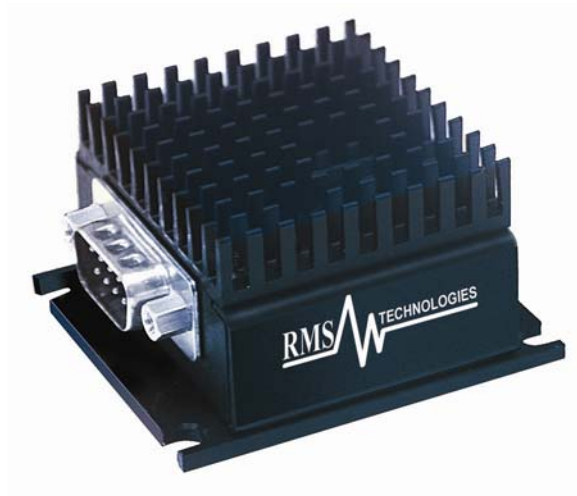


R256 Controller
with built-in 256 Microstepping Driver



User Manual
Version 1.02

RMS Technologies
2533 N. Carson St. #4698, Carson City, NV 89706-0147

Thank you for purchasing the R256 Controller with Microstepping Driver. This product is warranted to be free of manufacturing defects for one year from the date of purchase.

Technical Support for Lin Engineering, a distributor for RMS Technologies

By Telephone: 408-919-0200

(Mon.-Fri., 8:00 a.m.-5:00 p.m.)

On the Web: www.linengineering.com

Our technical support group is glad to work with you in answering your questions. If you cannot find the solution to your particular application, or, if for any reason you need additional technical assistance, please call technical support at **408-919-0200**.

PLEASE READ BEFORE USING

Before you begin, ensure there is a suitable DC Power Supply. **Do not disconnect the DB-9 cable while power is still being applied to the controller.** This will damage the board. Under any circumstances, do not exceed +40 VDC.

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.

RMS Technologies reserves the right to make changes without further notice to any products herein to improve reliability, function, or design. RMS Technologies 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.

There are known issues involving the Halt command (i.e., H01) when stored in memory location zero. Upon power up, the remaining command string after the Halt command might be executed if the user types in a new command. If memory location zero is not being used, the user is advised to always clear everything in memory by typing `/1?9`. Otherwise, the user may terminate the remaining command string in the buffer by issuing a `/1T`.

Special Symbols



Indicates a WARNING and that this information could prevent injury, loss of property, or even death (in extreme cases).

R256 User Manual

Product: R256
Version: 1.02
Date: 1/31/2007

Version History		
Version	Date	Description of Changes
1.00	01/11/2006	New User Manual
1.01	08/18/2006	Typographical errors
1.02	01/31/2007	Standardization of User Manuals

TABLE OF CONTENTS

1. FEATURES	5
Designer's Kit	5
Designer's Kit	5
Default Settings.....	5
2. ELECTRICAL SPECIFICATIONS	6
Digital I/O Specifications	6
3. OPERATING SPECIFICATIONS	6
COMMUNICATION SPECIFICATIONS.....	6
4. MECHANICAL SPECIFICATIONS	6
Dimensions.....	7
5. PIN ASSIGNMENTS	7
6. CONNECTION SPECIFICATIONS	9
QUICK START	9
Mating Connectors.....	10
7. CONFIGURING AND CONTROLLING THE R256	10
HYPERTERMINAL SETUP.....	10
SETTING THE CURRENT	11
CONNECTING MULTIPLE R256 CONTROLLERS	12
Changing the Address of the Controller.....	12
CONNECTING THE ACCESSORY PIECES	13
Push Button.....	13
Optical Sensor	14
Encoder Usage.....	15
8. MOTOR CONNECTIONS	16
4 LEAD WIRE MOTOR CONNECTION	16
6 LEAD WIRE MOTOR CONNECTION	16
8 LEAD WIRE MOTOR CONNECTION	17
9. TROUBLESHOOTING & FAQ	18

1. FEATURES

- Controller with built in Microstepping Driver
- Operates from +12V to 40V
- Single 4 wire bus linking up to 16 stepper motors
- 2.0 Amp Chopper (PWM) Driver
- 1/2, 1/4, 1/8, 1/16, 1/32, 1/64, 1/128, 1/256 step resolution
- Stand alone operation with no connection to a PC
- Execution Halt pending switch push button
- Pre-wired for Opto Switch inputs
- Homes to an Opto or Switch closure with a single command
- Fully programmable ramps and speeds
- Two digital I/O and two fixed input channels
- Switch selectable address
- Software selectable "Move" and "Hold" currents
- Hold Current automatically selected upon move completion
- Simple DB9 connection

