TOTAL CONTROL™

Total Control Chassis

SYSTEM OVERVIEW MANUAL

Table of Contents

System Overview

The Total Control chassis is a versatile, generic data communications platform for integrating local and wide area networks. The chassis can support virtually any data / voice / video application, governed by the Network Application Cards (NACs) and Network Interface Cards (NICs) plugged into the chassis midplane.

NACs function as intelligent data processors / routers. They communicate over the midplane to provide a full-duplex connection with external networks. NICs provide the physical network interface.

Internetworking Products

The Total Control platform can adapt to fit the needs of different applications. There are two internetworking products based on the Total Control chassis: the Enterprise Network Hub and the Transaction Processing Hub.

Both of these products have the following characteristics:

- Has evolved from U.S. Robotics' proprietary Digital Signal Processing (DSP) technology.
- Represents a highly integrated design (19" x 18" x 7"), the most compact dial-up solution available.
- Includes a 1 Gigabit per second chassis midplane, containing both circuit- and packet-switched buses.
- Can be modified and enhanced to take advantage of emerging technologies.
- Incorporates management expertise evolved from the original Total Control modem management system.
- Connects a variety of local area and wide area networks.

Enterprise Network Hub

The Enterprise Network Hub is a powerful internetworking tool that combines in one chassis the functions of analog and digital modems, Channel Service Units / Digital Service Units, X.25 PADs, Routers, Terminal Servers, and Frame Relay PADs (FRADs), all managed from a single PC.

The Enterprise Network Hub provides the greatest benefit for organizations that need to centralize processing capabilities for remote offices and LANs. It enables organizations to aggregate their dial traffic onto T1 lines and route it through a packet-switched network to their host computer at a central site.

This product is optimized for high speed dial access, and is ideally suited for all traditional dial-up applications, such as dial access to a host, electronic mail, file transfer, and dial access to a LAN. It incorporates Adaptive Speed Leveling (ASL), U.S. Robotics' proprietary method of monitoring phone line quality and shifting speed up and down to ensure data integrity. It offers the following modem options:

- V.32 *bis*, with maximum connection of 14,400 bps
- V.32 terbo, with maximum connection of 21,600 bps
- V.34 modems, with maximum connection of 28,800 bps

Transaction Processing Hub

The Transaction Processing Hub is designed to accommodate such applications as credit card and point-of-sale transactions. This product dramatically reduces connection and transaction verification times.

The Transaction Processing Hub is optimized for quick connection and disconnection. It incorporates protocol spoofing for such popular protocols as VISA I and VISA II.

The Transaction Processing Hub also meets the needs of the Regional Bell Operating Companies, who have agreed to provide uniform transaction processing capabilities under a banner called Transaction Switching and Transport Services (TSTS).

System Components

A minimum configuration of the Total Control chassis consists of the following components:

- One 19-inch chassis, or card cage, containing 17 card slots and a high-speed, multi-layer midplane that spans the length of the chassis.

  NOTE: The chassis is also available in an 11-inch, 7-slot version for smaller applications.

- Up to 16 front-loaded Network Application Cards (NACs) for the larger chassis, and up to 6 NACs for the smaller version. The Application Cards are paired with associated rear-loaded Network Interface Cards (NICs).
- One front-loaded management card (always loaded in slot 17 in the large chassis, slot 7 in the small chassis) and its rear-loaded interface card.
- One or two front-loaded Power Supply Units (PSUs), second PSU for redundancy, for the larger chassis. The smaller chassis houses a single integral PSU.

The graphic below represents a typical configuration of the Total Control chassis.

