

6270 Motion Controller User Guide

Revision B Change Summary

The following is a summary of the primary technical changes to this user guide since the last version was released. Most of the changes are due to product revision 3.0. This user guide, p/n 88-013913-01B (released in January 1995), supersedes 88-013913-01A.

Topic	Description	See Also
ANI Analog Input Voltage and Position Capture	<p>Change: When the ANI analog input is captured, you can use either the voltage data or the position data.</p> <ul style="list-style-type: none"> • Voltage: The captured ANI voltage is <u>not</u> affected by scaling, PSET, ANIPOL, or CMDDIR. The captured data (in units of volts) is available through the use of the TCA and CA commands. • Position: The captured ANI position is <u>is</u> affected by scaling, PSET, ANIPOL, and CMDDIR. The captured position (counts or scaled units) is available through the use of the TPCA and PCA commands. 	Pg. 74
Commanded Direction: <i>Polarity Reversal</i>	<p>New Command: The CMDDIR command allows you to change the sign of the commanded direction. Changing the sign of the commanded direction also reverses the polarity of the feedback devices. This allows you to reverse the direction of motion without the need to (a) change the connections to the drive/valve and reverse the wiring or mounting of the feedback device, or (b) change the sign of all the motion-related commands in your program.</p> <p>☞ HINT: Before changing commanded direction polarity, make sure there is a direct correlation between the commanded direction and the direction of the feedback source counts (i.e., a positive commanded direction from the 6270 must result in positive counts from the feedback device). This is required for servo stability.</p> <p>The CMDDIR command may not be executed while motion is in progress or while the drive/valve is enabled. The CMDDIR command is automatically saved in non-volatile memory.</p>	Pg. 114
DAC Limits	<p>New Command: In addition to the defining the maximum DAC voltage limit with the DACLIM command, you may now define a minimum DAC voltage limit with the DACMIN command. In so doing, you limit the DAC output to the range between DACMIN and DACLIM. You may not set the DACLIM value less than the DACMIN value.</p> <p>For example, if on both axes you wish to prevent motion in the negative direction and limit the maximum voltage to 8.5V, use the DACMIN0,0 and DACLIM8.5,8.5 commands. The DACMIN0,0 command sets the minimum DAC output to zero volts, which effectively prevents the 6270 from commanding motion in the negative direction. The DACLIM8.5,8.5 command sets the maximum DAC output to 8.5V.</p> <p>The DACMIN value tracks (but with a reverse sign) the value of DACLIM, until a DACMIN command is executed with a value other than the current DACLIM command value. After the DACMIN command is executed, DACMIN and DACLIM values must be entered separately. To re-establish the default mode where DACMIN tracks DACLIM, issue the DACMIN command with a minus sign (-) in the command field for the affected axis (e.g., DACMIN, - restores axis 2 to the default mode).</p>	Pg. 25
End-of-Travel Hardware Limits: <i>Default Setting</i>	<p>Change: The default before 6270 revision 3.0 was LH0,0, which disables both end-of-travel hardware limits on both axes. In revision 3.0, the default setting is now changed to LH3,3, which enables the limits. To disable the limits, issue the LH0,0 command or connect the CW and CCW limit terminals to the GND terminal on the LIMITS connector.</p>	Pg. 60

