05661

Linear Servo Amplifier

User Manual

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Morgan Hill, California 95037
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REQUESTING ASSISTANCE

If you have any difficulties with the 05661, please let us know by calling us at (408) 778-1127, Writing to us at the address shown on the cover, or emailing us at "info@seagullsolutions.net". When reporting a problem, Please have the serial number of your unit available and have a record of all circumstances and symptoms.

TRADEMARKS

05661 is a trademark of Seagull Solutions, Inc.

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SECTION 5

About This Manual

This manual is divided into the following sections:

SECTION 1 - GENERAL INFORMATION

Contains a brief overview of the 05661, its operating modes, and features.

SECTION 2 - SPECIFICATIONS

Includes the power and operating specifications for all modules.

SECTION 3 - INSTALLATION

Provides information on installing the 05661 and basic checkout information.

SECTION 4 - OPERATION

Details the various modes of operation by describing operating modes, front panel
controls, rear panel connections, and software commands.

SECTION 5 - COMMAND SET

Contains a complete list of the 05661's command set.

Manual Conventions

!! DANGER !!   Statement identifies any action or condition that could cause life-
threatening harm.

!! WARNING !!   Statement identifies a condition or procedure that could result in
personal injury.

!! CAUTION !!   Statement identifies a condition or procedure that could damage
the equipment or result in data loss.

NOTE   Statement identifies helpful or useful information.

"XXXX"   Statement references a 05661 command, where **XXXX** is the
command.

Safety Cautions

These safety notices should be read and complied with while operating or repairing this equipment. Failure to do so could result in damage to the equipment or result in personal injury or death.

GROUNDING

The 05661 is internally grounded through the power cord to Earth Ground. However, any spindle connected to the Linear Amplifier must also be grounded.

If this equipment is field installed, the installation instructions must be followed. Use the power cords and cables provided with the equipment; unauthorized substitutions may violate the safety of the equipment.

ENVIRONMENTAL

The Linear Amplifier must not be operated in the presence of flammable gases or fumes.

ELECTRICAL

Operating personnel must not remove equipment shields and covers. Replacement of assemblies or components and internal adjustments must be made by qualified personnel. Do not replace assemblies or components with AC or DC power applied.

SERVICE

Internal service on this equipment should not be performed alone. Another person capable of rendering first aid or of calling assistance should be present.

!! DANGER !!

VOLTAGES CAPABLE OF CAUSING DEATH OR SERIOUS INJURIES ARE PRESENT IN THIS EQUIPMENT AND AT THE MOTOR SUPPLY TERMINALS. USE EXTREME CAUTION WHEN SERVICING OR PERFORMING INTERNAL ADJUSTMENTS.

Section 1   General Information

1.1   GENERAL

This manual describes the 05661 Linear Amplifier and its operation. The 05661 is made up of four subassemblies:

- Front Panel Assembly
- Power Amplifier Assembly
- Pneumatics Assembly
- Main Electronics Assembly

1.2   INTRODUCTION

The 05661 Linear Servo Amplifier is an intelligent brushless DC spindle motor controller specifically designed for the Seagull® product line of precision air and ball bearing spindles. The 05661 is designed to provide reliable speed control, packaged for 19-inch rack mounting, and designed to enhance the testing capabilities for any media tester. It provides extremely accurate spindle speed control, a wide range of operating speeds, and low electrical noise operation.

Operation of the 05661 can be controlled by a host computer via a GPIB or a RS-232 communication interface (Factory Option). If a host computer is not available or necessary, the 05661 can be completely controlled by its front panel controls without any degradation of its performance. The 05661 contains the intelligence to monitor and control all functions related to spindle motor control once the parameters have been downloaded or input, and a run command initiated.

1.3   OVERVIEW

Ultimate speed control accuracy is one of the primary design goals, and is addressed by allowing customer-specific frequency inputs to be supplied to the 05661 via the rear panel connectors. Accuracy of one part per million is achievable with a stable frequency reference and a stable encoder feedback frequency.

