Chapter 1. Introduction

Chapter Objectives

The information in this chapter will enable you to:

- Understand the product's basic functions & features
- Understand basic motion control concepts and apply them to your application

Product Description

The JSI is a digital servo controller that utilizes a digital PID control algorithm. The versatility of the controller allows for different configurations. The output utilizes a 12-bit DAC and can be selected to be used either as a voltage command output for use with traditional servo amplifiers, or as a current command output to directly drive hydraulic servo valves. The position feedback information may be provided by incremental encoders, absolute encoders, acoustic transducers, or from an analog voltage signal.

The programs that control motor motion use the Compumotor standard motion control command language and are downloaded over a standard RS-232C interface. There may be up to 100 different motion programs stored in non-volatile memory. Ninety nine of these programs may be recalled from external BCD thumbwheel switches, programmable controller, or over the RS-232C port from a computer. The JSI motion programs are capable of complex motion control capabilities as well as interactive machine control using the 13 user-defined, programmable inputs and 8 programmable outputs.

The JSI is a fully self-contained package with built-in power supplies. All that is required is an input power source (VAC or VDC). The controller is easy to install, program, and operate.

Product Features

The JSI offers the following features:

- Sixteen-bit, 68000 microprocessor control
- Voltage/current selectable output for use with servo amplifiers, or for driving hydraulic servo valves
- Twelve-bit DAC output resolution
- Incremental and absolute encoder feedback is standard
- Analog input voltage command capability
- Servo loop update time 0.5 or 1.0 ms
- Non-volatile, battery-backed-up RAM
- Easy-to-use, push-button adjustment of PID servo parameters
- Two-digit LED to display diagnostic faults
- RS-232C command interface with selectable baud rate
- Utilizes the X-Series programming language
- Daisy-chaining up to 16 controllers is possible
- 8K of non-volatile memory
- Up to 100 motion programs may be stored in non-volatile memory
- Motion program execution may be initiated by external BCD switches, a programmable controller, or a computer
- Fully isolated dedicated inputs: Home and End-of-Travel Limits
- Thirteen user-defined, programmable inputs

- Eight user-defined, programmable outputs
- Fully self-contained package with built-in power supplies
- Simple installation, programming, and operation procedures
- Distance, velocity, sequence, and loop counts can be entered from parallel input
- Subroutine operations can be performed with this unit

Theory of Operation

The key operational procedures involved in running a closed- loop servo system with a JSI controller are described below.

- The JSI controller produces an analog signal (current or voltage) to control the analog servo control system (i.e., analog servo drive or servo valve).
- The JSI receives an encoder signal (incremental or absolute) to close the motor's position loop. This capability allows the analog servo system to accurately position the motor.
- You can operate the JSI from a host computer using RS-232C communications, pre-program the JSI for standalone operation, or run the unit with a programmable logic controller (PLC).
- The servo control (DC drive or hydraulic servo valve) must close the system's velocity loop.

Figure 1-1 is an example of a typical closed-loop servo system.