<p>Feedback Source Selection: <i>Inclusive Elements</i></p>	<p>Enhancement: Some additional commands have been made specific to the current feedback source (encoder, LDT or ANI) selected with the <i>SFB</i> command. When these commands are executed, they will apply only to the current feedback source. Then, when you switch feedback sources with the <i>SFB</i> command, the values of the items listed below will change to match the selected feedback source. (☞ denotes new inclusive elements)</p> <ul style="list-style-type: none"> SGP Proportional Gain ☞ SGPN Proportional Gain Negative SGV Velocity Gain ☞ SGVN Velocity Gain Negative SGI Integral Gain ☞ SGIN Integral Gain Negative SGVF Velocity Feedforward Gain ☞ SGVFN Velocity Feedforward Gain Negative SGAF Acceleration Feedforward Gain Negative ☞ SGAFN Acceleration Feedforward Gain Negative ☞ SGILIM Integral Windup limit PSET Position Offset ☞ SMPER Maximum Position Error ☞ SOFFS Servo Control Signal Offset ☞ SOFFSN Servo Control Signal Offset Negative 	<p>Pg. 25</p>
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<p>Feedback Source: <i>Polarity Reversal</i></p>	<p>New Commands: Servo stability requires a direct correlation between the commanded direction and the direction of the feedback source counts (i.e., a positive commanded direction from the 6270 must result in positive counts from the feedback device).</p> <p>If the feedback device is counting in the wrong direction, you may reverse the polarity with the command specific to the feedback source—<i>ENCPOL</i> for encoder feedback, <i>LDPOL</i> for LDT feedback, <i>ANIPOL</i> for ANI feedback (see table). This allows you to reverse the counting direction without having to change the actual wiring or mounting of the feedback device. For example, if the LDT on axis 2 was installed incorrectly and counted in the wrong direction, you could issue the <i>LDPOLx1</i> command to reverse the polarity.</p> <table border="1" data-bbox="406 1037 1289 1146"> <thead> <tr> <th>Source</th> <th>Command</th> <th>Syntax</th> <th>Reverse Polarity</th> <th>Restore to Default</th> </tr> </thead> <tbody> <tr> <td>Encoder</td> <td>ENCPOL</td> <td>ENCPOL</td> <td>ENCPOL1</td> <td>ENCPOLØ</td> </tr> <tr> <td>LDT</td> <td>LDPOL</td> <td>LDPOL</td> <td>LDPOL11</td> <td>LDPOLØØ</td> </tr> <tr> <td>ANI</td> <td>ANIPOL</td> <td>ANIPOL</td> <td>ANIPOL11</td> <td>ANIPOLØØ</td> </tr> </tbody> </table> <p>When you change the feedback polarity, the affect on the position report differs (i.e., reverses the sign of the LDT and ANI report; reverses the direction of subsequent encoder counts). Changing the feedback polarity effectively invalidates the existing absolute zero position (<i>PSET</i>) setting; therefore, you will have to re-establish the <i>PSET</i> position.</p> <p>The feedback polarity commands are automatically saved in non-volatile memory.</p>	Source	Command	Syntax	Reverse Polarity	Restore to Default	Encoder	ENCPOL	ENCPOL	ENCPOL1	ENCPOLØ	LDT	LDPOL	LDPOL	LDPOL11	LDPOLØØ	ANI	ANIPOL	ANIPOL	ANIPOL11	ANIPOLØØ	<p>Pg. 44, 114</p>
Source	Command	Syntax	Reverse Polarity	Restore to Default																		
Encoder	ENCPOL	ENCPOL	ENCPOL1	ENCPOLØ																		
LDT	LDPOL	LDPOL	LDPOL11	LDPOLØØ																		
ANI	ANIPOL	ANIPOL	ANIPOL11	ANIPOLØØ																		