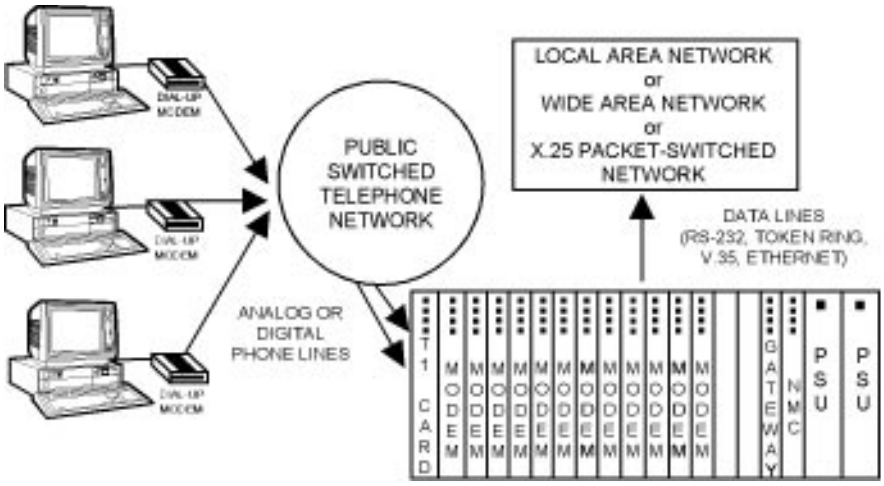

Figure 1. Total Control Configuration

Functional Summary

Chassis / Chassis Midplane

The Total Control access system is built around a Quad-bus chassis. The four buses on the midplane are as follows:

- TDM (Time Division Multiplexed) Bus—a 16 Mbps serial bus for communication between the T1 Card and the Quad Modem Cards.
- Packet Bus—a 1 Gbps, 32-bit parallel bus that carries data from the modems to any of several Gateway Cards.
- Management Bus—a 16 Mbps synchronous serial bus that allows communication between the management card and all application and interface cards.
- General Purpose Bus—a 256 Mbps bus reserved for future expansion and a wide variety of future applications.

The midplane design also supplies power to the wide array of NACs and NICs that can be configured and installed in the chassis to meet diverse LAN / WAN connectivity needs. The full-size chassis provides 17 connectors in front for NACs, and 17 connectors on the rear for NICs; the smaller chassis provides 7 connectors of each type. All NACs and most NICs can support hot-swapping, enabling insertion and removal while power is on.

The midplane can accommodate an aggregate data bandwidth in excess of 1 Gigabit per second (Gbps). The midplane data buses enable any application card to communicate with any other application card in the chassis. For example, the T1 to RS-232 application uses the TDM (Time Division Multiplexed) bus. This synchronous, serial bus provides 192 full duplex 64 Kbps time slots, and carries traffic between circuit-switched devices such as the T1 Card and the Quad Modems.

Power Supply Units (PSUs)

The PSUs enable AC or DC power input and supply DC power to the installed NICs and NACs via connectors in the midplane. A second PSU is optional, but recommended. One unit provides sufficient power to a fully loaded chassis, and the second provides full redundancy.

Analog Configuration

- Connects to the phone system using standard analog service.
- Each chassis houses up to 32 high-speed analog modems.
- May include a Hub Controller Unit (HCU) to maintain system data, cabled to a PC through an interface unit.
- May be managed with *Total Control PC* software, capable of configuring, monitoring and regulating up to 32 chassis.

Dual Analog Modem Application Card

The Dual Analog Modem Card provides two dial-up modems on a single card. Each modem supports MNP 1–5 or V.42 / V.42 *bis* error correction and data compression, and may be purchased in the following standards:

- V.32 *bis* modulation (up to 14.4 Kbps)
- V.32 terbo modulation (up to 21.6 Kbps)
- V.34 modulation (up to 28.8 Kbps)

These modems are also available in a Dual Standard version, offering U.S. Robotics' proprietary HST modulation.

A shared microprocessor-based circuit provides interfaces to the midplane. The analog (phone line) interface is input directly from the RS-232 NIC via the midplane. The digital interface is output to RS-232 ports on the RS-232 NIC.

