Lucas Control Systems Products
Deeco™ Systems

ST-C331
Swivel Mount Workstation

USER / MAINTENANCE MANUAL

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Baud Rate:	up to 14400 Baud
Data Bits:	8
Parity:	None
Stop Bits:	1
Flow Control:	XON/OFF
Emulation:	ANSI

For Returns - Contact Deeco Systems' customer service for a Return Authorization (RA) number prior to shipping product to the factory. Freight to the factory is prepaid by the customer. Freight return to the customer is paid by Deeco Systems. Ship product in its original packaging or equivalent to prevent transit damage.

Printed in the USA.

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Warning!!

Grounding circuit continuity is vital for safe operation of the machine. Never operate the machine with the grounding conductor disconnected. See installation instructions before connecting to the supply.

The Computer System contains voltages capable of producing a dangerous electrical shock. Only properly trained and authorized personnel should attempt to open the enclosure of the computer.

CAUTION: DISCONNECT POWER BEFORE OPENING.

1.0 Overview

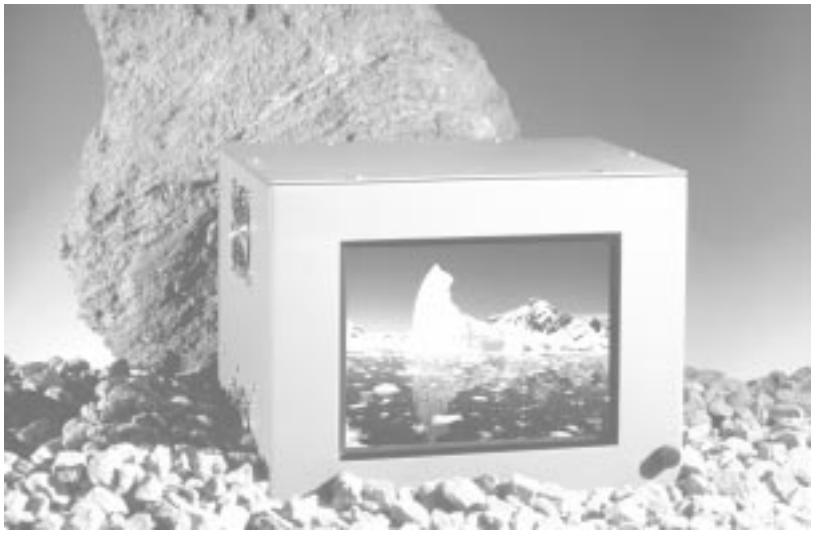
Lucas Control Systems Products (LCSP), Deeco™ Systems offers a complete line of rugged computers, VGA monitors, and terminals. These products are available in sealed standalone enclosures, with panelmount brackets, and as embedded modules. All Deeco Systems products are available with touch systems for a complete user interface. LCSP, Deeco Systems has manufactured quality flat panel display based products for harsh and industrial applications for more than a decade.

1.1 PRODUCT SUMMARY

- The ST-C331 is a rugged Pentium™ based computer that can be swivel-mounted in harsh environments.

- VGA (640 x 480) Active Matrix TFT Color LCD 10.4" diagonal flat panel display with dimming control.

- The standard Deeco IR touch system provides an easy to use operator interface.
  A serial mouse can be connected to the computer via the external COM2 or COM3 serial connectors. An external PC/AT keyboard can be connected to the computer via the external 5-pin keyboard connector.



- An external 10 BASE-2 (coax) connector provides an Ethernet connection.

- Two ISA slots (3/4 size) and one PCI slot (1/2 size) are available for accessory cards.

- A 540 MB hard drive and an internal 3.5" floppy drive provide local mass storage.

- Proprietary Power Assist™ software simplifies process control development.

- The ST-C331 external interface connectors include two 9-pin serial ports, a high density DB-15 CRT connector, a 25-pin parallel port, a keyboard connector, FDDI connector and a 10 BASE-2 Ethernet connector.
- The computer is available with Deeco's proprietary SealTouch infrared touch system and touch mouse software. These allow the operator to establish mouse control directly from the display by pointing and dragging a finger over the display. Modified mouse drivers are loaded onto the hard disk at the factory. These enable the user's finger to emulate a standard mouse. Available mouse drivers include QNX, SCO UNIX, MS-DOS, Windows™, Windows NT, Windows 95 and OS/2.

1.2 SINGLE BOARD COMPUTER

The ST-C331 uses a Pentium-class 100% PC-AT compatible industrial single board computer (SBC).

The SBC supports up to 64 MB of 72-pin SIMM DRAM, in increments of 8, 16, 32 or 64 MB configurations. The SBC comes with an integrated peripheral controller for floppy disks, IDE hard disks, and a bi-directional parallel port. Also included is an on-board C&T 65545 32-bit Super VGA controller, and COM1, COM2, COM3, and COM4 serial ports.

Ethernet is available on an AUI for 10 BASE-2 which eliminates the need for a separate network interface card.

All DOS-based software, Windows, Windows 95, Windows NT, Novell NetWare, UNIX, and OS/2 are supported. Software can be ordered pre-installed.

Power-up self-test diagnostics, a programmable watchdog timer, and Green PC energy management are standard features of the ST-C331.

1.3 ORDERING INFORMATION

Enclosed industrial PC designed for swivel mounting or swing arm. The system was designed for US Navy shipboard applications. The computer includes dual exhaust fans and air inlet filters. Automatic power-down mode is initiated if the ambient temperature inside the unit reaches 65°C.

Base System Includes:

- **10.4" AM TFT color LCD with dimming control**
- **Deeco IR touch screen system**
- **MS DOS and DOS/Windows Touch Mouse Driver**
- **540MB rugged 2.5" Fast-ATA-2 IDE hard disk drive**
- **1.44MB 3.5" floppy disk drive, rear access**
- **75 MHz Pentium, 256K L2 cache, pipeline burst**
- **2 ISA (3/4-size), 1 PCI (1/2-size) card slot**
- **2 External serial ports, 1 parallel port**
- **Ethernet™ 10BASE-2 (coax)**
- **On/Off and Reset Buttons**
- **130 Watt Power Supply**

Dimensions: 10.75" (H) x 13.50" (W) x 10.00" (D)
(273 mm x 343 mm x 254 mm)

ST-C331 BASE SYSTEM

Upgrade Options

Software - Operating Systems

800	Microsoft® Windows™ 3.1
811	Microsoft Windows 95®
812	Microsoft Windows NT for Workstations

Software - Touch Drivers

801	OS/2 Touch Mouse
802	QNX Touch Mouse
806	SCO UNIX Touch Mouse
810	Windows NT Touch Mouse
815	Windows 95 Touch Mouse

Software - Process Automation

807	Power Assist™ Developer Kit, DOS
808	Power Assist Run Time Kit, DOS
809	Power Assist Modular Kit, DOS
814	Power Assist for Windows 3.1

1.4 SPECIFICATIONS

Processor	Pentium™ 75 MHz
Cache	256K L2 cache, pipeline burst
VGA Controller	Chips & Technology 65545 Super VGA with 1 MB DRAM and GUI accelerators, 32-bit VESA bus, 32-bit video DRAM
Memory	Two 72-pin SIMM sockets support 2 MB to 64 MB, 32-bit Normal or EDO DRAM SIMMs
Parallel Port	One enhanced bi-direction SPP/EPP/ECP
Serial Ports	Two RS-232 and configured as COM2 on port J4 and COM3 on port J2
Floppy Disk	3½ (1.44 MB), sealed door, rear access
Bus Architecture	2 ISA slots 3/4 size card, 1 PCI slot 1/2 size card
Ethernet Support	Ethernet 10 BASE-2 (coax)
Display	10.4" VGA AM TFT LCD, 256 colors
Infrared Touch Controller	Self test on power: IR Beam ROM reset and RAM test
IR Touch Viewing Area	6.2" x 8.3" (157 mm x 211 mm), 1:1 Pixel Aspect Ratio, 80 x 60 touch zones = 4,800 points
Touch Mouse Driver	Windows, DOS, SCO UNIX, QNX, Windows 95, OS/2, Windows NT
Dimensions	10.8" H x 13.5" W x 10.0" D (274 mm x 343 mm x 254 mm)
System Weight	23.0 lbs (10.5 kg) nominal
Enclosure Material	Aluminum

Shock	At 11ms, 1/2 sine wave: Operating: 10G Non-operating: 50G
Vibration	At 5-10 Hz (1 octave/min.), 0.10 inch displacement double amplitude Operating : 0.5g rms Non-operating: 3.0g rms
Temperature	Operating: 0° to +40°C Storage: -25° to +60°C
Power Management	I/O peripheral devices support power saving and doze/standby/suspend modes.
Watchdog	Can generate devices support power saving and doze/standby/suspend modes.
System Power Supply	130 Watts nominal, 100-240 VAC
Sunlight Readable Display (Option)	30-1 Dim, 300 nits

1.4.1 Display Specifications

Supplier Product Code:	3031	3033
Display Manufacturer	**Sharp**	**Sharp**
Mfg. Model #	LQ10D321	LQ10D321 w/ CCFT SBBL
Display Type	AM TFT LCD, Color 10.4"	AM TFT LCD Sunlight Read 10.4"
Sunlight Readability	No	Yes
Colors	262,144 Colors (18-bit)	262,144 Colors (18-bit)
Pixel Matrix (H x V)	640 x 480 VGA	640 x 480 VGA
Text Format	80 x 25	80 x 25
Character Box	na	na
Vsync Freq. (Hz) Typ.	Clock 25.18 MHz	Clock 25.18 MHz
Luminance *	Typ./Max. (fL)	Min./Typ. (fL)
Brightness	23/30	80/300
Nonuniformity (lum)	1.45 ratio	1.45 ratio
Variation (time)	na	na
Variation (temp.)	na	na
Contrast	100:1 min @ 0 Lux ambient (all blk vs all wht)	100:1 min @ 0 Lux ambient (all blk vs all wht)
Viewing Angle (minimum) (+ = above center, - = below)	+10°/-30° Vertical ±35° Horizontal	+10/-30° Vertical ± 35° Horizontal
Display Characteristics	(H x W) mm	(H x W) mm
Active Area	158.4 x 211.2	158.4 x 211.2
Pixel (Dot) Pitch	0.330 x 0.330	0.330 x 0.330
Pixel (Dot) Size	1 pixel = R-G-B	1 pixel = R-G-B
Pixel Fill Factor	RGB Vert. Stripe	RGB Vert. Stripe
Temperature		
Operating	0°C to +50°C	0°C to +50°C
Storage	-25°C to +60°C	-25°C to +60°C
Humidity, Relative		
Operating	+40°C, 95%	+40°C, 95%
Vibration	10 - 57 Hz 58-500 Hz, 9.8m/s^2	10 - 57 Hz 58-500 Hz, 9.8m/s^2
Shock (mag., duration)	50g, 11 ms	50g, 11 ms
MTBF	>10,000 Hr @ 25°C, backlight	>10,000 Hr @ 25°C, backlight
Power Consumption	5V @ 650 mA Typ.	5V @ 200 mA Max. -12V 420 MA Max.
Backlight Power	3.2 W	30 W

na = information is not specified in manufacturers' data sheets.

2.0 INSTALLATION

Read this section prior to installing the computer. Following these steps will ensure a successful installation of the computer system.

2.1 UNPACKING

Components used in these systems are electrostatic sensitive. Observe proper electrostatic discharge (ESD) procedures when handling the computer.

The computer system is shipped to the customer with the following items:

1 Fully tested computer
1 User/Maintenance Manual
1 Mating connector for AC cable

Remove the computer from the protective wrapping and inspect the unit for any obvious damage incurred during shipping. Contact the shipper if any damage is noted.

2.2 MOUNTING

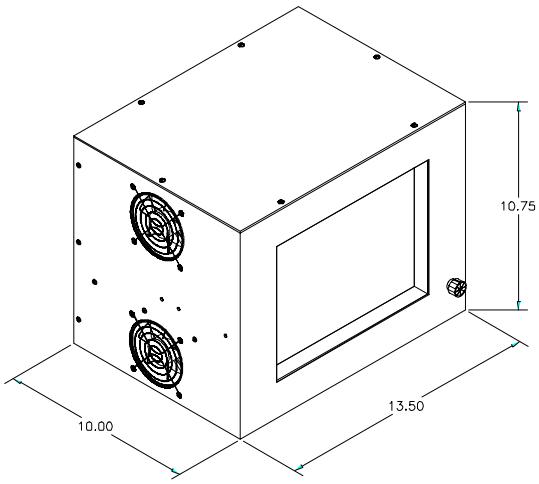
The system is designed to be mounted from the sides. Hard point mounting is provided on the chassis sides at approximately midpoint vertical dimensions. PEM nut fasteners are mounted to the metal housing to securely hold the mounting screws. All screws must be fastened to properly support the computer. Provisions are made for adjusting the tilt of the unit at the mounting point for optimum viewing angle. Mounting the unit requires three (3) No. 10 screws (not provided).

CAUTION: ***Failure to properly mount the computer may result in damage to the computer or personal injury. Any mounting arrangement must support at least five times the weight of the basic computer and resist hard touches.***

There are four (4) intake and exhaust fans on the sides of the computer enclosure, two fans on each side. See the illustration below. Care should be taken when mounting and operating the system to prevent blocking these ventilation openings.

CAUTION: Blocking air flow may affect the performance or damage the system when operating at high ambient temperatures.

- The unit should be mounted for optimum visibility of the display. Typically, this is at or slightly above eye level.
- The unit is not intended to be opened under normal operating conditions. However, the unit may be opened by authorized service personnel to perform necessary maintenance. This requires access to the screws sealing the enclosure of the computer system. Mount the unit so that these screws can be reached.



2.3 APPLYING POWER

Construct a power cable according to the power input connector diagram in section 5.5. Use the mating connector supplied with the ST-C331

Prior to applying power to the computer system the user should connect all peripheral equipment to be used with the system including printers, Ethernet, etc. Refer to the section on I/O ports for location information on peripheral connections. Once all associated equipment has been properly connected, the user should make the power connection. Mate the 3-pin connector to the receptacle mounted on the rear of the computer. Make sure the thread ring is securely fastened to the receptacle to prevent connector damage or electrical Refer to the I/O diagram in section 5.0.

