# PVP2435 3.5 Amp Bipolar Stepper Motor Drive Board

## Specification

### Electrical

Motor Supply:
+15 to +36 Vdc (+10% max.) smoothed unregulated.

Logic Supply:
+15 to +24 Vdc (+10% max.) smoothed unregulated.
**Note:** the motor and logic may share the same power supply up to +24V or provided a dropper resistor is fitted.

AUX Outputs:
+12V regulated 50mA max.
+ 5V regulated 50mA max. } available for external circuitry

Motor Drive Output:
Bipolar chopped constant current with overload protection.
3.5 Amps per phase max output – may be set lower by means of D.I.P. switch or external resistor.
Suitable for driving hybrid or permanent magnet motors with 4, 6 or 8 leads.

Control Inputs:
C.M.O.S. Schmitt trigger inputs operating at +12V with 10kΩ pull ups and diode isolation.
Logic 0 (low) – 0V to +2V or contact closure to 0V.
Logic 1 (high) – +9V to +30V max. or open circuit.

Monitor Outputs:
Open collector NPN transistor (ref. to 0V)
Low level – +1V max. at 30mA max.
High level – open circuit +24V dc max.

### Mechanical & Physical

Card Size
Eurocard format 160mm long x 100mm wide x 62mm high.

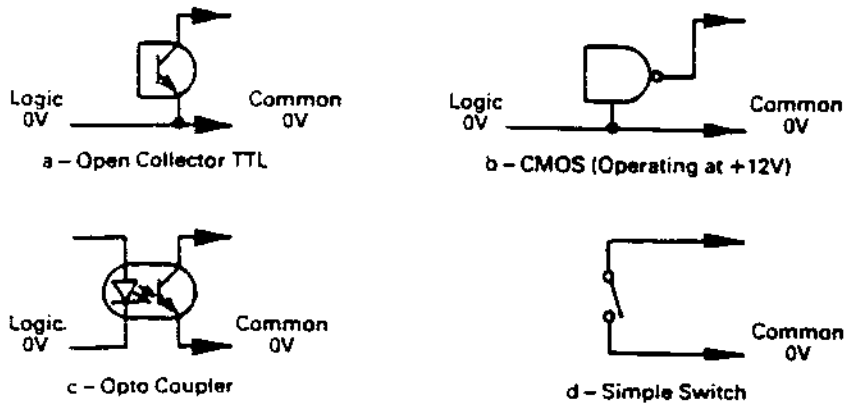
Weight
700 grams approx.

Connector
32 way PCB plug to DIN 41612 type D.

