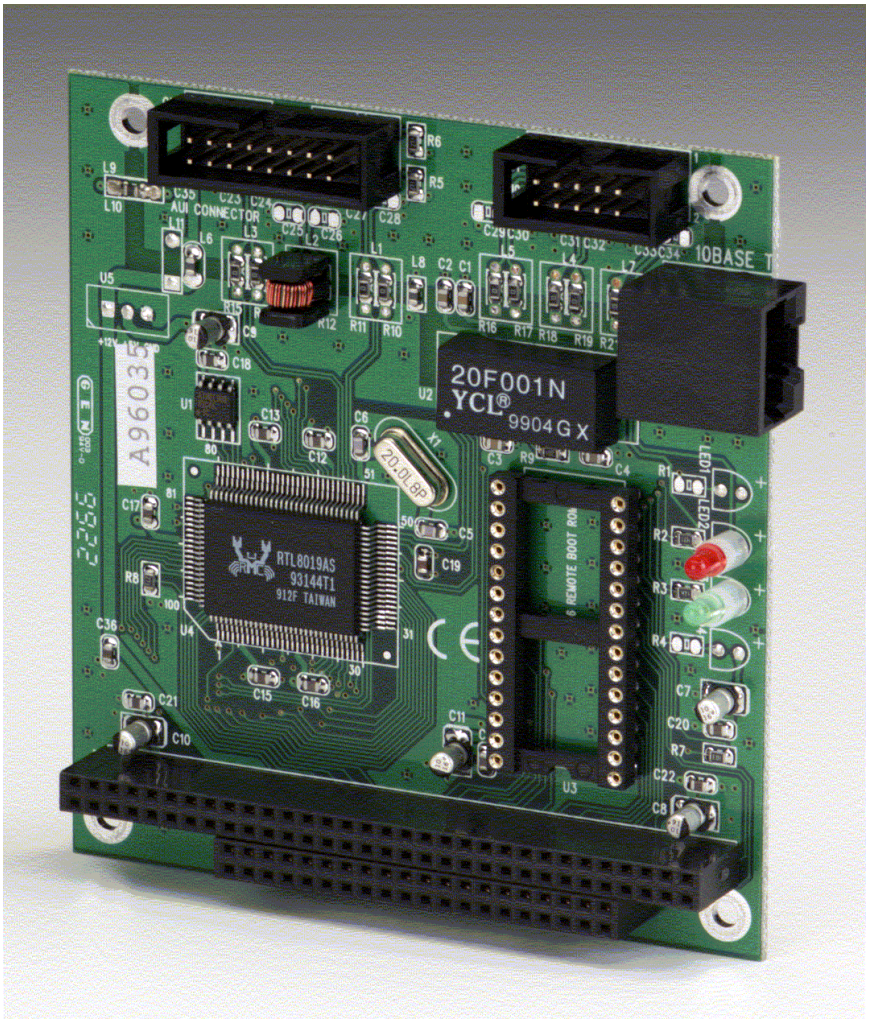
Technical Manual

SMART TRAC™
Ethernet Card



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Safety and Warranty Information

Warnings, Cautions and Notes

WARNING

A statement of conditions which MUST BE OBSERVED to prevent personal injury or death.

WARNING - ESD

A statement of conditions which must be observed to prevent damage to components due to ESD (ElectroStatic Discharge) and to prevent personal injury or death.

CAUTION

A statement of conditions which must be observed to prevent undesired equipment faults, Smart Trac AC1 system degradation and damage to equipment.

IMPORTANT

A statement of conditions which should be observed during Smart Trac AC DeviceNet setup or operation to ensure dependable service.

NOTE: Notes indicate information that is in addition to a discussion of the topic in adjoining text. Alternatively, it may limit or restrict the paragraph(s) that follow(s) to specific models or conditions.

TIP - Tips indicate information that should make a procedure easier or more efficient.

General Safety Precautions - Warnings

Important safety information follows. Please *read and understand* all precautions listed below before proceeding with the specification, installation, set-up or operation of your Smart Trac AC1. Failure to follow any of the following precautions may result in personal injury or death, or damage to the equipment.

WARNING - ESD

The Control Printed Circuit Board (PCB) employs CMOS Integrated Circuits that are easily damaged by static electricity. Use proper ElectroStatic Discharge (ESD) procedures when handling the Control PCB. See Smart Trac AC1 Technical Manual for details. Failure to comply may result in damage to equipment and/or personal injury.

Important Warranty Information.

Do not modify your Smart Trac AC1, its components, or any of the procedures contained in the technical documentation supplied by MagneTek. Any modification of this product by the user is not the responsibility of MagneTek and will void the warranty.

Smart Trac Ethernet Card

General Capabilities

With the Smart Trac Ethernet Card in your Smart Trac AC1, your system is fully compatible with the IEEE 802.3 Ethernet standard, the most widely used local area network (LAN) standard. The card provides a fast, reliable, PC-based interface to the Smart Trac AC1. As an alternative to a serial RS-232 connection, a Smart Trac Ethernet card may be used for high speed (10 Mbps) monitoring, program uploading and downloading, and running diagnostics.

Smart Trac AC1 on an Ethernet Network

The card also allows quick, easy and inexpensive networking of a Smart Trac AC1 with PCs, other Smart Trac AC1s, and other industrial devices. Using the TCP/IP protocol means that your Smart Trac AC1 system may operate as part of a Local Area Network (LAN) or a Wide Area Network (WAN).

Specifications

- Hardware and software compatible with Novell NE2000 ISA bus Ethernet adapter and PC/104 standard
- Complies with the 802.3 CSMA/CD Ethernet standard for 10 Mbps data transfer.
- Built-in 10Base-T transceiver for unsheilded, twisted pair cabling up to 100 meters in length. Optional 10Base2 transceiver module. AUI connector for external 10Base5 transceiver
- Single +5V power supply at 400 milliamp maximum without external transceiver).
- Two diagnostic LEDs
- On-board 32K memory provides a high-performance, multi-package buffer.
- Operating Temperature: 0° C to 70° C
- Operating Humidity: 10% to 90%

System Requirements

- Smart Trac AC1 Drive
- Smart Trac CPU card
- Smart Trac PS card
- Smart Trac Ethernet Network Option Kit
- Microsoft Windows NT 4.0 or newer version
- Smart Trac Workstation Lite™ software
- Ethernet 10Base-T twisted pair crossover cable OR two Ethernet 10Base-T twisted pair straight cables and an Ethernet hub

Quick Start

Your Smart Trac Ethernet card is ready to install. Its base I/O address is set at 0x320 hexadecimal with an IRQ of 5.