Once power is applied, and power-on circuit breaker is switched on, the computer will run a series of system BIOS and IR touch system self tests. Upon completion of these tests, the computer will display the DOS command prompt.

2.4 POWER REQUIREMENTS

Voltage:	Autoselect
	90-132VAC
	100-204VAC
Frequency:	47-63 Hz
Current	
Full Load	100V-2.7A RMS
	220V-1.7A RMS
Inrush	100V-15A
	220V-30A

3.0 Single Board Computer Operation

The separate Single Board Computer (SBC) user manual contains setup, operation, and maintenance documentation for the SBC. The SBC is factory configured by Deeco Systems, and modifications are usually unnecessary.

4.0 IR Touch System

4.1 MOUSE DRIVERS

The computer provides an integrated touch input system that can be used to provide a simple, intuitive operator interface. The touch system can be configured to emulate the standard mouse input device of the PC based host. Programs that use the mouse as an input device can use the touch system as well.

Like the standard mouse, the touch mouse provides two software drivers to interface applications to the physical device. The drivers process touch reports received from the touch system and perform a translation into a mouse-compatible format for use by applications. The translation is transparent to the given applications; they need not know that the mouse has been replaced by the touch system. The mouse emulation software drivers consist of the following files:

1) LDTOUCH.COM (MS-DOS Operating System)
2) LWTOUCH.DRV (Windows Operating System)
3) LOS2TM12.SYS (OS/2 Operating System)
4) MOUSE.QNX (QNX Operating System)

Note: A distribution disk is available for the SCO UNIX touch mouse emulation. This is loaded into the CO UNIX operating system according to the special installation procedures available with that software option.

4.1.1 Loading the MS-DOS Mouse Driver

The MS-DOS based driver consists of the Deeco touch driver, LDTOUCH.COM. It must be loaded into your host system for proper mouse emulation. LDTOUCH.COM “rides on top of” Microsoft mouse. Microsoft MOUSE.COM should be run before loading LDTOUCH.COM. The Deeco touch driver, LDTOUCH.COM, should be placed within the AUTOEXEC.BAT file following the path statement. The following software switches provide the Deeco mouse driver with variable functionality.

Mouse Pointer Offset Switch
If the user wishes the DOS mouse pointer, used in graphics mode, to be offset from the touch position, the Deeco touch driver should be specified in the AUTOEXEC.BAT file as described below:

LDTOUCH/o

Double Touch Switch
If the user wishes the mouse button to be activated only when a double touch is performed, the Deeco touch driver should be specified in the AUTOEXEC.BAT file as described below:

LDTOUCH /d

Right Mouse Buttons Switch
If the user wishes to disable the right mouse button option of the touch mouse, the Deeco touch driver should be specified in the AUTOEXEC.BAT file as described below. This will allow only the left mouse button function to be active.

LDTOUCH /l

4.1.2 Loading the Windows Mouse Driver

The Windows driver, LWTOUCH.DRV, must be copied to the \SYSTEM sub directory of the Windows directory. To specify the Deeco driver, the Windows initialization file SYSTEM.INI must be modified. The file may be modified by any suitable text editor. The mouse driver is specified by a line in the SYSTEM.INI file as shown here:

MOUSE.DRV=LWTOUCH.DRV

When Windows is started, the driver will load automatically. If the touch system is not operational, Windows will behave exactly as if the standard mouse driver were loaded without a mouse present. This behavior is characterized by the absence of the mouse cursor. Windows may still be controlled from the keyboard.

4.1.3 Loading the OS/2 Mouse Driver

The OS/2 mouse driver, LOS2TM12.SYS, must be copied to the C:\OS2 directory. To specify the mouse driver the OS/2 CONFIG.SYS must be modified as follows:

DEVICE = C:\OS2\MOUSE.SYS
to
DEVICE = C:\OS2\LOS2TM12.SYS

4.1.4 Loading the QNX Mouse Driver

This section details the installation procedure for the Lucas Deeco Touch Mouse Driver (V1.2) for the QNX Operating System. Refer to the following steps to load the QNX Mouse driver:

- Copy the QNX Mouse driver file MOUSE.QNX to the /BIN directory of the QNX Operating System.

- Type: MOUSE.QNX [-s] [-z] ltm </dev/serXX & <Carriage Return>

  Where: XX = 1 (com1)

  XX = 2 (com2)

- Use switch **-s** to set baud rate -s 9600 (baud = 9600, default is 1200)

- Use switch **-z** to set touch scanner sensitivity -z 10,2 (max touch size = 10, default is 6, min touch size = 2, default is 1)

4.1.5 Loading the SCO UNIX Mouse Driver

This section details the installation procedure for the Deeco Systems Touch Mouse Driver for SCO Open Desktop Release 3.0. The user may find it useful to refer to the following reference guides for more information regarding the SCO UNIX Operating System:

SCO Open Desktop/SCO Open Server Installation and Upgrade Guide.

SCO Open Desktop/SCO Open Server System Administrator's Guide.

SCO Open Desktop/SCO Open Server Graphical Environment Administrator's Guide.

Prior to installation the user must be familiar with the following:

- Installing and configuring SCO Open Desktop Release 3.0.

- Installing and removing additional software products onto the SCO Open Desktop.

4.1.5.1 System Requirements

The user must have the following:

- A computer system with SCO Open Desktop Release 3.0 already installed.
- The Deeco Systems Touch Screen. The RS-232 port COM1 is connected to the touch screen.
- The Deeco Systems Touch Mouse Distribution Disk.

4.1.5.2 Prior to Installation

The SCO Open Desktop System must be operating in Single User Mode before installing the Deeco Systems Touch Mouse Driver. The custom utility will fail to load the touch driver if the system is in multi-user mode, informing the user the reason for the failure.

Note: The user should exit the Desktop Graphical Environment and "shutdown" the UNIX system. This will allow for a reboot in single user mode. The user can now follow the installation instructions found in section 4.1.5.3.

If the previous release of the Deeco Systems Touch Mouse is already installed on your system, the user must first use the custom utility to remove it.

The user must know which system communication port is connected to the touch screen. Communication port 1 (COM PORT 1) is associated to the "/dev/tty1a" UNIX driver, while communication port 2 (COM PORT 2) is associated to the "/dev/tty2a" UNIX driver.

The double click duration on a standalone computer can be set graphically by using the scomouse client. Set the mouse double click duration to a longer time if the user wishes to use the double click function of the touch mouse. The user accomplishes this by entering the SCO Open Desktop Graphical Environment and selecting the Control Group. Start the scomouse client by selecting the Mouse Controls in the Control Group. The double click duration is set by dragging the Double Click Speed Slider to the desired speed. The slowest speed is recommended, since the time duration between performing the double click on a touch screen is longer than a physical mouse. To save the changes exit the Mouse Controls by selecting the OK Button.

The SCO Open Desktop/SCO Open Server Graphical Environment Administrator's Guide describes how to modify the double click duration and other mouse characteristics by editing the appropriate resource file.

4.1.5.3 Installation Procedure

In Single User Mode, start the custom utility at the command prompt and perform the following:

- Select “Install.”
- For the “Select a product:” prompt select “A New Product.”
- For the “Choose an option:” prompt select “Entire Product.”
- Insert the Deeco Systems Distribution Disk into the floppy drive and select “Continue.”
- Select “Continue” at the “Insert: LCSP/Deeco™ Systems Touch Mouse Floppy Volume 1" prompt.

The install script will automatically start the mkdev mouse utility. In order to install the touch mouse driver, the user must first remove the current mouse driver connected to the communication port that the touch screen is connected to, then add the touch mouse driver to the system. The install script will save the current mouse configuration, which will be restored when the custom utility is used to remove the touch driver. The user must perform the following to install the touch driver:

- Select option 3, “Remove a mouse from the system.”
- Remove the mouse driver (using the menu selections on the screen), attached to the UNIX driver associated with the communication port that the touch screen is connected to (if applicable). If the touch screen is connected to COM PORT 1, then the mouse driver attached to “/dev/tty1a” must be removed before the touch driver can be installed.
- At the “Mouse Initialization Program” Menu, select option 2, “Add a mouse to the system.”
- Select the option associated with the “Serial mouse” mouse device type, that is, if the “Serial mouse” is listed as option 1, then select option 1.
- Select the option associated with the LCSP, Deeco Systems Touch Mouse Driver.
- The default communication port that the touch screen is attached to is COM PORT 2, so the default configuration is the touch driver being attached to “/dev/tty2a.” If the user’s system has the touch screen connected to another communication port, then enter “y” at the “Do you want to install this mouse on a different port? (y/n)” prompt. If the user’s system has the touch screen connected to COM PORT 2, then enter “n” at the prompt.
- If the user entered “y” at the different port prompt, then enter the device that the touch screen is attached to at the “To which device (e.g. /dev/tty2a) do you want to attach the LCSP, Deeco Systems Touch Mouse?” prompt.

- Configure the system's terminals and multi-screens that will use the touch mouse.
- The user will be prompted to create a new kernel in order for the touch mouse driver to take effect. **Do not create a new kernel at this time, enter "n" at the prompt.**
- At the "Mouse Initialization Program" Menu enter "q" at the prompt.
- The user will be prompted to re-link the kernel in order to use the touch screen, enter "y" at the prompt. A new kernel will now be created with the touch mouse driver. This will take several minutes.
- Select "Quit" to exit the custom utility.

4.1.5.4 Removing the Driver

In Single User Mode, start the custom utility at the command prompt and perform the following:

- Select "Remove."
- For the "Select a product:" prompt select "LCSP, Deeco Systems Touch Mouse."
- Select "ALL", this will remove the entire touch mouse driver package.
- Select "Yes" to continue with the removal process. The system mouse drivers' configuration will be restored to the original configuration.
- Enter "y" at the re-link the kernel prompt.
- Select "Quit" to exit the custom utility.

4.1.5.5 Programming Interface

User-level programs can access mouse information through an ioctl (I/O control command) system call. Request 3 is the ioctl request for mouse event data. The program must open the *"/dev/lut"* device in read only mode, and supply a pointer to an event structure, which is defined in *"sys/event.h."* The touch driver fills the event structure with the current touch position, the time of the last event, the accumulated event tag, and the current button state. The ioctl request 3 provides the means by with the user-level program can poll the touch driver for mouse events. The user-level program should use the event macros defined in *"sys/event.h"* to access the fields in the event structure.

The touch position is expressed in both an X and Y position in absolute global screen coordinates. The time field has one second resolution and represents the time of the last event. The event tag field contains the accumulated events since the last ioctl call, which is **T_ABS_LOCATOR** (numeric value 8 Hex), or **T_BUTTON** (numeric value 2 Hex), or both. The button field represents the current state of the left mouse button, which is either **BUTTON3** (numeric value 4 Hex) or zero. The touch driver only supports a single button mouse, which is the left mouse button. The following table explains how a user-level program can interpret the data in the event structure:

Button Field	Tag Field	Description
4	0A Hex	The stylus has entered the touch screen at the screen position in EV_X(ev) and EV_Y(ev). The button is considered active.
0	08 Hex	The stylus has moved to the screen at the position in EV_X(ev) and EV_Y(ev).
0	02 Hex	The stylus has exited the touch screen. The button is considered inactive.
0	0A Hex	The stylus has entered and exited the screen. The last screen position was at EV_X(ev) and EV_Y(ev). The button is inactive.

The touch driver zeroes the event fields after completing the ioctl system call. The user-level program can determine if a valid event has occurred by checking for a non-zero value in the time field. Since the event tag field is accumulated, the user-level program must keep track of the previous touch states.

Both the open() and close() system calls re-initializes the state of the touch driver.

The following is example code illustrating how to access the touch events through ioctl request 3:

```
      .
      .
      .
#include <sys/event.h>

      .
      .
      .
int fd;
EVENT ev;
      .
      .
      .
/* Open the touch driver */
if ( ( fd = open( "/dev/lut", O_RDONLY ) ) == -1 )
      {
/* Failed to open error processing */
/* do not proceed any further in code */
      }
      .
      .
      .
/* Request touch events */
if ( ioctl( fd, 3, &ev ) == -1 )
      {
/* failed IOCTL request error processing */

      }


      .
      .
      .
/* Close the touch driver */
if ( close( fd ) == -1 )
      {
/* failed to close device error processing */
```

4.2 OPERATION OF THE TOUCH MOUSE

The touch mouse drivers emulate a two button mouse. They simulate mouse button actuations and motions. The left mouse button is the default button state. To make the right mouse button the active button, simply touch the upper right corner of the display. The left button is re-activated by touching the upper left corner of the display. The cursor will not move from the current position when changing the active mouse button. Be sure to touch in the corner of the display, and not just the general area.

There are three significant touch “events” used to emulate a mouse. The first event is the “entry” event. An entry event is the first touch by a finger detected by the system. The second event is a “track” event. Track events are changes in the finger position after the entry event. The last event is the “exit” event. An exit event is the removal of the finger from the touch system. When the touch system detects an entry touch event, the mouse position is updated to be identical with the touch position. This is signified by the visible cursor moving to a position beneath the finger.

There are two tracking modes, absolute and relative, with which an application can interface with the mouse. Absolute mode is the recommended mode to use with the mouse. Absolute mode refers to the mouse position being referenced to the screen’s absolute pixel position. When the application references the mouse position, it is only interested in the current position of the mouse. This mode works best with a touch mouse, since the application’s mouse position is dependent on the mouse driver’s position.

Relative mode refers to the mouse positioning being referenced to the last known position during tracking events. When the application references the mouse position, it wants to know the position changes from the last known position. This mode only works well with a touch mouse when the application uses the mouse driver to update and position the actual mouse cursor, or arrow on the screen. This mode does not work well when the application is maintaining the mouse position, and drawing the mouse cursor on the screen, rather than relying on the mouse driver. This mode causes problems because the application’s mouse position is independent of the mouse driver’s mouse position. This difference in mouse pointer positioning may cause an offset between the stylus and the mouse pointer. Typically, the user may “home” the mouse pointer by tracking the pointer into a corner that will allow the mouse pointer to arrive first. This allows the user to coordinate the X and Y coordinates of the applications mouse pointer with those of the touch mouse driver.