<p>Following Capability</p>	<p>New Features: With release 3.0, the 6270 supports ratio following, position following, and advance & retard. User information for Following features is provided in the 6000 Series Following User Guide.</p>	<p>6000 Series Following User Guide</p>
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<p>Gain Set Elements</p>	<p>Enhancement: When you issue the <i>SGSET</i> command to save a gain set, it not only saves the general gains (<i>SGP</i>, <i>SGV</i>, <i>SGI</i>, <i>SGVF</i>, and <i>SGAF</i>), but also saves these elements as well:</p> <ul style="list-style-type: none"> SGPN Proportional Gain Negative SGVN Velocity Gain Negative SGIN Integral Gain Negative SGVFN Velocity Feedforward Gain Negative SGAFN Acceleration Feedforward Gain Negative SGILIM Integral Windup Limit SOFFS Servo Control Signal Offset SOFFSN Servo Control Signal Offset Negative SMPER Maximum Allowable Position Error <p>The gain set saved with the <i>SGSET</i> command can be activated later with the <i>SGENB</i> command or the <i>SSWG</i> command.</p> <p>In addition, the <i>TGAIN</i> and <i>TSGSET</i> transfer commands will report all these elements noted above.</p>	<p>Pg. 39</p>
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LDT Gradient	Clarification: The LDT gradient may be changed with the LDTGRD command only of the drive is disabled with the DRIVE command.	Pg. 26
Maximum Velocity	Change: The maximum velocity is now 1,600,000 counts/sec.	Pg. 59, 105
Negative Control Signal Offset	New Command: The SOFFSN command allows you to set an offset voltage to be added to the DAC output when the DAC output is negative. The negative offset (SOFFSN) value changes with (tracks) the corresponding positive offset (SOFFS) value until the SOFFSN command is executed with a value other than the current SOFFS command value. After the SOFFSN command is executed, separate positive and negative offset commands must be used. To re-establish the default mode where SOFFSN tracks SOFFS, issue the SOFFSN command with a minus sign (-) in the command field for the affected axis (e.g., SOFFSN, - restores axis 2 to the default mode).	Pg. 41
Negative Gains	New Commands: The new negative gain commands (see list below) allow you to establish gains to be used when the position error is negative. SGPN.....Proportional Gain Negative SGVN.....Velocity Gain Negative SGIN.....Integral Gain Negative SGVFN.....Velocity Feedforward Gain Negative SGAFN.....Acceleration Feedforward Gain Negative Each negative gain changes with (tracks) the corresponding positive gain value (SGP, SGV, SGI, etc.) until a negative gain command is executed. For example, the SGPN value automatically tracks the SGP value until an SGPN command is executed with a value other than the current SGP command value. After the negative gain command is executed, separate positive and negative gain commands must be used. To re-establish the default mode where the negative gain tracks the positive gain, issue the negative gain command with a minus sign (-) in the command field for the affected axis (e.g., SGPN, - restores axis 2 to the default mode).	Pg. 39
RP240 Menus	Enhancements: Additional RP240 menus have been added: <ul style="list-style-type: none">• Jog in open-loop mode• Display position error• View and edit tuning gains and gain sets• View numeric and string variables, and edit numeric variables	Pg. 84
Servo Tuner Instructions	Change: All instructions for tuning the 6270 using the Servo Tuner option for Motion Architect have been removed and are found in the Servo Tuner User Guide which is included in the Servo Tuner box.	
Servo Update Rates	Change: Some of the servo update rates have been changed.	Pg. 47
Setpoint Window Gains	New Commands: You may now activate a specified set of gains to be used when with a defined region either side of the position setpoint ("setpoint window"). A hysteresis of 25% is enabled when the window is entered. The new commands are: SSWD.....Setpoint Window Distance SSWG.....Setpoint Window Gain Set The SSWD command is used to specify the distance on both sides of the position setpoint ("setpoint window") in which the gain set specified with the SWG command is used. The gain set is defined with the SGSET command (see <i>Gain Set Elements</i> note above).	Pg. 40

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O V E R V I E W

This user guide is designed to help you install, develop, and maintain your system. This section is intended to help you find and use the information in this user guide.

Assumptions

To effectively use this user guide to install, develop, and maintain your system, you should have a fundamental understanding of the following:

- Hydraulic system components such as valves, cylinders, LDTs, etc.
- Electronics concepts such as voltage, switches, current, etc.
- Motion control concepts such as torque, velocity, distance, force, etc.
- Programming skills in a high-level language such as BASIC, Fortran, or Pascal

Contents of This User Guide

Chapter	Purpose
① <i>Introduction</i>	Describes the 6270 and provides a brief account of its features.
② <i>Getting Started</i>	Lists and describes the items you should have received with your 6270 shipment. A <i>bench test</i> procedure is provided to verify the system's basic functionality.
③ <i>Installation</i>	Provides instructions for mounting, wiring, and testing the 6270 system. Complete all instructions in Chapter 3 before tuning the 6270 in Chapter 4.
④ <i>Servo Tuning</i>	Provides an empirical method for tuning the 6270. Complete all tuning instructions before implementing motion features. If you are using Servo Tuner™, refer to the Servo Tuner User Guide for instructions.
⑤ <i>Feature Implementation</i>	Describes the 6270's user features and instructs you on how to implement them in your application. Sample applications are provided. The 6000 Series Software Reference Guide provides programming guidelines and detailed descriptions of all the 6000 Series commands.
⑥ <i>Hardware Reference</i>	Use the <i>Hardware Reference</i> as a quick-reference tool for 6270 electrical specifications, optional DIP switch settings (address & baud rate), optional command output jumper settings, and I/O signal descriptions and circuit drawings.
⑦ <i>Troubleshooting</i>	Describes methods for isolating and resolving hardware and software problems.
Appendices	A: Reducing electrical noise in your application B: Alphabetical listing of the 6270's commands
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Installation Process Overview

