

# GSM5 USER MANUAL .....19th Jan 2000



Tel: 0208 302 4931

## PRODUCT OVERVIEW

The GSM5, together with the optional PSU5 power supply, provides a comprehensive facility for controlling 4 or 8 wire Bipolar driven stepper motors. Up to 4 GSM5 cards can be daisy-chained to control up to 4 motors. Simple software commands can be sent from a PC via the RS232 serial port to the GSM5 to control motor direction, number of steps, start and stop ramp length and slope, motor current. All commands carry address information. On board settings include card address (0, 1, 2, 3) motor current (set to suit motor specification) and number of steps / second (speed).

## SPECIFICATION

This equipment is designed to operate in half step mode only.

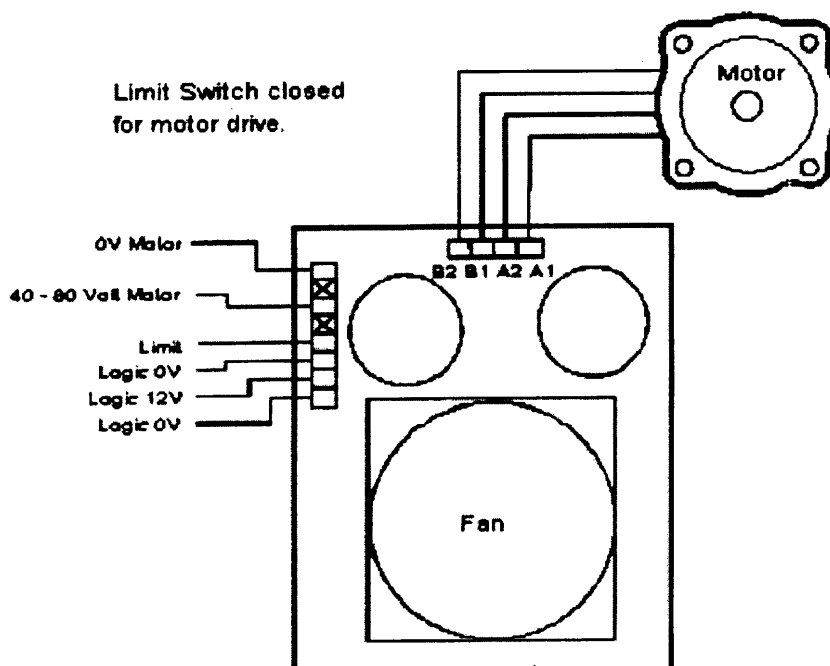
**MOTOR DRIVE:** 4 or 8 wire bipolar current switching, up to 5 ampere / phase Voltage 40 to 80 Volts DC (maximum).

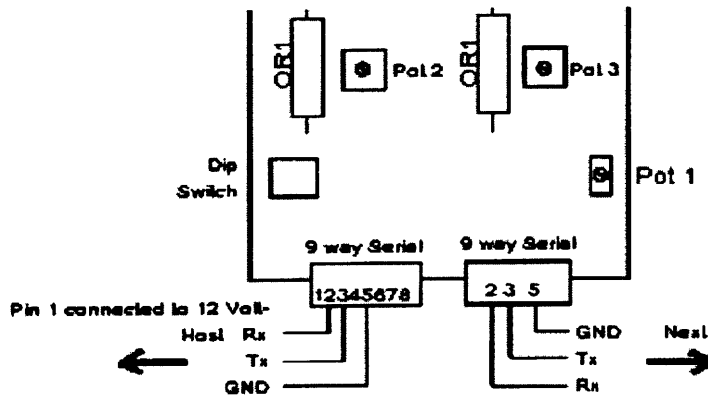
**INTERFACE:** RS232C 9600 Baud, DTE via 9 pin "D" connector, Tx, Rx & GND active (Null modem) daisy-chained from card to card.

