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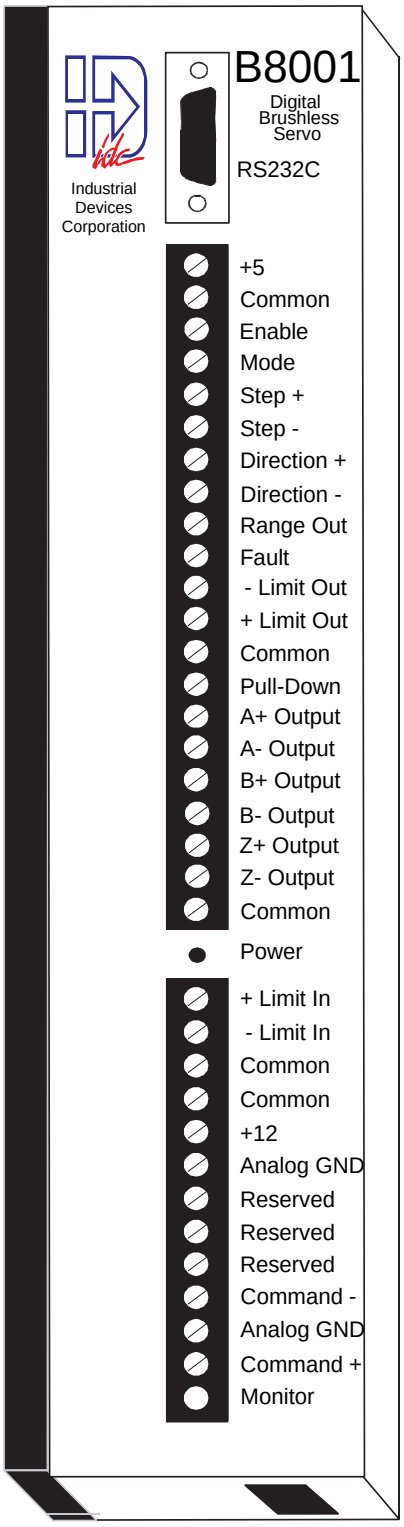
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B8001 Brushless Servo Drive

Operator's Manual

P/N PCW-4679 Rev. 1.5 5/98

This manual covers the following IDC Products:
B8001— Brushless Servo Drive



INDUSTRIAL DEVICES CORPORATION

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Product and Manual Overview

The B8001 is a 5 amp continuous, 10 amp peak, digital brushless servo drive using state of the art DSP technology to provide high performance closed loop servo control to a wide variety of permanent magnet brushless and brushed servo motors and actuators offered by Industrial Devices Corporation.

Compact and easy to mount, the single axis drive is designed for easy setup and operation. The B8001 can be driven by a step and direction or analog command signal from a motion controller. The step and direction signal can control position, velocity, and torque, while the analog command signal controls velocity or torque.

The B8001 drive is fully software configurable. Optimized motor data files for IDC motors are supplied on the *IDCMotion*™ disk and can be further customized for a specific application using an advanced, yet easy to use tuning software, *Servo Tuner*. This MS-Windows™ interface communicates with the B8001 via an RS232C serial link, allowing the user access to a clear and intuitive menu set. Through *Servo Tuner*, the user can upload and download motor configuration files as well as manually adjust the individual servo parameters. On-board diagnostic monitors allow you to connect an oscilloscope to selectively view the dynamic response of your system. For repeat systems, tuning parameters can be stored on diskette and simply downloaded to subsequent B8001s.

The B8001 Servo drive manual is divided into four main sections. The first section consists of a product overview and a manual outline. The second, *Quick Start*, gives an abbreviated setup and test procedure to confirm the basic functionality of the drive/motor system. The third, *Installing and Configuring Your Drive*, covers in detail all the hardware connections needed for proper operation. It also covers the initial software setup and drive configuration. More information on using *Servo Tuner*™ to optimize system performance can be found in the *Servo Tuner* manual. The last section, *Troubleshooting* provides a quick symptom / cause / remedy chart for tracking down setup errors and operating faults. If you cannot find the information that you need in this manual, please contact IDC's Applications Department . [(800) 747-0064 or (415) 883-3535]

B8000 Series Features

- Expanded torque-speed leads to higher throughput
- Vector control offers improved torque and velocity control when compared to sinusoidal or hall effect commutation.
- High bandwidth, closed-loop operation for consistent performance
- Ease of integration speeds time-to-market
- Ease of setup during production lowers costs
- Smooth, non-resonant performance is easy on machinery
- Efficient, cool-running operation
- Enhanced reliability by design

B8001 Compatibility

IDC Motors	Electric Cylinders	Drive Options
B23, B32, and B41 brushless servo motors and gearmotors H3 and H4 DC servo motors	NB, TB, NH, TH, R2B, R3B, R4B, R2H, R3H, R4H,	-FK1 and -FK2 fan kits RPACK-1 and RPACK-1 regen modules

IDC's B8001 digital amplifier is compatible with most manufacture's brushed and brushless servo motors. The motors must be supplied with encoders and be rated for the B8001's 160 VDC minimum bus voltage. For a one time charge, IDC will create and supply the custom software configuration file that the B8001 will require.

Shipping Contents

All B8001 Drives are fully tested and operational when shipped from Industrial Devices. Each shipment should contain the following items:

B8001 Only
- -1 B8001 Drive
- -1 B8001 Manual
- -1 Servo Tuner Manual
- -1 Mounting Bracket(attached)
- -1 AC Power Cable
- -1 IDC*Motion*™ Disk Set

B8001 w/Motor(or Motor/Actuator)
- -All items from first column
- -1 B Series Motor (or Mot/Actuator)
- -12 ft Motor/Feedback Cable Assembly
- - B Series Motor data sheet

Quick Start

Objective

The purpose of the “Quick Start” chapter is to help an experienced servo amplifier user quickly set up and bench test a standard IDC drive/motor/actuator system. It is not intended, nor should it be, a substitute to thoroughly reading and understanding the complete manual. Since the operation and tuning of the DSP based, vector controlled B8001 differs significantly from a traditional PID compensated analog servo amplifier, it is important for even experienced users to read the entire manual before connecting a load to any IDC motor or actuator.
This procedure also assumes that the user has a PC available with MS Windows installed and running. The B8001 has no hardware accessible test functions. Without a PC and IDC‘s Servo Tuner software, the amplifier can be powered up to confirm the proper function of the power LED, but no functional testing is possible.

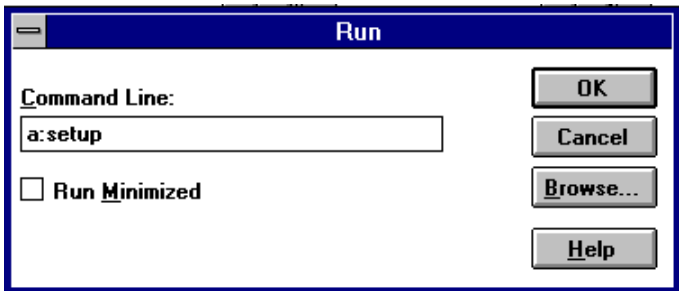
Caution:
When using the B8001 with a non-IDC motor please contact the IDC Applications department at (415) 883-3535 for start up assistance. The B8001 requires a unique motor data file to be downloaded for proper motor operation. The IDC motor files included on the IDCMotion disks could potentially damage other motors.

The “Quick Start” section consists of three main steps.
1. Install IDCMotion™ on your computer.
2. Connect the motor, encoder feedback, and power cables as described in *Wiring*.
3. Follow the directions in *Test Procedure* to power up the amplifier and confirm basic functionality of the drive/motor/actuator system in a non-loaded, bench top environment.

If you have any questions please consult the appropriate chapter with a full feature description later in the manual.

Install IDCMotion™

After starting Microsoft’s Windows (version 3.0 or later), from the **File** menu select **Run** and type *a:setup* as shown below and click on **OK**. From Windows ’95, access this dialog box from **Start**/ **Run**.

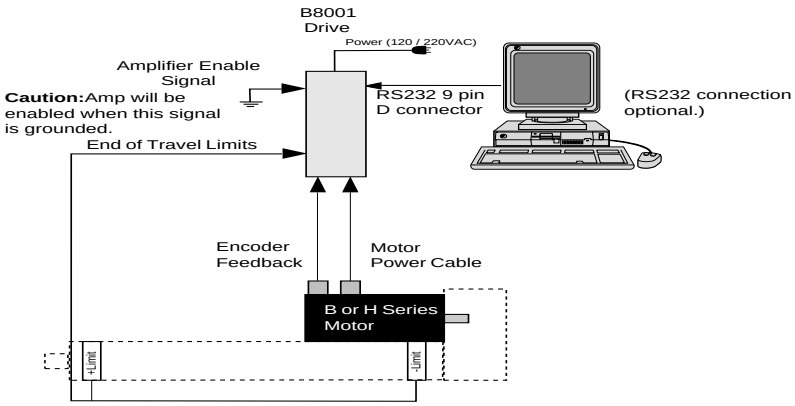


The installation program will display a Welcome/Registration screen. Throughout the installation process, the program will prompt you to enter information, and then click on the **Next** button to continue the installation. At any point during the installation, you can hit **Cancel** to abort the process. Select the **Typical Installation** when prompted to do so. Please consult the Installation sheet that came with the IDCMotion™ disk set if you have any questions or problems.

Wiring

Connect the pre-wired motor and encoder feedback cables as shown below. The B23 motors have a single MS connector at the motor end for both motor and feedback signals; the B32 and B41 motors have separate connectors for the motor and encoder signals. All motor models have a single, 20 pin Phoenix type connector at the drive end to terminate the motor and feedback signals.

Also connect the 5 pin 120 VAC power cord included in the ship kit. All B8001s can be run at 120 or 220 VAC; the 120 VAC power cable has been included for ease of set up and bench top testing. All the connectors are keyed to prevent miswiring.
Do NOT apply power at this time.



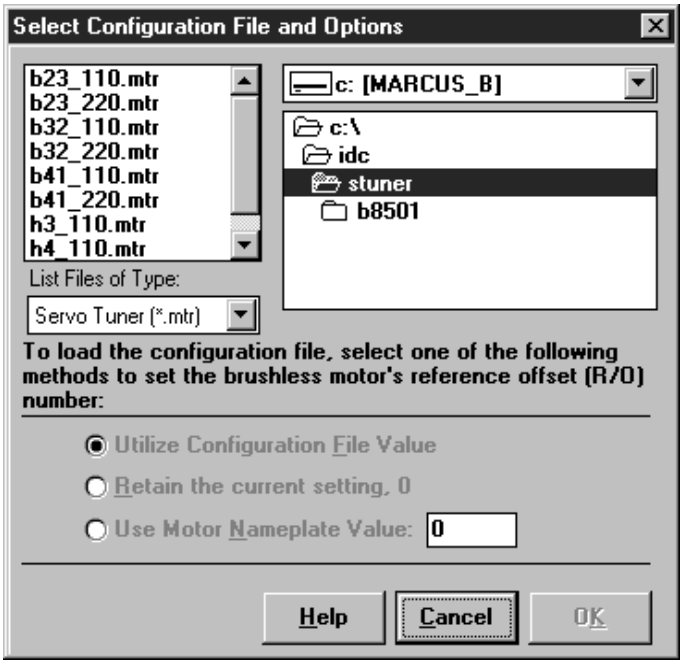
Test Procedure

A PC running MS Windows will be needed to do any functional testing of the drive/motor system. If a PC is not available, just confirm that the drive powers up when power is applying. The power LED should flicker at 24 Hz. If the power LED blinks slowly, see the Fault Code list in the Troubleshooting chapter of this manual to resolve the problem.