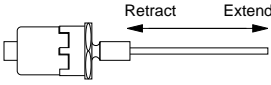
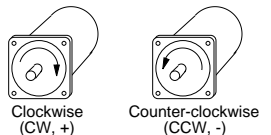
- Step 1* Review this entire user guide. Become familiar with the user guide's contents so that you can quickly find the information you need. At times you may want to refer to the **6000 Series Software Reference Guide** for programming tips and detailed descriptions of the 6000 Series commands used in this user guide.
- Step 2* Read Chapter 1, *Introduction*, and the user documentation for all **peripheral system components** to develop a basic understanding of all system components, their functions, and interrelationships.
- Step 3* Read Chapter 2, *Bench Test*, and verify that you have received all the proper components for your system, and that all the items in your shipment have arrived without damage. Follow the step-by-step bench test procedures to verify the 6270's basic operability, as well as the functionality of the host computer (or terminal).
- Step 4* Complete the system configuration, mounting, wiring, and testing instructions provided in Chapter 3, *Installation*. **Do not deviate from the sequence or installation methods provided.**
- Step 5* After you successfully complete all procedures in Chapter 3, you will be ready to proceed to Chapter 4, *Servo Tuning*, to tune the 6270 (and the drive if using one) for your application. The tuning procedures in Chapter 4 are based on using an empirical method to tune your system; if you are using Servo Tuner™, refer to the **Servo Tuner User Guide** for instructions.
- Step 6* After successfully completing all procedures in Chapter 4, you may proceed to Chapter 5 to implement the 6270's user features in your application. If you will be using the 6270's following features, refer to the **6000 Series Following User Guide**.

Conventions

Linear and Rotary Motion

The 6270 can be used in linear and rotary servo applications. The position feedback source can be an LDT (linear displacement transducer) or an incremental encoder. If you have the 6270-ANI option (equipped with two 14-bit, $\pm 10V$ analog inputs), you can position to a voltage using the analog feedback.

The table below will help to clarify the conventions when referring to the direction of motion, depending on the application type and feedback source.

Application Type	Negative (-) Direction *	Positive (+) Direction *	Perspective
Linear (e.g., hydraulic valve & cylinder using LDT feedback)	Retract	Extend	
Rotary ** (e.g., rotary drive & motor using incremental encoder feedback)	Counter-clockwise (CCW)	Clockwise (CW)	

* For 6270-ANI owners using analog feedback, negative direction refers to negative voltage and positive direction refers to positive voltage.

** This convention is accurate only if you connect the incremental encoder as described in Chapter 3.

When programming the 6270, the negative sign refers to retract or CCW or negative voltage. The positive sign refers to the extend or CW or positive voltage (e.g., the D+8 distance command indicates an 8-unit move in the extension/CW/positive voltage direction).

When referencing the 6270's software commands in the **6000 Series Software Reference Guide**, you will find all direction references in rotary terms—*clockwise* (CW) and *counter-clockwise* (CCW).

Units of Measure

The table below provides the units of measure for distance, acceleration/deceleration, and velocity, based on the feedback source selected. These conventions hold true unless you use the scaling feature, in which case the units of measure are determined by the scaling factors (see *Scaling* section in Chapter 5 for details).

Feedback Device	Accel/Decel Units	Velocity Units	Distance Units
LDT	inches/sec ²	inches/sec	steps (counts)
Incremental Encoder	revolutions/sec ²	revolutions/sec	steps (counts)
ANI Input	volts/sec ²	volts/sec	steps (counts)

6000 Series Commands

The command language conventions are provided in the **6000 Series Software Reference Guide**. Because some 6000 Series products have four-axis capability, the syntax of the example commands in the **Reference Guide** shows data fields for all four axes; ignore the third and fourth data fields when entering commands or reading status commands for the 6270.