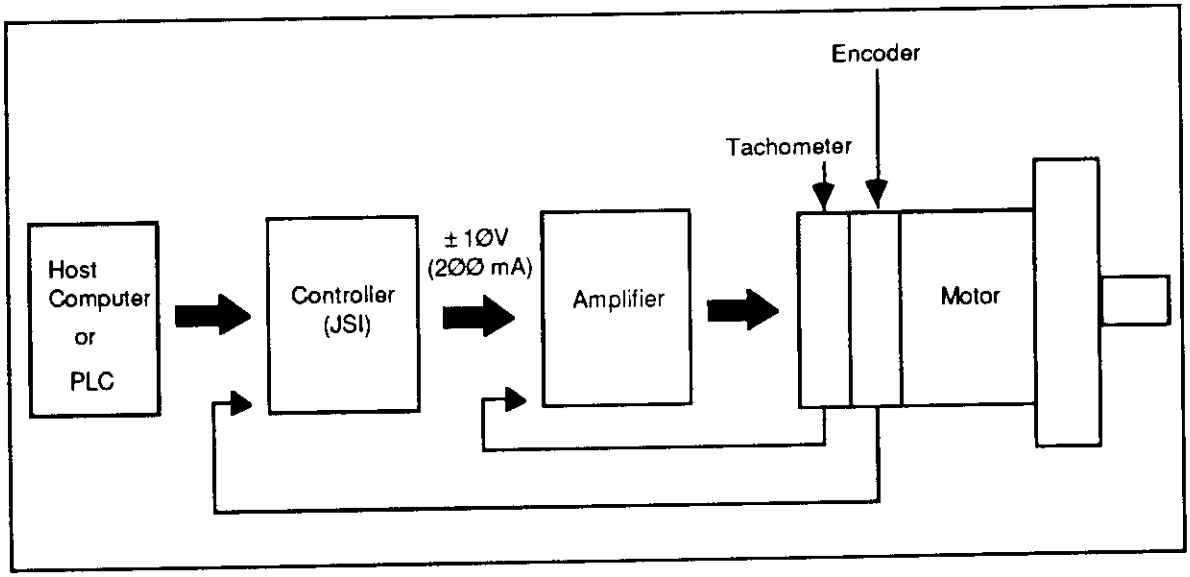

Figure 1-1. Typical Closed-Loop Servo System

Chapter 2. Getting Started

Chapter Objectives

The information in this chapter will enable you to:

- Verify that each component of your system has been delivered safely
- Become familiar with system components and their interrelationships
- Ensure that each component functions properly
- Configure the system properly

What You Should Have

You should inspect your JSI shipment upon receipt for obvious damage to its shipping container. Report any such damage to the shipping company as soon as possible. Parker Compumotor cannot be held responsible for damage incurred in shipment. Carefully unpack and inspect your JSI shipment. In addition to the JSI controller, the items listed in Table 2-1 should be present and in good condition.

Ship Kit Table

Description	Quantity	Part Number
AC Cable Assembly	1	71-009039-01
JSI User Guide	1	88-009040-01

Table 2-1. Ship Kit Table

Basic System Configuration

This section provides step-by-step instructions to complete the basic configuration of your JSI system. Parker Compumotor recommends that you configure your system components in the following order. *(Remember, this is a temporary configuration. The permanent installation will be performed in Chapter 3, Installation).*

1. Refer to the manual that accompanied your drive and follow the instructions specified to set the drive's functions and attach it to the motor. Be sure to test the drive and the motor to ensure that they are operating properly.
2. Follow the instructions provided in this manual to ensure that the JSI servo controller is operating properly.
   a. You will establish RS-232C communications and ensure that the communication function operates properly. If you are using an IBM or IBM-compatible computer, you will have to convert the computer to a terminal to perform communications with the JSI. If you are using a terminal, you will have set the terminal's parameter's to match the JSI controller's settings.
   b. You will need an oscilloscope or a multimeter to check voltage and current levels.
3. Follow the instructions provided in this manual to connect your encoder to the JSI. Refer to the encoder's user guide for procedures to set the encoder's functions. Be sure to test the encoder to ensure that it is working properly.
4. Attach the drive to the JSI. The entire system is now fully configured. You should try to operate all of the components to ensure that they function properly in this basic configuration. Try to simulate the moves you intend to perform when you install your system permanently.

Figure 2-1 is an illustration of the JSI controller's front panel.

