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GE Fanuc Automation

State Logic Products

State Logic[®] Processor For Series 90[™] -70 PLC

User's Guide

GFK-0727B

March 1998

Warnings, Cautions, and Notes as Used in this Publication

Warning

Warning notices are used in this publication to emphasize that hazardous voltages, currents, temperatures, or other conditions that could cause personal injury exist in this equipment or may be associated with its use.

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Chapter 2. Installation and Maintenance

Chapter 3. Troubleshooting

Chapter 4. Serial Communications

Chapter 5. Specifications

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Chapter 1

State Logic Processor Description

The State Logic Processor (SLP) is a module which inserts into a Series 90™-70 PLC chassis. This module has the State Engine operating system to execute State Logic control programs produced by the ECLiPS programming software package.

The SLP exists together with a CPU module in the Series 90 PLCs. The CPU may execute a Relay Ladder Logic Program at the same time the State Logic Processor is executing a State Logic Program. The SLP manipulates the CPU memory space and the CPU controls the I/O during its normal cycle of operations. More than one SLP can be installed in one Series 90-70 PLC system.

The software products, ECLiPS and OnTOP, are the user interfaces to the SLP. ECLiPS is a program development and on-line monitoring software product which runs on an IBM-PC® compatible computer. OnTOP, the On-Line Troubleshooting Operator Program, also runs on an IBM-PC compatible computer. For questions about programming or on-line functions, see the ECLiPS or OnTOP User's Manuals.

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Physical Description

The SLP occupies a single slot in the Series 90-70 rack, communicating with the PLC CPU over the backplane to perform its many control functions. The SLP controls and accesses CPU I/O, register, and system data.

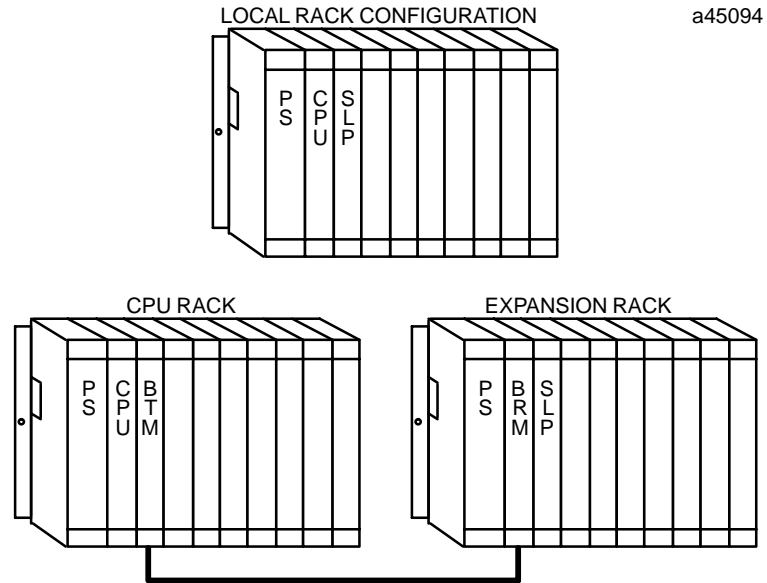


Figure 1-1. SLP in Series 90-70 Chassis

The 90-70 SLP uses a 12.5 mHz 80C186 microprocessor and has two serial ports that can be either RS-232 or RS-422/485. One port is designated the programming port, to be used to communicate with ECLiPS or OnTOP. One of the serial ports may also be configured to be a CCM port, communicating to a host computer using the CCM protocol. See the section on Serial Communications for more information on using the serial ports.

There are three LED indicators located at the top front edge of the SLP. The top LED is the status indicator for the SLP. During power-up this LED flashes while the SLP is running its diagnostic checks. If this LED is off, either the power is off, there is some hardware malfunction of the SLP, or there is no CPU present in the Series 90-70 PLC system. When the LED is on, the SLP is functioning normally.

