Computrol Control System

Using SYSdev 2000 Reference

SYSdev Programming

This document gives details relating to Systems PLCs and general SYSdev programming.

SYSdev originated in the days of DOS. Beginning with the release of Windows 2000, Microsoft changed the way a PC operating system interfaced with the common serial port. The standard DOS call to the serial port is no longer natively supported. SYSdev 2000 was developed to interact with Windows serial port handling where the support for the DOS call no longer worked properly. While the program shell is Windows based, the program editor and on-line monitoring feature are still the original DOS versions.

Installing SYSdev 2000

The installation CD has a standard "setup.exe" install package. Follow the instructions…
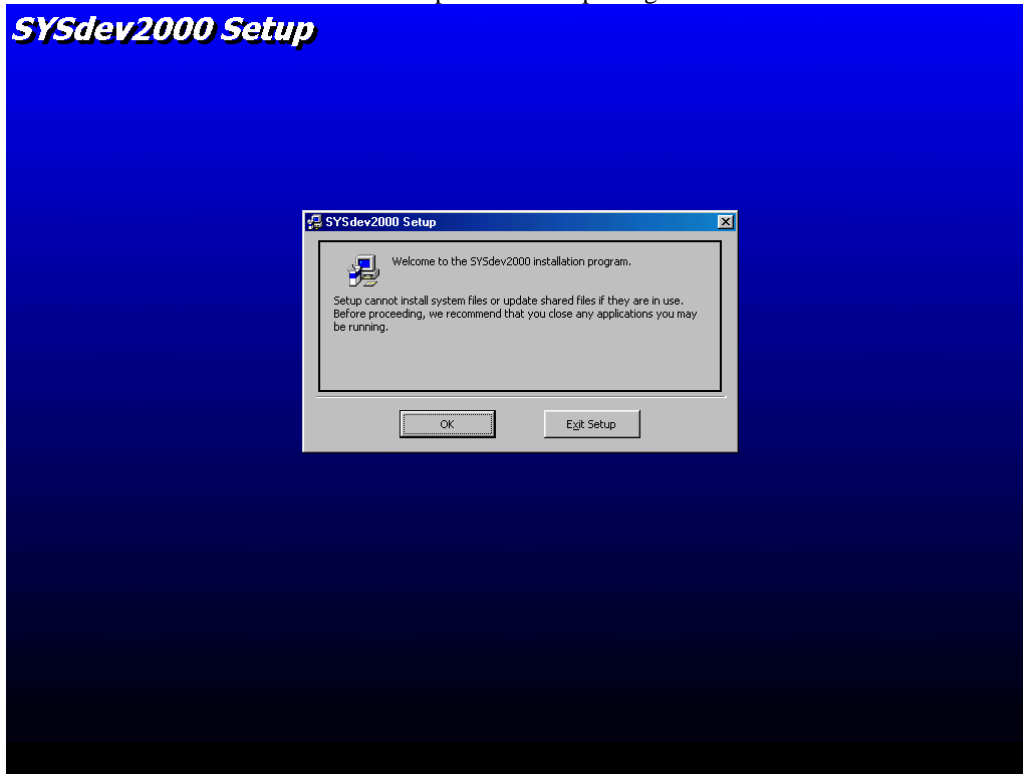
Figure 1 Initial Setup Screen
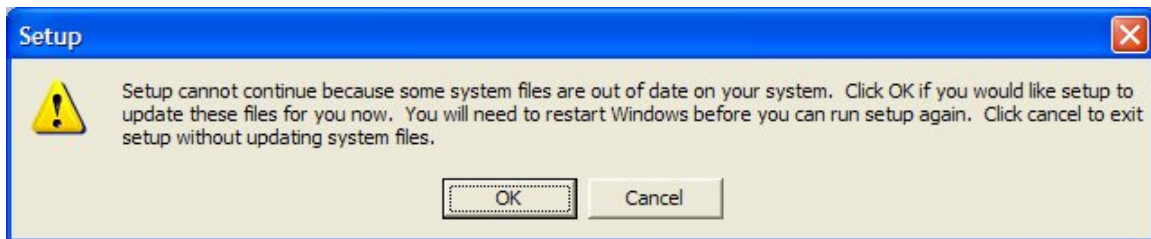
Figure 2 Some Files May Need To Be Updated, Requiring Restart
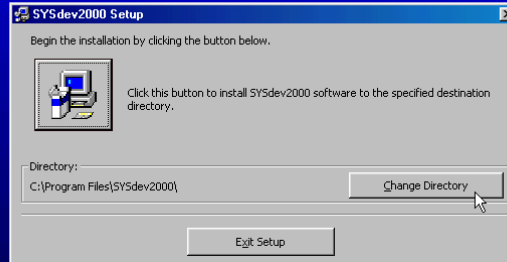
Figure 3 Change install directory if desired
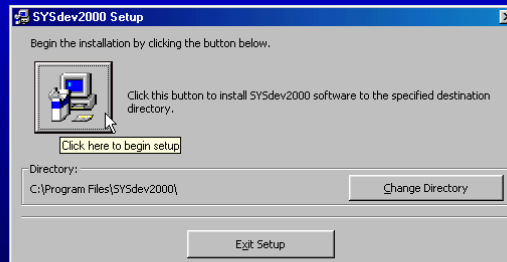
Figure 4 Begin Setup Installation
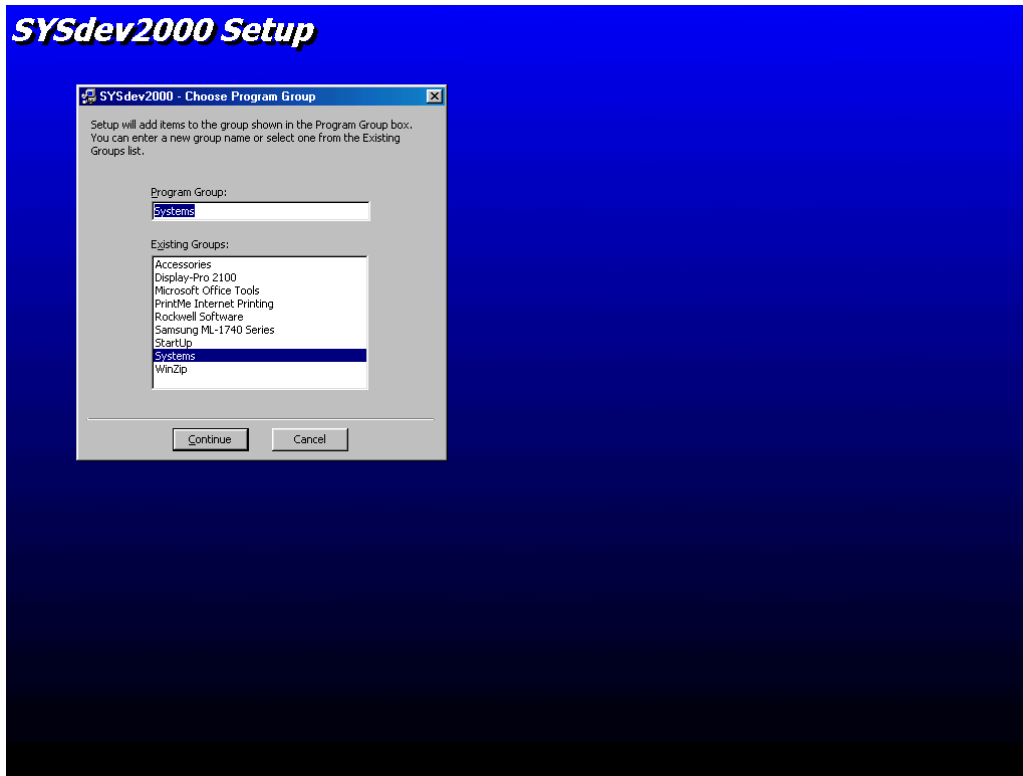
Figure 5 Choose Program Group for Start Menu
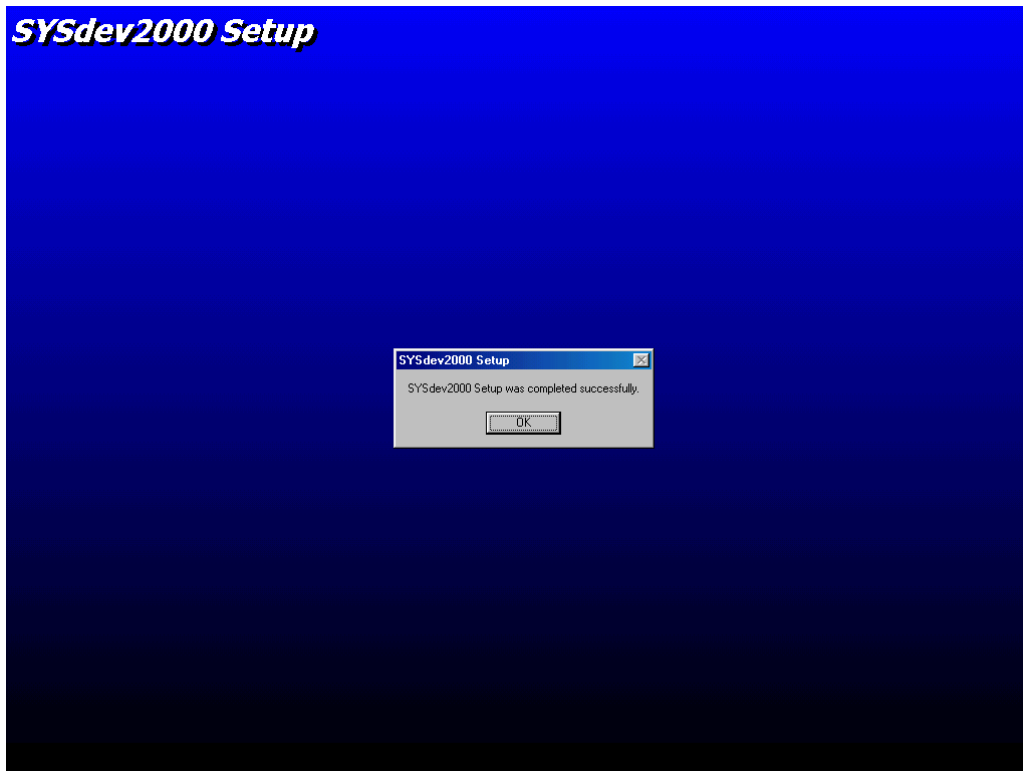
Figure 6 Installation Complete!

Running SYSdev 2000

You can run SYSdev 2000 from the Start Menu, using Programs and the group chosen at installation (default: Systems). The program opens with the shell and a splash screen as below.

Figure 7 Opening View of SYSdev 2000

The first time you run SYSdev 2000, when you click to clear the splash screen, it will do a background install of licensing information. A DOS window "sw2000.exe" runs in the background. Depending on the settings of your operating system, you may need to close the window manually when it has finished running.
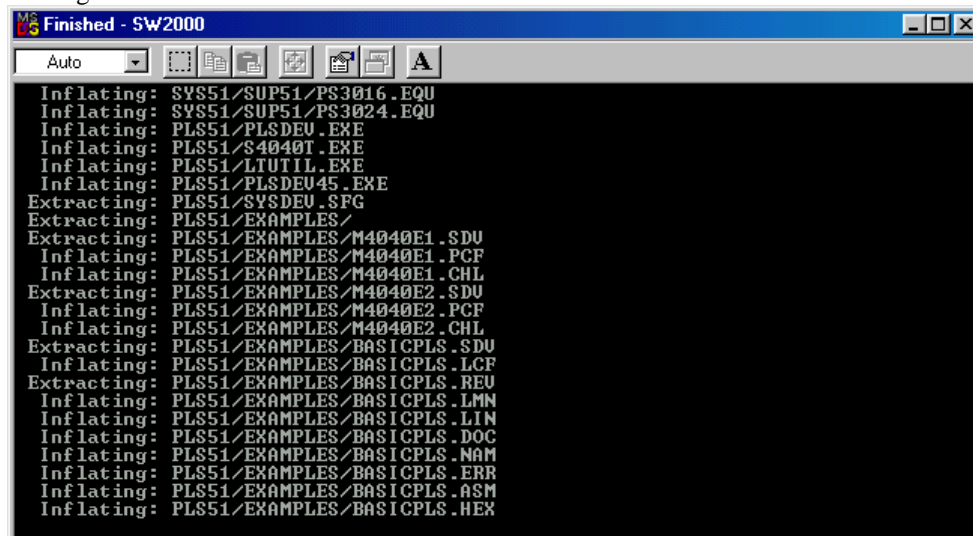
SYSdev 2000 Shell

After clicking on the splash screen, you are left with the SYSdev 2000 shell.
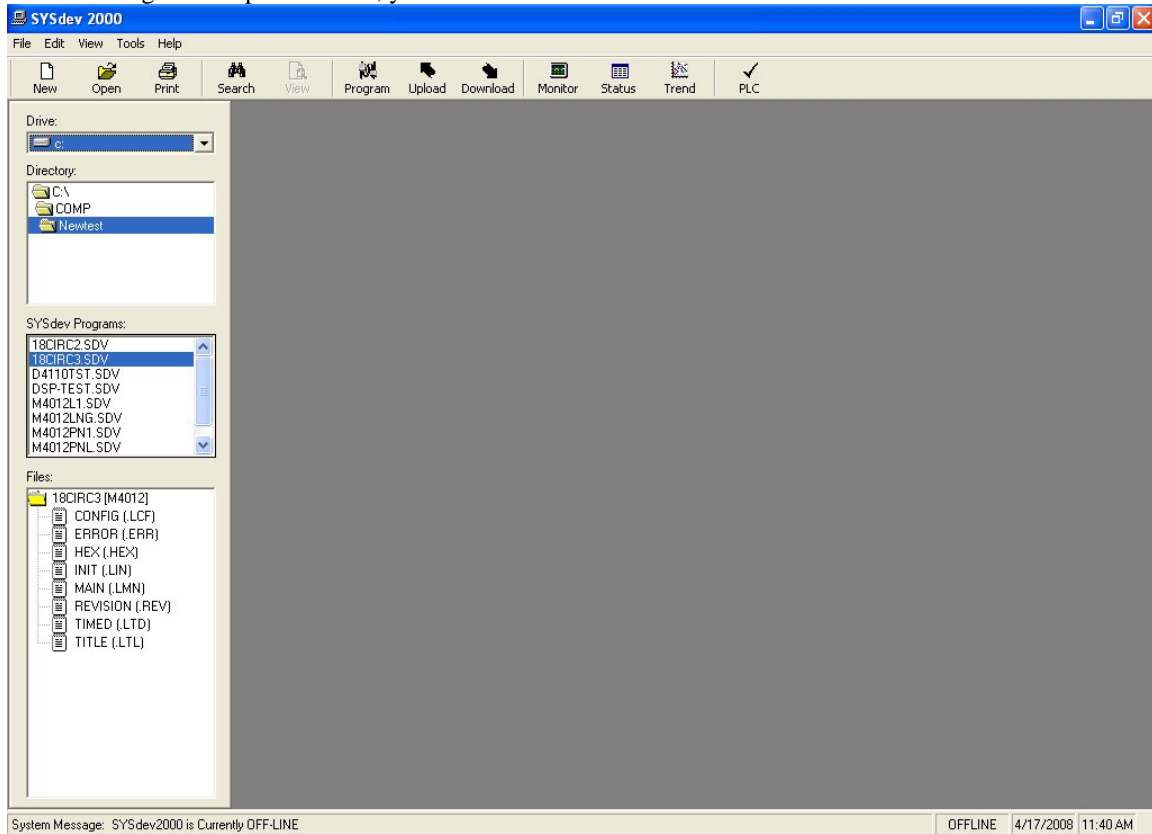
Figure 8 SYSdev 2000 Shell