1. Power OFF your Smart Trac AC1, lock out and tag "Out of Service."
2. Remove any existing PC/104 option cards from your Smart Trac AC1.
3. Install the Smart Trac Ethernet card on top of the Smart Trac PS Card.
4. Install any Smart Trac cards previously removed.
5. Connect the Ethernet network crossover cable between a PC and your Smart Trac AC1. Optionally, you may install one Ethernet straight cable between PC and hub with another straight cable between hub and Smart Trac AC1.
6. Power up your PC, hub and Smart Trac AC1.
7. Test your card installation.

Ethernet Basics

Introduction

Ethernet is a low cost, widely used LAN access method. Originally developed by Intel, Digital (now Compaq), and Xerox, it is an open network standard (IEEE 802.3).

The Open Systems Interconnect (OSI), established in 1984 by the ISO (International Standards Organization), divides network functions into seven layers: Physical, Data Link, Network, Transport, Session, Presentation and Application Protocol.

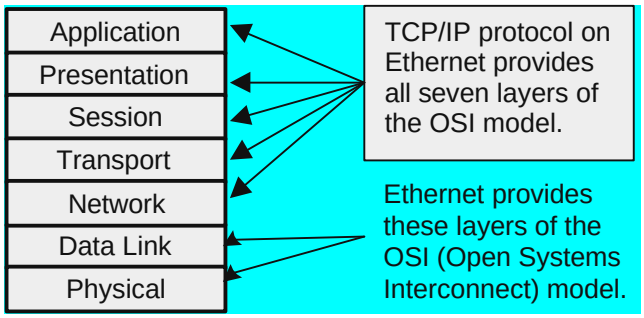

Figure 1. Ethernet and the OSI Model.

- The Physical Layer transforms data into bits that are sent across the physical media.
- The Data Link layer determines access to the network media in terms of frames. Its Media Access Control (MAC) sublayer is responsible for physical addressing.
- The Network Layer routes data through a large network.
- The Transport Layer provides end-to-end, reliable connections, often in terms of segments.
- The Session Layer allows users to establish connections using intelligently chosen names in packets.
- The Presentation Layer negotiates data exchange formats, also in terms of packets.

- Finally, the Application Layer provides the interface between the user's application and the network through messages.

Data is said to move from layer to layer within the seven layers of the OSI model.

Ethernet and the OSI Model

Ethernet supports the physical and data link layers. With TCP/IP as its protocol, it supports all seven layers of the OSI model.

Several types of Ethernet cables support the physical layer. See "Cabling and Cable Lengths" for details.

Using Carrier Sense Multiple Access/Collision Detection (CSMA/CD), Ethernet supports the data link layer. CSMA/CD checks the media for other devices before transmitting, managing data collisions and reducing the number of data collisions.

TCP/IP and the OSI Model

Ethernet uses Transmission Control Protocol/Internet Protocol (TCP/IP) to provide layers of the OSI model. Although developed under an older four-layer network model developed by the U.S. Department of Defense (DoD), we can loosely fit the four layers of the DoD model to the seven of the OSI model.

Physical and Data Link layers are supported through the Network Access layer of the DoD model. TCP/IP can run on many types of network connection, including ethernet. Ethernet supports both the Physical and Data Link layers of the OSI model.

The Network layer of the OSI model corresponds with the Internet layer of the DoD model. Internet Protocol provides this layer, moving data to other devices on the network.

The Transport layer corresponds to the Host-to-Host layer of the DoD model. Almost all devices on a TCP/IP network are considered hosts, and this layer communicates data peer-to-peer (or host-to-host).

The Session, Presentation and Application layers of the OSI model correspond to the Process/Application layer of the DoD model, providing network services.

Ethernet Network Topology

Devices on an Ethernet network are arranged in either a *bus* or *star* topology.

Bus

In a bus topology, all devices on the network connect to one trunk cable. This makes it easy to install and configure, and inexpensive. Ethernet in a bus topology requires no special equipment to amplify or regenerate the signal. Any device wanting to send information must first determine if the bus is being used by any other device. If no other device is attempting to transmit, the device sends the data. Bus networks generally require that proper terminations are made at each end of the trunk. If the trunk cable fails, all devices are affected.

Star

In a star topology, a separate cable connects each device with a central device, typically a hub. Unlike the bus topology, if a cable fails it affects only the one device connected to the failed cable. Star networks are easily expanded, easier to troubleshoot and support many types of cables. To connect more than two devices together in a star topology requires the use of either a passive or active hub. Passive hubs do not regenerate the signal. Use of active hubs extends network length by regenerating the signal and sending it across the network.

A typical PC-based network for operation of Smart Trac AC1s is depicted in Figure 2.