1.4   STANDARD FEATURES

The 05661 Linear Servo Amplifier has the following features:

- Specifically designed and packaged for Seagull® spindles
- Speed stability of .001% of commanded RPM (stock configuration)
  Speed stability of .0001% achievable with system-spindle matching
- Internal and external RPM control
- Spin-up and Spin-down rate of 10-10000 RPM/sec^2 (dependent on loads)
- Three-phase sin wave motor drive
- Amplifier over-temperature shutdown
- Power loss controlled motor shutdown
- System isolated AC and DC power sources
- Operating Range of 0 to 60000 RPM
- GPIB or RS-232 communications to host computer
- Integral Pneumatics with auto-shutdown interlock

1.5   SUB-ASSEMBLIES

There are four sub-assemblies in the 05661. They are:
- Front Panel Assembly
- Power Amplifier Assembly
- Pneumatics Assembly
- Main Electronics Assembly

1.5.1 FRONT PANEL ASSEMBLY

Located on the front panel assembly is the LCD display controlled by the front panel
CPU. The front panel assembly contains all the intelligence for the 05661 to operate in
Local Mode. The front panel parses the GPIB communication and feeds it to the Main
Electronics Assembly, where the Motor Controller CPU performs the task. On the front
panel are the push button switches that allow the user to enter the values for speed and
acceleration/deceleration settings, Run/Stop, Clamp/Unclamp, CCW/CW, and
Local/Remote.

1.5.2 POWER AMPLIFIER ASSEMBLY

The power amplifier assembly supplies the power to the spindle motor. It takes a signal from the Main Electronics assembly and amplifiies it to the needed power to drive the spindle as commanded by either the front panel or the host computer.

1.5.3 PNEUMATICS ASSEMBLY

The pneumatics assembly feeds air to the spindle, and the clamp and spindle brake. Air for the Seagull® air bearing spindle is monitored via pressure sensing switches, and controlled via air regulators in this assembly.

1.5.4 MAIN ELECTRONICS ASSEMBLY

All motor controller intelligence is contained within this assembly. It communicates with an internal supervising CPU, generates a speed control signal based on the commanded speed in Local or Remote Mode, and controls spindle motor phase generation based on the spindle encoder signals.

Control and monitoring of the spindle's clamp and brake are done within this assembly. During operation, spindle Velocity Error and Tachometer values are monitored to determine when the spindle is at speed and stabilized. RPM is monitored using the spindle's commutation encoder outputs.

1.6   OPERATING MODES

The 05661 Linear Servo Amplifier has two major modes of operation: Local and Remote. Local Mode is usually used for maintenance, adjustments, and troubleshooting. Remote Mode is the normal operating mode when controlled by a host computer.

1.6.1 LOCAL MODE

Local Mode enables the user to operate the controller from the front panel. The spindle can be run in either the clockwise or counterclockwise direction; however, the spindle must be stopped before a direction change is recognized. The disk clamp can also be operated while in Local Mode, however, safety rules cannot be violated. A disk must be clamped before the spindle is allowed to rotate. If the Clamp/Unclamp function is selected while the spindle is rotating, the command will be ignored.

1.6.2 REMOTE MODE

Remote Mode is used when the 05661 is under the direction of a host computer. Parameters such as spindle RPM, direction, disk clamping, and run/stop commands are sent to the 05661 from a host computer via a GPIB or RS-232 communication interface. The 05661 ensures that all commands are correctly sequenced, safety requires that the clamp is in the clamped position before the spindle is allowed to rotate.

Regardless of the origination of the commands, the 05661 does not allow safe operation to be overridden. Safety checks ensure that the spindle's air bearing has sufficient air, that main line pressure is within the recommended range, and that the clamp has the minimum air pressure to unclamp the disk.

1.7   SOFTWARE

Software is required for each of the 05661's CPU's to operate. The operating program is resident in each CPU's EPROM when shipped from the factory. The software revision level can be verified by issuing the **"ID?"** command from the GPIB/RS-232 communication interface.

1.8   DIAGNOSTICS

The 05661's Front Panel CPU has built-in diagnostics that automatically perform system checks during power up.

Section 2	Specifications

2.1   GENERAL

Contained within this section are specifications for the 05661. Specifications included are power requirements and physical dimensions.

