CSS PRODUCTS
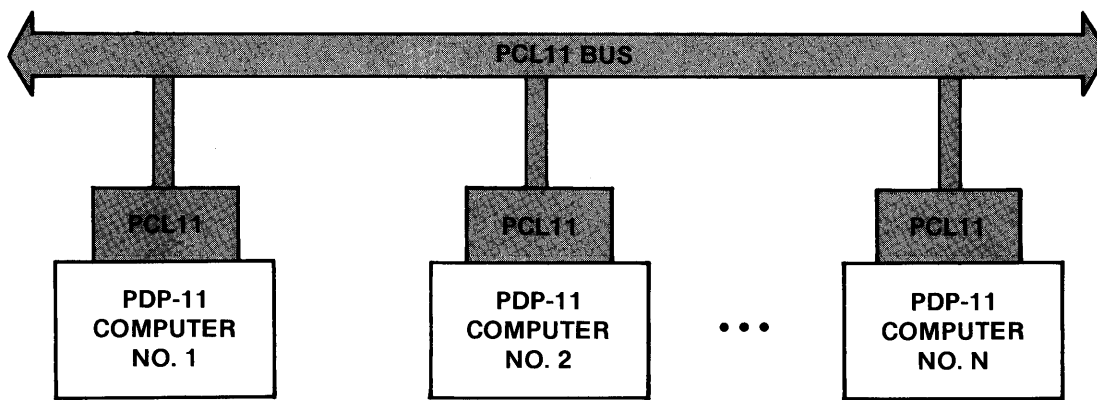
PCL11-B Parallel Communications Link

PDP-11 MULTIPLE PROCESSOR SYSTEM USING THE PCL11

FEATURES

- DMA BLOCK TRANSFER MULTI-CPU LINK

- UP TO 16 PDP-11 COMPUTERS

- HARDWARE PROTOCOL WITH ERROR CHECKING: CRC AND WORD PARITY

- PCL11 BUS BANDWIDTH IS UP TO 1 MEGABYTES/SEC

- TIME DIVISION MULTIPLEX BUS WITH ADJUSTABLE TIME SLICING

- RSX-11M DEVICE DRIVER AVAILABLE

- FAILURE PROTECTED FOR HIGH AVAILABILITY SYSTEMS

- INDIVIDUAL NODES CAN BE POWERED OFF

- PCL11 BUS IS T-CONNECTED; NOT DAISY-CHAINED

- COMPUTERS CAN BE REMOVED WITH PCL11 BUS RUNNING

- ANY NODE CAN BE EASILY SET UP AS BUS TIMING MASTER

- AUTOMATIC FAILOVER FROM PRIMARY TO SECONDARY PCL11 BUS MASTER

- RECEIVER CAN REJECT TRANSMITTER UNDER PROGRAM CONTROL

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THE PCL11

The Parallel Communications Link (PCL11) is a high performance computer link used for interconnecting multiple PDP-11 computers in a local distributed processing network. Up to 16 processors may be connected to the PCL11 network. Each computer may send or receive messages or data blocks to or from any other computer in the network. Communications occur in a DMA block transfer mode over a time division multiplexed (TDM) 16-bit parallel bus. Because of the TDM nature of the PCL11 bus, up to 16 conversations may be conducted concurrently.

The power and features of the PCL11 system make it the ideal multiprocessor communications link for applications of five or more processors in local networks. The PCL11 allows for communications between any computer pair in the network, a flexibility which would otherwise require a very large number of two processor links.

Even if your network is starting small at three or four processors with potential growth later, the PCL11 offers an attractive advantage: the ability to add more processors to the network by simply adding additional PCL11 nodes. There is no need to disrupt or reconfigure the existing nodes in the network.

The PCL11 is used to build local networks in a variety of applications. These include distributed processing, distributed data base management, industrial data collection and control systems, simulation systems, transaction processing, laboratory data collection and control networks, to name but a few.

SOFTWARE SUPPORTED

Additional ease of use is provided by the available RSX-11M device driver software which allows the user program to interface to the PCL11 by means of standard format I/O calls.

TRANSPARENCY OF OPERATION

The user experiences near perfect transparency of operation. The PCL11 hardware manages the protocol and error checking for establishment of communication with a desired recipient computer and for successful transfer of the data or message. The user simply tells the PCL11 what data is to be sent and to which recipient computer. The user is then notified upon successful completion of the transfer. If, after multiple attempts, the PCL11 is unsuccessful in transferring the data, it will inform the user of that fact together with an indication of the reason (receiver busy, no acknowledgment, unresolved errors, etc.).

ERROR CHECKING

The PCL11 hardware provides error checking in the hardware by use of word parity and block CRC-16. If an error is detected, the message is automatically retransmitted by the software driver.

HIGH AVAILABILITY SYSTEMS

The PCL11 is designed for use in high availability systems. The connection of the PCL11 interface on each computer to the PCL11 bus is such that a computer and interface may be powered on or off without disabling the bus or the rest of the network. The bus is not "daisy-chained" but is connected to the computer and interface by a "T connection". A computer may even be physically unplugged from the PCL11 bus, moved away, and replaced without stopping the network. If a data error should occur, the error will be detected by the hardware and the data automatically retransmitted by the software driver.

Provision is even made for backup of the PCL11 unit which is clocking the PCL11 bus. If the PCL11 interface on the network which has been designated to clock and control the PCL11 bus fails, a designated secondary or backup PCL11 unit automatically assumes control. That computer is notified of the action and the user may, via software, designate a new secondary or backup PCL11 unit. All PCL11 units are identical and any unit may be designated as master or secondary.

