TouchStar™
User Manual
TS9000/TS9050

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INTRODUCTION _____ 1

TOUCHSTAR INFORMATION SYSTEMS OVERVIEW

Citadel's TouchStar Information Systems are PC-compatible computers ruggedized to withstand the physical shock, vibration and temperature extremes of harsh industrial or commercial environments. All TouchStar systems provide a touchscreen, 10.4" display (either electroluminescent or LCD) multiple network options and full I/O capability. Each TouchStar system is fully PC-compatible with MS-DOS, Versions 3.3 through 6.22, Windows for Workgroups 3.11, Windows 3.1, Windows 95, and Windows NT operating systems.

Figure 1. The TouchStar Information System
(Shown with two power supply options; optional mounting brackets not shown)

TS9000

The TS9000 is designed for fixed-mount applications. It is powered by a standard 110VAC outlet via a plug-in power supply. It is hard-wired into the local area network (LAN). Standard Ethernet or Token Ring hard-wired LAN connections are supported. The TS9000 can also be equipped with wireless (RF) network communications and used in fixed-mount applications where the installation of a hard-wired LAN is not practical or cost-effective.

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TS9050

The TS9050 is designed for vehicular-mounted applications such as on forklifts, hostlers and motorized pallets. It is powered from the vehicle's electrical system (battery) through a power converter. It uses a 2.4 GHz spread-spectrum radio link to communicate with (RF) network access points hard-wired into the LAN. Antenna options include patch and "rubber duck" types. Antenna connectors are non-standard to prevent antenna substitution and resultant operation in violation of FCC regulations.

Front Panel

The TouchStar front panel consists of a gasketed infrared touchscreen mounted over a flat-panel video display. The TouchStar is operated by touching the screen to activate functions and initiate actions. Programming guidelines for touch-screen-based applications are provided in separate manuals, *Touchscreen Driver for DOS* and *Touchscreen Driver for Windows*. An on-line help file is available for *Windows 95* and *Windows NT*. Press the help key to access the appropriate help file.

The TouchStar is factory-configured with either an electroluminescent or active-matrix LCD flat-panel display system. All touchscreen/display combinations operate in a similar manner. The type of display provided in your particular TouchStar model is matched to the specific requirements of your application including ambient lighting, available viewing angle and environmental extremes.

Rear Panel

All cabled connections to the TouchStar are made through the rear panel, with the exception of the RF connection in wireless communication-equipped systems. Located on the rear panel are a RESET button, a power connector, a parallel I/O connector, two serial I/O connectors, and dual PCMCIA slots. Also located on the rear panel are connectors for an external PS/2 keyboard, mouse, network connections, stereo speaker and microphone connections, and a locking keyboard connector. To use the locking keyboard connector, please contact Citadel Computer Corporation to order the mating cable.

Figure 2. Rear Panel

Internal Configuration

Figure 3 depicts the block diagram of the TouchStar system. Each of the blocks are described briefly below.
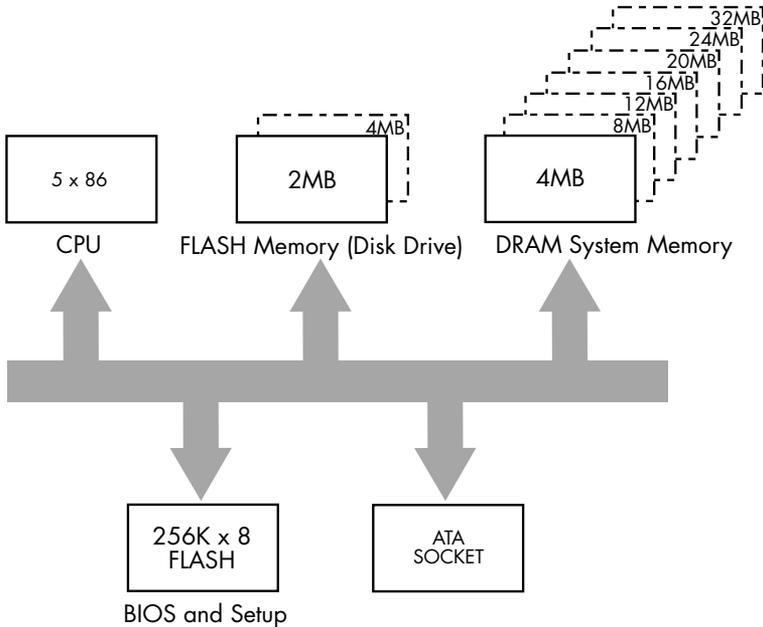
Figure 3. TouchStar Block Diagram

• **CPU and Memory**

The TouchStar is shipped with a 5X86 central processor unit (CPU). The system is configured with either 2MB or 4MB of non-volatile, solid-state FLASH memory to emulate standard drive functions. System memory is supplied as 4MB, 8MB, 12MB, 16MB, 20MB, 24MB, or 32MB of dynamic RAM (DRAM). The specific memory configuration is determined at the time the system is ordered. The FLASH device may be configured as drive c: or d:. Please refer to Table 1.

• **System Software**

A 256Kx8 flash device contains the System BIOS, the Video BIOS, and a Setup Utility.

• **Network Interface Card and Software**

The TouchStar is shipped with an on board single-chip ethernet controller. The TouchStar may also be factory configured with a Local Area Network Interface Card (NIC) installed in the system expansion slot. The specific NIC is determined by the type of network to be used, i.e. hard-wired or wireless. Each NIC has a unique hardware address and interrupt and DMA channel assignments, but no logical unit designation. The NIC allows the TouchStar to be configured for a variety of network environments.

The TouchStar is shipped with network protocol layers that are specific to the operating system or NIC. For the TouchStar to communicate with the network it requires the installation of a network driver (IPX). Both ODI and NDIS drivers support standard LAN operating systems.

• **ATA Socket**

The TouchStar is equipped with an internal dedicated ATA socket. The socket can be accessed by removing the rear cover. A standard Type II or Type III PC card, such as a Flash Card or miniature disk drive, can be installed. The ATA socket and on-board Flash memory are configured via jumper JP7, located adjacent to the socket. Please refer to figure 4 and Table 1.
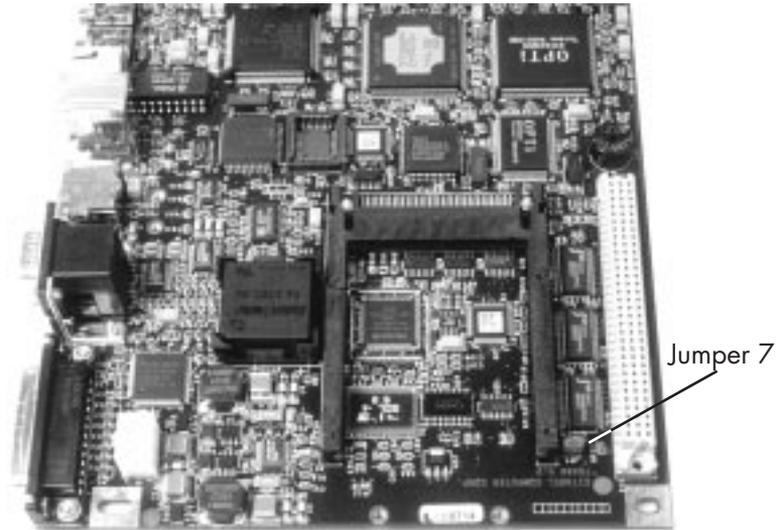
Figure 4. ATA Socket and Jumper JP7

