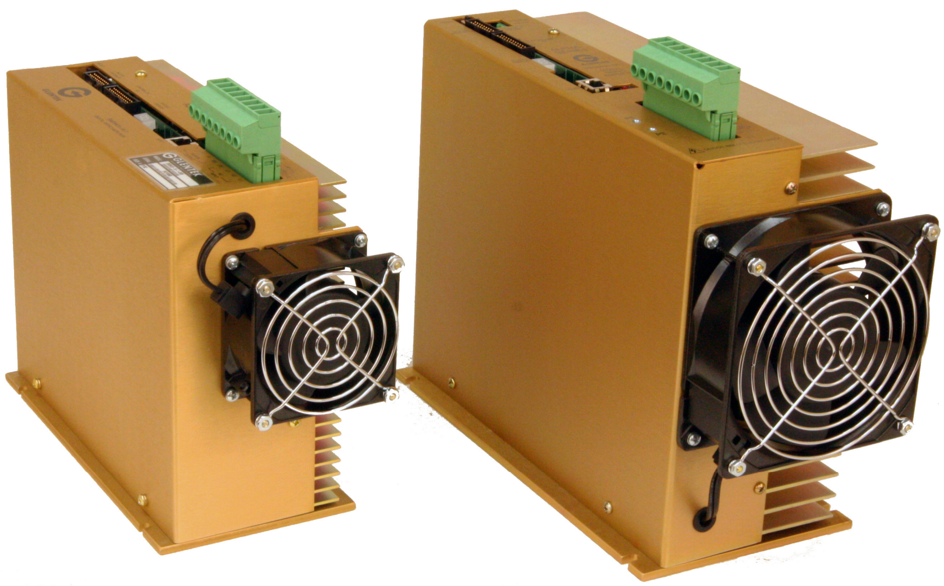
INSTALLATION & OPERATION MANUAL

Alpha Series
Digital High Bandwidth
High Speed Spindle Amplifiers

GLENTEK

Model SMB/SMC 9420 Model SMB/SMC 9430

SMB Designates BUS Powered Logic
SMC Designates Separate Keep Alive Logic Power



Congratulations, You Cared Enough to Buy the Very Best!

Manual Revision Date: 31 Jan 2012

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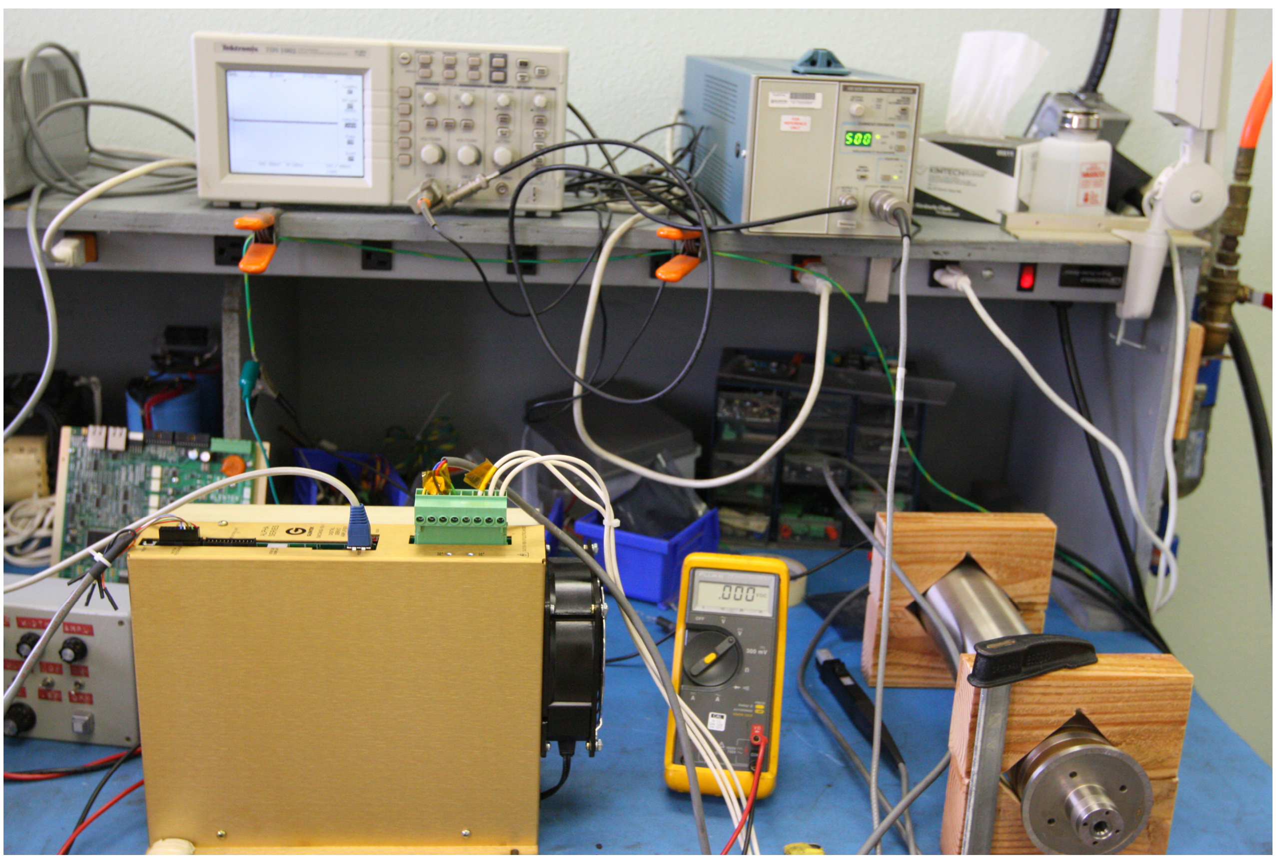


SMB9430 SPINDLE AMP UNDERGOING TESTING

Overview

Glentek's new High Speed Spindle Drives provide ultimate performance for your application. Advanced space vector algorithms and commutation techniques developed at Glentek provide sine wave output from square wave Hall sensor input. This eliminates higher order harmonics resulting in lower motor operating temperature and longer life.

By utilizing Field Oriented Control algorithms our drive can achieve speeds up to 100,000 RPM.

Typical applications include: Lens Grinding, Semiconductor Silicon Slicing, High Speed Die Grinding, High Speed Routers, Semiconductor Wafer Processing, High Speed Nut Driving (automotive) and many more.

Glentek's High Speed Spindle Drives can work with any feedback device, including Sentron's sine wave Hall Sensors.

Brand-label opportunities are available. Please contact Jason Mark at 310-322-3026 ext 173 (jmark@glentek.com) with any questions.

Examples of motors in successful applications using Glentek spindle amplifiers:

MANUFACTURER	MODEL #/ or PART #
Loadpoint Bearings Ltd.	D03698
Loadpoint Bearings Ltd.	5716/1 LH
Loadpoint Bearings Ltd.	D03604
Loadpoint Bearings Ltd.	D03209
Westwind	50-06160-00
Westwind	50-0617-0

This manual guides the application engineer through the steps necessary for installation of the Alpha series digital spindle amplifiers. All features of the Alpha series digital spindle amplifier are explained and the procedures for installation and tuning are covered. The following sections are presented in an order that will make installation easy for most first time users of the Alpha Series digital amplifiers.

The "Product Description" and "Features" sections provide the application engineers data for system integration of the Alpha Series digital amplifiers.

Next, MotionMaestro© software is introduced. Enough material is given here to familiarize the application engineer with the software tools necessary to setup, install and run a motor using the Alpha series digital spindle amplifiers. For additional information refer to the MotionMaestro© Software Guide at www.Glentek.com.

The application engineer is then guided through a step by step procedure for setting up and tuning a digital spindle system.

Again, thank you and we look forward to providing you a product that will make your system perform at its very best level.

Product Description

Glentek's Alpha Series Digital PWM High Speed Spindle Amplifiers offer the latest in high performance DSP control of both high speed spindle motors. With extensive utilization of surface mount technology and special heat transfer techniques, the Alpha Series offers one of the world's most powerful products for a given form factor.

The Full Feature amplifier operates in current (torque) mode or velocity (RPM) mode, accepts a +/-10V analog input as a command reference and commutates the motor sinusoidally for ultra smooth operation at low speeds. The amplifier utilizes an incremental encoder (or Hall signals) to derive the velocity signal and to commutate the motor. The absolute commutation angle is usually determined using Hall sensors or encoder commutation tracks. However, in some cost sensitive applications where slight motor movement is acceptable upon power up, the amplifier can perform a power-on phase finding algorithm which eliminates the need for Hall sensors or Commutation tracks. All modes of operation can also be supported utilizing synchro resolver feedback instead of an encoder. It is best to consult Glentek's sales application group. Also, we can customize a serial port digital interface to adapt to your controller as required to meet your protocols such as Ethernet, CAN, RS485, etc.

Current (Torque) Mode Servo Amplifier

The current mode spindle amplifier accepts a +/-10V analog input as a current command. For this mode of operation, the amplifier provides high current loop bandwidth for high acceleration and high speed spindle applications.

Velocity (RPM) Mode Servo Amplifier

The velocity mode spindle amplifier accepts a +/-10V analog input as a velocity command. For this mode of operation, a digital velocity value is continuously calculated from the Hall or encoder input signals. Glentek's high gain / high bandwidth velocity mode spindle amplifiers are preferred and utilized in many very high performance spindle systems.

CANopen Servo Amplifier

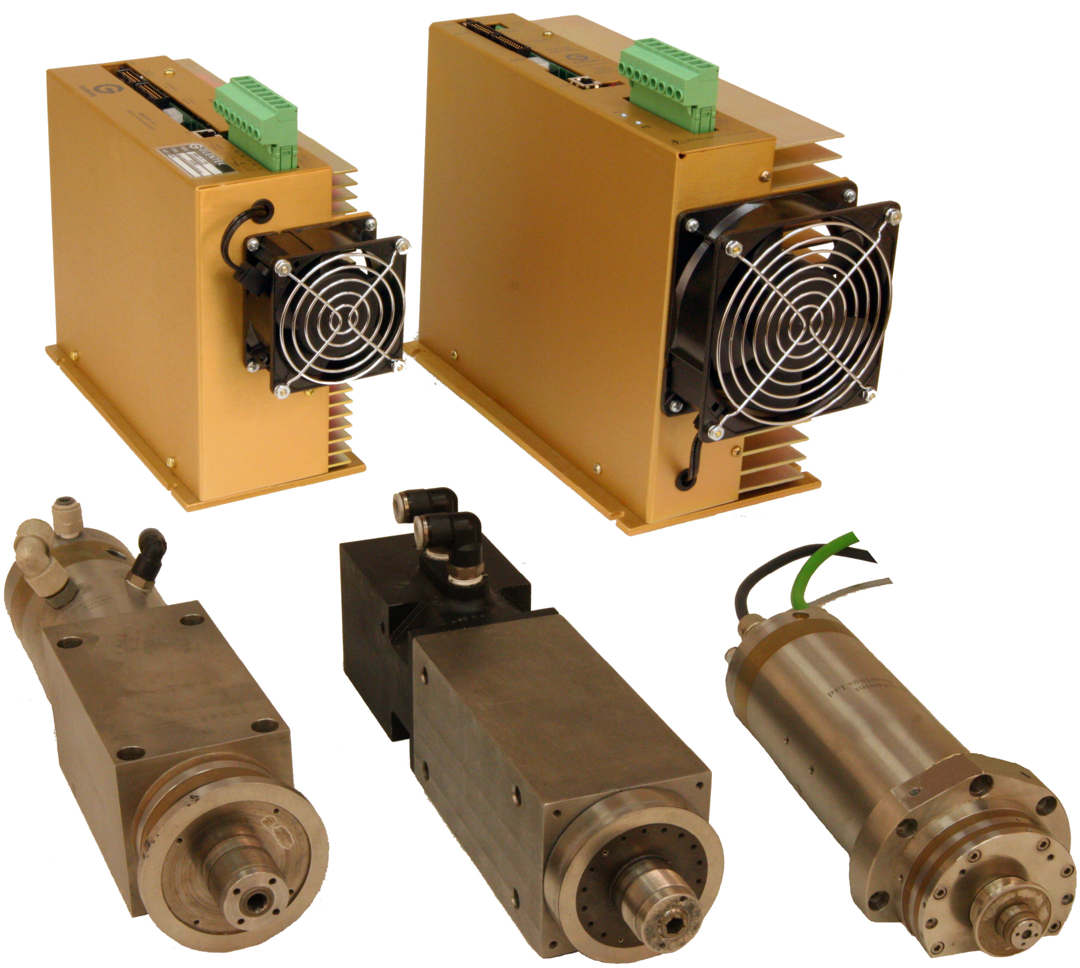
The CANopen spindle amplifier incorporates all the features of the Full Feature spindle amplifier and also accepts high speed serial digital command input. The digital command can be current command if the amplifier is operating in Current Mode or velocity command if the amplifier is operating in Velocity Mode. The CAN protocol is in compliance with CAN in Automation (CiA) DS-301 V4.02 standard. See CANopen Installation and Operation Manual for more detail.

Features

- **CE compliant:** All servo amplifiers are CE marked.
- **FOC:** All Alpha Series employ Field Oriented Control method which allows accurate control in both steady state or transient operation.
- **Digital current loops:** Current loop bandwidths up to 3 kHz.
- **Digitally tuned:** All parameters set digitally. No potentiometers to adjust. DSP control for the ultimate in high performance.
- **Silent operation:** 25 kHz PWM standard.
- **Wide operating voltage:** All models can be ordered for operation from either 110-130 VAC or 208-240 VAC (3-phase, 50/60 Hz)

  Note: Non-standard voltages can be ordered on request.
- **Stand alone operation:** All models include internal DC power supply, cooling fans and a regen clamp with dumping resistor. (Exception: SMC versions, see next feature).
- **External logic supply:** SMC versions require an external 24 - 48VDC, (600 mA min) power supply for amplifier logic, encoder or Hall sensors. This enables “keep alive” ability.
- **RS-232 or RS-485:** High speed (115.2K baud) serial communication interface for (RS -485 is optional) setup and tuning.
- **CANopen:** High speed (up to 1 Mb/s) serial communication interface for communications between nodes in real-time control applications.
- **Encoder feedback:** Accepts nominal encoder signals 5 MHz (maximum frequency of up to 10 MHz is possible, but is system dependent).
- **Parametric filtering:** Provides control engineers advanced filtering to eliminate unwanted system mechanical resonance.
- **Sinusoidal commutation:** For the ultimate in efficiency and smooth motion, Commutates from almost any resolution linear or rotary encoder.
- **Smart-Comm Initialization:** Eliminates the need for Hall sensor or commutation tracks for many applications.
- **Auto Phase Finding:** Plug and Play for all type of three phase brushless motors. Provides control engineers ability to connect any motor leads to any amplifier motor outputs. The amplifier’s smart algorithm will automatically find and align the motor phases to allow for most optimized smoothness and efficient commutation.
- **Auto Phase Advance:** Glentek’s advanced algorithms incorporated in the Alpha Series drives, automatically provide phase advance, insuring that the current is delivered at the appropriate time, provide the most efficient operation.
- **Space Vector Modulation:** Glentek’s advanced algorithms allow for maximum utilization of the DC BUS voltage while generating minimum harmonic distortion of the currents in the winding of 3-phase AC motor.

- **Software configurable:** Glentek's Windows™ based MotionMaestro© software provides ease of set-up, monitoring and tuning with no previous programming experience required. This software is Windows™ 95/98/2000/XP, NT, Vista, and 7 compatible.
- **Non-volatile memory:** All parameters are stored in non-volatile memory for reliable start up. In addition, up to two different configurations can be stored in the amplifier's non-volatile memory.
- **Dedicated inputs:** Go/Stop, E-Stop, inhibit, fault , motor over temp, reset signal, and +/- 10V analog input.
- **Dedicated outputs:** Selectable analog monitor signal, fault and encoder output.
- **Relay outputs:** (Optional) These two pins provide an interface for the relay. They turn on . when desired condition occurred.
- **Complete isolation:** Complete optical isolation between signal and power stage.
- **Fault protection:** Short from output to output, short from output to ground, amplfier RMS over current, amplifier under/over voltage, amplifier over temperature, motor over temperature.
- **Status indicator:** 7-segment display indicates amplifier status and diagnostics.
- **SMT construction:** Provides ultra compact size, cost competitive package and high reliability.



Standard Operating Conditions

Temperature

Min. = 0º C
Max. = 60º C

Humidity Range

5-95% Non-condensing

Altitude

This amplifier is rated for up to 1000m, above which performance may deteriorate.

Shock

Do not expose the amplifier to sudden shock (dropping, shaking, etc…)

Vibration

Do not install the amplifier in an area prone to constant vibration.

Electromagnetic Interference

Do not install the amplifier near sources of EMI

Atmospheric Pollutants

Do not install the amplifier in an environment where the atmosphere contains pollutants such as dust, corrosives, etc...

Water

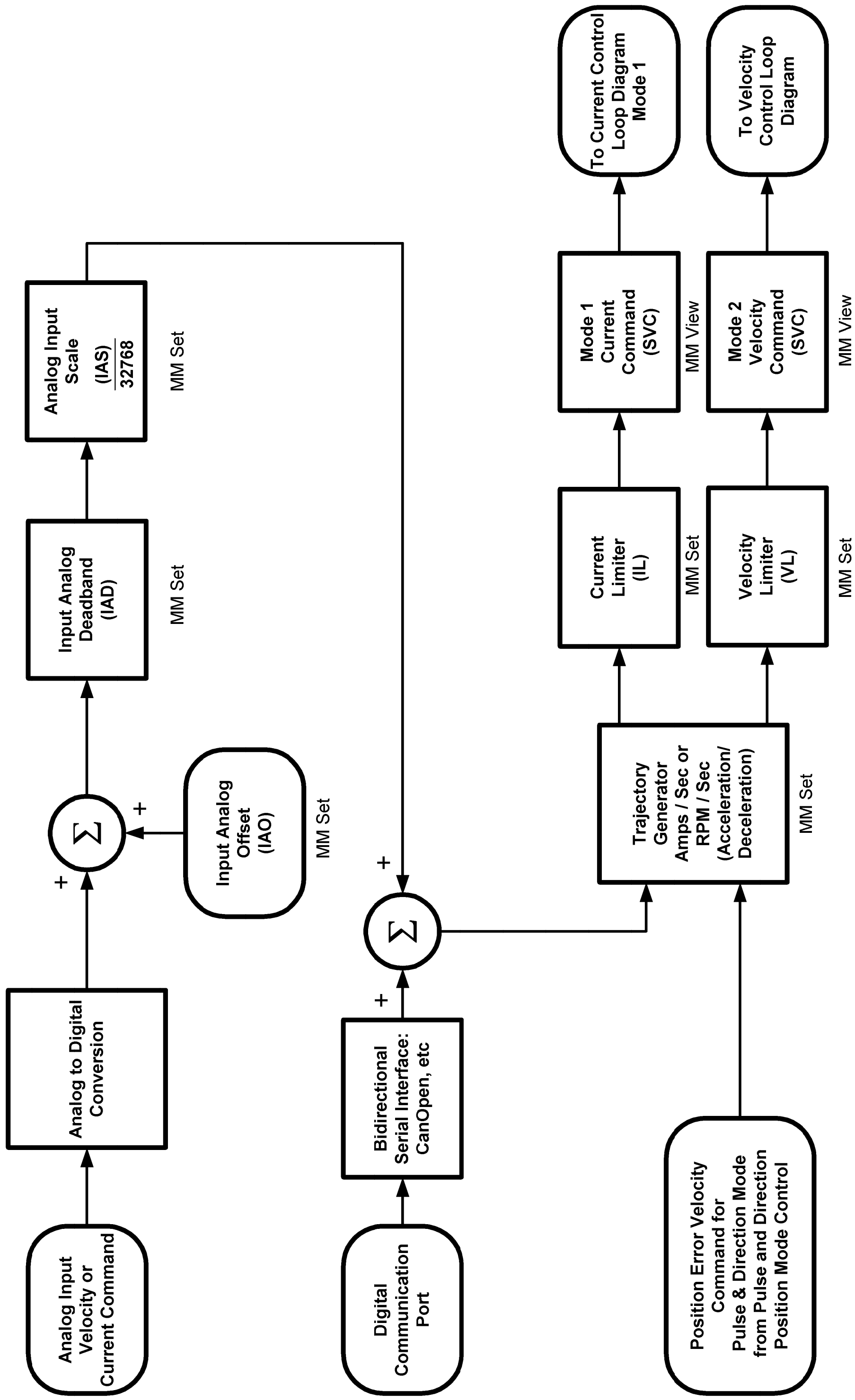
Keep the amplifier away from all water hazards, including pipes that may accumulate condensation and areas that can become excessively humid.

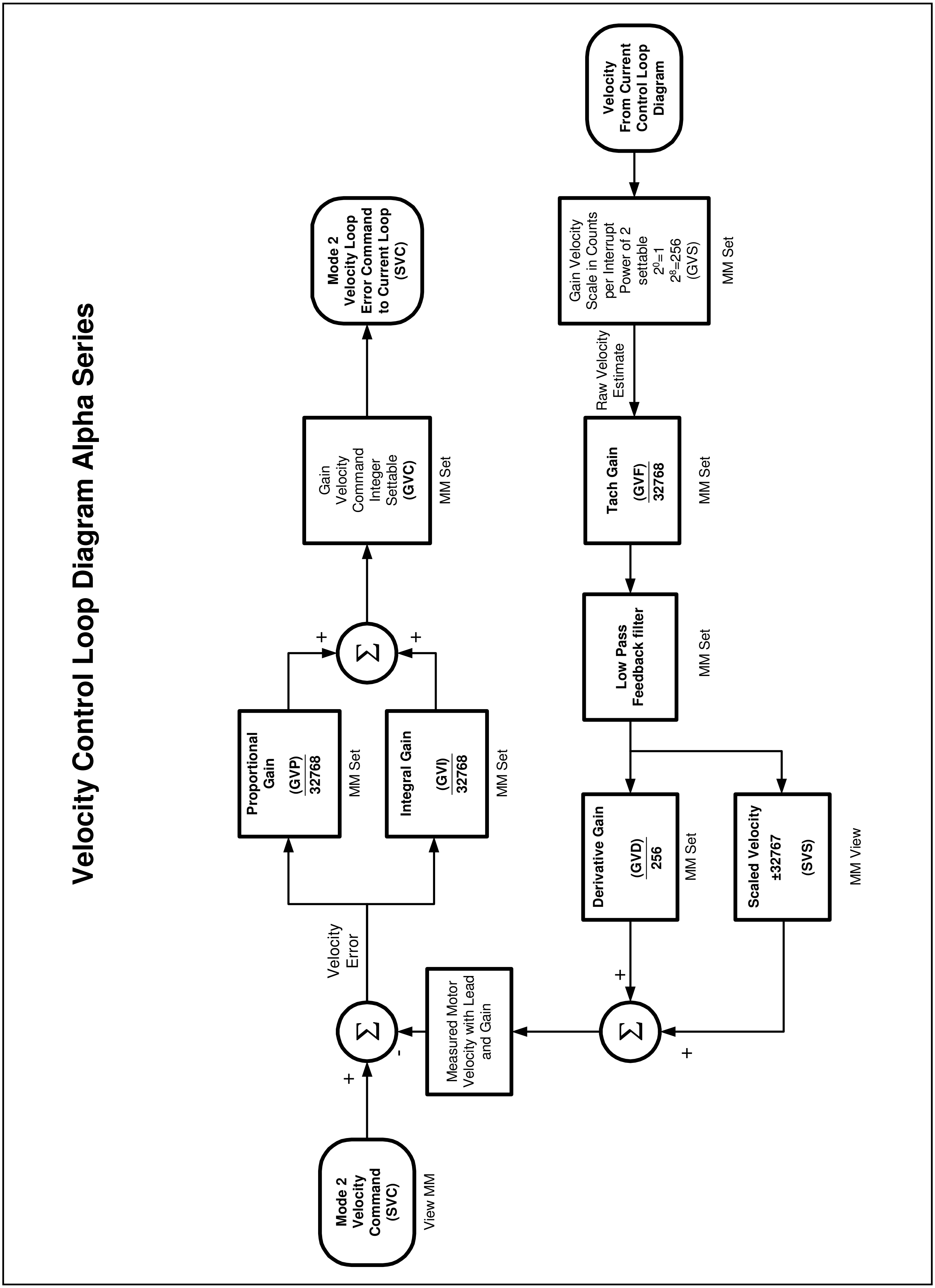
Overheating

Ensure that the amplifier's air vents are not obstructed. Allow a clearance of 75mm (minimum) above the amplifier for proper ventilation.

Control Block Diagrams

Command Input Control Diagram Alpha Series




Velocity Control Loop Diagram Alpha Series
Mode 2 Velocity Command (SVC)
View MM
Measured Motor Velocity with Lead and Gain
Velocity Error
Proportional Gain (GVP) / 32768
MM Set
Integral Gain (GVI) / 32768
MM Set
Gain Velocity Command Integer Settable (GVC)
MM Set
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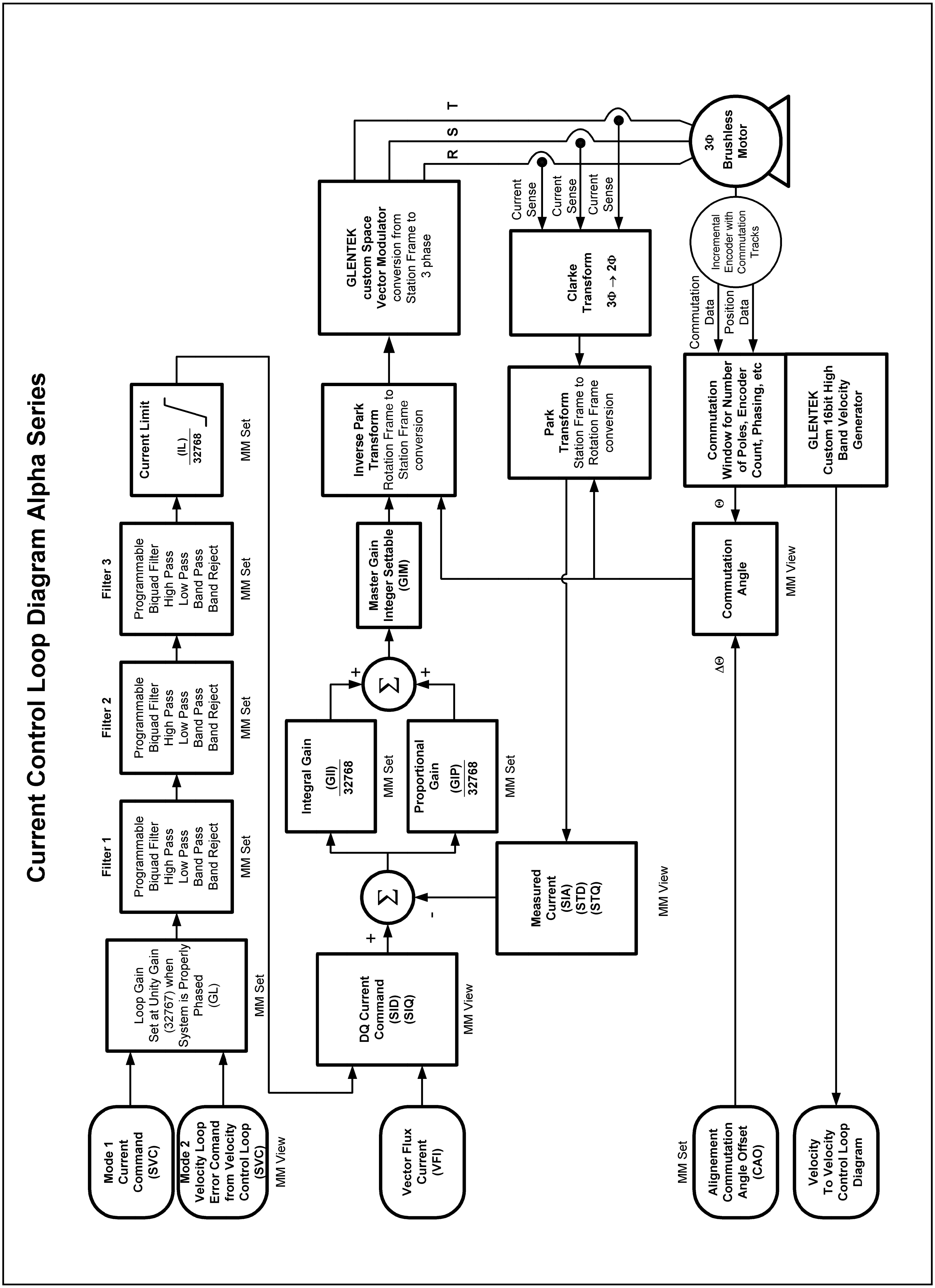
Velocity From Current Control Loop Diagram
Gain Velocity Scale in Counts per Interrupt Power of 2 settable 2^0=1 2^8=256 (GVS)
MM Set
Raw Velocity Estimate
Tach Gain (GVF) / 32768
MM Set
Low Pass Feedback filter
MM Set
Derivative Gain (GVD) / 256
MM Set
Scaled Velocity ±32767 (SVS)
MM View


Current Control Loop Diagram Alpha Series
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Mode 2 Velocity Loop Error Comand from Velocity Control Loop (SVC)
MM View
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MM Set
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Programmable Biquad Filter High Pass Low Pass Band Pass Band Reject
MM Set
Filter 2
Programmable Biquad Filter High Pass Low Pass Band Pass Band Reject
MM Set
Filter 3
Programmable Biquad Filter High Pass Low Pass Band Pass Band Reject
MM Set
Current Limit
(IL) / 32768
MM Set
Vector Flux Current (VFI)
DQ Current Command (SID) (SIQ)
MM View
+
-
Σ
Integral Gain (GII) / 32768
MM Set
Proportional Gain (GIP) / 32768
MM Set
Measured Current (SIA) (STD) (STQ)
MM View
Master Gain Integer Settable (GIM)
Inverse Park Transform Rotation Frame to Station Frame conversion
GLENTEK custom Space Vector Modulator conversion from Station Frame to 3 phase
R
S
T
3Φ Brushless Motor
Current Sense
Current Sense
Current Sense
Clarke Transform 3Φ → 2Φ
Park Transform Station Frame to Rotation Frame conversion
Incremental Encoder with Commutation Tracks
Commutation Data
Position Data
Commutation Window for Number of Poles, Encoder Count, Phasing, etc
GLENTEK Custom 16bit High Band Velocity Generator
Θ
Commutation Angle
MM View
ΔΘ
MM Set
Alignement Commutation Angle Offset (CAO)
Velocity To Velocity Control Loop Diagram

Amplifier Setup Software

MotionMaestro© is Glentek's Windows based application software that was designed to communicate with the Alpha series digital amplifiers. MotionMaestro© has many dialogs with values shown in engineering units to make it easy to select and setup the features of the amplifier. MotionMaestro© utilizes the standard binary command set and protocols. Although it is not necessary to use MotionMaestro©, installation, setup and tuning is made easier through its use. For more information please refer to the MotionMaestro© Software Guide at www.Glentek.com.

MotionMaestro© has many features that allow application engineers to easily configure a digital amp to an application. It has a terminal mode that operates at 115k baud transmission rates, an oscilloscope that can be used to monitor amplifier signals and a tuning dialog that can be used to control the motor input. By using the oscilloscope and tuning dialog, one can monitor step response to determine filter parameters for optimal control loop performance.

Glentek developed a Communication Module CM998-1 to provide Ethernet communication between the Host computer that is running MotionMaestro© and the amplifier. The Host computer communicates with the CM998-1 by Ethernet, and the CM998-1 communicates with the amplifier by RS-232 or RS485 (you must have the proper serial cable wired as described in the Amplifier Connection Interface section of this manual). The CM998-1 is plug-and-play, and there is no special setup required. Please contact one of Glentek's sale engineers for further details.

MotionMaestro© Installation

MotionMaestro© requires Windows95, Windows 98 SE, Windows ME, Windows NT 4.0, Windows 2000, Windows XP, Windows Vista or Windows 7 operating system running on a PC with at least one serial port. It is suggested that you have no less than 3 megabytes of application program disk space remaining on the hard drive prior to installation. The MotionMaestro© install disk is setup to utilize Install Shield to simplify installation. There are only a few setup options offered. In general you can press NEXT or YES until installation is complete. When installation is completed, you will find a MotionMaestro© shortcut on the windows Start\Programs menu.

DO NOT RUN MOTIONMAESTRO© UNTIL YOU HAVE READ ALL OF THIS SECTION.

The MotionMaestro© installation program is named Setup.exe. It is found in the MotionMaestro© \disk1 directory of the distribution CD. The installation will create a Glentek folder in the Program Files folder. A MotionMaestro©_X_X folder is created where _X_X matches the version number. You can have multiple versions of MotionMaestro© installed, if you wish, and they will be placed into their own directories.

MotionMaestro© amplifier setup features.

This section of this manual is an introduction to MotionMaestro's© features that are required for installation and setup of the Alpha series amplifiers. Only those features of MotionMaestro© required for defining motor characteristics are covered. This is not meant to be a step by step tutorial. The "Connecting the Amplifier to the motor" section is intended as a tutorial for motor setup. You may need to refer to this section when setting up a motor. The following features are reviewed here.

1. Opening of communications.
2. Model Information.
3. Digital I/O setup.
4. Mode setup.
5. Motor Parameters.
6. Motor Safety.
7. Commutation Setup.
8. Gearing/Encoders Setup.
9. Trajectory Generator.
10. Filters.
11. Analog I/O setup.
12. Oscilloscope.
13. Terminal Window.
14. Amplifier Status.
15. Control Panel.
16. Motor Tuning.
17. Saving parameters.
18. Backing up a copy of amplifier parameters.

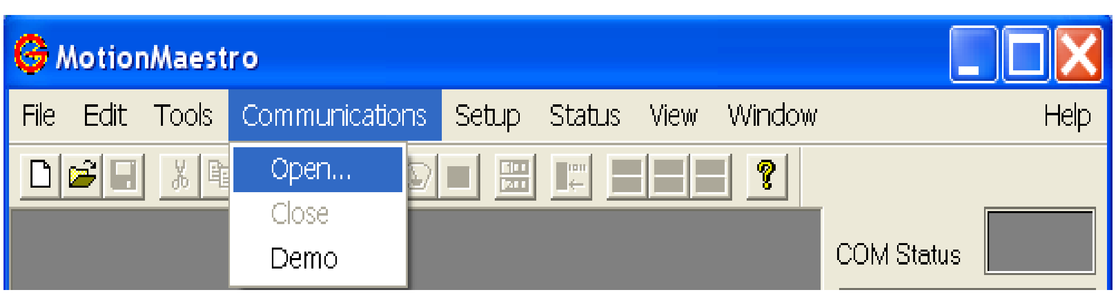
Opening of communications

Before MotionMaestro© can be used, communications must be established between the amplifier and the PC that MotionMaestro© is running on. Before opening communications in MotionMaestro©, you must decide what communication method between the Host computer and amplfier is used (RS-232 only, Ethernet to RS-232 or Ethernet to RS-485 using Communication Module CM998-1) and have a serial communications cable wired as described in the Amplifier Connection Interface section of this manual.

When MotionMaestro© is directed to establish communications with the amplifier, the amplifier is queried for a model ID and Firmware version. MotionMaestro© will configure itself and select the appropriate configuration files based on the amplifier returned values.

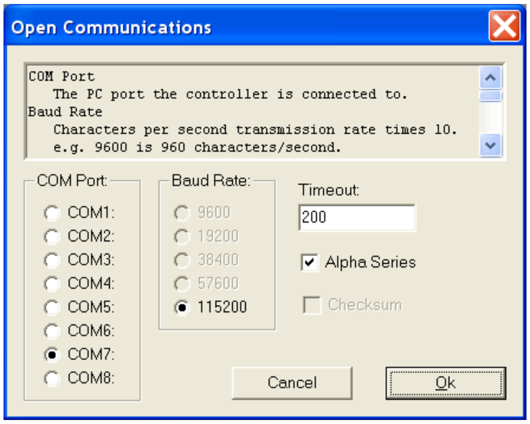
There are extensive help screens under the Help menu. Select Help Topics and you can read about the usage of MotionMaestro© and it's features.

Open communications by selecting the "Open" option on MotionMaestro's© main menu tool bar.



Open - To make connection with an amplifier

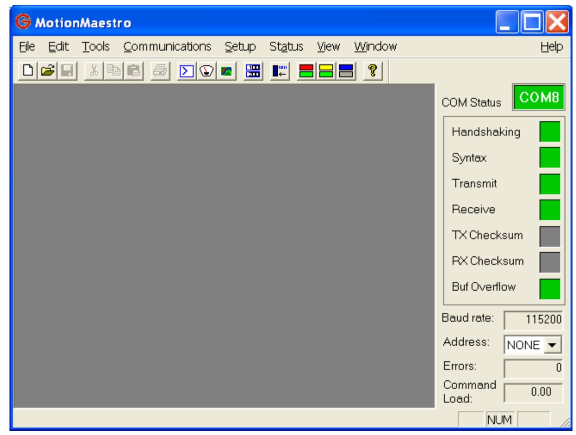
Depending on which communication method between the Host computer and amplifier is used, one of the following two screens for establishing communication link would be opened.



Open Communications dialog box using RS-232 between Host computer to amplifier

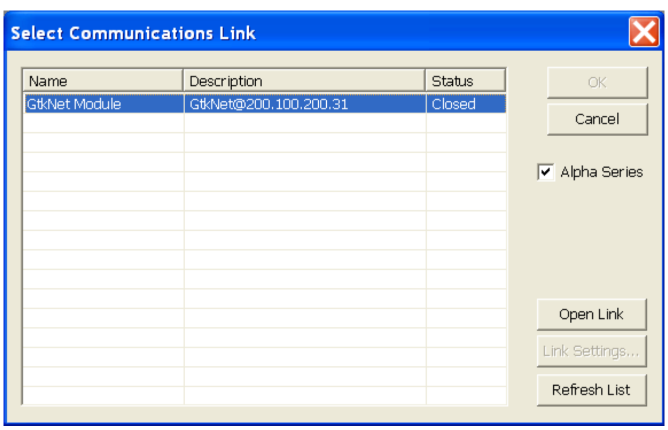
If the communication method is by RS-232 between the Host computer and amplifier, the "Open Communications" window is displayed.

Select the COM port that you connected the serial port cable to and ensure that a baud rate of 115200 is selected. Click and select the check box next to Alpha Series (to distinguish from Omega Series protocol). When you press OK, MotionMaestro© will query the amplifier to determine what amplifier model is connected.



MotionMaestro's main window using RS-

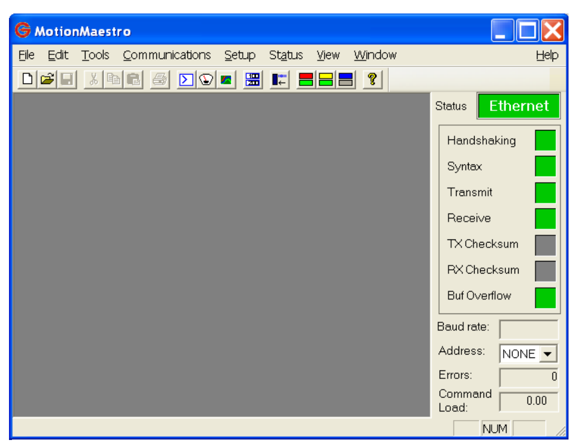
If communications is established, you should see a screen similar to the "MotionMaestro's main window using RS232" with all green communications status indicators.



Open Communications dialog box using Ethernet between Host computer to amplifier via Communication Module CM998-1

If the communication method is by Ethernet to RS-232 or Ethernet to RS-485 using Communication Module CM998-1 between the Host computer and amplifier, the "Select Communications Link" window is displayed.

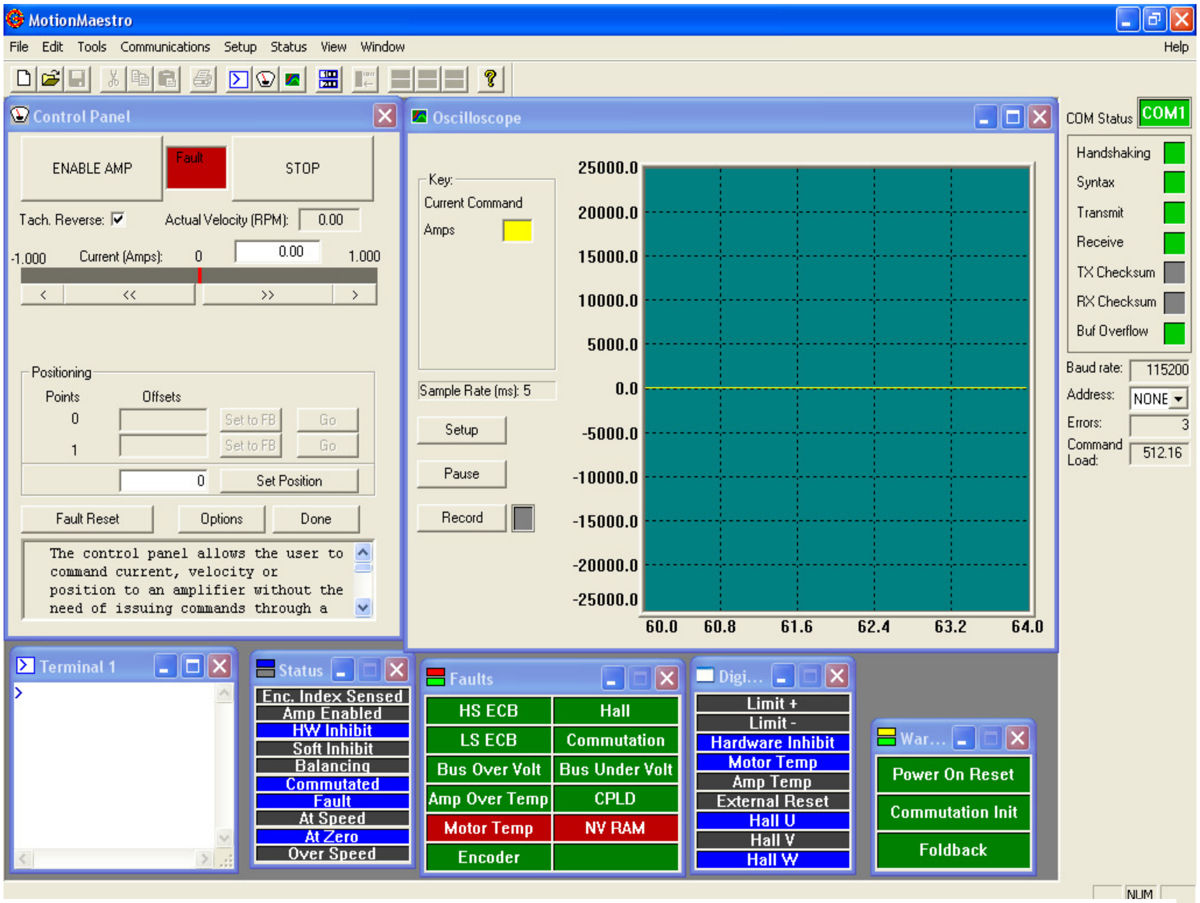
Click and select the check box next to Alpha Series (to distinguish from Omega Series protocol). Click to highlight "GtkNet Module", and click on "Open Link". When you press OK, MotionMaestro© will query the amplifier to determine what amplifier model is connected.