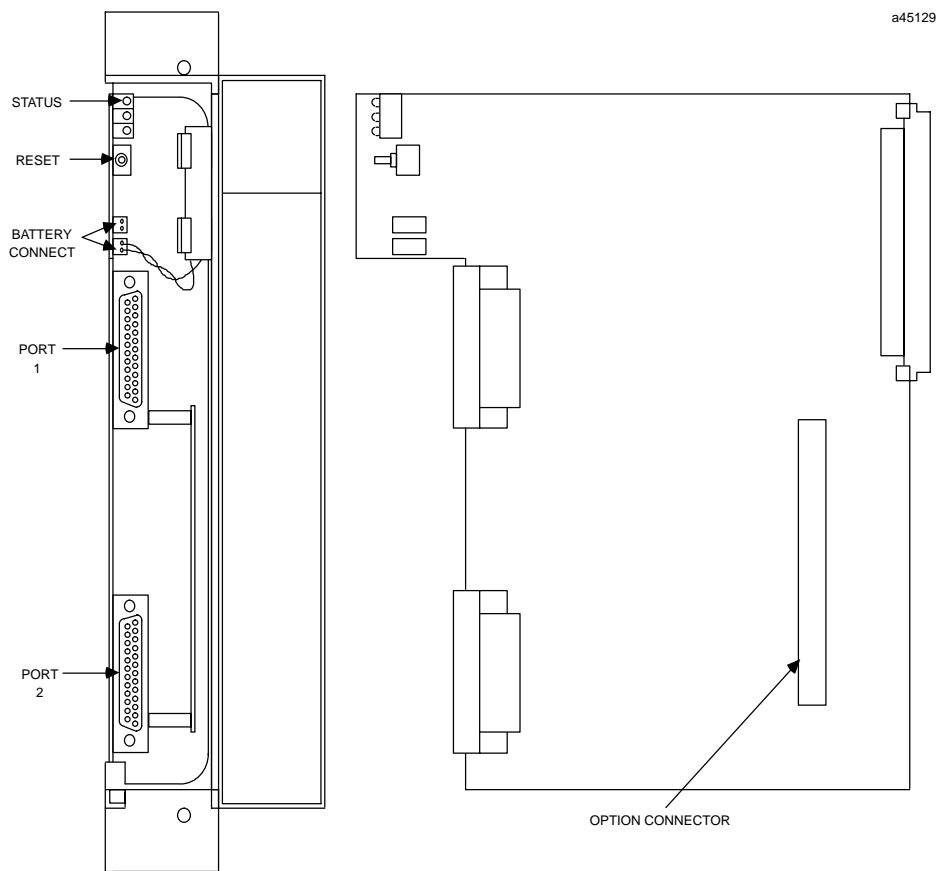


Figure 1-2. Series 90-70 State Logic Processor

The SLP comes with a battery to maintain memory when power is removed. This is a lithium battery which is installed as shown in the SLP drawings. When the battery reaches a low charge, this condition is reported to the PLC fault table.

Each SLP also comes with a Reset switch. When the reset button is pressed for less than 5 seconds, the SLP behaves as if power was lost momentarily. The program begins operation if the SLP is setup for auto-run operations, otherwise the SLP is in HALT mode. If the reset switch is pressed for more than 5 seconds, then the SLP memory is initialized and the program must be reloaded.

Operational Description

The State Logic Processor (SLP) uses areas in the CPU memory for I/O references and Register values. The SLP and the CPU communicate this information over the PLC backplane.

Backplane transfers are accomplished using two methods, the SLP initiates the transfer or a ladder program in the CPU initiates the transfer. ECLiPS gives the option of the type of transfer for the program. The SLP initiated type is called Co-Processor and the CPU initiated transfer is called the Controller type. Use the Co-Processor type for most applications and the Controller type for high speed applications.

There are two types of Controller programs; Large and Small. Use the Large for applications where a ladder program is executing in the CPU at the same time the SLP is executing its program. The Small Controller type is used for applications with no ladder program in the CPU.

The SLP addresses contiguous blocks of the CPU memory space for most of the different memory types (%I, %Q, %AI, %AQ, %M, %G, %T, %R, %S, %SA, %SB, %SC). These blocks can be mapped to any section of the available CPU memory space for each type of memory used.

When a Ladder Logic control program and a State Logic control program are running at the same time, the State Logic and Ladder Logic programs should not be controlling the same outputs. The SLP cannot control an output that is being controlled by the CPU, since the 90-70 CPU always takes precedence when both processors are controlling the same outputs.

