NCR RealPOS 70 (7402)

Release 1.1

User Guide

NCR

Preface

Audience

This book is written for hardware installer/service personnel, system integrators, and field engineers.

Notice: This document is NCR proprietary information and is not to be disclosed or reproduced without consent.

References

- *NCR RealPOS 70 Hardware Service Guide*
  (B005-0000-1465)

- *NCR RealPOS 70 Site Preparation Guide*
   (B005-0000-1464)

- *NCR RealPOS 70/EasyPoint 42 Parts Identification Manual*
  (B005-0000-1466)

- *NCR FitClient Software User's Guide* (B005-0000-1235)

- *NCR RealPOS 70/EasyPoint 42 Migration Guide* (B005-0000-1500)

Table of Contents

Chapter 2: **Hardware Installation**

Chapter 3: **Setup**

Chapter 4: **Operating System Recovery**

Chapter 5: **BIOS Updating Procedures**

Chapter 6: **2x20 Customer Display**

Chapter 7: **Integrated APA Customer Display**

Chapter 8: **Cash Drawer Interface**

Chapter 9: **Touch Screen Calibration**

Appendix B: **Feature Kits**

Appendix C: **Memory Map**

Revision Record

Issue	Date	Remarks
A	Nov 2003	First Issue
B	Mar 2004	Release 1.1

Safety and Regulatory Information

The NCR RealPOS 7443 conforms to all applicable legal requirements. To view the compliance statements see the *NCR RealPOS Terminals Safety and Regulatory Statements* (B005-0000-1589).

Chapter 1: Product Overview

Introduction

NCR's RealPOS 70 (also referred to as NCR 7402) is a scalable, retail-hardened Point-of-Sale Solution with an intuitive touch screen interface designed for extended life cycles, stability, and superior availability. Engineered to thrive in the most demanding environments, the RealPOS 70 offers leading retailers in Hospitality, Convenience Stores and General Merchandise a POS platform that offers the greatest value for their POS investment.

Unlike other POS solutions, the RealPOS 70 sets a new standard by offering an unprecedented combination of standard features including new embedded technology, ease of serviceability, and maximum configuration flexibility. The RealPOS 70 is available with either a 12.1" or 15" LCD display.
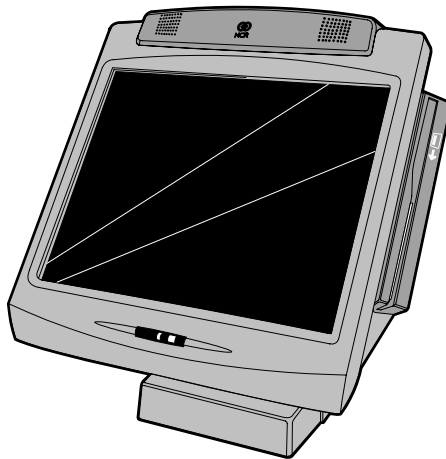
7402-xx2x 15" Model   7402-xx1x 12" Model

21243
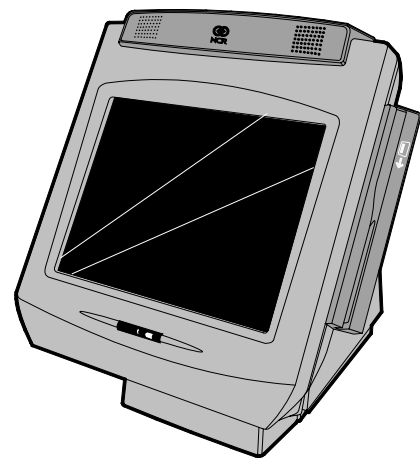
Model Numbers

The following table identifies the RealPOS 70 models.

Major Model	Description
7402-1000	Intel 2.0 GHz Celeron, 128MB Memory, 40GB Hard Disk, 12.1" LCD w/Resistive Touch, 3 RS-232, 3 Powered USB, 2 Standard USB, Audio/Mic. and US Power Cord, No MSR, No Customer Display, Integrated Stereo Speakers
7402-1010	Intel 2.0 GHz Celeron, 256MB Memory, 40GB Hard Disk, 12.1" LCD w/Capacitive Touch, 3 RS-232, 3 Powered USB, 2 Standard USB, Audio/Mic. and US Power Cord, MSR, No Customer Display, Integrated Stereo Speakers
7402-1020	Celeron 2 GHz, 400 MHz Front Side Bus, 256MB RAM, 40GB Hard Drive, MSR, 15" LCD w/Capacitive Touch, Tilt Mount
7402-1024	Celeron 2.4 GHz, 400 MHz Front Side Bus, 256MB RAM, 40GB Hard Drive, MSR, 15" LCD w/Capacitive Touch, Tilt Mount

Hinged LCD

The RealPOS 70 utilizes a top-hinged LCD which allows extremely quick and easy motherboard access. The LCD can be completely removed if necessary for upgrades or repair. Functioning much like the hood of a car to gain access to the *engine*, the LCD has a security mechanism permitting it to be locked into place if desired. For procedures about how to open the cabinet see the *Installing Peripherals* section in the *Hardware Installation* chapter.

20932
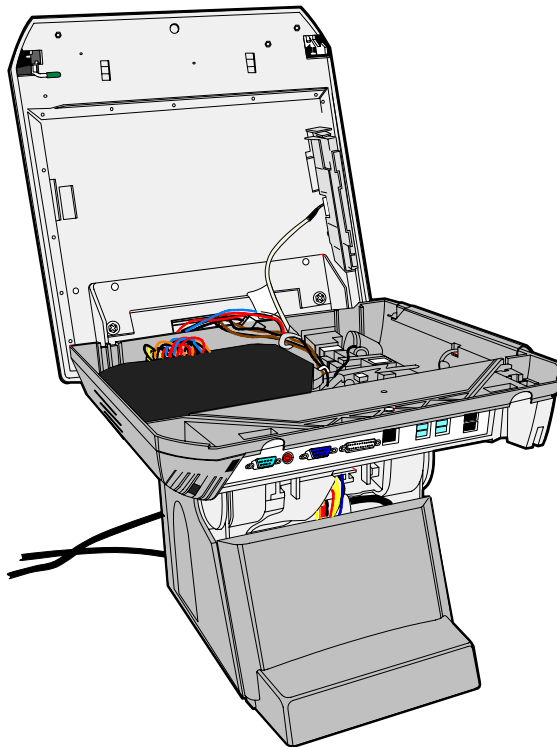
Label Locations

There are two serial number and model number labels located behind the cable cover. A third label is located on the back of the Display Assembly. If the terminal was shipped with an Operating System pre-installed then there is also a Certificate of Authenticity label.

Class:7402-1000

S/N:36309845   Date:21 November 2003

NCR Corp Class:7402-1000   Unit Serial:36309845

NCR Corporation   Atlanta, GA 30096   Made in Singapore 新加坡制造

Class 7402機型

Model No 型号   : 7402
Serial No 序号   : 36-309845
Date of Mfg 制造日期 21 NOV 2003

NO. 437 NCR

National NATIONAL

100-120 V~ac,
50-60 Hz   6A 300W

200-240 V~ac,
50-60 Hz   3A 300W

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:
(1) this device may not cause harmful interference, and
(2) this device must accept any interference received, including interference that may cause undesired operation.
This Class A digital apparatus complies with Canadian ICES-003.
Cet appareil numerique de la classe A est conforme a la norme NMB-003 du Canada Patents Pending

この装置は、クラスA情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。VCCI-A

21349

Hardware Options

- Integrated 3-Track ISO MSR

- Integrated Stereo Speaker Module

- Integrated Infrared Sensor

- PCMCIA (for wireless LAN)

- 128 MB, 256 MB, 512 MB non-ECC Memory DIMMs

- Hard Drive
- Internal Compact Flash
- 3M Touch Systems resistive or capacitive touch sensor
- Cash drawers
    - 2183 Mid-Size Cash Drawer (modular)
    - 2189 Full-Size Cash Drawer (modular)
    - Dual cash drawer cable
- MSR
    - ISO
    - JIS
- Keyboard
    - USB Alphanumeric Big Ticket Keyboard
    - PS/2 Alphanumeric Big Ticket Keyboard
- Customer Displays
    - Integrated 2 x 20 VFD
    - Integrated International APA (All Points Addressable)

- Printers
  - 7167 Thermal Receipt/Impact Printer
  - 7197 Thermal Receipt Printer
- Low-Profile ATX Power Supply – 300 Watts
- 12 or 15 inch LVDS TFT display – dual bulb enhanced brightness

Operating Systems

- DOS 6.22
- Windows NT Workstation
- Windows 2000 Professional
- Windows XPe
- Windows XP (certified)
- Linux (certified)

Removable Motherboard Sled

Complementing the hinged LCD is a motherboard tray mounting mechanism which allows the component to be easily removed without the use of tools.

Removable Power Supply

The 7402 utilizes an intuitive removable rear cover allowing easy access to the power supply. The Power Supply is mounted on a sled which permits removal or tool free service.

Removable Hard Disk

Removal of the back cover permits easy removal of the front cover, which permits tool-free removal of the hard disk.

Hardware Modules

Pentium 4 Embedded ATX Motherboard

- Intel 2.0 GHz Celeron Processor, 128kB L2 Cache, 400 MHz front side bus

- Intel 2.4 GHz P4 Processor, 512kB L2 Cache, 533 MHz front side bus

- Intel 852GM North Bridge with integrated LVDS and multi-monitor capability

- Inverter & LCD power support

- LCD Adapter Board

- DVI and VGA Interfaces for Secondary Displays

- DDR-SDRAM; 266MHz in desktop DIMM, 2 sockets (1GB Max)

- Intel ICH4 Desktop South Bridge

- USB 2.0, supports 6 ports, including 2 USB+Power (12V), 2 internal USB

- ATA-100 Primary & Secondary IDE Ports

- Intel Integrated 10/100 Ethernet

- Three Serial Ports, all with 12V Power Option, plus a fourth port for touch

- Support for Internal Wedge Peripherals (MSR)

- PCI Connector Supporting a Riser Card

- CPU and Power Supply Fan Speed Detection

- Integrated Audio with Amplified Speaker Output and Mic Input, Internal PC Speaker

- IRDA Interface

- Daughter Card GPIO Interface for Cash Drawer and Retail Function Support

- AMI BIOS with NCR Retail Customizations and ACPI support

Retail Daughter Card

- Cash Drawer Port (supports two drawers via a Y-cable)
- Touch Controller (3M EXII) for Resistive & Capacitive Touch Sensors
- NCR 2nd Generation Trigantor MSR Controller with Wedge I/F
- 24 V Powered USB Port
- Motion Sensor I/F

Hardware Module Descriptions

Motherboard

Processor/Chip Set

The terminal uses an Intel architecture processor, which permits it to leverage existing software drivers and applications, as well as provide the greatest flexibility in choosing an operating system. This provides several other advantages:

- Intel 2.0 GHz Celeron Processor, 128kB L2 Cache, 400 MHz front side bus

- Intel 2.4 GHz P4 Processor, 512kB L2 Cache, 533 MHz front side bus

- Capable of SW MPEG-1 or MPEG-2 playback at 30 frames per second with 22 kHz stereo audio (may be limited by OS constraints).

- SoundBlaster®-compatible audio

- Expansion capabilities for optional features and future requirements (PCI bus and USB)

System Memory

The memory used is 266MHz DDR-SDRAM on standard desktop 184 pin DIMMs at 2.5 volts. The board has two DIMM sockets. Release 1.0 supports 1GB maximum memory, which is the limit of the 852GM chipset. Larger memory configuration up to 2GB is supported with the 852GME chipset.

Memory sizes include 128MB, 256MB & 512MB non-ECC DIMMS.

The 128MB DIMM used with release 1.0 contains 256Mb memory chips with 16Mx16 configuration. The 256MB & 512MB DIMMs used with release 1.0 contain 256Mb memory chips with 32Mx8 configuration.

The 852GME chip set supports 333MHz DDR-SDRAM.

852GME Graphics & Memory Controller Hub

- Supports CPU with 400 MHz FSB
- Supports Desktop Intel Celeron or Pentium 4 processor with Northwood Core
- Memory: DDR-DRAM 200 or 266MHz, up to 2 double sided DIMMs, No ECC Support, 1GB maximum
- Integrated graphics with VGA, LVDS LCD, and 1 digital video (DVO) port
- Dual independent display with Windows multi-monitor support
- Shared memory architecture – 8-**64** MB   video memory dynamically allocated from system memory
- Hub interface to ICH4 south bridge at 266 Mb/s
- IOQD (In order Queue Depth) = 12

North Bridge Features

Release 1.0 includes the Intel 852GM GMCH (Graphics & Memory Controller Hub), which provides the following functions:

- Supports CPU with 400 MHz FSB only
- Supports Desktop CPU: P4 or Celeron
- Memory: DDR-DRAM 200 or 266MHz, up to 2 double sided DIMMs, No ECC Support, 1GB maximum
- Integrated graphics with VGA, LVDS LCD, and 1 digital video (DVO) port
- Dual independent display with Windows multi-monitor support
- Shared memory architecture – 8-64 MB video memory dynamically allocated from system memory
- Hub interface to ICH4 south bridge at 266 Mb/s
- IOQD (In order Queue Depth) = 12

Release 1.1 includes the 852GME board version, which adds support for:

- CPU with 533 MHz FSB
- DDR-SDRAM up to 333MHz, up to 2GB maximum, ECC or non-ECC
- Second digital video (DVO) port

South Bridge Features

The 7402 Motherboard uses the Intel ICH4 South Bridge, which provides the following functions:

- Integrated Intel Audio (requires external codec)
- Integrated 10/100 Ethernet controller (requires external 82562 PHY transceiver chip)
- IDE controller with Primary & Secondary channels, each supporting master & slave drives; ATA-100 support with automatic detection of 80-conductor cable
- USB Host controller – Four USB host controllers, six physical USB ports, USB 2.0 supported
- PCI Bus Host Controller – up to 6 bus masters supported
- LPC Bus Bridge Controller – interface to SuperIO & Trusted Platform Module
- Hub Interface to North Bridge at 266Mb/sec
- SMBUS (I2C) Controller – Interface Hardware monitor
- Firmware Hub (BIOS ROM) Interface
- ACPI Power management support
- Base PC functionality: DMA controller, Interrupt controller, Real-Time-Clock, and event timer

Video Memory

Shared memory architecture uses 8-64 MB video memory, with Dynamic video memory allocation (DVMT).

BIOS Memory

The 7402 includes 512KB of Flash BIOS and supports up to 1MB Flash parts. A DMI area in the BIOS ROM stores system information about the 7402, such as serial number and model number. Platform software detects board version via device ID of key components on the board. There is no board ID EEPROM.

Video

The 7402 uses integrated graphics in the 852GM and 852GME chip.

Graphics Controller Architecture
- Shared memory architecture uses 8-64MB video memory, with Dynamic video memory allocation (DVMT)
- Motion compensation for MPEG-2 support
- Software DVD playback at 30 frames/second full screen
- Video overlay support
- 2D Graphics engine includes 128 bit BLT engine and color space conversion
- 3D Graphics engine includes DirectX support, 16/24 bit Z-buffering, Enhanced texture functions, Double and triple render buffer support, 16 & 32 bit color, maximum 3D resolution of 1600x1200 @ 85Hz
- Dual independent display pipelines – appear as independent display devices to the OS
- Graphics core frequency 200 MHz (852GM) or 266 MHz (852GME)

Graphics Output Devices
Video outputs: VGA CRT (15 pin DB-9 connector), DVI-I external monitor, and LVDS LCD (internal)

- VGA CRT support up to 1600x1200x24 bit @ 85Hz

- Integrated LVDS transmitter: Supports up to 1400x1050@ 60Hz single or dual channel dual channel LVDS flat panel, with LVDS frequency up to 112MHz.

- Generates LCD power sequencing and backlight inverter control signals

- Bi-Linear panel fitting (stretching)

- Digital video (DVO) port used to drive DVI transmitter component

- Second DVO port (852GME only), which is used for display options on other NCR platforms

- DVI external monitor support up to 1600x1200 @ 60Hz, Compliant with DVI Specification 1.0

- Dual independent display support with Windows multi-monitor support (Extended Desktop and Simultaneous modes) VGA+DVI, VGA+LVDS, LVDS+DVI Extended Desktop mode only) supported, any device can be selected as primary.

Analog Monitor
DVI-I is provided as a convenience for users with analog monitors having a DVI connector. DVI-I means an analog VGA signal is present on the DVI connector, along with the digital DVI signals. On the 7402, the analog DVI-I signal is the same as that sent to the VGA 15 pin connector. A VGA monitor may be connected to either the VGA 15 pin connector or the DVI-I connector, but not both at the same time.

LCD Support
Intel generated a specification for integrated LCD support in PC systems, called *Common Panel Interface Specification (CPIS)*. The 852GM/GME graphics controller uses the LCD interfaces.

LVDS signals are brought out to a 50 pin header on the motherboard. Although CPIS specifies an LCD connector the 7402 does not use it because it does not support 24-bit color LCD.

DVI Interface

The DVI supports NCR display peripherals such as the 5964 as well as standard PC digital monitors.

Power Management

The BIOS supports the supports the Advanced Configuration and Power Management Interface (ACPI) 1.1 specification. The 7402 supports the system power states defined by ACPI:

- G3 Mechanical Off

  A computer state that is entered and left by a mechanical means (for example, turning off the system's power through the movement of a large red switch). Various government agencies and countries require this operating mode. It is implied by the entry of this off state through a mechanical means that no electrical current is running through the circuitry and that it can be worked on without damaging the hardware or endangering service personnel. The OS must be restarted to return to the Working state. No hardware context is retained. Except for the real-time clock, power consumption is zero.

- G2/S5 Soft Off

  A computer state where the computer consumes a minimal amount of power. No user mode or system mode code is run. This state requires a large latency in order to return to the Working state. The system's context will not be preserved by the hardware. The system must be restarted to return to the Working state. It is not safe to disassemble the machine in this state.

- G1 Sleeping

  A computer state where the computer consumes a small amount of power, user mode threads are not being executed, and the system "appears" to be off (from an end user's perspective, the display is off, and so on). Latency for returning to the Working state varies on the wake environment selected prior to entry of this state (for example, whether the system should answer phone calls). Work can be resumed without rebooting the OS because large elements of system context are saved by the hardware and the rest by system software. It is not safe to disassemble the machine in this state.

- G0 Working

  A computer state where the system dispatches user mode (application) threads and they execute. In this state, peripheral devices (peripherals) are having their power state changed dynamically. The user can select, through some UI, various performance/power characteristics of the system to have the software optimize for performance or battery life. The system responds to external events in real time. It is not safe to disassemble the machine in this state.

Under the G1 sleeping state ACPI defines levels of system sleep state support. The 7402 supports the following sleeping states:

- S0: Normal Powered-On state
- S1 (Standby): The S1 sleeping state is a low wake latency sleeping state. In this state, no system context is lost (CPU or chip set) and hardware maintains all system context.

The 7402 does not support the S2, S3 (Suspend to RAM), or S4 (Suspend to Disk) sleeping states. Reference the ACPI Specification for details.

Peripherals: ACPI defines power states for peripherals which are separate from the system power state. The device power states range from D0 (fully-on) to D3 (off) It is the responsibility of the driver developer for each peripheral to define and support the available power states.

USB Port Functionality

The motherboard supports six USB ports with the following characteristics:

- USB v.2.0 (EHCI) and Intel Universal HCI v.1.1 (UHCI) compatible
- Three independent UHCI host controllers plus the EHCI , all can map to any physical port
- Each Host Controller has its own root hub
- Integrated physical layer transceivers with over-current detection status on USB inputs
- Legacy PS/2 keyboard and PS/2 mouse support so that legacy software can run transparently in a non-USB-aware operating system environment.
- Permits hot plug and play and isochronous peripherals to be inserted into the system with universal driver support.

Two standard Type A USB ports, and two 12V Powered USB ports appear external to the terminal on I/O row. One 24V Powered USB port is available on the P4 Retail Daughter card. The remaining USB port is internal to the unit and reserved to support future releases (USB Touch, USB Biometrics, etc).

Ethernet LAN

The 7402 uses the Intel 82562EX Platform LAN component (10/100 PHY/transceiver used with ICH4 integrated LAN controller), which features:

- Compliance with Advanced Configuration and Power Interface and PCI Power Management standards
- Support for wake-up on interesting packets and link status change
- Support for remote power-up using Wake on LAN (WOL) technology
- Support of Wired for Management (WfM) Rev 2.0
- Transmit and Receive FIFOs 3kB each
- Backward compatible software with 82557, 82558 and 82559 (used on previous NCR products)
- TCP/UDP checksum off load capabilities
- Support for Intel's Adaptive Technology (robust operation at 100Mb/s)
- Intel PXE (network boot) support incorporated into system BIOS
- RJ-45 LAN connector with speed and link LED, and integrated magnetics for better cost/performance

Integrated Audio

The digital audio link in the ICH4 supports the Audio Codec '97, Revision 2.3 specification, which includes support for three codecs with independent PCI functions for audio and modem.

Note: The integrated Modem is not supported.

Microphone input and left and right audio channels are supported for a high quality, two-speaker audio solution.

The ICH4 supports up to six channels of PCM audio output (full AC3 decode). Six-channel audio consists of Front Left, Front Right, Back Left, Back Right, Center, and Subwoofer, for a complete surround-sound effect. ICH4 has expanded support for three audio codecs on the AC-link. The 7402 motherboard provides a single codec for Left and Right stereo sound. Surround sound is not supported.

An amplifier integrated on the motherboard allows direct drive of stereo speakers, up to 3 Watts/channel.

Intel provides Windows and Linux drivers for the integrated audio. Under DOS there is SoundBlaster compatibility.

Audio Outputs:

- A triple stack audio connector on the rear I/O with Line in (top), Speaker out (middle), and Mic in (bottom) on 3.5mm stereo jacks.
- An internal 14 pin header as defined by EmbeddedATX, implementing Line out (amplified), Speaker out, and Mic in.

Plugging a cable into the Speaker out or Mic in ports on the rear I/O disables that functionality on the internal header.

A piezo transducer on the motherboard provides basic PC beep functionality under DOS, and also for other OS when there are no speakers connected. The PC beep signal is connected to the audio codec to allow PC beep sounds to play through the speakers when these are present.

Fan Connectors

The motherboard has three fan connectors. One is reserved for the CPU fan. The power supply fan speed output is connected to a second fan connector, which is used to monitor power supply fan health.

All fan connectors are +12Vand are intended for fans with 300mA typical current draw.

The motherboard has hardware support for variable speed CPU fan, using the LM85 monitor. Variable speed fan can lower system noise levels, reduce dust ingress, and improve fan life. Fan speed control is via PWM signals generated by the LM85.

Cash Drawer Support

The 7402 Terminal controls the cash drawer through a cash drawer Kickout connector on the back of the terminal (Retail Daughter Card), or through the cash drawer Kickout connector on the transaction printer. The terminal can be configured with 0, 1, or 2 cash drawers. The first drawer is attached to the terminal through a cable with an RJ-45 connector. A second drawer can be connected using a 'Y' cable.

Note: A single *Open/Close* status signal is shared with both drawers. Therefore, it is not possible to determine which cash drawer is open.

MSR
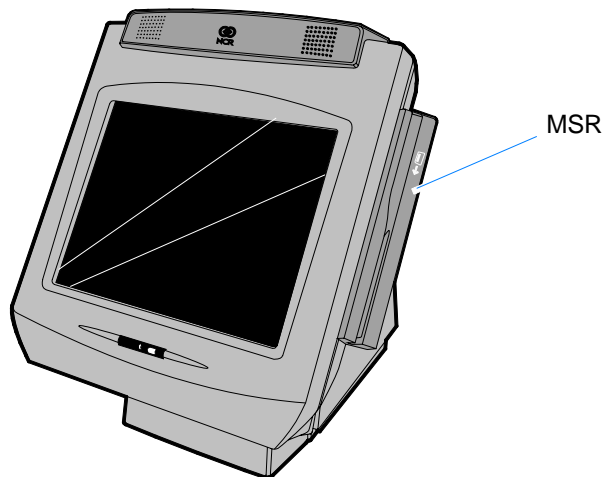
21366

The MSR interface supports a maximum of 3 tracks of magnetic stripe information for support of ISO format cards. Activate the MSR interface by enabling it in *BIOS Setup* under IO Configuration. The MSR interface controller is a memory-mapped device, which can reside at system memory addresses CA000, CC000, or D0000. If MSR capability is not desired, it may be disabled through *BIOS Setup*.

PCI Boards

PCI Riser Board

The PCI Riser Board is a single-slot board, which supports the custom 7402 PCI boards.

PCMCIA Adapter Board

This PCI board supports one Type 2 PCMCIA card. The PCMCIA socket supports 12V, 5V and 3.3V cards and is switched automatically by the Texas Instrument TPS2226A power switch. All cards are internally buffered to allow hot insertion and removal. The PCI card has an internal data path, which allows the host to access 8-, 16-, and 32-bit cards using full 32-bit PCI cycles for maximum performance. Pipeline architecture provides an unsurpassed performance level with sustained bursting. This card is register compatible with the Intel 82365SL-DF and 82356SL.

Dual RS-232 Adapter

This PCI board has two 16C550 compatible serial ports, which are addressed as COM6 and COM7. These two COM ports are located on the connector row of the 7402. COM6 is labeled RS232/5 and COM7 is labeled RS232/6. The card supports 5, 6, 7, 8-bit character selection along with even, odd, no parity, or force parity generations. The 9835 is capable of supporting fast data rates up to 1.0 Mbytes/s.

Storage Media

HARD DISK DRIVE

The 7402 supports one 3.5 inch, Ultra DMA 100 IDE hard disk drive. The drive is located in the front of the base. It has the following performance characteristics:

- Access Time: 12 msec (average)
- RPM: 5400
- Size: 40/80 GB
- 2 MB SDRAM Cache Buffer

Compact Flash

The 7402 supports Compact Flash through the IDE interface. The adapter board is located on the Retail Daughter Card Bracket. The compact flash must be set for Master Mode.

Operator Display

The motherboard, through the LVDS Adapter Board, supports an integrated Display Head with an LVDS TFT LCD panel.

LCD Panel

The 7402 provides two operator display options:

- 12.1″ dual bulb LVDS TFT display (Sharp LQ121S1DG41)
- 15″ dual bulb LVDS TFT display (Sharp LQ150X1LGN2H).

The display head has the following characteristics:

- LVDS interface used to control the LCD
- RS-232 interface used to communicate with the touch screen controller (located on Retail Daughter Card)
- The display head draws a maximum of 1.5A from the powered RS-232 interface
- 2 Backlights
- Field replaceable backlights
- MTBF of 50000 hours
- Brightness of 350 nits

LVDS

LVDS *(Low Voltage Differential Signaling)* is an improvement over the traditional parallel interface. LCD image data is sent on 4 pairs of wires rather than on 20 individual data lines. The Intel chipset drives LVDS directly with no additional logic required. Advantages of LVDS include:

- Reduces LCD Cable complexity
- Dramatically reduces radiated emissions
- Improves robustness of display signal timing
- Supports longer cable length up to several feet if required

Inverter

An inverter is used to drive the CCFL (cold cathode fluorescent) backlights of the LCD. Since the inverter is matched to the LCD, the 12.1″ and 15″ displays have different inverters. Inverter output power is approx. 9 watts for the the 12.1″ display and 13 watts for the 15″ display. The inverter mounts to the back of the LCD bracket near the PCI slot. A cover protects personnel and surrounding circuitry from the high voltage required to drive the backlight tubes.

Touch Screen

The 7402 supports either a five-wire resistive Touchscreen or a Capacitive Touchscreen. A hardware jumper on the Retail Daughter Card selects resistive or capacitive mode.

All applications and diagnostics use the touch interface for user interaction. The touch screen glass completely covers the LCD display and is mounted directly in front of the LCD, behind the front plastic bezel. The MicroTouch EX II chipset is used to control the Touchscreen, which is connected to the Retail Daughter Card through an internal RS232 cable and interface. The Touchscreen is designed to be easily replaced in case of damage or failure.

Integrated Customer Display

The 7402 supports an integrated Customer Display, which is located on the top of the display head, facing the back of the unit. There are two types:

- 2 x 20 VFD
- All Points Addressable Display

2 x 20 VFD

The 2 x 20 VFD Customer Display module consists of a VFD with 2 rows of 20 5x8 dot matrix characters, RS-232 interface, driver circuitry, DC to DC/AC converter, and character generator.

All Points Addressable Display

The All Points Addressable Customer Display module consists of a 128 x 64 dot matrix graphic VFD, RS232 interface, DC to DC/AC converter, and a character generator. The module is capable of displaying 64 luminance levels and 4 grayscale levels.

Additional Features

IRDA Infrared Interface

The 7402 supports IRDA communications with external portable devices such as Cell Phones and PDAs. The IR transceiver is located behind a dark plastic lens on the front bezel of the unit, below the LCD display. Typically the remote device must be placed with 1 meter of the 7402 to establish communications.

IRDA leverages serial interfaces and thus uses the COM2 serial port resources. Nominal data rate is 115kbps. Bright sunlight on the 7402 or remote device can reduce range or block communications completely. Appropriate drivers must be loaded for the installed operating system to recognize the IRDA interface.

Motion Sensor

The 7402 supports a motion sensor for system wakeup based on nearby activity. This is a photodiode sensor which detects changes in ambient light levels. The hardware generates an input signal to the motherboard which can be polled or used to generate interrupts depending on software architecture (NCR-supplied software and operating system software can both use this interface if configured correctly). The 7402 does not support wakeup from soft off via the motion sensor. However, wake from standby or screen saver are possible, and NCR driver software allows customer applications to directly use the motion sensor.

The photodiode mounts behind a clear plastic lens below the LCD panel, next to the IRDA transceiver. The circuitry is optimized for normal room lighting conditions. Excessive bright light or darkness can reduce its effective range. Typically motion within 2-4 feet of the system causes a wakeup.

Power Indicator

A green LED power indicator is located below the LCD near the motion sensor and IRDA transceiver. The LED illuminates whenever the system power supply is active. Thus the power indicator shows that the unit is *On* or in *Standby*.

Speakers

The 7402 has stereo speakers integrated into the top of the display head above the LCD panel. These connect to the motherboard internal audio header. Nominal audio power is 3W per channel, which provides full PC audio capability. For higher-fidelity sound, external speakers can be connected to the external audio jack on the I/O bracket. The integrated speakers are muted in hardware whenever a cable is plugged into the external audio jack. There is only enough power available to drive one set of speakers.

Printer Options

NCR 7167 Printer

The NCR 7167 Printer is a fast, quiet, relatively small and very reliable multi-function printer. It prints receipts, validates and prints checks, and prints on a variety of single or multiple part forms. There is not journal as it is kept electronically by the host terminal. The printer can connect through a USB port or a serial port. It can receive power from a power supply or through a USB+ power cable.

