LAN-PC

NETWORK CONTROLLER MANUAL

Intercontinental Micro Systems

DISCLAIMER

TABLE OF CONTENTS

**** INTRODUCTION ****

ICM proudly announces the LANPC Local Area Network Controller, which provides a simplified interface between an IBM-PC and an ARCnet Local Area Network. The LANPC is an IBM-PC Bus controller providing Modified Token Passing networking capability between itself and other PC's, Fileservers, Workstations and any computing system incorporating the same networking technique and ARCnet protocol. It complies with the PC's bus standards and can also be used on the PC Compatibles. The board contains the complete controller for this modified token passing network. The LANPC is ideal for converting PC's to LAN Intelligent Workstations, Diskless Workstations and File Processors. The LANPC can also be delivered with an optional 64K Bytes of RAM, expandable to 256K, on board. The on board RAM can be used to expand system memory, thus allowing you to put both ARCnet and RAM into one PC slot.

A high speed Fileserver can be integrated using ICM's CPZ-4800X as the Master Processor, the LANS100 (ICM's S-100 BUS ARCnet board), Floppy drives, a Hard-disk controller & Hard-disk drives, printers, other peripherals, and TurboLAN.

WHY ARCNET?

The ARCnet protocol allows linking up to 255 nodes per network segment. Each node can be an individual IBM-PC, or any other computer with ARCnet capability. The node can also be an Individual Workstation, a Fileserver or a Bus Structured Network with up to 16 Slaves per Master. The LANPC has been specifically designed to interface with other ICM hardware and the TurboDOS operating system using the revolutionary TurboLAN software drivers.

The Network self configures and efficiency increases as nodes are added. Communication is available up to 40 miles between processors (with Active HUBs) or 2300 FT (with a Passive Hub). ARCnet provides a 2.5 MBIT/SEC data transfer rate across Coaxial cable, or twisted pair.

ICM has carefully evaluated the alternatives and finds that Token Passing Networking is the clear choice over Carrier-Sensing Multiple Access/Collision Detection (CSMA/CD) Networking such as ETHERNET (tm). Token Passing has a clearcut price/performance ratio advantage. ETHERNET based hardware is typically three times more expensive than TOKEN PASSING hardware.

IBM-PC'S NETWORKED TOGETHER?

Since the advent of the Personal Computer (PC) and the proliferation of PC's, such as the IBM PC and the "Compatibles", users with several PC's in their possesion quickly discovered severe limitations and cost constraints when attempting to use PC's in the business environment. Several examples of limitations and cost constraints are listed:

1) How cost effective is it to dedicate a printer to each PC?
2) How cost effective is it to dedicate a Floppy drive to each PC?
3) How cost effective is it to dedicate a Hard Disk drive to each PC?
4) Must users queue up for use of that one PC that has the desired peripheral device (printer, hardisk, graphics printer)?
5) Can two or more users work on a given file? Can they do so simultaneously?
6) How convenient is it for a user to store a file on a floppy diskette so that another user can work on that file.

Wouldn't it make more sense if printers, hardisk drives and other costly peripherals were shared by all users? What about the convenience of a user accessing other files without temporarily storing information on diskettes? The answer, of course, is to provide a multiuser network system. ICM provides you the hardware and software to allow you to integrate a high performance/lowcost multiuser network system.

WHY ICM?

Intercontinental Micro Systems (ICM) has been a pioneer in the Single Board Computer industry since 1981. We have traditionally supported System Integrators and OEM's with our Bus Structured board level products and the software drivers to fully support those boards. Our current product line includes a complete line of Microcomputer Hardware and Software products for the S-100 bus. The S-100 line includes 8-bit and 16-bit Single Board Computers, Slave Processors, Hard Disk Controllers, Memory Boards and ARCnet Controller Boards.

We are now expanding our product line to include Single Board Computers and Controllers with Local Area Network (LAN) capabilities using Datapoint's well established ARCnet protocol. The LAN product line includes: (1) An S-100 Bus ARCnet board, (2) An IBM PC ARCnet board, (3) an 8-bit Diskless Workstation, and soon (4) a 16-bit Diskless Workstation. In addition our revolutionary TurboLAN drivers allow linking all of these products together. Our new products are aimed not only at our traditional OEM market, but also at Distributors, Dealers, and Manufacturers.

TurboLAN & TurboDOS NETWORK ARCHITECTURE

ICM's revolutionary TurboLAN multi-user architecture uses the sophisticated, cost effective TurboDOS Operating System. TurboLAN provides the flexibility of building multi-user systems with S-100 BUS Structured Networks and ARCnet protocol Local Area Networks. TurboLAN offers:

(A)   Ability to network S-100 Bus Systems, IBM-PC's, PC Compatibles, ICM's WS80 & WS16 Diskless Workstations, and other computers with ARCnet capability (requires a Master Processor/File Server such as ICM's CPZ-4800X SBC).

(C)   Up to 4000 users per network with 255 nodes per network segment.

TURBODOS OPERATING SYSTEM

TurboDOS is a true multi-user Operating System because it was designed from its beginnings to handle multiple computers running simultaneously on one or more networks. Each user is assigned an individual PC or a terminal attached to a Single Board Computer/Processor. This PC or individual processor is called a Slave Processor in the TurboDOS architecture and acts independently of all other slaves on the network. A Master Processor, also known as a File Server, controls the network by downloading the operating system to each slave. The Master also downloads system files and orchestrates the use of all common peripherals. With its modular architecture, TurboDOS can increase the number of users or add peripherals on the network with a general software command that "links and patches". TurboDOS is the most sophisticated, yet cost effective Multi-user operating system available today. It offers FEATURES such as:

(1)   Compatible with many OS's Application Software: CP/M, CP/M-86, PC-DOS, MS-DOS, MP/M, MP/M 86, CP/M PLUS, CONCURRENT CP/M 86.

(2)   Ability to mix Z-80, 8-bit; and 8086, 16-bit families of processors.

(3)   Flexibility to build Bus Structured (Tightly Coupled) Networks and Local Area (Loosely Coupled) Networks using ICM'S TurboLAN.

(4)   Record and File Locking with File Sharing among multiple users.

(5)   Typically 300% faster than CP/M, MP/M, Oasis or similar multi-user, single-processor, multi-tasking operating systems.

(6) 16 Logical Disk Drives per Master Processor/File Server.

(7) Up to 1000 MB per drive and 134 MB per file.

(8) 32 user areas (file libraries) on each disk.

(9) 25% to 30% more floppy disk capacity.

(10) Sharing of costly peripherals and disk drives.

(11) Read-after-Write verification of Floppy Disks and Hard Disks.

(12) Logon/Logoff & Privileged/Non-privileged Security.

(13) Background processing & Archival Back-up of files.

(14) Queueing of multiple tasks-processing or printing.

(15) Automatic Print Spooling.

(16) Each individual TurboDOS OS has 4 Circuit Drivers with 255 nodes (slaves) per ciruit driver for a total of 1020 users per OS.

(17) Multiple OS's can be linked together with ICM's TurboLAN drivers. There are theoretically no limit to the number of users on a single network.

**** FEATURES ****

* IBM PC Bus Compatible.
* I/O Polled or Interrupt Driven.
* Provides Interface from PC Bus System to PC Bus System or from PC Bus System to Workstation or Fileserver via a Modified Token Passing ARCnet Protocol Network.
* LAN Data Rate of 2.5 Megabits/Second.
* Attachment of up to 255 Nodes per Network Segment.
* Network self configures as nodes are added or deleted from network.
* Network efficiency increases with increasing attachment of nodes.
* Compatible with any interconnect media such as coaxial cable (RG62/93 ohm), twisted pair, etc.
* Up to 40 miles between nodes with use of repeaters (HUBS).
* 16 bit CRC check & generation.
* No host processor overhead for link control.
* TurboDOS Operating System compatible.
* 2 or 4 or 8 Kbyte EPROM for monitor or custom firmware applications.
* Optional 64 or 256 Kbytes of Dynamic RAM mapable on 64/256 Kbyte boundaries.