Active High/Active Low Convention

Many people refer to a voltage level when referencing the state of inputs and outputs. The 6270 offers the ability to configure the active level of its inputs and outputs. The active state refers to the voltage level as set by the appropriate level command (see table below). The product defaults to an input/output level of zero volts as its active level (referred to as “active low”). Thus, a “1” will appear in a status command (e.g., TIN) referencing an input/output state when the voltage level is zero volts.

Input/Output	Active Level Command
Home inputs	HOMLVL
End-of-travel limit inputs	LHLVL
Programmable inputs (including TRG-A and TRG-B)	INLVL
Programmable outputs (including OUT-A and OUT-B)	OUTLVL

Related Publications

- **6000 Series Software Reference Guide**, Parker Hannifin Corporation, Compumotor Division; part number 88-012966-01
- **6000 Series Following User Guide**, Parker Hannifin Corporation, Compumotor Division; part number 88-014217-01
- **Motion Architect User Guide**, Parker Hannifin Corporation, Compumotor Division; part number 88-013056-01
- **Servo Tuner User Guide**, Parker Hannifin Corporation, Compumotor Division; part number 88-014249-01
- **CompuCAM User Guide**, Parker Hannifin Corporation, Compumotor Division; part number 88-013921-01
- Schram, Peter (editor). *The National Electric Code Handbook (Third Edition)*. Quincy, MA: National Fire Protection Association

Introduction

6270 Description

The 6270 is a stand-alone, two-axis Motion Controller. The 6270 provides sophisticated two-axis control of any servo system driven by a voltage ($\pm 10\text{V}$) or a current ($\pm 20\text{mA}$, $\pm 50\text{mA}$, $\pm 60\text{mA}$, $\pm 80\text{mA}$, $\pm 100\text{mA}$, or $\pm 150\text{mA}$).

The 6270 implements a dual processor approach, comprising a microprocessor for executing high-level motion programs and a digital signal processor (DSP) for high-speed, sophisticated servo control.

The 6270 offers the flexibility of closing the positioning loop with three different types of feedback devices: linear displacement transducers (LDTs), an incremental encoder, or optional $\pm 10\text{V}$ analog inputs (6270-ANI option).

Using the 6000 Series Programming Language, you can program the 6270 via a PC or a dumb terminal. User programs are stored in the 6270's battery-backed RAM.

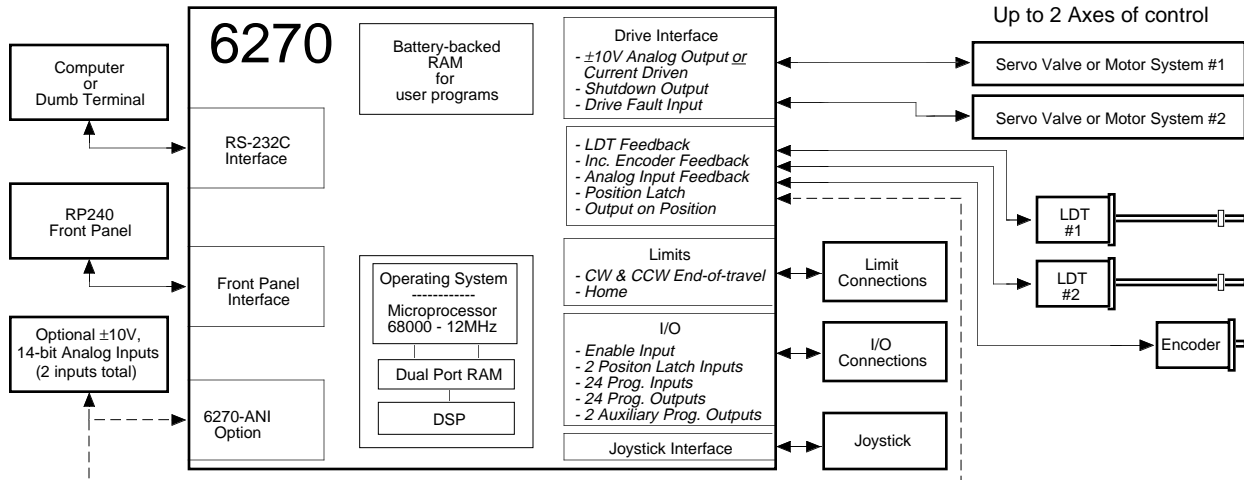
The 6270 also provides operator interface capabilities when used with the Compumotor RP240 Remote Operator Panel.

