SST-PB3-SLC

User Reference Guide

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This document applies to the SST-PB3-SLC scanner module for the SLC 500 interface card.

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Hardcopies are not controlled.

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Preface

Preface Sections:

- Purpose of this Guide

- Who Should Use this Guide?

- Conventions

⚠️ ## Warning

Only qualified electrical personnel familiar with the construction/ operation of this equipment and the hazards involved should install, adjust, operate, and/or service this equipment. Read and understand this guide in its entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or, in extreme cases, loss of life.

Purpose of this Guide

This manual explains how to install, configure and operate the SST-PB3-SLC scanner.

Who Should Use this Guide?

Use this manual if you are designing, installing, programming or troubleshooting control systems that use Allen-Bradley SLC processors and the SST-PB3-SLC scanner.

You should understand PLCs and have basic knowledge of SLC products. Familiarity with PROFIBUS modules and the PROFIBUS network would be an asset.

Conventions

This guide uses stylistic conventions, special terms and special notations to help enhance your understanding.

Style

The following stylistic conventions are used throughout this guide:

Bold   indicates field names, button names, tab names, command names and options or selections

Italics   indicates keywords (indexed) or instances of new terms and/or specialized words that need emphasis

CAPS   indicates a specific key selection, such as ENTER, TAB, CTRL, ALT, DELETE

`Code Font`   indicates command line entries or text that you would type into a field

<u>Underlining</u>   indicates a hyperlink

">" delimiter   indicates how to navigate through a hierarchy of menu selections/options

"0x" or "-H"   indicates a hexadecimal value

Terminology

The following special terms are used throughout this guide:

Card   The SLC 500 network interface card

Channel   A PROFIBUS network interface on the card

Firmware   The embedded software module that gets loaded to the scanner's memory
                      and runs on the scanner, enabling it to respond to commands from the host
                      and manage network communications.

Module   A synonym for *Scanner*

Scanner   The SST-PB3-SLC scanner module, consisting of hardware and firmware

Special Notation

The following special notations are used throughout this guide:

Warning

Warning messages alert the reader to situations where personal injury may result. Warnings are accompanied by the symbol shown, and precede the topic to which they refer.

Caution

Caution messages alert the reader to situations where equipment damage may result. Cautions are accompanied by the symbol shown, and precede the topic to which they refer.

Note

A note provides additional information, emphasizes a point, or gives a tip for easier operation. Notes are accompanied by the symbol shown, and follow the text to which they refer.

1
Overview

Chapter Sections:

- System Overview

- Hardware Features

1.1 System Overview

1.1.1 Scanner Capabilities

The SST-PB3-SLC is the PROFIBUS scanner for the SLC 500. It enables communication between an SLC processor (SLC 5/03 or later) and DP remote I/O devices on a PROFIBUS network, acting as a PROFIBUS DP remote I/O scanner. It:

- Can scan up to 125 Slaves

- Supports up to 244 bytes of input data and 244 bytes of output data per Slave

    - If you use the SST PROFIBUS Configuration Tool to configure the scanner, you can have up to 1032 words of input data and 1032 words of output data

    - If you use Siemens's COM PROFIBUS to configure the scanner, it supports up to 160 words of input data and 160 words of output data

- Can reside in any slot in the local SLC chassis except slot 0 (reserved for the SLC processor). You can have multiple scanners in the same rack.

- Supports all standard PROFIBUS baud rates (9600, 19200, 31.25k, 45.45k, 93.75k, 187.5k, 500k, 1.5M, 3M, 6M, 12M)

- Can act as a DP Slave to another DP Master on the same network

- Supports up to 122 words of input data and 122 words of output data as a Slave

- Supports up to four FDL SAPs and up to four FDL message blocks

- Supports DPV1 Master Class 1 and Class 2 messaging

1.1.2 Configuring the Scanner

You can configure the I/O on the DP network using either the SST PROFIBUS Configuration Tool or Siemens's COM PROFIBUS configuration software.

The SST PROFIBUS Configuration Tool allows you to upload the configuration directly to the card, via the scanner's serial port. The COM PROFIBUS exports the configuration to a *.2bf file (binary), which you can upload from any serial communications software via an Xmodem transfer.

The scanner stores the configuration in its flash memory, so you don't need to upload the configuration every time you start the SLC, and because all configuration is done with the Configuration Tool or COM PROFIBUS, you don't need to set up a G file in the SLC.

1.1.3 Input and Output Data

Input and output data for the Slaves is mapped into SLC I, O, M0 and M1 files. The mapping depends on the addresses you assign in your configuration.

The SLC processor scan and the scanner I/O scan are independent (asynchronous) of each other. The processor reads the scanner input data during its input scan and writes the output data during its output scan. The scanner continues reading input data from the Slaves and writing output data to the Slaves, regardless of what the SLC is doing.

1.1.4 Scanning Network and I/O Status

The scanner maintains the following status information about the network and connected modules:

- Slave status for each Slave

- Network diagnostic counters

- DP Master diagnostic counters

- FDL diagnostic counters

1.2 Hardware Features

Figure 1:   Front of SST-PB3-SLC Scanner
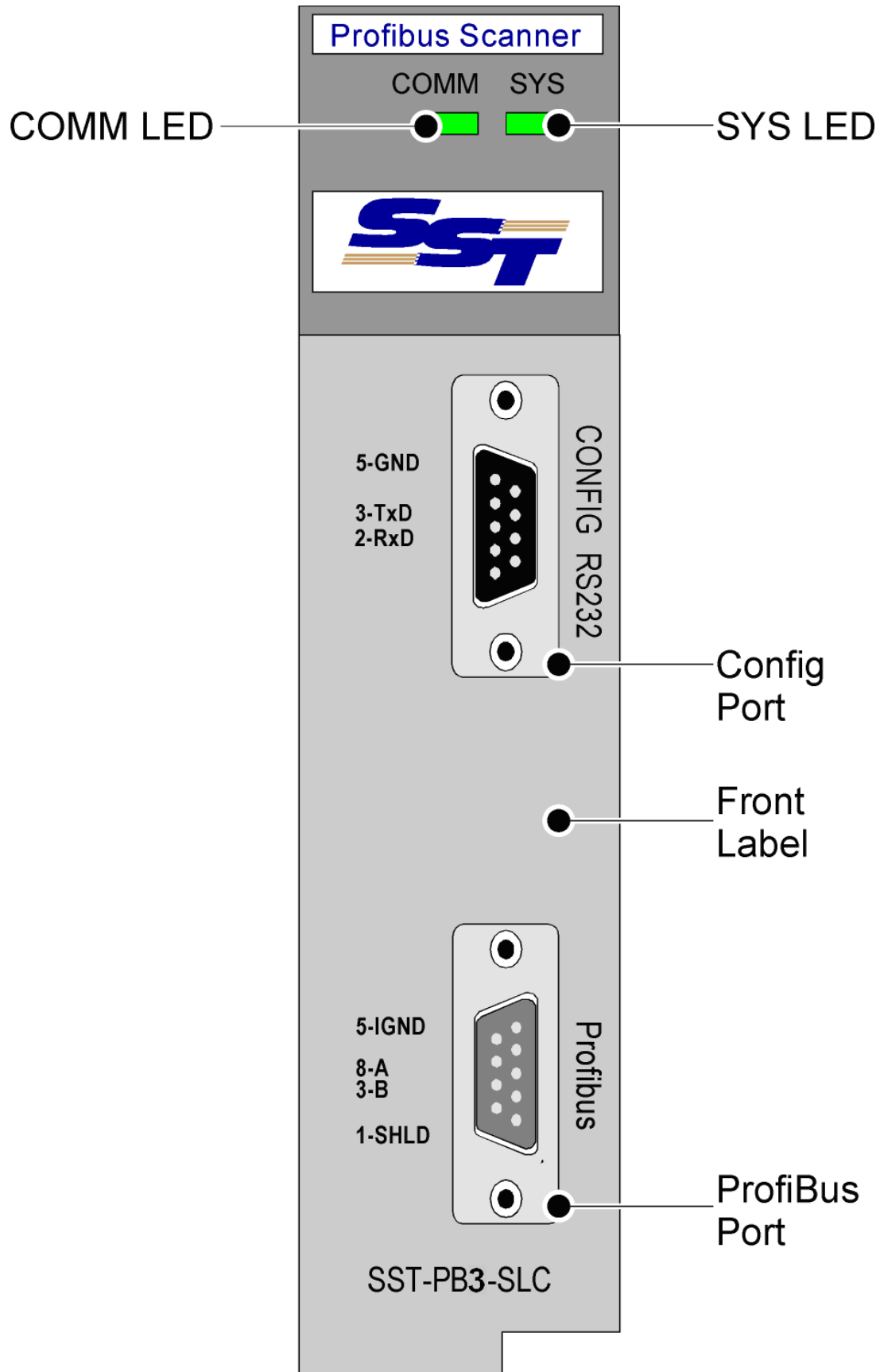
The following table describes the parts of the scanner. The scanner's side label provides module information.

Table 1:   Scanner Parts

Feature	Function
Status LEDs	Display the communication and system status
Front Label	Identifies the scanner
9-pin PROFIBUS Connector	Used for connecting to the PROFIBUS network
Self-Locking Tabs	Secure the scanner in the chassis slot
Side Label (Nameplate)	Provides module information
Configuration Port	Used for uploading I/O configuration data

1.2.1 LEDs

The scanner has two LEDs: the SYS LED and the COMM LED. For detailed information refer to Section 3.3 , Status LEDs.

COMM LED

At powerup, the COMM LED flashes green, red, amber then off.

The COMM LED indicates the health of the PROFIBUS network and flashes green when the PROFIBUS scanner is token passing or being monitored via the Configuration Tool. The LED is solid green when there are no network errors. If a network error occurs, the COMM LED can either be off, solid red, or flashing red periodically while it is green.

SYS LED

At powerup, the SYS LED flashes green, red, amber, red then off. While it flashes, you can enter System Configuration mode to download new firmware to the scanner.

When the scanner acts as a Master, the SYS LED indicates the communication status with PROFIBUS slaves. A solid red SYS LED indicates that one or more slaves are in error, and solid green means that all slaves are being scanned on the network in Run mode. When it's amber, all slaves are being scanned in Program mode (outputs are all zeroes).

When the scanner acts as a slave, the SYS LED indicates the communication status with the PROFIBUS Master. When the SYS LED is solid red, the PROFIBUS Master is no longer scanning, and when it is solid green, the PROFIBUS Master is successfully scanning the module as a slave in Run mode. An amber SYS LED indicates that the PROFIBUS Master is scanning the module as a slave in Program mode.

1.2.2 9-pin PROFIBUS Connector

The PROFIBUS connector connects the scanner to the PROFIBUS network.

1.2.3 Configuration Port

Use the configuration port to upload I/O configurations from the SST PROFIBUS Configuration Tool or to export them from the Siemens COM PROFIBUS to the scanner.

2

Scanner Quick Start

Chapter Sections:

- Overview

- Equipment and Tools

- Package Contents

- Power Requirements

- Procedures

2.1 Overview

This chapter provides information to get you up and running quickly. It:

- Tells you which tools and equipment you need

- Mentions preliminary considerations

- Describes how to address, configure and program the scanner module

- Explains how to wire and install the scanner module

- Discusses system power-up procedures

Note

The procedures in this chapter assume that you have a basic understanding of process control, and are able to interpret the ladder logic instructions that control the applications.

This chapter does not include detailed explanations of these procedures, but refers to later sections and chapters. If you have any questions or are unfamiliar with the terms used or concepts presented, read the referenced chapters and other documentation before you proceed.

Note

Before performing the procedures outlined in this section, ensure that the latest version of the software has been downloaded to the module. The firmware is available on the Molex web site at:

http://www.molex.com/

2.2 Equipment and Tools

Have the following tools and equipment ready:

- SLC programming equipment

- SST PROFIBUS Configuration Tool, or Siemens COM PROFIBUS software

- Communication software

- Null modem cable

- PROFIBUS cable to connect the scanner to the PROFIBUS network

2.3 Package Contents

Unpack the module. Make sure that the contents include:

- The PROFIBUS scanner

- A serial null modem cable for uploading I/O configurations

- A CD with files for Windows XP/Server 2003/Vista/Server 2008 and Windows 7 32-bit and 64-bit installation

2.4 Power Requirements

Review your system's power requirements to make sure that your chassis supports placement of the scanner module.

> **Note**
>
> The scanner consumes 750 mA @ 5VDC.
>
> For modular systems, calculate the total load on the system power supply using the procedure described in the SLC 500 Modular Style Installation & Operation Manual, Allen-Bradley Publication 1747-6.2, or the SLC 500 Family System Overview, Publication 1747-2.30.

2.5 Procedures

The setup of the SST-PB3-SLC PROFIBUS Scanner is divided into two parts:

1. Setting up the scanner.

2. Getting the scanner running.

2.5.1 Setting up the Scanner

⚠ **Warning**

Before working on or around this equipment, ensure that system power is off.

1. Insert the scanner module into your 1746 chassis.

2. Connect the scanner to the PROFIBUS devices, using appropriate cabling and termination. For more information, refer to Section 3.2, Wiring.

3. Set up your system I/O configuration for the particular slot in which you installed the scanner.

4. Set the module type to Other, and enter the scanner module ID (13635) at the prompt. For more information, refer to Section 1.1.2, Configuring the Scanner.

5. Set the M0 and M1 file sizes to 4200.

📝 **Note**

If you do not set the M0 and M1 file sizes, the programming device will not let you access the M files in the SLC control program. For more information, refer to Section 1.1.2, Configuring the Scanner.

If you are using fewer than 32 input words or 32 output words, you can reduce the size of scanned inputs or scanned outputs.

6. Write the rest of the control program that will use the scanned data.

7. Apply power to the SLC.

8. Put the SLC in Program mode and transfer the program to the SLC. For details, refer to your programming software manuals.

2.5.2 Getting the Scanner Running

1. Install the SST PROFIBUS Configuration Tool.

2. From the Windows distribution disk, run setup.exe.

3. Create your I/O configuration. For more information, refer to Section 4.2, Creating an I/O Configuration.

4. Create a new file.

5. Select the Master station number.

6. Configure the bus parameters and set the network baud rate.

7. Configure the Slave parameters for each Slave, set the Slave station number and Slave module type, and assign I/O addresses to the Slave.

8. Right-click on the Master and select **Connect**.

9. Right-click on the Master and select **Load Configuration**.

10. Put the SLC in run mode. The module is now scanning I/O.

3

Installing and Wiring the Scanner Module

Chapter Sections:

- Installing the Scanner Module

- Wiring

- Status LEDs

3.1 Installing the Scanner Module

Installation procedures for the scanner module are the same as for any other SLC module. To identify the chassis and module components listed in the installation procedures, refer to Figure 2.

Caution

Before attempting to install, remove or wire the scanner, disconnect system power. Adding or removing the module with the power on may cause electrical damage.

Note

Before installation, make sure that your modular SLC power supply has adequate reserve current capacity. The scanner requires 750 mA at 5 VDC.

Figure 2:   Chassis and Module Components
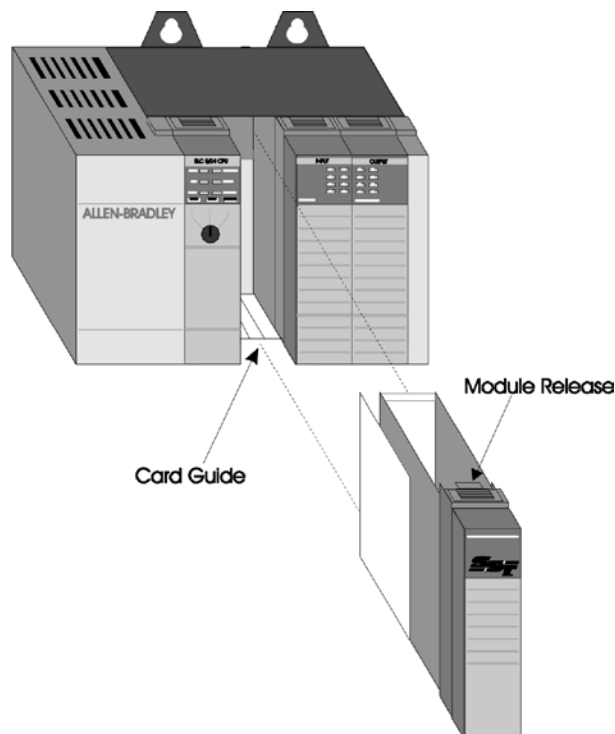
To install the scanner module:

1. Disconnect power.

2. Align the full-sized circuit board with the chassis card guides. The first slot (slot 0) of the first rack is reserved for the SLC 500 processor.

3. Slide the scanner module into the chassis until the top and bottom latches catch.

4. Attach the PROFIBUS cable. For cabling information, refer to Section 3.2.1, PROFIBUS Wiring.

5. Turn on termination as required (the stations at one of the two physical ends of each segment must be terminated).

6. Route the cable down and away from the scanner.

7. Cover all unused slots with the card slot filler, Allen-Bradley catalog number 1746-N2.

8. Power up the system.

Note

If there is a lot of electrical noise in your installation, you need to install an isolating transformer. For instructions, refer to Allen-Bradley's Installation and Operation Manual for Modular Hardware Style Programmable Controller, AB 1747-6.2.

3.1.1 Removing the Scanner Module

1. Disconnect power.

2. Remove all cabling from the scanner.

3. Press the releases at the top and bottom of the module and slide the module out of the slot.

4. Cover all unused slots with the card slot filler, Allen-Bradley catalog number 1746-N2.

5. Place the scanner into the static protective bag supplied with shipment packaging and store it in the original box in a dry and cool environment.

3.2 Wiring

3.2.1 PROFIBUS Wiring

The module contains a standard DB9 connector, which can be connected to a PROFIBUS bus terminal. The module has no termination but the bus terminal has built-in switchable termination.

DB9 Instructions

Table 2:   DB9 Instructions

Pin #	Pin Description	DB9 Termination when Using SST-PB3-SLC
1	Chassis ground	
2	Reserved	
3	Data +	Connect this pin to pin 8 (data -) with 220 ohm resistor
4	TX Enable	
5	Isolated ground	Connect this pin to pin 8 (data -) with 390 ohm resistor
6	Isolated +5V	Connect this pin to pin 3 (data +) with 390 ohm resistor
7	Reserved	
8	Data	
9	Reserved	

Selecting the Proper Line Type

Use this table to determine which line type best suits your system requirements.

Table 3:   Line Types

Baud Rate (bits/s)	Line A Distance (Max)	Line B Distance (Max)	Total Capacitance of All Drop Cables
9k6, 19.2k, 31.25 k, 45.45 k and 93.75k	1200 m**	1200 m**	*15nF
93.75k	1200 m**	1200 m**	*3nF
187.5k	1000 m**	600 m**	*1nF
500k	400 m**	200 m**	*0.6nF
1.5M	200 m**	NA	*0.2nF
3, 6 and 12M	100 m**	NA	*0.05nF
NA = Not Applicable *If using a combination of both line types, divide the lengths shown by two. **This is the sum of all bus segment and drop cable lengths.			

PROFIBUS Connector

The card has one standard PROFIBUS DB9 female connector per channel. Pin numbers are identified in the following figure.

Figure 3:   The PROFIBUS DB9 Female Connector
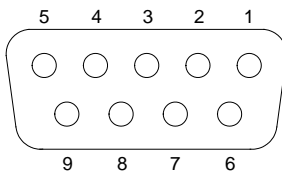
Note

The recommended male connector is the Brad Harrison PA9D01-42 Diagnostic D-Sub Connector.

The two physical ends of the network should be terminated. There should be only two terminators on a network.

The recommended cable is a Belden3079A. Examples include:

- Brad Harrison 85-001 PVR2 conductor with shield, UL-listed PROFIBUS cable

- Bosch Comnet DP #913 548 Flexible PROFIBUS Cable

- Bosch Comnet DP #917 201 Trailing PROFIBUS Cable

- Bosch Comnet DP #917 202 Massive PROFIBUS Cable

Note

Allen Bradley blue hose, which has an impedance of 78 ohms, is not recommended.

Caution

Do NOT Connect devices to the +5V line. It is there for termination purposes only.

3.2.2 Serial Port Wiring

Before scanning I/O, use the serial CONFIG port on the front of the scanner to upload an I/O configuration file.

Note

> Pins 2 and 3 of the serial port are wired the same as a PC 9-pin COM port, so the serial cable for a standard PC COM port must have lines 2 and 3 swapped. The serial connection doesn't require handshaking.

Connect to the serial port using any communication software, such as Windows Terminal or HyperTerminal. The scanner serial port supports any baud rate from 9600 baud to 115 kbaud, with no parity, 8 data bits, and 1 stop bit. Set the Flow Control to None. The scanner automatically detects the baud rate you are using by adjusting the baud rate until it receives an "*".

Figure 4:   Serial Port Wiring
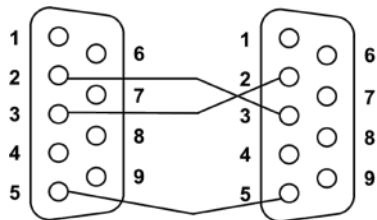
For an example of configuring the card as a Slave using a communications software package over the serial port, refer to Section 7.6, Displaying the DP Slave Configuration.

3.3 Status LEDs

3.3.1 SYS LED

If you are using the scanner as a DP Master and a DP Slave, the SYS LED shows the status of both operations sequentially. The Master status is flashed first, followed by the Slave status.
If you are using the scanner for FDL, the sequence is DP Master, DP Slave, FDL messages and FDL SAPs.

The SYS LED also flashes an 8-bit error code if an internal fatal error occurs, alternating red for 0 and green for 1.

The following tables provide a description of the LEDs.

Table 4:   DP Master

Color	Meaning
Red	One or more Slaves is reporting a fault condition.
Amber	The module is in Program or Test mode.
Green	The module is scanning in Run mode.

Table 5:   DP Slave

Color	Meaning
Red	The Slave is not being scanned or is faulted.
Amber	The Slave is being scanned in Program mode.
Green	The Slave is being scanned in Run mode.

Table 6:   FDL

Color	Meaning
Red	A fault has occurred.
Green	The system is functioning normally.

Table 7:   Fatal Error

Error Code	Meaning
0x10	On module startup SPIOGA3 memory test failed.
0x14	On module startup internal memory test failed.
0x15	Internal error.

3.3.2 COMM LED

The COMM LED indicates errors on the network. The following table provides a description of the status of the LEDs.

Table 8:   COMM LED Status

Color	Meaning
Red	A network error has occurred. The LED flashes red at one-second intervals.
Green	No network errors exist
Flashing Green	Token passing is occurring.

If you are using the scanner as a passive DP Slave only, this LED will normally be off.

4

Configuring and Programming the DP Master

Chapter Sections:

- Configuring the Scanner

- Creating an I/O Configuration

- Downloading to the Scanner

- Troubleshooting

- Importing the DP Master Binary Configuration (.bss) Using the SST PROFIBUS Configuration Tool

- Uploading the I/O Configuration to the Scanner

- Errors

- Running the Scanner

- Using the Watchdog Timer

4.1 Configuring the Scanner

4.1.1 RS Logix 500

Note

When you are configuring the scanner, ensure that the SLC is in Program mode.

1. Create a new program offline.

2. Select the SLC processor, memory, and operating system.

3. In the project tree, double-click on **I/O Configuration**.

4. Set the size for rack 1.

5. Highlight the SST-PB3-SLC slot.

6. In the list of available modules, double-click on **Other** and enter the scanner ID code (13635).

7. Highlight the scanner and click on **Adv. Config**.

8. Set the M0 length and M1 length to 4200.

9. If you are using fewer than 32 input words or 32 output words, you can change the scanned input and output words. You do not have to set the G File Length or set an Interrupt Service Routine number.

10. Click **OK** to exit Advanced I/O Configuration.

11. Close the I/O Configuration dialog box.

12. Create the rest of your control program.

13. Save the file and download it to the SLC.

4.2 Creating an I/O Configuration

The SST PROFIBUS Configuration Tool window consists of a main or Network view and two panes: the PROFIBUS Devices pane (Device Library) and the On-line Browse pane (DP view). Both of these are floating panes; drag and drop them to move them anywhere inside the Network view.