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==============================================
              PERFORMANCE SPECIFICATIONS
==============================================
```

Bus Interface.................................IBM PC Compatible.
        Control, interrupts, data & address. I/O port address
        jumper selectable for address range from 000h to 3FFh.
        Message Buffer address jumper selectable for address
        range from 00000h to FFFFFh. 64 or 256 Kbyte RAM address
        jumper selectable for address range from 00000h to
        FFFFFh.

                    Ready..........Requires connection to I/O CHRDY
                        for synchronous access to Data Packet
                        Buffer and control registers.
                    Interrupt......Interrupts Host Processor when
                        status bits become stable. Interrupt
                        connected via one of 5 interrupt lines.

Network Interface.......Modified Token Passing Local Area Network
        Transmission Mode.................................Baseband
        Transmission Medium............Coaxial Cable/RG62(93 ohm)
        Transmission Distance......................2300 feet (max)
        Transmission Speed........................2.5 Mbps, Typical
        Transmission Voltage
            Transmit Mode.....................20.1V P-P Typical
            Receive Mode.......................6.7V P-P Typical
        Protocol..ARCnet

Data Packet Buffer......................2 Kbyte X 8 Bit Static RAM
        Wait states..............Requires connection to I/O CHRDY
                for synchronous access to Data Packet Buffer
        Memory address.........selectable on 32 Kbyte boundaries

64 or 256 Kbyte Dynamic RAM (optional)
        Wait states...................................none required
        Memory address......selectable on 64/256 Kbyte boundaries

2 or 4 or 8 Kbyte EPROM
        Wait states........1 or 2 provided if EPROM requires them
        Memory address.........selectable on 32 Kbyte boundaries

Power Requirements
        Voltages................................+5 VDC @ 1.0 A(max)
                                               -12 VDC @ 25 MA(max)
        Power.......................................5.5 W(max)

Operating Environment
        Temperature.........................0 to 45 Degrees Celsius
        Relative Humidity................................0 to 95%

Construction
        Circuit Board...................Double Sided Glass Epoxy,
                Vacrel Solder over Bare Copper.
        All IC's in Sockets
        TESTING...........Completely tested and 24 hour burned-in
        WARRANTY..............One Year Warranty (Parts and Labor)

**** FUNCTIONAL DESCRIPTION ****

The LANPC is functionally partitioned into the following major groups:

- --Local Area Network Driver(LAND)/Interface

- --local Area Network Controller(LANC)

- --LANC ID Logic

- --Node & Circuit ID Logic

- --Data Packet Buffer

- --Wait State Generator

- --Reset Logic

- --Memory Address Select Logic

- --I/O Port Address Select Logic

- --PC Bus Interface

- --2/4/8 Kbyte EPROM

- --64/256 Kbyte RAM

Each group is described below to give the user a clear understanding of the hardware and software setup options. Prior to describing each group, a "thumbnail sketch" of the overall function of the LANPC is first described.

In order to help conceptualize Token Passing Network systems the following terminology is given:

- RIM (Resource Interface Module):

A RIM is a microprocessor based controller which controls the data transmission, buffer management, error detection and system reconfiguration as other RIMS are added or deleted to the network. A processor requires a RIM to get on the network. The LANPC is a RIM.

- HUB

A HUB is a repeater (amplifier) which extends the distance (range) between RIMS on the network. A PASSIVE HUB limits interconnect lengths to 2300 feet. An ACTIVE HUB can extend the range to 40 miles. A passive HUB can consist of up to 4 ports. The active HUB can be obtained in 4 or 8 port versions.

- FILE PROCESSOR

A File Processor (FP) is the processor which performs all major storage and data retrieval for the network. The File Processor:
- Buffers data
- Services data requests
- Optimizes use of shared disk resources
- Coordinates database transactions

A typical FP is an IBM XT. A high speed alternative consists of a CPZ4800X SBCP, a hard disk controller, a tape controller and a RIM (LANS100).

- APPLICATION PROCESSOR

The Application Processor (AP) is the processor which actually performs the user application programs. The application processor may be equipped with local storage, printers and other I/O devices. A typical AP is a diskless PC. A typical AP could be a BUS STRUCTURED NETWORK consisting of a CPZ4800X SBCP, peripheral controllers, CPS series slave processors and an LANS100. It could also be an intelligent terminal (workstation) with LAN capability.

A Local Area Network(LAN) typically consists of a file processor with several application processors interconnected via RIMS and one or more active HUBs. The interconnection media is normally coaxial cable. In ICM's case, the communications protocol of choice is the ARCnet Modified Token Passing protocol.

In a Token Passing arrangement, each RIM connected to the network is given an identification address. Next, a token (a unique 8-bit pattern such as 11111111) is sent to the first RIM (node). This token gives that node access to the network for transmitting purposes only. Node receivers are always on line. The node possessing the token sends a message by loading the ID of the intended receiver and the data packet to be transmitted in a data packet buffer. A command is then issued to transmit the ID and message packet followed by a 16 bit Cyclic Redundancy Check Character (CRC). If the intended receiver's ID matches with the transmitted ID, reception may then take place.

Each receiving node is responsible for acknowledging receipt of the token to prevent its loss. The node must respond in less than 78.2 microseconds; otherwise, the node is considered inoperative. The transferring node retains the token and a search is made for a node capable of receiving it. In this way, the network is never down and a node can be removed without disrupting the network. An interrupt is generated by the transmitting node when sucessful delivery of the packet is accomplished.

After the message is sent, the token is passed to the next node in line. However, it need not be the node with the next identification address. Let's say that node 19 has possession of the token. It may pass that token to node 53 if so programmed. If node 53 has a message to send, it takes advantage of the token and uses the network. If it doesn't, it simply forwards the token to the next programmed node, and the token travels from node to node, giving each one a chance to use the network.

Local Area Network Driver(LAND)/Interface

The LANPC utilizes a hybrid LAND which consists of passive and active components required to convert digital signals to dipulse format and vice versa and to transmit dipulse signals over coaxial cable, twisted pair or fiber optics. NRZ data is input to the LAND with data periods consisting of 400 ns intervals. Dipulses of 200 ns intervals are generated from this data and coupled to the coaxial cable via an RF transformer. In the same manner, dipulses being received are coupled into the LAND via the RF transformer. The LAND converts the dipulses into NRZ format.

The interface from the LAND is accomplished via an RG62 coaxial connector. The connector protrudes to the rear of the typical PC Bus chassis. Coaxial cable may then be used to connect the chassis to the network.

Local Area Network Controller(LANC)

The LANC consists of the COM9026 special purpose communications adapter. The LANC contains a microprogrammed sequencer and logic necessary to effect the token passing mechanism of the network and to transceive data packets over that network. The LANC also reads a switch settable identification code which is used for node identification purposes. A switch setting is input to a shift register and the LANC reads the contents of the shift register during reset time. The LANC also controls data & address buffer transfers and Data Packet Buffer reads or writes. The host processor may read status or issue commands via I/O port cycles(IORQ). The host processor may read or write data from/to the Data Packet Buffer via memory cycles (MREQ). The Data Packet Buffer is also under control of the COM9026.

Data Packet Buffer

The Data Packet Buffer consists of a 2 Kbyte static RAM used to buffer up to four data packets with a maximun length of 508 bytes per message. The Data Packet Buffer is accessed by both the LANC and the host processor.

Wait State Generator

The COM9026 generates wait states to the host processor when the host processor executes either memory or I/O request cycles (MREQ or IORQ respectively). Because these access cycles run asynchronously with respect to the COM9026, the COM9026 places the host in wait states. Wait states are generated via the I/O CHRDY LINE. Wait states are also generated when the EPROM is accessed. Either one or two wait states are generated depending on the WAIT SELECT jumper setting.

Reset Logic

Logic is provided in the LANPC to reset internal logic from one of two sources. The logic may be reset by the PC Bus signal, RESET DRV or by a signal generated under software control, RESREQ. RESET DRV is a signal generated by the PC as a result of power-on or low line voltage output. RESREQ is generated by executing a software I/O command (see SOFTWARE SECTION).

LANC ID Logic

The LANC reads in a switch settable identification code used for node identification purposes. A jumper setting is input to a shift register and the LANC reads the contents of the shift register during reset time. The switch is identified on the board as LANC ID.

Node & Circuit ID Logic

The Node and Circuit ID logic consists of a switch which is read by the host PC under software control. The Node portion of the switch constitutes 6 positions for a binary representation of 64 nodes and the Ciruit portion constitutes 2 positions for a binary representation of 4 circuits. This switch is the means by which the user specifies the fileserver source from which the operating system is obtained (downloaded) at poweron or reset time. There can be up to 255 fileservers which are identified by one of 64 Nodes in one of 4 Circuits. A setting of 00h is invalid. This switch may be used for general purpose sense switch settings if so desired.

Memory Address Select Logic

The address bus consists of 20 lines designated as A0 through A19. During PC memory access cycles to the LANPC Data Packet Buffer, the address lines A0 through A10 address one of 2 Kbytes of the Data Packet Buffer. During PC memory access cycles to the LANPC EPROM, the address lines A0 through A12 address one of 8 Kbytes of an 8 Kbyte EPROM (A0 through A11 for a 4 Kbyte EPROM and A0 through A10 for a 2 Kbyte EPROM). Address lines A15 through A19 map the Data Packet Buffer and the EPROM onto the PC's address space. When the PC executes a memory access cycle, a comparator on the LANPC is enabled. It compares the PC's address lines A15 through A19 against a five position jumper referred to as the MEM ADDR jumper.

I/O Port Address Select Logic

Address lines A4 through A9 are used by the LANPC during PC I/O cycles to transfer I/O commands from the PC and status inputs to the PC.

The I/O Port Address Decoder consists of a six bit comparator which compares the PC's address bits A4 through A9 against a six position jumper referred to as the I/O ADDR jumper. If the PC executes an I/O cycle transfer to the bus, and if the I/O ADDR jumper compares, the LANPC will respond to either a PC's command or to the PC's request for the LANPC's status.

PC BUS INTERFACE

The LANPC PC-BUS interface consists of 62 lines. These are grouped into sets used to transmit data, control & power. The groups are:

Group	No. of lines
Address Bus	20
Data Bus	8
Control Lines	4
Interrupt Lines	6
DMA Lines	9
Clock & Timing	4
Miscellaneous	3
System Power	8

Each of the PC Bus signals utilized by the LANPC are described on the following pages.

ADDRESS BUS

The address bus consists of 20 lines designated as AO through A19. During PC memory access cycles to the LANPC Data Packet Buffer, the address lines AO through A10 address one of 2 Kbytes of the Data Packet Buffer whereby address lines A15 through A19 map the Data Packet Buffer onto the PC's address space on 8 Kbyte boundaries.

During PC memory access cycles to the LANPC 64/256 Kbyte DRAM, address lines AO through A15 (for 64 Kbyte DRAMS) or AO through A17 (for 256 Kbyte DRAMS) address one of 64 Kbytes or 256 Kbytes respectively, whereby address lines A16 through A19 (for 64 Kbyte DRAMS) or A18 through A19 (for 256 Kbyte DRAMS) map the DRAM onto the PC's address space on 64 Kbyte boundaries, respectively.

During PC memory access cycles to the LANPC EPROM, the address lines AO through A12 address one of 8 Kbytes of an 8 Kbyte EPROM (AO through A11 for a 4 Kbyte EPROM and AO through A10 for a 2 Kbyte EPROM) whereby address lines A15 through A19 map the EPROM onto the PC's address space on 8 Kbyte boundaries.

Address lines A4 through A9 are used by the LANPC during PC I/O cycles to transfer I/O commands from the PC and status inputs to the PC.

DATA BUS

The bidirectional data bus consists of 8 lines designated as DO through D7. Data inputs from the PC are accepted during PC memory & I/O output cycles when the LANPC is addressed appropriately. Data outputs from the LANPC to the PC are accepted during PC memory & I/O input cycles when the LANPC is addressed appropriately.

CONTROL LINES

The Control lines consists of 4 PC output lines which define the current PC processor bus cycle. The Control lines used by the LANPC are:

CONTROL	FUNCTION
MEMR*	PC memory read cycle
MEMW*	PC memory write cycle
IOR*	PC input cycle
IOW*	PC output cycle

-MEMR*
     MEMR* is used by the LANPC to generate memory read cycles.

-MEMW*
     MEMW* is used by the LANPC to generate memory write cycles
in the LANC controller.

-IOR*
     IOR* is used to extract the LANPC's status:

```
BIT  0 1 2 3 4 5 6 7
     | | | | | | | |
     | | | | | | | +-----(RI) Receiver Inhibited
     | | | | | | |
     | | | | | | +-------(ETS2) Extended Timeout Status 2
     | | | | | |
     | | | | | +---------(ETS1) Extended Timeout Status 1
     | | | | |
     | | | | +-----------(POR) Power On Reset
     | | | |
     | | | +-------------(TEST) Test
     | | |
     | | +---------------(RECON) Reconfiguration
     | |
     | +-----------------(TMA) Transmit Message Acknowledged
     |
     +-------------------(TA) Transmitter Available
```
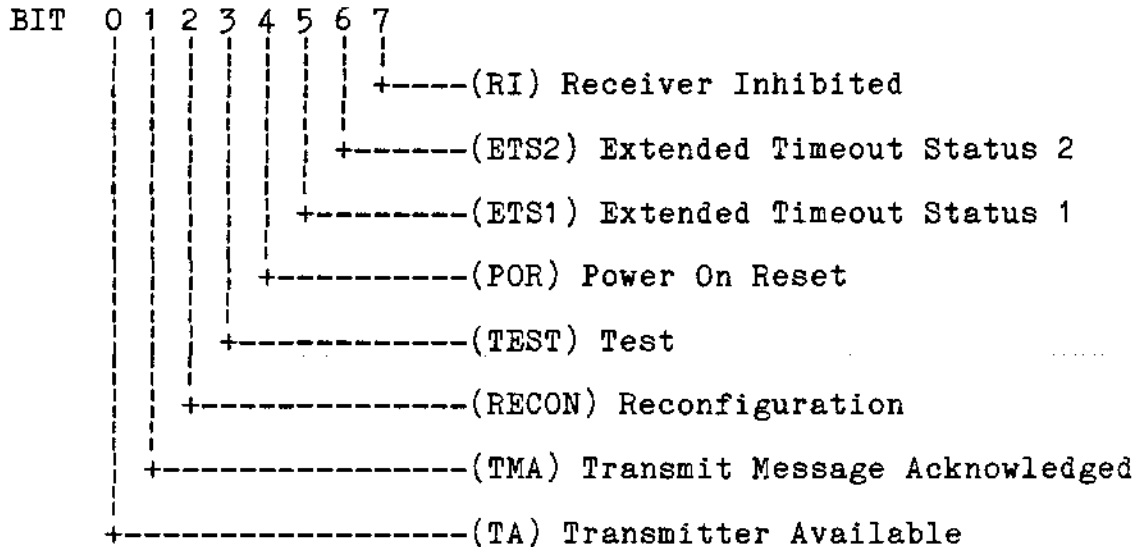

-IOW*
     IOW* is used in the LANPC to execute one of the eight
commands to the LANPC:

```
BIT  7 6 5 4 3 2 1 0
     | | | | | | | |
     0 0 0 0 0 0 0 0   Reserved For Future Use
     0 0 0 0 0 0 0 1   Disable Transmitter
     0 0 0 0 0 0 1 0   Disable Receiver
     0 0 0 n n 0 1 1   Enable Transmit from Page nn
     b 0 0 n n 1 0 0   Enable Receive to Page nn;
                         Broadcast if b=1
     0 0 0 0 c 1 0 1   Define Configuration; c defines
                         Data Packet Buffer(DPB) Size;
                         c=1 DPB=2K; c=0 DPB=1K
     0 0 0 r p 1 1 0   Clear Flags; p=1 clears POR
                         status; r=1 clears RECON status
```

INTERRUPT LINES

        The LANPC may generate an interrupt to the PC via one of
five interrupt lines. The interrupt pulse is generated by the
LANC when certain status bits go active and corresponding
register bit positions in the MASK register are set true. See
MASK register bit assignments below. The user may connect the
interrupt pulse generator to one of the five interrupt lines
(IRO2, IRQ3, IRQ4, IRQ5, or IRQ7) through a jumper option. See
"Solder/Trace Cut Options - IRQX SEL".

