IMC23 / IMCE23

INTEGRATED STEP MOTOR, DRIVER, AND CONTROLLER

USER MANUAL

Version 1.00

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IMC23/IMCE User Manual

Product: IMC23/IMCE23
Version: 1.00
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Version History		
Version	Date	Description of Changes
1.00	03/30/2006	Initial Release

TABLE OF CONTENTS

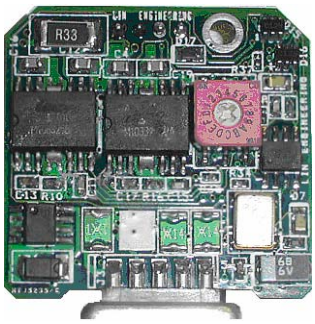
1. INTRODUCTION

RMS Technologies sells integrated solutions for your motion control needs; including motor and driver, motor and driver with an encoder, motor controller/drivers, and motor controller/drivers w/ encoder. The IMC comes in two sizes: NEMA 17 and 23.

The IMC23 is designed to allow for rapid implementation of stepper motors in products requiring automation.

With a fully intelligent controller attached to the back, the IMC23 accepts high level commands from an RS232/RS485 link. The controller only adds 1.68" to the length of the motor which otherwise is a standard RMS Technologies Size 23 High Torque Step Motor.

In addition to the IMC23 unit, RMS Technologies offers a developer's kit, enabling users to easily implement their own programs. The kit includes an RS485 to RS232 converter card, a CD-ROM with software and manuals, along with a DB-15 connector cable and accessory pieces. The converter card provides the connection between your IMC23 Unit and your PC. Commands can be issued from any serial terminal program (such as HyperTerminal). The commands to the IMC23 are intuitive and simple. For example the command A10000 will move the stepper motor to Absolute Position 10000 (steps). This communications protocol is compatible with devices that use the Cavro DT or OEM protocol.



The IMC23 is also capable of stand alone operation with no connection to a PC. It can be set to execute a preset string of commands upon power up. Commands include nested loops, execution halt pending a switch closure, and much more. It is also possible to daisy chain up to 16 different units at once.

This user manual is a complete guide to setting up the IMC23 unit. It also contains information on various types of inputs and outputs your unit can be used with. In addition, a highlighted list of commands for programming the IMC23 has been provided.

Thank you for purchasing the IMC23 Integrated Motor & Controller. The IMC23 is warranted to be free of manufacturing defects for 1 year from the date of purchase.

PLEASE READ FIRST BEFORE USING

Before you start, ensure that there is a suitable DC power supply. A current limited lab supply is recommended for first time users to guard against the possibility of miswire. In addition, in order to prevent any harm to the controller board, do not disconnect the unit while power is still being supplied. Do not exceed 40VDC under any circumstances.

DISCLAIMER

RMS Technologies reserves the right to make changes without further notice to this product 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 of others. The IMC23 Integrated Motor & Controller and RMS Technologies logo are trademarks of RMS Technologies.

ELECTRICAL SPECIFICATIONS

Power Supply Requirements

Voltage +12 VDC to +40 VDC

Motor Specifications

NEMA Size 23

Steps per Revolution (1.8° Motor) with Micro stepping:

400, 800, 1600, 3200, 6400, 12800, 25600, 51200

Available encoder resolutions on the 23CE:
32***, 50, 96, 100, 110**, 120**, 192, 200, 250, 256, 360, 400, 500, 512, 540**, 720***, 900***, 1000, 1016**, 1024, 1250**

* Resolutions >=1000 CPR use Index/Hi Res pricing.
** Index option not available.
*** 32, 720, 900, 1250 CPR only available with index.

I/O Specifications

Number of Outputs	2
Number of Analog/Digital Inputs	4
Input Voltage	+0 VDC to +24 VDC
Input Current	700 mA
Pull-up Resistors	20k Ω
Protection	Static Protection to the microprocessor

COMMUNICATION SPECIFICATIONS

Interface Type	RS485 to RS232 converter card
Baud Rate	9600 bps
# Bits per character	8 Data
Parity	None
Stop Bit	1
Flow Control	None