Figure 5:   SST PROFIBUS Configuration Tool Window
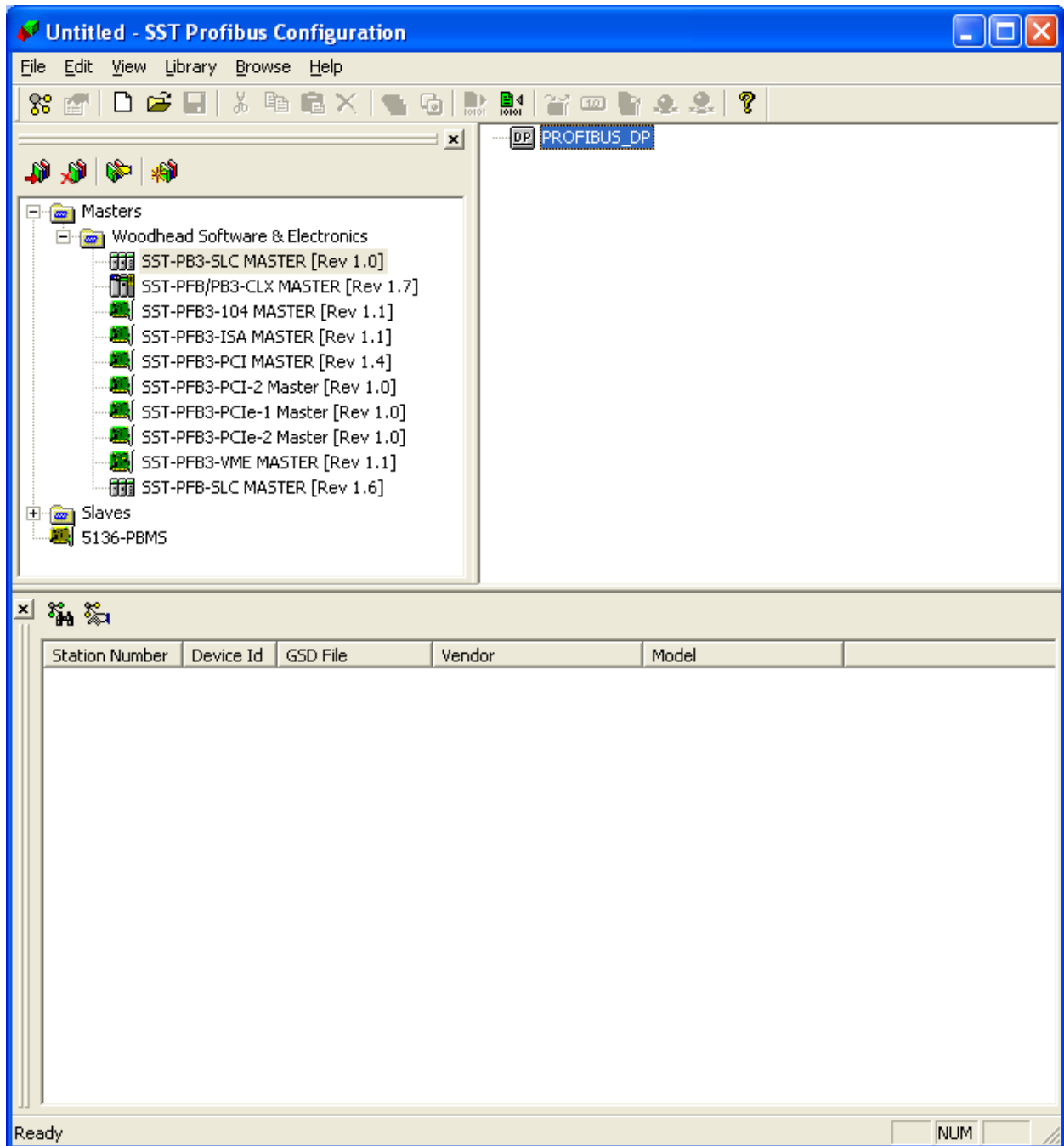
Configuring the SST-PB3-SLC Card as a DP Master

1. Click the Windows **Start** button.

2. Navigate to the SST PROFIBUS Configuration option (located in your Start menu) to run the SST PROFIBUS Configuration Tool.

3. Select **File>New** to create a new configuration.

    - To open the Device library (left-most pane), select **View>Library**. This pane appears by default in the upper left-hand side of the window.

    - To open the **On-line Browse** pane or DP view, select **View>On-line**. This pane appears by default at the bottom of the window.

4. Locate and select the SST-PB3-SLC Master device in the Device library (left-most pane).

    Figure 6:   SST-PB3-SLC Master Device
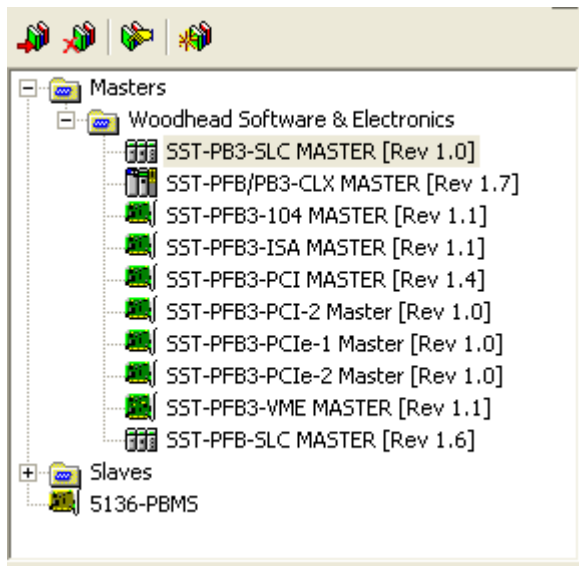
5. To add this Master device to the Network view:

- Drag and drop it into the Network view.

  OR

- Click on the **Add to Network** icon on the main toolbar. A Configuration window displays for the selected device.

Figure 7:   Device Configuration Window, General Tab
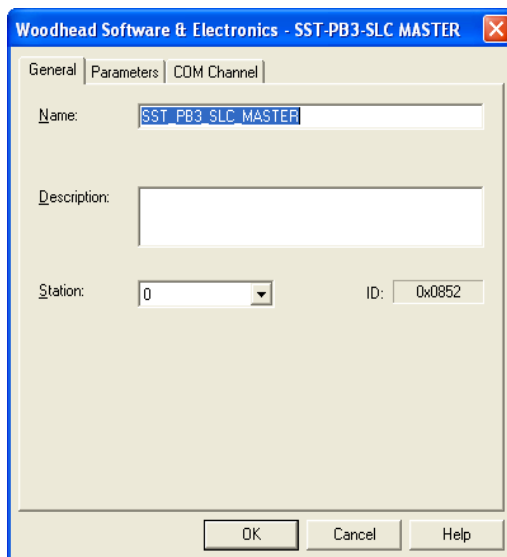
6. Click the **General** tab.

7. In the **Station** field, select the station number for the relevant Master.

8. Select the **COM Port** tab.

Figure 8:   Device Configuration Window, COM Port Tab
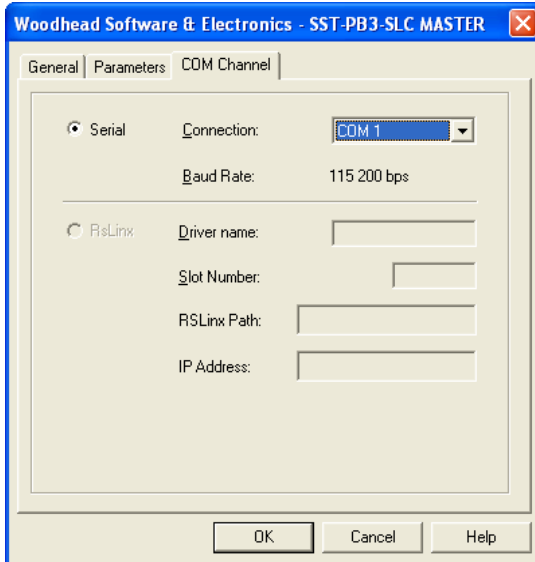
9. From the Connection: field, select the COM port that you want to use to download the Master Configuration.

10. Click **OK**. The Master device is added to the Network view (right-most pane).

Figure 9:   Network View
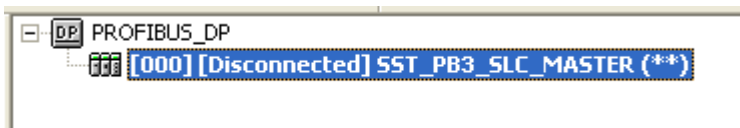
> ![Note icon] **Note**
>
> To edit device properties, right-click on the device and select **Properties** from the shortcut menu, or select the device from the Network view and select the **Properties** icon ![icon] on the main toolbar.

11. Find and select your Slave device from the Device library. If your Slave device is not listed:

a) In the Device library, click on the **New Device** icon ![icon] to add the GSD file for your device. The Add PROFIBUS Devices window opens.

Figure 10:   Add PROFIBUS Devices Window
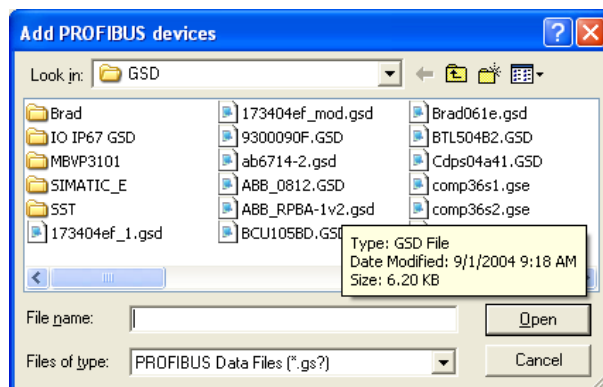
b) Locate the GSD file and click **Open**.

📝   **Note**

A GS* file should have been supplied with your Slave device.
If not, contact the vendor or search for it on the internet at:

http://www.PROFIBUS.com/

* signifies the language

The GSD file is added to the Device library (left-most pane).

Figure 11:   Device Library
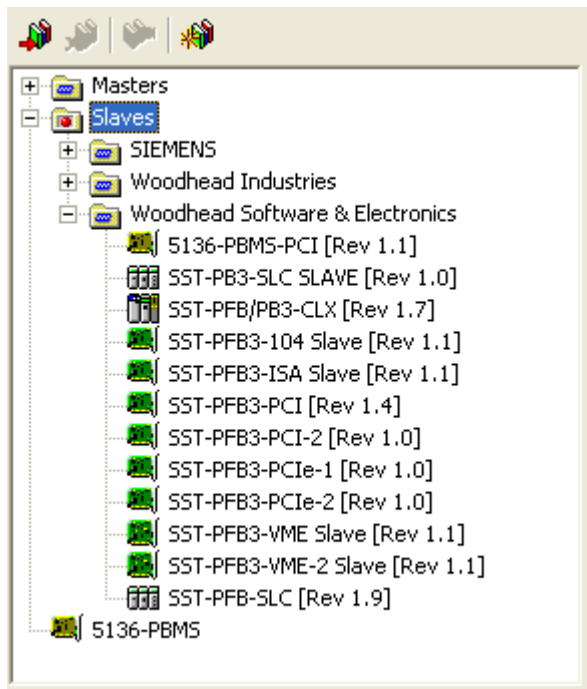
12. You can now add the device to the Network view in one of two ways.

- If you are connected to your PROFIBUS network, use the Online Browse feature to search for your Slaves on the network. For detailed information on how to perform this procedure, refer to Section 4.2.1, Online Browsing with DP View in the SST PROFIBUS Tool.

- If you are not connected to your PROFIBUS network, you can do the following:

    - Drag and drop each Slave to the network view under the Master device.

    - Click on the **Add to Network** icon [icon] on the main toolbar to display a configuration window for the selected Slave. This window displays the **General** tab, which is the default tab.

        Figure 12:   Configuration Window, General Tab
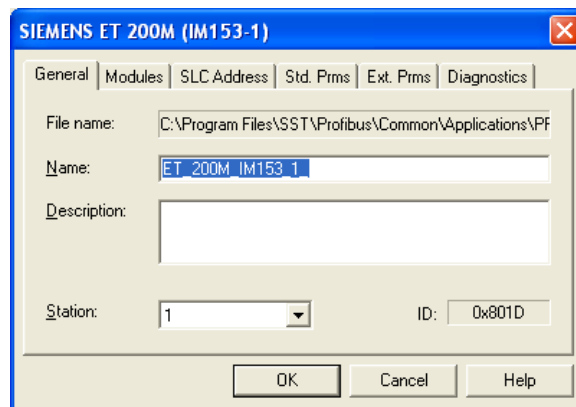
13. In the **Station** field, set the slave's station address.

14. Select the **Modules** tab.

Figure 13:   Configuration Window, Modules Tab
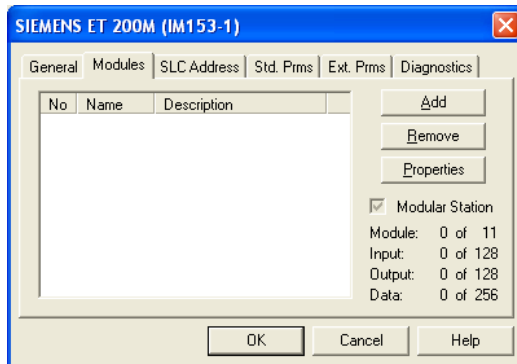
If your device is a modular device, you have to insert the modules that your Slave device uses. To do this, click the **Add** button to display the Add Modules window.

Figure 14:   Add Modules Window
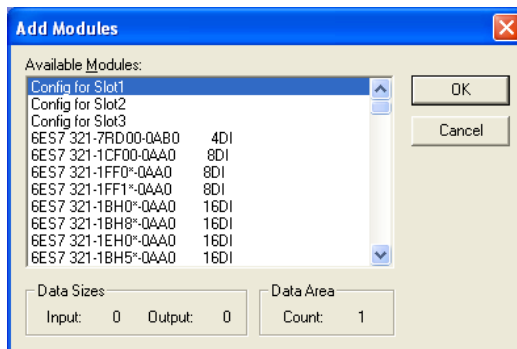
If your Slave is not a modular device (compact device), then the modules are already configured.

15. Select the module that you want the Slave to use.

16. Click **OK** to set the module and return to the Slave Properties window.

17. Select the **SLC Address** tab and assign the input and/or output address(es).

Figure 15:   Configuration Window, SLC Address Tab
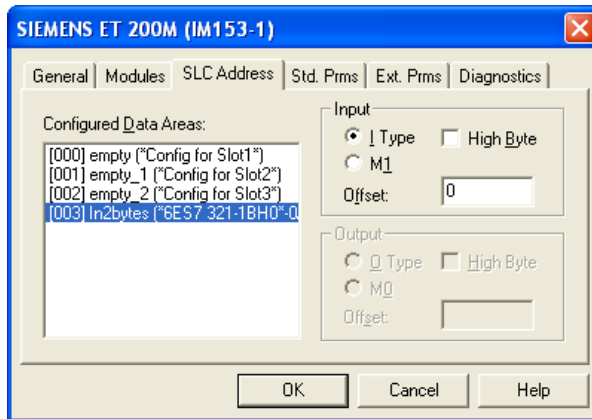
You have the option of using the default values that display as each module is highlighted, or of entering your own values.

> **Note**
>
> The software tries to make the best use of the available memory in the Input and Output files by packing the data. When modifying the offsets and using the M-files, you should avoid leaving large gaps between data blocks.

> **Note**
>
> You may now need to configure the Slave and module parameters.

18. Select the **Ext. Prms** tab (if it exists).

Figure 16:   Configuration Window, Ext. Prms Tab
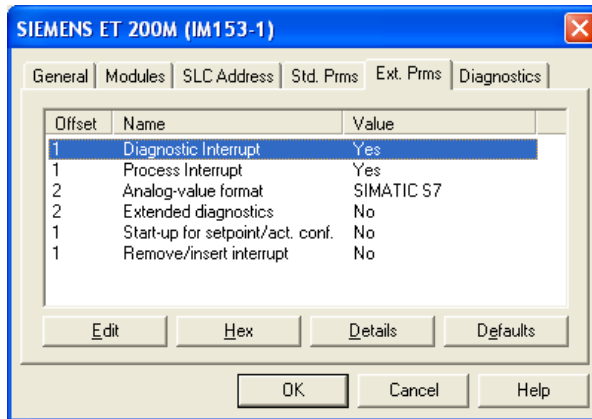
You can also click the following buttons:

- **Edit** - Allows you to change value of parameter. You can also double-click on a parameter to edit.

- **Hex** - Displays parameters data in hex format

- **Details** - Displays parameter characteristics

- **Offset** - Parameter byte offset. The first parameter starts at offset 0.

- **Name** - Parameter name

- **Value** - Displays as text (where available) or a numeric value

19. Configure any required parameters. You may now need to configure module parameters through the **Modules** tab.

20. Select the **Modules** tab.

Figure 17:   Configuration Window, Modules Tab
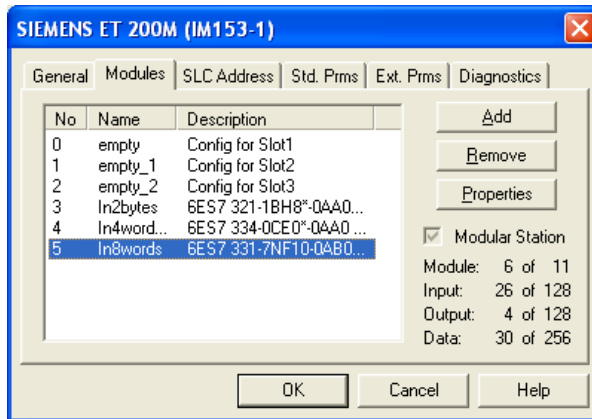
21. Select the module that needs parameterization and then **Properties**. The Data Area Properties window opens and displays the **General** tab.

Figure 18:   Data Area Properties Window, General Tab
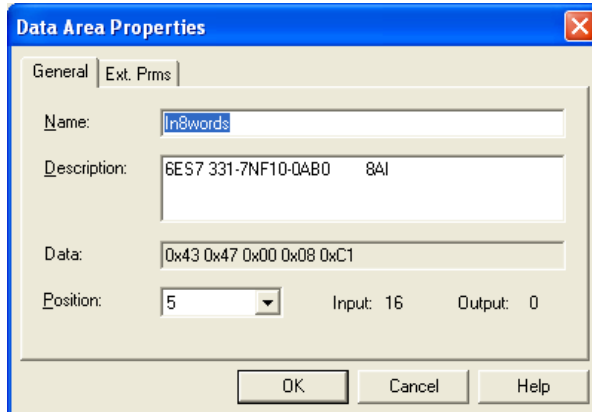
22. Select the **Ext. Prms** tab (if it exists) and set the parameters according to your device.

Figure 19:   Data Area Properties Window, Ext. Prms Tab
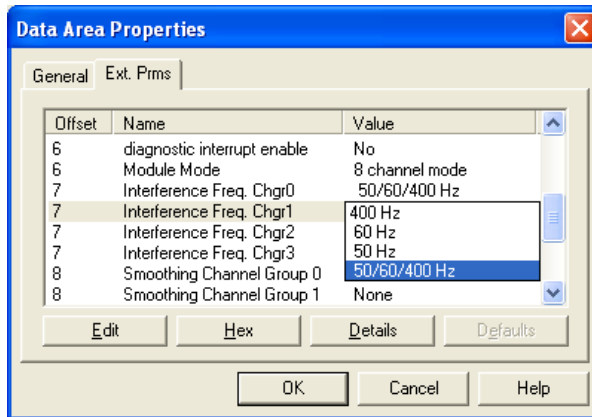
23. Click **OK**.

24. Right-click on the highest level of the Network view (default is PROFIBUS_DP) and select **Properties**. The Network window displays (opens in **General** tab), allowing you to set the Baud Rate and other parameters found in the **Timing** and **Parameters** tabs.

Figure 20:   Network Window, General Tab
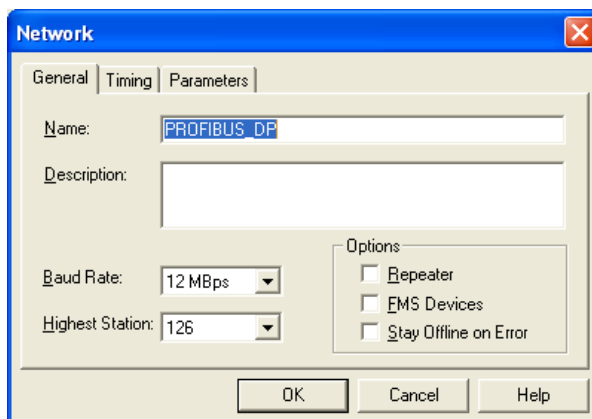
25. Configure the following parameters according to your PROFIBUS network:

- **Name** - Name of the network

- **Description** - Description of the network

- **Baud Rate** - Baud rate of the network

- **Highest Station** - Highest allowed station address for any active station on the network. The highest station affects how much time is spent soliciting for new nodes.

- **Options** - These affect the network parameters that the Configuration Tool assigns:

  - **Repeater** - indicates whether or not there are any repeaters on the network

  - **FMS Devices** - indicates whether or not there are any FMS devices on the network

  - **Stay Off-line on Error** - indicates whether or not the card stays off-line when the Token Error Limit or Response Error Limit is exceeded within 256 token cycles

26. Click **OK**.

27. Repeats steps 13-26 for each Slave device on your network.

28. Select **File>Save**. The Save As window displays.

Figure 21:   Save As Window
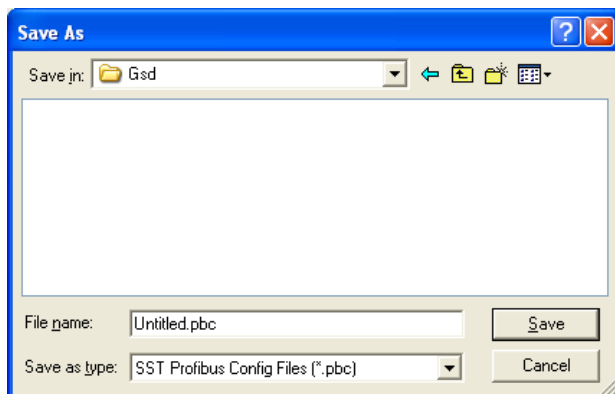
29. Specify a filename and location for your configuration and select **Save**. This saves your project as a .pbc file.

30. To download your configuration, refer to Section 4.3, [Downloading to the Scanner](#).

31. You now have the option of exporting your configuration to a binary (.bss) file, using one of the following methods:

- Select **Edit/Export Binary...** to export your configuration to a (.bss) file

  OR

- Right-click on the SST-PB3-SLC Master and select the **Export Binary...** option.

4.2.1 Online Browsing with DP View in the SST PROFIBUS Tool

1. Verify that the SLC PLC is in Program mode.

2. Connect the null modem cable between the scanner's serial port and your PC COM port. Verify that you are connected to the PROFIBUS network.

3. Select the **Network Search Properties** icon. The DP View window displays.

Figure 22:   DP View Window
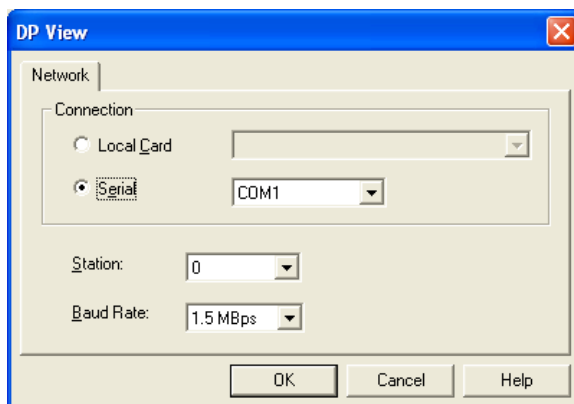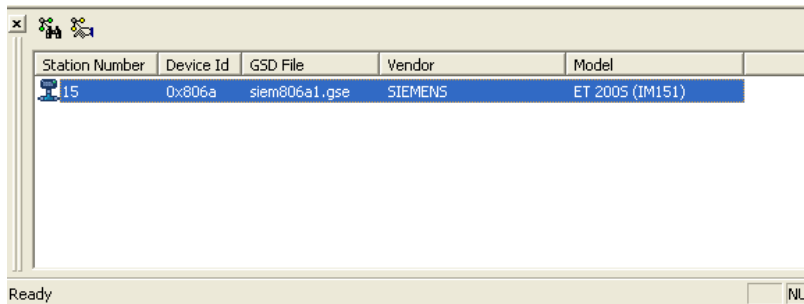
4. Configure the network by specifying the following:

    - **Local Card** - Default radio button selection only. Select the **Serial** radio button.

    - **Serial** - Ensure that you select this radio button. This is the COM port to which your serial cable is connected.

    - **Station** - Set a station number not used by any of the Slaves on the network

    - **Baud Rate** - Slaves that do not support the selected baud rate will not be detected

5. Click **OK**.

6. When you are ready to browse, select the **Search for Slave** ![icon] icon. Slaves that have been detected display in station address order as shown:

Figure 23:   List of Detected Slaves

7. Right-click on each Slave to assign its GSD file. A shortcut window displays with the following options:

- **GSD Files** - Displays GSD file(s) found with corresponding Slave ID and a default generated GSD file, in case no ID match found.