Power Supply

AC Adapter Cable
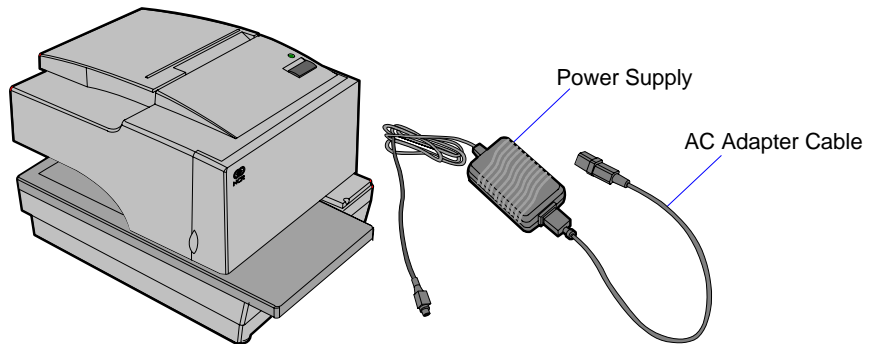
19711c

NCR 7197 Printer

The NCR 7197 Printer is a fast, quiet, relatively small and very reliable multi-function printer. It prints receipts and two-color printing. The printer can connect through a USB port or a serial port. It can receive power from a power supply or through a USB+ power cable.

Power Supply

AC Adapter Cable
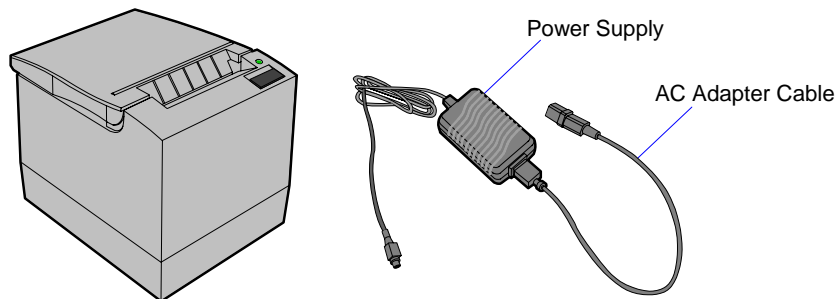
19712b

Optional Displays

5964 12.1-Inch Touch Screen
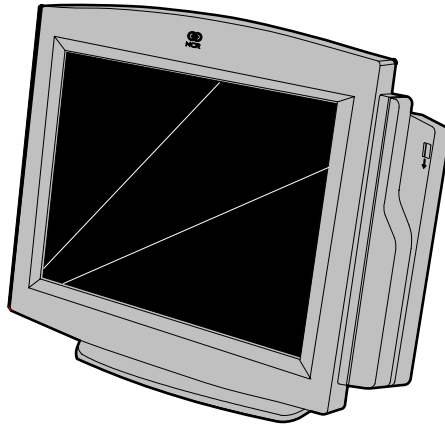
19429a

The 5964 is designed for touch-based applications and features a high-brightness 12.1-Inch Active Matrix Color LCD with SVGA resolution. The 5964 features a 5-wire Resistive Touch Screen, integrated MSR, Digital Video Interface (DVI), table top mount with tilt and swivel (or can be integrated on the terminal), and convenient connections for an external keyboard and hand held scanner.

Note: If *Simultaneous Mode* is used (same display on both the integrated LCD and the 5964) then Extended desktop (concurrent mode) is recommended.

Features

Resistive Touch Screen	Touch overlay uses 5-wire resistive technology for ease of use and long reliability.
	Resistive technology allows users to operate the touch screen with a gloved hand, stylus, etc.
Retail Hardened	Touch screen surface contains an anti-glare, spill-proof and hardening coating
12.1-Inch Active Matrix LCD	Dual backlight color LCD display offers exceptional brightness (300 nits max.) and viewability.
Brightness Control	The LCD is factory set to run at full brightness. Users can select reduced brightness through a user adjustable hardware switch below the right front bezel (high/low brightness).
Wide Viewing Angle	Horizontal viewing angle of $-60°$ to $+60°$ (right to left), vertical $-50°$ to $+50°$ (bottom to top)
SVGA Resolution	High resolution (800 x 600) supports the latest graphical and multimedia applications
PS/2 Keyboard Connector	A convenient PS/2 connector supports a non-wedge PC-style keyboard for alpha entry and diagnostics
Scanner Connector	RJ-45 interface provides 5 V power and communication for the NCR RS-232 hand-held scanner
Tone Speaker	Sounds error tones & audible feedback during operator input - controlled by TAPS/OPOS commands
DVI Video Interface	Industry standard DVI (Digital Video Interface) for connection to DVI-I connector on 7402

RS-232 Touch Interface	7402 Powered RS-232 connector provides power and touch interface for NCR 5964 display
Wedge Controller	Passes data (MSR, scanner, keyboard) to host terminal through PS/2 data stream via Y-cable
Terminal Powered	No additional power cord or power supply is required simplifying cable management
MSR Option	Integrated 3-track ISO MSR
Tilt / Swivel	The remote table top pedestal mount supports tilt and swivel to adjust display to optimum angle

5942 12.1-INCH Color LCD
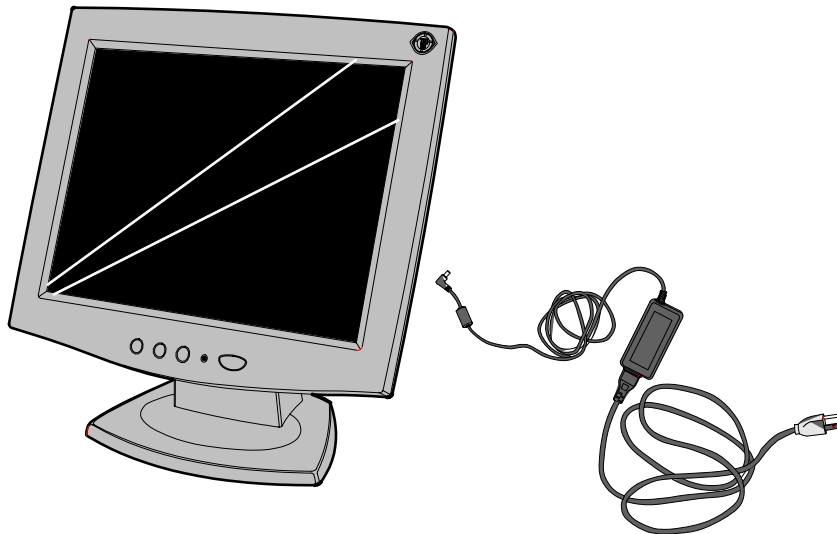
19809a

The 5942 12.1-Inch LCD is designed for customers who desire a color display and prefer the small footprint and ergonomic packaging of LCD technology versus traditional CRT's. Depending on the customer's requirements, this LCD display can be used either as an operator display or a customer information display (CID). The 5942 Display features a 12.1-Inch Active Matrix Color LCD with support for SVGA and XGA resolution.

The 5942 can be integrated on the terminal or installed on a remote mount.

7452-K419 15-Inch Color CRT

The 15-Inch CRT can be integrated on the terminal or installed on a remote mount.

Note: The 15-Inch display is too large for the Swivel Arm. For integrated configurations it is placed on the Large Peripheral Extension Deck, which is included in the Integration Tray Accessories Kit (7402-K310/K315).

19743
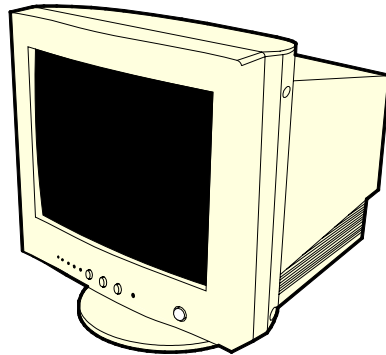
NCR 5932 Keyboards

There are three models of the 5932 Keyboard:

- 109-Key USB Keyboard
- 115-Key Big Ticket Keyboard (PS/2 interface)
- 68-Key POS Keyboard (PS/2 interface)

109-Key USB Keyboard
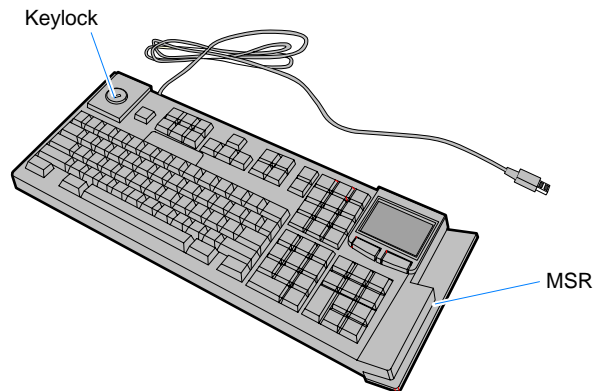
19586a

The 109-key USB keyboard is a multifunction keyboard that is two keyboards built into one.

The keyboard consists of two major sections:

- 38-key POS keyboard
- Industry-standard alphanumeric PC keyboard

The keyboard contains the key matrix and other POS-specific functions such as Keylock, speaker, system status indicator, and magnetic stripe reader (MSR). This 5932 keyboard also has a USB port to connect a Scanner or other USB device.

Features

The NCR 5932 USB Keyboard supports the following features:

- Keylock
- Speaker
- Magnetic Stripe Reader (MSR)
- Keyboard Status LEDs

Keylock

The USB keyboard has a four-position Keylock. You can rotate the Keylock between specific positions by use of three keys. The positions are explained in the following table.

Abbreviation	Position	Description
Ex	Exception	Used by the customer or service representative to perform low level programming such as workstation diagnostics, configuring the workstation, or loading the workstation.
L	Locked	Used to lock keyboard input to prohibit use of normal functions.
R	Register	Used when performing normal retail mode functions.
S	Supervisor	Used by the supervisor to provide highest level of workstation control in cases such as refunds and running totals.

Speaker

The programmable speaker is capable of generating key clicks and error tones.

MSR

The MSR is an optional feature that provides support for reading magnetically coded data cards. The keyboards support two different types of MSR:

- ISO Tracks 1, 2, and 3
- JIS-II and ISO Track 2

Keyboard Status LEDs

The keyboard has three status LEDs:

- Num Lock
- Caps Lock
- Scroll Lock

These features are used to provide the present state of the keyboard. The indicators are single color (Green) LED's. When the system is off, no LED's are illuminated.

115-Key PS/2 Big Ticket Keyboard

Keylock

Status
Indicator

MSR
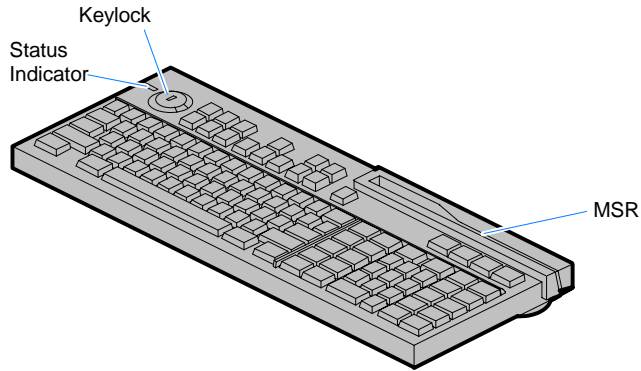
19745a

68-Key PS/2 POS Keyboard

Keylock

Status
Indicator

MSR
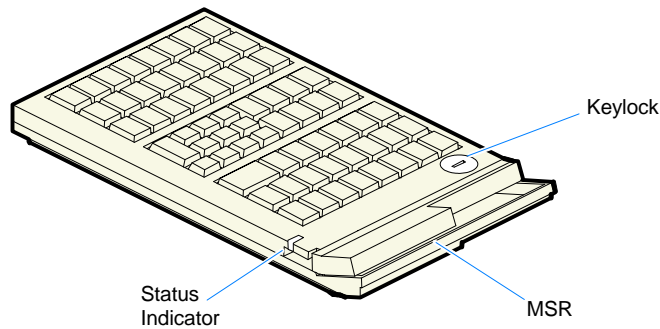
19746

Features

The 5932 PS/2 Keyboards include the following features:

- Keylock
- Speaker
- System Status Indicator LED
- Magnetic Stripe Reader (MSR)
- External Decoded Scanner Connector
- Special *PC Setup* mode on the 68-key keyboard

The operations of the user-programmable speaker, Magnetic Stripe
Reader (MSR), keylock, and scanner connector are handled by the
Wedge controller. Please refer to the *Wedge Software User's Guide*
(BD20-1368-A) for detailed information about interfacing and
configuring these devices.

Keylock
The Big Ticket and 68-key keyboards have a four-position keylock
switch. The positions are explained in the following table.

Abréviation	Position	Description
Ex	Exception	Used by the customer or service representative to perform low-level programming such as terminal diagnostics, configuring the terminal, or loading the terminal.
L	Locked	Used to lock keyboard input to prohibit use of normal functions.
R	Register	Used when performing normal retail mode functions.
S	Supervisor	Used by supervisor to provide highest level of terminal control in cases such as refunds and running totals.

Speaker
A programmable speaker generates key clicks and error tones.

Buzzer
The buzzer is an internal on board Buzzer.

System Status Indicator LED
The system status indicator is a two-color LED. The green color
indicates the keyboard is powered. Red indicates an error condition.
When the system is off, the LED is extinguished.

When the 68-key keyboard is in the special "PC setup" mode, the LED flashes red/green.

The status and condition indicated by the LED are shown as follows:

Status	Condition
Green	Power on
Red	Wedge controller reporting an error condition
Flashing red/green	Keypad of 68-key keyboard in "PC Setup" mode (See special keypad mode on next page)
Off	System off

Note: For more information about the Wedge controller, refer to *Wedge Software User's Guide* (BST0-1368-B).

MSR (Magnetic Stripe Reader)
The MSR is an optional feature that provides support for reading magnetically coded data cards. The keyboards support two different types of MSR:

* ISO Tracks 1, 2, and 3
* JIS-II and ISO Track 2 (Big Ticket and full-featured 68-key keyboards only)

Note: MSR signals are routed to the Wedge controller and passed into the system keyboard data stream. For more information about the Wedge controller, refer to *Wedge Software User's Guide* (BD20-1368-A)

External Decoded Scanner Connector
A decoded RS-232 input device that only requires TXD, RXD, CTS and RTS, such as a bar-code scanner, can be connected to the keyboard. RS-232 signals are routed to the Wedge controller and passed into the system keyboard data stream. The connector provides +5V to power the scanner. For more information about the Wedge controller, refer to *Wedge Software User's Guide* (BD20-1368-A).

Special "PC Setup" Keypad Layout for 68-key Keyboard

On power-up, the operator can switch the 68-key keyboard into an alternate keypad layout that can be used with many PC BIOS setup and configuration routines. The alternate layout contains keys such as ESC, TAB, END, "+", "-" and arrow keys which are not available in the normal keypad layout. The alternate layout allows the operator to configure a PC with the 68-key keyboard.

NCR 5972 2x20 Remote Customer Display

Tall Post Models
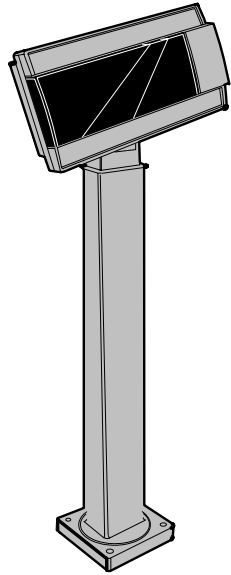
5972-1xxx (VFD)   5972-2xxx (LCD)   19750b
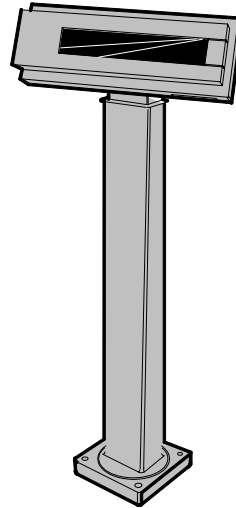
Desktop Models
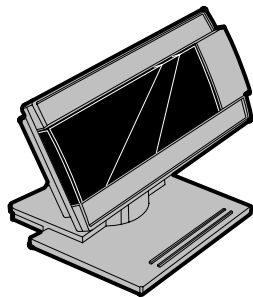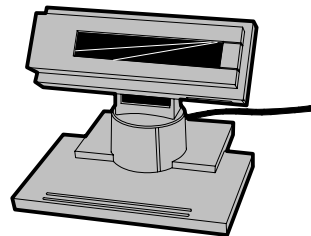
5972-1000/5973-1000 (VFD)   5972-2000 (LCD)   19749b

Features

- RS-23 Interface
- Socket for 32K of PROM for additional character sets (5972-1000 VFD).
- 7 x 9 pixel characters (5972-1000 VFD); 5 x 8 pixel characters on 5972-2000 LCD
- Diagnostics
- Character sets:
  - Code Page 850 (International)
  - Katakana (except 5972-2000)
  - Code Page 866 (Cyrillic) (except 5972-2000)

NCR 5973 2x20 International VFD Customer Display
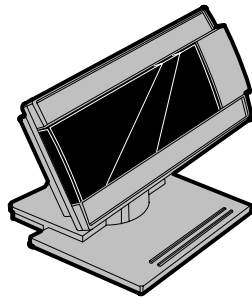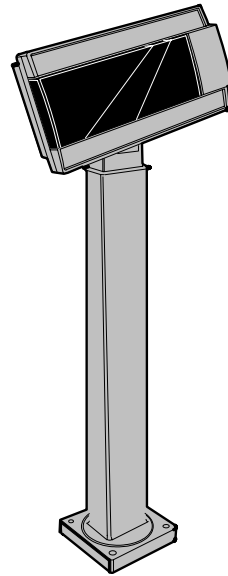
Desktop Model   16-Inch Post   20448a

Features

- 256x64 dots graphic VFD
- Micro-controller
- Flash ROM
- Display driver circuitry
- Communication/power connector
- Power converter circuitry
- Communication drivers
- Bi-directional parallel interface support

Compatibility

LAN Communications

The software associated with the terminal systems conform to the following standards:

- Network Driver Interface Specification (NDIS 4)

- IEEE 802.3 & 802.3u CSMA/CD (10/100 MB/s Ethernet)

- IEEE 802.2 Link Level Control (LLC)

- TCP/IP

Application Programmability

The software associated with the terminal systems conform to the following standards:

- OLE for Retail POS 1.4

- JavaPOS for Retail 1.4

- HTML 4.0

- ECMA Script

- Java Development Kit 1.1.3

Operating System Information

The software associated with the terminal systems conform to the following standards:

- Microsoft Windows NT

- Microsoft Windows 2000

- Windows XPe

System Configuration Diagram

CRT

5964
Touch Screen

5942

RS-232

DVI   RS-232
(Powered)   VGA

USB
(24 V)

Line In
Speaker Out
Mic In

7167   7197

5932 USB

Retail
Daughter
Card

7402 Motherboard

2nd Drawer (Y-Cable)

2189/2183

Cash
Drawer

Parallel

PS/2   5932 Big Ticket   Mouse

PS/2   RS-232

USB
(12 V)   USB

RS-232
(Powered)

RS-232 Peripherals

RS-232 Peripherals (Powered)

5972-1xxx

7197   7167   7162   5992   5945   7892   7882   7837

5972-2xxx   7875

20929a
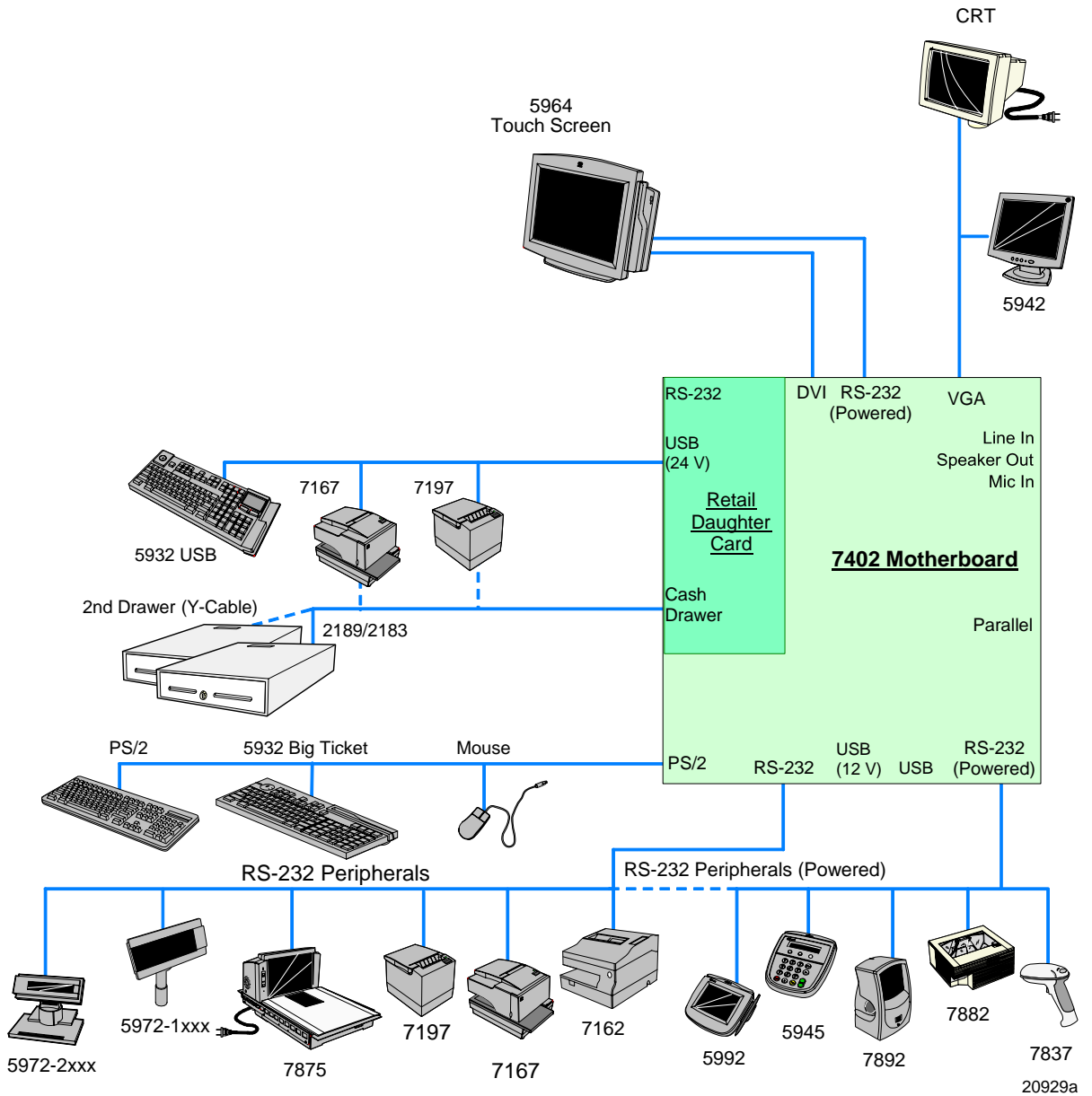
Chapter 2: Hardware Installation

Introduction

The 7402 is fully assembled at the factory. This chapter explains how to connect optional hardware components to these terminals.

Installation Summary

Remove the terminal from the shipping packaging and verify the hardware configuration. Connect the peripheral and communication cables.

Attach the Power Cord to the system and to an AC power source. After power is applied to the terminal the Power-up self-tests run to verify basic functionality.

ROM-based setup should be used to configure network options. Full configuration depends upon the system server and the management web site.

Installation Restrictions

- Before installing the terminal, read and follow the guidelines in the *NCR RealPOS 72 Site Preparation Guide* (B005-0000-1464) and the *NCR Workstation and Peripheral AC Wiring Guide* (BST0-2115-53).

- Install the terminal near an electrical outlet that is easily accessible. Use the power cord as a power-disconnect device.

- Do not permit any object to rest on the power cord. Do not locate the terminal where the power cord can be walked on.

- Use a grounding strap or touch a grounded metal object to discharge any static electricity from your body before servicing the terminal.

- If the power cord is replaced, it must be replaced with the same type of cord with the protective shroud.

- Do not route the power cord through openings with sharp edges.

Caution: This unit contains hazardous voltages and should only be serviced by qualified service personnel.

Caution: DO NOT connect or disconnect the transaction printer while the terminal is connected to AC power. This can result in system or printer damage.

Peripheral Cable Routing

The peripheral cables are routed down through the base and out the rear of the unit. They are secured internally with a Cable Clamp.

Cable Clamp

21025
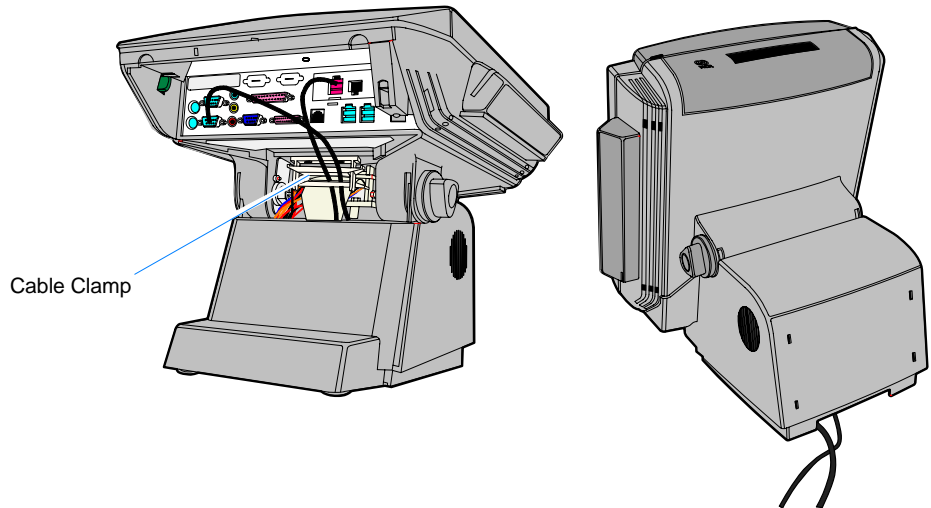
Installing Peripherals

Caution: Disconnect the AC power cord before disassembling the terminal. The ON/OFF switch does **NOT** remove power to the unit. Use appropriate Electro Static Discharge procedures during this modification.

The AC Power Cord can be disconnected from the wall or from the bottom of the terminal.

Power Cord

21047
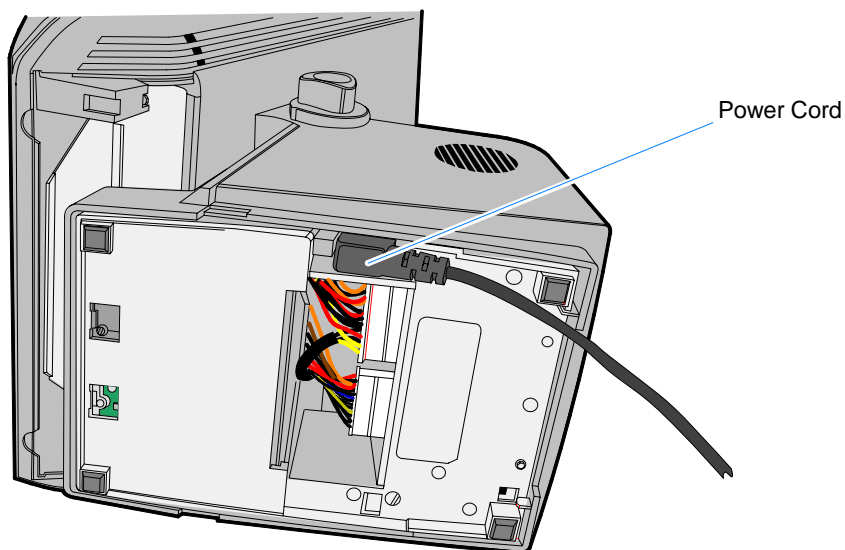
Accessing the Cable Connectors

This section describes how to install transaction printers and other peripherals supported by the 7402. The cable connectors are located behind the Cable Cover.

1. Tilt the Display Module.

2. Remove the Cable Cover.

   a. Remove the screw from the Cable Cover.

   b. Press down on the two plastic Cable Cover Release Tabs and slide the cover forward.

Front Cover Latches

Screw

20931
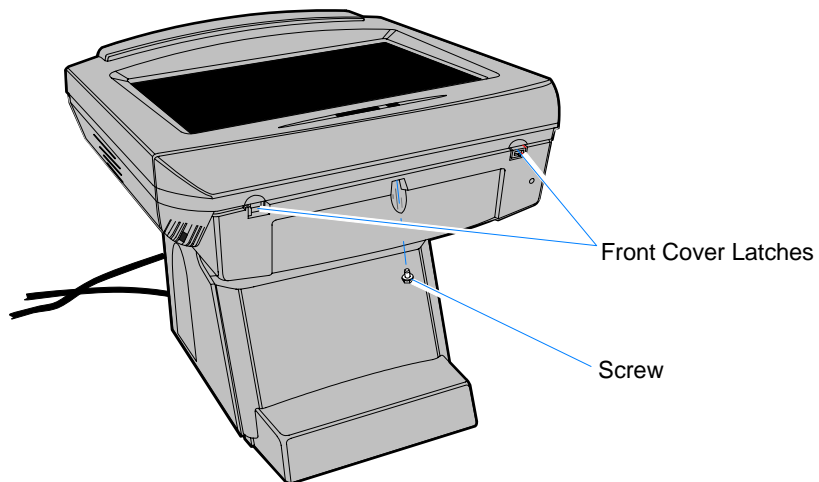
Cable Connector Identification

1. Connect the peripheral and LAN cables. The illustration identifies the peripheral connectors on the terminal. See the sections that follow for specific installation instructions for each of the peripherals.
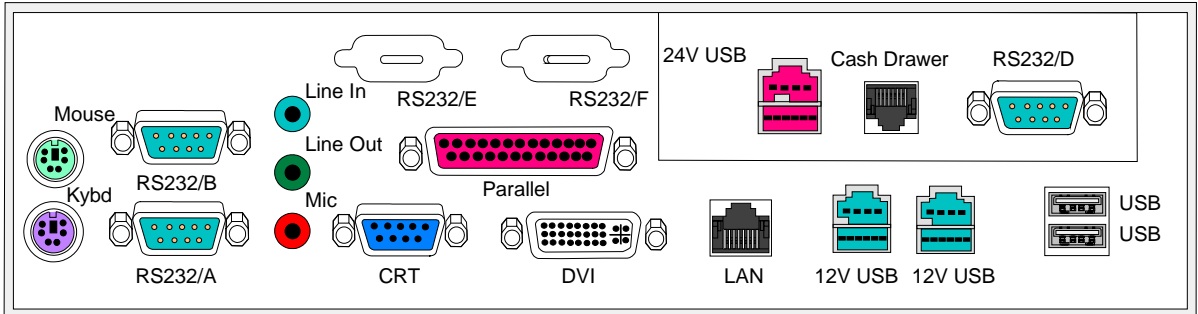
20917

Note: RS232/1, RS232/2, and RS232/4 can be powered ports. They are enabled via hardware straps on the Motherboard. RS232/3 is an internal port that is dedicated to the Touch feature.