Chapter 2

Installation and Maintenance

This chapter describes how to install the SLP into a Series 90 PLC rack. There is also a section describing maintenance considerations.

Selecting the Right Slot

The SLP can be installed in any unused slot in any rack of the Series 90 PLC if the following rules are followed:

1. Configuration created by Logicmaster must match the physical location of the modules. Configuration faults are logged in the PLC fault table.
2. For the 90-70 SLP all the slots between the SLP and CPU (main rack) or Bus Receiver Module (expansion rack) must be occupied. If any slots between are empty the SLP cannot communicate with the CPU.

Inserting the SLP

Follow these steps to insert the SLP into the Series 90 rack:

1. Power down the Series 90 PLC system
2. Locate the desired rack and slot.
3. Slide the 90-70 SLP completely into the slot.
4. Press down firmly to lock the module in place, but do not use excessive force.
5. Power up the PLC rack. The Status LED flashes during power-up diagnostics. The LED comes on steady when the SLP is ready for operations.

Configuration

Use the Logicmaster™ 90 configuration software to add the SLP to the Series 90 I/O configuration. This software is used to describe the modules present in the PLC racks. Rack and slot location and other features for each module are entered by completing setup screens that describe the modules in a rack.

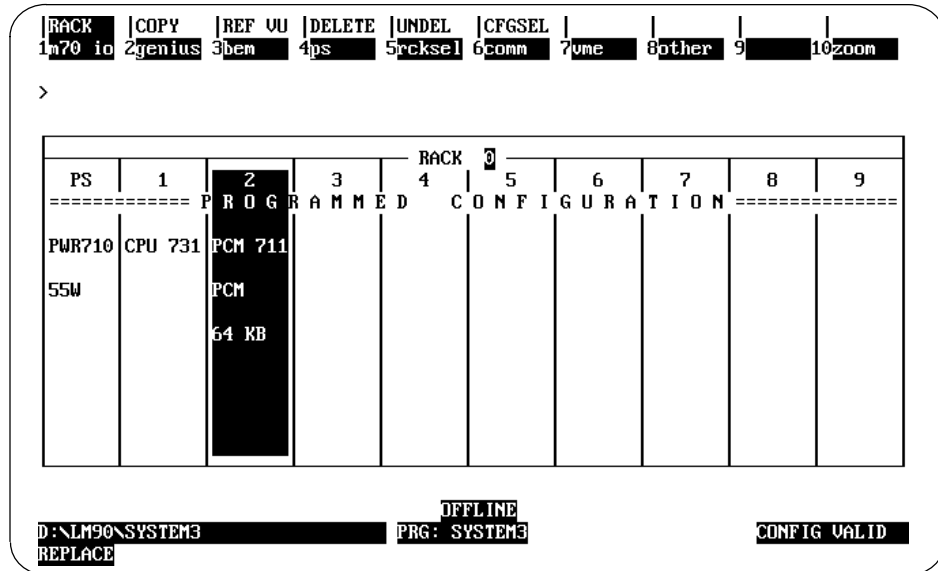


Figure 2-1. Sample Logicmaster Configuration Screen

From the main menu of the Logicmaster 90 configuration software, press I/O <F1>. The screen displays a representation of the modules in a rack. To add an SLP to the configuration, highlight the desired slot, then press Other <F8> and then PCM <F1>.

Now press Zoom <F10> to view the current configuration. Press <Enter> to enter the highlighted catalog number and display the PCM detail screen.

Now set the Configuration Mode to PCM CFG for the 90-70 SLP. First highlight the Config Mode option and repeatedly press the <Tab> key until NONE is displayed on the screen. The serial ports are under program control and the parameters are initialized by the State Logic Processor.

Now press the <Esc> key to save the configuration and return to the rack display. The display should now show a PCM in the correct slot. Send the configuration to the PLC CPU and the configuration is complete.

During program execution the CPU must be in run mode with the outputs enabled. Use LM90 to set the status of the CPU before executing the State Logic program.