2.2   SYSTEM REQUIREMENTS

The 05661 requires the following AC input:

AC INPUT POWER REQUIREMENTS (FACTORY SET)			
Voltage	Frequency	Current	Fuse(5mmx20mm)
100 VAC	50 Hz	4.8 A	5 A Slo-Blo
120 VAC	50/60 Hz	4 A	5 A Slo-Blo
220 VAC	50/60 Hz	2.2 A	3 A Slo-Blo

NOTE The appropriate fuse must be installed for the AC power input.

MAXIMUM OUTPUT POWER	
Amperage	Wattage
10 Amps DC (Peak)	720 Watts

AIR SUPPLY REQUIREMENTS			
Input Air Line	Air Supply Input	Air Supply Dew Pt.	Filtration
1/4 Inch NPT Fitting	120 psi Max.	35° F (non-condensing)	5 micron

2.3   MACHINE PARAMETERS

PHYSICAL DIMENSIONS			
Height	Width	Depth	Weight
7 inches	17 inches	15.5 inches	36 pounds

MOTOR CONTROL SPECIFICATIONS

Speed Stability of .001% or better over full range (stock configuration)
.0001% or better over full range (custom factory component matching)
Programmable from 10 to 18000 RPM
Encoder Commutation
Local or Remote Operation
GPIB or RS-232 Communication Link (Factory Option)
Greater than -65 dB signal-to-noise ratio
Spin-Up and Spin-Down rates of 10-10000 RPM/sec^2 (Dependent on loads)

2.4   SAFETY FEATURES

Input air pressure switches (main air supply)
Spindle bearing pressure switches
Amplifier over-temperature interlock
Electronic spindle position locking

2.5   COMMUNICATIONS

GPIB Communications meeting the IEEE-488.2 standard are allowed for the GPIB model.

RS-232C Communications (3-wire; Tx, Rx, Gnd) are allowed for the RS-232 model.

2.6   ENVIRONMENTAL REQUIREMENTS

Operating Temperature: 73°F ± 10°F
Storage Temperature: -20°F to 120°F
Operating Humidity: 90% RH Maximum (noncondensing)
Storage Humidity: 0% to 90% RH Maximum (noncondensing)

Section 3   Installation

This section describes how to install a 05661 Linear Servo Amplifier and how to verify its operation.

DISCLAIMER
This installation section is not a step-by-step installation procedure. Considerable experience is required of personnel installing the equipment. It is suggested that the installer be trained on the 05661 or have experience with similar test equipment. If there are any questions regarding installation, please call Seagull Solutions's Field Services <u>before</u> beginning installation.

Each assembly of the 05661 is subjected to extensive testing to ensure correct operation and to ensure proper installation. Should assistance be required, please use the following address and telephone numbers for installation and service assistance:

<div align="center">

Seagull Solutions, Inc
Field Services Division
15105 Concord Circle
Morgan Hill, California 95037
Phone: (408) 778-1127
Fax: (408) 779-2806

</div>

3.2   INSPECTION

When this equipment is first received, thoroughly inspect the shipping container for any damage. If the container is damaged and it is apparent that the damage was incurred during shipping, notify the carrier **at once**. After unpacking the equipment, inspect for any obvious physical damage such as scratches, nicks, and dents.

Remove the packing list from the container and verify that all listed materials were received. Should a discrepancy be detected, contact Seagull's Field Services Division immediately.

3.3   RACK INSTALLATION

The 05661 installs in a standard 7-inch high rack slot. The unit's fan input vents and amplifier exhaust must be free of any obstructions, allowing air to flow through and around the unit, preventing overheating. Select a site that is free of excessive dust, vibration, condensation, and flammable materials. The ambient temperature should be within the ranges specified in the Specifications section (Section 2).

3.4   AIR CONNECTIONS

Connect clean, dry air to the "Air In" connection on the rear panel of the 05661.

