.*

Table 4-9 CH 2 Parameters - Fractional T1 Interface

| Designation | Function                                                                                                                                                                                                                                                                                               | Values                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |             |         |       |      |         |      |         |      |         |      |         |      |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|---------|-------|------|---------|------|---------|------|---------|------|---------|------|
| FRAME       | Selects the multiframing mode.                                                                                                                                                                                                                                                                         | SF (D4): 12 frames per multiframe<br>ESF: 24 frames per multiframe<br>Default: ESF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |             |         |       |      |         |      |         |      |         |      |         |      |
| CODE        | Selects the zero suppression coding method.                                                                                                                                                                                                                                                            | TRAN: Transparent (AMI) coding, no zero suppression processing<br><br>B7ZS: B7ZS coding<br><br>B8ZS: B8ZS coding<br><br>Note: Clear channel option is available only for B8ZS coding<br><br>Default: B8ZS                                                                                                                                                                                                                                                                                                                                                                                                                                            |             |         |       |      |         |      |         |      |         |      |         |      |
| MASK        | Controls link transmit signal characteristics. Displayed options depend on link interface hardware (with /without CSU).<br>When the link includes a DSU, the mask can be selected according to transmit line length, meeting DSX-1 requirements (as specified by AT&T CB-119, and FCC Rules Part 68A). | For links without CSU: <ul style="list-style-type: none"> <li>DSX-1 operation, the following are the available options for line length (in feet): <table border="1"> <thead> <tr> <th>Length (ft)</th> <th>Display</th> </tr> </thead> <tbody> <tr> <td>0-133</td> <td>000-</td> </tr> <tr> <td>133-266</td> <td>133-</td> </tr> <tr> <td>266-399</td> <td>266-</td> </tr> <tr> <td>399-533</td> <td>399-</td> </tr> <tr> <td>533-655</td> <td>533-</td> </tr> </tbody> </table> </li> <li>An additional selection, FCC68A, provides compliance with FCC Rule 68.308 Option A output pulse mask.</li> </ul> <p>Default for links with DSU: 0-133</p> | Length (ft) | Display | 0-133 | 000- | 133-266 | 133- | 266-399 | 266- | 399-533 | 399- | 533-655 | 533- |
| Length (ft) | Display                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |             |         |       |      |         |      |         |      |         |      |         |      |
| 0-133       | 000-                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |             |         |       |      |         |      |         |      |         |      |         |      |
| 133-266     | 133-                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |             |         |       |      |         |      |         |      |         |      |         |      |
| 266-399     | 266-                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |             |         |       |      |         |      |         |      |         |      |         |      |
| 399-533     | 399-                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |             |         |       |      |         |      |         |      |         |      |         |      |
| 533-655     | 533-                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |             |         |       |      |         |      |         |      |         |      |         |      |
| SYNC        | Selects the recovery time after a loss of synchronization.                                                                                                                                                                                                                                             | 62411: After 10 seconds.<br>Complies with AT&T TR-62411 requirements<br>FAST: After 1 second.<br><br>Default: FAST                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |             |         |       |      |         |      |         |      |         |      |         |      |
| TS_START    | Selects the starting time slot for multiplexing.                                                                                                                                                                                                                                                       | Range: from 01 to 24<br>Default: 01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |             |         |       |      |         |      |         |      |         |      |         |      |
| TS_NUM      | Selects the total number of time slots transferred to the T1 links.                                                                                                                                                                                                                                    | Range: from 01 to 07<br><br>Default: NC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |             |         |       |      |         |      |         |      |         |      |         |      |
| BERT_PTRN   | Sets the BER test pattern.                                                                                                                                                                                                                                                                             | The selections available are the QRSS test pattern, and the following pseudo-random sequences:<br>2E3-1, 2E4-1, 2E5-1, 2E6-1, 2E7-1, 511, 2E10-1, 2047, 2E15-1, 2E17-1, 2E18-1, 2E20-1, QRSS, 2E21-1, 2E22-1, 2E23-1, 2E25-1, 2E28-1, 2E29-1, 2E31-1, 2E32-1<br><br>Default: 2E3-1                                                                                                                                                                                                                                                                                                                                                                   |             |         |       |      |         |      |         |      |         |      |         |      |
| BERT_ERR    | Enables/disables error injection in the BER test                                                                                                                                                                                                                                                       | Select NO ERR to disable.<br>Set rate at:<br>Single, 10E-1, 10E-2, 10E-3, 10E-4, 10E-5, 10E-6, 10E-7<br>Default: NO ERR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |             |         |       |      |         |      |         |      |         |      |         |      |

**SP Parameters** Table 4-10 provides the supervisory port configuration parameters, their function, and their default values.

*Table 4-10 SP Parameters*

| Designation | Function                                 | Values                                                                                                                                                                                                                                                                                                             |
|-------------|------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SPEED       | Selects supervisory port baud rate (bps) | DCE port: 300, 1200, 2400, 4800, 9600, 19200 bps<br>AUTO: Autobaud operation; the IMX-2T1/E1 automatically identifies the supervisory port baud rate. To do this, the transmission must start with three consecutive Carriage Returns.<br>DTE port: 300, 1200, 2400, 4800, 9600 bps, no Autobaud.<br>Default: AUTO |
| DATA        | Selects the number of bits per byte.     | 7 or 8 data bits.<br>Default: 8                                                                                                                                                                                                                                                                                    |
| PARITY      | Sets the parity.                         | ODD, EVEN, NONE (available only with 8 bits per byte)<br>Default: NONE                                                                                                                                                                                                                                             |
| INTERFACE   | Selects the supervisory port interface.  | DCE: The IMX-2T1/E1 operates as a DCE for the supervision terminal.<br>DTE: The IMX-2T1/E1 operates as a DTE, for connection via modem to the supervision terminal (future option).<br>Default: DCE                                                                                                                |
| AUX DEV     | Enables the SLIP protocol                | SLIP NMS: For using SLIP protocol with SNMP or Telnet management of the IMX-2T1/E1.<br>TERMINAL: For supervisory terminal support only.<br>Note: When AUX DEV is set to SLIP NMS, the terminal is disabled.                                                                                                        |

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## 4.4 IMX-2T1/E1 Operating Procedures

This section describes the following activities:

- Power Up
- Checking IMX-2T1/E1 configuration
- Normal IMX-2T1/E1 operating indications
- Monitoring IMX-2T1/E1 performance
- Power down

### Power Up

To power the IMX-2T1/E1, set the rear POWER switch to ON; the IMX-2T1/E1 performs self-test. Observe the front panel indications.

During the self-test, the IMX-2T1/E1 displays the software version in the X.Y format, as follows:

IMX-2T1/E1 REV: 0.X  
SELF TEST

After successfully completing the self-test, the IMX-2T1/E1 switches to the ALARM BUFFER , which is the default display.

### Notes

1. *If the IMX-2T1/E1 fails the self-test, the specific fault is displayed in the lower row of the LCD display. In this case, the IMX-2T1/E1 cannot be used. Refer to Chapter 5 for instructions.*
2. *If the configuration data stored by the IMX-2T1/E1 is corrupted, the DATABASE CKS ERR alarm message is generated. In this case, initialize the data base, then select again the desired parameters.  
To initialize the data base, do the following:  
a. Set section 3 of the internal switch SW1 to ON.  
b. Turn the IMX-2T1/E1 on, and then turn it off.  
c. Return section 3 to OFF (refer to Chapter 2 for detailed procedures).*

You can check the IMX-2T1/E1 configuration, as explained below. If the configuration does not require modification, the IMX-2T1/E1 is ready for operation immediately after the self-test is completed. To change the configuration, refer to Section 4.5.

## Checking Current Operating Configuration

Review Sections 4.3 and 4.5 for an explanation of the IMX-2T1/E1 configuration parameters.

---

### Note

*To prevent accidental change of parameters during the following procedure, do not press the ENTER pushbutton,.*

---

1. Using the CURSOR button, bring the cursor to the top row of the LCD display (if it is not already there).
2. Press SCROLL to display SYSTEM PARAMETER in the top row. The lower row shows the first system parameter, CLK MASTER, and its current selections.
3. Using the CURSOR button, bring the cursor to the leftmost field in the second row.
4. Press SCROLL repeatedly to see the other system parameters. Continue to scroll until the CLK MASTER parameter reappears.
5. Using the CURSOR button, bring the cursor to the leftmost field in the top row.
6. Scroll to display the next group of configuration parameters: LINK PARAM: LNK1. The lower row displays the first parameter of Link 1, CON, and its current value.
7. Using the CURSOR button, bring the cursor to the leftmost field in the second row.
8. Press SCROLL repeatedly to see the other parameters of Link 1. Continue to scroll until the CON parameter reappears.
9. Using the CURSOR button, bring the cursor to the rightmost field in the top row.
10. Scroll to display LNK2 in the top row. The lower row shows the first parameter of Link 2, CON, and its current value.
11. Using the CURSOR button, bring the cursor to the leftmost field in the lower row.
12. Press SCROLL repeatedly to see the other parameters of Link 2. Continue to scroll until the CON parameter reappears.
13. Using the CURSOR button, bring the cursor to the leftmost field in the top row.
14. Repeat steps 2 through 4 to display the supervisory port parameters: SP PARAMETER.
15. Repeat steps 2 through 4 to display the CH 2 parameters:  
For FT1 configured devices, the FRAME parameter is displayed first.  
For Data channel configured devices, the SPEED parameter is displayed first

## Normal Operating Indications

### Display

The default message displayed in the top row is ALARM BUFFER. You can change the display at any time.

The IMX-2T1/E1 automatically reverts to the ALARM BUFFER message if an alarm enters the alarm buffer or if no front panel-panel button is pressed for one minute, except during DIAGNOSTICS.

When the top row shows ALARM BUFFER, the lower row displays the following information:

- During normal operation, the second row is empty (no alarm messages).
- If the alarm buffer contains alarms, the word SCROLL is displayed in the leftmost field, CLEAR in the rightmost field.

Using the Cursor button, bring the cursor to the word SCROLL in left field of the second row and press ENTER. You may now scroll through the alarms stored in the alarm buffer by using the SCROLL button.

Table 5-1 describes the alarm messages. There are two alarm categories: ON/OFF and ON:

- An ON/OFF alarm message is displayed only when the alarm condition is present, and is automatically removed when the condition is cleared (after you scroll).
- An ON alarm message continues to be displayed even after the event that caused the alarm condition is cleared.

To clear an ON alarm message after the fault has been cleared, do the following:

1. Bring the cursor to the lower row, to CLEAR.
2. Press ENTER to clear the alarm messages in the alarm buffer. If there are no alarms in the alarms buffer, the lower row is empty.

### Normal Front panel Indications

During normal operation, all the IMX-2T1/E1 front panel indicators located in the LINK ALARMS area, and the TEST indicator are off. Only the DTE RD and TD indicators should light to indicate data transmission on the E1 interface (when the data channel is installed, RD,TD, and DCD LED's light up).

### Fault Indications

If any of the LINK ALARMS, FT1 or Data channel indicators, or the TEST indicator lights up, data transfer is interrupted.

- The TEST indicator lights when a test is active. If the test is activated from the local IMX-2T1/E1, you can see the test type by entering TEST OPTIONS (Chapter 5). You can disconnect a local, remote loop, or BERT test, as explained in Chapter 5.

**Link indicators:**

- The RED indicator of a link lights when a RED alarm (local unit loss of synchronization) condition is present on the corresponding link.
- The YEL indicator of a link lights when a YELLOW alarm (remote unit loss of synchronization) condition is present on the corresponding link.

**FT1 indicators:**

- The RED indicator of the FT1 lights when a RED alarm (local unit loss of synchronization) condition is present.
- The YEL indicator of the FT1 lights when a YELLOW alarm (remote unit loss of synchronization) condition is present.

**Data Port indicators:**

- The DCD indicator shuts off when a loss of synchronization occurs on the T1 link.
- When Loop R CH and/or BERT are activated, the DSR indicator is shut off.

