CDCNET
Device Interface Units

CONTROL DATA

Equipment for configuring and managing cost-effective distributed communications networks

CDCNET, Control Data's solution for distributed communications networking, provides cost-effective networking capabilities by distributing processing power and network management functions to small processors known as device interfaces (DIs). DIs eliminate the need for large, logically complex and expensive front-end processors traditionally used in networks.

A distributed network architecture built around DIs gives you:

- ☐ Better control of initial costs, by matching processing power to the needs of the network.
- ☐ Lower incremental costs, by adding specialized processors as needed when the network grows.
- ☐ Elimination of many modem and multiplexor costs by connecting terminals and workstations directly to CDCNET.
- ☐ Improved reliability through elimination of single-point failures, opportunities for fault-tolerant configurations, and the inherently simpler logic of smaller processors.

Device interfaces, like the one above, distribute major communications functions to different locations throughout the network, enhancing the reliability of your network. And, as your networking needs grow, you can incrementally add more DIs to accommodate those demands.

Functions of Device Interfaces

Device interfaces receive data from one network resource, such as a terminal, and translate it to a format compatible with its next destination in the network, such as a host.

Because there are many different computing resources used in CDCNET, there are different types of DIs. Each type performs a special interfacing function, including:

- ☐ Connecting a CYBER host computer to CDCNET.
- ☐ Connecting terminals, workstations and unit record devices to a system.
- ☐ Connecting remote CDCNET resources to a system.
- ☐ Connecting to a remote network whose architecture is totally different from CDCNET.
- ☐ Connecting workstations and terminals directly to a CYBER host in a small, entry-level configuration.
- ☐ Connecting CDCNET to an X.25 public data network.

Common DI Features

CDCNET device interfaces share the same basic hardware architecture. All DIs have eight slots for logic boards, eight slots for line interfaces, an internal system bus, plus the necessary chassis assembly, power supply and cooling. Optional logic boards are used to configure a variety of device interface variants to meet your networking requirements.

The logic boards and line interfaces used to configure DIs are described in a separate data sheet titled *CDCNET Logic and Memory Boards* (publication number 204935).

The internal system bus enables communication among up to eight logic boards. The bus transfers 16-bit data words plus parity bits between individual DI boards. The internal system bus supports a 16-megabyte address range and a minimum transfer rate of 5 megawords per second across the bus. It also includes signals to control DI status and interrupts.

Another common feature is the Ethernet* serial interface module, which is the logic board that enables DIs to interface to the Ethernet cable. You can install up to three of these boards per DI.

The needs of most networks are met by standard device interface configurations. There are three features common to all device interfaces: an internal system bus (described in the preceding paragraph), a main processor board, and a system main memory board.

The Main Processor Board provides the primary processing power for the DI software. The board contains a 10 MHz Motorola** 68000 microprocessor featuring:

- — Time of day clock
- — Master oscillator and timing
- — Temperature warning and shutoff
- — Power monitors
- — 16K of RAM with parity
- — 16K of ROM with checksum; includes diagnostics, loader and debug code
- — Two serial ports for maintenance and control
- — First failure capture registers
- — Bus control logic

The main processor board, like all other DI logic boards, contains ROM for on-board diagnostics and board identification. The main processor board also contains RAM. Each byte in RAM contains a parity bit, which is checked on all read operations.

The System Main Memory provides random access memory for use by every processor within the DI. All DIs contain at least one system main memory board with 1,024K bytes of RAM and single-bit error correction/double-bit error detection (SECDED). The maximum transfer time during an SMM read cycle is 312.5 nanoseconds or 625 nanoseconds for a read with corrected error. The maximum transfer time for a write cycle is 312.5 nanoseconds or 625 nanoseconds for a byte write.

Standard Device Interfaces

The Mainframe Device Interface (MDI) connects a CYBER host computer system to a network. Specifically, the MDI provides an I/O interface between the channel on a CYBER computer system and the Ethernet cable used in CDCNET.

In addition to the basic DI elements, the MDI includes one mainframe channel interface and one Ethernet serial channel interface.

An MDI can be configured to provide more performance. Additional memory can be utilized by adding a second system main memory board. A second mainframe channel interface also can be added, to provide:

- ☐ Greater fault tolerance, by providing an alternate path to a CYBER host.
- ☐ Linking of two hosts to a single MDI.

The MDI is identified by the product number 2621.

The Terminal Device Interface (TDI) connects user terminals and workstations to an Ethernet trunk. It will also connect unit record equipment, such as line printers, to a network using either serial or parallel interfaces.

