

Hardware Reference

Use this chapter as a quick-reference tool for 6270 system specifications (general specifications, I/O circuit drawings & pin outs, and DIP switch & jumper settings).

General Specifications

Parameter	Specification
Power	
AC or DC Input	85-240VAC (single-phase), 50/60Hz, 1.8A @ 120VAC; or 110 - 340VDC
Status LED	Refer to the <i>Common Problems & Solutions</i> table in Chapter 7
Environmental	
Operating Temperature	32°F to 122°F (0°C to 50°C)
Storage Temperature	-22°F to 185°F (-30°C to 85°C)
Humidity	0% to 95% non-condensing
Performance	
Position Range	±2,147,483,648 counts
Velocity Range	1 to 1,600,000 counts/sec
Acceleration Range	1 to 2,147,483,648 counts/sec ²
Velocity Accuracy	±0.02% of maximum rate
Velocity Repeatability	±0.02% of set rate
Motion Trajectory Update Period	Default is 1.6 ms (depends on SSFR and INDAX command values)
Servo Sampling Update Period	Default is 400 µs (depends on SSFR and INDAX command values)
System Update Period	Default is 1.6 ms (depends on SSFR and INDAX command values)
LDT Position Sampling Period	Default is 1.6 ms (depends on SSFR, INDAX, and LDTUPD values)
RS-232C Interface	
Connections	3-wire (Rx, Tx and GND) connection to the AUX connector (opto iso)
Maximum number of daisy-chained 6270s	Up to 99 units
Address settings	DIP switch Selectable (see <i>Optional DIP Switch Settings</i>), or use ADDR
Communication Parameters	9600 baud (auto-baud option—see <i>Optional DIP Switch Settings</i>), 8 data bits, 1 stop bit, no parity bit, full duplex
Inputs (see also <i>I/O Pin Outs & Circuit Drawings</i>)	All inputs are optically isolated
Home, CW/CCW Limits, Joystick Trigger, Joystick Release, Axes Select, Joystick Velocity, Drive Fault (DFT), Enable (ENBL)	TTL-compatible*; internal 6.8 KΩ pull-ups to 5V; voltage range is 0 - 24V.
Linear Displacement Transducer (LDT)	Differential comparator inputs for displacement or Start/Stop pulse. Maximum frequency = 48 MHz.
Incremental Encoder	Differential comparator accepts two-phase quadrature encoders with differential (recommended) or single-ended outputs (+5VDC TTL-compatible*). Maximum frequency = 1.2 MHz. Minimum time between transitions = 833 ns.
24 Programmable	TTL-compatible* with internal 6.8 KΩ pull-up (connect IN-P to +5V to source current or connect IN-P to GND to sink current). Voltage range = 0V - 24V. 50-pin plug is compatible with OPTO-22™ signal conditioning equipment. Controllable with the 6000 Series programming language.
Triggers (triggers [TRG-A and TRG-B] on AUX connector)	TTL-compatible* with internal 6.8 KΩ pull-up to +5VDC. Controllable with the 6000 Series programming language.
Analog (Joystick)	Voltage range = 0 - 2.5VDC, 8-bit A/D converter. Input voltage must not exceed 5V.
Analog (±10V optional inputs)	Voltage range = ±10VDC, 14-bit A/D converter (accuracy is 12 bits). (6270-ANI only)

* TTL-compatible voltage levels: Low ≤ 0.4V, High ≥ 2.4V

Specifications Table (continued)

Outputs (see also I/O Pin Outs & Circuit Drawings)	All outputs are optically isolated
26 Programmable (includes OUT-A and OUT-B on AUX connector)	Can be pulled up by connecting OUT-P to +5V on the AUX connector, or to a user-supplied voltage of up to 24V. 50-pin plug is compatible with OPTO-22™ signal conditioning equipment. Controllable with the 6000 Series programming language.
LDT Interrogate (INTR)	TTL-compatible*, open collector output. Max. voltage in OFF state (not sinking current) = 24V, max. current in ON state (sinking) = 30mA.
Command Out (CMD)	12-bit DAC. Load should be > 2KΩ impedance. Output is jumper selectable (see <i>Optional DIP Switch and Jumper Settings</i> section below): ±10V (default), ±20mA, ±50mA, ±60mA, ±80mA, ±100mA, or ±150mA.
Shutdown (SHTNO, SHTNC, and COM)	Shutdown relay output. Max. rating: 175VDC, 0.25A, 3W.

* TTL-compatible voltage levels: Low ≤ 0.4V, High ≥ 2.4V

I/O Pin Outs & Circuit Drawings

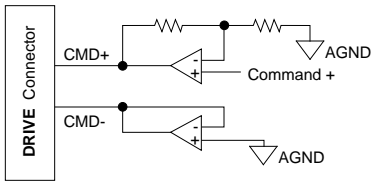
This section, organized by connector, provides pin outs and circuit drawings for all 6270 inputs and outputs. **All inputs and outputs are optically isolated.**

Drive Connectors

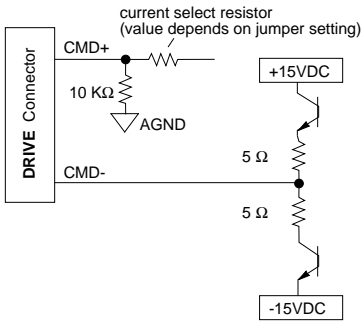
Pin #	In/Out	Name	Description
1	----	SHLD	Shield—internally connect to chassis (earth) ground.
2	----	COM	Signal common to which the shutdown relay outputs are referenced. Electrically isolated from any ground.
3	OUT	SHTNC	Shutdown relay output to drives that require a closed contact to disable the drive(see circuit drawing below). The shutdown relay is active (disabling the drive) when no power is applied to the 6270. When the 6270 is powered up, the shutdown relay remains active until you issue the <code>DRIVE11</code> command. Shutdown active (<code>DRIVE00</code>): This output is internally connected to COM. Shutdown inactive (<code>DRIVE11</code>): This output is disconnected from COM.
4	OUT	SHTNO	Shutdown relay output to drives that require an open contact to disable the drive(see circuit drawing below). The shutdown relay is active (disabling the drive) when no power is applied to the 6270. When the 6270 is powered up, the shutdown relay remains active until you issue the <code>DRIVE11</code> command. Shutdown active (<code>DRIVE00</code>): This output is disconnected from COM. Shutdown inactive (<code>DRIVE11</code>): This output is internally connected to COM.
5	IN	DFT	Drive fault input. Set active level with the <code>DRFLVL</code> command. The drive fault input will not be recognized until you enable the input functions with the <code>INFEN1</code> command. — see circuit diagram below
6	----	AGND	Analog ground. This is the ground reference for the ANI input.
7	IN	ANI	±10V, 14-bit analog input (12-bit accuracy). ANI Voltage reported with <code>[ANI]</code> & <code>TANI</code> commands. ANI position (counts) reported with <code>[PANI]</code> & <code>TPANI</code> commands or <code>[FB]</code> & <code>TFB</code> commands. (6270-ANI option only).
8	OUT	CMD-	Command signal return. — see circuit diagram below
9	OUT	CMD+	Command output signal (jumper selectable: ±10V is default; current settings are available). — see circuit diagrams

Internal Command Signal Output Circuit

If voltage output is selected

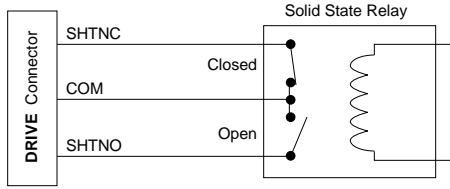


If current output is selected

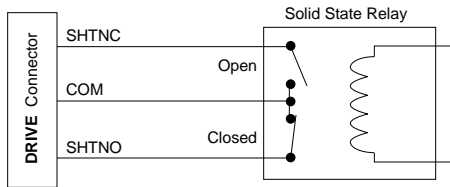


Internal Shutdown Output Circuit

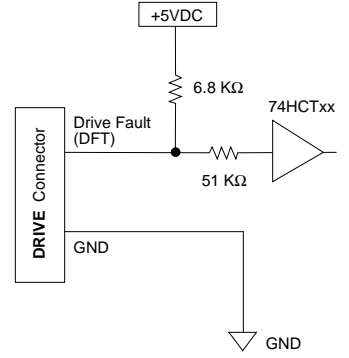
Shutdown Active:



Shutdown Inactive:



Internal Drive Fault Input Circuit



Linear Displacement Transducer (LDT) Connectors

Pin	In/Out	Name	Description	Internal Encoder Input Circuit
9	----	+15V	Power connection for LDT	
8	OUT	INTR+	Interrogate output to LDT (+) (sampling rate default is 1.5 ms, adjust with LDTUPD command)	
7	OUT	INTR-	Interrogate output to LDT (-)	
6	IN	GATE+	Return pulse from LDT (+)	
5	IN	GATE-	Return pulse from LDT (-)	
4	----	-15V	Power connection for LDT	
3	----	RSVD	Reserved for future enhancements	
2	----	GND	Isolated logic ground	
1	----	SHLD	Internally connected to chassis ground (earth)	