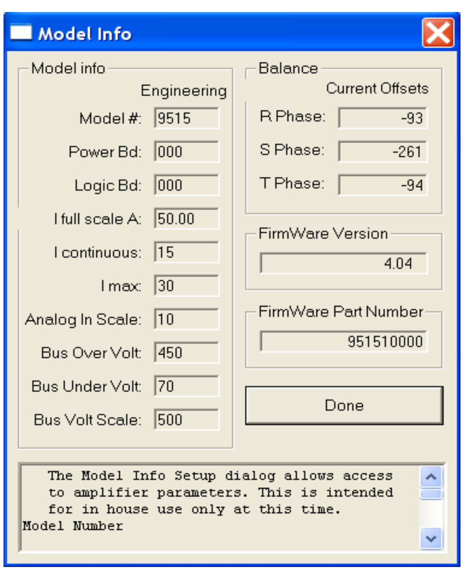
MotionMaestro's main window using

If communications is established, you should see a screen similar to the "MotionMaestro's main window using Ethernet" with all green communications status indicators.

Below, MotionMaestro's main window is shown where communications are successfully opened and various setup and monitoring screens are activated. These active screens do not necessarily need to remain within MotionMaestro's main window, they may reside anywhere on the Windows desktop.



MotionMaestro's Sever activated windows



Model Info Box

Model Information

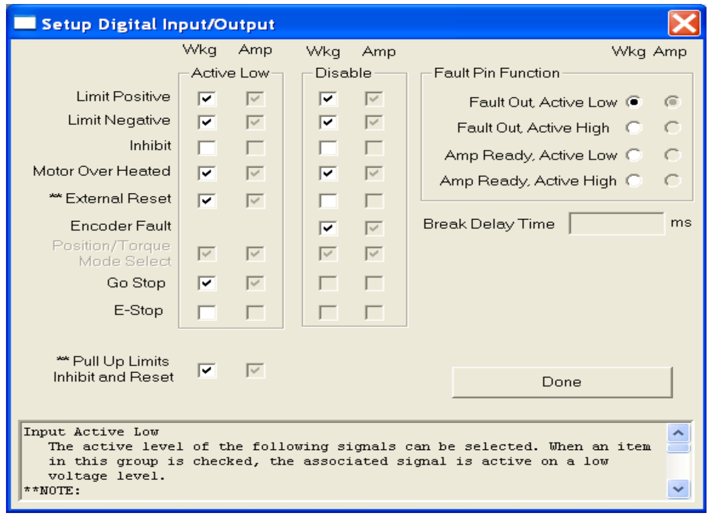
For informational purposes, you can refer to the Model Info dialog to view the design features and limits of the particular amplifier. To view this dialog, you must select the "Tools" option on MotionMaestro's© main menu tool bar, then select "Model Info".

Here you will be able to view your firmware version, amp model number, power board number and logic board number.

In addition, MotionMaestro's Model Info dialog window will display amplifier settings. For example, on the left these settings are current balance offsets, current feedback, continuous current and peak current settings. These settings, in addition to the Bus under-voltage and over-voltage settings, are useful informational tools and are required if the user performs his own scaling of amplifier values.

Digital I/O setup

The Digital I/O settings can be used to tailor the amplifier digital signal inputs to the requirements of your application. Failure to properly setup the Digital I/O signals may result in the amplifier powering up in a fault condition. (Or worse yet a reset condition). To view this dialog, select the "Setup" option on MotionMaestro's© main menu tool bar, then select "Digital IO...". Digital I/O signals can be active high or active low depending on the applications. The Motor Over Heated condition is a good example. From this window you can modify what state the amplifier considers to be a Motor Over Heated fault condition, either high or low.



Dialog box for setting digital I/O active level

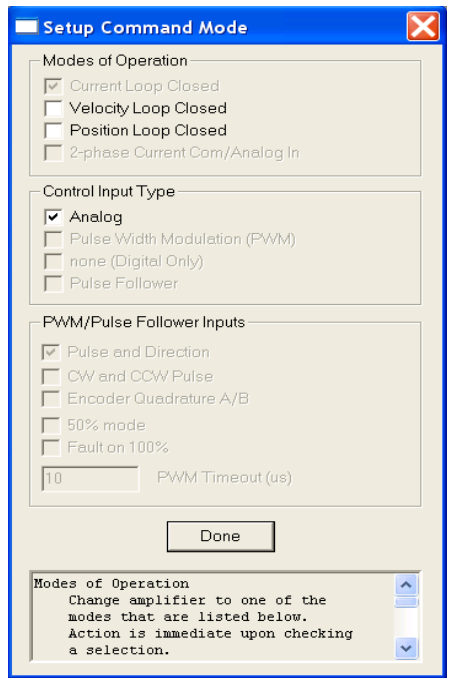
On this window there are two sets of checkboxes, for each signal, Wkg and Amp. Amp displays the current amp setting while Wkg displays the users choice. The amp is automatically updated as the Wkg box changes.

Amplifier Mode setup

The full featured amplifier can operate in either current or velocity mode. By selecting the "Setup Mode..." item on the "Setup" option menu, you can configure the amplifier to operate in desired mode.

MotionMaestro© uses the Mode setting to determine text and options on many of the dialog display windows. For example, when the Alpha series amplifiers are in current mode, parameters on the **Tuning** dialog pertaining to the velocity loop are not available.

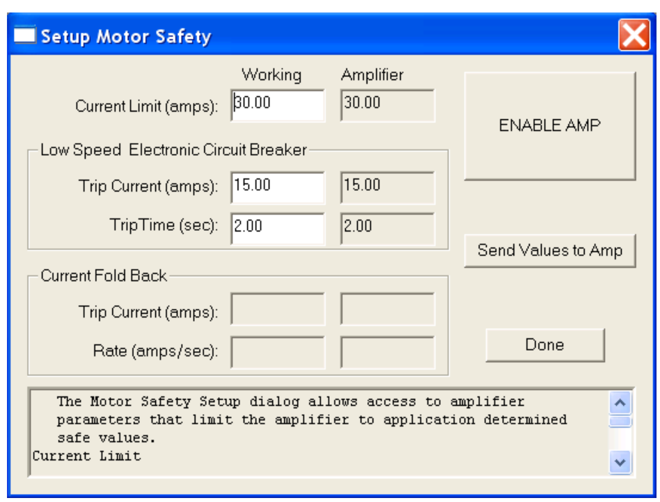
Engineering unit scaling used internally by MotionMaestro© is also adjusted to reflect proper units based on mode.



Dialog box for setting amplifier mode

Motor Safety setup

Motor safety is where limits to protect the motor are entered. The "Motor Safety Setup" dialog is available from the "Setup" menu. There are two sets of boxes, one labeled Working, the other Amplifier. Amplifier displays the current amp setting while Working displays the users selection. Here you can setup a maximum current limit, and low speed Motor safety is where limits to protect the motor are entered. In order to update the motor parameters in the amplifier, the amp must be disabled. You can do this by clicking on the "Disable/Enable Amp" button first, then the "Send Values To Amp" button. Pressing F1 displays the dialogs help text. After the values are sent to the amp, you may test the values by enabling the amplifier.

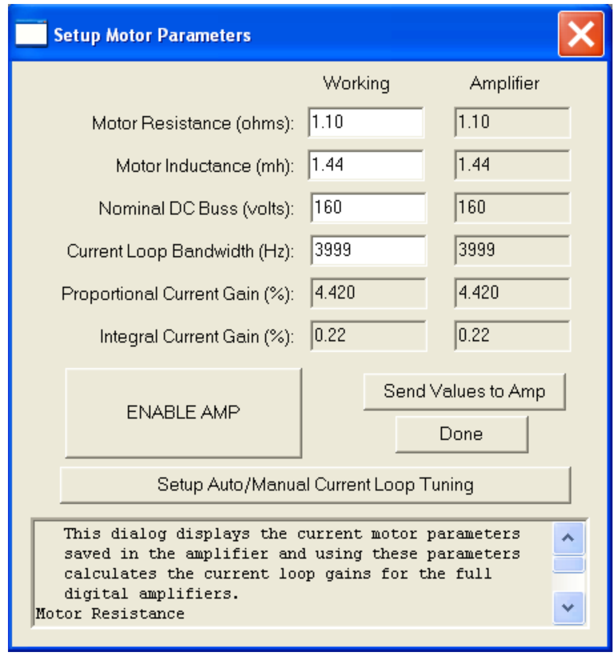


Dialog box for setting up motor safety parameters

Motor Parameters Setup

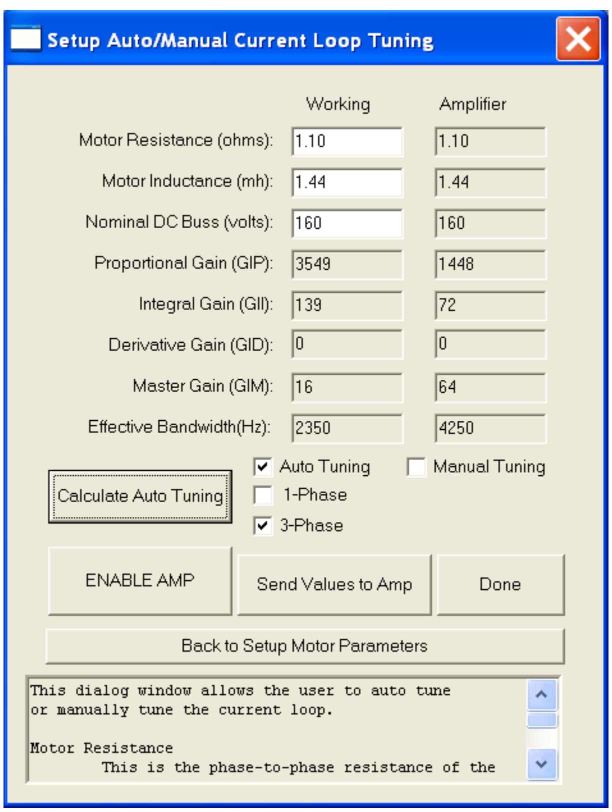
Note: Glentek recommends that you use the "Setup Motor Parameters" tuning, and only use the "Setup Auto/Manual Current Loop Tuning" window when you want some preliminary values to start with.

Select "Motor Parameters" on the "Setup" menu to activate the Motor Parameters dialog. The Motor Parameters dialog is used to set digital current loop gains. MotionMaestro© will calculate current loop gains based on the values entered. Select "Motor Parameters" on the "Setup" menu to activate this dialog.



Dialog box for entering motor parameters

Motor Resistance and Inductance are entered as phase to phase values. If these values are not indicated on the motor label, you can determine these values by measuring the resistance or inductance between two motor wires connecting two phases of the motor. Nominal DC bus voltage is the regulated bus voltage, 160 or 320 volts typically. Current loop bandwidth is a measure of the current loops responsiveness. Generally you want this to be as high as possible. A good starting point is 1500 Hz. In order to update the motor parameters in the amplifier, the amp must be disabled. You can do this by clicking on the "Disable/Enable Amp" button first then the "Send Values To Amp" button. Pressing F1 displays the dialogs help text.



Dialog box for entering motor and current loop auto/manual tuning parameters

Auto/Manual Current Loop Tuning Setup

Select "Setup Auto/Manual Current Loop Tuning" button on the "Setup Motor Parameters" window to activate this dialog.

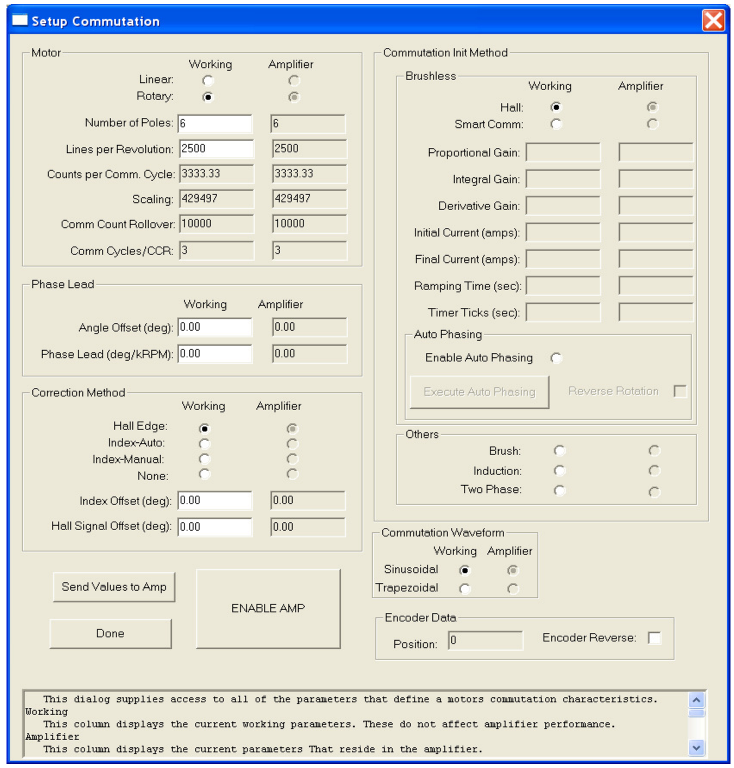
Motor Resistance, Inductance, and Nominal DC Buss voltage can be entered here if not already done so in the "Setup Motor Parameters" window. 1-Phase is selected when amplifier drives brush type DC motor or voice coil motor. 3-Phase is selected when amplifier drives 3 phase brushless motor.

There are two tuning methods that a user can choose. The auto tuning method is used to generate some preliminary values. In order to activate this method, Auto Tuning and motor type boxes are checked, then Calculate Auto Tuning button is depressed. The Proportional, Integral, Derivative, Master gains, and Effective Bandwith values are automatically calculated and optimized. You may also opt to use manual tuning method where the gains can be altered. In this mode, the Manual Tuning and motor type boxes are checked. Then all current loop gains may be adjusted and the new values send to the amplifier while viewing the current loop response with an oscilloscope or running a bode plot. For manual tuning setup information, refer to Current (Torque) Mode Tuning section of this manual.

Commutation Setup

The Commutation dialog window allows you to define a motor's commutation characteristics. Here you specify motor commutation parameters, correction and methods, and encoder positioning. In the motor section, most of the boxes are calculations based on your selected motor parameters. Select "Commutation…" on the "Setup" menu to activate the dialog on the right.

If Hall sensors or encoder commutation tracks are utilized, they need to be selected under "Commutation Method". Then, "Hall Edge" needs to be chosen as correction type. For information on Smart-Comm, refer to the Smart-Comm section in Appendix H. Finally, "Number of Poles" and "Lines per Revolution" need to be entered (Rotary). Selecting linear instead of rotary will display parameters that are specific to a linear motor.



Dialog box for setting up motor commutation

For additional information on edit box parameters, you may go to the help dialog at the bottom of the "Setup Commutation" window. You can scroll through the help dialog with the up or down arrows or press F1 to view the dialog help text in notepad.

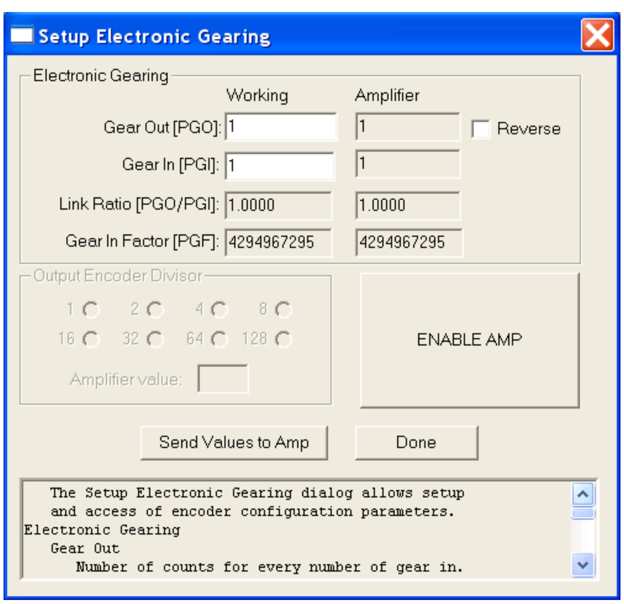
The working column represents modified values that are sent to the amplifier when clicking the "Send Values to Amp" button. In order to update the commutation values, the amp must be disabled. You can do this by clicking on the "Disable/Enable Amp" button.

Electronic Gearing Setup

To view the Encoder dialog window, you select the "Setup" option on MotionMaestro's© main menu tool bar, then select "Gearing/Encoders...". The encoder setup dialog allows configuring the gearing ratio for Pulse and Direction Position Mode Servo Amplifier. This window is only active or available when the amplifier is in "Position" mode.

"Gear Out" is the value of position counts that the motor would move for every number of gear in.

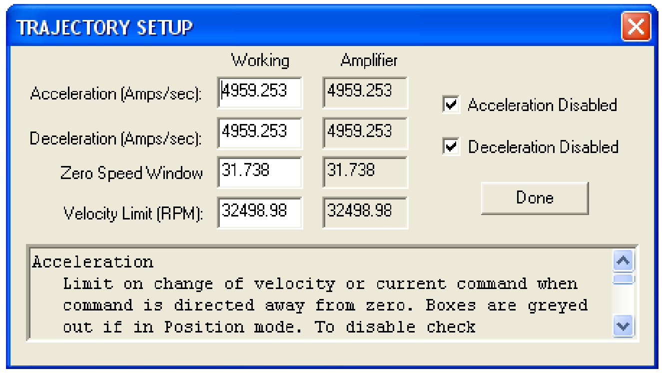
"Gear In" is the number of counts coming into the amplifier for every increment in the input position counter.



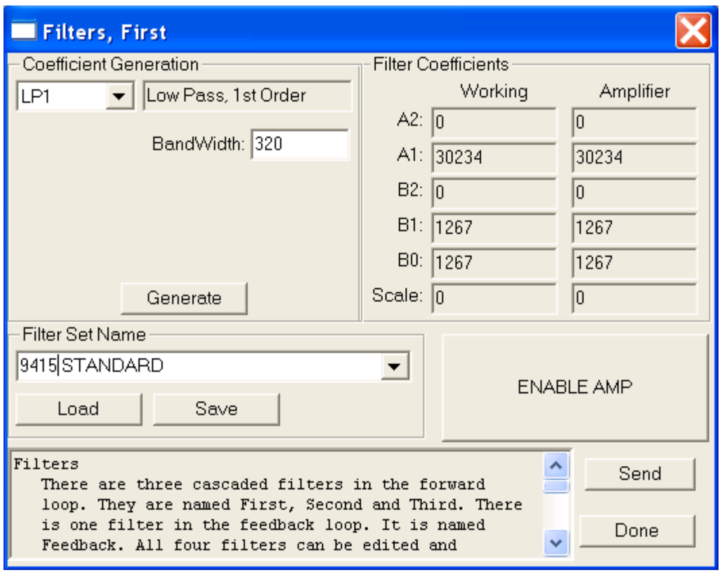
Gearing/Encoders Setup Dialog

Trajectory Generator Setup

The Trajectory setup dialog window will allow you to limit the change of velocity or current command. When command is directed away from zero it's "acceleration" or when directed toward zero it's "deceleration". If velocity is below the value in "Zero Speed Window", then the ZSW bit in system status register is set. "Velocity Limit" set the maximum velocity that a motor is allowed to achieve. You can view this dialog by selecting the "Setup" option on MotionMaestro's© main menu tool bar, then select "Trajectory Generator...".



Trajectory Setup Dialog



Filters Setup Dialog

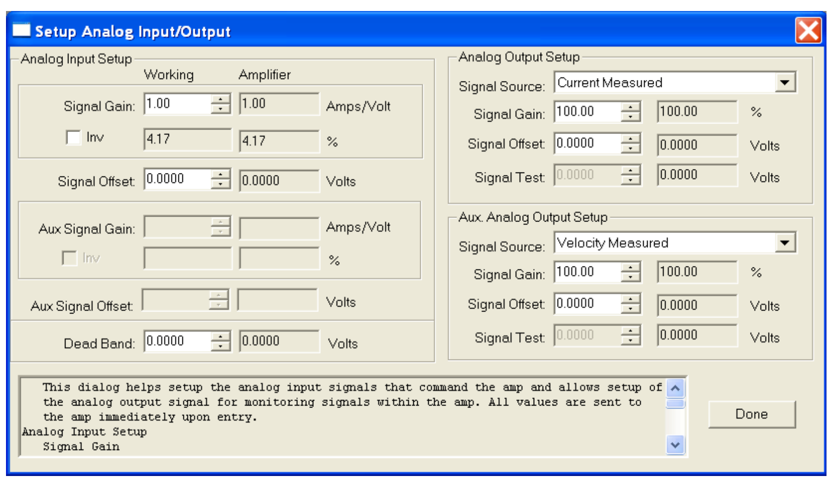
Filters Setup

To view the filter dialog window, select the "Setup" option on MotionMaestro's© main menu tool bar, then select "Filters...". At this point, select which of the four filters you would like to view/program. Three of the filters are cascaded filters in the forward loop and one is a filter in the encoder feedback loop. All four filters can be edited and displayed at the same time, but need to be opened one a time.

From these windows, MotionMaestro© allows you to enter values for defined filter equations. These equations were derived using the Tustin transform to convert variables in the frequency domain to coefficients for the digital domain equations. The first step in generating new coefficients is to select the type of filter desired., such as LL1, LP1,CLP1, etc. Once the type of filter is selected, the appropriate input edit boxes will be displayed.

Analog Input/Output Setup

The Analog Input/Output setup dialog window will allow you to setup the analog signal gains that command the amp and the analog output signals that monitor the status of the amp. The "Analog Input Setup" section on the left of the dialog window is amplifier mode dependent. For example, when the amplifier is in current mode, the signal gain is in Amps/Volt, and when the amplifier is in velocity mode, the signal gain is in RPM/Volt.

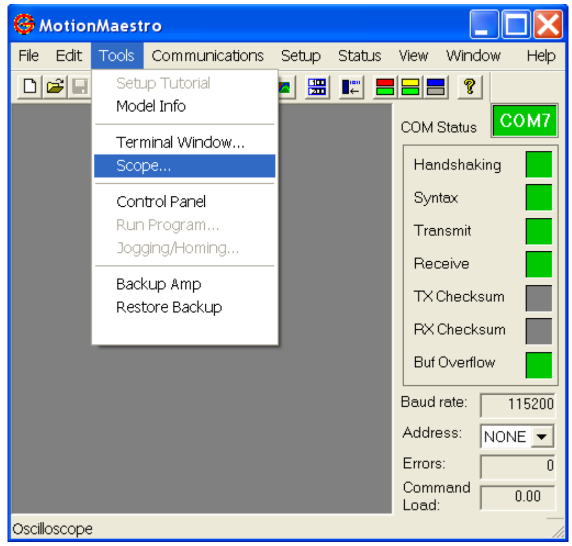


Dialog box for setting the analog input/output command signals

The "Analog Output Setup" section on the right of the dialog window allows setting up any signal to be monitor such as current or velocity of the motor, and the signal can be scaled higher or lower without affecting the signal input. One channel is default, and up to two (2) channels of different output sources can be monitor at the same time (need to specify when ordering).

Oscilloscope Setup

The Oscilloscope can either be accessed under the "Tools" option on MotionMaestro's© main menu or via a button on the toolbar.

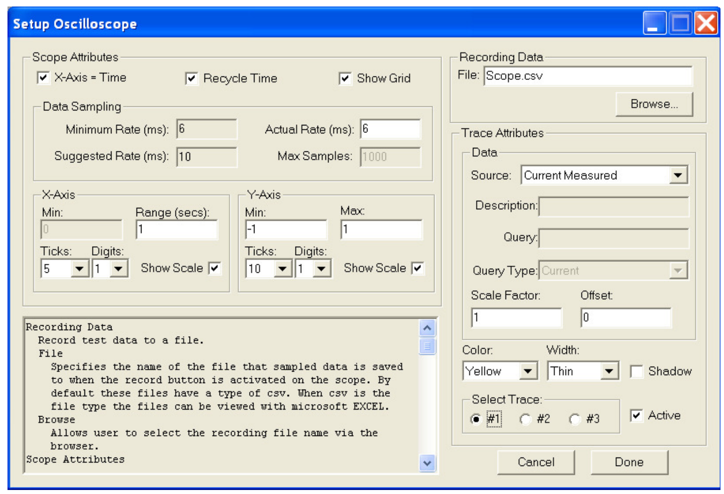


Scope in Tools tab

There is a "setup" window and a "trace display" window for the Oscilloscope. The Oscilloscope setup window provides for setup of the parameters needed to define the signals to be displayed on the Trace Window.

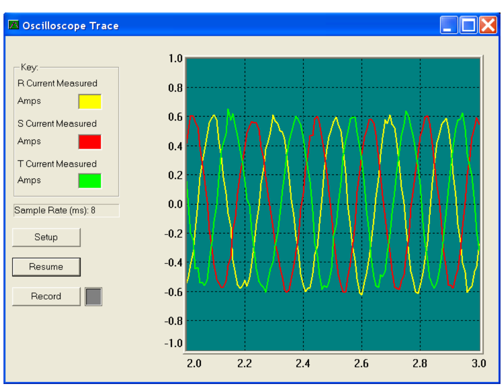
"Scope Attributes" define the X-Y attributes of the Trace display. An example is X-Axis = Time, this sets the units of the X axis to time. The range can be set for both the X and Y Axis, along with the data rate parameters.

"Trace Attributes" alters the data source and turns on/off different traces. You can monitor up to three traces at one time. All traces are color coded on the Oscilloscope Trace screen.



Oscilloscope Setup Screen

The Recording Data section is useful for recording test data to a file. The "File" specifies the name of the file that sampled data will be saved to when the record button is activated on the "Trace display" window. By default these files are saved as .csv file type. When .csv is the file type, the files can be viewed with Microsoft EXCEL.

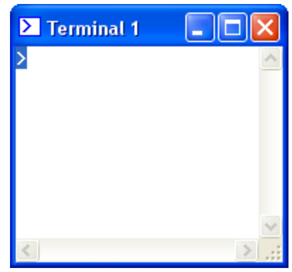


The Oscilloscope Trace display screen can display up to three active traces on the display. Each trace is color coded and labeled in the key. The sample rate is also displayed for convenience. The screen can be resized for versatility. Depressing the record button will allow you to record a portion of the trace waves. When record is activated a red light will be displayed near the button.

Oscilloscope Display Screen

Terminal Window

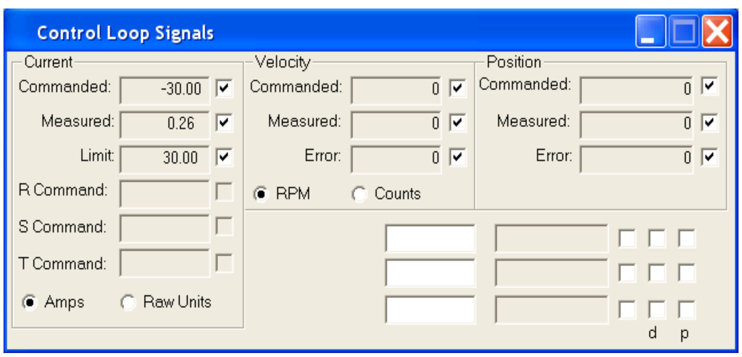
The Terminal Window can either be accessed under the "Tools" option on MotionMaestro's© main menu or via a button on the toolbar. The Terminal has direct communication to the amplifier. You can command the amplifier by typing commands to the terminal window. For example, typing BV then the enter key will send the request to read the Bus Voltage in the amplifier. If you wanted to change the Bus Voltage you would type BV200 then press enter. This would change the Bus Voltage to 200. Query command use just the ASCII letters of the command, where set commands use both Letters and a numerical value for an argument. **Caution** must be used when this window is activated due to the possibility of entering commands which would have undesirable effects.



Terminal Window

Amplifier Status

MotionMaestro© has a variety of status displays that assists the application engineer in setting up amplifier or diagnosing a amplifier setup. Rather than showing all possible status on one dialog, MotionMaestro© has been designed so that only those applicable to the situation at hand can be displayed. These dialogs continuously send queries to the amplifier to determine the amplifiers current status. The size and location of each status display is saved when exiting the display. When returning to the status the last size and position is used in positioning the window. F1 can be pressed to obtain help on the various items or status in the current dialog.



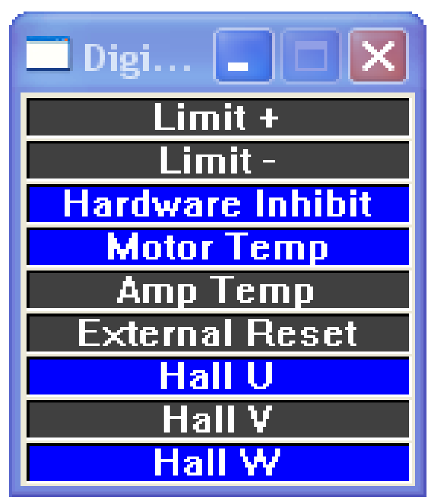
Dialog for observing control loop status

Control Loop Signals

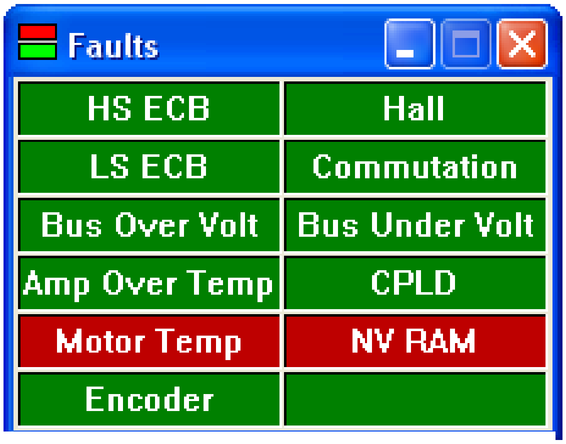
This dialog is useful for determining if an amplifier control loop is responding properly. Commanded and measured current can be displayed as well as the motors current velocity and position. Display this dialog by selecting "Status\Control Loop Signals..." or by utilizing MotionMaestro's toolbar.

Digital Inputs

This dialog indicates the state of digital inputs coming into the amplifier. Digital inputs are those inputs that can be characterized as being active or inactive. They are typically associated with one of the controller input and output signal pins. See the associated pin in the hardware section for a description of the digital input of interest. Display this dialog by selecting "Status\Inputs\Digital…" or by utilizing MotionMaestro's toolbar .



Status Display Digital inputs



Amplifier fault status display

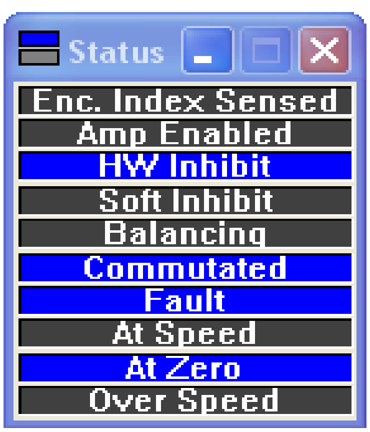
Faults

Faults occur on conditions that make it impossible to operate the amplifier in a safe and stable condition. When a fault condition occurs, the amplifier is disabled. The amplifier must be reset either with the hardware reset switch or with software (Control Panel dialog) or through the external reset pin. Conditions that cause faults are over currents, high or low bus voltages, excessive operating temperatures, and faulty sensors or amplifier hardware. An external fault can be generated by the controller through the /FAULT pin. See the hardware section for additional information on /FAULT. Display this dialog by selecting "Status\Faults " or by utilizing MotionMaestro's toolbar.

Warnings

A warning status indicates that the amplifier is fully operational, but that it is operating in an unusual mode or in a condition that warrants attention. Current fold back is such a condition. Display this dialog by selecting "Status\Warnings…" or by utilizing MotionMaestro's toolbar.

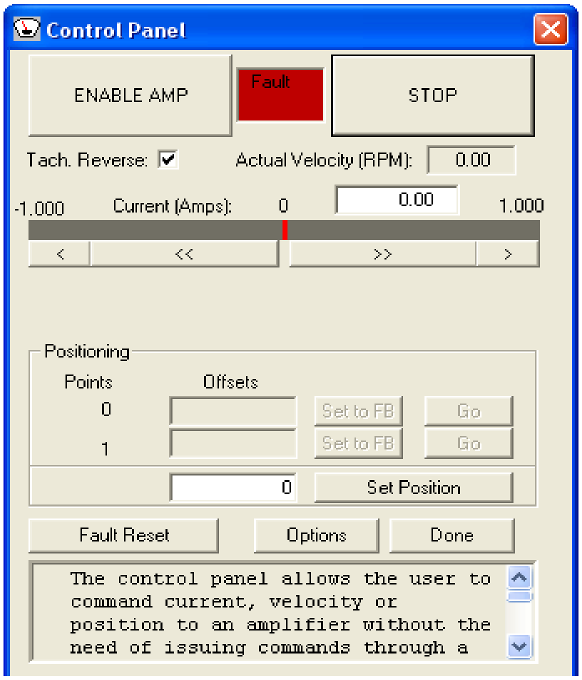
The Warning dialog



The System status display

Status

All other amplifier conditions that are not a fault or warning are displayed on the Status dialog. This status display is useful for diagnostics, setup or monitoring during operation. Display this dialog by selecting "Status\System Status…" or by utilizing MotionMaestro's toolbar.



The Control Panel display

Control Panel

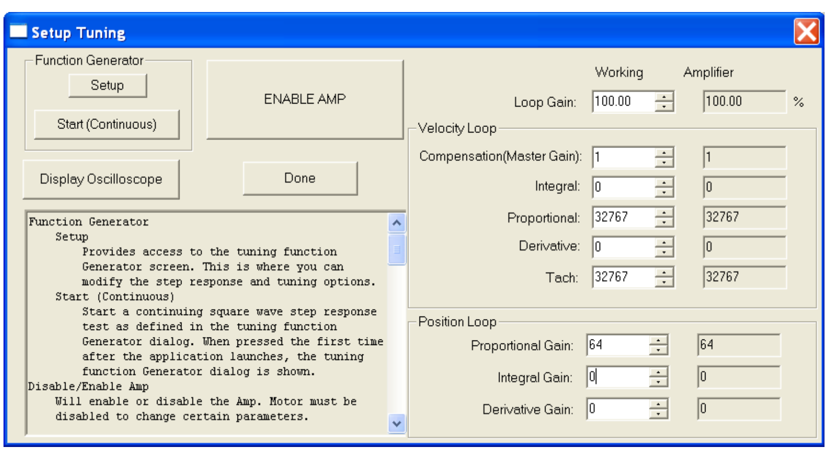
A properly connected motor can be controlled using the control panel. The control panel displays the amplifiers commanded current or velocity along with the motors actual velocity. From the control panel, you can easily command the motor. The control panel can be accessed through the “Tools” pull down menu or from the control panel icon on the tool bar.

You may set positioning offsets or an exact position by depressing the “Set Position” button. The Option button will allow you to set the maximum and minimum current, velocity, and position.

Motor Tuning

Fine tuning of motor control loop parameters is accomplished with the “Tuning” dialog. This dialog is accessed through the “Servo Tuning” item on the “Setup” menu.

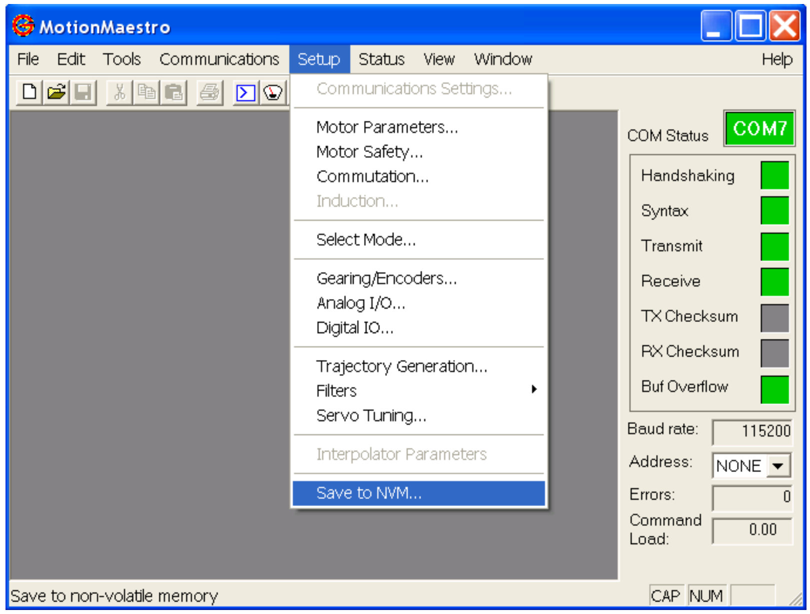
This dialog has many tools and features for tuning a motor. Real time motor velocity is always available. One can activate the motor with the “Continuous Step Response” button of the Function Generator. Then by viewing the response pattern on the scope you can see if changes to the tuning parameters improve or diminish performance. If in Velocity mode, velocity loop parameters can be altered. The Oscilloscope can query the amplifier down to a period of 2 milliseconds, which is adequate for most tuning requirements. The Tuning section describes in detail how a motor is tuned.



Dialog box for tuning the motor

Saving parameters to non-volatile memory

After a motor is configured and tuned to the applications satisfaction, the parameters must be saved to the amplifier's non-volatile memory. Upon power up or reset, the last saved parameters are loaded in the amplifier. The parameters can be saved to non-volatile memory by selecting the "Save to NVM…" option on the setup menu, as illustrated below.

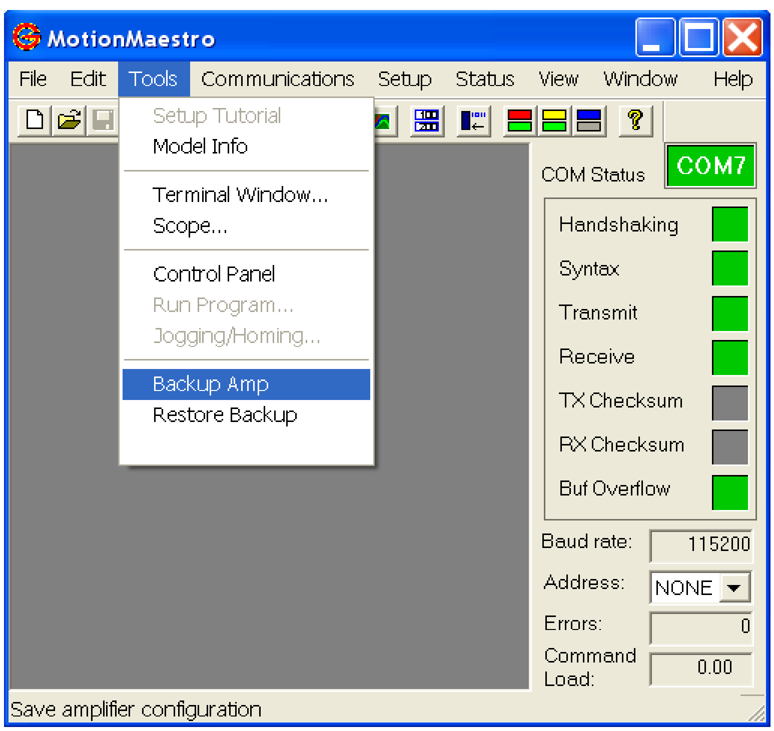


Saving parameters to amplifier non-volatile memory

Creating a back up copy of amplifier parameters on disk

An amplifier's current parameter settings can be saved to disk file that can later be used to configure another amplifier or to restore an amplifier's parameter settings. This is useful in production environments or where an application has several similar motors.

Select "Backup Amp" on the "Tools" menu to backup these parameters. You will be presented with a Windows style "Save File" dialog. Here you can give the file a meaningful name and location to save the file to. Restore backed up files to an amplifier with the "Restore Backup" selection.



Backing up amplifier parameters to a file on disk

Amplifier Connection Interface

This section describes the amplifier connections and how they are used in the typical application. Refer to the specific amplifier's installation drawing in Appendix K. This drawing indicates the location of the pins described below along with the location of the connector they can be found on.

Status Display

A 7-segment diagnostic LED display is provided for determining the general operating condition of the amplifier.