> ## !! CAUTION !!
> **Plant air must be conditioned, dehumidified, and filtered to prevent condensation at operating temperatures. Dew point of the supplied air must be less than 35° F.**
> **Input air pressure must not exceed 120 psi.**

3.5   ELECTRICAL CONNECTIONS

AC power to the 05661 is determined by the factory. The AC power cable must have a ground wire and must connect the 05661 to the plant AC ground. Before connecting the AC power cable to the 05661, ensure that the power switch on the front panel is off.

> ## NOTE
> If intending to use the 05661 with any spindle other than the one supplied by Seagull Solutions, please   contact the Field Services Division before operating the 05661.

3.6   SPINDLE CONNECTIONS

Any spindle assembly supplied with the 05661 is correctly pre-wired. It should only be necessary to connect it using the supplied cables to place the system into operation. Contact Seagull's Field Services Division before using any spindle not supplied by Seagull.
A spindle contains not only the air bearing, but also a brushless DC motor and a commutation encoder. The motor and encoder are connected to the 05661 using appropriate cables.

1. Connect the spindle's air connector to the "Spindle Air" connector located on the rear panel of the 05661.
2. Connect the spindle's motor cable to the "Motor" connector located on the rear panel of the 05661.
3. Plug in the encoder from the spindle to the "Encoder" connector located on the rear panel of the 05661.

3.7   APPLYING POWER

Before AC power is connected to the 05661's input receptacle, ensure that the AC power switch on the front panel is **OFF.**

3.8   INITIAL CHECKOUT

This brief checkout only addresses Local Mode operation; Remote Mode operation is determined by the Host Computer. Refer to Section 5 for a list and description of the 05661's command set.

1. Turn on the 05661's AC power switch.
2. Press the ENTER button to begin local operation.
3. Press the MENU button to set the speed and acceleration. Use the "up" and "down" arrows to change the value in the selected field. Press the enter button to move to the next field.
4. Press the MENU button to return to the main display.
5. The cursor should be blinking on the "Enable" status field. Press the "Enter" button to toggle Run/Stop. After about 3 seconds, the spindle will appear to "jerk"; spin up to 1000 RPM; stop; then spin to the commanded speed. *This only occurs the first time the spindle is run after power up.*

6. Press the "Enter" button to stop the spindle.
7. Use the "up" and "down" arrow button to select the clamp function.
8. Press the "Enter" button to toggle the state of the clamp.
9. Use the "up" and "down" arrow button to select the brake function.
10. Press the "Enter" button to toggle the state of the brake.

Section 4	Operation

4.1   GENERAL

Contained within this section are instructions for operating the 05661, an explanation of its modes and sub-modes of operation, and an explanation of the safety interlocks. This section of the manual explains basic motor controller operation; other sections of this manual should be read to understand the how and why of operation.

NOTE

Should any of the 05661's assemblies not operate as stated, call Seagull Solutions's Field Services Division.

4.2   POWER-UP SEQUENCE

Startup Sequence for the 05661 requires two steps:
1. Applying Air.
2. Applying Power.

4.2.1   APPLYING AIR

Before proceeding, ensure that the following air gauges display the proper pressure levels necessary for safe air bearing operation. Actual values may vary based on the spindle used with the 05661. The front panel displays four air gauges.

!! CAUTION !!

Damage to the spindle can occur if the spindle is operated without minimum air requirements.

Assuming that all connections have been made as indicated in Section 3 (Installation) of this manual, the 05661 can now be safely operated.

4.2.2 APPLYING POWER

Apply power to the 05661 by turning the POWER switch on. This supplies AC and DC power to the unit. When the POWER switch is first turned on, the 05661 will perform internal system checks if the subsystems pass the diagnostic tests the cursor will blink in the lower right hand corner of the display.

NOTE
On power-up of the 05661, the first time a RUN command is issued, the spindle will go through the auto-initialization routine. This ensures proper motor commutation.

4.3   BASIC OPERATING MODES

The 05661 has two basic modes of operation: Local and Remote. Local Mode is usually reserved for maintenance, adjustments, and troubleshooting. Remote Mode is the normal operating mode; this mode must be used for operations requiring host computer control. The 05661 powers up in the remote mode by default.

Regardless of the origination of commands, the 05661 does not allow unsafe operation. Safety checks also ensure that the spindle has sufficient air for safe operation.