Designer's Kit (083-00004) with RS232 comm

Here is the list of components if you have purchased the optional Designer's Kit:

- RS485 to RS232 converter card
- A DB-9 female connector cable, a switch push button, Opto Sensor, a 4 Pin connector for the converter card
- CD-ROM with Manuals and Software

Designer's Kit (083-00026) with USB comm

Here is the list of components if you have purchased the optional Designer's Kit:

- USB to RS232 converter card
- A DB-9 female connector cable, a switch push button, Opto Sensor, a 3 Pin connector for the converter card, a USB 6 foot long cable, a 3-Pin to 3-Pin cable
- CD-ROM with Manuals and Software

Default Settings

Function (command)	Description
Running Current (m)	30% of 2.0 Amps
Holding Current (h)	10% of the run current
Step Resolution (j)	256x
Top Velocity (V)	305175 pps (microsteps/sec)
Acceleration (L)	L=1000, 6103500 μ steps/sec ²
Position	0
Microstep smoothness (o)	1500
Outputs (J)	Both are turned off, J0
Baud Rate	9600 bps

2. ELECTRICAL SPECIFICATIONS

Supply Voltage: +12 to +40 VDC
Peak Current: 0.1 to 2.0 Amps

Digital I/O Specifications

Number of I/O	2
Number of Inputs	2
Input Voltage	+0 VDC to +5 VDC (0 to 24V tolerant, but 5V recommended)
Input Current	700 mA
Pull-up Resistors	10k Ω
Protection	Static Protection to the microprocessor

3. OPERATING SPECIFICATIONS

Maximum Step Frequency	2 ²⁴ (pps) or 16.7MHz
Operating Temperature Range	0° to 50° C
Storage Temperature Range	-20° to 70° C

Communication Specifications

Interface Type	RS485 (RS232 or USB with a converter card)
Baud Rate	9600*, 19200, or 38400 bps
# Bits per character	8 Data
Parity	None
Stop Bit	1
Flow Control	None

*default

4. MECHANICAL SPECIFICATIONS

Size: 1.932" x 2.192" x 1.228" (49.07 mm x 55.68 mm x 31.19 mm)
Weight: 3.6 oz (100 gm)
Mounting: Four #6-32 screws, 1.622" x 1.992" (41.20 mm x 50.60 mm)
Cover: Aluminum, Anodized
Plate: Aluminum, Hard Anodized
Color: Black exterior

Dimensions

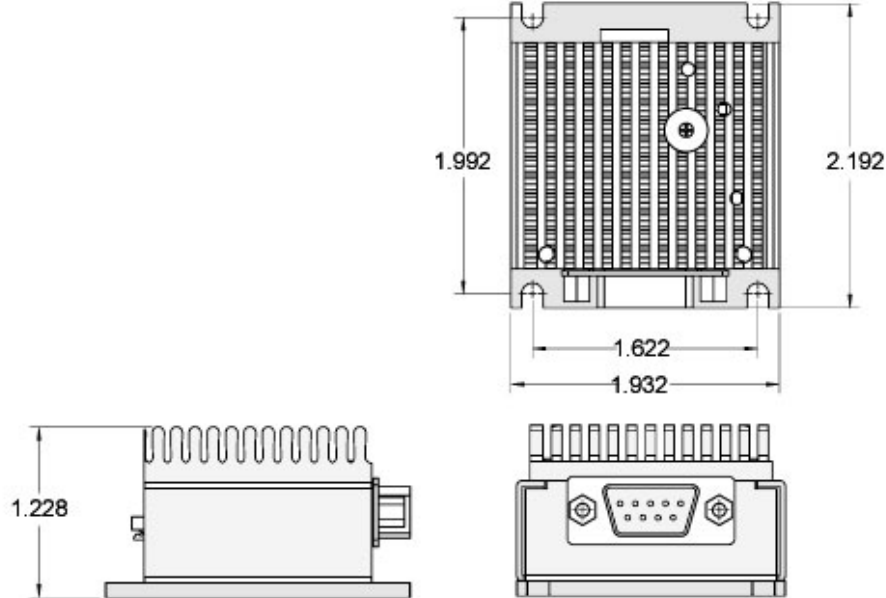


Figure 1: Dimensions Diagram

5. PIN ASSIGNMENTS

A DB-9 female connector cable receives power and provides the control connections for the R256 Controller. The DB-9 cable has a 4 pin connector provided for the converter card in order for the controller to communicate with the PC via RS232. For the USB communication, there should be a white 3-Pin connector. Other wires allow the user to solder and program the switch push button and the Opto Sensor, enabling several options. The I/O's will allow for options such as solenoids, relays, opto isolators, LED's and many other input and output connections. See *Table 2* below for details.

