SoftScreen® AT

PC/AT™ Engine

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF FIGURES (*continued*)

LIST OF TABLES

LIST OF TABLES (*continued*)

1.1 PRODUCT OVERVIEW

> **NOTE**
> Some information in this manual may pertain specifically to the SoftScreen industrial computer hardware, and where noted, should be **disregarded** by the stand-alone software user.

The SoftScreen AT ™ is designed to be a flexible and powerful PC/AT based Human Machine Interface (HMI) solution. The goal of this product is to give the user the greatest productivity and flexibility in the design of interface solutions for PLC control systems. There are two parts to SoftScreen: the Development System and the Run-time System.

The SoftScreen Development System was designed to support a wide range of Xycom interface products. When using SoftScreen AT runtime software, development may be accomplished on-line or off-line. All other SoftScreen runtime (engines) or targets, as they may be referred to, are off-line development.

The SoftScreen AT runtime system comes in three forms: stand-alone AT software, which runs on any PC/AT or compatible unit; software installed on a SoftScreen Industrial Computer; or the 9450-SoftScreen Workstation (9450-SSW), which is similar to the SoftScreen AT computer, but it does not have any disk drives and it boots directly into SoftScreen.

The Xycom SoftScreen AT Computer is an operator interface device for PLCs which incorporates a rugged enclosure, high resolution display (with impact-resistant shield), built-in sealed-membrane keypads, and external keyboard ports. The Xycom SoftScreen AT Computer is sealed to both NEMA 4 and NEMA 12 specifications, and can be mounted in a standard EIA 19" rack or in an equipment enclosure panel.

Like all of Xycom's terminals, the SoftScreen Computer is specifically designed for reliability under the extreme conditions of shock, vibration, temperature, and humidity found on a plant floor or other harsh environments. (See Xycom's hardware manual for specifications).

The SoftScreen AT Computer runs applications created on the development system. Applications are either downloaded to the SoftScreen AT Computer over a single RS-232C line or an RS-485 multi-drop network; run from the development system on-line; or called directly from DOS. The SoftScreen AT Computer is user configurable to provide simultaneous communication with multiple networks for most PLC interfaces. This communication link allows SoftScreen to directly access the PLC's data table to write and read information for plant floor personnel, usually without adding any additional control logic.

The SoftScreen Computer is an open, versatile system. Features include

- Two serial ports
- Printer port
- Time-of-day clock/calendar
- Self-diagnostics
- Password protection for the Development System and DOS

If you have a 9450-SSW system or have installed a 9000-RAD card in your system, you will have the following additional features:

- Two optically isolated and buffered serial ports (each port can be configured as RS-232C or RS-485)
- Fault relay output
- Temperature sensor
- On-board battery
- External battery connector
- Extended BIOS/data logging static RAM (SRAM)
- Watchdog timer
- Solid State Disk (SSD) eight memory sockets
- Off-line diagnostics

> **NOTE**
> The quick start-up sections provide the basic steps, for those already familiar with SoftScreen, to get the system up and running without going through the details in the manual.

1.2 SOFTSCREEN AT QUICK START-UP

To prepare the system for use, perform the steps listed below:

1. Install the SoftScreen AT Engine Software by typing **A:Install** or **B:Install**

2. Verify memory requirements (i.e., 720 Kbytes of expanded memory).

3. Attach protection key to the parallel printer port of your computer.

4. Create an application using the SoftScreen development system.

5. Connect any other peripherals to the appropriate ports.

6. Type **PCENGINE "APPNAME"**, where APPNAME is the name of the application you just created.

7. The system displays a message prior to executing the start-up screen.

1.3 9450-SSW QUICK START-UP

To prepare the system for use, perform the steps listed below:

> **NOTE**
> The touch screen driver will automatically be loaded. If you do not have a touch screen installed on your system, a message displays that says `Touch Screen not Installed`, but the system will continue to reboot.

1. Connect any peripherals to the appropriate ports.

2. Download an application. Refer to the SoftScreen Development System Manual for more information.

3. When the SoftScreen AT Runtime System screen appears, press <Ctrl><Break> to view the PCENGINE Main Menu.

4. Choose the Setup Menu, then select the Startup Application option.

5. Type in the application name, and then press Okay. This sends you back to the PCENGINE Main Menu.

6. Select the X in the top left corner and press <Enter>. This returns you to the DOS prompt.

7. Type PCENGINE to open the run-time system, or reboot. The SoftScreen Runtime Engine will open and the default application will appear on your computer screen.

2.1 INTRODUCTION

This chapter describes the software installation procedure for the SoftScreen PC/AT Runtime Engine.

2.2 SYSTEM REQUIREMENTS

Following are the recommended system requirements for operation of the SoftScreen AT Engine:

- IBM PC/AT-compatible computer with 386SX Processor @ 16 MHz or higher
  -SVGA graphics
  -20 Mbyte hard disk or larger*
  -High-density 5¼" or 3½" floppy drive*
  -2 Mbyte DRAM, DOS 5.0 or later loaded high
- EMM386 Memory Manager
- Hardware protection key*

**Not required on 9450-SSW systems*

Refer to your DOS user manual for specific details on loading DOS high. The engine software requires 720 Kbytes of extended memory. Systems with DOS versions before 5.0 cannot be loaded high and thus, cannot provide enough free memory to run PCENGINE.

> **NOTE**
> If you are using a 9450-SSW diskless system, sections 2.3 and 2.4 do not apply to you. Skip them and turn to Section 2.5, Exiting the Runtime System.

2.3 INSTALLING THE HARDWARE PROTECTION KEY

To run PCENGINE, a hardware protection key is required. The hardware protection key, provided with PCENGINE, must be connected to the parallel printer port of your computer. The side to be attached to the port is labeled ↑**COMPUTER**↑. Screws are provided to connect the key securely to the port. (A message is displayed if the key is not present when trying to run PCENGINE.)

If the computer is close to a wall or another obstacle, you can attach an extension cable to the port, then attach the key to the cable. Use a straight-through, 25-pin, male-to-female cable.

This key is transparent to any peripherals (such as a printer) attached to the system.

> **NOTE**
> If you have any problems with the hardware protection key, contact Xycom Technical Services Department. Do not discard or disassemble the key. If a replacement is necessary, you are required to return your key to Xycom.

2.4 INSTALLING THE SOFTSCREEN RUNTIME ENGINE SOFTWARE

Software is shipped on 5¼" high-density (1.2 Mbytes) and 3½" (720 Kbytes) diskettes. Files on the diskettes are compressed and cannot be copied directly to the hard drive.

To decompress the files, run the install program provided on the diskettes. Place the diskette into the disk drive and specify the program as shown below:

C:> **A:Install** or **B:Install**

The installation program asks a series of questions, including font selection and default language selection. If the installation is successful, a closing message indicating this is displayed. Otherwise, correct the detected condition and rerun the install program.

PCENGINE requires that an expanded memory manager such as EMM386 is present before it will run. An example of the CONFIG.SYS file is shown below:

```
DEVICE = HIMEM.SYS
DEVICE = EMM386.EXE 720
DOS = HIGH,UMB
```

> **NOTE**
> PCENGINE will not run without the 720 Kbytes of expanded memory called out in the EMM386 line.

> **NOTE**
> When using a board in the backplane that is memory based (S&S card or SA85) it may be necessary to exclude the memory that the board requires using the EMM386 X= address range parameter. See the DOS manual for more details.

To run PCENGINE, change to your SoftScreen directory and type PCENGINE. PCENGINE can be run from other directories if you add a path statement (shown below) to your AUTOEXEC.BAT file. PCENGINE will access disk data faster if you enable the read caching feature of SMARTDRV in the AUTOEXEC.BAT file.

```
PATH = C:\SOFTSCRN;
LH SMARTDRV.EXE C
```

NOTE
We do not recommend allowing write caching of data by SMARTDRV. Data could be lost if the engine is lost before SMARTDRV finishes.

NOTE
To use SMARTDRV with SoftScreen effectively, the system should have a minimum of 2 Mbytes of extended memory.

SMARTDRV should not be added to the AUTOEXEC.BAT file on units with 2 Mbytes RAM installed (this configuration only provides 1 Kbyte of extended memory).

2.5 EXITING THE RUNTIME SYSTEM

PCENGINE can be run four different ways, as described in sections 2.6, 2.7, 2.8, and 2.9. Once PCENGINE is running, you may do the following to exit the system:

<Ctrl> <Break> — This takes you into the Main Menu. (See Chapter 3 for information about the Main Menu). If a password is required, you must enter the password correctly before continuing. If the password is entered incorrectly, the original screen reappears. Once the password is entered correctly, control is passed to the menu.

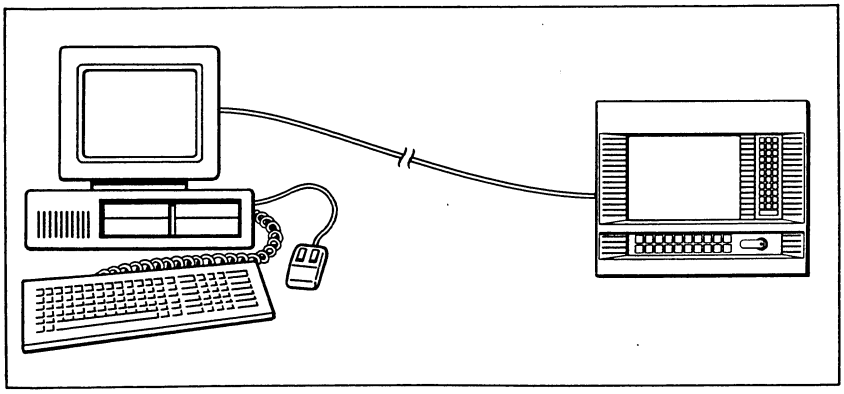
<Ctrl> <Alt> <Delete> — This returns you to DOS. If a password is required, you must enter the password correctly before continuing. If the password is entered incorrectly, the original screen reappears. Once the password is entered correctly, control is returned to DOS. Before returning to DOS, a message is logged to the alarm summary, ***EXITED RUNTIME ENGINE***.

Table 2-1. Keys to Exit PCENGINE

Where PCENGINE Started	<Ctrl><Alt><Delete>	<Ctrl><Break>
DOS (PCENGINE_App)	DOS	Main Menu then to DOS
SoftScreen Development Tools Run or App_Run	DOS	Main Menu then to the Development System, which loads the application

As of revision 4.5, you can configure pseudo keys, function keys, touch buttons, and selector buttons to exit to DOS from PCENGINE. This function is configured in the SoftScreen Development System (version 4.5 or later) by selecting "Exit SoftScreen" in the configuration menu function field for each of these features. Refer to the SoftScreen Development System Manual for more information.

2.6 CONNECTING TO AN OFF-LINE DEVELOPMENT SYSTEM



Although this may be used less frequently than using the development system on-line, the off-line development system will connect from COM 1 or COM 2 of your development system computer to COM1 of your SoftScreen Computer.

For RS-232C download, use the 9-pin to 25-pin SMART cable and adapter supplied with the SoftScreen development system. First, attach the female 25-pin side of the connector adapter to the 25-pin male end of the cable. Now your cable has two female 9-pin connectors, which can attach from port 1 or 2 of the off-line development system to COM 1 of your SoftScreen workstation. The switch on the cable should be positioned in the middle. Both yellow lights should be on during normal operation when attached to both COM ports.

For more information, see the sticker on the cable or the manual enclosed with the cable. The pinouts for a standard null modem cable, which can be used as well, are shown in Figure 2-1.

NOTE
Make sure the send port on the development system matches the one specified in the SoftScreen software under the Application-Load-Configuration-Edit-System-Send Port or Configuration-Send Port.

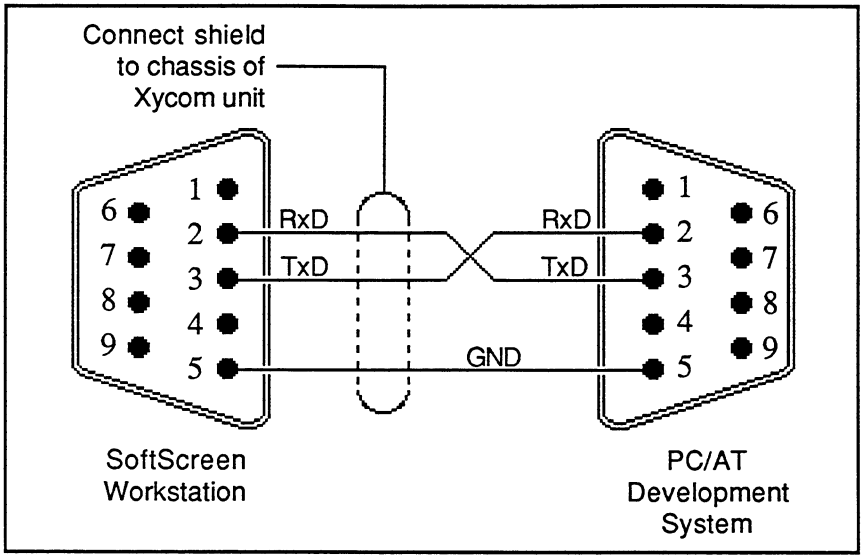


Figure 2-1. Development System to SoftScreen Engine Interface via RS-232C

For RS-485, construct a cable to connect from COM 1 of your SoftScreen workstation to COM1 or COM2 of your off-line development system.

To implement an RS-485 network, the development system and the runtime engine must support the RS-485 communication standard. Depending on your hardware, you may need to purchase an RS-232 to RS-485 converter. Refer to Figure 2-2 for an example of constructing an RS-485 wiring network. Depending on the manufacturer of your RS-485 converter, the pinouts for the cabling could be different. Refer to your converter manual for specific wiring information if you wish to set up a multidrop network of PC engines and an off-line development system.

To run PCENGINE as a slave on the multidrop network, start PCENGINE by typing "PCENGINE" from the DOS command line. This brings up the title screen for PCENGINE, but does not execute an application. At this point, you must download an application from the development system to the engine. In the development system application Port 1 must be set to MULTIDROP PORT to download an application to it; you must not configure Port 1 as a PLC PORT or NONE. Refer to Chapter 3 to set up your station address on the multidrop network. Once the application has been received, it begins executing and is fully operational. If an error occurs while invoking PCENGINE, verify that all of the system requirements have been met (refer to Section 2.2).

For additional information on RS-485 control lines, see Section 3.3.3.

NOTE

You must download the configuration *first* to the engine. The configuration contains the name of the application which is required before any screens, recipes, or reports can be received. (The configuration is always downloaded *first* when an "APPLICATION SEND" is done from the development system.)

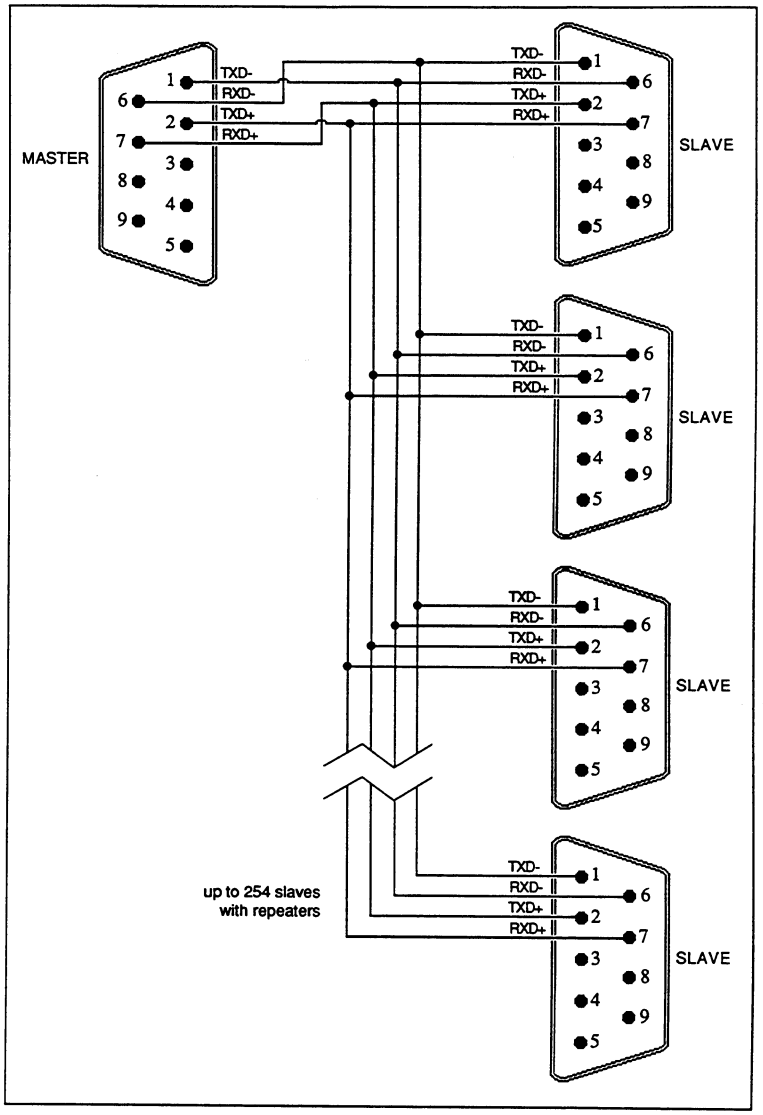


Figure 2-2. PC Engine Multidrop Interface Example via RS-485

2.7 RUNNING PCENGINE FROM THE DOS COMMAND LINE

The SoftScreen PC/AT engine can begin running an application immediately from the DOS command line. If you have an application that has already been created by the development system, you can proceed with this section. If not, refer to your development system manual for information on creating applications prior to attempting this technique.

To run an application, enter **PCENGINE "APPNAME"**. "APPNAME" is the name of the application that has been created. You should see two brief messages about constructing log tables (even if no trends are present) and filling internal PLC scan tables. The start-up screen will be drawn on the engine computer after you enter this command. At this point, PCENGINE executes your application. If any errors occur while trying to invoke PCENGINE, verify that the hardware key has been installed (on stand-alone systems) and system requirements have all been met (refer to Section 2.2 or Error Message Section 3.6.3).

2.8 RUNNING PCENGINE FROM THE DEVELOPMENT SYSTEM

If the development system software has been installed on the same workstation as PCENGINE (i.e., on-line), you can proceed with this section. If not, refer to the development system manual for information on its installation and then return to this section.

Once you have created an application with the SoftScreen Development System, it can be run directly from that system. To allow the development system and PCENGINE to call each other, **PCENGINE.EXE**, all of the font files **(*.FNT)**, and **SOFTSCRN.EXE** must be in the DOS path. (Refer to your DOS manual for information on the path command.) When the path is set up correctly, you may start the development system by typing **SoftScrn**. Next, select **"APPLICATION RUN"** from the development system. This starts PCENGINE by running that application. If errors are detected in this step, make sure the hardware key has been installed and system requirements (Section 2.2) have been met.

To run an application, PCENGINE must be invoked from the directory in which the application files reside. The SoftScreen Development System automatically changes to the directory in which the application resides before calling PCENGINE.

2.9 RUNNING PCENGINE FROM THE 9450-SSW

On the 9450-SSW, PCENGINE does not automatically load the default application. However, you can specify a default application by performing the following steps:

1. When the SoftScreen AT Runtime System start-up screen appears, press <Ctrl><Break> to view the PCENGINE Main Menu.

2. Choose the Setup Menu, then select the Startup Application command.

3. Type the application name, and then press Okay. This sends you back to the PCENGINE Main Menu.

4. Select the X in the top left corner and press <Enter>. This returns you to the DOS prompt.

5. Type PCENGINE to open the run-time system, or reboot. The SoftScreen Runtime Engine will open and the default application will appear on your computer screen.

3.1 INTRODUCTION

This section discusses the SoftScreen AT Runtime System menus and how the unit functions as the runtime engine for the SoftScreen software.

3.2 SELECTING ENGINE MENUS

When the SoftScreen AT Runtime System is running, type **<Ctrl><Break>** to access the Engine Menus. You are asked for a password when accessing Engine Menus from any screen if the security password is enabled in the current application.

Menu choices can be accessed from the keyboard in the following ways:

First Letter Method Type the highlighted letter of the selection (e.g., **D** for **D**iagnostics).

Cursor Method Use the cursor keys to select the menu item as indicated in the box at the bottom of the screen. When the menu item is highlighted, press **<Enter>**.

If a menu is selected, press <Esc> to return to the previous menu or the menu bar. If the menu bar is selected, press <Esc> to exit to the SoftScreen AT Runtime System start-up screen.

3.3 MAIN MENU

Following are the menu selections available on the Main Menu:

X - Exit to DOS or development system
Diagnostics
Setup
Clock

These four selections access all the features of the SoftScreen Engine Menus. The following sections explain how to get to the various features.

3.3.1 Exiting the Runtime Engine

When you type X, one of two things happens:

- You return to DOS if the engine was invoked from DOS.

  Or

- You return to the development system and your application is loaded if the engine was called from the development system.

3.3.2 Diagnostics Menu

The Diagnostics Menu has three options from which to choose:

Individual Tests Type **D**iagnostics **I**ndividual Tests from the Main Menu. This allows testing any of the system diagnostics one at a time. The system diagnostics—comm ports, printer port, and speaker—are described on the following page.

Continuous Test Type **D**iagnostic **C**ontinuous Test from the Main Menu. It accesses the SoftScreen continuous testing feature. Press <Esc> to exit.

Total Test Type **D**iagnostic **T**otal Test from the Main Menu. It accesses all of the SoftScreen continuous testing features (comm ports, printer port, and speaker) one by one. Press <Esc> to exit.

During any of the tests, a message that indicates the test is being performed appears on the screen. The message is cleared if the test passes. If the test fails, another message, which gives some indication of the type of failure, is displayed.

If a failure occurs, press the space bar to continue the test or press <Esc> to terminate the test. The following are brief descriptions of each test:

Comm Ports This test involves serial loopback wiring to be installed on all com ports. A failure indicates port and type of failure, specifying which pin is causing the error.

Connections needed for the com port test are as follows:

DCD(1) - DTR(4) RXD(2) - TXD(3) CTS(7) - RTS(8)

> **NOTE**
> All ports tested must be set for RS-232C operation.

Printer Port Printer test writes data to the printer. If it fails, either an out-of-paper or an off-line condition is indicated. A successful test prints three lines of data.

Speaker This test pulses the speaker for 0.5 seconds. Press any key to terminate.

3.3.3 Setup Menu

The Setup Menu provides the following selections:

- Station Address
- Current Engine Status
- Multidrop Port Configuration
- Screen Saver
- Touch Screen Calibration
- Internal Register Storage
- Language Choice
- Startup Application
- Disk Alarms

> **NOTE**
> Press the space bar to cursor through the available choices for each menu item or type in the appropriate value.
>
> Press <Esc> to return to the Setup Menu.

Station Address
Use the Setup Menu to define the station address for the SoftScreen Workstation engine. If more than one station is used, each workstation must be set up individually. This menu prompts for the station number to assign to the workstation. You can enter up to three digits. The number is displayed to three places on the engine's title screen. For example, if you enter 1, it is displayed as 001. Up to 255 stations can be connected on a multidrop network.

Current Engine Status
This displays the name of screens, recipes, and reports in the current application. It also indicates the engine version number and the configuration for the PLC ports. Press any key to advance one page; press <Esc> to exit.

Multidrop Port Configuration

If you have an RS-485 converter for any COM Port on the PCENGINE Workstation, you need to fill in this form:

Port to Configure
Comm Port (1-4)

Once a COM Port has been specified, press <Enter> and specify settings in the Configure Multidrop Port Form:

Configure Multidrop Port	
Enable Multidrop Control	Yes/No
RS-485 Tri-State Pin	RTS/DTR
Transmit Enable Pin Sense	High/Low

The options in the Configure Multidrop Port Form are described in Table 3-1:

Table 3-1. Configure Multidrop Port Form Options

Option	Description
Enable Multidrop Control	Defaults to no for all ports.
RS-485 Tri-State Pin	Selects which pin—RTS or DTR—controls the transmitter for your specific RS-485 converter.
Transmit Enable Pin Sense	Selects the state—High or Low—in which the pin must be set on the RS-485 converter to enable the transmitter.

NOTE

You must reconfigure the multidrop ports when updating to Revision 4.1 from 3.X.

Screen Saver
This option determines how long PCENGINE waits for a keystroke or touch screen selection before transferring control to a user-defined screen saver. The user must configure the system to enable this operation. The value entered can be between 1 and 255 minutes. Refer to Section 3.11 for information on how to use this option in conjunction with register #15.

Touch Screen Calibration
A program is available to calibrate your touch screen (the touch screen driver must be installed and turned on in the target configuration). This information is stored in the **PCENGINE.ICF** file and is used as the current calibration for the touch screen each time PCENGINE is invoked. To calibrate, touch two points on the screen for EGA, and then any key. Then touch two points on the screen for VGA mode calibration. If a touch screen is not installed, the calibration program will not run.

Internal Register Storage
This option specifies whether or not the engine's internal register values should be maintained when PCENGINE is properly exited. If Yes is selected, all register values are saved in the file PCENGINE.REG upon exiting the engine. When PCENGINE is started again, the registers are restored to these values. If No is selected, all registers are initialized to zero. This option does not effect the time and date registers. No is the default.

Language Choice
This option selects different languages for runtime standard alarm messages and date display. English, French, German, Italian, and Spanish are supported.

Startup Application
This option allows you to specify which application the engine will automatically run when invoked without an application name from DOS. None is the default.

Disk Alarms
If you specify No for this option, the engine will not generate an alarm if it finds the free space on a disk to be less than 5% of the total disk space. Yes is the default.

3.3.4 Clock Menu

The Clock Menu checks or sets the following parameters: year, month, day, hour, minute, and second.

Use the space bar to select check or set clock operation and press <Enter>. If you choose set, use the up and down arrow keys to highlight the area to change and enter the new specification. If you choose check, any changes made are not saved.

3.4 EXITING TO DOS

At any time while running the system, you can type <Ctrl><Alt><Delete> to return to DOS (if you are in the Engine Menu, <Ctrl><Alt><Delete> does not function). If the security password has been enabled by the development system for the application, you are prompted for a password before returning to DOS. If an alarm is on the screen, <Ctrl><Alt><Delete> is buffered until the alarm is acknowledged or goes off the screen.

3.5 OBJECT CONFIGURATION

Objects are either static or dynamic. Dynamic objects are objects that can change color, based on their configured states, and/or change size, based on their configured value expressions, minimum values, and maximum values. Bars can expand left, right, up, or down. Rectangles, squares, circles, and ovals expand outward from their centers. Pies expand in the same directions that they were created. Objects expand proportionately to their set minimum and maximum values. They are never displayed larger than the maximum or smaller than the minimum.

Static objects are objects that have no configured value expressions or states. They are displayed exactly as they are drawn.

The engine evaluates states entered in an object's configuration. If there is a list of conditional expressions, they are evaluated top to bottom. If a conditional expression is true (non-zero), the color or text changes, depending on the configured State. If the expression is false (0), and there is no state defining this condition, the object or text is displayed exactly as it was created.

> **NOTE**
> If there is a list of conditional expressions, the last one that evaluates to true is used by the engine to determine the current state of the object or text.

3.6 ALARMS

All alarms contained in an application are continuously scanned, even when they are not displayed on the current screen. This allows an alarm message to be displayed on the current screen if any alarm in the application occurs. The displayed message contains the object tag name in which the alarm occurred, the alarm value, the date, and time.

When Alarm Acknowledge = No is selected in an object's configuration, the alarm appears on screen for the time specified in the Target Configuration. Press <Home> to override the specified time and cancel the alarm message. When Alarm Acknowledge = Yes is selected, the alarm message appears until <Home> is pressed.

Other function keys or touch buttons can be configured to acknowledge an alarm. See the SoftScreen Development System Manual for more details.

> **NOTE**
> Alarms are not scanned while the engine is filling its internal PLC point scan table. This keeps invalid alarms that are tied to PLC points from occurring.

3.6.1 Alarm Summary

All alarms are recorded in an alarm summary and stored in a file named **APPLICATION.ALM**, where "APPLICATION" is the name of the current application. The file is stored in the current directory. The alarm summary contains the following information: object name, alarm condition (high, low, out of alarm), alarm value, date, time, and status. Alarms are listed chronologically, with the oldest alarm appearing first.

For an alarm requiring an acknowledgement, the status message is either the date and time of acknowledgement or a message that an acknowledgement is required. Use the <Arrow> keys and <Page Up> and <Page Down> keys to scroll through the alarm summary and select an alarm. Use <Home> to acknowledge a selected alarm. The status message is blank for an alarm with acknowledge disabled.

A sample alarm summary is shown below:

Object Name	Alarm Type	Value	Time	Date	Status
Object 1	HIGH alarm	345.00	13:30:20	11/15/91	ack 3:31:15 11/15/90
Object 1	out of HIGH alarm		13:35:20	11/15/91	
Object 7	LOW alarm	2.00	13:37:20	11/15/91	waiting for ack

> **NOTE**
> Use touch buttons or the keyboard to move around in the alarm summary and alarm view files. User-configured function keys do not work when you are in these files.

> **NOTE**
> The screen name of the alarm summary is **AlarmSum**. It is not user configurable. For AlarmSum to display on the engine, it must be tied to a function key, pseudo key, or touch button in the development system. No other screens can be named AlarmSum.

<Esc> exits the alarm summary and <Delete> deletes an alarm that is not waiting to be acknowledged. Alarms are listed white on blue. White on black indicates the alarm currently selected.

3.6.2 Alarm View

This screen is exactly like the Alarm Summary screen described in Section 3.6.1, except Delete (both keyboard and touch screen) is disabled.

> **NOTE**
> The screen name of the alarm view is **AlarmVu**. It is not user configurable. For AlarmVu to display on the engine, it must be tied to a function key, pseudo key, or touch button in the development system. No other screens can be named AlarmVu.

3.6.3 Alarms and Error Messages Generated by PCENGINE

The following is a list of Alarms and Error messages generated by PCENGINE.

HIGH alarm	An object has met or exceeded its maximum value.
LOW alarm	An object has met or has gone below its minimum value.
Out of HIGH alarm	An object is no longer at or exceeding its maximum value (must be preceded by "HIGH alarm").
Out of LOW alarm	An object is no longer at or below its minimum value (must be preceded by "LOW alarm").
Printer is offline alarm	The application is trying to print and there is an error with the printer.
Printer is online alarm	The printer resumes operation after a Printer is offline alarm is generated.

Communication Error ('xxxxx') on port 'y'	Communication to the device on port 'y' has stopped, or is in error.
Communication restored on port 'y'	Communication has been restored with the device on port 'y'.
Recipe Not Performed	PCENGINE has been given too many recipes too quickly to load.
Alarm Table exceeded	There are either too many alarm objects or alarmed points in the application. The internal table that contains these points for quick scanning by PCENGINE has been exceeded. You must decrease the number of objects that are tied to an alarm to resolve this error. (See Section 3.21.3 for more information).
Exited Runtime Engine	This message appears when exiting PCENGINE to either DOS or the Development System.
Engine In Idle Mode	This message appears when PCENGINE is put into IDLE mode by a function key, pseudo key, or touch button.
Engine In Active Mode	This message appears when PCENGINE is put into ACTIVE mode by a function key, pseudo key, or touch button (this is preceded by Engine in Idle Mode).
Trend Table Exceeded	The internal table that contains historical information about the pens for all Trends, Event Trends and XY Plot objects has been exceeded. Reduce the total number of pens to resolve this error. (See Section 3.21.4 for more information).
File Open Error	This error, '**nnnnnnnn.xxx**', occurs when PCENGINE has detected an error when trying to open the file 'nnnnnnnn.xxx'.
File Close Error	This error, '**nnnnnnnn.xxx**', occurs when PCENGINE has detected an error when trying to close the file 'nnnnnnnn.xxx'.
File Read Error	This error, '**nnnnnnnn.xxx**', occurs when PCENGINE has detected an error when trying to read from the file 'nnnnnnnn.xxx'.
File Write Error	This error, '**nnnnnnnn.xxx**', occurs when PCENGINE has detected an error when trying to write to the file 'nnnnnnnn.xxx'.
File Seek Error	This error, '**nnnnnnnn.xxx**', occurs when PCENGINE has detected an error when trying to seek a new location in the file 'nnnnnnnn.xxx'.

x:Less Than 5% Of Total Free Space	Total free space on the disk 'x:' is less than 5% of the total available space on the disk.
PLC Scan Table Overflow	There are more than 400 PLC points in the current screen plus the number of points that are tied to an alarm.

3.7 DATA ENTRY, STRING ENTRY, AND RECIPE ENTRY

This section explains data, string, and recipe entry.

3.7.1 Cursor Positioning During Data, String, and Recipe Entry

<Home>, **<Page Up>**, **<Page Down>**, and the **<Arrow>** keys (←↑↓→) move the cursor between entry objects. Press <Home> to view the cursor. Press <Enter> to hide the cursor.

Home Key
Press <Home> to place the cursor at the first entry object drawn. Each time <Home> is pressed, the cursor moves to the next entry object drawn. When the last object drawn is reached, <Home> wraps around to the first one created. (The order in which the objects are drawn can be changed with the development system.)

Page Up Key
Press <Page Up> to move the cursor between entry objects, in the reverse order they were drawn. When the first entry object created is reached, <Page Up> wraps around to the last one created.

Page Down Key
Use <Page Down> to move between entry objects in the order they were drawn. <Page Down> wraps around to the first entry object created when it reaches the last entry object created.

> **NOTE**
> The <Page Up> and <Page Down> keys are disabled when the cursor is not visible on the screen.

Arrow Keys
An <Arrow> key moves the cursor—in the direction the selected <Arrow> key points—to the closest entry object in the path of the currently selected entry object. If there is no entry object in the path of the selected entry object, the cursor moves to the closest entry object in the direction the <Arrow> key moves. For example, when the right arrow key is pressed, the cursor moves to the right of the currently selected entry object to the closest entry object in its path. If there are no entry objects in its path to the right, the closest entry object to the right is selected. If there are no entry objects to the right, the cursor does not move. The arrow keys can also initiate the cursor (similar to using the <Home> key).

3.7.1.1 Data Entry Objects

On the SoftScreen engine, data entry objects appear as pound signs (#'s), with one # per place. To enter data values in the place of #'s, press <Home> or hit an <Arrow> key (see Section 3.7.1 for cursor movement) to position the cursor at the first data entry field. Enter the information, and press <Enter>. If a value above the maximum or below the minimum (as defined in the Object Configuration at the development system) is entered, the maximum or minimum number will be used respectively. If a data scale expression was configured, the value will then be scaled. **This means that it is possible to scale data beyond the objects min/max boundaries.**

The numbers entered in place of the #'s at the SoftScreen engine data entry points are displayed until the screen is redrawn. When the screen is redrawn the #'s will reappear, even though the value entered has already been processed.

> **NOTE**
> A data entry object will only display the value it writes to the destination address. It will not reflect changes made by other objects to that address. To view the most current value at an address, use a data display object. Refer to the development system manual for details on data display.

3.7.1.2 String Entry Objects

On the SoftScreen engine, string entry objects appear as s's with one s per character. To enter data values in place of the s's, press <Home> to position the cursor at the first string entry field. Enter the information and press <Enter>.

A string entry can be configured with or without a terminator. A terminator is an ASCII character (0-255) that is added to the end of the entered data. Its purpose is to identify the end of the string. A string entry can write data to either an internal register address or a PLC address. How the string is handled depends on the terminator and the destination address.

Internal Register Address
The engine stores up to four characters per internal register. The first byte of the string is always the string length. Below are examples of how the string "ABCDEF" is stored in internal registers:

No Terminator

	1st register	2nd register
stored value:	06 41 42 43	44 45 46 00
	length A B C	D E F

Terminator = 13

	1st register	2nd register
stored value:	07 41 42 43	44 45 46 13
	length A B C	D E F Terminator

PLC Address
When the destination is a PLC address, the characters typed into the string entry are sent directly to the PLC. If a terminator is specified, it is sent at the end of the string. For example, if you type "ABC" and press <Enter>, the characters A, B, and C are sent to the PLC. If you specified the terminator to be ASCII character 13, A, B, C, and 13 are sent.

Long strings may have to be broken into multiple single writes by PCENGINE (depending on the PLC protocol). Long strings from the PLC may also require multiple reads.

> **NOTE**
> Use String Display objects to display the most current data at a string address. Refer to the development system manual for details on String Displays and on specifying string lengths and terminating characters.

3.7.1.3 Recipe Entry Objects

On the SoftScreen engine, recipe entry objects appear as r's with one r per decimal place. To enter data values in place of the r's, press <Home> (see Section 3.7.1 for cursor position) to position the cursor at the first recipe entry field. Enter the information and press <Enter>. If a value above the maximum or below the minimum is entered, the maximum or minimum number is used.

Editing Individual Recipe Entry Objects
Recipe entry objects are used to change the values in recipes during run time. Each recipe entry object represents one constant value in a single recipe line. Every time a recipe is changed by a recipe entry object, the change is written to the recipe file. When a Load Recipe function is performed, the changed recipe is loaded.

Since recipe entries overwrite stored recipe values, it is advisable to create several working copies of the recipes in a recipe file. This can be done in the File Manager (Section 3.15). This way, modified versions of the same recipe can be maintained. When a particular version of a recipe is needed, it can be loaded using the Load Selected Recipe function (Section 3.13).

3.8 XY PLOT

This object plots X and Y points—not lines—against each other instead of against time. These points can be logged, but cannot be played back. Both X and Y have a unique title, scale draw enable, scale format, minimum and maximum value, sampling rate (time or condition), and expression for both X and Y.

The sampling rate conditions can be either level or edge:

Level A level condition means that while the condition is true, the XY plot displays all XY Data (unless it is the same).

Edge An edge condition means that when the condition transitions from false to true, a single sample of the X and Y data is taken, (unless both X and Y are the same as the last sample). New points are drawn whenever the X or Y value changes. X and Y values that are out of range are drawn at either the minimum or maximum limits.

When using logged XY plots, if the sample condition is true (level triggered) and the log Enable condition is true, PCENGINE logs data to the disk continuously. If the log enable condition is false, data is not displayed or logged to disk.

Clear Plot Expression
When the results of the expression go from false to true, the plot area of the XY Plot is cleared. For historical and logged plots, the historical buffer is also cleared. In addition, any objects the user configured within the plot area to show the optimal plot curve are cleared.

States
If you have drawn objects inside the XY Plot area, the states of the objects inside the XY Plot area should match the Clear Plot expression so that when the XY Plot is cleared, the interior objects are redrawn. Some objects (such as circles and boxes) clear the area they encompass first, before being drawn. This clears any XY Plot points "inside" the objects, and is **not** recommended for visual correctness.

> **NOTE**
> It is recommended that any objects drawn in the interior of the XY Plot object be drawn as either lines or polylines. These objects can be Stated and only redraw on top of each other.

3.9 EVENT TREND

An event trend plots data against events instead of time. This trend plots a new point every time the event expression evaluates from false to true. An event trend specifies a number of samples, title, event scale enable, number of event points displayed, and an event expression. This trend can be real-time, historical, or logged. There is a date display version for each of the three types of Event Trends.

For logged event trends the following are specified:

- Log File name
- Log File format
- Log File path
- Log Enable Condition
- Log Sample/log rate (time or condition)

If the Log Enable Condition is false, data is neither displayed or logged to the disk.

> **NOTE**
> When using logged Event Trends, if the event expression is true (level triggered) and the Log Enable Condition is true, PCENGINE logs data to the disk continuously.

An event can be **level** or **edge** triggered:

Level A level condition means that while the condition is true, the Event Trend continues trending that data.

Edge An edge condition means that when the condition transitions from false to true, a single sample of the data is taken.