DIMENSIONS

A. Overall Body Length (Dimension A)

Motor body length is available in various lengths

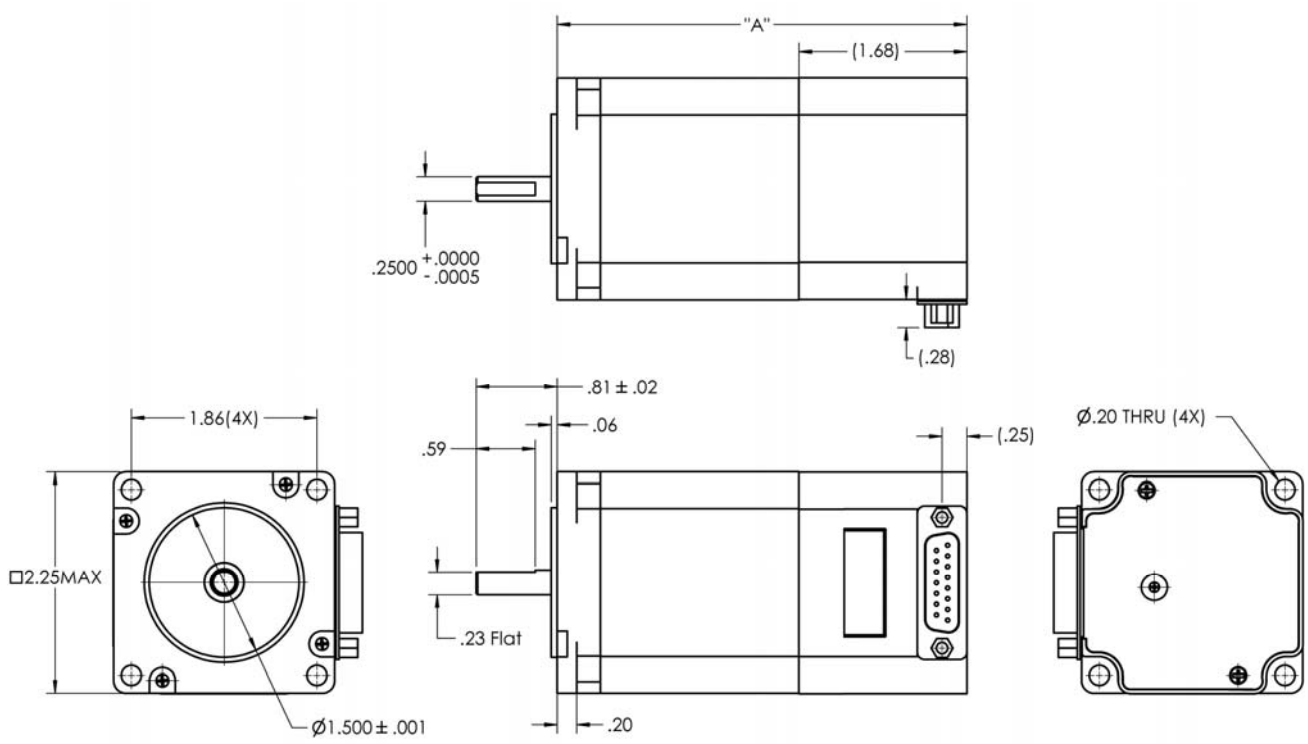
Model IMC23-S (3.41")
Model IMC23-M (3.85")
Model IMC23-L (4.78")

B. Motor Front Shaft Extension Length

Standard length is 0.81".

C. Motor Shaft Diameter

Standard shaft diameter is 0.2500".



IMC23 Dimensions

OPERATING SPECIFICATIONS

Maximum Step Frequency	16.77 MHz
Operating Temperature Range	0 to 50 °C
Storage Temperature Range	-20 to 70 °C

FEATURES

- Single 4 wire bus linking up to 16 stepper motors
- 3.0 Amp Chopper (PWM) Driver
- Operates from 12V to 40V
- Stand alone operation with no connection to a PC
- Execution Halt pending switch push button
- Pre-wired for Opto Switch inputs
- 1/2, 1/4, 1/8, 1/16, 1/32, 1/64, 1/128, 1/256 step resolution
- Homes to an Opto or Switch closure with a single command
- Fully programmable ramps and speeds
- Four analog/digital Inputs and two 24V, 0.7 Amp Power On/Off Drivers
- Switch selectable address
- Software selectable "Move" and "Hold" currents
- Hold Current automatically selected upon move completion
- Simple DB-15 connection

DEVELOPER'S KIT LIST

If you have purchased the Developer's Kit, here is the list of components:

- IMC23 Integrated Motor and Controller
- RS485 to RS232 converter card
- A DB-15 female connector cable, a switch push button, Opto Sensor (Honeywell HOA1887-012), a 4 Pin connector for the converter card, and extra wiring for I/O
- User Manual

