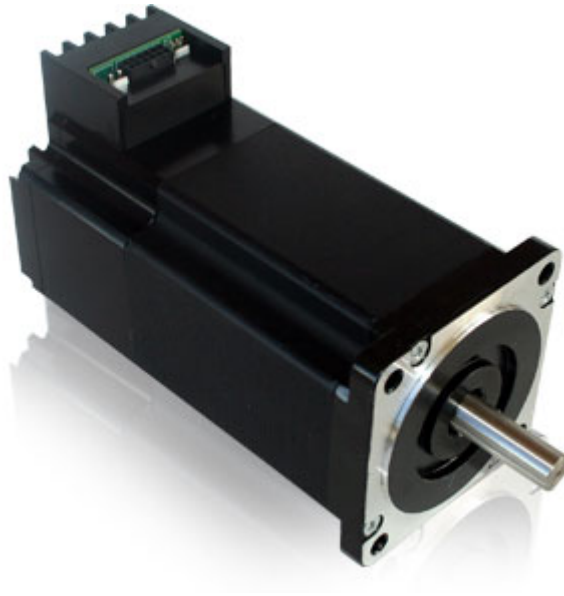


# **Silverpak 34D / 34DE**

## **Integrated NEMA 34 Motor and Drive**

### **With Encoder option**



User Manual  
**And Commands Guide**

Version 1.03

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Thank you for purchasing the Silverpak 34D or Silverpak 34DE Integrated Motor and Driver. This product is warranted to be free of manufacturing defects for one (1) year from the date of purchase.

### **PLEASE READ BEFORE USING**

Before you start, you must have a DC power supply suitable for the motor. It is recommended to use a power supply voltage between 4 times and 20 times the motor's rated voltage. (Rated voltage can be calculated by multiplying the motor's rated current and the motor's resistance value).

### **DISCLAIMER**

The information provided in this document is believed to be reliable. However, no responsibility is assumed for any possible inaccuracies or omissions. Specifications are subject to change without notice.

Lin Engineering reserves the right to make changes without further notice to any products herein to improve reliability, function, or design. Lin Engineering does not assume any liability arising out of the application or use of any product or circuit described herein; neither does it convey any license under its patent rights, nor the rights of others.

## Silverpak 34D/DE User Manual

Product: Silverpak 34D and Silverpak 34DE  
Version: 1.03  
Date: 1/20/2011

<b>Version History</b>		
<b>Version</b>	<b>Date</b>	<b>Description of Changes</b>
1.00	4/28/2009	New Manual
1.01	7/28/09	Updated image on front page
1.02	10/7/09	Updated RS485 description.
1.03	1/20/11	Updated with 34DE info

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# 1 **FEATURES**

- NEMA Size 34, 2 Phase, 1.8° Bipolar Step Motor w/ Built-In Microstepping Driver
- Operates from +24 to 75 VDC
- Selectable phase currents from 0.5 to 7.0 Amp Peak (in 0.1 A increments)
- Selectable hold currents from 0.0 to 7.0 Amps (in 0.1 A increments)
- Hold current delay time from 0.5 seconds to 6.0 seconds
- Step Resolutions include: Full step, 2x, 4x, 8x, 16x, 32x, 64x, 128x, and 256x microstepping
- Three Selectable Damping modes (Fast decay, mixed decay of 25% and 75%)
- Step sensing on the rising or falling edge of step pulse input
- Direction of rotation enables user to start rotation CW or CCW
- Three optically isolated control inputs (step, direction, disable)
- Sinusoidal current waveform to provide smooth motion
- Pole Damping Technology™ integrated within driver board

## **Pole Damping Technology™**

Pole Damping Technology™ (PDT) enhances step motor performance by dampening each full step in order to create a more accurate and smooth motion profile. Microstepping the step motor will optimize Pole Damping Technology™. PDT outputs the correct amount of run and hold currents to the motor, at the right time. Thus, it will overcome the step motor's natural tendency to want to forcefully pull towards the full step ON position.

## **Silverpak 34DE – Encoder Features**

- 32-2500 cycles per revolution (CPR)
- 128 to 10000 pulses per revolution (PPR)
- 2 Channel Quadrature
- TTL Squarewave Outputs and optional index (3<sup>rd</sup> Channel)
- Compatible with E2, E5, E5D, or E3 US Digital Encoder

## **Default Settings**

<b>Default Settings of the Silverpak 34D or DE</b>	
Direction of rotation	Counterclockwise
Step Resolution	8x step (3200 steps/rev)
Run Current	Motor's rated current or up to 7 Amps Peak if motor is rated for 7 or higher.
Holding Current	0.5 Amps
Damping Mode	75% mixed decay
Step signal sensing	Senses on the rising edge
Delay time from run to hold current	500 milliseconds

*Table 1: Default settings*

## 2 ELECTRICAL SPECIFICATIONS

### **Power Supply Requirements**

Voltage +24 VDC to 75 VDC

### **Driver**

Peak Current: 0.5 to 7.0 Amps Peak

### **Motor Specifications**

NEMA Size 34

Holding Torque when using motor's rated current:

DO-8718S-XX 435 oz-in

DO-8718M-XX 830 oz-in

DO-8718L-XX 1288 oz-in

Steps per Revolution (1.8° Motor)

200, 400, 800, 1600, 3200, 6400, 12800, 25600

### **I/O Specifications**

3x Optically Isolated Inputs: step, direction, disable

## 3 OPERATING SPECIFICATIONS

Maximum Step Frequency:

5 MHz

Operating Temperature\*:

-20°C to 75°C measured at the heat sink

-20°C to 90°C measured at the motor case

Duty cycle:

100% as long as temperatures do not exceed 75°C on the heat sink and 90°C on the motor case.

\* Lin Engineering integrated motor and drive products are designed and fully tested to withstand the rated operating temperature ranges.

### **Logic Timing**

Minimum Step Pulse Width 100 nanoseconds

Minimum Step Low Time 100 nanoseconds

Maximum Power-Down Recovery Time 20 milliseconds

## 4 MECHANICAL SPECIFICATIONS

### Motor Front Shaft Extension Length

Standard length is 1.46 +/- 0.02".

### Motor Shaft Diameter

Standard shaft diameter is 0.5000" +0.0000/-0.0005, with two flats, 90° apart.

### Overall Body Length (A)

Motor body length is available in various lengths

DO-8718S-XX (4.44")

DO-8718M-XX (5.62")

DO-8718L-XX (6.80")