2. After installing the peripheral and LAN cables replace the cable cover.

PS/2 Keyboard/Mouse Cable Connections

The 7402 has dedicated PS/2 connectors to support both a keyboard and mouse.
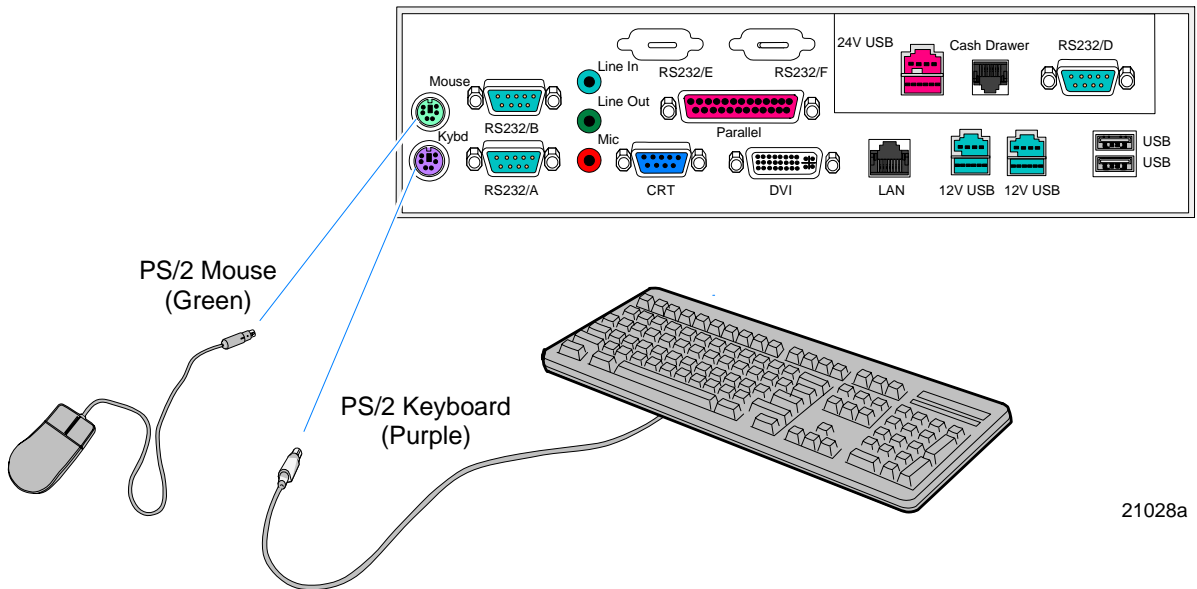
21028a

Mouse Installation Restriction

If you are running Windows NT you must make the following Registry entry in order to enable the Mouse Class Driver.

```
[HKEY_CURRENT_CONFIG/System/CurrentControlSet/Enum/ROOT/
LEGACY_MOUSCLASS/0000]
"CSConfigFlags"=dword:00000000
```

Opening the LCD Cabinet

1. Remove the shipping screw that locks the Display Assembly closed.

   Note: The shipping screw can be left out if desired, or replaced for security purposes.

Shipping Screw

21024
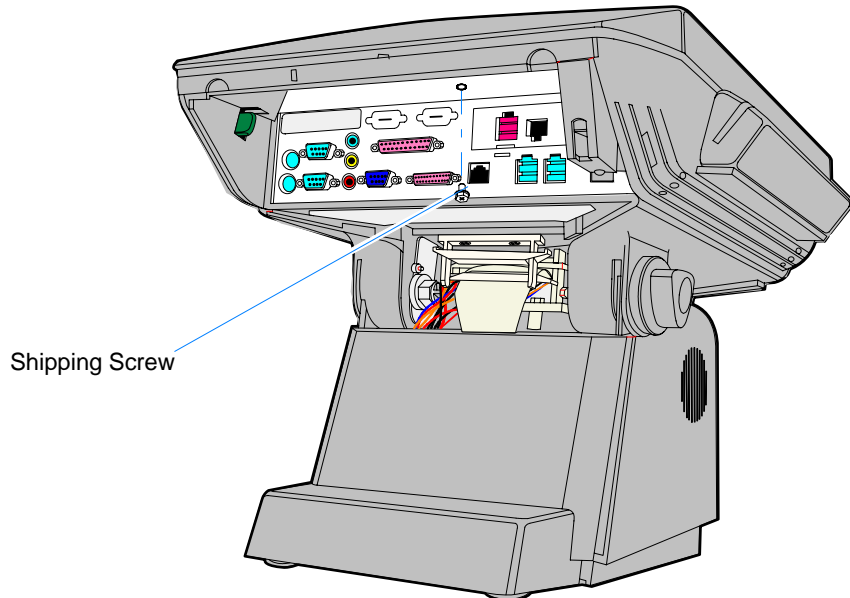
2. Press the Display Latch as shown and then open the Display Assembly.

Diaplay Latch

21026
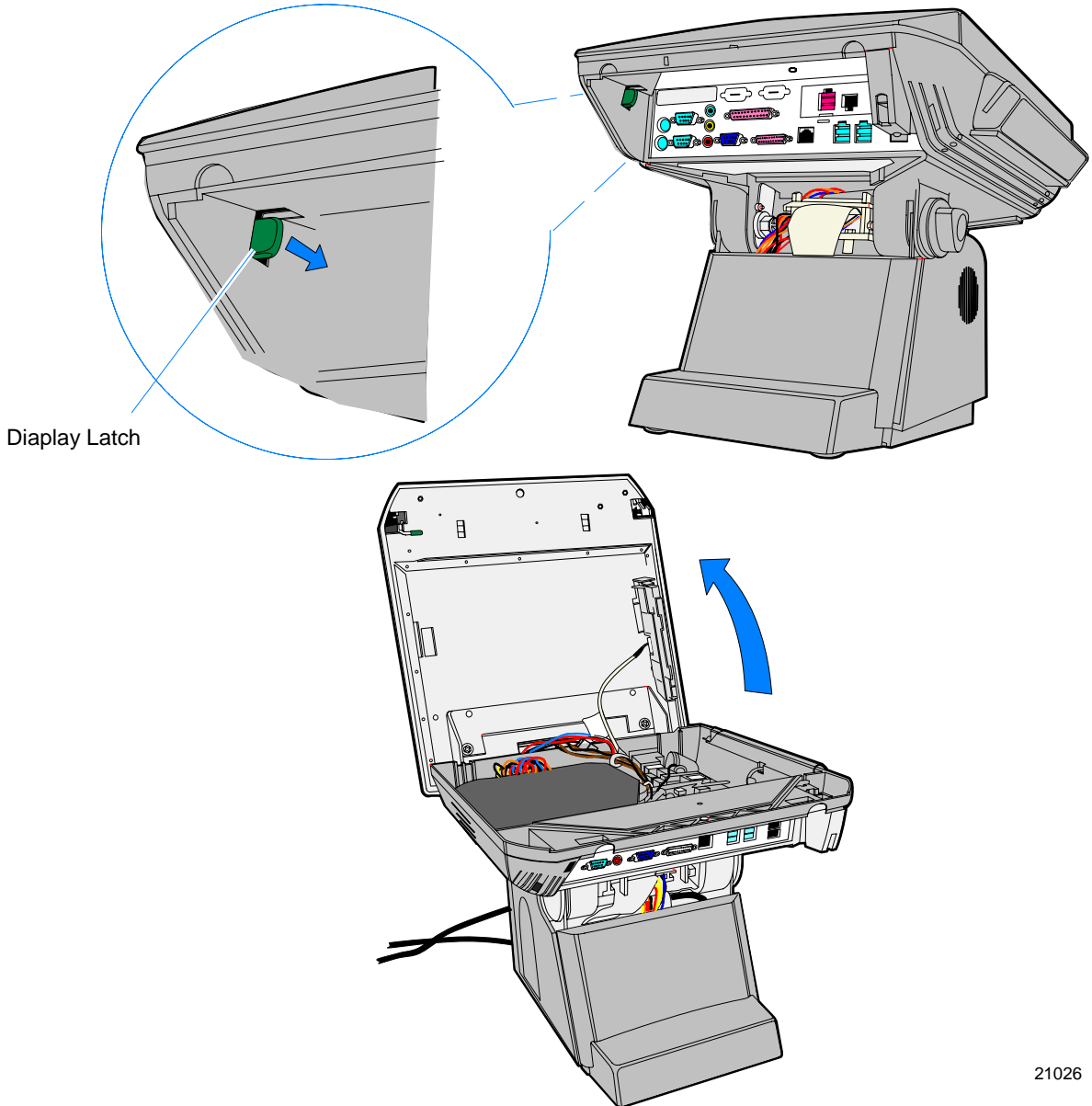
Installing an NCR 5964 12.1-inch Touch LCD

The NCR 5964 can be connected as a remote device.
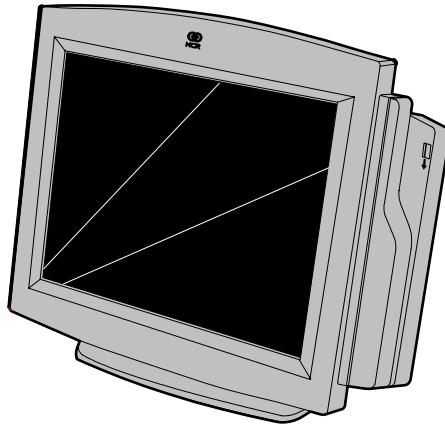
19429a

Note: A PC keyboard is required to configure a 5964 12.1-inch Touch LCD.

The following illustrations show the cable connections for the 5964 and the 7402. There are two cables required.

- DVI Cable – provides the video interface to the 5964
- RS-232 Y-Cable – provides a serial interface and power to the 5964. It also connects the 5964 PS/2 keyboard connector to the terminal, which provides an interface for the wedge controller (MSR, PS/2 Keyboard, Scanner, and Tone Speaker).

DVI Cable Connections

Connect the cable to the *DVI Connectors* on the 5964 display and 7402 terminal.

Mouse

Line In   RS232/E   RS232/F   24V USB   Cash Drawer   RS232/D

Line Out

RS232/B   Mic   Parallel

Kybd

RS232/A   CRT   DVI   LAN   12V USB 12V USB   USB   USB

DVI

DVI

497-0422831 - 1.0 m
(1416-C723-0010)

497-0422832 - 4.0 m
(1416-C723-0040)

21029
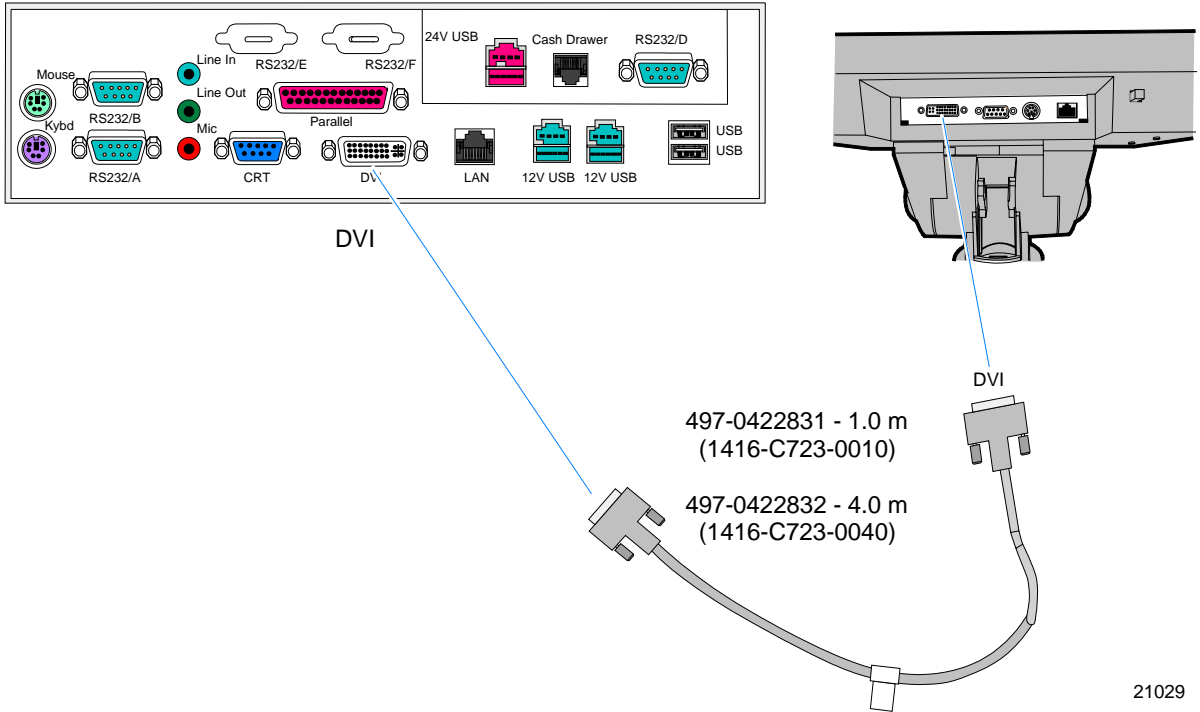
RS-232 Cable Connections

1. Connect the Y-cable to one of the *Powered RS-232* ports and to the *PS/2* connector on the 7402 terminal.

2. Connect the other end of the Y-Cable to the *RS-232* connector on the 5964 display.
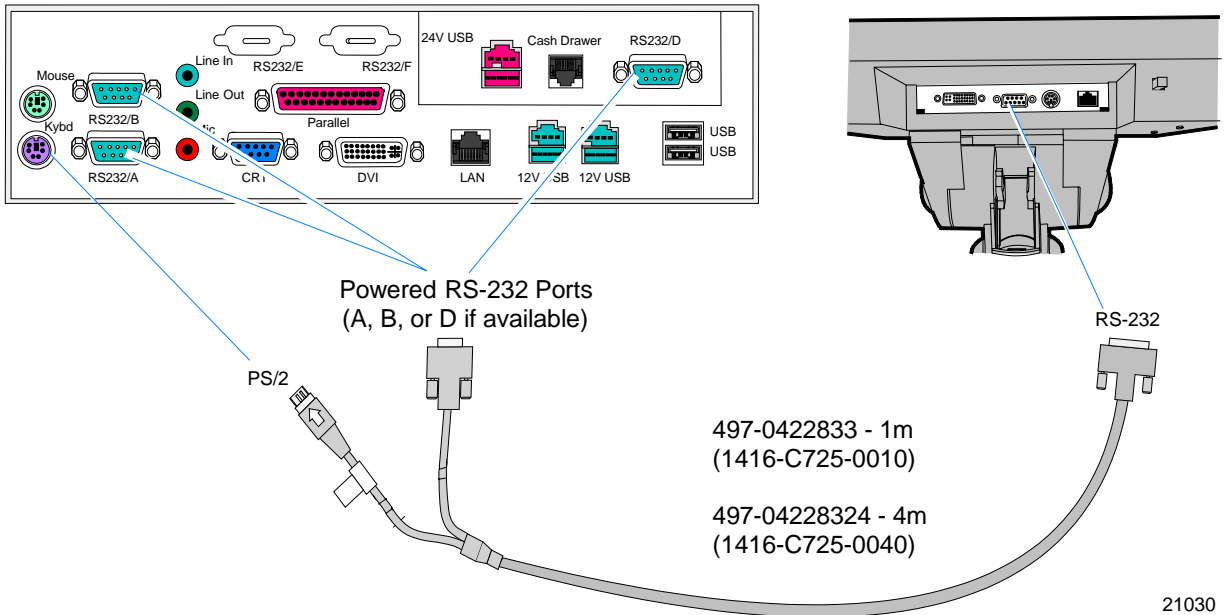
For more information refer to the *NCR 5964 12.1-Inch Touch LCD User's Guide* (B005-0000-1324)

Installing a 5942 12.1-Inch LCD Monitor

The NCR 5942 can be connected as a remote device.

497-0426160 - 4 m Beige
(1416-C803-0040)

497-0428512 - 4 m Black
(1416-C851-0040)
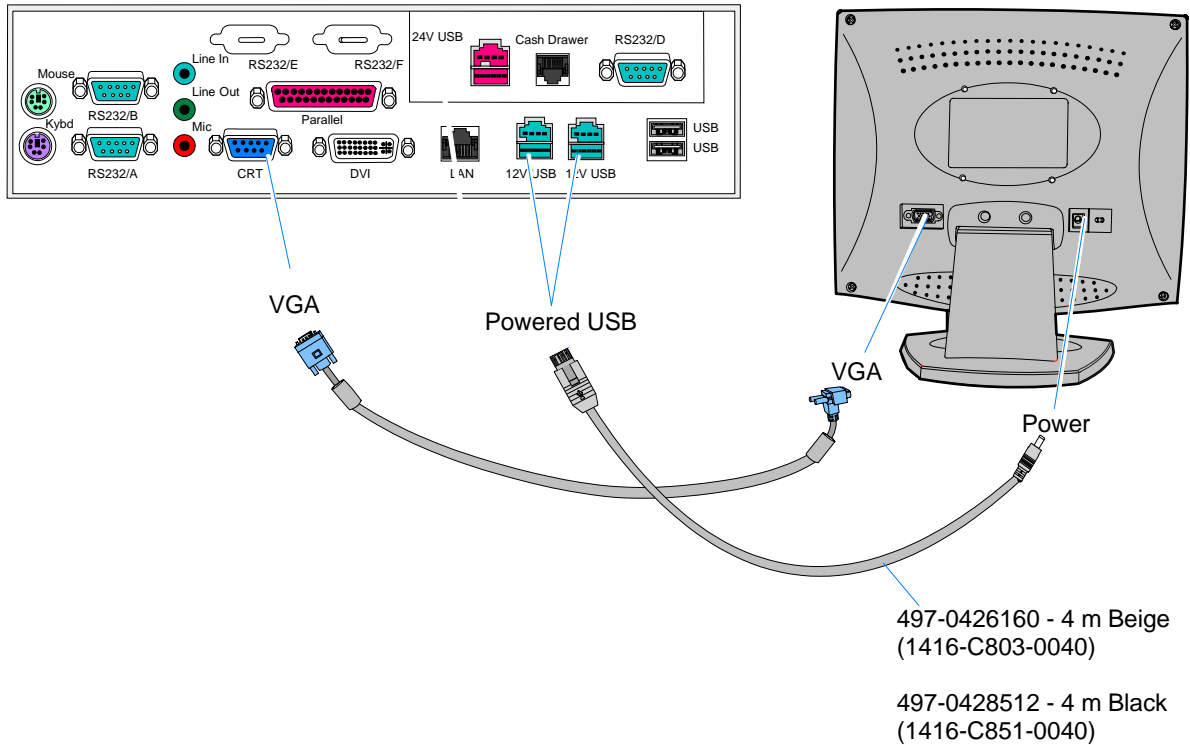
21031

1. Connect the LCD Cable to the *VGA* connectors on both the 5942 monitor and 7402 terminal.

2. Connect the Power Cable to the 5942 and to a *Powered USB* connector on the 7402 terminal.

For more information refer to the *NCR 5942 12.1-Inch LCD Monitor User's Guide* (B005-0000-1394)

Installing the Transaction Printer

The printers can connect through a USB connector or an RS-232 connector. It receives power through a Powered USB power cable.

USB Installation

Connect the Powered USB Printer Interface Cable to the *USB Connector* and *Power Connector* on the printer and to the *24 V Powered USB Connector* on the terminal.

Beige	**Black**
497-0424888 - 1 m (1416-C713-0010)	497-0430301 - 1 m (1416-C881-0010)
497-0424501 - 4 m (1416-C713-0040)	497-0430300 - 4 m (1416-C881-0040)

21032
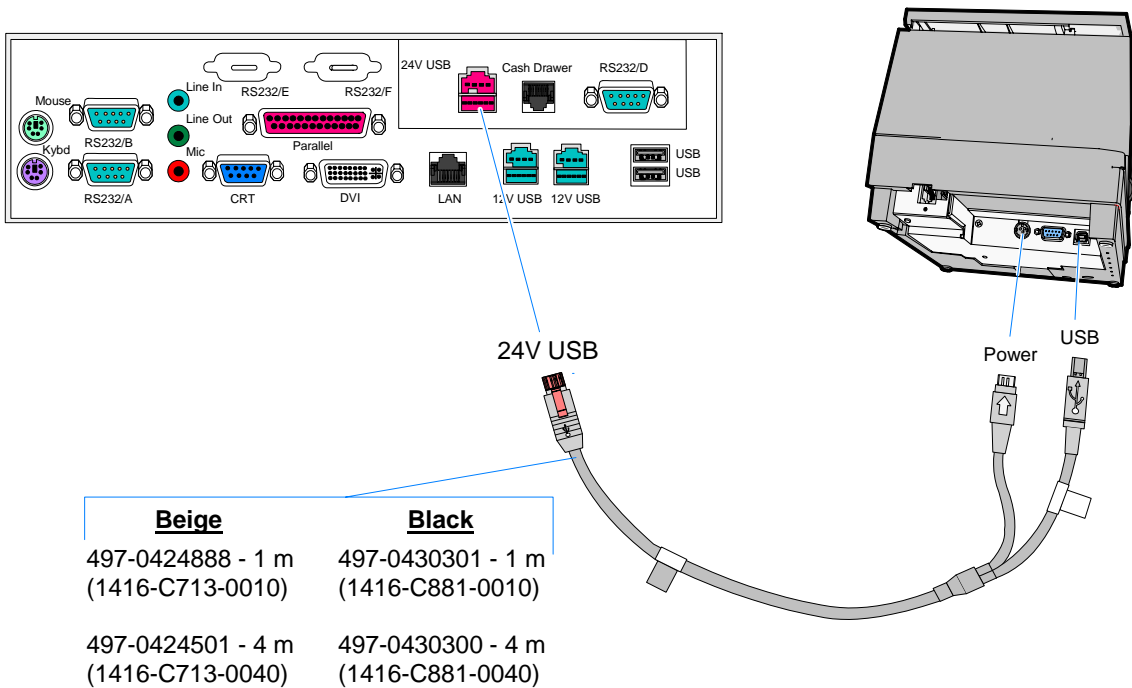
RS-232 Installation w/Power from Powered USB

1. Connect the RS-232 Printer Interface Cable to the *RS-232 Connector* on the printer and to an *RS-232 Connector* on the terminal.

2. Connect the Printer Power Cable to the *Power Connector* on the printer and to the *24 V Powered USB Connector* on the terminal.
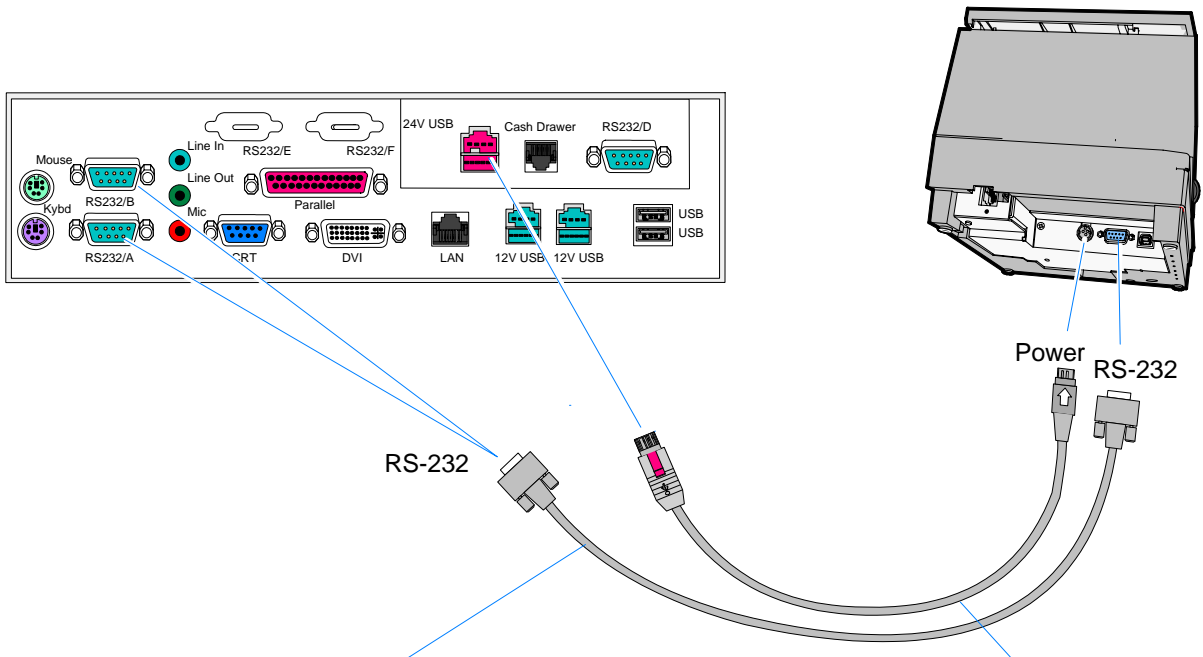
9-Pin to 9-Pin (Beige)	9-Pin to 9-Pin (Black)	9-Pin to 25-Pin (7162)
497-0408349 - 0.7 m (1416-C359-0007)	497-0430266 - 1.0 m (1416-C879-0010)	497-0407427 - 1.0 m (1416-C337-0010)
497-0407943 - 4 m (1416-C266-0040)	497-0430265 - 4 m (1416-C879-0040)	497-0407429 - 4 m (1416-C337-0040)
497-0409379 - 15 m (1416-C266-0152)		497-0407430 - 15.2 m (1416-C337-0152)

Beige	Black
497-0424887 - 1m (1416-C712-0010)	497-0430305 - 1m (1416-C880-0010)
497-0422292 - 4 m (1416-C712-0040)	497-0430306 - 4 m (1416-C880-0040)

21033

Installing an NCR 5972 Remote Customer Display

There are two models of the NCR 5972 Remote Customer Display:

- 5972-1xxx Vacuum Fluorescent Display (VFD)
- 5972-2xxx Liquid Crystal Display (LCD)

Tall Post Models
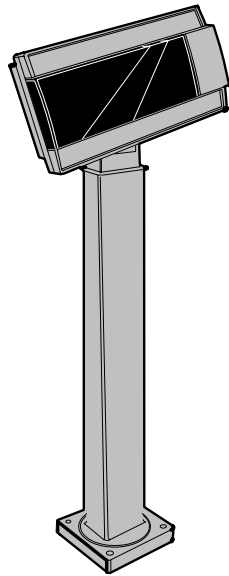
5972-1xxx (VFD)   5972-2xxx (LCD)   19750b
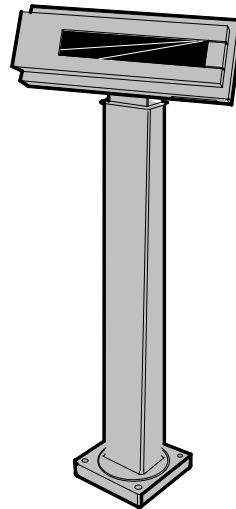
Desktop Models
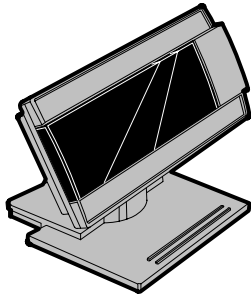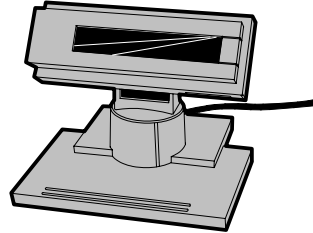
5972-1000/5973-1000 (VFD)   5972-2000 (LCD)

19749b

1. Locate the Display Mount within 4 meters (13 ft.) of the host terminal.

2. Determine if the cable should be routed down through the mounting surface or if it should be run on top of the surface. Drill a hole if necessary.

3. **High-Post Mount:** If you are installing High-Post model secure the Mounting Plate with screws (4) that are provided.

Mounting Plate

4.06 mm (0.160 in.) Diameter

7.6 cm
(3.0 in.)
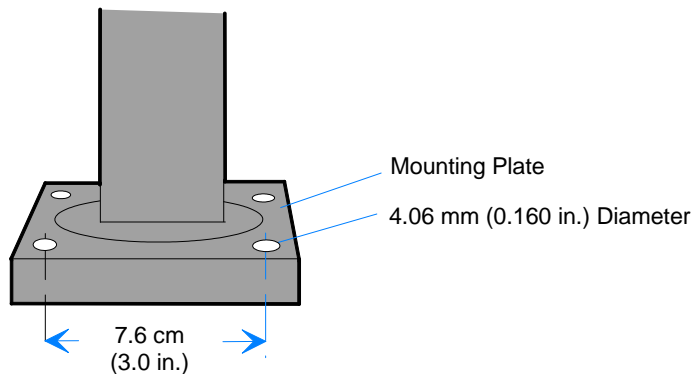
14622a

Cable Connections

1. Connect the Display Cable to a powered RS-232 connector on the terminal.
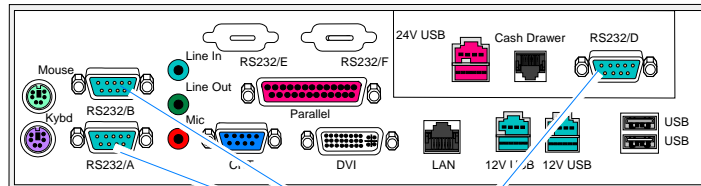
Powered RS-232 Ports
(A, B, or D if available)

21034

Installing a Cash Drawer

The Cash Drawer can be connected to the Cash Drawer connector or to the transaction printer.

