RAD
data communications

Installation and Operation Manual

# *IMX-4E1*

## *E1 Inverse Multiplexer*

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## Installation and Operation Manual

## Notice



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# Limited Warranty

RAD warrants to DISTRIBUTOR that the hardware in the IMX-4E1 to be delivered hereunder shall be free of defects in material and workmanship under normal use and service for a period of twelve (12) months following the date of shipment to DISTRIBUTOR.

If, during the warranty period, any component part of the equipment becomes defective by reason of material or workmanship, and DISTRIBUTOR immediately notifies RAD of such defect, RAD shall have the option to choose the appropriate corrective action: a) supply a replacement part, or b) request return of equipment to its plant for repair, or c) perform necessary repair at the equipment's location. In the event that RAD requests the return of equipment, each party shall pay one-way shipping costs.

RAD shall be released from all obligations under its warranty in the event that the equipment has been subjected to misuse, neglect, accident or improper installation, or if repairs or modifications were made by persons other than RAD's own authorized service personnel, unless such repairs by others were made with the written consent of RAD.

The above warranty is in lieu of all other warranties, expressed or implied. There are no warranties which extend beyond the face hereof, including, but not limited to, warranties of merchantability and fitness for a particular purpose, and in no event shall RAD be liable for consequential damages.

RAD shall not be liable to any person for any special or indirect damages, including, but not limited to, lost profits from any cause whatsoever arising from or in any way connected with the manufacture, sale, handling, repair, maintenance or use of the IMX-4E1, and in no event shall RAD's liability exceed the purchase price of the IMX-4E1.

DISTRIBUTOR shall be responsible to its customers for any and all warranties which it makes relating to IMX-4E1 and for ensuring that replacements and other adjustments required in connection with the said warranties are satisfactory.

Software components in the IMX-4E1 are provided "as is" and without warranty of any kind. RAD disclaims all warranties including the implied warranties of merchantability and fitness for a particular purpose. RAD shall not be liable for any loss of use, interruption of business or indirect, special, incidental or consequential damages of any kind. In spite of the above RAD shall do its best to provide error-free software products and shall offer free Software updates during the warranty period under this Agreement.

RAD's cumulative liability to you or any other party for any loss or damages resulting from any claims, demands, or actions arising out of or relating to this Agreement and the IMX-4E1 shall not exceed the sum paid to RAD for the purchase of the IMX-4E1. In no event shall RAD be liable for any indirect, incidental, consequential, special, or exemplary damages or lost profits, even if RAD has been advised of the possibility of such damages.

This Agreement shall be construed and governed in accordance with the laws of the State of Israel.

# General Safety Instructions

The following instructions serve as a general guide for the safe installation and operation of telecommunications products. Additional instructions, if applicable, are included inside the manual.

## Safety Symbols

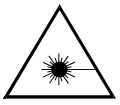
*Warning*

**This symbol may appear on the equipment or in the text. It indicates potential safety hazards regarding product operation or maintenance to operator or service personnel.**

**Danger of electric shock! Avoid any contact with the marked surface while the product is energized or connected to outdoor telecommunication lines.**

.

Protective earth: the marked lug or terminal should be connected to the building protective earth bus.



*Warning*

**Some products may be equipped with a laser diode. In such cases, a label with the laser class and other warnings as applicable will be attached near the optical transmitter. The laser warning symbol may be also attached. Please observe the following precautions:**

- **Before turning on the equipment, make sure that the fiber optic cable is intact and is connected to the transmitter.**
- **Do not attempt to adjust the laser drive current.**
- **Do not use broken or unterminated fiber-optic cables/connectors or look straight at the laser beam.**
- **The use of optical devices with the equipment will increase eye hazard.**
- **Use of controls, adjustments or performing procedures other than those specified herein, may result in hazardous radiation exposure.**

**ATTENTION: The laser beam may be invisible!**

Always observe standard safety precautions during installation, operation and maintenance of this product. Only qualified and authorized service personnel should carry out adjustment, maintenance or repairs to this product. No installation, adjustment, maintenance or repairs should be performed by either the operator or the user.

# Handling Energized Products

## General Safety Practices

Do not touch or tamper with the power supply when the power cord is connected. Line voltages may be present inside certain products even when the power switch (if installed) is in the OFF position or a fuse is blown. For DC-powered products, although the voltages levels are usually not hazardous, energy hazards may still exist.

Before working on equipment connected to power lines or telecommunication lines, remove jewelry or any other metallic object that may come into contact with energized parts.

Unless otherwise specified, all products are intended to be grounded during normal use. Grounding is provided by connecting the mains plug to a wall socket with a protective earth terminal. If an earth lug is provided on the product, it should be connected to the protective earth at all times, by a wire with a diameter of 18 AWG or wider. Rack-mounted equipment should be mounted only in earthed racks and cabinets.

Always make the ground connection first and disconnect it last. Do not connect telecommunication cables to ungrounded equipment. Make sure that all other cables are disconnected before disconnecting the ground.

## Connection of AC Mains

Make sure that the electrical installation complies with local codes.

Always connect the AC plug to a wall socket with a protective ground.

The maximum permissible current capability of the branch distribution circuit that supplies power to the product is 16A. The circuit breaker in the building installation should have high breaking capacity and must operate at short-circuit current exceeding 35A.

Always connect the power cord first to the equipment and then to the wall socket. If a power switch is provided in the equipment, set it to the OFF position. If the power cord cannot be readily disconnected in case of emergency, make sure that a readily accessible circuit breaker or emergency switch is installed in the building installation.

## Connection of DC Mains

Unless otherwise specified in the manual, the DC input to the equipment is floating in reference to the ground. Any single pole can be externally grounded.

Due to the high current capability of DC mains systems, care should be taken when connecting the DC supply to avoid short-circuits and fire hazards.

DC units should be installed in a restricted access area, i.e. an area where access is authorized only to qualified service and maintenance personnel.

Make sure that the DC supply is electrically isolated from any AC source and that the installation complies with the local codes.

The maximum permissible current capability of the branch distribution circuit that supplies power to the product is 16A. The circuit breaker in the building installation should have high breaking capacity and must operate at short-circuit current exceeding 35A.

Before connecting the DC supply wires, ensure that power is removed form the DC circuit. Locate the circuit breaker of the panel board that services the equipment and switch it to the OFF position. When connecting the DC supply wires, first connect the ground wire to the corresponding terminal, then the positive pole and last the negative pole. Switch the circuit breaker back to the ON position.

A readily accessible disconnect device that is suitably rated and approved should be incorporated in the building installation.

# Connection of Data and Telecommunications Cables

Data and telecommunication interfaces are classified according to their safety status.

The following table lists the status of several standard interfaces. If the status of a given port differs from the standard one, a notice will be given in the manual.

| Ports | Safety Status | |
|---|---|---|
| V.11, V.28, V.35, V.36, X.21, RS-530, X.21, 10 BaseT, 100 BaseT, Unbalanced E1, E2, E3, STM, DS-2, DS-3, S-Interface ISDN, Analog voice E&M | SELV | Safety Extra Low Voltage:<br>Ports which do not present a safety hazard. Usually up to 30 VAC or 60 VDC. |
| xDSL (without feeding voltage), Balanced E1, T1, Sub E1/T1 | TNV-1 | Telecommunication Network Voltage-1:<br>Ports whose normal operating voltage is within the limits of SELV, on which overvoltages from telecommunications networks are possible. |
| FXS (Foreign Exchange Subscriber) | TNV-2 | Telecommunication Network Voltage-2:<br>Ports whose normal operating voltage exceeds the limits of SELV (usually up to 120 VDC or telephone ringing voltages), on which overvoltages from telecommunication networks are not possible. These ports are not permitted to be directly connected to external telephone and data lines. |
| FXO (Foreign Exchange Office), xDSL (with feeding voltage), U-Interface ISDN | TNV-3 | Telecommunication Network Voltage-3:<br>Ports whose normal operating voltage exceeds the limits of SELV (usually up to 120 VDC or telephone ringing voltages), on which overvoltages from telecommunication networks are possible. |

**Always connect a given port to a port of the same safety status. If in doubt, seek the assistance of a qualified safety engineer.**

Always make sure that the equipment is grounded before connecting telecommunication cables. Do not disconnect the ground connection before disconnecting all telecommunications cables.

Some SELV and non-SELV circuits use the same connectors. Use caution when connecting cables. Extra caution should be exercised during thunderstorms.

When using shielded or coaxial cables, verify that there is a good ground connection at both ends. The earthing and bonding of the ground connections should comply with the local codes.

The telecommunication wiring in the building may be damaged or present a fire hazard in case of contact between exposed external wires and the AC power lines. In order to reduce the risk, there are restrictions on the diameter of wires in the telecom cables, between the equipment and the mating connectors.

***Caution*** To reduce the risk of fire, use only No. 26 AWG or larger telecommunication line cords.

***Attention*** Pour réduire les risques s'incendie, utiliser seulement des conducteurs de télécommunications 26 AWG ou de section supérieure.

Some ports are suitable for connection to intra-building or non-exposed wiring or cabling only. In such cases, a notice will be given in the installation instructions.

Do not attempt to tamper with any carrier-provided equipment or connection hardware.

# Electromagnetic Compatibility (EMC)

The equipment is designed and approved to comply with the electromagnetic regulations of major regulatory bodies. The following instructions may enhance the performance of the equipment and will provide better protection against excessive emission and better immunity against disturbances.

A good earth connection is essential. When installing the equipment in a rack, make sure to remove all traces of paint from the mounting points. Use suitable lock-washers and torque. If an external grounding lug is provided, connect it to the earth bus using braided wire as short as possible.

The equipment is designed to comply with EMC requirements when connecting it with unshielded twisted pair (UTP) cables. However, the use of shielded wires is always recommended, especially for high-rate data. In some cases, when unshielded wires are used, ferrite cores should be installed on certain cables. In such cases, special instructions are provided in the manual.

Disconnect all wires which are not in permanent use, such as cables used for one-time configuration.

The compliance of the equipment with the regulations for conducted emission on the data lines is dependent on the cable quality. The emission is tested for UTP with 80 dB longitudinal conversion loss (LCL).

Unless otherwise specified or described in the manual, TNV-1 and TNV-3 ports provide secondary protection against surges on the data lines. Primary protectors should be provided in the building installation.

The equipment is designed to provide adequate protection against electro-static discharge (ESD). However, it is good working practice to use caution when connecting cables terminated with plastic connectors (without a grounded metal hood, such as flat cables) to sensitive data lines. Before connecting such cables, discharge yourself by touching earth ground or wear an ESD preventive wrist strap.

## FCC-15 User Information

This equipment has been tested and found to comply with the limits of the Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the Installation and Operation manual, may cause harmful interference to the radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

# Canadian Emission Requirements

This Class A digital apparatus meets all the requirements of the Canadian Interference-Causing Equipment Regulation.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

# Warning per EN 55022 (CISPR-22)

| | |
|---|---|
| ***Warning*** | This is a class A product. In a domestic environment, this product may cause radio interference, in which case the user will be required to take adequate measures. |
| ***Avertissement*** | Cet appareil est un appareil de Classe A. Dans un environnement résidentiel, cet appareil peut provoquer des brouillages radioélectriques. Dans ces cas, il peut être demandé à l'utilisateur de prendre les mesures appropriées. |
| ***Achtung*** | Dieses ist ein Gerät der Funkstörgrenzwertklasse A. In Wohnbereichen können bei Betrieb dieses Gerätes Rundfunkströrungen auftreten, in welchen Fällen der Benutzer für entsprechende Gegenmaßnahmen verantwortlich ist. |

# Installation Instructions for Compliance with EMC Requirements

## V.35 and ETH Ports

To comply with electromagnetic compatibility requirements, a ferrite core (such as FAIR RITE catalog number 0443164151 or equivalent) should be installed on any unshielded data cable connected to the V.35 or ETH port.

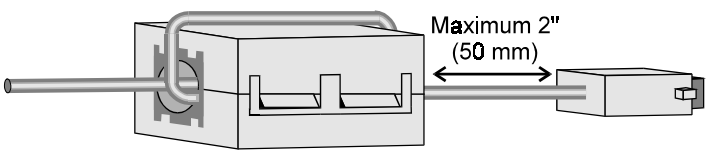
This limits the electromagnetic energy emitted from the unshielded cable.

Alternatively, replace unshielded data cable with shielded data cable.

***Note***: When using a shielded data cable, the cable shield should be connected to the metallic hood.

To install the ferrite core:

- Run the cable through the open core.
- If cable thickness allows, wrap it around the core and run it through again.
  Allow no more than 2 inches (5 cm) between the core and the cable connector to the unit.
- Snap the core shut.



***Note*:** to protect against electro-static discharge (ESD) into the V.35 port, use a connector with a hood that completely covers the pin connection.

## Station Clock Port

When using the station clock, use shielded cable to connect the station clock port to the equipment.

# Declaration of Conformity

**Manufacturer's Name:** RAD Data Communications Ltd.

**Manufacturer's Address:** 24 Raoul Wallenberg St.
Tel Aviv 69719
Israel

declares that the product:

**Product Name:** **IMX-4E1**

Conforms to the following standard(s) or other normative document(s):

| | | |
|---|---|---|
| **EMC:** | EN 55022 (1994) | Limits and methods of measurement of radio disturbance characteristics of information technology equipment. |
| | EN 50082-1 (1992) | Electromagnetic compatibility - Generic immunity standards for residential, commercial and light industry. |
| **Safety:** | EN 60950/A4 (1996) | 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, August 7th, 1996

Haim Karshen
VP Quality

**European Contact:** RAD Data Communications GmbH, Otto-Hahn-Str. 28-30, 85521 Ottobrunn-Riemerling, Germany

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# Introduction

## 1.1 Functional Description

### Purpose and Main Features

The IMX-4E1 is an inverse multiplexer that allows transparent transmission of high-speed synchronous data at rates up to a maximum of 7.680 Mbps over the E1 network, using up to four standard E1 lines. This provides a cost-effective, high-speed transmission medium for the interconnection of bridges, routers, etc.

*Figure 1-1* shows a basic application for the IMX-4E1, in which it is used to provide a high-speed data link for interconnecting two bridges or routers via standard E1 lines.

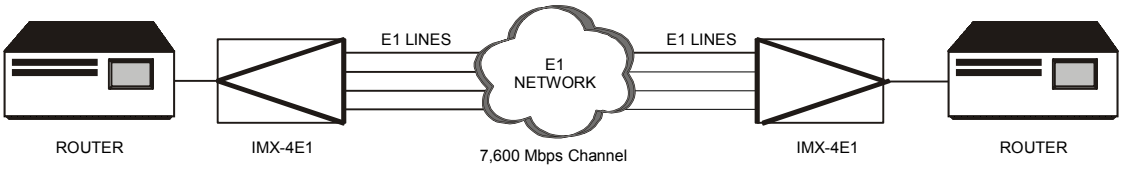


*Figure 1-1. Basic IMX-4E1 Application*

### Inverse Multiplexing

Inverse multiplexing is a technique that splits a high-speed data stream for parallel transmission over several lower-speed transmission lines. The IMX-4E1 uses E1 lines for data transmission. The number of E1 link interfaces of the IMX-4E1 is four. Therefore, it can transmit data at rates, which are a multiple of 1.920 Mbps, i.e., 3.840, 5.760, and 7.680 Mbps, respectively, in accordance with the number of E1 lines that are being used (1.920 Mbps is also supported as a fallback rate). The number of E1 lines is user-selectable. When the number of E1 lines is less than four, the user can specify the link interfaces to be used.

The IMX-4E1 supports an automatic rate fallback feature. If one of the E1 links fails, the IMX-4E1 automatically selects the next lower rate available and continues to provide service at the fallback rate. When the failed link recovers, the IMX-4E1 automatically returns to the original, user-selected rate. To make use of the fallback feature, the user's equipment must be able to tolerate changes in the data rate.

The IMX-4E1 tolerates differential delays up to 64 msec. This allows routing of the E1 lines used by a given IMX-4E1 over different paths or different facilities for increased flexibility and reliability. Note that although the IMX-4E1 tolerates differential delays up to 64 msec, the actual latency of an IMX-4E1 link is similar to the maximum differential delay encountered on the E1 lines being used.

## E1 Link Interface Characteristics

The IMX-4E1 is available with up to four E1 link interfaces. The link interfaces can also be ordered with a built-in LTU.

The IMX-4E1 E1 link interfaces meet the requirements of ITU-T Rec. G.703, and G.704, and supports 256N multiframes (2 frames per multiframe). The IMX-4E1 also supports the CRC-4 option specified in ITU-T Rec. G.704. CRC-4 is user-selectable.

Each IMX-4E1 E1 link has two line interfaces: a 120Ω balanced line interface terminated in an RJ-48C 8-pin female connector, and a 75Ω unbalanced interface terminated in two BNC female coaxial connectors. Line coding is HDB3. The nominal balanced interface transmit level is 3V, and the unbalanced interface transmit level is 2.37V. Jitter performance complies with the requirements of ITU-T Rec. G.823.

When the DSU balanced or unbalanced interface is used, the maximum line attenuation is up to 10 dB. When the integral LTU is used, the maximum line attenuation is up to 34 dB.

## Sync User Data Port Interface Characteristics

The IMX-4E1 can be ordered with one of several synchronous data interfaces for the DCE user Port. The sync data interfaces available are V.35, X.21, RS-530, V.36/RS-449 and HSSI (high-speed serial interface).

- 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 supplied adapter cable converts between the 25-pin D-type female connector of the RS-530 interface to a 37-pin D-type male connector.
- HSSI interface: 50-pin SCSI-2 female connector.

## Ethernet Interface Characteristics

IMX-4E1 can be ordered with an Ethernet Bridge port instead of a sync data port interface. One of the following Ethernet bridges is available:

- IR-ETH (Ethernet bridge) – see description below.
- IR-ETH/QH (Ethernet/Fast Ethernet bridge) – see full description in *Appendix B*.

### IR-ETH Ethernet Bridge

The Ethernet interface has a 10BaseT interface complying with the IEEE 802.3 standard, and is terminated in an 8-pin RJ-45 shielded connector, which can operate over UTP and STP media.

The interface includes a full-feature remote bridge, that operates at the physical and data link layers of the OSI model, and is therefore 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 bridge operates as a media access (MAC) layer remote bridge with self-learning capabilities: it learns and automatically recognized the address of the nodes attached to the local LAN (the LAN directly attached to the IMX-4E1 interface), and uses this information to filter the LAN traffic. The address information is stored in table, which can store up to 10,000 addresses. The address information is automatically updated (aging time is 5 minutes, that is, if no frames are received from a node for 5 minutes, the node address is automatically removed from the tables to ensuring that only fresh addresses are used).

Therefore the bridge block the packets addressed to local nodes, and forwards through the IMX-4E1 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 a rate of up to 15,000 packets per second (provided the bandwidth selected on the E1 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-4E1 operates as a repeater that transfers transparently all the traffic to the remote end.

***Notes***

1. *The factory setting of the clock is DCE mode.*
2. *It is not recommended to perform loops when this interface is used.*

## Timing

### System Timing

The IMX-4E1 has several timing modes that confer maximum flexibility in system integration.

The IMX-4E1 system timing reference can be locked to the desired user-selected clock source:

- The receive clock of each E1 link is always derived from the incoming line signal.
- The system clock, which also serves as the transmit clock source common to all the E1 links, is derived from a user-selected timing source:
  - An internal crystal oscillator with an accuracy of 32 ppm.
  - An external (station) clock signal, having a nominal rate of 2.048 Mbps, connected to a separate RJ-48C connector via a balanced E1-type interface.
  - The recovered receive clock signal of a user-selectable E1 link.

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.

### User Data Channel Timing

The IMX-4E1 user data channel interface has two timing modes. In both modes, the clock signals are derived from the internal IMX-4E1 system timing reference:

- DCE mode: the IMX-4E1 provides transmit and receive clock signals to the user's data terminal equipment. The user's DTE must read the data sent by the IMX-4E1 at the rate of the receive clock signal, and the IMX-4E1 samples the transmit data arriving from the user's DTE in accordance with the transmit signal provided to the user's DTE.
- E-DCE mode: this mode is similar to the DCE mode, except that the IMX-4E1 samples the transmit data arriving from the user's DTE in accordance with an external transmit signal returned by the user's DTE. This clock signal must be derived from the transmit signal provided to the user's DTE. This mode is not compatible with the X.21 user data channel.

***Note*** *E-DCE timing mode is not available for X.21 or Ethernet interfaces.*

## Test and Diagnostics Capabilities

The IMX-4E1 has comprehensive diagnostics capabilities that include local and remote loopbacks on the links and on the user's data channel, and bit error rate (BER) testing.

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

When operating with the CRC-4 option enabled, the IMX-4E1 stores E1 line statistics in compliance with the requirements.

## Alarms

The IMX-4E1 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. In addition to the alarm buffer, the front-panel LED indicators display in real time the status of the IMX-4E1 links and the activity of the user's data channel, and alert when test loops are present in the system.

The IMX-4E1 can provide an alarm indication by means of an alarm relay. The alarm relay is energized when the IMX-4E1 is powered and operating normally. It is de-energized when a major alarm condition is present, or when the IMX-4E1 power is off.

## Control of IMX-4E1 Operation

The IMX-4E1 system is designed for unattended operation. The configuration of the IMX-4E1, that is, a complete collection of operating parameters, is determined by a database stored in non-volatile memory.

### Front Panel LCD

The IMX-4E1 can be controlled by means of a simple menu, operated by push buttons located on the front panel. During setup, an LCD display guides the operator in the execution of the desired operations. The display provides information concerning the current system configuration and operating mode, and the available values of each programmable parameter. In case of operator errors, the IMX-4E1 displays a message that explains the error and helps the operator take the correct action.

### Supervision Terminal

In addition to the front panel control, the IMX-4E1 also includes an RS-232 supervisory port. The supervisory port allows full control over IMX-4E1 operation, remote reading of alarm messages, and remote monitoring of IMX-4E1 operation from a standard ASCII data terminal, using either point-to-point or polling communications.

For polling purposes, each IMX-4E1 can be assigned an eight-bit address, for a maximum of 255 nodes (the zero address is reserved).

It is also possible to connect a HayesTM compatible dial-up modem to the supervisory port, to provide call in and call out capabilities.

### Management by Telnet

The IMX-4E1 also supports the Telnet protocol, which enables remote management using the same command line interface available with a supervision terminal. Telnet uses TCP/IP communication through the RS-232 port of the IMX-4E1.

## Physical Characteristics

The IMX-4E1 is a compact unit, intended for installation on desktops or shelves. Unit height is only 1U (1.75"). An optional rack-mount adapter kit enables the installation of the IMX-4E1 units in a 19-inch rack. For rack installation instructions refer to the *Rack Mounting Kit for 19-inch Racks* guide that comes with the RM kit.

## Power

The IMX-4E1 can be powered by 100 to 240 VAC, 47 to 63 Hz, or -48 VDC.

## 1.2 Operating Environment

This section describes the E1 environment, in order to provide the background information required to understand the IMX-4E1 configuration parameters.

### The E1(CEPT) Environment

The E1 line interfaces of the IMX-4E1 comply with the applicable requirements of ITU-T Rec. G.703, G.704, and G.823.

### The E1 (CEPT) Signal Structure

The E1 line operates at a nominal rate of 2.048 Mbps. The data transferred over the E1 line is organized in frames. Each E1 frame includes 256 bits. The E1 frame format is shown in *Figure 1-2*.