The TDI provides an I/O interface between Ethernet cable and the individual terminals, workstations and unit record devices used in the network. Connection of TDIs to terminals and workstations in the areas where they are located eliminates the costs of multiplexors and modems. However, terminals and workstations can be connected via modems and multiplexors if required by your configuration.

A TDI readily accommodates a wide variety of terminal and line protocols via software that is downline-loaded. Line interface modules handle the electrical interfaces.

A TDI includes an Ethernet serial channel interface, a communications interface module, and at least one line interface module.

Communications interface modules perform protocol translation functions, translating data from terminal formats to internal Control Data application format. Each module handles one or two protocols. These modules also provide incremental network processing resources. Modules can be added as throughput requirements increase. You can install up to three communications interface boards in a single device interface.

TDIs are identified by the product number 2622.

The Network Device Interface (NDI) connects a CDCNET network to other networks, including:

- ☐ A remote CDCNET distributed network connected using a medium-speed link (such as a communications line using the HDLC protocol or X.25 virtual circuits).
- ☐ An X.25 public data network.
- ☐ A remote network with an architecture other than Control Data's. In such a case, the NDI uses downline-loaded software as a gateway.
- ☐ Another CDCNET distributed network in the same facility as the initial network. In this case, the NDI acts as a relay unit.

Because NDIs are capable of many functions, their configurations vary depending on the services needed. For instance, when configured to serve as a relay, two Ethernet serial channel interfaces are incorporated into the NDI. When an NDI is used to connect to a remote network, it must contain a communications interface module and at least one line interface module.

NDIs are identified by the product number 2623.

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The Mainframe/Terminal Device Interface (MTI) connects user terminals, workstations, unit record devices and modems directly to a CYBER host. Often, this is an attractive entry-level option for sites where terminals and workstations are located near the CYBER host. Because it combines the functions of an MDI and a TDI, this unit provides an economical entry-level configuration. However, due to its complexity, the throughput of this device interface is somewhat less than an MDI. An option kit allows you to upgrade the mainframe/terminal interface to an MDI and TDI without abandoning any of your hardware.

The MTI includes a mainframe channel interface, a communications interface module and a private memory module.

By adding a second mainframe channel interface, the MTI will link terminals, workstations, unit record devices and modems to two hosts. With more than one communications interface module and line interface modules, the MTI will support additional terminals, workstations, unit record devices and modems. The exact number of devices an MTI will support depends on the speeds of the I/O lines and their message rates.

The MTI is identified by the product number 2620.

Customized Device interfaces

If the standard DI configurations do not meet your needs, customized versions of device interfaces can be configured using a base device and various CDCNET logic boards and line interfaces. In addition to the chassis assembly, power supply and cooling, the base device consists of an internal system bus, main processor board, slots for up to seven additional logic boards, and slots for up to eight line interface modules.

(More information about logic boards and line interface modules is available in the data sheet titled *CDCNET Logic and Memory Boards*, publication number 204935.)

The base unit for customized DIs is identified by two product numbers. The 2601-2 is for 50 Hz systems; the 2601-3 is for 60 Hz systems.

Cables

Control Data supplies a full range of cables to suit different communications and physical environments when connecting line interfaces to terminals or modems. Cables supporting EIA flow control are available for installations requiring them. Three different cable lengths facilitate easy and economical installation.

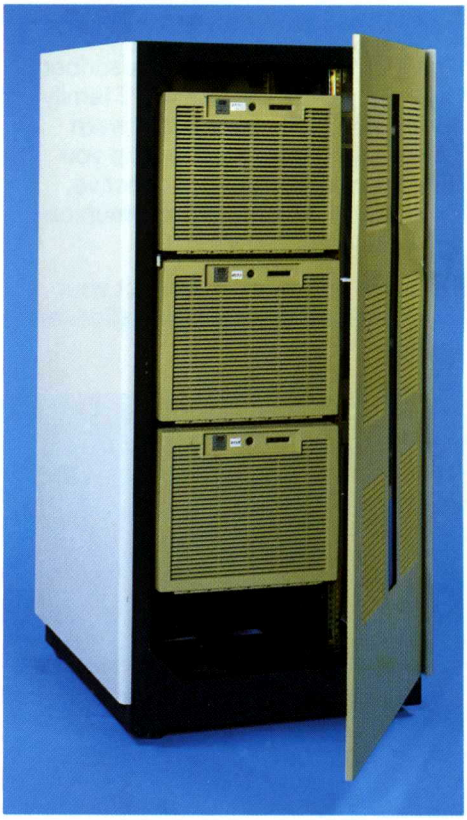
Cables are identified by parts numbers keyed to the product numbers of the CDCNET hardware with which they are used. Cables in the -6XX and -8XX series provide generic modem eliminator functions and EIA flow control. Cables in the -5XX and -7XX series provide direct terminal connection without modems. Cables in the -1XX series are for connections to modems.