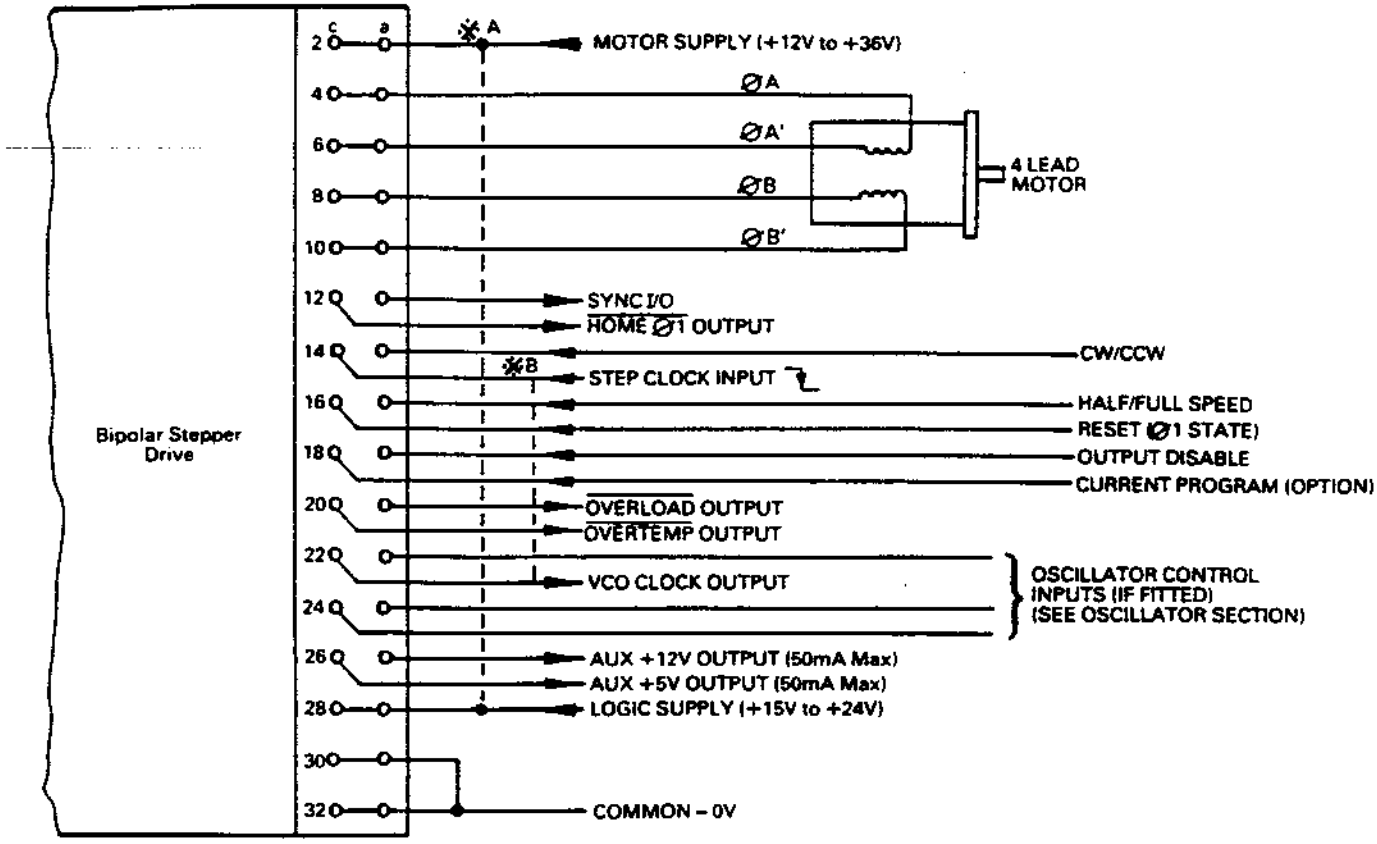
Printed Circuit Board
1.6mm Glass fibre with solder mask and component identification.

Temperature
Operating range 0°C to +40°C max. ambient.

**Figure 1 Control Input Options**



## Figure 2 Board Connections




* A – Logic may share motor supply if between +15v and +24v.
* B – If the on-board VCO has been fitted the VCO output may be connected directly to the step clock input.

### Board Connection Details

Connector style DIN 41612 type D 32 way rows 'a' & 'c'.

| *Pin* | *Function* |
|---|---|
| 2 a & c | Motor supply input |
| 4 a & c | Motor phase output 1 |
| 6 a & c | Motor phase output 1' |
| 8 a & c | Motor phase output 2 |
| 10 a & c | Motor phase output 2' |
| 12 a | Sync. Input/Output |
| 12 c | Home Phase Output |
| 14 a | CCW/CW Direction Control |
| 14 c | Clock Pulse Input |
| 16 a | Full/Half Step Control |
| 16 c | Reset Input |
| 18 a | Output Disable Input |
| 18 c | Current Program Input |

| *Pin* | *Function* | |
|---|---|---|
| 20 a | Overload output | |
| 20 c | Overtemp output (where fitted) | |
| 22 a | V.C.O. Control Input | where option fitted |
| 22 c | V.C.O. Pulse Output | where option fitted |
| 24 a | Base Speed Input | where option fitted |
| 24 c | Stop/Run Input | where option fitted |
| 26 a | Aux. +12V Output | |
| 26 c | Aux +5V Output | |
| 28 a & c | Logic Supply Input | |
| 30 a & c, 32 a & c | Supply Common 0V | |

### Pin Functions

2 a & c
Motor supply input. Should be smoothed unregulated and between +15V and +36V max.

4, 6, 8 & 10 a & c
Motor Phase Outputs. Connect one phase between pins 4 & 6 and the other phase between 8 & 10. These outputs are short circuit protected between phases and overload protected to 0V.

12 a
SYNC Input/Output. Used to synchronise drive cards in Multi-Axis systems to eliminate beat frequencies.