3.10 PASSWORDS

In some instances, you are prompted to enter a password before you can view a data/string/recipe entry object on screen in the engine. The password and its corresponding security level are set in the development system.

For more information on setting passwords, refer to Chapter 5 of the SoftScreen Development System manual.

If an entry object is password protected, it will not appear on screen until you enter the password that corresponds to its security level. Entering a password is controlled by a function key, pseudo key, or touch button that has been configured to Change Security Level.

The Enter Password prompt then appears. Type in the password that corresponds to the level set for the entry object you want to view. Once this level is entered, it becomes the current security level for entry objects.

If the security level(s) of an entry object is above the current level, that entry object does not appear on screen until its password has been entered.

3.11 INTERNAL REGISTERS

The following tables list the SoftScreen Internal Register assignments.

Table 3-2. SoftScreen Internal Register Assignments

Register	Description (Read/Write)
#1	Year
#2	Month
#3	Day
#4	Hour
#5	Minute
#6	Second
#7	Day of Week (i.e., 0 = Sunday, 1 = Monday, etc.)

Table 3-3. SoftScreen Internal Register Assignments (R/W)

Register	Description	R/W
#8	Port #2 Error Codes	R
#9	Port #3 (Error Codes)	R
#10	Port #4 (Error Codes)	R
#11	Port #1 (Error Codes)	R
#12	Printer Port (Error Codes)	R
#13	Current X Data Entry Cursor Position	R
#14	Current Y Data Entry Cursor Position	R
#15	Screen Saver Register	R
#16	Data Entry Security Level	R
#17 - #19	RESERVED	R
#20 - #999	General Purpose	R/W
#1000	Port #1 scan rate - (tenths of a second)	R
#1001	Port #2 scan rate - (tenths of a second)	R
#1002	Port #3 scan rate - (tenths of a second)	R
#1003	Port #4 scan rate - (tenths of a second)	R
#1004 - #1049	RESERVED - NOT USER CONFIGURABLE	R
#1050 - #2000	General Purpose	R/W

Internal registers can be optionally saved and restored from a file. See Internal Register Storage (Section 3.3.3) for more information.

Internal Register #15 (read only) is reserved to contain the current Screen Saver counter. You may select, via Engine menus, the amount of time in minutes in which to activate the Screen Saver. When a key or the touch screen is pressed, the Screen Saver register is automatically set back to the programmed Screen Saver time by PCENGINE. See Section 5.5 for instructions on creating a screen saver.

3.12 PCENGINE FILE USAGE

> **NOTE**
> On the 9450-SSW, drive D serves as the hard drive.

PCENGINE primarily uses RAM in a DOS based system. However, some aspects of PCENGINE do rely on the hard disk:

- Logging alarms (see Section 3.6)
- Logging recipe data (see Section 3.7.1.3)
- Logging trend data (see Section 3.12.2)
- Logging XY plot data (see Section 3.12.2)
- Logging event trend data (see Section 3.12.2)
- Logging reports (see Section 3.12.4)
- Screen changes
- Message objects

3.12.1 PCENGINE File Error Messages

If an error occurs while accessing the disk, an alarm message is displayed and logged to the alarm summary. Alarm messages, generated when a file error occurs, **must** be acknowledged by an operator to assure that all file errors are observed and **not** cleared automatically. The types of file error messages that can appear are

- File open error
- File close error
- File read error
- File write error
- File seek error

Errors may occur due to a full disk or a file, or group of files, on the hard disk has been corrupted. Exit PCENGINE and determine what caused the file error. If the disk is full, back up the alarm summary, log trend data, and report files to make room on your hard disk or enable the optional disk resolution feature (see Section 3.16).

3.12.2 Logging Trend, XY Plot, and Event Trend Files

Data for log trends, log XY plots, and log event trends are saved to a comma delimited ASCII file and a directory specified for each object. The filename extension changes according to the following scheme each time a new log file is created for a specific trend, XY plot, or event trend:

.001, .002, ... .009, .00A, .00B, ... .00E, .00F, .00G, ... .00Z, .010, ... .01Z, ... .02Z, ...ZZZ

This allows for a total of 42,875 unique log files.

For example, the first log file for a trend would be LOGTREND.001 (if the default filename was not changed).

NOTE
When a trend, event trend, or XY plot is logged, a corresponding read-only file is saved to the hard disk with an $$$ extension. This file is used by SoftScreen for file tracking during disk resolution.

NOTE
Floppy drives are not supported for logging data. To store logged data to a floppy, use the File Manager screen. (See Section 3.15 for File Manager.)

3.12.3 Playback for Log Trends and Event Trends

The playback feature allows you to select an active log trend or log event trend with the <Home> key (see Section 3.7.1 for information on using the <Home> key). The outer border of the trend (or event trend) changes color to indicate it is selected. You can then scroll through the trend using the <+> and <-> keys. Playback does not function with real-time and historical trends or event trends.

NOTE
During playback if there are two points which are separated by dead time, which is the time when the terminal is down or not communicating, they are connected by a dashed line. This dashed line indicates these points are not consecutive, relative to time.

3.12.4 Logging Reports

Reports are logged to a **unique report directory** specified in the application configuration by the development system. These are logged in the following way:

REPORTNAME.1
REPORTNAME.2
REPORTNAME.3
etc.

REPORTNAME is the name of the logged report. Report filename extensions are increased by one each time a report is logged. Each report can be logged to a disk up to 999 times.

3.13 LOADING RECIPES BY NAME

The Load Selected Recipe function lists possible recipes to load. Access to these recipes is controlled by a function key, pseudo key, or touch button that has been configured to Load Selected Recipe. Use the keyboard or touch screen touch buttons to scroll through the recipes. Once you have selected a recipe, press <Enter> to load it.

> **NOTE**
> User-configured function keys do not work when you are in the Load Selected Recipe screen.

3.14 EXTENDED CALCULATION

Table 3-4. Extended Calculation Functions

Function	Description
SQT (start)	Square root
AVG (start-end)	Average
MED (start-end)	Median
MAX (start-end)	Maximum value
MIN (start-end)	Minimum value

The following is a list of several rules for math functions:

1. Start and end values must be internal registers (#r), PLC addresses, or symbols. Indirect registers and constants may **not** be used.

2. The starting address must be lower than the ending address. The start and end values must be the same address type.

3. Legal (start-end) combinations are as follows:

   (#r-#r), (PLCaddr-PLCaddr), ($), ($-$), (#r-$), ($-#r), (PLCaddr-$), ($-PLCaddr)

   When using a symbol as a start-end value, the symbol expression must be the same address type as the other value address.

   Illegal combinations are (#r-PLCaddr) and (PLCaddr-#r)

All of the PLC points from start to end must be put into the internal engine PLC read scan table. Since the PCENGINE scan table can access a maximum of 400 unique PLC addresses, users have a higher probability of filling up the read scan table if they overuse the range functions (thus limiting the number of addresses that can be accessed in other areas of the application). For example, it would be possible to fill the entire PLC read scan table with the following function: AVG ([40010] - [40410]).

3.15 FILE MANAGER UTILITY

The file management utility (File Manager) can be invoked at any time during run time. Accessing File Manager is controlled by a function key, pseudo key, touch button, or selector touch button configured with the Go to Screen function and FileMan specified as the screen name. If the FileMan screen has been password protected, you must enter the password that corresponds to the specified security level.

> **NOTE**
> User-configured function keys do not work when you are in File Manager.

Using File Manager, you are able to manipulate application files. File Manager allows you to copy, compact, expand, delete, and move files using touch buttons or function keys. The table on the following page defines each key.

Table 3-5. Key Definitions

Key	Function
Up ↑	Moves up one line.
Down ↓	Moves down one line.
PageUp	Moves up one page.
PageDn	Moves down one page.
F1—Mark	Marks a group of files to be copied, deleted, compacted, expanded, or moved.
Enter/Go to	Changes current destination or source directory.
Home	Goes to top of current directory listing.
End	Goes to bottom of current directory listing.
F5—Dest/Src	Toggles between the selected destination and source directories.
*F2—Copy	Copies the selected file from the source directory to the destination directory. Use F1 if you want to mark a group of files to be copied.
*F4—Move	Moves the selected file from the source directory to the destination directory. Use F1 if you want to mark a group of files to be moved.
F10—Delete	Deletes the selected file. Use F1 if you want to mark a group of files to be deleted.
F7—Refresh	Refreshes the FileMan screen. If files change while you are in File Manager, they will not be updated until the screen is refreshed.
*F8—Compact	Compacts the selected file in the source directory and saves it in the destination directory. Use F1 if you want to mark a group of files to be compacted (it is recommended that you only compact a group of files that share the same filename such as LOGTREND.001, LOGTREND.002, etc.).
*F9—Expand	Expands the selected (compacted) file in the source directory and saves it in the destination directory. Use F1 if you want to mark a group of files to be expanded.
Esc	Exits the File Manager.

> ***WARNING**
> These operations, when performed on large files, may trigger PLC communications errors.

File Manager can also be used to copy and delete individual recipes within a recipe file. To do this, select a .REC file, then press <Enter>. The individual recipes are displayed. Use the <F2> and <F10> keys to copy and delete recipe files.

3.16 OPTIONAL DISK FULL RESOLUTION

PCENGINE provides optional Disk Full Resolution. This feature controls how much data is logged to the hard disk. Objects can be configured to continuously log data to disk without using up all of the disk free space. Approximately every six minutes PCENGINE checks the amount of free space on all valid drives (except floppy drives). Sections 3.16.1, 3.16.2, and 3.16.3 explain disk resolution.

3.16.1 Alarm Disk Resolution

In the Target Configuration Menu on the development system, the Disk Full Resolution option pertains to alarm disk resolution. Available choices are **Delete None** and **Save Number**.

None When None is selected, writing to disk continues until the disk is full.

Save Number When Save Number is selected, PCENGINE logs the specified number of alarms to the disk. When this number is reached (the largest number selectable is 65535) the oldest alarm is deleted before another alarm is logged. This guarantees that only the newest specified number of alarms is kept on disk.

3.16.2 Reports

Reports have their own unique disk full resolution option. When this feature is set to **Delete None**, logging reports to disk continues until the disk is full.

When this option is set to **Save Number**, PCENGINE writes the specified number of reports to disk. When this number is reached, the oldest report is deleted before another report is written to disk. This guarantees that only the specified number of the newest logged reports is kept on disk. Up to 999 reports can be logged.

3.16.3 Log Trends, Log Event Trends, and Log XY Plots

Disk Full Resolution can be enabled or disabled for each log trend, log event trend, and log XY plot. When disabled (**Delete None**), logging to disk continues until the disk is full.

To save a specified number of logged files on disk, choose **Save Number** and enter the number of log files you want to keep on the hard disk. When that number of logged files has been written to disk, any subsequent logged files are written only after the oldest file has been deleted.

> **NOTE**
> SoftScreen allows you to save up to 46,000 files to disk. However, the number that you can actually save depends on the size of the files and how much disk space is available on your system.

3.17 TOUCH SCREEN SUPPORT

On the development system (with the serial touch screen) you must specify which port is configured as the touch screen port. (Only ports 1 or 2 can be selected for touch screen). On the runtime engine, a driver has to be loaded via AUTOEXEC.BAT or the command line.

Serial Touch Screens
For serial touch screens, the following needs to be specified:

- Type of Elographics touch screen
- Installation port (either 1 or 2)
- Baud rate of the touch screen
  For example, (ELODEV2200,1,9600)

PCENGINE handles the serial port as a touch screen interface instead of a PLC interface.

Bus Version of Touch Screen
For the Bus version of the touch screen, the following needs to be specified:

- Type of touch screen
- Base I/O address
- Hardware interrupt
  For example, (ELODEV 2201,280,5)

With the **bus touch screen,** there is no need to reserve a port by the development system for the touch screen.

The functions **Repeat**, **No Repeat**, and **Press/Release** are supported on touch screens. A calibration program is available to calibrate your touch screen (if applicable). See Section 3.3.3 for a description of touch screen calibration.

3.18 SCREEN SELECTOR OBJECTS

This feature consists of two objects:

- Selector Display Text
- Selector Touch Button

Selector Text Objects
These are display objects that can encompass a list of 1 to 64 text lines displayable in a scrolling list equipped with a user-modifiable index. Up to 49 lines (with the smallest font selected) of these 64 can be displayed at once. Each of the 64 text lines can have 16 states each with a unique foreground color, background color, and associated text. The following list explains the features of Selector Display Objects:

Scrolling — The text scrolls in a user-defined window as the value of the index expression changes.

Index Expression — When the index expression returns a value, the text associated with it is highlighted with user-defined background and foreground colors to distinguish it from other text. Text not at the current index expression appears with the colors configured under states.

> **NOTE**
> Index highlight colors override configured state colors except when only one line of text is displayed on the screen.

States — Each selector text line has 16 states that can be configured to display different text strings in different colors when its associated state expression becomes true. See Section 3.5 for more information on states.

Lines Displayed — Up to 49 lines can be displayed on the screen at one time. With scrolling, a total of 64 lines can be displayed.

Selector Touch Buttons
Selector Touch Buttons look like regular touch buttons. When a selector touch button is pressed, the value returned by the index expression determines which press and/or release function is performed. A selector touch button can perform up to 64 functions.

If a post select address and a post select value have been specified, the post select value is written to the address when the selector touch button has been released.

> **NOTE**
> When the functions Go To Screen, Return To Previous Screen, and Load Selected Recipe are configured for On Press, neither the On Release function nor the Post Select expression is performed. For more details, see Section 3.2.

> **NOTE**
> If a selector touch button is configured to Go to Idle Mode on press, the On Release function is not performed. However, the post select value will be written to the post select address when the engine Returns to Active Mode. See Section 3.19 for details on Idle Mode.

Selector touch buttons are designed for use with selector text. Using a common selector index expression, a selector touch button can be configured to work with selector text. For example, when the common selector index expression value is returned, the highlighted selector text can tell the user what function should be performed. This function can then be performed by pressing the "matching" selector touch button.

Figure 3-1 on the following page shows how selector text and selector touch buttons work together.

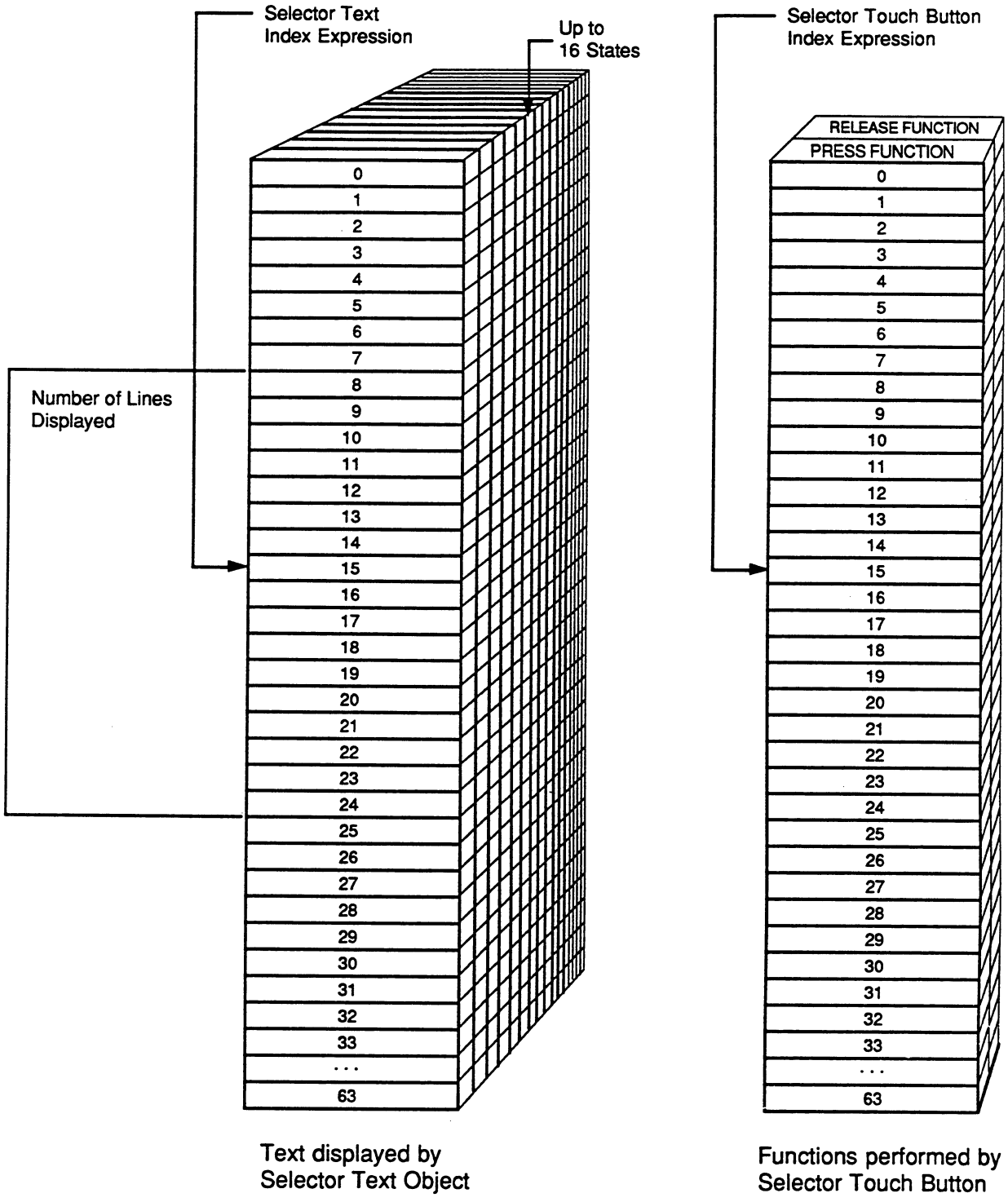


Figure 3-1. SoftScreen Selector Display Objects

3.19 SYSTEM SHUTDOWN

Before shutting the power off on the SoftScreen engine, you must execute the function Go To Idle Mode. This is a standard function available from the development system that can be invoked via function key, touch button, or pseudo key. (See the development system manual for more information).

The **Go to Idle Mode** function does the following:

- Closes all open files
- Does a controlled communication stop with all connected PLCs
- Suspends the PCENGINE

At this point it is safe to power-down the engine. If power is turned off without executing the Go To Idle Mode function, files can be left open when power is going down, and the integrity of the files on the hard disk will be jeopardized. If idle mode is not executed, any connected PLCs may get their communication link scrambled if the SoftScreen engine stops communication in the middle of the command.

When executing a Return To Active Mode function, the alarm message is displayed for five seconds. Pressing the <Home> key does not clear this alarm. The Return To Active Mode function redraws the current screen that previously executed the Go To Idle Mode function and returns PCENGINE to normal operation.

> **NOTE**
> It is not recommended that the SMARTDRV utility be used. PCENGINE does not know when SMARTDRV has written all of its data to the disk, which could mean a loss of engine data.

3.20 REPROGRAMMING XYCOM KEYBOARDS TO SUPPORT SOFTSCREEN

> **NOTE**
> The 9450 does not require the PKIM utility.

If you have a Xycom sealed keyboard or a front panel keypad with more than 10 function keys, ***please read this section.***

If you have a unit that shipped with PCENGINE installed, the Xycom factory programs its 20-function key front panel keypads to work with PCENGINE. If the unit was **not** shipped with PCENGINE, then you must reprogram the keypad on the keyboard to take advantage of the functionality of the SoftScreen engine.

If you have a Xycom KB3 or KB4 External Matrix Keyboard, it has to be reprogrammed to support the SoftScreen engine.

WARNING

If you have previously reprogrammed some of the keys on your keypad or keyboard and you reprogram to support SoftScreen, the definitions for those keys will be overwritten. To avoid overwriting any reprogrammed keys, see Section 3.20.1.

When reprogramming keys, make sure you have the **PKIM Utilities Disk** that was shipped with your Xycom unit. Bring up the utilities by typing **PKIM <Enter>** at the C prompt, then select **Files-Open**. At this point, you will select one of three PKIM macro files that have been installed in the SoftScreen directory on your hard disk, as shown in Table 3-6.

Refer to the table below to help determine which PKIM macro file needs to be loaded.

Table 3-6. PKIM Macro File

Xycom Hardware Type	**PKIM Macro File**
Any 20-function key front panel	20FUNC.PKM
KB3	SSKB3.PKM
KB4	SSKB4.PKM

Type the name of the correct PKIM file, chosen from Table 3-6, then press **<Enter>**.

Select **Download** and hit **<Enter>**. This reprograms your keypad or keyboard to work with SoftScreen. Hit <Esc> to exit the PKIM utilities.

3.20.1 Individually Programming Function Keys F11-F20

This section only applies to users who have previously reprogrammed the front panel keypad or external matrix keyboards on their Xycom hardware.

To avoid overwriting any reprogrammed keys, you must individually program function keys F11-F20 for them to function properly on press and release with SoftScreen.

Enter the PKIM utilities by typing **PKIM** at the C prompt. Select Upload, which loads the current key definitions from the PKIM module. At this point, use the Save As command to save this data to a file before proceeding.

Next, go into **Macros-Edit**, use the arrow keys to get to <F11>, and press <Enter>. To reprogram <F11> to send both press and release codes to SoftScreen, delete the current macro and enter FF <RT ARROW> 0B <Esc>.

For the remaining Function Keys (F12-F20), follow the sequence as described for F11, with the exception of the code following the (FF). This code is different for each function key. See Table 3-7 below:

Table 3-7. Function Key Codes

Function Key	Code
F11	FF 0B
F12	FF 0C
F13	FF 0D
F14	FF 0E
F15	FF 0F
F16	FF 10
F17	FF 11
F18	FF 12
F19	FF 13
F20	FF 14

When you are finished, download the MACRO to the PKIM and save these new key definitions to a file with **File Save**. At this point, everything is complete.

If you need more information about using the PKIM utilities, refer to the PKIM utilities manual provided with your hardware.

3.21 MAXIMUM CAPABILITIES OF PCENGINE

The following sections describe the limitations of the PCENGINE.

3.21.1 Screens, Recipes, Reports, and Messages

The maximum number of screens, recipes, and reports is 255 of each. The maximum number of screens allowed is 780.

3.21.2 PLC Points

To optimize PLC communication, all current PLC points (which include current screen points, pseudo key points, alarmed points, and historical and logging trend points) are stored in a single internal table that contains 400 entries.

Figure 3-8. PC/AT Engine PLC Points

Type of PLC Point	Total Included in Table
Alarm PLC Points	All alarm points in the application
Historical/Logging PLC Points	All historical/logging points in the application
Pseudo Key PLC Points	Current and global pseudo keys
Screen PLC Points	Current screen points

Report PLC Points The largest number of referenced PLC points in a single report is 200.

Recipe PLC Points The largest number of referenced PLC points in a single recipe is 990.

3.21.3 Alarm Objects

On the PC/AT engine, there is an internal table that consists of all the objects (in all screens) that are tied to an alarm. This includes objects that are alarm enabled and alarm objects. If the "Alarm Table Exceeded" error occurs, there are too many objects tied to an alarm to put into this internal table. The alarm table size is 32,767 bytes.

The following formulas and Table 3-9 can be used to compute how much space is required in the internal alarm table for any type of object tied to an alarm.

The formula for computing the size of an alarm object is

19 + EXP + ((number of alarms defined in this object (1 - 4)) * 46)

The formula for computing the size of an object that is alarm enabled is

26 + EXP

where EXP is the total byte size of the mathematical expression.

Table 3-9. Alarm Memory Usage

Application Element	Memory (in Bytes)
EXP (Expression)	
Internal register	3
Indirect register	3
External address	6
Operators	1
Constant	5
Symbol	2
Math function	
SQT	1 + EXP
AVG,MED,MAX,MIN	1 + EXP + EXP
9000-RAD Monitor Functions	1

EXP Math Function Examples:

SQT[ADDR1]	=	(1 + 6) for external address
SQT[#30]		(1 + 3) for internal register
AVG[ADDR1 - ADDR2]	=	(1 + 6 + 6) for range functions on external addresses
AVG[#30 - #40]	=	(1 + 3 + 3) for range functions on internal registers

The maximum number of alarms is 100.

3.21.4 **Historical Trend Pens**

On PC/AT engines, the following object types have their own internal Trend Table:

- Historical and logging trends
- Historical and logging event trends
- Historical and logging XY plots

If the "Trend Table Exceeded" error occurs, there are too many historical or logging objects in the application. The trend table size is 61,440 bytes.

To determine the size of each historical and logging table, add the object sizes together. For example, all historical and logging trend object sizes should be added together. If the size is greater than 61,440 bytes, the historical and logging trend table has overflowed.

Table 3-10. Trend Memory Usage

Application Element	Memory (in Bytes)
Historical Trend	65+ (4 * Samples)+(Pens)+(4 * # of pens)
Logging Trend	142+EXP1+[1+EXP2]+[1+EXP3]+[1+EXP4]+ (4 * Samples)+(Pens)+(4 * # of pens)
Historical XY Plot	138+EXP1+EXP2+EXP3+[1+EXP4]+ (8 * # of samples)
Logging XY Plot	210+EXP1+EXP2+EXP3+[1+EXP4]+ (8 * # of samples)+EXP5+[1+EXP6]+[1+EXP7]
Historical Event Trend	90+EXP1+(Pens)+(8 * # of samples)+(4* # of pens)
Logging Event Trend	162+EXP1+(Pens)+(8 * # of samples)+ (4* # of pens)+EXP2+[1+EXP3]+[1+EXP4]

The formula to determine the memory usage of pens is as follows:

(18+EXP) per pen

Tables 3-11 through 3-15 describe the EXPressions used in Table 3-10 on the previous page.

Table 3-11. Log Trend Expressions

Log Trend Expressions	**Description**
EXP1	Log enable condition
EXP2	Sampling condition
EXP3	Start condition
EXP4	Stop condition

Table 3-12. Historical XY Plot Expressions

Historical XY Plot Expressions	**Description**
EXP1	Sample rate condition
EXP2	Clear plot expression
EXP3	X expression
EXP4	Y expression

Table 3-13. Log XY Plot Expressions

Log XY Plot Expressions	**Description**
EXP1	Sample rate condition
EXP2	Clear plot expression
EXP3	X expression
EXP4	Y expression
EXP5	Log enable condition
EXP6	Start condition
EXP7	Stop condition

Table 3-14. Historical Event Trend Expression

Historical Event Trend Expression	**Description**
EXP1	Event expression

Table 3-15. Log Event Trend Expressions

Log Event Trend Expressions	**Description**
EXP1	Event expression
EXP2	Log enable condition
EXP3	Start condition
EXP4	Stop condition

3.21.5 Application Storage

Memory consists of the size of screens, recipes, reports, messages, and configurations added together on the engine. On PC/AT engines, application size is dependent on available hard disk or solid state disk space, not system memory.

If your application has become larger than the available memory on your system, you can delete objects.

To determine how much memory the application uses, add the application files together (i.e., Size = APPL.CON + APPL.MSG + APPL.REP + APPL.REC + APPL.SCR) or press <Shift> + <F1> after the application is loaded to determine the total application size. To determine the size of a screen, recipe, report, or configuration, press <Shift> + <F1> while in the screen, recipe, report, or configuration. If the screen, recipe, report, or configuration has not been saved, it will not be added to the application total.

The table below describes Xycom SoftScreen memory usage in bytes.

Table 3-16. Xycom SoftScreen Memory Usage in Bytes

Application	Memory (in Bytes)
EXP (Expression)	
Internal register	3
Indirect register	3
External address	6
Operators	1
Constant	5
Symbol	2
Math function	
SQT	1+EXP
AVG, MED, MAX, MIN	1+EXP+EXP
9000-RAD monitor functions	1
States	(3+EXP) per State
Text states	(84+EXP) per State
Pens	(18+EXP) per pen
Screen	18+
Touch button	150+(States)
Function keys	4+ (104 * # of function keys configured)
Pseudo keys	4+ (135 * # of pseudo keys configured)
Data entry	35
Alarm	19+EXP+(45 * # of conditions)
Passworded/scaled data entry	37+EXP
String entry	32+EXP
Selector touch button	51+(1+EXP)+(1+EXP)+(104 * # of functions)+(States)

Table continued on the following page.

Table 3-16. Xycom SoftScreen Memory Usage in Bytes (*continued*)

Application	Memory (in Bytes)
Screen (*continued*)	
All Display Objects	17+
Bar, rectangle, square, oval, circle, data display	9+ (22+EXP)+(States)
Pie	13+ (22+EXP)+(States)
Polygon, polyline	1+ (4 * each point)+(States)
Line	8+ (States)
Text < 11 characters	19+ (States)
Text > 10 characters	89+ (States)
Layered text, list text	8+ (Text States)
Graphics text	10+ (States)
Symbol	9+EXP
Date, time	8
Message	13
Real-time trend	56+ (Pens)
Historical trend	65+ (4 * # of samples)+(Pens)+(4 * # of pens)
Logging trend	142+EXP1+[1+EXP2]+[1+EXP3]+[1+EXP4]+ (4 * # of samples)+(Pens)+ (4 * # of pens)
String display	15+EXP+(States)
Selector text	15+(1+EXP)+((4+EXP) * (# of text lines)) + (total text for all lines)
Real-time XY plot	127+EXP1+EXP2+EXP3+[1+EXP4]
Historical XY plot	138+EXP1+EXP2+EXP3+[1+EXP4]+(8 * # of samples)
Logging XY plot	210+EXP1+EXP2+EXP3+[1+EXP4]+ (8 * # of Samples)+EXP5+[1+EXP6]+[1+EXP7]
Real-time event trend	90+EXP+(Pens)
Historical event trend	90+EXP+(Pens)+(8 * # of samples)+(4 * # of pens)
Logging event trend	162+EXP+(Pens)+(8 * # of samples)+(4 *# of pens)+ EXP+[1+EXP]+[1+EXP]
Report	14+
Data display	13+EXP
Form feed	3
Date, time	12
Text < 11 characters	22
Text > 10 characters	92
Config	15+EXP
String display	15+EXP
Control text	152
Layered text	20+States
Message	26+EXP
Recipe	14+
Each recipe entry	13+Value EXP
Message	2 + (83 * # of messages)
Configuration	3796

The following is an example of calculating memory usage for an expression:

[4001]+#30*5

where

4001 is an external address	=	6 bytes
+ is an operator	=	1 byte
#30 is an internal register	=	3 bytes
* is an operator	=	1 byte
5 is a constant	=	5 bytes
Total		16 bytes

When logging alarms, reports, XY plots, or trend data, the available application storage for logging is limited to the amount of free hard disk space.

3.21.6 **Screen Objects**

The number of screen objects is limited by engine memory—64 Kbytes on EGA/VGA systems—or by the maximum number of objects (1024), whichever occurs first. If you run out of available memory on the engine, you can delete objects. Table 3-16 describes how to determine the amount of memory each object uses.

3.21.7 **Expression Size**

After clicking the OK button when entering an expression, SoftScreen arranges and parenthesizes the expression for efficiency and readability. If the resulting expression exceeds the expression edit field, the following error message appears: "Equation is too long to translate in the space provided." This means you've either entered more than 55 text characters or the resulting expression is greater than 40 bytes. You must reduce the size of the expression until it fits into the expression edit field.

3.21.8 **Scanning of Pseudo Keys**

While running, SoftScreen engines scan and evaluate pseudo keys once per second.

3.21.9 **On Release Function**

Due to the nature of how certain control functions perform for function keys, touch buttons, and selector touch buttons, if one of these objects is configured to function On Press, the corresponding On Release function may either be performed, not performed, or forced. When the On Release function is forced, it will be performed regardless of whether the user has actually released the key/button. The table below describes how an On Release function is handled for each On Press situation.

Table 3-17. On Release Function Performed

On Press Function	Function Key	Touch	Selector
None	Yes	Yes	Yes
Write To Data Address	Yes	Yes	Yes
Go To Screen	Forced	No	No
Return To Previous Screen	Forced	No	No
Load A Recipe	Yes	Yes	Yes
Print A Report	Yes	Yes	Yes
Print The Current Screen	Yes	Yes	Yes
Go To Idle Mode	No	No	No
Return to Active Mode	Yes	Yes	Yes
Acknowledge Alarm	Yes	Yes	Yes
Simulate Key Press	Yes	Yes	Yes
Change Security Level	No	Yes	Yes
Load Selected Recipe	No	No	No
Execute Selector Button	Depends*	Depends*	N/A
Exit SoftScreen	No	No	No

If the On Release function of a selector touch button is not performed, the Post Select Value will **not** be written to the Post Select Address except when the On Press function is **GoTo Idle Mode**. Refer to Section 3.18.

We recommend that an On Release Function not be configured if the On Press Function is **Go To Screen, Return To Previous Screen, Go To Idle Mode, Change Security Level, Load Selected Recipe, Execute Selector Button***, or **Exit SoftScreen**.

**If a key or button is configured to Execute Selector Button, then the selector button's configured functions determine if the On Release function will be performed.*

4.1 INTRODUCTION

This chapter describes connecting SoftScreen to the following PLCs:

- Allen-Bradley Data Highway
- Allen-Bradley Data Highway Plus
- Allen-Bradley Data Highway Extended Addressing
- Allen-Bradley Remote I/O
- GE Series 6 CCM2
- GE Series 90
- Genius I/O
- Indramat
- Mitsubishi MELSEC-A
- Modbus Plus
- Modicon Modbus
- Omron
- SATT Controller
- Siemens
- Simulated PLC
- Square D SY/MAX
- Texas Instruments 405/435
- Texas Instruments 500/505
- Westinghouse Numa-Logic

The following note and table contain information pertinent to the PLC drivers described in this chapter.

NOTE

After every read or write to a PLC, communications status is returned from the PLC driver. These error codes are written to corresponding registers depending on the PLC port.

Table 4-1. Internal Register PLC Communications Status

Port	Register
1	#11
2	#8
3	#9
4	#10

These registers are read only. Refer to the individual PLC section for error codes.

4.2 ALLEN-BRADLEY DATA HIGHWAY

This section describes the functional definition of the SoftScreen to Allen-Bradley Data Highway interface. The interface to Data Highway is through a 1770-KF2, 1771-KG, or 1785-KE communication controller module (see Figures 4-1 through 4-3).

The specific communications commands (transparent to the user) required to allow the terminal to sit on the Highway and read and write data are listed below:

- Unprotected Write
- Unprotected Bit Write
- Unprotected Read

The user interface allows the user to monitor or change the areas of the PLC data table via the SoftScreen software menus. The user accesses the data table by specifying an address in the table. The data table area contains the values of timer/counter actual and preset values and an image of the I/O tables. The target PLC device can be PLC2 series, PLC3, or PLC5.

To access PLC3 and PLC5 devices you must first allocate an integer file in the PLC with a number that corresponds to the station number of the 1770-KF2 module. This is the only file in the PLC3 or PLC5 that can be read by the terminal.

4.2.1 Serial Port Configuration

Data Highway connects to SoftScreen via RS-232C. The port that you use **must** be the same one specified in your SoftScreen Development System under Configuration-Ports.

4.2.2 Electrical Interface

There are two ways to connect to PLCs. The first is network configuration, in which all PLCs are networked on Data Highway. The second is stand alone, which is a one-to-one link between the PLC and SoftScreen via RS-232C. A direct connect via a network configuration requires the SoftScreen PC/AT's serial port to be wired serially to a 1770-KF2 Communication Controller Module (see Figure 4-1 below).

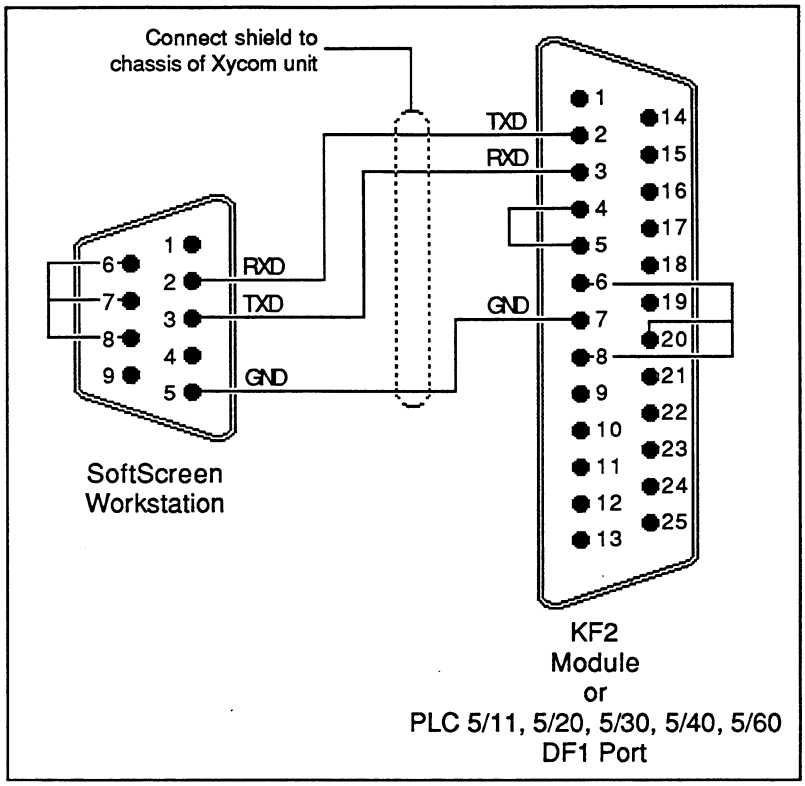


Figure 4-1. Cabling to the 1770-KF2 and PLC 5/11, /20, /30, /40, /60

A stand-alone direct connect requires the SoftScreen PC/AT's serial port to be wired serially to a 1771-KG, 1771-KE, or 1785-KE Communication Controller Module (see Figure 4-2 below).

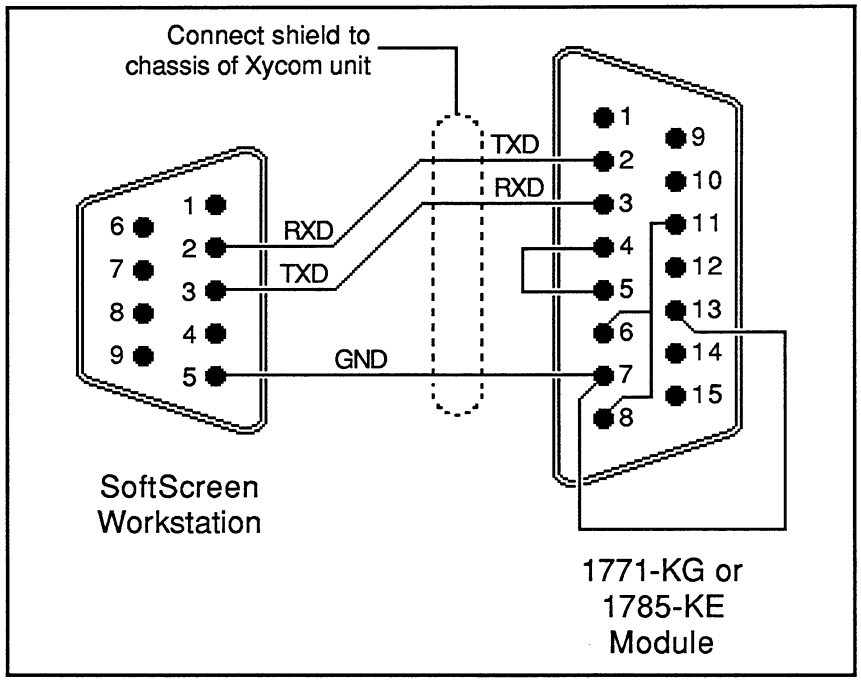


Figure 4-2. Cabling to the 1771-KG or 1785-KE

Figure 4-3, below, shows the stand-alone configuration.

