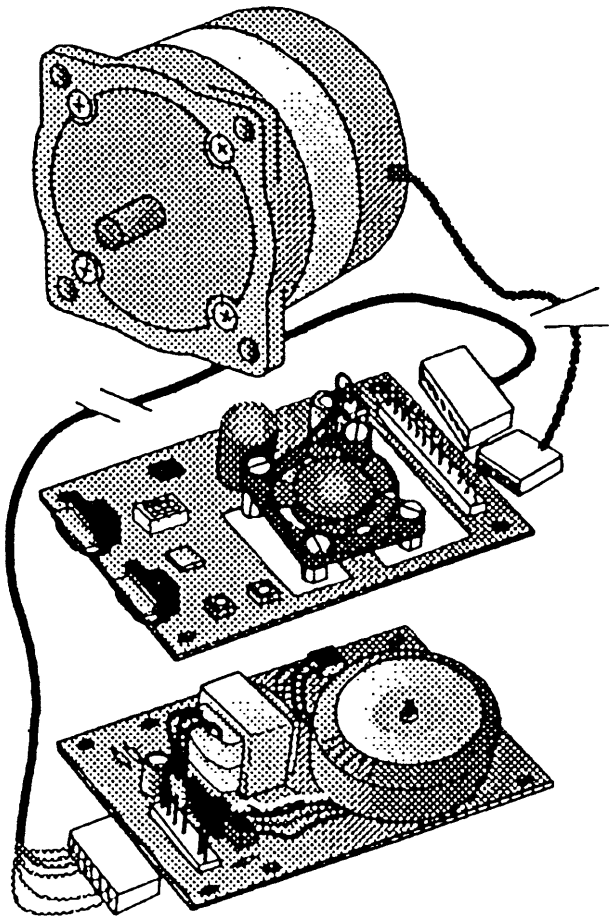
GREENWICH
INSTRUMENTS LTD

650-109

GSM4

INTELLIGENT RS232C TO 4 PHASE STEPPER MOTOR DRIVER CARD OPERATING MANUAL



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CONTENTS

Please read this manual fully before attempting to connect the GSM4 to the stepper motor.

Please read WARNINGS AND SAFETY INFORMATION on page 8

PRODUCT OVERVIEW

The GSM4, together with the optional PSU2 power supply, provides a comprehensive facility for controlling 4 or 8 wire Bipolar driven stepper motors. Up to 4 GSM4 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 GSM4 to control motor direction, number of steps, start and stop ramp length and slope, motor current and ½ / full step. 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

