CHAPTER THREE

Configuration

IN THIS CHAPTER

- Configuration
- Damping Configuration
- Stall Detect Configuration
- Motor Matching

Configuration

You can configure the Gemini drive's settings for optimum system performance. For most of these settings, configuration is optional—if you do nothing, the drive will use default values the very first time it powers up. If you change any settings, the new settings are automatically saved. Most changed settings are effective immediately, but some require that you issue a reset (software command, reset input, or cycle power) before the drive acts upon them.

This chapter will give an overview of all software commands that configure drive settings. For more in depth descriptions about the software commands, see the separate *Gemini Programmer's Reference*.

At the end of this chapter, we have provided procedures you can use to configure the Gemini drive's settings for advanced features, including damping and stall detect; and to match the drive to the motor.

Software Programs for Configuration

Two software programs used for drive configuration are located on the Motion Planner CD-ROM. *Motion Planner* runs on a personal computer (PC). *Pocket Motion Planner* runs on a palm PC or Handheld Personal Computer (HPC) that uses Windows CE 2.0 or higher, or on a PC. These programs are also available on the Compumotor web site at http://www.compumotor.com.

Information about installing and using each of these software tools can be found in the *Gemini Programmer's Reference*.

Overview of Configuration Commands

Motion Planner and Pocket Motion Planner's configuration procedures present commands in groups organized by function. The overview below is organized similarly to the software's *Full Configuration* procedure. (*Express Setup*, which was used in *Chapter 2 Installation*, gave you fewer configuration options.)

Motor Settings

If you select a Compumotor motor from the list of motors the software presents to you, the software will send settings to the drive for the motor you selected. No further motor configuration setting is necessary on your part.

If you use a non-Compumotor motor, or choose to configure a Compumotor motor, use the following commands to configure motor settings:

Command	**Description**
DMTSTT	static torque
DMTIC	continuous current
DMTIND	inductance
DMTRES	phase resistance
DMTJ	rotor inertia
DPOLE	number of pole pairs
DIGNA	current loop gain
DIGNB	current loop gain

DIGNC	current loop gain
DIGND	current loop gain

If you use a non-Compumotor motor, see *Appendix B – Using Non-Compumotor Motors* for additional instructions.

System Settings

The system settings configure the drive's mode of operation, resolution, inertia ratio, and fault modes.

Drive Settings

Command	Description	Options:
DMODE	mode of operation:	sequence (program)
		autorun[1]
DMEPIT	electrical pitch of magnets	you enter a number
DRES	motor step resolution	you enter a number
ORES	step/dir output resolution	you enter a number
DAUTOS	auto standby enable	you enter a number
DMVLIM	velocity limit	you enter a number

[1]Autorun mode commands motion with no program control. It is used during *Express Setup*, and for troubleshooting.

Load Settings

Command	Description	Options:
LJRAT	inertia ratio	you enter a number

Fault Settings

Command	Description	Options:
FLTDSB	fault on disable	can be turned on or off
ESK	fault on stall	can be turned on or off
KDRIVE	disable drive on kill	can be turned on or off
DSTALL	stall sensitivity	you enter a number

Input/Output (I/O) Settings

I/O settings configure the drive's digital inputs and outputs, and analog monitors.

Digital Inputs

Command	Description	Options:
LH	hard limit enable	both hard limits disabled
		negative limit only
		positive limit only
		both hard limits enabled
INDEB	input debounce time	can be set in milliseconds
LHAD	hard limit deceleration	you enter a number
LHADA	hard limit average decel.	you enter a number
Input Definition and Sense		configure up to 8 inputs

Digital Outputs

Command	Description	Options:
Output Definition and Sense		configure up to 7 outputs

Analog Monitors

Command	Description	Options:
DMONAV	analog monitor A variable	unused/turn off output
		drive temperature
		velocity setpoint
		acceleration setpoint
		phase A commanded current
		phase A actual current
		phase B commanded current
		phase B actual current
		phase A commanded voltage
		phase B commanded voltage
DMONAS	analog monitor A scaling[1]	you enter a percentage[1]
DMONBV	analog monitor B variable	same choices as DMONAV
DMONBS	analog monitor B scaling[1]	you enter a percentage[1]

[1]Monitor output is scalable from -2000% to +2000%, but is limited to ±10V peak to peak.

Communications Settings

The communication settings configure the drive for RS-232/485 communications.