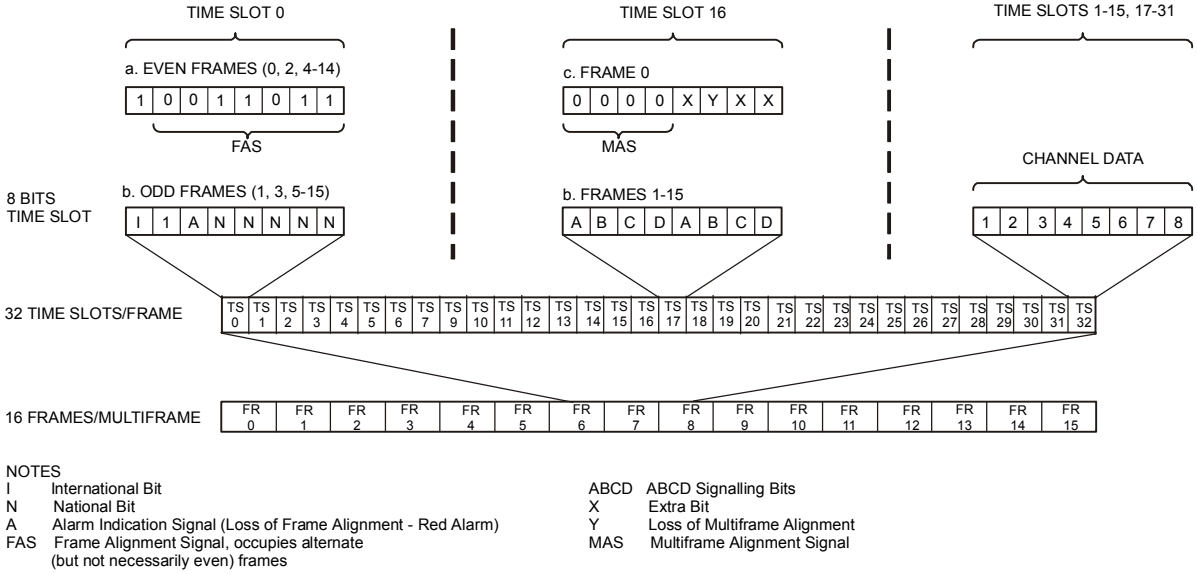


*Figure 1-2. E1 (CEPT) Frame Format*

The 256 bits consist of 32 timeslots of eight bits each, which carry the data payload. The frame repetition rate is 8,000 per second, and therefore the data rate supported by each timeslot is 64 kbps. The number of timeslots available for user data is maximum 31, because timeslot 0 is always used for frame synchronization.

The frames are organized in larger patterns, called multiframes. Two types of multiframes are generally used: G.732N, which includes 2 frames, and G.732S, which includes 16 frames:

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

The IMX-4E1 uses only G.732N framing.

## E1(CEPT) Line Signal

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

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.

The HDB3 coding rules restrict the maximum 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 these artificially introduced pulses and to enable their removal to restore the original data string, the encoding introduces intentional bipolar violations in the data sequence. The receiving end detects these violations and when they appear to be part of an encoded zero string it removes them. Other bipolar violations are probably due to line errors, and can be counted separately, to obtain information on the quality of the transmission link.

## E1 (CEPT) Line Statistics Using CRC-4 Error Detection

The IMX-4E1 supports the CRC-4 option in accordance with ITU-T Rec. G.704, which allows the evaluation of the quality of transmission over E1 links.

When the CRC-4 option is enabled, frames are arbitrarily grouped in groups of 16 (these groups are called CRC-4 multiframes, and do not bear any relationship to the 16-frame multiframe organization used with the G.732S super-frame explained above). A CRC-4 multiframe always starts with a frame that carries the frame alignment signal. The CRC-4 multiframe structure is identified by a six-bit CRC-4 multiframe alignment signal, which is multiplexed into bit 1 of timeslot 0 of each odd-numbered frame of the multiframe (up to frame 11 of the CRC-4 multiframe). Each CRC-4 multiframe is divided into two submultiframes of 8 frames (2,048 bits) each. The detection of errors is achieved by calculating a four-bit checksum on each 2,048-bit block (submultiframe). The four checksum bits calculated on a given submultiframe are multiplexed, bit by bit, in bit 1 of timeslot 0 of each even-numbered frame of the next submultiframe.

At the receiving end, the checksum is calculated again on each submultiframe and then compared against the original checksum (sent by the transmitting end in the next submultiframe). The results are reported by two bits multiplexed in bit 1 of timeslot 0 in frames 13, 15 of the CRC-4 multiframe, respectively. Errors are counted and reported as CRC-4 error statistics.

## The E1(CEPT) Line Alarm Conditions

**Loss of frame alignment** (also called loss of synchronization). This condition is declared when too many errors are detected in the frame alignment signal (FAS), e.g., when 3 or 4 FAS errors are detected in the last 5 frames. Loss of frame alignment is cleared after no FAS errors are detected in two consecutive frames. The loss of frame alignment is reported by means of the A bit (see *Figure 1-2*).

**Alarm indication signal (AIS)**. The AIS signal is an unframed all-ones signal, and is used to maintain line signal synchronization in case of loss of input signal, e.g., because an alarm condition occurred in the equipment that supplies the line signal. Note that the equipment receiving an AIS signal loses frame synchronization.

**Excessive bit error rate**. The bit error rate is measured on 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 is canceled when the error rate decreases below $10^{-4}$ for 4 to 5 consecutive seconds. The IMX-4E1 does not support this alarm.

# 1.3 System Application Considerations

This section presents typical IMX-4E1 applications and explains special application considerations.

## Clock Waveforms

The IMX-4E1 distributes the incoming user's data bits among the active E1 links on a bit-by-bit basis. You can select the number of active E1 links (up to the maximum of four available on a given IMX-4E1).

The number of active E1 links determines the user's data rate: the IMX-4E1 utilizes 30 timeslots of each frame transmitted on a E1 link for the transmission of user's data, therefore the user's data rate is 1.920 Mbps times the number of active links. The remaining timeslots in each E1 frame (timeslots 0 and 1) are used to transmit the overhead data. The overhead data includes the standard E1 frame synchronization and housekeeping data (see *Figure 1-2*), and information generated by the IMX-4E1. The information generated by the IMX-4E1 is used for the following main purposes:

- Identification of link numbers. This allows the receiving IMX-4E1 to detect connection errors such as accidental interchange between links, and alert the operator.
- Determining the differential delays among the active E1 links.
- Reassembling the bits in the correct order, to restore the original user's data stream at the remote end of the IMX-4E1 link.

The receive path of the IMX-4E1 provides the original user's data stream and a clock signal that is synchronized with the individual data bits. As a result, the receive clock supplied to the user's DTE consists of bursts separated by gaps that appear during the transmission of overhead data. The basic frequency of the clock bursts is 2.048 Mbps, and gap duration depends on the number of active links, n.

The gap duration is an integer multiple of the bit interval at the 2.048 Mbps clock burst rate. The gap duration is n x 16 bits, followed by a clock burst of n x 240 bits. For example, at a user's data rate of 7.680 Mbps (four active links), the gap has a duration of 64 bit intervals (4 x 16 bits) and appears after every group of 960 user's data bits (4 x 240 bits).

## System Timing Considerations

This section describes the timing modes offered by the IMX-4E1. The IMX-4E1 allows the selection of a timing mode for the user's data channel, and the selection of a system-timing mode.

### User's Data Channel Timing Modes

The IMX-4E1 user's data channel timing is always locked to the system clock. For flexibility, the flow of user's data channel timing signals can be configured to use either the DCE timing mode, or the E-DCE timing mode.

The basic user's data channel timing mode is called the DCE mode: in this mode, the user's data channel interface operates as a DCE interface, that is, the IMX-4E1 provides transmit and receive clock signals to the user's data terminal equipment. These signals are derived from the IMX-4E1 system clock. The user's DTE must read the data sent by the IMX-4E1 at the rate of the receive clock signal, the IMX-4E1 samples the transmit data arriving from the user's DTE in accordance with the transmit signal provided to the user's DTE. The flow of timing signals in the user's data channel interface, in the DCE mode, is shown in *Figure 1-3*.

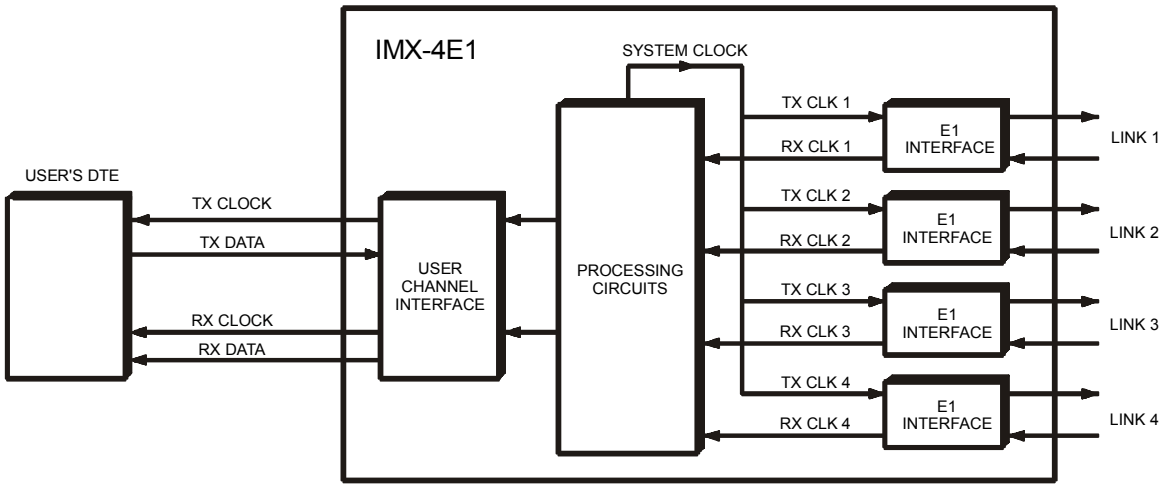


*Figure 1-3. Flow of Timing Signals in User's Data Channel Interface in the DCE Mode*

The second timing mode is the E-DCE mode: this mode is similar to the DCE mode, except that the IMX-4E1 samples the transmit data arriving from the user's DTE in accordance with an external transmit signal returned by the user's DTE. This clock signal must be derived from the transmit signal provided to the user's DTE. The flow of timing signals in the user's data channel interface, in the E-DCE mode, is shown in *Figure 1-4*.

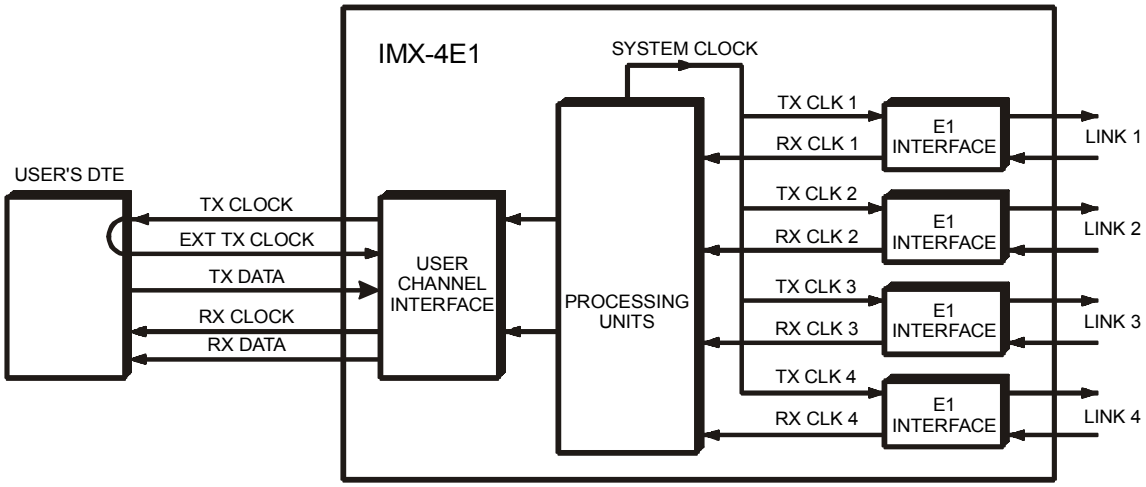


*Figure 1-4. Flow of Timing Signals in User's Data Channel Interface in the E-DCE Mode*

## System Timing Modes

The IMX-4E1 system clock serves as the reference source for the transmit clocks of all the link interfaces, and for the user's data channel interface clock signals. The IMX-4E1 has three system timing modes:

- Internal timing
- External timing
- Loopback timing.

### Internal Timing

With internal timing, the system clock of the IMX-4E1 is derived from a free-running internal crystal oscillator with an accuracy of 32 ppm. *Figure 1-5A* shows the flow of timing signals in an IMX-4E1 using the internal timing mode. When internal clocking is used by an IMX-4E1, the IMX-4E1 at the remote end of the link must use loopback timing, as shown in *Figure 1-5B*.

Note that the receive paths of the E1 link interfaces work with their own recovered clocks. These clock signals must be derived from the same source.

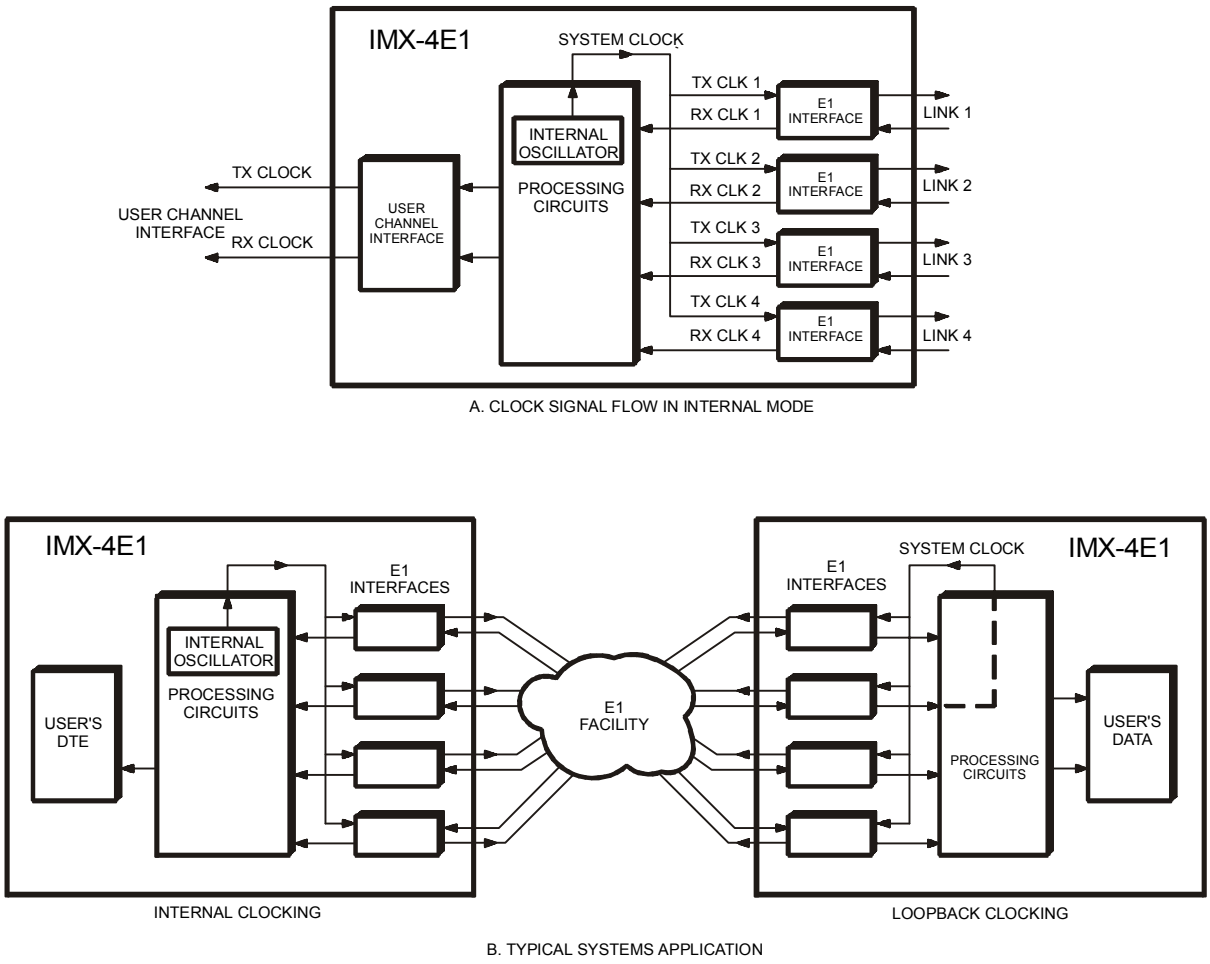


*Figure 1-5. Flow of Timing Signals in Internal Timing Mode*

## Loopback Timing

With loopback timing, the system clock is locked to the recovered receive clock signal of a user-selectable E1 link. *Figure 1-6A* shows the flow of timing signals in an IMX-4E1 using the loopback timing mode, when the timing source is the recovered clock signal of E1 link interface 2.

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-4E1 units to the E1 network clock. This is due to the fact that the network reference clock of most E1 carriers is locked to a master clock with very high accuracy and stability. This application is illustrated in *Figure 1-6B*.

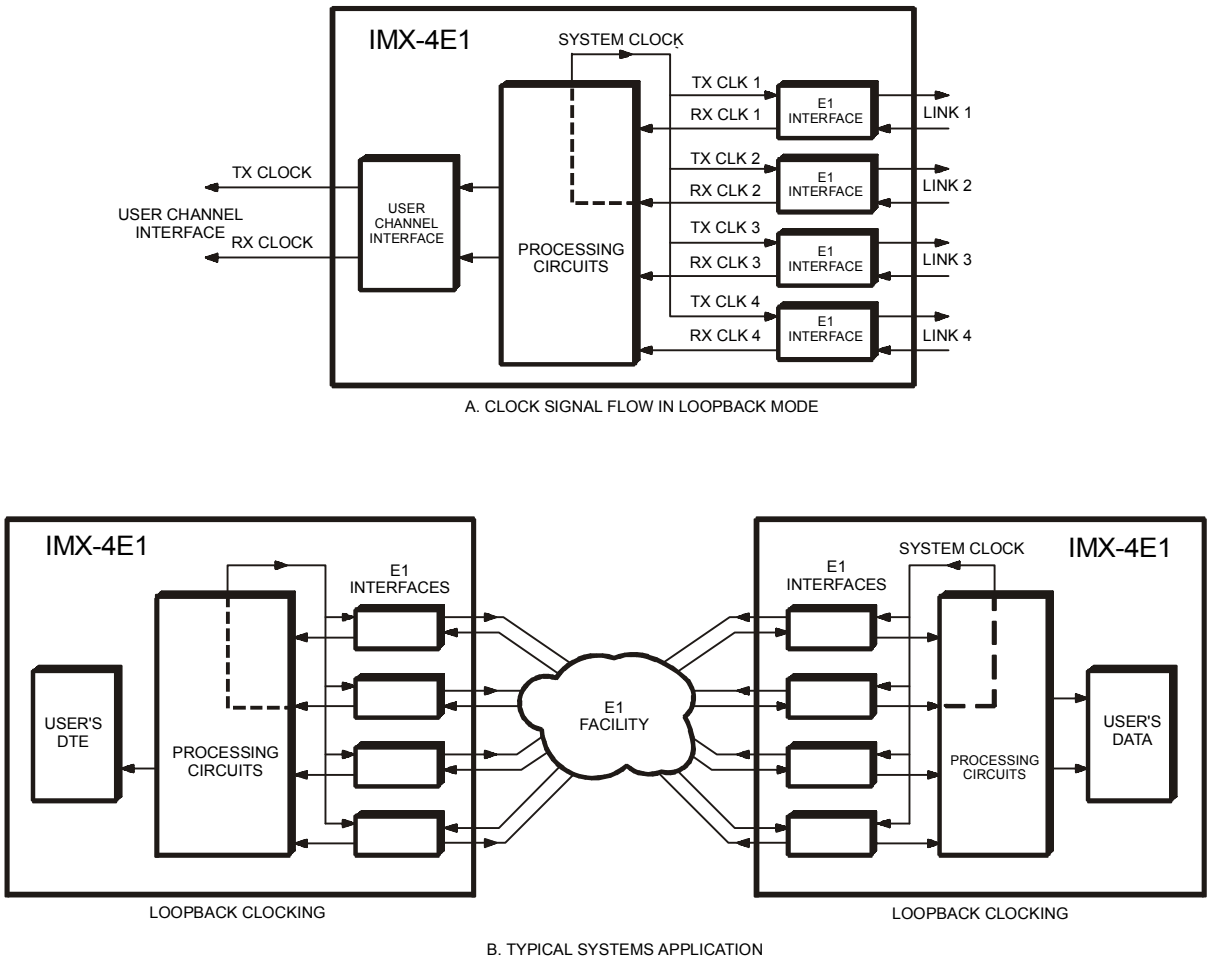


*Figure 1-6. Flow of Timing Signals in Loopback Timing Mode*

## External (Station) Timing

With external timing, the system clock is locked to an external (station) clock signal. The external clock interface is available in a separate RJ-48C connector, designated STATION CLOCK. The external clock interface accepts a balanced unframed all-ones signal having a nominal rate of 2.048 Mbps, and the maximum acceptable tolerance is 130 ppm. *Figure 1-7A* shows the flow of timing signals in an IMX-4E1 using the external timing mode.

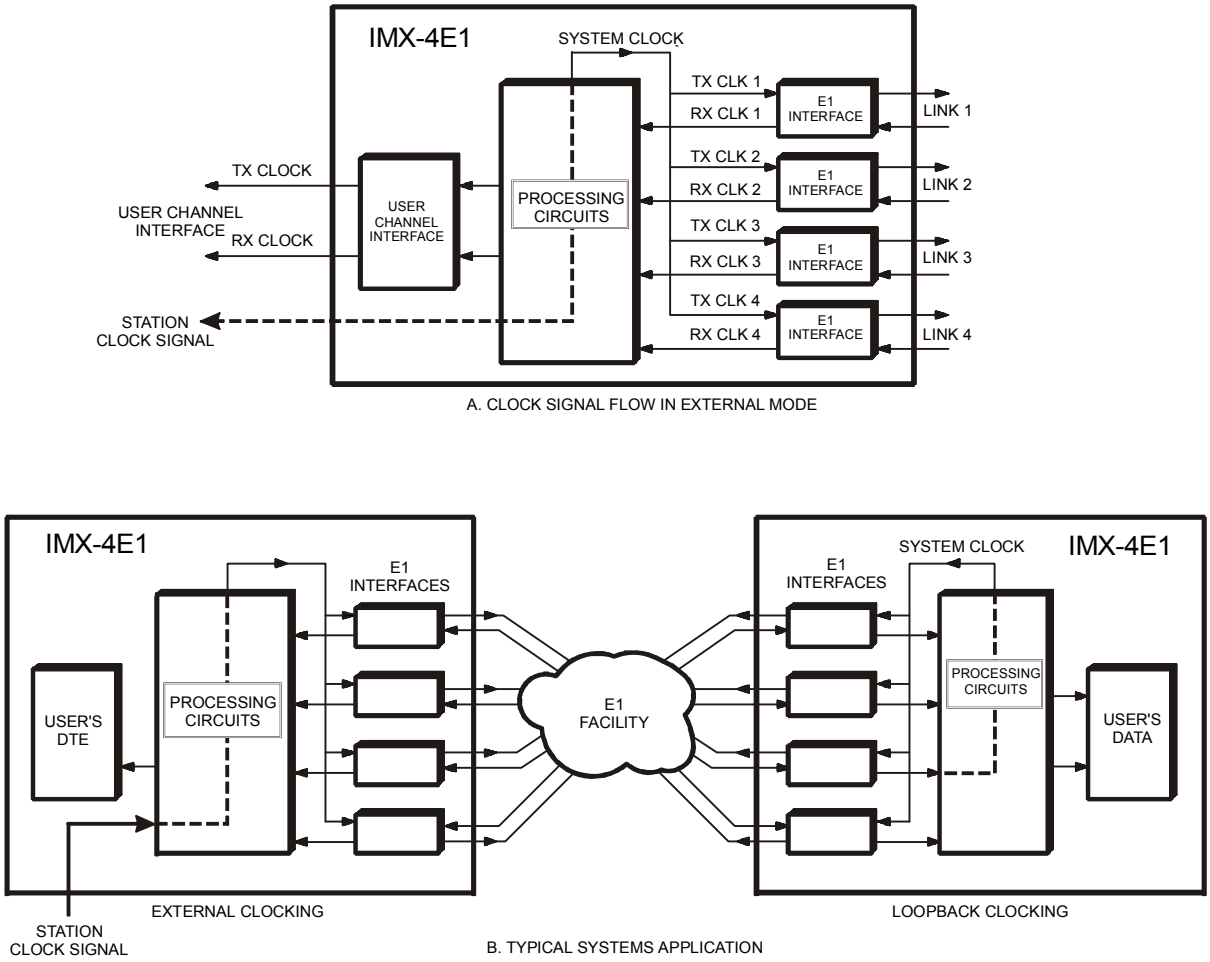


*Figure 1-7. Flow of Timing Signals in External (Station) Timing Mode*

Note that the receive paths of the E1 link interfaces work with their own recovered clocks. These clock signals must be derived from the same source.