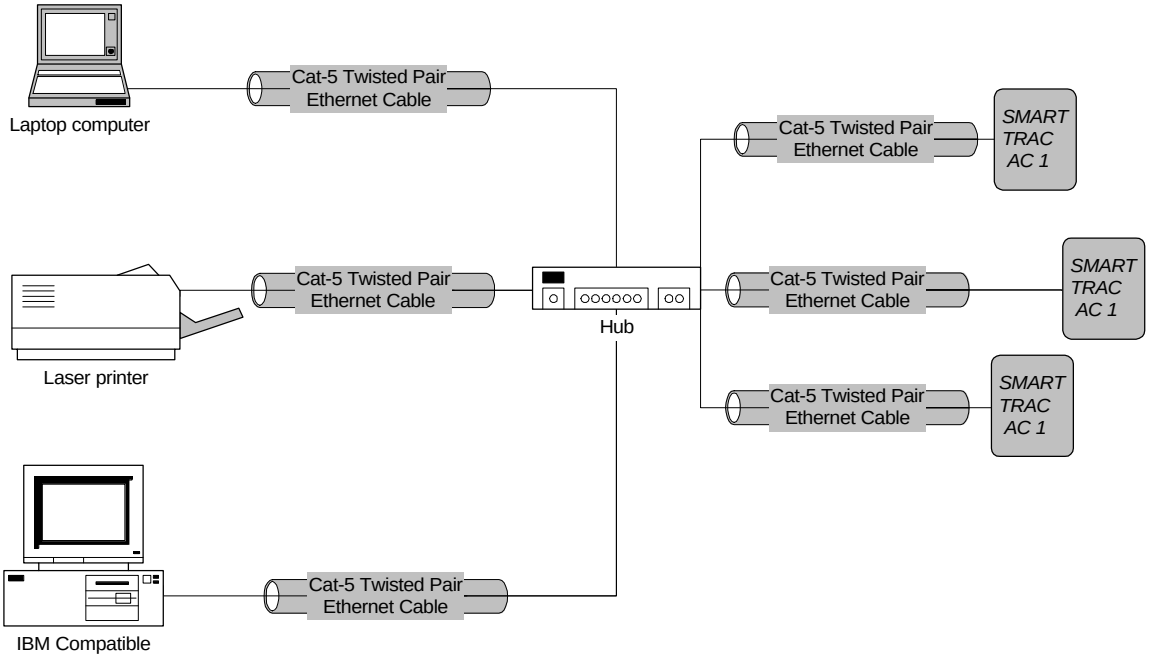

Figure 2. A typical local area network used for PC-based operation of Smart Trac AC1s.

Cabling and Cable Lengths

Ethernet supports several types of cables, each intended for different purposes:

- 10Base-T (Twisted-pair Ethernet) – The most widely used Ethernet cabling, it supports network speeds of 100Mbps. Uses 22- or 26-AWG UTP cabling to transmit baseband signals on maximum 100-meter segments. RJ-45 jacks connect separate cables between device and hub. Each device must be at least 2 feet apart and no more than 328 feet from the hub. Bridges or routers may be used to accommodate a larger network. There is no limit on network length. It permits a maximum of 1,024 segments and 1,024 nodes. See IEEE standard 802.3i.
- 10Base-2 (Thin Ethernet) – Supports network speeds of 10Mbps. Uses RG-58 coaxial cable to transmit baseband signals on 200-meter segments. Total network length can be 925 meters. Transceivers reside on the NIC, simplifying connections. The cable, thinner than 10Base-5, is more flexible for easier handling. See IEEE standard 802.3a.
- 10Base-5 (Thick Ethernet) – Now rarely used, this cable was popular for desktop connections until the introduction of 10BaseT. It supports networks speeds of up to 10Mbps and uses RG-8 or RG-11 coaxial cable to transmit baseband signals in 500-meter (1,640 feet) segments. Total network length can be 2,500 meters with up to 300 nodes. It requires the use of transceivers located at least 8 feet apart and tapped into the cable. A 15-pin AUI, or DIX (Digital, Intel, Xerox) connector is used between the network cable and the AUI port on the Ethernet NIC (Network Interface Card). See IEEE standard 802.3 for details.

Ethernet Hub or Crossover Cable?

An Ethernet hub is required if connecting more than two devices (more than one Smart Trac AC1 and one computer). If only connecting a single Smart Trac with a single computer, you need only a special "crossover" or "uplink" Ethernet cable.

You may construct a crossover cable using UTP Category 5 cable, two twisted pair connectors (WE8W 8 pin modular) and the pinouts indicated in Figure 3. The Tx and Rx pairs are swapped (orange and green wires, 1, 2 and 3, 6). You can locate Pin 1 of a twisted pair connector (WE8W 8-pin modular) by holding the connector with the keytab down and the contacts up. Looking from the back of the connector where the wire will be inserted, pin 1 is on the left.

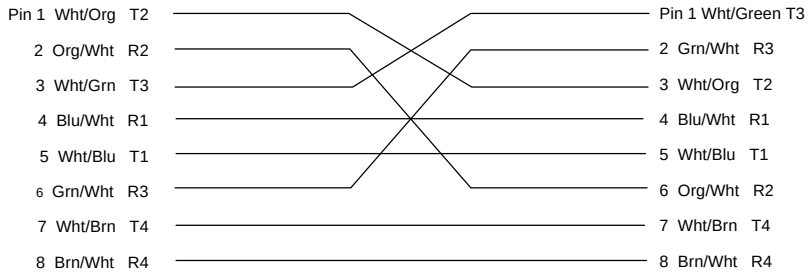

Figure 3. Ethernet crossover cable pinout.

Installing the Smart Trac Ethernet Card

Unpacking

Electrostatic Discharge (ESD) Procedures

WARNING - ESD

Keep electronic circuit boards in Electrostatic Discharge (ESD) protective bags when not being handled. Use proper ESD procedures (including an ESD wrist strap) when handling circuit boards. Failure to comply may result in damage to equipment.

When working with an electrostatic discharge (ESD) sensitive device, you should be grounded at all times. The easiest and most common way to provide this ground is to use an approved ESD wrist strap. The strap is secured to your wrist with a wire attached to the strap and clipped or taped to the chassis of the unit being worked on. Any static is dissipated through the wire to ground, greatly reducing the possibility of damage to the device.

It is a good idea to touch the chassis with your finger before handling any electrostatic sensitive device. Any static electricity will be discharged to chassis ground and will not be transferred to the device.

Always store devices (cards, other electronic components) in ESD protective bags when not being handled.

Unpacking Procedure

Remove the protective shipping and packing material from the card. Ensure contact wedges and other shipping devices have been removed.

Installing the Smart Trac Ethernet Card

The Smart Trac Ethernet Card must be positioned above the Smart Trac PS Card in the Smart Trac card stack.

NOTE: If replacing or adding a Smart Trac Ethernet card to an existing Smart Trac card stack, see "Appendix D – Removing the Smart Trac Card Stack" before continuing.