**Monitoring  
IMX-2T1/E1  
Performance**

The IMX-2T1/E1 continuously records diagnostics performance data. This data is available under DIAGNOSTICS. The recorded parameters are described in Chapter 3 and Chapter 5.

**Power down**

Switch the rear power switch to OFF.

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## 4.5 Local Configuration Setup Procedure

Before starting setup, do the following:

- Review the relevant configuration parameters given in Section 4.3 and Section 4.5.
- Obtain a list of the required parameters from your network subscription data, and/or from your system administrator.

Configure the IMX-2T1/E1 in the following order:

1. Select the system parameters.
2. Select the link parameters.
3. Select supervisory parameters when a supervision terminal is used.
4. Select Channel 2 parameters (when installed).

The IMX-2T1/E1 presents only those parameters available in the selected mode, therefore it is important to perform the configuration according to the order specified above.

This section describes the following:

- Password protection
- General configuration procedure
- Specific configuration guidelines

## Password Protection

The IMX-2T1/E1 is intended for configuration via the supervision port, using a supervision terminal. In the absence of a supervision terminal, you must configure the IMX-2T1/E1 from the front panel. To do this, you must disable the password function.

If the password is enabled, you can display the current parameter values, but you cannot modify them. If you try to modify a parameter or to perform a test function from the front panel when the password is enabled, you will see CONFIG ERROR 11.

When the IMX-2T1/E1 default setting for the password is Password Disabled. To load the default parameters, use the DBINI section of the internal switch SW1, as explained in Section 2.4.

You can enable and disable the password from the supervision terminal with the DEF SP command (refer to Chapter 3 for detailed instructions).

## General Configuration Procedure

The following steps are used to perform any configuration activity:

### Notes

- 
1. *Before starting the configuration procedure, always disconnect all the user-initiated loopbacks (select OFF on TEST OPTIONS).*
  2. *Refer to Section 4.6 for an explanation of the configuration error messages the IMX-2T1/E1 displays when you make an error.*
- 

1. Bring the cursor to the top row (if not already there).
2. Scroll to display the desired group of parameters in the top row. The lower row shows the first parameter in the selected group and its current value.

### Note

---

*When the desired group of parameters must be independently selected for each link, the top row includes an additional field (at the rightmost side of the top row). This field is used to select the desired link number. In this case, press the CURSOR pushbutton to bring the cursor to the rightmost field, then SCROLL to display the desired link number.*

---

3. When the lower row has more than one field, bring the cursor to the leftmost field (parameter name) in the lower row, and then scroll to display the desired parameter in the selected group. The second row shows the parameter name and its current value.
4. Bring the cursor to the rightmost field (the parameter value) in the lower row.
5. Scroll to display the legal parameter values.
6. When the desired parameter value is displayed, press the ENTER pushbutton to record it. The lower row briefly displays CONFIG ENTER, then returns to the normal display.  
If you do not press ENTER, the new value is not recorded. In this case, when you return to the top row and scroll to the next parameter group, the message CONFIG LOSS is displayed.
7. Repeat steps 3 through 6 to assign values to all parameters in the current parameter group.
8. When you have finished the configuration for the current parameter group, repeat steps 1 through 7 to assign parameters to the next parameter group.
9. After completing the configuration for all parameter groups, bring the cursor to the top row and scroll until ALARM BUFFER is displayed.

**Note**


---

*ALARM BUFFER is automatically displayed in the following cases:*

- *If an alarm enters the alarm buffer;*
  - *If you do not press a pushbutton for one minute.*
- 

## Specific Configuration Guidelines

This section presents specific configuration guidelines for the selection of parameter values in each parameter group. Refer to Sections 1.2 and 1.3, which describe the IMX-2T1/E1 operating environment and system nomenclature.

### System Parameter

- CLK MASTER** For connection to carrier lines, select one of the connected links: LNK1 or LNK2. If a station clock is available, you may also select ST.
- For a point-to-point application with standalone equipment at both link ends, you can also select INT or EXT (or ST, if available) at one end, and LNK1 or LNK2 at the other end.
- Default: INT

- CLK FBACK** Select a source different from that selected as master. To disable switching to the fallback source, select NONE. In this case, the default fallback clock source is the IMX-2T1/E1 internal clock oscillator.
- Default: NONE
- DOWNLOAD** Enables or disables download.
- TS1: Enables download, on 8 kbps channel for in-band and out-band communication.
- NONE: Disables download.
- Default: NONE
- STATE REPORT** Yes: Sends SNMP traps of State alarms to SNMP manager station.
- NO: Disable
- Default: NO
- See Table 5-1 in Chapter 5 for alarm buffer messages and their corresponding types.
- EVENT REPORT** Yes: Sends SNMP traps of Event alarms to SNMP manager station.
- NO: Disable
- Default: NO
- See Table 5-1 in Chapter 5 for alarm buffer messages and their corresponding types.
- INBAND LOOPS** Enable: Allows to activate the FDL in-band loops from any T1 interface.
- Disable: Disables the FDL in-band loop feature.
- Default - Enable

#### Channel Parameters - Data Channel

- SPEED** Select the data rate for the equipment connected to the data channel. The rate is a multiple (n) of the basic rate (128 kbps). The range of multiples (n) is: 1 to 7, corresponding to the number of T1 time slots needed to carry the data stream connected to the channel.
- Default: NC
- CTS** Select according to the required operation mode of the channel. In general, =RTS should be used for polling mode operation. With the RTS line off, the local IMX-2T1/E1 channel sends MARK in its main link time slots.
- For Ethernet interface, this parameter displays as N/A.

|                     |                                                                                                                                                                                                                                                                             |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     | Default: ON                                                                                                                                                                                                                                                                 |
| <b>RCV_CLOCK</b>    | Select according to the equipment connected to the user data channel. See <i>Data Channel Timing Considerations</i> in Chapter 1.<br><br>Default: DCE                                                                                                                       |
| <b>ETERNET MODE</b> | Selects the method used to handle LAN traffic.<br>HALF_DUP: Half duplex mode<br>FULL_DUP: Full duplex mode<br>(This parameter is available only when Ethernet 10 Base T interface is installed).<br><br>Default: HALF                                                       |
| <b>BRIDGING</b>     | FILTERED: Select FILTERED to operate the T1 link as a remote bridge (recommended).<br>TRAN: Select TRAN to operate the T1 link as a LAN extender or repeater.<br>(This parameter is available only when Ethernet 10 Base T interface is installed)<br><br>Default: FILTERED |

#### Channel Parameters - Fractional T1

|                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>FRAME</b>    | Select the framing mode specified for use in your network.<br><br>In general, always select ESF unless the T1 equipment connected to the IMX-2T1/E1 does not support this mode.<br><br>Default: ESF                                                                                                                                                                                                                                                                  |
| <b>CODE</b>     | Select the framing mode specified for use in your network. For point-to-point applications, B8ZS should be used whenever supported by the carrier.<br><br>Default: B8ZS                                                                                                                                                                                                                                                                                              |
| <b>MASK</b>     | Select in accordance with the required link operating mode, and the hardware installed on the link interface. <ul style="list-style-type: none"> <li>• For compliance with DSX-1 specifications per AT&amp;T CB-119 and ANSI T1.102-1987, select the value corresponding to the length of the cable (in feet) connected between the T1 LINK connector and network entry point.</li> <li>• For compliance with FCC Rules Part 68, select FCC.</li> </ul> Default: 000 |
| <b>TS_START</b> | Selects the starting time slot for multiplexing<br>Range: from 01 to 24<br><br>Default: 01                                                                                                                                                                                                                                                                                                                                                                           |

**TS\_NUM**      Selects the number of time slots from the start time slot  
Range: from 01 to 07

Default: NC

**BERT PTRN** The selections available are the QRSS test pattern, and the following pseudo-random sequences:  
2E3-1, 2E4-1, 2E5-1, 2E6-1, 2E7-1, 511, 2E10-1, 2047,  
2E15-1, 2E17-1, 2E18-1, 2E20-1, QRSS, 2E21-1, 2E22-1,  
2E23-1, 2E25-1, 2E28-1, 2E29-1, 2E31-1, 2E32-1

Default: 2E3-1

**BERT ERR** Select NO ERR to disable.  
Set rate at:  
Single, 10E-1, 10E-2, 10E-3, 10E-4, 10E-5, 10E-6, 10E-7

Default: NO ERR

### Link Parameter

**CON** Link is always active: Not configurable by the user, always set to YES.

**FRAME** Select the framing mode specified for use in your network.

In general, always select ESF unless the T1 equipment connected to the IMX-2T1/E1 does not support this mode.

**CODE** Select the framing mode specified for use in your network. For point-to-point applications, B8ZS should be used whenever supported by the carrier.

**MASK** Select in accordance with the required link operating mode, and the hardware installed on the link interface.

If the link interface does not include a CSU:

- For compliance with DSX-1 specifications per AT&T CB-119 and ANSI T1.102-1987, select the value corresponding to the length of the cable (in feet) connected between the T1 LINK connector and network entry point.
- For compliance with FCC Rules Part 68, select FCC68.

If the link interface includes a CSU, it is necessary to adjust the T1 output transmit level for reliable operation of the network and for compliance with FCC Rules Part 68. This adjustment is used to minimize the interference caused by your transmit signal to other users that transmit their signals on other pairs of the same cable.

The required setting depends mainly on the length of the cable that connects your IMX-2T1/E1 to the first repeater down the link. Repeaters are usually located every mile; therefore, they are designed to optimally handle signals attenuated by a one-mile length of cable. If your IMX-2T1/E1 is closer, the repeater would receive your signal at a higher level. This will not significantly improve

the handling of your signal, but will increase the interference coupled from your pair to repeaters that serve other pairs in the cable.

To prevent this, you can select an attenuation value that will bring your signal level closer to the expected repeater signal level. This is achieved by connecting, as required, one, two, or three artificial line sections in series with your T1 transmit signal. Each line section introduces a nominal attenuation of 7.5 dB (equivalent to the attenuation of approximately 1000 ft of cable). Your system administrator or data carrier will tell you what is the proper setting for your IMX-2T1/E1.

**SYNC** Select FAST, unless your application requires exact conformance with AT&T TR-62411 requirements.

**I\_TS\_CODE** Select the value specified for your network.

### CH Map

Not configurable by the user, always set to YES.

### SP Parameters

**SPEED** Select the supervisory port data rate (in bps). Select AUTO whenever feasible (except when connected to a modem).

**Note**

*The automatic baud rate recognition procedure must be repeated after the DTR line in the DCE front panel connector had been switched to OFF and then ON again.*

**DATA** Select the required number of data bits (same as on the terminal).

**PARITY** Select the required parity (same as on the terminal).

**INTERFACE** Select DCE when directly connected to the supervision terminal.  
Select DTE when connected to a modem.

**Note**

*The INTERFACE parameter only changes the direction of the interface control (handshaking) signals, but not the function of the interface pins. Therefore, when connecting to a modem, it is necessary to use a cross cable.*

**AUX\_DEV** Defines an auxiliary device connection. For SLIP protocol (SNMP or Telnet management) select SLIP NMS.

For regular supervision terminal support, select TERMINAL.

Default: TERMINAL

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## 4.6 LCD Configuration Error Messages

The IMX-2T1/E1 detects configuration errors and displays a CONFIG ERROR XY message. The code XY identifies the error.

The following is a list of error messages and remedial actions.