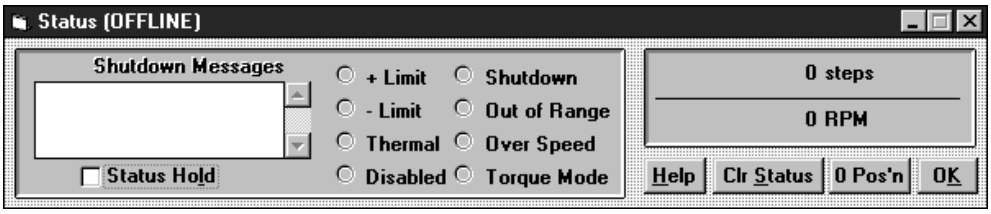
1. Double click on the Servo Tuner icon to start the program. From the COM Port menu, select the communications port that you want Servo Tuner to use. Servo Tuner will automatically configure this COM port for communication with the B8001. Unlike some communication programs, Servo Tuner can not share a COM port with the computer's mouse driver. The B8001 uses a standard 3 wire implementation of RS232. (2:TX, 3:RX, 5:GND, no handshaking, the RS232 hardware handshaking signal are jumpered together in the B8001)

2. Install a RS232 cable from the 9 pin D shell connector on the B8001 to the COM port of your computer. Apply power to the B8001. After a brief delay, your computer will give a series of short beeps, and the yellow OFFLINE status bar will change to ONLINE. The drive's power LED will flicker at 24 Hz. If the power LED blinks slowly, see the Fault Code list in the Troubleshooting chapter of this manual to resolve the problem.

3. Click on **File/Load Configuration**. Select the IDC motor model number and voltage the drive will run at in the application. i.e. B23_220 would be selected, if running a B23 motor at 220 VAC. A 220 volt motor data file can be loaded while the drive is running at 120 VAC for testing or setup purposes. Click on **OK** to download the motor data file to the drive. The mouse cursor turns into a black square while this download is taking place.

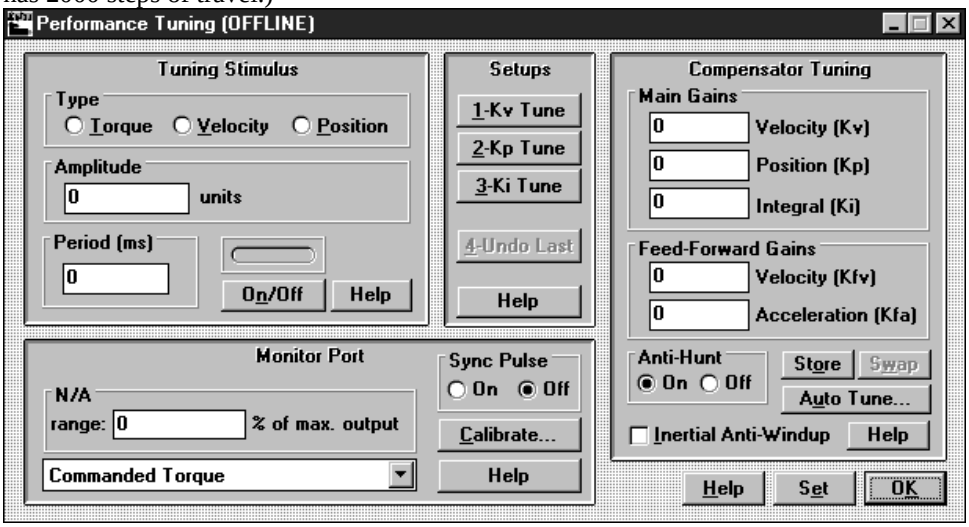


4. Click on **Status** and then **Show** under the Drive Setup window. In the status window, the end-of-travel limits and the disabled lights will be on. If the actuator was supplied with limit switches, connect them now. If not, jumper both limit inputs to common. The limit lights in the Status window will go out.



5. Click on **Setup** /**Performance Tuning** under the Drive Setup window. This window displays the servo gain parameters of the drive; it also provides a square wave velocity or position signal generator for tuning and testing purposes.

6. In the Toggle Generator section select the Position radio button, change the Period to 500 ms, and change the amplitude to 1000 steps 8000 steps=1 rev. (Assumes the actuator, if any, has 2000 steps of travel.)



7. Connect the Enable input on the drive to Common. There should now be holding torque at the motor shaft.

8. Click on the ON/OFF button in the toggle section. The motor will now move back and forth 1000 steps every 500 msec.

9. Click on the ON/OFF button to stop the toggle generator and power down the drive.

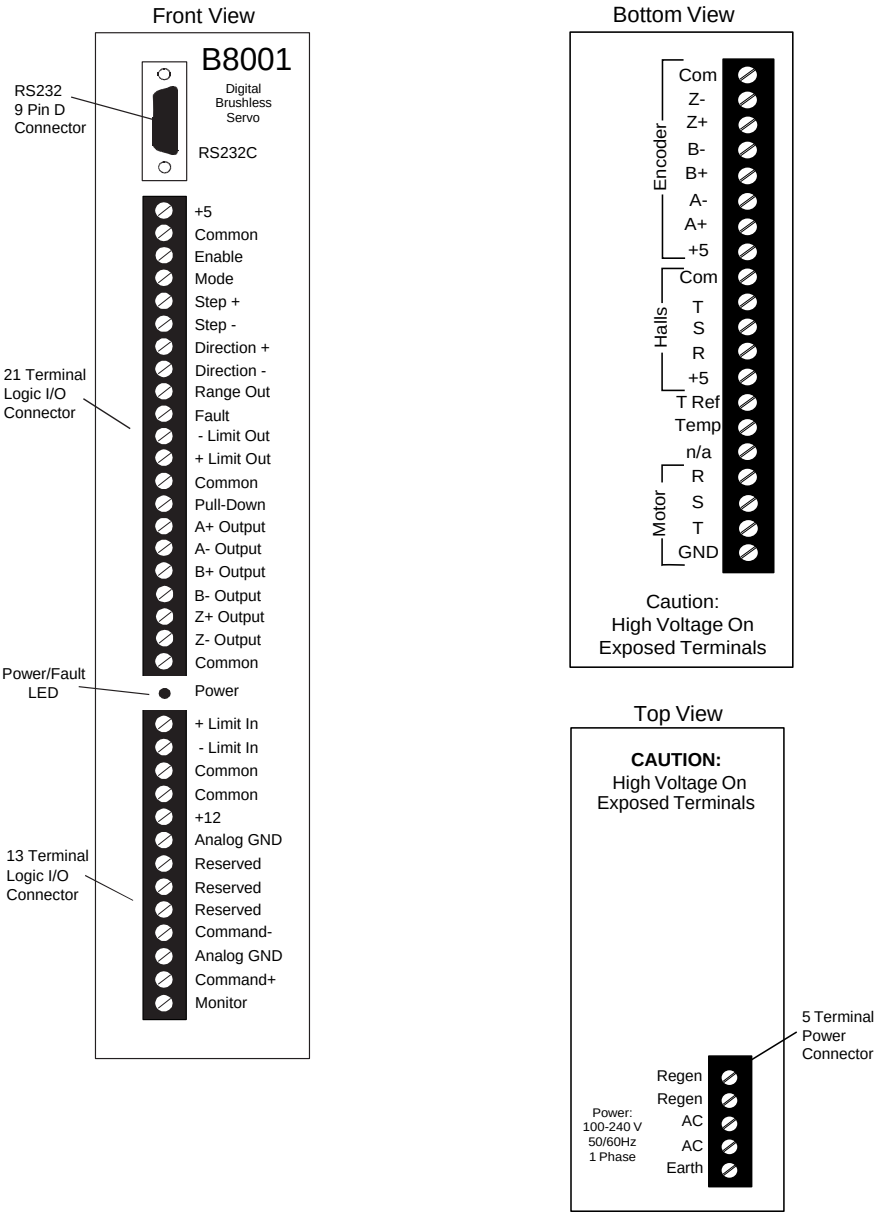
You have now confirmed that the power, motor, feedback, limit, and enable inputs are all functional on the B8001. If any of these steps were unsuccessful, check the trouble shooting section of the manual, or the installation section for more detailed information. You are ready to go on to the Installation section of this manual.

Where To Go From Here?

Hardware Specifications	p. 26
Hardware Installation	p. 7
Software Configuration	p. 18
Trouble Shooting	p. 23
Advanced System Tuning	(see the Servo Tuner manual)

Installing and Configuring Your Drive

The design of the B8001 minimizes the amount of wiring necessary. Pre-wired cables are provided for the Motor, Feedback and AC Power connections. In most cases, a single additional cable connecting to the limit switches and another connecting to the motion controller is all that is required. The following pages in this section describe the necessary wiring and the available hardware features. A physical layout of the drive hardware connections is shown below. Drawings showing the drives dimensions can be found under the *Drive Mounting* heading in this section.



The installation and configuration of the B8001 can be divided into main categories. Hardware and Software.

The specific hardware connections needed will vary with the application and the controller being used. Though every application will obviously require power, motor, and encoder wiring, most of the other inputs and outputs are optional. Hall effect commutation sensors are optional, though they come standard on all IDC supplied servo motors and cables.

The control inputs and outputs used will vary with the type of controller, and the specific application requirements. What follows are some guidelines as to the minimum connections required for analog and digital control schemes, as well as some suggestions as how to best utilize the optional I/O to meet your unique application requirements. A more complete description of the I/O signal and functions are later in this chapter. The following lists are intended to give a broad overview of the required, and available, control and feedback signals.

Important:
Both analog and step and direction control schemes require the user to download the appropriate software parameters to the drive before any motor motion is possible. See the *Software Configuration* section later in this chapter.

Step and Direction Control Hardware Connections

Required Hardware Connections:

1. Enable input from the indexer's shutdown output
2. Step +/- Inputs from indexer's step outputs
3. Direction +/- from indexer's direction outputs.