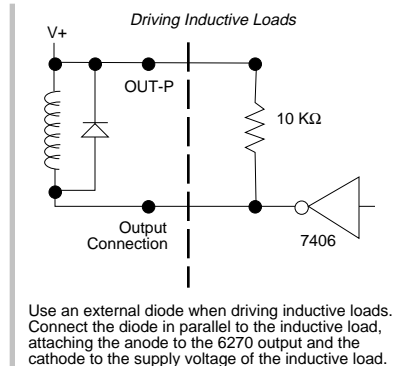
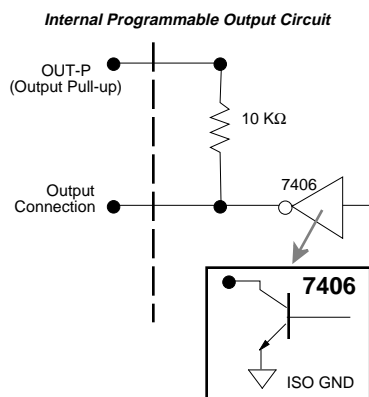
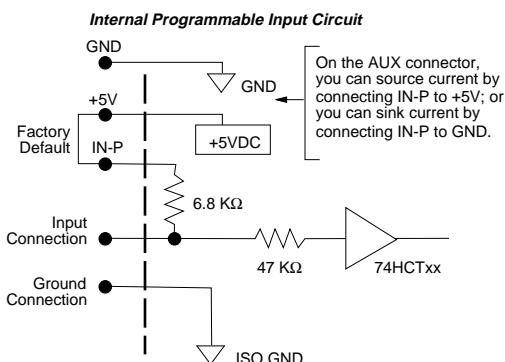
Encoder Connector (For Use With Incremental Encoder Only)

Pin	In/Out	Name	Compumotor E Series Encoder Cable Colors	Description	Internal Encoder Input Circuit
9	OUT	+5V	Red	+5VDC output to power the encoder	
8	IN	A +	Brown	A+ channel quadrature signal	
7	IN	A -	Brown/White	A- channel quadrature signal	
6	IN	B +	Green	B+ channel quadrature signal	
5	IN	B -	Green/White	B- channel quadrature signal	
4	IN	Z +	Orange	Z+ channel quadrature signal	
3	IN	Z -	Orange/White	Z- channel quadrature signal	
2	----	GND	Black	Isolated logic ground	
1	----	SHLD	Shield	Internally connected to chassis ground (earth)	

Programmable I/O Connectors

Pin	OUTPUTS Connector	INPUTS Connector	Pin	OUTPUTS Connector	INPUTS Connector
49	+5VDC	+5VDC	23	Output #13	Input #13
47	Output #1 (LSB)	Input #1 (LSB)	21	Output #14	Input #14
45	Output #2	Input #2	19	Output #15	Input #15
43	Output #3	Input #3	17	Output #16	Input #16
41	Output #4	Input #4	15	Output #17	Input #17
39	Output #5	Input #5	13	Output #18	Input #18
37	Output #6	Input #6	11	Output #19	Input #19
35	Output #7	Input #7	09	Output #20	Input #20
33	Output #8	Input #8	07	Output #21	Input #21
31	Output #9	Input #9	05	Output #22	Input #22
29	Output #10	Input #10	03	Output #23	Input #23
27	Output #11	Input #11	01	Output #24 (MSB)	Input #24 (MSB)
25	Output #12	Input #12			

All even-numbered pins are connected to logic ground.



Auxiliary (AUX) Connector

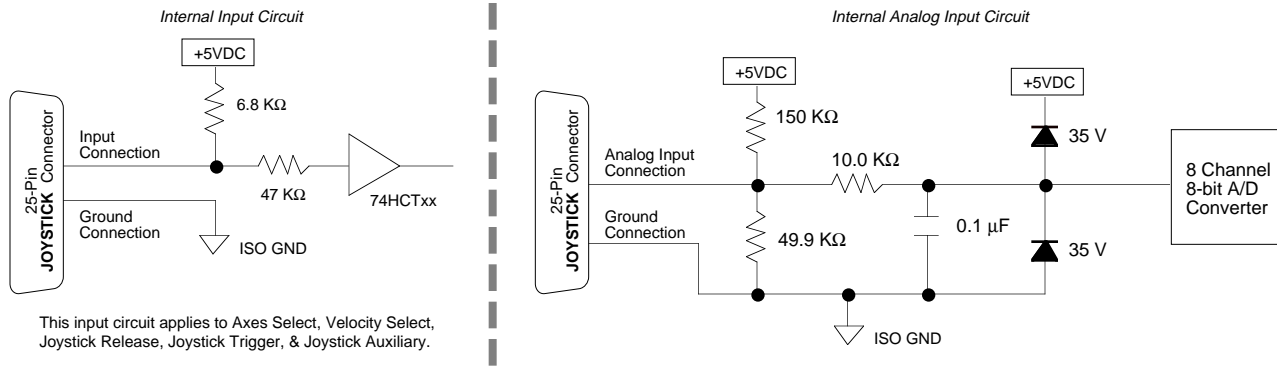
Pin	In/Out	Name	Description
1	IN	Rx	Receive input for RS-232C interface
2	OUT	Tx	Transmit output for RS-232C interface
3	-----	GND	Isolated ground for RS-232C interface
4	-----	SHLD	<i>Shield</i> —Internally connected to chassis ground (earth)
5	OUT	+5V	Connect to OUT-P to power the 26 programmable outputs. 1.8A limit (applies to total load on all of the I/O connectors) — e.g., if 2 encoders are drawing at total of 500mA, then 1.3A is left for other purposes.
6	OUT	OUT-P	Internally connected to pull-up resistors for the 24 general-purpose programmable outputs. Connecting this input to the +5V pin (this is already done at the factory) makes the outputs TTL compatible. Connection to other voltages (max. = 24V) allows for compatibility with other signal levels.
7	IN	IN-P	Internally connected to pull-up resistors for the 24 general-purpose programmable inputs. Connect this input to the +5V pin (already done at the factory) to source current; or connect to GND to sink current. Connection to other voltages (max. = 24V) allows for compatibility with other signal levels. Does not apply to triggers.
8	IN	TRG-A	Trigger input A: Like programmable inputs, but can function as a position latch input that latches positions within 1 encoder count of the trigger being activated (see <code>INFNC</code> command). Internal circuit is identical to the limit input (see limit input circuit drawing below).
9	IN	TRG-B	Same function as trigger input A above
10	-----	GND	Isolated ground
11	OUT	OUT-A	Auxiliary programmable output A: Function and circuit is identical to the other 24 programmable outputs (see programmable I/O circuit drawing above)
12	OUT	OUT-B	Same function as auxiliary programmable output A above
13	-----	GND	Isolated ground
14	IN	ENBL	Enable input. Normally grounded. When contact to ground is broken, the analog output signal to the drive is set to \emptyset V and the shutdown outputs are activated; this occurs independent of the DSP and the microprocessor. Internal input circuit is identical to the limit circuit below.

Limits Connector

Pin	In/Out	Name	Description	Internal Limit Input Circuit
9	IN	1CW	Clockwise limit input for axis 1	
8	IN	1CCW	Counter-clockwise limit input for axis 1	
7	IN	1HOM	Home limit input for axis 1	
6	—	GND	Isolated ground	
5	IN	2CW	Clockwise limit input for axis 2	
4	IN	2CCW	Counter-clockwise limit input for axis 2	
3	IN	2HOM	Home limit input for axis 2	
2	—	GND	Isolated ground	
1	—	SHLD	<i>Shield</i> —Internally connected to chassis ground (earth)	

Joystick Connector

Pin	In/Out	Name	Description
1	IN	Analog Channel 1	8-bit, analog input for joystick control of axis. Input voltage must not exceed 5V.
2	IN	Analog Channel 2	8-bit, analog input for joystick control of axis. Input voltage must not exceed 5V.
3	IN	Analog Channel 3	8-bit, analog input for joystick control of axis. Input voltage must not exceed 5V.
8	—	Shield	Shield
14	—	Ground	Isolated Ground
15	IN	Axes Select	If using only one analog channel, you can use this input to alternately control axes 1 or 2
16	IN	Velocity Select	Input to select high or low velocity range (as defined with <code>JOYVH</code> or <code>JOYVL</code> command)
17	IN	Joystick Release	When low (grounded), joystick mode can be enabled. When high (not grounded), program execution will continue with the first command after the joystick enable (<code>JOY</code>) statement.
18	IN	Joystick Trigger	Status of this active-low input can be read by a program (using the <code>INO</code> or <code>TINO</code> commands) to control program flow, or to enter the 6270 into joystick mode.
19	IN	Joystick Auxiliary	Status of this active-low input can be read by a program (using the <code>INO</code> or <code>TINO</code> commands) to control program flow.
23	OUT	+5VDC (out)	+5VDC power output



RP240 Connector

Pin	In/Out	Name	Description
5	—	Shield	Shield
4	OUT	Tx	Transmit output to RP240's Rx input
3	IN	Rx	Receive input from RP240's Tx output
2	—	Ground	Ground
1	OUT	+5VDC (out)	+5VDC power output

Optional DIP Switch and Jumper Settings

The 6270 is equipped with a four-position DIP switch package you can use to select the 6270's device address (used for daisy-chaining multiple 6270s with one RS-232C circuit), and to use the 6270's auto baud rate feature.

NOTE

As an alternative to setting the address with the DIP switch package, you can automatically establish an $n + 1$ unique address configuration with the `ADDR` command. Refer to the *RS-232C Daisy-Chaining* section in Chapter 5 for details.

The 6270 is also equipped with jumpers you can use to select a variety of command output voltage or current settings.