**ADDRESS:** On board card address selection 0, 1, 2, 3. Software commands include card address.

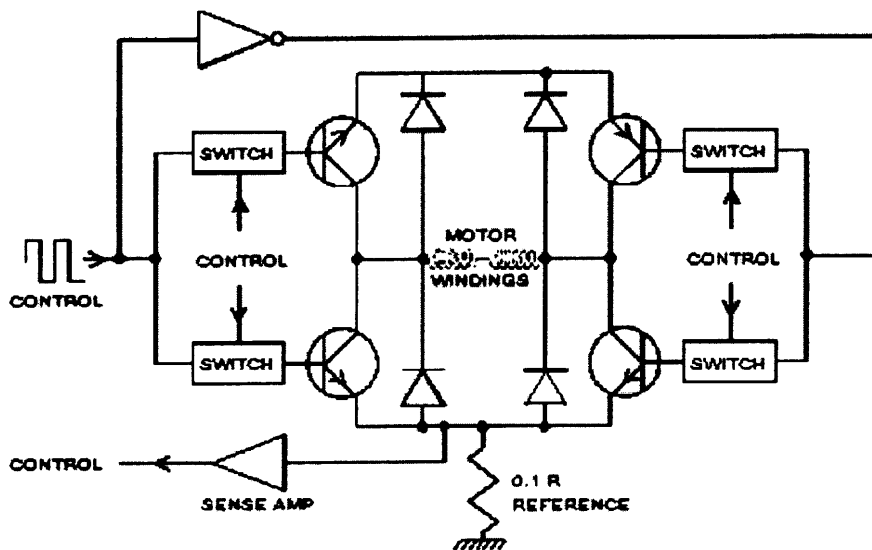
**MOTOR CONTROL:** Current, speed, direction, 1/2 current, boost, number of half steps (0-99999), ramp (length and slope), limit.

## BOARD LAYOUT

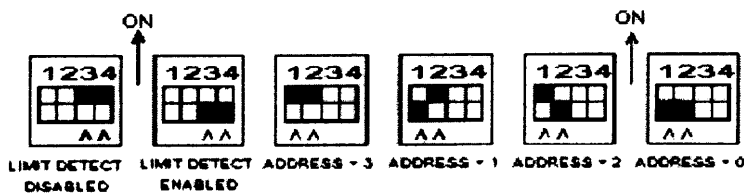




MOTOR DRIVE SCHEMATIC ( One Phase )



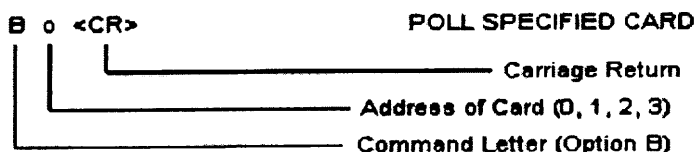
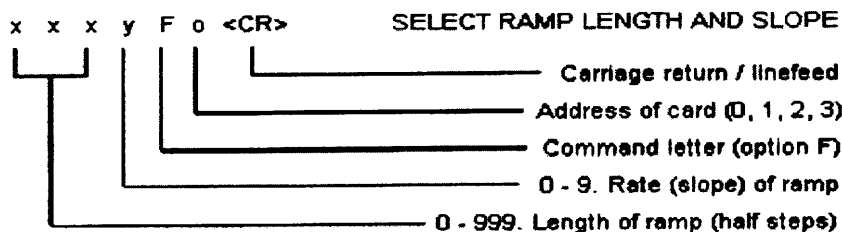
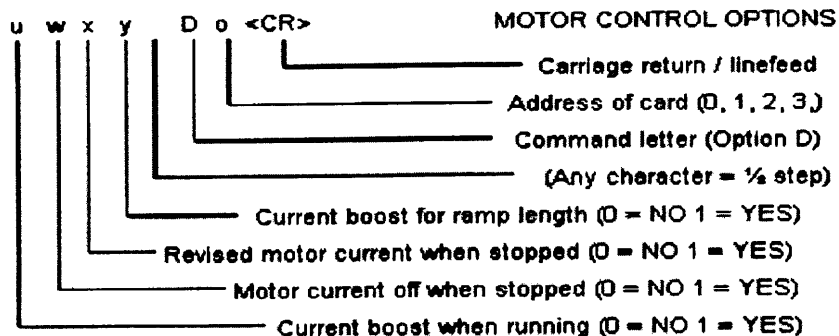
SWITCH SETTINGS