TABLE 1 - JUMPER JP7		
Jumper JP7	**On-Board Flash**	**ATA Socket (P10)**
Removed	Drive C: (Master)	Drive D: (Slave)
Installed	Drive D: (Slave)	Drive C: (Master)

CAUTION — The ATA card is NOT hot-swappable. Power must be removed from the system before a card is installed or removed.

Accessories

• TS9000

Hard-wired configurations of the TS9000 are supplied with a wall-mounted 110VAC power supply, this manual, and Touchscreen-based programming references. Wireless configurations also include an antenna. The mounting bracket for the TS9000 is optional.

Figure 5. TS9000 System and Accessories (Mounting brackets not shown)

• TS9050

The TS9050 is supplied with the TouchStar computer itself, a vehicle mounting bracket, DC power converter, vehicular electrical system access cord, antenna, this manual, and Touchscreen-based programming references.

Figure 6. TS9050 System and Accessories (Mounting brackets not shown)

INSTALLATION & MAINTENANCE _____ 2

PHYSICAL INSTALLATION

TS9000 – Fixed Installation

The TS9000 TouchStar can be mounted almost anywhere that is convenient to the operator. The mounting location must be near a standard 110 VAC electrical outlet, and there must be sufficient space below the unit for cable access to the rear panel, which faces downward when the unit is wall-mounted. The optional mounting bracket should be secured to the wall prior to attaching the TS9000 to the bracket.

All cable connections should be made to the TS9000 before the system is powered up. Since there is no ON/OFF switch, the unit will power up as soon as the power supply connections are completed and the power supply is plugged in to the 110 VAC outlet.

Power line transients, spikes and sags induced by other equipment in the operating environment can stress the TouchStar's power supply, and can reduce the voltage at the TouchStar below its nominal +12 VDC operating voltage. To avoid the possibility of large inrush currents which will open the power supply's internal fuses, necessitating the premature replacement of the power supply, the use of single-outlet surge suppresser/spike protector is highly recommended.

TS9050 – Wireless, Mobile Installation

The TS9050 mounts to a forklift or other vehicle with a custom bracket. Operating power is obtained from a DC power converter that attaches to the vehicle's electrical system via an access cord. Installation of the TS9050 requires mounting the custom bracket, installing the DC power converter, and attaching the access cord to the vehicle's electrical system. Since vehicle electrical systems vary, the wiring instructions given here are intended as a guide only. If you require specific instructions for a particular make and model forklift, hostler, or motorized pallet, please contact Citadel's factory.

- ## TS9050 Physical Installation

The mounting bracket should be located so that the TS9050 touchscreen is clearly visible, easily accessible and easily operated. Also, make sure that the intended mounting location provides adequate access for cables to the rear panel (bottom) of the TS9050. To provide maximum safety for both the vehicle operator and the equipment, the TS9050 and its DC power converter should both be mounted completely within the vehicle's outer dimensions and profile.

If required, mark and drill the mounting holes, using the mounting bracket as a template. Mount the bracket, and if used, the remote antenna. Mount the TS9050 to the bracket using the knobs and washers prior to making any final cable connections.

NOTE: When installing the TS9050 on an electric vehicle, electrical isolation between the vehicle chassis ground and the exterior case of the TS9050 should be maintained. The standard mounting bracket provides the necessary isolation *provided that* the TS9050 is positioned such that it does not make direct contact with the vehicle chassis.

- ## DC Power Converter Installation

The DC power converter mounts to a steel surface on the vehicle via its magnetic feet. It should be located so as not to interfere with either moving parts on the vehicle or the operator's vision. Be certain that the TS9050 DC power cable from the converter can reach the mating connector on the TS9050.

- ## Electrical Harness Access Cable

The access cable should be connected to the vehicle's electrical system, at a point that provides power at all times, and that is filtered and fused. Never connect the access cable directly to the battery terminals. Possible connection points are at the horn, lights (feed) or ignition switch (feed).

24-48 V Power Converter:
The electrical harness access cable for the 24-48 V Power Converter has two leads at one end which are permanently wired into the vehicle's electrical system. The other end of the cable has a circular 2-pin connector with rubber boot

that mates with a similar connector on the DC power converter's power input cable.

The BLACK harness wire is connected to a POSITIVE voltage source. The WHITE harness wire is connected to the NEGATIVE voltage source. The booted connector end of the cable should be accessible for convenient attachment to the DC power converter.

Make sure the DC power converter ON/OFF switch is in the OFF position. Once the access cable is wired to the electrical system, mate the connectors on the access cable and the DC power converter power input cable. All cable connections must be completed before applying power to the TS9050.

12 V Power Converter:
The electrical harness access cable for the 12 V Power Converter has three leads at one end which are permanently wired into the vehicle's electrical system. The leads are WHITE and BLACK, plus a third lead that is either shield braid or GREEN.   The other end of the cable has a circular 3-pin connector with rubber boot that mates with a similar connector on the DC power converter's power input cable.

The BLACK harness wire is connected to a POSITIVE voltage source. The WHITE harness wire is connected to the NEGATIVE voltage source. The GREEN or braided lead is connected to chassis ground. The booted connector end of the cable should be accessible for convenient attachment to the DC power converter.

Make sure the DC power converter ON/OFF switch is in the OFF position. Once the access cable is wired to the electrical system, mate the connectors on the access cable and the DC power converter power input cable. All cable connections must be completed before applying power to the TS9050.

NETWORK CONNECTIONS

The TouchStar is factory-equipped with a network interface and the appropriate network software for communicating with the network. The physical network connection requirements for hard-wired and wireless operation are provided below. The network ports on the TouchStar use different connectors for each type of network. For Token Ring connections, a DB9

connector is used. For Ethernet connections, an RJ-45 connector is used. For wireless network communications, a non-standard RF antenna connector (reverse BNC, reverse TNC or reverse SMA) is provided.

Hardwired Network Connections

In a hard-wired, fixed-mount application, the TouchStar computer connects to the LAN and server by connecting a cable to the NET connector on the computer's rear panel. The TS9000 supports Ethernet and Token Ring connections.

• Token Ring

The TouchStar system can be configured to support a 16 megabyte per second (Mbps) Token Ring connection.