When Hall sensors are being used and the amp is operating normally, one of the outer six segments is lit for a three phase brushless motor. Each of the six outer segments represents one of the six Hall states in a commutation cycle of a motor. A commutation cycle consists of two poles. In an 8-pole motor the LED will cycle through its six outer segments 4 times for one revolution of a rotary motor. When Hall sensors are not being used the display will show a "0", all outer segments of the LED are lit. When the motors current is clamped, (i.e. held to zero), or the amplifier is in a fault condition, one of the following characters will be displayed as is appropriate to the fault or state.

Note: See Appendix B for more information on Amplifier status codes.

Controller Input and Output Signals

Signals that typically are connected to an external controller are described in this section. These signals include: the primary command signal interface to the amplifier, an encoder output signal, Go/Stop, E-Stop, inhibits, analog output, reset and common.

The following is a list and description of the possible controller I/O signals that can be found on an installation drawing. Each amplifier may have these on different types of connectors depending on the model that was ordered. It is important to refer to appendix A-K.

Signal	Description
SIGNAL 1	Command signal analog input 1, differential signal input.
ANALOG OUT 1	User configurable analog output 1.
ANALOG OUT 2	User configurable analog output 2.
GO/STOP	Activates/Deactivates Signal 1 input (custom configuration available).
E-STOP	Activates emergency stop routine.
INHIBIT	Inhibits the motor in both directions.
/FAULT	Active low fault, Output.
RESET IN	Resets latched faults.
RELAY OUT	Relay contacts close when spindle is "at speed" (custom configuration is available).
ENCODER A	Encoder A channel Output.
ENCODER B	Encoder B channel Output.
ENCODER Z	Encoder Z index Output (reference).
+ 5V	5 volt source positive (input or output is model dependent).

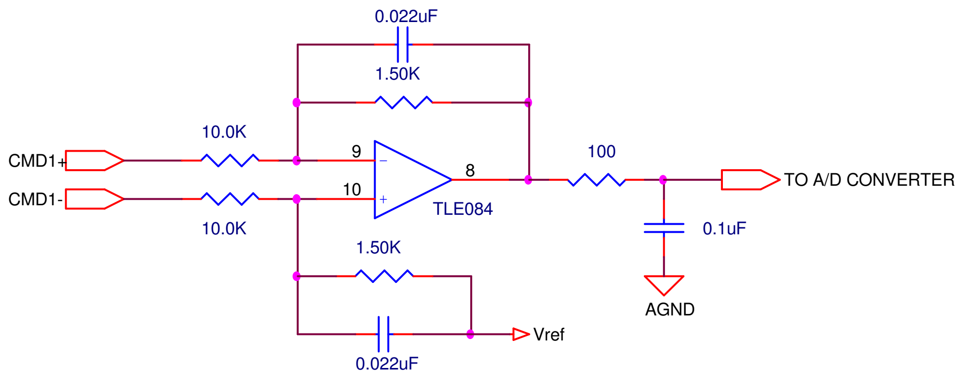
For the actual pin out of above signals, see Appendix A - Controller I/O Connector section.

Analog Input, Command Signal

Pins SIGNAL 1(+) and SIGNAL 1(-) are the command input pins. There is a primary and secondary command input. The command input takes a differential analog signal as referenced to the amplifiers' ground. Input voltage is expected to range from -10 volts to +10 volts (typical).

Note: Custom voltage ranges other than +/- 10 volts are available upon request.

The analog input stage is a difference amplifier with a differential input impedance of 20Kohm. If a single-ended input is desired, then Signal(-) should be connected to Signal common, and the command input should be connected to Signal(+). This will maintain the proper input gain for a +/-10V input range. In this configuration, the single-ended input impedance is 10Kohm. If the signal polarity is incorrect, the signal gain may be inverted in the software setup using MotionMaestro© (e.g., in "Setup Analog I/O" window, change "Signal Gain" to -300 RPM/Volt instead of +300 RPM/Volt).

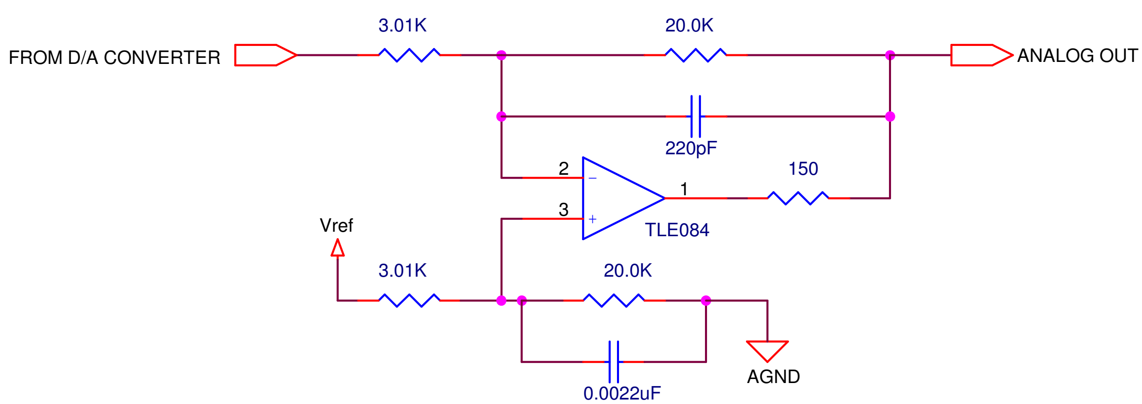


Command Signal Analog Input Schematic

Analog Outputs

There are up to two simultaneous analog output channels and each analog out is a user selectable analog output. The output ranges from -10 volts to +10 volts and has 12-bit resolution (16-bit resolution is available, specify when ordering).

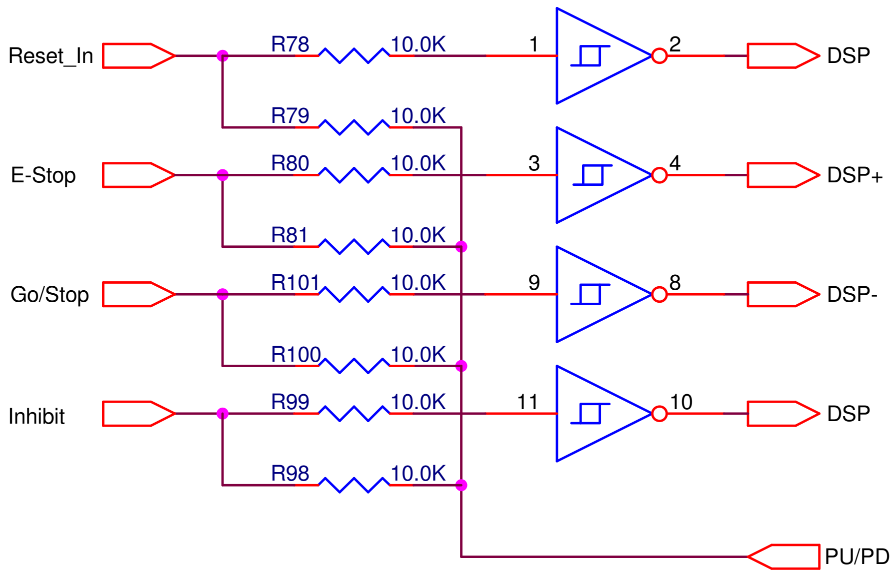
The analog output signals setup and usage can be found in the Motion Maestro Guide at www.Glentek.com. The analog output can be used to monitor amplifier signals at the servo update frequency. By doing so, the application engineer can determine the amplifiers true response to commanded signals. The analog output is for reference use only. It is not intended for control purposes. At power on, its value is undetermined until the power on reset has completed. During some amplifier functions, this output is temporarily disabled. These functions include saving and recalling parameters from non-volatile memory. The output is filtered to minimize the switching noise from the PWM amplifier.



Analog Output Schematic

Discrete Inputs

E-Stop, Go/Stop, Hardware Inhibit, and amplifier External Reset are all single ended discrete inputs using the following circuit.



Discrete Input Schematic

Amplifier Hardware Inhibit

An external discrete input is available for amplifier INHIBIT. When activated the amplifier is disabled. The display indicates C for clamped. The motor is free to rotate via externally applied forces. This pin can be configured as active high or low, (See Digital I/O Setup).

Amplifier Go/Stop

An external discrete input is available for amplifier Go/Stop. When activated the amplifier is not responding to command input. The motor is free to rotate via externally applied forces. This pin can be configured as active high or low, (See Digital I/O Setup).

Amplifier E-Stop

An external discrete input is available for amplifier E-Stop. When activated the amplifier is disabled. The display indicates C for clamped. The motor is free to rotate via externally applied forces. This pin can be configured as active high or low, (See Digital I/O Setup).

Amplifier Reset

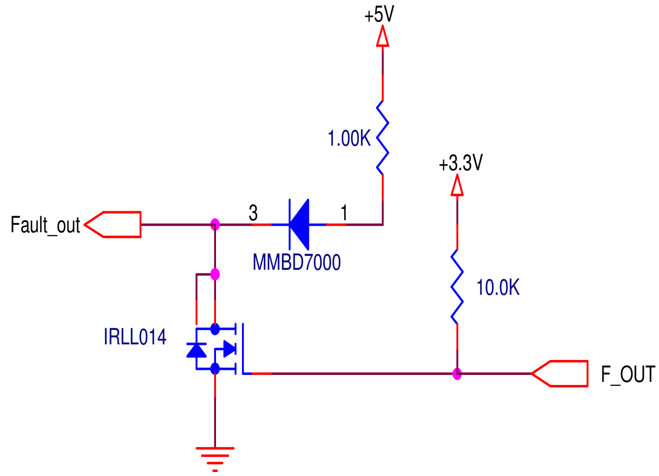
The amplifier can be externally commanded to reset with the RESET IN pin. This pin can be configured as active high or low. The amplifier displays 8, all seven segments lit, while in reset.

Relay Out

The relay closes, connecting the two relay out terminals when the spindle is “at speed”. Custom configuration is available.

Amplifier Fault Output

An external discrete fault output is available. This pin can be configured as either an active high or active low. The circuit below is used.



Fault Output Schematic

Power Input and Output Signals

The signal names for power are listed below:

Pin Name	Description
L1,L2,L3	Input - AC voltage (line 1, line 2, and line 3, respectively).
PE	Protective Earthing, Chassis GND.
PHASE T	Output - Motor phase T.
PHASE S	Output - Motor phase S.
PHASE R	Output - Motor phase R.

Input Power

All models rectify and filter the AC input to DC bus power. The SMB models derive the low voltage logic power internally from the DC bus power, the SMC models require an external 24-48VDC for logic power. External logic power facilitates “keep alive” machine designs.

Motor Power

Motor power is delivered at pins PHASE T, S and R. The motor power is Pulse Width Modulated signals used to drive the motor.

NOTE: It is best not to connect the motor power cable to the amplifier until it is established that the logic section is working and operational. One should be able to communicate with the amplifier via a serial cable and the motor encoder and Hall sensors should be functioning properly. This can all be determined without connecting the motor power cable.

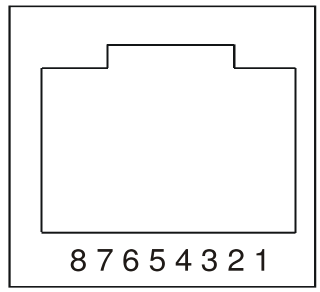
PC Interface

The PC interface can be found at the HOST connector. A RS-232 (or optional RS-485/422) interface is on the external of the amplifier. This port is the primary means of communication with the amplifier for setup and control. The port utilizes an RJ-45 type connector.

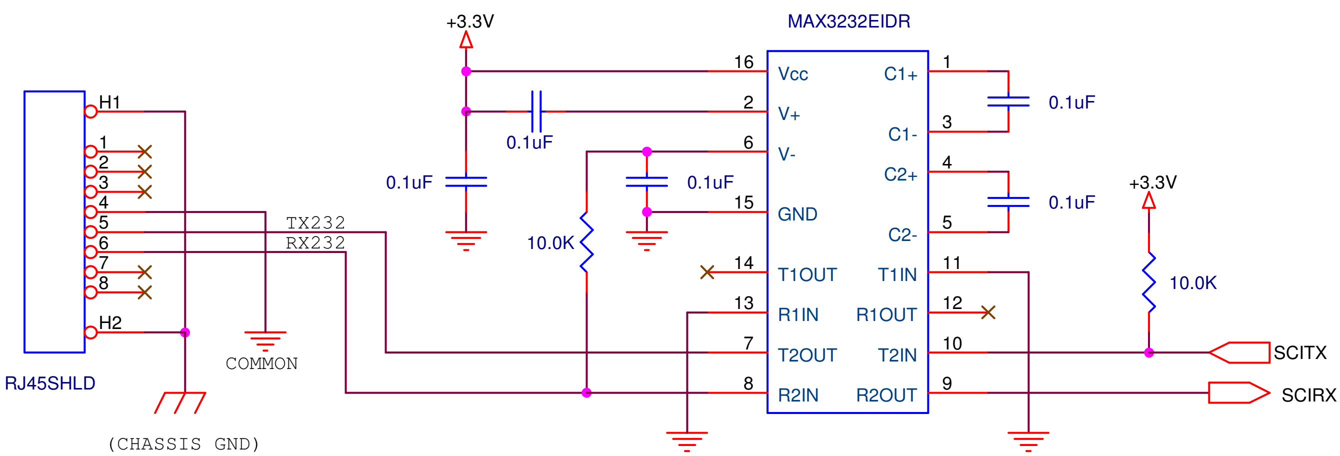
The serial cable can be made or purchased for communicating with a PC by configuring a cable with one end being a male RJ-45 plug and the other end being a DB-9 female connector. Remember that there is no standard for an RS-485 connector.

The pin-out names for the RJ-45 connector on the amplifier is shown below. A cable wired to a DB-9 connector, as shown below, will work with most RS-232 connections. RS-485 wiring depends on the pin-out of the RS-485 card communicating with the amplifier.

DB-9 pins Female		RJ-45 pins Male	AMP Pin description
6	<------------>	1	485 RX+
1	<------------>	2	485 RX -
4	<------------>	3	n/c
5	<------------>	4 *	COMMON
2	<------------>	5 *	232 TX
3	<------------>	6 *	232 RX
8	<------------>	7	485 TX+
9	<------------>	8	485 TX-
….7			n/c



Female RJ45 pin-out



RS-232 Input Schematic

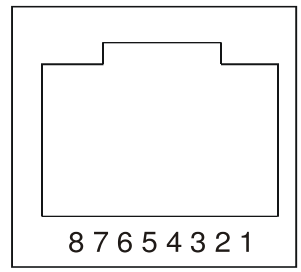
NOTE: RS-232 requires connecting only the 3 pins marked with an asterisk above. If required, Glentek can customize a serial port digital interface to adapt to your controller as required to meet your protocols. We are currently doing this for high speed Ethernet ports.

CANopen Interface

The CANopen interface can be found at the HOST. Glentek Alpha Series drives employ CANopen protocol that is based on the CAN Physical Layer as standardizes in the CAN in Automation (CiA) standard DS-301 V4.02.
This port is the primary means of communication with the CANopen network for real-time control. The port utilizes an RJ45 type connector.

The CANopen cable can be made or purchased for communicating with a CANopen network. The pin-out for the R-J45 connector on the amplifier is shown below.

RJ-45 pins	Pin description
1	CAN High (Dominant High)
2	CAN Low (Dominant Low)
3	Reserved
4	CAN Ground (Common)
5	Reserved
6	Reserved
7	Reserved
8	Reserved



Female RJ45 pin-out

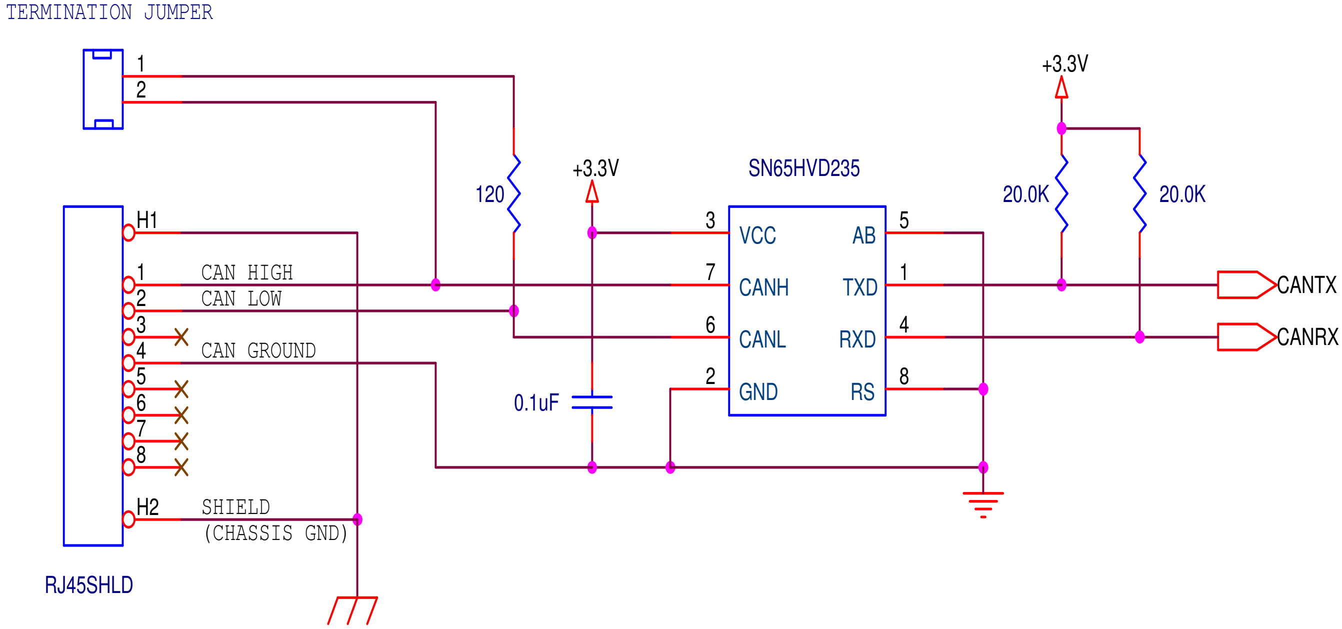
NOTE: CANopen requires connecting only the 3 pins. If required, Glentek can customize a serial port digital interface to adapt to your controller as required to meet your protocols. We are currently doing this for high speed Ethernet ports.

The rate of data transmission (bit rate) depends on the total overall length of the bus and the delays associated with the transceivers. Under normal conditions, all the devices in a system transfer at uniform and fixed bit-rates. The CANopen bus must be terminated at both ends so that reflections of signals are avoided. A 120 ohms termination resistor is required at the last amplifier node in the CANopen network. This resistor is provided inside the amplifier for convenience. The amplifier is terminated by placing a two pin micro-shunt jumper across the termination jumper connector. The following bit rate is capable to be achieved at the indicated total system bus length:

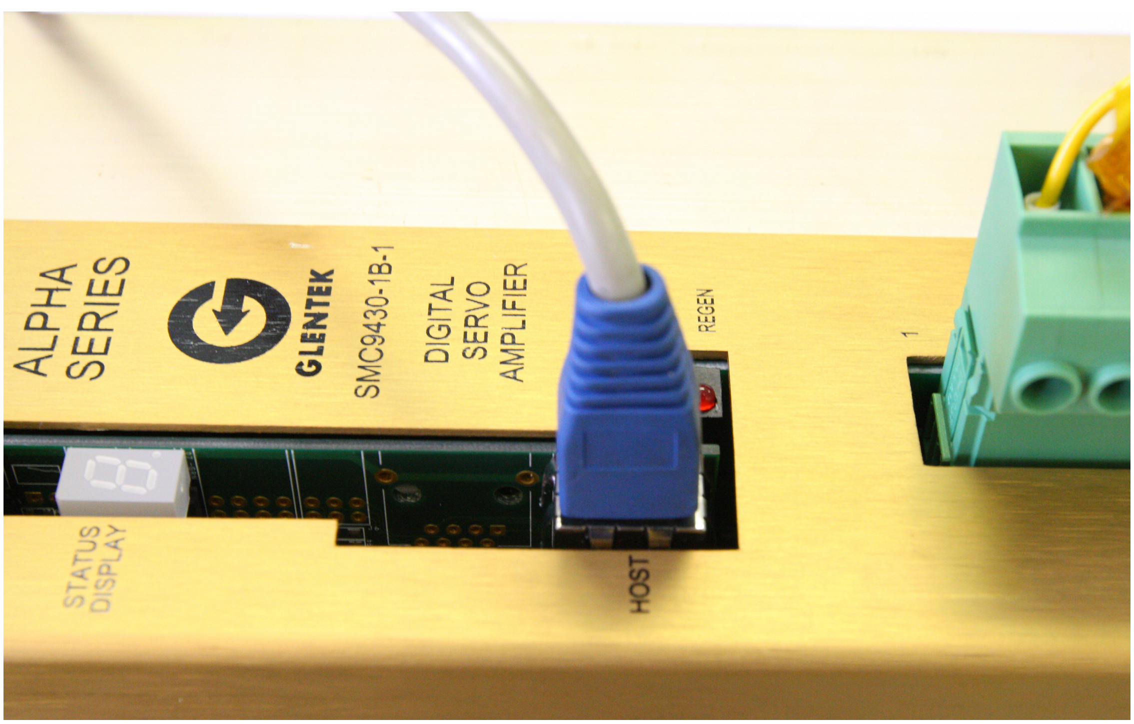
- 1 M bits per second at 25 meters (82 ft)
- 800 K bits per second at 50 meters (164 ft)
- 500 K bits per second at 100 meters (328 ft)
- 250 K bits per second at 250 meters (820 ft)
- 125 K bits per second at 500 meters (1640 ft)
- 50 K bits per second at 1000 meters (3280 ft)
- 20 K bits per second at 2500 meters (8200 ft)

The CANopen BAUD rates are programmable in all Glentek Alpha Series amplifiers. Refer to CANopen Installation and Operation Manual for more information.

All Glentek Alpha Series CANopen spindle amplifiers are provided with two RJ-45 ports to facilitate chaining multiple spindle amplifiers together. Either ports can be used as input or output. The signals are simply passed through the amplifier so that in the event of one servo amplifier node is down (power is off), the rest of the nodes on the CANopen network still operate.



CANopen Input Schematic



Communication cable connected to spindle amplifier

Motor Feedback

The following pin description defines the main encoder input port.

Signal	Description
+5V	Amplifier supplied 5 volt source (output)
ENCODER A	Encoder A channel input
ENCODER B	Encoder B channel input
ENCODER Z	Encoder Z channel input
HALL 1	Hall sensor 1 input
HALL 2	Hall sensor 2 input
HALL 3	Hall sensor 3 input
MTR TEMP	Motor over temperature switch input

Encoder Power, Amplifier Supplied

The amplifier can supply 5 volts of encoder power. It is accessible at the +5V pin. The source is rated at 150ma.

Encoder Channels A, B and Z

The encoder input uses a DS26LV32 differential line receivers. An encoder edge is considered valid if it holds a single state for three full encoder clock cycles. The amplifier accept nominal encoder frequency of 5 MHz (maximum frequency of up to 10 MHz is possible, but is system dependent).

The Z channel is edge sensitive such that swapping Z and Z* does not change the behavior of the amplifier.

Hall Channels 1, 2 and 3

The Hall input uses a DS26LV32 differential line receiver inputs. Compatible with differential or single-ended commutation tracks or Hall sensors. Single-ended connections should be made to the "+" input while leaving the "-" input unconnected.

Power-on phase-finding or Smart-Comm routines available for operation without commutation tracks or Hall sensors.

External Event Fault

The amplifier can be faulted on an external event with the MOTOR TEMP (motor over-temperature) pin. This pin can be configured as active high or low. The amplifier displays lower case “h” when this signal is active, latches the fault and disables the amplifier.

Reset

A reset clears all faults, resets the DSP and initializes the amplifier. All the Alpha Series amplifiers can be externally reset through the amplifier’s Controller I/O port (RESET IN pin). In addition, the SMX94XX amplifiers have an additional push button switch to performs a reset.

Connecting The Amplifier To The Motor

This section outlines how to connect an amplifier to a motor. In this section, you will connect your PC serial port to the amplifier establishing communication with the amplifier. After you have completed this, you will be ready to tune the amplifier.

External Wiring of The Amplifier

Serial Port

Purchase or manufacture a serial cable as described in the PC Interface section. The default serial port settings are:

Baud rate:	115200
Data bits:	8
Parity:	None
Stop bits:	1
Flow control:	None

Connect Host Computer that has your terminal software installed to Amplifier by using a Glentek made cable (Glentek P/N GC2400-AL005AM-000).

NOTE: GC2400-AL005AM-000 is a female DB-9 on one end and RJ45 on the other end. In case that the Host Computer only has USB ports, a USB to RS-232 adapter (Glentek P/N GC2410-001) is needed in addition to the Host cable. There are two industry standard adapters that Glentek had tested and known to be good that you may purchase. One is from USBGEAR P/N: USBG-232, and the other one is FUTURE TECHNOLOGY DEVICES INTERNATIONAL P/N: US232R-10. Make sure to use cable with shortest length possible (6 feet or less) as longer length cable will degrade and slow down the data rate between the Host Computer and Amplifier.

Encoder and Hall

Manufacture a motor feedback cable that will be connected to the motor feedback port. Use the pin out description under Motor Feedback in Appendix A and the installation drawings in Appendix K as a guide.

For the encoder, wire differential channels A, B and Z to the matching amplifier pins. Wire the encoder +5 volt to pin +5VDC (ENC PWR). Wire the encoder ground to a COMMON pin.

Hall sensor wires should be wired to their matching amplifier pins HALL 1+, HALL 2+ and HALL 3+. A rotation of the motor should activate Hall U, V and W sequentially. Ensure that 5 volts and ground are provided to the Hall sensors through either an external 5 Volts or from the amplifiers +5V pin. If encoder power is supplied from amplifiers +5V pin, make sure that the encoder’s current draw is less than the current rating of the +5V pin. (Less than 150 mA)

IMPORTANT: Use proper shielding for the motor feedback cable. Tie amplifier chassis to encoder/ Hall cable shield, and tie cable shield to motor case.

Applying Power

For this test, be sure that the encoder is connected and the motor power cable is not connected.

Testing of the amplifier communication with your PC requires that only logic power be turned on at the amplifier. Depending on the model amplifier you have, you will have to do one of the following:

1. Apply 24-48VDC keep alive logic power (for SMC models).
2. Apply AC power to L1, L2, and L3 (for SMB models).

Note: After the logic power is turned on, the LED status display will light indicating that the amplifier logic is powered.

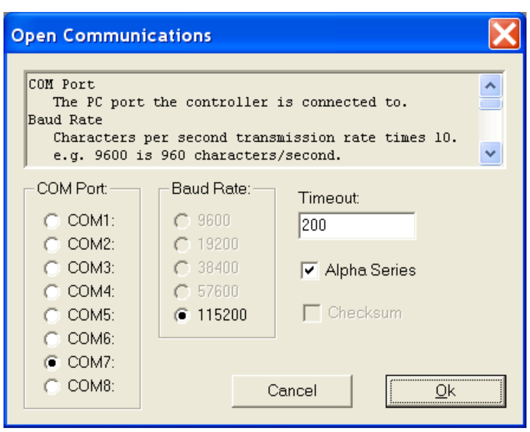
Amplifier Tuning

Glentek's digital servo amplifiers are tuned utilizing our proprietary motion control software, Motion-Maestro©. Tuning is a process where coefficients of the servo amplifier's internal equations are optimized to match the motor and the inertial load of the system it is driving. It is important to achieve a high gain, high bandwidth, critically damped velocity loop.

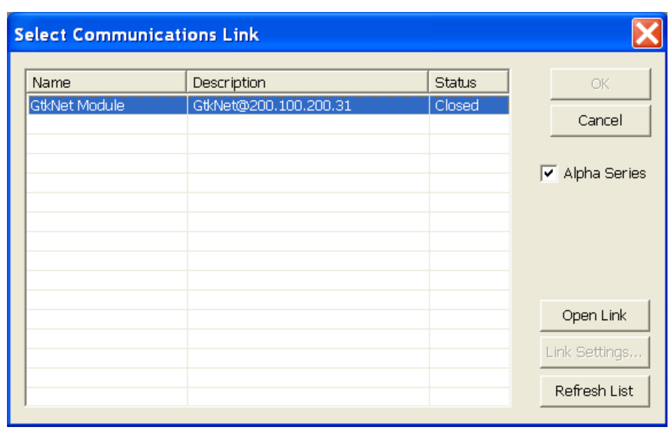
Parameter Setup

Depending on the motor used, new parameters may need to be set for the amplifier to properly drive the motor. When any parameters are changed it is necessary to send these changes to the amplifier. Then it is very important to save to non-volatile memory to make certain that the amplifier has the same parameters that were changed. If chose to use factory default values, these steps can be skipped.

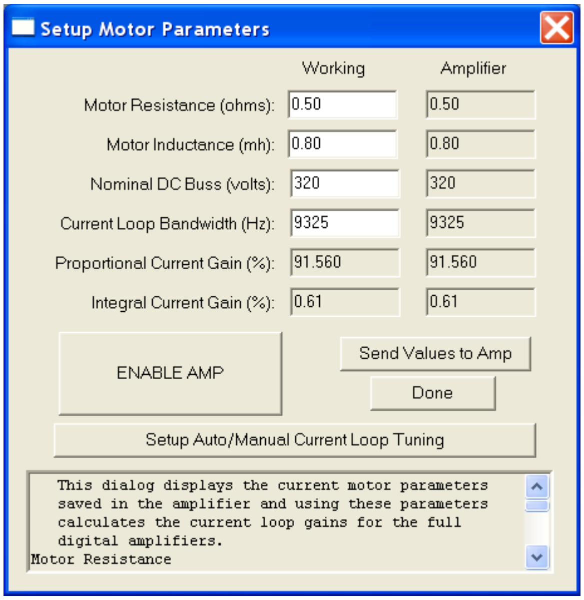
1. Start MotionMaestro©, establish communication with the amplifier in one of two methods below:
   a. Communications>Open> [select "Alpha Series", proper COM port, and ensure that a baud rate of 115200 is selected when communication method is by RS-232/USB, and then click "OK".]
   b. Communications>Open> [select "Alpha Series", click to highlight "GtkNet Module", click on "Open Link" when communication method is by Ethernet with Communication Module CM998-1, and then click "OK".]



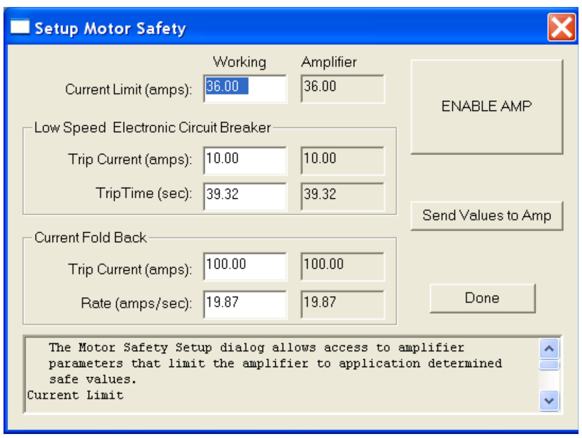
Open Communications dialog box using RS-232/USB between Host computer to amplifier



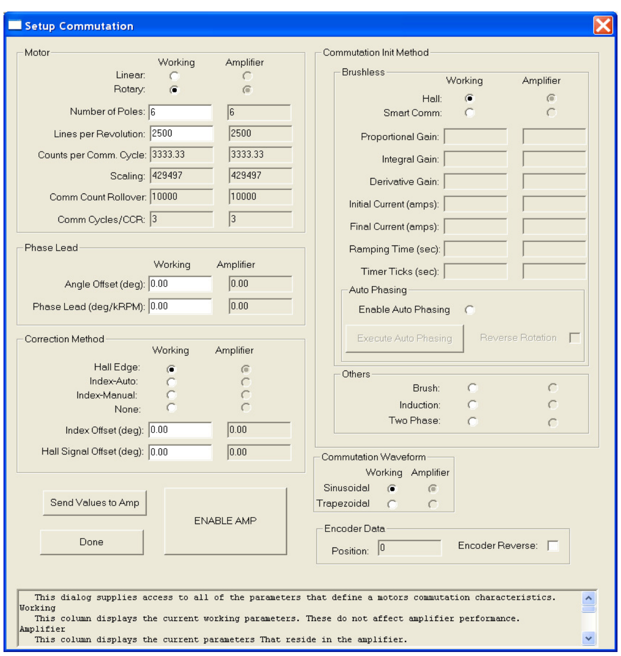
Open Communications dialog box using Ethernet between Host computer to amplifier via Communication Module CM998-1



Dialog box for entering motor parameters



Dialog box for setting up motor safety parameters



Dialog box for setting up motor commutation

2. In the menu bar, click on Setup>Motor Parameters… to enter the "Setup Motor Parameters" dialog. It is very important that motor values entered into **MotionMaestro**© match those of the motor you are driving. Enter the motor resistance, Inductance, the bus voltage and the current loop bandwidth desired, a good starting point is 1500 Hz. Disable the amp, if it is not already, and send the parameters to the amplifier.

NOTE: The Motor Resistance is the phase-to-phase resistance of the motor internal resistance and externally connected inductor. The Motor Inductance is the phase-to-phase inductance of the motor internal inductance and externally connected inductor. In simplicity, the values entered is the values measured across any two motor phases/leads before connected to the amplifier.

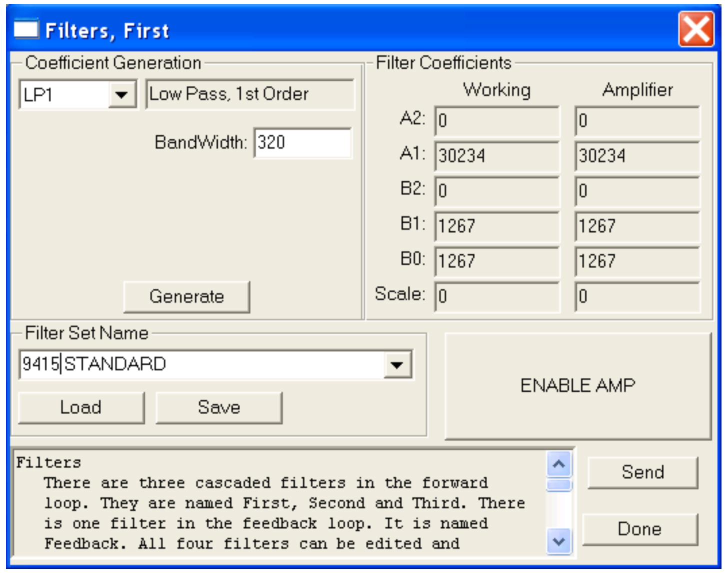
3. In the menu bar, click on Setup>Motor Safety… to enter the "Setup\Motor Safety" dialog. Set the Current limit to the rated peak current of the motor or the peak current of the amplifier, whichever is smaller. Set the Electronic Circuit Breaker (ECB) value. The low speed ECB protects the motor and amplifier from conditions when the current remains at the current limit for excessive periods of time. Set the LS/ECB threshold to the maximum continuous current of the motor or amplifier, whichever is smaller. Start with a 2 to 4 second filter time. Disable the amp, if it is not already, and send the parameters to the amplifier.

NOTE: If chose to use factory default values, this step can be skipped.

4. In the menu bar, click on Setup>Commutation... to enter the "Setup\Commutation" dialog. Configure the amplifiers commutation characteristics as indicated on the dialog. For rotary motors, enter the number of line counts per revolution, not the number of quadrature counts per revolution, which is always four times the line counts. This should be found on the encoder nameplate (if lines per revolution and number of poles are not documented for the motor (See appendix E "Determining Encoder Resolution and Number of Poles"). This number will need to be derived if linear scales are used. Select an appropriate commutation initialization method. See Appendix H "Amplifier Terms and Technology" for details. Disable the amp, if it is not already, and send the parameters to the amplifier. Please consult with Glentek for Hall only mode setups.

5. In the menu bar, click on Setup>Filters… to enter the "Setup\Filters" dialog. Start with Filter 1 and set with an initial value 250 Hz LP1 (Low Pass Filter), Filter 2 and Filter 3 at "NONE", no filter. Set Feedback Filter with an initial value of 24 Hz LP1 (Low Pass Filter). Send the new parameters to the amplifier.

   NOTE: At every filter selection, make sure to click on the "Generate" button every time a new "Bandwidth" value is entered to generate new coefficient values. New filter coefficients are not sent to the amplifier until the amplifier is disabled and by clicking on the "Send" button.



Filters Setup Dialog

6. In the menu bar, click on Setup>Select Mode… to enter the "Setup Command Mode" dialog.

7. Verify that the amplifier is configured for Current mode only (selected by default and can not be unchecked).

8. At this point you may want to save the parameters in non-volatile memory. Select "Setup\Save to NVM" from the menu bar. (**MotionMaestro**©: Setup > Save to NVM…)

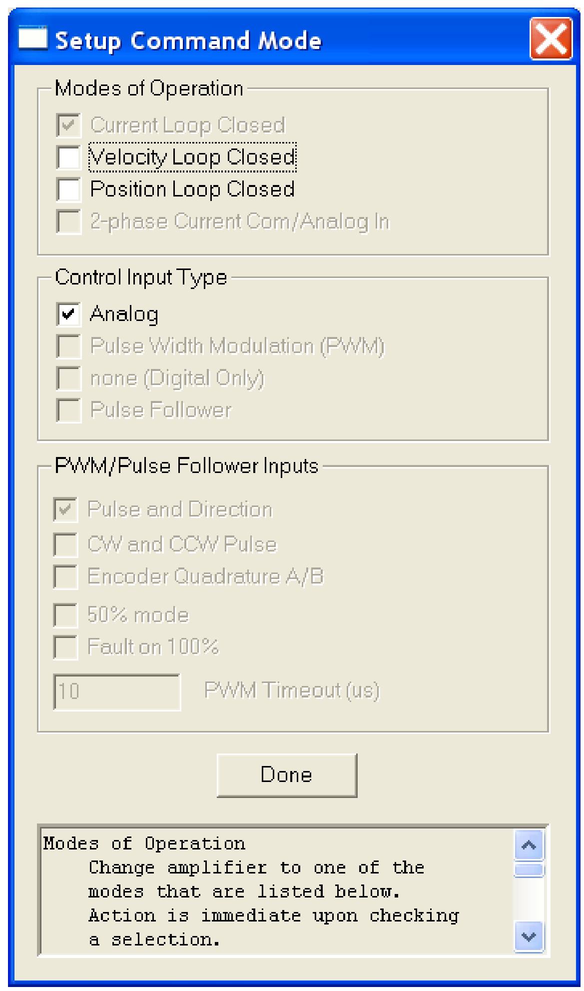
9. You may also choose to save the current parameters in the amplifier by saving them to hard disk. Select "Tools\Backup Amp" from the menu bar.

10. Turn off all power to the amplifier and connect the motor leads to the amplifier.

    NOTE: Check that AC Power is off and that there is no load on the motor. Make sure to wait for at least 30 seconds or until the DC BUS capacitor voltage is fully bleed off (LED is off) before turning the voltage back on.

11. First turn on Logic Power, then the AC Power.

    NOTE: If you are using the motors from the third parties (non-Glentek motors), you must make sure that the motor phasing and the hall sensor phasing are matching with the Glentek's servo drives. Please refer to Appendices A and D for more detail. Once you find the correct phasing, turn the Bus power off, connect the motor leads to the drive and proceed to the next step.



Setup Command Mode Dialog

12. You may now begin tuning your system to run in Current (Torque) mode or Velocity (RPM) mode.

Current (Torque) Mode Tuning

Tuning is a process where coefficients of the servo amplifier's internal equations are optimized to match the motor and the inertial load of the system it is driving.

NOTE: This section is carried out only if the proper motor phases are identified. If motor phases are unknown, please refer to Appendix D for information on how to find and identify motor phases. The Glentek 7156 Spindle amplifier is already installed with all the optimized parameters before shipping so that there should be minimum adjustments required. By default, all amplifiers shipped for the very first time are configured for running in Current mode (this is to prevent motor locking up or running away during initial setup).

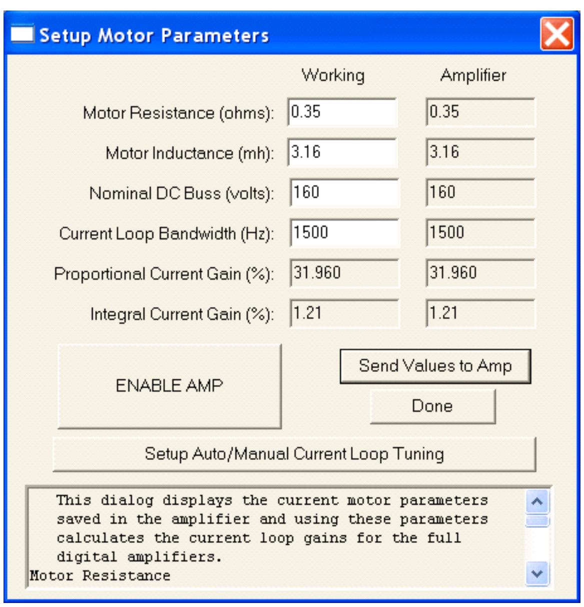
To enable the amplifier, tied the GO/STOP pin (pin12 of the Controller I/O connector on the amplifier or Red wire of the GC2600 cable), the E-STOP pin (pin13 of the Controller I/O or White wire of the GC2600 cable), and the +5V (pin16 of the Controller I/O or Red wire of the GC2600 cable) together. There are multiple Red wires in the GC2600 cable, make sure to ohm out for the correct Red wire.

1. To set up the Current Loop manually, in the menu bar click on Setup>Motor Parameters…, then click to select "Setup Auto/Manual Current Loop Tuning".