Dual Analog / RS-232 Interface Card

The Dual Analog / RS-232 Interface Card provides the physical interface for phone line and RS-232 ports. There are two 8-pin modular phone jacks on the rear of the card and two DB-25 connectors that control the serial ports at the computer interface for each modem.

Each RS-232 port supports the full complement of RS-232 signals necessary for synchronous or asynchronous operation. Each port is designed to operate at speeds up to 115.2 Kbps, and provides two TTL-level serial interfaces to the Dual Analog Modem Card.

Digital Configuration

Each digitally configured chassis has the following characteristics:

- Houses up to 64 high-speed digital modems.
- Connects to the phone system by direct T1 link(s).
- Routes data from T1 input to a LAN interface by way of digital modems and a LAN interface card.
- May contain a Network Management Card to maintain system data, cabled to a PC through an interface unit (via direct, LAN or WAN connection).
- May be managed with software ranging from a simple terminal interface menu system to *Total Control Manager/SNMP*, an SNMP-based, fully Windows-compatible, integrated Network Management System package.

Single/Dual T1 Application Card

The T1 Card allows high-performance digital T1 access to the public switched telephone network (PSTN). This card is available in either a single or dual version: the Single T1 Card can handle up to 24 DS0 channels from one four-wire T1 trunk, and the Dual T1 Card can handle up to 48 DS0 channels from two trunks.

Each channel can carry either a PCM-encoded voice channel or digital data. The T1 Card supports 64 Kbps clear channel operation for data channels, and supports Feature Group B for voice channels. Each of the DS0 channels can be connected to any other application card via the midplane. Fractional T1 applications are also supported, so users only pay for the number of DS0s needed.

The T1 Card allows you to use ANI and DNIS information provided by the public 950 services, Feature Groups B and D, and enhanced 800 services to route data. Using this call information, the Total Control chassis can independently route the individual DS0 channels of the T1 signal to specific modems.

Single/Dual T1 Interface Card

As with the Application Card, the T1 Interface Card is available in either a single or dual version. The Interface Card provides the physical interface for either one or two four-wire T1 trunks. The rear of the card provides RJ48 connector(s) to terminate the trunk(s), as well as Bantam monitor jack(s) for quick and easy problem diagnosis. There is also an RJ45 connector for support of the RS-232 interface port.

The T1 Interface Card performs all necessary auto equalization and auto gain functions to support 6000 feet of 24-gage shielded cable. This card complies with all Bell Core standards relating to T1 alarms, loopbacks, error detection, etc. The T1 Interface Card is compatible with an external Channel Service Unit (CSU) if required, and provides a TTL-level serial interface to the T1 Application Card.

Quad Modem Application Card

The Quad Modem Card provides four dial-up modems on a single card. These modems are available in digital only, analog only, and analog / digital versions.

Each modem supports MNP 1–5 or V.42 / V.42 *bis* error correction and data compression, and may be purchased in the following standards:

- V.32 *bis* modulation (up to 14.4 Kbps)
- V.32 terbo modulation (up to 21.6 Kbps)
- V.34 modulation (up to 28.8 Kbps)

These modems are also available in a Dual Standard version, offering U.S. Robotics' proprietary HST modulation.

A common microprocessor-based circuit provides interfaces to the midplane. The phone line interface is input directly from the T1 Card via the midplane. The modem card can either direct its interfaces to external RS-232 ports via an RS-232 NIC, or can direct this data to a Gateway Card via the midplane. The Gateway Card can then multiplex the data from many Quad Modem Cards onto an Ethernet or Token Ring LAN, or an X.25 / packet-switched network.

The modem can make use of the DNIS and ANI information provided by the public 950 services, Feature Groups B and D, and enhanced 800 services. The modem uses this information to customize its configuration prior to answering a call. For example, the dialed phone number can be associated with specific applications, and the same modem pool can be dynamically configured on a call-by-call basis to adjust to the requirements of the application.

