

# TouchStar™ User Manual

## TS3000/TS4000



**CITADEL™**  
COMPUTER CORPORATION

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Citadel Computer Corporation  
29 Armory Road  
Milford, NH 03058  
(603) 672-5500  
FAX: (603) 672-5590

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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, full VGA display (either electroluminescent or LCD), multiple network options and full I/O capability. Each TouchStar system is fully PC-compatible with the MS-DOS, Versions 3.3 through 6.22, Windows 3.1 and Windows for Workgroups 3.11 operating systems.



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

### **TS3000**

The TS3000 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 TS3000 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.

## TS4000

The TS4000 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 2.4GHz 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 touchscreen-based applications are provided in separate manuals, *Touchscreen Driver for DOS and Touchscreen Driver for Windows*.

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

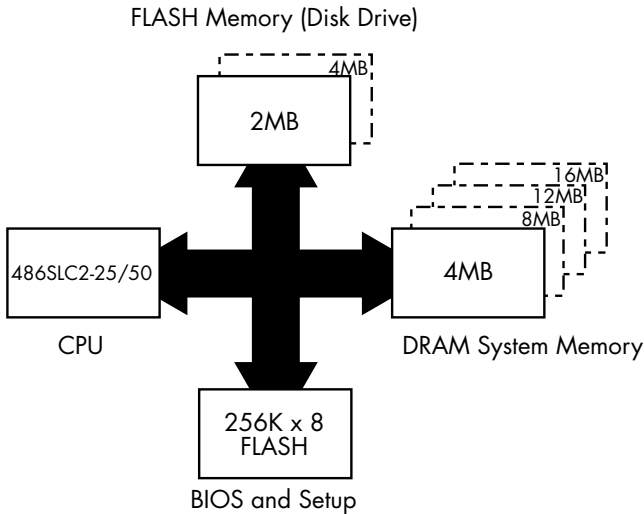
All cabled connections to the TouchStar are made through the rear panel, with the exception of the RF connection in wireless communication-equipped systems. Located on the rear panel are a RESET button, a power connector, a parallel I/O connector, two serial I/O connectors, and dual PCMCIA slots. Also located on the rear panel are connectors for an external keyboard, and network connections



*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 486SLC2-25/50 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 or 16MB of dynamic RAM (DRAM). The specific memory configuration is determined at the time the system is ordered.

- **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 factory-configured with a Local Area Network Interface Card (NIC) which is 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 factory-configured 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.

## **Accessories**

- **TS3000**

Hard-wired configurations of the TS3000 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 TS3000 is optional.



*Figure 4. TS3000 System and Accessories (Mounting brackets not shown)*

- **TS4000**

The TS4000 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 5. TS4000 System and Accessories (Mounting brackets not shown)*



## INSTALLATION & MAINTENANCE

# 2

### PHYSICAL INSTALLATION

#### **TS3000 – Fixed Installation**

The TS3000 TouchStar can be mounted almost anywhere that is convenient to the operator. The mounting location must be near a standard 110VAC 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 TS3000 to the bracket.

All cable connections should be made to the TS3000 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 110VAC 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 +12VDC 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.

#### **TS4000 – Wireless, Mobile Installation**

The TS4000 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 TS4000 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.

### • **TS4000 Physical Installation**

The mounting bracket should be located so that the TS4000 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 TS4000. To provide maximum safety for both the vehicle operator and the equipment, the TS4000 and its DC power converter should both be mounted completely within the vehicle's outer dimensions and profile.

### • **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 TS4000 DC power cable from the converter can reach the mating connector on the TS4000.

### • **Electrical Harness Access Cable**

The electrical harness access cable has WHITE and BLACK leads at one end which are permanently wired into the vehicle's electrical system. The other end 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 access cable should be connected either directly to the vehicle's battery or into the electrical system, at a filtered power tap if possible, at a point that provides power at all times. The BLACK harness wire is connected to the POSITIVE battery terminal. The WHITE harness wire is connected to the NEGATIVE battery terminal. 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 TS4000.