A special “double-click” algorithm has been developed to insure that double-click operations, a rapid entry-exit-entry-exit, are cleanly detected and reported.

4.3 MOUSE DRIVER SOFTWARE INTERFACING

For certain OEM applications, it may be necessary to develop custom touch system software. This section outlines the commands required to communicate with the computer's touch controller.

The IR Touch Controller communicates with the host system over COM1. The default UART settings are:

Baud Rate:	1200
Data bits:	7
Stop bits:	2
Parity:	None

COM1 uses IRQ 4. The interrupt vector associated with IRQ 4 is located at 000:0030.

To obtain direct communication with the touch controller, an interrupt handler should be written and coupled to IRQ 4. The mouse driver **should not** be loaded after the new handler is installed.

Host System Protocol and Self Tests

The following information provides self tests and system communication settings.

Host Communication Protocol:

7 Data Bits, No Parity, 2 Stop Bit.
The touch controller requires a total of 10 bits, unused bits should be set high.
XON/XOFF Software Protocol.

Note: ***Modes 0-3 require that the host system sends 10 data bits, including start and stop bits. Modes 4-7 require that the host system sends 11 data bits, including start and stop bits. The touch interface may act erratically if framing is not compatible.***

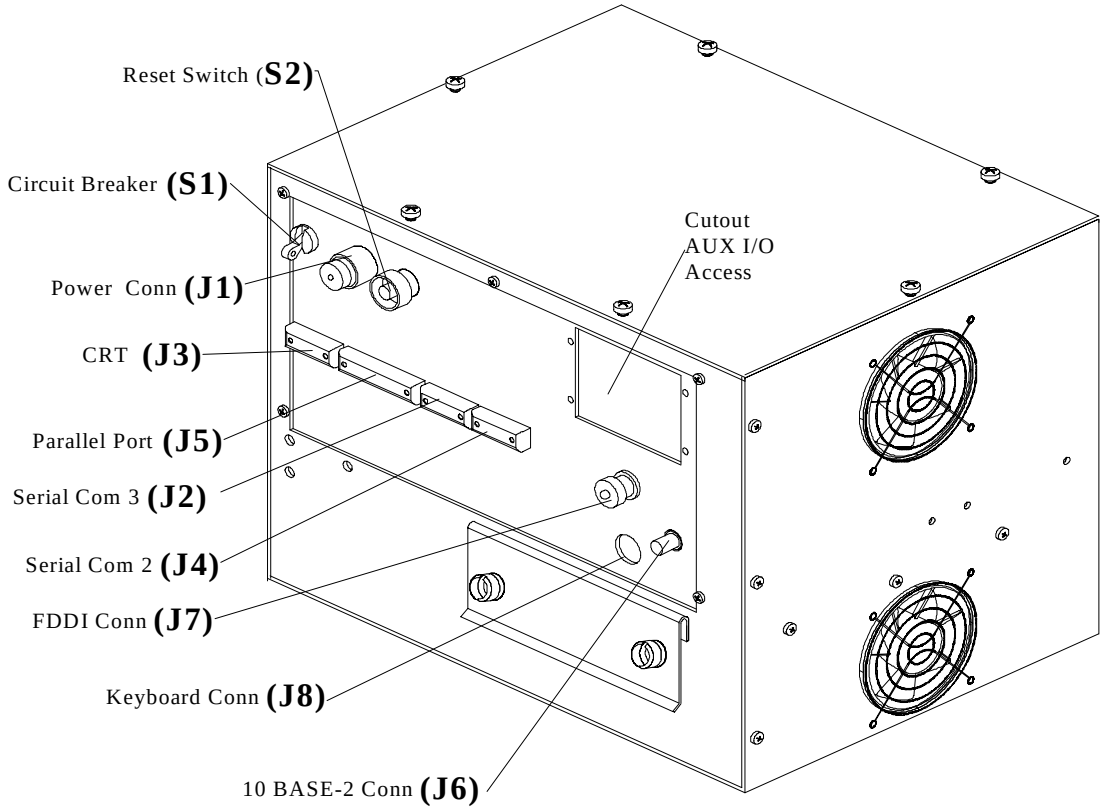
Resetting the Controller Serial Channel:

The touch controller serial channel can be reset to the default values by toggling the RTS/DTR serial lines together, that is, both RTS from low to high, and DTR from high to low for 55 msecs. The ability to reset via the RTS/DTR serial lines can be disabled through Command 05H. Before resetting the serial channel, the host and controller should be in an idle state. The touch controller will respond to the serial reset by transmitting the byte<4DH>, 'M', to the host.

Buzzer Tones at Start Up:

Buzzer Tones	Message
1	Normal Operation - Test Passed
2	RAM Test Failure
3	ROM Checksum Error
4	RAM Failure and ROM Checksum Failure
5	Bad IR Beams Detected
6	RAM and IR system errors
7	ROM Checksum and IR system errors

5.0 Input/Output Interface Ports



ST-C331 External Connectors

5.1 SERIAL COMMUNICATIONS CONNECTORS (J2 AND J4)

The computer provides external access to two serial ports. J2 is configured as COM3 and J4 as COM2. The ports are 16C550 compatible with 16 Bytes of FIFO per port. COM1 is internally connected to the IR Touch Controller.

J2 and J4 Serial 9-pin DSUB Connector Pin-outs:

Pin	Signal
1	RLSD
2	RX Data
3	TX Data
4	DTR
5	GND
6	DSR
7	RTS
8	CTS
9	RI

5.1.1 Internal 4-COM Port Serial Card

This card is used to connect the PCI SBC to the ISA IDE Adapter PC/104 2-card ISA card slot. The card mounts directly to the PCI SBC using the standard PC/104 pin-connector configuration. The card also includes 4 COM port connectors, two of which are routed to the rear of the enclosure. All jumpers and switches have been pre-configured at the factory. Refer the DOS or operating system manual when reconfiguring the COM port IRQs.

Model Number: PCM-3640

Features

- Four (4) RS-232 serial interfaces
- High speed data transmission
- Switch selectable addresses (COM1 - COM4 or any other address from hex 200 to 3F8)
- 16 bytes FIFOs
- Jumper selectable interrupt level
- Eight (8) LEDs indicate status of TX (red), RX (green) lines
- Supported by PC-ComLib serial communications programming library (optional)

Specifications

- Dimensions 3.775" x 3.550" (9.6 cm x 9.0 cm)
- Bus: PC/104
- Baud rate: 50 to 115,200 bps
- Character length: 5, 6, 7 or 8 bits
- Parity: Even, odd or none
- Stop bit: 1, 1.5 (5-bit data only) or 2
- I/O connectors: Four (4) male DB-9
- Interrupt level: IRQ3, 4, 5, 6, 7 or 9
- Clock Input: 1.8432 MHz
- Power consumption: +5V @ 220 mA max.

Switches and Jumpers

Switch/Jumper	Function
SW1	I/O base address (enhanced mode)
JP1	Channel 1 Interrupt level
JP2	Channel 2 Interrupt level
JP3	Channel 3 Interrupt level
JP4	Channel 4 Interrupt level

PCM-3640
PC/104 4-port RS-232 Module

PCM-3640 PC/104 4-port RS-232

Introduction

The PCM-3640 is a PC/104-compatible 4-port RS-232 serial interface module. It works with PC/104 CPU modules or CPU cards which accept PC/104 expansion modules. It provides four independent serial interfaces, accessed through male DB-9 connectors.

The module's industry-standard 16C550 asynchronous communication chip is fully programmable. The module requires no special commands or control codes if you use the standard COM1 – COM4 port addresses.

Features

- Four RS-232 serial interfaces
- High speed data transmission—up to 115,200 Bps.
- Switch selectable addresses (COM1 – COM4 or any other address from hex 200 to 3F8)
- 16 bytes FIFOs
- Jumper selectable interrupt level
- Eight LEDs indicate status of TX, RX lines (red LED represents TX, green LED represents RX)
- Supported by PC-ComLib serial communication programming library (optional)

Specifications

- **Dimensions:** 3.775" x 3.550" (9.6 cm x 9.0 cm)
- **Bus:** PC/104
- **Baud rate:** 50 to 115,200 bps
- **Character length:** 5, 6, 7 or 8 bits
- **Parity:** Even, odd or none
- **Stop bit:** 1, 1.5 (5-bit data only) or 2
- **I/O connectors:** Four male DB-9
- **Interrupt level:** IRQ 3, 4, 5, 6, 7 or 9
- **Clock input:** 1.8432 MHz
- **Power consumption:** +5 V @ 220 mA max.

Initial inspection

We carefully inspected the PCM-3640 both mechanically and electrically before we shipped it. It should be free of marks and scratches and in perfect electrical order on receipt.

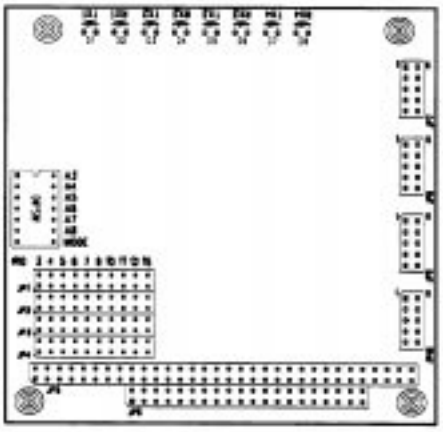
Handle the board only by its edges. The static charge on your body may damage its integrated circuits. Keep the card in its anti-static package whenever it is not installed. You can use this package to return the card if it should need repair.

Switches and jumpers

The following chart shows the switches and jumpers used to configure the PCM-3640:

Switch	Function
SW1	I/O base address (enhanced mode)
JP1	Channel 1 Interrupt level
JP2	Channel 2 Interrupt level
JP3	Channel 3 Interrupt level
JP4	Channel 4 Interrupt level

Board Layout



Default jumper settings

The PCM-3640 will be shipped in standard mode, with the following I/O address and IRQ settings:

Port	I/O address	IRQ no.
Port 1	3F8	IRQ4
Port 2	2F8	IRQ3
Port 3	3E8	IRQ12
Port 4	2E8	IRQ15

Jumper and Switch settings

The PCM-3640 can be used in two modes: standard or enhanced mode. In standard mode the I/O addresses are compatible with the standard PC communication ports, COM1 – COM4. In enhanced mode you can select a different base address. The offset of each port from the base address is fixed.

Standard / Enhanced mode selection

Switch 7 of DIP switch SW1 selects between standard and enhanced mode.

Standard mode

SW1

In standard mode, the I/O address of the ports are as follows:

Port	I/O address	Interrupt No
Port1	3F8	Selectable (see p.3)
Port2	2F8	Selectable (see p.3)
Port3	3E8	Selectable (see p.3)
Port4	2E8	Selectable (see p.3)

Enhanced mode

SW1

Base address selection(SW1)

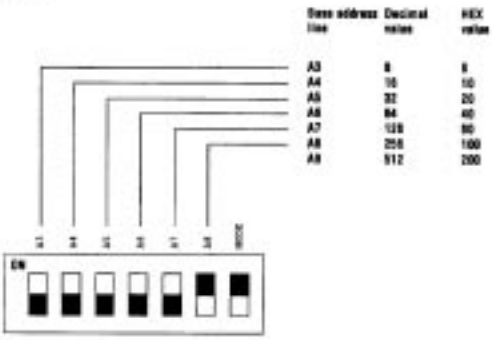
In enhanced mode, you can select a different base address. The base address determines the address for each of the four ports.

The I/O addresses for the four ports are as follows:

Port	I/O address
Port 1	Base + 00H
Port 2	Base + 08H
Port 3	Base + 10H
Port 4	Base + 18H

You use switches 1-6 of DIP switch SW1, a 7-position DIP switch, to set the base address. You can set the base address anywhere from hex 200 to 3F8.

To set the base address, you have to calculate the base address as follows:



NOTE: On the PCM-3640 the address line A9 does not appear on the DIP switch as it is permanently hard-wired to HEX 200 on the card.

The following table shows different base address settings.

Port base address (SW1)						
Base address	**A3**	**A4**	**A5**	**A6**	**A7**	**A8**
200-207	●	●	●	●	●	●
208-20F	○	●	●	●	●	●
. .						
2E8-2EF	○	●	○	○	○	●
. .						
3E8-3EF	○	●	○	○	○	○
. .						
*3F8-3FF	○	○	○	○	○	○

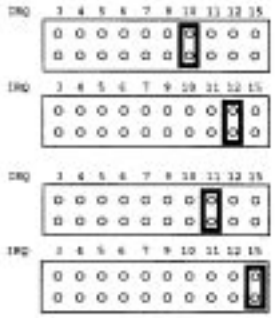
●:ON ○:OFF *:Default

Note: *If your CPU module or card has serial interface ports, you will need to adjust the I/O port addresses (or disable the ports) to avoid conflicts.*

Interrupt level selection (JP1– JP4)

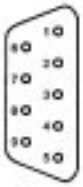
You can set the interrupt level for each port from 3 to15, except 8, 13 and 14. Jumpers JP1, JP2, JP3 and JP4 sets the interrupt level for port 1, port 2, port 3 and port 4 respectively.

Simply short the pins on the jumper corresponding to the interrupt level required (as illustrated below).



Note: *Do not use interrupts that are used by other cards/ ports, unless you have made provision for interrupt sharing in your programs.*

Signal wiring



Connector pin assignments

You access the PCM-3640's ports through four external male DB-9 connectors. RS-232 connector pin assignments are as follows :

Pin		description
1	DCD	receive line signal detector
2	RD	received data
3	TD	transmitted data
4	DTR	data terminal ready
5	GND	ground
6	DSR	data set ready
7	RTS	request to send
8	CTS	clear to send
9	RI	ring indicator

RS-232 Signal wiring

Since the RS-232 interface is not strictly defined, many devices have their own connection methods which may ignore some signal lines or define reserved lines to other functions. It is best to refer to the user's manual for your device for installation instructions. You may find the following helpful.

In general, DTE (Data Terminal Equipment) refers to the device that is leading the communication. Examples include PC's, terminals and some printers. DCE refers to the device being communicated with or controlled. Examples include modems, DSU's (digital service units), printers and lab/ factory equipment.