Quad RS-232 Interface Card

The Quad RS-232 Interface Card provides the physical interface for four RS-232 ports. There is a single 50-pin connector on the rear of the card. A fan-out cable is provided to adapt this interface to standard DB-25/ DB-9 RS-232 connectors.

Each RS-232 port supports the full complement of RS-232 signals necessary for synchronous or asynchronous operation. The ports support operation at speeds up to 115.2 Kbps, and provide four TTL-level serial interfaces to the Quad Modem Card.

For Quad Analog Modems, there are also four RJ11 connectors to provide input for four PSTN phone lines.

Applications

Analog to RS-232 Application

The Total Control Analog to RS-232 application uses the standard analog telephone service (RJ11 interface) to connect to the Public Switched Telephone Network.

This application requires the following components:

- Dual Analog Modem Card
- Dual Analog/RS-232 Network Interface Card

The managed version of this product uses either *Total Control Manager/SNMP* software and a Network Management Card, or *Total Control PC* software and a Hub Controller Unit. See a description under *Management Systems* later in this manual.

Application Features

- Offers the U.S. Robotics "V.Everything" modem technology, with wide compatibility to other standards up to and including V.34, the 28.8 Kbps ITU-T standard.
- Offers compatibility with both the *Total Control PC* and *Total Control Manager/SNMP* software packages, expert systems for automating modem management.
- Uses the same Quad-Bus chassis as the digital application, providing network designers a clear migration path to emerging digital network services.

T1 to RS-232 Application

The T1 to RS-232 application combines a direct T1 input, advanced modem technology and a digital network interface to provide an integrated solution to high-speed data center operations.

This application combines the functions of six devices:

- Data Service Unit / Channel Service Unit (DSU / CSU)
- Intelligent T1 Channel Bank / MUX
- Front-end processor / gateway
- Router
- Analog modems
- Local RS-232 interface

The Total Control chassis provides a full-duplex connection between 48 DS0 channels (input via two T1 trunks) and 48 sync / async RS-232 channels. The 12 Quad Modem Cards provide 48 modem channels to demodulate calls. The Quad RS-232 NICs provide the 48 sync / async RS-232 channels.

This application requires the following components:

- T1 Network Application Card
- T1 Network Interface Card
- Quad Modem Card
- Quad RS-232 Network Interface Card

The T1 to RS-232 application uses the TDM (Time Division Multiplexed) bus on the chassis midplane to carry traffic between the T1 Card and the Quad Modems. A complete description of this application, along with timing charts, can be found in the *T1 Card Reference Manual*.

Application Features

- Increases performance and reliability by eliminating unnecessary digital-analog-digital conversions. Using two T1 lines as opposed to 48 telephone lines increases throughput, and reduces cabling and network costs.
- Supports cost-effective, high-speed, enhanced digital public network services. Takes advantage of the technology in Feature Groups B and D for extra services to reduce costs.

- Interprets network call information to process, route, and respond to incoming calls. Routes any DS0 to any RS-232, based on DNIS (Dialed Number Identification Service) and ANI (Automatic Number Identification) signaling.
- Eliminates multiple components and cabling, thereby improving reliability.
- Allows a single management system to control all system components and modules.
- Permits Wide Area Networks (WANs) to perform transaction processing, point-of-sale, LAN-to-LAN or other multi-point applications, using digital or analog network services.
- Offers a flexible and upgradable design—when tariffs and services change, the Total Control chassis can adapt.
- Reduces connection times by using U.S. Robotics' high-speed Quick Train technology.
- Uses U.S. Robotics' core modem technology to maximize performance and improve overall customer service.

T1 to X.25 PAD Application

The X.25 Network Application Card connects any Quad Modem Card in the chassis to an X.25 packet-switched network. As an integral card, the X.25 PAD eliminates external equipment and RS-232 cables to improve performance and reduce per-channel cost.