DI Enclosures

Device interfaces are packaged in individual structural foam enclosures that can be placed on an appropriate table or shelf. For safety reasons, units should never be placed on the floor. Control Data supplies two custom enclosures. One is specially designed to accommodate up to three DI units (model 2650). It features access from both the front and back of the cabinet, convenient cable routing and power distribution, easy viewing of DI indicators through the front door, and castors and leveling pads for fast setup. The second enclosure (model 2651) is an attractive table-height stand table that holds one DI unit within. It has a rear access for cable installation.

CDCNET 16 LIM System: An Entry-Level Package

Control Data offers an entry-level configuration consisting of a Mainframe Device Interface (MDI) and two Terminal Device Interfaces (TDIs) along with a model 2650 enclosure to house all three DIs. The package also includes an Ethernet multiplexor and Ethernet transceiver cables to connect the multiplexor to the DIs. The system will support up to 16 line interface modules.



The 16 LIM System is an entry-level configuration that consists of one MDI and two TDIs housed in a model 2650 enclosure. It accommodates up to 16 line interface modules.

The CDCNET 16 LIM System for 60 Hz 120V operation is identified by product number 2699-1; the system for 50 Hz 220V is product number 2699-2.

Related Publications

More information about CDCNET and device interfaces can be found in two other publications. A general overview is available in *CDCNET Conceptual Overview*, publication number 60461540. A more detailed overview is available in the *CDCNET Product Description Manual*, publication number 60460590.

Other CDCNET data sheets describe the logic and memory boards used to customize device interfaces (publication number 204935), and the Ethernet equipment—the multiplexor, transceiver, and repeater—used as the serial distribution media within CDCNET (publication number 204936).

For More Information

The device interface units described here are part of the CDCNET family of compatible hardware, software and services designed to help you develop and manage an effective, economical, distributed communications network.

For more information, contact your nearest Control Data sales office, or write:

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CDCNET
Logic and Memory Boards

CONTROL DATA

Equipment for configuring CDCNET device interface units

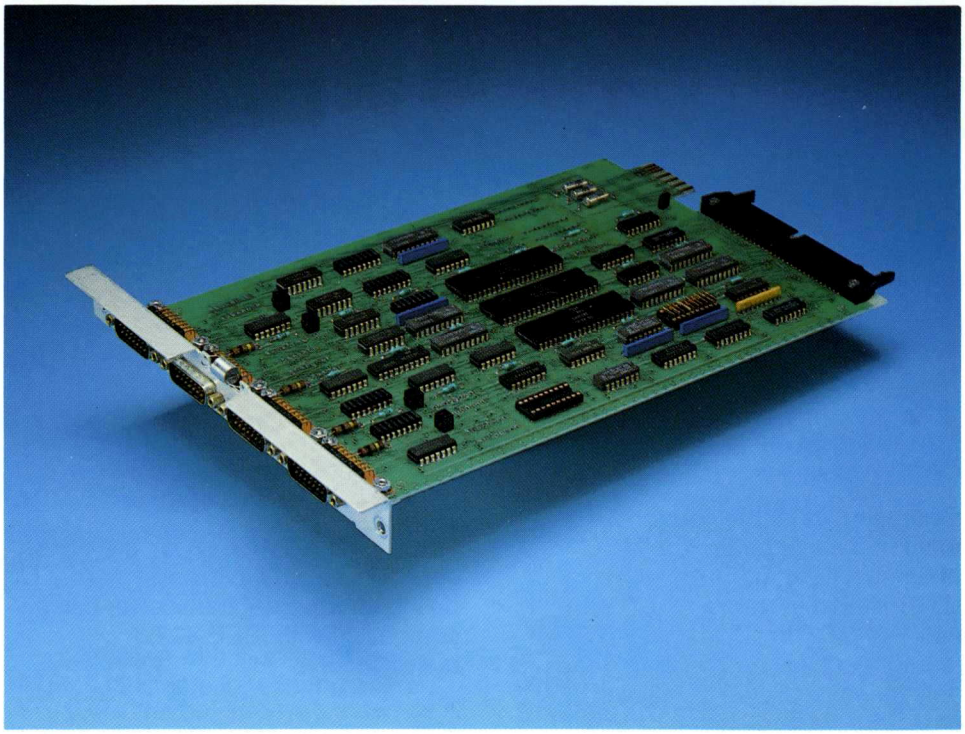
A Control Data Distributed Communications Network (CDCNET) uses small, specialized communications processors, called device interfaces (DIs) to distribute the major communications functions of a network to different network locations, thereby increasing your network's cost-effectiveness, efficiency and reliability.