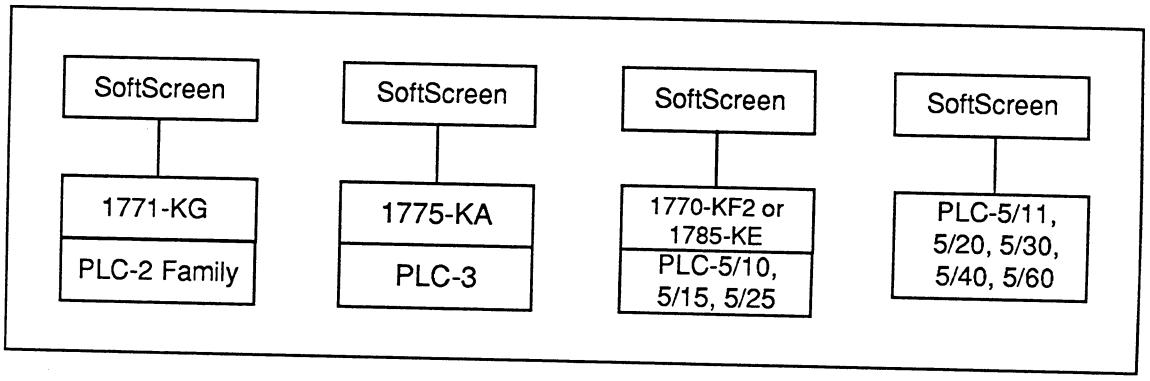


Figure 4-3. Allen-Bradley Stand-Along Configuration
(Non-Data Highway, RS-232C only)

Figure 4-4, below, shows the network configuration.

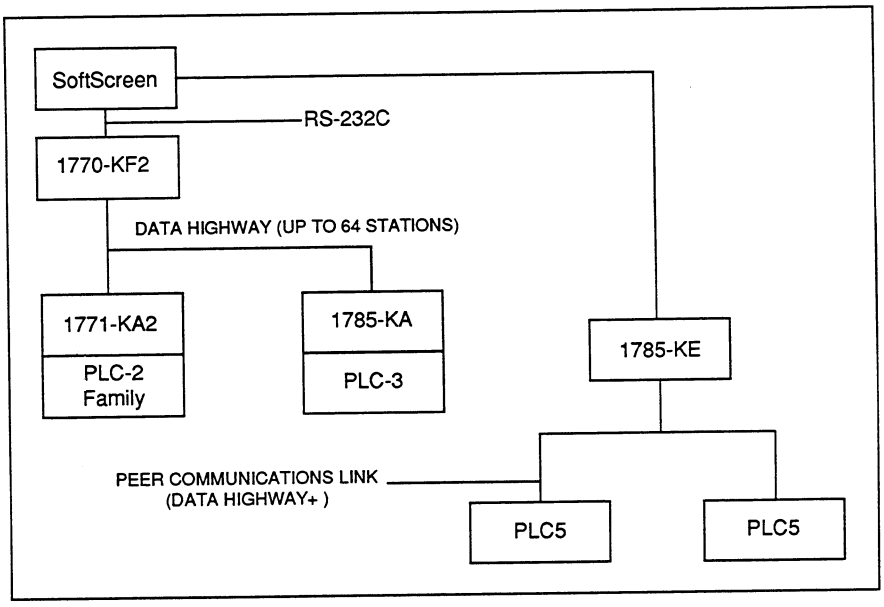


Figure 4-4. Allen-Bradley Network Configuration

4.2.3 Allen-Bradley Data Highway Addressing

The address expressions specific to the Allen-Bradley Data Highway interface are shown below:

Table 4-2. Allen-Bradley Data Highway Addressing

Device	PLC Address	Number Type	Size	R/W
All	▵10-77, 110-177777	Octal	Word	R/W
All	0-7, 100-107	Octal	Word	R

For example, if the expression **[PLC1:70 3]** is entered in the development system software for a data display object, the engine reads and displays the value in PLC1, word 70, fourth bit. Valid bit addresses are octal 0 to 7 and 10 to 17. When using the PLC5 family, you must address Xycom to reference an integer file. Refer to the SoftScreen Development System Manual for more information on expression value formats.

▵NOTE
String entry and string display are allowed to and from these addresses.

4.2.4 Allen-Bradley Data Highway Communication Status Registers

The communication status registers contain information about communication between the Data Highway module and the SoftScreen runtime engine. The following is a list of the communication status registers, one for each COM port:

#11	Communication status for port 1
#8	Communication status for port 2
#9	Communication status for port 3
#10	Communication status for port 4

The communication status registers are 32-bit fixed point registers with the following bit assignments:

Upper 16 Bits

Bit 0	Transmit error
Bit 1	Receive error
Bit 2	Timeout Error
Bit 3	Checksum error
Bit 4	NAK error
Bit 5	TNS error
Bit 6	Unused
Bits 8 - 15	Message status from Data Highway module

Lower 16 Bits

unused

By testing specific bits in the communication status registers, the appropriate text, alarm or message can be generated to indicate the current status of communication. For example, the expression #8&4 could be used to test for a timeout error. A timeout error is indicated if the expression evaluated to 4, while no timeout error is indicated with a 0 value.

4.3 ALLEN-BRADLEY DATA HIGHWAY PLUS

This section describes the functional definition of the SoftScreen to Allen-Bradley Data Highway Plus interface. The interface to Data Highway Plus uses the extended addressing capabilities of the PLC5.

The areas of the PLC5 data table that can be monitored and changed by SoftScreen include the following:

- Accumulated and preset values in timer files
- Accumulated and preset values in counter files
- Status files
- Integer files
- Floating point files
- Binary files
- Image of the I/O tables

The direct connect to Allen-Bradley's Data Highway Plus is accomplished through a high-speed serial adapter card. In order for the card to run Data Highway Plus, the file (SDDHP.SS1) supplied with PCENGINE must be present in the current directory or path.

4.3.1 Port Connector and LEDs

The direct connect adapter card for Allen-Bradley Data Highway Plus provides the following features:

Port Connector This six-pin connector is the interface to your PLC.

Red LED When on, the red LED indicates that the card has not been initialized. If the red LED is off after power up, the card has been successfully initialized. The red light turns off when the PCENGINE is powered up.

Green LED The green LED is on whenever the card is transmitting data over the Data Highway Plus network.

4.3.2 Adapter Card

This section discusses the jumper and switch settings for the direct connect adapter card.

> **NOTE**
> Set the jumpers and switches before connecting to the PLC.

4.3.2.1 Jumper Settings

Jumper JB2 on the direct connect adapter card is used to enable/disable the transmitter on that card. Since the Data Highway Plus software module must transmit, the transmission jumper (JB2) must be positioned to ENABLE. This is the default position.

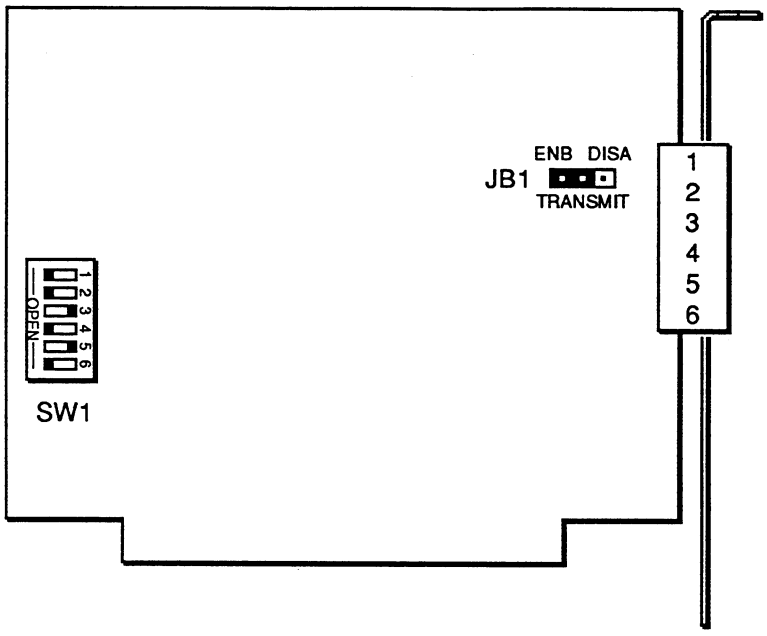


Figure 4-5. Direct Connect Adapter Card Jumper and Switch

4.3.2.2 Switch Settings §

The following table shows possible port address locations and the corresponding switch settings. The default address is 0x250. Unless there is a known hardware conflict, you should use the default setting. The I/O space required is 8 bytes. Therefore, a setting of 250 actually uses addresses 250-257.

Table 4-3. Allen-Bradley Data Highway Plus Address Locations

Host I/O Address	Switch Bits 1	2	3	4	5	6
0x0200	ON	ON	ON	ON	ON	ON
0x0208	ON	ON	ON	ON	ON	OFF
0x0210	ON	ON	ON	ON	OFF	ON
0x0218	ON	ON	ON	ON	OFF	OFF
0x0220	ON	ON	ON	OFF	ON	ON
0x0228	ON	ON	ON	OFF	ON	OFF
0x0230	ON	ON	ON	OFF	OFF	ON
0x0238	ON	ON	ON	OFF	OFF	OFF
0x0240	ON	ON	OFF	ON	ON	ON
0x0248	ON	ON	OFF	ON	ON	OFF
0x0250	ON	ON	OFF	ON	OFF	ON
0x0258	ON	ON	OFF	ON	OFF	OFF
0x0260	ON	ON	OFF	OFF	ON	ON
0x0268	ON	ON	OFF	OFF	ON	OFF
0x0270	ON	ON	OFF	OFF	OFF	ON
0x0278	ON	ON	OFF	OFF	OFF	OFF
0x0280	ON	OFF	ON	ON	ON	ON
0x0288	ON	OFF	ON	ON	ON	OFF
0x0290	ON	OFF	ON	ON	OFF	ON
0x0298	ON	OFF	ON	ON	OFF	OFF
0x02A0	ON	OFF	ON	OFF	ON	ON

Table continued on the following page.

§ *This information is taken from the Sutherland-Schultz Direct-Link Interface Reference Manual for the 5136-SD.*

Table 4-3. Allen-Bradley Data Highway Plus Address Locations (*continued*)

Host I/O Address	Switch Bits 1	2	3	4	5	6
0x02A8	ON	OFF	ON	OFF	ON	OFF
0x02B0	ON	OFF	ON	OFF	OFF	ON
0x02B8	ON	OFF	ON	OFF	OFF	OFF
0x02C0	ON	OFF	OFF	ON	ON	ON
0x02C8	ON	OFF	OFF	ON	ON	OFF
0x02D0	ON	OFF	OFF	ON	OFF	ON
0x02D8	ON	OFF	OFF	ON	OFF	OFF
0x02E0	ON	OFF	OFF	OFF	ON	ON
0x02E8	ON	OFF	OFF	OFF	ON	OFF
0x02F0	ON	OFF	OFF	OFF	OFF	ON
0x02F8	ON	OFF	OFF	OFF	OFF	OFF
0x0600	OFF	ON	ON	ON	ON	ON
0x0608	OFF	ON	ON	ON	ON	OFF
0x0610	OFF	ON	ON	ON	OFF	ON
0x0618	OFF	ON	ON	ON	OFF	OFF
0x0620	OFF	ON	ON	OFF	ON	ON
0x0628	OFF	ON	ON	OFF	ON	OFF
0x0630	OFF	ON	ON	OFF	OFF	ON
0x0638	OFF	ON	ON	OFF	OFF	OFF
0x0640	OFF	ON	OFF	ON	ON	ON
0x0648	OFF	ON	OFF	ON	ON	OFF
0x0650	OFF	ON	OFF	ON	OFF	ON
0x0658	OFF	ON	OFF	ON	OFF	OFF
0x0660	OFF	ON	OFF	OFF	ON	ON
0x0668	OFF	ON	OFF	OFF	ON	OFF

Table continued on the following page.

Table 4-3. Allen-Bradley Data Highway Plus Address Locations *(continued)*

Host I/O Address	Switch Bits 1	2	3	4	5	6
0x0670	OFF	ON	OFF	OFF	OFF	ON
0x0678	OFF	ON	OFF	OFF	OFF	OFF
0x0680	OFF	OFF	ON	ON	ON	ON
0x0688	OFF	OFF	ON	ON	ON	OFF
0x0690	OFF	OFF	ON	ON	OFF	ON
0x0698	OFF	OFF	ON	ON	OFF	OFF
0x06A0	OFF	OFF	ON	OFF	ON	ON
0x06A8	OFF	OFF	ON	OFF	ON	OFF
0x06B0	OFF	OFF	ON	OFF	OFF	ON
0x06B8	OFF	OFF	ON	OFF	OFF	OFF
0x06C0	OFF	OFF	OFF	ON	ON	ON
0x06C8	OFF	OFF	OFF	ON	ON	OFF
0x06D0	OFF	OFF	OFF	ON	OFF	ON
0x06D8	OFF	OFF	OFF	ON	OFF	OFF
0x06E0	OFF	OFF	OFF	OFF	ON	ON
0x06E8	OFF	OFF	OFF	OFF	ON	OFF
0x06F0	OFF	OFF	OFF	OFF	OFF	ON
0x06F8	OFF	OFF	OFF	OFF	OFF	OFF

4.3.3 Electrical Interface §

The Allen-Bradley Data Highway Plus connection is made through a daisy chain configuration using a Belden 9463 twin-axial cable (or "blue hose"). The cabling is shown below:

Table 4-4. Allen-Bradley Data Highway Plus Cabling

PLC	Blue Hose	Direct Connect Adapter
1	Blue	1 (or 4)
Shield	Shield	2 (or 5)
2	Clear	3 (or 6)

Pin 1 (positioned farthest from the LEDs) is the top pin of the connector (the edge connector is on the bottom of the card).

The alternate connectors on the board are used for wiring the Data Highway Plus in a daisy chain configuration.

> **NOTE**
> If the connector is disconnected from the card, the connection between 1 and 4, 2 and 5, and 3 and 6 is broken and communication may be lost to the end of the chain.

The direct connect card represents a single node on the network. It should be connected the same as any other node. The adapter card does not have on-board termination. If a terminator is required, it should consist of a 150 ohm resistor between the blue and clear wires (1 and 3 *or* 4 and 6). In environments with high noise, two 75 ohm resistors may be used; one between blue and shield (1 and 2 *or* 4 and 5), the other between clear and shield (2 and 3 *or* 5 and 6).

§This information is taken from the Sutherland-Schultz *Direct-Link Interface Reference Manual for the 5136-SD.*

4.3.4 Allen-Bradley Data Highway Plus Addressing

The address expressions specific to the Allen-Bradley Data Highway Plus interface are shown in Table 4-5. The list below shows the addressing forms:

```
[O:a/b]
[I:a/b]
[Tf:e.acc/b]
[Tf:e.pre/b]
[Cf:e.acc/b]
[Cf:e.pre/b]
[Nf:e/b]
[Ff:e]
[Bf:e/b]
[Bf/b]
[S:e/b]
```

For example, if the expression **[O:01/17]** is entered in the development system software, the engine reads output rack 0, group 1, octal bit 17.

The file, SDDHP.SS1, supplied with PCENGINE must be present in the current directory or path in order to run the Allen-Bradley Data Highway Plus.

NOTE
When accessing a Floating Point File, the expression **MUST** contain a "FP" (i.e., [F f:e, FP] if FP is not the default format.

Table 4-5. Allen-Bradley Data Highway Plus Addressing

File Type	f	a	e	b	R/W
O	-	00-377o	-	0-17o	R
I	-	00-377o	-	0-17o	R
S	-	-	0-31d	0-15d	R
▵B	3, 9-999d	-	0-999d	0-15d	R/W
B*	3, 9-999d	-	-	0-8191d	R/W
T	4, 9-999d	-	0-999d	0-15d	R/W
C	5, 9-999d	-	0-999d	0-15d	R/W
▵N	7, 9-999d	-	0-999d	0-15d	R/W
F	8, 9-999d	-	0-999d	-	R/W

* [Bf/b] form
d decimal
o octal

Legend

File Types	
I	Input data image area
O	Output
T	Timer
C	Counter
▵N	Integer
F	Floating point
▵B	Binary
S	Status
Other Parameters	
a	I/O address rrg where r = rack number and g = group number
b	bit number (optional, except for Bf/b form)
e	element
f	file number

4.3.5 Allen-Bradley Data Highway Plus Communication Status Registers

The communication status registers contain information about communication between the SoftScreen runtime engine and the Data Highway Plus network. The following is a list of the communication status registers, one for each COM port:

#11	Communication status for port 1
#8	Communication status for port 2
#9	Communication status for port 3
#10	Communication status for port 4

The communication status registers are 32-bit fixed point registers with the following bit assignments:

Upper 16 Bits

Bit 0	Transmit error
Bit 1	Receive error
Bit 2	TNS error
Bit 3	Timeout error
Bit 4	Destination station # error
Bit 5	Source station # error
Bit 6	Command code error
Bit 7	Initialization error
Bits 8-15	Message status from PLC

Lower 16 Bits

Unused

4.4 ALLEN-BRADLEY DATA HIGHWAY EXTENDED ADDRESSING

This section describes the functional definition of the SoftScreen to Allen-Bradley Data Highway serial interface. This interface is capable of accessing a PLC 5 data table by specifying a file and address in the table. The data table area contains the values of timer/counter actual and preset values, status, integer, floating point, and binary files, and an image of the I/O tables.

The protocol will be referred to as Data Highway Extended to separate it from the SoftScreen to Allen-Bradley Data Highway protocol described earlier in this chapter. The Data Highway Extended interface may only be used with the Allen-Bradley PLC5 series controllers.

4.4.1 Serial Port Configuration

Data Highway Extended connects to SoftScreen via RS-232C.

> **NOTE**
> Make sure the port you use is the same one specified in your SoftScreen Development System under Configuration-Ports.

The file, SDDH.SS1, supplied with PCENGINE must be present in the current directory or path in order to run the Allen-Bradley Data Highway Extended.

4.4.2 **Electrical Interface**

There are two distinct ways to connect the SoftScreen Workstation. The first is a network configuration, in which the workstation is a node on a network of PLCs. The second is a stand-alone configuration. This is a one-to-one link between the PLC and SoftScreen via RS-232C.

Connecting the SoftScreen Workstation to a network requires the use of a 1770-KF2 or 1785-KE Communication Controller Module (see figures 4-6 and 4-7). For a stand-alone configuration, if the PLC is equipped with an RS-232C serial port, the workstation may be directly connected to it (see Figure 4-6). Otherwise, either of the Communication Controller Modules can be used.

On the following pages, Figure 4-8 shows the different stand-alone configurations, while Figure 4-9 shows possible network connections.

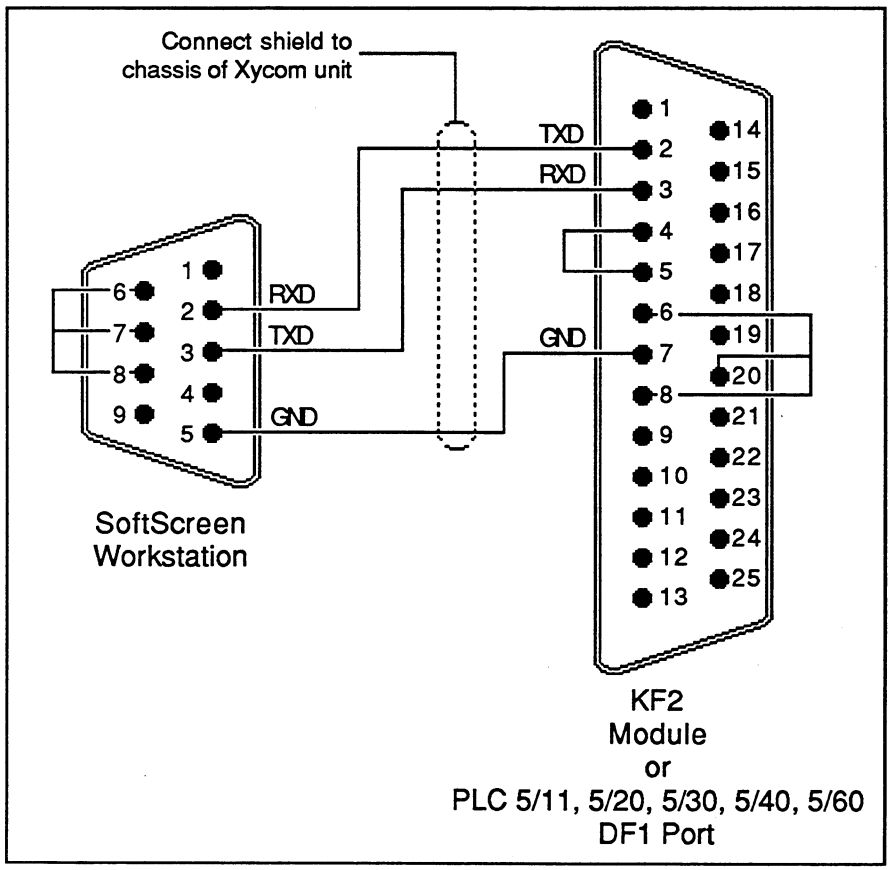


Figure 4-6. Cabling to the 1770-KF2 and PLC 5/11, /20, /30, /40, /60

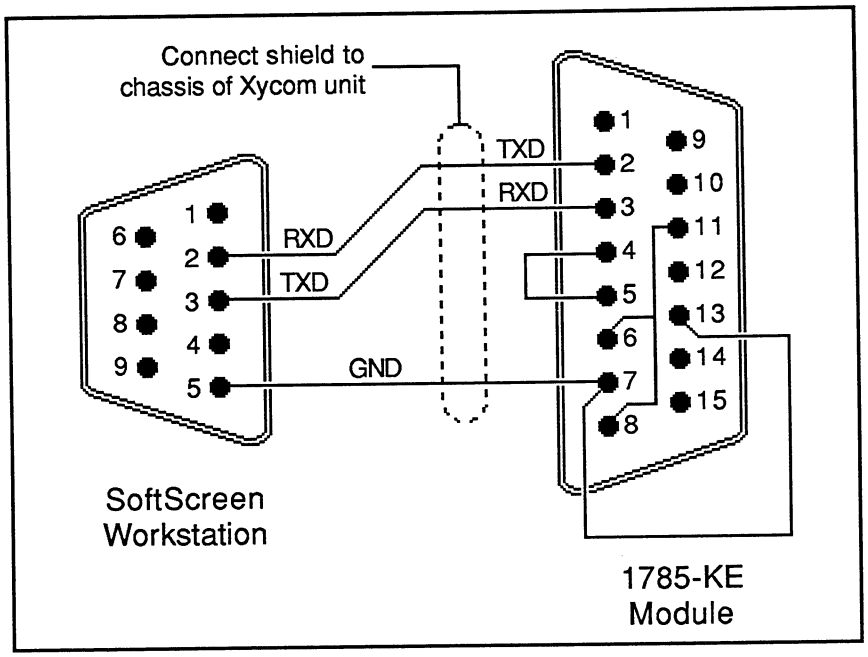


Figure 4-7. Cabling to the 1785-KE

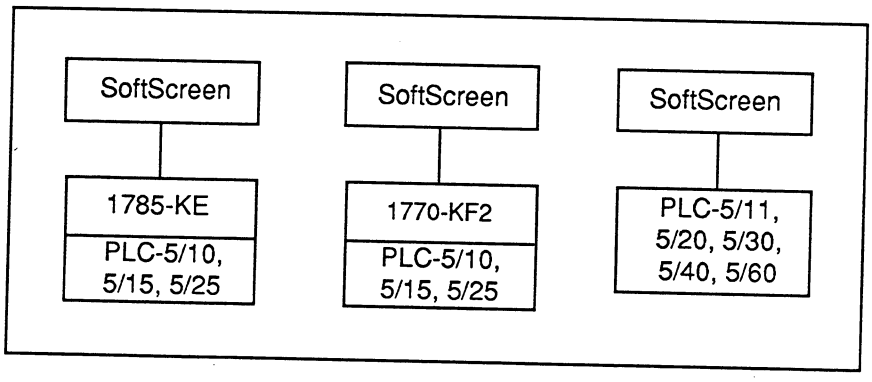


Figure 4-8. Allen-Bradley Stand-Alone Configuration

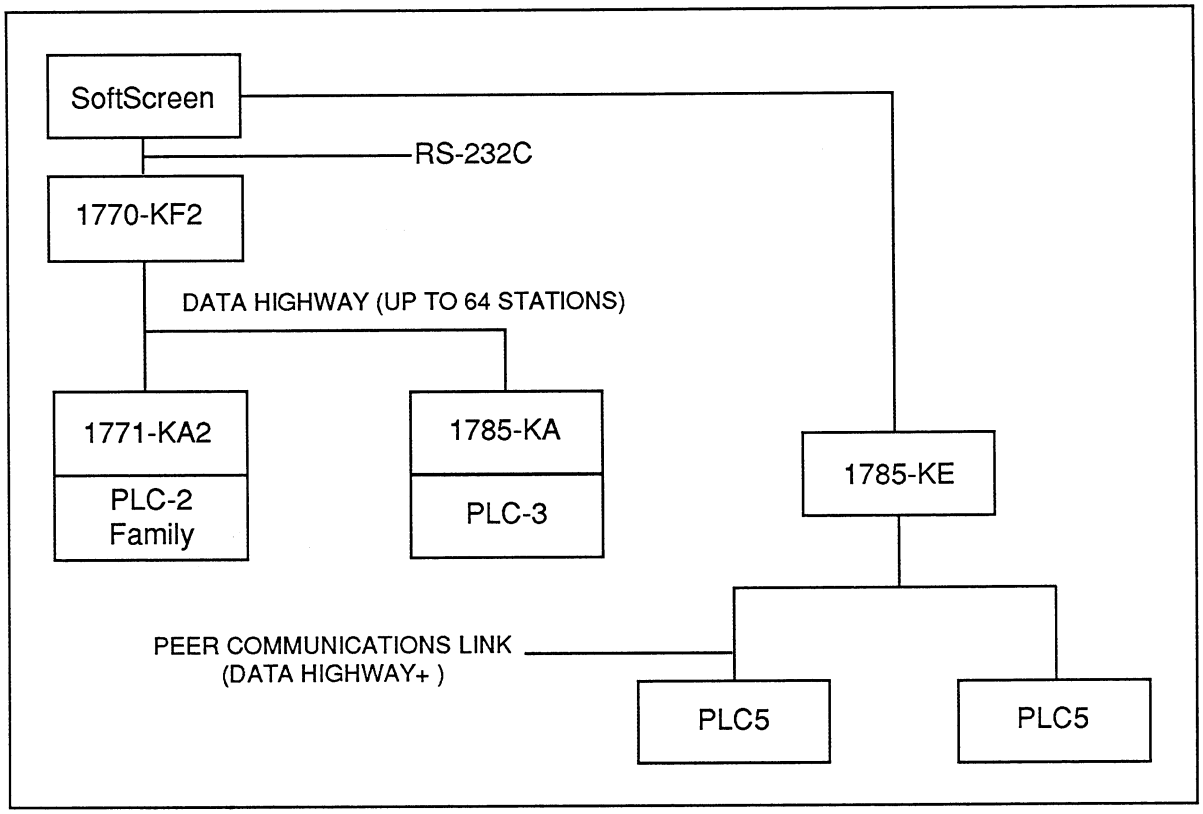


Figure 4-9. Allen-Bradley Network Configuration

4.4.3 Allen-Bradley Data Highway Extended Addressing

The address expressions specific to the Allen-Bradley Data Highway Extended interface are shown in the table below:

Table 4-6. Allen-Bradley Data Highway Extended Addressing

File Type	f	a	e	b	R/W
O	-	00-377o	-	0-17o	R
I	-	00-377o	-	0-17o	R
S	-	-	0-31d	0-15d	R
▵B	3, 9-999d	-	0-999d	0-15d	R/W
B*	3, 9-999d	-	-	0-8191d	R/W
T	4, 9-999d	-	0-999d	0-15d	R/W
C	5, 9-999d	-	0-999d	0-15d	R/W
▵N	7, 9-999d	-	0-999d	0-15d	R/W
F	8-999d	-	0-999d	-	R/W

* [B f/b] form
d decimal
o octal

> **▵NOTE**
> String entry and string display are allowed to and from these addresses.

For example, if the expression **[O:01/17]** is entered in the development system software, the engine reads output rack 0, group 1, octal bit 17.

See the Legend for Table 4-6 on the following page.

Legend

File Types	
I	Input data image area
O	Output
T	Timer
C	Counter
N	Integer
F	Floating point
B	Binary
S	Status
Other Parameters	
a	I/O address rrg where rr = rack number and g = group number
b	bit number (optional)
e	element
f	file number

NOTE
You may use numbers 9-999 to identify any additional bit, timer, counter, integer or floating point file types if you need more file storage.

4.4.4 Allen-Bradley Data Highway Extended Communication Status Registers

The SoftScreen driver for the Data Highway Extended link is constantly communicating with the network. An error could occur at any time during a message transaction. SoftScreen provides communication status registers that contain the current error status of the communication link. The following is a list of the communication status registers, one for each COM port:

#11	Communication Status for Port 1
#8	Communication Status for Port 2
#9	Communication Status for Port 3
#10	Communication Status for Port 4

The communication status registers are 32-bit fixed point registers. A zero value means there are no errors. A non-zero value indicates a communication error. A list of the error code bit assignments is shown below:

Upper 16 Bits

Bit 0	Transmit error
Bit 1	Receive error
Bit 2	Timeout error
Bit 3	Checksum error
Bit 4	NAK error
Bit 5	TNS error
Bit 6	Not used
Bit 7	Initialization error
Bits 8-15	Error codes from PLC

Lower 16 Bits

Unused

4.5 ALLEN-BRADLEY REMOTE I/O

The direct connect to Allen-Bradley's I/O network is accomplished through a high-speed serial expansion card. The remote I/O direct connect is capable of monitoring and simulating remote I/O on the network. It can report the status of any I/O point on the network and it can simulate a remote I/O rack.

The direct connect can also monitor block transfer reads (BTRs) and block transfer writes (BTWs) between the PLC and remote I/O racks. When simulating a remote I/O rack, it can also simulate block transfer modules. The direct connect can supply data for BTRs from the PLC and accept data from BTWs from the PLC.

The remote I/O connection uses double buffering capabilities of the direct connect adapter card. This ensures that the values of groups of data are kept together, and also that changes will be read from or sent to the PLC at the same time.

The file, SDDEM.SS1, supplied with PCENGINE must be present in the current directory or path to run the Allen-Bradley Remote I/O.

4.5.1 Port Connector and LEDs

The direct connect adapter card for Allen-Bradley Data Highway Plus provides the following features:

Port Connector This six-pin connector is the interface to your PLC.

Red LED When on, the red LED indicates that the card has not been initialized. If the red LED is off after power-up, the card has been successfully initialized. The red light turns off when the PCENGINE is powered up.

Green LED The green LED is on whenever the card is transmitting data over the Remote I/O network. This only happens if the workstation is simulating a remote I/O rack.

4.5.2 Adapter Card Jumper Settings

> **NOTE**
> Set the jumpers before connecting to the PLC.

Jumper JB2 on the direct connect adapter card is used to enable/disable the transmitter on that card. Since the Data Highway Plus software module must transmit, the transmission jumper (JB2) must be positioned to ENABLE. This is the default position. Refer to Figure 4-10 on the following page.

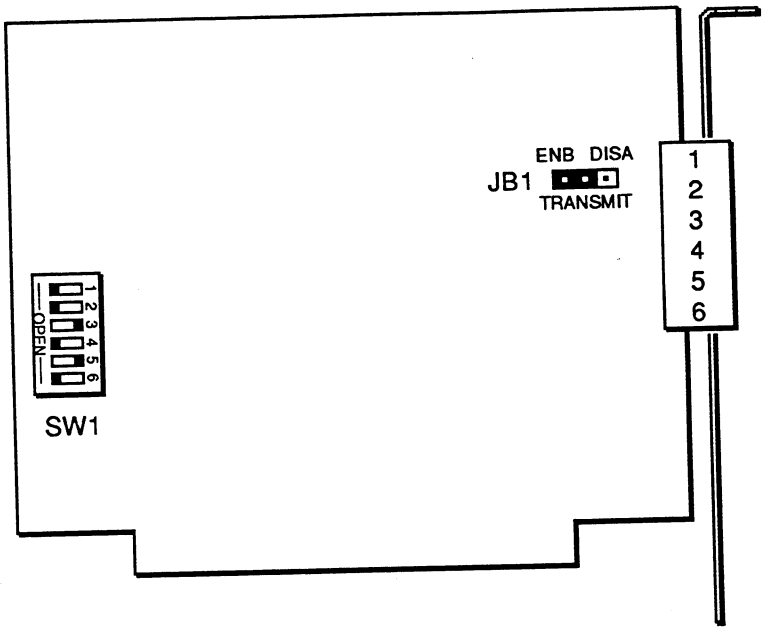


Figure 4-10. Direct Connect Adapter Card Jumper and Switch

4.5.3 **Adapter Card Switch Settings §**

> **NOTE**
> Set the switches before connecting to the PLC.

Table 4-7 on the following pages shows possible port address locations and the corresponding switch settings. The default address is 0x250. Unless there is a known hardware conflict, you should use the default setting. The I/O space required is 8 bytes. Therefore, a setting of 250 actually uses addresses 250-257.

Table 4-7. Allen-Bradley Remote I/O Address Locations §

Host I/O Address	Switch Bits 1	2	3	4	5	6
0x0200	ON	ON	ON	ON	ON	ON
0x0208	ON	ON	ON	ON	ON	OFF
0x0210	ON	ON	ON	ON	OFF	ON
0x0218	ON	ON	ON	ON	OFF	OFF
0x0220	ON	ON	ON	OFF	ON	ON
0x0228	ON	ON	ON	OFF	ON	OFF
0x0230	ON	ON	ON	OFF	OFF	ON
0x0238	ON	ON	ON	OFF	OFF	OFF
0x0240	ON	ON	OFF	ON	ON	ON
0x0248	ON	ON	OFF	ON	ON	OFF
0x0250	ON	ON	OFF	ON	OFF	ON
0x0258	ON	ON	OFF	ON	OFF	OFF
0x0260	ON	ON	OFF	OFF	ON	ON
0x0268	ON	ON	OFF	OFF	ON	OFF
0x0270	ON	ON	OFF	OFF	OFF	ON
0x0278	ON	ON	OFF	OFF	OFF	OFF
0x0280	ON	OFF	ON	ON	ON	ON
0x0288	ON	OFF	ON	ON	ON	OFF
0x0290	ON	OFF	ON	ON	OFF	ON
0x0298	ON	OFF	ON	ON	OFF	OFF
0x02A0	ON	OFF	ON	OFF	ON	ON

Table continued on the following page.

§ *This information taken from the Sutherland-Schultz Direct-Link Interface Reference Manual for the 5136-SD.*

Table 4-7. Allen-Bradley Remote I/O Address Locations (*continued*)

Host I/O Address	Switch Bits 1	2	3	4	5	6
0x02A8	ON	OFF	ON	OFF	ON	OFF
0x02B0	ON	OFF	ON	OFF	OFF	ON
0x02B8	ON	OFF	ON	OFF	OFF	OFF
0x02C0	ON	OFF	OFF	ON	ON	ON
0x02C8	ON	OFF	OFF	ON	ON	OFF
0x02D0	ON	OFF	OFF	ON	OFF	ON
0x02D8	ON	OFF	OFF	ON	OFF	OFF
0x02E0	ON	OFF	OFF	OFF	ON	ON
0x02E8	ON	OFF	OFF	OFF	ON	OFF
0x02F0	ON	OFF	OFF	OFF	OFF	ON
0x02F8	ON	OFF	OFF	OFF	OFF	OFF
0x0600	OFF	ON	ON	ON	ON	ON
0x0608	OFF	ON	ON	ON	ON	OFF
0x0610	OFF	ON	ON	ON	OFF	ON
0x0618	OFF	ON	ON	ON	OFF	OFF
0x0620	OFF	ON	ON	OFF	ON	ON
0x0628	OFF	ON	ON	OFF	ON	OFF
0x0630	OFF	ON	ON	OFF	OFF	ON
0x0638	OFF	ON	ON	OFF	OFF	OFF
0x0640	OFF	ON	OFF	ON	ON	ON
0x0648	OFF	ON	OFF	ON	ON	OFF
0x0650	OFF	ON	OFF	ON	OFF	ON
0x0658	OFF	ON	OFF	ON	OFF	OFF
0x0660	OFF	ON	OFF	OFF	ON	ON
0x0668	OFF	ON	OFF	OFF	ON	OFF

Table continued on the following page.

Table 4-7. Allen-Bradley Remote I/O Address Locations (*continued*)

Host I/O Address	Switch Bits 1	2	3	4	5	6
0x0670	OFF	ON	OFF	OFF	OFF	ON
0x0678	OFF	ON	OFF	OFF	OFF	OFF
0x0680	OFF	OFF	ON	ON	ON	ON
0x0688	OFF	OFF	ON	ON	ON	OFF
0x0690	OFF	OFF	ON	ON	OFF	ON
0x0698	OFF	OFF	ON	ON	OFF	OFF
0x06A0	OFF	OFF	ON	OFF	ON	ON
0x06A8	OFF	OFF	ON	OFF	ON	OFF
0x06B0	OFF	OFF	ON	OFF	OFF	ON
0x06B8	OFF	OFF	ON	OFF	OFF	OFF
0x06C0	OFF	OFF	OFF	ON	ON	ON
0x06C8	OFF	OFF	OFF	ON	ON	OFF
0x06D0	OFF	OFF	OFF	ON	OFF	ON
0x06D8	OFF	OFF	OFF	ON	OFF	OFF
0x06E0	OFF	OFF	OFF	OFF	ON	ON
0x06E8	OFF	OFF	OFF	OFF	ON	OFF
0x06F0	OFF	OFF	OFF	OFF	OFF	ON
0x06F8	OFF	OFF	OFF	OFF	OFF	OFF

4.5.4 Electrical Interface

The Allen-Bradley Remote I/O connection is made through a daisy chain configuration using a Belden 9463 twin-axial cable (or blue hose). Table 4-8 shows the cabling:

Table 4-8. Allen-Bradley Remote I/O Cabling

PLC	Blue Hose	Direct Connect Adapter
1	Blue	1 (or 4)
Shield	Shield	2 (or 5)
2	Clear	3 (or 6)

Pin 1 is the top pin of the connector (the edge connector is on the bottom of the card).

The alternate connectors on the board are used for wiring the Remote I/O in a daisy chain configuration.

The direct connect adapter card should be connected to the PLC the same as any other remote rack. The adapter card does not have on-board termination. If a terminator is required, it should consist of a 150 ohm resistor between the blue and clear wires (1 and 3 or 4 and 6). In environments with high noise, two 75 ohm resistors may be used; one between blue and shield (1 and 2 or 4 and 5), the other between clear and shield (2 and 3 or 5 and 6).

4.5.5 Allen-Bradley Remote I/O Addressing

Table 4-9 shows the Allen-Bradley Remote I/O Addressing.

Table 4-9. Allen-Bradley Remote I/O Addressing

Device	PLC Addressing	Number Type	Size	R/W
Output (O)	Orrg	Octal	Word	R
Input (I)	Irrg	Octal	Word	R/W
Rack Information (RINF)	RINF rr q	Octal	Word	R
Block Transfer Read (BTR)	BTRrrg m off	Octal/Decimal	Word	R/W
Block Transfer Write (BTW)	BTWrrg m off	Octal/Decimal	Word	R
Block Transfer Read Status (BRS)	BRSrrg m	Octal	Word	R
Block Transfer Write Status (BWS)	BWSrrg m	Octal	Word	R
Communication Status (CS)	CS	-	Byte	R

Valid bit addresses for all devices, except CS, are 0-7, 10-17 octal and are read only, except for outputs.

rr	rack, 1-40 for PLC 2 and 0-37 for PLC 3/5
g	group, 0-7
q	starting quarter, 1-4
m	module, 0 or 1
off	word offset into the Block Transfer Module, 0-63 decimal

NOTE
Each block transfer module simulated uses the bits defined by the rack, group, and module to control the block transfers. These bits cannot be used by the PLC or SoftScreen.

