REQUESTING ASSISTANCE

If you have any difficulties with the 03620, 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, have the serial number of your unit available and have a record of all circumstances and symptoms.

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TRADEMARKS

Table of Contents

About This Manual

This manual is divided into the following sections:

SECTION 1 - GENERAL INFORMATION

Contains a brief overview of the B3620, its operating mode, and features.

SECTION 2 - SPECIFICATIONS

Includes the power and operating specifications for all modules.

SECTION 3 - INSTALLATION

Provides information on installing the B3620 and basic checkout information.

SECTION 4 - OPERATION

Details the operation by describing controls, rear panel connections, and software commands.

SECTION 5 - COMMAND SET

Contains a complete list of the B3620'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 B3620 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 B3620 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 B3620 Linear Amplifier and its operation. The B3620 is made up of two subassemblies:

- Power Amplifier Assembly
- Main Electronics Assembly

1.2 INTRODUCTION

The B3620 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. Spindles produced by other manufacturers may be used with the B3620 controller if configured properly. The B3620 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 B3620 can be controlled by a host computer via a RS-232 communication interface (Factory Option). The B3620 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 B3620 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 B3620 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 18000 RPM
- RS-232 communications to host computer

1.5 SUB-ASSEMBLIES

There are two sub-assemblies in the B3620. They are:
- Power Amplifier Assembly
- Main Electronics Assembly

1.5.1 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.

1.5.2 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 SOFTWARE

Software is required for each of the B3620's CPU's to operate. The operating program is resident in each CPU's EPROM when shipped from the factory.

Section 2 Specifications

2.1 GENERAL

Contained within this section are specifications for the B3620. Specifications included are power requirements and physical dimensions.

2.2 SYSTEM REQUIREMENTS

The B3620 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

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
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

Amplifier over-temperature interlock
Electronic spindle position locking

2.5 COMMUNICATIONS

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 B3620 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 B3620 or have experience with similar test equipment. If there are any questions regarding installation, please call Seagull Solutions's Field Services before beginning installation.

Each assembly of the B3620 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:

SEAGULL SOLUTIONS, INC.
Field Services Division
15105 Concord Circle
Morgan Hill, California 95037
Phone: (408) 778-1127
Fax: (408) 779-2806

3.1 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.

3.2 RACK INSTALLATION

The B3620 installs in a 3.5-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).

3.3 ELECTRICAL CONNECTIONS

AC power to the B3620 is determined by the factory. The AC power cable must have a ground wire and must connect the B3620 to the plant AC ground. Before connecting the AC power cable to the B3620, ensure that the power switch on the front panel is off.

NOTE

If intending to use the B3620 with any spindle other than the one supplied by Seagull Solutions, please contact the Field Services Division before operating the B3620.

3.4 SPINDLE CONNECTIONS

Any spindle assembly supplied with the B3620 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 B3620 using appropriate cables.

1. Connect the spindle's motor cable to the "Motor" connector located on the rear panel of the B3620.
2. Plug in the encoder from the spindle to the "Encoder" connector located on the rear panel of the B3620.

3.5 APPLYING POWER

Before AC power is connected to the B3620's input receptacle, ensure that the AC power switch on the front panel is **OFF.**

Section 4 Operation

4.1 GENERAL

Contained within this section are instructions for operating the B3620, an explanation of its mode 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

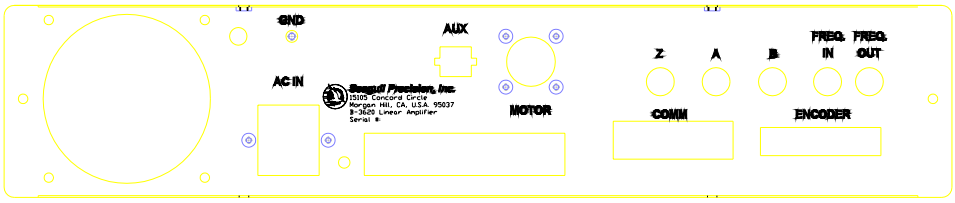
Should any of the B3620's assemblies not operate as stated, call Seagull Solutions's Field Services Division.

4.2 REMOTE OPERATION

Remote operation is used when the B3620 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 B3620's command set. The B3620 utilizes RS232C communication protocols. All command strings can be sent individually terminated with the ascii character (13) - 0Dh. Commands that generate a response are return to the host computer terminated by the ascii character (13) - 0Dh.