All DIs have the same basic architecture, which consists of a main processor board, internal system bus and system main memory. Beyond these basic components, each DI has a specific combination of removable logic boards that enable it to perform its special processing functions in the network. For instance, any DI must contain at least two input/output (I/O) interfaces.

These field-installable, modular logic boards make it possible to tailor DIs to the exact needs of the network. This, in turn, gives users important benefits, including:

- ☐ Control of the initial network costs.
- ☐ Elimination of processing bottlenecks.
- ☐ Higher reliability and fault tolerance.
- ☐ Easy, economical modification of the network.

Control Data offers standard, preconfigured DIs to meet the needs of most CDCNET systems. However, you also can customize DIs to address your organization's unique networking needs. This data sheet describes the removable logic boards used in either standard or customized device interfaces.



Line interface modules, above, allow DIs to interface with user terminals, workstations, modems and other devices, like line printers.

System Main Memory (SMM)

Each DI includes at least one SMM board to provide random access memory (RAM) for every processor within the unit. The SMM provides 1,024K bytes of RAM with single-bit error correction/double bit error detection (SECDED). It is formatted in two banks of 256K by 22 bits, with a starting address defined by the DI processor during initialization.

The maximum transfer time during an SMM read cycle is 312.5 nanoseconds; 625 nanoseconds for a read with corrected error. The maximum transfer time for a write cycle is also 312.5 nanoseconds; 625 nanoseconds for a byte write.

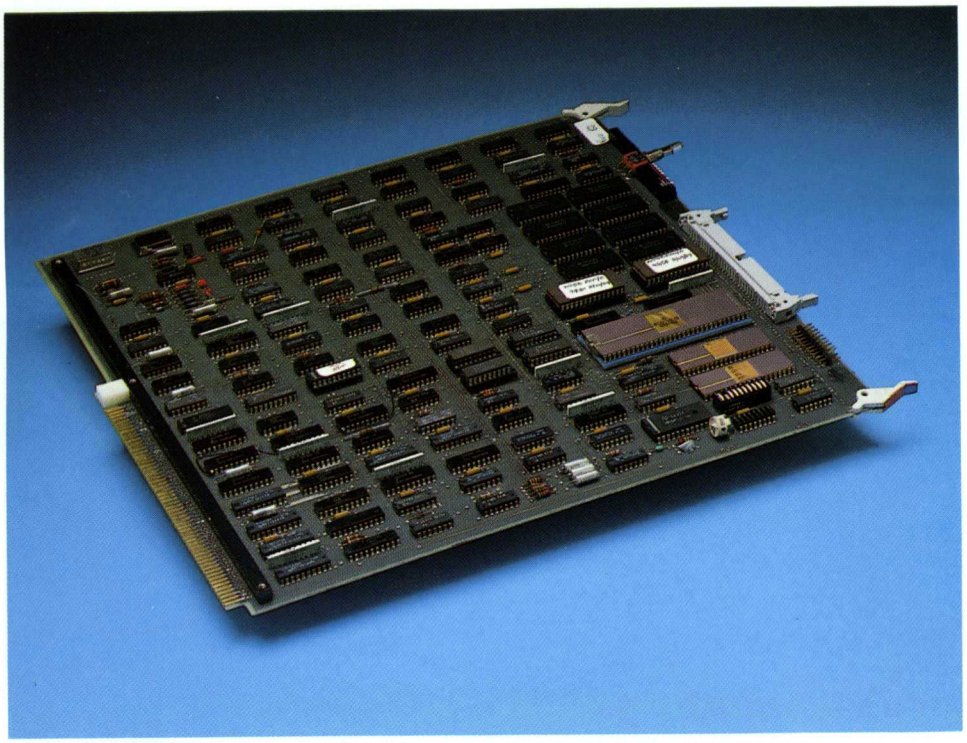
Up to five SMM boards can be installed in a DI. The SMM is identified by product number 2604.

