# Infinity Series H.110
# Basic Rate ISDN Board

## OPERATIONS INFORMATION

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## 1.0 Introduction

The Infinity Series H.110 Basic Rate Interface ISDN Board is designed to provide thirty-two Basic Rate ISDN (Integrated Services Digital Network) interfaces connected to the H.110 bus on a board with the *Compac*tPCI bus form factor. Each interface or port provides a D channel for call control signaling and two 64 kbps. B channels for either speech or circuit switched data. Each port can be independently configured as either a TE (Terminal Equipment) or NT (Network Termination) interface. The board provides complete support for the ISDN Layer 1 and Layer 2 protocols, as well as optional support for the Layer 3 protocols as defined in Q.931. In addition, the board is equipped with several DSP's to provide tone generation and detection.

The H.110 bus was devised by the Enterprise Computer Telephony Forum (ECTF) to provide a single telecom bus for the entire industry. It is intended for add-in boards using the *Compac*tPCI form factor. A variety of boards are available from a number of different vendors. The H.110 specifications also provides for hot swap capabilities for use in high availability applications. The board is equipped with a processor that can be used to control the lower level functions of the board. The host PC controls the board using messages passed through dual-ported RAM. The board shares a common message passing and control scheme with other Infinity Series H.110 boards.

## 1.1 Features and Capabilities

This section presents an overview of the features and capabilities of the Infinity Series H.110 Basic Rate Interface ISDN Board.



*Figure 1:* The H.110 Basic Rate ISDN Board Functional Areas

### 1.1.1 The Physical Interface

Thirty-two independent ports are provided on the board. Each port on the board provides a complete S/T Basic Rate ISDN interface. This interface can be configured under software control as either a piece of terminal equipment to interface to a central office or PBX, or as a network termination to interface to terminal equipment such as ISDN phone sets or ISDN modems. Layer 1 support is provided by the board to handle all the details of framing and clocking. Each port provides two independent B1 channels which operate at 64 kbps.



These channels can be switched to the H.110 bus, to each other, or to one of the DSP resources. In addition, there is a 16 kbps D channel which is used for signaling.

### 1.1.2 Signaling Protocols

ISDN uses the LAPD protocol on the D channel for call control. The Layer 2 protocol defines the mechanism used for the exchange of messages between terminal equipment and the network termination. The board manages the details of this protocol while providing commands to control aspects such as TEI (Terminal Endpoint Identifier) address management. Call control is handled by the exchange of Layer 3 messages as defined by the Q.931 standard. The H.110 BRI Board allows the application to directly read and write the raw binary information field of these messages.  Optionally, a higher level interface is provided that masks some of the details of these messages, making for a simplified applications interface. This is done through the use of “D” messages.

### 1.1.3 DSP Functions

The H.110 BRI ISDN Board is equipped with DSP’s that performs a variety of functions. DTMF and Energy detectors are available for each B channel. DTMF generators are available for each B channel for signaling purposes. Call Progress tones are also available, with dial-tone, busy, reorder, and audible ringback being provided as well as silence and a 1004 Hz. calibration tone.

### 1.1.4 The H.110 Bus

The H.110 bus is a digital bus for transporting PCM (Pulse Code Modulation) signals between telephony boards. It was created by the ECTF to provide a common bus structure for future development that would end the “bus wars” between the various legacy busses such as the SCbus and the MVIP bus.



PCM is a standard method of digitizing phone signals. It involves encoding each channel at an 8 kHz rate using eight bits. The signals from multiple channels are then combined into a frame. On the H.110 bus, each frame consists of 128 channels or timeslots. The bit rate of the H.110 bus is 8.192 MHZ. Thirty-two wires, also called streams, each carrying 128 timeslots, are combined to form the bus, and provide a total of 4096 timeslots. Two timeslots are required for a full conversation, one for each talker.

In addition to the streams, a number of other signals necessary to maintain synchronization between all the boards in the system are carried on the bus. These signals provide the clocking and framing information. Redundant clocks are provided to aid in recovery if the primary clock should fail. The H.110 bus consists of backplane connections on a 6U *Compact*PCI backplane that is used to interconnect the boards in the system. The CT Bus connections are made through the J4/P4 connector. The electrical and mechanical requirements of H.110 boards are tightly specified to insure the reliability and consistent performance of the CT Bus in any valid configuration of conforming boards.