This is the starting place for working with the program. All other tasks are launched from here. As a general note, if you use the toolbar buttons, they will apply to the currently highlighted program in the program selection tool; if you use the menu items, you will need to select the program from a pop-up screen regardless of the highlighted program in the program selection tool.
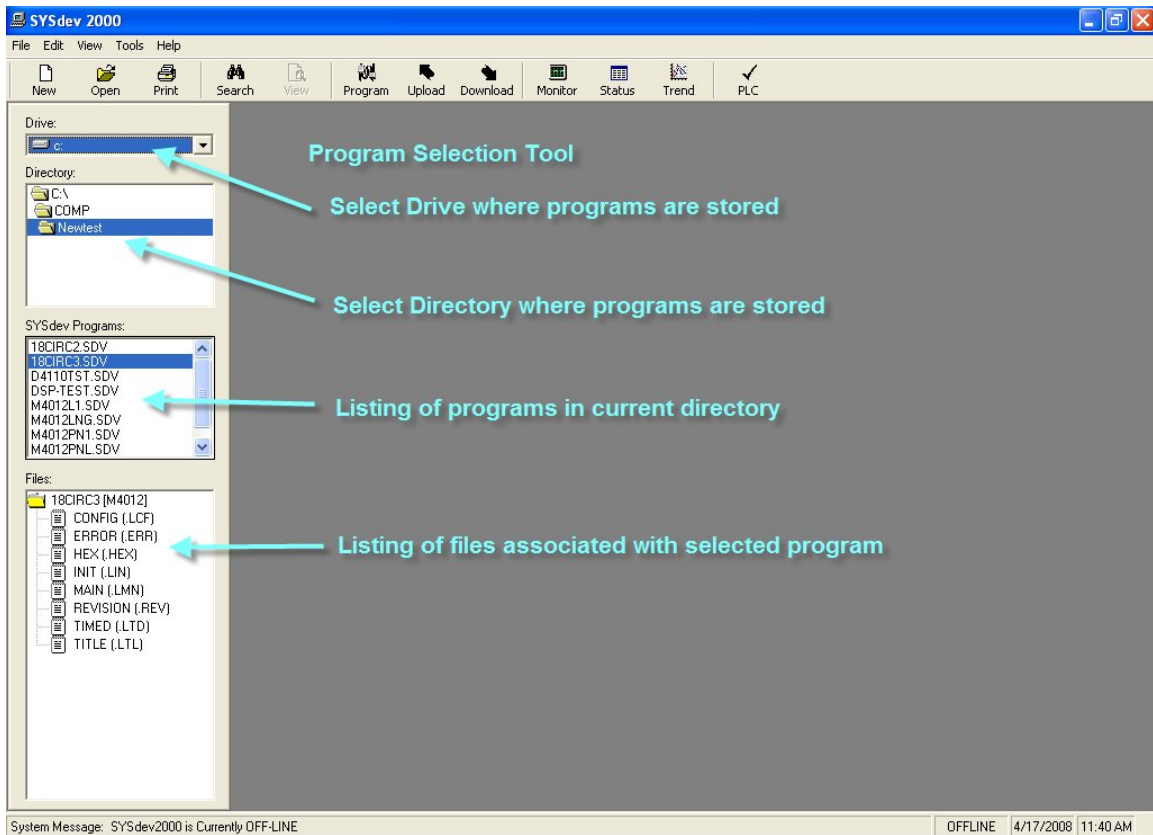
Figure 9 Program Selection Tool

Setting up the DOS Windows in Windows 2000/XP/Vista

Off-line programming and on-line monitoring are executed using pop-up DOS windows. You can launch several off-line programming windows at the same time or have one on-line window and one (or more) off-line windows open at the same time. You can only have one on-line window open at a time because the serial port control is assigned to the first opened window. Similarly, if you have an on-line monitoring window open, you cannot use a status table or trending tool at the same time.

The default settings for DOS windows do not present SYSdev in its most readable form. The first time you open a SYSdev DOS window by going on-line or viewing a program off-line, you may find it beneficial to modify the window properties to make viewing easier.

Using SYSdev2000
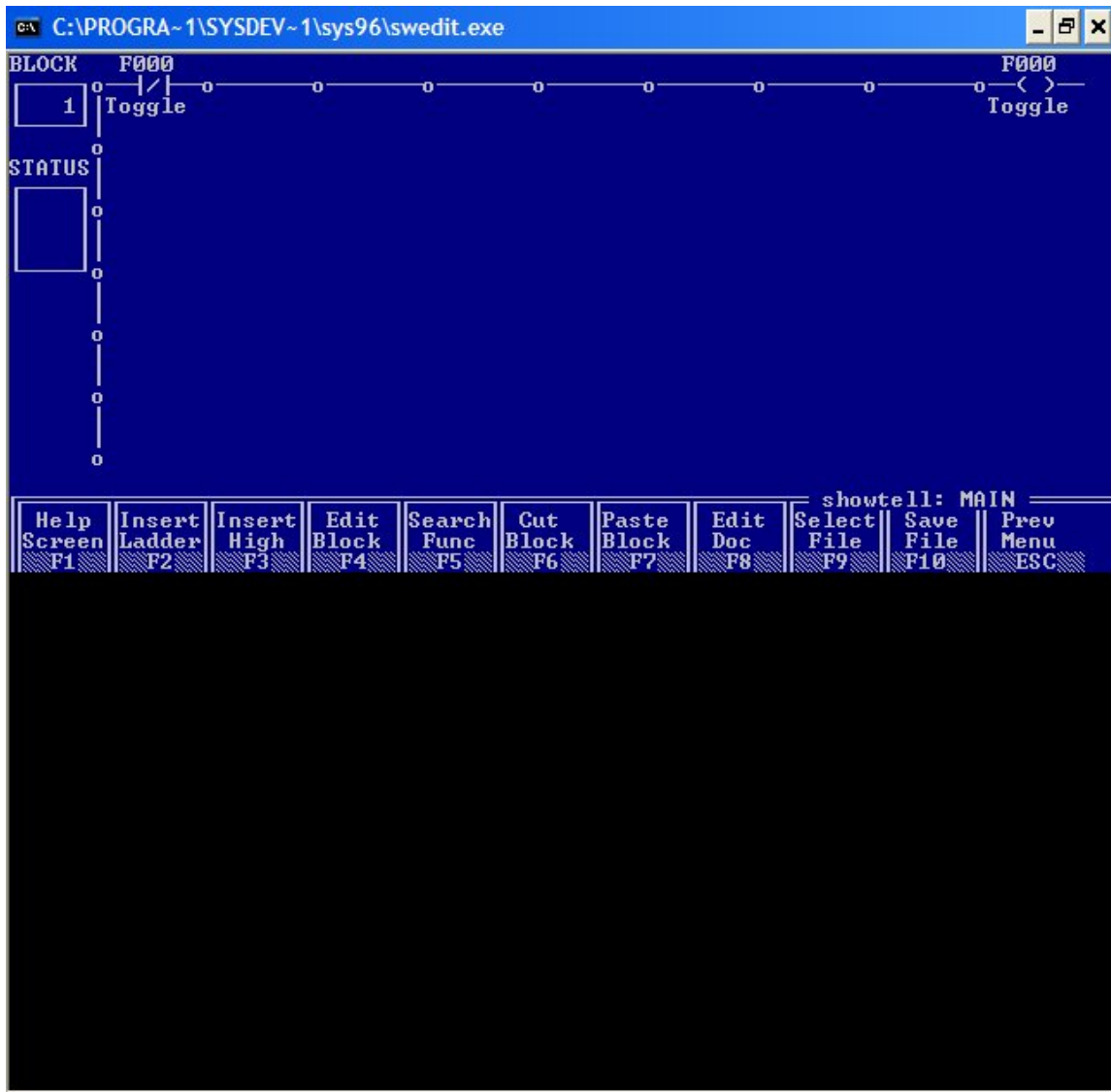
Figure 10 Initial View of a SYSdev DOS Window in XP

To get the windows on your PC to look like those shown in this manual, you will need to edit the properties of the DOS windows manually. You will need to click on the window icon at the top left of the window, and then choose Properties. Edit the settings to match Figure 12 below. When you click OK, you will be asked whether to use these settings one time only, or for default settings. Choose Save Properties for future windows with same title. You will need to close the window and open it again for the changes to take effect. Sometimes it is necessary to make the changes twice for the operating system to take them – it will modify the settings part way between the initial values and the values entered.
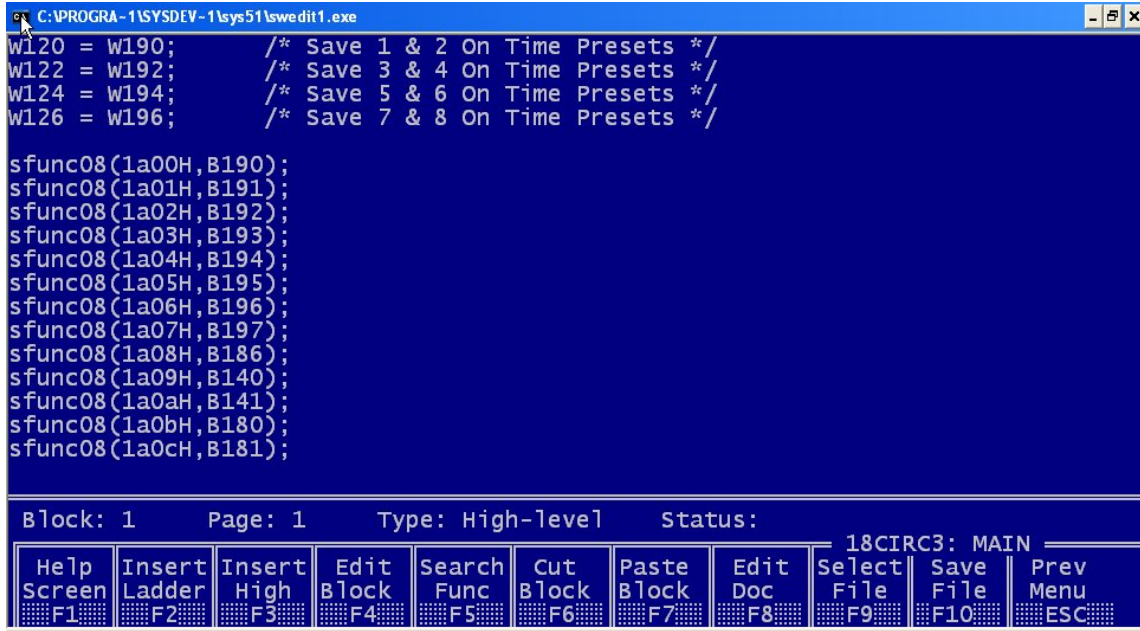
Figure 11 Choosing the Window icon
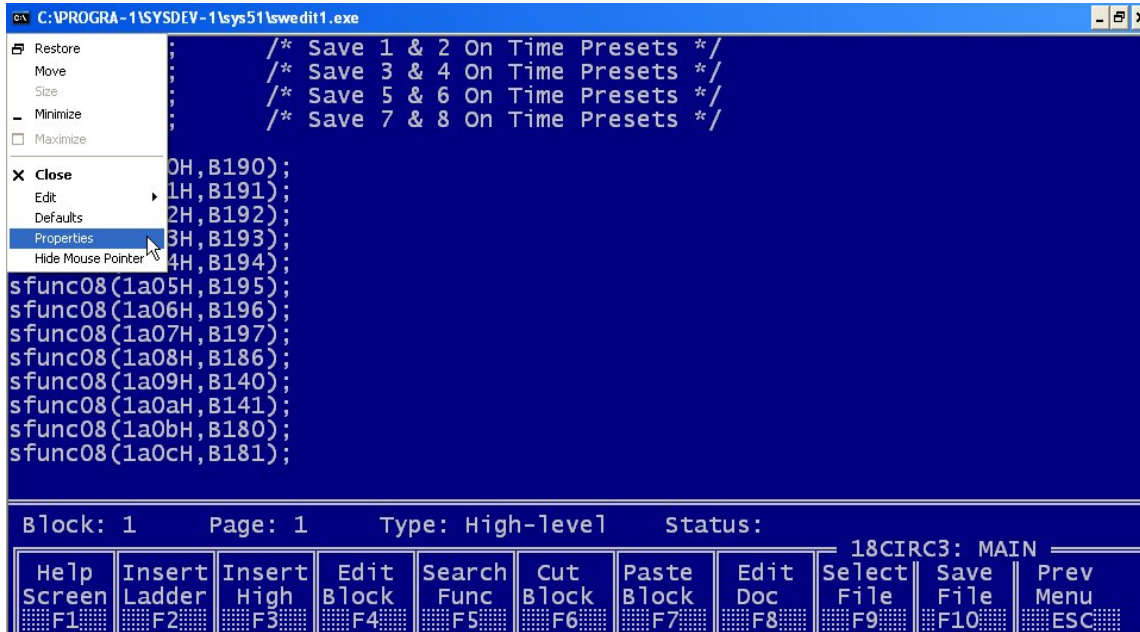
Figure 12 Selecting Properties
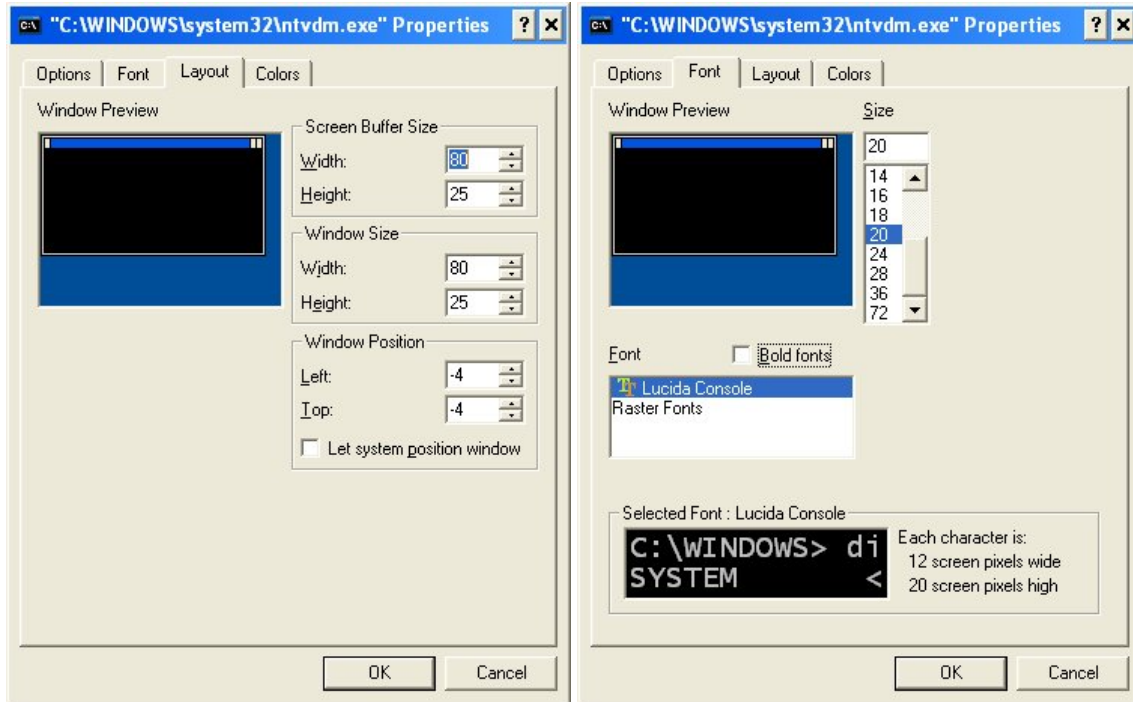
Figure 13 Window Properties Tabs
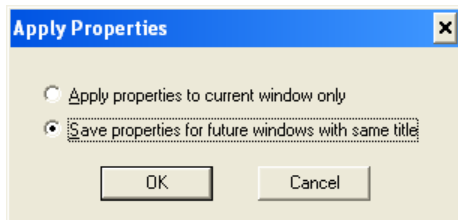
Figure 14 Save properties for future use