### Dimensions

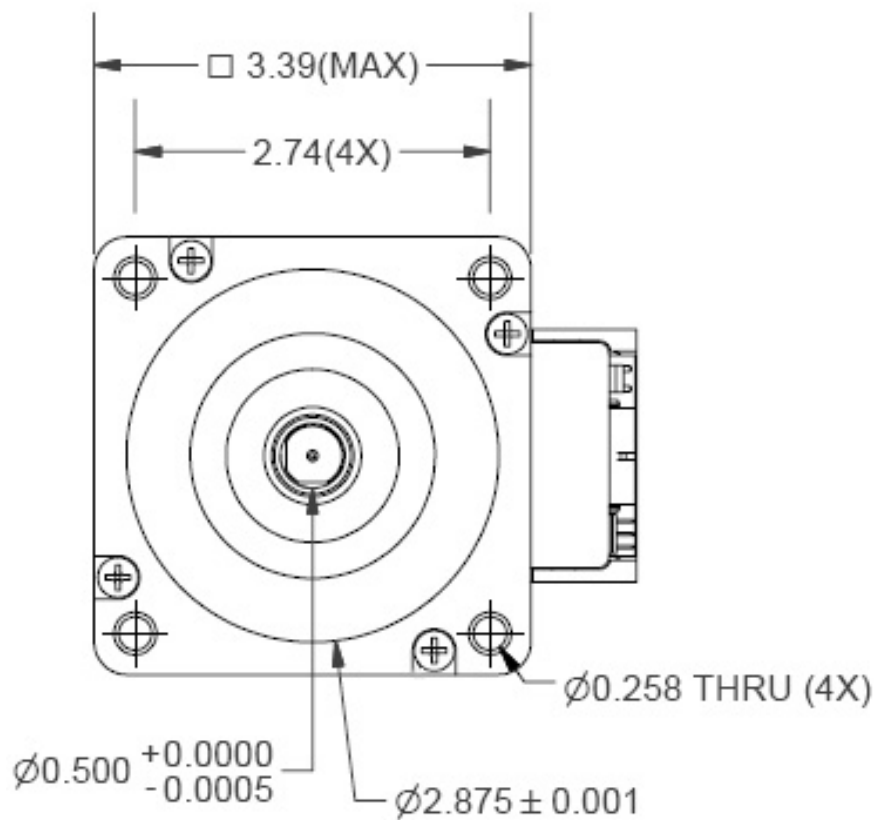


Figure 1: Front Mounting dimensions

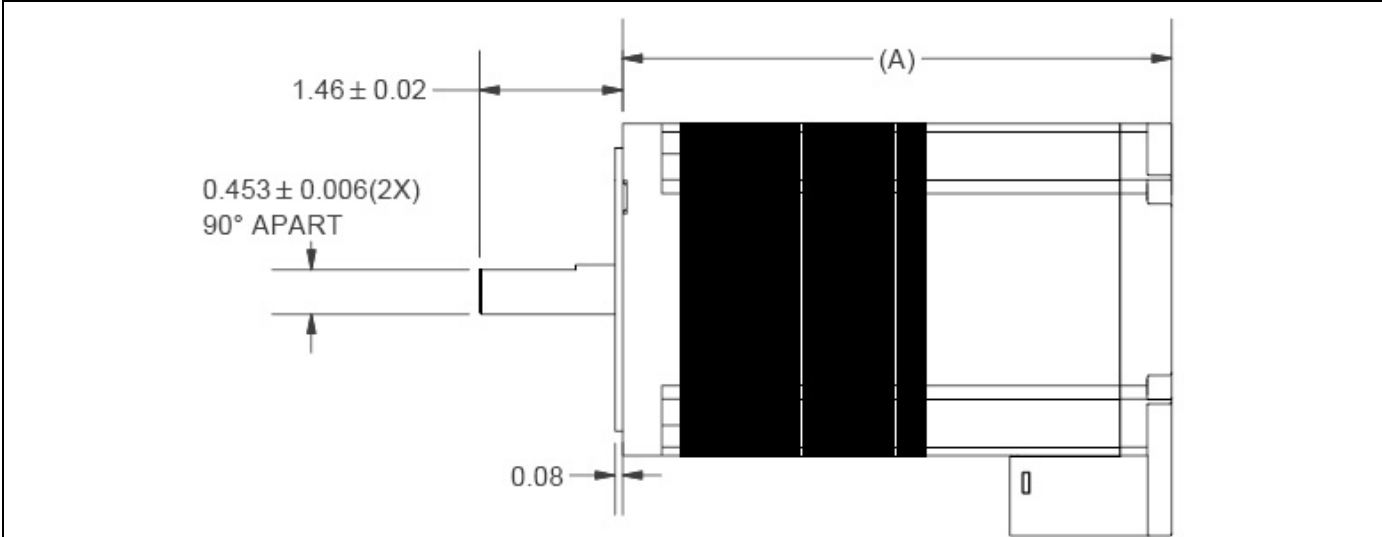


Figure 2: Side view of Silverpak 34D

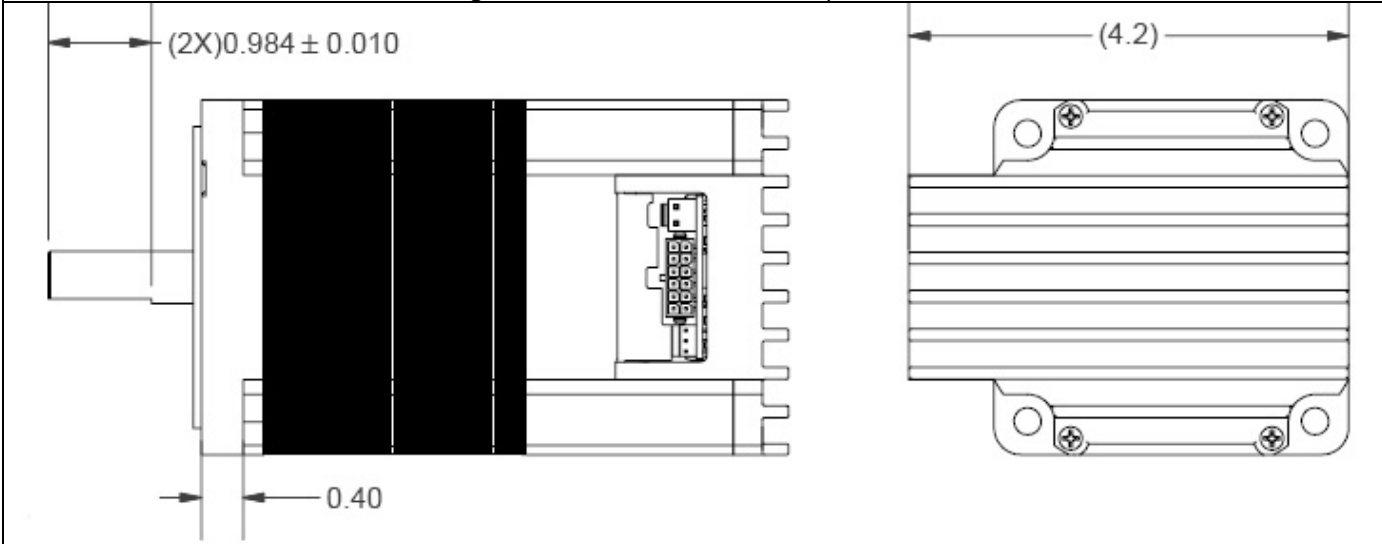


Figure 3: Side connection view

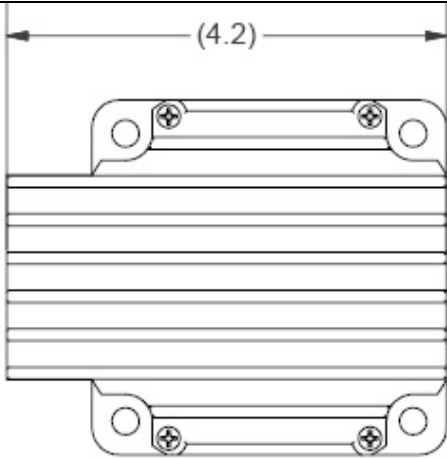
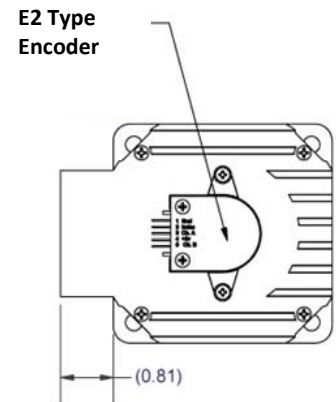
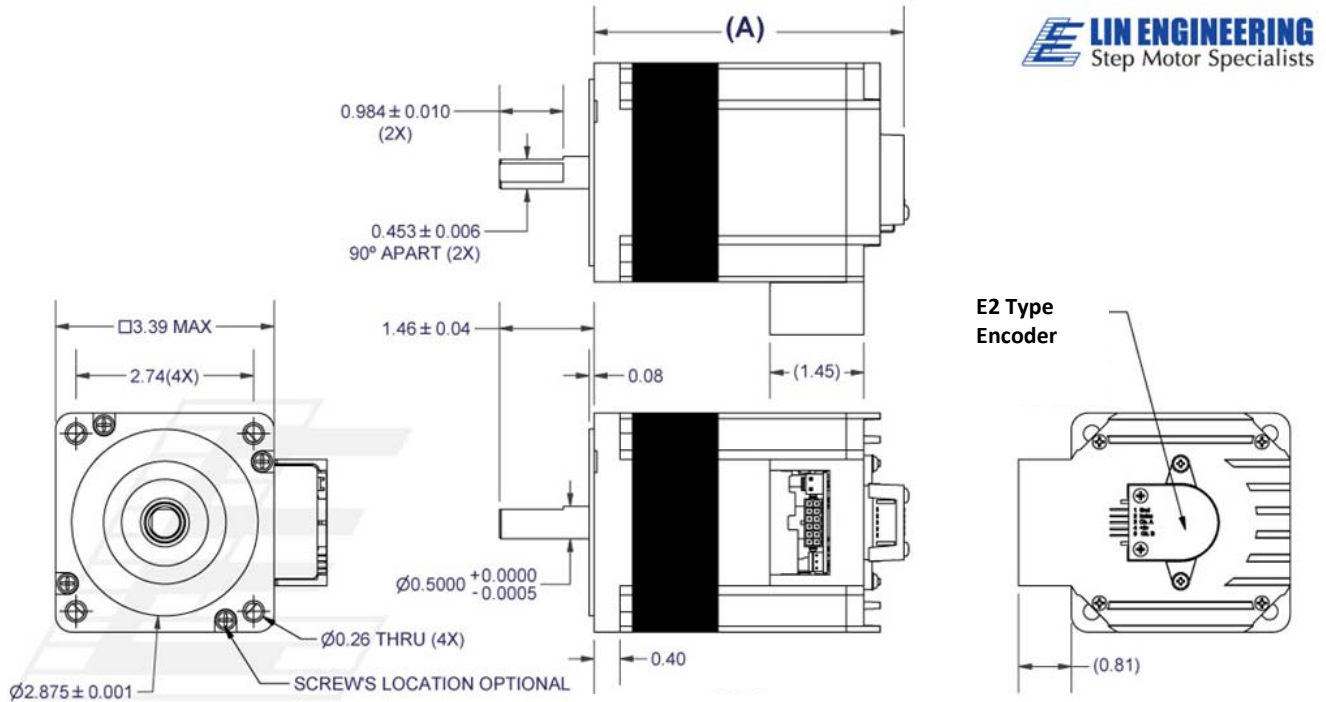