## **NETWORK CONNECTIONS**

The TouchStar is factory-equipped with a network interface card (NIC) 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 port on the TouchStar uses different connectors, depending on the type of network for which the TouchStar is factory-configured. For Token Ring connections, a DB9 connector is used. For Ethernet connections, an RJ-45 or BNC connector is used. For wireless network communications, a non-standard RF antenna connector (reverse BNC, reverse TNC or reverse SMA) is provided.

### **Hard-wired Network Connection**

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 TS3000 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**

When specified to use Ethernet connections, the TouchStar system is supplied with the appropriate Ethernet adapter which operates with most network adapters that comply with IEEE 802.3 10Base2 (thin coax), 10Base5 (thick coax) or 10BaseT (twisted pair) standards.

### **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 2.4GHz 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

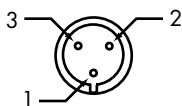
With the exception of the antenna connection for wireless operation, all connections to the TouchStar system are made via connectors on the rear panel.



*Figure 6. 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.



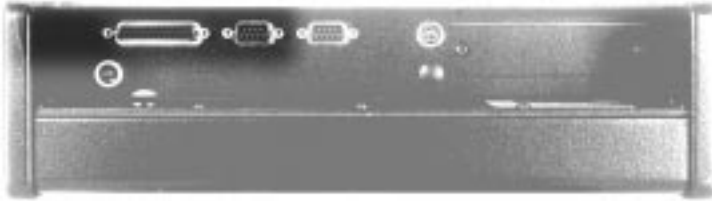
*Figure 7. DC Power Connector Pinout*

Pin	Signal
1	No connection
2	GND (+12V return; NOT chassis ground)
3	+12VDC

*Table 1. DC Power Connector Pinout*

## 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 and floppy drives are connected to the TouchStar via this parallel port.



*Figure 8. LPT1 Parallel Port Connector Pinout*

<b>Pin</b>	<b>Signal</b>
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

*Table 2. LPT1 Parallel Port Connector Pinout*



**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. If factory configured to do so, either serial communication port can also support a serial bar code scanner.

Each is a 9-pin (DB9), DOS-compatible, RS232C serial port, each with its own address. Each port 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.

Port	Base I/O	IRQ
COM1	03F8	4
COM2	02F8	3

*Table 3. Serial Port Configuration*



*Figure 9. Serial Port (DB9) Connector Pinout*

Pin	Signal
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

*Table 4. Serial Port Connector Pinout*

## Keyboard Port

The keyboard connector is a IBM PS/2 standard, 6-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 10. Keyboard DIN Connector Pinout*

<b>Pin</b>	<b>Signal</b>
1	Keyboard data
2	No connection
3	Ground
4	+5V
5	Keyboard clock
6	No connection

*Table 5. Keyboard 6-pin DIN Connector Pinout*

## PCMCIA Slots

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. PCMCIA Type I (SRAM) cards are also supported. Memory and storage cards will typically appear on the system as drive D:\ or E:\.

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.

### **Antenna Connection**

TouchStar systems configured with the 2.4GHz 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 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.

### **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**

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### **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 TS3000, plug the wall-mounted power supply into a surge-protected 110VAC outlet. To eliminate potential damage to the TS3000, 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 TS4000, turn the DC power converter ON/OFF switch to ON.

### **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.

Memory and storage cards appear as unique drives under the TouchStar operating system. Their drive designation depends on the particular card and 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 or keyboard emulator on the touchscreen. 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 (TS3000), or turning off the power ON/OFF switch on the DC power converter (TS4000).
2. Turn the power back on by plugging the power supply back into the wall outlet (TS3000) or turning on the power ON/OFF switch on the DC power converter (TS4000).

OR,

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

## **OPERATING MODES AND ENVIRONMENTS**

The TS3000/TS4000 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 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 TS3000 system's wall-mounted power supply, or turn off the power switch on the TS4000'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 KEYBOARD connector on the rear panel.
3. Insert a bootable disk in the floppy drive.
4. Power up the TouchStar unit again.
5. Press F2 on the keyboard to go into the Setup Mode.
6. When prompted, set the drive for a 1.44MB diskette.
7. Exit the Setup Mode.

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.

- **Logging On to the Network**

The TouchStar is factory-configured with system code that automatically logs into the specific network for which it is configured 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 opposite 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 firmware 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 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*.

### **• 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 see)

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.