Setting up the Serial Port

SYSdev 2000 allows easy configuration of the connection between the PC and the PLC. Choose Edit→Comm. Port and the following window will pop up.
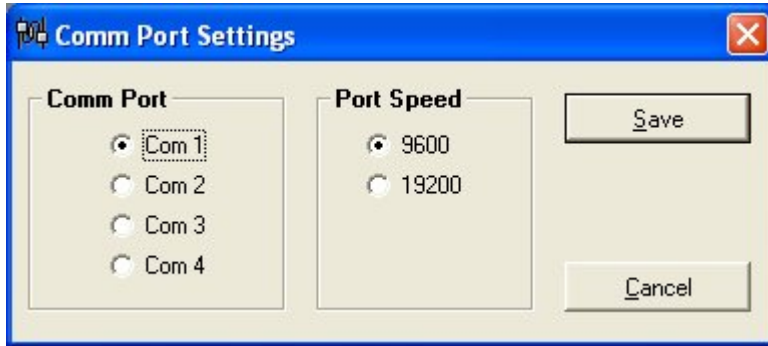
Simply choose the Serial Port to use and the baud rate. All current Systems PLCs only support 9600 baud. The 19200 baud setting was included for possible future offerings.

Windows™ does not allow for two programs to have control of one serial port at the same time. It will be necessary to close any other programs that use the serial port to be used with SYSdev. Keep in mind that some programs (notably RSLogix™) take control of a serial COM port when they are opened, and don't necessarily relinquish this control when they are closed.

This also applies to SYSdev 2000 itself. You will not be able to use multiple windows connected to the PLC at the same time. Target Board Interface, On-Line Monitoring, Status Tables, Trending windows all require control of the serial port to function, so they will only function one at a time.

Serial Port Alternatives

Many newer notebook computers do not ship with a standard serial port, so a USB to serial adapter may be required. Not all adapters work the same way, and some have shown to not work well with the limitation to Com1 through Com4 inherent in SYSdev.

Systems Electronics Group recommends Black Box IC199A-R3, and Computrol carries these units for sale. Contact sales@computrol1.net for a quote.

Computrol has also had success using Keyspan model USA-19QW, and there are probably many others that would work just as well. An alternative is a PCMCIA serial adapter. Again, it must be able to use Com1 through Com4. Computrol has used the Socket (http://www.socketserial.com/) Serial I/O (ruggedized version) with success.

Serial Cable

Please see attached specification for the serial cable referenced in all communication procedures. Note that Computrol builds these cables with the 4-6 and 7-8 jumpers installed on both ends of the cable. This removes the requirement to mark one end of the cable for the PLC and the other end for the PC.

Windows commands vs. DOS commands

On-line monitoring and the PLS editor still use legacy DOS calls to the serial port. These routines look in a different place for the COM port configuration. If the rest of the communication functions work properly, but On-line Monitoring or PLS editing does not, these files may need to be altered manually.

Under each support directory (/SYS51, /SYS96 and /PLS51) there is a file called "sysdev.sfg". This is a 1 byte file containing the COM port to use. The character in this file must be set to one less than the desired COM port (0=COM1, 1=COM2, 2=COM3, 3=COM4). All three copies should be altered to the same value. Altering one file, then copying and pasting into the other two locations works well.

Introduction to Systems PLCs

Systems Engineering PLCs are compiled PLCs. This means that programs are compiled into machine code for the processor before being downloaded to the processor. This provides the fastest possible execution time of control programs. This also means that on-line programming is not possible, because the PLC itself is not able to compile or interpret programs.

Introduction to SYSdev

SYSdev (Systems Development) allows the programmer a choice of 3 programming languages: Ladder logic, High Level (subset of C) and Assembly Language. The program is divided into Blocks of code to allow mixing of program languages easily. The compiler compiles all logic into Assembly Language, then assembles it into Hex code. This Hex file is downloaded to and used by each PLC. The choice of 3 languages means that decompiling the Hex code back into the original source code is impossible. SYSdev2000 makes it possible to upload the program, but only the machine code and revision and checksum information is uploaded. There is no way to recover the source code from the PLC.
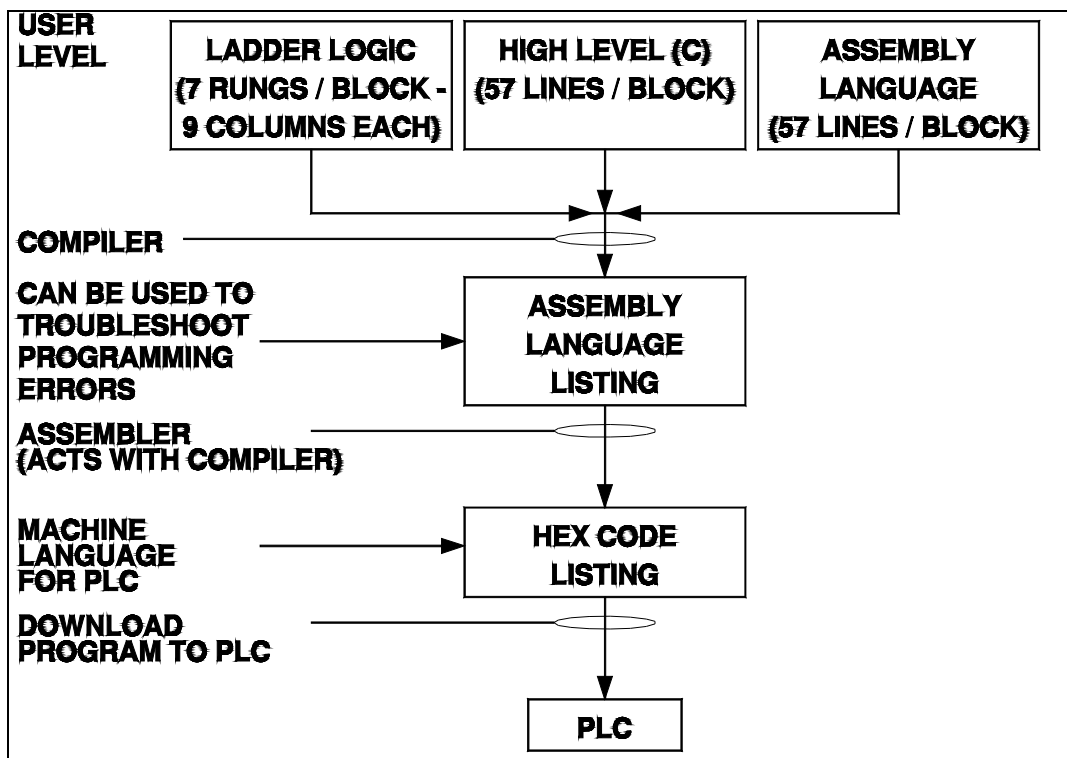
Figure 15 SYSdev Programming Languages

Program File Structure

SYSdev uses several program files to comprise each control program. They include: the Initialization file (executed once upon power-up), the Main Program file (cycled continuously), the Timed Interrupt file (executed once every 0.5ms or 1.0ms), and User Function files (subroutines called explicitly).

Note: There are other files associated with each program, but they do not contain program code (documentation, configuration, etc.).
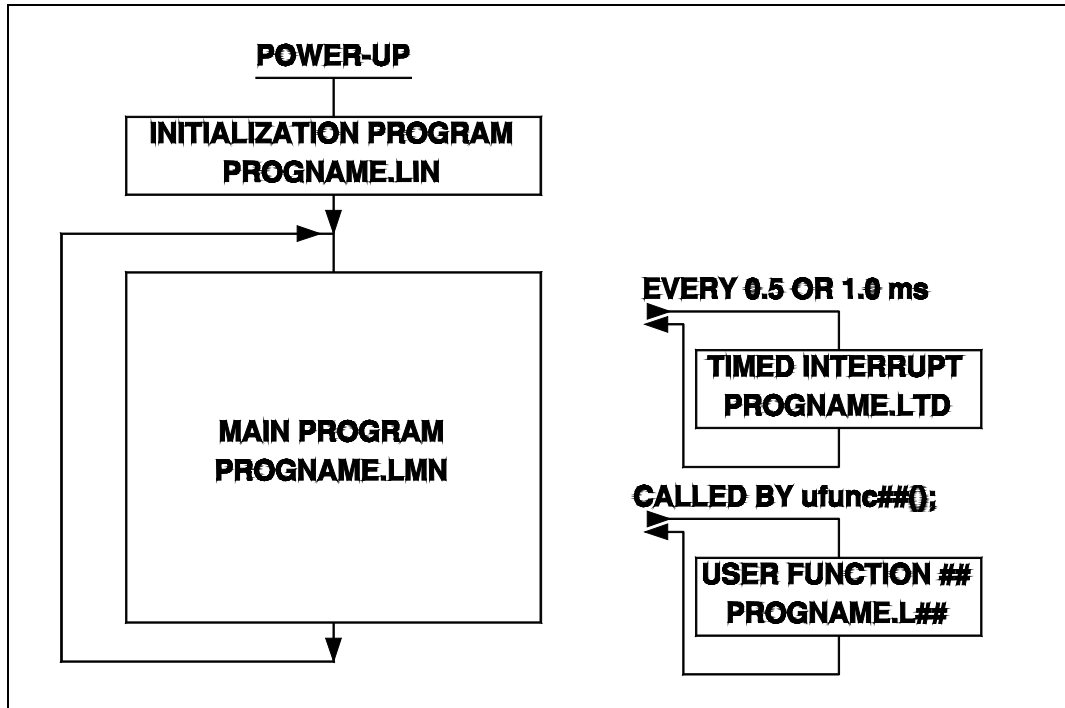
Figure 16 SYSdev File Structure

SYSdev Variables

The variables to be used in SYSdev programming are actually register addresses. Each register address can be given off-line documentation (3 lines, 7 characters each) and a "nickname" which serves as on-line documentation for Ladder Logic blocks. This documentation is not interchangeable with the address for program development purposes. All programming must use the variable address. Note that I/O addresses are the only addresses with an assigned function. Every specific address is free to use however the programmer desires. All variables are stored as unsigned integers.

PLC Variable Formats

F = Flag = 1 Bit = (0 or 1)
B = Byte = 8 Bits = (0 – 255)
W = Word = 16 Bits = 2 Bytes (Even, Odd = Low, High) = (0 – 65535)
X = Input Xaab.c
Y = Output Yaab.c
where aa = slot number, b = group number, c = output point
Notes:
1.   X and Y addressing is not used for the M4500 PLC/PLS. In the M4500, I/O is directly addressed.
2.   Leading zeroes in the variable name are optional. For example, B32 is the same address as B032.

Variable Overlap Map

Because it is possible to refer to registers using different size variables (1 bit, 8 bits, or 16 bits), there is overlap between variable names. For example, W32 refers to B32 (low byte) and B33 (high byte) and also F0 (bit 0) – F15 (bit 15). SYSdev does not support addressing a bit of a word (e.g. W100.4), to access a bit that is in Upper Memory (not in Flag memory), the program must use the byte.bit format (e.g. B100.4). A partial memory layout is shown below. For a complete memory map, please refer to the User / Program Development Manual for the PLC in question.

Table 1 Flag Memory Example

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Byte	Word
F007	F006	F005	F004	F003	F002	F001	F000	**B032**	**W032 (L)**
F015	F014	F013	F012	F011	F010	F009	F008	**B033**	**W032 (H)**
F023	F022	F021	F020	F019	F018	F017	F016	**B034**	**W034 (L)**
F031	F030	F029	F028	F027	F026	F025	F024	**B035**	**W036 (H)**

Table 2 Upper Memory Example

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Byte	Word
B66.7	B66.6	B66.5	B66.4	B66.3	B66.2	B66.1	B66.0	**B066**	**W066 (L)**
B67.7	B67.6	B67.5	B67.4	B67.3	B67.2	B67.1	B67.0	**B067**	**W066 (H)**
B68.7	B68.6	B68.5	B68.4	B68.3	B68.2	B68.1	B68.0	**B068**	**W068 (L)**
B69.7	B69.6	B69.5	B69.4	B69.3	B69.2	B69.1	B69.0	**B069**	**W068 (H)**

Reading the Program (Off-line Programming)

All programming using SYSdev is done off-line. There are 3 available languages: High Level, Ladder Logic, and Assembly Language. This manual explains some of the commonly used commands. For more detail, please reference the SYSdev Program Development Manual included with the control system.

To view (and / or edit) a program off-line, highlight the program in the program selection tool, then either double-click on it or press <Enter>

Menu Highlights

<F1> Help
<F2> Insert Ladder - inserts Ladder Block after the current Block.
<F3> Insert High – inserts High Level Block after current Block.
<F4> Enters Edit Mode for the current Block.
<F5> Enters Search Mode. See Section Below.
<F6> Cuts current Block to DOS buffer. Can be pasted multiple times.
<F7> Pastes Block in DOS Buffer after the current Block.
<F8> Edits the Offline Block documentation (up to 57 lines).
<F9> Select File – brings up file Menu to allow editing of files other than the Main Program.
<F10> Save File – saves the current file.
<F12> (Hidden) Adds Assembly Language Block after the current Block.
<Esc> Previous Menu – works the same as <F9>.

Note: To close the program, press <Esc> from the file selection screen.