JSI Front Panel Diagram

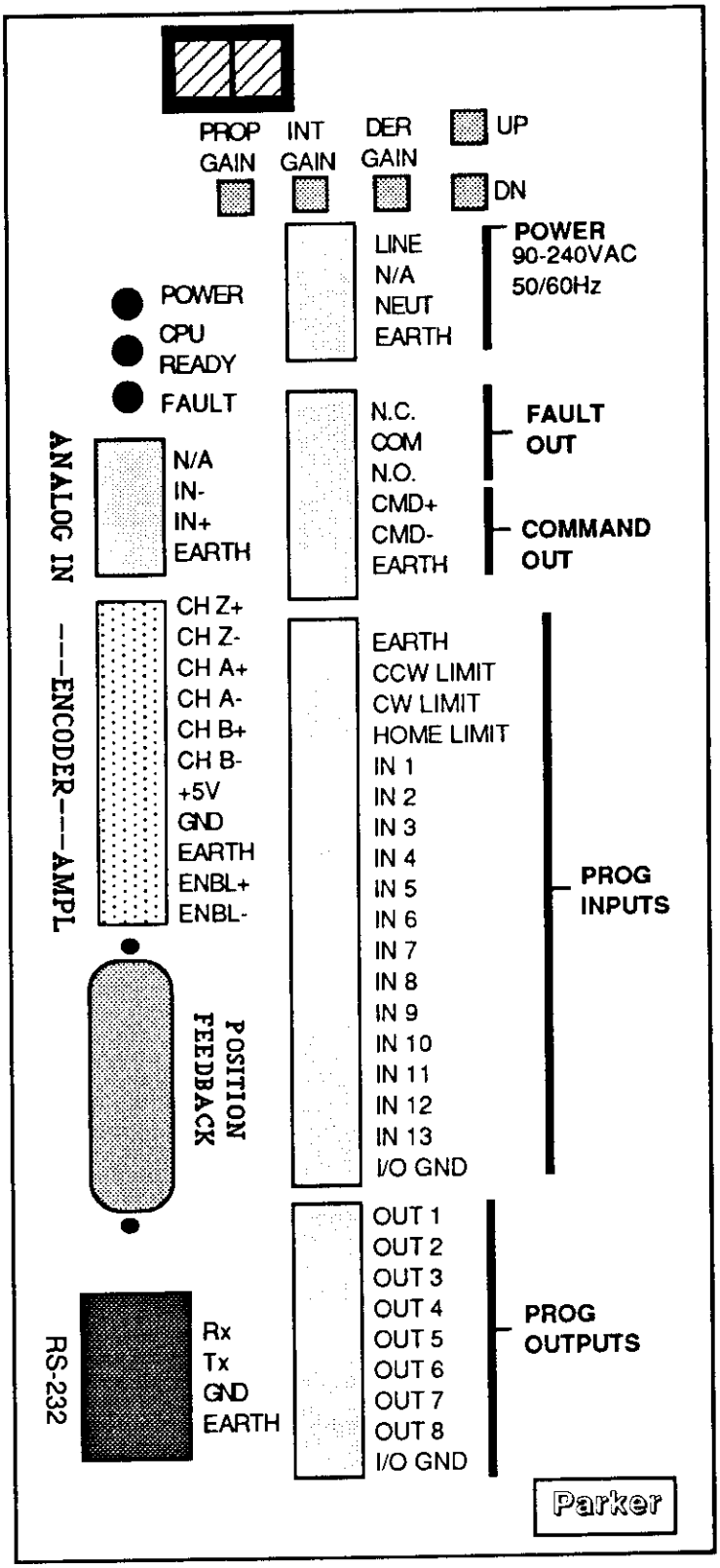

Figure 2-1. JSI Front Panel Diagram

Setting Controller Functions

This section discusses the various functions that must be properly set before you can operate the JSI controller.

Enable Input

Two enable input pins (ENBL+ and ENBL-) are located on the 11-pin screw terminal connector labeled ENCODER on the JSI's front panel. The outputs (CMD+ and CMD-) command will be disabled if you do not short-circuit this input. The input is optically isolated and single ended. To disable the command output, apply 5V to this input, or open the inputs between the **ENBL+** and **ENBL-** inputs.

Applying Power to the System

Once you have properly set the functions described above, you should prepare to wire and apply power to the JSI. You must apply power to test the JSI functions and features that are presented throughout the remainder of this chapter. You may power the JSI controller with AC or DC power. Figures 2-2 and 2-3 illustrate the proper power wiring connections for AC and DC power respectively.