- **Export GSD** - Export a GSD file that will be saved with a new name, which by default is the station number Slave ID.

- **Edit GSD** - Edit the selected GSD file. The generated GSD is the default; if it isn't, select another GSD file. Here you are allowed to specify the vendor and model name, as well as Slave-specific options such as freeze, sync, auto baud, set Slave address, and user parameters.

- **Properties** - Displays module information for that Slave

Note

To create a configuration with these Slaves, you must first have a Master in your configuration. You can then drag over the Slaves from the DP library to your Network view.

8. Select the GSD File from the shortcut menu.

Figure 24:   GSD File Selection

9. Drag and drop each Slave from the DP library to the Network view, below the Master. You may be prompted with the following window to select the correct I/O modules for the Slave.

Figure 25:   Add Modules Window
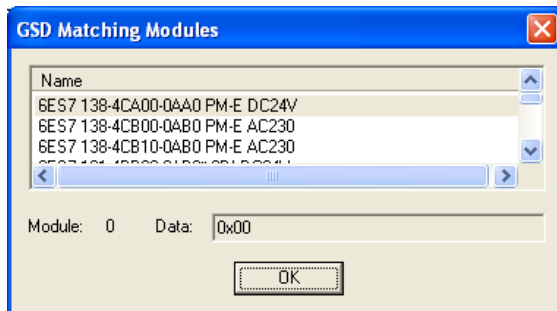
10. Click **OK**. The Slave is added and appears in your Network view.

Figure 26:   Network View, Slave Added
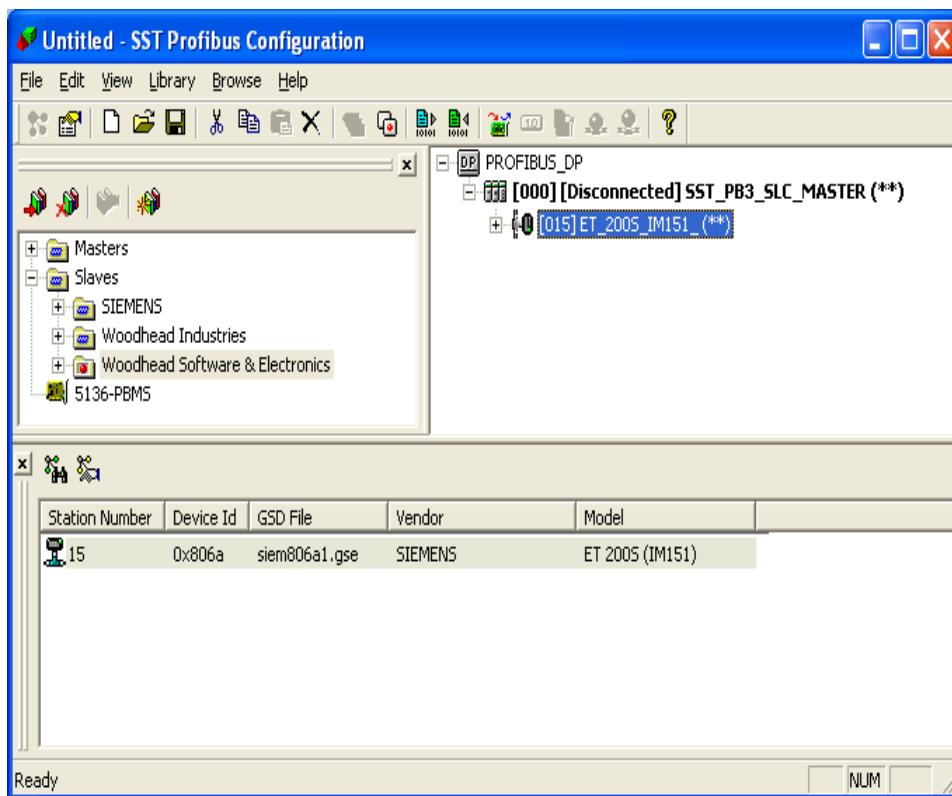
11. Right-click on the Slave in your Network view.

12. Select **Properties** from the shortcut menu. The Slave Properties window displays.

Figure 27:   Slave Properties Window, General Tab
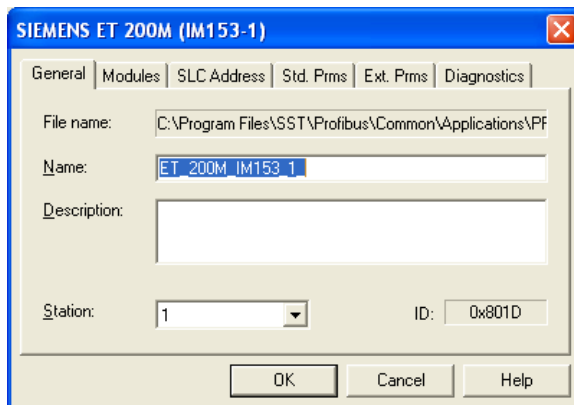
13. Select the **SLC Address** tab and assign the I/O offset(s).

Figure 28:   Slave Properties Window, Address Tab
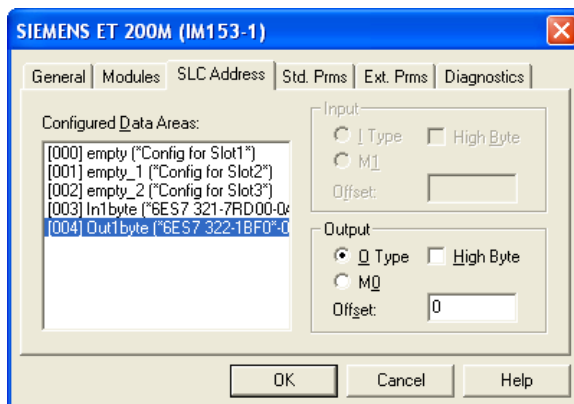
You have the option of using the default values that display in the **Offset** fields, or of selecting each Configured Data Area and entering your own values.

> ### Note
>
> The software attempts to make the best use of the available memory in the Input and Output files by packing the data. When modifying the offsets and using the M files, you should avoid leaving large gaps between blocks of data.

14. Select the **Ext. Prms** tab (if it exists).

Figure 29:   Slave Properties Window, Ext. Prms Tab
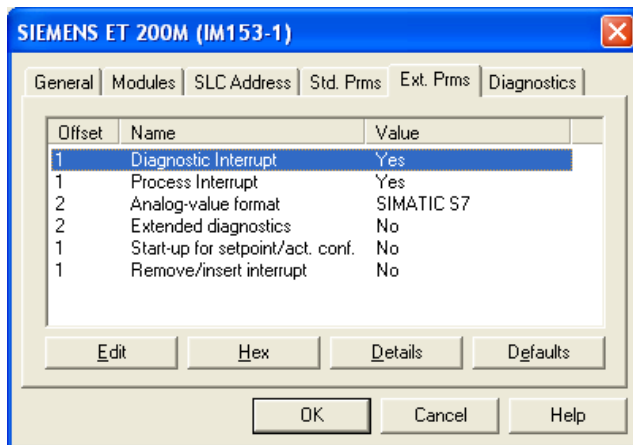
15. Configure any parameters that need to be set:

- **Edit** - Allows you to change a parameter's value. You can also double-click on a parameter to edit.

- **Hex** - Displays parameters data in hex format

- **Details** - Displays parameter characteristics

- **Offset** - Parameter byte offset. The first parameter starts at offset 0.

- **Name** - Parameter name

- **Value** - Displays as text (where available) or a numeric value

You may now need to configure module parameters, via the **Modules** tab.

16. Select **OK**.

17. Repeat steps 8-15 until all of your Slaves are configured and exist under your Master in the Network View.

18. Right-click on **PROFIBUS-DP** in Network view and select **Properties** from the shortcut menu. The Network window displays.

Figure 30:   Network Window, General Tab
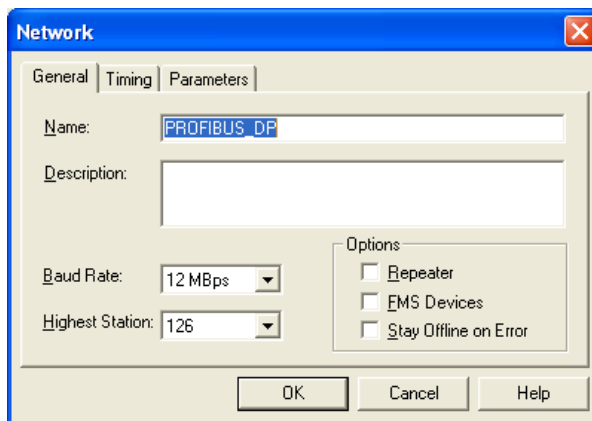
19. Configure the following parameters according to your PROFIBUS network:

- **Name** - Name of the network.

- **Description** - Description of the network.

- **Baud Rate** - Baud rate of the PROFIBUS network.

- **Highest Station** - Highest allowed station address for any active station on the network. The highest station affects how much time is spent soliciting for new nodes.

- **Options** - These affect the network parameters that the Configuration Tool assigns:

  - **Repeater** - Indicates whether or not there are any repeaters on the network

  - **FMS Devices** - Indicates whether or not there are any FMS devices on the network.

  - **Stay Off-line on Error** - Indicates whether or not the card stays off-line when Token Error Limit or Response Error Limit is exceeded within 256 token cycles.

20. Click **OK**.

21. Select **File>Save**. The Save As window displays.

Figure 31:   Save as Window
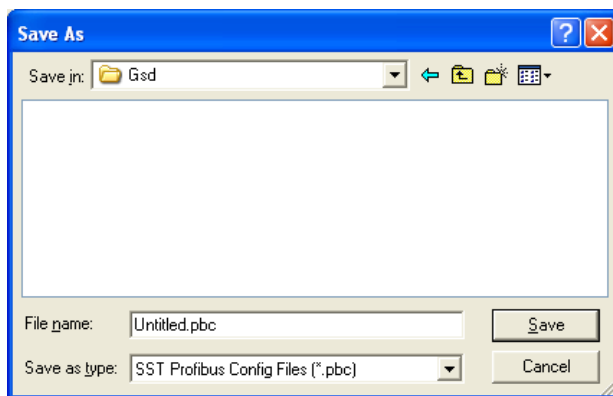
22. Specify a filename and location for your configuration and select **Save**. This saves your project as a .pbc file.

4.3 Downloading to the Scanner

4.3.1 Downloading the DP Master Configuration File to the Scanner

Use the serial CONFIG port on the front of the scanner to download configuration files.

The serial cable for a standard PC COM port must have lines 2 and 3 swapped. No handshaking is required. Pins 2 and 3 are wired the same as a PC 9-pin COM port.

Figure 32:   Serial Port Wiring
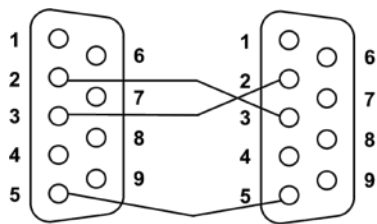
If you are using HyperTerminal, refer to Section 4.6 , Downloading the I/O Configuration to the Scanner Using HyperTerminal for detailed information.

4.3.2 Downloading to the Scanner via the SST PROFIBUS Configuration Tool

1. Verify that the SLC PLC is in Program mode.

2. Connect the modem serial cable between the PC COM port and the scanner serial port (top one).

3. In your Master configuration, right-click on **Master** to display the shortcut menu.

   Figure 33:   Shortcut Menu

4. Select **Connect**. You can also select the first icon above PROFIBUS-DP *. If you do not have a mouse, select **Connect** from the Edit menu.

You may be prompted with a message indicating a configuration mismatch between what is in the scanner and your current PROFIBUS project. In this case, select **Yes** to retain your configuration.

Figure 34:   Configuration Mismatch Dialog
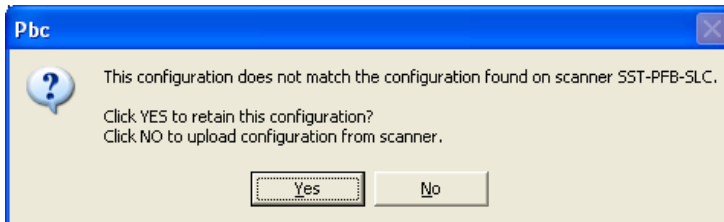
Any configuration mismatches are listed under the Master status.

Figure 35:   List of Configuration Mismatches

5. Load the configuration to the Master via one of the following methods:

- Right-click on the Master and select **Load Configuration**.

   Figure 36:   Shortcut Menu

   OR

- Select the **Load Configuration** icon in the toolbar. If the scanner is online, the following message displays:

   —Card is online. Do you want to load configuration?

6. Select **Yes** to load your new configuration. The Master status now changes to Configured Program mode.

   Figure 37:   Master Status of Configured Program
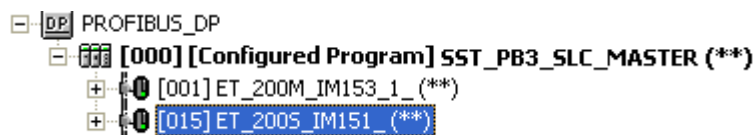
   Your scanner is now configured and ready.

4.3.3 Monitoring the Scanner via the SST PROFIBUS Configuration Tool

1. Verify that the scanner is online by switching the SLC PLC to Run mode. Both the COMM (green) and SYS (red) LEDs should be ON.

2. Right-click on the Master and select **Connect** from the shortcut menu.

Note

> You may get a message indicating a configuration mismatch. Select **YES** to retain and download the configuration.

3. Select the **Online** icon in the toolbar. The Master should now display either:

Figure 38:   Master Status OK
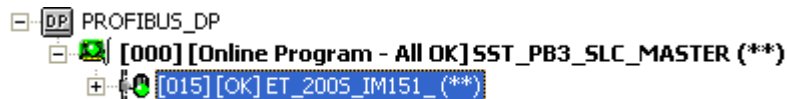
OR

Figure 39:   Master Status Error

If this displays, refer to Section 4.3.5, Diagnosing Slave Errors in the SST PROFIBUS Configuration Tool.

4.3.4 Reconnecting to the Scanner that is Already Configured and Online

1. Right-click on the Master and select **Connect** from the shortcut menu.

Note

You may get a message indicating a configuration mismatch. Select **YES** to retain the configuration and download the configuration.

2. Select the **Online** icon in the toolbar. The Master should now display either:

Figure 40:   Master Online, All OK
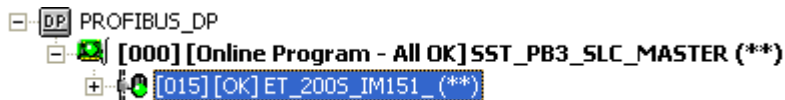
OR

Figure 41:   Master Online, Error
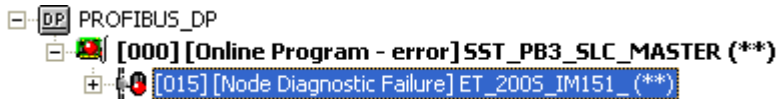
If this displays, refer to Section 4.3.5, Diagnosing Slave Errors in the SST PROFIBUS Configuration Tool, for further information.

4.3.5 Diagnosing Slave Errors in the SST PROFIBUS Configuration Tool

1. To diagnose Slaves in error (Red status), right-click on the Slave with the error.

    Figure 42:   Configuration Tool

2. Select **Diagnostics** from the shortcut menu.

    Figure 43:   Shortcut menu

    A Slave Diagnostics window displays, indicating the errors specific to that Slave.

    Figure 44:   Slave Diagnostics Window
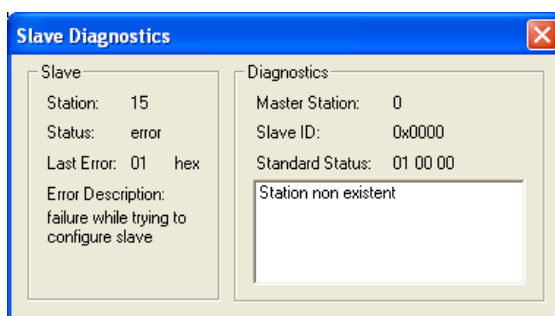
3. Troubleshoot your Slave errors as required (refer to Section 4.4, Troubleshooting).
    Once you have verified that all errors have been corrected, right-click on the Master and
    select **Disconnect**.

4.4 Troubleshooting

This section supplies troubleshooting details for messages that may be displayed during configuration or programming.

Station Non-Existent

Check the Slave PROFIBUS interface to ensure that it's powered on and connected to your network. The Slave might not support the configured baud rate, which can happen when using the incorrect GSD file for a Slave.

Configuration Data Fault

Check that the I/O modules are configured in the order they appear in the Slave device and that they match the exact description of the modules you selected (i.e., module serial number).

Station Not Ready

This message will appear if there are outstanding errors, or if you are trying to scan the Slave too quickly. This may be caused by using a wrong GSD file.

Extended Diagnostic Data

This data is device specific. Retrieve it by requesting Slave diagnostics in your RSLogix 500 program. Extended diagnostic data starts at byte 7 of the Slave diagnostics. Compare the values with descriptions that may be given for your Slave by viewing the Slave's properties and selecting the **Diagnostics** tab in the SST PROFIBUS Configuration Tool.

Function Not Supported

The slave does not support commands such as **Sync** or **Freeze** coming from the Master. Check that you are using the correct GSD file.

Invalid Slave Response

This usually occurs when the Slave is returning more diagnostic information than the Master can handle. Check your GSD file.

Parameter Fault

This usually means that an incorrect Indent - Number or Invalid parameter was sent to the Slave. Check that you have set the Slave parameters correctly by viewing the Slave's properties and selecting the **Ext. Prms** tab. Also, view the module parameters by selecting the **Modules** tab under Slave properties, checking the module's properties and selecting the **Ext. Prms** tab.

Master Lock

The DP Slave has been parameterized by another Master. Put the controlling Master offline.

Param/Config Required

This message remains present until the parameterization has been completed properly. You may be using the incorrect GSD file or haven't set the Slave and module parameters to the correct values. These can be found under the **Ext. Prms** tab.

Static Diagnostics

Check your Slave diagnostic data in the scanner status area by writing the Slave station number to M1:x.3828. The Slave diagnostics show up, starting at M1:x.3829.

DP Slave Set

This is OK and is set by the Slave.

WatchDog

This is OK and should be set when the Slave status is OK.

Ext Diags Overflow

More Diagnostic data is being returned from the Slave than what is specified in its GSD file. You may be using an incorrect GSD file.

4.5 Importing the DP Master Binary Configuration (.bss) Using the SST PROFIBUS Configuration Tool

1. Select **File>New**.

2. Select **Edit>Import Binary** from the menu.

Figure 45:   Import Binary Command
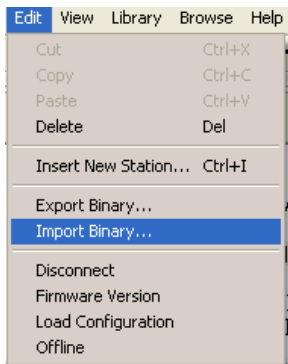
OR

Select the **Import Binary** icon from the toolbar. The Open window displays.

Figure 46:   Open Window
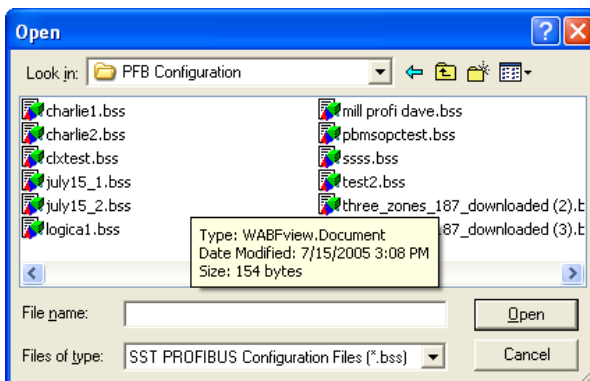
3. Select and open your .Bss file. The Import Wizard displays.

Figure 47:   Import Wizard
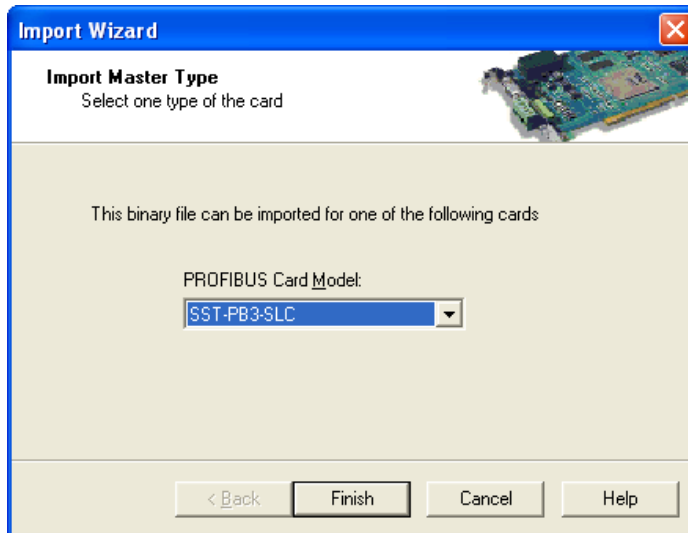
4. From the dropdown menu, select **SST-PB3-SLC**.

5. Select the **Next>** or **Finish>>** button. If you have multiple GSD files for the same Slave
    in your binary configuration, select the **Next>** button and follow the process to assign the
    correct GSD file.

6. Select **Finish>>**.

7. Select **File>Save**.

4.5.1 Uploading the DP Master Configuration File from the Scanner Using the SST PROFIBUS Configuration Tool

1. Verify that the SLC PLC is in Program mode.

2. Select File>New.

3. Drag and drop the scanner from the Device Library (upper left-hand side) into the Network view. The Master Properties window displays.

   Figure 48:   Master Window, General Tab
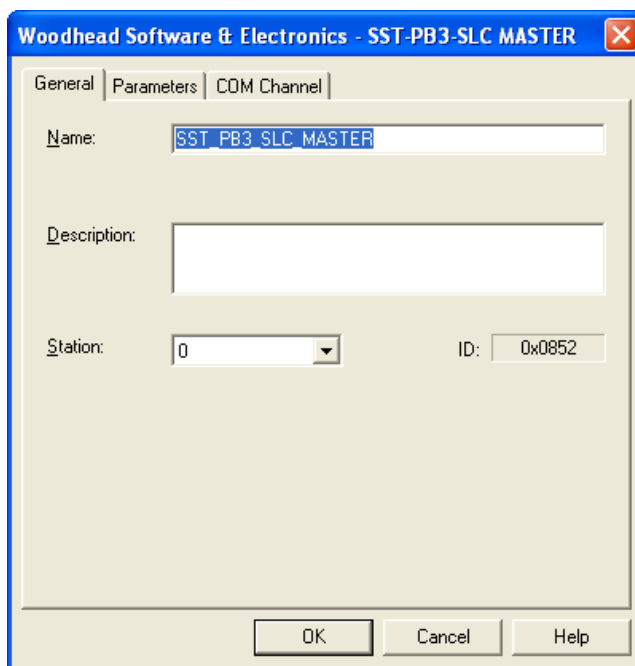
4. Select the **COM Port** tab.

5. Specify the COMM port in the **Connection** field.

Figure 49:   Master Window, COM Port Tab
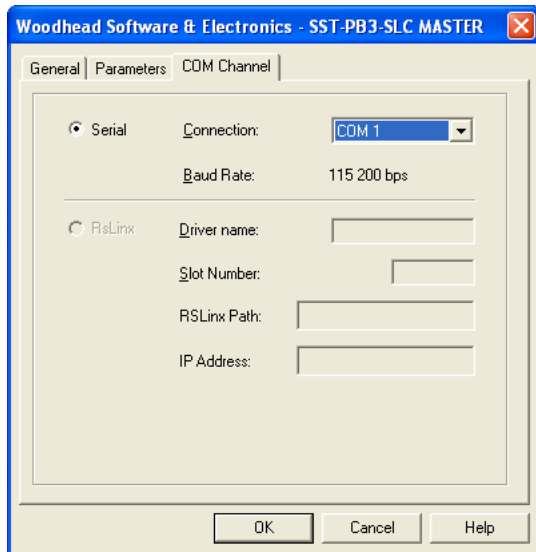
6.   Click **OK**.

7.   Right-click on the Master and select **Connect** from the shortcut menu.

8.   Select **NO** in response to the message "Do you want to ignore configuration?". You may be prompted to go through the Configuration wizard to assign the correct GSD files.

> **Note**
>
> If the PROFIBUS module is online, in order to upload the actual offsets for the slave data, the configuration tool will prompt you to take the module offline. Otherwise default offsets will be used.

9.   Select **Finish** if you went through the Configuration wizard process. You can now save this uploaded configuration as a .pbc file.