When external clocking is used by an IMX-4E1, the IMX-4E1 at the remote end of the link must use either loopback timing, or external timing derived from the same timing source that provides the timing signal for the other IMX-4E1. An external (station) clock signal is usually available in locations that include higher level multiplexers, e.g., E3 multiplexers. *Figure 1-7B* shows a system that uses station timing at one end of the link, and loopback timing at the other end.

## Main/Fallback Timing Sources

To prevent the loss of system timing in case the selected timing source fails, the IMX-4E1 will automatically switch to internal timing in case the selected timing source fails, e.g., because of a loss of synchronization condition on the link selected as the main source.

To ensure that the system timing integrity is not lost in case the main timing source fails, the user can specify an additional timing source as a fallback source. The source selected as a fallback source is automatically selected in case the main source fails (if the fallback source fails, the IMX-4E1 will nevertheless switch automatically to internal timing).

When the main timing source returns to normal operation, the IMX-4E1 will automatically switch back to the main source.

## 1.4 Technical Specifications

| | | |
|---|---|---|
| **General** | *Number of Links* | 4 or 2 (according to order) |
| | *Maximum Differential Delay between Links* | 64 msec |
| | *Latency* | Equal to the highest actual differential delay between links |
| **E1 Interface** | *Applicable Standards* | ITU-T Rec. G.703, G.704, G.732 |
| | *Framing with CRC-4* | Timeslot 0 multiframe for CRC-4 protection, and no multiframe (G.732N), intended for use with CCS. |
| | *Framing without CRC-4* | No multiframe (G.732N), intended for use with CCS |
| | *Nominal Line Data Rate* | 2.048 Mbps |
| | *Line Code* | HDB3 |
| | *Line Impedance* | 120Ω, balanced |
| | | 75Ω, unbalanced |
| | | The line impedance is selectable by jumpers |
| | *Nominal Transmit Levels* | Balanced interface: ±3V 10% |
| | | Unbalanced interface: ± 2.37V 10% |
| | *Receive Levels* | 0 to -34 dB with LTU |
| | | 0 to -10 dB without LTU |
| | *Jitter Performance* | Per ITU-T Rec. G.823 |
| | *Connectors* | Balanced interface: RJ-48C |
| | | Unbalanced interface: two BNC coaxial connectors |
| **Station Clock Interface** | *Nominal Rate* | 2.048 Mbps |
| | *Line Code* | HDB3 |
| | *Impedance* | 120Ω, balanced |
| | *Format* | Unframed or framed all-ones signal |
| | *Connector* | RJ-48C |

| | | |
|---|---|---|
| **User Data Port Interface** | *Data Rate* | 1.920, 3.840, 5.760, or 7.680 Mbps, in accordance with number of E1 links being used Automatic fallback to next lower rate when a E1 link fails |
| | *Timing Modes* | DCE (supplies transmit and receive clocks to user)<br>E-DCE (supplies receive and transmit clocks to user and accepts an external transmit clock from user) |
| | *Interfaces and Connectors* | • V.35 Interface: 34-pin female connector<br>• X.21 Interface: 15-pin D-type female connector<br>• RS-530 Interface: 25-pin D-type female connector<br>• V.36/RS-449 Interface: via adapter cable, converting the 25-pin D-type female connector of the RS-530 interface to a 37-pin D-type male connector<br>• HSSI Interface: 50-pin SCSI-2 female connector<br>• IR-ETH Interface: RJ-45 connector<br>• IR-ETH/QH Interface: RJ-45 connector |
| **Diagnostics** | | • Local and remote E1 loopbacks<br>• Local or remote user's channel loopbacks<br>• BER testing |
| **Statistics** | | E1 CRC 4 statistics per ITU-T Rec. G.704 |
| **Front Panel Controls** | *LCD* | Two rows of 16 characters |
| | *Push-buttons* | CURSOR, SCROLL, ENTER |
| **Indicators** | | • Local sync loss alarm for each E1 link<br>• Remote sync loss alarm for each E1 link<br>• User's data channel transmit and receive activity<br>• Test active<br>IR-ETH interface only:<br>• Ethernet port link status<br>• Ethernet port collision indicator<br>• Ethernet port transmit and receive data activity<br>IR- ETH/QH interface only:<br>• Ethernet port link status<br>• Ethernet port transmit and receive data activity<br>• 10/100 Mbps operation |

| | | |
|---|---|---|
| **Supervisory Port** | *Interface* | V.24/RS-232, asynchronous |
| | *Connector* | 9-pin D-type female connector |
| | *Data Rate* | 300, 1200, 2400, 4800 and 9600 bps, with automatic detection of data rate (Autobaud) |
| **Alarm Relay** | Via the STATION CLOCK RJ-48C connector | |
| | *Normally closed* | On pin 7 and 8 |
| | *Normally open* | On pin 6 and 8 |
| **Power Requirements** | *Supply Voltage* | 100 to 240 VAC, 47 to 63 Hz |
| | | -48 VDC (-36 to -72 VDC) |
| | *Power Consumption* | 18.5W |
| **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 |
| **Environment** | *Operating Temperature* | 0 to +45C (32 to 113F) |
| | *Relative Humidity* | Up to 90%, non-condensing |

# Chapter 2
# Installation and Setup

## 2.1 General

The IMX-4E1 is delivered completely assembled. It is designed for installation as a desktop unit or for mounting in a 19-inch rack. For rack installation instructions refer to the *Rack Mounting Kit for 19-inch Racks* guide that comes with the RM kit.

Mechanical and electrical installation procedures for the IMX-4E1 are provided in the following paragraphs.

After installing the unit, refer to the *Front Panel Operating Instructions* chapter for system configuration information and procedures using the front panel controls, or to the *Control from the Supervisory Port* chapter for system configuration procedures using an ASCII terminal connected to the IMX-4E1 supervisory port.

In case a problem is encountered, refer to the *Troubleshooting and Diagnostics* chapter for test and diagnostics instructions.

## 2.2 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 either open or remove top.
- Take out the IMX-4E1 carefully and place it securely on a clean surface.

Inspect the product for damage. Report immediately any damage found.

## 2.3 Site Requirements

AC-powered IMX-4E1 units should be installed within 1.5 m (5 ft) of an easily accessible grounded AC outlet capable of furnishing the required supply voltage.

DC-powered IMX-4E1 units require a -48 VDC power source, which must be adequately isolated from the mains supply.

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.

The ambient operating temperature of the IMX-4E1 should be 32° to 113°F (0 to 45C), at a relative humidity of up to 90%, non-condensing.

## 2.4 Setting the Jumpers and Switches

### Introduction

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.

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.

Prior to IMX-4E1 installation, it is necessary to check the positions of its internal jumpers and switches. If necessary, change the settings in accordance with the specific requirements of your application.

***Warning***

**Disconnect the unit from the power line and from all the cables before removing cover.**
**Dangerous high voltages are present inside the IMX-4E1 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 form its source of supply.**

***Caution*** The IMX-4E1 contains components sensitive to electrostatic discharge (ESD). To prevent ESD damage, avoid touching the internal components, and before moving jumpers, touch the IMX-4E1 frame.

## Opening the IMX-4E1 Case

To reach the internal jumpers and switches of the IMX-4E1, use the following procedure:

1. Disconnect all the cables connected to the IMX-4E1.
2. Unscrew the large captive screws fastening the top cover to the rear panel.
3. Remove IMX-4E1 top cover.

## IMX-4E1 Structure

*Figure 2-1* shows the IMX-4E1 construction. The main components of the IMX-4E1 are the motherboard, four link interface boards, and a DCE interface board.

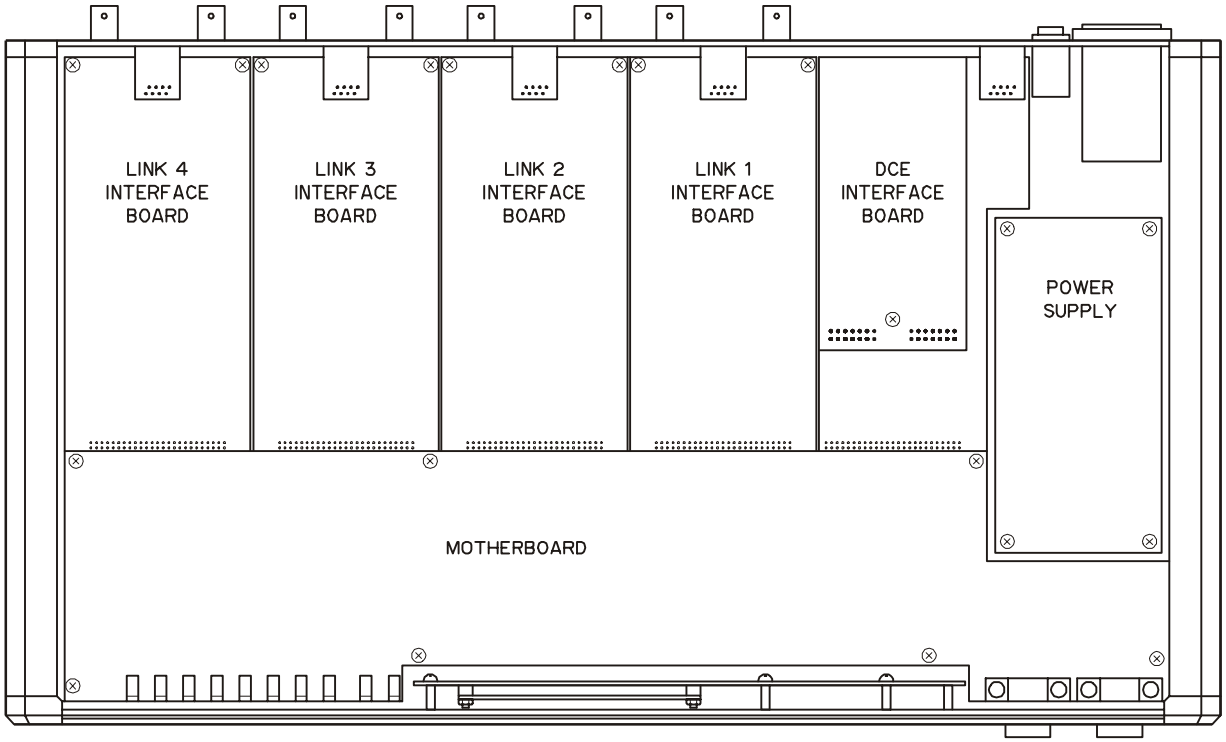


*Figure 2-1. IMX-4E1 Construction*

## Motherboard Jumpers and Switch, Location and Functions

The jumpers and switches located on the IMX-4E1 motherboard are identified in *Figure 2-2*. Their functions are described below.

In addition to the jumpers listed below, the IMX-4E1 has additional jumpers that are set by the manufacturer and must not be changed by the user.

### WD Selection, Jumper JP5

The WD (watchdog) jumper is used to disable the internal watchdog function during maintenance. The WD jumper, JP5, has two positions:

- ON – watchdog enabled.
- OFF – watchdog disabled.

**The IMX-4E1 is shipped with the jumper set at ON.**

## FGND Jumper JP22

The jumper JP22 controls the connection between the IMX-4E1 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-4E1 is shipped with the jumper set at YES (connected).**

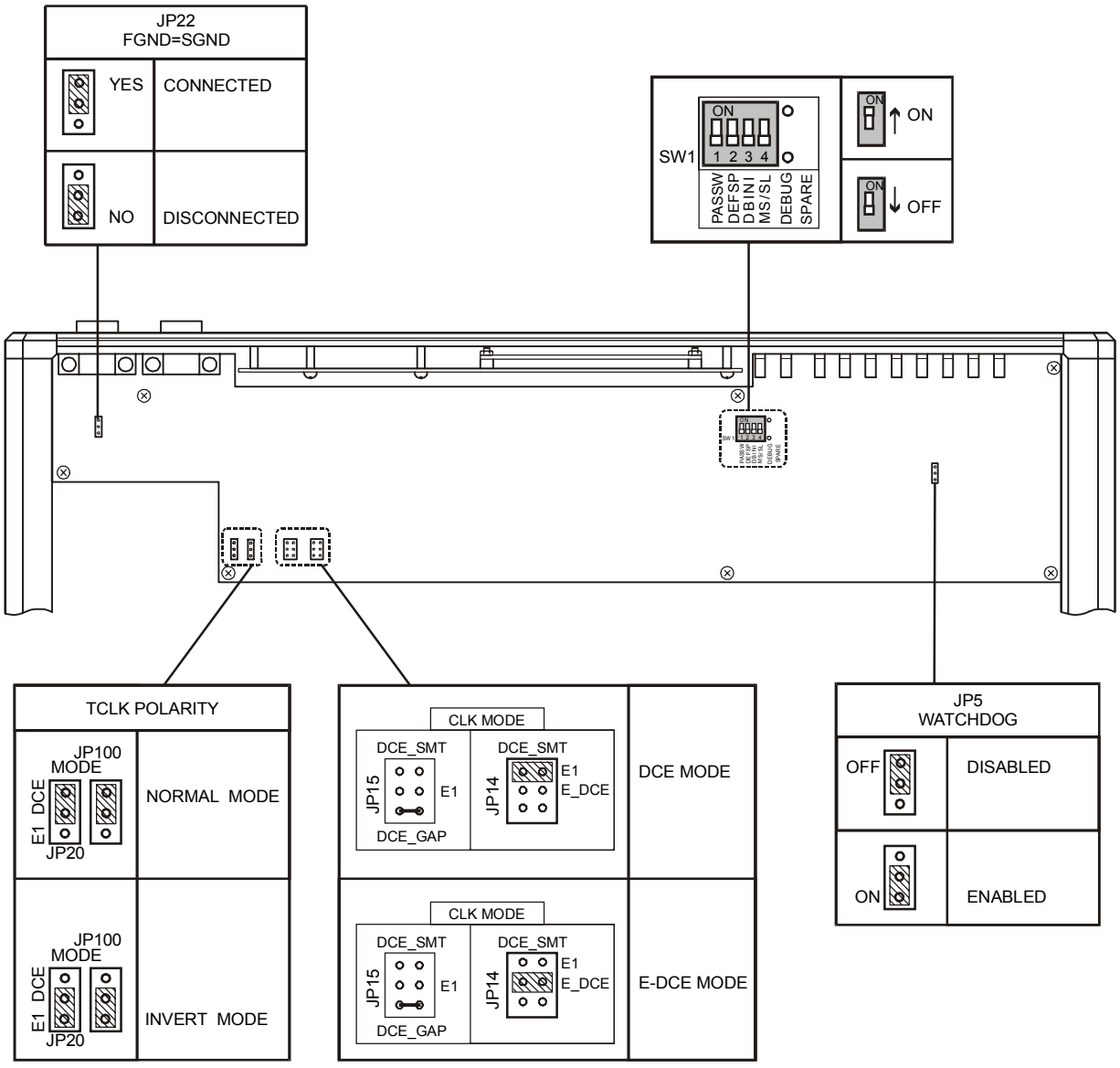


*Figure 2-2. IMX-4E1 Motherboard, Internal Settings*

***Warning***

**Setting the JP22 jumper to NO is not recommended for connection to E1 and T1 networks which are subject to permanent excessive voltages on the line.**

## Switch SW1

The IMX-4E1 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-4E1, the user specifies custom parameter values; these parameter values are stored in the IMX-4E1 database (located in non-volatile memory), and are automatically loaded each time the IMX-4E1 is powered up.

***Note*** *If during the power-up self-test, it is found that the user's configuration has been corrupted, the IMX-4E1 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-4E1 parameters from the front panel, and from using the IMX-4E1 supervision program. Note that the personnel can read the configuration parameters of the IMX-4E1 from its front panel even when the password is used.

  The IMX-4E1 is delivered with a default password, IMX, but normally the user selects the password.

  Section 1 of SW1 is used to select between the default IMX-4E1 password (the ON position) and the user-selected password (the OFF position). The IMX-4E1 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-4E1 is shipped with section 1 set at OFF.**

- **Section 2 DEFSP**. This section selects the source of the supervisory port parameters:

  **ON** IMX-4E1 uses the default parameters stored in its program EPROM. The default values are Autobaud, eight data bits, and no parity.

  **OFF** IMX-4E1 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-4E1 through its supervisory port.

  **The IMX-4E1 is shipped with section 2 set at OFF.**

- **Section 3 DBINI**. This section selects the source of the data base configuration parameters:

  **ON** IMX-4E1 uses the default parameters stored in its program EPROM.

  **OFF** IMX-4E1 uses the user-selected parameters.

  The IMX-4E1 is delivered with the database 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-4E1 is shipped with section 3 set at OFF.**

***Note*** *User-selected parameter values are not erased by setting one or more of SW1 sections 1, 2, 3 to ON: this action merely causes the IMX-4E1 to use the default values. However, if the IMX-4E1 is turned off and then powered up again, the default values replace the user values.*

- **Section 4 - MS/SL**. This section selects the maximum differential delay between links. Relevant for models with an Ethernet interface only.

  **ON** IMX-4E1 uses differential delay of 64 msec.

  **OFF** IMX-4E1 uses differential delay of 16 msec (for compatibility with older versions of the IMX-4E1).

***Note*** *IMX-4E1 models with sync data interfaces always operate with a differential delay of 64 msec. For these models, changing this section setting has no effect.*

**The IMX-4E1 is shipped with section 4 set at ON.**

### DEBUG Jumper

On certain IMX-4E1 models, this jumper is factory installed. Do not change the factory setting.

### Clock Mode Selection Jumper JP14

The jumper designated JP14 is used to determine the clocking mode. The two settings of this jumper currently available to the user, shown in *Figure 2-2*, are as follows:

- DCE – the IMX-4E1 user's data channel operates in the DCE mode explained in *System Application Considerations* on page 1-8.
- E-DCE – the IMX-4E1 user's data channel operates in the E-DCE mode explained in *System Application Considerations* on page 1-8. Note that this mode can be selected only when the user's equipment can provide an external transmit clock.

In both settings, the clock waveform is gapped.

***Note*** *E-DCE timing mode is not available for X.21 or Ethernet interfaces.*

**The IMX-4E1 is shipped with the jumper set for the E-DCE mode (models with X.21 or Ethernet interfaces are set for DCE mode).**

### Polarity Selection, Jumpers JP20 and JP100

These jumpers determine the polarity of the TCLK clock that samples the incoming data:

- DCE (Normal): the incoming data sample with the rising edge of TCLK.
- E1 (Invert): the incoming data sample with the falling edge of TCLK.

***Note*** *Variation in cable length, round trip delay and other factors can cause the clock and the data to shift out of phase. Inverting the polarity of TCLK by using the E1 (Invert) mode may often correct this shift. See the E1/T1 Link Limit Supplement at the beginning of this manual for more information.*

**These jumpers are factory set according to the data port interface ordered: for the X.21 and HSSI interfaces the factory setting is E1, for the rest of interfaces the factory setting is DCE.**

## E1 Link Interface Boards

The four E1 link interface boards include user-selectable jumpers. These jumpers are identified in *Figure 2-3*.

***Note*** *Each interface board has protection fuses for the surge protection circuits located on the line side of the line isolation transformers. These fuses are also identified in Figure 2-3.*

### Termination Selection Jumpers JP1, JP2, JP6

The jumpers JP1, JP2 and JP6 are used to select the link interface. All jumpers must be set to the same position.

- BAL for operation with the balanced interface.
- UNBAL for operation with the unbalanced interface.

**The IMX-4E1 is shipped with all the jumpers set at BAL.**

### Interface Type Selection Jumper JP4

The JP4 jumper is used to select the link interface type. Note that jumper setting depends on the type of link interface installed on the IMX-4E1, DSU or LTU.

- CSU T1/E1 for operation with either balanced or unbalanced interface, when LTU is installed.
- BAL E1 for operation with balanced interface, when LTU is not installed (DSU installed).
- DSU T1 – not applicable for IMX-4E1.
- UNBAL E1 for operation with unbalanced interface, when LTU is not installed (DSU installed).

**The IMX-4E1 is shipped with the jumper set at BAL E1.**

## Transmit Side Ground Reference Jumper JP7

The JP7 jumper is used to control the ground reference of the link transmit output when the unbalanced interface is used.

- BAL for TX-OUT signal not connected to frame ground.
- UNBAL for TX-OUT signal connected to frame ground.

In accordance with ITU-T recommendations, the jumper needs to be set for UNBAL when the unbalanced interface is used. Jumper must be set to BAL when working with balanced interface.

**The IMX-4E1 is shipped with the jumper set at BAL.**

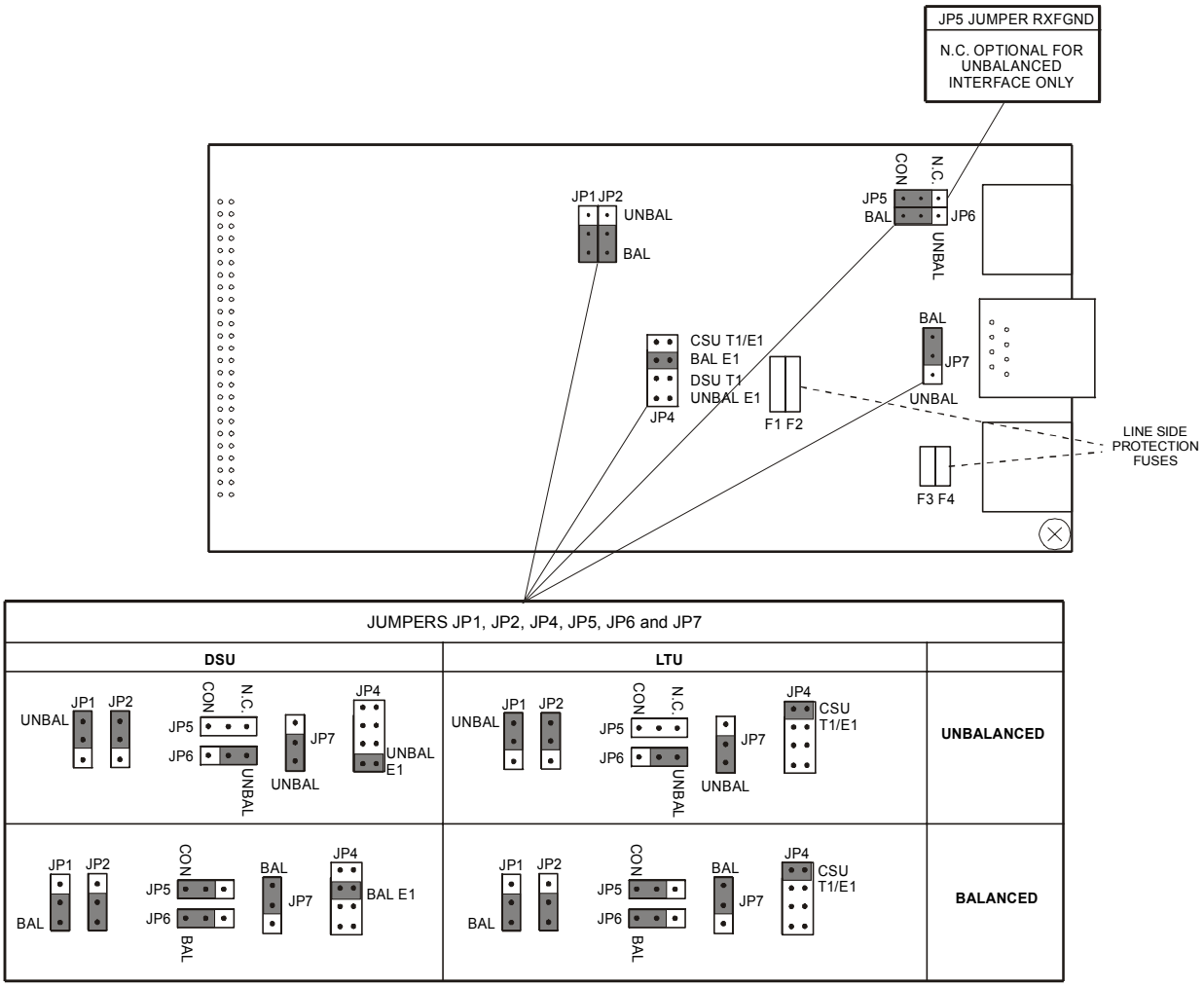


*Figure 2-3. E1 Link Interface Board, Internal Settings*

## Receive Side Ground Reference Jumper JP5

The RXFGND JP5 jumper is used to control the ground reference of the link receive input when the unbalanced interface is used.