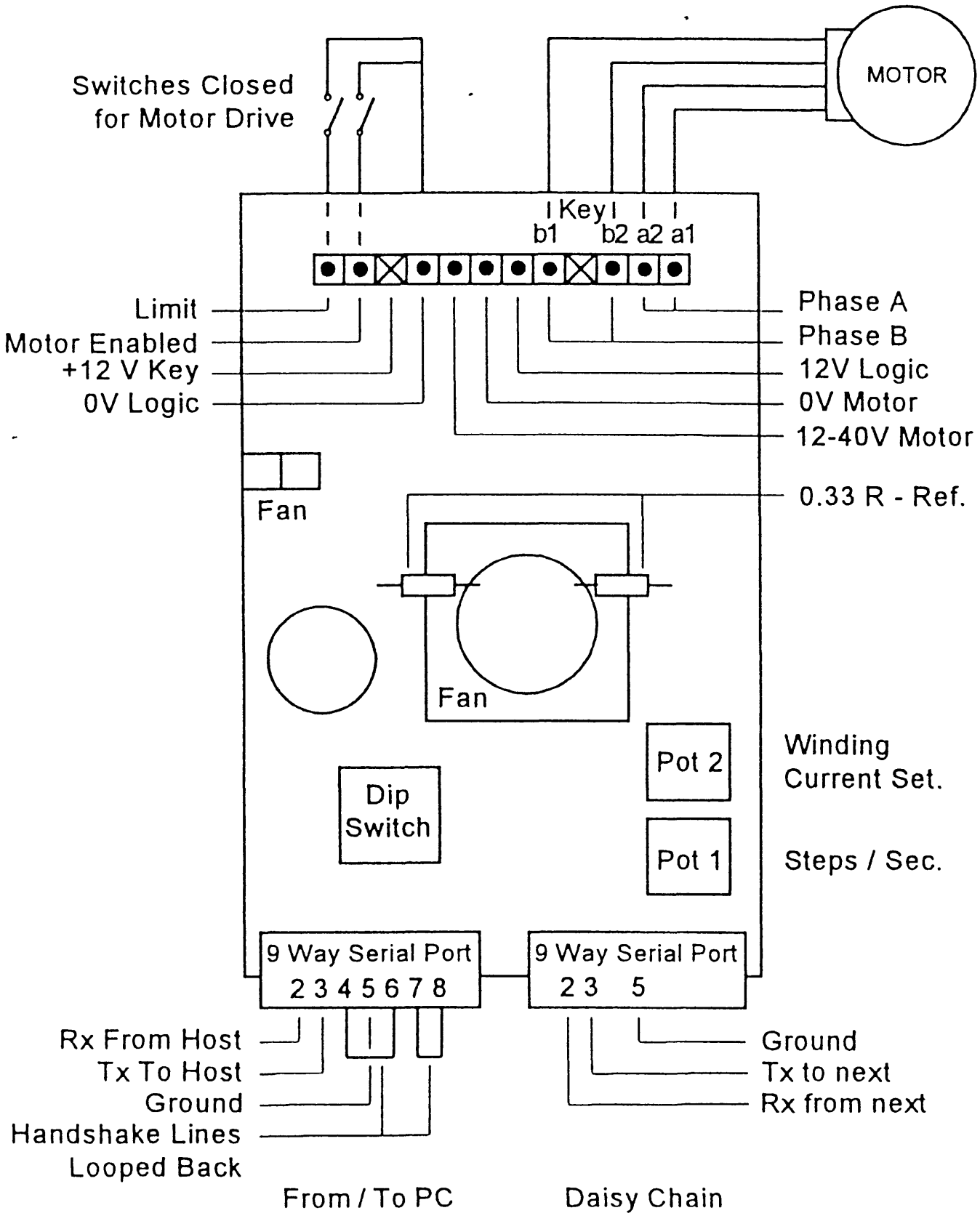
MOTOR DRIVE: 4 or 8 wire bipolar current switching, up to 1.5 ampere / phase Voltage 12 to 40 Volts DC (maximum).

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.

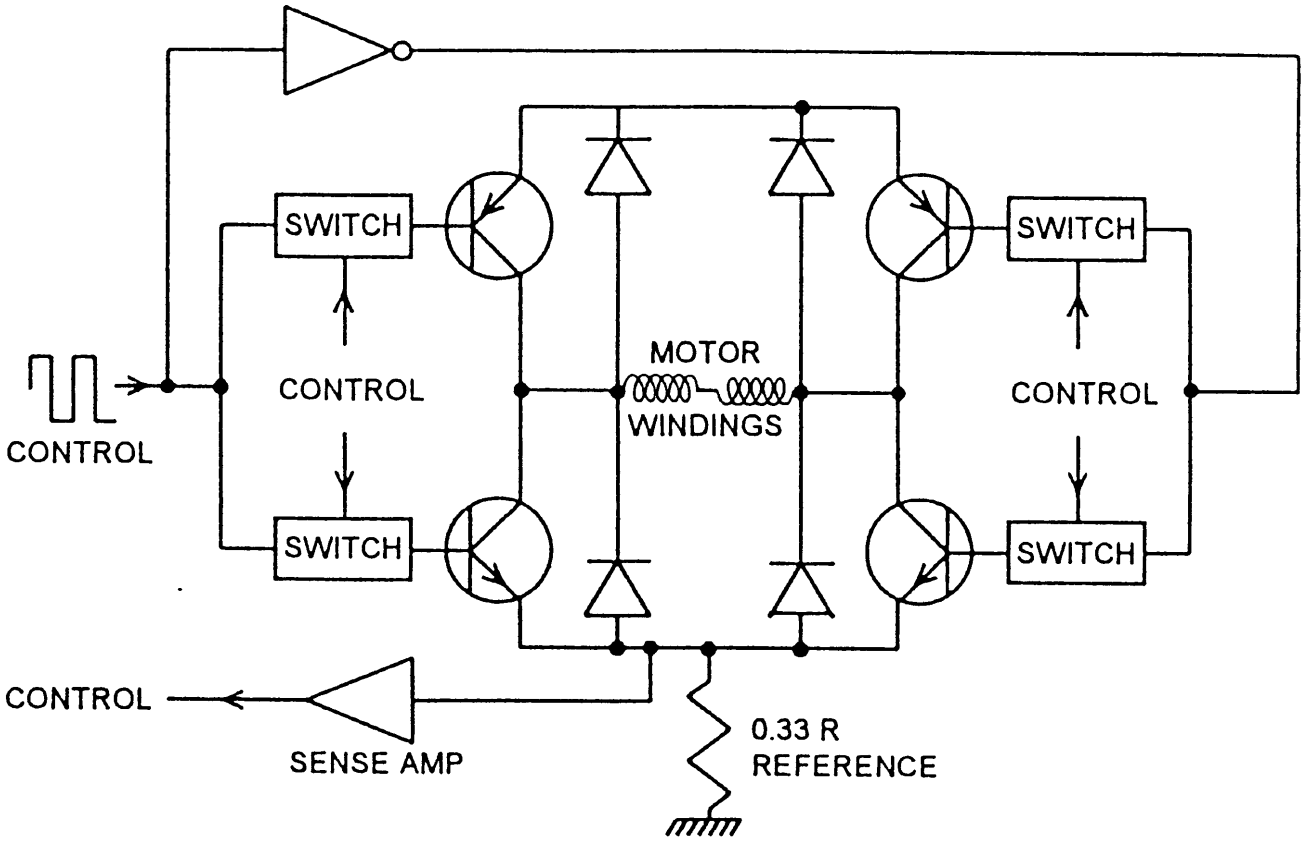
MOTOR CONTROL: Current, speed, direction, ½ current, boost, ½ / full step, number of steps (0-99999), ramp (length and slope), limit and enable switch provision.