```
BIT  7 6 5 4 3 2 1 0
     | | | | | | | |
     | | | | | | | +-----Transmitter Available
     | | | | | | |
     | | | | | | +-------(not assigned)
     | | | | | |
     | | | | | +---------Recon Timer
     | | | | |
     | +-+-+-+-----------(not assigned)
     |
     +------------------------Receive Inhibit
```
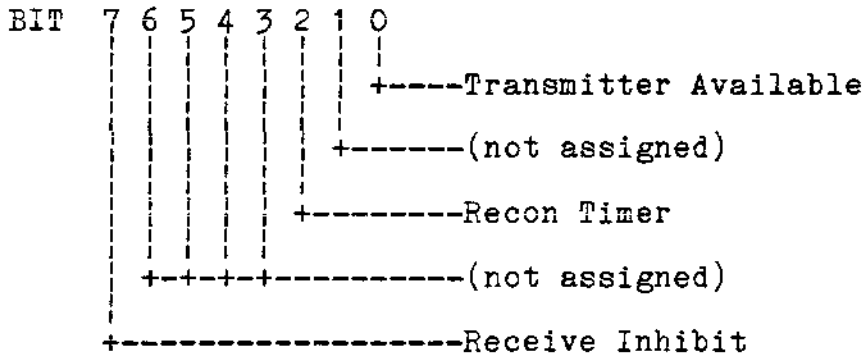
DMA LINES

        The DMA lines consist of three input lines and six output
lines. Of these, AEN and DACKO are used. DACKO is used to refresh
the 64/256 Kbyte Dynamic RAM. AEN is used to disable the LANPC
from the I/O Channel to allow DMA transfers to take place on the
I/O Channel.

CLOCK & TIMING

The clock and timing signals consist of 4 signals. The signals utilized by the LANPC are CLOCK and I/OCHRDY.

CLOCK, which is the PC system clock, is used by the LANPC wait state generator to generate wait states in appropriate timing sequences. I/OCHRDY is the PC input which, when asserted, will cause the PC to enter wait states.

MISCELLANEOUS

The LANPC uses one of three remaining signals of the PC bus: RESET DRV (Reset Driver). This signal resets the LANPC logic upon power-up or during low line voltage output.

SYSTEM POWER

The system power provided by the PC consists of:

+5 VDC	(2 lines)
-5 VDC	(1 line)
+12 VDC	(1 line)
-12 VDC	(1 line)
Ground	(3 lines)

The LANPC utilizes all but the + and -12 volt lines. The +5 volt line powers the logic and the - 5 volts powers the LAND. PC Bus ground pins B01, B10 & B31 are connected to the PCB ground plane.

2/4/8 KBYTE EPROM

The LANPC incorporates a socket for a 2 or 4 or 8 Kbyte EPROM. The EPROM may be used for monitor and network functions. The EPROM size is selectable by appropriately installing a jumper option and by installing the EPROM in a given fashion in the EPROM socket provided (see OPERATING INSTRUCTIONS Section). During PC memory access cycles to the LANPC EPROM, the address lines A0 through A12 address one of 8 Kbytes of an 8 Kbyte EPROM (A0 through A11 for a 4 Kbyte EPROM and A0 through A10 for a 2 Kbyte EPROM) whereby address lines A15 through A19 map the EPROM onto the PC's address space on 8 Kbyte boundaries.

64/256 KBYTE RAM

The LANPC incorporates an optional 64 or 256 Kbyte Dynamic RAM. The RAM is for general purpose usage. During PC memory access cycles to the LANPC 64/256 Kbyte DRAM, address lines AO through A15 (for 64 Kbyte DRAMS) or AO through A17 (for 256 Kbyte DRAMS) address one of 64 Kbytes or 256 Kbytes respectively, whereby address lines A16 through A19 (for 64 Kbyte DRAMS) or A18 through A19 (for 256 Kbyte DRAMS) map the DRAM onto the PC's address space on 64/256 Kbyte boundaries, respectively.

**** OPERATING INSTRUCTIONS ****

Instructions are given herein to configure the LANPC from both the hardware and software standpoint.

Hardware Setup Instructions

The hardware is configured via jumper, switch options and solder/trace cut areas. All jumper options and solder/trace cut areas are referred to by name on the silk screen of the PCB. The solder/trace cut options are located on the "solder" side of the board. Jumper areas are provided on the "component" side. These are implemented by header jumpers.

Jumper Options

Refer to figure 1 to locate the header jumper areas. These are designated as:

    LOCAL AREA NETWORK STATION IDENTIFICATION (LANS ID)
    DYNAMIC RAM ADDRESS (DRAM ADDR)
    NODE SELECT
    CIRCUIT NUMBER (CIRCUIT NO)
    I/O PORT ADDRESS (IO ADDR)
    PACKET BUFFER/EPROM MEMORY ADDRESS (MEM ADDR)
    INTERRUPT REQUEST LINE SELECT (IRQX SEL)

LOCAL AREA NETWORK STATION IDENTIFICATION (LANS ID)

The LANC reads in a switch settable identification code used for node identification purposes. A switch setting is input to a shift register and the LANC reads the contents of the shift register during reset time. The switch is identified on the board as LANS ID.

```
                        LANS ID
            lsb                        msb
          +----------------------------+
     on   | [] [] [] [] [] [] [] [] |
     off  | [] [] [] [] [] [] [] [] |
          +----------------------------+
          |  1  2  3  4  5  6  7  8  |
          +----------------------------+
```

EXAMPLE:

    To configure the WS80-X identification number for F5 hex, set the switch in the following positions:

                    1 - off
                    2 - on
                    3 - off
                    4 - on
                    5 - off
                    6 - off
                    7 - off
                    8 - off

Note: 1. A switch position set to "ON" corresponds to a logic O setting and the setting to "OFF" corresponds to a logic 1 setting.

       2. Under no circumstances should 2 or more boards have the same ID settings while attached to the same coax bus structure. Each workstation must have its own ID setting.

       3. **ID setting OO hex is not allowed.**

DYNAMIC RAM ADDRESS (DRAM ADDR)

The LANPC incorporates an optional 64 or 256 Kbyte Dynamic RAM. Address lines A0 through A15 (for 64 Kbyte DRAM) or A0 through A17 (for 256 Kbyte DRAM) address one of 64 Kbytes or 256 Kbytes respectively, whereby address lines A16 through A19 (for 64 Kbyte DRAM) or A18 through A19 (for 256 Kbyte DRAM) map the DRAM onto the PC's address space on 64 or 256 Kbyte boundaries respectively. A jumper, DRAM ADDR, is provided to enable the user to define where in the PC address space the RAM is to exist. If the PC executes a memory cycle transfer from/to the bus, and if the DRAM ADDR jumper compares, the LANPC RAM will respond.

```
                        DRAM ADDR

                MS            LS
              +-------------+
          a   | O   O   O   O |
          b   | O   O   O   O |
              +-------------+
                1   2   3   4

          (A19)            (A16)
```
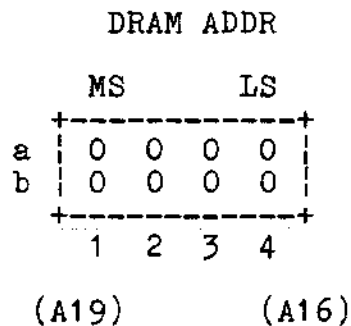
EXAMPLE 1:

    To install the 64 Kbyte DRAM at an address of
    50000h through 5FFFFh, install a jumper from a2 to
    b2 and from a4 to b4. The Trace/Cut jumper area,
    64/256K, should be open and DIS A16 & DIS A17 should
    each have a jumper from a1 to a2 respectively.

EXAMPLE 2:

    To install a 256 Kbyte DRAM to occupy an address of
    40000h through 7FFFFh, install a jumper from a2 to
    b2. Jumper positions a3 to b3 and a4 to b4 are
    undefined in this configuration and may be left
    open. The Trace/Cut jumper area, 64/256K, should be
    closed and DIS A16 & DIS A17 should each be in
    position a2 to a3 respectively.

Note: 1. A jumper installed in DRAM ADDR corresponds to
           a logic 0 setting and the absence of a jumper
           corresponds to a logic 1 setting.

       2. Under no circumstances should 2 or more boards
           occupy the same address space. Each LANPC must
           have its own unique RAM address setting.

----------   ------------------------------
NODE SELECT & CIRCUIT NUMBER (CIRCUIT NO)
----------   ------------------------------

The Node and Circuit ID settings are determined by an 8 position switch. The Node portion of the switch constitutes 6 positions for a binary representation of 64 nodes and the Ciruit portion constitutes 2 positions for a binary representation of 4 circuits. This switch is the means by which the user specifies the fileserver source from which the operating system is obtained (downloaded) at power-on or reset time. There can be up to 255 fileservers which are identified by one of 64 Nodes in one of 4 Circuits. A setting of 00h is invalid. This switch may be used for general purpose sense switch settings if so desired.

```
          +-CKT-+ +--NODE SELECT--+
          | NO  | | |             |
          lsb    | |           msb
          +------------------------+
      on  | [:] [:] [:] [:] [:] [:] [:] [:] |
     off  | [:] [:] [:] [:] [:] [:] [:] [:] |
          +------------------------+
          | 1   2   3   4   5   6   7   8 |
          +------------------------+
```

To configure the LANPC Node & Circuit numbers, follow the table below:

CIRCUIT NUMBER

S2	S1	Circuit Number
C	C	0
C	O	1
O	C	2
O	O	3

NODE SELECT

S8	S7	S6	S5	S4	S3	Node Select
C	C	C	C	C	C	0
C	C	C	C	C	O	1
C	C	C	C	O	C	2
C	C	C	C	O	O	3
C	C	C	O	C	C	4
			..			..
			..			..
O	O	O	O	O	C	62
O	O	O	O	O	O	63

Note: 1. A closed switch position corresponds to a logic 0 setting and is designated in the tables above as "C". An open switch position corresponds to a logic 1 setting and is designated in the tables above as "O".

2. Under no circumstances should 2 or more boards have the same Node and Circuit Number settings while attached to the same coax bus structure. Each PC system acting as a fileserver must have its own unique Node and Circuit Number settings.

I/O PORT ADDRESS (IO ADDR)

Address lines A4 through A9 are used by the LANPC during PC I/O cycles to transfer I/O commands from the PC and status inputs to the PC. The I/O Port Address Decoder consists of a six bit comparator which compares the PC's least significant address bits A4 through A9 against the six position IO ADDR jumper. If the PC executes an I/O cycle transfer to the bus, and if the IO ADDR jumper compares, the LANPC will respond to either a PC's command or to the PC's request for the LANPC's status.


```
                      IO ADDR

        MS(A9)                  LS(A4)
        +--------------------+
     a  | 0   0   0   0   0   0 |
        |   |   |   |   |   |   |
     b  | 0   0   0   0   0   0 |
        +--------------------+
          1   2   3   4   5   6
```

EXAMPLE:

To map the LANPC into the I/O address space 00200H, install a jumper in all positions except a1-b1. The LANPC is shipped per the configuration as shown above.

Note: A jumper installed corresponds to a logic 0 setting and the absence of a jumper corresponds to a logic 1 setting.

PACKET BUFFER/EPROM MEMORY ADDRESS (MEM ADDR)

The address bus consists of 20 lines designated as A0 through A19. During PC memory access cycles to the LANPC Data Packet Buffer, the address lines A0 through A10 address one of 2 Kbytes of the Data Packet Buffer. During PC memory access cycles to the LANPC EPROM, the address lines A0 through A12 address one of 8 Kbytes of an 8 Kbyte EPROM (A0 through A11 for a 4 Kbyte EPROM and A0 through A10 for a 2 Kbyte EPROM). Address lines A15 through A19 map the Data Packet Buffer and the EPROM onto the PC's address space. When the PC executes a memory access cycle, a comparator on the LANPC is enabled. It compares the PC's address lines A15 through A19 against a five position jumper referred to as the MEM ADDR jumper.