DEFAULT SETTINGS

Running Current	25%
Holding Current	10%
Step Resolution	256 Microstepping
Start Velocity	0 pps
Top Running Velocity	305175 pps
Position	0

2. CONNECTORS

A DB-15 female connector cable receives power and provides the control connections for the IMC23 Unit. On the opposite end of the DB-15 female connector cable, there is a 4 pin connector provided for the converter card in order for the driver to communicate with the PC. This allows the user to solder and program the switch push button and the Opto Sensor, enabling several options. The four I/O wires are colored Orange, Orange/White, White and Red/White. This will allow for options such as solenoids, relays, opto isolators, LED's and many other input and output connections. See Figure 2.1 for details.

PIN #	COLOR	FUNCTION	INPUT
1	Green	Power Input Ground	
2	Black	1A ON OFF DRIVER OC PULLDOWN	
3	Yellow/Green	OPTO ISOLATED STEP PULL DOWN INPUT	
4	Yellow	OPTO ISOLATED STEP AND DIR INPUT +VE POWER	
5	Orange	INPUT	2
6	Yellow/White	OPTO SENSOR LED	
7	Orange/White	INPUT	3
8	Black/White	RS485 A	
9	Red	"+12V TO +40V INPUT POWER"	
10	Blue	1A ON OFF DRIVER OC PULLDOWN	
11	Blue/White	OPTO ISOLATED DIR PULL DOWN INPUT	
12	Green/White	QUIET SIGNAL GROUND	
13	White	INPUT	1
14	Red/White	INPUT	4
15	Brown	RS485 B	

Table 2.1

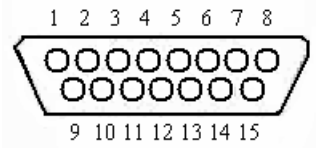


Figure 2.1: DB-15 Female Cable Connector (Rear View)

DB-15 Connector Cable

*****Inputs are labeled 1, 2, 3 and 4 for programming the 'Halt' and 'Skip' Commands. See page 22 and 23 for more information.

3. 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 from HyperTerminal

Current is set based on the Maximum amount of current the controller board can output. 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%	=	0.21	0.30
20%	=	0.42	0.60
30%	=	0.63	0.90
40%	=	0.84	1.20
50%	=	1.05	1.50
60%	=	1.26	1.80
70%	=	1.47	2.10
80%	=	1.68	2.40
90%	=	1.90	2.70
100%	=	2.10	3.00

Example: If you have a motor that is rated at 0.84 Amps, then you would want to set the current to 40% of the maximum current. This is what you'd program, if you are speaking to Address Number 1 (you can change the address from the Red Dial at the bottom of your unit):

```
/1l40m40R
```

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

PLEASE READ:
The column labeled "Driver's Equivalent Current" refers to the Peak Current, which is simply 1.4 * Motor Rated Current. In actuality, you are inputting more current than the Motor's Rated current (1.4 times more). This will give you optimal performance, specifically for microstepping. Microstepping refers to anything more than half stepping.

4. GETTING STARTED

1. Connect the DB-15 Female Cable to the back of the IMC23 unit.
2. On the opposite end of the DB-15 cable, there is a 4 pin female connector. Connect this female mating connector to the header of the converter card (RS485 to RS232 converter card).
3. Then connect two wires from the converter card to a power supply. Plus and minus signs should already be allocated on the converter card. The plus (+) sign is for the positive terminal of the power supply; and the minus (-) sign is for the ground terminal of the power supply.
4. Connect one end of a serial cable to the converter card, and the other end to a serial port on a PC (This cable is not provided in the kit.)
5. Turn on your Power Supply (See Figure 3.1 below).

WARNING: DO NOT DISCONNECT THE UNIT WHILE POWER IS STILL BEING SUPPLIED.