BOARD LAYOUT

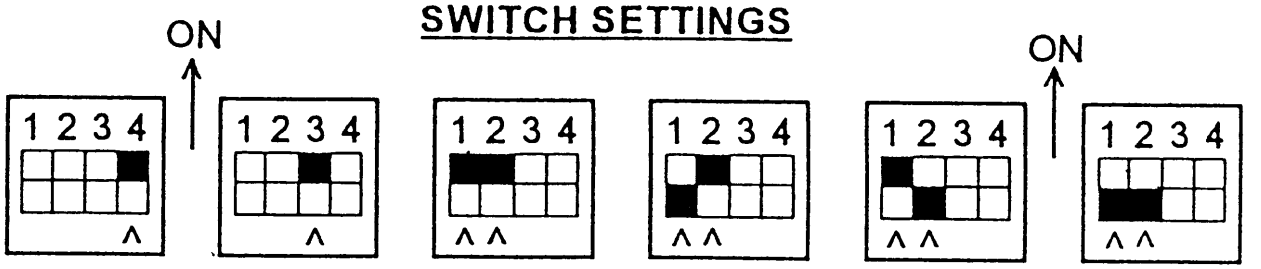


MOTOR DRIVE SCHEMATIC

(One Phase)



SWITCH SETTINGS



DIMENSIONS

Length = 150mm Width = 100mm height = 35mm

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 **<CR>** or **linefeed**. The card will echo back via the RS232 the command letter and the card address.

SOFTWARE OPTION COMMANDS

The following commands select card parameter options associated with motor current, ½ / full step, ramp length and slope. (If not specified default settings would apply - See page 7)

u w x y z D o <CR> — MOTOR CONTROL OPTIONS

- Carriage return / linefeed
- Address of card (0, 1, 2, 3,)
- Command letter (Option D)
- ½ step (0 = full step 1 = ½ step)
- Current boost for ramp length (0 = NO 1 = YES)
- ½ motor current when stopped (0 = NO 1 = YES)
- Motor current off when stopped (0 = NO 1 = YES)
- 100% motor current when running (0 = NO 1 = YES)
  (Approximately 66% if not selected)

x x x y F o <CR> — SELECT RAMP LENGTH AND SLOPE

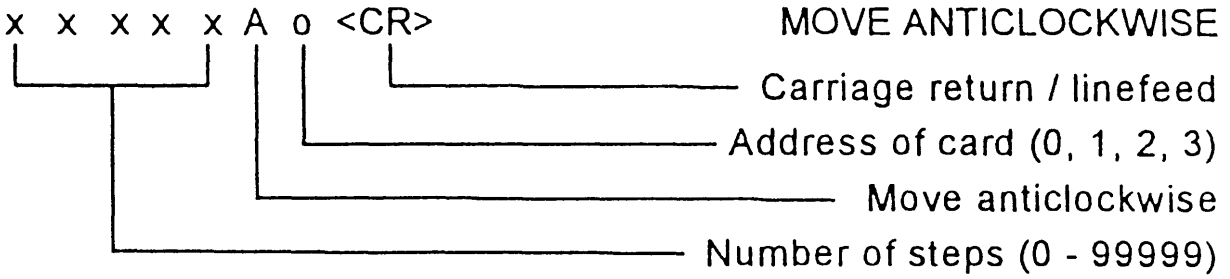
- Carriage return / linefeed
- Address of card (0, 1, 2, 3)
- Command letter (option F)
- 0 - 9. Rate (slope) of ramp
- 0 -999. Length of ramp (steps)