Figure 4: Bottom view

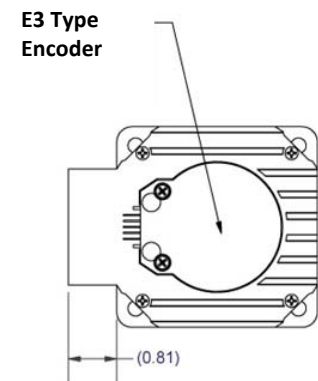
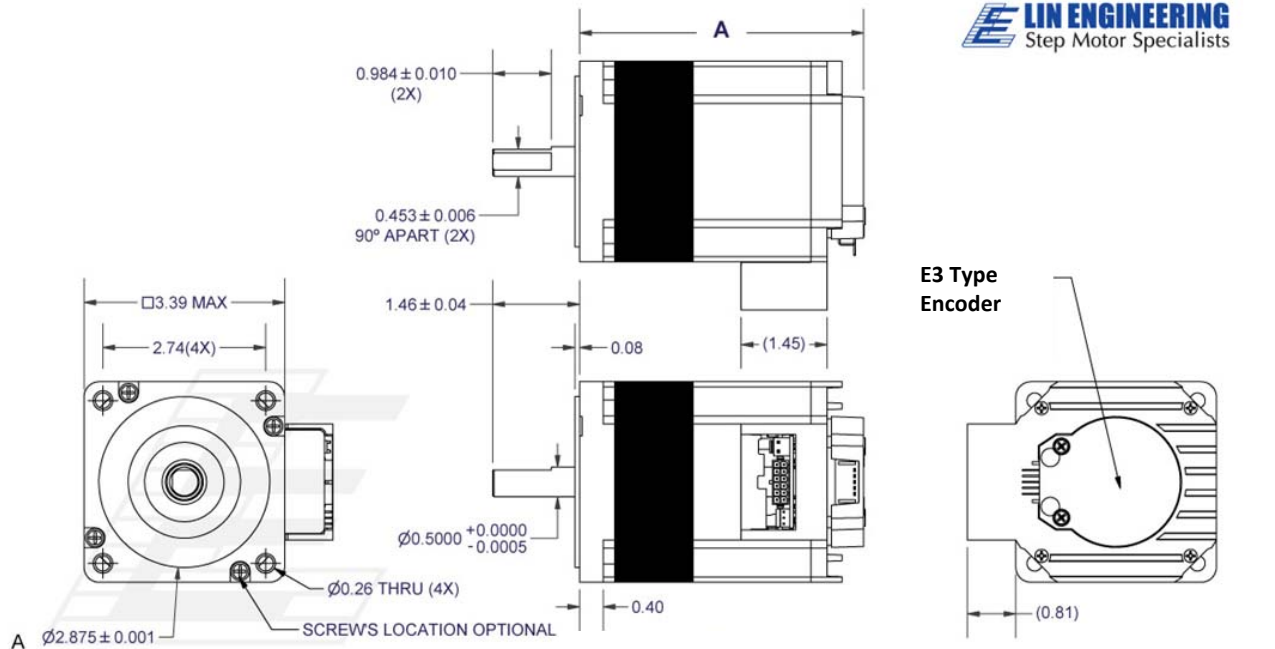
**Silverpak 34DE - E2 Encoder Option**  
**Dimension (A):**

DE-8718S: 4.78"  
 DE-8718M: 5.96"  
 DE-8718L: 7.15"



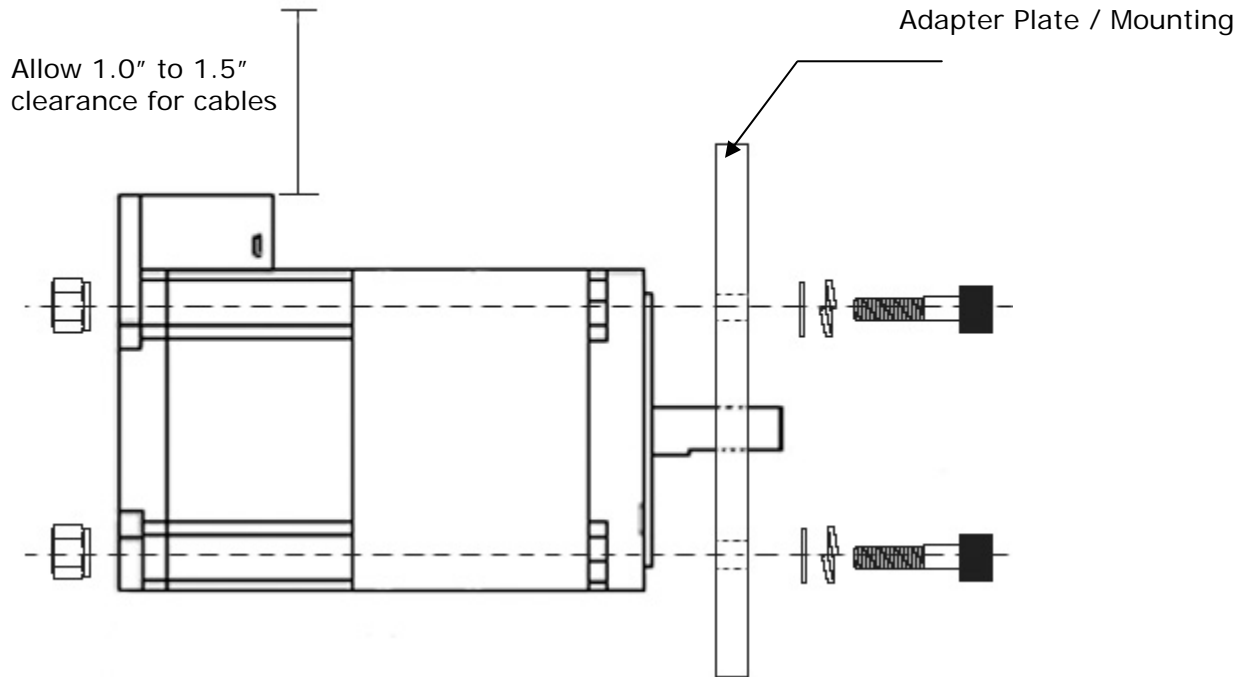
**Silverpak 34DE - E3 Encoder Option**  
**Dimension (A):**

DE-8718S: 4.78"  
 DE-8718M: 5.96"  
 DE-8718L: 7.15"



## 5 MOTOR MOUNTING SPECIFICATIONS

There are four (4) 0.258" thru holes on the motor flange for mounting the motor to an adapter plate. Recommended screws for mounting the motor are 0.250" or ¼-20.



*Figure 6: Mounting Specifications*

Recommended hardware (not included with Silverpak 34D)

- 4 x ¼-20 screw
- 4 x ¼" Split lockwasher
- 4 x ¼" Flat washer
- 4 x ¼-20 lock nuts

## 6 PIN ASSIGNMENTS

A female 12-Pin connector cable provides the control connections for the Silverpak 34D unit. Active signals are optically isolated. An open collector drive is required to provide pulses for Step, levels for Direction, and Disable/Enable.

A separate 2-Pin connector needs to receive main power between +24VDC to 75VDC.

All of the signals are optically isolated. The common opto supply can be +5 to 30 VDC with respect to the signal input; however if the supply is greater than 5 VDC then a resistor must be inserted in series with each signal line to limit the current to 10 mA.