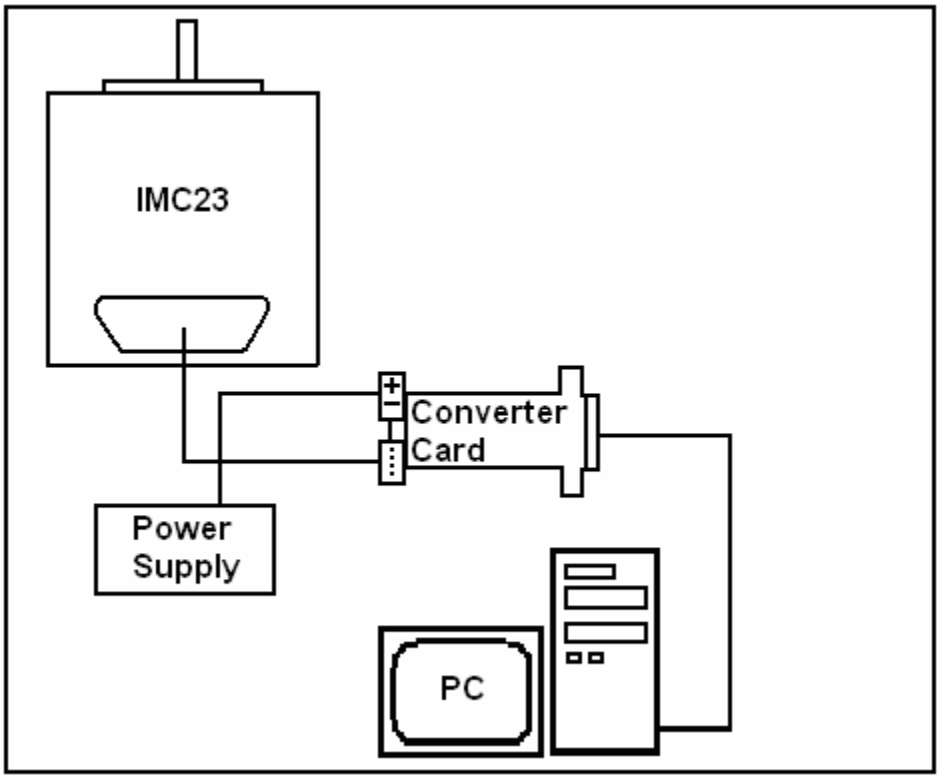


Figure 3.1

HYPERTERMINAL SETUP

Please follow these steps in order to properly set up HyperTerminal (Windows 98 and above required):

1. Open a terminal from your PC by following these steps:

   Start Menu → Programs → Accessories →
   Communications → HyperTerminal

2. Assign a name for your terminal
3. Make sure your COMM connection corresponds to the same COMM connection as your PC serial port (i.e. COMM 1, COMM 2, etc.)
4. Set your Port Settings to default (i.e. 9600 baud, 8 data, no parity, 1 stop bit, no flow control) To get to your Port Settings, perform the following steps:

   File → Properties → Settings

5. Turn on local echo by going to:

   File→ Properties →Settings → ASCII Setup:

   Click on the box for "Echo Typed Characters Locally" and click on the box for "Send Line ends with line feeds". These options will be useful when typing commands in HyperTerminal.

6. Click OK
7. Now you can type your commands
8. Example: `/1A10000R`
   - This will run driver 1 to the Absolute position 10000
   - Visit www.rmsmotion.com for a full list of commands
   - The computer should respond with this string of characters: `'/0@ '`

5. USING THE ANALOG/DIGITAL INPUTS AND OC OUTPUTS

The IMC23 contains four analog/digital Inputs and two Open collector w/pulldown outputs. It is possible to receive input from external devices such as sensors, switches, PLC outputs or POT. Outputs such as relays, solenoids, LED's and PLC inputs may be controlled from the IMC23 Unit.

All Inputs feature internal 20k Ω pull-up resistors and can handle up to 24V. For analog operation of the inputs it is recommended to have a Pot that has a value of 500 Ω or less due to the internal pull up resistor. The Output lines feature a switch closure to ground, which can be used to drive loads connected externally of up to 24V and 700ma.

INPUT CONNECTIONS

Connecting a Switch Push Button

A Red Capped Switch Push Button is provided in your kit. After completing the 'Getting Started' section, you are now ready to program an input. Please refer to the 'Soldering Accessory Pieces' on page 16 in order to use your switch push button. Figure 4.1 shows a circuit schematic of how the switch push button is configured.