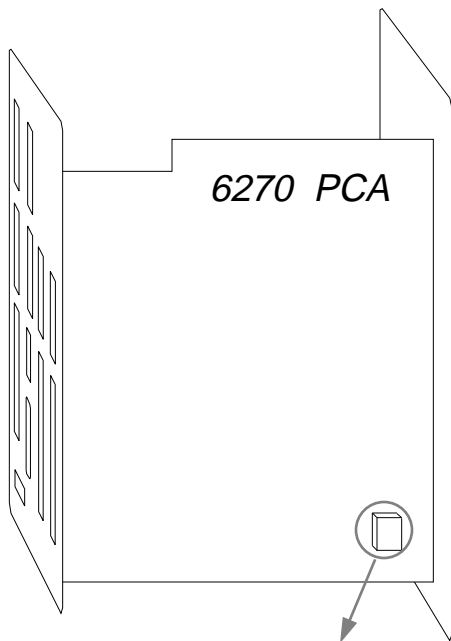
Accessing the DIP Switch Package and Jumpers

CAUTION

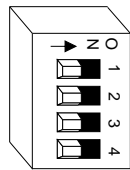
While handling the 6270 printed circuit assembly (PCA), be sure to observe proper grounding techniques to prevent electro-static discharge (ESD).

1. Remove power before removing the 6270's enclosure.
2. Lay the 6270 on its back (the side with the mounting brackets).
3. Using a Phillips screwdriver, remove the four screws on the front panel and the two screws on the bottom panel.
4. Gently slide the enclosure away from the chassis.

The illustration below shows the DIP switch package and jumpers and lists the optional settings.



DIP Switch
Factory Default Setting Shown



Switch #3	Switch #2	Switch #1	Device Address
OFF	OFF	OFF	Ø (default)
OFF	OFF	ON	1
OFF	ON	OFF	2
OFF	ON	ON	3
ON	OFF	OFF	4
ON	OFF	ON	5
ON	ON	OFF	6
ON	ON	ON	7

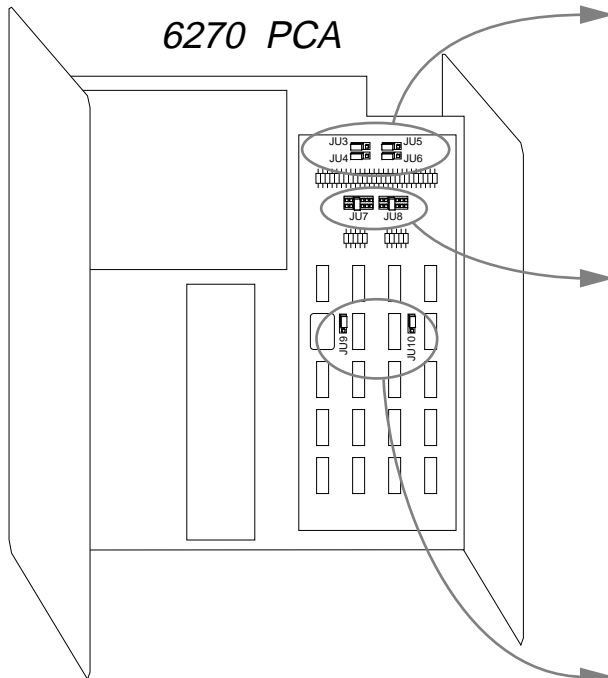
* Device address is checked upon power up or reset.

Switch #4 ON = Auto Baud Enabled
Switch #4 OFF = Auto Baud Disabled (default)

Following these steps to implement the Auto Baud feature:

1. Change Switch #4 to the ON position.
2. Connect the terminal to the 6270's RS-232C serial port on the AUX connector.
3. Power up the terminal.
4. Cycle power to the 6270 and immediately press the space bar several times.
5. The 6270 should send a message to the terminal confirming the baud rate (i.e., *9600). You should now be communicating to the 6270 via the terminal. If no baud rate messages is received, verify steps 1 through 3 and repeat step 4.
6. Change Switch #4 to the OFF position.
7. Cycle power to the 6270. You should be communicating to the 6270 via the terminal at the previously determined rate.

NOTE: If Auto Baud is enabled, the 6270 performs its auto baud routine every time it is powered up or reset. The 6270 is capable of matching 1200, 2400, 4800, and 9600 baud. Once the baud rate has been determined, the 6270 stores that baud rate in non-volatile memory; therefore, Switch #4 should be set to the OFF position after the baud rate has been determined.



CURRENT OR VOLTAGE CONTROL

Note: Two jumper settings are required for each axis

JUMPER	FUNCTION	OPTIONS
JU5 and JU6	Axis #1	Position 1/2 = ±10 volt output Position 2/3 = current output (select range with JU8)
JU3 and JU4	Axis #2	Position 1/2 = ±10 volt output Position 2/3 = current output (select range with JU7)

CURRENT RANGE OPTIONS

JUMPER	FUNCTION	OPTIONS
JU8	Axis #1	Position 1/2 = ± 20 mA Position 3/4 = ± 50 mA Position 5/6 = ± 60 mA Position 7/8 = ± 80 mA Position 9/10 = ± 100 mA Position 11/12 = ± 150 mA
JU7	Axis #2	Position 1/2 = ± 20 mA Position 3/4 = ± 50 mA Position 5/6 = ± 60 mA Position 7/8 = ± 80 mA Position 9/10 = ± 100 mA Position 11/12 = ± 150 mA

LDT FEEDBACK OPTIONS

JUMPER	FUNCTION	OPTIONS
JU9	Axis #1	Position 1/2 = pulse duration feedback Position 2/3 = start/stop feedback
JU10	Axis #2	Position 1/2 = pulse duration feedback Position 2/3 = start/stop feedback

Troubleshooting

The information in this chapter will enable you to isolate and resolve system hardware and software problems.

Troubleshooting Basics

If your system does not function properly (or as you expect it to operate), the first thing that you must do is identify and isolate the problem. When you have accomplished this, you can effectively begin to resolve the problem.

The first step is to isolate each system component and ensure that each component functions properly when it is run independently. You may have to dismantle your system and put it back together piece by piece to detect the problem. If you have additional units available, you may want to exchange them with existing components in your system to help identify the source of the problem.

Determine if the problem is mechanical, electrical, or software-related. Can you repeat or re-create the problem? Do not attempt to make quick rationalizations about problems. Random events may appear to be related, but they are not necessarily contributing factors to your problem. You must carefully investigate and decipher the events that occur before the subsequent system problem.

You may be experiencing more than one problem. You must isolate and solve one problem at a time. Log (document) all testing and problem isolation procedures. You may need to review and consult these notes later. This will also prevent you from duplicating your testing efforts.

If you are having difficulty isolating a problem be sure to document all occurrences of the problem along with as much specific information, such as time of occurrence, 6270 status, and anything else that was happening when the problem occurred.

Once you have isolated a problem, take the necessary steps to resolve it. Refer to the problem solutions contained in this chapter.

Reducing Electrical Noise

For detailed information on reducing electrical noise, refer to Appendix A.

Error Messages and Debug Tools

A list of all possible error messages, and their causes, is provided in the **6000 Series Software Reference Guide**. For instructions on using the 6270's program debug tools (Trace mode, Single-Step mode, I/O activation, bad command detection, etc.) refer to *Program Debug Tools* in the *Programming Guide* section of the **6000 Series Software Reference Guide**.

Common Problems & Solutions

The following table presents some guidelines to help you isolate problems with your motion control system. Some common symptoms are listed along with a list of possible causes and remedies.

- Look for the symptom that most closely resembles what you are experiencing.
- Look through the list of possible causes so that you better understand what may be preventing proper operation.
- Start from the top of the list of remedies and use the suggested procedures to isolate the problem.
- Refer to other sections of the manual for more information on 6270 set up, system connections, and feature implementation. You may also need to refer to the **6000 Series Software Reference Guide**.

Problem	Cause	Solution
Erratic operation	<ol style="list-style-type: none"> 1. Electrical Noise 2. Improper shielding 3. Improper wiring 	<ol style="list-style-type: none"> 1. Reduce electrical noise or move the 6270 away from noise source (refer also to Appendix A) 2. Ground Joystick Release input (refer also to Appendix A) 3. Check wiring for opens, shorts, and mis-wired connections
LEDs: DISABLED1/2 LEDs are red	<ol style="list-style-type: none"> 1. Shutdown input active 2. No AC power to drive or valve 3. Drive or valve not connected 4. Position error (LDT not connected) 5. LDT read error (LDT not connected, LDT failure, or LDTUPD setting too fast) 	<ol style="list-style-type: none"> 1. Issue DRIVE11 command 2. Check AC power to drive or valve 3. Connect drive or valve 4. Connect LDT and issue DRIVE11 command 5.a. Connect LDT and issue DRIVE11 command 5.b. Replace faulty LDT and issue DRIVE11 command 5.c. Increase the LDTUPD value and issue DRIVE11 command <p>NOTE: To enable an axis (DRIVE11) without an LDT connected, connect GATE+ to GND on the LDT connector.</p>
LEDs: STATUS LED is off	<ol style="list-style-type: none"> 1. No AC power 	<ol style="list-style-type: none"> 1. Check AC power
LEDs: STATUS LED is red	<ol style="list-style-type: none"> 1. Internal Board Monitor Alarm (BMA) has detected a non-recoverable fault 	<ol style="list-style-type: none"> 1.a. Recycle power to the 6270 1.b. Ensure +5V is not shorted to GND on the I/O connections
Missing counts from feedback device	<ol style="list-style-type: none"> 1. Improper wiring 2. Feedback device slipping 3. Feedback device too hot 4. Electrical noise 5. Feedback device frequency too high 6. LDT read error (LDT not connected, LDT failure, or LDTUPD setting too fast) 	<ol style="list-style-type: none"> 1. Check wiring 2. Check and tighten feedback device coupling 3. Reduce encoder temperature with heatsink, thermal insulator, etc. 4.a. Shield wiring (refer also to Appendix A) 4.b. Use encoder with differential outputs 5. Peak encoder frequency must be below 1.2 MHz post-quadrature; peak frequency must account for velocity ripple 6.a. Connect LDT and issue DRIVE11 command 6.b. Replace faulty LDT and issue DRIVE11 command 6.c. Increase the LDTUPD value and issue DRIVE11 command <p>NOTE: To enable an axis (DRIVE11) without an LDT connected, connect GATE+ to GND on the LDT connector.</p>