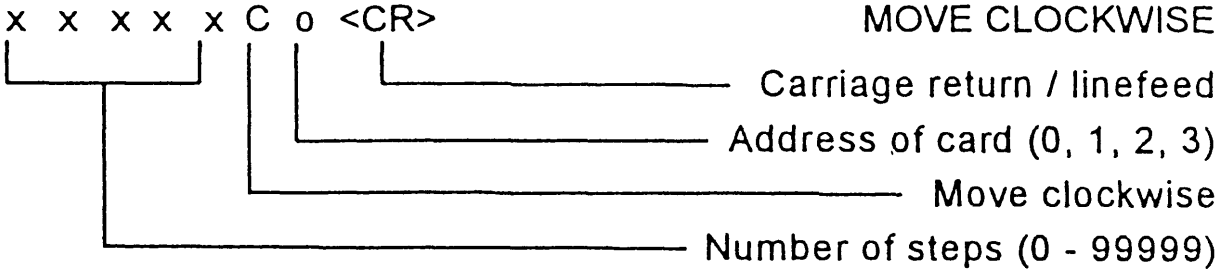
B o <CR> — POLL SPECIFIED CARD

- Carriage Return
- Address of Card (0, 1, 2, 3)
- Command Letter (Option B)

This command polls the card specified at address entered and returns an ID message plus limit switch status. e.g. B GSM4 999 JAN 95 L/F C/R or B GSM4 999 JAN 95 Limit Open L/F C/R

SELECT MOTOR MOVEMENT COMMANDS





x x x x x E 0 <CR> MOVE ANTICLOCKWISE
SPECIFIC NUMBER OF STEPS (0 -99999) OR UNTIL LIMIT SWITCH OPERATES. No Ramp, stays at start speed. (See Ramp Parameters page 11)

x x x x x G o <CR> MOVE CLOCKWISE
SPECIFIC NUMBER OF STEPS (0 -99999) OR UNTIL LIMIT SWITCH OPERATES. No Ramp, stays at start speed. (See Ramp Parameters page 11).

GSM4 - ON BOARD SETTINGS

POT 1 Pot 1 adjusts the speed of the motor in 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 Pot 2 is adjusted to provide the required winding current for the motor. It is advisable to start with the pot at minimum (fully anticlockwise) and increase slowly until motor current is sufficient to drive the motor. Accurate setting of the pot can be achieved by connecting a meter set to Volt DC across R ref. (0.33R) and adjusting the pot to give the correct meter reading. 1mV., across R ref. = 3mA., winding current.

ON BOARD SETTINGS (Cont.)

POT 2 (Cont.)

For example if the motor winding recommended current is 1.5 Ampere then the pot 2 should be adjusted to read 500mV. **Warning !** Under no circumstances connect a meter set to Ohms Range, or any other voltage source, across R ref., as this will destroy the motor drive controller.

Limit and motor enable switches may be connected to the GSM4. If the motor enable switch is NOT used the appropriate terminal on the GSM4 must be linked to OV logic.

DEFAULT SETTINGS

On power up the GSM4 sets to the following default settings.

Full step mode.
No Ramp.
100% motor current option OFF.
Motor current ON when stopped.
Current boost for ramp OFF.

PSU2 - POWER SUPPLY CARD
(For use with the GSM4)

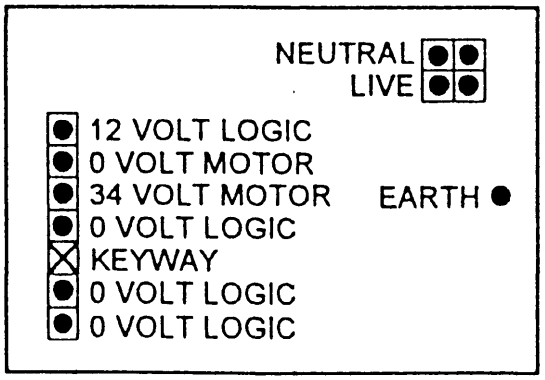
Two transformer isolated DC outputs are provided, one for logic and a second for motor drive.