Optional Hardware Connections:

1. +/- Limit Ins from the End-of-Travel switches. Please note that these inputs require a Normally Closed type switch for amplifier operation.
2. Fault output to the indexer's fault input. Used to signal the indexer of a fault condition. With the exception of a thermal fault, fault conditions disable the B8001, and can be cleared by toggling the Enable input.
3. Range Out / Move Done output. This output can be used to coordinate sequential moves or operations. For example, a stamping operation would require that the motor be in position and settled before the actual stamping.
4. Mode input, used to toggle the drive between position and torque mode. When left open, the drive defaults to position mode.
5. +/- Limit Outs to the Indexer EOT limit inputs. Please note that these outputs emulate a Normally Open limit switch. If your controller requires a Normally Closed end of travel limit switch signal, consider jumpering the B8001's limits to COMMON, and connecting the end of travel switches only to your controller.
6. Encoder outputs to the indexer encoder inputs. The encoder signal is the actual hardware encoder signal from the encoder. It is not software buffered, or scaled, and does not necessarily match the software scaleable input resolution of the drive

Analog Torque/Velocity Hardware Connections

Required Hardware Connections:

1. Enable input from the servo controller's enable output.
2. The **Mode** input must be jumpered to **Common** to run in torque mode. The amplifier will run in velocity mode if this input is left open. The velocity scale used in velocity mode can be changed from the **Inputs and Limits** screen in Servo Tuner.
3. Command +/- inputs from the servo controller's +/-10VDC torque or velocity command signal.
4. Encoder output signals from the B8001 to the servo controller's encoder inputs.

Optional Hardware Connections:

1. +/- Limit Ins from the End-of-Travel switches. Please note that these inputs require a Normally Closed type switch for amplifier operation.
2. Fault output to the controller's fault input. Used to signal the controller of a fault condition. With the exception of a thermal fault, fault conditions disable the B8001, and can be cleared by toggling the Enable input.
3. Range Out / Move Done output. This output can be used to coordinate sequential moves or operations. For example, a stamping operation would require that the motor be in position and settled before the actual stamping.
4. +/- Limit Outs to the Indexer EOT limit inputs. Please note that these outputs emulate a Normally Open limit switch. If your controller requires a Normally Closed end of travel limit switch signal, consider jumpering the B8001's limits to COMMON, and connecting the end of travel switches only to your controller.

Please see the detailed explanations later in this chapter for the specific I/O hardware details needed for interfacing the B8001 to your indexer or servo controller.

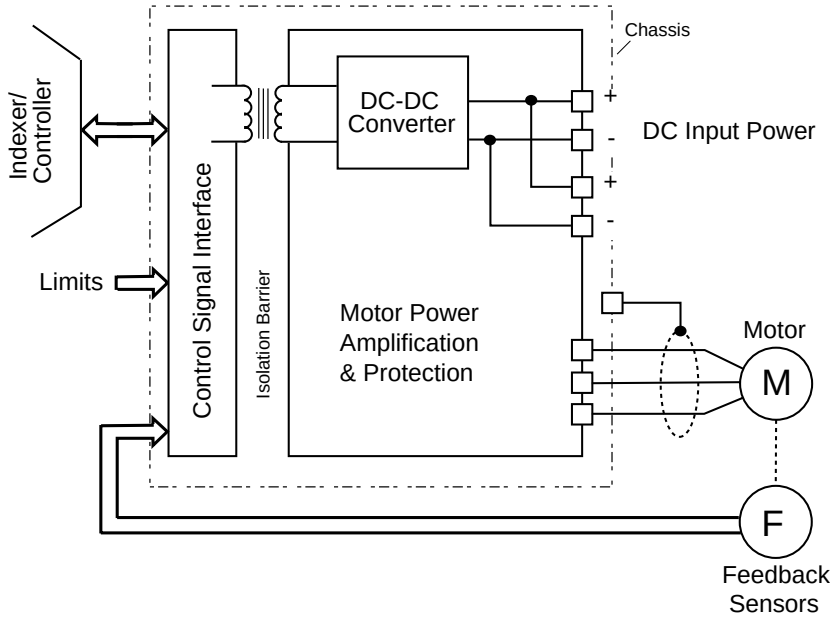
Important Notes Before Installing the B8001

Static Precautions

When installing a B8001 drive you should observe the same static sensitive procedures as you would for any piece of electronic equipment. Although most of the B8001 inputs are protected from small amounts of electrostatic discharge (ESD), it should not be considered immune to ESD. The use of wrist straps is preferred during installation. Note that both the control signal ground and the case ground should be used for grounding the unit for ESD protection purposes during installation.

Electrical Isolation

In order to eliminate the possibility of ground loops in B8001 systems, the control signal ground (GND), power circuits and chassis are each electrically isolated from each other as shown below.

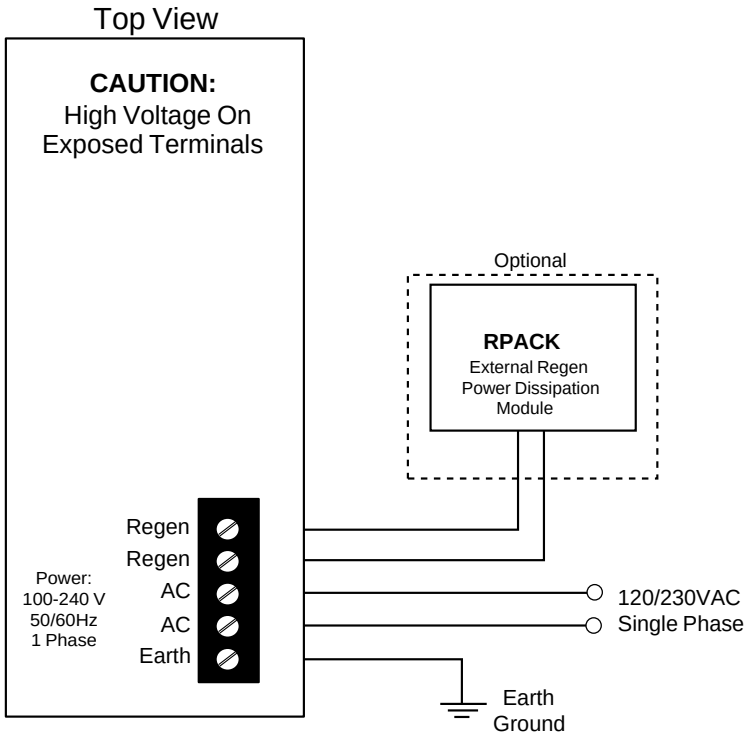


All of the control signals used by the indexer/controller are electrically isolated from the B8001's rectified AC power input and motor output circuits as well as the B8001 chassis (Case Ground). This feature insures that currents will not be induced into the indexer/controller wiring by motor and/or power supply currents.

B8001 Installation and Wiring

Input Power

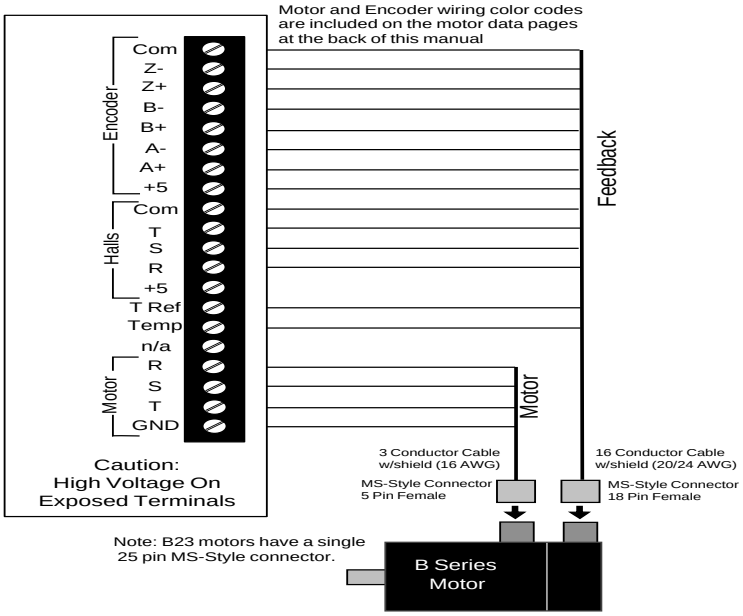
The B8001 accepts single phase 110 or 220 VAC wired directly into the AC input terminals. The B8001 does not distinguish between the Line and Neutral power signals. The power input circuit automatically detects the voltage input level and rectifies it to its appropriate level on the DC Bus. There is no jumper or dipswitch setting required to select between 110 or 220 volts, but the motor configuration file used is voltage level dependent.



When the B8001 is used in applications where ball screws are moving a load vertically, or large inertial loads are being quickly decelerated, regenerated power may cause an over-voltage condition in the drive. The B8001 will safely shut itself down if such a condition occurs. Using an IDC supplied RPack-1(110VAC) or RPack-2(220VAC) to dissipate this regenerated energy will help prevent an over-voltage fault, and allow faster cycle times in applications that would normally be limited to slow speeds because of regen concerns.

Motor and Feedback Wiring

Each B Series Motor used with the B8001 comes with built-in male, MS style connectors for the motor and feedback connections. Industrial Devices supplies pre-wired 12 ft cable(s) (longer cable length are available, contact IDC for details) and mating connectors with each motor. The motor and feedback cables are wired into a single, 20 pin removable screw terminal connector that plugs into the Motor/Halls/Encoder port located at the bottom of the drive. Complete cabling color codes and signal names can be found on the motor data sheets in the Hardware Reference section at the back of this manual.



The shield of the Feedback cable should always be connected to the "COM" terminal and the shield for the motor cable should be connected to the "GND" terminal.

Input Command Signals

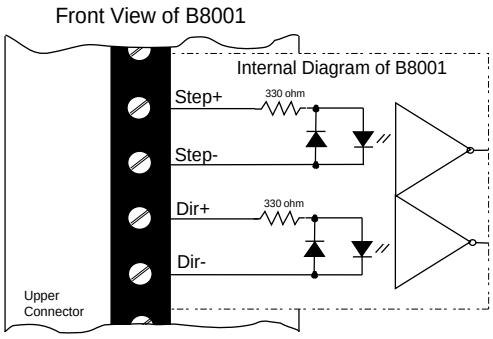
The B8001 can be driven by a step and direction or analog command signal from a motion controller. The step and direction signal can control position, velocity, and torque, while the analog command signal controls velocity or torque. See the **Hardware Reference** section for complete electrical specifications.

Step and Direction Inputs (Step+, Step-, Dir+, Dir-)

The step and direction command inputs are optically isolated inputs designed to connect directly to industry standard TTL level or open collector step and direction output signals provided by indexers or PLC's. The maximum step input frequency is 1.5Mhz. (A 2Mhz input frequency option is available. Please contact the factory for details.) The motor will be commanded to take one step for every rising transition on the step line when the *MODE* line is not grounded. When the *MODE* line is pulled to ground, the frequency of

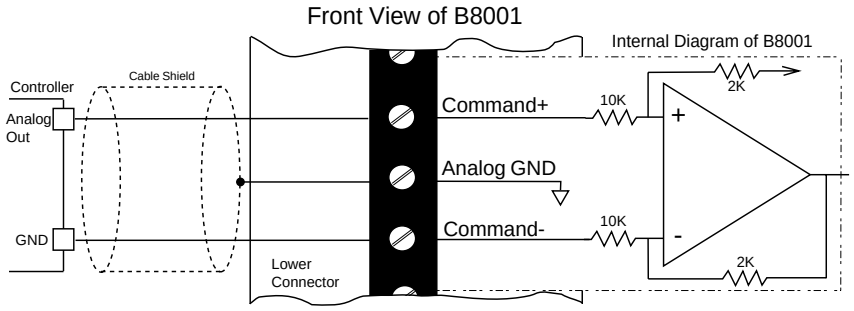
the signal on the step input is proportional to the torque of the motor. Information on the use of the *MODE* input is available later in this chapter.