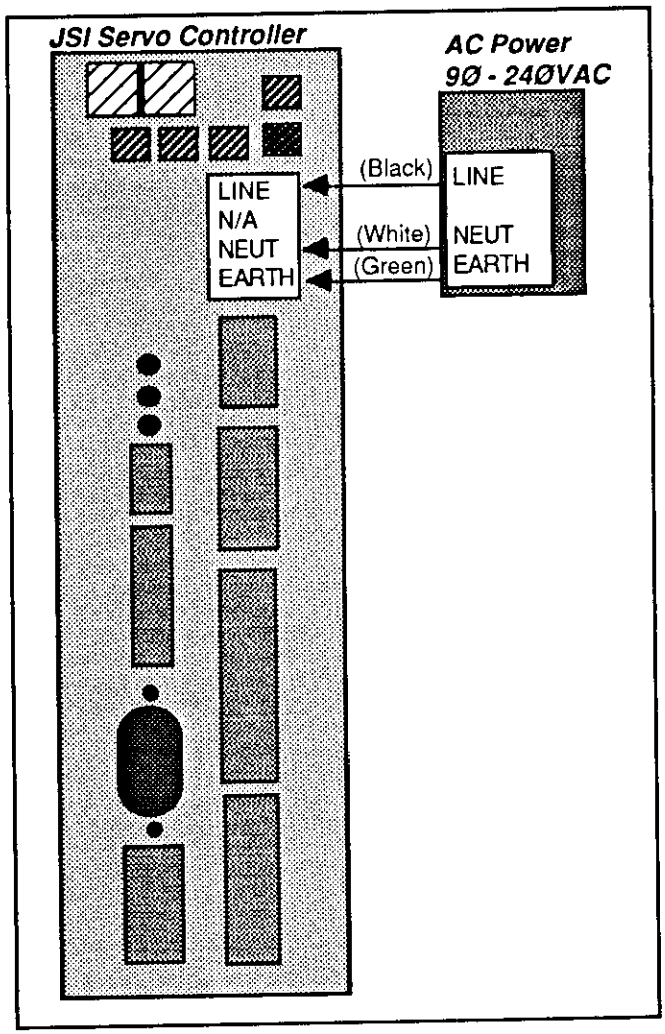

Figure 2-2. JSI Controller AC Power Wiring Diagram

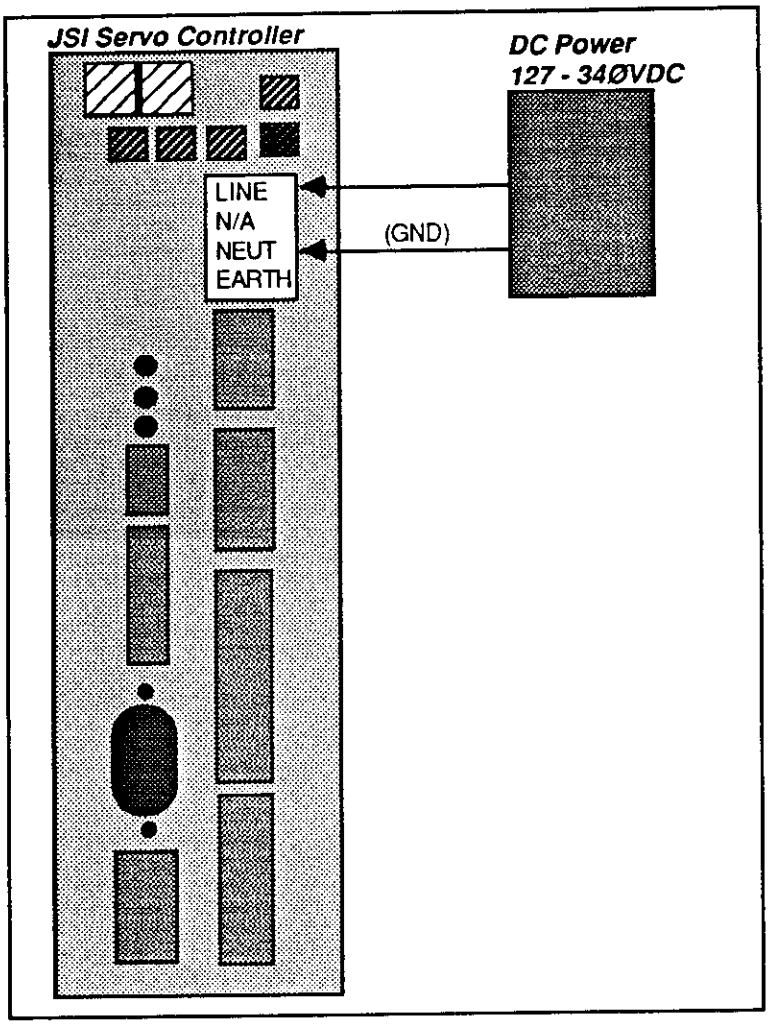

Figure 2-3. JSI Controller DC Power Wiring Diagram

Setting the Device Address

The default address setting for the JSI controller is **01**. To confirm that the JSI's device address is set to 1, push the PROP GAIN and DER GAIN button at the same time. The digits **01** will be displayed on the two-digit LED in the upper left corner of the JSI controller. Refer to Figure 2-4.