10. Select **File>Save**, assign a filename and location, and select **Save**.

11. Right-click on the Master and select **Disconnect** from the shortcut menu.

4.6 Downloading the I/O Configuration to the Scanner Using HyperTerminal

If you are using HyperTerminal, here is how to set up a connection:

1. When configuring the scanner, the SLC must be in Program mode.

2. Start HyperTerminal and create a new connection.

3. Select 115 200 baud, with no parity, 8 data bits, 1 stop bit and no flow control. The scanner serial port supports any baud rate from 9600 to 115 200 baud, but 115 200 is the suggested rate.

4. Type an asterisk (*) to get the scanner's attention. You may need to type several asterisks to let the scanner auto-detect the baud rate being used. The scanner displays the following message, followed by a ">" prompt at the terminal:

    ```
    ;Copyright (c) 1995-2009 WSE, a division of Molex.
    For SST-PB3-SLC Card
    Version x.xx

    Reading Configuration from FLASH...
    ```

5. The scanner is now in CONFIG mode. While in CONFIG mode, the scanner LEDs are off. You can't put the scanner online until you exit CONFIG mode.

> **Note**
>
> If the module has no configuration in flash, the following message is displayed in HyperTerminal:
>
> ```
> Error '30' while Reading FLASH
> Don't understand saved configuration…
> Clearing configuration
> pfbStnAddr = xxx
>
> Master Parameters Cleared
> Error '30' while clearing FLASH
> ```
>
> Once a configuration is saved in flash, this error will no longer occur.

6. To download a .bss DP Master configuration file, issue the RecBssXmodem command, then initiate an XModem file download from your communication software. Refer to the

documentation supplied with your Communication software for more detailed information.

7. To download a .2bf DP Master configuration file, issue the Rec2bfXmodem command, then initiate an XModem file download from your communication software.

8. Type Exit to end the Serial communication.

9. If prompted with:

```
Configuration has changed. Do you want to UPDATE FLASH? (y/n)
```

Type "y" and press ENTER to accept.

Note

When you download a Configuration file to the scanner, the configuration is stored in memory on the scanner. Use the UpdFlash command to store the configuration into flash memory.

4.6.1 Listing Available Commands

Once you are talking to the scanner, type `Help` at the terminal to view a summary of the available commands. Not all available commands are listed in the main Help. There are several additional Help commands to display the other ones.

The following table lists commonly used serial port commands:

Table 9:   Commonly Used Serial Port Commands

Command	Function
Ver	Displays the version number of the firmware running on the scanner.
Help	Displays the general help screen.
HelpNet	Lists commands to set network parameters.
HelpMas	Lists commands related to DP Master operation.
HelpSlv	Lists commands related to DP Slave operation. Refer to Chapter 7, Using the Scanner Module as a DP Slave, for more information.
HelpMsg	Lists the FDL message blocks configuration commands.
HelpSAP	Lists the FDL SAP configuration commands.
ShowNet	Displays network parameters.
ShowMas	Displays the DP Master configuration.
ShowSlv	Displays the DP Slave configuration. Refer to Chapter 7, Using the Scanner Module as a DP Slave, for more information.
ShowMsg	Displays the enabled/disabled status of FDL messaging.
ShowSAP	Displays the FDL SAP configuration.
RecBssXmodem	Receives a DP Master configuration exported as a binary file from the SST PROFIBUS Configuration Tool. Initiates the download of your DP Master Binary configuration exported from the Configuration Tool.
Rec2bfXmodem	Uploads a DP Master configuration exported as a binary file from Siemens COM PROFIBUS.
UpdFlash	Stores the current network and DP Master configuration into flash memory.
Exit	Exits terminal mode and puts the module in Offline state.

4.7 Errors

4.7.1 Network Parameter Errors

The following status errors may occur when setting network parameters. Values are in hexadecimal.

Table 10:   Network Parameter Errors

Value	Error Type
02h	STS_BAD_BAUD
03h	STS_BAD_STN_ADR
04h	STS_BAD_HI_STN_ADR
05h	STS_BAD_TOK_ROT
06h	STS_BAD_SLOT_TME
07h	STS_BAD_IDLE_1
08h	STS_BAD_IDLE_2
09h	STS_BAD_RDY_TME
0ah	STS_BAD_QUI_TME
0bh	STS_BAD_GAP_UPD
0ch	STS_BAD_TOK_RETRY
0dh	STS_BAD_MSG_RETRY
0eh	STS_BAD_TOK_ERR_LIM
0fh	STS_BAD_RSP_ERR_LIM
10h	STS_BAUD_DET_ERROR

4.7.2 Binary File Configuration Errors

The following errors occur when configuring the scanner using a binary file generated by your configuration software.

Table 11:   Binary File Configuration Errors

Value	Error Type
20h	STS_CFG_BAD_CHK_PATTERN
21h	STS_CFG_BIN_TOO_SHORT
22h	STS_CFG_BIN_TOO_LONG
23h	STS_CFG_BAD_CHKSUM
24h	STS_CFG_INVALID_CPU_HDR
25h	STS_CFG_INVALID_SLV_REC_TYP
26h	STS_CFG_RX_OVERFLOW
27h	STS_CFG_TX_OVERFLOW
35h	STS_CFG_MAS_EXT_ALLOC_ERROR

- Error 20h occurs if you are using old firmware with the SST PROFIBUS Configuration Tool or firmware version 1.5x or later with the old Configuration Tool beta (ver 0.x).

- Error 23h typically occurs when new firmware has just been loaded. Issue the **ClrMas** command and try downloading again.

- Error 25h occurs when you use the incorrect command. Use Rec2bfXmodem for binary files from Siemens COM PROFIBUS and RecbssXmodem for binary files from the Configuration Tool.

4.7.3 Flash Programming Errors

The following errors may occur when programming flash memory.

Table 12:   Flash Programming Errors

Value	Error Type	Meaning
30h	STS_CFG_NO_CONFIG	No configuration present to program into flash.
31h	STS_FLASH_BAD_ID	Internal flash error.
32h	STS_FLASH_ERASE_ERR	Internal flash error.
33h	STS_FLASH_PROG_ERR	Internal flash error.
34h	STS_FLASH_VRFY_ERR	Internal flash error.

4.7.4 COM PROFIBUS Address Assignment Errors

Table 13:   COM PROFIBUS Address Assignment Errors

Value	Meaning
37h	Address out of range. The address assigned in COM PROFIBUS is outside the allowed range; for example, P66.
38h	Copy table overflow. This happens when I/O modules addresses are too fragmented. Try putting modules at consecutive addresses, grouping input and output modules, and so on.

4.7.5 Fatal Errors

The following errors are fatal. You must power down the system and restart it to clear them

Table 14:   Fatal Errors

Value	Error Type	Meaning
80h	STS_CFG_INTERNAL_ERROR	Internal error.
81h	STS_OUT_OF_APBS	Out of application blocks.
82h	FATAL ERROR:pfb Status=82,errArg=00,interr=00	The Host did not kick the watchdog within the watchdog period.
83h	STS_HEAP_ALLOC_FAIL	Internal error.
84h	STS_SH_HEAP_ALLOC_FAIL	Internal error.

If the status register contains STS_CFG_INTERNAL_ERROR (80h), there has been an internal error on the scanner. Record the contents of the errInternal and errArg registers and contact Technical Support (for details, refer to Section C.3, Technical Support). ErrInt is stored in the high byte of register 4129 of the m1 file. ErrArg is stored in the low byte of register 4130 of the M1 file and also in register 4012 of the M1 file.

Another way of notifying the user that a fatal error occurred is through the SYS LED blinking an 8-bit error code (green for 1, red for 0), call Technical Support. This error reporting method is used when the severity of the error prevents the scanner from running and notifying the SLC accordingly.

Table 15:   Fatal Errors Reported by SYS LED

Code	Possible Reason
10h	On startup, SLC ASIC memory test failure.
14h	On startup, internal memory test failure.
15h	Catastrophic internal failure.

4.8 Running the Scanner

With the SLC in Run mode, the scanner scans the PROFIBUS I/O network. You can now begin accessing the data at the addresses that have been assigned in the Configuration Tool.

4.8.1 SLC Modes

The scanner's mode of operation follows the SLC mode of operation (Program, Test, Run).

- When the SLC is in Program mode, the scanner outputs are off and inputs hold their last state.

- When the SLC is in Test mode, inputs are read and updated but outputs are off.

- When the SLC is in Run mode, the scanner updates inputs and outputs.

4.8.2 SLC Fault Codes

The scanner may fault the SLC with one of the following error codes (x being the slot number of the slot occupied by the scanner).

Table 16:   SLC Fault Codes

Code	Possible Reason
x61	Configuration faults. This happens when you try to go online with invalid configuration information. I/O faults. This can be caused by Slaves in error or by mismatches between the configured and actual Slave types.
x62	This happens when you are in configuration mode (using the serial port to talk to the scanner) and try to put the SLC in RUN MODE.
x70	Catastrophic internal failure. Call Technical Support.

4.8.3 Using the Watchdog Timer

During a power "brown-out", the AB SLC Processor can enter a reset condition, while the SST-PB3-SLC module remains fully functional. Although all SLC Scanner product installations should have adequate power conditioning and power failure equipment, brown-outs can still occur. To ensure that the SST-PB3-SLC returns the fieldbus to a known, safe state, a watchdog timer has been implemented in the firmware.

4.8.4 How the Host Watchdog Works

After the scanner has been reset or powered up, a default time of 1000 ms is used for the watchdog period, which exists for communications with the SLC Processor. If the scanner does not get an I/O update from the SLC processor within this timeframe, the scanner faults.

The watchdog timer, may be set to a different value, in multiples of 10 milliseconds, by writing the contents of the S:3 work (from the SLC Processor's status file) to the M:0[slot].4011 register. The firmware takes the upper 8 bits of the S:3 word (the maximum scan time setting) and applies it as the new watchdog period. Your program can now control the scanner watchdog time and avoid any false faults that result from an extended processor scan time.

Logic Example

You can use the following rung of logic to automatically have the scanner's watchdog period track that of the SLC processor.

Figure 50:   Logic Example
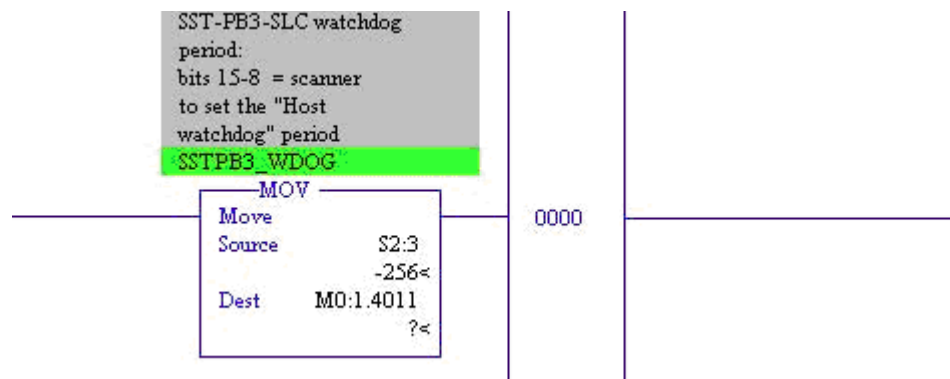
The SST-PB3-SLC is located in the first slot of the SLC rack. The watchdog register is M0:1.4011.

5

DP Master Application Example

Chapter Sections

- Example: Accessing Data

5.1 Example: Accessing Data

The following example shows how to:

- Use an internal SLC file to set up the Ignore Slave Status table (see Section 10.4, DP Master Slave Status Table) and copy it to the scanner on the first scan. Most users will not want to use the Global Fault Enable since they will not want the SLC CPU to fault on a Profibus fault. However, for those who need the card to behave in this manner, this example shows how.

- Use a delay at startup to allow Slaves to go online before you configure the module to generate a fault, if any DP Slaves are faulted

- Use internal SLC timers to distribute access to the M0 and M1 files over time to minimize the impact on the SLC logic scan

Figure 51:   Sample Program
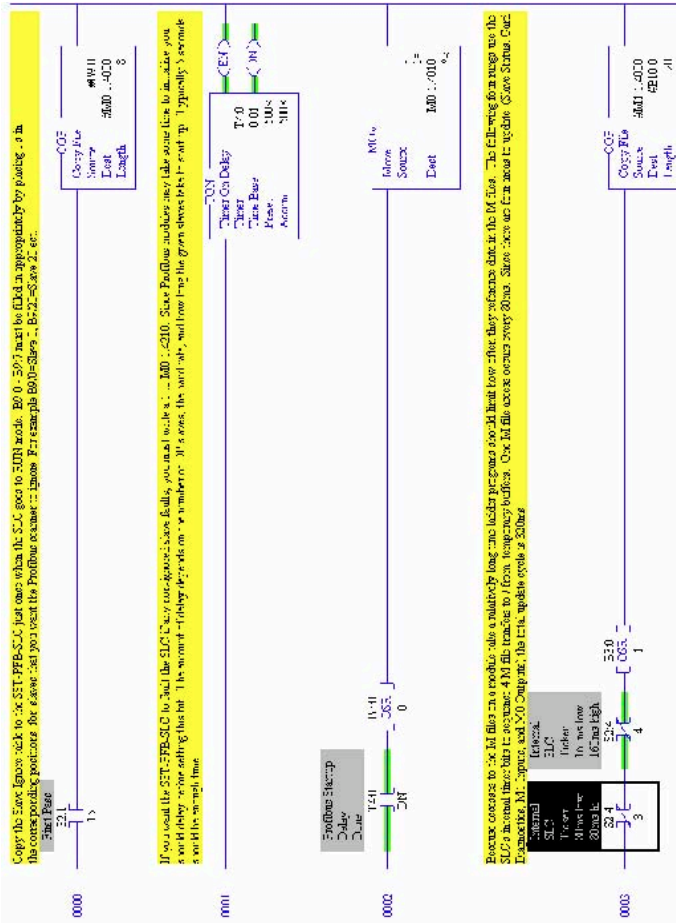
(Continued on following page).

(Figure 52, continued).

80ms timer
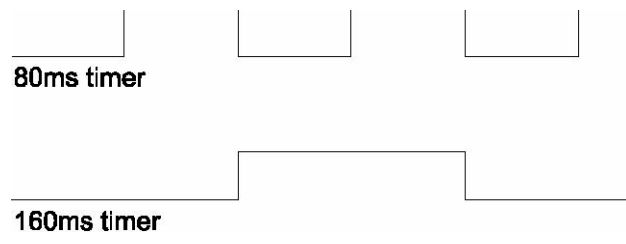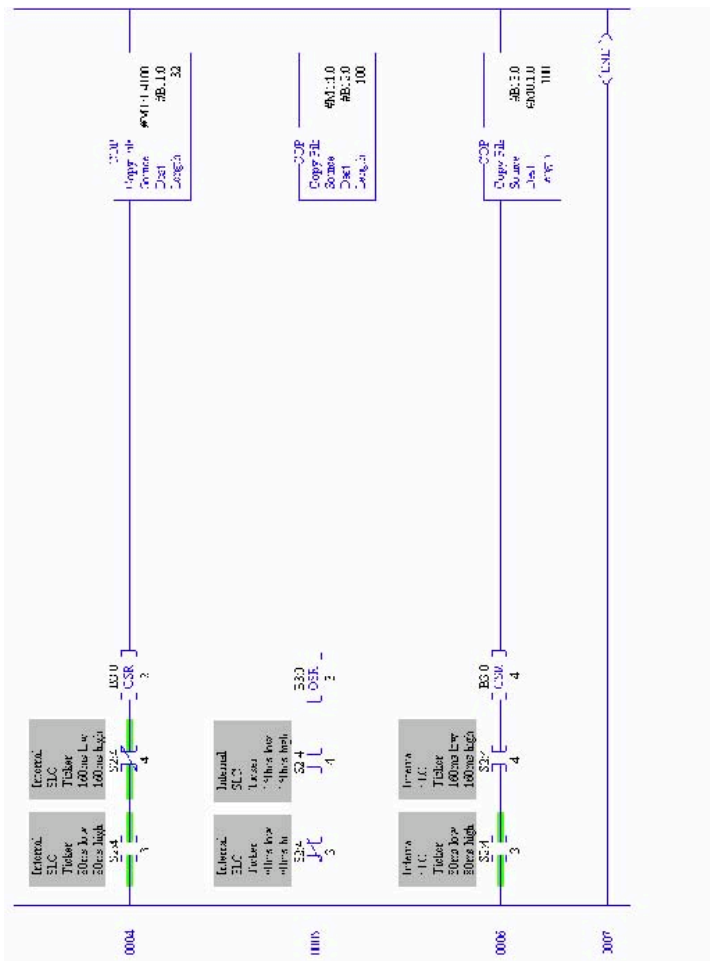
160ms timer

The program uses 80 ms and 160 ms internal timers to implement four states, with a combined period of 320 ms. The OSR instructions ensure that the SLC executes the COP instruction only at the start of one of these states. The result is that all four blocks are accessed within the 320 ms combined period of the two timers.

6

Using COM PROFIBUS with the SST-PB3-SLC Card

Chapter Sections:

- Addressing

- 32 Discrete Output Module

- 32 Discrete Input Module

- Example: M0/M1 Addressing

- Example: Using Flex I/O

- Creating an I/O Configuration in COM PROFIBUS

6.1 Addressing

The scanner occupies slot 2 in the SLC rack. The following table shows the modules in the I/O configuration, the address assigned in COM PROFIBUS, and the location of the I/O data in the SLC.

Table 17:   Module Addresses

Module	Address in COM PROFIBUS	Address in SLC
32DO	P0	O:2.0 O:2.1
8DO/DI	out P4	O:2.2 low byte
	in P4	I:2.2 low byte
32DI	P0	I:2.0 I:2.1
8DO/24DI	out P6	O:2.3 low byte
	in P6	I:2.3 I:2.4 low byte

6.2 32 Discrete Output Module

The following table shows where the data appears in the SLC for a Siemens ET200B 32DO module mapped at different addresses in COM PROFIBUS (the scanner is in slot 2).

Table 18:   Siemens ET200B Discrete Output Module Addresses

Module Data Address	Module Starting Address in COM PROFIBUS			
	P0	P1	Q0	Q1
Q0.0	O:2.0/0	O:2.0/8	M0:2.0/0	M0:2.0/8
Q0.7	O:2.0/7	O:2.0/15	M0:2.0/7	M0:2.0/15
Q1.0	O:2.0/8	O:2.1/0	M0:2.0/8	M0:2.1/0
Q1.7	O:2.0/15	O:2.1/7	M0:2.0/15	M0:2.1/7
Q2.0	O:2.1/0	O:2.1/8	M0:2.1/0	M0:2.1/8
Q2.7	O:2.1/7	O:2.1/15	M0:2.1/7	M0:2.1/15
Q3.0	O:2.1/8	O:2.2/0	M0:2.1/8	M0:2.2/0
Q3.7	O:2.1/15	O:2.2/7	M0:2.1/15	M0:2.2/7

6.3 32 Discrete Input Module

The following table shows where the data appears in the SLC for a Siemens ET200B 32DI module mapped at different addresses in COM PROFIBUS (The scanner is in slot 2.).

Table 19:   Siemens ET200B Discrete Output Module Addresses

Module Data Address	Module Starting Address in COM PROFIBUS			
	P0	P1	Q0	Q1
I0.0	I:2.0/0	I:2.0/8	M1:2.0/0	M1:2.0/8
I0.7	I:2.0/7	I:2.0/15	M1:2.0/7	M1:2.0/15
I1.0	I:2.0/8	I:2.1/0	M1:2.0/8	M1:2.1/0
I1.7	I:2.0/15	I:2.1/7	M1:2.0/15	M1:2.1/7
I2.0	I:2.1/0	I:2.1/8	M1:2.1/0	M1:2.1/8
I2.7	I:2.1/7	I:2.1/15	M1:2.1/7	M1:2.1/15
I3.0	I:2.1/8	I:2.2/0	M1:2.1/8	M1:2.2/0
I3.7	I:2.1/15	I:2.2/7	M1:2.1/15	M1:2.2/7

6.4 Example: M0/M1 Addressing

The scanner occupies slot 2 in the SLC rack. An 8DO/24DI module is assigned output address Q240 and input address Q250 in COM PROFIBUS. The output data is found at M0:2.120 low byte. The input data is found at M1:2.125 and M1:2.126 low byte.

6.5 Example: Using Flex I/O

When you configure the Flex I/O using COM PROFIBUS, always configure 18 slots, even if the slots are empty. The first two slots are used for status, with the first slot configured as an input word and the second slot as an output word. The remaining 16 slots are used for I/O modules. For each module, configure two slots.

The following table shows how to configure the various Flex I/O modules. An entry of 000 means "do not configure a length" for that slot.

Configure the I/O address as a P address so that the data maps into the I or O file in the SLC for fast access, and the status part of the address as a Q address, so that the data maps into the M area.

Table 20:   Flex I/O Module Configurations

Module	First Slot	Second Slot
1794-IB16	1 word in	1 word out
1794-OB16	000	1 word out
1794-IB8S	1 word in	1 word out
1794-IA8	1 word in	1 word out
1794-OA8	000	1 word out
1794-OW8	000	1 word out
1794-IE8	9 words in	1 word out
1794-OE4	1 word in	6 words out
1794-IEX4OE2	5 words in	4 words out
1794-IR8	11 words in	3 words out
1203-FM1	6 words in	5 words out
1794-IB16 full format	1 word in	000
1794-OB16 full format	000	1 word out
1794-IB8S full format	1 word in	000
1794-IA8 full format	1 word in	000
1794-OA8 full format	000	1 word out
1794-OW8 full format	000	1 word out
1794-IE8 full format	9 words in	000
1794-OE4 full format	1 word in	4 words out
1794-IEX4OE2 full format	5 words in	2 words out
1794-IR8 full format	11 words in	000
1203-FM1 full format	4 words in	3 words out

Assign an address for each slot with a configured length.

In the following example, the first module is a 1794-IB16, the second is a 1794-OB16, and the third is a 1794-IE8. The scanner is in slot 2 of the SLC rack.

Table 21:   Example of Module Input and Output Addressing

Module	Slot	Assigned Type	I Addr	O Addr
Pre-assigned	0	1AI	Q0	-
Pre-assigned	1	1AO	-	Q2
1794-IB16	2	1AI	P0	-
	3	1AO	-	Q4
1794-OB16	4	000	-	-
	5	1AO	-	P2
1794-IE8	6	9AI	P4	-
	7	1AO	-	Q6
Empty	8	000	-	-
	9	000	-	-
Empty	10	000	-	-
	11	000	-	-
Empty	12	000	-	-
	13	000	-	-
Empty	14	000	-	-
	15	000	-	-
Empty	16	000	-	-
	17	000	-	-

The input data for the 1794-IB16 maps into I:2/0 to I:2/15. The output data for the 1794-OB16 module maps into O:2/16 to O:2/31.

6.6 Creating an I/O Configuration in COM PROFIBUS

Use Siemens's COM PROFIBUS software to configure a Master/Slave system on the SST-PB3-SLC.

The COM PROFIBUS software does the following:

- Calculates all the details for each Slave. For example, the configuration check data and the watchdog factors.

- Calculates the details for the entire collection of Slaves. For example, the target token rotation time.

- Assigns appropriate values for all the network parameters and includes them in the binary file

To use the SST-PB3-SLC with COM PROFIBUS, install the update files for the SST-PB3-SLC in the appropriate COM PROFIBUS directories. These files can be downloaded from the www.molex.com website.

This procedure describes the steps to create a binary file for configuring the SST-PB3-SLC as a DP Master. In this procedure, the network being configured consists of only PROFIBUS DP remote I/O devices. For detailed information, refer to the COM PROFIBUS software documentation.

1. Create a new file (File/New).

2. Select the Master station number. This sets the scanner's station number on the PROFIBUS network.

3. For the Master station type, select **SST-PB3-SLC Master**. If the update files for the SST-PB3-SLC have not been installed, set the Master station type to be IM 308-C and the host type to S5-115U/ CPU 944A or S5-115U/CPU 944B.

4. Select **Configure/Bus parameters...**

   - Set the baud rate for the network

   - If there is a repeater on the bus, check the Repeater on bus checkbox

   - If there are FMS devices on the network, change the Bus profile to DP/FMS

   - If the network has only PROFIBUS DP devices, leave the bus profile as PROFIBUS-DP. COM PROFIBUS takes care of assigning appropriate default values for all the network parameters.

5. Click **OK**.

6. Select **Configure/Slave parameters...** to create and configure each Slave:

   - Select the Slave station number

   - Select the Slave device family

   - Select the Slave station type

   - Select the Slave module type

4. Click Configure... to assign the Slave's I/O addresses. These determine where the Slave data appears in the SLC. For detailed information on addressing, refer to Section 6.6.1, Mapping the Addresses.

