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NI3210 MULTIBUS ETHERNET/IEEE-802 CSMA/CD Communications Controller

FEATURES:

- **Low-Cost Ethernet Data Link Controller**
- **Compatible with Ethernet and IEEE-802.3 LAN Standards**
- **Advanced Multibus Interface Architecture**
  - **8KB Dual Port RAM Memory**
  - **Linked List Buffer Management**
  - **Onboard DMA Controller**
  - **Byte Swap Facility**
- **Supports Full 10Mbps Thruput**
- **Extensive Diagnostic Features**
- **Network Software Support**
  - **Unix Device Driver**
  - **Unix XNS Internet Transport Protocols**

DESCRIPTION

The NI3210 Multibus Ethernet Communications Controller is a low cost board that provides any Multibus system with a data link connection to the Ethernet/IEEE-802.3 local area network. Employing state-of-the-art VLSI circuitry and an advanced architecture to interface to the Multibus, the board provides 10 Mbps thruput with minimum loading on the host Multibus system.

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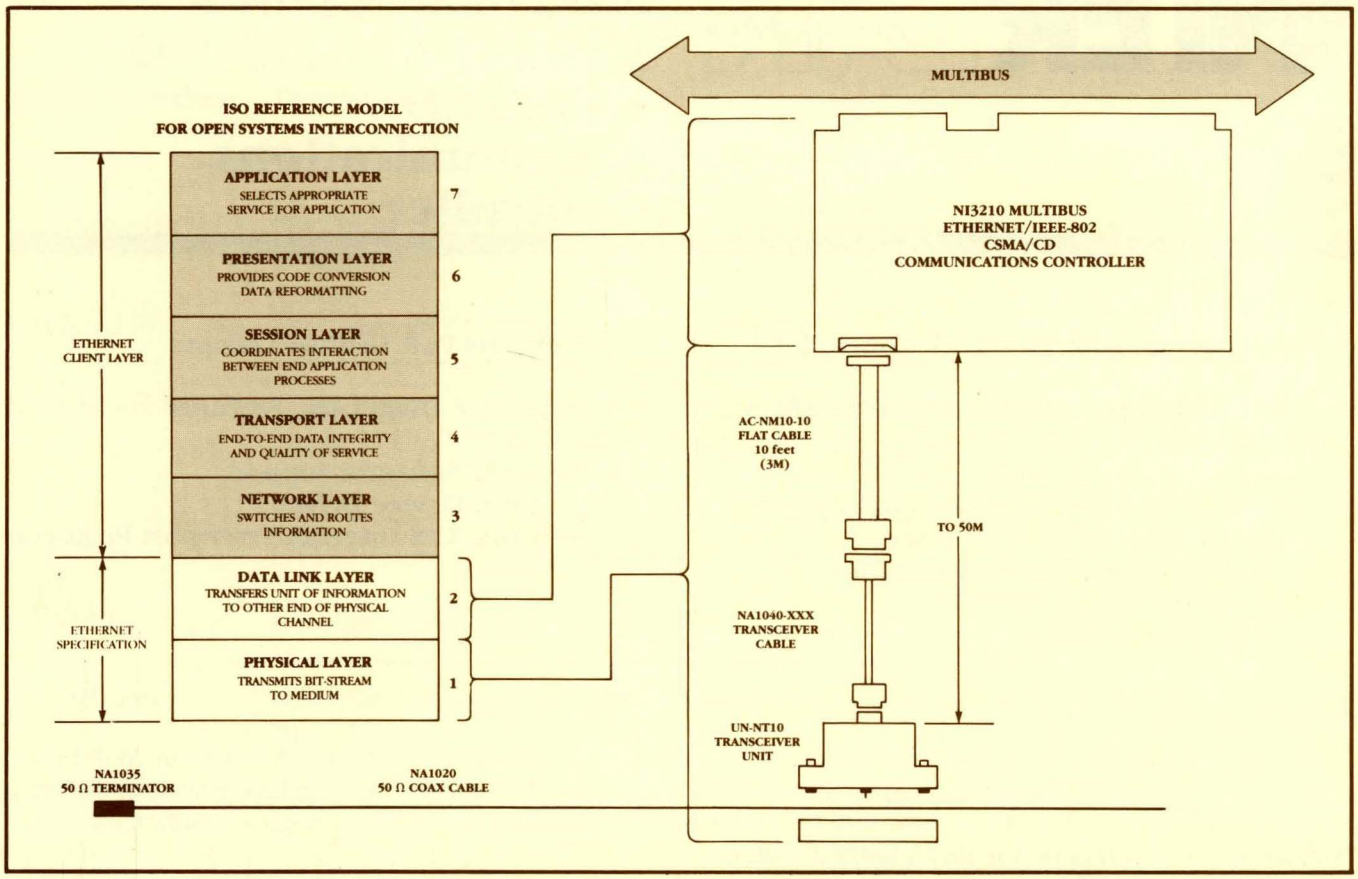