Private Memory Module (PMM)

When a DI requires additional performance, a PMM can be added to the configuration. PMM improves performance only in activities limited by main processor capability. Improvements of up to 30 percent are possible.

A PMM consists of one 128K byte by 18 bits (byte parity) memory card. The maximum transfer time for a PMM read cycle is 140 nanoseconds. Because PMM memory is static, no constraint applies to its minimum transfer time. Maximum transfer time for a PMM write cycle is 180 nanoseconds.

Only one PMM can be installed in a DI. Its product number is 2605.



The main processor board, above, generates primary processing power for DI software.

Mainframe Channel Interface (MCI)

Operating under the control of the main processor board, the MCI enables a DI to interface with a CYBER host system's 12-bit channel. The MCI provides chained direct memory access and onboard read only memory (ROM) containing bootstrap code, diagnostics and checksum. It also has two data packing/unpacking modes with channel and bus parity.

The CYBER mainframe allows only one MCI to be linked per channel; pass-on/pass-back is not supported.

Two MCI boards can be installed in a DI. The MCI product number is 2607.

Ethernet* Serial Channel Interface (ESCI)

The ESCI enables a DI to interface with an Ethernet multiplexor or transceiver via transceiver cables. It consists of the following major components:

- ☐ One Ethernet controller chip.
- ☐ One Ethernet serial interface chip.
- ☐ One Motorola** 68000 microprocessor
- ☐ 16K bytes of RAM.
- ☐ 16K bytes of ROM that contains initialization bootstrap code, diagnostics and checksum.

When installed within a DI, the ESCI connects the DI's internal system bus to an Ethernet transceiver cable compatible with IEEE 802.3 specifications.

A software driver, called the ESCI Driver, is loaded into DIs configured with one or more ESCI boards. It moves data between the DI's system main memory and the Ethernet transceiver, and informs the ESCI's controller chip about the physical location of data buffers for outgoing data and empty buffers for incoming data, thus helping to ensure a smooth flow. The driver resides/executes in the ESCI and provides the physical interfaces that enable a DI to be connected to an Ethernet coax via an Ethernet transceiver.

A stream service routine, loaded into DIs that interface with Ethernet trunks, opens and closes a DI's Ethernet interface so that data can be exchanged between the DI and an Ethernet network. Layer 2 functions, defined by the International Standards Organization reference model, are performed by the Ethernet controller that resides in the ESCI logic board. This chip uses the Carrier Sense Multiple Access with Collision Detection protocol (CSMA/CD) to facilitate these functions.

Up to three ESCIs can be installed in a DI. This logic control board is product number 2608.

The Ethernet equipment to which the ESCI attaches is described in a separate CDCNET data sheet (publication number 204936).

Communications Interface Module (CIM)

The communications interface module is the logic board that controls transmissions between the DI and line interface modules. This combination permits CDCNET to incorporate equipment using different electrical interfaces. When a CIM is configured within a DI it is connected to the internal system bus and a line interface module bus. Each CIM can act as controller for up to eight line interface modules.

A CIM consists of one Motorola 68000 microprocessor, 24K bytes of RAM, and 16K bytes of ROM.

As it interfaces with the line interface modules, the communications interface module can perform all the character processing (protocol/message handling) for up to 32 communications lines. The maximum throughput is 256K bits per second, depending on protocols and network applications.

The CIM software driver, which resides/executes in the board's processor, establishes the logical interfaces that are required for the particular types of communication lines that are connected to the DI.

Up to three CIM boards can be installed in a DI. The product number for the CIM is 2609.

Line Interface Modules (LIMs)

LIMs are small logic boards that enable a DI to interface with user terminals, workstations and modems as well as unit record devices, such as line printers.

These modules are connected to a communications interface module via a ribbon cable bus. In effect, the communications interface module acts as a controller for up to eight line interface modules that can be installed in a DI.