Cash Drawer Connector

Cash Drawer Connector

21035a
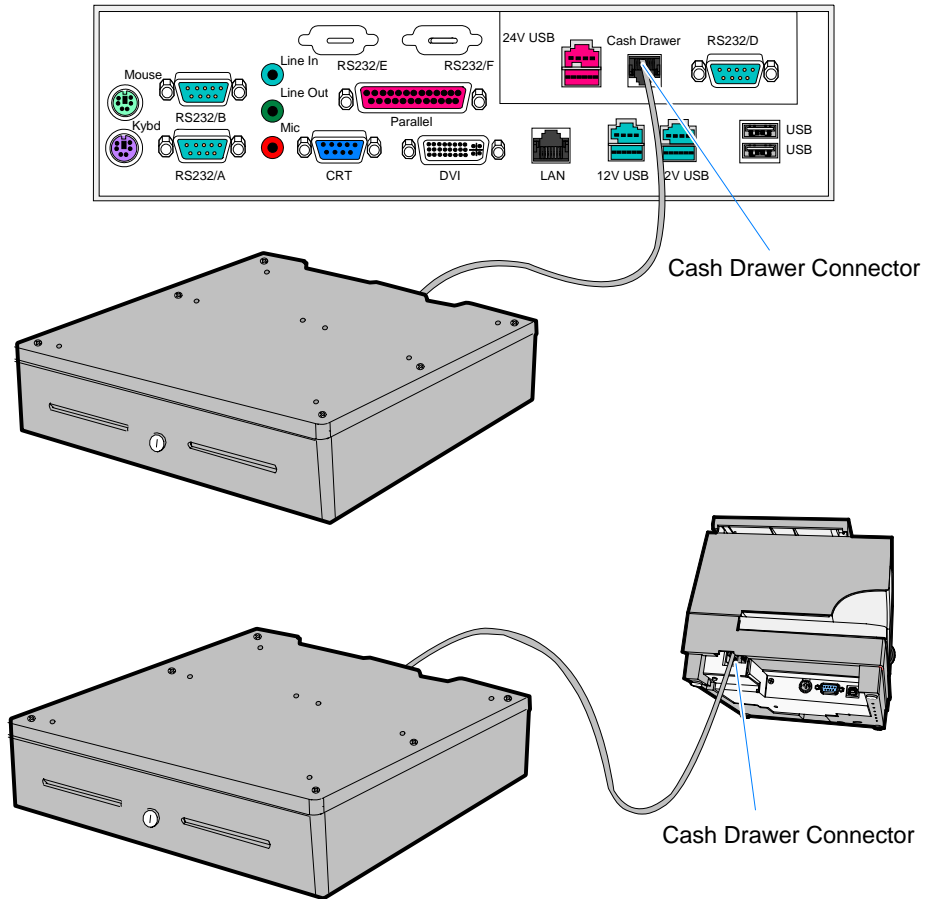
Installing a Second Cash Drawer

The terminal supports a 2-drawer configuration with a Y-cable (1416-C372-0006).

1. Place the cash drawer in the desired location, within cable's length of the printer.

2. Connect the Y-cable to the transaction printer cash drawer connector.

Powering Up the Terminal

Terminal On/Off Switch

The Terminal On/Off Switch is located behind the Cable Cover. There is a hole in the Cable Cover that you can insert a small object to access the switch, or you can remove the Cable Cover to gain access to the switch. This is a logic switch only, which has two states.

- Last State – the terminal resumes the last power state when power is restored.

- Power On – the terminal powers on when power is restored.
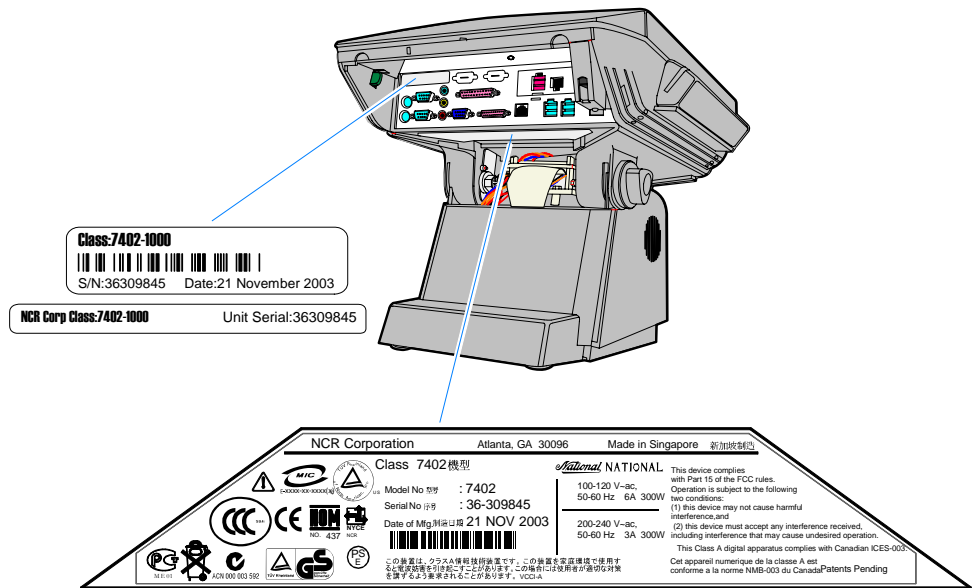
20946

The power state can be set to user preference in the BIOS Setup. Change the *After Power Failure* parameter in the **Boot Menu**. By default the Terminal Power Switch is set to *Last State*. See the *Setup* chapter for information about using the Setup Utility.

Note: There is also a On/Off Power Switch located on the Power Supply Power.

Power Supply AC
On/Off Switch
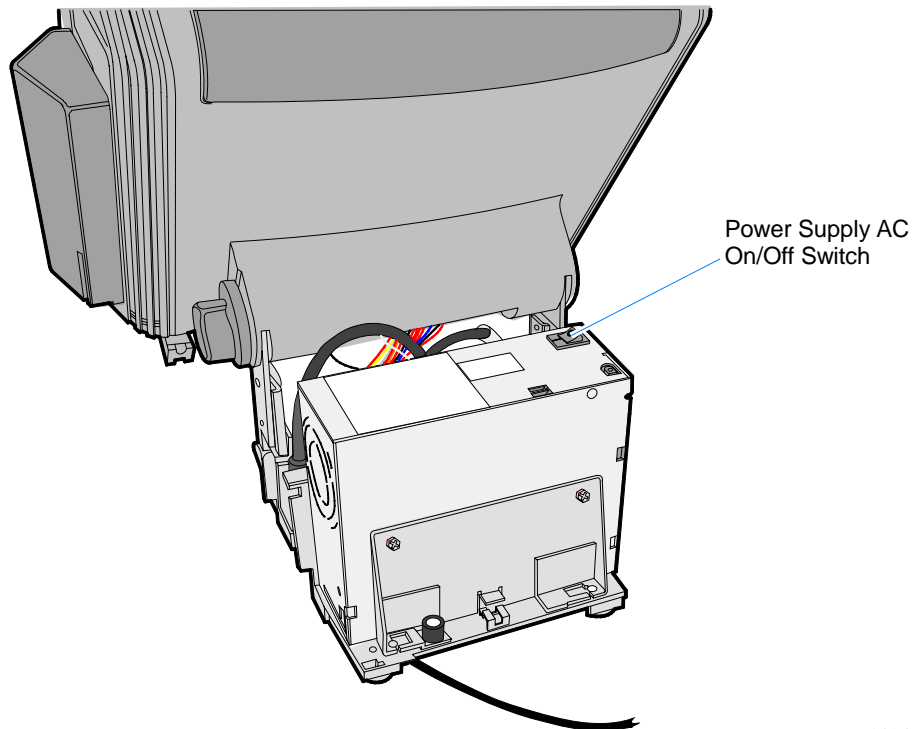
21347

After power is applied to the terminal the Power-up self-tests run to verify basic functionality. ROM-based setup should be used to configure network options. Full configuration depends upon the system server and the management web site.

Attach the Power Cord to the system and to an AC power source.

Power Cord
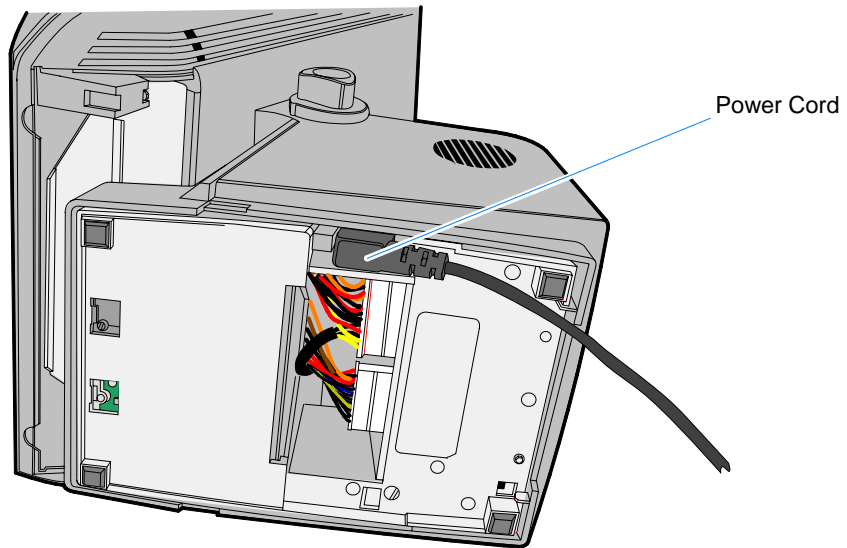
21047

Calibrating the Touch Screen

See the *Touch Screen Calibration* chapter.

Out-of-Box Failures

The RSD-Atlanta Customer Satisfaction Hotline will replace <u>out-of-box</u> failed hard disks with identical, preloaded drives. Once a system is successfully installed, all disk contents are the responsibility of the customer. The customer is responsible for restoring operating system software and/or customer-specific data onto replacement disks sent to repair a failed or damaged disk in the field. NCR provides recovery tools for the operating system and platform software.

Chapter 3: Setup

Entering Setup

1. Connect an alphanumeric PS/2 keyboard to the terminal.

    Note: If a USB keyboard is used then *Legacy USB Support* in the BIOS Setup must be enabled.

2. Apply power to the terminal.
3. When you see the *American Megatrends* logo displayed press **[Del]**.

Keyboard Shortcuts

Function	Keystroke	Notes
Enter SETUP	DEL	1
Load AMIBIOS "failsafe" CMOS SETUP values	END	
Display extra AMIBIOS information at boot	INS	8
Switch between AMIBIOS "Silent Boot" graphical logo and standard text boot screen	TAB	2, 6
Boot from Network Device	F12	1, 2
Enter SETUP after system error	F1	1
Load CMOS SETUP defaults after system error	F2	1
Initiate BIOS RECOVERY & clear CMOS	CTRL-HOME	7, 8
Initiate BIOS RECOVERY, clear CMOS & NVRAM	CTRL-PGUP	7, 8

Function	Keystroke	Notes
Initiate BIOS RECOVERY, preserve CMOS & NVRAM	CTRL-PGDN	7
PopUp Boot Menu	F8 or F11*	1, 2, 3
Enter SETUP (for serial console redirection)	F4	1, 2, 3, 4
PopUp Boot Menu (for serial console redirection)	F3	1, 2, 3, 4
Activate AMIKey Recovery Boot Services	F9	1, 2, 5

Notes:

1. This keystroke can be configured to be a different value, based on the system manufacturer's specification. The keystroke listed here is the "default" setting in AMIBIOS8.

2. This feature is not enabled in all AMIBIOS products.

3. The assigned keystroke & a short description of its function is typically displayed by the BIOS on system startup.

4. These keystrokes are only available when using the AMIBIOS "serial console redirection", which allows access to the BIOS boot screen via a VT-100/ANSI terminal connected to a serial port.

5. This feature is only available if AMIKey Recovery Boot Services are installed on the system drive and the BIOS is configured to use these services.

6. AMIBIOS will automatically switch from the "Silent Boot" logo to the standard BIOS text screen if an error occurs that requires user attention. Some error messages are displayed over the "Silent Boot" logo, depending on system configuration.

7. These BIOS functions are only available during the very early
    stages of system initialization, also known as "boot block code". To
    initiate these functions, please hold down the keys immediately
    after powering on the system.

8. After AMIBIOS recognizes this keystroke, the BIOS will wait and
    display the following message: *Press <F1> to Run SETUP, Press <F2>
    to load default values and continue*.

How to Select Menu Options

The following keyboard controls are used to select the various menu
options and to make changes to their values.

-   Use the arrow keys to select (highlight) options and menu screens.

-   Use the **[Enter]** key to select a submenu.

-   Use the **[+]** and **[-]** keys to change field values.

-   To view General Help at any time, press **[F1]**.

-   To save the changes, move the cursor to the *Exit Menu*, select either
    Save Changes & Exits, and press **[Enter]**.

BIOS Default Values

The following tables show default settings. On such settings as IDE drives, where there are no defaults, typical settings are shown

Main Menu

System Time	(variable)
System Date	(variable)

Advanced Menu

CPU Configuration	
IDE Configuration	
OnBoard PCI IDE Controller	[Both]
Primary IDE Master	[Hard Disk]
Type	[Auto]
LBA/Large Mode	[Auto]
Block (Multi-Sector Transfer)	[Auto]
PIO Mode	[Auto]
DMA Mode	[Auto]
S.M.A.R.T.	[Auto]
32Bit Data Transfer	[Disabled]

Primary IDE Slave	[ATAPI CDROM]
Type	[Auto]
PIO Mode	[Auto]
DMA Mode	[Auto]
Secondary IDE Master	[Not Detected]
Secondary IDE Slave	[Not Detected]
Hard Disk Write Protect	[Disabled]
IDE Detect Time Out (Sec)	[35]
ATA (PI) 80Pin Cable Detection	[Device]
SuperIO Configuration	
OnBoard Floppy Controller	[Enabled]
Serial Port A Address	[3F8/IRQ4]
Serial Port B Address	[2F8/IRQ3]
Serial Port 2 Mode	[Normal]
Serial Port C Address	[3E8/IRQ10]
Serial Port D Address	[2E8/IRQ11]
Parallel Port Address	[378]
Parallel Port Mode	[ECP]
ECP Mode DMA Channel	[DMA3]
Parallel Port IRQ	[IRQ7]

Hardware Health Configuration

H/W Health Function	[Enabled]

ACPI Configuration

Advanced ACPI Configuration

ACPI 2.0 Support	[No]
BIOS→AML ACPI table	[Enabled]
Headless mode	[Disabled]

DMI Event Logging

Remote Access Configuration

Remote Access	[Disabled]

USB Configuration

Legacy USB Support	[Enabled]
USB 2.0 Controller Mode	[HiSpeed]

Multiple Option ROM Configuration

On-board Intel LAN	[Enabled]
On-board Intel PXE	[Enabled]
Parallel CD-ROM Boot	[Disabled]
User ROM 3	[Disabled]
User ROM 4	[Disabled]
User ROM 5	[Disabled]
User ROM 6	[Disabled]
User ROM 7	[Disabled]

PCI/PnP Menu

Plug & Play O/S	[No]
PCI Latency Timer	[64]
Allocate IRQ to PCI VGA	[Yes]
Palette Snooping	[Disabled]
PCI IDE BusMaster	[Disabled]
OffBoard PCI IDE Card	[Auto]
DMA Channel 0	[Available]
DMA Channel 1	[Available]
DMA Channel 3	[Available]
DMA Channel 5	[Available]
DMA Channel 6	[Available]
DMA Channel 7	[Available]
Reserved Memory Size	[Disabled]

Boot Menu

Boot Settings Configuration	
Quick Boot	[Disabled]
Quiet Boot	[Enabled]
Boot Type	[Cold Boot]
AddOn ROM Display Mode	[Force BIOS]
Bootup Num-Lock	[On]
PS/2 Mouse Support	[Enabled]
Typematic Rate	[Fast]
System Keyboard	[Present]
Parity Check	[Disabled]
Boot To OS/2	[No]
Wait For 'F1' If Error	[Enabled]
Hit 'DEL' Message Display	[Enabled]
Interrupt 19 Capture	[Disabled]
Continuous POST	[Disabled]
After Power Failure	[Last State]
Boot Device Priority	
1st Boot Device	[IBA FE Slot 0441 v]
2nd Boot Device	[1st Floppy Drive]
3rd Boot Device	[IPS-SR244W]
4th Boot Device	[PM-ST320410A]

Hard Disk Drives	
1st Drive	[PM-ST320410A]
2nd Drive	[SM-ST320012A]
Removable Drives	
1st Drive	[1st Floppy Drive]
ATAPI CDROM Drives	
1st Drive	[PS-SR244W]
Initiate Pre-boot Services	[Hot Key]

Security Menu

Supervisor Password:	:Not Installed
User Password:	:Not Installed
Change Supervisor Password	[Enter]
Change User Password	[Enter]
Clear User Password	[Enter]
Boot Sector Virus Protection	[Disabled]

Chipset Menu

Intel Montara-GML NorthBridge Configuration	
Primary Video Device	[Auto]
Graphics Mode Select	[Enabled, 8MB1]
IGD – Device 2,Function 1:	[Enabled]
Boot Type	[CRT+LFP]
Flat Panel Type:	[800x600 LVDS]
TV Standard:	[Automatic]
NTSC Minor Standards:	[NTSC M]
PAL Minor Standards:	[PAL B]
SECAM Minor Standards:	[SECAM L]
Flat Panel Scaling:	[Auto]
Intel ICH4 SouthBridge Configuration	
ICH4 Dev31 Func1, IDE	[Enabled]
ICH4 Dev31 Func3, SMBUS	[Enabled]
ICH4 Dev31 Func5, AC'97	[Enabled]

ICH4 Dev29 Func8, USB#1	[Enabled]
ICH4 Dev29 Func1, USB#2	[Enabled]
ICH4 Dev29 Func2, USB#3	[Enabled]
ICH4 Dev29 Func7, EHCI	[Enabled]
MIDI Decode	[Disabled]
Adlib Range 388h-38Bh	[Enabled]
LPC 4Eh-4Fh Decode	[Enabled]
LPC 2Eh-2Fh Decode	[Enabled]
Onboard LAN	[Enabled]
IDAPIC	[Disabled]
Extended IDAPIC	[Disabled]
CPU B.I.S.T.	[Disabled]
ICH4 DMA Collection	[Disabled]
DMA-0 Type	[LPC DMA]
DMA-1 Type	[LPC DMA]
DMA-2 Type	[LPC DMA]
DMA-3 Type	[LPC DMA]
DMA-4 Type	[LPC DMA]
DMA-5 Type	[LPC DMA]
DMA-6 Type	[LPC DMA]
DMA-7 Type	[LPC DMA]

Chapter 4: Operating System Recovery

Introduction

This chapter discusses procedures how to recover the Operating System using the integrated or an external USB CD-ROM drive.

Note: It is also possible to perform a BIOS update using a network connection. Refer to the *NCR FitClient Software User's Guide* (B005-0000-1235) for information about that procedure.

Prerequisites

The following are required in order to perform an OS recovery from a CD.

- Bootable CD-ROM drive (internal or external)
- Keyboard

Connecting an External CD-ROM Drive

If your terminal contains an integrated CD-ROM, skip to *OS Recovery Procedures*.

1. Connect the external CD-ROM (2336-K208) drive to the *USB* connector on the terminal.
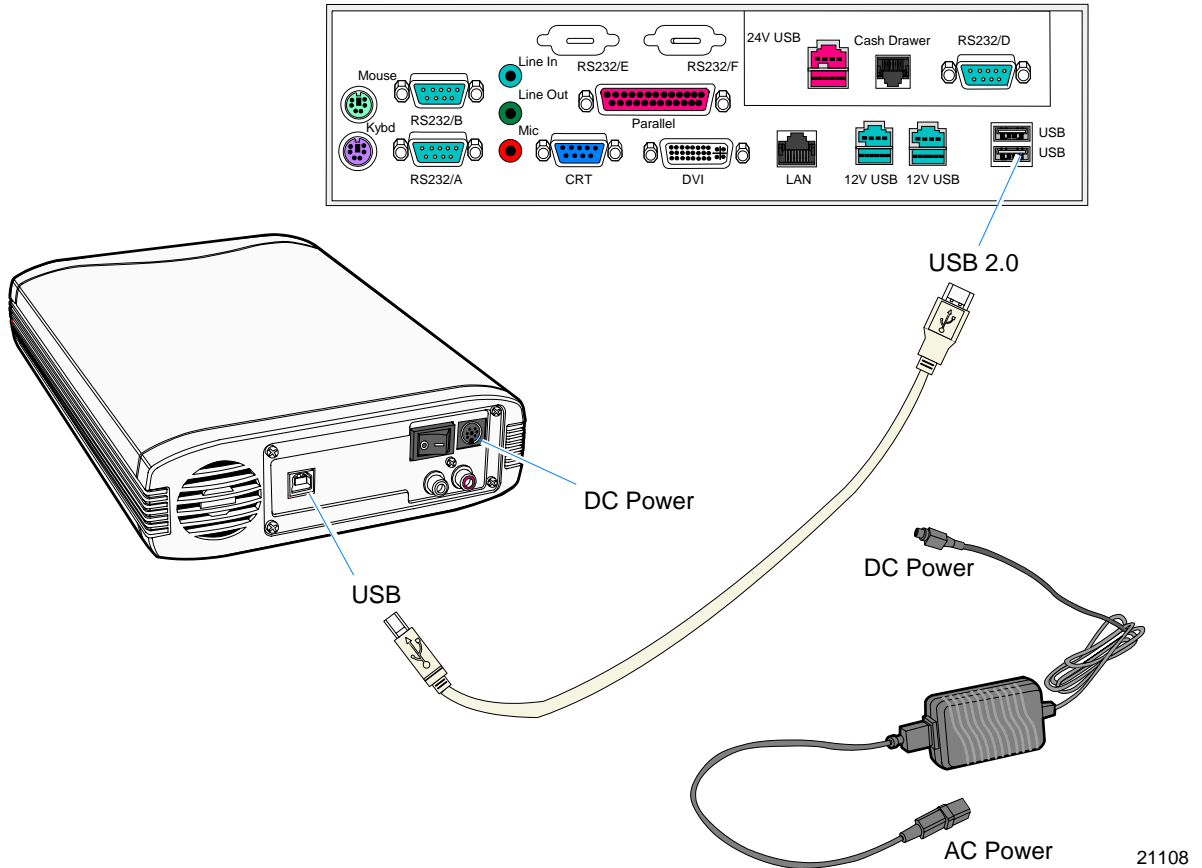
2. Connect the Power Supply to the CD-ROM and to an AC outlet.

3. Apply power to the CD-ROM drive (switch on the back).

OS Recovery Procedures

1. Apply power to the terminal.

2. Press **[DEL]** during boot to enter Setup.

3. At the Setup Utility menu, select **Advanced BIOS Features**.

4. Set the **First Boot Device** to **USB-CDROM**.

   Note: The **CDROM** selection is used when you want to boot from an internal CD-ROM drive.

5. Press **[Esc]** to return to the Setup Utility menu.

6. Select **Save and Exit Setup**.

7. As the system reboots, insert the *NCR Partition Image Application* CD (D370-0605-0100). You should see a message during boot, indicating that the CD-ROM has been recognized.

8. At the menu, enter **1** to select the image restore function.

   ```
   ###############################
      NCR Boot CD for Partimage
   ###############################

   Select an option
           1 – Restore an Image
           2 – Exit to a shell
   ```

9. At the prompt, insert the CD which contains the operating system image. Press **[Enter]**.

Windows 2000	D370-0586-0100
Windows NT	D370-0587-0100
Windows XPe	D370-0588-0100

10. At the prompt, press **1** (Yes) to *Continue*.

11. Press **[Enter]** to mount the CDROM, or **[*]** to cancel.

```
+------+ Automatic mount +------+
|                              |
| Please press "ok" to mount   |
| [/dev/cdrom] on [mnt/cdrom]  |
|                              |
|                              |
|           +----+             |
|           | Ok |             |
|           +----+             |
|                              |
+------------------------------+
```

Some Operating Systems occupy more than one CD. The restore program behaves differently between CDs, depending on which OS you are restoring:

Win2000: The program will pause when it is time to insert the next CD, displaying the *Automatic Mount* message. Insert the next CD and press **[Enter]** to continue.

WinNT: The program will pause when it is time to insert the next CD, without displaying any message. Press **[Ctrl-Q]** to continue. Insert the next CD and press **[Enter]** to continue.

12. Remove the CD from the drive.

Completing the OS Installation

Windows 2000

The system automatically reboots when the image recovery is complete and starts the software installation. This installation also installs most of the additional software and drivers included in the disk image. Complete the installation as follows.

1. Accept the license agreement.
2. Enter the *User Name* and *Organization*.
3. Enter the *Computer Name* for the client.
4. Enter the *Administrator's Account Password* (optional)
5. Login when prompted after the reboot.
6. Run the touch calibration (if using a touch screen).

Windows NT 4.0

The system automatically reboots when the image recovery is complete and starts the software installation. This installation also installs most of the additional software and drivers included in the disk image.

Note: The mouse port is disabled. You must use the keyboard to complete the installation. The mouse can be enabled later.

Complete the installation as follows.

1. Accept the license agreement.
2. Enter the *User Name* and *Organization*.
3. Enter the *Computer Name* for the client.
4. Enter the *Administrator's Account Password* (optional)
5. Login when prompted.
6. Run the touch calibration (if using a touch screen).

Windows XPe

The system automatically reboots when the image recovery is complete and opens at the Welcome screen.

Gold Disk Contents

This section describes the contents of each of the Gold Disk Images, including all the additions and changes that were made on top of the generic operating system.

For each operating system, NCR **strongly** recommends that the drivers placed in the `c:\install` directory be left there for the purposes of servicing and maintaining the system. If you are using the information in this section to build your own operating system image and not using NCR's provided OS Recovery image as a base image, then we recommend that all installed drivers be placed in a similar `c:\install` directory for support.

Microsoft Operating System License Agreements

When purchasing a workstation or kiosk preloaded with a Microsoft operating system, the application provider must follow certain license agreement guidelines. Listed below are some of the major points of Microsoft's "Embedded Software" agreement, which currently covers DOS, Win 3.11, Windows 95, Windows 98, Windows NT, Windows 2000, and Windows XPe.

- The end user application should not permit the user (typically a cashier) to exit the application so that they may be able to browse the operating system desktop, explorer, or other Microsoft operating system user interface elements. This does not apply to servicing, upgrading, or diagnosing problems for the workstation by services or field engineers. This restriction is meant to ensure that the end user is only permitted to navigate within the confines of the end user's application under normal operating conditions.

- The NCR OS Recovery image can only be used to recover or update systems with licenses procured from NCR.

Operating System Restrictions

Standby and Hibernate Mode Restriction

When using a 7402 terminal without a keyboard or mouse, the Windows 2000, Windows XP PRO, and Windows XP Embedded OS *Standby Mode* should be avoided. This mode places the hardware in a *low power state* that requires an interrupt to restart the processor.

The Windows 2000 and Windows XP Embedded Gold Disk Images disable *Standby Mode* on the 7402 terminal. ***This mode should not be used without a keyboard or mouse.***

Note: Hibernate Mode is not supported.

NCR 7402 Win2000OS Recovery Software
(LPIN: D370-0586-0100)

The *NCR 7402 Windows 2000 Operating System Recovery Software* provides the means of restoring the operating system to the terminal hard disk to the preinstalled state as shipped from the factory.

Installed Software:

- Microsoft Windows 2000 Professional w/ SP3
- Security Rollup Package (SRP) 1
- Microsoft Internet Explorer 6.0 with SP1 (6.0.2800.1106)
- Intel 85x Video driver (6.14.10.3606)
- Intel Control Panel
- RealTek Audio driver (5.10.0.4050)
- Intel Ethernet LAN driver (7.0.26.0)
- Intel ProSet diagnostic control panel application for LAN
- Windows Installer 2.0
- Intel Application Accelerator installed (2.11.15.)
- Intel Chipset Software Installation Utility installed (5.0.1.1015)

- Microsoft SNMP service installed but not activated
- Edgeport EPIC I/O Networks USB drivers available (2.30)
- 3M TouchWare driver available (5.64 SR 2)
- Hampshire USB Touch available (6.07)
- Promise Raid Card available

Software Drivers

The following drivers are not installed automatically, but can be installed from their respective locations (Readme files exist in these locations, as well):

- Edgeport USB   `C:\Install\Drivers\Edgeport USB`
- Hampshire USB Touch   `C:\Install|Drivers\Hampshire USB Touch`
- Promise Raid Card   `C:\Install\Drivers\Promise Raid Card`

Special Settings

Furthermore, the following settings/revisions are configured:

- Sysprep.inf answer file and sysprep.bat batch file created to: Accept EULA, Preinstall the Product ID Number (PID)
- Gold Drive Identification in Registry
- Terminal Check utility to validate that the OS Recovery is only being installed on NCR workstations
- Dynamic resolution configuration utility
- Dynamic RS232 touch detection utility

Note: This product should only be used on NCR 7402 terminals with a Microsoft Windows 2000 license.

Recommendation

For each operating system, NCR strongly recommends that any drivers placed in the `C:\Install directory` be left intact for the purposes of servicing and maintaining the system. If you are using this information in order to build your own operating system image and not using NCR's provided OS Recovery image as a base image, we recommend that all drivers that are installed be placed in a similar `C:\Install` directory for support.

NCR RealPOS 7402 WinNT OS Recovery Software
(LPIN: D370-0587-0100)

The NCR 7402 Windows NT 4.0 Operating System Recovery Software provides the means of restoring the operating system to the terminal hard disk to the preinstalled state as shipped from the factory.

Installed Software:

- Microsoft Windows NT Workstation 4.0 w/ SP6a
- Microsoft Internet Explorer 6.0 SP1 (6.0.2800.1106 SP1)
- Intel Extreme Graphics Driver 2 13.2 Video (4.03.1381.3606)
- RealTek AC'97 Audio (ALC201A) (A3.35)
- Intel 82562 LAN driver(4.0.100.1124)
- Windows Installer (2.0)
- Backpack CD-Rom available (2.04)
- 3M TouchWare (5.64 SR2)
- Edgeport USB available (2.20)
- C&T Video available

Software Drivers

The following drivers are not installed automatically, but can be installed from their respective locations (Readme files exist in these locations, as well):

- Backpack CD-ROM   `C:\Install\Drivers\CDRom`
- Edgeport USB   `C:\Install\Drivers\USB`
- C&T Video   `C:\Install|Drivers\Video`
- Promise Card   `C:\Install\Drivers\Promiseraid`
- SIIG Card   `C:\Install\Drivers\SIIG`

Special Settings

Furthermore, the following settings/revisions are configured:

- Preinstalled NT to include the Product ID Number (PID)
- Placed the Gold Drive Part Number, Date Created, LPIN, and Release in Registry under:
  `HKey-Local_Machine\Software\NCR\Gold Drive`
- Ran Sysprep (so that the mini installation will run on initial boot) with the following parameters:

  - Automatically include PID
- Host.cmd set in RunOnce to update the registry
- Established a 2gb FAT16 primary system partition
- Established a secondary NTFS partition that fills the remainder of the drive
- Included necessary OS cab files in C:\Install
- Made SP6a folder available in C:\Install (installed)
- Made I386 folder available in C:\Install
- Installed MS SNMP, set to Manual
- Replaced the standard EULA with the NCR-specific EULA.
- TerminalCheck.exe in Run registry to determine correct hardware platform (otherwise it will shut down)
- Hide MS splash screen by adding `/noguiboot` parameter to boot.ini
- SerMouse device disabled
- Added `/noserialmice` to boot.ini
- Set resolution to 800x600
- Set colors to 65536
- Disabled MousClass service
- Updated C:\Install\drivers\touch folder to Microtouch 5.64 SR1
- 20.Manually added Com5

Note: This product should only be used on NCR 7402 terminals with a Microsoft Windows NT 4.0 license.