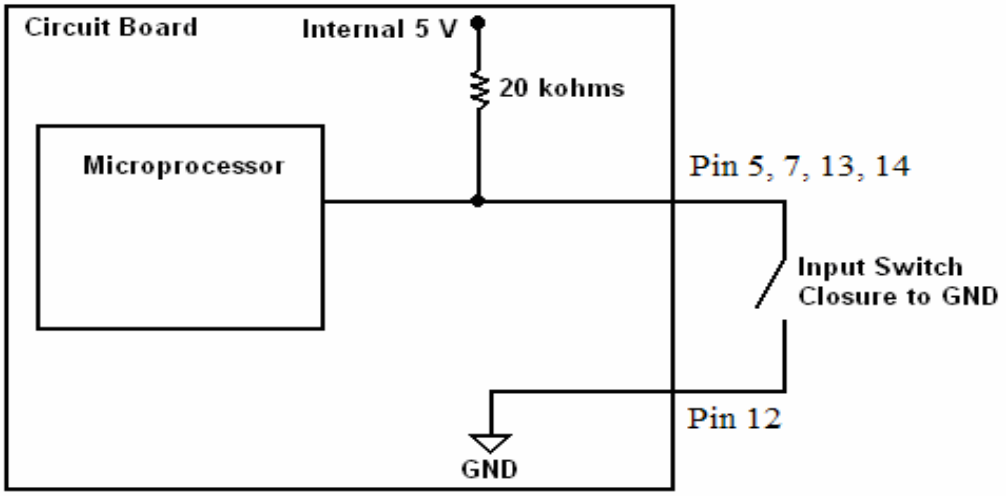


Figure 4.1

Using HyperTerminal, here is how to program your Unit to move 1000 steps in the positive direction each time you press the button. This code will work when using Pin 5 as your switch closure to ground. Assuming the motor address is set to 1 (see the 'Changing Addresses' section on page 16), type in the following code:

```
/1gH02P1000G0R
```

Connecting a Direct Digital Circuit

This enables the user to have one unit's output to be another unit's input. Below, Figure 4.2 shows the input driver on the left, and the output driver on the right.

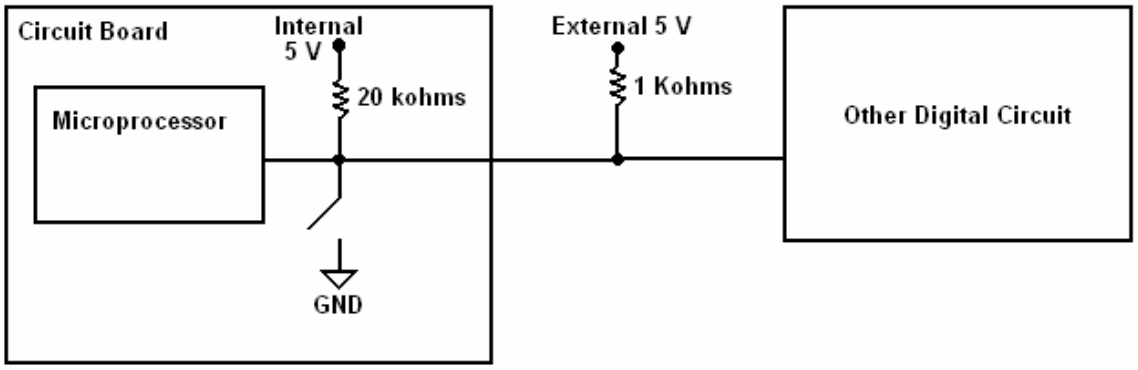


Figure 4.2

Be aware of the possibility of a ground shift between the output driver and the input driver. The wiring between the two drivers should be a short 6 inch distance. If your wiring is too long, it is possible that the ground voltage on the input side may be as high as 2 VDC, thus not enabling this connection to work properly. To connect motors further apart, use an opto isolator, as shown in the

following section. It is also recommended to connect multiple motors as shown on page 16.

Connecting two motors with an Opto Isolator

Connection of two motors is possible using an opto isolator. Be sure to use a transistor opto that has a current, Ic > 1mA at IF = 20mA.