Search Mode

A few notes about the search function
- The search mode allows you to search by Block Number or Variable. The variable must be referred to by its address. There is no way to search for a variable using its documentation.
- The search function cannot find calls to System Functions or User Functions, or strings in general.
- The off-line search function is not global. This means that searching for a variable will only detect usage inside the current file. For example, if you are searching the Main Program, and the variable is only used inside the Timed Interrupt File, the search will show the variable as not used. For global search, use the search function from the shell.
- Repeatedly pressing <F2><Enter> will cycle through the uses of the variable inside the current file. This cycling will not stop when all of the uses are found – it will start over from the beginning. The exception to this rule is if the variable is only used inside a single Block.
- Press <Esc> to exit search mode.

On-line Monitoring

As mentioned earlier, the compiled nature of Systems PLCs makes on-line programming impossible. On-line monitoring is available so a user with a personal computer (PC) can connect to the PLC and monitor the status of the machine. Quick highlights of the most commonly used features are detailed here. For more information, please refer to the SYSdev Program Development Manual.

Getting On-line (Monitoring)

1. Connect a serial cable between a serial port of your computer and the Prog (program) Port of the PLC.
2. Run SYSdev2000.
3. Highlight the desired program in the directory list.
4. Click on the "Monitor" button in the toolbar.

Note that SYSdev 2000 allows the launching of multiple windows from the shell. Only the first monitoring window will have access to the serial port.
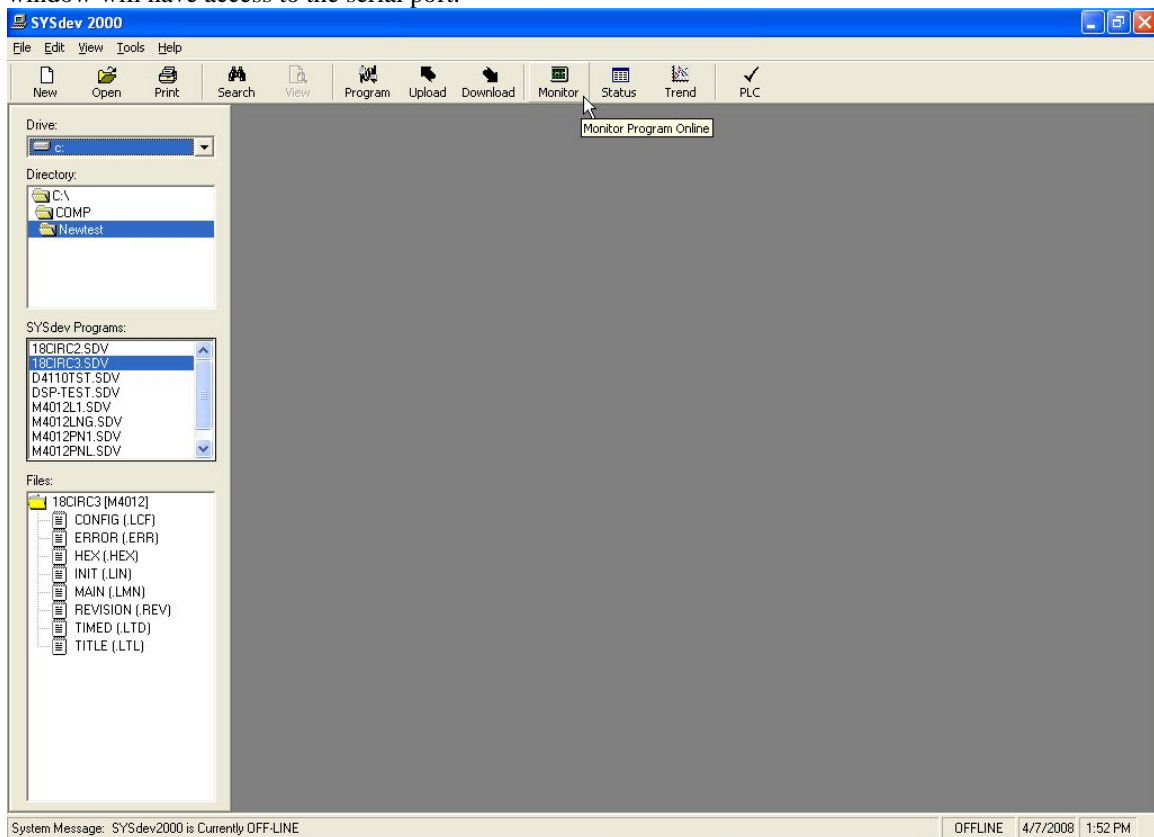
Figure 17 On-line Monitoring Button on the Toolbar

Using SYSdev2000

On-Line Monitoring Window Menu Highlights

\<F1\> Decimal/ Hex - switches the display format of the variables in the data table (see below).
\<F2\> Change Value – allows the user to change the current value of a register (see below).
\<F3\> Status Table – switches to a full screen data table (no logic visible).
\<F4\> Help
\<F5\> Enters Search Mode. See Section Below.
\<F6\> Select File – brings up file Menu to allow display of files other than the Main Program.

Search Mode

A few notes about the search function

- The search mode allows you to search by Block Number or Variable. The variable must be referred to by its address. There is no way to search for a variable using its documentation.
- The search function is not global. This means that searching for a variable will only detect usage inside the current file. For example, if you are searching the Main Program, and the variable is only used inside the Timed Interrupt File, the search will show the variable as not used. To execute a global search, choose this option from the Main Development Menu.
- Repeatedly pressing \<F2\>\<Enter\> will cycle through the uses of the variable inside the current file. This cycling will not stop when all of the uses are found – it will start over from the beginning. The exception to this rule is if the variable is only used inside a single Block.
- While in search mode, the current values of variables are not updated to the PC. This does not mean that the PLC values are not changing. It means the monitoring software is not showing the latest status.
- Press \<Esc\> to exit search mode.

Using the Data Table

1. Once On-line, the screen will look similar to this:

```
B102 = B191;                     /* Set input image for keypad input */

if <B102 == 0>                   /* No function switches */
    F40 = 0, F47 = 0, F44 = 0;     /* Clear Reset, Adjust */
else if <B102 == 1>              /* Time switch depressed */
    F41 = 1, F42 = 0, F45 = 0;     /* Set Time and reset Lift, Speeds */
else if <B102 == 2>              /* Lift switch depressed */
    F41 = 0, F42 = 1, F45 = 0;     /* Set Lift and reset Time, Speeds */

else if <B102 == 3>              /* Guns Auto switch depressed */
    F32 = 1, F33 = 0;              /* Set Auto flag and reset Bleed flag */
else if <B102 == 4>              /* Guns Man switch depressed */
    F32 = 0, F33 = 0;              /* Reset Auto & Bleed flags for Manual */
else if <B102 == 5>              /* Guns Bleed switch depressed */
    F32 = 0, F33 = 1;              /* Set Bleed flag and reset Auto flag */

else if <B102 == 6>              /* Speeds switch depressed */
    F41 = 0, F42 = 0, F45 = 1;     /* Set Speeds and reset Time, Lift */


  Block: 1       Page: 1      Type: High-level     Status: comm stat
                                                          FILE: MAIN PROG
 1▶───────=─────   4:───────=─────   F1-Decimal/Hex   F4-Help Screen  ║ Prev
 2:───────=─────   5:───────=─────   F2-Change Value  F5-Search Func  ║ Menu
 3:───────=─────   6:───────=─────   F3-Status Table  F6-Select File  ║░ESC░
```

2. The bottom left part of the screen has 6 placeholders for monitoring variable values:

```
                                                          FILE: MAIN PROG
 1▶───────=─────   4:───────=─────   F1-Decimal/Hex   F4-Help Screen  ║ Prev
 2:───────=─────   5:───────=─────   F2-Change Value  F5-Search Func  ║ Menu
 3:───────=─────   6:───────=─────   F3-Status Table  F6-Select File  ║░ESC░
```

3. To find the current value of a specific variable, simply type the variable name. For example, typing *B1174<Enter>* would change the display to this:

```
                                                          FILE: MAIN PROG
 1:B1174  =150    4:───────=─────   F1-Decimal/Hex   F4-Help Screen  ║ Prev
 2▶───────=─────   5:───────=─────   F2-Change Value  F5-Search Func  ║ Menu
 3:───────=─────   6:───────=─────   F3-Status Table  F6-Select File  ║░ESC░
```

where the value of B1174 is 150 in this case.

4. To change the value stored in an address, choose *<F2>* Change value. A new prompt will appear changing the bottom of the screen to:

```
                                                          FILE: MAIN PROG
 1:B1174  =150    4:───────=─────   Enter "Addr=Value":            ║ Prev
 2:───────=─────   5:───────=─────                                 ║ Menu
 3:───────=─────   6:───────=─────                                 ║░ESC░
```

5. As the prompt suggests, simply enter the address, "=", and the value to change to. For example:

```
                                                          FILE: MAIN PROG
 1:B1174  =150    4:───────=─────   Enter "Addr=Value": B1174=100  ║ Prev
 2:───────=─────   5:───────=─────                                 ║ Menu
 3:───────=─────   6:───────=─────                                 ║░ESC░
```

6. Pressing *<Enter>* will change the value stored in the specified address:

```
                                                          FILE: MAIN PROG
 1:B1174  =100    4:───────=─────   F1-Decimal/Hex   F4-Help Screen  ║ Prev
 2▶───────=─────   5:───────=─────   F2-Change Value  F5-Search Func  ║ Menu
 3:───────=─────   6:───────=─────   F3-Status Table  F6-Select File  ║░ESC░
```

Notes:

- SYSdev does not support Forces. The user can change the value of any register, but the PLC will overwrite all addresses according to program logic.
- Any valid variable (address) can be monitored in this fashion, and the variables can be viewed in any order.
- Use the arrow keys to move the pointer to a different location as desired.
- To monitor a different variable in the same slot, simply position the pointer and type the new variable address.
- <F3> will change the whole screen to a data table to monitor more values at once without viewing the logic.
- While in the process of changing a value, the displayed data is not updated by the monitoring software. The program is still running in the PLC, however, so values may be changing inside the PLC.

On-line Monitoring Ladder Logic

When on-line monitoring a Ladder Logic Block, the contacts that enable power to pass to the right are highlighted with reverse video. The data table is still present. Note that contact highlighting, similar to data table values, will not change to reflect current values while in Search mode or while changing a value manually.
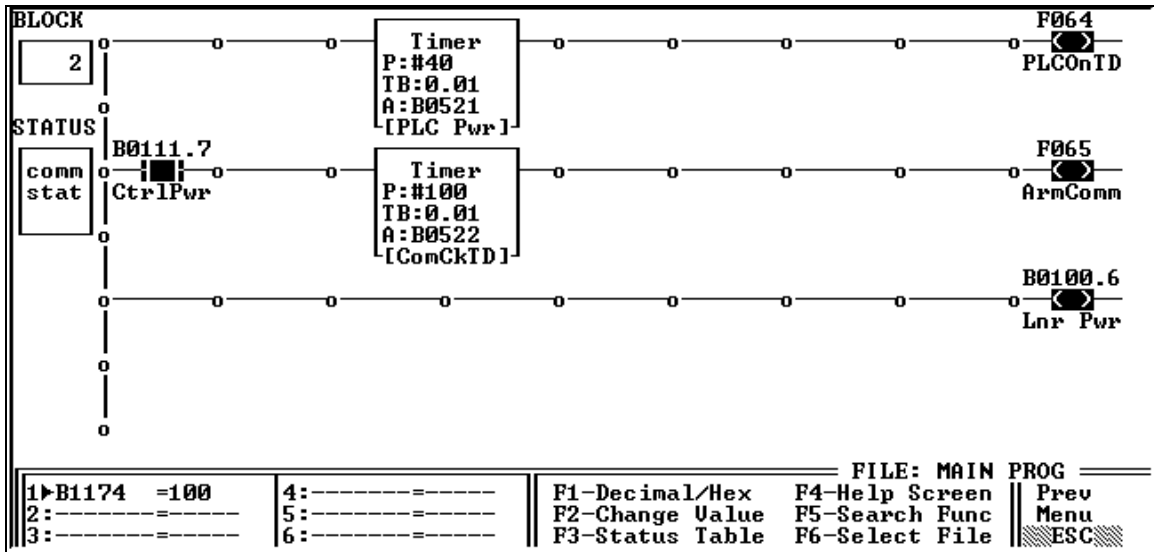
Figure 18 A Ladder Block viewed in On-line Monitoring