For example, if the expression **[0103]** is entered in the development system software, the engine reads rack 01, group 0, and bit 3 of Remote I/O output data.

4.5.6 Allen-Bradley Remote I/O Communication Status Registers

The communication status registers contain information about the communication between the Allen-Bradley Remote I/O and the SoftScreen PC/AT engine. There are four communication status registers, one for each COM port:

#11	Communication status for port 1
#8	Communication status for port 2
#9	Communication status for port 3
#10	Communication status for port 4

The communication status registers are 32-bit fixed point registers with the following bit assignments:

Upper 16 Bits

Equal to 1	Error in initializing the S & S card
Equal to 2	Communication lost with the network
Equal to 3	Error cannot write to real input
Equal to 5	File error. Binary file problem

Lower 16 Bits
Unused

By testing specific bits in the communication status registers, the appropriate text, alarm, or message can be generated to indicate the current status of communication.

For example, the expression #8&2 could be used to test for a communication error. A communication error would be indicated if the expression evaluated to 2, while a 0 would indicate no communication error occurred.

4.6 GE SERIES 6 CCM2

This section describes the functional definition of the SoftScreen to the General Electric (GE) Series 6 CCM2 interface.

4.6.1 Serial Port Configuration

The GE Series 6 CCM2 PLC can connect to SoftScreen on any port and can be used in RS-232C or RS-422 communication standard. Figure 4-11 shows the connection to the GE Series 6 CCM2 PLC. Figures 4-12, 4-13, and 4-14 on the following pages, show the GE Series 6 CCM2 connections to Ports J1 and J2.

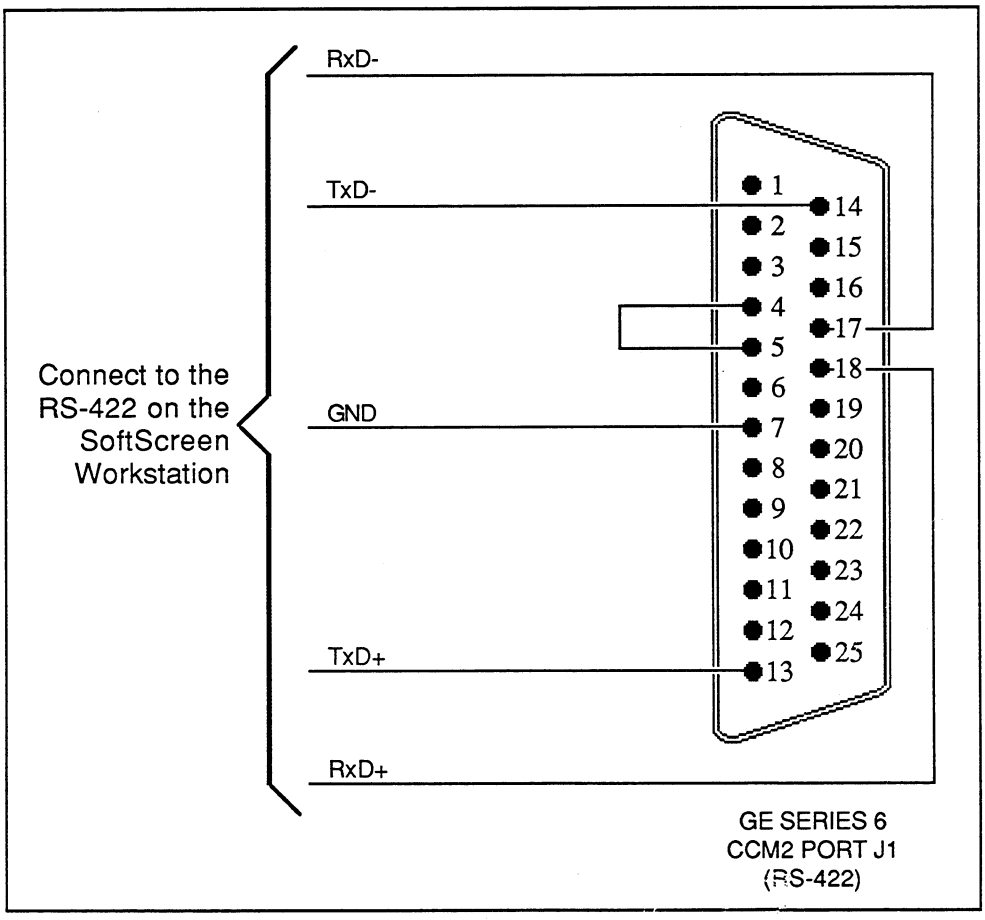


Figure 4-11. RS-422 Connection to GE Series 6 CCM2 Port J1

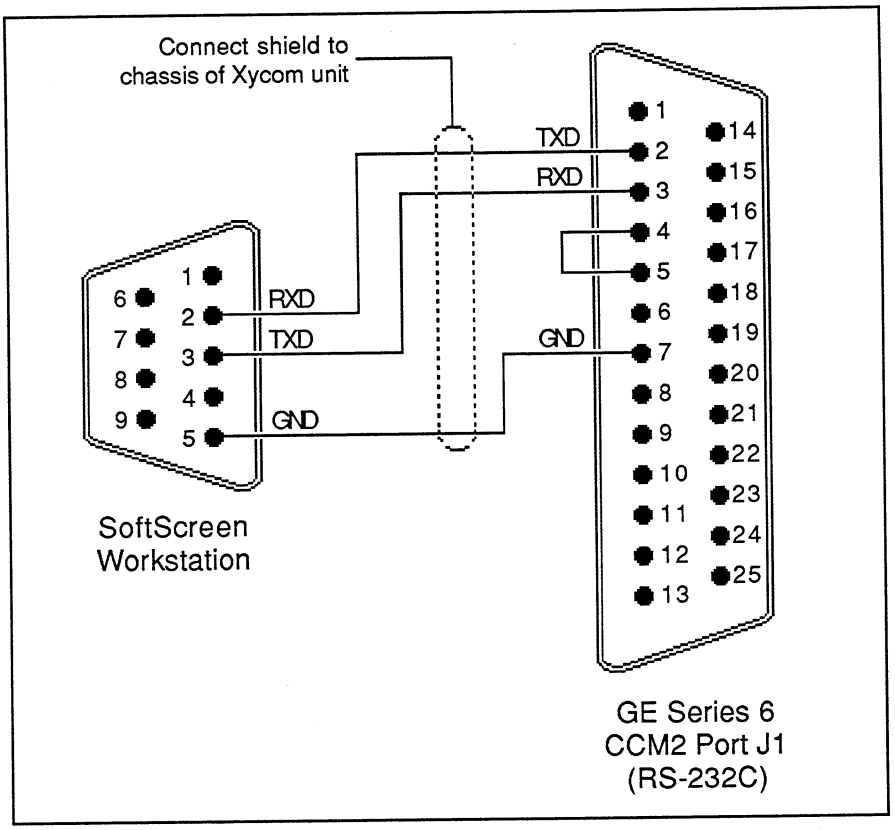


Figure 4-12. RS-232C Connection to GE Series 6 CCM2 Port J1

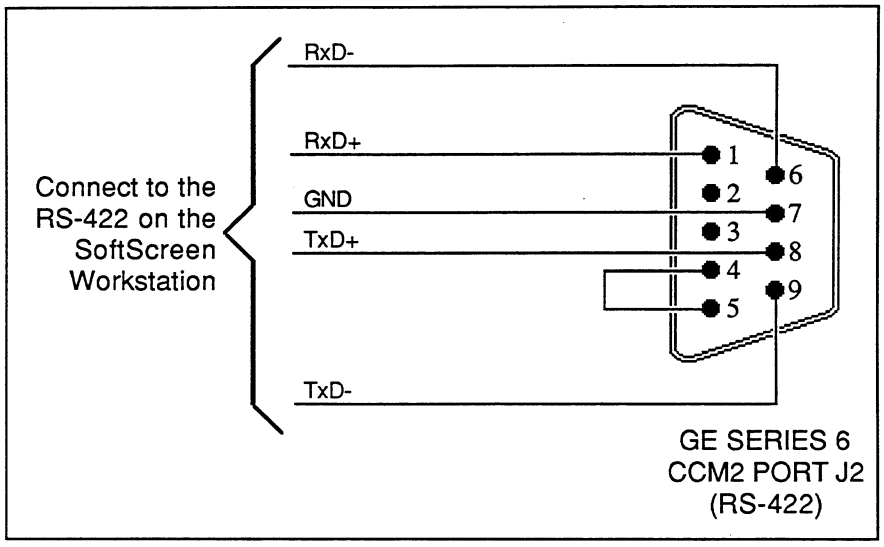


Figure 4-13. RS-422 Connection to GE Series 6 CCM2 Port J2

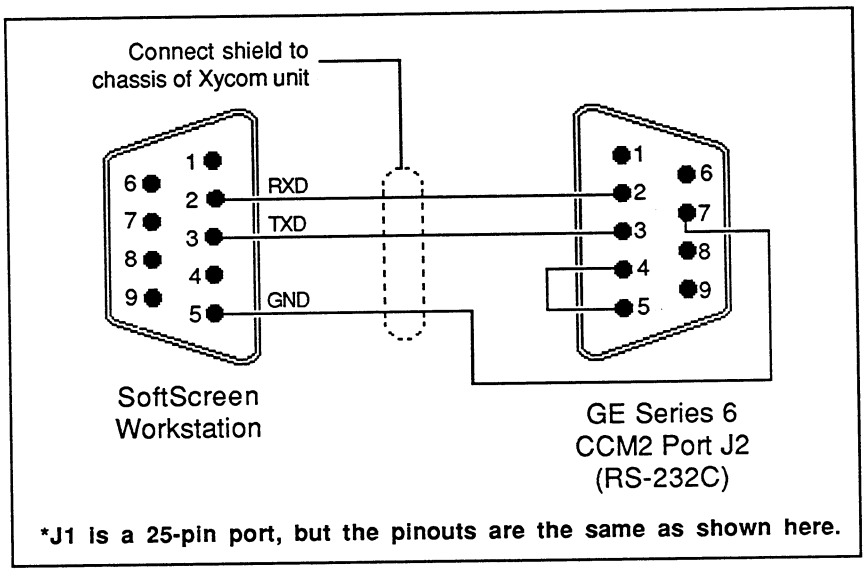


Figure 4-14. RS-232C Connection to GE Series 6 CCM2 Port J2

4.6.2 GE Series 6 CCM2 Addressing

The address expressions (entered for Expression in various configuration forms) that are specific to the GE Series 6 interface are shown in the table below:

Table 4-10 GE Series 6 Addressing

Device	PLC Address	Number Type	Size	R/W
Input	I0001-I65535	Decimal	Bit	R
Output	O0001-O65535	Decimal	Bit	R
▵Register	R0001-R65535	Decimal	Word	R/W

Valid bit addresses for register addresses are 0-15.

For example, if the expression **[PLC1:R0005 3]** is entered in the development system software for a data display object, the engine reads and displays the value in PLC1, word R0005, bit 3.

> **▵NOTE**
> String entry and string display are allowed to and from these addresses.

4.6.3 GE Series 6 CCM2 Communication Status Registers

The communication status registers contain information about the communication between the GE Series 6 CCM2 PLC and the SoftScreen Workstation engine. There are four communication status registers, one for each COM port:

#11	Communication status for port 1
#8	Communication status for port 2
#9	Communication status for port 3
#10	Communication status for port 4

The communication status registers are 32-bit fixed point registers with the following bit assignments:

Upper 16 Bits

Bit 0	Receive error
Bit 1	Transmit error
Bit 2	Enquiry error
Bit 3	Address error
Bit 4	Timeout error
Bit 5	Parity error
Bit 6	PLC timeout error
Bits 7-15	Unused

Lower 16 Bits

Unused

By testing specific bits in the communication status registers, the appropriate text, alarm or message can be generated to indicate the current status of communication. For example, the expression #8&64 could be used to test for a PLC timeout error. A PLC timeout error would be indicated if the expression evaluated to 64, while a value of 0 would indicate no PLC timeout error.

4.7 GE SERIES 90

This section describes the functional description of the SoftScreen to General Electric (GE) Series 90 interface.

4.7.1 Serial Port Configuration

The GE Series 90 PLC can be connected to the SoftScreen PC/AT via an RS-485 connection.

4.7.2 Electrical Interface

Figures 4-15 and 4-16 show the cabling between the SoftScreen PC/AT and the GE Series 90 CPU.

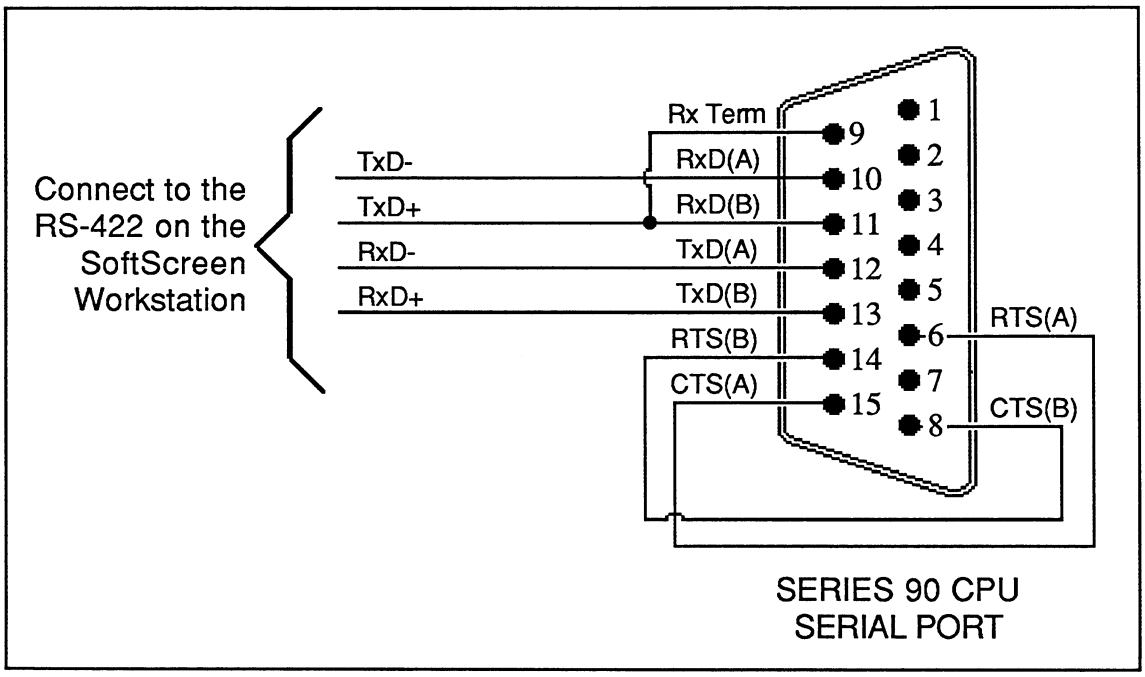


Figure 4-15. Point-to-Point Cabling Diagram

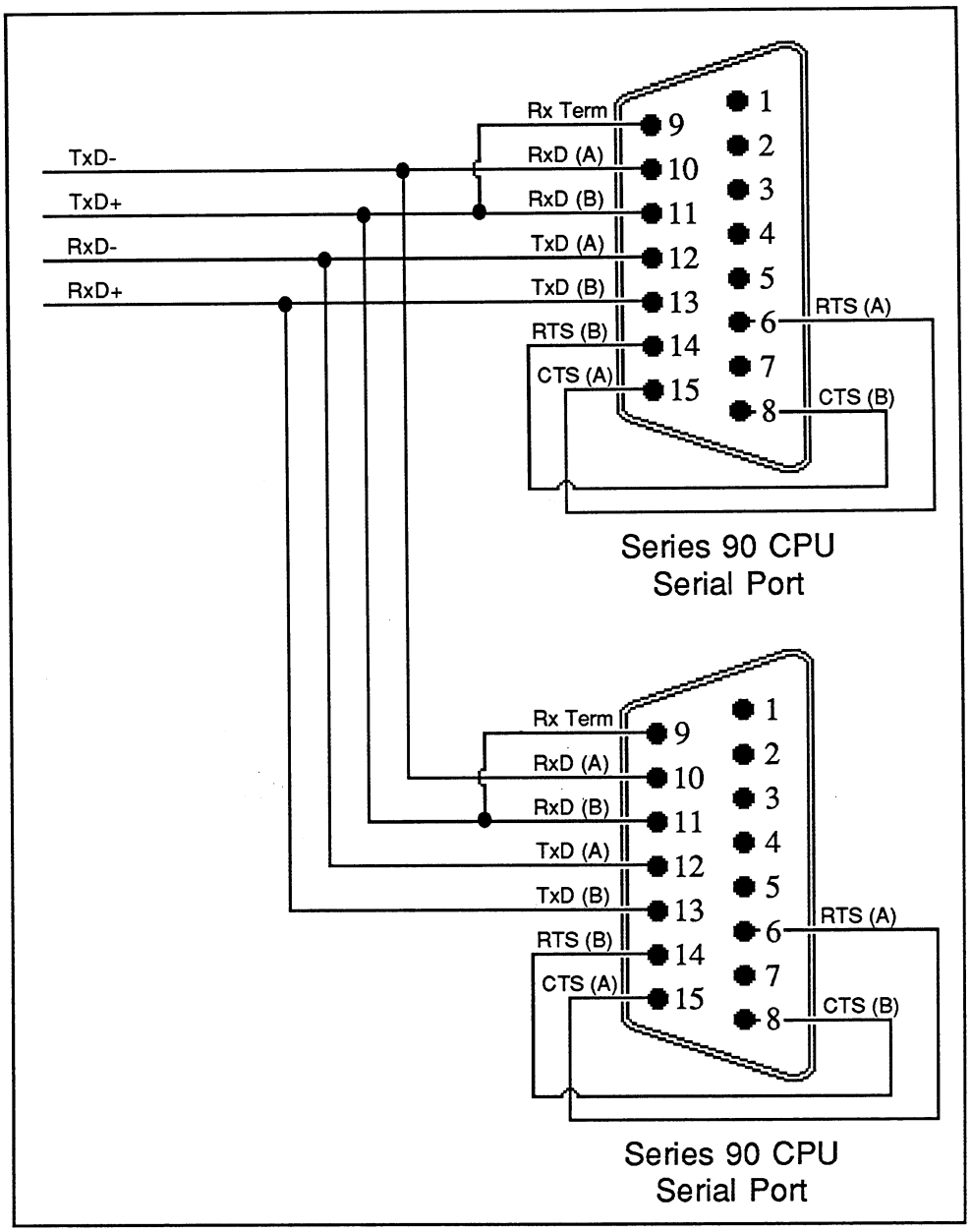


Figure 4-16. Multidrop Cabling Diagram

4.7.3 GE Series 90 Addressing

The address expressions (entered for Expression in various configuration forms) that are specific to the GE Series 90 PLC interface are shown in the table below:

Table 4-11. GE Series 90 Addressing

Device	Range	Dec/Hex	Size	R/W
Input	I0001-I65535	Decimal	Bit	R
Output	Q0001-Q65535	Decimal	Bit	R
Temporary	T0001-T65535	Decimal	Bit	R/W
Internal	M0001-M65535	Decimal	Bit	R/W
SA discrete	SA001-SA65535	Decimal	Bit	R/W
SB discrete	SB001-SB65535	Decimal	Bit	R/W
SC discrete	SC001-SC65535	Decimal	Bit	R/W
S discrete	S0001-S65535	Decimal	Bit	R
Genius global data	G0001-G65535	Decimal	Bit	R/W
Analog input	AI001-AI65535	Decimal	Word	R
Analog output	AQ001-AQ65535	Decimal	Word	R
▵Register	R0001-R65535	Decimal	Word	R/W

Valid bit addresses for analog input, analog output, and register are 0-15.

For example, if the expression **[PLC1:AI100 3]** is entered in the development system software for a data display object, the engine reads and displays the value in PLC1, word AI100, bit 3.

> **▵NOTE**
> String entry and string display are allowed to and from these addresses.

4.7.4 GE Series 90 Communication Status Registers

The communication status registers contain information about the communication between the GE Series 90 PLC and the SoftScreen PC/AT engine. There are four communication status registers, one for each COM port:

#11	Communication status for port 1
#8	Communication status for port 2
#9	Communication status for port 3
#10	Communication status for port 4

The communication status registers are 32-bit fixed point registers with the following bit assignments:

Upper 16 Bit

Bit 0	Receive error
Bit 1	Transmit error
Bit 2	Attach error
Bit 3	Address error
Bit 4	Timeout error
Bit 5	Checksum error
Bit 6	Parity error
Bit 7	Protocol error engine
Bit 8	Bad command error
Bit 9	Framing error
Bit 10	Protocol error PLC
Bit 11	PLC privilege violation
Bits 12-15	Unused

Lower 16 Bits

Unused

By testing specific bits in the communication status registers, the appropriate text, alarm, or message can be generated to indicate the current status of communication.

For example, the expression #8&4 could be used to test for an attach error. An attach error would be indicated if the expression evaluated to 4, while a value of 0 would indicate no attach error.

4.8 GENIUS I/O

The direct connect to Genius I/O network is accomplished through a PC Interface Module (PCIM). This direct connect can read and write directly to many of the memory locations in a GE Series 90-70 PLC. It can also send and receive broadcast global data to and from GE Series 90-70 PLCs and GE Series 90-30 PLCs. It can also read from both discrete and analog Genius I/O blocks.

4.8.1 PCIM Switch Settings

The following table shows the switch settings for the PCIM. The default setting is 222h. Use the default setting unless there is a known hardware conflict. If there is more than one PCIM installed or if an addressing conflict occurs, change the address to within 102h-3FEh.

> **NOTE**
> Set the switches before connecting to the PLC.

Switches 1 and 2 set the high hexadecimal digit; switches 3, 4, and 5 set the middle hexadecimal digit; and switches 7 and 8 set the low hexadecimal digit.

Table 4-12. High Hexadecimal Digit

	Switch	
Digit	**1**	**2**
0	ON	ON
1	ON	OFF
2	OFF	ON
3	OFF	OFF

Table 4-13. Middle Hexadecimal Digit

	Switch			
Digit	**3**	**4**	**5**	**6**
0	ON	ON	ON	ON
1	ON	ON	ON	OFF
2	ON	ON	OFF	ON
3	ON	ON	OFF	OFF
4	ON	OFF	ON	ON
5	ON	OFF	ON	OFF
6	ON	OFF	OFF	ON
7	ON	OFF	OFF	OFF
8	OFF	ON	ON	ON
9	OFF	ON	ON	OFF
A	OFF	ON	OFF	ON
B	OFF	ON	OFF	OFF
C	OFF	OFF	ON	ON
D	OFF	OFF	ON	OFF
E	OFF	OFF	OFF	ON
F	OFF	OFF	OFF	OFF

Table 4-14. Low Hexadecimal Digit

	Switch	
Digit	**7**	**8**
2	ON	ON
6	ON	OFF
A	OFF	ON
E	OFF	OFF

4.8.2 Bus Connectors and LEDs

The PCIM provides the following features:

Bus Connectors — There are two bus connectors on the PCIM, one for each daughterboard. Each bus connector has four terminals.

LEDs — There are four LEDs, two for each daughterboard. When the COM LED is red, communications are working; when it is not lit up, a communications problem has occurred. When the GENI LED is red, the daughterboard is functioning properly; when it is not lit up, there is a problem with the daughterboard.

4.8.3 Electrical Interface

The Genius I/O connection is made using terminal connectors on the PCIM. There are two connectors on the PCIM board—one for each daughterboard—and each connector has four terminals for the bus cable (Serial 1, Serial 2, Shield In, and Shield Out).

The bus cable is created with two AWG #20 wires and one lead of a quarter-Watt resistor. The minimum recommended wire size is AWG #22. When making bus connections, there should be no more than two inches of exposed bare wire. For added protection, each shield drain wire should be insulated with spaghetti tubing to prevent the Shield In and Shield Out wires from touching.

Connect the Serial 1 terminal of each connector to the Serial 1 terminals of the previous device and the next device. Connect the Serial 2 terminal of each connector to the Serial 2 terminals of the previous device and the next device. If the PCIM has two daughterboards, they may be connected to the same bus or to different busses.

Shield In of each connector must be connected to Shield Out of the preceding device. Shield In does not have to be connected for the first device on the bus, and Shield Out does not have to be connected for the last device on the bus. Refer to Figure 4-17 on the following page.

There should be a terminating resistor across the Serial 1 and Serial 2 terminals at the start and end of the bus. Refer to the Single-Slot PC Interface Module (PCIM) Manual for more information.

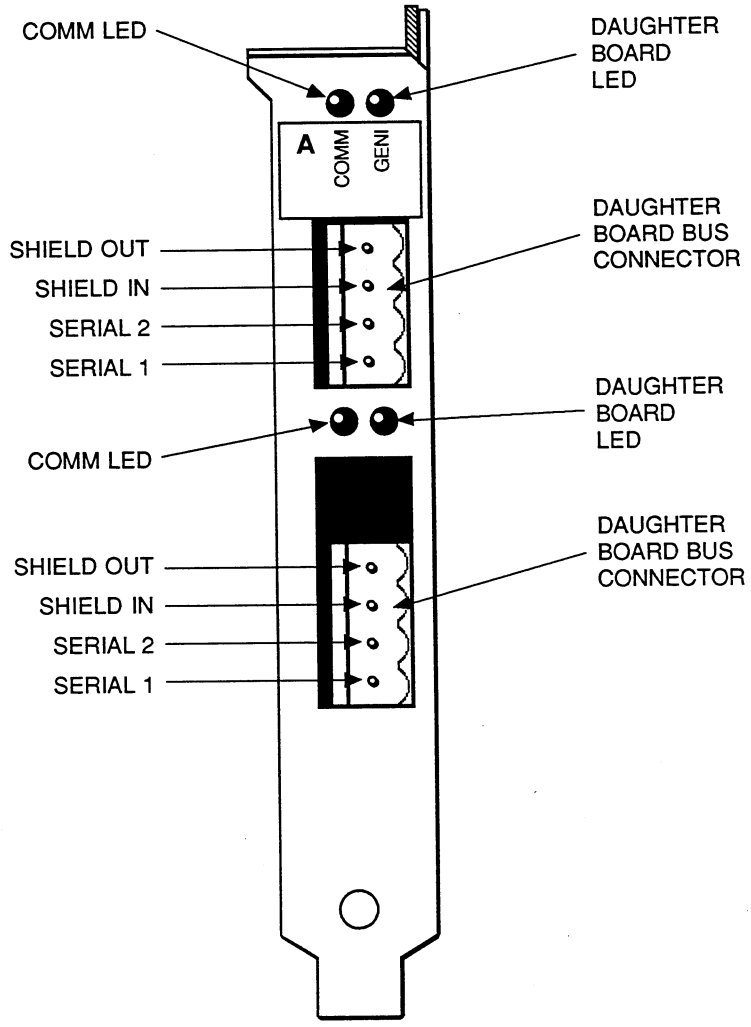


Figure 4-17. Genius I/O Connection

4.8.4 PCIM Configuration

Use dpcimcfg.exe, the PCIM configuration software, to configure the PCIM card (use dpcimcfg = pXXX for a switch setting that differs from the default setting). When configuring the PCIM with dpcimcfg.exe, set the memory base to either 0D0000 or 0CC000 and the I/O base to either 3E0 or 3E4. These settings must match the memory base and I/O base as configured in the SoftScreen Development System when creating applications for the Genius I/O driver. Also, with the dpcimcfg.exe file, set Interrupt to Disabled, Output to Enabled, and Watchdog to Disabled. Refer to the Single-Slot PC Interface Module (PCIM) Manual for more information on configuring the dpcimcfg.exe file.

4.8.5 Genius I/O Addressing

The address expressions (entered for Expression in various configuration forms) that are specific to the Genius I/O interface are shown in the table below:

Table 4-15. Genius I/O Addressing (GE series 90-70)

Device	Range	Dec/Hex	Size	R/W
Input	I0001-I65535	Decimal	Bit	R
Output	Q0001-Q65535	Decimal	Bit	R
Temporary	T0001-T65535	Decimal	Bit	R/W
Internal	M0001-M65535	Decimal	Bit	R/W
SA discrete	SA001-SA65535	Decimal	Bit	R/W
SB discrete	SB001-SB65535	Decimal	Bit	R/W
SC discrete	SC001-SC65535	Decimal	Bit	R/W
S discrete	S0001-S65535	Decimal	Bit	R
Seamless global data	G0001-G65535	Decimal	Bit	R/W
Analog input	AI001-AI65535	Decimal	Word	R
Analog output	AQ001-AQ65535	Decimal	Word	R
▵Register	R0001-R65535	Decimal	Word	R/W
Global word data	GWD001-GWD064	Decimal	Word	R/W
Global discrete data	GBD001-GBD1024	Decimal	Bit	R/W

Table 4-16. Genius I/O Addressing (GE series 90-30)

Device	Range	Dec/Hex	Size	R/W
Global word data	GWD001-GWD064	Decimal	Word	R/W
Global discrete data	GBD001-GBD1024	Decimal	Bit	R/W

Table 4-17. Genius I/O Addressing (I/O Blocks)

Device	Range	Dec/Hex	Size	R/W
Input	I0001-I65535	Decimal	Bit	R
Output	Q0001-Q65535	Decimal	Bit	R
Analog input	AI001-AI65535	Decimal	Word	R
Analog output	AQ001-AQ65535	Decimal	Word	R

Valid bit addresses for global word data, analog input, analog output, and register are 0-15 (read only).

For example, if the expression **[PLC1:AI100 3]** is entered in the development system software for a data display object, the engine reads and displays the value in PLC1, word AI100, bit 3.

> **ΔNOTE**
> String entry and string display are allowed to and from these addresses.

4.8.6 Genius I/O Communication Status Registers

The communication status registers contain information about the communication between the Genius I/O and the SoftScreen PC/AT engine. There are four communication status registers, one for each COM port:

#11	Port 1
#8	Port 2
#9	Port 3
#10	Port 4

The communication status registers are 32-bit fixed point registers with the following bit assignments:

Bit 0	No Datagram messages available
Bit 1	Card processing, command not completed
Bit 2	Transmit reply not completed in 10 seconds
Bit 3	Exceeds data length of device
Bit 4	Transmit message failure
Bit 5	Invalid message parameter
Bit 6	Device is offline
Bit 7	Invalid network/device address
Bit 8	Genius network fail
Bit 9	Invalid PCIM I/O base
Bit 10	Invalid PCIM memory base
Bit 11	PCIM failed, heartbeat/voltage off
Bit 12	PCIM failed, watchdog timed out (not used)
Bits 13-32	Unused

By testing specific bits in the communication status registers, the appropriate text, alarm, or message can be generated to indicate the current status of communication.

For example, the expression #8&4 could be used to test for a transmit reply timeout. A transmit reply timeout would be indicated if the expression evaluated to 4, while a value of 0 would indicate no error.

4.9 MITSUBISHI MELSEC-A

This section describes the functional definition of the SoftScreen to Mitsubishi MELSEC-A interface.

> **NOTE**
> The SoftScreen Mitsubishi MELSEC-A driver uses a checksum. You must set the SUM CHECK dipswitch on your PLC to the YES position. See your PLC manual for more information.

4.9.1 Serial Port Configuration

The Mitsubishi PLC can connect to SoftScreen via RS-232C or RS-422 on any serial port.

> **NOTE**
> Make sure the port you use is the same one specified in the SoftScreen Development System under Configuration-Ports.

This direct connect communicates with the Mitsubishi MELSEC-A PLC using the AJ71C24 unit. Because multiple PLC stations can be networked to Xycom's 2000-18, the specific station number must be specific in the direct connect commands.

> **NOTE**
> AJ71C24 refers to the Mitsubishi Computer Link Unit and PC CPU refers to the Internal Mitsubishi PLC CPU (A1CPU, A2CPU, or A3CPU).

4.9.2 Electrical Interface

The electrical interface for the Mitsubishi interface is either asynchronous RS-232C or RS-422. Figure 4-18 shows the cabling for RS-232C, Figure 4-19 shows the cabling for A1S via RS-232, and Figure 4-20 shows cabling to the Mitsubishi PLC via RS-422.

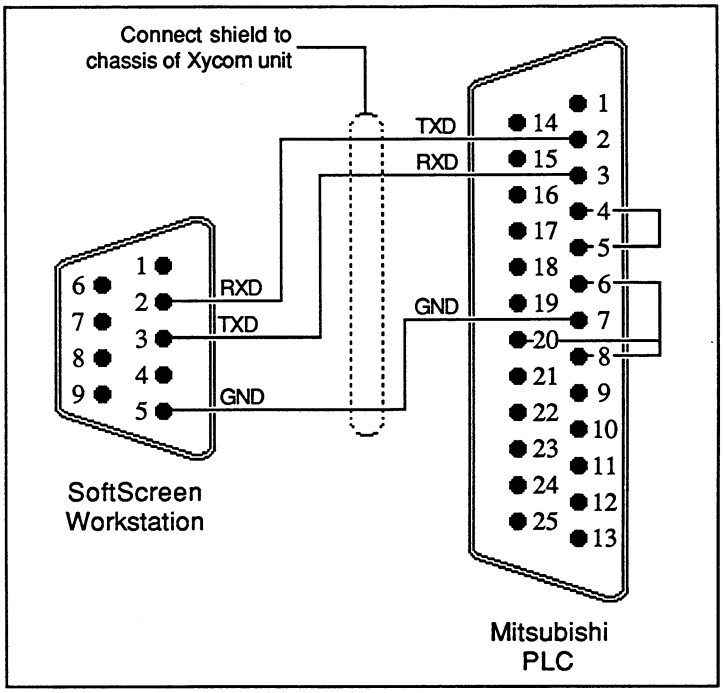


Figure 4-18. RS-232C Cabling to the Mitsubishi PLC

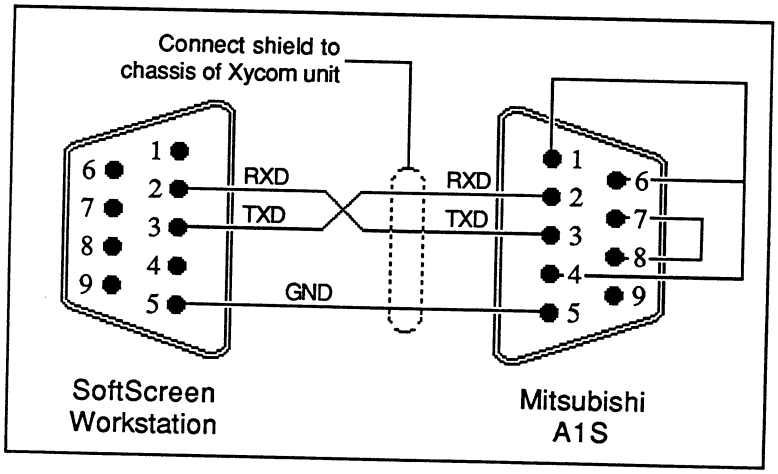


Figure 4-19. RS-232C Cabling to the Mitsubishi A1S

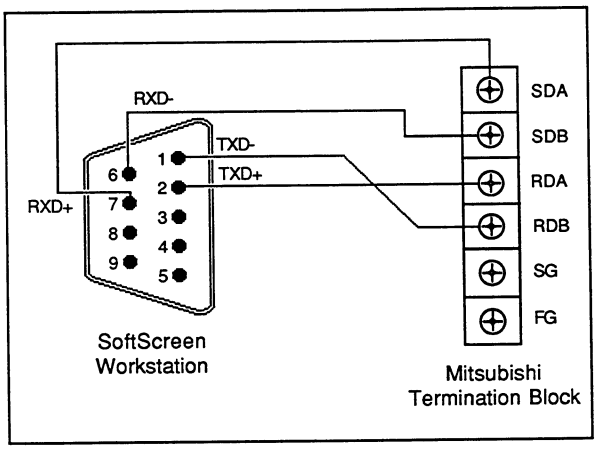


Figure 4-20. RS-422 Cabling to the Mitsubishi PLC

4.9.3 Mitsubishi MELSEC-A Addressing

The address expressions specific to the Mitsubishi PLC interface are shown in the table below:

Table 4-18. Mitsubishi MELSEC-A Addressing

Device	PLC Address	Number Type	Size	R/W
Input X	X0000-X07FF	Hex	Bit	R/W
Output Y	Y0000-Y07FF	Hex	Bit	R
Internal relay M	M0000-M2047	Decimal	Bit	R/W
Latch relay L	L0000-L2047	Decimal	Bit	R/W
Link relay B	B0000-B03FF	Hex	Bit	R/W
Annunciator F	F0000-F0255	Decimal	Bit	R/W
Special relay M	M9000-M9255	Decimal	Bit	R
Timer contact TS	TS000-TS255	Decimal	Bit	R/W
Timer coil TC	TC000-TC255	Decimal	Bit	R/W
Counter contact CS	CS000-CS255	Decimal	Bit	R/W
Counter coil CC	CC000-CC255	Decimal	Bit	R/W
Timer value TN	TN000-TN255	Decimal	Word	R/W
Counter value CN	CN000-CN255	Decimal	Word	R/W
▵Data register D	D0000-D1023	Decimal	Word	R/W
Link register W	W0000-W03FF	Hex	Word	R/W
▵File register R	R0000-R8191	Decimal	Word	R/W
Special register D	D9000-D9255	Decimal	Word	R
Buffer direct BU	BU100-BU7FF	Hex	Word	R/W
Buffer indirect BI	BI1200-BI1FFF	Hex	Word	R/W
Special function SF	SFXX-AAAA*	Hex	Word	R/W

*Where:
XX is special function unit number, 0x00-0x27
AAAA is the address in SFU, 0x0000-0xFFFF
for example: [SF1E-15CD]

For example, if the expression **[PLC1:TN123 3]** is entered in the development system software for a data display object, the engine reads and displays the value in PLC1, word TN123, bit 3.

For TN, CN, D, W, R, and BU, the bit addresses are 0-15. For B1 and SF, the bit addresses are 0-7.

> **△NOTE**
> String entry and string display are allowed to and from these addresses.

Table 4-18 Mitsubishi Addressing (*continued*)

Device	PLC Address	Number Type	Size	R/W
Input word XW	XW000-XW07F	Hex	Word	R/W
Output word YW	YW000-YW07F	Hex	Word	R
Internal relay word MW	MW000-MW127	Decimal	Word	R/W
Latch relay word LW	LW000-LW127	Decimal	Word	R/W
Link relay word BW	BW000-BW03F	Hex	Word	R/W
Annunciator word FW	FW00-FW15	Decimal	Word	R/W
Timer contact word TSW	TSW00-TSW15	Decimal	Word	R/W
Timer coil word TCW	TCW00-TCW15	Decimal	Word	R/W
Counter contact word CSW	CSW00-CSW15	Decimal	Word	R/W
Counter coil word CCW	CCW00-CCW15	Decimal	Word	R/W
Special relay word MW	MW9000-MW9015	Decimal	Word	R

Refer to the SoftScreen Development System Manual for more information on expression value formats.