INPUT	240 Volt AC
OUTPUT	250 mA., @ 12 Volt DC (Logic and Fan)
	800 mA., @ 34 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.

BLOCK DIAGRAM



DIMENSIONS

LENGTH.....150mm
WIDTH.....100mm
HEIGHT.....45mm

WARNINGS AND SAFETY INFORMATION

1. Stepper motors get very **HOT!**
2. Ensure motors are not over driven! Refer to motor specification.
3. Ensure the GSM4 and PSU2 are well ventilated.
4. **DO NOT** disable the GSM4 fan.
5. **DO NOT** connect or disconnect the motor with power supplied to the GSM4
6. Stepper motors generate high "Back EMF" voltages. Allow time for the magnetic fields to decay before disconnecting motors.
7. The **MAXIMUM** motor drive voltage is 40 V. **DO NOT** exceed 40 VOLTS.
8. Ensure the mains input is adequately fused. The recommended mains input fuse rating is 250mA Slow Blow.
9. The GSM4 and stepper motors generate RF frequencies, appropriate screening is recommended. CE an EMC directive!
10. **DO NOT** connect a meter set to Ohms Range to the Reference resistors.

USING CONTROL PROGRAMME

INTRODUCTION

The GSM4TERM.EXE program is a simple self contained RS232 controller which allows new users of the GSM4 stepper motor controller to get a system up and running very quickly. It offers all the features of the GSM4 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 GSM4 units, while test mode allows the software to be used without the need for a GSM4 unit to be present. To run the software in test mode, enter the following at the DOS prompt :

C:\> GSM4TERM 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:\> GSM4TERM

USING CONTROL PROGRAMME (Cont.)

When the software first runs, it sends ID requests to each of the four possible GSM4 units which could be connected. If any respond, this is noted and a status message is printed showing which GSM4 addresses are active. The last GSM4 which responded, becomes the default one. To select a different GSM4, use the number keys 0,1,2 & 3. If the requested GSM4 is not active, an error message will be displayed.

USING THE SOFTWARE

Each of the GSM4 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 GSM4 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.

Sub-option "z" selects ½ or full step. 0 = full step.

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.

(See page 11 for further explanation of ramp settings).

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

A and E give anticlockwise movement.

C and G give clockwise movement.

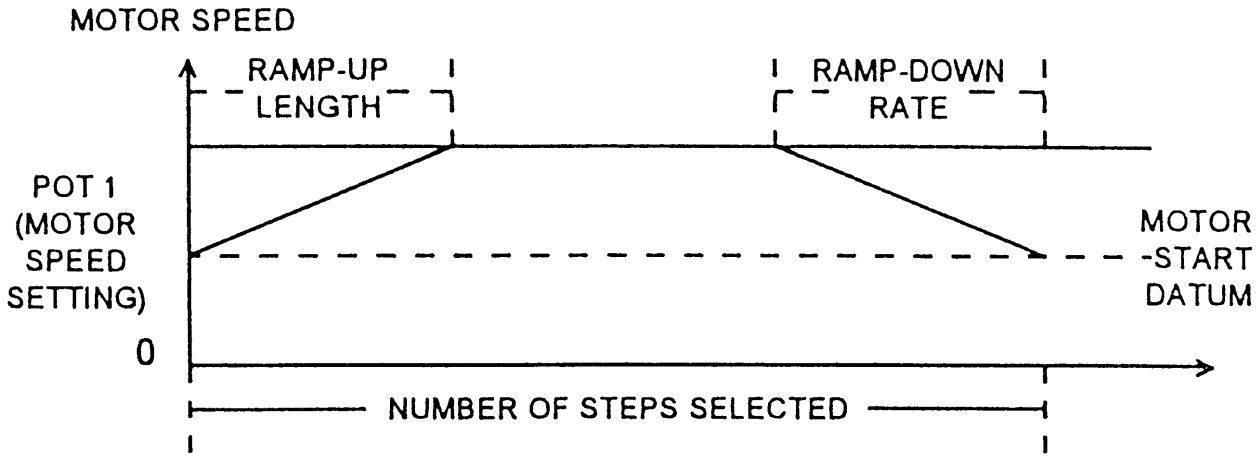
Command option A specifies anticlockwise movement for 1 to 99999 steps

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).

UNDERSTANDING SOFTWARE (Cont.)