- |                        |                                                                                                                                                                                                                                                  |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CONFIG ERROR 1</b>  | You are trying to select the same source as both master and fallback clock source. Check and change as required.                                                                                                                                 |
| <b>CONFIG ERROR 2</b>  | You are trying to select as clock source a link that is not connected to the IMX-2T1/E1. Check and change as required.                                                                                                                           |
| <b>CONFIG ERROR 3</b>  | Illegal combination of loopbacks: you are trying to activate simultaneously local and remote loopbacks on links and on the data channel, or a network-activated loopback may already be activated. Only one loopback can be connected at a time. |
| <b>CONFIG ERROR 4</b>  | Link 3 and 4 are not available to the IMX-2T1/E1 configuration.                                                                                                                                                                                  |
| <b>CONFIG ERROR 5</b>  | You are trying to map a link that is not active.                                                                                                                                                                                                 |
| <b>CONFIG ERROR 6</b>  | You are trying to activate a link that is not connected to the IMX-2T1/E1. Check and change as required.                                                                                                                                         |
| <b>CONFIG ERROR 7</b>  | You are trying to disconnect a link that has been selected as clock source, or a link that is mapped to the user's data channel. Check and change as required.                                                                                   |
| <b>CONFIG ERROR 8</b>  | You are trying to disconnect a loopback that is not active.                                                                                                                                                                                      |
| <b>CONFIG ERROR 11</b> | You are trying to change a parameter from the front panel when the password is enabled.                                                                                                                                                          |
| <b>CONFIG ERROR 21</b> | Illegal loop on Ethernet mode                                                                                                                                                                                                                    |
| <b>CONFIG ERROR 22</b> | Trying to activate a BERT/loop on CH2 while CH2 speed is 0. CH2 rate must be defined as other than nc=0.                                                                                                                                         |
| <b>CONFIG ERROR 23</b> | You are trying to connect a loopback that is already active.                                                                                                                                                                                     |
| <b>CONFIG ERROR 24</b> | Active loop can not change CH-2 configuration.                                                                                                                                                                                                   |
| <b>CONFIG ERROR 25</b> | Illegal command for installed CH-2 interface.                                                                                                                                                                                                    |
| <b>CONFIG ERROR 28</b> | Fractional time slot allocation out of range.                                                                                                                                                                                                    |

# Chapter 5

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## Diagnostics

This chapter provides the following information:

- Status indications and messages
- Performance diagnostics data
- Test functions
- Power-up self-test
- Troubleshooting procedures

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### 5.1 Status Indications and Messages

#### Indicators

IMX-2T1/E1 status is indicated by the RED and YEL alarm indicators of its links, by the E1 RD and TD indicators of the E1 data channel, and Fractional T1 or Data Port indicators when installed. Indicator functions are listed in Table 3-1, see also in Section 4.4.

#### Alarms

The IMX-2T1/E1 maintains an alarm buffer. The buffer can store one alarm event of each type. Up to 100 alarms can be displayed on the supervision terminal. In addition, alarms are also sent as traps to the network management station.

The IMX-2T1/E1 operator can view the contents of the alarm buffer on the front panel LCD display, and can delete the event alarms from the buffer when no longer needed. This procedure is explained in Section 4.4.

Table 5-1 presents the alarm messages displayed on the IMX-2T1/E1 display in alphabetical order, and lists the actions required to correct the alarm condition (the messages displayed on the supervision terminal have a similar syntax). In these messages, X is the link number, 1 or 2.

To correct the reported problem, perform the corrective actions in the given order, until the problem is corrected. If the problem cannot be corrected by carrying out the listed actions, have the IMX-2T1/E1 checked by the technical support personnel.

Table 5-1 IMX-2T1/E1 Alarm Buffer Messages

| Message                       | Description                                                                                                                          | Corrective Actions                                                                                                                                                                                                                                                 | Alarm Status and Type |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| ALARM BUFFER OVERFLOW         | More than 100 alarms entries have been written in the alarm buffer since the last clear command.                                     | Read the messages. If you are using the front panel, delete all the event alarms by selecting CLEAR. From the supervision terminal, send the CLR ALM command.                                                                                                      | ON<br>Event           |
| AIS OCCURRED, LNK:X CH2       | Unframed "all ones" sequence is received in the link data stream.                                                                    | Problem at the remote equipment.                                                                                                                                                                                                                                   | ON<br>OFF<br>State    |
| AIS RED ALM, LNK:X            | Local loss of frame synchronization alarm on the specified link caused by AIS condition.                                             | Problem at the remote equipment.                                                                                                                                                                                                                                   | ON<br>OFF<br>State    |
| BPV ERROR, LNK:X CH2          | Bipolar violations in the link receive signal. Updated once per second.                                                              | Have the link checked.                                                                                                                                                                                                                                             | ON<br>Event           |
| CLOCK WAS CHANGED TO FALLBACK | The IMX-2T1/E1 switch to the fallback clock source, because the master clock source failed.                                          | Check the link providing the master clock source.<br>The IMX-2T1/E1 replaces a recovered link clock when the corresponding link loses frame synchronization or its input signal is missing.                                                                        | ON<br>Event           |
| CLOCK WAS CHANGED TO INTERNAL | The IMX-2T1/E1 switched to the internal clock source, because both the master and the fall back clock sources failed.                | Check the link providing the master and/or fallback clock source.<br>The IMX-2T1/E1 replaces a recovered link clock with the internal clock when the link loses frame synchronization or its input signal is missing, or when no fallback clock source is defined. | ON<br>Event           |
| DATABASE CKS ERR              | IMX-2T1/E1 technical failure (internal data base error).                                                                             | 1. Load the default configuration instead of the current database (from the supervision terminal, enter the INIT DB command).<br>2. Replace the IMX-2T1/E1.                                                                                                        | ON<br>Event           |
| DB-INIT SW IS ON              | Section 3, DBINI, of switch SW1 is set to ON.                                                                                        | If it is no longer necessary to enforce the default database parameters, set to OFF.                                                                                                                                                                               | ON<br>Event           |
| DUPLICATE NAME IN THE NETWORK | Another node in the network is using the IMX-2T1/E1 logical name                                                                     | Check, and change the name if necessary.                                                                                                                                                                                                                           | ON<br>OFF<br>State    |
| EXCESSIVE BPV, LNK:X CH2      | The rate of bipolar violations in the link receive signal exceeds $1 \times 10^{-6}$ during a measurements interval of 1000 seconds. | Problem in network facilities.                                                                                                                                                                                                                                     | ON<br>OFF<br>State    |
| FRAME SLIP, LNK:X CH2         | Frame slips are detected (not displayed during local loss of frame synchronization). Updated once per second.                        | 1. Incorrect selection of clock source.<br>2. Problem at far end (unstable clock source).<br>3. Replace the IMX-2T1/E1 only if no problem has been detected in steps 1 and 2.                                                                                      | ON<br>Event           |

Table 5-1 IMX-2T1/E1 Alarm Buffer Messages (Cont.)

| Message                         | Description                                                                                                                                | Corrective Actions                                                                                                                                                                                                                                                                                               | Alarm Status and Type |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| HARDWARE FAILURE                | IMX-2T1/E1 technical failure (one of the internal programmable components).                                                                | Replace the IMX-2T1/E1.                                                                                                                                                                                                                                                                                          | ON<br>Event           |
| LAN NOT CONNECTED               | The Ethernet interface is not connected to an operating LAN.                                                                               | Check the cable connecting to LAN, the LAN media, and check that at least one station is active on the LAN.                                                                                                                                                                                                      | ON<br>OFF<br>State    |
| MANAGEMENT PORT IS DOWN         | IMX-2T1/E1 cannot communicate with the management station due to malfunction or incorrect setup.                                           | <ol style="list-style-type: none"> <li>1. Correct the parameters</li> <li>2. Check for disconnection</li> <li>3. Check for hardware failure</li> <li>4. check the management communication path</li> </ol>                                                                                                       | ON<br>OFF<br>State    |
| MANAGEMENT PORT IS LOOPED       | The management port is receiving its own messages. This may be caused by a loopback on the communication path used by the management port. | Find the location of the loopback, and request disconnection.                                                                                                                                                                                                                                                    | ON<br>OFF<br>State    |
| NETWORK LLB, LNK:X              | Line loopback command received from the network.                                                                                           | Wait until the loopback condition is removed.                                                                                                                                                                                                                                                                    | ON<br>OFF<br>State    |
| NETWORK PLB, LNK:X              | Payload loopback command received from the network.                                                                                        | Wait until the loopback condition is removed.                                                                                                                                                                                                                                                                    | ON<br>OFF<br>State    |
| PSWRD SW IS ON                  | Section 1, PASSW, of switch SW1 is set to ON.                                                                                              | If it is no longer necessary to enforce default password and node number, set to OFF.                                                                                                                                                                                                                            | ON<br>Event           |
| REAL TIME CLOCK BATTERY FAILURE | The battery that powers the internal real-time clock when IMX-2T1/E1 is not powered has failed.                                            | Have the IMX-2T1/E1 repaired.                                                                                                                                                                                                                                                                                    | ON<br>Event           |
| RECEIVE OOS CODE, LNK:X         | The IMX-2T1/E1 detects the OOS (out-of-service) code on the specified link.                                                                | <p>Problem at the remote equipment. Perform the following Check on the remote equipment:</p> <ol style="list-style-type: none"> <li>1. Check cable connections to the link connector.</li> <li>2. Check line and/or other communication equipment providing the linking link to the remote equipment.</li> </ol> | ON<br>OFF<br>State    |

Table 5-1 IMX-2T1/E1 Alarm Buffer Messages (Cont.)

| Message                       | Description                                                                          | Corrective Actions                                                                                                                                                                                                                                         | Alarm Status and Type  |
|-------------------------------|--------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
| RED ALARM,<br>LNK:X<br>CH2    | Local loss of frame synchronization alarm on the specified link.                     | 1. Check cable connections to the link connector.<br>2. Check line and/or other communication equipment providing the linking to the remote IMX-2T1/E1.<br>3. Replace the IMX-2T1/E1.                                                                      | ON<br>OFF<br><br>State |
| YELLOW ALARM,<br>LNK:X<br>CH2 | Remote loss of frame synchronization alarm on the specified link (only on T1 links). | Problem in remote equipment.<br>Check the remote equipment:<br>1. Check cable connections to the link.<br>2. Check line and/or other communication equipment providing the link to the remote IMX-2T1/E1.<br>3. Replace the IMX-2T1/E1.                    | ON<br>OFF<br><br>State |
| SELF TEST ERROR               | A problem has been detected during IMX-2T1/E1 self-test.                             | Replace the IMX-2T1/E1.                                                                                                                                                                                                                                    | ON<br><br>Event        |
| SIGNAL LOSS,<br>LNK:X<br>CH2  | Loss of link receive signal.                                                         | 1. Check cable connections to the link.<br>2. Check line and/or other communication equipment providing the link to the remote IMX-2T1/E1.                                                                                                                 | ON<br>OFF<br><br>State |
| SP-PAR SW IS ON               | Section 2, DEFSP, of switch SW1 is set to ON.                                        | If it is no longer necessary to enforce the default supervisory port parameters, change setting to OFF.                                                                                                                                                    | ON<br><br>Event        |
| DP ALTERNATE CALL FAILED      | The call attempts to the alternate dial-out number failed.                           | If the number is not busy, check the modem connected to the CONTROL DCE connector. If the called number is often busy, you may also increase the number of call retries.                                                                                   | ON<br><br>Event        |
| DP DIAL CYCLE FAILED          | The current cycle of call attempts failed.                                           | Check the modem connected to the CONTROL DCE connector. If the called number is often busy, you may also increase the number of call retries.                                                                                                              | ON<br><br>Event        |
| DP PRIMARY CALL FAILED        | The call attempts to the primary dial-out number failed.                             | If the number is not busy, check the modem connected to the CONTROL DCE connector. If the called number is often busy, you may also increase the number of call retries.                                                                                   | ON<br><br>Event        |
| CH 1 AIS RED ALARM            | An unframed "all- ones" signal is received at the E1 port interface.                 | This message usually indicates a problem in the equipment connected to the E1 port.                                                                                                                                                                        | ON<br>OFF<br>State     |
| CH 1 SIGNAL LOSS              | Loss of signal on the E1 port interface.                                             | This problem could be caused by improper or defective cable connections between the E1 port and the E1 equipment. If the connection between the E1 port and the E1 equipment is made via additional communication equipment, check that equipment as well. | ON<br>OFF<br><br>State |

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## 5.2 Performance Diagnostics Data

This section describes the performance evaluation and monitoring functions provided by the IMX-2T1/E1. The functions actually available depend on the framing in use, ESF or SF (D4):

- **ESF Framing:** when ESF framing is used, it is possible to monitor end-to-end data transmission performance. With this type of framing (see Section 1.2), the data stream transmitted end-to-end includes supervision and error detection information.