12 c
$\overline{\text{Home Phase}}$ Output. This output is low when the unit is powered up and subsequently when the translator logic is in its initial state.

14 a
CCW/$\overline{\text{CW}}$ Direction Control. Connecting this pin to 0V will reverse the direction of shaft rotation.

14 c
$\overline{\text{Clock Pulse}}$ Input. The motor will increment one step on a high to low going inpulse, which should remain active for at least 10$\mu$S. Maximum input frequency 20kHz.

16 a
Full/$\overline{\text{Half}}$ Step Control. Connecting this pin to 0V will select half step mode i.e. if the motor is normally 200 steps/rev. It will then produce 400 steps/rev. The output torque will normally be lower but resonance conditions are usually eliminated.

16 c
$\overline{\text{Reset}}$ Input. Connecting this pin to 0V will reset the internal logic to the Home Phase state (Home Phase output will be active).

18 a
$\overline{\text{Output Disable}}$ Input. Connecting this pin to 0V will disable the output stage thus allowing the motor to be rotated by hand if required.

18 c
Current Program Input. The motor current is normally programmed using the on-board D.I.P. switches but may be reduced by connecting a resistor from this pin to 0V. This may prove useful where the system current can be reduced with the motor at standstill.

20 a
$\overline{\text{Overload}}$ Output. This output will go low, and remain latched, if an overload or short circuit is detected and will also disable the output stage. This circuit is reset by either temporarily removing the power or by taking the Reset input low.

20 c
$\overline{\text{Overtemp}}$ Output. If the thermal switch has been fitted then this output will go low and remain low for as long as the condition exists. There is also provision on board to link this funtion into the output Disable circuit if required.

22 a
VCO Input. Applying a control voltage of between 0V and +12V will proportionally vary the output frequency of the internal V.C.O. (Optionally fitted)

22 c
VCO Output. A standard CMOS output (at +12V) of the internal V.C.O. This may be fed straight into the Clock Input (14 c). (Optionally fitted)

24 a
Base Speed. Connect a variable resistor (10k to 1 meg) between this pin and 0V if base speed is required. Base speed is defined as a V.C.O. offset frequency which the motor will start and stop at when the Stop/Run input is operated. (Optionally fitted)

24 c
Stop/$\overline{\text{Run}}$ Input. Connecting this pin to 0V will enable the internal V.C.O.

26 a
Aux +12V Output (50mA max) (available for external circuitry)

26 c
Aux +5V Output (50mA max) (available for external circuitry)

28 a & c
Logic Supply Input. Should be smoothed unregulated +15V to +24Vdc maximum.

30 a & c
Supply Common 0V.

32 a & c
Supply Common 0V.

### On Board Links

LK 1
Inserting this link disables the internal sync oscillator and converts the board into a SLAVE when being used in a Multi Axis system.