SOFTWARE COMMANDS

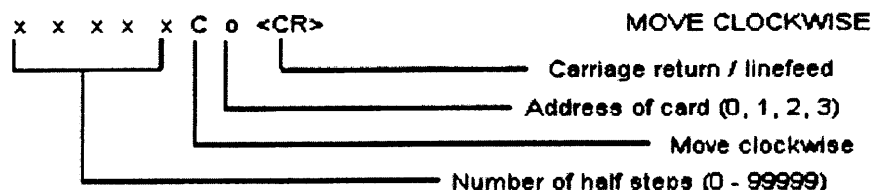
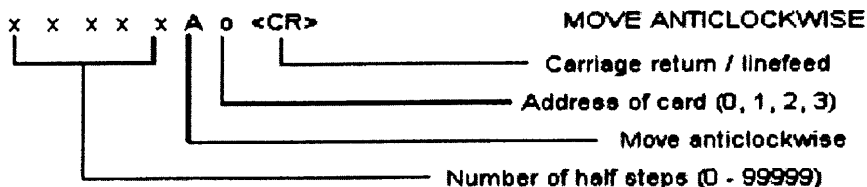
All software commands, sent via the RS232 interface , are of the format - **number, command letter, address (0, 1, 2, 3, )** followed by **carriage return** or **linefeed**. The card will echo back via the RS232 the command letter and the card address.

The following commands select card parameter options associated with motor current, 1/2 step, ramp length and slope. (If not specified default settings would apply).



This command polls the card specified at address entered and returns an ID message plus limit switch status. e.g. B GSM5 999 JAN 95 L/F C/R or B GSM5 999 JAN 95 Limit Open L/F C/R

**SELECT MOTOR MOVEMENT COMMANDS**



x x x x x E o <CR> **MOVE ANTICLOCKWISE**  
 SPECIFIC NUMBER OF HALF STEPS (0-99999) OR UNTIL LIMIT SWITCH OPERATES. No Ramp, stays at start speed. (See Ramp Parameters)

x x x x x G o <CR> **MOVE CLOCKWISE**  
 SPECIFIC NUMBER OF HALF STEPS (0-99999) OR UNTIL LIMIT SWITCH OPERATES. No Ramp, stays at start speed. (See Ramp Parameters).

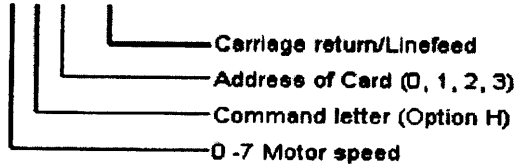
**PROGRAMMABLE MOTOR SPEED CONTROL**

Programming command H has been assigned to provide seven programmable motor speeds.

The format of the command is :-

Motor speed settings are:-

x H o <CR>



- 0 = Speed as set by Pot 1
- 1 = 4,800 half steps per second
- 2 = 2,400 ditto
- 3 = 1,200 ditto
- 4 = 600 ditto
- 5 = 300 ditto
- 6 = 150 ditto
- 7 = 75 ditto

The default/power on setting is 0; speed setting defined by POT 1 adjustment.

### GSM5TERM>EXE Software Control of Motor Speed

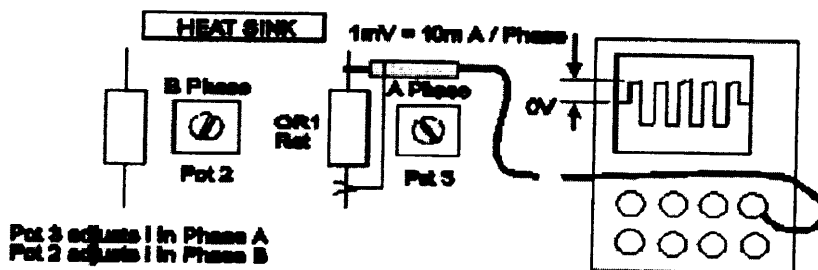
When the programme GSM5TERM is run, or GSM5TERM TESTMODE, the motor speed selection column is shown to the right of the screen. The up/down cursor keys are used to select the required motor speed. The => point to the selected speed. The speed selected will apply for all other commands until another speed is selected.

The "Variable" option is the speed selected by the pot 1 setting.

### GSM5 - ON BOARD SETTINGS

**POT 1** adjusts the speed of the motor in 1/2 steps / second. This pot should only be adjusted as required during the setting up stage of the process to give the required motor speed.