4.3.1 LOCAL MODE

The front panel allows the user to perform motor control functions without the need for a host computer. To initiate the "Local Mode" control the user must press the Enter button. The controller will flash a (+) sign signal in the lower right hand corner while it prepares the system for local operation. When the system is ready for local control a letter "L" will be displayed in the lower right hand corner and the cursor will be flashing over the enable status field. The system is now ready for local operation.

1. To select a Speed, Acceleration or Direction.

   Press the "Menu" button to view the Input Parameters menu. The cursor should be flashing over the speed entry field. Use the "up" and "down" arrows to change the value in the field. I.E. SPEED:02000. Then press the "Enter" button to accept the changed value. The cursor should now be flashing on the Accel entry field. Use the "up" and "down" arrows to change the value in the field. Press the "Enter" button accept the changed value. The cursor will now be flashing on the Direction field.

Local Mode Continued.

Use the right and left arrows to change the direction command.
Press the "Enter" button to accept the changed value.

Press the "Menu" button to return to the main display screen.

The cursor will be flashing on the enable status field.
Use the "down" arrow to move to the clamp status field.
Press "Enter" button to toggle the state of the clamp.
Use the "down" arrow to move to the brake status field.
Press "Enter" button to toggle the state of the brake.

The main display also shows the direction as sensed by the encoder and displays the
speed in RPM.

4.3.2 REMOTE MODE

Remote Mode is used when the 05661 is under the direction of a host computer. This is
usually the case in media testers. Parameters such as spindle RPM, revolution direction,
disk clamping, and spindle run/stop commands are sent to the controller from a host
computer. The controller ensures that all commands are correctly sequenced.
See Section 5 for a complete list and description of the 05661's command set.
The 05661 utilizes GPIB 488.2 communication protocols. All command strings can
be sent with individual commands delimited by a semicolon. The strings must be
terminated with the ascii character (13) - 0Dh. Commands that generate a response are
return to the host computer terminated by the ascii character (10) - 0Ah.

4.3.3 GPIB ADDRESS SELECTION

The GPIB device address is selected by configuring the address dip switch located on the
upper left hand corner of the front panel PCB. To access the dip switch the user must
remove the top cover of the controller. The dip switch "S7" must be changed with the
controllers power off for the new address to take affect. The dip switch represents a
binary code for addresses between 0 and 15. A switch in the UP or ON position
represents a logic level "1". The first switch weighted by 1, the second by 2, the
third by 4, the fourth by 8. Select a combination that adds up to the address you
desire.
    I. E. The address (3) is selected by setting the switches 1 and 2 to the on position.
        The address (5) is selected by setting the switches 1 and 4 to the on position.

4.4   REAR PANEL CONNECTIONS

A rear panel view is provided to show location of the rear panel connectors, inputs, and outputs.
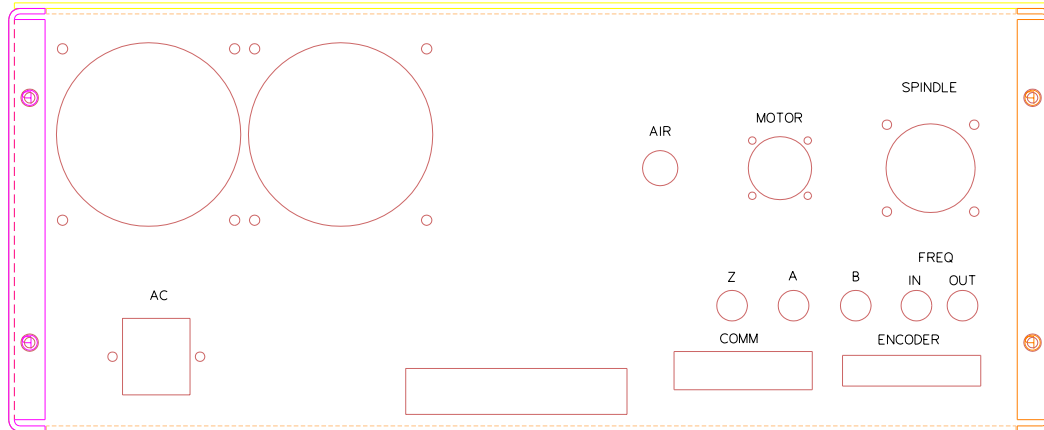

Figure 4-2
Rear Panel Connections

4.5   ENCODER COMMUTATION

An encoder is installed below the spindle housing and is directly coupled to the spindle's shaft. This encoder provides three outputs: Index, Data A, and Data B, which are used by the Main Electronics Assembly to maintain the spindle's RPM.