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Battery

The State Logic Processor comes with a 3 volt lithium battery (IC697ACC701) to maintain memory through a power cycle. If the battery charge becomes low, a fault is set in the fault table. These faults can be monitored by the State Logic program.

To replace the battery, connect the new battery to the extra set of battery connections then disconnect the old battery. A Product Safety Data Sheet for the battery is available. Order from GE Fanuc using number GFK-0633.

Chapter 3

Troubleshooting

This chapter provides procedures for diagnosing State Logic Processor (SLP) problems. If these procedures do not solve the problem, contact the GE Fanuc Hotline (1-800-828-5747) for assistance.

Status LED is not ON Steady

1. Check that power is supplied to the I/O rack housing the SLP. Try removing and reinstalling the SLP.
2. Cycle power to the SLP, then press the reset button for more than 5 seconds.
3. Turn the power OFF and disconnect the battery and short the SLP battery terminal connection points to clear the SLP. Reconnect the battery, turn ON power again, and reset the SLP.
4. Check that the CPU is functioning properly by checking its "OK" LED.
5. Check that there are no empty slots between the CPU and the SLP. If there are empty slots, the Status LED blinks continuously.
6. If the Status LED is still not ON, try to download a program from ECLiPS or OnTOP. If you can connect with the SLP and download a program, then the Status LED is faulty.
7. If you get a message that ECLiPS or OnTOP cannot connect to the controller, then check the fault table in the CPU using Logicmaster 90. If there is a fault "Bad or missing module", then the SLP is faulty and must be returned for repairs.
8. If there is no fault then contact the GE Fanuc Hotline for assistance.

Serial Communication Problems

This section is split into two parts, communication problems to ECLiPS or OnTOP and problems with other serial devices.

Communications Problems with ECLiPS or OnTOP

1. Check that the serial cable used conforms to one of the types specified for communications to the SLP ports. Check that the cable is firmly secured at both ends.
2. When there is a communications problem, a message indicating problems connecting to the controller is displayed together with some options. Select the "Change Host Comm Port Settings" option to check the computer port being used and the baud rate. The default SLP baud rate is 19.2K.
3. The SLP programming port may have been changed. ECLiPS and OnTOP must be connected to the designated programming port. The default programming port is Port 1 but can be changed by ECLiPS or OnTOP. Make sure the serial cable is connected to the current programming port.
4. The SLP serial port configuration may have been changed. These parameters can only be changed by Statements using the Set_Commport keyword in the State Logic program. Reset the SLP to return the SLP serial port parameters to their default state. If the program is setup to start running automatically and the program continues to change the serial port parameters after the reset switch is pressed, turn off the power to the SLP, remove the battery, and short the SLP battery leads to reset the SLP.
5. Both ports of the 90-70 SLP can be configured to be an RS-422 port. Make sure that the host computer serial port setup matches the SLP port for RS-232/RS-422 option.
6. If there is still no communication between the SLP and OnTOP or ECLiPS then call the GE Fanuc Hotline for assistance.

Communications Problems with Another Serial Device

1. Check that the serial cable used conforms to one of the types specified for communications to the SLP ports. Check that the cable is firmly secured at both ends.
2. Make sure that the serial port parameters of the serial device match the settings of the SLP. The default settings of the SLP are 19.2K baud rate, 8 data bits, 2 stop bits, and no parity.
3. Make sure the RS-422/RS-232 SLP option matches the device setup.
4. When connecting some device to the programming port, make sure that you exit ECLiPS or OnTOP normally before disconnecting from the SLP.
5. If there are still problems contact the GE Fanuc Hotline for assistance.

Chapter 4

Serial Communications

Serial communications with the State Logic Processor (SLP) is provided through one of the two serial ports. Each of these ports can send and receive serial data independent from the other. Each of these ports on the 90-70 SLP may be either an RS-232 or an RS-422/485 port.

ECLiPS and OnTOP must communicate with the SLP through the programming port. Either port can be the programming port, but port one is the default programming port. When ECLiPS or OnTOP is not connected to the SLP, the programming port can be used to communicate with some other serial device. To properly set the programming port to communicate with another device, exit ECLiPS or OnTOP normally before disconnecting from the SLP.