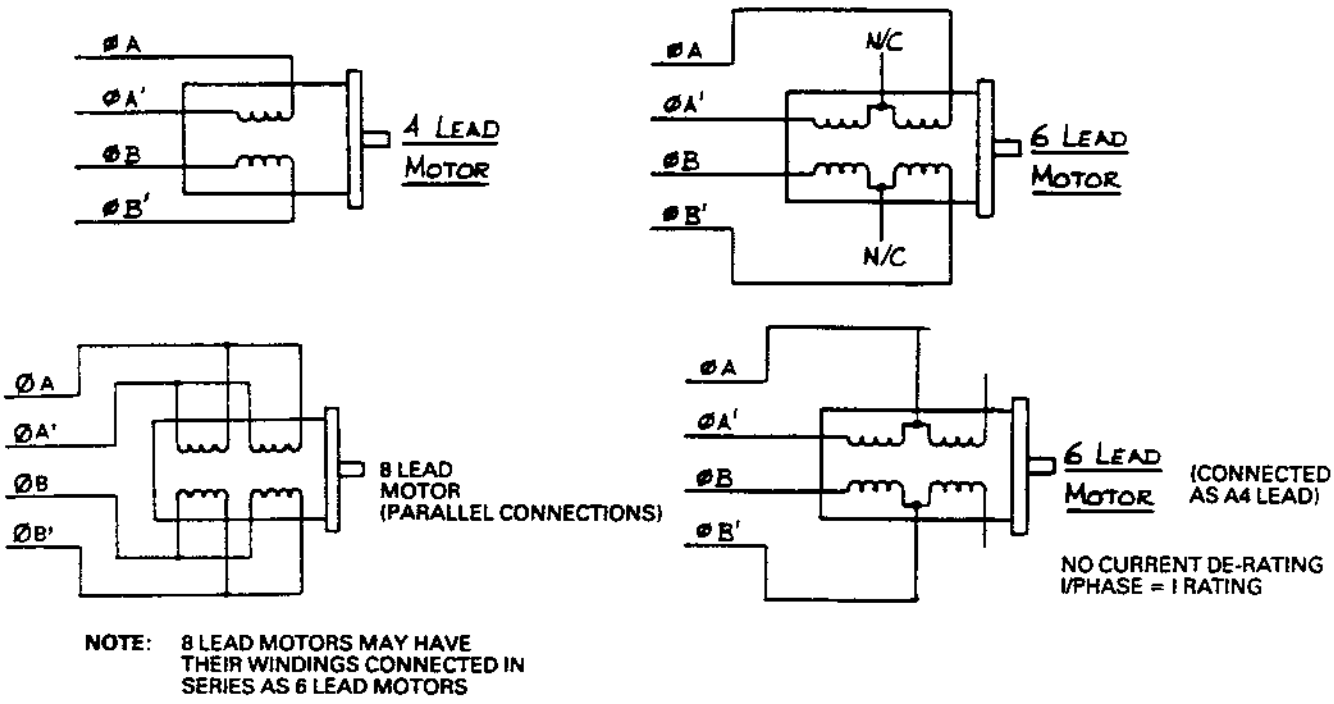
LK 2
Reserved.

LK 3
Reserved.

LK 4
Inserting this link will activate the output disable circuit in responding to the thermal switch.

### Connection to Stepper Motors and Motor Selection

Fig. 3




NOTE: 8 LEAD MOTORS MAY HAVE THEIR WINDINGS CONNECTED IN SERIES AS 6 LEAD MOTORS

The flexibility of on-board motor current selection enables a wide range of motors to be utilised. The best high speed torque performance will be obtained by using a motor with a higher current rating than the drive card (typically 3.5A to 6A) and a low winding inductance although low speed torque may suffer. Conversely for high torque low speed operation a motor with a higher winding resistance and inductance should be used.

When using 8 lead motors with coils in parallel the motor current should be set no greater than:–

$$\text{I per phase} \times \sqrt{2}$$

When using 6 lead or 8 lead motors with coils in series the motor current should be set no greater than:–

$$\text{I per phase} \times \left(\frac{1}{\sqrt{2}}\right)$$

Motors with 4 leads have a bipolar rating and can be used according to manufacturers specification.

## Nominal Motor Current vs Switch Settings

| *Nominal Current Per Phase* | *Switch Settings* | | | |
|---|---|---|---|---|
| | *S1* | *S2* | *S3* | *S4* |
| 3.5A | ON | ON | ON | ON |
| 3.25A | OFF | ON | ON | ON |
| 3.0A | ON | ON | ON | OFF |
| 2.7A | OFF | ON | ON | OFF |
| 2.4A | ON | ON | OFF | OFF |
| 2.25A | OFF | OFF | ON | ON |
| 2A | ON | OFF | ON | OFF |
| 1.6A | OFF | OFF | ON | OFF |
| 1.2A | ON | OFF | OFF | OFF |
| 0.7A | OFF | OFF | OFF | OFF |

An external current setting resistor may also be added between pin 18C and 0V to reduce the motor current if required. This facility is particularly useful for interchangeability in multi axis systems using difference motors, as all drive boards can be set at maximum and an external resistor added to dedicate that particular axis.

Another useful application for this feature is to switch in a resistor at standstill to produce a holding torque (typically 20%) and conserve power. To select the required current connect a high impedance voltmeter from pin 18c to 0V and increase/decrease the external resistor until the correct voltage is achieved, where the nominal scaling factor is

V = I per phase x 0.47

### On-Board Oscillator Assembly

If an external clock source is not available, an on-board oscillator can be assembled simply by soldering into place the PVP 2435 V.C.O. Kit.