The error detection information is derived from the data payload included in each extended super-frame, by performing a cyclic redundancy check (CRC). The resulting CRC checksum is transmitted in addition to the raw data bits.

The receiving end recalculates the checksum and compares the results with the received checksum: any difference between the two checksums indicates that one or more bit errors are contained in the current data block (ESF) being evaluated.

- **SF Framing:** the SF-framed signal does not support the capabilities listed above. However, the IMX-2T1/E1 is capable of gathering the number of bipolar violations measured during the last minute.

### ANSI T1.403-1989 ESF Statistics

When using ESF framing, the IMX-2T1/E1 stores T1 line statistics for each T1 link interface in compliance with the ANSI T1.403-1989 requirements. The statistic data is gathered once per second. The statistics are collected over the last four seconds, and then transmitted via the 4 kbps control and supervision data link (FDL) of the ESF frames. This permits real-time monitoring of data transmission performance.

The performance parameters defined for AT&T Pub. 54016 statistics are listed below:

- **Current ESF error events (ERROR EV):**  
An ESF error event is any extended super-frame containing a CRC error and/or OOF event. The number of events is collected in a current ESF error events register.

#### **Note**

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*Register contents can be displayed at any time. When the ESF error events are displayed on the front-panel LCD, the register can be reset by pressing ENTER.*

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- **Current seconds (SECS):**  
The number of seconds in the current measurement interval. A measurement interval has 900 seconds (15 minutes).
- **Current errored seconds (ES):**  
An errored second is any second containing one or more CRC error events, or one or more OOF events, or one or more controlled slip

events. The data is collected for the current 15-minute interval.

- **Current unavailable seconds (UAS):**  
An unavailable second is any second in which a failed signal state exists. A failed signal state is declared when 10 consecutive severely errored seconds (SES) occur, and is cleared after 10 consecutive seconds of data are processed without a SES.
- **Current severely errored seconds (SES):**  
A SES is a second with 320 or more CRC error events, or one or more OOF events. The data is collected for the current 15-minute interval.
- **Current bursty errored seconds (BES):**  
A BES is a second with 2 to 319 CRC error events. The data is collected for the current 15-minute interval.
- **Current loss of frame counter (LOFC):**  
The loss of frame (LOF) counter counts the loss of frame alignment events. The data is collected for the current 15-minute interval.
- **Current slip second counter (CSS):**  
A CSS is a second with one or more controlled slip events. The data is collected for the current 15-minute interval.

IMX-2T1/E1 also provides local statistics support that meets the requirements of AT&T Pub. 54016. These are long-term statistics gathered over the long-term interval (96 intervals of 15 minutes, i.e., a total of 24 hours) for each T1 link interface. The additional parameters included in this class are:

- **Long-term errored seconds (ES):**  
The total number of ES in the current 24-hour interval.
- **Long-term fail seconds (UAS):**  
The total number of UAS in the current 24-hour interval.
- **Long-term severely errored seconds (SES):**  
The total number of SES in the current 24-hour interval.
- **Long-term loss of frame counter (LOFC):**  
The total number of LOF events in the current 24-hour interval.
- **Long-term slip second counter (CSS):**  
The total number of CSS in the current 24-hour interval.
- **Long-term (BES):**  
The total number of BES in the current 24-hour interval.
- **Long-term interval:**  
The number of valid 15-minute intervals in the previous 24 hour period.
- **Current degraded minutes:**  
The total number of degraded minutes in the current 24-hour interval. A degraded minute is a minute in which the bit error rate (BER) exceeded  $1 \times 10^{-6}$ . This number is updated every minute.

- Last degraded minutes:  
The total number of degraded minutes in the last 24-hour interval. This number is updated every 24 hours.

## SF Statistics

The performance evaluation and monitoring parameters collected by the IMX-2T1/E1 for SF framing are listed below:

- Bipolar violations (BPV) count (BPV last minute):  
The total number of bipolar violations counted in the last minute. This number is updated every minute.
- Bipolar violations worst count:  
The number of bipolar violations counted in the worst minute since the last resetting of the BPV count. This number is updated every minute.

## Summary of Performance Monitoring from the Front Panel

A summary of the performance diagnostics data displayed on the IMX-2T1/E1 front panel, under DIAGNOSTICS, is given in Table 5-2. To reset the performance diagnostics, press the ENTER pushbutton.

*Table 5-2 Summary of Performance Monitoring from the Front Panel*

| Display      | Description                                                                                                          | Range   |
|--------------|----------------------------------------------------------------------------------------------------------------------|---------|
| CURR ES      | Number of ES measured in the current 15-minute interval. Refresh rate: 1 sec.                                        | 0-900   |
| CURR UAS     | Number of UAS measured in the current 15-minute interval. Refresh rate: 1 sec.                                       | 0-900   |
| CURR SECS    | The time in seconds that expired from the start of the current 15-minute interval. Refresh rate: 1 sec.              | 0-900   |
| CURR SES     | Number of SES measured in the current 15-minute interval. Refresh rate: 1 sec.                                       | 0-900   |
| CURR BES     | Number of BES measured in the current 15-minute interval. Refresh rate: 1 sec.                                       | 0-900   |
| CURR LOFC    | Number of loss of frame synchronization event measured in the current 15-minute interval. Refresh rate: 1 sec.       | 0-255   |
| CURR CSS     | Number of CSS synchronization event measured in the current 15-minute interval. Refresh rate: 1 sec.                 | 0-255   |
| L. TERM ES   | Number of ES measured in the current 24-hour interval. Refresh rate: 15 min.                                         | 0-900   |
| L. TERM UAS  | Number of UAS measured in the current 24-hour interval. Refresh rate: 15 min.                                        | 0-65535 |
| L. TERM SES  | Number of SES measured in the current 24-hour interval. Refresh rate: 15 min.                                        | 0-65535 |
| L. TERM BES  | Number of BES measured in the current 24-hour interval. Refresh rate: 15 min.                                        | 0-65535 |
| L. TERM LOFC | Number of loss of frame synchronization events measured in the current 24-hour interval. Refresh rate: 15 min.       | 0-255   |
| L. TERM CSS  | Number of CSS measured in the current 24-hour interval. Refresh rate: 15 min.                                        | 0-255   |
| L. TERM INT  | The number of 15-minute intervals that expired from the start of the current 24-hour interval. Refresh rate: 15 min. | 0-96    |
| ERROR EV     | The number of ESF error events recorded since the last time the register was cleared. Refresh rate: 1 sec.           | 0-1000  |
| BPV COUNT    | The total number of BPV error in the last minute. Refresh rate: 1 min.                                               | 0-9999  |

|             |                                                                                |        |
|-------------|--------------------------------------------------------------------------------|--------|
| CUR DEG MIN | Number of degraded minutes measured in the last 24 hours. Refresh rate: 1 min. | 0-1440 |
| BPV WORST   | The number of BPV error measured in the worst minute. Refresh rate: 1 min.     | 0-9999 |
| LST DEG MIN | Last 24-hour count of degraded minutes. Refresh rate: 24 hours.                | 0-1440 |

### Displaying the Performance Data on the Front Panel

Use the following procedure to display the performance diagnostics data on the IMX-2T1/E1 front-panel LCD:

1. Bring the cursor to the left-hand field of the top row (if not already there).
2. Scroll to display DIAGNOSTICS in the top row.  
The rightmost field of the top row indicates LNK1, meaning that the displayed diagnostics data pertains to Link 1.  
The lower row shows the first performance item for Link 1, and its current value. The displayed item depends on the framing mode used on this link.
3. Bring the cursor under the leftmost field in the lower row.
4. Scroll to see the other statistics.  
Each time you press SCROLL, the lower row shows the current value of the next item.  
Continue until the first item reappears.
5. Bring the cursor under the rightmost field of the top row (if not already there).
6. Scroll to display LNK2.  
The lower row shows the first performance item for Link 2, and its current value. The displayed item depends on the link type and framing mode.
7. Repeat steps 3, 4 above to see the other statistics of Link 2.  
Each time you press SCROLL, the lower row shows the current value of the next item. Continue until the first item reappears.

### Resetting the Performance Data Registers

The registers storing diagnostics data can be reset. To reset a register, display the register and press ENTER.

To ensure that the collected data remains meaningful and correlated after a specific register is reset, the IMX-2T1/E1 automatically performs the following actions:

- Since the data collected on a given link for the current interval and for the current 24-hour interval is correlated, pressing ENTER while any of the following CURR or L.TERM data items is displayed clears all the performance diagnostics registers, not only that appearing on the display. These registers are: ES, UAS, SES, BES, LOFC, CSS, and the registers for CURR SECS, CURR DEG MIN, LST DEG MIN, and L.TERM INT.
- In case the BPV COUNT register of a given link is reset, the BPV WORST register of that link is also reset, and vice versa.

The only register that can be reset independently of the other registers is the ERROR EV register (available for T1 links using ESF framing).

## Displaying the Performance Data on a Supervision Terminal

The performance data can be displayed on the supervision terminal by means of the DSP PM command, as explained in Chapter 3. By adding the /CA switch to the command, you can reset all the performance diagnostics registers.

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### 5.3 Test Functions

The IMX-2T1/E1 supports five types of test functions:

- Local channel loopback (LOOP L CH 1/CH 2);
- Remote channel loopback (LOOP R CH 1/CH 2);
- Local link loopback (LOOP L LINK);
- Remote link loopback (LOOP R LINK);
- BER testing (LOOP BERT CH 2, BERT ON - for CH 1)
- Channel 2 In-band loopback (LOOP INBAND CH 2).

The user-controlled test functions are accessed from the TEST OPTIONS menu.

The available test functions are described in the following paragraphs. The test functions are identified by the designation displayed by the IMX-2T1/E1.

#### Loop L CH 1 or CH 2

When activated, the local channel loopback returns the received signal after passing through the user channel interface of the IMX-2T1/E1. The local loopback is obtained by connecting the transmit signal to the input of the receive path of the user channel interface. The test signal is provided by the DTE connected to the IMX-2T1/E1, that must receive its own transmission without errors while the loopback is activated. During the loopback, the local IMX-2T1/E1 continues sending the user's data to the link.

Figure 5-1 shows a typical local channel loopback on CH 1 and CH 2.

This test is generally used to check the connections of the DTE to the IMX-2T1/E1.

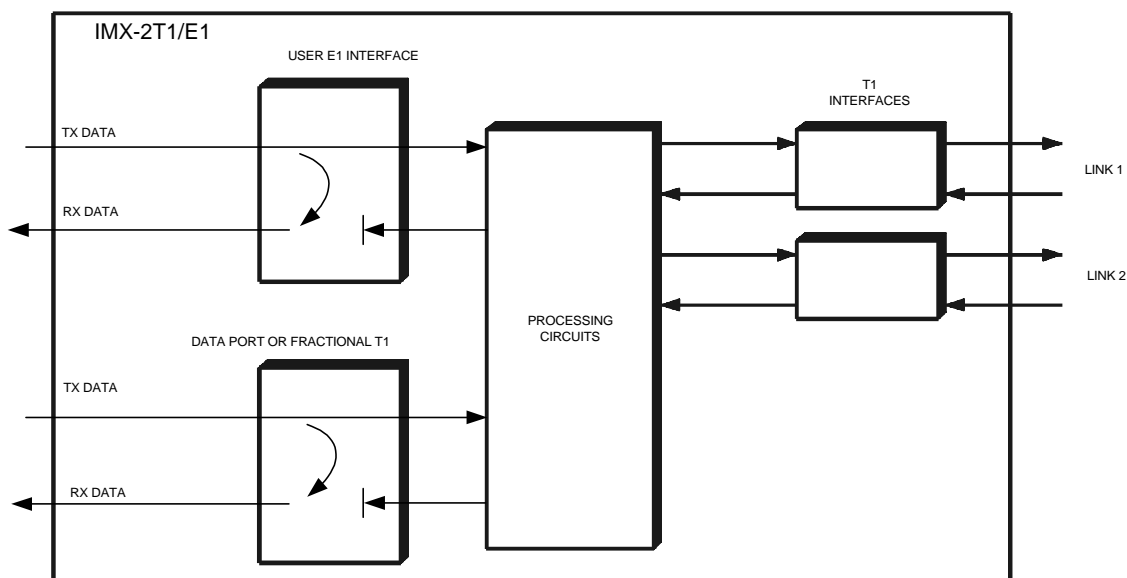


Figure 5-1 LOOP L CH 1 and L CH 2 Loopback

**Loop R CH 1 or CH 2**

When activated, the remote channel loopback returns the received data channel signal toward the remote user DTE. The remote loopback is performed by internally connecting the data channel receive signal, to the input of the transmit path. The received data channel signal remains connected to the local user's DTE. The test signal is provided by the user DTE connected to the remote end of the link, that must receive its own transmission without errors while the loopback is activated.