Either of these ports may also be a CCM port. The CCM port uses the GE Fanuc CCM2 protocol for all communications. This protocol is used for connecting the SLP with a host computer which collects data and changes data in the SLP. Typical CCM uses are connecting to a graphical user interface program such as CIMPLICITY® or for custom host interaction with the SLP.

The SLP is always a slave to the host, i.e., all communications are initiated by the host computer. The SLP may be one of several devices on a CCM network. The CCM port is always the port that is not designated as the programming port. The CCM port is a normal RS-232 or RS-422/485 port when CCM communications are not enabled.

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Programming Serial Communications

The program communicates through two ports using WRITE and READ terms. For example:

State: Get_Setpoint

Write "Enter New Setpoint" to Operator_Panel.

Read SetPoint1 from Operator_Panel, then go to Check_Setpoint State.

The Write Term sends the string of characters, Enter New Setpoint, to the port defined as the Operator_Panel. This same port is then monitored for input by the Read Term in the next Statement. The variable Setpoint1 is set to the value entered through the specified port.

In this example the WRITE and READ term information is directed to a particular port. Operator_Panel in this case is defined in ECLiPS as Port 1 or Port 2. Use the ECLiPS, DEFINE or LIST menus to make the port definitions. The default names are Port_1 and Port_2.

The Read and Write Terms may also be used without being directed to any particular channel, for example:

State: Choose_Recipe

Write "Enter Recipe Number".

Read Recipe_Number, then go to StartBatch State.

Since no port is specified in this example, information is sent to the programming port. For a more detailed discussion of programming serial input and output, refer to the Reference Section of the ECLiPS User's Manual.

Serial Port Setup

There are several serial port configuration options. Some of these options are set using ECLiPS or OnTOP, and others can only be set by an executing State Logic program.

ECLiPS or OnTOP Options

The options available in the ECLiPS or OnTOP menus to change the configuration of the SLP serial ports are displayed below.

- Change Programming Port
- Enable/Disable CCM Port
- Set CCM Station Number
- Set the RS-422/485 Status of each Port

Serial Options Set by ECLiPS or OnTOP

Each of these options is set in the State Engine Configuration Menu selected from the Debug Mode Project Menu in ECLiPS or from the Controller Option in OnTOP.

Programmable Setup Options

On power up the serial port parameters are set to their default settings. These settings may be changed by using the Set_Commport programming keyword in the control program. The Set_Commport keyword and parameters must be executed by the control program to change the serial port settings. Just changing the parameters in the ECLiPS serial communications setup form does not automatically change these settings.

After the SLP serial port parameters are set, ECLiPS automatically enters the Set_Commport instruction into the program when the following selections are made. Select the LIST option from the program mode menu; then select the Communication Ports option. Highlight the appropriate port and press <Enter>. ECLiPS prompts whether to enter the port name only or enter reconfiguration data. After selecting Enter Reconfiguration Data, the Set_Commport keyword plus the instructions to change the serial port parameters are entered into the ECLiPS program.

These options affect the SLP serial port configuration only, not the ECLiPS or OnTOP serial port setup. The option to change the ECLiPS or OnTOP host computer serial port configuration is available only when there is some problem connecting ECLiPS or OnTOP to the SLP. The only options which can be changed on the ECLiPS or OnTOP serial port configuration are selecting COM1 or COM2 and changing the baud rate.

Table 4-1. Serial Port Parameters

Parameter	Settings
Baud Rate	<u>19.2K</u> 1200 9600 300 4800 2400
Data Bits	<u>8</u> , 7 or 6
Parity	Even, Odd, <u>None</u>
Stop Bits	<u>2</u> , 1.5, or 1
Respond to Backspace	<u>Enabled</u> Disabled
Stop Transmit on Receive	<u>Enabled</u> Disabled
Receiver Always On	Enabled <u>Disabled</u>
Line Feed After Carriage Return	<u>Enabled</u> Disabled
Auto Echo	<u>Enabled</u> Disabled
XON/XOFF Protocol	<u>Enabled</u> Disabled
End of Message Character	Hex OD (Carriage Return)

* Default Settings are Underlined

Serial Cables

The State Logic Processor (SLP) is designed to work with two GE Fanuc standard serial cables. One cable is the Mini Converter Kit that comes with ECLiPS. The other is the PCM to IBM-PC cable. Use the RS-422/485 serial cables if RS-422/485 communications are used.