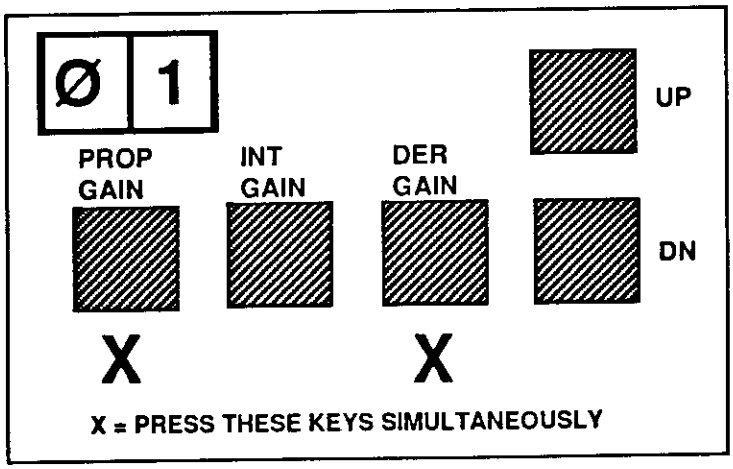

Figure 2-4. Confirm Device Address Setting

Changing the Address Setting

The LED display shown in Figure 2-5 verifies that the controller is set to **01**. If these digits (**01**) do not appear, use the following steps to set the device address to **01**.

1. Press and hold the PROP GAIN and DER GAIN buttons.
2. While holding the two buttons, push the DN button until the LED displays **01**. Refer to Figure 2-4.

If you need to increase the address setting, push the UP button instead of the DN button. You will need to modify the device address settings if you use several JSI units in your application. Each JSI controller must have a unique device address.

For testing purposes, the JSI's device address should always be set to ***01****.*

Establish Communications

To communicate with the JSI, your computer or terminal must have an RS-232C serial port. If your computer or terminal does not have a serial port, you can purchase one from your local computer dealer. The JSI uses a simple three-wire implementation of serial communication. The JSI uses RECEIVE DATA (Rx), TRANSMIT DATA (Tx), and GROUND(GND) signals on its auxiliary connector (as shown in Figure 2-5). *The ground (GND) connections on the auxiliary connector are signal ground or common as opposed to earth ground (EARTH).*