**APPENDIX**

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**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 reseal all rear panel cable connections.
3. Check to be sure the TouchStar is receiving operating power.
  - a. TS3000 - 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. TS4000 - 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.

## **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.

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## **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.

---

## **PCMCIA Card(s) Not Working**

The peripheral on the PCMCIA card does not function, or the system does not display the card as drive D:\ or E:\ (memory cards).

## **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.

**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.

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**TS3000 Does Not Communicate with the Network**

The TS3000 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.

---

**TS4000 Does Not Communicate with the Network**

The TS4000 is operating, but does not communicate with the network through its wireless connection.

**Possible Causes and Solutions**

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

## **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**

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**SYSTEM REFERENCE****CPU**

The TouchStar main circuit board assembly contains the central processing unit (CPU), DRAM, and 2MB of Flash-ROM configured as a DOS device. The TouchStar is configured with a 486SLC2-25/50 processor. This CPU is driven by a 50MHz clock signal from the main timer circuits. It runs internally at 50MHz.

**TouchStar 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 system hardware, bootstrap load the operating system and bootstrap 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 4, 8, 12, or 16 MB of dynamic random access memory (DRAM). The DRAM is implemented in two SIMMs (single in-line memory modules) that plug in to sockets on the motherboard. Each SIMM socket can hold either a single- or dual-bank SIMM containing 1, 2, 4, 8 or 16 MB. All system memory above 1MB is accessible as extended memory. Table 1 illustrates some possible DRAM combinations installed in the two SIMM sockets.

Total RAM	Socket 1	Socket 2
4MB	4	0
8MB	4	4
8MB	8	0
12MB	8	4
16MB	8	8
16MB	16	0

*Table 1. System Memory SIMM Combinations*

## 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<sub>H</sub> - 0071<sub>H</sub>. Table 2 shows the configuration of the system's available memory.

Location	Description
0 - 13	Real-time clock (RTC) functions
14 - 127	General low-power static RAM

*Table 2. CMOS RAM Memory Allocation*

Multiple memory locations in the TouchStar are reserved for storing BIOS-dependent configuration information. To access CMOS RAM, the index address (0 to 7F<sub>H</sub>) is output to port 70<sub>H</sub>, and the data is then read or written at port 71<sub>H</sub>. Interrupts should be inhibited while the entire port 70<sub>H</sub>/71<sub>H</sub> 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<sub>H</sub> and the subsequent I/O to port 71<sub>H</sub>, overwriting the port 70<sub>H</sub> value.

## Flash Drives

The TouchStar contains 2MB of Flash memory configured as a solid-state drive. The on-board flash array is supported as a bootable, read-writable drive using the True Flash File System (TFFS). TFFS requires two software components that are either installed in the System BIOS device, or at the start of the Flash Array. Once these components are installed and the Flash Array is formatted, the arrays becomes a bootable drive and is 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 TFFS 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.

When initializing or preparing a Flash drive, software components can be placed on either the Flash Array or in the BIOS device. To initialize a Flash drive:

1. Boot from a floppy with the following lines in the config.sys file
  - device = fdass.com
  - device = tffs.com
2. Add "fdass.com" and "tffs.com" in the root directory of the diskette and format.com, fdass4m.bin.

As the system boots, the sign-on messages will be displayed. When the system completes booting:

3. Run format c: /s:fdass4m.bin.

This runs the low-level format and transfers the boot image to the start of the FLASH Array.

4. Edit the config.sys file to remove the TFFS drivers.

5. Place the bootable floppy in the drive and reboot the system. This time, the TFFS drivers will be loaded from the boot image in the Flash Array.
6. From the A:\ prompt, run the standard DOS format  
Format C:/S/U

Once the format is completed, remove the floppy and reboot the system.