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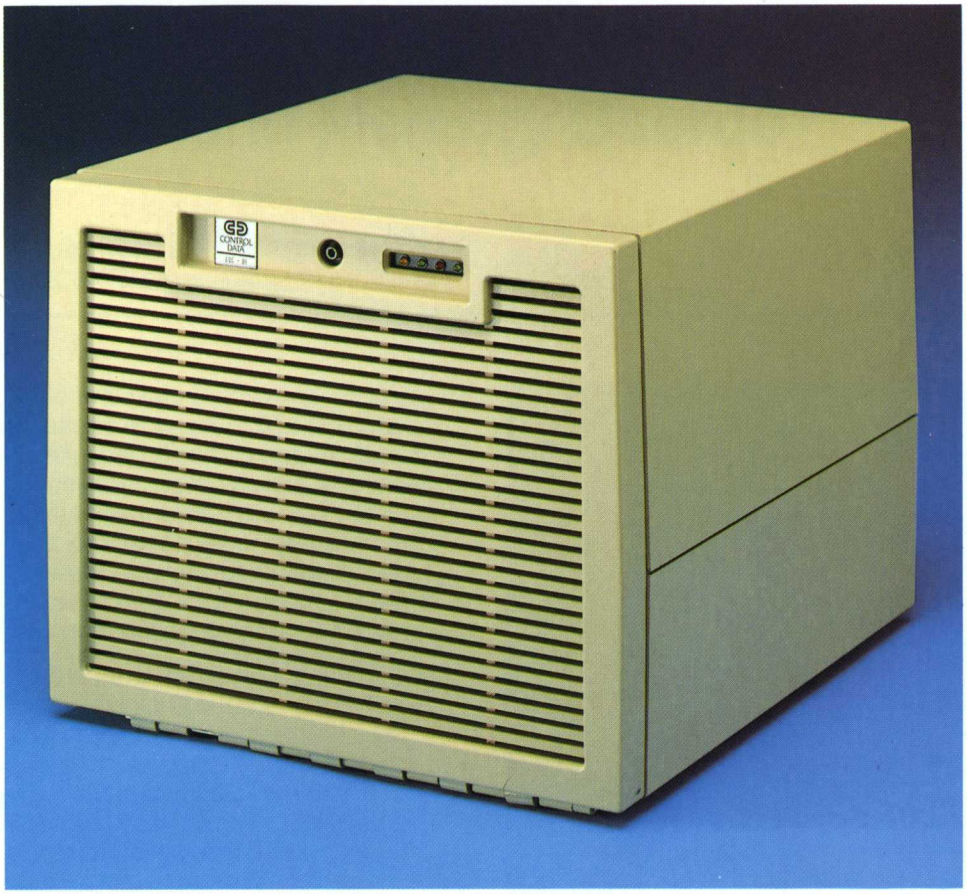

Device interfaces, above, consist of a main processor board, system main memory and an internal bus system in addition to a combination of removable logic boards. DIs distribute major communications functions to different network locations.

CDCNET offers modules with two or four channels that permit connecting the DI to I/O cables, which in turn plug into terminals, workstations, modems and unit record devices.

All line interface modules have VLSI line controllers that support the following programmable features:

- ☐ Baud rate per channel (receive/transmit)
- ☐ External/internal clock
- ☐ Auto echo and loop back
- ☐ Interrupt (vectors, enable)
- ☐ Modem control response
- ☐ Mark or space idle
- ☐ Off/even/odd line parity

CDCNET provides several line interface modules designed to accommodate a variety of network solutions. The initial release includes:

- ☐ LIM model 2610 for the industry-standard RS449, which provides two channels of full duplex serial data along with significant parallel data/status for either modem control or autodial use.
- ☐ LIM model 2612 for the industry-standard RS232, which supports signalling rates up to 64K bits per second synchronous and from 50bits per second to 38.4K bits per second asynchronous. (RS232 standard is limited to 20K bits per second and line length limitations apply. A maximum of 25 feet is recommended at the highest speed.) This LIM provides four channels of full duplex serial connection as specified by Electronic Industries Association RS232 application notes option D.
- ☐ LIM model 2617 provides physical and electrical modifications to comply with the international standards of CCITT V.35. This module provides two channels and will allow terminal or workstation operation at signalling rates up to 128 KHz.

These line interface modules are planned for subsequent releases of CDCNET:

- ☐ LIM model 2611, which provides four channels of full duplex serial data plus those signals specified by CCITT X.21 (leased line) excluding "byte" and "frame synch."
- ☐ LIM model 2613, a unit record interface, which provides a physical parallel port connection compatible with the 8-bit interfaces for Centronix*, Data Products** and similar devices.

Cables

Control Data also supplies a full range of cables specifically suited to the hardware elements, transmission media and physical requirements of CDCNET installations.

Other Publications

Related and additional information about CDCNET hardware, software and services also is available. Data sheets about device interface units (publication number 204934) and Ethernet equipment (publication number 204936) may be useful to readers of this data sheet. A general overview of CDCNET is given in publication number 60461540, the *CDCNET Conceptual Overview.*

For More Information

For more information about the CDCNET family of distributed network products, contact your nearest Control Data sales office, or write:

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