Pin #	Color	Function	Input*
1	Red	+V (Main Power In)	
2	Black	I/O	1
3	Brown	RS485B (-)	
4	Black/White	RS485A (+)	
5	Orange	Switch Closure to GND (IN)	4
6	Green	GND (-V of main power in)	
7	White	Opto Sensor Phototransistor (IN)	3
8	Blue	I/O	2
9	Yellow	Opto Sensor LED (Power Out)	

Table 2: Pin Assignments

*Inputs are labeled 1, 2, 3 and 4 for programming the 'Halt' and 'Skip' Commands.

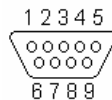
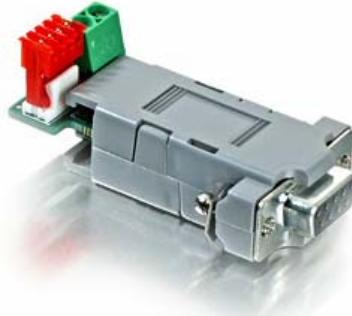


Figure 2: DB-9 Female Cable Connector (Rear View)

Connecting to the RS232 card

R256 pin#	R256 color	RS232 card pin#
4	Black/white	A (RS485A)
3	Brown	B (RS485B)
6	Green	- (GND)
1	Red	+ (PWR)



The RS232 card requires power (7-40VDC). Power is then sent to the motor via the Red 4-Pin connector.

Connecting to the USB card

R256 pin#	R256 color	*USB pin#
4	Black/white	1 (RS485A)
6	Green	2 (GND connect to Power Supply Ground)
3	Brown	3 (RS485B)

*Where Pin #1 is located here:



RS485 Connection View

The USB converter card does not require power (it receives power from the PC). Power is still needed for the R256 controller/driver.

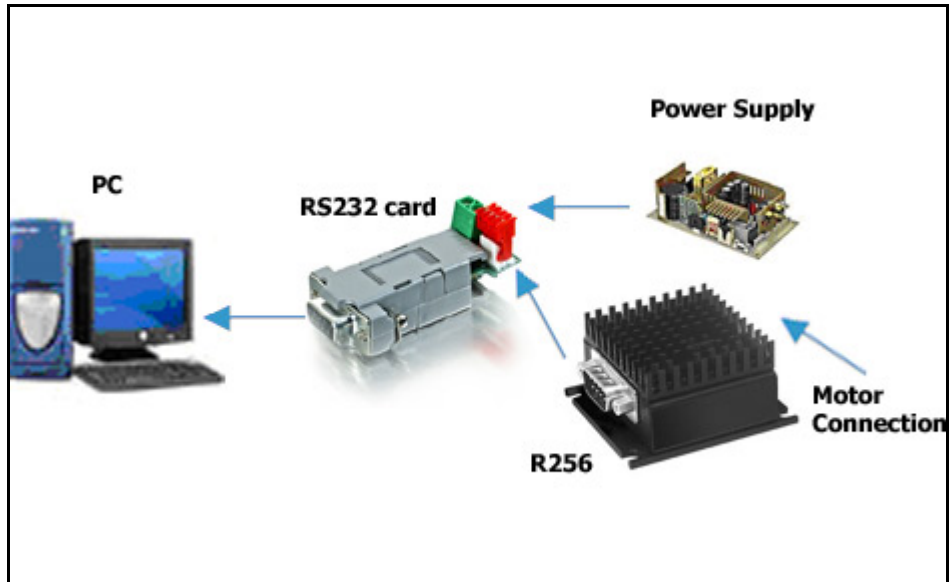


6. CONNECTION SPECIFICATIONS

Quick Start

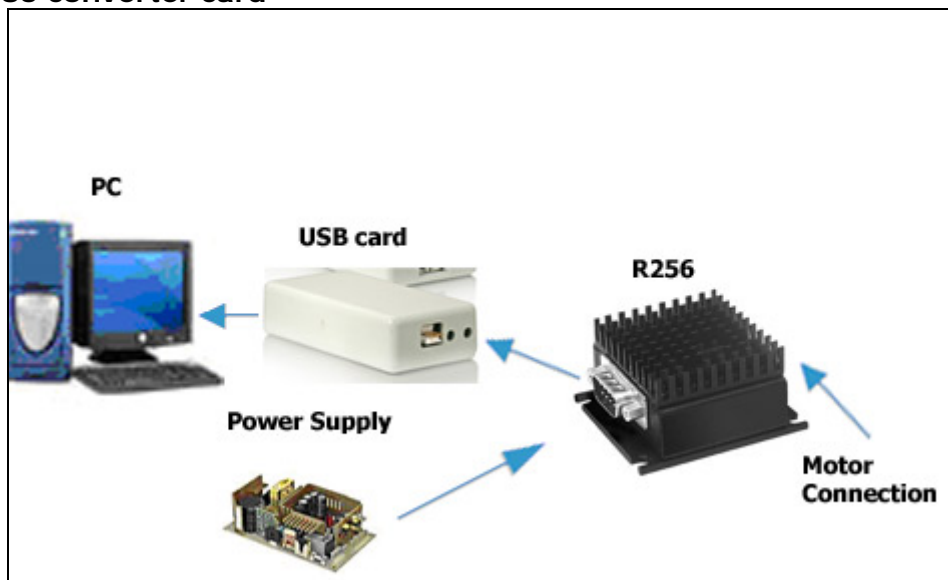
DO NOT PLUG IN POWER UNTIL EVERYTHING IS CONNECTED.