Mini Converter Kit

ECLiPS comes with a serial cable kit that can be used to both connect the CPU with Logicmaster and to connect the SLP with ECLiPS or OnTOP running on an IBM PC. This cable kit comes with three adapters:

Table 4-2. Mini Converter Kit Adapters

9-pin Male to 15-pin Male	CPU Port	HE693SNP232
9-pin Male to 25-pin Male	SLP Ports 1 or 2	AD232/1-2
9-pin Male to 25-pin Female	IBM PC COM 2	HE693XTADP

The cable provided in the kit is terminated with two 9-pin connectors. One of the adapters connects the 9-pin serial cable to the 15-pin serial port on the CPU (HE693SNP232), another adapter connects the serial cable to the 25-pin female serial ports on the SLP (AD232/1-2), and the third adapter can be used to connect to a 25-pin port on the IBM computer running Logicmaster 90, ECLiPS, or OnTOP (HE693XTADP).

Other Cable Options

Other cables that work with the SLP are the IBM-AT cable, IC697CBL702, and the Workmaster II or PS/2 cable, IC697CBL705. The connector on the SLP end can be made to be a right angle connector, so that the SLP front cover can be closed and the cable brought out the side of the SLP or through the bottom of the Series 90-70 chassis.

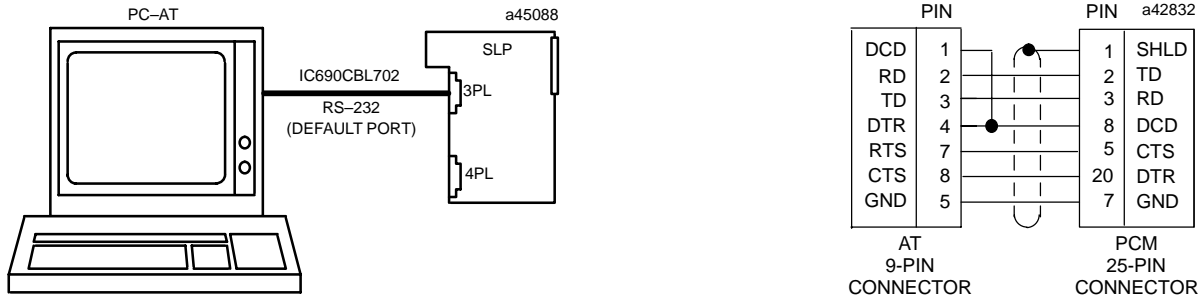


Figure 4-1. IBM-PC-AT to SLP Cable

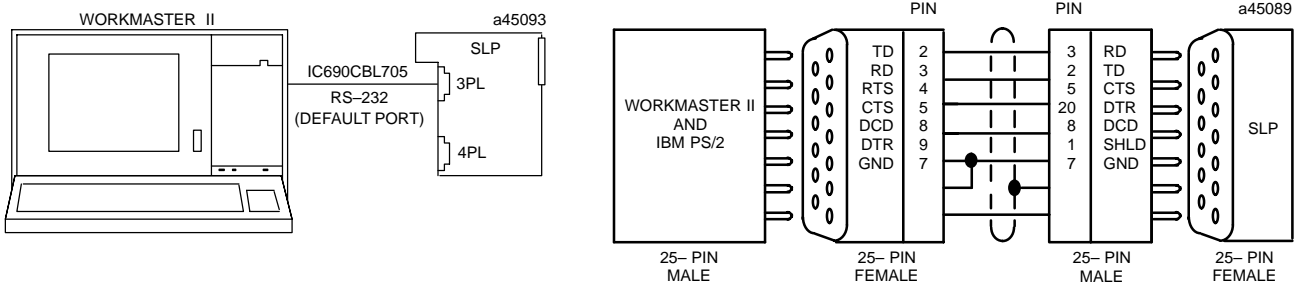


Figure 4-2. Workmaster II or PS/2 to SLP Cable

Custom Made Cables

If you want to make your own cable to connect to some serial device, use the drawing of the SLP pin assignments and the cable connection drawings in the previous section for the required connections. Hardware flow control lines must be used when communicating with the SLP using RS-232. The flow control lines are not used for RS-422/485 communications.