RS-232/485

Command	Description	Options:
ERRLVL	error level	you enter a number
ECHO	echo enable	can be turned on or off

Motor Control Settings

Motor control settings are divided into two groups: motor matching, and damping .

Motor Matching

Motor matching is used to match the drive to your specific motor. A procedure for performing motor matching is presented at the end of this chapter. Relevant commands are:

Command	Description	Options:
DWAVEF	% 3rd harmonic current waveform component	you enter a number
DPHBAL	phase B balance	you enter a percentage
DPHOFA	phase A current offset	you enter a percentage
DPHOFB	phase B current offset	you enter a percentage

Damping

These commands are used to configure the drive's settings for damping. A procedure for adjusting damping settings is presented below. Relevant commands are:

Command	Description	Options:
DACTDP	active damping gain	you enter a number
DDAMPA	damping during acceleration	can be turned on or off
DELVIS	electronic viscosity	can be turned on or off
DABSD	ABS damping	can be turned on or off

Procedure for Configuring Advanced Features

The Gemini drive has advanced motor control features that you can configure for increased damping, increased low speed smoothness, and increased disturbance rejection; and for detecting motor stalls.

Configuring Damping Settings

The Gemini drive's three damping modes reduce vibration, increase low speed smoothness, and decrease load settling time. These damping modes are independent of each other, and operate within specific velocity ranges.

ABS Damping

ABS damping provides load-invariant damping at extreme low speeds. It targets applications that require minimal zero-speed settling time (for example, pick-and-place applications with varying load).

Command	Function	Velocity Range	Default	Required Parameters
DABSD	ABS Damping	0 to 0.2 rps*	Disabled	DMTRES, DMTIND
		*motor dependent		

Electronic Viscosity

Electronic viscosity targets applications that require reduced low-speed velocity ripple and increased smoothness, as well as aggressive low-speed damping. NOTE: If ABS Damping is enabled, it overrides electronic viscosity in the 0 to 0.2 rps velocity range.

Command	Function	Velocity Range	Default	Required Parameters
DELVIS	Electronic Viscosity	0 to 3 rps**	Disabled	DMTJ, DMTSTT, DPOLE DMTIC, DMTIND, LJRAT
		**motor and load dependent		

Active Damping

Active damping targets applications that require high accelerations, fast settling at commanded speed, mechanical vibration disturbance rejection, and highly stable (non-resonant) motion.

Command	Function	Velocity Range	Default	Required Parameters
DACTDP	Active Damping	>3 rps	Enabled (DACTDP4)	DMTJ, DMTIND, DMTSTT, LJRAT

Note: You can use the DDAMPA command to disable ABS damping and electronic viscosity during acceleration rates greater than 50 rps^2. This allows full motor torque to be used during acceleration.

Use the following procedures to configure the damping settings. You can usually find the best setting by using touch or sound. If this is not adequate, use a tachometer attached directly to the motor by means of a stiff coupler.

Configuring ABS Damping (DABSD)

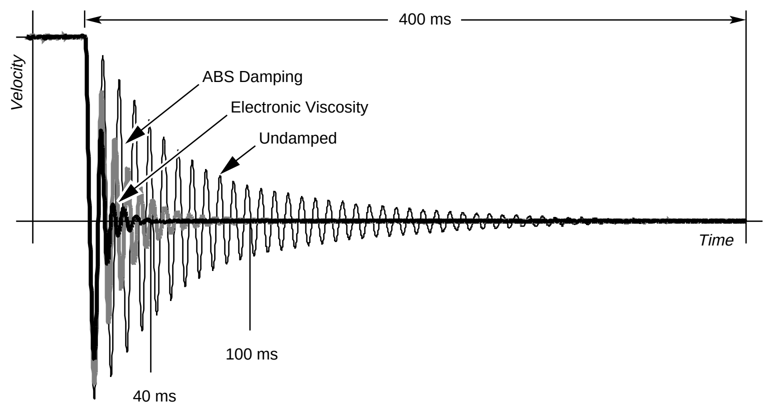
The default setting is *disabled*. (DABSD0)

1. To turn ABS damping *on*, use the DABSD command. (DABSD1)
2. If you use a Parker motor, the following parameters are automatically set when you use the configuration utilities (Motion Planner or Pocket Motion Planner) to select a motor. You do not need to enter values for them now.