Problems, Causes & Solutions (continued)

Problem	Cause	Solution
Load does not move in joystick mode	<ol style="list-style-type: none"> 1. Joystick Release input not grounded 2. Improper wiring 	<ol style="list-style-type: none"> 1. Ground Joystick Release input 2. Check wiring for opens, shorts, and mis-wired connections
Runaway (if encoder or LDT counts positive when turned clockwise or extended)	<ol style="list-style-type: none"> 1. Direction connections reversed 	<ol style="list-style-type: none"> 1. Switch CMD– with the CMD+ connection to drive or valve <p>NOTE: The CMD+/- Connection is not differential. Do not connect CMD+ to ground on your valve/drive</p>
No Motion	<ol style="list-style-type: none"> 1. Status LED off or red 2. Limits engaged 3. Drive fault level incorrect. 4. Improper wiring 5. Load is jammed 6. No torque from motor 7. Maximum position error exceeded 8. Drive has activated the Drive fault input 9. ENBL input is not grounded to GND 	<ol style="list-style-type: none"> 1. See status LED problems above. 2a. Move load off of limits or disable limits with <code>LH0, 0</code> 2b. If using soft limits, make sure <code>LSCW>LSCCW</code> 3. Set drive fault level using <code>DRFLVLxx</code> (for S, Z, and K drives, use <code>DRFLVL11</code>) 4. Check command, shutdown, drive fault, and limit connections. 5. Remove power and clear jam 6. See problem: <i>No Torque</i> 7. Check to see if <code>TAS</code> bit #23 is set, and issue the <code>DRIVE1</code> command to the axis that exceeded the position error limit. 8a. Check to see if <code>TAS</code> bit #14 is set, and check the <code>DRFLVL</code> command to ensure the drive fault level is correct. 8b. Inspect the drive to determine the cause 9. Ground the ENBL input to GND and reset
No RS-232C Communication	<ol style="list-style-type: none"> 1. Improper RS-232C Interface or communication parameters 2. RS-232C disabled 3. In daisy chain, unit may not be set to proper address 	<ol style="list-style-type: none"> 1. See <i>RS-232C Troubleshooting</i> section 2. Enable RS-232C with the <code>E</code> command (all units if daisy-chained) 3. Verify DIP switch settings (see <i>Optional DIP Switch Settings</i> in Chapter 6), verify proper application of the <code>ADDR</code> command
No Torque/Force	<ol style="list-style-type: none"> 1. Improper wiring 2. No power to drive 3. Drive or valve failed 4. Drive faulted 5. Shutdown issued 	<ol style="list-style-type: none"> 1. Check wiring to the drive, or valve, as well as other system wiring 2. Check power to drive 3. Check drive or valve status 4. Check drive status 5. Enable drive or valve with <code>DRIVE11</code>
Power-up Program does not execute	<ol style="list-style-type: none"> 1. ENBL input is not grounded to GND 2. <code>STARTP</code> program is not defined 	<ol style="list-style-type: none"> 1. Ground the ENBL input to GND and reset 2. Check the response to the <code>STARTP</code> command. If no program is reported, define the <code>STARTP</code> program and reset
Program access denied: receive the message *ACCESS DENIED when trying to use the DEF, DEL, ERASE, INFNC, or MEMORY commands	<ol style="list-style-type: none"> 1. Program security function has been enabled (<code>INFNCi-Q</code>) and the program access input has not been activated 	<ol style="list-style-type: none"> 1.a. Activate the assigned program access input, perform your programming changes, then deactivate the program access input. 1.b. Refer to the instructions in the <code>INFNC</code> command description in the 6000 Series Software Reference Guide.
Program execution: stops at the <code>INFEN1</code> command	<ol style="list-style-type: none"> 1. <code>INFEN1</code> enables drive fault monitoring, but the drive fault level (<code>DRFLVL</code>) command is set incorrectly for the drive being used. 	<ol style="list-style-type: none"> 1. Issue the correct <code>DRFLVL</code> command for your drive (refer to the <code>DRFLVL</code> command)
Program execution: the first time a program is run, the move distances are incorrect. Upon downloading the program the second time, move distances are correct.	<ol style="list-style-type: none"> 1. Scaling parameters were not issued when the program was downloaded; or scaling parameters have been changed since the program was defined 	<ol style="list-style-type: none"> 1. Issue the scaling parameters (<code>SCALE1</code>, <code>SCLA</code>, <code>SCLD</code>, <code>SCLV</code>, <code>PSCLA</code>, <code>PSCLV</code>) before saving any programs
Programmable inputs not working	<ol style="list-style-type: none"> 1. IN-P (input pullup) not connected 2. If external power supply is used, the grounds must be connected together 3. Improper wiring 	<ol style="list-style-type: none"> 1.a. When inputs will be pulled down to 0V by an external device, connect IN-P to +5V or to another positive supply 1.b. When inputs will be pulled up to 5V or higher by an external device, connect IN-P to 0V <ol style="list-style-type: none"> 2. Connect external power supply's ground to ground (GND) 3. Check wiring for opens, shorts, and mis-wired connections
Programmable outputs not working	<ol style="list-style-type: none"> 1. Output connected such that it must source current (pull to positive voltage) 2. OUT-P not connected to +5V or other positive voltage source 3. If external power supply is used, the grounds must be connected together 4. Improper wiring 	<ol style="list-style-type: none"> 1. Outputs are open-collector and can only sink current -- change wiring. 2. Connect OUT-P to +5V supplied or other voltage in system 3. Connect the external power supply's ground to ground (GND) 4. Check wiring for opens, shorts, and mis-wired connections

Problems, Causes & Solutions (continued)

Problem	Cause	Solution
Trigger inputs not working	1. Improper wiring	1. Check wiring for opens, shorts, and mis-wired connections
Wrong Direction— Stable	1. Command output (CMD) connections and feedback device connections or mounting are reversed	1. Software remedy: Issue the <code>CMDDIR1</code> command to the affected axis. This reverses the polarity of the commanded direction and the feedback direction so that servo stability is maintained. Hardware remedy: Switch CMD- with the CMD+ connection to drive or valve (if your valve or drive does not accept differential outputs this will not work). You will also have to change the feedback device wiring or mounting so that it counts in same direction as the commanded direction.
Wrong Direction— Unstable	1. Not tuned properly 2. Phase of encoder reversed or mounting of ANI input or LDT is such that it counts in the opposite direction as the commanded direction.	1. Refer to Chapter 4 for tuning instructions 2. Software remedy: For the affected axis, issue the appropriate feedback polarity reversal command (<code>LDPOL1</code> if LDT, <code>ANIPOL1</code> if ANI analog input, or <code>ENCPOL1</code> if encoder). Hardware remedy: If encoder feedback, swap the PHA+ and PHA- connections to the 6270. If LDT or ANI feedback, change the mounting so that the counting direction is reversed.
Wrong Speed or Distance	1. Wrong resolution setting 2. Wrong scaling value	1.a. Encoder feedback: Check and set resolution on 6270 with <code>ERESx, x</code> 1.b. LDT feedback: Check and set resolution on 6270 with <code>LDTRESx, x</code> 2. Check the scaling parameters (<code>SCALE1</code> , <code>SCLA</code> , <code>SCLD</code> , <code>SCLV</code> , <code>PSCLA</code> , <code>PSCLV</code>)

RS-232C Troubleshooting

If you are having problems communicating with the 6270, try the following procedure to troubleshoot the communications interface.

1. Power-up your computer or terminal *and then* power-up the 6270.
2. The serial port of your computer/terminal may require hardware handshaking. If so, you must disable handshaking with your terminal emulator software package. You can also disable hardware handshaking by connecting the computer's/terminal's RTS & CTS lines together (usually pins 4 and 5) and DSR & DTR lines together (usually pins 6 to 20).
3. Verify that the computer/terminal and 6270 are configured to the same baud rate, number of data bits, number of stop bits, and parity. If your terminal is not capable of 9600 baud, you can use the 6270's *auto-baud* function to automatically set the 6270's baud rate equal to the terminal's baud rate. Refer to the *Optional DIP Switch and Jumper Settings* section in Chapter 6 for instructions.
4. Check to make sure you are using DC common or signal ground as your reference, *not* earth ground.
5. Cable lengths for RS-232C should not exceed 50 feet. As with any control signal, be sure to shield the cable to earth ground at one end only.
6. Press the return key several times. The cursor should move down one or two lines each time you press the return key. If your terminal displays garbled characters, check the terminal's protocol set-up; the baud rate setting probably does not match the 6270's setting (see step ③ above). The problem could also be caused by a poor ground connection.
7. If the cursor does not move after pressing the space bar:
 - a. Disconnect the RS-232C cable from the 6270.
 - b. Connect the RS-232C cable's Rx and Tx lines together at the end that connects to the 6270.
 - c. Press the space bar. If the cursor does not move, either the computer (or terminal) or the cable is defective.
8. Once you are able to make the cursor move, enter some characters. These characters should appear on the computer or terminal display. If each character appears twice, your host is set to half-duplex; set it to full-duplex.