4.9.4 Mitsubishi Communication Status Registers

The communication status registers contain information about communication between the Mitsubishi PLC and the SoftScreen PC/AT engine. There are four communication status registers, one for each COM port:

#11	Communication status for port 1
#8	Communication status for port 2
#9	Communication status for port 3
#10	Communication status for port 4

The communication status registers are 32-bit fixed point registers with the following bit assignments:

Upper 16 Bits

Bit 0	Receive error
Bit 1	Timeout error
Bit 2	Checksum error
Bit 3	Bad response error
Bits 4-7	Unused
Bits 8-15	PLC error codes

Lower 16 Bits

Unused

By testing specific bits in the communication status registers, the appropriate text, alarm or message can be generated to indicate the current status of communication. For example, the expression #8&4 could be used to test for a checksum error. A checksum error would be indicated if the expression evaluated to 4, while a value of 0 would indicate no checksum error.

4.10 MODBUS PLUS

This section describes the functional definition of the SoftScreen to Modbus Plus interface. The interface to Modbus Plus is through any Modbus port on a Modicon programmable controller. The purpose of the Modbus Plus interface is to access and/or modify registers and coils of the target programmable controller from a Xycom SoftScreen PC/AT engine. Thus, the user is able to monitor registers, output coils, and discrete inputs and to change registers via the SoftScreen Development System menus.

4.10.1 Port Configuration

Modicon Modbus Plus connects to the SoftScreen PC/AT via Modicon's SA85 port via a network cable.

4.10.2 Cabling to the Modbus Plus Network

The network bus consists of a twisted-pair shielded cable that is run in a direct path between successive nodes. Figures 4-21 and 4-22 show cabling and networking of the Modbus Plus.

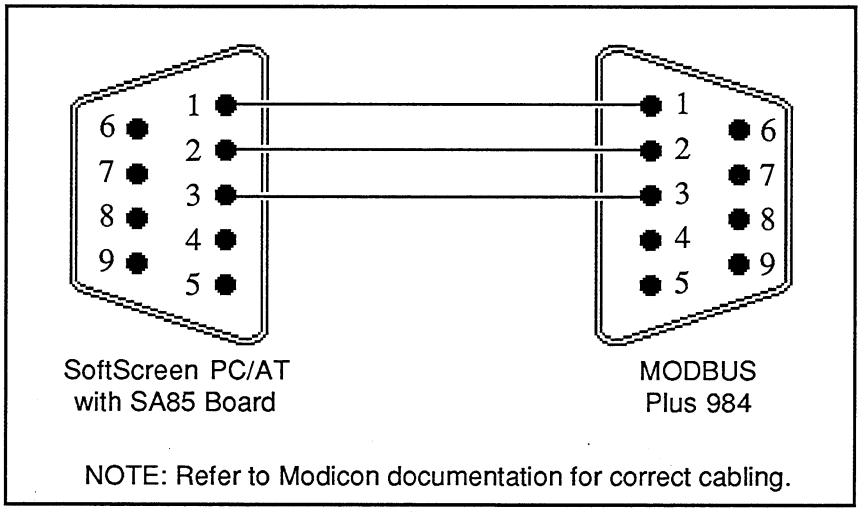


Figure 4-21. Cabling to the Modbus Plus 984

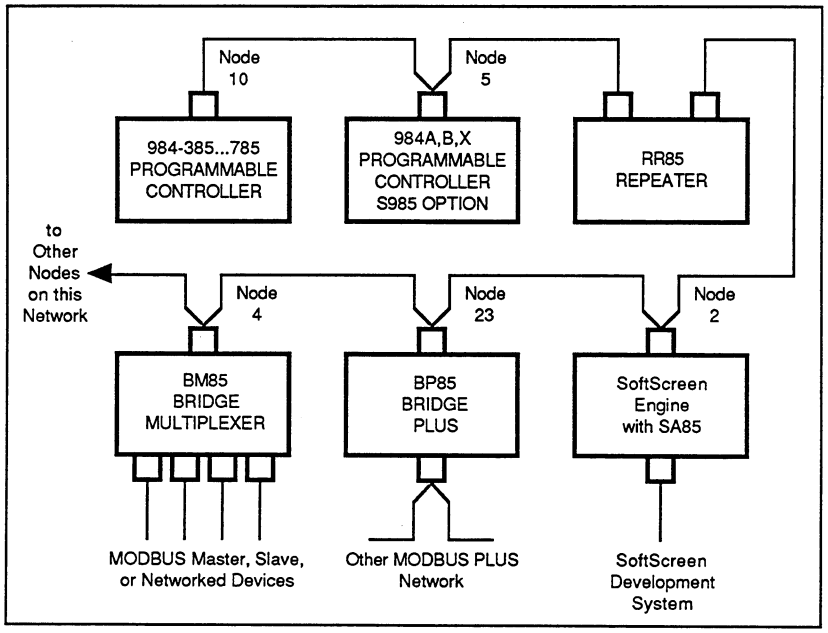


Figure 4-22. Modbus Plus Network Configuration

4.10.3 Modbus Plus Addressing

The address expressions (entered for Expression in various configuration forms) that are specific to the Modbus Plus PLC interface are shown in the table below:

Table 4-19. Modbus Plus 984 Addressing

Device	PLC Address	Number Type	Size	R/W
Coil status	00001-09999	Decimal	Bit	R
Input status	10001-19999	Decimal	Bit	R
▵Holding register	40001-49999	Decimal	Word	R/W
Input register	30001-39999	Decimal	Word	R

▵Valid bit Read addresses for holding and input registers are 0-15.

> **▵NOTE**
> String entry and string display are allowed to and from these addresses.

For example, if the expression **[PLC1:40001,SB]** is entered in the development system software, the engine reads and displays the value in signed binary of PLC1, word 40001.

Table 4-20 shows the ranges that the development system allows for the 785XR support.

Table 4-20. Modbus Plus 984/785XR Addressing

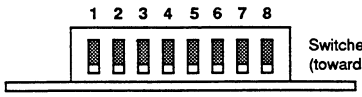
Device	PLC Address	Number Type	Size	R/W
Outputs	000001 - 65504	Decimal	Bit	R
Inputs	100001 - 165504	Decimal	Bit	R
Input Registers	300001 - 364992	Decimal	Word	R
▵Output Holding Registers	400001 - 457766	Decimal	Word	R/W

> **▵NOTE**
> String entry and string display are allowed to and from these addresses.

Expressions follow the same format whether they are used in data display objects, data entry objects, or recipe values. For example, if the expression **[PLC1:40001, SB]** is entered in the development system software for a data display object, the engine will read and display the value in signed binary of PLC1, word 40001.

4.10.4 Setting the Modbus Plus Address

A unique network address is required for each device on the Modbus Plus network. As shown on the following page, you need to set the SA85 address to one that will be used in your application. The resulting address will be one higher than the binary value you set into switches 1 through 6. Switches 7 and 8 are not used. This address should be the same as the one used in the configuration form on the development system. Figure 4-23 shows the network address switch settings, and Figure 4-24, on the following page, shows the location of switches and jumper on the SA85 Network Adapter Board.



ADDRESS	SWITCH POSITION 1	2	3	4	5	6	ADDRESS	SWITCH POSITION 1	2	3	4	5	6
1	0	0	0	0	0	0	33	0	0	0	0	0	1
2	1	0	0	0	0	0	34	1	0	0	0	0	1
3	0	1	0	0	0	0	35	0	1	0	0	0	1
4	1	1	0	0	0	0	36	1	1	0	0	0	1
5	0	0	1	0	0	0	37	0	0	1	0	0	1
6	1	0	1	0	0	0	38	1	0	1	0	0	1
7	0	1	1	0	0	0	39	0	1	1	0	0	1
8	1	1	1	0	0	0	40	1	1	1	0	0	1
9	0	0	0	1	0	0	41	0	0	0	1	0	1
10	1	0	0	1	0	0	42	1	0	0	1	0	1
11	0	1	0	1	0	0	43	0	1	0	1	0	1
12	1	1	0	1	0	0	44	1	1	0	1	0	1
13	0	0	1	1	0	0	45	0	0	1	1	0	1
14	1	0	1	1	0	0	46	1	0	1	1	0	1
15	0	1	1	1	0	0	47	0	1	1	1	0	1
16	1	1	1	1	0	0	48	1	1	1	1	0	1
17	0	0	0	0	1	0	49	0	0	0	0	1	1
18	1	0	0	0	1	0	50	1	0	0	0	1	1
19	0	1	0	0	1	0	51	0	1	0	0	1	1
20	1	1	0	0	1	0	52	1	1	0	0	1	1
21	0	0	1	0	1	0	53	0	0	1	0	1	1
22	1	0	1	0	1	0	54	1	0	1	0	1	1
23	0	1	1	0	1	0	55	0	1	1	0	1	1
24	1	1	1	0	1	0	56	1	1	1	0	1	1
25	0	0	0	1	1	0	57	0	0	0	1	1	1
26	1	0	0	1	1	0	58	1	0	0	1	1	1
27	0	1	0	1	1	0	59	0	1	0	1	1	1
28	1	1	0	1	1	0	60	1	1	0	1	1	1
29	0	0	1	1	1	0	61	0	0	1	1	1	1
30	1	0	1	1	1	0	62	1	0	1	1	1	1
32	0	1	1	1	1	0	63	0	1	1	1	1	1
32	1	1	1	1	1	0	64	1	1	1	1	1	1

Figure 4-23. Modbus Plus Network Address Switch Settings

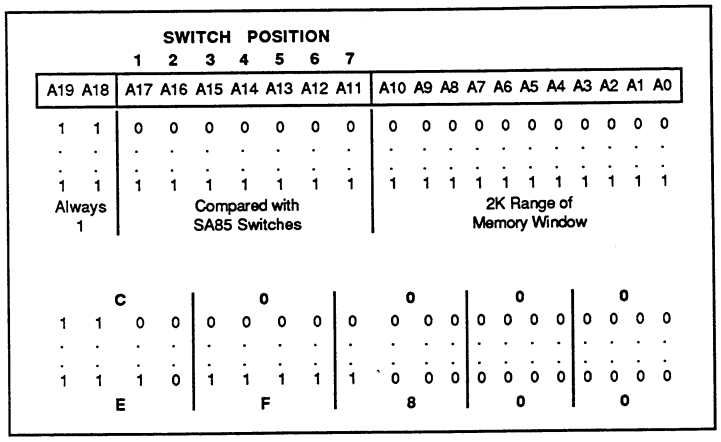


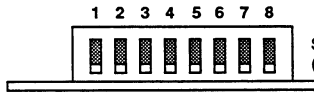
Figure 4-24. SA85 Network Adapter Board Layout

4.10.5 **Setting the Memory Base Address**

The SA85 board uses a memory area in your computer as a buffer for the board's status and message transactions. You must define a base address for this memory area that prevents conflict with other option boards in your computer.

Valid base address settings range from C0000...EF800 hexadecimal. The area used in memory is a 2 Kbyte (800h) portion starting at the base address. Select an area that will not be overwritten by your application or by other options.

The upper part of Figure 4-25 shows the address bus range from all 0 to all 1, with the portion seen by the board's switches. The lower part of the figure shows the lowest and highest base addresses in binary and hexadecimal.



ADDRESS	SWITCH POSITION 1	2	3	4	5	6	7	ADDRESS	SWITCH POSITION 1	2	3	4	5	6	7
C0000	0	0	0	0	0	0	0	D2800	0	1	0	0	1	0	1
C0800	0	0	0	0	0	0	1	D3000	0	1	0	0	1	1	0
C1000	0	0	0	0	0	1	0	D3800	0	1	0	0	1	1	1
C1800	0	0	0	0	0	1	1	D4000	0	1	0	1	0	0	0
C2000	0	0	0	0	1	0	0	D4800	0	1	0	1	0	0	1
C2800	0	0	0	0	1	0	1	D5000	0	1	0	1	0	1	0
C3000	0	0	0	0	1	1	0	D5800	0	1	0	1	0	1	1
C3800	0	0	0	0	1	1	1	D6000	0	1	0	1	1	0	0
C4000	0	0	0	1	0	0	0	D6800	0	1	0	1	1	0	1
C4800	0	0	0	1	0	0	1	D7000	0	1	0	1	1	1	0
C5000	0	0	0	1	0	1	0	D7800	0	1	0	1	1	1	1
C5800	0	0	0	1	0	1	1	D8000	0	1	1	0	0	0	0
C6000	0	0	0	1	1	0	0	D8800	0	1	1	0	0	0	1
C6800	0	0	0	1	1	0	1	D9000	0	1	1	0	0	1	0
C7000	0	0	0	1	1	1	0	D9800	0	1	1	0	0	1	1
C7800	0	0	0	1	1	1	1	DA000	0	1	1	0	1	0	0
C8000	0	0	1	0	0	0	0	DA800	0	1	1	0	1	0	1
C8800	0	0	1	0	0	0	1	DB000	0	1	1	0	1	1	0
C9000	0	0	1	0	0	1	0	DB800	0	1	1	0	1	1	1
C9800	0	0	1	0	0	1	1	DC000	0	1	1	1	0	0	0
CA000	0	0	1	0	1	0	0	DC800	0	1	1	1	0	0	1
CA800	0	0	1	0	1	0	1	DD000	0	1	1	1	0	1	0
CB000	0	0	1	0	1	1	0	DD800	0	1	1	1	0	1	1
CB800	0	0	1	0	1	1	1	DE000	0	1	1	1	1	0	0
CC000	0	0	1	1	0	0	0	DE800	0	1	1	1	1	0	1
CC800	0	0	1	1	0	0	1	DF000	0	1	1	1	1	1	0
CD000	0	0	1	1	0	1	0	DF800	0	1	1	1	1	1	1
CD800	0	0	1	1	0	1	1	E0000	1	0	0	0	0	0	0
CE000	0	0	1	1	1	0	0	E0800	1	0	0	0	0	0	1
CE800	0	0	1	1	1	0	1	E1000	1	0	0	0	0	1	0
CF000	0	0	1	1	1	1	0	E1800	1	0	0	0	0	1	1
CF800	0	0	1	1	1	1	1	...	.	.	.	.	.	.	.
D0000	0	1	0	0	0	0	0	...	.	.	.	.	.	.	.
D0800	0	1	0	0	0	0	1	EE000	1	0	1	1	1	0	0
D1000	0	1	0	0	0	1	0	EE800	1	0	1	1	1	0	1
D1800	0	1	0	0	0	1	1	EF000	1	0	1	1	1	1	0
D2000	0	1	0	0	1	0	0	EF800	1	0	1	1	1	1	1

Figure 4-25. Memory Window Addressing

To decode a memory address, the SA85 compares the computer's address bus bits A19 and A18 with logic 1s. Bits A17...A11 are compared with the SA85 switch settings. The board is selected when an address matches bits A19...A11. Bits A19...A11 define the 2 Kbyte address range to be accessed by the application software. Locations within the 2 Kbyte range are addressed by bits A10...A0.

The address selected must match the base address used in the port configuration form on the development system. Refer to the board layout in Figure 4-26 to locate the memory base address switches. Set switches 1 through 7 as shown to define the base address. Switch 8 is not used.

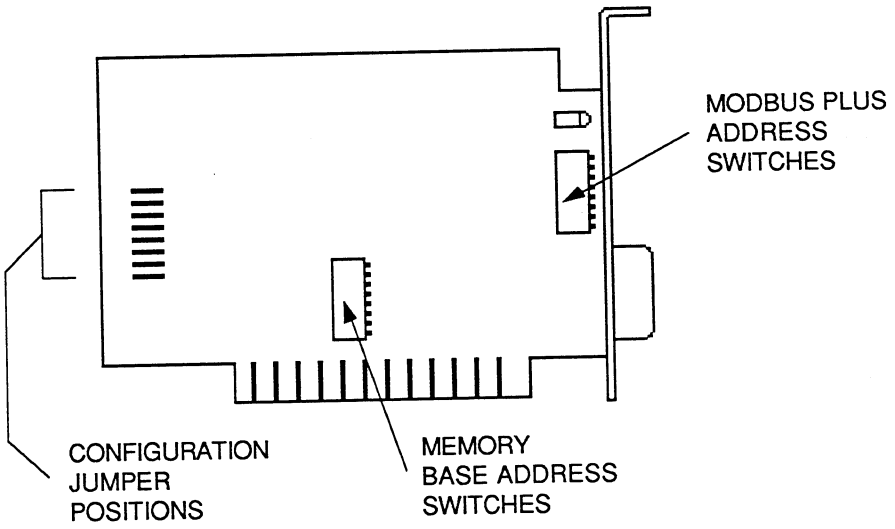


Figure 4-26. Memory Base Address Switch Settings

4.10.6 **Setting the Board Configuration**

The SA85 board contains a jumper which enables a hardware interrupt. You should verify the jumper setting prior to installing the board.

The jumper positions are shown in Figure 4-27. Verify that the jumper is installed into the polled mode position as shown. Only one jumper should be installed. All the other jumper positions should be open. For SoftScreen, the jumper must be in the polled mode position.

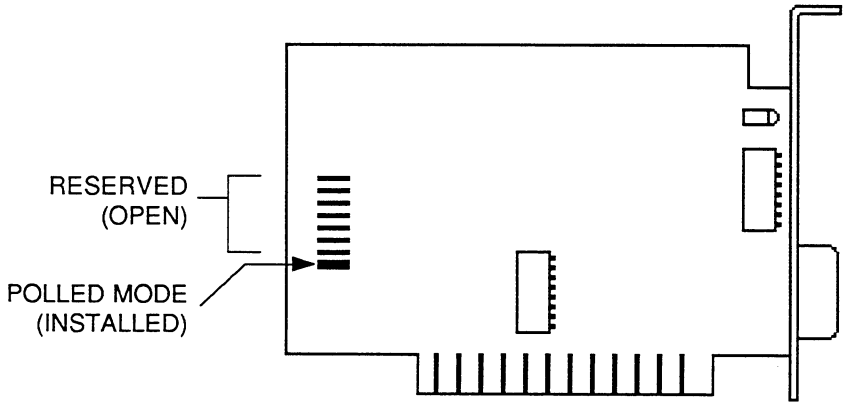


Figure 4-27. SA85 Configuration Jumper Setting

4.10.7 Reading the Network Indicator

The board has a rear panel indicator that shows the communication status at the Modbus Plus port. Figure 4-28 shows the indicator location.

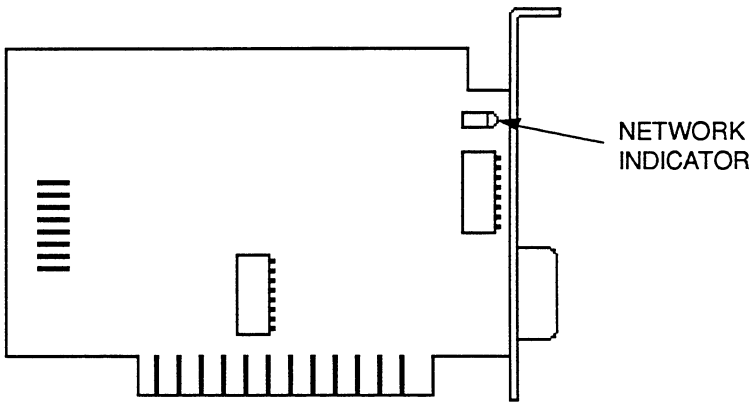


Figure 4-28. SA85 Network Indicator

Modbus Plus status is shown by flashing a repetitive pattern. The patterns are as follows:

Six flashes per second
The node's normal operating state. The node is successfully receiving and passing the token. All nodes on the network should be flashing this pattern.

One flash per second
The node is off-line after being powered up or after exiting the four flashes per second mode. In this state, the node monitors the network and builds a table of active nodes and token-holding nodes. It remains in this state for five seconds, then attempts to go to its normal operating state.

Two flashes, then OFF for two seconds
The node is hearing the token being passed among other nodes, but is never receiving the token. Check the network for an open circuit or defective termination.

Three flashes, then OFF for 1.7 seconds
The node is not hearing any other nodes. It is periodically claiming the token, but finding no other node to which to pass it. Check the network for an open circuit or defective termination.

Four flashes, then OFF for 1.4 seconds
The node has heard a valid message from another node that is using the same address as this node. The node remains in this state as long as it continues to hear the duplicate address. If the duplicate address is not heard for five seconds, the node then changes to the pattern of one flash every second.

4.10.8 Modbus Plus Error Codes

The following table shows the Modbus Plus error codes.

Table 4-21. Modbus Plus Error Codes

Error	Reason
1	Initialization error
2	Communications lost
3	Routing error
4	Interface command error
5	No SA85 board
6	No XT 2112 board
7	First diagnostic test failed
8	Second diagnostic test failed
9	Configured node address doesn't match SA85s
60	Node not running
64	Address error. Station address sent doesn't match the one received.
113	2.5-second interface timeout
114	Bad interface opcode
115	Interface data error
116	Interface test error
117	Interface transfer-done error
118	Bad interface path
119	Bad transfer state
120	Bad transfer length
128	Timeout; took too long to get a response
129	Illegal Modbus function for the slave
130	Illegal data address for the slave
131	Illegal data value for the slave

Table continued on the following page

Table 4-21. Modbus Plus Error Codes (*continued*)

Error	Reason
132	Device failure; the slave's PC has failed to respond
133	Acknowledge; a delay is occurring because the slave's PC is processing the message
134	Busy; the PC is processing another message

4.11 MODICON MODBUS

This section describes the functional definition of the SoftScreen to Modbus interface. The interface to Modbus is through any Modbus port on a Modicon programmable controller. The purpose of the Modbus interface is to access and/or modify registers and coils of the target programmable controller from a Xycom SoftScreen PC/AT engine. Thus, the user is able to monitor registers, output coils, and discrete inputs and to change registers via the SoftScreen Development System menus. SoftScreen supports both Modbus RTU and Modbus ASCII protocols.

4.11.1 Serial Port Configuration

Modicon Modbus connects to SoftScreen via RS-232C, and can connect to any of the serial ports.

> **NOTE**
> Make sure the port you use is the same one specified in the SoftScreen Development System under Configuration-Ports.

4.11.2 **Electrical Interface**

The electrical interface for the Modbus interface is asynchronous RS-232C. Figure 4-29 shows the cabling between the SoftScreen PC/AT and the Modbus 584, and Figures 4-30 and 4-31 show cabling to the Modbus 984 via 9- and 25-pin connectors, respectively.

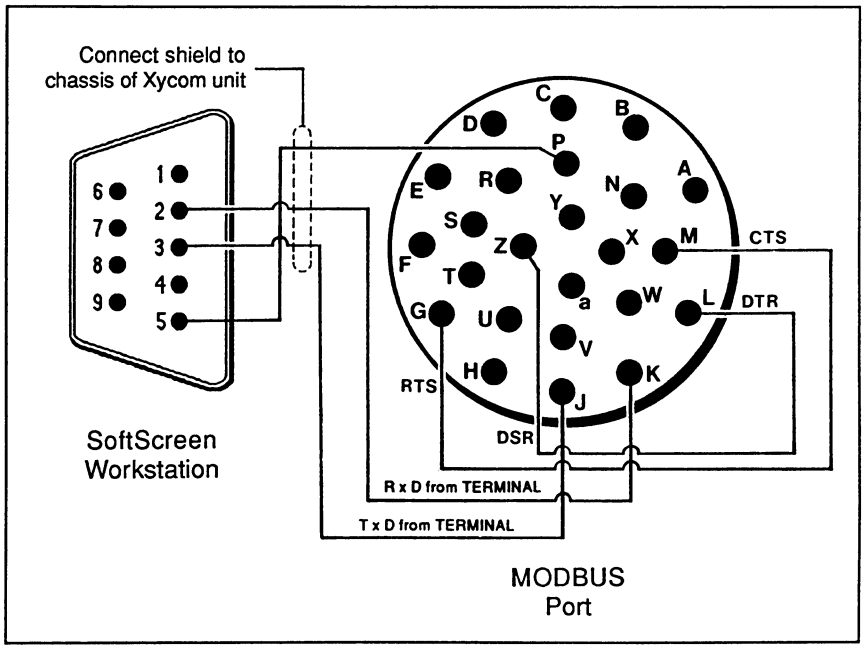


Figure 4-29. Cabling to the Modbus 584

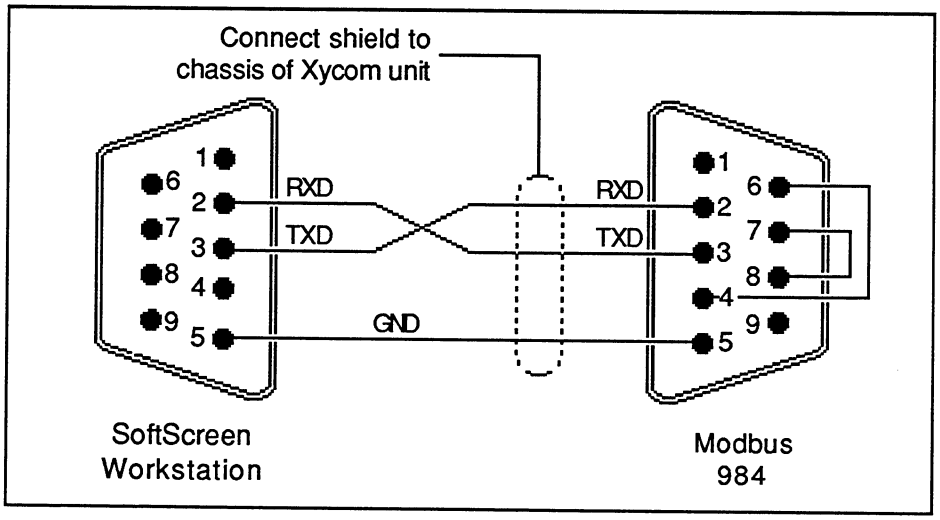


Figure 4-30. Cabling to the Modbus 984 via a 9-pin Connector

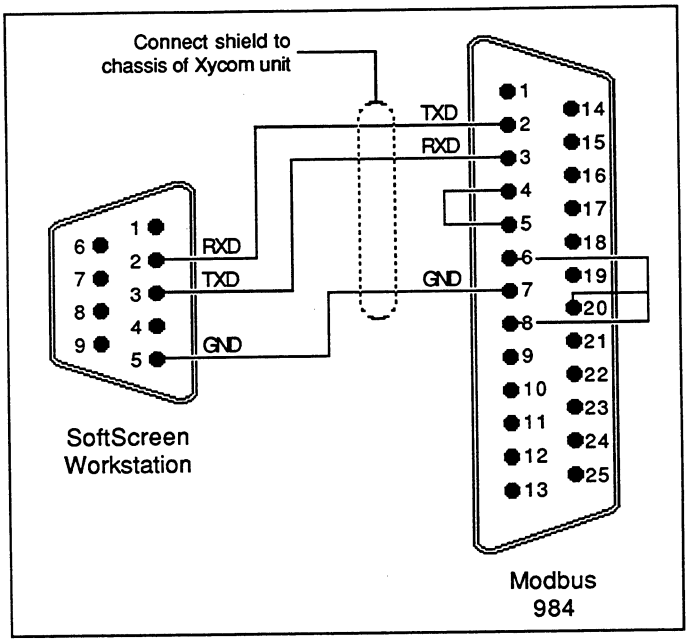


Figure 4-31. Cabling to the Modbus 984 via 25-pin Connector

Figure 4-32 shows the network configuration for the Modbus interface.

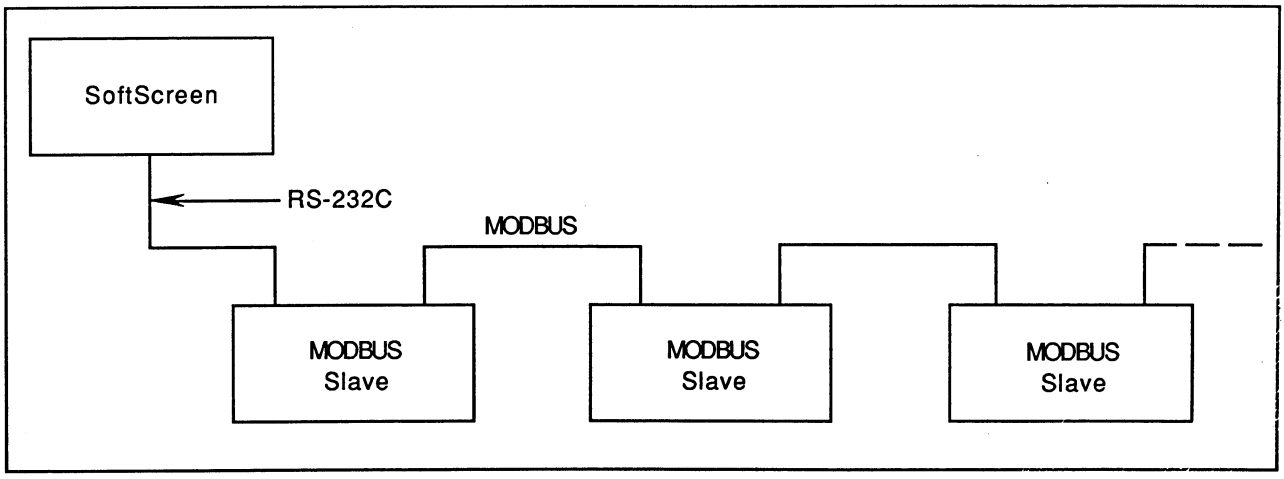


Figure 4-32. Modbus Network Configuration

4.11.3 Modicon Modbus Addressing

The address expression formats specific to the Modbus PLC interfaces are shown below:

Table 4-22. Modbus 384 and 484 Addressing

Device	PLC Address	Number Type	Size	R/W
Coil status	0001-0999	Decimal	Bit	R
Input status	1001-1999	Decimal	Bit	R
▵Holding register	4001-4999	Decimal	Word	R/W
Input register	3001-3999	Decimal	Word	R

Table 4-23. Modbus 584 and 984 Addressing

Device	PLC Address	Number Type	Size	R/W
Coil status	00001-09990	Decimal	Bit	R
Input status	10001-19999	Decimal	Bit	R
▵Holding register	40001-49999	Decimal	Word	R/W
Input register	30001-39999	Decimal	Word	R

▵Valid bit Read addresses for holding and input registers are 0-15.

> **▵NOTE**
> String entry and string display are allowed to and from these addresses.

Table 4-24. Modbus 984/785XR Addressing

Device	PLC Address	Number Type	Size	R/W
Outputs	000001 - 65504	Decimal	Bit	R
Inputs	100001 - 165504	Decimal	Bit	R
Input Registers	300001 - 364992	Decimal	Word	R
▵Output Holding Registers	400001 - 457766	Decimal	Word	R/W

Expressions follow the same format whether they are used in data display objects, data entry objects, or recipe values. For example, if the expression **[PLC1:40001, SB]** is entered in the development system software for a data display object, the engine reads and displays the value in signed binary of PLC1, word 40001. Refer to the SoftScreen Development System Manual for more information on expression value format.

4.11.4 Modbus Communication Status Registers

The communication status registers contain information about the communication between the Modbus PLC and the SoftScreen PC/AT engine. There are four communication status registers, one for each COM port:

#11	Communication status for port 1
#8	Communication status for port 2
#9	Communication status for port 3
#10	Communication status for port 4

The communication status registers are 32-bit fixed point registers with the following bit assignments:

Upper 16 Bits

Bits 0 - 2	Not used
Bit 3	Receive error
Bit 4	Transmit error
Bit 5	CRC error
Bit 6	Address error
Bit 7	Timeout error

Lower 16 Bits

Unused

By testing specific bits in the communication status registers the appropriate text, alarm, or message can be generated to indicate the current status of communication. For example, the expression #8&4 could be used to test for a receive error. A receive error would be indicated if the expression evaluated to 4, while a value of 0 would indicate no receive error.

4.12 OMRON

The SoftScreen PC/AT supports both single-link and multi-link communications to the Omron PLC. The single-link configuration is for a single PLC connected to the terminal. The multi-link configuration connects up to 31 PLCs.

4.12.1 Serial Port Configuration

The SoftScreen PC/AT can communicate with the Omron PLC in both RS-232C, and RS-422 modes. Figure 4-33 shows the RS-232C connection between SoftScreen and Omron and Figure 4-34, on the following page, shows the RS-422 connection between SoftScreen and Omron PLC.

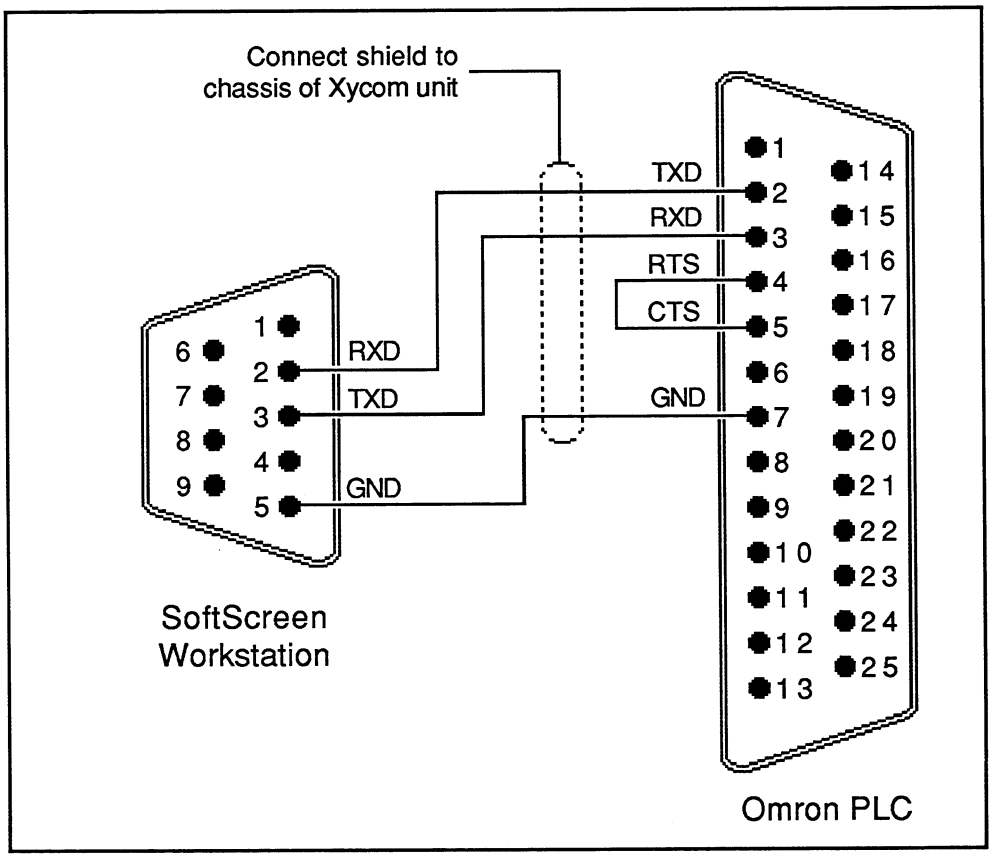


Figure 4-33. RS-232C Connection to Omron PLC

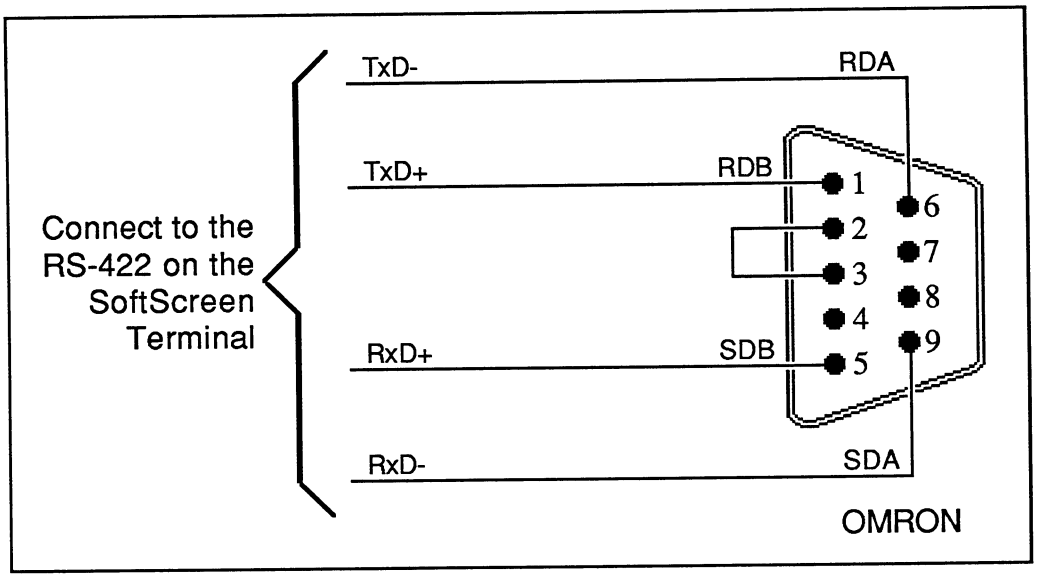


Figure 4-34. RS-422 Connection to Omron PLC

4.12.2 **Omron Addressing**

The address expressions (entered for Expression in various configuration forms) that are specific to the Omron PLC interface are shown in the table below:

Table 4-25. Omron Addressing

Device	**PLC Address**	**Number Type**	**Size**	**R/W**
Internal relay	IR0000-IR0246	Decimal	Word	R0-246 W30-49 W232-246
Holding relay	HR0000-HR0099	Decimal	Word	R/W
Auxiliary relay	AR0000-AR0022	Decimal	Word	R0-22 W7-22
Data memory	DM0000-DM1999	Decimal	Word	R0-1999 W0-999
Timer/counter	TC0000-TC0511	Decimal	Bit	R/W

Valid bit addresses for all devices except TC are 0-15.

For example, if the expression **[PLC1:DM706 3]** is entered in the development system software for a data display object, the PCENGINE reads and displays the value in PLC1, word DM706, bit 3.

4.12.3 Omron Communication Status Registers

The communication status registers contain information about the communication between the Omron PLC and the SoftScreen PC/AT engine. There are four communication status registers, one for each COM port:

#11	Communication status for port 1
#8	Communication status for port 2
#9	Communication status for port 3
#10	Communication status for port 4

The communication status registers are 32-bit fixed point registers with the following bit assignments:

Upper 16 Bits

Bits 0-4	Unused
Bit 5	Receive error
Bit 6	Frame check sequence (FCS) error
Bit 7	Timeout error
Bits 8-15	Unused

Lower 16 Bits

Bits 0-15	Unused

By testing specific bits in the communication status registers, the appropriate text, alarm, or message can be generated to indicate the current status of communication. For example, the expression #8&128 could be used to test for a timeout error. A timeout error would be indicated if the expression evaluated to true while a false value would indicate no timeout error.

4.13 SATT CONTROLLER

This section describes the functional definition of the SoftScreen to SATT PLC interface.

4.13.1 Serial Port Configuration

The SATT PLC connects to the SoftScreen engine via RS-232C.

> **NOTE**
> Make sure the port you use is the same one specified in the SoftScreen Development System under Configuration-Ports.

4.13.2 **Electrical Interface**

The SATT PLC connects to the SoftScreen PC/AT through RS-232C, as shown below. This cable is a standard 9-to-25 pin cable available on the market.