   If you use a non-Parker motor, use the following commands to enter accurate values for the specified motor parameters:

Command:	**Motor Parameter:**
DMTRES	motor resistance
DMTIND	motor inductance

   The figure below shows performance with ABS Damping, with Electronic Viscosity, and without damping.



Damping Performance

Configuring Electronic Viscosity (DELVIS)

1. Enter an accurate value for the load parameter, using the following command:

Command:	**Parameter:**
LJRAT	system load-to-rotor inertia ratio

2. If you use a Parker motor, the following parameters are automatically set when you use the configuration utilities (Motion Planner or Pocket Motion Planner) to select a motor. You do not need to enter values for them now.

   If you use a non-Parker motor, use the following commands to enter accurate values for the specified motor parameters:

Command:	**Motor Parameter:**
DMTJ	rotor inertia
DMTSTT	static torque
DPOLE	number of motor pole pairs
DMTIC	continuous current
DMTIND	inductance

3. Start with DELVIS set to 0, which is *disabled*. (This is the default setting.)
4. Increase DELVIS until your system performs as you require.
   - 1 - 7 is the full range
   - 5 provides optimal damping
   - 0 is *off*

   The figure above shows performance with Electronic Viscosity, with ABS Damping, and without damping.

Configuring Active Damping (DACTDP)

Using motor and load parameters, the drive calculates the optimum damping setting for your system, and scales this value to a setting of DACTDP20. However, the default setting is DACTDP4.

1. Enter an accurate value for the load parameter, using the following command:

Command:	**Parameter:**
LJRAT	system load-to-rotor inertia ratio

2. If you use a Parker motor, the following parameters are automatically set when you use the configuration utilities (Motion Planner or Pocket Motion Planner) to select a motor. You do not need to enter values for them now.

   If you use a non-Parker motor, use the following commands to enter accurate values for the specified motor parameters:

Command:	**Motor Parameter:**
DMTJ	rotor inertia
DMTSTT	static torque
DMTIND	inductance

3. Begin configuration with low values of DACTDP. Low values yield less aggressive damping.
4. Increase DACTDP until the system performs as you require. The optimum setting is DACTDP20. Note that higher values tend to cause overly aggressive damping, and generate jerk impulses that may result in machine vibration.

Configuring Stall Detect Settings

You can use the Gemini drive's encoderless stall detect function to detect motor stalls. A stall occurs when the motor's rotor loses synchronism with the stator. An external feedback device is not required to detect stalls.

Some machine safety regulations require that external hardware feedback be used. Do not use the Gemini's stall detect function as a replacement for external feedback in such cases.

In order for the drive to detect a stall, the duration of the stall must be greater than 50 milliseconds. NOTE: if you use high values of active damping, extremely aggressive accelerations are possible during which the motor may skip poles (lose position). This loss of position can be less than 50 milliseconds; if so, it will not be recognized as a stall.

Because the command velocity must be in the 3 – 37 rps range for stall detect to be active, the drive will not recognize static loss of position as a stall. Therefore, do not use this function to detect loss of holding torque in vertical applications.

Settings are summarized below.

Stall Detect Settings:

Command:	DSTALL
Default:	Disabled (DSTALL0)
Velocity Range:	3 to 37 rps
Required Parameter:	LJRAT

Stall detect performance is based on motor parameters that you set up with the configuration utility in Motion Planner or Pocket Motion Planner. For optimum performance, accurate motor parameters are required.

If you select a Compumotor motor with the configuration utility, the motor parameters are set automatically, according to the motor you have chosen. If you use other motors, see *Appendix B Using Non-Compumotor Motors*.

Use the following procedures to configure the stall detect settings.

Configuring Stall Detect

The DSTALL command sets the sensitivity for the stall detection circuitry. The default setting is *disabled*. (DSTALL0)

NOTE: Match the motor to the load (see the procedure on the following pages) *before* you configure stall detect settings.

1. Enter an accurate value for LJRAT.

   The LJRAT command sets the system's load-to-rotor inertia ratio. LJRAT must be set accurately in order for stall detect to function properly.