5. After all the Slaves have been configured, select **File>Save**.

6. Export the configuration to a binary file (File/Export/Binary File). This generates a .2bf file.

> **Note**
>
> If there are multiple Masters on the same network, include both Masters in the COM PROFIBUS file. Select the Master system to export and COM PROFIBUS will take care of increasing the target token rotation times, watchdog times, and so on, to appropriate values.

> **Note**
>
> The I/O addresses determine where the Slave data maps into the SLC data table. Siemens inputs P0 to P63 map into I0 to I31. Siemens outputs P0 to P63 map into O0 to O31.

6.6.1 Mapping the Addresses

The addresses assigned in the Configuration Tool determine where the I/O data for the module appears in SLC memory.

Note

> If you do not assign an address to a module, the data for that module will be unavailable.

Addresses in the P range appear in the SLC's I and O areas. Addresses P0 to P63 map to I0-31 for inputs and O0-31 for outputs.

Note

> P addresses in the Configuration Tool are byte addresses, while I and O addresses in the SLC are word addresses.

Addresses in the Q range appear in the M0 area (outputs) and the M1 area (inputs). Addresses Q0 to Q255 map to M1:0-127 for inputs and M0:0-127 for outputs.

Note

> Q addresses in the Configuration Tool are byte addresses, while the SLC's M0 and M1 addresses are word addresses.

- For analog or word modules, assign addresses on even boundaries.

- For 8-bit modules, if the address is even, the module occupies the low byte of the register. If the address is odd, it occupies the high byte.

- Whenever possible, assign addresses so that everything maps into the I and O areas of memory. Accessing data in the M0 and M1 area slows the overall SLC scan.

7

Using the Scanner Module as a DP Slave

Chapter Sections:

- Overview

- Serial Port Setup

- Using the Module as a DP Slave Only

- Slave Received Data

- Slave Transmit Data

- Displaying the DP Slave Configuration

- Saving the DP Slave Configuration to Flash

- Disabling DP Slave Operation

- Exiting Configuration Mode

7.1 Overview

This chapter explains how to use the scanner module as a DP Slave.

You can configure the scanner module to act as a DP Slave to another DP Master on the same network. For example, this feature can be used to pass data in a distributed system, or to/from an operator interface. The DP Slave operation can only be configured from the serial port.

Note

The scanner module does not check for address conflicts between the DP Master and DP Slave operations. You are responsible for ensuring that addresses have been assigned without conflicts or overlaps.

If you are configuring the SST-PB3-SLC as a Master with its own Slaves, you must create the Master file separately.

7.2 Serial Port Setup

For a general description of the serial port settings, see Section 3.3.2, Serial Port Wiring.

To set up the serial port, follow these steps:

1. Start a HyperTerminal session.

2. Set the baud rate to 115 200, 8 data bits, no parity, 1 stop bit and No Flow Control.

3. Put the SLC into PROG mode and then type several asterisks, "*".

Note

If you are using the SST-PB3-SLC as a DP Slave only, proceed to Section 7.3, Using the Module as a DP Slave Only. If you are using the card as both a DP Master and DP Slave, proceed to Section 7.4, Slave Received Data.

7.3 Using the Module as a DP Slave Only

If you are using the scanner module s a DP Slave only, you'll need to clear any DP Master configuration currently stored in the module. Issue the **ClrMas** command.

Several network parameters must be set from the serial port before the module is put online. To begin, issue the **ClrNet** command to reset all network parameters to default. At a minimum, set the local station number and baud rate and make sure that the station is passive, not active. The module sets appropriate default values for the remaining network parameters.

If the station is to be active, and if there are repeaters or FMS devices on the network, set the network options so that the module can set appropriate values for the network parameters. If the station is passive, most of them are not needed.

7.3.1 Local Station

To set the local station number, issue the **LocStn** command with the station number (0-125) as a parameter.

Example

```
LocStn 22
```

7.3.2 Active/Passive

To set the station to be passive, issue the **Active 0** command. If you have issued the **ClrMas** command, this should already be 0.

7.3.3 Baud Rate

To set the baud rate, issue the **Baud** command with the baud rate as a parameter. Allowed values for this parameter are 9k6, 19k2, 31k25, 45k45, 93k75, 187k5, 500k, 750k, 1m5, 3m, 6m and 12m.

Example

Issuing **Baud 1m5** sets the baud rate to 1.5 Mbaud.

7.3.4 Other Network Options

- To tell the module that there are one or more repeaters on the network, issue the **Repeater 1** command from the serial port.

- To tell the module that there are FMS devices on the network, issue the **FmsDevices 1** command from the serial port.

7.3.5 Displaying Network Settings

To display the current network parameter settings, issue the **ShowNet** command from the serial port.

7.4 Slave Received Data

Received data is data received from the remote Master. It has the following capabilities:

- From 0 to 122 words

- The data can be configured to be partly in the input file and partly in the M1 file

- Up to 32 words can be put in the input file

- All received data can be put in the M1 file, if desired

- Data in the input file can be accessed more quickly than data in the M1 file, but the more DP Slave data you put in the input file, the less input data you can scan with the module acting as a DP Master

In the M1 file, DP Slave received data always starts at offset 1000. To set the received data length and location, use the **SlvRxLen** command, using the following three parameters:

- <io>: the offset of the received data in the input file (0-31)

- <il>: the length of received data in the input file (0-32)

- <ml>: the length of received data in the M1 file (0-122)

The format of the command would be:

```
SlvRxLen <io> <il> <ml>
```

Example

If you enter `SlvRxLen 30 2 10`, there will be two words of received data in the input file, starting at offset 30, and ten words of received data in the M1 file, starting at offset 1000. There are a total of 12 words of received data.

7.5 Slave Transmit Data

Transmit data is the data the scanner module sends to the remote Master. It has the following capabilities:

- From 0 to 122 words of transmit data

- The data can be configured to be partly in the output file and partly in the M0 file

- Up to 32 words of transmit data can be placed in the output file.

- Data in the output file can be accessed more quickly than data in the M0 file, but the more DP Slave data you put in the output file, the less output data you can scan with the module acting as a DP Master.

Transmit data in the M0 file always starts at offset 1000. To set the transmit data length and location, use the **SlvTxLen** command, using the following three parameters:

- <oo>: the offset of the transmit data in the output file (0-31)

- : the length of transmit data in the output file (0-32)

- <ml>: the length of transmit data in the M0 file (0-122)

The format of the command would be:

```
SlvTxLen <oo> <ol> <ml>
```

Example

If you enter SlvTxLen 31 1 100, there will be one word of transmit data in the output file, starting at offset 31, and one hundred words of transmit data in the M0 file, starting at offset 1000. There are a total of 101 words of transmit data.

7.6 Displaying the DP Slave Configuration

If you issue the **ShowSlv** command from the serial port, the module displays the DP Slave configuration.

Example

If you use the **ShowSlv** command after issuing the configuration commands in the previous examples, the scanner displays:

```
DP Slave Configuration:
SlvTxLen O:x.31 Len=1 M0:x.1000 Len=100
SlvRxLen I:x.30 Len=2 M1:x.1000 Len=10
```

7.7 Saving the DP Slave Configuration to Flash

Once you are satisfied with the DP Slave Configuration, issue the **UpdFlash** command to save the configuration to flash memory.

7.8 Disabling DP Slave Operation

To clear the DP Slave configuration data and disable DP Slave operation, issue the **ClrSlv** command from the serial port.

7.9 Exiting Configuration Mode

Once you have finished all of your configurations, issue the **exit** command to exit Configuration Mode.

8

Using FDL

Chapter Sections:

- FDL (Layer 2) Messaging

- FDL Messages

- FDL SAPs

- FDL Diagnostic Counters

- FDL Network Parameters

8.1 FDL (Layer 2) Messaging

The SST-PB3-SLC can send and receive FDL (layer 2) messages. Features include:

- Support for up to 4 Service Access Points (SAPs)

- Support for up to 4 message request blocks

Messages and SAPs are enabled from the serial port and any required configuration is done from the SLC.

⚠️ **Caution**

If you are using FDL, the scanner uses words I:31 and O:31 in the I/O tables for FDL control and status. You must not configure any I/O modules to use these words, or unpredictable operation will occur.

The scanner sets the bits in the input file; the SLC application sets the bits in the output file.

8.1.1 Input Table I:31

The scanner uses the following bits in the input word:

Table 22:   Input Word Offsets

Message/SAP Block (0-3)	Bit Offsets			
SAP indication update	0	1	2	3
Message done	8	9	10	11
Message error	12	13	14	15

The subsequent sections explain how these bits are used.

8.1.2 Output Table O:31

The SLC application uses the following bits in the output word:

Table 23:   Output Word Offsets

Message/SAP Block (0-3)	Bit Offsets			
SAP indication acknowledge	0	1	2	3
Message trigger	8	9	10	11

The subsequent sections explain how these bits are used.

8.1.3 M0 and M1 Files

The scanner uses areas in the M0 and M1 files for FDL message and SAP configuration information and data.

Table 24:   M0 Offsets

M0 Offsets	Use
1122-1251	FDL message control/Tx buffer 0
1252-1381	FDL message control/Tx buffer 1
1382-1511	FDL message control/Tx buffer 2
1512-1641	FDL message control/Tx buffer 3
1642-1771	FDL SAP Tx buffer 0
1772-1901	FDL SAP Tx buffer 1
1902-2031	FDL SAP Tx buffer 2
2032-2161	FDL SAP Tx buffer 3

Table 25:   M1 Offsets

M1 Offsets	Use
1122-1251	FDL message status/Rx buffer 0
1252-1381	FDL message status/Rx buffer 1
1382-1511	FDL message status/Rx buffer 2
1512-1641	FDL message status/Rx buffer 3
1642-1771	FDL SAP Status/Rx buffer 0
1772-1901	FDL SAP Status/Rx buffer 1
1902-2031	FDL SAP Status/Rx buffer 2
2032-2161	FDL SAP Status/Rx buffer 3

8.2 FDL Messages

To enable FDL messages, issue the **EnaMsg** command from the serial port while in
configuration mode and talking to the scanner. The state of FDL messages (enabled/disabled)
is stored in flash when you exit configuration mode.

8.2.1 Setting up a Message

To set up a message block, select which message block (0-3) is being used. This determines
which of the areas in the M0 and M1 files will be used.

In the corresponding area of the M0 file, set the appropriate values in the FDL message control
block for the message.

The following table shows the offsets to the message control block elements for each of the four message control blocks (0-3), and their locations in the M0 file.

Table 26:   Message Control Block Offsets

Offset	Name	0	1	2	3
0	CntCfg	1122	1252	1382	1512
1	reserved	1123	1253	1383	1513
2	reserved	1124	1254	1384	1514
3	DstStn	1125	1255	1385	1515
4	DstSap	1126	1256	1386	1516
5	SrcSap	1127	1257	1387	1517
6	FrmCntrl	1128	1258	1388	1518
7	TxLen	1129	1259	1389	1519
8-129	TxData	1130-1251	1260-1381	1390-1511	1520-1641

To set up a message, set:

- Bits in the Control/Config register, CntCfg, if necessary.

  If you set bit 2, the scanner sends the message to its high priority queue. The scanner maintains two FDL message queues: high priority, and low priority. The scanner can send one message from the high priority queue when it gets the token, even if the token hold time has expired.

> **Note**
>
> In this case, high priority refers to how the message is processed by the scanner in getting it out on the network; it has nothing to do with a high- priority frame control value. For example, if the message type is SRDL, the message is processed as low-priority at the destination.

  If you set bit 4 in the CntCfg register, the scanner does not include this message block when it is displaying the status of FDL messages on the LED.

- The destination station, DstStn. The allowed range is 0 to 126.

- The destination SAP, DstSap, if required. This is almost always needed. The default value is 255, which means the message gets sent to the default SAP at the destination. You usually send the message to some specific SAP. The allowed range is 0 to 63, or 255.

  When you send a message with a destination SAP, the scanner automatically sets the high bit in the destination station number. Do not set the high bit when you set the destination station number.

- The source SAP, SrcSap, if required. If you are sending a destination SAP, you almost always want to send a source SAP. The default value is 255. The use of the source SAP is application and module dependent; the destination station may or may not require or use the source SAP.

- The message type, or frame control, FrmCntrl. The message type can be one of the following:

Table 27:   Message Types

Message Type	Address	Function/Description
FC_SDAl	03h	Send Data with Ack Lo Pri (SDAL)
FC_SDAh	05h	Send Data with Ack Hi Pri (SDAH)
FC_SDNl	04h	Send Data No Ack Lo Pri (SDNL)
FC_SDNh	06h	Send Data No Ack Hi Pri (SDNH)
FC_SRDl	0Ch	Send and Request Data Lo Pri (SRDL)
FC_SRDh	0Dh	Send and Request Data Hi Pri (SRDH)
FC_SmTime1	00h	First SM time message
FC_SmTime2	80h	Second SM time message
FC_SmSDN	02h	SM Send Data No ack
FC_SmSRD	01h	SM Send and Request Data
FC_SmSRDSltDel	0Ah	SM Send and Request Data Slot Del
FC_SmSRDSltKeep	0Bh	SM Send and Request Data Slot Keep
FC_DdbSRD	07h	DDB Send and Request Data
FC_DiagSRD	08h	Diagnosis Send and Request Data
FC_ReqFDL	09h	Request FDL status
FC_ReqId	0Eh	Request ID
FC_ReqLSAPSts	0Fh	Request LSAP Status

- The transmit data length, TxLen, in bytes. The allowed values are 0 to 244.

- The transmit data, TxData

8.2.2 Sending the Message

To send the message, set the appropriate trigger bit in word O:31 of the output file for the message block.

Table 28:   Message Trigger Offsets

Message/SAP Block (0-3)	Bit Offsets			
Message block	0	1	2	3
Message trigger	8	9	10	11

The scanner sends the message. Wait for the Message Done bit to be set and check the error bit in word I:31 of the input file.

Table 29:   Message Done Offsets

Message/SAP Block (0-3)	Bit Offsets			
Message block	0	1	2	3
Message done	8	9	10	11
Message error	12	13	14	15

If there is an error with the message, both the done bit and the error bit will be set.

8.2.3 Message Replies

The scanner module always fills in the message reply area in the M1 file. Some of the data comes from the destination station; some comes from the scanner.

Table 30:   Message Reply Offsets

Offset	Name	0	1	2	3
0	Reserved	1122	1252	1382	1512
1	Status	1123	1253	1383	1513
2	Error	1124	1254	1384	1514
3	Reserved	1125	1255	1385	1515
4	RspStatus	1126	1256	1386	1516
5	Reserved	1127	1257	1387	1517
6	Reserved	1128	1258	1388	1518
7	RxLen	1129	1259	1389	1519
8-129	RxData	1130-1251	1260-1381	1390-1511	1520-1641

- If the message has good status, Status will have bit 7 set

- If the scanner could not deliver the message, the value in Error is 1. For more information on the cause, look in RspStatus.

- If the transmit length was greater than 244, the value in Error is 3.

RspStatus contains the value returned by the LAN controller when it encounters an error. Mask the value with BFh and use the following table to determine the meaning. X indicates "do not care" values in the upper half of the byte.

Table 31:   Message Reply Values

Value, hex	Meaning
X0	OK
X1	User error. SAP locked. The destination station did not accept the message because the SAP was locked.
X2	No resource for send data. The SAP could not accept the message. For example, this happens when the SAP's receive buffer is too small.
X3	No service available (destination SAP doesn't exist, or when strict frame control checking is enabled on the destination station, and there's a mismatch)
X4	Access point blocked.
80	Short character, problems with wiring, termination, etc.
9F	No access. The destination station isn't available.
AF	Double token detected, problems with wiring, termination, etc.
BF	Response buffer too small.
8F	Noise at **SM** command, problems with wiring, termination, etc.

If the destination station sends reply data, the reply data length in bytes is in RxLen. Possible values are 0 to 244. The reply data itself is found in RxData.

8.2.4 Sending Broadcast and Multicast Messages

Broadcast and multicast messages are sent to destination station 127. Broadcast messages are sent to destination SAP 63. The frame control must be SDNl or SDNh, as all broadcast/multicast messages are unconfirmed.

In order for the destination station to receive a broadcast or multicast message, it must have strict station checking disabled. To receive a broadcast message, it must have a SAP configured on SAP 63.

Figure 52:   FDL SAP Message Send Handshake Example
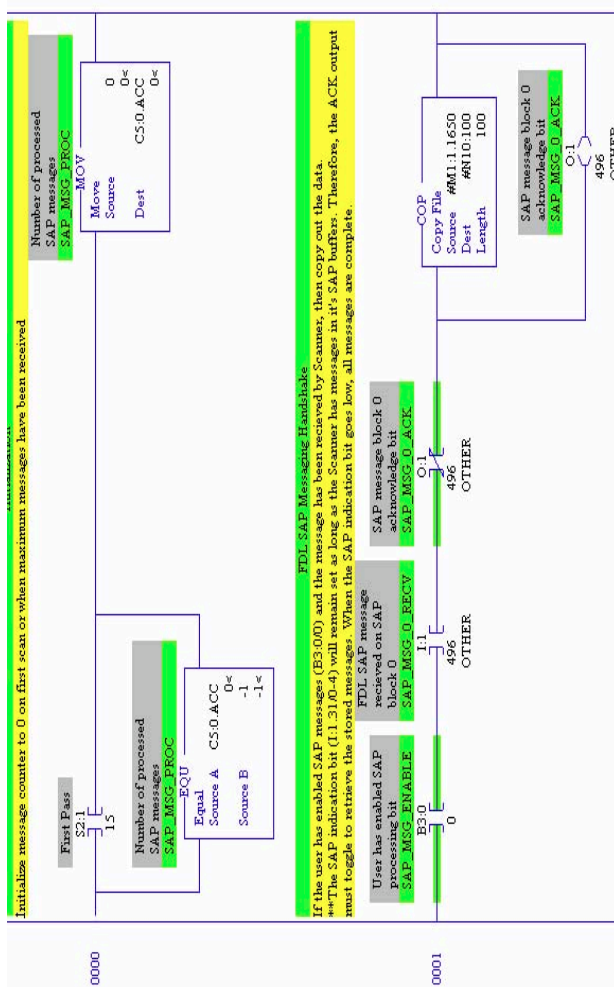
(Continued on following page).

(Figure 53, continued).
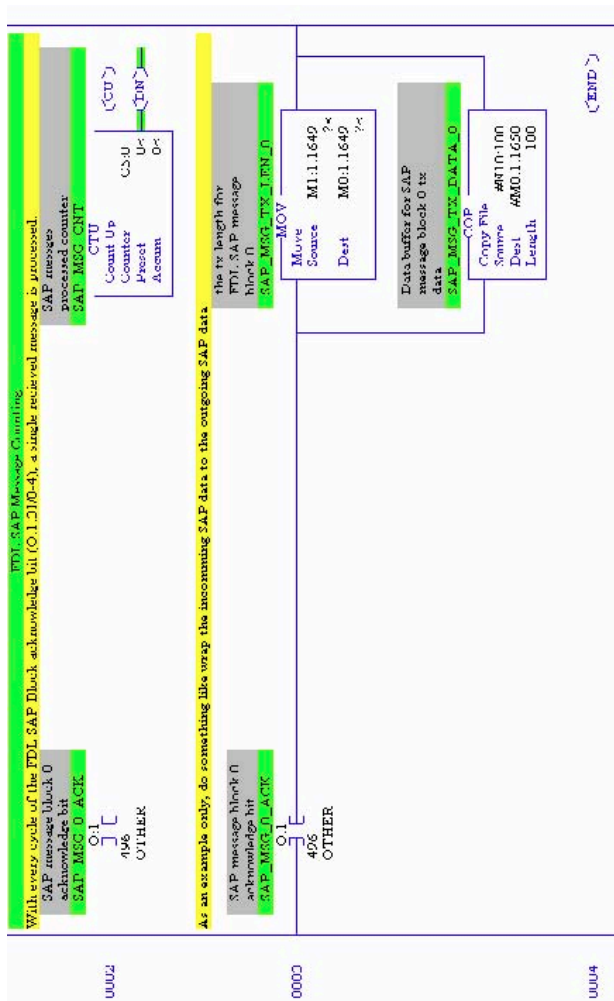
8.3 FDL SAPs

You can enable up to four Service Access Points (SAPs) on the scanner. You enable SAPs from the serial port, using the **SAPBlk** command. The syntax is SAPBlk <blk> <sap>, where <blk> is the block number, from 0 to 3, and <sap> is the SAP number, from 0 to 63.

To disable all SAPs, use the **ClrSap** command. SAPs are used to receive FDL messages from remote stations. When the scanner receives an update on a configured SAP, it sets the corresponding bit in input word I:31 and sends reply data, if you have set it up.

Table 32:   SAP Indication Update Offsets

Message/SAP Block (0-3)	Bit Offsets			
SAP block	0	1	2	3
SAP indication update	0	1	2	3

To acknowledge the SAP update, set the corresponding bit in output word O:31.

Table 33:   SAP Indication Acknowledge Offsets

Message/SAP Block (0-3)	Bit Offsets			
SAP block	0	1	2	3
SAP indication ACK	0	1	2	3

Setting the SAP indication ACK bit tells the scanner to clear the SAP indication update bit in the input word and transfers the current reply data from the area in the M0 file for this SAP block to the area the scanner uses to send a reply the next time the SAP is updated.

Note

The scanner automatically sends the reply data when the SAP is updated. In order for the scanner to have reply data ready when the SAP is first updated, you must set the SAP indication ACK bit for the SAP block when your program starts.

When the scanner clears the SAP indication update bit in the input word, your application should clear the SAP indication acknowledge bit.

8.3.1 SAP Receive Buffers

Whenever an SAP is updated, the scanner fills in the appropriate receive buffer in the M1 file. Some of the data comes from the source station; some comes from the scanner.

Table 34:   SAP Receive Buffer Offsets

Offset	Name	0	1	2	3
0	Reserved	1642	1772	1902	2032
1	Status	1643	1773	1903	2033
2	Error	1644	1774	1904	2034
3	Reserved	1645	1775	1905	2035
4	SrcStn	1646	1776	1906	2036
5	SrcSap	1647	1777	1907	2037
6	Reserved	1648	1778	1908	2038
7	RxLen	1649	1779	1909	2039
8-129	RxData	1650-1771	1780-1901	1910-2031	2040-2161

- Bit 7 in Status is set if the SAP is operating with no problems. If this bit is 0, there is a problem with this SAP, and Error contains the value 1.

- SrcStn contains the number of the station that updated the SAP

- Bit 7 is set if the message was sent with a source SAP

- SrcSap is the source SAP sent in the message and is valid only if bit 7 in SrcStn is set

- RxLen is the length of received data, in bytes. Possible values are 0 to 244.

- RxData contains the received data

8.3.2 SAP Transmit Buffers

If you are sending reply data, you must set up an FDL transmit buffer in the M0 file.

Table 35:   SAP Transmit Buffer Offsets

Offset	Name	0	1	2	3
0-6	reserved	1642-1648	1772-1778	1902-1908	2032-2038
7	TxLen	1649	1779	1909	2039
8-129	TxData	1650-1771	1780-1901	1910-2031	2040-2161

Write the transmit length, in bytes, to TxLen, and write the transmit data in TxData.

Note

The scanner automatically sends the reply data when the SAP is updated. In order for the scanner to have reply data ready when the SAP is first updated, you must set the SAP indication ACK bit for the SAP block when your program starts.

8.3.3 Receiving Broadcast/Multicast Messages

To receive broadcast messages, you must have an SAP configured on SAP number 63.
To receive a multicast message, you must have an SAP configured to match what the sender is using.

Figure 53:   FDL SAP Message Receipt Handshake Example
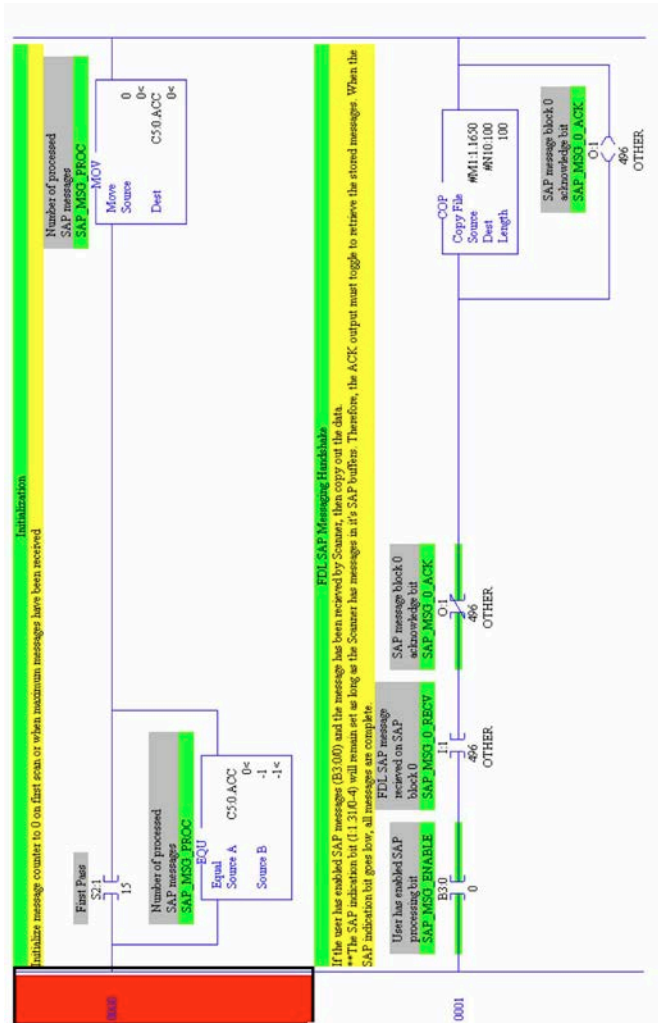
(Continued on following page).