The X.25 Network Application Card emulates a true X.25 PAD. It is available in both 24 and 48 channel versions. With this application, users can dial in through the public network asynchronously and treat the X.25 PAD Card as a packet mode DTE. This allows access to a Packet Switched Network (PSN) via the X.25 DTE interface.

In a typical application, a user dials into the Total Control chassis through the public telephone network. Calls may come into the chassis either through the T1 Card or the Quad Analog Modem. The call is routed to the X.25 PAD Card based on the dialed number (DNIS), the calling number (ANI), or on the preconfigured user identity. These numbers enable the X.25 PAD to determine if the dial-in user is requesting an interactive or noninteractive service, and to route the call to permanent or switched virtual circuits.

V.35/RS-232 Network Interface Card

The V.35/RS-232 NIC supports one RS-232 interface port (for management and software download), and two async/sync ports, which allow the card to interface to an X.25 Packet Switched Network. These two ports are independently software-configurable to function as either V.35 or RS-232.

Both ports communicate with the PSN synchronously. When configured for RS-232, the maximum port speed is 57.6 Kbps. When configured for V.35, the maximum port speed is 256 Kbps.

T1 to TCP/IP Terminal Server Application

Total Control offers LAN connections through the NETServer Card, which functions as a dedicated TCP/IP Terminal Server. This card emulates a true terminal server, and is available in both 24 and 48 channel versions. It can be mated with either a Token Ring or Ethernet Network Interface Card for LAN connections.

On the LAN side, the card performs both TCP/IP and LAT (Local Area Transport, a DEC standard). On the channel side, the card accepts async connections as well as two synchronous protocols: SLIP (Serial Line Internet Protocol) and PPP (Point-to-Point Protocol).

Token Ring Network Interface Card

The Token Ring NIC is designed to work with both the Network Management Card (NMC) and the NETServer. It provides the physical interface for a single 4/16 Mbps, IEEE 802.5-compatible Token Ring LAN. The Token Ring NIC provides two LAN interface ports.

- RJ45 connector, for connection to Unshielded Twisted Pair (UTP)
- DB-9 connector, for connection to a Shielded Twisted Pair (STP)

The Token Ring NIC also provides two serial channels to establish a SLIP connection or to access an RS-232 local interface.

Ethernet Network Interface Card

The Ethernet NIC is designed to work with both the Network Management Card (NMC) and the NETServer to provide a connection between the Total Control chassis and an Ethernet network. There are three LAN connectors to accommodate thick, thin or twisted pair Ethernet cable (as defined by the IEEE 802.3 specification). The Ethernet NIC also provides two serial channels to establish a SLIP connection or to access an RS-232 local interface.

TCP / IP API Development Set

With the API Development Set, application developers can build programs that process and route data received by the Total Control chassis. These applications can then be installed on a special TCP / IP Gateway Card.

Like our other Gateway Cards (the NETServer Card and the X.25 PAD), this card emulates a true terminal server. We provide the TCP / IP API to access a LAN (through either Token Ring or Ethernet), and we also provide a Packet Bus API to gain access to the modems. The customer can then write a high layer transfer protocol to handle data.

Using the API set, customized application programs have access to all DNIS and ANI call routing information handled by the Total Control chassis. This makes it possible to perform the following functions:

- Pre-process incoming data packets
- Convert / compress data formats
- Emulate or spoof higher level application protocols
- Collect statistics
- Offload communications from the host computer
- Consolidate network traffic

Management Systems

DOS-based Modem Management

The original U.S. Robotics Total Control modem management system has been adapted for the Enterprise Network Hub. It incorporates the following components.

Hub Controller Unit (HCU)

This card is an adaptation of the Total Control Rack Controller Unit (RCU), and the new microprocessor-based controller is even more powerful. Processor clock speed has been increased from 16 MHz to 20 MHz. Access times for SRAM and DRAM are faster. And the HCU is loaded with 896 Kbytes of RAM to store system configurations, as opposed to the RCU's maximum of 640 Kbytes. The HCU is supplied with a rear-loaded HCU NIC to provide the physical interface to a PC.