The direction line controls which way (CW or CCW) a step is taken or the direction the torque is applied. The motor rotates CCW (while looking at the motor face) when the direction line is low. A 400nS setup time is required between a direction signal transition and the next step.



Analog Command Inputs Command+, Command-, Analog GND

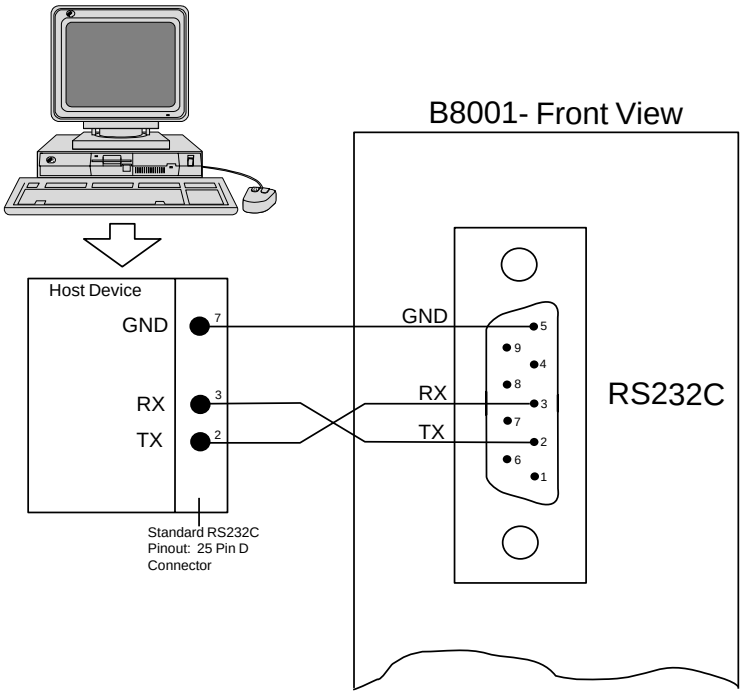
An analog command input is provided on the B8001 for use with an analog output servo controller. The analog input responds to +/-10Vdc input signal which can be used to control torque or velocity. When the analog signal is used to control velocity the maximum speed which corresponds to a full 10V input can be programmed using IDC*Motion*™ Servotuner Software. The *MODE* line configures the analog input as a velocity or torque signal. The analog input is a differential input which reduces the effect of common-mode noise. For optimum noise immunity shielded twisted pair cable wiring should be used with the shield terminated at the drive end only.



RS-232C Interface

An RS-232C serial interface is provided for configuring the B8001 using IDC*Motion*™ *Servo Tuner*. Since the B8001 is software configurable, RS-232 must be used for initial system setup, but, there is no need to install this interface permanently unless constant status is required from the B8001 system. RS-232C handshaking signals are not provided or used by the B8001. The communication protocol is 8 bit, asynchronous, half duplex with a single start bit, a single stop bit and no parity. The communication rate is fixed at

9,600 Baud. The RS232 port is a 9 Pin D female connector. The user must supply a mating 9 Pin male connector and cable to the host device.



Digital Control Inputs

The digital inputs are optically isolated inputs rated to draw 20ma at 12vdc. They are activated when connected to common via a switch or sinking output.

Enable

The Enable input is used to enable the power stage of the drive. When the input is on (connected to ground), power will be applied to the motor. When the input is off (open circuit high), the motor will be de-energized (allowing the motor shaft to spin freely). In the event of a fault shutdown, the Enable input can be used to clear the fault. Switching the input off and on will clear the fault and re-enable the drive.

Mode

The Mode input switches the B8001 between two operating modes, position/velocity control mode and torque control mode. When the input is on (connected to ground), the drive will be in torque control mode. When the input is off (open circuit high), the drive will be in Position mode if being controlled by a step and direction signal. It will be in velocity mode if being controlled by an analog signal. For more information on toggling the drive between step mode and analog mode, see the *Inputs and Limits* section of the *Servo Tuner* manual.

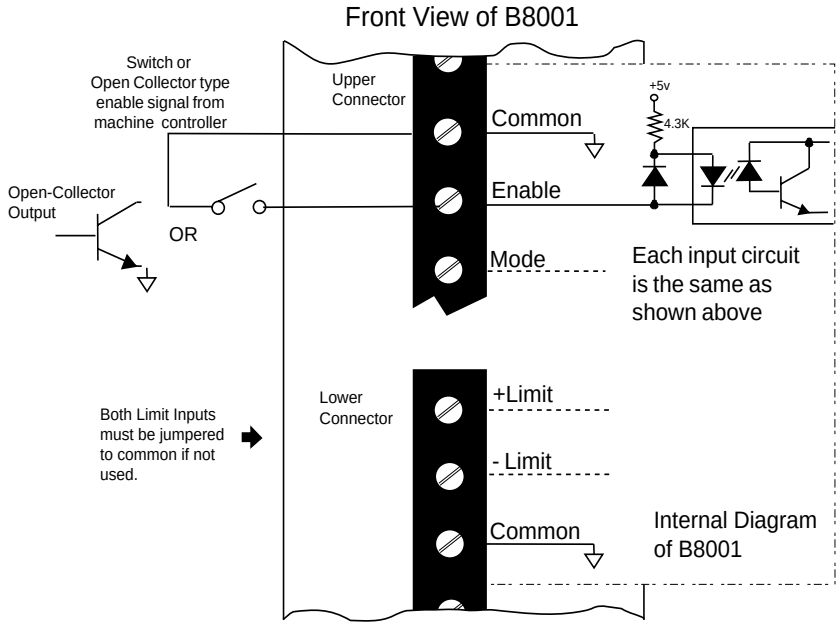
The state of the Mode signal can be changed at any time. The B8001 responds to a signal level change within 120µS. If you want to switch between the two modes "on the fly," the MODE input should be controlled by an output from your indexer or servo controller. If the Mode of control is to be permanent, the input should be left disconnected when using position/velocity control, and should be hard wired permanently to common if using the torque mode.

+Limit In, - Limit In

The +Limit and -Limit inputs are provided for safety shutdown of the motor in case of over travel. The inputs are configured to operate with normally closed switches only, so that under normal operating conditions, the inputs should always be active (connected to ground). When an input is off (open circuit high) via a tripped limit switch or a break in the circuit elsewhere, motor motion will cease.

Two limit modes are available. In the default mode, when a limit switch is made, motor torque in that direction is clamped to zero. This will cause the motor to coast to a stop. A second mode is available, where the motor position is latched when that limit is made. The B8001 then servos the motor to this position. This mode is most often used in vertical ballscrew applications where the load would otherwise back-drive into a physical end of travel. Because of the instantaneous commanded velocity change this optional operating mode should be used with caution. Please contact IDC for details if your application requires a position limit. *If limit switches are not used in the B8001 application, both limit inputs must be connected to ground.*

Digital Input Schematic- Input wiring diagram showing typical connection types



Digital Outputs

The digital outputs are optically isolated, open collector, sinking outputs rated for switching non-inductive loads up to 12 volts at 7mA max. They can be used directly to switch low current non-inductive loads such as LED's or external opto devices.

Range Out / End of Move

The Range Out signal is turned on (sins to ground) when the following-error (instantaneous difference between the commanded position and the actual position) of the B8001 is more than a pre-programmed limit. This limit is set, in user units, from the **Inputs and Limits** screen in Servo Tuner. It can be used as a synchronizing signal when making point-to-point moves or it can be used as a following-error flag to alert your indexer/controller to reduce the feed-rate in contouring applications.

When the B8001 is in Step and Direction positioning mode this output can also be configured as an End-of-Move signal. In the **Inputs and Limits** screen of Servo Tuner, the user can specify an end of move position window and settling time. After the motor is within this position window for the time specified by the *time qualifier*, the End of Move signal will turn on.
The *time qualifier* is intended to allow end of move ringing to settle before signaling another device that the move is actually over. The End of Move option can not be used during ultra-slow speed moves if the period of the pulses the B8001 is receiving is longer than settling time specified.

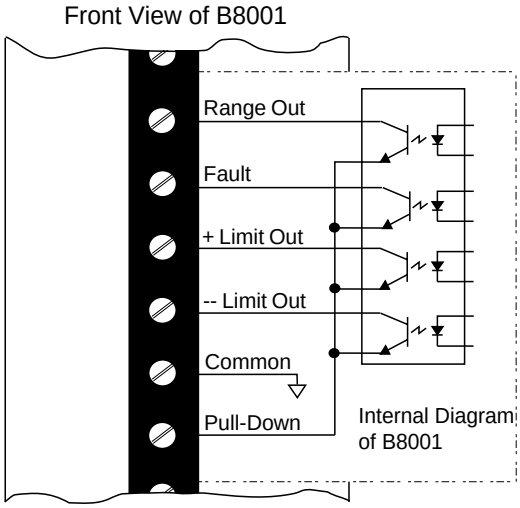
Fault

The Fault output signal is a normally active (sinking) output. When a fault is detected in the B8001 drive or motor, this output is turned off. The drive is shut down immediately if the fault was caused by over current, over voltage, or RMS over-current. However, if the fault is caused by a motor or drive thermal overload, Fault Out will turn off immediately, but the drive will not be shut down for 5 seconds. This gives your indexer/controller time to bring the axis to controlled stop during a thermal fault.

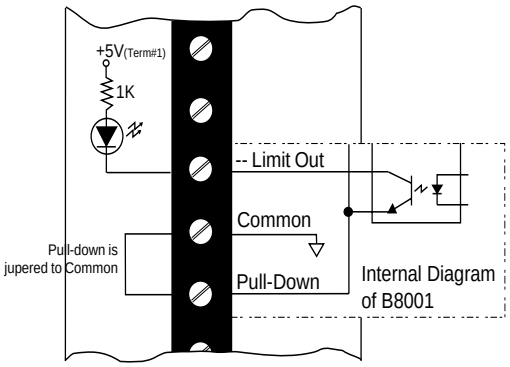
+Limit Out, -Limit Out

The +Limit Out signal turns on (sinks to ground) when the respective "+ Limit" input connection is broken (it is normally closed).
The -Limit Out signal turns on (sinks to ground) when the respective "- Limit" input connection is broken (it is normally closed). Please note that these outputs signals mimic a Normally Open switch, while the Limit In inputs require a Normally Closed switch for proper operation.