- CON for RX-IN signal connected to frame ground.
- N.C. for RX-IN signal not connected to frame ground.

In accordance with ITU-T recommendations, the N.C. setting is an option only when the unbalanced interface is used (the line is normally grounded at the transmit side). The jumper setting does not influence balanced interface operation.

**The IMX-4E1 is shipped with the jumper set at CON.**

## DCE Interface Boards

The DCE interface boards include a single user-selectable jumper (JP2).

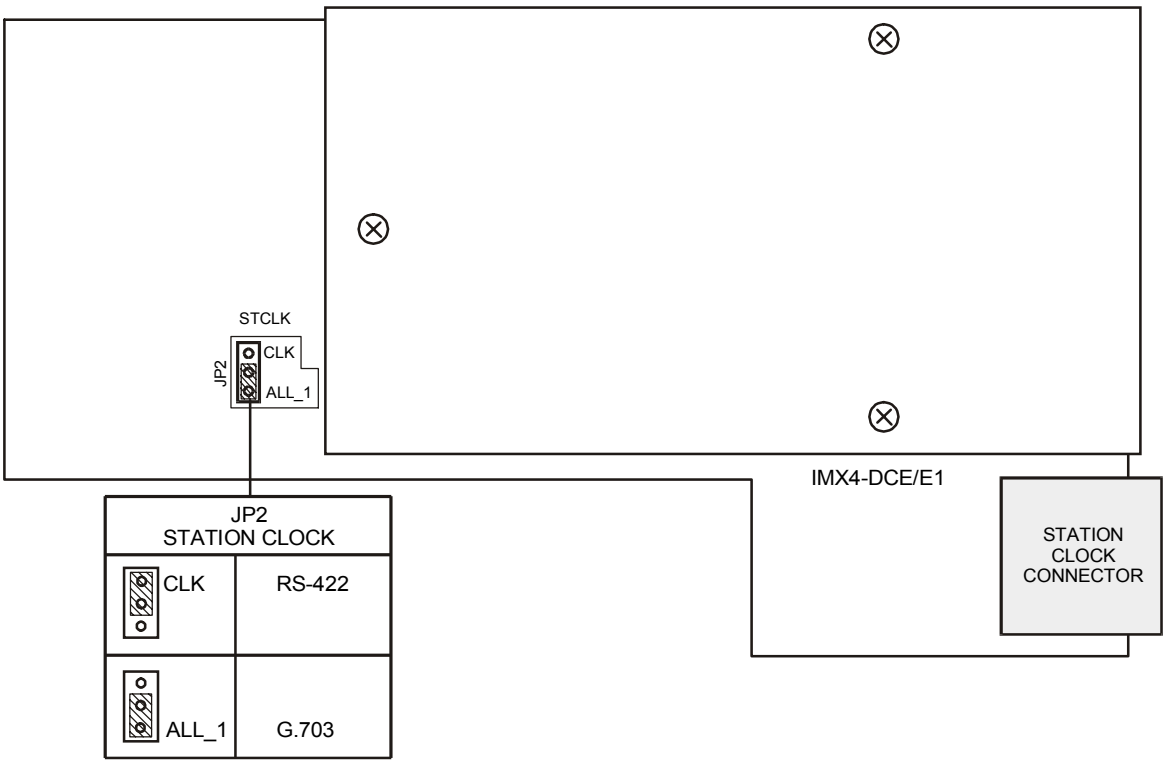


*Figure 2-4. DCE Interface Board*

### Station Clock Source Selection Jumper JP2

The jumper designated JP2 on the DCE interface board is used to select the station clock interface type. The two settings of this jumper, shown in *Figure 2-4*, are as follows:

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

**The IMX-4E1 is shipped with the jumpers set at ALL_1.**

## Internal Settings Procedure

Refer to *Figure 2-2*, *Figure 2-3* and *Figure 2-4*, and identify jumper and switch locations and settings. Change settings as required.

After completing the internal settings, reinstall the top cover of the IMX-4E1 and fasten it to the rear panel by fully screwing in the large rear panel screws.

# 2.5 Connecting the Interfaces

## Connector Locations

*Figure 2-5* shows the rear panel of an IMX-4E1 unit (AC version) and identifies connector locations.

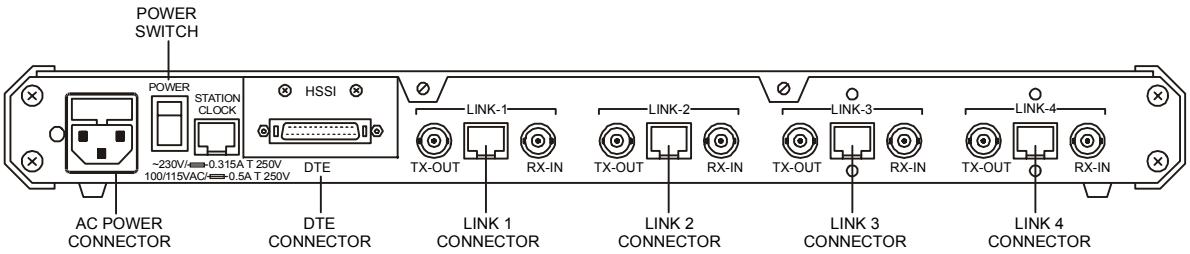


*Figure 2-5. IMX-4E1 Rear Panel*

## 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-4E1 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.**

## Connecting the E1 Interface

Each IMX-4E1 link interface has one RJ-48C connector (for the balanced link interface), and two BNC connectors (for the unbalanced interface). The *Connector Wiring* appendix provides the pin allocation for the RJ-48C connector.

Connect each of the link cables to the connector(s) corresponding to the link to be used. ***Do not connect cables to both the balanced and unbalanced connectors of the same link!***

- When using the balanced interfaces, connect the cable to the RJ-48C connectors designated LINK-1, LINK-2, LINK-3, or LINK-4, respectively.
- When using the unbalanced interface, connect the cables to the two BNC connectors designated RX-IN and TX-OUT of the appropriate interfaces. Pay attention to correct connection of the transmit and receive cables to the TX-OUT and RX-IN connectors.

## Connecting the Station Clock

The IMX-4E1 has one RJ-48C connector for the external (station) clock interface. The *Connector Wiring* appendix provides the pin allocation for the RJ-48C connector.

The maximum allowable line attenuation between the IMX-4E1 station clock port and the network interface is 10 dB.

If an external clock signal will be used, connect the external clock cable to the STATION CLOCK connector.

## Connecting the User's Data Port

The connection of the user's data terminal equipment is made to the rear panel connector marked DTE. The label displayed above the connector indicates the interface type installed in the IMX-4E1. *Figure 2-5* shows an IMX-4E1 with HSSI interface). Connector pin allocations and adapter cable wiring data appear in the *Connector Wiring* appendix.

**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.

**HSSI Interface** The HSSI interface has a 50-pin SCSI-2 female connector wired for direct connection to HSSI 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 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** Both Ethernet ports (IR-ETH and IR-ETH/QH) have a shielded RJ-45 connector, wired for direct connection to LAN.

## Connecting the Supervisory Port

Connect a cable prepared in accordance with the *Connector Wiring* appendix between the supervisory port connector marked DCE, located on the front panel of the IMX-4E1, and the supervision terminal. If the supervision terminal is connected via modems, use a cross-over cable.

To enable communication with the IMX-4E1, the supervisory terminal should be set to the same data rate, data word format and parity type as the IMX-4E1, before you start operations.

## Connecting the Power

### AC Power Connection

AC power should be supplied to the IMX-4E1 through a 5-feet (1.5 m) standard power cable terminated by a standard 3-prong plug.

- Check that the ON/OFF switch on the IMX-4E1 rear panel is set to OFF.
- Connect the power cable first to the connector on the IMX-4E1 rear panel, then to the mains outlet.

### DC Power Connection

To connect DC power to IMX-4E1, refer to the *DC Power Supply Connection* supplement.

# Chapter 3

# Front Panel Operating Instructions

## 3.1 Scope

This chapter explains how to operate the IMX-4E1 from the front panel. The information presented in this chapter includes:

- Description of IMX-4E1 control, display and push-button functions, and menu organization
- IMX-4E1 configuration parameters
- IMX-4E1 operating procedures (turn-on, front-panel indications, performance monitoring and turn-off)
- IMX-4E1 local configuration setup including specific configuration guidelines
- IMX-4E1 configuration error messages.

Refer to the *Control from the Supervisory Port* chapter for instructions on the use of a supervision terminal to remotely control and monitor IMX-4E1 operation.

## 3.2 Front Panel Controls, Connectors and Indicators

*Figure 3-1* shows the front panel of the IMX-4E1. *Table 3-1* lists the functions of the IMX-4E1 controls, connectors and indicators, located on the IMX-4E1 front panel. The index numbers in *Table 3-1* correspond to the item numbers in *Figure 3-1*.

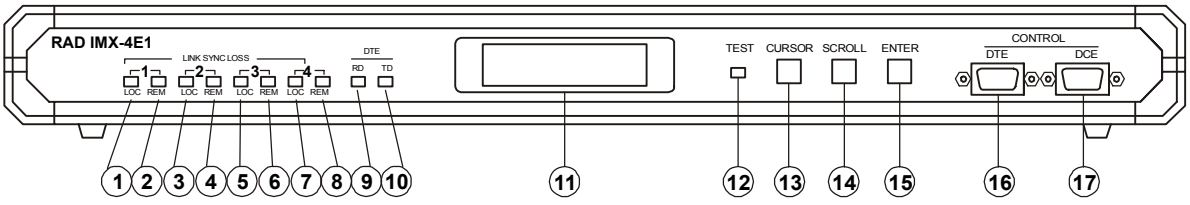


*Figure 3-1. IMX-4E1 Front Panel*

*Table 3-1. IMX-4E1 Controls, Connectors and Indicators*

| No | Control or Indicator | Function |
|---|---|---|
| 1 | LINK 1 LOC indicator | Lights when a local loss of synchronization alarm is detected on link 1 |
| 2 | LINK 1 REM indicator | Lights when a remote loss of synchronization alarm is detected on link 1 |
| 3 | LINK 2 LOC indicator | Lights when a local loss of synchronization alarm is detected on link 2 |
| 4 | LINK 2 REM indicator | Lights when a remote loss of synchronization alarm is detected on link 2 |
| 5 | LINK 3 LOC indicator | Lights when a local loss of synchronization alarm is detected on link 3 |
| 6 | LINK 3 REM indicator | Lights when a remote loss of synchronization alarm is detected on link 3 |
| 7 | LINK 4 LOC indicator | Lights when a local loss of synchronization alarm is detected on link 4 |
| 8 | LINK 4 REM indicator | Lights when a remote loss of synchronization alarm is detected on link 4 |
| 9 | DTE RD indicator | Lights when data is present on the receive line of the user's interface |
| 10 | DTE TD indicator | Lights when data is present on the transmit line of the user's interface |
| 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 push-button | Used to move among the information fields |
| 14 | SCROLL push-button | Used to scroll among the available options of the displayed functions |
| 15 | ENTER push button | Used to enter the changes made in the IMX-4E1 operation, and initiate operation under the new set-up |
| 16 | DTE connector | Reserved for future use |
| 17 | DCE connector | Connection to supervision terminal |

## Ethernet Interface Indicators

The Ethernet Interface (both IR-ETH and IR-10/100 versions) have their own LED indicators located on the module panel so that they make part of the IMX-4E1 rear panel.

*Figure 3-2* shows the LED indicators of the IR-ETH module. *Table 3-2* describes their functions. The IR-10/100 indicators are described in *Appendix B*.

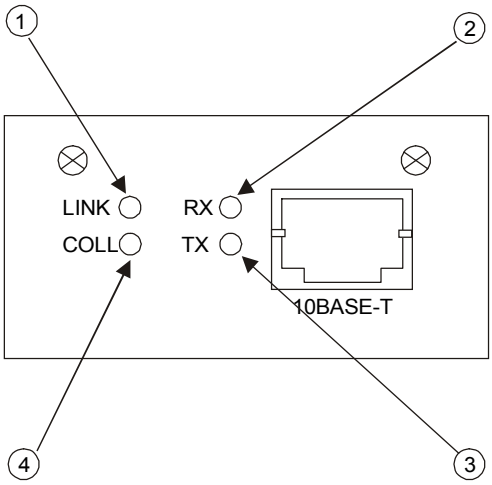


*Figure 3-2. Ethernet 10BaseT Interface*

*Table 3-2. Ethernet 10BaseT Interface Indicators*

| No. | Indicator | Function |
|---|---|---|
| 1 | LINK indicator | Lights when the Ethernet interface is connected to an active LAN (i.e., a LAN with at least one active stations) |
| 2 | RX indicator | Lights when receive activity is present on the Ethernet interface |
| 3 | TX indicator | Lights when transmit activity is present on the Ethernet interface |
| 4 | COLL indicator | Lights temporarily for each collision |

## 3.3 Control of IMX-4E1 Operation

### Introduction

IMX-4E1 operating mode is determined by a set of parameters stored in an internal non-volatile memory. The user, using the IMX-4E1 front panel push buttons, or a supervision terminal selects these parameters. After the operating parameters are loaded, the configuration set-up process begins and no further operator attendance is required.

The configuration stored in the IMX-4E1 memory is not affected when power is turned off. Upon turn-on, the IMX-4E1 checks the validity of the stored configuration data, and if everything is OK, it assumes the last selected configuration. If the configuration does not require modification, the IMX-4E1 is then ready for operation immediately after power is applied. However, if the configuration data is not valid, the IMX-4E1 lets you load instead a default configuration. The default configuration, prepared by the manufacturer, is stored in the program EPROM.

## General Operating Instructions

All operations are performed using an interactive, menu-driven user-friendly interface. The interface is controlled by means of the display and three push buttons. The IMX-4E1 guides you in the execution of the required task by means of simple and clear messages, presents the range of available parameter values and checks your inputs.

Moreover, the IMX-4E1 will present to you only those parameter values available on your IMX-4E1 model in the selected operating mode.

If you make a configuration error, e.g., you select a parameter value that conflicts with the current operating mode, the IMX-4E1 rejects the erroneous selection and displays an error message that identifies the error.

You will find detailed instructions for operating the IMX-4E1 in *Operating Instructions* on page 3-10 and *Local Configuration Setup Procedure* on page 3-14. *LCD Configuration Error Messages* on page 3-17 explains the configuration error messages, and presents instructions for correcting the problem.

## Organization of IMX-4E1 Display

The IMX-4E1 display has two rows:

- **Upper row**. Shows the name of the displayed function, group of configuration parameters, or test option.
- **Lower row**. The lower row displays:
  - Parameter name and value.
  - Status messages.
  - Loopback status.
  - Error messages.
  - Diagnostics messages.

## Information Displayed on the LCD

The IMX-4E1 display has four functions:

- Display of status messages
- Display of diagnostics performance data
- Display of test functions
- Display of configuration parameters.

### Status Messages (Alarms)

When the IMX-4E1 is not being configured and no test is active, its display shows status messages. The alarm buffer can store up to 100 alarms. The status messages appear under the header ALARM BUFFER. The status messages are described in the *Troubleshooting and Diagnostics* chapter.

## Diagnostic and Performance Monitoring Data

The IMX-4E1 displays the traffic performance parameters gathered when the CRC-4 function is enabled. The IMX-4E1 can also display BPV statistics even when the CRC-4 function is disabled. The diagnostics data appears under the header DIAGNOSTICS. The *Troubleshooting and Diagnostics* chapter explains the diagnostics data displayed by the IMX-4E1.

## Test Functions

The test functions include:

- Local and remote loopbacks, for rapid isolation of faults.
- BER test.

The test function messages appear under the header TEST OPTIONS. The *Troubleshooting and Diagnostics* chapter describes the available test functions.

## Configuration Parameters

The IMX-4E1 has three groups of configuration parameters:

- System parameters
- Link parameters
- Channel parameters
- Supervisory port parameters.

The configuration parameter groups are detailed in *Table 3-3*.

*Table 3-3. Configuration Parameter Groups*

| Display | Description | See... |
|---|---|---|
| SYSTEM PARAMETER | Display and selection of system parameters:<br>- Master clock source<br>- Fallback clock Source<br>- Broadcast control data transmission<br>- Ethernet interface selection<br>- Bridging control Ethernet traffic | *System Configuration Parameters* on page 3-7 |
| LINK PARAMETER | Display and selection of link parameters:<br>- Link connection<br>- Idle time slot fill-up code<br>- Use of CRC-4 option<br>- Synchronization time | *Link Configuration Parameters* on page 3-8 |
| CH MAP | Display and selection of IMX-4E1 links to be used | *Channel Map Configuration Parameters* on page 3-9 |
| SP PARAMETER | Display and selection of IMX-4E1 supervisory port parameters:<br>- Data rate<br>- Number of data bits<br>- Parity<br>- Interface type | *Supervisory Port Configuration Parameters* on page 3-9 |

In addition to the parameters configured from the front panel, there are parameters that can be controlled only from the supervision terminal. These are presented in the *Control from the Supervisory Port* chapter.

After configuration, if alarm messages are stored in its ALARM BUFFER, the IMX-4E1 automatically returns to the display of status messages.

## Using Front-Panel Pushbuttons

IMX-4E1 operation is controlled by means of the display and the three push buttons designated CURSOR, SCROLL and ENTER. The same control actions are consistently used for all the activities:

**CURSOR** Use this push-button to indicate what you want to change. Pressing the CURSOR push-button moves the cursor among the fields in the current display. The cursor is a bar that underlines the selected field.

Some fields list several different items. To select an item, place the cursor under the desired item. The item displayed above the cursor can be changed (scrolled) by pressing SCROLL.

**SCROLL** Press repeatedly to display the alternatives for the current field/item indicated by the cursor. Holding the push-button depressed causes automatic scrolling of the available alternatives.

**ENTER** Press it once to select the value displayed in the field/item indicated by the cursor. If the selected value is valid, it replaces the old value and the change takes effect immediately. The ENTER key has two additional functions:

- When the alarm buffer is displayed, the ENTER key can be used to delete all the alarms in the buffer.
- When DIAGNOSTICS is displayed, the ENTER key can be used to reset the following error counters:

  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.

If you make an incorrect selection, the selection is not accepted. In this case, you see a CONFIG ERROR message with a two-digit code in the second display row. The code indicates what is wrong. *LCD Configuration Error Messages* on page 3-17 explains the codes and what to do to correct the error.

After a short time, the error message disappears and the original display returns. At this time, you can correct the error.

## 3.4 System Configuration Parameters

*Table 3-4* lists the available system configuration parameters and their functions. The table also lists the parameter values included in the IMX-4E1 default configuration.

*Table 3-4. System 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>LNK 3 – Locked to the recovered receive clock of link 3<br>LNK 4 – Locked to the recovered receive clock of link 4<br>ST – External clock signal connected to the STATION CLOCK connector<br>INT – Internal oscillator<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>LNK3 – Locked to the recovered receive clock of link 3<br>LNK4 – Locked to the recovered receive clock of link 4<br>ST – External clock signal connected to the STATION CLOCK connector<br>**Default: NONE** |
| BRODCAST_TX | Selects the data transmission function | YES – Data transmitted to every link regardless of whether the link is operational<br>NO – Data transmitted to a link only when the link is operational<br>**Default: NO** |
| ETRNET | Selects the Ethernet LAN traffic transfer mode | HALF – Half duplex operation<br>FULL – Full duplex operation<br>**Default: HALF** |
| BRIDGING | Select the Ethernet traffic control function | FILTER – The internal bridge of the IMX-4E1 is enabled, and filters the traffic transferred to the remote end<br>TRANS – The internal bridge of the IMX-4E1 is disabled, and the Ethernet traffic is transparently transferred (LAN extender function)<br>**Default: FILTER** |

## 3.5 Link Configuration Parameters

*Table 3-5* lists the available link configuration parameters and their functions. The table also lists the parameter values included in the IMX-4E1 default configuration. Parameter values can be independently selected for each link.

*Table 3-5. Link Parameters*

| Designation | Function | Values |
|---|---|---|
| CON | Used to control the use of the selected link<br>To actually use a given link, first it must be assigned to the data channel (*Channel Map Configuration Parameters* on page 3-9) | NO – Link is not used<br>YES – Link is used to carry user's data<br>**Default: YES** (provided the link is installed) |
| CRC-4 | Enables the generation of check bits (in accordance with the CRC-4 polynomial specified by ITU-T Rec. G.704) for the frames transmitted on the link, and the checking of the check bits carried by the received link frames | NO – CRC-4 option disabled<br>YES – CRC-4 option enabled<br>**Default: NO** |
| SYNC | Permits to reduce the time required for the selected link to return to normal operation after local loss of synchronization | CCITT – Complies with ITU-T Rec. G.732<br>62411 – Similar to the requirements of AT&T TR-62411 (after 10 seconds)<br>FAST – After 1 second<br>**Default: CCITT** |
| I_TS_CODE | Selects the code transmitted to fill idle (unused) time slots in the frames transmitted on the selected link, when it is not used (not mapped) | The available selections are 00 to FF (hexa).<br>**Default: 3F** |

## 3.6 Channel Map Configuration Parameters

*Table 3-6* lists the channel map configuration parameters. The table also lists the parameter values included in the IMX-4E1 default configuration.

*Table 3-6. Channel Map Parameters*

| Designation | Function | Values |
|---|---|---|
| LINK X | Controls the connection of each individual link to the user's data channel<br>X designates the link number, 1 through 4 | YES – Link can be used by the user's data channel<br>NO – Link cannot be used to carry user data, even if it is installed on the IMX-4E1 channel<br>**Default: YES** (provided the link is installed on the IMX-4E1) |

## 3.7 Supervisory Port Configuration Parameters

*Table 3-7* lists the available supervisory port configuration parameters and their functions. The table also lists the parameter values included in the IMX-4E1 default configuration.

In addition to the parameters listed below, the IMX-4E1 supports additional parameters, which can be modified only via the supervisory port. These parameters are explained in the *Control from the Supervisory Port* chapter.

*Table 3-7. Supervisory Port Parameters*

| Designation | Function | Values |
|---|---|---|
| SPEED | Selects supervisory port data rate (bps) | 300, 1200, 2400, 4800, 9600<br>AUTO – Autobaud operation. The IMX-4E1 automatically identifies the supervisory port data rate.<br>**Default: AUTO** |
| DATA | Selects the number of data bits in the word format | 7 or 8 data bits.<br>**Default: 8** |
| PARITY | Controls the use of parity | ODD – Odd parity<br>EVEN – Even Parity<br>NONE – Parity disabled (only available with 8 data bits)<br>**Default: NONE** |
| INTERFACE | Selects supervisory port interface type | DCE – The IMX-4E1 functions as a DCE for the supervision terminal.<br>DTE – The IMX-4E1 functions as a DTE, for connection via modem to the supervision terminal.<br>***Note***: for either setting, use the DCE supervisory port connector.<br>**Default: DCE** |

## 3.8 Operating Instructions

This paragraph covers the following activities:

- Turn-on
- Checking IMX-4E1 configuration
- Normal IMX-4E1 operating indications
- Monitoring IMX-4E1 performance
- IMX-4E1 turn-off.

For local configuration setup instructions, refer to *Local Configuration Setup Procedure* on page 3-14.

### Turn-on

To turn the IMX-4E1 on, set the rear POWER switch to ON. Upon turn-on, the IMX-4E1 performs self-test; observe the front-panel indications.

During the self-test, the IMX-4E1 displays the software version in the format X.Y:

```
IMX-4E1 REV: X.Y SELF TEST
```

After successfully completing the self-test procedure, the IMX-4E1 will switch to the default display - the ALARM BUFFER.

***Notes***

1. *If the IMX-4E1 fails the self-test, you will see a description of the fault in the second row. In this case, the IMX-4E1 must be repaired before it can be used again. Refer to the Troubleshooting and Diagnostics chapter for instructions.*
2. *If the configuration data stored by the IMX-4E1 is corrupted, the DATABASE CKS ERR alarm message is generated. In this case, it is necessary to initialize the database (after initialization, you can select again the desired parameters). To initialize the database, set section 3 of the internal switch SW1 to ON, turn the IMX-4E1 on, and then turn it off and return section 3 to OFF (refer to the Installation and Setup chapter for detailed procedures).*
3. *The parameter values included in the default configuration are listed in Section 3.4 to Section 3.7.*

You can verify the IMX-4E1 configuration as explained below. If the configuration does not require modification, the IMX-4E1 is ready for operation immediately after self-test is completed. To change the configuration, refer to *Local Configuration Setup Procedure* on page 3-14.