In some situations you may be able to get by with just three lines: data on TxD, a Signal Ground and a handshaking line. Examples are printer or plotter connections, troubleshooting and situations where you require only one-wire communication.

Terminal or PC (DTE) connections

PCM-3640 (DTE): (DB-9)		Terminal (DTE):DB-25	
Pin	Signal	Pin	Signal
3	TxD	3	RxD
2	RxD	2	TxD
7	RTS	5	CTS
8	CTS	4	RTS
6	DSR	20	DTR
5	GND	7	GND
4	DTR	6	DSR
1	DCD	8	DCD

Modem connections

PCm-3640: DB-9 Male		Modem (DCE)	
Pin	Signal	Pin	Signal
3	TxD	2	RxD
2	RxD	3	TxD
7	RTS	4	CTS
8	CTS	5	RTS
6	DSR	6	DTR
5	GND	7	GND
4	DTR	20	DSR
1	DCD	8	DCD

For DTE to DCE connection, use straight through cable connections, i.e. you don't have to reverse lines 2 and 3, lines 4 and 5, and lines 6 and 20. Because in general DCE RS-232 interfaces are reversed themselves.

Terminal without handshake

PCM-3640: DB-9 MALE		Terminal (DTE)	
Pin	Signal	Pin	Signal
3	TxD	3	RxD
2	RxD	2	TxD
7	RTS		
8	CTS		
6	DSR		
5	GND	7	GND
4	DTR		
1	DCD		

The maximum length of a RS-232 cable is 100 ft. If you need to connect over longer distances, (longer than 100 ft), you will have to use another standard (like RS-422 or RS-485).

If you do not use CTS, RTS, DSR, DTR signals, please loop them back, otherwise the PC-ComLIB software will not function correctly. PC-ComLIB always checks for handshake signals.

Hardware installation

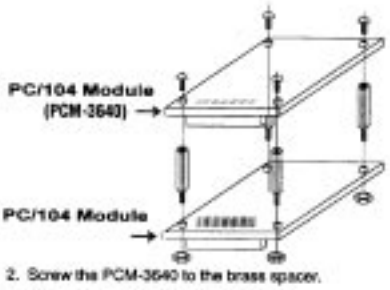
Warning! *TURN OFF your PC power supply whenever you install or remove the PCM-3640 or connect and disconnect cables.*

Installing the module on a CPU card

1. Turn the PC's power off. Turn the power off to any peripheral devices such as printers and monitors.
2. Disconnect the power cord and any other cables from the back of the computer.
3. Remove the system unit cover (see the user's guide for your chassis if necessary).
4. Remove the CPU card from the chassis (if necessary) to gain access to the card's PC/104 connector.
5. Screw the brass spacer (included with the module) into the threaded hole on the CPU card. Do not tighten too much, or the threads may be damaged.
6. Carefully align the pins of the PCM-3640 with the PC/104 connector. Slide the module into the connector. The module pins may not slide all the way into the connector; do not push too hard or the module may be damaged.
7. Secure the module to the CPU card to the threaded hole in the CPU card using the included screw.
8. Attach any accessories to the PCM-3640.
9. Reinstall the CPU card and replace the system unit cover. Reconnect the cables you removed in step 2. Turn the power on.

Connecting to another PC/104 module

1. Insert the pins of connector JP6 (on the end of the PCM-3640 module) into the piggyback connector on the other PC/104 module.



2. Screw the PCM-3640 to the brass spacer.

This completes the hardware installation.

Programming

Programming with COM1 or COM2

If you set the PCM-3640's ports as COM1 and COM2, you can send and receive data using the normal communication functions found in high-level languages. The following examples use BASIC to demonstrate PCM-3640 programming.

The BASIC communication process starts with the `OPEN "COMn: , , ..."` statement. This statement assigns a buffer for communication purposes and sets up the communication parameters.

Command format

```
OPEN "COMn: [speed][,parity][,data][,stop]
[,BS][,CS[n]][,DS[n]][,CD[n]][,LF][,PE]"
AS [#]filenum
```

Example:

```
OPEN "COM1:9600,N,8,,CS,DS,CD" AS #1
```

Where:

COMn:	n is 1 or 2, indicating either COM1 or COM2
speed:	An integer constant specifying the baud rate in bits per second
parity:	One of the following characters: S: space O: odd M: mark E: even N: none
data:	An integer constant indicating the number of data bits. Valid values are 4, 5, 6, 7 and 8. The default is 7.
stop:	The number of stop bits. Valid values are 1 and 2. The default is 2 for 75 and 110 bps, 1 for all others.
BS:	Suppresses RTS
CS:	Controls CTS
DS:	Controls DSR
CD:	Controls CD
LF:	Sends a line feed following each carriage return

PE: Enables parity checking

filenum: filenum is an integer expression which evaluates to a valid file number

You must put the speed, parity, data and stop parameters in this position and order, but you can put the RS, CS, DS, CD, LF and PE parameters in any order. The n argument in the CS, DS and CD parameters specifies the number of milliseconds to wait for the signal before returning a "device timeout" error. n may range from 0 to 65535. If you omit n or set it equal to 0, then the line status is not checked at all.

Refer to the IBM BASIC reference manual for more detailed information.

Programming example — standard COM ports

You can use the following BASIC program to test the PCM-3640's send and receive functions.

```
10  '*************************************************
20  '* Program: DEMO01.BAS                           *
30  '* Description: This demo program transmits a    *
40  '* string through COM1 and receives it through   *
50  '* COM2                                          *
70  '*************************************************
100 'Set the proper parameters
170 'COM1 & COM2: baud rate=9600 ; no parity check;
180 'Data bit=8; stop bit=1
190 'Ignore the CTS, RTS and DSR signals.
200 OPEN "COM1:9600,N,8,1,RS,CS,DS,CD" FOR RANDOM AS #1
210 OPEN "COM2:9600,N,8,1,RS,CS,DS,CD" FOR RANDOM AS #1
220 INPUT "INPUT COMMAND:";CMD$
230 IF CMD$="Q" OR "q" THEN CLOSE:END ELSE GOSUB 250
240 GOSUB 300:GOTO 220
250 '****** Transmit data sub-routine ******
260 PRINT #1,CMD$
270 RETURN
280 '****** Receive data sub-routine ******
310 T=TIMER:TEMP$="":RES=""
320 IF TIMER>T+.5 THEN PRINT "TIMEOUT ERROR":RETURN
330 IF LOC(2)>0 THEN TEMP$=INPUT$(1,#2) ELSE GOTO 320
340 RES=RES+TEMP$
350 IF TEMP$=CHR$(13) THEN GOTO 360 ELSE GOTO 320
360 PRINT "RECEIVE DATA:";RES:RETURN
```

Using other I/O port addresses

If you are going to use I/O ports other than COM1 or COM2, you will need to directly program the registers of the PCM3640's 16C550 chip.

See page 7 for information on the format and programming of these registers. See page 8 if you have trouble finding a free I/O port base address.

You can use the following program as a base as you develop your own driver. The program exchanges data (the numbers 0 to 256) between two ports. It uses I/O port addresses hex 2E8 and 3E8. Set JP4, JP5 and JP10 for RS485 or RS-422 mode (described on page 2).

Programming example—arbitrary I/O ports

```
10  '*****************************************
20  'Clear the screen
30  CLS
40  'Set the I/O port base addresses for
50  'both cards
60  PORT1%=&H3E8
70  PORT2%=&H2E8
80  'Read all registers once to
90  'clear any random data
100 FOR I=PORT1% TO PORT1%+6
110 DUM=INP(I)
120 NEXT I
130 FOR I=PORT2% TO PORT2%+6
140 DUM=INP(I)
150 NEXT I
160 'Initialize the registers of
170 'port1. First, set DLAB = 1 so the
180 'desired baud rate can be programmed.
190 OUT PORT1%+3,&H80
200 'Write the value of divisor into
210 'registers: hex 180 = dec 384 = 300 BAUD
220 OUT PORT1%,&H80:OUT PORT1%+1,&H1
230 'Set word length = 8 bits, stop bits = 2,
240 'even parity, DLAB = 0.
250 OUT PORT1%+3,&H1F
260 'Do the same thing for port2.
270 OUT PORT2%+3,&H80
280 OUT PORT2%,&H80:OUT PORT2%+1,&H1
290 OUT PORT2%+3,&H1F
300 'Loop over data (0-255) and send it
310 'from port1 to port2
320 FOR BYTE=0 TO 255
330 'Wait until the transmitter buffer
340 'is empty.
350 IF (INP(PORT1%+5) AND 32)=0 GOTO 350
360 'Output the data through port1.
370 OUT PORT1%,BYTE
380 'See if the data is available by checking
390 'the Data Ready bit.
400 IF (INP(PORT2%+5) AND 1)=0 GOTO 400
410 J=INP(PORT2%)
420 'Print out the data byte received
430 PRINT "port ";HEX$(PORT2%)" = ";HEX$(J)
440 'If the value sent <> the received value then error
450 IF J<>BYTE GOTO 620
460 NEXT BYTE
470 'Loop over data (0-255) and send it
480 'from port2 to port1.
490 FOR BYTE=0 TO 255
500 'See if the transmitter buffer is empty.
510 IF (INP(PORT2%+5) AND 32)=0 GOTO 510
520 OUT PORT2%,BYTE
530 'See if the data is available by
540 'checking the Data Ready bit.
550 IF (INP(PORT1%+5) AND 1)=0 GOTO 550
560 J=INP(PORT1%)
570 PRINT "port ";HEX$(PORT1%)" = ";HEX$(J)
580 IF J<>BYTE GOTO 620
590 NEXT BYTE
600 'If everything is OK, then stop.
610 END
620 PRINT "Data transmission error!":BEEP:END
```

Programming example—communication

The following pair of example programs show how you can set up communication between two computers. The first program sends data then receives data. The second program receives data then sends data. Run the first program on one computer and the second on another.

Program for first computer

```
10  '************ STEP 1: INITIALIZATION *************
20  'Clear screen
30  CLS
40  'Define variables A to Z as integer
50  DEFINT A-Z
60  'Set port base address (must match hardware)
70  PORT = &H2F8
80  'Set baud rate to 300
90  OUT PORT + 3, &H80
100 OUT PORT, &H80
110 OUT PORT, 1
120 OUT PORT + 3, &H1F
130 '******** STEP 2: SEND DATA ********
140 FOR I = 65 TO 90
150 '
160 GOSUB 290
170 NEXT I
180 GOTO 260
190 STATUS = INP(PORT + 5) AND &H20
200 IF STATUS = 0 THEN 290
210 OUT PORT, I
220 FOR J = 0 TO 1200: NEXT J
230 RETURN
240 '****** STEP 3: RECEIVE DATA *****
250 FOR I = 65 TO 90: GOSUB 290: NEXT I
260 END
280 STATUS = INP(PORT + 5)
290 IF (STATUS AND &H1E) THEN 300
300 IF (STATUS AND &H1) = 0 THEN 280
310 D = INP(PORT)
320 PRINT "DATA= "; CHR$(D)
330 RETURN
```

Program for second computer

```
10  '********** STEP1: INITIALIZATION **********
20  'Clear screen
30  CLS
```

```
40   'Define variables A TO Z as integer
50   DEFINT A-Z
60   'Set port base address (must match hardware)
70   PORT = &H2F8
80   'Set baud rate to 38
90   OUT PORT + 3, &H80
100  OUT PORT, &H60
110  OUT PORT, 1
120  OUT PORT + 3, &H1F
130  '****** STEP 2: RECEIVE DATA FROM ANOTHER PC ******
140  FOR I = 65 TO 90: GOSUB 190: NEXT I
150  PRINT: PRINT: PRINT
160  PRINT"DATA RECEIVED END. THEN DATA SEND BEGINNING."
170  PRINT: PRINT "PRESS ANY KEY..."
180  IF INKEY$ = "" THEN 180 ELSE 200
190  STATUS = INP(PORT + 5)
200  IF STATUS AND &H1E THEN GOTO 190
210  IF (STATUS AND &H1) = 0 THEN 190
220  d = INP(PORT)
230  PRINT "DATA= "; CHR$(d)
240  RETURN
250  '--------------- STEP 3: SEND DATA ---------------
260  FOR I = 65 TO 90
270  d = I
280  GOSUB 310
290  NEXT I
300  END
310  STATUS = INP(PORT + 5) AND &H20
320  IF STATUS = 0 THEN 310
330  OUT PORT, d
340  FOR J = 0 TO 1200: NEXT J
350  RETURN
```

C language test program

You can use the following C program to test the PCM-3640's send and receive functions.

```
/*************************************************************/
/*  Program:  DEMO01.C                                       */
/*  Description: This demo program transmits a string        */
/*  to COM1 and receives a string from COM2                  */
/*  Compiler: Turbo C 2.0                                    */
/*************************************************************/

#include <dos.h>
#include <io.h>
#include <stdio.h>
#include <conio.h>

#define   TIME_OUT   10000

static   int base0 = 0x3F8;  /* Base address of port 0 */
static   int base1 = 0x2F8;  /* Base address of port 1 */
static   char rec[16]; /* Buffer for received string */
static   char cmd[16]; /* Buffer for transmitted string */

void main()
{
   int i; /* Counter for character being sent/received */
   char flag; /* Flag for end of output/input data */
   int timeout; /* Timeout counter */

   outport((base0+2), 0xC7);  /* enable port 0 FIFO */
   outport((base1+2), 0xc7);  /* enable port 1 FIFO */

   /* Set communication parameters for port 0 */
   outp(base0+1, 0x80);  /* Set DLAB=1 */
   /* Set baud = 115200 */
   outp(base0, 0x01);
   outp(base1+1, 0);
   /* Set data=8, stop=1, no parity */
   outp(base0+1, 0x03);
   /* Disable port 0 interrupt */
   outp(base0+1, 0x00);

   /* Set communication parameters for port 1 */
   outp(base1+1, 0x80);  /* Set DLAB=1 */
   /* Set baud = 115200 */
   outp(base1, 0x01);
   outp(base1+1, 0);
   /* Set data=8, stop=1, no parity */
      outp(base1+2, 0x03);
   /* Disable port 1 interrupt */
   outp(base1+1, 0x00);

   printf("\nEnter a string to be transmitted "
          "(15 characters or less) or Q to quit:");
   gets(cmd);
   while (cmd[0] != 'q' && cmd[0] != 'Q')
   {
      i=0;
      cmd[strlen(cmd)] = 0x0d;
      flag=1;
      while (flag)
      {
         outportb(base0, cmd[i]);   /* Send data */
         if (cmd[i] == 0x0D)
            flag=0;
         i++;
      }

      i=0;
      flag=1;
      timeout=TIME_OUT;
      while (flag)
      {
         /* Check if receiver data is ready */
         if ((inportb(base1+5) & 1) !=0)
         {
            rec[i]=inportb(base1);  /* Receive data */
            if (rec[i] == 0x0d)
            {
               rec[i+1]='\0';
               flag=0;
               printf("\nReceived data: %s\n", rec);
            }
            i++;
         }
         else
         {   /* Check timeout */
            timeout--;
            if (timeout == 0)
            {
               flag = 0;
               printf("\nTimeout error\n");
            }
         }
      }
   printf("\nEnter a string to be transmitted "
          "(15 characters or less) or Q to quit:");
   gets(cmd);
   }
}
```

Register structure and format

This section gives short description of each of the module's registers. For more information please refer to the data book for the STARTECH 16C550 UART chip.