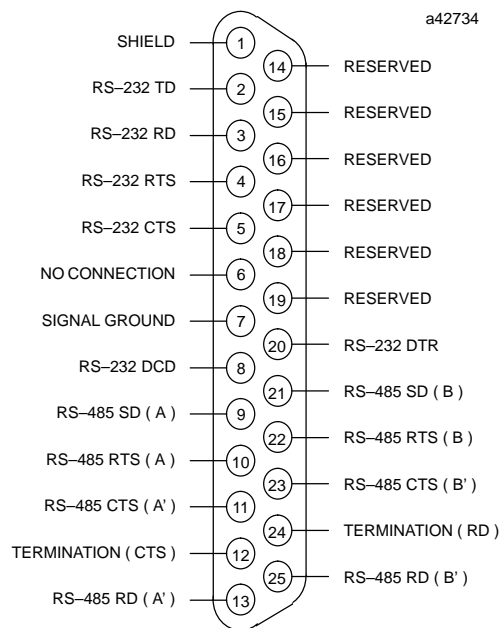


Figure 4-3. Serial Port Assignments for Series 90-70 SLP

NOTE

In the drawing above, the SD (Send Data) and RD (Receive Data) connections are the same as TXD and RXD used in other terminologies. (A) and (B) are the same as - and +. A' and B' denote inputs, and A and B denote outputs.

Chapter 5

Specifications

Table 5-1. Hardware Specifications

Serial Ports	RS-232/422/485
Memory Backup Battery	3 Volt Lithium
Battery Shelf Life	10 years
Battery Memory Retention with Power OFF	6 months nominal
Operating Temperature	0 to 60°C
Storage Temperature	-40 to 85°C
Humidity (non-condensing)	5-95%
Vibration	3.5 mm, 5-9 Hz: 1.0 G 9-150 Hz
Shock	15 G's 11 msec

Table 5-2. Standards

IEC	485, 380
JIS	C 0912, JIS C 0911
DIN	435, 380
UL	508, 1012
CSA	C22.2 No. 142, C22.2
NEMA/IS	2-230.40
ANSI/IEEE	C-37.90A-1978
VDE	805, 806, 871-877
FCC	15J Part A
VME	Supports VME Standard C.1

Table 5-3. Firmware Specifications

Tasks	256
States Per Task	255
Integer Variables (range -32768 to +322767)	1000
FloatingPoint Variables (range +/- 1.175494E-38 to +/- 3.402823E+38) 32 BIT IEEE Format.	1000
String Variables	100
String VariableSize	80Characters
Character Variables	64
PID Loops	20
Number of Timers	Unlimited
TimerResolution	1/100second
MaximumTotal Number of States	3000
AvailableProgramMemory	21 KBytes-Expandable
Flags	1000
Total VariablesPlusI/O	3000

90-70 SLP I/O and Register Specifications

The CPU selection determines the I/O and register ranges that can be accessed by the control program. ECLiPS generates different control programs depending on the type of CPU selected (731/732, 771/772, or 781/782).

The State Logic program can access a set number of points for each of the I/O types and registers. These points must form a continuous block anywhere within the range of the selected CPU. The SLP cannot have any more I/O or registers than those provided by the CPU in the system.

Table 5-4. 90-70 CPU and SLP I/O and Register Capacity

Processor	731/732	771/772	781/782	SLP
%I	512	2048	12288	1024
%Q	512	2048	12288	1024
%AI	8K	8K	8K	256
%AQ	8K	8K	8K	256
%T	256	256	256	256
%M	2048	4096	12288	2048 *
%G	1280	7680	7680	1280
%S	128	128	128	128
%SA	128	128	128	128
%SB	128	128	128	128
%SC	128	128	128	128
%R	16K	16K	16K	2048 **

* Programs with I/O transfer type Co_Processor are limited to 2000 % M I/O.

** Programs with I/O transfer type Controller are limited to 600 %R registers.