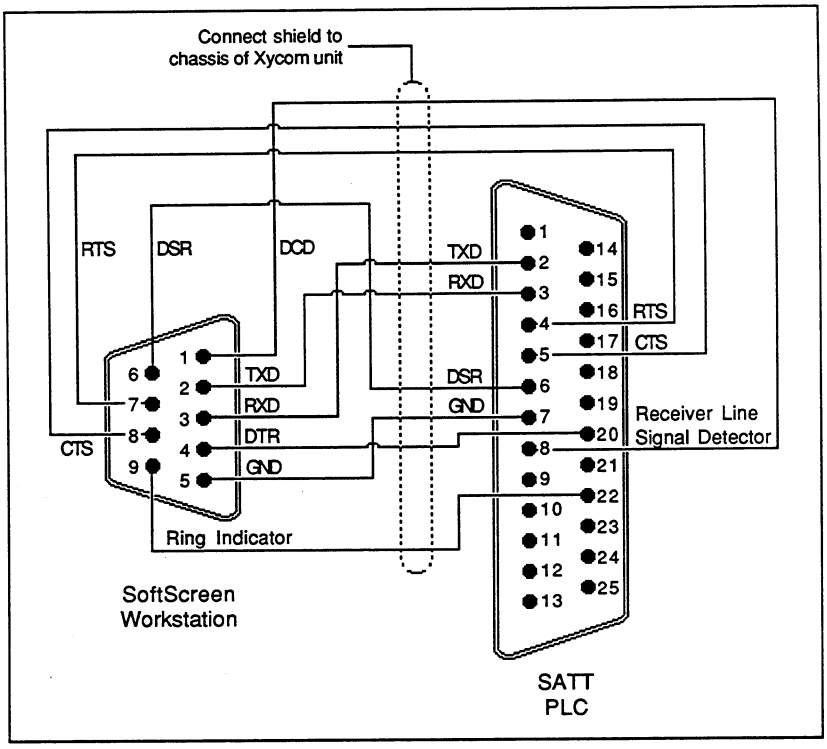


Figure 4-35. Cabling to the SATT PLC

4.13.3 **SATT Addressing**

The address expression format specific to the SATT PLC interface is shown in the table below:

Table 4-26. SATT Addressing

Device	PLC Address	Number Type	Size	R/W
Register	DN0000-DN3071	Decimal	Word	R/W*
I/O RAM	IOR000-IOR37770	Octal	Byte	R
I/O RAM	IOR000-IOR37777	Octal	Bit	W

*Bits are Read Only

For register reads, the allowable bit range is 0-15. For IOR reads, the allowable bit range is 0-7.

For example, if the expression **[PLC1:DN100]** is entered in the development system software for a data display object, the engine reads PLC1, register 100. If **[PLC1:DN100 4]** is entered, the engine reads PCL1, register 100, bit 4. If **[PLC1:1OR100 4]** is entered, the engine reads PCL1, I/O RAM. For more information on expression value formats, see Appendix C of the SoftScreen Development System Manual.

4.13.4 SATT Communication Status Registers

The communication status registers contain information about the communications between the SATT PLC and the SoftScreen PC/AT engine. There are four communication status registers, one for each COM port:

#11	Communication status for port 1
#8	Communication status for port 2
#9	Communication status for port 3
#10	Communication status for port 4

The communication status registers are 32-bit fixed point registers with the following bit assignments:

Upper 16 Bits

Bit 0-3	Unused
Bit 4	Receive error
Bit 5	BCC error
Bit 6	Timeout error
Bits 7-15	Unused

Lower 16 Bits

Unused

By testing the specific bits in the communication status registers, the appropriate text, alarm or messages can be generated to indicate the current status of communication. For example, the expression #8&0x40 could be used to test for a timeout error. A timeout error would be indicated if the expression evaluated to 64, while a value of 0 would indicate no timeout error.

4.14 SIEMENS

The Siemens direct connect can read data from the addresses listed below. Since the programming port does not allow data to be written to these addresses, there will not be a corresponding command to write data to these addresses.

Table 4-27. Siemens Addressing

Type	Description
I0 - I127	Input image (PII)
QO - 0127	Output image (PIQ)
F0 - F255	Flags (F)
TS0 - TS127	Timer status
TV0 - TV127	Timer value
CS0 - CS127	Counter status
CV0 - CV127	Counter value

For the input image, output image, and flags, the address used in the PLC program is of the form b.x where b is the byte number in that address type and x is the bit number within the specified byte. The address used in SoftScreen is of the form [b x] where b is the byte number in that address type and x is the bit number within the specified byte. For example, **[F3 7]** specifies flag memory byte 3, bit 7.

This direct connect can also read and write data blocks 2/3 through 255.

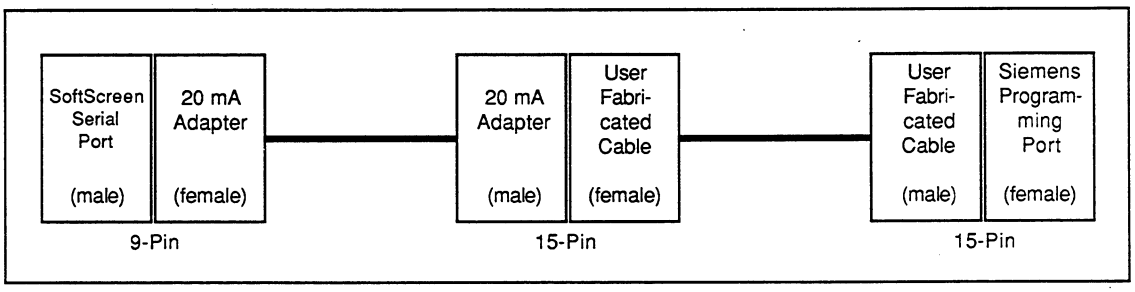
4.14.1 Serial Port Configuration

The Siemens PLC connects to SoftScreen via RS-422 and a 20 mA connector or any serial port.

> **NOTE**
> Make sure the port you use is the same one specified in the SoftScreen Development System under Configuration-Ports.

4.14.2 **Electrical Interface**

The SoftScreen Workstation connects to the Siemens PLC via RS-422 and a 20 mA current loop adapter, which is optionally available from Xycom. This loop adapter connects to the 9-pin serial port of the SoftScreen engine and to a 15-pin user-fabricated cable. The other end of the cable then connects to the Siemens PLC as illustrated in the diagram below:



The pinouts for the connection between the 20 mA adapter and the Siemens programming port are shown in Figure 4-36.

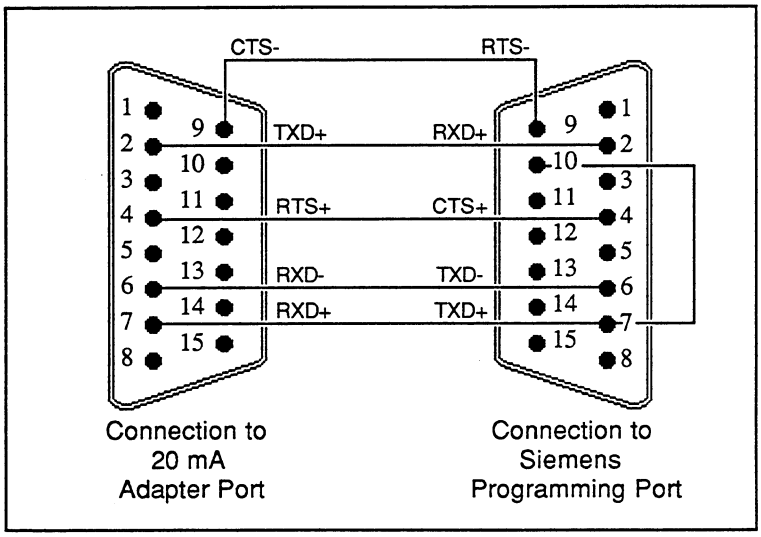


Figure 4-36. Cabling to the Siemens PLC (P/N 97054-001)

4.14.3 Siemens Addressing

All Siemens addresses are in decimal. The address explanation formats specified to the Siemens PLC interface are shown below:

Table 4-28. Siemens 100 Series CPU Addressing

Device	100 CPU Address	102 CPU Address	103 CPU Address	Size	R/W
Input (I)	I0000-I0127	I0000-I0127	I0000-I0127	Byte	R
Output (Q)	Q0000-Q0127	Q0000-Q0127	Q0000-Q0127	Byte	R
Flag (F)	F0000-F0127	F0000-F0127	F0000-F0127	Byte	R
Timer status (TS)	TS0000-TS015	TS0000-TS028	TS0000-TS0127	Word	R
Timer value (TV)	TV0000-TV015	TV0000-TV028	TV0000-TV0127	Word	R
Counter status (CS)	CS0000-CS015	CS0000-CS031	CS0000-CS031	Word	R
Counter value (CV)	CV0000-CV015	CV0000-CV031	CV0000-CV031	Word	R
Data block	DB2-DB63	DB2-DB63	DB2-DB255	N/A	N/A
*Right byte (DB DR)	DR000-DR255	DR000-DR255	DR000-DR255	Byte	R
*Left byte (DB DL)	DL000-DL255	DL000-DL255	DL000-DL255	Byte	R
*Word (DB DW)	DW000-DW255	DW000-DW255	DW000-DW255	Word	R/W
*§Floating pt.(DB FP)	FP000-FP254	FP000-FP254	FP000-FP254	Double word	R/W
*Bit in word (DB BI)	BI000-BI255	BI000-BI255	BI000-BI255	Bit	R

Table 4-29. Siemens 900 Series CPU Addressing

Device	921/922 CPU Address	928 CPU Address	94X CPU Address	Size	R/W
Input (I)	I0000-I0127	I0000-I0127	I0000-I0127	Byte	R
Output (Q)	Q0000-Q0127	Q0000-Q0127	Q0000-Q0127	Byte	R
Flag (F)	F0000-F0255	F0000-F0255	F0000-F0255	Byte	R
Timer status (TS)	TS0000-TS0127	TS0000-TS0255	TS0000-TS0127	Word	R
Timer value (TV)	TV0000-TV0127	TV0000-TV0255	TV0000-TV0127	Word	R
Counter status (CS)	CS0000-CS0127	CS0000-CS0255	CS0000-CS0127	Word	R
Counter value (CV)	CV0000-CV0127	CV0000-CV0255	CV0000-CV0127	Word	R
Data block	DB2-DB0255	DB3-DB0255	DB2-DB255	N/A	N/A
*Right byte (DB DR)	DR000-DR255	DR000-DR255	DR000-DR255	Byte	R
*Left byte (DB DL)	DL000-DL255	DL000-DL255	DL000-DL255	Byte	R
*Word (DB DW)	DW000-DW255	DW000-DW255	DW000-DW255	Word	R/W
*§Floating pt.(DB FP)	FP000-FP254	FP000-FP254	FP000-FP254	Double word	R/W
*Bit in word (DB BI)	BI000-BI255	BI000-BI255	BI000-BI255	Bit	R

Table continued on the following page.

Table 4-29. Siemens 900 Series CPU Addressing *(continued)*

Device	90U CPU Address	95U CPU Address	Size	R/W
Input (I)	I0000-I0127	I0000-I0127	Byte	R
Output (Q)	Q0000-Q0127	Q0000-Q0127	Byte	R
Flag (F)	F0000-F0128	F0000-F0256	Byte	R
Timer status (TS)	TS0000-TS0031	TS0000-TS0127	Word	R
Timer value (TV)	TV0000-TV0031	TV000-TV0127	Word	R
Counter status (CS)	CS0000-CS0031	CS0000-CS0031	Word	R
Counter value (CV)	CV0000-CV0031	CV0000-CV0031	Word	R
Data block	DB2-DB0127	DB2-DB0255	N/A	N/A
*Right byte (DB DR)	DR000-DR255	DR000-DR255	Byte	R
*Left byte (DB DL)	DL000-DL255	DL000-DL255	Byte	R
*Word (DB DW)	DW000-DW255	DW000-DW255	Word	R/W
*§Floating pt.(DB FP)	FP000-FP254	FP000-FP254	Double word	R/W
**Bit in word (DB BI)	BI000-BI255	BI000-BI255	Bit	R

* These data items are contained within a data block. To access an item, you must specify the data block number, data item type, and data item word address. For example, to specify the left byte in word 22 of data block 12, use [DB12-DL22]. To specify the floating point value at word address 31 of data block 9, use [DB9-FP31].

** For data block bit in word, (DB BI), a bit address from 0-15 **must** be specified. Valid bit addresses for I, Q, and F are 0-7. Valid bit addresses for TS, CS, TV, and CU are 0-15. Valid bit addresses for DW, DR, and DL are 0-7 and are read-only.

If you do not specify floating point format in your expressions for floating point registers, SoftScreen automatically assigns floating point format, regardless of the default PLC format setting.

SoftScreen and the Siemens PLC store floating point data types in different formats. SoftScreen uses a fixed point format in which more than nine significant digits can be displayed, while the Siemens PLC uses IEEE single floating point format in which only seven significant digits can be displayed. For example, SoftScreen can display the eight-digit value 1234.5678, but a digit will be lost when the value is sent to and stored in the PLC. When the value is read back, it may be displayed as 1234.5677 or 1234.5679.

4.14.4 Siemens Communication Status Registers

The communication status registers contain information about the communication between the Siemens PLC and the SoftScreen PC/AT engine. There are four communication status registers, one for each COM port:

#11	Communication status for port 1
#8	Communication status for port 2
#9	Communication status for port 3
#10	Communication status for port 4

The communication status registers are 32-bit fixed point registers with the following bit assignments:

Upper 16 Bits

Bits 0	No response
Bit 1	Timeout error
Bit 2	Parity error
Bit 3	Bad response
Bit 4	Unused
Bit 5	Block write error
Bit 6	Block length error
Bit 7	No block exists
Bits 8-15	Unused

Lower 16 Bits

Bits 0-15	Unused

By testing specific bits in the communication status registers the appropriate text, alarm or message can be generated to indicate the current status of communication. For example, the expression #8&2 could be used to test for a timeout error. A timeout error would be indicated if the expression is evaluated to 2, while a value of 0 would indicate a timeout error.

4.15 SIMULATED PLC

The SoftScreen PC/AT can simulate a PLC. This direct connect is typically used for testing an application when a real PLC is not available.

4.15.1 Electrical Interface

No interface is necessary as this is a simulated PLC.

4.15.2 Simulated PLC Addressing

> **NOTE**
> The simulated PLC does not have a configuration form. Only the PLC configuration form requesting the PLC Name appears.

The address expressions that are specific to the Simulated PLC are shown in the table below:

Table 4-30. Simulated PLC Addressing

Device	PLC Address	Number Type	Size	R/W
Random Number	RAND	-	Word	R
Ramp Up	RAMPUP	-	Word	R/W
Ramp Down	RAMPDN	-	Word	R/W
Address	0-49	Decimal	Fixed Point	R/W

Valid bit addresses for all devices except address are 0-15 and are read-only.

Use the following formats when using these expressions:

Expression	Format
Read/write registers	[0]-[49]. These registers hold values written to them.
Ramp Up variable	[RAMPUP]. This register increments by one from 0-32767.
Ramp Down variable	[RAMPDN]. This register decrements by one from 32767.
Random variable	[RAND]. This register generates a random number between 0-32767.

NOTE
Only one port per application may be configured for the simulated PLC.

4.15.3 Simulated PLC Communication Status Registers

No errors are returned by the simulated PLC.

4.16 SQUARE D SY/MAX

The Square D interface provides the ability to access and/or modify the data table area of the target SY/MAX PC from a Xycom intelligent terminal. The target SY/MAX device contains up to 9999 readable or writable registers. All processors are supported with the exception of the Model 100, which requires a slightly different software protocol.

The SoftScreen PC/AT can be connected directly to a Square D processor or can be connected via the SY/MAX network. In the network configuration, the workstation is connected to a Network Interface module (NIM), which, in turn, is connected to the Square D processor. The NIM can also be connected to a network of NIMs and processors which gives the workstation accessibility to a network of SY/MAX devices.

The user interface provides the ability to monitor or change areas of the SY/MAX devices via SoftScreen menus. The user accesses the device by specifying a network address (optional) and a register address in the SY/MAX device. All SY/MAX devices use the decimal numbering system.

4.16.1 Serial Port Configuration

The Square D PLC connects to SoftScreen via RS-422, and can connect to any port.

> **NOTE**
> Make sure the port you use is the same one specified in the SoftScreen Development System under Configuration-Ports.

4.16.2 Electrical Interface

The electrical interface for Square D is asynchronous RS-422, linked serially to the target SY/MAX family device. Figure 4-37 shows the necessary cabling.

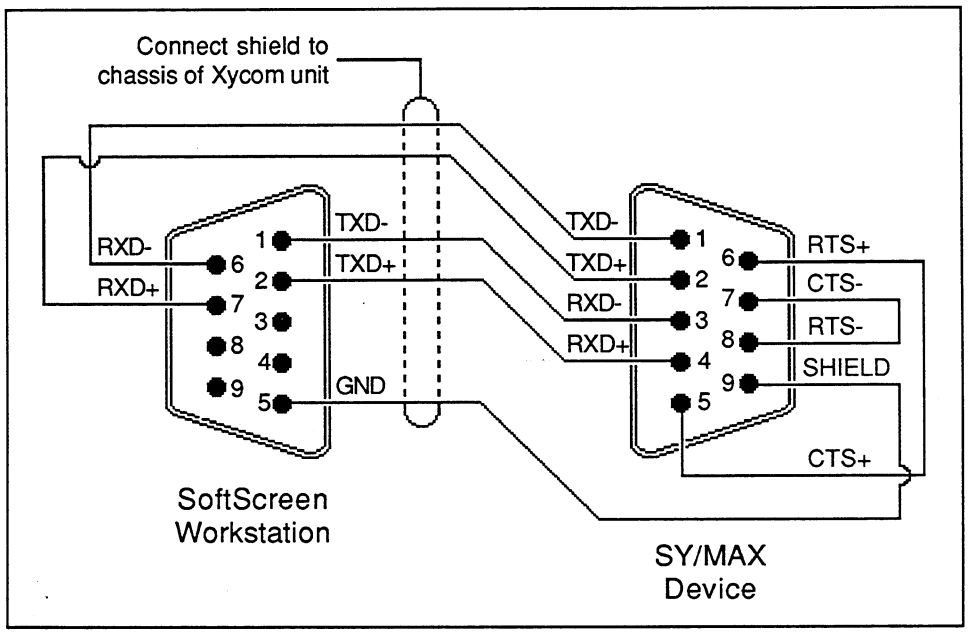


Figure 4-37. Cabling to the SY/MAX PLC

4.16.3 Square D Addressing

The address expression formats specific to the Square D PLC interface are shown below:

Table 4-31. Square D Addressing

Device	PLC Address	Number Type	Size	R/W
All	S0001-S9999	Decimal	Word	R/W

For example, if the expression **[PIC:S1234 3]** is entered in the development system software for a data display object, the engine reads and displays the value in PLC1, word S1234, bit 3.

Refer to the SoftScreen Development System Manual for more information on expression value formats.

4.16.4 Square D Communication Status Registers

The communication status registers contain information about the communication between the Square D PLC and the SoftScreen Workstation engine. There are four communication status registers, one for each COM port:

#11	Communication status for port 1
#8	Communication status for port 2
#9	Communication status for port 3
#10	Communication status for port 4

The communication status registers are 32-bit fixed point registers with the following bit assignments:

Upper 16 Bits

Bits 0	Transmit error
Bit 1	Receive error
Bit 2	Timeout error
Bit 3	Bit Write error
Bits 4-15	Unused

Lower 16 Bits

Bits 0-15	Unused

By testing specific bits in the communication status registers, the appropriate text, alarm, or message can be generated to indicate the current status of communication. For example, the expression #8&4 could be used to test for a timeout error. A timeout error would be indicated if the expression evaluated to a 4, while a value of 0 would indicate no timeout error.

4.17 TEXAS INSTRUMENTS 405/435

This section describes the functional definition of the SoftScreen to Texas Instruments Series 405/435 interface. The interface to the TI PLC is through the PLC's programming port.

The purpose of the Texas Instruments driver is to access and/or modify memory and time/counter variables of the target programmable controller from a Xycom SoftScreen Engine.

4.17.1 Serial Port Configuration

The Texas Instruments 405/435 PLC connects to SoftScreen via RS-232C and any port.

> **NOTE**
> Make sure the port you use is the same one specified in the SoftScreen Development System under Configuration-Ports.

4.17.2 Electrical Interface

The Texas Instruments Series 405/435 PLC connects to the SoftScreen PC/AT through RS-232C. Figure 4-38 shows the necessary cabling between the PC/AT and the TI PLC.

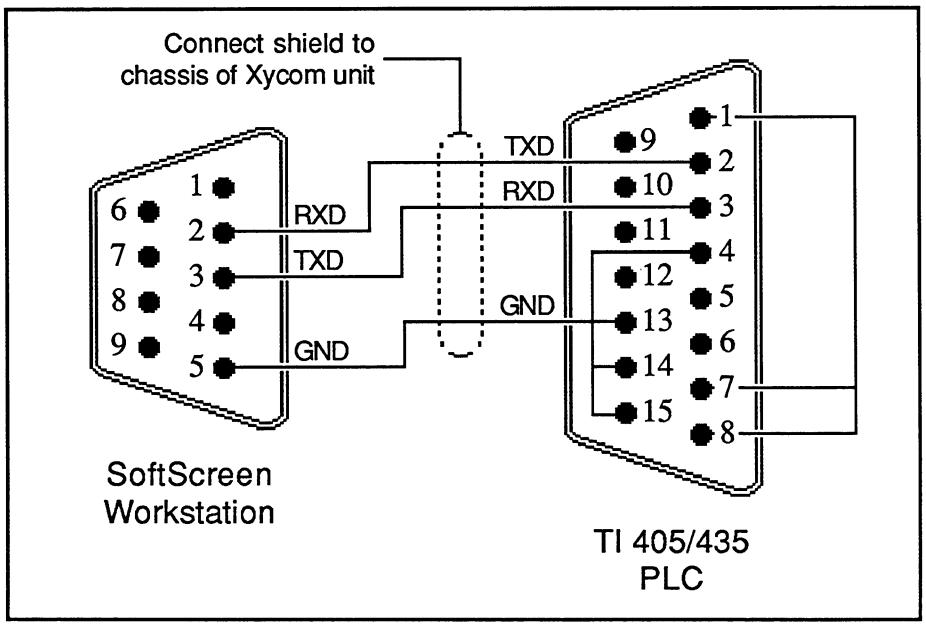


Figure 4-38. Cabling to the TI Series 405/435

4.17.3 TI-405/435 Addressing

The address expression formats specific to the TI-405/435 PLC interfaces are shown in the table below:

Table 4-32. TI 405/435 Addressing

Device	PLC Address	Number Type	Size	R/W
Timer	T0000-T0177	Octal	Word	R/W
Counter	CT000-CT177	Octal	Word	R/W
User register	U0000-U6377	Octal	Word	R/W
Remote I/O memory	GX000-GX777	Octal	Bit	R/W
Input memory	X0000-X0477	Octal	Bit	R/W
Output memory	Y0000-Y0477	Octal	Bit	R
Control relay	C0000-C0737	Octal	Bit	R/W
Stage memory	S0000-S0577	Octal	Bit	R/W
Timer relay	TR000-TR177	Octal	Bit	R/W
Counter relay	CTR00-CTR177	Octal	Bit	R/W
Special relay	SP000-SP137, SP320-SP617	Octal	Bit	R
V memory	V0000-V41230	Octal	Word	R/W
Scratch pad memory	SPD00-SPD8FF	Hex	Byte	R/W

For example, if the expression **[PLC1:CT123 3]** is entered in the development system software for a data display object, the engine reads and displays the value in PLC1, word CT123, bit 3.

> **NOTE**
> Valid bit addresses for T, CT, U, and V are 0-15 and read-only. Valid bit addresses for SPD are 0-7 and read-only.

4.17.4 TI 405/435 Communication Status Registers

The communication status registers contain information about the communication between the TI 405/435 PLC and the SoftScreen PC/AT engine. There are four communication status registers, one for each available COM port:

#11	Communication status for port 1
#8	Communication status for port 2
#9	Communication status for port 3
#10	Communication status for port 4

The communication status registers are 32-bit fixed point registers with the following bit assignments:

Upper 16 Bits

Bit 0-3	Unused
Bit 4	Receive error
Bit 5	Enquiry error
Bit 6	BCC error
Bits 7	Timeout error
Bits 8-15	Unused

Lower 16 Bits
Unused

By testing specific bits in the communication status registers, the appropriate text, alarm or message can be generated to indicate the current status of communication. For example, the expression #8&128 could be used to test for a timeout error. A timeout error would be indicated if the expression is evaluated to 128, while a value of 0 would indicate no timeout error.

4.18 TEXAS INSTRUMENTS 500/505

This section describes the functional definition of the SoftScreen to Texas Instruments Series 500/505 interface. The interface to the TI PLC is through the PLC's programming port.

The purpose of the Texas Instruments driver is to access and/or modify memory, drum variables and time/counter variables of the target programmable controller from a Xycom SoftScreen PC/AT.

4.18.1 Serial Port Configuration

The Texas Instruments 500/505 PLC connects to SoftScreen via RS-422 or RS-232C or on any port.

> **NOTE**
> Make sure the port you use is the same one specified in the SoftScreen Development System under Configuration-Ports.

4.18.2 **Electrical Interface**

The Texas Instruments Series 500/505 PLC connects to the SoftScreen PC/AT through RS-422 or RS-232C. Figure 4-39 shows the necessary cabling between the SoftScreen PC/AT and the TI PLC for RS-422, while Figures 4-40 and 4-41 show the connections for RS-232C.

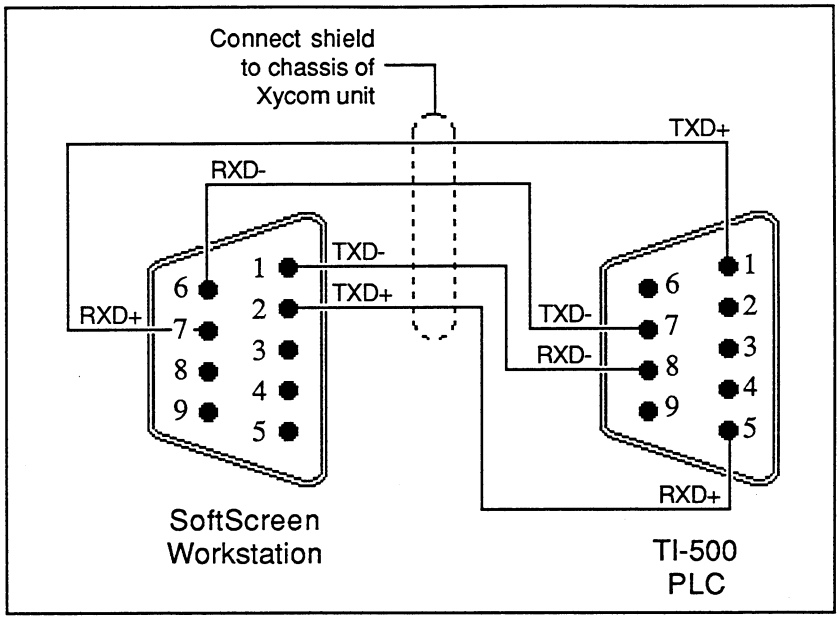


Figure 4-39. Cabling to the TI-Series 500/505 via RS-422

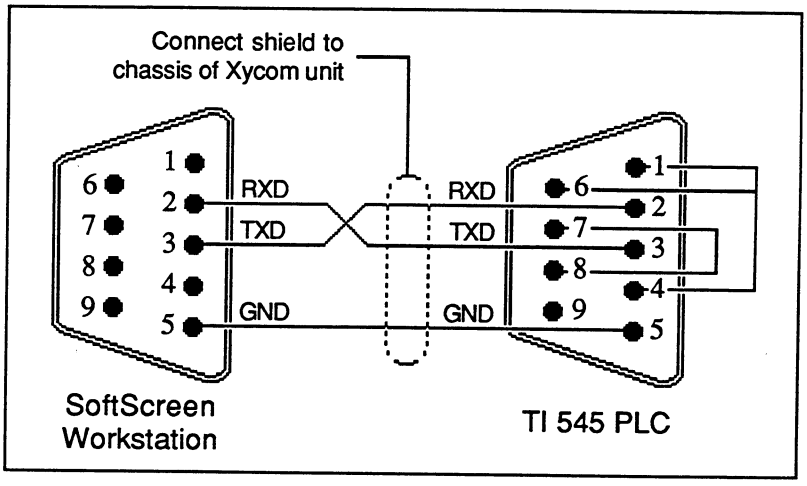


Figure 4-40. Cabling to the TI 500/505 via RS-232C via 9-pin Connector

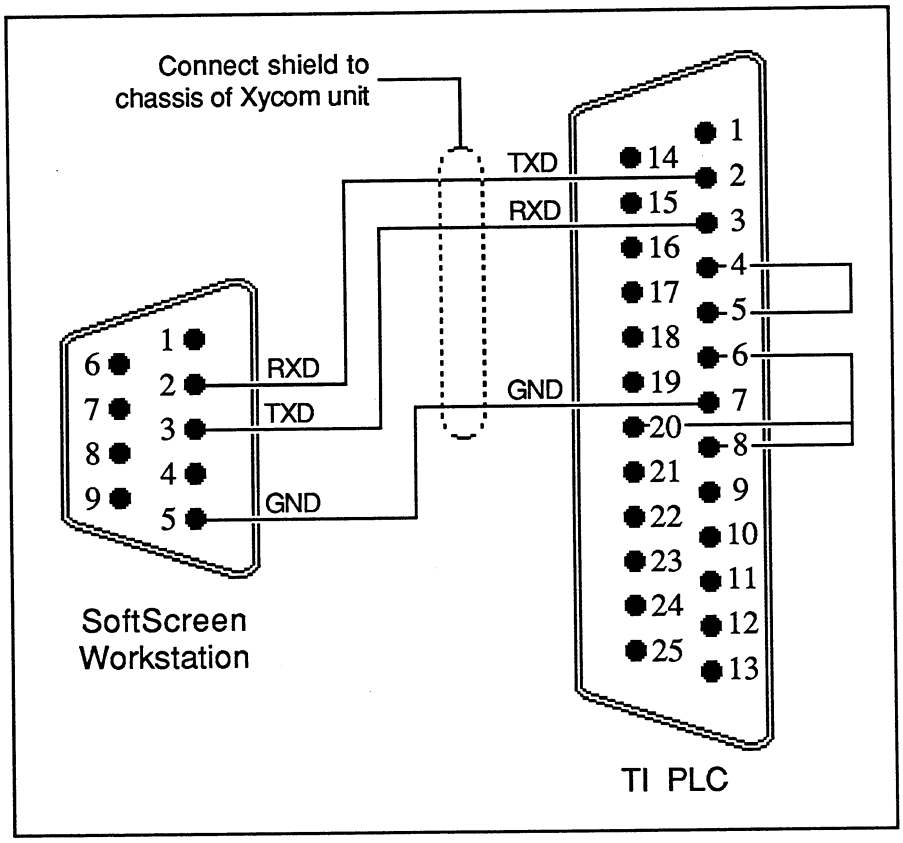


Figure 4-41. Cabling to the TI-500/505 via RS-232C via 25-pin Connector

4.18.3 TI-500/505 Addressing

The address expression formats specific to the TI-500/505 PLC interfaces are shown in the table below. All addresses are decimal and have a starting address of 1.

Table 4-33. TI-500/505 Addressing

Device	PLC Address*	Size	R/W
Input	X0001-X65535	Bit	R/W
Output	Y0001-Y65535	Bit	R
Internal coil	C0001-C65535	Bit	R/W
▵Variable	V0001-V65535	Word	R/W
▵Constant	K0001-K65535	Word	R/W
Word input	WX001-WX65535	Word	R/W
Word output	WY001-WY65535	Word	R
Drum step current	DSC01-DSC65535	Word	R/W
Drum step preset	DSP01-DSP65535	Word	R/W
Status word	STW01-STW65535	Word	R
Timer/counter preset	TCP01-TCP65535	Word	R/W
Timer/counter current	TCC01-TCC65535	Word	R/W
Analog alarm acknowledge	AACK1-AACK65535	Word	R/W
Analog alarm deadband	AADB1-AADB65535	Floating point	R/W
Most significant word of analog alarm C-flags	ACFH1-ACFH65535	Word	R/W
Least significant word of analog alarm C-flags	ACFL1-ACFL65535	Word	R/W
Analog alarm error	AERR1-AERR65535	Floating point	R/W
Analog alarm high alarm limit	AHA1-AHA65535	Floating point	R/W
Analog alarm high-high alarm limit	AHHA1-AHHA65535	Floating point	R/W
Analog alarm low alarm limit	ALA1-ALA65535	Floating point	R/W
Analog alarm low-low alarm limit	ALLA1-ALLA65535	Floating point	R/W
Analog alarm orange deviation alarm limit	AODA1-AODA65535	Floating point	R/W
Analog alarm process variable	APV1-APV65535	Floating point	R/W
Analog alarm process variable high limit	APVH1-APVH65535	Floating point	R/W
Analog alarm process variable low limit	APVL1-APVL65535	Floating point	R/W
Analog alarm rate of change alarm limit	ARCA1-ARCA65535	Floating point	R/W
Analog alarm set point	ASP1-APS65535	Floating point	R/W
Analog alarm set point high limit	ASPH1-ASPH65535	Floating point	R/W
Analog alarm set point low limit	ASPL1-ASPL65535	Floating point	R/W
Analog alarm sample rate	ATS1-ATS65535	Floating point	R/W
Analog alarm flags	AVF1-AVF65535	Word	R/W
Analog alarm yellow deviation alarm limit	AYDA1-AYDA65535	Floating point	R/W

Table continued on the following page.

▵NOTE
String entry and string display are allowed to and from these addresses.

Table 4-33. TI 500/505 Addressing (*continued*)

Device	PLC Address*	Size	R/W
Loop alarm acknowledge	LACK1-LACK65535	Word	R/W
Loop alarm deadband	LADB1-LADB65535	Floating point	R/W
Most significant word of loop C-flags	LCFH1-LCFH65535	Word	R/W
Least significant word of loop C-flags	LCFL1-LCFL65535	Word	R/W
Loop error	LERR1-LERR65535	Floating point	R/W
Loop high alarm limit	LHA1-LHA65535	Floating point	R/W
Loop high-high alarm limit	LHHA1-LHHA65535	Floating point	R/W
Loop gain	LKC1-LKC65535	Floating point	R/W
Loop derivative gain limiting coefficient	LKD1-LKD65535	Floating point	R/W
Loop low alarm limit	LLA1-LLA65535	Floating point	R/W
Loop low-low alarm limit	LLLA1-LLLA65535	Floating point	R/W
Loop output	LMN1-LMN65535	Floating point	R/W
Loop bias	LMX1-LMX65535	Floating point	R/W
Loop orange deviation alarm limit	LODA1-LODA65535	Floating point	R/W
Loop process variable	LPV1-LPV65535	Floating point	R/W
Loop process variable high limit	LPVH1-LPVH65535	Floating point	R/W
Loop process variable low limit	LPVL1-LPVL65535	Floating point	R/W
Loop rate of change alarm limit	LRCA1-LRCA65535	Floating point	R/W
Loop ramp/soak flags	LRSF1-LRSF65535	Word	R/W
Loop ramp/soak step number	LRSN1-LRSN65535	Word	R/W
Loop set point	LSP1-LSP65535	Floating point	R/W
Loop set point high limit	LSPH1-LSPH65535	Floating point	R/W
Loop set point low limit	LSPL1-LSPL65535	Floating point	R/W
Loop rate	LTD1-LTD65535	Floating point	R/W
Loop reset	LTI1-LTI65535	Floating point	R/W
Loop sample rate	LTS1-LTS65535	Floating point	R/W
Loop V-flags	LVF1-LVF65535	Word	R/W
Loop yellow deviation limit	LYDA1-LYDA65535	Floating point	R/W

Valid bit addresses for all devices except X, Y, and C are 0-15.

***NOTE**

PLC address numbers are for reference only. Check your PLC documentation for memory size limits.

Expressions follow the same format whether they are used in data display objects, data entry objects, or recipe values. For example, if the expression **[PLC0:WX10 3]** is entered in the development system software for a data display object, the engine reads and displays the value in PLC0, word WX10, bit 3.

Refer to the SoftScreen Development System Manual for more information on expression value formats.

NOTE

SoftScreen and the TI Series 500 PLC store floating point data types in different formats. SoftScreen uses a fixed point format in which more than nine significant digits can be displayed, whereas the TI PLC uses IEEE single floating point format in which only seven significant digits can be displayed. For example, the eight-digit value 1234.5678 can be displayed in SoftScreen, but a digit will be lost when the value is sent to and stored in the PLC. When the value is read back, it may be displayed as 1234.5677 or 1234.5679.

NOTE

If you do not specify floating point format in your expressions for floating point registers, SoftScreen automatically assigns floating point format, regardless of the default PLC format setting.

NOTE

When using V memory as floating point (FP) values, two V memory locations are needed to store the value. Once a V memory location is defined as FP in an application, it must always be defined as floating point in that application. For example, if you specify [V1, FP] the value will be stored in both V1 and V2 locations.

4.18.4 TI-500/505 Communication Status Registers

The communication status registers contain information about the TI-500/505 PLC and the SoftScreen PC/AT engine. There are four communication status registers, one for each available COM port:

#11	Communication status for port 1
#8	Communication status for port 2
#9	Communication status for port 3
#10	Communication status for port 4

The communication status registers are 32-bit fixed point registers with the following bit assignments:

Upper 16 Bits

Bit 0	Receive error
Bit 1	Transmit error
Bit 2	CRC error
Bit 3	Address error
Bit 4	Timeout error
Bit 5	Read Only error
Bit 6	Unused
Bit 7	Error task code returned by PLC (see bits 8-15)
Bits 8-15	Error task codes
00010	Address out of range
00011	Data not found
00100	Illegal request
00101	Request exceeds memory size
00111	Fatal error detected
01000	Keylock protect error
01001	Incorrect amount of data
01010	Illegal in current mode
01110	Illegal write
01111	Data not inserted
10000	Invalid data
10001	Invalid in current mode

Lower 16 Bits

Unused

By testing specific bits in the communication status registers, the appropriate text, alarm, or message can be generated to indicate the current status of communication.

For example, the expression #8&16 could be used to test for a timeout error. A timeout error would be indicated if the expression evaluated to 16, while a value of 0 would indicate no timeout error.

4.19 WESTINGHOUSE NUMA-LOGIC

This section describes the functional definition of the SoftScreen to Westinghouse Numa-Logic PLC interface. The protocol used is specific to the Numa-Logic PLC. Refer to the Westinghouse documentation for details.

4.19.1 Serial Port Configuration

The Westinghouse PLC connects to SoftScreen on any port. The connection is done in RS-232C mode.

4.19.2 Electrical Interface

Figure 4-42 shows how to connect the SoftScreen PC/AT to a Westinghouse programmable controller via asynchronous RS-232C.

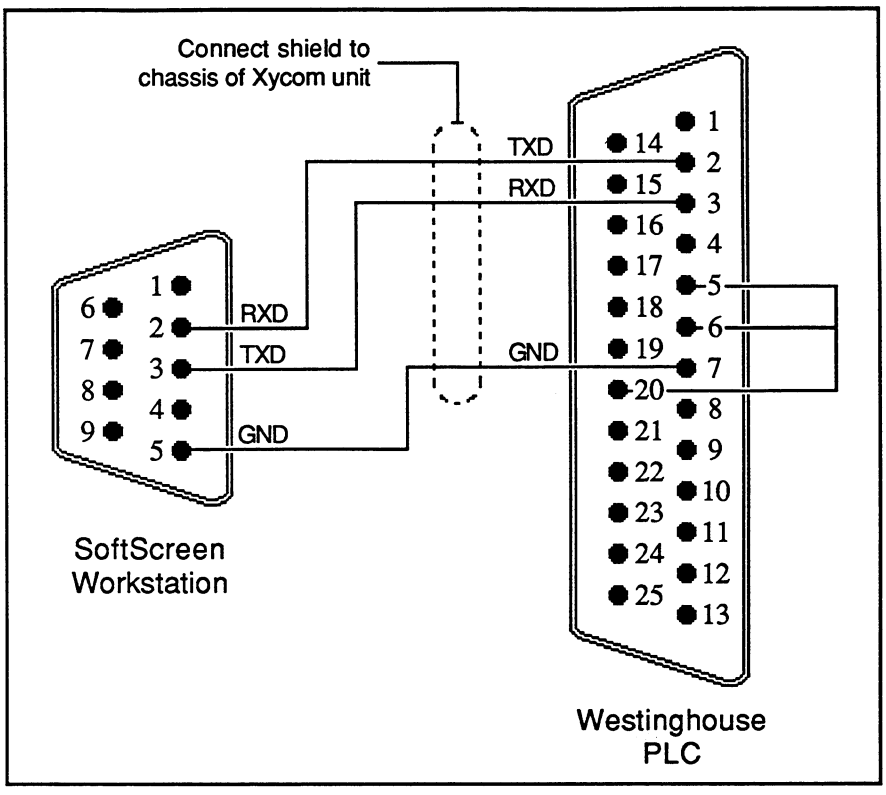


Figure 4-42. RS-232C Connection to Westinghouse PLC

4.19.3 Westinghouse Addressing

The address expressions (entered for Expression in various configuration forms) that are specific to the Westinghouse PLC interface are shown in the table below:

Table 4-34. Westinghouse Addressing

Device	PLC Address	Number Type	Size	R/W
All	0000-FFFF	Hex	Word	R/W

Valid bit addresses are 0-15.