Figure 5-2 shows a typical remote channel loopback.

This test fully checks the data link, including the cables connecting the two IMX-2T1/E1 to the links, the transmission plant connecting the two IMX-2T1/E1, and the cable connecting the remote user DTE to the remote IMX-2T1/E1.

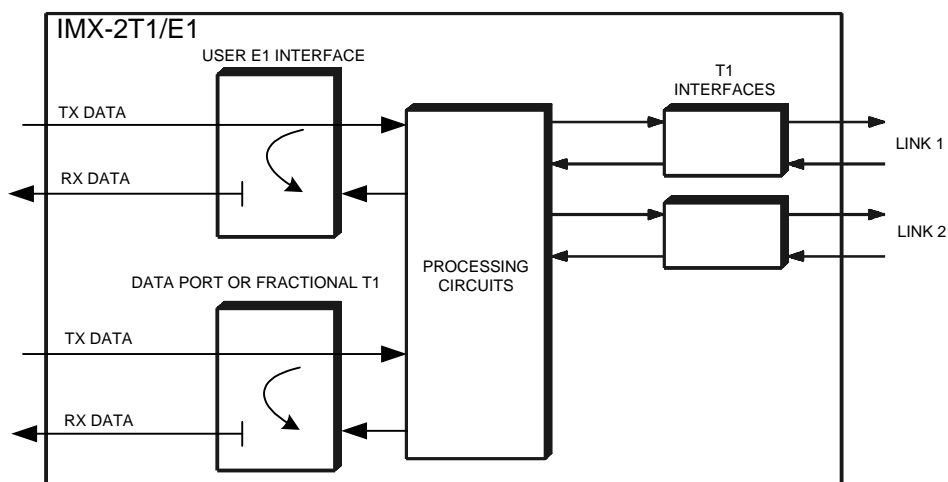


Figure 5-2 LOOP R CH 1 and R CH 2 Loopback

**Loop L Link**

When activated, the local link loopback returns the signals transmitted by

each T1 link interface of the local IMX-2T1/E1 to the receive input of the same interface. Therefore, this loop tests all the local IMX-2T1/E1 circuits.

The local loop is obtained by connecting the link transmit signal to the input of the receive path. The test signal is provided by the local DTE, that must receive its own transmission without errors while the loopback is activated. During the loopback, the local IMX-2T1/E1 sends an unframed “all-ones” signal to the links.

Figure 5-3 shows a typical local link loopback.

This test fully checks local IMX-2T1/E1 operation, and the connections to the local user's DTE.

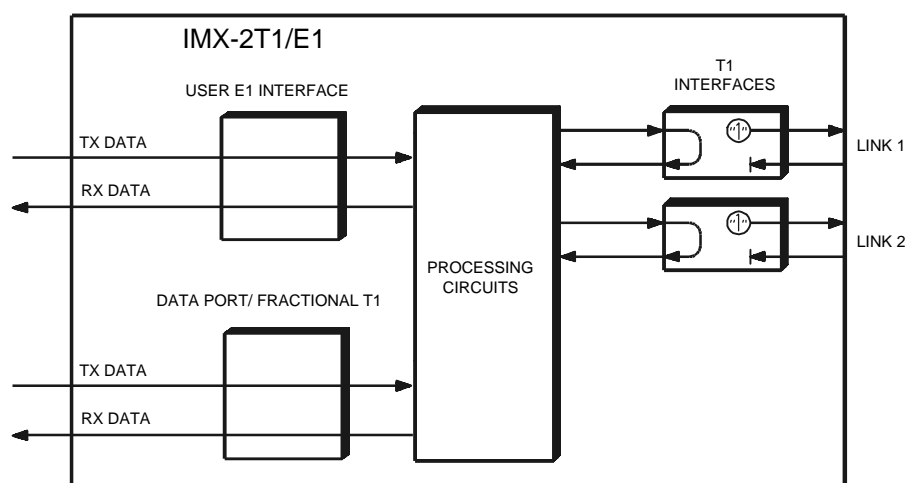


Figure 5-3 LOOP L LINK Loopback

## LOOP R LINK

When activated, the remote link loopback returns the signals received by each IMX-2T1/E1 link interface toward the remote user DTE, on the same link. The loopback is performed by connecting the link receive signal, after regeneration, to the input of the transmit path. The test signal is provided by the user DTE connected to the remote end of the link, that must receive its own transmission. Figure 5-4 shows a typical remote link loopback.

This test fully checks the data link, including the cables connecting the two IMX-2T1/E1 to the links, the transmission plant connecting the two IMX-2T1/E1, and the cable connecting the remote user DTE to the remote IMX-2T1/E1.

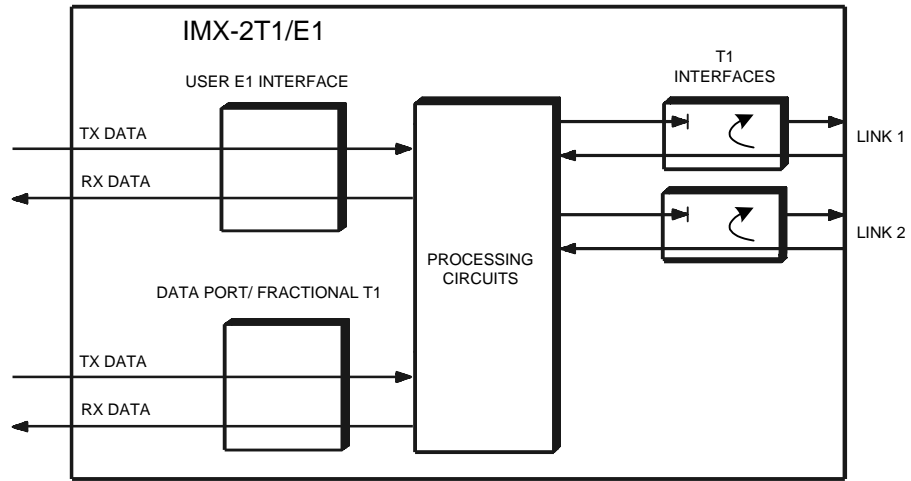


Figure 5-4 LOOP R LINK Loopback

**BER Testing CH 1** The BER testing is performed by replacing the transmit user's data with a pseudo-random sequence having a length of 211-1 (2047 bits) provided by a test sequence generator. The test sequence is returned to an error detector by means of a loopback connection, at the desired location along the signal path; for example, for testing the local IMX-2T1/E1, a local link loopback should be used. However, you can also perform BERT testing by activating this test on both IMX-2T1/E1 units connected in a link.

The error detector compares the received sequence with a copy of the transmitted sequence, and counts the errored seconds detected during the test.

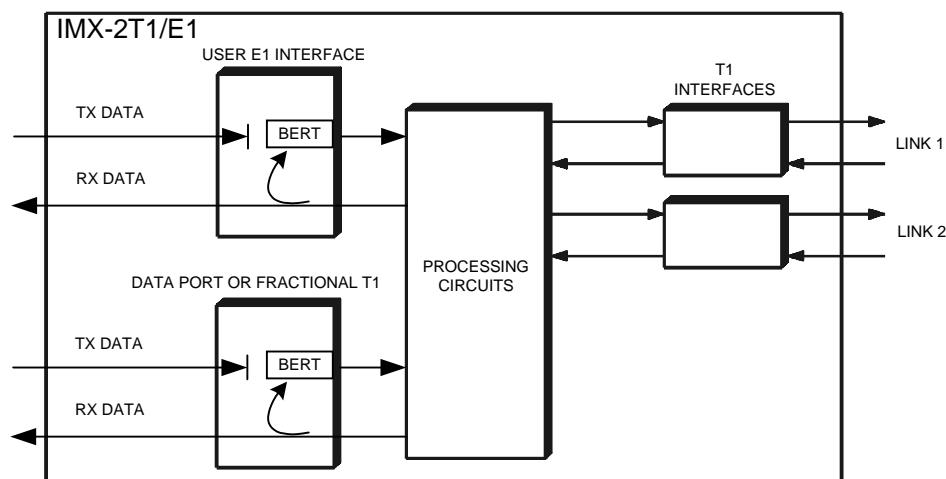


Figure 5-5 BERT on CH1 or CH2

## LOOP INBAND CH 2

The In-band activated channel loopback is similar to the remote channel loopback, except that it is connected on the remote IMX-2T1/E1 and responds to a command from the local IMX-2T1/E1. The loopback is directed at the local user DTE connected to the same channel as the loopback.

The remote loopback is activated by transmitting special sequences for approximately 2 seconds.

When operating the T\_INBAND command, the interface transmission rate must be defined. Transmission rates at both ends of the link should match in order to prevent errors.

## LOOP BERT CH 2

BER testing can be performed on one channel at a time. To perform the test over the whole link, end to end, use the in-band activated loopback. For a local test, use one of the local main link loopbacks, or any other loopback that returns data to the local DTE.

During the test, the local DTE is disconnected, and the DSR line is off. An internal pattern generator connects a user selected test sequence to the transmit input of the local data channel interface. To calibrate the system, the can inject errors at a selectable rate. Transmission rate must be defined in the data/FT1 channel interface.

The receive output is connected to a pattern evaluator. The evaluator compares the received and transmitted patterns, and detects errors. Results are presented as follows:

- Detailed data is displayed on the supervisory terminal, including information such as the number of seconds of lost frame synchronization (see the DSP BERT CH 2 description in Chapter 3).
- The front panel LCD displays GOOD ( no errors) or BAD ( at least one error detected during the specified interval).

### Selecting BERT parameters

The BERT parameters consist of the test pattern, and error injection. See Figure 5-5 for an illustration of the BERT on CH 2.

1. To display the CH 2 parameters menu:

Using the CURSOR button, bring the cursor to the leftmost field in the top row.

Press SCROLL until CH 2 PARAMETERS is displayed.

2. To select test pattern (PATTERN) or error injection (ERR RATE):

Using the CURSOR button, bring the cursor to the leftmost field in the second row.

Press SCROLL until BERT PATTERN or BERT ERR is displayed.

The lower right field shows the current value.

To change the value, press CURSOR to move the cursor to the lower right field, then press SCROLL to scroll the required value.

3. Press ENTER to set the parameters.

### To initiate a test option:

1. Using the CURSOR button, bring the cursor to the leftmost field in the top row.  
Press SCROLL until TEST OPTION is displayed.

2. Press CURSOR to move the cursor to the upper right field, then press SCROLL to scroll CH 2.

3. Using the CURSOR button, bring the cursor to the leftmost field in the second row.  
Press SCROLL until BERT or T\_INBAND is displayed.

4. Press CURSOR to move the cursor to the lower right field, then press SCROLL to scroll ON.  
Press ENTER.

The BERT display begins in the lower row of the LCD. Two fields are displayed: test results (GOOD/ BAD), and error injection status (I). When error injection is on, the BER result will always show BAD.