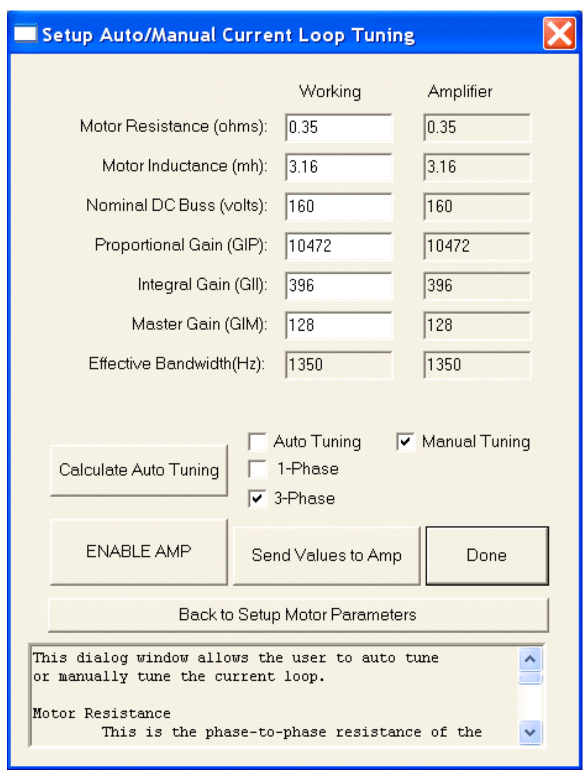
   NOTE: Manually tuning the Current Loop is not necessary. This procedure is needed only if the motor inductance is less than 1 mH, or the Current Loop bandwidth is very critical.

2. First, enter the motor resistance and the motor inductance at "Motor Resistance (ohms)", and "Motor Inductance (mh)", respectively. You may also enter the operating voltage at "Nominal DC Bus (volts)", and specify 1500 Hz as a starting point in "Effective Bandwidth (Hz)".

3. Then, adjust GIP, GII and GIM to obtain the desired response.



Setup Motor Parameters Dialog



Setup Motor Parameters Manually or Automatically Dialog

3. First, increase the Proportional Gain (GIP) to as high as you can until the motor starts making audible sound. Then, back down (decrease) the GIP gain to about eighty (80) percent of the current value. In most cases, increasing GIP value should tune the amplifier to the application. Maximum GIP gain value is 32,767. In addition, the Master Gain (GIM) can also be increased at the same time to reduce overshoot and to achieve a critically damped response. GIM gain is integer. The overall gain is (GIP ÷ 32,767) * GIM. In other words, keep GIP as high as possible, then adjust GIM to get maximum computation resolution.

4. Next, Integral Gain (GII) may be increased to achieve desired response. For most application, the GII gain never gets more than ten (10) percent of GIP. Therefore, do not add too much as system may become unstable (motor makes audible sound).

5. Save setting to NVM by click on Setup>Save to NVM… in the menu bar.

6. In the menu bar, click on Setup > Select Mode… to enter Setup Command Mode window.

7. Verify that “Current Loop Closed” (selected by default, and can not be deselected) is the only item checked under “Modes of Operation”.

8. Select Tools>Control Panel in Menu Tool Bar of Motion Maestro to display the control interface.

9. Apply one amps command (or until the motor starts to move slowly) by entering in the box right below “Actual Velocity (RPM)” box. Alternately, you can click on any portion of the slider right below the “Current (Amps)” label to issue a current command.

10. While the motor is moving, verify that the velocity reading in “Actual Velocity (RPM)” displays positive number for a positive current command and negative number for a negative current command.

11. If the “Actual Velocity (RPM)” reading is not matching the current command in sign, select or de-select the box next to “Tach Reverse” so that the “Actual Velocity (RPM)” displays positive number for a positive current command and negative number for a negative current command.

12. Be sure to save changes often.

13. The amplifier is now ready to run in Velocity mode.

Velocity (RPM) Mode Setup

This section contains procedures to setup the amplifier to run in Velocity (RPM) mode.

NOTE: Be sure that the amplifier has been properly configured to run in Current (Torque) mode before attempting to run in Velocity (RPM) mode.

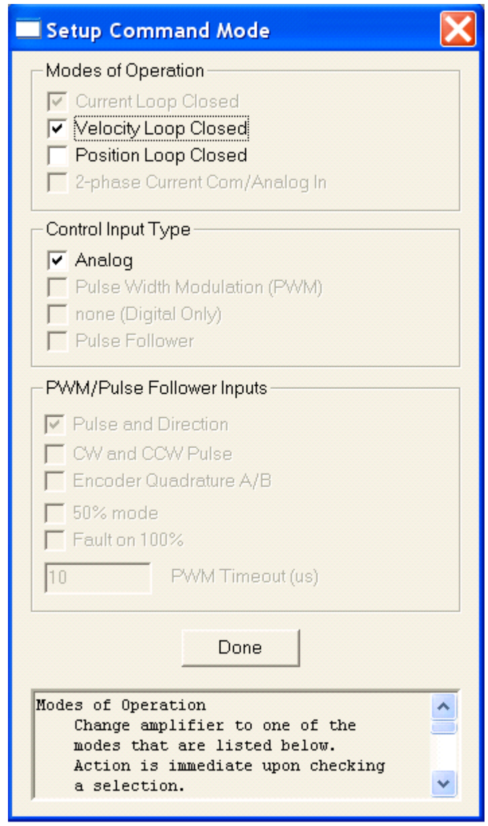
1. Stop the motor, and disable the amplifier by clicking on the "Stop" and "Disable" button on the "Control Panel" window.

2. In the menu bar, click on Setup>Select Mode… to enter the Setup Command Mode dialog.

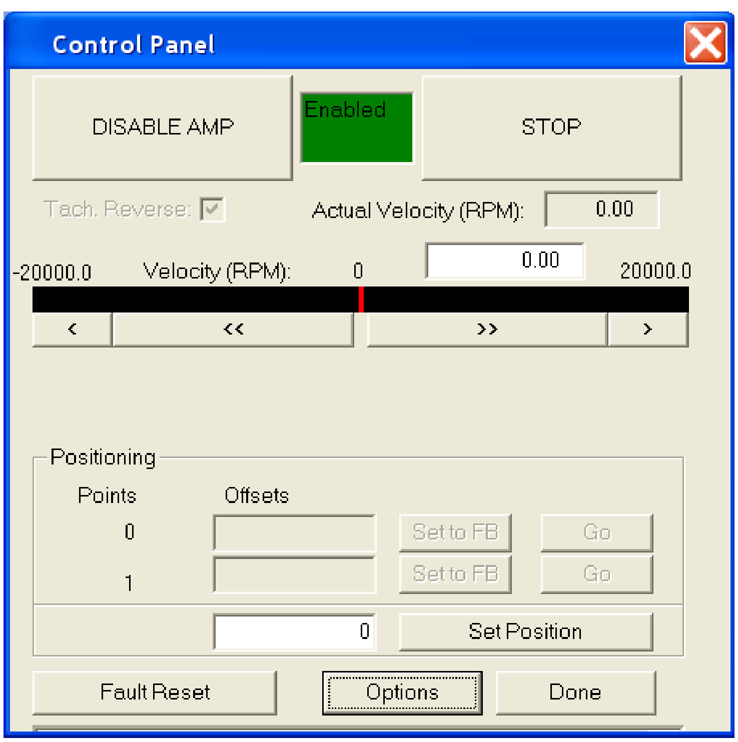
3. Click to apply a check mark next to "Velocity Loop Closed" box to change the amplifier to run in Velocity mode.

4. When the amplifier is set to run in Velocity mode, all the windows and dialogs will changes and become active for changing parameters as appropriate for Velocity mode. As can be seen from "Control Panel" window, the command variable now become RPM (was Ampere for Current mode).

5. Apply 1000 RPM command by entering in the box right below "Actual Velocity (RPM)" box. Alternately, you can click on any portion of the slider right below the "Velocity (RPM)" label to issue a velocity command.



Setup Command Mode Dialog



Control Panel Dialog (Velocity Mode)

6. While the motor is moving, verify that the velocity reading in "Actual Velocity (RPM)" displays is the same or very close to the velocity command values.

7. Repeat for both motor directions.

8. Be sure to save changes often.

9. The amplifier is now ready to accept command from the Battery box.

Analog Input Setup

This section contains procedures to setup the analog signal command input. The command input is an analog voltage signal that ranges from –10 V to +10V. Depending on the mode the amplifier is in, the signal input can means different thing. That is, if the amplifier is in Current mode, the signal input scale is in Ampere/V. If the amplifier is in Velocity mode, the signal input scale is in RPM/V.

Signal Gain Setting

1. Select Setup > Analog I/O… in Menu Tool Bar of Motion Maestro to enter the Setup Analog Input/Output window.

2. For amplifier running in Current mode, in the “Signal Gain” box, enter the amps per volt scale for the signal input. For example, if the peak current for your application is 20 amps, and your maximum differential input command voltage is 10 volts, then you would enter 2.2 in the “Signal Gain” box (try to keep operating range not greater than 90% of full range).

   NOTE: If the amplifier is in Velocity mode, the “Signal Gain” box would be in RPM/V (revolution per minute per volt input). For example, if the maximum velocity for your application is 50,000 RPM, and your maximum differential input command voltage is 5 volts, then you would enter 11,111 in the “Signal Gain” box (try to keep operating range not greater than 90% of full range)

3. Save the configuration to non-volatile memory by select Setup > Save to NVM… in Menu Tool Bar of Motion Maestro.

Signal Offset (Balance) Setting

1. Connect Battery box’s OUTPUT to “Signal 1+” and COMMON pin to “Signal 1-” inputs of the amplifier (Signal 1+ is pin23 of Controller I/O or Red wire of the GC2600 cable. Signal 1– is pin 24 of Controller I/O or Black wire of the GC2600 cable). There are multiple Red and Black wires in the GC2600 cable, make sure to ohm out for the correct Red and Black wires to use.

2. Command 0V from Battery box to the amplifier “Signal 1+” and “Signal 1-” inputs.

3. Select Tools > Scope… in Menu Tool Bar of Motion Maestro to enter the Setup Oscilloscope window.

   3.1 For Current mode amplifier, select “Current Command” (or “Velocity Command” for Velocity mode amplifier) option from “Source “pull down menu under “Trace Attributes”.
   3.2 In the “ Y-Axis Range”, set the values to -1 min and +1 max.
   3.3 Press “Done” to display oscilloscope.
   3.4 You should see a trace scanning across the scope.

4. Select Setup > Analog I/O… in Menu Tool Bar of Motion Maestro to enter the Setup Analog Input/Output window.

5. Adjust the “Signal Offset” box in “Analog Input Setup” section until the “Current Command” waveform sweeps at “0” Amp on the oscilloscope (or until the “Velocity Command” waveform sweeps at “0” RPM on the oscilloscope).

6. Save the configuration to non-volatile memory by select Setup > Save to NVM… in Menu Tool Bar of Motion Maestro.

Velocity (RPM) Mode Tuning

Before starting this section, check that you have completed the amplifier current mode tuning section.

GVS (Gain Velocity Scale) Setting

Before starting the velocity tuning, be sure to select a proper GVS (gain velocity scale) multiplier.

The encoder counts per revolution are sampled and velocity is computed at a 25KHz (typical) interrupt sampling rate. The GVS number is set as a power of 2. Example: GVS of 8 = 2^8 = 256.

If you do not initially set the GVS number, the amplifier will select 256 as a default value. Each edge of the encoder quadrature channels is counted and multiplied by the GVS number and stored to represent scaled velocity. The GVS number is chosen such that encoder edge count at maximum RPM is scaled below 32,768. For low resolution encoders, the GVS number should be increased. The standard default value for GVS is 256 and it is chosen for a 8,192 line encoder rotating at a maximum of 5,000 RPM.

The 256 GVS value is calculated as follows:

(8,192 * 4 counts / rev) * (5,000 rev / min) * (1 min / 60 sec) = 2,730,667 counts / sec

At a 25KHz interrupt sample rate, you will get

2,730,667 / 25000 = 109 counts / sample interrupt

109 * 256 (GVS) = 27,904 which is less than 32,768 as it should be.

Typical value for 5,000 line encoder @ 4,000 RPM is a GVS value of **9** = 2^9 = 512

Typical value for 2,000 line encoder @ 4,000 RPM is a GVS value of **10** = 2^10 = 1024

Typical value for 1,000 line encoder @ 4,000 RPM is a GVS value of **11** = 2^11 = 2048

To change the GVS pre-scale, you will have to use the terminal window (Tools > Terminal Window).

If you type GVS followed by pressing the enter key, you should get a response of 8. To change it to 9, type GVS 9 and press enter, then you can type GVS and press enter to verify the change. The rest of the gains can be set in the servo tuning window as long as the velocity loop option is selected.

Note: Any time you change GVS or GVF (Tach Gain), the **MotionMaestro**© features that use RPM conversions will have to be closed and re-opened to recalculate the proper RPM conversion. These include the control panel, the scope, the control loop signals status display and the function generator in the servo tuning window.

PID (Proportional, Integral, and Derivative) Setting and Tuning

This section contains procedures to run the motor by signal command from the Battery box and tune the Velocity response.

NOTE: Glentek's Spindle amplifiers are already installed with all the optimized parameters before shipping so that there should be minimum adjustments required. However, should there be any changes required, the following procedures can be used as a guide.

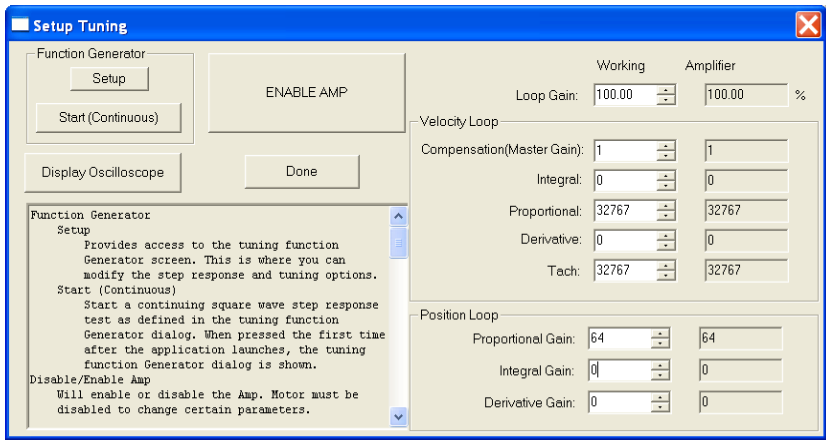
1. With the Battery box still connected to the amplifier "Signal 1+" and "Signal 1-", adjust the output signal from far left to far right of the control knob and observe that the motor spins CW and CCW, respectively.

2. To stop the motor, command a "0V" signal or turn off the Battery box.

3. In the menu bar, click on Setup > Servo Tuning…

4. The following velocity loop coefficient values should be used for initial tuning as shown in Figure 12:

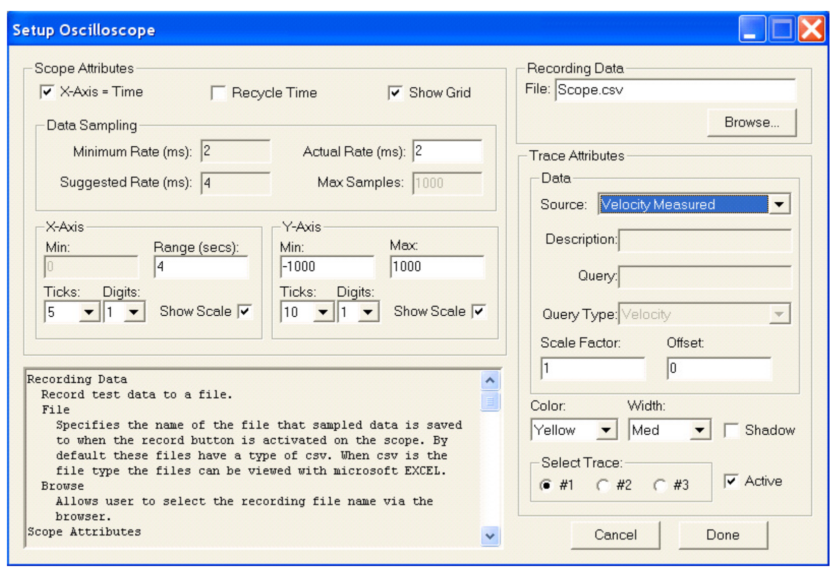
   4.1 Compensation Gain: 1
   4.2 Integral Gain: 0
   4.3 Proportional Gain: 32767
   4.4 Derivative Gain: 0
   4.5 Tach Gain: 32767



Setup Tuning Dialog

5. Next the Scope function needs to be setup and started to display the system velocity response. Press the "Display Oscilloscope" button on the Tuning Dialog window to open the "Setup Oscilloscope" dialog window, and do/select the followings.

   5.1 Select X-Axis = time
   5.2 Enter Data sampling "Actual Rate (mS)" select time equal to or greater than the "Minimum Rate". The "Minimum Rate" is calculated based on **MotionMaestro**© activity and could be too high if activity is increased.
   5.3 Select the "Velocity Measured" option under "Trace Attributes>Data>Source".
   5.4 Enter " X-Axis Range": oscilloscope sweep speed.
   5.5 Enter " Y-Axis Range": Sets the Y axis plus and minus maximum values.
   Note: The maximum values should be higher than the actual "Target Velocity (RPM)".
   5.6 Press "Done" to display oscilloscope.



Setup Oscilloscope Dialog

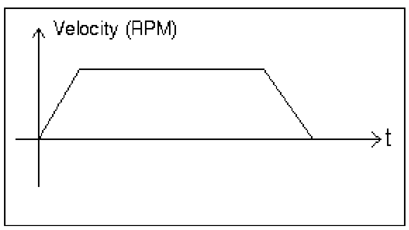
5.7 You can always go back to the “Setup Oscilloscope” window to reset the ranges by clicking “Setup” in the “Oscilloscope” window.
5.8 You should see a trace scanning across the scope. If you do not, press “Setup” button, and adjust the scope until a trace is visible.

6. Turn on the Battery box, adjust its output to command a voltage signal to the amplifier.

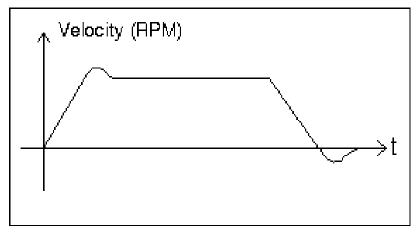
7. Slowly increase the “Compensation (Master Gain)” until the oscilloscope waveform shows critically damped response.

   7.1 This should be achieved without the system becoming unstable.
   7.2 The “Compensation (Master Gain)” can be increased or decreased by the up and down arrow keys on the keyboard when the Compensation (Master Gain) edit box on tuning dialog has the focus.

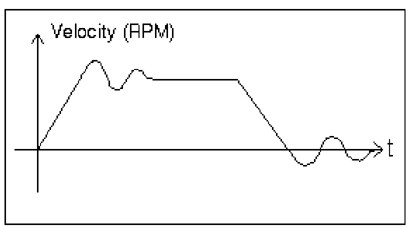
8. A reference for the velocity response waveforms on the Oscilloscope is shown below.



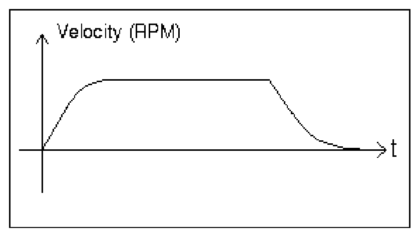
A.) Critically Damped Signal



B.) 1 Hook Overshoot Signal



C.) Under Damped Signal



D.) Over Damped Signal

Velocity Response Waveforms

9. Tuning suggestions:

   9.1. In most cases, increasing compensation value should tune the amplifier to the application. Try to achieve compensation value of six or better for high gain loop.
   9.2 Integral gain may be increased to achieve stiffness at zero speed. However, do not add too much as system may become unstable. Try to keep the maximum integral gain to less than 1000.
   9.3 In systems with high inertia, you may want to increase derivative gain toward 2,000, and in systems with low inertia, you may want to decrease derivative gain toward 1,000 to achieve a critically damped response.

10. When you are satisfied with the tuning, save the parameters to non-volatile memory.

NOTE: When tuning is completed, you can save the amplifier parameters to a backup file by using MotionMaestro © 's Backup command. You will find this command under the Tools pull-down menu. Select Backup amplifier. You will be prompted for a file name. The file can later be found under the application directory with a .bk file type descriptor. At a later time this file can be used to quickly load default parameters for an application.

Appendices

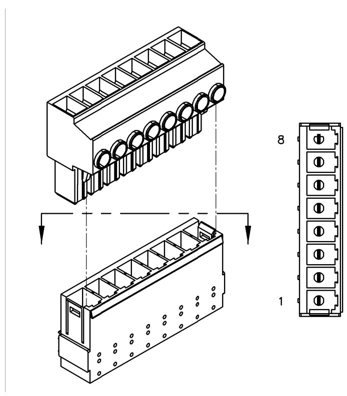
APPENDIX A

Spindle Amplifier Connections

Spindle Amplifier Motor and Power Connectors

SMx9420 Stand-Alone Power/Motor Designations

Designations Pin#	I/O	Name	Function
1	Output	T	Motor Phase T
2	Output	S	Motor Phase S
3	Output	R	Motor Phase R
4	Input	PE	Protective Earthing / Chassis Gnd
5	Input	PE	Protective Earthing / Chassis Gnd
6	Input	L 3	AC LINE 3 (three phase only)
7	Input	L 2	AC LINE 2, single phase/three phase
8	Input	L 1	AC LINE 1, single phase/three phase



SMx9420/SMx9430

SMx9420 Stand-Alone Mating Connector

Description/Type	8-Pin Female Mating Connector
Right angle	Phoenix PC 5/ 8-ST-7,62

SMx9430 Stand-Alone Power/Motor Designations

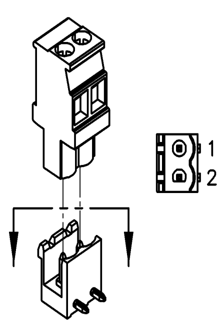
Designations Pin#	I/O	Name	Function
1	Output	T	Motor Phase T
2	Output	S	Motor Phase S
3	Output	R	Motor Phase R
4	Rsvd	Reserved	Reserved
5	Rsvd	Reserved	Reserved
6	Input	L 3	AC LINE 3 (three phase only)
7	Input	L 2	AC LINE 2 (three phase only)
8	Input	L 1	AC LINE 1 (three phase only)

SMx9430 Stand-Alone Mating Connector

Description/Type	8-Pin Female Mating Connector
Right angle	Phoenix PC 5/ 8-ST-7,62

SMC External Power Supply Designations

Designations Pin#	I/O	Name	Description
1	Input	COMMON	COMMON (Logic Ground)
2	Input	+24VDC	24 to 48VDC, 600mA max. @ 24VDC Powers all amplifier logic and encoder

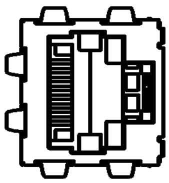


SMC External Power Supply Mating Connectors

Description/Type	2-Pin Female Mating Connector
Right angle	Phoenix P/N: GMVSTBW 2,5/2-ST-5,08

SMC9420/SMC9430

Spindle Amplifier Serial Communications Connector



RS232/485/CANopen

RS-232 / RS-485 Communications Designations

Pin#	I/O	Name	Function
1	Input +	RS-485 RX +	RS-485 Receive +
2	Input -	RS-485 RX -	RS-485 Receive -
3	Reserved	Reserved	Reserved
4	Input/output	COMMON	Logic Ground
5	Output	RS-232 TX	RS-232 Transmit
6	Input	RS-232 RX	RS-232 Recieve
7	Output	RS-485 TX +	RS-485 Transmit +
8	Output	RS-485 TX -	RS-485 Transmit -

CANopen Communications Designations

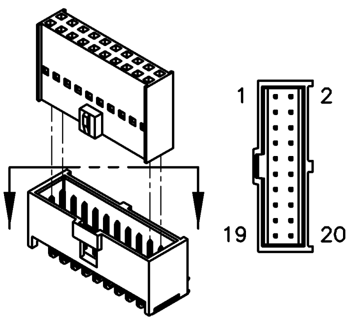
Pin#	I/O	Name	Function
1	Input/output	CAN HIGH	Dominant High
2	Input/output	CAN LOW	Dominant Low
3	Reserved	Reserved	Reserved
4	Input/output	COMMON	Logic Ground
5	Reserved	Reserved	Reserved
6	Reserved	Reserved	Reserved
7	Reserved	Reserved	Reserved
8	Reserved	Reserved	Reserved

Serial Communications Mating Connectors

Description/Type	8-Pin Male Mating Connector
Standard Commercial, RJ-45	Commercial, RJ45

Spindle Amplifier Motor Feedback Connector (Molex)

Motor Feedback Designations



Pin#	I/O	Name	Function
1	Reserved		
2	Reserved		
3	Reserved	`	
4	Input	Mtr Temp SW	MotorTemp Switch Input
5	Input *	Enc Z +	Encoder Channel Z +
6	Input *	Enc Z –	Encoder Channel Z – (not)
7	Input *	Enc B +	Encoder Channel B +
8	Input*	Enc B –	Encoder Channel B – not)
9	Input *	Enc A +	Encoder Channel A +
10	Input *	Enc A –	Encoder Channel A – (not)
11	Input	Hall U+	Hall Sensor U+ Signal
12	Input	Hall U-	Hall Sensor U- Signal
13	Input	Hall V+	Hall Sensor V+ Signal
14	Input	Hall V-	Hall Sensor V- Signal
15	Input	Hall W+	Hall Sensor W+ Signal
16	Input	Hall W-	Hall Sensor W- Signal
17	Power	Enc/Hall Pwr	Encoder +5VDC Power out, 150 mA max
18	Power	Common	Enc Pwr Return, Logic Ground (Digital)
19	Power	Enc/Hall Pwr	Encoder +5VDC Power out, 150 mA max
20	Power	Common	Enc Pwr Return, Logic Ground (Digital)

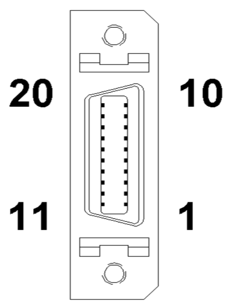
* Optional

Motor Feedback Mating Connector

Connector Description/Type	20-Pin Male Mating Connector Housing	Female Crimp Terminal
C-GRID III DUAL ROW CRIMP CONNECTOR, 22-24 AWG	MOLEX 90142-0020	MOLEX 90119-2110

Spindle Amplifier Motor Feedback Connector (Mini-D)

Motor Feedback Designations



Pin#	I/O	Name	Function
1	Power	Enc Pwr	Encoder +5VDC Power out, 150 mA max
2	Power	Common	Enc Pwr Return, Logic Ground (Digital)
3	Power	Enc Pwr	Encoder +5VDC Power out, 150 mA max
4	Power	Common	Enc Pwr Return, Logic Ground (Digital)
5	Input *	Enc A +	Encoder Channel A +
6	Input *	Enc A –	Encoder Channel A – (not)
7	Input *	Enc B +	Encoder Channel B +
8	Input *	Enc B –	Encoder Channel B – not)
9	Input *	Enc Z +	Encoder Channel Z +
10	Input *	Enc Z –	Encoder Channel Z – (not)
11	Input	Hall U+	Hall Sensor U+ Signal
12	Input	Hall U-	Hall Sensor U- Signal
13	Input	Hall V+	Hall Sensor V+ Signal
14	Input	Hall V-	Hall Sensor V- Signal
15	Input	Hall W+	Hall Sensor W+ Signal
16	Input	Hall W-	Hall Sensor W- Signal
17	Input	Mtr Temp SW	MotorTemp Switch Input
18	Power	Common	Logic Ground (Digital)
19	Power	Common	Logic Ground (Digital)
20	Power	Common	Logic Ground (Digital)

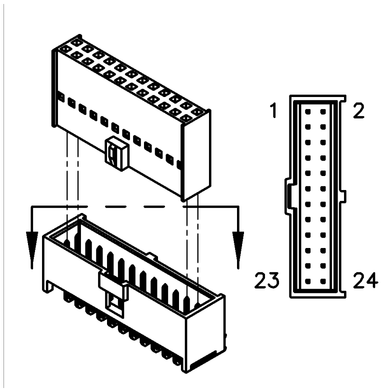
* Optional

Motor Feedback Mating Connector

Connector Description/Type	20-Pin Male Mating Connector Housing	20-Pin Male Mating Backshell
Mini D Ribbon, 28-30 AWG, Insulation Displacement, Plastic Backshell, Squeeze Latch	AMP 2-175677-2	AMP 176793-2
Mini D Ribbon, 28-30 AWG, Insulation Displacement, Metal Backshell, Squeeze Latch	3M 10120-6000EC	3M 10320-A200-00
Mini D Ribbon, 24-30 AWG, Solder Cup, Plastic Backshell, Squeeze Latch	3M 10120-3000VE	3M 10320-52F0-008

Spindle Amplifier Controller I/O Connectors (Molex)

I/O Connection Designations



Designations Pin#	I/O	Name	Function
1	Output *	Enc A +	Encoder Channel A +
2	Output *	Enc A -	Encoder Channel A -
3	Output *	Enc B +	Encoder Channel B +
4	Output *	Enc B -	Encoder Channel B -
5	Output *	Enc Z +	Encoder Channel Z +
6	Output *	Enc Z -	Encoder Channel Z -
7	Reserved		
8	Reserved		
9	Reserved		
10	Reserved		
11	Input	Reset In	Reset Amp
12	Input	Go/Stop	Activates Go or Stop (accel/decel ramp)
13	Input	E-Stop	Activates E-Stop Routine
14	Input	Hw Inhibit	Hardware inhibit
15	Output	Fault Out	Fault out
16	Reserved		
17	Power	Common	Logic Ground (Analog)
18	Power	Common	+24VDC return, Logic Ground (Digital)
19	Output *	Analog Out (Aux.)	Analog out (Auxiliary)
20	Output	Analog Out	Analog out
21	Output	Relay Out	Contact closure 21 to 22 (at speed)
22	Output	Relay Out	Contact closure 21 to 22 (at speed)
23	Input	Signal 1 +	Differential command signal +
24	Input	Signal 1 -	Differential command signal –

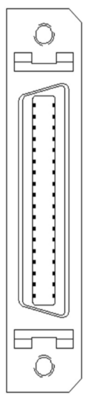
* Optional

I/O Mating Connectors

Connector Description/Type	24-Pin Male Mating Connector Housing	Female Crimp Terminal
C-GRID III DUAL ROW CRIMP CONNECTOR, 22-24 AWG	MOLEX 90142-0024	MOLEX 90119-2110

Spindle Amplifier Controller I/O Connector (Mini-D)

I/O Connection Designations



Designations Pin#	I/O	Name	Function
1	Input	Signal 1 +	Analog 1 command signal +
2	Input	Signal 1 –	Analog 1 command signal – (not)
3	Reserved		
4	Reserved		
5	Output *	Analog Out (Aux.)	Analog out (Auxiliary)
6	Output	Common	Logic Ground (Analog)
7	Output	Analog Out	Analog out
8	Input	Go/Stop	Activates Go or Stop (accel/decel ramp)
9	Input	E-Stop	Activates E-Stop Routine
10	Input	Hw inhibit	Hardware inhibit
11	Output	Fault Out	Fault out
12	Input	Common	Logic Ground (Digital)
13	Input	Reset In	Reset Amp
14	Input	Mtr Temp SW	MotorTemp Switch Input
15	Reserved		
16	Input	Common	Logic Ground (Digital)
17	Output *	Encoder Z –	Encoder Z – output (not)
18	Output *	Encoder Z +	Encoder Z + output
19	Output	Relay Out	Contact closure 19 to 20 (optional)
20	Output	Relay Out	Contact closure 19 to 20 (optional)
21	Input	Common	Logic Ground (Analog)
22	Input	Common	Logic Ground (Digital)
23	Input *	Pulse –	Pulse input – (not)
24	Input *	Pulse +	Pulse input +
25	Input *	Direction –	Direction input – (not)
26	Input *	Direction +	Direction input +
27	Output	+5V Out	+5 VDC out, 150 mA max
28	Output	+5V Out	+5 VDC out, 150 mA max
29	Output	Common	+5 VDC return, Logic Ground (Digital)
30	Output	Common	+5 VDC return, Logic Ground (Digital)
31	Reserved		
32	Reserved		
33	Output *	Encoder A +	Encoder A + output
34	Output *	Encoder A –	Encoder A – output (not)
35	Output *	Encoder B +	Encoder B + output
36	Output *	Encoder B –	Encoder B – output (not)

* Optional

I/O Mating Connectors

Connector Description/Type	24-Pin Male Mating Connector Housing	36-Pin Male Mating Backshell
Mini-D Ribbon, 24-30 AWG, Solder cup. Plastic backshell, squeeze latch	3M10136-3000VE	3M10336-52F0-008

APPENDIX B

Amplifier Status Codes

This appendix contains definitions of status codes displayed at the amplifier.

Condition for each of the display values by a 7-segment LED display.

Display	Name	Description
1	EEPROM Fault*	Parameter EEPROM checksum fault
2	Reserved	Reserved
3	Reserved	Reserved
4	Reserved	Reserved
8	Reset	External reset
b	Bus Over Voltage	DC bus exceeded 450VDC nominal (for 320VDC in-put) DC bus exceeded 250VDC nominal (for 160VDC in-put)
C	Clamp (Disabled)	Output stage disabled
E	Encoder Fault	Encoder fault detected
F	Foldback	Foldback condition active
H	Heatsink Over Temperature	Heatsink thermal switch tripped (65ºC typical)
h	Motor Over Temperature	Motor thermal switch / thermister tripped
L	LS/ECB	Motor RMS over current
0	Normal Operation	Amp enabled (no Hall only)
S	HS/ECB	Output short circuit detected
U	Bus Under Voltage	DC bus below 150VDC nominal (for 320VDC input) DC bus below 80VDC nominal (for 160VDC input)
=	Hall Fault	Invalid hall state (000 or 111)
≡	Commutation Fault	Hall angle does not match encoder counter angle No Halls: Phase finding routine failed
8.	Reset	Drive processor is in reset Logic power indicator
Single outer segment	Amp Enabled, Hall	Amp enabled Segment indicates one of six hall states

APPENDIX C

SMB/SMC94XX Ratings and Specifications

This appendix contains specifications for the application engineer which are necessary to utilize the SMX94XX series amplifiers.

Power, Input and Output

Amplifier Model Number	Input power	Output Power (Amps)*	
		Cont. (Rated)	Peak
SMB/SMC9420-1A-1	110-130 VAC or 208-240 VAC	20	40
SMB/SMC9430-1B-1	110-130 VAC or 208-240 VAC	30	60

*3 Phase AC input. Output power is derated by 40% of the amp rating for single phase AC input.

Signal Inputs

Input Source	Maximum Voltage VDC	Minimum Impedance Ohms
Differential	+/- 10	20,000
Single Ended	+/- 10	10,000

Digital Inputs

Input Source	Specification
Go/Stop	See *
E-Stop	See *
Inhibit	See *
Reset	See *
Motor Temp	See *

*40V max. -.5V min. Terminated by 10k Ohms. Digital inputs have hysteresis with thresholds at 1/3 and 2/3 of 3.3V.

Outputs

Output	Specification
Fault (as output)	Active low, open collector output can sink 500 mA max.
Analog Out	User selectable D/A. Output +/- 10V.
Encoder Outputs:	26C31 differential line driver.

System

Feature	Specification
Frequency response	
Velocity Loop:	Implementation dependent.
Current Loop:	Typical, depending on motor inductance, 2kHz typical. (Bandwidths available up to 3 kHz.)

Notes

1) All data in this section is based on the following ambient conditions: 25 °C (77 °F)
2) Forced air cooling is required to meet the maximum power ratings specified.

APPENDIX D - MOTOR PHASING PROCEDURES

Matching Amplifier Phase Output Voltages to Three Phase Brushless Spindle Motors with Phase Sensing Hall Sensors is Described in The Following Procedures.

Section D1 describes the auto phasing procedure, section D2 describes the manual phasing procedure, and Section D3 describes the Smart-Com phasing procedure.

Please read this procedure prior to connecting the system and powering up.

D1 – Auto Phasing Procedure

This procedure should only be used at the initial start up of a system. Once completely saved in the amplifier, the settings can be saved as a back up file in the host computer, and these settings can then be restored in future systems. Future systems must be identical and wired exactly the same.

Please note: At Glentek we take great care that all motors are phased identically, during final test, we insure the motor back EMF, encoder and hall sensors are aligned exactly the same way for each motor we ship.

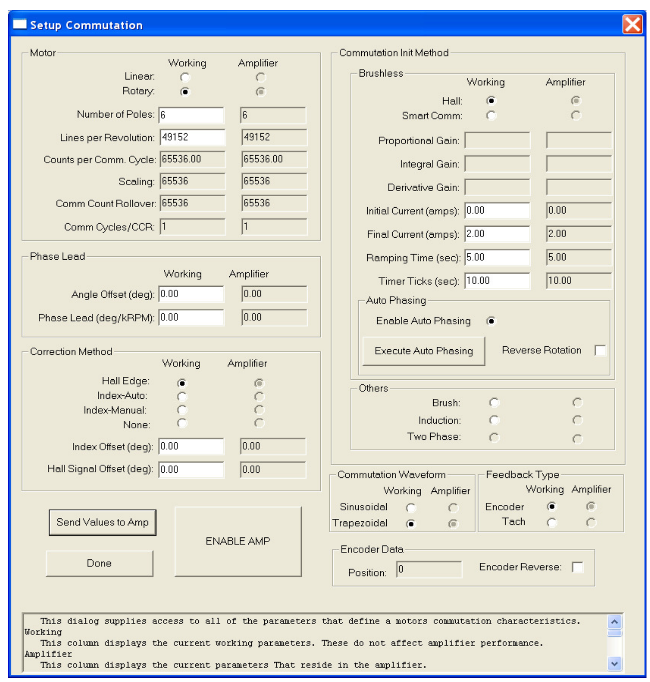
A) Check that the motor power and the feedback cables are connected properly to the amplifier and the amplifier is powered on and disabled.

NOTE: Check that nothing is connected to the motor shaft.

B) Check that the amplifier has no faults, and the amplifier is set for Current (Torque) mode.

C) Check that the information in the Motor column of the Setup Commutation window is correct (the Number of Poles and Lines per Revolution).

NOTE: You need to enter the number of individual poles (not pole pairs) and the lines per revolution as 49152. Even though the spindle motor has no encoder (only Hall sensors) a phase locked simulated encoder is generated within the amplifier so that phase lead can be calculated and high resolution sinusoidal waveforms to the motor can be synthesized.



Dialog box for setting up motor commutation

D) Check that “Hall Edge” is selected in the Correction Method column.

E) Select the Enable Auto Phasing radio button.

F) Set the Initial and Final Current as 0 and 2, respectively. Set the Ramping Time and Timer Ticks as 5 and 10, respectively.

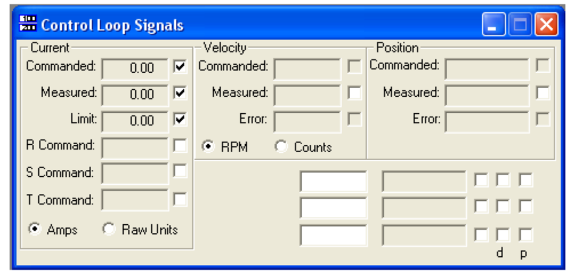
NOTE: Final Current should be less than the motor’s rated current.

G) Click Send Values to Amp button to send all new parameters to amplifier.

H) Enable the amplifier and press the Execute Auto Phasing button.

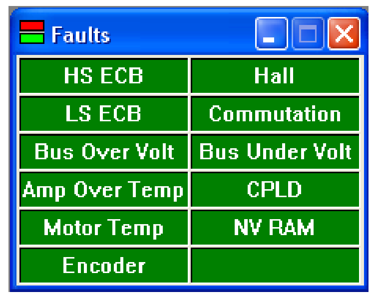
I) Observe Commanded current and Measured current from the Control Loop Signals window.

NOTE: Values should start at the initial current and end at the final current. Motor will have slight movement. Commutation Init (Initialization) on the Warning window will light yellow during execution time, then return to green.



Dialog box for viewing control loop signals

Dialog box for viewing warning



Dialog box for viewing fault status

J) Check the Fault window, if Commutation is lit green (No Fault), then go to step O. If it is red (Fault), then go to step K.

K) Verify that the motor is connected properly. Check to see if the Number of Poles (this is not pole pairs), and Lines per Revolution (49152) settings are correct. If all were correct, then increase final current to approximately 20% of motor rated current. Check that nothing is connected to the motor shaft.

L) Click Send Values to Amp button to send all new parameters to amplifier.

M) Clear fault by pressing Fault Reset button on the Control Panel window.

N) Repeat from the beginning (from Step D).

O) From the Control Panel window, slowly increase (positive) the current until the motor starts to spin. Check that shaft is rotating in the desired direction for a positive current command.

NOTE: If the motor is not running in the desired direction, select or deselect (depend on what was saved previously) the Reverse Rotation check box from the Commutation Init Method column in the Setup Commutation window (next to Execute Auto Phasing button).

P) Press Stop button, the command will go to zero (0), and the motor will stop.

Q) Disable the amplifier and save all settings by selecting “Save to NVM” from the setup menu.