Appendix A: Reducing Electrical Noise

Noise-related difficulties can range in severity from minor positioning errors to damaged equipment from runaway loads crashing blindly through limit switches. In microprocessor-controlled equipment such as the 6270, the processor constantly retrieves instructions from memory in a controlled sequence. If an electrical disturbance occurs, it may cause the processor to misinterpret an instruction or access the wrong data. This can be catastrophic to the program and force you to reset the processor.

Sources of Noise

Being invisible, electrical noise can be very mysterious, but it invariably comes from the following sources:

- Power line noise
- Externally conducted noise
- Transmitted noise
- Ground loops

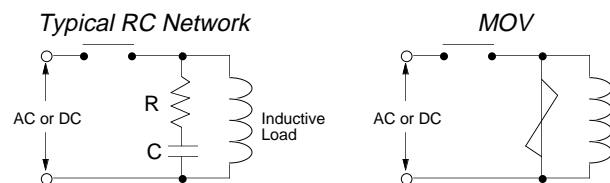
The following electrical devices are notorious for generating unwanted electrical noise conditions:

- Coil-driven devices: conducted and power line noise
- SCR-fired heaters: transmitted and power line noise
- Valves, motors & motor drives: transmitted and power line noise
- Welders (electric): transmitted and power line noise

Power Line Noise

Power line noise is usually easy to resolve due to the wide availability of line filtering equipment for the industry. Only the most severe situations call for an isolation transformer. Line filtering equipment is required when other devices connected to the local power line are switching large amounts of current, especially if the switching occurs at a high frequency.

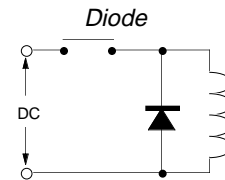
Any device having coils is likely to disrupt the power line when it is switched off. Surge suppressers, such as metal oxide varistors (MOVs) are capable of limiting this type of electrical noise. A series resistor/capacitor (RC) network across the coil is also effective (resistance: 500 to 1,000 Ω ; capacitance: 0.1 to 0.2 μF). Coil-driven devices (inductive loads) include relays, solenoids, contractors, clutches, brakes, and motor starters.



Externally Conducted Noise

Externally-conducted noise is similar to power line noise, but the disturbances are created on signal and ground wires that are connected to the 6270. This kind of noise can get into logic circuit ground or into the processor power supply and scramble the program. The problem here is that control equipment often shares a common DC ground wire that may be connected to several devices, such as a DC power supply, programmable controller, remote switches, etc. When a noisy device such as a relay or solenoid is attached to the DC ground, it may cause disturbances within the 6270.

To solve a noise problem caused by DC mechanical relays and solenoids, you can connect a diode backwards across the coil to clamp the induced voltage *kick* that the coil will produce. The diode should be rated at 4 times the coil voltage and 10 times the coil current. Using solid state relays is another way to eliminate this problem.



Multiple devices on the same circuit should be grounded together at a single point.

Furthermore, power supplies and programmable controllers often have DC common tied to Earth (AC power ground). As a rule, it is preferable to have the 6270 signal ground or DC common floating with respect to Earth. This prevents noisy equipment which is grounded to Earth from sending noise into the 6270. When floating the signal ground is not possible, you should make the Earth ground connection at only one point.

In many cases, optical isolation may be required to completely eliminate electrical contact between the 6270 and a noisy environment. Solid state relays provide this type of isolation.

Transmitted Noise

Transmitted noise is picked up by external connections to the 6270, and in severe cases can attack the 6270 when there are no external connections. The 6270's sheet metal enclosure will typically shield the electronics from this, but openings in the enclosure for connections and front panel controls may *leak*.

When high current contacts open, they draw an arc, producing a burst of broad spectrum radio frequency noise that can be picked up on a limit switch or other wiring. High-current and high-voltage wires have an electrical field around them and may induce noise on signal wiring, especially when they are tied in the same wiring bundle or conduit.

When this kind of problem occurs, you should consider shielding signal cables or isolating the signals. A proper shield surrounds the signal wires to intercept electrical fields, but this shield must be tied to Earth to drain the induced voltages. At the very least, wires should be run in twisted pairs to limit straight line antenna effects.

Installing the 6270 in a NEMA enclosure ensures protection from this kind of noise, unless noise-producing equipment is also mounted inside the enclosure. Connections external to the enclosure must be shielded.

Even the worst noise problems in environments near 600 amp welders and 25kW transmitters have been solved using enclosures, conduit, optical isolation, and single-point ground techniques.

Ground Loops

Ground Loops are the most mysterious noise problems. They seem to occur most often in systems where a control computer is using RS-232C communication. Symptoms like garbled transmissions and intermittent operation are typical.

The problem occurs in systems where multiple Earth ground connections exist, particularly when these connections are far apart.

Ground Loops—Noise Scenario

Suppose a 6270 is controlling an axis, and the limit switches use an external power supply. The 6270 is controlled by a computer in another room. If the power supply Common is connected to Earth, the potential exists for ground loop problems. This is because most computers have their RS-232C signal common tied to Earth. The loop starts at the 6270 system limit switch ground, goes to Earth through the drive, and on to Earth at the computer. From there, the loop returns to the 6270 system through RS-232C signal ground. If a voltage potential exists between drive Earth and remote computer Earth, ground current will flow through the RS-232C ground, creating unpredictable results.

The way to test for and ultimately eliminate a ground loop is to lift or *cheat* Earth ground connections in the system until the symptoms disappear.

Defeating Noise

The best time to handle electrical noise problems is before they occur. When a motion system is in the design process, the designer should consider the following set of guidelines for system wiring (in order of importance):

1. Put surge suppression components on all electrical coils: Resistor/capacitor filters, MOVs, Zener and clamping diodes.
2. Shield all remote connections, use twisted pairs. Shields should be tied to Earth at one end.
3. Put all microelectronic components in an enclosure. Keep noisy devices outside. Watch internal temperature.
4. Ground signal common wiring at one point. Float this ground from Earth if possible.
5. Tie all mechanical grounds to Earth at one point. Run chassis and motor grounds to the frame, and the frame to Earth.
6. Isolate remote signals. Solid state relays or opto isolators are recommended.
7. Filter the power line. Use common RF filters, and use an isolation transformer for worst case.

A noise problem must be identified before it can be solved. The obvious way to approach a problem situation is to eliminate potential noise sources until the symptoms disappear, as in the case of ground loops. When this is not practical, use the above guidelines to *shotgun* the installation.

References

Information about the equipment referred to may be obtained by calling the numbers listed below.

- Corcom line filters, (214) 386-5515
- Opto-22 optically isolated relays, (408) 496-6611
- Crydom optically isolated relays, (415) 463-2250
- Potter Brumfield optically isolated relays, (812) 386-1000
- Teal power line isolation filters, (800) 888-8325