**Note:** the oscillator clock output must be externally wired to the clock, input pin 14c.
It is necessary to remove the main heatsink to gain access to the p.c.b. To do this remove the 4 screws located on the top of the heatsink.

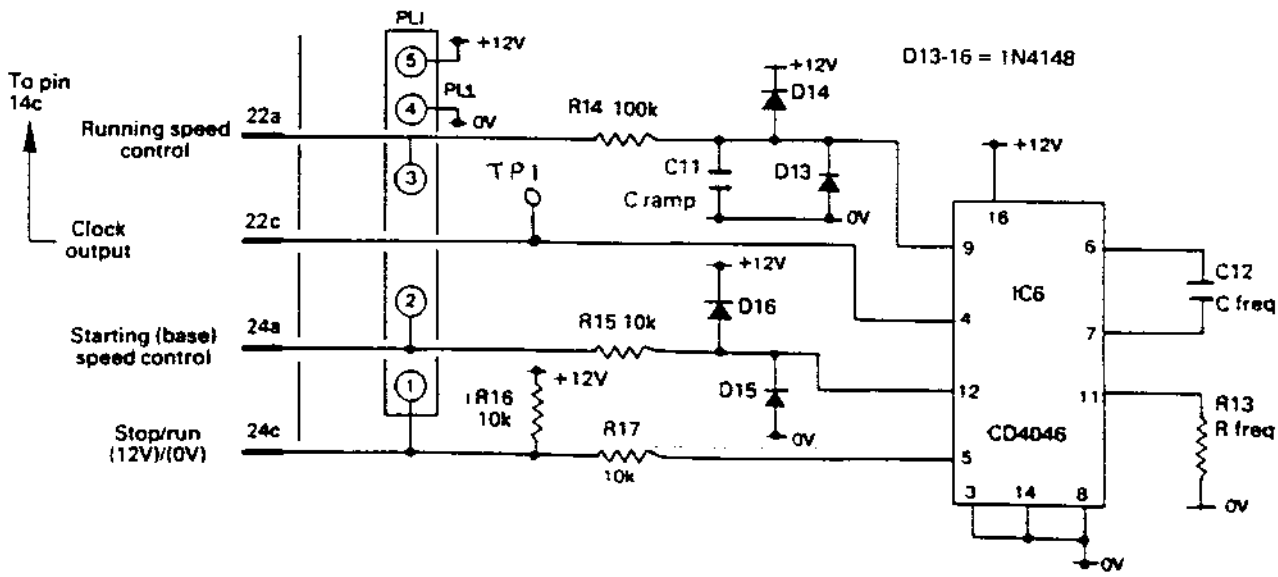



Fig. 4

### Starting (base) and running speed control

The on-board oscillator can be arranged to start at a fixed frequency (thus a fixed motor speed) and then ramp up to a final value (the running motor speed). This facility is available to start the motor within its pull-in performance region and then accelerate the motor through so that it can operate within the pull-out mode. On switch-off the motor decelerates automatically. Three parameters need to be determined for any application:

a. The starting speed: this should be below the pull-in speed for the motor (with any additional load).

b. The running (final) speed: this should be within the pull-out capability of the motor (with any additional load).

c. The acceleration and deceleration rate between starting and running speeds: this is limited by the motor capability to accelerate through its own (plus any load) inertia.