```
                     MEM ADDR

         MS(A19)          LS(A15)
         +----------------+
       a | 0  0  0   0   0 |
         |            |   | |
       b | 0  0  0   0   0 |
         +----------------+
           1  2  3   4   5
```

EXAMPLE:

To map the LANPC into the memory address space E0000H, install a jumper in positions a4-b4 and a5-b5 only. The LANPC is shipped per the configuration as shown above.

Note: A jumper installed corresponds to a logic 0 setting and the absence of a jumper corresponds to a logic 1 setting.

INTERRUPT REQUEST LINE SELECT (IRQX SEL)

The LANPC may generate an interrupt to the PC via one of five interrupt lines. The interrupt pulse is generated by the LANC when certain status bits go active and corresponding register bit positions in the MASK register are set true. The user may connect the interrupt pulse generator to one of the five interrupt lines (IRO2, IRQ3, IRQ4, IRQ5, or IRQ7) through jumper option IRQX SEL.

```
                    IRQX SEL

          IRQ-7 5 4 3 2
             +-----------+
           a| 0 0 0 0 0  |
           b| 0 0 0 0 0  |
             +-----------+
              1 2 3 4 5
```

As an example, to connect the Interrupt line to IRQ4, connect a jumper from a3-to-b3.

DYNAMIC RAM
ADDRESS

LOCAL AREA NETWORK
STATION IDENTIFICATION

NODE SELECT/
CIRCUIT NUMBER

INTERRUPT REQUEST
LINE SELECT

I/O PORT
ADDRESS

PACKET BUFFER/EPROM
MEMORY ADDRESS

JUMPER OPTIONS
- FIGURE 1 -

SOLDER/TRACE CUT OPTIONS

Refer to figure 2 for location of the following Solder/Trace cut options:

    64/256 KBYTE RAM SELECT (64/256K)
    PROM SELECT (PROM SEL)
    WAIT SELECT
    DISABLE ADDRESS A16 (DIS A16)
    DISABLE ADDRESS A17 (DIS A17)
    NETWORK CONTROLLER EXTERNAL TIMEOUT 1 (JP16)
    NETWORK CONTROLLER EXTERNAL TIMEOUT 2 (JP17)

64/256 KBYTE RAM SELECT (64/256K)

The LANPC incorporates an optional 64 or 256 Kbyte Dynamic RAM. If the LANPC is configured for 64 Kbyte DRAM, jumper 64/256K is open. If the LANPC is configured for 256 Kbyte DRAM, jumper 64/256K is closed.

```
           64/256K

         +-----+
         |  0  0  |
         +-----+
```

PROM SELECT (PROM SEL)

Either a 2716, 2732 or 2764 EPROM may be used with the
LANPC.   Instructions are given to incorporate any of these three
EPROMS.

2716/2732

A 28 pin socket is provided on the LANPC in order to
accommodate any of the three EPROM sizes. In the case of the
2716 and 2732, pin 1 of the EPROM must connect to pin three of
the socket. This is illustrated below:

```
                       socket(U41)
           +-------------------------------------+
           |   +-----------------------------+   |
           |   |                             |   |
           |   |                             |   |
           ]   ]       EPROM                 |   |
           |   |                             |   |
           |   |                             |   |
           |   +-----------------------------+   |
           +-------------------------------------+
           1 2 3                               14
```
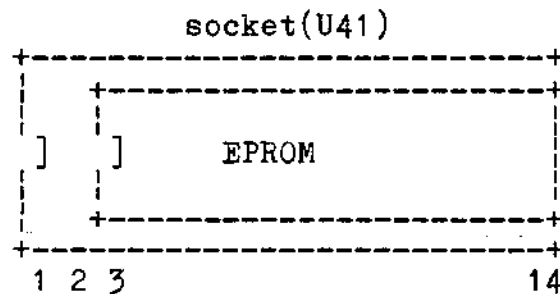
On jumper PROM SEL, for the 2716 connect 1-2 and for the 2732
connect 2-3.

```
                      PROM SEL

                   +--------+
                   | 0-0  0 |
                   +--------+
                     1  2  3
```
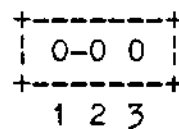
2764

Install the EPROM in the normal fashion; i.e., pin 1 mates with
pin 1.

On jumper PROM SEL connect 2-3.

```
------------
```
WAIT SELECT
```
------------
```

        Wait states are generated via the I/O CHRDY LINE when the
EPROM is accessed. Either one or two wait states are generated
depending on the WAIT SELECT jumper setting. The LANPC is
delivered with 350-450 nanosecond EPROMS which require two wait
states for reliable operation. Other EPROMS may be installed and
if their access time is in the 250-350 nanosecond range, WAIT
SELECT should be configured for 1 wait state.

                        WAIT SELECT

                    +--------+
                    | 0 0-0 |
                    +--------+
                     AS C BS

        To configure the LANPC for 1 wait state, connect C-AS.
        To configure the LANPC for 2 wait states, connect C-BS.

DISABLE ADDRESS LINE A16 (DIS A16)

&

DISABLE ADDRESS LINE A17 (DIS A17)

The LANPC incorporates an optional 64 or 256 Kbyte Dynamic RAM. If the LANPC is configured for 64 Kbyte DRAMS, jumpers DIS A16 and DIS A17 are connected from 1-2 respectively. If the LANPC is configured for 256 Kbyte DRAMS, jumpers DIS A16 and DIS A17 are connected from 2-3 respectively.

```
        DIS A16              DIS A17

     +-------+            +-------+
     ¦ 0-0 0 ¦            ¦ 0-0 0 ¦
     +-------+            +-------+
       1 2 3                1 2 3
```

NETWORK CONTROLLER EXTERNAL TIMEOUT 1 (JP16)

&
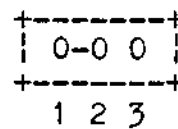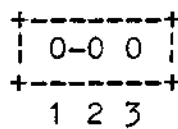
NETWORK CONTROLLER EXTERNAL TIMEOUT 2 (JP17)

The jumpers, JP16 & JP17 allow the network to operate over longer distances than 4 miles. The table below illustrates the Response Time and Reconfiguration time as a function of the JP16 and JP17 jumpers. The idle time will always be equal to the Response Time plus 3.5 microseconds. It should be noted that for proper network operation, all COM9026's connected to the same network must have the same response time, idle time and reconfiguration time. The LANPC is factory set to a Response Time of 74.7 microseconds and Reconfiguration Time of 840 milliseconds.

JP17	JP16	RESPONSE TIME (US)	RECONFIGURATION TIME (MS)
1	1	74.7	840
1	0	283.4	1680
0	1	561.8	1680
0	0	1118.6	1680

```
        JP16              JP17
      +---+             +---+
      ¦ 0 ¦             ¦ 0 ¦
      ¦ 0 ¦             ¦ 0 ¦
      +---+             +---+
```

64/256 KBYTE RAM SELECT
DISABLE ADDRESS A16
DISABLE ADDRESS A17
PROM SELECT
WAIT SELECT

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INTERCONTINENTAL MICRO SYSTEMS INC.
LANPC BD.

SOLDER/TRACE CUT OPTIONS
- FIGURE 2 -

Intercontinental
Micro Systems
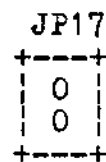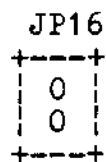
**** SOFTWARE SECTION ****

1. SCOPE

This section was not generated to be a complete description of the S100 and IBM-PC network systems. Instead, assumptions have been made in the knowledge of the TurboDOS system integrator. TurboDOS version 1.40 is assumed to be the operating system version number of the target system.

This section has been explicitly prepared for use with the Intercontinental Micro Systems (ICM) single board master (CPZ-4800X) and the IBM-PC and PC/XT computers using the ICM local area network controller products (LANPC & LANS100).

Section 2 is an overview of the task involved to network the CPZ-4800X and IBM-PC and PC/XT's.

Section 3 explains all driver modules supplied with this preliminary version of the network driver modules. These drivers are above and beyond those which are distributed by Software 2000 for the IBM-PC. You should obtain a copy of the driver modules generated by Software 2000 for the IBM-PC and read this section carefully. There is not much at this time but more is due to come.

Section 4 explains additional programs that have provided for the management of certain tasks concerning the IBM-PC and PC/XT's.

In section 5, some GEN and PAR file examples are provided as an outline for configuring the target network system.

Finally, ICM hopes that your experience in configuring the IBM-PC network is an easy one. The purpose of this pre-release is to begin testing the applications for this network, so your feedback will be greatly apreciated.

2. OVERVIEW

The ICM local area network allows S100 type 8-bit machines (CPZ-4800X) and IBM-PC and PC/XT's to be networked together over a common base-band coax cable and utilizing the power of the TurboDOS operating system. The system offers the flexibility to create any imaginable combination of file servers, masters, and slaves. In its simple form, 8-bit S100 masters may be linked together to increase the size of one system. In another form, simple IBM-PC's with only single floppy disk drives may be attached to a CPZ-4800X serving as the master processor. The shaping of the network is entirely up to the system integrator due to the flexibility of the LAN and the driver software. See diagrams shown below.

INTEGRATION FOR 8-BIT S100 MACHINES

In the 8-bit S100 world, LANS100 controllers are pluged into the bus with the CPZ-4800X single board master. The local area network driver module is then GEN'ed into the master operating system and parameters for the LAN devices are configured in the PAR file. The LAN100 driver has already been pre-configured for proper operation with the CPZ-4800X. It assumes a base I/O port address of 68 hex and the memory onboard the LANS100 controller is configured for extended memory addressing. Main system memory can remain 64 Kbytes in size.

INTEGRATION FOR IBM-PC'S AND IBM-PC/XT'S

In the 16-bit PC world, system disks are supplied pre-configured to boot directly from the IBM-PC and PC/XT's. The LANPC controller is also supplied with a 2 Kbyte ROM containing operating system download code for the purpose of boot loading diskless PC's. PC and PC/XT's may also may the operating systems downloaded via the network.