The internal 1024 line count encoder is factory aligned to ensure that the spindle motor windings and the encoder's index track are correctly phased. If any adjustment is made to the encoder, the encoder must be realigned to the motor; otherwise, the spindle motor may not operate accurately or perhaps not at all.

!! CAUTION !!

Improper alignment of the spindle encoder can damage the 05661's power amplifier circuitry.

4.6   SAFETY INTERLOCKS

DC power, AC motor drive power, and the amplifier overtemperature thermistor are monitored to prevent spindle motor damage caused by excessive current or heat. The air bearing spindle pressure is monitored for a low pressure condition. The clamp air pressure is monitored to assure that the clamping mechanism is engaged.

Power supply voltages monitored are +5 Vdc, ±15 Vdc, and motor supply voltage (±V). Inputs are constantly monitored, and if any or all inputs deviate from their assigned value, spindle operation is disabled and a fault condition occurs.

4.7   FREQUENCY REFERENCE

The 05661 is shipped from the factory with an internal frequency reference.

The 05661 can accept an external frequency reference, if the user wishes to synchronize with an external reference. The user must hook up their external reference to the "Frequency In" connector on the back of the 05661, and select external frequency from the front panel or through RS232 or GPIB command and issue a speed command of 10 and an acceleration of 10000 from either the front panel or the host computer. The 05661 will then track the external reference after the user issues a run command. The 05661 will use maximum acceleration in tracking the reference. All other commands will operate normally.

5.1   05661 COMMAND SET

Command	Definition
acc:XXXXX	Defines the acceleration rate in RPM/sec. XXXXX is a 5-digit integer from 00001 to 10000. 00000 is invalid, and will default to 01000. Communication Response: NONE
brakeoff	Deactivates the spindle brake solenoid, if the spindle is so equipped. Communication Response: NONE
brakeon	Activates the spindle brake solenoid, if the spindle is so equipped. Communication Response: NONE
clamp1	Activates the spindles primary clamp solenoid. Communication Response: NONE
clamp2	Activates the spindles secondary clamp solenoid. Communication Response: NONE
ccw	Commands counter clock-wise rotation. *NOTE: Direction may only be changed while spindle is stopped. Communication Response: NONE
cw	Commands clock-wise rotation. *NOTE: Direction may only be changed while spindle is stopped. Communication Response: NONE
dir?	Queries the direction status. Communication Response: Returns 'CCW' for counterclockwise, and 'CW' for clockwise.
disable	Decelerates the spindle, disables the spindle motor and applies the spindle motor brake, if spindle is so equipped. (See also 'stop' command.) Communication Response: NONE