All registers are one byte. Bit 0 is the least significant bit, and bit 7 is the most significant bit. The address of each register is specified as an offset from the port base address (BASE), selected with DIP switch SW1.

DLAB is the "Divisor Latch Access Bit", bit 7 of BASE+3.

BASE+0 Receiver buffer register when DLAB=0 and the operation is a read.

BASE+0 Transmitter holding register when DLAB=0 and the operation is a write.

BASE+0 Divisor latch bits 0 - 7 when DLAB=1.

BASE+1 Divisor latch bits 8 - 15 when DLAB=1.

The two bytes BASE+0 and BASE+1 together form a 16-bit number, the divisor, which determines the baud rate. Set the divisor as follows:

Baud rate	Divisor
50	2304
75	1536
110	1047
133.5	857
150	768
300	384
600	192
1200	96
1800	64
2000	58
2400	48
3600	32
4800	24
7200	16
9600	12
19200	6
38400	3
56000	2
115200	1

BASE+1 Interrupt Status Register (ISR) when DLAB=0

- bit 0 Enable received-data-available interrupt
- bit 1 Enable transmitter-holding-register-empty interrupt
- bit 2 Enable receiver-line-status interrupt
- bit 3 Enable modem-status interrupt

BASE+2 FIFO Control Register (FCR)

- bit 0 Enable transmit and receive FIFOs
- bit 1 Clear contents of receive FIFO
- bit 2 Clear contents of transmit FIFO
- bit 3 Change RXRDY and TXRDY from mode 0 to mode 1.
- bits 6-7 Set trigger level for receiver FIFO interrupt.

Bit 7	Bit 6	FIFO trigger level
0	0	01
0	1	04
1	0	08
1	1	14

BASE+3 Line Control Register (LCR)

- bit 0 Word length select bit 0
- bit 1 Word length select bit 1

Bit 1	Bit 0	Word length (bits)
0	0	5
0	1	6
1	0	7
1	1	8

- bit 2 Number of stop bits
- bit 3 Parity enable
- bit 4 Even parity select
- bit 5 Stick parity
- bit 6 Set break
- bit 7 Divisor Latch Access Bit (DLAB)

BASE+4 Modem Control Register (MCR)

- bit 0 DTR
- bit 1 RTS

BASE+5 Line Status Register (LSR)

- bit 0 Receiver data ready
- bit 1 Overrun error
- bit 2 Parity error
- bit 3 Framing error
- bit 4 Break interrupt
- bit 5 Transmitter holding register empty
- bit 6 Transmitter shift register empty
- bit 7 At least one parity error, framing error or break indication in the FIFO

BASE+6 Modem Status Register (MSR)

- bit 0 Delta CTS
- bit 1 Delta DSR
- bit 2 Trailing edge ring indicator
- bit 3 Delta received line signal detect
- bit 4 CTS
- bit 5 DSR
- bit 6 RI
- bit 7 Received line signal detect

BASE+7 Temporary data register

PC/104 Bus signal assignments

Pin	J1/P1 Row A	J1/P1 Row B	J2/P2 Row C	J2/P2 Row D
0	--	--	0V	0V
1	IOCHCHK*	0V	SBHE*	MEMCS16*
2	SD7	RESETDRV	LA23	IOCS16*
3	SD6	+5V	LA22	IRQ10
4	SD5	IRQ9	LA21	IRQ11
5	SD4	-5V	LA20	IRQ12
6	SD3	DRQ2	LA19	IRQ15
7	SD2	-12V	LA18	IRQ14
8	SD1	ENDXFR*	LA17*	DACK0*
9	SD0	+12V	MEMR*	DRQ0*
10	IOCHRDY	(KEY)*	MEMW*	DACK5*
11	AEN	SMEMW*	SD8	DRQ5
12	SA19	SMEMR*	SD9	DACK6*
13	SA18	IOW*	SD10	DRQ6
14	SA17	IOR*	SD11	DACK7*
15	SA16	DACK3*	SD12	DRQ7
16	SA15	DRQ3	SD13	+5V
17	SA14	DACK1*	SD14	MASTER*
18	SA13	DRQ1	SD15	0V
19	SA12	REFRESH*	(KEY)*	0V
20	SA11	SYSCLK	--	--
21	SA10	IRQ7	--	--
22	SA9	IRQ6	--	--
23	SA8	IRQ5	--	--
24	SA7	IRQ4	--	--
25	SA6	IRQ3	--	--
26	SA5	DACK2*	--	--
27	SA4	TC	--	--
28	SA3	BALE	--	--
29	SA2	+5V	--	--
30	SA1	OSC	--	--
31	SA0	0V	--	--
32	0V	0V	--	--

Standard PC I/O port assignments

The following chart shows the I/O addresses used by standard PC peripheral devices.

I/O address (hex)	Assignment
000-1FF	used by base system board
200	not used
201	game control
202-277	not used
278-27F	second printer port
280-2F7	not used
2F8-2FF	COM2
300-377	not used
378-37F	printer port
380-3AF	not used
3B0-3BF	monochrome adapter and printer
3C0-3CF	not used
3D0-3DF	color and graphics adapters
3E0-3EF	not used
3F0-3F7	floppy diskette drive
3F8-3FF	COM1:

5.1.2 Port Address Selection

Port	I/O Address	IRQ	Function
COM1	3F8-3FFH	IRQ 4	IR Touch
COM2	2F8-2FFH	IRQ 3	Port J4
COM3	3E8-3EFH	IRQ 7	Port J2
COM4	2E8-2EFH	IRQ 5	Not Used

5.2 PARALLEL COMMUNICATIONS PORT (J5)

There is a fully compatible IBM AT bi-directional printer port available on this computer system. The parallel port uses a 25-pin IDC style D-SUB. The pin out for the connector is:

Signal	Pin	Pin	Signal
/STB	1	14	/AFD
Data 0	2	15	/Error
Data 1	3	16	/Init
Data 2	4	17	/Slin
Data 3	5	18	Gnd
Data 4	6	19	Gnd
Data 5	7	20	Gnd
Data 6	8	21	Gnd
Data 7	9	22	Gnd
/ACK	10	23	Gnd
Busy	11	24	Gnd
PE	12	25	Gnd
SLCT	13	-	-

5.2.1 Port Address Selection

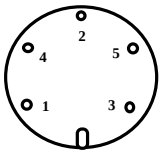
By default, the printer port is configured as LPT1. It can also be disabled or configured as LPT2/LPT3 through Setup. Refer to the accompanying SBC manual for more information.

Default I/O base address is 278 H.

Port	Address
LPT1	3BC-3BE H
LPT2	378-37A H
LPT3	278-27A H

5.3 KEYBOARD PORT (J8)

The computer supports an AT style 101 Keyboard, and a PS/2 mouse interface. BIOS support for the PS/2 mouse is also included.

Keyboard Connector **(Front View)**	**Pin** **Signal** 1 Keyboard clock 2 GND 3 Keyboard Data 4 +5V 5 /Keyboard Reset	

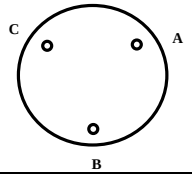
5.4 CRT (VGA VIDEO INTERFACE) (J3)

The system provide a 15-pin VGA D-SUB connector for CRT connection (CRT is not included.)

Pin	Signal	Pin	Signal
1	Red	10	GND
2	Green	11	-
3	Blue	12	-
4	GND	13	Hsync
5	GND	14	Vsync
6	GND	15	-
7	GND		
8	GND		
9	-		

5.5 POWER CONNECTOR (J1)

Input power is supplied through a 3-pin male, circular, military type connector.

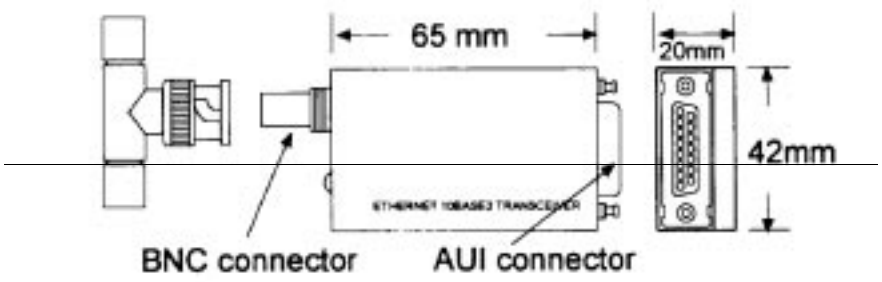
Power Connector **(Front View)**	**Pin** **Signal** A Line B Neutral C Ground	

5.6 10BASE-2 AUI ETHERNET CONNECTOR (J6)

The ST-C331 includes a DB-15 AUI Ethernet connector.

Option: 10BASE-2 Transceiver
Type: Ethernet 10BASE-2

Description:
The Ethernet transceiver complies with IEEE 802.3 transceiver specifications and 10Mbps Ethernet CSMA/CD operation to provide a connection interface to thin Ethernet coaxial cable. The transceiver is attached to the AUI connector of an Ethernet device via standard AUI cable.

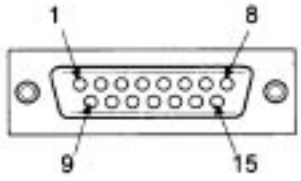


Key Features:

- Provides a complete AUI to thin Ethernet (10BASE-2) interface including:
  - Transmit function
  - Receiver function
  - Collision presence function
  - Jabber function
  - SQE (Signal-Quality-Error) test
- Supports data transfer rate of 10Mbps
- Capability for driving the coaxial trunk cable segment up to 185M (600ft) without a repeater.
- CSMA/CD access mechanism
- Selectable SQE test
- Power LED indication
- Dimensions: 42 mm x 65 mm x 20 mm
- Input voltage: 10.2 to 15.75VDC
- Input current: 250mA @ 12 VDC (typical)

Connectors and Cables

BNC connection: BNC female connector, RG-58A/U thin coaxial cable
AUI connection: D-sub 15 pin male connector, AUI drop cable (50 meters max.)

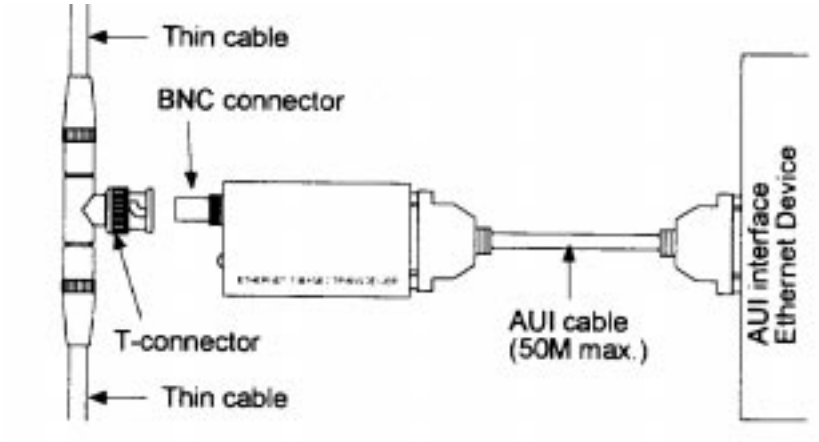


Pin Assignments of the AUI (DB15) Connector

Pin	Name	Pairs	Use
3	DO +	Transmit	Data Out (+)
10	DO -	Pair	Data Out (-)
11	DO S		Data Out Shield
5	DI +	Receive	Data In +
12	DI -	Pair	Data In -
4	DI S		Data In Shield
7	CO +	Optional	Control Out +
15	CO -	Pair	Control Out -
8	CO S		Control Shield
2	CI +	Collision	Control In +
9	CI -	Pair	Control In -
1	CI S		Control Shield
6	VC	Power	Voltage Common
13	VP	Pair	Voltage Plus
14	VS		Voltage Shield

Installation

1. Connect a BNC T-connector to the BNC female connector on a transceiver (not supplied) then connect thin coaxial cable to the T-connector. If the T-connector is located a the end of the cable segment, plug a 50 Ohm BNC terminator onto another female end of the T-connector.



2. A standard AUI cable (50 meters max.) is required to connect the transceiver to the AUI port of the Ethernet device. You may also directly mount the transceiver to the AUI port.

Setting Switches

Switch Setting	Function
SW1 ON	Enable 50 Ohm cable terminator
SW1 OFF	Disable 50 Ohm cable terminator
SW2 ON	Enable SQE test
SW2 OFF	Disable SQE test

The 50 Ohm cable terminator is built in the transceiver. If the transceiver is located at the end of a thin coaxial cable, the built-in terminator can be enabled to eliminate the need for plugging an external BNC terminator.

The transceiver is shipped from the factor with the SQE test enabled. Depending on the Ethernet device to which the AUI connector is attached, you can set the SW2 switch to OFF position to disable the SQE test function or set the switch to ON position to enable the SQE test function.