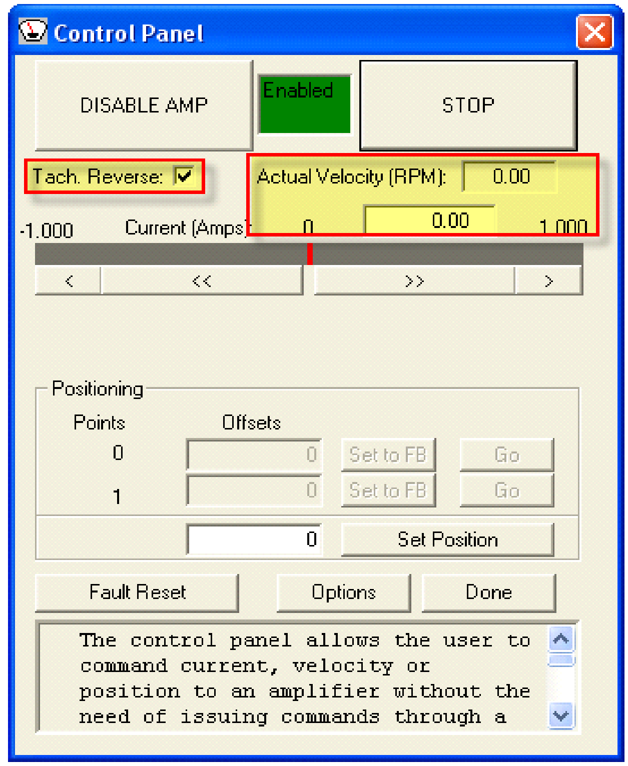
NOTE: The system is now aligned. You can create a backup file, and then restore to identical systems at a later time. Systems must be identical and connected exactly the same. At this point, the phase alignment is still not yet optimized. That is, for Hall sensors feedback only, the phasing is only accurate to within ±30° commutation angle. In order to fine tune the motor/amplifier system so that the motor would run cool and efficiently the next steps should be followed for every new motor/amplifier system.

NOTE: The correct Hall phasing and most optimized Hall alignment is where for the same magnitude current command (in both directions), the motor would yield the HIGHEST and most similar velocity readings in both directions. This can be realized by the fact that motor torque is proportional to the commanded current, and if a motor is built properly the same magnitude current would create the same magnitude torque, and hence the same magnitude velocity in both directions.

R) The amplifier should still be in **Current Mode** and **Enabled** (unless the external inhibit is active). From the Control Panel, issue a digital current command of **0.25 amps** (or just enough so the motor begins to rotate on its own).

S) While the motor is rotating, verify that the sign of the actual velocity matches the sign of the commanded current. If NOT, select or un-select the **Tach Reverse** checkbox on the Control Panel and verify that the signs now match. Record the velocity. Command the opposite polarity current to the motor, **-0.25 amps** (or the same magnitude current command as in step R) and verify that the motor reverses direction and runs at approximately the same speed. The signs of the current command and actual velocity should still match.

T) Verify that for the same magnitude current command in both directions, the actual velocity readings in both directions are within 10% of each other. If there is a large discrepancy in the readings, go to Setup Commutation window, and adjust the value of Hall Signal Offset (deg) in the Correction Method section (in 5° increments). Adjust the values until the actual velocity readings are as close as possible for the same magnitude current command in both motor rotation directions.



The Control Panel display

NOTE: The most optimized and correct Hall Signal Offset value is the one that gives the HIGHEST and most similar velocity readings in both directions for the same magnitude current command in both directions (equal symmetrical torque in both directions).

U) Set the current command back to 0 by clicking on the **STOP** button of the Control Panel. Save the settings by selecting “Save to NVM” from the setup menu.

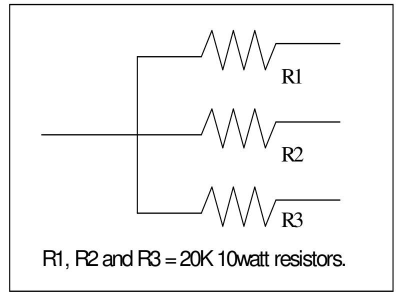
The motor/amplifier system should now be properly commutated, phased, and optimized. If in the future the system is not producing the desired torque, you should verify optimization by using this procedure.

D2 – Manual Phasing Procedure

It is intended that this procedure be done once by the engineering staff, whereupon they will incorporate the findings into production drawings, wiring labels and procedures.

A) Locate or prepare the required equipment.

1. A 2 channels oscilloscope (four channels is best).
2. A 3-phase Y-connected resistive load as illustrated on the right.
3. A computer with MotionMaestro© installed.



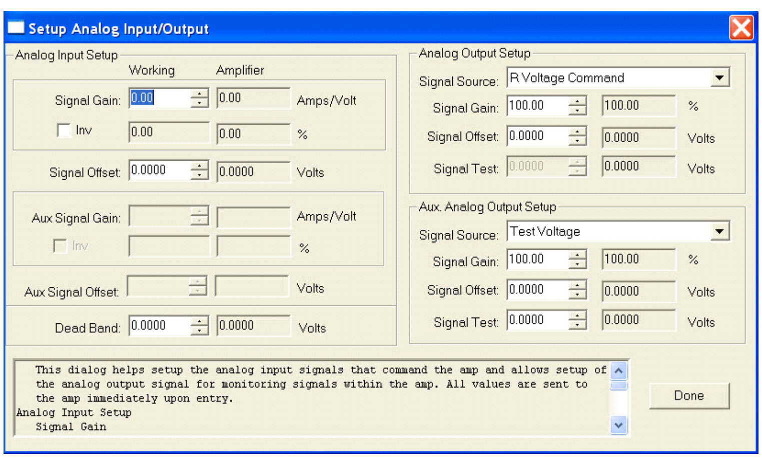
Specification for resistive load

B) With the power off, connect the motor encoder outputs and the Hall sensor outputs to the amplifier. **Leave the motor power leads disconnected**. Connect the RS232 serial cable from the amplifier to the serial port on the computer (MotionMaestro©).

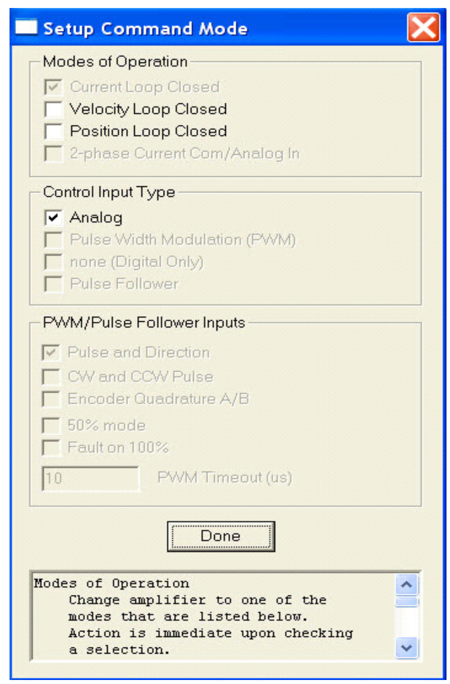
C) Apply power to the amplifier and establish communications between the amplifier and MotionMaestro©.

D) Prepare the amplifier using the following dialogs.

1. Insure that the amplifier is in **current mode**. Deselect all modes except the **current mode**.
2. Set the analog command input signal gain to zero. Use the Setup Analog Input/Output dialog as shown.



Dialog box for setting the analog input command signals



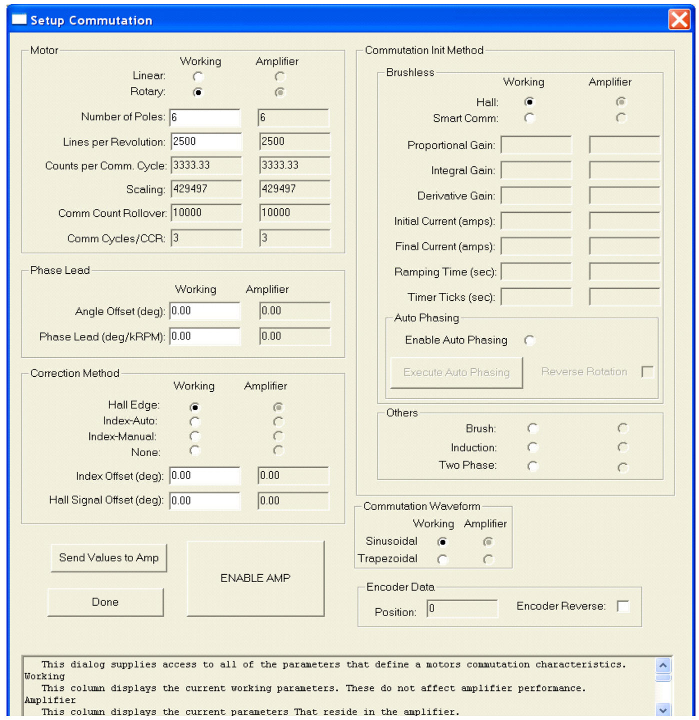
Dialog box for setting amplifier mode

3. Check then clear all faults by referring to the Amplifier Faults and Amplifier Status displays on the toolbar.
   For example, if there is an External Inhibit status warning you must open the Setup Digital IO dialog and check the inhibit box, then fix all remaining amplifier faults. After all faults have been corrected a fault reset must be completed. You may perform a reset by typing RST at the terminal window or by opening the Control Panel and depressing the "**Fault Reset**" button.

   NOTE: Commutation alignment can not begin until all faults are cleared.

E) From the MotionMaestro© “Setup” menu, open the “Setup Commutation” dialog and setup the following items:

1. Motor type. Are you phasing a rotary or linear motor?
2. Number of Poles.
3. Encoder resolution.
4. Commutation angle offset = 0 (-30 degrees if Halls aligned phase to neutral?)
5. Commutation phase advance gain = 0
6. Init Method = Hall
7. Correction Method = Hall
8. Depress “Send Values To Amp” button



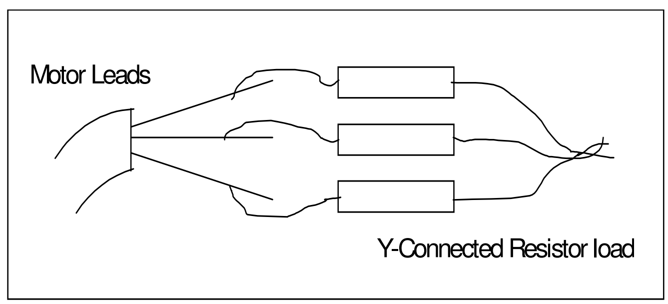
Dialog box for setting up motor commutation

F) With the Commutation dialog still open, enable the amplifier. You will see on the amp, one segment lit on the seven segment display. This display segment indicates the Hall state. Rotate the motor shaft by hand, such that the LED segments rotate clockwise as viewed from the top of the amplifier. Verify the Encoder Data Position counts up in the Commutation dialog. If not, check the Encoder Data Reverse box. The Encoder Data Position should now count up as the seven segment display cycles clockwise.

G) Save the new settings by selecting “Save to NVM” from the Setup menu. Answer Yes when prompted to save.

H) Connect the 3-phase Y-connected resistor load to the **Motor** power leads for monitoring the motor back EMF (BEMF).

NOTE: do not connect the motor leads or the resistor load to the amplifier.



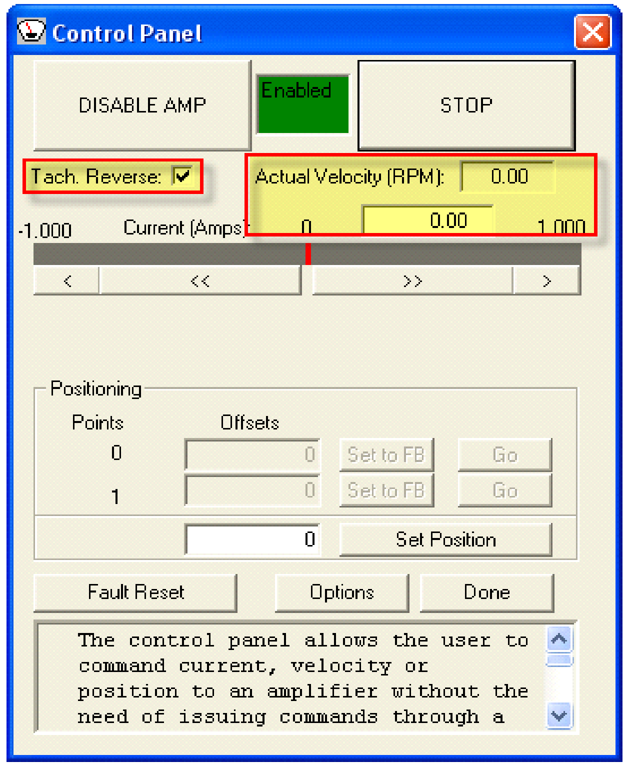
3-phase Y-connected resistor load

I) Connect the channel 1 scope probe to the amplifiers Analog Out pin. Connect the channel 1 scope common to the amplifiers Common pin. Set the channel 1 vertical scale to around **2V per division**. From the “Setup Analog Input/Output” dialog, Set the Analog Output Signal Source to “R Voltage Command” and directly below change the Analog Output Signal Gain to 100 percent.

J) Connect the channel 2 scope probe to one of the motors leads. Connect the channel 2 scope common to the center of the Y-connected resistor load. Set the channel 2 vertical scale to around **2V per division**. Set the horizontal scale to around **100 ms per division**. Scaling may need to be changed in order to best see the data.

NOTE: If using a 4 channels oscilloscope, connect channel 3 and 4 to the remaining two motor leads with respect to the center of the Y-connected resistor load.

K) Open the Control Panel. The square colored status box will give you the amplifier status. If the box is yellow or disabled then press the “Enable/Disable Amp” button. If the box is red the amp has a fault and must be cleared before you can proceed.



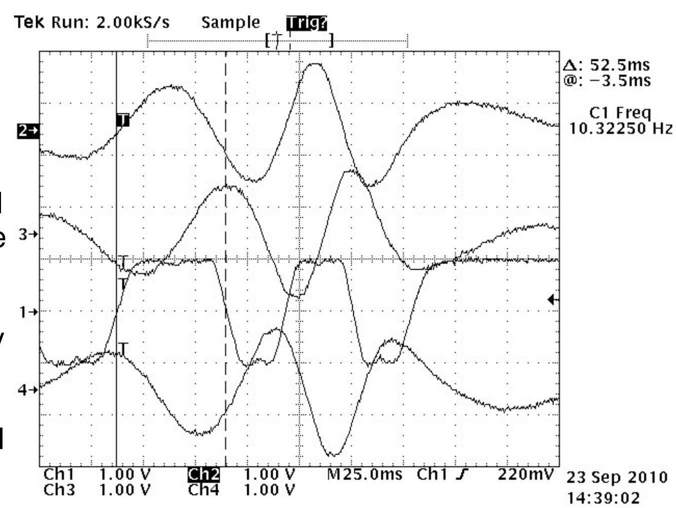
The Control Panel display

L) From the Control Panel, apply a digital current command of **10 amps** to the amplifier. To do this you may have to expand the range that can be commanded from the control panel by selecting the Options button.

M) **Find the phase R motor lead.**

Rotate the motor by hand and verify the trace on channel 1 (Phase R Voltage Command) follows a sinusoidal pattern (except with a flat top). Move the channel 2 scope probe to each motor lead to determine which BEMF waveform is in phase or 180° out of phase with the phase R command. Label this lead Phase R.

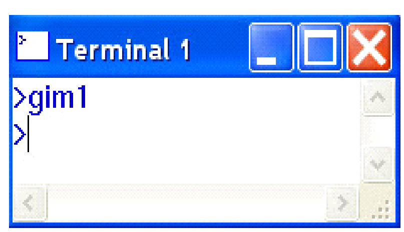
NOTE: For each phase, R, S and T, one direction of rotation should cause the back EMF (BEMF) to be in phase with the command while the reverse rotation direction should cause the BEMF to be 180° out of phase. Determine which direction of rotation is in phase for the phase R motor lead, then rotate the motor in that same direction when determining the S and T motor leads. Once the phases are labeled, double check that the phase R and S motor leads result in waveforms that are in phase with the corresponding digital current commands on the amplifier when rotating the motor in the same direction for both.



Oscilloscope Waveforms

The Oscilloscope Waveforms displays channel 1 as Phase R Voltage Command, channel 2, 3, and 4 as the three motor phases BEMF (captured from a 4 channels oscilloscope). As can be seen, channel 1 is in phase with channel 2. Therefore, channel 2 is motor Phase R. If the channel 1 waveform is noisy or distorted (does not produce a flat top sine wave), open terminal window, then type “gim” and press the enter key to query for the current value (write this number down so that you can reinstall it later). Next, type “gim1” to set the amplifier gain to a minimal value and repeat the phasing procedure at the beginning of step M. Remember to set the “gim” value back to original value after finish phasing motor leads or amplifier might not run.

This method of matching motor leads to the amplifier requires that the motor’s Hall sensors transitions are aligned with the motor phase to phase BEMF zero crossings. If the Hall sensors are aligned with the motor’s phase to neutral BEMF, then the commutation offset angle must be set to ±30 degrees (you have to try both) before comparing the commands to the BEMF waveforms.



The Terminal window

Remember, this procedure is for coarsely finding the correct motor phasing for the motor leads. Do not be too concerned if the Phase R Voltage Command is not exactly aligned with the BEMF at this point since it can be corrected later once all three motor phases have been determined (see step T).

If the Hall sensors are aligned with the motor's BEMF at some unknown arbitrary angle that the Phase R Voltage Command is not aligned with any of the three motor phases, some random value for Hall angle offsets should be selected. That is, go to Setup Commutation window, and enter the value of Hall Signal Offset (deg) in the Correction Method section. Coarsely adjust the values until the Phase R Voltage Command is aligned with the BEMF of one of the three motor phases. Label this lead Phase R.

N) **Find the phase S motor lead.**

In MotionMaestro©, change the Analog Output Signal Source *S Voltage Command*. Place the channel 2 scope probe on one of the two remaining motor leads. Rotate the motor in the same direction that was used for phase R above. Determine which of the remaining two leads of the motor result in a waveform that is in phase with the phase S command. Label this lead Phase S. Move the channel 2 probe to the remaining motor lead.

O) **Find the phase T motor lead.**

Same procedure as above with the analog output source set to *T Voltage Command*. If phases R and S were properly found, phase T will be the remaining motor wire. Label this lead phase T.

P) Set the current command back to **0 by clicking the STOP button on the Control Panel.** Reset any current limits, foldback thresholds to the desired operational settings. Reset the Control Panel options to appropriately safe values. Set the Analog Input Signal Gain back to the desired operational value. Save the settings by selecting "Save to NVM" from the Setup menu.

Q) Remove the amplifier's power. Remove the scope probes. Connect the motor R, S, and T leads to the amplifier's R, S, and T terminals respectively.

R) Apply power to amplifier. The amplifier should still be in **Current Mode** and **Enabled** (unless the external inhibit is active). From the Control Panel, see following picture, issue a digital current command of **0.5 to 2 amps**, enough so the motor begins to rotate.

S) While the motor is rotating, verify that the sign of the actual velocity matches the sign of the commanded current. If NOT, mark the **Tach Reverse** checkbox on the control panel and verify that the signs now match. Command the opposite polarity current to the motor, **-.5 to -2.0 amps** and verify that the motor reverses direction and runs at approximately the same speed. The signs of the current command and actual velocity should still match.

T) Verify that for the same magnitude current command in both directions, the actual velocity readings in both directions are very close to each other. If there is a large discrepancy in the readings, go to Setup Commutation window, and adjust the value of Hall Signal Offset (deg) in the Correction Method section. Adjust the values until the actual velocity readings are as close as possible for the same magnitude current command in both motor rotation directions.

U) Set the current command back to 0 by clicking on the **STOP** button of the Control Panel. Save the settings by selecting "Save to NVM" from the setup menu.

The motor should now be properly commutated and phased.

D3 – Smart-Comm Phasing Procedure

In this mode of operation, the amplifier built-in smart algorithm will find the correct motor phases for optimum commutation without the need for Hall sensor or commutation tracks. Refer to Appendix H, Smart-Comm section for more information on how to set the coefficients.

NOTE: For smart-comm commutation method, the commutation tracks are not needed (only incremental encoder is needed).

1. First, open "Setup Commutation" window and set the number of poles of the motor and the lines per revolution of the encoder.

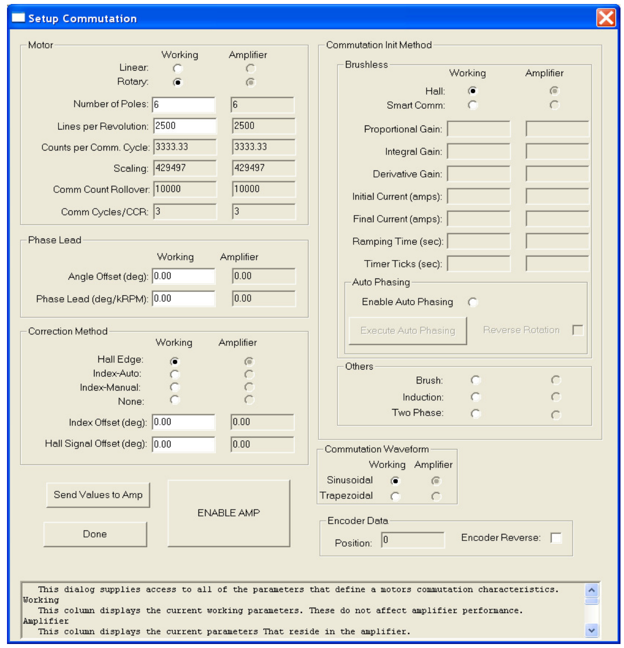
2. If the motor has an encoder with an index pulse, check the "Index-Auto" button under "Correction Method". If the encoder does not have an index pulse, check "None".

3. For Smart-Comm method, check "Smart Comm" button under "Commutation Method".

4. Start with the default values for tuning. At this time, be sure to set the "Final Current" at the motor's rated stall current.

5. Send these values to the amplifier by pressing "Send Values to Amp" button.

6. Make sure the amplifier is in current mode.



Dialog box for setting up motor commutation

7. Then save to Non-Volatile Memory (NVM) under the setup pull-down menu.

8. Next, the amplifier needs to be reset for these settings to take effect. Press the reset button on the amplifier.

9. As soon as the amplifier is enabled, the motor should be correctly commutated and ready for the next step.

10. Using "Control Panel" window, command +/- current to the motor and see if the RPMs are equal for the same +/- commanded currents. If the motor does not rotate when the current is commanded, open the "Setup Commutation" window and change the "Encoder Reverse" box setting by select or de-select the selection box. Then, repeat the steps 7, 8, 9 and 10.

11. Refer to Appendix D2 step "S" for phasing the velocity loop (Tach).

12. If you need further assistance, contact your Glentek sales agent, and he/she will gladly assist you to optimize your system.

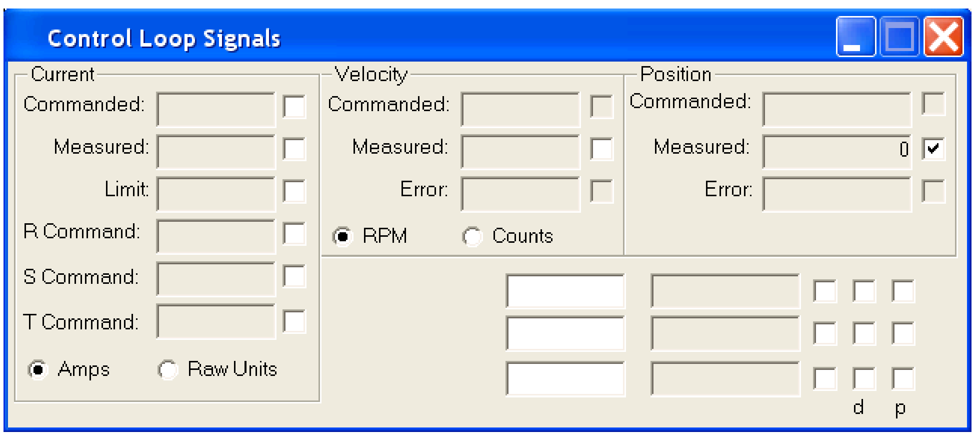
APPENDIX E

E – Determining Encoder Resolution and Number of Poles.

A) **Encoder Resolution**

From the MotionMaestro© Status menu, open the "Control Loop Signals" dialog . Check the box that allows you to monitor "Measured" "position" of the encoder, then mark a start position on the motor shaft. Turn the shaft 360 degrees clockwise and monitor the encoder position in the Control Loop Signals dialog. Note the change in encoder counts. Take the change in encoder counts per 1 revolution (360 degrees) and divide by four (4). This is your Lines of Resolution that you will enter in your Commutation dialog. (Note: For better accuracy, you may rotate by 10 turns and divide by 40 instead of 4.)

Common encoder line counts include but are not limited to 250. 256. 500, 512, 1000, 1024, 2000. 2048, 2500, 4096, 5000, 8192, and 10,000 lines/revolution.

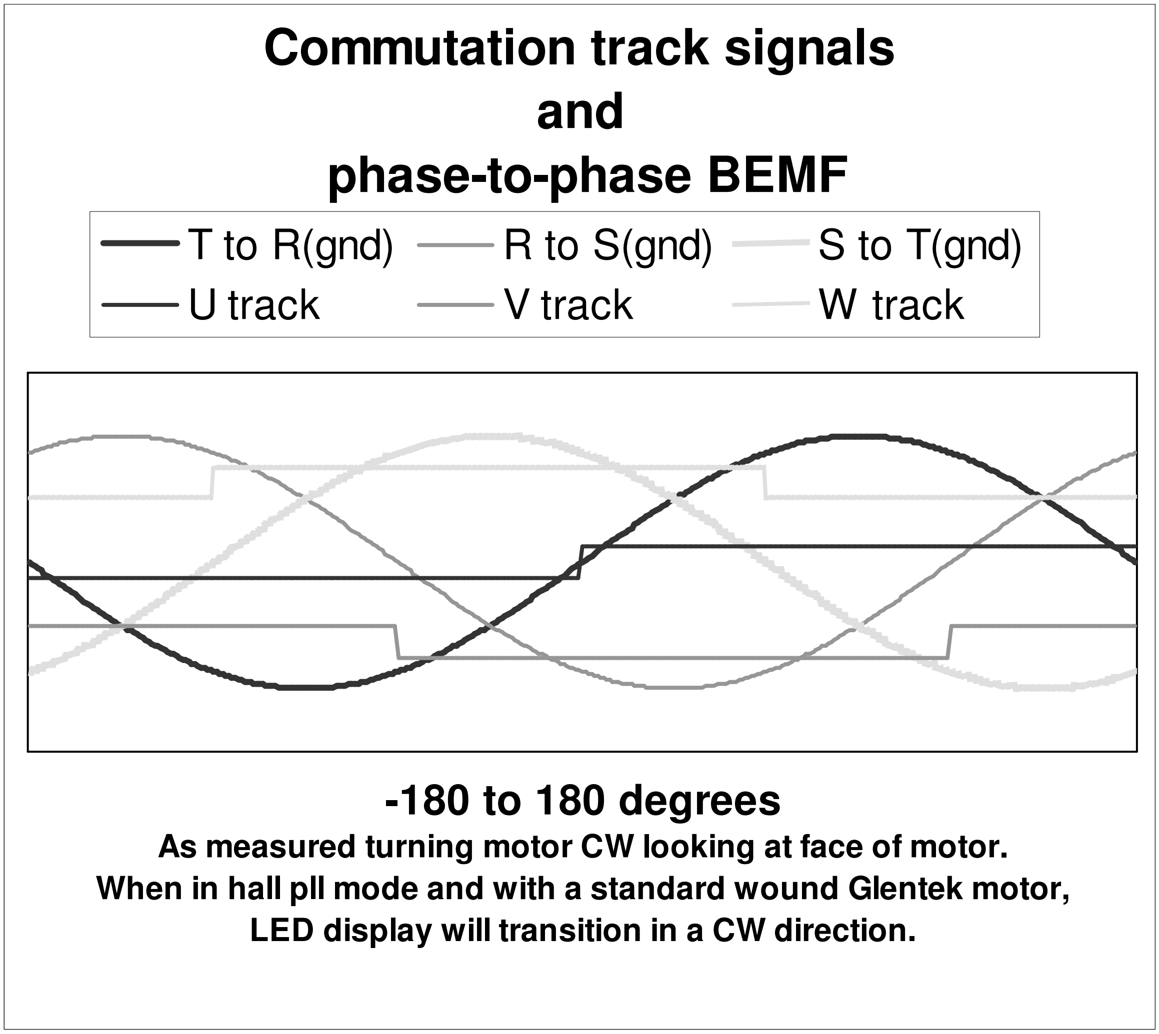


B) **Number of Poles** (Note: requires Hall sensors)

Enable the amplifier. Mark a start position on the motor shaft. You will be monitoring the seven segment display on the amplifier as shaft is rotated. Note the lit segment before rotating the motor shaft, now turn the shaft 360 degrees clockwise. As you are rotating shaft, count the number of times the seven segment display goes through a full led rotation. Take the number of full LED cycles and multiply by two. This is the Number of Poles that you will enter in your Commutation dialog.

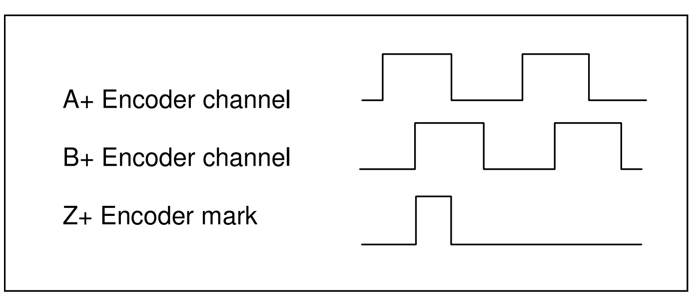
APPENDIX F

F – Commutation Track Signals and Phase-to-Phase BEMF.



Encoder Outputs

The following illustrates the encoder signals for a standard Glentek motor that is correctly commutated where the encoder is not reversed (FER=0) and the tachometer feedback is reversed (TR=1).



APPENDIX G

G – European Union EMC Directives

Electromagnetic Compatibility Guidelines For Machine Design

This document provides background information about Electromagnetic Interference (EMI) and machine design guidelines for Electromagnetic Compatibility (EMC).

Introduction

Perhaps no other subject related to the installation of industrial electronic equipment is so misunderstood as electrical noise. The subject is complex and the theory easily fills a book. This section provides guidelines that can minimize noise problems.

The majority of installations do not exhibit noise problems. However, these filtering and shielding guidelines are provided as counter measures. The grounding guidelines provided below are simply good grounding practices. They should be followed in all installations.

Electrical noise has two characteristics: generation or emission of electromagnetic interference (EMI); and response or immunity to EMI. The degree to which a device does not emit EMI, and is immune to EMI is called the device's Electromagnetic Compatibility (EMC).

Equipment, which is to be brought into the European Union legally, requires a specific level of EMC. Since this applies when the equipment is brought into use, it is of considerable importance that a drive system, as a component of a machine, be correctly installed.

"EMI Source-Victim Model" shows the commonly used EMI model. The model consists of an EMI source, a coupling mechanism and an EMI victim. A device such as servo drives and computers, which contain switching power supplies and microprocessors, are EMI sources. The mechanisms for the coupling of energy between the source and victim are conduction and radiation. Victim equipment can be any electromagnetic device that is adversely affected by the EMI coupled to it.

Saving pa-
non-volatile

After a motor
and tuned to
tions satisfac-
rameters must
the amplifier's
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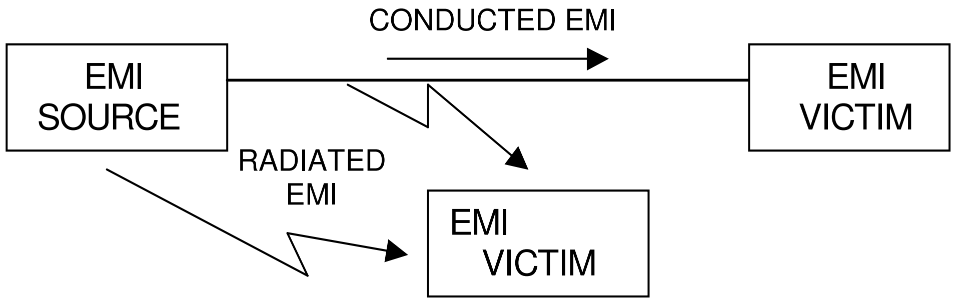


rameters to
memory

is configured
the applica-
tion, the pa-
be saved to
non-volatile
Upon power

Figure 1- EMI Source-Victim Model

Immunity to EMI is primarily determined by equipment design, but how you wire and ground the device is also critical to achieving EMI immunity. Therefore, it is important to select equipment that has been designed and tested for industrial environments. The EMI standards for industrial equipment include the EN61000-4-X series (IEC 1000-4-X and IEC8O1-X), EN55011 (CISPR11), ANSI C62 and C63 and

MIL-STD-461. Also, in industrial environments, you should use encoders with differential driver outputs rather than single ended outputs, and digital inputs/outputs with electrical isolation, such as those provided with optocouplers.

The EMI model provides only three options for eliminating the EMC problem:

- Reduce the EMI at the source,
- Increase the victim's immunity to EMI (harden the victim),
- Reduce or eliminate the coupling mechanism,

In the case of servo drives, reducing the EMI source requires slowing power semiconductor switching speeds. However, this adversely affects drive performance with respect to heat dissipation and speed/ torque regulation. Hardening the victim equipment may not be possible, or practical. The final and often the most realistic solution is to reduce the coupling mechanism between the source and victim. Filtering, shielding and grounding can achieve this.

Filtering

As mentioned above, high frequency energy can be coupled between circuits via radiation or conduction. The AC power wiring is one of the most important paths for both types of coupling mechanisms. The AC line can conduct noise into the drive from other devices, or it can conduct noise directly from the drive into other devices. It can also act as an antenna and transmit or receive radiated noise between the drive and other devices.

One method to improve the EMC characteristics of a drive is to use an isolation AC power transformer on the amplifier's input power. This minimizes inrush currents on power-up and provides electrical isolation. In addition, it provides common mode filtering, although the effect is limited in frequency by the interwinding capacitance. Use of a Faraday shield between the windings can increase the common mode rejection bandwidth, (shield terminated to ground) or provide differential mode shielding (shield terminated to the winding). In some cases an AC line filter will not be required unless other sensitive circuits are powered off the same AC branch circuit.

NOTE:" Common mode" noise is present on all conductors that are referenced to ground. "Differential mode" noise is present on one conductor referenced to another conductor.

The use of properly matched AC line filters to reduce the conducted EMI emitting from the drive is essential in most cases. This allows nearby equipment to operate undisturbed. The basic operating principle is to minimize the high frequency power transfer through the filter. An effective filter achieves this by using capacitors and inductors to mismatch the source impedance (AC line) and the load impedance (drive) at high frequencies.

For drives brought for use in Europe, use of the correct filter is essential to meet emission requirements. Detailed information on filters is included in the manual and transformers should be used where specified in the manual.

AC Line Filter Selection

Selection of the proper filter is only the first step in reducing conducted emissions. Correct filter installation is crucial to achieving both EMIL attenuation and to ensure safety. All of the following guidelines should be met for effective filter use.

1) The filter should be mounted to a grounded conductive surface.

2) The filter must be mounted close to the drive-input terminals, particularly with higher frequency emissions *(5-30* MHz). If the distance exceeds 600mm (2 feet), a strap should

be used to connect the drive and filter, rather than a wire.

3) The wires connecting the AC source to the filter should be shielded from, or at least separated from the wires (or strap) that connects the drive to the filter. If the connections are not segregated from each other, then the EMI on the drive side of the filter can couple over to the source side of the filter, thereby reducing, or eliminating the filter effectiveness. The coupling mechanism can be radiation, or stray capacitance between the wires. The best method of achieving this is to mount the filter where the AC power enters the enclosure. "AC Line Filter Installation" shows a good installation and a poor installation.

When multiple power cables enter

POOR **GOOD**

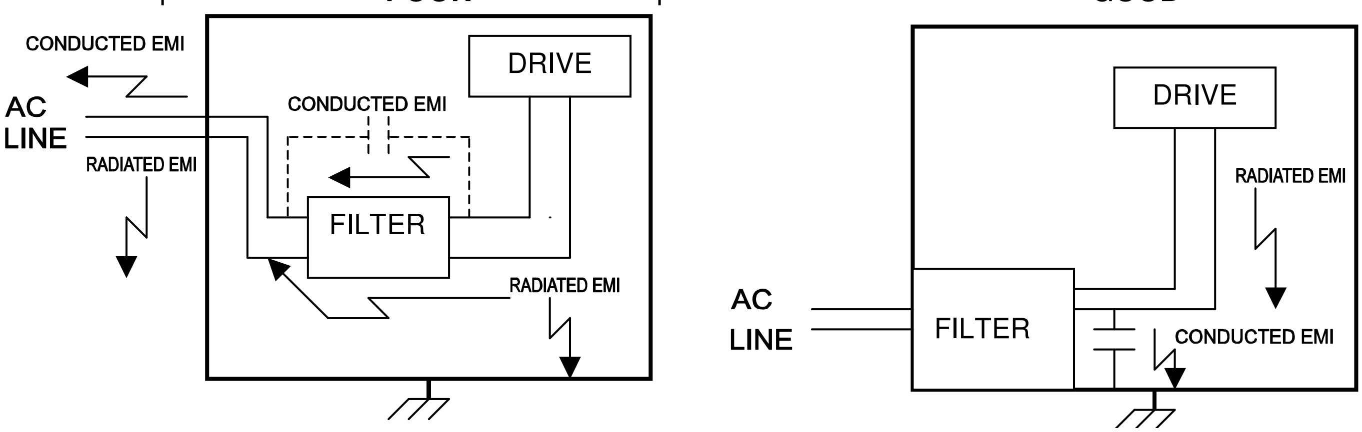


Figure 2- AC Line Filter Installation

A unfiltered line can contaminate a filtered line external to the enclosure. Therefore, all lines must be filtered to be effective. The situation is similar to a leaky boat. All the holes must be plugged to prevent sinking.

If the filter is mounted excessively far from the drive, it may be necessary to mount it to a grounded

	WARNING
	Large leakage currents exist in AC line filters. They must be grounded properly before applying power. Filter capacitors retain high voltages after power removal. Before handling the equipment, voltages should be measured to determine safe levels prior to handling the equipment. Failure to observe this precaution could result in severe bodily injury.

conductive surface, such as the enclosure, to establish a high frequency (HF) connection to that surface. To achieve the HF ground, direct contact between the mounting surface and the filter must be achieved. This may require removal of paint or other insulating material from the cabinet or panel.

The only reasonable filtering at the drive output terminals is the use of inductance. Capacitors would slow the output switching and deteriorate the drive performance. A common mode choke can be used to reduce the HF voltage at the drive output. This will reduce emission coupling through the drive back to the AC line. However, the motor cable still carries a large HF voltage and current. Therefore, it is very important to segregate the motor cable from the AC power cable. More information on cable shielding and segregation is contained in the section on shielding.

Grounding

High frequency (HF) grounding is different from safety grounding. A long wire is sufficient for a safety ground, but is completely ineffective as a HF ground due to the wire inductance. As a rule of thumb, a wire has an inductance of 8 nH/in regardless of diameter. At low frequencies it acts as constant impedance, at intermediate frequencies as an inductor, and at high frequencies as an antenna. The use of ground straps is a better alternative to wires. However the length to width ratio must be *5:1,* or better yet 3:1, to remain a good high frequency connection.

The ground system's primary purpose is to function as a return current path. It is commonly thought of as an equipotential circuit reference point, but different locations in a ground system may be at different potentials. This is due to the return current flowing through the ground systems finite impedance. In a sense, ground systems are the sewer systems of electronics and as such are sometimes neglected.

The primary objective of a high frequency ground system is to provide a well-defined path for HF currents and to minimize the loop area of the HF current paths. It is also important to separate HF grounds from sensitive circuit grounds. "Single Point Ground Types" shows single point grounds for both series (daisy chain) and parallel (separate) connections. A single point, parallel connected ground system is recommended.

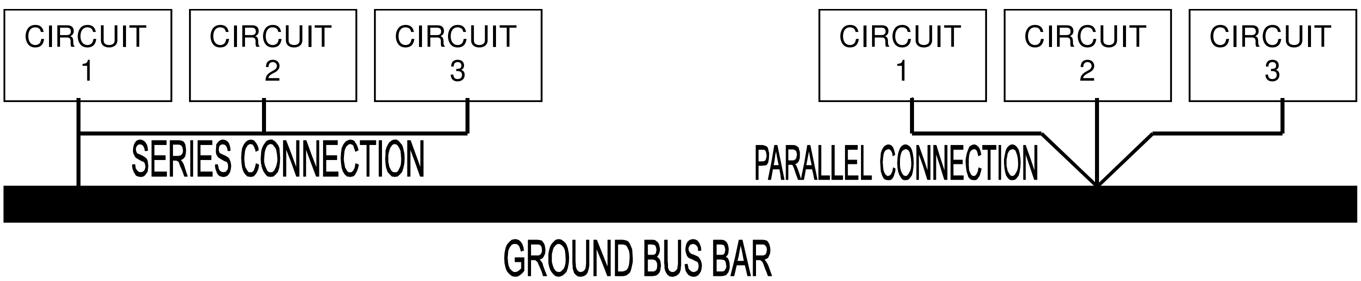


Figure 3-Single Point Ground Types

A ground bus bar or plane should be used as the "single point" where circuits are grounded. This will minimize common (ground) impedance noise coupling. The ground bus bar (GBB) should be connected to the AC ground, and if necessary, to the enclosure. All circuits or subsystems should be connected to the GBB by separate connections. These connections should be as short as possible and straps should be used when possible. The motor ground conductor must return to the ground terminal on the drive, not the GBB.

Shielding and Segregation

The EMI radiating from the drive enclosure drops off very quickly over distance. Mounting the drive in an enclosure, such as an industrial cabinet, further reduces the radiated emissions. The cabinet should have a high frequency ground and the size of the openings should be minimized. In addition, the drive is considered an "open" device that does not provide the proper IP rating for the environment in which it is installed. For this reason the enclosure must provide the necessary degree of protection. An IP rating or Nema rating (which is similar to IP) specifies the degree of protection that an enclosure provides.