**POT 2 & 3** are adjusted to provide the required winding current for the motor. It is advisable to start with the pot at minimum (fully clockwise) and increase slowly until motor current is sufficient to drive the motor. To adjust the current connect an oscilloscope across Ref. (0.1R) resistor. Adjust POT 2 or 3 for required reading of wave form where 0.1mV = 10 mA winding current.



For example if the motor winding recommended current is 4.5 Ampere then the pot 2 should be adjusted to read 450mV+ VE on oscilloscope. A limit switch may be connected to the GSM5.

### SERIAL PORT SETUP (COM 1)

9600 Baud

8 Bits

No Parity

1 Stop Bit

## DEFAULT SETTINGS

On power up the GSM5 sets to the following default settings.

100% motor current option OFF.

Half motor current when stopped.

Current boost for ramp OFF.

No Ramp.

Half step mode

## WARNINGS AND SAFETY INFORMATION

- 1/. Stepper motors and some components on the GSM5 get very **HOT!**
- 2/. Ensure motors are not over driven! Refer to motor specification.
- 3/. Ensure the GSM5 and PSU5 are well ventilated.
- 4/. **DO NOT** disable the GSM5 fan.
- 5/. **WARNING** High voltages are generated on the GSM5 circuit board. Stepper motors generate high "Back EMF" voltages. Allow time for the magnetic fields to decay and caps to discharge after disconnecting the power before disconnecting the motor.
- 6/. **DO NOT** connect or disconnect the motor with power supplied to the GSM5.
- 7/. The **MAXIMUM** motor drive voltage is 80 V.
- 8/. Ensure the mains input is adequately fused.
- 9/. The GSM5 and stepper motors generate RF frequencies, appropriate screening is recommended.

## USING CONTROL PROGRAMME

### INTRODUCTION

The GSM5TERM.EXE program is a simple self contained RS232 controller which allows new users of the GSM5 stepper motor controller to get a system up and running very quickly. It offers all the features of the GSM5 to the user by assigning the various commands to function keys and

asking for the required parameters where necessary. The software can be used in two modes. Normal mode allows the control of up to 4 GSM5 units, while test mode allows the software to be used without the need for a GSM5 unit to be present. To run the software in test mode, enter the following at the DOS prompt : C:\> **GSM5TERM TESTMODE**. Use this mode to become familiar with the software.

To run the software in the normal control mode, enter the following at the DOS prompt : C:\> **GSM5TERM** .

When the software first runs, it sends ID requests to each of the four possible GSM5 units which could be connected. If any respond, this is noted and a status message is printed showing which GSM5 addresses are active. The last GSM5 which responded, becomes the default one. To select a different GSM5, use the number keys 0,1,2 & 3. If the requested GSM5 is not active, an error message will be displayed.

### USING THE SOFTWARE

Each of the GSM5 commands has been assigned to a function key as follows:

Command .....	Key .....	Purpose
A .....	F1 .....	Move Anticlockwise
C.....	F2 .....	Move Clockwise
E.....	F3 .....	Move Anticlockwise or until limit switch operates
G.....	F4 .....	Move Clockwise or until limit switch operates
D .....	F5 .....	Set-up Motor control options
F .....	F6 .....	Set-up Ramp length and slope

Each of the above commands will ask for any required parameters and will wait until the command has finished and the GSM5 is ready for another command before continuing.

An additional mode is included in the software in which the motor can be driven using the left and right cursor keys and displays the total offset from the start position. Each press of the left or right cursor keys moves the motor 10000 steps in the chosen direction (left cursor = clockwise, right cursor = anticlockwise). The number of steps can be changed using the PgUp and PgDn keys. The total number of steps moved is displayed with the direction. It also allows the motor to be automatically moved back to the "zero" reference point. This is a simple way of checking the repeatability of the mechanical system attached to the motor.

### UNDERSTANDING THE SOFTWARE COMMANDS

There are two motor drive option commands, options D and F.

Option D has 5 sub-options

.....Sub-option "u" selects 100% motor current when running. (If not selected motor runs at 66%).

.....Sub-option "w" selects motor current Off when motor stopped.

.....Sub-option "x" selects ½ motor current when motor stopped.

Note: If both options "w" and "x" are selected then option "w" will override option "x".