Total Control PC Software

This is the software component of the original Total Control system, adapted to manage Dual Analog Modems installed in the new Total Control chassis. *Total Control PC* allows an operator to configure, control, monitor, and test modems in up to 32 fully loaded chassis. It features Auto Response template management, so that system events can be programmed to generate alarms and/or dynamic responses. System logs allow easy tracking of performance, and an optional Dial Security feature restricts both dial-out and dial-in access to approved users.

SNMP-based Network Management

The application cards installed in a Total Control chassis can also be managed with an SNMP-based application that runs under Microsoft Windows and can be integrated into Novell's NetWare Management System. This system incorporates the following components.

Network Management Card (NMC)

The NMC maintains constant communication with all application cards in the chassis via the management bus on the chassis midplane. The NMC is able to configure all NAC parameters, perform tests, issue commands, query statistics and performance data, download operational software, and perform many other vital management functions.

The NMC communicates with other Network Management systems using the Simple Network Management Protocol (SNMP). Management can be performed using either U.S. Robotics' own *Total Control Manager/SNMP* software, or by an independent network management system that can accept the ASN.1-formatted MIBs (Management Information Bases).

NOTE: As the U.S. Robotics MIBs are compatible with other SNMP hosts, such as HP OpenView and SunNet Manager, they are packaged along with the Network Management.

NMC NICs

The NMC uses the interface ports located on its installed NIC to communicate with external devices. The NIC provides interface ports for both LAN and RS-232 connections. Its function depends on the software loaded in the NMC to communicate with a specific type of LAN.

Depending on your LAN requirements, the NMC can be mated with either an Ethernet or Token Ring Network Interface Card.

Management Station Software

The Management Station software can manage any number of local and remote hubs from a single console. It consists of two software components.

Network Management Map (NMM)

Developed by Novell and licensed by U.S. Robotics, the main function of this software is creating, saving, and opening maps. It functions as the SNMP host framework for managing network devices. Along with the U.S. Robotics-developed software, this provides a complete network management solution. The U.S. Robotics software can be launched from within the Novell application.

Total Control Manager/SNMP Software

Developed by U.S. Robotics, Inc., the main function of this software is configuring devices in the chassis, saving those configurations, and monitoring device performance. This includes downloading Flash ROM code to each NAC, as well as monitoring power supply and fan status for the chassis. This software communicates with the Network Management Card, which performs SNMP (Simple Network Management Protocol) proxy agent functions for communications between the Management Station and all other cards in the chassis. There are options to add on functions for both Security and Auto Response.

Total Control Document Structure

The following reference material is available for the Total Control products:

- *Hardware Install Guides*. These materials describe the essential hardware components, and provide a description of the card's features, configuration options, installation and cabling instructions, and technical specifications. These guides are shipped independently along with hardware components. The following are available:
  - Total Control Chassis Hardware Install Guide
  - Single / Dual T1 Card / T1 NIC Hardware Install Guide
  - Network Management Card / Ethernet NIC / Token Ring NIC Hardware Install Guide
  - *Total Control Manager/SNMP* Installation / Configuration Roadmap
  - Quad Modem Card / Quad NIC Hardware Install Guide
  - X.25 PAD / V.35 NIC Hardware Install Guide
  - NETServer Card / Ethernet NIC / Token Ring NIC Hardware Install Guide
- *Total Control Reference Library*. These materials describe the software components required to manage each card, as well as the system as a whole. These manuals are packaged together and shipped as a unit. The following reference manuals are included:
  - System Overview Manual
  - Single / Dual T1 Card Reference Manual
  - Network Management Card Reference Manual
  - Total Control Manager / SNMP Software Guide
  - Total Control SNMP MIB Reference Manual
  - Quad Modem Card Reference Manual
  - X.25 PAD Reference Manual
  - NETServer Card Reference Manual