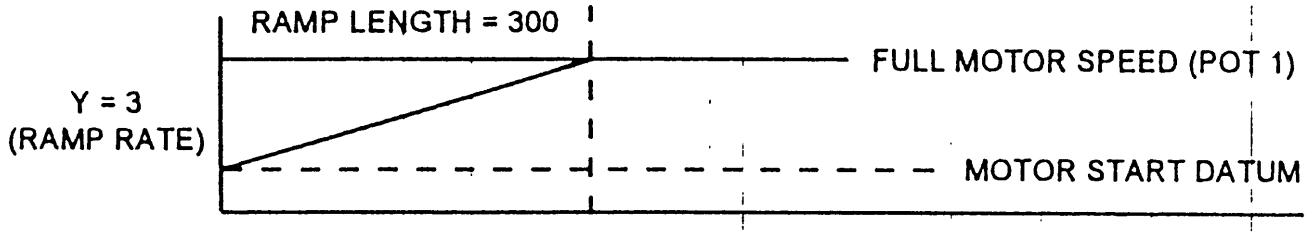
RAMPS



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

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

EXAMPLE



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

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

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

UNDERSTANDING SOFTWARE (Cont.)

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.

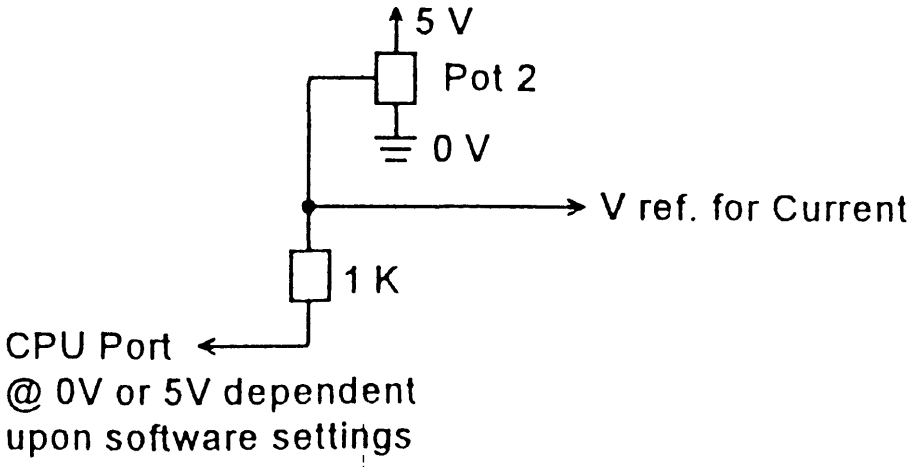
V REF SETTINGS

Full step V ref @ 5V I = 1 Amp. Both windings.
Half step V ref @ 5V I = 1.5 Amp. One winding.
} Pot 2 set to maximum

Boost = CPU Port switched to 5V. - Software selected

Full Power, Full Step V ref @ 5V I = 1.5 Amp. Both windings. (Software selected option)

V ref @ 0V I = 0 mA



GENERAL NOTES

1 The stepper motor chosen for use with the GSM4 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 GSM4 will supply sufficient current for motors specified at 1.5 Amp / winding. Motors with higher current requirements can be driven but they will not run at full power.

5 If motor enable switch is not used the appropriate connector must be linked to 0 Volt Logic.

6 Ramps are used to provide increased starting torque and to overcome motor resonance.

7 Current boost is dependent upon the setting of Pot 2 and is available for the length of the ramp only.

8 When adjusting Pot 2 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).

9 Stepper motor drivers generate large amounts of RFI and should be enclosed in an adequately screened enclosure, having good ventilation.

WARRANTY

By this Consumer Guarantee Greenwich Instruments Limited guarantees this product to be free of defects in materials and workmanship at the time of its original purchase from the Retailer for the period of one year. If during this period of guarantee the product proves defective due to improper materials or workmanship Greenwich Instruments will without charge for labour or parts repair or (at its option) replace this product or its defective parts on the conditions set out below.

1. The customer will not alter, adapt, change or in any way adjust the product, except as detailed in this manual.

2. This guarantee does not cover:
   i) Maintenance or replacement of parts due to fair wear and tear.
   ii) Home service or transport costs to the Dealer.
   iii) Damage to this product resulting from a) abuse or misuse by the customer including failure to follow Greenwich Instruments instructions in the user manual or b) the installation or use of the product in a manner inconsistent with the technical or safety standards in force at the time.

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