Support software for the Microsoft® Windows™ and DOS® operating environments comes standard with the 6270:

- *Motion Architect*® is an innovative, easy-to-use Microsoft® Windows™ based programming aide to help you easily create and implement complex motion programs. For more information, refer to the ***Motion Architect User Guide***. Special add-on modules are available:
 - Servo Tuner™ tuning aide allows you to visually gather data and tune your controller/drive system.
 - CompuCAM™ CAD-to-Motion (CAM) software allows you to translate DXF, HP-GL, and G-Code files into 6000 Series Language motion programs.
- The *6000 DOS Support Disk* contains a DOS-based program editor and terminal emulator package. Also included are sample 6000 Command Language programs.

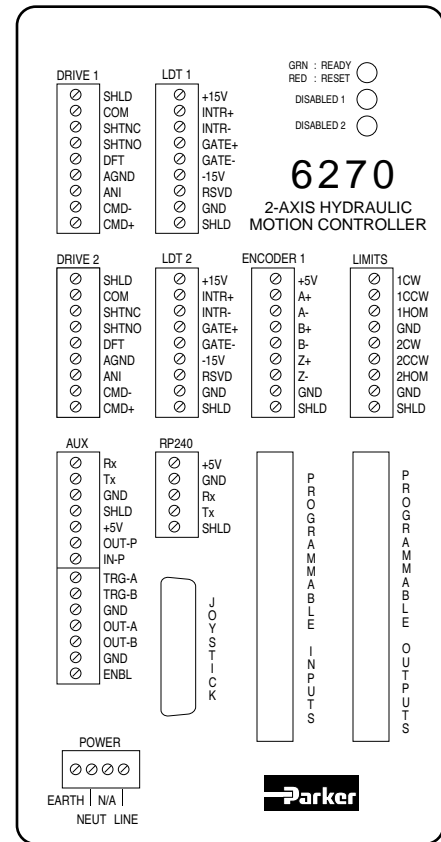
Additional 6270 features are listed below in the *6270 Features* section.

System Hardware Block Diagram



6270 Features

- 1 or 2 axes of control for current-driven or voltage-driven servo systems; feedback from linear displacement transducer (LDT) or incremental encoder feedback (or voltage feedback with ANI option)
- Controls electric servo drives in the velocity or torque mode
- Digital signal processor (DSP) for servo control (digital Proportional, Integral, and Velocity feedback, plus acceleration and velocity Feedforward—PIV&F)
- DOS Support Disk provided
- Motion Architect® for Windows™ provided
- Windows™-based visual data gathering and tuning aide available when using the Motion Architect® Servo Tuner™ option
- 40,000 bytes of non-volatile memory for storing programs; 150,000 bytes are available with the -M option
- Capability to interrupt program execution on error conditions
- Multi-axis teach mode
- S-curve motion profiling
- 2-axis linear interpolation
- Ratio following, position following, advance & retard (see **6000 Series Following User Guide** for details)
- Variable storage, conditional branching, and math capability
- Program debug tools — *single-step* and *trace* modes, breakpoints, and simulation of I/O
- Internal universal power supply
- Direct interface to RP240 Remote Operator Panel
- Operates stand-alone or interfaces to PCs & PLCs
- 3-wire, RS-232C interface to PC or dumb terminal
- I/O capabilities (all I/O are optically isolated):
 - ±10V analog control output (both axes)
 - Shutdown output for N.O. or N.C. relays (both axes)
 - Drive Fault input (both axes)
 - LDT input (both axes)
 - Incremental encoder input (axis 1 only)
 - CW & CCW end-of-travel limit inputs (both axes)
 - Home limit input (both axes)
 - 3 8-bit analog inputs for joystick control and variable input (0.0V - 2.5V)
 - 2 (trigger) inputs — use for hardware position latch
 - 24 programmable inputs (Opto-22™ compatible)
 - 24 programmable outputs (Opto-22™ compatible)
 - 2 auxiliary programmable outputs that can be configured for accurate output on position
- 6270-ANI Option offers two ±10V, 14-bit analog inputs; can be used for position feedback