### 1.1.5 Clock Modes

The H.110 BRI Board can operate in a variety of clock modes. Modes are available so that the master clock can either be derived from the H.110 bus, one of the Basic Rate Interfaces, or be provided by the H.110 BRI Board. The clock redundancy and clock fallback functions of the H.110 bus are also supported so that the H.110 BRI Board can be set to provide a clock to the H.110 bus if the master clock on that bus should fail.

### 1.1.6 Hot Swap Capability

The H.110 Specification includes “hot swap” capability. This capability allows for the insertion and removal of boards from a live system. Not only are there provisions for controlling the electrical signals to prevent disruption when inserting and removing boards, but also for informing



drivers and applications so that the board resources can be managed as they are added or deleted. Each H.110 board is provided with a blue LED that is used to inform an operator when it is safe to insert or remove a board.

### 1.1.7 Message Passing

The board occupies 8K of memory space on the host PC. This 8K may reside anywhere within the PC’s address space. As a *Compact*PCI board, the address and interrupt of the board is assigned at boot time. The message passing scheme used by the Infinity Series H.110 BRI Board is identical to that of the other Infinity Series H.110 boards, allowing for the easy combination of a variety of Infinity Series H.110 boards in a single system.

The message passing scheme and message syntax of Infinity Series H.110 boards is similar to that of the older Infinity Series H.100 boards and XDS series of MVIP and SCbus boards. This facilitates the easy migration from ISA and PCI systems to designs using *Compact*PCI boards

### 1.1.8 Flash EAROM for Firmware

The firmware for both the main processors and for the DSP’s is contained in Flash EAROM. This allows for easy upgrades of the firmware on the board in the field without requiring time consuming downloads every time a system boots. Once reprogrammed, the new firmware is retained even when the power is removed. The original, factory programmed firmware is also retained on board and can be accessed by installing a jumper.

### 1.1.9 EEPROM for Configuration Information

ISDN interfaces can require a substantial amount of information to be programmed into the system. These includes items such as the SPIDs (Service Profile Identifiers) and DNs (Directory Numbers) associated with each interface as well as board configuration information such as the type of port (NT or TE) and the protocol level supported. To reduce the burden



on the application, the board has an EEPROM capable of providing non-volatile storage for this information. This allows the board to automatically configure itself upon a restart.

### 1.1.10 Mezzanine Boards

The H.100 BRI Board provides connectors for attaching two mezzanine boards. These mezzanine boards can be used for additional processing of signals on the B-channels. The connectors are compatible with the Bicom Flex Port DSP Card which can be used for speech processing or providing fax services. Future mezzanine boards may be provided to allow for digital data services using the B-channels.

## 1.2 How to Use This Manual

The first five sections in this manual are organized in the order you should read and use them to get started with your H.110 BRI ISDN Board. We recommend that you begin with these three steps.

1. Follow the instructions in section 2.0 (Quick Start) and 3.0 (Installation). These sections will tell you if your board is operating correctly within your system. You don't need to be familiar with the board's command set to complete this step.

2. Read section 4.0 (Initialization) to initialize the board within your system. Your application must perform these initialization procedures whenever the computer is powered up in order for the board to communicate with application.

3. Read section 5.0 (Communications with the Computer) for an overview of how to communicate with the H.110 BRI ISDN Board. Section 5.0 includes a summary of the commands for constructing your application and details concerning system interrupts.



Before you can actually build your application, read section 6.0 (The H.110 Bus and Clock Modes), 7.0 (Layer 1 and Layer 2 Protocols), 8.0 (Using "D" Messages for Layer 3) and 9.0 (Controlling the B-Channels). These sections explain, with practical examples, how the H.110 BRI ISDN Board operates and how to use the command set to achieve the desired results. Section 10.0 explains diagnostic and error messages that may occur. The Appendix contains information on power requirements and interfacing that will be helpful installing your H.110 BRI ISDN Board.