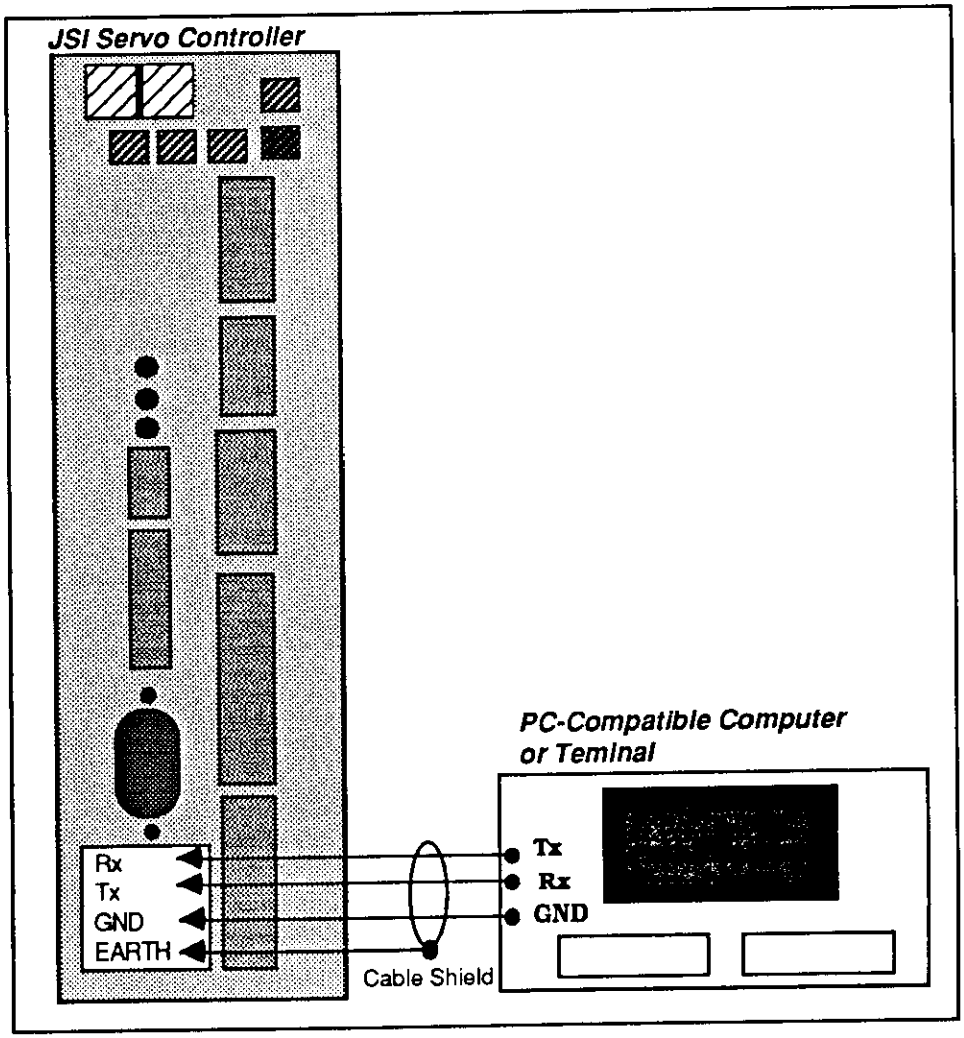

Figure 2-5. Wiring RS-232C Interface to a Computer or a Terminal.

You can change the baud rate communication parameter on the JSI. The other communication settings are fixed. The variable baud rates and fixed parameters are listed below.

- Baud Rates: 9,600 (default setting), 4,800, 2,400, 1,200, 600, 300
- Data Bits: 8
- Parity: None
- Stop Bits: 1
- Echo: Off (Full Duplex)

Selecting the Baud Rate Setting

You can use the pushbuttons and two-digit LED to display and change the baud rate. To display the current baud rate setting (*the first two digits of the baud rate are shown*), push the PROP GAIN and INT GAIN buttons at the same time. The default setting is 9,600. Refer to Figure 2-6.

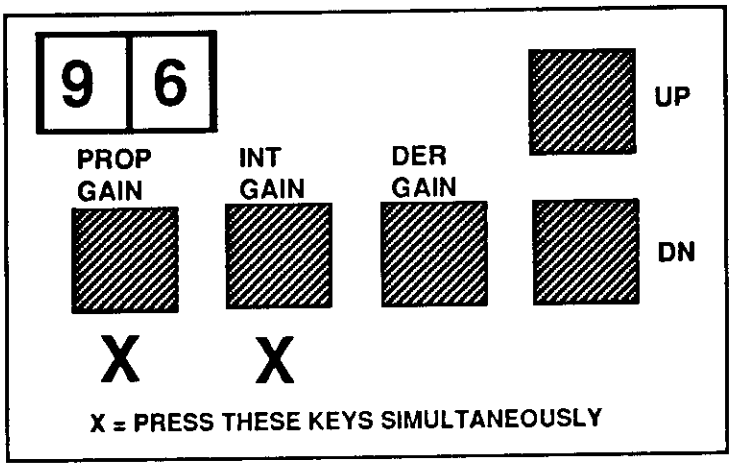

Figure 2-6. Display Baud Rate Setting

Changing the Baud Rate

The LED display shown in Figure 2-6 verifies that the baud rate is set to 9,600. If you want to change the current baud rate setting, use the following steps to set the baud rate.

1. Press and hold the PROP GAIN and INT GAIN buttons.
2. While holding the two buttons, push the UP or DN button until the LED displays the baud rate setting that you desire.

The baud rate setting is automatically saved to the JSI's non-volatile memory. Therefore, the last LED setting that is displayed before you release the PROP GAIN and INT GAIN buttons will be the baud rate that is implemented and saved until you change it again.

Once you have accurately set the baud rate and address settings, you can begin to test the RS-232C interface, which controls the JSI.

If you are using a terminal, you can start testing the RS-232C link by completing the steps outlined below (after you have properly set all of the parameters discussed above). If you are using an IBM or IBM-compatible computer, you will have to convert the computer into a terminal to prepare it for RS-232C communications. Several software vendors offer programs that you can use to convert your computer into a terminal.

- X-Talk
- PC-Talk
- ProCom

You can also refer to the sample programs provided inChapter 4, *Application Design*, of this manual. These programs can help you set up your computer to send commands to the JSI controller.