For example, if the expression **[PLC1:FFFF 3]** is entered in the development system software for a data display object, the engine will read and display the value in PLC1, word FFFF, bit 3.

4.19.4 Westinghouse Communication Status Registers

The communication status registers contain information about the communication between the Westinghouse PLC and the SoftScreen PC/AT engine. There are four communication status registers, one for each available COM port:

#11	Communication status for port 1
#8	Communication status for port 2
#9	Communication status for port 3
#10	Communication status for port 4

The communication status registers are 32-bit fixed point registers with the following bit assignments:

Upper 16 Bits

Bit 0	Transmit error
Bit 1	Receive error
Bit 2	Timeout error
Bit 3	Synchronization error
Bit 4	Block checksum error
Bits 8-15	Message status from Westinghouse PLC

Lower 16 Bits

Bits 0-15	Unused

By testing specific bits in the communication status registers, the appropriate text, alarm or message can be generated to indicate the current status of communication. For example, the expression #8&4 could be used to test for a timeout error. A timeout error would be indicated if the expression evaluated to 4, while a value of 0 would indicate no timeout error.

4.20 OTHER MACHINES RUNNING SOFTSCREEN (XYCOM TERMINAL)

This method is used to access data from other machines running SoftScreen. The other machine behaves similar to a PLC. Multiple machines can be connected on the same line.

4.20.1 Serial Port Configuration

The RS-485 mode of communication is used. Any serial port can be used on the host machine. However, port 1 has to be used on the machine acting as the PLC.

4.20.2 Electrical Interface

Figure 4-43 shows the electrical interface used when connecting other machines to Xycom terminals.

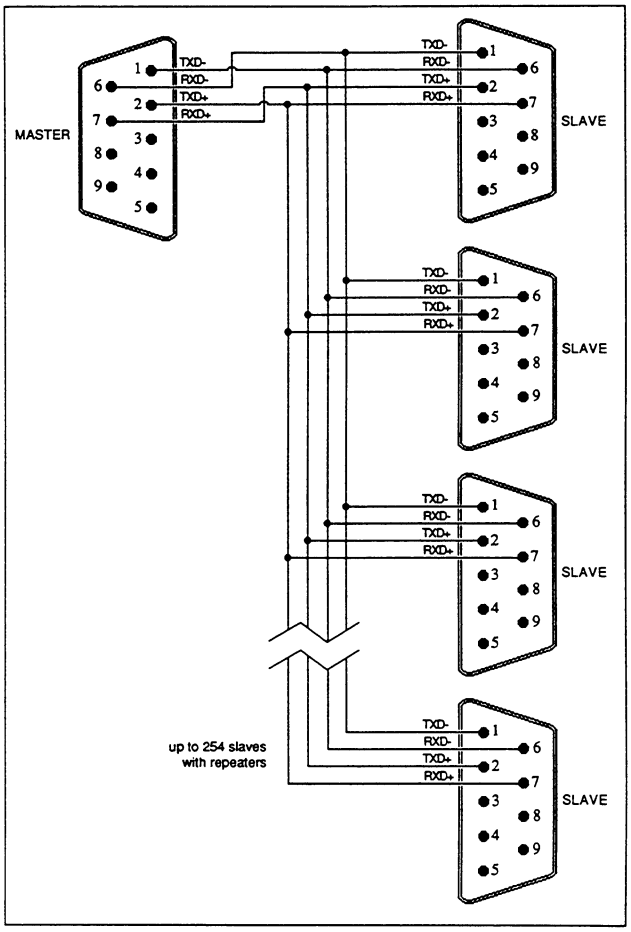


Figure 4-43. RS-485 Connection of SoftScreen

4.20.3 Xycom Terminal Addressing

The address expressions (entered for Expression in various configuration forms) that are specific to the Xycom Terminal interface are shown in the table below:

Table 4-35. Xycom Terminal Addressing

Device	PLC Address	Number Type	Size	R/W
Terminal ▵Internal Register	Station number #reg	Decimal	Fixed point	R/W

The Station number of the Xycom Terminal is 0-255. The internal register of the terminal is 1-2000.

For example, if the expression **[3#50]** is entered in the development system software for a data display object, the SoftScreen engine reads and displays the value in register 50 of Station 3.

> **▵NOTE**
> String entry and string display are allowed to and from these addresses.

4.21 INDRAMAT

This section describes the functional definition of the SoftScreen to Indramat interface. The interface to the Indramat is through the DLC's programming port. For informations on the correct settings for your DLC, refer to your DLC manual.

4.21.1 Serial Port Configuration

The RS-485 mode of communication is used to connect the Indramat DLC to the SoftScreen Workstation.

4.21.2 Electrical Interface

The electrical interface for the Indramat interface is RS-485 mode. Figure 4-44 shows the cabling between the SoftScreen PC/AT and Indramat.

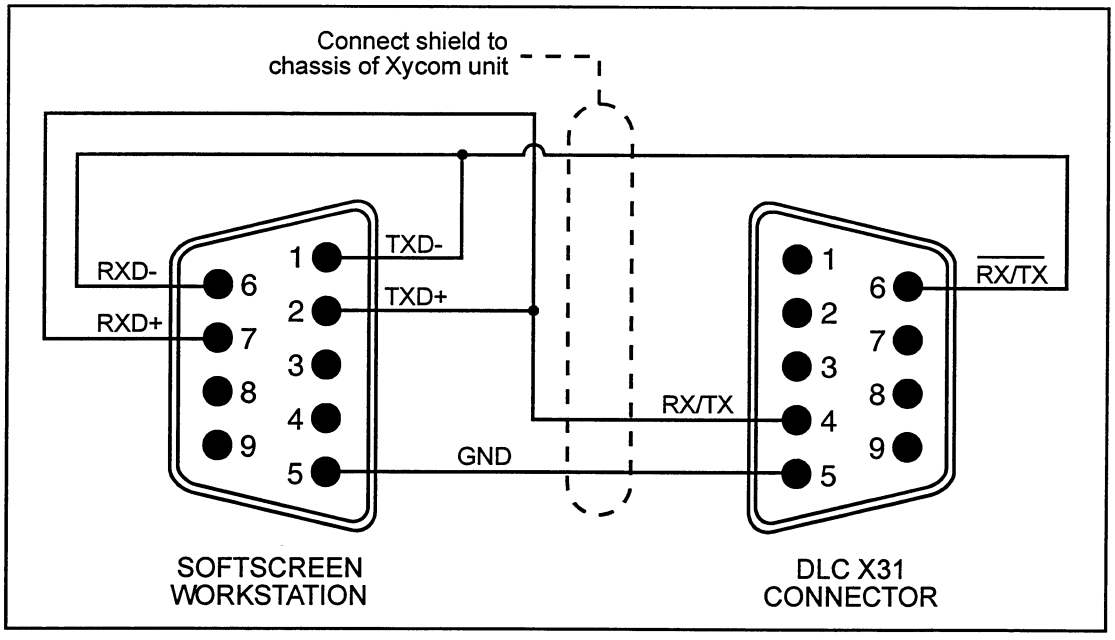


Figure 4-44. RS-485 Connection of SoftScreen

4.21.3 **Indramat Addressing**

The Indramat address expressions (entered for Expression in various configuration forms) that are specific to the Indramat DLC interface are shown in the table below:

Table 4-36. Indramat Addressing

Device	**PLC Address**	**Number Type**	**R/W**
A Parameter	A100-A125	String	R/W
B Parameter	B000-B023	String	R/W
D Parameter	D01-D19	String	R/W
M Function	MH00-MH63 ML00-ML63	String	R/W
Status	S00, S02-S10, S18-S19, S46-S48, S50-S53	String	R
Program Block	BL0000-BL2999	String	R/W

Note: A, B, and D parameters are eight characters long.
B003 and B004 are read only.
Expressions for S06, S07, S46, and program blocks require extra data fields.

Valid ranges for these data fields are listed in the table below.

Address	Data Field
S04	**0000**-2999
S06	**0**-5
S07	**0**-7
S46	**0**-1
BL000	0-4

Example of a DLC program:

Block #	Numonic				
100	PSA	-	1	-000005.000	010
Parameter:			#0	#1	#2

Example 1:
If the expression is **[PLC0: BL0100]** in string display, the engine reads and displays the command stored in block 100 of PLC0.

Example 2:
To write a program block parameter **[PLC0: BL0100 1]**, the engine would read program block 100 from PLC0, change parameter #1, then write the program block to the DLC.

Example 3:
The expression **[PLC0: S04 0002]** in a string display would display status 04 (counter status), counter block #2.

NOTE

Floating point numbers are displayed with the decimal point implied, as they are on the CTA. To display the decimal point, use "text" to place the decimal point on top of the string display.

4.21.4 **Indramat Communication Status Registers**

The communication status registers contain information about the communication between the Indramat PLC and the SoftScreen Workstation engine. There are four communication status registers, one for each available COM port:

#11 Communication status for port 1
#8 Communication status for port 2
#9 Communication status for port 3
#10 Communication status for port 4

The communication status return codes are 32-bit fixed point registers with the following descriptions:

Code	Description
00	Success
01	Block # Wrong
02	Format Error
03	Block data Error
04	Checksum Error
05	Invalid Mode
06	Parameter # False
07	Parameter # illegal
08	Status # False
09	Status # illegal
10	M-Wheel Parameter False
11	Invalid Parameter Block
12	Block # too large
13	Invalid Program Command
14	Invalid Address
15	Timeout
16	BCC Fail
17	Transmission Fail
18	Transmission Missing Acknowledge
19	Buffer Overflow
20	Invalid Response

5.1 INTRODUCTION

The following sections detail applications to SoftScreen.

5.2 USING MICROSOFT EXCEL TO IMPORT SOFTSCREEN TREND LOG

The use of Microsoft Excel™ can greatly enhance the functionality of SoftScreen log trends. Following is the format of log trends:

Date, Time, pen1, pen2, pen3, pen4

Example:
5/13/93, 08:41:23, 50, 32719, 32719, 6868

Excel imports this information in DOS/Text format.

The keystrokes/mouse clicks used to import into Excel 4.0 are as follows:

1. Start Excel.
2. Click on **File**.
3. Click on **Open**.
4. Select the **Drive** and **Directory**.
5. Select the **File Types** as All Files (***.***).
6. Select the file name of the logged trend that you want to import.
7. Click on the **Text** button.
8. Click on **Comma** as the Column Delimiter.
9. Click on **Dos** or **OS/2 (PC-8)** as the File Origin.
10. Click on the **OK** button.
11. Click on the next **OK** button.

The file should load with the file name at the top of the spread sheet. From here, further charting and analysis can be done.

5.3 DISPLAYING MORE THAN FIVE DIGITS WITH SOFTSCREEN

Refer to Figure 5-2 for A, B, and C references while reading the next few paragraphs. To display the number 123456789, you must put it into two registers (12345 and 6789). You must always add 10000 to **A** (this will cause 0's to be displayed if, for example, the number is 3450001).

Turn on the grid and overlap a filled rectangle (**B**) (same color as the background) over the ± and the 1 of **A**. Now draw **C** and overlap number five of **C** over number one of **A**.

Configure the display in the following way:

A Tie this to the *least* significant register and change the format to 00000 (no decimal place) and add 10000. Maximum = 19999.

B Same register as **A**

Background	Foreground	Condition
Base	Base	Same as A

Figure 5-1. States

C Tie this to the *most* significant register and add the value from the register associated with A and then subtract it. Change the format to 00000 (no decimal place). Maximum 32,767. This has to be done in case **A** gets updated and **C** does not. You will see the 1 from **A** (over the top of 5 in **C**). By adding and subtracting **A** from **C**, you force **C** to be updated every time **A** is updated.

Make sure the objects are drawn in this order:

1. A
2. B
3. C

This same procedure can be extended to get more than a nine-digit display by duplicating this to three, four, or more registers.

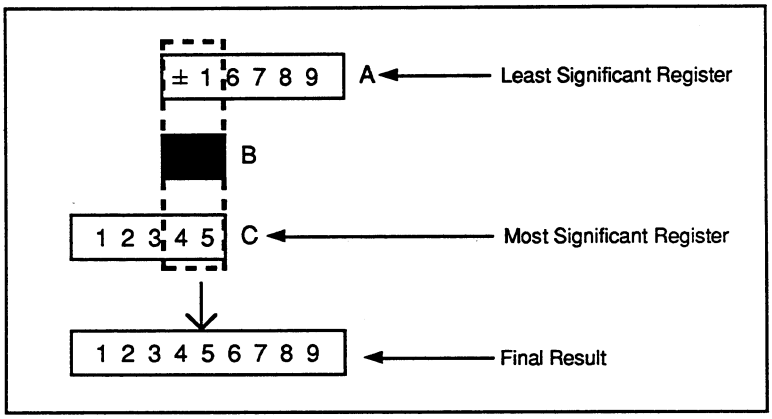


Figure 5-2. Displaying More than Five Digits

5.4 TOUCH SCREEN PASSWORDS

This application explains how to enter a password on the touch screen unit when there is no external keyboard. The following paragraphs explain how to create a keypad.

Let's say you want to go from the MAIN screen to the TEST screen, and the TEST screen is password protected with the password 1234. This application works from a user-defined screen that appears and requires keyboard or keypad entry. One way to accomplish this is to create an intermediate screen called TEST_PW. Instead of having MAIN screen go directly to TEST, have it go to TEST_PW. The figure below shows TEST__ PW.

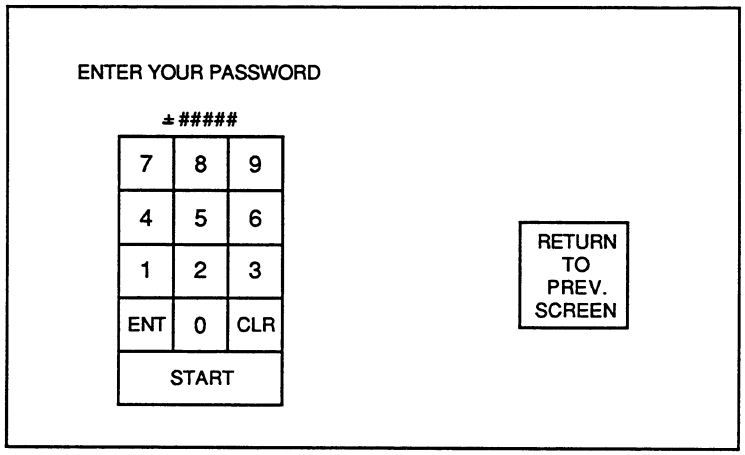


Figure 5-3. Entering Passwords on the Touch Screen Unit

The ±##### is the data entry writing to #50. The number keypad is built of touch buttons. The numbers simulate the keypress, the value being the number. ENT simulates the keypress, the value being carriage return (<C). CLR is write data to address, address is #50, value is 0. START simulates a keypress, the value being home (<H). The button to the right is defined as return to previous screen. There is a pseudo key defined as the following:

CONDITION BECOMES TRUE
#50 == 1234
Function: GOTO SCREEN
Screen: TEST

If you enter the correct password of 1234, you will go to the screen called TEST.

5.5 CREATING A SCREEN SAVER WITH SOFTSCREEN

Perform the following steps to create a screen saver:

1. Create a global Pseudo key:

   Trigger Event: Condition becomes true: #15 = = 0
   Function: Go to Screen "ScrenSav" (use any screen name you like)

2. Create a screen "ScrenSav" (use the same screen name as above):

   In this screen, create a Pseudo key:
   Trigger Event: Condition becomes true: #15 ! = 0
   Function: Return to previous screen

3. While the SoftScreen Engine is running (as long as the keyboard or Touch Screen is not pressed), #15 will countdown until it becomes zero. At this point, the screen saver time has elapsed, and the global pseudo key will change control to the "ScrenSav" screen. Any time the keyboard is used or the touch screen is pressed, #15 is reset to its countdown value, and the pseudo key in the "ScrenSav" screen will do a "Return to Previous Screen."

5.6 POST INCREMENT AND DECREMENT WITH SELECTOR TOUCH BUTTONS

This application explains how to configure automatic increment and decrement of the selector index after performing the function configured for the selector touch buttons.

In the selector touch button configuration form, there are two items: post select address and post select value. Using the correct expressions for these two items, the index that is used by the selector touch button and the selector text can be automatically incremented and decremented.

In the example outlined below, the common select index is #30 (internal register). Its contents range from 0 to 5 (six choices). The selector text is configured to display six lines of text. There are two selector touch buttons, one for incrementing and one for decrementing.

Selector Display Object

Lines displayed: 6
Selector index expression: #30
Configure six indexes, each with one line of text.

Selector Touch Button (Increment)

Number of functions: 6
Selector index expression: #30
Post select address: #30
Post select expression: #30 + (#30<5)) - (#30 >=5) * 5
Configure six functions (indexes 0 - 5).

Selector Touch Button (Decrement)

Number of functions: 6
Selector index expression: #30
Post select address: #30
Post select expression: #30 - (#30 > 0)) + (#30 <= 0) * 5
Configure six functions (indexes 0 - 5).

Both selector touch buttons wrap #30 to the top or the bottom of the list when the function at either the top or the bottom of the list is executed.

APPENDIX A - OFFLINE COMPRESSING AND DECOMPRESSING UTILITIES

A.1 INTRODUCTION

Compact and **Expand** are two utilities shipped along with PCENGINE. Xycom recommends that these utilities be used to compress or expand logged data associated with logging trends, event trends, or XY plots. These utilities are compatible with the compact and expand functions available through the File Manager screen in PCENGINE. Compact and Expand cannot be used on all types of files, but are designed to work with Xycom logged files.

A.2 COMPACT UTILITY

The Compact utility can be used to reduce the amount of disk space required to store PCENGINE logged data files. This utility compresses like-named files such as TREND1.001, TREND1.002, and TREND1.003 into a single file named TREND1.###. This compressed file occupies much less space on the hard disk than the original files (original files remain on the disk). **This utility will only compress one file at a time**. The syntax for invoking the Compact utility is as follows:

COMPACT source_file [destination path]

where: source_file	=	The single filename to compress (you must include an extension)
[destination path]	=	An optional destination path to store the compressed file

A.3 EXPAND UTILITY

The Expand utility can be used to decompress files that were compressed by the File Manager in PCENGINE or by the Compact utility. This utility restores the original files that are contained in a compressed file. In the above example, if you expand TREND1.###, it expands the files: TREND1.001, TREND1.002, and TREND1.003. The syntax for invoking the Expand utility is as follows:

EXPAND source_file [destination path]

where: source_file	=	The file name to expand (must have the .### extension)
[destination path]	=	An optional destination path to store the decompressed file(s)

B.1 BOARD FEATURES

The 9000-RAD Run-time Alarm Detection And Recording (RADAR) Card is standard in the 9450-SSW. This card provides the SoftScreen Runtime System and MS-DOS on ROM. RAM is provided for user applications. In addition, the card provides preventive measures for extra protection. These measures include monitoring internal temperature, hard disk life, and battery life. It can even notify operators of scheduled maintenance or imminent failures. All RADAR functions are user-selectable.

Features of the 9000-RAD board include the following:

- Two optically isolated and buffered serial ports (each port can be configured as RS-232C or RS-485)
- ROM with SoftScreen Runtime System and MS-DOS
- Fault relay output
- Temperature sensor
- On-board battery
- External battery input connector
- Extended BIOS/data logging static RAM (SRAM)
- Watchdog timer
- Solid State Disk (SSD) eight memory sockets
- Off-line diagnostics

B.2 OPERATIONAL DESCRIPTION

A block diagram of the 9000-RAD board is depicted in Figure B-1, on the following page.

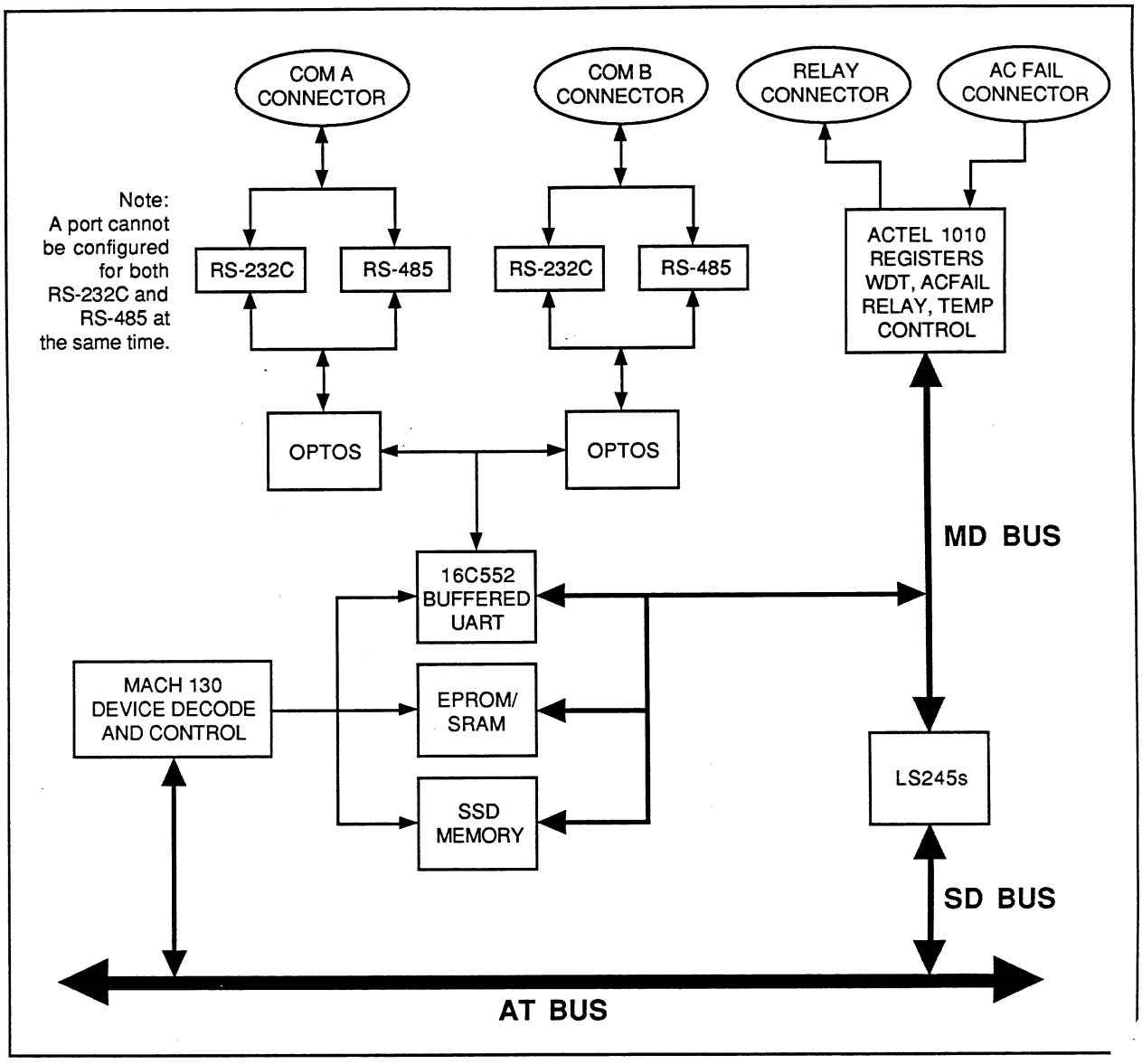


Figure B-1. 9000-RAD Block Diagram

B.2.1 SSD Memory Interface

The board contains eight sockets consisting of two banks of four chips each. There are two constraints when using the SSD memory:

- A bank must have the same device type and size.
- A bank containing devices must be filled.

B.2.2 Extended BIOS Base Address

A 128, 256, or 512 Kbyte EPROM is provided to store all extended BIOS code. The EPROM is broken into sixteen 32 Kbyte pages. Each page can be mapped into the memory space by writing the page number into I/O register 232. The location of the extended BIOS is switch selectable, as described in Table B-1.

Table B-1. Extended BIOS Switch Positions

SW2-1	SW2-2	Location
Closed✓	Closed✓	0C8000h-0CFFFFh
Open	Closed	0D0000h-0D7FFFh
Closed	Open	0D8000h-0DFFFFh
Open	Open	Disabled

✓=Factory setting

B.2.3 Battery

An on-board battery is available to battery back the data SRAM and SSD memory. An external battery connector is also provided. The battery test circuit tests the on-board battery if there is no external battery installed. Otherwise, the external battery is tested.

B.2.4 **Relay**

The relay is controlled by SoftScreen, independent of the RADAR BIOS Fault Relay menu settings (the RADAR BIOS Fault Relay menu default setting is Ignore). The relay can also be optionally relaxed through the use of a switch when the watchdog timer expires. Relay contacts are isolated to 500V.

B.2.5 **Optically Isolated Serial Ports**

There are two serial ports, configurable as COM1, COM2, COM3, COM4, or disabled. The interrupts are IRQ4 or IRQ10 for serial port 0 (jumper selectable as COM1 or COM3) and IRQ3 or IRQ11 for serial port 1 (jumper selectable as COM2 or COM4). The base port addresses are as follows:

COM1	3F8h
COM2	2F8h
COM3	3E8h
COM4	2E8h

Each port has the capability of being either RS-232C or RS-485.

> **NOTE**
> A conflict will occur if these ports are configured as COM1 or COM2 because COM1 and COM2 are located on the CPU board.

Both serial ports are individually isolated to 500V. This isolation is maintained through the use of a 5V-9V DC-DC converter and a 5V regulator for each port. All signal lines between the UART and the serial connectors are optically isolated.

B.3 JUMPER AND SWITCH SETTINGS

This section describes the 9000-RAD jumper and switch settings. Figure B-2 illustrates jumper and switch locations on the board.

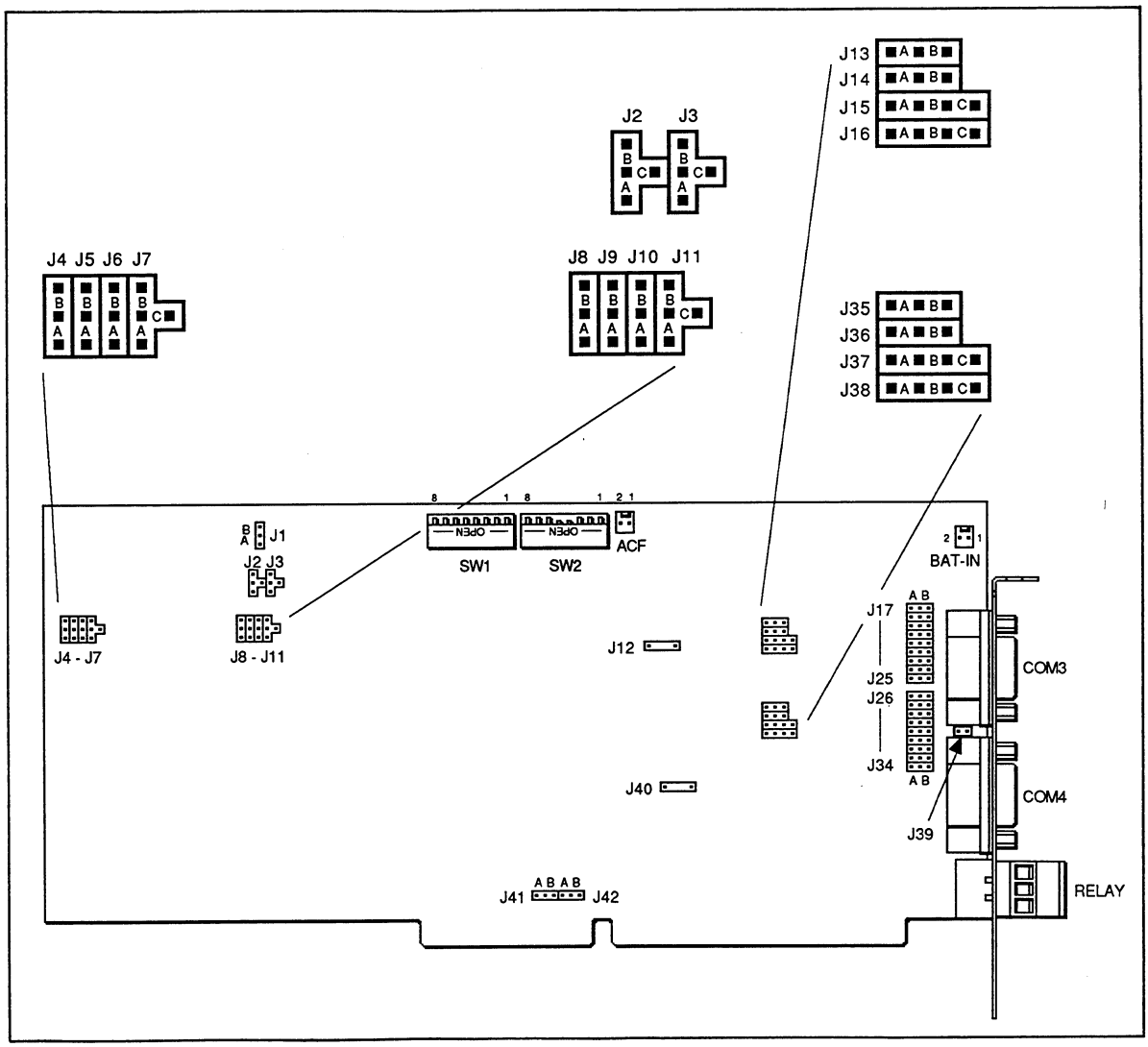


Figure B-2. 9000-RAD Jumpers, Connectors, and Switches

B.3.1 Jumper Settings

Table B-2, on the following page, lists the 9000-RAD jumpers, their default positions, and their functions.

Table B-2. 9000-RAD Jumper Settings

Jumper	Position	Function
J1	A B✓	On-board battery disconnected On-board battery connected
J2	A✓ B C	128Kx8, 256Kx8, or 512Kx8 EPROM 128Kx8, 256Kx8, or 12V 512Kx8 FLASH EPROM 5V 512Kx8 FLASH EPROM
J3	A✓ B C	128Kx8 or 256Kx8 EPROM 512Kx8 EPROM or 12V 512Kx8 FLASH EPROM 128Kx8, 256Kx8, or 5V 512Kx8 FLASH EPROM
J4	A✓ B	Selects Vcc to pin 32: +5V VBU
J5	A✓ B	Selects Vpp to pin 1: +5V +12V
J6	A✓ B	Selects function of pin 30 to the sockets: A(17) [MA(18)] +5V
J7	A B✓ C	Selects function of pin1 to the sockets: A(18) [MA(19)] Vpp A(19) [MA(20)]
J8	A B✓	Selects Vcc to pin 32: +5V VBU
J9	A✓ B	Selects Vpp to pin 1: +5V +12V
J10	A B✓	Selects function of pin 30 to the sockets: A(17) [MA(18)] +5V
J11	A✓ B C	Selects function of pin1 to the sockets: A(18) [MA(19)] Vpp A(19) [MA(20)]

Table continued on the following page.

Table B-2. 9000-RAD Jumper Settings *(continued)*

Jumper	Position	Function
J12	IN OUT✓	Connects isolated GND to digital GND on serial port 0 Isolates isolated GND and digital GND on serial port 0
J13-J14	A✓ B	No serial port 0 RS-485 termination RXD termination on serial port 0
J15-J16	A✓ B C	No RS-485 termination on serial port 0 CTS termination on serial port 0 TXD termination on serial port 0
J17-J25	A✓ B	Serial port 0 = RS-232C Serial port 0 = RS-485
J26-J34	A✓ B	Serial port 1 = RS-232C Serial port 1 = RS-485
J35, J36	A✓ B	No RS-485 termination on serial port 1 RXD termination on serial port 1
J37, J38	A✓ B C	No RS-485 termination on serial port 1 CTS termination on serial port 1 TXD termination on serial port 1
J39	IN OUT✓	Connects chassis GND to digital GND Isolates chassis GND and digital GND
J40	IN OUT✓	Connects isolated GND to digital GND on serial port 1 Isolates isolated GND and digital GND on serial port 1
J41	A B✓ OUT	Serial port 1 drives IRQ3 Serial port 1 drives IRQ11 Serial port 1 cannot drive IRQ3/IRQ11
J42	A B✓ OUT	Serial port 0 drives IRQ4 Serial port 0 drives IRQ10 Serial port 0 cannot drive IRQ4/IRQ10

✓=Factory setting

B.3.2 **Switch Settings**

Table B-3 lists the default switch settings on the 9000-RAD.

Table B-3. 9000-RAD Switch Settings

Switch	**Position**	**Function**
SW1-1 through SW1-3	Open✓ Closed	SSD device type register
SW1-4	Open Closed✓	SSD device type register
SW1-5	Open✓ Closed	SSD device type register
SW1-6 through SW1-8	Open Closed✓	SSD device type register
SW2-1	Open Closed✓	Extended BIOS location (refer to Table B-2)
SW2-2	Open Closed✓	Extended BIOS location (refer to Table B-2)
SW2-3	Open Closed✓	Serial ports disabled Serial ports enabled
SW2-4	Open✓ Closed	Serial port 0 set to COM3 Serial port 0 set to COM1
SW2-5	Open✓ Closed	Serial port 1 set to COM4 Serial port 1 set to COM2
SW2-6	Open Closed✓	WDT time-out will relax relay WDT time-out will not relax relay
SW2-7	Open Closed✓	SSD memory read only SSD memory read/write
SW2-8	Open Closed✓	Not used

✓=Factory setting

B.4 MEMORY DEVICE SELECTION

Table B-4 lists the jumper and switch settings necessary to select SRAM.

Table B-4. Memory Device Selection

Device	Bank 1:	J8	J9	J10	J11	SW1- 8	7	6	5
No devices	Don't Care					C	C	C	C
SRAM									
128Kx8		*	A	B	A	C	C	C	O
512Kx8		*	A	A	A	C	C	O	C

*A = SRAM not battery backed; B = SRAM battery backed

This chapter contains information on accessing the RADAR Setup Menus for systems that incorporate 9000-RAD boards. All pertinent menu instructions are included.

RADAR features are intended to decrease system down time by providing indicators when various system components require maintenance or when a fault occurs. Each feature monitors a single component and can be enabled or disabled, allowing users to control which features are operational. When a feature is enabled, it can be attached to the Fault or Maintenance LED. In addition, the Fault Relay Control feature can energize or relax the relay based upon the state of the Fault LED. This allows users to attach critical features to the Fault LED, which, in turn, can be attached via the Fault Relay to an alarm or other external signal.

C.1 SOFTWARE COMPATIBILITY

The RADAR Setup Menus use the LED Register (231h) found on Xycom's CPU boards. If register 231h is used for another purpose, there will be a conflict with the RADAR firmware. If register 231h is not present, the status of the RADAR will not be visible.

C.2 ACCESSING THE RADAR SETUP MENUS

To access the RADAR Setup Menu, press <Ctrl> <Alt> <R> at any time after the ROM scan.

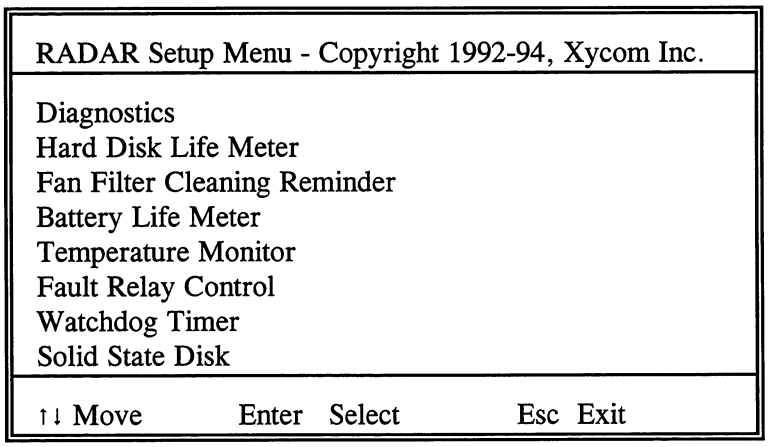


Figure C-1. RADAR Setup Menu

If any of the RADAR features turn on the Fault or Maintenance LEDs, a flashing "Fault Occurred," "Data Corrupted," or "Maintenance Required" message will appear to the right of the feature responsible. For example, if the Filter Cleaning Interval (see Fan Filter Reminder Menu) had elapsed since the last cleaning, the flashing Maintenance Required message would appear to the right of the Fan Filter Reminder option on the RADAR Setup Menu, as shown below.

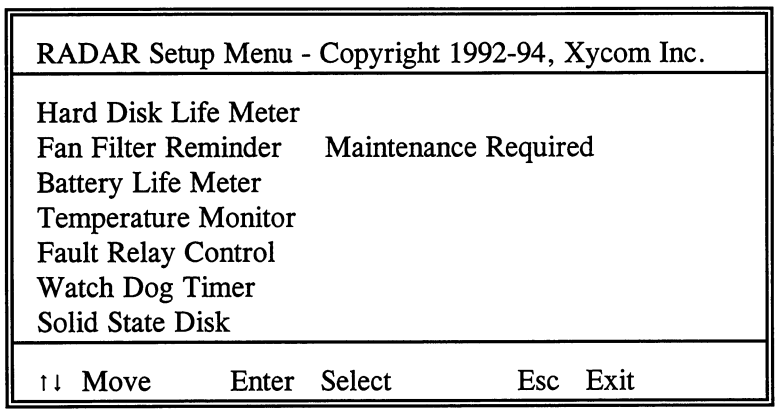


Figure C-2. RADAR Setup Menu (Maintenance Required)

The RADAR Setup Menu follows Quadtel System BIOS Main Menu conventions:

(↑↓)	Moves the cursor to an item to select.
<Enter>	Selects the item.
<Esc>	Exits the menu. Press <Esc> in the RADAR Setup Menu to reboot the system.

The individual menus selected from the RADAR Setup Menu follow the conventions of the Quadtel Setup menus. Arrow keys and <Enter> are used to move the cursor to the item to modify. Some fields can be modified by typing in a new value. White space is used in the menus to separate the items the user can change from those that are used to report the collected statistics.

<F5>	Selects the previous or smaller value.
<F6>	Selects the next or higher value.
<F2>, <F3>	Reset values in selected menus.
<F10>	Saves the new configuration.
<Esc>	Exits the menu. Users will be given a chance to save changes if <Esc> is pressed before <F10>.