RS232-485 converter card



1. The RS232 converter card connects to the R256 using the DB-9 cable that is provided to you. The red 4-Pin connector is placed onto the converter card.
2. Your power supply will be connected to the RS232 card where the green header is located. **+ is for +12-40VDC, - is for the Power Supply Ground.**
3. The motor is connected to the R256 using the other cable that is provided. It is a white 4-pin connector. The Red wire is A, Blue is A Bar, Green is B, and Black is B Bar.
4. Connect the RS232 card to your PC using a standard female to female DB-9 cable.
5. Turn your power supply on and follow instructions for using HyperTerminal.

USB-485 converter card



1. The USB converter card connects to the R256 using the DB-9 cable that is provided to you. The white 3-Pin connector is placed onto the converter card.
2. Your power supply will be connected to the R256 controller/driver directly. The USB card is powered via the PC. **R256's pin1, Red wire is +12-40VDC, pin 6, Green wire is Ground.**
3. The motor is connected to the R256 using the other cable that is provided. It is a white 4-pin connector. The Red wire is A, Blue is A Bar, Green is B, and Black is B Bar.
4. Connect the USB card to your PC using the USB cable provided to you. You will need to download driver files (2 of them). You can find them at: <http://www.linengineering.com/site/products/usb485.htm>
5. Turn your power supply on and follow instructions for using HyperTerminal.

Mating Connectors

A mating D-Sub connector and crimp style connector are provided.



Part # 90-022



The table to the right depicts the function
Part # 90-018

Color	Function
Red	A+ Phase
Blue	A- Phase
Green	B+ Phase
Black	B- Phase

(Part # 90-044 is the DB-9 cable that has a white 3-Pin header for the USB card).

7. CONFIGURING AND CONTROLLING THE R256

HyperTerminal Setup

Please follow these steps in order to properly set up HyperTerminal:

1. Open a terminal from your PC by following these steps: Start Menu → Programs → Accessories → Communications → HyperTerminal
2. Assign a name for your New Connection
3. Under 'Connect using', select the COM connection that corresponds to your PC serial port (i.e. COM 1, COM 2, etc.) then click 'OK'
4. Set your Port Settings to default (i.e. 9600 baud, 8 data, no parity, 1 stop bit, no flow control)
5. Turn on local echo by going to: File → Properties → Settings tab → ASCII Setup: Click on the box for "Echo Typed Characters Locally" and click on the box for "Send Line ends with line feeds". Click "OK".
6. Now you can type your commands
7. Example: /1A1000R
 - This will run Driver 1 to the Absolute position 10000
 - You can check the address of your driver by checking the dial at the top of the driver. (See the following page for Changing the Address)
 - A full list of commands is available in the R256 Command List

HyperTerminal Responses:

/0@□ indicates good command and that it was received correctly
/0b□ indicates bad command
/0C□ indicates that the command is out of range
/0'□ indicates that the command is terminated
/00□ Overflow

Setting the Current



CAUTION! DO NOT SET THE CURRENT ABOVE THE MOTOR'S RATED CURRENT.

In order to set the correct current for your motor, you must program the specified amount in HyperTerminal

Current is set based on the Maximum amount of current the controller board can output, which is 2.0 Amps Peak. Below is a table of how much current will be applied to your motor for each setting.

Percent		Motor's Current Rating (Amps)	Driver's Equivalent Current (Amps)
10%	=	0.14	0.20
20%	=	0.28	0.40
30%	=	0.42	0.60
40%	=	0.57	0.80
50%	=	0.70	1.00
60%	=	0.85	1.20
70%	=	0.99	1.40
80%	=	1.13	1.60
90%	=	1.27	1.80
100%	=	1.41	2.00

Table 3: Desired Current

To achieve the equivalent Driver Current (Amps), multiply your motor's rated current by 1.4. Follow these examples:

Example One:

You have a motor that is rated at **0.85 Amps**, $0.85 \text{ Amps} \times 1.4 = \sim 1.2 \text{ Amps}$. Using *Table 3* we would see that 1.2 Amps is 60% of the driver's maximum output current.