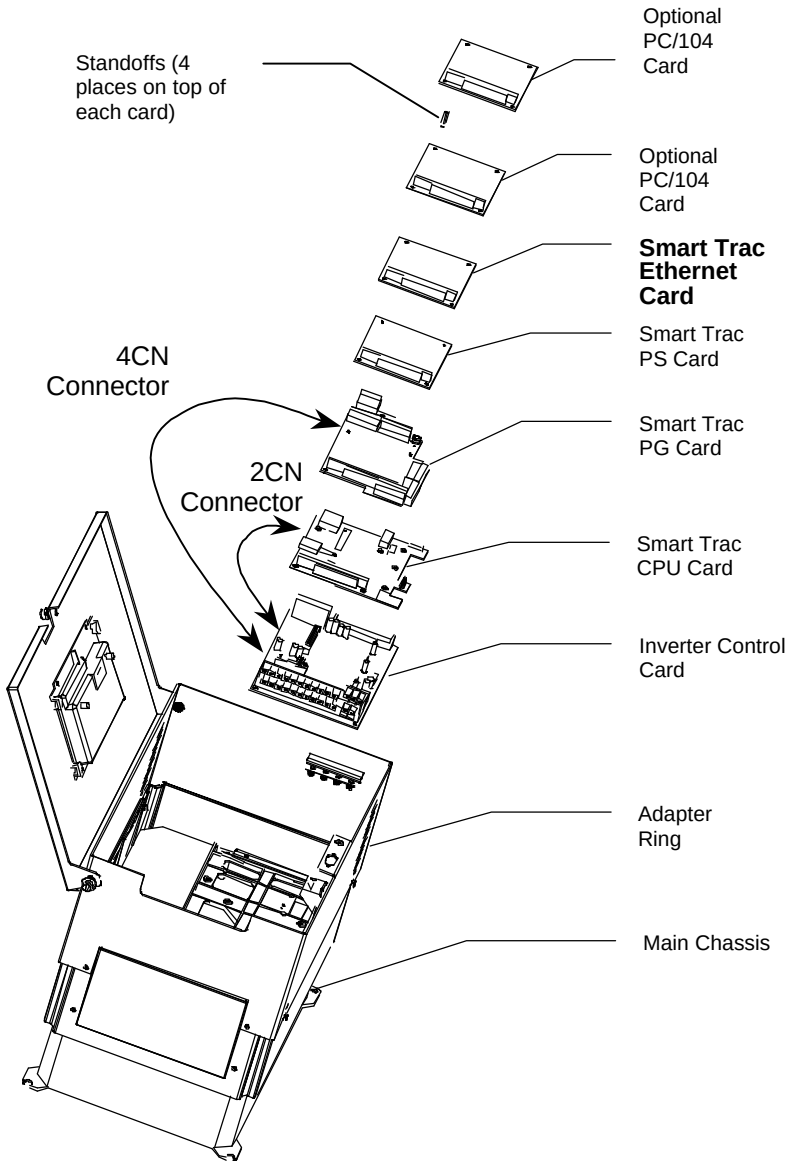

Figure 4. Smart Trac Ethernet Card Stack Position

1. To install the Ethernet card, orient the pins on the card at ZJ1 and ZJ2 with the female pin connector on the card below it (the PS Card). Gently but firmly push the Smart Trac Ethernet card onto the card below it. Make sure connecting pins are in alignment before pushing the two boards tightly together. Secure the card using four (4) metal standoffs.
2. Replace all other cards, securing each with four (4) metal standoffs and the reverse of steps in "Appendix D – Removing the Smart Trac Card Stack".

Connecting the Smart Trac Ethernet Card to an Ethernet Network

1. Take one of the following three actions:
   - Using twisted pair cable for 10Base-T, plug the RJ-45 UTP cable connector into the receptacle at the RJ-45 connector on the card.
   - If using an AUI Ethernet connector for 10Base5, connect the Thick Ethernet RG-8 or RG-11 cable to the 16-pin AUI connector.
   - If using the optional 10Base-2 daughterboard, use either the BNC connector for a T-connection to 10Base-2 thin cable ethernet or the 16-pin connection to the AUI port.
2. Route cable so that it is not routed along with A/C wires. Ethernet cable should not be bundled. Before applying power to the system, inspect the planned cable route to ensure it is not near A/C wires .

Configuring the Smart Trac Ethernet Card

The Ethernet Card's Jumperless Settings

The Smart Trac Ethernet Card is preconfigured and jumperless.

Interrupt

The interrupt is factory-set to "5."

Using interrupt 5 assures you that there will be no conflicts with other basic Smart Trac components if all are set according to their default values.

Base I/O Address

The Base I/O Address is set to 0x320. You must maintain unique addresses and interrupts for all cards in the Smart Trac card stack.

Ethernet Network Configuration

Depending on whether you are networking for PC-based operation on a small LAN or an enterprise-wide LAN, you may need the assistance of your LAN Administrator to specify unique TCP/IP address, a subnet mask, and gateway addresses.

Addresses and subnet mask

All Ethernet cards use a unique TCP/IP address. Every device (Smart Trac AC1, printer, computer, etc) connected to a TCP/IP network requires at least one IP address, unique within that network. This is true whether the device is part of a control network or not.

A TCP/IP address (i.e. "207.21.32.12") identifies the unique network ID and host ID of a computer or host using 32-bit numbers. Each component number of the TCP/IP address, separated by a decimal point, is referred to as an "octet". This is because it can be represented by an eight-digit binary number.

For discussion of subnet masks and gateway addresses, see "TCP/IP Subnet Masks" and "The Gateway Address." However, you may not need to concern yourself with exactly what they are, viewing them only as values to be entered during configuration.

For typical applications, you may determine the subnet mask and gateway address as follows:

1. At the PC to which the Smart Trac AC1 is connected, select **Start, Settings, Control Panel**. The Control Panel dialog box appears, displaying the control icons.
2. Click the **Network** icon. The Network dialog box appears.
3. Click the **Protocols** tab.
4. In **Network** Protocols, select **TCP/IP Protocol**.
5. Click **Properties**, then read and record the subnet mask and gateway address of your computer. These same values will be entered into your Smart Trac AC1s, the desktop PC running Smart Trac Workstation software and any other devices on your LAN.

NOTE: For most applications, you may set the subnet mask and gateway address as described. The information in the balance of this chapter supplies details needed only in unusual situations. Further details are provided in the Application Notes entitled "TCP/IP and Ethernet Addressing."

Configuration for PC-Based Operation

You configure each Smart Trac TCP/IP address on your network using the digital operator. You configure the TCP/IP address, on a PC running Smart Trac Workstation, in Windows NT.

Entering addresses and subnet mask

To enter the TCP/IP address, Subnet Mask, and Gateway Address into the Digital Operator:

1. Press **MENU** on the digital operator within 2 seconds of bootup. The message "TCP/IP Config" screen should appear.
2. Press **DATA/ENTER**. You are prompted with the message "IP Address" and below it 0.0.0.0. or another IP address.
3. Press **DATA/ENTER**. The first digit of the first octet will flash, indicating it is ready to accept new data. Enter the values of each octet, in succession, pressing the right arrow key (**>RESET**) to move one octet to the right if all three digits of an octet are not required entries.
4. Once all octets are entered, press **DATA/ENTER** to accept the new IP Address.
5. Press the **UP** arrow key to the message "Subnet Mask". Enter it as you did the IP Address in step 3.
6. In a similar manner, enter the desired Gateway Address and DNS Server Address, should they be required.