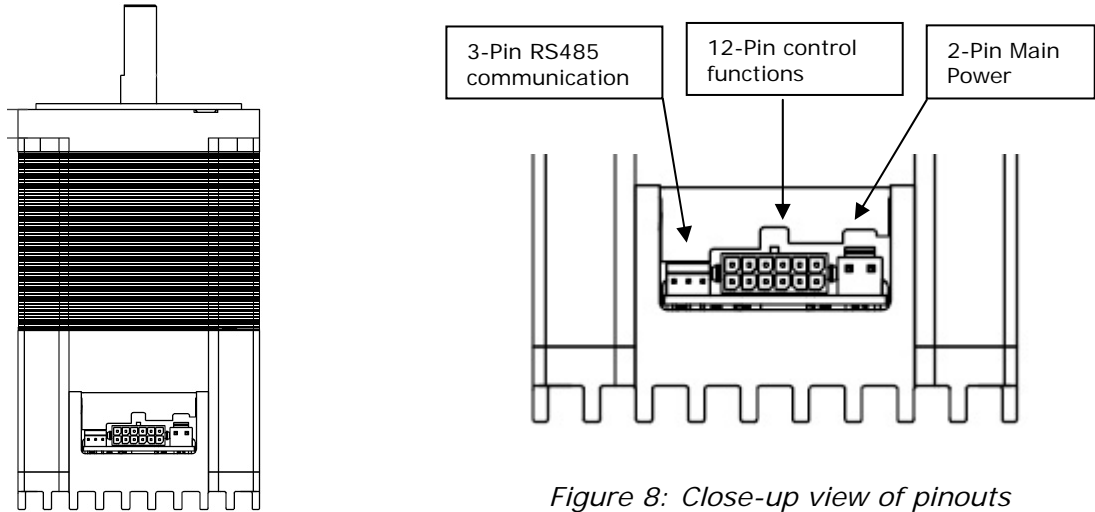


Figure 7: Image of Silverpak 34

Figure 8: Close-up view of pinouts

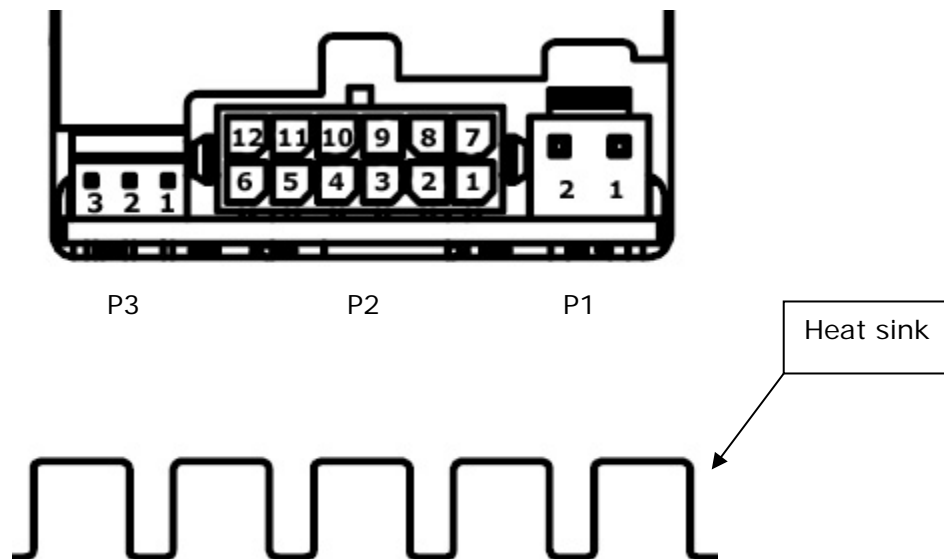


Figure 9: Pin numbers for all three connections

## Control Pinouts & Description (P2)

Provides input to the Silverpak 34D driver.

Color	Pin	Function	Description
Black	1	No Connection	This pin is not used
Blue	2	Opto supply input	This pin requires 5VDC to supply the optically isolated inputs (use resistors if supply is greater than 5V) See end of Section 6 for details.
White	3	Disable/Enable input	This input is used to enable/disable the driver/motor. By default, the unit is enabled. Tie to ground in order to disable unit. When disabled, no power is sent.
Red	4	Internal 5V supply (output)	The 34D has an internal 5V supply. To use this as your opto supply, jump pins 2 and 4 together. By doing so, the inputs are no longer optically isolated; the main power and this 5V supply share the same circuit.
Green	5	Ground	Same as main ground.
Black	6	Internal use	Internal use
Black	7	No Connection	This pin is not used
Yellow	8	Step Pulse Input	This pin takes in step pulses from a controller, PLC, or signal generator. The step pulse must be a clean TTL squarewave signal, max of 10 mAmps current. If needed, use resistors to limit it to 10mAmps.
Brown	9	Direction Input	This input is used to change the direction of rotation. By default, it rotates counterclockwise (CCW). By tying this pin to ground, the motor should rotate CW.
Black	10	No Connection	This pin is not used
Black	11	No Connection	This pin is not used
Black	12	No Connection	This pin is not used

Table 2: Pin Assignments for Controls

Note: All Black wires above are for "No-Connection"

## Main Power Pinouts & Description (P1)

Provides main power to the Silverpak 34D

Color	Pin	Function	Description
Red	1	PWR +ve	Motor Supply Voltage. +24 to 75 VDC
Black	2	Ground -ve (GND)	The ground or return of the power supply connects here

Table 3: Pin Assignments for Power

## Communication via RS485 Pinouts & Description (P3)

Provides connection to the PC via RS485 in order to set motor parameters.

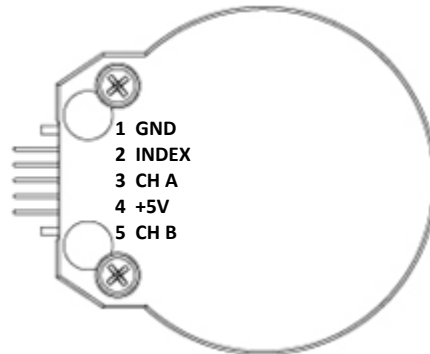
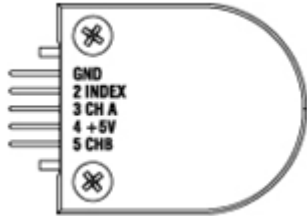
Color	Pin	Function	Description
Red	1	RS485A	RS485 communication (A)
Black	2	Ground (GND)	Ground connection (must connect to power supply ground)
Green	3	RS485B	RS485 communication (B)

Table 4: Pin Assignments for Communication

In order to set the run current, hold current, step resolution, damping or decay modes, step and direction of rotation, you must connect to a PC and program these settings. View section 7 which describes how to configure the settings via the GUI software.

## Silverpak 34DE Encoder Pin Outs for both E2 and E3

Pin	Function
1	Ground input
2	Index output (optional)
3	Channel A output
4	+5VDC input
5	Channel B output



### Recommended Cable:



#### 5-PIN CONNECTOR

Lin part # 090-00223

12" long lead wires

Use with E2, E3, or E5 Encoders

*(Sold Separately)*

## 7 Configuring The Settings

### Connecting the Silverpak 34D to your PC via USB

All units come with the following cables:

- A 12-Pin cable for supplying step, direction, and other functions
- A 2-Pin cable for main power

If you purchased a **USB485 Designer's Kit (Lin p/n USBKIT-03)**, then you should have received the following items:

- A 3-Pin to 3-Pin cable for communication (p/n 090-00202)
- USB to RS485 converter card
- A USB cable (6 feet long)



If you purchased a **RS232-485 Designer's Kit (Lin p/n RS232KIT-03)**, then you should have received the following items:

- An extra 3-pin cable
- An RS232 to 485 converter card
- A 3-Pin to 3-Pin cable for communication (p/n 090-00202)



## 1. Download driver files for the USB485 converter card

Go to [www.linengineering.com](http://www.linengineering.com) and navigate to the USB485 converter card page by going to: Accessories → USB to RS485 Converter card. Then click on “Download”, or simply scroll to the bottom of the page.

Save the zip file called “USB485 Driver Files” and extract all files to your PC.

## 2. Connect the USB485 converter card to the Silverpak unit.

If using Lin Engineering’s USB485 converter card, simply take the 3-Pin to 3-Pin cable and plug one end to the converter card, and plug the other end to the Silverpak 34D.