## Checking Current Operating Configuration

Review *Sections 3.4* through *3.7* for an explanation of the IMX-4E1 configuration parameters.

***Note*** *During the following procedure, do not press the ENTER push-button, to prevent accidental change of parameters.*

| Step | Action | Key | Display |
|---|---|---|---|
| 1 | Bring the cursor under the top row (if not already there) | CURSOR | |
| 2 | Scroll to display SYSTEM PARAMETER in the top row | SCROLL | Second row shows the first system parameter, CLK MASTER, and its current selections. |
| 3 | Bring the cursor under the left-hand field in the second row | CURSOR | |
| 4 | Scroll to see the other system parameters | SCROLL | After each pressing of the SCROLL button, the second display row shows the current value of the next system parameter. Continue until CLK MASTER appears again. |
| 5 | Bring the cursor under the right-hand field in the top row | CURSOR | |
| 6 | Bring to display the next group of configuration parameters (the link parameters of link 1), LINK PARAMETER LINK1 | SCROLL once | The second row shows the first parameter of link 1, CON, and its current value. |
| 7 | Bring the cursor under the left hand field in the second row | CURSOR | |
| 8 | Scroll to see the other parameters of link 1 | SCROLL | After each pressing of the SCROLL, button, the second display row shows the current value of the next parameters. Continue until CON appears again. |
| 9 | Bring the cursor under the right-hand field in the top row | CURSOR | |
| 10 | Scroll to display LNK2 in the top row | SCROLL | The second row shows the first parameter of link 2, CON, and its current value. |
| 11 | Bring the cursor under the left-hand field in the second row | CURSOR | |
| 12 | Scroll to see the other parameters of link 2 | SCROLL | After each pressing of the SCROLL button, the second display row shows the current value of the next parameters. Continue until CON appears again. |

| Step | Action | Key | Display |
|---|---|---|---|
| 13 | Repeat steps 9 through 12 for link 3 | CURSOR SCROLL | |
| 14 | Repeat steps 9 through 12 for link 4 | CURSOR SCROLL | |
| 15 | Bring the cursor under the left-hand field in the top row | CURSOR | |
| 16 | Bring the cursor under the left-hand field in the top row | CURSOR | |
| 17 | Bring to display the next group of configuration parameters, CH MAP | CURSOR SCROLL | Second row shows the first channel parameter, LINK 1, and its current selection. |
| 18 | Scroll to see the other channel parameters | SCROLL | After each pressing of the SCROLL button, the second display row shows the next link, Continue until LINK 1 appears again. |
| 19 | Bring the cursor under the left-hand field in the top row | CURSOR | |
| 20 | Bring the cursor under the left-hand field in the top row | CURSOR | |
| 21 | Repeat steps 1 through 4 to display the supervisory port parameters – SP PARAMETER | CURSOR SCROLL | |

## Normal Indications

### LCD

The normal message displayed in the top row is ALARM BUFFER. However, if no alarm is stored in the alarm buffer, the IMX-4E1 will continue displaying the last user-selected display.

In addition, the IMX-4E1 will automatically abort the current activity and will redisplay the ALARM BUFFER message if no front-panel button is pressed for 1 minute, thereby ensuring that it will not remain in an indeterminate state even if the operator does not complete a configuration activity. This, however, does not apply to the DIAGNOSTICS display.

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

- During normal operation, the second row should show EMPTY (no alarm messages).
- If the alarm buffers contains alarms, you will see SCROLL in the left-hand field of the second row, and CLEAR in the right-hand field.

The alarms can be displayed by bringing the cursor under SCROLL, and then pressing ENTER. You can now scroll between the alarms stored in the alarm buffer. To interpret the alarm messages displayed in the second row, refer to *Table 5-1*. In *Table 5-1*, you will find two types of alarms, designated as ON/OFF and ON:

- A message indicating an ON/OFF alarm is displayed only when the alarm condition is present, and is automatically removed when the condition is cleared (if the alarm is being displayed, it will disappear only when the display is refreshed by scrolling).
- A message indicating an ON alarm persists even after the event that caused the alarm condition is cleared.

If IMX-4E1 operates normally, but an alarm message of the ON type is displayed, you can clear the event alarm message from the display following this procedure:

| Step | Action | Key | Display |
|---|---|---|---|
| 1 | Bring the cursor in the second row, under CLEAR | CURSOR | |
| 2 | Press ENTER to clear the event messages in the alarm buffer | ENTER | If no state alarms are present, the second row should show EMPTY |

### Normal Front-Panel Indications

During normal operation, all the IMX-4E1 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 user's data channel interface.

### Fault Indications

If any of the LINK ALARMS indicators and/or the TEST indicator lights, data transfer is interrupted.

- The TEST indicator lights when a test is active. If the test is activated from the local IMX-4E1, you can see the test type by entering the TEST OPTIONS (see the *Troubleshooting and Diagnostics* chapter). You can disconnect a local or remote loop as explained in the *Troubleshooting and Diagnostics* chapter.
- The LOC indicator of a link lights when a local loss of synchronization alarm condition is present on the corresponding link.
- The REM indicator of a link lights when a remote loss of synchronization alarm condition is present on the corresponding link.

## Monitoring the IMX-4E1 Performance

The IMX-4E1 continuously measures diagnostics performance data. The diagnostics data is available under DIAGNOSTICS. The measured parameters are explained in the *Control from the Supervisory Port* and *Troubleshooting and Diagnostics* chapters.

## Turn-off

Set the IMX-4E1 rear power switch to OFF.

## 3.9 Local Configuration Setup Procedure

Before starting any configuration action:

- Review the relevant configuration parameters given in *Sections 3.4 through 3.6*.
- Obtain a list of the required parameters from your network subscription data, and/or from your system administrator.

IMX-4E1 configuration is set-up by a simple three-step procedure:

1. Select the system parameters.
2. Select the link parameters.
3. Select the channel parameters.

When a supervision terminal will be used to control the IMX-4E1, you should also select the parameters of the supervisory port.

The general configuration procedure is explained on the following page. The general procedure is followed by special considerations for each group of parameters.

The IMX-4E1 presents only those parameters available in the selected mode, therefore it is important to perform the configuration according to the order specified above.

### Password Protection

The IMX-4E1 is intended for configuration via the supervision port, using a supervision terminal. If you cannot use a terminal for performing the configuration procedures, it is necessary to configure the IMX-4E1 from the front panel. This, however, is possible only when the use of the password is disabled: if the password is enabled, you can use the IMX-4E1 front panel to display the current parameter values, but 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-4E1 uses the default parameter values, the use of the password is disabled (to load the default parameters, use the DBINI section of the internal switch SW1, as explained in *Setting the Jumpers and Switches* on page 2-11). The use of the password can be enabled or disabled by means of the supervision terminal, by entering the DEF SP command (refer to the *Control from the Supervisory Port* chapter 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 LCD Configuration Error Messages on page 3-17 for an explanation of the configuration error messages the IMX-4E1 displays when you make an error.*

| Step | Action | Key | Display |
|---|---|---|---|
| 1 | Bring the cursor under the top row (if not already there) | CURSOR | |
| 2 | Scroll to display the desired group of parameters in the top row | SCROLL | Second 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 and additional field (at the rightmost side of the top row): this field is used to select the desired link number. In this case, use the CURSOR key to bring the cursor to the rightmost field, then SCROLL to show the desired link number | | | |
| 3 | When the second row has more than one field, bring the cursor under the left-hand field (parameter name) in the second row, and then scroll to display the desired parameter in the selected group | CURSOR<br>SCROLL | The second row shows the parameter name and its current value |
| 4 | Bring the cursor under the right-hand filed (the parameter value) in the second row | CURSOR | |
| 5 | Scroll to set the required value for the displayed parameter | SCROLL | The second row shows the available values |
| 6 | When the desired parameter value is displayed, select the new parameter value | ENTER | The cursor returns to the first field in the top row. The second row displays shortly CONFIG ENTER, then returns to the normal display |
| ***Note***: You must press ENTER after changing parameters of a certain group, e.g., SYSTEM, LINK, etc. If you change parameter values, but return the cursor to the first field and scroll to another group without pressing ENTER, the changes are discarded and you will see the message CONFIG LOST | | | |
| 7 | Repeat steps 3 through 6 until values are assigned to all the parameters in the group | SCROLL | The second row shows the current selection |
| 8 | Repeat steps 1 through 7 until values are assigned to all the parameters in the desired groups | SCROLL | The second row shows the current selection |
| 9 | After completing the configuration actions, you can use steps 1, 2 or return to the ALARM BUFFER.<br>If alarm messages are stored in the ALARM BUFFER, ALARM BUFFER will be automatically displayed if no push button is pressed for one minute. | SCROLL | The top row shows:<br>ALARM BUFFER |

## Specific Configuration Guidelines

This section presents specific configuration guidelines for the selection of parameter values. You may also wish to refer to *Operating Environment* on page 1-6, which provides a concise description of the IMX-4E1 operating environment, including explanations for many of the relevant terms.

### System Parameter

See parameter definitions in *System Configuration Parameters* on page 3-7.

**CLK MASTER** For connection to carrier lines, select any one of the connected links: LNK1, LNK2, LNK3, or LNK4. If a station clock is available, you may also select ST.

For a point-to-point application with stand-alone equipment at both link ends, you can also select INT (or ST, if available) at one end and LNK1, LNK2, LNK3, or LNK4 at the other end.

**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-4E1 internal clock oscillator.

**BRODCAST_TX** For data transmitted over the link.

**Yes** – the data is transmitted to all the links, regardless of whether the link is operational or not

**No** – the data is transmitted to a link only when it is operational.

**ETRNET** Select the method used to handle the LAN traffic, half-duplex (HALF_DUP) or full-duplex (FULL_DUP). This parameter is relevant only for the Ethernet interface: for other interfaces, it always shows N/A

**BRIDGING** Select FILTERED if you want to operate the E1 link as a remote bridge (the recommended method). To operate the link as a LAN extender (or repeater), select TRAN.

This parameter is relevant only for the Ethernet interface: for other interfaces, it always shows N/A.

### Link Parameter

For each link, select the following parameters. See parameter definitions in *Link Configuration Parameters* on page 3-8.

**CON** For an active link select YES. The number of active links determines the user's channel data rate (the user's channel data rate is n x 1.920 Mbps, where n is the total number of active links).

Make sure you connect the required number of links using the CH MAP function.

**SYNC** Select CCITT, unless your application has special requirements.

**I_TS_CODE** Select the value specified for your network.

**CRC-4** Select YES, unless the IMX-4E1 is connected to transmission equipment that does not support this capability.

### CH Map

For each link, select the following parameters. See parameter definitions in *Channel Map Configuration Parameters* on page 3-9.

### SP Parameters

See parameter definitions in *Supervisory Port Configuration Parameters* on page 3-9.

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

**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 functions of the interface pins. Therefore, when connecting to a modem, it is necessary to use a cross cable. For either setting, use the DCE supervisory port connector.*

## 3.10 LCD Configuration Error Messages

The IMX-4E1 detects configuration errors and displays a CONFIG ERROR XY message. The code XY identifies the error. You will find below the list of error messages and instructions that will help you correct the problem.

**CONFIG ERROR 1** You are trying to select the same source as both master and fallback clock source. Check and change as required.

**CONFIG ERROR 2** You are trying to select as clock source a link that is not connected to the IMX-4E1. Check and change as required.

**CONFIG ERROR 3** 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.

**CONFIG ERROR 4** Reserved.

**CONFIG ERROR 5** You are trying to map a link that is not active.

**CONFIG ERROR 6** You are trying to activate a link, which is not connected to the IMX-4E1. Check and change as required.

**CONFIG ERROR 7** 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.

**CONFIG ERROR 8** You are trying to disconnect a loopback that is not active.

**CONFIG ERROR 11** You are trying to change a parameter from the front panel when the password is enabled.

**CONFIG ERROR 23** You are trying to activate a loopback that is already running.

# Chapter 4

# Control from the Supervisory Port

## 4.1 General

This chapter provides instructions for the control of the IMX-4E1 operation from a supervision terminal connected to the IMX-4E1 supervisory port. The information presented in this chapter includes:

- Description of supervision terminal hardware requirements, communication and handshaking – *Hardware Requirements* on page 4-2.
- Preparation for use of supervision terminal – *Preparation for Use of Supervision Terminal* on page 4-5.
- Description of supervision terminal set of commands and command syntax – *IMX-4E1 Supervision Language* on page 4-6 and *IMX-4E1 Command Set Description* on page 4-10.
- General operating instructions, including start-up, routine operations, and stopping of remote control – *Supervision Terminal Operating Instructions* on page 4-34.
- Configuration error messages – *Configuration Error Messages* on page 4-36.

## 4.2 Hardware Requirements

### Terminal Characteristics

Any standard ASCII terminal (dumb terminal or personal computer emulating an ASCII terminal) equipped with an RS-232 communication interface can be used to control IMX-4E1 operation. The software necessary to run the IMX-4E1 supervision program is contained in the IMX-4E1.

### Communication Requirements

The supervision terminal can be connected either directly to the IMX-4E1 supervisory port, or through a modem or any other type of full-duplex data link. The IMX-4E1 supervisory port interface type must be set in accordance with the connection method (see the *Supervisory Port Configuration Parameters* section on page 3-9 ):

- DCE - for direct connection to a supervision terminal, or for connection through a modem or data link (cross cables must then be connected 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-4E1 can communicate with the supervision terminal at rates of 300, 1200, 2400, 4800 or 9600 bps. The word format consists of one stop bit and 7 or 8 data bits. Parity can be odd, even or disabled.

The communication interface of the terminal and the IMX-4E1 must be configured for operation with the same parameters.

The IMX-4E1 supports two types of modems:

- Dial-up Hayes compatible modems, e.g., RAD miniature DLM/AT modem. The IMX-4E1 features call-in/call-out capability.
- Multidrop modems, e.g. RAD SRM-6 miniature multidrop modem.

For multidrop operation, each IMX-4E1 can be assigned a node address in the range of 1 through 255. Assigning address 0 to the IMX-4E1 means that it will accept and answer any message: this is not permitted in multidrop operation. Address 0 is however recommended for use with both point-to-point and dial-up modes. Each IMX-4E1 can be assigned a logical name of up to eight characters. The logical name is sent in each transmission of alarm messages. The name helps the operator to identify the source of messages that are received by the supervision terminal.

The relevant IMX-4E1 configuration parameters are described in *Supervisory Port Configuration Parameters* on page 3-9 and *IMX-4E1 Command Set Description* on page 4-10. Instructions for configuring the IMX-4E1 supervisory port appear in *Local Configuration Setup Procedure* on page **Error! Bookmark not defined.**.

## Handshaking Protocol

The handshaking between the IMX-4E1 and the supervision terminal uses the control lines in the DCE connector located on the front panel of the IMX-4E1.

The control lines being used in each mode and the direction of the control signals is detailed in the following chart.

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

## Data Terminal Ready (DTR)

The terminal sets the DTR line ON (active) to gain control over the IMX-4E1 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-4E1 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.

## 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-4E1 interprets any data received from the terminal on the TD line as MARK.

## Clear to Send (CTS)

The state of the CTS line is determined by the CTS parameter:

**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-4E1 recognizes its own address in the data stream.

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

## 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-4E1 front-panel DCE connector detects an incoming call.

## 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 while 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-4E1 always sets DSR OFF (inactive) for 5 seconds when the EXIT command is executed, or the disconnect time-out expires.

## AUTOBAUD Function

When the AUTOBAUD function is enabled, the IMX-4E1 can identify the operating data rate of the terminal by analyzing the timing of three consecutive Carriage Return + Line Feed characters (generated by pressing three times the **<Enter>** key). 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.

In case one of these events occurred, the IMX-4E1 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-4E1.

## 4.3 Preparation for Use of Supervision Terminal

### IMX-4E1 Preparations

#### Internal Settings

See *Setting the Jumpers and Switches* section 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-4E1 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-4E1 password (IMX), and change the node address to the default value of 0. The change will be made after you turn the IMX-4E1 off for a short time, and then turn it back on.

#### Supervisory Port Configuration

Configure the IMX-4E1 supervisory port as required. See *Supervisory Port Configuration Parameters* on page 3-9 through *Local Configuration Setup Procedure* on page **Error! Bookmark not defined.**.

If the supervisory port parameters are not correct, the IMX-4E1 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. The change will be made after you turn the IMX-4E1 off for a short time, and then turn it back on.

### Supervision Terminal

Configure the terminal for the same communication parameters you selected for the IMX-4E1 supervisory port.

### Connections

Connect the supervision cable (coming directly from the terminal or from the modem used to connect the terminal) to the front-panel DCE connector of the IMX-4E1. See the *Connector Wiring* appendix for cable wiring information.

Turn the supervision terminal on and when applicable, turn on the modems and the other communication equipment used to connect the terminal to the IMX-4E1.

## 4.4 IMX-4E1 Supervision Language

This paragraph presents the IMX-4E1 supervision language syntax, usage, and set of commands.

### Command Language Syntax

- Commands can only be entered when the IMX-4E1 supervisory port prompt is displayed. The prompt is IMX-4E1>, and it always appears at the beginning of a new line. The cursor appears to the right of the prompt.
- Commands are not case-sensitive. Therefore, you can type commands in either lower case and/or upper case letters.
- To correct typing errors, backspace by pressing the BACKSPACE key until the error is cleared, and then type again the correct command.
- Use space as a separator between command fields and/or parameters. Commands must end with an **<Enter>**.
- To cancel the current command, press BREAK or type CTRL-C. You will obtain again the IMX-4E1 prompt.

### Command Options

The following general types of options are available with some commands. See details in *Table 4-1*.

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

## Command Protocol

- If AUTOBAUD is on, start any session by pressing the **<Enter>** key three times in sequence. This will ensure identification of terminal data rate.
- When the IMX-4E1 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-4E1.

  The echoing of the node address part, i.e. Node<SP>nnn<SP>, where <SP> stands for space, indicates acknowledgment.
- 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-4E1 waits for the password before continuing. After the correct password is received, the IMX-4E1 sends the working prompt, IMX-4E1>.

  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-4E1 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 **<Enter>** key is pressed.
- In case an error is detected during command evaluation, the command is not executed. Instead, the IMX-4E1 will send the erroneous command back to the terminal, and you will see BAD COMMAND OR PARAMETER. TYPE 'H' FOR HELP in the next row. The correct command must then be sent again.
- The command is executed only after it is validated.
- Pressing BREAK or CTRL-C can interrupt command execution. This will result in the display of the IMX-4E1 prompt, 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-4E1 will automatically disconnect the ongoing session if no command is received from the terminal for the specified time-out interval.

## Index of Commands

*Table 4-1* lists the IMX-4E1 commands in alphabetical order.

*Table 4-1. IMX-4E1 Command Set Index*

| Command | Purpose | Options |
|---|---|---|
| BERT OFF | Deactivate the BER test on the IMX-4E1 | |
| BERT ON | Activate the BER test on the IMX-4E1 | |
| CLR ALM | Clear the alarms stored in the IMX-4E1 alarm buffer | /A |
| CLR LOOP L CH<br>CLR LP L CH<br>CLR LOOP R CH<br>CLR LP R CH | Clear user initiated loopbacks on the user's data channel | |
| CLR LOOP L LINK<br>CLR LP L LINK<br>CLR LOOP R LINK<br>CLR LP R LINK | Clear user-initiated loopbacks on the IMX-4E1 links | |
| CLR TST | Clear all the user-initiated tests and loopbacks | |
| DATE | Set the date for the IMX-4E1 internal clock | |
| DEF CALL | Define the call out parameters | |
| DEF CH | Define the link connections | |
| DEF LINK X | Define the link parameters. The parameters can be defined for a specified link, or simultaneously for the entire link.<br>X stand for the link identification, 1 through 4 | /A |
| DEF NAME | Define the logical name of the IMX-4E1 | |
| DEF NODE | Define the node number of the IMX-4E1 | |
| DEF PWD | Define new password | |
| DEF SP | Define supervisory port parameters | |
| DEF SYS | Define system parameters | |
| DSP ALM | Display the contents of the alarm buffer and optionally clear the buffer | /C<br>/CA |
| DSP BERT | Display the last results (errors seconds) of the on-going BER tests | /R<br>/C |
| DSP CH | Displays current IMX-4E1 link utilization, the user's data channel interface type, and the state of the loops on the user's data channel | |
| DSP HDR TST | Display hardware faults (detected during the power-on self-test, and during normal operation) | |
| DSP PM X | Display the contents of the performance monitoring registers, and optionally clear these registers. X stands for the link identifications, 1 through 4 | /C<br>/CA |

*Table 4-1. IMX-4E1 Command Set Index (Cont.)*

| Command | Purpose | Options |
|---|---|---|
| DSP ST LINK X | 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.<br>X stands for the link identification, 1 through 4 | /R<br>/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 4-3* lists default parameter values | |
| INIT F | Reset the codes for “clear the screen”, “cursor right”, and “cursor home” to 0 | |
| LOOP L LINK<br>LP L LINK<br>LOOP R LIN<br>LP R LINK | Activate a specified user-controlled loopback on the IMX-4E1 links | |
| LOOP L CH<br>LP L CH<br>LOOP R CH<br>LP R CH | Activate a specified user-controlled loopback on the user’s data channel | |
| NODE | Send the node address to the IMX-4E1; followed by the node address itself | |
| RESET | Reset the IMX-4E1 system | |
| TIME | Set the time of the IMX-4E1 internal clock | |

## 4.5 IMX-4E1 Command Set Description

This section describes the IMX-4E1 commands. 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 |
| <Enter> | indicates the pressing of the **<Enter>** key |
| X | identifies the link (1 for link 1, 2 for link 2, 3 for link 3, 4 for link 4) |

### BERT OFF

#### Purpose

Deactivate (stop) the BER test.

#### Format

BERT OFF

#### Use

1. To deactivate the BER test, type:

   **BERT OFF <Enter>**

2. You will see the time and date, followed by the IMX-4E1 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 <Enter>**

2. You will see the time and date, followed by the IMX-4E1 prompt.

## 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 <Enter>**

2. To clear all the alarms stored in the alarm buffer (including ON/OFF alarms):

   **CLR ALM /A <Enter>**

3. You will see the time and date, followed by the IMX-4E1 prompt.

## CLR LOOP CH

### Purpose

Deactivate the specified user-initiated loopback on the user's data channel.

### 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-4E1 user's data channel:

   **CLR LOOP L CH <Enter>**

   **CLR LOOP R CH <Enter>**

2. You will see the time and date, followed by the IMX-4E1 prompt.
3. If no loopback of the specified type is activated, you will receive ERROR 8.

## CLR LOOP LINK

### Purpose

Deactivate the specified user-initiated loopback on the IMX-4E1 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-4E1 links, type:

   **CLR LOOP L LINK <Enter>**

   **CLR LOOP R LINK <Enter>**

2. You will see the time and date, followed by the IMX-4E1 prompt.
3. If no loopback of the specified type is activated, you will receive ERROR 8.

## CLR TST

### Purpose

Deactivate all the user-initiated tests and loopbacks on the IMX-4E1.

### Format

CLR TST

### Use

1. To deactivate all the user-initiated tests and loopbacks, type:

   **CLR TST <Enter>**

2. You will see the time and date, followed by the IMX-4E1 prompt.
3. If no test or loopback is now activated, you will receive ERROR 8.

## DATE

### Purpose

Set the date for the IMX-4E1 internal real-time clock.

### Format

DATE

### Use

1. Type

   **DATE <Enter>**

2. The IMX-4E1 sends the date entry form:

   **DAY = 06**

   **MONTH = 09**

   **YEAR = 1994**

3. Bring the cursor to the first field to be changed by pressing <**Enter**>.
4. To change the selected field, press F to increase and B to decrease the displayed values. When done, press <**Enter**> to move to the next field.
5. To end, press <**Enter**> after the YEAR field. The IMX-4E1 will display the TIME and DATE fields (note that DATE has changed), followed by the IMX-4E1 prompt.

# DEF CALL

## Purpose

Define the call-out parameters for the IMX-4E1 supervisory port (connector CONTROL DCE).