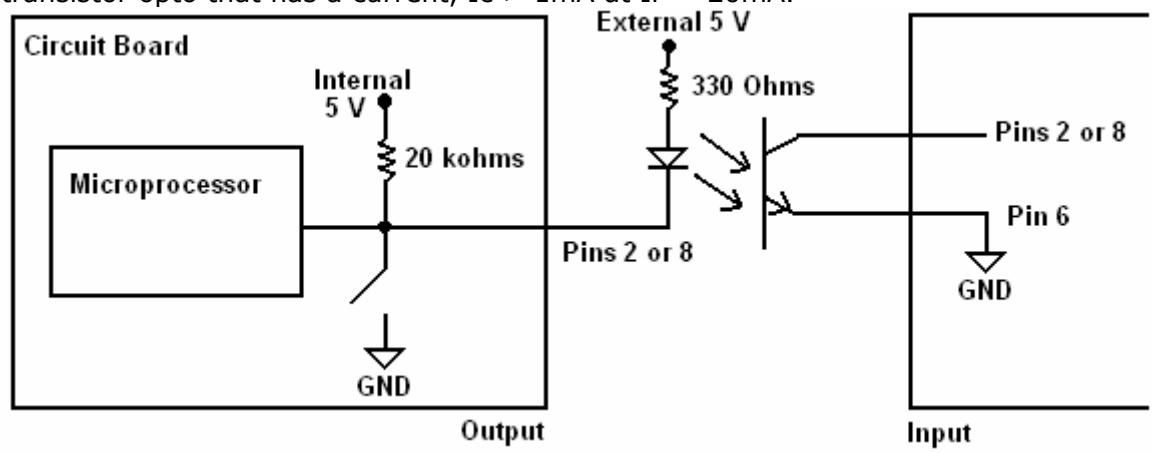


Figure 4.3

OUTPUT CONNECTIONS

Connecting an Opto Sensor

An Opto Sensor is provided in your developer's kit. After completing the 'Getting Started' Section, you can now program the Opto in HyperTerminal. Please refer to page 18 for Soldering the Opto.

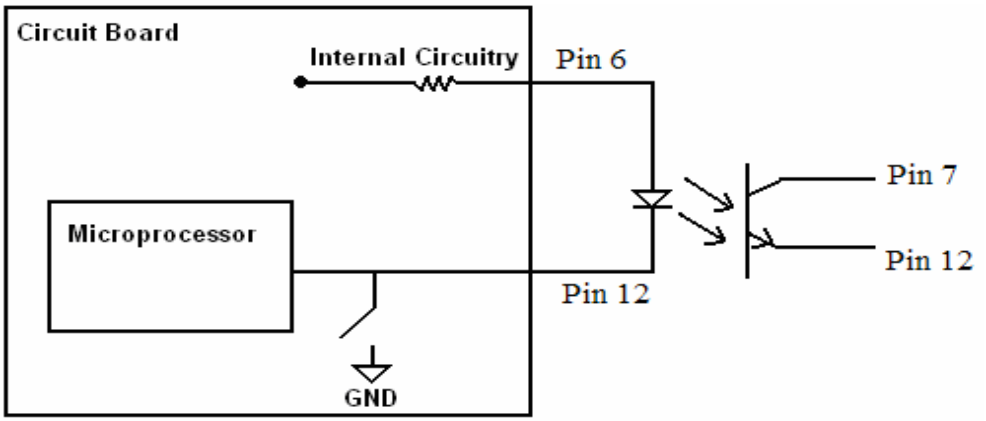


Figure 4.4

Here is how to program your Unit to wait for a switch closure on pin 7, home the stepper to the opto, move to position 1000, then move to position 0:

```
/1H03ZA1000A0R
```

Driving a Relay
It is necessary to place a 1N4001 diode across the relay as shown in order to protect against inductive spikes.

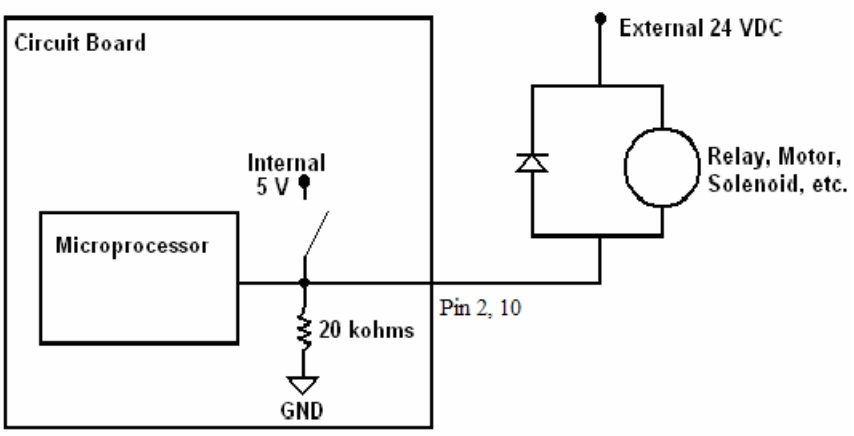


Figure 4.5

Example: To activate the relay, then wait for 500 milliseconds, and then deactivate the relay, type in the following commands:

```
/1gJ3M500J0G5R
```

CONNECTING AN LED TO AN OUTPUT

An LED is connected to use a 20V Zener Diode in series with the main external power supply, shown below:

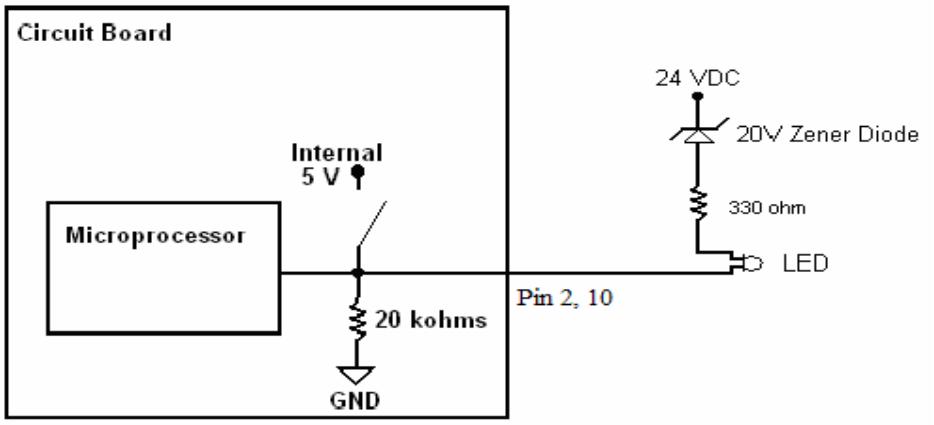


Figure 4.6

CONNECTING MULTIPLE DRIVERS

- Ensure that each unit has its own unique address if you choose to have different motions per unit. If you choose to run the same motion on multiple units, then the same address for each unit may be used.
- Figure 4.7 shows a basic schematic of the connections between two motors and the converter card

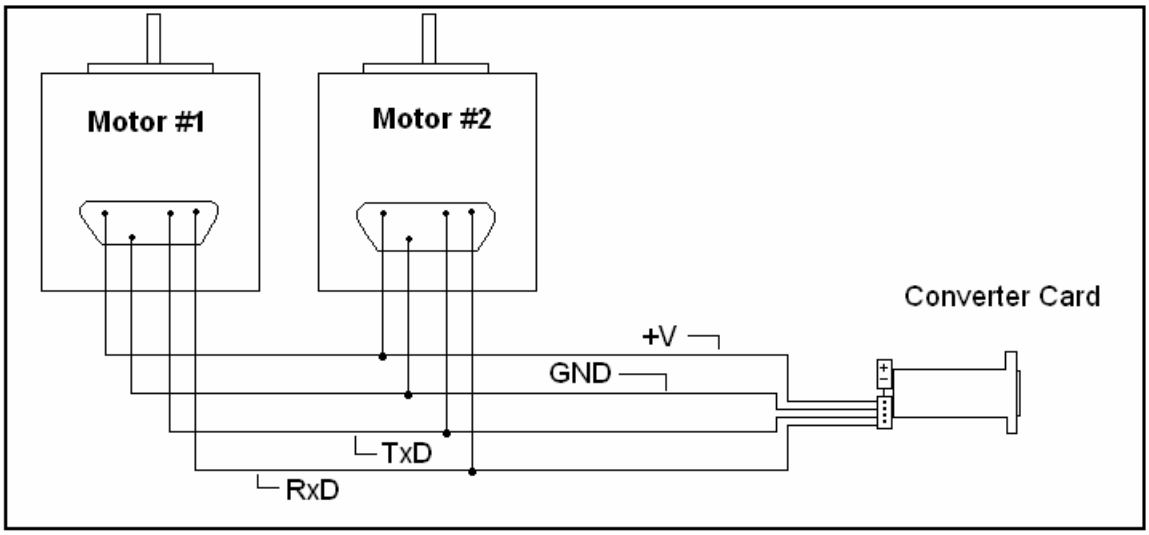


Figure 4.7

CHANGING ADDRESSES

- Locate the channel selector on the bottom of the IMC23
- Using a small flat screwdriver, turn dial to the desired channel
- See Figure 4.8 below