To induce error injection, press ENTER.

The lower row of the LCD displays the letter 'I', indicating that injection is on. To stop error injection, press ENTER again.

5. To stop the test, repeat steps 1-4, and select OFF.

## Test Options Operating Instructions

Before starting the execution of a test, note that in general you should activate only one loopback at a time. However, the IMX-2T1/E1 will allow you to activate remote loopback on links, and local loopback on the data port.

To activate or deactivate a specific test, use the following procedure:

1. Bring the cursor under the left-hand field of the top row (if not already there).
2. Scroll to display TEST OPTIONS in the top row.  
The rightmost field of the top row indicates OFF, to indicate that no test is active. The lower row is empty.
3. To select the type of test, bring the cursor under the rightmost field in the top row, and scroll to display the desired type. (For BERT testing, refer to Note 1, and for BERT CH 2 refer to the previous section). The rightmost field of the top row indicated LNKS when the test is to be activated on the links, or CH 1 when the test is to be activated on the E1 channel. CH 2 is displayed for the data or FT1 channel. On CH 2, there is an added command, T-INBAND, required for sending a Remote Loopback command to the remote device.
4. After the desired type is selected, bring the cursor under the leftmost field in the second row, and scroll to display the desired type of loopback or BERT testing, LOCAL LOOP or REMOTE LOOP or BERT testing. (For BERT testing, refer to Note 2). The lower row shows the current state of the selected test, OFF or ON. When BERT on CH 2 is initiated at both ends of the channel, both devices must be set to the same rate.
5. To change the test state, bring the cursor under the rightmost field in the lower row and scroll to display the desired state.  
The lower row shows the new state of the selected test; for example, OFF
6. Press ENTER to activate the displayed test. (For BERT testing, refer to Note 3).  
The TEST indicator turns on if the test is activated, or turns off if no test is activated.

To deactivate all the tests, perform steps 1, 2, 3 above and press ENTER. The TEST indicator will turn off.

### Notes

1. *Choose LNKS.  
The BERT test is displayed as BERTC, referring to CH1.*
2. *Before activating the BERT test, the local link loopback must be activated, or the BERT test must be activated at both ends of the link.*
3. *Once the BERT CH 1 test is activated, the E symbol in the second row will display the error per second of the current BERT test.*
4. *Loopback, local loopback CH1, and BERT CH1 cannot operate simultaneously.*

## Network-Controlled T1 Loopback Functions

The IMX-2T1/E1 supports two types of network-controlled loopbacks: network latching loopback (LLB) and network payload loopback (PLB). Note that these loopbacks are not initiated from the IMX-2T1/E1.

The available network-controlled loopback functions are described below. The loopbacks are identified by the designation displayed by the IMX-2T1/E1.

### Network LLB

The latching network line loopback is connected upon the reception of the appropriate code from the network. The loopback connections are shown in Figure 5-6.

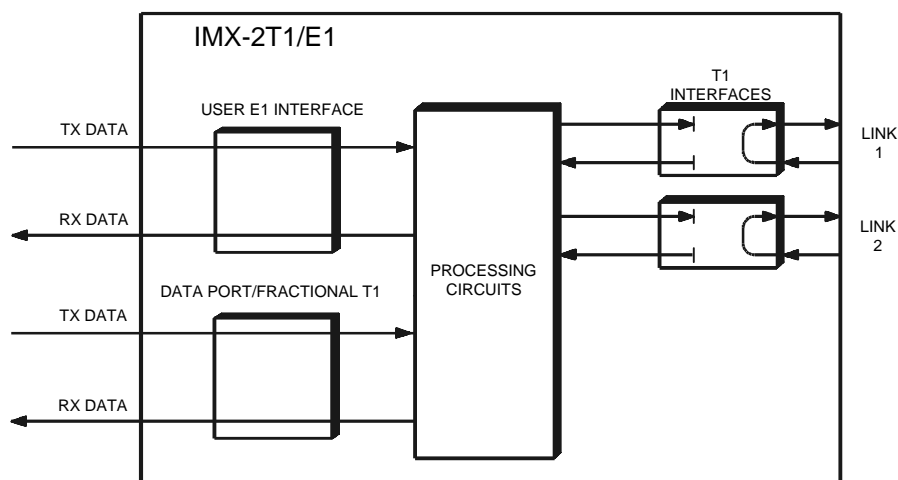


Figure 5-6 Latching Network Line Loopback

The activation/deactivation code depends on the main link framing mode:

**SF (D4)** The network line loopback is activated when the IMX-2T1/E1 detects the continuous transmission of the repeating sequence 10000..... for at least 5 seconds, and is deactivated by the transmission of the sequence 100..... for at least 5 seconds.

**ESF** The network line loopback is activated when the IMX-2T1/E1 detects the pattern 00001110 11111111 on the FDL, and is disconnected by the reception of the pattern 00111000 11111111 (rightmost bit transmitted first). Alternately, the network line loopback is also activated by the pattern listed above for SF (D4) framing.

The latching network line loopback has priority over all the user-controlled loopbacks, therefore, when a network loopback command is received, the user-controlled loopbacks are disconnected; they are automatically reconnected upon the reception of the network loopback disconnection command.

While the network line loopback is connected, the IMX-2T1/E1 displays NETWORK LLB.

## Network PLB

The latching network payload loopback is connected upon the reception of the appropriate code from the network. The loopback connections are shown in Figure 5-7.

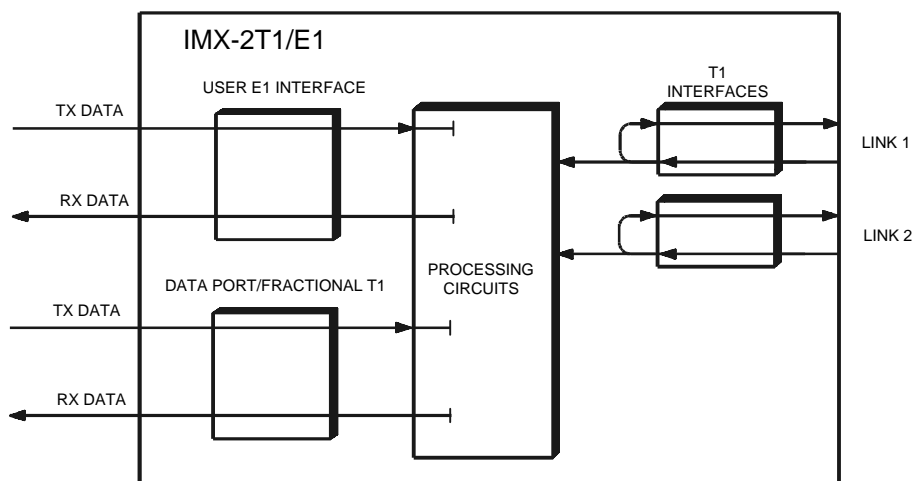


Figure 5-7 Latching Network Payload Loopback

The loopback can only be connected when ESF main link framing is used. The connection is performed by means of commands transmitted through the FDL link:

- The network payload loopback is activated when the IMX-2T1/E1 detects the pattern 00010100 11111111 on the FDL.
- The network payload loopback is disconnected by the reception of the pattern 00110010 11111111 (rightmost bit transmitted first).

The latching network payload loopback has priority over all the user-controlled loopbacks. Therefore, when a network loopback command is received, the user-controlled loopbacks are disconnected; they are automatically reconnected upon the reception of the network loopback disconnection command.

While the network line loopback is connected, the IMX-2T1/E1 displays NETWORK PLB.

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## 5.4 Power Up Self Test

The IMX-2T1/E1 performs a power-up self test during power up. The self-test sequence, described in Section 4.4, tests the critical circuit functions and the display.

In case of failure, the IMX-2T1/E1 displays an alarm message in the lower row of the LCD display.

## 5.5 Troubleshooting Procedures

In case a problem occurs, check the displayed alarm messages and refer to Section 5.1 and Table 5-1 for their interpretation.

If the trouble cannot be corrected by performing the actions listed in Table 5-1, use Table 5-3. Identify the symptoms and perform the actions listed under Corrective Measures in the order given in Table 5-3 until the problem is corrected.

*Table 5-3 Troubleshooting Chart*

| No | Trouble Symptoms                       | Probable Cause            | Corrective Measures                                                                                                                                                   |
|----|----------------------------------------|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | The IMX-2T1/E1 is "dead".              | 1. No Power.              | Check that both ends of the power cable are properly connected.                                                                                                       |
|    |                                        | 2. Blown Fuse.            | Disconnect power cable from both ends and replace the fuse with another fuse of proper rating.                                                                        |
|    |                                        | 3. Defective IMX-2T1/E1.  | Replace the IMX-2T1/E1.                                                                                                                                               |
| 2  | IMX-2T1/E1 reports red alarm.          | 1. External problem.      | Activate the local link loopback. Check that the previously lit RED indicator turns OFF. If the indicator turns OFF, the problem is external.                         |
|    |                                        | 2. Defective IMX-2T1/E1.  | Perform power-up self test and replace the IMX-2T1/E1, if necessary.                                                                                                  |
| 3  | IMX-2T1/E1 reports yellow alarm.       | 1. Problem at remote end. | Activate the local link loopback on the remote IMX-2T1/E1. Check that all the RED indicators turn OFF. If a RED indicator remains ON, replace the remote IMX-2T1/E1.  |
|    |                                        | 2. Defective IMX-2T1/E1.  | Perform power-up self test and replace the IMX-2T1/E1, if necessary.                                                                                                  |
| 4  | Local user's E1 does not receive data. | 1. Cable problem.         | Activate the local data channel loopback. If the local E1 does not receive its own transmission, check the cable connecting it to the E1 connector on the IMX-2T1/E1. |
|    |                                        | 2. Defective DTE.         | Perform self test on the DTE.                                                                                                                                         |
|    |                                        | 3. Defective IMX-2T1/E1.  | Perform the power-up self test and replace the IMX-2T1/E1.                                                                                                            |
| 5  | CH 2 does not receive data             | 1. Incorrect timing mode  | Select the timing mode (DCE or E-DCE) according to the type of equipment connected to the IMX-2T1/E1.                                                                 |
|    |                                        | 2. Cable problem          | Activate the local data channel loopback. If the local DTE does not receive its own transmission, check the cable connecting it to the IMX-2T1/E1 DTE connector.      |
|    |                                        | 3. Defective DTE          | Perform self-test on the DTE                                                                                                                                          |
|    |                                        | 4. Defective IMX-2T1/E1   | Perform power-up self-test and replace the                                                                                                                            |

Table 5-3 Troubleshooting Chart (Cont.)

| No | Trouble Symptoms                                                                  | Probable Cause                          | Corrective Measures                                                                                                                                         |
|----|-----------------------------------------------------------------------------------|-----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6  | Local IMX-2T1/E1 reports the reception of the OOS code.                           | 1. Problem with remote equipment.       | 1. Check the cable connections at the remote equipment.<br>2. Check the line and/or the communication equipment providing the link to the remote equipment. |
| 7  | Ethernet interface COLL indicator lights most of the time, and LAN cannot operate | 1. Loopback connected on the IMX-2T1/E1 | If the TST indicator lights, check and disconnect the loopback                                                                                              |
|    |                                                                                   | 2. Cable problem                        | Check and/or replace the cable connecting the IMX-2T1/E1 10BaseT connector to the LAN                                                                       |
|    |                                                                                   | 3. Problem on LAN                       | Disconnect the IMX-2T1/E1 from the LAN; if problem persists, troubleshoot the LAN                                                                           |
|    |                                                                                   | 4. Defective IMX-2T1/E1                 | Perform power-up self-test and replace the IMX-2T1/E1 if defective                                                                                          |
| 8  | Ethernet interface LINK indicator not lit                                         | 1. No active station on the LAN         | Check that at least one LAN station is active.                                                                                                              |
|    |                                                                                   | 2. Cable problem                        | Check and/or replace the cable connecting the IMX-2T1/E1 10BaseT connector to the LAN                                                                       |
|    |                                                                                   | 3. Problem on LAN                       | Check LAN media                                                                                                                                             |
|    |                                                                                   | 4. Defective IMX-2T1/E1                 | Perform power-up self-test and replace the IMX-2T1/E1 if defective                                                                                          |

# Appendix A

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## Connector Wiring

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### A.1 T1 Link and Fractional T1 Connectors

The T1 LINK/Fractional T1 connectors have eight-pin RJ-48C connectors. Table A-1 outlines the pin allocations for the connector.