• Ethernet

The Ethernet connection operates with most network adapters that comply with IEEE 802.3 10Base2 (thin coax), 10Base5 (thick coax) or 10BaseT (twisted pair) standards.

Figure 7. Network Connection

Wireless Network Connections

In wireless applications, the radio link between the TouchStar and hard-wired network access points provides the network connection. The TouchStar is equipped with a 2.4 GHz spread-spectrum radio transceiver and antenna which provide the link to strategically-located network access points which are hard-wired into the network. These access points provide overlapping RF coverage (cells) within a building or other facility which enables uninterrupted network communications regardless of vehicle location. Line-of-sight configurations are recommended whenever possible. A site survey should be performed to measure the link quality and received signal strengths prior to permanently mounting the access points. For detailed information regarding the planning of a wireless network, please contact Citadel directly.

CONNECTING EXTERNAL/OPTIONAL EQUIPMENT

With the exception of the antenna connection for wireless operation, all connections to the TouchStar system are made via connectors on the rear panel.

Figure 8. Rear Panel Connectors

DC Power Connector

The DC power connector is a locking 3-pin connector that accepts +12VDC from either a wall-mounted power supply in fixed-mount installations, or the DC power converter in mobile, wireless installations. The power converter connector is a locking type. Remove by pulling back the connector shell. **Do not attempt to remove the power supply connector by unscrewing the strain relief.** See Figure below.

Figure 9a. Power Connector release

Figure 9b. DC Power Connector

TABLE 2 - DC POWER CONNECTOR PINOUT	
Pin	**Signal**
1	No Connection
2	GND (+12 V Return; NOT chassis ground)
3	+12 VDC

LPT1 – Enhanced Parallel Port

The LPT1 printer port is an enhanced parallel port with a 25-pin (DB25) female connector. It provides bi-directional data communications. Line printers, floppy drives and CD-ROM drives are connected to the TouchStar via this parallel port.
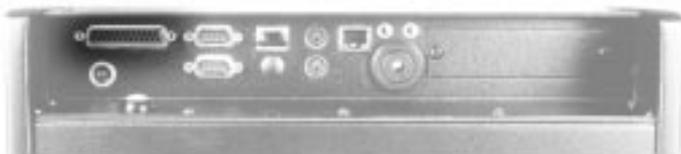
Figure 10. LPT1 Parallel Port Connector

TABLE 3 - LPT1 PARALLEL PORT CONNECTOR PINOUT	
Pin	**Signal**
1	PSTB; data strobe
2	PLD0; data 0
3	PLD1; data 1
4	PLD2; data 2
5	PLD3; data 3
6	PLD4; data 4
7	PLD5; data 5
8	PLD6; data 6
9	PLD7; data 7
10	PACK; acknowledge
11	PBUSY; busy
12	PPE; paper end
13	PSLCT; printer selected
14	PAFD; auto feed
15	PERR; printer error
16	PINIT; printer initialized
17	PSLIN; printer select
18-23	Ground
24	Ground; parallel not floppy; connect to +5V to switch the EPP to the floppy mode
25	Ground

Serial Communication Ports

The TouchStar provides two serial ports, labeled COM1 and COM2. These ports are used to connect devices such as serial

printers, a mouse, an external modem, or to make a serial network connection.

COM1 is a 9-pin (DB9), DOS-compatible, RS232C serial port, with its own address. COM1 occupies two input/output locations. The maximum supported data rate for serial channel operation through any of these ports is programmable up to 115.2Kbaud. The serial controller tied to these ports conforms to the UAR/T industry-standard PC16550 device architecture (including 16-byte FIFOs) with fully independent baud rate generation. Pin 9 (RI) can be factory-configured as a +5 VDC supply for optional barcode scanner power.

COM2 is a 9-pin (DB9), DOS-compatible, serial port that can be software-configured to support RS232C or RS422/RS485 protocols. COM2 has its own address, and occupies two input/output locations. The maximum supported data rate for serial channel operation through any of these ports is programmable up to 115.2Kbaud. The serial controller tied to these ports conforms to the UAR/T industry-standard PC16550 device architecture (including 16-byte FIFOs) with fully independent baud rate generation.

Software-configuration of the COM2 port protocol is accomplished by running the Setup Utility and specifying which protocol is to be used.

TABLE 4 - SERIAL PORT CONFIGURATION		
Port	**Base I/O**	**IRQ**
COM1	03F8	4
COM2	02F8	3

Figure 11. Serial Port (DB9) Connectors

TABLE 5 - SERIAL PORT CONNECTOR PINOUT		
Pin	**Signal**	**Description**
1	DCD	Data Carrier Detect
2	RXD	Receive Data
3	TXD	Transmit Data
4	DTR	Data Terminal Ready
5	GND	Ground
6	DSR	Data Set Ready
7	RTS	Request To Send
8	CTS	Clear To Send
9	RI	Ring Indicator; optional +5V scanner power

Keyboard Ports

Two keyboard connectors are provided. One is an IBM PS/2 standard, 5-pin mini-DIN connector. This connector accepts an optional traditional ASCII keyboard. Wedge-type barcode scanners should be connected to this port; the (optional) keyboard should then be plugged into the barcode scanner.

Figure 12. Keyboard Connectors

TABLE 6 - KEYBOARD 5-PIN DIN CONNECTOR PINOUT	
Pin	**Signal**
1	Keyboard data
2	No connection
3	Ground
4	+5V
5	Keyboard clock

The second keyboard port is a 4-pin locking connector. It is typically used in mobile applications where movement and vibration would require a more robust connection than the standard connector can provide.

TABLE 7 - KEYBOARD 4-PIN LOCKING CONNECTOR PINOUT	
Pin	**Signal**
1	+5V
2	Keyboard Data
3	Keyboard Clock
4	Ground

Mouse Port

The mouse connector is a IBM PS/2 standard, 5-pin mini-DIN connector.

Figure 13. Mouse DIN Connector

TABLE 8 - MOUSE 5-PIN DIN CONNECTOR PINOUT	
Pin	**Signal**
1	Mouse Data
2	No Connection
3	Ground
4	+5 V
5	Mouse Clock

PCMCIA

The TouchStar is supplied with dual PCMCIA slots which provide an interface for portable memory cards, miniature disk drives, modems, fax/modem cards, and network connections. The TouchStar system software is provided with the appropriate PCMCIA drivers which work with all operating systems supported by the TouchStar. The TouchStar's two PCMCIA slots each contain a standard 68-pin PCMCIA connector, and can accept both Type II (add-on devices such as Flash Cards, modems and network adapters) and Type III (miniature disk drive interface) cards. Memory and storage cards will typically appear on the system as drive E:\ or F:\.

PCMCIA cards are inserted into Slot 0 (lower) or Slot 1 (upper) on the rear panel by holding the card with the connector facing toward the slot and sliding the card into the slot until firmly seated. System access of the card can be verified under the operating system software.