4.3 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

4.4 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.

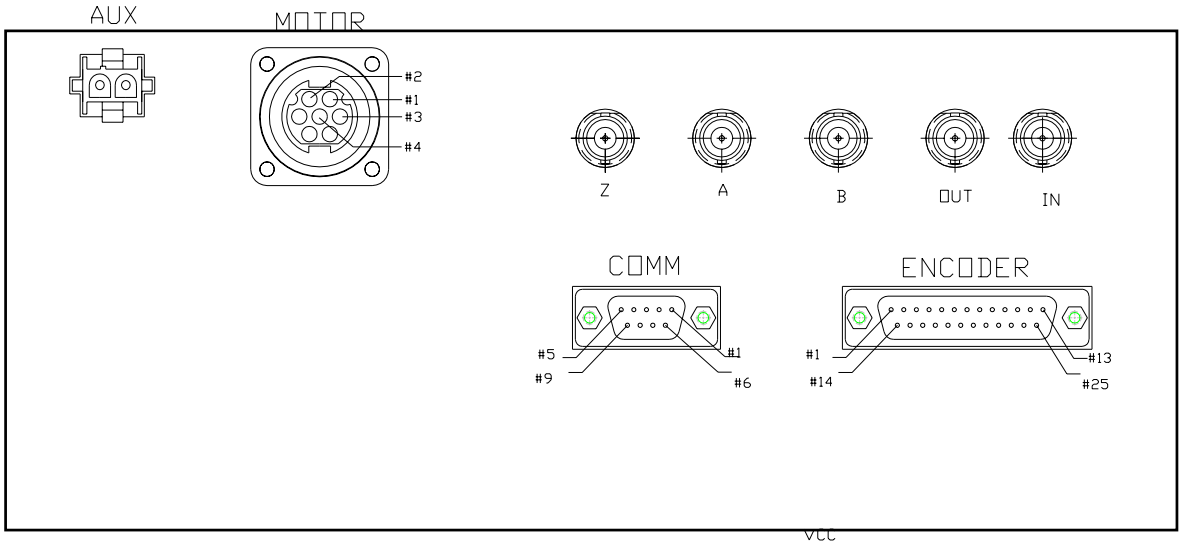
The internal 1024 line count encoder is factory aligned to ensure that the spindle motor windings and the encoder's index track are correctly phased. If any adjustment is made to the encoder, the encoder must be realigned to the motor; otherwise, the spindle motor may not operate accurately or perhaps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

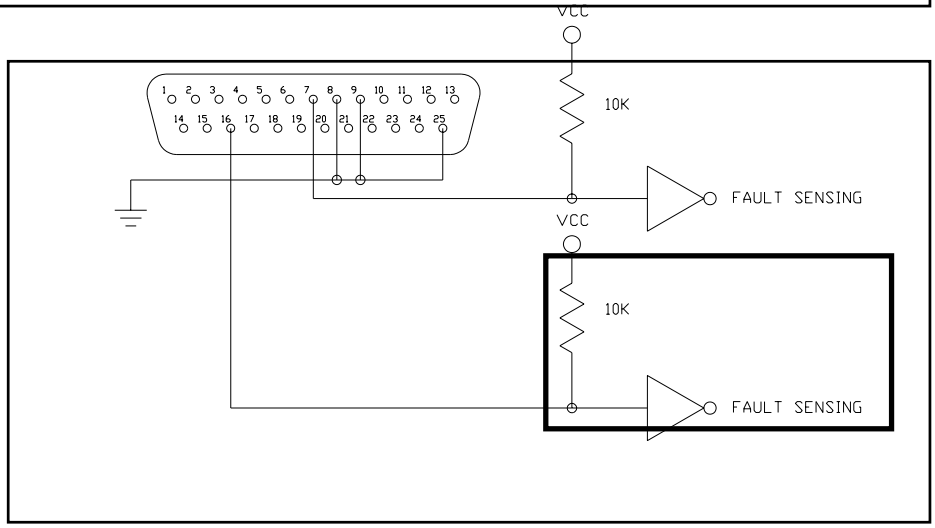
!! CAUTION !!

Improper alignment of the spindle encoder can damage the B3620's power amplifier circuitry.