```
+------------------------------+
|  8-bit Network File Server   |
|  (CPZ-4800X based system)    |
+------------------------------+
         | |
         | |  ARCNET                    ----------------
         P1                      ++========| IBM-PC SLAVE |
         | |                     | |       ----------------
+-----------+                    | |
|  4-PORT   |==P2===++           | |       ----------------
|  PASSIVE  |==P3===============| IBM-PC SLAVE |
|  HUB      |==P4===++           ----------------
+-----------+                    | |
                                 | |       ----------------
                          ++========| IBM-PC SLAVE |
                                     ----------------
```
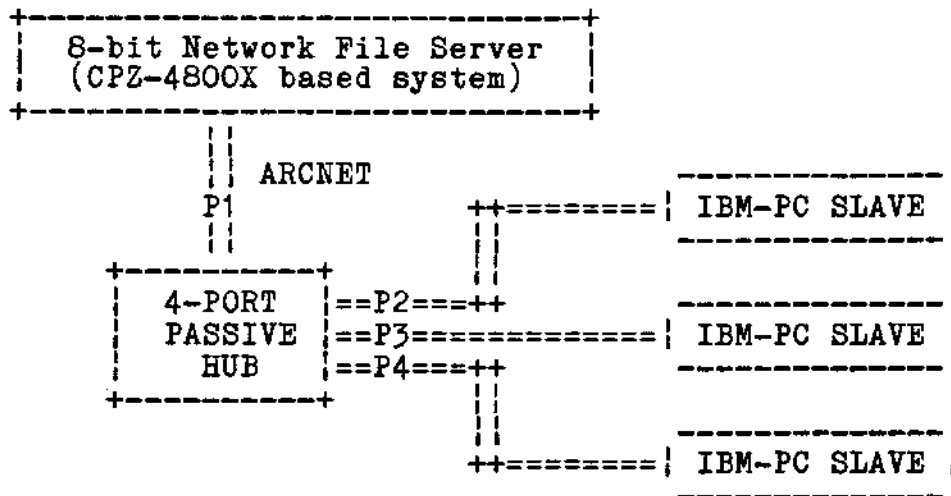
Figure 1 - Simple configuration of IBM-PC's to a CPZ-4800X
master.

3. DRIVER MODULES

HDCIPC.O - Hard disk driver module. (system and loader level)

Hard disk driver module for the IBM-PC/XT. Supports up to four
drives (Disk assignments 0 through 3). Device independency
through the ROM BIOS interrupt vector. Currently, only 10MB hard
disk drives are supported with this driver and no formatting.
The hard disk must be formatted using the standard PC-DOS method
and then an ERASEDIR once TurboDOS is running. There are no user
patchable globals in this module yet.

HPBIPC.O - Cold boot loader hard disk driver. (OSBOOT driver)

The cold boot loader for the IBM-PC/XT hard disk is linked
together with the standard TurboDOS OSBOOT module to generate the
512 byte boot sector in image form as it resides on the very
first sector of the hard disk. The program SECGEN has been
created to alter the output file from TLINK into the IBM
compatible hard disk boot sector (see section below for
additional information on the SECGEN utility). To generate the
cold boot sector and place it on the reserved track, follow these
steps from a running TurboDOS system on the PC/XT.

STEP #1

Link the modules OSBOOT and HPBIPC together. The file HPBIPC is
supplied already containing these two modules.

```
TLINK HPBIPC.SEC
* OSBOOT
* HPBIPC
* <RET>
```

STEP #2

Run the program SECGEN to modify the output file from the linker.

```
SECGEN  HPBIPC.SEC
```

STEP #3

Run the TurboDOS BOOT program to write the file to the reserved
area of the hard disk.

```
BOOT HPBIPC.SEC C:
```

The destination device will depend on where the hard disk has
been specified in the disk assignment table.

DSKIPC.O - Floppy disk driver module (system and loader level)

Floppy disk driver module for the IBM-PC and PC/XT. Supports up
to four drives (Disk assignments 0 through 3). Contains the
format routine for drive initialization (with the transient
program FMTIPC). Supports standard TurboDOS disk format types
plus the 512 byte per sector (8 sector per track) standard PC-DOS
format type. The PC-DOS disk format type is used primarily for
cold boot loading and recovering PC-DOS programs with the READPC
utility. There are no user patchable globals in the module yet.

MPBIPC.O - Floppy disk cold boot driver (OSBOOT level)

The cold boot loader for the IBM-PC floppy disk is linked
together with the standard TurboDOS OSBOOT module to generate the
512 byte boot sector in image form as it resides on the very
first sector of the floppy disk (8-sector IBM 512 byte format
only). To generate the cold boot sector and place it on the
reserved track, follow these steps from a running TurboDOS system
on the PC.

STEP #1

Link the modules OSBOOT and MPBIPC together with the TLINK
utility. The file MPBIPC.GEN is supplied with these modules
described.

```
    TLINK MPBIPC.SEC
    * OSBOOT
    * MPBIPC
    * <RET>
```

STEP #2

Run the TurboDOS BOOT program to write the file to the reserved
area of the floppy disk.

```
    BOOT MPBIPC.SEC A:
```

The destination device will depend on where the floppy disks have
been specified.

LANIPC.O - Local area network driver module for the IBM-PC and
PC/XT.

Supports fully bidirectional network traffic. One of the four
board level message buffers is used for receiving a message,
while the other three buffers are filled and queued with outgoing
messages. Supports the ability to download an operating system
to IBM PC and PC/XT's via the network. Optional message time-out
routine for disabled remote processor detection. Patchable board
level base memory address and base I/O port address.

When describing network addresses for the circuit assignment
table in the TurboDOS paramter files, only the network circuit
BYTE must be specified. LANIPC will create it's own network node
BYTE from the ARCNET ID switches on the board and patch the
TurboDOS tables during initialization.

For network downloading applications, LANIPC provides a 255 byte
table of OSSLAVE.SYS suffix characters. When a request for
download is received by the driver, the requesting node's ID is
used to index into this table and load the suffix character.
This suffix character is then passed back to the download
requesting node for subsequent download requests.

PATCHABLE GLOBALS:

Patchable globals for the LANIPC driver are designed to allow
multiple copies of the driver to be GEN'd together. All globals
use an "_" character at the end of the name to follow TurboDOS
convention as in disk driver modules. Depending on the number
occurrances of the driver module in the GEN file, this character
will begin with an "A" and increment for each occurrance. All
globals are shown with there default values.

LANSG_ = (OXE000) On board memory segment base.

     This WORD variable represents the address equivalences of
     A19-A16 where the least significant nibble is 0. This can
     be set to any even 64k boundry, but segment E000 was chosen
     as to not conflict with other IBM peripherals.

LANIO_ = (OXO200) Base address of the I/O ports.

     This WORD variable can be positioned on 16 port boundries to
     represent address equivalences of A15-A4. Base 200 was
     chosen for the default and represents that I/O area that IBM
     has reserved for the paddle board modules.

LANTF_ = (OXFF)   Send message time-out enable flag.

     This BYTE variable is normally set to enable send message
     time-outs but can be disabled by patching it to a 0. When
     time-outs are disabled, requests made on remote processors
     that have left the network will hang the requesting node
     untill that processor has responded.

LANTC_ = (OXOA)   Send message time-out variable.

     This BYTE variable represents the amount of time in seconds
     that the circuit driver delays before it aborts sending a
     message. It can be patched from 1 to 256 seconds, where 256
     seconds is equal to 0. This variable has no meaning if
     LANTF_ has been patched to a 0.

LAN100.REL - Local area network driver module for S100 systems.

Supports fully bidirectional network traffic. One of the four
board level message buffers is used for receiving a message,
while the other three buffers are filled and queued with outgoing
messages. Supports the ability to download an operating system
to other LAN controller on the network. Optional message time-out
routine for disabled remote processor detection. Patchable board
level base memory address and base I/O port address.

When describing network addresses for the circuit assignment table in the TurboDOS paramter files, only the network circuit BYTE must be specified. LAN100 will create it's own network node BYTE from the ARCNET ID switches on the board and patch the TurboDOS tables during initialization.

For network downloading applications, LAN100 provides a 255 byte table of OSSLAVE.SYS suffix characters. When a request for download is received by the driver, the requesting node's ID is used to index into this table and load the suffix character. This suffix character is then passed back to the download requesting node for subsequent download requests.

PATCHABLE GLOBALS:

Patchable globals for the LAN100 driver are designed to allow multiple copies of the driver to be GEN'd together. All globals use an "@" character at the end of the name to follow TurboDOS convention as in disk driver modules. Depending on the number of occurrances of the driver module in the GEN file, this character start with an "A" and increment for each occurrance. All globals are shown with there default values.

LANSG@   = (0B800)   On board memory segment base.

     This WORD variable represents the address equivalences of
     A15-A11 for the base address on 2k boundrys.

          NOTE: This address represents that area of memory where
          the LANS100 memory appears in the master's 64k after
          extended address re-mapping is performed. The actual
          extended board address referenced by the MMU is 0FF800
          (full 24-bit hex address).

LANIO@   = 68   Base address of the I/O ports.

     This BYTE variable can be positioned on 8 port boundries to
     represent address equivalences of A7-A3.

LANTF@   = 0FF   Send message time-out enable flag.

     This BYTE variable is normally set to enable send message
     time-outs but can be disabled by patching it to a 0. When
     time-outs are disabled, requests made on remote processors
     that have left the network will hang the requesting node
     untill that processor has responded.

LANTC@ = OA   Send message time-out variable.

     This BYTE variable represents the amount of time in seconds
     that the circuit driver delays before it aborts sending a
     message. It can be patched from 1 to 256 seconds, where 256
     seconds is equal to O. This variable has no meaning if
     LANTF@ has been patched to a O.

LNSST@ = " "[repeated 256 times]

     This table of 256 bytes contain the OSSLAVE.SYS suffix
     characters sent back to a respective LAN ID after a request
     for download is performed. For example, a LAN processor
     with a physical ID of O2 hex will be requesting downloads
     from a CPZ-4800X network master and the file OSSLAVEI.SYS.
     The slave suffix table address LNSST@+02 should be patched
     to an "I" character.

LANLOD2K.O - IBM-PC and PC/XT network download driver for 2k
EPROM.
LANLOD4K.O - IBM-PC and PC/XT network download driver for 4k
EPROM.
LANLOD8K.O - IBM-PC and PC/XT network download driver for 8k
EPROM.
LANLODPG.O - IBM-PC and PC/XT network download program.

LANLOD.REL - CPZ-4800X network download for 2k EPROM.

The LANLOD group of drivers allow IBM-PC's, IBM-PC/XT's, and CPZ-
4800x's to request their operating systems to be downloaded via
the network from any networking master on the circuit. The
different versions of the driver are linked with the associated
DO file (LANLOD2K.DO, LANLOD4K.DO, LANLOD8K.DO, LANLODPG.DO, or
LANLODZ.DO). The output from this DO files will be LANLOD2K.ROM,
LANLOD4K.ROM, LANLOD8K.ROM, LANLODPG.CMD, or LANLODZ.ROM
respectively. The ROMGEN utility is used for IBM downloaders
which are programmed into EPROM to reside on the LANPC board.
Consult the DO files for information on how the files are
generated.

LANLOD operation will be automatic, and only required operator
intervention if an un-recoverable error occurs. Requests for OS
downloads are made on 10 second intervals. If a machine
requesting downloading is powered on or reset before the
networking master that will receive the request, it can take up
to 10 seconds for the OS download to proceed after the network
master has powered up and initialized.

"O" FILE PATCHABLE GLOBALS:

LANIO   = (OXO200)

>   This BYTE global performs the exact same function as the
>   LANIO_ global in the system driver (see LANIPC module).
>
>   NOTE: Only the LANLODPG.CMD version of the driver will
>   assume that the on board memory segment base is EOOO
>   hex. The EPROM versions of LANLOD can automatically
>   determine their memory segment when called from the ROM
>   BIOS.

LANSG = (OB800)   LAN base memory segment address.

>   This word global corresponds exactly with the global
>   contained in the LAN100 driver module.

LANIO = 68   LAN base I/O address.

>   This byte global corresponds exactly with the global
>   contained in the LAN100 driver module.

SIOBBR = OE   Serial channel B baud rate code.

>   This byte global may be patched to change the baud rate for
>   channel B (used for console interaction). See T-function
>   set communications channel baud rate for code details. This
>   byte is not applicable if the console I/O disable flag is
>   set (see below).

CIODIS = O   Console I/O disable flag.

>   This byte global may be patched to an FF hex if console
>   interaction over channel B of the SIO device is not desired.
>   When console I/O is disabled, the download code will make
>   continuous requests on the networking master.

DLDID = (8)   Download processor destination ID.

>   This word global contains the circuit/node ID of the
>   processor that download requests will be made upon. Only
>   the low order byte (node) of the global may be patched.
>   LANLOD for the CPZ-4800X will derive the circuit number of
>   the LAN ID switches. See boot processor identification
>   section below.

LANPC BOOT PROCESSOR IDENTIFICATION:

An eight position switch option (NODE SELECT & CIRCUIT NUMBER) is
provided on the LANPC controller to select the master processors
circuit and node identifications. This TurboDOS ID will be the
processor that LANLOD will request OSSLAVE.SYS downloads from.
The data bit assignments are as follows:

```
                  +---+---+---+---+---+---+---+---+
NODE SELECT       | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |  CIRCUIT NUMBER
                  +---+---+---+---+---+---+---+---+
                    |   |   |   |   |   |   |   |
                    |   |   |   |   |   |   |   |
                    |   |   |   |   |   |   +---+--> Circuit Number 0-3
                    |   |   |   |   |   |
                    +---+---+---+---+---+----------> Node Number 1-63
                                                     (node 0 is invalid)
```

NOTE: This approach for boot processor identification with the
LANS100 controller was chosen to allow the EPROM to make download
requests on one of four circuit numbers without the need to be
reprogrammed.   Circuit number identifications are logical
assignments only needed by the TurboDOS operating system.
Allowing one of four circuits provides some flexibility for
assigning the logical circuit number.

LANS100 BOOT PROCESSOR IDENTIFICATION:

Currently, a sense switch does not exist on the LANS100 for
identifying the boot processor ID. Instead, the boot processor's
node ID is fixed within the code (see DLDID above), and the boot
processor's circuit assignment is derived from the LANS ID
switch. The data bits are assigned as follows:

```
                  +---+---+---+---+---+---+---+---+
     LANS ID      | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
                  +---+---+---+---+---+---+---+---+
                            |   |
                            |   |
                            +---+---> Circuit number 0-3
```

Examples: Assuming that the DLDID node byte has been fixed for
node 8, LAN ID assigned values from 1-15 (1-OF hex) will cause
LANLOD download requests to be made on circuit 0/node 8. LAN ID
assigned values from 16-31 (10-1F hex) will cause LANLOD download
requests to be made on circuit 1/node 8. LAN ID's from 32-47
(20-2F hex) make requests on circuit 2/node 8. LAN ID's from 48-
63 (30-3F hex) make requests on circuit 3/node 8.

NOTE: This approach for boot processor identification with the
LAN100 controller was chosen to allow the EPROM to make download
requests on one of four circuit numbers without the need to be
reprogrammed.   Circuit number identifications are logical
assignments only needed by the TurboDOS operating system.
Allowing one of four circuits provides some flexibility for
assigning the logical circuit number.

OSSLAVE.SYS DERIVED SUFFIX CHARACTER:

The OSSLAVE.SYS download suffix character is assigned at system
GEN time within the master operating system responsible for
downloading to this physical LANS ID.   This master OS must always
be the one assigned for download requests on the LANPC by the
NODE SELECT switch block (described above).   The LANLOD driver
will first issue a special single body message as an intent to
download.   The master OS will acknoledge this request by passing
back the OSSLAVE.SYS suffix character found in it's table
(LNSST@+SID or LNSST_+SID).   The LANLOD driver stores this suffix
character for subsequent download requests on the master OS until
the end of download is reached.

The important thing to remember here is that the OS master is
responsible for maintaining the table of OSSLAVE.SYS download
suffix characters for each physical LANS ID that will be
requesting downloads.   Full flexibility exists here to assign one
common OSSLAVE.SYS download file for all requesting LANS ID's or
descrete OSSLAVE.SYS download files for each requesting LANS ID.

LANLOD OPERATION:

When the LANLOD drivers are executed from program or EPROM.
Information will be display immediately on the screen.   All
values are in hexidecimal.   The ARCNET-PC memory and I/O bases
are displayed first followed by the source processor ID (who it
is) and the destination processor ID (who it is trying to boot
from).   These values are givin in TurboDOS circuit/node notation
(the circuit number being the MSB and the node being the LSB).
For example, if the LANPC board ID switch is assigned to be node
2 on the network and the NODE SELECT switches are set for circuit
2, node 8, the following sign-on message would be displayed.

        ARCNET I/O base: E000   ARCNET MEM base: 0200
        SID circuit/node: 0202   DID circuit/node: 0208

        Requesting network download

LANLOD will print the "!" character for each download packet
request sent over the network and the "+" character for each
valid OS record received over the network.

After all OS records have been loaded via the network, LANLOD
will print the message just prior to execution of the operating
system.

Network download completed

ERROR MESSAGES:

ERROR: ARCNET not present in system

This error message can only be generated from the program
"LANLODPG" version of the loader. The ARCNET-PC could not be
found and initialized by the loader.

Network download error

This message is printed when an invalid OS download record has
been determined by the loader. A new download request will be
retried ten times before the loader will give up and print the
following message.

Press <RET> to continue

The return key may be pressed to initiate a completely new
download sequence with up to 10 retries like before.

OS download system not present

This message is printed if the requested OSSLAVE.SYS download
file was not found by the OS master processor. Check your
directory for the proper download file and the slave suffix table
in the master for the correct assignments.

MSTIPC.O   - Memory specification table for the IBM-PC.
MSTIPCXT.O - Memory specification table for the IBM-PC/XT.

This module contains the global address "MEMTBL" for proper
TurboDOS 16-bit operation. The base memory segment value for
both module is 0050 hex, to give TurboDOS all memory above
address 0:500 hex. Unique to each module is the reading of the
IBM-PC and PC/XT switches for the amount of memory in the system.
Make sure that the memory switches have been setup according to
the IBM handbook. The memory length is paragraphs is
automatically patched by this module after reading the system
switches. The IBM-PC sign-on message module will display the
amount of memory found in the system.

NITIPC.O - Initialization module for the IBM-PC and PC/XT.

Contains all the CALLS to external initialization code for proper operation of these drivers. Be sure to use this module instead of that supplied by Software 2000 for the IBM-PC system.

RTCIPC.O - Real time clock driver for the IBM-PC and PC/XT.

Standard driver module as supplied by Software 2000.

CDRIPC.O - Console keyboard driver for the IBM-PC and PC/XT.

Contains all neccessary code for the operation of the IBM-PC keyboard. Keyboard input is acheived through the use of a poll routine calling the IBM ROM BIOS for keyboard input, then translating function keys and special keys for Televideo 920 compatability. Experience with the operating system will give you information as to the codes generated by the keyboard until they are properly documented. ALT-F1 through ALT-F10 are reserved for special use and do not generate any codes.

PATCHABLE GLOBALS:

CIBSIZ = (32)   Console input buffer size.

     This word global is the size (in bytes) of the allocated keyboard input buffer. This global cannot be patched to a value greater than 127 decimal.

SCRIPC.O - Screen Driver for the IBM-PC and PC/XT.

Televideo 920 emulation ability. Interaction with keyboard input functions for support of keyboard lock and unlock functions.

PATCHABLE GLOBALS:

TABSIZ = 8   Tab size.

     This global byte may be patched to select tab sizes to every nth column.

SLFLAG = OXFF   Status line initialization flag.

     This global byte (normally set to enable the status line display) may be patched to a 0 if the status line is not desired. The status line can also be enabled and disable via screen escape functions after start-up.

IBM-PC and PC/XT SCREEN FUNCTIONS

The IBM-PC and PC/XT screen driver provided with the PC network
supports Televideo type terminal emulation with additional
features. Most functions (not associated with the printer port)
have been implemented.

ASCII Control Character Table

ASCII CODE	DESCRIPTION
07H (BELL)	rings the terminal bell
08H (BS)	back space (cursor left)
09H (HT)	horizontal tab (cursor to next tab stop)
0AH (LF)	line feed (cursor dows)
0BH (VT)	vertical tab (cursor up)
0CH (FF)	forward space (cursor right)
0DH (CR)	return (cursor to beginning of line)
1AH (SUB)	clear unprotected
1BH (ESC)	escape lead-in
1EH (RS)	home cursor

ESCAPE Sequences Character Table

```
+===============+=================================================+
|  ESC  "       |  unlock the keyboard                            |
|  ESC  #       |  lock the keyboard                              |
|  ESC  &       |  write protect mode on                          |
|  ESC  '       |  write protect mode off                         |
|  ESC  (       |  end protected field                            |
|  ESC  )       |  begin protected field                          |
|  ESC  *       |  clear protected screen                         |
|  ESC  +       |  clear unprotected screen                       |
|  ESC  .  n    |  set cursor mode n                              |
|  ESC  ^       |  begin blink field                              |
|  ESC  ;       |  clear unprotected screen                       |
|  ESC  =  x y  |  set cursor x/y (row/column) address            |
|  ESC  A  s e  |  define screen s/e (start/end) lines            |
|  ESC  E       |  insert a line                                  |
|  ESC  N       |  display screen on                              |
|  ESC  O       |  display screen off                             |
|  ESC  P  n    |  select screen n                                |
|  ESC  Q       |  insert a character                             |
|  ESC  R       |  delete a line                                  |
|  ESC  T       |  clear unprotected to end-of-line               |
|  ESC  W       |  delete a character                             |
|  ESC  Y       |  clear unportected to end-of-screen             |
|  ESC  _       |  begin blank field                              |
|  ESC  j       |  begin reverse video                            |
|  ESC  k       |  end reverse video                              |
|  ESC  l       |  begin underline field                          |
|  ESC  m       |  end underline field                            |
|  ESC  q       |  end blink/blank field                          |
|  ESC  t       |  clear all to end-of-line                       |
|  ESC  y       |  clear all to end-of-screen                     |
+===============+=================================================+
```

SIOIPC.O - Serial I/O driver for INS8250 type UARTS.

Compatible with the IBM-PC and IBM-PC/XT serial ports (primary and secondary asyncronous channels). Up to four serial ports supported by the driver. Contains the global TurboDOS entries "SERIAL" and "COMDRV" for remote console and communications operations.

FUNCTIONS:

0 - Return serial status, and possible character.
1 - Return serial input, dispatching if neccessary.
2 - Send serial output, dispatching if neccessary.
3 - Set serial baud rate.
4 - Return serial baud rate.
5 - Set MODEM controls.
6 - Return MODEM controls.
10 - Conditional serial output.

PATCHABLE GLOBALS:

These globals are the base I/O port address for INS8250 devices located in the system. A default of "(O)" means that the device is not present and will not be used. INS8250 devices are validated by the driver and will not respond if found not to be present.

SIOA   = (OXO3F8)   Primary asyncronous serial device.
SIOB   = (OXO2F8)   Secondary asyncronous serial device.
SIOC   = (O)   Optional additional serial device.
SIOD   = (O)   Optional additional serial device.

SOMIPC.O - Sign-on message for the IBM-PC and PC/XT.

This module contains the TurboDOS global address "USRSOM" that may be patched by the user for a custom sign-on message. Additional code is present for displaying the IBM-PC and PC/XT's network circuit, node, and memory size. The user may patch the first 60 bytes beginning at the "USRSOM" global, and MUST NOT append the "$" termination character to the message.

4.   SUPPORT PROGRAMS
————————————————————

Additional support programs for the IBM-PC and PC/XT network. These programs are supplied for convenience in altering the network.

ROMGEN.CMD - IBM-PC and PC/XT ROM generation utility.

The ROMGEN utility is designed to alter a specified file for use with the IBM ROM BIOS. The specified file is read into memory, checked for the proper ROM configuration and an output file by the same name is created to store the altered file. Consult the IBM documentation for user supplied ROM's in the system.

In order to insure enough room to create the checksum byte at the end of the file, an explicit "BYTE 0" must be located at the end of the file.

The specified file must contain the following information in the first three bytes.

BASE+1 = 55 hex   ROM ID word (LSB).

BASE+2 = AA hex   ROM ID word (MSB).

BASE+3 = ss   Number of 512 byte blocks in the ROM, must be an even 2k boundry (4,8,12, etc.).

The specified file must be included on the command line as follows. The drive name "d:" is optional.

ROMGEN d:filename.typ

ROMGEN Utility v1.0

Header specified length: ssss
Writing output file: d:filename.typ

ERROR MESSAGES:

File not specified.
Ambiguous files not supported.
Cannot open file: d:filename.typ.
Cannot make file: d:filename.typ.
Not enough memory.
ROM file error in first 3 bytes.
ROM code not on even 2k boundry.
ROM file read past header specified length.
Cannot write output file.

SECGEN.CMD - Hard disk boot sector generation utility.

The SECGEN utility was created to ease the burden of creating the appropriate file format that can be written to the reserved area of the hard disk. The input filename is specified on the command line and the output file of the same name is generated. The drive name "d:" is optional.

     SECGEN d:filename.typ

     SECGEN Utility v1.0

     Writing output file: d:filename.typ

SWITCH.CMD   - Display switch settings for IBM-PC.
SWITCHXT.CMD - Display switch settings for IBM-PC/XT.

The SWITCH program will display switch settings for the IBM-PC as follows:

     SWITCH #1 = XX   (displayed in hexidecimal)
     SWITCH #2 = YY   (displayed in hexidecimal)

The SWITCHXT program will display switch settings for the IBM-PC/XT as follows:

     SWITCH = XX   (displayed in hexidecimal)

DTYPE.CMD - Dual type utility for the SCRIPC screen driver.

The DTYPE utility will display two files concurrently on the IBM-PC display. This is made possible through the SCRIPC screen driver provided for Televideo 920 emulation. Both files may be specified on the command line or from the DTYPE subsystem prompt as follows. The drive name "d:" is optional.

FROM THE COMMAND LINE:

     DTYPE d:filenam1.typ d:filenam2.typ

FROM THE SUBSYSTEM LINE:

     DTYPE

     TYPE Utility v1.0

     * d:filenam1.typ d:filenam2.typ

5. SAMPLE GEN AND PAR FILES

These sample GEN and PAR files are provided here for documentation purposes and DO NOT represent the current files provided on the disk. Please refer to the distribution disk for the current image of these files.

TDOSPC.GEN - COMPLEX SLAVE FOR THE IBM-PC.