C.3 DIAGNOSTICS MENU

The Advanced Diagnostics Software System is a collection of utility programs that provide advanced tests for PC/AT-compatible systems. This section contains information on using the Advanced Diagnostics Software System. The Diagnostics Menu offers the following choices:

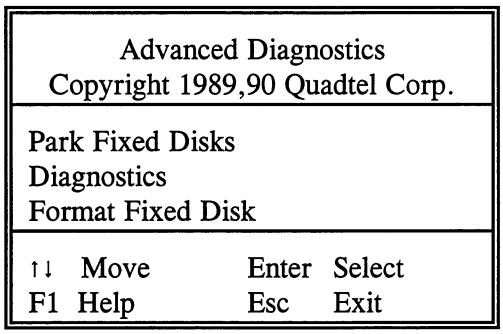


Figure C-3. Advanced Diagnostics Menu

Each of the options from the menu is explained in the sections below. <Esc> exits the Diagnostics and reboots the system.

C.3.1 Park Fixed Disks

This feature does not apply to the 9450-SSW.

C.3.2 **Diagnostics**

When Diagnostics is selected from the Advanced Diagnostics Menu, the following warning message is displayed:

Warning!
You have selected the Diagnostics. The diagnostics should be run on a system with no device drivers or TSRs loaded. Many of the diagnostic functions directly operate on the system hardware and memory. This can cause problems with installed software such as hard disk caches or RAM drives. The system should be rebooted after the diagnostics have been run. Floppy disks must be formatted by DOS after exiting the diagnostics to be usable. Insert scratch diskettes in all drives.
Continue Y/[N]

Figure C-4. Diagnostics Warning Message

After reading the warning and inserting the disks, press N to abort the operation or Y to continue.

If you select Y, the Main Diagnostics Menu appears (shown in Figure C-5 on the following page).

CAUTION
The diagnostics should be run on a system with no device drivers or TSRs loaded.

```
Advanced Diagnostics v1.04a Copyright 1989, 1990 Quadtel Corp.

Continuous: [No]    Stop on error: [Yes]    Echo log to LPT1: [No]

[P] System Board                    [N] Monochrome Adapter
[101] Keyboard                      [N] Color Graphics Adapter
[ 640K] System Memory               [N] Enhanced Graphics Adapter
[ 3072K] Extended Memory            [P] Video Graphics Array
                                    [N] Monochrome Parallel
[1.44 M] Diskette Drive 0           [P] Primary Parallel
[ None] Diskette Drive 1            [P] Secondary Parallel
[P] Fixed Disk 0                    [P] Primary Serial
[N] Fixed Disk 1                    [P] Secondary Serial
                                    [N] Internal Mouse

↑↓ Move      F5 Previous value      F9  Test Present Devices
F1 Help      F6 Next Value          F10 Test Selected Device
Esc Exit
```

Figure C-5. Main Diagnostics Menu

Items that appear in brackets indicate fields that can be changed. Default settings initially appear on the screen.

Each of the selections on the menu indicate the hardware item to test and the configuration of that item. Some items are present (P) or not present (N), while others specify a hardware type. For example, Keyboard can be an 84-key keyboard, a 101-key keyboard, or not present.

The initial hardware selections shown in the menu are determined by the system configuration that is detected by the diagnostics software. To override the initial selections or exclude certain tests from being performed, use the arrow keys (←↑↓→), <Tab>, or <Enter> to move the cursor to the item(s), and use <F5> or <F6> to change the selection.

<Esc>	Exits the menu.
<F5>	Selects the previous or smaller value.
<F6>	Selects the next or higher value.
<F9>	Tests all currently available items. If there are specific tests that you do not want to perform, set these selections to not present (N, None, or 0).
<F10>	Selects a single test on which the cursor is placed. This selection cannot be set to N, None, or 0.

The fields at the top of the screen are options that control how the tests are performed. These options must be set before a test or tests are initiated.

The Continuous option can be set to Yes or No. When set to Yes, the test performs continuously until you press <Esc> to stop it. After pressing <Esc>, press the space bar to continue the test or press <Esc> again to abort the test(s). Continuous test works with either a single test (selected by <F10>) or several tests (selected by <F9>).

The Stop on Error option can be set to Yes or No. When set to Yes, the diagnostic system stops after detecting an error. After the system reports the error, press the space bar to continue or <Esc> to end testing.

The Echo log to LPT1 option can be set to Yes or No. If set to Yes, the test result data is written to a printer attached to LPT1. This feature is useful if you set Continuous Test to Yes, Stop Error to No, and are running the test(s) unattended.

> **NOTE**
> Some of the submenu tests require you to respond to prompts. These are identified as interactive. If you are performing continuous unattended tests, do not select any interactive tests.

Each of the tests available on the Diagnostics Menu is described on the following pages.

When a test is initiated, a menu like that shown in Figure C-6, on the next page, is displayed. The actual information shown depends on the type of test selected.

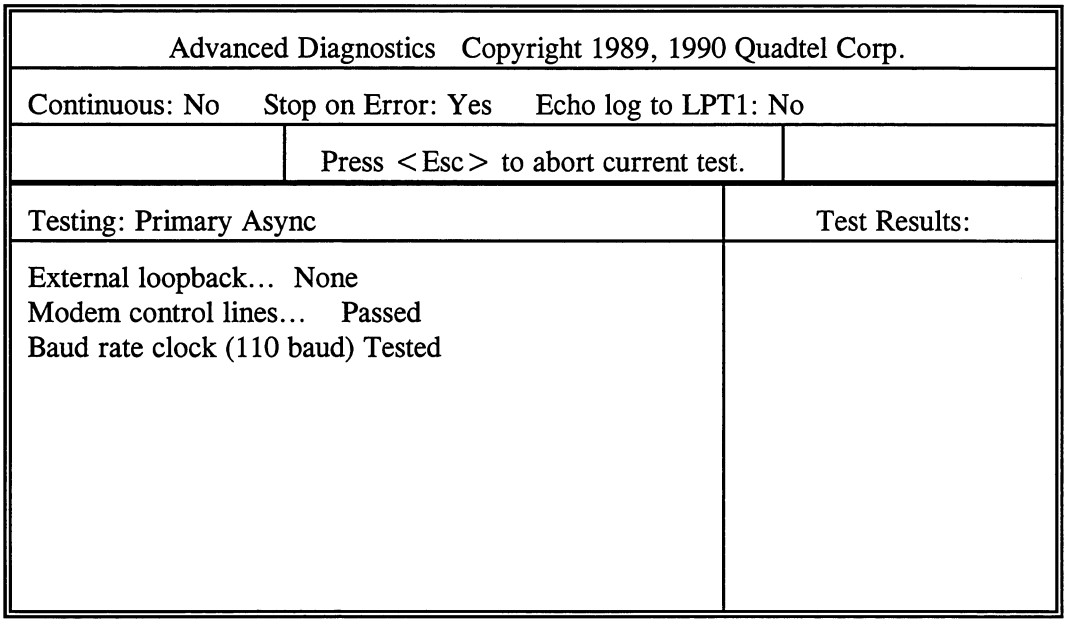


Figure C-6. Sample Advanced Diagnostics Test Menu

The left side of the screen shows information relating to the test(s) being performed, while the right side of the screen shows results of completed tests.

CAUTION
Tests that are labeled destructive could destroy information.

C.3.2.1 **Test Control Option Menu**

Many of the hardware items shown in the Advanced Diagnostics Menu have an associated Test Control Option Menu. One or more of these menus will appear depending on how many tests have been started. Each of these menus allow you to enable or disable parts of each test. Below is a description of the keys used in these menus:

<↑↓>, <Tab>, <Enter>	Move the cursor to another option.
<Esc>	Returns to the Diagnostics menu.
<F5>	Enables the selected test option if it is currently disabled, or disables the selected test option if it is currently enabled.
<F7>	Enables all test options.
<F8>	Disables all test options.
<F10>	Moves to the next test option menu if there are any that must be examined and set, or starts the test(s).

C.3.2.2 **System Board**

This selection tests the processor, DMA registers, CMOS RAM, real-time clock, timers, and interrupt controller. After the test is completed, press <Esc> to return to the Main Diagnostics Menu or the space bar to run the test again.

C.3.2.3 **Keyboard**

If selected, this menu will appear before the Keyboard test is executed.

Select tests for Keyboard:		
Keyboard test (interactive)		[No]
Controller test (non-interactive)		[Yes]
↑↓ Move	F5 Toggle	F7 All
Esc Abort	F8 None	F10 Accept

Figure C-7. Keyboard Test Menu

If the interactive Keyboard test is executed, a picture of the keyboard defined in the Main Diagnostics Menu (84- or 101-key) is displayed. The first time you press and release a key, the equivalent key on the screen should highlight. Subsequent press/release cycles should cause the highlight on that key to blink. Pressing and holding a key should cause the equivalent key on the screen to blink, and the key on the screen should be highlighted when the key is released.

The Caps Lock, Num Lock, and Scroll Lock LEDs will match those on the screen unless you press and hold one of these keys long enough to make them blink on the screen.

After testing all of the keys, press <Ctrl><Y> if the keyboard is functioning correctly, otherwise press <Ctrl><N>.

C.3.2.4 **System Memory**

This diagnostic tests the system memory.

C.3.2.5 **Extended Memory**

This diagnostic tests the extended memory. Separate read/write and address line tests are performed.

C.3.2.6 **Diskette Drives 0 and 1**

This feature does not apply to the 9450-SSW.

C.3.2.7 **Fixed Disk 0 and 1**

This feature does not apply to the 9450-SSW.

C.3.2.8 **Monitor Type**

Set your monitor type to [P] and the other monitor types to [N]. All of the monitor tests are interactive except the Memory test. The monitor selections and their test control option menus are as follows:

- Monochrome Adapter

Select tests for Monochrome adaptor:		
Attribute test		[No]
Character test		[No]
Text test		[No]
Memory test		[Yes]
↑↓ Move	F5 Toggle	F7 All
Esc Abort	F8 None	F10 Accept

Figure C-8. Monochrome Adapter Menu

- Color Graphics Adapter (CGA)

Select tests for CGA adaptor:		
Attribute test		[No]
Character test		[No]
Text test		[No]
Page test		[Yes]
Graphics test		[No]
Background test		[No]
Memory test		[No]
↑↓ Move	F5 Toggle	F7 All
Esc Abort	F8 None	F10 Accept

Figure C-9. Color Graphics Adapter Menu

- Enhanced Graphics Adapter (EGA)

Select tests for EGA adaptor:		
Attribute test		[No]
Character test		[No]
Text test		[No]
Page test		[No]
Graphics test		[No]
Background test		[No]
Memory test		[Yes]
↑↓ Move	F5 Toggle	F7 All
Esc Abort	F8 None	F10 Accept

Figure C-10. Enhanced Graphics Adapter Menu

- Video Graphics Array (VGA)

Select tests for VGA adaptor:	
Attribute test	[No]
Character test	[No]
Text test	[No]
Page test	[No]
Graphics test	[No]
Background test	[No]
Memory test	[No]
↑↓ Move F5 Toggle	F7 All
Esc Abort F8 None	F10 Accept

Figure C-11. Video Graphics Array Menu

C.3.2.9 **Parallel Port**

Set the primary, secondary, and monochrome parallel ports to [P] if present in your system or [N] if not present. When a parallel port test is selected, a menu similar to the one below appears:

Select Tests for Parallel		
Internal Loopback		[Yes]
Printed Pattern		[No]
(requires connected printer)		
External Loopback		[No]
(requires loopback connector)		
↑↓ Move	F5 Toggle	F7 All
Esc Abort	F8 None	F10 Accept

Figure C-12. Parallel Port Test Menu

The port(s) selected can be tested for external loopback, internal loopback, and printer pattern.

If performing an external loopback test, there must be a loopback connector on the selected output ports. The pinouts for this connector are shown in Figure C-13:

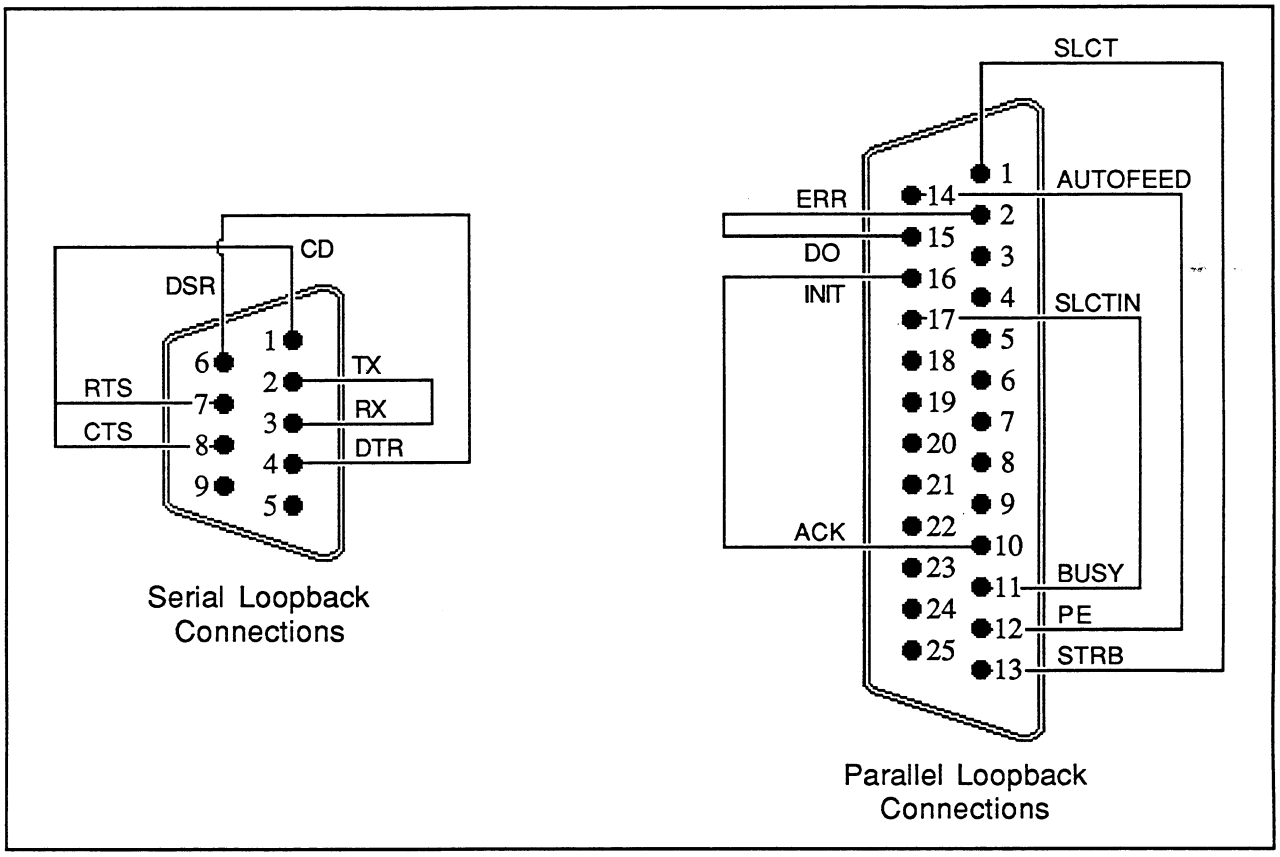


Figure C-13. Serial and Parallel Loopback Connections

C.3.2.10 **Serial Ports**

Set the primary and secondary serial ports to [P] if present or [N] if not present in your system. A menu appears when you select the port(s) to test. You can test baud rate clock, internal transmit and receive data lines, and modem control data lines. The external loopback test requires a loopback connector.

Select Tests for Primary Async		
Baud rate clock		[Yes]
Internal Tx / Rx		[Yes]
Modem control lines		[Yes]
External loopback		[No]
(requires loopback connector)		
↑↓ Move	F5 Toggle	F7 All
Esc Abort	F8 None	F10 Accept

Figure C-14. Select Tests for Primary Async Menu

C.3.2.11 **Internal Mouse**

The test control option menu appears as shown below:

Select tests for Internal Mouse		
Movement test (interactive)		[No]
Controller test (non-interactive)		[Yes]
↑↓ Move	F5 Toggle	F7 All
Esc Abort	F8 None	F10 Accept

Figure C-15. Internal Mouse Test Menu

C.3.3 Format Fixed Disk

This feature does not apply to the 9450-SSW.

C.3.3.1 Using the Bad Track Table

This feature does not apply to the 9450-SSW.

C.3.3.2 Setting the Interleave

This feature does not apply to the 9450-SSW.

C.3.3.3 Analyzing the Fixed Disk Surface

This feature does not apply to the 9450-SSW.

C.3.3.4 Formatting a New Fixed Disk Drive

This feature does not apply to the 9450-SSW.

C.3.3.5 Formatting an Already Formatted Disk

This feature does not apply to the 9450-SSW.

C.3.3.6 Finishing the Formatting

This feature does not apply to the 9450-SSW.

C.3.4 Error Codes

When the diagnostics system detects an error, a two-byte hexadecimal code is displayed. The first byte of this code is the class of error and the second byte is the sub-class. The error code class generally corresponds to a specific hardware system or group of systems. For example, the first class (01) is used for the system planar board, and error 0108 indicates a system board error regarding the 8253 counters.

Table C-1, on the following pages, describes the error codes.

Table C-1. Error Codes

Code	Class	Failure Type
0101	System board	DMA registers
0102		DMA memory move
0103		Interrupt mask
0104		Hot interrupt line
0105		Struck NMI
0106		Process registers
0107		System timer
0108		8253 counters
0109		System timer interrupts (1)
010A		System timer interrupts (2)
010B		Processor flags
0110		CMOS memory
0111		Real time clock
0120		BIOS checksum
0701	Keyboard	Controller
0702		Keyboard map
1001	Co-processor	Registers
1002		Calculations
1701	Video	Text attributes
1702		Background colors
1703		Character set
1704		Text page registration
1705		Text pages
1706		Graphics display
1707		EGA/VGA palette
1708		Memory
1709		VGA sequencer
170A		VGA controller registers
170B		VGA attribute controller
170C		VGA DAC
1730		Cannot initialize video
2001	Serial	Baud rate clock
2002		Internal loopback data
2003		Internal loopback control
2004		External loopback data

Table is continued on the following page.

Table C-1. Error Codes (*continued*)

Code	Class	Failure Type
2701	LPT	Registers read/write
2702		Control loopback
2703		Printed pattern
2704		Printer not ready
2705		Unknown error
2706		No paper/paper jam
2707		Printer timeout
2708		Printer busy
3001	Memory	Address lines
3002		Data patterns
3003		Walking bits
3701	Disk	Invalid parameter
3702		Address mark not found
3703		Write protect error
3704		Sector not found
3705		Reset failed
3706		Change line active
3707		Drive parameter error
3708		DMA overrun
3709		Attempt to DMA across 64 K
370A		Bad sector flag found
370B		Bad cylinder detected
370C		Media type not found
370D		Invalid format sectors count
370E		Control data mark detected
3710		CRC or ECC error detected
3711		ECC corrected error
3720		General controller failure
3740		Seek operation
3750		Change line test
3780		Drive not ready
37BB		Undefined error occurred
37CC		Write fault on selected drive
37EO		Status error
37FF		Sense operation failed

C.4 HARD DISK LIFE METER MENU

The RADAR Hard Disk Life Meter monitors hard disk usage. When enabled, the Hard Disk Life Meter keeps track of how long the computer has been on since the hard disk was last serviced and replaced. The user indicates how long the hard disk is allowed to be used without maintenance. When this period expires, the Hard Disk Life Meter will inform RADAR that an error has occurred. It also logs when the user indicates that the hard disk has been serviced and/or replaced.

Select the Hard Disk Life Meter option from the RADAR Main Menu to access the Hard Disk Life Meter Menu, shown below:

```
Hard Disk Life Meter, Copyright 1992-94, Xycom Inc.

Hard Disk Life Meter: [Disabled        ]

Maintenance Reminder Interval (hours): [ 60000]

Date Installed or Serviced: 01/10/1980
Hours since drive replacement or maintenance: 0
Total Hard Drive Power On Hours: 0

↑↓  Move        F5  Previous Value    F2   Drive Serviced
Esc  Exit       F6  Next Value        F3   Drive Replaced
                                      F10  Save Configuration
```

Figure C-16. Hard Disk Life Meter Menu

Menu options are described below. Underlined items indicate the default setting for a menu option.

C.4.1 **Hard Disk Life Meter** (Disabled; Enabled/Fault LED; Enabled Maintenance LED)

This selection allows the user to enable or disable the Hard Disk Life Meter. When enabled and tied to the Maintenance LED, it indicates when maintenance is required when the Reminder Interval expires. When enabled and tied to the Fault LED, it indicates when a fault has occurred when the Reminder Interval expires.

C.4.2 **Maintenance Reminder Interval** (0-60000-999999)

When the Hard Disk Life Meter is enabled and the Hours since drive replacement or maintenance field is equal to or greater than the value in this field, the Maintenance or Fault LED turns on. The maximum value of this item is 999,999 hours. The manufacturer's reliability specifications for the mean time between failures (MTBF) for the ProDrive ELS and the LPS is 250,000 hours.

> **NOTE**
> If you do not know what to set the Maintenance Reminder Interval to, start with the MTBF of the hard drive that is in your system. As you gain experience with the reliability of hard drives in your specific application, modify this value appropriately.

C.4.3 **Date Installed or Serviced** (mm/dd/yy)

This field shows the last date at which the drive was serviced or replaced. Press <F2> or <F3> to set this field to the current date. The format of the date field is month/day/year.

C.4.4 **Hours since drive replacement or maintenance**

This field displays the number of hours since the drive was last replaced or maintained. The RADAR BIOS maintains this number when the Hard Disk Life Meter is enabled. It is set to zero when the user presses <F2> or <F3>.

C.4.5 **Total Hard Drive Power On Hours**

This field indicates the total number of hours the drive has been powered on. Press <F3> to set this field to zero. The RADAR BIOS maintains this number when the Hard Disk Life Meter is enabled.

C.5 FAN FILTER CLEANING REMINDER MENU

The Fan Filter Cleaning Reminder Menu monitors how long the system has run since the fan filter was last cleaned. When enabled, it keeps track of how long the computer has been on since the fan filter has been cleaned and/or replaced. The user indicates how long the fan filter is allowed to be used between cleanings. When this period expires, the Fan Filter Cleaning Reminder informs RADAR that an error has occurred. It also logs when the user indicates that the fan filter has been cleaned or replaced.

Select the Fan Filter Cleaning Reminder option from the RADAR Main Menu to access the Fan Filter Cleaning Reminder Menu, shown below:

```
Fan Filter Cleaning Reminder, Copyright 1992-94, Xycom Inc.

Fan Filter Cleaning Reminder: [Disabled       ]

Filter Cleaning Interval (hours): [ 720]

Date Serviced: 11/15/1992
Hours since cleaning: 0

↑↓   Move        F5  Previous Value    F2   Fan Filter Cleaned
Esc  Exit        F6  Next Value        F10  Save Configuration
```

Figure C-17. Fan Filter Cleaning Reminder Menu

Menu options are described below. Underlined items indicate the default setting for a menu option.

C.5.1 **Fan Filter Cleaning Reminder** (Disabled; Enabled/Fault LED; Enabled/Maintenance LED)

This field is used to enable or disable the Fan Filter Cleaning Reminder. When enabled and tied to the Maintenance LED, it indicates when it is time to clean the fan filter. When enabled and tied to the Fault LED, it indicates when a fault has occurred.

C.5.2 **Filter Cleaning Interval** (0-720-17532)

When the Fan Filter Cleaning Reminder is enabled and the value in the Hours since cleaning field is equal to or greater than the value in this field, the Maintenance or Fault LED turns on. The maximum value of this item is 17,532 hours (two years).

C.5.3 **Date Serviced** (mm/dd/yy)

This item shows the last date that the fan filter was cleaned. Press <F2> to set this item to the current date. The format of the date field is month/day/year.

C.5.4 **Hours Since Cleaning**

This field shows the number of hours the system has been powered on since the last time the filter was cleaned. This field is updated by the RADAR BIOS when the Fan Filter Cleaning Reminder is enabled. Press <F2> to clear this value.

C.6 BATTERY LIFE METER MENU

The Battery Life Meter monitors battery usage. When enabled, it monitors how long the computer has been off since the battery was last replaced. The user indicates how long the battery is expected to live and how much of this time is allowed to pass without replacement. When this time period expires, the Battery Life Meter informs RADAR that an error has occurred. It also logs when the user indicates that the battery has been replaced.

Select the Battery Life Meter option from the RADAR Main Menu to access the Battery Life Meter Menu, shown below:

Battery Life Meter, Copyright 1992-94, Xycom Inc.					
Battery Life Meter: [Disabled]					
Battery Life (hours): [41463]					
Battery Replacement Interval (% ; hours): [90] ; 37316					
Date New Battery Installed: 11/15/1992					
Hours battery in use: 0					
Remaining Battery Life: 41463					
↑↓	Move	F5	Previous Value	F2	Battery Replaced
Esc	Exit	F6	Next value	F10	Save Configuration

Figure C-18. Battery Life Meter

Menu options are described on the following pages. Underlined items indicate the default setting for a menu option.

C.6.1 **Battery Life Meter** (Disabled; Enabled/Fault LED; Enabled/Maintenance LED)

This option is used to enable or disable the Battery Life Meter. When enabled and tied to the Maintenance LED, it indicates when it is time to change the battery. When enabled and tied to the Fault LED, it indicates when a fault has occurred.

C.6.2 **Battery Life** (0-41463-87672)

Specify the life of the battery in hours in this field. The maximum value of this item is 87,672 hours (10 years).

C.6.3 **Battery Replacement Interval** (50-90-100%)

This field is used to specify at what percentage of battery life the battery should be replaced. After the percentage is set, the number of hours that the percentage represents is updated on the screen when the highlight bar is moved to another item in the menu. When the value of the Hours battery in use option is equal to or greater than the number of hours specified in this item and the Battery Life Meter is enabled, the Maintenance or Fault LED turns on. The minimum value of this item is 50 percent and the maximum is 100 percent.

C.6.4 **Date New Battery Installed** (mm/dd/yy)

This field displays the date the battery was last replaced. The format of the date field is month/day/year. Press <F2> to set this item to the current date.

C.6.5 **Hours Battery In Use**

This field shows how long the current battery has been in use. The RADAR BIOS maintains this number when the Battery Life Meter is enabled. Press <F2> to set this value to zero.

C.6.6 **Remaining Battery Life**

This option shows the remaining life of the battery. RADAR BIOS maintains this number when the Battery Life Meter is enabled. Press <F2> to set this value to the same value as Battery Life.

C.7 TEMPERATURE MONITOR MENU

When enabled, the Temperature Monitor reads the ambient temperature from the 9000-RAD's D/A converter, updating the lowest and highest temperatures as they change. The user sets the allowable temperature range, and, if this range is violated, the Temperature Monitor will inform RADAR that an error has occurred. The event must be acknowledged to reset the error condition. The user may also reset the lowest and highest readings themselves.

> **NOTE**
> The Temperature Monitor reads the temperature around the 9000-RAD card, which is most often located in a closed unit. Therefore, the temperature range selected should reflect the monitoring of the internal system temperature rather than the room temperature.

Select the Temperature Monitor option from the RADAR Main Menu to access the Temperature Monitor Menu, shown below:

```
Temperature Monitor, Copyright 1992-94, Xycom Inc.

Temperature Monitor: [Disabled          ]

High Temperature Limit (Celsius): [50]
Low Temperature Limit (Celsius): [ 0]

Temperature Fault: No
Last Temperature (Celsius): NA
Highest Temperature (Celsius): NA
Lowest Temperature (Celsius): NA

↑↓  Move          F5  Previous Value    F2   Reset Fault
Esc Exit          F6  Next Value        F3   Reset Highest/Lowest
                                        F10  Save Configuration
```

Figure C-19. Temperature Monitor Menu

Menu options are described on the following pages. Underlined items indicate the default setting for a menu option.

C.7.1 **Temperature Monitor** (Disabled; Enabled/Fault LED; Enabled/Maintenance LED)

When this option is enabled, the Fault or Maintenance LED turns on to indicate that the temperature has gone above or below the specified limits.

C.7.2 **High Temperature Limit** (1-50°C)

This field is used to specify the highest allowable temperature. If the temperature goes out of the specified range, the Fault or Maintenance LED turns on. Temperature limits can be set as low as +1°C and as high as 50°C.

C.7.3 **Low Temperature Limit** (0-49°C)

This field is used to specify the lowest allowable temperature. If the temperature goes out of the specified range, the Fault or Maintenance LED turns on. Temperature limits can be set as low as 0°C and as high as -1°C.

C.7.4 **Temperature Fault** (Yes; No)

This field displays a Yes when a temperature fault occurs. Press <F2> to reset this field to No.

C.7.5 **Last/Highest/Lowest Temperature**

These fields show the last, highest, and lowest temperatures measured when the temperature monitor was enabled. The temperature is measured once a minute. Press <F3> to reset the Highest and Lowest Temperature fields.

C.8 FAULT RELAY CONTROL MENU

The Fault Relay Control ties the state of the Fault Relay on the 9000-RAD to the Fault LED. When enabled, the user indicates what action the Fault Relay will take when the Fault LED is turned on and off. The Fault Relay can be energized, relaxed, or ignored.

Select the Fault Relay Control option from the RADAR Main Menu to access the Fault Relay Control Menu, shown below:

Fault Relay Control, Copyright 1994, Xycom Inc.			
[Ignore] Fault Relay when Fault LED is on			
[Ignore] Fault Relay when Fault LED is off			
↑↓ Move	F5 Previous Value	F2	Energize Relay
Esc Exit	F6 Next Value	F3	Relax Relay
		F10	Save Configuration

Figure C-20. Fault Relay Control Menu

> **NOTE**
> If you want SoftScreen to control the relay, set the options in the Fault Relay Control Menu to Ignore.

Menu options are described below. Underlined items indicate the default setting for a menu option.

C.8.1 (Ignore; Energize; Relax) Fault Relay when Fault LED is on

This field indicates the state of the Fault Relay when the Fault LED is on. The user can choose to energize or relax the Fault Relay or have it remain in its current state (Ignore).

C.8.2 (Ignore; Energize; Relax) Fault Relay when Fault LED is off

This field indicates the state of the Fault Relay when the Fault LED is off. The user can choose to energize or relax the Fault Relay or have it remain in its current state (Ignore).

C.9 WATCHDOG TIMER MENU

The Watchdog Timer (WDT) is an interval timer that must be strobed within a specified period or it will time out. When this feature is enabled, RADAR periodically strobes the WDT.

> **NOTE**
> While having the RADAR control the WDT provides some system integrity, having an application control the WDT provides greater integrity. That is because the RADAR is tied to the timer interrupt and it will continue to strobe the WDT even when an application has become unstable.

Select the Watchdog Timer option from the RADAR Main Menu to access the Watchdog Timer Menu, shown below:

```
Watchdog Timer, Copyright 1994, Xycom Inc.

Watchdog Timer: [Disabled        ]
Last timeout of the Watchdog Timer: 01/01/1980    00:00 (24 hour clock)

↑↓  Move          F5  Previous Value
Esc Exit          F6  Next Value          F10  Save Configuration
```

Figure C-21. Watchdog Timer Menu

Menu options are described below. Underlined items indicate the default setting for a menu option.

C.9.1 **Watchdog Timer** (Disabled; Enabled/Fault LED)

This option is used to enable or disable the Watchdog Timer. When enabled, it is tied to the Fault LED.

C.9.2 **Last timeout of the Watchdog Timer** (mm/dd/yy; hh:mm)

The field displays the date (mm/dd/yy) and 24-hour clock time (hh:mm) at which the Watchdog Timer last timed out.

C.10 SOLID STATE DISK MENU

On the 9450-SSW, the Solid State Disk (SSD) feature allows the socketed chip sites on the 9000-RAD board to emulate a ROM (bootable) drive C on one bank and a 512 Kbyte battery-backed RAM drive D on the second bank. Drive C has DOS and the SoftScreen Runtime System in ROM. Drive D is for application storage. In addition to the 9000-RAD board, up to 15 4100-SSD boards can be added to the backplane and become part of the Solid State Disk. Both the 9000-RAD and 4100-SSD boards can contain two banks of chips. (Refer to the 4100-SSD manual for more information.) When two disks are being emulated, the first disk size is specified in the setup menus (see below) as the number of banks allocated to C. The second drive starts at the following bank, and its size is determined by the number of boards remaining and the dipswitches on each remaining board.

Select the Solid State Disk option from the RADAR Main Menu to access the Solid State Disk Menu, shown in Figure C-22. This menu is selected whenever a change to the Solid State Disk configuration is needed. An example could be when you are adding more memory to an existing 9000-RAD board or installing an additional 4100-SSD board.

NOTE
Initializing the SSD board(s) clears existing memory from your emulated drives. Be sure to back up important data before performing this initialization.

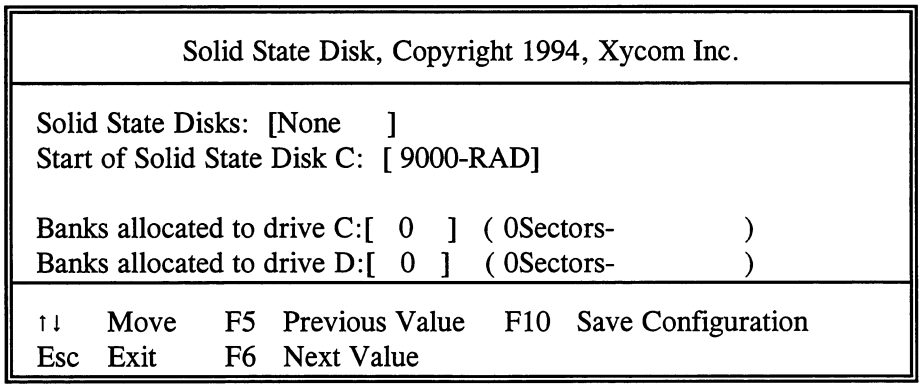


Figure C-22. Solid State Disk Menu

The user is asked whether or not to perform SSD initialization when changes to the SSD configuration indicate that initialization should occur. In some cases, you must force an initialization to occur. An example is when you are adding an additional 4100-SSD board to an existing C drive. When you add an additional board, you do not need to change any of the menu items, and when you don't change any menu items, pressing <F10> will not perform an initialization. To force initialization, change one of the fields, and press <Enter>, then change the field back to the desired value and press <F10> again.

C.10.1 **Menu Options**

Menu options are described below. Underlined items indicate the default setting for a menu option.

> **NOTE**
> Refer to Appendix D for information on reinitializing the 9000-RAD board.

C.10.1.1 **Solid State Disks** (None; C; D; C and D)

Set this feature to emulate two hard drives (C and D). Two is the maximum number of real and emulated hard drives in a system. The initialization will return an error message if you tell it to configure the system with more than two drives.

C.10.1.2 **Start of Solid State Disk C** (9000-RAD; 4100-SSD)

This feature specifies that the SSD memory starts on the 9000-RAD board.

> **NOTE**
> Each SSD board in the backplane must have a unique board number. The 9000-RAD board is always board 0. 4100-SSD boards have a rotary switch SW1 on them to determine their unique board number. Therefore, to add 4100-SSD boards to backplane that contains a 9000-RAD board, the first 4100-SSD board SW1 must be set to 1. Each additional 4100-SSD board that is added to the system must have its switches set sequentially to 2, 3, 4... etc. with SW1.

C.10.1.3 **Banks Allocated to drive C** (0-31)

Set this option to 1. The remaining number of banks are allocated to drive D.

C.10.1.4 **Banks allocated to drive D** (1-31)

The system automatically allocates the number of banks for D, and displays the number in this field. Drive D can include banks on additional 4100-SSD cards.

C.10.2 **Partitioning and Formatting the SSD**

Once you have initialized the SSD via the RADAR Setup Menus, it must be partitioned and then formatted. Refer to Appendix D for more information.

After you have partitioned and formatted the SSD, reboot your system. Your C and D drives should now appear to the system as mechanical hard disks. To make sure that the disk data on the board(s) remains intact during power-down, enable the battery for the SRAM chips on all SSD board(s).

The following steps describe how to reinitialize the 9000-RAD card for drives C and D:

1. Turn on the system.

2. Press <Ctrl><Alt><R> after the post-RAM test. The RADAR Setup Menu will appear.

3. Select the Solid State Disk option.

4. Set the value for the Banks allocated to drive C: and Banks allocated to drive D: fields to 1.

5. Press <F10> to save these changes.

6. Press <Esc> once to exit the Solid State Disk Menu, and press <Esc> again to exit to DOS. The system will reboot.

   The following error message will appear:

   ```
   ERROR: RAM drive D: not partitioned.
   Correct the problem (1,Y=YES / 0,N=NO)?
   ```

7. Press Y (or 1). The following message will appear:

   ```
   Press <Enter> to automatically partition RAM drive D:, or to
   abort press <Ctrl>+ <Break> simultaneously.
   ```

8. Press <Enter>. The system runs the DOS function FDISK. It uses the full RAM size it finds to create drive D.

   The following message will then appear:

   ```
   ERROR: RAM drive D: not formatted.
   Correct the problem (1,Y=YES / 0,N=NO)?
   ```

9. Select Y (or 1). The following message appears:

   ```
   DOS format for RAM drive D: about to begin. Warning, all data
   on the non-removable drive will be lost! Press <Enter> to
   automatically format RAM drive D:, or to abort press
   <Ctrl>+<Break> simultaneously.
   ```

11. Press <Enter>. The system runs the DOS function FDISK. It uses the full RAM size it finds to create drive D. The system will reboot, and then the following message will appear:

```
ERROR: RAM drive D: not formatted.
Correct the problem (1,Y=YES / 0,N=NO)?
```

12. Select Y (or 1). The following message appears:

```
DOS format for RAM drive D: about to begin. Warning, all data
on the non-removable drive will be lost! Press <Enter> to
automatically format RAM drive D:, or to abort press
<Ctrl>+<Break> simultaneously.
```

13. Press <Enter> and the disk will be formatted.

The touch screen driver will automatically be loaded. If you do not have a touch screen installed on your system, the following message will display, but the system will continue to reboot:

```
Touch Screen not Installed
```

After this process is complete, the SoftScreen Window will appear on your display. The system is now ready for an application to be downloaded. Refer to Chapter 1.

This section describes the pinouts for the serial port, relay, external battery, and AC fail connectors that are found on the 9000-RAD board.

E.1 SERIAL PORTS

The serial port 0 and 1 connectors are located on the ORB. Pinouts are listed in tables E-1 and E-2.

Table E-1. Serial Port 0 Connectors

Pin	RS-232C	RS-485
1	DCD	TXD-
2	RXD	TXD+
3	TXD	RTS-
4	DTR	RTS+
5	GND	GND
6	DSR	RXD-
7	RTS	RXD+
8	CTS	CTS+
9	RI	CTS-

Table E-2. Serial Port 1 Connectors

Pin	**RS-232C**	**RS-485**
1	DCD	TXD-
2	RXD	TXD+
3	TXD	RTS-
4	DTR	RTS+
5	GND	GND
6	DSR	RXD-
7	RTS	RXD+
8	CTS	CTS+
9	RI	CTS-

E.2 RELAY

RELAY is located on the ORB. Pinouts are described in Table E-3.

Table E-3. Relay Connectors

Pin	**Description**
1	Normally closed
2	Common
3	Normally open

E.3 EXTERNAL BATTERY

BAT-IN is located in the upper corner of the PCB nearest the ORB. Pinouts are described in Table E-4.

Table E-4. External Battery Connectors

Pin	Description
1	Battery Negative
2	Battery Positive

E.4 AC FAIL

ACF is located near the top center of the PCB. Pinouts are described in Table E-5.

Table E-5. AC Fail Connectors

Pin	Description
1	External AC Fail Input
2	Ground

Numerical

A

B

C

D

H

I

J

K

L

M

O