Figure 1. Ethernet Architecture and Implementation

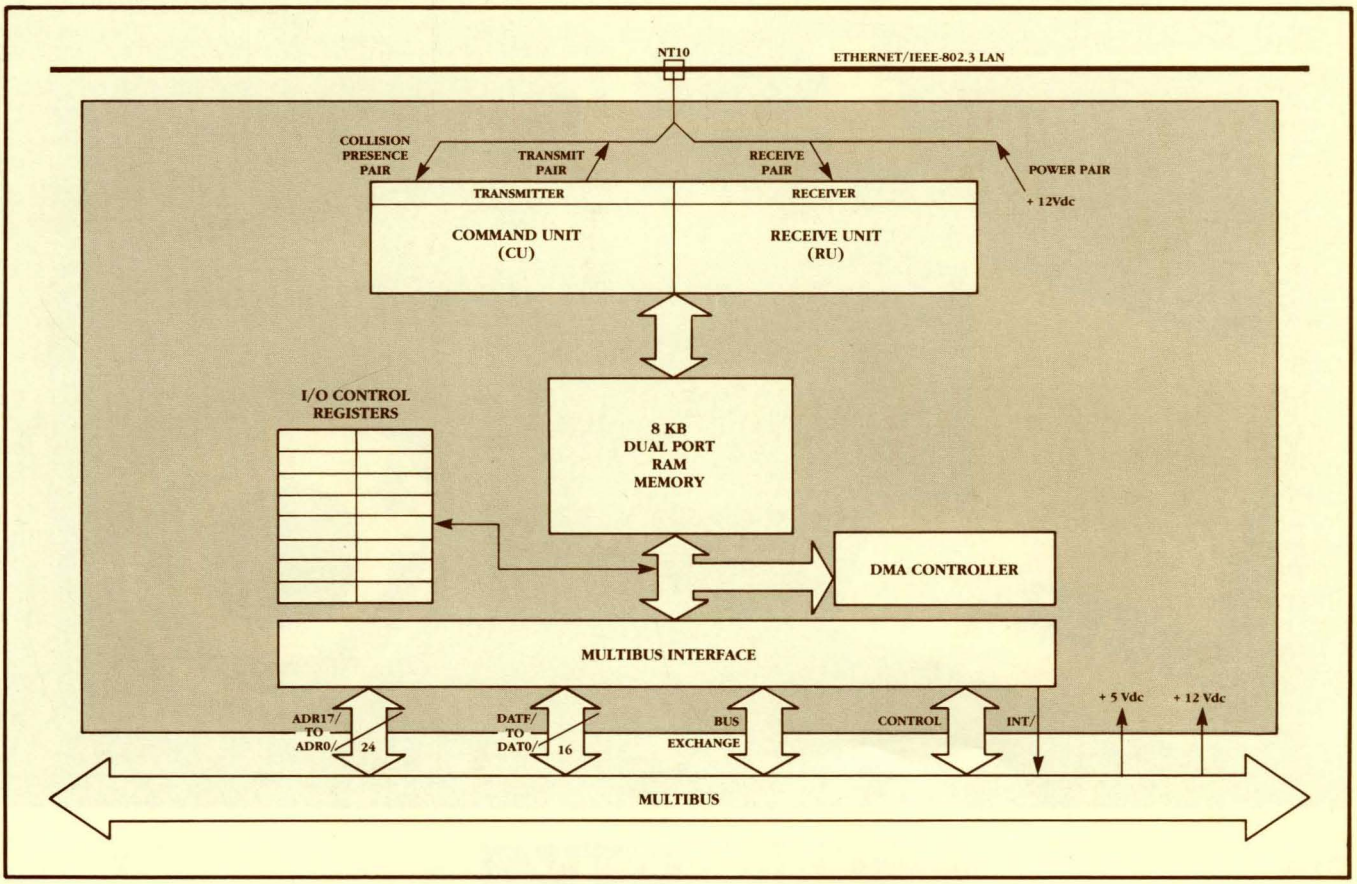

Figure 2. NI3210 Functional Block Diagram

IMPLEMENTS ETHERNET AND IEEE-802.3 SPECIFICATIONS

The NI3210 complies with the Ethernet, IEEE-802.3, and ECMA 80/81/82 local area network specifications. The board performs the specified data link and physical channel functions, permitting 10 Mbps data communications between stations separated by up to 2500 meters. As shown in Figure 1, the NI3210, when attached to a transceiver unit, provides a Multibus host system with a complete connection onto the CSMA/CD local area network.

ADVANCED MULTIBUS INTERFACE ARCHITECTURE

The NI3210 employs an advanced architecture for interfacing to the host Multibus system. This interface, designed to offer high network performance with minimum service load on the host Multibus system, consists of four powerful elements: dual ported RAM memory, linked list buffer management, an onboard DMA controller, and a programmable byte swap facility. Figure 2 shows a functional block diagram of the NI3210.

Dual Port RAM Memory

The NI3210 contains 8KB of dual port RAM memory for accepting commands and data to be transmitted from the host Multibus system, and returning data received from the Ethernet.

One of the ports to the NI3210's RAM makes the entire memory directly addressable on the Multibus. This provides a convenient way for a host CPU to preprocess received frames (e.g., inspect protocol headers) prior to moving them into main memory.