Figure 14. PCMCIA Slot

Audio Input/Output

The TouchStar is equipped with a 16-bit Plug-N-Play audio input/output sound system (Windows and Soundblaster compatible). Standard 3.5mm phono jacks are provided on the rear panel for connection to a microphone input and head-phone/line output.

Figure 15. Audio Input/Output

Audible Indicator

The TouchStar is equipped with a 95dBA @ 12" ceramic audible indicator. The indicator is activiated by writing a logic "1" to I/O address 300H, Bit 1.
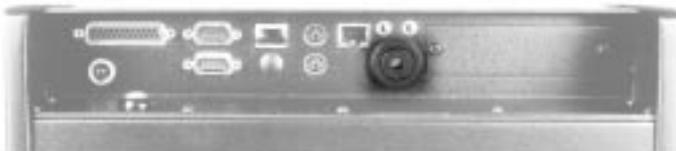
Figure 16. Audible Indicator

RF Connection

TouchStar systems configured with the 2.4 GHz spread-spectrum transceiver for wireless operation can be supplied with patch or "rubber duck" type antennas. Antenna connections may be made to connectors mounted on the top or bottom of the case or internally, depending on the specific system configuration. All antenna connections use non-standard connectors to prevent antenna substitution and subsequent violation of FCC regulations.
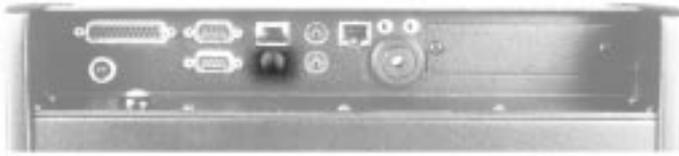
Figure 17. RF Connection

Maintenance

The TouchStar computer is designed to operate normally in industrial environments which may contain high levels of airborne contaminants including dirt and smoke. Periodic cleaning of the TouchStar is recommended to remove build-up of foreign substances on the case and touchscreen. Before cleaning the TouchStar, remove power from the unit. Wipe accumulated dirt and dust from the aluminum case with a slightly dampened cloth, paying particular attention to the angled edge of the bezel. Clean the touchscreen with a commercial brand of computer screen cleaner and a soft, damp cloth, or compressed air.

BASIC OPERATION _____ 3

POWER-UP

Before powering up the TouchStar for the first time, be sure it is securely mounted, that all cable connections have been made, and that the DC power cable is securely attached to the DC connector on the rear panel.

The TouchStar computers do not have an ON/OFF switch. Both models will power up immediately when they receive incoming electrical power. **It is important to make all peripheral connections BEFORE powering up the TouchStar system.**

To turn on the TS9000, plug the wall-mounted power supply into a surge-protected 110VAC outlet. To eliminate potential damage to the TS9000, be sure the power supply is removed from the wall outlet before connecting or disconnecting the power cord to the rear panel.

To turn on the TS9050, turn the DC power converter ON/OFF switch to ON.

SYSTEM CONFIGURATION UTILITY (SCU)

The System Configuration Utility is accessed by pressing CTRL-ALT-S on the keyboard when prompted during boot-up. This prompt occurs just after the system memory tests. The system settings (CMOS) may now be configured.

Start up

The Start up menu contains date and time, fast/normal boot and boot device options.

Boot Device

Set the boot configuration to FULL if you are using DOS or Windows 3.x operating systems.

Set the boot configuration to BOOT DEVICES only if you are using Windows 95.

These options allow the sound and ethernet controllers to be properly configured and activated. (see Ethernet and Sound System Controller sections in Appendix B).

Disks

The disks menu contains settings for diskette and hard disk configurations.

Components

The components menu contains settings for COM ports parallel (LPT) ports, the Ethernet port and keyboard settings.

Ethernet Port

- Set to DISABLED if the onboard ethernet controller is not in use.
- Set to ENABLED to activate controller.

BOOTING-UP

Upon receiving electrical power, the TouchStar will boot up immediately with no action required. On power up, the TouchStar conducts a power-on self-test, runs the hardware initialization program, and then boots DOS. (If your system does not boot, or does not have a factory-installed version of DOS, refer to the following section, "Installing the DOS Operating System".) The system then processes the config.sys and autoexec.bat start-up files from the boot drive, which is typically the Flash Drive (C:\). When the boot process is completed, the C:\ prompt is displayed on the screen. If Windows is installed, the system will then load the Windows graphical user interface. Please refer to Figure 4 and Table 1 for information on configuration of the Flash Drive and ATA Socket.

PCMCIA cards appear as unique drives under the TouchStar operating system. Their drive designation depends on the PCMCIA slot in which it is installed.

REBOOT

If the system freezes or locks up during normal operation, the system can be reset by performing a reboot. The type of reboot will depend upon the desired state of the TouchStar system.

Perform a warm boot when you
- need to clear the system's memory to run another program,
- do not want the computer to perform a self-test.

You must have a keyboard or keyboard emulator previously attached to the system to perform a warm boot.

Perform a cold boot when the screen is frozen, or the system is otherwise locked up. The cold boot is essentially a power-up sequence.

Warm Boot

To perform a warm boot:

1. Press CTRL-ALT-DEL on the keyboard. This causes the system to reprocess the config.sys and autoexec.bat files.

2. Reload the desired software application, if necessary.

Cold Boot

To perform a cold boot:

1. Remove power from the TouchStar by removing the power supply from the wall outlet (TS9000), or turning off the power ON/OFF switch on the DC power converter (TS9050).
2. Turn the power back on by plugging the power supply back into the wall outlet (TS9000) or turning on the power ON/OFF switch on the DC power converter (TS9050).

OR,

3. Push the RESET button on the rear panel of either unit.

OPERATING MODES AND ENVIRONMENTS

The TS9000/TS9050 TouchStar systems can be operated in either a client-server environment, or in a terminal emulation mode. Operating software installation is briefly described for each mode.

Client-Server Environment

• Installing The DOS Operating System

If your TouchStar system has not been factory-configured with a bootable Flash drive, the unit will display the following message on power-up after the self-tests have been completed.

No Boot Device Found

For information on initializing a bootable Flash disk, refer to Appendix B, System Reference.

To install a DOS operating system using a floppy disk drive, perform the following procedure. Please note that the floppy drive must be specially modified by CITADEL to operate with the TouchStar system. Please contact CITADEL COMPUTER directly.

1. Remove power from the system to turn it off. Unplug the TS9000 system's wall-mounted power supply, or turn off the power switch on the TS9000's power converter.

2. Attach a floppy drive to the LPT1 parallel port on the rear panel of the TouchStar. If there is no keyboard connected to the TouchStar, attach one to the KEY-BOARD connector on the rear panel.