NOTE: For most networks, the default of no gateway address and no DNS Server address should be accepted.

7. Press **MENU** when completed.

Configuration for an Enterprise-wide LAN

Smart Trac AC1s may be connected, in certain situations, to an enterprise-wide LAN. In such cases, your LAN Administrator will need to be involved to supply certain required addresses.

While you may be able to determine the TCP/IP address as described in "Configuration for PC-Based Operation", you may require the more detailed information below:

Obtaining TCP/IP addresses

The easiest way to obtain a TCP/IP address for your Smart Trac AC1 host or computer is to request one from your LAN Administrator. This is especially true if the device will be on a enterprise-wide LAN.

NOTE: If your internal network is to be used on a self-contained network and **not** connecting directly to the public internet or a larger enterprise-wide LAN, you may use any valid TCP/IP address except for certain reserved addresses (0.0.0.0, 127.0.0.1, 224.0.0.0 and 255.255.255.255). Most industrial devices fall into this category.

If on a private network (intranet) you may use any valid Class A, B, or C address, described below. Most other LANs fall into one of these address classes and are assigned by the corporation's LAN Administrator.

Any device that connects directly to the internet (not through a "proxy" server) must be assigned a network ID from the Internet Network Information Center (InterNIC at www.internic.com). Smart Trac AC1s do not fall into this category.

TCP/IP Address Classes

TCP/IP addresses are grouped into five classes, from Class A through Class E. The first octet of the IP address specifies its classification.

- Class A – First octet is between 1 and 126 (0 is not allowed, 127 is reserved as "loopback" address). Organizations with a very large number of hosts (networked devices) require a Class A address.
- Class B – First octet is between 128 and 191. Large organizations with as many as 65, 534 networked devices (workstations, printers, routers, etc) require at least a Class B address.
- Class C – First octet is between 192 and 223. A network with less than 255 networked devices may be assigned a Class C address.
- Class D – First octet is between 224 and 239. These addresses are for multicast groups, such as RealAudio and Microsoft NetShow.
- Class E – First octet is between 240 and 247. These addresses are reserved for experimental purposes.

TCP/IP Subnet Masks

A *Subnet Mask* defines the split between network and host (device) parts of the TCP/IP address. It identifies the network octets of the IP address with the number "255" or "252" and the host octets with the number "0". This defines the maximum number of different devices (hosts) allowed on the network. A subnet mask of 255.255.255.0, then, identifies the first three octets of the IP address as network parts and the last as a single host part. The use of "252" provides one or bits of additional resolution for hosts.

Example: The address 200.20.16.5 with a subnet mask of 255.255.0.0 identifies a network with (255*255)-2 hosts, or 65,534 hosts (two is subtracted to allow for reserved numbers) on the network identified as "200.20".

Fortunately, Microsoft's Windows NT assigns a default subnet mask to an IP address. It can be changed if necessary. The defaults result in the following maximum number of networks and hosts allowed per TCP/IP address:

- Class A – 126 networks, 16,777,214 hosts (default subnet mask=255.0.0.0).
- Class B – 16,384 networks, 65,534 hosts (default subnet mask=255.255.0.0)

- Class C – 2,097,152 networks, 254 hosts (default subnet mask=255.255.255.0)

The Gateway Address

The Gateway Address provides the IP address to which packets of data should be sent to route them to their final destination, if on a large enterprise-wide LAN or the internet. While the Smart Trac AC1 allows you to change the gateway address to any required, *the default of no address will work in nearly all situations*. In enterprise-wide LANs the default may not be acceptable. Contact your LAN Administrator to determine the proper gateway address.

The DNS Server Address

The DNS Server is unavailable for changes. This accepts the default of no address. Selecting DNS Server will cause a "Not Available" message to be displayed on the digital operator.

Verifying Your TCP/IP Configuration

Refer to your computer's Operating System documentation when installing TCP/IP services and protocol.

You typically verify your TCP/IP configuration with two simple commands: IPCONFIG and PING:

1. Click **START**, **PROGRAMS**, **COMMAND PROMPT**. A DOS window appears with the cursor at the default directory.

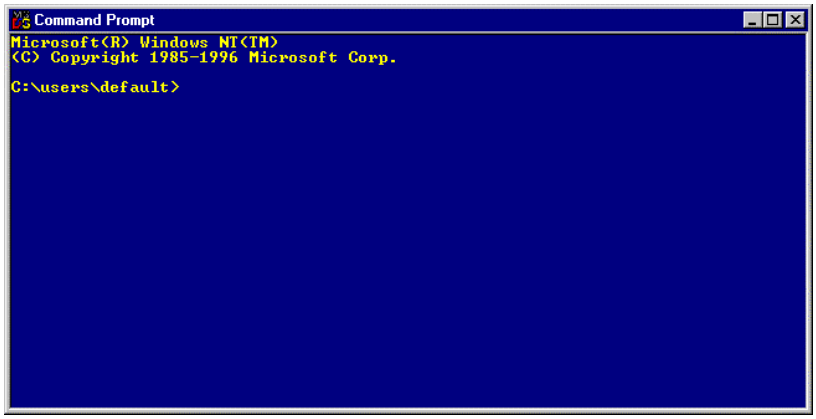

Figure 5. The Command Prompt from Windows NT

2. Type **IPCONFIG**. A listing should appear of the IP Address, subnet mask, and default gateway for all network adapters to which TCP/IP is bound on your computer.

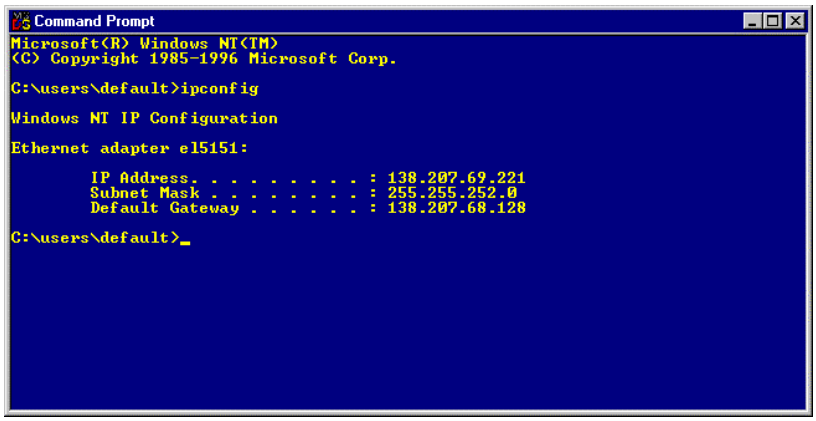

Figure 6. IPCONFIG results

3. Type **PING 127.0.0.1**. The PING utility, included in Windows NT, tests for proper TCP/IP configuration on your system with the special "loopback" address. You should get the results shown in the following screen. If not, the TCP/IP configuration is not correct and must be fixed before proceeding.