Verify RS-232C Communications

After you enable your computer to serve as a terminal, ensure that you have properly set your communications parameters.

- Baud Rates: 9,600 (the default setting), 4,800, 2,400, 1,200, 600, 300
- Data Bits: 8
- Parity: None
- Stop Bits: 1
- Echo: Off (Full Duplex)

To test your RS-232C communications link and ensure that it is operating properly, follow the steps outlined below.

Step 1 Be sure that the Command outputs (**CMD+** and **CMD-**) are ***not connected*** to the drive.

Step 2 If your connections are correct, and the device address is set to **01**, you should see the following message on your screen when you apply power to your unit.

```
* READY
>
```

*If the device address is not set to **01**, you will not receive this message.*

Step 3 Issue the command shown below. The proper response is also shown below.

Command	Response
> 1PR	*+ØØØØØØØØØØ

The Position Report (**PR**) command is a status request command (the **1** refers the the JSI controller's device address). The response given is the current encoder position. This response confirms that you have proper two-way communication between your computer and the controller. If you do not receive a response, return to the *Setting Controller Functions* section earlier in this chapter. Check your connections, and try to issue the **1PR** command again. If the problem persists, refer to Chapter 7, *Maintenance & Troubleshooting*.

Testing Output Levels

Now that you have tested the JSI's RS-232C communication link, you should test the functionality of the voltage output of the command outputs (**CMD+** and **CMD-**). These outputs will be used to move a DC motor. *Do not connect the **CMD+** and **CMD-** outputs to the drive until you are instructed to do so in these procedures. You will need these outputs to attach a voltmeter and perform voltage and current output testing.*

JSI LEDs

When an AC or DC power source is properly wired to the JSI, the green Power LED and the green CPU Ready LED will illuminate when you apply power to the unit. If you do not have the **ENBL+** and **ENBL-** inputs jumpered, the red Fault LED will also illuminate when you apply power to the JSI (the LED will display the digits **23**). If the Fault LED is lit and **23** is flashing, jumper the **ENBL+** and **ENBL-**inputs. Error code **16** will flash in the LED display. Error **16** indicates that the JSI **COMMAND OUTPUT** is disabled. Cycle power to the JSI. You can also use the **ON** command to remove error code **16** from the Fault LED). Only the Power and CPU Ready LEDs will remain on after you cycle the power.

Testing Voltage Output

If the LED display presents any other fault/error conditions, refer to Chapter 7. If no fault/error conditions exist, check the JSI's voltage output. *Do not connect the* **CMD+** *and* **CMD-** *outputs to the drive at this time. You will need these outputs to attach a voltmeter and perform voltage testing.* Refer to Figure 2-7 for an illustration of the proper voltmeter connections—the **CMD+** and **CMD-** outputs).