*Table A-1 LINK Connectors, Pin Allocation*

| Pin  | Line Connector Pin Function |
|------|-----------------------------|
| 1    | Receive Data (A wire)       |
| 2    | Receive Date (B wire)       |
| 3    | Frame Ground                |
| 4    | Transmit Data (A wire)      |
| 5    | Transmit Date (B wire)      |
| 6    | Frame Ground                |
| 7, 8 | Not Connected               |

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### A.2 E1 Port Connectors

The E1 port has one RJ-48C connector (balanced interface), and two BNC connectors (unbalanced interface) labeled RX-OUT and TX-IN. The connector wiring is outlined in Table A-1.

*Table A-2 Wiring Designations for E1 Port*

| Function                      | RJ-48C Pin | BNC Connector         |
|-------------------------------|------------|-----------------------|
| Receive Data Input (A wire)   | 1          | RX-IN center contact  |
| Receive Data Input (B wire)   | 2          | RX-IN outer contact   |
| Frame Ground                  | 3          |                       |
| Transmit Data Output (A wire) | 4          | TX-OUT center contact |
| Transmit Data Output (B wire) | 5          | TX-OUT outer contact  |
| Frame Ground                  | 6          |                       |

### A.3 RS-232 (V.24) Supervisory Port Connector

The IMX-2T1/E1 supervisory port has a standard RS-232 interface. The physical interface is a 9-pin female connector, wired as described in Table A-3.

Table A-3 Supervisory Port Interface Signals (ITU-T V.24/EIA RS-232 Interface)

| Pin | Line                      | Notes                                                                                                    | Connected to Terminal | Connected to Dial-Out Modem |
|-----|---------------------------|----------------------------------------------------------------------------------------------------------|-----------------------|-----------------------------|
| 1   | Data Carrier Detect (DCD) | From IMX-2T1/E1                                                                                          | 8                     | 4                           |
| 2   | Receive Data (RD)         | From IMX-2T1/E1                                                                                          | 3                     | 2                           |
| 3   | Transmit Data (TD)        | To IMX-2T1/E1                                                                                            | 2                     | 3                           |
| 4   | Data Terminal Ready (DTR) | To IMX-2T1/E1                                                                                            | 20                    | 6                           |
| 5   | Signal Ground (SIG)       | Common reference and DC power supply ground. Can be isolated from chassis ground (AA) (Strap-selectable) | 7                     | 7                           |
| 6   | Data Set Ready            | From IMX-2T1/E1                                                                                          | 6                     | 20                          |
| 7   | Request to Send (RTS)     | To IMX-2T1/E1                                                                                            | 4                     | 8                           |
| 8   | Clear to Send (CTS)       | From IMX-2T1/E1                                                                                          | 5                     | -                           |
| 9   | Ring indicator (RI)       | To IMX-2T1/E1                                                                                            | -                     | 22                          |

### A.4 Station Clock Connector

The station clock port physical interface is an eight-pin RJ-48C connector, wired as described in Table A-4

Table A-4 Station Clock Connector, Pin Allocation

| Pin | Designation  | Function                            | Direction     |
|-----|--------------|-------------------------------------|---------------|
| 1   | CLK (T)      | Station Clock (Tip)                 | To IMX-2T1/E1 |
| 2   | CLK (R)      | Station Clock (Ring)                | To IMX-2T1/E1 |
| 3   | N/A          | N/A                                 | N/A           |
| 4   | N/A          | N/A                                 | N/A           |
| 5   | N/A          | N/A                                 | N/A           |
| 6   | RELAY        | Normally open (connects to pin 8)   |               |
| 7   | RELAY        | Normally closed (connects to pin 8) |               |
| 8   | RELAY COMMON | Common alarm relay contact          |               |

## A.5 10BaseT User Data Channel Connector

The IMX-2T1/E1 has an Ethernet interface, terminated in an eight-pin RJ-45 connector, wired as described in Table A-5.

Table A-5 Ethernet Interface Connector

| Pin  | Designation | Direction       | Function               |
|------|-------------|-----------------|------------------------|
| 1    | TxD+        | To IMX-2T1/E1   | Transmit Data - wire + |
| 2    | TxD-        | To IMX-2T1/E1   | Transmit Data - wire - |
| 3    | RxD+        | From IMX-2T1/E1 | Receive Data +         |
| 4    | -           | N/A             | Not connected          |
| 5    | -           | N/A             | Not connected          |
| 6    | RxD-        | From IMX-2T1/E1 | Receive Data -         |
| 7, 8 | -           | N/A             | Not connected          |

## A.6 RS-530 User Data Channel Connector and V.36/RS-449 Adapter Cable

When the IMX-2T1/E1 is ordered with a RS-530 interface, the physical interface is a 25-pin female connector, wired as described in Table A-6. Table A-7 details the wiring for the V.36/RS-449 channel interface adapter cable.

Table A-6 RS-530 Channel Connector Pinout

| Pin | Direction       | Designation | Function                      | RS-530 |
|-----|-----------------|-------------|-------------------------------|--------|
| 1   | ↔               | FG          | Frame Ground                  | AA     |
| 2   | To IMX-2T1/E1   | SDA         | Send Data A                   | BA(A)  |
| 3   | From IMX-2T1/E1 | RDA         | Receive Data A                | BB(A)  |
| 4   | To IMX-2T1/E1   | RTSA        | RTS A                         | CA(A)  |
| 5   | From IMX-2T1/E1 | CTSA        | CTS A                         | CB(A)  |
| 6   | From IMX-2T1/E1 | DSRA        | DSR A                         | CC(A)  |
| 7   | ↔               | SG          | Signal Ground                 | AB     |
| 8   | From IMX-2T1/E1 | DCDA        | DCD A                         | CF(A)  |
| 9   | From IMX-2T1/E1 | RCB         | Receive Clock B               | DD(B)  |
| 10  | From IMX-2T1/E1 | DCDB        | DCD B                         | CF(B)  |
| 11  | To IMX-2T1/E1   | SCEB        | Send External Clock B         | DA(B)  |
| 12  | From IMX-2T1/E1 | SCB         | Send Clock B                  | DB(B)  |
| 13  | From IMX-2T1/E1 | CTSB        | CTS B                         | CB(B)  |
| 14  | To IMX-2T1/E1   | SDB         | Send Data B                   | BA(B)  |
| 15  | From IMX-2T1/E1 | SCA         | Send Clock A                  | DB(B)  |
| 16  | From IMX-2T1/E1 | RDB         | Receive Data B                | BB(B)  |
| 17  | From IMX-2T1/E1 | RCA         | Receive Clock A               | DD(A)  |
| 18  | N/A             | -           | Not Connected                 | -      |
| 19  | To IMX-2T1/E1   | RTSB        | RTS B                         | CA(B)  |
| 20  | To IMX-2T1/E1   | DTRA/RCEA   | DTRA/Receive External Clock A | CD(A)  |
| 21  | N/A             | -           | Not Connected                 | -      |
| 22  | From IMX-2T1/E1 | DSRB        | DSR B                         | CC(B)  |
| 23  | To IMX-2T1/E1   | DTRB/RCEB   | DTRB/Receive External Clock B | CD(B)  |
| 24  | To IMX-2T1/E1   | SCEA        | Send External Clock A         | DA(A)  |
| 25  | N/A             | -           | Not Connected                 | -      |

Table A-7 V.36/RS-449 Channel Interface Adapter Cable (CBL-HS2/R1) - DCE Timing Mode

| Pin | Direction       | Designation | Function                 | V.36/RS-449 |
|-----|-----------------|-------------|--------------------------|-------------|
| 1   | ↔               | FG          | Frame Ground             | 1           |
| 2   | To IMX-2T1/E1   | SDA         | Send Data A              | 4           |
| 3   | From IMX-2T1/E1 | RDA         | Receive Data A           | 6           |
| 4   | To IMX-2T1/E1   | RTSA        | RTS A                    | 7           |
| 5   | From IMX-2T1/E1 | CTSA        | CTS A                    | 9           |
| 6   | From IMX-2T1/E1 | DSRA        | DSR A                    | 11          |
| 7   | ↔               | SG          | Signal Ground            | 19          |
| 8   | From IMX-2T1/E1 | DCDA        | DCD A                    | 13          |
| 9   | From IMX-2T1/E1 | RCB         | Receive Clock B          | 26          |
| 10  | From IMX-2T1/E1 | DCDB        | DCD B                    | 31          |
| 11  | To IMX-2T1/E1   | SCEB        | Send External Clock B    | 35          |
| 12  | From IMX-2T1/E1 | SCB         | Send Clock B             | 23          |
| 13  | From IMX-2T1/E1 | CTSB        | CTS B                    | 27          |
| 14  | To IMX-2T1/E1   | SDB         | Send Data B              | 22          |
| 15  | From IMX-2T1/E1 | SCA         | Send Clock A             | 5           |
| 16  | From IMX-2T1/E1 | RDB         | Receive Data B           | 24          |
| 17  | From IMX-2T1/E1 | RCA         | Receive Clock A          | 8           |
| 18  | N/A             | -           | Not Connected            | -           |
| 19  | To IMX-2T1/E1   | RTSB        | RTS B                    | 25          |
| 20  | To IMX-2T1/E1   | RCEA        | Receive External Clock A | -           |
| 21  | N/A             | -           | Not Connected            | -           |
| 22  | From IMX-2T1/E1 | DSRB        | DSR B                    | 29          |
| 23  | To IMX-2T1/E1   | RCEB        | Receive External Clock B | -           |
| 24  | To IMX-2T1/E1   | SCEA        | Send External Clock A    | 17          |
| 25  | N/A             | -           | Not Connected            | -           |

**Note** The V.36/RS-499 connector is a 37-pin D-type male connector.

## A.7 V.35 User Data Channel Connector

When the IMX-2T1/E1 is ordered with a V.35 interface, the physical interface is a 34-pin female connector, wired as described in Table A-8.

Table A-8 V.35 User Data Channel Connector, Pin Allocation

| Pin | Designation | Direction       | Function                         |
|-----|-------------|-----------------|----------------------------------|
| A   | PG          | ↔               | Protective Ground                |
| B   | SG          | ↔               | Signal Ground                    |
| C   | RTS         | To IMX-2T1/E1   | Request to Send                  |
| D   | CTS         | From IMX-2T1/E1 | Clear to Send                    |
| E   | DSR         | From IMX-2T1/E1 | Data Set Ready                   |
| F   | DCD         | From IMX-2T1/E1 | Data Carrier Detect              |
| H   | DTR         | To IMX-2T1/E1   | Data Terminal Ready              |
| P   | TDA         | To IMX-2T1/E1   | Transmit Data (A wire)           |
| R   | RDA         | From IMX-2T1/E1 | Receive Data (A wire)            |
| S   | TDB         | To IMX-2T1/E1   | Transmit Data (B wire)           |
| T   | RDB         | From IMX-2T1/E1 | Receive Data (B wire)            |
| U   | ETCA        | To IMX-2T1/E1   | External Transmit Clock (A wire) |
| V   | RCA         | From IMX-2T1/E1 | Receive Clock (A wire)           |
| W   | ETCB        | To IMX-2T1/E1   | External Transmit Clock (B wire) |
| X   | RCB         | From IMX-2T1/E1 | Receive Clock (B wire)           |
| Y   | TCA         | From IMX-2T1/E1 | Transmit Clock (A wire)          |
| Z   | ERCB        | To IMX-2T1/E1   | External Receive Clock (B wire)  |
| AA  | TCB         | From IMX-2T1/E1 | Transmit Clock (B wire)          |
| BB  | ERCA        | To IMX-2T1/E1   | External Receive Clock (A wire)  |

## A.8 X.21 User Data Channel Connector

When the IMX-2T1/E1 is ordered with an X.21 interface, the physical interface is a 15-pin female D-type connector, wired as described in Table A-9.