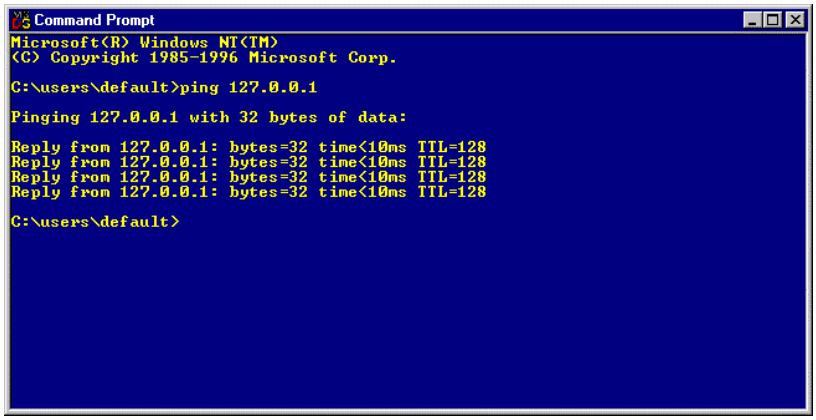

Figure 7. A successful PING of the computer you are using

4. Type **PING [Your IP Address]**. For example, type "PING 200.20.16.5" (substitute your computer's IP Address). Results similar to those in step 2 confirms that the IP address on your computer is configured correctly. You will also find out if duplicate addresses exist on your network.
5. Type **PING [Address of another networked computer]**. You should get results similar to those in step 2. This confirms the IP address of the chosen computer. You may test all other networked computers in the same way.
6. Type **PING [Address of the default network gateway]**. This step is necessary only if your system uses a gateway, to confirm your connection to the gateway.
7. Type **PING [Address of computer on other side of gateway]**. This step confirms that you can connect to remote computing resources. Again, it is only needed if your system uses a gateway and you need to access remote systems.

Testing Card Installation

Testing the Network

Once installed, check the on-board indicator Light Emitting Diodes (LEDs). Normally:

- red LED2 should be flashing, indicating network traffic from the card.
- green LED3 should be steady ON, indicating receive activity on the network and that your Smart Trac AC1 is an active participant in network activities.

On-board Indicator Lights

Two LEDs on the Smart Trac Ethernet Card indicate network activity and status information. For location, see "Appendix B – Card Layout."

Table 1. Interpretation of the LEDs.

On-board LED Functions	
LED	**Function**
LED2 (Red)	Network traffic present if flashing
LED3 (Green)	Ethernet card status OK if ON, not OK if OFF

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Troubleshooting Your Smart Trac Ethernet Card

Status and Error Messages

When installed, the Smart Trac Ethernet driver automatically creates a set of global

These global variables may be assigned symbol names and used in function blocks, application programs and/or the fault manager. If read by the fault manager, they may be programmed to annunciate and/or to be displayed on the Digital Operator as they occur.

Troubleshooting Ethernet Network Problems

Use the following general guidelines to troubleshoot your Ethernet network:

1. Disconnect parts of the network and watch where the fault goes. Disconnecting part of the network frequently solves the problem.
2. If the network was previously operating, determine what has changed.
3. Record symptoms in detail. Keep good notes about your network and its problems to properly define the problem.
    - Look for patterns in the symptoms. Do intermittent problems occur when other un-related equipment is in use?
    - Do some nodes communicate correctly? What is the difference between the functioning nodes and the others?

Table 2. Hardware Configuration Troubleshooting.

Troubleshooting Hardware Configuration		
Symptom	**Probable Cause**	**Corrective Action**
Devices will not communicate	Cable break, short or faulty cable connector	Check cable continuity for break or short. Inspect connector for damage, broken pins, or wires that have pulled loose. Repair or replace as necessary.
	Newly installed Ethernet Card not configured properly	Check jumper settings of other cards in the Smart card stack to eliminate any conflicting IRQ, I/O Base Address, modes, etc. Correct as required. Check LED3 (link activity). It should be ON, indicating a good connection with the hub (used if more than two devices on the network) or other device(s). If not ON, check for a loose or damaged connection at hub. Check hub for damage. Check LED2 (transmit activity). It should be ON intermittently, indicating that the card is transmitting data.
	Corrupt Ethernet card driver	Reinstall driver. Check configuration of Ethernet card and driver. Check IP address, subnet mask, and default gateway. Make changes as required.
	Improper network protocol selected	If network response slows down, check for a improper configuration in Windows NT.
	Power loss, surge or large fluctuations	Install an Uninterruptible Power Supply (UPS).

Appendix A – Technical Support

Technical Support

Should you need technical assistance with installation or troubleshooting of your Smart Trac AC1, you can phone our Help Desk at either (800)-541-0939 or (262)-782-0200. Alternatively, you may copy the *Problem Report* form, found on the next page, and fax it to us at (262)-782-3418.