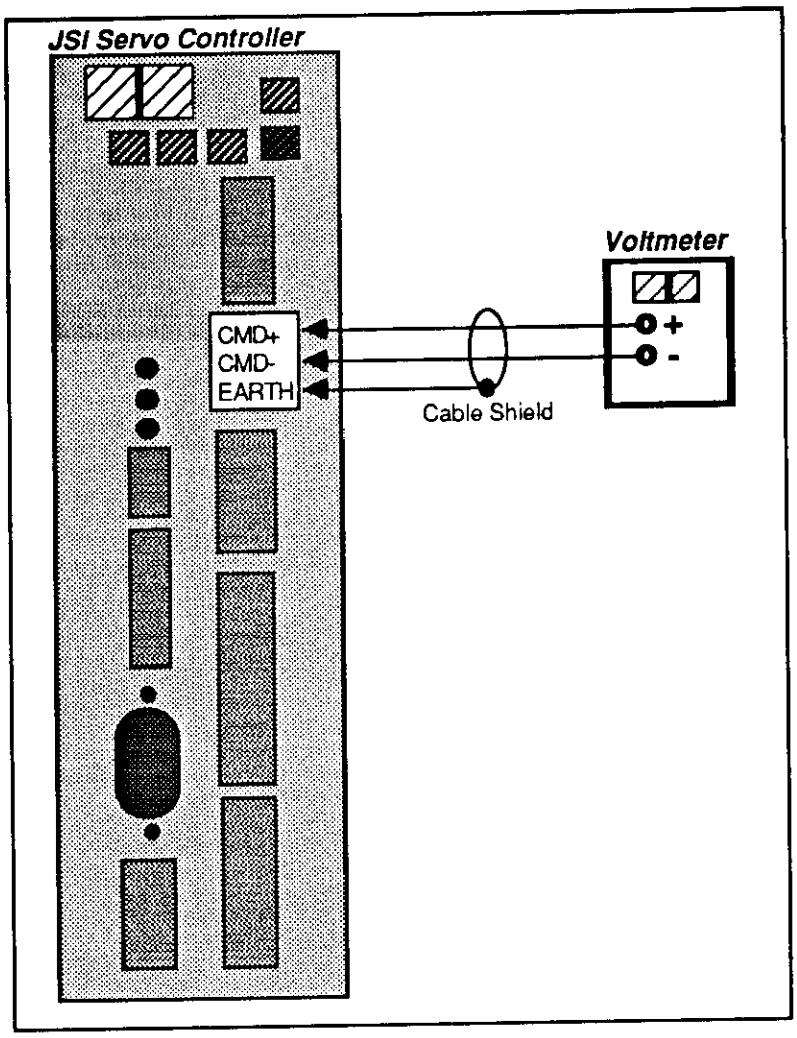

Figure 2-7. JSI/Voltmeter Wiring Diagram

Step 1 Use a voltmeter to measure the DC voltage between the **CMD+** and **CMD-** outputs The JSI controller should provide approximately ØV. The voltage level will appear on the voltmeter's LED.

Step 2 Enter the following commands:

Command	Description
> LD3	Disables CW and CCW limits
> CPE1ØØØØØØØØ	Defines the allowable position error
> A1	Sets acceleration to 1 rps^2
> V5	Sets velocity to 5 rps
> MC	Sets unit to Continuous mode
> G	Executes the move (Go)

Step 3 Measure the DC voltage between the **CMD+** and **CMD-** outputs. These outputs should generate approximately 7 to 8VDC. If the voltmeter does not indicate any voltage change from the previous test, check the wiring and try the test again. If the problem persists and you are unable to get the expected voltage reading (7 to 8VDC), refer to Chapter 7, *Maintenance & Troubleshooting.*

Step 4 Enter the following command:

Command	Description
`> 1DOI`	Instructs the system to report the voltage level continuously until you press any key. The controller should generate approximately 8.5VDC.

Step 5

Command	Description
`> K`	Kills motor motion. The JSI controller will generate approximately ØVDC.

The successful completion of this test confirms that the proper output voltages are being generated from the JSI controller's **CMD+** and **CMD-** outputs.

Testing Current Output

You should now prepare to test the JSI controller current output levels. *(proceed with this test only if no error conditions are present).* The JSI is configured at the factory to serve as a voltage output controller. Therefore, to perform this test, you will have to reconfigure the JSI as a current output controller. *Do not connect the **CMD+** and **CMD-** outputs to the drive at this time. You will need these outputs to attach a voltmeter and perform current output testing.*

Step 1 Remove power to the JSI controller.

Step 2 Connect a 20Ω, two-watt resistor from the **CMD+** and **CMD-** outputs.

Step 3 Apply power to the JSI controller

Step 4 Enter the following command:

Command	Description
`> COCH`	Configures the JSI controller as a current output controller. The JSI can generate between 0 and 200 mA of current.

Step 5

Command	Description
`> LD3`	Disables CW and CCW limits
`> CPE1ØØØØØØØØ`	Defines the allowable position error
`> A1`	Sets acceleration to 1 rps^2
`> V5`	Sets velocity to 5 rps
`> MC`	Sets unit to Continuous mode
`> G`	Executes the move (Go)

Step 6 Measure the DC voltage across the 20Ω resistor. The JSI controller should generate approximately 3.2VDC.

Step 7 Enter the following command:

Command	Description
`> 1DOI`	Instructs the system to report the output current level continuously until you press any key. The controller should generate approximately 160mA.

Step 8

Command	Description
`> K`	Kills motor motion. The JSI controller will generate approximately ØVDC.

Step 9

Command	Description
`> COV`	Reconfigures the JSI as a voltage output controller.

The successful completion of this test confirms that the proper current output levels are being generated from the JSI controller's **CMD+** and **CMD-** outputs.