Assuming the R256 Controller is addressed to Number 1, this is what you'd program: **/1m60R**

Example Two:

You have a motor that is rated at **1.0 Amps**, and your Controller is addressed to Number 1, this is what you'd program: **/1m70R**

This will set the controller to 1.4 Amps Peak. How did we get 1.4 Amps? $\rightarrow 1.0 \text{ Amps} \times 1.4 = 1.4 \text{ A}$

WARNING!: Setting the Current to a value greater than the Motor's rated current will damage your motor, and may overheat the controller.

Connecting Multiple R256 Controllers

Connect multiple controllers by using the Converter card, shown below:

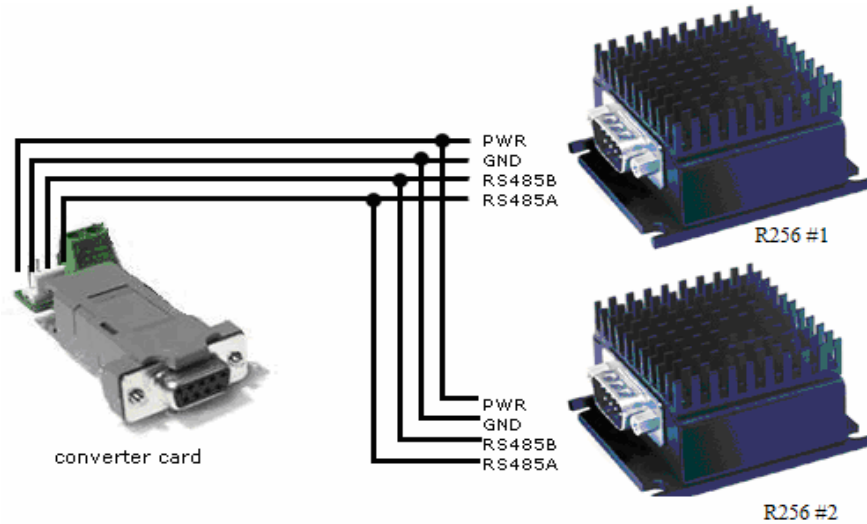


Figure 4: Connecting multiple R256's

Changing the Address of the Controller

Use a screwdriver to turn the dial so the arrow points to the desired Address. Use this number when programming commands. For example, /1P1000R



Figure 5: Address Dial

Note: New RoHS compliant boards have a **Black** dial instead of a Red one.

Connecting the Accessory Pieces

If you have purchased the Designer's Kit, there is a Red Push Button and an Optical Sensor included. Follow the schematics below in order to properly assemble accessory pieces.

Push Button

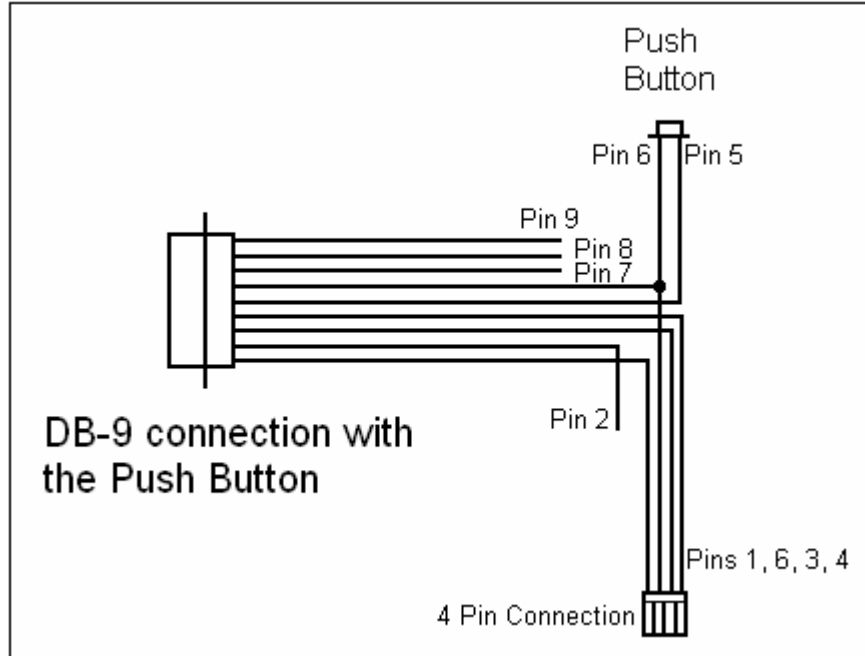


Figure 6: Push Button Schematic

It is best to solder the Push Button to Pin 5 which corresponds to Input 4, then solder Pin 6 (Power Ground) to the other side of the push button.