## 3. Connect USB cable to the PC.

Then plug one end of the USB cable into the converter card and the other end into your PC.

When the converter card connects to your PC, it will find the new hardware and automatically ask you to download files. **It will download two files.**

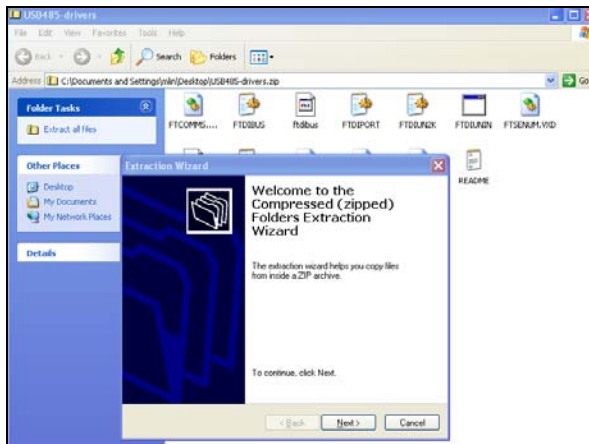


Figure 10: Extracting files



Figure 11: Downloading driver files



Fig 12: Connection of Silverpak to USB Card to PC

Note the COM Port number that was assigned to the converter card device by right-clicking on "My Computer" and going to:

Hardware Tab → Device Manager → Ports (COM & LPT) → RMS Motion US485

### Connecting the Silverpak 34D to your PC via RS232

If you purchased a Designer's Kit, then you should have received the following items:

- RS485-to-RS232 converter card (Black gray cover, DB-9 on one end)
- 3-Pin to IDC connector type of cable with flying lead wires (36 inches long)

Follow the connection schematic shown below if using the RS485-RS232 Converter card.

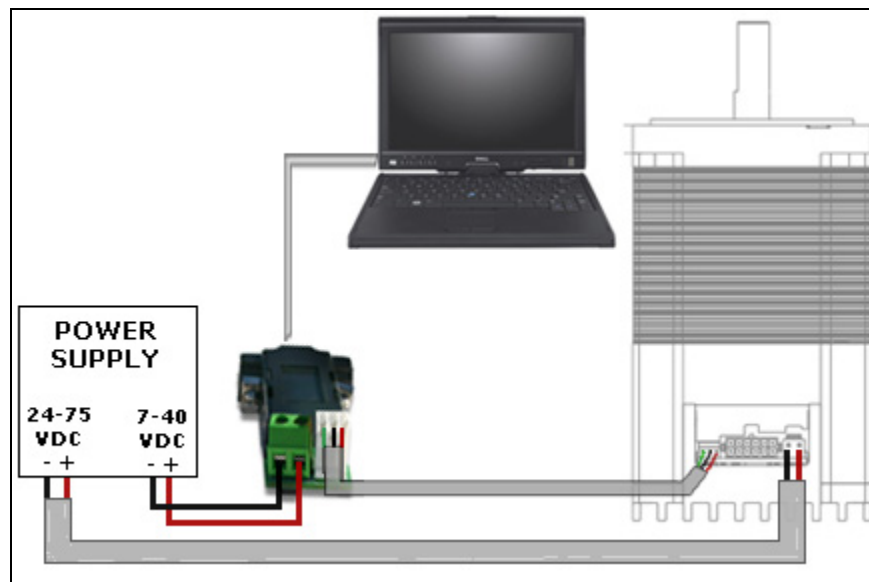


Fig 13: Connection of Silverpak to RS485-232 Card & PC

## Connecting Power

After downloading files for the USB485 converter card, connect main power to the Silverpak 34D.

## Using HyperTerminal To Set Motor Parameters

Open a HyperTerminal connection by going to:

All Programs → Accessories → Communications → HyperTerminal

### 1. Settings

Give your connection a name. It will then ask you to select the correct COM port. See note above this section to find the COM Port number.

It should direct you to the properties of the connection. Or, click on "Configuration" in the Properties section. Click on the default settings, or:

57600 Bits per second, 8 data bits, none parity, 1 stop bits, none flow control:



Figure 14: Selecting the COM port

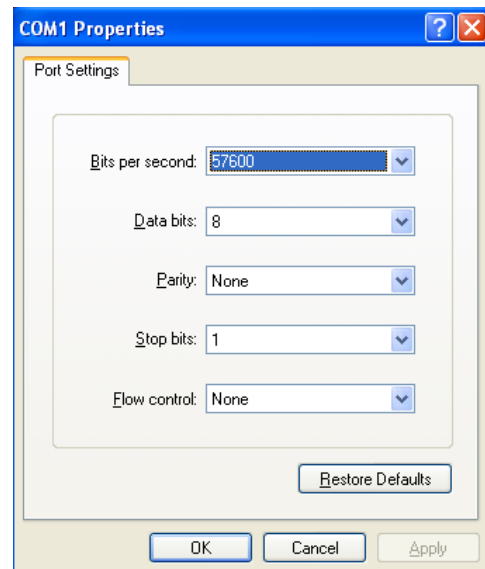


Figure 15: Port settings

Next, go to File → Properties → Settings tab → ASCII setup and check box the top two options:

- Send line ends with line feeds
- Echo typed characters locally

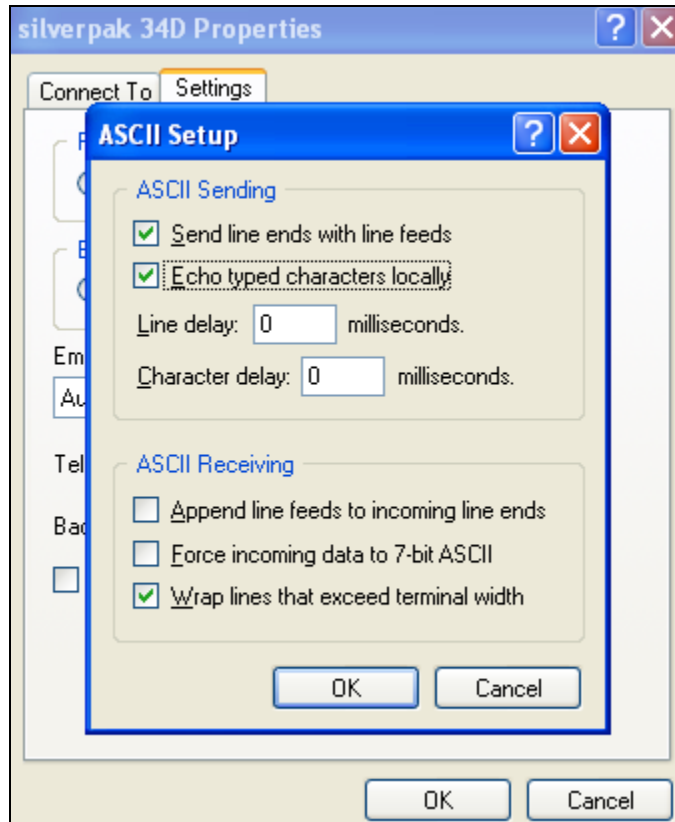


Figure 16: ASCII settings

## 2. Programming

If programming in HyperTerminal, follow the syntax shown below:

#[ADDRESS][COMMAND][VALUE]

The following list contains the parameters with examples for HyperTerminal:

Command	Range	Example	Default value	Function
DR	0 or 1	#ADR1	0	<b>Direction of Rotation.</b> Changes direction of rotation. By default, motor will rotate CCW.
FR	n/a	#AFR	n/a	<b>Firmware Revision.</b> Displays the existing firmware revision.
HI	0 - 7000	#AHI5000	2500	<b>Holding Current.</b> Changes the amount of current supplied to the motor while holding in place (during which no step pulses are input to the drive). Units are in mAmps, therefore the default value sets the hold current to 2.5 Amps Peak.
HT	500 – 6000	#AHT500	2000	<b>Hold Timeout.</b> Sets the length of time unit will go from running current to hold current (in milliseconds).
LD	n/a	#ALD	n/a	<b>Load Defaults.</b> Loads default settings.
MA	A – Z	#AMAB	A	<b>My Address.</b> Changes the address of the unit. Default is address "A". All examples are assuming the address is "A".
PF	0 – 3	#APF2	1	<b>Percent Fast Decay.</b> Changes the decay mode at which the current depletes after each step is issued. 0 – Fast Decay; 1 – 25% fast decay; 2 – 75% fast decay. General rule is to use 0 for slow speeds, 1 and 2 for medium and fast speeds, respectively.
RI	0 – 7000	#ARI5000	2500	<b>Run Current.</b> Changes amount of peak current supplied to motor during running (when step pulses are input to the drive). Units are in mAmps, therefore the default value sets the current to 2.5 Amps Peak.
<b>SD*</b>	<b>n/a</b>	<b>#ASD</b>	<b>n/a</b>	<b>Save Data.</b> After all settings have been set, the user must type this command in order to save all existing data set on the unit. If settings are changed and power is lost, changes will not be saved.
<b>*NOTE: After entering desired parameters, you must enter #ASD, Save Data, to store values.</b>				
SR	1 – 256	#ASR4	8	<b>Step Resolution.</b> Sets the microstep resolution of motor 1= full step, 2 = 2x, 4 = 4x, 8x, 16x, 32x, 64x, 128x, 256x.
SS	0, 1	#ASS1	1	<b>Step Sensing.</b> Senses each step pulse on the falling or rising edge of the pulse. 0 for falling edge, 1 for rising edge. Default is 1 for rising edge.