Appendix B: Alphabetical Command List

Command Name	Command Description	Command Name	Command Description
[<cr>]	Carriage Return	D	Distance
[<lf>]	Line Feed	[D]	Distance Assignment
[:]	Colon	[DAC]	Current DAC Commanded Voltage
!	Immediate Command Identifier	DACLIM	DAC Limit
@	Global Command Identifier	DACMIN	Minimum DAC Output Voltage
;	Begin Comment	[DAT]	Data Assignment
\$	Label Deceleration	DATA	Data Statement
#	Step Through a Program	[DATP]	Data Program
'	Enter Data (Single quote)	DATPTR	Set Data Pointer
[.]	Bit Select	DATRST	Reset Data Pointer
["]	Begin and End String	DATSIZ	Data Program Size
[\]	ASCII Character Designator	DATTCH	Data Teach
[=]	Assignment or Equivalence	DCLEAR	Clear RP240 Display
[>]	Greater Than	DEF	Define a Program/Subroutine
[>=]	Greater Than or Equal	DEL	Delete a Program/Subroutine
[<]	Less Than	DJOG	Enable RP240 Jog Mode
[<=]	Less Than or Equal	DLED	Turn RP240 LEDs On/Off
[<>]	Not Equal	DPASS	Set RP240 Password
[()]	Operation Priority Level	DPCUR	Position Cursor on RP240 Display
[+]	Addition	[DPTR]	Data Pointer Assignments
[-]	Subtraction	[DREAD]	Read Numeric Keypad on RP240
[*]	Multiplication	[DREADF]	Read Function Key on RP240
[/]	Division	DREADI	RP240 Data Read Immediate Mode
[&]	Boolean And	DRFLVL	Drive Fault Level
[]	Boolean Or	DRIVE	Drive Shutdown
[^]	Boolean Exclusive Or	DVAR	Display Variable on RP240 Display
[~()]	Boolean Not	DWRITE" "	Write Text to the RP240 Display
[>>]	Shift from Right to Left	E	RS-232C Enable
[<<]	Shift from Left to Right	ECHO	Echo Enable
A	Acceleration	ELSE	Else Condition of IF Statement
[A]	Acceleration Assignment	ENCPOL	Encoder Polarity
AA	Average Acceleration for S-curve	END	Program/Subroutine End
AD	Deceleration	EOL	End of Line Terminating Characters
[AD]	Deceleration Assignment	EOT	End of Transmission Characters
ADA	Average Deceleration for S-curve	[ER]	Error Value
ADDR	Daisy-Chain Address	ERASE	Erase all Programs/Subroutines
[AND]	And	ERES	Encoder Resolution
[ANI]	Analog Input Value (for -ANI Option)	ERRBAD	Bad Prompt
ANIPOL	ANI Input Polarity	ERRDEF	Program Definition Prompt
[ANV]	Analog Input Value	ERRLVL	Error Detection Level
ANVO	Analog Input Voltage Override	ERROK	Good Prompt
ANVOEN	Analog Input Voltage Override Enable	ERROR	Error Program Enable
[AS]	Axis Status Value	ERRORP	Error Program
[ATAN()]	Inverse Tangent	[FB]	Position of Feedback Device
[b]	Binary Identifier	GO	Initiate Motion
BP	Set a Program Break Point	GOL	Initiate Linear Interpolated Motion
BREAK	Terminate Program Execution	GOSUB	Execute a Subroutine with Return
C	Continue	GOTO	Execute a Subroutine without Return
[CA]	Value of Captured ANI Input	[h]	Hexadecimal Identifier
CMDDIR	Commanded Direction Polarity	HALT	Terminate Program Execution
COMEXC	Enable Continuous Command Mode	HELP	Applications Help
COMEXL	Continue Command Execution on Limit	HOM	Go Home
COMEXR	Continue Motion on Pause/Resume Input	HOMA	Home Acceleration
COMEXS	Continue Command Execution on Stop	HOMAA	Average Homing Acceleration
[COS()]	Cosine	HOMAD	Home Deceleration
		HOMADA	Average Homing Deceleration
		HOMBAC	Home Backup Enable
		HOMDF	Home Direction Final
		HOMEDG	Home Reference Edge

Command Name	Command Description	Command Name	Command Description
HOMLVL	Home Active Level	MA	Absolute / Incremental Mode Enable
HOMV	Home Velocity	MC	Preset / Continuous Mode Enable
HOMVF	Home Velocity Final	MEMORY	Configure Memory
HOMZ	Home to Z-channel Enable	[MOV]	Axis Moving Status
IF()	If Statement	NIF	End IF Statement
[IN]	Input Status	[NOT]	Not
INDAX	Participating Axes	NWHILE	End WHILE Statement
INDEB	Input Debounce Time	ONCOND	On Condition Enable
INDUSE	Enable/Disable User Status	ONIN	On an Input Condition Gosub
INDUST	User Status	ONP	On Program
INEN	Input Enable	ONUS	On a User Status Condition Gosub
INFEN	Input Function Enable/Disable	ONVARA	On Variable 1 Condition Gosub
INFNC	Input Function	ONVARB	On Variable 2 Condition Gosub
INLVL	Input Active Level	[OR]	Or
[INO]	Other Input Status	OUT	Output State
INPLC	Establish PLC Data Inputs	[OUT]	Output Status
INSELP	Select Program Enable	OUTALL	Multiple Output State
INSTW	Establish Thumbwheel Data Inputs	OUTEN	Output Enable
JOG	Jog Mode Enable	OUTFEN	Output Function Enable
JOGA	Jog Acceleration	OUTFNC	Output Function
JOGAA	Average Jogging Acceleration	OUTLVL	Output Active Level
JOGAD	Jog Deceleration	OUTPA	Output on Position — Axis 1
JOGADA	Average Jogging Deceleration	OUTPB	Output on Position — Axis 2
JOGVH	Jog Velocity High	OUTPLC	Establish PLC Strobe Data Outputs
JOGVL	Jog Velocity Low	OUTTW	Establish Thumbwheel Strobe Data Outputs
JOY	Joystick Mode Enable		
JOYA	Joystick Acceleration	PA	Path Acceleration
JOYAA	Average Joystick Acceleration	PAA	Average Path Acceleration for S-curve
JOYAD	Joystick Deceleration	PAD	Path Deceleration
JOYADA	Average Joystick Deceleration	PADA	Average Path Deceleration for S-curve
JOYAXH	Joystick Analog Input High	[PANI]	Position of ANI Inputs (6270-ANI Only)
JOYAXL	Joystick Analog Input Low	[PC]	Commanded Position
JOYCDB	Joystick Center Deadband	[PCA]	Position of Captured ANI Input Voltage
JOYCTR	Joystick Center	[PCC]	Captured Commanded Position
JOYEDB	Joystick End Deadband	[PCE]	Position of Captured Encoder
JOYVH	Joystick Velocity High	[PCL]	Position of Captured LDT
JOYVL	Joystick Velocity Low	[PE]	Position of Encoder
JOYZ	Joystick Zero	[PER]	Position Error
JUMP	Jump to a Subroutine without Return	[PI]	Pi (π)
K	Kill Motion	PS	Pause Program Execution
<ctrl>K	Immediate Kill	PSCLA	Path Acceleration Scale Factor
KDRIVE	Disable Drive on Kill	PSCLV	Path Velocity Scale Factor
L	Loop	PSET	Establish Absolute Position
[LDT]	Position of LDT	PV	Path Velocity
LDTGRD	LDT Gradient	RADIAN	Radian Enable
LDTPOL	LDT Polarity	[READ]	Read a Value from RS-232C port
LDTRES	LDT Resolution	REPEAT	Repeat Statement
LDTUPD	LDT Position Sampling Update Rate	RESET	Reset 6270
LH	Hard Limit Enable	RUN	Execute a Program/Subroutine
LHAD	Hard Limit Deceleration	S	Stop Motion
LHADA	Average Hard Limit Deceleration	SCALE	Enable/Disable Scale Factors
LHLVL	Hard Limit Active Level	SCLA	Accel / Decel Scale Factor
[LIM]	Limit Status	SCLD	Distance Scale Factor
LN	End Loop	SCLV	Velocity Scale Factor
LS	Soft Limit Enable	SDTAMP	Servo Dither Amplitude
LSAD	Soft Limit Deceleration	SDTFR	Servo Dither Frequency Ratio
LSADA	Average Soft Limit Deceleration	SFB	Servo Feedback Source
LSCCW	Soft Limit CCW Range	SGAF	Servo Acceleration Feedforward Gain
LSCW	Soft Limit CW Range	SGAFN	Acceleration Feedforward — Negative
LX	Terminate Loop	SGENB	Servo Gain Set Enable
		SGI	Servo Integral Feedback Gain
		SGIN	Integral Feedback Gain — Negative

Command Name	Command Description	Command Name	Command Description
SGILIM	Servo Integral Windup Limit	TSS	Transfer System Status
SGP	Servo Proportional Feedback Gain	TSTAT	Transfer Servo Controller Status
SGPN	Proportional Feedback Gain — Negative	TSTLT	Transfer Servo Settling Time
SGSET	Servo Gain Set Save	TTIM	Transfer Time
SGV	Servo Velocity Feedback Gain	TUS	Transfer User Status
SGVN	Velocity Feedback Gain — Negative	TVEL	Transfer Present Commanded Velocity
SGVF	Servo Velocity Feedforward Gain	TVELA	Transfer Present Actual Velocity
SGVFN	Velocity Feedforward Gain — Negative	[TW]	Thumbwheel Data Read
[SIN()]	Sine	UNTIL()	Until Part of REPEAT Statement
SMPER	Servo Max. Allowable Position Error	[US]	User Status
SOFFS	Servo Control Signal Offset	V	Velocity
SOFFSN	Control Signal Offset — Negative	[V]	Velocity Assignment
[SQRT()]	Square Root	VAR	Numeric Variable
[SS]	System Status	VARB	Binary Variable
SSFR	Servo Sampling Frequency Ratio	VARS	String Variable
SSWD	Setpoint Window Distance	VCVT()	Variable Type Conversion
SSWG	Setpoint Window Gain Set	[VEL]	Current Velocity
STARTP	Set Power-up Program	WAIT()	Wait for a Specific Condition
STEP	Program Step Mode Enable	WHILE()	While a Condition is True
STRGTD	Servo Target Zone Distance	WRITE" "	Transmit String to RS-232C port
STRGTE	Servo Target Zone Mode Enable	WRVAR	Transmit Variable to RS-232C port
STRGTT	Servo Target Zone Timeout Period	WRVARB	Transmit Binary Variable to RS-232C port
STRGTV	Servo Target Zone Velocity	WRVARS	Transmit String Variable to RS-232C port
T	Time Delay		
[TAN()]	Tangent		
TANI	Transfer Analog Input Value (6270-ANI only)		
TANV	Transfer Analog Input Value		
TAS	Transfer Axis Status		
TCA	Transfer Value of Captured ANI Input		
TCMDER	Transfer Command Error		
TDAC	Transfer Digital-to-Analog Converter Voltage		
TDIR	Transfer Directory		
TDPTR	Transfer Data Pointer Status		
TER	Transfer Error Status		
TEX	Transfer Program Execution Status		
TFB	Transfer Position of Feedback Devices		
TGAIN	Transfer All Servo Gains		
[TIM]	Current Timer Value		
TIMST	Start Timer		
TIMSTP	Stop Timer		
TIN	Transfer Input Status		
TINO	Transfer Other Input Status		
TLABEL	Transfer Labels		
TLDT	Transfer Position of LDTs		
TLIM	Transfer Limit Status		
TMEM	Transfer Memory Usage		
TOUT	Transfer Output State		
TPANI	Transfer Position of ANI Inputs (6270-ANI only)		
TPC	Transfer Position Commanded		
TPCA	Transfer Voltage of Captured Analog Input		
TPCC	Transfer Captured Commanded Position		
TPCE	Transfer Position of Captured Encoder		
TPCL	Transfer Position of Captured LDT		
TPE	Transfer Position of Encoder		
TPER	Transfer Position Error		
TPROG	Transfer Program		
TRACE	Program Trace Mode Enable		
TRANS	Translation Mode Enable		
TREV	Transfer Revision Level		
TSGSET	Transfer Servo Gain Set		