6270 Front Panel

C H A P T E R 2

Getting Started

The information in this chapter will enable you to:

- Verify that each component of your 6270 system has been delivered safely and configured properly
- Bench test the 6270's power and RS-232C interface to the host computer/terminal

Inspect The Shipment

You should inspect your 6270 shipment upon receipt for obvious damage to its shipping container. Report any damage to the shipping company as soon as possible. The items listed below should be present and in good condition.

Part

6270 main unit (w/ship kit)

Ship kit: *This user guide*

6000 Series Software Reference Guide

Motion Architect™ diskettes

Motion Architect Servo Tuner diskette (optional)

Motion Architect User Guide

DOS Support Disk

DOS Support Disk Quick Reference

8-foot AC power cord

NOTE: The 6270-ANI is an optional version of the 6270 which provides two $\pm 10V$, 14-bit analog inputs.

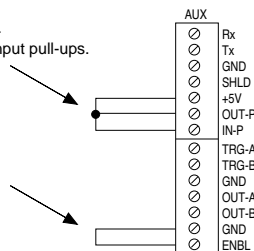
If you ordered a -ANI option, check the serial tag on the side of the 6270's chassis; it should say **6270-ANI**.

Pre-Wired Connections

You should receive your 6270 with the following connections on the AUX connector prewired (from the factory):

+5V supplies power to OUT-P and IN-P.
This provides power to the output and input pull-ups.

If this connection is broken, the 6270's analog command output signal is held to zero volts (independent of the DSP and microprocessor).



Bench Test

This section leads you through step-by-step instructions to bench test your 6270 system. *This is a temporary (bench top) configuration; the permanent installation will be performed in Chapter 3, Installation.* In this section, you will complete the following tasks:

- ① RS-232C Communications
- ② Connect Power Cable
- ③ Test Procedure

① RS-232C Communications

To communicate with the 6270, your computer or terminal must have an RS-232C serial port.

The 6270 uses a three-wire implementation of standard EIA RS-232C signals.

Computer-to-Terminal Conversion

If you are using an IBM/compatible computer, you must use a terminal emulator software package to communicate with the 6270. The 6270 comes standard with Motion Architect™ for Windows™ and the 6000 DOS Support Disk; both provide a terminal emulator and program editor (refer to the **Motion Architect User Guide** or the **6000 DOS Support Disk Quick Reference** for installation and other user information). You may also use communication programs such as Crosstalk™, PC-Talk™, and Procomm™.

Set Communication Parameters

Make sure your computer or terminal is set to the following communication parameters. You can configure these parameters by using one of the terminal emulation software packages listed above in *Computer-to-Terminal Conversion*. If you are using Motion Architect™ or the 6000 DOS Support Disk, verify that the baud rate, data bit, parity, and stop bit parameters are set as follows:

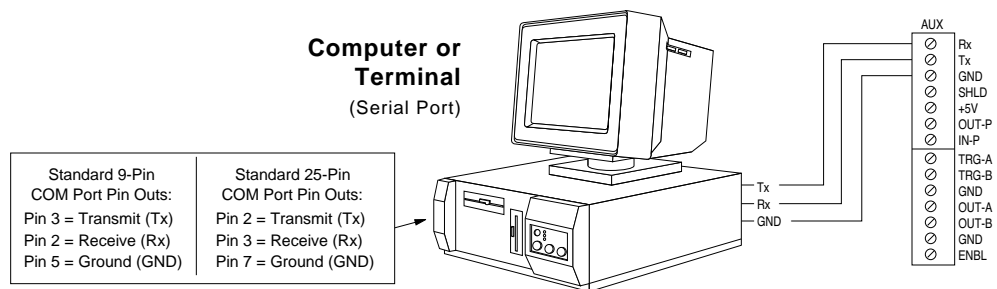
- Baud Rate: 9600*
 - Data Bits: 8
 - Parity: None
 - Stop Bits: 1
 - Full Duplex
 - XON/XOFF: Enabled
- * If your terminal is not capable of 9600 baud, use the 6270's *auto-baud* function to automatically set the 6270's baud rate equal to the terminal's baud rate. Refer to *Optional DIP Switch Settings* in Chapter 6 for instructions.