***Note*** *For call-in/call-out applications, a cross cable must be used for connection to the CONTROL DCE connector.*

The specified call-out parameters are used by the IMX-4E1 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

1. To define the supervisory port call-out parameters, type:

   **DEF CALL<Enter>**

2. 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 | 60SEC | TONE | NO |

3. Change the parameter values as follows:
   - Bring the cursor to the beginning of the first field to be changed by pressing the space bar.
   - To change the selected field, press F or B to scroll among the available selections.
   - When the desired selection is displayed, press the space bar to move to the next field.

4. The call-out parameters displayed on the first page of the data form, and their range of values, are as follows:

**NUM_OF_RETRIES** This parameter is used to control the number of dialing retries.

- 0 – no redialing attempts are made in case the call is not established on the first attempt.
- 1 through 8 – in case the call is not established on the first attempt, the IMX-4E1 will redial the specified number of times.

The NUM_OF_RETRIES parameter applies to both the primary and the alternate numbers:

- If the call is not established after dialing the primary directory number the specified number of times, the IMX-4E1 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).
- If the call cannot be established within the specified number of redialing attempts on neither of the two directory numbers, the IMX-4E1 stops the call attempts. When a new alarm report must be sent, the call attempts are started again.

  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).

**WAIT_FOR_CONNECT** This parameter specifies the time the IMX-4E1 will wait for an answer after each dialing attempt. If the called station does not answer within the specified time, the IMX-4E1 disconnects. If additional call attempts are allowed, the IMX-4E1 will redial immediately after disconnecting.

The available selections are 30, 45, or 60 seconds.

**DIAL_MODE** This parameter is used to select the dialing mode:

- TONE – the modem is instructed to use DTMF dialing.
- PULSE – the modem is instructed to use pulse dialing.

The appropriate dialing mode depends on the dialing mode supported by the telephone network.

**ALT_NUM_MODE** This parameter is used to control the use of an alternate number. The alternate number is dialed used after the specified number of call attempts on the primary number failed:

- NO – no alternate number. In this case, the IMX-4E1 stops the call attempts after the specified number of call attempts on the primary number failed.
- YES – the use of an alternate number is enabled.

5. When done, press **<Enter>** 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 **<Enter>**:
   - If the ALT_NUM_MODE parameter is NO (no alternate number), the IMX-4E1 will display the TIME and DATE fields, followed by the IMX-4E1 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 **<Enter>** to end.

## DEF CH

### Purpose

Define the IMX-4E1 link connections. See *Local Configuration Setup Procedure* on page **Error! Bookmark not defined.** for practical selection recommendations.

### Format

DEF CH

### Use

1. To define the link connectivity data form, type:

```
DEF CH <Enter>
```

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      YES      YES
```

3. The data form includes one field for each link. The field shows the current connection status:
   - NO – link is not used.
   - 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 **<Enter>** to end. The IMX-4E1 will display the TIME and DATE fields, followed by the IMX-4E1 prompt.

# DEF LINK

## Purpose

Assign values to the link parameters for a selected IMX-4E1 link.

See *Link Configuration Parameters* on page 3-8 for parameter description and allowable ranges, and *Operating Instructions* on page 3-10 for practical selection recommendations.

## Format

DEF LINK [link]

## Use

1. To define the parameters of each link, type:

   **DEF LINK X <Enter>**

   where X stands for the link identification (1, 2, 3, or 4).

2. To define the parameters of all the installed links, type:

   **DEF LINK /A <Enter>**

3. The link parameters data form for the selected link is displayed. A typical display is shown below.

   ```
   CON     CRC-4     SYNC     IDLE_TS_CODE
   YES     YES       CCITT    3F
   ```

4. Change the parameter values as follows:
   - Bring the cursor to the beginning of the first field to be changed by pressing the space bar.
   - To change the selected field, press F or B to scroll among the available selections. When the desired selection is displayed, press the space bar to move to the next field.

5. After the desired parameter values are selected, press **<Enter>** to display the second page of the link parameters data form. Change the parameter values as explained above.

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

## DEF NAME

### Purpose

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

### Format

DEF NAME

### Use

1. To define the IMX-4E1 node name, type:

   **DEF NAME <Enter>**

2. The IMX-4E1 displays the node name entry form:

   ```
   ENTER NODE NAME (MAX 8 CHARACTERS) =
   CURRENT NODE NAME                  = 'name'
   ```

   where 'name' is the node name the IMX-4E1 is currently assigned.

3. Type the desired name, and then press **<Enter>**. The IMX-4E1 will display the TIME and DATE fields, followed by the IMX-4E1 prompt.

***Note*** *Before entering a node name, make sure that section 1, PASSW, of the IMX-4E1 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-4E1. The allowed range is 0 to 255.

### Format

DEF NODE

### Use

1. To define the IMX-4E1 node number, type:

   **DEF NODE <Enter>**

2. The IMX-4E1 displays the node entry form:

   ```
   NODE (0 to 255) = 0
   ```

3. Type the desired number in the range of 0 to 255 and press **<Enter>**. IMX-4E1 will display the TIME and DATE fields, followed by the IMX-4E1 prompt.

***Note*** *Before entering a node name, make sure that section 1, PASSW, of the IMX-4E1 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-4E1. The password must have 4 to 8 characters.

### Format

DEF PWD

### Use

1. Type

   **DEF PWD <Enter>**

2. The password entry screen appears, e.g.:

   ```
   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 **<Enter>**. The IMX-4E1 will display the TIME and DATE fields, followed by the IMX-4E1 prompt.

***Note*** *Before entering a node name, make sure that section 1, PASSW, of the IMX-4E1 internal switch SW1 is not set to ON, because in such a case the default password (IMX) is enforced.*

## DEF SP

### Purpose

Assign values to supervisory port parameters. See *Supervisory Port Configuration Parameters* on page 3-9 for parameter description and allowable ranges, and *Local Configuration Setup Procedure* on page **Error! Bookmark not defined.** for practical selection recommendations.

### Format

DEF SP

### Use

1. Type

   **DEF SP<Enter>**

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 space bar.
   - To change the selected field, press F or B to scroll among the available selections.
   - When the desired selection is displayed, press the space bar to move to the next field.
4. When done, press **<Enter>** to display the next page of supervisory port parameters. A typical form is shown below.

| POP_ALM | PWD | LOG_OFF | CALL_OUT_MODE |
|---|---|---|---|
| NO | NO | NO | NONE |

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

**SPEED** Selects supervisory port data rate (in bps):

300, 1200, 2400, 4800, 9600, or AUTO (Autobaud - in this mode the IMX-4E1 automatically identifies the supervisory port data rate)

***Note***: Select AUTO whenever feasible. In this case, start the communication with pressing three times **<Enter>**, to ensure positive identification of terminal data rate.
However, If a modem is to be connected to the supervisory port for call-in/call-out function, the speed selected for the port must match the data rate of the modem (do not use AUTO).

**Default: AUTO**

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

**Default: 8**

**PARITY** Controls the use of parity:

ODD – Odd parity

EVEN – Even Parity

NONE – Parity disabled (only available with 8 data bits)

**Default: NONE**

**INTERFACE** Selects supervisory port interface function:

DCE –IMX-4E1 functions as a DCE for the supervision terminal.

DTE –IMX-4E1 functions as a DTE, for connection via modem to the supervision terminal.

***Note***: For either setting, use the DCE supervisory port connector.

**Default: DCE**

***Note*** *The following parameters can be programmed only from the supervision terminal (they are not available via the front panel controls).*

**CTS** Determines CTS state:

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

=RTS – The CTS line follows the RTS line.

**Default: =RTS**

**DCD_DEL** If IMX-4E1 supervisory port INTERFACE parameter set to DTE operation, this parameter indicates delay (in msec) between DCD=ON and the sending of data.

If the INTERFACE parameter is set for DCE, you must leave the default value of 0 msec.

Values: 0, 10, 50, 100, 200, 300 msec.

**Default: 0 MS**

**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.

If the supervisory port INTERFACE parameter is set for DTE, the DSR parameter must be set to =DTR (the DSR line will switch to ON for five seconds when the RI line is ON while the DTR line is OFF).

**Default: ON**

**POP_ALM** Controls the automatic display of alarms in the terminal

YES – The terminal automatically displays every 10 minutes the alarm status (or whenever an alarm changes state to ON)

NO – The automatic display feature is disabled

**Default: NO**

**PWD** Password protection: select YES or NO

**Default: NO**

**LOG_OFF** Idle disconnect time:

NO – automatic session disconnection disabled.

10_MIN – automatic disconnection after ten minutes if no input data is received by the IMX-4E1.

**Default: NO**

**CALL_OUT_MODE** This parameter controls the use of the call-out function

NONE – the call-out function is disabled

ALL – the IMX-4E1 will initiate a call after each new alarm

**Default: NONE**

6. After the desired parameter values are selected, press **<Enter>** to end. The IMX-4E1 displays the TIME and DATE fields, followed by the IMX-4E1 prompt.

# DEF SYS

## Purpose

Assign values to system parameters. See *System Configuration Parameters* on page 3-7 for parameter description and allowable ranges, and *Local Configuration Setup Procedure* on page **Error! Bookmark not defined.** for practical selection recommendations.

## Format

DEF SYS

## Use

1. Type

   **DEF SYS <Enter>**

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 | N/A | N/A | N/A |

3. Change the parameter values as follows:
   - Bring the cursor to the beginning of the first field to be changed by pressing the space bar.
   - To change the selected field, press F or B to scroll among the available selections.
   - When the desired selection is displayed, press the space bar to move to the next field.

4. After the desired parameter values are selected, press **<Enter>** to end. The IMX-4E1 displays the TIME and DATE fields, followed by the IMX-4E1 prompt.

# DSP ALM

## Purpose

Display the contents of the alarm buffer. This buffer can contain up to 100 alarms.

## Format

DSP ALM <**Enter**>

## Use

1. To display the complete contents of the buffer, type:

   **DSP ALM <Enter>**

2. To display the complete buffer contents and then clear the type-ON alarms, type:

   **DSP ALM /C <Enter>**

3. To display the complete buffer and then clear all the stored alarms, type:

```
DSP ALM /CA  <Enter>
```

## 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. A header precedes each block of alarms received from an IMX-4E1. The header lists the assigned node name and the node number of the IMX-4E1 unit, which sent the alarm block, and thus it serves as an easily identified separator between alarms transmitted by different IMX-4E1 units.

*Table 4-2* lists all the alarm messages that can be displayed by the terminal. X stands for the link identification, 1, 2, 3 or 4.

*Table 4-2. Supervision Terminal Alarm Messages*

| Alarm No. | Alarm Syntax | Meaning | Status | Time |
|---|---|---|---|---|
| 01 | SIGNAL LOSS, LNK:X | Loss of input signal on link X | [ON] | hh:mm:ss |
| 02 | BPV ERROR, LNK:X | A bipolar violation error has been detected on link X | [ON] | hh:mm:ss |
| 03 | FRAME SLIOP, LNK:X | A frame slip occurred on link X | [ON] | hh:mm:ss |
| 04 and 05 | Reserved for future use | | | |
| 06 | EXCESSIVE BPV, LNK:X | The rate of bipolar violation errors on link X is too high | [ON] [OFF] | hh:mm:ss |
| 07 | CRC-4 ERROR, LNK:X | Bit error have been detected by CRC-4 checking on link X | [ON] | hh:mm:ss |
| 09 | AIS OCCURRED, LNK:X | AIS is being detected on link X | [ON] [OFF] | hh:mm:ss |
| 10 | AIS SYNC LOSS, LNK:X | AIS and loss of frame alignments on link X | [ON] [OFF] | hh:mm:ss |
| 11 | LOCAL SYNC LOSS | Local loss of frame alignment on link X | [ON] [OFF] | hh:mm:ss |
| 12 | DB CHECKSUM ERROR | The database currently stored in the non-volatile memory of IMX-4E1 is corrupted. Message can appear only upon power-up | [ON] | hh:mm:ss |
| 13 | ALARM BUFFER OVERFLOW | The IMX-4E1 alarm buffer is full, and new alarms overwrite the older alarms | [ON] [OFF] | hh:mm:ss |
| 14 | CLOCK WAS CHANGED TO FALL BACK | The main clock source of the IMX-4E1 failed, and the IMX-4E1 switched to the clock source selected as fall back | [ON] | hh:mm:ss |
| 15 | CLOCK WAS CHANGED TO INTERNAL | The current clock source of the IMX-4E1 failed, and the IMX-4E1 switched to the internal oscillator | [ON] | hh:mm:ss |
| 16 | SELF TEST ERROR | A fault has been detected during the power-up self-test | [ON] | hh:mm:ss |
| 17 | HARDWARE FAILURE | A hardware fault has been detected | [ON] | hh:mm:ss |

*Table 4-2. Supervision Terminal Alarm Messages (Cont.)*

| Alarm No. | Alarm Syntax | Meaning | Status | Time |
|---|---|---|---|---|
| 18 | PSWRD SWITCH IS ON | Section 1, PASSW, of switch SW1 is set to ON | [ON] | hh:mm:ss |
| 19 | SP-PAR SWITCH IS ON | Section 2, DEFSP, of switch SW1 is set to ON | [ON] | hh:mm:ss |
| 20 | SB-INIT SWITCH IS ON | Section 3, DMINI, of switch SW1 is set to ON | [ON] | hh:mm:ss |
| 21 | REAL TIME CLOCK BATTERY FAILURE | The battery that power the IMX-4E1 internal real-time clock when IMX-4E1 is not powered has failed | [ON] | hh:mm:ss |
| 22 | REMOTE SYNC LOSS LNK:X | A bipolar violation error has been detected on link X | [ON] [OFF] | hh:mm:ss |
| 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] [OFF] | hh:mm:ss |
| 39 | LAN NOT CONNECTED | The Ethernet interface is not connected to an operating LAN (i.e., at least one station must be active ion the LAN) | [ON] [OFF] | hh:mm:ss |
| 40 | DP DIAL CYCLE FAILED | The dial-out cycle failed, and the IMX-4E1 stopped the redial attempts until a new alarm must be reported | [ON] | hh:mm:ss |
| 41 | DP PRIMARY CALL FAILED | The call setup attempts to the primary directory number failed | [ON] | hh:mm:ss |
| 42 | DP ALTERNATE CALL FAILED | The call setup attempts to the alternate directory number failed | [ON] | hh:mm:ss |

## DSP BERT

### Purpose

Display the BER test results while a BER test is being performed. The BER test results are given as the number of errors seconds detected since the BER test has been started, or since the results have been last cleared (the latter of the two events). The error seconds counter range is 0 through 63555. If the count exceeds the maximum count, the counter continues showing 65535 (an overflow message will be displayed).

### Format

DSP BERT [Option]

### Use

1. To display the current BER test results, type:

```
DSP BERT  <Enter>
```

2. To monitor continuously the BER test results, type:

   **DSP BERT /R <Enter>**

   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 <Enter>**

## DSP CH

### Purpose

Display the current IMX-4E1 link connections, the data channel interface type, and the state of the loops on the user's data channel.

### Format

DSP CH

### Use

1. To display the link connectivity data form, type:

   **DSP CH <Enter>**

2. 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      YES      YES      V.35
CH LOOPS:     LOCAL     REMOTE
              NO        NO
```

3. 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.

4. 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 <Enter>
```

### Display Format

The display has one field that shows NO ERROR if everything checks well, or lists the detected problem:

- DATABASE FAILURE
- EPROM FAILURE
- I/O EXPANDER ERROR
- COUNTER ERROR

## DSP PM

### Purpose

Display the contents of the performance monitoring registers. This option is available only when the CRC-4 function enabled. For an explanation of the performance monitoring registers, refer to *Performance Diagnostics Data* on page 5-5.

### Format

DSP PM X [Option]

### Use

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

   ```
   DSP PM X <Enter>
   ```

   where X stands for the link identification, L1, L2, L3, or L4.

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

   ```
   DSP PM X /C <Enter>
   ```

   where X stands for the link identification, L1, L2, L3, or L4.

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

   **DSP PM X /CA <Enter>**

   where X stands for the link identification, L1, L2, L3, or L4.

In case the CRC-4 function is disabled, you will receive an error message (illegal command for current link mode).

### Display Format

The performance monitoring registers displayed for a E1 link with the CRC-4 function enabled are listed in the following order:

```
CRC ERROR EVENTS              = [0] ..... [1000]
CRC AVG ERR EVENTS            = [0] ..... [1000]
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 ST LINK

### Purpose

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

### Format

DSP ST LINK X [Option]

### Use

1. To display status information for any link, type:

   **DSP ST LINK X<Enter>**

   where X stands for the link identification, L1, L2, L3, or L4.

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

   **DSP ST LINK X /C<Enter>**

   where X stands for the link identification, L1, L2, L3, or L4.

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

   **DSP ST LINK X /R<Enter>**

   where X stands for the link identification, L1, L2, L3, or L4.

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

### Display Format

A typical link status display for an E1 link is shown below. X stands for the link identification: L1 for link 1, L2 for link 2, L3 for link 3, and L4 for link 4.

```
STATUS OF LINK X
TYPE                    = E1
FUNCTION                = DSU
ALARM                   = L.SYNC LOSS       R.SYNC LOSS
                        NO                  NO
LNK LOOPS               = LOCAL             REMOTE
                        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, E1.

**FUNCTION** Displays the type of interface hardware installed on the selected link: LTU 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 in the last minute. This counter is displayed only when the CRC-4 function is disabled.

**BPV WORST 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 CRC-4 function is disabled.

## DSP ST SYS

### Purpose

Display system status information.

### Format

DSP ST SYS [option]

### Use

To view the current system status, type:

```
DSP ST SYS <Enter>
```

### Display Format

A typical status information display is shown below.

```
NODE                    = 0
NAME                    = 'IMX-4E1 name'
NODAL CLOCK             = INT
BERT STATE              = OFF
SOFTWARE REV            = X.Y
HARDWARE REV            = X.Y
```

The system status fields are described below (from top to bottom)

| | |
|---|---|
| **NODE** | The node number of the IMX-4E1. |
| **NAME** | The node name of the IMX-4E1. |
| **NODAL CLOCK** | Indicates the current source for the IMX-4E1 system clock:<br>INT, ST, LNK-1, LNK-2, LNK-3, LNK-4 (see *System Configuration Parameters* on page 3-7). |
| **BERT STATE** | Indicates the current state of the BER test: ON or OFF. |
| **SOFTWARE REV** | IMX-4E1 software version. |
| **HARDWARE REV** | IMX-4E1 hardware version. |

## EXIT

### Purpose

End the current session and return control to the IMX-4E1 front panel.

### Format

EXIT

### Use

Type:

```
EXIT <Enter>
```

# F

## Purpose

Define the codes that are 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 below:

| Function | Terminal Type | | | | |
|---|---|---|---|---|---|
| | **TV920** | **VT52** | **VT100** | **Freedom 100/110** | **Freedom 220** |
| Clear Screen | 1B2A0000 | N/A | 1B5B325A | 1B2A0000 | 1B5B325A |
| Cursor Home | 1E000000 | 1B480000 | 1B5B4800 | 1E000000 | 1B5B4800 |
| Cursor Right | 0C00000 | 1B430000 | 1B5B3143 | 0C00000 | 1B5B3143 |

## Format

F

## Use

1. To display the current codes, type:

   **F <Enter>**

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 <**Enter**>, 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 & Use

H <**Enter**>

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

## INIT DB

### Purpose

Load a specified set of default parameter values instead of the user configuration (see *Table 4-3*).

### Format

INIT DB <**Enter**>

### Use

1. Type

   **INIT DB <Enter>**

2. IMX-4E1 displays the TIME and DATE fields followed by the IMX-4E1 prompt.

*Table 4-3. IMX-4E1 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 | |
| | | w/o Ethernet: | with Ethernet: |
| | BROADCAST | N/A | NO |
| | ETHERNET_MODE | N/A | HALF_DUP |
| | BRIDGING | N/A | FILTER |
| Channel | LNK-1 | YES | |
| | LNK-2 | YES | |
| | LNK-3 | YES | |
| | LNK-4 | YES | |
| Link | CON | YES | |
| | SYNC | CCITT | |
| | IDLE_TS_CODE | 3F | |
| | CRC-4 | YES | |
| SP (Supervisory Port) | SPEED | AUTO | |
| | DATA | 8 | |
| | PARITY | NONE | |
| | INTERFACE | DCE | |
| | CTS | =RTS | |
| | DCD_DEL | 0 MS | |
| | DSR | ON | |
| | POP_ALM | NO | |
| | PWD | NO | |
| | LOG_OFF | NO | |
| | CALL_OUT_MODE | NONE | |

## 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 <**Enter**>

## LOOP CH

### Purpose

Activate a user-controlled loopback on the IMX-4E1 user's data channel (see *Performance Diagnostics Data* on page 5-5 for loopback description).

### 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 <Enter>** **or** **LP L CH <Enter>**

   **LOOP R CH <Enter>** **or** **LP R CH <Enter>**

2. You will see the time and date, followed by the IMX-4E1 prompt.

At any time, you can activate only one loopback on the IMX-4E1 user's data channel. 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 LINK

### Purpose

Activate a user-controlled loopback on the IMX-4E1 links (see *Performance Diagnostics Data* on page 5-5 for loopback description).

### Format

LOOP [looptype] LINK or LP [looptype] LINK

### Use

1. To activate a local (L) or remote (R) loopback on the IMX-4E1 links, type:

   **LOOP L LINK<Enter>** **or** **LP L LINK<Enter>**

   **LOOP R LINK 1<Enter>** **or** **LP R LINK<Enter>**

2. You will see the time and date, followed by the IMX-4E1 prompt.

At any time, you can activate only one loopback on the IMX-4E1 links. If you try to activate a second loopback on the IMX-4E1 links, you will see an error message (illegal link loop combination). You must deactivate the other loopback before you can activate the new one.

## NODE

### Purpose

Select an IMX-4E1 for establishing a control session.

### Format

NODE 'node number'

### Use

1. To connect to the desired IMX-4E1, type:

   **NODE 'node number'<Enter>**

   where 'node number' is the three-digit node number, in the range of 1 through 255.

2. When the addressed IMX-4E1 is on-line, it will echo the complete string: NODE<SP>nnn<SP>. After you see the echo, type the desired command.

## PASSWORD

### Purpose

Enter the password when prompted to type the password upon the start of a control session.

### Format

PWD<SP> 'password'

### Use

1. When you see the prompt

   **PASSWORD>**

   type:

   **'password'<Enter>**

   where 'password' is the string of four to eight alphanumeric characters that has been defined by the user (or the default, IMX, as appropriate).

2. The IMX-4E1 sends the current time and date, and then the prompt IMX-4E1> is displayed on the next line.

# RESET

## Purpose

Reset the IMX-4E1. This will cause the IMX-4E1 to initialize, therefore the traffic through the IMX-4E1 will be disrupted until the IMX-4E1 returns to normal operation.

## Format

RESET

## Use

To reset the IMX-4E1, type:

**RESET<Enter>**

# TIME

## Purpose

Set the time for the IMX-4E1 internal real-time clock.

## Format

TIME

## Use

1. Type

   **TIME<Enter>**

2. The IMX-4E1 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 space bar.
   - To change the selected field, press F or B to scroll among the available selections.
   - When the desired selection is displayed, press the space bar to move to the next field.

4. Set the time about one minute beyond the current time, and then press **<Enter>** at the correct instant.

   The IMX-4E1 will display the TIME and DATE fields (note that TIME has changed), followed by the IMX-4E1 prompt.

## 4.6 Supervision Terminal Operating Instructions

Before using the supervision terminal, make sure the preparations listed in *Preparation for Use of Supervision Terminal* on page 4-5 were completed and all the relevant equipment has been turned on.

### Starting a Session - Single IMX-4E1

When the terminal is used to control a single IMX-4E1, always assign node address 0 to the IMX-4E1. Use the following start-up sequence to connect to an IMX-4E1 that has been assigned node number 0.

1. If you use the AUTO (Autobaud) mode, press the **<Enter>** key three times. This allows the IMX-4E1 to identify the terminal data rate.
2. Assuming that the IMX-4E1 successfully identified the data rate of the supervision terminal, you will be notified if the IMX-4E1 failed the power-up self-test:
   - If you see IMX-4E1 SELFTEST FAILED, the IMX-4E1 must be repaired before you can continue using it.
   - If the IMX-4E1 successfully passed the power-up self-test (IMX-4E1 SELFTEST OK), it sends the following message:

     **IMX SUPERVISORY PORT ON LINE. TYPE H FOR HELP**
3. By now, the IMX-4E1 prompt should already be displayed on the terminal screen, after the ON-LINE announcement.