The primary propagation route for EMI emissions from a drive is through cabling. The cables conduct the EMI to other devices, and can also radiate the EMI. For this reason, cable segregation and shielding are important factors in reducing emissions. Cable shielding can also increase the level of immunity for a drive. For example:

- Shield termination at both ends is extremely important. The common misconception that shields should be terminated at only one end originates from audio applications with frequencies <20 kHz. RF applications must be terminated with the shield at both ends, and possibly at intermediate points for exceptionally long cables.

- When shielded cables are not terminated at the cable connection and pass through the wall of a cabinet, the shield must be bonded to the cabinet wall to prevent noise acquired inside the cabinet from radiating outside the cabinet, and vice versa.

- When shielded cables are terminated to connectors, the shield must be able to provide complete 360^0 coverage and terminate through the connector backshell. The shield must *not* be grounded inside the connector through a drain wire. Grounding the shield inside the connector couples the noise on the shield to the signal conductors sharing the connector and virtually guarantees failure to meet European EMC requirements.

- The shield must be continuous. Each intermediate connector must continue the shield connection through the backshell.

- All cables, both power and signal should use twisted wire pairing.

The shield termination described above provides a coaxial type of configuration, which provides magnetic shielding, and the shield provides a return path for HF currents that are capacitively coupled from the motor windings to the frame. If power frequency circulating currents are an issue, a 250 VAC capacitor should be used at one of the connections to block 50/60 Hz current while passing HF currents. Use of a properly shielded motor cable is essential to meet European EMC requirements.

The following suggestions are recommended for all installations.

1. Motor cables must have a continuous shield and be terminated at both ends. The shield must connect to the ground bus bar or drive chassis at the drive end, and the motor frame at the motor end. Use of a properly shielded motor cable is essential to meet European EMC requirements.

2. Signal cables (encoder, serial, and analog) should be routed away from the motor cable and power wiring. Separate steel conduit can be used to provide shielding between the signal and power wiring. Do not route signal and power wiring through common junctions or raceways.

3. Signal cables from other circuits should not pass within 300 mm (1 ft.) of the drive.

4. The length or parallel runs between other circuit cables and the motor or power cable should be minimized. A rule of thumb is 300 mm (1 ft.) of separation for each 10 m (30 ft.) of parallel run. The 300 mm (1 ft.) separation can be reduced if the parallel run is less than 1 m (3 ft.).

5. Cable intersections should always occur at right angles to minimize magnetic coupling.

6. The encoder mounted on the brushless servomotor should be connected to the amplifier with a cable using multiple twisted wire pairs and an overall cable shield. Encoder cables are offered in various lengths that have correct terminations.

Persistent EMI problems may require additional countermeasures. The following suggestions for system modification may be attempted.

1. A ferrite toroid or “doughnut” around a signal cable may attenuate common mode noise, particularly RS-232 communication problems. However, a ferrite toroid will not help differential mode noise. Differential mode noise requires twisted wire pairs.

2. Suppress each switched inductive device near the servo amplifier. Switch inductive devices include solenoids, relay coils, starter coils and AC motors (such as motor driven mechanical timers).

3. DC coils should be suppressed with a “free-wheeling” diode connected across the coil.

4. AC coils should be suppressed with RC filters (a 200 Ohm 1/2 Watt resistor in series with a *0.5* uF, 600 Volt capacitor is common).

Following these guidelines can minimize noise problems. However, equipment EMC performance must meet regulatory requirements in various parts of the world, specifically the European Union. Ultimately, it is the responsibility of the machine builder to ensure that the machine meets the appropriate requirements as installed.

RECOMMENDATIONS FOR GLENTEK AMPLIFIERS

All amplifiers installed in a NEMA 12 enclosures or equivalent with wiring in metal conduit or enclosed metal wire trough (see Shielding and segregation).

Use Glentek shielded feedback and motor cables.

An AC line filter properly installed in a NEMA 12 enclosure or equivalent (see Filtering).

AC line filters for single-phase applications

1A-15A	input current, 120-250VAC use: Schaffner FN2070-16 or equivalent.
15A-25A	input current, 120-250VAC use: Schaffner FN2070-25 or equivalent.
25A-36A	input current, 120-250VAC use: Schaffner FN2070-36 or equivalent.

AC line filters for 3-phase applications

1A-15A	input current, 120-250VAC use: Schaffner FN258-16 or equivalent.
15A-25A	input current, 120-250VAC use: Schaffner FN258-30 or equivalent.
25A-36A	input current, 120-250VAC use: Schaffner FN258-42 or equivalent.
36A-50A	input current, 120-250VAC use: Schaffner FN258-55 or equivalent.
50A-75A	input current, 120-250VAC use: Schaffner FN258-75 or equivalent.
75A-100A	input current, 120-250VAC use: Schaffner FN258-100 or equivalent.

EUROPEAN UNION
DECLARATION OF INCORPORATION
MOTION CONTROL SYSTEMS

Classified as Components of Machinery

Model Series SMX9Yaa

Council Directive 89/392/EEC Machinery Directive

The Products cited below and their accessories comply with the following Safety of Machinery Standards when installed and operated in accordance with the Instructions provided in the Operation & Installation Manuals. The products are declared to comply by virtue of Design Third Party Evaluations and Testing. EMC Testing and Product Safety Evaluations and Risk Assessments were conducted by Intertek ETL SEMKO, an independent Nationally Recognized Test Laboratory, located in Laguna Niguel, CA 92677, USA.

As components of Machinery, please be advised that:

1. These are not individually classified as machinery within the scope of directive 89/392/EEC.
2. These are intended to be incorporated into machinery or to be assembled with other machinery to constitute machinery covered by directive 89/392/EEC, as amended.
3. As such, do therefore not in every respect comply with the provisions of directive 89/392/EEC.

SAFETY STANDARDS

EN60204-1 (IEC204-1)	Electrical Equipment of Industrial Machines
	Collateral Test Standards, Specified by EN60204-1
EN61000-6-4:2001	EMC – Emission standard for industrial environments
EN61000-6-2:2001	EMC – Immunity for industrial environments
	Collateral Test Standards, Specified by EN61000-6-2

Manufacturers Name:	GLENTEK INC.
Manufacturers Address:	208 Standard Street El Segundo, CA 90245, USA
Description of Equipment:	Motion Control Systems including Amplifiers and Servo Motors
Model / Type Reference:	Omega series: SMX9Yaa, where X can be A, B or C, Y can be 1-9 and aa represents amp rating which can be 08, 15, 20, 30, 45, or 75. Maybe followed by bbb-, may be followed by ccc-, may be followed by ddd-, may be followed by ef-, may be followed by g-, may be followed by h where b,c,d,e,g, and h can be 0 to 9 and f can be A-E.

The undersigned hereby declares that the equipment specified above conforms to the noted Directives and Standards.

MANUFACTURER

Helen M. Vasak

HELEN M. VASAK

SECRETARY-TREASURER

1-22-2008

Prepared By: Intertek Testing Services, Laguna Niguel, CA
Confirmed By: John Quigley, Quality Manager

APPENDIX H

H - Amplifier Terms and Technology

This appendix contains information that describes and explains the terms and concepts referred to in this manual. The information contained here is generic to amplifiers and motion control technology in general and does not apply specifically to the SMX94XX series amplifiers. The TERMS section is a glossary that defines the terms used when discussing amplifiers. The TECHNOLOGY section describes methods or concepts that involves the usage of multiple terms.

TERMS

Analog Current Command Mode

Analog current mode, also called Torque mode or Current mode, indicates that the amplifier is being commanded by an analog signal and that the amplifiers' control loop is controlling current. This command mode is used when one needs to control torque. The analog signal, in volts, is a scaled representation of desired current as measure at the output. For instance -10 volts to 10 volts at the analog input becomes -15 amps to 15 amps at the amplifiers output. The scaling is different for different amplifiers.

Analog Velocity Command Mode

Analog velocity mode indicates that the amplifier is being commanded by an analog signal and that the amplifiers' control loop is controlling velocity. This command mode is used when one needs to control the speed of some device. The analog signal, in volts, is a scaled representation of desired velocity as measured at the output. For instance -10 volts to 10 volts at the analog input becomes -3000 rpm to 3000 rpm at the device being moved. The scaling is can often be configured by the application engineer.

Command Mode

A term used to refer to the method by which a command is given to an amplifier. The amplifier uses this command in its' control loop as a target to be achieved. The command mode usually includes how the amplifier is to interpret the command. That is, is the command to represent current, velocity or position. There are many forms and methods by which commands are submitted to an amplifier. Traditionally the command was given as an analog voltage input to the amplifier. Today there is analog, digital, serial communications or some combination of these.

Commutation

Commutation is the term used to describe the method by which current is applied to the windings of a motor such that the applied current moves the motor in a desired direction, or to a desired position, with the minimum current. Brushes are the method of commutation in a brush motor. In a three phase brushless motor, Sinusoidal Commutation is the usual method of commutation. See Sinusoidal Commutation.

Commutation Initialization Method

In order to properly commutate a brushless motor, the servo drive must know the absolute position of the rotor with respect to the motor windings in the stator. Since incremental shaft encoders only supply "relative" rotor position, the servo drive must perform a power-on, phase-finding scheme to determine the absolute position of the shaft. This is known as commutation initialization. Once the absolute position is determined, the position from the encoder can be used to maintain the absolute position. The SMX94XX amplifiers have two power-on commutation initialization methods available for finding the absolute position of the rotor. The Smart-Comm method requires the rotor to move; the second scheme, Hall, does not require motion. The Hall method does require the addition of Hall sensors or commutation tracks. Commutation tracks are simulated Hall sensors built into the shaft encoder.

Hall Commutation Initialization

Hall commutation initialization is a method that relies on sensors to give an approximation of the initial commutation angle of a motor. Hall initialization uses Hall sensors or commutation tracks (simulated Hall sensors built into the shaft encoder) to determine the rotor angle. In a brushless motor three Hall sensors are used to detect rotor position. The three Hall sensors employed are commonly named U, V and W; S1, S2 and S3; or A, B and C. The l sensors are digital (on/off) devices and therefore the combination of the three can result in eight different states. The sensors are aligned with the motor in a way that causes the output of the sensors to transition through six of the eight possible states as the motor is rotated through 360 electrical degrees. Each Hall state corresponds to 60 electrical degrees. Only one sensor changes states at any given transition.

At power up, the servo drive reads the state of the Hall sensors and from this state can determine within ±30 electrical degrees where the motor shaft is located. This is close enough to start commutating the motor, so the servo drive uses this approximation as the actual rotor position. Once motion is commanded (position, velocity or torque), the servo drive starts commutating with this value and watches for a transition of the Halls state. Upon this transition, the servo drive knows the exact location of the rotor shaft and updates the commutation angle based on this known location.

The hall method does not move the rotor shaft at power up. Instead, it uses a non-optimal commutation angle at start-up and corrects to the optimal commutation angle upon the first Hall state transition once motion is commanded.

Phase Lead

Glentek's advanced algorithms provide automatic phase lead and eliminate the need to manually specify phase lead. These advanced algorithms ensure that the system is operating at the highest possible speed and with maximum efficiency.

Sinusoidal Commutation

In sinusoidal commutation a sinusoidal current is applied to each phase of the motor to cause the motor to rotate. In a three phase motor, the relationship of the currents applied in the three phases for a positive rotation of the rotor is:

$IR(\theta e) = I * \sin(\theta e)$,
$IS(\theta e) = I * \sin(\theta e - 120°)$,
$IT(\theta e) = I * \sin(\theta e - 240°)$;

where:

IR, IS, and IT are the currents applied to phase R, S, and T respectively,
I is the amplitude of the commanded current,
θe is the "electrical angle" of the applied currents.

The relationship between the electrical angle, θc, and the mechanical angle (the angle of the rotor), θm, is:

$\theta m = \theta c \times 2/N$,

where

N is the number poles in the motor.

For example, a 4-pole motor (two North poles and two South poles) will rotate 180 mechanical degrees as the currents applied are varied through 360 electrical degrees.

Smart-Comm

Smart-Comm commutation is a method that does not rely on encoder commutation tracks or hall sensors for motor commutation. It is important to note that the smart-comm algorithm always returns the motor shaft to its initial starting position after moving the motor shaft a few encoder counts to determine the correct commutation angle. The following gain variables listed below can be used to additionally tune the algorithm if it is desired.

NOTE: For smart-comm commutation method, the commutation tracks are not needed (only incremental encoder is needed) as shown in the Current Loop Control Diagram Alpha Series.

If you are planning to use smart-comm, be sure to contact your Glentek sales agent first, and he/she can have these following variables preset at the factory before shipment. However, the default value in the amplifier will work for most cases.

Proportional Gain: This value should initially be set to a low value. The default value is 1024 and this should be a low enough value to start off with in most situations. Depending on the shaft size or the inertia of the motor, the beginning Proportional Gain may need to be set lower than the default value. The higher the Proportional Gain value is set to, it will make the shaft have less movement during commutation initialization. The max value for this value is 32767.

Integral Gain: This value can be initially set to 0. If a high Proportional Gain can be achieved, there will be very little movement during commutation initialization, and Integral Gain may not be necessary. However, any value of Integral Gain will pull the motor back to its original position. The higher the integral gain the faster this will happen. This value should be relatively low and the max value should be no more than 100.

Derivative Gain: This value can be initially zero but after the Proportional Gain is set then the Derivative Gain can be set as high as possible, typically 1/2 of Proportional Gain.

Initial Current: This value can always be 0. The only reason to use it would be to reduce the total initialization time by giving the current a head start. This is especially true if the Final Current is a large number.

Final Current: This value must be greater than the Initial Current. The Final Current should be enough to make the motor shaft move or enough current to make the load move. Typically, the final current is set at the motor’s rated stall current.

Ramping Time: This value is the amount of time that it will take the to change the initial current to the final current. This value is in seconds.

Timer Ticks: This value is the amount of time that the commutation initialization will take. This value must be greater than the Ramping Time. This value is in seconds.

TECHNOLOGY

Selection of a commutation initialization method

The first step in selecting a commutation initialization method is to determine whether motion can be tolerated upon power up. If motion is not acceptable, then the motor must be equipped with Hall sensors or commutation tracks and Hall initialization should be used. If motion is acceptable at power up, then the second item which will prevent Smart-Comm initialization from working properly is the presence of large external torque applied on the motor rotor. If large external torque exist which either resist rotor motion (such as a break or excessive friction), or cause the rotor to rotate (such as a gravity), then Smart-Comm can result in a non-optimal commutation angle. This occurs because these modes both rely upon finding equilibrium between the applied motor current and the rotor position; an external torque will alter this equilibrium position. If a large enough current is applied during initialization, this external torque can be overcome and an acceptable commutation angle can be achieved.

If Smart-Comm is selected, the amount of current to the motor during initialization must be set. The values such as initial current and final current need to be set for commutation initialization to occur. The default value can be used as a basis. After following the process outlined in the Terms section of this appendix, these values can be tuned to the application necessary.

FOC (Field Oriented Control)

This is a math-intensive technique for controlling brushless dc and ac induction motors that consists of controlling the stator currents represented by a vector. This control is based on projections which transform a three-phase time and speed dependent system into a two co-ordinate (d and q co-ordinates) time invariant system. This makes the control accurate in every working operation (steady state and transient) and independent of the limited bandwidth mathematical model. This reduces motor size, cost and power consumption.

SVPWM (Space Vector Pulse Width Modulation)

This is an algorithm for the control of pulse width modulation (PWM). It is used for the creation of alternating current (AC) waveforms; most commonly to drive 3 phase AC powered motors at varying speeds from DC using multiple class-D amplifiers. The SVPWM generates minimum harmonic distortion of the currents in the winding of 3-phase AC motor. SVPWM also provides a more efficient use of the supply voltage in comparison with sinusoidal modulation methods.

APPENDIX I

I - Amplifier Model Numbering

This appendix explains the model numbering system for the Glentek Alpha Series Digital Spindle Amplifiers. The model numbering system is designed so that you, our customer, will be able to quickly and accurately create the model number for the amplifier that best suits your needs. This manual contains complete model numbering information for the following amplifier types:

SMB/SMC 9420 **SMB/SMC 9430**

In order to minimize confusion, the above amplifier types have their own respective model numbering sections on the pages that follow. In order to accurately select a complete part number, please follow the steps shown below:

1. Select the amplifier type which meets your power requirements and proceed to that section of model numbering.

2. Utilize the model number key in conjunction with the tables at the beginning of each section to select the complete model number for your requirements.

   NOTE: A complete model number example follows the model number key and includes a full description of the individual codes which make up the complete model number.

The difference between SMB94XX and SMC94XX.

1. SMB94XX uses BUS input to power up the logic board and encoder.

- Advantage: Only requires one input power source to operate the amplifier.
- Disadvantage: In case of input power failure, the amplifier will shut down completely including the logic board and encoder.

2. SMC94XX requires external 24VDC “Keep Alive” input to power up the logic board and encoder.

- Advantage: As long as the external 24VDC stays on, the logic board and encoder power will stay alive even if the BUS input shuts down.
- Disadvantage: Needs two separate input power sources (external 24VDC & BUS input) to operate the amplifier.

SMx9420 Amplifier Model Numbering

The following tables are used to fill in the different parts of the model number. Refer to these when constructing a model number for your requirements.

SMx9420 Stand Alone

Model number key: **SMx9420 - bbb - jcc - 1A - 1**

x = B Designates BUS Logic Power.

x = C Designates External 24VDC Logic Power.

bbb Input BUS and Power Rating Configuration Code.

jcc Logic Board Configuration Code.

1A Mounting Configuration Code, Single axis Stand Alone, with Built-in Regen.

1 Single amplifier module.

bbb		Power	Power Input Voltage	Continuous Current (Amps)	Peak Current (Amps)
SMB	**SMC**		Stand Alone (VAC)		
000	**100**	Standard	208 - 240	20	40
003	**103**	Standard	110 - 130	20	40

jcc	Controller I/O & Feedback Connectors		Functionality Description	Host Connector
	j = 0	j = 1		
j21*	Mini-D	Molex	Standard Spindle	RJ45
j25*	Mini-D	Molex	CANopen Spindle	RJ45

Stand Alone Example :

SMB9420 - 000 - 021 - 1A - 1

- 1 → One amplifier installed
- 1A → Single axis Stand Alone, AC Input
- 021 → Standard Spindle, Mini-D
- 000 → Standard Power, 208 - 240 VAC
- SMB → BUS Logic Power

SMx9430 Amplifier Model Numbering

The following tables are used to fill in the different parts of the model number. Refer to these when constructing a model number for your requirements.

SMx9430 Stand Alone

Model number key: **SMx9430 - bbb - jcc - 1B - 1**

- **x = B** Designates BUS Logic Power.
- **x = C** Designates External 24VDC Logic Power.
- **bbb** Input BUS and Power Rating Configuration Code.
- **jcc** Logic Board Configuration Code.
- **1B** Mounting Configuration Code, Single axis Stand Alone, with Built-in Regen.
- **1** Single amplifier module.

bbb		Power	Power Input Voltage	Continuous Current (Amps)	Peak Current (Amps)
SMB	**SMC**		Stand Alone (VAC)		
000	**100**	Standard	208 - 240	30	60
003	**103**	Standard	110 - 130	30	60

jcc	Controller I/O & Feedback Connectors		Functionality Description	Host Connector
	j = 0	j = 1		
j21*	Mini-D	Molex	Standard Spindle	RJ45
j25*	Mini-D	Molex	CANopen Spindle	RJ45

Stand Alone Example :

SMC9430 - 100 - 125 - 1B - 1

- 1 → One amplifier installed
- 1B → Single axis Stand Alone, AC Input
- 125 → CANopen Spindle, Molex
- 100 → Standard Power, 208 - 240 VAC
- SMC → External 24VDC Logic Power

Appendix J
Factory Repair, Maintenance and Warranty

Factory Repair

Should it become necessary to return an servo drive to Glentek for repair, please follow the procedure described below:

1. Reassemble the unit, if necessary, making certain that all the hardware is in place.
2. Tag the unit with the following information:
   - A. Serial number and model number.
   - B. Company name, phone number, and name of representative returning the unit.
   - C. A brief notation explaining the malfunction.
   - D. Date the unit is being returned.
3. Repackage the unit with the same care and fashion in which it was received. Label the container with the appropriate stickers (e.g.: FRAGILE: HANDLE WITH CARE).
4. Contact a Glentek representative, confirm that the unit is being returned to the factory and obtain an RMA (Return Material Authorization) number. The RMA number must accompany the unit upon return to Glentek. Do not ship unit with RMA number. Show RMA number on outside of package.
5. Return the unit by the best means possible. The method of freight chosen will directly affect the timeliness of its return.

Glentek may offer a 24-48 hr. expedited repair service, in the unlikely event that your system is down and you do not have a replacement.

Maintenance

There are no field-serviceable or replaceable parts or components in the SMX94XX amplifiers. Should the amplifier require a service, please contact Glentek about repairs.

Warranty:

Any product, or part thereof, manufactured by Glentek, Inc., which, under normal operating conditions in the plant of the original purchaser thereof, proves defective in material or workmanship within one year from the date of shipment by us, as determined by an inspection by us, will be repaired or replaced, at our discretion, free of charge, FOB our factory, El Segundo, California, U.S.A. Provided that you promptly send to us notice of the defect and establish that the product has been properly installed, maintained, and operated within the limits of rated and normal usage, and that no factory sealed adjustments have been tampered with. Glentek's liability is limited to repair or replacement of defective parts. Repaired items will carry a 90-day warranty.

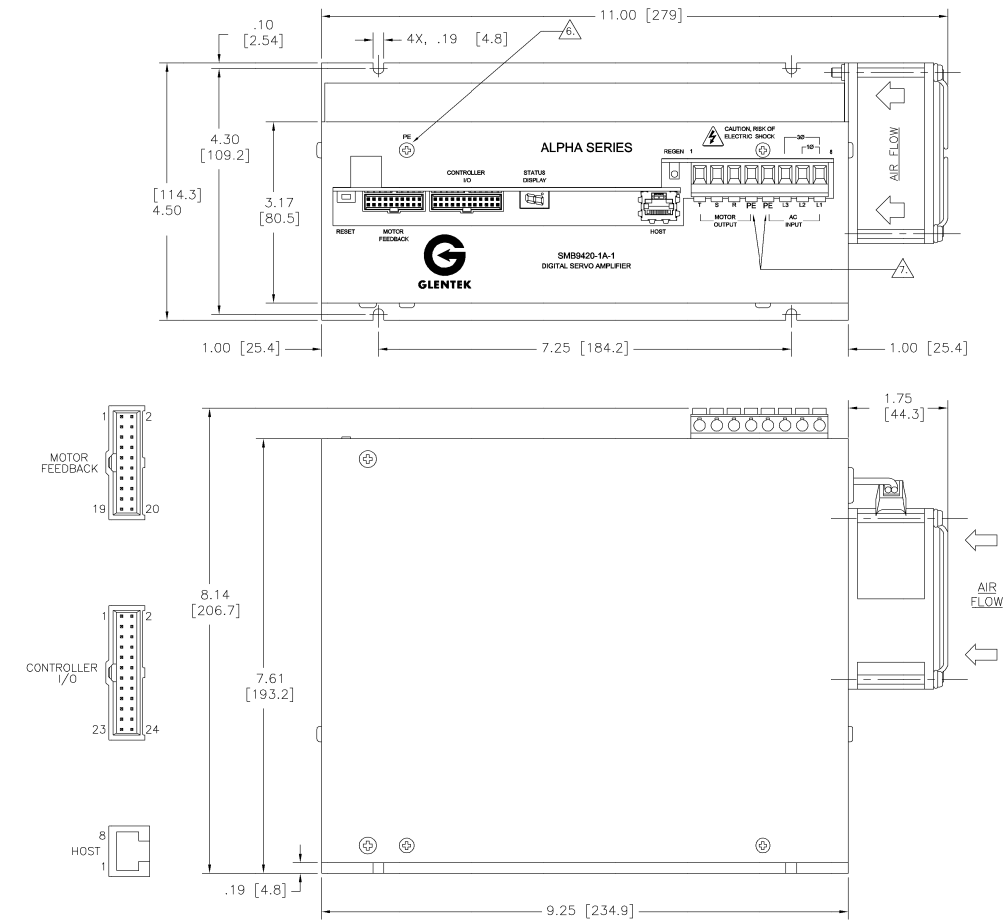
Any product or part manufactured by others and merely installed by us, such as an encoder, etc., is specifically not warranted by us and it is agreed that such product or part shall only carry the warranty, if any, supplied by the manufacturer of that part. It is also understood that you must look directly to such manufacturer for any defect, failure, claim or damage caused by such product or part.

Under no circumstances shall Glentek, Inc. or any of our affiliates have any liability whatsoever for claims or damages arising out of the loss of use of any product or part sold to you. Nor shall we have any liability to yourself or anyone for any indirect or consequential damages such as injuries to person and property caused directly or indirectly by the product or part sold to you, and you agree in accepting our product or part to save us harmless from any and all such claims or damages that may be initiated against us by third parties.

APPENDIX K

K– Drawings

SMB9420-1A-1	Amplifier, With Built-In DC Power Supply, Molex, Standard Power (Stand Alone, With Regen)
SMC9420-1A-1	Amplifier, With Built-In DC Power Supply, Molex, 24VDC Keep Alive, Standard Power (Stand Alone, With Regen)
SMB9420-1A-1	Amplifier, With Built-In DC Power Supply, Mini-D, Standard Power (Stand Alone, With Regen)
SMC9420-1A-1	Amplifier, With Built-In DC Power Supply, Mini-D, 24VDC Keep Alive, Standard Power (Stand Alone, With Regen)
SMB9430-1B-1	Amplifier, With Built-In DC Power Supply, Molex, Standard Power (Stand Alone, With Regen)
SMC9430-1B-1	Amplifier, With Built-In DC Power Supply, Molex, 24VDC Keep Alive, Standard Power (Stand Alone, With Regen)
SMB9430-1B-1	Amplifier, With Built-In DC Power Supply, Mini-D, Standard Power (Stand Alone, With Regen)
SMC9430-1B-1	Amplifier, With Built-In DC Power Supply, Mini-D, 24VDC Keep Alive, Standard Power (Stand Alone, With Regen)



NOTE:

1. ALL UNITS ARE IN INCHES AND [MILLIMETERS].
2. RECOMMEND ALL POWER WIRING, 14 AWG (2.08 MM²) OR LARGER, 105°C RATED PVC OR BETTER.
3. PLEASE MAINTAIN A MIN. OF 2" - 3" OF SPACE AT BOTH ENDS AND TOP OF THE AMPLIFIER TO ENSURE PROPER VENTILATION FOR THE UNIT.
4. COMMON (ANALOG) AND COMMON (DIGITAL) SIGNALS ARE CONNECTED TOGETHER INSIDE AMPLIFIER.
5. MAXIMUM HEIGHT IS 8.14 INCHES.
6. CONNECT CONTROLLER I/O & MOTOR FEEDBACK CABLE SHIELD TO THIS #6-32 GREEN GROUND SCREW.
7. CONNECT POWER AND MOTOR GROUND TO THESE GROUND TERMINALS.
8. OUTPUT POWER IS DERATED BY 40% FOR SINGLE PHASE AC INPUT.
9. RECOMMEND SIGNAL WIRING TO MOLEX SOCKET CONNECTOR, 22 AWG (0.326 MM²) OR 24 AWG (0.205 MM²). USE CRIMPING TOOL MOLEX ORDER NO. 11-01-0185 (CR2262C).

Controller I/O Connector

PIN	SIGNAL NAME
1	ENCODER A+(OUT) *
2	ENCODER A-(OUT) *
3	ENCODER B+(OUT) *
4	ENCODER B-(OUT) *
5	ENCODER Z+(OUT) *
6	ENCODER Z-(OUT) *
7	PULSE + *
8	PULSE - *
9	DIR + *
10	DIR - *
11	RESET IN
12	GO/STOP
13	E-STOP
14	INHIBIT
15	FAULT OUT
16	+5VDC *
17	COMMON (ANALOG)
18	COMMON (DIGITAL)
19	ANALOG OUT (AUX.) *
20	ANALOG OUT
21	RELAY OUT
22	RELAY OUT
23	SIGNAL 1+
24	SIGNAL 1-

(* - OPTIONAL)

Motor Feedback Connector

PIN	SIGNAL NAME
1	RESERVED
2	RESERVED
3	RESERVED
4	MOTOR TEMP
5	ENCODER Z+ (IN) *
6	ENCODER Z- (IN) *
7	ENCODER B+ (IN) *
8	ENCODER B- (IN) *
9	ENCODER A+ (IN) *
10	ENCODER A- (IN) *
11	HALL U+
12	HALL U- *
13	HALL V+
14	HALL V- *
15	HALL W+
16	HALL W- *
17	ENCODER PWR (+5VDC)
18	COMMON (DIGITAL)
19	ENCODER PWR (+5VDC)
20	COMMON (DIGITAL)

(* - OPTIONAL)

Host Connector

PIN	SIGNAL NAME
1	RESERVED
2	RESERVED
3	RESERVED
4	COMMON (DIGITAL)
5	TX232
6	RX232
7	RESERVED
8	RESERVED

Power/Motor Connector

PIN	SIGNAL NAME
1	MOTOR PHASE T
2	MOTOR PHASE S
3	MOTOR PHASE R
4	PROTECTIVE EARTHING (CHASSIS GND)
5	PROTECTIVE EARTHING (CHASSIS GND)
6	AC LINE 3
7	AC LINE 2
8	AC LINE 1

Status Display

DISPLAY	FAULT DESCRIPTION
1	EEPROM FAULT
2	RAM FAULT
3	CPLD FAULT
8	EXTERNAL RESET
b	BUS OVERVOLTAGE
C	CLAMP
c	FAULT INPUT
E	ENCODER FAULT
F	FOLDBACK
H	HEATSINK OVERTEMP
h	MOTOR OVERTEMP
L	LS/ECB
O	NORMAL OPERATION
S	HS/ECB
U	UNDER VOLTAGE
=	HALL FAULT
≡	COMMUTATION FAULT
8.	PROCESSOR IN RESET
SINGLE OUTER SEGMENT	AMP ENABLED, HALL

Bus Over Voltage, Under Voltage, and Regen Voltage Settings

POWER INPUT VOLTAGE	BUS OVER VOLTAGE	BUS UNDER VOLTAGE	REGEN VOLTAGE
208 - 240 VAC	450 VDC ± 5%	150 VDC ± 5%	395 VDC ± 5%
110 - 130 VAC	250 VDC ± 5%	60 VDC ± 5%	230 VDC ± 5%

Regen Resistance

POWER INPUT VOLTAGE	REGEN RESISTANCE
208 - 240 VAC	45 Ohms, 95W max (with forced air cooling)
110 - 130 VAC	30 Ohms, 95W max (with forced air cooling)

REVISION HISTORY

ZONE	REV	DESCRIPTION	ECO	DATE	CHANGED	APPD
-	A	INITIAL RELEASE	3291	30DEC11	NTHALLA	J.M.

Specifications and Features

AC Supply Input	208 - 240 VAC, (1-Phase or 3-Phase, 50/60 Hz)
Inrush Current at Power Up	170A max @ 240VAC
Peak Current Output	40 A @ 25°C Ambient (with forced air cooling)
Continuous Current Output	20 A @ 25°C Ambient (with forced air cooling)
Fault Protection	Short circuit protection from motor phase to phase, motor phase to DC bus, motor phase to case (chassis GND). Amplifier RMS over current. DC bus over/under voltage. Amplifier over temperature. Motor over temperature (switch or thermistor input). Encoder broken wire. Invalid Hall/comm track state. Commutation fault.
Amplifier Status Indication	7-Segment display indicates amplifier status and diagnostics
Low Speed Electronic Circuit Breaker (LS/ECB)	Latches when programmable current (20 A max.), and time (10 sec max.) exceed limit.
Bus Overvoltage	See Table
Bus Undervoltage	See Table
Internal Regen	See Table
Regen Voltage	See Table
Internal Output Inductors (Optional)	300 uH ± 10% per motor output phase, Qty = 3 (600 uH phase to phase)
Amplifier Type	See Model Number Key (from product manual)
Analog Command Input	±10V for analog velocity or current command
Pulse & Direction Inputs	Accepts TTL level Step & Direction signals
Encoder Feedback	Accepts TTL level encoder signals
Dedicated Inputs	E-stop, go/stop, inhibit, motor overtemp and reset signal
Dedicated Fault Output (Programmable Level)	TTL Compatible
Analog Out	±10 V analog output (12-Bit) for monitoring DSP signals, output source selectable and scalable using MotionMaestro™ setup software, 2 channels and 16-Bit are available (optional)
Auto Phasing	Plug & Play for all types of three phase Brushless Motors.
Smart Com Initialization at Amplifier turn on	Eliminates the need for Hall sensor or commutation tracks for many applications.
RS-232 Host Port	Host Port for Setup and Monitoring 115.2 Kbaud, 8 Bits, no parity, 1 Stop Bit
Software Configurable	Glentek's Windows™ based MotionMaestro software™ provides ease of set-up and tuning with no previous programming experience required. This software is Windows required. This software is Windows
Digitally Tuned	All parameters set digitally. No potentiometers to adjust. RS-232 high speed serial communication interface for all gain and PID tuning parameters.
At Speed Relay	Relay closure when actual speed is within 1% (50RPM Minimum) of command. Max. operating current 1A
Non-Volatile Memory	All parameters are stored in non-volatile memory
Switching Frequency	25KHz Base/50 KHz effective
Current Loop Bandwidth	Tunable up to 3 KHz
Amplifier Isolation	Logic Completely Isolated from High Voltage Output Stage
Operating Temperature	0 °C to +60 °C
Storage Temperature	-40 °C to +80 °C
Humidity	5% to 95% non-condensing
Mounting Hardware	#8-32 or M4 Screw, Qty = 4
Dimension (L x H x W - inches)	L 11.00, H. 8.14, W. 4.50
Backup File	xxxx-5.BK

Mating Connectors

Controller I/O, 24 Pin Molex	Glentek P/N: EJB22F12; Molex P/N: 90142-0024
Encoder Feedback, 20 Pin Molex	Glentek P/N: EJB22F10; Molex P/N: 90142-0020
Controller I/O & Motor Feedback Socket Connector, Molex	Glentek P/N: EJB21F01; Molex P/N: 90119-2110
Host, RJ45 Molex	Glentek P/N: EJ018083; Molex P/N: 87522-8012
Power Input / Motor Output, 8 Pin Phoenix	Glentek P/N: EJ531F08; Phoenix P/N: 1975642

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES ARE AS FOLLOWS: DECIMAL: .XX = ±0.01, .XXX = ±0.005; ANGULAR: < = ±0.5°; FINISH: 125 MAXIMUM

APPROVAL	DATE
DWN BY: NTHALLA	03JAN12
CHK BY: L.L.	03JAN12
APP BY: J.M.	03JAN12

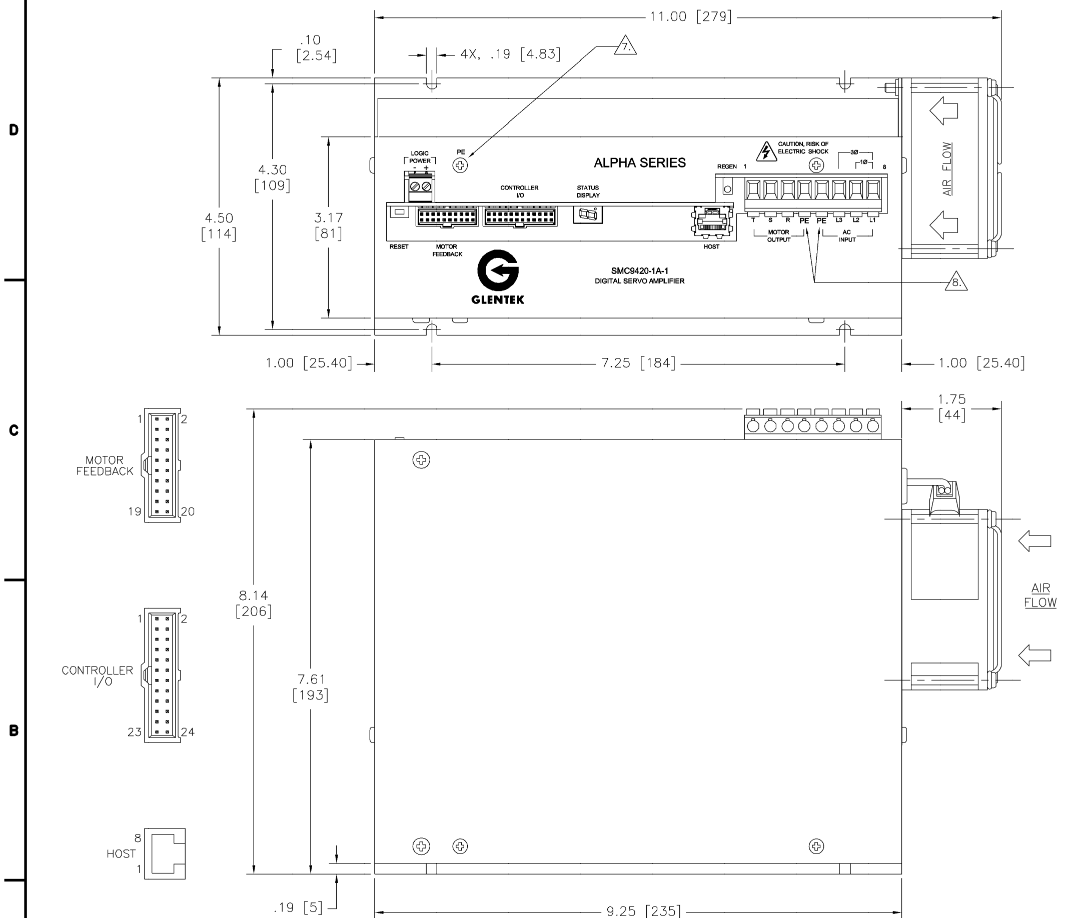
GLENTEK "Solutions for Motion Control" 208 Standard Street El Segundo, CA 90245 USA 310.322.3026 FAX 310.322.7709 www.glentek.com

DRAWING TITLE: INSTALLATION, SMB9420-1A-1 SPINDLE, MOLEX

SIZE: D | MODEL: SMB9420-1A-1 | DRAWING NUMBER: 9420-1038-000 | REV: A

SCALE: 1:1 | FILE NAME: 9420-1038-000-A.DWG | SHEET 1 OF 1

CONFIGURATION CODE: -



NOTE:

1. ALL UNITS ARE IN INCHES AND [MILLIMETERS].
2. RECOMMEND ALL POWER WIRING, 14 AWG (2.08 MM²) OR LARGER, 105°C RATED PVC OR BETTER.
3. PLEASE MAINTAIN A MIN. OF 2" - 3" OF SPACE AT BOTH ENDS AND TOP OF THE AMPLIFIER TO ENSURE PROPER VENTILATION FOR THE UNIT.
4. EXTERNAL +24VDC FOR LOGIC POWER IS SUPPLIED BETWEENPIN 1 (COMMON) AND PIN 2 (+24VDC) OF LOGIC POWER CONNECTOR.
5. COMMON (ANALOG) AND COMMON (DIGITAL) SIGNALS ARE CONNECTED TOGETHER INSIDE AMPLIFIER.
6. MAXIMUM HEIGHT IS 8.14 INCHES.
7. CONNECT CONTROLLER I/O & MOTOR FEEDBACK CABLE SHIELD TO THIS #6-32 GREEN GROUND SCREW.
8. CONNECT POWER AND MOTOR GROUND TO THESE GROUND TERMINALS.
9. OUTPUT POWER IS DERATED BY 40% FOR SINGLE PHASE AC INPUT.
10. RECOMMEND SIGNAL WIRING TO MOLEX SOCKET CONNECTOR, 22 AWG (0.326 MM²) OR 24 AWG (0.205 MM²). USE CRIMPING TOOL MOLEX ORDER NO. 11-01-0185 (CR2262C).

Controller I/O Connector

PIN	SIGNAL NAME
1	ENCODER A+(OUT) *
2	ENCODER A-(OUT) *
3	ENCODER B+(OUT) *
4	ENCODER B-(OUT) *
5	ENCODER Z+(OUT) *
6	ENCODER Z-(OUT) *
7	PULSE + *
8	PULSE - *
9	DIR + *
10	DIR - *
11	RESET IN
12	GO/STOP
13	E-STOP
14	INHIBIT
15	FAULT OUT
16	+5VDC *
17	COMMON (ANALOG)
18	COMMON (DIGITAL)
19	ANALOG OUT (AUX.) *
20	ANALOG OUT
21	RELAY OUT
22	RELAY OUT
23	SIGNAL 1+
24	SIGNAL 1-

(* - OPTIONAL)

Motor Feedback Connector

PIN	SIGNAL NAME
1	RESERVED
2	RESERVED
3	RESERVED
4	MOTOR TEMP
5	ENCODER Z+ (IN) *
6	ENCODER Z- (IN) *
7	ENCODER B+ (IN) *
8	ENCODER B- (IN) *
9	ENCODER A+ (IN) *
10	ENCODER A- (IN) *
11	HALL U+
12	HALL U- *
13	HALL V+
14	HALL V- *
15	HALL W+
16	HALL W- *
17	ENCODER PWR (+5VDC)
18	COMMON (DIGITAL)
19	ENCODER PWR (+5VDC)
20	COMMON (DIGITAL)

(* - OPTIONAL)

Status Display

DISPLAY	FAULT DESCRIPTION
1	EEPROM FAULT
2	RAM FAULT
3	CPLD FAULT
8	EXTERNAL RESET
b	BUS OVERVOLTAGE
C	CLAMP
c	FAULT INPUT
E	ENCODER FAULT
F	FOLDBACK
H	HEATSINK OVERTEMP
h	MOTOR OVERTEMP
L	LS/ECB
O	NORMAL OPERATION
S	HS/ECB
U	UNDER VOLTAGE
=	HALL FAULT
≡	COMMUTATION FAULT
8.	PROCESSOR IN RESET
SINGLE OUTER SEGMENT	AMP ENABLED, HALL

Host Connector

PIN	SIGNAL NAME
1	RESERVED
2	RESERVED
3	RESERVED
4	COMMON (DIGITAL)
5	TX232
6	RX232
7	RESERVED
8	RESERVED

Power/Motor Connector

PIN	SIGNAL NAME
1	MOTOR PHASE T
2	MOTOR PHASE S
3	MOTOR PHASE R
4	PROTECTIVE EARTHING (CHASSIS GND)
5	PROTECTIVE EARTHING (CHASSIS GND)
6	AC LINE 3
7	AC LINE 2
8	AC LINE 1

Logic Power Connector

PIN	SIGNAL NAME
1	COMMON (DIGITAL)
2	+24VDC

Mating Connectors

Controller I/O, 24 Pin Molex	Glentek P/N: EJB22F12; Molex P/N: 90142-0024
Encoder Feedback, 20 Pin Molex	Glentek P/N: EJB22F10; Molex P/N: 90142-0020
Controller I/O & Motor Feedback Socket Connector, Molex	Glentek P/N: EJB21F01; Molex P/N: 90119-2110
Host, RJ45 Molex	Glentek P/N: EJ018083; Molex P/N: 87522-8012
Power Input / Motor Output, 8 Pin Phoenix	Glentek P/N: EJ531F08; Phoenix P/N: 1975642
Logic Power, 2 Pin Phoenix	Glentek P/N: EJ741V02; Phoenix P/N: 1792757

Bus Over Voltage, Under Voltage, and Regen Voltage Settings

POWER INPUT VOLTAGE	BUS OVER VOLTAGE	BUS UNDER VOLTAGE	REGEN VOLTAGE
208 - 240 VAC	450 VDC ± 5%	150 VDC ± 5%	395 VDC ± 5%
110 - 130 VAC	250 VDC ± 5%	60 VDC ± 5%	230 VDC ± 5%

REVISION HISTORY

ZONE	REV	DESCRIPTION	ECO	DATE	CHANGED	APPD
-	A	INITIAL DRAWING RELEASE	3291	30DEC11	NTHALLA	J.M.