Printing the Program

You can print the program by choosing File→Print Program or by choosing the Print Button on the toolbar. It should be noted that the print button on the toolbar is context sensitive. If search results or compiler errors are in the main display window, it will print this information through the standard Windows™ printer interface. If neither search results nor the compiler errors are active, the button will bring up the DOS-driven print menu. The menu option will always bring up the DOS-driven menu.
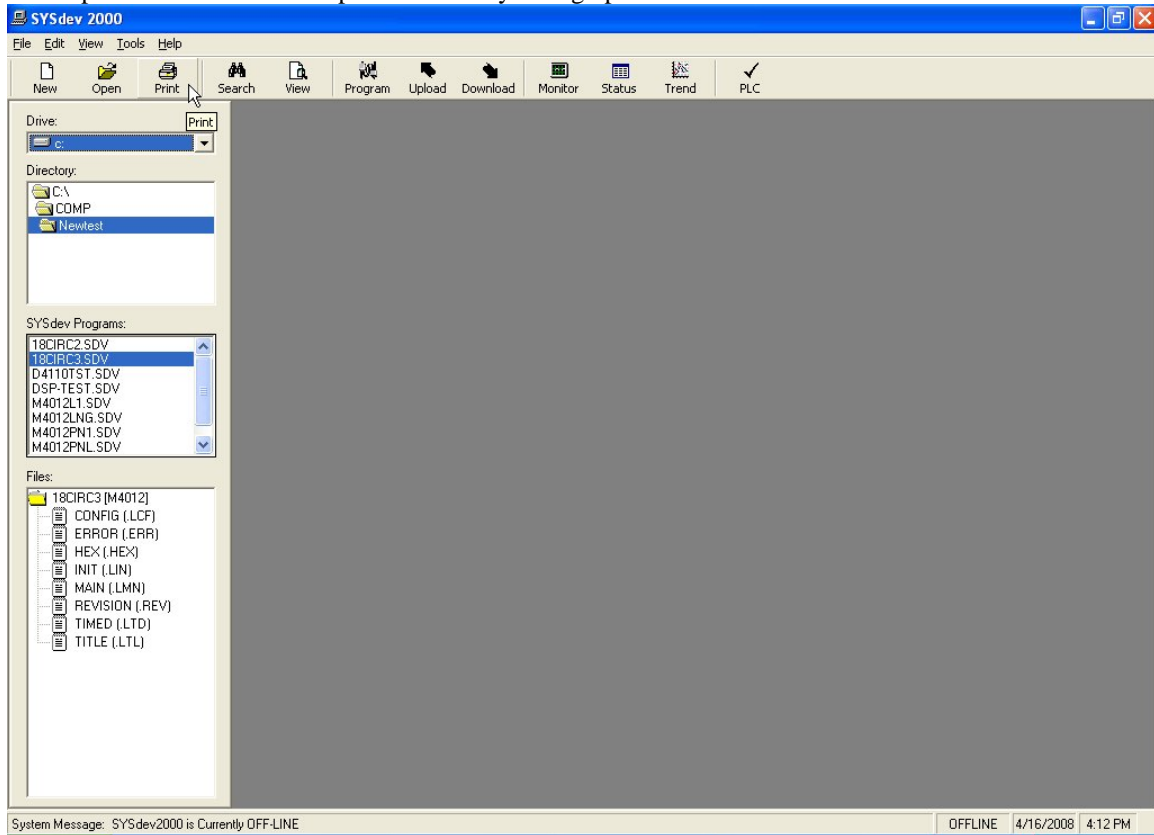
Figure 19 Print Button on Toolbar

```
      Systems S3000 Program Development - SYSdev96 Version 4.3
                     Program Name: C:\LINERS\18VSPNL1


                       Printer Selections Menu


                   1:   Standard printer
                   2:   Okidata 92/93
                   3:   Okidata 192/193/321
                   4:   Epson FX86/FX286/EX800/EX1000
                   5:   IBM Proprinter II/XL
                   6:   HP LaserJet



                   Enter selection:
```
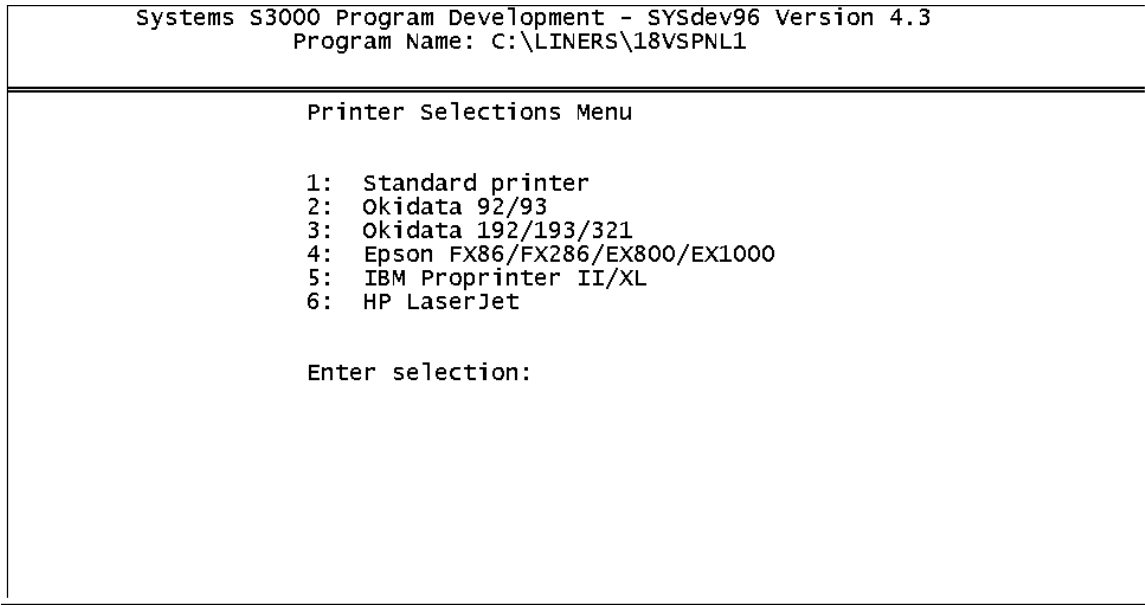
Figure 20 Printer Selection Screen

The purpose of this screen is to allow for special print commands. Most modern printers use the commands for option 6. HP Laserjet. If this causes problems, use 1. Standard Printer.

Using SYSdev2000

```
Systems S3000 Program Development - SYSdev96 Version 4.3
             Program Name: C:\LINERS\18VSPNL1


                    Program Print-outs Menu


         1:   Print complete program
         2:   Print Initialization file
         3:   Print Main Program file
         4:   Print Timed Interrupt file
         5:   Print Co-Cpu Com Interrupt file
         6:   Print User Function file
         7:   Print Cross Reference
         8:   Print Variables Overlap map
         9:   Print Memory map
        10:   Print System Configuration
        11:   Enter Program Title

        12:   Return to Main Development menu


             Enter selection:
```

Figure 21 Program Printouts Menu

Program Printout Menu Notes

As with most DOS programs, this print menu will print to LPT1. It will not bring up a printer selection window. You will need to make sure that the printer you intend to use is mapped to LPT1.

* All printouts of program files include top of Block documentation and full variable documentation. The user is given the option to print a cross-reference for every Block, which includes every address used inside that Block.
1. Prints all of the control logic from all files used.
2. Prints the selected Blocks of the Initialization File only.
3. Prints the selected Blocks of the Main Program File only.
4. Prints the selected Blocks of the Timed Interrupt File only.
5. Prints the selected Blocks of the Co-CPU File only. Note: the Liner control programs do not include any Co-CPU files. These files are used for an older model PLC.
6. Prints the selected Blocks of a selected User Function File only.
7. Prints the Cross Reference, which lists every used address along with the File, Block and line of every occurrence of that address in the program.
8. Prints a cross reference listing showing where addresses overlap with each other due to differing references to the address (I.e. Bytes that hold the Flag memory, and Bytes included in each Word), and a listing of variables that are used in multiple places. This is a tool to prevent using an address for two different purposes.
9. Prints a memory map showing which addresses have been used in the program.
10. Prints the System Configuration File.
11. Allows the user to enter a title for the program, which shows up on the printouts.
12. Exits the Print Menu (closes window).

Target Board Interface

The Target Board Interface is used to check fault codes for the connected PLC (and reset them), and check which program is currently running inside the PLC. There are also tabs for viewing and changing serial network addresses of the connected PLC as well as setting the real-time clock on a few of the processors. Liner programs do not use the real time clock, and the network addresses for all PLCs are set automatically in the latest versions of all liner programs.
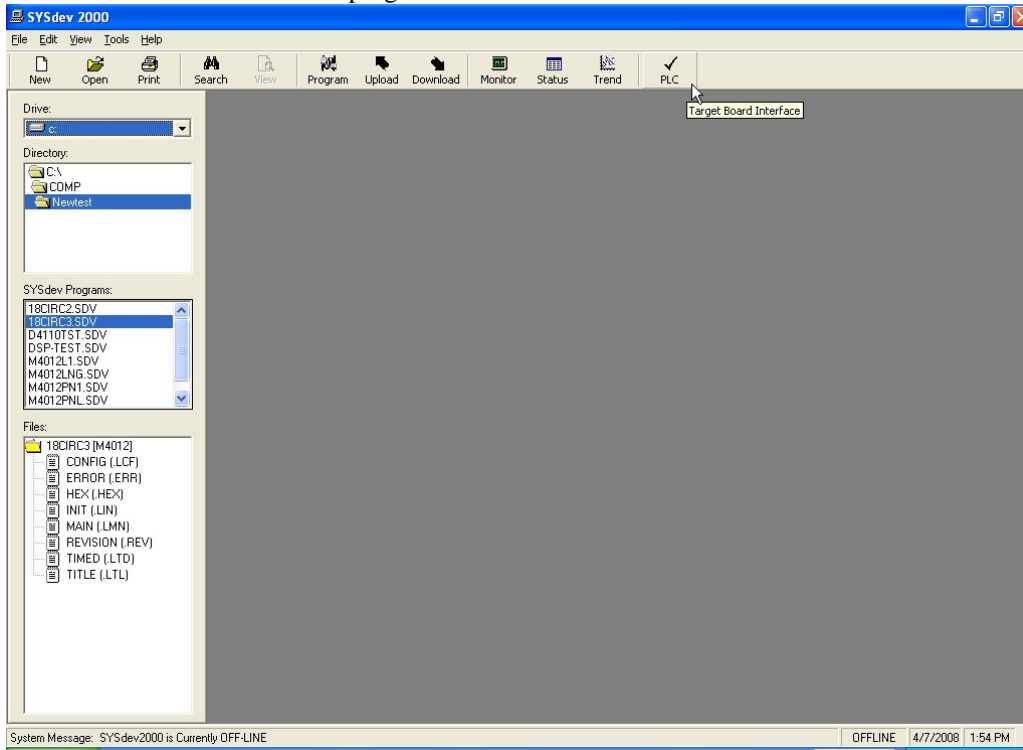

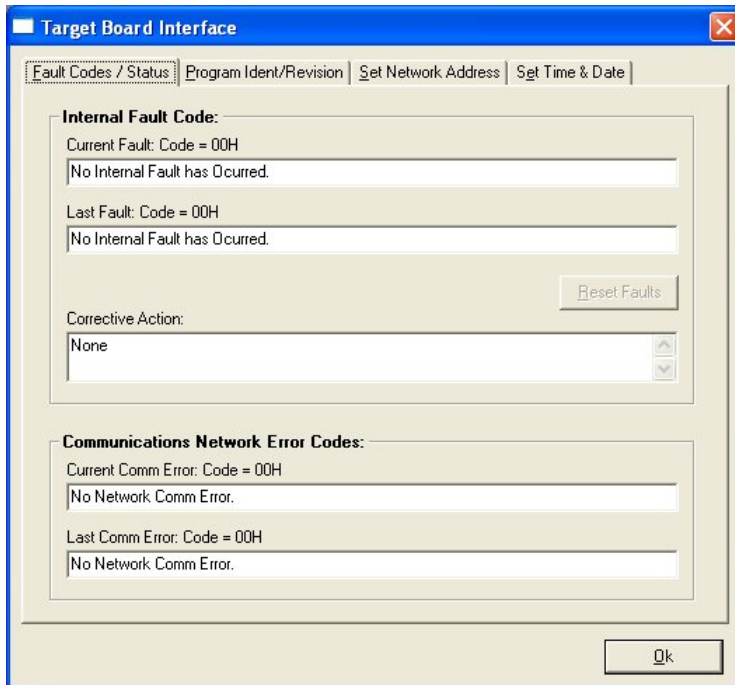**Figure 22 Target Board Interface (Check PLC) Toolbar Button**

Figure 23 Fault Codes / Status Tab of Target Board Interface Window

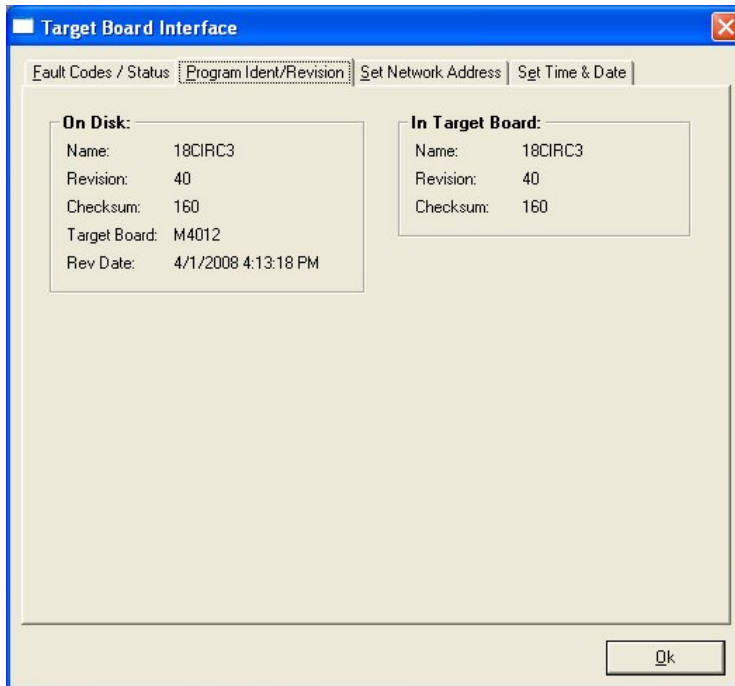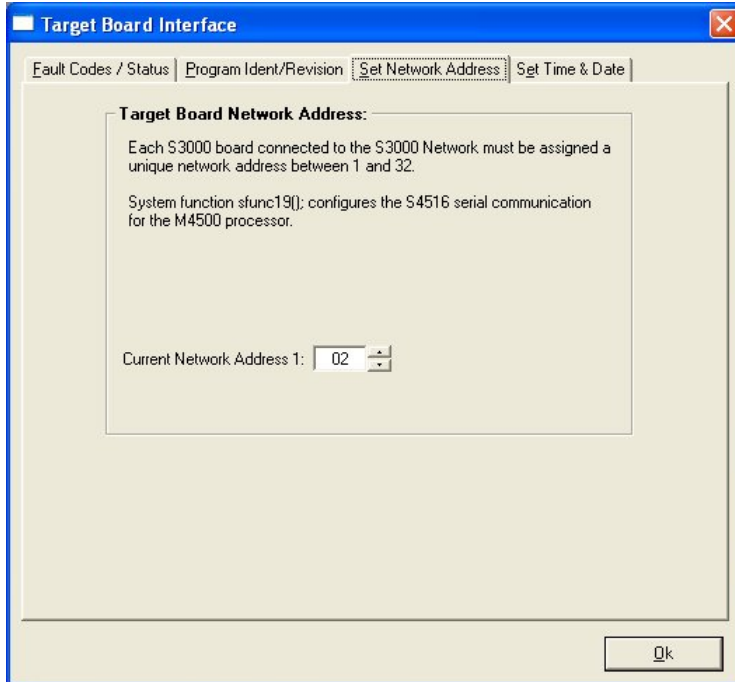**Figure 24 Program Ident/Revision Tab of Target Board Interface Window**

Figure 25 Set Network Address Tab of Target Board Interface Window

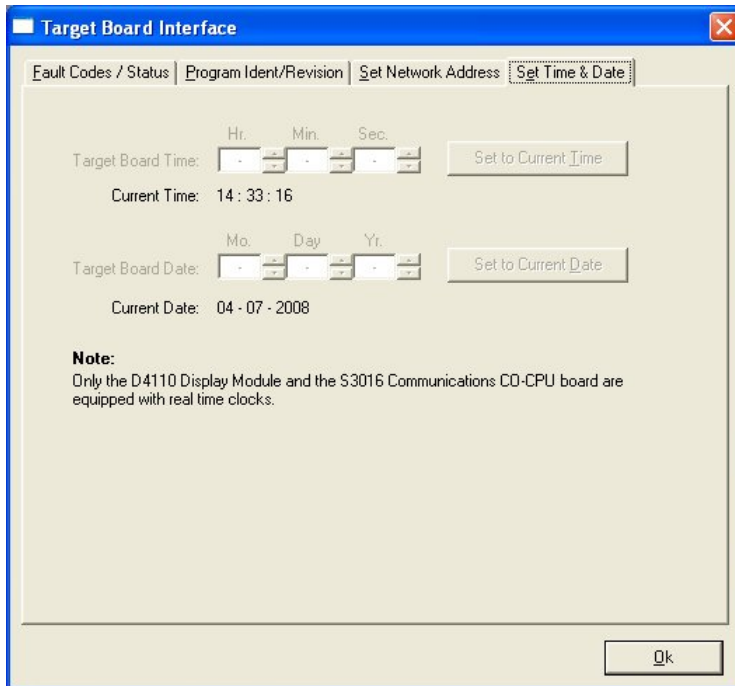**Figure 26 Set Time & Date Tab of Target Board Interface Menu**

Procedures

The common tasks involved for working with a detailed in step-by-step procedures in this section. These procedures often involve connecting the serial cable to the Program Port of the PLC.