.....Sub-option "y" selects current boost for ramp length.

All sub-options are selected / deselected by 1 or 0. (1 = select 0 = deselect).

Option F has two sub-options

.....Sub-option "xxx" can be specified between 001 and 999 to set the length of the ramp, (number of ½ steps)

.....Sub option "y" can be specified between 1 and 9 to set the slope of the ramp.

(Further explanation of ramp settings later).

There are four movement command options A, C, E, G.

.....A and E give anticlockwise movement.

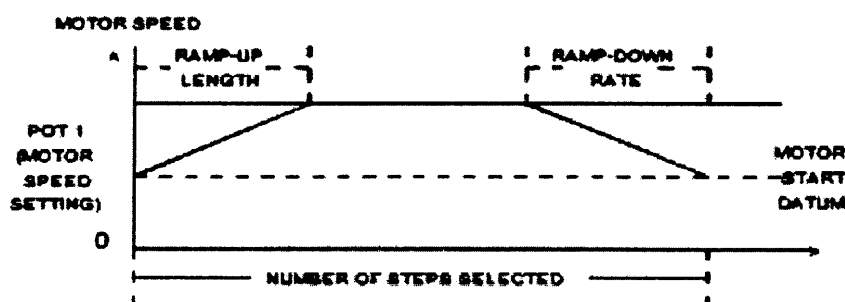
.....C and G give clockwise movement.

.....Command option A specifies anticlockwise movement for 1 to 99999 steps.

.....Command option C specifies clockwise movement for 1 to 99999 steps

.....Command options E and G specifies anticlockwise or clockwise movement for 1 to 99999 steps or until the limit switch opens, which ever event happens first. (No Ramp, stays at start speed).

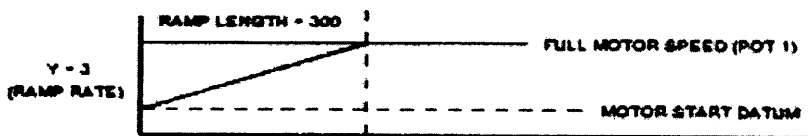
## RAMPS



$$\text{MOTOR START DATUM SPEED} = \frac{\text{MOTOR MAXIMUM SPEED} \times 48}{48 + \left( \frac{\text{RAMP LENGTH}}{\text{RAMP RATE}} \right)}$$

\* If the slope of 0 is specified then Ramp Rate = 256 otherwise the rate is as programmed by the F command.

**EXAMPLE**



$$\text{MOTOR START DATUM SPEED} = \frac{\text{MOTOR MAX. SPEED (POT 1 SETTING)} \times 48}{48 + \left(\frac{\text{RAMP LENGTH}}{\text{RAMP RATE}}\right)}$$

For the example above, if motor speed set at 400 step / second.

$$\text{MOTOR START DATUM SPEED} = \frac{400 \times 48}{48 + \frac{300}{3}} = \frac{19200}{148} = 130 \text{ Steps / Sec.}$$

**NOTES**

1/. If limit switches are used and motor drive options E or F are specified then the ramp parameters are disabled except that, where a ramp has been programmed, the motor speed will start at, and remain at, the motor start datum speed appropriate to the ramp specified.

2/. Ramp Parameter. Ramp length ÷ Ramp rate (slope) is limited to a ratio of 200 : 1

If Ramp length ÷ Ramp rate > 200 then the motor will be driven at the motor start datum speed until the ratio is equal to or less than 200 and then the ramp up will apply.

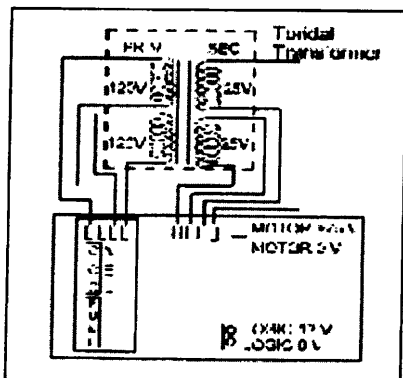
Therefore if a ramp length of 500 steps is chosen with a rate of 2 the ratio will be 250 and the motor will run for 100 ½ steps at datum speed until the ratio is 200 whereupon the motor speed will increase at the chosen rate until the ramp length has been achieved.