Recommendation

For each operating system, NCR strongly recommends that any drivers placed in the C:\Install directory be left in tack for the purposes of servicing and maintaining the system. If you are using this information in order to build your own operating system image and not using NCR's provided OS Recovery image as a base image, we recommend that all drivers that are installed be placed in a similar C:\Install directory for support.

NCR 7402 Windows XPe Operating System Recovery Software
(LPIN: D370-0588-0100)

The NCR 7402 Windows XPe Operating System Recovery Software provides the means of restoring the operating system to the terminal hard disk to the preinstalled state as shipped from the factory.

Installed Software:

- Microsoft Windows XPe w/ SP1
- Intel Extreme Video (6.14.10.3606)
- Intel Pro/100 LAN (7.0.26.0)
- Intel Chip Set Utility (5.01.1015)
- RealTek Audio Driver (5.10.0.4050)
- MicroTouch drivers available (5.64 SR1)
- Hampshire TSHARC USB Touch Drivers available (6.07)
- Edgeport USB drivers (2.30)
- Globetek drivers available (2.55.4.0)
- Promise FastTrak Raid Driver available (2.00.0.34)

Software Drivers

The following drivers are not installed automatically, but can be installed from their respective locations (Readme files exist in these locations, as well):

- 3M TouchWare   `C:\Install\Drivers\Touch`
- Globetek   `C:\Install\Drivers\Camera`
- Hampshire USB Touch   `C:\Install|Drivers\Hampshire_`
                         `USB_Touch`
- Promise Raid Card   `C:\Install\Drivers\Promise Raid`

Special Settings

Furthermore, the following settings/revisions are configured:

- Preinstalled XPe to include the Product ID Number (PID)
- Placed the Gold Drive Part Number, Date Created, LPIN, and Release in Registry under:
  `HKey-Local_Machine\Software\NCR\Gold Drive`
- Established a NTFS primary system partition that fills the entire drive
- Installed RealTek Audio Driver
- Installed Intel Chipset Utility
- Installed Intel LAN Driver
- Set virtual memory to 384
- Added NCR-specific EULA

Note: This product should only be used on NCR RealPOS 80/80c terminals with a Microsoft Windows XPe license.

Recommendation

For each operating system, NCR strongly recommends that any drivers placed in the `C:\Install directory` be left intact for the purposes of servicing and maintaining the system. If you are using this information in order to build your own operating system image and not using NCR's provided OS Recovery image as a base image, we recommend that all drivers that are installed be placed in a similar `C:\Install` directory for support.

Chapter 5: BIOS Updating Procedures

Introduction

This chapter discusses procedures how to update the terminal BIOS by using the external USB CD-ROM drive.

Note: It is also possible to perform a BIOS update using a network connection. Refer to the *NCR FitClient Software User's Guide* (B005-0000-1235) for information about that procedure.

Crisis Recovery
In the event the BIOS becomes corrupt, such as the result of a power failure during the BIOS Update procedure, you can use the method discussed later in this chapter in the *BIOS Crisis Recovery* section to recover the BIOS.

Prerequisites

The following are required on the 7402 in order to perform a BIOS update using a CD.

- Bootable USB CD-ROM drive (2336-K208)
- Keyboard
- Download the BIOS Software from the NCR website.

  http://www.ncr.com

  a. At this site, select **Support**.
  b. Under Related Items, Services; select **Drivers and Patches**.
  c. Select **Retail Support Files**.
  d. Select **Retail Platform Software**.
  e. Select **7402**.
  f. Follow the path for the terminal model/Operating System and download the BIOS software.

Building the Bootable Flex Diskette

The downloaded file is a self-extracting zip file containing the files necessary to create a bootable flex diskette that is used to perform the BIOS update. You need a system with a flex drive to perform this function.

1. Insert a flex diskette in the flex drive.

2. From a DOS box run the **.exe* file that you downloaded BIOS file. This creates a FreeDOS bootable flex diskette containing the necessary files to perform the BIOS update on your terminal.

3. Use the flex diskette to create a bootable CD. Follow the CD-ROM burner manufacturer's recommended procedures to create the CD.

Installing the USB External CD-ROM Drive

If your terminal contains an integrated CD-ROM, skip to *Updating Procedures*.

1. Connect the external USB CD-ROM drive to the *USB* connector on the terminal.
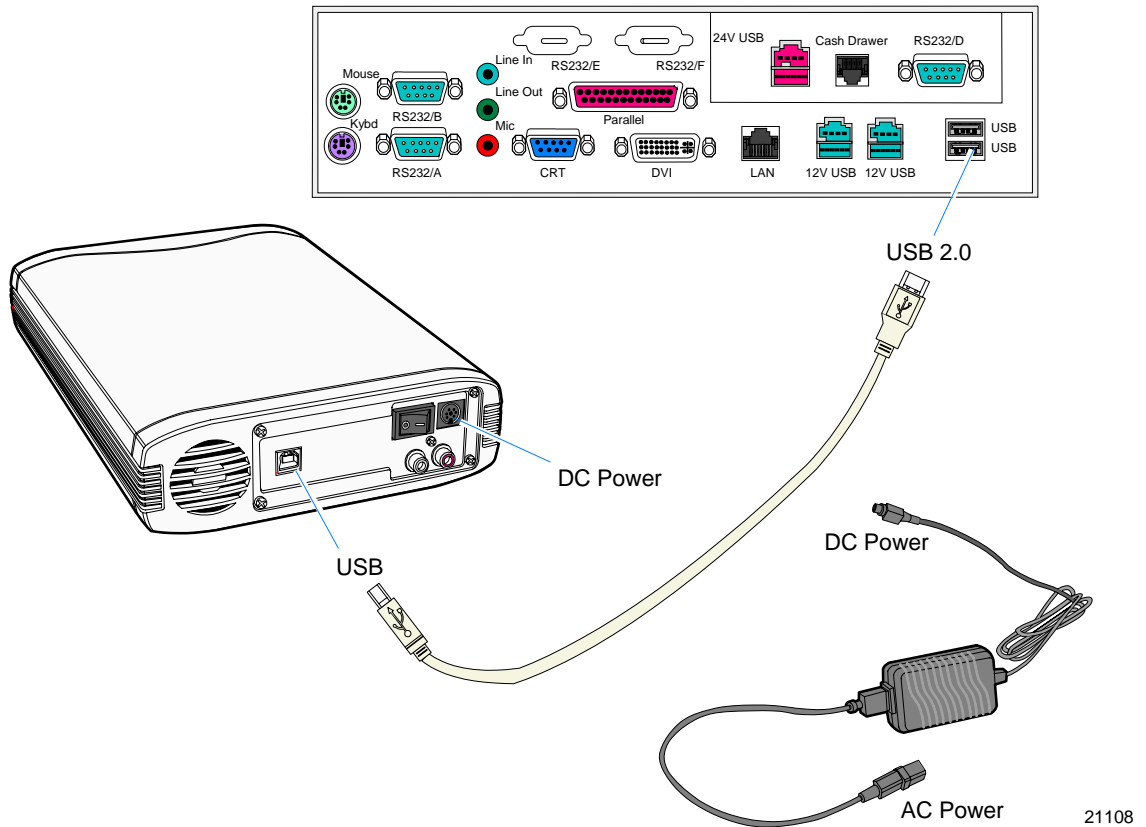
2. Connect the Power Supply to the *DC Power* connector on the CD-ROM and to an AC outlet.

3. Apply power to the CD-ROM drive (switch on the back).

Updating Procedures

1. Apply power to the terminal.

2. Press **[DEL]** during boot to enter Setup.

3. At the Setup Utility menu, select **Advanced BIOS Features**.

4. Set the **First Boot Device** to **USB-CDROM**.

   Note: The **CDROM** selection is used when you want to boot from an internal CD-ROM drive.

5. Press **[Esc]** to return to the Setup Utility menu.

6. Select **Save and Exit Setup**.

7. Insert the media containing the BIOS update software.

8. Follow the screen prompts on the client to update the BIOS. You can select two methods to run the update program.

   - Automatic BIOS Update – update process runs unattended

     Note: You will see a prompt for terminal model and serial number information if the program detects invalid information in the current BIOS, or if you are replacing the processor board, in which case there is not model/serial number information in the BIOS.

     Important: Model/Serial Number is mandatory.

   - Interactive BIOS Update – permits you to input/replace the model/serial number information that is stored in the BIOS.

     Note: Model/Serial number data that is currently stored in the BIOS is displayed during power up.

9. The Flash program updates the BIOS and then reboots the terminal.

10. Remove the CD before the system reboots.

BIOS Crisis Recovery

The procedures in this section provide a way to restore the BIOS resulting from a non-recoverable condition.

Note: Use this BIOS crisis recovery procedure only for a **NON-RECOVERABLE** BIOS failure. A non-recoverable BIOS state typically results from power loss during a flash BIOS update process. This is a rare occurrence and should not be confused with other hardware errors that cause a *no video* state. **This procedure is not intended to be used for changing or upgrading an operational BIOS**.

Required Hardware

Part Number	Part Name	Use
	PC with an RS-232 port	Download BIOS
497-0408349	Cable, 9-Pin Female to 9-Pin Female RS232	PC to terminal connection
497-0413418	Parallel Dongle	Forces BIOS recovery

Required Software

Acquire the following software from NCR.

NCR 7402-4xxx BIOS and BIOS Update Software
(LPIN: A370-0056-0100)

Recovery Procedures

1. Connect the Parallel Dongle to the parallel connector on the terminal.

2. Connect the two machines with an RS-232 cable. Use COM1 on both machines.
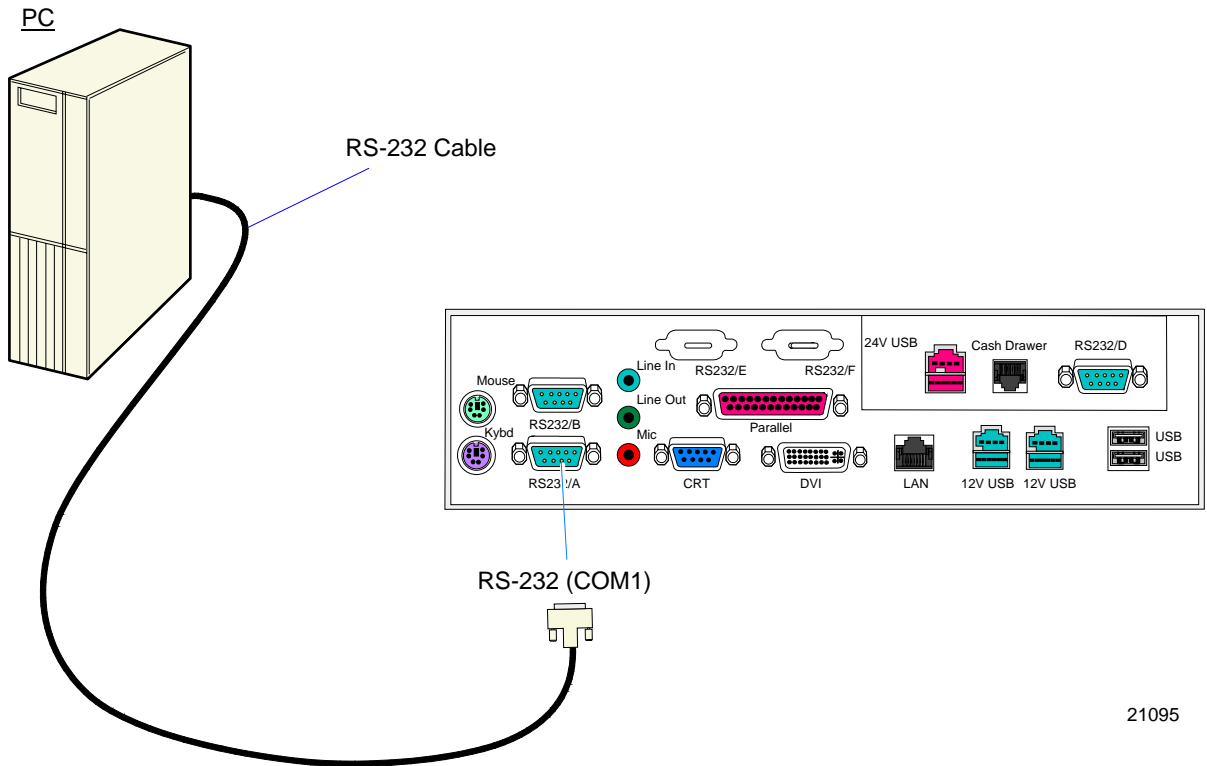
3. Boot the PC in the DOS mode. (If you are using CD-ROM media boot with CD-ROM support drivers.)

   Note: The PC must be running in the DOS mode (not in a Windows DOS box) for the software to operate correctly.

4. Insert the BIOS update CD into the PC.

5. Apply power to the terminal.

6. On the PC, change directory to the CD-ROM drive.

    ```
    E: [Enter]
    ```

7. Enter the update command:

    ```
    EMBflash [Enter]
    ```

8. Select the number for the 7402 terminal from the menu list:

    ```
    1) 7454
    2) 7401
    3) 7452
    4) 7453
    5) 7455
    6) 7460
    7) 7451
    8) 7456
    9) 7458

    9 [Enter]
    ```

A blue screen displays as the program runs, showing the program progress, followed by a green screen, indicating a successful load.

PhoenixPhlash Status

Flash memory has been successfully programmed

PRESS ANY KEY TO EXIT
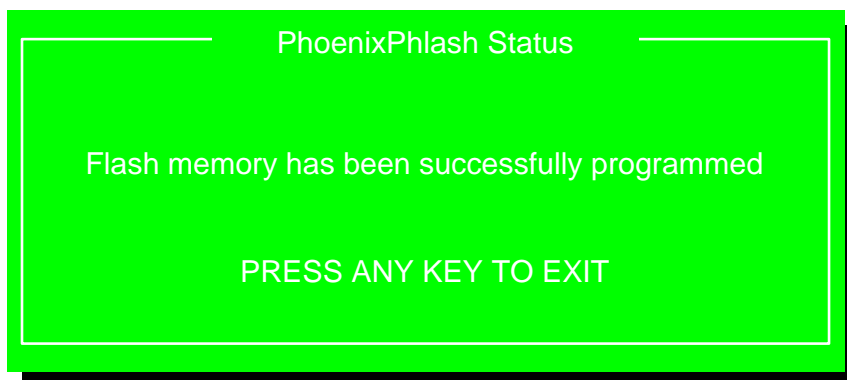
19502

The Class/Model/Serial # information is deleted using the Crisis Recovery procedure.

Use the normal BIOS update procedures as discussed earlier in this chapter to restore the information.

Cable/Connector Pin-Out Information

Parallel Dongle

25-Pin D-shell Receptacle
(Viewed from wiring side)

13   12   11   10   9   8   7   6   5   4   3   2   1

25   24   23   22   21   20   19   18   17   16   15   14

19513

RS-232 Cable

P1

P2

5 1
9 6

9-Pin
D-shell
Receptacle

9-Pin
D-shell
Receptacle

1 6
5
9

P1		P2
1		1
2		2
3		3
4		4
5		5
6		6
7		7
8		8
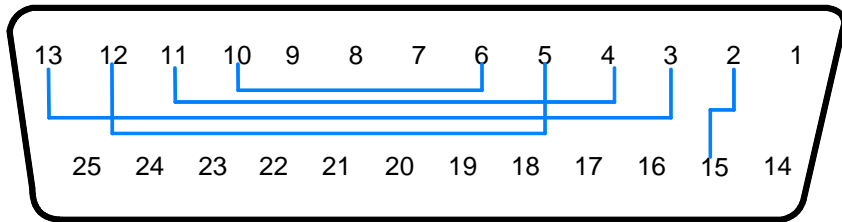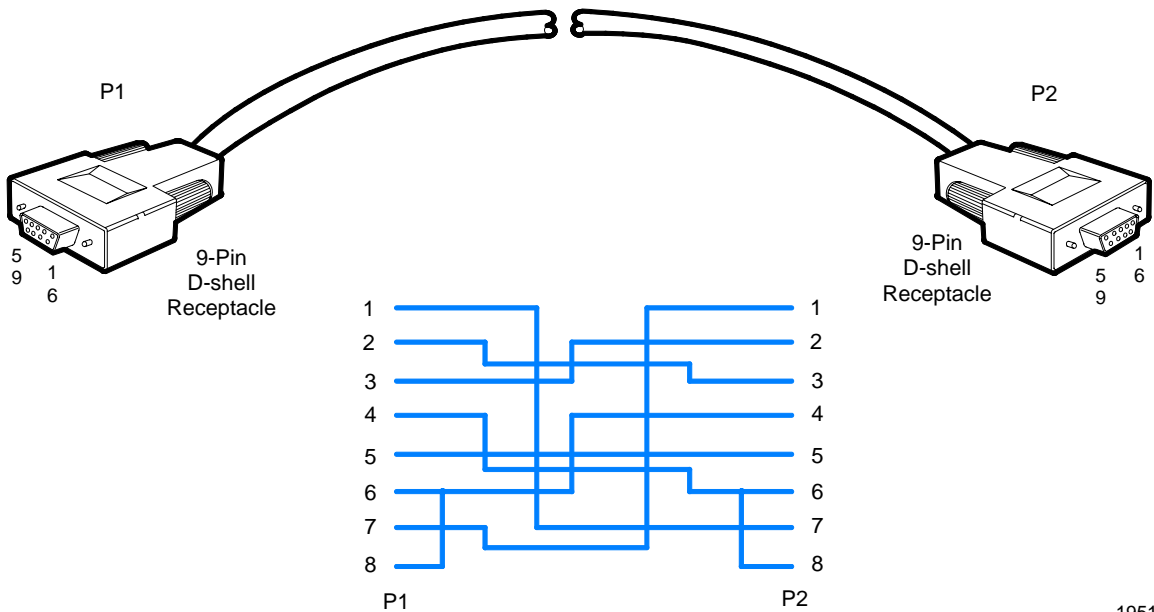
19512

Chapter 6: 2x20 Customer Display

Introduction

The 2x20 Customer Display consists of a Vacuum Florescent Display (VFD) with two rows of twenty 5x8 dot matrix characters, an RS-232 serial interface, driver circuitry, DC to DC/AC converter, and a character generator.

General Specifications

Item	Value
Number of characters	2 Rows x 20 Characters
Character Configuration	5x8
Character Height	8.86 mm
Character Width	3.90 mm
Character Pitch	5.15 mm
Line Pitch	9.64 mm
Peak Wavelength of Illumination	505 mm
Luminance	350 Cd/m2 (102 fL) (Minimum), 700 Cd/m2 (204 fL) (Typical)

Serial Communication Interface

The display receives commands and data from the host using an RS-232 serial interface, framed at 9600 baud, 8 data bits, no parity, and one stop bit.

Command Codes

User Defined Character Definition (08h, CODE, Byte1…Byte5)

This command defines a user defined character (UDC). The UDC character code is set by the CODE byte and must be 00H to 07H. All other values for CODE will this command. The five bytes following a valid CODE byte define the character. D1 through D40 represent the character dots. A (1) indicates the dot is on and (0) indicates the dot is off in the following format:

D1	D2	D3	D4	D5
D6	D7	D8	D9	D10
D11	D12	D13	D14	D15
D16	D17	D18	D19	D20
D21	D22	D23	D24	D25
D26	D27	D28	D29	D30
D31	D32	D33	D34	D35
D36	D37	D38	D39	D40

5 x 8 Dot Matrix Character

BYTE#	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	D1	D2	D3	D4	D5	D6	D7	D8
2	D9	D10	D11	D12	D13	D14	D15	D16
3	D17	D18	D19	D20	D21	D22	D23	D24
4	D25	D26	D27	D28	D29	D30	D31	D32
5	D33	D34	D35	D36	D37	D38	D39	D40

Character Table Select (09h, TABLE CODE)

This command selects which character table to display. The TABLE CODE byte determines the character set as defined in the table below. If bits 0 to 3 are all zero then this command is ignored. When a new character table is selected all characters on the display will be updated to display the character of the new table. After a reset the character table is set to Table 1.

Table Code	Character Table
01h	Table 1
02h	Table 2
03h	Table 3
04h	Table 4

Clear Display (12h)

This command sets all 40 characters to 20h (space) and moves the cursor to the first position of the top line.

Luminance Control (11h, LUMINANCE)

This command selects the display luminance. The LUMINANCE byte sets the display luminance level as defined in the table below. This command is ignored if the LUMINANCE byte is 00h.

LUMINANCE	Display Luminance
01h	25%
02h	50%
03h	75%
04h	100%

Cursor Position (10h, POSITION)

This command sets the cursor position. The POSITION byte moves the cursor position according to the table below. The next character byte writes to the new position and the cursor auto-increments to the next position. This command is ignored if the POSITION byte value is greater than 27h.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	00h	01h	02h	03h	04h	05h	06h	07h	08h	09h	0Ah	0Bh	0Ch	0Dh	0Eh	0Fh	10h	11h	12h	13h
2	14h	15h	16h	17h	18h	19h	1Ah	1Bh	1Ch	1Dh	1Eh	1Fh	20h	21h	22h	23h	24h	25h	26h	27h

Reset (13h)

This command resets the module to the following conditions:

- 100% luminance
- All 5x8 dot matrix characters set to 20h (space)
- Cursor position set to 00h
- Character table set to Table 1
- All user defined characters cleared

Character Tables and Codes

Data is written to the display one byte at a time. If the byte received is greater than 1Fh it is considered as 5x8 dot matrix character data. This character is written to the current cursor position and the cursor position is then incremented by one. When data is written to the last character position of the top line the cursor position moves to the first position of the bottom line. When data is written to the last character position of the bottom line the cursor position moves to the first position of the top line.

CP437

CP858

CP866

CP932

Chapter 7: Integrated APA Customer Display

Introduction

The APA (All Points Addressable) Customer Display consists of a 128 by 64 dot matrix graphic Vacuum Fluorescent Display (VFD), an RS-232 serial interface, driver circuitry, DC to DC/AC converter, and a character generator. The module is capable of displaying 64 luminance levels and 4 grayscale levels.

General Specifications

Item	Value
Number of Dots	128 x 64
Dot Height	0.5 mm
Dot Width	0.5 mm
Dot Pitch	0.65 mm
Pattern Width	83.05 mm
Pattern Height	41.45 mm
Color of Illumination	Green (x = 0.235, y = 0.405)
Luminance	250 Cd/m2 (73 fL) (Minimum), 500 cd/m2 (146 fL) (Typical)

Serial Communication Interface

The module receives commands and data from the host over an RS-232 single wire serial interface framed with one start bit, 8 data bits, and one stop bit. The baud rate is 115.2K or 9600 if JP1 is placed on the PCB.

Architecture

Display Data RAM

The on-board Display Data RAM (DDRAM) stores the pixel
information used for displaying images. DDRAM is divided into two
equal sections, Display 0 and Display 1. The image in either section can
be displayed and/or updated at any time using the D and H display
control bits. Both DDRAM sections are further divided into 4 equal
pages, Page 0 through Page 3. These pages are used to display 4-level
grayscale images.
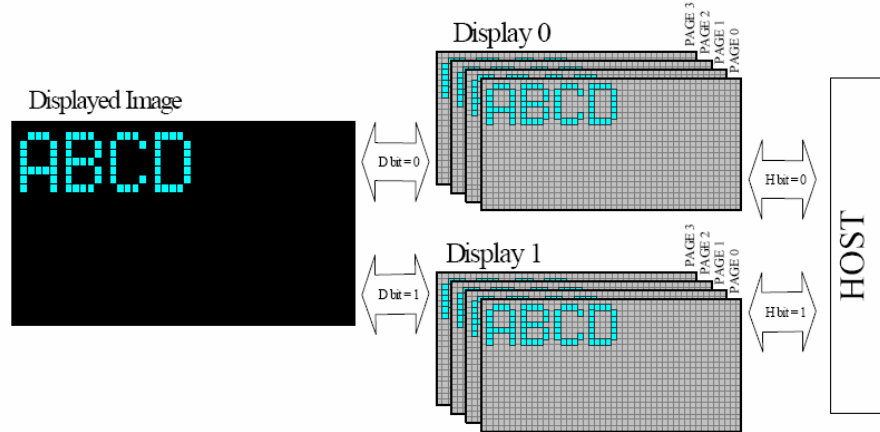
Display Page Map

Image data for the 8192 pixels of each display page is stored as 1024 bytes, which are addressed via the X Address Register (XAR) and the Y Address Register (YAR). The XAR corresponds to the display row, 8 pixels tall, and the YAR corresponds to the display column, 1 pixel wide, of a particular byte. The most (least) significant bit, B7 (B0), of each byte corresponds to the bottom (top) pixel of that address.

XAR = 0

	YAR = 0	YAR = 1	YAR = 2	YAR = 3	YAR = 4			YAR = 125	YAR = 126	YAR = 127	
	0	1	2	3	4			125	126	127	
0	0	1	1	1	0	-	-	0	0	0	B0
1	1	0	0	0	1	-	-	0	0	0	B1
2	1	0	0	1	1	-	-	0	0	0	B2
3	1	0	1	0	1	-	-	0	0	0	B3
4	1	1	0	0	1	-	-	0	0	0	B4
5	1	0	0	0	1	-	-	0	0	0	B5
6	0	1	1	1	0	-	-	0	0	0	B6
7	0	0	0	0	0	-	-	0	0	0	B7

XAR = 7

56	1	1	1	1	1			0	0	0	B0
57	0	0	0	0	1			0	0	0	B1
58	0	0	0	1	0			0	0	0	B2
59	0	0	1	0	0			0	0	0	B3
60	0	1	0	0	0	-	-	0	0	0	B4
61	0	1	0	0	0	-	-	0	0	0	B5
62	0	1	0	0	0	-	-	0	0	0	B6
63	0	0	0	0	0	-	-	0	0	0	B7
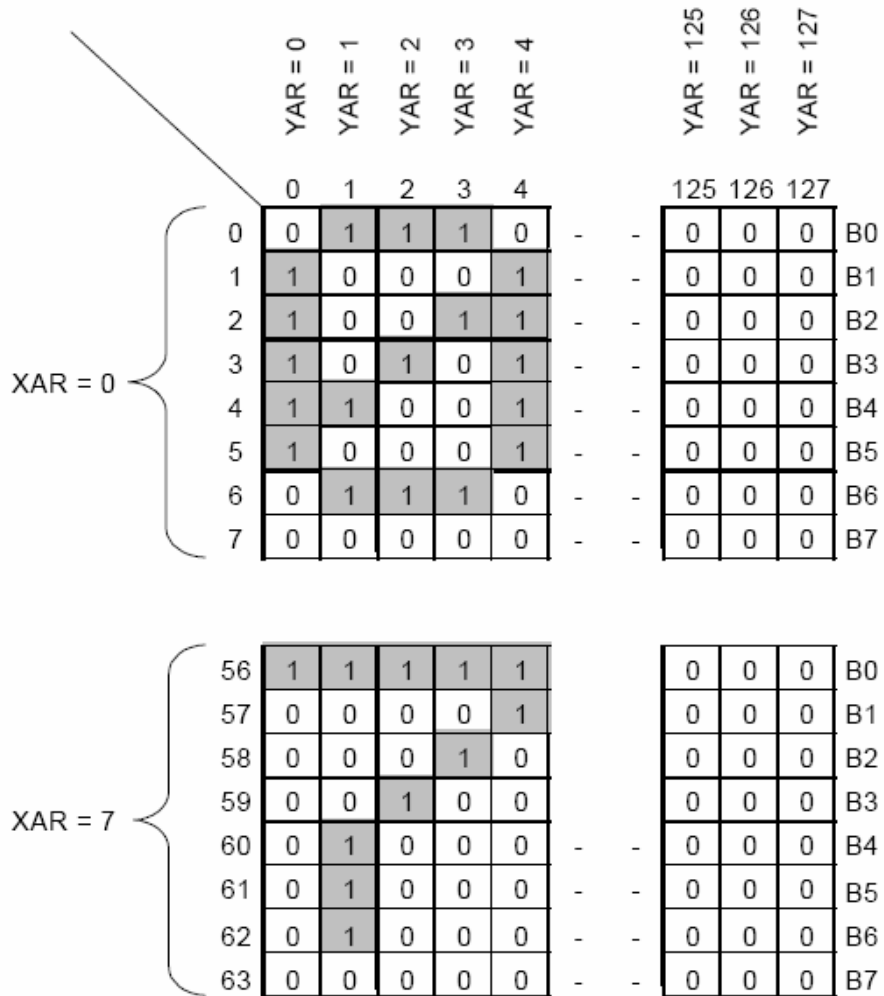
Monochrome Display Mode

In the monochrome display mode, image data is stored in DDRAM
Page 0 only. Image data bits stored as logic 1's are illuminated and bits
stored as logic 0's are dark. Overall luminance can be controlled to 64
levels.
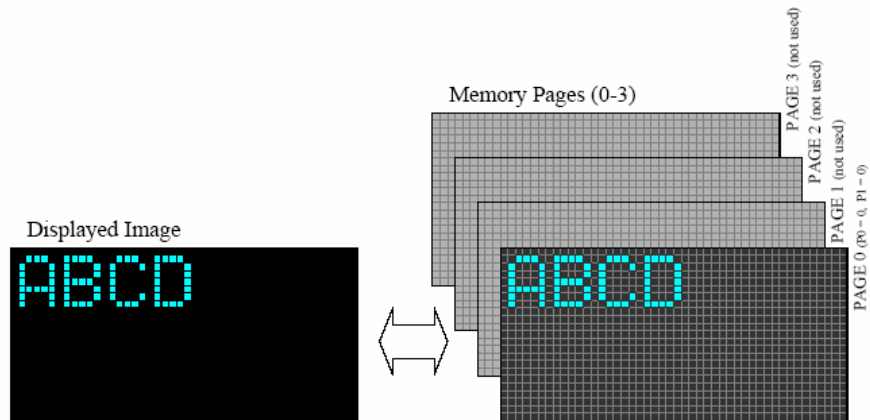
Grayscale Display Mode

In the grayscale display mode, image data is stored in DDRAM Pages 0, 1, 2, and 3. The display controller combines the data from all 4 pages to create a grayscale image. Image data bits add 25% relative luminance to the image for each page they are stored in as logic 1's. All of the 8192 pixels in an image can be configured for 0%, 25%, 50%, 75%, or 100% relative luminance independently. Overall luminance can also be simultaneously controlled to 64 levels.
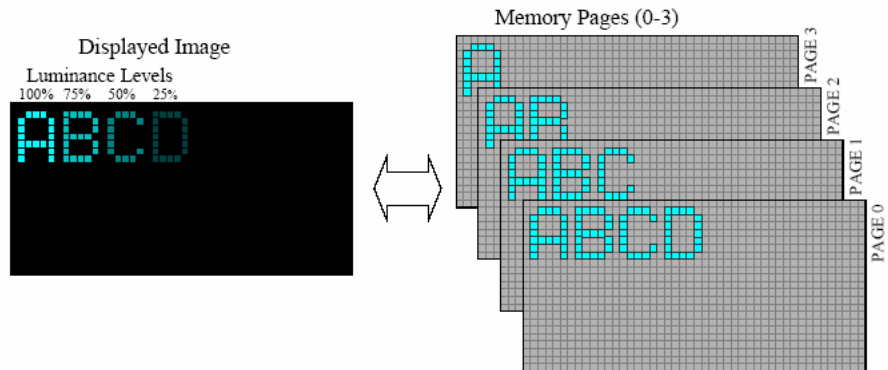
Display Control Bits

Display Control Bit		Description
H	0	DDRAM Display 0 selected for host communications (default)
	1	DDRAM Display 1 selected for host communications
D	0	DDRAM Display 0 image displayed (default)
	1	DDRAM Display 1 image displayed
P1, P0	0,0	DDRAM Page 0 selected for host communications (default)
	0,1	DDRAM Page 1 selected for host communications
	1,0	DDRAM Page 2 selected for host communications
	1,1	DDRAM Page 3 selected for host communications
G	0	Monochrome display mode selected (default)
	1	Grayscale display mode selected
I/G	0	XAR and YAR increment after a data write (default)
	1	XAR and YAR decrement after a data write

Note: P1 and P0 are automatically cleared if G is low.