Checking the Revision and Checksum of a program

It is always good practice to check the Revision and Checksum of the program inside the PLC before downloading a new program. Make sure the current program is available in case there is an error in the new program. **Please have Revision and Checksum information available before calling Computrol for technical support.**

1. To check the Revision and Checksum of the program being used by the PLC, you must connect a serial cable between a serial port of your computer and the Prog (program) Port of the PLC. Note that the Program Port for the Liner Tank PLC is extended to a connector on the outside of the upper turret electrical tank. To simply check the program on your computer, this is not necessary.
2. Run SYSdev 2000.
3. Highlight the program you want to compare in the program selection tool.
4. Click on the Check PLC Target Board Interface button on the toolbar.
5. Alternatively, you can choose View→Target Board Interface from the Menu. You will need to choose the file to compare from a pop-up menu.
6. The Target Board Interface Window will pop up with the Fault Codes / Status tab selected.
7. Click on the Program Ident / Revision tab.
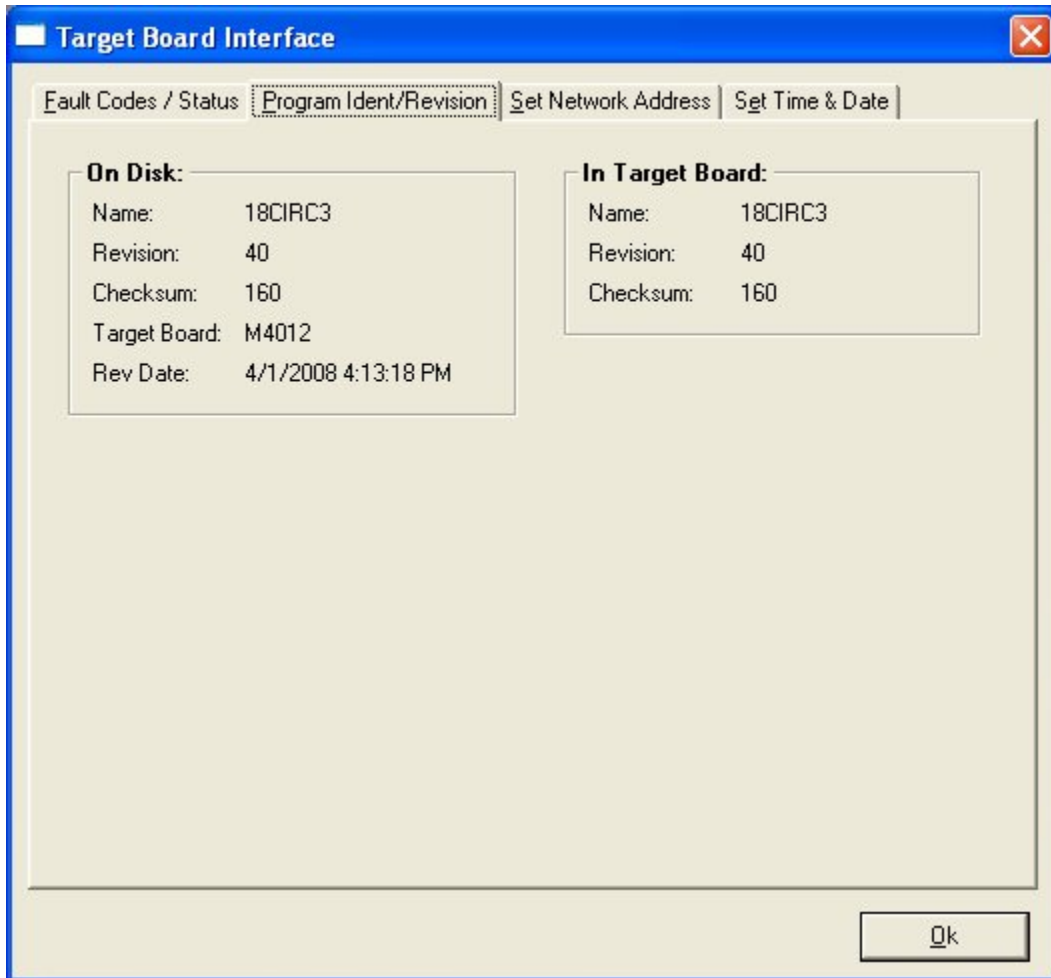
If the PC cannot communicate with the PLC due to PLC fault, PLC not powered, or serial cable or PC Comm. Port problems, there will be a pop-up window:

WARNING - Communication Error!

Cannot Communicate with Target Board. Verify RS-232 Cable is Connected Between COMM Port and PROG Port.

Retry   Cancel

8. If you click cancel, SYSdev 2000 will report the information for the program on the PC, with dashes in place of target board information:

Target Board Interface

Fault Codes / Status | Program Ident/Revision | Set Network Address | Set Time & Date

On Disk:

Name: 18CIRC3
Revision: 40
Checksum: 160
Target Board: M4012
Rev Date: 4/1/2008 4:13:18 PM

In Target Board:

Name: -
Revision: -
Checksum: -

Go Online   Ok
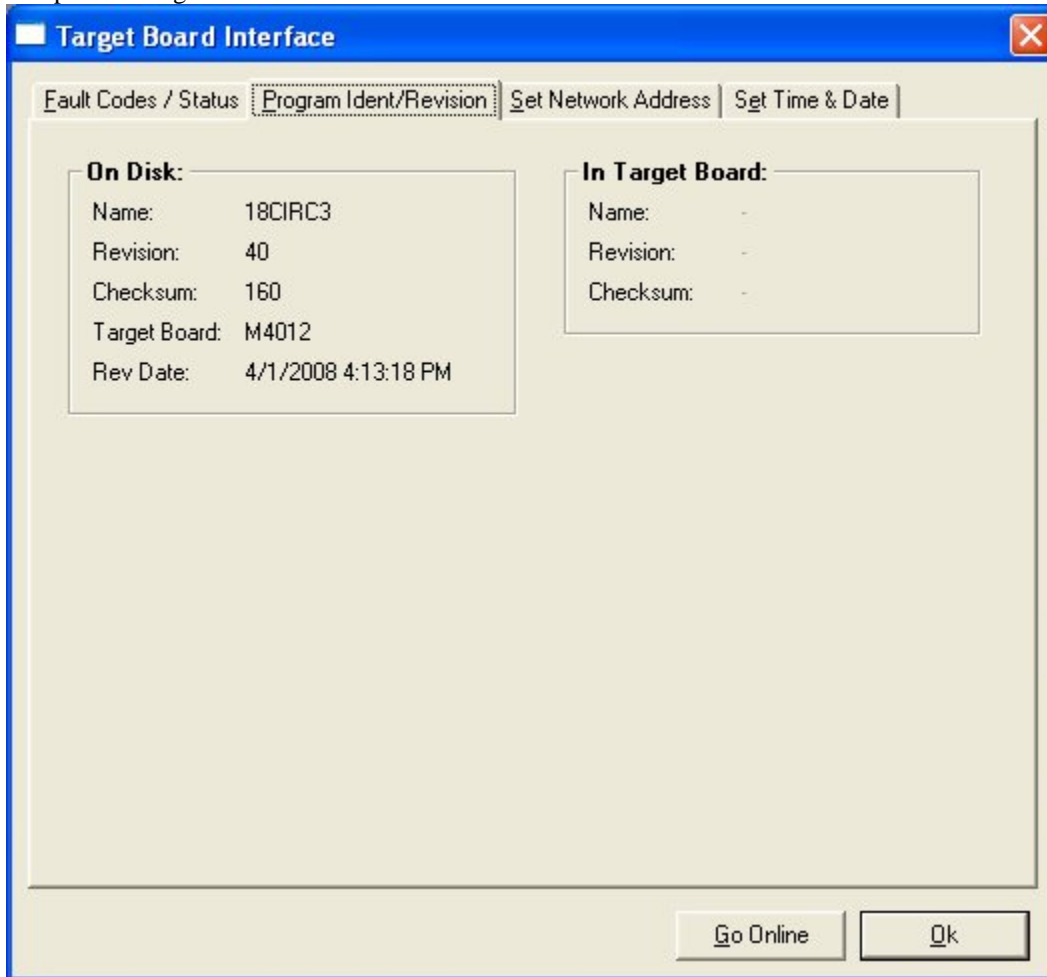
Downloading a program

1. Connect a serial cable between a serial port of your computer and the Prog (program) Port of the PLC. Note that the Program Port for the Liner Tank PLC is extended to a connector on the outside of the upper turret electrical tank.
2. Run SYSdev 2000.
3. Highlight the desired program in the program selection tool.
4. Click on the "Program" button on the toolbar.
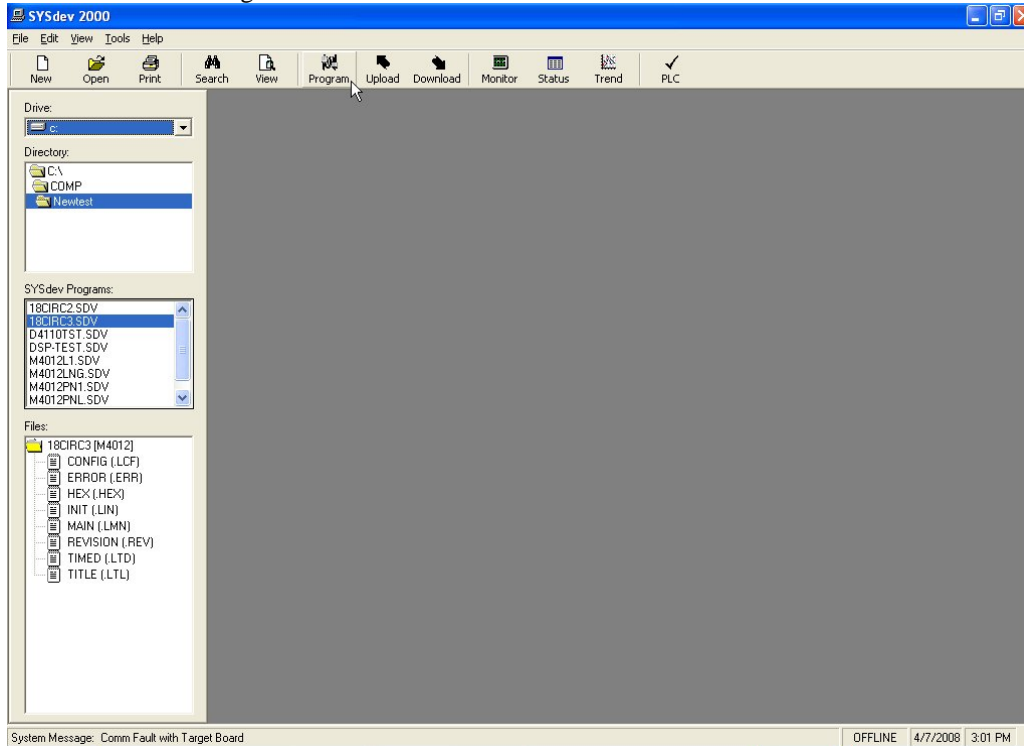
A pop-up window shows the current program selected as well as the target board for which the program is written. Verify that the correct program was chosen initially and that you are connected to the PLC model for which the program was intended and click "Yes" or press <Enter>.
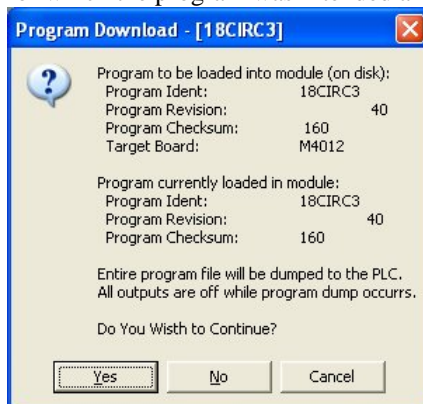
1. Another pop-up window animates the download progress by scrolling the current address of program memory being programmed.
2. When the download is complete (the pop-up window will change to "Program dump completed successfully!" Click "OK" or press *<Enter>*.

Uploading a Program

As mentioned previously in this manual, uploading a program includes only the machine code and the revision and checksum information. There is nothing for the program editor to show. Uploading the program can be valuable if you want to download the program from one PLC into another, but do not know where the original program is stored. Note that the PLC continues to execute the program while an upload is in progress: the upload is executed as a background task by the PLC, similar to on-line monitoring. For this reason, uploading a program takes considerably longer than downloading a program (which halts program execution and devotes the entire PLC processor to handling the incoming information).

1. Connect a serial cable between a serial port of your computer and the Prog (program) Port of the PLC. Note that the Program Port for the Liner Tank PLC is extended to a connector on the outside of the upper turret electrical tank.
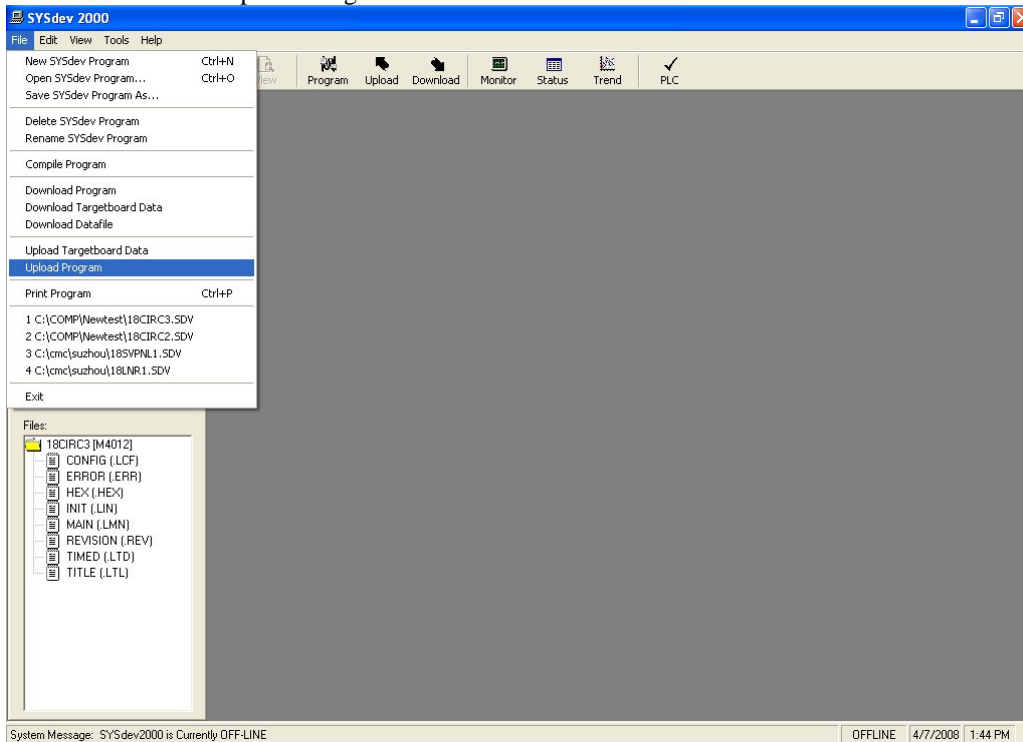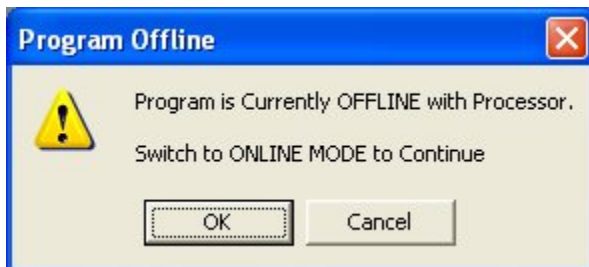2. Choose File → Upload Program.