**PSU5 - POWER SUPPLY CARD (For use with the GSM5)**

Two transformer isolated DC outputs are provided, one for logic and a second for motor drive.

INPUT .....240 Volt AC

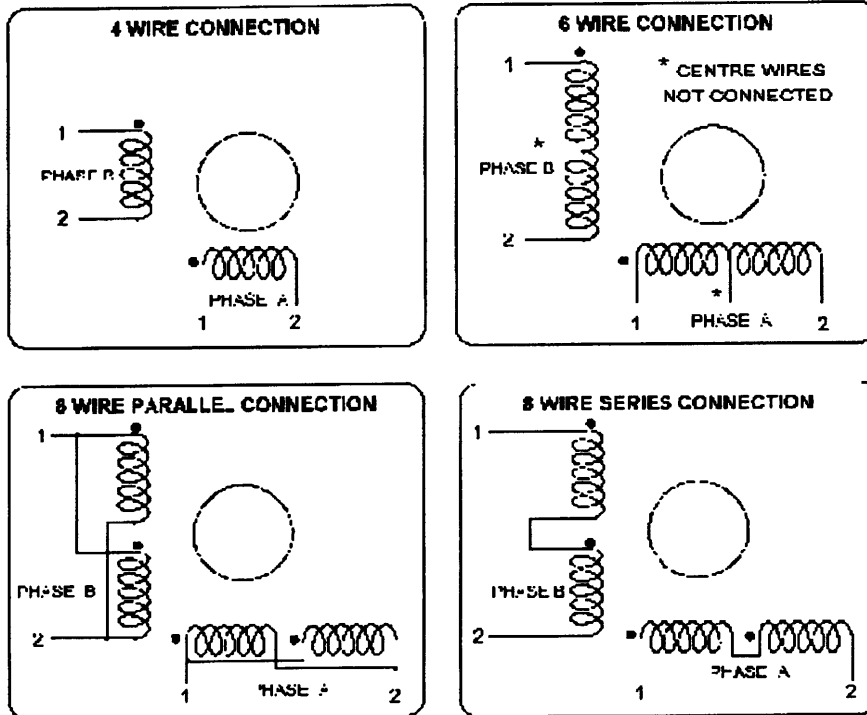
OUTPUT .....250 mA., @ 12 Volt DC (Logic and Fan).....3.2 Amp., @ 70 Volt DC (Motor)





**NOTES** For pinout / connections see block diagram. Although the motor supply is only rated at 800 mA., this should be sufficient for most 1.5 Amp. / phase stepper motors. Fuse, short circuit protection, and mains voltage shielding is left to the customer to implement.

### STEPPER MOTOR CONNECTIONS



#### NOTES:

- 1/. The GSM5 is not suitable for 5 wire motors.
- 2/. Reversing the wires of any one phase will reverse the direction the motor rotates in response to commands.
- 3/. 8 Wire parallel connections give higher rotational speed.
- 4/. 8 wire series connections provide higher motor torque.
- 5/. Always refer to the motor manufacturers data.

### GENERAL NOTES

- 1/. The stepper motor chosen for use with the GSM5 must be fully compatible with Bipolar drivers.
- 2/. Motor torque is motor current and motor speed related. Torque is proportional to current and inversely proportional to speed.

- 3/. The effective motor impedance is proportional to the load and the speed of the motor.
- 4/. The GSM5 will supply sufficient current for motors specified at 5 Amp / phase. Motors with higher current requirements can be driven but they will not run at full power.
- 5/. Ramps are used to provide increased starting torque and to overcome motor resonance.
- 6/. Current boost is dependent upon the setting of Pots 2 & 3 and is available for the length of the ramp only.
- 7/. When adjusting Pots 2 & 3 it is recommended that the initial winding current is set at less than the value recommended for the motor and that the motor is driven at this current whilst the motor temperature is monitored. Avoid running the motor at high temperatures. (See motor manufacturers specification).
- 8/. Stepper motor drivers generate large amounts of RFI and should be enclosed in an adequately screened enclosure, having good ventilation.
- 9/. The GSM5 gets hot and generates high discharge voltage. Take all reasonable precautions when using.