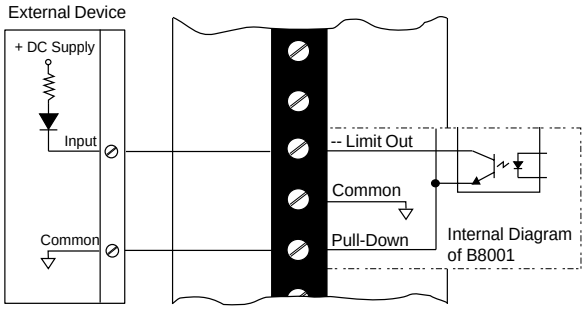
Logic Output Schematic-Internal Circuit Diagram of Outputs



Typical output wiring (using the drives internal supply)



Typical output wiring (using an external supply)



Encoder Output

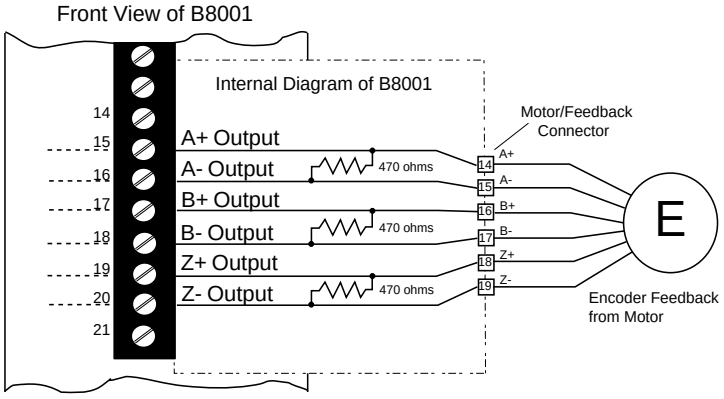
A+/- Output, B+/- Output, Z+/- Output

The encoder output signals provide a differential, dual channel quadrature output which can be routed to an external indexer or controller.

Using the encoder feedback is optional when the B8001 is in Step and Direction mode. When being routed back to an indexer, be sure the any position maintenance features are disabled. The B8001 will close the position loop. The Range Out/End of Move output can be used to signal the indexer that motor is in position.

The encoder output signals are required when the B8001 is in analog velocity or torque mode. In this case, the analog servo controller will close the position and/or velocity loops.

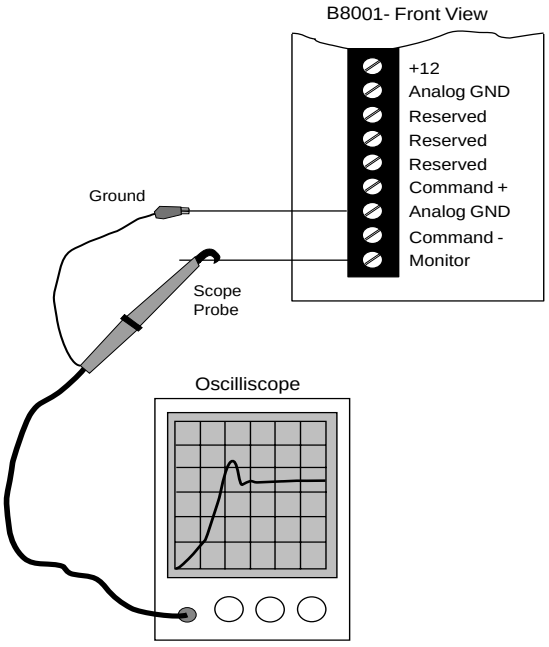
The signals tap off (internally) the corresponding encoder input lines on the motor/feedback connector. Each balanced pair of encoder input lines has a 470 ohm termination resistor to prevent the overloading of the encoder's drivers when routing to an indexer/controller. If you are routing the encoder signals, then termination resistors should be installed at the controller end equal to R_c (cable impedance, normally equal to 100 - 200 ohms).



Diagnostic Monitor Port

The B8001 includes an analog monitor output (diagnostic output port) for viewing system parameters on an oscilloscope or for use with a data logger. The monitor output is a 0.5 - 4.5 volt signal centered around a 2.5 volt “zero” reference, with a 2kHz update frequency. This tool provides objective, real time torque, velocity, and position data. It is invaluable as a tuning and system bench marking utility.

Actual velocity, commanded velocity, velocity error, position error, commanded torque as well as other parameters can be displayed with ease. More information on using and configuring the Monitor Port is found in the Servo Tuner manual.



B8001 Software Configuration

Since the B8001 is a fully digital drive, motor data must be downloaded to it prior to operation. On the IDCMotion disk set that came with this drive are motor data files (ex. B23_220.mtr) that supply the drive all the necessary motor data. This data includes motor winding information, pole count, and encoder resolution. These files also contain default tuning parameters. The tuning parameters have been optimized for use with IDC motors and actuators. They work very well with inertia ratios up to about 15 to 1. Most applications require **NO ADDITIONAL TUNING**. If your application does require higher performance than the default tuning parameters provide, please refer to the tuning procedure detailed in the *Servo Tuner* manual.

The rest of this section gives a quick overview of what Servo Tuner can do, and how to download the correct motor file. After this procedure the drive will be ready to be installed in the application. If further tuning is required, please follow the procedures and application descriptions in the *Servo Tuner* manual.

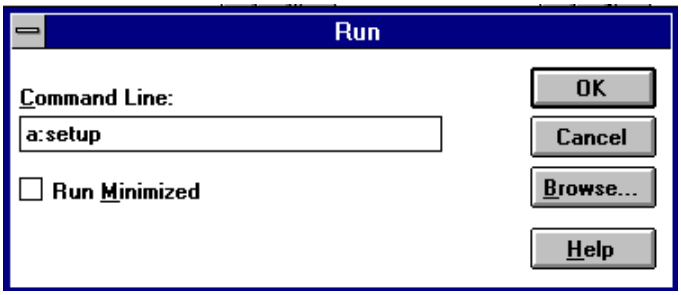
Servo Tuner does all the configuration of a B8001 electronically, there are no DIP switches or jumpers. All configurations can be stored on your computer for quick transfer into other B8001's, minimizing set-up and troubleshooting time during production. Each B8001 has a unique electronic serial number so individual configurations can be tracked easily.

Servo Tuner also allows you to monitor the performance of the drive during machine integration. You can view position and velocity error in user defined units and monitor the full status of any B8001. *Servo Tuner* also allows you to set up the B8001's internal signal generator and analog monitor port. These built-in instruments within the B8001 can be used in conjunction with your oscilloscope to stimulate and monitor the performance of your entire electro-mechanical system.

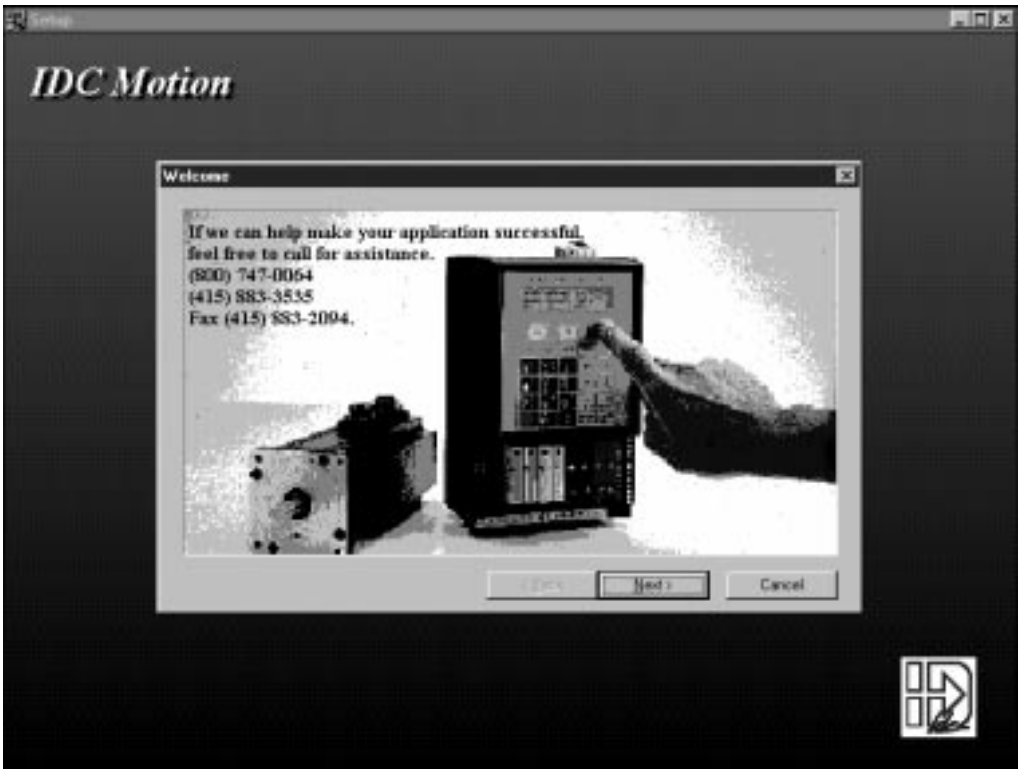
More information on using Servo Tuner and on optimizing system performance can be found in the Servo Tuner manual.

IDCMotion Installation Procedure

After starting Microsoft's Windows (version 3.0 or later), from the **File** menu select **Run** and type *a:setup* as shown below and click on **OK**. From Windows '95, access this dialog box from **Start**/ **Run**.



The installation program will display the Welcome screen shown below. Throughout the installation process, the program will prompt you to enter information, and then click on the **Next** button to continue the installation. At any point during the installation, you can hit **Cancel** to abort the process.

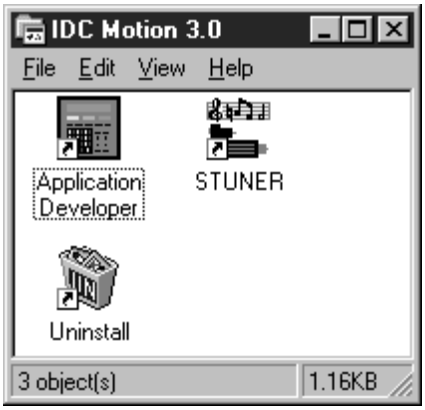


The installation program will take you through a series of screens to verify user information and destination directories. Please note that this installation program will over-write any existing versions of Application Developer and Servo Tuner. If you want to save the older versions of these programs, install the new versions to a different directory, or rename the older files.

The screen shown below will prompt you to select an installation type. Select Typical unless a partial installation is required. Selecting Custom allows you to select/de-select applications and various IDCMotion support files. Application Developer and Servo Tuner may not run properly if these support are not installed.



The installation program will then prompt you to select a program group (or program folder in Win'95) to install the program icons. The default program group is shown below.



The install program will also create a series of sub-directories containing Application Developer, Servo Tuner, and an icon list. Also included in the Application Developer directory is a readme.txt file, a PowerPoint training presentation, and a terminal program for use in troubleshooting SmartDrive daisy chains.

Common Installation Errors and Remedies

IDC recommends closing all applications, including MS-Mail and MS-Office, before running **SETUP** to help avoid file conflicts.
There are no know installation problems with IDCMotion 3.0. Please call the IDC Applications Department at (800) 747-0064 or (415) 883-3535 for assistance.