Input 1	Pin 2
Input 2	Pin 8
Input 3	Pin 7
Input 4	Pin 5

Table 4

Optical Sensor

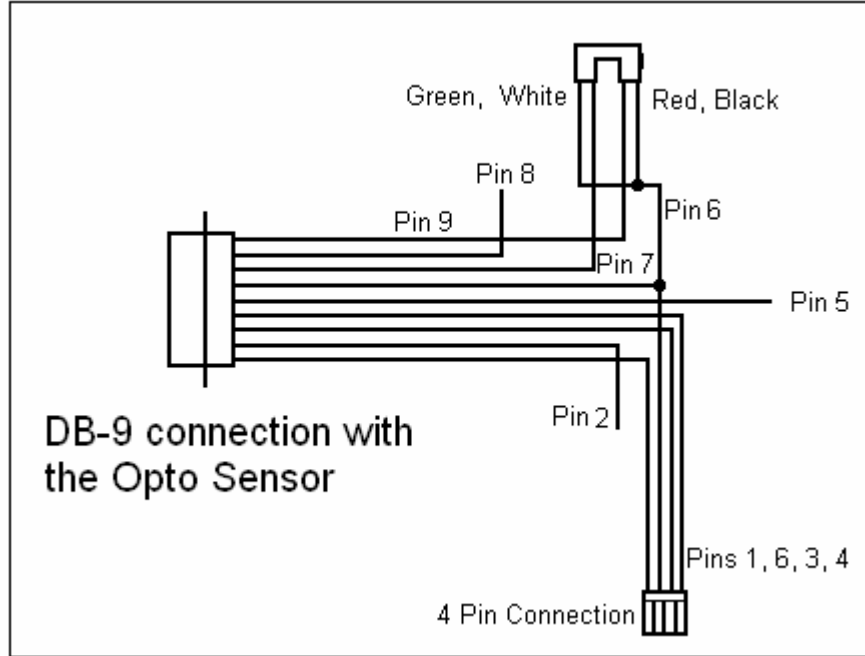


Figure 7: Opto Sensor Connection Schematic

The Opto Sensor uses Pins 6, 7, and 9. Use the following table to solder the corresponding wires.

Optical Sensor	DB9 Cable
Green →	Green
Black →	Green
Red →	Yellow
White →	White

Table 5

Encoder Usage

The R256 can also be used as reference to home by connecting to an US Digital E2 Encoder. The pinouts are as follows:

Pin Number	Function
1	Ground
2	Index
3	Channel A
4	+ 5 VDC
5	Channel B

The E2 encoder requires a separate +5 Volt power supply, as the R256 controller cannot provide a strong enough source of power.

In order to use the Indexer as a reference to home, connect Pin 2 from the encoder to one of the inputs on the controller. From the controller's side, for best results use Pin 5, the switch closure to ground.

In addition, use a pull-down resistor (10k Ω) to ensure that the controller will recognize the difference between high and low (4.85V and 0.5V).

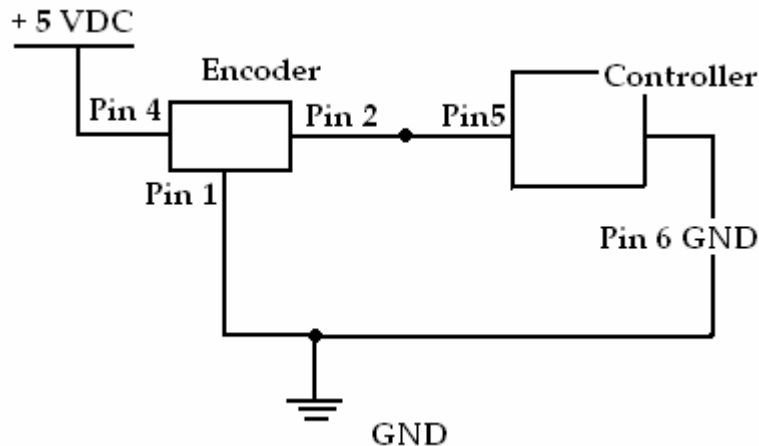


Figure 8: Encoder Pin Connection Schematic

After successfully connecting the encoder to the controller, now you can program the controller to run continuously. The motor will stop movement when the indexer goes high. This will send the high signal to Pin 5 on the controller.