4.5 SAFETY INTERLOCKS

DC power, AC motor drive power, and the amplifier over-temperature thermistor are monitored to prevent spindle motor damage caused by excessive current or heat. External interlock connections may be utilized to allow user control of motor disable features. Pins 7 and 16 are used as external fault inputs. These inputs cause a fault / disable condition when they are pulled low. Pin 18 is a factory optional fault input, standard models do not use this input.

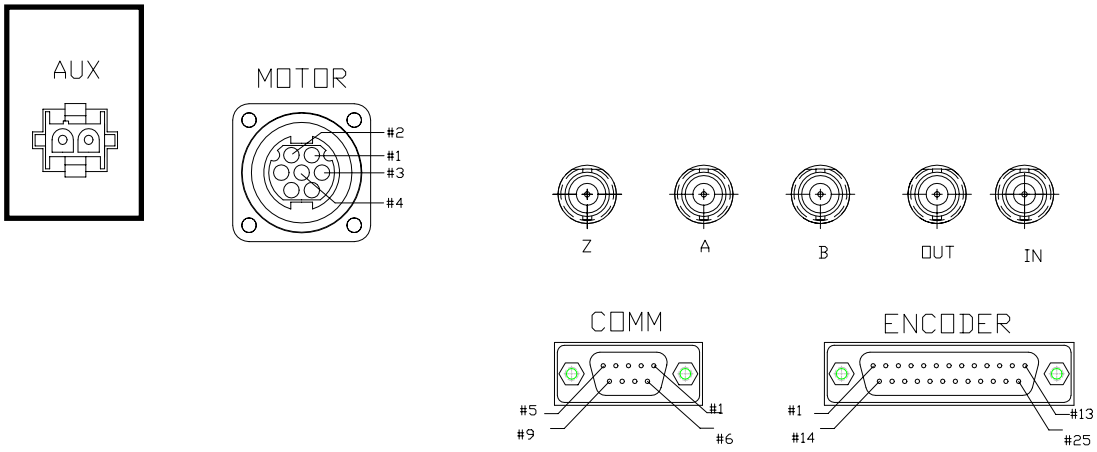


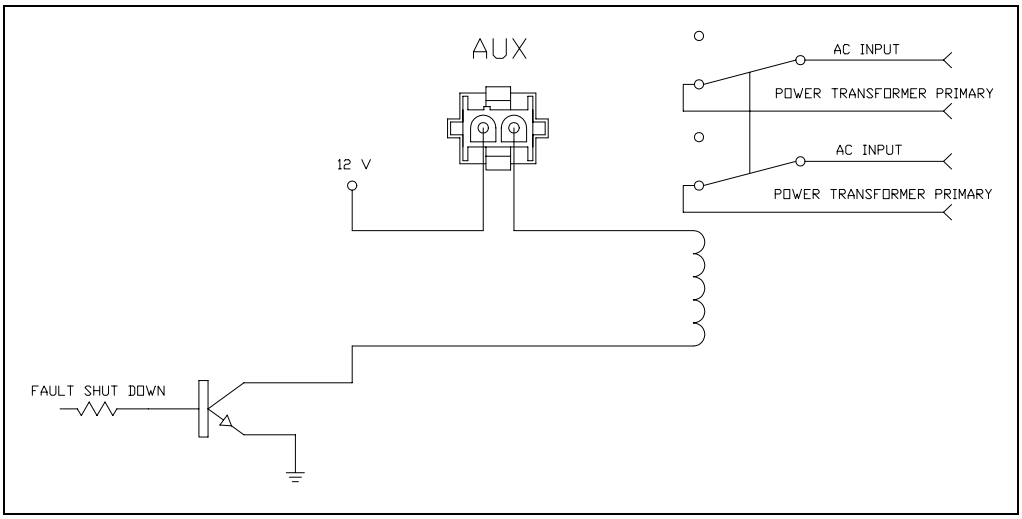


ENCODER
MALE DB–25

PIN NO.	FUNCTION
01	ENCODER POWER 5V @ 200 mA
02	ENCODER CHANNEL A INPUT
03	ENCODER CHANNEL B INPUT
04	ENCODER CHANNEL Z INPUT
05	N.C.
06	N.C.
07	AUX FAULT 1 INPUT
08	ENCODER GROUND
09	GROUND
10	N.C.
11	USER OUTPUT 1
12	USER OUTPUT 2
13	N.C.
14	N.C.
15	N.C.
16	AUX FAULT 2 INPUT
17	N.C.
18	AUX FAULT 3 INPUT
19	N.C.
20	N.C.
21	N.C.
22	N.C.
23	+15V @ 200mA OUTPUT
24	ENCODER CHANNEL A OUTPUT
25	GROUND

An additional ‘AUX’ input is provided to remotely disengage the motor high voltage.