Command Codes (00h - 0Fh)

Reset (00h)

This command resets the module to the following conditions:

- 0% luminance XAR and YAR set to 0
- Entire DDRAM cleared
- All display control bits set to 0
- Data write mode set to default mode (overwrite)
- Character size set to 5x7
- Character luminance set to 100%

Set Luminance (01h, LUMINANCE)

This command sets the overall display luminance to 1 of 64 levels. Bits 5 through 0 of the LUMINANCE byte select the luminance level, bits 7 and 6 are ignored.

LUMINANCE Byte	Display Luminance
00h	0%
01h	1.5%
- - -	- - -
3Eh	98.5%
3Fh	100%

Set Y Address Register (02h, YAR)

This command sets the YAR. Bits 6 through 0 of the YAR byte are used, bit 7 is ignored.

Set X Address Register (03h, XAR)

This command sets the XAR. Bits 2 through 0 of the XAR byte are used, bits 7 through 3 are ignored.

Set Display Control Bits (04h, DCB)

This command sets the display control bits. Bits 5 through 0 of the DCB byte are used, bits 7 and 6 are ignored.

DCB Byte							
B7	B6	B5	B4	B3	B2	B1	B0
x	x	I/D	G	P1	P0	D	H

Write Data Byte (05H, DATA)

This command writes the DATA byte, using the current data write mode, into the DDRAM location addressed by the XAR, the YAR, the P1 and P0 bits, and the H bit. This command also automatically increments (I/D=0) or decrements (I/D=1) the X and Y address registers. When the YAR overflows from 127 to 0, the XAR is also incremented, when the YAR underflows from 0 to 127, the XAR is also decremented.

Write Data Page (06h, BYTE1, BUTE2,... BYTE1024)

This command writes BYTE1 through BYTE1024, using the current data write mode, into the DDRAM page addressed by the P1 and P0 bits, and the H bit. This command ignores the XAR, the YAR, and the I/D bit and stores BYTE1 at (XAR,YAR) location (0,0), BYTE2 at (0,1),... BYTE129 at (1,0),... and BYTE1024 at (7,127). This command also clears the XAR and the YAR.

Write Data w/Shift (07h, DIRECTION, ROW, BYTE1, BYTE2,... BYTE32)

This command shifts the image data, selected by the ROW byte and the data control bits, one column to the left or right depending on the DIRECTION byte and fills the empty column in DDRAM with new data. Data shifted off the end of each row is lost. Bit 0 of the DIRECTION byte selects the shift direction, 0=left, 1=right, bits 7 through *2 are ignored.

Each bit of the ROW byte selects whether a given row is shifted or not, 1=row is shifted, 0=row not shifted. ROW byte bit 0 represents the top row (XAR=0), bit 1 the next row (XAR=1),... and bit 7 the bottom row (XAR=7). The data bytes, BYTE1, BYTE2,... BYTE32 fill the empty column from the top row to the bottom row skipping non-shifted rows, starting with Page 0 followed by Pages 1, 2, and 3 when in the grayscale mode.

One data byte is required for each row shifted when in the monochrome mode (G=0), 4 are required for each row shifted when in the grayscale mode (G=1). The XAR, the YAR, and the display control bits are not affected by this command.

* - If bit 1 of the DIRECTION byte is set, the module will use BYTE1 as the character code and BYTE2 as the character column number for the "new" data for filling the empty column in DDRAM.

Data Write Mode (08h, MODE)

This command determines how incoming data and characters will be combined with existing data in DDRAM.

Description	Mode Byte							
	B7	B6	B5	B4	B3	B2	B1	B0
DATA => DDRAM (default)	x	x	x	x	x	0	0	0
DATA AND DDRAM => DDRAM	x	x	x	x	x	0	0	1
DATA OR DDRAM => DDRAM	x	x	x	x	x	0	1	0
DATA XOR DDRAM => DDRAM	x	x	x	x	x	0	0	1
NOT DATA => DDRAM	x	x	x	x	x	0	1	0
DATA NAND DDRAM => DDRAM	x	x	x	x	x	1	0	1
DATA NOR DDRAM => DDRAM	x	x	x	x	x	1	1	0
DATA XNOR DDRAM => DDRAM	x	x	x	x	x	1	1	1

Character Write Mode (09h, MODE)

This command determines the size of incoming characters, which DDRAM page(s) they will be stored in, and enables/disables character kerning.

Description	Mode Byte							
	B7	B6	B5	B4	B3	B2	B1	B0
5x7 character size (default)	x	x	x	x	-	-	-	0
10x14 character size	x	x	x	x	-	-	-	1
Character luminance 25%	x	x	x	x	-	0	0	-
Character luminance 50%	x	x	x	x	-	0	1	-
Character luminance 75%	x	x	x	x	-	1	0	-
Character luminance 100% (default)	x	x	x	x	-	1	1	-
Character kerning enabled (default)	x	x	x	x	0	-	-	-
Character kerning disabled (fixed	x	x	x	x	1	-	-	-

Invert Screen (0Ah)

This command logically inverts (0's become 1's, 1's become 0's) the contents of DDRAM selected by the H and G bits. In the monochrome mode (G=0) only Page 0 is affected. The XAR, the YAR, and the data control bits are not affected by this command.

Reserved (0Bh - 0Fh)

These codes are reserved for future use and are currently ignored by the module.

Character Codes (10h - FFh)

Data values received by the module that are within the range 10h through FFh, are character codes. The character selected from the character table by the character code is written, using the current character write and data write modes, into the DDRAM location addressed by the XAR, the YAR, the data control bits. The XAR and YAR point to the DDRAM location that the left hand side of a 5x7 (upper left hand side of a 10x14) character will be stored.

This command adds 1 *blank column to 5x7 characters or 2 *blank columns to 10x14 characters, for character spacing.

This command also automatically increments (I/D=0) or decrements (I/D=1) the X and Y address registers to point to the next character (some characters are wider than others, see font table for sizes). YAR overflows, 127 to 0, increment the XAR (by 2 for 10x14 characters) and YAR underflows, 0 to 127, decrement the XAR (by 2 for 10x14 characters). Characters are top-justified leaving the bottom pixel row (2 pixel rows for 10x14 characters) *blank.

*"blank" is dependent on the current data write mode.

5X7 Character Table

10x14 Character Table

Command Execution Times

The following table lists all available commands and their corresponding execution times. There are no delays required between command and parameter bytes in a multi-byte commands. All times shown below are measured from the receipt of the last byte (except for the Write Data Page command).

Command	Code	Execution Time		Unit
		Monochrome	Grayscale	
Reset	00h	27	27	ms
Set Luminance	01h	N/A *see note 1		ms
Set Y Address Register	02h	N/A *see note 1		ms
Set X Address Register	03h	N/A *see note 1		ms
Set Display Control Bits	04h	N/A *see note 1		ms
Write Data Byte	05h	N/A *see note 1		ms
Write Data Page	06h	N/A *see note 1		ms
Write Data With Shift	07h			ms
Data Write Mode	08h	N/A *see note 1		ms
Character Write Mode	09h	N/A *see note 1		ms
Invert Screen	0Ah			ms
Not used	0Bh	N/A *see note 1		ms
Not used	0Ch	N/A *see note 1		ms
Not used	0Dh	N/A *see note 1		ms
Not used	0Eh	N/A *see note 1		ms
Not used	0Fh	N/A *see note 1		ms
5x7 Character Write	10H - FFH	0.35 *see note 2	0.8 *see note 2	ms
10x14 Character Write	10H - FFH	0.7 *see note 2	2.1	ms

Note 1: Execution times shorter than the time needed to transmit the next byte at 115.2K baud.

Note 2: N/A at 9600 baud

Chapter 8: Cash Drawer Interface

Introduction

This document is intended to be a guide for writing software to use the 7402 cash drawer interface. It is intended to assist software engineers to design and code software to control the cash drawer port. This is not a specification on the cash drawer interface. The sample code included has not been compiled or tested but can be helpful in coding the cash drawer interface.

The 7402 cash drawer interface has unique signals to:

- control the cash drawer solenoid(s) for up to 2 cash drawers.
- enable the arming of an external driving circuit.
- for reporting the status of the drawer, either open or close (input signal).

Logic Description

long Initialize( );
Initialize () creates the mutex handles and opens the NCR port driver if the OS requires it.

void Terminate();
Terminate() closes the handles to the mutexes and the NCR port driver if opened.

long OpenPort();
OpenPort () initializes the port by calling *QueryConf()* and sets the solenoid control bits and the arming bit to inputs.

long OpenDrawer();

> *OpenDrawer ()*, sets the control bits to output, enables the arming circuitry using the arm bit, energizes the solenoid of the selected drawer, waits a constant time, then releases the cash drawer solenoid(s) bit(s) and disables the arming circuit. These output bits are then configured as inputs again. This method uses *SetState*() for controlling the drawer. See the section on Hardware/Firmware Interfaces for more detail.

void ClosePort();

> *ClosePort()* resets the port opened status flag to false.

DWORD GetDrawerStatus();

> *GetDrawerStatus ()*, reads from the port that monitors the cash drawer status bit and masks unused bits to determine the drawer state. This method uses *ReadIOPort* () for monitoring the status bit. See the section on Hardware/Firmware Interfaces for more detail.

BOOL SetState(DWORD dwState);

> *SetState ()*, uses the constant masks to create the data to write to the port that control the cash drawer solenoid(s) bit(s). This method uses *WriteIOPort* () for controlling the solenoid(s). See the section on Hardware/Firmware Interfaces for more detail.

BOOL QueryConf();

> In *QueryConf()*, we must initiate a configuration cycle with the PCI registers that control the cash drawer solenoid(s) and monitor the status bit. Interaction with GP*IO_BASE (General Purpose I/O Base Address Register)* takes place in order to determine the port address used for controlling the solenoid(s) and for monitoring the status bit. See the section on Hardware/Firmware Interfaces for more detail.

BOOL WriteIOPort(DWORD databytes, WORD ioport);

> *WriteIOPort ()*, writes data to the port that control the cash drawer
> solenoid(s) bit(s). This method uses the port address obtained in
> *QueryConf*() for controlling the solenoid(s). See the section on
> Hardware/Firmware Interfaces for more detail.

BOOL ReadIOPort(DWORD *databytes, WORD ioport);

> *ReadIOPort ()*, reads from the port that monitors the cash drawer
> status bit. This method uses the port address obtained in
> *QueryConf*() for monitoring the status bit. See the section on
> Hardware/Firmware Interfaces for more detail.

Component Architecture

The developer should provide a description, either textually or diagrammatically (i.e., block diagram), of how the components of the module subsystem interact in this sub-section.

The member function *Initialize()* is subsequently called to open the NCR Windows NT port driver (if applicable) and perform other initialization tasks. Then, the device's *OpenPort()* member function is called to make the device available, at which time *QueryConf()* is called.

Once the device has been configured, the member functions *OpenDrawer()*, *GetDrawerStatus() and SetState()* can be called to interact with the cashdrawer. These methods themselves invoke the member functions *WriteIOPort()* and *ReadIOPort()* to actually send and receive data to the cashdrawer via the port addresses obtained in *QueryConf()*.

Code Changes

Following is an enumeration of the code changes needed to support the 7402:

The interface of the new device supports two separate fields for GPIO select port address (read/write) and solenoid and status bit port address (read/write). The chip GPIO bits must be selected for use as GPIO and as either input or output.

It is desired that the driving circuit be disabled at power on and when not actively driving the solenoid. Two output control implementations will be used:

1. Use the *m_nIOPort_Select* address register to set the solenoid bit to an output function before driving the bit high using *m_nIOPort*, set the solenoid bit low after the charging time and then setting the bit function to input using *m_nIOPort_Select*.

2. Use the arming bit at address *m_nIOPort* to enable an external driving circuit, set the solenoid bit high, set the solenoid low after the charge time and finally disable the arming bit.

QueryConf():

QueryConf() uses the PCI configuration cycle protocol at Bus 0, Device 31 and Function 0 and offset 0x58 to obtain the contents of *GPIOBase* register. When *GPIOBase* is referenced in the following paragraphs it is referring to the contents of register *GPIOBase [15:6]*. The primary differences are:

a. One port address needs to be configured for reading the status bit and reading/writing to control the cash drawer solenoids, and if necessary the ARM bit using register GPIO Level for Input or Output 2 Register (GP_LVL2) offset *GPIOBase* + 0x38.

b. GPIO must be selected for use as GPIO through register GPIO Use Select 2 Register (GPIO_USE_SEL2) offset GPIOBase + 0x30.

c. GPIO bits used by the cash drawer must be selected as either input or output through GPIO Input/Output Select 2 Register(GP_IO_SEL2) GPIOBase + offset 0x34.

d. An ARM bit may need to be setup as output and controlled with the solenoid and status port address. This bit enables the driving circuit for the solenoid outputs.

Hardware/Firmware Interfaces

In some previously supported models, no preliminary interaction with the hardware was required to determine the port address(s) used for communication with the cash drawer; these data were instead obtained from the registry. For the 7402, the port address is set dynamically by the BIOS and hence the hardware must be queried to obtain this information. This dictates the need for the generation of a configuration cycle as described previously.

Configuration mechanism one utilizes two 32bit I/O ports located at addresses 0x0CF8 and 0x0CFC. These two ports are:

- 32-bit configuration address port - occupying I/O addresses 0x0CF8 through 0x0CFB.

- 32-bit configuration data port - occupying I/O addresses 0x0CFC through 0x0CFF.

Accessing a PCI function's configuration port is a two step process:

- Write the target bus number, physical device number, function number and doubleword number to the configuration address port

- Perform an I/O read from or a write to the configuration data port.

The ICH4 Configuration Address Register should be defined as follows:

- Configuration Space Mapping enabled

- Bus number 0

- Device number 31

- Function number 0

- GPIO base register offset address 0x58

Within the ICH4, the General Purpose I/O ports are addressed using an offset read from the GPIO Base Address Register, [GPIOBASE] (offset 0x58). The base address included in Bits [15:6] is assigned by the BIOS. The GPIO Control Register [GPIO_CNTL] (offset 0x5C) has a R/W bit [4] that enables(1)/disables(0) the decode of the I/O range pointed to by the GPIO Base register and enables/disables the GPIO function. The GPIO Control Register is set by the BIOS to enable GPIO.

Intel® 82801DB ICH4 Datasheet

GPIO_USE_SEL2—GPIO Use Select 2 Register
Offset Address: GPIOBASE +30h Attribute: R/W
Default Value: 00000FFFh Size: 32-bit
Lockable: No Power Well: Core
Bit Description
31:0

GPIO_USE_SEL2[43:32] — R/W. Each bit in this register enables the corresponding GPIO (if it exists) to be used as a GPIO, rather than for the native function.

   0 = Signal used as native function.

   1 = Signal used as a GPIO.

For 7402, cash drawer bits GPIO_USE_SEL2 [35:32] will be set =1 for use as a GPIO, write value = read value ANDed with 0xF.

After a full reset (RSMRST#) all multiplexed signals in the resume and core wells are configured as their native function rather than as a GPIO. After just a PCIRST#, the GPIO in the core well are configured as their native function.

LPC Interface Bridge Registers (D31:F0)

GP_IO_SEL2—GPIO Input/Output Select 2 Register
Offset Address: GPIOBASE +34h Attribute: R/W
Default Value: 00000000h Size: 32-bit
Lockable: No Power Well: Core

GP_LVL2—GPIO Level for Input or Output 2 Register

Offset Address: GPIOBASE +38h Attribute: R/W
Default Value: 00000FFFh Size: 32-bit
Lockable: No Power Well: See below
Bit Description
31:12 Always 0. No corresponding GPIO.
11:0

GP_IO_SEL2[43:32] — R/W. When set to a 1, the corresponding GPIO signal (if enabled in the GPIO_USE_SEL2 register) is programmed as an input. When set to 0, the GPIO signal is programmed as an output.
Bit Description
31:12 Reserved. Read-only 0
11:0

GP_LVL2[43:32] — R/W. If GPIO[n] is programmed to be an output (via the corresponding bit in the GP_IO_SEL2 register), then the corresponding GP_LVL2[n] bit can be updated by software to drive a high or low value on the output pin. 1 = high, 0 = low. If GPIO[n] is programmed as an input, then the corresponding GP_LVL2 bit reflects the state of the input signal (1 = high, 0 = low). Writes will have no effect.

Since these bits correspond to GPIO that are in the core well, these bits will be reset by PCIRST#.

Three GPO bits and one GPI bit of South Bridge ICH4 are used to control the cash drawer(s). They are defined below:

GPIO 32 CD_SW_AB

   Input 1, high Drawer(s) closed. Input 0, low Drawer(s) open.

GPIO 33 CD_SOL_A

   Output 0, low turn off solenoid A. Output 1, high Activates Solenoid A.

GPIO 34 CD_SOL_B

   Output 0, low turn off solenoid B. Output 1, high Activates Solenoid B.

GPIO 35 CD_ARM

> Output 0, low Drawer(s) solenoid signals enabled. Output 1, high disabled.

There is only one cash drawer status signal CD_SW_AB. It is the status of either cash drawer or both cash drawers.

Dependencies/Assumptions/Constraints

Hardware Dependencies

Constraint: For systems in which two cashdrawers are in use on the Darlington, the drawers must share a status bit using a 'Y' cable.

Software Dependencies

NCR Windows NT Port Driver (NCRKMPDR.sys).

Sample Code

CPP Source File: DarlingtonCDSample.cpp

```
long Initialize( )
{

    // Init -- I/O Port -- Standard Configuration Register Address for PCI
Devices
   m_nIOConf = 0x0CF8;

    // Read -- I/O Port -- If these defaults are left unchanged, errors will be
reported
  m_nIOPort  = 0;  // R/W port for solenoid bits and status
   m_nIOPort_select = 0;  //R/W port for selecting GPIO Input/Output config

    m_nDrawerNumber = 1;  //Default


     m_bPortDrvr = FALSE;

     // determine if OS is WIN95 or WINNT
     if (GetVersion() < 0x80000000)
     {
    m_nOSVersion = OS_WINDOWS_NT;
    // Lock Mutex when accessing shared memory TAR 95236
    WaitForSingleObject( g_hSharedMemoryMutex, INFINITE );

     if ( g_hPortDrvr == NULL )
```

```
     {
            // -rtf- Create a security attribute allowing global access
            GetGlobalSA( _T("CreateFile"), _T("NCRKPDev"), &m_Attributes, &m_SD
);

            g_hPortDrvr = CreateFile(
                    "\\\\.\\NCRKPDev",              // Open the Device "file"
                    GENERIC_WRITE | GENERIC_READ,
                    FILE_SHARE_READ | FILE_SHARE_WRITE,
                    (LPSECURITY_ATTRIBUTES) &m_Attributes,  // no security
                    OPEN_EXISTING,
                    0,                                 // flags
                    NULL);

            if (g_hPortDrvr == INVALID_HANDLE_VALUE)  // Was the device opened?
            {
                DWORD hr = GetLastError();

                m_bPortDrvr = FALSE;

                InitError = TRUE;
            }

            else
            {
             m_bPortDrvr = TRUE;
            }

     }   // end if (g_hPortDrvr==0)


      ReleaseMutex( g_hSharedMemoryMutex );

     }// WINNT OS

      else
      {
        m_nOSVersion = OS_WINDOWS_95;
      }


     } // end if (!InitError)


     // if the (OS is WINNT AND the port driver was opened )
     if ( !InitError )
     {

        // Create a security attribute allowing global access
        GetGlobalSA( _T("mutex"), sData, &m_Attributes, &m_SD );
```

```
    // Lock Mutex when accessing shared memory
    WaitForSingleObject( g_hSharedMemoryMutex, INFINITE );

    g_hHWPortMutex = CreateMutex( &m_Attributes, FALSE, (LPCTSTR) sData );

         if ( g_hHWPortMutex != NULL )
         {

         m_pDC->DCPrintf(
                       DCM_APIHIGH,
                       _T(" ..create m_hPowerMutex") );
        // Create a security attribute allowing global access
        GetGlobalSA( _T("mutex"), _T("NCRPowerSharingMutex"), &m_Attributes,
&m_SD );

            // create named mutex that prevents the cash drawer from firing
            // when the printer is printing
            // "NCRPowerSharingMutex"
            m_hPowerMutex = CreateMutex( &m_Attributes, FALSE,
_T("NCRPowerSharingMutex") );

         }  // HWPortMutex created

      }

      ReleaseMutex( g_hSharedMemoryMutex );    // TAR 95236

       }  // OS is WIN95 or WINNT and NCRKPDev driver present


    return RetStatus;
}
```

```
//////////////////////////////////////////////////////////
void Terminate()
{

  if ( m_bInitialized )
  {
    // Lock Mutex when accessing shared memory
    WaitForSingleObject( g_hSharedMemoryMutex, INFINITE );

    CloseHandle( m_hPowerMutex );
    CloseHandle( g_hHWPortMutex );      // TAR 95236

    // if the NT port driver was opened...
        if (m_bPortDrvr )
      {
            // close the file handle
            m_bPortDrvr = FALSE;
            g_nPortDrvr=0;   // Dec to zero using and close handle
            CloseHandle(g_hPortDrvr);
            g_hPortDrvr = NULL;

      }
    m_bInitialized = FALSE;

  ReleaseMutex( g_hSharedMemoryMutex );
  }
}

//////////////////////////////////////////////////////////
long OpenPort()
{
  CString sData;
  long RetStatus;
  CString Result;
  static TCHAR szIOPort[] = _T("Port");

  // Get the IO H/W Configuration to set IOPORT addresses

  // If other of same type exists then use same IOPort addresses
      QueryConf(); // Sets IOPORT addresses based on H/W configuration

    // initialize state
      DWORD sBytes=0;
      DWORD bMask = ~(CD7402DRWR1SOLENOID | CD7402DRWR2SOLENOID); // Set
Solenoid bits LOW
      bMask = bMask | CD7402ARM_OFF; // set solenoid bits low and arm bit high

      // **program solenoid bits as inputs to start
      if ( !ReadIOPort(&sBytes, m_nIOPort_select) )
    {
      // Error logged in ReadIOPort
```

```
      RetStatus = CDD_E_IOFAILURE;
      Result = _T("I/O read operation failed");
     }
     else if ( !WriteIOPort( sBytes | CD7402SELECT_GPI,
                               m_nIOPort_select))  // Darlington 1 = select input
     {
      // Error logged in WriteIOPort
      RetStatus = CDD_E_IOFAILURE;
      Result = _T("I/O write operation failed");
     }

     //** set solenoid bits de-activated, even though they are supposed to be
inputs now
     if ( !ReadIOPort(&sBytes, m_nIOPort) )
     {
      // Error logged in ReadIOPort
      RetStatus = CDD_E_IOFAILURE;
      Result = _T("I/O read operation failed");
     }
      // Darlington 0 = solenoid de-activated, 1 = ARM de-activated
     else if ( !WriteIOPort( sBytes & bMask,
                               m_nIOPort))
     {
      // Error logged in WriteIOPort
      RetStatus = CDD_E_IOFAILURE;
      Result = _T("I/O write operation failed");
     }
     else
     {
      RetStatus = CDD_SUCCESS;
      Result = _T("Success");

      m_bIFOpened = TRUE;      //InterFace is OPENed

      // initialize Position variable in aCDData array element
      GetDrawerStatusLIO();

     }

   return RetStatus;

}
```

```
/////////////////////////////////////////////////////////////////////
void ClosePort()
{

  if ( m_bIFOpened )
  {
    m_bIFOpened = FALSE;
  }

}


//////////////////////////////////////////////////////////////////////////////
// CDevice7402::OpenDrawer [called from polling thread]

long OpenDrawer()
{
  long RetStatus;
  CString RetString;

  WaitForSingleObject( g_hHWPortMutex, INFINITE );   // TAR 95236

  if ( m_bIFOpened )
  {
    WaitForSingleObject( m_hPowerMutex, INFINITE );

    // Set Device in RELEASE State
    if ( SetState( STATE_RELEASE ) )
    {
      // Give time for Drawer to see the RELEASE state change, then
      // check the drawer position.
      Sleep( CD7402_OPEN_WAIT );

      // Set Device in IDLE State
      if ( SetState( STATE_IDLE ) )
      {
        if (( GetDrawerStatusLIO() == DRAWER_OPENED ) ||
         ( m_pCashDrawer->m_bCapStatus == FALSE))   // no drawer status
available return success
        {
          RetStatus = OPOS_SUCCESS;
        }
        else
        {
          RetStatus = OPOS_E_TIMEOUT;
        }
      }//SetState( STATE_IDLE )
      else
      {
        RetStatus = OPOS_E_NOEXIST;
```

```
      }
    }//SetState( STATE_RELEASE )
    else
    {
      RetStatus = OPOS_E_NOEXIST;
    }

    ReleaseMutex( m_hPowerMutex );
  }

  ReleaseMutex( g_hHWPortMutex );

  return RetStatus;
}


//////////////////////////////////////////////////////////////////////////
// CDevice7402::GetDrawerStatus [called from polling thread]
//
// Return Value:    DrawerStatus
//          DRAWER_OPENED
//          DRAWER_CLOSED
//
DWORD GetDrawerStatus()
{
  int Result;
  CString ResString;
  DWORD bMask;

  Result = DRAWER_INVALID;
  ResString = _T("INVALID");

  if ( m_bIFOpened && ( m_pCashDrawer->m_bCapStatus) )  // Opened and Drawer
status is available
  {
    switch( m_nDrawerNumber )
    {
      case 1:
        bMask = CD7402DRWR1CLOSED;
        break;

      case 2:
        bMask = CD7402DRWR2CLOSED;
        break;
    }

    DWORD sBytes;

    // if the status clear was successful, we will read a closed drawer
    BOOL sResult = ReadIOPort(&sBytes, m_nIOPort);
```

```
    if ( sResult )
    {
      if ( sBytes & bMask )  // bit = 1 means drawer CLOSED for DARLINGTON
      {
        ResString = _T("CLOSED");
        Result = DRAWER_CLOSED;
      }
      else
      {
        ResString = _T("OPENED");
        Result = DRAWER_OPENED;
      }
    }//sResult
  }

  return Result;

}

///////////////////////////////////////////////////////////////////////////
// CDevice7402::SetState

BOOL SetState( DWORD dwState )
{
    // Fire cashdrawer mechanism by setting drawer to the RELEASE State.

    // Can't open both cash drawers at the same time. Must set H/W mutex
    // in OpenDrawerLIO() around SetState(RELEASE) and SetState(IDLE) to
    // insure this.

  // To engage solenoid, we must set the solenoid bit HIGH and the ARM bit
  // LOW.  The ARM bit controls the external arming circuit to drive the
  // solenoid.

    CString sState;

    DWORD bMask;
    DWORD sBytes = 0;
    DWORD oBytes = 0;
    BOOL  result = TRUE;
  // Read select register
  // Solenoid GPIO bits and ARM bit have been set to input when not using.
  if ( ReadIOPort(&sBytes, m_nIOPort_select) )
  {

     // solenoid bits  and ARM bit as outputs, Low enables output
     sBytes = sBytes & CD7402SELECT_GPO;
     result = WriteIOPort( sBytes, m_nIOPort_select );
  }

  else      // Error logged in ReadIOPort
```

```
          result = FALSE;
    if(result)
    {
        switch( m_nDrawerNumber )
        {
          case 1:
              // set solenoid bit high, arm bit low
            bMask = CD7402DRWR1SOLENOID;
            break;

          case 2:
            bMask = CD7402DRWR2SOLENOID;
            break;
        }
        // Read solenoid bit
        if ( ReadIOPort(&oBytes, m_nIOPort) )
        {
            switch (dwState)
            {
              case ( STATE_RELEASE ):
                // activate solenoid (open cash drawer)
                // bit = 1 activates solenoid, = 0 de-activates
                // Set the solenoid bit ON to energize, leave other bits alone
                oBytes = oBytes | bMask;
                    // driving circuit arming bit,LOW for arming
                oBytes = oBytes & CD7402ARM_ON;

                result = WriteIOPort( oBytes, m_nIOPort );
                sState = _T("STATE_RELEASE");
                break;

              case ( STATE_IDLE ):
                // deactivate solenoid
                oBytes = oBytes & (~bMask);   // Set the solenoid bit OFF to de-
energize, leave other bits alone
                oBytes = oBytes | CD7402ARM_OFF;
                sState = _T("STATE_IDLE");
                // write new solenoid bit
                result = WriteIOPort( oBytes, m_nIOPort );
                sBytes = sBytes | CD7402SELECT_GPI;  // set solenoid bits and status
bit as inputs
                // write new select with solenoid bits enabled as Inputs.
                WriteIOPort( sBytes, m_nIOPort_select );
                break;

              default:
                // Set the INVALID state configuration.
                return FALSE;
            }

        }
```

```
        else        // Error logged in ReadIOPort
            result = FALSE;

    }   //result


    return result;
}


//////////////////////////////////////////////////////////////////////////////
// CDeviceDarlington::QueryConf -

/*Configuration mechanism one utilizes two 32bit I/O ports located at addresses
0x0CF8 and 0x0CFC.
These two ports are:
· 32-bit configuration address port, occupying I/O addresses 0x0CF8 through
0x0CFB.
· 32-bit configuration data port, occupying I/O addresses 0x0CFC through
0x0CFF.
Accessing a PCI function's configuration port is a two step process:
· Write the target bus number, physical device number, function number
and doubleword number to the configuration address port
· Perform and I/O read from or a write to the configuration data port.

The ICH4 Configuration Address Register(CONFIG_ADDRESS) should be defined as
follows:
· Configuration Space Mapping enabled
· Bus number 0x0
· Device number 0x31
· Function number 0x00
· GPIO BASE Port offset address 0x58
The configuration address register at 0x0CF8 value for DWORD access:
  - for GPI/O GPIO_BASE register 80007858
  - for GPI/O GPIO_CNTL register 8000785C

Within the ICH4, the General Purpose I/O ports are addressed using an offset
from
the base address assigned by the BIOS.  The offset to GP I/O ports is as
follows:
· GPIO_USE_SEL2: DWORD offset GPIO_BASE contents + 0x30
· GPIO_IO_SEL2: DWORD offset GPIO_BASE contents + 0x34
· GPIO_LVL2: DWORD offset GPIO_BASE contents + 0x38

Two GPO ports one GPI port of South Bridge VT686B are used to control cash
drawer. They are defined as below:

· GPIO 33 CD_SOL_A     output 0, low turn off solenoid A.  Output 1, high
Activates Solenoid A.
```

· GPIO 34 CD_SOL_B   output 0, low turn off solenoid B. Output 1, high
Activates Solenoid B.
· GPIO 32 CD_SW_AB   input 1, high Drawer(s) open.   Input 0, low
Drawer(s) closed.
· GPIO 35 CD_ARM   output 0, low Drawer(s) solenoid signals enabled. Output
1, high disabled.
There is only one cash drawer status signal CD_SW_AB. It is the status of
either cash drawer or
both cash drawers.