3. Insert a bootable disk in the floppy drive.

4. Power up the TouchStar unit again.

5. Press CTRL-ALT-S on the keyboard to go into the Setup Mode.

6. In the Disks menu, set the drive for a 1.44MB diskette.

7. Select Save and reboot in the Exit menu.

DOS will now boot.

• Loading DOS Applications

FLASH Disk

Standard DOS applications can be developed and tested on a floppy or hard disk and then conveniently moved onto the FLASH disk.

The FLASH disk can be loaded with DOS or another suitable operating system to serve as the system boot device. This allows programs to be executed without the need to boot from a floppy drive or other external disk drive.

Floppy Disk

If there is no floppy drive attached to the TouchStar, install one using steps 1-4 of the previous procedure (Installing the DOS Operating System). In step 3, instead of a bootable disk, insert the disk containing the software application to be loaded into the drive.

Downloading from the Network

When multiple copies of a software application must be installed on a number of TouchStar units, copy the software application from the server onto the Flash drive (C:\) of each TouchStar using the DOS copy command.

Installing Windows 95

Windows 95 (CD) can be installed on the TouchStar's ATA drive. To do so, the ATA drive is first formatted and pre-pared, then the software is installed from the CDROM as described below. It is recommemded that the ATA drive be configured as the Master C: drive (Please refer to the ATA Socket Table 1 - Jumper JP-7.)

1. Connect the backpack floppy drive to the TouchStar's parallel port, and install the floppy drive in the setup portion of the System Configuration Utility (SCU).

2. Set the Boot Device to BOOT DEVICES ONLY (WIN95), and either enable or disable the Ethernet controller as desired.

3. Format and prepare the TouchStar's ATA drive using CITADEL's WIN95 ATA Drive Prep diskette. Once the drive is prepared, disconnect the floppy drive and remove the drive in the SCU.

4. Connect the backpack CDROM drive to the parallel port.

5. Boot the system from the ATA Drive (C:). The CDROM drive should be visible as either Drive D: or E:.

6. Install the Windows 95 CD in the CDROM drive, and run Setup. Windows 95 will prompt you for the remainder of the installation. Note the TouchBase (T5) driver for Windows 95 is available from CITADEL, and may be installed after the Windows 95 installation is complete.

- **Logging On to the Network**

    The TouchStar is shipped with network drivers that will
    allow a specific network connection whenever the system is
    booted.

Terminal Emulation Mode

The TouchStar system can be configured to operate in terminal
emulation mode by running a terminal emulation application
loaded on a PCMCIA card or Flash Disk. Terminal emulation
programs are available from a number of sources to operate
with a variety of hosts.

THE TOUCHSCREEN SUBSYSTEM AND
TOUCH-BASED OPERATION

The touchscreen subsystem is a collection of components that
provides the touch-based control of the TouchStar computer.
These components – the touch frame, and touch controller
firmware – combined with specific touch-based programming
techniques, allow touch-based applications to be implemented
on the TouchStar system.

Touchscreen Components

- **Touch Frame and Protective Bezel**

    The touch frame is a screen overlay mounted on top of the
    TouchStar's video display. Around the periphery of the
    overlay, behind a protective bezel, are 34 horizontal and 26
    vertical infrared emitter/detector pairs mounted on oppo-
    site sides. These emitter/detector pairs form a grid of
    scanning beams which detect where the video display is
    touched. The location information is passed to the
    TouchStar's CPU by the touch system controller firmware.

- **Touch Controller Firmware and Driver Software**

    The touch controller firmware accepts and interprets
    incoming coordinate data from the touch frame. The firm-
    ware outputs specific coded data based upon the physical
    location on the screen that was touched. The touch driver
    software provides additional smoothing and anti-aliasing to
    support cursor tracking for mouse-based touch applications.
    The TouchStar system currently supports DOS, Windows,
    Windows 95, Windows NT, and Windows for Workgroups
    driver software.

Programming Touch-based Applications

The following information is provided to impart an overview of how touch-based applications are structured. For specific details on programming touch-based applications, please refer to the programming manuals supplied with your TouchStar system – *Touchscreen Driver for DOS* and *Touchscreen Driver for Windows*. An on-line help file is available directly in both *Windows 95* and *Windows NT*. Press the help key for the appropriate help file.

• General Functions and Guidelines

The TouchStar is designed and configured for touch-based applications, where the video screen displays graphical icons whose corresponding function is activated when touched by a user. Touch-based applications can be divided into two different categories:
  • Graphical User Interface (GUI) applications, based on a GUI operating system, such as Windows
  • DOS-based applications

For GUI applications, a "mouse-like" touch driver is installed allowing standard applications to be executed. However, for optimum ease of use, applications should:

  • use only one button
  • avoid double-clicks whenever possible
  • keep touch targets large (for example, scroll bars are very difficult to use)

With these provisions, applications can be developed using standard tools and practices including Visual C++, Visual Basic, etc.

Touch-based applications are composed of three parts – the main application program, a touch library, and a graphics library. Each of these is described below.

• Main Application Program

The main application program must perform the functions of system initialization, enabling of touch targets, processing of touch input data, and providing feedback to the user.

During system initialization, the program initializes the system hardware, establishes a communication path to the touch system, checks the touch system status, and converts

the touch system coordinates to screen coordinates, thereby allowing the application's display to fit on the TouchStar's video display.

After initializing the system, the program must establish a list of active target areas which correspond to the current graphics menu. The target manager does this by loading a specific set of targets from a previously created target database.

To process touch input, a touch system handler and the target manager are used. When a touch is detected, the main program module calls the target processing function from the target manager, which in turn, calls a low-level input routine from the touch handler. The low-level routine accepts and processes touch reports and exit reports while polling other input devices.

When writing touch-based applications, it is important to provide visual feedback to the user that their input has been accepted. Without some form of feedback, it is easily assumed that the system is not functioning properly. Reversing the touched icon or "zooming" to the next screen are two examples of visual feedback.

• Touch Library

The touch library manages the application's touch targets, and also sends and receives information from the touch system and the CPU.

A touch target is a very specific area of the display screen that the user touches to accomplish a task. The target consists of two pieces – a graphic icon representing the task or function to be performed, and an invisible touch target that resides directly over and completely contains the graphic icon. The touch target should be at least as large as the end of a typical finger, and should completely cover its associated touch target so that a touch anywhere on the icon will activate the target. Large, well-spaced targets allow quick and precise selections. Touch targets should be separated by large non-active touch areas ("dead" zones) to prevent unintentional activation of more than one target at the same time.

• **Graphics Library**

The graphics library portion of the touch-based application contains the graphics displayed on the TouchStar video display. These graphic images are maintained separately until they are needed in response to input from the touch system.

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APPENDIX_____A

TROUBLESHOOTING, TECHNICAL SUPPORT & EQUIPMENT RETURNS

This chapter provides a checklist of common problems and their potential solutions.