Figure 27 Upload Program Menu Option

If you are not already in on-line mode, a pop-up window will ask to switch to on-line mode.

After SYSdev 2000 is in on-line mode, a pop-up window for creating a new program appears.
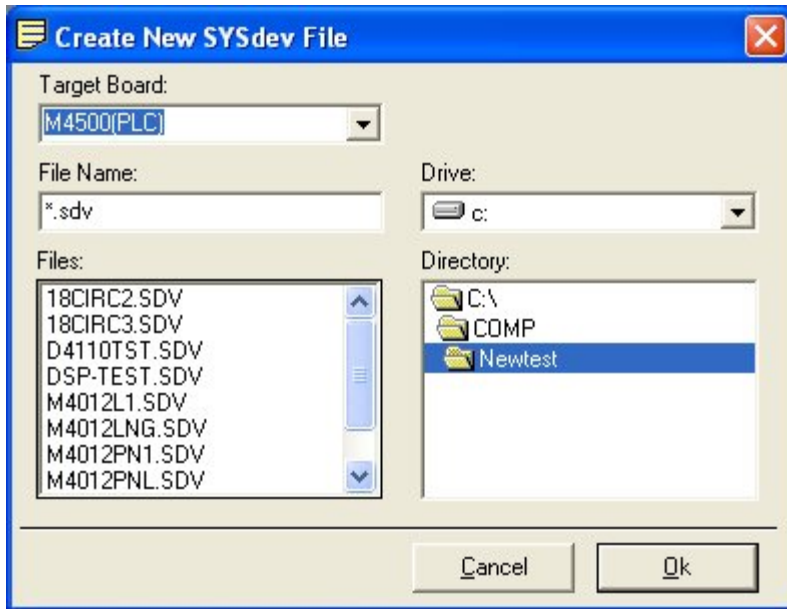
Figure 28 Create New File for Upload Window

Be sure to choose the correct Target Board for the program. Choose a name for the uploaded file and click Ok. **Caution: using an existing program name will erase the existing program before uploading the files. Choose an unused name for the uploaded program.**

The program will begin uploading. A new window scrolls the program memory address that is being read as a progress mechanism. Remember, this is a slow process because the program is still running in the PLC.
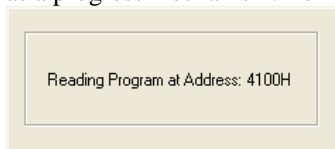
Figure 29 Reading Program Progress Window

When the program upload is complete, the window changes.

Click OK to clear this window.

The program is now on the PC. Note that only the .hex (machine code file) and .rev (revision and checksum information) are shown in the "Files" listing. This program can be downloaded like any other with no problem. If the program is opened for off-line programming, the prompt will say that the program does not exist, and ask if it should be created. This is because the editor is looking for a source code file to open, which does not exist.
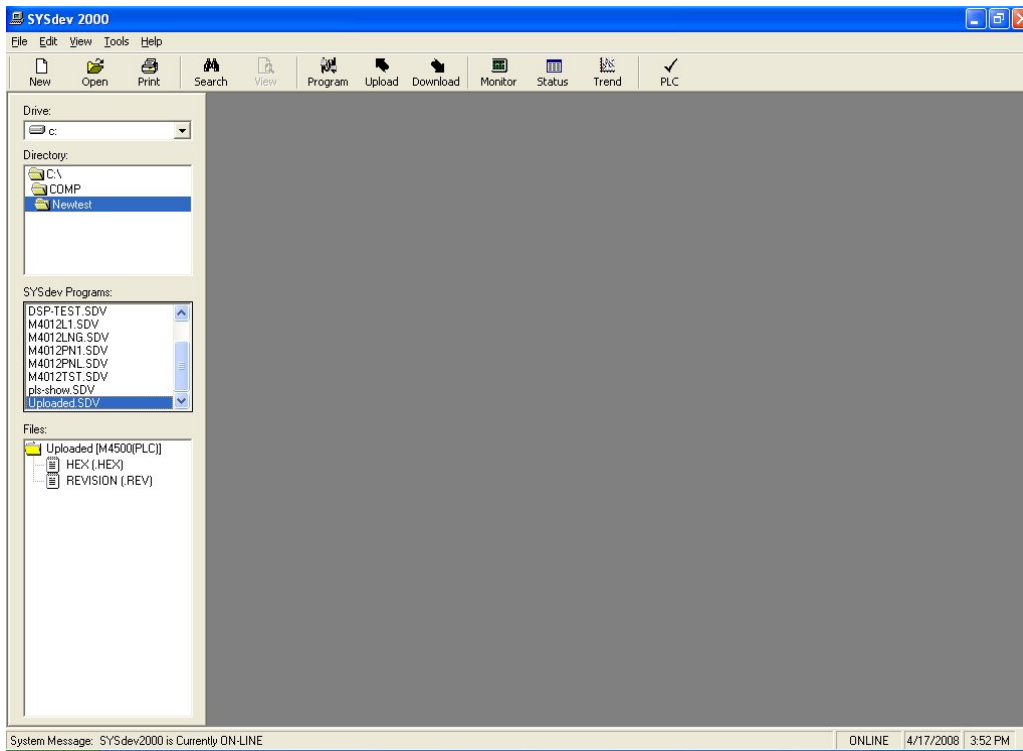
Figure 30 Uploaded Program Selected

Setting Up the PLS

The PLS is integrated into the panel PLC. Connecting to the Prog Port of the M4500 enables communication with both the M4500 PLC and the M4500 PLS. To work with the PLS program, highlight a program written for a PLS, then double-click on it or press <Enter>. A window with the PLS Main Development Menu will pop up.

Figure 31 PLS Main Development Menu

Using SYSdev2000

PLS Menu Notes

1. Online Channel Setpoint Programming - changes the values of the timing channels inside the PLS/PLC.
2. Offline Channel Setpoint Programming - changes the values of the timing channels on your personal computer.
3. Edit PLS Configuration - changes the number of channels and scale factor
4. Download Channels to PLS – transfers timing channels and offset information from PC to PLS/PLC.
5. Upload Channels from PLS – transfers timing channels and offset information from PLS/PLC to the PC.
6. Print Channels – brings up Print Menu for PLS
7. File Utilities – brings up Utilities Menu for PLS
12. Return to SYSdev Shell – exits PLS Window

```
┌──────────────────────────────────────────────────────────────────────┐
│ CHANNEL:00  │ DESCRIPTION: Lane 1 Open Knives │ PROG MODE: ONLINE │
│                      CHANNEL SET-POINTS                                │
│      ON   OFF        ON  OFF       ON  OFF       ON  OFF      ON   OFF  │
│  1: 0074-0084   11: ____-____  21: ____-____  31: ____-____  41: ____-____ │
│  2: ____-____   12: ____-____  22: ____-____  32: ____-____  42: ____-____ │
│  3: ____-____   13: ____-____  23: ____-____  33: ____-____  43: ____-____ │
│  4: ____-____   14: ____-____  24: ____-____  34: ____-____  44: ____-____ │
│  5: ____-____   15: ____-____  25: ____-____  35: ____-____  45: ____-____ │
│  6: ____-____   16: ____-____  26: ____-____  36: ____-____  46: ____-____ │
│  7: ____-____   17: ____-____  27: ____-____  37: ____-____  47: ____-____ │
│  8: ____-____   18: ____-____  28: ____-____  38: ____-____  48: ____-____ │
│  9: ____-____   19: ____-____  29: ____-____  39: ____-____  49: ____-____ │
│ 10: ____-____   20: ____-____  30: ____-____  40: ____-____  50: ____-____ │
│                                                                        │
│ SCALE FACTOR:360  │ MESSAGE:                                           │
│ OFFSET:313  │ PULSE TRAIN:NO   ON:---   OFF:---   START:----           │
│ Next │ Prev │Select│ Doc │Pulse │Fine │Clear │Clear │POS/ │ Set  │Prev │
│ Chan │ Chan │ Chan │Chan │Train │Tune │SetPnt│ Chan │ RPM │Offset│Menu │
│  F1  │  F2  │  F3  │ F4  │ F5   │ F6  │  F7  │  F8  │ F9  │ F10  │ ESC │
└──────────────────────────────────────────────────────────────────────┘
```

Checking And Setting The Offset (Zero) On The PLS

After any maintenance that involves the gear train or downstacker being taken apart, it is necessary to check the zero of the PLS.

1. Connect a serial cable between a serial port of your computer and the Prog (program) Port of the PLC
2. Run SYSdev 2000.
3. Use the Program Selection Tool to highlight the PLS program and press *<Enter>*.
4. From the Main Development Menu, choose 1: Online Channel Setpoint Programming: *1<Enter>*.
5. Once on-line, Press *<F9>* POS/RPM - A box will show up on the screen with position and rpm information.
6. Align the timing marks on the lower turret and the tabletop.
7. The position indicated on the screen should be 0. If so, the zero is properly set.
8. *<ESC>* to exit POS/RPM mode.
9. To set the zero, Press *<F10>* Set Offset. The Offset on the lower left of the screen will disappear and be replaced by the cursor.
10. Type *0<Enter>*.
11. To double-check, press *<F9>* POS/RPM. If the position indicated is 0, the zero is properly set. If the position is not 0, repeat steps 9 & 10.

Changing the PLS program

The PLS is programmed using channels. Each channel represents one timing signal. The timing signal to be programmed is documented next to the Channel number. The channel outputs are read by the PLC program directly from the PLS section of memory, so no I/O points are used. Please note **these channels are fairly standard for each machine and would not normally need to be changed**.

Using SYSdev2000

Program logistics

The PLS program can be changed on-line or off-line.
1. Connect a serial cable between a serial port of your computer and the Prog (program) Port of the PLC.
2. Run SYSdev 2000.
3. Use the Program Selection Tool to highlight the PLS program and press *<Enter>*.
4. A Window is launched showing the PLS Main Development Menu.

When editing off-line:
5. From the Main Development Menu, choose 5: Upload Channels from PLS: *5<Enter>*.
6. When channels have been uploaded, choose 2: Offline Channel Setpoint Programming: *2<Enter>*.
7. Change channels as detailed below.
8. When Changes are complete, choose 4: Download Channels to PLS *4<Enter>*.

When editing on-line:
5. From the Main Development Menu, choose 1: Online Channel Setpoint Programming: *1<Enter>*.
6. Change channels as detailed below.
7. When changes are complete, choose 5: Upload Channels from PLS: *5<Enter>*.

Changing PLS channels

Each channel can be programmed by individual setpoints or as a pulse train.

To program an individual setpoint:

1. Type resolver position to start pulse in the "on" column: *###<Enter>*. The cursor will move to the "off" column.
2. Type resolver position to stop pulse: *###<Enter>*.

The output for this channel will be "on" or "1" when the resolver position is between the two values entered.

To program a pulse train:

1. *<F8>* Clear channel (unless the channel is already empty).
2. *<F5>* Pulse Train.
3. Next to the "On:" prompt, enter the duration in degrees for the signal to be on. *##<Enter>*.
4. Next to the "Off:" prompt, enter the amount of degrees between pulses. *##<Enter>*.
5. Next to the "Start:" prompt, enter the start position of any pulse. *##<Enter>*.
6. The channel will be filled in with on and off setpoints.

Note: The total pulse length (on + off) must divide evenly into the scale factor.
E.g. Scale factor = 360, 8 pulses, on + off should = 45, (on = 10, off = 35; on = 15, off = 30; etc.)

Status Tables

Another feature of SYSdev 2000 that did not exist on the DOS versions is the Status Tables. You can launch the Status Tables from the toolbar button or from the Menu via Tools → Status Table.
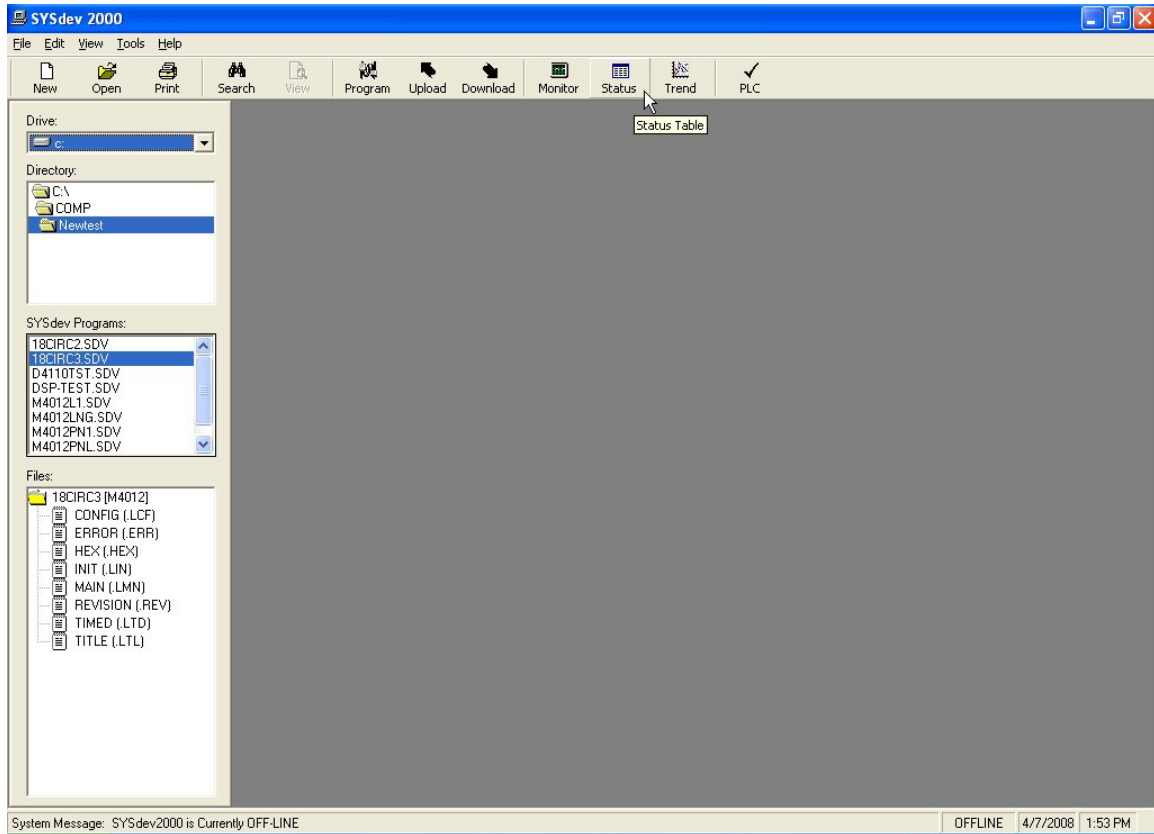