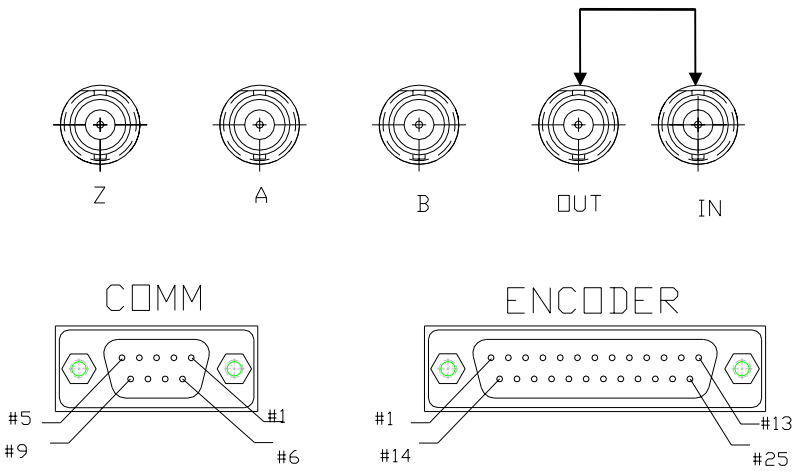


Power supply voltages monitored are +5 Vdc, ±15 Vdc, and motor supply voltage (±V). Inputs are constantly monitored, and if any or all inputs deviate from their assigned value, spindle operation is disabled and a fault condition occurs.

4.6 FREQUENCY REFERENCE

The 03620 is shipped from the factory with an internal frequency reference. A BNC loopback cable must be connected from the "Frequency In" to the "Frequency Out" connectors on the back panel in order for the unit to run.

The 03620 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 03620, and issue a speed command of 10 and an acceleration of 10000 from either the front panel or the host computer. The 03620 will then track the external reference after the user issues a run command. The 03620 will use maximum acceleration in tracking the reference. All other commands will operate normally.



Section 5 03620 Command Set

5.1 COMMAND SET LISTING

The 03620's Command Set is case-sensitive.

Command	Definition
ACC:XXXXX	Defines the acceleration rate in RPM/sec^2. XXXXX is a 5-digit integer from 00001 to 10000. 00000 is invalid, and will default to 00005.
BRAKEOFF	Disables the spindle motor brake, if spindle is so equipped.
BRAKEON	Enables the spindle motor brake, if spindle is so equipped.
CLAMP	Activates the spindle disk clamp, if spindle is so equipped.
DIR:CCW	Commands counter-clockwise rotation.
DIR:CW	Commands clockwise rotation.
INIT	Initializes the spindle motor to establish commutation. This command MUST be issued prior to running the spindle.
RUN	Enables the spindle, and commands the spindle to run at the last entered speed, acceleration, and direction. NOTE: If no direction, speed, or acceleration has been commanded, spindle will attempt to maintain zero RPM.
SPD:XXXXX	Sets the requested speed to XXXXX RPM. XXXXX is an integer from 00010 to 18000.
STAT?	Returns the status of the controller as an ASCII value that represents bit fields set. The fields are decoded as follows: Bit 1, 0=Rotating, 1=Stopped Bit 2, 0=Clamped, 2=Not Clamped Bit 3, 0=Brake On, 4=Brake Off Bit 4, 0=No Fault, 8=Fault Bit 5, 0=At Speed, 16=Not At Speed Bit 6, 0=CCW, 32=CW Bit 7, RESERVED

	Bit 8, RESERVED
STOP	Disables the spindle motor, and applies the spindle motor brake, if spindle is so equipped. (See DIS command.)
UNCLAMP	Causes the disk clamp to unclamp, on spindles so equipped. NOTE: If an UNCLAMP is attempted while the spindle is rotating, the command will be ignored.

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