If using channel 1, use this command to start the homing routine:

```
/1P0R
```

8. MOTOR CONNECTIONS

Step Motors have 4, 6, or 8 wires. To better understand how to connect your step motor with your R256 Controller, follow the Figures below for the corresponding motor. NOTE: The dots indicate the starting position of the wires when wound.

4 Lead Wire Motor Connection

Connect one set of windings to the A terminals. Connect the other set of windings to the B terminals. If the set of windings is unclear, take a pair of wires; use an ohmmeter to check for continuity. When you find the first two wires that have continuity, connect it to the A terminals. Connect the other two to the B terminals.

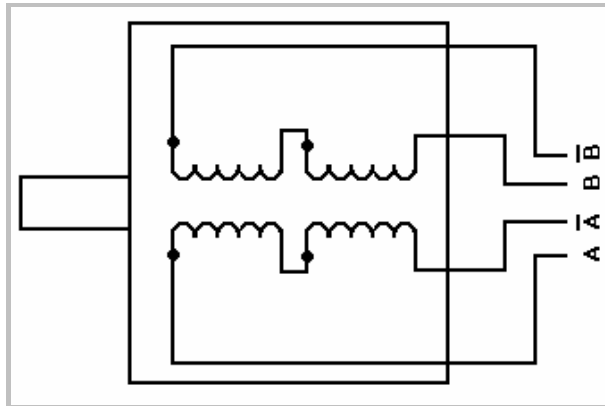


Figure 9.1: 4 Lead Wire Motor Connection

6 Lead Wire Motor Connection (Half Winding)

Six wire motors can be wound in two ways: Half Winding and Full Winding. Six wire motors contain a center tap on each of the two windings. For a half-winding connection, the center tap and one end of the wires are used.

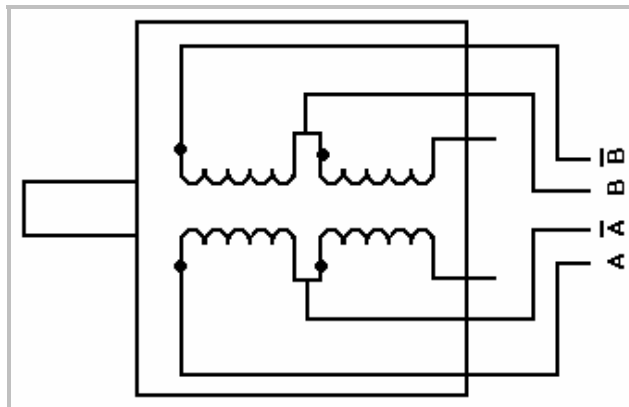


Figure 9.2: 6 Lead Wire Half Winding Connection

6 Lead Wire Motor Connection (Full-Winding)

For a full winding connection, use both end wires, the center tap is ignored. (NC: No Connection).

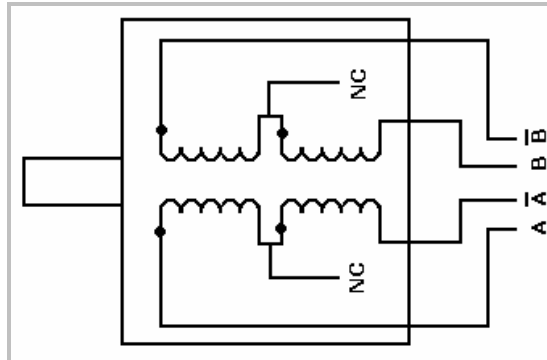


Figure 9.3: 6 Lead Wire Full Winding Connection

8 Lead Wire Motor Connection (Parallel Connection)

Eight wire motors can be connected in two ways: Parallel and Series. When in parallel, the wires are simply connected such that the beginning of each winding are connected together.

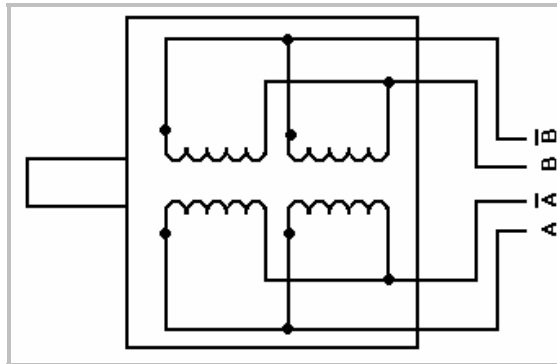


Figure 9.4: 8 Lead Wire Parallel Connection

8 Lead Wire Motor Connection (Series Connection)

Be sure to set the drive current to exactly half of the motor's rated parallel current rating when using the series connection.