Specifications and Features

AC Supply Input	208 - 240 VAC, (1-Phase or 3-Phase, 50/60 Hz)
Inrush Current at Power Up	170A max @ 240VAC
Logic Supply Input	24 to 48 VDC, 600mA max @24VDC. Powers all amplifier logic and encoders.
Peak Current Output	40 A @ 25°C Ambient (with forced air cooling)
Continuous Current Output	20 A @ 25°C Ambient (with forced air cooling)
Fault Protection	Short circuit protection from motor phase to phase, motor phase to DC bus, motor phase to case (chassis GND). Amplifier RMS over current. DC bus over/under voltage. Amplifier over temperature. Motor over temperature (switch or thermistor input). Encoder broken wire. Invalid Hall/comm track state. Commutation fault.
Amplifier Status Indication	7-Segment display indicates amplifier status and diagnostics
Low Speed Electronic Circuit Breaker (LS/ECB)	Latches when programmable current (20 A max.), and time (10 sec max.) exceed limit.
Bus Overvoltage	See Table
Bus Undervoltage	See Table
Internal Regen	See Table
Regen Voltage	See Table
Internal Output Inductors (Optional)	300 uH ± 10% per motor output phase, Qty = 3 (600 uH phase to phase)
Amplifier Type	See Model Number Key (from product manual)
Analog Command Input	±10V for analog velocity or current command
Pulse & Direction Inputs	Accepts TTL level Step & Direction signals
Encoder Feedback	Accepts TTL level encoder signals
Dedicated Inputs	E-stop, go/stop, inhibit, motor overtemp and reset signal
Dedicated Fault Output (Progammable Level)	TTL Compatible
Analog Out	±10 V analog output (12-Bit) for monitoring DSP signals, output source selectable and scalable using MotionMaestro™ setup software, 2 channels and 16-Bit are available (optional)
Auto Phasing	Plug & Play for all types of three phase Brushless Motors.
Smart Com Initialization at Amplifier turn on	Eliminates the need for Hall sensor or commutation tracks for many applications.
RS-232 Host Port	Host Port for Setup and Monitoring 115.2 Kbaud, 8 Bits, no parity, 1 Stop Bit
Software Configurable	Glentek's Windows™ based MotionMaestro software™ provides ease of set-up and tuning with no previous programming experience required. This software is Windows required. This software is Windows
Digitally Tuned	All parameters set digitally. No potentiometers to adjust. RS-232 high speed serial communication interface for all gain and PID tuning parameters.
At Speed Relay	Relay closure when actual speed is within 1% (50RPM Minimum) of command. Max. operating current 1A
Non-Volatile Memory	All parameters are stored in non-volatile memory
Switching Frequency	25KHz Base/50 KHz effective
Current Loop Bandwidth	Tunable up to 3 KHz
Amplifier Isolation	Logic Completely Isolated from High Voltage Output Stage
Operating Temperature	0 °C to +60 °C
Storage Temperature	-40 °C to +80 °C
Humidity	5% to 95% non-condensing
Mounting Hardware	#8-32 or M4 Screw, Qty = 4
Dimension (L x H x W - inches)	L. 11.00, H. 8.14, W. 4.50
Backup File	xxxx-5.BK

Regen Resistance

POWER INPUT VOLTAGE	REGEN RESISTANCE
208 - 240 VAC	45 Ohms, 95W max (with forced air cooling)
110 - 130 VAC	30 Ohms, 95W max (with forced air cooling)

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	APPROVAL	DATE
TOLERANCES ARE AS FOLLOWS: DECIMAL: .XX = ±0.01, .XXX = ±0.005; ANGULAR: < = ±0.5°	DWN BY: NTHALLA	30DEC11
	CHK BY: L.L.	30DEC11
FINISH: 125 MAXIMUM	APP BY: J.M.	30DEC11

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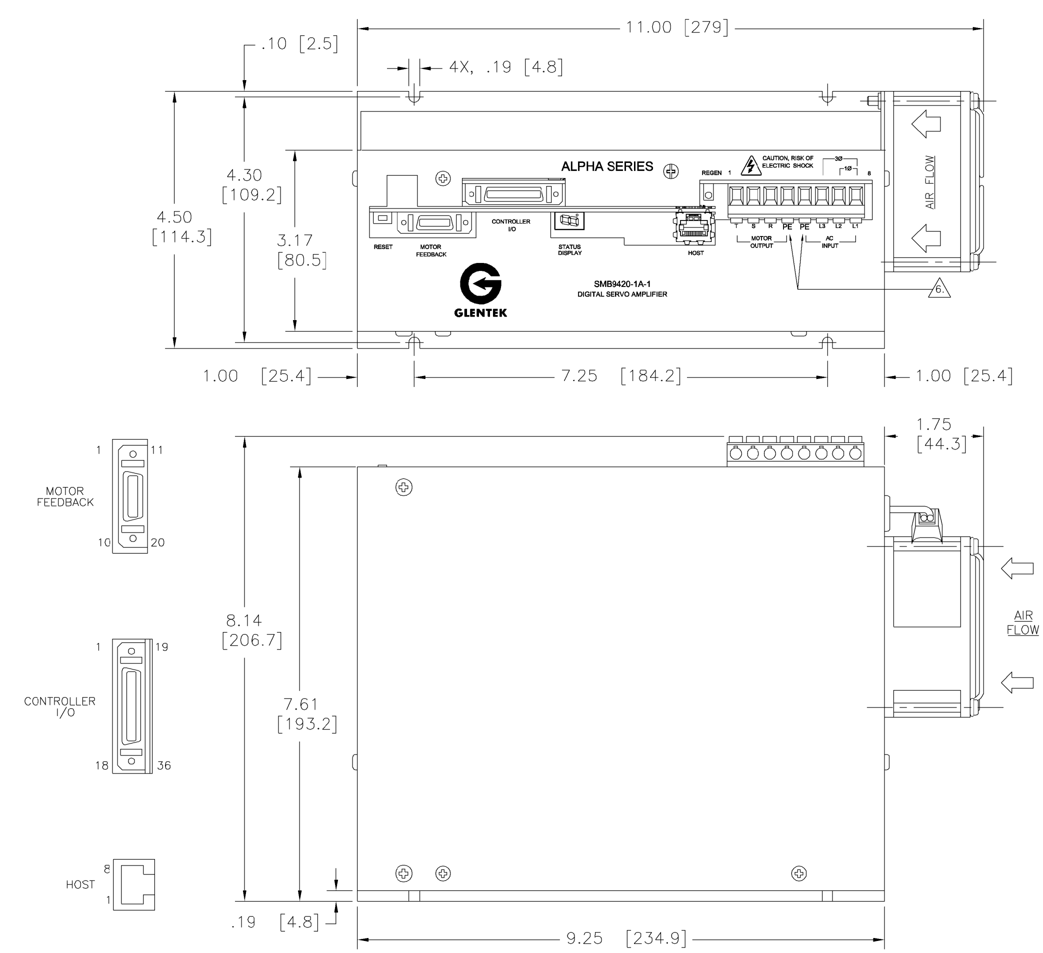
GLENTEK "Solutions for Motion Control" 208 Standard Street El Segundo, CA 90245 USA 310.322.3026 FAX 310.322.7709 www.glentek.com

DRAWING TITLE: INSTALLATION, SMC9420-1A-1 SPINDLE, MOLEX

SIZE	MODEL	DRAWING NUMBER	REV
D	SMC9420-1A-1	9420-1039-000	A

SCALE: 1:1 | FILE NAME: 9420-1039-000-A.DWG | SHEET 1 OF 1

CONFIGURATION CODE: -



NOTE:
1. ALL UNITS ARE IN INCHES AND [MILLIMETERS].
2. RECOMMEND ALL POWER WIRING, 14 AWG (2.08 MM²) OR LARGER, 105°C RATED PVC OR BETTER.
3. PLEASE MAINTAIN A MIN. OF 2" – 3" OF SPACE AT BOTH ENDS AND TOP OF THE AMPLIFIER TO ENSURE PROPER VENTILATION FOR THE UNIT.
4. COMMON (ANALOG) AND COMMON (DIGITAL) SIGNALS ARE CONNECTED TOGETHER INSIDE AMPLIFIER.
5. MAXIMUM HEIGHT IS 8.14 INCHES.
6. CONNECT POWER AND MOTOR GROUND TO THESE GROUND TERMINALS.
7. OUTPUT POWER IS DERATED BY 40% FOR SINGLE PHASE AC INPUT.
8. RECOMMEND SIGNAL WIRING TO MINI-D SOCKET CONNECTOR, 22 AWG (0.326 MM²) OR 24 AWG (0.205 MM²).

Controller I/O Connector

PIN	SIGNAL NAME
1	SIGNAL 1+
2	SIGNAL 1-
3	RESERVED
4	RESERVED
5	ANALOG OUT (AUX.) *
6	COMMON (ANALOG)
7	ANALOG OUT
8	GO/STOP
9	E-STOP
10	INHIBIT
11	FAULT OUT
12	COMMON
13	RESET IN
14	MTR TEMP SW
15	RESERVED
16	COMMON (DIGITAL)
17	ENCODER Z - (OUT) *
18	ENCODER Z + (OUT) *
19	RELAY OUT
20	RELAY OUT
21	COMMON (ANALOG)
22	COMMON (DIGITAL)
23	PULSE - *
24	PULSE + *
25	DIRECTION - *
26	DIRECTION + *
27	+5 VDC
28	+5 VDC
29	COMMON (DIGITAL)
30	COMMON (DIGITAL)
31	RESERVED
32	RESERVED
33	ENCODER A+ (OUT) *
34	ENCODER A- (OUT) *
35	ENCODER B+ (OUT) *
36	ENCODER B- (OUT) *

(* - OPTIONAL)

Power/Motor Connector

PIN	SIGNAL NAME
1	MOTOR PHASE T
2	MOTOR PHASE S
3	MOTOR PHASE R
4	PROTECTIVE EARTHING (CHASSIS GND)
5	PROTECTIVE EARTHING (CHASSIS GND)
6	AC LINE 3
7	AC LINE 2
8	AC LINE 1

Motor Feedback Connector

PIN	SIGNAL NAME
1	ENCODER PWR (+5VDC)
2	COMMON (DIGITAL)
3	ENCODER PWR (+5VDC)
4	COMMON (DIGITAL)
5	ENCODER A + (IN) *
6	ENCODER A - (IN) *
7	ENCODER B + (IN) *
8	ENCODER B - (IN) *
9	ENCODER Z + (IN) *
10	ENCODER Z - (IN) *
11	HALL 1 +
12	HALL 1 -
13	HALL 2 +
14	HALL 2 -
15	HALL 3 +
16	HALL 3 -
17	MTR TEMP SW
18	COMMON (DIGITAL)
19	COMMON (DIGITAL)
20	COMMON (DIGITAL)

(* - OPTIONAL)

Host Connector

PIN	SIGNAL NAME
1	RESERVED
2	RESERVED
3	RESERVED
4	COMMON (DIGITAL)
5	TX232
6	RX232
7	RESERVED
8	RESERVED

Status Display

DISPLAY	FAULT DESCRIPTION
1	EEPROM FAULT
2	RAM FAULT
3	CPLD FAULT
8	EXTERNAL RESET
b	BUS OVERVOLTAGE
C	CLAMP
c	FAULT INPUT
E	ENCODER FAULT
F	FOLDBACK
H	HEATSINK OVERTEMP
h	MOTOR OVERTEMP
L	LS/ECB
O	NORMAL OPERATION
S	HS/ECB
U	UNDER VOLTAGE
=	HALL FAULT
≡	COMMUTATION FAULT
8.	PROCESSOR IN RESET
SINGLE OUTER SEGMENT	AMP ENABLED, HALL

Regen Resistance

POWER INPUT VOLTAGE	REGEN RESESTENCE
208 - 240 VAC	45 Ohms, 95W max (with forced air cooling)
110 - 130 VAC	30 Ohms, 95W max (with forced air cooling)

Bus Over Voltage, Under Voltage, and Regen Voltage Settings

POWER INPUT VOLTAGE	BUS OVER VOLTAGE	BUS UNDER VOLTAGE	REGEN VOLTAGE
208 - 240 VAC	450 VDC ± 5%	150 VDC ± 5%	395 VDC ± 5%
110 - 130 VAC	250 VDC ± 5%	60 VDC ± 5%	230 VDC ± 5%

REVISION HISTORY

ZONE	REV	DESCRIPTION	ECO	DATE	CHANGED	APPD
-	A	INITIAL DRAWING RELEASE	3291	30DEC11	NTHALLA	J.M.

Specifications and Features

AC Supply Input	208 - 240 VAC, (1-Phase or 3-Phase, 50/60 Hz)
Inrush Current at Power Up	170A max @ 240VAC
Peak Current Output	40 A @ 25°C Ambient (with forced air cooling)
Continuous Current Output	20 A @ 25°C Ambient (with forced air cooling)
Fault Protection	Short circuit protection from motor phase to phase, motor phase to DC bus, motor phase to case (chassis GND). Amplifier RMS over current. DC bus over/under voltage. Amplifier over temperature. Motor over temperature (switch or thermistor input). Encoder broken wire. Invalid Hall/comm track state. Commutation fault.
Amplifier Status Indication	7-Segment display indicates amplifier status and diagnostics
Low Speed Electronic Circuit Breaker (LS/ECB)	Latches when programmable current (20 A max.), and time (10 sec max.) exceed limit.
Bus Overvoltage	See Table
Bus Undervoltage	See Table
Internal Regen	See Table
Regen Voltage	See Table
Internal Output Inductors (Optional)	300 uH ± 10% per motor output phase, Qty = 3 (600 uH phase to phase)
Amplifier Type	See Model Number Key (from product manual)
Analog Command Input	±10V for analog velocity or current command
Pulse & Direction Inputs	Accepts TTL level Step & Direction signals
Encoder Feedback	Accepts TTL level encoder signals
Dedicated inputs	E-stop, go/stop, inhibit, motor overtemp and reset signal
Dedicated Fault Output (Progammable Level)	TTL Compatible
Analog Out	±10 V analog output (12-Bit) for monitoring DSP signals, output source selectable and scalable using MotionMaestro™ setup software, 2 channels and 16-Bit are available (optional)
Auto Phasing	Plug & Play for all types of three phase Brushless Motors.
Smart Com Initialization at Amplifier turn on	Eliminates the need for Hall sensor or commutation tracks for many applications.
RS-232 Host Port	Host Port for Setup and Monitoring 115.2 Kbaud, 8 Bits, no parity, 1 Stop Bit
Software Configurable	Glentek's Windows™ based MotionMaestro software™ provides ease of set-up and tuning with no previous programming experience required. This software is Windows required. This software is Windows
Digitally Tuned	All parameters set digitally. No potentiometers to adjust. RS-232 high speed serial communication interface for all gain and PID tuning parameters.
At Speed Relay	Relay closure when actual speed is within 1% (50RPM Minimum) of command. Max. operating current 1A
Non-Volatile Memory	All parameters are stored in non-volatile memory
Switching Frequency	25KHz Base/50 KHz effective
Current Loop Bandwidth	Tunable up to 3 KHz
Amplifier Isolation	Logic Completely Isolated from High Voltage Output Stage
Operating Temperature	0 °C to +60 °C
Storage Temperature	-40 °C to +80 °C
Humidity	5% to 95% non-condensing
Mounting Hardware	#8-32 or M4 Screw, Qty = 4
Dimension (L x H x W - inches)	L. 11.00, H. 8.14, W. 4.50
Backup File	xxxx-5.BK

Mating Connectors

Controller I/O, 36 Pin 3M	Glentek P/N: EJC10136; 3M P/N: 10136-3000VE
36 Pin Mini-D, Backshell	Glentek P/N: EJC10336 ; 3M P/N: 10336-52A0-008
Motor Feedback, 20 Pin 3M	Glentek P/N: EJC10120; 3M P/N: 10120-3000VE
20 Pin Mini-D, Backshell	Glentek P/N: EJC10320; 3M P/N: 10320-52A0-008
Host, RJ45 Molex	Glentek P/N: EJ018083; Molex P/N: 87522-8012
Power Input / Motor Output, 8 Pin Phoenix	Glentek P/N: EJ531F08; Phoenix P/N: 1975642

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE AS FOLLOWS: DECIMAL: .XX = ±0.01, .XXX = ±0.005; ANGULAR: < = ±0.5°
FINISH: 125 MAXIMUM

APPROVAL	DATE
DWN BY: NTHALLA	30DEC11
CHK BY: L.L.	30DEC11
APP BY: J.M.	30DEC11

GLENTEK "Solutions for Motion Control"
208 Standard Street, El Segundo, CA 90245 USA, 310.322.3026 FAX 310.322.7709, www.glentek.com

DRAWING TITLE: INSTALLATION, SMB9420-1A-1 SPINDLE, MINI-D
SIZE: D | MODEL: SMB9420-1A-1 | DRAWING NUMBER: 9420-1041-000 | REV: A
SCALE: 1:1 | FILE NAME: 9420-1041-000-A.DWG | SHEET 1 OF 1
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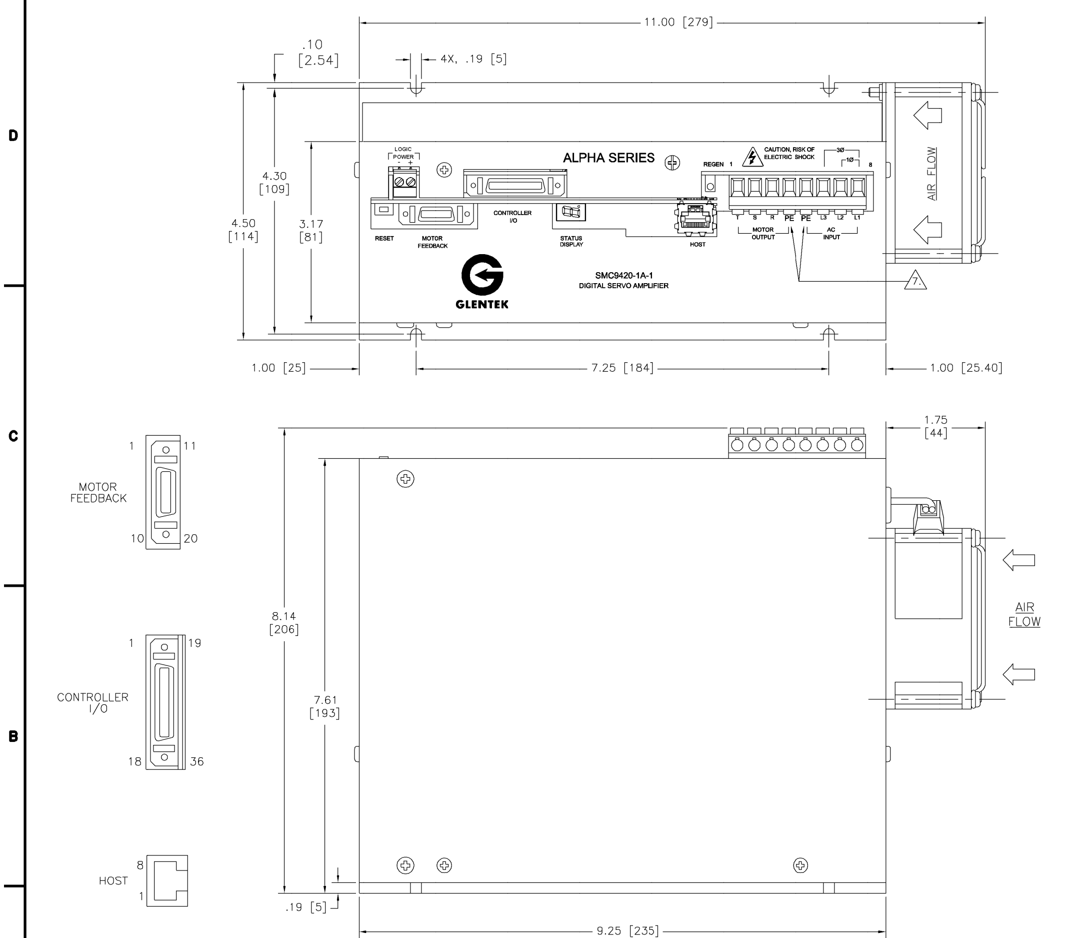

NOTE:
1. ALL UNITS ARE IN INCHES AND [MILLIMETERS].
2. RECOMMEND ALL POWER WIRING, 14 AWG (2.08 MM²) OR LARGER, 105°C RATED PVC OR BETTER.
3. PLEASE MAINTAIN A MIN. OF 2" - 3" OF SPACE AT BOTH ENDS AND TOP OF THE AMPLIFIER TO ENSURE PROPER VENTILATION FOR THE UNIT.
4. EXTERNAL +24VDC FOR LOGIC POWER IS SUPPLIED BETWEENPIN 1 (COMMON) AND PIN 2 (+24VDC) OF LOGIC POWER CONNECTOR.
5. COMMON (ANALOG) AND COMMON (DIGITAL) SIGNALS ARE CONNECTED TOGETHER INSIDE AMPLIFIER.
6. MAXIMUM HEIGHT IS 8.14 INCHES.
7. CONNECT POWER AND MOTOR GROUND TO THESE GROUND TERMINALS.
8. OUTPUT POWER IS DERATED BY 40% FOR SINGLE PHASE AC INPUT.
9. RECOMMEND SIGNAL WIRING TO MINI-D SOCKET CONNECTOR, 22 AWG (0.326 MM²) OR 24 AWG (0.205 MM²).

Controller I/O Connector

PIN	SIGNAL NAME
1	SIGNAL 1+
2	SIGNAL 1-
3	RESERVED
4	RESERVED
5	ANALOG OUT (AUX.) *
6	COMMON (ANALOG)
7	ANALOG OUT
8	GO/STOP
9	E-STOP
10	INHIBIT
11	FAULT OUT
12	COMMON
13	RESET IN
14	MTR TEMP SW
15	RESERVED
16	COMMON (DIGITAL)
17	ENCODER Z - (OUT) *
18	ENCODER Z + (OUT) *
19	RELAY OUT
20	RELAY OUT
21	COMMON (ANALOG)
22	COMMON (DIGITAL)
23	PULSE - *
24	PULSE + *
25	DIRECTION - *
26	DIRECTION + *
27	+5 VDC
28	+5 VDC
29	COMMON (DIGITAL)
30	COMMON (DIGITAL)
31	RESERVED
32	RESERVED
33	ENCODER A+ (OUT) *
34	ENCODER A- (OUT) *
35	ENCODER B+ (OUT) *
36	ENCODER B- (OUT) *

(* - OPTIONAL)

Power/Motor Connector

PIN	SIGNAL NAME
1	MOTOR PHASE T
2	MOTOR PHASE S
3	MOTOR PHASE R
4	PROTECTIVE EARTHING (CHASSIS GND)
5	PROTECTIVE EARTHING (CHASSIS GND)
6	AC LINE 3
7	AC LINE 2
8	AC LINE 1

Logic Power Connector

PIN	SIGNAL NAME
1	COMMON (DIGITAL)
2	+24VDC

Motor Feedback Connector

PIN	SIGNAL NAME
1	ENC PWR (+5VDC)
2	COMMON (DIGITAL)
3	ENC PWR (+5VDC)
4	COMMON (DIGITAL)
5	ENCODER A + (IN) *
6	ENCODER A - (IN) *
7	ENCODER B + (IN) *
8	ENCODER B - (IN) *
9	ENCODER Z + (IN) *
10	ENCODER Z - (IN) *
11	HALL 1 +
12	HALL 1 -
13	HALL 2 +
14	HALL 2 -
15	HALL 3 +
16	HALL 3 -
17	MTR TEMP SW
18	COMMON (DIGITAL)
19	COMMON (DIGITAL)
20	COMMON (DIGITAL)

(* - OPTIONAL)

Status Display

DISPLAY	FAULT DESCRIPTION
1	EEPROM FAULT
2	RAM FAULT
3	CPLD FAULT
8	EXTERNAL RESET
b	BUS OVERVOLTAGE
C	CLAMP
c	FAULT INPUT
E	ENCODER FAULT
F	FOLDBACK
H	HEATSINK OVERTEMP
h	MOTOR OVERTEMP
L	LS/ECB
O	NORMAL OPERATION
S	HS/ECB
U	UNDER VOLTAGE
=	HALL FAULT
≡	COMMUTATION FAULT
8.	PROCESSOR IN RESET
SINGLE OUTER SEGMENT	AMP ENABLED, HALL

Host Connector

PIN	SIGNAL NAME
1	RESERVED
2	RESERVED
3	RESERVED
4	COMMON (DIGITAL)
5	TX232
6	RX232
7	RESERVED
8	RESERVED

Regen Resistance

POWER INPUT VOLTAGE	REGEN RESESTENCE
208 - 240 VAC	45 Ohms, 95W max (with forced air cooling)
110 - 130 VAC	30 Ohms, 95W max (with forced air cooling)

Bus Over Voltage, Under Voltage, and Regen Voltage Settings

POWER INPUT VOLTAGE	BUS OVER VOLTAGE	BUS UNDER VOLTAGE	REGEN VOLTAGE
208 - 240 VAC	450 VDC ± 5%	150 VDC ± 5%	395 VDC ± 5%
110 - 130 VAC	250 VDC ± 5%	60 VDC ± 5%	230 VDC ± 5%

REVISION HISTORY

ZONE	REV	DESCRIPTION	ECO	DATE	CHANGED	APPD
-	A	INITIAL DRAWING RELEASE	3291	30DEC11	NTHALLA	J.M.

Specifications and Features

AC Supply Input	208 - 240 VAC, (1-Phase or 3-Phase, 50/60 Hz)
Inrush Current at Power Up	170A max @ 240VAC
Logic Supply Input	24 to 48 VDC, 600mA max @24VDC. Powers all amplifier logic and encoders.
Peak Current Output	40 A @ 25°C Ambient (with forced air cooling)
Continuous Current Output	20 A @ 25°C Ambient (with forced air cooling)
Fault Protection	Short circuit protection from motor phase to phase, motor phase to DC bus, motor phase to case (chassis GND). Amplifier RMS over current. DC bus over/under voltage. Amplifier over temperature. Motor over temperature (switch or thermistor input). Encoder broken wire. Invalid Hall/comm track state. Commutation fault.
Amplifier Status Indication	7-Segment display indicates amplifier status and diagnostics
Low Speed Electronic Circuit Breaker (LS/ECB)	Latches when programmable current (20 A max.), and time (10 sec max.) exceed limit.
Bus Overvoltage	See Table
Bus Undervoltage	See Table
Internal Regen	See Table
Regen Voltage	See Table
Internal Output Inductors (Optional)	300 uH ± 10% per motor output phase, Qty = 3 (600 uH phase to phase)
Amplifier Type	See Model Number Key (from product manual)
Analog Command Input	±10V for analog velocity or current command
Pulse & Direction Inputs	Accepts TTL level Step & Direction signals
Encoder Feedback	Accepts TTL level encoder signals
Dedicated Inputs	E-stop, go/stop, inhibit, motor overtemp and reset signal
Dedicated Fault Output (Progammable Level)	TTL Compatible
Analog Out	±10 V analog output (12-Bit) for monitoring DSP signals, output source selectable and scalable using MotionMaestro™ setup software, 2 channels and 16-Bit are available (optional)
Auto Phasing	Plug & Play for all types of three phase Brushless Motors.
Smart Com Initialization at Amplifier turn on	Eliminates the need for Hall sensor or commutation tracks for many applications.
RS-232 Host Port	Host Port for Setup and Monitoring 115.2 Kbaud, 8 Bits, no parity, 1 Stop Bit
Software Configurable	Glentek's Windows™ based MotionMaestro software™ provides ease of set-up and tuning with no previous programming experience required. This software is Windows required. This software is Windows
Digitally Tuned	All parameters set digitally. No potentiometers to adjust. RS-232 high speed serial communication interface for all gain and PID tuning parameters.
At Speed Relay	Relay closure when actual speed is within 1% (50RPM Minimum) of command. Max. operating current 1A
Non-Volatile Memory	All parameters are stored in non-volatile memory
Switching Frequency	25KHz Base/50 KHz effective
Current Loop Bandwidth	Tunable up to 3 KHz
Amplifier Isolation	Logic Completely Isolated from High Voltage Output Stage
Operating Temperature	0 °C to +60 °C
Storage Temperature	-40 °C to +80 °C
Humidity	5% to 95% non-condensing
Mounting Hardware	#8-32 or M4 Screw, Qty = 4
Dimension (L x H x W - Inches)	L. 11.00, H. 8.14, W. 4.50
Backup File	xxxx-5.BK

Mating Connectors

Controller I/O, 36 Pin 3M	Glentek P/N: EJC10136; 3M P/N: 10136-3000VE
36 Pin Mini-D, Backshell	Glentek P/N: EJC10336 ; 3M P/N: 10336-52A0-008
Motor Feedback, 20 Pin 3M	Glentek P/N: EJC10120; 3M P/N: 10120-3000VE
20 Pin Mini-D, Backshell	Glentek P/N: EJC10320; 3M P/N: 10320-52A0-008
Host, RJ45 Molex	Glentek P/N: EJ018083; Molex P/N: 87522-8012
Power Input / Motor Output, 8 Pin Phoenix	Glentek P/N: EJ531F08; Phoenix P/N: 1975642
Logic Power, 2 Pin Phoenix	Glentek P/N: EJ741V02; Phoenix P/N: 1792757

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE AS FOLLOWS: DECIMAL .XX = ±0.01, .XXX = ±0.005; ANGULAR < = ±0.5°; FINISH 125 MAXIMUM

APPROVAL	DATE
DWN BY: NTHALLA	30DEC11
CHK BY: L.L.	30DEC11
APP BY: J.M.	30DEC11

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GLENTEK "Solutions for Motion Control" 208 Standard Street, El Segundo, CA 90245 USA 310.322.3026 FAX 310.322.7709 www.glentek.com

DRAWING TITLE: INSTALLATION, SMC9420-1A-1 SPINDLE, MINI-D

SIZE: D | MODEL: SMC9420-1A-1 | DRAWING NUMBER: 9420-1042-000 | REV: A
SCALE: 1:1 | FILE NAME: 9420-1042-000-A.DWG | SHEET 1 OF 1
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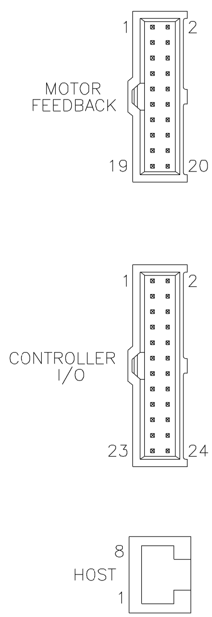

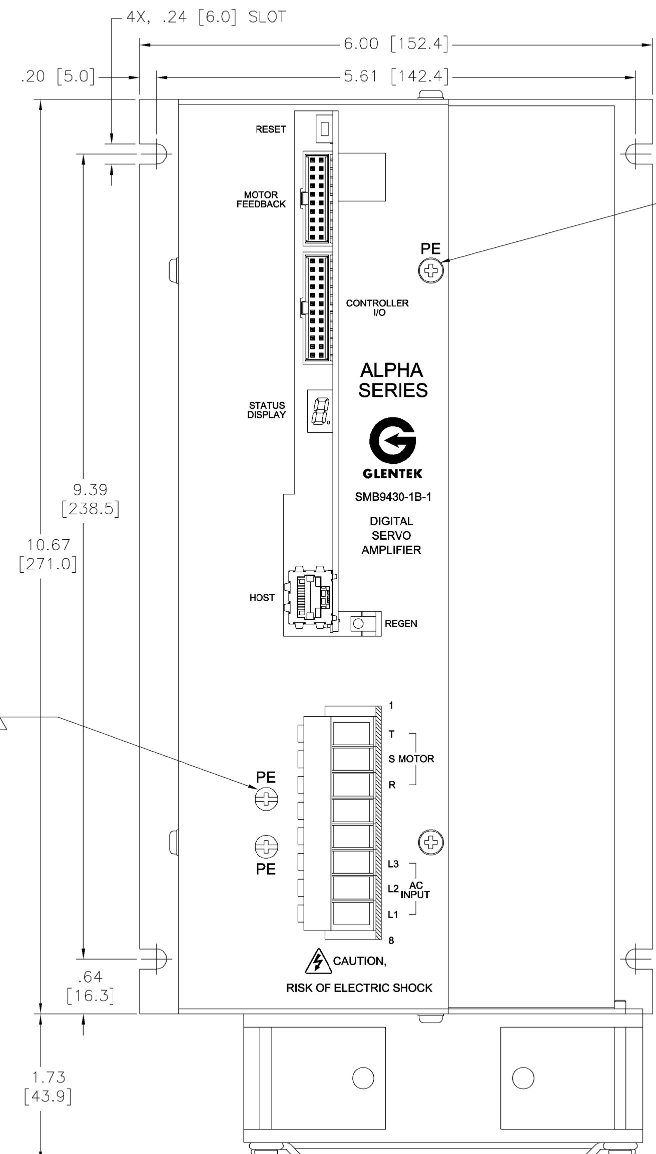

NOTE:
1. ALL UNITS ARE IN INCHES AND [MILLIMETERS].
2. RECOMMEND ALL POWER WIRING, 14 AWG (2.08 MM²) OR LARGER, 105°C RATED PVC OR BETTER.
3. PLEASE MAINTAIN A MIN. OF 2" – 3" OF SPACE AT BOTH ENDS AND TOP OF THE AMPLIFIER TO ENSURE PROPER VENTILATION FOR THE UNIT.
4. OUTPUT POWER IS DERATED BY 40% FOR SINGLE PHASE AC INPUT.
5. COMMON (ANALOG) AND COMMON (DIGITAL) SIGNALS ARE CONNECTED TOGETHER INSIDE AMPLIFIER.
6. MAXIMUM HEIGHT IS 10.09 INCHES.
7. CONNECT CONTROLLER I/O & MOTOR FEEDBACK CABLE SHIELD TO THIS #6-32 GREEN GROUND SCREW.
8. CONNECT POWER AND MOTOR GROUND TO THESE GROUND TERMINALS.
9. RECOMMEND SIGNAL WIRING TO MOLEX SOCKET CONNECTOR, 22 AWG (0.326 MM²) OR 24 AWG (0.205 MM²). USE CRIMPING TOOL MOLEX ORDER NO. 11-01-0185 (CR2262C).

Controller I/O Connector

PIN	SIGNAL NAME
1	ENCODER A+(OUT) *
2	ENCODER A-(OUT) *
3	ENCODER B+(OUT) *
4	ENCODER B-(OUT) *
5	ENCODER Z+(OUT) *
6	ENCODER Z-(OUT) *
7	PULSE + *
8	PULSE - *
9	DIR + *
10	DIR - *
11	RESET IN
12	GO/STOP
13	E-STOP
14	INHIBIT
15	FAULT OUT
16	+5VDC *
17	COMMON (ANALOG)
18	COMMON (DIGITAL)
19	ANALOG OUT (AUX.)
20	ANALOG OUT
21	RELAY OUT
22	RELAY OUT
23	SIGNAL 1+
24	SIGNAL 1-

(* - OPTIONAL)

Motor Feedback Connector

PIN	SIGNAL NAME
1	TACH + *
2	TACH - *
3	RESERVED
4	MOTOR TEMP
5	ENCODER Z+ (IN) *
6	ENCODER Z- (IN) *
7	ENCODER B+ (IN) *
8	ENCODER B- (IN) *
9	ENCODER A+ (IN) *
10	ENCODER A- (IN) *
11	HALL U+
12	HALL U- *
13	HALL V+
14	HALL V- *
15	HALL W+
16	HALL W- *
17	ENC PWR (+5VDC)
18	COMMON (DIGITAL)
19	ENC PWR (+5VDC)
20	COMMON (DIGITAL)

(* - OPTIONAL)

Status Display

DISPLAY	FAULT DESCRIPTION
1	EEPROM FAULT
2	RAM FAULT
3	CPLD FAULT
8	EXTERNAL RESET
b	BUS OVERVOLTAGE
C	CLAMP
c	FAULT INPUT
E	ENCODER FAULT
F	FOLDBACK
H	HEATSINK OVERTEMP
h	MOTOR OVERTEMP
L	LS/ECB
O	NORMAL OPERATION
S	HS/ECB
U	UNDER VOLTAGE
=	HALL FAULT
≡	COMMUTATION FAULT
8.	PROCESSOR IN RESET
SINGLE OUTER SEGMENT	AMP ENABLED, HALL

Host Connector

PIN	SIGNAL NAME
1	RESERVED
2	RESERVED
3	RESERVED
4	COMMON (DIGITAL)
5	TX232
6	RX232
7	RESERVED
8	RESERVED

Power/Motor Connector

PIN	SIGNAL NAME
1	MOTOR PHASE T
2	MOTOR PHASE S
3	MOTOR PHASE R
4	PROTECTIVE EARTHING (CHASSIS GND)
5	PROTECTIVE EARTHING (CHASSIS GND)
6	AC LINE 3
7	AC LINE 2
8	AC LINE 1

Bus Over Voltage, Under Voltage, and Regen Voltage Settings

POWER INPUT VOLTAGE	BUS OVER VOLTAGE	BUS UNDER VOLTAGE	REGEN VOLTAGE
208 - 240 VAC	450 VDC ± 5%	150 VDC ± 5%	395 VDC ± 5%
110 - 130 VAC	250 VDC ± 5%	60 VDC ± 5%	230 VDC ± 5%

REVISION HISTORY

ZONE	REV	DESCRIPTION	ECO	DATE	CHANGED	APPD
-	A	INITIAL RELEASE	3291	30DEC11	NTHALLA	J.M.