Figure 32 Status Tables Toolbar Button

The Status Tables allow the user to create a customized table of addresses to be viewed. The tables can show on-line (current) or off-line (previously uploaded) data. To view current data, one need only enter the addresses to be monitored. To view off-line data, the program must be selected so the uploaded data can be located.
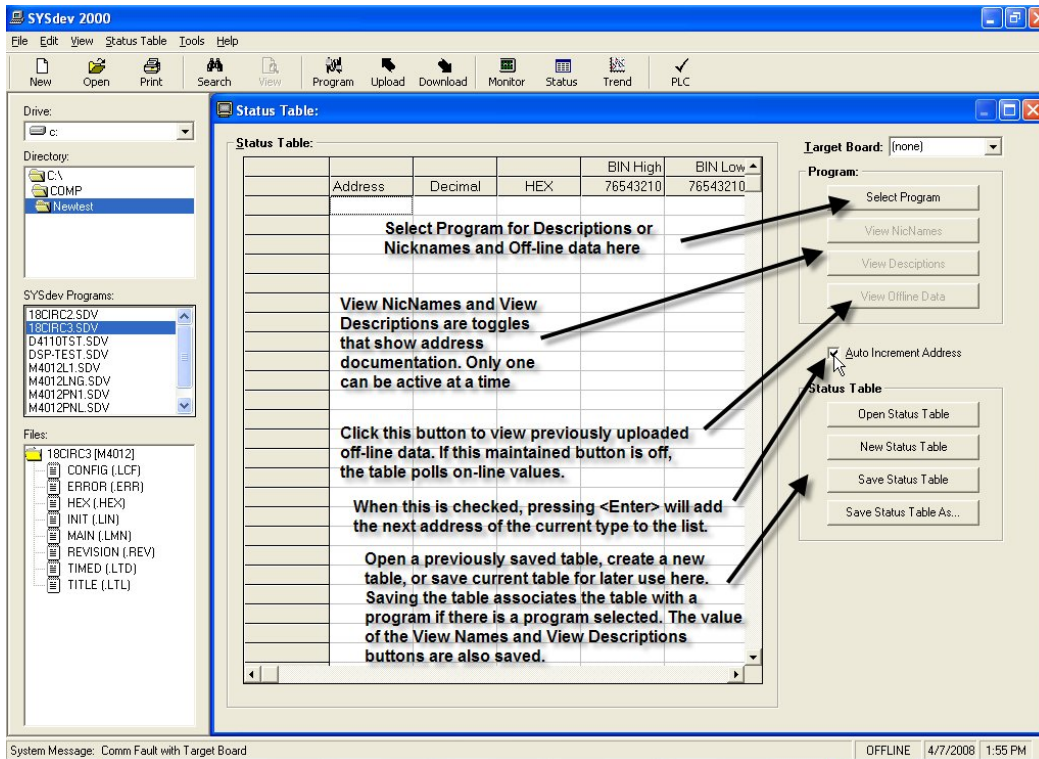
Figure 33 Blank Status Table With Notes

Notes on Status Tables

- The "Auto Increment Address" check box allows quick entry of consecutive addresses. Pressing <Enter> will load the next address of the variable type as the previously entered address. For example, if the current address is B32, pressing <Enter> will add B33 to the table; if the current address is W32, pressing <Enter> will add W34 to the table.
- User can choose to see either address description (3x7 off-line documentation) or Nicknames (1x7 documentation seen on-line with ladder) if the program has been chosen.
- The more addresses loaded onto a single table, the longer it takes for the addresses to be updated.
- To send a command to change the value of an address in the table, simply type the value in the "Decimal" or "Hex" column and press <Enter>. Note that this is not a force - the address will be set to the value entered, but the program will use that address as normal.
- The data in the tables can be copied and pasted into a spreadsheet using the Windows™ clipboard. Simply highlight the desired information and use standard clipboard commands.
- Each table can be saved once configured, and loaded again at a later time for re-use.
- The number of tables is only limited by disk space.

Using SYSdev2000
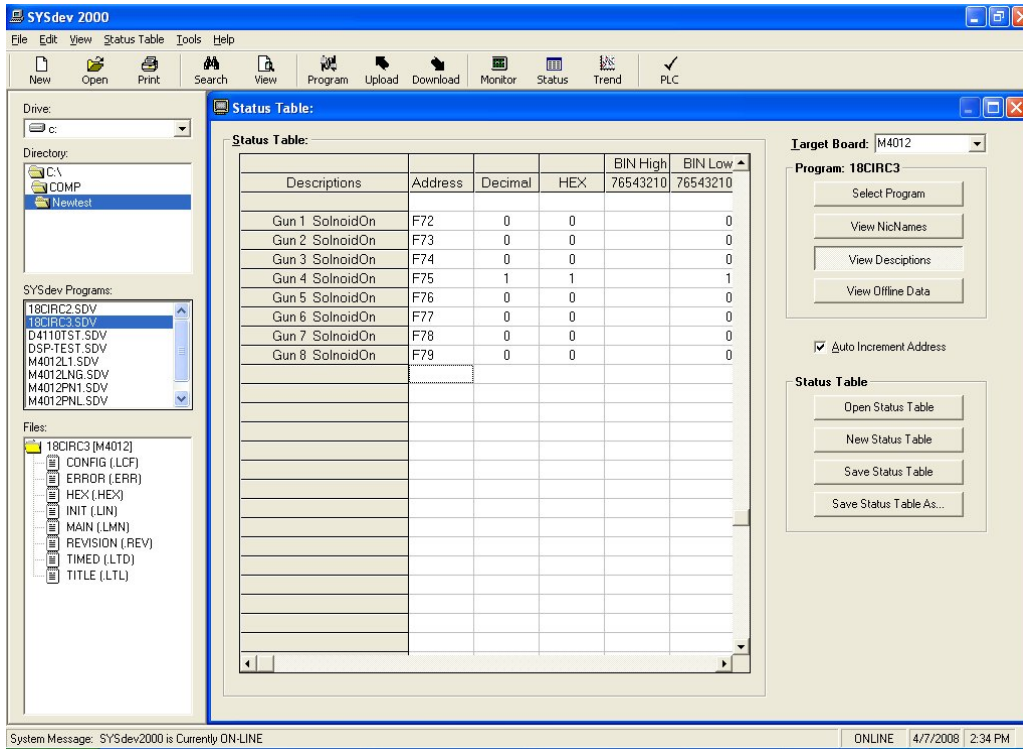
Figure 34 Status Table With Program Selected

The Trending Tool

SYSdev 2000 also has a trending tool that makes it possible to take short term historical data, based on timed sampling or change of state. The resulting data can be shown in graphical form, or copied and pasted into a spreadsheet if desired. For more information on the trending tool, please refer to the SYSdev 2000 Help feature, or the SYSdev Programming manual from Systems Electroncis Group.

Setting Up PLC Presets

There are variables inside the panel PLC program that are changed only by a PC connected on-line. These variables are called Presets. The Presets for each control system are listed in the documentation located in Block 0 of the Main Program for the panel PLC. This list should be printed for your reference. To print just his list, choose option 3 from the Print Menu and print block 0 to block 0. For instructions on viewing and changing the current values of these registers, please refer to the section on On-line Monitoring with SYSdev. It can also be useful to set up a status table with all "preset" addresses for easy access. A sample listing of presets is provided below:

Table 3 Sample Listing of PLC Presets

BYTE	DEFAULT	UNITS	FUNCTION
W1100	3000	Rpm	Desired Chuck Speed
W1102	4000	Rpm	Maximum Chuck Speed
W1104	****	Rpm	Minimum Chuck Speed (Default = Min Possible)
B1114	000	.5ms	Gun Pre-Spin Timer
B1115	255	.5ms	Gun Anti-Bounce Timer
B1120 through B1127	100	.5ms	Gun On Times
B1130 through B1137	040	Steps	Gun Lift Tracking Values
B1170	102	1.0ms	Infeed On Lead For Mechanical Delay
B1171	102	1.0ms	Infeed Off Lead For Mechanical Delay
B1174	150	.5ms	Maximum Gun On Time
B1175	020	.5ms	Minimum Gun On Time
B1176	065	Steps	Maximum Gun Lift Setting
B1177	015	Steps	Minimum Gun Lift Setting
B1178	050	.1s	Drive Up To Speed To Allow Infeed
B1179	090	1.0s	Purge Air Cycle (SB Only)
B1179	030	1.0s	Compound Slow Fill Check (WB Only)
W1180	1800	1.0s	Compound No Refill Check (WB Only)
B1184	002	retries	Serial Comm. Retries Before Fault
B1185	001	revs	Turret Revolutions Per End Prx Check
B1186	002	ends	Ends Per Exit Jam Check
B1187	050	10ms	Line Control Turn On Filter
B1188	050	10ms	Line Control Turn Off Filter
W1200	2000	epm	Liner Auto Speed
W1202	2100	epm	Maximum Liner Speed
W1204	****	epm	Minimum Liner Speed (Default Is MinHz Speed)
W1206	240	1s	Power Brush Cleaning Interval (WB Only)
B1208	015	1s	Power Brush Liquid Applied Time (WB Only)
B1209	030	1s	Power Brush Air Applied Time (WB Only)

Troubleshooting

This section provides some troubleshooting guidance for possible problems with the Liner beyond the information given on the display. For a full list of display messages, refer to the Computrol Operator's Manual, which is included on the engineering package Compact Disc.

PLC Faults

If the red FLT (fault) LED is lit on the PLC, there is a problem with the PLC itself.

Check Power Supply Voltages

1. Use a Digital Multimeter to check the incoming AC line voltage and DC output voltages for normal values.
2. Use an oscilloscope to check the 24VDC bus. Noise on the 24V can cause problems for the liner tank PLC. Computrol carries line filters that have shown good results reducing electrical noise on the 24VDC for these control systems.

Check (and Reset) the PLC Fault Code

For most PLC faults, the PLC stops running the program before the program memory is corrupted. When this is the case, we can reset the fault manually and re-initialize the program.

1. Connect a serial cable between a serial port of your computer and the Prog (program) Port of the PLC
2. Run SYSdev 2000.
3. Use the Program Selection Tool to highlight the PLS program and press *<Enter>*.
4. Click the "Check PLC" toolbar button. The Target Board Interface window appears.
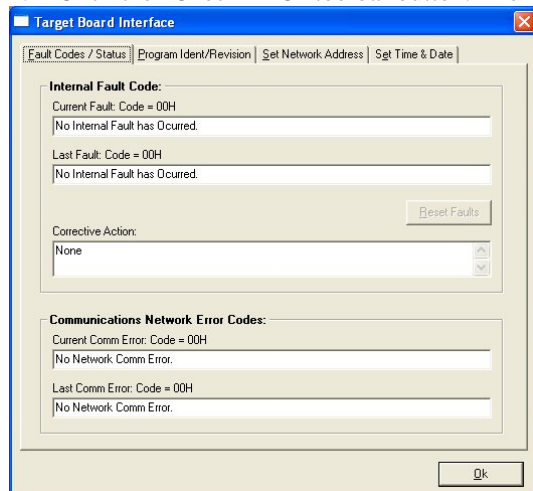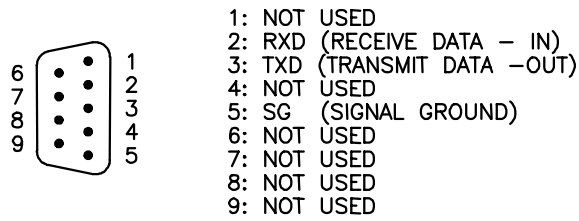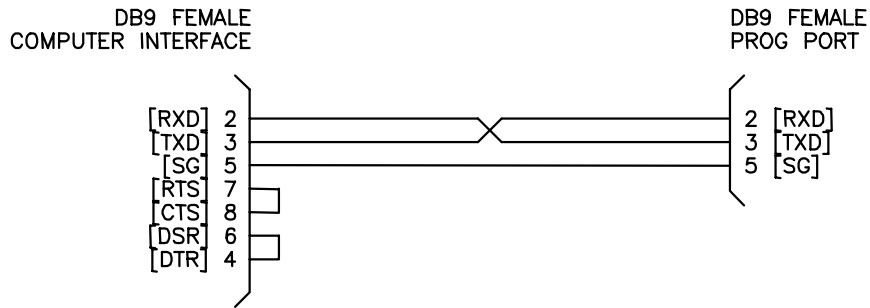

Figure 35 PLC Fault Code Check Screen

8. If Internal Fault Code is anything but 42H (Cannot communicate with Target Board), click the "Reset Faults" button to re-initialize the PLC.
9. If the Target Board Internal Fault Code is 42H (Cannot communicate with Target Board), double-check the cable connection, and that the PLC is powered-up. If these are OK, try cycling the power to the PLC. If the fault persists, contact Computrol.
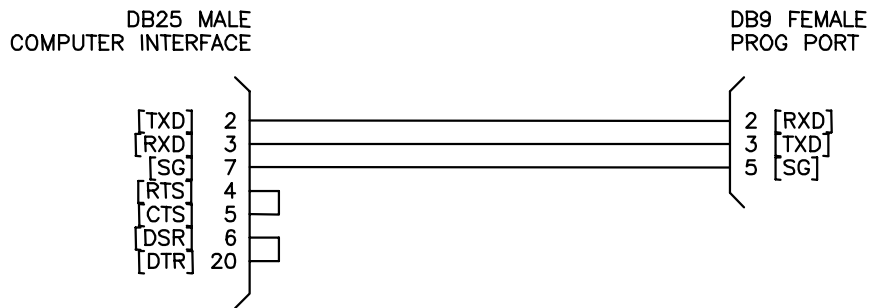
```
1: NOT USED
2: RXD (RECEIVE DATA – IN)
3: TXD (TRANSMIT DATA –OUT)
4: NOT USED
5: SG  (SIGNAL GROUND)
6: NOT USED
7: NOT USED
8: NOT USED
9: NOT USED
```

PROG Port Pin Out

```
DB9 FEMALE                          DB9 FEMALE
COMPUTER INTERFACE                  PROG PORT

[RXD] 2 ──────────╲╱────────── 2 [RXD]
[TXD] 3 ──────────╱╲────────── 3 [TXD]
[SG]  5 ────────────────────── 5 [SG]
[RTS] 7 ─┐
[CTS] 8 ─┘
[DSR] 6 ─┐
[DTR] 4 ─┘
```

DB9 (com1) to PROG Port Cable

```
DB25 MALE                           DB9 FEMALE
COMPUTER INTERFACE                  PROG PORT

[TXD] 2  ───────────────────── 2 [RXD]
[RXD] 3  ───────────────────── 3 [TXD]
[SG]  7  ───────────────────── 5 [SG]
[RTS] 4 ─┐
[CTS] 5 ─┘
[DSR] 6 ─┐
[DTR] 20─┘
```

DB25 (com1) to PROG Port Cable