Problem Report

Name:

Address:

City: State: Zip

Serial Number: Smart Trac PG Card

Occurrence: ☐ Frequently ☐ Intermittantly ☐ Rarely

Nature of Problem:

Conditions when problem occurs:

References

Ethernet	For a good primer on ethernet, visit Charles Spurgeon's Ethernet Web Site at: http://www.ots.utexas.edu:8080/ethernet
IEEE Standards 802.3, 802.3a, 802.3I	Institute of Electrical and Electronics Engineers. Standards may be downloaded on a subscription basis from the web site: http:http://www.standards.ieee.org
MagneTek Drives and Systems	For more information about MagneTek drives and systems, training programs and contacts, visit: http://www.magnetekdrives.com
MagneTek Drives and Systems Application Note "TCP/IP and Ethernet Addressing"	Obtain this Application Note from your MagneTek representative.
PC/104 Specification, Version 2.1	PC/104 Consortium. An overview and the specification may be obtained at the web site address: http://www.controlled.com/pc104/index.html
Windows NT 4.0	For information about Windows NT 4.0, technical support and troubleshooting your Ethernet network, contact Microsoft's web site at: http://www.microsoft.com

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Appendix B – Card Layout

Smart Trac Ethernet Card Layout

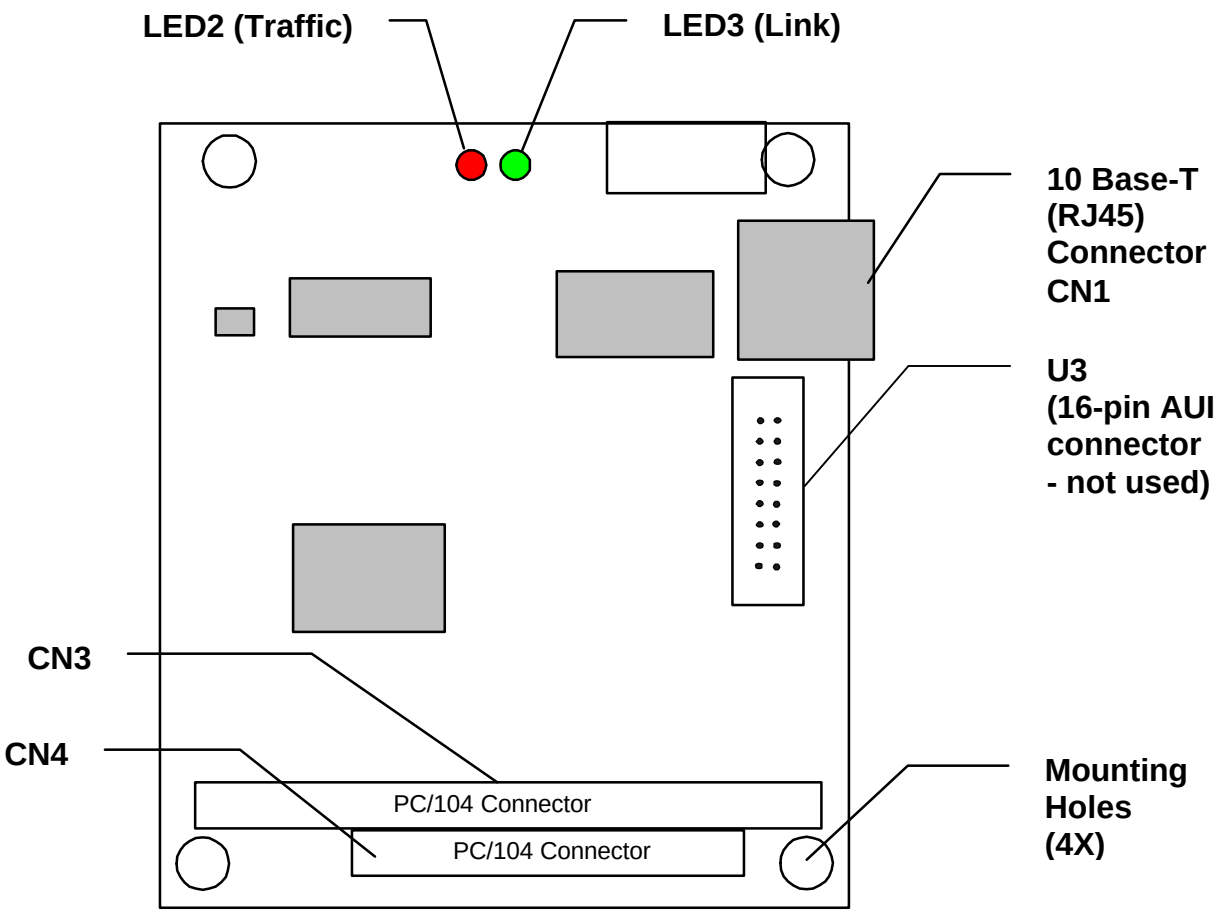

Table 3. Pinout of RJ-45 (10Base-T) Connector

Pin	Signal	Description
1	TD+	Data transmission positive
2	TD-	Data transmission negative
3	RD+	Data reception positive
6	RD-	Data reception negative

NOTE: To reduce crosstalk noise spikes in the Ethernet cable, it is recommended that you install a ferrite loop in the cable close to the RJ45 connection.

To further reduce noise in the Ethernet cable, use shielded-twisted pair cable with shielded connectors.

Appendix C – Replaceable Parts

Replaceable Parts Listing

Description	MagneTek Part Number	Qty
Smart Trac Ethernet Network Interface Option Kit	46S03643-0060	1
Technical Manual TM 73554-0060 – Smart Trac Ethernet Card	D-TM3554-0060	1
Card Extraction Tool	(Parvus Corporation P/N PRV-0760A-01)	Option
Standoffs, 4.5mm, Hex, Stl, CL ZINC, 15mm, M/F, M3, M3	05P00618-0006	4
Hardware Tools Kit for Smart Trac AC1	TBD	Option

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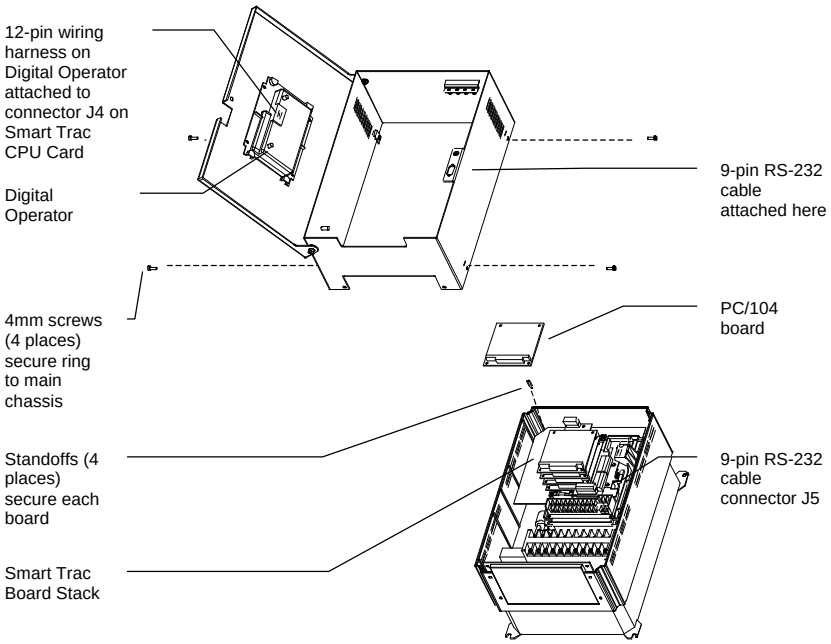
Appendix D – Removing the Smart Trac Card Stack

General Procedures

1. Power off the Smart Trac AC1. Disconnect it and tag "Out of Service".
2. Do one of the following:
   - Open the cover to the Smart Trac AC1 by rotating the spring-loaded, captive screw counterclockwise. Use a large screwdriver if necessary to free the slotted screw.