**Figure 5 Oscillator Controls (External)**

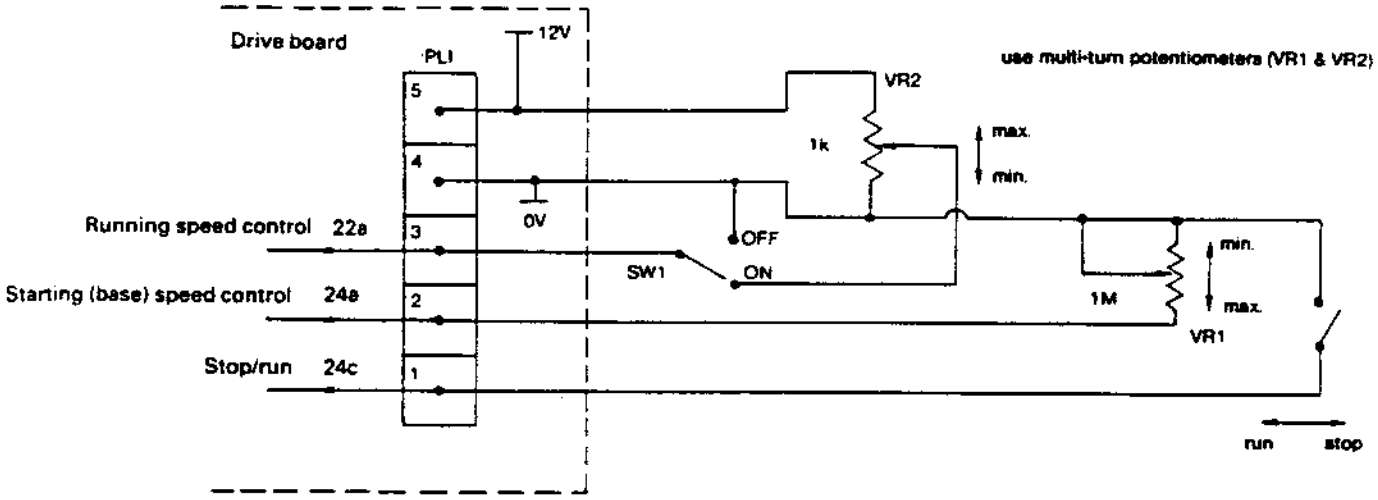
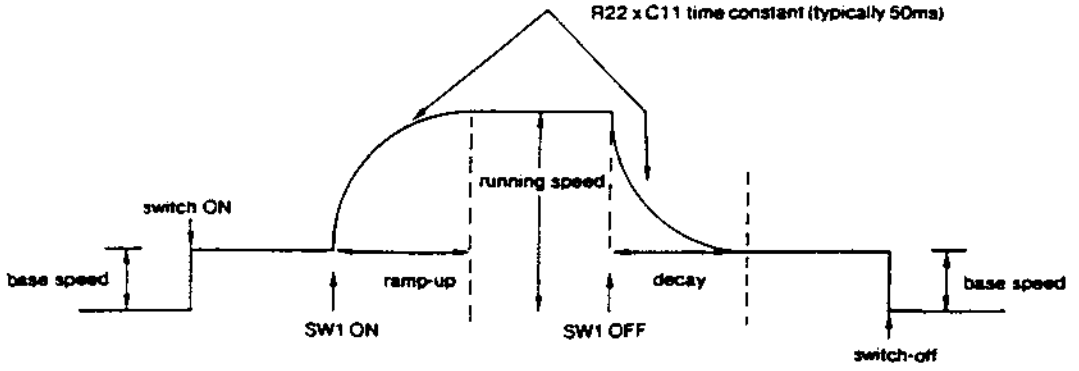


**Figure 6 Motor Speed-Ramping Characteristic**




**Note:** Oscillator frequency corresponds directly to motor speed in steps/s or half steps/s depending on motor drive mode.

For a 1.8° stepper motor

speed in revs/min = $\frac{60}{200}$ x speed in steps/s

or $\frac{60}{400}$ x speed in half steps/s

For a 7.5° stepper motor

speed in revs/min = $\frac{60}{48}$ x speed in steps/s

or $\frac{60}{96}$ x speed in half steps/s

## Oscillator Frequency Setting

Recommended component values

| | |
|---|---|
| VR1 | 0–1MΩ |
| VR2 | 1kΩ |
| R13 | 10kΩ–1MΩ |
| C12 | greater than 100pf |

Determine the base frequency and maximum running frequency. Using Fig. 7 and the base frequency value choose a value for C12 and VR1. Calculate the ratio max. running frequency/base frequency to determine the ratio of $\frac{\text{VR1 + R15 (fixed at 10kΩ)}}{\text{R13}}$

and thus using Fig 8 establish the required value for R13.