```
STDSLAVX           ; Standard complex slave OS
NETSVC             ; Network service
SUBMIT,CPMSUP
MSTIPC             ; IBM-PC Memory specification table
NITIPC             ; IBM-PC initialization module
SOMIPC             ; IBM-PC sign-on message module
CDRIPC,SCRIPC      ; IBM-PC smart console interface
;CON96              ; Null console interface
;SIOIPC             ; IBM-PC comm channel driver
DSKIPC             ; IBM-PC floppy disk driver
RTCIPC             ; IBM-PC real-time-clock driver
LANIPC             ; IBM-PC local area network driver (ARCNET-PC)
```

TDOSPC.PAR - COMPLEX SLAVE FOR THE IBM-PC.

```
USRSOM  = OXOD,OXOA,"IBM-PC COMPLEX SLAVE (8/07/84)"
;
COMPAT  = OXB8   ;COMPATABILITY FLAGS
ATNCHR  = O      ;ATTENTION CHARACTER
AUTUSR  = OX80   ;AUTO LOGON USER NUMBER
OSMLEN  = 256    ;O/S MEMORY LENGTH
;
SRHDRV  = OXFF   ;O/S PROGRAM SEARCH DRIVE (O=OFF,1-16="A"-"P",
                  FF=BOOT DRIVE)
;LDCOLD = O      ;COLD START AUTOLOAD ENABLE FLAG (O=DISABLE)
;LDWARM = O      ;WARM START AUTOLOAD ENABLE FLAG (O=DISABLE)
;NMBUFS = 4      ;NUMBER OF BUFFERS
;
DSKAST  = OX00,(DSKDRA),OX01,(DSKDRA),OX82,(OX0228),OX83,(OX0228),
          OX84,(OX0228),OX85,(OX0228),OX86,(OX0228),OX87,(OX0228),
          OX88,(OX0228),OX89,(OX0228),OX8A,(OX0228),OX8B,(OX0228),
          OX8C,(OX0228),OX8D,(OX0228),OX8E,(OX0228),OX8F,(OX0228)
;
PTRAST  = OX80,(OX0228),OX81,(OX0228),OX82,(OX0228),OX83,(OX0228),
          OX84,(OX0228),OX85,(OX0228),OX86,(OX0228),OX87,(OX0228),
          OX88,(OX0228),OX89,(OX0228),OX8A,(OX0228),OX8B,(OX0228),
          OX8C,(OX0228),OX8D,(OX0228),OX8E,(OX0228),OX8F,(OX0228)
;
QUEAST  = OX80,(OX0228),OX81,(OX0228),OX82,(OX0228),OX83,(OX0228),
          OX84,(OX0228),OX85,(OX0228),OX86,(OX0228),OX87,(OX0228),
          OX88,(OX0228),OX89,(OX0228),OX8A,(OX0228),OX8B,(OX0228),
          OX8C,(OX0228),OX8D,(OX0228),OX8E,(OX0228),OX8F,(OX0228)
```

```
;
NMBCKT  = 1          ;NUMBER OF ACTIVE CIRCUITS
CKTAST  = (OXO200),CKTDRA ;CIRCUIT ASSIGNMENT TABLE, AUTO NODE ID
DEFDID  = (OXO228)        ;DEFAULT NETWORK DESTINATION ID (MASTER)
NMBMBS  = 2          ;NUMBER OF PRE-ALLOCATED MESSAGE BUFFERS
NMBRPS  = 2          ;NUMBER OF PRE-ALLOCATED REPLY BUFFERS
MAXMBS  = 6          ;MAX NUMBER OF MESSAGE BUFFERS
MAXRPS  = 6          ;MAX NUMBER OF REPLY BUFFERS
;
;LANSGA  = (OXEOOO)  ;LANPC MEMORY SEGMENT ADDRESS
;LANIOA  = (OXO200)  ;LANPC I/O BASE ADDRESS
;LANRPA  = 0         ;RESET PRESENT FLAG (OXFF=ENABLED)
;LANTFA  = 0         ;DISABLE SEND MESSAGE TIMEOUT ROUTINE
                        (OXFF=ENABLED)
;LANTCA  = 10        ;SEND MESSAGE TIMEOUT IN SECONDS (O=256 SECS.)
;
SLFLAG  = 0          ;INIT TO STATUS LINE OFF (SCRIPC)
;
```

TDOSXT.GEN - COMPLEX SLAVE FOR THE IBM-PC/XT.

```
STDSLAVX          ; Standard complex slave OS
NETSVC            ; Network server module
SUBMIT,CPMSUP
MSTIPCXT          ; IBM-PC/XT Memory specification table
NITIPC            ; IBM-PC initialization module
SOMIPC            ; IBM-PC sign-on message module
CDRIPC,SCRIPC     ; IBM-PC smart console interface
;CON96            ; Null console interface
;SIOIPC           ; IBM-PC comm channel driver
DSKIPC            ; IBM-PC floppy disk driver
HDCIPC            ; IBM-PC hard disk driver
RTCIPC            ; IBM-PC real-time-clock driver
LANIPC            ; IBM-PC local area network driver (ARCNET-PC)
```

TDOSXT.PAR - COMPLEX SLAVE FOR THE IBM-PC/XT.

```
USRSOM  = OXOD,OXOA,"IBM-PC/XT COMPLEX SLAVE (8/07/84)"
;
COMPAT  = OXB8    ;COMPATABILITY FLAGS
ATNCHR  = 0       ;ATTENTION CHARACTER
AUTUSR  = OX80    ;AUTO LOGON USER NUMBER
OSMLEN  = 256     ;O/S MEMORY LENGTH
;
SRHDRV  = OXFF    ;O/S PROGRAM SEARCH DRIVE (O=OFF,1-16="A"-"P",
                    FF=BOOT DRIVE)
;LDCOLD  = 0      ;COLD START AUTOLOAD ENABLE FLAG (O=DISABLE)
;LDWARM  = 0      ;WARM START AUTOLOAD ENABLE FLAG (O=DISABLE)
;NMBUFS  = 4      ;NUMBER OF BUFFERS
;
```

```
DSKAST  = OXOO,(DSKDRA),OXO1,(DSKDRA),OXOO,(DSKDRB),OX83,(OXO228),
          OX84,(OXO228),OX85,(OXO228),OX86,(OXO228),OX87,(OXO228),
          OX88,(OXO228),OX89,(OXO228),OX8A,(OXO228),OX8B,(OXO228),
          OX8C,(OXO228),OX8D,(OXO228),OX8E,(OXO228),OX8F,(OXO228)
;
PTRAST  = OX80,(OXO228),OX81,(OXO228),OX82,(OXO228),OX83,(OXO228),
          OX84,(OXO228),OX85,(OXO228),OX86,(OXO228),OX87,(OXO228),
          OX88,(OXO228),OX89,(OXO228),OX8A,(OXO228),OX8B,(OXO228),
          OX8C,(OXO228),OX8D,(OXO228),OX8E,(OXO228),OX8F,(OXO228)
;
QUEAST  = OX80,(OXO228),OX81,(OXO228),OX82,(OXO228),OX83,(OXO228),
          OX84,(OXO228),OX85,(OXO228),OX86,(OXO228),OX87,(OXO228),
          OX88,(OXO228),OX89,(OXO228),OX8A,(OXO228),OX8B,(OXO228),
          OX8C,(OXO228),OX8D,(OXO228),OX8E,(OXO228),OX8F,(OXO228)
;
NMBCKT  = 1          ;NUMBER OF ACTIVE CIRCUITS
CKTAST  = (OXO200),CKTDRA ;CIRCUIT ASSIGNMENT TABLE, AUTO NODE ID
DEFDID  = (OXO228)       ;DEFAULT NETWORK DESTINATION ID (MASTER)
NMBMBS  = 2          ;NUMBER OF PRE-ALLOCATED MESSAGE BUFFERS
NMBRPS  = 2          ;NUMBER OF PRE-ALLOCATED REPLY BUFFERS
MAXMBS  = 6          ;MAX NUMBER OF MESSAGE BUFFERS
MAXRPS  = 6          ;MAX NUMBER OF REPLY BUFFERS
;
;LANSGA  = (OXEOOO) ;LANPC MEMORY SEGMENT ADDRESS
;LANIOA  = (OXO200) ;LANPC I/O BASE ADDRESS
;LANRPA  = O          ;RESET PRESENT FLAG (OXFF=ENABLED)
;LANTFA  = O          ;DISABLE SEND MESSAGE TIMEOUT ROUTINE
                      (OXFF=ENABLED)
;LANTCA  = 10         ;SEND MESSAGE TIMEOUT IN SECONDS (O=256 SECS.)
;
SLFLAG  = O          ;INIT TO STATUS LINE OFF (SCRIPC)
;
```

TLOADPC.GEN - LOADER FOR THE IBM-PC.

```
STDLOADR            ; standard loader system
NITIPC              ; IBM-PC initialization module
CDRIPC,SCRIPC       ; IBM-PC smart console interface
                      (TVI-920 emulation)
;CON96              ; Null console interface
;SIOIPC             ; IBM-PC comm channel serial driver
DSKIPC              ; IBM-PC floppy disk driver
RTCIPC              ; IBM-PC real-time-clock driver
```

TLOADPC.PAR - LOADER FOR THE IBM-PC.

```
LODSEG  = 0x0050          ;LOAD SEGMENT PARAGRAPH ADDRESS
DSKAST  = O,DSKDRA,1,DSKDRA
SLFLAG  = O              ;INIT TO STATUS LINE OFF (SCRIPC)
```

TLOADXT.GEN - LOADER FOR THE IBM-PC/XT.

```
STDLOADR              ; standard loader system
NITIPC                ; IBM-PC initialization module
CDRIPC,SCRIPC         ; IBM-PC smart console interface (TVI-920 emulation)
;CON96                 ; Null console interface
;SIOIPC                ; IBM-PC comm channel serial driver
DSKIPC                ; IBM-PC floppy disk driver
HDCIPC                ; IBM-PC hard disk driver
RTCIPC                ; IBM-PC real-time-clock driver
```

TLOADXT.PAR - LOADER FOR THE IBM-PC/XT.

```
LODSEG  = 0x0050           ;LOAD SEGMENT PARAGRAPH ADDRESS
DSKAST  = 0,DSKDRA,1,DSKDRA,0,DSKDRB,0xFF,(0)
SCANDN  = OXFF             ;SCAN DEVICES DOWNWARD
SLFLAG  = 0               ;INIT TO STATUS LINE OFF (SCRIPC)
```

CPZMASTR.SYS - CPZ-4800X MASTER FILE SERVER.