   OR

   - Loosen the screws holding down the cover.
3. Disconnect the 12-pin wiring harness from connector J4 at the digital operator.
4. Using the Phillips head screwdriver, remove the ground strap from the left inside and the ground strap from the top inside of the Smart Trac AC1 adapter ring.
5. Disconnect the 9-pin RS-232 cable at connector J5 on the Smart Trac CPU card.



6. Using a 4.5mm hex head driver, remove four standoffs from the topmost card.
7. Using the PC/104 extraction tool, remove the topmost card from the stack.

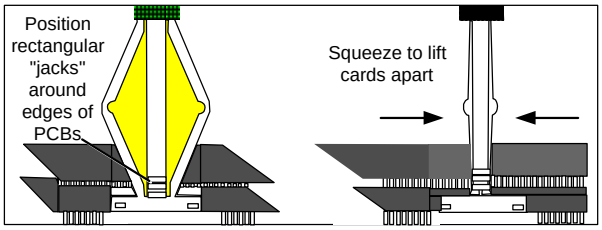


Figure 8. Using the PC/104 Extraction Tool.

8. Repeat step 8 above until all PC/104 cards have been removed.
9. *To remove the Smart Trac PG card*:
   - Disconnect the 4CN connector on the PG card.
   - Using a tubular extraction tool or pliers, squeeze the plastic, spring-loaded retainer built-in to the long plastic standoff located at the top of the PG card, just above connector J6.
   - Using a PC/104 extraction tool, remove the card.

NOTE: The Smart Trac PG card requires unique handling. Wedge the extracting tool between the PG card and the CPU card. The area between the terminal strip on the CPU card and the serial numbered edge of the PG card can be lifted first, then the opposite side (nearest TB1) on the PG card). Alternate sides until the card is free of the CPU card.

10. *To remove the Smart Trac CPU card*:

- Disconnect the card at the 2CN connector on the CPU card.
- The CPU card is secured with three plastic standoffs with spring-loaded clips on the end. Squeeze the top of the standoffs (the clips) with the special cylindrical removal tool, your fingers or needle-nosed pliers and lift the CPU card from the Smart Trac Inverter Control Card.

You have removed the entire card stack. The inverter card, considered part of the drive, is in clear view.

Glossary of Terms

Application Layer — The seventh layer of the OSI networking model. This layer provides the translation between an application program (which uses the network to move data) and the network. When a program makes an API (Application Program Interface) call, this layer determines the devices it must communicate with, whether a communications session should be established between devices, and if packet delivery must be guaranteed.

AUI — Acronym for Attachment Unit Interface. An AUI is a 15-pin connector, used to connect a cable to a network interface card, that allows for the use of a transceiver and is often used with a coaxial cable.

Bridges — An intellignet device used to transmit data from one network segment or port to another, according to a set of rules.

CSMA/CD — Acronym for Carrier Sense Multiple Access/Collision Detection. It is used to manage collisions of data packets on the network. When a collision is detected, it instructs each network card to stop transmitting, wait a random amount of time, then listen for other data transmissions before proceeding to transmit data frames.

Data Link layer — The second layer of the OSI network model. This layer creates and interprets frame types, and interprets the information received from the Physical Layer.

enterprise-wide LAN — A Local Area Network (LAN) that serves more than one purpose, may network devices physically separated by long distances, and may be connected to the internet.

hub — A connection device that receives a signal, then transmits it to the connected devices.

IEEE 802.3 — The open network Ethernet standard, issued by the Institute of Electrical and Electronics Engineers. The standard has sections to describe cable types, among others.

LED — Acronym for Light Emitting Diode.

Network Layer — The thrid layer of the OSI network model. It directs the flow of data from a source to a destination through addressing and routing. It must do this in spite of the fact that devices are not always on the same physical wire or segment.

NIC — Acornym for Network Interface Card. It is an adapter that transforms data into signals for transfer across the transmission media to a destination device.

PC/104 standard — An embedded PC bus standard. The standard defines the mechanical size of a self-stacking bus. Also an IEEE draft standard, called the P996.1 Standard for

Compact Embedded PC Modules, the PC/104 Specification, Version 2.1, July 1994, PC Consortium.

Physical Layer The first layer of the OSI networking model. This layer provides a physical connection for transmission of data bits over the network media and between devices.The layer also maintains data integrity as it moves from source to destination.

Presentation Layer The sixth layer of the OSI network model. This layer translates and converts data from one format to another as the data moves from one device to another (i.e. ASCII to EBCDIC).

router A device used to regenerate a signal's voltage and retransmit it, allowing longer network lengths. Unlike bridges, a router does not have the intelligence to distinguish signals directed to a device on the same segment and instead retransmits it to all segments on the network. This generates more traffic on the network than if a bridge were used.

Session Layer The fifth layer of the OSI networking model. The layer manages connections between two devices while they are communicating. It has built-in error correction and recovery. It determines whether all information has been sent or received between two networked devices.

topology The manner in which a network is configured, usually one or a combination of bus, star, ring.

Transport Layer The fourth layer of the OSI networking model. This layer concerns itself with the delivery of packets transmitted by the Network Layer. This may involve error control of data to guarantee delivery of the packets.

UTP Acronym for Unshielded Twisted Pair. UTP is a type of cable containing a pair of wires that are twisted at regular intervals to prevent signal interference with electrical noise. UTP is commonly used with 10Base-T Ethernet networks.

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SMART TRAC Ethernet Card

MagneTek
Drives and Systems
16555 West Ryerson Road
New Berlin, WI 53151
(800) 541-0939, (262) 782-0200, FAX (414) 782-3418

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