(Figure 54, continued).
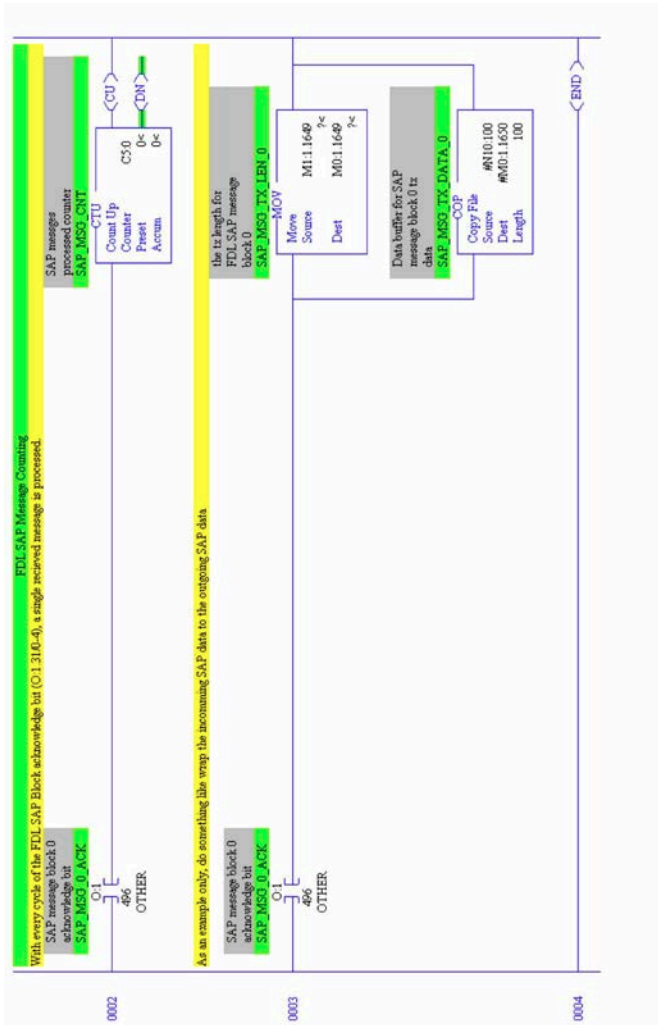
8.4 FDL Diagnostic Counters

The scanner maintains several diagnostic counters for FDL operation.

Table 36:   FDL Diagnostic Counters

Name	Location	Meaning
diagLay2MsgOk	4116	FDL messages sent OK. The scanner increments diagLay2MsgOk whenever it sends an FDL message and receives the appropriate acknowledge or response data.
errLay2MsgNotOk	4117L	FDL message errors. The scanner increments errLay2MsgNotOk whenever it sends an FDL message and doesn't receive appropriate acknowledge or response data.
diagLay2SapOk	4118	FDL SAP requests processed OK. The scanner increments diagLay2SapOk when it processes an FDL SAP request with no errors.
errLay2SapNotOk	4119L	FDL SAP errors. The scanner increments errLay2SapNotOk when there is an error receiving an SAP request.

8.5 FDL Network Parameters

If you are using the scanner only for FDL, you must also set several network parameters from the serial port before putting the module online. At a minimum, set the local station number and the baud rate. If you are sending FDL messages, make sure that the station is active. The station does not have to be active to send replies to SAP updates. The scanner sets appropriate default values for the remaining network parameters.

If the station is to be active, and if there are repeaters or FMS devices on the network, set the network options so that the scanner can set appropriate values for the network parameters. Most of them are not needed if the station is passive.

You may also want to change the high station address to optimize performance. The default high station address is 126.

8.5.1 Local Station

To set the local station number, issue the **LocStn** command with the station number (0-126) as a parameter.

Example

```
LocStn 22
```

8.5.2 Active/Passive

To set the station to be active, issue the **Active 1** command.

8.5.3 Baud Rate

To set the baud rate, issue the **Baud** command with the baud rate as a parameter. Allowed values for this parameter are 9k6, 19k2, 31k25, 45k45, 93k75, 187k5, 500k, 750k, 1m5, 3m, 6m and 12m.

Example

Baud 1m5 sets the baud rate to 1.5 Mbaud.

8.5.4 Other Network Options

To tell the module that there are one or more repeaters on the network, issue the **Repeater 1** command from the serial port.

To tell the module that there are FMS devices on the network, issue the **FmsDevices 1** command from the serial port.

8.5.5 Displaying Network Settings

To display the current network parameter settings, issue the **ShowNet** command from the serial port.

9

DPV1 Master Functionality

Chapter Sections:

- Overview

- DPV1-Supported Functions

- DPV1 Command Description

- DPV1 Sample Code

9.1 Overview

The SST-PB3-SLC can act on a PROFIBUS network as a DPV1 Class 1 & Class 2 master. The DPV1 module is able to:

- Send DPV1 Class 1 and Class 2 commands

- Manage up to 32 simultaneous Class 2 connections

9.2 DPV1-Supported Functions

The following table lists the supported DPV1 functions.

Table 37:   Supported DPV1 Functions

Supported DPV1 Functions	Service
MSAC1_Read	0x52
MSAC1_Write	0x53
MSAC2_Initiate	0x54
MSAC2_Idle	0x58
MSAC2_Abort	0x55
MSAC2_Read	0x56
MSAC2_Write	0x57

9.3 DPV1 Command Description

The backplane CPU can send DPV1 commands to slaves through the scanner. The scanner uses areas in the M0 and M1 files for DPV1 message configuration. The scanner writes to the M1 file; the SLC application writes to the M0 file.

9.3.1 DPV1 Message Configuration

The scanner uses the following areas in the M0 and M1 files.

Table 38:   M0 Message Configuration

M0 Offset	Use
2162	Transaction number
2163	DPV1 service code
2164-2299	DPV1 transmit data

Table 39:   M1 Message Configuration

M0 Offset	Use
2162	Transaction number
2163	Received data length
2164	Status – error code
2165-2166	Extended error code
2167-2302	DPV1 received data

The SLC application sets the transaction number in the M0 file to indicate to the module that a new message request is available. The scanner processes the request and it sets the transaction number in the M1 file to the same value as read from M0. The SLC application should read the reply from M1 only when the two transaction numbers are identical. The scanner does not process another transaction until the transaction number in M0 differs from the one in M1. At startup the transaction number in M1 is 0 and the scanner expects a non zero value for the transaction number in M0, before processing the first message.

9.3.2 DPV1 Init Command

This command, service code 0x50, initializes DPV1 functionality on the scanner. One block corresponds to one DPV1 frame on the PROFIBUS network. This command should be called in offline mode, therefore the SLC application must send it within the first scan, before the module is put online.

Note

If the scanner is online prior to issuing the Run command (when using the Configuration Tool, for example) and the SLC application initiates DPV1 messaging, ensure the module is taken offline before going to Run mode.

Table 40:   Request Format

Tx Offset	Use
0	Number of blocks required [1…32]

Table 41:   Reply Format

Rx Offset	Use

0	Number of blocks allocated [1…32]

Table 42:   Error Codes

Value	General Status
00h	Successful
E1h	Unknown command
E2h	Invalid command data length
E8h	Resources unavailable
EDh	DPV1 already initialized
EEh	Invalid number of bloc requested
F0h	Offline state expected

9.3.3 DPV1 Exit Command

This command, service code 0x51, stops DPV1 functionality in the scanner.

Request Format: None

Reply Format: None

Table 43:   Error Codes

Value	General Status
00h	Successful
E1h	Unknown command
E2h	Invalid command data length
EFh	DPV1 is not initialized

9.3.4 DPV1 Class 1 Read Command

This command, service code 0x52, reads data from a DPV1 slave using Slot_Number and Index parameters.

Table 44:   Request Format

Tx Offset	Use
0-3	Command timeout
4	Slave address [0…126]
5	Slot number where the data should be read [0…254]
6	Index where the data should be read [0…254]
7	Number of bytes to read [1…240]

Table 45:   Reply Format

Rx Offset	Use

0-239	Data read (size, 1-240 bytes)

Table 46:   Error Codes

Value	General Status
00h	Successful
E1h	Unknown command
E2h	Invalid command data length
E5h	FDL error (see extended error code)
E6h	DPV1 error (see extended error code)
E7h	Another command is already in progress for this slave / class 2 connection.
EAh	Invalid remote address
ECh	Invalid data length
EFh	DPV1 is not initialized
F1h	Online state expected
F3h	Invalid slave response
F6h	No space left on command queue
F7h	Command Timeout

9.3.5 DPV1 Class Write Command

This command, service code 0x53, writes data to a DPV1 slave using Slot_Number and Index parameters.

Table 47:   Request Format

Tx Offset	Use
0-3	Command timeout
4	Slave address [0…126]
5	Slot number where the data should be written [0…254]
6	Index where the data should be written [0…254]
7	Number of bytes to write [1…240]
8-247	Data to be written (size, 1-240 bytes)

Table 48:   Reply Format

Rx Offset	Use
0	Number of bytes written [1…240]

Table 49:   Error Codes

Value	General Status
00h	Successful
E1h	Unknown command
E2h	Invalid command data length

E5h	FDL error (see extended error code)
E6h	DPV1 error (see extended error code)
E7h	Another command is already in progress for this slave / class 2 connection.
EAh	Invalid remote address
ECh	Invalid data length
EFh	DPV1 is not initialized
F1h	Online state expected
F3h	Invalid slave response
F6h	No space left on command queue
F7h	Command Timeout

9.3.6 DPV1 Initiate Command

This command, service code 0x54, initiates a DPV1 Class 2 connection to a slave.

Note

When using Class 2 communication, up to 32 connections can be initiated.

Table 50:   Request Format

Tx Offset	Use
0-3	Time allowed for message reply in ms
4	Slave address [0…126]
5-6	Time expected in 10 ms
7-8	Features supported by the master
11-12	Desired profile ID number (0 = no profile)
	Subnet parameters
13	STYPE: 0 or 1; if STYPE = 1 the optional Net_addr and Mac_addr is present in S_Addr.
14	S_Addr_Len: Length of the S_Addr : if STYPE = 0, the S_Addr_Len = 2 if STYPE = 1, the S_Addr_Len = 8 + length of Mac_addr (x)
15	DTYPE: 0 or 1; if DTYPE = 1 the optional Net_addr and Mac_addr is present in D_Addr.
16	D_Addr_Len: Length of the D_Addr : if DTYPE = 0, the D_Addr_Len = 2 if DTYPE = 1, the D_Addr_Len = 8 + length of Mac_addr (y)
	S_Addr
17	Application process instance
18	Access level
19-24	Network address according to ISO/OSI Network

	addresses
25-(25+x-1)	MAC Address
	D_Addr
25+x	Application process instance
26+x	Access level
(27+x)-(33+x-1)	Network address according to ISO/OSI Network addresses
(33+x)-(33+x+y-1)	MAC Address

Table 51:   Reply Format

Rx Offset	Use
0	Connection reference
1-2	Updated time by the slave in 10 ms units (high byte first)
3-4	Features supported by the slave (high byte first)
5-6	Service functionality supported by the slave (high byte first)
7-8	Profile ID supported by the slave (high byte first)

Table 52:   Error Codes

Value	General Status
00h	Successful
E1h	Unknown command
E2h	Invalid command data length
E5h	FDL error (see extended error code)
E6h	DPV1 error (see extended error code)
E7h	Another command is already in progress for this slave / class 2 connection.
EAh	Invalid remote address
EFh	DPV1 is not initialized
F1h	Online state expected
F2h	Invalid Add_Addr parameter
F3h	Invalid slave response
F4h	Could not manage more Class 2 connections
F6h	No space left on command queue
F7h	Command Timeout

9.3.7 DPV1 Class 2 Abort Command

This command, service code 0x55, aborts a DPV1 Class 2 connection.

Table 53:   Request Format

Tx Offset	Use
0-3	Reserved

4	Connection reference returned by initiate
5	Location of the source of the abort request (0)
6	Protocol instance and reason for the abort (2)

Reply Format: None

Table 54:   Error Codes

Value	General Status
00h	Successful
E1h	Unknown command
E2h	Invalid command data length
E7h	Another command is already in progress for this slave / class 2 connection.
EBh	Invalid connection reference
EFh	DPV1 is not initialized
F1h	Online state expected
F5h	Class 2 connection is not initialized
F6h	No space left on command queue
F7h	Command Timeout

9.3.8 DPV1 Class 2 Read Command

This command, service code 0x56, reads data from a DPV1 slave using Slot_Number and Index parameters through a Class 2 connection.

Table 55:   Request Format

Tx Offset	Use
0-3	Command timeout
4	Connection reference
5	Slot number where the data should be read [0…254]
6	Index where the data should be read [0…254]
7	Number of bytes to read [1…240]

Table 56:   Reply Format

Rx Offset	Use
0-239	Data read (size, 1-240 bytes)

Table 57:   Error Codes

Value	General Status
00h	Successful
E1h	Unknown command
E2h	Invalid command data length

E5h	FDL error (see extended error code)
E6h	DPV1 error (see extended error code)
E7h	Another command is already in progress for this slave / class 2 connection.
ECh	Invalid data length
EFh	DPV1 is not initialized
F1h	Online state expected
F3h	Invalid slave response
F5h	Class 2 connection is not initialized
F6h	No space left on command queue
F7h	Command Timeout

9.3.9 DPV1 Class 2 Write Command

This command, service code 0x57, writes data to a DPV1 slave using Slave_Number and Index parameters through a DPV1 Class 2 connection.

Table 58:   Request Format

Tx Offset	Use
0-3	Command timeout
4	Connection reference
5	Slot number where the data should be written [0…254]
6	Index where the data should be written [0…254]
7	Number of bytes to write [1…240]
8-247	Data to be written (size, 1-240 bytes)

Table 59:   Reply Format

Rx Offset	Use
0	Number of bytes written [1…240]

Table 60:   Error Codes

Value	General Status
00h	Successful
E1h	Unknown command
E2h	Invalid command data length
E5h	FDL error (see extended error code)
E6h	DPV1 error (see extended error code)
E7h	Another command is already in progress for this slave / class 2 connection.
ECh	Invalid data length
EFh	DPV1 is not initialized
F1h	Online state expected

F3h	Invalid slave response
F5h	Class 2 connection is not initialized
F6h	No space left on command queue
F7h	Command Timeout

9.3.10 DPV1 Class 2 Idle Command

This command, service code 0x58, sends an Idle command to the DPV1 Class 2 slave. The scanner automatically sends an Idle frame to the slave to keep the connection alive, however this function can be used to force the Idle.

Table 61:   Request Format

Tx Offset	Use
0-3	Command timeout
4	Connection reference

Reply Format: None

Table 62:   Error Codes

Value	General Status
00h	Successful
E1h	Unknown command
E2h	Invalid command data length
E5h	FDL error (see extended error code)
E6h	DPV1 error (see extended error code)
E7h	Another command is already in progress for this slave / class 2 connection.
ECh	Invalid data length
EFh	DPV1 is not initialized
F1h	Online state expected
F3h	Invalid slave response
F5h	Class 2 connection is not initialized
F6h	No space left on command queue
F7h	Command Timeout

9.3.11 Extended Error Code

9.3.11.1 FDL Error (0xE5)

If an FDL error (0xE5) occurs, the extended error code contains the FDL error code.

The following table describes the meaning of the FDL_ErrorCode:

Table 63:   FDL_ErrorCode Description

Value	Meaning/Description
00h	OK
01h	User error, SAP locked
02h	No resource for sending data, tried to send to SAP that was not configured
03h	No service available (SAP does not exist)
04h	Access point blocked
80h	Short character, problems with wiring, termination, etc.
9Fh	No access
AFh	Double token detected, problems with wiring, termination, etc.
BFh	Response buffer too small
8Fh	Noise at SM command, problems with wiring, termination, etc.

9.3.11.2 DPV1 Error (0xE6)

If a DPV1 error (0xE6) occurs, the extended error code contains the DPV1 error code. Three bytes are significant:

- The first indicates the type of error (its value is always 0x80: DPV1 error)

- The second consists of two parts:

    - The highest four bits represent the error class

    - The lowest four bits represent the error code

- The third contains a slave-specific error code

The following table describes the meaning of the error class and error code of the second error byte.

Table 64:   DPV1 Errors

Error_Class	Meaning/Description	Error_Code
0-9	Reserved	
10=	Application	0 = read error
		1 = write error
		2 = module failure
		3 to 7 = reserved
		8 = version conflict
		9= features not supported
		10 to 15 = user specific

11=	Access	0 = invalid index
		1 = write length error
		2 = invalid slot
		3 = type conflict
		4 = invalid area
		5 = state conflict
		6 = access denied
		7 = invalid range
		8 = invalid parameter
		9 = invalid type
		10 to 15 = user specific
12=	Resource	0 = read constrain conflict
		1 = write constrain conflict
		2 = resource busy
		3 = resource unavailable
		4 to 7 = reserved
		8 to 15 = user specific
13 to 15	User specific	

9.4 DPV1 Sample Code

The PB3-SLC uses a transaction number to handle the processing of DPV1 requests to the M0 File. This transaction number must change each time a DPV1 request is sent. Reading the last transaction number written to M0:Slot.2162 is required and adding 1 to it will be the first transaction number you will use to begin DPV1 communication. This transaction number will be used in DPV1_INIT. In the sample ladder code, this step is done in the Initialize routine, rung 2 in SST_PB3_SLC_DPV1_CLASS1.RSS ladder code.

The code below is a routine called DPV1_INIT. This routine sets the card up for DPV1 communication and must be called prior to sending DPV1 Class 1 and Class 2 messages. This code is included with ladder programs, SST_PB3_SLC_DPV1_CLASS1.RSS, SST_PB3_SLC_DPV1_CLASS2.RSS.

LAD 3 -- DPV1_INIT

Update the DPV1 Tx Data (M0 offsets 2164) with the number of DPV1 blocks to allocate (1 - 32). The number of blocks allocated with be returned in M1:1.2162 when DPV1_INIT srevice has been executed successfully

0000
```
                                                              COMMAND_TIMEOUT1
                                                              ┌─MOV───────────────┐
                                                              │ Move              │
                                                              │ Source    N10:134 │
                                                              │              5<   │
                                                              │ Dest      N10:2   │
                                                              │           1000<   │
                                                              └───────────────────┘

                                                              DP_SERVICE_CODE
                                                              ┌─MOV───────────────┐
                                                              │ Move              │
                                                              │ Source       80   │
                                                              │             80<   │
                                                              │ Dest      N10:1   │
                                                              │             84<   │
                                                              └───────────────────┘
```

Write the DPV1_Init Service ID 0x50 to M0:3.2162 (High byte) and the transaction number (unique and non-zero each time) to M0:1.2162 (low byte). This will trigger the DPV1_Init Message

0001
```
 DPV1_INIT_SENT                                               ┌─COP───────────────┐
    B3:0                                                      │ Copy File         │
    ─]/[─                                                     │ Source     #N10:0 │
     2                                                        │ Dest    #M0:1.2162│
                                                              │ Length        3   │
                                                              └───────────────────┘

                                                              DPV1_INIT_SENT
                                                                 B3:0
                                                                ─(L)─
                                                                  2
```

Check to see if tranaction number written to M0:1.2162 matches transaction number in M1:1.2162 which means the module has processed the request and increment the transaction number for next DPV1 Message

0002
```
 RX_TRANSACTION_NUM                                           REQUEST_PROCESSED
 ┌─EQU──────────┐                                                 B3:0
 │ Equal        │                                                ─(L)─
 │ Source A N11:0│                                                  4
 │        21690< │
 │ Source B N10:0│                                            INCREMENT_TRANSNUM
 │        21691< │                                            ┌─JSR──────────────────┐
 └──────────────┘                                            │ Jump To Subroutine    │
                                                              │ SBR File Number   U:6 │
                                                              └───────────────────────┘
```

If the transaction number matches, status is 0 and the number of DPV1 blocks allocated is 1, OR transaction number matches and we get the error "DPV1 Already Initialized" then set DPV1_Init to TRUE.

0003
```
 REQUEST_PROCESSED   STATUS_CODE         DPV1_RX_STARTS             DPV1_INITIALIZED
    B3:0             ┌─EQU──────────┐    ┌─EQU──────────┐               B3:0
    ─] [─            │ Equal        │    │ Equal        │              ─(L)─
     4               │ Source A N11:2│    │ Source A N11:5│               1
                     │         0<   │    │       1028<   │
                     │ Source B   0 │    │ Source B   1 │           REQUEST_PROCESSED
                     │         0<   │    │         1<   │               B3:0
                     └──────────────┘    └──────────────┘              ─(U)─
                                                                         4
 REQUEST_PROCESSED   STATUS_CODE
    B3:0             ┌─EQU──────────┐
    ─] [─            │ Equal        │
     4               │ Source A N11:2│
                     │         0<   │
                     │ Source B 237 │
                     │        237<  │
                     └──────────────┘
```

Check for DPV1_INIT response

0004
```
 DPV1_INITIALIZED                                             #RX_TRANSACTION_NUM
    B3:0                                                      ┌─COP───────────────┐
    ─]/[─                                                     │ Copy File         │
     1                                                        │ Source  #M1:1.2162│
                                                              │ Dest      #N11:0  │
                                                              │ Length        6   │
                                                              └───────────────────┘
```

0005
```
                                                                             ─(END)─
```

Below is sample code for sending a DPV1_CLASS_1 Read to Slave at station 4, Slot 0, index 99. The sample code uses N7:0 – N7:1 for Command Timeout, N7:2 (low byte) for station address, N7:2(High byte) for slot number, N7:3 (high byte) for number of bytes to Read, and N7:3 (Low byte) for index. Integer file N10 is used for DPV1 Request and N11 is used for DPV1 Response.

See rung 6 below, when the DPV1_READ request has been processed (transaction number in M0:1.2162 matches M1:1.2162), we set a Request processed flag and increment the transaction number for next request. If successful (M1:1.2164 Status = 0), we set a success flag.

LAD 4 -- DPV1_READ -- DPV1 CLASS 1 READ

0000
Clear DPV1 reply area (N11) before we receive next DPV1 reply

#RX_TRANSACTION_NUM
— FLL —
Fill File
Source   0
Dest   #N11:0
Length   125

0001
Set the DPV1_C1_READ service code 0x52

DP_SERVICE_CODE
— MOV —
Move
Source   82
               82<
Dest   N10:1
               82<

0002
SSet 1 sec as timeout (N7:0 - N7:1) for processing the command by the SST-PB3-SLC. N7:0.0 - 7 is least significat byte.

#BEGIN_OF_DPV1_TXDATA
— COP —
Copy File
Source   #N7:0
Dest   #N10:2
Length   2

0003
Set the Address of the DPV1 Class 1 slave (low byte) to 1 and the slot number (high byte) to 0 to specify where to read the data

SLOT_NUM__SLV_ADDR
— MOV —
Move
Source   N7:2
                4<
Dest   N10:4
                1<

0004
Set the number of bytes of data to read to 100 (N7:3, high byte) and the index to 99 (N7:3, low byte) to specify where to read the data

NUM_BYTES__INDEX
— MOV —
Move
Source   N7:3
             25699<
Dest   N10:5
             25699<

0005
When a DPV1_C1_READ has NOT been triggered already, trigger the DPV1_C1_Request by updating the Transaction Number in M0 2162 and the DPV1 Service code in M0 2163 with 0x52 (DPV1_C1_READ) along with DPV1 Request data

DPV1_C1_MSG_TRIGGER
B3:0
─┘ ├─
  5

#RX_TRANSACTION_NUM
— COP —
Copy File
Source   #M1:1.2162
Dest   #N11:0
Length   125

0006
Check to see if tranaction number written to M0:1.2162 matches transaction number in M1:1.2162 which means the module has processed the request and increment the transcation number for the next request.