The other port on this memory is used by the NI3210's two onboard processing functions; the Command Unit (CU) and the Receive Unit (RU). The Command Unit obtains, from the dual port RAM, controller commands and data for frame transmission onto the Ethernet. The Receive Unit uses this memory to buffer Ethernet frames as they are received. For maximum system versatility, allocation of the 8KB memory between the CU and RU is user programmable.

Linked List Buffer Management

For handling controller commands, transmit data, and receive data through the dual port RAM memory, the NI3210 uses linked lists for "chaining" data buffers together. This buffer management technique lets the host system manipulate NI3210 command and data structures in the most flexible and efficient manner possible.

As shown in Figure 3, Ethernet frames may vary in length from a minimum of 64 bytes to a maximum of 1518 bytes. To obtain maximum use of the NI3210's dual port RAM memory, transmit and receive frames may be located in data buffers of programmable length that are chained together. This buffer management technique lets the host system efficiently accommodate both short and long frames by, for example, letting short frames fill in just one data buffer and letting longer frames occupy multiple data buffers as needed. Without buffer chaining, buffer space would be wasted as all transmit and receive data buffers would have to be as long as the maximum allowable frame.

Onboard DMA Controller

The NI3210 contains a DMA controller for efficiently transfering data over the Multibus between the NI3210's dual port RAM and the host's system memory. This DMA controller provides significant savings of CPU cycles that would otherwise be expended to block move Ethernet data.