Table A-9 X.21 User Data Channel Connector, Pin Allocation

| Pin | Designation | Direction       | Function                 |
|-----|-------------|-----------------|--------------------------|
| 1   | FG          | ↔               | Frame Ground             |
| 2   | TA          | To IMX-2T1/E1   | Transmit Data (A wire)   |
| 3   | CA          | To IMX-2T1/E1   | Control (A wire)         |
| 4   | RA          | From IMX-2T1/E1 | Receive Data (A wire)    |
| 5   | IA          | From IMX-2T1/E1 | Indication Data (A wire) |
| 6   | SA          | From IMX-2T1/E1 | Signal Timing (A wire)   |
| 7   | BA          | To IMX-2T1/E1   | External Timing (A wire) |
| 8   | G           | ↔               | Signal Ground            |
| 9   | TB          | To IMX-2T1/E1   | Transmit Data (B wire)   |
| 10  | CB          | To IMX-2T1/E1   | Control (B wire)         |
| 11  | RB          | From IMX-2T1/E1 | Receive Data (B wire)    |
| 12  | IB          | From IMX-2T1/E1 | Indication Data (B wire) |
| 13  | SB          | From IMX-2T1/E1 | Signal Timing (B wire)   |
| 14  | BB          | To IMX-2T1/E1   | External Timing (B wire) |
| 15  | -           | N/A             | Not Connected            |

# Appendix B

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## SNMP Management

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### B.1 Scope

This Appendix provides information for the management of the IMX-2T1/E1 by means of the Simple Network Management Protocol (SNMP).

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### B.2 SNMP Environment

#### General

The SNMP management functions of the IMX-2T1/E1 are provided by an internal SNMP agent, which can use in-band and out-of-band communication. In the IMX-2T1/E1, the SNMP agent is not managed by a management station, but it can send SNMP traps triggered by alarms to the SNMP manager.

The SNMP management communication uses the User Datagram Protocol (UDP). UDP is a connectionless-mode transport protocol, part of the suite of protocols of the Internet Protocol (IP).

#### Note

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*Telnet management uses the TCP protocol over IP for management communication. After a Telnet session is started, the management interface is similar to that used for the supervision terminal (Chapter 3).*

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This section describes the SNMP environment. For a description of the IP environment, refer to section B.3.

#### SNMP Principles

The SNMP management protocol is an asynchronous command/response polling protocol: all the management traffic is initiated by the SNMP-based network management station, which addresses the managed entities in its management domain. Only the addressed managed entity answers the polling of the management station (except for trap messages).

The managed entities include a function called an "SNMP agent", which is responsible for interpretation and handling of the management station requests to the managed entity, and the generation of properly-formatted responses to the management station.

## SNMP Operations

The SNMP protocol includes four types of operations:

|                       |                                                                                                                                                                                        |
|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>getRequest</b>     | Command for retrieving specific management information from the managed entity. The managed entity responds with a <b>getResponse</b> message.                                         |
| <b>getNextRequest</b> | Command for retrieving sequentially specific management information from the managed entity. The managed entity responds with a <b>getResponse</b> message.                            |
| <b>setRequest</b>     | Command for manipulating specific management information within the managed entity. The managed entity responds with a <b>getResponse</b> message.                                     |
| <b>trap</b>           | Management message carrying unsolicited information on extraordinary events (that is, events which occurred not in response to a management operation) reported by the managed entity. |

## The Management Information Base

The management information base (MIB) includes a collection of *managed objects*. A managed object is defined as a parameter that can be managed, such as a performance statistics value.

The MIB includes the definitions of relevant managed objects. Various MIB's can be defined for various management purposes, types of equipment, etc.

An object's definition includes the range of values (also called "instances") and the "access" rights:

|                       |                                                          |
|-----------------------|----------------------------------------------------------|
| <b>Read-only</b>      | Instances of that object can be read, but cannot be set. |
| <b>Read-write</b>     | Instances of that object can be read or set.             |
| <b>Write-only</b>     | Instances of that object can be set, but cannot be read. |
| <b>Not accessible</b> | Instances of that object cannot be read, nor set.        |

## MIB Structure

The MIB has an inverted tree-like structure, with each definition of a managed object forming one leaf, located at the end of a branch of that tree. Each "leaf" in the MIB is reached by a unique path, therefore by numbering the branching points, starting with the top, each leaf can be uniquely defined by a sequence of numbers. The formal description of the managed objects and the MIB structure is provided in a special standardized format, called Abstract Syntax Notation 1 (ASN.1).

Since the general collection of MIB's can also be organized in a similar structure, under the supervision of the Internet Activities Board (IAB), any parameter included in a MIB that is recognized by the IAB is uniquely defined.

To provide the flexibility necessary in a global structure, MIB's are classified in various classes (branches), one of them being the experimental branch, and another the group of private (enterprise-specific) branch. Under the private enterprise-specific branch of MIB's, each enterprise (manufacturer) can be assigned a number, which is its enterprise number. The assigned number designates the top of an enterprise-specific sub-tree of non-standard MIB's. Within this context, RAD has been assigned the enterprise number 164. Therefore, enterprise MIB's published by RAD can be found under 1.3.6.1.4.1.164.

MIB's of general interest are published by the IAB in the form of a Request for Comment (RFC) document. In addition, MIB's are also often assigned informal names that reflect their primary purpose. Enterprise-specific MIB's are published and distributed by their originator, which is responsible for their contents.

## MIB's Supported by the IMX-2T1/E1 SNMP Agent

The interpretation of the relevant MIB's is a function of the SNMP agent of each managed entity. The general MIB's supported by the IMX-2T1/E1 SNMP agent are as follows:

- RFC 1158 (standard MIB-II).
- RFC 1406 (standard T1/T1 MIB).

In addition, the IMX-2T1/E1 SNMP agent supports the RAD-private (enterprise-specific) MIB identified as (read the following as a continuous string):

```
iso(1).org(3).dod(6).internet(1).private(4).enterprises(1).rad(164).radGen(6).systems(1).radSysWAN(3).radFcdT1(30).
```

Enterprise-specific MIB's supported by RAD equipment, including those for the FCD-T1, are available in ASN.1 format from the RAD Technical Support Department.

## Management Domains Under SNMP

SNMP enables, in principle, each management station that knows the MIB's supported by a device to perform all the management operations available on that device. However, this is not desirable in practical situations, so it is necessary to provide a means to delimit management domains.

### SNMP Communities

To enable the delimitation of management domains, SNMP uses "communities". Each community is identified by a name, which is an alphanumeric string of up to 255 characters defined by the user.

Any SNMP entity (this term includes both managed entities and management stations) is assigned by its user a community name. In parallel, the user defines for each SNMP entity a list of the communities which are authorized to communicate with it, and the access rights associated with each community (this is the SNMP community name table of the entity).

In general, SNMP agents support two types of access rights:

- **Read-only** – the SNMP agent accepts and processes only SNMP **getRequest** and **getNextRequest** commands from management stations which have a read-only community name.
- **Read-write** – the SNMP agent accepts and processes all the SNMP commands received from a management station with a read-write community name. SNMP agents are usually configured to send traps to management stations having read-write communities.

### Authentication

In accordance with the SNMP protocol, the SNMP community of the originating entity is sent in each message.

When an SNMP message is received by the addressed entity, first it checks the originator's community: messages with community names not included in the SNMP community names table of the recipient are discarded (SNMP agents of managed entities usually report this event by means of an authentication failure trap).

The SNMP agents of managed entities evaluate messages originated by communities appearing in the agent's SNMP community names table in accordance with the access rights, as explained above. Thus a **setRequest** for a MIB object with read-write access rights will nevertheless be rejected if it comes from a management station whose community has read-only rights with respect to that particular agent.

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## B.3 IP Environment

### General

The SNMP agent of the IMX-2T1/E1 can communicate either out-of-band or in-band:

- Out-of-band communication is performed via the CONTROL DCE port. The communication uses the Serial Link Internet Protocol (SLIP).
- In-band communication uses a proprietary protocol. The user can select the way in-band management traffic is carried: by the FDL, which supports a data rate of 4 kbps, or in a dedicated time slot of each link. When a dedicated time slot is used, the data rate is selectable (8, 16, 32, or 64 kbps), but the sub link supports only 8 kbps.

### Note

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*The FDL option can be used only when ESF framing is used.*

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The user can separately enable the use of out-of-band communication, and of in-band communication on each link (main and/or sub).

### IP Environment

The SNMP agent of the IMX-2T1/E1 uses either the UDP or the TCP transport protocol, part of the suite of IP protocols.

### IP Address Structure

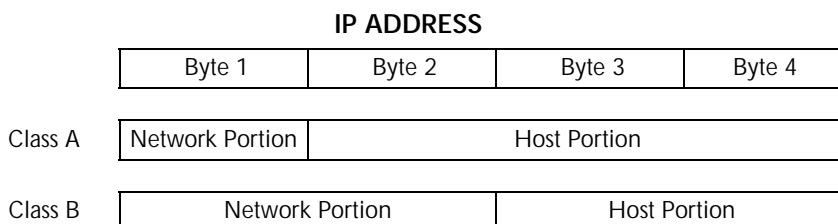
Under the IP protocol, each IP network element (SNMP agents, network management stations, etc.) is called an IP host and must be assigned an IP address. An IP address is a 32-bit number, usually represented as four 8-bit bytes. Each byte represents a decimal number in the range of 0 through 255.

The address is given in decimal format, with the bytes separated by decimal points, e.g., 164.90.70.47. This format is called ***dotted quad notation***.

An IP address is logically divided into two main portions:

- **Network Portion** – The network portion is assigned by the Internet Assigned Numbers Authority (IANA). There are five IP address classes: A, B, C, D, and E. However, only the classes A, B and C are used for IP addressing. Consult your network manager with respect to the class of IP addresses used on your network.

The network portion of an IP address can be one, two or three bytes long, in accordance with the IP address class. This arrangement is illustrated below:





The class of each IP address can be determined from its leftmost byte, in accordance with the following chart:

| Address Class | First Byte      | Address Range               |
|---------------|-----------------|-----------------------------|
| Class A       | 0 through 127   | 0.H.H.H through 127.H.H.H   |
| Class B       | 128 through 191 | 128.N.H.H through 191.N.H.H |
| Class C       | 192 through 223 | 192.N.N.H through 223.N.N.H |

N – indicates bytes that are part of the network portion

H – indicates bytes that are part of the host portion

- **Host Portion** – The host portion is used to identify an individual host connected to the network. The host identifier is assigned by the using organization, in accordance with its specific needs.

#### Note

*The all-zero host identifier is always interpreted as a network identifier, and must not be assigned to an actual host.*

Often, the host portion is further sub-divided into two portions:

- **Subnet number.** For example, subnet numbers can be used to identify departmental subnetworks. The subnet number follows the network identifier.
- **Host number** - the last bits of the IP address.

### Automatic Routing of IP Traffic

The SNMP agent of the IMX-2T1/E1 units includes a proprietary IP router function, that is used to route management messages automatically.

The proprietary IP router operates both on the in-band, as well as on the out-of-band traffic, depending on the communication methods that have been enabled.

The router of each SNMP agent collects information on the other SNMP agents whose messages pass through by monitoring the IP source and destination addresses of the IP messages, and combining this information with the information on the direction to the management station. This automatic learning capability enables using any network topology, including topologies with closed loops.

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## B.4 SNMP Traps

The SNMP agent of the IMX-2T1/E1 supports the standard MIB-II traps. In addition, a change in the alarm state from ON to OFF will send a trap to the SNMP.