Table 5: Programming commands

Example:  
 #AFR show the firmware version  
 #ASR256 set the step resolution to 256 microstepping  
 #ARI5000 set the current to 5A peak  
 #ASD Save data

### Using the Lin GUI Software to Set Parameters:

If using the Lin GUI interface, simply download the executable from the Silverpak 34D webpage in the download section. Unzip the file.

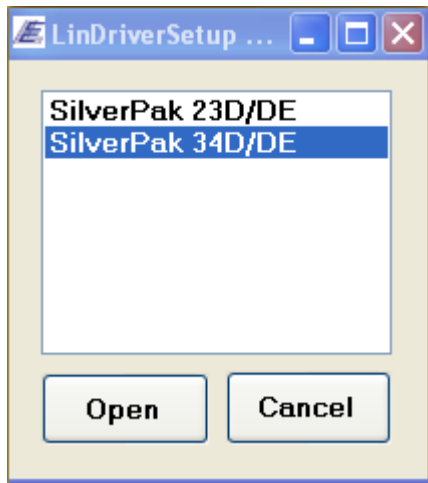
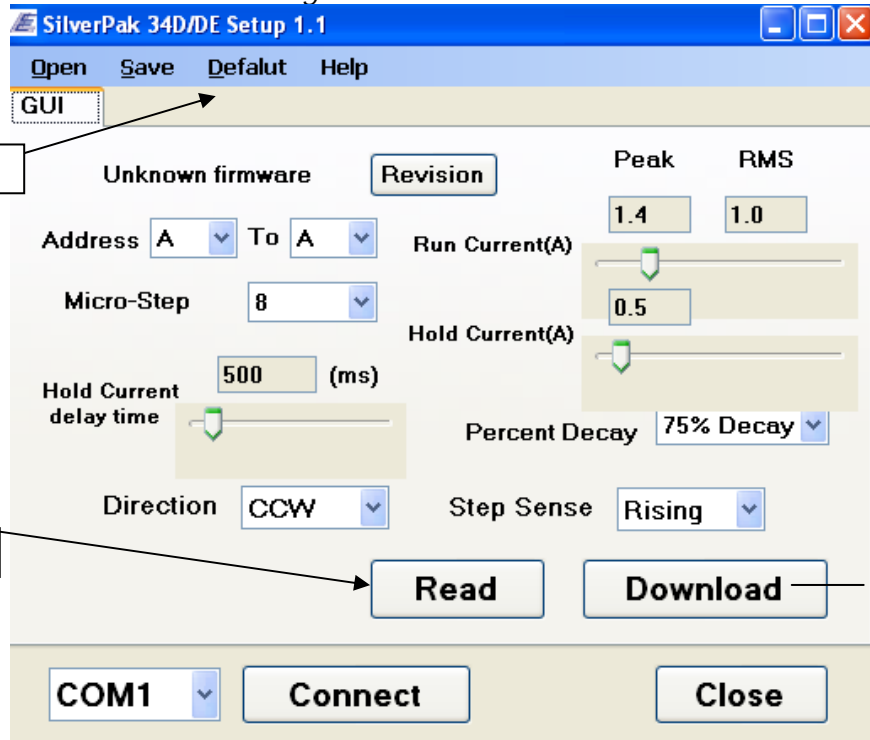


Figure 17: GUI

Upon opening the Lin Driver GUI, a screen shown above will pop up. Select the "Silverpak 34D/DE" Product, and click "Open".

- Address = command "MA"
- Micro-step = command "SR"
- Run Current = command "RI"
- Hold Current = command "HI"
- Percent Decay = command "PF"
- Step – rising sensing / falling sensing = command "SS"
- Forward direction / Reverse direction = command DR

Figure 18: GUI Interface



Loads default values

Select the motor winding for the run current to properly display.

Reads back stored data

1. Select COM port and click "Connect"

2. Change desired settings.

3. Click "Download" to store desired settings.

## 8 Connection Specifications

List of components needed to rotate the motor:

- +24 to 75 VDC Power Supply
- Additional +5 VDC Volt Power Supply
- Signal Generator

Ensure that the Silverpak 34D is not connected to the Main Power Supply until the following procedures have been properly carried out.

### **1. Connect the step pulse generator**

Connect Pin 8, step pulse input, to the Positive Terminal of your pulse generator. Then connect the negative terminal to main ground power.

### **2. Connect the 5VDC supply**

The Silverpak 34D requires a separate 5VDC supply for the optics that turn on the step, direction, and disable inputs.

Connect the positive terminal of your 5VDC supply to Pin 2, the opto input supply. The ground terminal of your supply should connect to the ground wire of the step pulse function generator.

Users have an option to use the Silverpak 34D's internal 5VDC supply for ease of use. Connect pin 2 to pin 4 with a wire. By doing so, the system is no longer optically isolated.

### **3. Connect the direction pin**

The Silverpak 34D unit will rotate counterclockwise if the direction pin is not connected to anything. If the direction pin is pulsed low, the direction of rotation will change to a clockwise direction.

Connect a switch from the direction pin to the ground connection on your opto supply.

### **4. Connect the disable pin**

Simply connect a switch from the disable/enable pin to the ground connection on your opto supply. Connection to ground will disable the drive. No power will go to the motor.

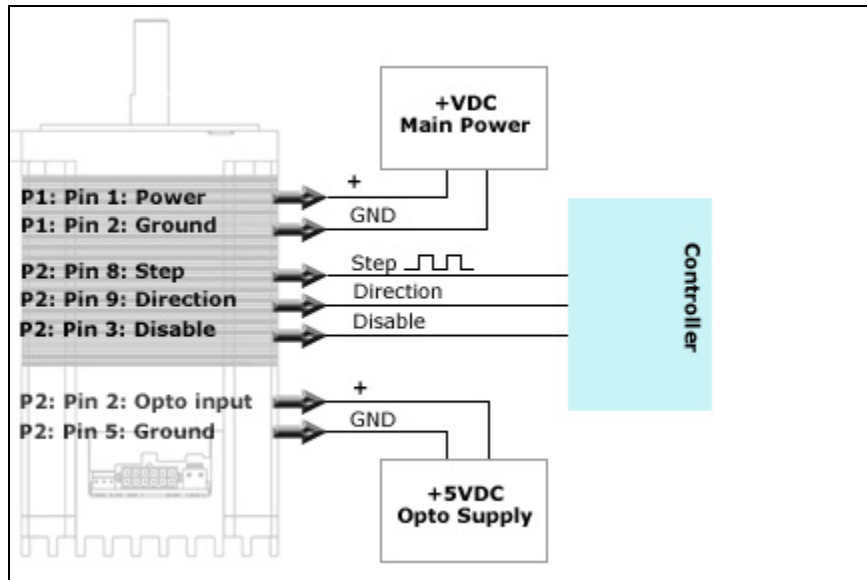


Figure 19: Connection Schematic – Connecting to a Controller

### Connecting the Power

The Silverpak 34D requires a supply voltage of +24-75 VDC. First, connect the positive end of the power supply to Power (Pin 1), and then connect the negative of the power supply to the Ground (Pin 2) on the Silverpak 34D.

**WARNING!** Be careful not to reverse the polarity from the power supply to the driver. Reversing the connection will destroy your driver and void the warranty.

## Connection Schematics

### Using external 5VDC supply for optos

If using an external 5VDC supply, connect the positive (+) terminal to the Silverpak's opto supply input, PIN 2.