Programmable Byte Swap Facility

Many Multibus host systems organize their odd/even data bytes in a manner that is opposite that required by their network architecture (e.g, a 68000 processor running XNS ITP or DoD TCP/IP). To relieve the host CPU of the time consuming task of swapping odd/even data bytes in every transmit and receive frame, the NI3210 provides a programmable byte swap facility that properly re-orders the data bytes as they are transferred to/from the controller.

10MBPS THRUPUT

The NI3210 supports a full 10 Mbps thruput to and from the Ethernet.

EXTENSIVE DIAGNOSTIC FEATURES

The NI3210 offers comprehensive network diagnostic tools for simplifying the process of identifying and isolating network communication problems. Diagnostic functions include:

- **Internal and External Loopback Modes of operation** — to isolate a suspected transmission problem to either the controller or the network.
- **Heartbeat Detection** — to verify that the NI3210 is attached to an Ethernet transceiver unit and that it's collision detect logic performs well.
- **Excess Collision Detection** — to notify the host of an open Ethernet transmission line.

In addition, the NI3210 generates data for characterizing the quality of service offered by the network:

- **Transmit Deference Indicator** — informs the host that its controller had to wait to get its frame onto the network.
- **Transmit Collision Count** — the number of transmit retries required by the controller to get its frame onto the network.
- **CRC Error Count** — the number of frames received but discarded because of a CRC error.
- **Alignment Error Count** — the number of frames received but discarded because of a frame alignment error.
- **Receive Overrun Error Count** — the number of frames received but discarded because of a lack of receive buffers.

NETWORK SOFTWARE SUPPORT

NS2044 UNIX System V Device Driver

A UNIX System V device driver is available for the NI3210. The driver provides UNIX processes a packet-level interface to the Ethernet via the standard UNIX system calls of open ( ), read ( ), write ( ), ioctl ( ), and close ( ), and allows for packet reception based on Ethernet Type field. Written in C language, the driver can operate with various different CPUs and variations of UNIX System V. No special requirements are imposed on the UNIX System V kernel. The driver is distributed in source form on 1600 bpi mag tape with tar format.

NS4244 XNS Internet Transport Protocols for UNIX System V

XNS Internet Transport Protocols (ITP) under UNIX System V are available for the NI3210. This powerful transmission protocol package provides a virtual circuit communication service for reliable, flow-controlled communications over the Ethernet between user-written processes. Also included in the package is:

- Support for multiple concurrent processes
- An internetwork routing communication service
- A reliable datagram service
- A basic datagram service
- Comprehensive network management
- Full compatibility with Interlan's VAX/VMS and RSX-11M implementations of XNS ITP.

For a full description of the features and functions of this powerful protocol package, refer to the "NS4200 Internet Transport Protocols" data sheet.