Initial Checklist

Perform an initial check of the TouchStar unit as follows:

1. Check the unit for any signs of exterior damage.
2. Check and reseat all rear panel cable connections.
3. Check to be sure the TouchStar is receiving operating power.
   a. TS9000 - Check the circuit breakers feeding the 110VAC wall outlet supplying power to the TouchStar. Make sure the wall-mounted power supply is firmly seated in the wall outlet. If a surge protector is installed between the wall-mounted power supply and the wall outlet, make sure that if it has an ON/OFF switch, that it is on, and that any fuses or circuit breakers on the surge protector have not blown or tripped.
   b. TS9050 - Be sure the vehicle's battery is not dead. Verify that the ON/OFF switch on the DC power converter is on. Reseat the connectors on both the power input and output cables on the DC power converter.

Specific Problems

The following pages present solutions to specific problems or malfunctions.

PROBLEM: Touchscreen Does Not Respond

The video display appears to be working properly, however, touching the screen does not cause anything to happen.

Possible Causes and Solutions:

The touchscreen drivers did not load, the touchscreen may be disconnected or defective. Reboot the TouchStar. If this does not solve the problem, contact the factory for assistance. In DOS applications, in CONFIG.SYS, verify command line reads TBDRIVER /A: 2AO /I:9l

PROBLEM: Application Program Does Not Appear

An image is displayed on the display, such as the self-test message, but the application is not displayed.

Possible Causes and Solutions

The application software is corrupted, or the config.sys and autoexec.bat files are not set up properly. Reload the application software on the system, verify the config.sys and autoexec.bat files are set up correctly to load the application program and reboot the system.

PROBLEM: PCMCIA Card(s) Not Working

The peripheral on the PCMCIA card does not function, or the system does not display the card as drive E:\ or F:\.

Possible Causes and Solutions

Verify the config.sys and autoexec.bat files are set up correctly to recognized PCMCIA cards, try the card in the other PCMCIA slot, or check to make sure the card is firmly seated in the slot.

PROBLEM: Modem Card Does Not Work

With a PCMCIA modem card installed in one of the slots, the TouchStar does not receive a dial tone.

Possible Causes and Solutions

Check to be sure the modem card is firmly seated in the PCMCIA slot. Check the modem setup strings in the software package used with the modem card. Check the telephone line connections.

PROBLEM: TS9000 Does Not Communicate with the Network

The TS9000 is operating, but does not communicate with the network through its hard-wired connection.

Possible Causes and Solutions

Check for cable breaks, shorts and bad crimps using a cable scanner. Check for electrical interference. Check the security ID and domain station type.

PROBLEM: TS9050 Does Not Communicate with the Network

The TS9050 is operating, but does not communicate with the network through its wireless or ethernet connection.

Possible Causes and Solutions – Wireless Connection

Check that the antenna connection is secure. Replace broken antennas or cables. Check the security ID and domain station type.

Possible Causes and Solutions – Ethernet Connection

Remove any other installed NICS in the ISA expansion slot or PCMCIA slots. Check that the Network configuration is set for I/O 240, interrupt 15 and DMA 3.Check that the Ethernet is enabled.

Technical Support

If a problem persists, direct technical support assistance is available from the Citadel Technical Support Center at (603) 672-5500. The Center is open Monday through Friday, 8:30 am to 5:30 pm, Eastern time. When calling, please have the unit's serial number available. Also, please tell the operator whether you are requesting a system upgrade or reporting a system failure. When requesting a system upgrade, please do so by specifying the upgrade number.

Equipment Returns

If you are reporting a system failure, please be able to provide a description of the problem. In many cases, inoperable equipment is not damaged, and may simply need a minor modification that can be accomplished over the telephone. If the system is significantly damaged, the unit will need to be returned to Citadel for authorized repair. Do not return a unit to Citadel without first speaking with a Center representative. If it is necessary to return a unit to Citadel, specific instructions and a Return Material Authorization will be provided.

If instructed to return the unit to Citadel for repair, pack the unit securely to prevent damage in transit. In addition to the unit, include the following in the package:

- the RMA number provided by Citadel
- a description of the problem or an upgrade request
- a telephone contact at your company

Instructions to Citadel to either repair the problem or call the telephone contact with an estimate prior to starting repairs should also be included.

Mark the outside of the shipping carton with the RMA number. Ship the unit to:

Citadel Computer Corporation
29 Armory Road
Milford, NH 03055

APPENDIX_____ B

SYSTEM REFERENCE

CPU

The TouchStar main circuit board assembly contains the central processing unit (CPU), DRAM, and an optional Flash-ROM configured as a DOS device. The TouchStar is configured with an AMD 5X86 processor. This CPU is driven by a 33MHz clock signal from the main timer circuits. It runs internally at 133MHz.

System Cache

The TouchStar is configured with a 16 KB Level 1 processor cache memory. Optional configurations include 128 KB or 256 KB Level 2 processor cache memory.

TouchStar System BIOS

The TouchStar System BIOS is an industry-standard basic input/output system configured to support all onboard input/output (I/O) functions. It incorporates an advanced system set-up utility, as well as an extensive series of internal diagnostics for system test and verification.

The standard BIOS is contained in a single 128Kbyte Flash device and uses non-volatile CMOS RAM to store the real-time clock, system configuration, and system diagnostic information. The Flash device supports in-circuit reprogramming for BIOS updates, adding features, or reconfiguring certain system parameters.

The BIOS has been initialized to facilitate all communications between the operating system, CPU and peripheral devices. The TouchStar BIOS includes the main System BIOS, the Video BIOS, and the system Set-Up Utility. Additional device drivers can also be added.

The System BIOS consists of a routine designed to test the sys–tem hardware, bootstrap load the operating system and boot-strap load the device drivers. The 64Kbyte System BIOS module resides in memory address spaces $0C,0000_H$ to $0C,FFFF_H$.

The 32Kbyte Video BIOS module resides in memory address spaces 0E,0000$_H$ to 0E,7FFF$_H$.

The Set-Up Utility is used to configure the system parameters.

System Memory Configuration

The TouchStar system memory can be configured with up to 64MB of dynamic random access memory (DRAM). The DRAM is implemented in two 3.3 Volt SODIMMs (small outline dual-in-line memory modules) that plug into sockets on the motherboard. Each SODIMM socket can hold either a SODIMM containing 4, 8, or 16 MB. All system memory above 1MB is accessible as extended memory. Table 9 illustrates some possible DRAM combinations installed in the two SODIMM sockets. SODIMMs differ in physical dimensions; please refer to Figure 18 for the required outline dimensions and component clearances on SODIMMs used in the TouchStar system.