Specifications and Features

AC Supply Input	208 - 240 VAC, (3-Phase, 50/60 Hz)
Inrush Current at Power Up	170A max @ 240VAC
Peak Current Output	60A @ 25°C Ambient (with forced air cooling)
Continuous Current Output	30 A @ 25°C Ambient (with forced air cooling)
Fault Protection	Short circuit protection from motor phase to phase, motor phase to DC bus, motor phase to case (chassis GND). Amplifier RMS over current. DC bus over/under voltage. Amplifier over temperature. Motor over temperature (switch or thermistor input). Encoder broken wire. Invalid Hall/comm track state. Commutation fault.
Amplifier Status Indication	7-Segment display indicates amplifier status and diagnostics
Low Speed Electronic Circuit Breaker (LS/ECB)	Latches when programmable current (30 A max.), and time (10 sec max.) exceed limit.
Bus Overvoltage	See Table
Bus Undervoltage	See Table
Internal Regen	30 Ohms, 95W Max. with forced air cooling
Regen Voltage	See Table
Amplifier Type	See Model Number Key (from product manual)
Analog Command Input	±10V for analog velocity or current command
Pulse & Direction Inputs	Accepts TTL level Step & Direction signals
Encoder Feedback	Accepts TTL level encoder signals
Dedicated Inputs	E-stop, go/stop, inhibit, motor overtemp and reset signal
Dedicated Fault Output (Progammable Level)	TTL Compatible
Analog Out	±10 V analog output (12-Bit) for monitoring DSP signals, output source selectable and scalable using MotionMaestro™ setup software, 2 channels and 16-Bit are available (optional)
Auto Phasing	Plug & Play for all types of three phase Brushless Motors.
Smart Com Initialization at Amplifier turn on	Eliminates the need for Hall sensor or commutation tracks for many applications.
RS-232 Host Port	Host Port for Setup and Monitoring 115.2 Kbaud, 8 Bits, no parity, 1 Stop Bit
Software Configurable	Glentek's Windows™ based MotionMaestro software™ provides ease of set-up and tuning with no previous programming experience required. This software is Windows required. This software is Windows
Digitally Tuned	All parameters set digitally. No potentiometers to adjust. RS-232 high speed serial communication interface for all gain and PID tuning parameters.
At Speed Relay	Relay closure when actual speed is within 1% (50RPM Minimum) of command. Max. operating current 1A
Non-Volatile Memory	All parameters are stored in non-volatile memory
Switching Frequency	25KHz Base/50 KHz effective
Current Loop Bandwidth	Tunable up to 3 KHz
Amplifier Isolation	Logic Completely Isolated from High Voltage Output Stage
Operating Temperature	0 °C to +60 °C
Storage Temperature	-40 °C to +80 °C
Humidity	5% to 95% non-condensing
Mounting Hardware	#8-32 or M4 Screw, Qty = 4
Dimension (L x H x W - inches)	L. 12.40, H. 10.09, W. 6.00
Backup File	xxxx-5.BK

Mating Connectors

Controller I/O, 24 Pin Molex	Glentek P/N: EJB22F12; Molex P/N: 90142-0024
Encoder Feedback, 20 Pin Molex	Glentek P/N: EJB22F10; Molex P/N: 90142-0020
Controller I/O & Motor Feedback Socket Connector, Molex	Glentek P/N: EJB21F01; Molex P/N: 90119-2110
Host, RJ45 Molex	Glentek P/N: EJ016083; Molex P/N: 87522-8012
Power Input / Motor Output, 8 Pin Phoenix	Glentek P/N: EJ531F08; Phoenix P/N: 1975642

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE AS FOLLOWS: DECIMAL .XX = ±0.01, .XXX = ±0.005; ANGULAR: ∠ = ±0.5°; FINISH: 125 MAXIMUM

	APPROVAL	DATE
DWN BY:	NTHALLA	30DEC11
CHK BY:	L.L.	30DEC11
APP BY:	J.M.	30DEC11

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GLENTEK "Solutions for Motion Control" 208 Standard Street, El Segundo, CA 90245 USA, 310.322.3026 FAX 310.322.7709, www.glentek.com

DRAWING TITLE: INSTALLATION, SMB9430-1B-1 SPINDLE, MOLEX

SIZE	MODEL	DRAWING NUMBER	REV
D	SMB9430-1B-1	9430-1034-000	A

SCALE: 1.5:1 FILE NAME: 9430-1034-000-A.DWG SHEET 1 OF 1
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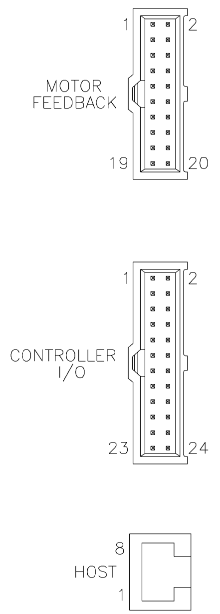

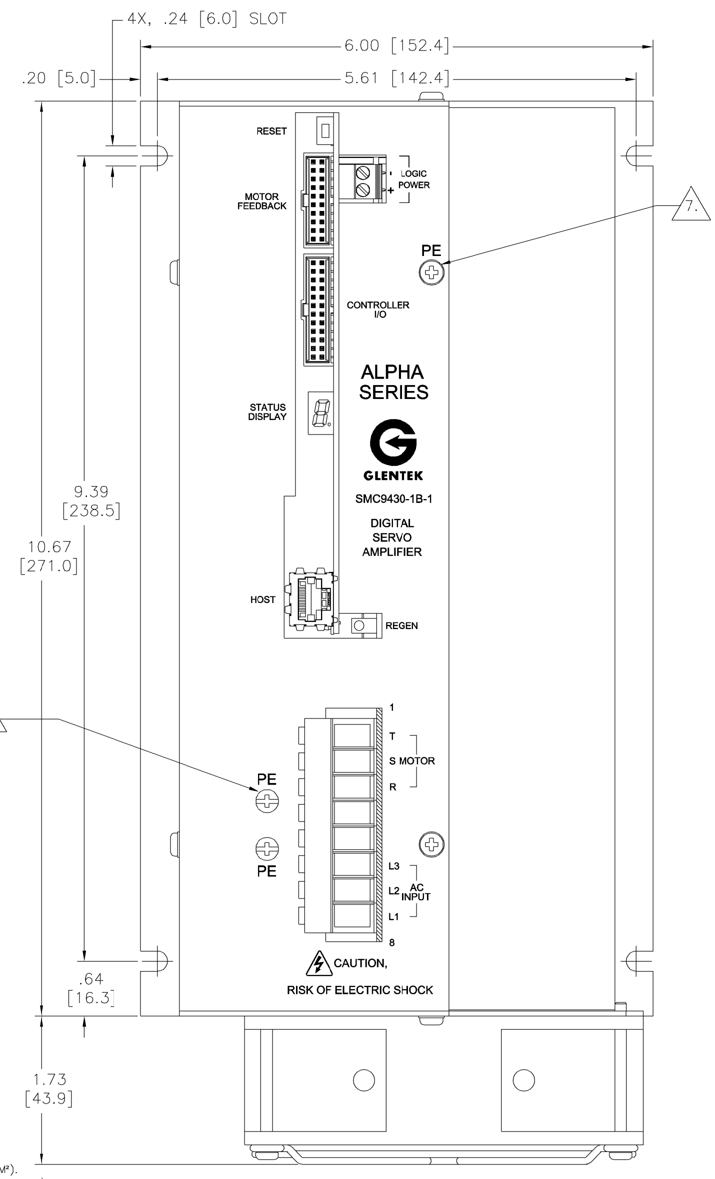

NOTE:
1. ALL UNITS ARE IN INCHES AND [MILLIMETERS].
2. RECOMMEND ALL POWER WIRING, 14 AWG (2.08 MM²) OR LARGER, 105°C RATED PVC OR BETTER.
3. PLEASE MAINTAIN A MIN. OF 2" – 3" OF SPACE AT BOTH ENDS AND TOP OF THE AMPLIFIER TO ENSURE PROPER VENTILATION FOR THE UNIT.
4. EXTERNAL +24VDC FOR LOGIC POWER IS SUPPLIED BETWEEN PIN 1 (COMMON) AND PIN 2 (+24VDC) OF LOGIC POWER CONNECTOR.
5. COMMON (ANALOG) AND COMMON (DIGITAL) SIGNALS ARE CONNECTED TOGETHER INSIDE AMPLIFIER.
6. MAXIMUM HEIGHT IS 10.09 INCHES.
7. CONNECT CONTROLLER I/O & MOTOR FEEDBACK CABLE SHIELD TO THIS #6–32 GREEN GROUND SCREW.
8. CONNECT MOTOR GROUND TO THESE GROUND TERMINALS.
9. OUTPUT POWER IS DERATED BY 40% FOR SINGLE PHASE AC INPUT.
10. RECOMMEND SIGNAL WIRING TO MOLEX SOCKET CONNECTOR, 22 AWG (0.326 MM²) OR 24 AWG (0.205 MM²). USE CRIMPING TOOL MOLEX ORDER NO. 11–01–0185 (CR2262C).

Controller I/O Connector

PIN	SIGNAL NAME
1	ENCODER A+(OUT) *
2	ENCODER A-(OUT) *
3	ENCODER B+(OUT) *
4	ENCODER B-(OUT) *
5	ENCODER Z+(OUT) *
6	ENCODER Z-(OUT) *
7	PULSE + *
8	PULSE - *
9	DIR + *
10	DIR - *
11	RESET IN
12	GO/STOP
13	E-STOP
14	INHIBIT
15	FAULT OUT
16	+5VDC *
17	COMMON (ANALOG)
18	COMMON (DIGITAL)
19	ANALOG OUT (AUX.)
20	ANALOG OUT
21	RELAY OUT
22	RELAY OUT
23	SIGNAL 1+
24	SIGNAL 1-

(* - OPTIONAL)

Motor Feedback Connector

PIN	SIGNAL NAME
1	TACH + *
2	TACH - *
3	RESERVED
4	MOTOR TEMP
5	ENCODER Z+ (IN) *
6	ENCODER Z- (IN) *
7	ENCODER B+ (IN) *
8	ENCODER B- (IN) *
9	ENCODER A+ (IN) *
10	ENCODER A- (IN) *
11	HALL U+
12	HALL U- *
13	HALL V+
14	HALL V- *
15	HALL W+
16	HALL W- *
17	ENC PWR (+5VDC)
18	COMMON (DIGITAL)
19	ENC PWR (+5VDC)
20	COMMON (DIGITAL)

(* - OPTIONAL)

Status Display

DISPLAY	FAULT DESCRIPTION
1	EEPROM FAULT
2	RAM FAULT
3	CPLD FAULT
8	EXTERNAL RESET
b	BUS OVERVOLTAGE
C	CLAMP
c	FAULT INPUT
E	ENCODER FAULT
F	FOLDBACK
H	HEATSINK OVERTEMP
h	MOTOR OVERTEMP
L	LS/ECB
O	NORMAL OPERATION
S	HS/ECB
U	UNDER VOLTAGE
=	HALL FAULT
≡	COMMUTATION FAULT
8.	PROCESSOR IN RESET
SINGLE OUTER SEGMENT	AMP ENABLED, HALL

Host Connector

PIN	SIGNAL NAME
1	RESERVED
2	RESERVED
3	RESERVED
4	COMMON (DIGITAL)
5	TX232
6	RX232
7	RESERVED
8	RESERVED

Power/Motor Connector

PIN	SIGNAL NAME
1	MOTOR PHASE T
2	MOTOR PHASE S
3	MOTOR PHASE R
4	PROTECTIVE EARTHING (CHASSIS GND)
5	PROTECTIVE EARTHING (CHASSIS GND)
6	AC LINE 3
7	AC LINE 2
8	AC LINE 1

Logic Power Connector

PIN	SIGNAL NAME
1	COMMON (DIGITAL)
2	+24VDC

Bus Over Voltage, Under Voltage, and Regen Voltage Settings

POWER INPUT VOLTAGE	BUS OVER VOLTAGE	BUS UNDER VOLTAGE	REGEN VOLTAGE
208 - 240 VAC	450 VDC ± 5%	150 VDC ± 5%	395 VDC ± 5%
110 - 130 VAC	250 VDC ± 5%	60 VDC ± 5%	230 VDC ± 5%

REVISION HISTORY

ZONE	REV	DESCRIPTION	ECO	DATE	CHANGED	APPD
-	A	INITIAL RELEASE	3291	30DEC11	NTHALLA	J.M.

Specifications and Features

AC Supply Input	208 - 240 VAC, (3-Phase, 50/60 Hz)
Inrush Current at Power Up	170A max @ 240VAC
Logic Supply Input	24 to 48 VDC, 600mA max @24VDC. Powers all amplifier logic and encoders.
Peak Current Output	60 A @ 25°C Ambient (with forced air cooling)
Continuous Current Output	30 A @ 25°C Ambient (with forced air cooling)
Fault Protection	Short circuit protection from motor phase to phase, motor phase to DC bus, motor phase to case (chassis GND). Amplifier RMS over current. DC bus over/under voltage. Amplifier over temperature. Motor over temperature (switch or thermistor input). Encoder broken wire. Invalid Hall/comm track state. Commutation fault.
Amplifier Status Indication	7-Segment display indicates amplifier status and diagnostics
Low Speed Electronic Circuit Breaker (LS/ECB)	Latches when programmable current (30 A max.), and time (10 sec max.) exceed limit.
Bus Overvoltage	See Table
Bus Undervoltage	See Table
Internal Regen	30 Ohms, 95W Max. with forced air cooling
Regen Voltage	See Table
Amplifier Type	See Model Number Key (from product manual)
Analog Command Input	±10V for analog velocity or current command
Pulse & Direction Inputs	Accepts TTL level Step & Direction signals
Encoder Feedback	Accepts TTL level encoder signals
Dedicated Inputs	E-stop, go/stop, inhibit, motor overtemp and reset signal
Dedicated Fault Output (Programmable Level)	TTL Compatible
Analog Out	±10 V analog output (12-Bit) for monitoring DSP signals, output source selectable and scalable using MotionMaestro™ setup software, 2 channels and 16-Bit are available (optional)
Auto Phasing	Plug & Play for all types of three phase Brushless Motors.
Smart Com Initialization at Amplifier turn on	Eliminates the need for Hall sensor or commutation tracks for many applications.
RS-232 Host Port	Host Port for Setup and Monitoring 115.2 Kbaud, 8 Bits, no parity, 1 Stop Bit
Software Configurable	Glentek's Windows™ based MotionMaestro software™ provides ease of set-up and tuning with no previous programming experience required. This software is Windows required. This software is Windows
Digitally Tuned	All parameters set digitally. No potentiometers to adjust. RS-232 high speed serial communication interface for all gain and PID tuning parameters.
At Speed Relay	Relay closure when actual speed is within 1% (50RPM Minimum) of command. Max. operating current 1A
Non-Volatile Memory	All parameters are stored in non-volatile memory
Switching Frequency	25KHz Base/50 KHz effective
Current Loop Bandwidth	Tunable up to 3 KHz
Amplifier Isolation	Logic Completely Isolated from High Voltage Output Stage
Operating Temperature	0 °C to +60 °C
Storage Temperature	-40 °C to +80 °C
Humidity	5% to 95% non-condensing
Mounting Hardware	#8-32 or M4 Screw, Qty = 4
Dimension (L x H x W - inches)	L. 12.4, H. 10.09, W. 6.00
Backup File	xxxx-5.BK

Mating Connectors

Controller I/O, 24 Pin Molex	Glentek P/N: EJB22F12; Molex P/N: 90142-0024
Encoder Feedback, 20 Pin Molex	Glentek P/N: EJB22F10; Molex P/N: 90142-0020
Controller I/O & Motor Feedback Socket Connector, Molex	Glentek P/N: EJB21F01; Molex P/N: 90119-2110
Host, RJ45 Molex	Glentek P/N: EJ018083; Molex P/N: 87522-8012
Power Input / Motor Output, 8 Pin Phoenix	Glentek P/N: EJ531F08; Phoenix P/N: 1975642
Logic Power, 2 Pin Phoenix	Glentek P/N: EJ741V02; Phoenix P/N: 1792757

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE AS FOLLOWS: DECIMAL .XX = ±0.01, .XXX = ±0.005; ANGULAR < = ±0.5°; FINISH 125 MAXIMUM

APPROVAL		DATE
DWN BY:	NTHALLA	30DEC11
CHK BY:	L.L.	30DEC11
APP BY:	J.M.	30DEC11

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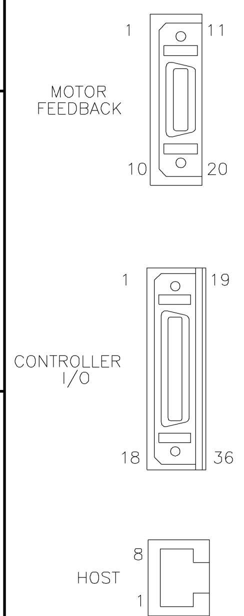
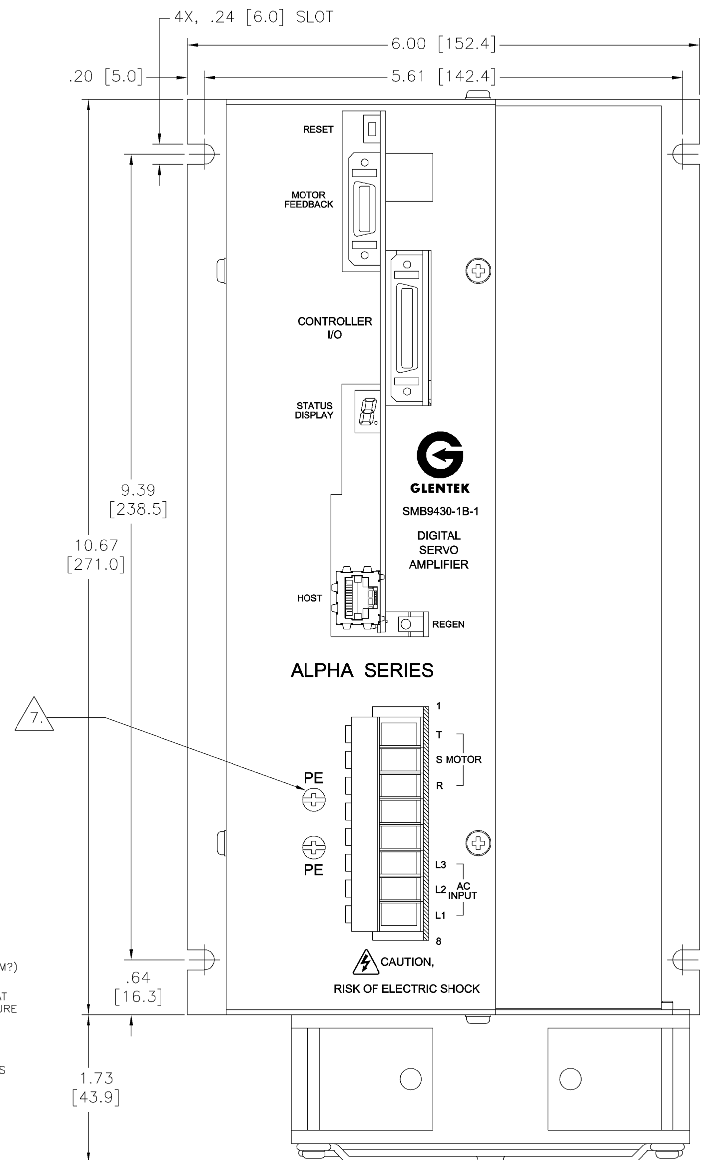
GLENTEK "Solutions for Motion Control" 208 Standard Street El Segundo, CA 90245 USA 310.322.3026 FAX 310.322.7709 www.glentek.com

DRAWING TITLE: INSTALLATION, SMC9430-1B-1 SPINDLE, MOLEX

SIZE: D | MODEL: SMC9430-1B-1 | DRAWING NUMBER: 9430-1035-000 | REV: A
SCALE: 1.5:1 | FILE NAME: 9430-1035-000-A.DWG | SHEET 1 OF 1
CONFIGURATION CODE: -





NOTE:

1. ALL UNITS ARE IN INCHES AND [MILLIMETERS].
2. RECOMMEND ALL POWER WIRING, 14 AWG (2.08 MM²) OR LARGER, 105°C RATED PVC OR BETTER.
3. PLEASE MAINTAIN A MIN. OF 2" – 3" OF SPACE AT BOTH ENDS AND TOP OF THE AMPLIFIER TO ENSURE PROPER VENTILATION FOR THE UNIT.
4. OUTPUT POWER IS DERATED BY 40% FOR SINGLE PHASE AC INPUT.
5. COMMON (ANALOG) AND COMMON (DIGITAL) SIGNALS ARE CONNECTED TOGETHER INSIDE AMPLIFIER.
6. MAXIMUM HEIGHT IS 8.12 INCHES.
7. CONNECT POWER AND MOTOR GROUND TO THESE GROUND TERMINALS.
8. RECOMMEND SIGNAL WIRING TO MINI-D SOCKET CONNECTOR, 22 AWG (0.326 MM²) OR 24 AWG (0.205 MM²).

Controller I/O Connector

PIN	SIGNAL NAME
1	SIGNAL 1+
2	SIGNAL 1-
3	RESERVED
4	RESERVED
5	ANALOG OUT (AUX.) *
6	COMMON (ANALOG)
7	ANALOG OUT
8	GO/STOP
9	E-STOP
10	INHIBIT
11	FAULT OUT
12	COMMON
13	RESET IN
14	MTR TEMP SW
15	RESERVED
16	COMMON (DIGITAL)
17	ENCODER Z - (OUT) *
18	ENCODER Z + (OUT) *
19	RELAY OUT
20	RELAY OUT
21	COMMON (ANALOG)
22	COMMON (DIGITAL)
23	PULSE - *
24	PULSE + *
25	DIRECTION - *
26	DIRECTION + *
27	+5 VDC
28	+5 VDC
29	COMMON (DIGITAL)
30	COMMON (DIGITAL)
31	RESERVED
32	RESERVED
33	ENCODER A+ (OUT) *
34	ENCODER A- (OUT) *
35	ENCODER B+ (OUT) *
36	ENCODER B- (OUT) *

(* - OPTIONAL)

Power/Motor Connector

PIN	SIGNAL NAME
1	MOTOR PHASE T
2	MOTOR PHASE S
3	MOTOR PHASE R
4	PROTECTIVE EARTHING (CHASSIS GND)
5	PROTECTIVE EARTHING (CHASSIS GND)
6	AC LINE 3
7	AC LINE 2
8	AC LINE 1

Motor Feedback Connector

PIN	SIGNAL NAME
1	ENCODER PWR (+5VDC)
2	COMMON (DIGITAL)
3	ENCODER PWR (+5VDC)
4	COMMON (DIGITAL)
5	ENCODER A + (IN) *
6	ENCODER A - (IN) *
7	ENCODER B + (IN) *
8	ENCODER B - (IN) *
9	ENCODER Z + (IN) *
10	ENCODER Z - (IN) *
11	HALL 1 +
12	HALL 1 -
13	HALL 2 +
14	HALL 2 -
15	HALL 3 +
16	HALL 3 -
17	MTR TEMP SW
18	COMMON (DIGITAL)
19	COMMON (DIGITAL)
20	COMMON (DIGITAL)

(* - OPTIONAL)

Host Connector

PIN	SIGNAL NAME
1	RESERVED
2	RESERVED
3	RESERVED
4	COMMON (DIGITAL)
5	TX232
6	RX232
7	RESERVED
8	RESERVED

Status Display

DISPLAY	FAULT DESCRIPTION
1	EEPROM FAULT
2	RAM FAULT
3	CPLD FAULT
8	EXTERNAL RESET
b	BUS OVERVOLTAGE
C	CLAMP
c	FAULT INPUT
E	ENCODER FAULT
F	FOLDBACK
H	HEATSINK OVERTEMP
h	MOTOR OVERTEMP
L	LS/ECB
O	NORMAL OPERATION
S	HS/ECB
U	UNDER VOLTAGE
=	HALL FAULT
≡	COMMUTATION FAULT
8.	PROCESSOR IN RESET
SINGLE OUTER SEGMENT	AMP ENABLED, HALL

Specifications and Features

AC Supply Input	208 - 240 VAC, (3-Phase, 50/60 Hz)
Inrush Current at Power Up	170A max @ 240VAC
Peak Current Output	60 A @ 25°C Ambient (with forced air cooling)
Continuous Current Output	30 A @ 25°C Ambient (with forced air cooling)
Fault Protection	Short circuit protection from motor phase to phase, motor phase to DC bus, motor phase to case (chassis GND). Amplifier RMS over current. DC bus over/under voltage. Amplifier over temperature. Motor over temperature (switch or thermistor input). Encoder broken wire. Invalid Hall/comm track state. Commutation fault.
Amplifier Status Indication	7-Segment display indicates amplifier status and diagnostics
Low Speed Electronic Circuit Breaker (LS/ECB)	Latches when programmable current (30 A max.), and time (10 sec max.) exceed limit.
Bus Overvoltage	See Table
Bus Undervoltage	See Table
Internal Regen	30 Ohms, 95W Max. with forced air cooling
Regen Voltage	See Table
Amplifier Type	See Model Number Key (from product manual)
Analog Command Input	±10V for analog velocity or and current command
Pulse & Direction Inputs	Accepts TTL level Step & Direction signals
Encoder Feedback	Accepts TTL level encoder signals
Dedicated Inputs	E-stop, go/stop, inhibit, motor overtemp and reset signal
Dedicated Fault Output (Progammable Level)	TTL Compatible
Analog Out	±10 V analog output (12-Bit) for monitoring DSP signals, output source selectable and scalable using MotionMaestro ™ setup software, 2 channels and 16-Bit are available (optional)
Auto Phasing	Plug & Play for all types of three phase Brushless Motors.
Smart Com Initialization at Amplifier turn on	Eliminates the need for Hall sensor or commutation tracks for many applications.
RS-232 Host Port	Host Port for Setup and Monitoring 115.2 Kbaud, 8 Bits, no parity, 1 Stop Bit
Software Configurable	Glentek's Windows™ based MotionMaestro software™ provides ease of set-up and tuning with no previous programming experience required. This software is Windows required. This software is Windows
Digitally Tuned	All parameters set digitally. No potentiometers to adjust. RS-232 high speed serial communication interface for all gain and PID tuning parameters.
At Speed Relay	Relay closure when actual speed is within 1% (50RPM Minimum) of command. Max. operating current 1A
Non-Volatile Memory	All parameters are stored in non-volatile memory
Switching Frequency	25KHz Base/50 KHz effective
Current Loop Bandwidth	Tunable up to 3 KHz
Amplifier Isolation	Logic Completely Isolated from High Voltage Output Stage
Operating Temperature	0 °C to +60 °C
Storage Temperature	-40 °C to +80 °C
Humidity	5% to 95% non-condensing
Mounting Hardware	#8-32 or M4 Screw, Qty = 4
Dimension (inches)	L. 12.40, H. 10.09, W. 6.00
Backup File	xxxx-5.BK

Mating Connectors

Controller I/O, 36 Pin 3M	Glentek P/N: EJC10136; 3M P/N: 10136-3000VE
36 Pin Mini-D, Backshell	Glentek P/N: EJC10336 ; 3M P/N: 10336-52A0-008
Motor Feedback, 20 Pin 3M	Glentek P/N: EJC10120; 3M P/N: 10120-3000VE
20 Pin Mini-D, Backshell	Glentek P/N: EJC10320; 3M P/N: 10320-52A0-008
Host, RJ45 Molex	Glentek P/N: EJ018083; Molex P/N: 87522-8012
Power Input / Motor Output, 8 Pin Phoenix	Glentek P/N: EJ531F08; Phoenix P/N: 1975642

Bus Over Voltage, Under Voltage, and Regen Voltage Settings

POWER INPUT VOLTAGE	BUS OVER VOLTAGE	BUS UNDER VOLTAGE	REGEN VOLTAGE
208 - 240 VAC	450 VDC ± 5%	150 VDC ± 5%	395 VDC ± 5%
110 - 130 VAC	250 VDC ± 5%	60 VDC ± 5%	230 VDC ± 5%

REVISION HISTORY

ZONE	REV	DESCRIPTION	ECO	DATE	CHANGED	APPD
-	A	INITIAL RELEASE	3291	30DEC11	NTHALLA	J.M.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES ARE AS FOLLOWS: DECIMAL: .XX = ±0.01, .XXX = ±0.005; ANGULAR: < = ±0.5°

FINISH: 125 MAXIMUM

	APPROVAL	DATE
DWN BY:	NTHALLA	30DEC11
CHK BY:	L.L.	30DEC11
APP BY:	J.M.	30DEC11

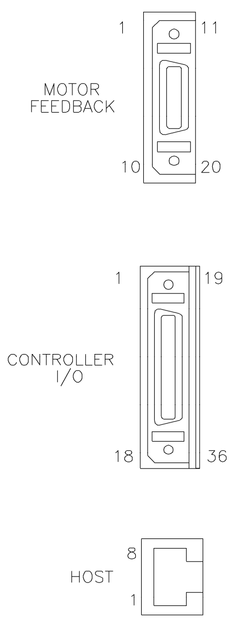
GLENTEK "Solutions for Motion Control"
208 Standard Street
El Segundo, CA 90245 USA
310.322.3026 FAX 310.322.7709
www.glentek.com

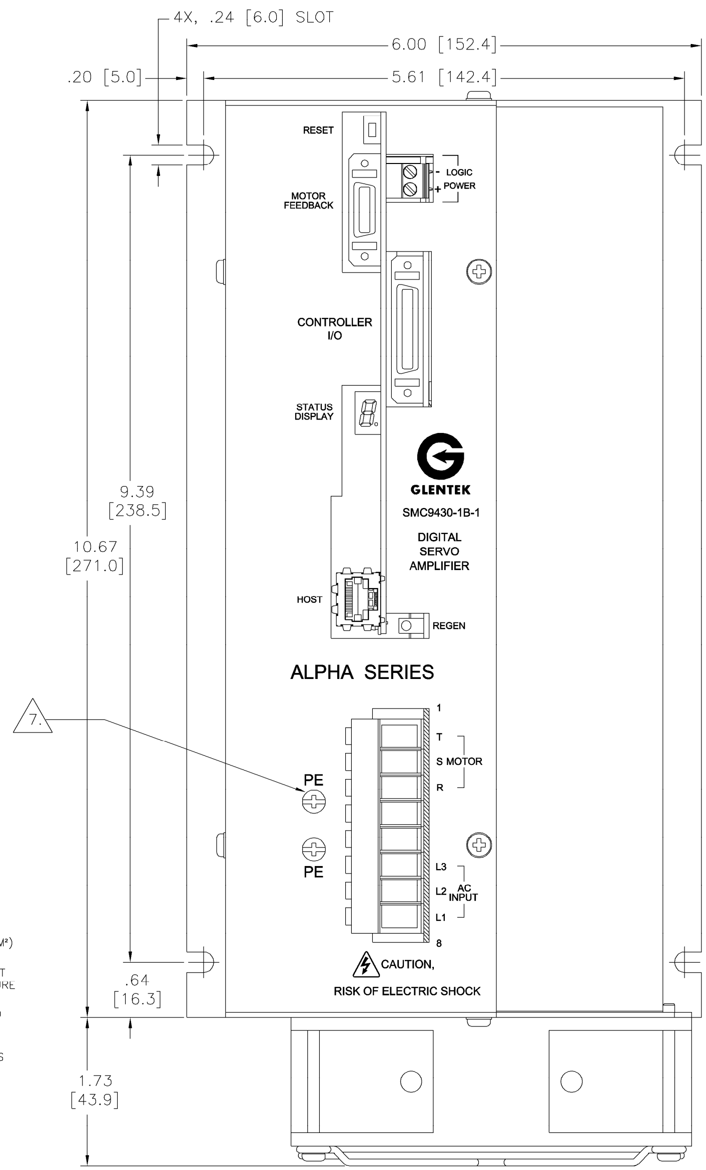
DRAWING TITLE: INSTALLATION, SMB9430-1B-1 SPINDLE, MINI-D

SIZE: D | MODEL: SMB9430-1B-1 | DRAWING NUMBER: 9430-1036-000 | REV: A

SCALE: 1.5:1 | FILE NAME: 9430-1036-000-A.DWG | SHEET 1 OF 1

CONFIGURATION CODE: -





NOTE:

1. ALL UNITS ARE IN INCHES AND [MILLIMETERS].
2. RECOMMEND ALL POWER WIRING, 14 AWG (2.08 MM^2) OR LARGER, 105°C RATED PVC OR BETTER.
3. PLEASE MAINTAIN A MIN. OF 2" – 3" OF SPACE AT BOTH ENDS AND TOP OF THE AMPLIFIER TO ENSURE PROPER VENTILATION FOR THE UNIT.
4. EXTERNAL +24VDC FOR LOGIC POWER IS SUPPLIED BETWEEN PIN 1 (COMMON) AND PIN 2 (+24VDC) OF LOGIC POWER CONNECTOR.
5. COMMON (ANALOG) AND COMMON (DIGITAL) SIGNALS ARE CONNECTED TOGETHER INSIDE AMPLIFIER.
6. MAXIMUM HEIGHT IS 10.1 INCHES.
7. (△) CONNECT POWER AND MOTOR GROUND TO THESE GROUND TERMINALS.
8. OUTPUT POWER IS DERATED BY 40% FOR SINGLE PHASE AC INPUT.
9. RECOMMEND SIGNAL WIRING TO MINI–D SOCKET CONNECTOR, 22 AWG (0.326 MM^2) OR 24 AWG (0.205 MM^2).

Controller I/O Connector

PIN	SIGNAL NAME
1	SIGNAL 1+
2	SIGNAL 1-
3	RESERVED
4	RESERVED
5	ANALOG OUT (AUX.) *
6	COMMON (ANALOG)
7	ANALOG OUT
8	GO/STOP
9	E-STOP
10	INHIBIT
11	FAULT OUT
12	COMMON
13	RESET IN
14	MTR TEMP SW
15	RESERVED
16	COMMON (DIGITAL)
17	ENCODER Z - (OUT) *
18	ENCODER Z + (OUT) *
19	RELAY OUT
20	RELAY OUT
21	COMMON (ANALOG)
22	COMMON (DIGITAL)
23	PULSE - *
24	PULSE + *
25	DIRECTION - *
26	DIRECTION + *
27	+5 VDC
28	+5 VDC
29	COMMON (DIGITAL)
30	COMMON (DIGITAL)
31	RESERVED
32	RESERVED
33	ENCODER A+ (OUT) *
34	ENCODER A- (OUT) *
35	ENCODER B+ (OUT) *
36	ENCODER B- (OUT) *

(* - OPTIONAL)

Power/Motor Connector

PIN	SIGNAL NAME
1	MOTOR PHASE T
2	MOTOR PHASE S
3	MOTOR PHASE R
4	PROTECTIVE EARTHING (CHASSIS GND)
5	PROTECTIVE EARTHING (CHASSIS GND)
6	AC LINE 3
7	AC LINE 2
8	AC LINE 1

Logic Power Connector

PIN	SIGNAL NAME
1	COMMON (DIGITAL)
2	+24VDC

Motor Feedback Connector

PIN	SIGNAL NAME
1	ENCODER PWR (+5VDC)
2	COMMON (DIGITAL)
3	ENCODER PWR (+5VDC)
4	COMMON (DIGITAL)
5	ENCODER A + (IN) *
6	ENCODER A - (IN) *
7	ENCODER B + (IN) *
8	ENCODER B - (IN) *
9	ENCODER Z + (IN) *
10	ENCODER Z - (IN) *
11	HALL 1 +
12	HALL 1 -
13	HALL 2 +
14	HALL 2 -
15	HALL 3 +
16	HALL 3 -
17	MTR TEMP SW
18	COMMON (DIGITAL)
19	TACH +
20	TACH -

(* - OPTIONAL)

Host Connector

PIN	SIGNAL NAME
1	RESERVED
2	RESERVED
3	RESERVED
4	COMMON (DIGITAL)
5	TX232
6	RX232
7	RESERVED
8	RESERVED

Status Display

DISPLAY	FAULT DESCRIPTION
1	EEPROM FAULT
2	RAM FAULT
3	CPLD FAULT
8	EXTERNAL RESET
b	BUS OVERVOLTAGE
C	CLAMP
c	FAULT INPUT
E	ENCODER FAULT
F	FOLDBACK
H	HEATSINK OVERTEMP
h	MOTOR OVERTEMP
L	LS/ECB
O	NORMAL OPERATION
S	HS/ECB
U	UNDER VOLTAGE
=	HALL FAULT
≡	COMMUTATION FAULT
8.	PROCESSOR IN RESET
SINGLE OUTER SEGMENT	AMP ENABLED, HALL

Bus Over Voltage, Under Voltage, and Regen Voltage Settings

POWER INPUT VOLTAGE	BUS OVER VOLTAGE	BUS UNDER VOLTAGE	REGEN VOLTAGE
208 - 240 VAC	450 VDC ± 5%	150 VDC ± 5%	395 VDC ± 5%
110 - 130 VAC	250 VDC ± 5%	60 VDC ± 5%	230 VDC ± 5%

REVISION HISTORY

ZONE	REV	DESCRIPTION	ECO	DATE	CHANGED	APPD
-	A	INITIAL RELEASE	3291	30DEC11	NTHALLA	J.M.

Specifications and Features

AC Supply Input	208 - 240 VAC, (3-Phase, 50/60 Hz)
Inrush Current at Power Up	170A max @ 240VAC
Logic Supply Input	24 to 48 VDC, 600mA max @24VDC. Powers all amplifier logic and encoders.
Peak Current Output	60 A @ 25°C Ambient (with forced air cooling)
Continuous Current Output	30 A @ 25°C Ambient (with forced air cooling)
Fault Protection	Short circuit protection from motor phase to phase, motor phase to DC bus, motor phase to case (chassis GND). Amplifier RMS over current. DC bus over/under voltage. Amplifier over temperature. Motor over temperature (switch or thermistor input). Encoder broken wire. Invalid Hall/comm track state. Commutation fault.
Amplifier Status Indication	7-Segment display indicates amplifier status and diagnostics
Low Speed Electronic Circuit Breaker (LS/ECB)	Latches when programmable current (30 A max.), and time (10 sec max.) exceed limit.
Bus Overvoltage	See Table
Bus Undervoltage	See Table
Internal Regen	30 Ohms, 95W Max. with forced air cooling
Regen Voltage	See Table
Amplifier Type	See Model Number Key (from product manual)
Analog Command Input	±10V for analog velocity or current command
Pulse & Direction Inputs	Accepts TTL level Step & Direction signals
Encoder Feedback	Accepts TTL level encoder signals
Dedicated Inputs	E-stop, go/stop, inhibit, motor overtemp and reset signal
Dedicated Fault Output (Progammable Level)	TTL Compatible
Analog Out	±10 V analog output (12-Bit) for monitoring DSP signals, output source selectable and scalable using MotionMaestro ™ setup software, 2 channels and 16-Bit are available (optional)
Auto Phasing	Plug & Play for all types of three phase Brushless Motors.
Smart Com Initialization at Amplifier turn on	Eliminates the need for Hall sensor or commutation tracks for many applications.
RS-232 Host Port	Host Port for Setup and Monitoring 115.2 Kbaud, 8 Bits, no parity, 1 Stop Bit
Software Configurable	Glentek's Windows™ based MotionMaestro software™ provides ease of set-up and tuning with no previous programming experience required. This software is Windows required. This software is Windows
Digitally Tuned	All parameters set digitally. No potentiometers to adjust. RS-232 high speed serial communication interface for all gain and PID tuning parameters.
At Speed Relay	Relay closure when actual speed is within 1% (50RPM Minimum) of command. Max. operating current 1A
Non-Volatile Memory	All parameters are stored in non-volatile memory
Switching Frequency	25KHz Base/50 KHz effective
Current Loop Bandwidth	Tunable up to 3 KHz
Amplifier Isolation	Logic Completely Isolated from High Voltage Output Stage
Operating Temperature	0 °C to +60 °C
Storage Temperature	-40 °C to +80 °C
Humidity	5% to 95% non-condensing
Mounting Hardware	#8-32 or M4 Screw, Qty = 4
Dimension (inches)	L. 12.40, H. 10.09, W. 6.00
Backup File	xxxx-5.BK

Mating Connectors

Controller I/O, 36 Pin 3M	Glentek P/N: EJC10136; 3M P/N: 10136-3000VE
36 Pin Mini-D, Backshell	Glentek P/N: EJC10336 ; 3M P/N: 10336-52A0-008
Motor Feedback, 20 Pin 3M	Glentek P/N: EJC10120; 3M P/N: 10120-3000VE
20 Pin Mini-D, Backshell	Glentek P/N: EJC10320; 3M P/N: 10320-52A0-008
Host, RJ45 Molex	Glentek P/N: EJ018083; Molex P/N: 87522-8012
Power Input / Motor Output, 8 Pin Phoenix	Glentek P/N: EJ531F08; Phoenix P/N: 1975642
Logic Power, 2 Pin Phoenix	Glentek P/N: EJ741V02; Phoenix P/N: 1792757

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES ARE AS FOLLOWS: DECIMAL: .XX = ±0.01, .XXX = ±0.005; ANGULAR: < = ±0.5°

FINISH: 125 √ MAXIMUM

APPROVAL	DATE
DWN BY: NTHALLA	30DEC11
CHK BY: L.L.	30DEC11
APP BY: J.M.	30DEC11

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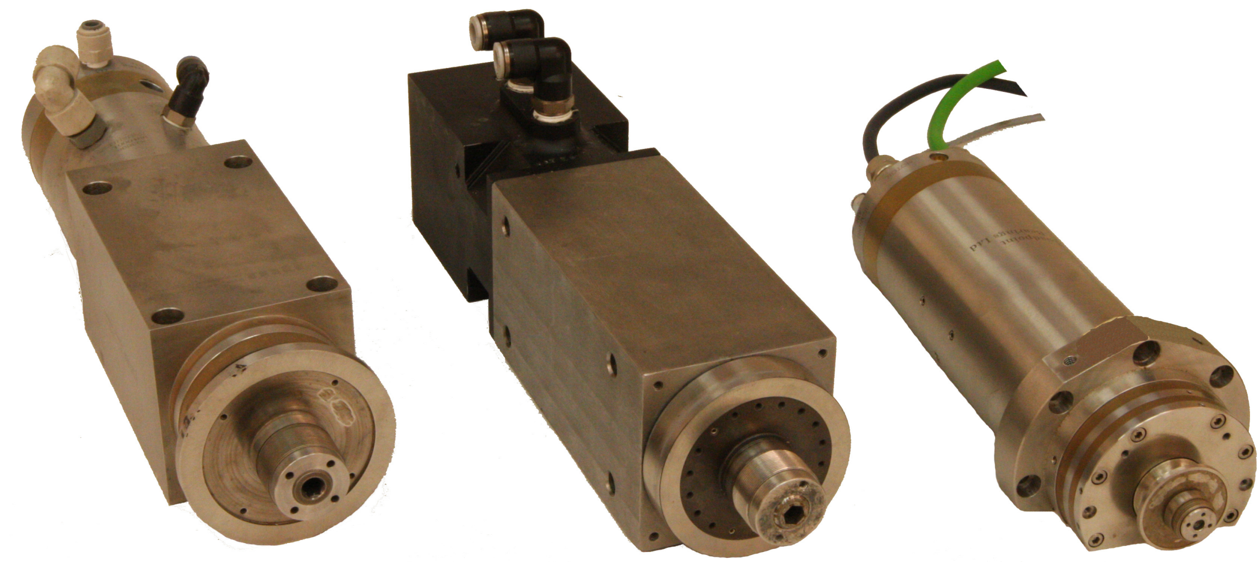
DRAWING TITLE: INSTALLATION, SMC9430-1B-1 SPINDLE, MINI-D

SIZE: D | MODEL: SMC9430-1B-1 | DRAWING NUMBER: 9430-1037-000 | REV: A

SCALE: 1.5:1 | FILE NAME: 9430-1037-000-A.DWG | SHEET 1 OF 1

CONFIGURATION CODE: -

NOTES



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"Solutions for Motion Control"

Manual#: 9420-1040-000-B
Manual Revision Date:
31 Jan 2012

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