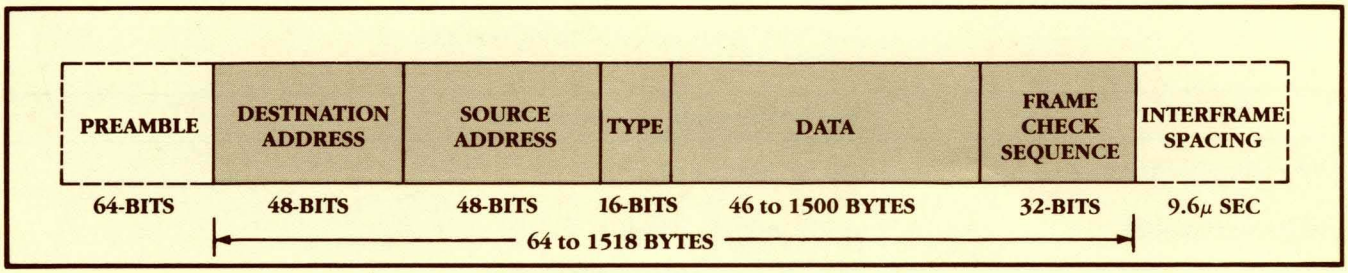

Figure 3. Ethernet Frame Format

SPECIFICATIONS

Ethernet Receiver	
Receiver Turnaround Time	Less than 9.6 μSec.
Receiver Thruput	10 Mbps
Ethernet Address	Host configurable. A unique 48-bit Physical address assigned by Interlan for each controller is contained in an onboard PROM.
Address Recognition	Physical, Multicast (up to 64), Broadcast, and Promiscuous Receive Mode.
Error Detection	Frames with CRC, Alignment, Length, and Receive Overrun errors.
Error Handling	The controller may be programmed to either save or discard frames in error.
Ethernet Transmitter	
Transmitter Turnaround Time	9.6 μSec.
Transmitter Thruput	10 Mbps
Encapsulation	Automatic generation of preamble and FCS fields.
CSMA/CD Information Returned	Transmit Deference Indicator, and Number of Transmit Collisions Incurred.
Error Detection	Excess Transmit Collisons, Loss of Transceiver Heartbeat, and Internal/ External Loopback Operation.
Transceiver Interface	
Mating Connector	16-pin Berg #65846-01, 3M #3452, or equivalent.
Mating Transceiver Cable	Interlan AC-NM10-10 10-foot flat transceiver cable with connectors.
Multibus Specifications	
Compatibility	Electrically, mechanically, and architecturally compatible with the Multibus and IEEE-796 specifications.
Multibus Device Type	Slave: Dual Ported RAM and I/O Registers. Master: DMA Controller.
Multibus Compliance	Master/Slave D16 M24 I16 V0 L: 16-bit data transfers, 24-bit memory addressing, 16-bit I/O addressing, Non-Bus Vectored interrupts.
Data lines	DATF/ to DAT0/. Programmable byte swap for byte ordering compatibility with host CPU.
Dual Ported RAM Base Address	Selectable on any 8KB boundary within the 24-bit address range (000000 to FFE000 H).
I/O Register Base Address	Selectable on any 16-byte boundary within the 16-bit address range (0000 H to FFF0 H).
Interrupt Priority Level	Programmable as INT0/ to INT7/.
Bus Arbitration Technique	Selectable as either Serial or Parallel priority.
Multibus Auxillary Connector (P2)	Carries address lines ADR14/ through ADR17/; may be disconnected.
Power Requirements	+5Vdc (+/- 5%) @ 4.0A typ. +12Vdc (+/- 5%) @ 0.5A max. (for transceiver only)
Physical	One Multibus board, occupying one slot. 12.00″ x 6.75″ x 0.48″ (30.5cm x 17.1cm x 1.22cm)
Environmental Specifications	
Operating Temperature	0 to 50° C (32 to 122° F)
Relative Humidity	to 90%, non-condensing

ORDERING INFORMATION

Model Number	Description
BD-NI3210	NI3210 Multibus Ethernet/IEEE-802 CSMA/CD Communications Controller board
AC-NM10-10	Flat Transceiver Cable with connectors for use with NI3210 controller board; 10-feet long.
UM-NI3210	User Manual for NI3210 controller board.
DK-NS2044-MT16	UNIX System V Device Driver for the NI3210 controller board; includes User Manual (UM-NS2044), Source Code, and Supported Software License (SL-NS2044-S). Prerequisite: Interlan Software License Agreement.
UN-NT10	NT10 Ethernet Transceiver Unit.
IK-NT10	Installation Kit for NT10 transceiver unit.
NA1040-xxx	Ethernet Transceiver Cable with connectors; available in lengths (xxx) of 10, 50, and 150 feet.
NA1020-xxx	Ethernet 50 Ohm Coaxial Cable (PVC); available in lengths (xxx) of 77, 230, and 384 feet.
NA1035	50 Ohm N-type Female Cable Terminator.

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