en	Initializes the spindle motor if spindle has not been run before, enables the spindle, and commands the spindle to run at the last commanded speed, acceleration, and direction. *NOTE: If no direction, speed, or acceleration has been commanded, spindle will attempt to maintain zero RPM. (See also 'run' Command.) Communication Response: NONE
enable?	Queries the enable status. Communication Response: "ENABLED" or "DISABLED".
fault?	Queries the system fault status. Communication Response: "OK" if there are no faults, or "FAULT" if the controller is faulted.
faults?	Queries the controllers fault register. Communication Response: 'X' where X represents a single binary byte that is decoded as follows: Bit 1, 0- NO 1- YES (External Air Fault) Bit 2, 0- NO 2- YES (External Interlock) Bit 3, 0- NO 4- YES (AMP Over Temp) Bit 4, 0- NO 8- YES (External Aux Fault) Bit 5, 0- NO 16- YES (Servo error limit cw) Bit 6, 0- NO 32- YES (Servo error limit ccw) Bit 7, 0- NA 64- NA (Always set true) Bit 8, 0- NA 128- NA
faults:XX	Enables and disables specific controller fault inputs. 'XX' represents two **ASCII** characters that mask the corresponding faults. Each byte has a decimal range of 0..7 bits 4-8 of both bytes are not used. This allows ASCII fault masking with predetermined byte boundries. The bytes decode as follows: (XX) = (Byte 1| Byte 2) Byte 1 Bit 1, 0- DISABLE 1- ENABLE (External Air Fault) Bit 2, 0- DISABLE 2- ENABLE (External Interlock) Bit 3, 0- DISABLE 4- ENABLE (AMP Over Temp) Byte 2 Bit 1, 0- DISABLE 1- ENABLE (External Aux Fault) Bit 2, 0- DISABLE 2- ENABLE (Servo error limit cw) Bit 3, 0- DISABLE 4- ENABLE (Servo error limit ccw) Communication Response: NONE

id?	Queries the controllers identification data. Communication Response: Manufacturer Data, Model Number, and software revision of the controller. *NOTE: 9 bytes returned.
inpos?	Queries the 'in position' status. Communication Response: 'YES' if spindle is holding requested position, 'NO' if spindle is not at requested position. (Used with 'pos:XXXX')
mp?	Queries the instantaneous spindle motor power usage. Communication Response: XXX.XX % where XXX.XX represents the percentage of the maximum power presently being applied to the spindle motor.
pos:XXXX	Activates absolute positioning mode. XXXX corresponds to a rotational position ranging from 0000..4095 as counted incrementally from the rising edge of index in the counter-clockwise direction. When this command is issued the spindle is rotated to the requested position. Communication Response: NONE
pos?	Queries the spindles current rotational position. Communication Response: 'XXXX' where XXXX represents the spindles current position. integer ranging from 0000-4095. *NOTE: The 4 successive character are sent in ASCII format.
ref:X	Defines the source of the reference frequency. X can be '1' for internal frequency reference or X can be '0' for external frequency reference. Communication Response: NONE
run	Initializes the spindle motor if spindle has not been run before, enables the spindle, and commands the spindle to run at the last commanded speed, acceleration, and direction. *NOTE: If no direction, speed, or acceleration has been commanded, spindle will attempt to maintain zero RPM. (See also 'en' Command.) Communication Response: NONE
spd:XXXXX	Sets the requested speed to XXXXX RPM. XXXXX is an integer from 00001 to 25000. Communication Response: NONE

spd?	Requests the last commanded speed. Communication Response: XXXXX, where XXXXX is an integer from 00001 to 18000.

stat?	Requests the controllers status information.
	
	Communication Response:
	
	Returns the status of the controller as two 8-bit binary registers decoded as follows:
	  BYTE 1
	Bit 1, 0=Not Enabled, 1=Enabled
	Bit 2, 0=Not Ready, 1=Ready
	Bit 3, 0=No High Voltage, 1=High Voltage Present
	Bit 4, 0=Speed not Zero, 1=Speed is Zero
	Bit 5, 0=Not at Speed, 1=At Speed
	Bit 6, 0=CCW, 1=CW
	Bit 7, RESERVED
	Bit 8, 0=No Fault, 1=Fault
	  BYTE 2
	Bit 1, 0=Not Clamped, 1=Clamped (Clamp1)
	Bit 2, 0=Not Clamped, 2=Clamped (Clamp2)
	Bits 3-8 are reserved.

stop	Decelerates the spindle, disables the spindle motor, and applies the spindle motor brake, if spindle is so equipped. (See also 'dis' command.) Communication Response: NONE
unclamp1	Releases primary clamp solenoid. *NOTE: If 'unclamp1' command is issued while the spindle is rotating, the command will be ignored as to not allow unsafe operation. Communication Response: NONE
unclamp2	Releases secondary clamp solenoid. *NOTE: 'unclamp2' can be issued at any time. Communication Response: NONE
zero?	Queries the at zero speed status. Communication Response: 'YES' if the spindle is stopped or 'NO' if the spindle is still rotating.

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