### **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.

<b>Interrupt</b>		<b>Level Function</b>
NMI	02 <sub>H</sub>	Parity
IRQ0	08 <sub>H</sub>	Counter/Timer (18.2 fps)
IRQ1	09 <sub>H</sub>	Keyboard
IRQ2	0A <sub>H</sub>	Slaved from IRQ8 - IRQ15
IRQ3	0B <sub>H</sub>	COM2/COM4
IRQ4	0C <sub>H</sub>	COM1/COM3
IRQ5	0D <sub>H</sub>	unassigned
IRQ6	0E <sub>H</sub>	Floppy disk
IRQ7	0F <sub>H</sub>	Parallel port
IRQ8	70 <sub>H</sub>	Real-time clock (RTC)
IRQ9	71 <sub>H</sub>	Touchscreen, slaved to IRQ2 in software
IRQ10	72 <sub>H</sub>	unassigned
IRQ11	73 <sub>H</sub>	Mouse (no connector)
IRQ12	74 <sub>H</sub>	unassigned
IRQ13	75 <sub>H</sub>	Coprocessor
IRQ14	76 <sub>H</sub>	Fixed disk (not supported)
IRQ15	77 <sub>H</sub>	Audio

**Table 3. Hardware Interrupts**

## **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 4 provides a summary of the DMA channel assignments.

<b>Channel</b>	<b>I/O Address</b>	<b>Description</b>
DMA0	000 <sub>H</sub> - 00F <sub>H</sub>	
DMA1	0C0 <sub>H</sub> - 0DF <sub>H</sub>	I/O addresses 080H - 080FH are occupied by the DMA page registers.
DMA2		DMA2 is occupied by the on-board floppy disk controller.
DMA3		Provides the cascade interconnection for the two DMA devices, thereby maintaining IBM AT compatibility.
DMA4		unused
DMA5		Audio playback
DMA6		Audio record
DMA7		unused

*Table 4. TouchStar IBM AT-Standard DMA Channel Assignments*

**Programmable Interval Timer**

The programmable interval timer is equivalent to the Intel 8254, and occupies I/O addresses 0040<sub>H</sub> through 0043<sub>H</sub>. 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 5. It should be noted that modes 1 and 5 do not have external hardware trigger signals.

<b>Mode</b>	<b>Function</b>
0	Interrupt on terminal count
1	Hardware-retriggerable one-shot
2	Rate generator
3	Squarewave generator
4	Software-triggered strobe
5	Hardware-retriggerable strobe

*Table 5. Counter Modes*

## **PCMCIA Slots**

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

```
DEVICE HIGH = C:\CARDSOFT\SSCIRRUS.EXE
DEVICE HIGH = C:\CARDSOFT\SC.EXE
DEVICE HIGH = C:\CARDSOFT\ATADRV.EXE
DEVICE HIGH = C:\CARDSOFT\CSALLCR.EXE
DEVICE HIGH = C:\CARDSOFT\CARD ID.EXE
```

To remove the PCMCIA driver, modify the autoexec.bat file by deleting the line that reads:

```
LOADHIGH C:\PCMCIA_2\CS_APM.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 audio beeper 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.

## APPENDIX

# C

### SPECIFICATIONS

**CPU** 486SLC2-25/50 (50MHz)

**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  
VRTX Real-Time System, etc.

**System Memory** 4, 8, 12, and 16 MB

**Supported Network Interfaces** Ethernet; 10Mbps  
Token Ring; 16Mbps  
Wireless; 2.4GHz, spread-spectrum  
RF interface (802.11 compliant)

**Input/Output**

Serial I/O 2 channels; RS232C standard  
Parallel I/O 1 port, enhanced; DB25 standard  
Keyboard IBM PS/2 standard 6-pin mini-DIN

**Clock** Real-time, battery-backed; time/day/date

**Battery Backup** Rayovac FB2325 H2; 6 volts  
10 year expected life

**Audio Indicator** 95dBA at 12" (30cm), typical

**Solid-state Storage** 2MB & 4MB 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**

Electro-luminescent (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	+12VDC $\pm$ 0.5VDC 1500mA maximum <25W dissipation; typical
TS3000 Wall-Mount Power Supply	110VAC, 60Hz 0.6A
TS4000 DC Power Converter	+12.0 to +36.0VDC 2.5A

**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**

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

**Storage Temperature Range**

Electro-luminescent 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



**CITADEL**<sup>TM</sup>  
COMPUTER CORPORATION

29 Armory Road Milford, NH 03055  
TEL: (603) 672-5500 FAX: (603) 672-5590  
[www.citadelcomputer.com](http://www.citadelcomputer.com)