Terminal Connections

The Receive Data (Rx), Transmit Data (Tx), and Ground (GND) signals are on the 6270's AUX connector (shown below). *The ground (GND) connection on the connector is signal ground or common as opposed to earth ground (SHLD).*

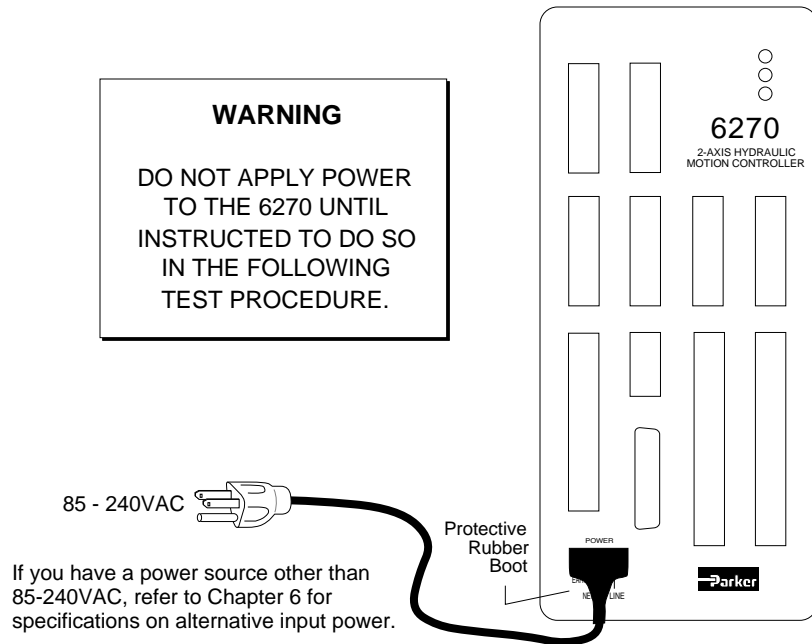
NOTE

If you intend to daisy chain multiple 6270 Motion Controllers, **do not attempt the daisy-chain connections now**. Daisy-chain instructions are provided in Chapter 5, *Feature Implementation*.



② Connect Power Cable

The 6270 is shipped with an 8-foot power cable that is prewired and keyed. Attach the power cable to the 6270's POWER connector as illustrated below.



③ Test Procedure

Use the following procedure to test the 6270's power and RS-232C connections. In Chapter 3, *Installation*, you will test the analog output, end-of-travel and home limits, LDTs, encoder, RP240, joystick, and programmable I/O.

- Step 1* Apply power to the 6270 by plugging the power cable into a grounded power source.

CAUTION

The Earth ground connection must be made by plugging into a grounded receptacle or by physically connecting the green wire to earth ground.

- Step 2* Watch the LEDs on the 6270. The **STATUS** LED should be green, indicating the 6270 is ready for operation. The other two LEDs (**DISABLED 1/2**) should be red because the valves or drives are not yet enabled with the `DRIVE11` command. If the **STATUS** LED is red, or if none of the LEDs illuminate, check your power source and cable connections. If these connections seem correct, disconnect power and consult Chapter 7, *Troubleshooting*.

- Step 3* If you are using the 6000 DOS Support Disk, go to the Set-up menu and move the cursor down to `CHECK OUT` and press `ENTER` to automatically verify the communication interface to the 6270.

If the interface is not successful (Device not Ready message will flash on the screen), refer to the RS-232C troubleshooting procedures in Chapter 7, *Troubleshooting*.

- Step 4* Initiate the terminal emulator in Motion Architect or in the 6000 DOS Support Disk (refer to the *Motion Architect User Guide* or the **6000 DOS Support Disk Quick Reference** if necessary). You could also use your own terminal emulator package.

Press the `RETURN` key. The cursor should move down one or two lines each time you press the `RETURN` key. If the cursor does not move as described, refer to the RS-232C troubleshooting procedures in Chapter 7, *Troubleshooting*.