If the transceiver (not supplied) is connected to an Ethernet repeater, a 10BASE-T hub, or a wiring concentrator, the SQE test function should be disabled.

6.0 General Maintenance

The bezel and filter are made of an acrylic material, so strong solvents should not be used for cleaning purposes. A soft, lint-free cloth, along with a non-abrasive, non-acidic cleaner can be used to clean the touch screen. Refer to the following section for details regarding suitable cleaning compounds.

6.1 EFFECTS OF CHEMICALS ON THE BEZEL/FILTER

The following table provides a list of chemicals and their effect on acrylic plastic after 7 days immersion at 77° F (25° C).

Class	Name	% Solution	Effect
Acids	Acetic Acid	100	Dissolves
	Chromic Acid	40	Discolors
	Citric Acid	10	Negligible
	Hydrochloric Acid	38	Attacks
	Hydrochloric Acid	10	Negligible
	Nitric Acid	40	Attacks
	Nitric Acid	10	Negligible
	Oleic Acid	Any	Negligible
	Sulfuric Acid	98	Dissolves
	Sulfuric Acid	30	Negligible
Bases	Ammonium Hydroxide	28	Negligible
	Sodium Carbonate	20	Negligible
	Sodium Hydroxide	60	Negligible
Commercial	Cottonseed Oil	Any	Negligible
	Detergent Solution	Any	Negligible
	Kerosene No. 2 D396	Any	Negligible
	Lacquer Thinner	Any	Dissolves
	Mineral Oil	Any	Negligible
	Soap Solution	Any	Negligible
	Transformer Oil D1040	Any	Negligible
	Turpentine D13	Any	Attacks

(Continued on next page)

Class	Name	% Solution	Effect
Inorganic Compounds	Distilled Water	Any	Negligible
	Hydrogen Peroxide	28	Negligible
	Sodium Chloride	10	Negligible
	Sodium Hypochlorite	5	Negligible
Organic Compounds	Carbon Tetrachloride	Any	Attacks
	Dibutyl Sebacate	Any	Negligible
	Diethyl Formimide	Any	Swells
	Acetone	Any	Dissolves
	Aniline	Any	Dissolves
	Benzene	Any	Dissolves
	Ethyl Acetate	Any	Dissolves
	Ethyl Alcohol	95	Dissolves
	Ethyl Dichloride	50	Absorbs 2%
	2-Ethylhexyl Sebacate	Any	Dissolves
	Heptane	Any	Negligible
	Isooctane	Any	Negligible
	Methyl Alcohol	Any	Attacks
	Phenol (Aqueous)	5	Attacks
	Toluene	Any	Dissolves

7.0 Opening and Closing Procedures

The following sections provide detailed, step by step procedures for properly opening the enclosure of the computer.

Note: Anti-static handling procedures must be followed to protect against damage to the system.

7.1 OPENING AND CLOSING THE ST-C331

Note: Only qualified computer technicians should attempt to open the unit.

- Disconnect the power cable and any peripheral inputs to the system.
- Remove the top panel by unscrewing the 6 quarter-turn screws.
- Place the computer system screen down on a flat, sturdy surface, and remove the 9 440 screws along the edge of the computer and the 5 440 screws located on the back of the unit.
- Remove the LCD display interface cable from the CN2 header of the SBC.
- Disconnect the cooling fan connector from the power supply.
- Disconnect 2 flat ribbon cables (a 20-pin and a 40-pin) from the touch controller.
- Unscrew 3 screws on each side of the base plate.
- Now, the base plate that contains the SBC, hard drive and other components can slide out.

To close the enclosure of the computer, simply reverse the procedures used to open the enclosure. Refer to Appendix B to ensure that connectors are replaced in their proper sockets.

8.0 Troubleshooting

Lucas Deeco maintains a repair facility at the factory and at various international locations. Call Technical Support and ask for a RA (return authorization) number before shipping computers needing repairs. Use the telephone number in the front of this manual.

If the computer suddenly ceases to function, disconnect the power, and re-seat all the cables on their connectors. Be careful to re-connect all the cables correctly. Appendix B contains an internal cabling diagram.

Note: Troubleshooting Guide should only be used by qualified computer technicians.

Problem: System does not boot, or boots improperly.

Sub-System to Check:

- Fuse (See section 9.1)
- Single Board Computer (See section 8.4, 9.3, and refer to the accompanying SBC manual)
- BIOS system (refer to the accompanying SBC manual)
- Power Supply (See section 8.1, 9.1)
- Memory Systems (refer to the accompanying SBC manual)

Problem: Malfunctioning Display

Sub-System to Check:

- Display (See section 9.4)
- Single Board Computer (refer to the accompanying SBC manual)
- Power Supply (See section 8.1, 9.1)

Problem: Malfunctioning Memory Systems

Sub-System to Check:

- Single Board Computer (refer to the accompanying SBC manual)
- BIOS System (refer to the accompanying SBC manual)

Problem: Mouse pointer unresponsive to touch

Sub-System to Check:

- Mouse Drivers (See section 4.1)
- IR touch controller (See section 8.2.1)

Problem: Serial, Parallel, External Floppy Drive, Keyboard I/O Malfunction

Sub-System to Check:

- Single Board Computer (refer to the accompanying SBC manual)
- BIOS System (refer to the accompanying SBC manual)
- Cabling (Refer to Appendix B)

If after following the appropriate troubleshooting guidelines you cannot determine the nature of the problem, contact Deeco technical support.

8.1 POWER SUPPLY

- **Input Power:**
  Check to see if the input power to the power supply meets the requirement in section 2.4 of this manual. Refer to section 9.1 for power supply test procedures.

If the measured input power is not within the values shown, provide an alternative source of input power to the computer that satisfies the proper input power requirements. If the measured power falls within the values shown, proceed to the next troubleshooting guideline.

- **Output Power:**
  Refer to section 9.1 for procedures for testing the power supply output.

8.2 TOUCH INTERFACE

8.2.1 IR Controller Board

- **Input Power:**
  Check to see if the input power to the IR controller board meets the specifications in the following table.

Pin	Power
1	+12 VDC
2	Ground if E2 is installed, else NC
3	Ground
4	+5 VDC

If the measured input power is incorrect, refer to section 9.1 to test for possible power supply malfunctions. If you are receiving correct power, move on to the next troubleshooting guideline.

- **Touch Frame Cables:**
  Ensure that the 20-pin and 40-pin touch frame cables are properly seated at header J1 and J2, respectively. If the touch problem persists, move on to the next troubleshooting guideline.
- **SBC Interface Cable:**
  Ensure that the SBC Interface cable is properly seated at header J4 of the controller board.

If none of the above troubleshooting guidelines solves the problem, refer to section 9.2 for the test procedures for the IR Touch System.

8.3 DISPLAY

8.3.1 Active Matrix (AM) Display

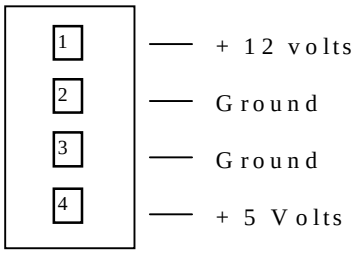
- Using a multi-meter, check the continuity of the display interface cable to ensure that it is undamaged. Verify that the cable is properly connected to the CN2 header on the SBC. Refer to Appendix B for cabling information.

Refer to section 9.4 for test procedures for the AM display.

8.4 SINGLE BOARD COMPUTER

Input Power:
Check to see if the input power to the SBC meets the voltage specifications in the following diagram:

MAIN POWER CONNECTOR, CN11



If the measured input power is incorrect, refer to section 9.1 to test for possible power supply malfunctions. If the SBC is receiving correct power, move on to the next troubleshooting guideline.

- **SBC Mounting:**
  Make sure that the solder side of the SBC is insulated from making contact with the case of the computer system. Any shorting of the SBC can cause system failure and damage to the SBC.
- **Strapping Fields (Jumper Settings):**
  Refer to the accompanying SBC manual.
- **BIOS System:**
  Determine whether or not the BIOS system is properly set for your system's configuration. Refer to the accompanying SBC manual for details on how to check and update the BIOS system. If the BIOS system is correctly configured and the problem persists, continue to the next troubleshooting guideline.
- **SIMMs:**
  Check the SIMMs to verify that they are properly installed. Missing or incorrectly aligned SIMMs will prevent the SBC from operating. Refer to section 10.4 and the accompanying SBC manual for details on proper installation procedures.

9.0 Component Test Procedure

9.1 POWER SUPPLY

This section details the procedures for testing the functionality of the power supply. Prior to running any tests on the power supply, open the computer enclosure as described in section 7.

Warning: ***The power supply produces dc voltages that can cause a severe electric shock if handled improperly. Disconnect power before opening.***

- **Input Power:**
  Plug the computer into the desired power source. The voltage should fall within this range at the power supply input connector.

Voltage @ connector J1

Pin	Power
1	Ground
2	Neutral
3	100-240 VAC at 47-63 Hz

If the measured input voltage is not within the values shown, provide an alternative source of input power to the computer that satisfies this power requirement.

- **Output Power:**
  Using a multi-meter set for DC voltage, measure the potential between ground and the pins in the following table. The voltage should match the values shown when the supply is loaded.

AC Power Supply			
Pin	**Function**	**Pin**	**Function**
1	+5 VDC	8	+12 VDC
2	+5 VDC	9	+12 VDC
3	+5 VDC	10	NC
4	Ground	11	-12 VDC
5	Ground	12	KEY
6	Ground	13	-5 VDC
7	Ground	14	Isolated Return

If the measured output power is not within the values shown, replace the power supply. Refer to section 10.1 for procedures for removing the power supply.

If no output is measured, disconnect the power supply from source voltage and check the fuse on the power supply board.

Power Supply Order Number	Description	Value of F1
704	100-240 VAC 100W	2 A/250 VAC, Fast Blow

Different suppliers may qualify as power supply vendors. Always match replacement fuses to original fuses.

Warning: For protection against fire replace the fuse only with the same type and rating of fuse.

Some power supplies have axial fuse holders. Place a screwdriver on the metal portion of the fuse, and gently lift the fuse from the socket.

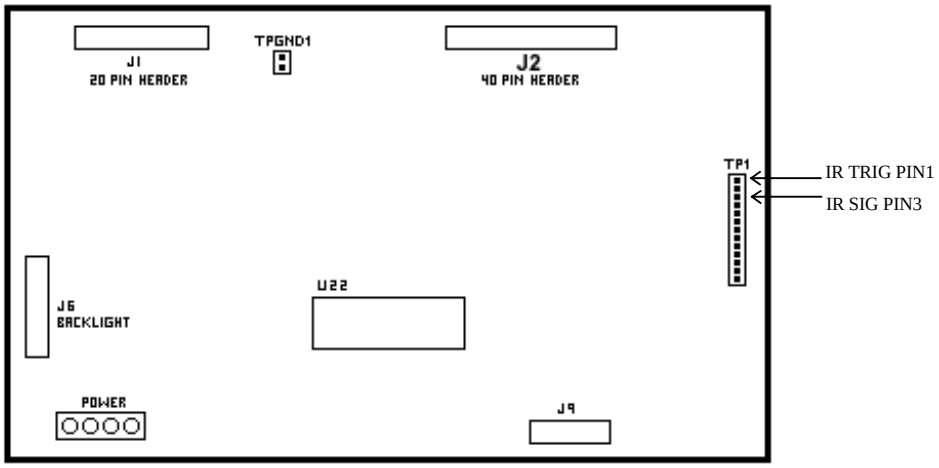
Some power supplies have fuse holders with round caps. These fuse holders are sealed with a silicon RTV type adhesive. Break the silicon seal. Use a flat bladed screwdriver to gently open the top of the fuse holder, then remove the fuse. Apply a suitable adhesive to the fuse holder cap upon re-assembly to preserve the computer's shock and vibration specifications.

9.2 TOUCH INTERFACE SYSTEM

This section provides procedures for testing the IR Touch Interface System.

- Make sure the power has been disconnected.
- Open the computer according to section 7.0, leaving the internal power cable as well as the IR Touch Frame cables connected to the controller.
- Power up the computer system.
- Connect an oscilloscope's channel A and B probes to pins 1 and 3 of Test Point 1 (TP1) on the IR controller board. Connect the ground probe to TP GND1 on the controller board. Refer to the following tables for oscilloscope settings and pin locations.

IR Touch Controller Test Point Pin Locations



OSCILLOSCOPE SETTINGS			
Signal	**Timing**	**Sec/Div**	**V/Div**
IR Trig	68 ms	20 ms	1 V
IR sig	N/A	5 ms	1 V

Verify that the 31 horizontal beam signals, and the 41 vertical beam signals all exceed a minimum of 1.2 VDC. Due to the greater distance between IR sensors, the horizontal beams will have a slightly lower voltage signal than the vertical beams.

- Place a finger on the IR Bezel and slowly move your finger in a horizontal direction, while observing the effects on the oscilloscope screen. You should see the vertical beam signals disappear and reappear as your finger breaks each IR beam on the L-boards.
- Repeat the preceding step in a vertical direction to test the horizontal beams of the L-boards. Similar results should be observed for each IR beam.

Test Results

If any of the IR beam oscilloscope signals are missing, or do not exceed 1.2 VDC, the appropriate IR sensors must be replaced. The diodes have a purple color and are located on the L-board with the 20-pin header. The transistors are clear, and are located on the L-board with the 40-pin header. Refer to the following table to determine the replacement part number for each sensor type.

Type	Part #
Diode SFH 409-2	8942
Transistor SFH 309-5	8945

If the preceding test procedures do not reveal any L-board malfunctions, it is possible that the IR controller board is the root of the malfunction. If possible, the user should swap any component suspected of being bad with a working spare. This will enable the user to determine the exact component causing the malfunction.

9.3 SINGLE BOARD COMPUTER

9.3.1 Video Output Test Procedures

- Make sure the power has been disconnected.
- Open the outer enclosure as shown in section 7, leaving the power cable connected to the SBC.
- Power up the computer system.

Connect the Channel A probe of an oscilloscope to the CN2 header of the SBC as in the following table. The ground lead may be attached to the chassis of the computer system. If the timing values do not agree with those listed in the following table, the SBC will need to be replaced.