Servo Tuner runtime errors

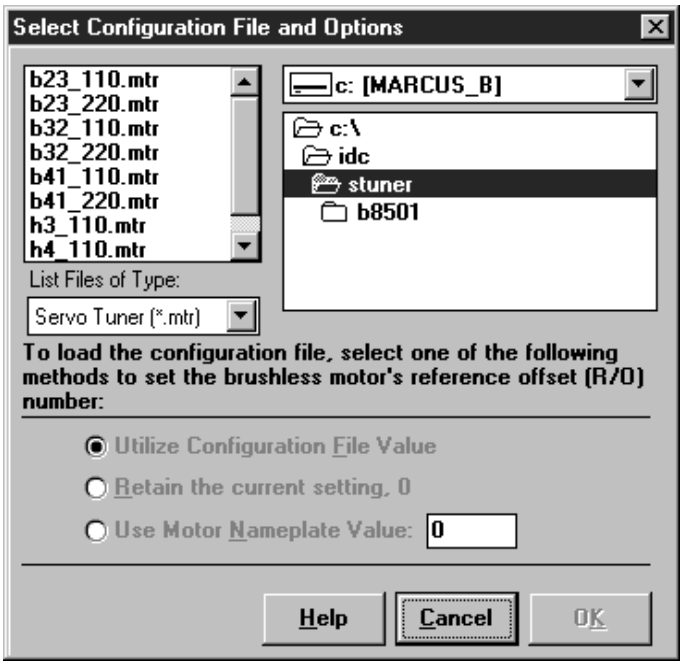
When running Servo Tuner without a B8001 or B8501 drive connected and **ONLINE** a 'Type mismatch' error message is displayed. This error window can be closed, and the program will run normally.

Problems occur when a computer tries to share a communication port between a mouse and Servo Tuner. The program requires a dedicated communications port.

Configuring the B8001 with an IDC motor

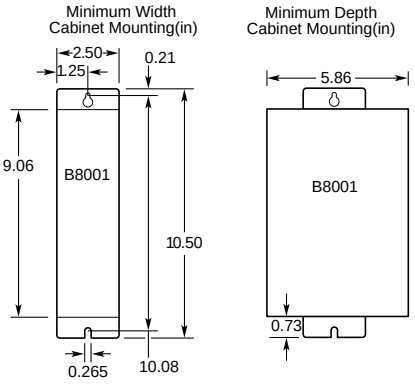
Before you attempt to communicate with your B8001, make sure that you have connected COM 1, 2, 3 or 4 of your computer to the drive via the RS232C connections shown in the "Installation and Hardware" section of this manual. Apply power to the B8001 and start the Servo Tuner program. The B8001 can be powered up and configured with no motor connected. Please note that Servo Tuner will detect a Thermal Fault if there is no motor. After communication is established with the B8001, indicated by the **ONLINE** in the Servo Tuner status bar, the drive needs to be configured to run with a specific motor. Select **File**, **Load Configuration**.

A list of IDC motor and voltage levels will appear.



Select the appropriate motor and voltage level file. For example B32_220.mtr is the file that must be loaded for a B32 motor running at 220 VAC. B32_110.mtr is used when running at 110VAC.
Then click the **OK** button to download the motor file.
This operation loads all motor parameters, and default tuning gains. To customize these gains to your mechanical system and move profiles, see the “Tuning for Performance” section of the *Servo Tuner* manual.

Drive Mounting

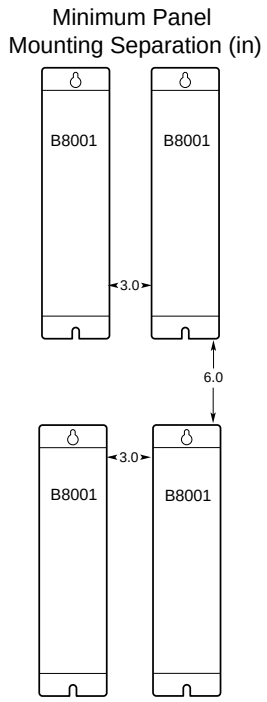


Drive dimensions are shown to the right.

Your B8001 drive arrived ready for a minimum width mounting. By moving the mounting bracket to the wide side of the heatsink, you can mount the B8001 in a minimum depth configuration.

The B8001 depends on air flow for cooling. In all but the least demanding applications, the following mounting guidelines should be observed:

- The heat sink fins should be oriented vertically to allow convection airflow along the fins.
- The horizontal clearance between an B8001 drive and other equipment or surfaces of the enclosure should be a minimum of 3.0 inches, and the vertical clearance should be a minimum of 6.0 inches. See drawing.
- High heat-generating equipment should not be mounted directly below the B8001.



Forced air cooling may be necessary if air flow is extremely poor, or if the ambient temperature is excessive (above 35°C). See *FK1 and FK2 Fan Kit* below.

FK1 and FK2 Fan Kit

The -FK1 Fan Kit Option may be necessary if air flow across the B8001 drive heat sink is extremely poor, or if the ambient temperature is excessive. The FK1 and the FK2 are the 110VAC and 220VAC versions of IDC's fan kit. They can be ordered individually for drive mounting in the field, or ordered as part of a system (i.e. B8001-FK2) for factory mounting. Mounting a fan kit on the B8001 will add 1.05 inches to the width of the drive. Since the B8001 supplies power to the fan no additional wiring or mounting is required.

See the 1996 IDC catalog for additional information on the fan kit, including mounting dimensions.

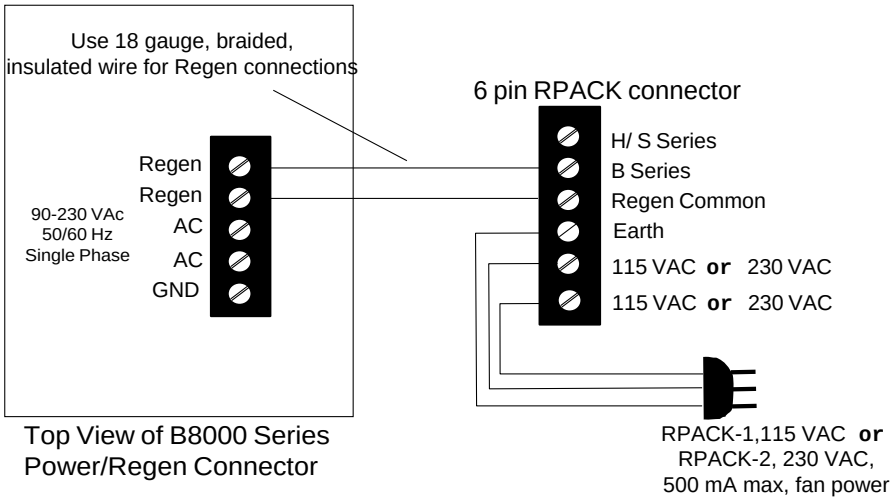
RPACK-1 and RPACK-2 Mounting and Installation

The RPACK-1 and the RPACK-2 are packaged power dump devices consisting of high voltage power resistors, a heatsink and a cooling fan. They are accessories to IDC's B Series controls. The RPACK-1 has a 110VAC fan while the RPACK-2 has a 220VAC fan. Please note that unlike a fan kit, the RPACK is a standalone box that does not share a power supply with the B8001.

A RPACK is typically used when it is necessary to very rapidly decelerate heavy vertical loads or large inertial loads. The RPACK-1 dissipates the kinetic and potential energy that would otherwise cause the drive to shutdown due to an Over-Voltage or Regen fault. Using an RPACK-1 can help reduce overall cycle time by allowing a higher deceleration rate than would be possible without it.

The RPACK has the same dimensions and mounting footprint as the B8001. The recommended panel spacing is also the same. Electrical connections should be made according to the diagram below.

RPACK-1 and RPACK-2
B8000 series wiring diagram



Troubleshooting

Most problems encountered during the startup and operation of a B8001 based servo system can be traced to a few basic causes such as mechanical problems, incorrect or noisy signal wiring, attempting to operate beyond the systems capabilities, or incorrect or non-optimal software configuration parameters. A combination of these underlying problems can present an overwhelming variety of symptoms that make is very difficult to track down the root cause of the difficulties.

A logical and methodical approach to trouble shooting is essential to isolating and resolving these problems. The B8001 provides a number of tools to make this task easier. The Fault LED and it's associated fault code will usually be the first clue in tracking down any problems. The next step is connecting a PC to the drive and running Servo Tuner. The **Status** / **Show** screen displays the current fault status of the drive as well as the current motor position and velocity. It can also be configured to log faults as they occur. For more information on using Servo Tuner, press F1 to access help while running Servo Tuner, or consult the Servo Tuner manual shipped with the B8001. The monitor output port is also a powerful troubleshooting tool. It can be configured to show actual and commanded velocity to help resolve controller difficulties. Configuring the port to output actual torque can be helpful in determining when a move's torque demands are starting to approach your systems theoretical limits. This mode can also be used to document your machine's torque safety margin. Again more details are available in the Servo Tuner manual or from Servo Tuner Help.

Power/Fault LED

The B8001 is equipped with a green power/fault indicator LED. This LED blinks at 24Hz (a fast flicker) when the drive operation is normal. If the digital signal processor (DSP) fails, this LED will be illuminated continuously. If the LED does not illuminate at all when power is supplied, the B8001 internal power supply is probably at fault.

This LED indcates faults by blinking error codes. These codes are blinked in a Morse code-like fashion and repeated continuously until the "Enable" line is toggled or the power on the B8001 is cycled. For example, error code 3 would blink the LED:

✷✷✷ ✷✷✷ ✷✷✷ ...

In the event of multiple faults, the codes repeat in a cyclic manner. For example, the combination of error codes 2 and 3 would blink the LED:

✷✷ ✷✷✷ ✷✷ ✷✷✷ ...

The DSP checks the internal subsystems of the B8001. If it detects an error with this internal hardware it will not allow the drive to operate. The fault chart on the next page decodes the Fault LED blink codes. All faults require the drive to be reset before further operation is possible. The drive can be reset by cycling power, toggling the state of the Enable input, or by sending a reset command over RS-232. After decoding the blink code, check the Symptom / Remedy chart at the end of this chapter for possible fault causes. Please call IDC's Application Engineering Department at (800) 747-0064 or (415) 883-3535 if you have further questions or problems.

Fault Codes

Fault #	Description	Requires Reset
2	Over Current, Over Voltage	YES
3	Thermal Shutdown	YES
4	Tracking Error Shutdown	YES
5	RMS Over Current fault	YES
6	Encoder Counter Over Speed	YES
7	Step Counter Over Speed	YES
8	Serial Character Receive Overrun	YES
9	A/D Failure	Hardware failure
10	Can't Initialize EEPROM	Hardware failure
11	EEPROM Hardware Failure	Hardware failure
12	Motor Parameter Error	Hardware failure
13	Current Sensor Failure	Hardware failure

The status register activated from the **Status** / **Show** window of Servo Tuner usually contains a more detailed description of the error.. Please see the IDC Servo Tuner manual that came with this product for more details on reading error conditions in the amplifier.

Symptoms and Solutions

The following table will help you isolate some of the more common application problems when using B8001 drives.