RX_TRANSACTION_NUM
— EQU —
Equal
Source A   N11:0
             21690<
Source B   N10:0
             21691<

REQUEST_PROCESSED
B3:0
─(L)─
  4

INCREMENT_TRANSNUM
— JSR —
Jump To Subroutine
SBR File Number   U:6

0007
If the request has been processed, and the status is 0 indicate a DPV1 C1 read success.

REQUEST_PROCESSED   STATUS_CODE
B3:0   — EQU —
─┘ ├─   Equal
  4   Source A   N11:2
                                           0
                          Source B   0
                                           0

DPV1_C1_MSG_SUCCESS
B3:0
─(L)─
  6

DPV1_CLASS_1 Read_Continued.
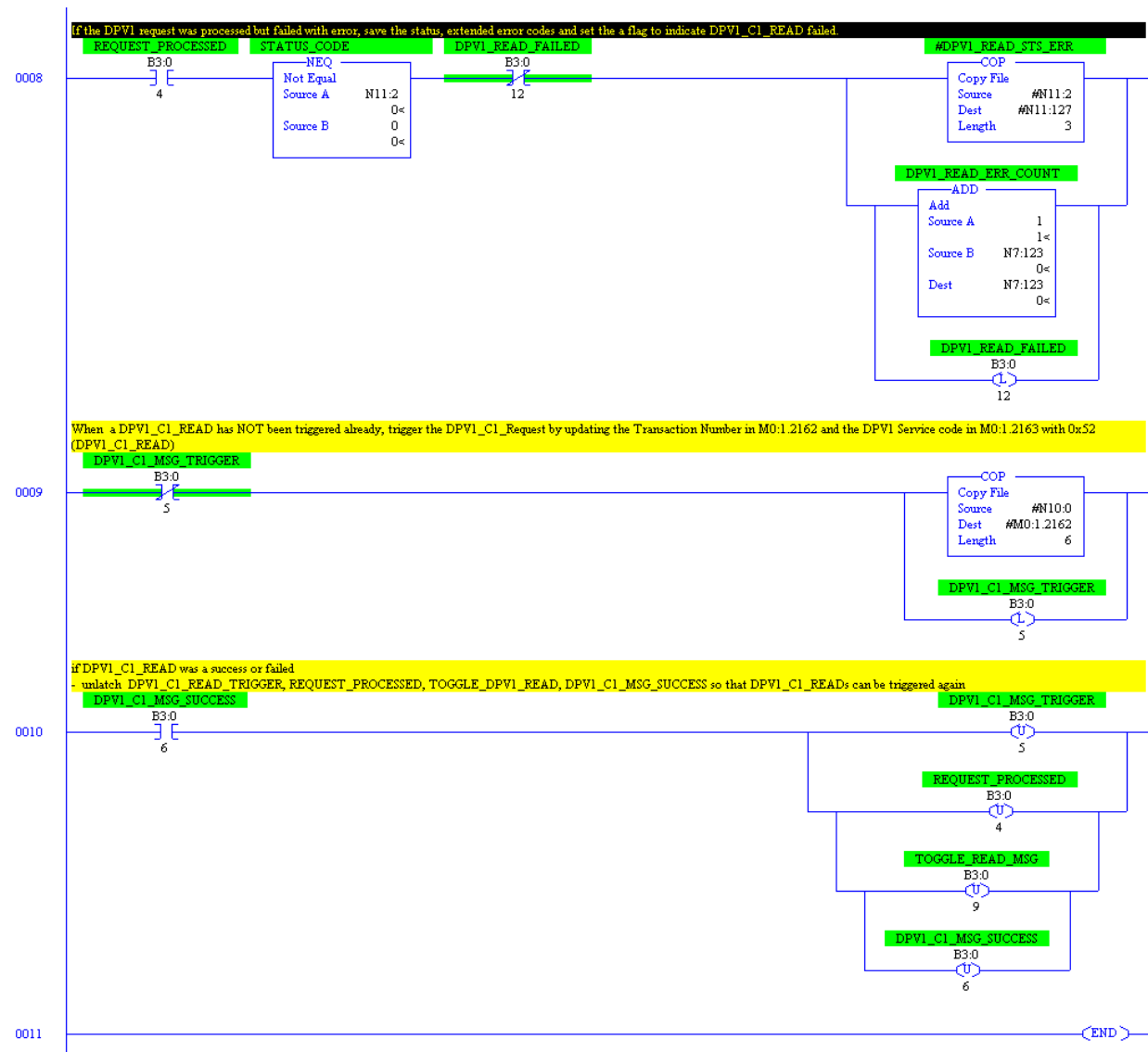
Below is sample code for sending a DPV1_CLASS_1 WRITE to Slave at station 4, Slot 0, index 99. The sample code uses N7:0 – N7:1 for Command Timeout, N7:2 (low byte) for station address, N7:2(High byte) for slot number, N7:3 (high byte) for number of bytes to write, and N7:3 (Low byte) for index. Integer file N10 is used for DPV1 Request and N11 is used for DPV1 Response.

See rung 6 below, when the DPV1_Write request has been processed (transaction number in M0:1.2162 matches M1:1.2162), we set a Request processed flag and increment the transaction number for next request. If successful (M1:1.2164 Status = 0), we set a success flag.

LAD 5 -- DPV1_WRITE -- DPV1 CLASS 1 WRITE

0000

Clear DPV1 reply area (N11) before we receive next DPV1 reply

```
                                                              #RX_TRANSACTION_NUM
                                                                    FLL
                                                              Fill File
                                                              Source          0
                                                              Dest        #N11:0
                                                              Length         125
```

0001

Set the DPV1_C1_WRITE service code 0x53

```
                                                              DP_SERVICE_CODE
                                                                    MOV
                                                              Move
                                                              Source         83
                                                                            83<
                                                              Dest         N10:1
                                                                            82<
```

0002

Set 1 sec as timeout (N7:0 - N7:1) for processing the command by the SST-PB3-SLC. N7:0.0 - 7 is least significat byte.

```
                                                              #BEGIN_OF_DPV1_TXDATA
                                                                    COP
                                                              Copy File
                                                              Source        #N7:0
                                                              Dest         #N10:2
                                                              Length          2
```

0003

Set the Address of the DPV1 Class 1 slave to 1 (N7:2, low byte) and the slot number to 0 (N7:2, high byte) to specify where to write the data to.

```
                                                              SLOT_NUM__SLV_ADDR
                                                                    MOV
                                                              Move
                                                              Source        N7:2
                                                                            4<
                                                              Dest         N10:4
                                                                            1<
```

0004

Set the number of bytes of data to write (i.e. 100) (N7:3, high byte) and the index to 99 (N7:3, low byte) to specify where to write the data

```
                                                              NUM_BYTES__INDEX
                                                                    MOV
                                                              Move
                                                              Source        N7:3
                                                                          25699<
                                                              Dest         N10:5
                                                                          25699<
```

0005

When the DPV1_C1_WRITE has been triggered start checking to see if Request has been processed on the next PLC scan after the request has been sent. Length has to be 6 words (Transaction number, DPV1 data Length, Status, Exteneded Error code 1, extended Error code 2, 1st byte of DPV1 data containing number of bytes of DPV1 data written to slave.

```
  DPV1_C1_MSG_TRIG                                            #RX_TRANSACTION_NUM
     B3:0                                                            COP
     ] [                                                       Copy File
     10                                                        Source    #M1:1.2162
                                                               Dest        #N11:0
                                                               Length          6
```

0006

Check to see if tranaction number written to M0:1.2162 matches transaction number in M1:1.2162 which means the module has processed the request and increment the transcation number for the next request.

```
  RX_TRANSACTION_NUM                                          REQUEST_PROCESSED
       EQU                                                          B3:0
   Equal                                                            (L)
   Source A       N11:0                                             4
                  21690
   Source B       N10:0                              INCREMENT_TRANSNUM
                  21691                                         JSR
                                                     Jump To Subroutine
                                                     SBR File Number     U:6
```

0007

If the request has been processed, and the status is 0 indicate a DPV1 C1 write success.

```
 REQUEST_PROCESSED    STATUS_CODE                             DPV1_C1_MSG_SUCCESS
      B3:0                EQU                                         B3:0
    ] [                Equal                                         (L)
      4                Source A       N11:2                          6
                                       0
                       Source B         0
                                        0
```

DPV1_CLASS_1 WRITE Continued…

If the DPV1 request was processed but failed with error, save the status, extended error codes and set the a flag to indicate DPV1_C1_WRITE failed.

```
0008   REQUEST_PROCESSED      STATUS_CODE            DPV1_WRITE_FAILED                          #DPV1_WRITE_STS_ERR
            B3:0                  NEQ                      B3:0                                     COP
           ] [ ─────────────── Not Equal ──────────── ]/[ ─────────────────────────────── Copy File
             4                 Source A      N11:2         11                                 Source      #N11:2
                                              0<                                             Dest       #N11:130
                               Source B         0                                            Length          3
                                              0<
                                                                                         DPV1_WRITE_ERR_COUNT
                                                                                            ADD
                                                                                         Add
                                                                                         Source A        1
                                                                                                         1<
                                                                                         Source B   N7:122
                                                                                                         0<
                                                                                         Dest       N7:122
                                                                                                         0<

                                                                                          DPV1_WRITE_FAILED
                                                                                             B3:0
                                                                                             ─(L)─
                                                                                              11
```

When a DPV1_C1_WRITE has NOT been triggered already, trigger the DPV1_C1_Request by updating the Transaction Number in M0 2162 and the DPV1 Service code in M0 2163 with 0x53 (DPV1_C1_WRITE) along with DPV1 Request data (up to 240 bytes)

```
0009   DPV1_C1_MSG_TRIG                                                                         COP
            B3:0                                                                                Copy File
           ]/[                                                                                  Source      #N10:0
             10                                                                                 Dest    #M0:1.2162
                                                                                               Length        126

                                                                                         DPV1_C1_MSG_TRIG
                                                                                             B3:0
                                                                                             ─(L)─
                                                                                              10
```

if DPV1_C1_WRITE was a success or failed
- unlatch DPV1_C1_WRITE_TRIG, WRITE_REQ_PROCESSED,TOGGLE_DPV1_WRITE, DPV1_C1_MSG_SUCCESS so that DPV1_C1_WRITE can be triggered again.

```
0010   DPV1_C1_MSG_SUCCESS                                                                  DPV1_C1_MSG_TRIG
            B3:0                                                                                 B3:0
           ] [ ───────────────────────────────────────────────────────────────────────────────(U)─
             6                                                                                    10

                                                                                          REQUEST_PROCESSED
                                                                                             B3:0
                                                                                             ─(U)─
                                                                                              4

                                                                                          TOGGLE_DPV1_WRITE
                                                                                             B3:0
                                                                                             ─(U)─
                                                                                              8

                                                                                         DPV1_C1_MSG_SUCCESS
                                                                                             B3:0
                                                                                             ─(U)─
                                                                                              6

0011                                                                                             ─( END )─
```

Below is sample code for sending a DPV1_CLASS_2 INITIATE to Slave at station 4, Slot 0, index 99. The sample code uses N7:0 – N7:1 for Command Timeout, N7:2 (low byte) for station address. Integer file N10 is used for DPV1 Request and N11 is used for DPV1 Response.

DPV1_CLASS_2 INITIATE Continued…

The communication reference is returned in N11:5 and then saved in N11:140 so that it can be used for other Class 2 commands (Read, Write, Abort, IDLE).

Below is sample code for DPV1 Class 2 Read.

LAD 4 -- C2_READ -- DPV1 CLASS 2 READ

0000 — Set the DPV1_C2_READ service code 0x56

DP_SERVICE_CODE
MOV — Move
Source 86
86<
Dest N10:1
84<

0001 — Set 1 sec as timeout (n7:0 - N7:1) for processing the command by the SST-PB3-SLC. N7:0.0 - 7 is least significat byte.

#COMMAND_TIMEOUT1
COP — Copy File
Source #N7:0
Dest #N10:2
Length 2

0002 — Copy the CREF (Connection Reference) that was returned in DPV1_C2_Initiate response into DPV1_C2_READ Request and the slot number (high byte of N10:151) to specify where to read the data

SLOT_NUM__CREF
MOV — Move
Source N11:140
128<
Dest N10:4
-14332<

SLOT_NUM__CREF
MVM — Masked Move
Source N10:151
0<
Mask 0FF00h
-256<
Dest N10:4
-14332<

0003 — Set the number of bytes of data to read (02dec) and the index (99dec) to specify where to read the data

NUM_BYTES__INDEX
MOV — Move
Source -3997
-3997<
Dest N10:5
256<

0004 — When the module has been DPV1_IINITIALIZED and DPV1_C1_READ has been triggered start checking to see if Request has been processed on the next PLC scan afer the requet has been sent. Length has to be 124 if we want to be able to read the maximum 240 bytes of dpv1 data including 8 bytes for the header reply

DPV1_C2_MSG_TRIG
B3:0
] [
10

#RX_TRANSACTION_NUM
COP — Copy File
Source #M1:1.2162
Dest #N11:0
Length 125

0005 — Check to see if tranction number written to M0:1.2162 matches transaction number in M1:1.2162 which means the module has processed the request and increment the transcation number for the next request.

RX_TRANSACTION_NUM
EQU — Equal
Source A N11:0
2<
Source B N10:0
12676<

REQUEST_PROCESSED
B3:0
(L)
4

INCREMENT_TRANSNUM
JSR — Jump To Subroutine
SBR File Number U:10

0006 — If the request has been processed, and the status is 0 indicate a DPV1 C1 read success.

REQUEST_PROCESSED
B3:0
] [
4

STATUS_CODE
EQU — Equal
Source A N11:2
0<
Source B 0
0<

DPV1_C2_MSG_SUCCESS
B3:0
(L)
6

DPV1 Class 2 Read continued…

Below is sample code for DPV1 Class 2 Write.

DPV1 Class 2 Write Continued…

If the request was processed but failed with error, save the status, extened error codes and set the a flag to indicate DPV1_C2_WRITE failed.

```
          REQUEST_PROCESSED      STATUS_CODE                                                          DPV1_WRITE_FAILED
              B3:0                   NEQ                                                                    B3:0
0007      ──┘ ├──              ─ Not Equal ─                                                            ──( L )──
               4                  Source A    N11:2                                                         11
                                                  0<
                                  Source B        0
                                                  0<
                                                                                          ─ COP ─
                                                                                          Copy File
                                                                                          Source     #N11:2
                                                                                          Dest       #N11:155
                                                                                          Length          3

                                                                                          ─ ADD ─
                                                                                          Add
                                                                                          Source A         1
                                                                                                          1<
                                                                                          Source B    N11:158
                                                                                                          0<
                                                                                          Dest        N11:158
                                                                                                          0<
```

When a DPV1_C1_WRITE has NOT been triggered already, trigger the DPV1_C1_Request by updating the Transaction Number in M0 2162 and the DPV1 Service code in M0 2163 with 0x57 (DPV1_C2_WRITE)

```
          DPV1_C2_MSG_TRIG
              B3:0                                                                            ─ COP ─
0008      ──┘/├──                                                                             Copy File
               10                                                                             Source     #N10:0
                                                                                              Dest       #M0:1.2162
                                                                                              Length         126

                                                                                          DPV1_C2_MSG_TRIG
                                                                                              B3:0
                                                                                            ──( L )──
                                                                                               10
```

if DPV1_C2_WRITE was a success or failed
- unlatch C2_WRITE_SUCCESS, DPV1_C1_WWRITE_TRIG, WRITE_REQ_PROCESSED, and TOGGLE_DPV1_C2_WRITE so that DPV1_C1_WRITES can be triggered again.

```
          DPV1_C2_MSG_SUCCESS                                                          DPV1_C2_MSG_SUCCESS
              B3:0                                                                            B3:0
0009      ──┘ ├──                                                                           ──( U )──
               6                                                                                6

                                                                                       DPV1_C2_MSG_TRIG
                                                                                              B3:0
                                                                                            ──( U )──
                                                                                               10

                                                                                       REQUEST_PROCESSED
                                                                                              B3:0
                                                                                            ──( U )──
                                                                                                4

                                                                                       TOGGLE_DPV1_WRITE
                                                                                              B3:0
                                                                                            ──( U )──
                                                                                                8

0010                                                                                                    ─( END )─
```
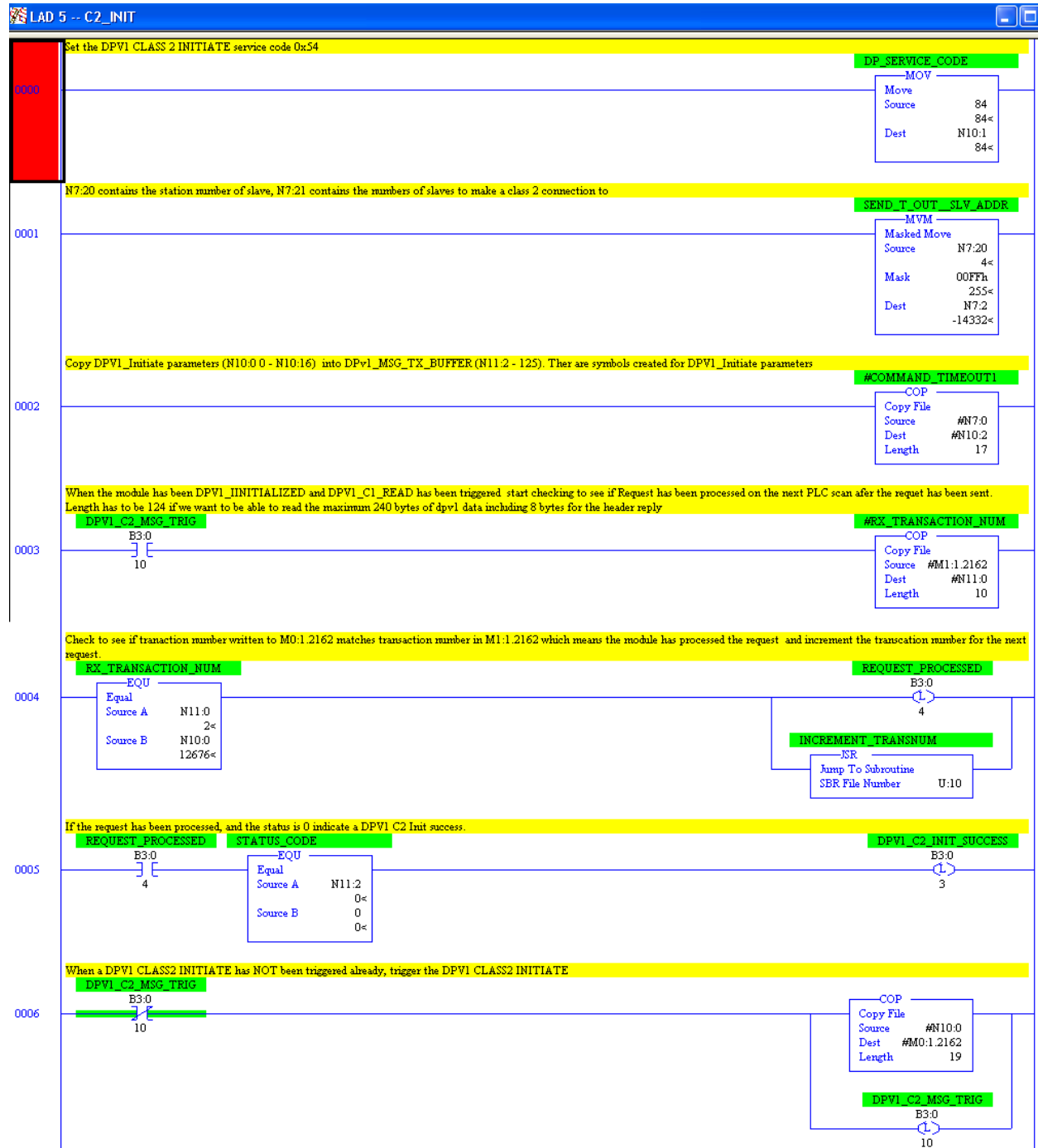
10
Diagnostics

Chapter Sections:

- Overview

- Status Register

- Scanner Firmware Version Number

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- DP Master Slave Error Table

- DP Master Slave Extended Status Table

- DP Master Error Information Table

- DP Slave Status Register

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- Diagnostic Counters

- Summary of Diagnostic Locations

10.1 Overview

This chapter describes system diagnostics.

The scanner maintains a variety of diagnostic information in the M1 file in the area from 4000 to 4200.

10.2 Status Register

Register 4011 in the M1 file is the PROFIBUS status register. The following tables show possible status register values.

If the status register contains STS_CFG_INTERNAL_ERROR (80h), there has been an internal error on the scanner. Record the contents of the errInternal and errArg registers and contact Technical Support. ErrInt is stored in the high byte of register 4129 of the M1 file; ErrArg is stored in the low byte of register 4130 of the M1 file and also in register 4012 of the M1 file.

If the status register contains STS_OUT_OF_APBS (81h), the scanner has run out of application blocks. The DP Slave uses 2 application blocks, and the DP Master uses 2 application blocks per configured Slave. There are a total of 835 application blocks. If you get this error, reduce the number of application blocks used.

If the status register contains STS_HEAP_ALLOC_FAIL (83h) or STS_SH_HEAP_ALLOC_ FAIL (84h), there has been an internal error in allocating memory. Contact Technical Support.

10.3 Scanner Firmware Version Number

The version number of the scanner firmware is stored in register 4014 in the M1 file. For example, if the value is 0116h, the firmware is version 1.22.

10.4 DP Master Slave Status Table

The area in the M1 file from 4000 to 4007 contains the status of the Slaves, one bit per Slave. For example, if the Slave at station address 1 is good, bit 1 of register 4000 is set.

In addition, if the status of all Slaves is good, bit 0 of register 4013 is set. If this bit is 0, one or more Slaves have bad status.

Table 65:   DP Master Slave Status Table

Register	Bit / Slave															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
4000	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
4001	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
4002	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
4003	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
4004	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
4005	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
4006	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96
4007		126	125	124	123	122	121	120	119	118	117	116	115	114	113	112

This table can be used in conjunction with the global fault enable, bit 0 of register 4010 in the M0 file, and the ignore Slave fault table, 4000-4007 in the M0 file, to fault the SLC if Slaves are in error.

If the global fault enable bit is 0, the scanner will not fault the SLC when there are Slave errors. This is the default.

If the global fault enable bit is 1, the scanner will fault the SLC when there are Slave errors. However, you can use the ignore Slave fault table to tell the scanner to ignore the status of some Slaves.

The ignore Slave fault table is organized exactly like the Slave status table above. Set the bit that corresponds to a Slave if you want the scanner to ignore the status of that Slave. If the bit for a Slave is set, the status is shown in the Slave status table but it is not included in the All Slaves Good flag, bit 0 of register 4013.

Wait an appropriate amount of time before turning on the global fault enable bit, as it takes some time for DP Slaves to start up. The amount of time depends on the baud rate and the startup time for the Slaves on the network.

10.5 DP Master Slave Error Table

The area in the M1 file from 4020 to 4027 shows Slaves that are in error, one bit per Slave. For example, if the Slave at station address 1 is in error, bit 1 of register 4020 is set.

Table 66:   DP Master Slave Error Table

Register	Bit / Slave															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
4020	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
4021	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
4022	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
4023	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
4024	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
4025	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
4026	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96
4027		126	125	124	123	122	121	120	119	118	117	116	115	114	113	112

This table is similar to the Slave status table, except that it shows errors rather than stations with good status.

10.6 DP Master Slave Extended Status Table

The area in the M1 file from 4030 to 4037 shows Slaves that are reporting extended status, one bit per Slave. For example, if the Slave at station address 1 is reporting extended status, bit 1 of register 4030 is set.

Table 67:   DP Master Slave Extended Status Table

Register	Bit / Slave															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
4030	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
4031	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
4032	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
4033	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
4034	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
4035	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
4036	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96
4037		126	125	124	123	122	121	120	119	118	117	116	115	114	113	112

10.6.1 Reading the Extended Status

To read a Slave's extended status, write the station number to the diagnostic status station select register, register 3828 in the M1 file. The scanner then retrieves the diagnostics for that Slave. If the scanner successfully gets the diagnostics, it puts them in registers 3829-3950 and sets the high byte of the diagnostic status station select register to 80h. If there is an error in getting the extended diagnostics, the scanner sets the high byte of the diagnostic status station select register to 40h.

10.7 DP Master Error Information Table

The area in the M1 file from 3700 to 3827 contains error information about each Slave, one register per station number. This table can be used in conjunction with the Slave status table (4000-4007) or the Slave error table (4020-4027) to determine the cause of the error.