*/

```
//In the PCI device configuration space, query the
// GPIO Base Address Register (GPIOBASE) to determine the address for reading
// the GPI port assigned to the select register (m_nIOPort_select) and the
address
// we can read/write the solenoid bits and read the status bit (m_nIOPort).
// The BIOS assigns these addresses dynamically. We obtain the addresses as
// follows:
//
// A. Write to m_nIOConf, then read GPIOBASE from m_nIOConf+4 and add the
respective
//    offset to the result to obtain m_nIOPort and m_nIOPort_select.
// B. We can now control the solenoid bits and read the status bit via
m_nIOPort
//    and Input/Output select via m_nIOPort_select.
//    (see ReadInPort() and WriteOutPort() for details)
//
// REFERENCES: Shanley/Anderson, "PCI System Architecture" 3rd. ed. (Chapter
15-17)
//             "INTEL ICH4 I/O Controller Hub" Datasheet

BOOL QueryConf()
{
  BOOL  result = TRUE;
  DWORD FileOffset=0x40;
  DWORD DataRead=0;
  // Configuration Address Register at 0x0CF8
  // bit 31 = 1; Enable Configuration Space Mapping
  // bits 30 - 24 = 0 ; Reserved
  // bits 23 - 16 = 0 ; Bus number
  // bits 15 - 11 = 31   ; Device
  // bits 10 - 8  = 0 ; Function
  // bits 7 - 0 = 58; Register bits 1 - 0 Always zero (See NOTE 1)
  // NOTE 1:  GPIO base Address is read from General Purpose I/O Register Base
Address at a fixed Offset = 0x58
  // The GPIO Register Base Address value provides a base address in bits 15:6.
Therefore mask is 0x0FFC0.
  DWORD n_configGPIOReqData = 0x8000F858;  // Dev. 31, Func. 0, Reg. 0x58

  DWORD gpioport=0;
```

```
  UCHAR uc_gp_offset = 0x38; //DWORD IOoffset for the GPIO solenoid and status
bits
  // GPI[34:32] are bits 2:0
  UCHAR uc_gpsel_offset  = 0x34;  //DWORD IOoffset for the GPIO select
register
  // GPO[34:32] are bits 2:0
  UCHAR uc_gpuse_offset = 0x30; // IOoffset for GPIO Use select reg, 1 = GPIO
  int CD7402USE_GPIO   = 0x0000000F;
  WORD nUsePort =0;

  UCHAR status_mask = 0x01;  // GPI[32]
  UCHAR solenoidA_mask = 0x02;  // GPO[33]
  UCHAR solenoidB_mask = 0x04;  // GPO[34]

  DWORD DataWritten=0;
  WaitForSingleObject( g_hHWPortMutex, INFINITE );

  if ((m_nOSVersion == OS_WINDOWS_95) || (m_nOSVersion == OS_WINDOWS_CE))

  { // WIN 95 I/O config
     //*******************************PART A
*************************************
     _outpd(m_nIOConf, n_configGPIOReqData);       // request communication
with GPIO_BASE
     gpioport = (LOWORD(_inpd(m_nIOConf+4)))
                                 & 0x0FFC0;        // get GPIO base address
(only 10 bits)
     m_nIOPort_select = (WORD)gpioport+uc_gpsel_offset;   // GP Sel Base
address from GPIO Base Register
     m_nIOPort = (WORD)gpioport+uc_gp_offset;   // GPO Base address from GPIO
Base Register
     nUsePort = (WORD)gpioport+uc_gpuse_offset;

  } //Win95

  else // WIN NT I/O Config
  {
    if (m_bPortDrvr == TRUE) // if Wedge NT driver opened successfully
    {
     //*******************************PART A
*************************************

      SetFilePointer( g_hPortDrvr, m_nIOConf, (PLONG)&FileOffset, FILE_BEGIN);

      // request communication with GPIOBASE
      if ( WriteFile(
            g_hPortDrvr,              // Handle to device
            (LPSTR) &n_configGPIOReqData,
            (DWORD) 4,                // Length of buffer in bytes
            &DataWritten,             // bytes written
```

```
                NULL ) == FALSE )        // NULL means wait till I/O completes.
      {
        DWORD hr = GetLastError();
        result = FALSE;
      return result;
       }

       else
       {
         SetFilePointer( g_hPortDrvr, (m_nIOConf+4), (PLONG)&FileOffset,
FILE_BEGIN);//TIGER +4

        // get GPIO base address
        if ( result &&
         ( ReadFile(
               g_hPortDrvr,             // Handle to device
               (LPSTR) &gpioport,
               (DWORD) 4,                // Length of buffer in bytes
               &DataRead,                // bytes read
               NULL ) == FALSE ) )       // NULL means wait till I/O completes.
        {
         gpioport = 0;        //Read failed
         DWORD hr = GetLastError();
         result = FALSE;
        return result;
        }
       }  // end if WriteFile(...)

      gpioport &= 0x0FFC0;  // strip resource indicator
     m_nIOPort_select = (WORD)gpioport+uc_gpsel_offset;    // GP Sel Base
address from GPIO Base Register
     m_nIOPort = (WORD)gpioport+uc_gp_offset;    // GPO Base address from GPIO
Base Register
     nUsePort = (WORD)gpioport+uc_gpuse_offset;

   } // m_bPortDrvr
   }   //NT

   // End Read Configuration Register

   if ( result )
   {
     if ( (m_nIOPort == 0) || (m_nIOPort_select == 0) )
     {
       result = FALSE;
      }
     else
     {

         DWORD sBytes =0;
       // Read USE select register
```

```
      if ( ReadIOPort(&sBytes, nUsePort) )
      {

         sBytes = sBytes | CD7402USE_GPIO; //35:32 bits as GPIO
         // write new USE
         result = WriteIOPort( sBytes, nUsePort );
      }
      else
         result = FALSE;

        // Read select register
      if (( ReadIOPort(&sBytes, m_nIOPort_select) ) && result)
      {

         sBytes = sBytes | CD7402SELECT_GPI;  //solenoid bits as inputs
         // write new select with solenoid bits enabled as Outputs.
         result = WriteIOPort( sBytes, m_nIOPort_select );
      }
      else
         result = FALSE;
    }
  }

  ReleaseMutex( g_hHWPortMutex );
  return result;
}


/////////////////////////////////////////////////////////////////////////////
// CDevice7402::WriteIOPort
//We use the port address obtained from QueryConf().

BOOL WriteIOPort( DWORD databytes, WORD ioport )
{
  BOOL  result = TRUE;
  DWORD FileOffset=0x40;
  DWORD DataWritten;

  WaitForSingleObject( g_hHWPortMutex, INFINITE );   // TAR 95236

  if ((m_nOSVersion == OS_WINDOWS_95) || (m_nOSVersion == OS_WINDOWS_CE))

  { // WIN 95 I/O write
      _outpd( ioport, databytes );
  } //Win95

  else
  { // WIN NT I/O write
    if (m_bPortDrvr == TRUE)     // if Wedge NT driver opened successfully
    {
```

```
            //*********TIGER Write Register address dword to IOPort***************
             SetFilePointer( g_hPortDrvr, ioport, (PLONG)&FileOffset, FILE_BEGIN);

            m_pDC->DCPrintf( DCM_APILOW,
            _T("*CDeviceNCR7402:WriteIO: databytes= %X; IOPort= %X"), databytes,
                                                                  ioport );

             if ( WriteFile(
                     g_hPortDrvr,              // Handle to device
                     (LPSTR) &databytes,
                     (DWORD) 4,                // Length of buffer in bytes
                     &DataWritten,             // bytes written
                     NULL ) == FALSE )         // NULL means wait till I/O completes.
             {
                DWORD hr = GetLastError();
                result = FALSE;
             }
        } //m_bPortDrvr
    } //NT
    ReleaseMutex( g_hHWPortMutex );   // TAR 95236

    return result;
}

///////////////////////////////////////////////////////////////////////////////
// CDevice7402::ReadIOPort
// We use the port addresses obtained from QueryConf().

BOOL ReadIOPort( DWORD *databytes, WORD ioport )
{
    BOOL  result = TRUE;
    DWORD FileOffset=0x40;
    DWORD DataRead;

    WaitForSingleObject( g_hHWPortMutex, INFINITE );

    if ((m_nOSVersion == OS_WINDOWS_95) || (m_nOSVersion == OS_WINDOWS_CE))

    { // WIN 95 I/O write
         *databytes = _inpd( ioport );   //Read 32-bits from ioport
    } //Win95

    else

    {   // WIN NT I/O read
      if (m_bPortDrvr == TRUE) // if Wedge NT driver opened successfully
      {
            SetFilePointer( g_hPortDrvr, ioport, (PLONG)&FileOffset, FILE_BEGIN);

            if ( ReadFile(
                 g_hPortDrvr,              // Handle to device
```

```
                (LPSTR) databytes,        // address of data buffer
                (DWORD) 4,                // Length of buffer in bytes
                &DataRead,                // bytes read
                NULL ) == FALSE )         // NULL means wait till I/O completes.
        {

          DWORD hr = GetLastError();
          result = FALSE;
        }
    } // m_bPortDrvr
  }  // NT

  ReleaseMutex( g_hHWPortMutex );

  return result;
}

// 7402 Modifications End Here!
/////////////////////////////////////////////////////////////////////////////
////////

//..end..
```

Header file: DarlingtonCDSample.h

```
////////////////////////////////////////////////////////////////////////////
// NCR7402 (Darlington Motherboard) Modifications start here ////////////
// - 7402 cash drawer port definitions
/*INTEL ICH4 South Bridge used to control cash drawer.
They are defined as below:

· GPI 32    CD_SW_AB       input 1, high Drawer(s) CLOSED.              Input
0, low Drawer(s) OPEN.
· GPO 33    CD_SOL_A       output 0, low turn off solenoid A.     Output 1,
high Activates Solenoid A.
· GPO 34    CD_SOL_B        output 0, low turn off solenoid B.       Output 1,
high  Activates Solenoid B.
. GPO 35  CD_ARM    output 0, low activates driving circuit.      Output 1,
high  De-activates driving circuit.
*/
const int CD7402DRWR1SOLENOID      = 0x000002;   //Darlington: GPIO bit 33
high actuates solenoid
const int CD7402DRWR2SOLENOID      = 0x000004;   //Darlington: GPIO bit 34
high actuates solenoid

const int CD7402SELECT_GPO       = 0xFFFFF1;  //Darlington: GPIO bit 32 high
selects bit as INPUT, low GPIO[35:33] output
const int CD7402SELECT_GPI       = 0x00000F;   //Darlington: GPIO bit [35:32]
high selects bit as INPUT,


const int CD7402DRWR1CLOSED           = 0x00000001;  //Darlington: GPIO bit
32 high means drawer closed
const int CD7402DRWR2CLOSED           = 0x00000001;   // This definition
assumes shared status bit

const int CD7402ARM_OFF             = 0x00000008;   // Disable Active low
ARM driving circuit, high is off.
const int CD7402ARM_ON              = 0xFFFFFFF7;   // Enable Active low ARM
driving circuit, high is off.

////////////////////////////////////////////////////////////////////////////
// NCR7402 Modifications End here ////////////
HANDLE     g_hSharedMemoryMutex;   // mutex used to protect shared memory
area
HANDLE   g_hHWPortMutex;              // protects access to h/w I/O port

long Initialize( );
void Terminate();
long OpenPort();
void ClosePort();
long OpenDrawer();
```

```
DWORD GetDrawerStatus();
BOOL SetState( DWORD dwState );
BOOL QueryConf();
BOOL WriteIOPort( DWORD databytes, WORD ioport );
BOOL ReadIOPort( DWORD *databytes, WORD ioport );


//..end..
```

Chapter 9: Touch Screen Calibration

Calibration Guidelines

Observe for the following Touch Screen calibration guidelines:

- Calibrate the touch screen as part of the initial installation.

- Recalibrate whenever the terminal is moved to a new location.

- Recalibrate after replacing any component in the terminal.

- Recalibrate after running the *Stabilize Cursor* or *25-Point Linearization* procedures.

- Recalibrate whenever a customer reports a touch screen problem.

- The Touch Screen can be calibrated using TouchWare (Windows) or Microcal (DOS).

- If the Touch Screen, Hard Drive, or the Retail Daughter Card is replaced, the *25-Point Linearization* procedure must be performed (Windows only).

- If the calibration is consistently off, even after performing the *TouchWare 2-Point Calibration*, then perform the Restore Defaults function and the *25-Point Linearization*. This should be done before resorting to touch screen glass replacement.

- Recalibrate the first time you use a new screen resolution

# Calibration Using TouchWare (Windows)

1. From the Windows Start button, select **Settings→Control Panel→TouchWare**.

2. From the *MicroTouch Touchscreen Properties* screen, select **Calibrate** to begin calibration.
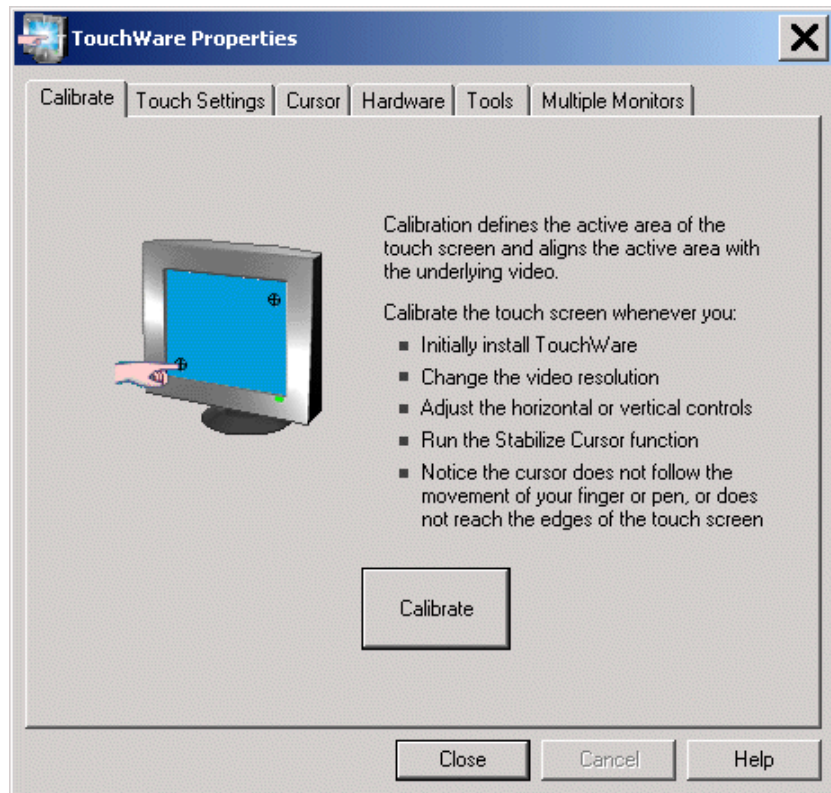
3. Place your finger on the target that has a finger icon pointing towards it and hold it until *Touch Enable* is displayed beside the finger icon.

    Note: There are two-target or four-target calibration methods available. The following screen is shows the two-target method.

    For best results, press the target as accurately as possible. Hold your finger in place until notified by the target and then lift your finger off the target.
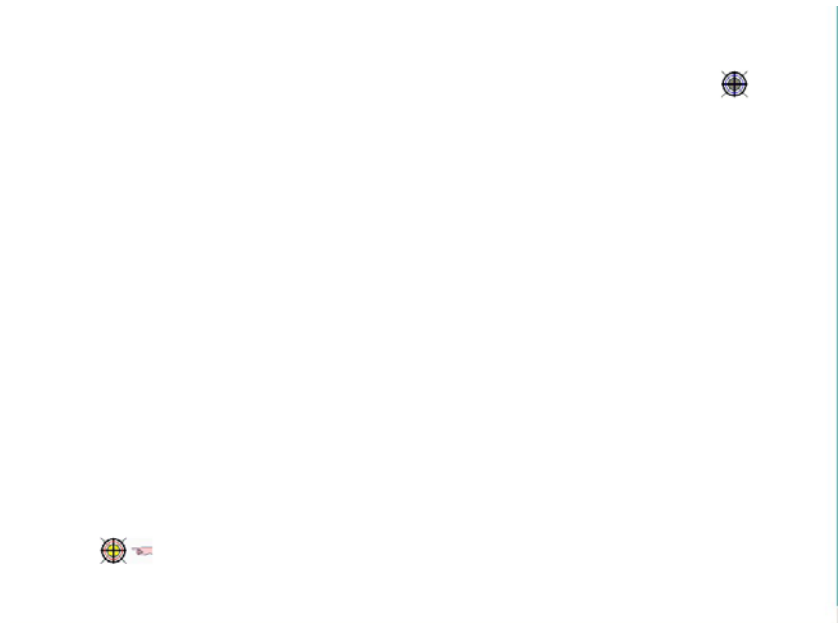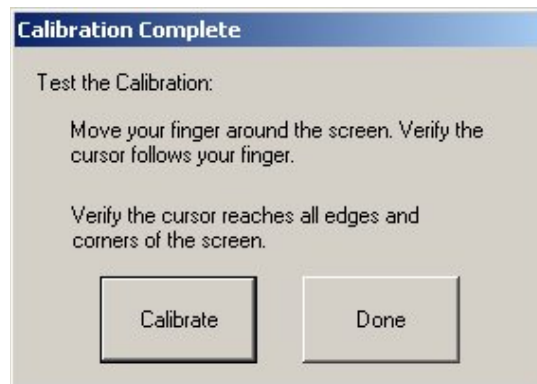

4. Repeat this procedure for the other target.

5. A *Warning* dialog box is displayed while the data is saved. Do not touch the screen until this dialog box is no longer displayed.
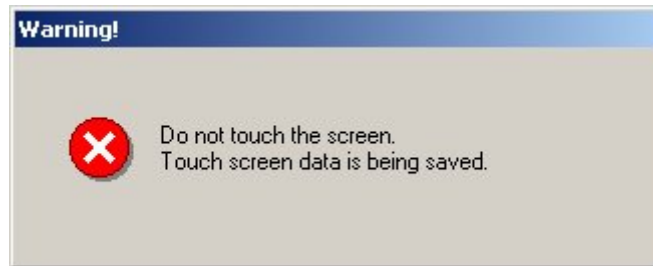
6. Test the calibration by moving your finger around on the screen and verifying that the cursor follows your finger.

7. Select **Done**.

8. If you are satisfied with the calibration results you can select **Close** to exit the TouchWare program. Otherwise, perform the *25-Point Linearization* and *16-Point Accuracy Test* in the following section.

25-Point Linearization Procedure

The 25-Point Linearization should normally only be done if the Touch Screen, Hard Drive, or Retail Daughtercard has been replaced. However, if there is a calibration error around the edges of the screen that is not resolved by the Standard 2 or 4-Point Calibration, you may also try the 25-Point Linearization method.
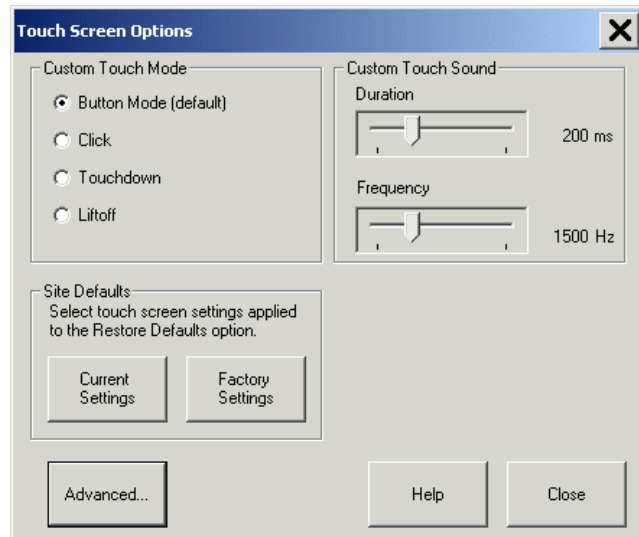
1. In **TouchWare**, go to the **Tools** tab and Select the **Linearize** button. Perform the *25-Point Linearization* and *16-Point Accuracy Test*. If the Linearize button is grayed out (not accessible) you have to enable the feature.
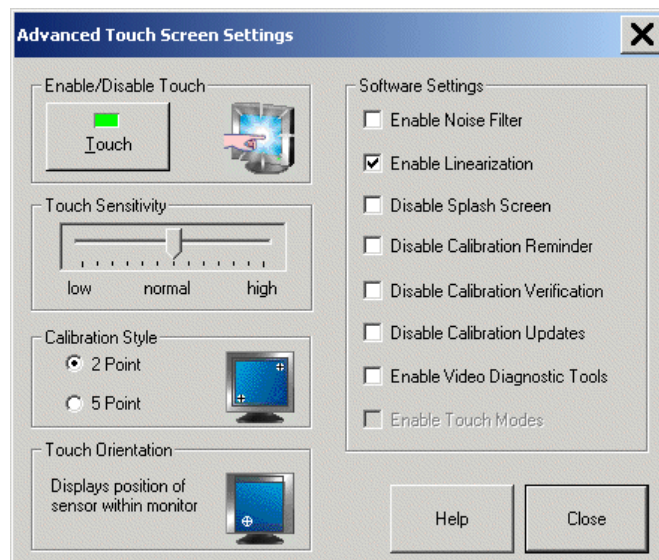
Enabling the Linearization Function

a. Select the **Options** button
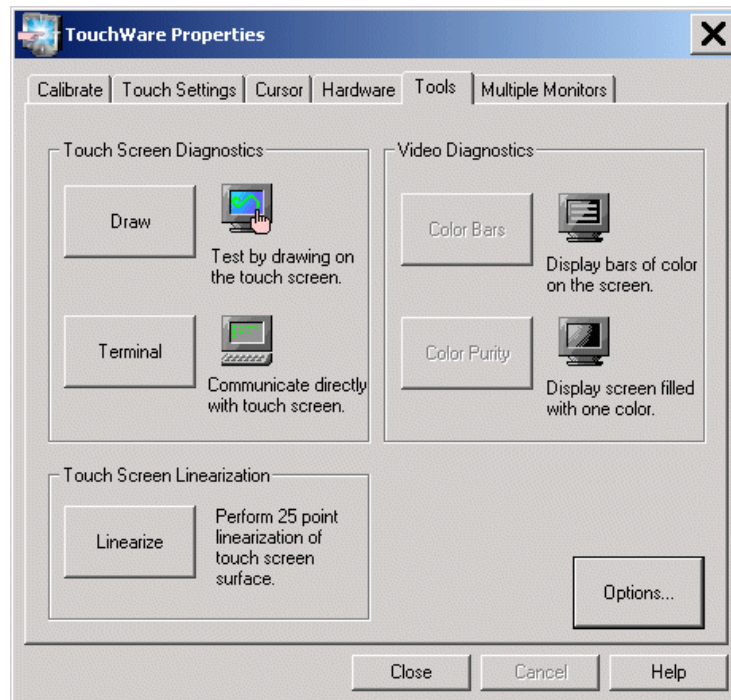
b. Select the **Advanced** button.

c. In the list of *Advanced Features*. Check the box for **Enable Linearization**. None of the other items should be checked.


d. Select the **Close** -> **Close** to return to the **Tools** tab. You can now select the **Linearize** button.

2. Perform the *25-Point Linearization*. Use the same method for touching the targets as you used in the *TouchWare 2-Point Calibration* procedure.
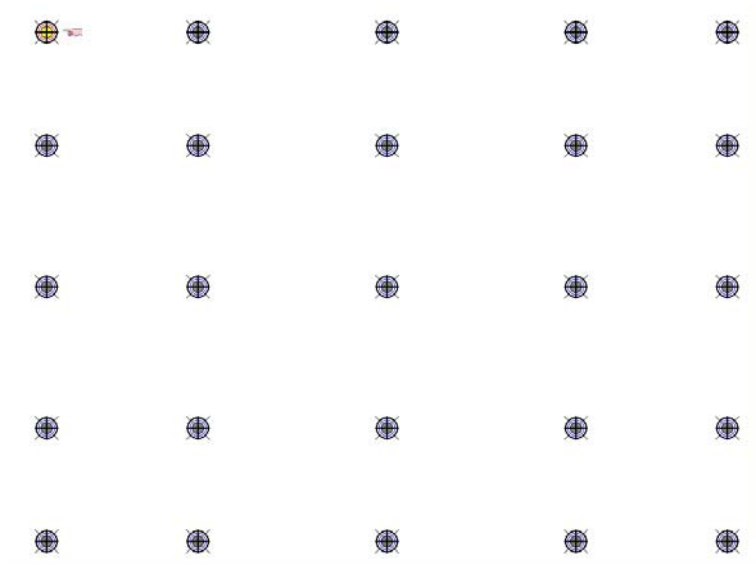
3. After touching all 25 points select the **Continue** button to perform the *16-Point Accuracy Test* or select **Done** to save the Linearization Data. If neither is selected the program will time out and the Original Linearization Data will be restored.
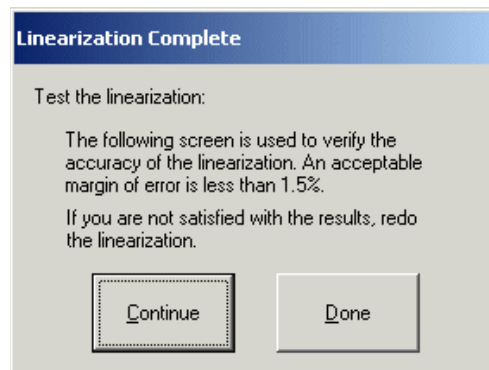
4. Perform the *16-Point Accuracy Test*. Touch each of the targets to check the accuracy of the calibration.
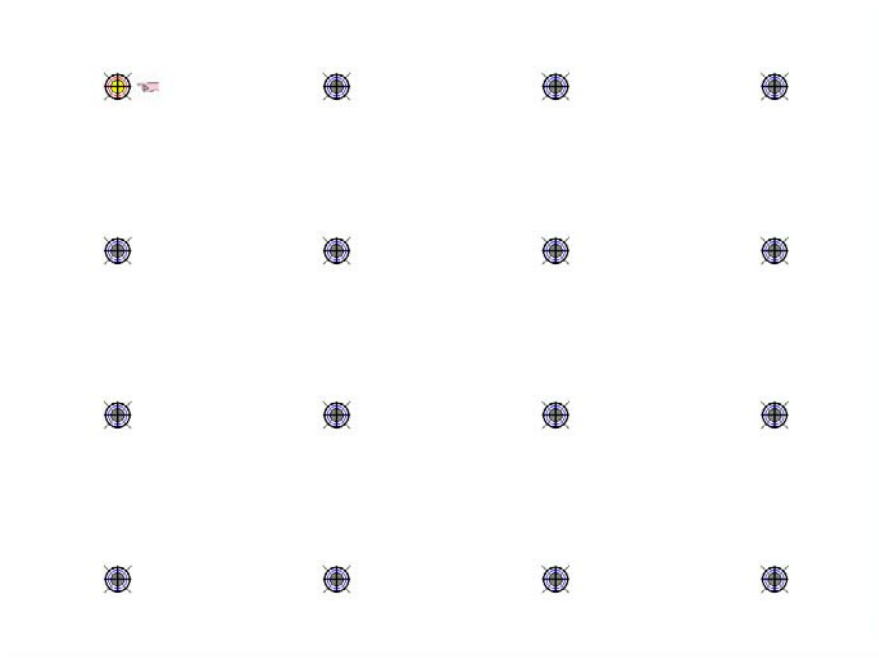
As each target is touched the vertical/horizontal Error Range is displayed. The acceptable range is 1.00%, 1.00%.

Error -0.20%,-0.24%

If you are still having calibration problems perform the *Restore Defaults Function*.

Note: If you ever find the system to be far out of calibration, for example if you touch the upper right corner and the cursor goes to the upper left corner, first perform the 2-Point Calibration. If this does not resolve the problem then perform a *Restore Defaults Function*.
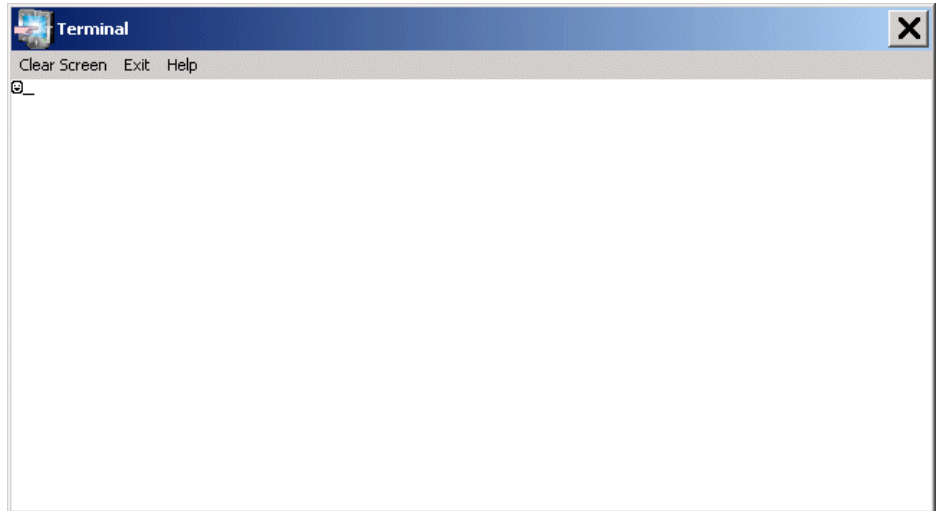
Restore Defaults Function

This procedure returns the touch firmware to the factory default values and is performed to correct severe touch calibration problems.