```
STDMASTR              ; Standard networking master
;PATCH                 ; Include PATCH Module
FASLOD                ; Use fast disk loader module
NETREQ                ; Network request module
MSGFMT                ; Message format module
NETLOD                ; Network load module
NETFWD                ; Network forwarding module
CPMSUP                ; CP/M function support module
;CONREM                ; Use remote console module
;CON192                ; Null 19.2 Kbaud Console Driver
CON96                 ; Null 9600 Baud Console driver
CPZBRT                ; CPZ-48000 baud rate table and real time clock constants
CPZNIT                ; CPZ-48000 hardware initialization
CPZIO                 ; CPZ-48000 Serial and Parallel I/O
LSTCTS                ; TI810 CTS Driver (LSTDR@ assigned to LSTDRA)
;LSTPAR                ; Parallel Printer driver (CPI-100 centronics board)
CPZRTC                ; CPZ-48000 real time clock driver
;MSTRCLK               ; Include ICM clk board drvr to set TurboDOS date/time
CPZFDC                ; CPZ-48000 floppy disk driver
DSKFMT8               ; Disk specification tables for 8-INCH diskettes
MD131DRV              ; Monitor Dynamics Model #1013 with 1 drive installed
;MD132DRV              ; Monitor Dynamics Model #1013 with 2 drive installed
CPZMCD                ; CPZ-48000 / CPS-MX Master Circuit Driver
MCDS86                ; CPZ-48000 / CPS-16 Master Circuit Driver
LAN100                ; LAN100 Local Area Network driver
```

```
CPZMASTR.PAR - CPZ-4800X MASTER FILE SERVER.
-----------------------------------------------
AUTUSR = 80        ; Auto Log-on to user one, privileged
SRHDRV = OFF       ; Search system disk for command files
;LDCOLD = 0        ; Cold start autoload enable flag (FF=enabled)
;LDWARM = 0        ; Warm start autoload enable flag (FF=enabled)
;
COMPAT = OF8       ; File/Record Locking Flags
;
NMBUFS = OA        ; Number of Disk Buffers (hex)
BUFSIZ = 03        ; Disk buffer size (log2(size/128))
MEMRES = (0400)    ; Memory reserved for the OS
;
NMBCKT = 3         ; 2 circuit drivers
CKTAST = (0000),CKTDRA,(0100),CKTDRB,(0200),CKTDRC
;
;++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
;                      **** NOTE ****                                  +
;     NMBMBS & NMBRPS must be preset for LAN100 driver.                +
;                                                                      +
NMBSVC = 02        ; Number of "Server Processes" (LAN100 slaves)  +
NMBMBS = 06        ; Pre-allocate NMBSVC * 3 message buffers        +
NMBRPS = 06        ; Pre-allocate NMBSVC * 3 reply buffers          +
;                                                                      +
;++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
;
;   8 Bit Slave Options
;
;PATCPS = 7F,7E,7D,7C   ; Status port table for CPS-MX
;SSTCPS = "          "; O/S suffix table for CPS-MX
;
;   16 Bit Slave Options
;
;PATS86 = 3F,3E,3D,3C   ; Status port table for CPS-86
;SRSTAD = 8F        ; If using 256K Byte rams
;SRSTAD = 4F        ; If using 64K Byte rams
;SSTS86 = "Z       "; O/S suffix table for CPS-86
;
;   LAN100 options
;
;LANSGA = (0B800)       ; LAN memory segment base address
;LANIOA = 068       ; LAN I/O base address
;LANTFA = OFF       ; LAN timeout enable flag
;LANTCA = OOA       ; LAN timeout count in seconds
;LNSSTA+2 = "I"     ; LAN download suffix table (256 bytes)
;
CONAST = 01,CONDRA     ; Console on port 1 of CPZ-48000
;STOPBB = 44
;
PTRAST = OO,LSTDRA     ; List assignment table
STOPBA = 44
```

```
;
FLSRT  = 01                    ; Floppy step rate (0=3ms,1=6ms,2=10ms,3=15ms)
ATNCHR = "^@"                  ; New attention character (Break Key)
PRTMOD = 1                     ; Print mode (0 = direct, 1 = Spooled)
;
;  Disk Assignment Table.
;  Drives A&B are floppy drives, Drive E is the MD hard disk.
;  Drive F is remote on LAN100 circuit (drive F).
;
DSKAST = 000,DSKDRA,001,DSKDRA,OFF,(0000),OFF,(0000)
         001,DSKDRB,085,(0202)
```

6. HARDWARE CONFIGURATION

   All LANPC boards for all systems reside in the same memory
space and I/O space address. Each board shipped from
Intercontinental Micro Systems will be configured for their
default Memory and I/O space address, so that the customer will
not have to be concerned about it.

DEFAULT Packet Buffer/EPROM Address = E0000h
DEFAULT I/O address = 00200h

   Each LANPC board will also be shipped with the board ID
jumpers already set. The ID jumpers establishes that board's
network ID address so that during a power up, the entire network
can establish who is attached to the network. Under no
circumstances should 2 or more boards have the same ID switch
settings while attached to the same coax bus structure. Each PC
system must have its own ID setting. NOTE: ID setting 00 is not
allowed on any LANPC board as this is the Internal Broadcast ID
of the 9026 to all LANPC boards attached to the system. The
GLOBAL Broadcast function is not used by I.C.M.

ID Jumper Settings

O = Open jumper position
S = Close jumper position

Position ---	1	2	3	4	5	6	7	8
ID	¦	¦	¦	¦	¦	¦	¦	¦
01	S	S	S	S	S	S	S	O
02	S	S	S	S	S	S	O	S
03	S	S	S	S	S	S	O	O
04	S	S	S	S	S	O	S	S
05	S	S	S	S	S	O	S	O
				etc				
FE	O	O	O	O	O	O	O	S
FF	O	O	O	O	O	O	O	O

------------   ---------------------------------
NODE SELECT   &   CIRCUIT NUMBER (CIRCUIT NO)
------------   ---------------------------------

```
              +-CKT-+ +--NODE SELECT--+
              ¦ NO  ¦ ¦ ¦             ¦
              lsb           msb
              +----------------------------+
        on    ¦ [] [] [] [] [] [] [] [] ¦
        off   ¦ [] [] [] [] [] [] [] [] ¦
              +----------------------------+
              ¦ 1  2  3  4  5  6  7  8 ¦
              +----------------------------+
```

        To configure the LANPC Node & Circuit numbers, follow the
table below:

                    CIRCUIT NUMBER

S2	S1	Circuit Number
C	C	0
C	O	1
O	C	2
O	O	3

NODE SELECT

S8	S7	S6	S5	S4	S3	Node Select
C	C	C	C	C	C	0
C	C	C	C	C	O	1
C	C	C	C	O	C	2
C	C	C	C	O	O	3
C	C	C	O	C	C	4
			..			..
			..			..
O	O	O	O	O	C	62
O	O	O	O	O	O	63

Note: 1. A closed switch position corresponds to a logic 0 setting and is designated in the tables above as "C". An open switch position corresponds to a logic 1 setting and is designated in the tables above as "O".

2. Under no circumstances should 2 or more boards have the same Node and Circuit Number settings while attached to the same coax bus structure. Each PC system acting as a fileserver must have its own unique Node and Circuit Number settings.

LANPC STATUS

```
BIT  0 1 2 3 4 5 6 7
     | | | | | | | |
     | | | | | | | +-----(RI) Receiver Inhibited
     | | | | | | |
     | | | | | | +-------(ETS2) Extended Timeout Status 2
     | | | | | |
     | | | | | +---------(ETS1) Extended Timeout Status 1
     | | | | |
     | | | | +-----------(POR) Power On Reset
     | | | |
     | | | +-------------(TEST) Test
     | | |
     | | +---------------(RECON) Reconfiguration
     | |
     | +-----------------(TMA) Transmit Message Acknowledged
     |
     +-------------------(TA) Transmitter Available
```

LANPC COMMANDS

One of the eight commands may be executed by the LANPC. See
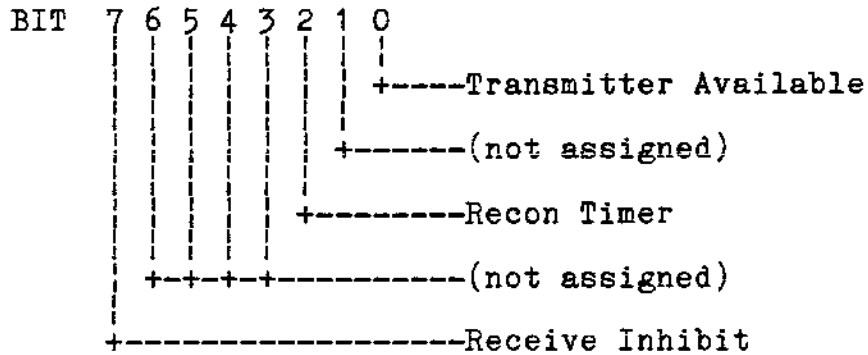Command Register Bit assignments below:

```
BIT  7 6 5 4 3 2 1 0
     | | | | | | | |
     | | | | | | | |
     0 0 0 0 0 0 0 0   Reserved For Future Use
     0 0 0 0 0 0 0 1   Disable Transmitter
     0 0 0 0 0 0 1 0   Disable Receiver
     0 0 0 n n 0 1 1   Enable Transmit from Page nn
     b 0 0 n n 1 0 0   Enable Receive to Page nn;
                           Broadcast if b=1
     0 0 0 0 c 1 0 1   Define Configuration; c defines
                           Data Packet Buffer(DPB) Size;
                           c=1 DPB=2K; c=0 DPB=1K
     0 0 0 r p 1 1 0   Clear Flags; p=1 clears POR
                           status; r=1 clears RECON status
```

INTERRUPT LINES

    The interrupt pulse is generated by the LANC when certain
status bits go active and corresponding register bit positions in
the MASK register are set true. See MASK register bit assignments
below.

```
BIT  7 6 5 4 3 2 1 0
     | | | | | | | |
     | | | | | | | +-----Transmitter Available
     | | | | | | |
     | | | | | | +-------(not assigned)
     | | | | | |
     | | | | | +---------Recon Timer
     | | | | |
     | +-+-+-+-----------(not assigned)
     |
     +-------------------Receive Inhibit
```

**** WARRANTY ****

All products sold hereunder are under warranty on a return to factory basis against defects in workmanship and material for a period of one (1) year from the date of delivery.

Conditions of this warranty are as follows: Purchaser must 1) obtain a return material authorization (RMA) number and shipping instructions, 2) product must be shipped prepaid, 3) written description of the failure must be included with the defective product. All transportation charges inside the continental U.S. will be paid by Intercontinental Micro Systems (ICM) Corp. For products returned from all other locations, transportation must be prepaid. Should ICM determine that the products are not defective, the purchaser must pay all return transportation charges. All repairs will be provided at repair rates being charged at the time by ICM. Under the above product warranty, ICM may, at its option, either repair or replace any component which fails during the warranty period providing the purchaser has reported same in a prompt manner. All replaced products or parts shall become property of ICM.

All above warranties are contingent upon proper use of the product. These warranties will not apply 1) if any repair, parts replacement, or adjustments are necessary due to accident , unusual physical, electrical or electromagnetic stress, neglect, misuse, failure of electric power, air conditioning, humidity control, transportation, failure of rotating media not furnished by ICM, operation with media not meeting or not maintained in accordance with ICM specifications or causes other than ordinary use, 2) if the product has been modified by purchaser, 3) where ICM's serial numbers or warranty date decals have been removed or altered, 4) if the product has been dismantled by purchaser without the supervision of or prior written approval of ICM.

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After the warranty period, the products will be repaired for a service charge plus parts, provided that it is returned prepaid to ICM after retaining a return material authorization (RMA) number.