TABLE 9 - SYSTEM MEMORY SODIMM COMBINATIONS		
Total RAM	**Socket 1**	**Socket 2**
4MB	4	0
8MB	4	4
8MB	8	0
12MB	8	4
16MB	8	8
16MB	16	0
20MB	16	4
24MB	16	8
32MB	16	16
32MB	32	0
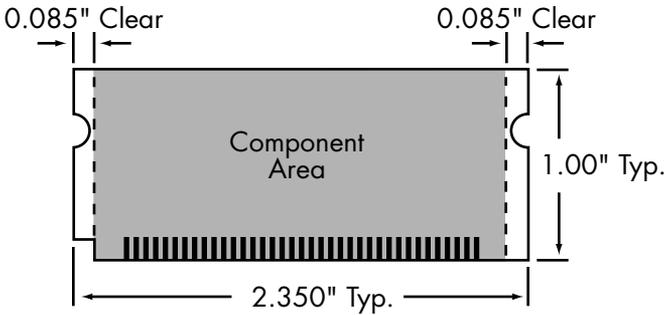
Figure 18. SODIMM Guide Clearance Requirements

CMOS RAM

On-board feature configuration information is stored in AT-style CMOS random access memory (RAM). The TouchStar integrates 128 bytes of CMOS RAM and real time clock (RTC) into the main system controller. The system's CMOS RAM is accessed via I/O locations 0070_H - 0071_H. Table 9 shows the configuration of the system's available memory.

TABLE 10 - CMOS RAM MEMORY ALLOCATION	
Location	**Description**
0 -13	Real-time Clock (RTC) Functions
14 - 127	General Low-Power Static RAM

Multiple memory locations in the TouchStar are reserved for storing BIOS-dependent configuration information. To access CMOS RAM, the index address (0 to $7F_H$) is output to port 70_H, and the data is then read or written at port 71_H. Interrupts should be inhibited while the entire port $70_H/71_H$ sequence is completed. Alternatively, the port sequence can occur during an interrupt service routine before re-enabling interrupts. If these precautions are not observed, an interrupt service routine could potentially intervene between the output to port 70_H and the subsequent I/O to port 71_H, overwriting the port 70_H value.

Flash Drives

The TouchStar contains 2MB or 4MB of Flash memory config-ured as a solid-state drive. The on-board flash array is sup-ported as a bootable, read-writable drive. Once the Flash Array

is formatted, the arrays becomes a bootable drive accessible as a normal DOS fixed disk (such as drive C:\). Standard start-up files config.sys and autoexec.bat can be placed on the drive to tailor the system configuration and automatically start application programs. Any standard DOS application developed and tested on floppy or hard disks can be moved onto the Flash drive using standard DOS utilities and commands, such as copy, etc.

Real-Time Clock

The CMOS real time clock combines a complete time-of-day clock and alarm with a one hundred year calendar and a programmable periodic interrupt.

Battery Backup

An on-board, socket-mounted, Rayovac FB2325 H2 six volt battery operates the clock and maintains RAM amount, video adapter type and I/O device configuration information when external electrical power is removed from the system. Citadel recommends replacing the battery every 10 years.

Interrupt Controller

Hardware-level interrupts are used to support several of the TouchStar system's on-board I/O functions. The system controller incorporates two programmable interrupt controllers that are compatible with the Intel 82C59A. These controllers accept requests from peripherals, resolve priority on both pending interrupts and interrupts in service, issue interrupt requests to the CPU, and provide a vector used by the CPU as an index to determine which interrupt service routine to execute.

The controllers are addressed and cascaded in a manner compatible with the IBM AT. The Master controller is located at I/O addresses 020_H - 021_H, while the Slave controller is located at addresses $0A0_H$ - $0A1_H$. The priority assignment modes can be reconfigured at any time during system operation, allowing the complete interrupt subsystem to be restructured, as needed.

TABLE 11 - HARDWARE INTERRUPTS		
Interrupt		**Level Function**
IRQ0	08H	Counter/Timer (18.2 fps)
IRQ1	09H	Keyboard
IRQ2	0AH	Slaved from IRQ8 - IRQ15
IRQ3	0BH	COM2/COM4
IRQ4	0CH	COM1/COM3
IRQ5	0DH	Unassigned
IRQ6	0EH	Unassigned
IRQ7	0FH	Parallel port
IRQ8	70H	Real-time clock (RTC)
IRQ9	71H	Touchscreen, slaved to IRQ2 in software
IRQ10	72H	Unassigned
IRQ11	73H	Mouse
IRQ12	74H	Unassigned
IRQ13	75H	Coprocessor
IRQ14	76H	Fixed disk
IRQ15	77H	Unassigned

DMA Controller

The direct memory access (DMA) controller handles requests for input/output activity that can transfer data without intervention from the CPU. This allows data transfers to occur at a 5 to 10MB per second rate.

Each of the two controllers is a four-channel DMA device that can generate the memory addresses and control signals necessary to transfer information directly between a peripheral device and memory. The two DMA controllers are internally cascaded to provide four DMA channels for transfers to 8-bit peripherals (DMA1), and three channels for transfers to 16-bit peripherals (DMA2). Table 12 provides a summary of the DMA channel assignments.

TABLE 12 - DMA CHANNEL ASSIGNMENTS		
Channel	I/O Address	Description
DMA0	000H - 00FH	DMA Controller
DMA1	0C0H - ODFH	I/O addresses 080H - 08FH are occupied by the DMA page registers
DMA2		Floppy Disk Controller
DMA3		AMD Ethernet Adapter (Windows 3.X, DOS)
DMA4		DMA Access Controller
DMA5		Unused
DMA6		Unused
DMA7		Unused

Programmable Interval Timer

The programmable interval timer is equivalent to the Intel 8254, and occupies I/O addresses 0040_H through 0043_H. This general purpose counter/timer generates accurate time delays under software control.

Counter/Timer Circuit

The counter control circuit (CCC) contains three independently operating, 16-bit counters driven by a common 1.19MHz clock. Each counter counts in binary or binary-coded decimal (BCD). Each can be programmed for operation as either a counter or timer. Common control logic decodes the information written to the counter control circuit to load, read, configure, and control each timer.

Counter 0 connects to IRQ0 of the internal interrupt controller for system time-keeping and task-switching.

Counter 1 generates pulses for the DRAM refresh generator.

Counter 2 is used as an interval time, counter, or gated rate/pulse generator. Counter 2 output can be used as an audio speaker tone generator.

Each counter can be programmed to operate in any of the six modes shown in Table 13. It should be noted that modes 1 and 5 do not have external hardware trigger signals.

| TABLE 13 - COUNTER MODES ||
Mode	Function
0	Interrupt on terminal count
1	Hardware-retriggerable one-shot
2	Rate generator
3	Squarewave generator
4	Software-triggered strobe
5	Hardware-retriggerable strobe

PCMCIA Slots

The following is the typical PCMCIA section of config.sys supporting ATA drivers:

```
DEVICE HIGH = C:\CARDSOFT\SS365SL.EXE
DEVICE HIGH = C:\CARDSOFT\SC.EXE
DEVICE HIGH = C:\CARDSOFT\ATADRV.EXE /S:2
DEVICE HIGH = C:\CARDSOFT\MTSRAM.EXE
DEVICE HIGH = C:\CARDSOFT\MTDDRV.EXE
DEVICE HIGH = C:\CARDSOFT\CARD ID.EXE
```

Save the changes, return to the Program Manager, and reboot the system. The PCMCIA driver will not be deleted if the system is not rebooted.