Note: A keyboard is required for this procedure.

1. In **TouchWare**, go to the **Tools** tab and Select the **Terminal** button.
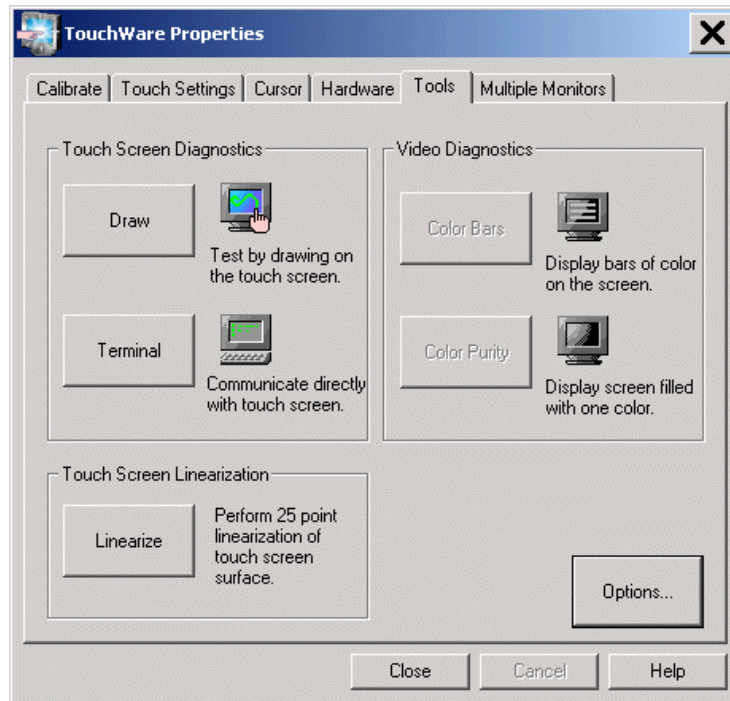
9. At the *Terminal* screen enter [CTRL A]. A *smiley face* is displayed.

10. Enter [Shift RD] [Enter]. A *smiley face* followed by a zero [0] is displayed indicating successful restore.
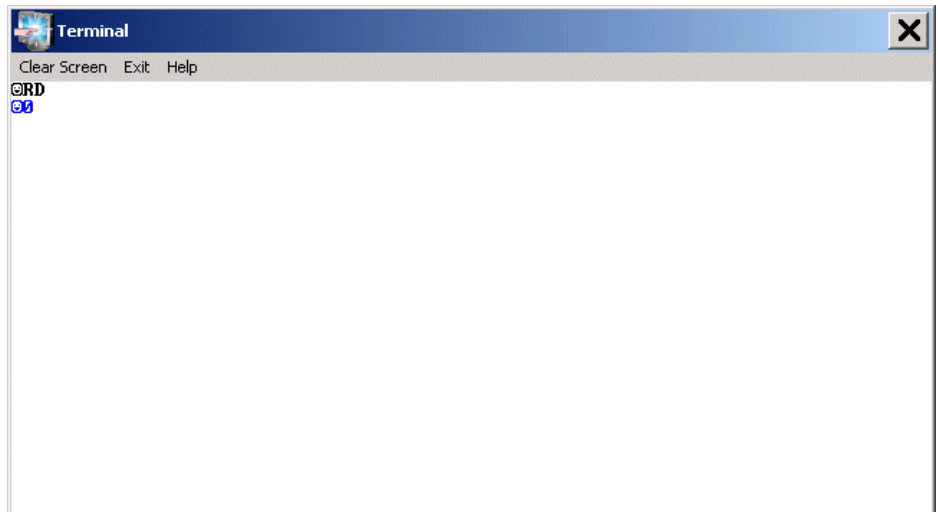
11. Enter [Alt X] to exit the program.

12. Restart the system.

13. Perform the *25-Point Linearization* and the *TouchWare 2-Point Calibration* and procedures.

Calibration Using Microcal (DOS)

Note: Customers who are running a Windows application should always use TouchWare to calibrate. Do not boot into DOS and run Microcal.

The Microcal calibration program looks at where your finger is when you lift it off the screen, not where you touch it. Therefore, calibrate the screen as follows:

1. Touch the screen near the calibration target.

2. Keep your finger on the screen and slide it to the center of the target.

3. Hold your finger firmly on the target for two seconds, then lift it off.

4. Verify that the calibration was set accurately before making a service call. Perform the calibration again if necessary.

If the cursor is not stable, or false touches are suspected, run the *Noise Check Utility* from the Microcal program. Choose the recommended frequency (the one with the lowest noise level). This should also be done if the Touch Screen is still not calibrated after one attempt to recalibrate it.

1. Set the video resolution by going to the **Tools** menu, Video and selecting **800 x 600 256 colors** (12 inch display) or **1024x768** (15 inch display).

2. Go to the **Tools** menu, select **Noise Check**.

3. Follow the instruction prompts. Choose the frequency with the lowest noise level.

Application software can possibly generate a dialog box from the Touch Driver, with the message that the touch screen needs to be recalibrated. If the screen appears to be working normally, then this message can be ignored. There will be a check box labeled `Do not show this message again`. Make sure this box is checked.

The DOS command line on the 7402 is usually:

```
Microcal.exe /c3 /ill
```

unless the serial port setting has been changed.

Summary

If there is a Touch Screen calibration issue during or after installation, take the following actions in the order listed:

1. Recalibrate (2-Point or 4-Point).

2. If recalibration is unsuccessful after two attempts, then run the Noise Check to change the frequency (DOS) or the Linearization (Windows).

3. Reset Defaults.

4. If you are still unable to calibrate, change the touch screen glass. (First check the cable connections on the Touch Screen glass.

5. The final step is to replace the Retail Daughtercard. If this corrects the problem, then the old glass is probably OK to reuse.

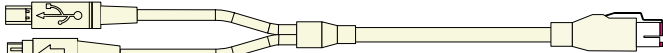If there are problems in detecting the Touch Controller then:

1. Check that all harnesses on the Retail Daughtercard are connected and firmly seated.

2. Uninstall the Touch Driver; reinstall.

3. Check the BIOS settings for COM3 Serial Port.

4. Replace the Retail Daughtercard.

When you replace the Retail Daughtercard or re-image the Hard Drive, Windows displays a dialog box indicating that the Hardware Calibration Data does not match the Windows Registry settings. Answering either **OK** or **Cancel** is not important, provided you perform the 25-Point Linearization before placing the terminal back into service.

Appendix A: Cables

Printer Cables

USB+Power

	Beige	**Black**
	497-0424888 - 1 m (1416-C713-0010)	497-0430301 - 1 m (1416-C881-0010)
	497-0424501 - 4 m (1416-C713-0040)	497-0430300 - 4 m (1416-C881-0040)

USB (Printer)

Power (Printer)

24V USB+
(Terminal)

19307a

USB+Power (Power Only)

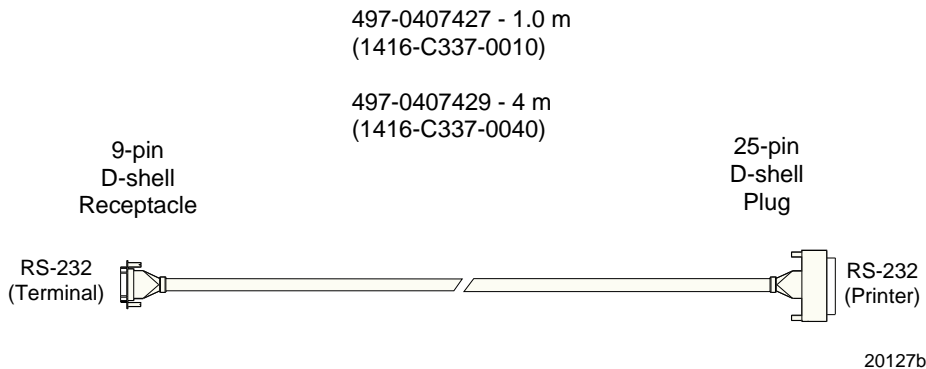|	**Beige**	**Black**
	497-0424887 - 1m (1416-C712-0010)	497-0430305 - 1m (1416-C880-0010)
	497-0422292 - 4 m (1416-C712-0040)	497-0430306 - 4 m (1416-C880-0040)

Power
(Printer)

24V USB+
(Terminal)

19721a

RS-232 (9-Pin to 9-Pin)

(Beige)   **(Black)**

497-0408349 - 0.7 m   497-0430266 - 1.0 m
(1416-C359-0007)   (1416-C879-0010)

497-0407943 - 4 m   497-0430265 - 4 m
(1416-C266-0040)   (1416-C879-0040)

497-0409379 - 15 m
(1416-C266-0152)

9-pin   9-pin
D-shell   D-shell
Receptacle   Receptacle

RS-232   RS-232
(Printer)   (Terminal)

19722a

RS-232 (9-Pin to 25-Pin)

497-0407427 - 1.0 m
(1416-C337-0010)

497-0407429 - 4 m
(1416-C337-0040)

9-pin   25-pin
D-shell   D-shell
Receptacle   Plug

RS-232   RS-232
(Terminal)   (Printer)

20127b

Scanner Cables

7872 or 7875 Scanner/Scale (RS-232)
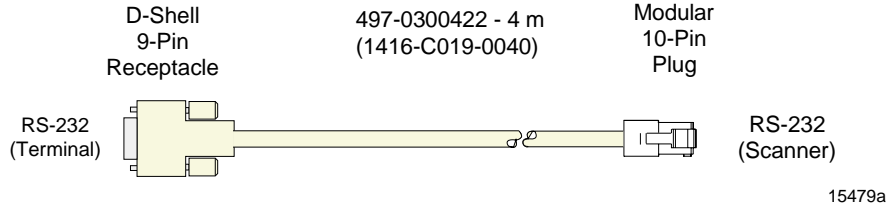
D-Shell
9-Pin
Receptacle

497-0300422 - 4 m
(1416-C019-0040)

Modular
10-Pin
Plug

RS-232
(Terminal)

RS-232
(Scanner)

15479a

7892 Scanner (Powered RS-232)

497-0425593 - 3.0 m
(1416-C643-0030)

D-Shell
9-Pin
Receptacle

Modular
10-Pin
Plug

RS-232
(Terminal)

Scanner

20450a

7882 Scanner (Powered RS-232)

497-0419723 - 4.0 m
(1416-C653-0040)

D-Shell
9-Pin
Receptacle

Modular
10-Pin
Plug

RS-232
(Terminal)

Scanner

19728a

7837 Scanner (Powered RS-232)

497-0412952 - 2.5 m
(1416-C430-0025)

Powered
RS-232
(7402/7448)

Scanner

D-Shell
9-Pin
Receptacle

Modular
10-Pin
Plug

21153
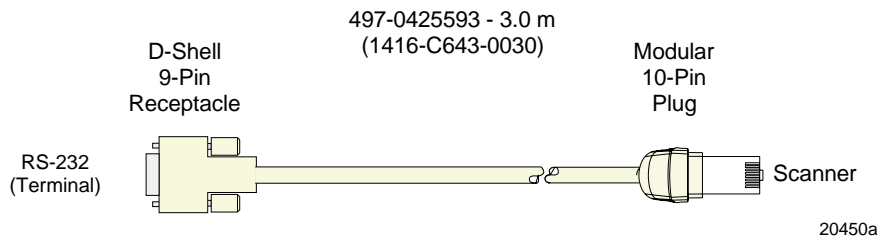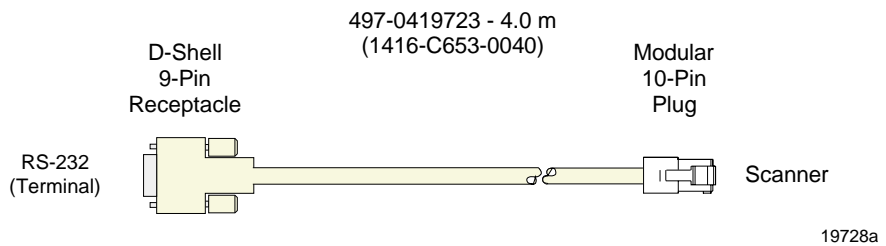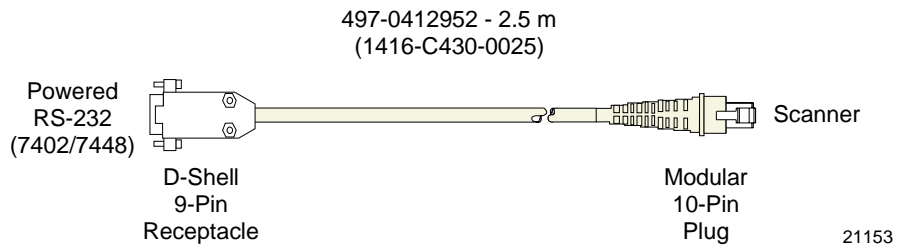
7837 Scanner (RS-232, External Power)

External
Power

497-0412951 - 2.5 m
(1416-C429-0025)

RS-232
(Terminal)

Scanner

D-Shell
9-Pin
Receptacle

Modular
10-Pin
Plug

21154
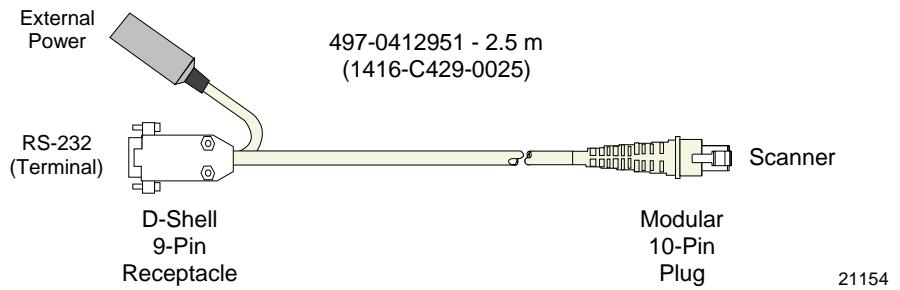
Display Cables

VGA Display, Mono

Sub Miniature D-Shell
15-Pin
Plug

497-0008164 - 4 m
1416-C042-0040

Sub Miniature D-Shell
15-Pin
Receptacle

VGA
(Terminal)

VGA
(CRT Display)
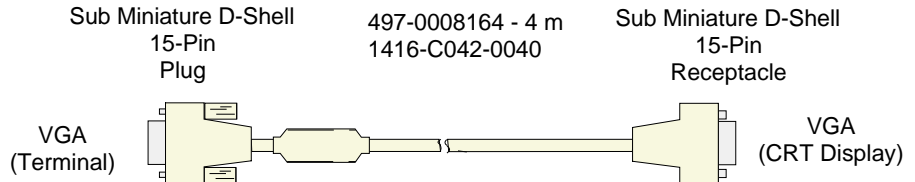
14607a

VGA Display, Color

1.0 m	Black	497-0428080	1416-C840-0010
1.5 m	Black	497-0428068	1416-C839-0015
1.0 m	White	497-0424530	1416-C753-0015
1.5 m	White	497-0424531	1416-C754-0010

Sub Miniature D-Shell
15-Pin Plug

Sub Miniature D-Shell
15-Pin Receptacle

VGA
(Terminal)

VGA
(Display)
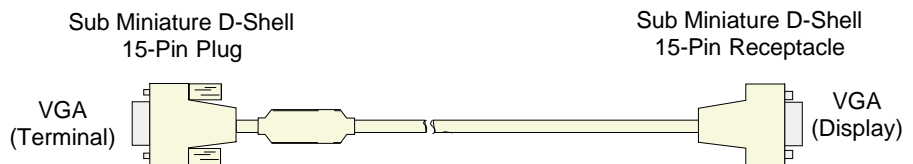
16318a

CRT AC Power Extension

497-0406237 - 4m
(1416-C508-0040)
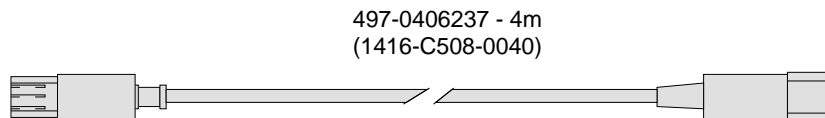
19741a

5972 VFD Customer Display (Powered RS-232)

497-0420926 - 1 m
1416-C683-0010

9-pin
D-Shell
Receptacle

497-0420927 - 4 m
1416-C683-0040

24-Position
Microfit
Receptacle

Terminal
RS-232 Port

Customer
Display

20279

DVI to DVI

497-0422831 - 1.0 m
(1416-C723-0010)

497-0422832 - 4.0 m
(1416-C723-0040)

DVI
(Display)

DVI
(Terminal)

19725a

PS/2 - RS-232 & Power

497-0422833 - 1m
(1416-C725-0010)

497-04222834 - 4m
(1416-C725-0040)

RS-232
(Terminal)

PS/2
(Terminal)

12 V COM
(5964)
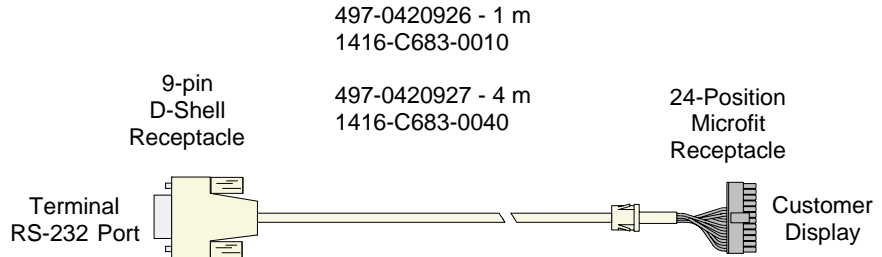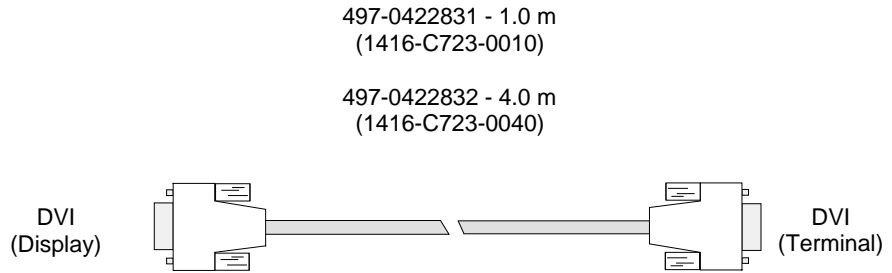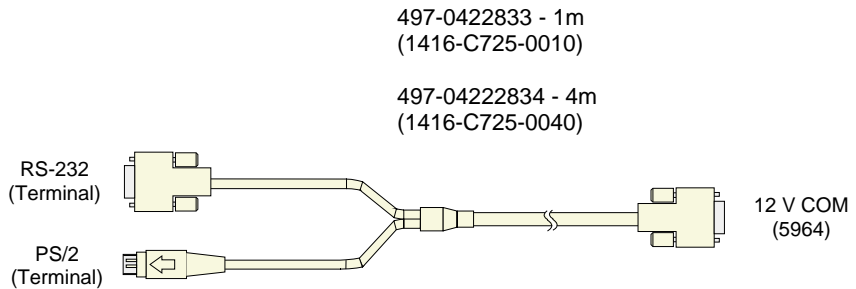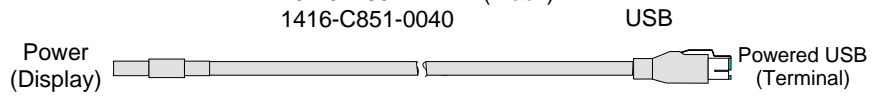
19734a

LCD Power Cable

497-0426160 - 4 m (White)
1416-C803-0040

497-0428512 - 4 m (Black)
1416-C851-0040   USB

Power
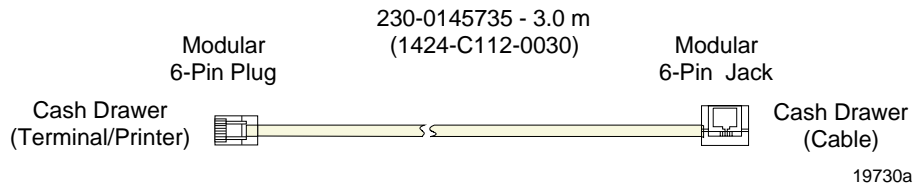(Display)   Powered USB
                                                              (Terminal)

20444

Cash Drawer Cables

Dual Cash Drawer, Y-Cable

497-0409394 - 0.6 m
(1416-C372-0006)

Cash
DWR. #1

Cash Drawer
(Terminal/Printer)

Cash
DWR. #2

15808a
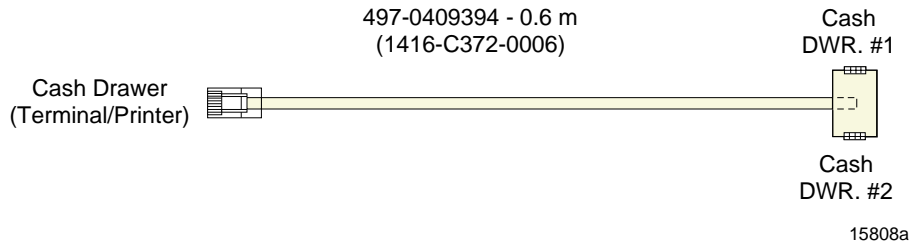
Cash Drawer, Extension Cable

230-0145735 - 3.0 m
(1424-C112-0030)

Modular
6-Pin Plug

Modular
6-Pin Jack

Cash Drawer
(Terminal/Printer)

Cash Drawer
(Cable)

19730a

Communications Cable

Ethernet, 10/100BaseT

Modular
8-Pin
Plug

497-0420456 - 3.0 m
(1416-C672-0030)

Modular
8-Pin
Plug

21094
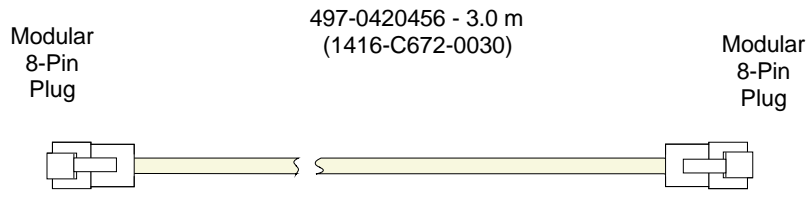
Keyboard Cables

PS/2 Keyboard Extension

6-pin
Mini-DIN
Plug

497-0406056 - 1.8 m
(1416-C281-0018)

6-pin
Mini-DIN
Receptacle

PS/2
(Terminal)

PS/2
(Keyboard)
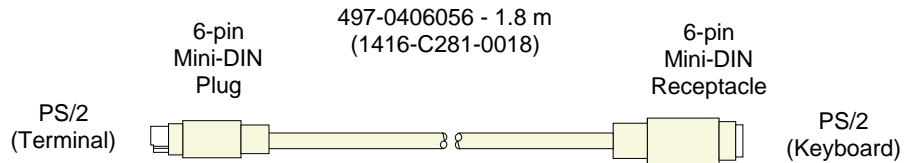
15403a

Signature Capture/Electronic Payment Terminal Cable

5945/5992 EPT (RS-232 w/Power)

9-pin
Mini-DIN
Plug

497-0418406 - 4.0 m
(1416-C634-0040)

9-pin
D-shell
Receptacle

RS-232
(EFT Unit)

RS-232
(Terminal)
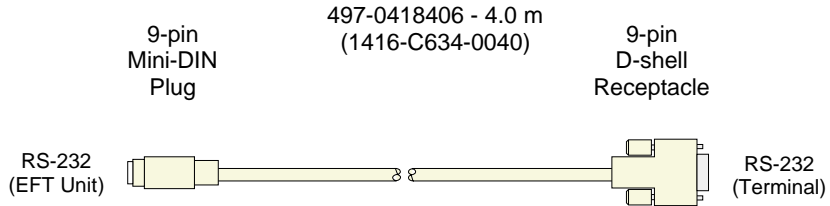
19723a

Power Cables (AC)

1416-C325-0030   006-1009037 - U.S.

Terminal/CRT
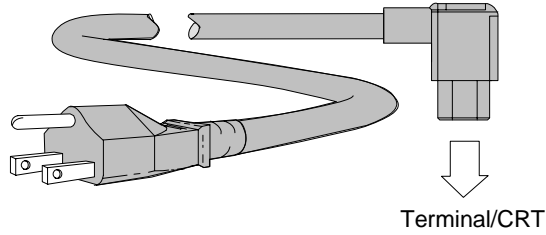
The following power cables (not shown)
also have an 45 mm IEC connection:
   1416-C320-0030   006-8601011 - SEV
   1416-C321-0030   006-8601012 - U.K.
   1416-C322-0030   006-8601019 - Australia
   1416-C323-0030   006-8601010 - International
   1416-C391-0030   006-8605488 - China
   1416-C608-0030   006-8604879 - Japan

15405b

Appendix B: Feature Kits

Below is a list of the optional hardware Feature Kits that can be installed in the customer environment. Kit installation instructions (for those requiring instruction) are available on the Information Products web sites.

- *NCR Intranet:* http://inforetail.atlantaga.ncr.com

- *Internet:* http://www.info.ncr.com

To locate the installation guides on these sites:

1. Select **General Search**.

2. Select the **Kit Instructions** icon.

3. In the **Kit Title** field, enter the *Kit Title*.

   Example: *MSR*

   or

   In the **Kit Number** field, enter the *Kit Number*.

   Example: *7402-K452*

4. Select Search

   The file can be viewed online by left-mouse clicking on the pub title, or if you prefer to download the entire file you can right-mouse click on the title then select the *Save Target as...* option*.*

If you aren't sure of the title of number you can display all kits associated with a terminal product class by:

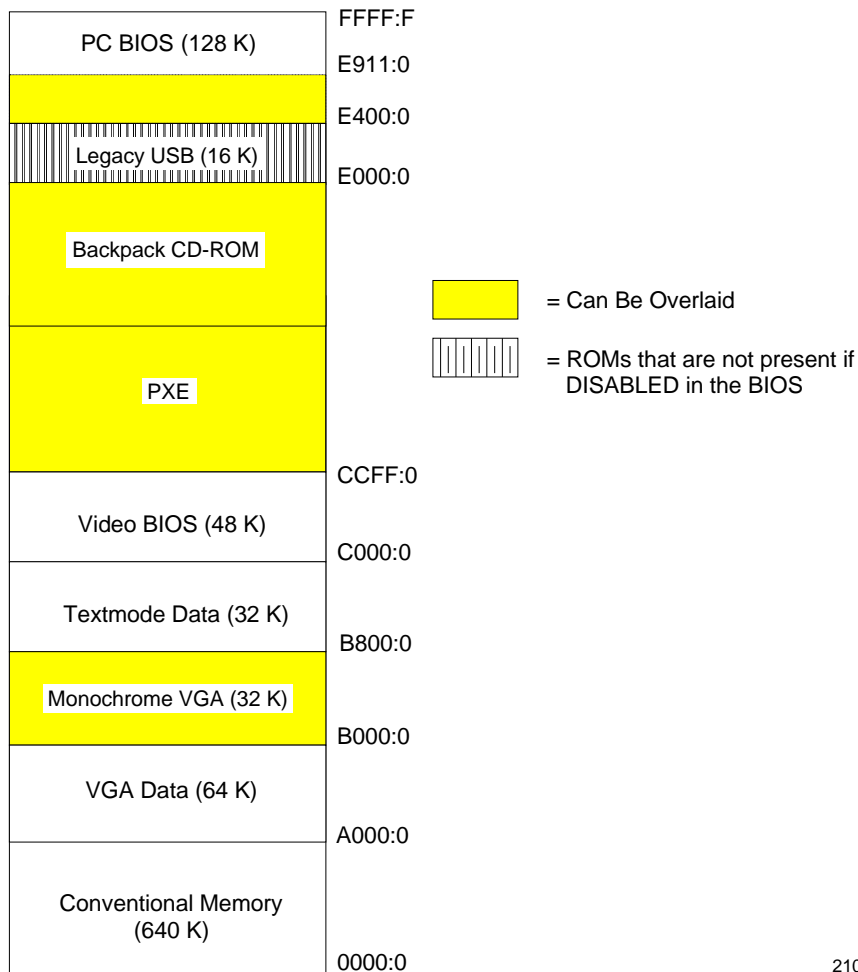1. In the **Class** drop-down list, select the *Class* of the terminal.

   Example: *7402*

2. Select **Search.**

Kit Number	Description
2336-K208	External USB CD-ROM Drive
7402-K160	Hard Drive (Standard Capacity)
7402-K161	Hard Drive (High Capacity)
7402-K221	3-Track ISO MSR (12.1″)
7402-K225	3-Track ISO MSR (15″)
7402-K226	JIS MSR (15″)
7402-K232	128 MB DIMM Memory Upgrade
7402-K233	256 MB DIMM Memory Upgrade
7402-K234	512 MB DIMM Memory Upgrade
7402-K301	PCMCIA Expansion Slot
7402-K302	PCI Dual Serial
7402-K305	RealPOS 70 Integration Tray
7402-K451	Integrated U.S. 2 x 20 VFD Customer Display
7402-K452	Integrated International APA (All Points Addressable) Customer Display
7402-K533	Wall Mount Bracket (Tilt Mount)

Appendix C: Memory Map

<u>ACPI BIOS 1.0.0.9</u>

PC BIOS (128 K)	FFFF:F
	E911:0
	E400:0
Legacy USB (16 K)	E000:0
Backpack CD-ROM	
PXE	
	CCFF:0
Video BIOS (48 K)	C000:0
Textmode Data (32 K)	B800:0
Monochrome VGA (32 K)	B000:0
VGA Data (64 K)	A000:0
Conventional Memory (640 K)	0000:0

= Can Be Overlaid

= ROMs that are not present if DISABLED in the BIOS

21011

DOS Considerations

EMM386 must be configured with the correct parameters, based on the BIOS Memory Map.