SIGNAL	PIN	APPROXIMATE TIMING (T)	SETTING
Horizontal Sync (HS) (LP)	38	80 µS	20 µS/Div
Clock (Clk) (SHFCLK)	35	0.04 µS	0.05 µS/Div
Vertical Sync (VS) (FLM)	36	20 mS	5 mS/Div

Any problem not solved by the steps in the troubleshooting section, or by the video output test procedures indicates the SBC is malfunctioning in an area not covered by the scope of this manual. This component should be returned for testing after checking the accompanying SBC manual.

9.4 DISPLAY SYSTEMS

Displays:

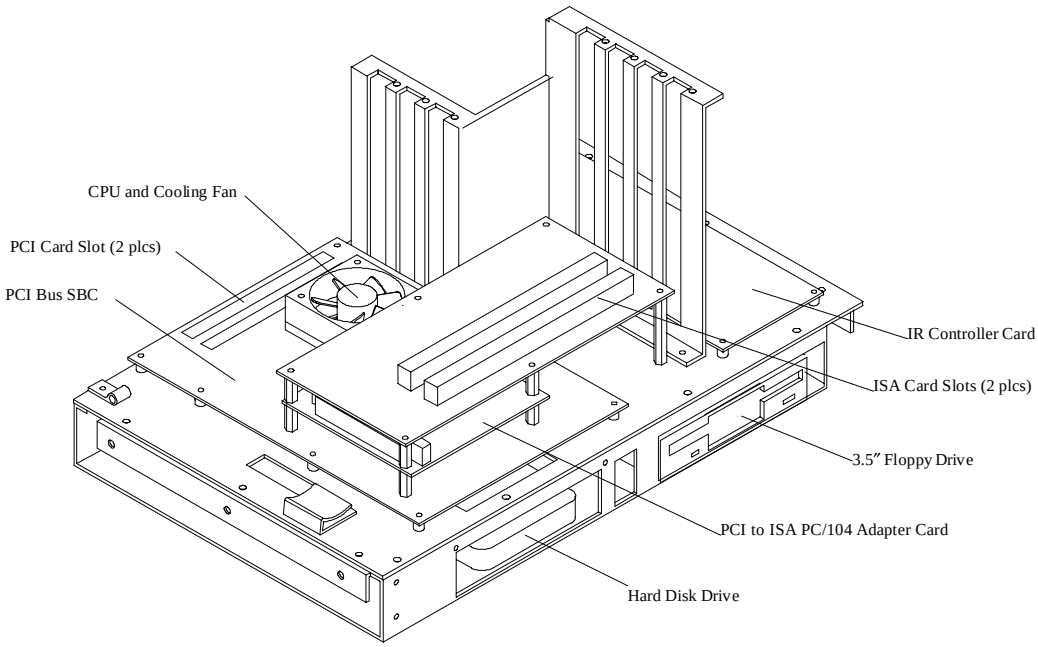
- Make sure the power has been disconnected.
- Open the computer enclosure as described in section 7.
- Remove the display interface cable and check each wire for continuity with an ohmmeter. If any of the wires are damaged, repair or replace the cable.

LCD Displays only:

- Remove the backlight interface cable and check each wire for continuity with an ohmmeter. If any of the wires are damaged, repair or replace the cable.
- Verify that all of the fluorescent lamps within the backlight assembly are properly lit. If any of the lamps are inoperative, replace the backlight assembly. Refer to section 10.7 for removal procedures.

If none of these tests provide results, the user should send the system back to the factory for testing and repair.

10.0 Component Installation and Removal



ST-C331 Component Locations

10.1 POWER SUPPLY

The following sections provide step by step procedures for the removal and installation of the power supply.

10.1.1 Removal

- Make sure the power has been disconnected.
- Open the enclosure of the computer as detailed in section 7.1.
- Remove the output power cable from the J2 power supply cable header.
- Remove the 44-pin Hard Disk Drive interface cable from the header on the SBC.
- Remove the 5-pin input power cable from the power supply.
- Remove the mounting plate holding the power supply to the enclosure. Unscrew the 4 #4 nuts from the screws.
- Remove the 4 Phillips screws holding the power supply to the mounting plate.
- Remove the power supply from the mounting plate.

10.1.2 Installation

To install the power supply reverse the order of the removal procedure.

10.2 IR TOUCH CONTROLLER BOARD

10.2.1 Removal

- Make sure the power has been disconnected.
- Open the enclosure of the computer. See section 7.
- Remove the 20-pin and 40-pin touch frame ribbon cables from the J1 and J2 headers on the IR touch controller.
- Remove the IR Interface cable from the J4 header on the controller board.
- Remove the 4-pin power cable.
- Remove the 4 Phillips mounting screws holding the controller board to the clamp plate.

Remove the IR touch controller from the computer system.

10.2.2 Installation

To install the touch controller, simply reverse the order of the removal procedures specified in the previous sections.

10.3 SINGLE BOARD COMPUTER

The following sections provide step by step procedures for the removal and installation of the SBC.

10.3.1 Removal

- Make sure the power has been disconnected.
- Open the enclosure of the computer as detailed in section 7.
- Remove the video interface assembly from the CN2 header on the SBC.
- Remove the IR Interface cable from the CN13 header on the SBC.
- Remove the input power cable from the CN11 header on the SBC.
- Remove the auxiliary power cable from the CN6 header.
- Remove the Floppy Drive interface cable from the CN15 header on the SBC.
- Remove the Parallel Port Interface cable from the CN16 header on the SBC.
- Remove the Serial Port Interface cable from the CN8 header on the SBC.
- Remove the Keyboard Interface cable from the CN9 header on the SBC.
- Remove the HDD Interface cable from the CN12 header on the SBC.
- Remove the 7 kep nuts holding the SBC to the enclosure.
- Remove the SBC from the computer system.

10.3.2 Installation

To install the SBC, simply reverse the order of the removal. Make sure that the solder side of the SBC is fully insulated from making contact with the enclosure of the computer system. Any short circuit in the SBC will prevent the system from functioning, and can cause damage to the SBC.

10.4 MEMORY REMOVAL AND INSTALLATION

10.4.1 SIMMs Removal

- Open the enclosure of the computer system as detailed in section 7.
- Gently press the retaining clips on each end of the SIMM socket outward until the SIMM comes loose form the retaining tabs.
- Gently pull the SIMM module out of the socket of the SBC.

10.4.2 SIMMs Installation

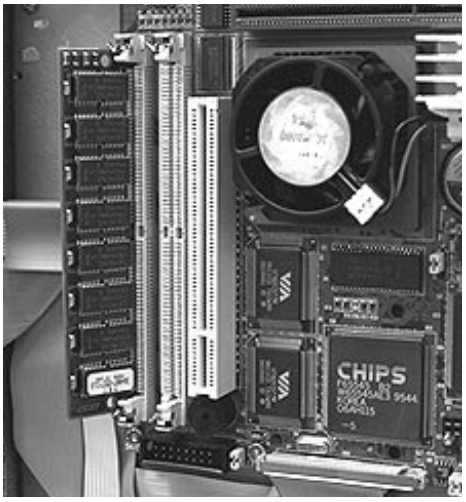


Figure A

Figure B

- Insert the SIMM at an angle as shown in Figure A. The SIMM will not physically fit in the socket unless pin 1 of the SIMM matches pin 1 of the socket.

- Gently press the SIMM into the vertical position. The SIMM will snap easily into place if the connectors are at the correct depth in the socket.

Refer to the SBC manual for memory configuration requirements.

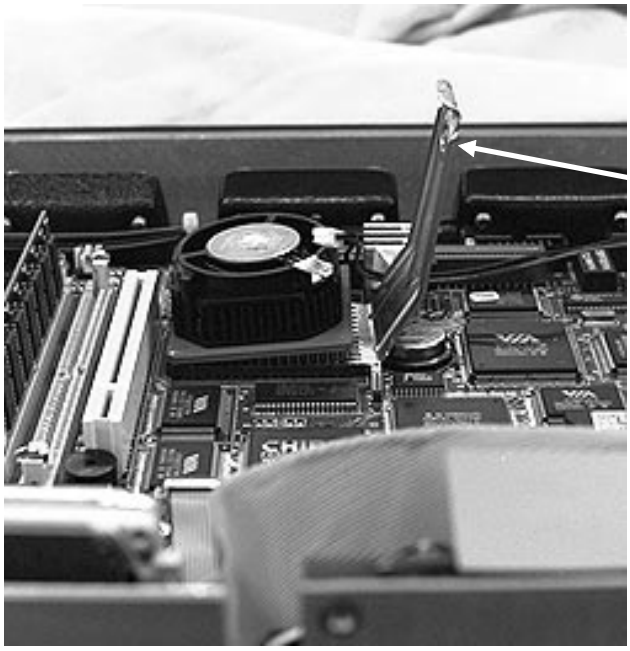
10.5 BACKUP BATTERY

Refer to the accompanying SBC User Manual for battery removal and installation.

Caution: ***There is a danger of battery explosion if the battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the manufacturer. Discard used batteries according to the manufacturers instructions. The battery is a lithium-cadmium type, and is harmful to the environment unless disposed of correctly.***

10.6 MICROPROCESSOR

10.6.1 Removal



Removing the microprocessor from the socket

Use a special IC replacement tool to remove the microprocessor from the socket.
Refer to the accompanying SBC User Manual for more guidelines.

10.6.2 Installation

The heatsink is glued to certain microprocessors. Consult the factory for replacement microprocessors with similar heat sinks.

When replacing the microprocessor, note the bevel on one corner of the IC. This designates pin 1.

Refer to the accompanying SBC User Manual for more guidelines.

10.7 DISPLAY

The following sections provide step by step procedures for the removal and installation of the display.

10.7.1 Removal

- Make sure the power has been disconnected.
- Open the ST-C331 enclosure as detailed in section 7.
- Remove the IR touch board.
- Remove the inverter connector, if the display is a LCD.
- Remove the cable adapter board. Remove the 2 screws and 2 5/16" spacers.
- Remove the display interface cable from the display.
- Remove the 4 screws holding the display assembly to the enclosure of the computer system, and remove the display assembly.

10.7.2 Installation

To install the display assemblies in the computer system, reverse the removal procedure.

10.8 L-BOARD ASSEMBLY

The L-boards provide the direct touch interface for the computer. The following sections provide step by step procedures for the removal and installation of the L-boards.

10.8.1 Removal

- Make sure the power has been disconnected.
- Remove the display assembly from the enclosure as detailed in section 10.7.
- Remove the large heavy clamp plate. Unscrew the #10 Allen head screws.
- Remove the 10 Phillips screws holding the L-board assembly to the display mounting plate.
- Remove the L-board assembly from the computer system.

10.8.2 Installation

To install the L-board assembly, simply reverse the order of the removal procedures as detailed above.

10.9 HARD DISK DRIVE

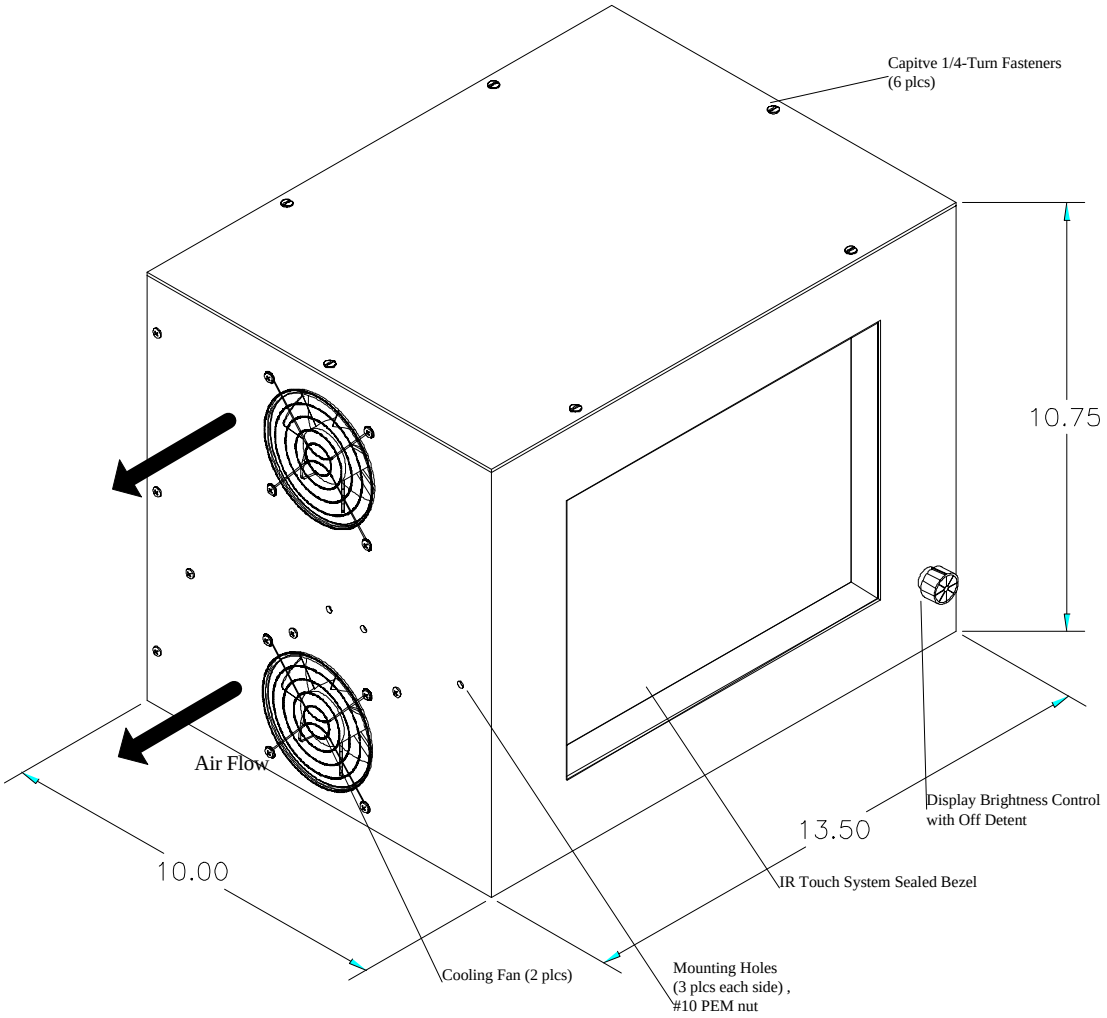
10.9.1 Removal

- Make sure the power has been disconnected.
- Open the enclosure of the computer as detailed in section 7.
- Remove the power cable from the power supply cable header.
- Remove the 44-pin Hard Disk Drive interface cable from the CN12 header on the SBC.
- Disconnect the in-line fan power connector located beneath the HDD.
- Remove the LED power indicator light.
- Remove the mounting plate holding the HDD to the enclosure.
- Remove the HDD from the mounting plate. Unscrew the 4 ¼" screws holding the HDD to the bracket.