2. Begin configuration with low DSTALL values.

   - 1 - 50 is the full range
   - 0 is *off*

   The table below lists effective ranges of DSTALL values. Enter a value, based on your motor size:

Motor Frame Size:	Size 23	Size 34	Size 42
DSTALL Value Range:	1 – 15	10 – 40	30 – 50

3. Verify the DSTALL value you entered by forcing a stall as you monitor TASX. At the precise moment the stall occurs, TAS Bit #17 should be set. If Bit #17 is set before or after the stall occurs, modify the DSTALL value as follows:

   - If Bit #17 is set *before* the stall occurs, *decrease* the DSTALL value
   - If Bit #17 is set *after* the stall occurs, *increase* the DSTALL value

4. Run the system for an extended period of time to verify that no false stalls are detected.

Configuring Fault on Stall Mode

1. If you enable the Fault on Stall mode (ESK1), the occurrence of a stall will immediately stop pulses from being sent to the motor and will disable the drive (DRIVE0)
2. If Fault on Stall is enabled (ESK1), the stall is reported by the following commands:

   - TAS bit #12
   - TER bit #1

Procedure for Motor Matching

Due to slight manufacturing variations, each motor has its own particular characteristics. The drive has three settings—phase offset, balance and waveform—that can be adjusted to match the drive to a specific motor. The factory settings for these parameters will be acceptable in most applications. If you need increased smoothness or accuracy in your system, or if motor resonance causes vibration problems, perform the following procedure. You will match your drive to your motor by adjusting the drive settings, and selecting the best current waveform.

⚠ CAUTION ⚠

Verify correct series or parallel wiring. The label on the motor may be inaccurate if the motor has been rewired after it left the factory.

⚠ WARNING ⚠

The following procedure causes the motor shaft to rotate.

Setting Up Your System for the Motor Matching Procedure

Before beginning the *Motor Matching* procedure, set up your system as follows:

1. The *Motor Matching* procedure below is a *bench top* procedure—temporarily connect the drive, motor, and PC running Motion Planner (or a palm PC running Pocket Motion Planner), but do not permanently mount the components yet.
2. Properly secure the motor
3. Set the motor current at the value recommended for your motor.
4. Do not attach a load to the motor shaft, or anything else that affects or changes the inertia of the rotor. The characteristics you are matching are those only of the drive/motor combination.
5. Before beginning the *Motor Matching* procedure, you must use Motion Planner or Pocket Motion Planner to configure the drive for your motor. See *Step 3* of *Chapter 2 Installation* for instructions.
6. Apply AC power when necessary to perform the steps below.

Motor Matching Procedure

1. Apply power to the drive, enable the drive, and allow the drive and motor to reach a stable operating temperature. This will take at least 5 minutes, and may take up to 30 minutes. For optimum results, perform the matching procedure at the same ambient temperature at which your application will operate.
2. Launch the *Interactive Motor Matching* procedure of Motion Planner (MP) or Pocket Motion Planner (PMP).
3. Select the *PHASE A OFFSET* button. Note the recommended motor speed in the comment box.
4. Using the terminal emulator, set the motor speed to the recommended value for your motor.
5. Vary the motor speed about the recommended value, and find the most resonant operating speed. (Varying the speed makes resonance more noticeable.) You can find the *resonant speed* by touching the motor lightly with your fingertips as you vary the speed. When you notice the strongest vibrations and increased noise, the motor is running at a resonant speed. Note the actual speed; you will use it in the steps below. Return to *Interactive Motor Matching*.
6. Change the *PHASE A OFFSET* adjustment using the left and right arrow keys or by using the touch screen (if available). Adjust the offset for smoothest operation.
7. Select the *PHASE B OFFSET* button.
8. Change the offset adjustment using the left and right arrow keys or by using the touch screen (if available). Adjust the offset for smoothest operation.
9. Select the *PHASE B BALANCE* button.
10. Using the terminal emulator, set the motor speed to one half the speed found in *Step 5*. Vary the motor speed about this setting, and find the most resonant operating speed. Return to *Interactive Motor Matching*.
11. Change the *PHASE B BALANCE* adjustment using the left and right arrow keys or by using the touch screen (if available). Adjust the balance for smoothest operation.
12. Repeat steps 3-10 if necessary.
13. Select the *WAVEFORM* button.
14. Using the terminal emulator, set the motor speed to one fourth the speed found in *Step 5*. Vary the motor speed about this setting, and find the most resonant operating speed. Return to *Interactive Motor Matching*.
15. Change the current waveform using the left and right arrow keys or by using the touch screen (if available). Adjust the current waveform for the smoothest operation.
16. Select the *OK* button when you are finished matching the drive to the motor. By selecting *OK*, you will be storing the adjusted values in the parameter configuration file. *Selecting the CANCEL button will return the adjusted values to the values previously stored in the configuration file.*

This completes the motor matching procedure.