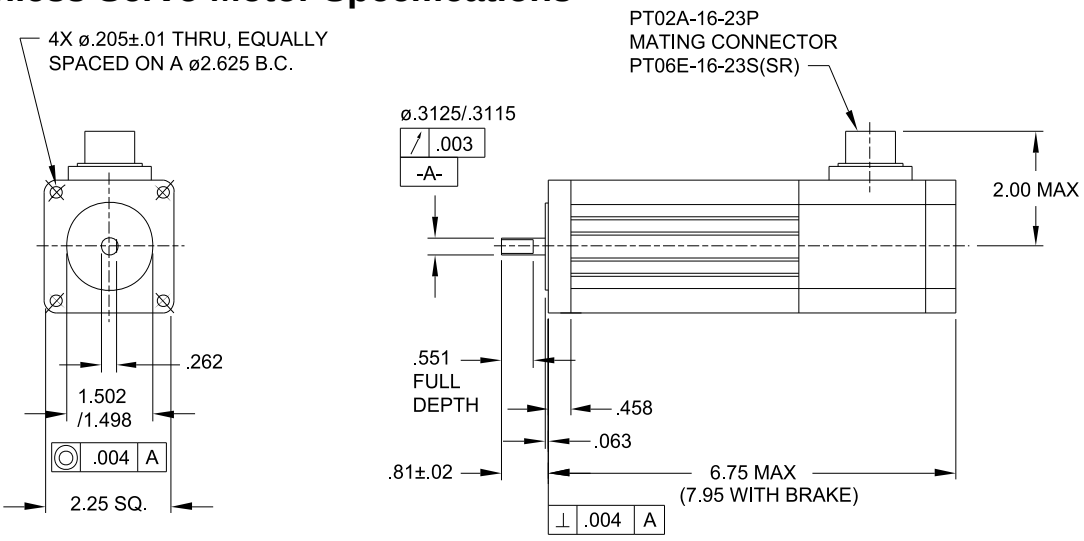
Symptoms	Probable Causes	Possible Remedies
Power/Fault LED is on	24 Hz "flicker" is normal.	
	Steadily illuminated LED	This indicates an internal hardware failure. Contact IDC.
	Slow blinking, followed by a pause.	Count the "blinks" and check the Fault code chart in this chapter
I/V Fault	Overvoltage due to excessive regen energy from the motor.	Install an RPACK module for additional regen capacity, or reduce the cycle time.
	Line Voltage exceeds 240VAC	Reduce input voltage to allow for surges or spikes caused by other equipment.
	Over current due to a motor short.	Replace shorted motor.
	Over current due over tuned current loop gain parameters.	Down load the correct motor file for the motor AND operating voltage.
Thermal Shutdown	Motor winding temperature exceeded 155C Drive heatsink temperature exceeded 55C	Increase cooling: circulate more air past heatsink, add -FK1 or FK2 fan kit, , or reduce duty cycle.
	Missing or damaged motor thermostat	Jumper Temp and Temp Ref together if the motor has no thermostat.
Tracking Error Shutdown	Too narrow a tracking shutdown window. Commanded moves too aggressive for system. Mechanical binding causing excessive following error.	Set the tracking error shutdown range from the **Inputs and Limits** screen in Servo Tuner. Check for unusual binding
	Poor or "soft" tuning allowing excessive following error.	Follow the tuning procedure outlined in the Servo Tuner manual, or download the default tuning parameters

Symptoms	Probable Causes	Possible Remedies
O/T Shutdowns (DSP V1.6 only)	Mechanical jam, amplifier shut down to prevent motor overheating. Vertical or constant force application causing false O/T fault. Wrong motor file loaded	Check for binding or reduce acceleration and duty cycle. Contact IDC's application department Load correct file via Servo Tuner.
RMS shutdowns (DSP V1.7 or later)	Mechanical jam, amplifier shut down to prevent motor overheating or the RMS current limit exceeded. Wrong motor file loaded	Check for binding or reduce acceleration and duty cycle. Load correct *.mtr file via Servo Tuner.
Motor will not move/ has no holding torque.	Drive not enabled Command input type configured wrong End of travel limit switches are active The B8001 is not configured to motor.	The enable input must be pulled low for drive operation. The command input type, step and direction or analog must be configured the **Input and Limits** screen of Servo Tuner. Drive requires Normally Closed limit switches. Inputs should be jumpered if not being used. The default drive configuration is "NONE". The correct motor file must be loaded via Servo Tuner prior to operation.
Motor "jerks" on power up	Hall effect sensors mis-wired Wrong motor.mtr file downloaded to the B8001	Check feedback cabling Load the correct configuration file with Servo Tuner.
Motor "whines"	Highly resonant mechanical system Tuning parameters are set too "hot"	Stiffen the mechanical transmission Reduce the gain parameters. K_i is often a strong contributor to this instability.
Motor moves the wrong distance.	Drive and control resolution don't match.	Check that drive resolution setting coincides with the indexer.
Motor won't change direction or moves only in one direction.	One EOT limit switch is active Direction signal not connected or working properly.	Check status of limit switches from the **Status / Show** window of Servo Tuner Check control signal wiring.
Motor moves when no command signal is given.	Noise on the step lines Incorrect offset voltage command from the servo controller. (analog input only)	Use properly grounded, shielded, twisted pair step and direction cabling Properly close the position loop at the servo controller. See the controllers documentation for adjusting offset voltages.
Motor moves in the wrong direction.	Control and Drive directions conflict with each other.	Change the indexer's sense of direction (polarity of direction bit).
Motor runs hot	High accelerations and duty cycles. IDC motors are rated up to a case temp of 100C, and are protected by a thermostat.	Reduce duty cycle. Motor heating is not normally a problem unless is causes Thermal Shutdowns.

Hardware Specifications

General	
Mounting dimensions:	10.5" X 5.93" X 2.50"
Weight:	5lbs
Environmental	
Drive Temperature:	Thermal Shutdown occurs if the drive heatsink temp. exceeds 55C
Motor Temperature:	Max winding temp 155C (thermostat protected)
Humidity:	0 - 90% non-condensing
Power	
Input:	90-230 VAC, single phase, 50/60Hz 1150VA@115VAC, 2300VA@230VAC
Motor Output	
Current:	5 amps continuous, 10 amps peak
Protection:	Protected against phase to phase shorts and shorts to ground. Internally fused.
Encoder Input	
Type:	Incremental, Dual channel encoder Differential, quadrature output
Max Rate:	2.0 MHz
Power:	5VDC @250ma
RS232C	
Data Format:	RS232C Serial Interface, half-duplex, 9600 Baud, 8 data bits, no parity, 1 stop bit Three wire implementation(no handshaking)
Diagnostic Output	
Format:	0 to 5VDC analog signal(centered @2.5v)
Variables	Velocity, position error, velocity error, programmable scaling
Logic	
Power:	5VDC @250ma, 12VDC @100ma
Inputs:	Optically isolated, draws 20ma@12VDC
Outputs:	Optically isolated, open collector outputs, rated for switching non-inductive loads up to 12VDC@7ma
Command Signal	
Step & Direction:	
Current range:	5-15 mA
Max frequency:	1.5 MHz , min. pulse width 400 nsec
Resolution:	200-65,534 steps/revolution (programmable) Even numbers only
Analog:	+/-10VDC differential velocity or torque signal, 10Kohm input impedance, scale is digitally programmable

B23 Brushless Servo Motor Specifications



Motor Data

Continuous Stall Torque	oz-in	161
Cont. Torque at Rated Speed	oz-in	144
Winding Resistance @ Ambient	ohms	10.6
Winding Resistance @ T_{max}	ohms	15.2
Inductance	mH	16.1
Phase to Phase Peak K_t	oz-in/A	57.6
K_v	V_{p-p}/kRPM	45.5
Rotor Inertia	oz-in-s^2	0.0019
Static Friction	oz-in	12.8
Dynamic Friction	oz-in/kRPM	2.0
Thermal Resistance	°C/W	1.07
Max. Winding Temperature	°C	155
Motor Constant	oz-in/$\sqrt{W}$	18.2
0 Ohm Damping	oz-in/kRPM	246
Mechanical Time Constant	ms	0.684
Electrical Time Constant	ms	1.769
Number of Poles		4

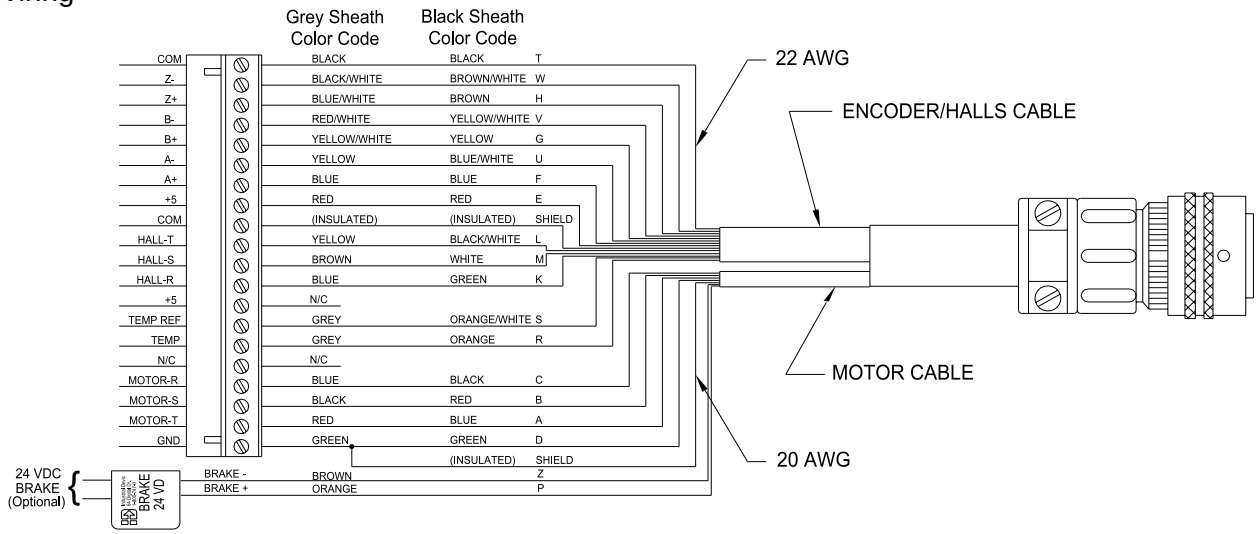
Notes:

- Axial Shaft Load - 15lb max.
- Radial Shaft Load - 40 LB @ 1/2 in
- Motor Weight - 4lbs (1.8kg)