   If you see

   **PASSWORD>**

   this indicates that password protection is enabled. In this case, type the password:

   **'password'<Enter>**

   where 'password' stands for the current password (four to eight characters). For each password character typed by you, the terminal displays an asterisk *.

   **The default password is IMX.**

   If your password is accepted, you will see the prompt IMX-4E1>.
4. The IMX-4E1 is now in session, under your control:
   - The following prompt is displayed:

     **IMX-4E1>**
   - On the IMX-4E1 front panel, you will see the message:

     **TERMINAL ON LINE**

   The front panel controls are disabled as long as the IMX-4E1 is under remote control.

***Note*** *While the supervision terminal is in session with the IMX-4E1, the IMX-4E1 local operator can regain control by disconnecting the cable from the IMX-4E1 front-panel DTE connector, or by sending the EXIT command from the supervision terminal.*
*The IMX-4E1 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 however be disabled.*

## Starting a Session – Multiple IMX-4E1

When one terminal is used to control several IMX-4E1 connected via modems, non-zero node addresses are assigned to each IMX-4E1. 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-4E1.

**IMPORTANT** If you are using a multidrop configuration, do not assign address 0 to any of the IMX-4E1 connected to a given terminal. Make sure the interface type is set as DTE, and select the appropriate DCD_DEL parameter.

1. Press the **<Enter>** key three times.
2. Type NODE, space, the desired IMX-4E1 node address and another space, and then type the desired command and press **<Enter>**. For example, with node address 234, type:

   **NODE<SP>234<SP> 'command' <Enter>**
3. If the addressed IMX-4E1 does not use password protection, it will immediately execute the command.
4. If the addressed IMX-4E1 is password protected, you will see the prompt:

   **PASSWORD>**

   Type again the node address and then the password. For example, for node address 234, type:

   **NODE<SP>234<SP>'password'<Enter>**
5. If the password is correct, the IMX-4E1 will execute the command. Otherwise, you will see ENTER PASSWORD>.

## Control Session

1. During the control session, type the desired commands at the terminal keyboard. You must see the IMX-4E1 echo character by character.

   If a bad command appears, backspace to clear the error, and then type again the correct character.

   - When you see the correct and complete command in the echo line, press **<Enter>** to execute the command. The IMX-4E1 will process the command and display the appropriate response. At the end of the

command execution, the IMX-4E1 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 again receive the prompt, 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-4E1 will not execute it, but will echo again the command, with a bad command message in the following line. Type again the correct command.
3. If the terminal screen fills up during the exchange with the IMX-4E1, 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-4E1 prompt will disappear. Now you can control the IMX-4E1 from its front panel.

***Note*** *A control session may also be terminated by the IMX-4E1 if the idle disconnect time-out is enabled, or when the DTR line switches to the inactive (OFF) state.*

# 4.7 Configuration Error Messages

The IMX-4E1 provides configuration error messages for the supervision terminal user. The configuration messages have the format ERROR, followed by a two-digit code. The IMX-4E1 will display a short description of the error message after the ERROR code.

The error messages are explained below.

**ERROR 01** MASTER AND FALLBACK CLOCKS ARE SAME

You are trying to select the same source as both master and fallback clock source. Check and change as required.

**ERROR 02** CLOCK SOURCE FROM NOT VALID LINK

You are trying to select as clock source a link that is not connected to the IMX-4E1. Check and change as required.

**ERROR 03** ILLEGAL LOOP COMBINATION

Illegal combination of loopbacks: you are trying to activate simultaneously 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).

**ERROR 04** Reserved.

**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-4E1. 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 10** ILLEGAL COMMAND FOR CURRENT LINK MODE

You are trying to select a parameter value, which is not supported under the current link-framing mode. Check and change as required.

**ERROR 11** ILLEGAL DCD_DEL AND INTERFACE COMBINATION

There is a conflict caused using DEF SP command via the supervision terminal: the INTERFACE parameter is set for DCE and the DCD_DEL parameter is set for a value other than 0 MS. (Must be set for 0 msec when supervisory port interface functions as DCE)

**ERROR 12** CONFLICT IN INTERFACE AND DSR PARAMETERS

There is a conflict caused using DEF SP command via the supervision terminal: the INTERFACE parameter is set for DTE and the DSR parameter is set to ON. (Needs to be set to =DTR)

**ERROR 23** LOOP ALREADY ACTIVE

You are trying to activate a loopback that is already running.

# Chapter 5

# Troubleshooting and Diagnostics

## 5.1 General

The IMX-4E1 diagnostics functions include:

- Status indications and messages – *Status Indications and Messages* on page 5-1
- Performance diagnostics – *Performance Diagnostics Data* on page 5-5
- Test functions – *Test Functions* on page 5-10
- Power-up self-test – *Power-Up Self-Test* on page 5-14
- Troubleshooting – *Troubleshooting Instructions* on page 5-15.

## 5.2 Status Indications and Messages

### LED Indicators

IMX-4E1 status is indicated by the LOC and REM alarm indicators of its links, and by the DTE RD and TD indicators of the user's data channel. Indicator functions are listed in *Table 3-1*.

### Alarms

The IMX-4E1 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.

The IMX-4E1 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 *Operating Instructions* on page 3-10.

*Table 5-1* presents the alarm messages displayed on the IMX-4E1 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 identifies the link, 1, 2, 3 or 4.

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-4E1 checked by the technical support personnel.

*Table 5-1. IMX-4E1 Alarm Buffer Messages*

| Message | Description | Corrective Actions | Alarm 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/OFF |
| AIS OCCURRED, LNK:X | Unframed "all ones" sequence is received in the link data stream | Problem at the remote equipment | ON/OFF |
| AIS SYNC LOSS, LNK:X | Local loss of frame synchronization alarm on the specified link caused by AIS condition | Have the link checked | ON |
| CLOCK WAS CHANGED TO FALLBACK | The IMX-4E1 switch to the fallback clock source, because the master clock source failed | Check the link providing the master clock source.<br>The IMX-4E1 replaces a recovered link clock when the corresponding link loses frame synchronization or its input signal is missing. | ON/OFF |
| CLOCK WAS CHANGED TO INTERNAL | The IMX-4E1 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-4E1 replaces a recovered link clock with the internal clock when the corresponding link loses frame synchronization or its input signal is missing, and also when no fallback clock source is defined. | ON/OFF |
| CRC-4 ERROR, LNK:X | CRC-4 errors detected in the E1 link receive signal. Updated once per second | Have the E1 link checked | ON |
| DATABASE CKS ERR | IMX-4E1 technical failure (internal data base error) | 1. Load the default configuration instead of the current data base (from the supervision terminal, enter the INIT DB command)<br>2. Replace the IMX-4E1 | ON/OFF |
| 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 data base parameter values, change setting to OFF | ON |
| EXCESSIVE BPV, LNK:X | The rate of bipolar violations in the link receive signal exceeds $1x10^{-6}$ during a measurements interval of 1000 seconds | Problem in network facilities | ON/OFF |

*Table 5-1. IMX-4E1 Alarm Buffer Messages (Cont.)*

| Message | Description | Corrective Actions | Alarm Type |
|---|---|---|---|
| FRAME SLIP, LNK:X | 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-4E1 only if no problem has been detected in steps 1 and 2 | ON |
| HARDWARE FAILURE | IMX-4E1 technical failure (one of the internal programmable components) | Replace the IMX-4E1 | ON/OFF |
| LOCAL SYNC LOSS | Local loss of frame synchronization alarm on the specified link | 1. Check cable connection to the link connector.<br>2. Check link and/or other communication equipment providing the link to the remote IMX-4E1<br>3. Replace the IMX-4E1 | ON/OFF |
| PSWRD SW IS ON | Section 1, PASSW, of switch SW1 is set to ON | If it is no longer necessary to enforce the default password and node number, change setting to OFF | ON |
| REAL TIME CLOCK BATTERY FAILURE | The battery that powers the IMX-4E1 internal real-time clock when IMX-4E1 is not powered has failed | Have the IMX-4E1 repaired | ON |
| RECEIVE OOS CODE, LNK:X | The IMX-4E1 detects the OOS (out-of-service) code on the specified link | Problem at the remote equipment. Perform the following check on the remote equipment.<br>1. Check cable connections to the link connector<br>2. Check line and/or other communication equipment providing the link to the remote equipment | ON/OFF |
| REMOTE SYNC LOSS, LNK:X | Remote loss of frame synchronization alarm on the specified link | Problem at the remote equipment. Perform the following checks on the remote equipment:<br>1. Check cable connections to the link connector<br>2. Check line and/or other communication equipment providing the link to the remote equipment<br>3. Replace the equipment | ON/OFF |
| SELF TEST ERROR | A problem has been detected during IMX-4E1 self-test | Replace the IMX-4E1 | ON |

*Table 5-1. IMX-4E1 Alarm Buffer Messages (Cont.)*

| Message | Description | Corrective Actions | Alarm Type |
|---|---|---|---|
| SIGNAL LOSS, LNK:X | Loss of link receive signal | 1. Check cable connections to the link connector<br>2. Check line and/or other communication equipment providing the link to the remote IMX-4E1 | ON/OFF |
| 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 |
| 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 |
| DP DIAL CYCLE FAILED | The current cycle of call attempts failed | Check the modem connected to the CONTROL DCE connector.<br>If the called number is often busy, you may also increase the number of call retries | ON |
| 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 |
| LAN NOT CONNECTED | The Ethernet interface is not connected to an operating LAN | Check the cable connecting to the LAN, the LAN media, and check that at least one station is active on the LAN | ON/OFF |

## 5.3 Performance Diagnostics Data

This section describes the performance evaluation and monitoring functions provided by the IMX-4E1. The functions that are available depend on whether the CRC-4 function is enabled or not, as explained below:

- **CRC-4 Enabled**: when the CRC-4 function enabled is used, it is possible to monitor end-to-end data transmission performance.

  The error detection information is derived from the data payload, 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 being evaluated.

- **CRC-4 Disabled**: in this case, the IMX-4E1 does not support the capabilities listed above. However, the IMX-4E1 is capable of gathering the number of bipolar violations measured during the last minute.

### Performance Monitoring with CRC-4 Enabled

When the CRC-4 function is enabled, the IMX-4E1 stores E1 line statistics for each E1 link interface. This permits real-time monitoring of data transmission performance.

The performance parameter statistics are listed below:

- Current CRC-4 error events (ERROR CRC).

  A CRC-4 error event is any multiframe containing a CRC error and/or OOF event. The number of CRC events in the current second is collected in a current CRC error events register.

- Current average CRC-4 errors (AVG ERR CRC).

  The average number of CRC events per second. The average is updated every second.

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

- 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 832 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 831 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-4E1 also provides local statistics support. These are long-term statistics gathered over the long-term interval (96 intervals of 15 minutes each, i.e., a total of 24 hours) for each E1 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.

## Performance Monitoring with CRC-4 Disabled

The performance evaluation and monitoring parameters collected by the IMX-4E1 when the CRC-4 function is disabled 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-4E1 front panel, under DIAGNOSTICS, is given in *Table 5-2*.

The IMX-4E1 allows the user to reset the performance diagnostics by pressing the ENTER button.

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

| Display | Description | Range |
|---|---|---|
| CURR ES | Number of ES measured during the current 15-minute interval. The display is updated every second | 0 - 1000 |
| CURR UAS | Number of UAS measured during the current 15-minute interval. The display is updated every second | 0-900 |
| CURR SECS | The time in seconds that expired from the start of the current 15-minute interval. The display is updated every second | 0-900 |
| CURR SES | Number of SES measured during the current 15-minute interval. The display is updated every second | 0-900 |
| CURR BES | Number of BES measured during the current 15-minute interval. The display is updated every second. | 0-900 |

*Table 5-2. Summary of Performance Monitoring from the Front Panel (Cont.)*

| Display | Description | Range |
|---|---|---|
| CURR LOFC | Number of loss of frame synchronization event measured during the current 15-minute interval. The display is updated ever second | 0-255 |
| CURR CSS | Number of CSS synchronization event measured during the current 15-minute interval. The display is updated ever second | 0-255 |
| L. TERM ES | Number of ES measured during the current 24-hour interval. The display is updated every 15 minutes. | 0-900 |
| L. TERM UAS | Number of UAS measured during the current 24-hour interval. The display is updated every 15 minutes. | 0-65535 |
| L. TERM SES | Number of SES measured during the current 24-hour interval. The display is updated every 15 minutes | 0-65535 |
| L. TERM BES | Number of BES measured during the current 24-hour interval. The display is updated every 15 minutes | 0-65535 |
| L. TERM LOFC | Number of loss of frame synchronization events measured during the current 24-hour interval. The display is updated every 15 minutes | 0-255 |
| L. TERM CSS | Number of CSS measured during the current 24-hour interval. The display is updated every 15 minutes | 0-255 |
| L. TERM INT | The number of 15-minute intervals that expired from the start of the current 24-hour interval. The display is updated every 15 minutes | 0-96 |
| ERROR CRC | The number of CRC error events recorded since the last time the register was cleared. The display is updated every second | 0-1000 |
| AV ERR CRC | The average number of CRC error events recorded since the last register was cleared. The display is updated every second | 0-1000 |
| BPV COUNT | The total number of BPV error during the last minute the display is updated every minute | 0-9999 |
| CUR DEG MIN | Number of degraded minutes measured during the last 24 hours. The display is updated every minute | 0-1440 |
| BPV WORST | The number of BPV error measured during the worst minute. The display is updated every minute. | 0-9999 |
| LST DEG MIN | Last 24-hour count of degraded minutes. The display is updated every 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-4E1 front-panel LCD:

| Step | Action | Key | Display |
|---|---|---|---|
| 1 | Bring the cursor under the left-hand field of the top row (if not already there). | CURSOR | |
| 2 | Scroll to display DIAGNOSTICS in the top row. | SCROLL | The right-hand field of the top row indicates LNK1, meaning that the displayed diagnostics data pertains to link 1.<br>Second 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 left-hand field in the second row. | CURSOR | |
| 4 | Scroll to see the other statistics. | SCROLL | After each SCROLL pressing, the second row shows the current value of the next item.<br>Continue until the first item appears again. |
| 5 | Bring the cursor under the right-hand field of the top row (if not already there). | CURSOR | |
| 6 | Scroll to display LNK2. | SCROLL | Second 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. | SCROLL | After each SCROLL pressing, the second row shows the current value of the next item. Continue until the first item appears again. |
| 8 | Repeat steps 6, 7 above to see the statistics of link 3, and then for those of link 4. | SCROLL, CURSOR | |

## Resetting the Performance Data Registers

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

To ensure that the collected data remains meaningful and correlated after a specific register is reset, the IMX-4E1 will automatically perform 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 those appearing on the display: 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 CRC register (available for E1 links using the CRC-4 function enabled).

### 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 the *Control from the Supervisory Port* chapter. By adding the /CA switch to the command, you can reset all the performance diagnostics registers.

## 5.4 Test Functions

### Test Functions

The IMX-4E1 supports five types of test functions:

- Local channel loopback (LOOP L CH).
- Remote channel loopback (LOOP R CH).
- Local link loopback (LOOP L LINK).
- Remote link loopback (LOOP R LINK).
- BER testing on the data channel.

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-4E1.

### LOOP L CH

When activated, the local channel loopback returns the signal received from the user's DTE, after passing through the user channel interface of the IMX-4E1. 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-4E1, that must receive its own transmission without errors while the loopback is activated. During the loopback, the local IMX-4E1 continues sending the user's data to the link.

*Figure 5-1* shows a typical local channel loopback.

This test is generally used to check the connections to the DTE to the IMX-4E1.

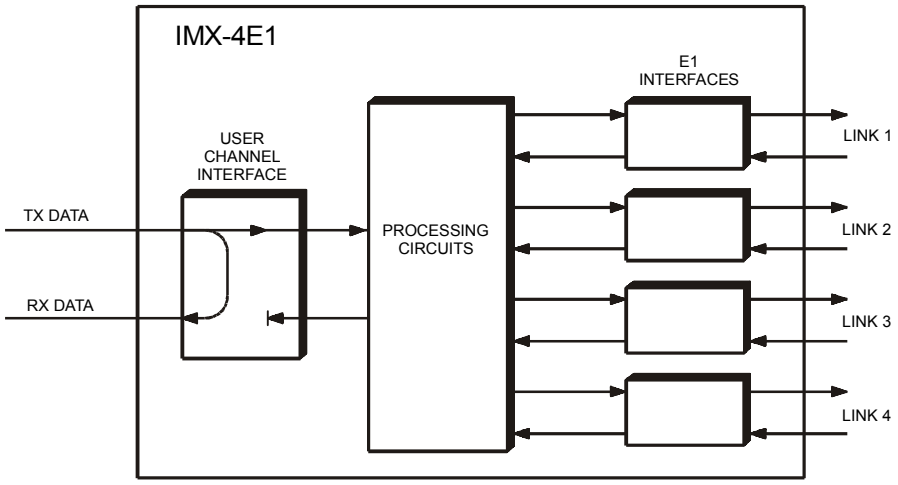


*Figure 5-1. LOOP L CH Loopback*

## LOOP R CH

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.

For this test, the IMX-4E1 must be configured to use the DCE timing mode.

*Figure 5-2* shows a typical remote channel loopback.

This test fully checks the data link, including the cables connecting the two IMX-4E1 to the links, the transmission plant connecting_the two IMX-4E1, and the cable connecting the remote user DTE to the remote IMX-4E1.

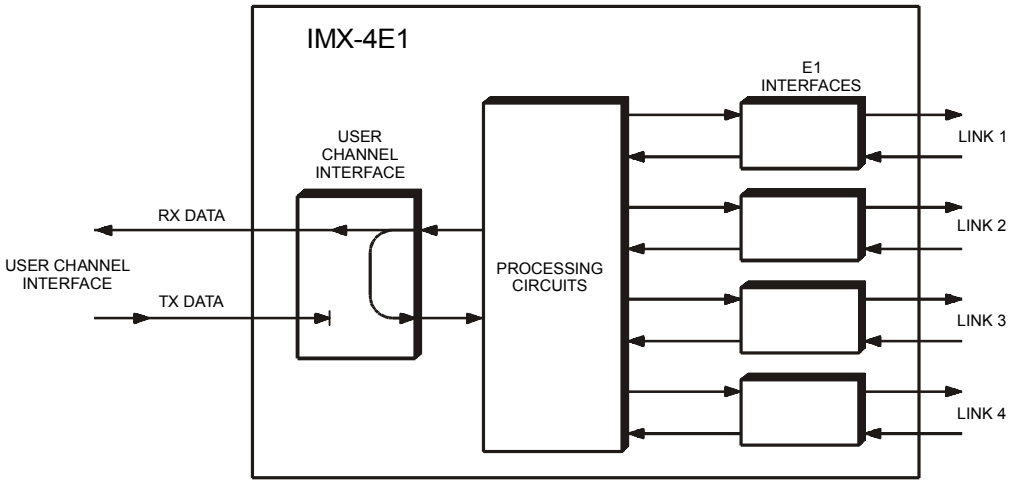


*Figure 5-2. LOOP R CH Loopback*

## LOOP L LINK

When activated, the local link loopback returns the signals transmitted by each E1 link interface of the local IMX-4E1 to the receive input of the same interface. Therefore, this loop tests all the local IMX-4E1 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-4E1 sends an unframed all-ones signal to the links.

*Figure 5-3* shows a typical local link loopback.

This test fully checks local IMX-4E1 operation, and the connections to the local user's DTE.

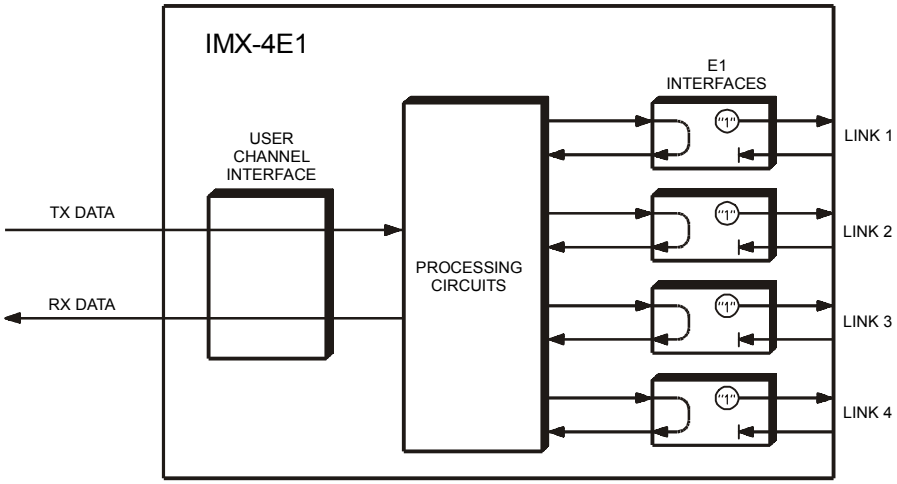


*Figure 5-3. LOOP L LINK Loopback*

## LOOP R LINK

When activated, the remote link loopback returns the signals received by each IMX-4E1 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-4E1 to the links, the transmission plant connecting the two IMX-4E1, and the cable connecting the remote user DTE to the remote IMX-4E1.

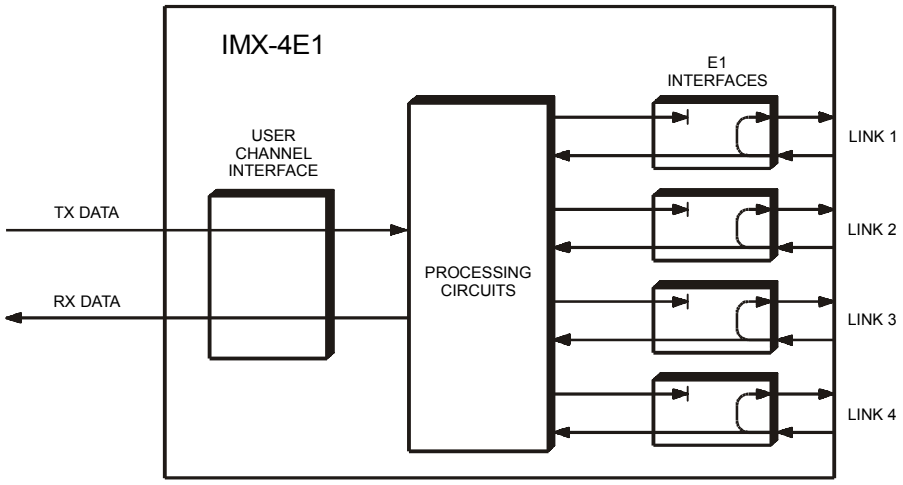


*Figure 5-4. LOOP R LINK Loopback*

## BER Testing

The BER testing is performed by replacing the transmit user's data with a pseudorandom sequence having a length of 211-1 (2.047 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-4E1, a local link loopback should be used. However, you can also perform BERT testing by activating this test on both IMX-4E1 units connected in a link.

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

For the BERT test, the IMX-4E1 must be configured to use the DCE timing mode.

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-4E1 will allow you to activate the following combinations: remote loopback on links or local loopback on the data port or local loopback on links and BERT test.

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

| Step | Action | Key | Display |
|---|---|---|---|
| 1 | Bring the cursor under the left-hand field of the top row (if not already there). | CURSOR | |
| 2 | Scroll to display TEST OPTIONS in the top row. | SCROLL | The right-hand field of the top row indicates OFF, to indicate that no test is active. Second row is empty. |
| 3 | To select the type of test, bring the cursor under the right-hand field in the top row, and scroll to display the desired type (For BER test refer to *Note 1*). | CURSOR, SCROLL | The right-hand field of the top row indicates LNKS when the test is to be activated on the links, or CH when the test is to be activated on the data channel. |
| 4 | After the desired type is selected, bring the cursor under the left-hand 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 BER test refer to *Note 2*). | CURSOR, SCROLL | Second row shows the current state of the selected test, OFF or ON. |
| 5 | To change the test state, bring the cursor under the right-hand field in the second row and scroll to display the desired state. | CURSOR, SCROLL | The second row shows the new state of the selected test, for example, OFF. |
| 6 | Press ENTER to activate the displayed test (For BER test 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.*
2. *Before activating the BER test, the local link loopback must be activated, or the BER test must be activated at both ends of the link.*
3. *Once the BER test is activated, the E symbol in the second row will display the error per second of the current BERT test.*
4. *Before activating the BERT test, make sure that the timing mode is set for DCE.*

## 5.5 Power-Up Self-Test

The IMX-4E1 performs a power-up self-test upon turn-on. The self-test sequence, described in *Supervisory Port Configuration Parameters* on page 3-9, tests the critical circuit functions and the display.