To disable a pre-loaded PCMCIA drivers, modify the config.sys file by typing "rem" (remark) in front of every device showing PCMCIA. This instructs the operating system to ignore those lines. Save the changes, return to the Program Manager, and reboot the system. The PCMCIA drivers will not be disabled if the system is not rebooted.

Audible Indicator

The TouchStar is equipped with an audible indicator capable of producing tones at output levels of 95dBA at one foot. This can be used to alert the system operator to error conditions, acknowledge data entry or to provide other (audible) feedback. It is controlled at I/O 300, Bit 1.
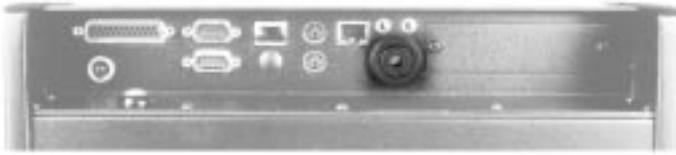
Figure 19. Audible Indicator

ATA-Drive Socket

The TouchStar is equipped with an internal ATA-drive socket. Options using this dedicated slot are factory-configured.

System Expansion

The TouchStar is equipped to accommodate single ISA bus expansion options. Options using these slots are factory-configured.

Ethernet Controller

The AMD PCNET ISA II on-board Ethernet controller is enabled by selecting the "Enabled (PNP Mode)" item in the Components menu of the SCU (setup).

The controller is configured for I/O address 240, interrupt 15 and DMA 3 when the start up boot configuration is set to full (DOS, Windows 3.x) in the SCU.

16 Bit Plug and Play Sound system

The TouchStar is shipped with an on-board integrated single-chip audio controller. It supports full duplex stereo audio and Windows 95 compliant 16-bit plug and play. The microphone input and stereo output jacks are located on the rear panel. The audio controller is factory configured via serial EEPROM to be Sound Blaster Pro-compatible and use the following re-sources:

I/O Ranges:	0534 – 0537
	0380 – 038B
	0220 – 022F
	0E8D – 0E8F
Interrupt:	5
DMA:	00, 01

C

APPENDIX_____

SPECIFICATIONS

CPU	5X86 (133 MHz)
Operating System Compatibility	Fully PC-compatible, industry-standard software environment MS-DOS, Version 3.3 through 6.22 Windows, Version 3.1 Windows for Workgroups 3.11 Windows 95 Windows NT
System Memory	4, 8, 12, 16, 20, 24, and 32 MB
System Cache	16 KB Level 1 standard 128 KB and 256 KB Level 2 optional
Supported Network Interfaces	Ethernet; [Plug-N-Play] 10Mbps Token Ring; 4/16Mbps Wireless; spread-spectrum RF interface (802.11 compliant) 2.4G Hz
Input/Output **Serial I/O**	1 channel; RS232C, DB9 standard; 1 channel; RS232C/422/485, software-configurable; DB9
Parallel I/O	1 port, enhanced; DB25 standard
Keyboard	IBM PS/2 standard 5-pin mini-DIN 4-pin locking connector
Mouse	IBM PS/2 standard 5-pin mini-DIN
Power	3-pin locking circular connector
Network	Token Ring, 16 Mbps; DB9 Ethernet, 10 Mbps; RJ-45 Wireless, internal and external antenna options

Audio	16-bit, Plug-N-Play sound system (Windows and Soundblaster compatible) 3.5mm phone jack for microphone and headphone/line out
Audible Indicator	95 dBA at 12" (30cm), typical
Clock	Real-time, battery-backed; time/day/date
Battery Backup	Rayovac FB2325 H2; 6 volts 10 year expected life
Solid-state Storage	2 MB & 4 MB FLASH disk configurations

PCMCIA Slots

Slot A

Type	PCMCIA V2
Compatibility	Type II; Slot A can be used alone or with Slot B while using Type II devices. Type III; Slot A must be used alone while using Type III devices; do not use Slot B

Slot B

Type	PCMCIA V2
Compatibility	Type II; Slot B can be used alone or with Slot A while using Type II devices. Type III; Slot B must be used alone while using Type III devices; do not use Slot A

Video Display Subsystem

Video Memory	1 MB; with hardware-based Windows acceleration

Video Display Options

Electroluminescent (EL)	
Color	amber
Gray Levels	64
Viewing Angle	160 degrees
Active Area	8.31" x 6.23" (21.11cm x 15.83cm)
	10.4" (26.41cm) diagonal
Pitch	.33 x .33 mm

Active-Matrix	
Liquid Crystal Display (LCD)	
Colors	262,140
Active Area	9.70" x 7.06" (24.65cm x 17.94cm)
	10.4" (26.41cm) diagonal
Pitch	.33 x .33 mm

VGA Resolution	640 x 480

SVGA Resolution	800 x 600

Touchscreen Controller	
Height	9.47" (24.05 cm)
Width	11.78" (29.92 cm)
Depth	0.36" (0.91 cm)
Scan Rate	45 scans/second; typical
Reporting Modes	Scan/coordinate
Operating Modes	Enter Point; Tracking; Continuous; Exit Point; Add Exit Point (modifier)

Input Power Requirements

TouchStar	+12 VDC ±0.5 VDC
	2500 mA maximum
	<25 W dissipation; typical

TS9000 Wall-Mount Power Supply	110 VAC, 60Hz
	2.5 A

24-48 V DC Power Converter (P/N PWR-TSTR-01)	+17.0 to +48.0 VDC

12 V DC Power Converter (P/N PWR-TSTR-02)	+6.0 to +20 VDC

C - SPECIFICATIONS

Physical

Height	10.5" (26.67 cm)
Width	12.0" (30.48 cm)
Depth	3.5" (8.89 cm)
Weight	< 7 pounds (<3.18 kg)
Case Material	Aluminum
Case Finish	Black

Operating Temperature Range

Electroluminescent Display	-25°C to +60°C
Active Matrix Color	
Liquid Crystal Display	0°C to +6 0°C

Storage Temperature Range

Electroluminescent Display	-40°C to +85°C
Active Matrix Color	
Liquid Crystal Display	-40°C to +85°C

Relative Humidity	0 to 95%, non-condensing

Reliability

Mean Time Between Failure	50,000 hours; estimated (MIL-HDBK-217E)
Mean Time to Repair	Less than 30 minutes