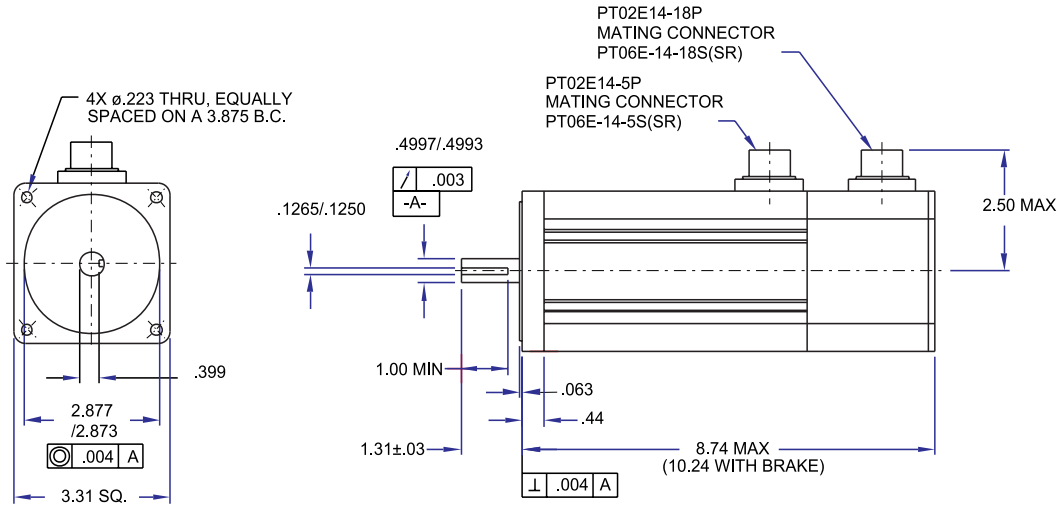
Drive/System Data with B8000

		110VAC	220VAC
Max. Speed	RPM	3200	6500
Drive Bus Voltage	V	155	311
Drive Peak Current	A	8.3	8.3
Ambient Temperature	°C	25	25
RMS Output Power	W	288	355
Nominal Peak Power	W	353	1238
Nominal Peak Stall Torque	oz-in	478	478

Motor Wiring



B32 Brushless Servo Motor Specifications



Motor Data

Continuous Stall Torque	oz-in	480
Cont. Torque at Rated Speed	oz-in	400
Winding Resistance @ Ambient	ohms	3.4
Winding Resistance @ T_{max}	ohms	5.1
Inductance	mH	9.8
K_t, Phase to Phase Peak	oz-in/A	99.2
K_v	V_{p-p}/kRPM	77.8
Rotor Inertia	oz-in-s^2	0.016
Static Friction	oz-in	12.8
Dynamic Friction	oz-in/kRPM	2.0
Thermal Resistance	°C/W	1.0
Max. Winding Temperature	°C	155
Motor Constant	oz-in/$\sqrt{W}$	53.4
0 Ohm Damping	oz-in/kRPM	2110
Mechanical Time Constant	mS	0.793
Electrical Time Constant	mS	2.837
Number of Poles		6

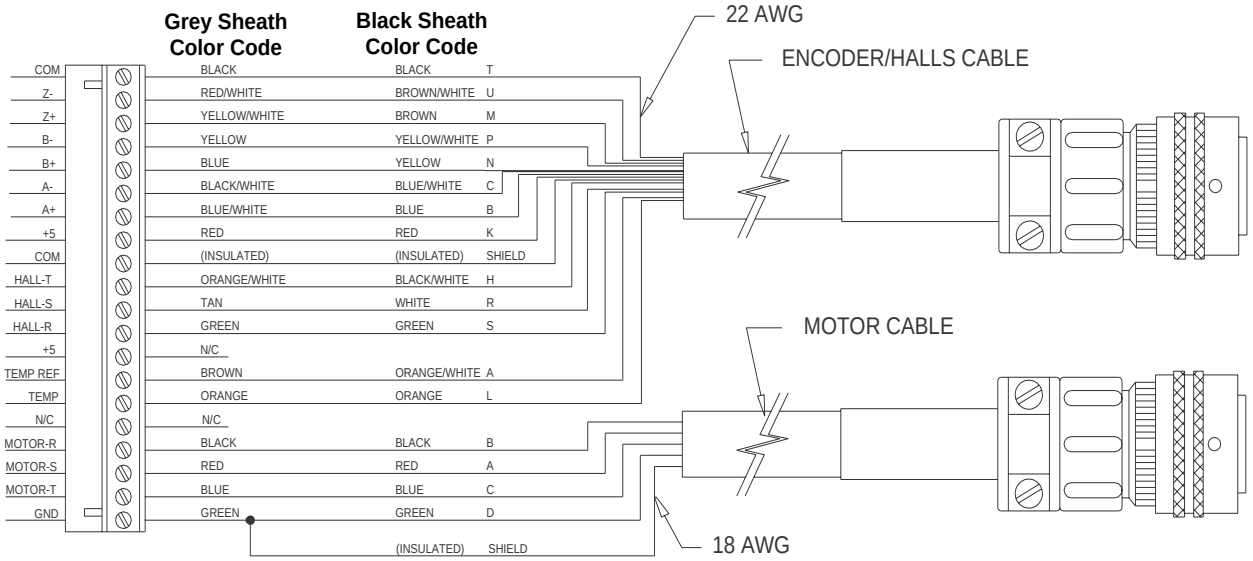
Notes:

- Axial Shaft Load - 25lb max.
- Radial Shaft Load - 48 lb @ 1/2 in
- Motor Weight - 12lbs (5.4kg)

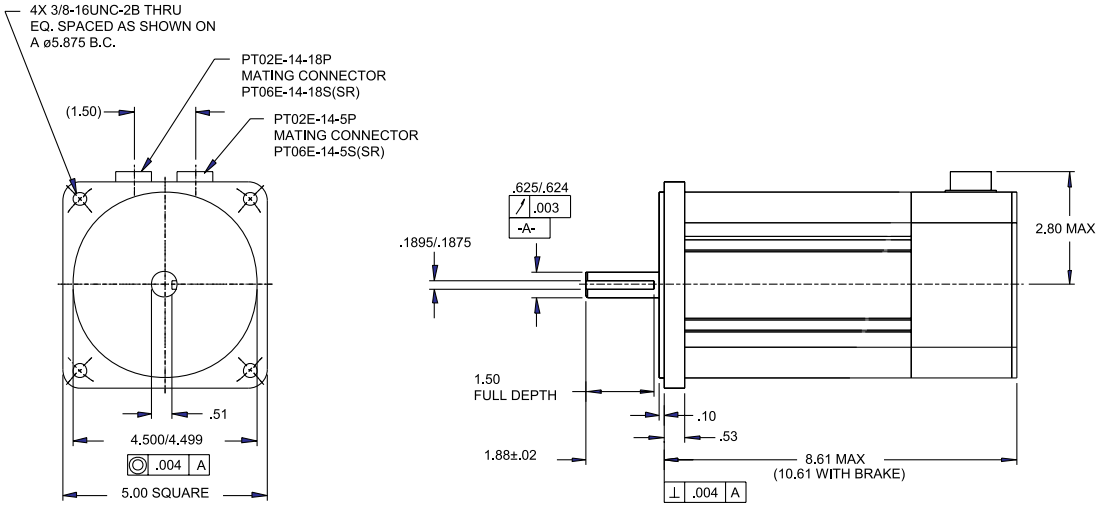
Drive/System Data with B8000

		110VAC	220VAC
Max. Speed	RPM	1900	3800
Drive Bus Voltage	V	155	311
Drive Peak Current	A	10.0	10.0
Ambient Temperature	°C	25	25
RMS Output Power	W	459	918
Nominal Peak Power	W	978	1957
Nominal Peak Stall Torque	oz-in	853	853

Motor Wiring



B41 Brushless Servo Motor Specifications



Motor Data

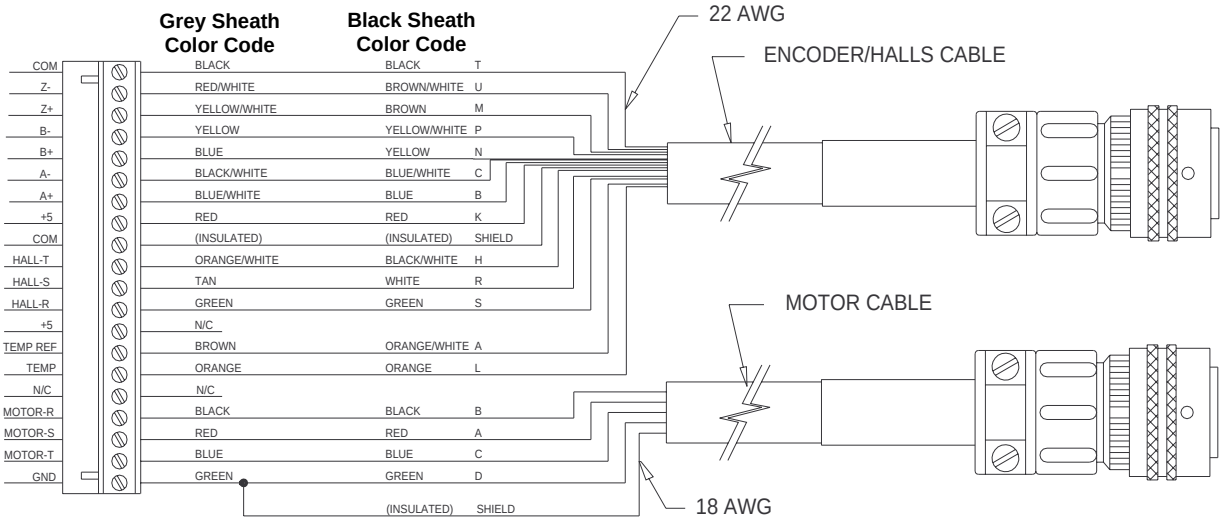
Continuous Stall Torque	oz-in	864
Cont. Torque at Rated Speed	oz-in	768
Winding Resistance @ Ambient	ohms	3.6
Winding Resistance @ T_{max}	ohms	5.4
Inductance	mH	24.0
Phase to Phase Peak K_t	oz-in/A	187
K_v	V_{p-p}/kRPM	148
Rotor Inertia	oz-in-s^2	0.0416
Static Friction	oz-in	16.0
Dynamic Friction	oz-in/kRPM	8.0
Thermal Resistance	°C/W	0.47
Max. Winding Temperature	°C	155
Motor Constant	oz-in/$\sqrt{W}$	98.3
0 Ohm Damping	oz-in/kRPM	7150
Mechanical Time Constant	mS	0.609
Electrical Time Constant	mS	6.667
Number of Poles		6

Notes:

- Axial Shaft Load - 50lb max.
- Radial Shaft Load -110 lb @ 1/2 in
- Motor Weight - 20lbs (9.1kg)

Drive/System Data with B8000

		110VAC	220VAC
Max. Speed	RPM	1000	2000
Drive Bus Voltage	V	155	311
Drive Peak Current	A	10.0	10.0
Ambient Temperature	°C	25	25
RMS Output Power	W	455	909
Nominal Peak Power	W	888	1770
Nominal Peak Stall Torque	oz-in	1500	1500



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✔ Purchase Order	Prepare a purchase order for possible repair cost, in the event the unit is not covered by warranty.
✔ RMA Number	Contact your local IDC distributor or Industrial Devices Corporation (1-800-747-0064) to obtain an RMA number.
✔ Description of Failure	Provide detailed information in writing describing the nature of the failure. A **RMA Data Form** is available from IDC for this purpose.
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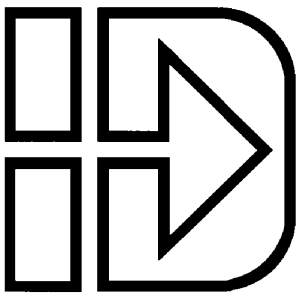
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