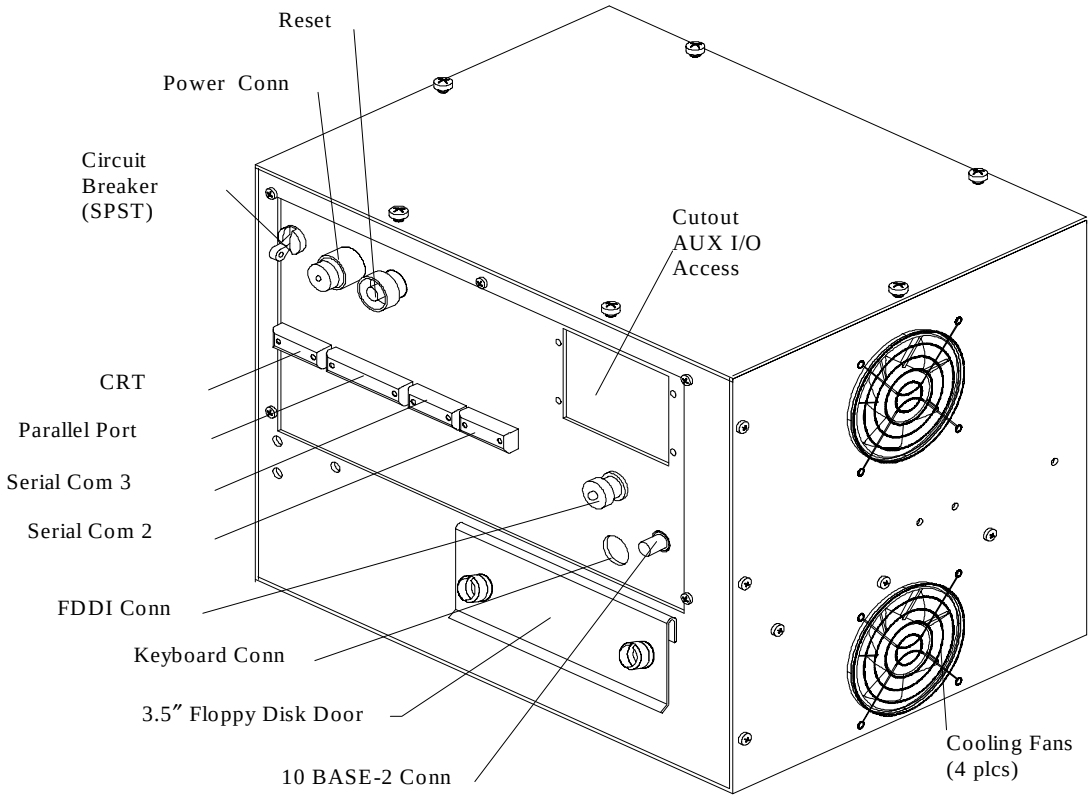
10.9.2 Installation

To install the HDD reverse the order of the removal procedure.

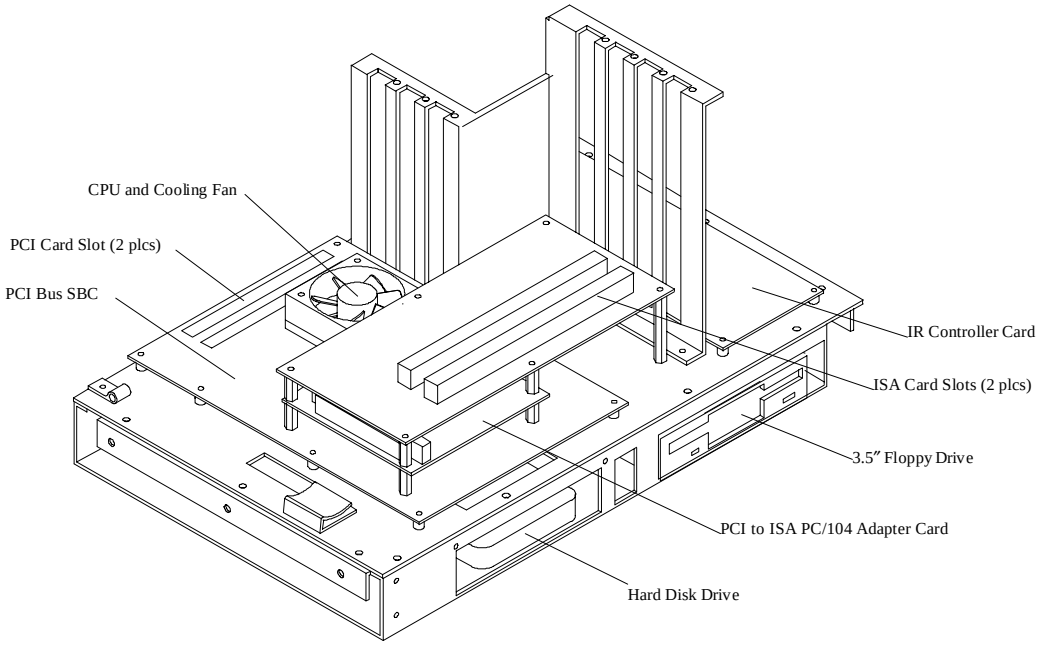
Appendix A: Mechanical Drawings



Front View

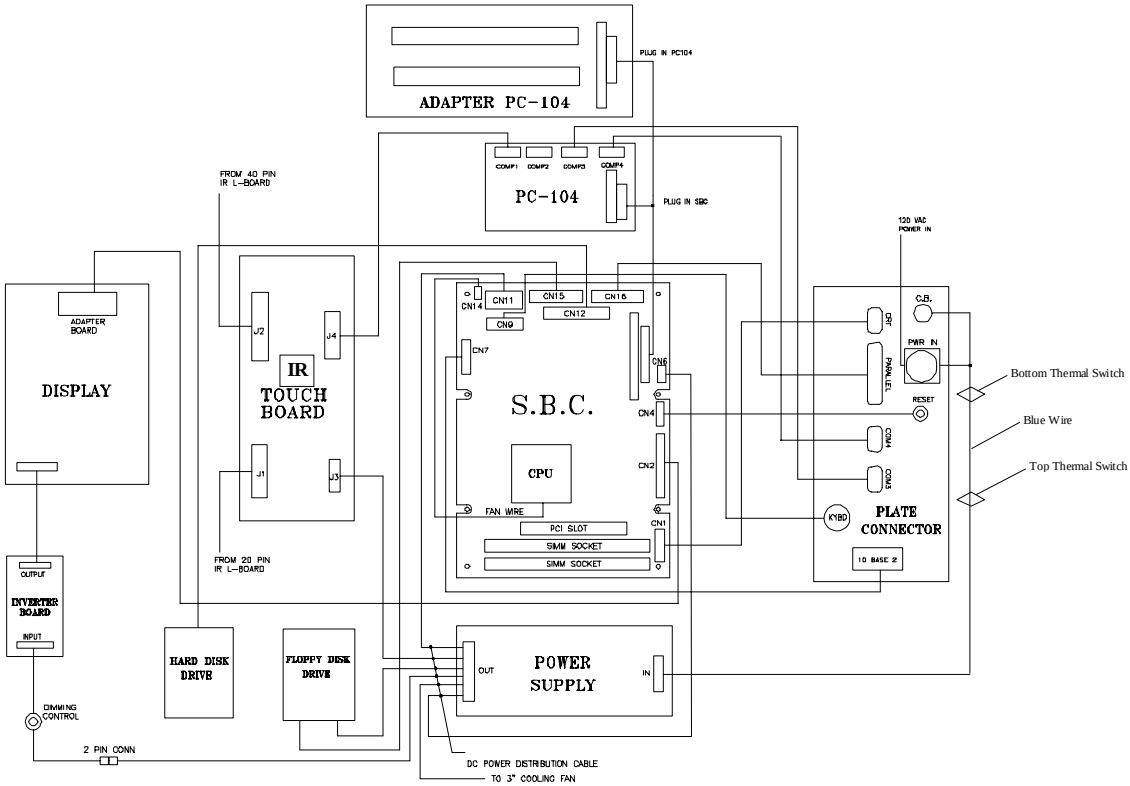

Reset
Power Conn
Circuit
Breaker
(SPST)
Cutout
AUX I/O
Access
CRT
Parallel Port
Serial Com 3
Serial Com 2
FDDI Conn
Keyboard Conn
3.5″ Floppy Disk Door
10 BASE-2 Conn
Cooling Fans
(4 plcs)

Rear View

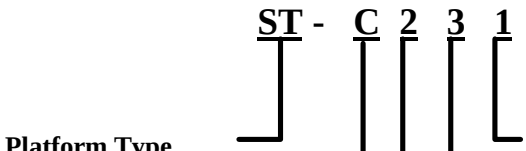


Computer System Level Layout

Appendix B: Internal Cabling Diagrams



Appendix C: Product Naming Convention



Platform Type

ST	**Enclosed System**
EM	**Embedded Module**

Processing Configuration

Designator:	**0**	**1**	**2**
Computers	**486**	**586**	**-**
Terminals	**-**	**C9**	**-**
Monitors	**-**	**Receiver Card**	**Bus Card**

Functional Type

C	**Computer, CPU-based**
T	**Serial Terminal**
M	**Monitor System**

Display Size

1	**NA**
2	**8.4"**
3	**10.4"**
4	**11.3"**
5	**12.1"**
6	**13.8"**
7	**17.7"**

Case Style

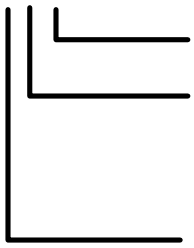
0	**No case**
1	**Rack mount**
2	**Medium Sealed Enclosure**
3	**Swivel Housing**
4	**Panel Mount Housing**
5	**Large Sealed Enclosure**
6	**Small Sealed Enclosure**

Examples

ST-C331	Sealed Computer, Medium case, 10.4" display, Pentium/SBC
EM-C031	Embedded computer, 10.4" display, Pentium/SBC
EM-T031	Embedded Module, Serial Terminal, 10.4" with a C9 controller
EM-M061	Embedded Module, VGA Monitor, 13.8" with receiver card

Display Nomenclature

3 f d s



Sequential number ID

Size of display (same as specified in base unit ID #)

1	NA	3	10.4"	5	12.1"	7	17.7"
2	8.4"	4	11.3"	6	13.8"	8	NA

Format

0 = VGA	640.480
1 = SVGA	800.600
2 = XGA	1024.768
3 = SXGA	1280.1024

Examples:

3261 = 14" (13.8") 1024.768 XGA display
3153 = 12" (12.1") 800.600 SVGA display

Limited Warranty

Lucas Control Systems Products (LCSP) warrants this product against defects in materials and workmanship for a period of one year (12 months) from the date of original shipment from the factory with the following exceptions:

- Active Matrix LCD Display. The original equipment manufacturers warranty will apply.
- Electroluminescent Display. The original equipment manufacturers warranty will apply.

During this warranty period, LCSP will, at no cost to the buyer, promptly repair or replace defective equipment returned to the factory or other authorized warranty repair center, transportation charges pre-paid by the buyer, and will return such equipment, transportation charges pre-paid. LCSP's sole obligation shall be at its option, to repair or replace any goods which have been determined to be defective by LCSP.

Equipment returned to the factory shall be accompanied by the following information:

- Returned Material Authorization (RMA) number, obtained from LCSP.
- Reason for return, with a comprehensive description of the malfunction.
- The name and telephone number of the person to contact in the event of questions or problems.
- Shipping instructions.

This warranty shall not apply to damage resulting from the improper handling, accident, negligence, loss or damage in transit, or abuse (such as applying the wrong voltage). This warranty shall be voided should the buyer attempt repairs or alterations without prior written permission from LCSP.

LCSP makes no other warranty, either expressed or implied, and disclaims any warranty or merchantability or fitness for a particular purpose.

Any action by Buyer for any alleged breach of this warranty shall be brought to the attention of LCSP by the Buyer within the warranty period.

Repairs and/or replacement under terms of this warranty shall not extend the warranty life of the original equipment supplied.

LIMITATIONS OF LIABILITY

THE BUYER AND LUCAS CONTROL SYSTEMS PRODUCTS AGREE THAT THE SOLE AND EXCLUSIVE REMEDIES FOR BREACH OF ANY WARRANTY SHALL BE REPAIR OR REPLACEMENT OF DEFECTIVE PARTS ACCORDING TO THE TERMS DESCRIBED ABOVE. LCSP SHALL NOT BE LIABLE FOR CONTINGENT OR CONSEQUENTIAL DAMAGES TO PERSONS OR PROPERTY, AND LCSP's SOLE LIABILITY IS AS SET FORTH ABOVE. THIS STATEMENT OF WARRANTY IS A COMPLETE AND EXCLUSIVE STATEMENT OF ALL WARRANTY AND LIABILITY REPRESENTATIONS OF LCSP. IT MAY NOT BE VARIED, SUPPLEMENTED, QUALIFIED OR INTERPRETED BY ANY PRIOR DEALINGS BETWEEN THE PARTIES OR BY ANY USAGE OF THE TRADE OR UPON THE FACE OR REVERSE OF ANY FORM TO WHICH THIS IS ATTACHED OR PART OF, NOR MAY IT BE MODIFIED BY ANY AGENT, EMPLOYEE, OR REPRESENTATIVE OF LCSP.

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