In case of failure, the IMX-4E1 displays an alarm message in the second row.

## 5.6 Troubleshooting Instructions

In case a problem occurs, check the displayed alarm messages and refer to *Status Indications and Messages* on page 5-1 and *Table 5-2* for their interpretation.

If the trouble cannot be corrected by performing the actions listed in *Table 5-1*, use *Table 5-2*: identify the trouble 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-4E1 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-4E1 | Replace the IMX-4E1. |
| 2 | IMX-4E1 reports local loss of synchronization alarm. | 1. External Problem | Activate the local link loopback, and check that the previously lit LOC indicator turns OFF.<br>If the indicator turns OFF, the problem is external. |
| | | 2. Defective IMX-4E1 | Perform power-up self-test and replace the IMX-4E1. |
| 3 | IMX-4E1 reports remote loss of synchronization alarm. | 1. Problem at remote end | Activate the local link loopback on the remote IMX-4E1, and check that all the LOC indicators turn OFF.<br>If a LOC indicator remains ON, replace the remote IMX-4E1. |
| | | 2. Defective IMX-4E1 | Perform power-up self-test and replace the IMX-4E1 if defective. |
| 4 | Local user's DTE does not receive data. | 1. Incorrect timing mode | Select the timing mode (DCE or E-DCE) in accordance with the type and characteristics of the equipment connected to the IMX-4E1. |
| | | 2. Cable problem | Activate the local data channel loopback.<br>If the local DTE does not receive its own transmission, check the cable connecting it to the IMX-4E1 DTE connector. |
| | | 3. Defective DTE | Perform self-test on the DTE. |
| | | 4. Defective IMX-4E1 | Perform power-up self-test and replace the IMX-4E1. |

*Table 5-3. Troubleshooting Chart (Cont.)*

| No | Trouble Symptoms | Probable Cause | Corrective Measures |
|---|---|---|---|
| 5 | Remote unit does not receive data when the LOOP R CH is activated, or when performing the BER Test. | Incorrect timing mode | Select the DCE timing mode during the test. |
| 6 | Local IMX-4E1 reports receiving of the OOS code. | Problem at the remote equipment | Check the cable connections at the remote equipment.<br>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-4E1 | If the TST indicator lights, check and disconnect the loopback. |
| | | 2. Cable problem | Check and replace if necessary the cable that connects the IMX-4E1 10BaseT connector to the LAN. |
| | | 3. Problem on the LAN | Disconnect the IMX-4E1 from the LAN; if problem persists, troubleshoot the LAN. |
| | | 4. Defective IMX-4E1 | Perform power-up self-test and replace the IMX-4E1 if defective. |
| 8 | Ethernet interface LINK indicator does not light. | 1. No active station on the LAN | Check that at least one station is active on the LAN. |
| | | 2. Cable problem | Check and replace if necessary the cable that connects the IMX-4E1 10BaseT connector to the LAN. |
| | | 3. Problem on the LAN | Check LAN media. |
| | | 4. Defective IMX-4E1 | Perform power-up self-test and replace the IMX-4E1 if defective. |

# Appendix A
# Connector Wiring

## A.1 E1 Link Connectors

The E1 LINK connectors have eight-pin RJ-48C connectors, wired in accordance with *Table A-1*.

*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 |

## A.2 E1 Link Limit when using Extension Cables

The data port interface type, clock mode selected and actual length of the extension cable used limit the number of E1 links (and thus the data rate) that can be used.

In *Table A-2*, the number of E1 links that can be used are listed according to data port interface, clock mode used and cable length tested. Corresponding data rates (shown in parenthesis) are in Mbps.

*Table A-2. Maximum Number of E1 Links using Extension Cables*

| Interface | Clock Mode | Number of E1 Links | |
|---|---|---|---|
| X.21 | | 1m Cable | 2m Cable |
| | DCE Normal | up to 3 (5.76) | up to 3 (5.76) |
| | DCE Invert | up to 4 (7.68) | up to 4 (7.68) |
| | EDCE Normal | N/A | N/A |
| | EDCE Invert | N/A | N/A |
| V.35 | | 1m Cable | 2m Cable |
| | DCE Normal | up to 2 (3.84) | up to 2 (3.84) |
| | DCE Invert | up to 4 (7.68) | up to 4 (7.68) |
| | DCE Normal | up to 4 (7.68) | up to 4 (7.68) |
| | EDCE Invert | – | – |
| RS-530, V.36/RS-449 | | 1m Cable | 2m Cable |
| | DCE Normal | up to 3 (5.76) | up to 3 (5.76) |
| | DCE Invert | up to 4 (7.68) | up to 4 (7.68) |
| | EDCE Normal | up to 4 (7.68) | up to 4 (7.68) |
| | EDCE Invert | up to 4 (7.68) | up to 4 (7.68) |
| HSSI | | 2m Cable | 15m Cable |
| | DCE Normal | up to 4 (7.68) | 1 (1.92) only |
| | DCE Invert | up to 4 (7.68) | up to 2 (3.84) |
| | EDCE Normal | up to 4 (7.68) | up to 4 (7.68) |
| | EDCE Invert | up to 4 (7.68) | up to 4 (7.68) |

***Note*** *All tests were carried out using Fireberd 6000A equipment (S/W ver. M)*

## A.3 RS-530 User Data Channel Connector and V.36/RS-449 Adapter Cable

When the IMX-4E1 is ordered with a RS-530 interface, the physical interface is a 25-pin female connector wired in accordance with *Table A-3*.

*Table A-3. RS-530 Channel Connector Pinout*

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

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

***Note*** *The V.36/RS-449 connector is a 37-pin D-type male connector.*

## A.4 V.35 User Data Channel Connector

When the IMX-4E1 is ordered with a V.35 interface, the physical interface is a 34-pin female connector wired in accordance with *Table A-5*.

*Table A-5. V.35 User Data Channel Connector, Pin Allocation*

| Pin | Designation | Direction | Function |
|---|---|---|---|
| A | PG | ↔ | Protective Ground |
| B | SG | ↔ | Signal Ground |
| C | RTS | To IMX-4E1 | Request to Send |
| D | CTS | From IMX-4E1 | Clear to Send |
| E | DSR | From IMX-4E1 | Data Set Ready |
| F | DCD | From IMX-4E1 | Data Carrier Detect |
| H | DTR | To IMX-4E1 | Data Terminal Ready |
| P | TDA | To IMX-4E1 | Transmit Data (A wire) |
| R | RDA | From IMX-4E1 | Receive Data (A wire) |
| S | TDB | To IMX-4E1 | Transmit Data (B wire) |
| T | RDB | From IMX-4E1 | Receive Data (A wire) |
| U | ETCA | To IMX-4E1 | External Transmit Clock (A wire) |
| V | RCA | From IMX-4E1 | Receive Clock (A wire) |
| W | ETCB | To IMX-4E1 | External Transmit Clock (B wire) |
| X | RCB | From IMX-4E1 | Receive Clock (B wire) |
| Y | TCA | From IMX-4E1 | Transmit Clock (A wire) |
| Z | ERCB | To IMX-4E1 | External Receive Clock (B wire) |
| AA | TCB | From IMX-4E1 | Transmit Clock (B wire) |
| BB | ERCA | To IMX-4E1 | External Receive Clock (A wire) |

## A.5 X.21 User Data Channel Connector

When the IMX-4E1 is ordered with an X.21 interface, the physical interface is a 15-pin female D-type connector wired in accordance with *Table A-6*.

*Table A-6. X.21 User Data Channel Connector, Pin Allocation*

| Pin | Designation | Direction | Function |
|---|---|---|---|
| 1 | FG | ↔ | Frame Ground |
| 2 | TA | To IMX-4E1 | Transmit Data (A wire) |
| 3 | CA | To IMX-4E1 | Control (A wire) |
| 4 | RA | From IMX-4E1 | Receive Data (A wire) |
| 5 | IA | From IMX-4E1 | Indication Data (A wire) |
| 6 | SA | From IMX-4E1 | Signal Timing (A wire) |
| 7 | BA | To IMX-4E1 | External Timing (A wire) |
| 8 | G | ↔ | Signal Ground |
| 9 | TB | To IMX-4E1 | Transmit Data (B wire) |
| 10 | CB | To IMX-4E1 | Control (B wire) |
| 11 | RB | From IMX-4E1 | Receive Data (B wire) |
| 12 | IB | From IMX-4E1 | Indication Data (B wire) |
| 13 | SB | From IMX-4E1 | Signal Timing (B wire) |
| 14 | BB | To IMX-4E1 | External Timing (B wire) |
| 15 | – | N/A | Not Connected |

## A.6 HSSI User Data Channel Connector

When the IMX-4E1 is ordered with an HSSI interface, the physical interface is a 50-pin female D-type connector wired in accordance with *Table A-7*.

*Table A-7. HSSI User Data Channel Connector, Pin Allocation*

| Pin | Designation | Direction | Function |
|---|---|---|---|
| 1 | SG | ↔ | Signal Ground |
| 2 | RT | From IMX-4E1 | Receive Timing (+ wire) |
| 3 | CA | From IMX-4E1 | DCE Available (+ wire) |
| 4 | RD | From IMX-4E1 | Receive Data (+ wire) |
| 5 | LC | From IMX-4E1 | Loopback Circuit C (+ wire) - optional |
| 6 | ST | From IMX-4E1 | Send Timing (+ wire) |
| 7 | SG | ↔ | Signal Ground |
| 8 | TA | To IMX-4E1 | DTE Available (+ wire) |
| 9 | TT | To IMX-4E1 | Terminal Timing (+ wire) |
| 10 | LA | To IMX-4E1 | Loopback Circuit A (+ wire) |
| 11 | SD | To IMX-4E1 | Send Data (+ wire) |
| 12 | LB | To IMX-4E1 | Loopback Circuit B (+ wire) |
| 13 | SG | ↔ | Signal Ground |
| 14 - 18 | - | To IMX-4E1 | Ancillary to DCE (reserved ) (+ wire) -optional |
| 19 | SG | ↔ | Signal Ground |
| 20 - 23 | - | From IMX-4E1 | Ancillary to DCE (reserved ) (+ wire) -optional |
| 24 | TM | From IMX-4E1 | Test Mode (+ wire) |
| 25 | SG | ↔ | Signal Ground |
| 26 | SG | ↔ | Signal Ground |
| 27 | RT | From IMX-4E1 | Receive Timing (-wire) |
| 28 | CA | From IMX-4E1 | DCE Available (-wire) |
| 29 | RD | From IMX-4E1 | Receive Data (-wire) |
| 30 | LC | From IMX-4E1 | Loopback Circuit C (-wire) - optional |
| 31 | ST | From IMX-4E1 | Send Timing (-wire) |
| 32 | SG | ↔ | Signal Ground |

*Table A-7. HSSI User Data Channel Connector, Pin Allocation (Cont.)*

| Pin | Designation | Direction | Function |
|---|---|---|---|
| 33 | TA | To IMX-4E1 | DTE Available (-wire) |
| 34 | TT | To IMX-4E1 | Terminal Timing (-wire) |
| 35 | LA | To IMX-4E1 | Loopback Circuit A (-wire) |
| 36 | SD | To IMX-4E1 | Send Data (-wire) |
| 37 | LB | To IMX-4E1 | Loopback Circuit B (-wire) |
| 38 | SG | ↔ | Signal Ground |
| 39 - 43 | - | To IMX-4E1 | Ancillary to DCE (reserved ) (-wire) |
| 44 | SG | ↔ | Signal Ground (- wire) |
| 45-48 | - | From IMX-4E1 | Ancillary to DCE (reserved ) (-wire) |
| 49 | TM | From IMX-4E1 | Test Mode (-wire) |
| 50 | SG | ↔ | Signal Ground |

## A.7 10BaseT User Data Channel Connector

The IMX-4E1 has an Ethernet interface, terminated in an eight-pin RJ-45 connector wired in accordance with *Table A-8*.

*Table A-8. Ethernet Interface Connector*

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

## A.8 RS-232 (V.24) Supervisory Port Connector

The IMX-4E1 supervisory port has a standard RS-232 interface. The physical interface is a 9-pin female connector wired in accordance with *Table A-9*.

*Table A-9. Supervisory Port Interface Signals (V.24/RS-232 Interface)*

| Pin | Line | Notes | Connected to Terminal | Connected to Dial-Out Modem |
|---|---|---|---|---|
| 1 | Data Carrier Detect (DCD) | From IMX-4E1 | 8 | 4 |
| 2 | Receive Data (RD) | From IMX-4E1 | 3 | 2 |
| 3 | Transmit Data (TD) | To IMX-4E1 | 2 | 3 |
| 4 | Data Terminal Ready (DTR) | To IMX-4E1 | 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-4E1 | 6 | 20 |
| 7 | Request to Send (RTS) | To IMX-4E1 | 4 | 8 |
| 8 | Clear to Send (CTS) | From IMX-4E1 | 5 | - |
| 9 | Ring indicator (RI) | To IMX-4E1 | - | 22 |

## A.9 Station Clock Connector

The station clock port physical interface is an eight-pin RJ-48C connector, wired in accordance with *Table A-10*.

*Table A-10. Station Clock Connector, Pin Allocation*

| Pin | Designation | Function | Direction |
|---|---|---|---|
| 1 | CLK (T) | Station Clock (Tip) | To IMX-4T1 |
| 2 | CLK (R) | Station Clock (Ring) | To IMX-4T1 |
| 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 | |

# Appendix B
# IR-ETH/QH Interface Module

## B.1 Introduction

The IR-ETH/QH interface module includes a high performance self-learning Fast Ethernet bridge, which is connected to the LAN via a single 10BaseT or 100BaseT port, operating in full duplex and providing offer simple and cost-effective interconnection between 10/100BaseT LANs via VDSL links. The IR-ETH/QH interface module also supports IEEE 802.1/P frames and IEEE 802.1/Q frames, enabling VLAN applications.

The module automatically learns MAC addresses of the LAN to which it is connected. Its LAN table stores up to 1,000 addresses with 5-minute automatic aging.

Filtering and forwarding is performed at the maximum theoretical rate of 150,000 packets per second (wire speed). The buffer with 0.512 Mbit SRAM can hold 85 frames with a throughput latency of one frame. The forwarding of the multicast messages from LAN to WAN can be disabled.

*Figure B-1* shows a typical application using IMX-4E1 with IR-ETH/QH module.

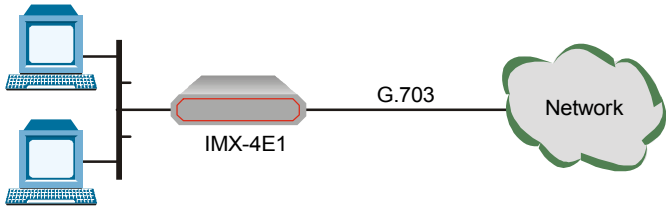


*Figure B-1. Typical Application of IMX-4E1 with IR-ETH/QH Module*

## B.2 IR-ETH/QH Connector

*Figure B-2* shows the rear panel of IMX-4E1, equipped with IR-ETH/QH module. *Table B-1* lists the module's RJ-45 connector pinout.

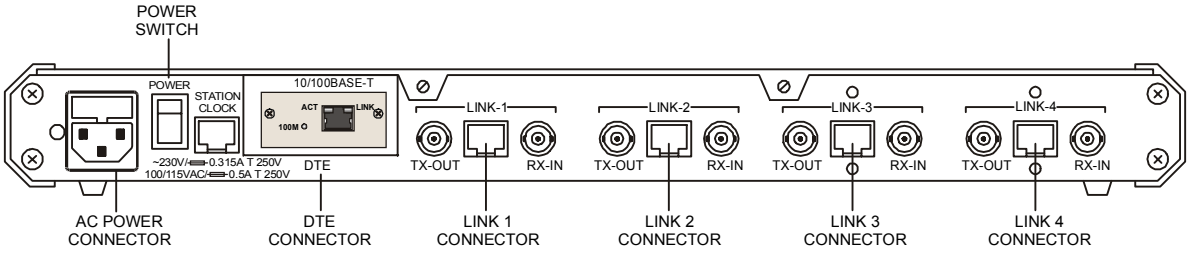


*Figure B-2. Rear Panel of IMX-4E1 with IR-ETH/QH Module*

*Table B-1. RJ-45 Connector Pinout*

| Pin | Signal | Function |
|---|---|---|
| 1 | RD (+) | Receive Data (positive) |
| 2 | RD (-) | Receive Data (negative) |
| 3 | TD (+) | Transmit Data (positive) |
| 6 | TD (-) | Transmit Data (negative) |

## B.3 Technical Specifications

| | | |
|---|---|---|
| **Bridge** | *LAN Table* | 1,000 MAC addresses |
| | *Aging* | 5 minute, automatic |
| | *Filtering and Forwarding Rate* | 150,000 packets per second |
| | *Buffer Size* | 85 frames |
| | *Delay* | 1 frame |
| **LAN** | *Standard* | IEEE 802.3/Ethernet V.2, IEEE 802.1/Q, IEEE 802.1/P |
| | *Data Rate* | • 10BaseT: 10 Mbps (20 Mbps in full duplex)<br>• 100BaseT: 100 Mbps (200 Mbps in full duplex) |
| | *Transmission Line* | 4-wire, Category 5 UTP, 19 AWG to 26 AWG |
| | *Line Code* | • 10BaseT: Manchester<br>• 100BaseT: MLT3 |
| | *Connector* | RJ-45 |
| **WAN** | *Protocol* | Point-to-point |
| | *Data Rate* | 512 kbps to 45 Mbps |

## B.4 Installation and Operation

*Figure B-3* shows location of the configuration DIP switch on the module's board.

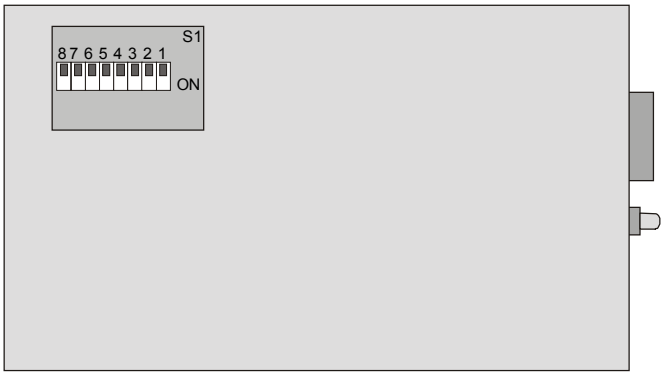


*Figure B-3. DIP Switch Location*

### Setting the DIP Switch

Configure the IR-ETH/QH module by setting the DIP switch in accordance with *Table B-2*. The DIP switch is located on the reverse side of the IR-ETH/QH module. To change the switch settings, you must undo three screws on the board and detach the module from the main unit.

*Table B-2. DIP Switch Settings*

| Section | Name | Description | Possible Settings | Factory Setting |
|---|---|---|---|---|
| 1 | NC | | | OFF |
| 2 | FLC | Enables or disables flow control | **ON** – Flow control is enabled | |
| | | | **OFF** – Flow control is disabled | OFF |
| 3 | 10/100 | Selects the LAN speed | **ON** – LAN speed is set to 100 Mbps | OFF |
| | | | **OFF** – LAN speed is set to 10 Mbps | |
| 4 | AN1 | Controls the LAN autonegotiation | **ON** – LAN autonegotiation is disabled | |
| | | | **OFF** – LAN autonegotiation is enabled | OFF |
| 5 | HF1 | Selects the LAN mode | **ON** – LAN full duplex mode | |
| | | | **OFF** – LAN half duplex mode | OFF |
| 6 | BPR | Controls the backpressure | **ON** – Backpressure is enabled | |
| | | | **OFF** – Backpressure is disabled | OFF |
| 7 | MUL | Controls LAN to WAN multicasting | **ON** – Multicast messages from LAN to WAN are blocked | |
| | | | **OFF** – Multicast messages from LAN to WAN are not blocked | OFF |
| 8 | BRD | Controls LAN to WAN broadcasting | **ON** – Broadcast messages from LAN to WAN are blocked | |
| | | | **OFF** – Broadcast messages from LAN to WAN are not blocked | OFF |

## LED Indicators

*Table B-3* lists the IR-ETH/QH rear-panel LED indicators and describes their functions.

*Table B-3. IR-ETH/QH LED Indicators*

| LED Name | Color | Description | Location |
|---|---|---|---|
| LINK | Green | ON – LAN is connected to the IR-ETH/QH module | Connector |
| ACT | Yellow | ON – LAN is receiving/transmitting data | Connector |
| 100M | Green | ON – LAN is operating at 100 Mbps<br>OFF – LAN is operating at 10 Mbps | Panel |

## Connecting the LAN

Use either a straight cable or a cross cable for the LAN connection.
Use a cross cable when connecting to a port that does not implement the crossover function internally. Otherwise, use a straight cable.

***Note*** *Hubs usually implement the crossover function internally, while NICs and other devices do not.*

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# SUPPLEMENT

## DC Power Supply Connection – Circular 3-pin Connector

*Note: 1) Ignore this supplement if the unit is AC-powered.*
*2) For Megaplex/MAXcess units see supplement SUP-209.*

Certain DC-powered units are equipped with a circular 3-pin (male) *DC-IN* power input connector, located on the unit rear panel (shown in *Figure 1*). Supplied with such a unit is a compatible (female) cable connector for attaching to your power supply cable.

### DC Power Supply Wire Voltage Polarity

- If your power supply cable already has a compatible connector, just verify that the voltage polarity is as required.
- If not, connect the wires of your power supply cable to the supplied cable connector according to the voltage polarity mapping shown in *Figure 2.* Note that the **solder side** of the connector is shown.

***Caution:***
*Prepare all connections to the cable connector **before** inserting it into the unit's DC-IN connector.*

Refer to *Figure 3* for assistance in assembling the cable connector.

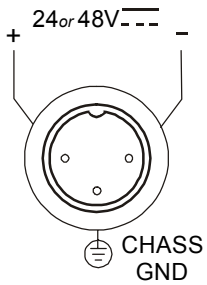


**Figure 1. DC Power Input Connector (on unit panel)**

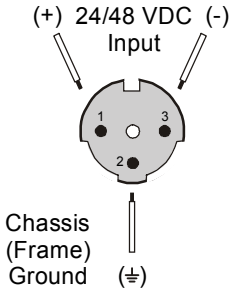


**Figure 2. Voltage Polarity Mapping for Female Cable Connector (solder side)**

***Warning:***
- *Reversing the wire voltage polarity can cause damage to the unit!*
- *Always connect a ground (earth) wire to the connector Chassis (frame) Ground terminal. Connecting the unit without a protective ground, or interruption of the grounding (for example, by using an extension power cord without a grounding conductor) can cause harm to the unit or to the equipment connected to it!*

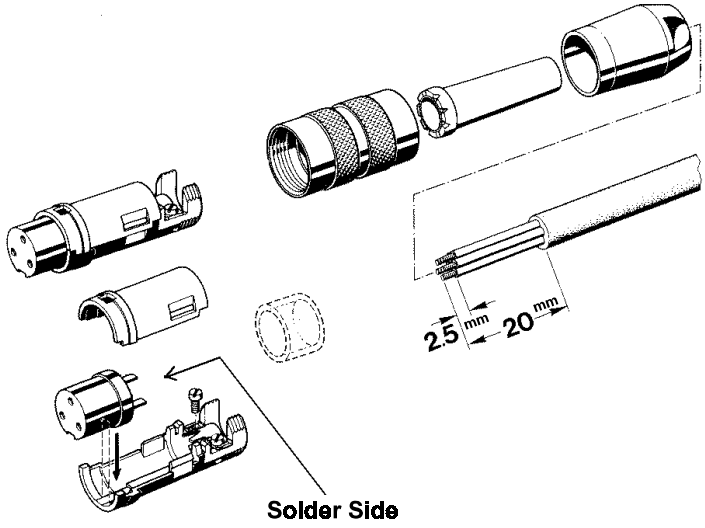


**Figure 3. Female Cable Connector Assembly**

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Publication Number: 443-200-08/02

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| Operating instructions | ❒ | ❒ | ❒ | ❒ | ❒ |
| Manual organization | ❒ | ❒ | ❒ | ❒ | ❒ |
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