## **Application Notes for GSM5 Series Stepper Motor Controller.**

### **Programming Advice**

The following notes are intended to serve as a starting point in showing the possible options for controlling stepper motors using the Greenwich Instruments range of GSM5 Driver Cards.

### **What Is The Purpose Of The GsmTerm Program Supplied With The Card?**

The GSM5 Controller is supplied with a software driver disk. The Disk contains a very simple DOS based program that can be used to test that your motor and controller are set up correctly. Using the software it is possible to test simple movements and functions of the motor configuration. It's main use is to allow you to verify that the the motor and card have been set up and wired correctly.

### **Using The ASCII Commands**

It is most likely however that you will require a much greater control over the stepper motor. In which case you can use the ASCII text commands listed under the section SOFTWARE COMMANDS in the GSM5 Operating Manual.

The Serial Port must have it's parameters set to 9600 Baud, 8 Data Bits, No Parity, and no hardware or software handshaking.

All commands are sent as plain ASCII text through the appropriate Serial Port. For testing it is possible to use any terminal type program with the serial port configured as described above. (e.g. HyperTerminal as supplied with Windows 95/98).

The following characters show an example of how to move the motor anticlockwise 200 steps on a card set to address 0 :- **200A0<CR>**

(\*<CR> being a carriage return).

Upon receiving the command the card will echo back the command letter and the drive address, which in this case would be :- **A0**

This forms the basis upon which sequences of commands can be put together.

### **How Do I Create A Sequence Of Motor Movements?**

There are a number of ways in which sequences of commands can be created. The method you decide to use is basically down to your relevant programming experience and the tools you have available to you.

#### **1) Terminal Programs**

Many "Terminal" programs have the facility to allow "Scripts" to be written. Therefore it is normally possible to use the Scripting Language to create sequences of commands. Normally scripts can be used to create loops, delays between successive commands, and decisions dependant upon the controller responses.

#### **2) DOS using BASIC**

QBASIC or QuickBasic are two DOS based development tools that are relatively straight forward to use. QBasic was supplied as part of MSDOS versions 5 and 6.xx. The on-line help pages provide examples of how to open the serial port, and how to send and receive ASCII data through the port. The commands associated with setting up the serial port and sending data to it are:- OPEN COM, COM, PRINT, GET & PUT. Once a serial port has been successfully opened it is possible use the PRINT command to send strings of text (e.g. 200A0) through the port.

#### **3) Control under Windows**

Control under Windows can be achieved using any development tools that allows access to the Serial port. Visual Basic, Visual C++, Borland Delphi & C++ Builder are all popular programming languages that can be used to control the motor.

Windows does not allow you to send data to the directly as with DOS, instead you need to communicate to the serial port through a serial port driver. Visual Basic & C++ ship with a control called MSCOMM32 which can be used for this purpose. If the programming language does not come with a driver is normally possible to use a third party serial port driver.

The programming pages of the internet provide a rich source of information and freeware & commercial drivers. [www.marshallsoft.com](http://www.marshallsoft.com) provides a good shareware driver with excellent documentation and examples on using the driver with Windows 3.11 95/98/NT. Look at the example file Simple for a quick guide to setting up and using the serial port.

#### **4) Other Languages**

Basically it is possible to control the Stepper Motor Card from any software that can access the

serial port. The device used to control the motor is not limited to being a PC, it can be any device that has a serial port that can be configured as described above.

### **How Do I Know When A Command Has Finished Executing?**

When a command is sent to the GSM5, the card immediately responds by echoing back to the PC with the command letter and drive address. The GSM5 will then ignore any further commands being sent until it has completed the previous task. i.e. any commands that are transmitted to the GSM5 whilst the GSM5 is currently executing will not receive an echo back to indicate the the command has been successfully received by the GSM5.

Therefore to guarantee that all commands in the sequence are executed in turn, each command that is sent must receive an acknowledgement back from the GSM5 before moving onto the next command. One such way of doing this is to wait for a valid response after each command is sent. If the response is not received, it can be assumed that the card was still busy when the command was sent, in which case the command will need to be resent.

Alternatively it is possible to use the "B" command to Poll the card to see if it is busy. In this case the card will again ignore all the "B" commands until the it is free to respond with the ID message plus the limit switch status, which signals that the motor has finished the previous command.

[Homepage](#)[SALES FORM](#)[Distribution](#)