Table 68:   DP Master Error Information Table

Register	Bit / Slave															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
3700	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
3716	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
3732	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
3748	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63
3764	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
3780	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
3796	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111
3812	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	

The scanner sets various values in the high byte to indicate the cause of any Slave problems. Some errors occur during parameterizing the Slave, others occur at runtime. If there are multiple errors, only the last one is shown. The host acknowledges these errors by clearing the register.

Table 69:   Error Status Table

Value	Cause
01h	Failure while trying to configure Slave.
02h	Slave's real ID does not match Slave's configured ID.
03h	Frame delivery problem while updating Slave data.
04h	Frame delivery problem while reading Slave diagnostics.
05h	Error in diagnostic status byte #1 during configuration.
06h	Error in diagnostic status byte #2 during configuration.
07h	Error in diagnostic status byte #1 during diagnostic read.
08h	Error in diagnostic status byte #2 during diagnostic read.
09h	Station address from diagnostic read does not match.
0ah	Timeout waiting for I/O update.
0bh	Warning: Slave watchdog is not enabled.

For some values in the high byte, the scanner provides additional information in the low byte to help pinpoint the cause of the problem.

high byte = 01h (failure while trying to configure Slave)

The following tables list possible values in the low byte.

Table 70:   Error 01

Value	Meaning
1	No response or NAK after sending the first diagnostic status request to the Slave.
2	No response or NAK after sending parameter data to the Slave.
3	No response or NAK after sending configuration check data to the Slave.
4	No response or NAK after sending the second diagnostic status request to the Slave.
5	Invalid response after sending the first diagnostic status request to the Slave.
6	Invalid response after sending parameter data to the Slave.
7	Invalid response after sending configuration check data to the Slave.
8	Response to configuration check packet was non-zero length (Slave should never return anything).
9	Invalid response after sending the second diagnostic status request to the Slave.

high byte = 03h (frame delivery problem while updating Slave data)

Table 71:   Error 03

Value	Meaning
1	Error in data update during configuration.
2	No response or NAK when updating data while online.

high byte = 04h (frame delivery problem while reading Slave diagnostics)

Table 72:   Error 04

Value	Meaning
1	Invalid response when reading Slave diagnostics while online.
2	No response or NAK when reading Slave diagnostics while online.

high byte = 05h (error in diagnostic status byte #1 during configure)

The value in the low byte depends on the value returned by the Slave in the first station status byte when the Master reads diagnostics during configuration. Mask the value with 0F5h, and any bits that are set in the result should not be set. Mask the value in the low byte with 02h, and bit 1 should be set.

The bits in station status byte 1 are:

Table 73:   Error 05 and Error 07

Bit	Meaning
7	DP Slave has been parameterized by another Master.
6	Slave received an invalid parameter frame, wrong Ident, wrong length, invalid parameters, etc.
5	Invalid response from the Slave.
4	Master requested a function that the Slave does not support.
3	An entry exists in the Slave-specific diagnostic area.
2	Configuration check data for the Slave was incorrect.
1	Slave is not ready for data transfer.
0	DP Slave non-existent.

high byte = 07h (error in diagnostic status byte #1 during diagnostic read)

The value in the low byte depends on the value returned by the Slave in the first station status byte when the Master reads diagnostics while online. Mask the value with 0F7h, and any bits that are set should not be set. The bits in station status 1 are shown in the above table.

high byte = 06h (error in diagnostic status byte #2 during configure)

The value in the low byte depends on the value returned by the Slave in the second station status byte when the Master reads diagnostics during configuration. Mask the value with 060h and any bits that are set in the result should not be set. Mask the value in the low byte with 04h, and bit 2 should be set.

The bits in station status byte 2 are:

Table 74:   Error 06 and Error 08

Bit	Meaning
7	Slave has been marked inactive by the Master.
6	Reserved.
5	The Slave has received a **Sync** command.
4	The Slave has received a **Freeze** command.
3	The Slave watchdog has been activated.
2	The Slave sets this bit to 1.
1	Th Slave is requesting a diagnostic read.
0	The Slave is requesting reparameterization

high byte = 08h (error in diagnostic status byte #2 during diagnostic read)

The value in the low byte depends on the value returned by the Slave in the second station status byte when the Master reads diagnostics while online. Mask the value with 080h, and any bits that are set should not be set. Mask the value in the low byte with 04h, and bit 2 should be set. The bits in station status 2 are shown in the above table.

10.8 DP Slave Status Register

- The scanner reports the status of its DP Slave operation by setting bits in the Slave status register, register 4017 in the M1 file.

- The scanner sets bit 6, SLV_STS_RUN_MODE, if it's being scanned by a DP Master in Run mode.

- The scanner sets bit 7, SLV_STS_OK, if the current Slave status is OK. This means parameterization was successful and the Slave watchdog hasn't timed out.

10.9 DP Slave Error Register

The scanner module sets the Slave error register, register 4018 in the M1 file, to the following values to report various error conditions in its operation as a DP Slave. If there are multiple errors, the register contains the value for the last error encountered.

Table 75:   DP Slave Error Table

Error	Value	Meaning
SLV_ERR_ID_MISM	01h	ID from Master does not match configured ID. Slave will not communicate with the Master.
SLV_ERR_READY_TIME_MISM	02h	PfbReadyTime does not match what Master sent. The card can communicate as a Slave even if the times are different, but you may experience network errors.
SLV_ERR_UNSUP_REQ	03h	Master is requesting Freeze or Sync, which is not supported.
SLV_ERR_RX_LEN_MISM	04h	Length of data from Master is incorrect. The card won't communicate as a Slave.
SLV_ERR_TX_LEN_MISM	05h	Length of data to Master is incorrect. The card won't communicate as a Slave.
SLV_ERR_WD_FACT_INV	06h	One of the watchdog factors from the Master was 0. This is not allowed.
SLV_ERR_TIME_OUT	07h	Slave watchdog timeout. The Slave has gone offline and must be reinitialized by the Master. Check response timeout.
SLV_ERR_WARN_WD_DIS	08h	Slave timeout watchdog disabled from Master.

All these errors, except TIME_OUT, happen when the Slave is being parameterized by the Master.

10.10 Diagnostic Counters

The scanner maintains a variety of diagnostic counters to indicate:

- General statistics on messages sent and received, for example

- The state of the Master

- Network statistics

The counters are located in the M1 file from 4100 to 4200.

To reset these counters to 0, set the low byte of register 4100 to a non-zero value. The scanner then clears the counters to 0 and clears register 4100 back to 0.

The counters are also cleared when you put the SLC in Program mode.

In the following tables, counters with a name beginning with "diag" or "err" roll over to zero when they reach their maximum value. "L" indicates low byte; "H" indicates high byte.

Table 76:   Diagnostic Counters

Name	Location	Meaning
pfbInitCtrs	4100L	If non-zero, scanner clears counters.
errLanOffline	4100H	LAN went offline because of errors.
diagConf	4101	Total confirmations.
diagInd	4102	Total indications.
errNotOk	4103	Total not OK confirmations and indications.
diagTokHldTime	4104-4105	Instantaneous token hold time.
diagMinTokHldTime	4106-4107	Minimum token hold time.
diagMasterUpdate	4108	Master I/O update cycles completed.
errMasErr	4109L	Master->DP Slave errors.
errMasReConfig	4109H	Master->DP went offline and had to be reconfigured.
diagMasScanTime	4110-4111	Master scan time (µs).
diagMasMaxScanTime	4112-4113	Maximum Master scan time (µs).
diagSlaveUpdate	4114	Slave updates.
errSlvErr	4115L	Slave configuration failures.
errSlvTout	4115H	Slave watchdog timeouts.
diagLay2MsgOk	4116	FDL messages sent OK.
errLay2MsgNotOk	4117L	FDL message errors.
diagLay2SapOk	4118	FDL SAP requests processed OK.
errLay2SapNotOk	4119L	FDL SAP errors.
errInvReqLen	4124L	Invalid request length errors.
errFifo	4124H	FIFO overflow errors.
errRxOverrun	4125L	Receive overrun errors.
errDblTok	4125H	Double token errors.
errRespErr	4126L	Response errors.
errSyniErr	4126H	SYNI errors.
errNetTout	4127L	Network timeout errors.
errHsa	4127H	Station higher than HSA was heard.
errStn	4128L	Duplicate station detected.
errPasTok	4128H	Unable to pass token.
errLasBas	4129L	Active station list invalid.
ErrInternal	4129H	Internal error.
errArg	4130L	Internal error.

Diagnostics   167

10.10.1 General Statistics

These counters relate to the overall operation of the scanner on PROFIBUS.

Table 77:   General Statistics Counters

Name	Location	Meaning
errLanOffline	4100H	Increments when the LAN encounters errors and goes offline.
diagConf	4101	Counts total confirmations (good replies to messages that this station has generated).
diagInd	4102	Counts total indications (unsolicited messages to this station).
errNotOk	4103	Counts total Not OK confirmations and indications (total bad replies and bad unsolicited messages).
diagTokHldTime	4104-4105	Instantaneous token hold time, in Tbits. This is the time available to send messages when the scanner gets the token.
diagMinTokHldTime	4106-4107	Minimum token hold time, in Tbits. This is the minimum value of diagTokHldTime. If this number is 0, you may need to increase the target token rotation time or delta TTR in COM PROFIBUS.

10.10.2 DP Master Statistics

These counters relate to the scanner's operation as a DP Master.

Table 78:   DP Master Statistics Counters

Name	Location	Meaning
diagMasterUpdate	4108	The number of Master I/O update cycles completed.
errMasErr	4109L	The number of DP Master to DP Slave communication errors. Incremented anytime the message failed because of retries exceeded, and so on.
errMasReConfig	4109H	The number of times a DP Slave went offline and had to be reconfigured, e.g., 120the scanner was actively updating a node and got a faulty message. This counter increments after the scanner has retried the message the number of times specified in pfbMsgRetryLimit (set by COM PROFIBUS).
diagMasScanTime	4110-4111	Contains the instantaneous Master scan time in microseconds, i.e., the time to scan all the Slaves assigned to this Master. The scanner adds 100 microseconds to the measured time to allow for overhead in starting the timer, and so on.
diagMasMaxScanTime	4112-4113	Contains the maximum value that diagMasScanTime has reached since it was last cleared.

10.10.3 DP Slave Statistics

These counters relate to the operation of the card as a DP Slave.

Table 79:   DP Slave Statistics Counters

Name	Location	Meaning
diagSlaveUpdate	4114	Increments when the card receives an I/O data update from the Master.
errSlvErr	4115L	Increments when there are errors while the Master is parameterizing the Slave.
errSlvTout	4115H	Increments when the Slave hasn't received a message from the Master within the Master timeout period.

10.10.4 ASPC2 PROFIBUS Controller Statistics

The ASPC2 LAN controller maintains the following counters. They are all 1 byte long. When these counters reach 255, they hold at 255 until cleared.

Table 80:   ASPC2 Controller Counters

Counter Name	Function
errInvReqLen	This is the low byte of register 4124. It counts invalid request length errors. These errors occur when the scanner software gives the LAN controller a message that is too long. This error is an internal error and should never occur.
errFifo	This is the high byte of register 4124. It counts FIFO overflow errors. These errors occur when the LAN controller can't write to memory fast enough. This error is an internal error and should never occur.
errRxOverun	This is the low byte of register 4125. It counts receive overrun errors. This error is an internal error and should never occur.
errDblTok	This is the high byte of register 4125. It counts double token errors. These errors may occur when more than one node thinks it has the token or due to wiring errors, duplicate nodes, and so on. The scanner withdraws to the "not hold token" state (decides it doesn't have the token) and waits until it gets the token passed to it again.
errRespErr	This is the low byte of register 4126. It counts response errors when a message failed or there was no response from the destination. This error may be due to bad hardware or faulty wiring.
errSyniErr	This is the high byte of register 4126. It indicates general network errors. These errors occur when there are problems on the network but before a network timeout error occurs.
errNetTout	This is the low byte of register 4127. It counts network timeout errors. These errors occur when the network is dead. If a timeout occurs, the scanner enters the claim token state.
errHsa	This is the high byte of register 4127. It increments when a station higher than the set high station address is heard. If the scanner is going online, it increments the counter and stays offline.
errStn	This is the low byte of register 4128. It increments when a duplicate station is detected. If this error occurs when the scanner is going online, the scanner increments the errStn counter and stays offline.
errPasTok	This is the high byte of register 4128. It increments when the scanner is unable to pass the token. This is usually caused by bad wiring (usually shorted) or other hardware problems. The scanner tries to pass the token, fails to hear its own token pass message, and puts itself offline.
errLasBad	This is the low byte of register 4129. It increments when the active station list on the ASPC2 LAN controller is invalid because of multiple network errors. This error is caused by bad wiring or hardware.
errInternal	This is the high byte of register 4129. This location is reserved. If a fatal error occurs, the value in this register may indicate the source of the problem. Record it for Technical Support. However, the scanner uses this location for other purposes. If there is a value in this location, it doesn't necessarily indicate that a fatal error has occurred.
errArg	This is the low byte of register 4130. This location is reserved. If a fatal error occurs, the value in this register may indicate the source of the problem. Record it for Technical Support. However, the scanner uses this location for other purposes. If there is a value in this location, it doesn't necessarily indicate that a fatal error has occurred. The scanner also copies this counter to the low byte of register 4012.

10.11 Summary of Diagnostic Locations

The following tables summarize the locations used.

10.11.1 M1 File

Table 81:   M1 File Diagnostic Locations

Locations	Use
3700-3827	DP Master error information.
3828	DP Master diagnostic station select.
3829-3950	DP Master diagnostic status buffer.
4000-4007	Slave status table.
4011	PROFIBUS status.
4012	errArg.
4013	Bit 0 = all Slaves good flag.
4014	Firmware revision.
4017	DP Slave status.
4018	DP Slave error.
4020-4027	DP Master Slave error table.
4030-4037	DP Master extended status table.
4100-4200	Diagnostic counters.

10.11.2 M0 File

Table 82:   M0 File Diagnostic Locations

Locations	Use
4000-4007	Ignore Slave fault table.
4010	Global fault enable.

11

Upgrading the Scanner Firmware

Chapter Sections:

- Upgrading the Scanner Firmware

11.1 Upgrading the Scanner Firmware

Use the serial CONFIG port on the front of the scanner to upload configuration files to the scanner.

The serial cable for a standard PC COM port must have lines 2 and 3 swapped. It doesn't require handshaking. Pins 2 and 3 are wired the same as a PC 9-pin COM port.

Connect to the serial port using any communication software, such as HyperTerminal. The scanner serial port supports any baud rate from 9600 baud to 115 kbaud, with no parity, 8 data bits, 1 stop bit and no Flow Control. The scanner automatically detects the baud rate being used. **115 Kbaud is recommended**.

To upgrade the scanner firmware, follow these steps:

1. Cycle power on the SLC.

2. When the SLC is powering up, the SYS LED flashes green, red, amber then solid red for approximately 3 seconds before turning off. While it is flashing, hit the exclamation mark (!) in your communication software to tell the scanner that you want to upload software. You may need to press it several times while the scanner tries to autodetect the baud rate.

    The LEDs flash red alternately to tell you the scanner is in system configuration mode. The commands available are:

Table 83:   Download Commands

Command	Description
ver pb3slc.ss3	Displays the current ss3 firmware revision number. Typing "ver" by itself displays boot code version
help	Displays the available commands
ry pb3slc.ss3	Loads new pb3slc.ss3 into flash
burn	Loads new pb3slc.ss4 into flash
run pb3slc.ss3	Exits system configuration mode

3. Type "ry pb3lsc.ss3". The scanner responds with a query.

4. Using your communication software, initiate a Ymodem send of the module firmware file. For Hyperterminal, this is done by selecting the Transfer menu and choosing *Send File.* Set the protocol to Ymodem, browse for the firmware file and then press Send. When the download is complete, the module automatically programs it into flash.

5. When the module has been programmed into flash, use the "ver pb3slc.ss3" command to

confirm that the version number is correct.

6. Use the "run pb3slc.ss3" command to exit System Configuration mode and startup. The scanner turns off the SYS LED.

7. Type "burn".

8. Initiate a Ymodem send of the firmware module "pb3slc.ss4", using the communication software.

9. Wait for a "Success!! Please Restart Module" message.

10. Cycle power on the module.

12

Network Parameter Defaults

Chapter Sections:

- Network Parameter Default Tables

12.1 Network Parameter Default Tables

The following tables show the default values assigned by the scanner for the network parameters. The values depend on:

- The baud rate

- Whether there are repeaters on the network

- Whether there are FMS devices on the network

Idle time 1 is the amount of time the scanner waits after it receives a response before it sends. This corresponds to the PROFIBUS Idle Time.

Idle time 2 is the amount of time the scanner waits after it sends before it sends again. This corresponds to the PROFIBUS Max TSDR.

Table 84:   No Repeater, No FMS

Baud Rate	Slot Time	Idle Time 1	Idle Time 2	Ready Time	Quiet Time
9600	100	37	60	11	0
19200	100	37	60	11	0
31.25 K	100	37	60	11	0
45.45 K	100	37	60	11	0
93.75 K	100	37	60	11	0
187.5K	100	37	60	11	0
500K	200	37	100	11	0
1.5M	300	37	150	11	0
3M	400	45	250	11	3
6M	600	55	450	11	6
12M	1000	75	800	11	9

Table 85:   No Repeater, FMS

Baud Rate	Slot Time	Idle Time 1	Idle Time 2	Ready Time	Quiet Time
9600	125	37	60	30	0
19200	250	61	120	60	0
31.25 K	300	61	120	60	0
45.45 K	400	61	120	60	0
93.75 K	600	126	250	125	0
187.5K	1500	251	500	250	0
500K	3500	251	1000	250	0
1.5M	3000	151	980	150	0
3M	400	45	250	11	3
6M	600	55	450	11	6
12M	1000	75	800	11	9

Table 86:   Repeater, No FMS

Baud Rate	Slot Time	Idle Time 1	Idle Time 2	Ready Time	Quiet Time
9600	100	37	60	11	0
19200	100	37	60	11	0
31.25 K	100	37	60	11	0
45.45 K	100	37	60	11	0
93.75 K	100	37	60	11	0
187.5K	100	37	60	11	0
500K	200	37	100	11	0
1.5M	300	37	150	11	0
3M	400	45	250	11	3
6M	600	55	450	11	6
12M	1000	75	800	11	9

Table 87:   Repeater, FMS

Baud Rate	Slot Time	Idle Time 1	Idle Time 2	Ready Time	Quiet Time
9600	125	37	60	30	0
19200	250	61	120	60	0
31.25 K	300	61	120	60	0
45.45 K	400	61	120	60	0
93.75 K	600	126	250	125	0
187.5K	1500	251	500	250	0
500K	3500	251	1000	250	0
1.5M	3000	151	980	150	0
3M	400	45	250	11	3
6M	600	55	450	11	6
12M	1000	75	800	11	9

13

M0 and M1 Files

Chapter Sections:

- Overview

- Addressing M0 and M1 Files

13.1 Overview

The following data is based on information in the SLC 500 Instruction Set Reference Manual, Allen-Bradley publication 1747.6.15, and is provided here for reference.

M0 and M1 files reside in specialty I/O modules only. There is no image for these files in the processor memory. This means that when an application running on the SLC accesses the data, the SLC must go out to the module and read the data. The contents of these files depend on the specialty I/O module's function. Both types of files are considered read/write files by the SLC processor. M0 and M1 files can be addresses in your ladder program and they can also be acted upon by the specialty I/O module, independent of the processor scan. It is important to keep the following in mind when creating and applying your ladder logic.

During the processor scan, M0 and M1 data can be changed by the processor, according to ladder diagram instructions addressing the M0 and M1 files. During the same scan, the specialty I/O module can change the M0 and M1 data, independent of the rung logic applied during the scan.

13.2 Addressing M0 and M1 Files

The addressing format for M0 and M1 files is `Mf:e.s/b`, where:

- f = file type, 0 or 1

- e = slot (1 to 30)

- s = word (0 to maximum supplied by module)

- b = bit (0 to 15)

13.2.1 Restrictions on Using M0-M1 Data File Addresses

M0 and M1 data file addresses can be used in all instructions except the OSR instruction and the instruction parameters noted below.

Table 88:   M0 and M1 File Access Restrictions

Instruction	Parameter (Uses File Indicator #)
BSL,BSR	File (bit array)
SQO, SQC, SQL	File (sequencer file)
LFL, LFU	LIFO (stack)
FFL, FFU	FIFO (stack)

13.2.2 Monitoring Bit Addresses

M0 and M1 Bit Monitoring Disabled

When you monitor a ladder program in Run or Test mode, the following bit instructions, addressed to an M0 or M1 file, are indicated as false (regardless of their actual true/false logical state):

--| |-- --|/|-- --( )-- --(L)-- --(U)--

M0 and M1 Bit Monitoring Enabled

The SLC 5/03, SLC 5/04 and SLC 5/05 processors allow you to monitor the actual state of each addressed M0/M1 address (or data table). The highlighting appears normal when compared with other processor data files. The SLC 5/03's performance will be reduced to the degree of M0/M1 referenced screen data.

If you need to show the state of the M0 or M1 addressed bit, you can transfer the state to an internal processor bit.

Transferring Data between Processor Files and M0/M1 Files

The SLC processor does not contain an image of the M0 or M1 file. As a result, you must edit and monitor M0 and M1 file data via instructions in your ladder program. For example, you can copy a block of data from a processor data file to an M0 or M1 data file or vice versa using the COP instruction in your ladder program.

Access Time

During the program scan, the SLC processor must access the scanner card to read or write M0 or M1 data. This access time must be added to the execution time of each instruction referencing M0 or M1 data. The SLC 500 Instruction Set Reference Manual contains details about this access time.

Minimizing the SLC Scan Time

You can limit the SLC processor scan time by minimizing the use of instructions that address M0 or M1 files.

A
Technical Data

Appendix Sections:

- Technical Data

A.1 Technical Data

Table 89:   Technical Data for the SST-PB3-SLC Module

Part Number	SST-PB3-SLC
Function	SLC-500 scanner for PROFIBUS networks
SLC Interface	32 words direct Input and Output data
	1000 words of M0 and M1 mapped data
Environmental	Storage temperature -40°C to 85°C
	Operating temperature 0°C to 50°C
	Operating RH level 5% to 95%
	Pollution Degree 1 - no pollution, or only non-conductive or non-corrosive pollution
Backplane Current Consumption	750 mA @ 5 VDC*

*The 5VDC backplane voltage must be from a supply delivering Separated Extra Low Voltage (SELV).

B
CE Compliance

Appendix Contents:

- CE Compliance

B.1 CE Compliance

Marking of this equipment with the C€ symbol indicates compliance with with European Council Directive 89/336/EEC - The EMC Directive as amended by 92/31/EEC and 93/68/EEC.

Warning

This is a Class A product. In a domestic environment, this product may cause radio interference, in which case you may be required to take adequate measures.

Caution

This equipment is neither designed for, nor intended for operation in installations where it is subject to hazardous voltages and hazardous currents.

Note

To maintain compliance with the limits and requirements of the EMC Directive, it is required to use quality interfacing cables and connectors when connecting to this device. Refer to the cable specifications in the Hardware Guide for the selection of cable types.

Note

The Backplane voltage supply for this equipment must be delivered as Separated Extra Low Voltage (SELV).

C

Warranty and Support

Appendix Sections:

- Warranty

- Reference Documents

- Technical Support

C.1 Warranty

For warranty information pertaining to this product, refer to
http://www.molex.com/images/woodhead/woodhead_limited_warranty.pdf.

C.2 Reference Documents

Table 90:   Reference Documents

For…	Read this Document	Document Number
An overview of SLC products	SLC 500 System Overview	A-B 1747-2.30
A description of how to install and use the SLC 500 PLC	Installation and Operation Manual for Modular Hardware Style Programmable Controllers	A-B 1747-6.2
An index of Allen-Bradley publications	Allen-Bradley Publication Index	A-B SD499

For information on PROFIBUS, refer to one of the following:

- PROFIBUS Standard DIN 19 245, parts 1 and 3. Part 1 describes the low-level protocol and electrical characteristics. Part 3 describes the DP protocol.

- European Standard EN 50170

- ET 200 Distributed I/O System Manual, 6ES5 998-3ES22

- IEEE 518 Guide for the Installation of Electrical Equipment to Minimize Electrical Noise Input to Controllers

C.3 Technical Support

Please ensure that you have the following information readily available before calling for technical support:

- Card type and serial number

- Computer's make, model, CPU speed and hardware configuration (other cards installed)

- Operating system type and version

- Details of the problem you are experiencing: firmware type and version, target network and circumstances that may have caused the problem

C.3.1 Getting Help

Technical support is available during regular business hours by telephone, fax or email from www.Molex.com. Documentation and software updates are also available on the website.

North America

Canada:
Tel: +1-519-725-5136
Fax: +1-519-725-1515
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