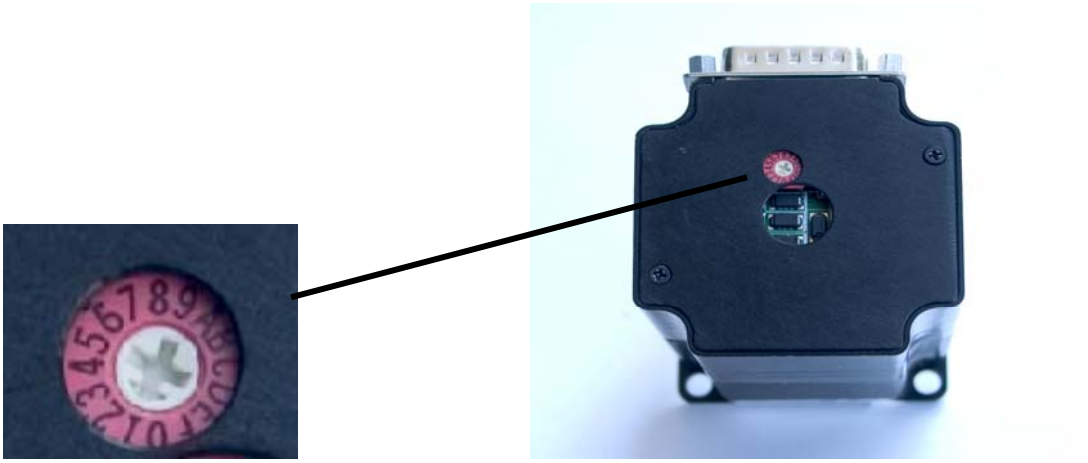


Figure 4.8

6. SOLDERING ACCESSORY PIECES

PUSH BUTTON

The push button can be soldered to wire 5, 7, 13, or 14 and the other end of the lead wire connected to wire 12 (Green/White). There is no difference in polarity for the push button; therefore, the lead wires of the push button terminals can be interchanged.

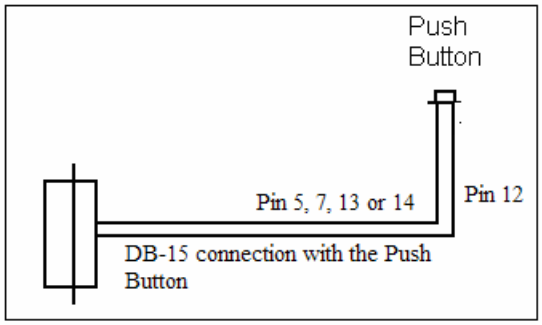


Figure 5.1

Now you can program your switch push button. See 'Examples' in Section 6.

Note: When programming a specific input, note that:
Input 1 corresponds to Pin 13
Input 2 corresponds to Pin 5
Input 3 corresponds to Pin 7
Input 4 corresponds to Pin 14
See the commands list on how to program switches and halt statements.

OPTO SENSOR

The opto sensor (Honeywell HOA1887-012) uses wire 6 (Yellow/White), wire 7 (Orange/White), and wire 12 (Green/White). Four wires are already connected to the opto sensor, colored Red, Black, White, and Green. On the opto sensor, wires Green and Black are both Ground, which need to be soldered together, then soldered to wire 12 (Green/White) on your DB-15 cable. Then the red wire on the opto sensor needs to be soldered to wire 6 (Yellow/White) on your DB-15 cable. And the white wire on the sensor needs to be soldered to wire 7 (Orange/White) on your DB-15 cable.

Opto Sensor	Cable	Cable Pin
Green →	Green/White	12
Black →	Green/White	12
Red →	Yellow/White	6
White →	Orange/White	7

Table 5.1

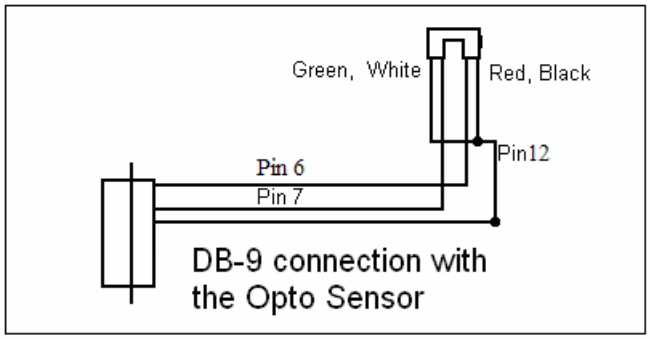


Figure 5.2

Now you can program your Opto Sensor. See 'Examples' in Section 7.

Note: When programming a specific input, note that:
Input 1 corresponds to Pin 13
Input 2 corresponds to Pin 5
Input 3 corresponds to Pin 7
Input 4 corresponds to Pin 14

7. DOWNLOADS

Visit www.rmsmotion.com for the following information:

- For the most up to date version of the IMC23 Manual
- IMC23 Full Command Set List