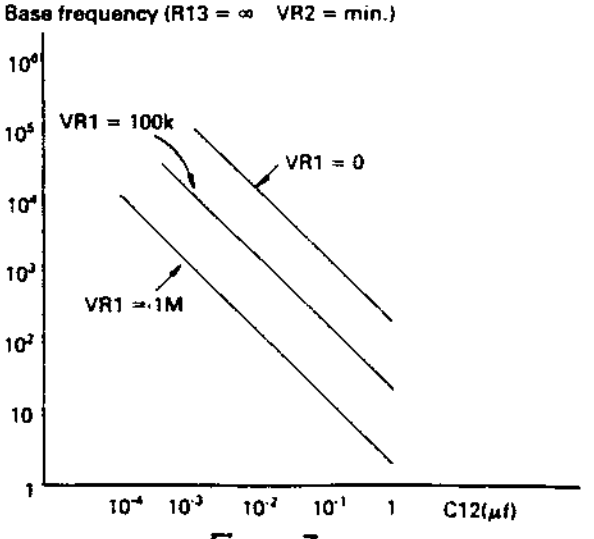



**Figure 7**

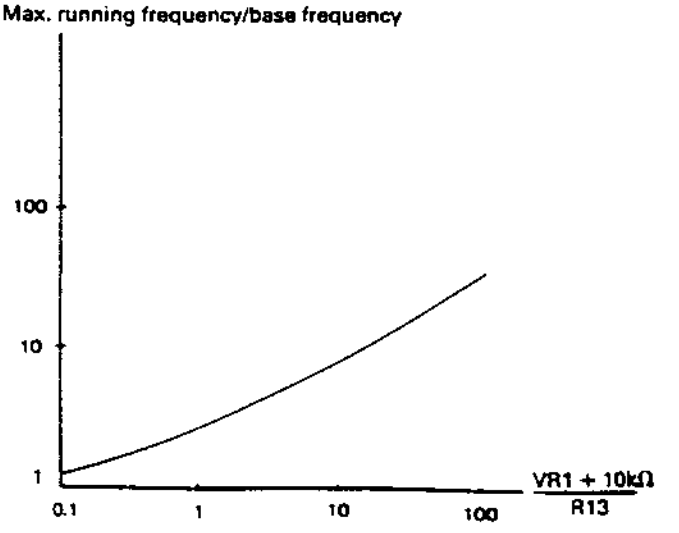



**Figure 8**

Once all component values are established and assembled the oscillator frequency range is as shown in Fig. 9. If SW1 is OFF the oscillator runs at base frequency. When SW1 is ON the oscillator builds up (at a rate depending on R14 x C11 time constant) to a frequency determined by VR2 setting.

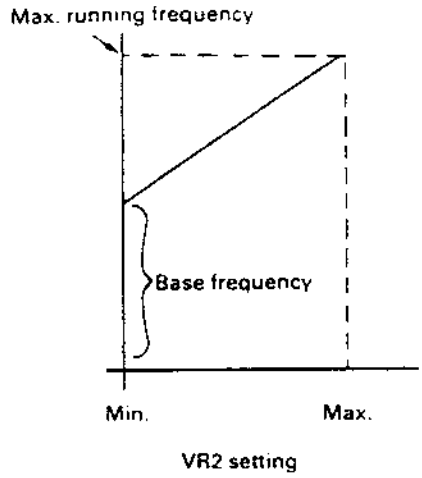



**Figure 9**

## Installation – General Notes

1) SERIOUS DAMAGE **WILL** OCCUR if a motor lead becomes disconnected whilst the drive is energised.

2) The drive board should always be mounted such that the heatsink fins are vertical i.e. board on edge, and adequate clearance be given top and bottom i.e. 25mm minimum. When rack mounting the board there should be at least a 15mm clearance between the heatsink and an adjacent board.

3) When using the drive at high ambient temperatures or at slow speeds/standstill at maximum current and voltage it will prove advantageous to force cool the heatsink.

4) Motor and power supply connections should be made in at least 24/0.2mm wire due to the high peak currents flowing, all other wiring can be 7/0.2mm.

5) No damage will occur, but the Full step/Half step input (pin 16a) should be connected as required before the drive is energised.

6) SERIOUS DAMAGE **CAN** OCCUR if this board is plugged in or out with power still applied or the power supply not fully discharged. Once the power supply has been switched off WAIT AT LEAST 30 SECONDS before unplugging the board. When using Power Supplies other than those manufactured by Alzanti please ensure that a suitable discharge (bleed) resistor (i.e. 1K at 6W) is fitted across the Motor Supply rail (pins 2ac to 32ac). This will help prevent any residual voltage from damaging the Stepper Drive if the board is plugged in or out prematurely.

THE DRIVING FORCE IN MOTION CONTROL

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