HIGH BANDWIDTH AND FLEXIBILITY

The PCL11 provides high bandwidth data transfer rates plus flexibility in the allocation of that bandwidth among the various nodes in the network.

The maximum PCL11 bus bandwidth is 1 million bytes per second. There are two mechanisms for dividing the bandwidth among nodes. The default allocation simply divides the bus bandwidth equally among the PCL11 nodes on the bus. That is, the TDM time slices simply go "round robin" among the nodes.

In addition, the allocation of the TDM time slices can be set and varied under software control. The user may load a register in the PCL11 with an explicit list of the time slice allocations by transmitter number. This may be set to give whatever bandwidth allocation is desired to different PCL11 transmitters in the network to handle differing data rate requirements including a maximum of half of the bandwidth to one node and a minimum of none to another. For example, a large data base management processor in a network might be given a greater proportion of the bandwidth since it presumably needs to send large amounts of data to other processors in the network.

For total PCL11 bus lengths in excess of 50 feet, the bandwidth is reduced as a function of the bus length.

MULTIPLE UNITS AND MULTIPLE BUSES

Additional flexibility and power are provided by the ability to put multiple PCL11 units on one processor and the ability to implement multiple bus systems.

The use of two or three PCL11 buses to interconnect the processors can give increased reliability through redundancy as well as increased throughput. In the unlikely event of a failure disabling one PCL11 bus, the system would continue operation using the other bus. The use of dual bus systems is recommended for medium to large networks.

In addition, a dual or triple bus system gives greater flexibility. For example, one bus could be heavily loaded with long data transfers while another bus is kept lightly loaded and used for command and control messages where quick response is desired. A third bus could be kept in reserve for backup.

A processor may also have more than one PCL11 node on the same PCL11 bus. The use of two nodes from the same bus might be used for processors having large amounts of traffic. The two nodes operate independently and concurrently, thus allowing for greater throughput on that processor.

BUILDING THE SYSTEM

A PCL11 network is a system constructed from several components which are combined to meet the particular application needs.

The PCL11-B is the Unibus interface which contains the PCL11 electronics and connects to the PCL11 bus cable. One PCL11-B forms one node on the network. The PCL11-B interfaces are interconnected by cables of appropriate length to suit the site geometry.

Trained personnel from DIGITAL's Computer Special Systems group work with you to design the PCL11 network and then integrate the system. Because of the complexities of medium to large PCL11 networks, separate special integration services may be required.

SAMPLE APPLICATIONS

The PCL11 is being successfully utilized in many different applications. The following are a few examples.

Several customers have implemented various forms of distributed data base management and processing systems using the PCL11. Typical of these is one application consisting of several PDP-11/40 processors, each of which manages a particular data base and performs given functions. User terminals are connected to some of the processors. The application software is written to interpret the inquiry or command from the terminal and, if it is not one performed in that processor, to send the inquiry or command via the PCL11 to the appropriate processor for servicing. The response is generated and returned back to the originating processor and displayed on the user terminal. Thus a distributed data base is implemented by means of a "virtual computer" concept.

Although the initial implementation of this system required only three processors, the software was designed in a modular manner for the general case so that as the application grows, additional processors can be added and part of the work load moved to them. The PCL11 facilitates this expansion since all that is required to expand the network is to add another length of PCL11 bus cable and another PCL11 node. There is no need to rewrite the software or to rebuild the existing processors to allow links to the new processor. This ease of expansion was key to the successful implementation of the system.

In another application, a high energy nuclear physics research laboratory, a PCL11 network is being utilized to control the very large and complex instrumentation. Different processors are interfaced with certain portions of the facility and perform certain functions. The PCL11 network permits an experimental run to be set up in minutes rather than many hours as would otherwise be required. Thus, it becomes an important contributor in the research for new forms of energy.

In a very large transaction processing network, 500 on-line terminals are serviced by 16 PDP-11/34 and PDP-11/70 processors acting as communications processors, transaction processors, and data base managers. The processors are all interconnected by a dual PCL11 network. The system is designed for very high availability and fail-soft operation. Each processor in the network backs up another processor in the network and receives duplicate data inputs. In the event of a processor failure the data has been fully protected and the system automatically reconfigures itself for continued operation without interruption.

GENERAL SPECIFICATIONS

Mechanical

Mounting   PCL11-B interface: 9-slot double system unit. Space required in standard PDP-11 mounting box or in PDP-11 processor box.

Electrical   Powered from PDP-11 mounting box.
14 amp at +5V
0.5 amp at −15V

Operational

PCL11 Bus Length   300-foot (91 meter) maximum.

Units   Any number up to 16 maximum may be accommodated on one PCL11 bus.

Transfer Rate   Per Unit: 500 kilo bytes/sec maximum
PCL11 bus aggregate bandwidth:

PCL11 bus cable length up to	Bandwidth 8 bit bytes/sec
50 ft (15m)	1000K
100 ft (30m)	800K
140 ft (42m)	666K
240 ft (73m)	500K
300 ft (91m)	400K

Message Length   64K bytes maximum

Error Checking   Word parity on each transfer
CRC character after each 400_8 bytes

Unibus

Loads   1½ Unibus loads

Mode   NPR DMA transfers, full duplex, fully silo buffered, 16 bit word mode

Complete specifications are included in the PCL11-B hardware manual.

INFORMATION AVAILABILITY
Further information may be obtained by contacting your nearest Digital Sales Office.

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