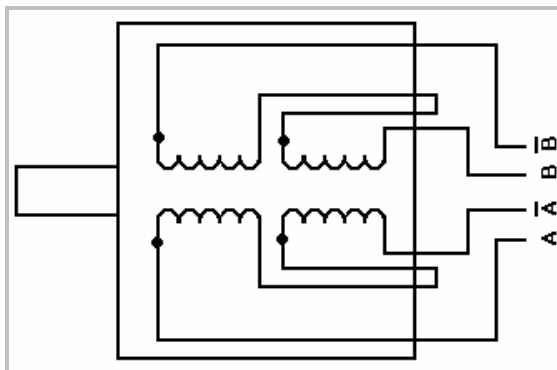


Figure 9.5: 8 Lead Wire Series Connection

9. Troubleshooting & FAQ

Cannot Type anything in HyperTerminal:

Is the correct COM Port selected? Are you using Windows 95? Windows 95 has had problems with its HyperTerminal. Use an operating system of Windows 98 or higher. Are you working on a Laptop? Sometimes there is a shift in Ground on Laptop Serial Ports. Pin 5 on the Serial Port is Ground. Make sure that this is connected to a true ground.

Did you check the Properties in HyperTerminal? Check the box in Properties → ASCII Settings → ASCII setup → 'Echo Typed Characters Locally'.

Is the LED flashing on the R256 Controller? A flashing light indicates it is waiting for Commands and power is OK. Motor shaft should be difficult to rotate.

Check the Converter Card. Use a voltmeter to measure if Power is coming into the card correctly and if power is being supplied to the Controller properly.

Can Type in HyperTerminal, but nothing is happening:

Check the LED on the top of the R256 unit. If there is no LED lit, the problem may be the Power Supply, check the connections. If you see one LED that flashes on and off about 5 seconds at a time, then power is OK.

Is the R256 Controller set to the correct Address? Check the Red Dial (new RoHS compliant boards have a black dial) on the top of the controller. The white arrow should be pointing to the corresponding Address. Make sure that the arrow is not between 2 Addresses. Use a small screw to verify that it clicks in place.

Check the Converter Card. Use a voltmeter to measure if Power is coming into the card correctly and if power is being supplied to the Controller.

Assuming the Properties of HyperTerminal are set as described in the Manual (HyperTerminal Setup), does HyperTerminal respond with a string of characters?
/0'□ indicates that the command is terminated
/0@□ indicates good command and that it was received correctly
/0C□ indicates that the command is out of range
/0b□ indicates bad command

The unit is by default, set to 256 microsteps. Therefore, by typing in a position move of /1P200R, you will not see anything. It takes 51,200 steps to make one revolution, so try a large value, like /1P100000R

Windows Application: When pressing 'Run' it gives the error - File Already Open:

Another program could also be running at the same time. Click End, and then try again. Sometimes if you are connected through a Network, there are problems with permissions in running programs. Check with your Administrator.

If HyperTerminal is open concurrently, you will receive an error. Only one program can be running at one time.

R256 Controller will accept commands, but the Motor will stall in the middle of a command:

This means there is not enough current being supplied to the Motor. Use the m command to change the current, or run the Motor at a Lower Speed (V command). Or, make the motor accelerate slower using the L command.

Halt Command (H01) Issues

There are known issues involving the Halt command (i.e., H01) when stored in memory location zero. Upon power up, the remaining command string after the Halt command might be executed if the user types in a new command. If memory location zero is not being used, the user is advised to always clear everything in memory by typing /!?. Otherwise, the user may terminate the remaining command string in the buffer by issuing a /!T.

I want to use one of the I/Os to turn on a LED to confirm that the motor has finished moving or moved to a certain position. How do I do it?

To turn on a LED to confirm that the motor finished moving you must use the "J" command in the command list section On/Off Drivers. We are assuming the unit executes the command sent. We cannot detect skipping because the set up is open loop. Example: /!P200J10R, is a position move 200 steps, then turn on driver 2.

What's the minimum and maximum voltage the RS485 to RS 232 Converter Card can handle?

Min and Max voltage levels: 7 to 40 VDC

Using a PLC to communicate with board

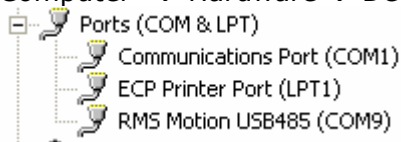
After the command, you need to issue a carriage return and linefeed.

Example: /!A1000R (absolute position move 1000). After the R, send a 0x0d in hex.

USB Converter card setup

The USB converter card requires you to install the unit as a hardware. Two files should be downloaded, and they can be found online at www.linengineering.com → Products → Step Motors → USB485 Card → Downloads → Driver files.

You should be able to view the converter card if you go to Properties of "My Computer" → Hardware → Device Manager → Ports.



The LED's on the USB485 converter card only light up during sending and receiving of a command.