If using a signal generator, connect the 5VDC supply ground terminal to the negative line of the generator.

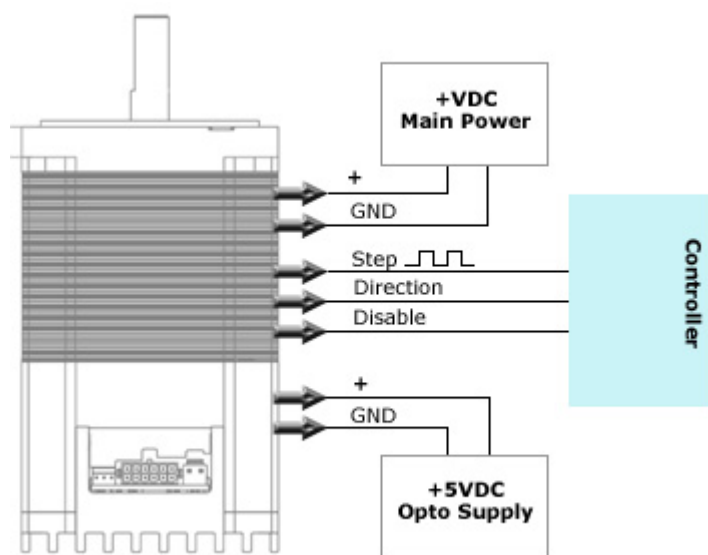


Figure 20: Schematic with 5VDC

## Using Silverpak's Internal 5VDC supply for optos

If using the internal 5VDC supply, simply connect PIN 2 to PIN 4.

Be sure to connect step pulse ground to the Silverpak's Ground, PIN 9.

Changing direction and disabling the drive is achieved by connecting these two inputs to PIN 9, ground.

This type of connection no longer optically isolates the inputs.

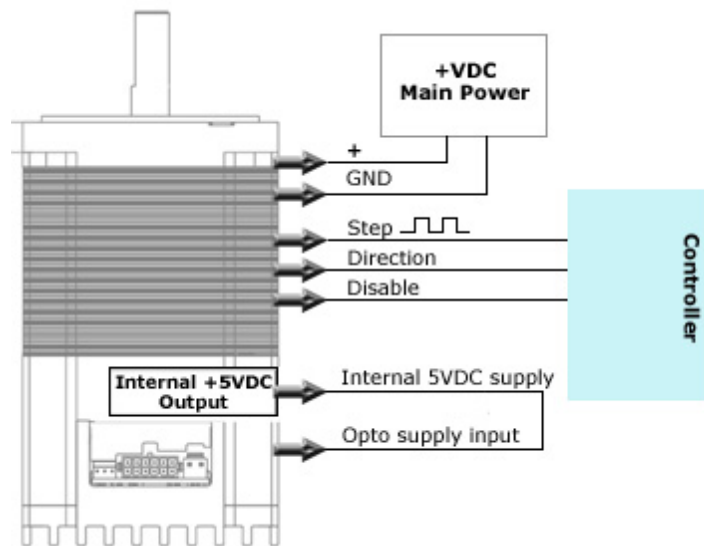


Figure 21: Schematic with internal 5VDC

## Using more than 5VDC for external supply for the optos

If using more than 5VDC, connect resistors in series with the opto supply input, PIN 2. Use the table below to determine what resistor to use.

Connect the 5VDC supply ground terminal to the Silverpak's Ground, PIN 9.

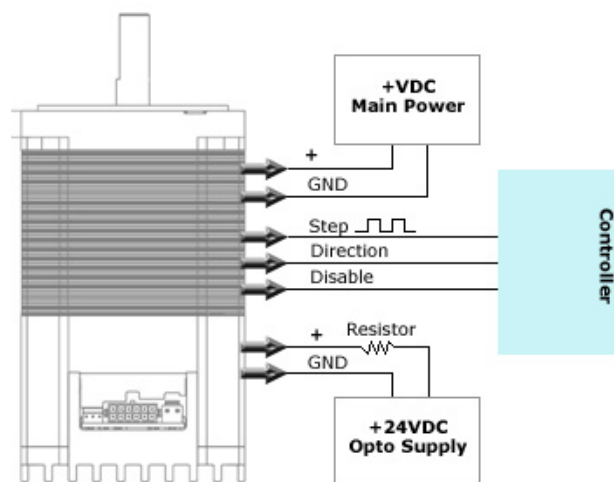


Figure 22: Schematic for more than 5VDC

## Resistor Values for the Opto Supply

The optocouplers must be powered by an external power supply to maintain isolation. The Opto Supply for the optocouplers can be between +5 to 24 VDC with respect to the signal input. It is recommended to use a +5 VDC Opto Supply in order to limit the current going into the optocouplers to 10 mA. However, if the supply is greater than +5 VDC then a resistor must be connected in series with each signal line to maintain 10 mA of current running through the optocouplers (step, direction, and disable lines). **Do NOT provide more than 10 mA or damage may occur to the driver.**

### Step, Direction, and Disable lines have a 475 ohm internal resistor

<b>Voltage:</b>	5V	10V	12V	15V	24V
<b>Ohms needed:</b>	0	500	668	1000	2000
<b>Wattage rating:</b>	0	¼ watt	¼ watt	¼ watt	½ watt

Table 6: Required resistance for more than 5VDC on opto supply input

If the desired voltage level is not listed above, below is how to calculate the resistor and wattage:

$$\frac{\text{Voltage}}{475\Omega + R} = 0.010\text{Amps}$$

or

$$R = \left( \frac{\text{Voltage}}{0.010\text{Amps}} \right) - 475\Omega$$

Equation 1: Resistance Equations

$$\text{Power} = \text{Voltage} \times \text{Amps}$$

or

$$\text{Wattage} = \text{Voltage} \times 0.010\text{Amps}$$

Equation 2: Wattage equations

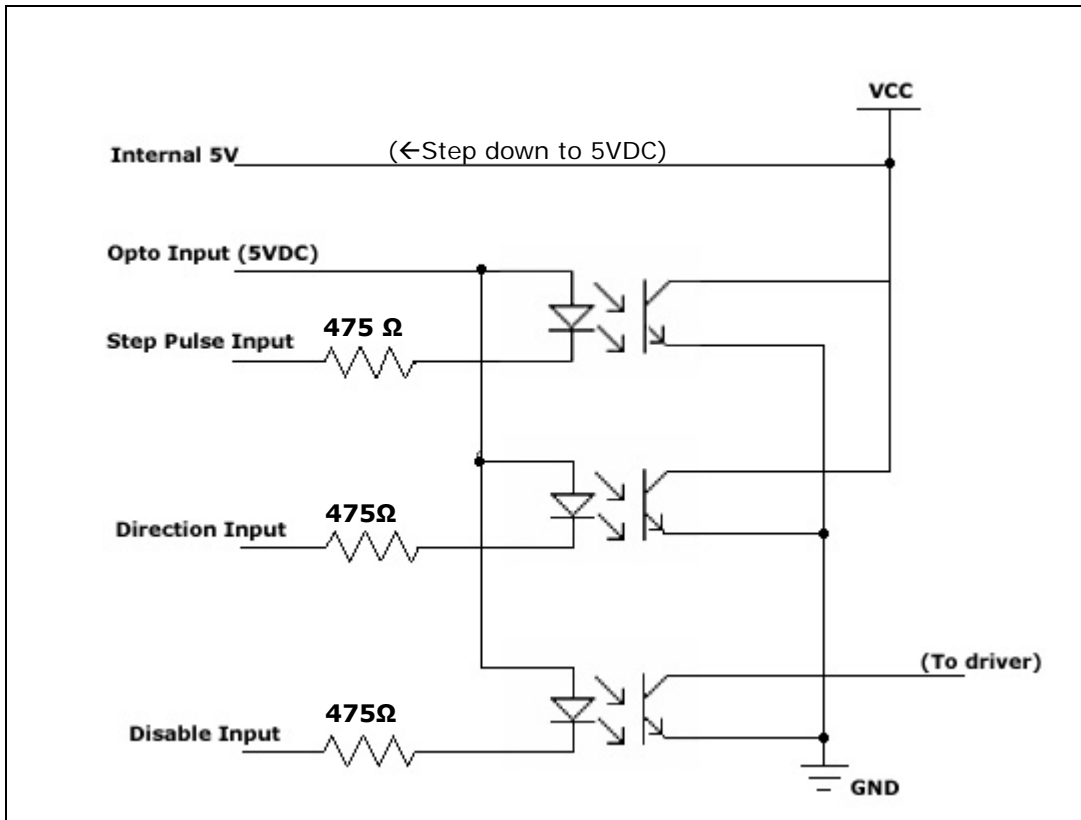


Figure 23: Internal Schematic for Inputs

## 9 Step Sensing

The Silverpak 34D is equipped with a parameter setting that allows users to change how it reads the step pulse input.