I N D E X

6000 DOS Support Disk 27, 56
6000 Series Command Language 56
6000 Series Software Reference Guide
iii, 56
6270
description 1
features 2
ship kit 3

A

absolute position
absolute positioning mode 64
absolute zero position 64
status 64
AC input voltage 5, 105
acceleration
acceleration feedforward control
(SGAF) 38
change on the fly 66
range 105
S-curve profiling 99
scaling 58
access to RP240 functions 88
active high/active low convention iii
actual position 31
address
daisy chain 103
DIP switch settings 109
airborne contaminants 7
alphabetical command list 117
ambient temperature 7
analog inputs 20
override 81
analog output
range 106
selecting voltage or current 25, 110
setting max & min limits 25
ANI input 21, 82
4-20 mA feedback 82
connections 21
test 23
feedback for servo control 30
position 31, 88
units of measure iii
application examples 67
application requirements 27
assumptions
skills required to use the 6270 i
auto-baud 4, 109, 114
auxiliary (AUX) connector 108
auxiliary +5V output 16
auxiliary programmable outputs 2, 17,
70
axes
number of 25
axes select input 20
axis status 87

B

baud rate 4, 109
auto baud feature 109
BCD program select input 72
bench test 4
binary variables 91, 93
bitwise operations (and, or, not, etc.)
93
block diagram, system hardware 2
Boolean operations 93
buffered commands 65

C

cables
custom
encoder 21
I/O 21
RS-232C 114
shielding 21
CAD-to-motion software 1, 56
capture positions
encoder, LDT, ANI, commanded 74
CCW end-of-travel limits, *see limits, end-of-travel*
center joystick position 80
chattering servo response 32
circuit drawings 106
analog output 106
command 106
drive enable 106
drive fault 106
encoder input 107
joystick/analog input 108
LDT input 107
limit inputs 108
programmable I/O 108
shutdown 106
trigger input 108
closed-loop operation 14, 30
color codes
encoder cable 16
command
buffer 73
after pause 74
after stop 73
list, alphabetical 117
queue 65
command, servo output 30
commanded position 31
communication
daisy-chaining 102
parameters 4
test 5
troubleshooting 114
via RP240 terminal (to an external
RS-232C device) 83
CompuCAM™ 56
computer-to-terminal conversion 4
conduit 7, 21
configuration
address 103
controller 25
DAC output limits 25
DIP switch settings 109
inputs 71
jogging 75
jumper settings 25, 109, 110
LDT feedback type 110
outputs 68
output—voltage or current 25, 110
system ii
thumbwheel 77
connections
AC power cable 5
analog input 19
ANI inputs 21
cable extensions 21
daisy-chain 102
drive 9
electronic I/O devices 78
encoder 15
end-of-travel limits 14
factory default 3
home limit 14
installation process overview ii
joystick 19
LDT 15
PLC 78
RP240 19
RS-232C 4, 102
thumbwheels 76
TM8 Thumbwheel Module 77
valve 9
VM50 adaptor 18
contaminants 7
continue (!C) 73
continue execution on pause/resume
(COMEXR) 74
continue execution on stop (COMEXS)
73
continue input 74
continuous command execution mode
(COMEXC) 20, 65
continuous positioning mode 64, 65
control signal 30
controller output saturation 30
conventions
active high/active low iii
direction of motion ii
units of measure iii
coordinate measurement machines 74
critically damped servo response 32
Crosstalk™ 4
current settings, output to valve 25,
110
current settings, output to valve 110
CW end-of-travel limits, *see limits, end-of-travel*

D

- DAC output, limiting 25
- daisy-chain 102, 109
 - including RP240 104
- damping 32
- data bits 4
- data storage – teach mode 94
- DC common 115
- DC ground wire 115
- DC input voltage 105
- deadband
 - joystick 80
- debounce time
 - position capture 74
 - program select input 73
 - programmable inputs 71
- debug tools 84, 112
- deceleration
 - change on the fly 66
 - S-curve profiling 99
 - scaling 58
- default hardware connections 3
- defeating noise 116
- device address, *see address*
- dimensions 8
- DIP switch settings
 - address 102, 109
 - baud rate 109
- direction of motion ii
- distance
 - fractional step truncation 59
 - setpoint window 40
- distance scaling (SCLD) 60
- disturbance 32
 - rejection of 36
- dithering hydraulic valves 66
- DOS Support Disk 56
- drive 57
 - connections 9, 106
 - test 22
 - fault input 71
 - fault level (DRFLVL) 25
 - on/off status 5, 87
 - shutdown
 - on kill 27, 73
 - tuning procedure 45

E

- Earth ground 5, 115, 116
- electric codes iii
- electrical noise 7, 21, 44, 112, 115
- electro-static discharge (ESD) 109
- electronic sensors 18
- electronics concepts i
- emergency shutdown 43, 55
- enable input 16, 57, 113
 - test 23
- encoder
 - compatibility 15
 - Compumotor encoder cable colors 16
 - connections 15, 107
 - test 23
 - custom cabling 21
 - differential outputs 16
 - feedback for servo control 30

- position 31, 88
 - after ENBL stop 16
 - capture 74
 - resolution 26, 58
 - single-ended outputs 16
 - test 22
 - units of measure iii
 - Z channel 14
- end point
 - linear interpolation 101
- end-of-travel limits, *see limits, end of travel*
- error handling 57
 - error level 1 on power up 102
 - error program 16
- extend ii

F

- factory settings
 - connections 3
 - DIP switches 109
- fault output 70
- feedback data 30
- feedback device polarity reversal 114
- feedback device selection 25
- full duplex 4

G

- gains
 - definition 30
 - editing via the RP240 89
 - gain set 30
 - saving, recalling 39
 - setpoint window 40
 - gain sets 30
 - negative 39
 - setpoint window 40
 - specific to feedback source 25
 - tuning
 - controller 46
 - drive 45
 - setup 43
- general specifications 105
- grounding 7, 116

H

- hard limits, *see limits, end-of-travel*
- heat 7
- high I/O state iii
- home input, *see limits, home*
- homing 61
 - home limit, *see limits, home*
 - home reference position 14
 - zeroing the absolute position 61
- host computer operation 67, 90
- humidity 7, 105
- hydraulic system components i
- hysteresis, setpoint window 40

I

- I/O cabling 21
- I/O device interface 78
- immediate commands 65
- immediate stop 65
- in position output 69

- IN-P, *see inputs, programmable, pull-up*
- incremental encoder, *see encoder*
- inductive loads 107
- inputs
 - active high/active low iii
 - analog 19, 79, 108
 - ANI option 21, 67, 82
 - overriding 81
 - drive 9, 106
 - fault 57
 - enable (ENBL) 16, 57, 113
 - encoder 15, 21, 107
 - capture (position latch) 74
 - end-of-travel limits 14, 57, 60, 65, 108
 - home limits 14, 61, 108
 - jogging 75
 - joystick 19, 79, 108
 - kill 73
 - LDT 15, 107
 - no function 72
 - one-to-one program select 75
 - pause/continue 74
 - PLC 78
 - program security 76
 - program select 73, 75
 - programmable 17, 68, 107
 - change from sourcing to sinking 78
 - debounce time 72
 - function assignments 71
 - kill 65
 - pin outs 18, 107
 - polarity iii, 68
 - problems 113
 - pull-up 3, 17, 78, 108
 - screw terminal connections 18
 - status 68, 71, 87
 - stop 65
 - test 23
 - RP240 19
 - specifications 105
 - stop 73
 - testing 22
 - thumbwheel 77
 - trigger 18
 - triggers 108
 - debounce time 71
 - position latch 74
 - user fault 57, 74
 - valve 9
- instability 32
- installation
 - ANI analog input connections 21
 - drive connections 9
 - enable input connection 16
 - encoder connections 15
 - I/O cables 21
 - joystick connections 19
 - LDT connections 15
 - limit connections 14
 - mounting 8
 - PLC connections 78
 - precautions 7
 - procedure 8
 - programmable I/O connections 17
 - RP240 connections 19

installation (*continued*)
test/verification 22
thumbwheels 76
trigger connections 18
valve connections 10
VM50 connections 18
installation process overview ii
integral feedback control (SGI) 37
integral windup limit (SGILIM) 37
interface options 67
interpolation – linear 101
interrogation rate 107