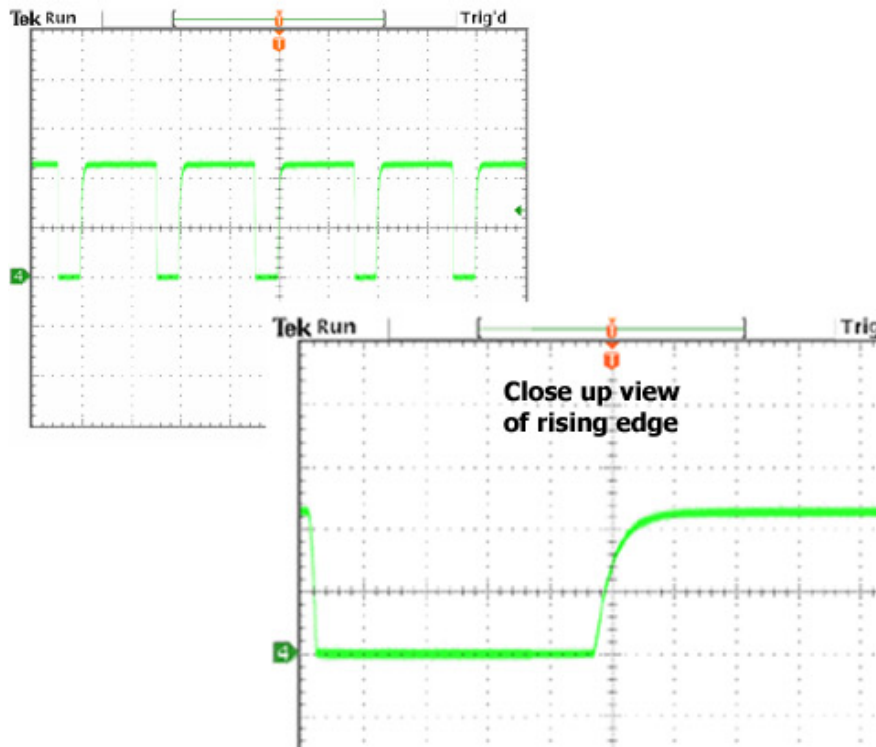
### Step Sensing

This feature allows for more compatibility with controllers and PLC's. The Silverpak 34D driver board receives step pulses from a pulse train, normally a TTL signal, sensing each pulse, one by one.

The "step sense" feature can choose where to sense each pulse: on the rising edge of the step or the falling edge (also known as the positive or negative edge).

Below depicts a step pulse train waveform where the rising edge is more of a curve. If the Silverpak 34D is set to read this type of signal on the rising edge, inaccurate steps and unsmooth motion may occur.

It is best to switch the step sensing to the negative edge, or falling edge. Notice in this example, the falling edge is a clear signal and a definite difference between high to low.



*Figure 24: Example of a bad rising edge waveform*

Below is an example of a good step pulse waveform where sensing the step on either edge would be fine:

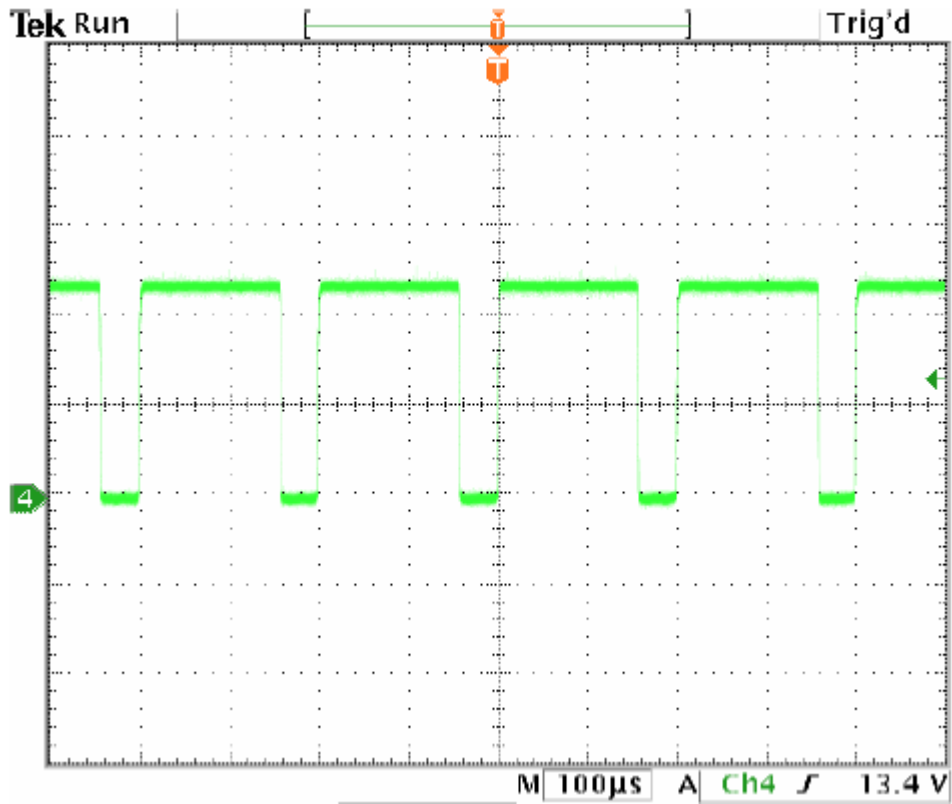
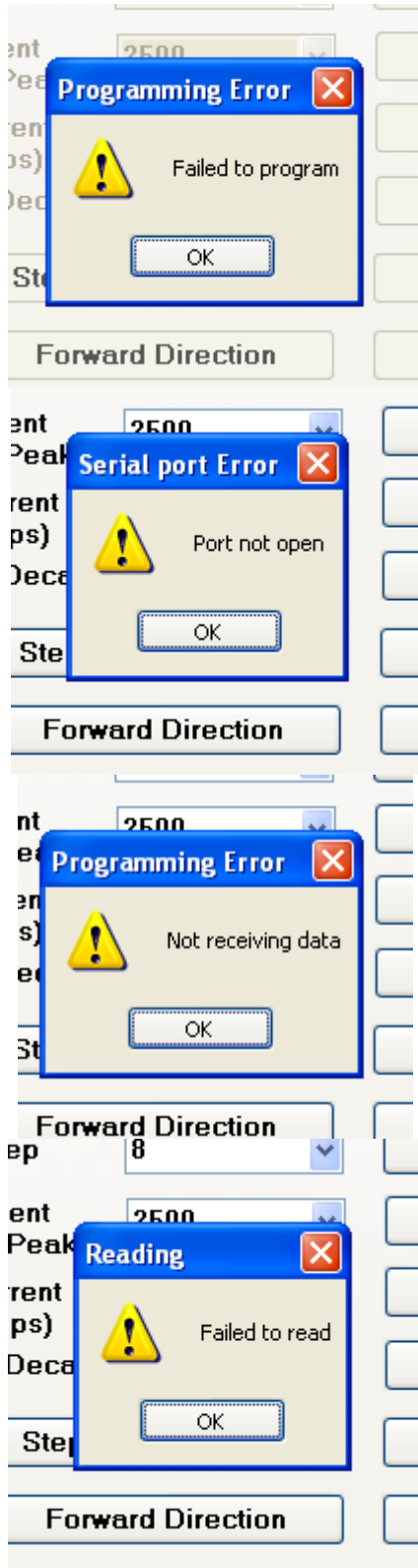


Figure 25: Example of a good waveform

## 10 Lin GUI Error Codes



This error occurs if you click on "Save DATA" and the board EEPROM does not respond.

Check for main power  
Check for communication connection  
Check COM Port number

This error occurs when you click on "Connect" and the COM Port does not respond.

Check for main power  
Check for communication connection  
Check COM Port number

This error occurs when you click on "Set" or "Set All" and the driver board is not receiving data from the PC.

Check for main power  
Check for communication connection  
Check COM Port number

This error occurs when you click on "Read Data" and the device could not read any parameters.

Check for main power  
Check for communication connection  
Check COM Port number