J

jerk, acceleration
reducing 99
jogging 75
RP240 jog mode 86
speed select high/low (INFNCi-aL)
75
status 86
velocity 86
high (JOGVH) 75
low (JOGVL) 75
joystick
application example 67, 96
auxiliary input 21
center deadband 80
center voltage 80
connections 19, 108
test 23
interface 67, 79
release input 20
select input 80
status 87
test 22
trigger input 21
velocity resolution 80
jumper settings 109

K

kill
assigned input function 65, 73
effect on drive 27, 73

L

LDT
connections 15, 107
test 23
distance scaling 59
feedback for servo control 30
feedback type (start-stop, or pulse)
110
gradient 26
interrogation rate 107
position 31, 88
capture 74
read error 112
update rate 26, 105
recirculation 26
resolution 26, 58
units of measure iii
LEDs 5, 112
RP240 83
limit to DAC output 25

limits 14
connector pin outs 108
end-of-travel 14, 22, 57, 60, 65
connections 14
used as basis to activate output
70
home 14, 61, 108
polarity 15
test 22
status 87
test 22
linear and rotary motion ii
linear interpolation 101
acceleration scaling 58
end point 101
velocity scaling 59
low I/O state iii

M

master/slave daisy-chain 102, 104
mathematical operations 91
maximum position error exceeded 70
memory – locking 76
menus
RP240 85
microelectronic components 116
motion
test 22
Motion Architect 27, 56
servo tuner option 27, 29
motion control concepts i
motion trajectory update 47, 105
mounting 8
panel layout 8
move completion criteria 53
moving/not moving status 69

N

National Electric Code Handbook iii
negative gains 39
no function input 72
noise, electrical 7, 21, 44, 112
suppression 115
limits & triggers 21
on analog inputs 19
numeric variables 91
display & edit with RP240 89

O

on-the-fly velocity & accel changes 66
one-to-one program select input 75
open loop operation 30, 42, 43
operating system 56
operating temperature 105
operator interface – RP240 83
oscillatory servo response 32, 37
output saturation 31
outputs
activate on position 68, 70
active high/active low iii
analog 106
selecting voltage or current
output 25, 110
configuration 68
fault output 70
limit encountered 70

maximum position error exceeded
70
moving/not moving (in position) 69
OUT-A 17, 70
OUT-B 17, 70
program in progress 69
programmable 17, 68, 78, 107
function assignments 68
inductive loads 107
pin outs 18, 107
polarity iii, 68
problems 113
pull-up 3, 17, 78, 107
screw terminal connections 18
status 68, 69, 87
switching thresholds 17
test 23
shutdown 9, 57
specifications 106
over-damped servo response 32
overshoot 33, 37

P

panel layout – mounting 8
parity 4
password
RP240 83
password, RP240 88
pause/continue input 74
PC-Talk™ 4
performance specifications 105
peripheral system components ii
pin outs 106
auxiliary connector 108
drive connector 106
encoder connector 16, 107
joystick connector 19, 108
LDT connector 15, 107
limits connector 14, 108
programmable I/O connector 18,
107
RP240 connector 109
triggers 108
valve/drive connector 9
PIV&F gains 36
PLC interface 67, 78
application example 67
point-to-point move 64
polarity
end-of-travel limits iii, 14
home input iii, 14
programmable I/O iii, 68
trigger inputs 19
position
absolute 64
actual (based on feedback device)
31
after ENBL stop 16
ANI 88
capture 74
commanded 31, 88
capture 74
encoder capture 74
error 31, 88, 112
max. allowable 25, 57
home 14
incremental 65

- position (*continued*)
 - latch 17, 74
 - LDT 88
 - offset 25
 - overshoot 37
 - positioning modes 64
 - range 105
 - response (servo) 31
 - types 32
 - setpoint 31
 - status 87
 - tracking error 31
 - used to activate output 70
 - zeroed after homing 61
- potentiometer 19
 - joystick 80
- power cable connection 5
- power line noise 115
- power-up 5
 - start-up program (STARTP) 24, 84
 - problems 113
- pre-wired connections 3
- precautions
 - installation 7
 - mounting 8
- preset positioning mode 64
- Procomm™ 4
- program in progress 69
- programmable inputs, *see inputs, programmable*
- programmable outputs, *see outputs, programmable*
- programming
 - command data fields iii
 - debug tools 112
 - debugging via RP240 84
 - downloading programs from Motion Architect 56
 - error messages 112
 - error programs 57
 - power-up program 24
 - problems 113
 - program editing
 - in Motion Architect 56
 - program security 76
 - program selection
 - BCD 72
 - debounce time 73
 - one-to-one 75
 - skills required i
- proportional feedback control (SGP) 36
- pulse duration LDT feedback, selecting 110

R

- reading inputs and outputs 68
 - thumbwheel data 76
- recirculation 26
- reference documents iii
- RESET
 - check for address & auto baud 109
 - via the RP240 89
- resolution
 - encoder 26
 - joystick 80
 - LDT 26
- response – servo 32

- retract ii
- revision levels for 6270, DSP, RP240 88
- rise time 33
- rotation ii
- RP240 82
 - access security, password 88
 - application example 67
 - connections 19, 109
 - test 23
 - editing gains & gain sets 89
 - in daisy chain 104
 - menu structure 85
 - send text via the connector 83
 - test 22
 - view & edit variables 89
- RS-232C communication 4, 116
 - connections 4
 - daisy-chaining 102
 - disable handshaking 114
 - RP240 connector 83
 - specifications 105
 - test 5
 - troubleshooting 114
 - runaway motor 14, 113

S

- s-curve profiling 99
- safety features 57
- saturation of the control output 30
- scaling 58, 64
 - specific to feedback source 25
- servo
 - control methods/types 36
 - open loop operation 43
 - sampling frequency 21, 30, 46, 47, 105
 - tuning, *see tuning*
 - Servo Tuner™ 56
 - setpoint 31
 - setpoint window
 - distance 40
 - gain set 40
 - settling time 33
 - actual 54
 - shielding 7, 21
 - shift left to right (>>) 93
 - shift right to left (<<) 93
 - shipment – inspection 3
 - shut down in case of emergency 43, 55
 - shutdown 9, 57, 106
 - on kill 27, 73
 - single-ended encoders 16
 - single-step mode 2, 84
 - sinking/sourcing current 17, 78
 - sourcing/sinking current 17
 - specifications 105
 - square-wave signal (dither) 66
 - stability 32
 - causing wrong direction 114
 - stand-alone operation 67
 - start-up program (STARTP) 24
 - problems 113
 - start/stop LDT feedback, selecting 110

- status
 - assigned to binary variable 91
 - axis 87
 - inputs 71, 87
 - joystick inputs 20, 87
 - LEDs 5, 112
 - limits 87
 - numeric & string variables 89
 - outputs 69, 87
 - position
 - capture 74
 - RP240 display 87
 - system 87
- steady-state 33
 - position error 31
- stiction 66
 - overcoming 44
- stop
 - assigned input function 65
 - effect on program execution 73
- stop bits 4
- storage temperature 105
- string variables 91
 - display with RP240 89
- support software 56
 - CompuCAM 56
 - DOS Support Disk 56
 - Motion Architect 56
 - Servo Tuner 56
- surge suppression 115, 116
- system connections 9
- system status 87
- system update rate 26, 47, 105

T

- target zone 53
 - affects moving/not moving output 69
 - criterion for entering setpoint
 - window 41
 - timeout error 53
- teach mode 94
- temperature
 - operating 105
- terminal emulation 56
 - 6000 DOS support disk 56
 - Motion Architect 56
- test
 - ANI inputs 23
 - bench test procedure 5
 - enable input 22
 - encoder 22
 - joystick 22
 - limits 22
 - motion 22
 - programmable I/O 22
 - RP240 22
 - RS-232C communication 5
 - system installation 22
- thumbwheels
 - application example 67
 - connections 17, 77
 - TM8 module 76
 - use of 76
- timeout error 53
- trace mode 2, 84
- transient 33

- transmitted noise 115
- travel limit, *see limits, end-of-travel*
- trigger inputs
 - connections 18, 108
 - position latch 74
- trigonometric operations 92
- troubleshooting
 - common problems & solutions 112
 - diagnostic LEDs 112
 - error messages 112
 - methods 111
 - RS-232C 114
- TTL-compatible voltage levels 105, 106
- tuning 29, 30
 - 6270 tuning procedure 46
 - gains, definition 36
 - PIV&F algorithm 36
 - process flow diagram 48
 - related 6000 series commands 34
 - scenario (case example) 51
 - setup procedure 43
 - target zone mode 53
 - velocity drive tuning procedure 45

U

- under-damped servo response 32
- units of measure iii
- unstable 32
- user fault input 57, 70, 74
- user interface options 67

V

- valve
 - connections 9
 - test 22
 - dithering 66
 - stiction 66
 - voltage or current operation 110
- variables
 - binary 91
 - conversion between binary & numeric 91
 - numeric 91
 - display & edit with RP240 89
 - teach mode 94
 - string 91
 - display with RP240 89
- velocity
 - accuracy 105
 - change on the fly 66
 - joystick 20
 - range 105
 - repeatability 105
 - resolution 80
 - scaling 59
 - velocity feedback control (SGV) 38
 - velocity feedforward control (SGVF) 38
- verification – bench test 5
- verification – installation test 22
- VM50 adaptor 18
- voltage control – valve 25, 110

W-Z

- watchdog timer 57
- window, setpoint
 - distance 40
 - gain set 40
- windup of the integral action 37
- X-Y linear interpolation 101
- Z channel output 15
- zero position after homing 61